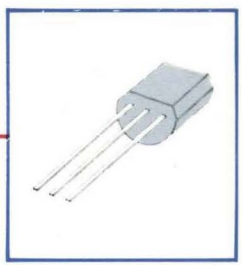
SAMSUNG

Data Book

Transistor

VOL.1, 1991



- Small Signal TR

SAMSUNG

Transistor Data Book Vol.1
(Small Signal TR)

1991

II-1

SAMSUNG
DATA BOOK LIST

I. Semiconductor Product Guide

II. Transistor Data Book

- Vol. 1: Small Signal TR
- Vol. 2: Bipolar Power TR
- Vol. 3: TR Pellet

III. Linear IC Data Book

- Vol. 1: Audio/CDP/Toy
- Vol. 2: Video
- Vol. 3: Telecom
- Vol. 4: Industrial
- Vol. 5: Data Converter IC

IV. CMOS Consumer IC Data Book

V. High Speed CMOS Logic Data Book

VI. MOS Memory Data Book

- Vol. 1: DRAM/DRAM Module/Video RAM
- Vol. 2: SRAM/EEPROM/MASK ROM/FIFO

VII. SFET Data Book

VIII. MPR Data Book

IX. LCD Dot Matrix Data Book

TRANSISTOR DATA BOOK

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KSC Series
KSD Series
KSK Series
KSR Series
2N Series
BC Series
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NOTES

1

QUALITY ASSURANCE and RELIABILITY PROGRAM

1. Introduction

Samsung utilizes rigorous qualification and reliability programs to monitor the integrity of its devices. All industry standard (and various non-standard) stresses are run. Testing is done not only to collect data, but also to detect trends and product anomalies, with rectification to take place immediately (if necessary). This protects the customer from receiving discrepant material. Careful attention is given to any manufacturing changes, both through Engineering Change Notices and appropriate reliability stressing.

Items such as particular tests, frequency, sample sizes, acceptance criteria, and methods of stressing are detailed later in this chapter.

2. Policy

Samsung is committed to supplying high-quality semiconductors to its consumers. All product released for general sales has been fully tested and qualified. By meeting or exceeding normal industry standards for reliability, Samsung can confidently supply products to the world that will meet customer applications and reliability standards. Of course special programs can be run for customers who have particular requirements which are considered non-standard.

The quality organization must approve any product before it is officially qualified and sitributed. To do this most effectively, fully-functional devices must pass two critical stages prior to sales. Step 1 is product evaluation; step 2 is product qualification. Details are listed below.

3. Scope

Pass/Fail criteria are established by the quality assurance organization. All products have specifications which apply to then regarding reliability stressing, periodical monitoring, and final lot disposition.

The quality department is responsible for investigating mass-produced product for sicrepancies, and enforcing corrective actions. All outoging product goes through "QA-gating", where tests particularly critical to the product are accomplished. Only when quality assurance approves a device, either through qualification or gating acceptance, is it released. Fundamental "no-rework" policies ensure only highly reliable material leaves the factory. Testing is done to MIL-STD 883 and MIL-STD 750 standards, with sampling done in accordance with MIL-STD 19500E and MIL-STD 105D. Samsung also has internal specifications where its requirements exceed those of MIL-STDs.

4. Qualification Procedures

Procedures to qualify devices are listed below. There are both general and product-specific requirements. Procedures are detailed for new products, die-only qualifications, and package-only qualifications. The latter two are for products and/or packages already qualified, but where there is room for further product optimization.

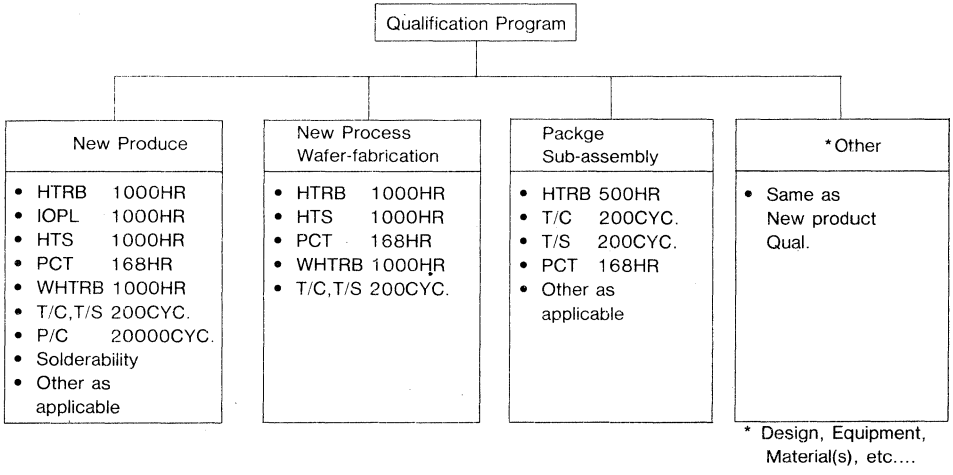


Fig. 1. Qualification Programs.

4.1 New product qualification test items

No.	Test Item	Test Condition	Sample Size	LTPD	ACC. No	Reference Method	Note
1	High Temperature Reverse Bias (HTRB)	$T_a=T_j$(max) $V_{CB}=0.8\times V_{CBO}$ 1000HRS	45	10	1		48HR for PRT
2	High Temperature Storage (HTS)	$T_a=T_j$(max) 1000HRS	45	10	1		
3	Operating Life (OPL)	$T_a=25°C$ $P_c=P_c$(max) 1000HRS	45	10	1	MIL-STD-750 1026.3	For Small-Signal Device
4	Intermittent OPL (IOPL)	$T_a=25°C$ $P_c=P_c$(max) 2min/2min On/Off 1000HRS	45	10	1	MIL-STD-750 1036.3	
5	Power Cycle (P/C)	$\Delta T_j=125°C$ 45Sec/90Sec On/Off 20000CYC.	45	10	1		For PWR TR,
6	Pressure Cooker Test (PCT)	$T_a=121°C\pm2°C$ RH=100% 15PSIG 168HRS	45	10	1		48HR for PRT
7	Wet High Temperature Reverse Bias (WHTRB)	$T_a=85°C$, RH=85% $V_{CB}=0.8\times V_{CBO}$ 1000HRS	45	10	1		
8	Thermal Shock (T/S)	$-65°C\leftrightarrow150°C$ (Liquid) 5min,<10Sec, 5min 200 Cycles	45	10	1	MIL-STD-883 1011	
9	Temperature Cycle (T/C)	$-65°C\leftrightarrow150°C$ 10min, 10min 200 Cycles	45	10	1	MIL-STD-883 1011	
10	Solder Heat Resistance (S/H)	$T_a=260°C\pm5°C$ $t=10\pm1$Sec (once with flux)	10	N/A	0	MIL-STD-750 2031	
11	Solderability	$T_a=260°C\pm5°C$ $t=5\pm0.5$ sec Reject is>10% uncovered surface	10	N/A	0	MIL-STD-883 2003	
12	Salt Atmosphere	$T_a=35°C$, 5% NaCl 24HRS	10	N/A	0	MIL-STD-883 1009A	
13	Mechanical Shock	1500G, 05ms 3 Times Each direction of X,Y and Z Axis	10	N/A	0	MIL-STD-750 2016	For Hermeitc
14	Vibration	20G, 3Axis f=100 to 2000 cps for 4min, 4 cycles	10	N/A	0	MIL-STD-883 2007	For Hermetic
15	Constant Acceleration	2000G X,Y,Z Axis 1 min for each Axis	10	N/A	0	MIL-STD-883 2001	For Hermetic
16	ESD (Human Body Model)	R=1.5kΩ C=100pF 5 Discharge $V\geq\pm1500V$	5	N/A	0	MIL-STD-883 3015	

Note: •SOT-23 PKG, TO-92S PKG, Al Wire Device: PCT 96HR
•N/A: Not available

4.2 New process, wafer fabrication qualification

No	Test Item	Test Condition	Sample Size	LTPD	ACC No
1	High Temperature Reverse Bias (HTRB)	$T_a=T_j$(max) $V_{CB}=0.8\times V_{CBO}$ 1000HRS	45	10	1
2	High Temperature Storage (HTS)	$T_a=T_j$(max) 1000HRS	45	10	1
3	Pressure Cooker Test (PCT)	$T_a=121°C\pm2°C$ RH=100% 15 PSIG 168HRS	45	10	1
4	Wet High Temperature Reverse Bias (WHTRB)	$T_a=85°C$, RH=85% $V_{CB}=0.8\times V_{CBO}$ 1000HRS	45	10	1
5	Thermal Shock (T/S)	$-65°C\rightleftharpoons150°C$(Liquid) 5min,<10sec, 5min 200 cycles	45	10	1
6	Temperature Cycle (T/C)	$-65°C\rightleftharpoons150°C$ 10min, 10min 200 Cycles	45	10	1

4.3 Package Sub-Assembly Qualification

No	Test Item	Test Condition	Siample Size	LTPD	ACC No	Notes
1	High Temperature Reverse Bias (HTRB)	$T_a=T_j$(max) $V_{CB}=V_{CBO}\times0.8$ 500HRS	45	10	1	
2	Temperature Cycle (T/C)	$-65°C\rightleftharpoons150°C$ 10min, 10min 200 CYCLES	45	10	1	
3	Pressure Cooker Test (PCT)	$T_a=121°C\pm2°C$ RH=100%, 15PSIG 168HRS	45	10	1	
4	Thermal Shock (T/S)	$-65°C\rightleftharpoons150°C$(Liquid) 5min,<10sec, 5min 200 CYCLES •	45	10	1	
5	Solder Heat Resistance (S/H)	$260°C\pm5°C$ 10 ± 1 sec Once without Flux	10	N/A	0	
6	Vibration (Variable-Frequency)	100~2000~100Hz 20G, 5min, 5Times, X,Y,Z	10	N/A	0	
7	Mechanial Shock (M/S)	1500G, 0.5ms 3 Times, X,Y,Z	10	N/A	0	
8	Constant Acceleration	20000G X,Y,Z Axis 1 min for each Axis	10	N/A	0	

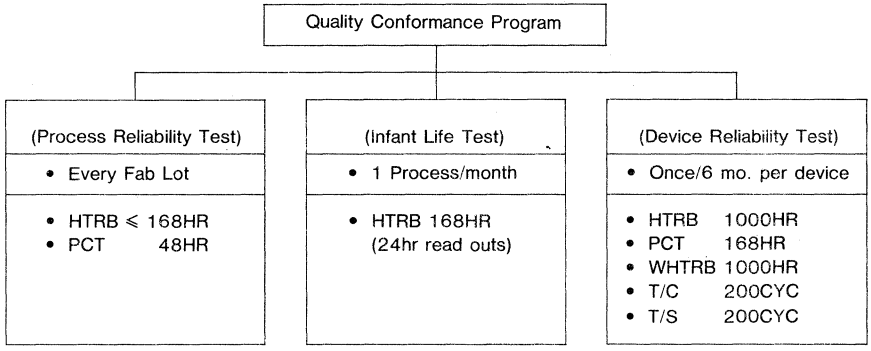
Note) • N/A: not available

5. Product Reliability (Quality Conformance) Monitors

Samsung implements periodic testing to monitor the ongoing reliability of its products. A subset of stresses used for qualification are run; they are seen as most critical for basic device reliability. Formally this is known as the Device Reliability Test System, or simply as DRT.

Lot-by-lot infant mortality reliability testing is also accomplished at Samsung. The purpose of this is to verify process integrity in a full QA step. Formally this is konwn as Process Reliability Testing, or more simply as PRT. Normally a short term accelerated lifetest and package reliability test are done, although exceptions are made in the case of special devices.

Although Samsung scrupulously utilizes statistical controls throughout it's production process, DRT and PRT serve as confirmation that indeed the customer does receive only high-grade units. The tables on the following give details of DRT and PRT processing.



Note: Test descriptions given on following pages.

Fig. 2. Quality Conformance Program

(PRT/DRT Product Stress Methodologies)

1. PRT (Process Reliability Test) Frequency: Every outgoing lot

No.	Test Item	Test Condition	Sample Size	LTPD	Accept. No.	Note
1	High Temperature Reverse Bias (HTRB)	$T_a=T_j(max)$ $V_{CB}=V_{CBO}\times0.8$ 168HR max	45	10	1	
2	Pressure Cooker Test (PCT)	$T_a=121°C\pm2°C$ 100% RH, 15PSIG 48HR	45	10	1	

2. ILT (Infant Life Test) Frequency: 1 Process/month

No.	Test Item	Test Condition	Sample Size	Note
1	High Temperature Reverse Bias (HTRB)	$T_a=T_j(max)$ $V_{CB}=V_{CBO}\times0.8$ 168HR	300	for Discrete

3. DRT (Device Reliability Test)

No.	Test Item	Test Condition	Sample Size	LTPD*	Accept. No.	Note
1	High Temperature Reverse Bias (HTRB)	$T_a=T_j$(max) $V_{CB}=V_{CBO}\times0.8$ 1000HRS	45	5 10	0 1	
2	Pressure Cooker Test (PCT)	$T_a=121°C\pm2°C$ RH=100%, 15PSIG 168HRS	45	5 10	0 1	
3	Wet High Temperature Reverse Bias (WHTRB)	$T_a=85°C$, RH=85% $V_{CB}=0.8\times V_{CBO}$ 1000HRS	45	5 10	0 1	
4	Temperature Cycle (T/C)	$-65°C\leftrightharpoons150°C$ 10min, 10min 200 Cycles	45	5 10	0 1	
5	Thermal Shock (T/S)	$-65°C\leftrightarrow150°C$(Liquid) 5min,<10sec, 5min 200 Cycles	45	5 10	0 1	

* LTPD 5: S Grade Units LTPD 10: A,B Grade Units.

6. Reliability Tests

The test run by the quality department are accelerated tests, serving to model "real world" applications through boosted temperatures, voltages, and/or humidities. Accelerated conditions are used to derive device knowledge through means quicker than that of typical application situations. These accelerated conditions are then used to assess differing failure rate mechanisms that correlate directly with ambient conditions. Following are summaries of various stresses (and their conditions) run by Samsung on discrete and integrated devices.

High Temperature Reverse Bias (80% max. BV_{CBO}, 150°C, static)
For this test, device integrity is checked through stressing of the main blocking junction at an elevated temperature and voltage. Overall product stability is investigated through leakage current monitoring; low leakage indicates good integrity.

Intermittent Operating Life (P_{MAX}, 25°C, 2 min on/2 min off)
This test is normally applied to scrutinize die bond thermal fatigue. A stressed device undergoes an "on" cycle, where there is thermal heating due to power dissipation, and an "off" cycle, where there is thermal cooling due to lack of inputted power. Die attach (between die and package) and bond attach (between wire and die) are the critical areas of concern.

Wet High Temperature Reverse Bias (80% max. BV_{CBC}, 85°C, 85% R.H., static) or ($V_{CC}=V_{CC}$(typ), 85°C, 85% R.H, static)
Wet High Temperature Reverse Bias Test is used to accelerate failure mechanisms by applying static bias on alternate pins at high temperature and humidity ambient (85°C/85°C R.H.). This test checks for resistance to moisture penetration by using an electrolytic principle to accelerate corrosive mechanisms.

Pressure Cooker Test (Unbiased, 121°C, 15 PSIG, 100% R.H.)
The Pressure Cooker Test checks for resistance to moisture penetration. A highly pressurized vessel is used to force water (thereby promoting corrosion) into packaged devices located within the vessel.

High Temperature Storage (Unbiased, 150°C)
High Temperature Storage is utilized to test for both package and die weaknesses. For example, sensitivities to ionic contamination and bond integrity are closely scrutinized.

Temperature Cycling (Unbiased, −65°C to +150°C, air)
This stress uses a chamber with alternating temperatures of −65°C and +150°C (air ambient) to thermally cycle devices within it. No bias is applied. The cycling checks formechanical integrity of the packaged device, in particular bond wires and die attach, along with metal/polysilicon microcracks.

Thermal Shock (Unbiased, −65°C to +150°C, liquid)
This stress uses a chamber with alternating temperatures of −65°C to +150°C (liquid ambient) to thermally cycle devices within it. No bias is applied. The cycling is very rapid, and primarily checks for die/package compatibility.

Resistance to Solder Heat (Unbiased, 260°C, 10 sec)
Solder Heat Resistance is performed to establish that devices can withstand the thermal effects of solder dip, soldering iron, or solder wave operations.

Mechanical Shock (Unbiased, 1500g, Pulse=0.5msec)
This test determines the suitability of a device to be used in equipment where mechanical "shocks" may occur. Such shocks ersult from sudden or abrupt changes produced by rough (non-standard) handling, transportation, or field operations.

Variable Frequency Vibration (Unbiased, Range=100 to 2000 Hz)
Variable Frequency Vibration is done to model the effects of differential vibration in the specified range. Die attach and bonding integrity are particularly stressed, testing the mechanical soundness of device packaging.

Constant Acceleration (Unbiased, 10kg to 20kg)
This is an accelerated test designed to indicate types or modes of structural and mechanical weaknesses not necessarily detectable in Mechanical Shock and Variable Frequency Vibration stressing.

7. Failure criteria

Parameter	Symbol	Unit	SCOPE	Min.	Max.
Collector Cut-off Current	I_{CBO}	μA	COMMON	—	USL×2
Emitter Cut-off Current	I_{CEO}	μA	COMMON	—	USL×2
H_{FE} Variation Ratio	H_{FE}	—	H_{FE}(min)<500	I.V.×0.8	I.V.×1.2
		—	H_{FE}(min)≥500	I.V.×0.7	I.V.×1.3
		—	H_{FE}(min)≥1000	I.V.×0.6	I.V.×1.4
Collector-Emitter Saturation Voltage	V_{CE}(sat)	mV	COMMON	LSL	USL
Base-Emitter Saturation Voltage	V_{BE}(sat)	mV	COMMON	LSL	USL
Thermal, Resistance	ΔV_{BE}	mV	Power	LSL	USL
Noise	N_F,N_V	dB	Low Noise	—	USL×1.5

Note 1) USL: Upper Specification Limit 2) LSL: Lower Specification Limit 3) I.V.: Initial Value

8. Relative Stress Comparisons

Many stresses are run at Samsung on many different devices. Through both theoretical and actual results, it was clearly determined which stresses were most effective. Also established were the stresses which weren't fully effective.

Comparisons have been made on the basis of defects able to be determined, efficiency in detection, and cost. For the reader's benefit, Samsung provides the results of its conclusions on the following pages.

Comparison of Reliability Test Methods

Test Method	Defect	Effectivenss	Cost	Remarks
Internal Visual Inspection	Lead Structure Metallization Oxide Film Foreign Particles Die Bond Wird Bond Contamination Corroded Substrate	Good	Slightly Inexpensive to Moderate	This method of screening must be performed for high reliability devices. Cost is affected by the degree of visual inspection
Infrared ray	Design(thermal)	Very Good	Expensive	For use in design evaluation only
Radiography	Die Bond Lead Structure(Gold) Foreign Particles Manufacturing (Gross Error) Seal Package Contamination	Extremely Good Good Good Good Good Good Good Good	Moderate	Advantage to using this screening method lies in the ability to test die frame/ header bonding, and to be able to perform inspection after sealing However, some materials being transparent to X-rays (for example, Al and Si) are not able to be analyzed. The use of the complex test system results in cost six times that of visual inspection.
High Temperature Storage	Electrical stability Metallization Bulk Silicon Corrosion	Good	Very Inexpensive	This is a highly desirable screening method
Temperature Cycling	Package Seal Die Bond Wire Bond Cracked Substrate Thermal Mismatching	Good	Very Inexpensive	This screening method is one of the most effective for use
Thermal Shock	Package Seal Die Bond Wire Bond Cracked Substrate Thermal Mismatching	Good	Inexpensive	While this screening method is similar to temperature cycling, it enables high stress levels as well. It is probably equal to the temperature cycling method.
Constant Accelertion	Lead Structure Die Bond Wire Bond Cracked Substrate	Good	Moderate	Doubt exists as to the effectiveness of screening aluminum wires with stress levels in the range of 0~20,000 G
Shock (Without Monitoring)	Lead Structure	Fairly Poor	Moderate	Drop shock testing is thought to be inferior to constant acceleration methods. However, the pneupactor shock test is more effective. Shock test is a destructive test method.
Shock (With Monitoring)	Particles Intermittent Short Intermittent Open	Fairly Poor Failry Good Fairly Good	Expensive	Visual inspection or radiography is more desirable for detection of particles

Comparison of Reliability Test Methods (continued)

Test Method	Defect	Effectivenss	Cost	Remarks
Vibration Fatigue	Lead Structure Package Die Bond Wire Bond Cracked Substrage	Fairly Poor	Expensive	This test is destructive and without merit.
Variable Frequency Vibration (Without Monitoring)	Package Die Bond Wire Bond Substrate	Fairly Poor	Expensive	
Variable Frequency Vibration (Without Monitoring)	Foreign Particles Lead Structure Intermittent Open	Fairly Good Good Good	Very Expensive	The effectiveness of the method for detecting particles depends on the type of particle
Random Vibration (Without Monitoring)	Package Die Bond Wire Bond Substrate	Good	Expensive	This screening method is more effective than variable frequency vibration(without monitoring), when used with equipment intended for space vehicle operation, although it is more expensive.
Random Vibration (With Monitoring)	Foreign Particle Lead Structure Intermittent Open	Fairly Good Good Good	Very Expensive	This is one of the most expensive screening methods
Vibrational Noise	Foreign Particles	Good	Expensive	
Radioisotope Leak Test	Package Seal	Good	Moderate	This screening method is effective for detecting leakage in the range 10E6~10E12 atm. ml/sec
Helium Leak Test	Package Seal	Good	Moderate	This screening method is effective for detecting leak in the range 10E6~10E12 atm. ml/sec
Gross Leak Test	Package Seal	Good	Inexpensive	Effectiveness is dependent upon volume. Testing is possible for detecting leaks above 10E-3 atm. ml/sec.
High Voltage Test	Oxide Film	Good	Inexpensive	Effectiveness Depends on structure
Insulation Resistance	Lead Structure Metallization Contamination	Fairly Good	Inexpensive	
Intermittent Operation	Metallization Bulk Silicon Oxide Film Inversion/Channeling Design Parmeter Drift Contamination	Good	Expensive	Probably about the same as AC operating life

Test Method	Defect	Effectivenss	Cost	Remarks
AC Operation	Metallization Bulk Silicon Oxide Film Inversion/Channeling Design Parmeter Drift Contamination	Very Good	Expensive	
DC Operation	Basically the Same as Intermittent Operation	Good	Expensive	The AC operation life method is more effective for any failure mechanism
High Temperature AC Operation	Same as AC Operation Life Test	Extremely Good	Very Expensive	Failures are accelerated by temperature. This is probably the most expensive and one of the most effective screening methods.
High Temperature Reverse Bias	Inversion /Channeling	Fairly Poor	Expensive	

9. Reliability Test Results

Extensive test results have been compiled through long term reliability monitoring (DRT) of devices. Current and historical data is entered into Samsung's Reliability Newtork, SRN. Thus, past performance of a device or it's family, assembly evaluation results, manufacturing change reliability results, etcetera, can all be seen via computer through SRN.

Results included in this manual are representative of products stressed, and contain data fro mthe past year. Data is summarized from both die and package tests, on five critical stresses. Failure rates for long term life testing are in FITs, which are calculated using Arrhenius' Equation. (Arrhenius' Equation is summarized in the Appendix section). Samsung's failure rates are well below 50 FITs, which is acknowledged by customers and competitors alike as among the industry's elite.

9.1 Long Term Life Test Results (KSC945, KSD288)

Family	Test Item	Steady State Operation Life			High Temperature Storage Life		
	Test Condition	$T_a = T_j$(max.) $V_{CB} = V_{CBO} \times 0.8$ 1000 HRS			T_a = 125°C, 150°C 1000 HRS		
	Device	Number of Samples	Number of Failures	Failure Rate (FIT)	Number of Samples	Number of Failures	Failure Rate (FIT)
TR	KSC945	870	0	1	765	0	1
	KSD288	540	0	1	360	0	1

Note 1) FIT: Failure in time or failure unit; represents the number of failures expected per 10^9 (one billion) device hours (at 55°C).
2) TR: Transistor

9.2 Environmental Test Results

Family	Test Item	High Temp/High Humidity			Pressure Cooker			Thermal Shock		
	Test Condition	See 4.1			See 4.1			85°C, 85% R.H., V_{CBO} × 0.8		
	Device	Number of Samples	Number of Failures	Failure Rate (%1 1KHRS)	Number of Samples	Number of Failure	Failure Rate (%1 168HRS)	Number of Samples	Number of Failures	Failure Rate (%1 200CYC)
TR	KSC945	514	0	0.0	615	0	0.0	507	0	0.0
	KSD288	225	0	0.0	405	0	0.0	576	1	0.17

10. Product Outgoing Quality Levels

The quality of Samsung products reaching customers has improved steadily over the years. Nearly on order of magnitude reduction in outgoing product PPM levels has been achieved from 1987-90. Results can be seen below.

Average Outgoing Quality, or AOQ, is measured by the Quality Assurance Department. Prior to release, product is sampled according to MIL-STD 105D. Both electrical and visual/mechanical inspections occur. If inspection standards are met, product is approved for sales. Depending on the nature of the failure(s), rejected samples can cause an entire lot to be 100% tested and/or inspected, re-worked to screen out defective devices, or scrapped.

Electrical testing is typically done to product specification limits, guardbanded by a fixed percentage. Visual/mechanical inspection is performed to check for key package, marking, and lead parameters. (More extensive details are provided in Chapter 3, Assembly process control)

Although Samsung's AOQ levels are acceptable, efforts are constantly underway to reduce the figures (thereby increasing outgoing quality).

Samsung Product Electrical AOQ Levels

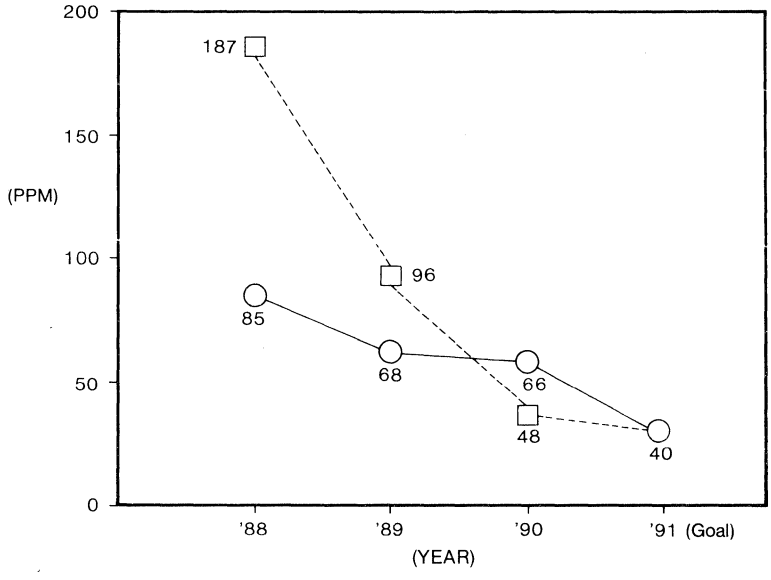
(in PPM)

Product Family	1988	1989	1990	1991 (Goal)
Small-Signal Transistor	42	23	16	15
Power Transistor	103	39	23	15

Samsung Product Visual/Mechanical AOQ Levels

(in PPM)

Product Family	1988	1989	1990	1991 (Goal)
Small Signal Transistor	43	45	50	25
Power Transistor	84	57	25	25



Note: Total=Electrical + Visual/Mechanical
S/S TR=Small Signal Transistor
PWR TR=Power Transistor

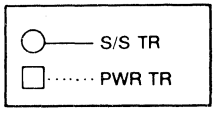


Fig. 3. Total AOQ Levels

NOTES

PRODUCT GUIDE 2

I. KS Type Series
II. American Type Series
III. European Type Series
IV. Quick Reference Table

I. KS Type Series

1. Small Signal Transistors.
2. Power Transistors.

1. SMALL SIGNAL TRANSISTORS

1-1. General Purpose Transistors

1.1.1 SOT-23 Type Transistors

Device and Polarity (Marking)				Condition			h_{FE}	Condition		V_{CE}(sat), V_{BE}(sat)(V)		Condition		f_T(MHz)	
NPN	PNP	V_{CEO} (V)	I_C (A)	V_{CE} (V)	I_C (mA)	MIN	MAX	I_C (mA)	I_B (mA)	MAX	MAX	V_{CE} (V)	I_C (mA)	MIN	MAX
KSC1623(C1X)	KSA812(D1X)	50	0.1	6	1	90	600	100	10	0.3	1	6	10		250
KSC2859(E1X)	KSA1182(F1X)	30	0.5	1	100	70	240	100	10	0.25		6	20		200
KSC3256(K1X)	KSA1298(J1X)	25	0.8	1	100	100	320	500	20	0.4		5	10		120

1.1.2 TO-92S Type Transistors

Device and Polarity				Condition		h_{FE}		Condition		$V_{CE(sat)}$ V_{BE}(sat)(V)				Condition		f_T(MHz)	
NPN	PNP	V_{CEO} (V)	I_C (A)	V_{CE} (V)	I_C (mA)	MIN	MAX	I_C (mA)	I_B (mA)	TYP	MAX	TYP	MAX	V_{CE} (V)	I_C (mA)	MIN	TYP
KSD1021		30	1	1	100	70	400	1000	100		0.5		1.2	6	10		130
	KSA1378	25	0.3	1	50	70	400	300	30	0.35	0.6		1.3				
	KSB810	25	0.7	1	100	70	400	700	70	0.25	0.4	0.95	1.2	6	10	50	160
	KSB811	25	1	1	100	70	400	1000	100		0.5		1.2	6	10		110
KSC3488		25	0.3	1	50	70	400	300	30	0.14	0.4						
KSD1020		25	0.7	1	100	70	400	700	70	0.2	0.4	0.95	1.2	6	10	50	170
	KSA1150	20	0.5	1	100	40	400	500	50	0.3	0.4	1	1.3	6	10		
KSC2710		20	0.5	1	100	40	400	500	50	0.18	0.4						

1.1.3 TO-92 Type Transistors

Device and Polarity				Condition			h_{FE}	Condition		V_{CE}(sat), V_{BE}(sat)(V)		Condition		f_T(MHz)	
NPN	PNP	V_{CEO} (V)	I_C (A)	V_{CE} (V)	I_C (mA)	MIN	MAX	I_C (mA)	I_B (mA)	MAX	MAX	V_{CE} (V)	I_C (mA)	MIN	MAX
KSC2003	KSA954	80	0.3	1	50	90	400	300	30	0.6	1.2	6	10	50	100
KSD1616A	KSB1116A	60	1	2	100	135	400	1000	50	0.3	1.2	2	100	70	
KSC1008	KSA708	60	0.7	2	50	40	240	500	50	0.7	1.1	10	50		50
KSC2002	KSA953	60	0.3	1	50	90	400	300	30	0.6	1.2	6	10	50	100
KSD1616	KSB1116	50	1	2	100	135	400	1000	50	0.3	1.2	2	100	70	100
KSC815	KSA539	45	0.2	1	0.05	40	240	150	15	0.5	1.2				
KSD471A		30	1	1	100	70	400	1000	100	0.5	1.2	6	10		130
KSC839		30	0.1	12	2	40	400	10	1	0.4		10	1	80	200
	KSB564A	25	1	1	100	70	400	1000	100	0.5	1.2	6	10		110
KSD227	KSA642	25	0.3	1	50	70	400	300	30	0.6					
KSC184	KSA542	25	0.05	6	1	40	400	20	2	0.3		6	1		100
KSD261	KSA643	20	0.5	1	100	40	400	500	50	0.4	1.3				
KSD5041		20	5	2	500	180	600	3000	100	1.0		6	50		150
KSC5019		10	2	1	500	140	600	2000	50	0.5		1	500		150
SS9014	SS9015	45	0.1	5	1	60	1000	100	5	0.3	1.0	5	10	150	270
SS9011		30	0.03	5	1	28	198	10	1	0.3		5	1	150	370
SS8055	SS8550	25	1.5	1	100	85	300	800	80	0.5	1.2	10	50	100	190
SS9013	SS9012	20	0.5	1	50	64	202	500	50	0.6	1.2				

1.1.4 TO-92L Type Transistor

Device and Polarity				Condition			h_{FE}	Condition		V_{CE}(sat), V_{BE}(sat)(V)		Condition		f_T(MHz)	
NPN	PNP	V_{CEO} (V)	I_C (A)	V_{CE} (V)	I_C (mA)	MIN	MAX	I_C (mA)	I_B (mA)	MAX	MAX	V_{CE} (V)	I_C (mA)	MIN	MAX
KSC2331	KSA931	60	0.7	2	50	40	240	500	50	0.7	1.2	10	50		100
KSC2328A	KSA928A	30	2	2	500	100	320	1500	30	2.0		2	500	50	120
KSC2500		10	2	1	500	140	600	2000	50	0.5		1	500		150

1.2 Low Noise Transistors

1.2.1 TO-92S Type Transistor

Device and Polarity		NF(dB)		V_{CEO}	I_C	Condition		h_{FE}		Condition		V_{CE}(sat)	Condition		f_T(MHz)	
NPN	PNP	MAX	Condition Frequency	(V)	(A)	V_{CE} (V)	I_C (mA)	MIN	MAX	I_C (mA)	I_B (mA)	(V) MAX	V_{CE} (V)	I_C (mA)	MIN	MAX
	KSA1175	6	Audio	50	0.15	6	1	40	700	100	10	0.3	6	10		180
KSC2785		4	Audio	50	0.15	6	1	40	700	100	10	0.3	6	10		300

1.2.2 TO-92 Type Transistors

Device and Polarity		NF(dB)		V_{CEO}	I_C	Condition		h_{FE}		Condition		V_{CE}(sat)
NPN	PNP	MAX	Condition Frequency	(V)	(A)	V_{CE} (V)	I_C (mA)	MIN	MAX	I_C (mA)	I_B (mA)	(V) MAX
KSC945	KSA733	4	Audio	50	0.15	6	1	40	700	100	10	0.3
KSC1222		**40	Audio	45	0.05	3	0.5	120	1000	20	2	0.3
KSC900		**30	Audio	25	0.05	3	0.5	120	1000	20	2	0.2

Audio=10Hz to 15.7KHz
*=MAX, **=Noise Level

1.3. RF/VHF/UHF Amplifier Transistors

1.3.1 SOT-23 Type Transistors

Device (Marking) NPN	Condition		f_T(MHz)		V_{CEO}	C_{obe}		Condition		h_{FE}		N_F(dB)		lagc Condition Gain	Reduction
	V_{CE} (V)	I_C (mA)	MIN	TYP	(pF) MAX	(V)	(dB) MIN	V_{CE} (V)	I_C (mA)	MIN	MAX	MAX	Condition f(MHz)	(mA) MAX	(dB)
KSC2734(H8Z)	10	10	1400	3500	1.5	12		10	5	20	200				
KSC3120(H9Z)	10	2	1500	2400	#0.9	15	$12	10	5	40	200	*8	800		
KSC2759(H6X)	10	5	1250	2000	1.3	14	$10	10	5	40	180				
KSC3123(HAX)	10	5	900	1400	#0.5	20	$20	10	5	60	240	5.5	200		
KSC2757(H3X)	10	5	800	1100	1.5	15		10	5	60	240				
KSC2758(H4Z)	10	3	750	1000	0.8	25	14	10	3	60	240	4.5	900	11	30
KSC2756(H2X)	10	5	500	850	#0.5	20	$15	10	5	60	240	*6.5	200		
KSC2755(H1X)	10	3	400	600	#0.5	30	20	10	3	60	240	3	200		
KSC2223(H5X)	6	1	400	600	*1	20		6	1	40	180	*3	100		
KSC3125(A1Z)	10	10	250	600	1.6	25		10	10	20	200				
KSC2715(B1X)	10	1	100		3.2	30	27	12	2	40	240				

1.3.2 TO-92 Type Transistors

Device (Marking) NPN	Condition		f_T(MHz)		Cob	V_{CEO}	Gpe	Condition		h_{FE}		NF(dB)		lagc Condition Gain	
	V_{CE} (V)	I_C (mA)	MIN	TYP	(pF) MAX	(V)	(dB) MIN	V_{CE} (V)	I_C (mA)	MIN	MAX	MAX	Condition f(MHz)	(mA) MAX	Reduction (dB)
MPS5179	6	5	900	2000	@1	12	15	1	3	25	250	4.5	200		
MPSH17	10	5	800		@0.9	15	*24	10	5	25	250	6	200		
MPSH11	10	4	650		@0.7	25		10	4	60					
MPSH10	10	4	650		@0.7	25		10	4	60					
MPSH24	10	8	400	620	@0.36	30	$19	10	8	30					
MPSH20	10	4	400	620	@0.65	30	$18	10	4	25					

*=TYP, #=Cre, @=Ccb, $=Gce.

1.4 High Voltage Transistors

1.4.1 SOT-23 Type Transistors

Device and Polarity				Condition		h_{FE}		Condition		V_{CE}(sat), V_{BE}(sat)(V)		Conition		f_T(MHz)	
NPN	PNP	V_{CEO} (V)	I_C (A)	V_{CE} (V)	I_C (mA)	MIN	MAX	I_C (mA)	I_B (mA)	MAX	MAX	V_{CE} (V)	I_C (mA)	MIN	TYP
MMBTA42(1D)	MMBTA92(2D)	300	0.5	10	30	40		20	2	0.5	0.9	20	10	50	
MMBTA43(1E)	MMBTA93(2E)	200	0.5	10	30	40		20	2	0.5	0.9	20	10	50	
	MMBT5401(2L)	150	0.5	5	10	60	240	50	5	0.5	1	10	10	100	
MMBT5550(1F)		140	0.6	5	10	60	250	50	5	0.25	1.2	10	10	100	

1.4.2 TO-92 Type Transistors

Device and Polarity				Condition		h_{FE}		Condition		V_{CE}(sat), V_{BE}(sat)(V)		Conition		f_T(MHz)	
NPN	PNP	V_{CEO} (V)	I_C (A)	V_{CE} (V)	I_C (mA)	MIN	MAX	I_C (mA)	I_B (mA)	MAX	MAX	V_{CE} (V)	I_C (mA)	MIN	TYP
2N6517	2N6520	350	0.5	10	30	30	200	30	3	0.5	0.9	20	10	40	
2N6516	2N6519	300	0.5	10	30	45	270	30	3	0.5	0.9	20	10	40	
2N6515	2N6518	250	0.5	10	30	50	300	30	3	0.5	0.9	20	10	40	
2N5551		160	0.6	5	10	80	250	50	6	0.2	1.0	10	10	100	
	2N5401	150	0.6	5	10	60	240	50	5	0.5	1.0	10	10	100	
2N5550		140	0.6	5	10	60	250	50	5	0.25	1.2	10	10	100	
	2N5400	120	0.6	5	10	40	180	50	5	0.5	1.0	10	10	100	
MPSA44		400	0.3	10	10	50	200	10	1	0.5	0.75				
MPSA45		350	0.3	10	10	50	200	10	1	0.5	0.75				
MPSA42	MPSA92	300	0.5	10	30	40		20	2	0.5	0.9	20	10	50	
MPSA43	MPSA93	200	0.5	10	30	40		20	2	0.5	0.9	20	10	50	
MPSL01		120	0.05	6	1	200	800	10	1	0.3		6	1	50	100
	MPSL51	100	0.6	5	50	40	250	50	5	0.3	1.2	10	10	50	

1.4.3. TO-92L Type Transistors

Device and Polarity				Condition		h_{FE}		Condition		V_{CE}(sat) V_{BE}(sat)(V)		Condition		f_T(MHz)	
NPN	PNP	V_{CEO} (V)	I_C (A)	V_{CE} (V)	I_C (mA)	MIN	MAX	I_C (mA)	I_B (mA)	MAX	MAX	V_{CE} (V)	I_C (mA)	MIN	TYP
KSC2330		300	0.1	10	20	40	240	10	1	0.5		30	10		50
KSC2383	KSA1013	160	1	5	200	60	320	500	50	1.5		5	200	15	50
KSC2310	KSA910	150	0.05	5	10	40	240	10	1	0.8		30	10		100
KSC2316	KSA916	120	0.8	5	100	80	240	500	50	1.0		5	100		120

1.5. Digital Transistors

1.5.1 SOT-23 Type Transistors

Device and Polarity		R1	R2	V_{CEO}	I_C	Condition		h_{FE}		Condition		V_{CE}(sat)(V)		Condition		f_T(MHz)
NPN	PNP	KΩ	KΩ	(V)	(mA)	V_{CE} (V)	I_C (mA)	MIN	MAX	I_C (mA)	I_B (mA)	TYP	MAX	V_{CE} (V)	I_C (mA)	TYP
KSR1101	KSR2101	4.7	4.7	50	100	5	10	20		10	0.5	0.1	0.3	10	5	250/200
KSR1102	KSR2102	10	10	50	100	5	4	30		10	0.5	0.1	0.3	10	5	250/200
KSR1103	KSR2103	22	22	50	100	5	5	56		10	0.5	0.1	0.3	10	5	250/200
KSR1104	KSR2104	47	47	50	100	5	5	68		10	0.5	0.1	0.3	10	5	250/200
KSR1105	KSR2105	4.7	10	50	100	5	5	30		10	0.5	0.1	0.3	10	5	250/200
KSR1106	KSR2106	10	47	50	100	5	5	68		10	0.5	0.1	0.3	10	5	250/200
KSR1107	KSR2107	22	47	50	100	5	5	68		10	0.5	0.1	0.3	10	5	250/200
KSR1108	KSR2108	47	22	50	100	5	5	56		10	0.5	0.1	0.3	10	5	250/200
KSR1109	KSR2109	4.7		40	100	5	5	100	600	10	1	0.1	0.3	10	5	250/200
KSR1110	KSR2110	10		40	100	5	1	100	600	10	1	0.1	0.3	10	5	250/200
KSR1111	KSR2111	22		40	100	5	1	100	600	10	1	0.1	0.3	10	5	250/200
KSR1112	KSR2112	47		40	100	5	1	100	600	10	1	0.1	0.3	10	5	250/200
KSR1113	KSR1113	2.2	47	50	100	5	5	68		10	0.5	0.1	0.3	10	5	250/200
KSR1114	KSR2114	4.7	47	50	100	5	5	68		10	0.5	0.1	0.3	10	5	250/200

1.5.2 TO-92S Type Transistors

Device and Polarity		R1	R2	V_{CEO}	I_C	Condition		h_{FE}		Condition		V_{CE}(sat)(V)		Condition		f_T(MHz)
NPN	PNP	KΩ	KΩ	(V)	(mA)	V_{CE} (V)	I_C (mA)	MIN	MAX	I_C (mA)	I_B (mA)	TYP	MAX	V_{CE} (V)	I_C (mA)	TYP
KSR1201	KSR2201	4.7	4.7	50	100	5	10	20		10	0.5	0.1	0.3	10	5	250/200
KSR1202	KSR2202	10	10	50	100	5	4	30		10	0.5	0.1	0.3	10	5	250/200
KSR1203	KSR2203	22	22	50	100	5	5	56		10	0.5	0.1	0.3	10	5	250/200
KSR1204	KSR2204	47	47	50	100	5	5	68		10	0.5	0.1	0.3	10	5	250/200
KSR1205	KSR2205	4.7	10	50	100	5	5	30		10	0.5	0.1	0.3	10	5	250/200
KSR1206	KSR2206	10	47	50	100	5	5	68		10	0.5	0.1	0.3	10	5	250/200
KSR1207	KSR2207	22	47	50	100	5	5	68		10	0.5	0.1	0.3	10	5	250/200
KSR1208	KSR2208	47	22	50	100	5	5	56		10	0.5	0.1	0.3	10	5	250/200
KSR1209	KSR2209	4.7		40	100	5	5	100	600	10	1	0.1	0.3	10	5	250/200
KSR1210	KSR2210	10		40	100	5	1	100	600	10	1	0.1	0.3	10	5	250/200
KSR1211	KSR2211	22		40	100	5	1	100	600	10	1	0.1	0.3	10	5	250/200
KSR1212	KSR2212	47		40	100	5	1	100	600	10	1	0.1	0.3	10	5	250/200
KSR1213	KSR2213	2.2	47	50	100	5	5	68		10	0.5	0.1	0.3	10	5	250/200
KSR1214	KSR2214	4.7	47	50	100	5	5	68		10	0.5	0.1	0.3	10	5	250/200

1.5.3. TO-92 Type Transistors

Device and Polarity		R1	R2	V_{CEO}	I_C	Condition		h_{FE}		Condition		V_{CE}(sat)(V)		Condition		f_T(MHz)
NPN	PNP	KΩ	KΩ	(V)	(mA)	V_{CE} (V)	I_C (mA)	MIN	MAX	I_C (mA)	I_B (mA)	TYP	MAX	V_{CE} (V)	I_C (mA)	TYP
KSR1001	KSR2001	4.7	4.7	50	100	5	10	20		10	0.5	0.1	0.3	10	5	250/200
KSR1002	KSR2002	10	10	50	100	5	5	30		10	0.5	0.1	0.3	10	5	250/200
KSR1003	KSR2003	22	22	50	100	5	5	56		10	0.5	0.1	0.3	10	5	250/200
KSR1004	KSR2004	47	47	50	100	5	5	68		10	0.5	0.1	0.3	10	5	250/200
KSR1005	KSR2005	4.7	10	50	100	5	5	30		10	0.5	0.1	0.3	10	5	250/200
KSR1006	KSR2006	10	47	50	100	5	5	68		10	0.5	0.1	0.3	10	5	250/200
KSR1007	KSR2007	22	47	50	100	5	5	68		10	0.5	0.1	0.3	10	5	250/200
KSR1008	KSR2008	47	22	50	100	5	5	56		10	0.5	0.1	0.3	10	5	250/200
KSR1009	KSR2009	4.7		40	100	5	1	100	600	10	1	0.1	0.3	10	5	250/200
KSR1010	KSR2010	10		40	100	5	1	100	600	10	1	0.1	0.3	10	5	250/200
KSR1011	KSR2011	22		40	100	5	1	100	600	10	1	0.1	0.3	10	5	250/200
KSR1012	KSR2012	47		40	100	5	1	100	600	10	1	0.1	0.3	10	5	250/200
KSR1013	KSR2013	2.2	47	50	100	5	5	68		10	0.5	0.1	0.3	10	5	250/200
KSR1014	KSR2014	4.7	47	50	100	5	5	68		10	0.5	0.1	0.3	10	5	250/200

1.6 JUNCTION FETS

1.6.1 SOT-23 Type J-FET

DEVICE	V_{GDO}	I_G	P_D	I_{DSS}(mA)			g_m(mS)			Condition		V_{GS}(OFF)	
	(V)	(mA)	(mW)	MIN	MAX	V_{DS} (V)	MIN	TYP	V_{DS} (V)	V_{DS} (V)	I_D (μA)	MIN	MAX
KSK123	20	2	200	0.13	0.47	4.5	0.9	1.6	4.5				
KSK211	18	10	200	1	10	10		9	10	10	10	0.4	4

1.6.2 TO-92S Types J-FET

DEVICE	V_{GDO}	I_G	P_D	I_{DSS}(mA)			g_m(mS)			Condition		V_{GS}(OFF)	
	(V)	(mA)	(mW)	MIN	MAX	V_{DS} (V)	MIN	TYP	V_{DS} (V)	V_{DS} (V)	I_D (μA)	MIN	MAX
KSK653	12	2	20	0.04	0.8	4.5	0.3	0.5	4.5				
KSK161	18	10	200	1	10	10		9	10	10	1	0.4	4
KSK596	20	10	100	0.1	0.8	5	0.4	1.2	5	5	1		1.5

1.6.3 TO-92 Type J-FET

DEVICE	V_{GDO}	I_G	P_D	I_{DSS}(mA)			g_m(mS)			Condition		V_{GS}(OFF)	
	(V)	(mA)	(mW)	MIN	MAX	V_{DS} (V)	MIN	TYP	V_{DS} (V)	V_{DS} (V)	I_D (μA)	MIN	MAX
KSK30	50	10	100	0.3	6.5	10	1.2		10	10	0.1	0.4	5
KSK117	50	10	300	0.6	14	10	4	15	10	10	0.1	0.2	1.5

1.6.4 SOT-143 Type MOS FET (Dual Gate)

DEVICE	V_{DS}	I_D	P_D	I_{DSS}(mA)			g_m(mS)		C_{is}(pF)		C_{rs}(pF)		NF(dB)(200MHz)	
	(V)	(mA)	(mW)	MIN	MAX	V_{DS} (V)	MIN	TYP	TYP	MAX	TYP	MAX	TYP	MAX
*KSK5043	15	30	150	0	6	6	13	20	4.25	5.5	0.03	0.05	1.4	2.8
*KSD5044	15	30	150	0	6	6		17	2			0.03	3.2	

*: Under Development

2. POWER TRANSISTORS

2-1. General Purpose Transistors

2.1.1 TO-126 Type Transistors

I_C	V_{CEO}	Device Type		Condition		h_{FE}		Condition		V_{CE}(sat)(V)		Condition		f_T(MHz)		P_C
				V_{CE}	I_C			I_C	I_B			V_{CE}	I_C			
(A)	(V)	NPN	PNP	(V)	(A)	MIN	MAX	(A)	(A)	TYP	MAX	(V)	(A)	MIN	TYP	(W)
0.1	180	KSC2682	KSA1142	5	0.01	100	320	0.05	0.005	0.16	0.5	10	0.02		180	8
	200	KSC3502		10	0.01	40	320	0.02	0.002		0.6	30	0.01		150	5
	300	KSC3503	KSA1386	10	0.01	40	320	0.02	0.002		0.6	30	0.01		150	7
0.2	300	KSC2688		10	0.01	40	250	0.05	0.005		1.5	30	0.01	50	80	10
1.2	120	KSC2690	KSA1220	5	0.3	60	320	1	0.2	0.4	0.7	5	0.2		155	20
	160	KSC2690A	KSA1220A	5	0.3	60	320	1	0.2	0.4	0.7	5	0.2		155	20
3	30	KSD882	KSB772	2	1	60	400	2	0.2	0.3	0.5	5	0.1		80	10
	45	KSD794	KSB744	5	0.5	60	320	1.5	0.15	0.5	2	5	0.1		45	10
	60	KSD794A	KSB744A	5	0.5	60	320	1.5	0.15	0.5	2	5	0.1		45	10
5	60	KSD1691	KSB1151	1	2	100	400	2	0.2	0.1	0.3					20

2.1.2 D-PACK Type Transistors

I_C	V_{CEO}	Device Type		Condition		h_{FE}		Condition		V_{CE}(sat)(V)		Condition		f_T(MHz)		P_C
(A)	(V)	NPN	PNP	V_{CE} (V)	I_C (A)	MIN	MAX	I_C (A)	I_B (A)	TYP	MAX	V_{CE} (V)	I_C (A)	MIN	TYP	(W)
0.5	400	KSC5054		5	0.05	20	80	0.3	0.06		1					10
2	50	KSC3076	KSA1241	2	0.5	70	240	1	0.05		0.5	2	0.5		100	10
	400	KSC3233		5	0.1	20		1	0.2		1					20
3	30	KSC3073	KSA1243	2	0.5	70	240	2	0.2		0.8	2	0.5		100	15
	60	KSD1221	KSB906	5	0.5	60	300	3	0.3	0.4	1	5	0.5		3	20
5	20		KSA1242	2	0.5	100	320	4	0.1		1	2	0.5		180	10
	50	KSC3074	KSA1244	1	1	70	240	3	0.15		0.5	4	1		60	20

2.1.3 TO-220 Type Transistors

I_C	V_{CEO}	Device Type		Condition		h_{FE}		Condition		V_{CE}(sat)(V)		Condition		f_T(MHz)		P_C
(A)	(V)	NPN	PNP	V_{CE} (V)	I_C (A)	MIN	MAX	I_C (A)	I_B (A)	TYP	MAX	V_{CE} (V)	I_C (A)	MIN	TYP	(W)
0.2	300	KSC1507		1	0.01	40	240	0.05	0.005		2	30	0.01	40	80	15
1.5	150	KSC2073	KSA940	10	0.5	40	140	0.5	0.05		1.5	10	0.5	4		25
2	150	KSD401	KSB546	10	0.4	40	240					10	0.4		5	25
3	30	KSC1173	KSA473	5	0.5	70	240	2	0.2	0.3	0.8	2	0.5		100	10
	55	KSD288	KSA614	5	0.5	40	240	1	0.1	0.15	0.5					25
	60	KSD880	KSB834	5	0.5	60	220	3	0.3	0.5		5	0.5		9	30
4	60	KSC2233		5	1	30	150	4	0.4		1	5	0.5		10	40
	80	KSD526	KSB5960	5	0.5	40	240	3	0.3	1	1.7	5	0.5	3		30
5	60	KSD73		10	2	70	240	5	0.5		2	10	0.3		20	30
	70	KSD362		5	5	20	140	5	0.5		1	5	0.5		10	40
	100	KSC2517		5	2	40	200	3	0.3		0.5					30
6	120	KSD363		5	1	40	240	1	0.4		1	5	0.5		10	40
7	60	KSD568	KSB707	1	3	40	200	5	0.5		0.5					40
	80	KSD569	KSB708	1	3	40	200	5	0.5		0.5					40
	100	KSC2334	KSA1010	5	3	40	200	5	0.5		0.6					40

2.1.4 TO-220F Type Transistors

I_C	V_{CEO}	Device Type		Condition		h_{FE}		Condition		V_{CE}(sat)(V)		Condition		f_T(MHz)		P_C
(A)	(V)	NPN	PNP	V_{CE} (V)	I_C (A)	MIN	MAX	I_C (A)	I_B (A)	TYP	MAX	V_{CE} (V)	I_C (A)	MIN	TYP	(W)
1.5	150	KSC3296	KSA1304	10	0.5	40	140	0.5	0.05		1.5	10	0.5		4	20
3	60	KSD1406	KSB1015	3	0.3	60	300	3	0.3		1	5	0.5		9	25
	60	KSD2012	KSB1366	5	0.5	100	320	2	0.2		1	5	0.5		9	25
4	80	KSD1408	KSB1017	5	0.5	40	240	3	0.3		1.5	5	0.5		9	25
5	70	KSD1362	KSA1614	5	5	20	140	5	0.5		1	5	0.5		10	20
7	60	KSD1588	KSB1097	1	3	40	200	5	0.5		0.5					20

2.2 Darlington Transistors

IC	V_{CEO}	Device Type		Condition		h_{FE}			Condition		V_{CE}(sat)(V)		P_C	Package
(A)	(V)	NPN	PNP	V_{CE} (V)	I_C (A)	MIN	TYP	MAX	I_C (A)	I_B (A)	MIN	MAX	(W)	
1.5	60	KSD985	KSB794	2	1	2K		30K	1	0.001		1.5	10	TO-126
	80	KSD986	KSD795	2	1	2K		30K	1	0.001		1.5	10	TO-126
3	40	KSD1222	KSB907	2	1	2K			2	0.004		1.5	15	D-PACK
	60	*KSC1983		4	0.5	500			2	0.05		1	30	TO-220
	60	*KSD1273		4	0.5	500		2.5K	2	0.05		1	40	TO-220F
	60	*KSD1943		4	0.5	400		2K	2	0.05		1.5	30	TO-220
	60	*KSD1944		4	0.5	400		2K	2	0.05		1.5	30	TO-220F
	100	KSD1692	KSB1149	2	1.5	2K		20K	1.5	0.015		1.2	15	TO-126
4	275	KSD5018							3	0.02		1.5	40	TO-220
5	100	KSD560	KSB601	2	3	2K	6K	15K	3	0.003		1.5	30	TO-220
	100	KSD1589	KSB1098	2	3	2K	6K	15K	3	0.003		1.5	30	TO-220F
15	50	*KSC5047		5	5	80			5	0.12		0.5	100	TO-3P

*: high β

2.3 Swtitching Transistors

V_{CEO}	I_C		Condition		h_{FE}		Cond ition		V_{CE}(sat)(V)		Switching Time			P_C	Package
(V)	(A)	(NPN)	V_{CE} (V)	I_C (A)	MIN	MAX	I_C (A)	I_B (A)	TYP	MAX	t_{on} (us)	t_{stg} (us)	t_f (us)	(W)	
400	0.5	KSA1156	5	0.01	30	200	0.1	0.01		1	1	4	1	10	TO-126(PNP)
		KSC2752	5	0.05	30	80	0.3	0.06		1	1	2.5	1	10	TO-126
	2	KSC2333	5	0.1	20	80	0.5	0.1		1	1	2.5	1	15	TO-220
		KSC3569	5	0.1	20	80	0.5	0.1		1	1	2.5	1	15	TO-220F
	5	KSC2518	5	0.5	20	80	2	0.4		1	1	2.5	0.7	40	TD-220
	7	KSC2335	5	1	20	80	3	0.6		1	1	2.5	1	40	TO-220
		KSC3158	5	1	20	80	3	0.6		1	1	2.5	1	40	TO-220F
	10	KSC2749	5	1	15	80	6	1.2		1	1	2.5	0.7	100	TO-3P
	15	KSC2751	5	2	15	80	10	2	0.3	1	1	2.5	0.7	120	TO-3P
500	3	KSC5020	5	0.3	15	50	1.5	0.3		1	0.5	3	0.3	40	TO-220
		KSC5060	5	0.3	15	50	1.5	0.3		1	0.5	3	0.3	40	TO-220
	4	KSC5022	5	0.3	15	50	1.5	0.3		1	0.5	3	0.3	60	TO-3P
	5	KSC5021	5	0.6	15	50	3	0.6		1	0.5	3	0.3	50	TO-220
		KSC5061	5	0.6	15	50	3	0.6		1	0.5	3	0.3	50	TO-220
	7	KSC5023	5	0.6	15	50	3	0.6		1	0.5	3	0.3	80	TO-3P
	10	KSC5024	5	0.8	15	50	4	0.8		1	0.5	3	0.3	90	TO-3P
	15	KSC5025	5	1.2	15	50	6	1.2		1	0.5	3	0.3	100	TO-3P
800	1.5	KSC5026	5	0.1	10	40	0.75	0.15		2	0.5	3	0.3	40	TO-220
	3	KSC5027	5	0.2	10	40	1.5	0.3		2	0.5	3	0.3	50	TO-220
		KSC5028	5	0.2	10	40	1.5	0.3		2	0.5	3	0.3	80	TO-3P
	4.5	KSC5029	5	0.3	10	40	2	0.4		2	0.5	3	0.3	100	TO-3P
	6	KSC5030	5	0.4	10	40	3	0.6		2	0.5	3	0.3	100	TO-3P
	8	KSC5031	5	0.6	10	40	4	0.8		2	0.5	3	0.3	140	TO-3P
	12	KSC3552	5	0.8	10	40	6	1.2		2	0.5	3	0.3	150	TO-3P

2.4 Horizontal Deflection Output Transistors

2.4.1 TO-3P Type Transistors

V_{CBO} (V)	V_{CEO} (V)	I_C (A)	Device (NPN)	Condition V_{CE} (V)	Condition I_C (A)	h_{FE} MIN	h_{FE} MAX	Condition I_C (A)	Condition I_B (A)	V_{CE}(sat)(V) TYP	V_{CE}(sat)(V) MAX	Switching Time t_{on} (us)	Switching Time t_{stg} (us)	Switching Time t_f (us)	P_C (W)	COMMENT
1500	800	2.5	KSD5000	5	0.5	8		2	0.6		8			0.4	80	Built in Damper Diode
		3.5	KSD5001	5	0.5	8		2.5	0.8		8			0.4	80	
		5	KSD5002	5	1	8		4	0.8		8			0.4	120	
		6	KSD5003	5	1	8		5	1		8			0.4	120	
		2.5	KSD5004	5	0.5	8		2	0.6		8			0.4	80	
		3.5	KSD5005	5	0.5	8		2.5	0.8		8			0.4	80	
		5	KSD5006	5	1	8		4	0.8		5			0.4	120	
		6	KSD5007	5	1	8		5	1		5			0.4	120	

2.4.2 TO-3PF Type Transistors

V_{CBO} (V)	V_{CEO} (V)	I_C (A)	Device (NPN)	Condition V_{CE} (V)	Condition I_C (A)	h_{FE} MIN	h_{FE} MAX	Condition I_C (A)	Condition I_B (A)	V_{CE}(sat)(V) TYP	V_{CE}(sat)(V) MAX	Switching Time t_{on} (us)	Switching Time t_{stg} (us)	Switching Time t_f (us)	P_C (W)	COMMENT
1500	800	2.5	KSD5010	5	0.5	8		2	0.6		8			0.4	50	Built in Damper Diode
		3.5	KSD5011	5	0.5	8		2.5	0.8		8			0.4	50	
		5	KSD5012	5	1	8		4	0.8		8			0.4	60	
		6	KSD5013	5	1	8		5	1		8			0.4	60	
		2.5	KSD5014	5	0.5	8		2	0.6		8			0.4	50	
		3.5	KSD5015	5	0.5	8		2.5	0.8		8			0.4	50	
		5	KSD5016	5	1	8		4	0.8		5			0.4	60	
		6	KSD5017	5	1	8		5	1		5			0.4	60	

II. American Type Series

1. Small Signal Transistors
2. Power Transistors

1. SMALL SIGNAL TRANSISTORS

1-1. General Purpose Transistors

1.1.1 SOT-23 Type Transistors

Device and Polarity (Marking)				Condition		h_{FE}		Condition		V_{CE}(sat)	V_{BE}(sat)(V)	Condition		f_T(MHz)	
NPN	PNP	V_{CEO} (V)	I_C (A)	V_{CE} (V)	I_C (mA)	MIN	MAX	I_C (mA)	I_B (mA)	MAX	MAX	V_{CE} (V)	I_C (mA)	MIN	MAX
MMBTA06(1G)	MMBTA56(2G)	80	0.5	1	100	50		100	10	0.25		2	10	100	
	MMBT2907A(2F)	60	0.6	10	150	100	300	500	50	1.6	2.6	20	50	200	
MMBTA05(1H)	MMBTA55(2H)	60	0.5	1	100	50		100	10	0.25		2	10	100	
	MMBA811C5(C5)	45	0.05	3	0.5	135	270	20	2	0.3		6	1	75	
	MMBA811C6(C6)	45	0.05	3	0.5	200	400	20	2	0.3		6	1	75	
	MMBA811C7(C7)	45	0.05	3	0.5	300	600	20	2	0.3		6	1	75	
	MMBA811C8(C8)	45	0.05	3	0.5	450	900	20	2	0.3		6	1	75	
MMBT2222A(1P)		40	0.6	10	150	100	300	500	50	1.6	2.6	20	20	300	
	MMBT2907(2B)	40	0.6	10	150	100	300	500	50	1.6	2.6	20	50	200	
MMBT4401(2X)	MMBT4403(2T)	40	0.6	1	150	100	300	500	50	0.75	1.2	10	10	250	
MMBT3903(1Y)		40	0.2	1	10	50	150	50	5	0.3	0.95	20	10	250	
MMBT3904(1A)	MMBT3906(2A)	40	0.2	1	10	100	300	50	5	0.3	0.95	20	10	300	
MMBC1623L3(L3)	MMBA812M3(M3)	40	0.1	6	1	60	120	30	3	0.5					
MMBC1623L4(L4)	MMBA812M4(M4)	40	0.1	6	1	90	180	30	3	0.5					
MMBC1623L5(L5)	MMBA812M5(M5)	40	0.1	6	1	135	270	30	3	0.5					
MMBC1623L6(L6)	MMBA812M6(M6)	40	0.1	6	1	200	400	30	3	0.5					
MMBC1623L7(L7)	MMBA812M7(M7)	40	0.1	6	1	300	600	30	3	0.5					
MMBTA20(1C)	MMBTA70(2C)	40	0.1	10	5	40	400	10	1	0.25		10	5	125	
MMBC1622D6(D6)		35	0.1	3	0.5	200	400	100	10	0.3		6	1	100	
MMBC1622D7(D7)		35	0.1	3	0.5	300	600	100	10	0.3		6	1	100	
MMBC1622D8(D8)		35	0.1	3	0.5	450	900	100	10	0.3		6	1	100	
MMBT2222(1B)		30	0.6	10	150	100	300	500	50	1.6	2.6	20	20	200	
MMBT4123(5B)	MMBT4125(ZD)	30	0.2	1	2	50	150	50	5	0.3	0.95	20	10	250	
MMBT4124(ZC)	MMBT4126(C3)	25	0.2	1	2	120	360	50	5	0.3	0.95	20	10	300	
MMBC1009F1(F1)		25	0.05	3	0.5	30	60	10	1	0.3		6	1	150	
MMBC1009F2(F2)		25	0.05	3	0.5	40	80	10	1	0.3		6	1	150	
MMBC1009F3(F3)		25	0.05	3	0.5	60	120	10	1	0.3		6	1	150	
MMBC1009F4(F4)		25	0.05	3	0.5	90	180	10	1	0.3		6	1	150	
MMBC1009F5(F5)		25	0.05	3	0.5	135	270	10	1	0.3		6	1	150	

1.1.2 TO-92 Type Transistors

Device and Polarity				Condition		h_{FE}		Condition		V_{CE}(sat)	V_{BE}(sat)(V)	Condition		f_T(MHz)	
NPN	PNP	V_{CEO} (V)	I_C (A)	V_{CE} (V)	I_C (mA)	MIN	MAX	I_C (mA)	I_B (mA)	MAX	MAX	V_{CE} (V)	I_C (mA)	MIN	MAX
2N4400	2N4402	40	0.6	1	150	50	150	500	50	0.75	1.2	10	20	200	
2N4401	2N4403	40	0.6	1	150	100	300	500	50	0.75	1.2	10	20	200	
2N3903	2N3905	40	0.2	1	10	50	150	50	5	0.3	0.95	20	10	250	
2N3904	2N3906	40	0.2	1	10	100	300	50	5	0.3	0.95	20	10	300	
MPS8099	MPS8599	80	0.5	5	1	100	300	100	10	0.3		5	10	150	
MPSA06	MPSA56	80	0.5	1	100	50		100	10	0.25		2	10	100	
MPS8098	MPS8598	60	0.5	5	1	100	300	100	10	0.3		5	10	150	
MPSA05	MPSA55	60	0.5	5	100	50		100	10	0.25		2	10	100	
MPS6602		40	1	1	500	50		1000	100	0.6		10	50	100	
MPS2222A	MPS2907	40	0.6	10	150	100	300	500	50	1.6	2.6	20	20	300	
MPS6513	MPS6517	40	0.1	10	2	90	180	50	5	0.5					
MPSA10		40	0.1	10	5	40	400					10	5	125	
MPSA20	MPSA70	40	0.1	10	5	40	400					10	5	125	
MPS2222		30	0.6	10	150	100	300	500	50	1.6	2.6	20	20	250	
MPS3704		30	0.6	2	50	100	300	100	5	0.6		2	50	100	
MPS3705	MPS3703	30	0.6	2	50	30	150	50	5	0.25		5	50	100	
MPS6601	MPS6651	25	1	1	500	50		1000	100	0.6		10	50	100	
	MPS3702	25	0.6	5	50	60	300	50	5	0.25		5	50	100	
MPS6560	MPS6562	25	0.5	1	500	50	200	500	50	0.5		10	10	60	
MPS5172		25	0.1	10	10	100	500	10	1	0.25		5	2		120

1.2 Low Noise Transistors

1.2.1 SOT-23 Type Transistors

Device and Polarity (Marking)		NF(dB)				Condition		h_{FE}		Condition		V_{CE}(sat)
NPN	PNP	MAX	Condition Frequency	V_{CEO} (V)	I_C (A)	V_{CE} (V)	I_C (mA)	MIN	MAX	I_C (mA)	I_B (mA)	(V) MAX
MMBT6428(1K)		4	Audio	50	0.2	5	0.1	250	650	100	5	0.6
MMBT6429(1L)		4	Audio	45	0.2	5	0.1	500	1250	100	5	0.6
MMBT2484(1U)		3	Audio	60	0.05	5	1	250		1	0.1	0.35
	MMBT5086(2P)	3	Audio	50	0.05	5	0.1	150	500	10	1	0.3
MMBT5088(1Q)		3	Audio	30	0.05	5	0.1	300	900	10	1	0.5
	MMBY5087(2Q)	2	Audio	50	0.05	5	0.1	250	800	10	1	0.3
MMBT5089(1R)		2	Audio	25	0.05	5	0.1	400	1200	10	1	0.5

1.2.2 TO-92 Type Transistors

Device and Polarity		NF(dB)				Condition		h_{FE}		Condition		V_{CE}(sat)
NPN	PNP	MAX	Condition Frequency	V_{CEO} (V)	I_C (A)	V_{CE} (V)	I_C (mA)	MIN	MAX	I_C (mA)	I_B (mA)	(V) MAX
2N6428		6	Audio	50	0.2	5	0.1	250	650	100	5	0.6
2N4123		6	Audio	30	0.2	1	2	50	150	50	5	0.3
	2N4125	5	Audio	30	0.2	1	2	50	150	50	5	0.4
2N4124		5	Audio	25	0.2	1	2	120	360	50	5	0.3
	2N4126	4	Audio	25	0.2	1	2	120	360	50	5	0.4
	2N5086	3	Audio	50	0.05	5	0.1	150	500	10	1	0.3
2N5088		3	Audio	30	0.05	5	0.1	300	900	10	1	0.5
	2N5087	2	Audio	50	0.05	5	0.1	250	800	10	1	0.3
2N5089		2	Audio	25	0.05	5	0.1	400	1200	10	1	0.5
2N5209		*2	Audio	50	0.05	5	0.1	100	300	10	1	0.7
2N5210		*2	Audio	50	0.05	5	0.1	200	600	10	1	0.7
2N6428A		*4	Audio	50	0.2	5	0.1	250	650	100	5	0.6
	MPS4249	3	Audio	60		5	0.1	100	300	10	0.5	0.25
	MPS6522	3	Audio	25	0.1	10	2	200	400	50	5	0.5
MPS6520		3	Audio	25	0.1	10	2	200	400	50	5	0.5
	MPS6523	3	Audio	25	0.1	10	2	300	600	50	5	0.5
MPS6521		3	Audio	25	0.1	10	2	300	600	50	5	0.5
	MPS4250A	2	Audio	60		5	0.1	250	700	10	0.5	0.25
	MPS4250	2	Audio	40		5	0.1	250	700	10	0.5	0.25

Audio=10Hz to 15.7KHz, *=Max, **=Noise Level

1.3. RF/VHF/UHF Amplifier Transistors

1.3.1 SOT-23 Type Transistors

Device (Marking) NPN	Condition		f_T(MHz)		Cob	V_{CEO}	Gpe	Condition		h_{FE}		NF(dB)		Iagc Condition	
	V_{CE} (V)	I_C (mA)	MIN	TYP	(pF) MAX	(V)	(dB) MIN	V_{CE} (V)	I_C (mA)	MIN	MAX	MAX	Condition f(MHz)	(mA) MAX	Reduction (dB)
MMBR5179(7H)	6	5	900	2000	@1	12	15	1	3	25	250	4.5	200		
MMBTH10(3E)	10	4	650		@0.7	25		10	4	60					
MMBTH24(3A)	10	8	400	620	@0.36	30	$19	10	8	30					

*=TYP, #Cre, @=Ccb, $=Gce, &=Gcb

1.3.3 TO-92 Type Transistors

Device (Marking) NPN	Condition V_{CE} (V)	Condition I_C (mA)	f_T(MHz) MIN	f_T(MHz) TYP	Cob (pF) MAX	V_{CEO} (V)	Gpe (dB) MIN	Condition V_{CE} (V)	Condition I_C (mA)	h_{FE} MIN	h_{FE} MAX	NF(dB) MAX	NF(dB) Condition f(MHz)	Iagc Condition Gain (mA) MAX	Iagc Condition Gain Reduction (dB)
MPS5179	6	5	900	2000	@1	12	15	1	3	25	250	4.5	200		
MPSH17	10	5	800		@0.9	15	*24	10	5	25	250	6	200		
MPSH11	10	4	650		@0.7	25		10	4	60					
MPSH10	10	4	650		@0.7	25		10	4	60					
MPSH24	10	8	400	620	@0.36	30	$19	10	8	30					
MPSH20	10	4	400	620	@0.65	30	$18	10	4	25					

*=TYP, #=Cre, @=Ccb, $=Gce.

1.4 High Voltage Transistors

1.4.1 SOT-23 Type Transistors

Device and Polarity NPN	Device and Polarity PNP	V_{CEO} (V)	I_C (A)	Condition V_{CE} (V)	Condition I_C (mA)	h_{FE} MIN	h_{FE} MAX	Condition I_C (mA)	Condition I_B (mA)	V_{CE}(sat), V_{BE}(sat)(V) MAX	V_{CE}(sat), V_{BE}(sat)(V) MAX	Conition V_{CE} (V)	Conition I_C (mA)	f_T(MHz) MIN	f_T(MHz) TYP
MMBTA42(1D)	MMBTA92(2D)	300	0.5	10	30	40		20	2	0.5	0.9	20	10	50	
MMBTA43(1E)	MMBTA93(2E)	200	0.5	10	30	40		20	2	0.5	0.9	20	10	50	
	MMBT5401(2L)	150	0.5	5	10	60	240	50	5	0.5	1	10	10	100	
MMBT5550(1F)		140	0.6	5	10	60	250	50	5	0.25	1.2	10	10	100	

1.4.2 TO-92 Type Transistors

Device and Polarity NPN	Device and Polarity PNP	V_{CEO} (V)	I_C (A)	Condition V_{CE} (V)	Condition I_C (mA)	h_{FE} MIN	h_{FE} MAX	Condition I_C (mA)	Condition I_B (mA)	V_{CE}(sat), V_{BE}(sat)(V) MAX	V_{CE}(sat), V_{BE}(sat)(V) MAX	Conition V_{CE} (V)	Conition I_C (mA)	f_T(MHz) MIN	f_T(MHz) TYP
2N6517	2N6520	350	0.5	10	30	30	200	30	3	0.5	0.9	20	10	40	
2N6516	2N6519	300	0.5	10	30	45	270	30	3	0.5	0.9	20	10	40	
2N6515	2N6518	250	0.5	10	30	50	300	30	3	0.5	0.9	20	10	40	
2N5551		160	0.6	5	10	80	250	50	6	0.2	1.0	10	10	100	
	2N5401	150	0.6	5	10	60	240	50	5	0.5	1.0	10	10	100	
2N5550		140	0.6	5	10	60	250	50	5	0.25	1.2	10	10	100	
	2N5400	120	0.6	5	10	40	180	50	5	0.5	1.0	10	10	100	
MPSA44		400	0.3	10	10	50	200	10	1	0.5	0.75				
MPSA45		350	0.3	10	10	50	200	10	1	0.5	0.75				
MPSA42	MPSA92	300	0.5	10	30	40		20	2	0.5	0.9	20	10	50	
MPSA43	MPSA93	200	0.5	10	30	40		20	2	0.5	0.9	20	10	50	
MPSL01		120	0.05	6	1	200	800	10	1	0.3		6	1	50	100
	MPSL51	100	0.6	5	50	40	250	50	5	0.3	1.2	10	10	50	

1.5 Darlington Transistors

1.5.1 SOT-23 Type Transistors

Device and Polarity NPN	Device and Polarity PNP	V_{CBO} (V)	I_C (A)	Condition V_{CE} (V)	Condition I_C (mA)	h_{FE} MIN	h_{FE} MAX	Condition I_C (mA)	Condition I_B (mA)	V_{CE}(sat), V_{BE}(sat)(V) MAX	V_{CE}(sat), V_{BE}(sat)(V) MAX	Conition V_{CE} (V)	Conition I_C (mA)	f_T(MHz) MIN	f_T(MHz) TYP
MMBT6427(1V)		40	0.5	5	100	20K	200K	500	0.5	1.5	2				
MMBTA13(1M)		30	0.3	5	100	10K		100	0.1	1.5		5	10	125	
MMBTA14(1N)		30	0.3	5	100	10K		100	0.1	1.5		5	10	125	
	MMBTA63(2U)	30	0.5	5	100	10K		100	0.1	1.5	5	10	125		
	MMBTA64(2V)	30	0.5	5	100	10K		100	0.1	1.5	5	10	125		

*: V_{CEO}

1.5.2 TO-92 Type Transistors

Device and Polarity				Condition		h_{FE}		Condition		$V_{CE}(sat)$, $V_{BE}(sat)$(V)		Conition		f_T(MHz)	
NPN	PNP	V_{CEO} (V)	I_C (A)	V_{CE} (V)	I_C (mA)	MIN	MAX	I_C (mA)	I_B (mA)	MAX	MAX	V_{CE} (V)	I_C (mA)	MIN	TYP
MPSA27		60	0.5	5	100	10K		100	0.1	1.5					
	MPSA77	60	0.5	5	100	10K		100	0.1	1.5					
MPSA26		50	0.5	5	100	10K		100	0.1	1.5					
	MPSA76	50	0.5	5	100	10K		100	0.1	1.5					
2N6427		40	0.5	5	100	10K	200K	500	0.5	1.5	2				
	MPSA75	40	0.5	5	100	10K		100	0.1	1.5					
MPSA25		40	0.5	5	100	10K		100	0.1	1.5					
MPSA14	MPSA64	30	0.5	5	100	10K		100	0.1	1.5		5	10	125	
MPSA13	MPSA63	30	0.5	5	100	20K		100	0.1	1.5		5	10	125	
MPSA12	MPSA62	20	0.5	5	10	20K		10	0.01	1					

2. POWER TRANSISTORS

2.1.1 TO-126 Type Transistors

I_C	V_{CEO}	Device Type		Condition		h_{FE}		Condition		$V_{CE}(sat)$(V)		Condition		f_T(MHz)		P_C
(A)	(V)	NPN	PNP	V_{CE} (V)	I_C (A)	MIN	MAX	I_C (A)	I_B (A)	TYP	MAX	V_{CE} (V)	I_C (A)	MIN	TYP	(W)
0.5	300	MJE340	MJE350	10	0.05	30	240									20
3	40	MJE180	MJE170	1	0.1	50	250	3	0.6		1.7	10	0.1	50		12.5
	60	MJE181	MJE171	1	0.1	50	250	3	0.6		1.7	10	0.1	50		12.5
	80	MJE182	MJE172	1	0.1	50	250	3	0.6		1.7	10	0.1	50		12.5
5	25	MJE200	MJE210	1	2	45	180	2	0.2		0.75	10	0.1	65		15

2.1.2 D-PACK Type Transistors

I_C	V_{CEO}	Device Type		Condition		h_{FE}		Condition		$V_{CE}(sat)$(V)		Condition		f_T(MHz)		P_C
(A)	(V)	NPN	PNP	V_{CE} (V)	I_C (A)	MIN	MAX	I_C (A)	I_B (A)	TYP	MAX	V_{CE} (V)	I_C (A)	MIN	TYP	(W)
0.5	300	MJD340	MJD350	10	0.05	30	340									
1	40	MJD29	MJD30	4	1	15	75	1	0.125		0.8	10	0.2		3	15
	100	MJD29C	MJD30C	4	1	15	75	1	0.125		0.7	10	0.2		3	15
	250	MJD47		10	0.3	30	150	1	0.2		1	10	0.2		10	15
	400	MJD50		10	0.3	30	150	1	0.2		1	10	0.2		10	15
3	40	MJD31	MJD32	4	3	10	50	3	0.375		1.2	10	0.5		3	15
	100	MJD31C	MJD32C	4	3	10	50	3	0.375		1.2	10	0.5		3	15
5	25	MJD200	MJD210	1	2	45	180	2	0.2		0.75	10	0.1	65		12.5
6	100	MJD41C	MJD42C	4	3	15	75	6	0.6		1.5	1.0	0.5		3	20
8	80	MJD44H11	MJD45H11	1	2	60		8	0.4		1	10	0.5		50	20
10	60	MJD3055	MJD2955	4	4	20	100	4	0.4		1.1	10	0.5	2		20

2.1.3 TO-220 Type Transistors

I_C	V_{CEO}	Device Type		Condition		h_{FE}		Condition		$V_{CE}(sat)$(V)		Condition		f_T(MHz)		P_C
(A)	(V)	NPN	PNP	V_{CE} (V)	I_C (A)	MIN	MAX	I_C (A)	I_B (A)	TYP	MAX	V_{CE} (V)	I_C (A)	MIN	TYP	(W)
1	40	TIP29	TIP30	4	1	15	75	1	0.125		0.7	10	0.2	3		30
	60	TIP29A	TIP30A	4	1	15	75	1	0.125		0.7	10	0.2	3		30
	80	TIP29B	TIP30B	4	1	15	75	1	0.125		0.7	10	0.2	3		30
	80	TIP29B	TIP30B	4	1	15	75	1	0.125		0.7	10	0.2	3		30
	100	TIP29C	TIP30C	4	1	15	75	1	0.125		0.7	10	0.2	3		30
	250	TIP47		10	0.3	30	150	1	0.2		0.1	10	0.2	10		40
	300	TIP48		10	0.3	30	150	1	0.2		0.1	10	0.2	10		40
	400	TIP50		10	0.3	30	150	1	0.2		0.1	10	0.2	10		40

2.1.3 TO-220 Type Transistors

I_C	V_{CEO}	Device Type		Condition		h_{FE}			Condition		V_{CE}(sat)(V)		Condition		f_T(MHz)		P_C
(A)	(V)	NPN	PNP	V_{CE} (V)	I_C (A)	MIN	MAX		I_C (A)	I_B (A)	TYP	MAX	V_{CE} (V)	I_C (A)	MIN	TYP	(W)
3	40	TIP31	TIP32	4	3	10	50		3	0.375		1.2	10	0.5	3		40
	60	TIP31A	TIP32A	4	3	10	50		3	0.375		1.2	10	0.5	3		40
	80	TIP31B	TIP32B	4	3	10	50		3	0.375		1.2	10	0.5	3		40
	100	TIP31C	TIP32C	4	3	10	50		3	0.375		1.2	10	0.5	3		40
6	40	TIP41	TIP42	4	3	15	75		6	0.6		1.5	10	0.5	3		65
	60	TIP41A	TIP42A	4	3	15	75		6	0.6		1.5	10	0.5	3		65
	80	TIP41B	TIP42B	4	3	15	75		6	0.6		1.5	10	0.5	3		65
	100	TIP41C	TIP42C	4	3	15	75		6	0.6		1.5	10	0.5	3		65
10	60	MJE3055T	MJE2955T	4	4	20	100		4	0.4		1.1	10	0.5	2		75
	80	D44H	D45H	1	2	60			8	0.4		1	10	0.5		40	50

2.2 Darlington Transistors

IC	V_{CEO}	Device Type		Condition		h_{FE}			Condition		V_{CE}(sat)(V)		P_C	Package
(A)	(V)	NPN	PNP	V_{CE} (V)	I_C (A)	MIN	TYP	MAX	I_C (A)	I_B (A)	MIN	MAX	(W)	
2	60	TIP110	TIP115	4	2	500			2	0.008		2.5	50	TO-220
	80	TIP111	TIP116	4	2	500			2	0.008		2.5	50	TO-220
	100	TIP112	TIP117	4	2	500			2	0.008		2.5	50	TO-220
	100	MJD112	MJD117	3	2	1K		12K	2	0.008		2	20	D-PACK
4	60	MJE800	MJE700	3	1.5	750			1.5	0.03		2.5	40	TO-126
	60	MJE801	MJE701	3	2	750			2	0.04		2.8	40	TO-126
	80	MJE802	MJE702	3	1.5	750			1.5	0.03		2.5	40	TO-126
	80	MJE803	MJE703	3	2	750			2	0.04		2.8	40	TO-126
5	60	TIP120	TIP125	3	3	1K			3	0.012		2	65	TO-220
	80	TIP121	TIP126	3	3	1K			3	0.012		2	65	TO-220
	100	TIP122	TIP127	3	3	1K			3	0.012		2	65	TO-220
8	6	TIP100	TIP105	4	3	1K		20K	3	0.006		2	80	TO-220
	80	TIP101	TIP106	4	3	1K		20K	3	0.006		2	80	TO-220
	100	TIP102	TIP107	4	3	1K		20K	3	0.006		2	80	TO-220
	100	MJD122	MJD127	4	4	1K		12K	4	0.016		2	20	D-PACK
10	60	TIP140	TIP145	4	5	1K			5	0.01		2	125	TO-3P
	60	TIP140T	TIP145T	4	5	1K			5	0.01		2	80	TO-220
	60	TIP140F	TIP145F	4	5	1K			5	0.01		2	60	TO-3PF
	80	TIP141	TIP146	4	5	1K			5	0.01		2	125	TO-3P
	80	TIP141T	TIP146T	4	5	1K			5	0.01		2	80	TO-220
	80	TIP141F	TIP146F	4	5	1K			5	0.01		2	60	TO-3PF
	100	TIP142	TIP147	4	5	1K			5	0.01		2	125	TO-3P
	100	TIP142T	TIP147T	4	5	1K			5	0.01		2	80	TO-220
	100	TIP142F	TIP147F	4	5	1K			5	0.01		2	60	TO-3PF

2.3 Swtitching Transistors

V_{CEO}	I_C		Condition		h_{FE}		Cond ition		V_{CE}(sat)(V)		Switching Time			P_C	Package
(V)	(A)	(NPN)	V_{CE} (V)	I_C (A)	MIN	MAX	I_C (A)	I_B (A)	TYP	MAX	t_{on} (us)	t_{stg} (us)	t_f (us)	(W)	
300	4	MJE13004	5	2	8	40	2	0.5		0.6	0.8	3	0.7	75	TO-220
	8	MJE13006	5	5	5	30	5	1		2	0.8	3	0.7	80	TO-220
	12	MJE13008	5	8	6	30	8	1.6		1.5	0.8	3	0.7	100	TO-220
400	4	MJE13005	5	1	10	60	1	0.2		0.5	0.8	3	0.7	75	TO-220
	8	MJE13007	5	2	8	60	2	0.4		1	0.8	3	0.7	80	TO-220
	12	MJE13009	5	5	8	40	5	1		1	0.8	3	0.7	100	TO-220

NOTES

III. European Type Series

1. Small Signal Transistors.
2. Power Transistors.

1. SMALL SIGNAL TRANSISTORS

1-1. General Purpose Transistors

1.1.1 SOT-23 Type Transistors

Device and Polarity (Marking)				Condition		h_{FE}		Condition		V_{CE}(sat)	V_{BE}(sat)(V)	Condition		f_T(MHz)	
NPN	PNP	V_{CEO} (V)	I_C (A)	V_{CE} (V)	I_C (mA)	MIN	MAX	I_C (mA)	I_B (mA)	MAX	MAX	V_{CE} (V)	I_C (mA)	MIN	MAX
	BCW70(H2)	45	0.1	5	2	215	500	10	0.5	0.3					
BCW71(K1)		45	0.1	5	2	110	220	50	2.5			5	10		300
BCW72(K2)		45	0.1	5	2	100	450	50	2.5			5	10		300
BCX70G(AG)		45	0.1	5	2	120	220	50	1.25	0.55	1.05	5	10	125	
BCX70H(AH)		45	0.1	5	2	180	310	50	1.25	0.55	1.05	5	10	125	
BCX70J(AJ)		45	0.1	5	2	250	460	50	1.25	0.55	1.05	5	10	125	
BCX70K(AK)		45	0.1	5	2	380	630	50	1.25	0.55	1.05	5	10	125	
	BCX71G(BG)	45	0.1	5	2	120	220	50	1.25	0.55	1.05				
	BCX71H(BH)	45	0.1	5	2	180	310	50	1.25	0.55	1.05				
	BCX71J(BJ)	45	0.1	5	2	250	450	50	1.25	0.55	1.05				
	BCX71K(BK)	45	0.1	5	2	380	630	50	1.25	0.55	1.05				
BCW60A(AA)	BCW61A(BA)	32	0.1	5	2	120	220	50	1.25	0.55	1.05	5	10	125	
BCW60B(AB)	BCW61B(BB)	32	0.1	5	2	180	310	50	1.25	0.55	1.05	5	10	125	
BCW60C(AC)	BCW61C(BC)	32	0.1	5	2	250	460	60	1.25	0.55	1.05	5	10	125	
BCW60D(AD)	BCW61D(BD)	32	0.1	5	2	380	630	50	1.25	0.55	1.05	5	10	125	
	BCW29(C1)	20	0.1	5	2	120	260	10	0.5	0.3					
	BCW30(C2)	20	0.1	5	2	215	500	10	0.5	0.3					
BCW31(D1)		20	0.1	5	2	110	220	10	0.5	0.3					
BCW32(D2)		20	0.1	5	2	200	450	10	0.5	0.3					
BCW33(D3)		20	0.1	5	2	420	800	10	0.5	0.3					

TO-92 Type Transistors

Device and Polarity				Condition		h_{FE}		Condition		V_{CE}(sat)	V_{BE}(sat)(V)	Condition		f_T(MHz)	
NPN	PNP	V_{CEO} (V)	I_C (A)	V_{CE} (V)	I_C (mA)	MIN	MAX	I_C (mA)	I_B (mA)	MAX	MAX	V_{CE} (V)	I_C (mA)	MIN	MAX
BC639	BC640	80	1	2	150	40	250	500	50	0.5		5	10		100
BC546	BC556	65	0.1	5	2	110	800	10	0.5	0.25		5	10		300
BC637	BC638	60	1	2	150	40	250	500	50	0.5		5	10		100
BC635	BC636	45	1	2	150	40	250	500	50	0.5		5	10		100
BC237	BC307	45	0.1	5	2	120	800	10	0.5	0.2	0.83	5	10	150	
BC337	BC327	45	0.1	5	2	100	630	500	50	0.7		5	10		100
BC547	BC557	45	0.1	5	2	110	800	10	0.5	0.25		5	10		300
BC550	BC560	45	0.1	5	2	110	800	10	0.5	0.25		5	10		300

2. POWER TRANSISTORS

2.1.1 TO-126 Type Transistors

I_C	V_{CEO}	Device Type		Condition		h_{FE}		Condition		V_{CE}(sat)(V)		Condition		f_T(MHz)		P_C
(A)	(V)	NPN	PNP	V_{CE} (V)	I_C (A)	MIN	MAX	I_C (A)	I_B (A)	TYP	MAX	V_{CE} (V)	I_C (A)	MIN	TYP	(W)
0.5	250	BD157		10	0.05	30	240	0.025		2.5						20
	300	BD158		10	0.05	30	240	0.25	0.025		2.5					20
	350	BD159		10	0.05	30	240	0.25	0.025		2.5					20
1.5	45	BD135	BD136	2	0.15	40	250	0.5	0.05		0.5					13
	60	BD137	BD138	2	0.15	40	250	0.5	0.05		0.5					13
	80	BD139	BD140	2	0.15	40	250	0.5	0.05		0.5					13
2	45	BD375	BD376	2	0.15	40	375	1	0.1		1					25
	45	BD233	BD234	2	1	25		1	0.1		0.6	10	0.25	3		25
	60	BD377	BD378	2	0.15	40	375	1	0.1		1					25
	60	BD235	BD236	2	1	25		1	0.1		0.6	10	0.25	3		25
	80	BD379	BD380	2	0.15	40	375	1	0.1		1					25
	80	BD237	BD238	2	1	25		1	0.1		0.6	10	0.25	3		25
3	45	BD175	BD176	2	0.15	40		1	0.1		0.8	10	0.25	3		30
	60	BD177	BD178	2	0.15	40		1	0.1		0.8	10	0.25	3		30
	80	BD179	BD180	2	0.15	40		1	0.1		0.8	10	0.25	3		30
4	22	BD433	BD434	1	0.5	85		2	0.2		0.5	1	0.25	3		36
	32	BD435	BD436	1	0.5	85		2	0.2		0.5	1	0.2	3		36
	45	BD437	BD438	1	0.5	85		2	0.2		0.6	1	0.25	3		36
	60	BD439	BD440	1	0.5	40		2	0.2		0.8	1	0.25	3		36
	80	BD441	BD442	1	0.5	40		2	0.2		0.8	1	0.25	3		36

2.1.2 TO-220 Type Transistors

I_C	V_{CEO}	Device Type		Condition		h_{FE}		Condition		V_{CE}(sat)(V)		Condition		f_T(MHz)		P_C
(A)	(V)	NPN	PNP	V_{CE} (V)	I_C (A)	MIN	MAX	I_C (A)	I_B (A)	TYP	MAX	V_{CE} (V)	I_C (A)	MIN	TYP	(W)
2	45	BD239	BD240	4	1	15		1	0.1		0.7	10	0.2	3		30
	60	BD239A	BD240A	4	1	15		1	0.1		0.7	10	0.2	3		30
	80	BD239B	BD240B	4	1	15		1	0.1		0.7	10	0.2	3		30
	100	BD239C	BD240C	4	1	15		1	0.1		0.7	10	0.2	3		30
3	45	BD241	BD242	4	3	10		3	0.6		1.2	10	0.5	3		40
	60	BD241A	BD242A	4	3	10		3	0.6		1.2	10	0.5	3		40
	80	BD241B	BD242B	4	3	10		3	0.6		1.2	10	0.5	3		40
	100	BD241C	BD242C	4	3	10		3	0.6		1.2	10	0.5	3		40
6	45	BD243	BD244	4	3	15		6	1		1.5	10	0.5	3		65
	60	BD243A	BD244A	4	3	15		6	1		1.5	10	0.5	3		65
	80	BD243B	BD244B	4	3	15		6	1		1.5	10	0.5	3		65
	100	BD243C	BD244C	4	3	15		6	1		1.5	10	0.5	3		65
7	150	BU407						5	0.5		1	10	0.5	10		60
	150	BU407H						5	0.8		1	10	0.5	10		60
	200	BU406						5	0.5		1	10	0.5	10		60
	200	BU406H						5	0.8		1	10	0.5	10		60
	200	BU408						6	1.2		1	10	0.5	10		60
8	45	BD533	BD534	2	2	30	100	2	0.2		0.8	5	0.5	3		50
	60	BD535	BD536	2	2	30	100	2	0.2		0.8	5	0.5	3		50
	80	BD537	BD538	2	2	30	100	2	0.2		0.8	5	0.5	3		50

2.2 Darlington Transistors

IC	V_{CEO}	Device Type		Condition		h_{FE}			Condition		V_{CE}(sat)(V)		P_C	Package
(A)	(V)	NPN	PNP	V_{CE} (V)	I_C (A)	MIN	TYP	MAX	I_C (A)	I_B (A)	MIN	MAX	(W)	
6	45	BDW23	BDW24	3	2	750		20K	2	0.008		2	50	TO-220
	60	BDW23A	BDW24A	3	2	750		20K	2	0.008		2	50	TO-220
	80	BDW23B	BDW24B	3	2	750		20K	2	0.008		2	50	TO-220
	100	BDW23C	BDW24C	3	2	750		20K	2	0.008		2	50	TO-220
8	45	BDX53	BDM54	3	3	750			3	0.012		2.5	60	TO-220
	60	BDX53A	BDM54A	3	3	750			3	0.012		2.5	60	TO-220
	80	BDX53B	BDM54B	3	3	750			3	0.012		2.5	60	TO-220
	100	BDX53C	BDM54C	3	3	750			3	0.012		2.5	60	TO-220
	150	BU807							5	0.05		1.5	60	TO-220
	200	BU806							5	0.05		1.5	60	TO-220
10	45	BDX33	BDX34	3	4	750			4	0.008		2.5	70	TO-220
	60	BDX33A	BDX34A	3	4	750			4	0.008		2.5	70	TO-220
	80	BDX33B	BDX34B	3	3	750			3	0.006		2.5	70	TO-220
	100	BDX33C	BDX34C	3	3	750			3	0.006		2.5	70	TO-220
12	45	BDX93	BDX94	3	5	754		20K	5	0.02		2	80	TO-220
	60	BDX93A	BDX94A	3	5	754		20K	5	0.02		2	80	TO-220
	60	BDV65	BDV64	4	5	1K			5	0.02		2	125	TO-3P
	80	BDX93B	BDX94B	3	5	754		20K	5	0.02		2	80	TO-220
	80	BDV65A	BDV64A	4	5	1K			5	0.02		2	125	TO-3P
	100	BDX93C	BDX94C	3	5	754		20K	5	0.02		2	80	TO-220
	100	BDV65B	BDV64B	4	5	1K			5	0.02		2	125	TO-3P

2.3 Swtitching Transistors

V_{CEO}	I_C		Condition		h_{FE}		Condition		V_{CE}(sat)(V)		Switching Time			P_C	Package
(V)	(A)	(NPN)	V_{CE} (V)	I_C (A)	MIN	MAX	I_C (A)	I_B (A)	TYP	MAX	t_{on} (us)	t_{stg} (us)	t_f (us)	(W)	
375	5	*BU426	5	0.6		60	2.5	0.5		1.5	0.5	3.5	0.5	113	TO-3P
400	5	*BUT11	5	2	5		3	0.6		1.5	1	4	0.8	100	TO-220
	5	*BUW11	5	2	5		3	0.6		1.5	1	4	0.8	113	TO-3P
	6	*BU426A	5	0.6		60	2.5	0.5		1.5	0.5	3.5	0.5	113	TO-3P
	8	*BUW12	5	3	5		6	1.2		1.5	1	4	0.8	125	TO-3P
	9	*BUV47	5	5	5		9	3		3	0.8	2.5	0.8	120	TO-3P
	15	*BUV48	5	10	5		12	2.4		5	1	3	0.8	100	TO-3P
450	5	**BUT11A	5	2	5		2.5	0.5		1.5	1	4	0.8	100	TO-220
	5	**BUW11A	5	2	5		2.5	0.5		1.5	1	4	0.8	113	TO-3P
	8	**BUW12A	5	3	5		6	1.2		1.5	1	4	0.8	125	TO-3P
	9	**BUV47A	5	5	5		8	2.5		3	0.7	3	0.8	120	TO-3P
	15	**BUV48A	5	10	5		15	3		5	1	3	0.8	150	TO-3P
600	15	***BUV48B	5	10	5		10	4		5	1	3	0.7	150	TO-3P
700	15	***BUV48C	5	10	5		10	4		5	1	3	0.7	150	TO-3P

*: BV_{CES} 850V, **: BV_{CES} 1000V, ***: BV_{CES} 1200V

NOTES

IV. Quick Reference Table

3. QUICK REFERENCE TABLE (APPLICATION)

3.1 Audio Equipment

Application	Package	SOT-23	TO-92	TO-92L	TO-126	TO-220	TO-220F
FM	RM AMP	KSC2223	KSC1674				
	Mix, Conv	KSC2223	KSC1674				
	Local Osc	KSC2223	KSC1674,KSC1675				
	IF	KSC2715	KSC838,KSC1675				
AM	RF	KSC1623	KSC945,KSC815				
	Conv Osc	KSC2715	KSC1675,KSC945				
			KSC838				
	IF	KSC2715	KSC1675,KSC945				
			KSC838				
Diff Amp	10W	KSA812,KSC1623	KSA733,KSC945				
	20W	KSA812,KSC1623	KSA733,KSC945				
	25W	KSA812,KSC1623	KSA733,KSC945				
	30W	KSA812,KSC1623	KSA733,KSC945				
	35W	KSA812,KSC1623	KSA733,KSC945				
	40W		KSA992,KSC1845				
	50W		KSA992,KSC1845				
	60W		KSA991,KSC1845				
	80W		KSA992,KSC1845				
	100W		KSA992,KSC1845				
	150W		KSA992,KSC1845				
Pre Driver	20W		KSA954,KSC2003				
	25W		KSA954,KSC2003				
	30W			KSA910,KSC2310			
	35W			KSA910,KSC2310			
	40W			KSA910,KSC2310			
	50W			KSA910,KSC2310			
	60W			KSA910,KSC2310			
	80W			KSA910,KSC2310			
	100W			KSA910,KSC2310	KSA1112,KSC2668		
	150W				KSA1142,KSC2682		
	20W				KSA1142,KSC2682		
Driver	3W		KSA642,KSD227				
	5W		KSA642,KSD227				
	10W		KSA954,KSC2003				
	20W		KSA954,KSC2003				
	25W		KSA954,KSC2003				
	30W		KSA954,KSC2003				
	40W			KSA916,KSC2316			
	50W			KSA916,KSC2316	KSA1220,KSC2690		
	60W				KSA1220,KSC2690		
	80W				KSA1220A,KSC2690A		
Output	3W			KSA928A,KSC2328A			
	5W				KSB772,KSD882		
	20W				KSB744,KSD794	KSB834,KSD880	
						KSA614,KSD288	KSA1614
	25W					KSB596,KSD526	KSB1015,KSD1406
	30W					TIP41C,TIP42C	KSB1017,KSD1408
	35W					TIP41C,TIP42C	

3.2 Video Equipment

Application			Package	Color TV	B/W TV
Tuner	VHF	RF	SOT-23	KSC2755	KSC2755
			TO-92		KSC1393
		MIX	SOT-23	KSC2756, KSC3123	KSC2756, KSC3123
			TO-92	KSC1393, MPSH24	KSC1394, MPSH24
		UHF	SOT-23	KSC2757, KSC2759, KSC3120, MMBR5179	KSC2757, KSC2759, KSC3120, MMBR5179
			TO-92	KSC1730, MPS5179, MPSH10	KSC1730, MPS5179, MPSH10
	UHF	RF	SOT-23	KSC2758	KSC2758
		MIX	SOT-23	KSC2758	KSC2758
		UHF	SOT-23	KSC2757, KSC2759, KSC3120, MMBR5179	KSC2757, KSC2759, KSC3120, MMBR5179
			TO-92	KSC1730, MPS5179, MPSH10	KSC1730, MPS5179, MPSH10
Video Chroma	Output		TO-92	KSA643, KSA733	KSA733, KSC945
			TO-92L	KSC2330, KSC2340	KSC2330, KSC2340
			TO-126	KSC2688	
			TO-220		KSC1507
Vertical Defelection	OSC		TO-92		KSA733, KSC945
	Driver		TO-92		KSA642, KSA643, KSD227, KSD261
			TO-92L	KSC2310, KSA910	
	Output		TO-92L		KSC2328A, KSA928A
			TO-126	KSA1220A, KSC2690A	KSA1220A, KSC2690A, KSB772, KSD882
			TO-220	KSB546, KSD401, KSA940, KSC2073	KSD880, KSD288, KSA614, KSB834
			TO-220F	KSC3296, KSA1307	KSA1614, KSB1015, KSD1406
Sound	Output		TO-92		KSD261, KSB564, KSB1116, KSA643, KSD471, KSD1616
			TO-92L	KSC2383, KSA1013	KSC2328A, KSA928A
			TO-126	KSA1220A, KSC2690A	
			TO-220	KSB546, KSD401, KSA940, KSC2073	
			TO-220F	KSA1304, KSC3296	
AGC			TO-92	KSC945, KSA733	KSC945, KSA733
Sync Separator			TO-92	KSC945, KSA733	KSC945, KSA733
Horizontal Defelection	OSC		TO-92	KSC945, KSA733	KSC945, KSA733
	Driver		TO-92L	KSC2330, KSC2316, KSA916	
	Output		TO-220		KSD362, KSD73
			TO-220F		KSD1362
			TO-3P	KSD5000, KSD5001, KSD5002, KSD5003, KSD5004, KSD5006, KSD5007	
			TO-3PF	KSD5010, KSD5011, KSD5012, KSD5013, KSD5014, KSD5015, KSD5016, BU508DF, BU508D	
Series Regulator	Error Amp		TO-92		KSA733, KSC945
			TO-92L	KSC2310, KSA910	
	Driver		TO-92		KSA733, KSC945
			TO-92L	KSC2310, KSA910	
	Output		TO-126		KSB772, KSD882
			TO-220	KSD560	KSD288, KSD880, KSB834, KSA614
			TO-220F	KSD1589	KSA1614, KSB1015, KSD1406
Switching Regulator	Driver		TO-92	KSD471A, KSB564A, KSD261, KSA643	KSD471A, KSB564A, KSD261, KSA643
	Output		TO-3P	KSD5006, KSD5007	KSD5006, KSD5007

SOT-23 TYPE

I_C / V_{CEO}	20mA	30mA	50mA	70mA	0.1A	0.2A	0.3A	0.5A	0.6A	0.8A	10mA
12V			MMBR5179	KSC2753							
14V			KSC2734 KSC2759								
15V			KSC3120 KSC2757								
20V	KSC2223	KSC2756	KSC3123		BCW29 33						(12mA) KSK123
25V	KSC2758		KSC3125 MMBT5089 MMBC1009F1-5		MMBTH10	MMBTA4124 MMBTA4126				KSA1298 KSC3265	
30V	KSC2755		KSC2715 MMBT5088		MMBTH24 MMBTA4125	MMBTA4123 MMBTA14	MMBTA13 KSC2859 MMBTA63 MMBTA64	KSA1182	MMBT2222		
32A					BCW60A-D BCW61A-D						
35V					MMBC1622D6-8						
40V					MMBA812M3-7 MMBC1623L3-7 MMBTA20 MMBTA70 KSR1109-12 KSR2109-12	MMBT3903 MMBT3904 MMBT3906		MMBT6427	MMBT2222A MMBT2907 MMBT4401 MMBT4403		
45V			MMBA811C5-8		BCW69-72 BCW70G-Kı BCW71G-K	MMBT6429					
50V			MMBT5086 MMBT5087		KSA812 KSC1623 KSR1101-8 KSR2101-8 KSR1113/4 KSR2113/4	MMBT6428					
60V			MMBT2484					MMBTA05 MMBTA55	MMBT2907A		
80V								MMBTA06 MMBTA56			
140V									MMBT5550		
150V								MMBT5401			
200V								MMBTA43 MMBTA93			
300V								MMBTA42 MMBTA92			

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TO-92S, TO-92 & TO-92L TYPE (V_{CEO}: 12V-60V)

V_{CEO} / I_C	12V	15V	20V	25V	30V	35V	40V	45V	50V	60V
10mA			KSK596							
20mA	KSK65 (2mA)	KSC1395	KSK161(10mA) KSK211(10mA) KSC1674 KSC2786	KSC1070	KSC1393 KSC1394				KSK117 (10mA) KSK30 (10mA)	
25mA			SS9016							
30mA			KSC1187		SS9011 KSC838 KSC2669					
50mA	MPS5179	KSC1730 SS9018		KSA542 KSC184 KSC2787 KSC388 KSC900 2N5089	2N5088 KSC1675			KSC1222	KSA640 2N5087 2N5209 2N5210	2N5086
0.1A		MPSH17		MPS5172 MPS6520 MPS6521 MPS6522 MPS6523 MPSH10 MPSH11	KSC839 KSC921 MPSH20 MPSH24		MPS6513 MPS6517 MPSA10 MPSA20 MPSA70 KSR1009-12 KSR2009-12 KSR1209-12 KSR2209-12	SS9014 SS9015	KSR1201-8 KSR1213/4 KSR2201-8 KSR2213/4 KSR1001-8 KSR2001-8 KSR1013/4 KSR2013/4	
0.15A							MPS4250		KSA1175 KSC2785 KSA733 KSC945	MPS4250A MPS4249
0.2A				2N4124 2N4126	2N4123 2N4125		2N3903 2N3904 2N3905 2N3906 MPS8097	KSA539 KSC815	2N6428 2N6428A	
0.3A				KSC3488 KSA1378 KSA642 KSD227						KSA953 KSC2002
0.5A			MPSA12 MPSA62 KSA643 KSD261 SS9012 SS9013 KSA1150 KSC2710	MPS6560 MPS6562	MPSA13 MPSA14 MPSA63 MPSA64		2N6427 MPSA25 MPSA75		MPSA26 MPSA76	MPS8098 MPS8598 MPSA05 MPSA55 MPSA27 MPSA77
0.6A			MPS3706	MPS3702	MPS2222 MPS3703 MPS3704 MPS3705		2N4400 2N4401 2N4402 2N4403 MPS2222A MPS2907			MPS2907A
0.7A				KSB810 KSB811						KSA708 KSC1008 KSA931 KSC2331

TO-92S, TO-92 & T-92L TYPE (Continued)

V_{CEO} / I_C	12V	15V	20V	25V	30V	35V	40V	45V	50V	60V
0.8A										
1A				KSB564A KSB811 MPS6601 MPS6651	KSD1021 KSD471A		MPS6602		KSB1116 KSD1616	KSB116A KSD1616A
1.5A				SS8050 SS8550						
2A	(10V) KSC2500 KSD5019				KSA928A KSC2328A					
5A			KSD5041							

TO-92S, TO-92 & TO-92L Type (V_{CEO}: 80V-400V)

V_{CEO} / I_C	80V	100V	120V	140V	150V	160V	200V	250V	300V	350V	400V
20mA											
25mA											
30mA											
50mA			KSA992 KSC1845 KSA1174 KSC2874		KSA910 KSC2310						
0.1mA									KSC1506 KSC2330		
0.15A			MPSL01								
0.2A											
0.3A	KSA954 KSC2003									MPSA45	MPSA44
0.5A	MPS8099 MPS8599 MPSA06 MPSA56						MPSA43 MPSA93	2N6515 2N6518	2N6519 MPSA92 2N6516 MPSA42	2N6517 2N6520	KSA1625
0.6A		MPSL51	2N5400	2N5550	2N5551						
0.7A				KSC1009	KSA709						
0.8A			KSA916 KSC2316								
1A						KSA1013 KSC2383					
1.5A											
2A											

D-PACK & TO-126 Type (V_{CEO}: 25V-400V)

V_{CEO} / I_C	20V	25V	30V	40V	45V	50V	60V	80V	100V	120V	150V/160V	180V	220V	250V	300V	400V
0.1A												KSC2682 KSA1142	KSC3602		KSA1381 KSC3503	
0.15A																
0.2A															KSC2688	
0.3A																
0.5A														BD157	MJD340 MJD350 BD158 BD159 MJE340 MJE350	KSC2752 KSA1156 KSC5054
1A				MJD29 MJD30					MJD29C MJD30C							
1.2A										KSC2690 KSA1220	KSC2690A KSA1220A					
1.5A					BD135 BD136		BD138 KSB794 BD137	KSD986 KSB795 BD139 BD140								
2A					BD233 BD378 BD375 BD376	KSA1241 KSC3076	BD377 BD237 BD235 BD236	BD379 BD237 BD238 BD380	MJD112 MJD117		KSD1033 KSB768					KSC3233
3A			KSD882 KSB772 KSC3073 KSA1243	MJE170 MJE180 MJD31 MJD32	KSD794 KSB744 BD175 BD176		KSD794A KSB744A MJE171 MJE181 BD177 BD178 KSD1221 KSB906	MJE172 MJE182 BD179 BD180	KSD1692 KSB1149 MJD31C MJD32C							
4A		BD433 BD434	BD435 BD436		BD437 BD438 BD675 BD675A BD676 BD676A		MJE700 MJE701 BD677 BD677A BD678 BD678A MJE800 MJE801 BD439 BD440	MJE702 MJE703 BD679 BD679A BD680 BD680A MJE802 MJE803 BD441 BD442 KSD1222 KSB907	BD681 BD682	BD683 BD684						
5A	A1242	MJD200 MJD210				KSA1244 KSC3076	KSD1691 KSB1151		MJD122 MJD127							
6A									MJD41C MJD42C							
10A							MJD2955 MJD3055									

TO-220 TYPE

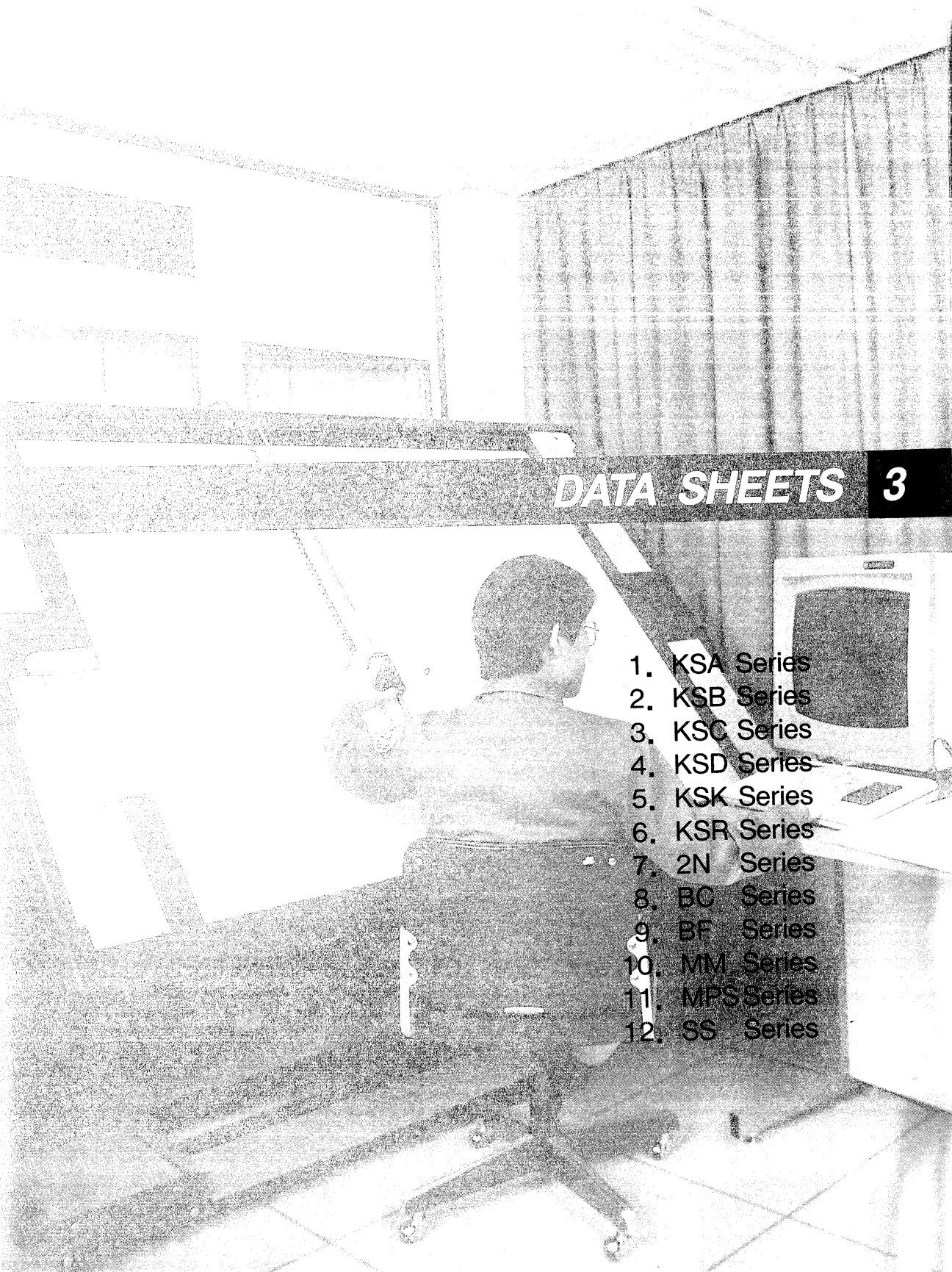
V_{CEO} / I_C	30V	40V	45V	55V	60V	70V	80V	100V	120V	150V	200V	250V	300V	350V	400V	450V	500V	800V
0.2													KSC1507					
1		TIP29 TIP30			TIP29A TIP30A		TIP29B TIP30B	TIP29C TIP30C				TIP47	TIP48	TIP49	TIP50			
1.5										KSC2073 KSA940								KSC5026
2A			BD239 BD240		TIP110 TIP115 BD239A BD240A		TIP111 TIP116 BD239B BD240B	TIP112 TIP117 BD239C BD240C		KSD41 KSB546					KSC2333 BUX84			
3A	KSC1173 KSA473	TIP31 TIP32	BD241 BD242	KSD288 KSA614	TIP31A TIP32A KSD880 KSB834 KSC1983 BD241A BD242A KSC1943		TIP31B TIP32B BD241B BD242B	TIP31C TIP32C BD241C BD242C									KSC5020 KSC5060	KSC5027
4A					KSC2223		KSD526 KSB596						KSD5018 MJE 13004		MJE 13005			
5A					KSD73 TIP120 TIP125	KSD362	TIP121 TIP126	KSC2517 TIP122 TIP127 KSB601 KSD560							KSC2518 BUT11	BUT11A	KSC5021 KSC5061	
6		TIP41 TIP42	BDW23 BDW24 BD243 BD244		TIP41A TIP42A BDW23A BDW24A BD243A BD244A		TIP41B TIP42B BUW23B BUW24B BD243B BD244B	TIP41C TIP42C BD243C BD244C BDW23C BDW24C	KSD363						KSC2335			
7					KSD568 KSB707		KSD569 KSB708	KSC2334 KSA1010		BU407 BU407H	BU406 BU406H BU408							
8			BDX53 BDX54 BD533 BD534		TIP100 TIP105 BDX53A BDX54A BD535 BD536		TIP101 TIP106 BDX53B BDX54B BD537 BD538	TIP102 TIP107 BDX53C BDX54C		BU807	BU806		MJE 5740 MJE 13006	MJE 5741	MJE 5742 MJE 13007			
10			BDX33A BDX34A		MJE3055T MJE2955T TIP140T TIP145T BDX33A BDX34A		TIP141T TIP146T BDX33B BDX34B D44H D45H	TIP142T TIP147T BDX33C BDX34C										
12			BDW93 BDW94		BDW93A BDW94A		BDW93B BDW94B	BDW93C BDW94C					MJE 13008		MJE 13009			

TO-220F TYPE

V_{CEO} / I_C	40V	50V	55V	60V	70V	80V	100V	150V	400V
1.5								C3296 A1304	
2									C3569
3	D1413 B1023		A1614	D1406,D2012 B1015,B1366 D1273, D1944					
4						D1408 B1017			
5					D1362		D1589 B1098		
7		D1417,B1022		D1588 B1097					C3158

TO-3P & TO-3PF TYPE

I_C / V_{CEO}	2.5A	3A	3.5A	4A	4.5A	5A	6A	7A	8A	9A	10A	12A	15A
50													KSC5047
375							BU426						
400						BUW11	BU426A		BUW12	BUV47	KSC2749		KSC2751 BUV48
450						BUT11A BUW11A			BUW12A	BUV47A			BUV48A
500				KSC5022				KSC5023			KSC5024		KSC5025
600													BUV48B
700						BU508A BU508D BU508AF BU508DF							BUW48C
80	KSD5000 KSD5004 KSD5010 KSD5014	KSC5028	KSD5000 KSD5005 KSD5011 KSD5012		KSC5029	KSD5002 KSD5006 KSD5012 KSD5016	KSC5030 KSD5003 KSD5007 KSD5013 KSD5017		KSC5031			KSC3552	



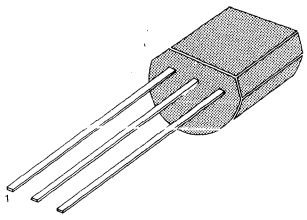
DATA SHEETS 3

1. KSA Series
2. KSB Series
3. KSC Series
4. KSD Series
5. KSK Series
6. KSR Series
7. 2N Series
8. BC Series
9. BF Series
10. MM Series
11. MPS Series
12. SS Series

LOW FREQUENCY AMPLIFIER

- Complement to KSC815
- Collector-Base Voltage $V_{CBO} = -60V$
- Collector Dissipation $P_C = 400mW$

TO-92



1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS ($T_a = 25°C$)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−60	V
Collector-Emitter Voltage	V_{CEO}	−45	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current	I_C	−200	mA
Collector Dissipation	P_C	400	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ 150	°C

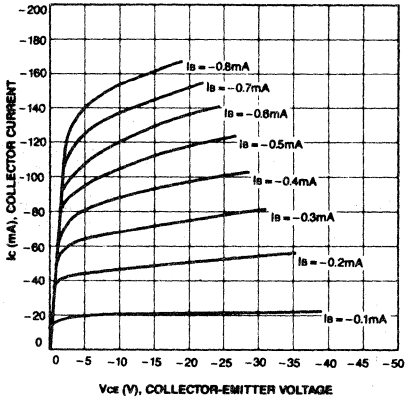
ELECTRICAL CHARACTERISTICS ($T_a = 25°C$)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	$I_C = -100\mu A$, $I_E = 0$	−60			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	$I_C = -10mA$, $I_B = 0$	−45			V
Emitter-Base Breakdown Voltage	BV_{EBO}	$I_E = -10\mu A$, $I_C = 0$	−5			V
Collector Cut-off Current	I_{CBO}	$V_{CB} = -45V$, $I_E = 0$			−100	nA
Emitter Cut-off Current	I_{EBO}	$V_{EB} = -3V$, $I_C = 0$			−100	nA
DC Current Gain	h_{FE}	$V_{CE} = -1V$, $I_C = -50mA$	40		240	
Base-Emitter On Voltage	V_{BE} (on)	$V_{CE} = -1V$, $I_C = -10mA$	−0.60	−0.65	−0.90	V
Collector-Emitter Saturation Voltage	V_{CE} (sat)	$I_C = -150mA$, $I_B = -15mA$		−0.25	−0.5	V
Base-Emitter Saturation Voltage	V_{BE} (sat)	$I_C = -150mA$, $I_B = -15mA$		−0.9	−1.2	V

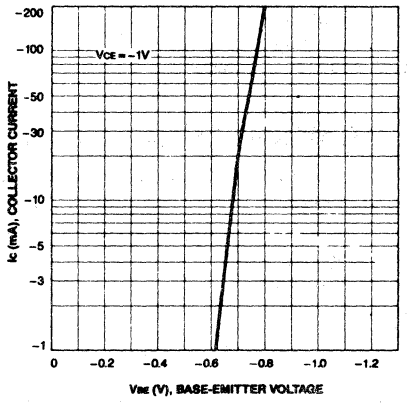
h_{FE} CLASSIFICATION

Classification	R	O	Y
h_{FE}	40-80	70-140	120-240

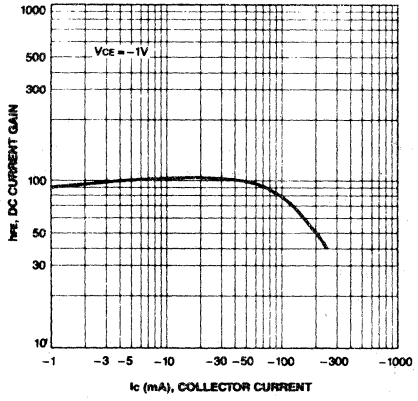
STATIC CHARACTERISTIC



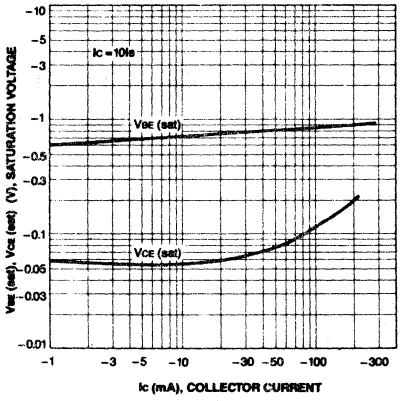
BASE-EMITTER ON VOLTAGE



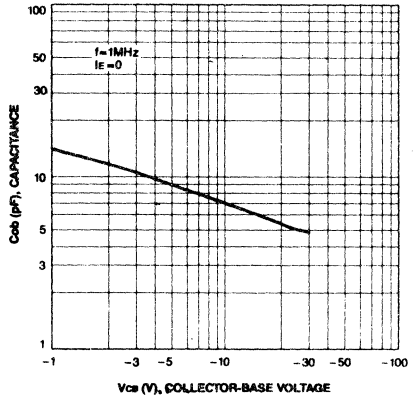
DC CURRENT GAIN



BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



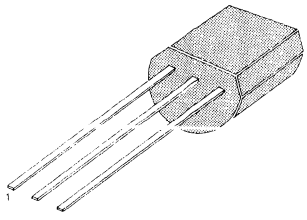
COLLECTOR OUTPUT CAPACITANCE



LOW FREQUENCY AMPLIFIER

- **Collector-Base Voltage $V_{CBO} = -30V$**
- **Low Collector-Emitter Saturation Voltage V_{CE} (sat) = −0.15V (TYP)**
- **Complement to KSC184**

TO-92



1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS ($T_a = 25°C$)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	-30	V
Collector-Emitter Voltage	V_{CEO}	−25	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current	I_C	−50	mA
Collector Dissipation	P_C	250	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ 150	°C

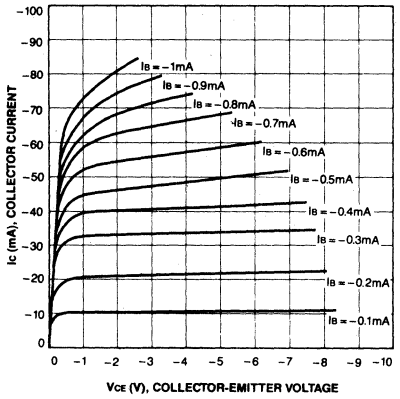
ELECTRICAL CHARACTERISTICS ($T_a = 25°C$)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	$I_C = -100\mu A$, $I_E = 0$	−30			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	$I_C = -10mA$, $I_B = 0$	−25			V
Emitter-Base Breakdown Voltage	BV_{EBO}	$I_E = -10\mu A$, $I_C = 0$	−5			V
Collector Cut-off Current	I_{CBO}	$V_{CB} = -25V$, $I_E = 0$			−100	nA
Emitter Cut-off Current	I_{EBO}	$V_{EB} = -3V$, $I_C = 0$			−100	nA
DC Current Gain	h_{FE}	$V_{CE} = -6V$, $I_C = -1mA$	40		400	
Collector-Emitter Saturation Voltage	V_{CE} (sat)	$I_C = -20mA$, $I_B = -2mA$		−0.15	−0.3	V
Base-Emitter On Voltage	V_{BE} (on)	$V_{CE} = -6V$, $I_C = -1mA$		−0.65	−1.0	V
Current Gain-Bandwidth Product	f_T	$V_{CE} = -6V$, $I_C = -1mA$		100		MHz
Output Capacitance	Cob	$V_{CB} = -6V$, $I_E = 0$ f = 1MHz		2.5		pF

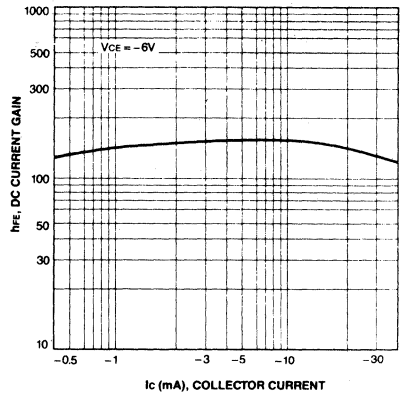
h_{FE} CLASSIFICATION

Classification	R	O	Y	G
h_{FE}	40-80	70-140	120-240	200-400

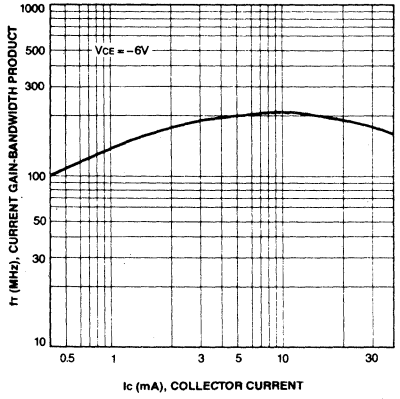
STATIC CHAHACTERISTIC



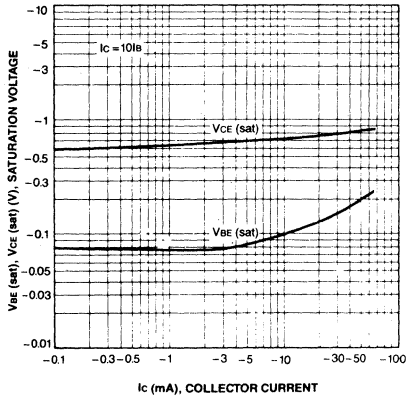
DC CURRENT GAIN



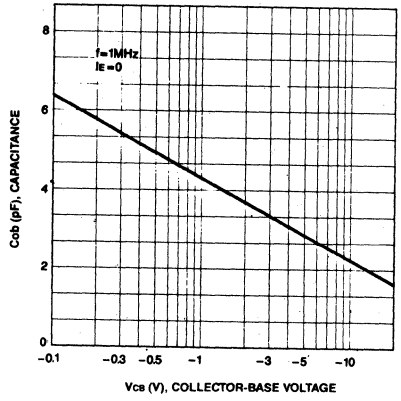
CURRENT GAIN-BANDWIDTH PRODUCT



BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



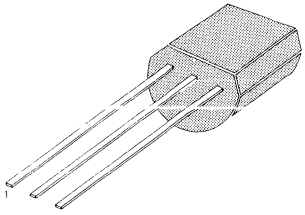
COLLECTOR OUTPUT CAPACITANCE



LOW FREQUENCY POWER AMPLIFIER

- **Complement to KSD227**
- **Collector Dissipation P_C =400mW**

TO-92



1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a =25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−30	V
Collector-Emitter Voltage	V_{CEO}	−25	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current (DC)	I_C (DC)	−300	mA
Collector Current (pulse)	I_C(pulse)*	−500	mA
Collector Dissipation	P_C	400	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ 150	°C

* PW ≤ 10ms, duty cycle ≤ 50%

ELECTRICAL CHARACTERISTICS (T_a =25°C)

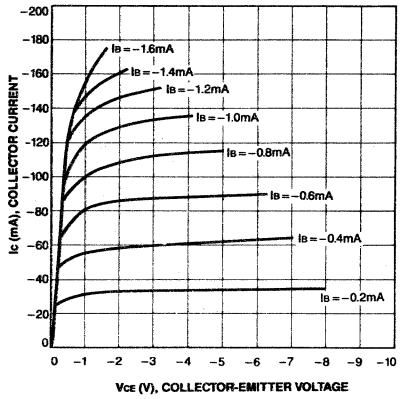
Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C = −100μA, I_E =0	−30			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C = −10mA, I_B =0	−25			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E = −10μA, I_C =0	−5			V
Collector Cut-off Current	I_{CBO}	V_{CB} = −25V, I_E =0			−100	nA
Emitter Cut-off Current	I_{EBO}	V_{EB} = −3V, I_C =0			−100	nA
DC Current Gain	h_{FE}	V_{CE} = −1V, I_C = −50mA*	70		400	
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C = −300mA, I_B = −30mA*		−0.35	−0.6	V

* Pulse Test: PW ≤ 350μs, duty cycle ≤ 2%

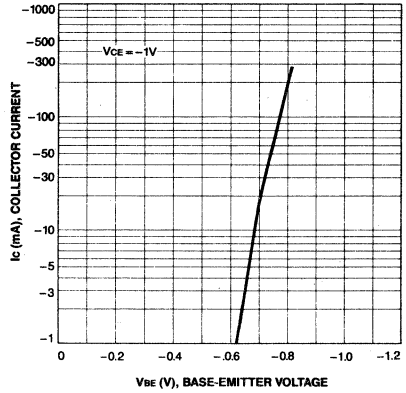
h_{FE} CLASSIFICATION

Classification	O	Y	G
h_{FE}	70-140	120-240	200-400

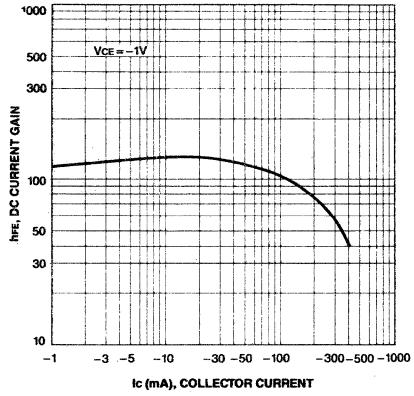
STATIC CHARACTERISTIC



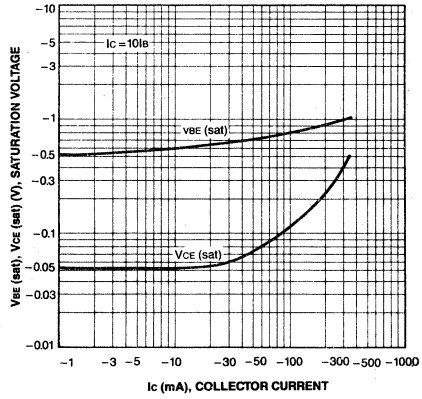
BASE-EMITTER ON VOLTAGE



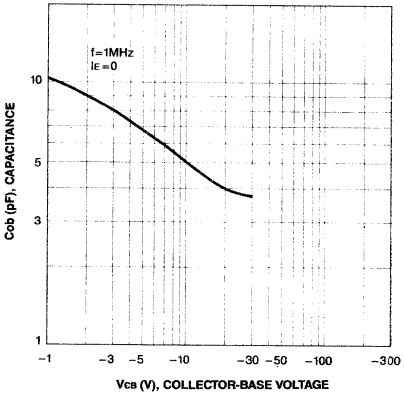
DC CURRENT GAIN



BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



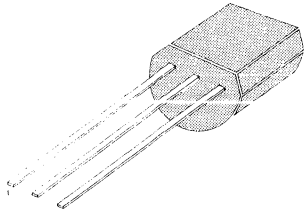
COLLECTOR OUTPUT CAPACITANCE



LOW FREQUENCY POWER AMPLIFIER

- **Complement to KSD261**
- **Collector Dissipation P_C = 500mW**

TO-92



1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a = 25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−40	V
Collector-Emitter Voltage	V_{CEO}	−20	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current (DC)	I_C (DC)	−500	mA
Collector Current (pulse)*	I_C (pulse)*	−700	mA
Collector Dissipaiton	P_C	500	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ 150	°C

* PW ≤ 10mS, duty Cycle ≤ 50%.

ELECTRICAL CHARACTERISTICS (T_a = 25°C)

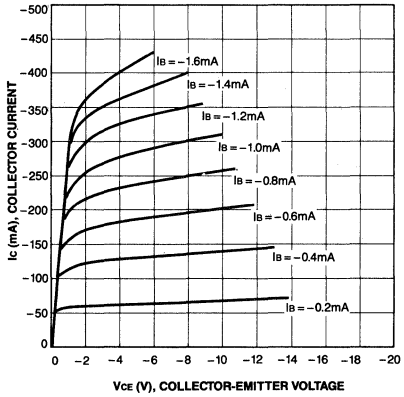
Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C = −100μA, I_E = 0	−40			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C = −10mA, I_B = 0	−20			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E = −100μA, I_C = 0	−5			V
Collector Cut-off Current	I_{CBO}	V_{CB} = −25V, I_E = 0			−200	nA
Emitter Cut-off Current	I_{EBO}	V_{EB} = −3V, I_C = 0			−200	nA
DC Current Gain	h_{FE}	V_{CE} = −1V, I_C = −100mA*	40		400	
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C = −500mA, I_B = −50mA*		−0.3	−0.4	V
Base-Emitter Saturation Voltage	V_{BE} (sat)	I_C = −500mA, I_B = −50mA*		−1.0	−1.3	V

* Pulse Test: PW = 350μs, duty cycle = 2%

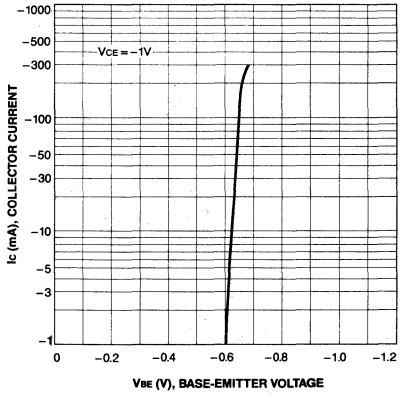
h_{FE} CLASSIFICATION

Classification	R	O	Y	G
h_{FE}	40-80	70-140	120-240	200-400

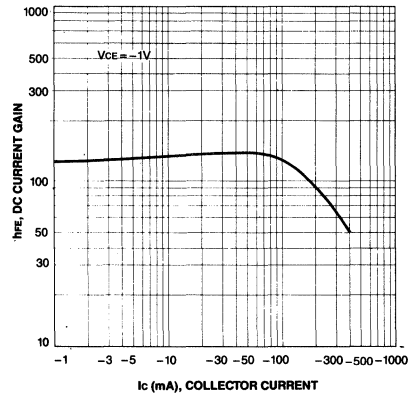
STATIC CHARACTERISTIC



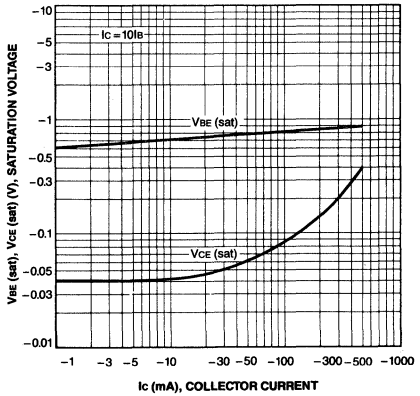
BASE-EMITTER ON VOLTAGE



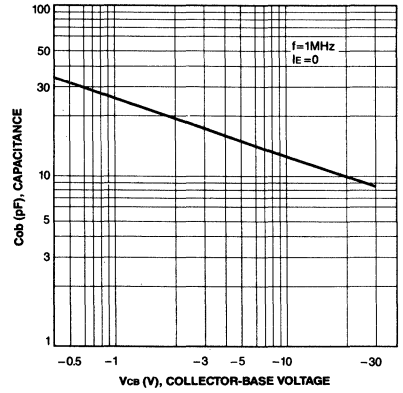
DC CURRENT GAIN



BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



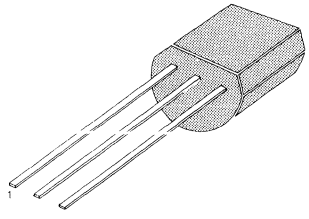
COLLECTOR OUTPUT CAPACITANCE



LOW FREQUENCY AMPLIFIER
MEDIUM SPEED SWITCHING

- **Complement to KSC1008**
- **Collector-Base Voltage $V_{CBO} = -80V$**
- **Collector Dissipation $P_C = 800mW$**

TO-92



1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS ($T_a = 25°C$)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−80	V
Collector-Emitter Voltage	V_{CEO}	−60	V
Emitter-Base Voltage	V_{EBO}	−8	V
Collector Current	I_C	−700	mA
Collector Dissipation	P_C	800	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ 150	°C

ELECTRICAL CHARACTERISTICS ($T_a = 25°C$)

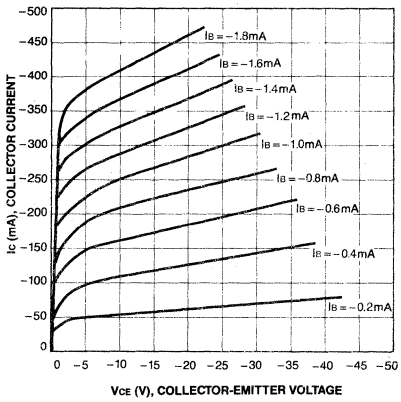
Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	$I_C = -100\mu A$, $I_E = 0$	−80			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	$I_C = -10mA$, $I_B = 0$	−60			V
Emitter-Base Breakdown Voltage	BV_{EBO}	$I_E = -100\mu A$, $I_C = 0$	−8			V
Collector Cut-off Current	I_{CBO}	$V_{CB} = -60V$, $I_E = 0$			−0.1	μA
Emitter Cut-off Current	I_{EBO}	$V_{EB} = -5V$, $I_C = 0$			−0.1	μA
DC Current Gain	h_{FE}	$V_{CE} = -2V$, $I_C = -50mA$*	40		240	
Collector-Emitter Saturation Voltage	V_{CE}(sat)	$I_C = -500mA$, $I_B = -50mA$*		−0.3	−0.7	V
Base-Emitter Saturation Voltage	V_{BE} (sat)	$I_C = -500mA$, $I_C = -50mA$		−0.9	1.1	V
Current-Gain-Bandwidth Product	f_T	$V_{CE} = -10V$, $I_C = -50mA$		50		MHz
Output Capacitance	Cob	$V_{CB} = -10V$, $I_E = 0$ f = 1MHz		13		pF

* Pulse Test: PW ≤ 350μs, duty cycle ≤ 2%

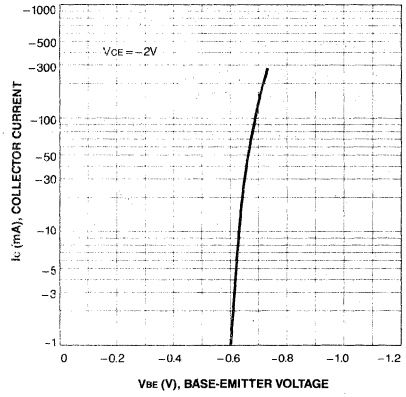
h_{FE} CLASSIFICATION

Classification	R	O	Y
h_{FE}	40-80	70-140	120-240

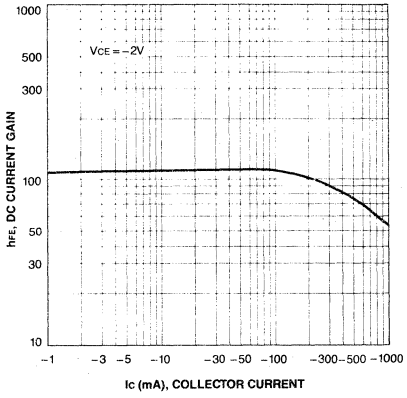
STATIC CHARACTERISTIC



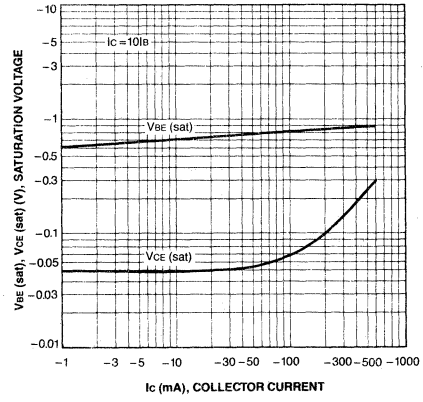
BASE-EMITTER ON VOLTAGE



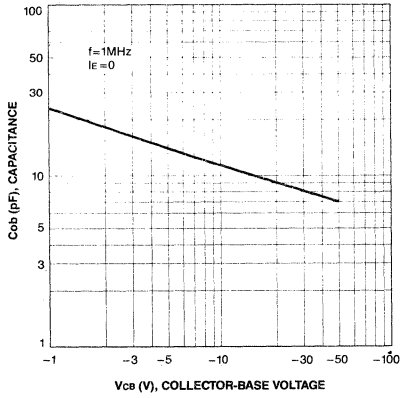
DC CURRENT GAIN



BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



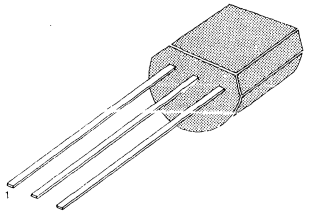
COLLECTOR OUTPUT CAPACITANCE



HIGH VOLTAGE AMPLIFIER

- **Collector-Base Voltage $V_{CBO} = -160V$**
- **Collector Dissipation $P_C = 800mW$**
- **Complement to KSC1009**

TO-92



1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS ($T_a = 25°C$)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−160	V
Collector-Emitter Voltage	V_{CEO}	−150	V
Emitter-Base Voltage	V_{EBO}	−8	V
Collector Current	I_C	−700	mA
Collector Dissipation	P_C	800	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ 150	°C

ELECTRICAL CHARACTERISTICS ($T_a = 25°C$)

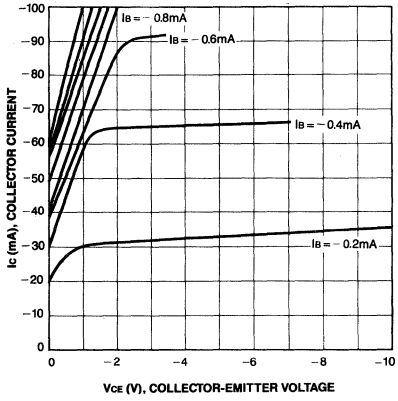
Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	$I_C = -100\mu A$, $I_E = 0$	−160			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	$I_C = -10mA$, $I_B = 0$	−150			V
Emitter-Base Breakdown Voltage	BV_{EBO}	$I_E = -100\mu A$, $I_C = 0$	−8			V
Collector Cut-off Current	I_{CBO}	$V_{CB} = -100V$, $I_E = 0$			−0.1	μA
Emitter Cut-off Current	I_{EBO}	$V_{EB} = -5V$, $I_C = 0$			−0.1	μA
DC Current Gain	h_{FE}	$V_{CE} = -2V$, $I_C = -50mA$*	40		400	
Collector-Emitter Saturation Voltage	$V_{CE}(sat)$	$I_C = -200mA, I_B = -20mA$*		−0.3	−0.4	V
Base-Emitter Saturation Voltage	V_{BE} (sat)	$I_C = -200mA, I_B - 20mA$*		−0.9	−1.0	V
Current Gain-Bandwidth Product	f_T	$V_{CE} = -10V$, $I_C = -50mA$		50		MHz
Output Capacitance	Cob	$V_{CB} = -10V$, $I_E = 0$ f = 1MHz			10	pF

* pulse measured PW ≤ 350μs, duty cycle ≤ 2%

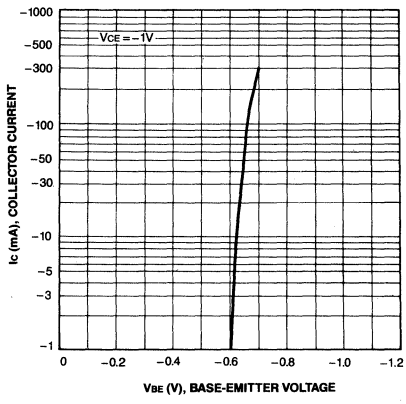
h_{FE} CLASSIFICATION

Classification	R	O	Y	G
h_{FE}	40-80	70-140	120-240	200-400

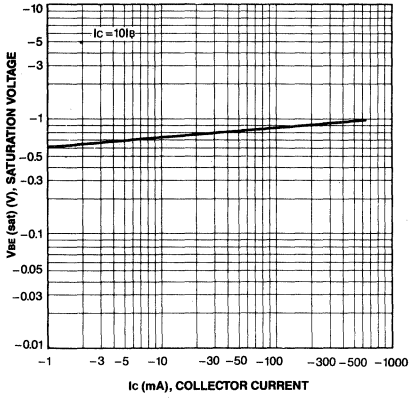
STATIC CHARACTERISTIC



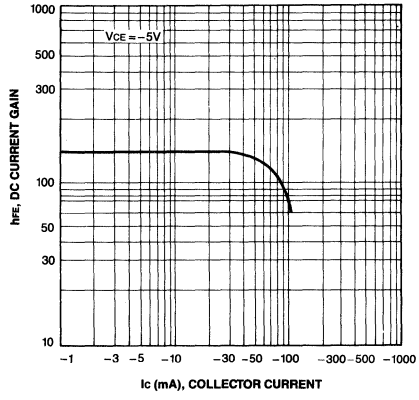
BASE-EMITTER ON VOLTAGE



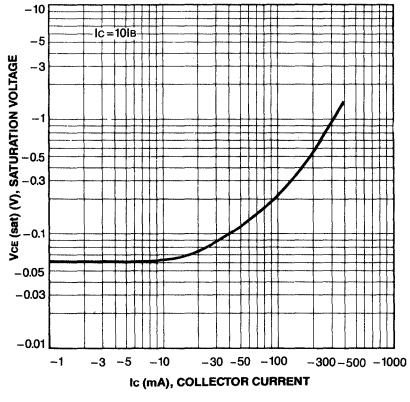
BASE-EMITTER SATURATION VOLTAGE



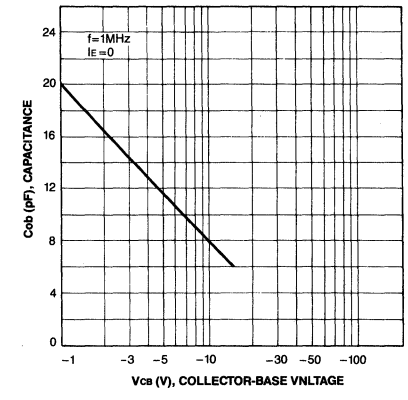
DC CURRENT GAIN



COLLECTOR-EMITTER SATURATION VOLTAGE



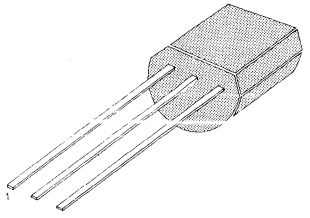
COLLECTOR OUTPUT CAPACITANCE



LOW FREQUENCY AMPLIFIER

- **Complement to KSC945**
- **Collector-Base Voltage $V_{CBO} = -60V$**

TO-92



1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS ($T_a = 25°C$)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−60	V
Collector-Emitter Voltage	V_{CEO}	−50	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current	I_C	−150	mA
Collector Dissipation	P_C	250	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ 150	°C

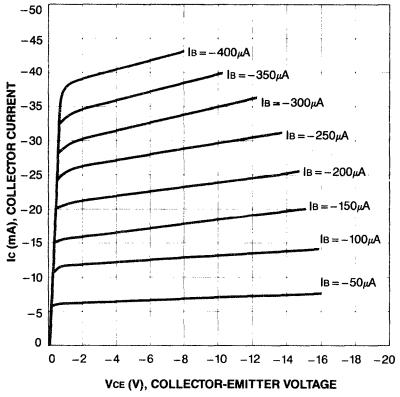
ELECTRICAL CHARACTERISTICS ($T_a = 25°C$)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	$I_C = -100\mu A$, $I_E = 0$	−60			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	$I_C = -10mA$, $I_B = 0$	−50			V
Emitter-Base Breakdown Voltage	BV_{EBO}	$I_E = -10\mu A$, $I_C = 0$	−5			V
Collector Cut-off Current	I_{CBO}	$V_{CB} = -60V$, $I_E = 0$			−0.1	μA
Emitter Cut-off Current	I_{EBO}	$V_{EB} = -5V$, $I_C = 0$			−0.1	μA
DC Current Gain	h_{FE}	$V_{CE} = -6V$, $I_C = -1mA$	40		700	
Collector-Emitter Saturation Voltage	$V_{CE}(sat)$	$I_C = -100mA$, $I_B = -10mA$		−0.18	−0.3	V
Base-Emitter On Voltage	V_{BE} (on)	$V_{CE} = -6V$, $I_C = -1mA$	−0.50	−0.62	−0.80	V
Current-Gain-Bandwidth Product	f_T	$V_{CE} = -6V$, $I_C = -10mA$	50	180		MHz
Output Capacitance	Cob	$V_{CB} = -10V$, $I_E = 0$ f=1MHz		2.8		pF
Noise Figure	NF	$V_{CE} = -6V$, $I_C = -0.3mA$ f=100Hz, $R_S = 10K\Omega$		6.0	20	dB

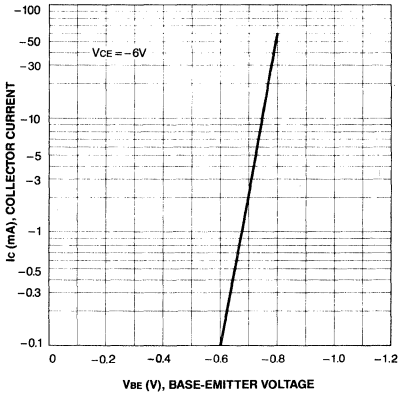
h_{FE} CLASSIFICATION

Classification	R	O	Y	G	L
h_{FE}	40-80	70-140	120-240	200-400	350-700

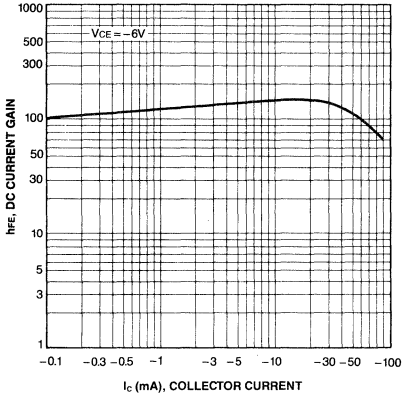
STATIC CHARACTERISTIC



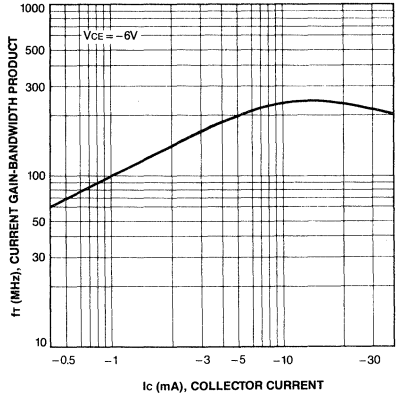
BASE-EMITTER ON VOLTAGE



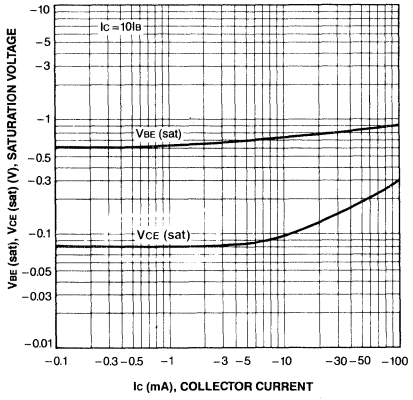
DC CURRENT GAIN



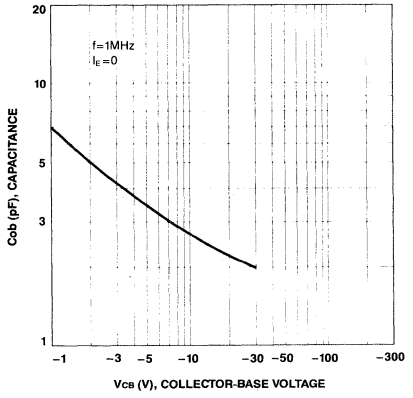
CURRENT GAIN-BANDWIDTH PRODUCT



BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



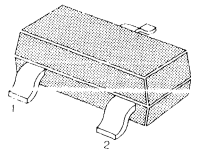
COLLECTOR OUTPUT CAPACITANCE



LOW FREQUENCY AMPLIFIER

- Complement to KSC1623
- Collector-Base Voltage $V_{CBO} = -60V$

SOT-23



1. Base 2. Emitter 3. Collector

ABSOLUTE MAXIMUM RATINGS ($T_a = 25°C$)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−60	V
Collector-Emitter Voltage	V_{CEO}	−50	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current	I_C	−100	mA
Collector Dissipation	P_C	150	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ 150	°C

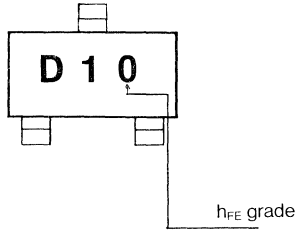
ELECTRICAL CHARACTERISTICS ($T_a = 25°C$)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Cutoff Current	I_{CBO}	$V_{CB} = -60V$, $I_E = 0$			−0.1	μA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = -5V$, $I_C = 0$			−0.1	μA
DC Current Gain	h_{FE}	$V_{CE} = -6V$, $I_C = -1mA$	90	200	600	
Collector-Emitter Saturation Voltage	$V_{CE}(sat)$	$I_C = -100mA$, $I_B = -10mA$		−0.18	−0.3	V
Base-Emitter On Voltage	$V_{BE}(on)$	$I_C = -1mA$, $V_{CE} = -6V$	−0.55	−0.62	−0.65	V
Current Gain-Bandwidth Product	f_T	$I_C = -10mA$, $V_{CE} = -6V$		180		MHz
Output Capacitance	Cob	$V_{CB} = -10V$, $I_E = 0$ f = 1MHz		4.5		pF

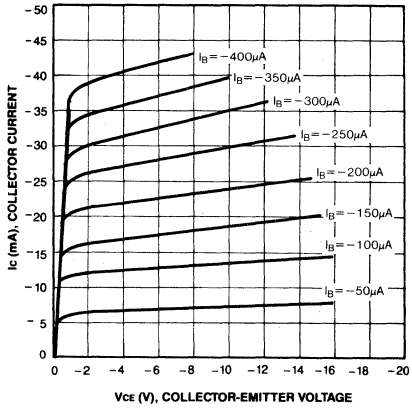
h_{FE} CLASSIFICATION

Classification	O	Y	G	L
h_{FE}	90-180	135-270	200-400	300-600

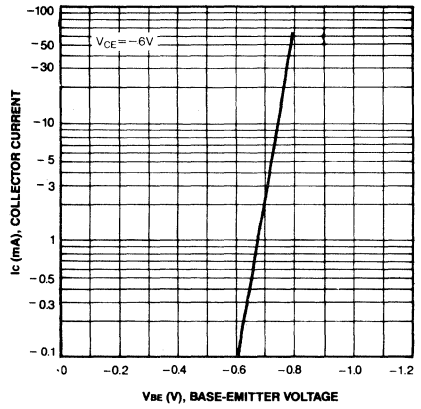
Marking



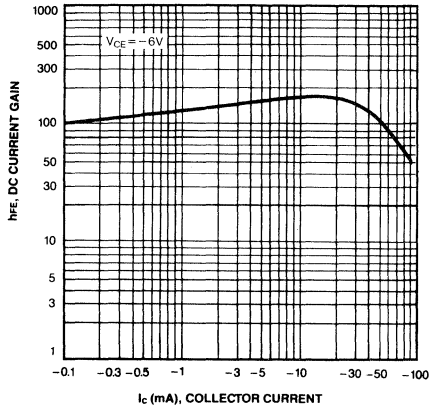
STATIC CHARACTERISTIC



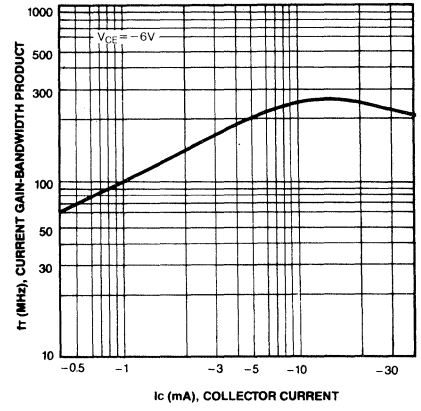
BASE-EMITTER ON VOLTAGE



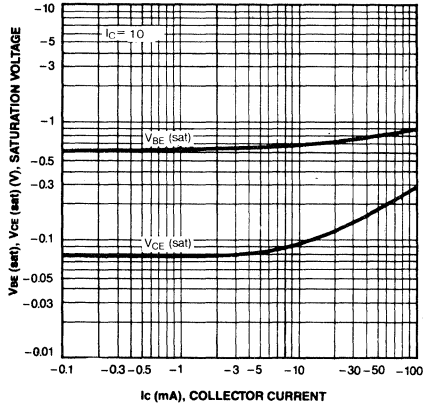
DC CURRENT GAIN



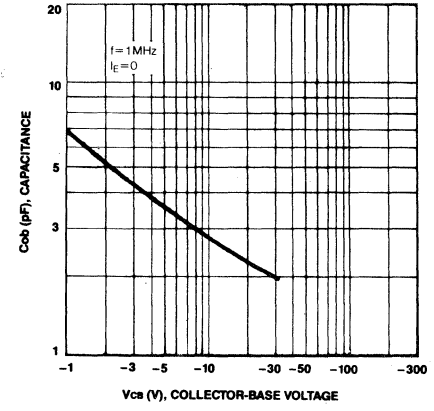
CURRENT GAIN-BANDWIDTH PRODUCT



BASE-EMITTER SATURATION VOLTAGE COLLECTOR-EMITTER SATURATION VOLTAGE



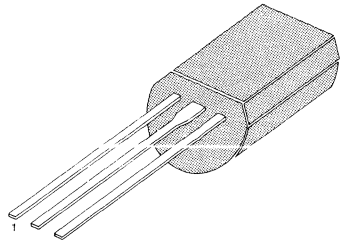
COLLECTOR OUTPUT CAPACITANCE



DRIVER STAGE AUDIO AMPLIFIER
HIGH VOLTAGE SWITCHING APPLICATIONS

- **Complement to KSC2310**
- **Collector-Emitter Voltage V_{CEO} = −150V**
- **Output Capacitance: Cob=5pF (MAX)**

TO-92L



1. Emitter 2. Collector 3. Base

ABSOLUTE MAXIMUM RATINGS (T_a =25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	− 150	V
Collector-Emitter Voltage	V_{CEO}	− 150	V
Emitter-Base Voltage	V_{EBO}	− 5	V
Collector Current	I_C	− 50	mA
Collector Dissipation	P_C	800	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ +150	°C

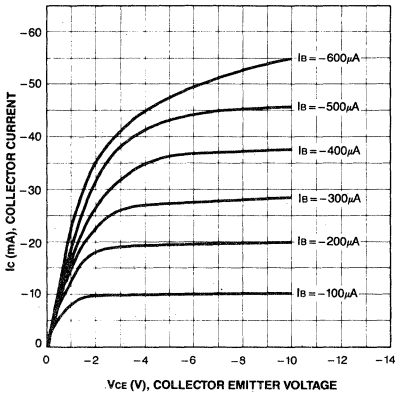
ELECTRICAL CHARACTERISTICS (T_a =25°C)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C = −100μA, I_E =0	− 150			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C = −5mA, I_B =0	− 150			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E = −10μA, I_E =0	− 5			V
Collector Cutoff Current	I_{CBO}	V_{CB} = −150V, I_E =0			− 100	nA
DC Current Gain	h_{FE}	V_{CE} = −5V, I_C = −10mA	40		240	
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C = −10mA, I_B = −1mA			− 0.8	V
Current-Gain-Bandwidth Product	f_T	V_{CE} = −30V, I_C = −10mA		100		MHz
Output Capacitance	Cob	V_{CB} =10V, I_E =0, f=1MHz			5.0	pF

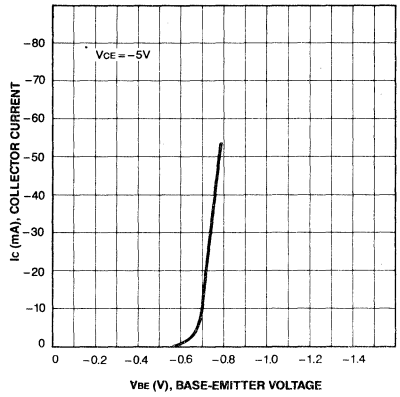
h_{FE} CLASSIFICATION

Classification	R	O	Y
h_{FE}	40-80	70-140	120-240

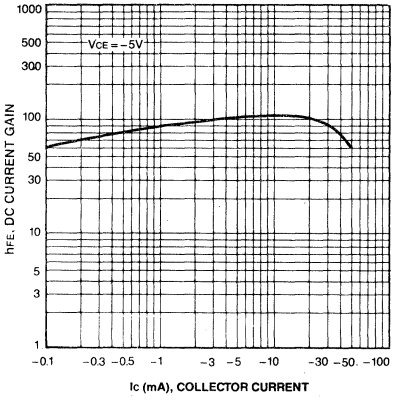
STATIC CHARACTERISTIC



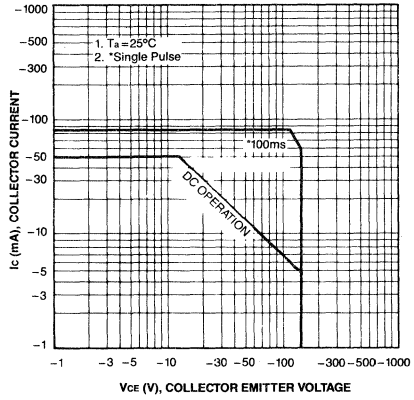
BASE-EMITTER ON VOLTAGE



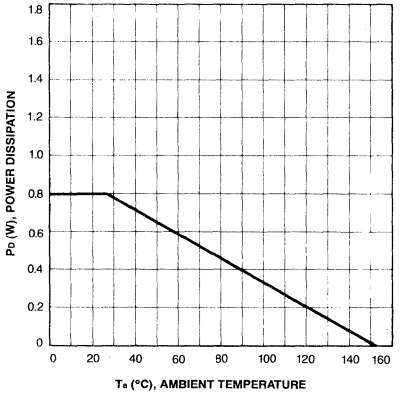
DC CURRENT GAIN



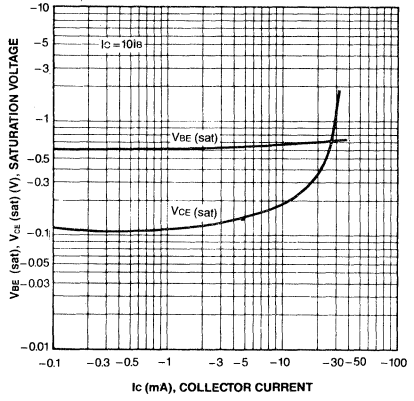
SAFE OPERATING AREA



POWER DERATING



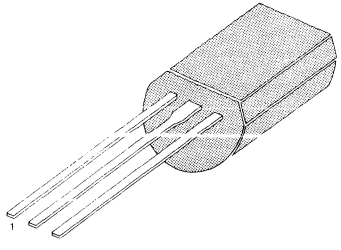
COLLECTOR-EMITTER SATURATION VOLTAGE.
BASE-EMITTER SATURATION VOLTAGE.



AUDIO POWER AMPLIFIER

- **Driver Stage Amplifier**
- **Complement to KSC2316**

TO-92L



1. Emitter 2. Collector 3. Base

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−120	V
Collector-Emitter Voltage	V_{CEO}	−120	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current	I_C	−800	mA
Collector Dissipation	P_C	900	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ +150	°C

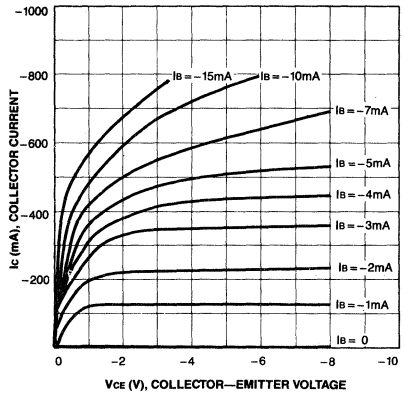
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=−1mA, I_E=0	−120			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=−10mA, I_B=0	−120			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=−1mA, I_C=0	−5			V
Collector Cutoff Current	I_{CBO}	V_{CB}=−120V, I_E=0			−0.1	μA
DC Current Gain	h_{FE1}	V_{CE}=−5V, I_C=−10mA	60			
	h_{FE2}	V_{CE}=−5V, I_C=−100mA	80		240	
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=−500mA, I_B=−50mA			−1	V
Current-Gain Bandwidth Product	f_T	V_{CE}=−5V, I_C=−100mA		120		MHz
Output Capacitance	Cob	V_{CB}=−10V, I_E=0 f=1MHz			40	pF

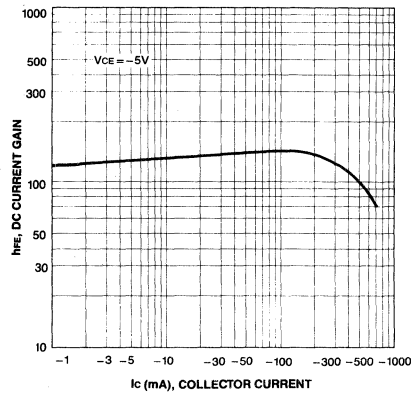
h_{FE} CLASSIFICATION

Classification	O	Y
$h_{FE(2)}$	80-160	120-240

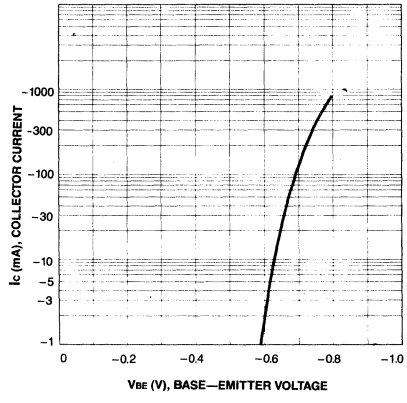
STATIC CHARACTERISTIC



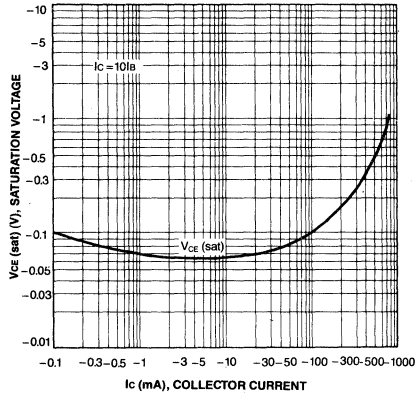
DC CURRENT GAIN



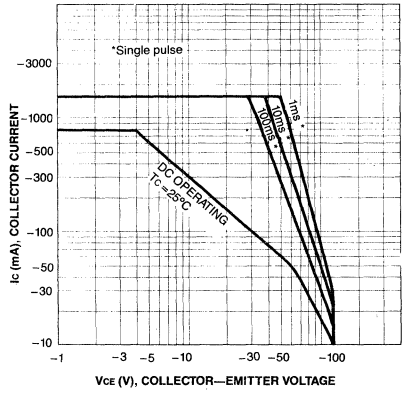
BASE-EMITTER ON VOLTAGE



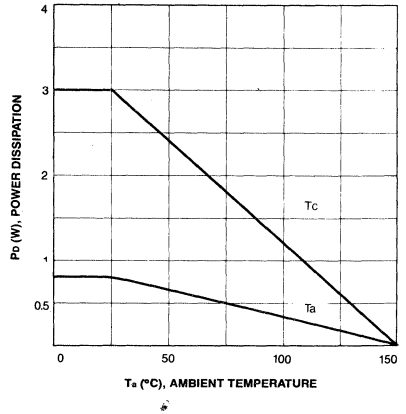
COLLECTOR—EMITTER SATURATION VOLTAGE



SAFE OPERATING AREA



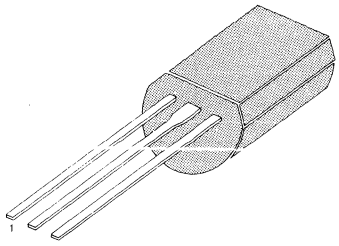
POWER DERATING



AUDIO POWER AMPLIFIER

- Complement of KSC2328A
- Collector Dissipation P_C =1 Watt
- 3 Watt Output Application

TO-92L



1. Emitter 2. Collector 3. Base

ABSOLUTE MAXIMUM RATINGS (T_a =25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−30	V
Collector-Emitter Voltage	V_{CEO}	−30	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current	I_C	−2	A
Collector Dissipation	P_C	1	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ +150	°C

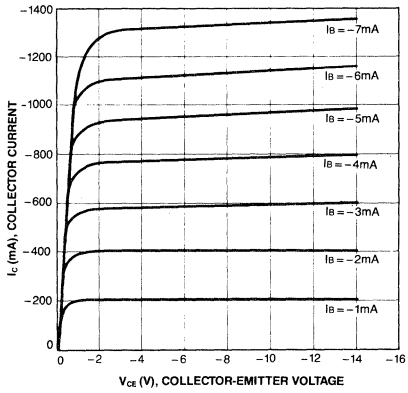
ELECTRICAL CHARACTERISTICS (T_a =25°C)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C =−100μA, I_E =0	−30			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C =−10mA, I_B =0	−30			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E =−1mA, I_C =0	−5			V
Collector Cutoff Current	I_{CBO}	V_{CB} =−30V, I_E =0			−100	nA
Emitter Cutoff Current	I_{EBO}	V_{EB} =−5V, I_C =0			−100	nA
DC Current Gain	h_{FE}	V_{CE} =−2V, I_C =−500mA	100		320	
Base-Emitter On Voltage	V_{BE} (on)	V_{CE} =−2V, I_C =−500mA			−1.0	V
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C =−1.5A, I_B =−0.03A			−2.0	V
Output Capacitance	Cob	V_{CB} =−10V, I_E =0, f=1MHz		48		pF
Current Gain Bandwidth Product	f_T	V_{CE} =−2V, I_C =−500mA		120		MHz

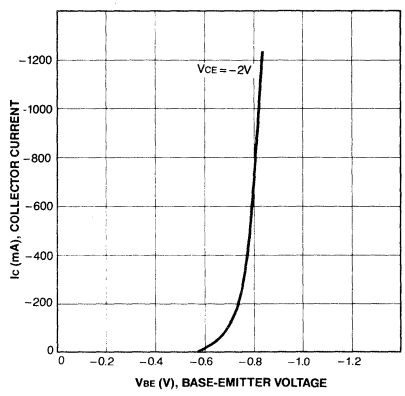
h_{FE} CLASSIFICATION

Classification	O	Y
h_{FE}	100-200	160-320

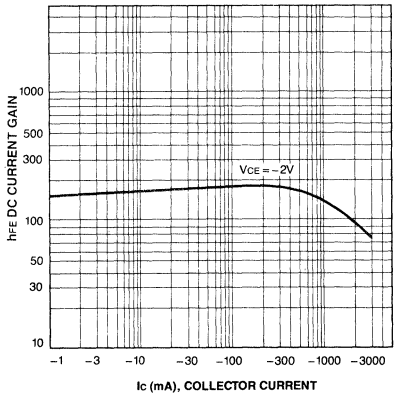
STATIC CHARACTERISTIC



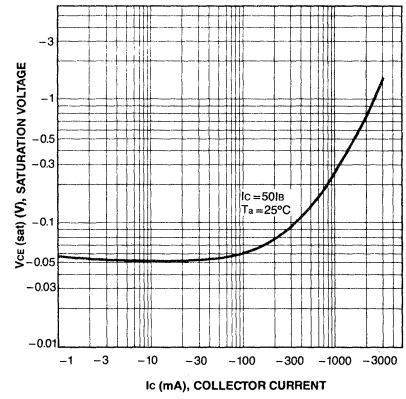
BASE-EMITTER ON VOLTAGE



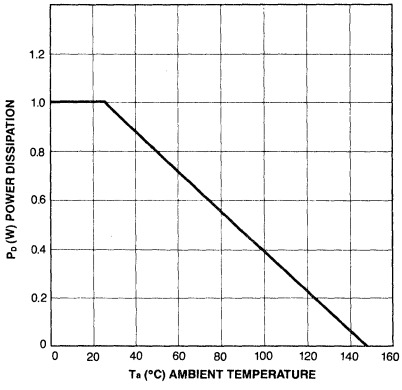
DC CURRENT GAIN



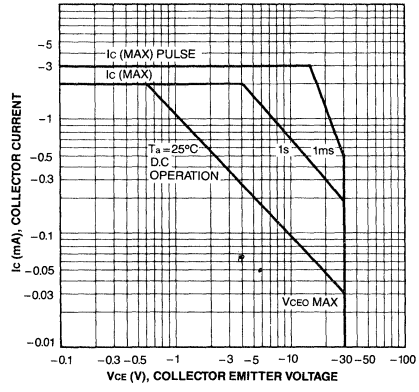
COLLECTOR-EMITTER SATURATION VOLTAGE



POWER DERATING



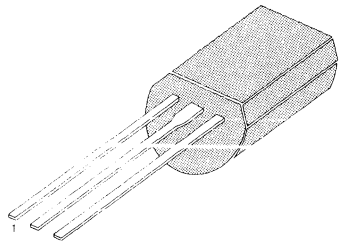
SAFE OPERATING AREA



LOW FREQUENCY AMPLIFIER
MEDIUM SPEED SWITCHING

- Complement to KSC2331
- Collector-Base Voltage $V_{CBO} = -80V$
- Collector Dissipation $P_C = 1W$

TO-92L



1. Emitter 2. Collector 3. Base

ABSOLUTE MAXIMUM RATINGS (T_a =25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−80	V
Collector-Emitter Voltage	V_{CEO}	−60	V
Emitter-Base Voltage	V_{EBO}	−8	V
Collector Current	I_C	−700	mA
Collector Dissipation	P_C	1	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ +150	°C

ELECTRICAL CHARACTERISTICS (T_a =25°C)

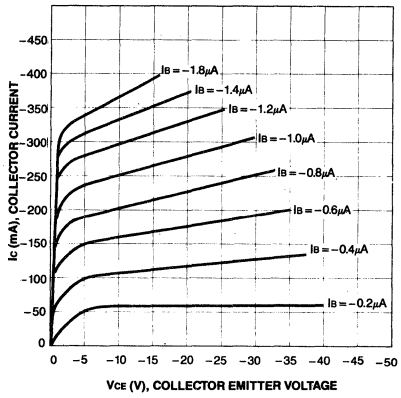
Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	$I_C = -100\mu A$, $I_E = 0$	−80			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	$I_C = -10mA$, $I_B = 0$	−60			V
Emitter-Base Breakdown Voltage	BV_{EBO}	$I_E = -100\mu A$, $I_C = 0$	−8			V
Collector Cut-off Current	I_{CBO}	$V_{CB} = -60V$, $I_E = 0$			−0.1	μA
Emitter Cut-off Current	I_{EBO}	$V_{EB} = -5V$, $I_C = 0$			−0.1	μA
DC Current Gain	h_{FE}	$V_{CE} = -2V$, $I_C = -50mA$*	40		240	
Collector-Emitter Saturation Voltage	V_{CE} (sat)	$I_C = -500mA$, $I_B = -50mA$*		−0.3	−0.7	V
Base-Emitter Saturation Voltage	V_{BE} (sat)	$I_C = -500mA$, $I_B - 50mA$*		−0.9	−1.2	V
Current Gain-Bandwidth Product	f_T	$V_{CE} = -10V$, $I_C = -50mA$		100		MHz
Output Capacitance	Cob	$V_{CB} = -10V$, $I_E = 0$, f = 1MHz		13		pF

* Pulse Test PW ≤ 350μs, duty cycle ≤ 2%

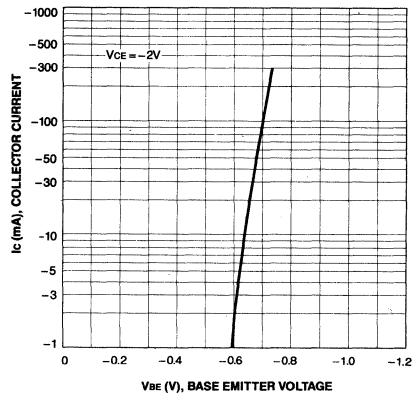
h_{FE} CLASSIFICATION

Classification	R	O	Y
h_{FE}	40-80	70-140	120-240

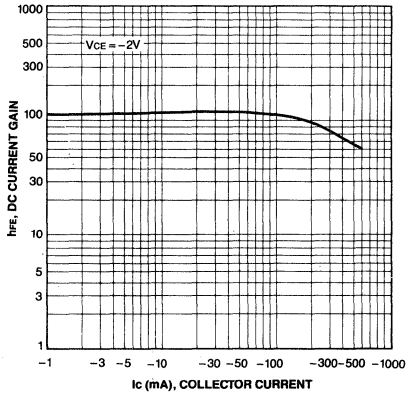
STATIC CHARACTERISTIC



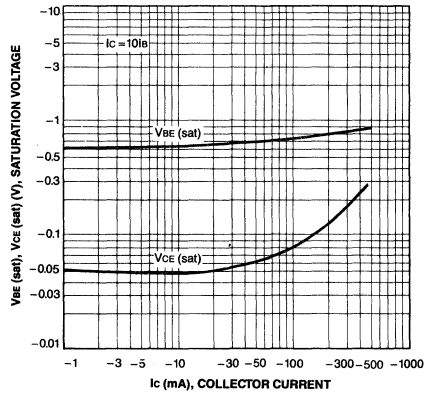
BASE-EMITTER ON VOLTAGE



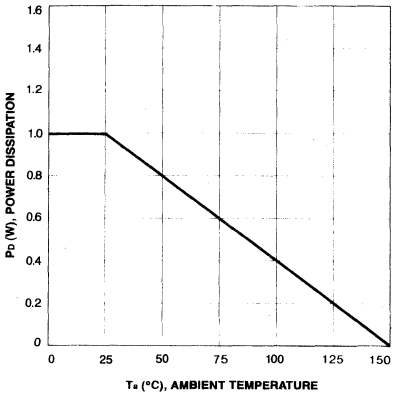
DC CURRENT GAIN



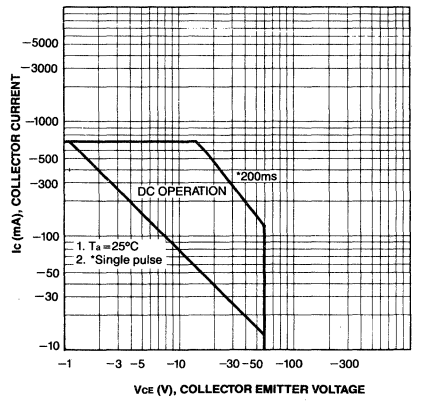
BASE-EMITTER SATURATION VOLTAGE COLLECTOR-EMITTER SATURATION VOLTAGE



POWER DERATING



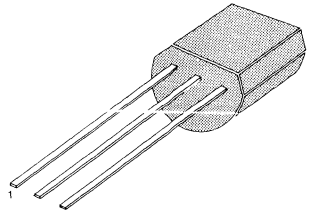
SAFE OPERATING AREA



AUDIO FREQUENCY AMPLIFIER

- **Complement to KSC2002/KSC2003**

TO-92



1. Emitter 2. Collector 3. Base

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic		Symbol	Rating	Unit
Collector-Base Voltage	: KSA953	V_{CBO}	−60	V
	: KSA954		−80	V
Collector-Emitter Voltage	: KSA953	V_{CEO}	−60	V
	: KSA954		−80	V
Emitter-Base Voltage		V_{EBO}	−5	V
Collector Current (DC)		I_C	−300	mA
* Collector Current (Pulse)		I_C	−500	mA
Collector Dissipation		P_C	600	mW
Junction Temperature		Tj	150	°C
Storage Temperature		Tstg	−55~150	°C

* PW≤10ms, Duty Cycle ≤50%

ELECTRICAL CHARACTERISTICS (T_a=25°C)

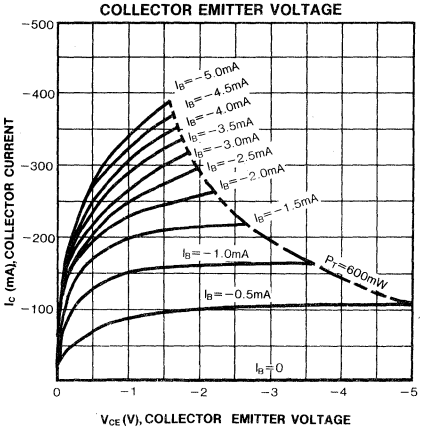
Characteristic		Symbol	Test Condition	Min	Typ	Max	Unit
Collector Cutoff Current	: KSA953	I_{CBO}	V_{CB}=−60V, I_E=0			−100	nA
	: KSA954		V_{CB}=−80V, I_E=0			−100	nA
Emitter Cutoff Current		I_{EBO}	V_{EB}=−5V, I_C=0			−100	nA
*DC Current Gain		h_{FE1}	V_{CE}=−1V, I_C=−50mA	90	200	400	
		h_{FE2}	V_{CE}=−2V, I_C=−300mA	30	80		
*Base-Emitter On Voltage		V_{BE} (on)	V_{CE}=−6V, I_C=−10mA	−600	−660	−700	mV
*Base Emitter Saturation Voltage		V_{BE} (sat)	I_C=−300mA, I_B=−30mA		−0.85	−1.2	V
*Collector-Emitter Saturation Voltage		V_{CE} (sat)	I_C=−300mA, I_B=−30mA		−0.15	−0.6	V
Output Capacitance		Cob	V_{CB}=−6V, I_E=0, f=1MHz		13	25	pF
Current Gain-Bandwidth Product		f_T	V_{CE}=−6V, I_E=10mA	50	100		MHz

* Pulse Test: PW≤350μs, Duty Cycle≤2% Pulsed

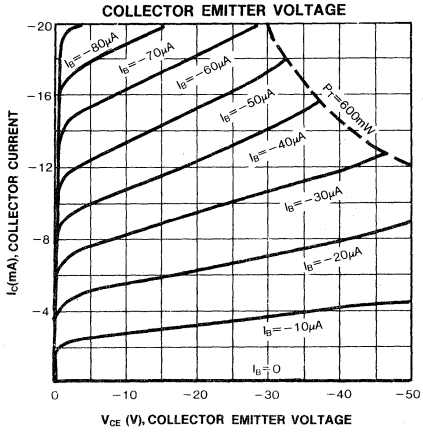
h_{FE}(1) CLASSIFICATION

Classification	O	Y	G
h_{FE}1	90-180	135-270	200-400

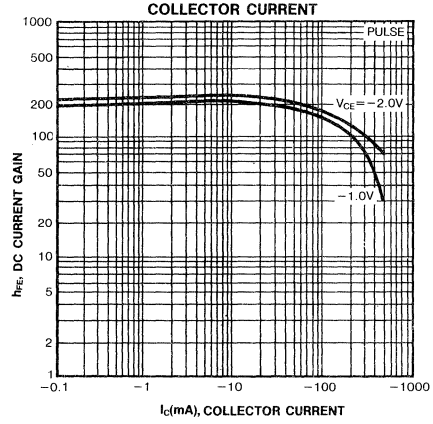
COLLECTOR CURRENT vs.
COLLECTOR EMITTER VOLTAGE



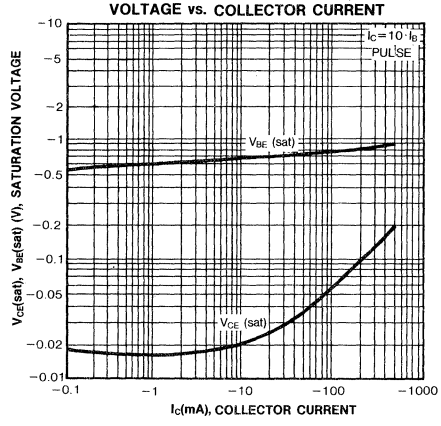
COLLECTOR CURRENT vs.
COLLECTOR EMITTER VOLTAGE



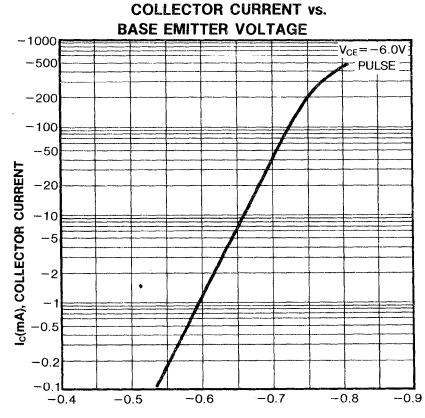
DC CURRENT GAIN vs.
COLLECTOR CURRENT



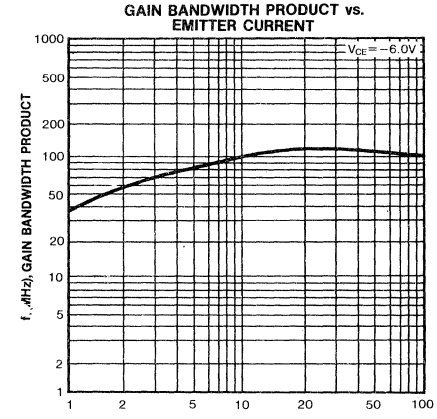
BASE AND COLLECTOR SATURATION
VOLTAGE vs. COLLECTOR CURRENT



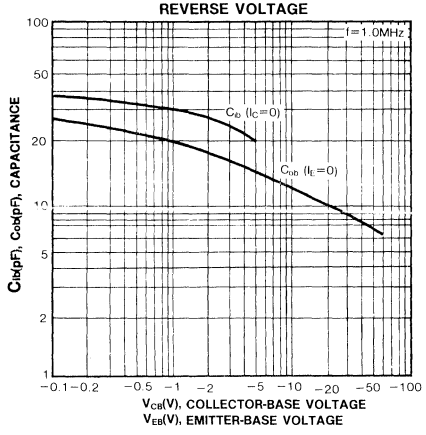
COLLECTOR CURRENT vs.
BASE EMITTER VOLTAGE



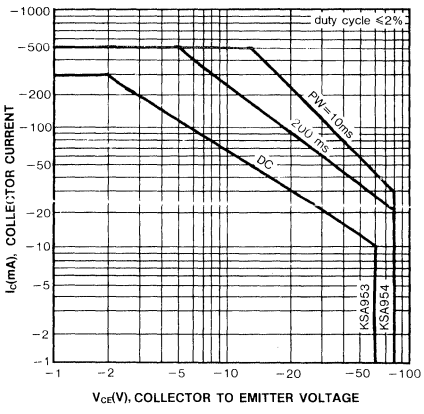
GAIN BANDWIDTH PRODUCT vs.
EMITTER CURRENT



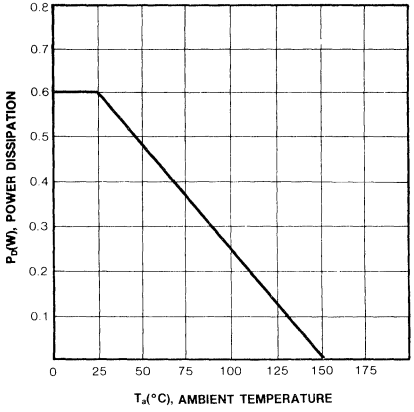
INPUT AND OUTPUT CAPACITANCE vs. REVERSE VOLTAGE



SAFE OPERATING AREA



POWER DERATING

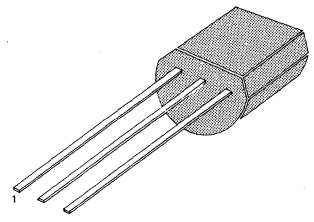


3

AUDIO FREQUENCY LOW NOISE AMPLIFIER

- **Complement to KSC1845**

TO-92



1. Emitter 2. Collector 3. Base

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−120	V
Collector-Emitter Voltage	V_{CEO}	−120	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current	I_C	−50	mA
Base Current	I_B	−10	mA
Collector Dissipation	P_C	500	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ 150	°C

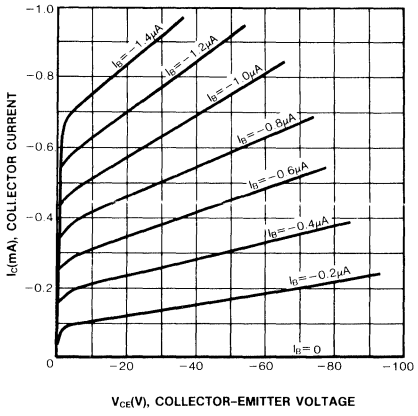
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Cutoff Current	I_{CBO}	V_{CB}=−120V, I_E=0			−50	nA
Collector Cutoff Current	I_{CEO}	V_{CE}=−100V, R_{BE}=∞			−1	μA
Emitter Cutoff Current	I_{EBO}	V_{EB}=−5V, I_C=0			−50	nA
DC Current Gain	h_{FE1}	V_{CE}=−6V, I_C=−0.1mA	150	500		
	h_{FE2}	V_{CE}=−6V, I_C=−1mA	200	500	800	
Base Emitter On Voltage	V_{BE} (on)	V_{CE}=−6V, I_C=−1mA	−0.55	−0.61	−0.65	V
Collector Emitter Saturation Voltage	V_{CE} (sat)	I_C=−10mA, I_B=−1mA		−0.09	−0.3	V
Current Gain Bandwidth Product	f_T	V_{CE}=−6V, I_E=1mA	50	100		MHz
Output Capacitance	Cob	V_{CB}=−30V, I_E=0 f=1MHz		2	3	pF
Noise Voltage	NV			25	40	mV

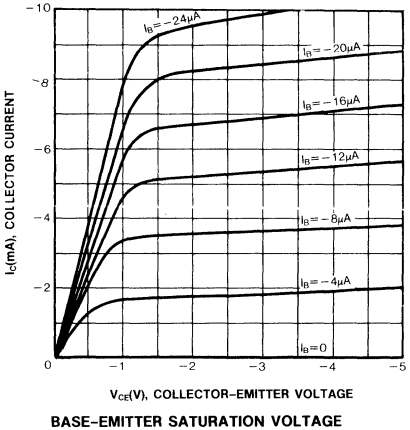
h_{FE}(2) CLASSIFICATION

Classification	P	F	E
h_{FE}(2)	200-400	300-600	400-800

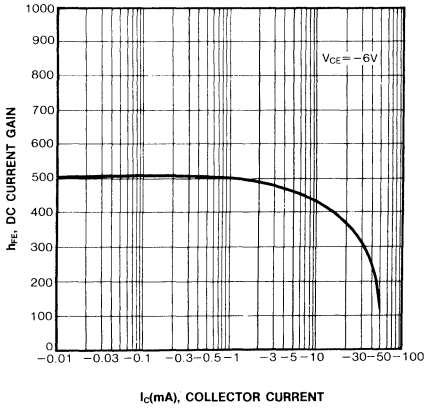
STATIC CHARACTERISTIC



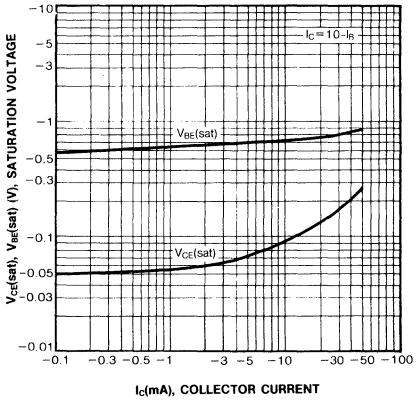
STATIC CHARACTERISTIC



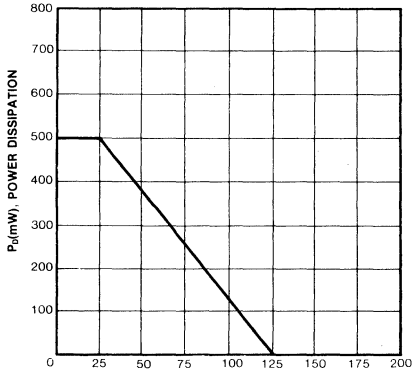
DC CURRENT GAIN



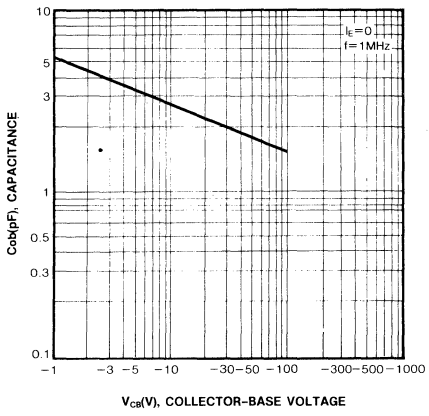
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



POWER DERATING

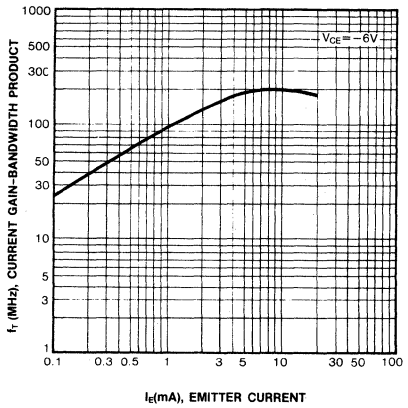


COLLECTOR OUTPUT CAPACITANCE



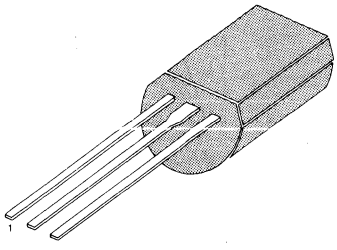
3

CURRENT GAIN-BANDWIDTH PRODUCT



COLOR TV AUDIO OUTPUT
COLOR TV VERTICAL DEFLECFION OUTPUT

TO-92L



1. Emitter 2. Collector 3. Base

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−160	V
Collector-Emitter Voltage	V_{CEO}	−160	V
Emitter-Base Voltage	V_{EBO}	−6	V
Collector Current	I_C	−1	A
Base Current	I_B	−0.5	A
Collector Dissipation	P_C	900	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

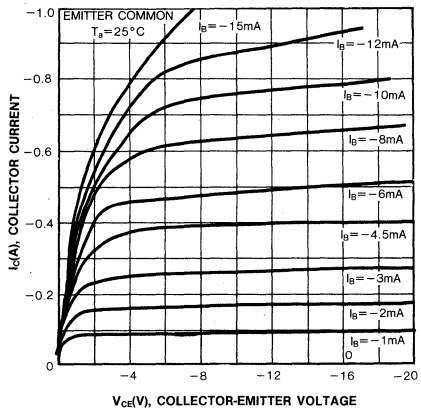
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Cutoff Current	I_{CBO}	V_{CB}=−150V, I_E=0			−1	μA
Emitter Cutoff Current	I_{EBO}	V_{EB}=−6V, I_C=0			−1	μA
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=−10mA, I_B=0	−160			V
DC Current Gain	h_{FE}	V_{CE}=−5V, I_C=−200mA	60		320	
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=−500mA, I_B=−50mA			−1.5	V
Base Emitter On Voltage	V_{BE} (on)	V_{CE}=−5V, I_C=−5mA	−0.45		−0.75	V
Current Gain-Bandwidth Product	f_T	V_{CE}=−5V, I_C=−200mA	15	50		MHz
Output Capacitance	Cob	V_{CB}=−10V, I_E=0 f=1MHz			35	pF

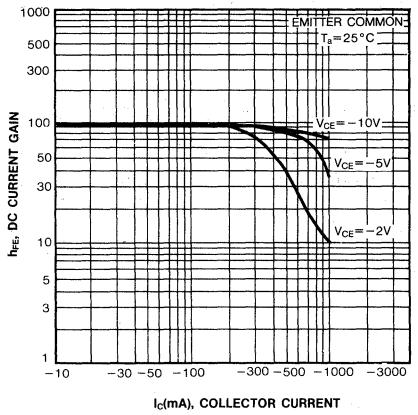
h_{FE} CLASSIFICATION

Classification	R	O	Y
h_{FE}	60-120	100-200	160-320

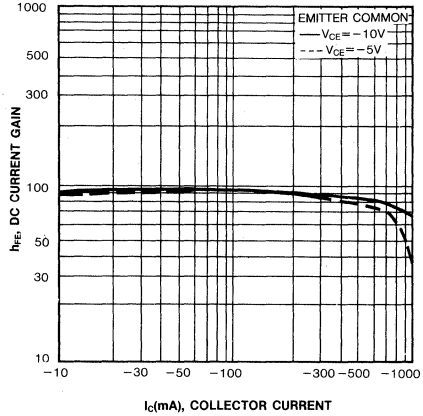
STATIC CHARACTERISTIC



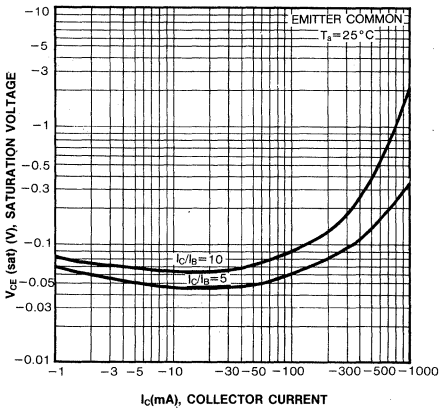
DC CURRENT GAIN



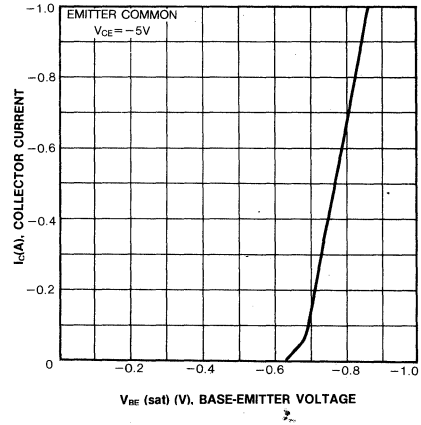
DC CURRENT GAIN



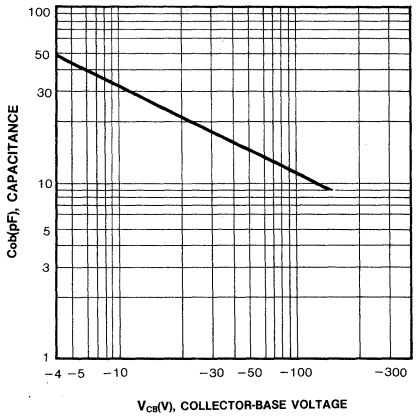
COLLECTOR-EMITTER SATURATION VOLTAGE



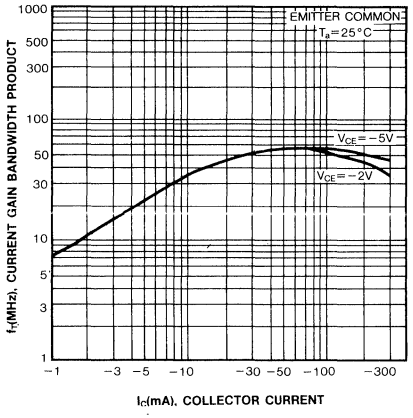
BASE-EMITTER VOLTAGE



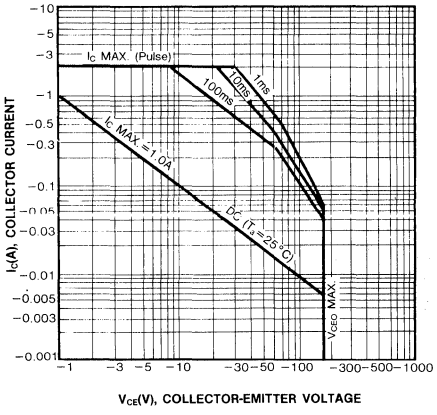
COLLECTOR OUTPUT CAPACITANCE



CURRENT GAIN-BANDWIDTH PRODUCT



SAFE OPERATING AREA

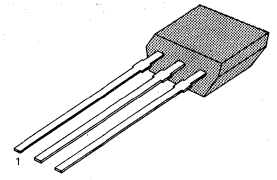


3

LOW FREQUENCY POWER AMPLIFIER

- **Complement to KSC2710**
- **Collector Dissipation P_C = 300mW**

TO-92S



1. Emitter 2. Collector 3. Base

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−40	V
Collector-Emitter Voltage	V_{CEO}	−20	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current (DC)	I_C (DC)	−500	mA
* Collector Current (pulse)	I_C (pulse)	−700	mA
Collector Dissipaiton	P_C	300	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ 150	°C

* PW ≤ 10mS, duty Cycle ≤ 50%.

ELECTRICAL CHARACTERISTICS (T_a=25°C)

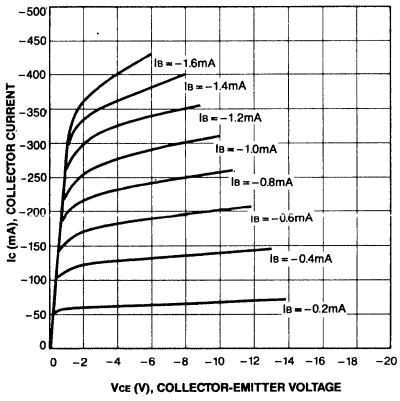
Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=−100μA, I_E=0	−40			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=−10mA, I_B=0	−20			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=−100μA, I_C=0	−5			V
Collector Cut-off Current	I_{CBO}	V_{CB}=−25V, I_E=0			−100	nA
Emitter Cut-off Current	I_{EBO}	V_{EB}=−3V, I_C=0			−100	nA
* DC Current Gain	h_{FE}	V_{CE}=−1V, I_C=−100mA	40		400	
* Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=−500mA, I_B=−50mA		−0.3	−0.4	V
* Base-Emitter Saturation Voltage	V_{BE} (sat)	I_C=−500mA, I_B=−50mA*		−1.0	−1.3	V

* Pulse Test: PW ≤ 350μs, duty cycle ≤ 2%

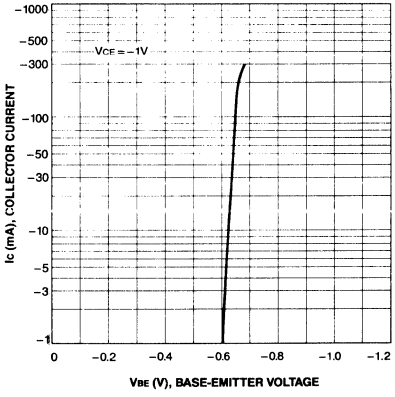
h_{FE} CLASSIFICATION

Classification	R	O	Y	G
h_{FE}	40-80	70-140	120-240	200-400

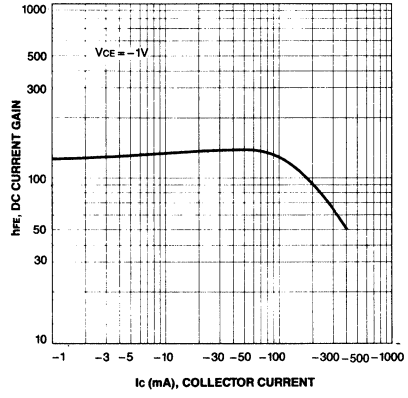
STATIC CHARACTERISTIC



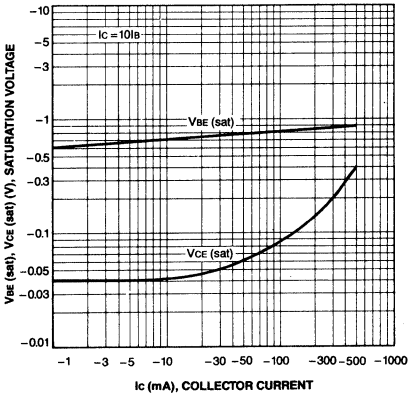
BASE-EMITTER ON VOLTAGE



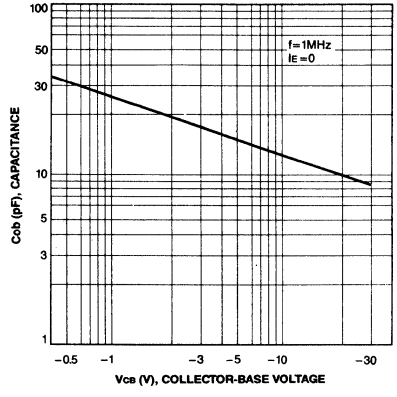
DC CURRENT GAIN



BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



COLLECTOR OUTPUT CAPACITANCE

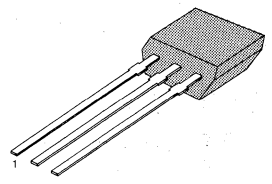


3

AUDIO FREQUENCY LOW NOISE AMPLIFIER

- **Complement to KSC2784**

TO-92S



1. Emitter 2. Collector 3. Base

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−120	V
Collector-Emitter Voltage	V_{CEO}	−120	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current	I_C	−50	mA
Base Current	I_B	−10	mA
Collector Dissipation	P_C	300	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

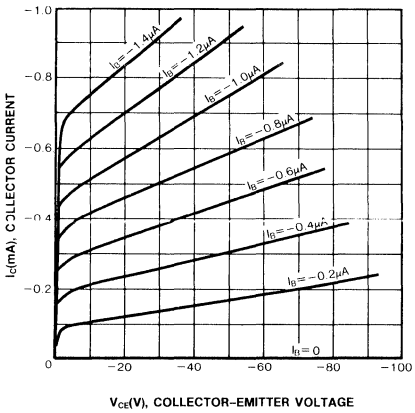
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Cutoff Current	I_{CBO}	V_{CB}=−120V, I_E=0			−50	nA
Collector Cutoff Current	I_{CEO}	V_{CE}=−100V, R_{BE}=∞			−1	μA
Emitter Cutoff Current	I_{EBO}	V_{EB}=−5V, I_C=0			−50	nA
DC Current Gain	h_{FE1}	V_{CE}=−6V, I_C=−0.1mA	150	500		
	h_{FE2}	V_{CE}=−6V, I_C=−1mA	200	500	800	
Base Emitter On Voltage	V_{BE} (on)	V_{CE}=−6V, I_C=−1mA	−0.55	−0.61	−0.65	V
Collector Emitter Saturation Voltage	V_{CE} (sat)	I_C=−10mA, I_B=−1mA		−0.09	−0.3	V
Current Gain Bandwidth Product	f_T	V_{CE}=−6V, I_E=1mA	50	100		MHz
Output Capacitance	Cob	V_{CB}=−30V, I_E=0 f=1MHz		2	3	pF
Noise Voltage	NV			25	40	mV

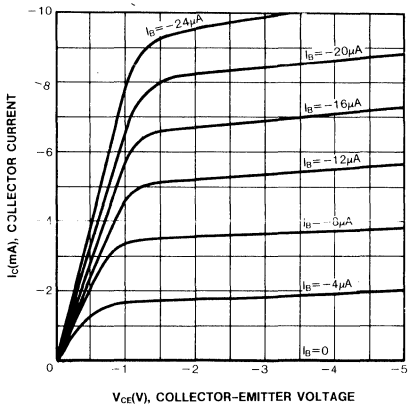
h_{FE}(2) CLASSIFICATION

Classification	P	F	E
h_{FE}(2)	200-400	300-600	400-800

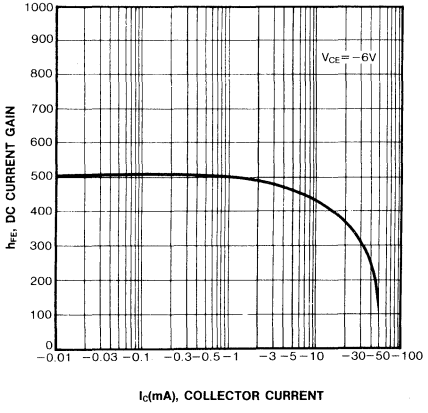
STATIC CHARACTERISTIC



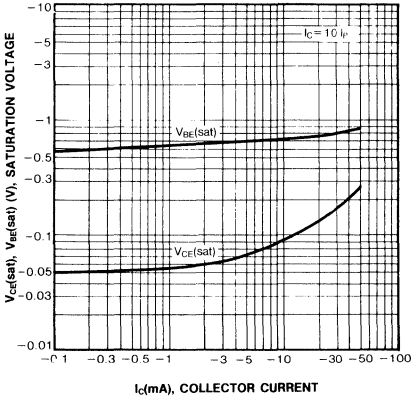
STATIC CHARACTERISTIC



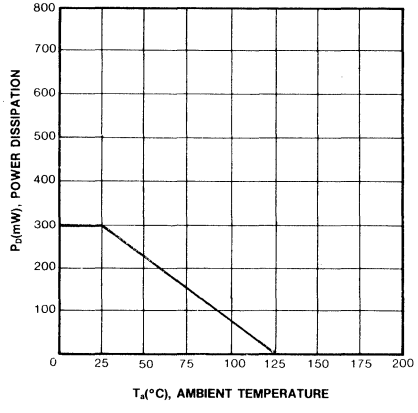
DC CURRENT GAIN



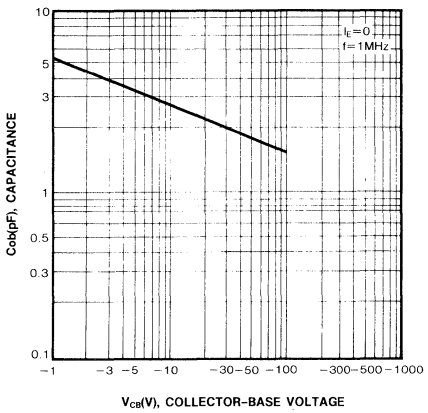
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



POWER DERATING

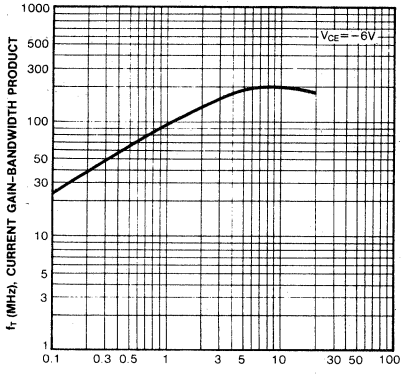


COLLECTOR OUTPUT CAPACITANCE



3

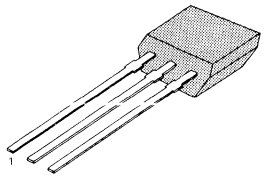
CURRENT GAIN-BANDWIDTH PRODUCT



LOW FREQUENCY AMPLIFIER

- **Complement to KSC2785**
- **Collector-Base Voltage $V_{CBO} = -60V$**

TO-92S



1. Emitter 2. Collector 3. Base

ABSOLUTE MAXIMUM RATINGS ($T_a = 25°C$)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−60	V
Collector-Emitter Voltage	V_{CEO}	−50	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current	I_C	−150	mA
Collector Dissipation	P_C	250	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ 150	°C

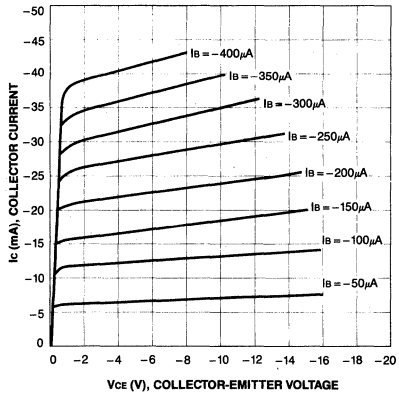
ELECTRICAL CHARACTERISTICS ($T_a = 25°C$)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	$I_C = -100\mu A$, $I_E = 0$	−60			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	$I_C = -10mA$, $I_B = 0$	−50			V
Emitter-Base Breakdown Voltage	BV_{EBO}	$I_E = -10\mu A$, $I_C = 0$	−5			V
Collector Cut-off Current	I_{CBO}	$V_{CB} = -60V$, $I_E = 0$			−0.1	μA
Emitter Cut-off Current	I_{EBO}	$V_{EB} = -5V$, $I_C = 0$			−0.1	μA
DC Current Gain	h_{FE}	$V_{CE} = -6V$, $I_C = -1mA$	40		700	
Collector-Emitter Saturation Voltage	$V_{CE}(sat)$	$I_C = -100mA$, $I_B = -10mA$		−0.18	−0.3	V
Base-Emitter On Voltage	V_{BE} (on)	$V_{CE} = -6V$, $I_C = -1mA$	−0.50	−0.62	−0.80	V
Current-Gain-Bandwidth Product	f_T	$V_{CE} = -6V$, $I_C = -10mA$	50	180		MHz
Output Capacitance	Cob	$V_{CB} = -10V$, $I_E = 0$ f=1MHz		2.8		pF
Noise Figure	NF	$V_{CE} = -6V$, $I_C = -0.3mA$ f=100Hz, Rs=10KΩ		6.0	20	dB

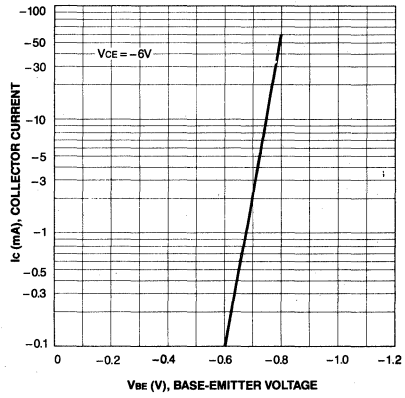
h_{FE} CLASSIFICATION

Classification	R	O	Y	G	L
h_{FE}	40-80	70-140	120-240	200-400	350-700

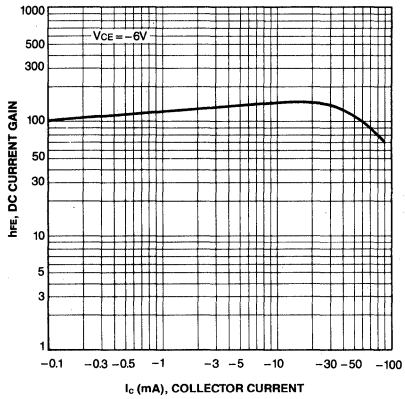
STATIC CHARACTERISTIC



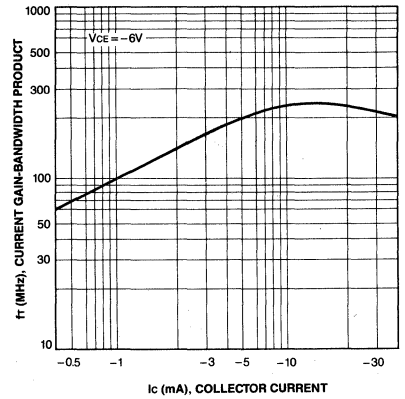
BASE-EMITTER ON VOLTAGE



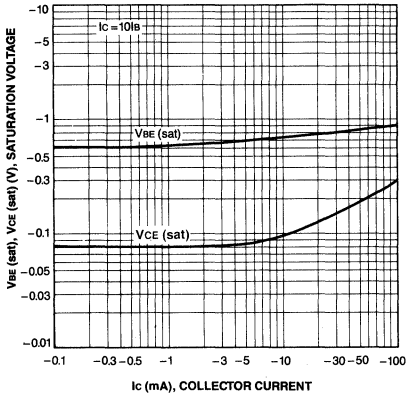
DC CURRENT GAIN



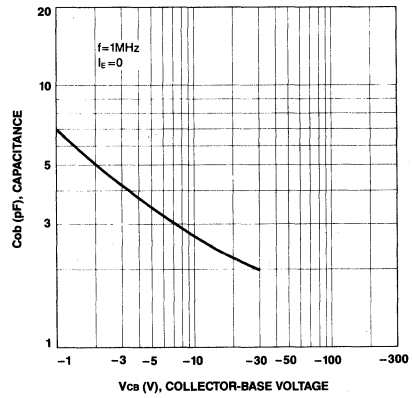
CURRENT GAIN-BANDWIDTH PRODUCT



BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



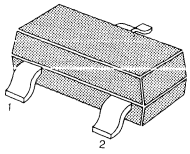
COLLECTOR OUTPUT CAPACITANCE



LOW FREQUENCY POWER AMPLIFIER

- **Complement to KSA2859**

SOT-23



1. Base 2. Emitter 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−35	V
Collector-Emitter Voltage	V_{CEO}	−30	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current	I_C	−500	mA
Collector Dissipation	P_C	150	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

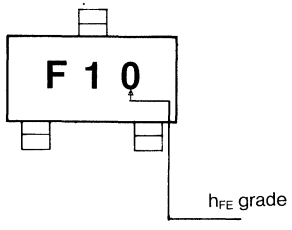
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Cutoff Current	I_{CBO}	V_{CB}=−35V, I_E=0			−0.1	μA
Emitter Cutoff Current	I_{EBO}	V_{EB}=−5V, I_C=0			−0.1	μA
DC Current Gain	$h_{FE}1$	V_{CE}=−1V, I_C=−100mA	70		240	
	$h_{FE}2$	V_{CE}=−6V, I_C=−400mA	25			
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=−100mA, I_B=−10mA		−0.1	−0.25	V
Base-Emitter On Voltage	V_{BE}(on)	I_C=−100mA, V_{CE}=−1V		−0.8	−1.0	V
Current Gain-Bandwidth Product	f_T	I_C=−20mA, V_{CE}=−6V		200		MHz
Output Capacitance	Cob	V_{CB}=−6V, I_E=0 f=1MHz		13		pF

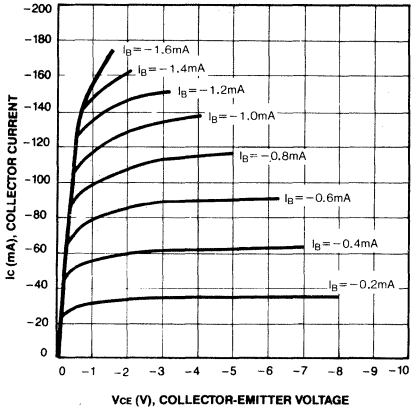
h_{FE} CLASSIFICATION

Classification	O	Y
h_{FE} (1)	70-140	120-240

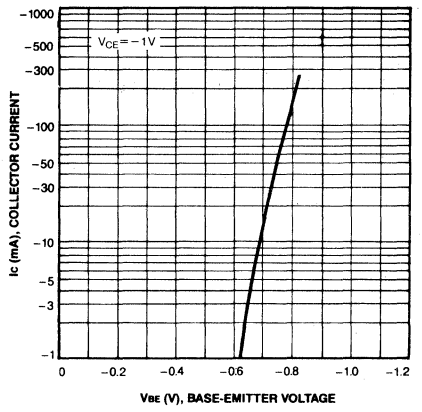
Marking



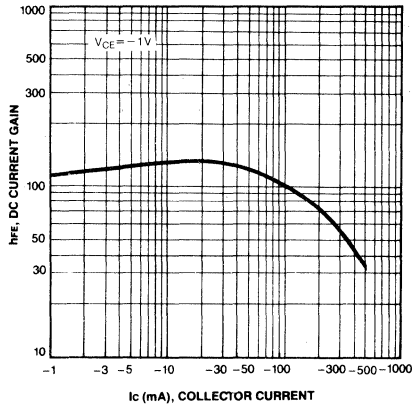
STATIC CHARACTERISTIC



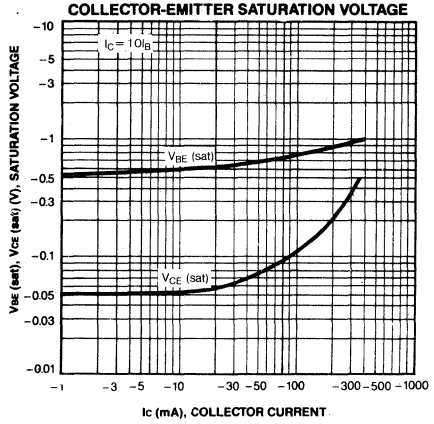
BASE-EMITTER ON VOLTAGE



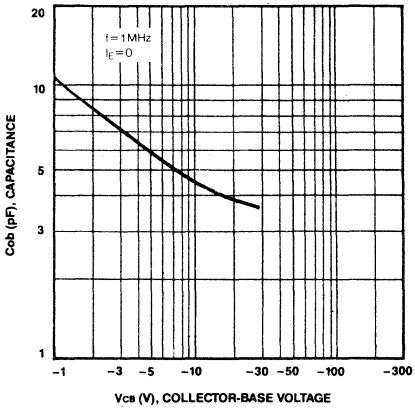
DC CURRENT GAIN



BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



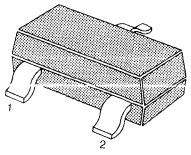
COLLECTOR OUTPUT CAPACITANCE



LOW FREQUENCY AMPLIFIER

- **Complement to KSC3265**

SOT-23



1. Base 2. Emitter 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−30	V
Collector-Emitter Voltage	V_{CEO}	−25	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current	I_C	−800	mA
Base Current	I_B	−160	mA
Collector Dissipation	P_C	200	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

- Refer to KSA643 for graphs.

3

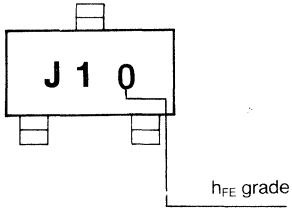
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=−10mA, I_B=0	−25			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=−1mA, I_C=0	−5			V
Collector Cutoff Current	I_{CBO}	V_{CB}=−30V, I_E=0			−100	nA
Emitter Cutoff Current	I_{EBO}	V_{EB}=−5V, I_C=0			−100	nA
DC Current Gain	h_{FE1}	V_{CE}=−1V, I_C=−100mA	100		320	
	h_{FE2}	V_{CE}=−1V, I_C=−800mA	40			
Collector Emitter Saturation Voltage	V_{CE} (sat)	I_C=−500mA, I_B=−20mA			−0.4	V
Base-Emitter (on) Voltage	V_{BE} (on)	V_{CE}=−1V, I_C=−10mA	−0.5		−0.8	V
Current Gain-Bandwidth Product	f_T	V_{CE}=−5V, I_C=−10mA		120		MHz
Output Capacitance	Cob	V_{CB}=−10V, I_E=0 f=1MHz		13		pF

h_{FE} (1) CLASSIFICATION

Classification	O	Y
h_{FE} (1)	100-200	160-320

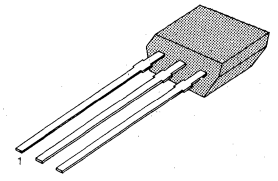
Marking



LOW FREQUENCY POWER AMPLIFIER

- **Complement to KSC3488**
- **Collector Dissipation P_C = 300mW**

TO-92S



1. Emitter 2. Collector 3. Base

ABSOLUTE MAXIMUM RATINGS (T_a =25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−30	V
Collector-Emitter Voltage	V_{CEO}	−25	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current (DC)	I_C (DC)	−300	mA
* Collector Current (pulse)	I_C(pulse)	−500	mA
Collector Dissipation	P_C	300	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

* PW≤10ms, duty cycle ≤50%

ELECTRICAL CHARACTERISTICS (T_a =25°C)

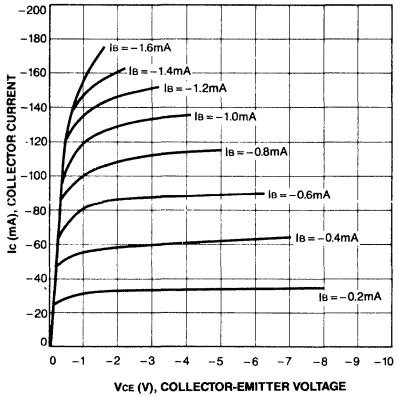
Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C = −100μA, I_E = 0	−30			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C = −10mA, I_B = 0	−25			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E = −10μA, I_C = 0	−5			V
Collector Cut-off Current	I_{CBO}	V_{CB} = −25V, I_E = 0			−100	nA
Emitter Cut-off Current	I_{EBO}	V_{EB} = −3V, I_C = 0			−100	nA
* DC Current Gain	h_{FE}	V_{CE} = −1V, I_C = −50mA	70		400	nA
* Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C = −300mA, I_B = −30mA		−0.35	−0.6	V

* Pulse Test: PW≤350μs, duty cycle≤2%

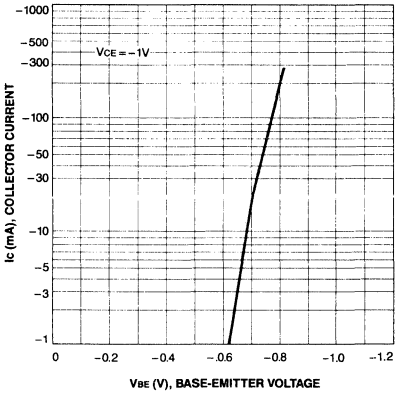
h_{FE} CLASSIFICATION

Classification	O	Y	G
h_{FE}	70-140	120-240	200-400

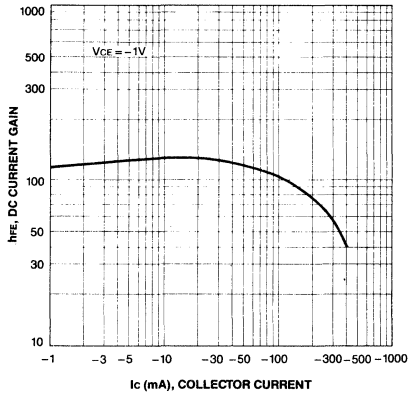
STATIC CHARACTERISTIC



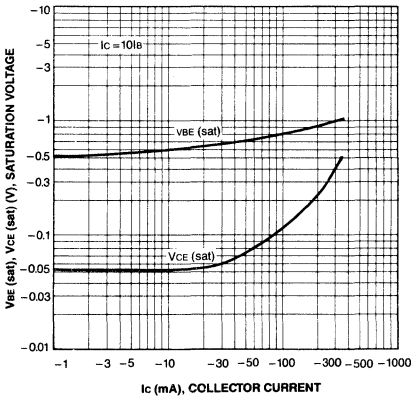
BASE-EMITTER ON VOLTAGE



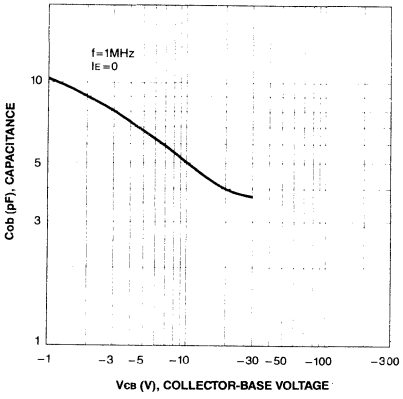
DC CURRENT GAIN



BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



COLLECTOR OUTPUT CAPACITANCE

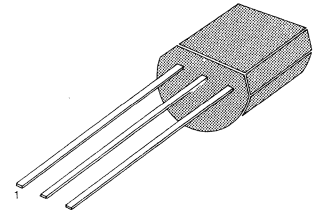


3

HIGH VOLTAGE SWITCH

- **High Breakdown Voltage**
- **High Speed Switching**

TO-92



1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (Ta=25°C)

Characteristics	Symbol	Rating	Unit
Collector Base Voltage	V_{CBO}	−400	V
Collector Emitter Voltage	V_{CEO}	−400	V
Emitter Base Voltage	V_{EBO}	−7	V
Base Current	I_B	−0.25	A
Collector Current (DC)	I_C	−0.5	A
Collector Current (Pulse)	I_C	−1.0	A
Collector Dissipation (Ta=25°C)	P_C	0.75	W
Collector Dissipation (Tc=25°C)	P_C	2	W
Junction Temperature	T_J	150	°C
Storage Temperature	Tstg	−55~150	°C

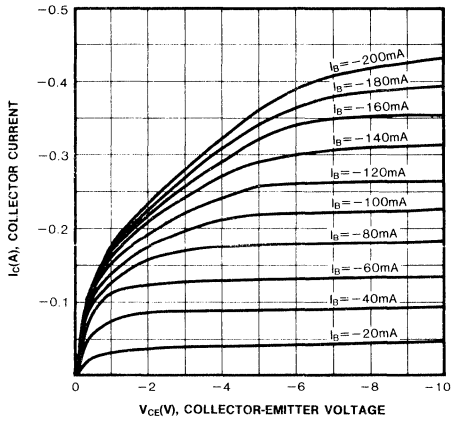
ELECTRICAL CHARACTERISTICS (Ta=25°C)

Characteristics	Symbol	Test Conditions	Min	Max	Unit
Collector Emitter Breakdown Voltage	BV_{CEO}	I_C=−1mA, I_B=0	−400		V
Collector Cutoff Current	I_{CBO}	V_{CB}=−400V, I_E=0		−1	μA
Emitter Cutoff Current	I_{EBO}	V_{EB}=−5V, I_C=0		−1	μA
DC Current Gain	h_{FE}	V_{CE}=−5V, I_C=−50mA	40	200	
Collector Emitter Saturation Voltage	V_{CE}(sat)	I_C=−100mA, I_B=−10mA		−1	A
Base Emitter Saturation Voltage	V(sat)	I_C=−100mA, I_B=−10mA		−1.2	V
Current Gain Bandwidth Product	f_T	V_{CE}=−10V, I_E=−10mA	10		MHz
Output Capacitance	C_{OB}	V_{CB}=−10V, f=1MHz		25	pF
Turn On Time	t_{ON}	I_C=−100mA, R_L=1.5kΩ		1	us
Storage Time	t_{STG}	I_B1=−10mA, I_B2=−10mA		5	us
Fall Time	t_F	V_{CC}=−150V		1	us

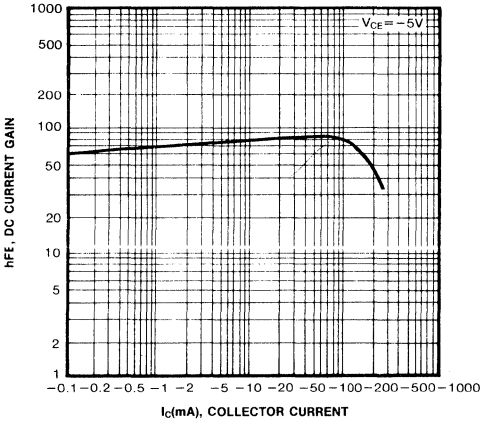
hFE CLASSIFICATION

Classification	M	L	K
hFE	40-80	60-120	100-120

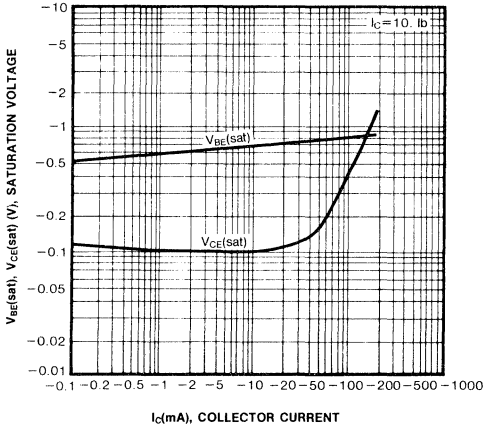
STATIC CHARACTERISTIC



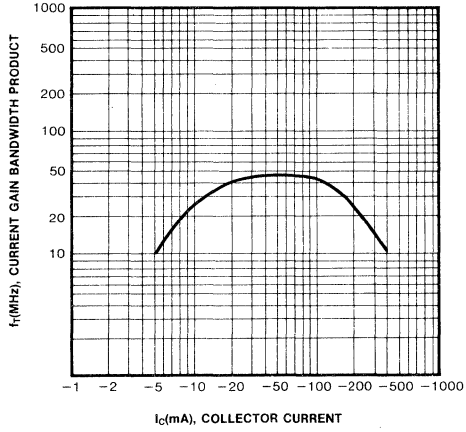
DC CURRENT GAIN



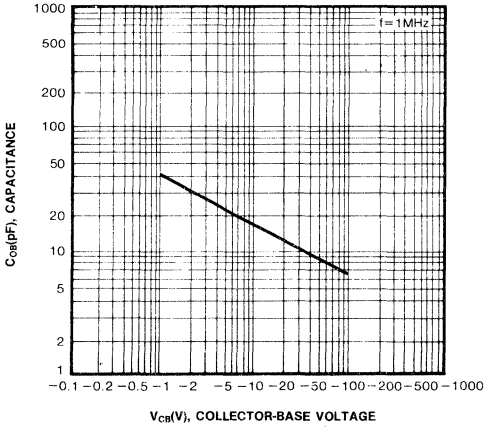
COLLECTOR-EMITTER SATURATION VOLTAGE
BASE-EMITTER SATURATION VOLTAGE



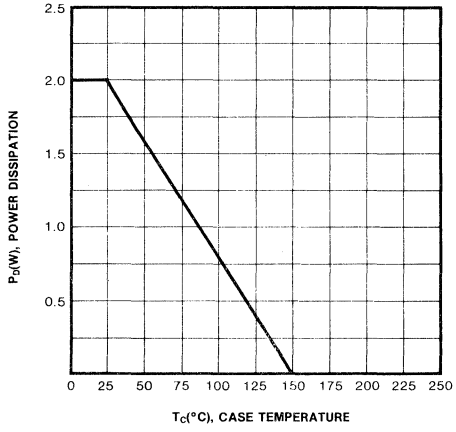
CURRENT GAIN BANDWIDTH PRODUCT



COLLECTOR OUTPUT CAPACITANCE

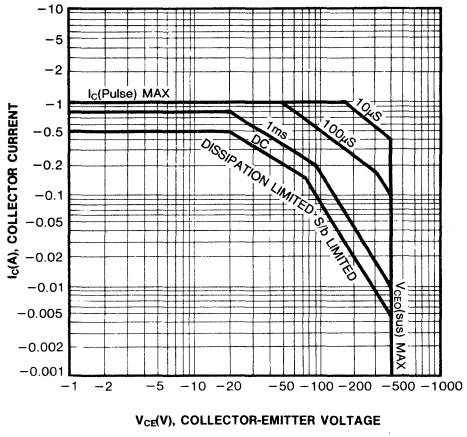


POWER DERATING



3

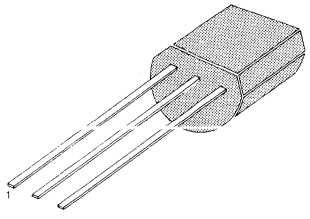
SAFE OPERATING AREA



AUDIO FREQUENCY POWER AMPLIFIER

- **Complement to KSD471A**
- **Collector Current $I_C = -1A$**
- **Collector Dissipation $P_C = 800mW$**

TO-92



1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS ($T_a = 25°C$)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−30	V
Collector-Emitter Voltage	V_{CEO}	−25	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current	I_C	−1.0	A
Collector Dissipation	P_C	800	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ 150	°C

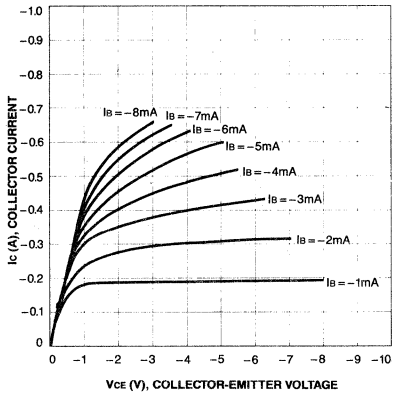
ELECTRICAL CHARACTERISTICS ($T_a = 25°C$)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	$I_C = -100\mu A$, $I_E = 0$	−30			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	$I_C = -10mA$, $I_B = 0$	−25			V
Emitter-Base Breakdown Voltage	BV_{EBO}	$I_E = -100\mu A$, $I_C = 0$	−5			V
Collector Cut-off Current	I_{CBO}	$V_{CB} = -30V$, $I_E = 0$			−0.1	μA
DC Current Gain	h_{FE}	$V_{CE} = -1V$, $I_C = -100mA$	70		400	
Collector-Emitter Saturation Voltage	V_{CE} (sat)	$I_C = -1A$, $I_B = -0.1A$			−0.5	V
Base-Emitter Saturation Voltage	V_{BE} (sat)	$I_C = -1A$, $I_B = -0.1A$			−1.2	V
Current-Gain-Bandwidth Product	f_T	$V_{CE} = -6V$, $I_C = -10mA$		110		MHz
Output Capacitance	Cob	$V_{CB} = -6V$, f=1 MHz, $I_E = 0$		18		pF

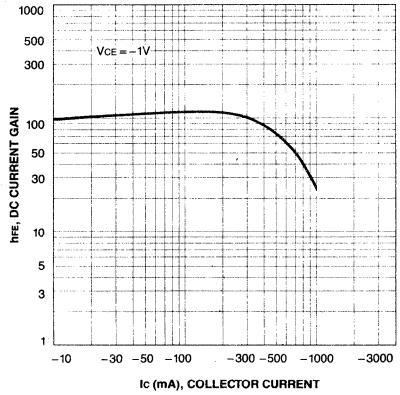
h_{FE} CLASSIFICATION

Classification	O	Y	G
h_{FE}	70-140	120-240	200-400

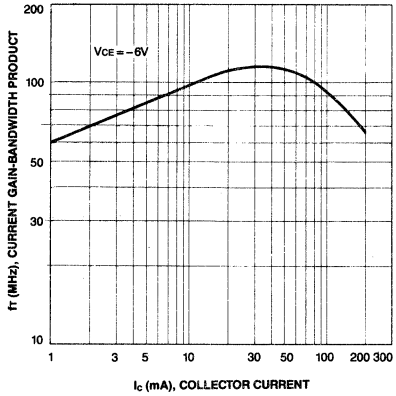
STATIC CHARACTERISTIC



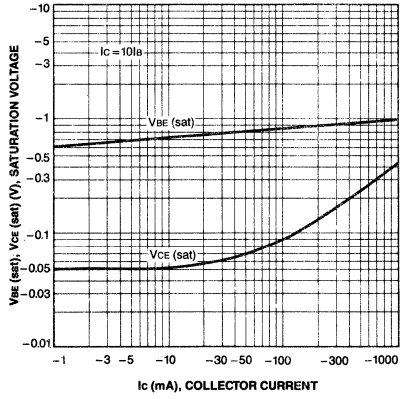
DC CURRENT GAIN



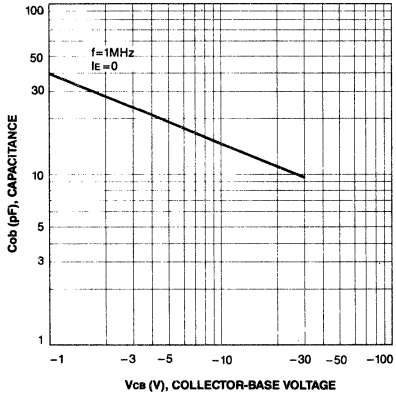
CURRENT GAIN-BANDWIDTH PRODUCT



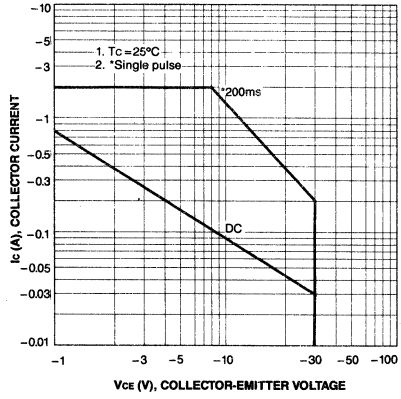
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



COLLECTOR OUTPUT CAPACITANCE



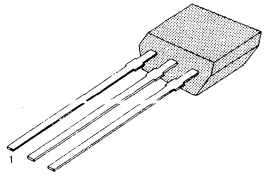
SAFE OPERATING AREA



AUDIO FREQUENCY AMPLIFIER

- **Complement to KSD1020**

TO-92S



1. Emitter 2. Collector 3. Base

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−30	V
Collector-Emitter Voltage	V_{CEO}	−25	V
Emitter-Base Voltage	V_{EBO}	−5.0	V
Collector Current (DC)	I_C	−700	mA
*Collector Current (Pulse)	I_C	−1.0	A
Collector Dissipation	P_C	350	mW
Junction Temperature	T_j	150	°C
Storage Temperature	Tstg	−55 ~ 150	°C

* PW ≤ 10 ms, duty cycle ≤ 50 %

3

ELECTRICAL CHARACTERISTICS (T_a=25°C)

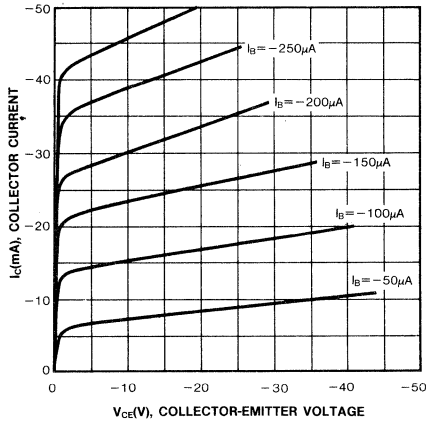
Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Cutoff Current	I_{CBO}	V_{CB}=−30V, I_E=0			−100	nA
Emitter Cutoff Current	I_{EBO}	V_{EB}=−5V, I_C=0			−100	nA
*DC Durrent Gain	$h_{FE}1$	V_{CE}=−1V, I_C=−100mA	70	200	400	
	$h_{FE}2$	V_{CE}=−1V, I_C=−700mA	35	100		
*Base Emitter Voltage	V_{BE}	V_{CE}=−6V, I_C=−10mA	−600	−640	−700	mV
*Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=−700mA, I_B=−70mA		−0.25	−0.4	V
*Base-Emitter Saturation Voltage	V_{BE}(sat)	I_C=−700mA, I_B=−70mA		−0.95	−1.2	V
Output Capacitance	C_{OB}	V_{CB}=−6V, I_E=0, f=1MHz		17	40	pF
Current Gain-Bandwidth Product	f_T	V_{CE}=−6V, I_E=10mA	50	160		MHz

* Pulse Test: PW≤350 μs, Duty Cycle ≤ 2% Pulsed

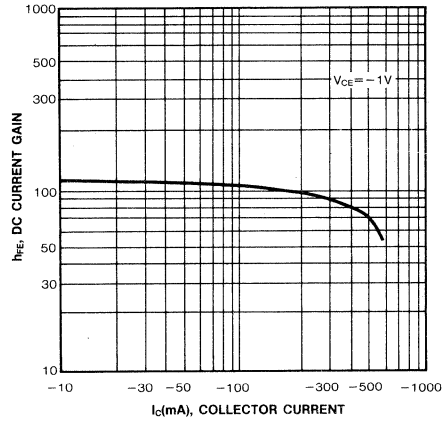
h_{FE}(1) CLASSIFICATION

Classification	O	Y	G
h_{FE}(1)	70-140	120-240	200-400

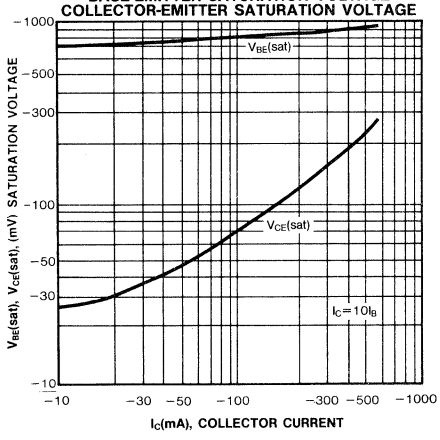
STATIC CHARACTERISTIC



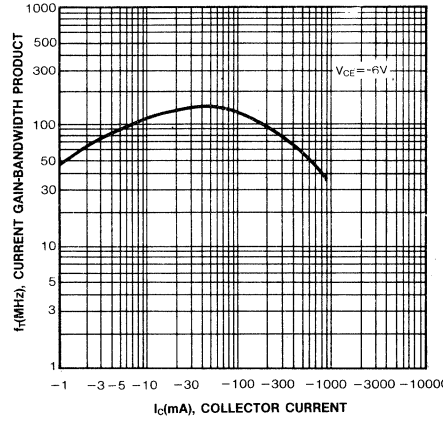
DC CURRENT GAIN



BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



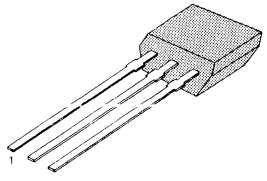
CURRENT GAIN-BANDWIDTH PRODUCT



AUDIO FREQUENCY POWER AMPLIFIER

- **Complement to** KSD1021
- **Collector Current** $I_C = -1A$
- **Collector Dissipation** $P_C = 350mW$

TO-92S



1. Emitter 2. Collector 3. Base

ABSOLUTE MAXIMUM RATINGS ($T_a = 25°C$)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−30	V
Collector-Emitter Voltage	V_{CEO}	−25	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current	I_C	−1.0	A
Collector Dissipation	P_C	350	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ 150	°C

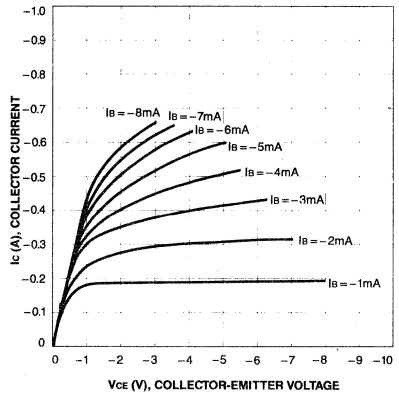
ELECTRICAL CHARACTERISTICS ($T_a = 25°C$)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	$I_C = -100\mu A$, $I_E = 0$	−30			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	$I_C = -10mA$, $I_B = 0$	−25			V
Emitter-Base Breakdown Voltage	BV_{EBO}	$I_E = -100\mu A$, $I_C = 0$	−5			V
Collector Cut-off Current	I_{CBO}	$V_{CB} = -30V$, $I_E = 0$			−0.1	μA
DC Current Gain	h_{FE}	$V_{CE} = -1V$, $I_C = -100mA$	70		400	
Collector-Emitter Saturation Voltage	V_{CE} (sat)	$I_C = -1A$, $I_B = -0.1A$			−0.5	V
Base-Emitter Saturation Voltage	V_{BE} (sat)	$I_C = -1A$, $I_B = -0.1A$			−1.2	V
Current-Gain-Bandwidth Product	f_T	$V_{CE} = -6V$, $I_C = -10mA$		110		MHz
Output Capacitance	Cob	$V_{CB} = -6V$, f=1 MHz, $I_E = 0$		18		pF

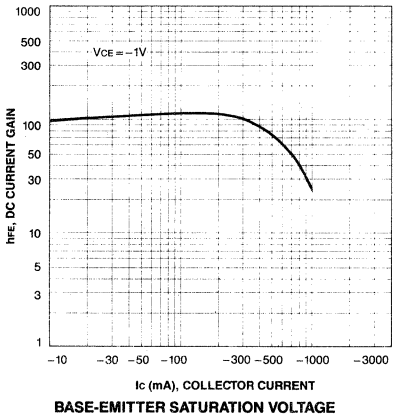
h_{FE} CLASSIFICATION

Classification	O	Y	G
h_{FE}	70-140	120-240	200-400

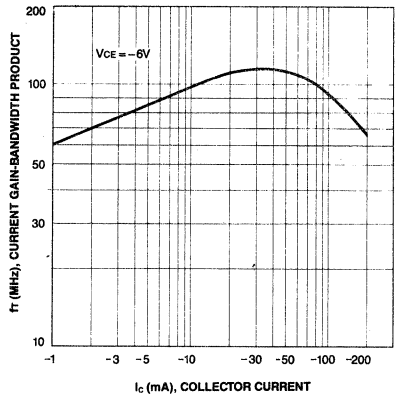
STATIC CHARACTERISTIC



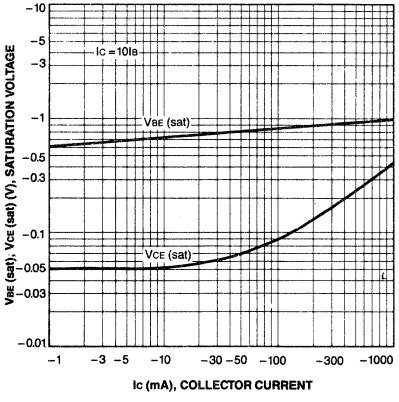
DC CURRENT GAIN



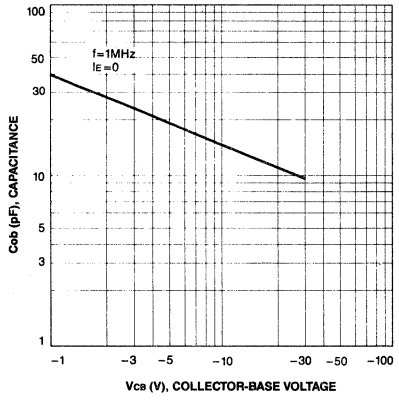
CURRENT GAIN-BANDWIDTH PRODUCT



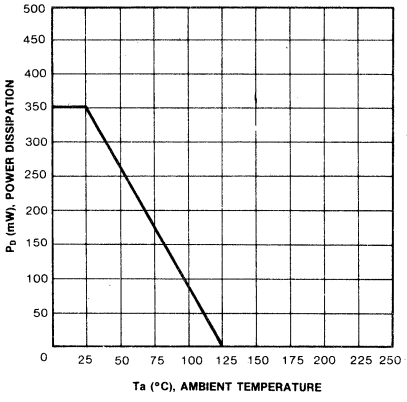
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



COLLECTOR OUTPUT CAPACITANCE

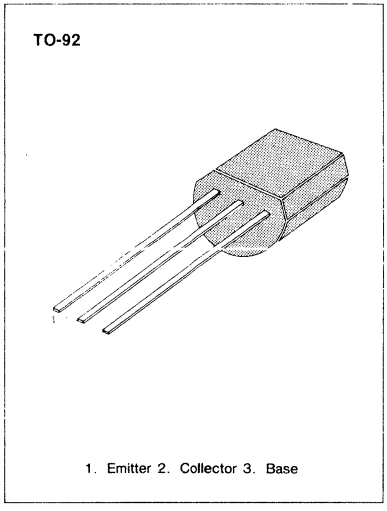


POWER DERATING



AUDIO FREQUENCY POWER AMPLIFIER
MEDIUM SPEED SWITCHING

• **Complement to KSD1616/1616A**



ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic		Symbol	Rating	Unit
Collector-Base Voltage	: KSB1116	V_{CBO}	−60	V
	: KSB1116A		−80	V
Collector-Emitter Voltage	: KSB1116	V_{CEO}	−50	V
	: KSB1116A		−60	V
Emitter-Base Voltage		V_{EBO}	−6	V
Collector Current (DC)		I_C	−1	A
*Collector Current (Pulse)		I_C	−2	A
Collector Dissipation		P_C	0.75	W
Junction Temperature		Tj	150	°C
Storage Temperature		Tstg	−55∼150	°C

* PW≤10ms, Duty Cycle≤50%

ELECTRICAL CHARACTERISTICS (T_a=25°C)

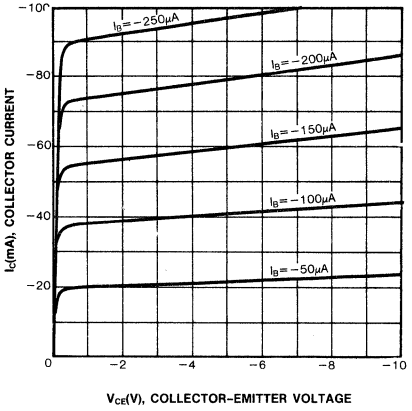
Characteristic		Symbol	Test Conditions	Min	Typ	Max	Unit
Collector Cutoff Current		I_{CBO}	V_{CB}=−60V, I_E=0			−100	nA
Emitter Cutoff Current		I_{EBO}	V_{EB}=−6V, I_C=0			−100	nA
*DC Current Gain	: KSB1116	h_{FE1}	V_{CE}=−2V, I_C=−100mA	135		600	
	: KSB1116A			135		400	
		h_{FE2}	V_{CE}=−2V, I_C=−1A	81			
*Base Emitter On Voltage		V_{BE} (on)	V_{CE}=−2V, I_C=−50mA	−600	−650	−700	mV
*Collector Emitter Saturation Voltage		V_{CE} (sat)	I_C=−1A, I_B=−50mA		−0.2	−0.3	V
*Base Emitter Saturation Voltage		V_{BE} (sat)	I_C=−1A, I_B=−50mA		−0.9	−1.2	V
Output Capacitance		Cob	V_{CB}=−10V, I_E=0 f=1MHz		25		pF
Current Gain Bandwidth Product		f_T	V_{CE}=−2V, I_C=−100mA	70	120		MHz
Turn On Time		ton	V_{CC}=−10V, I_C=−100mA		0.07		μs
Storage Time		ts	I_B1=−I_B2=−10mA		0.7		μs
Fall Time		tf	V_{BE} (off)= 2∼3V		0.07		μs

* Pulse Test: PW≤350μs, Duty Cycle≤2% Pulsed

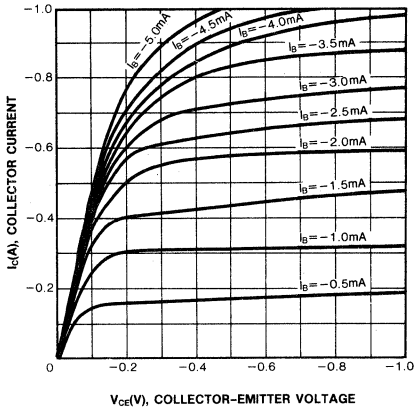
h_{FE}(1) CLASSIFICATION

Classification	Y	G	L
h_{FE}(1)	135-270	200-400	300-600

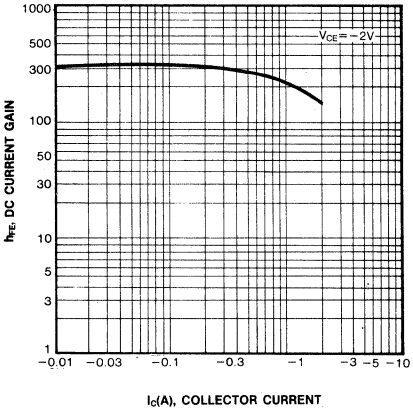
STATIC CHARACTERISTIC



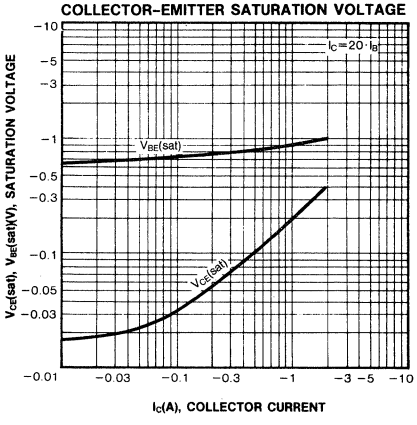
STATIC CHARACTERISTIC



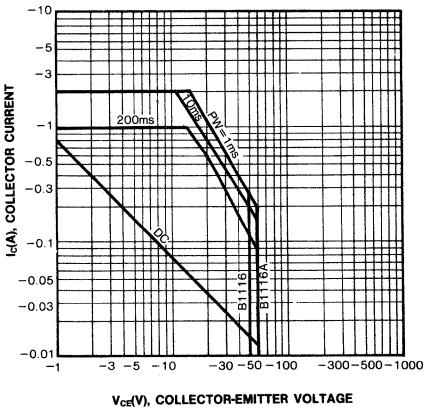
DC CURRENT GAIN



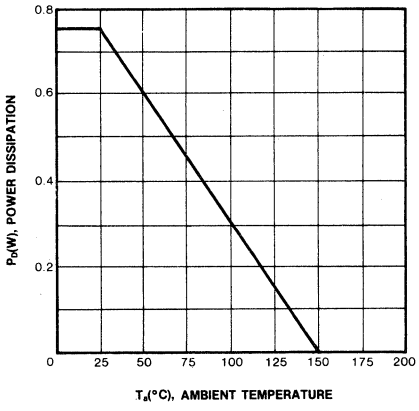
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



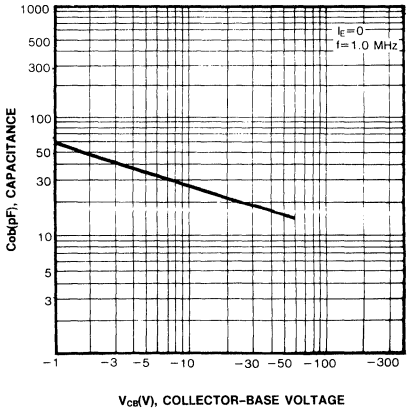
SAFE OPERATING AREA



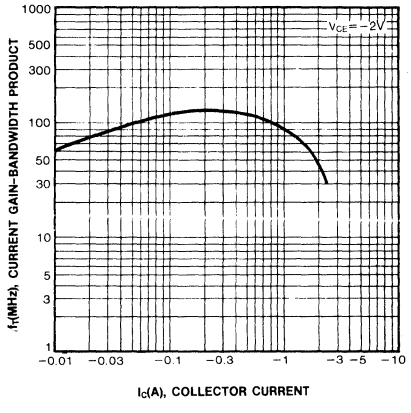
POWER DERATING



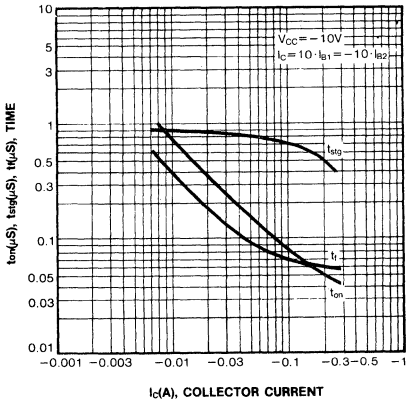
COLLECTOR OUTPUT CAPACITANCE



CURRENT GAIN-BANDWIDTH PRODUCT



SWITCHING TIME

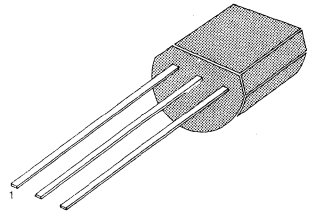


3

AM FREQUENCY CONVERTER
IF AMPLIFIER

- **Current Gain Bandwidth Product f_T=100MHz (Typ)**
- **Complement to KSA542**

TO-92



1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	30	V
Collector-Emitter Voltage	V_{CEO}	25	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	50	mA
Collector Dissipation	P_C	250	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ 150	°C

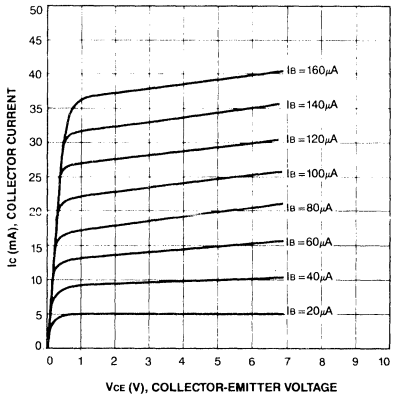
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=100μA, I_E=0	30			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=10mA, I_B=0	25			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=10μA, I_C=0	5			V
Collector Cut-off Current	I_{CBO}	V_{CB}=25V, I_E=0			0.1	μA
Emitter Cut-off Current	I_{EBO}	V_{EB}=5V, I_C=0			0.1	μA
DC Current Gain	h_{FE}	V_{CE}=6V, I_C=1mA	40		1000	
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=10mA, I_B=1mA		0.1	0.2	V
Current Gain-Bandwidth Product	f_T	V_{CE}=6V, I_C=1mA		100		MHz
Output Capacitance	Cob	V_{CB}=6V, I_E=0 f=1MHz		2.6	4.4	pF

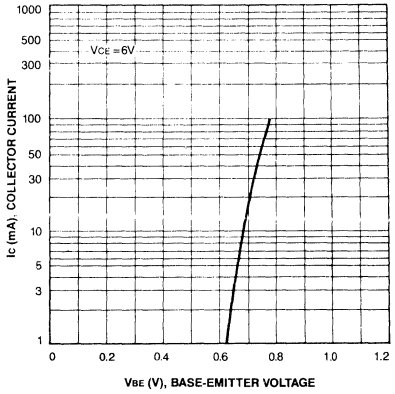
h_{FE} CLASSIFICATION

Classification	R	O	Y	G	L	V
h_{FE}	40-80	70-140	120-240	200-400	350-700	600-1000

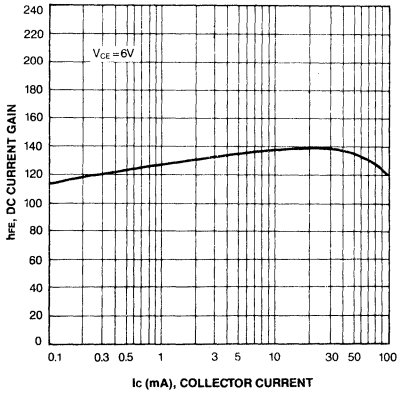
STATIC CHARACTERISTIC



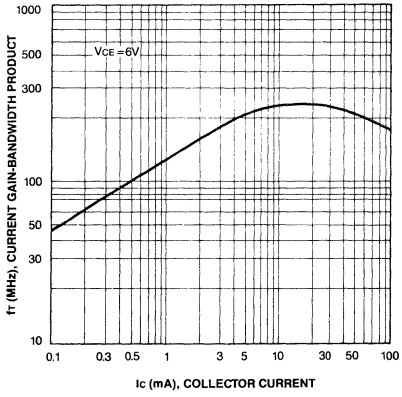
BASE-EMITTER ON VOLTAGE



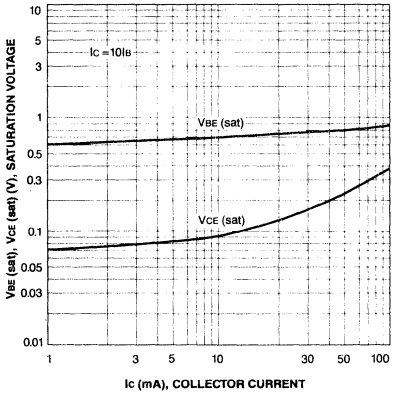
DC CURRENT GAIN



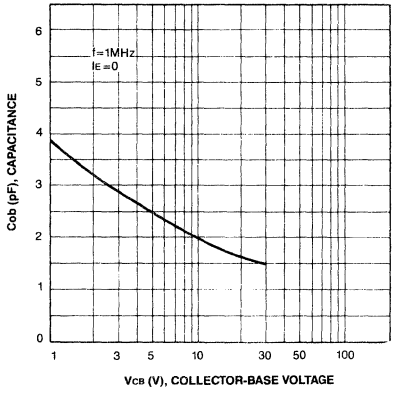
CURRENT GAIN-BANDWIDTH PRODUCT



BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



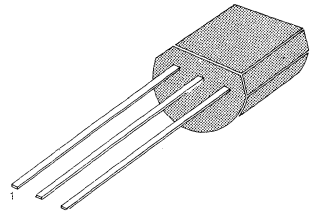
COLLECTOR OUTPUT CAPACITANCE



TV FINAL PICTURE IF AMPLIFIER APPLICATIONS

- G_{Pe}=33dB (Typ) (f=45MHz)

TO-92



1. Emitter 2. Base 3. Collector

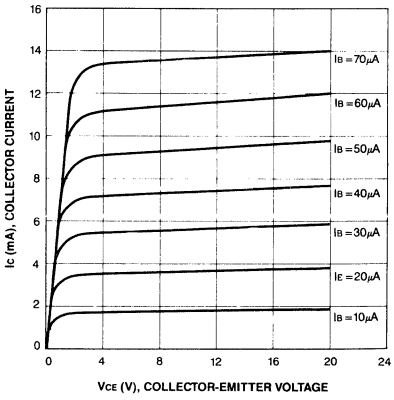
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	30	V
Collector-Emitter Voltage	V_{CEO}	25	V
Emitter-Base Voltage	V_{EBO}	4	V
Collector Current	I_C	50	mA
Collector Dissipation	P_C	300	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ 150	°C

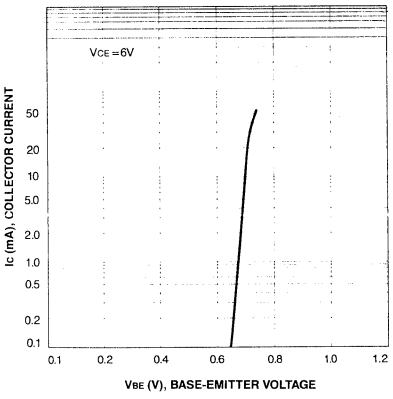
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=10μA, I_E=0	30			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=5mA, I_B=0	25			V
Collector Cut-off Current	I_{CBO}	V_{CB}=30V, I_E=0			0.1	μA
Emitter Cut-off Current	I_{EBO}	V_{EB}=3V, I_C=0			0.1	μA
DC Current Gain	h_{FE}	V_{CE}=12.5V, I_C=12.5mA	20		200	
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=15mA, I_B=1.5mA			0.2	V
Base-Emitter Saturation Voltage	V_{BE} (sat)	I_C=15mA, I_B=1.5mA			1.5	V
Output Capacitance	Cob	V_{CB}=10V, I_E=0, f=1MHz	0.8		2	pF
Collector-Base Time Constant	Cc·rbb′	V_{CB}=10V, I_E=−1mA f=30MHz			25	ps
Current Gain-Bandwidth Product	f_T	V_{CE}=12.5V, I_C=12.5mA	300			MHz
Power Gain	Gpe	V_{CC}=12.5V, f=45MHz I_E=−12.5mA	28		36	dB

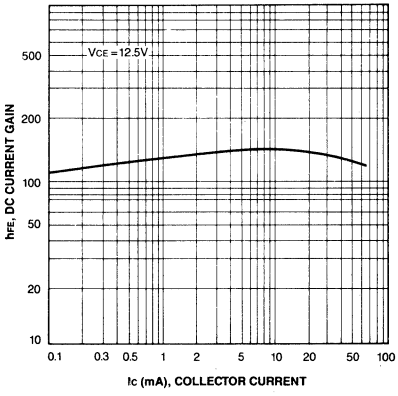
STATIC CHARACTERISTIC



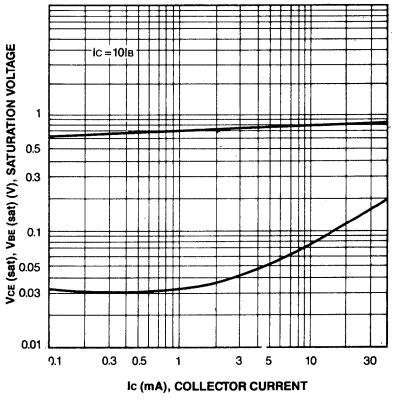
BASE-EMITTER ON VOLTAGE



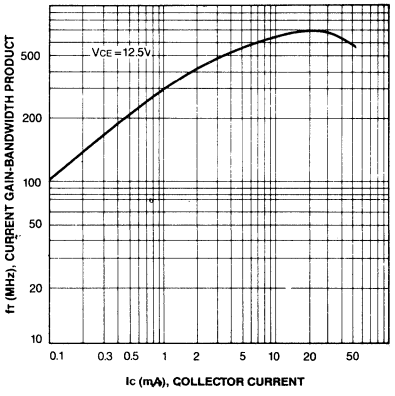
DC CURRENT GAIN



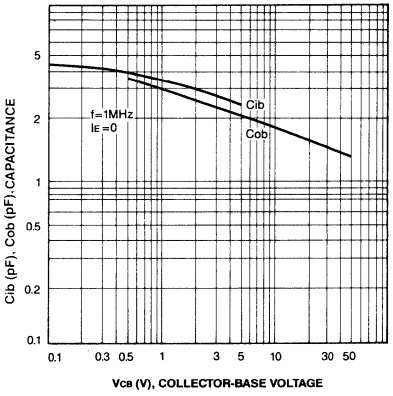
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



CURRENT GAIN-BANDWIDTH PRODUCT



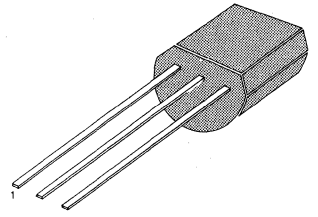
COLLECTOR INPUT CAPACITANCE
COLLECTOR OUTPUT CAPACITANCE



LOW FREQUENCY AMPLIFIER
HIGH FREQUENCY OSCILLATOR

- **Complement to KSA539**
- **Collector-Base Voltage V_{CBO} =60V**

TO-92



1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	60	V
Collector-Emitter Voltage	V_{CEO}	45	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	200	mA
Collector Dissipation	P_C	400	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ 150	°C

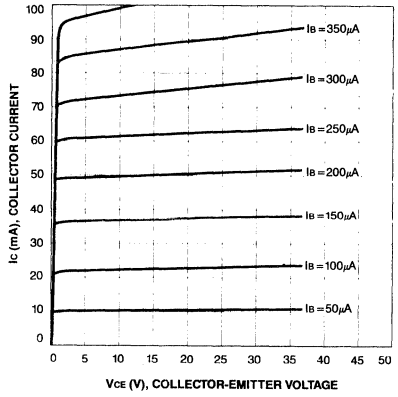
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=100μA, I_E=0	60			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=10mA, I_B=0	45			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=10μA, I_C=0	5			V
Collector Cut-off Current	I_{CBO}	V_{CB}=45V, I_E=0			0.1	μA
Emitter Cut-off Current	I_{EBO}	V_{EB}=3V, I_C=0			0.1	μA
DC Current Gain	h_{FE}	V_{CE}=1V, I_C=50mA	40		400	
Base-Emitter On Voltage	V_{BE} (on)	V_{CE}=10V, I_C=10mA	0.6	0.65	0.9	V
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=150mA, I_B=15mA		0.15	0.4	V
Base-Emitter Saturation Voltage	V_{BE} (sat)	I_C=150mA, I_B=15mA		0.83	1.1	V
Current Gain-Bandwidth Product	f_T	V_{CE}=10V, I_C=10mA	100	200		MHz
Output Capacitance	Cob	V_{CB}=10V, I_E=0 f=1MHz		4		pF

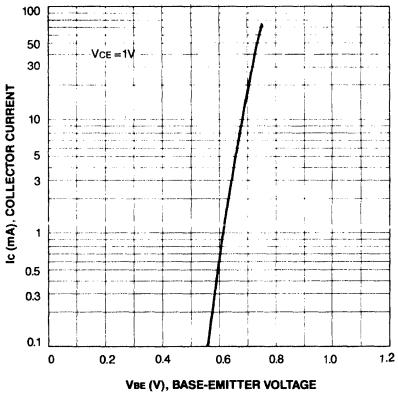
h_{FE} CLASSIFICATION

Classification	R	O	Y	G
h_{FE}	40-80	70-140	120-240	200-400

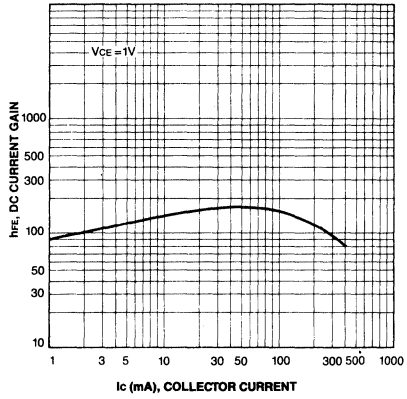
STATIC CHARACTERISTIC



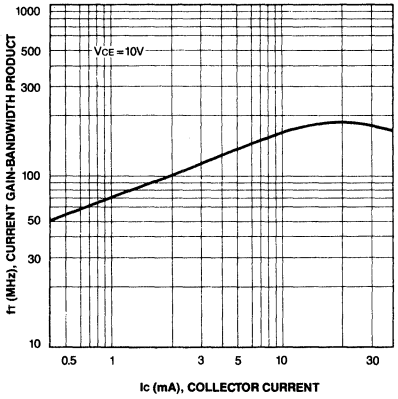
BASE-EMITTER ON VOLTAGE



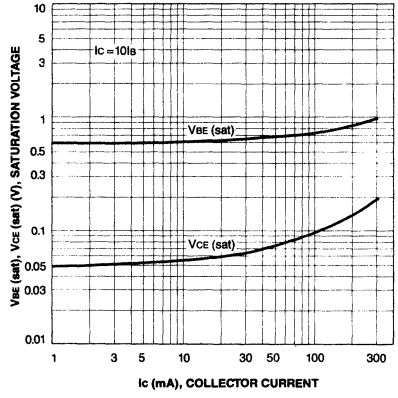
DC CURRENT GAIN



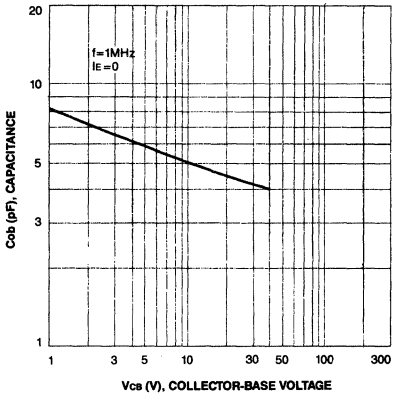
CURRENT GAIN-BANDWIDTH PRODUCT



BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



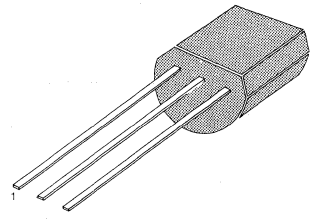
COLLECTOR OUTPUT CAPACITANCE



FM RADIO RF AMP, MIX, CONV, OSC, IF AMP

- **High Current Gain Bandwidth Product f_T =250MHz (Typ)**

TO-92



1 Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a =25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	35	V
Collector-Emitter Voltage	V_{CEO}	30	V
Emitter-Base Voltage	V_{EBO}	4	V
Collector Current	I_C	30	mA
Collector Dissipation	P_C	250	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ 150	°C

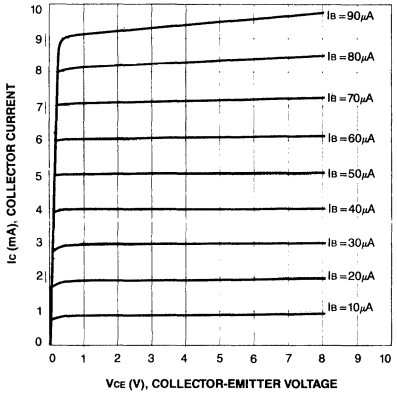
ELECTRICAL CHARACTERISTICS (T_a =25°C)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C =100μA, I_E =0	35			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C =5mA, I_B =0	30			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E =10μA, I_C =0	4			V
Collector Cut-off Current	I_{CBO}	V_{CB} =30V, I_E =0			0.1	μA
Emitter Cut-off Current	I_{EBO}	V_{EB} =4V, I_C =0			0.1	μA
DC Current Gain	h_{FE}	V_{CE} = 12V, I_C = 2mA	40		240	
Base-Emitter On Voltage	V_{BE} (on)	V_{CE} =6V, I_C =1mA	0.65	0.70	0.75	V
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C =10mA, I_B =1mA		0.1	0.4	V
Current Gain-Bandwidth Product	f_T	V_{CE} =10V, I_C =1mA	100	250		MHz
Output Capacitance	Cob	V_{CB} =10V, I_E =0 f=1MHz		2.0	3.2	pF

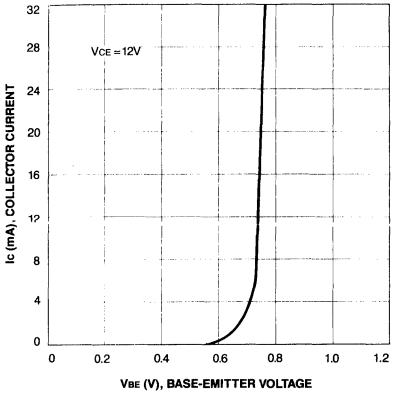
h_{FE} CLASSIFICATION

Classification	R	O	Y
h_{FE}	40-80	70-140	120-240

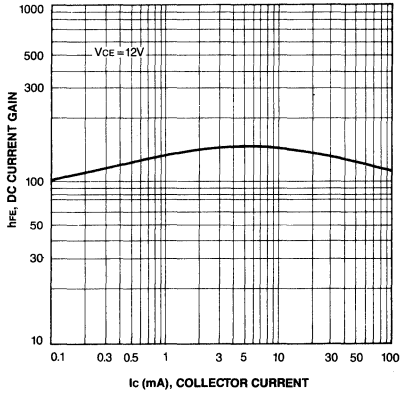
STATIC CHARACTERISTIC



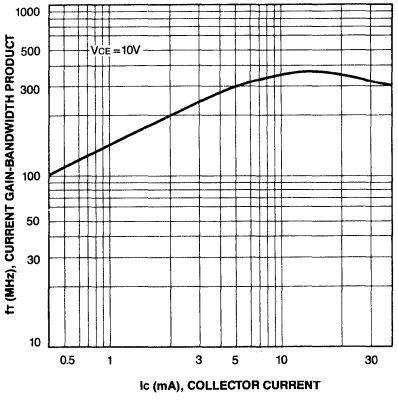
BASE-EMITTER ON VOLTAGE



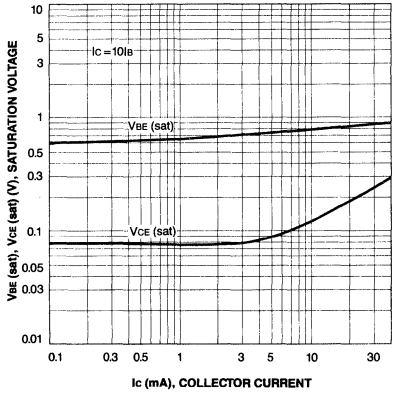
DC CURRENT GAIN



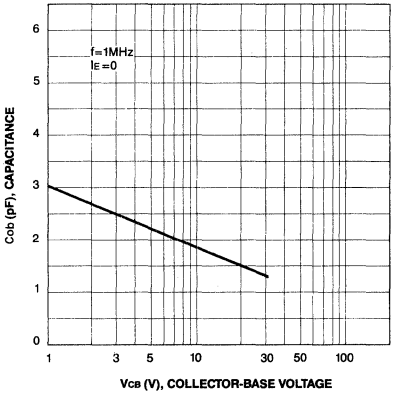
CURRENT GAIN-BANDWIDTH PRODUCT



BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



COLLECTOR OUTPUT CAPACITANCE



FM/AM RADIO RF AMP, CONV, OSC, IF AMP

- **Current-Gain-Bandwidth Product f_T =200MHz**

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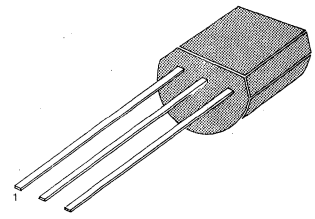


1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a =25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	35	V
Collector-Emitter Voltage	V_{CEO}	30	V
Emitter-Base Voltage	V_{EBO}	4	V
Collector Current	I_C	100	mA
Collector Dissipation	P_C	250	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ 150	°C

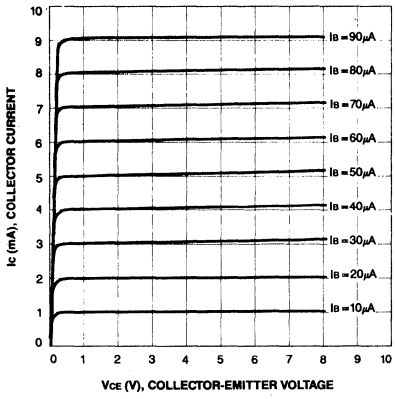
ELECTRICAL CHARACTERISTICS (T_a =25°C)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C =100μA, I_E =0	35			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C =5mA, I_B =0	30			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E =10μA, I_C =0	4			V
Collector Cut-off Current	I_{CBO}	V_{CB} =30V, I_E =0			0.1	μA
Emitter Cut-off Current	I_{EBO}	V_{EB} =4V, I_C =0			0.1	μA
DC Current Gain	h_{FE}	V_{CE} = 12V, I_C = 2mA	40		400	
Base-Emitter On Voltage	V_{BE}(on)	V_{CE} =6V, I_C =1mA	0.65	0.70	0.75	V
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C =10mA, I_B =1mA		0.1	0.4	V
Current Gain-Bandwidth Product	f_T	V_{CE} =10V, I_C =1mA	80	200		MHz
Output Capacitance	Cob	V_{CB} =10V, I_E =0 f=1MHz		2.0	3.5	pF

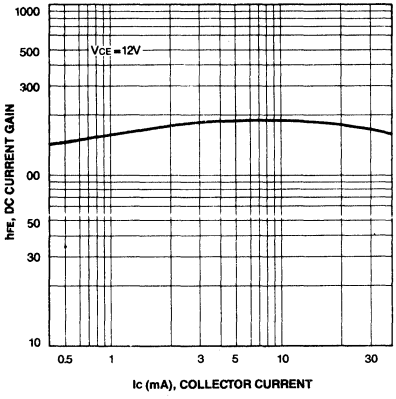
h_{FE} CLASSIFICATION

Classification	R	O	Y	G
h_{FE}	40-80	70-140	120-240	200-400

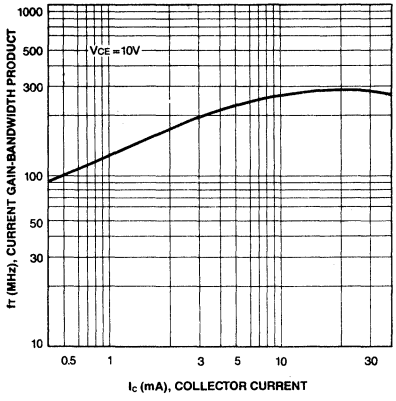
STATIC CHARACTERISTIC



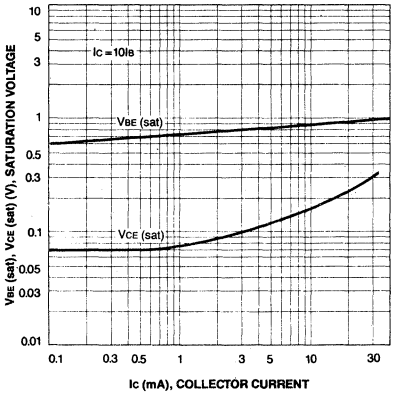
DC CURRENT GAIN



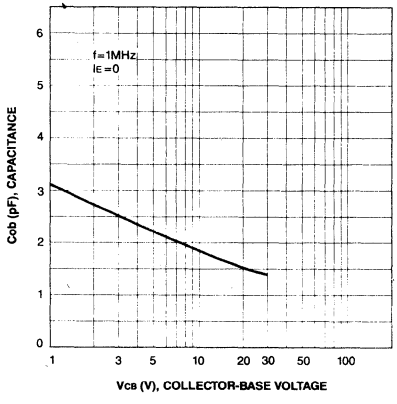
CURRENT GAIN-BANDWIDTH PRODUCT



BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



COLLECTOR OUTPUT CAPACITANCE



3

LOW FREQUENCY, LOW NOISE AMPLIFIER

- **Collector-Base Voltage V_{CBO}=30V**
- **Low Noise Level NL=50mV (Max)**

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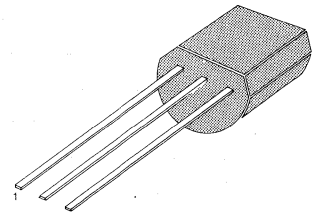


1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	30	V
Collector-Emitter Voltage	V_{CEO}	25	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	50	mA
Collector Dissipation	P_C	250	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

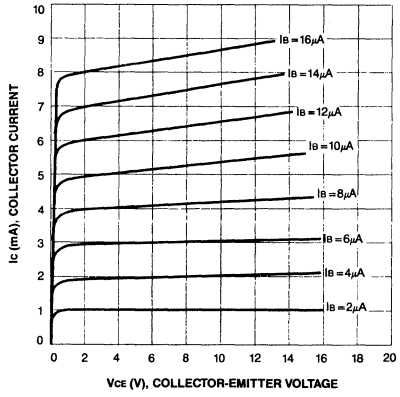
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=100μA, I_E=0	30			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=10mA, I_B=0	25			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=10μA, I_C=0	5			V
Collector Cut-off Current	I_{CBO}	V_{CB}=25V, I_E=0			50	nA
Emitter Cut-off Current	I_{EBO}	V_{EB}=3V, I_C=0			100	nA
DC Current Gain	h_{FE}	V_{CE}=3V, I_C=0.5mA	120		1000	
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=20mA, I_B=2mA		0.1	0.2	V
Base-Emitter On Voltage	V_{BE} (on)	V_{CE}=3V, I_C=0.5mA		0.62	0.7	V
Current Gain-Bandwidth Product	f_T	V_{CE}=3V, I_C=1mA		100		MHz
Noise Level	NL	V_{CC}=12V, I_C=0.1mA Rs=25KΩ A_V=80dB, (f=1KHz)		30	50	mV

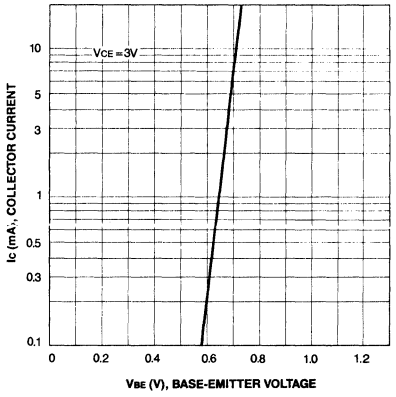
h_{FE} CLASSIFICATION

Classification	Y	G	L	V
h_{FE}	120-240	200-400	350-700	600-1000

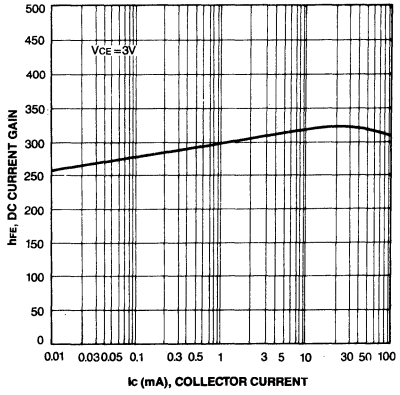
STATIC CHARACTERISTIC



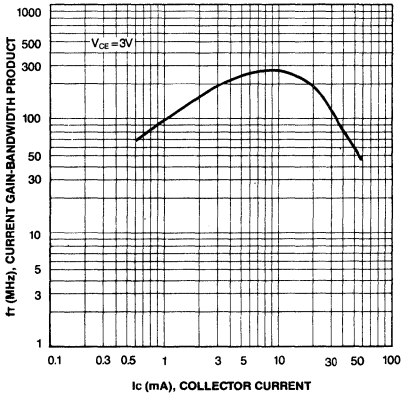
BASE-EMITTER ON VOLTAGE



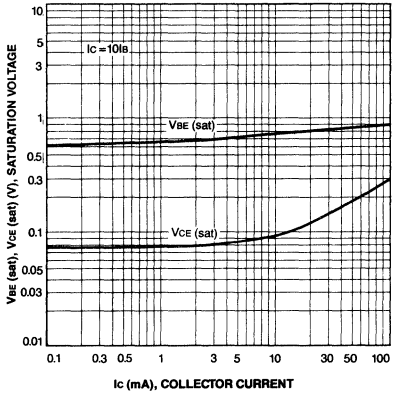
DC CURRENT GAIN



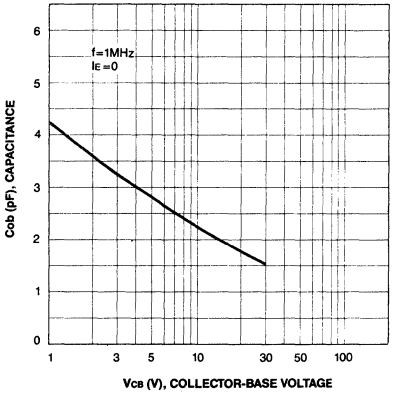
CURRENT GAIN-BANDWIDTH PRODUCT



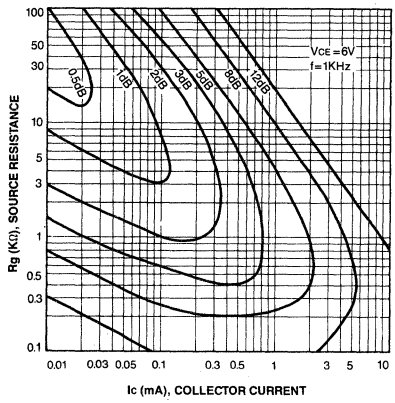
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



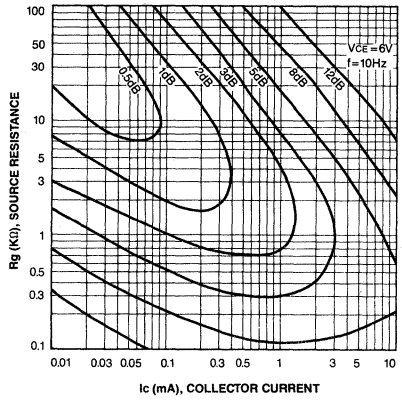
COLLECTOR OUTPUT CAPACITANCE



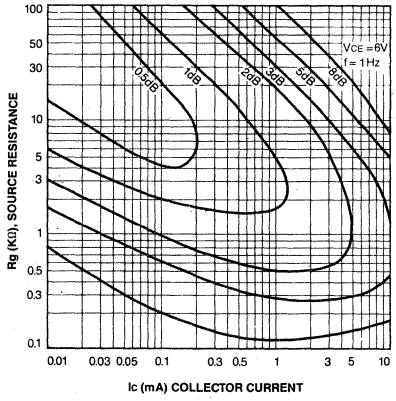
NOISE FIGURE



NOISE FIGURE



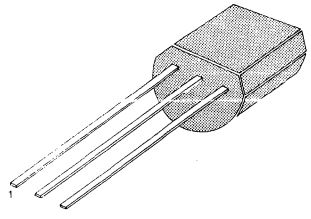
NOISE FIGURE



AUDIO FREQUENCY AMPLIFIER
HIGH FREQUENCY OSC.

- **Complement to KSA733**
- **Collector-Base Voltage V_{CBO} = 60V**
- **High Current Gain Bandwidth Product f_T = 300MHz (Typ)**

TO-92



1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a = 25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	60	V
Collector-Emitter Voltage	V_{CEO}	50	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	150	mA
Collector Dissipation	P_C	250	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ 150	°C

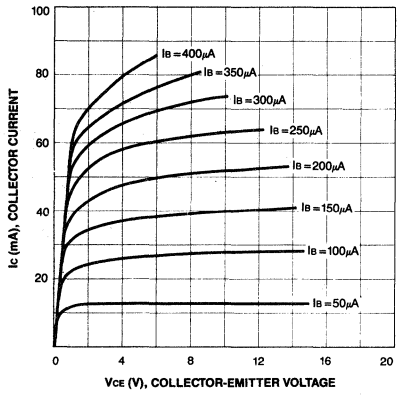
ELECTRICAL CHARACTERISTICS (T_a = 25°C)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C = 100μA, I_E = 0	60			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C = 10mA, I_B = 0	50			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E = 10μA, I_C = 0	5			V
Collector Cut-off Current	I_{CBO}	V_{CB} = 40V, I_E = 0			0.1	μA
Emitter Cut-off Current	I_{EBO}	V_{EB} = 3V, I_C = 0			0.1	μA
DC Current Gain	h_{FE}	V_{CE} = 6V, I_C = 1.0mA	40		700	
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C = 100mA, I_B = 10mA		0.15	0.3	V
Current-Gain-Bandwidth Product	f_T	V_{CE} = 6V, I_C = 10mA		300		MHz
Output Capacitance	Cob	V_{CB} = 6V, I_E = 0 f = 1MHz		2.5		pF
Noise Figure	NF	V_{CE} = 6V, I_E = −0.5mA f = 1KHz, Rs = 500Ω		4.0		dB

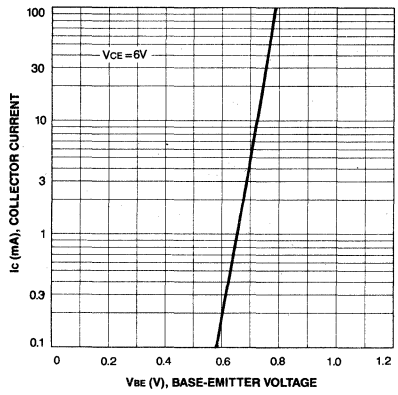
h_{FE} CLASSIFICATION

Classification	R	O	Y	G	L
h_{FE}	40-80	70-140	120-240	200-400	350-700

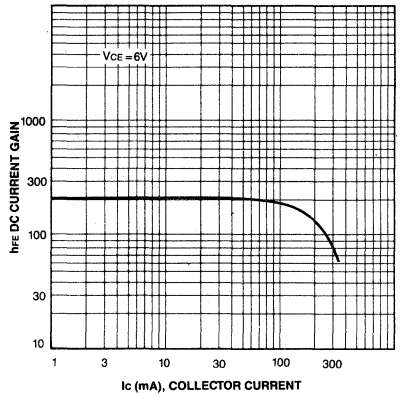
STATIC CHARACTERISTIC



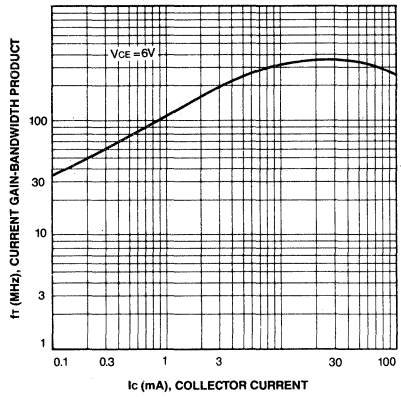
TRANSFER CHARACTERISTIC



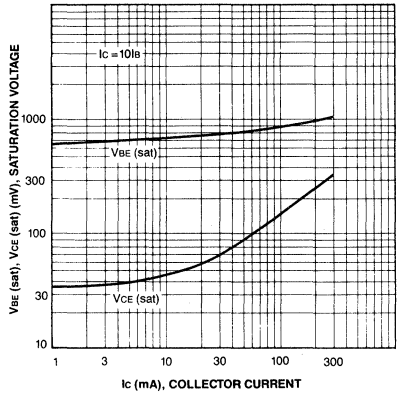
DC CURRENT GAIN



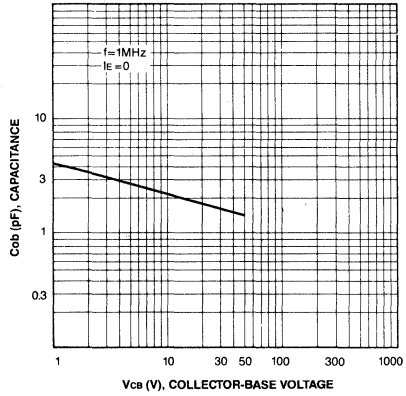
CURRENT GAIN BANDWIDTH PRODUCT



BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



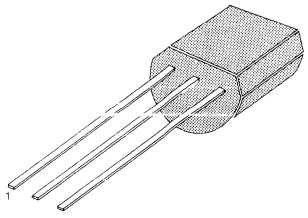
OUTPUT CAPACITANCE



LOW FREQUENCY AMPLIFIER
MEDIUM SPEED SWITCHING

- **Complement to KSA708**
- **High Collector-Base Voltage V_{CBO} = 80V**
- **Collector Current I_C = 700mA**
- **Collector Dissipation P_C = 800mW**

TO-92



1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a = 25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	80	V
Collector-Emitter Voltage	V_{CEO}	60	V
Emitter-Base Voltage	V_{EBO}	8	V
Collector Current	I_C	700	mA
Collector Dissipation	P_C	800	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ 150	°C

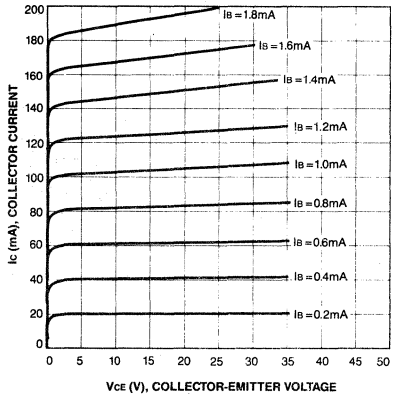
ELECTRICAL CHARACTERISTICS (T_a = 25°C)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C = 100μA, I_E = 0	80			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C = 10mA, I_B = 0	60			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E = 10μA, I_C = 0	8			V
Collector Cut-off Current	I_{CBO}	V_{CB} = 60V, I_E = 0			0.1	μA
Emitter Cut-off Current	I_{EBO}	V_{EB} = 5V, I_C = 0			0.1	μA
DC Current Gain	h_{FE}	V_{CE} = 2V, I_C = 50mA	40		400	
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C = 500mA, I_B = 50mA		0.2	0.4	V
Base-Emitter Saturation Voltage	V_{BE} (sat)	I_C = 500mA, I_B = 50mA		0.86	1.1	V
Current Gain-Bandwidth Product	f_T	V_{CE} = 10V, I_C = 50mA	30	50		MHz
Output Capacitance	Cob	V_{CB} = 10V, I_E = 0 f=1MHz		8		pF

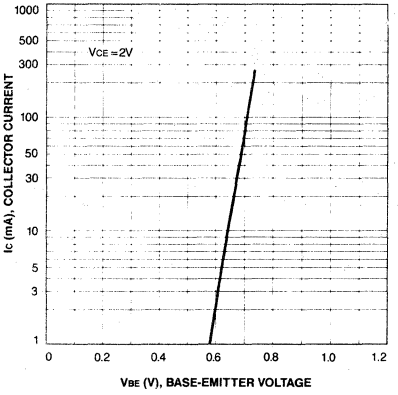
h_{FE} CLASSIFICATION

Classification	R	O	Y	G
h_{FE}	40-80	70-140	120-240	200-400

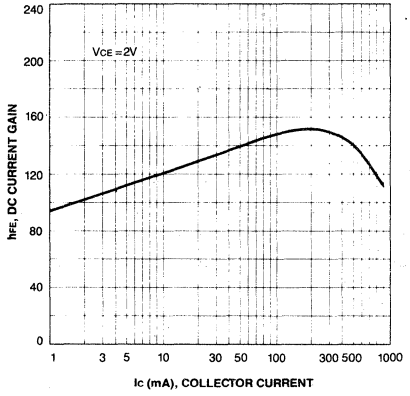
STATIC CHARACTERISTIC



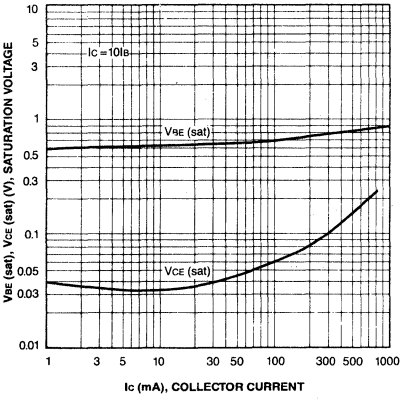
BASE-EMITTER ON VOLTAGE



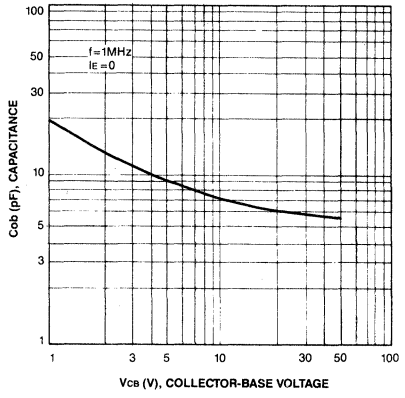
DC CURRENT GAIN



BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



COLLECTOR OUTPUT CAPACITANCE



HIGH VOLTAGE AMPLIFIER

- **High Collector-Base Voltage V_{CBO} =160V**
- **Collector Current I_C =700mA**
- **Collector Dissipation P_C =800mW**
- **Complement to KSA709**

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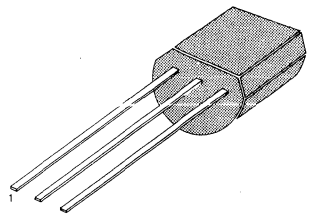


1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a =25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	160	V
Collector-Emitter Voltage	V_{CEO}	140	V
Emitter-Base Voltage	V_{EBO}	8	V
Collector Current	I_C	700	mA
Collector Dissipation	P_C	800	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ 150	°C

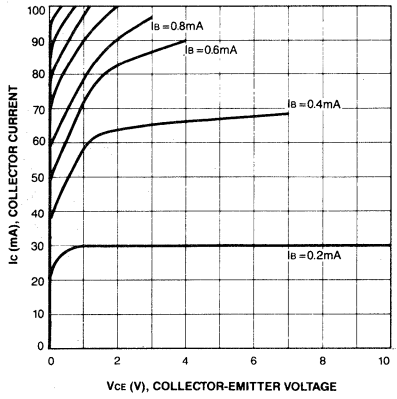
ELECTRICAL CHARACTERISTICS (T_a =25°C)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C =100μA, I_E =0	160			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C =10mA, I_B =0	140			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E =10μA, I_C =0	8			V
Collector Cut-off Current (Continuous)	I_{CBO}	V_{CB} =60V, I_E =0			0.1	μA
Emitter Cut-off Current	I_{EBO}	V_{EB} =5V, I_C =0			0.1	μA
DC Current Gain	h_{FE}	V_{CE} =2V, I_C =50mA	40		400	
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C =200mA, I_B =20mA		0.2	0.7	V
Base-Emitter Saturation Voltage	V_{BE} (sat)	I_C =200mA, I_B =20mA		0.86	1.0	V
Current Gain-Bandwidth Product	f_T	V_{CE} =10V, I_C =50mA	30	50		MHz
Output Capacitance	C_{ob}	V_{CB} =10V, I_E =0 f=1MHz		8		pF

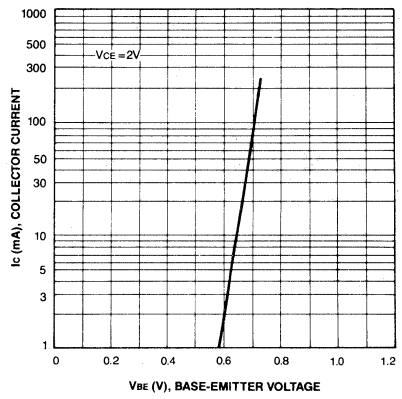
h_{FE} CLASSIFICATION

Classification	R	O	Y	G
h_{FE}	40-80	70-140	120-240	200-400

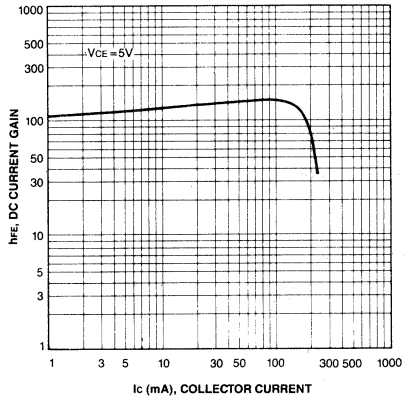
STATIC CHARACTERISTIC



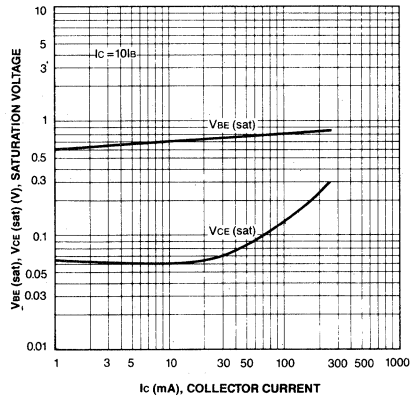
BASE-EMITTER ON VOLTAGE



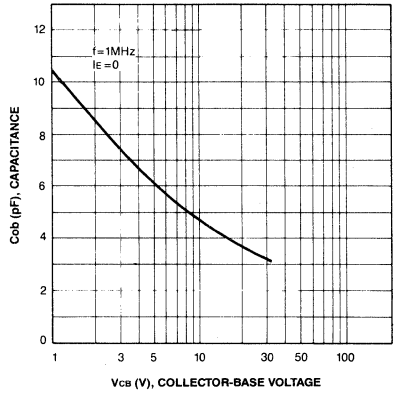
DC CURRENT GAIN



BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



COLLECTOR OUTPUT CAPACITANCE



TV 1ST, 2ND PICTURE IF AMPLIFIER (FORWARD AGC)

- High Current Gain Bandwidth Product f_T=700MHz
- High Power Gain Gpe=24dB (Typ) at 45MHz

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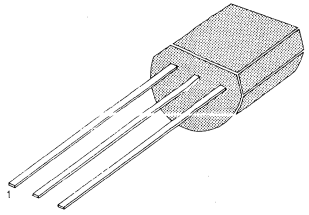


1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	30	V
Collector-Emitter Voltage	V_{CEO}	20	V
Emitter-Base Voltage	V_{EBO}	4	V
Collector Current	I_C	30	mA
Collector Dissipation	P_C	250	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

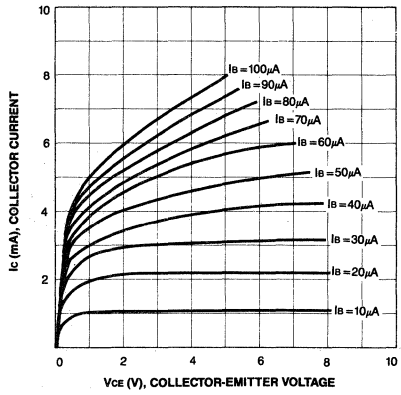
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=10μA, I_E=0	30			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=5mA, I_B=0	20			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=10μA, I_C=0	4			V
Collector Cut-off Current	I_{CBO}	V_{CB}=20V, I_E=0			0.1	μA
DC Current Gain	h_{FE}	V_{CE}=10V, I_C=2mA	40		240	
Current Gain-Bandwidth Product	f_T	V_{CE}=10V, I_C=3mA	400	700		MHz
Reverse Transfer Capacitance	C_{re}	V_{CB}=10V, I_E=0 f=1MHz		0.6		pF
Power Gain	Gpe	V_{CE}=10V, I_E=−3mA f=45MHz	20	24		dB
AGC Voltage	V_{AGC}	G_{PE}=−30dB f=45MHz	4.4	5.2	6.0	V

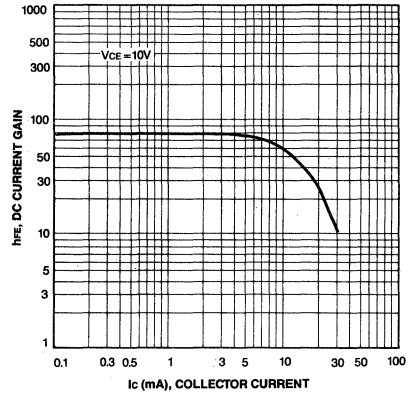
h_{FE} CLASSIFICATION

Classification	R	O	Y
h_{FE}	40-80	70-140	120-240

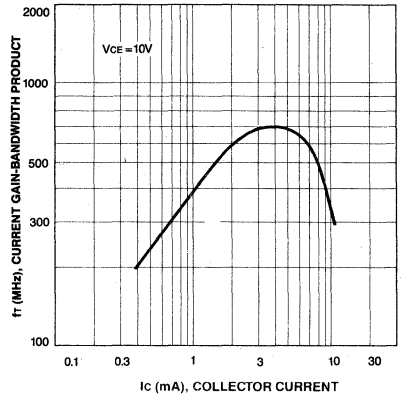
STATIC CHARACTERISTIC



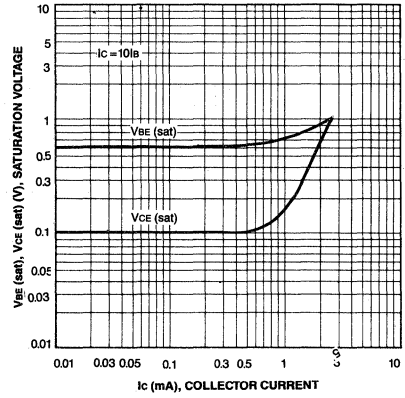
DC CURRENT GAIN



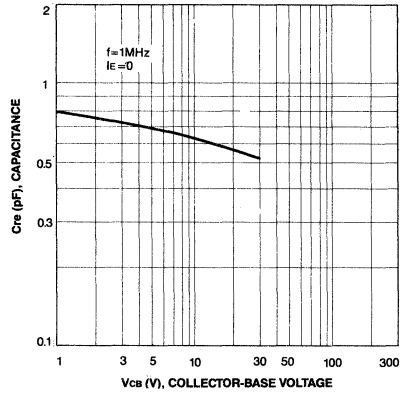
CURRENT GAIN-BANDWIDTH PRODUCT



BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



REVERSE CAPACITANCE



LOW FREQUENCY LOW NOISE AMPLIFIER

- **Collector-Base Voltage V_{CBO} = 50V**
- **Low Noise Level NL = 40mV (Max)**

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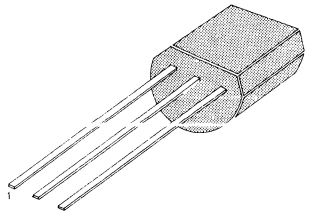


1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a = 25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	50	V
Collector-Emitter Voltage	V_{CEO}	45	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	50	mA
Collector Dissipation	P_C	250	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ 150	°C

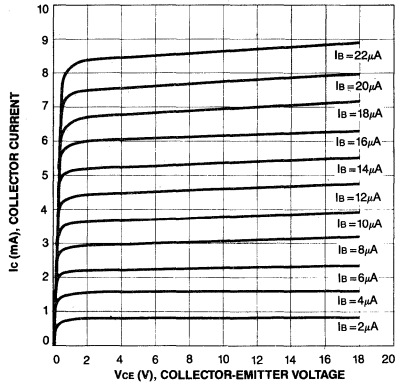
ELECTRICAL CHARACTERISTICS (T_a = 25°C)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C = 100μA, I_E = 0	50			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C = 10mA, I_B = 0	45			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E = 10μA, I_C = 0	5			V
Collector Cut-off Current	I_{CBO}	V_{CB} = 50V, I_E = 0			50	nA
Emitter Cut-off Current	I_{EBO}	V_{EB} = 5V, I_C = 0			100	nA
DC Current Gain	h_{FE}	V_{CE} = 3V, I_C = 0.5mA	120		1000	
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C = 20mA, I_B = 2mA		0.1	0.2	V
Base-Emitter On Voltage	V_{BE} (on)	V_{CE} = 3V, I_C = 0.5mA		0.62	0.7	V
Current Gain-Bandwidth Product	f_T	V_{CE} = 3V, I_C = 1mA	50	100		MHz
Noise Level	NL	V_{CE} = 12V, I_E = − 0.1mA R_S = 25KΩ A_V = 80dB, (f = 1KHz)		27	40	mV

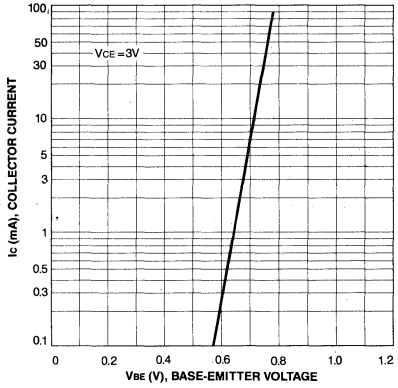
h_{FE} CLASSIFICATION

Classification	Y	G	L	V
h_{FE}	120-240	200-400	350-700	600-1000

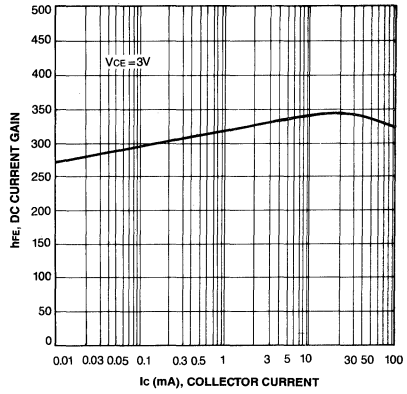
STATIC CHARACTERISTIC



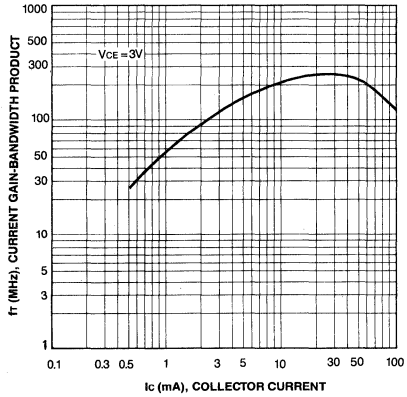
BASE-EMITTER ON VOLTAGE



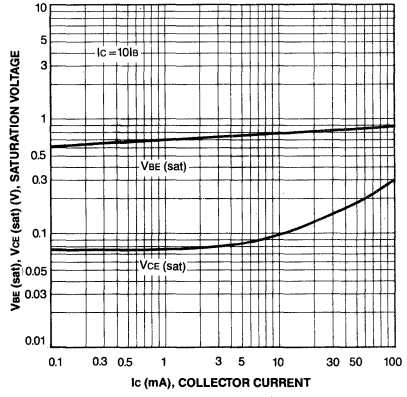
DC CURRENT GAIN



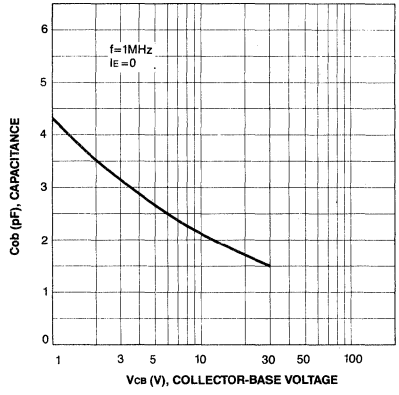
CURRENT GAIN-BANDWIDTH PRODUCT



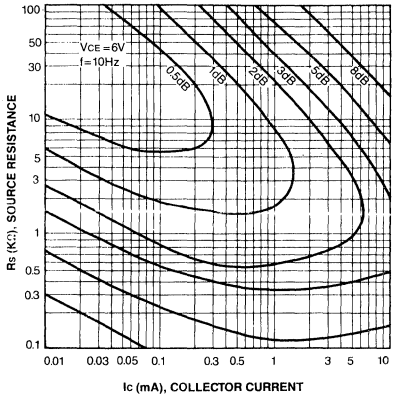
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



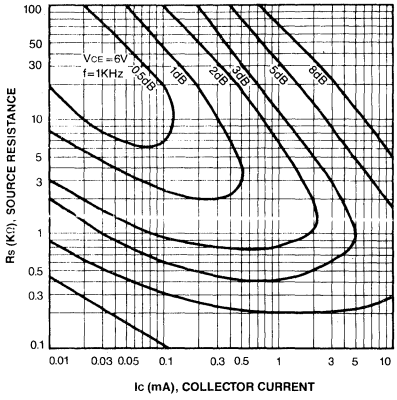
OUTPUT CAPACITANCE



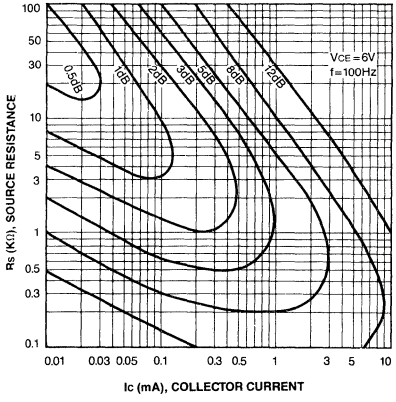
NOISE FIGURE



NOISE FIGURE



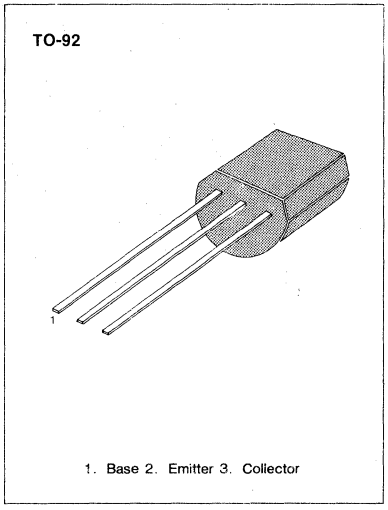
NOISE FIGURE



3

TV VHF TUNER RF AMPLIFIER (FORWARD AGC)

- **High Current Gain Bandwidth Product f_T=700MHz (Typ)**
- **Low Noise Figure NF=3.0dB (Max) at f=200MHz**
- **Low Reverse Transfer Capacitance Cre=0.5pF (Max)**



1. Base 2. Emitter 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	30	V
Collector-Emitter Voltage	V_{CEO}	30	V
Emitter-Base Voltage	V_{EBO}	4	V
Collector Current	I_C	20	mA
Collector Dissipation	P_C	250	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ 150	°C

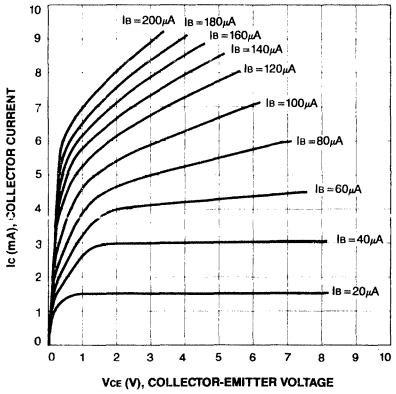
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=10μA, I_E=0	30			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=5mA, I_B=0	30			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=10μA, I_C=0	4			V
Collector Cut-off Current	I_{CBO}	V_{CB}=20V, I_E=0			0.1	μA
DC Current Gain	h_{FE}	V_{CE}=10V, I_C=2mA	40		180	
Current Gain-Bandwidth Product	f_T	V_{CE}=10V, I_C=3mA	400	700		MHz
Reverse Transfer Capacitance	Cre	f=1MHz, V_{CB}=10V, I_E=0		0.35	0.5	pF
Power Gain	Gpe	f=200MHz, I_E=−3mA, R_S=50Ω, V_{CE}=10V	20	24		dB
AGC Current	I_{AGC}	I_E at Gpe=−30dB, f=200MHz		−10	−12	mA
Noise Figure	NF	f=200MHz, I_E=−3mA, V_{CE}=10V, R_S=50Ω		2.0	3.0	dB

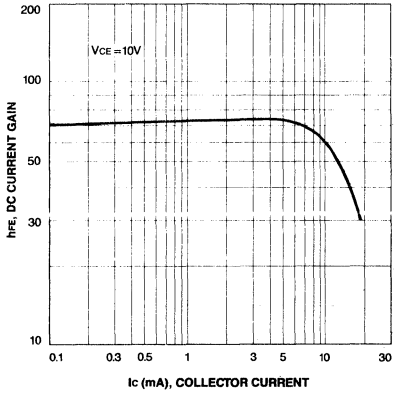
h_{FE} CLASSIFICATION

Classification	R	O	Y
h_{FE}	40-80	60-140	90-180

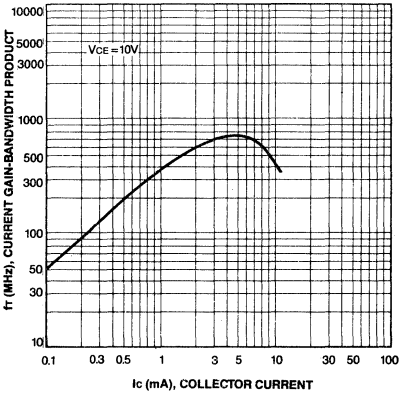
STATIC CHARACTERISTIC



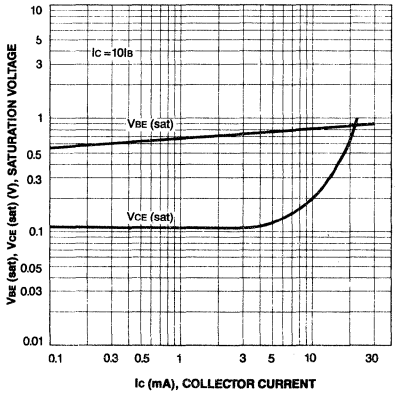
DC CURRENT GAIN



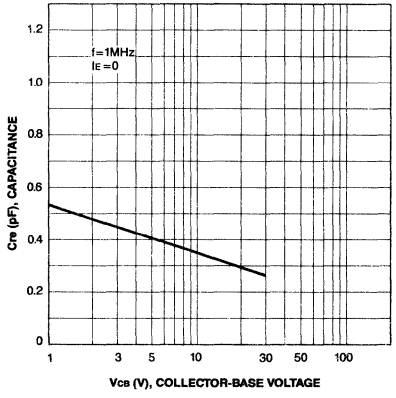
CURRENT GAIN-BANDWIDTH PRODUCT



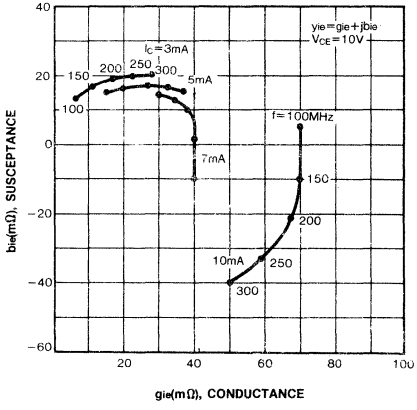
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



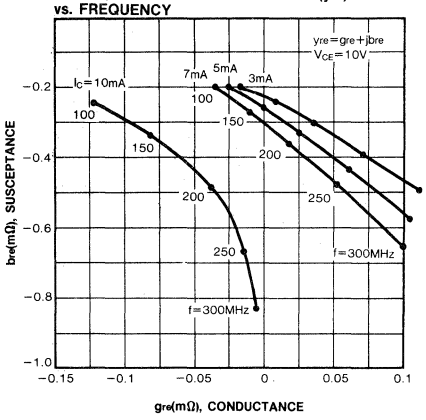
REVERSE CAPACITANCE



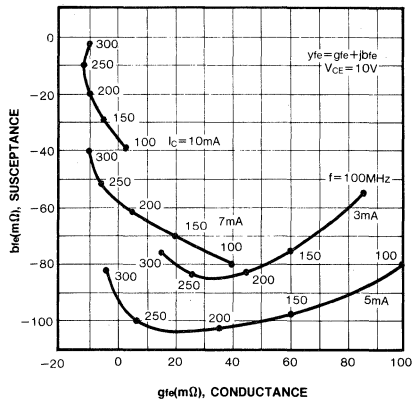
INPUT ADMITTANCE (yie) vs. FREQUENCY



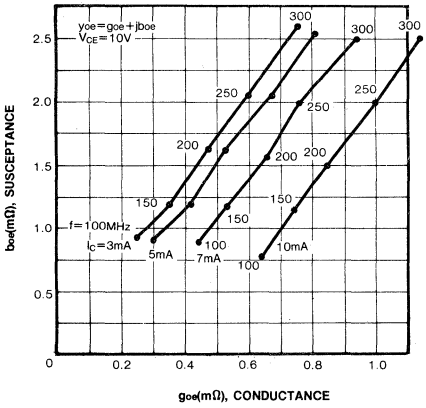
REVERSE TRANSFER ADMITTANCE (yre) vs. FREQUENCY



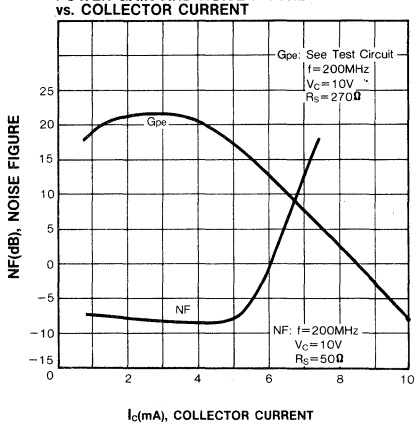
FORWARD TRANSFER ADMITTANCE (yfe) vs. FREQUENCY



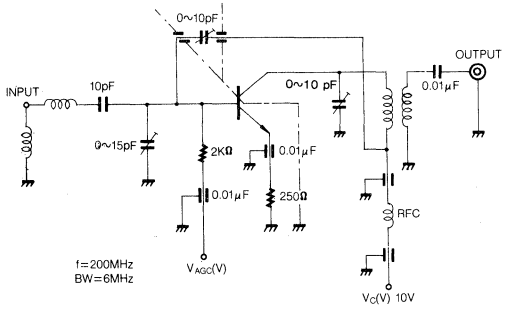
OUTPUT ADMITTANCE (yoe) vs. FREQUENCY



POWER GAIN AND NOISE FIGURE vs. COLLECTOR CURRENT



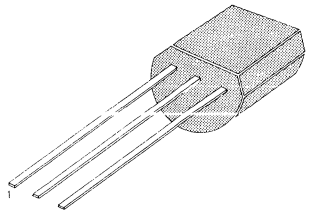
POWER GAIN AND NOISE FIGURE TEST CIRCUIT



TV VHF TUNER MIXER

- **High Current Gain Bandwidth Product f_T =700MHz (Typ)**
- **High Power Gain Gpe=20dB (Min) at f=200MHz**
- **Low Noise Figure NF=3.5dB (Max) at f=200MHz**

TO-92



1. Base 2. Emitter 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a =25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	30	V
Collector-Emitter Voltage	V_{CEO}	30	V
Emitter-Base Voltage	V_{EBO}	4	V
Collector Current	I_C	20	mA
Collector Dissipation	P_C	250	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ 150	°C

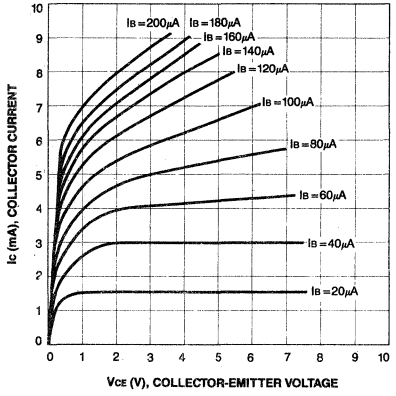
ELECTRICAL CHARACTERISTICS (T_a =25°C)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C =10μA, I_E =0	30			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C = 5mA, I_B =0	30			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E =10μA, I_C =0	4			V
Collector Cut-off Current	I_{CBO}	V_{CB} =20V, I_E =0			0.1	μA
DC Current Gain	h_{FE}	V_{CE} =10V, I_C =2mA	40		180	
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C =10mA, I_B =1mA			0.7	V
Current Gain-Bandwidth Product	f_T	V_{CE} =10V, I_C =3mA	400	700		MHz
Reverse Transfer Capacitance	Cre	V_{CB} =10V, I_E =0 f=1MHz,		0.35	0.5	pF
Power Gain	Gpe	V_{CE} =6V, I_E =−3mA R_S =50Ω, f=200MHz	20			dB
Noise Figure	NF	V_{CE} =6V, I_E =−3mA R_S =50Ω, f=200MHz			3.5	dB

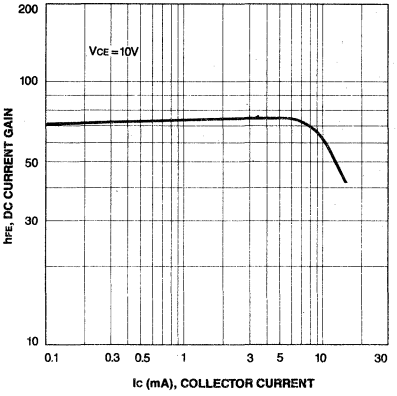
h_{FE} CLASSIFICATION

Classification	R	O	Y
h_{FE}	40-80	60-140	90-180

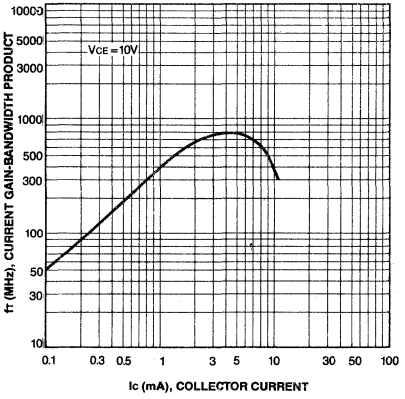
STATIC CHARACTERISTIC



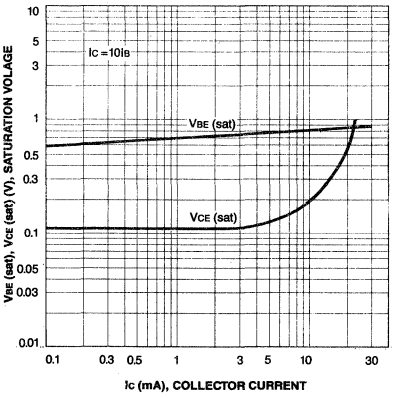
DC CURRENT GAIN



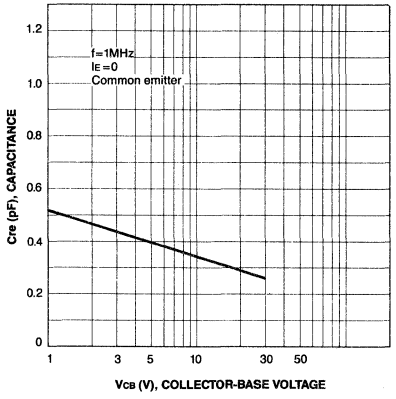
CURRENT GAIN-BANDWIDTH PRODUCT



BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



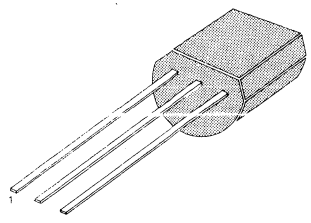
REVERSE CAPACITANCE



TV VHF TUNER OSCILLATOR

- **High Current-Gain Bandwidth Product f_T =600MHz (Min)**
- **Output Capacitance Cob=1.5pF (Max)**

TO-92



1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a =25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	30	V
Collector-Emitter Voltage	V_{CEO}	15	V
Emitter-Base Voltage	V_{EBO}	4	V
Collector Current	I_C	20	mA
Collector Dissipation	P_C	250	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ 150	°C

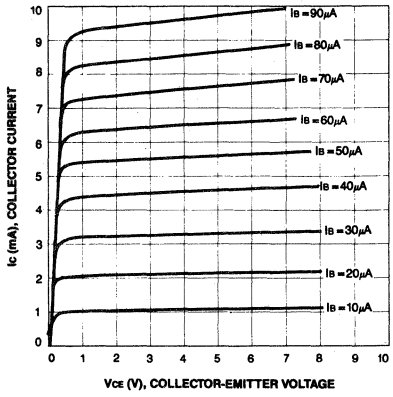
ELECTRICAL CHARACTERISTICS (T_a =25°C)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C =10μA, I_E =0	30			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C = 5mA, I_B =0	15			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E =10μA, I_C =0	4			V
Collector Cut-off Current	I_{CBO}	V_{CB} =12V, I_E =0			0.1	μA
Emitter Cut-off Current	I_{EBO}	V_{EB} =3V, I_C =0			0.1	V
DC Current Gain	h_{FE}	V_{CE} =10V, I_C =5mA	40		240	
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C =10mA, I_B =1mA			0.5	V
Current-Gain-Bandwidth Product	f_T	V_{CE} =10V, I_C =5mA	600	1100		MHz
Output Capacitance	Cob	V_{CB} =10V, f=1MHz I_E =0			1.5	pF

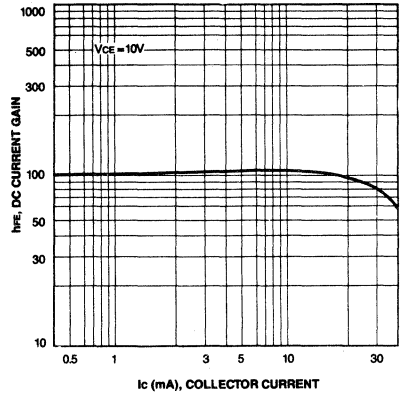
h_{FE} CLASSIFICATION

Classification	R	O	Y
h_{FE}	40-80	70-140	120-240

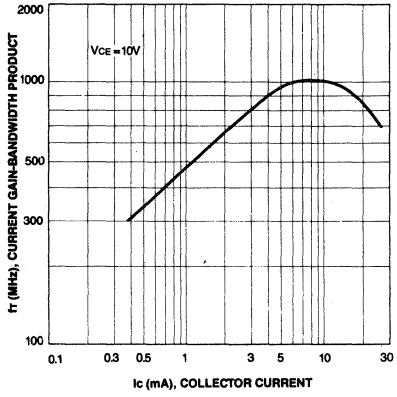
STATIC CHARACTERISTIC



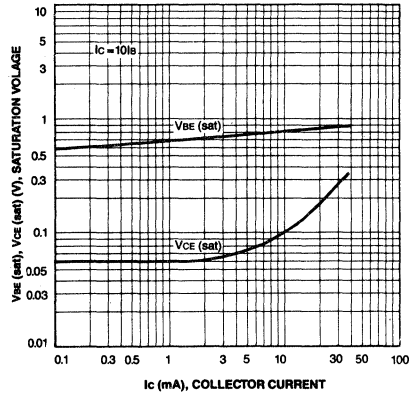
DC CURRENT GAIN



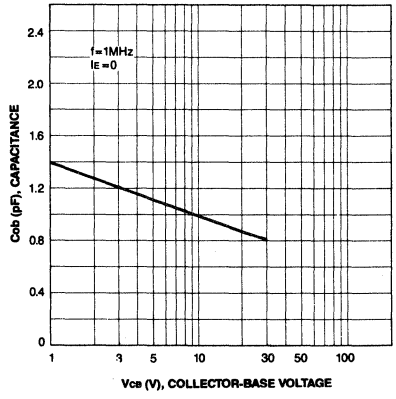
CURRENT GAIN-BANDWIDTH PRODUCT



BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



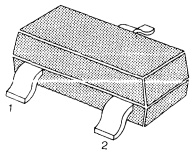
COLLECTOR OUTPUT CAPACITANCE



LOW FREQUENCY AMPLIFIER
HIGH FREQUENCY OSC

- **Complement to KSA812**

SOT-23



1. Base 2. Emitter 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	60	V
Collector-Emitter Voltage	V_{CEO}	50	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	100	mA
Collector Dissipation	P_C	200	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

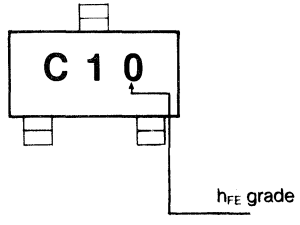
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Cutoff Current	I_{CBO}	V_{CB}=60V, I_E=0			0.1	μA
Emitter Cutoff Current	I_{EBO}	V_{EB}=5V, I_C=0			0.1	μA
DC Current Gain	h_{FE}	V_{CE}=6V, I_C=1mA	90	200	600	
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=100mA, I_B=10mA		0.15	0.3	V
Base-Emitter Saturation Voltage	V_{BE}(sat)	I_C=100mA, I_B=10mA		0.86	1.0	V
Base-Emitter On Voltage	V_{BE}(on)	I_C=1mA, V_{CE}=6V	0.55	0.62	0.65	V
Current Gain-Bandwidth Product	f_T	I_E=10mA, V_{CE}=6V		250		MHz
Output Capacitance	Cob	V_{CB}=6V, I_E=0 f=1MHz		3		pF

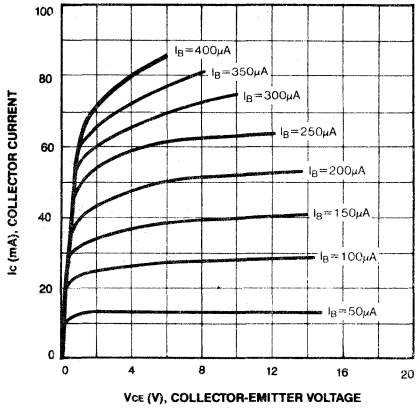
h_{FE} CLASSIFICATION

Classification	O	Y	G	L
h_{FE}	90-180	135-270	200-400	300-600

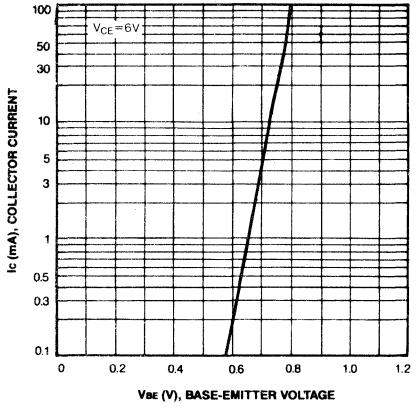
Marking



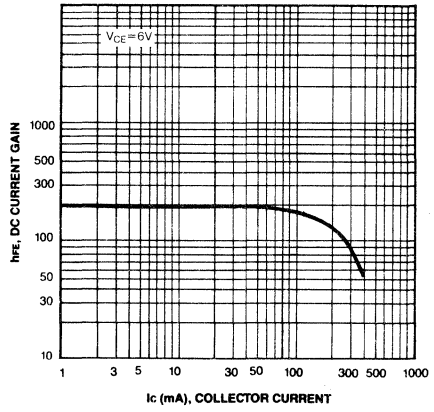
STATIC CHARACTERISTIC



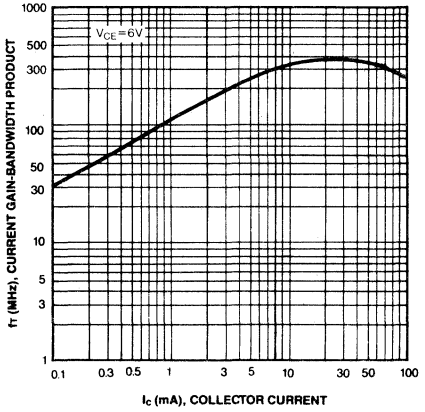
TRANSFER CHARACTERISTIC



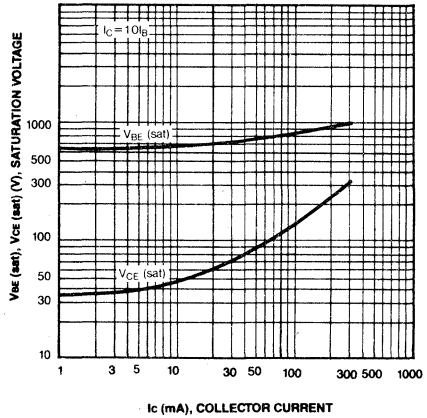
DC CURRENT GAIN



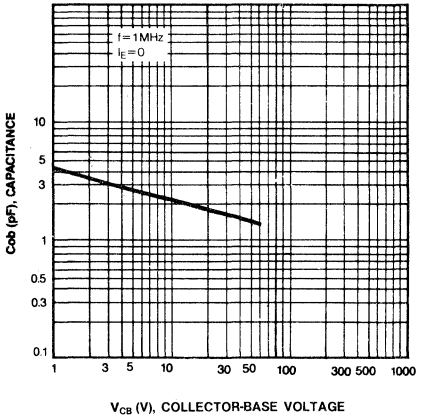
CURRENT GAIN-BANDWIDTH PRODUCT



BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



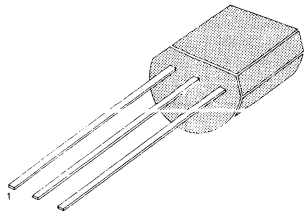
OUTPUT CAPACITANCE



TV PIF AMPLIFIER, FM TUNER RF AMPLIFIER, MIXER, OSCILLATOR

- **High Current-Gain-Bandwidth Product f_T =600MHz (Typ)**
- **High Power Gain Gpe=22dB at f=100MHz**

TO-92



1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a =25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	30	V
Collector-Emitter Voltage	V_{CEO}	20	V
Emitter-Base Voltage	V_{EBO}	4	V
Collector Current	I_C	20	mA
Collector Dissipation	P_C	250	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ 150	°C

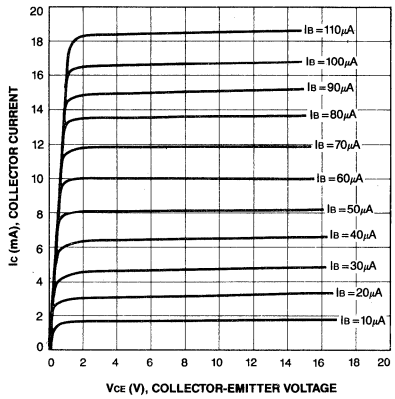
ELECTRICAL CHARACTERISTICS (T_a =25°C)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C =10μA, I_E =0	30			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C = 5mA, I_B =0	20			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E =10μA, I_C =0	4			V
Collector Cut-off Current	I_{CBO}	V_{CB} =30V, I_E =0			0.1	μA
Emitter Cut-off Current	I_{EBO}	V_{EB} =4V, I_C =0			0.1	μA
DC Current Gain	h_{FE}	V_{CE} =6V, I_C =1mA	40		240	
Base-Emitter On Voltage	V_{BE} (on)	V_{CE} =6V, I_C =1mA		0.72		V
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C =10mA, I_B =1mA		0.1	0.3	V
Current-Gain-Bandwidth Product	f_T	V_{CE} =6V, I_C =1mA	400	600		MHz
Output Capacitance	Cob	V_{CB} =6V, I_E =0 f=1MHz		1.2		pF
Collector-Base Time Constant	Cc·rbb'	V_{CE} =6V, I_E =1mA f=31.9MHz		12	15	ps
Common Source Noise Figure	NF	V_{CE} =6V, I_E =1mA Rs =50Ω, f=100MHz		3.0	5.0	dB
Power Gain	Gpe	V_{CE} =6V, I_E =1mA Rs =50Ω, f=100MHz (Typ)	18	22		dB

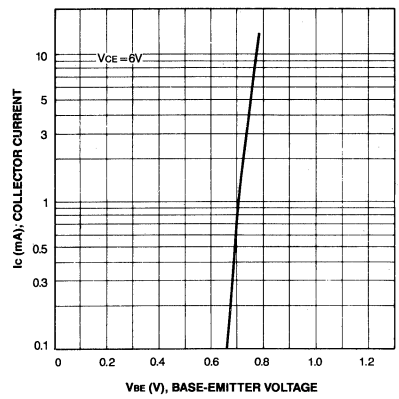
h_{FE} CLASSIFICATION

Classification	R	O	Y
h_{FE}	40-80	70-140	120-240

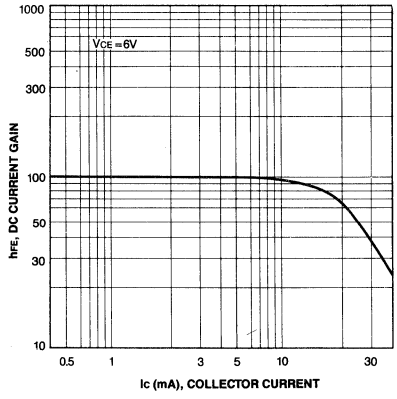
STATIC CHARACTERISTIC



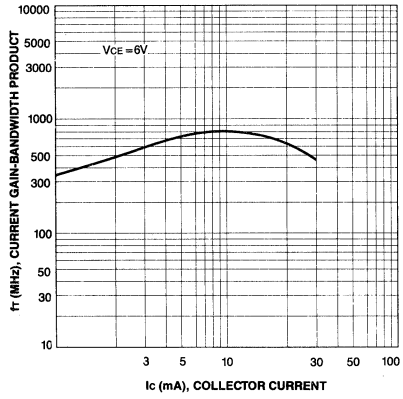
BASE-EMITTER ON VOLTAGE



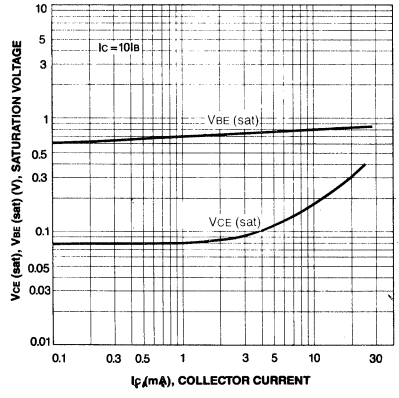
DC CURRENT GAIN



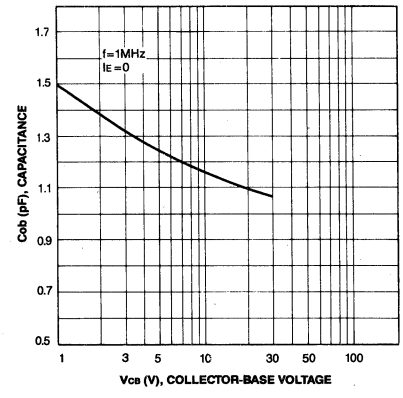
CURRENT GAIN-BANDWIDTH PRODUCT



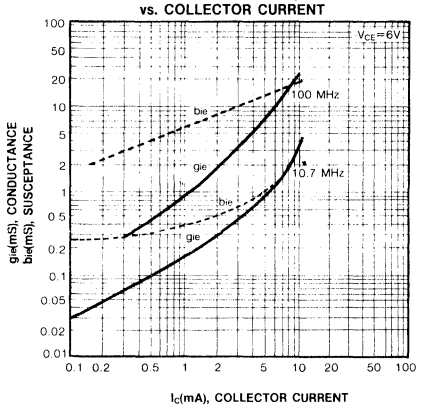
BASE-EMITTER SATURATION VOLTAGE
COLECTOR-EMITTER SATURATION VOLTAGE



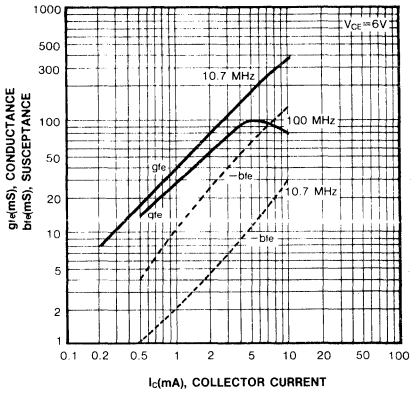
COLLECTOR OUTPUT CAPACITANCE



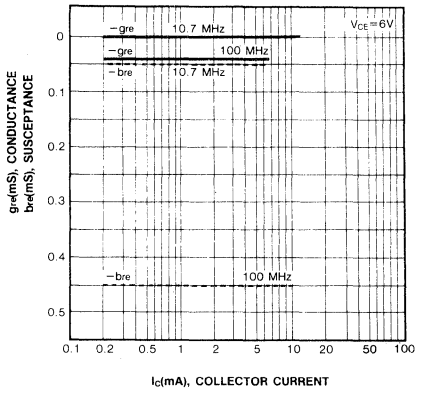
INPUT ADMITTANCE (yie)
vs. COLLECTOR CURRENT



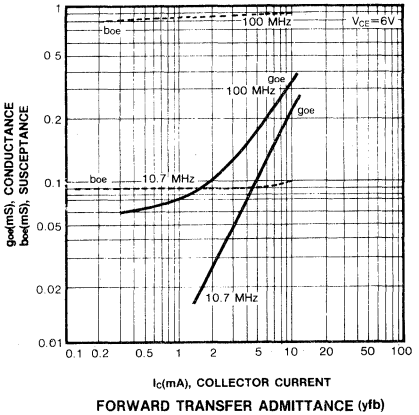
FORWARD TRANSFER ADMITTANCE (yfe)
vs. COLLECTOR CURRENT



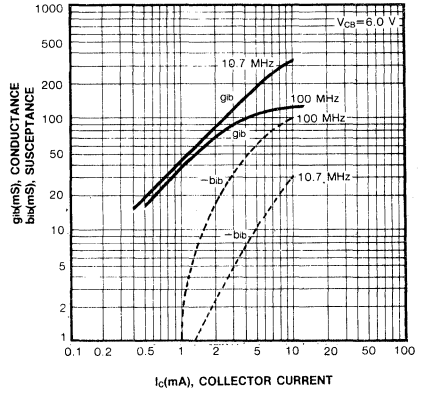
REVERSE TRANSFER ADMITTANCE (yre)
vs. COLLECTOR CURRENT



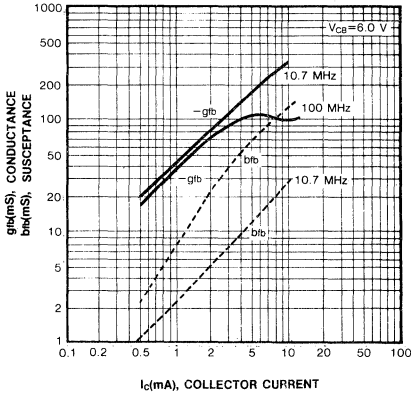
OUTPUT ADMITTANCE (yoe)
vs. COLLECTOR CURRENT



INPUT ADMITTANCE (yib) vs. COLLECTOR CURRENT



FORWARD TRANSFER ADMITTANCE (yfb)
vs. COLLECTOR CURRENT



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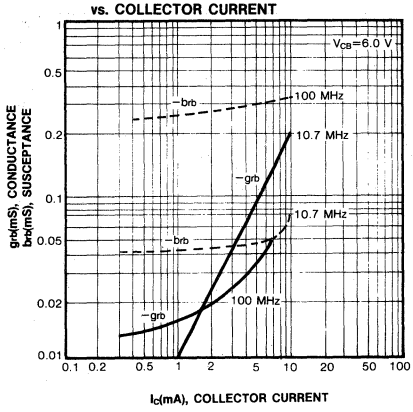
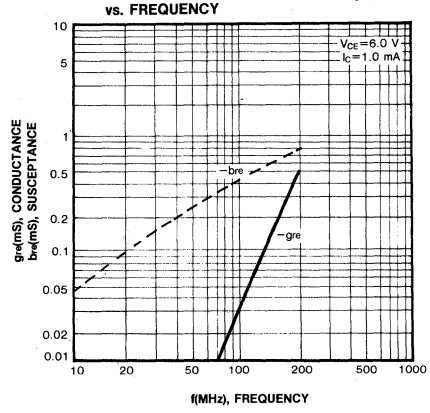
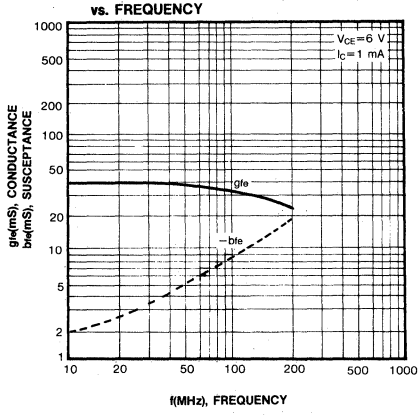
REVERSE TRANSFER ADMITTANCE (yrb) vs. COLLECTOR CURRENT



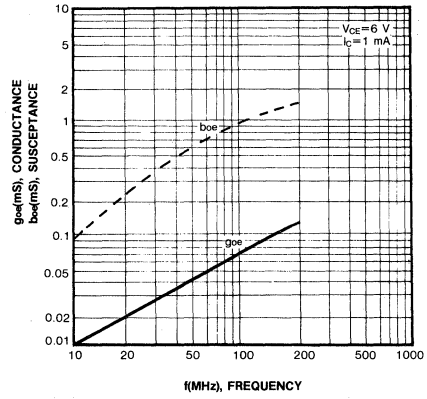
REVERS TRANSFER ADMITTANCE (yre) vs. FREQUENCY



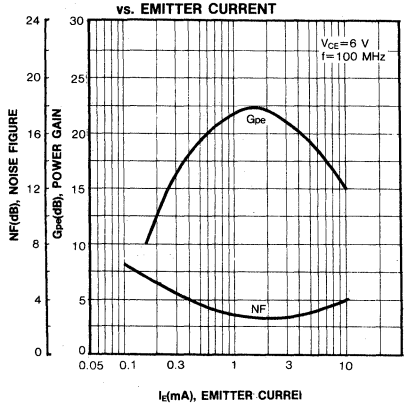
FORWARD TRANSFER ADMITTANCE (yfe) vs. FREQUENCY



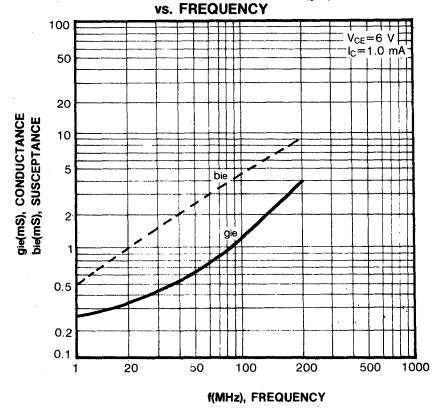
OUTPUT ADMITANCE (yoe) vs. FREQUENCY



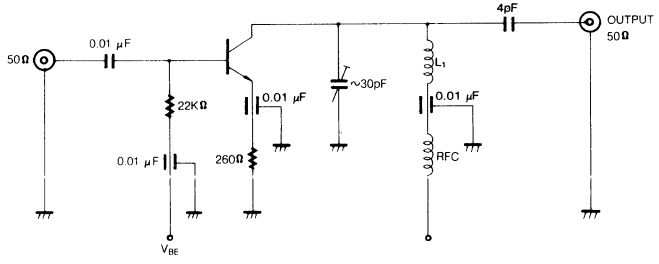
POWER GAIN AND NOISE FIGURE vs. EMITTER CURRENT



INPUT ADMITTANCE (yie) vs. FREQUENCY



100MHz Gpe, NF TEST CIRCUIT



FM/AM RF AMP, MIX, CONV, OSC, IF

- **Collector-Base Voltage V_{CEO} = 30V**
- **High Current Gain Bandwidth Product f_T = 300MHz (Typ)**
- **Low Collector Capacitance Cob: 2.0PF (Typ)**

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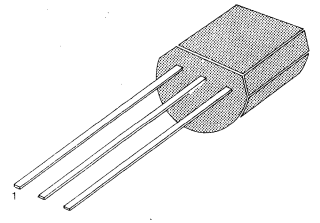


1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a = 25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	50	V
Collector-Emitter Voltage	V_{CEO}	30	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	50	mA
Collector Dissipation	P_C	250	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ 150	°C

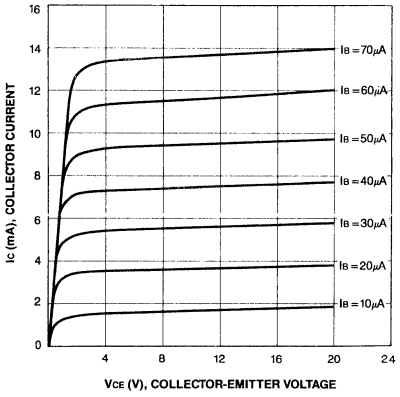
ELECTRICAL CHARACTERISTICS (T_a = 25°C)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C = 10μA, I_E = 0	50			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C = 5mA, I_B = 0	30			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E = 10μA, I_C = 0	5			V
Collector Cut-off Current	I_{CBO}	V_{CB} = 50V, I_E = 0			0.1	μA
Emitter Cut-off Current	I_{EBO}	V_{EB} = 5V, I_C = 0			0.1	μA
DC Current Gain	h_{FE}	V_{CE} = 6V, I_C = 1mA	40		240	
Base-Emitter On Voltage	V_{BE} (on)	V_{CE} = 6V, I_c = 1mA		0.67	0.75	V
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C = 10mA, I_B = 1mA		0.08	0.3	V
Current Gain-Bandwidth Product	f_T	V_{CE} = 6V, I_C = 1mA	150	300		MHz
Output Capacitance	Cob	f=1MHz, V_{CB} = 6V		2.0	2.5	PF

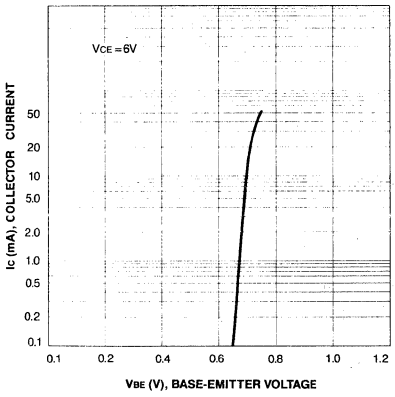
h_{FE} CLASSIFICATION

Classification	R	O	Y
h_{FE}	40-80	70-140	120-240

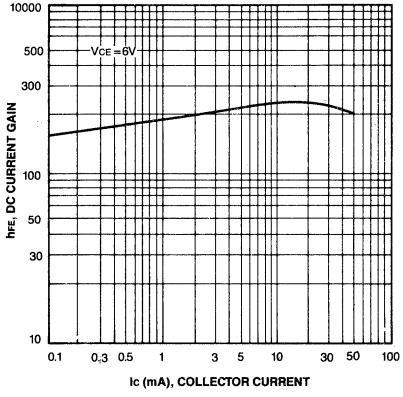
STATIC CHARACTERISTIC



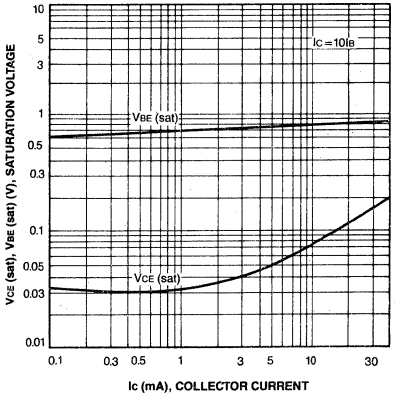
BASE-EMITTER ON VOLTAGE



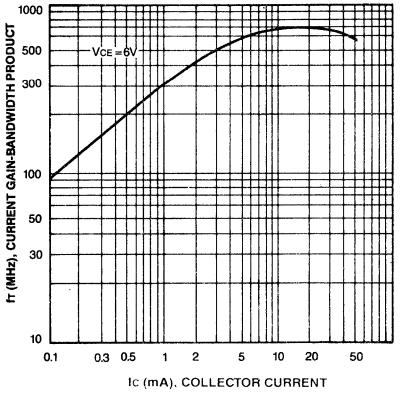
DC CURRENT GAIN



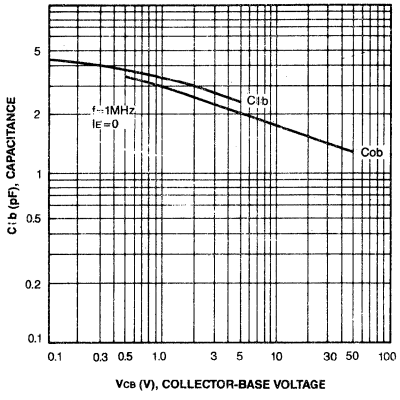
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



CURRENT GAIN-BANDWIDTH PRODUCT



COLLECTOR INPUT CAPACITANCE
COLLECTOR OUTPUT CAPACITANCE



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TV VHF, UHF TUNER OSCILLATOR

- **High Current Gain Bandwidth Product f_T =1100MHz (Typ)**
- **Output Capacitance Cob=1.5pF (Max)**

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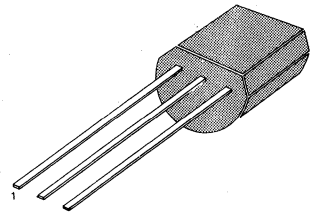


1. Emitter 2. Collector 3. Base

ABSOLUTE MAXIMUM RATINGS (T_a =25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	30	V
Collector-Emitter Voltage	V_{CEO}	15	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	50	mA
Collector Dissipation	P_C	250	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ 150	°C

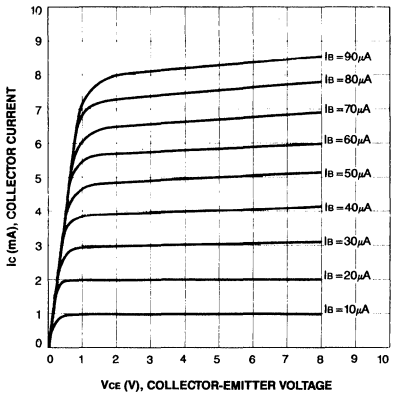
ELECTRICAL CHARACTERISTICS (T_a =25°C)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C =10μA, I_E =0	30			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C = 5mA, I_B =0	15			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E =10μA, I_C =0	5			V
Collector Cut-off Current	I_{CBO}	V_{CB} =12V, I_E =0			0.1	μA
DC Current Gain	h_{FE}	V_{CE} =10V, I_C =5.0mA	40		240	
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C =10mA, I_B =1mA			0.5	V
Current Gain-Bandwidth Product	f_T	V_{CE} =10V, I_C =5mA	800	1100		MHz
Output Capacitance	Cob	V_{CB} =10V , f=1MHz I_E =0			1.5	pF
Collector-Base Time Constant	Cc · rbb	V_{CE} =10V, f=31.9MHz I_E =5mA		10	20	ps

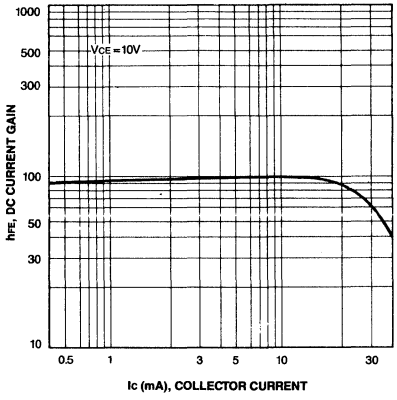
h_{FE} CLASSIFICATION

Classification	R	O	Y
h_{FE}	40-80	70-140	120-240

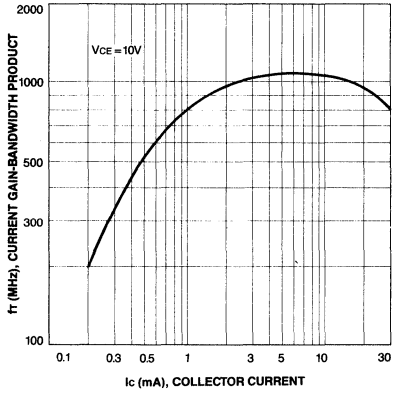
STATIC CHARACTERISTIC



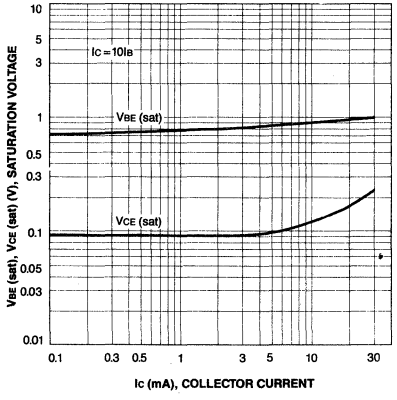
DC CURRENT GAIN



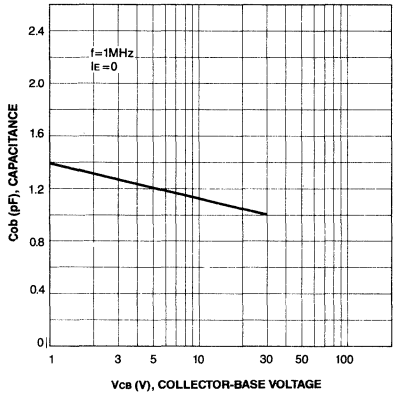
CURRENT GAIN-BANDWIDTH PRODUCT



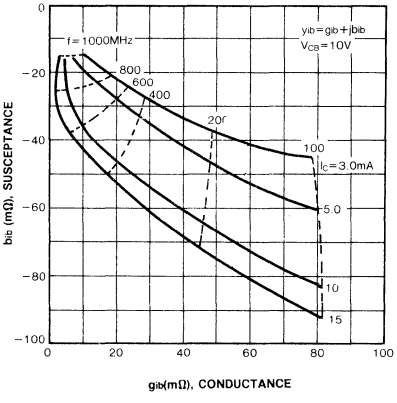
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



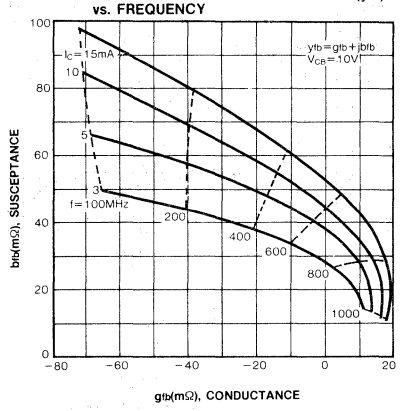
OUTPUT CAPACITANCE



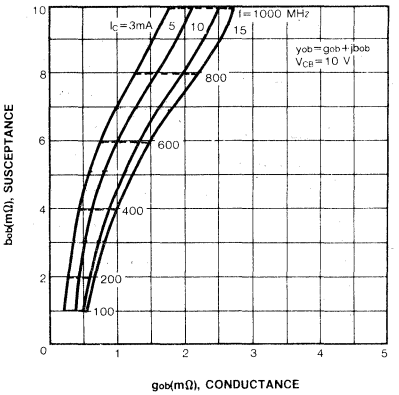
INPUT ADMITTANCE (yib) vs. FREQUENCY



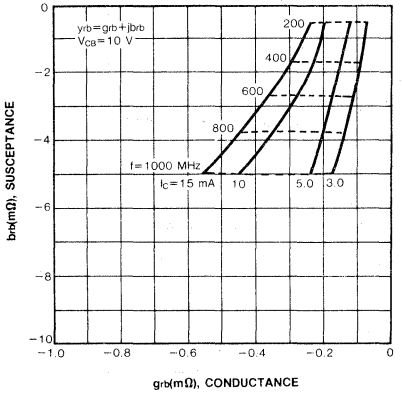
FORWARD TRANSFER ADMITTANCE (yfb) vs. FREQUENCY



OUTPUT ADMITTANCE (yob) vs. FREQUENCY



REVERSE TRANSFER ADMITTANCE(yrb) vs. FREQUENCY



AUDIO FREQUENCY LOW NOISE AMPLIFIER

- Complement to KSA992

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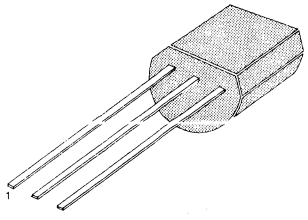


1. Emitter 2. Collector 3. Base

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	120	V
Collector-Emitter Voltage	V_{CEO}	120	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	50	mA
Base Current	I_B	10	mA
Collector Dissipation	P_C	500	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ 150	°C

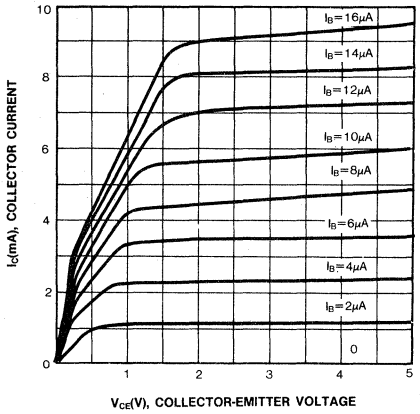
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Cutoff Current	I_{CBO}	V_{CB}=120V, I_E=0			50	nA
Emitter Cutoff Current	I_{EBO}	V_{EB}=5V, I_C=0			50	nA
DC Current Gain	h_{FE1}	V_{CE}=6V, I_C=0.1mA	150	580		
	h_{FE2}	V_{CE}=6V, I_C=1mA	200	600	1200	
Base Emitter On Voltage	V_{BE} (on)	V_{CE}=6V, I_C=1mA	0.55	0.59	0.65	V
Collector Emitter Saturation Voltage	V_{CE} (sat)	I_C=10mA, I_B=1mA		0.07	0.3	V
Current Gain Bandwidth Product	f_T	V_{CE}=6V, I_E=1mA	50	110		MHz
Output Capacitance	Cob	V_{CB}=30V, I_E=0 f=1MHz		1.6	2.5	pF
Noise Voltage	NV			25	40	mV

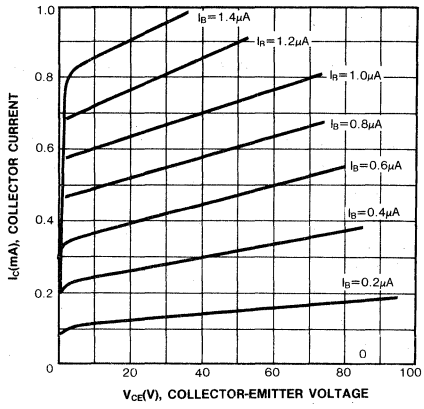
h_{FE}(2) CLASSIFICATION

Classification	P	F	E	U
h_{FE}(2)	200-400	300-600	400-800	600-1200

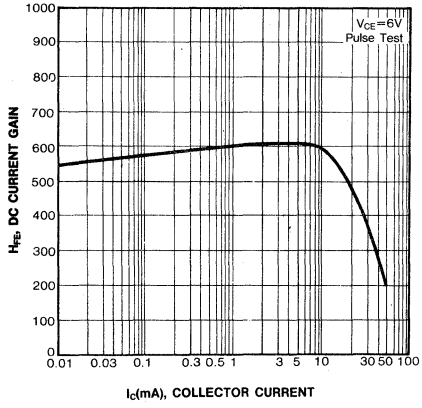
STATIC CHARACTERISTIC



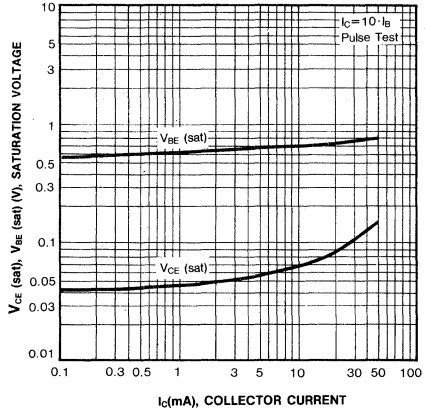
STATIC CHARACTERISTIC



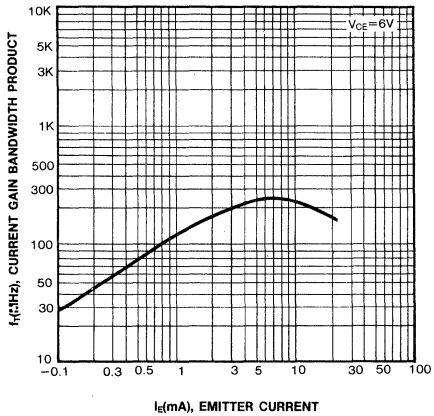
DC CURRENT GAIN



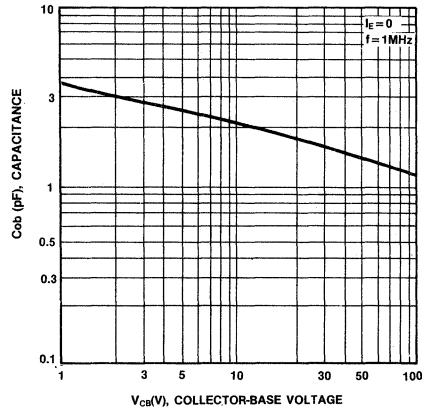
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



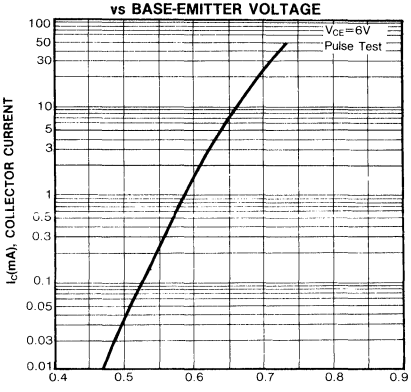
CURRENT GAIN-BANDWIDTH PRODUCT



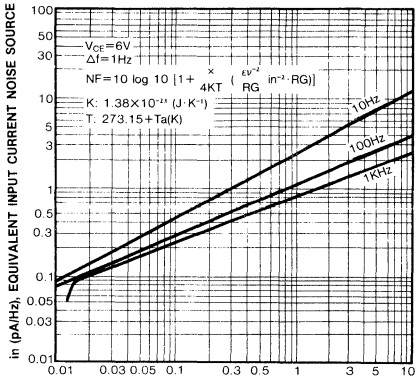
COLLECTOR OUTPUT CAPACITANCE



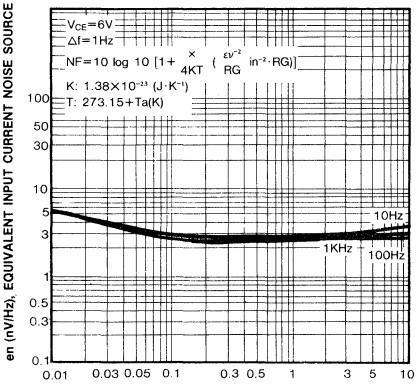
COLLECTOR CURRENT
vs BASE-EMITTER VOLTAGE



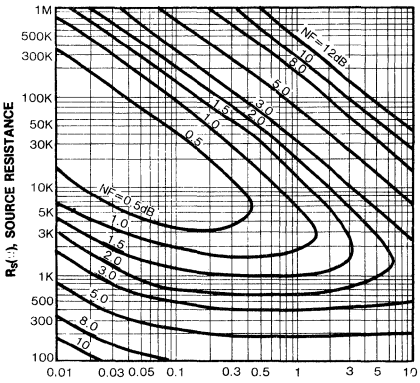
EQUIVALENT INPUT CURRENT NOISE SOURCE



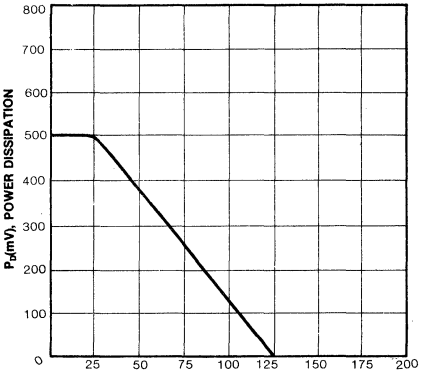
EQUIVALENT INPUT CURRENT NOISE SOURCE



NOISE FIGURE MHP



POWER DERATING



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GENERAL PURPOSE APPLICATIONS
HIGH TOTAL POWER DISIPATION (PT=600 mW)

High h_{FE} and LOW $V_{CE}(sat)$

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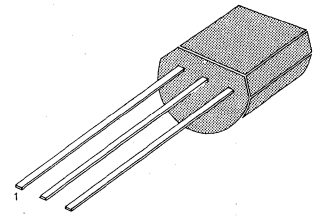


1. Emitter 2. Collector 3. Base

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	30	V
Collector-Emitter Voltage	V_{CEO}	25	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	700	mA
Base Current	I_B	150	mA
Collector Dissipation	P_C	600	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55∼150	°C

ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
*Base Emitter Voltage	V_{BE}	V_{CE}=6V, I_C=10mA	600	640	700	mV
Collector Cutoff Current	I_{CBO}	V_{CB}=30V, I_E=0			100	nA
Emitter Cutoff Current	I_{EBO}	V_{EB}=5V, I_C=0			100	nA
*DC Current Gain	$h_{FE}1$	V_{CE}=1V, I_C=100mA	90	200	400	
	$h_{FE}2$	V_{CE}=1V, I_C=700mA	50	140		
*Collector Emitter Saturation Voltage	$V_{CE}(sat)$	I_C=700mA, I_B=70mA		0.2	0.6	V
*Base-Emitter Saturation Voltage	$V_{BE}(sat)$	I_C=700mA, I_B=70mA		0.95	1.2	V
Output Capacitance	C_{ob}	V_{CB}=6V, I_E=0, f=1MHz		13	25	pF
Curent Gain Bandwidth Product	f_T	V_{CE}=6V, I_E=10mA	50	170		MHz

* Pulse test: PW ≤ 350 μs, duty cycle ≤ 2% Pulsed

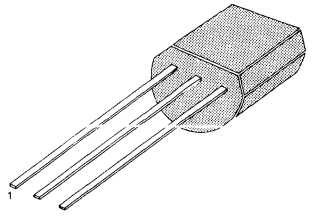
$h_{FE}1$ CLASSIFICATION

Classification	O	Y	G
$h_{FE}1$	90-180	135-270	200-400

AUDIO FREQUENCY AMPLIFIER

- Complement to KSA953/KSA954

TO-92



1. Emitter 2. Collector 3. Base

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic		Symbol	Rating	Unit
Collector-Base Voltage	: KSC2002	V_{CBO}	60	V
	: KSC2003		80	V
Collector-Emitter Voltage	: KSC2002	V_{CEO}	60	V
	: KSC2003		80	V
Emitter-Base Voltage		V_{EBO}	5	V
Collector Current (DC)		I_C	300	mA
*Collector Current (Pulse)		I_C	500	mA
Collector Dissipation		P_C	600	mW
Junction Temperature		Tj	150	°C
Storage Temperature		Tstg	−55∼150	°C

* PW≤10ms, Duty Cycle ≤50%

ELECTRICAL CHARACTERISTICS (T_a=25°C)

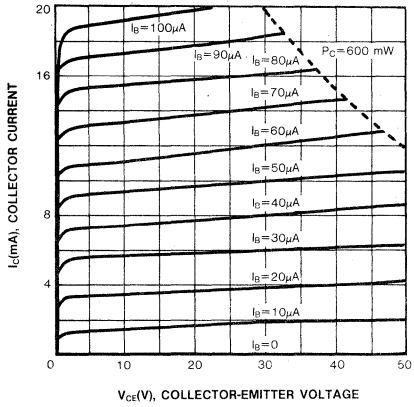
Characteristic		Symbol	Test Condition	Min	Typ	Max	Unit
Collector Cutoff Current	: KSC2002	I_{CBO}	V_{CB}=60V, I_E=0			100	nA
	: KSC2003		V_{CB}=80V, I_E=0			100	nA
Emitter Cutoff Current		I_{EBO}	V_{EB}=5V, I_C=0			100	nA
*DC Current Gain		h_{FE1}	V_{CE}=1V, I_C=50mA	90	200	400	
		h_{FE2}	V_{CE}=2V, I_C=300mA	30	80		
Base-Emitter On Voltage		V_{BE} (on)	V_{CE}=6V, I_C=10mA	600	645	700	mV
*Collector-Emitter Saturation Voltage		V_{CE} (sat)	I_C=300mA, I_B=30mA		0.15	0.6	V
*Base Emitter Saturation Voltage		V_{BE} (sat)	I_C=300mA, I_B=30mA		0.86	1.2	V
Current Gain-Bandwidth Product		f_T	V_{CE}=6V, I_E=10mA	50	140		MHz
Output Capacitance		Cob	V_{CB}=6V, I_E=0, f=1MHz		7	15	pF

* Pulse Test: PW≤350μs, Duty Cycle≤2% Pulsed

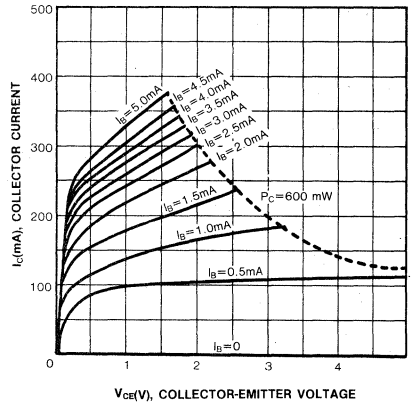
h_{FE} (1) CLASSIFICATION

Classification	O	Y	G
h_{FE}(1)	90-180	135-270	200-400

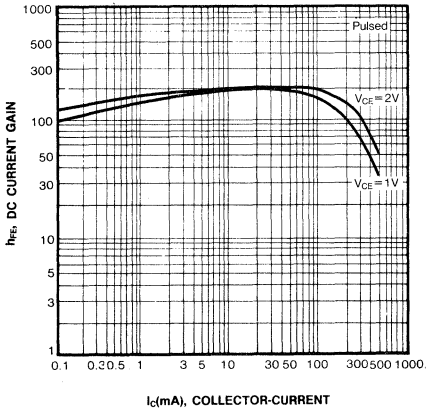
STATIC CHARACTERISTIC



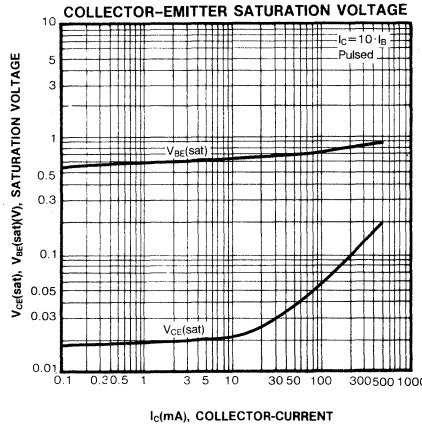
STATIC CHARACTERISTIC



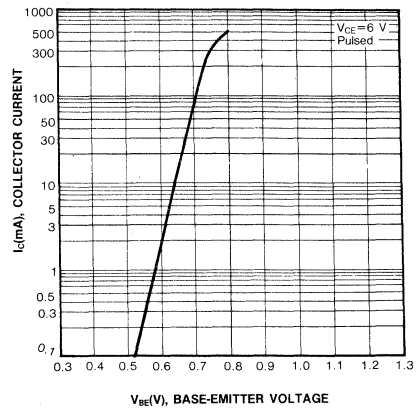
DC CURRENT GAIN



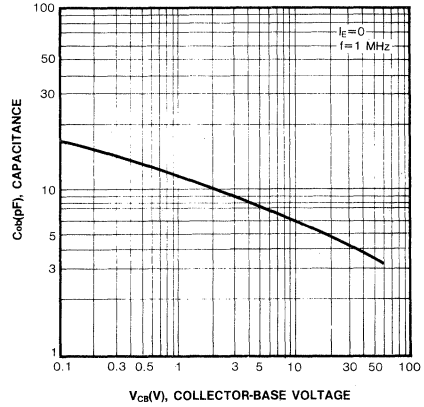
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



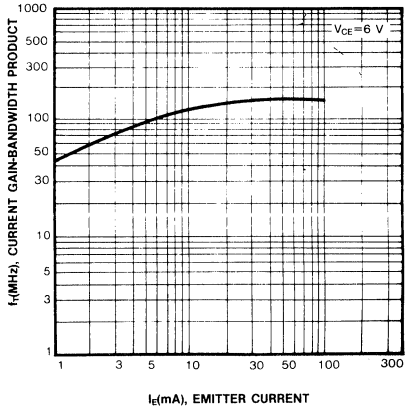
BASE-EMITTER ON VOLTAGE



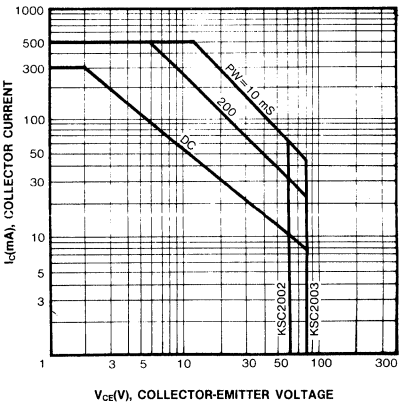
COLLECTOR OUTPUT CAPACITANCE



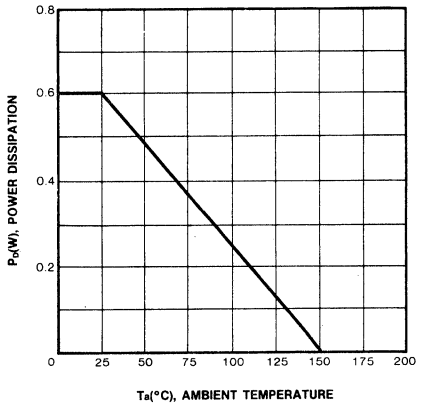
CURRENT GAIN-BANDWIDTH PRODUCT



SAFE OPERATING FREA



POWER DERATING



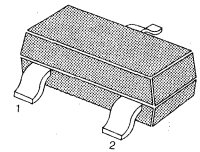
3

HIGH FREQUENCY AMPLIFIER

Very small size to assure good space factor in hybrid IC applications

- f_T = 600MHz Typ. (I_E = −1mA)
- Cob = 1pF Typ (V_{CB} = 6V)
- NF = 3dB Typ (f = 100MHz)

SOT-23



1. Base 2. Emitter 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a = 25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	30	V
Collector-Emitter Voltage	V_{CEO}	20	V
Emitter-Base Voltage	V_{EBO}	4	V
Collector Current	I_C	20	mA
Collector Dissipation	P_c	150	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ 150	°C

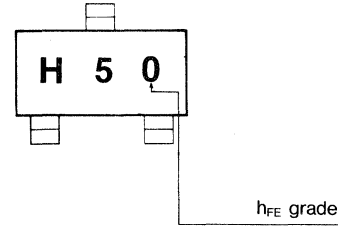
ELECTRICAL CHARACTERISTICS (T_a = 25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Cutoff Current	I_{CBO}	V_{CB}=30V, I_E=0			0.1	μA
DC Current Gain	h_{FE}	V_{CE}=6V, I_C=1mA	40	90	180	
Collector Emitter Saturation Voltage	V_{CE} (sat)	I_C=10mA, I_B=1mA		0.1	0.3	V
Output Capacitance	Cob	V_{CB}=6V, I_E=0, f=1MHz		1		pF
Current Gain Bandwidth Product	f_T	V_{CE}=6V, I_C=1mA	400	600		MHz
Time Constant	Cc rbb	V_{CB}=6V, I_E=1mA f=31.9MHz		12		ps
Noise Figure	NF	V_{CE}=6V, I_E=1mA f=100MHz, R_S=50Ω		3		dB

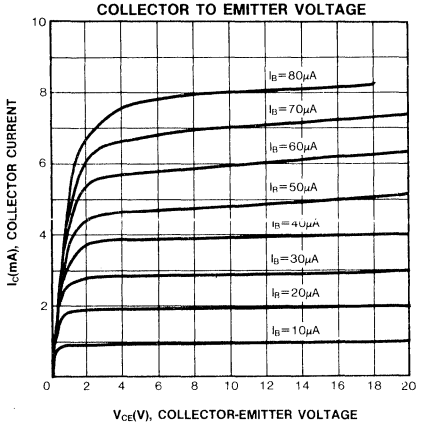
h_{FE} CLASSIFICATION

Classification	R	O	Y
h_{FE}	40-80	60-120	90-180

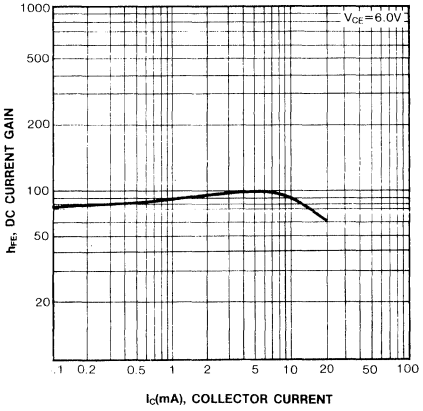
Marking



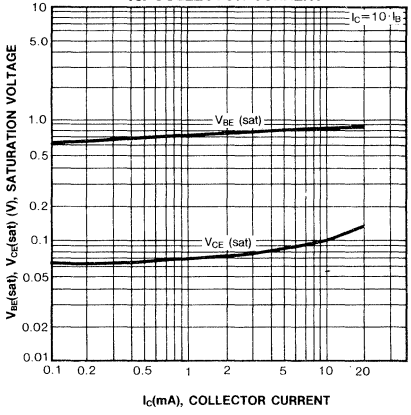
COLLECTOR CURRENT vs.
COLLECTOR TO EMITTER VOLTAGE



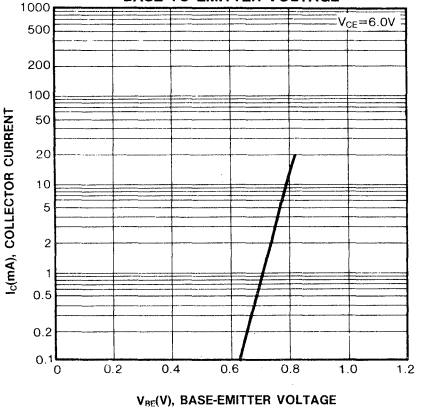
DC CURRENT GAIN vs. COLLECTOR CURRENT



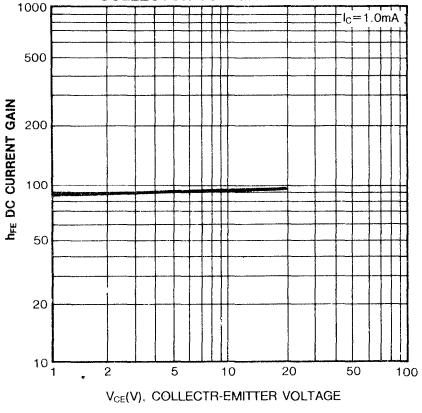
BASE AND COLLECTOR SATURATION VOLTAGE
vs. COLLECTOR CURRENT



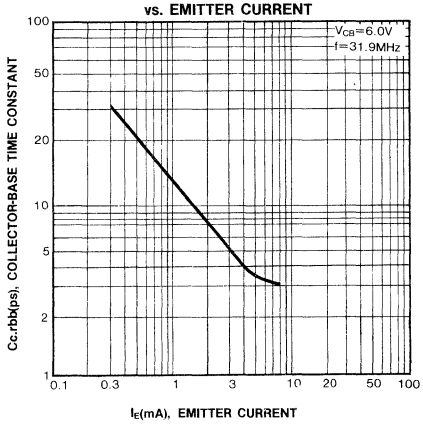
COLLECTOR CURRENT vs.
BASE TO EMITTER VOLTAGE



DC CURRENT GAIN vs.
COLLECTOR TO EMITTER VOLTAGE

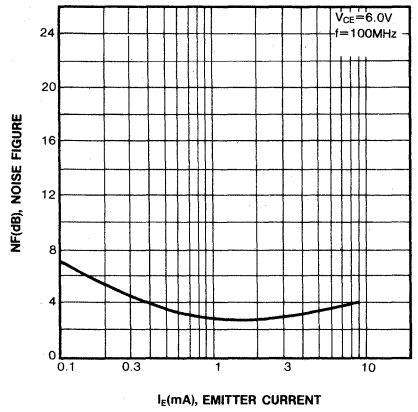


COLLECTOR TO BASE TIME CONSTANT
vs. EMITTER CURRENT

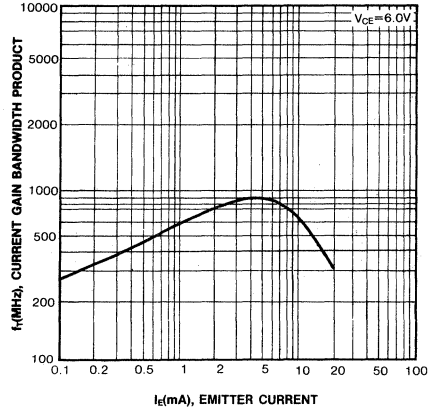


3

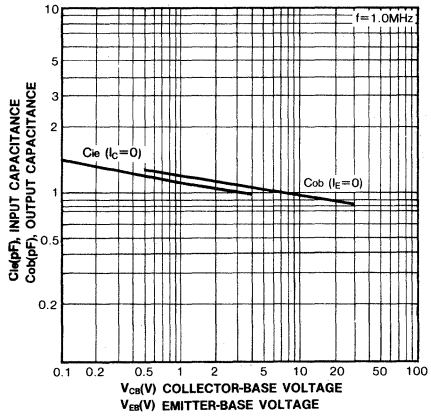
NOISE FIGURE
vs. EMITTER CURRENT



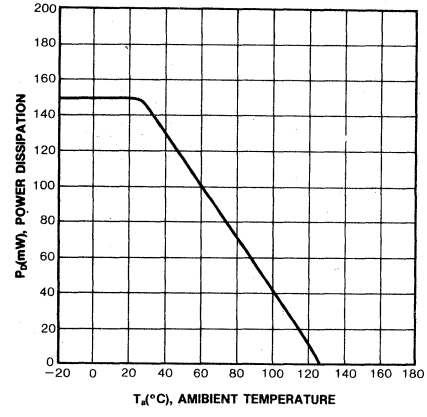
GAIN BANDWIDTH PRODUCT
vs. EMITTER CURRENT



INPUT AND OUTPUT CAPACITANCE



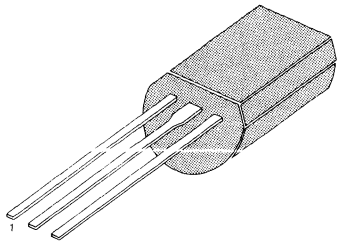
POWER DERATING



HIGH VOLTAGE POWER AMPLIFIER

- **Collector — Base Voltage V_{CBO} =200V**
- **Current Gain-Bandwidth Product f_T =100MHz (Typ)**

TO-92L



1. Emitter 2. Collector 3. Base

ABSOLUTE MAXIMUM RATINGS (T_a =25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	200	V
Collector-Emitter Voltage	V_{CEO}	150	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	50	mA
Collector Dissipation	P_C	800	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ +150	°C

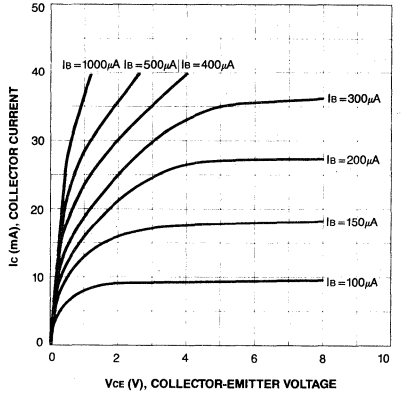
ELECTRICAL CHARACTERISTICS (T_a =25°C)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C =100μA, I_E =0	200			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C = 5mA, I_B =0	150			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E =100μA, I_C =0	5			V
Collector Cut-off Current	I_{CBO}	V_{CB} =200V, I_E =0			0.1	μA
DC Current Gain	h_{FE}	V_{CE} =5V, I_C =10mA	40		240	
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C =10mA, I_B =1mA			0.5	V
Current Gain-Bandwidth Product	f_T	V_{CE} =30V, I_C =10mA		100		MHz
Output Capacitance	Cob	V_{CB} =10V, I_E =0 f=1KHz		3.5	5	pF

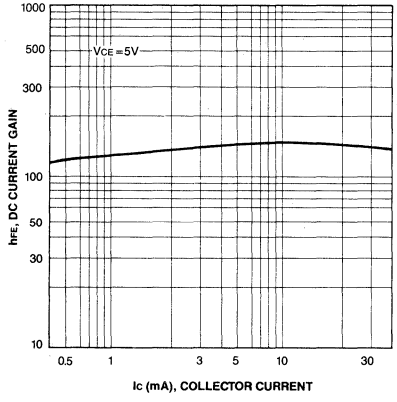
h_{FE} CLASSIFICATION

Classification	R	O	Y
h_{FE}	40-80	70-140	120-240

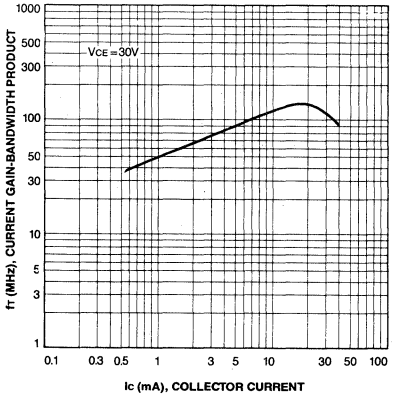
STATIC CHARACTERISTIC



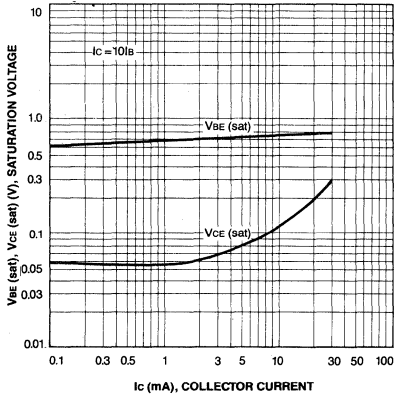
DC CURRENT GAIN



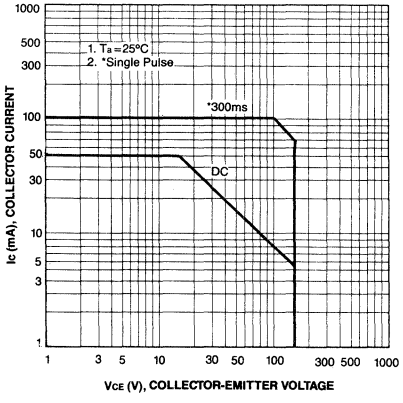
CURRENT GAIN-BANDWIDTH PRODUCT



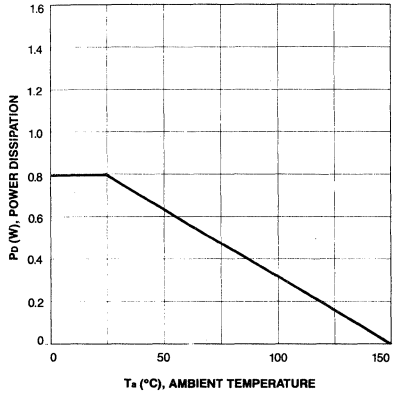
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



SAFE OPERATING AREA



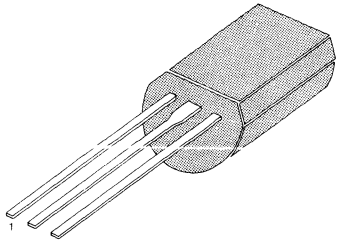
POWER DERATING



AUDIO POWER AMPLIFIER APPLICATIONS

- **Driver Stage Amplifier**
- **Complement to KSA916**

TO-92L



1. Emitter 2. Collector 3. Base

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	120	V
Collector-Emitter Voltage	V_{CEO}	120	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	800	mA
Collector Dissipation	P_C	900	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ +150	°C

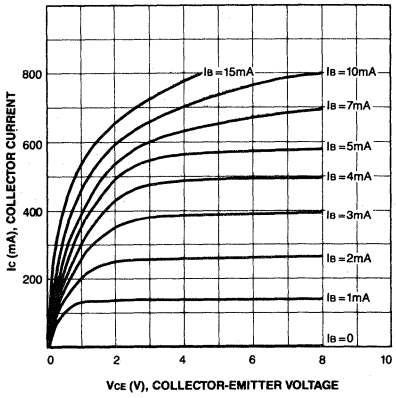
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=1mA, I_E=0	120			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=10mA, I_B=0	120			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=1mA, I_C=0	5			V
Collector Cutoff Current	I_{CBO}	V_{CB}=120V, I_E=0			0.1	μA
DC Current Gain	h_{FE1}	V_{CE}=5V, I_C=10mA	60			
	h_{FE2}	V_{CE}=5V, I_C=100mA	80		240	
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=500mA, I_B=50mA			1	V
Current-Gain-Bandwidth Product	f_T	V_{CE}=5V, I_C=100mA		120		MHz
Collector Output Capacitance	Cob	V_{CB}=10V, I_E=0 f=1MHz			30	pF

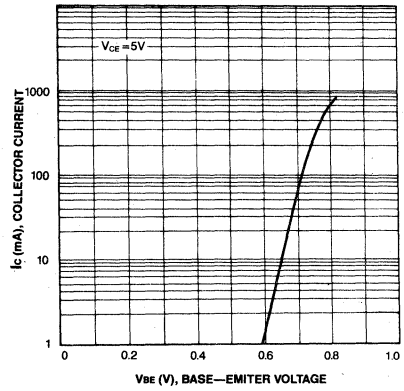
h_{FE} CLASSIFICATION

Classification	O	Y
h_{FE}(2)	80-160	120-240

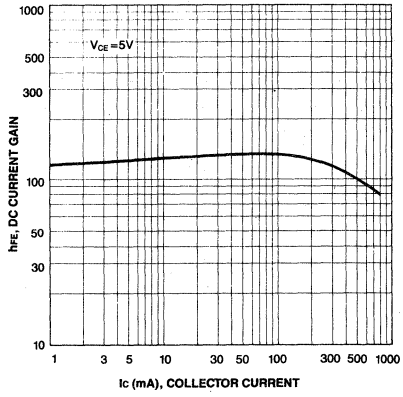
STATIC CHARACTERISTIC



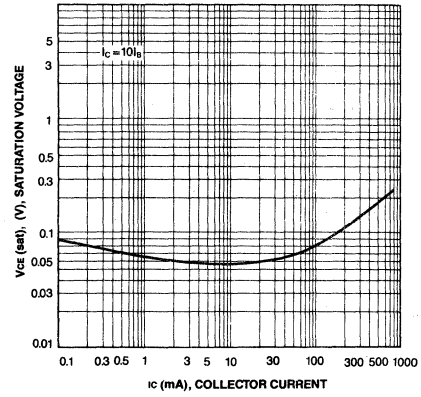
BASE-EMITTER ON VOLTAGE



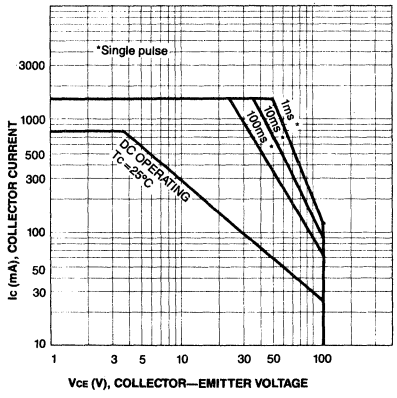
DC CURRENT GAIN



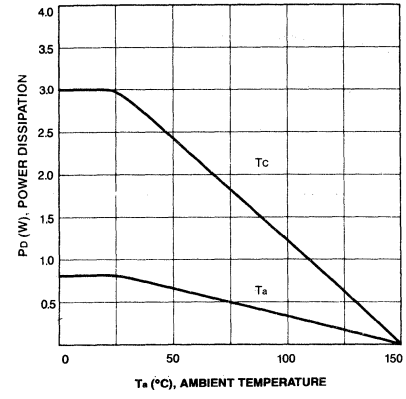
COLLECTOR-EMITTER SATURATION VOLTAGE



SAFE OPERATING AREA



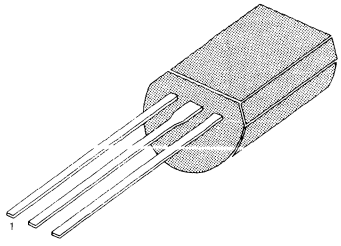
POWER DERATING



AUDIO POWER AMPLIFIER APPLICATIONS

- **Complement to KSA928A**
- **Collector Dissipation P_C =1 Watt**
- **3 Watt Output Application**

TO-92L



1. Emitter 2. Collector 3. Base

ABSOLUTE MAXIMUM RATINGS (T_a =25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	30	V
Collector-Emitter Voltage	V_{CEO}	30	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	2	A
Collector Dissipation	P_C	1	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ +150	°C

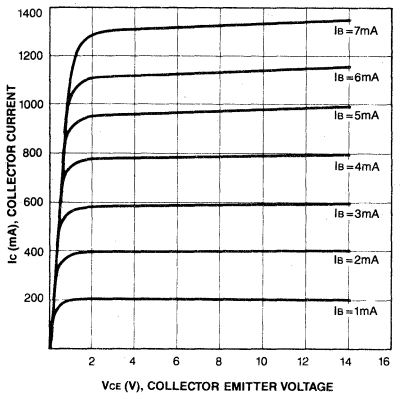
ELECTRICAL CHARACTERISTICS (T_a =25°C)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C =100μA, I_E =0	30			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C =10mA, I_B =0	30			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E =1mA, I_C =0	5			V
Collector Cutoff Current	I_{CBO}	V_{CB} =30V, I_E =0			100	nA
Emitter Cutoff Current	I_{EBO}	V_{EB} =5V, I_C =0			100	nA
DC Current Gain	h_{FE}	V_{CE} =2V, I_C =500mA	100		320	
Base-Emitter On Voltage	V_{BE} (on)	V_{CE} =2V, I_C =500mA			1.0	V
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C =1.5A, I_B =0.03A			2.0	V
Current Gain-Bandwidth Product	f_T	V_{CE} =2V, I_C =500mA		120		MHz
Output Capacitance	Cob	V_{CB} =10V, I_E =0, f=1MHz		30		pF

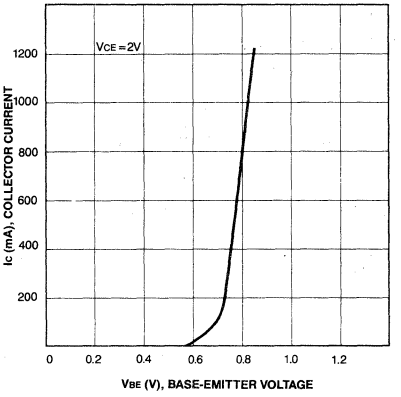
h_{FE} CLASSIFICATION

Classification	O	Y
h_{FE}	100-200	160-320

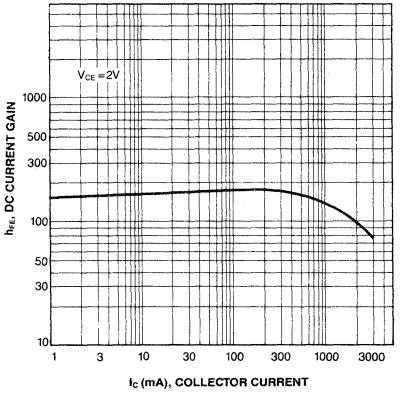
STATIC CHARACTERISTIC



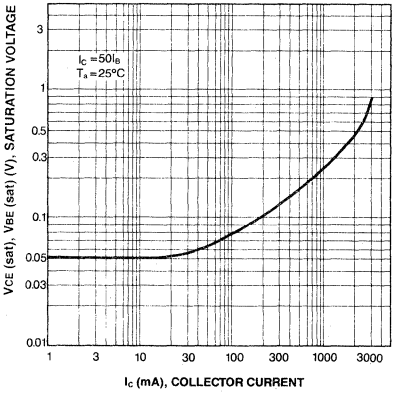
BASE-EMITTER ON VOLTAGE



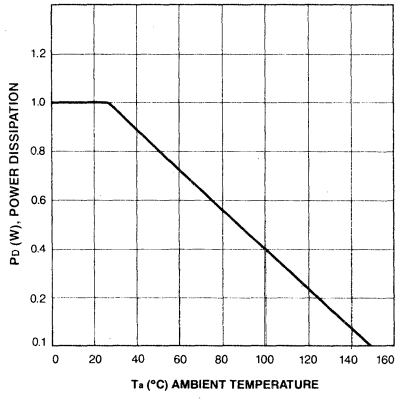
DC CURRENT GAIN



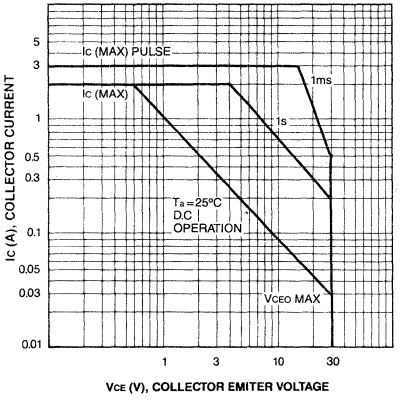
COLLECTOR-EMITTER SATURATION VOLTAGE



POWER DERATING



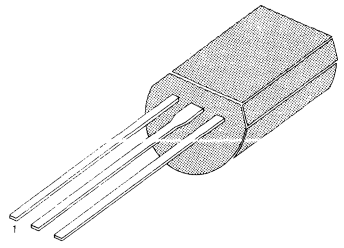
SAFE OPERATING AREA



COLOR TV CHROMA OUTPUT

- **Collector-Base Voltage V_{CBO} =300V**
- **Current Gain-Bandwidth Product f_T =50MHz (Typ)**

TO-92L



1. Emitter 2. Collector 3. Base

ABSOLUTE MAXIMUM RATINGS (T_a =25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	300	V
Collector-Emitter Voltage	V_{CEO}	300	V
Emitter-Base Voltage	V_{EBO}	7	V
Collector Current	I_C	100	mA
Collector Dissipation	P_C	1	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ +150	°C

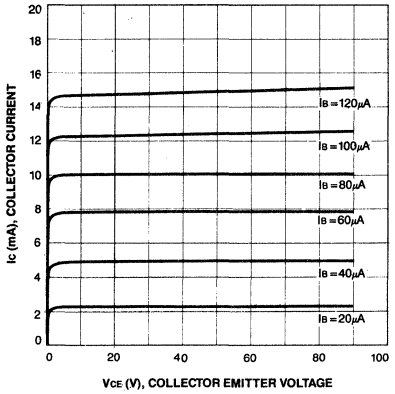
ELECTRICAL CHARACTERISTICS (T_a =25°C)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C =100μA, I_E =0	300			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C =5mA, I_B =0	300			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E =100μA, I_C =0	7			V
Collector Cut-off Current	I_{CBO}	V_{CB} =200V, I_E =0			0.1	μA
DC Current Gain	h_{FE}	V_{CE} =10V, I_C =20mA	40		240	
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C =10mA, I_B =1mA			0.5	V
Current Gain-Bandwidth Product	f_T	V_{CE} =30V, I_C =10mA		50		MHz
Output Capacitance	Cob	V_{CB} =10V, I_E =0 f = 1MHz		4		pF

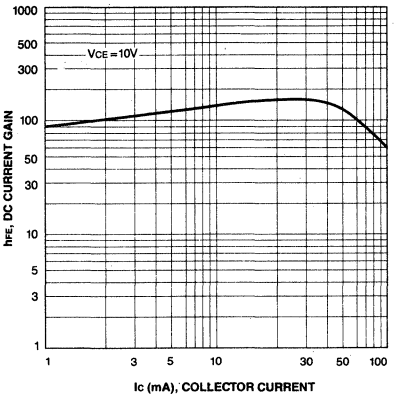
h_{FE} CLASSIFICATION

Classification	R	O	Y
h_{FE}	40-80	70-140	120-240

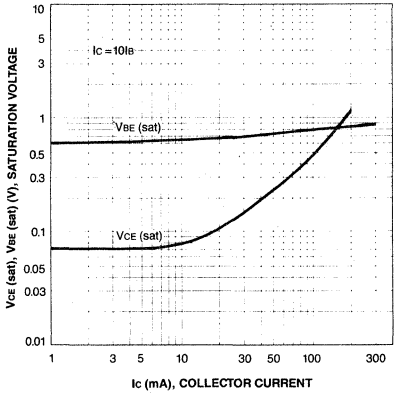
STATIC CHARACTERISTIC



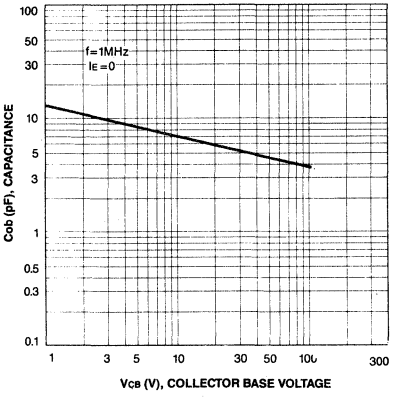
DC CURRENT GAIN



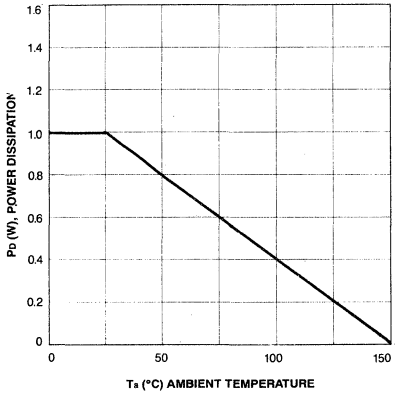
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



COLLECTOR OUTPUT CAPACITANCE



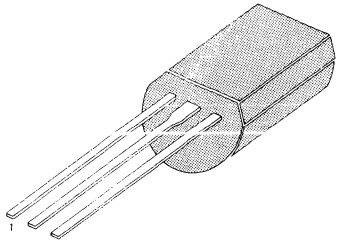
POWER DERATING



LOW FREQUENCY AMPLIFIER
MEDIUM SPEED SWITCHING

- **Complement to KSA931**
- **High Collector-Base Voltage V_{CBO} = 80V**
- **Collector Current I_C = 700mA**
- **Collector Dissipation P_C = 1W**

TO-92L



1. Emitter 2. Collector 3. Base

ABSOLUTE MAXIMUM RATINGS (T_a = 25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	80	V
Collector-Emitter Voltage	V_{CEO}	60	V
Emitter-Base Voltage	V_{EBO}	8	V
Collector Current	I_C	700	mA
Collector Dissipation	P_C	1	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ +150	°C

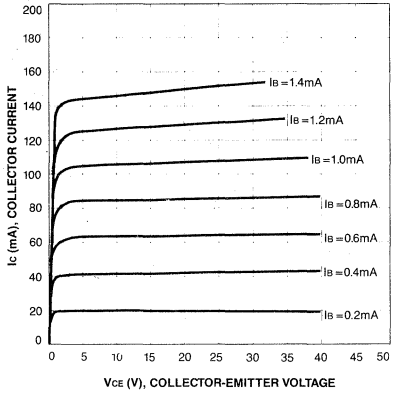
ELECTRICAL CHARACTERISTICS (T_a = 25°C)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C = 100μA, I_E = 0	80			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C = 10mA, I_B = 0	60			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E = 10μA, I_C = 0	8			V
Collector Cut-off Current	I_{CBO}	V_{CB} = 60V, I_E = 0			0.1	μA
Emitter Cut-off Current	I_{EBO}	V_{EB} = 5V, I_C = 0			0.1	μA
DC Current Gain	h_{FE}	V_{CE} = 2V, I_C = 50mA	40		240	
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C = 500mA, I_B = 50mA		0.2	0.7	V
Base-Emitter Saturation Voltage	V_{BE} (sat)	I_C = 500mA, I_B = 50mA		0.86	1.20	V
Current-Gain-Bandwidth Product	f_T	V_{CE} = 10V, I_C = 50mA	30	50		MHz
Output Capacitance	Cob	V_{CB} = 10V, I_E = 0 f = 1MHz		8		pF

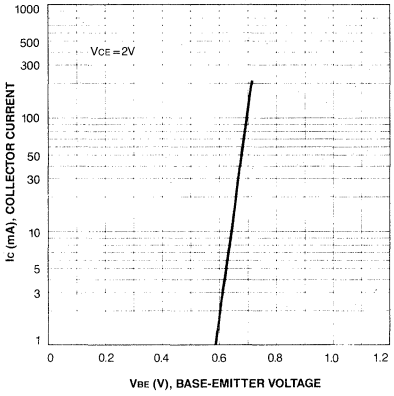
h_{FE} CLASSIFICATION

Classification	R	O	Y
h_{FE}	40-80	70-140	120-240

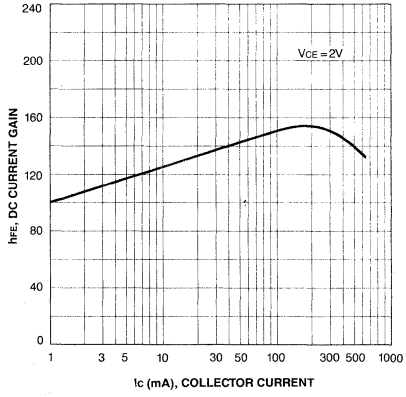
STATIC CHARACTERISTIC



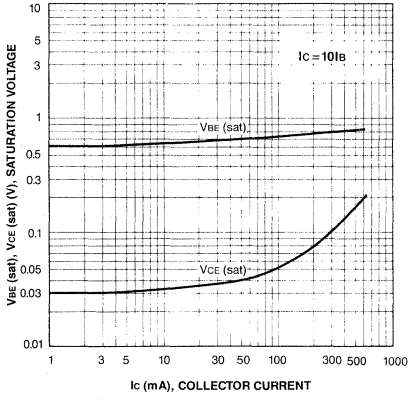
BASE-EMITTER ON VOLTAGE



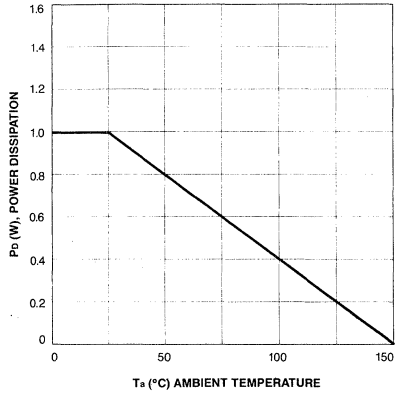
DC CURRENT GAIN



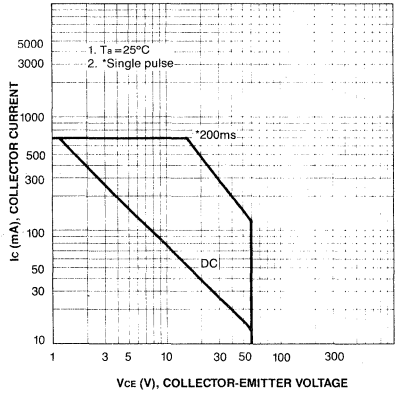
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



POWER DERATING

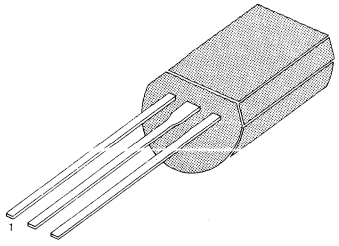


SAFE OPERATING AREA



COLOR TV AUDIO OUTPUT
COLOR TV VERTICAL DEFLECFION OUTPUT

TO-92L



1. Emitter 2. Collector 3. Base

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	160	V
Collector-Emitter Voltage	V_{CEO}	160	V
Emitter-Base Voltage	V_{EBO}	6	V
Collector Current	I_C	1	A
Base Current	I_B	0.5	A
Collector Dissipation	P_C	900	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

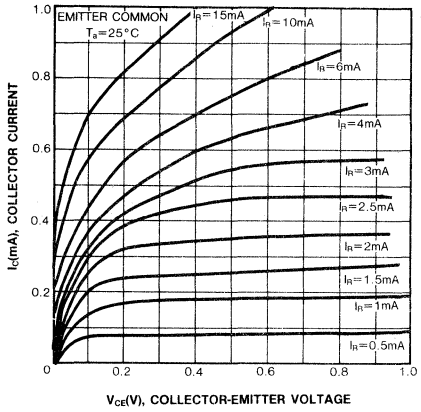
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Cutoff Current	I_{CBO}	V_{CB}=150V, I_E=0			1	μA
Emitter Cutoff Current	I_{EBO}	V_{EB}=6V, I_C=0			1	μA
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=10mA, I_B=0	160			V
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=200mA	60		320	
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=500mA, I_B=50mA			1.5	V
Base Emitter On Voltage	V_{BE} (on)	V_{CE}=5V, I_C=5mA	0.45		0.75	V
Current Gain-Bandwidth Product	f_T	V_{CE}=5V, I_C=200mA	20	100		MHz
Output Capacitance	Cob	V_{CB}=10V, I_E=0, f=1MHz			20	pF

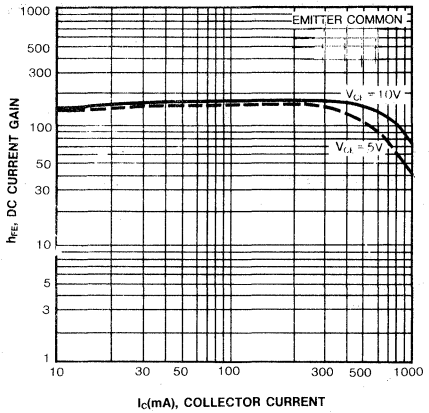
h_{FE} CLASSIFICATION

Classification	R	O	Y
h_{FE}	60-120	100-200	160-320

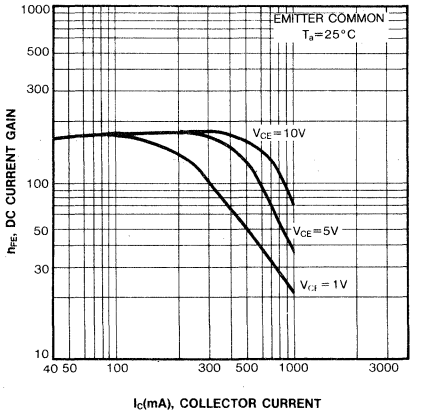
STATIC CHARACTERISTIC



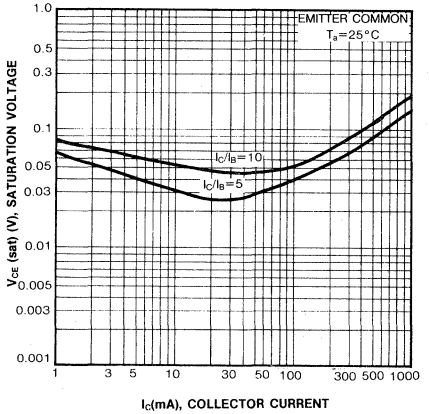
DC CURRENT GAIN



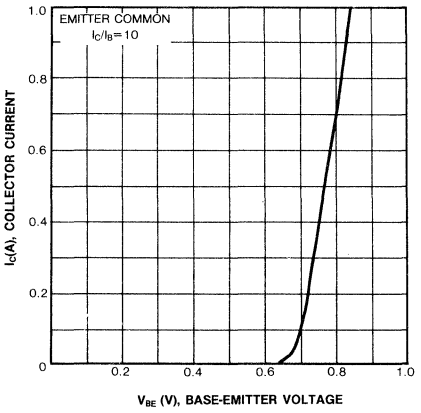
DC CURRENT GAIN



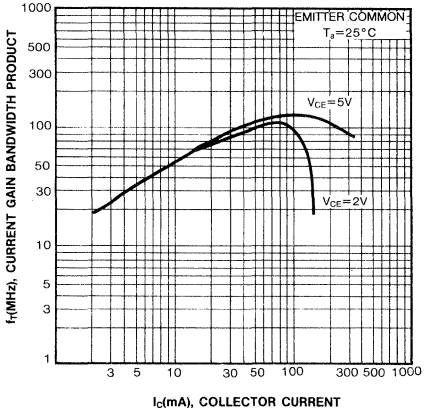
COLLECTOR-EMITTER SATURATION VOLTAGE



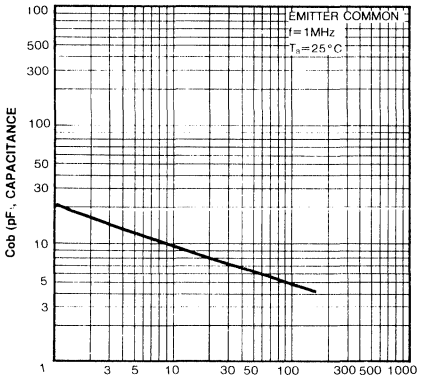
BASE-EMITTER ON VOLTAGE



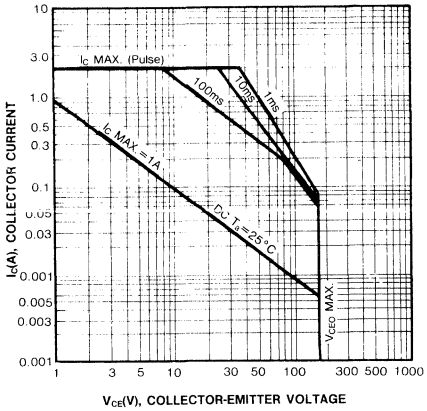
CURRENT GAIN-BANDWIDTH PRODUCT



COLLECTOR OUTPUT CAPACITANCE



SAFE OPERATING AREA

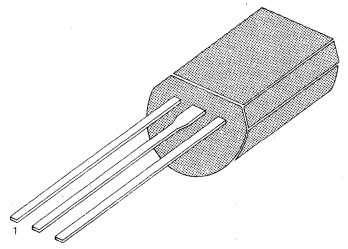


3

MEDIUM POWER AMPLIFIER
LOW SATURATION

- V_{CE} (sat)=0.5V (I_C=2A, I_B=50mA)

TO-92L



1. Emitter 2. Collector 3. Base

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	30	V
Collector-Emitter Voltage	V_{CES}	30	V
Collector-Emitter Voltage	V_{CEO}	10	V
Emitter-Base Voltage	V_{EBO}	6	V
Collector Current (DC)	I_C	2	A
*Collector Current (Pulse)	I_C	5	A
Base Current	I_B	0.5	A
Collector Dissipation	P_C	900	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55∼150	°C

* PW≤10ms, Duty Cycle≤30%

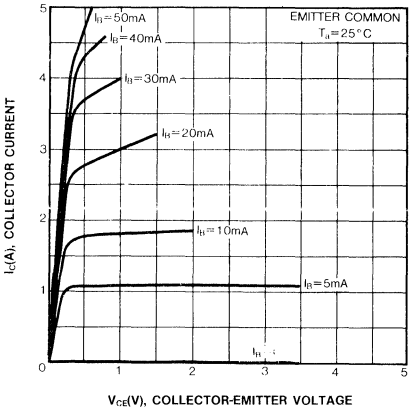
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Cutoff Current	I_{CBO}	V_{CB}=30V, I_E=0			100	nA
Emitter Cutoff Current	I_{EBO}	V_{EB}=6V, I_C=0			100	nA
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=10mA, I_B=0	10			V
Emitter Base Breakdown Voltage	BV_{EBO}	I_E=1mA, I_C=0	6			V
DC Current Gain	h_{FE1}	V_{CE}=1V, I_C=0.5A	140		600	
	h_{FE2}	V_{CE}=1V, I_C=2A	70	200		
Collector Emitter Saturation Voltage	V_{CE} (sat)	I_C=2A, I_B=50mA		0.2	0.5	V
Base Emitter On Voltage	V_{BE} (on)	V_{CE}=1V, I_C=2A		0.86	1.5	V
Current Gain Bandwidth Product	f_T	V_{CE}=1V, I_C=0.5A		150		MHz
Output Capacitance	Cob	V_{CB}=10V, I_E=0, f=1MHz		27		pF

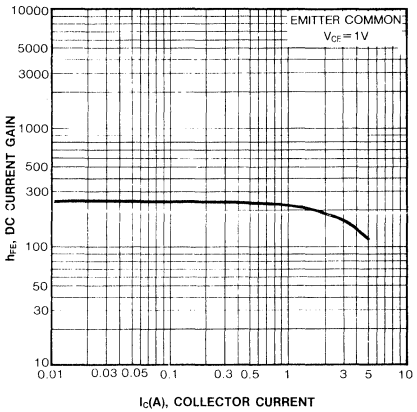
h_{FE} (1) CLASSIFICATION

Classification	A	B	C	D
h_{FE}(1)	140-240	200-330	300-450	420-600

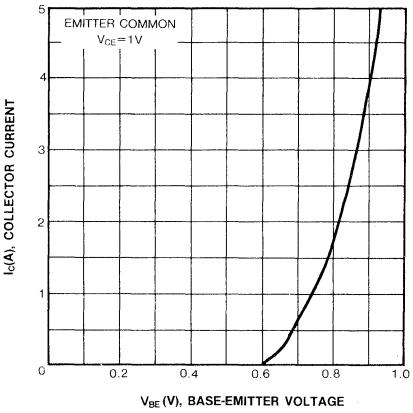
STATIC CHARACTERISTIC



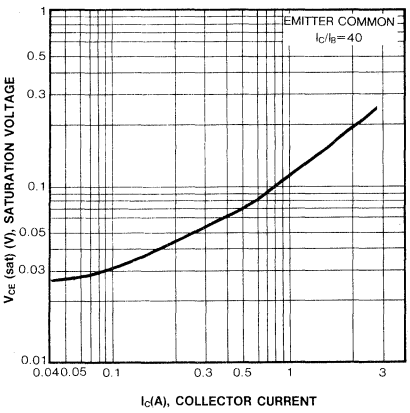
DC CURRENT GAIN



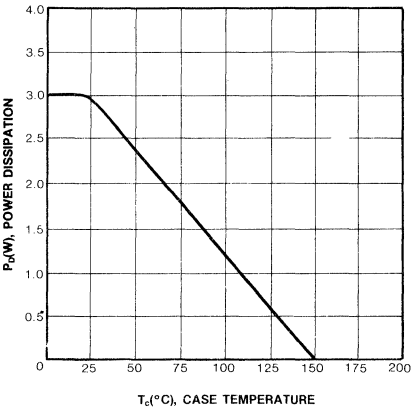
BASE-EMITTER ON VOLTAGE



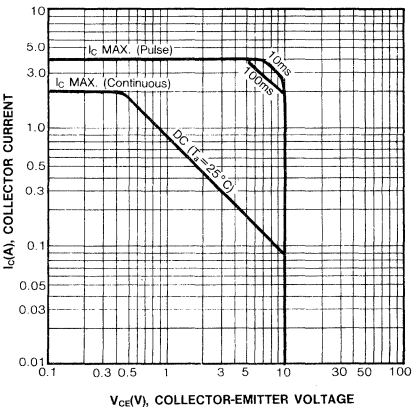
COLLECTOR-EMITTER SATURATION VOLTAGE



POWER DERATING



SAFE OPERATING AREA

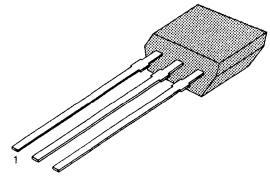


3

FM RADIO RF AMP, MIX, CONV, OSC, IF AMP

- **High Current Gain Bandwidth Product f_T=250MHz (Typ)**

TO-92S



1. Emitter 2. Collector 3. Base

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	35	V
Collector-Emitter Voltage	V_{CEO}	30	V
Emitter-Base Voltage	V_{EBO}	4	V
Collector Current	I_C	30	mA
Collector Dissipation	P_C	200	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

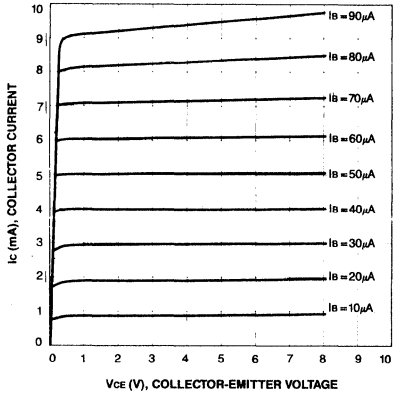
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=100μA, I_E=0	35			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=5mA, I_B=0	30			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=10μA, I_C=0	4			V
Collector Cut-off Current	I_{CBO}	V_{CB}=30V, I_E=0			0.1	μA
Emitter Cut-off Current	I_{EBO}	V_{EB}=4V, I_C=0			0.1	μA
DC Current Gain	h_{FE}	V_{CE}=12V, I_C=2mA	40		240	
Base-Emitter On Voltage	V_{BE} (on)	V_{CE}=6V, I_C=1mA	0.65	0.70	0.75	V
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=10mA, I_B=1mA		0.1	0.4	V
Current Gain-Bandwidth Product	f_T	V_{CE}=10V, I_C=1mA	100	250		MHz
Output Capacitance	Cob	V_{CB}=10V, I_E=0 f=1MHz		2.0	3.2	pF

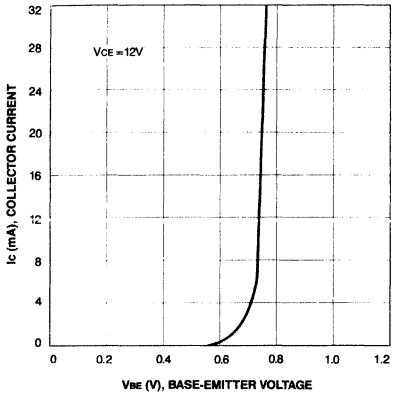
h_{FE} CLASSIFICATION

Classification	R	O	Y
h_{FE}	40-80	70-140	120-240

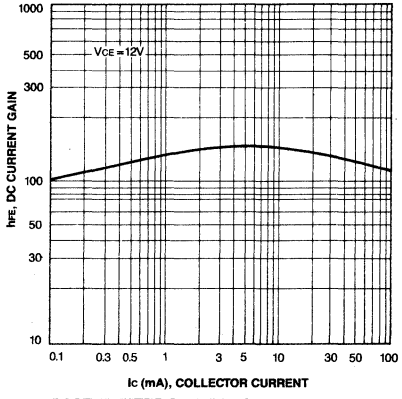
STATIC CHARACTERISTIC



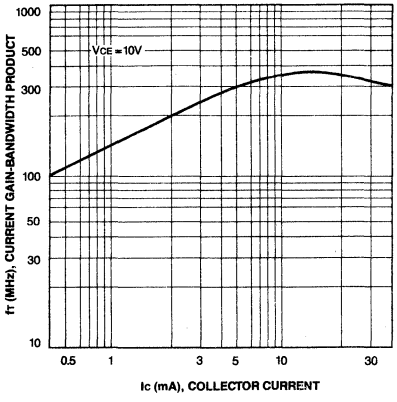
BASE-EMITTER ON VOLTAGE



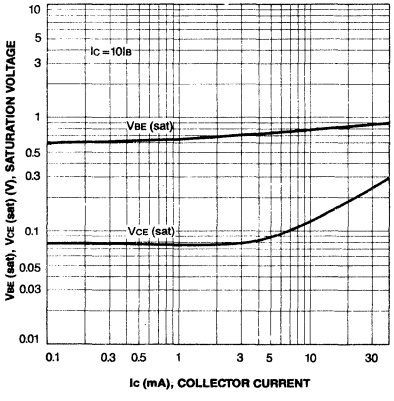
DC CURRENT GAIN



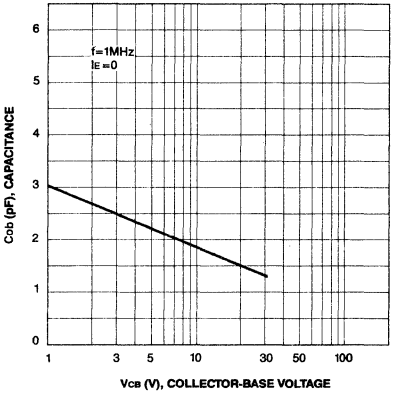
CURRENT GAIN-BANDWIDTH PRODUCT



BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



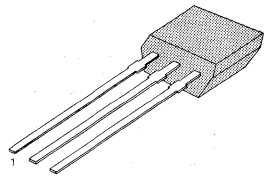
COLLECTOR OUTPUT CAPACITANCE



LOW FREQUENCY POWER AMPLIFIER

- **Complement to** KSA1150
- **Collector Dissipation** $P_C = 300mW$

TO-92S



1. Emitter 2. Collector 3. Base

ABSOLUTE MAXIMUM RATINGS ($T_a = 25°C$)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	40	V
Collector-Emitter Voltage	V_{CEO}	20	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	500	mA
Collector Dissipation	P_C	300	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ 150	°C

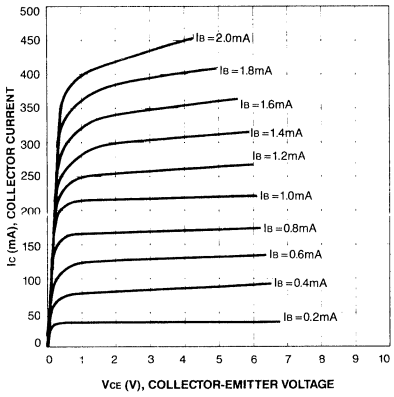
ELECTRICAL CHARACTERISTICS ($T_a = 25°C$)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	$I_C = 100\mu A$, $I_E = 0$	40			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	$I_C = 10mA$, $I_B = 0$	20			V
Emitter-Base Breakdown Voltage	BV_{EBO}	$I_E = 100\mu A$, $I_C = 0$	5			V
Collector Cut-off Current	I_{CBO}	$V_{CB} = 25V$, $I_E = 0$			0.1	μA
Emitter Cut-off Current	I_{EBO}	$V_{EB} = 3V$, $I_C = 0$			0.1	μA
DC Current Gain	h_{FE}	$V_{CE} = 1V$, $I_C = 0.1A$	40		400	
Collector-Emitter Saturation Voltage	V_{CE} (sat)	$I_C = 0.5A$, $I_B = 0.05A$		0.18	0.4	V

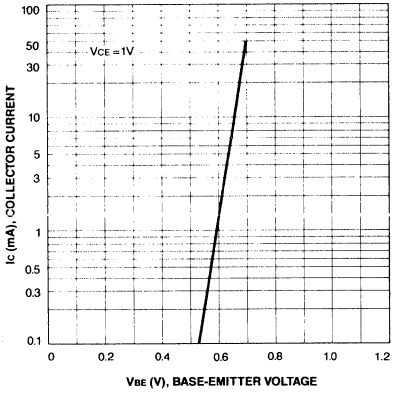
h_{FE} CLASSIFICATION

Classification	R	O	Y	G
h_{FE}	40-80	70-140	120-240	200-400

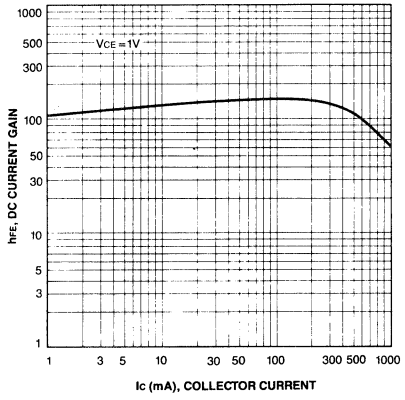
STATIC CHARACTERISTIC



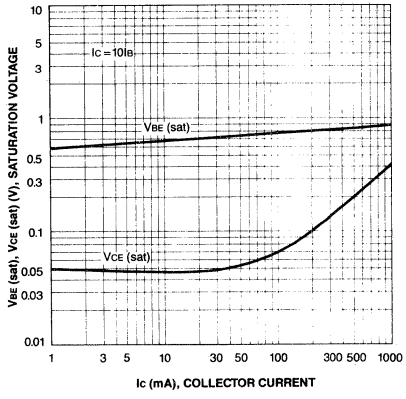
BASE-EMITTER ON VOLTAGE



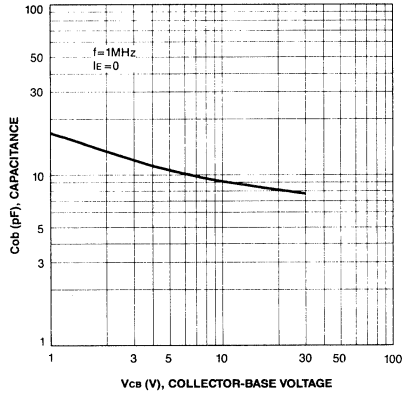
DC CURRENT GAIN



BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



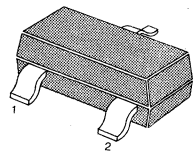
COLLECTOR OUTPUT CAPACITANCE



FM RADIO AMP, MIX, CONV OSC, IF AMP

- **High Power Gain** Gpe=30dB

SOT-23



1. Base 2. Emitter 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	35	V
Collector-Emitter Voltage	V_{CEO}	30	V
Emitter-Base Voltage	V_{EBO}	4	V
Collector Current	I_C	50	mA
Collector Dissipation	P_C	150	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

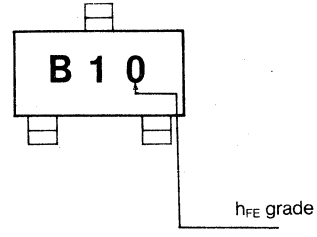
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Cutoff Current	I_{CBO}	V_{CB}=35V, I_E=0			0.1	μA
Emitter Cutoff Current	I_{EBO}	V_{EB}=4V, I_C=0			1	μA
DC Current Gain	h_{FE}	V_{CE}=12V, I_C=2mA	40		240	
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=10mA, I_B=1mA			0.4	V
Base-Emitter Saturation	V_{BE} (sat)	I_C=10mA, I_B=1mA			1.0	V
Current Gain-Bandwidth Product	f_T	I_C=1mA, V_{CE}=10V	100		400	MHz
Output Capacitance	Cob	V_{CB}=10V, I_E=0 f=1MHz		2.	3.2	pF
Power Gain	Gpe	V_{CE}=6V, I_E=1mA f=10.7MHz	27	30	33	dB

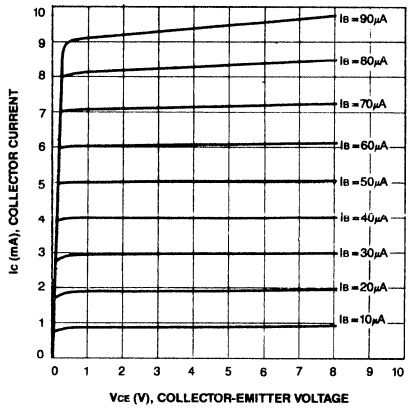
h_{FE} CLASSIFICATION

Classification	R	O	Y
h_{FE}	40-80	70-140	120-240

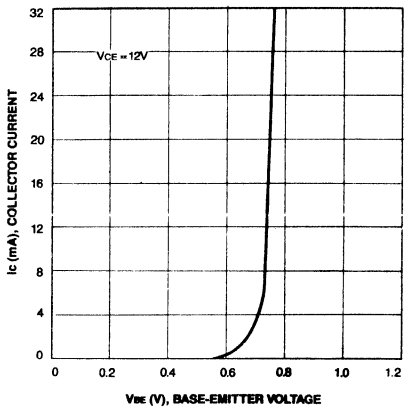
Marking



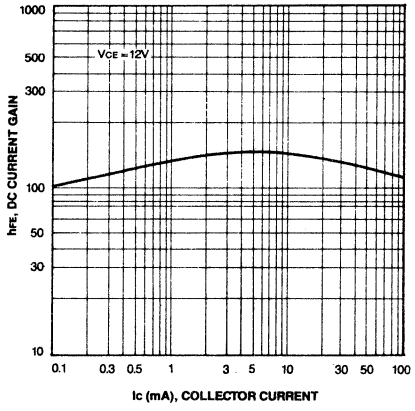
STATIC CHARACTERISTIC



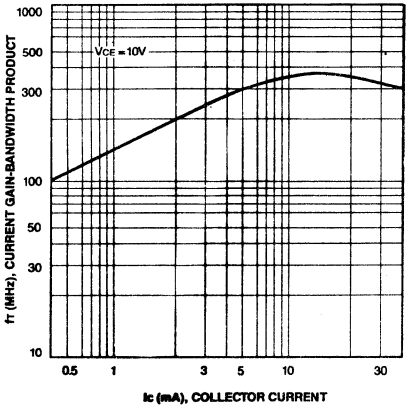
BASE-EMITTER ON VOLTAGE



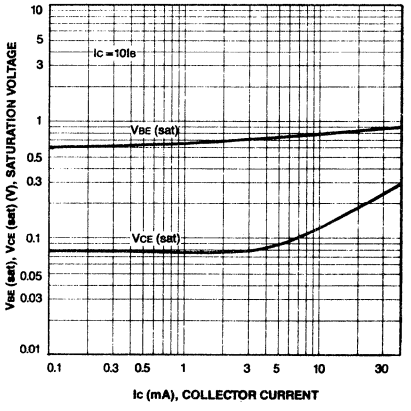
DC CURRENT GAIN



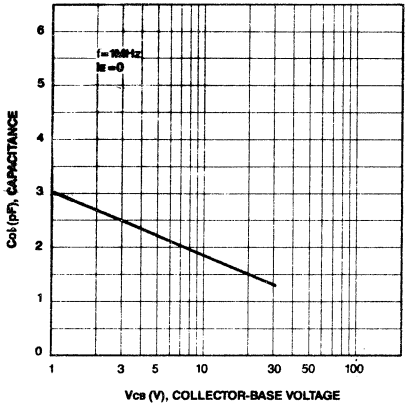
CURRENT GAIN-BANDWIDTH PRODUCT



BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



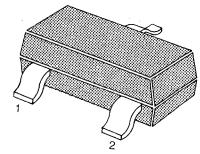
COLLECTOR OUTPUT CAPACITANCE



MIXER, OSC. FOR UHF TV TUNER

High f_T: 3.5GHz (TYP)

SOT-23



1. Base 2. Emitter 3. Collector

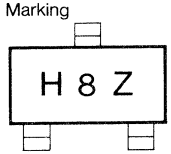
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	20	V
Collector-Emitter Voltage	V_{CEO}	12	V
Emitter-Base Voltage	V_{EBO}	3	V
Collector Current (DC)	I_C	50	mA
Collector Dissipation	P_C	150	mW
Junction Temperature	Tj	125	°C
Storage Temperature	Tstg	−55~125	°C

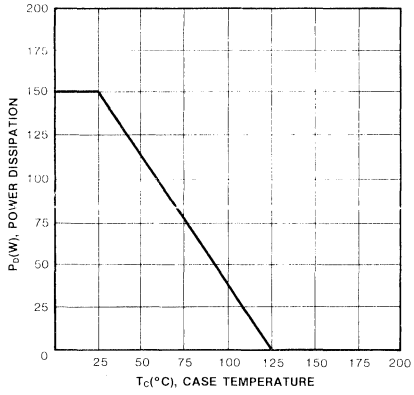
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=10μA, I_E=0	20			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=1mA, R_{BE}=∞	12			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=10μA, I_C=0	3			V
Collector Cutoff Current	I_{CBO}	V_{CB}=15V, I_E=0			700	nA
DC Current Gain	h_{FE}	V_{CE}=10V, I_C=5mA	20	90	200	
Collector Emitter Saturation Voltage	V_{CE}(sat)	I_C=10mA, I_B=5mA			0.7	V
Current Gain Bandwidth Product	f_T	V_{CE}=10V, I_C=10mA	1.4	3.5		GHz
Output Capacitance	C_{ob}	V_{CB}=10V, I_E=0, f=1MHz		0.9	1.5	pF

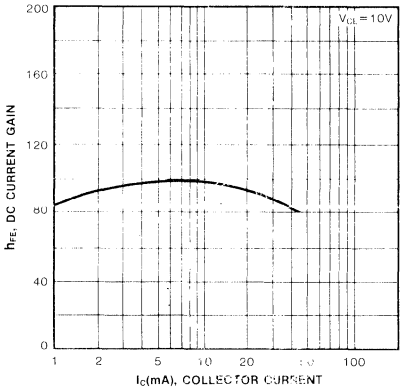
Marking



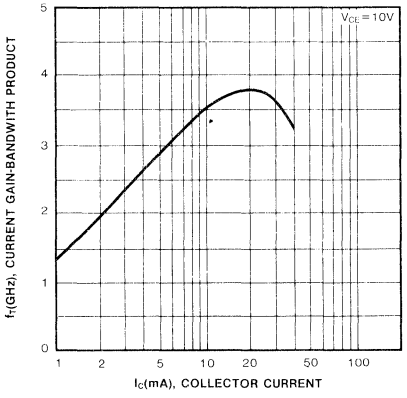
POWER DERATING



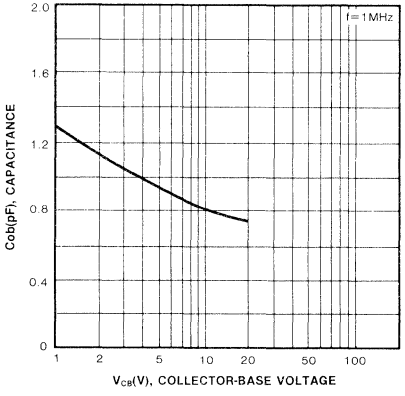
DC CURRENT GAIN



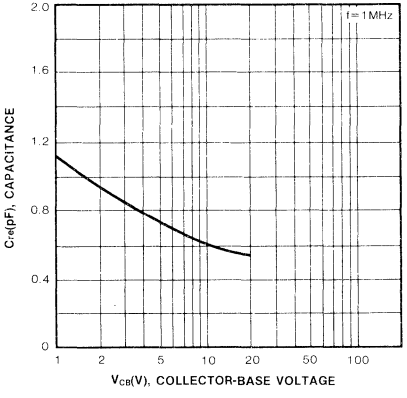
CURRENT GAIN BANDWIDTH PRODUCT



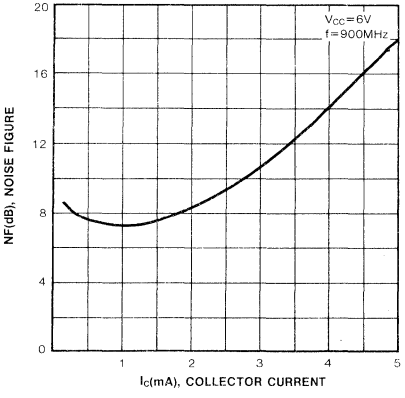
COLLECTOR OUTPUT CAPACITANCE



REVERSE TRANSFER CAPACITANCE

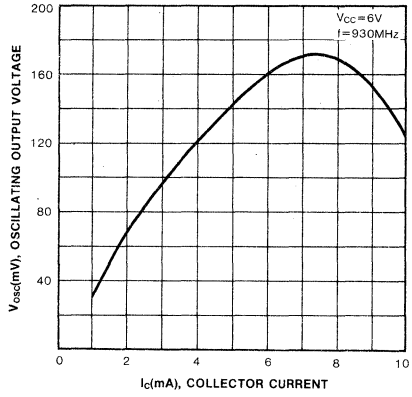


NOISE FIGURE vs. COLLECTOR CURRENT

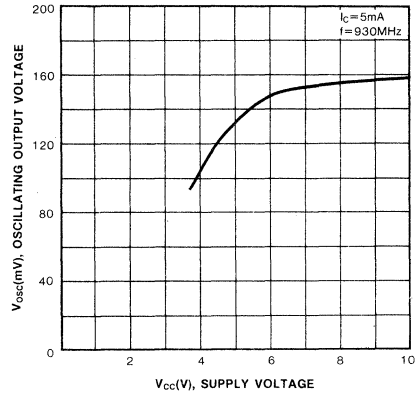


3

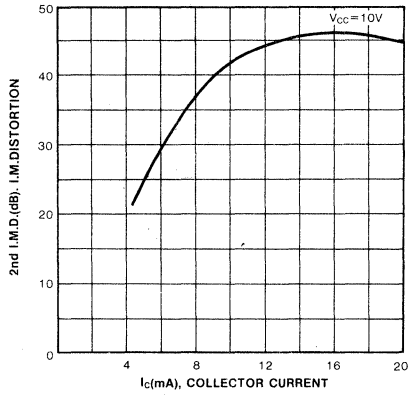
OSCILLATING OUTPUT VOLTAGE vs. COLLECTOR CURRENT



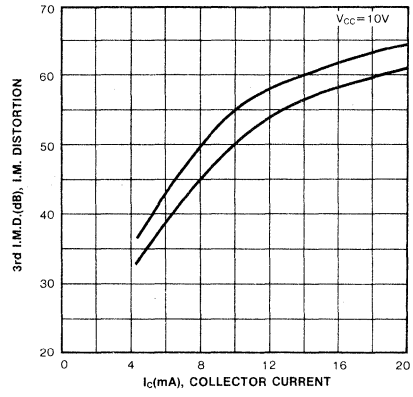
OSCILLATING OUTPUT VOLTAGE vs. SUPPLY VOLTAGE



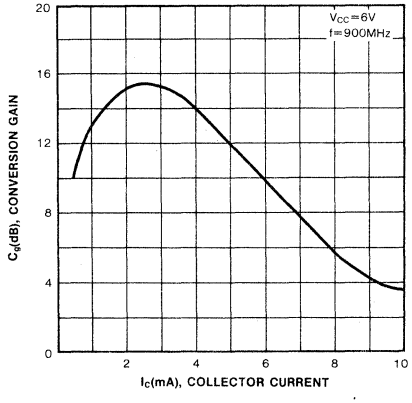
2ND I.M.DISTORTION vs. COLLECTOR CURRENT



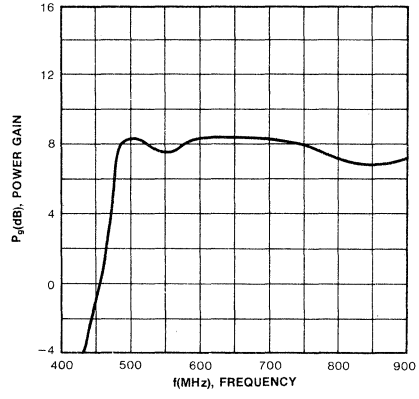
3RD I.M. DISTORTION vs. COLLECTOR CURRENT



CONVERSION GAIN vs. COLLECTOR CURRENT



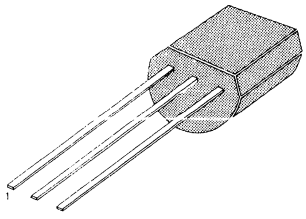
POWER GAIN vs. FREQUENCY



LOW NOISE AMPLIFIER FOR VHF/UHF

High fT = 5GHz
NF = 1.5dB, $|S21e|^2$ = 16dB (f = 500MHz)
NF = 1.7dB, $|S21e|^2$ = 10.5dB (f = 1000MHz)

TO-92



1. Base 2. Emitter 3. Collector

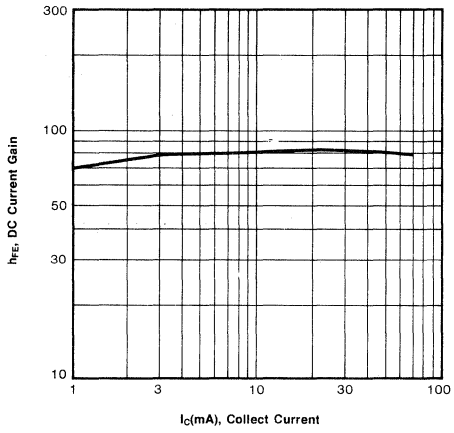
ABSOLUTE MAXIMUM RATINGS (Ta=25°C)

Characteristics	Symbol	Rating	Unit
Collector Base Voltage	V_{CBO}	17	V
Collector Emitter Voltage	V_{CEO}	12	V
Emitter Base Voltage	V_{EBO}	3	V
Collector Current	I_C	70	mA
Base Current	I_B	30	mA
Collector Dissipation	P_C	300	mW
Junction Temperature	T_J	150	°C
Storage Temperature	Tstg	−55∼150	°C

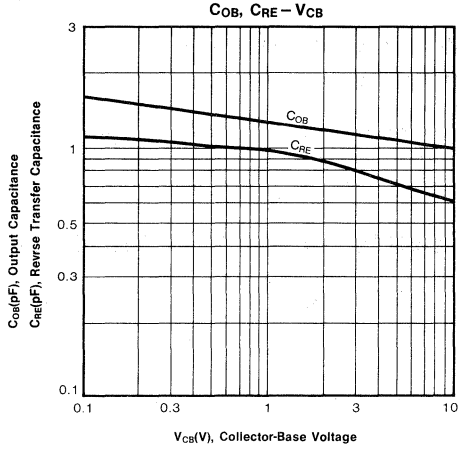
ELECTRICAL CHARACTERISTICS (Ta=25°C)

Characteristics	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector Cutoff Current	I_{CBO}	V_{CB}=10V, I_E=0	—	—	1	μA
Emitter Cutoff Current	I_{EBO}	V_{EB}=1V, IC=0	—	—	1	μA
D.C Current Gain	h_{FE}	V_{CE}=10V, I_C=20mA	30	—	180	
Current Gain-Bandwidth Product	fT	V_{CE}=10V, I_C=20mA	—	5	—	GHz
Output Capacitance	C_{OB}	V_{CB}=10V, I_E=0, f=1MHz	—	1.1	—	pF
Reverse Transfer Capacitance	C_{RE}	V_{CB}=10V, I_E=0, f=1MHz	—	0.65	—	pF
Isertion Gain	$\|S21e\|^2$(1)	V_{CE}=10V, I_C=20mA, f=500MHz	—	16	—	dB
	$\|S21e\|^2$(2)	V_{CE}=10V, I_C=20mA, f=1000MHz	—	10.5	—	dB
Noise Figure	NF(1)	V_{CE}=10V, I_C=5mA, f=500MHz	—	1.5	—	dB
	NF(2)	V_{CE}=10V, I_C=5mA, f=1000MHz		1.7		dB

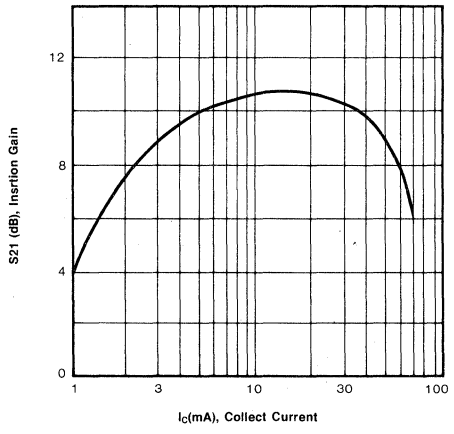
DC Current Gain



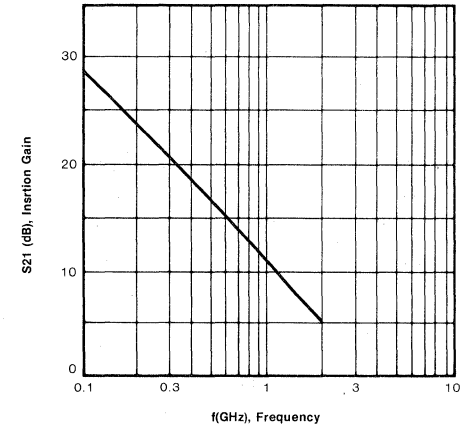
C_{OB}, C_{RE} – V_{CB}



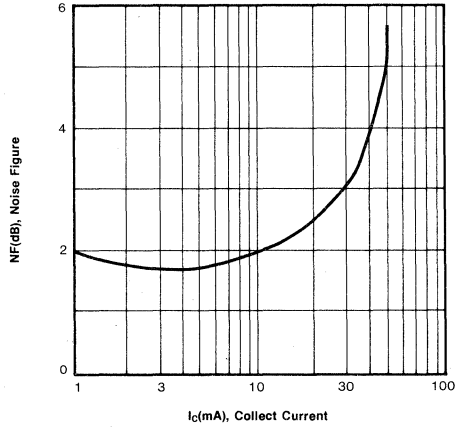
Insrtion Gain



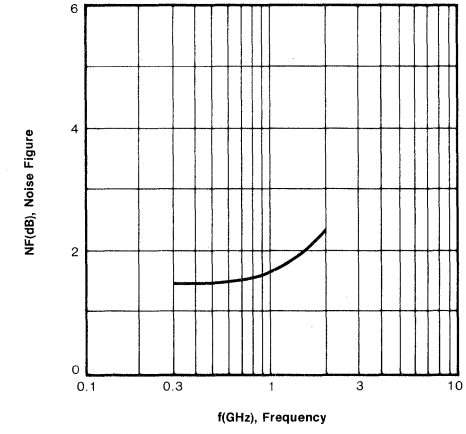
$|S_{21}e|^2$-f

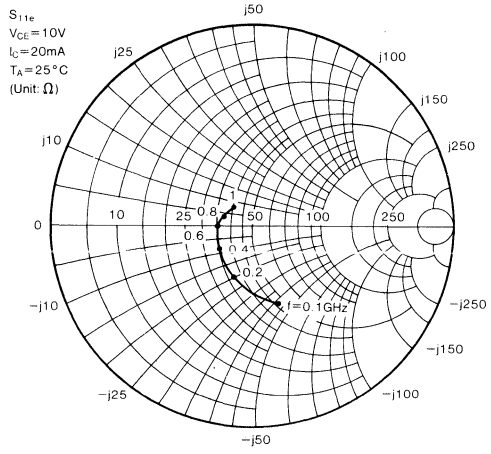


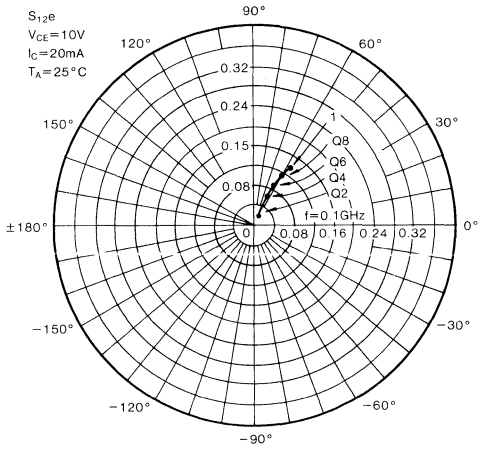
Noise Figure

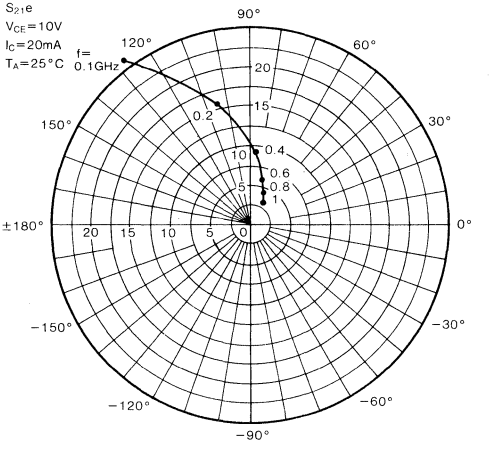


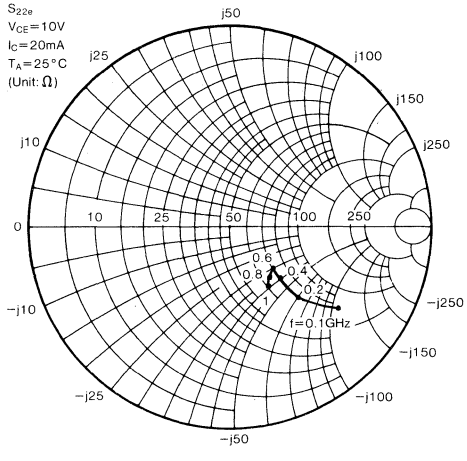
NF-f




S_{11e}
V_{CE}=10V
I_C=20mA
T_A=25°C
(Unit: Ω)
j50
j25
j100
j150
j250
j10
0
10
25
50
100
250
−j10
−j250
−j150
−j25
−j100
−j50
f=0.1GHz


S_{12e}
V_{CE}=10V
I_C=20mA
T_A=25°C
90°
120°
60°
150°
30°
±180°
0°
−150°
−30°
−120°
−60°
−90°
0.32
0.24
0.15
0.08
Q8
Q6
Q4
Q2
f=0.1GHz
0.08
0.16
0.24
0.32


S_{21e}
V_{CE}=10V
I_C=20mA
T_A=25°C
f=
0.1GHz
90°
120°
60°
150°
30°
±180°
0°
−150°
−30°
−120°
−60°
−90°
20
15
10
5
0
0.2
0.4
0.6
0.8
1

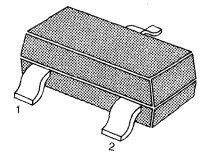

S_{22e}
V_{CE}=10V
I_C=20mA
T_A=25°C
(Unit: Ω)
j50
j25
j100
j150
j250
j10
0
10
25
50
100
250
−j10
−j250
−j150
−j25
−j100
−j50
f=0.1GHz

3

RF AMP, FOR VHF TV TUNER

- **LOW NF, HIGH Gpe**
- **NF=2.0dB Typ. Gpe=23dB Typ. (f=200MHz)**
- **FORWARD AGC CAPABILITY TO 30 dB**

SOT-23



1. Base 2. Emitter 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	30	V
Collector-Emitter Voltage	V_{CEO}	30	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current (DC)	I_C	20	mA
Collector Dissipation	P_C	150	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

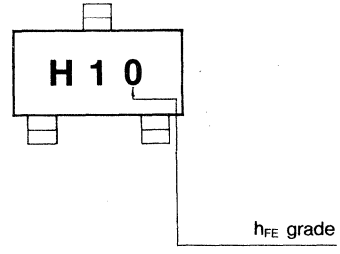
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Cutoff Current	I_{CBO}	V_{CB}=20V, I_E=0			0.1	μA
DC Current Gain	h_{FE}	V_{CE}=10V, I_C=3mA	60	120	240	
Current Gain Bandwidth Product	f_T	V_{CE}=10V, I_C=3mA	400	600		MHz
Reverse Transfer Capacitance	Cre	f=1MHz, V_{CB}=10V, I_E=0		0.3	0.5	pF
Power Gain	Gpe	f=200MHz, I_C=3mA	20	23		dB
AGC Current	I_{AGC}	f=200MHz I_E of Gpe −30dB		−10	−12	mA
Noise Figure	NF	f=200MHz, I_C=3mA		2.0	3.0	dB

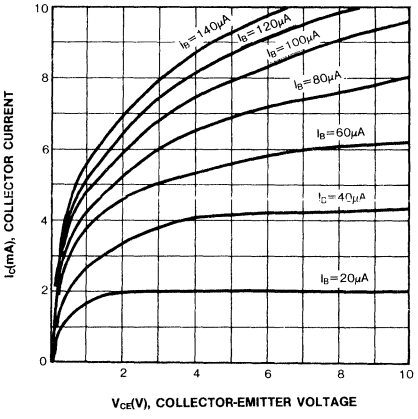
h_{FE} CLASSIFICATION

Classification	R	O	Y
h_{FE}	60-120	90-180	120-240

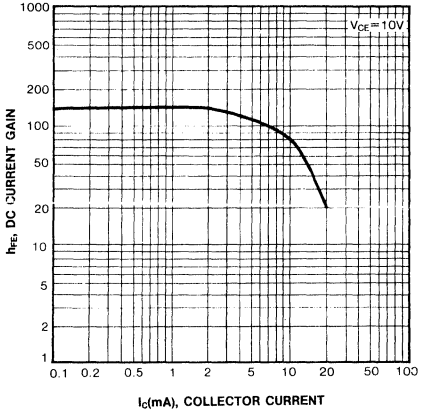
Marking



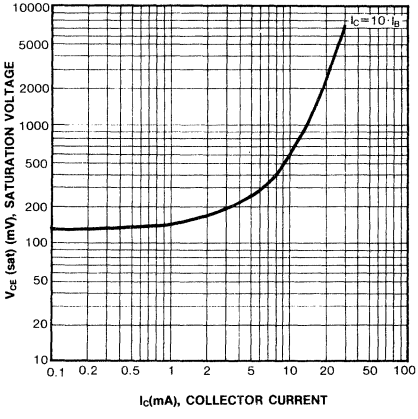
I_C-V_{CE} CHARACTERISTIC



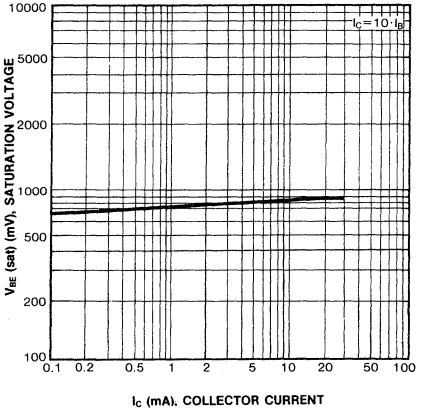
h_{FE}-I_C CHARACTERISTIC



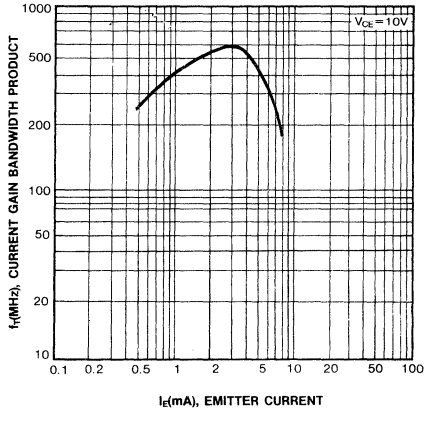
V_{CE} (sat)-I_C CHARACTERISTIC



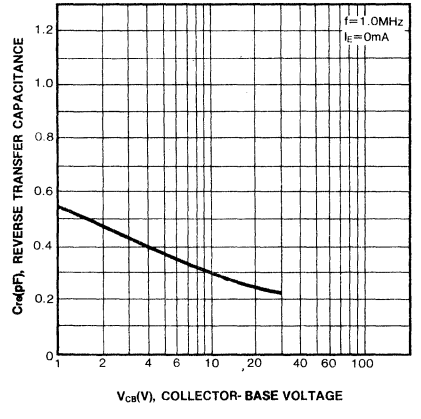
V_{BE} (sat)-I_C CHARACTERISTIC



f_T-I_E CHARACTERISTIC



Cre-V_{CB} CHARACTERISTIC



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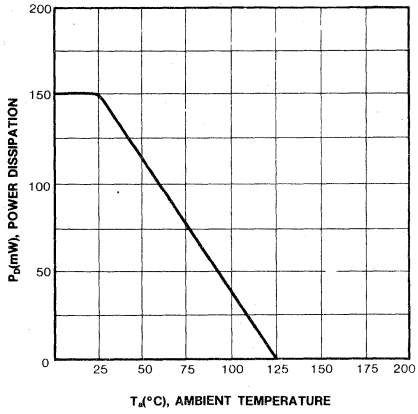
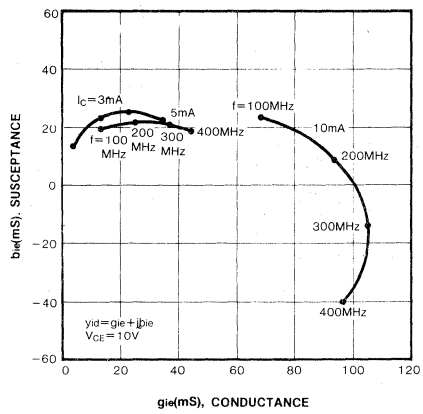
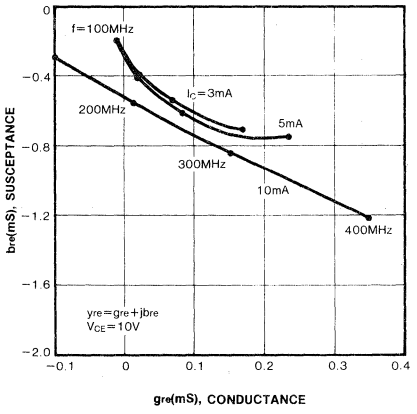
P_D-T_a CHARACTERISTIC



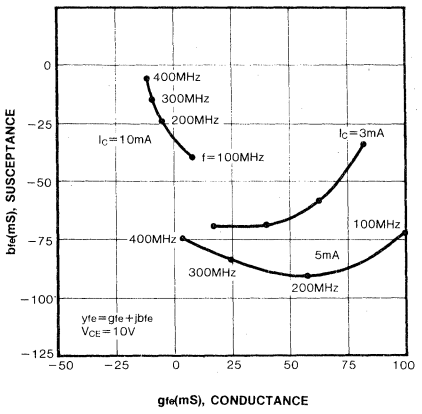
yie-f CHRACTERISTIC



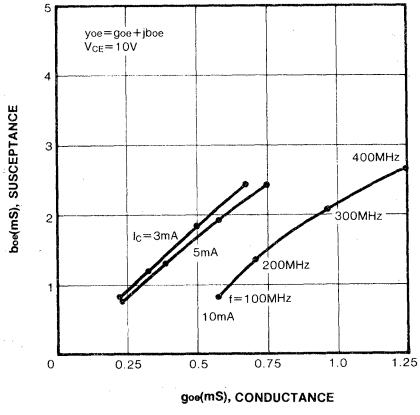
yre-f CHRACTERISTIC



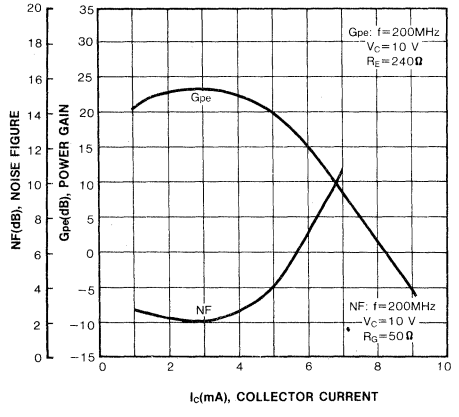
yfe-f CHRACTERISTIC



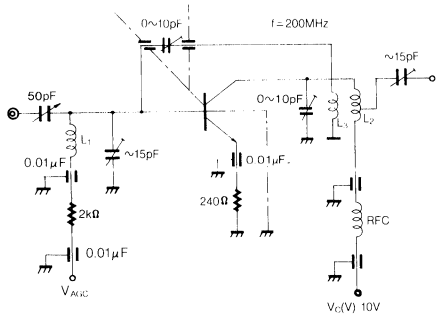
yoe-f CHRACTERISTIC



Gpe-I_C, NF-I_C CHRAÇTERISTIC



POWER GAIN AND NOISE FIGURE TEST

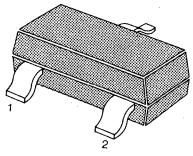


3

MIXER FOR VHF TV TUNER

- **HIGH Gce (Typ. 23dB)**

SOT-23



1. Base 2. Emitter 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	30	V
Collector-Emitter Voltage	V_{CEO}	20	V
Emitter-Base Voltage	V_{EBO}	4	V
Collector Current	I_C	30	mA
Collector Dissipation	P_C	150	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

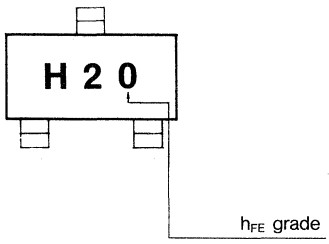
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Cutoff Current	I_{CBO}	V_{CB}=20V, I_E=0			0.1	μA
DC Current Gain	h_{FE}	V_{CE}=10V, I_C=5mA	60	120	240	
Collector Emitter Saturation Voltage	V_{CE} (sat)	I_C=10mA, I_B=1mA			0.5	V
Current Gain Bandwidth Product	f_T	V_{CE}=10V, I_E=5mA	500	850		MHz
Reverse Transfer Capacitance	Cre	V_{CB}=10V, I_E=0, f=1MHz		0.35	0.5	pF
Conversion Gain	Gce	V_{CE}=10V, I_C=3mA f_{RF}=200MHz, I_F=58MHz	15	23		dB
Noise Figure	NF	V_{CE}=10V, I_C=3mA f_{RF}=200MHz, I_F=58MHz		6.5		dB

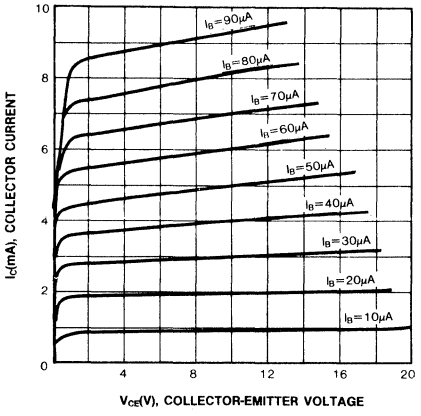
h_{FE} CLASSIFICATION

Classification	R	O	Y
h_{FE}	60-120	90-180	120-240

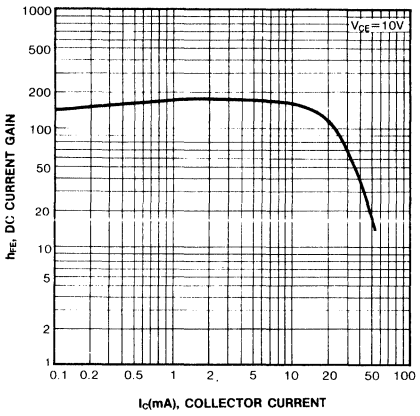
Marking



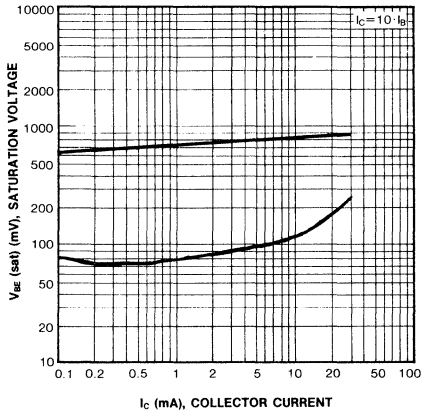
I_C-V_{CE} CHARACTERISTIC



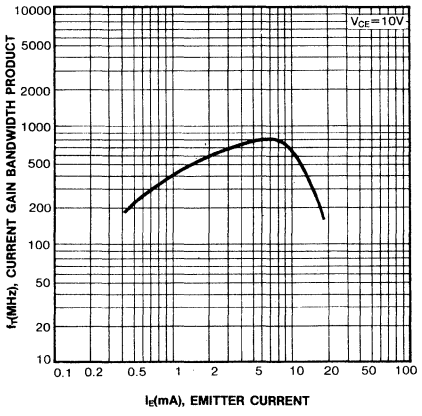
h_{FE}-I_C CHARACTERISTIC



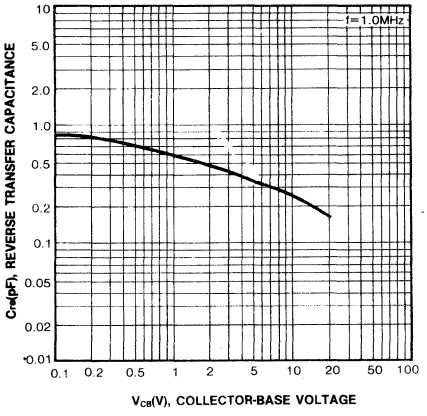
V_{CE}(sat), V_{BE}(sat)-I_C CHARACTERISTIC



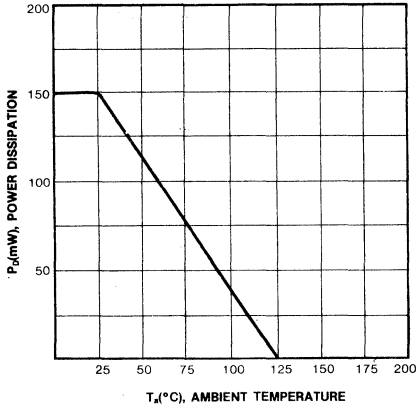
f_T-I_E CHARACTERISTIC



Cre-V_{CB} CHARACTERISTIC

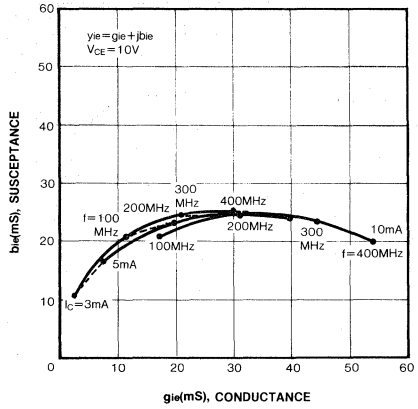


P_D-T_a CHARACTERISTIC

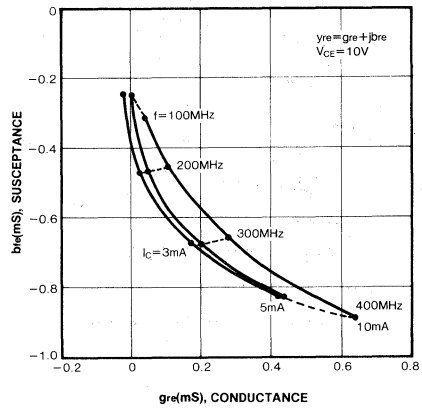


3

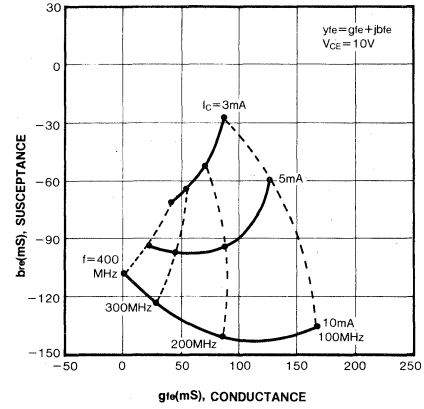
yie-f CHRACTERISTIC



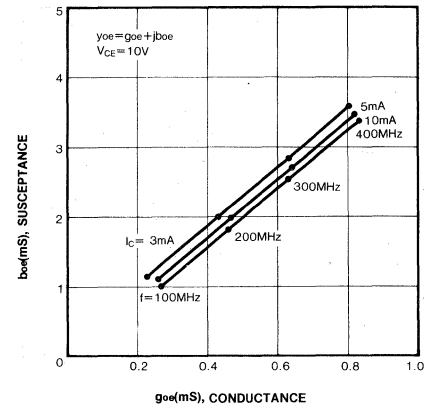
yre-f CHRACTERISTIC



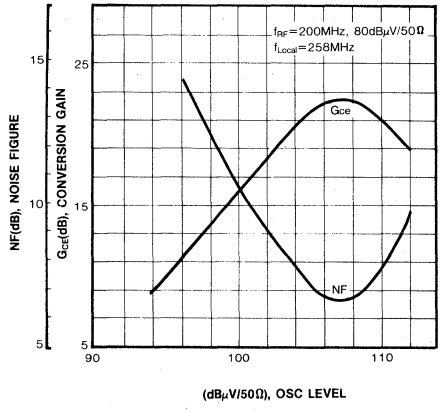
yfe-f CHRACTERISTIC



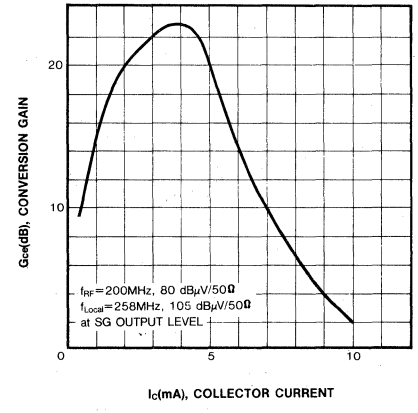
yoe-f CHRACTERISTIC



NF-OSC LEVEL, Gce-OSC LEVEL



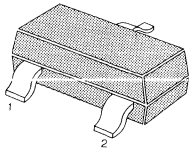
Gce-I_C CHRACTERISTIC



MIXER OSCILLATOR FOR VHF TUNER

HIGH f_T (f_T=1100MHz Typ.)

SOT-23



1. Base 2. Emitter 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector Base Voltage	V_{CBO}	30	V
Collector-Emitter Voltage	V_{CEO}	15	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	50	mA
Collector Dissipation	P_C	150	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ 150	°C

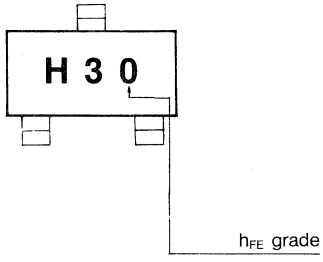
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Cutoff Current	I_{CBO}	V_{CB}=12V, I_E=0			0.1	μA
DC Current Gain	h_{FE}	V_{CE}=10V, I_C=5mA	60	120	240	
Collector Emitter Saturation Voltage	V_{CE} (sat)	I_C=10mA, I_B=1mA			0.5	V
Current Gain Bandwidth Product	f_T	V_{CE}=10V, I_E=5mA	800	1100		MHz
Output Capacitance	Cob	f=1MHz, V_{CB}=10V I_E=0			1.5	pF
Collector Base Time Constant	Cc · rbb'	f=31.9MHz, V_{CE}=10V I_E=5mA		10	15	ps

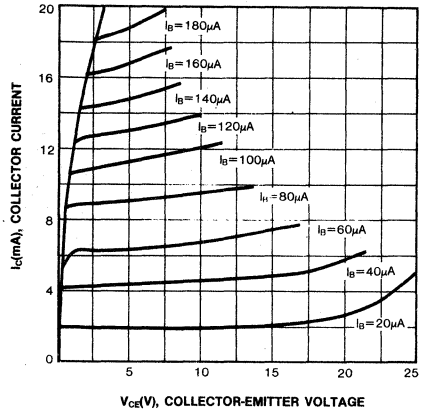
h_{FE} CLASSIFICATION

Classification	R	O	Y
h_{FE}	60-120	90-180	120-240

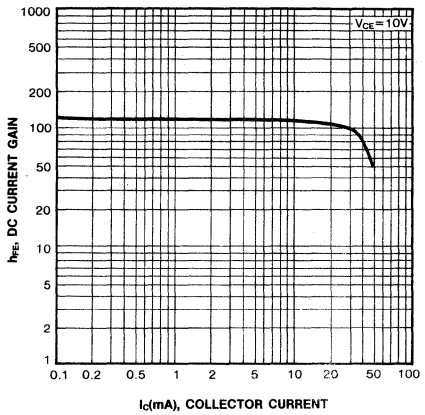
Marking



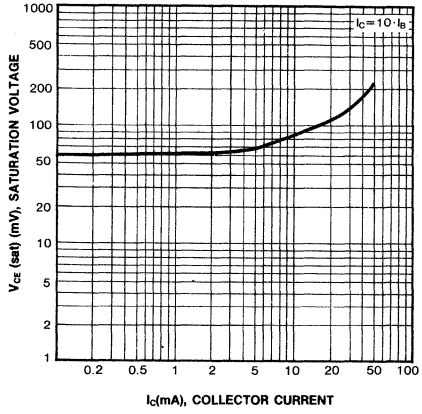
I_C-V_{CE} CHARACTERISTIC



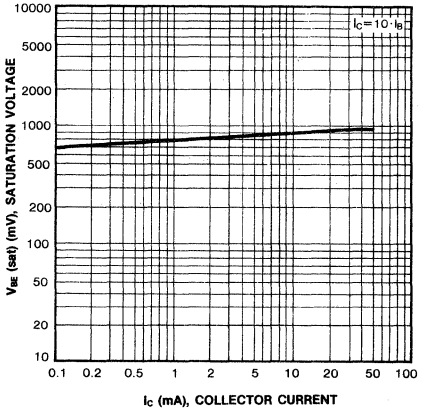
h_{FE}-I_C CHARACTERISTIC



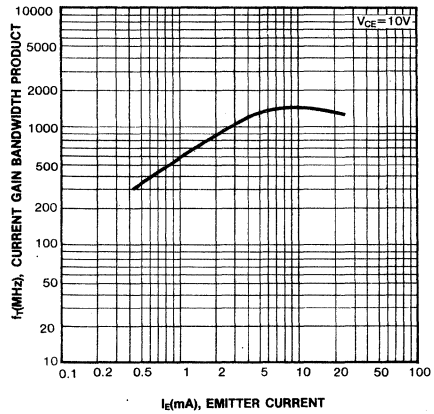
V_{CE} (sat)-I_C CHARACTERISTIC



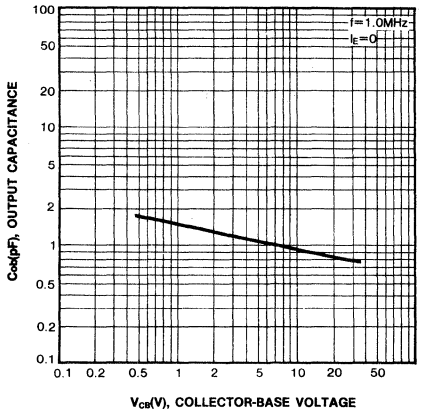
V_{BE} (sat)-I_C CHARACTERISTIC



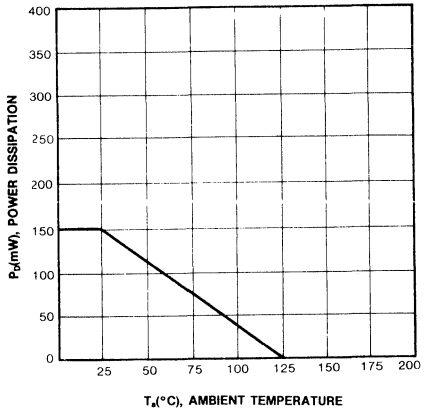
f_T-I_E CHARACTERISTIC



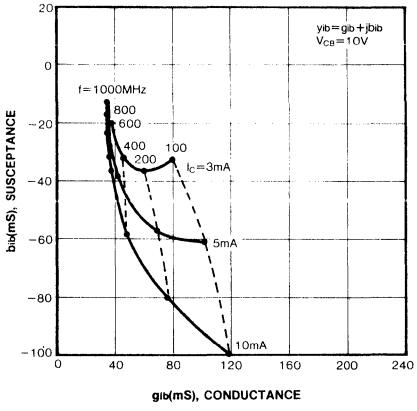
Cob-V_{CB} CHARACTERISTIC



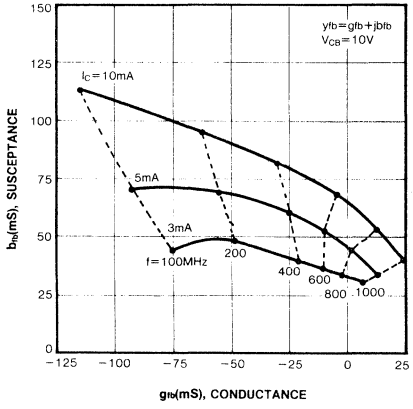
P_D-T_a CHARACTERISTIC



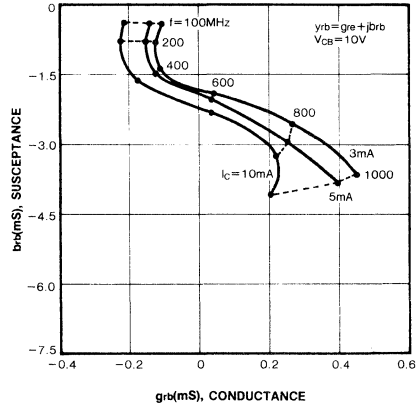
INPUT ADMITTANCE (yib) vs. FREQUENCY



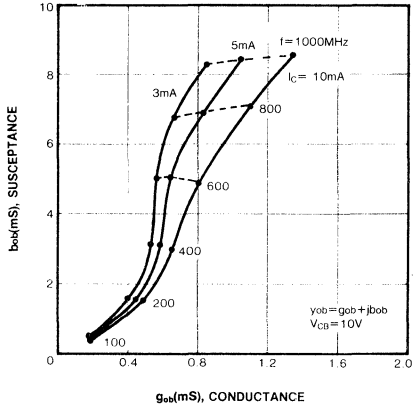
FORWARD TRANSFER ADMITTANCE (yfb) vs. FREQUENCY



REVERSE TRANSFER ADMITTANCE (yrb) vs. FREQUENCY



OUTPUT ADMITTANCE (yob) vs. FREQUENCY

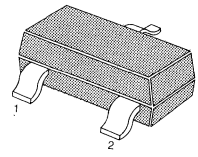


3

RF. MIXER FOR UHF TUNER

- HIGH POWER GAIN TYP. 17dB
- LOW NF TYP. 2.8dB

SOT-23



1. Base 2. Emitter 3. Collector

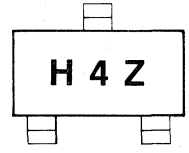
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	30	V
Collector-Emitter Voltage	V_{CEO}	25	V
Emitter-Base Voltage	V_{EBO}	4	V
Collector Current (DC)	I_C	20	mA
Collector Dissipation	P_C	150	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

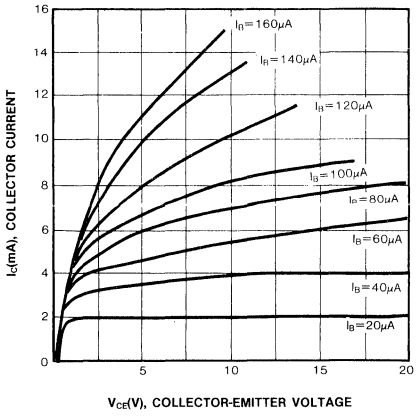
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Cutoff Current	I_{CBO}	V_{CB}=25V, I_E=0			0.1	μA
DC Current Gain	h_{FE}	V_{CE}=10V, I_C=3mA	60	120	240	
Current Gain Bandwidth Product	f_T	V_{CE}=10V, I_E=3mA	750	1000		MHz
Output Capacitance	Cob	f=1MHz, V_{CB}=10V, I_E=0		0.6	0.8	pF
Noise Figure	NF	V_{CB}=10V, I_E=3mA f=900MHz		2.8	4.5	dB
Power Gain	Gpb	V_{CB}=10V, I_E=3mA, f=900MHz	14	17		dB
AGC Current	I_{AGC}	Gpb AGC=I_E of G_{Pb}−30dB		−8	−11	mA

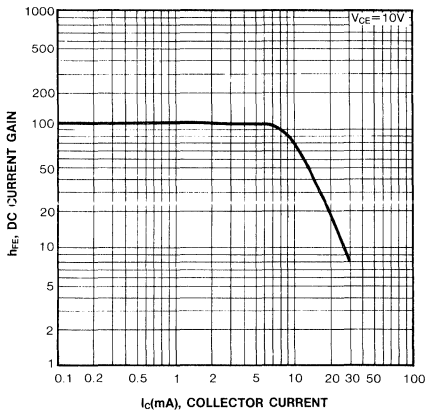
Marking



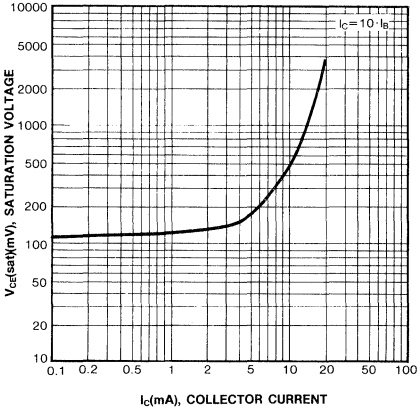
I_C-V_{CE} CHARACTERISTIC



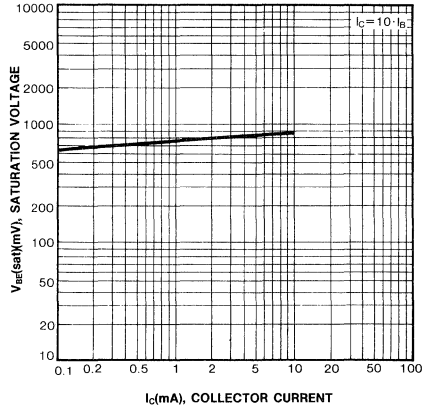
h_{FE}-I_C CHARACTERISTIC



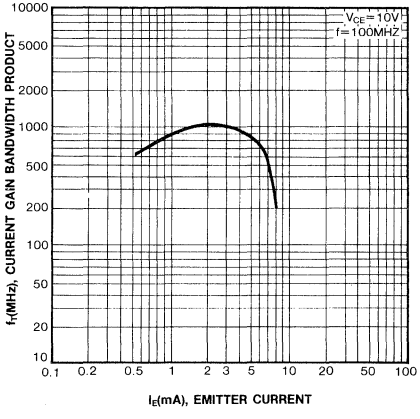
V_{CE}(sat)-I_C CHARACTERISTIC



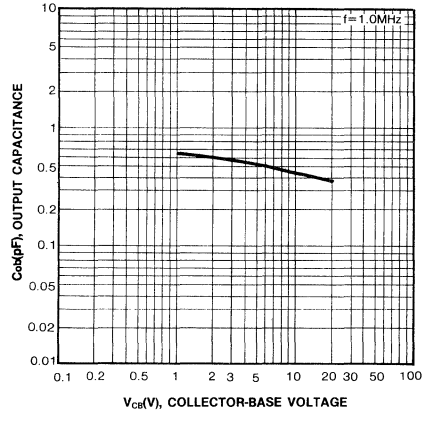
V_{BE}(sat)-I_C CHARACTERISTIC



f_T-I_E CHARACTERISTIC

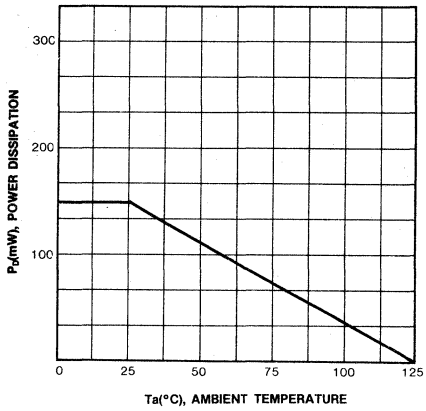


Cob-V_{CB} CHARACTERISTIC

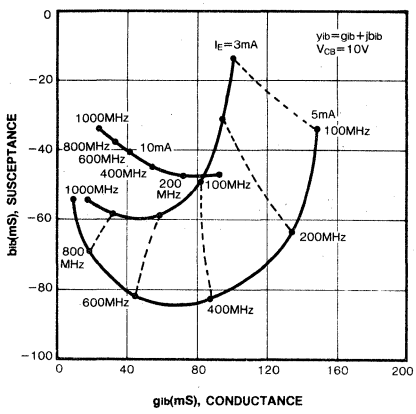


3

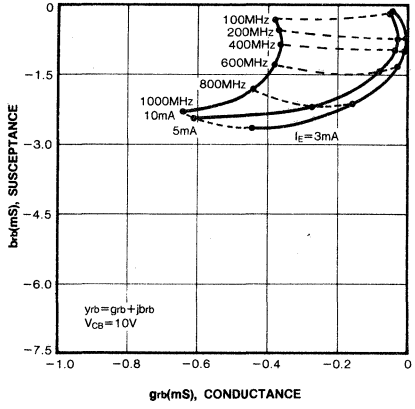
P_D-T_a CHARACTERISTIC



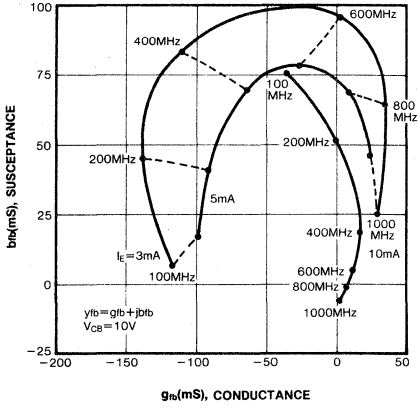
INPUT ADMITTANCE vs. FREQUENCY



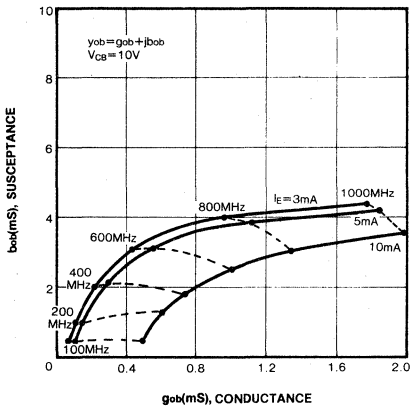
REVERSE TRANSFER ADMITTANCE vs. FREQUENCY



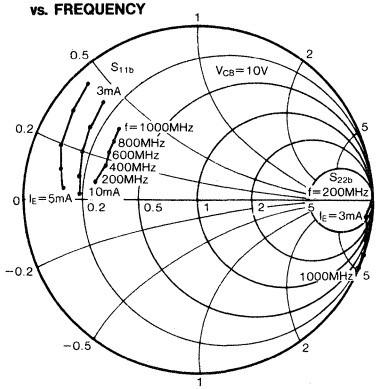
FORWARD TRANSFER ADMITTANCE vs. FREQUENCY



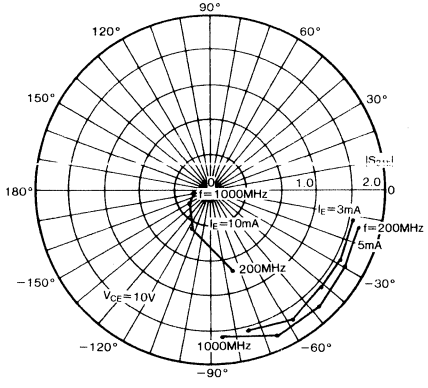
OUTPUT ADMITTANCE vs. FREQUENCY



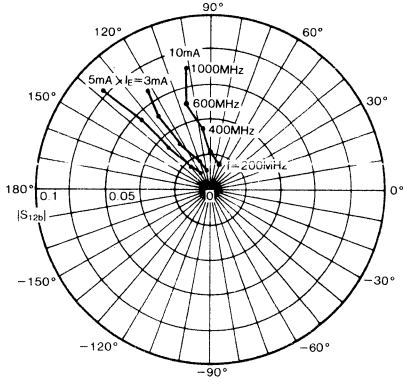
INPUT AND OUTPUT REFLECTION COEFFICIENT vs. FREQUENCY



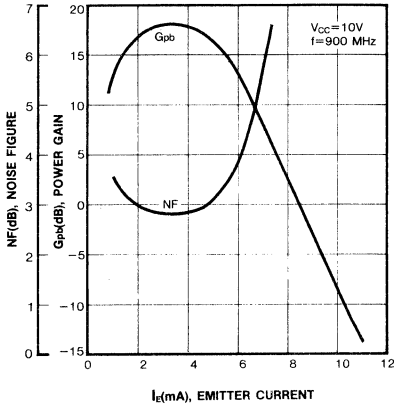
FORWARD INSERTION GAIN vs. FREQUENCY



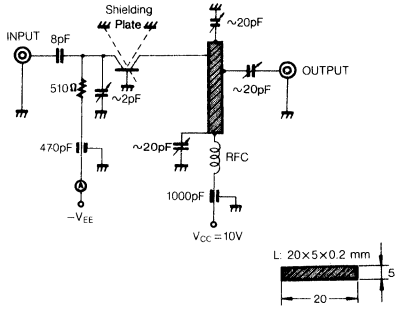
REVERSE INSERTION GAIN vs. FREQUENCY



POWER GAIN AND NOISE FIGURE vs. COLLECTOR CURRENT



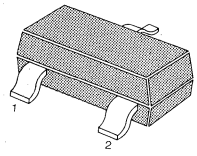
900 MHz Gpb, NF TEST CIRCUIT



3

MIXER, OSCILLATOR FOR UHF TUNER

SOT-23



1. Base 2. Emitter 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	30	V
Collector-Emitter Voltage	V_{CEO}	14	V
Emitter-Base Voltage	V_{EBO}	3	V
Collector Current	I_C	50	mA
Collector Dissipation	P_C	150	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ 150	°C

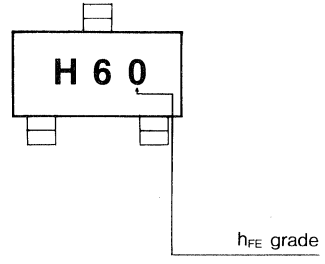
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Cutoff Current	I_{CBO}	V_{CB}=15V, I_E=0			0.1	μA
DC Current Gain	h_{FE}	V_{CE}=10V, I_C=5mA	40	100	180	
Current Gain Bandwidth Product	f_T	V_{CE}=10V, I_C=5mA	1.5	2		GHz
Output Capacitance	Cob	V_{CB}=10V, I_E=0, f=1MHz		1	1.3	pF
Conversion Gain	Gcb	V_{CB}=10V, I_E=5mA f_{RF}=900MHz, fosc=935MHz 115dBμ	10	12.5		dB

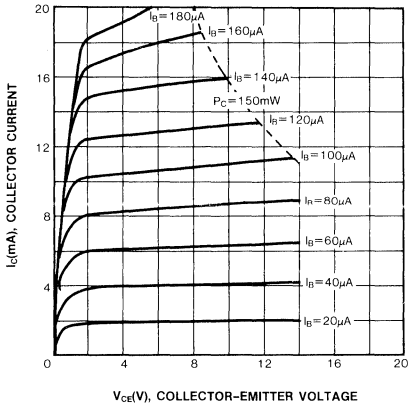
h_{FE} CLASSIFICATION

Classification	R	O	Y
h_{FE}	40-80	60-120	90-180

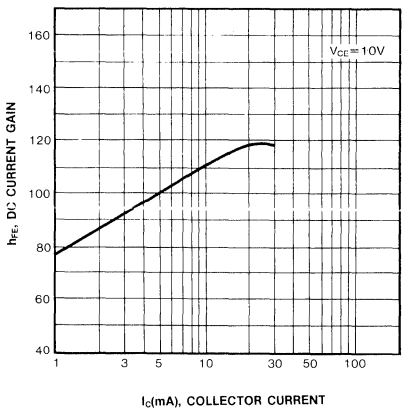
Marking



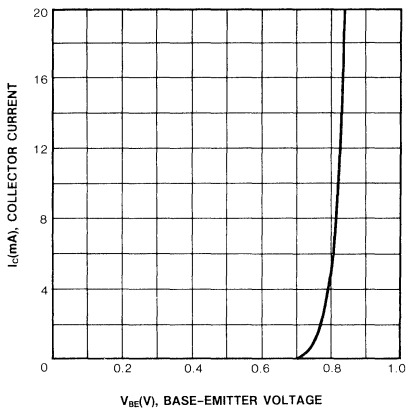
STATIC CHARACTERISTIC



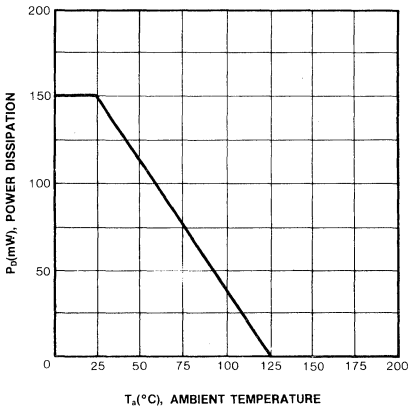
DC CURRENT GAIN



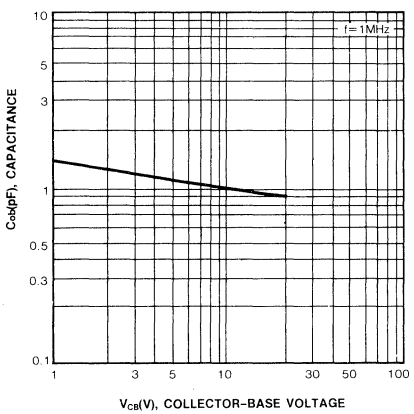
BASE-EMITTER ON VOLTAGE



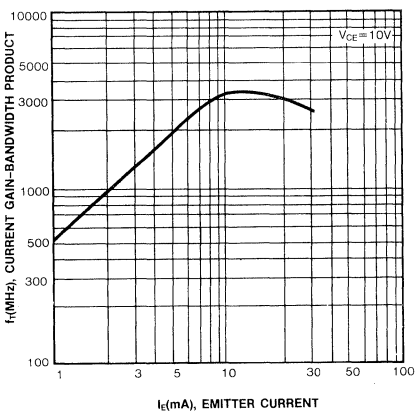
POWER DERATING



COLLECTOR OUTPUT CAPACITANCE

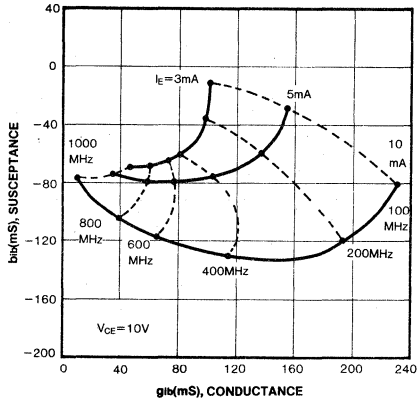


CURRENT GAIN - BANDWIOTH PRODUCT

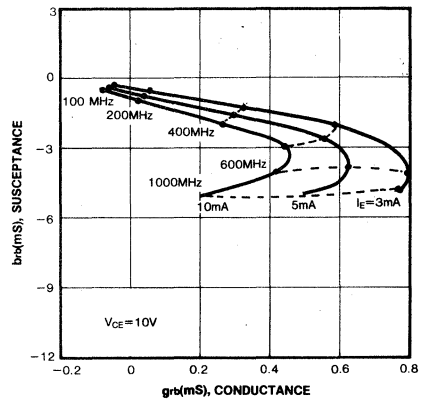


3

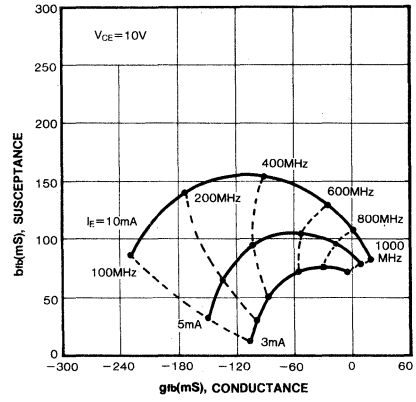
INPUT ADMITTANCE (yib)
vs. FREQUENCY



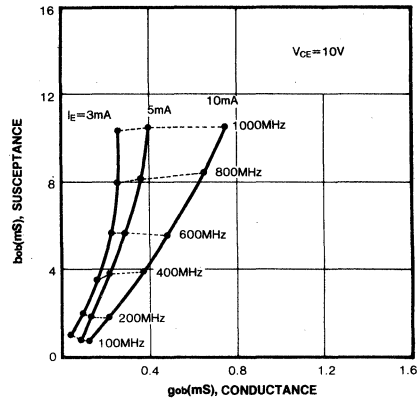
REVERSE TRANSFER ADMITTANCE (yrb)
vs. FREQUENCY



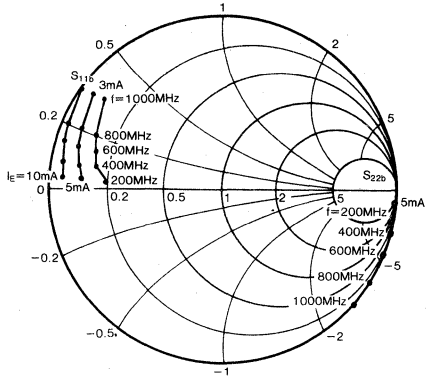
FORWARD TRANSFER ADMITTANCE (yfb)
vs. FREQUENCY



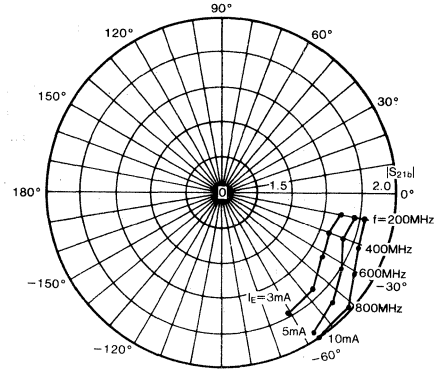
OUTPUT ADMITTANCE (yob)
vs. FREQUENCY



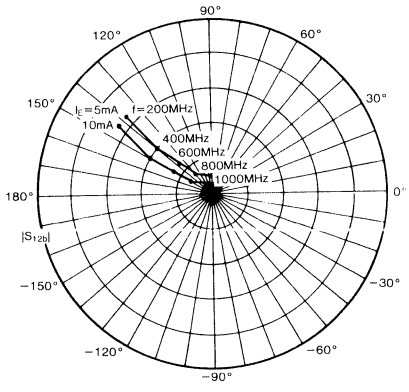
S_{11}, S_{22} Vs f



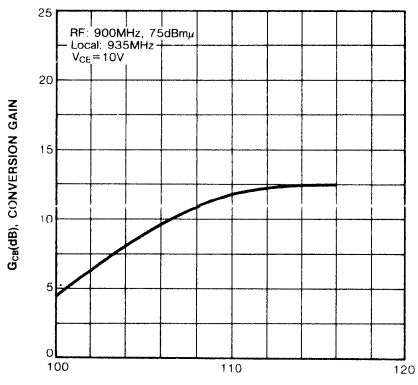
S_{21}, vs. f



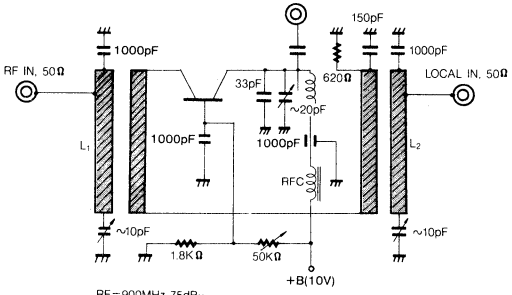
S_{12}, vs. f



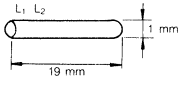
Gcb vs. OSC LEVEL



Gcb TEST CIRCUIT



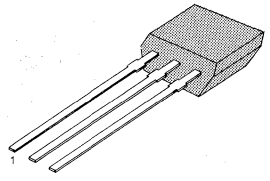
RF=900MHz 75dBμ
Local 935MHz 115 dBμ
I_E=5mA



AUDIO FREQUENCY LOW NOISE AMPLIFIER

- **Complement to KSA1174**

TO-92S



1. Emitter 2. Collector 3. Base

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	120	V
Collector-Emitter Voltage	V_{CEO}	120	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	50	mA
Base Current	I_B	10	mA
Collector Dissipation	P_C	300	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

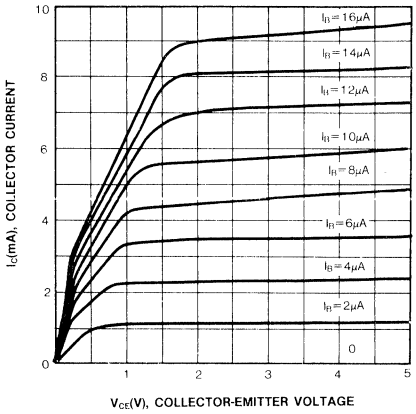
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Cutoff Current	I_{CBO}	V_{CB}=120V, I_E=0			50	nA
Emitter Cutoff Current	I_{EBO}	V_{EB}=5V, I_C=0			50	nA
DC Current Gain	h_{FE1}	V_{CE}=6V, I_C=0.1mA	150	580		
	h_{FE2}	V_{CE}=6V, I_C=1mA	200	600	1200	
Base Emitter On Voltage	V_{BE} (on)	V_{CE}=6V, I_C=1mA	0.55	0.59	0.65	V
Collector Emitter Saturation Voltage	V_{CE} (sat)	I_C=10mA, I_B=1mA		0.07	0.3	V
Current Gain Bandwidth Product	f_T	V_{CE}=6V, I_E=1mA	50	110		MHz
Output Capacitance	Cob	V_{CB}=30V, I_E=0 f=1MHz		1.6	2.5	pF
Noise Voltage	NV			25	40	mV

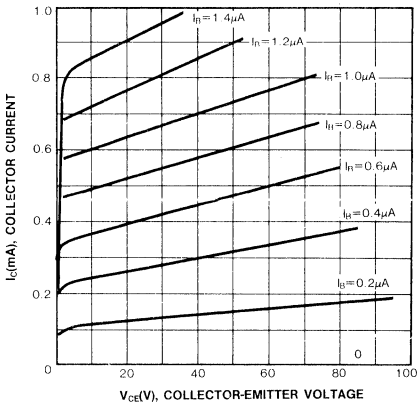
h_{FE}(2) CLASSIFICATION

Classification	P	F	E	U
h_{FE}(2)	200-400	300-600	400-800	600-1200

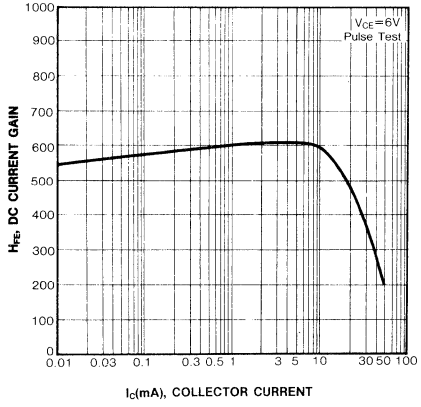
STATIC CHARACTERISTIC



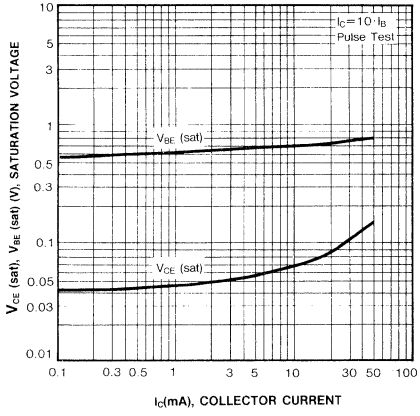
STATIC CHARACTERISTIC



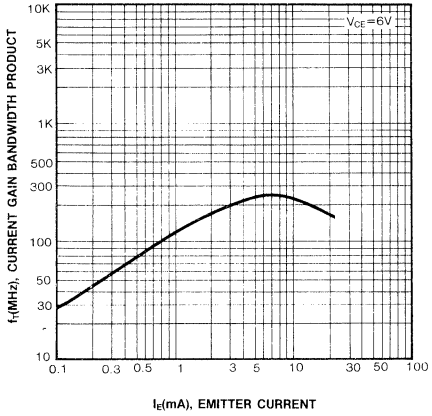
DC CURRENT GAIN



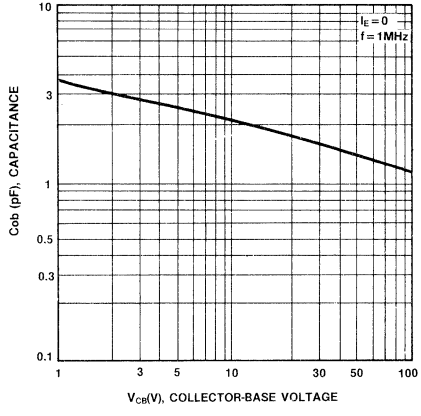
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



CURRENT GAIN-BANDWIDTH PRODUCT



COLLECTOR OUTPUT CAPACITANCE

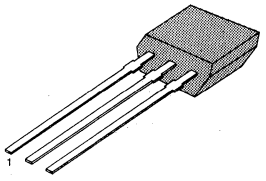


3

AUDIO FREQUENCY AMPLIFIER
HIGH FREQUENCY OSC.

- **Complement to KSA1175**
- **Collector-Base Voltage V_{CBO} = 60V**
- **High Current Gain Bandwidth Product f_T = 300MHz (Typ)**

TO-92S



1. Emitter 2. Collector 3. Base

ABSOLUTE MAXIMUM RATINGS (T_a = 25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	60	V
Collector-Emitter Voltage	V_{CEO}	50	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	150	mA
Collector Dissipation	P_C	250	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ 150	°C

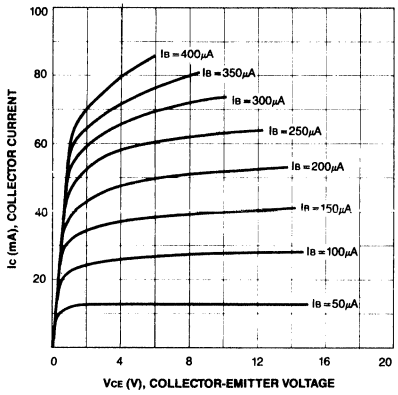
ELECTRICAL CHARACTERISTICS (T_a = 25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C = 100μA, I_E = 0	60			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C = 10mA, I_B = 0	50			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E = 10μA, I_C = 0	5			V
Collector Cut-off Current	I_{CBO}	V_{CB} = 40V, I_E = 0			0.1	μA
Emitter Cut-off Current	I_{EBO}	V_{EB} = 3V, I_C = 0			0.1	μA
DC Current Gain	h_{FE}	V_{CE} = 6V, I_C = 1.0mA	70		700	
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C = 100mA, I_B = 10mA		0.15	0.3	V
Current-Gain-Bandwidth Product	f_T	V_{CE} = 6V, I_C = 10mA		300		MHz
Output Capacitance	Cob	V_{CB} = 6V, I_E = 0 f = 1MHz		2.5		pF
Noise Figure	NF	V_{CE} = 6V, I_E = 0.5mA f = 1KHz, Rs = 500Ω		4.0		dB

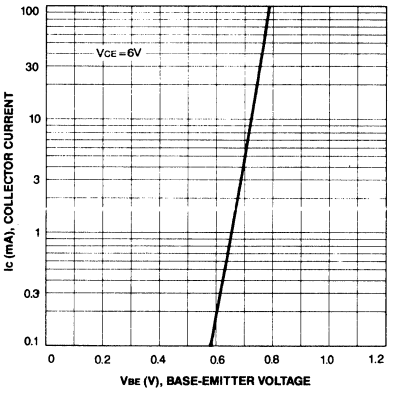
h_{FE} CLASSIFICATION

Classification	O	Y	G	L
h_{FE}	70-140	120-240	200-400	350-700

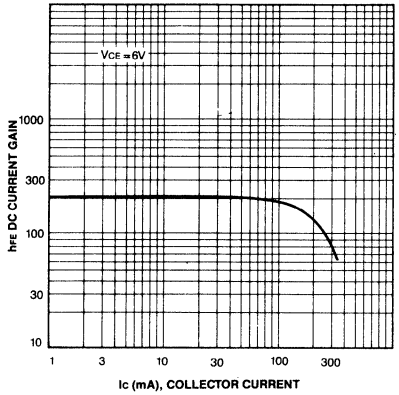
STATIC CHARACTERISTIC



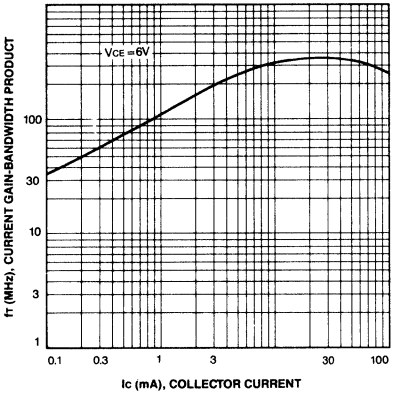
TRANSFER CHARACTERISTIC



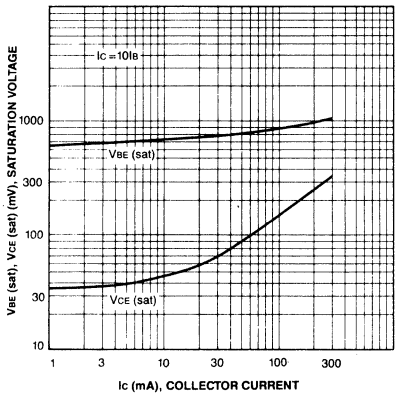
DC CURRENT GAIN



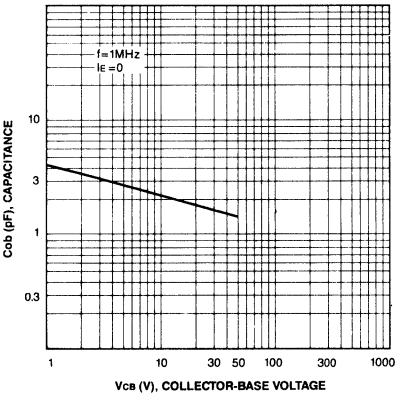
CURRENT GAIN BANDWIDTH PRODUCT



BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



OUTPUT CAPACITANCE

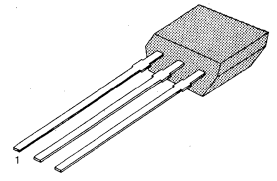


3

TV PIF AMPLIFIER, FM TUNER RF AMPLIFIER, MIXER, OSCILLATOR

- **High Current-Gain-Bandwidth Product f_T =600MHz (Typ)**
- **High Power Gain Gpe=22dB at f=100MHz**

TO-92S



1. Emitter 2. Collector 3. Base

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	30	V
Collector-Emitter Voltage	V_{CEO}	20	V
Emitter-Base Voltage	V_{EBO}	4	V
Collector Current	I_C	20	mA
Collector Dissipation	P_C	250	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ 150	°C

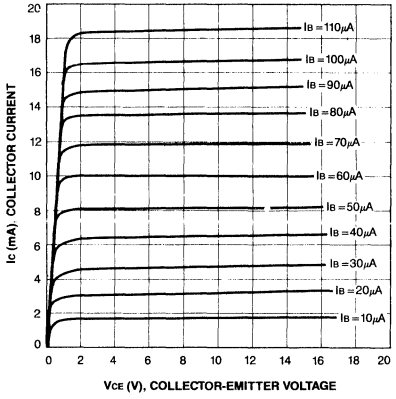
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=10μA, I_E=0	30			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=5mA, I_B=0	20			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=10μA, I_C=0	4			V
Collector Cut-off Current	I_{CBO}	V_{CB}=30V, I_E=0			0.1	μA
Emitter Cut-off Current	I_{EBO}	V_{EB}=4V, I_C=0			0.1	μA
DC Current Gain	h_{FE}	V_{CE}=6V, I_C=1mA	40		240	
Base-Emitter On Voltage	V_{BE} (on)	V_{CE}=6V, I_C=1mA		0.72		V
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=10mA, I_B=1mA		0.1	0.3	V
Current-Gain-Bandwidth Product	f_T	V_{CE}=6V, I_C=1mA	400	600		MHz
Output Capacitance	Cob	V_{CB}=6V, I_E=0 f=1MHz		1.2		pF
Collector-Base Time Constant	Cc·rbb'	V_{CE}=6V, I_E=1mA f=31.9MHz		12	15	ps
Common Source Noise Figure	NF	V_{CE}=6V, I_E=1mA Rs=50Ω, f=100MHz		3.0	5.0	dB
Power Gain	Gpe	V_{CE}=6V, I_E=1mA Rs=50Ω, f=100MHz (Typ)	18	22		dB

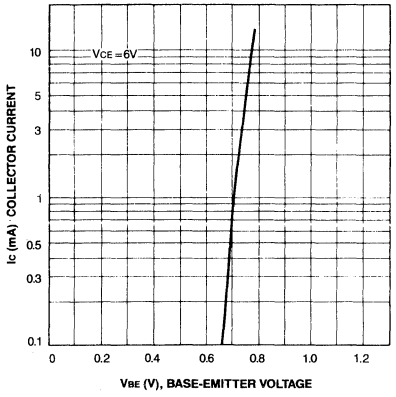
h_{FE} CLASSIFICATION

Classification	R	O	Y
h_{FE}	40-80	70-140	120-240

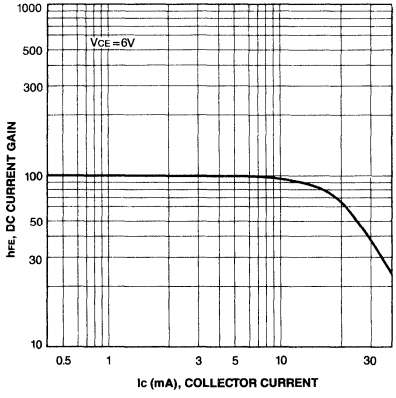
STATIC CHARACTERISTIC



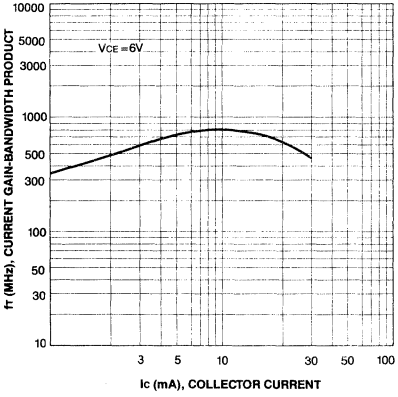
BASE-EMITTER ON VOLTAGE



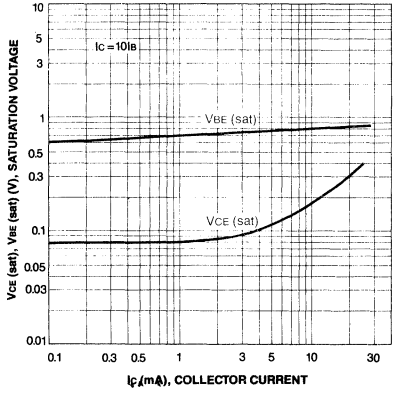
DC CURRENT GAIN



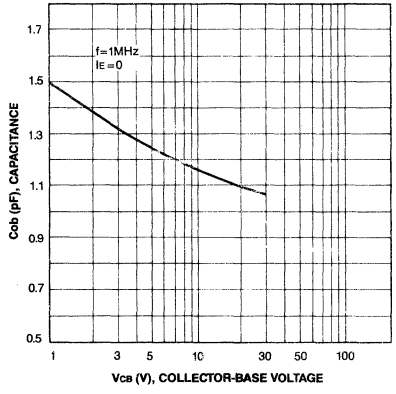
CURRENT GAIN-BANDWIDTH PRODUCT



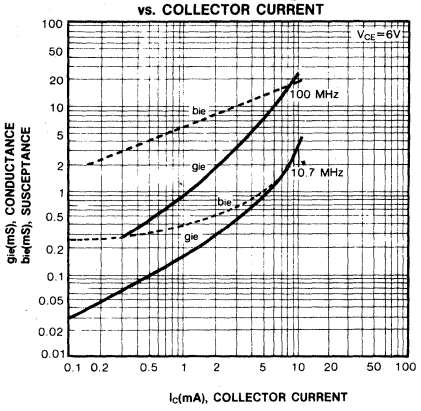
BASE-EMITTER SATURATION VOLTAGE
COLECTOR-EMITTER SATURATION VOLTAGE



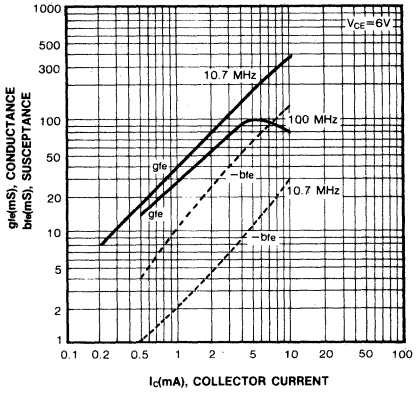
COLLECTOR OUTPUT CAPACITANCE



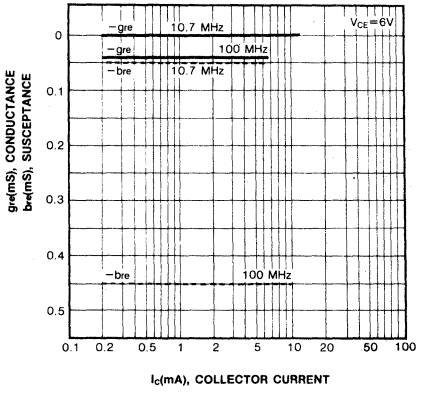
INPUT ADMITTANCE (yie)
vs. COLLECTOR CURRENT



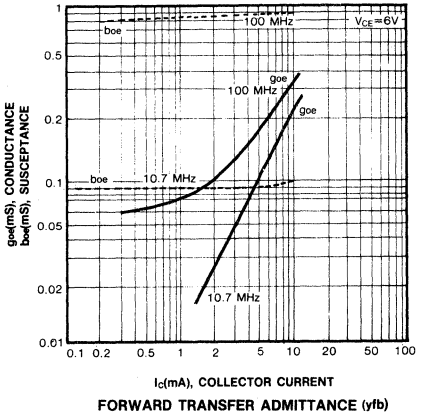
FORWARD TRANSFER ADMITTANCE (yfe)
vs. COLLECTOR CURRENT



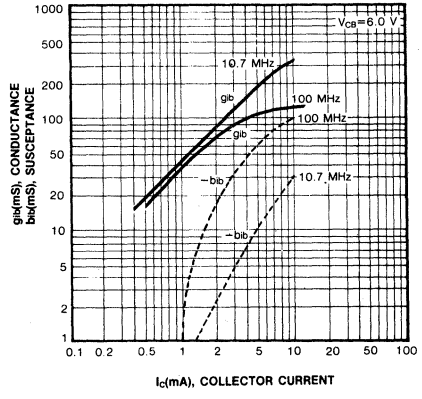
REVERSE TRANSFER ADMITTANCE (yre)
vs. COLLECTOR CURRENT



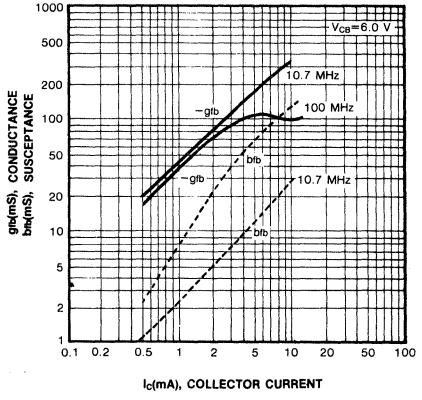
OUTPUT ADMITTANCE (yoe)
vs. COLLECTOR CURRENT



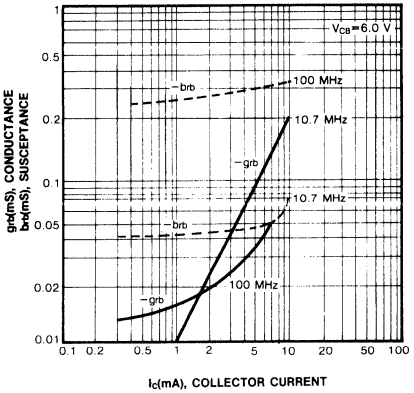
INPUT ADMITTANCE (yib) vs. COLLECTOR CURRENT



FORWARD TRANSFER ADMITTANCE (yfb)
vs. COLLECTOR CURRENT

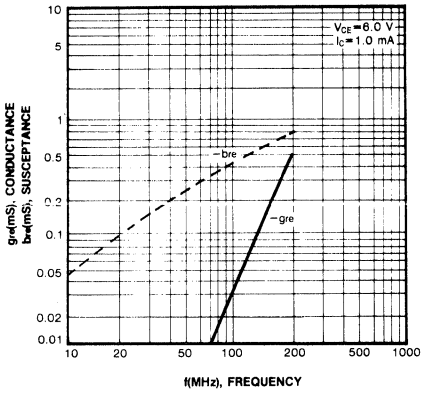


REVERSE TRANSFER ADMITTANCE (yrb) vs. COLLECTOR CURRENT



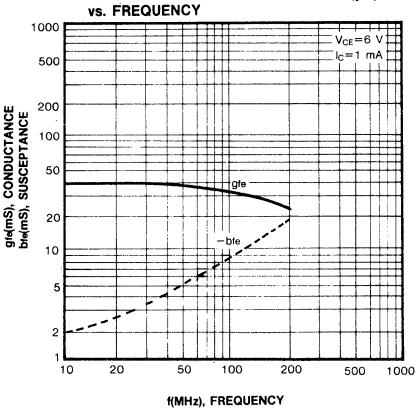
I_C(mA), COLLECTOR CURRENT

REVERS TRANSFER ADMITTANCE (yre) vs. FREQUENCY



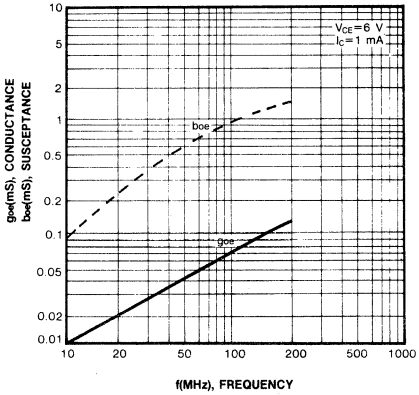
f(MHz), FREQUENCY

FORWARD TRANSFER ADMITTANCE (yfe) vs. FREQUENCY



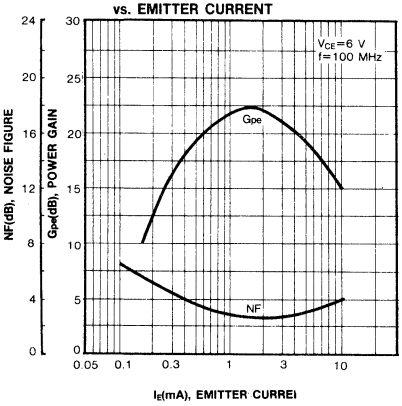
f(MHz), FREQUENCY

OUTPUT ADMITANCE (yoe) vs. FREQUENCY



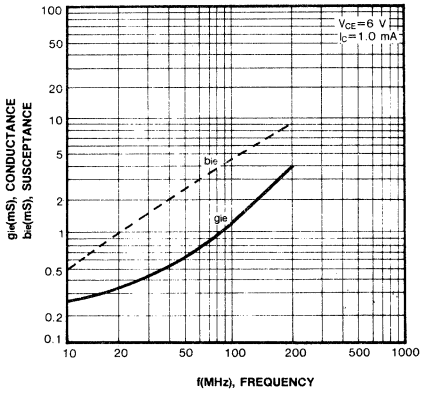
f(MHz), FREQUENCY

POWER GAIN AND NOISE FIGURE vs. EMITTER CURRENT



I_E(mA), EMITTER CURREI

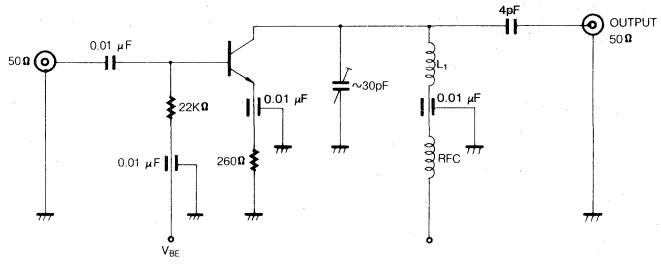
INPUT ADMITTANCE (yie) vs. FREQUENCY



f(MHz), FREQUENCY

3

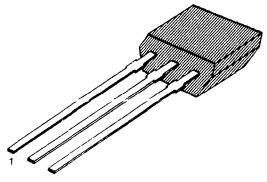
100MHz Gpe, NF TEST CIRCUIT



FM/AM RF AMP, MIX, CONV, OSC, IF

- Collector-Base Voltage V_{CEO} = 30V
- High Current Gain Bandwidth Product f_T = 300MHz (Typ)
- Low Collector Capacitance Cob: 2.0PF (Typ)

TO-92S



1. Emitter 2. Collector 3. Base

ABSOLUTE MAXIMUM RATINGS (T_a = 25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	50	V
Collector-Emitter Voltage	V_{CEO}	30	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	50	mA
Collector Dissipation	P_C	250	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ 150	°C

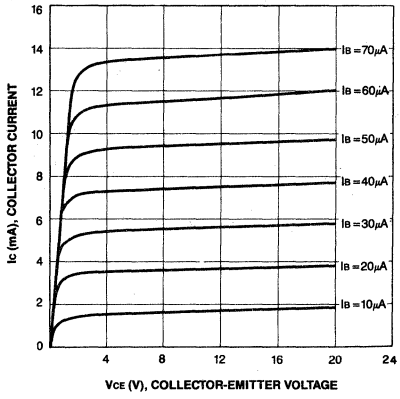
ELECTRICAL CHARACTERISTICS (T_a = 25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C = 10μA, I_E = 0	50			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C = 5mA, I_B = 0	30			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E = 10μA, I_C = 0	5			V
Collector Cut-off Current	I_{CBO}	V_{CB} = 50V, I_E = 0			0.1	μA
Emitter Cut-off Current	I_{EBO}	V_{EB} = 5V, I_C = 0			0.1	μA
DC Current Gain	h_{FE}	V_{CE} = 6V, I_C = 1mA	40		240	
Base-Emitter On Voltage	V_{BE} (on)	V_{CE} = 6V, I_c = 1mA		0.67	0.75	V
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C = 10mA, I_B = 1mA		0.08	0.3	V
Current Gain-Bandwidth Product	f_T	V_{CE} = 6V, I_C = 1mA	150	300		MHz
Output Capacitance	Cob	V_{CB} = 6V, f = 1MHz		2.0	2.5	PF

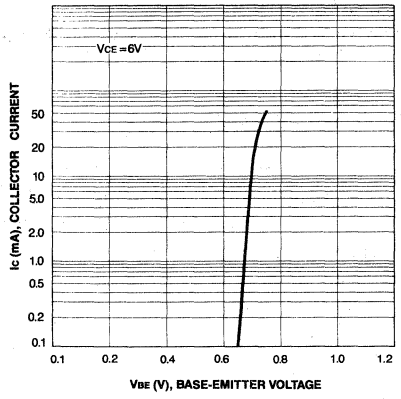
h_{FE} CLASSIFICATION

Classification	R	O	Y
h_{FE}	40-80	70-140	120-240

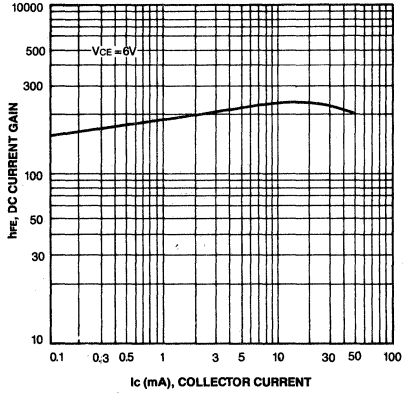
STATIC CHARACTERISTIC



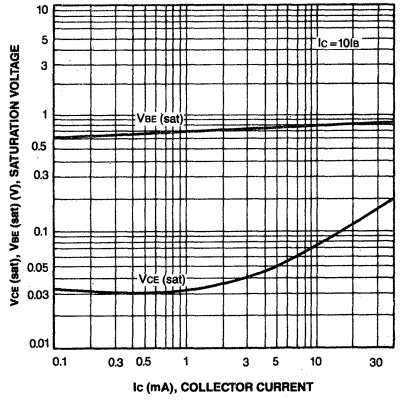
BASE-EMITTER ON VOLTAGE



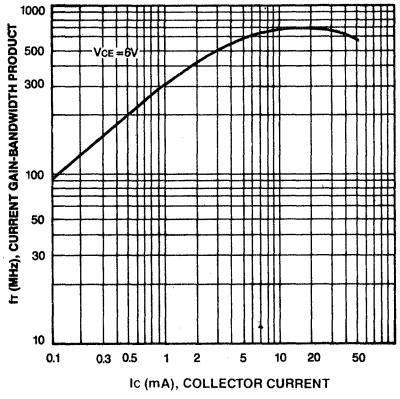
DC CURRENT GAIN



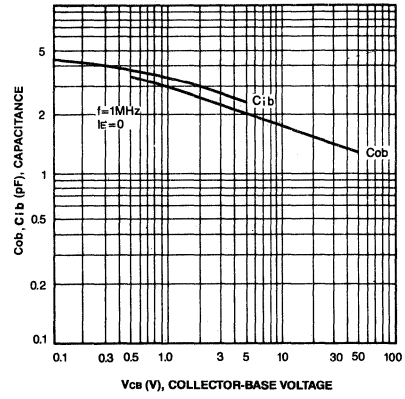
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



CURRENT GAIN-BANDWIDTH PRODUCT



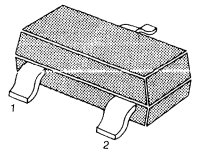
COLLECTOR INPUT CAPACITANCE
COLLECTOR OUTPUT CAPACITANCE



LOW FREQUENCY POWER AMPLIFIER

- **Complement to KSA1182**

SOT-23



1. Base 2. Emitter 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	35	V
Collector-Emitter Voltage	V_{CEO}	30	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	500	mA
Collector Dissipation	P_C	150	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ 150	°C

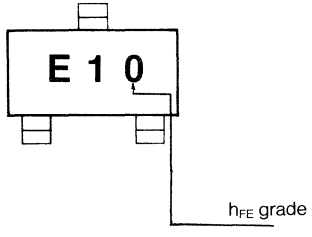
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Cutoff Current	I_{CBO}	V_{CB}=35V, I_E=0			0.1	μA
Emitter Cutoff Current	I_{EBO}	V_{EB}=5V, I_C=0			0.1	μA
DC Current Gain	$h_{FE}(1)$	V_{CE}=1V, I_C=100mA	70		240	
	$h_{FE}(2)$	V_{CE}=6V, I_C=400mA	25			
Collector-Emitter Saturation Voltage	$V_{CE}(sat)$	I_C=100mA, I_B=10mA		0.1	0.25	V
Base-Emitter On Voltage	$V_{BE}(on)$	I_C=100mA, V_{CE}=1V		0.8	1.0	V
Current Gain-Bandwidth Product	f_T	I_C=20mA, V_{CE}=6V		300		MHz
Output Capacitance	Cob	V_{CB}=6V, I_E=0 f=1MHz		7		pF

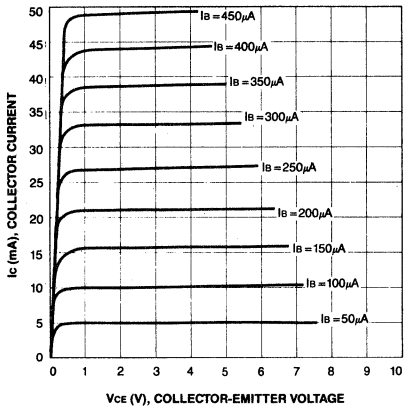
h_{FE} CLASSIFICATION

Classification	O	Y
$h_{FE}(1)$	70-140	120-240

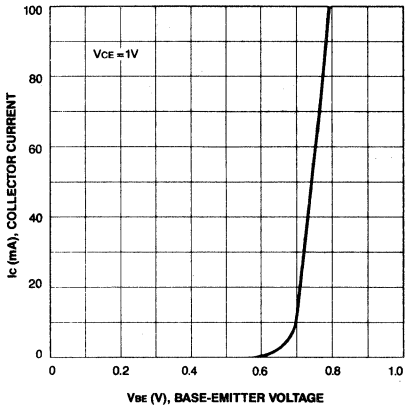
Marking



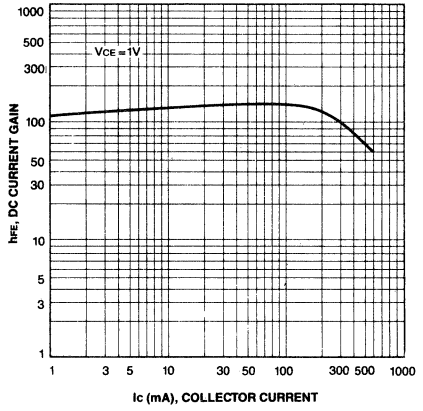
STATIC CHARACTERISTIC



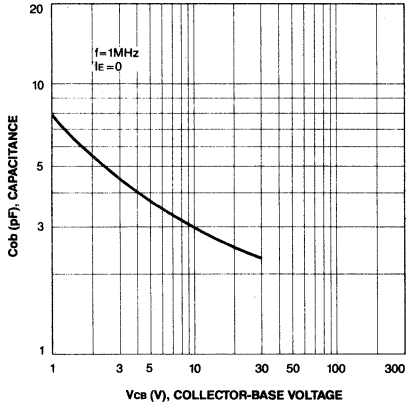
BASE-EMITTER ON VOLTAGE



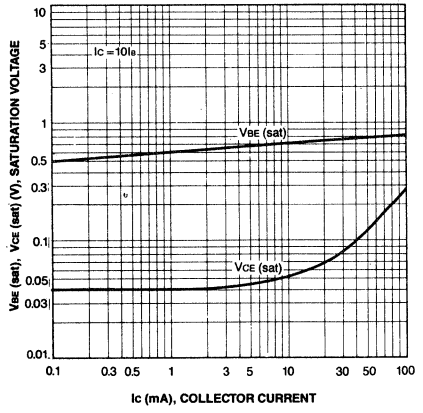
DC CURRENT GAIN



COLLECTOR OUTPUT CAPACITANCE



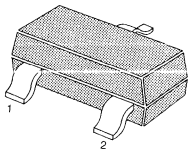
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



MIXER FOR UHF TV TUNER

G_{CE} = 17dB (TYP)
C_{re} = 0.6pF (TYP)

SOT-23



1. Base 2. Emitter 3. Collector

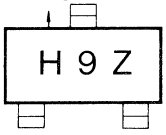
ABSOLUTE MAXIMUM RATINGS (T_a = 25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	30	V
Collector-Emitter Voltage	V_{CEO}	15	V
Emitter-Base Voltage	V_{EBO}	3	V
Collector Current	I_C	50	mA
Base Current (DC)	I_B	25	mA
Collector Dissipation (T_c=25°C)	P_C	150	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ 150	°C

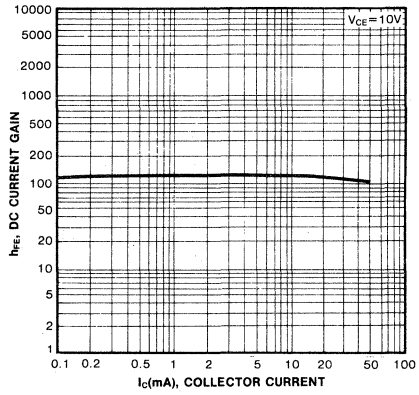
ELECTRICAL CHARACTERISTICS (T_a = 25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=1mA, I_B=0	15			V
Collector Cutoff Current	I_{CBO}	V_{CB}=30V, I_E=0			0.1	μA
Emitter Cutoff Current	I_{EBO}	V_{EB}=2V, I_C=0			1	μA
DC Current Gain	h_{FE}	V_{CE}=10V, I_C=5mA	40	100	200	
Current Gain Bandwidth Product	f_T	V_{CE}=10V, I_C=2mA	1500	2400		MHz
Reverse Transier Capacitance	C_{re}	V_{CB}=10V, I_E=0, f=1MHz		0.6	0.9	pF
Conversion Gain	G_{ce}	V_{CC}=10V, I_C=2mA				
		f=800MHz, f_L=830MHz	12	17		dB
Noise Figure	NF	V_{CC}=10V, I_C=2mA				
		f=800MHz, f_L=830MHz		8		dB

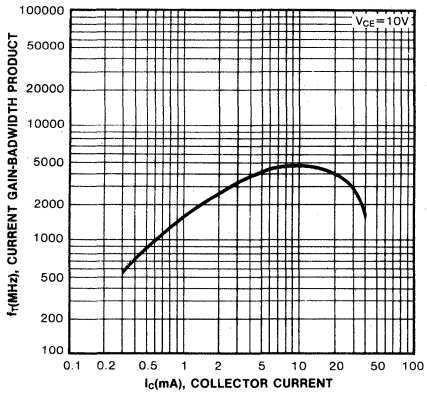
Marking



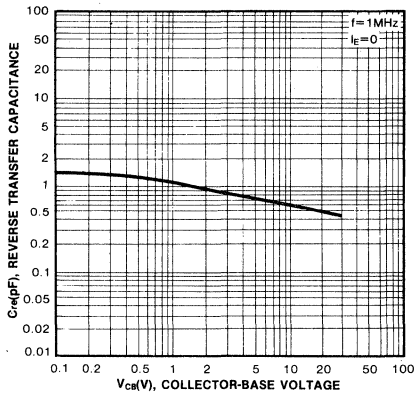
DC CURRENT GAIN



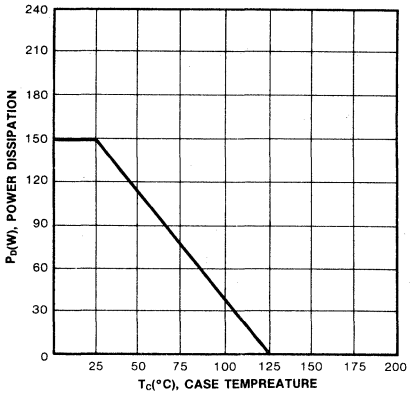
CURRENT GAIN BANDWIDTH PRODUCT



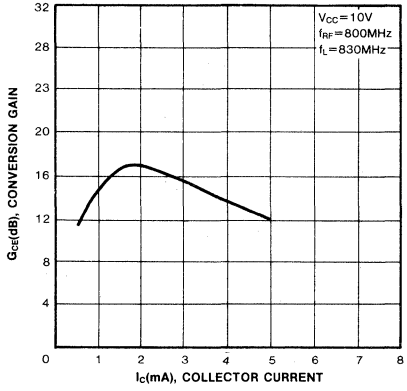
Cre-Vcb CHARACTERISTIC



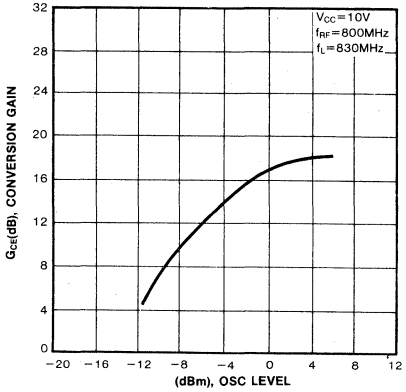
POWER DERATING



Gce-Ic CHARACTERSTIC



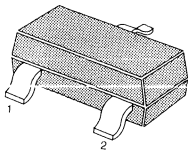
OSC LEVEL



MIXER FOR VHF TV TUNER

G_{CE} = 23dB
C_{RE} = 0.4pF

SOT-23



1. Base 2. Emitter 3. Collector

ABSOLUTE MAXIMUM RATINGS (Ta=25°C)

Characteristic	Symbol	Value	Unit
Collector Base Voltage	V_{CBO}	30	V
Collector Emitter Voltage	V_{CEO}	20	V
Emitter Base Voltage	V_{EBO}	3	V
Collector Current	I_C	50	mA
Base Current	I_B	25	mA
Collector Dissipation	P_C	150	mW
Junction Temperature	T_J	150	°C
Storage Temperature	Tstg	−55~150	°C

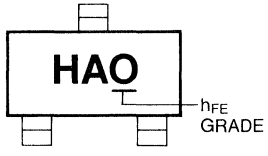
ELECTRICAL CHARACTERISTICS (Ta=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=1mA, I_B=0	20	—	—	V
Collector Cutoff Current	I_{CBO}	V_{CB}=25V, I_E=0	—	—	0.1	μA
Emitter Cutoff Current	I_{EBO}	V_{EB}=3V, I_C=0	—	—	1	μA
D.C Current Gain	h_{FE}	V_{CE}=10V, I_C=5mA	60		240	
Current Gain-Bandwidth Product	f_T	V_{CE}=10V, I_C=5mA	900	1400	—	MHz
Reverse Transfer Capacitance	C_{RE}	V_{CB}=10V, I_E=0, f=1MHz	—	0.4	0.5	pF
Conversion Gain	G_{CE}	V_{CC}=12V, f=200MHz, f_L=260MHz (0dBm)	20	23	—	dB
Noise Figure	NF	V_{CC}=12V, f=200MHz, f_L=260MHz (0dBm)	—	3.8	5.5	dB

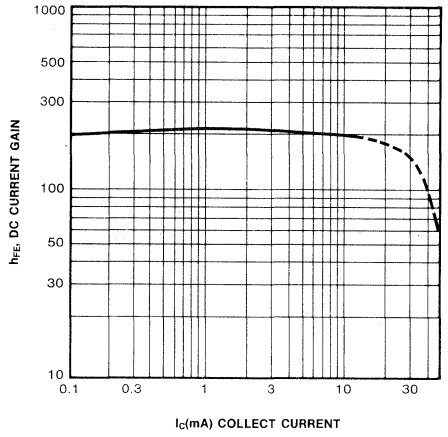
h_{FE} CLASSIFICATION

Classification	R	O	Y
h_{FE}	60~120	90~180	120~240

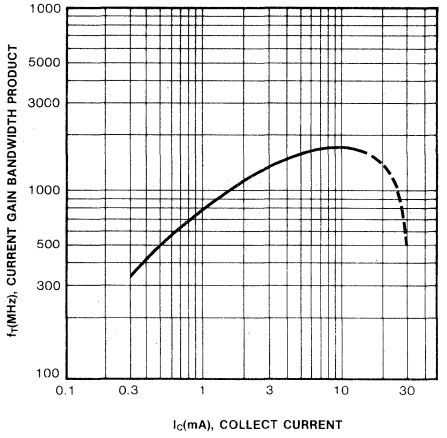
Marking



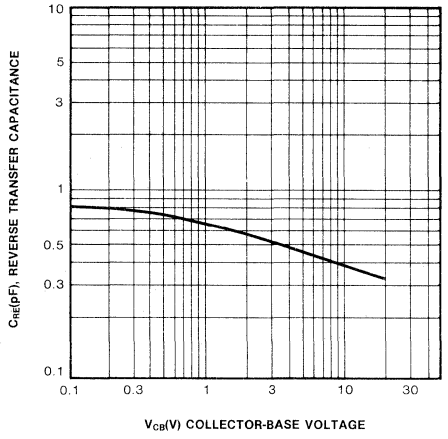
DC CURRENT GAIN



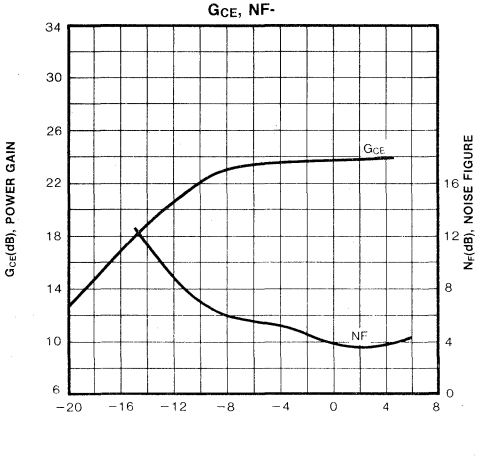
CURRENT GAIN BANDWIDTH PRODUCT



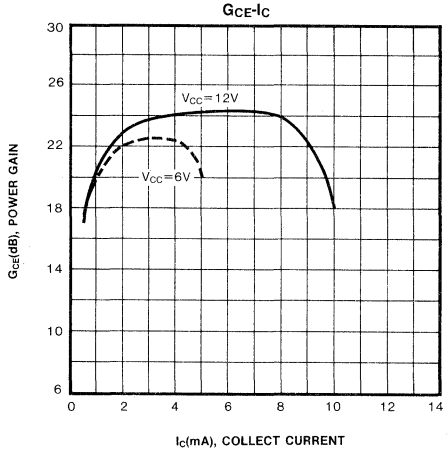
C_{RE}-V_{CB}



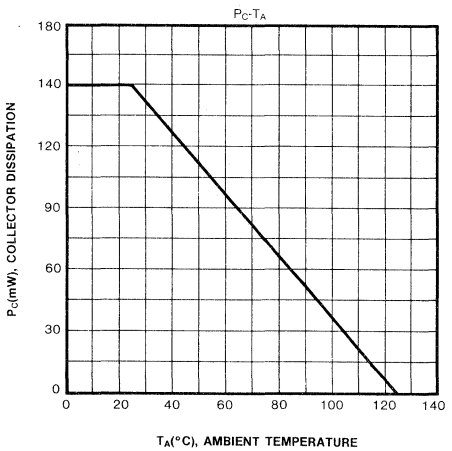
G_{CE}, NF-

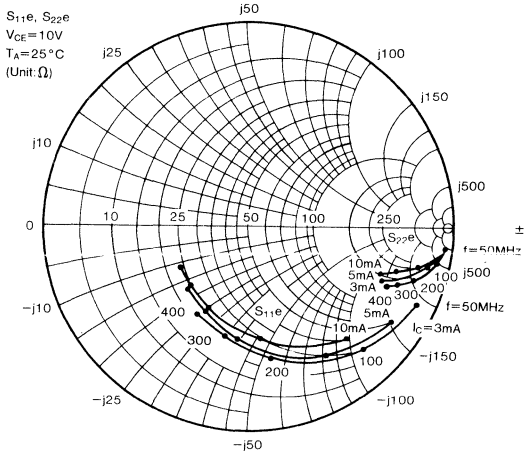


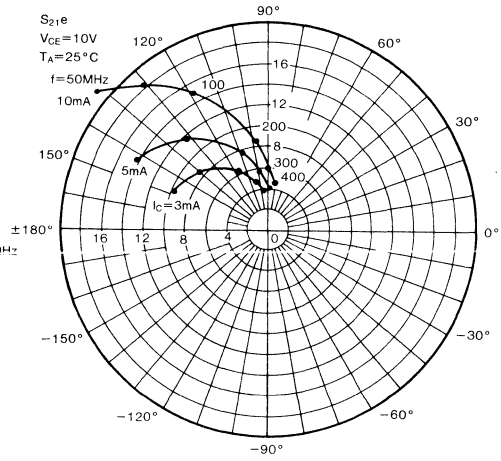
G_{CE}-I_C

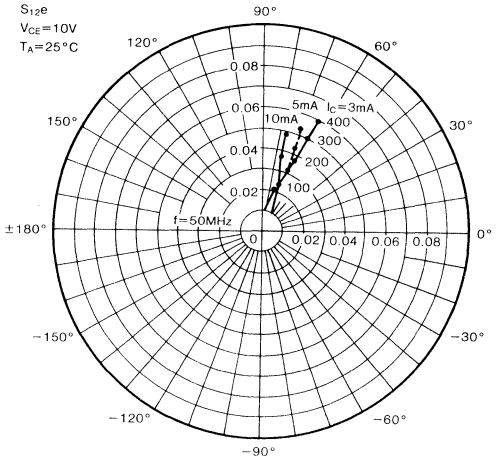


P_C-T_A




S11e, S22e
VCE=10V
TA=25°C
(Unit:Ω)
j50
j25
j100
j150
j10
j500
0
10
25
50
100
250
S22e
f=50MHz
10mA
5mA
3mA
400
300
200
100
j500
-j10
400
S11e
5mA
f=50MHz
300
10mA
IC=3mA
200
100
-j150
-j25
-j100
-j50

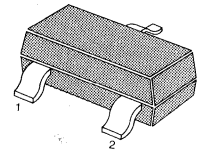

S21e
VCE=10V
TA=25°C
90°
120°
60°
f=50MHz
16
10mA
100
12
200
30°
8
150°
300
5mA
400
IC=3mA
±180°
0°
16
12
8
4
0
-150°
-30°
-120°
-60°
-90°


S12e
VCE=10V
TA=25°C
90°
120°
60°
0.08
0.06
5mA
IC=3mA
10mA
400
150°
30°
0.04
300
200
0.02
100
f=50MHz
±180°
0°
0
0.02
0.04
0.06
0.08
-150°
-30°
-120°
-60°
-90°

3

TV FINAL PICTURE AMPLIFIER APPLICATION

SOT-23



1. Base 2. Emitter 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

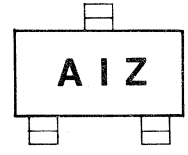
Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	30	V
Collector-Emitter Voltage	V_{CEO}	25	V
Emitter-Base Voltage	V_{EBO}	4	V
Collector Current	I_C	50	mA
Collector Dissipation	P_C	150	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ 150	°C

• Refer to KSC388 for graphs

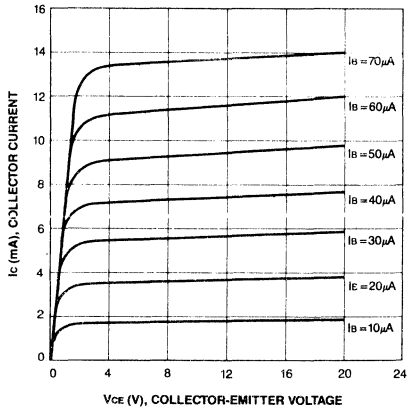
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Emitter Breakdown Voltage		I_C=1mA, I_R=0	25			V
Collector Cutoff Current	I_{CBO}	V_{CB}=30V, I_E=0			0.1	uA
Emitter Cutoff Current	I_{EBO}	V_{EB}=3V, I_C=0			0.1	uA
DC Current Gain	h_{FE}	V_{CE}=10V, I_C=10mA	20	70	200	
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=15mA, I_B=1.5mA			0.2	V
Base-Emitter Saturation Voltage	V_{BE}(sat)	I_C=15mA, I_B=1.5mA			1.5	V
Current Gain-Bandwidth Product	f_T	I_C=10mA, V_{CE}=10 V	250	600		MHz
Output Capacitance	Cob	V_{CB}=10V, I_E=0 f=1MHz		1.1	1.6	pF

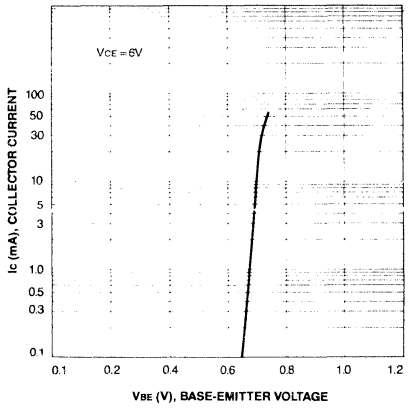
Marking



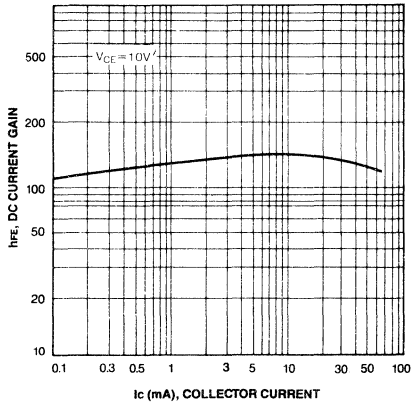
STATIC CHARACTERISTIC



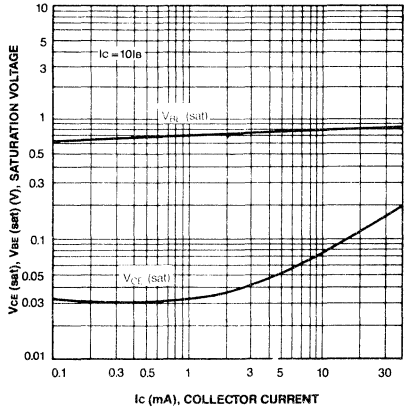
BASE-EMITTER ON VOLTAGE



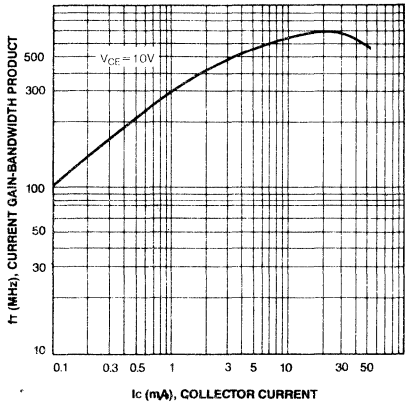
DC CURRENT GAIN



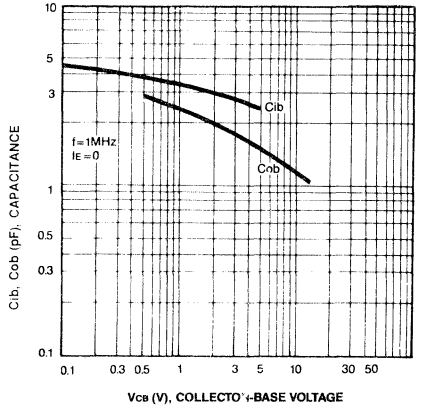
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



CURRENT GAIN-BANDWIDTH PRODUCT



INPUT CAPACITANCE
COLLECTOR OUTPUT CAPACITANCE

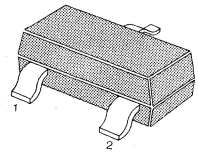


3

LOW FREQUENCY AMPLIFIER

- **Complement to KSA1298**

SOT-23



1. Base 2. Emitter 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a = 25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	30	V
Collector-Emitter Voltage	V_{CEO}	25	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	800	mA
Base Current	I_B	160	mA
Collector Dissipation	P_C	200	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

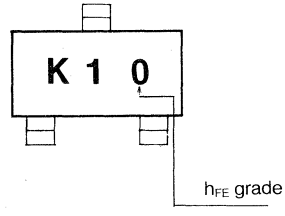
- Refer to KSD261 for graphs

ELECTRICAL CHARACTERISTICS (T_a = 25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=10mA, I_B=0	25			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=1mA, I_C=0	5			V
Collector Cutoff Current	I_{CBO}	V_{CB}=30V, I_E=0			100	nA
Emitter Cutoff Current	I_{EBO}	V_{EB}=5V, I_C=0			100	nA
DC Current Gain	h_{FE1}	V_{CE}=1V, I_C=100mA	100		320	
	h_{FE2}	V_{CE}=1V, I_C=800mA	40			
Collector Emitter Saturation Voltage	V_{CE}(sat)	I_C=500mA, I_B=20mA			0.4	V
Base-Emitter On Voltage	V_{BE}(on)	V_{CE}=1V, I_C=10mA	0.5		0.8	V
Current Gain Bandwidth Product	f_T	V_{CE}=5V, I_C=10mA,		120		MHz
Output Capacitance	Cob	V_{CB}=10V, I_E=0 f=1MHz		13		pF

h_{FE} (1) CLASSIFICATION

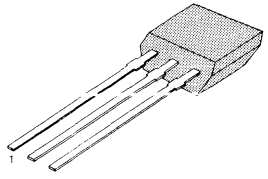
Classification	O	Y
h_{FE} (1)	100-200	160-320



LOW FREQUENCY POWER AMPLIFIER

- **Complement to** KSA1378
- **Collector Dissipation** P_C = 300mW

TO-92S



1. Emitter 2. Collector 3. Base

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	30	V
Collector-Emitter Voltage	V_{CEO}	25	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	300	mA
Collector Dissipation	P_C	300	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ 150	°C

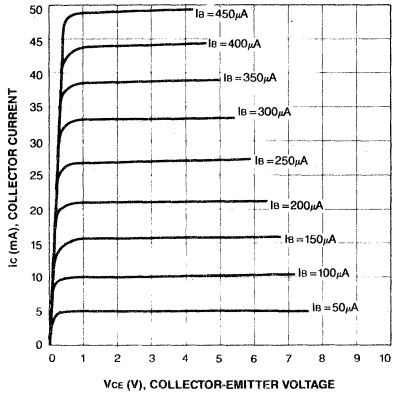
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=100μA, I_E=0	30			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=10mA, I_B=0	25			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=10μA, I_C=0	5			V
Collector Cut-off Current	I_{CBO}	V_{CB}=25V, I_E=0			0.1	μA
Emitter Cut-off Current	I_{EBO}	V_{EB}=3V, I_C=0			0.1	μA
DC Current Gain	h_{FE}	V_{CE}=1V, I_C=50mA	70		400	
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=300mA, I_B=30mA		0.14	0.4	V

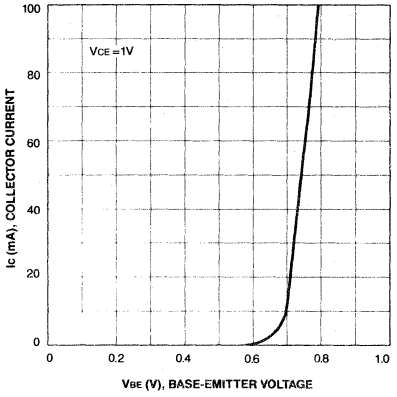
h_{FE} CLASSIFICATION

Classification	O	Y	G
h_{FE}	70-140	120-240	200-400

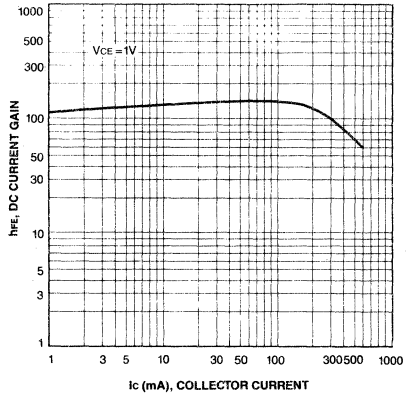
STATIC CHARACTERISTIC



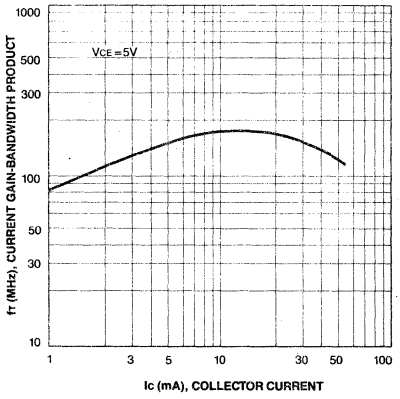
BASE-EMITTER ON VOLTAGE



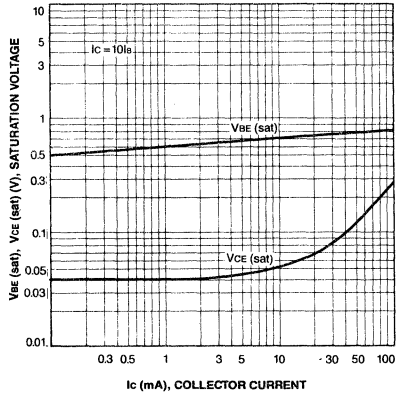
DC CURRENT GAIN



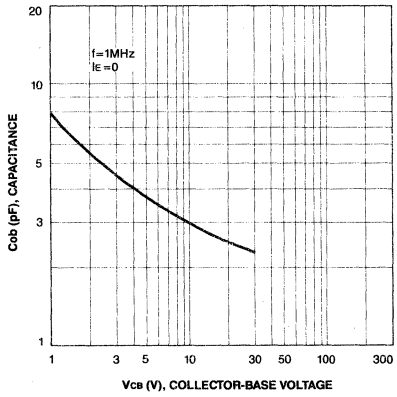
CURRENT GAIN-BANDWIDTH PRODUCT



BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



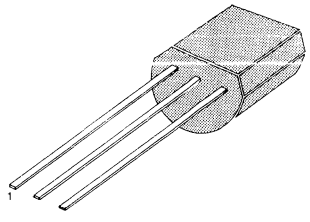
COLLECTOR OUTPUT CAPACITANCE



LOW SATURATION

- $V_{CE}(sat)=0.5V$ ($I_C=2A$, $I_B=50mA$)

TO-92



1. Emitter 2. Collector 3. Base

ABSOLUTE MAXIMUM RATINGS ($T_a=25°C$)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	30	V
Collector-Emitter Voltage	V_{CES}	30	V
Collector-Emitter Voltage	V_{CEO}	10	V
Emitter-Base Voltage	V_{EBO}	6	V
Collector Current (DC)	I_C	2	A
*Collector Current(Pulse)	I_C	5	A
Base Current	I_B	2	A
Collector Dissipation	P_C	750	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55∼150	°C

* PW≤10ms, Duty Cycle≤30%

3

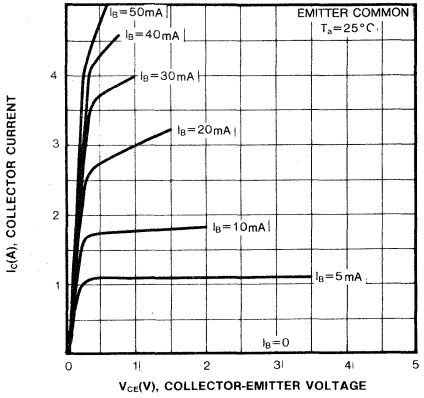
ELECTRICAL CHARACTERISTICS ($T_a=25°C$)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Cutoff Current	I_{CBO}	$V_{CB}=30V$, $I_E=0$			100	nA
Emitter Cutoff Current	I_{EBO}	$V_{EB}=6V$, $I_C=0$			100	nA
Collector-Emitter Breakdown Voltage	BV_{CEO}	$I_C=10mA$, $I_B=0$	10			V
Emitter Base Breakdown Voltage	BV_{EBO}	$I_E=1mA$, $I_C=0$	6			V
DC Current Gain	$h_{FE}1$	$V_{CE}=1V$, $I_C=0.5A$	140		600	
	$h_{FE}2$	$V_{CE}=1V$, $I_C=2A$	70	200		
Collector Emitter Saturation Voltage	$V_{CE}(sat)$	$I_C=2A$, $I_B=50mA$		0.2	0.5	V
Base Emitter On Voltage	$V_{BE}(on)$	$V_{CE}=1V$, $I_C=2A$		0.86	1.5	V
Current Gain Bandwidth Product	f_T	$V_{CE}=1V$, $I_C=0.5A$		150		MHz
Output Capacitance	Cob	$V_{CB}=10V$, $I_E=0$, f=1MHz		27		pF

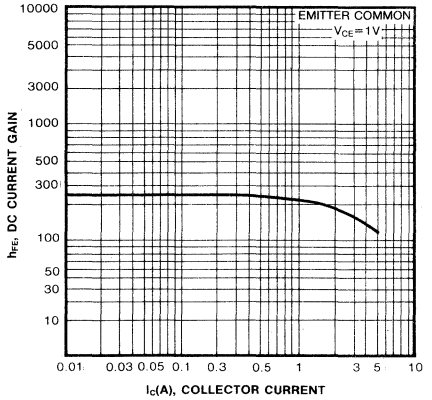
$h_{FE}(1)$ CLASSIFICATION

Classification	A	B	C	D
$h_{FE}(1)$	140-240	200-330	300-450	420-600

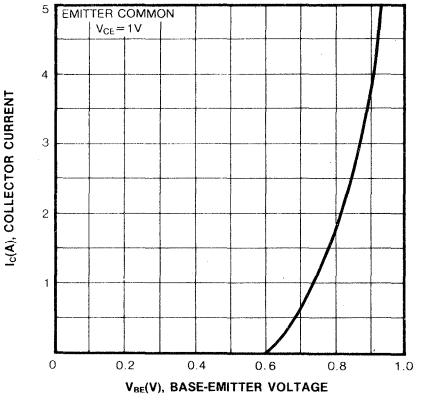
STATIC CHARACTERISTIC



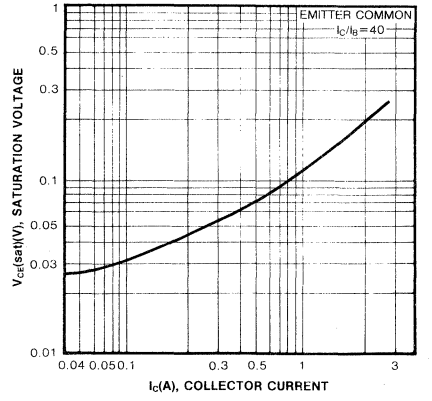
DC CURRENT GAIN



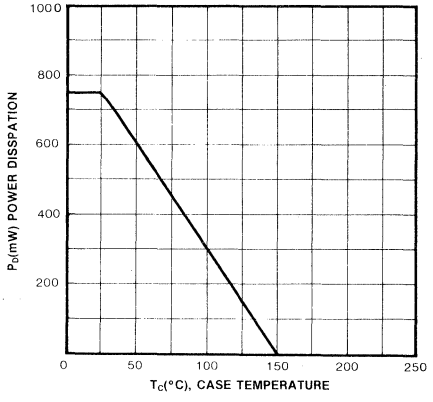
BASE-EMITTER ON VOLTAGE



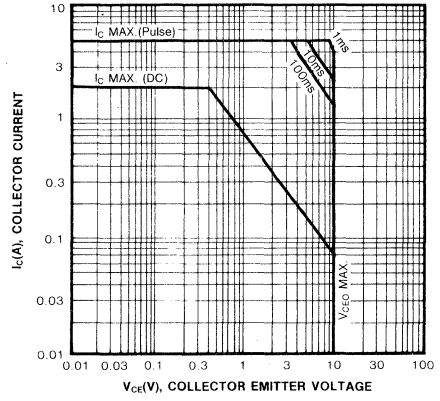
COLLECTOR-EMITTER SATURATION VOLTAGE



POWER DERATING



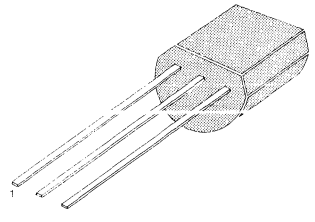
SAFE OPERATING AREA



LOW FREQUENCY POWER AMPLIFIER

- **Complement to KSA642**
- **Collector Dissipation P_C=400mW**

TO-92



1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	30	V
Collector-Emitter Voltage	V_{CEO}	25	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	300	mA
Collector Dissipation	P_C	400	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ 150	°C

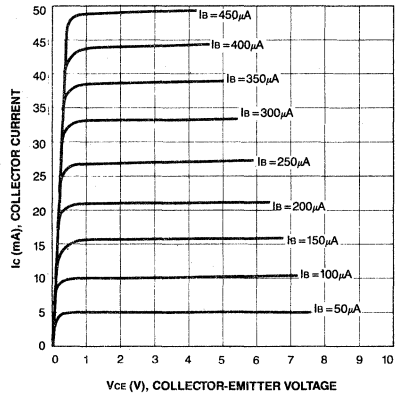
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=100μA, I_E=0	30			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=10mA, I_B=0	25			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=10μA, I_C=0	5			V
Collector Cut-off Current	I_{CBO}	V_{CB}=25V, I_E=0			0.1	μA
Emitter Cut-off Current	I_{EBO}	V_{EB}=3V, I_C=0			0.1	μA
DC Current Gain	h_{FE}	V_{CE}=1V, I_C=50mA	70		400	
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=300mA, I_B=30mA		0.14	0.4	V

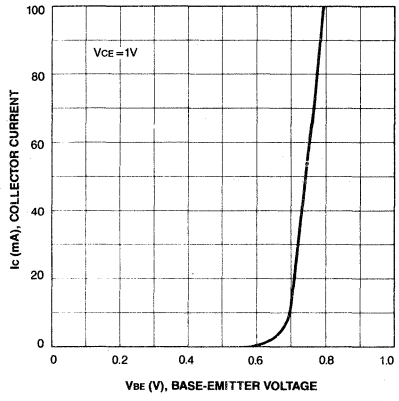
h_{FE} CLASSIFICATION

Classification	O	Y	G
h_{FE}	70-140	120-240	200-400

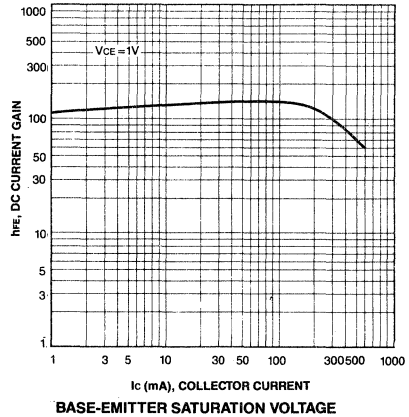
STATIC CHARACTERISTIC



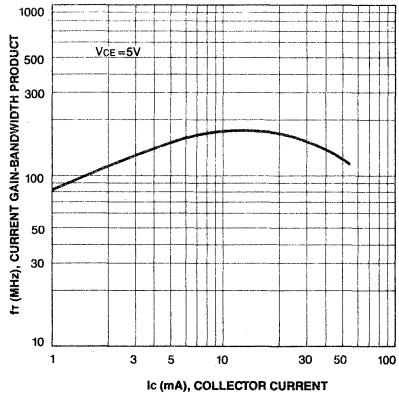
BASE-EMITTER ON VOLTAGE



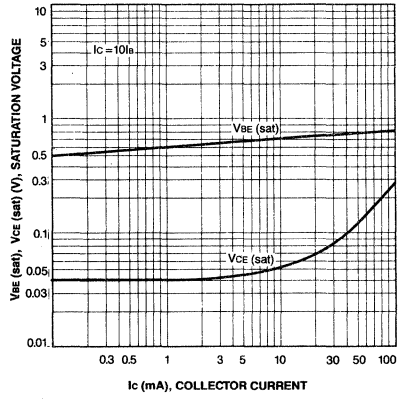
DC CURRENT GAIN



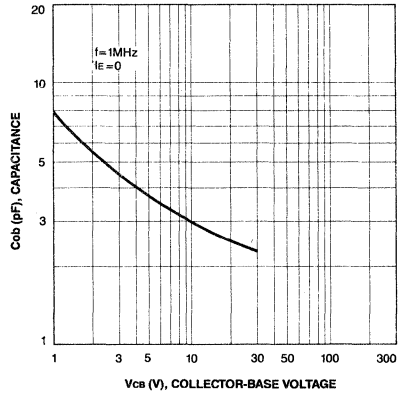
CURRENT GAIN-BANDWIDTH PRODUCT



BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



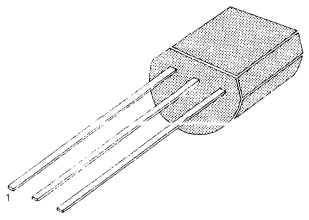
COLLECTOR OUTPUT CAPACITANCE



LOW FREQUENCY POWER AMPLIFIER

- **Complement to KSA643**
- **Collector Dissipation P_C=500mW**

TO-92



1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	40	V
Collector-Emitter Voltage	V_{CEO}	20	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	500	mA
Collector Dissipation	P_C	500	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ 150	°C

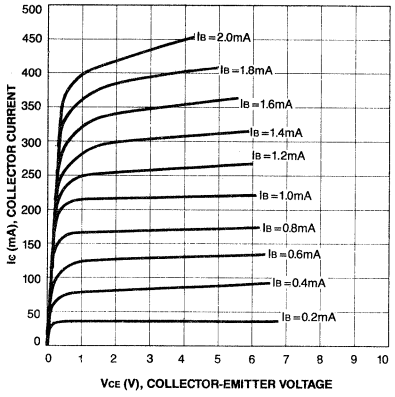
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=100μA, I_E=0	40			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=10mA, I_B=0	20			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=100μA, I_C=0	5			V
Collector Cut-off Current	I_{CBO}	V_{CB}=25V, I_E=0			0.1	μA
Emitter Cut-off Current	I_{EBO}	V_{EB}=3V, I_C=0			0.1	μA
DC Current Gain	h_{FE}	V_{CE}=1V, I_C=0.1A	40		400	
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=0.5A, I_B=0.05A		0.18	0.4	V

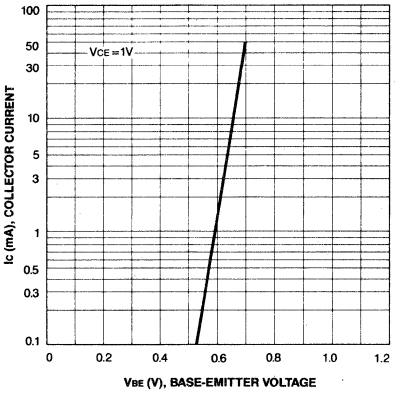
h_{FE} CLASSIFICATION

Classification	R	O	Y	G
h_{FE}	40-80	70-140	120-240	200-400

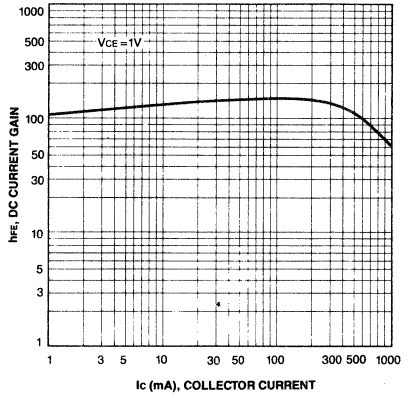
STATIC CHARACTERISTIC



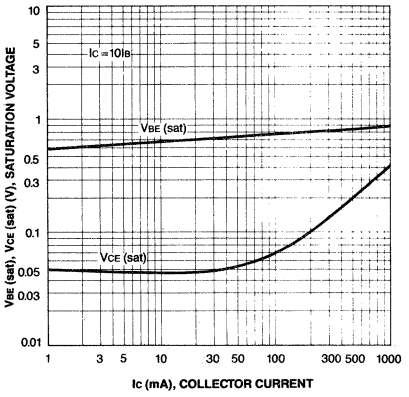
BASE-EMITTER ON VOLTAGE



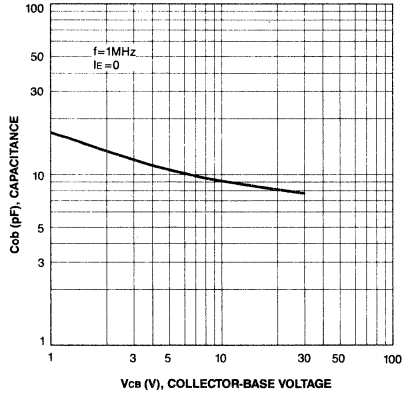
DC CURRENT GAIN



BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



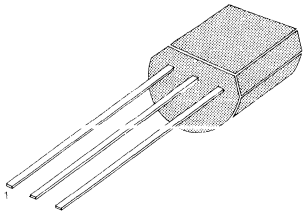
COLLECTOR OUTPUT CAPACITANCE



AUDIO FREQUENCY POWER AMPLIFIER

- **Complement to KSB564A**
- **Collector Current I_C=1A**
- **Collector Dissipation P_C=800mW**

TO-92



1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	40	V
Collector-Emitter Voltage	V_{CEO}	30	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	1	A
Collector Dissipation	P_C	800	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ 150	°C

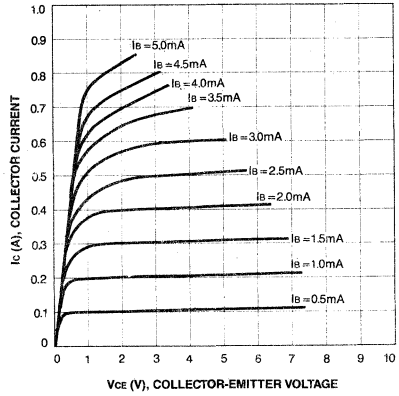
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=100μA, I_E=0	40			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=10mA, I_B=0	30			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=100μA, I_C=0	5			V
Collector Cut-off Current	I_{CBO}	V_{CB}=30V, I_E=0			0.1	μA
DC Current Gain	h_{FE}	V_{CE}=1V, I_C=100mA	70		400	
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=1A, I_B=0.1A			0.5	V
Base-Emitter Saturation Voltage	V_{BE} (sat)	I_C=1A, I_B=0.1A			1.2	V
Current Gain-Band width Product	f_T	V_{CE}=6V, I_C=10mA		130		MHz
Output Capacitance	Cob	V_{CB}=6V, I_E=0, f=1MHz		16		pF

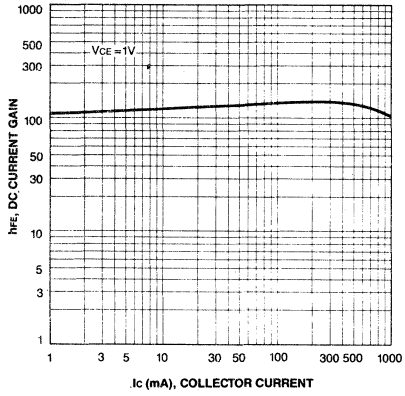
h_{FE} CLASSIFICATION

Classification	O	Y	G
h_{FE}	70-140	120-240	200-400

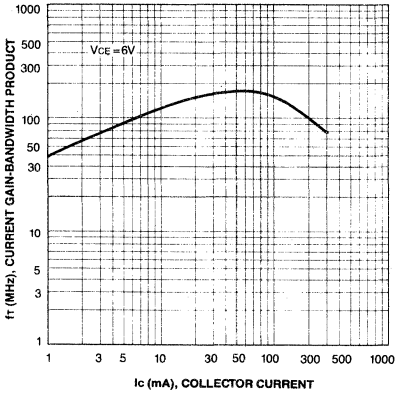
STATIC CHARACTERISTIC



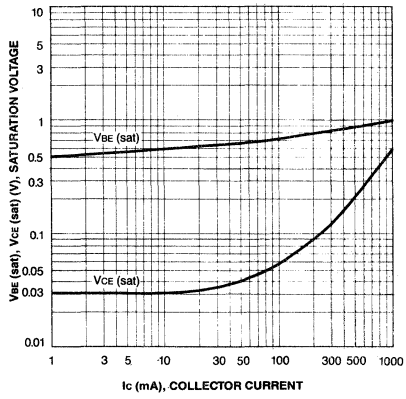
DC CURRENT GAIN



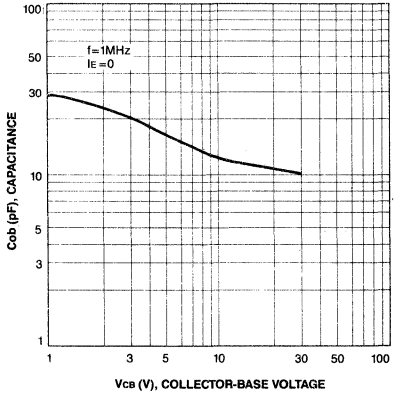
CURENT GAIN-BANDWIDTH PRODUCT



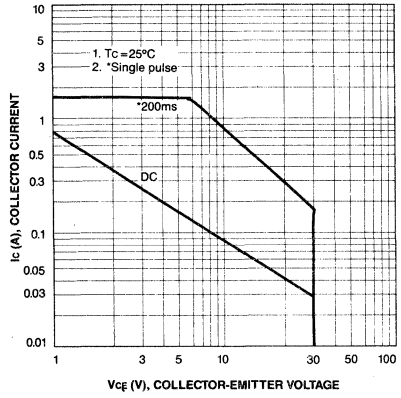
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



COLLECTOR OUTPUT CAPACITANCE



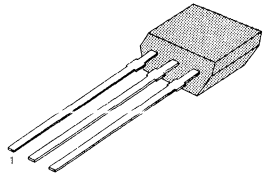
SAFE OPERATING AREA



AUDIO FREQUENCY AMPLIFIER

- **Complement to KSB810**

TO-92S



1. Emitter 2. Collector 3. Base

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	30	V
Collector-Emitter Voltage	V_{CEO}	25	V
Emitter-Base Voltage	V_{EBO}	5.0	V
Collector Current (DC)	I_C	700	mA
*Collector Current (Pulse)	I_C	1.0	A
Collector Dissipation	P_C	350	mW
Junction Temperature	T_j	150	°C
Storage Temperature	Tstg	−55~150	°C

* PW ≤ 10 ms, duty cycle ≤ 50 %

ELECTRICAL CHARACTERISTICS (T_a=25°C)

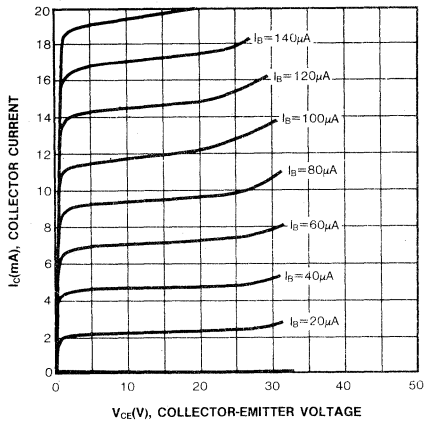
Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Cutoff Current	I_{CBO}	V_{CB}=30V, I_E=0			100	nA
Emitter Cutoff Current	I_{EBO}	V_{EB}=5V, I_C=0			100	nA
*DC Durrent Gain	$h_{FE}1$	V_{CE}=1V, I_C=100mA	70	200	400	
	$h_{FE}2$	V_{CE}=1V, I_C=700mA	35	140		
*Base Emitter Voltage	V_{BE}	V_{CE}=6V, I_C=10mA	600	640	700	mV
*Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=700mA, I_B=70mA		0.20	0.4	V
*Base-Emitter Saturation Voltage	V_{BE}(sat)	I_C=700mA, I_B=70mA		0.95	1.2	V
Output Capacitance	C_{OB}	V_{CB}=6V, I_E=0, f=1MHz		13	25	pF
Current Gain-Bandwidth Product	f_T	V_{CE}=6V, I_E=10mA	50	170		MHz

* Pulse Test: PW≤350 μs, Duty Cycle ≤ 2% Pulsed

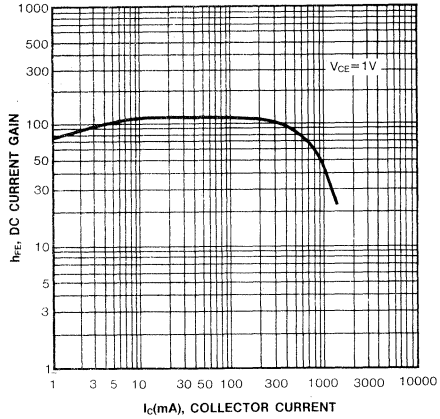
h_{FE}(1) CLASSIFICATION

Classification	O	Y	G
h_{FE}(1)	70-140	120-240	200-400

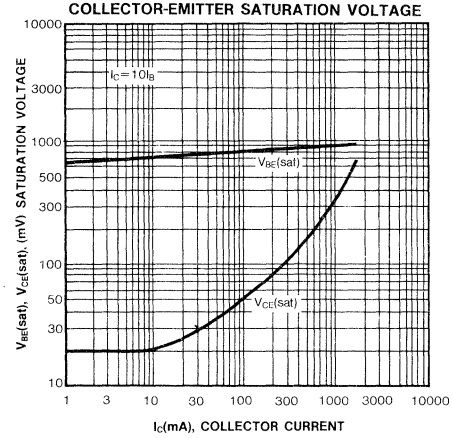
STATIC CHARACTERISTIC



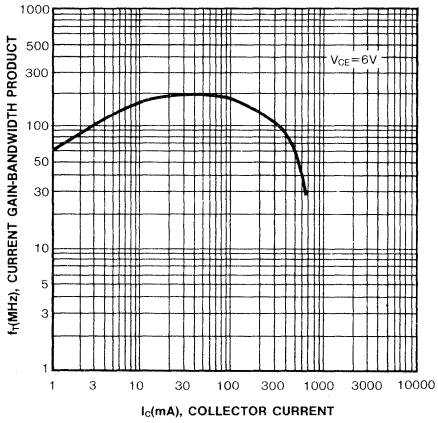
DC CURRENT GAIN



BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



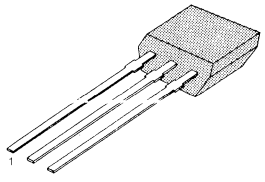
CURRENT GAIN-BANDWIDTH PRODUCT



AUDIO FREQUENCY POWER AMPLIFIER

- **Complement to** KSB811
- **Collector Current** I_C=1A
- **Collector Dissipation** P_C= 350mW

TO-92S



1. Emitter 2. Collector 3. Base

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	40	V
Collector-Emitter Voltage	V_{CEO}	30	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	1	A
Collector Dissipation	P_C	350	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ 150	°C

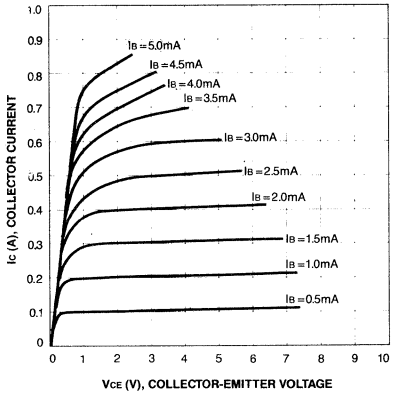
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=100μA, I_E=0	40			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=10mA, I_B=0	30			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=100μA, I_C=0	5			V
Collector Cut-off Current	I_{CBO}	V_{CB}=30V, I_E=0			0.1	μA
DC Current Gain	h_{FE}	V_{CE}=1V, I_C=100mA	70		400	
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=1A, I_B=0.1A			0.5	V
Base-Emitter Saturation Voltage	V_{BE} (sat)	I_C=1A, I_B=0.1A			1.2	V
Current Gain-Band width Product	f_T	V_{CE}=6V, I_C=10mA		130		MHz
Output Capacitance	Cob	V_{CB}=6V, I_E=0, f=1MHz		16		pF

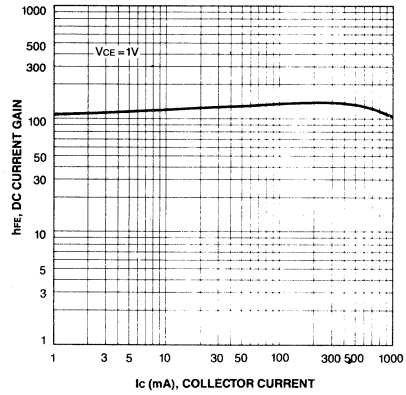
h_{FE} CLASSIFICATION

Classification	O	Y	G
h_{FE}	70-140	120-240	200-400

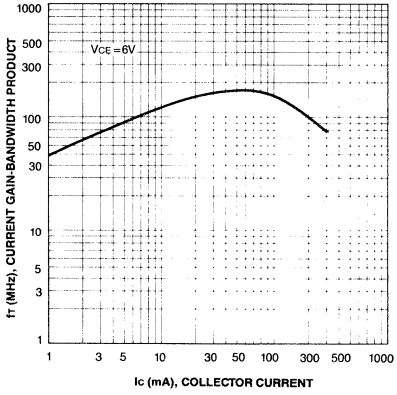
STATIC CHARACTERISTIC



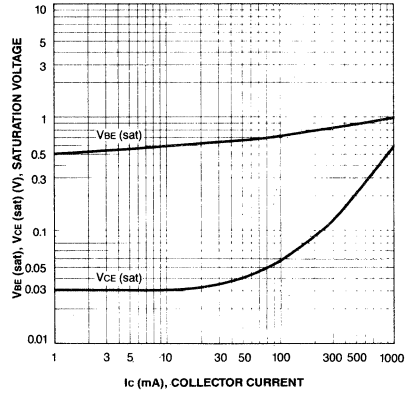
DC CURRENT GAIN



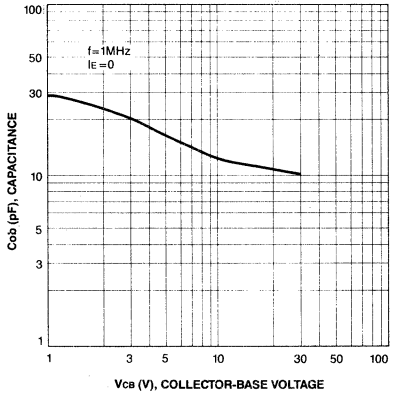
CURENT GAIN-BANDWIDTH PRODUCT



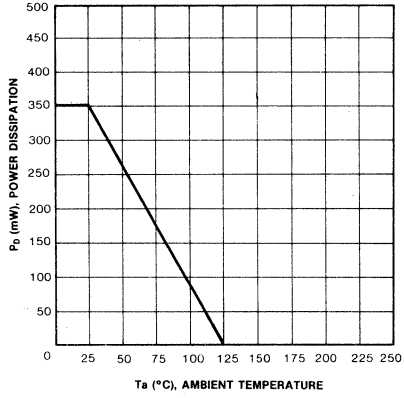
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



COLLECTOR OUTPUT CAPACITANCE



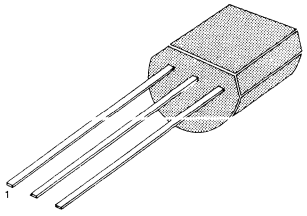
POWER DERATING



AUDIO FREQUENCY POWER AMPLIFIER
MEDIUM SPEED SWITCHING

- Complement to KSB1116/1116A

TO-92



1. Emitter 2. Collector 3. Base

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic		Symbol	Rating	Unit
Collector-Base Voltage	: KSD1616	V_{CBO}	60	V
	: KSD1616A		120	V
Collector-Emitter Voltage	: KSD1616	V_{CEO}	50	V
	: KSD1616A		60	V
Emitter-Base Voltage		V_{EBO}	6	V
Collector Current (DC)		I_C	1	A
* Collector Current (Pulse)		I_C	2	A
Collector Dissipation		P_C	0.75	W
Junction Temperature		Tj	150	°C
Storage Temperature		Tstg	−55∼150	°C

* PW≤10ms, Duty Cycle<50%

ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Cutoff Current	I_{CBO}	V_{CB}=60V, I_E=0			100	nA
Emitter Cutoff Current	I_{EBO}	V_{EB}=6V, I_C=0			100	nA
* DC Current Gain : KSD1616	h_{FE1}	V_{CE}=2V, I_C=100mA	135		600	
: KSD1616A			135		400	
	h_{FE2}	V_{CE}=2V, I_C=1A	81			
* Base Emitter On Voltage	V_{BE} (on)	V_{CE}=2V, I_C=50mA	600	640	700	mV
* Collector Emitter Saturation Voltage	V_{CE} (sat)	I_C=1A, I_B=50mA		0.15	0.3	V
* Base Emitter Saturation Voltage	V_{BE} (sat)	I_C=1A, I_B=50mA		0.9	1.2	V
Output Capacitance	Cob	V_{CB}=10V, I_E=0, f=1MHz		19		pF
Current Gain Bandwidth Product	f_T	V_{CE}=2V, I_C=100mA	100	160		MHz
Turn On Time	ton	V_{CC}=10V, I_C=100mA		0.07		μs
Storage Time	ts	I_{B1}=−I_{B2}=10mA		0.95		μs
Fall Time	tf	V_{BE} (off)=−2∼−3V		0.07		μs

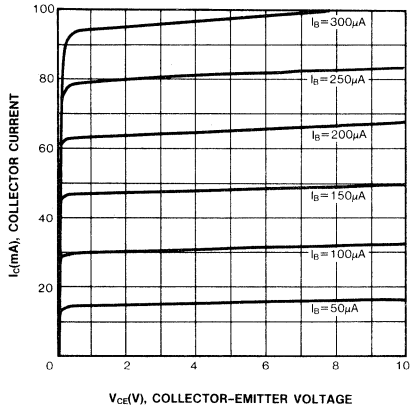
* Pulse Test: PW<350μs, Duty Cycle≤2% Pulsed

h_{FE}(1) CLASSIFICATION

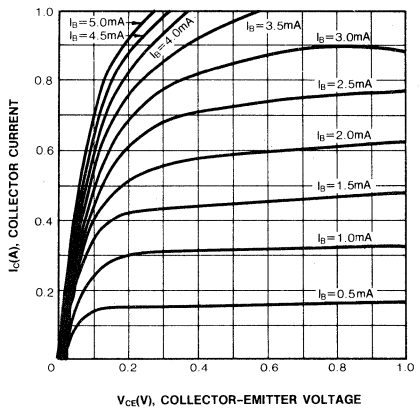
Classification	Y	G	L
h_{FE}(1)	135-270	200-400	300-600

3

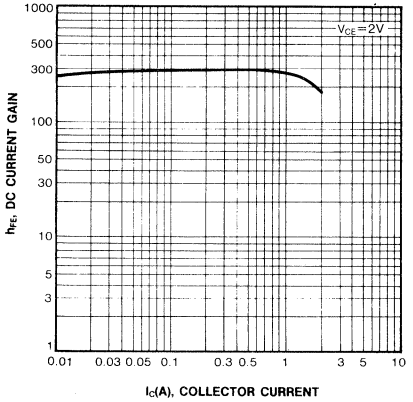
STATIC CHARACTERISTIC



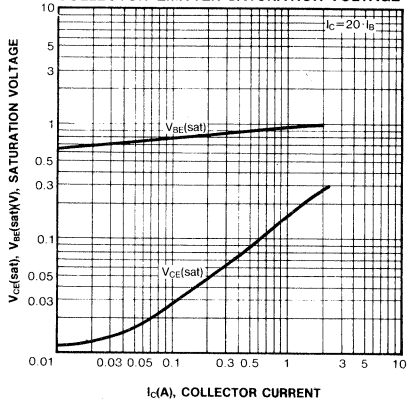
STATIC CHARACTERISTIC



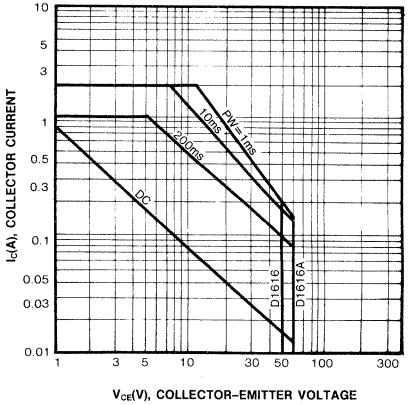
DC CURRENT GAIN



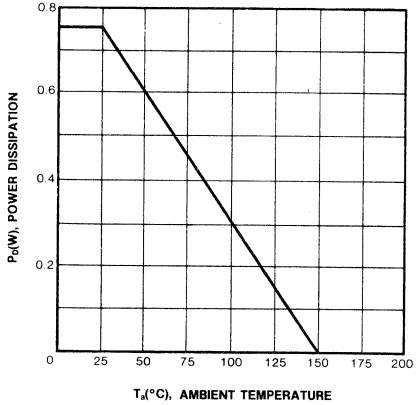
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



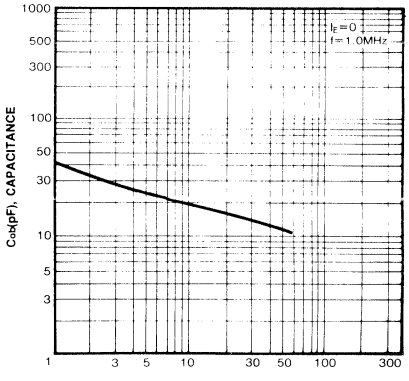
SAFE OPERATING AREA



POWER DERATING

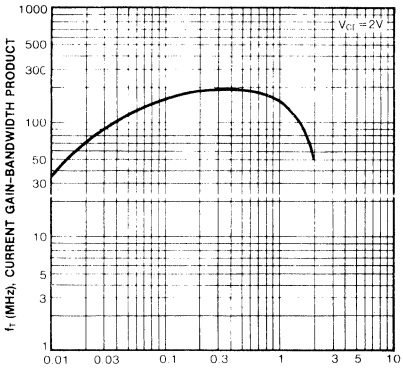


COLLECTOR OUTPUT CAPACITANCE



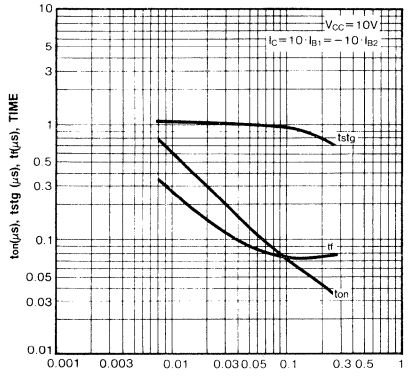
V_{CB}(V), COLLECTOR-BASE VOLTAGE

CURRENT GAIN-BANDWIDTH PRODUCT



I_C(A), COLLECTOR CURRENT

SWITCHING TIME



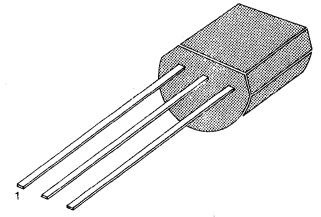
I_C(A), COLLECTOR CURRENT

3

AF OUTPUT AMPLIFIER FOR ELECTRONIC FLASH UNIT

- Low Vce(sat)
- High Performance at Low Supply Voltage

TO-92



1. Emitter 2. Collector 3. Base

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	40	V
Collector-Emitter Voltage	V_{CEO}	20	V
Emitter-Base Voltage	V_{EBO}	7	V
Collector Current	I_C	5	A
Collector Dissipation	P_C	0.75	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

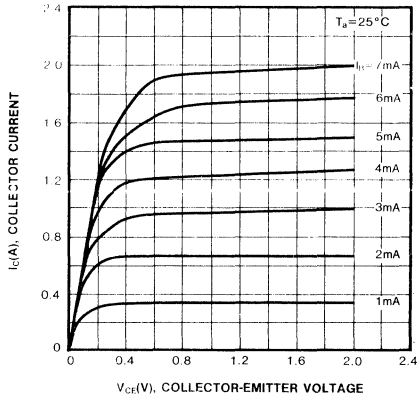
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Emitter Voltage	BV_{CEO}	I_C=1mA, I_B=0	20			V
Emitter Base Voltage	BV_{EBO}	I_C=10μA, I_C=0	7			V
Collector Cutoff Current	I_{CBO}	V_{CB}=10V, I_E=0			0.1	μA
Emitter Cutoff Current	I_{EBO}	V_{EB}=7V, I_C=0			0.1	μA
DC Current Gain	$h_{FE}1$	V_{CE}=2V, I_C=0.5A	180		600	
	$h_{FE}2$	V_{CE}=2V, I_C=2A	150			
Collector Emitter Saturation Voltage	V_{CE}(sat)	I_C=3A, I_B=0.1A			1	V
Current Gain Bandwidth Product	f_T	V_{CE}=6V, I_C=50mA		150		MHz
Output Capacitance	C_{ob}	V_{CB}=20V, I_E=0, f=1MHz			50	pF

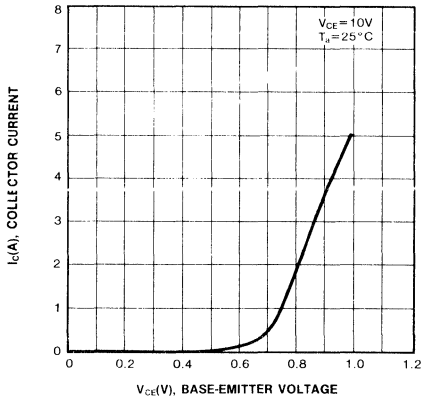
$h_{FE}1$ CLASSIFICATION

Classification	P	Q	R
$h_{FE}1$	180-270	230-380	340-600

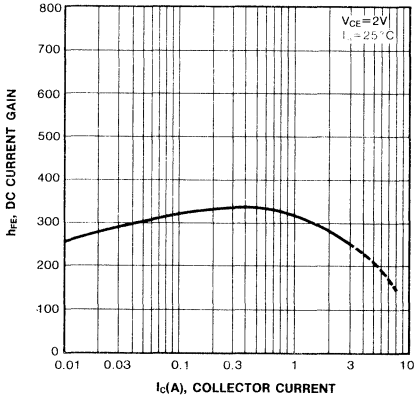
STATIC CHARACTERISTIC



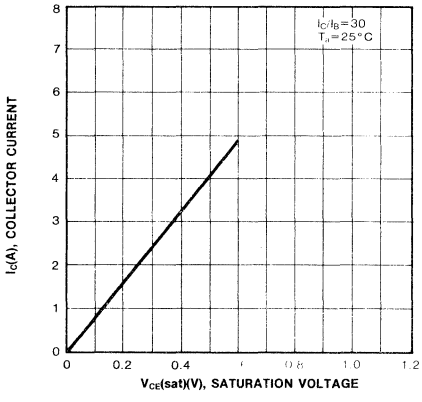
BASE-EMITTER SATURATION VOLTAGE



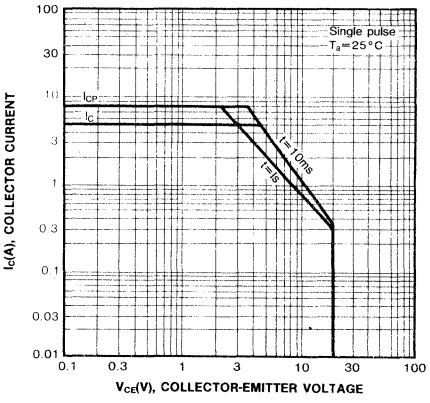
DC CURRENT GAIN



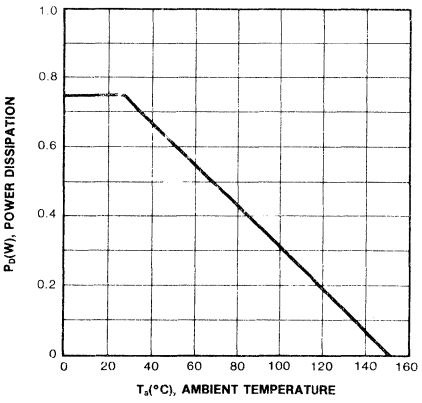
COLLECTOR-EMITTER SATURATION VOLTAGE



SAFE OPERATING AREA



POWER DERATING



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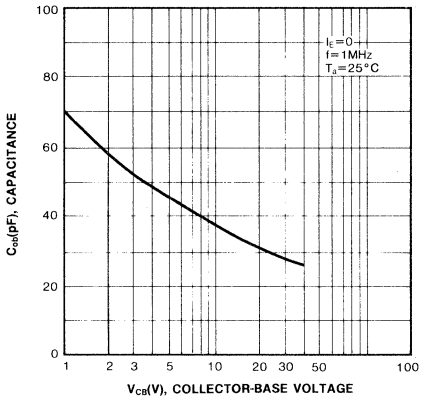
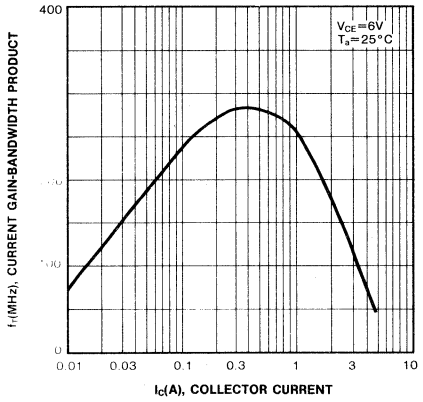
OUTPUT CAPACITANCE



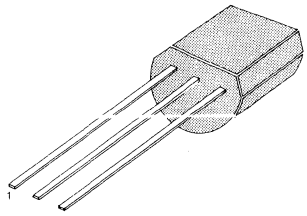
CURRENT GAIN BANDWIDTH PRODUCT



LOW NOISE PRE-AMP. USE

High Input Impedance: I_{gss} = 1nA (MAX)
Low Noise: NF = 0.5dB (TYP)
High Voltage: V_{gds} = −50V

TO-92



1. Source 2. Gate 3. Drain

ABSOLUTE MAXIMUM RATINGS (T_a = 25°C)

Characteristic	Symbol	Rating	Unit
Gate-Drain Voltage	V_{gds}	−50	V
Gate Current	I_g	10	mA
Collector Dissipation	P_C	100	mW
Junction Temperature	Tj	125	°C
Storage Temperature	Tstg	−55∼125	°C

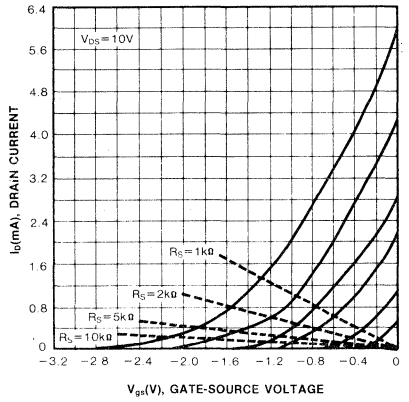
ELECTRICAL CHARACTERISTICS (T_a = 25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Gate-Drain Breakdown Voltage	BV_{gds}	V_{DS}=0, I_g=−100μA	−50			V
Gate Leak Current	I_{gss}	V_{gs}=−30V, V_{DS}=0			−1	nA
Drain Leak Current	I_{DSS}	V_{DS}=10V, V_{GS}=0	0.3		6.5	mA
Gate-Source Voltage	V_{gs}(off)	V_{DS}=10V, I_D=0.1μA	−0.4		−5	V
Forward Transfer Admittance	$\|Y_{fs}\|$	V_{DS}=10V, V_{gs}=0, f=1KHz	1.2			mS
Input Capacitance	Ciss	V_{DS}=0, V_{gs}=0, f=1MHz		8.2		pF
Feedback Capacitance	Crss	V_{gd}=10V, V_{DS}=0 f=1MHz		2.6		pF
Noise Figure	NF	V_{DS}=15V, V_{gs}=0 R_g=100kΩ f=120Hz		0.5	5	dB

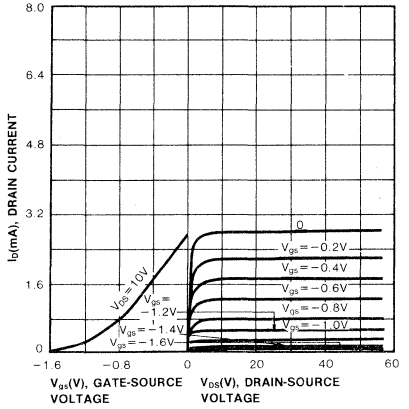
I_{DSS} CLASSIFICATION

Classification	R	O	Y	G
I_{DSS}(mA)	0.30-0.75	0.60-1.40	1.20-3.00	2.60-6.50

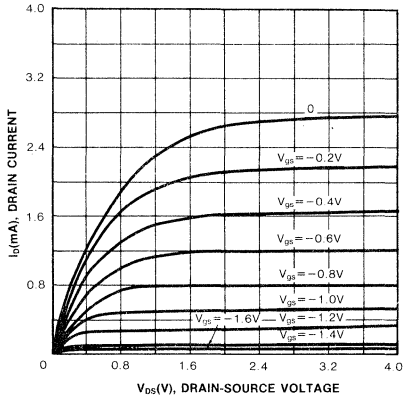
I_D-V_{gs}



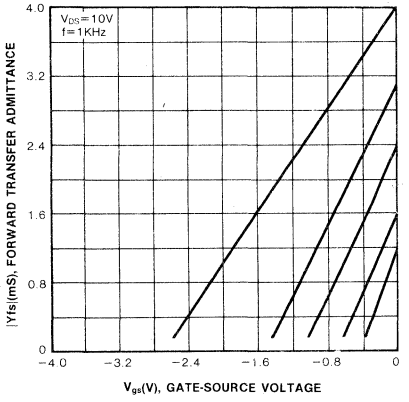
STATIC CHRACTERISTICS



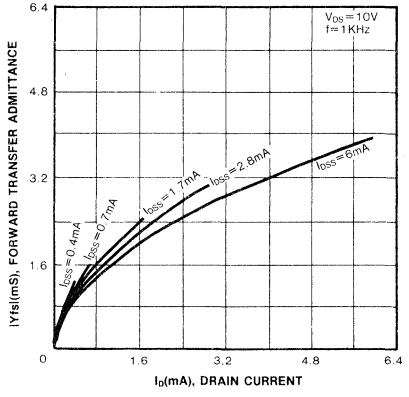
I_D-V_{DS}



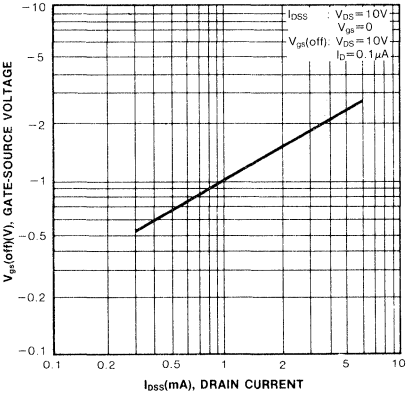
|Yfs|-Vgs



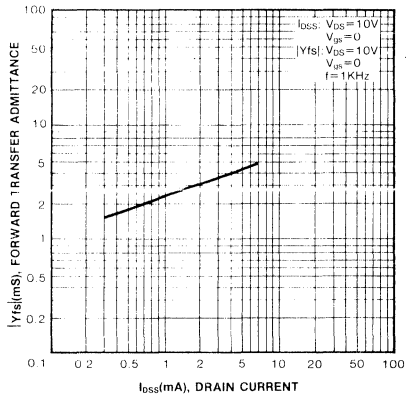
|Yfs|-I_D



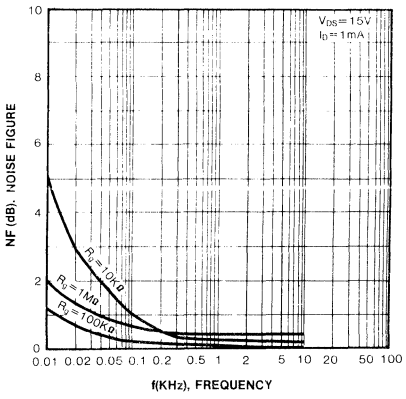
$V_{gs(off)}$-I_{DSS}



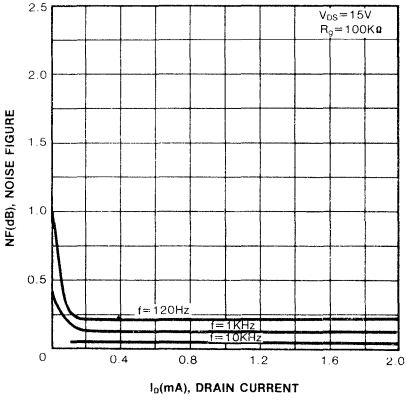
|Yfs|-I_{DSS}



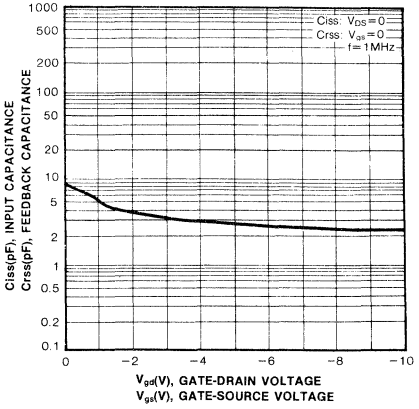
NF-f



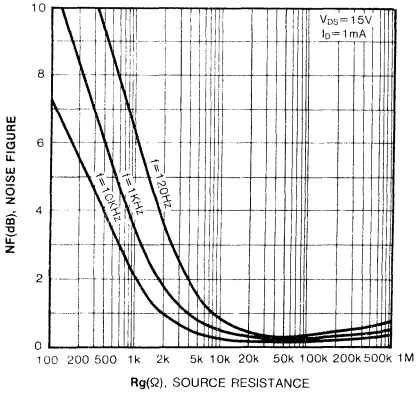
NF-I_D



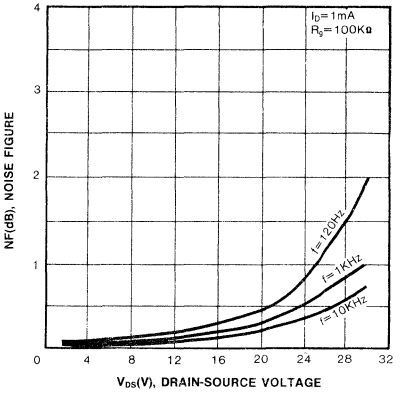
Ciss-Vgs, Crss-V_{GD}

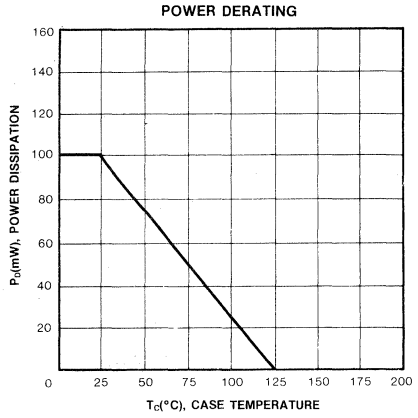


NF-Rg



NF-V_{DS}

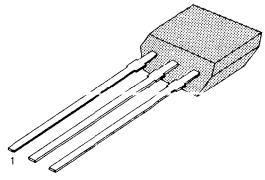



POWER DERATING
160
140
120
100
80
60
40
20
0
25
50
75
100
125
150
175
200
P_D(mW), POWER DISSIPATION
T_C(°C), CASE TEMPERATURE

AF IMPEDANCE CONVERTER

- **Built-In Diode Between G and S**
- **Low NV**

TO-92S



1. Source 2. Gate 3. Drain

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Drain-Source Voltage	V_{DSO}	12	V
Gate-Drain Voltage	V_{GDO}	12	V
Drain-source Current	I_{DSO}	2	mA
Drain-Gate Current	I_{DGO}	2	mA
Gate-Source Current	I_{GSO}	2	mA
Power Dissipation	P_D	20	mW
Operate Temperature	T_{OPR}	−10∼+70	°C
Storage Temperature	Tstg	−20∼+80	°C

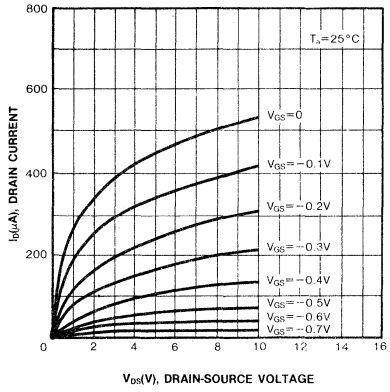
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Drain Current	I_{DSS}	V_{DS}=4.5V, V_{GS}=0, R_S=2.2kΩ±1%	0.04		0.8	mA
Transconductance	gm	V_{DS}=4.5V, V_{GS}=0, R_S=2.2kΩ±1%, f=1kHz	300	500		μS
Noise Voltage	NV	V_{DS}=4.5V, R_S=2.2kΩ±1%, C_G=10pF, A curve			4	μV
Voltage Gain	G_{v1}	V_{DS}=4.5V, R_S=2.2kΩ±1%, C_G=10pF, E_G=100mV, f=70Hz		−10		dB
Voltage Gain	G_{v2}	V_{DS}=12V, R_S=2.2kΩ±1%, C_G=10pF, E_G=100mV, f=70Hz		−9.5		dB
Voltage Gain	G_{v3}	V_{DS}=1V, R_S=2.2kΩ1%, C_G=10pF, E_G=100mV, f=70Hz		−11		dB

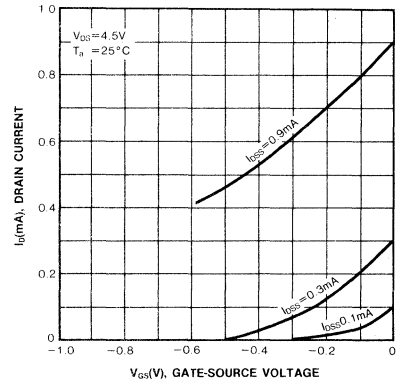
I_{DSS}-G_V CLASSIFICATION

Classification	P	Q
I_{DSS} (mA)	0.04-0.2	0.15-0.8
G_{v1} (dB)	>−13	>−12
G_{v2} (dB)	>−12	>−11
$\Delta \lvert G_{v1}-G_{v2} \rvert$(dB)	<3	<3
$\Delta \lvert G_{v1}-G_{v3} \rvert$(dB)	<3	—

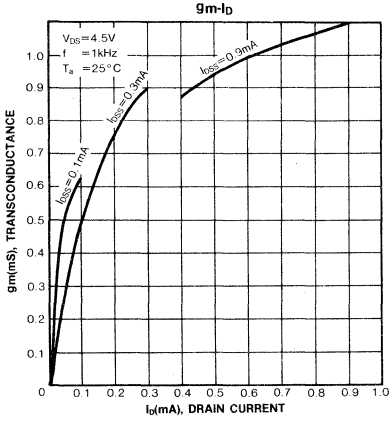
I_D-V_{DS}



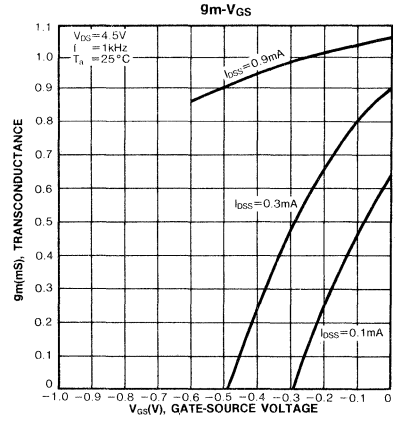
I_D-V_{GS}



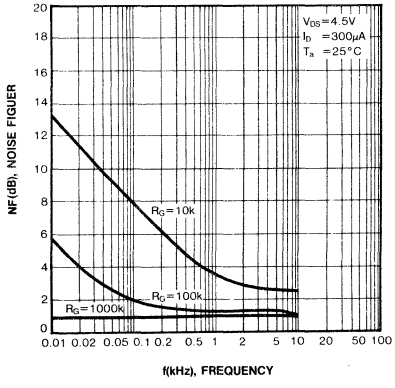
9m-I_D



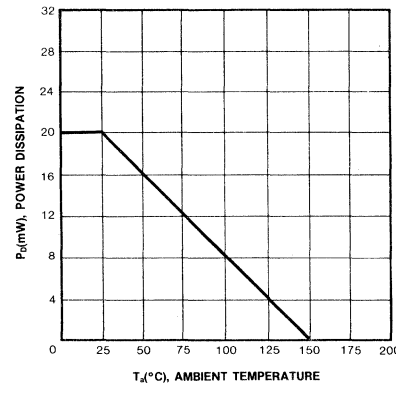
9m-V_{GS}



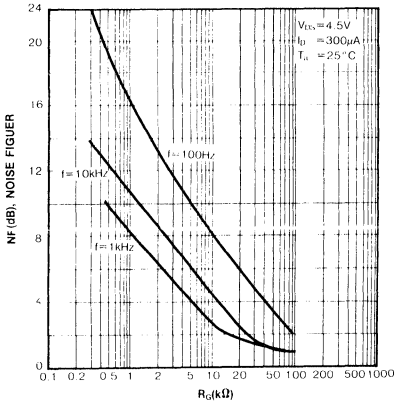
NF-f



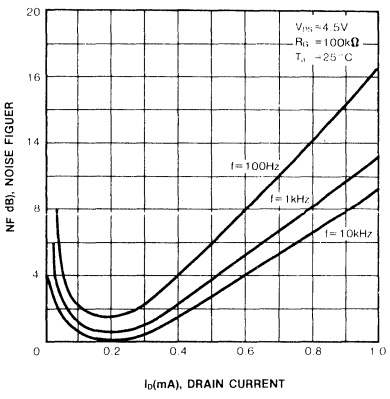
P_D-T_A



NF-R_G


V_{DS}=4.5V
I_D =300μA
T_a =25°C
f=100Hz
f=10kHz
f=1kHz
NF (dB), NOISE FIGUER
R_G(kΩ)

NF-I_D

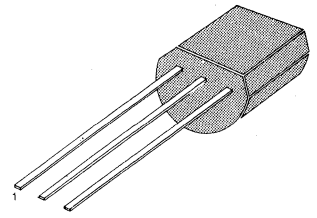

V_{DS}=4.5V
R_G =100kΩ
T_a =25°C
f=100Hz
f=1kHz
f=10kHz
NF (dB), NOISE FIGUER
I_D(mA), DRAIN CURRENT

3

LOW FREQUENCY LOW NOISE AMP.

High|Yfs|: 15mS (TYP)
High Input Impedance : I_{gss} = −1nA
Low Noise, NF = 1dB (TYP)

TO-92



1. Drain 2. Gate 3. Source

ABSOLUTE MAXIMUM RATINGS (T_a = 25°C)

Characteristic	Symbol	Rating	Unit
Gate-Drain Voltage	V_{gds}	−50	V
Gate Current	I_g	10	mA
Collector Dissipation	P_C	300	mW
Junction Temperature	Tj	125	°C
Storage Temperature	Tstg	−55∼125	°C

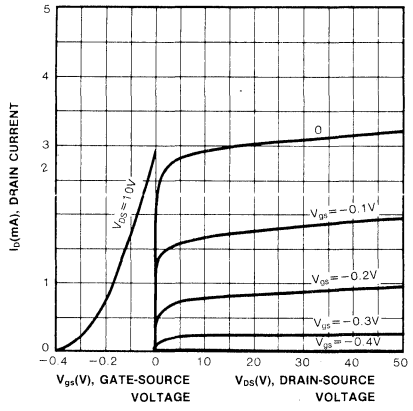
ELECTRICAL CHARACTERISTICS (T_a = 25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Gate-Drain Breakdown Voltage	BV_{gds}	V_{DS}=0, I_g=−100μA	−50			V
Gate Leak Current	I_{gss}	V_{gs}=−30V, V_{DS}=0			−1	nA
Drain Leak Current	I_{DSS}	V_{DS}=10V, V_{GS}=0	0.6		14	mA
Gate-Source Voltage	V_{gs}(off)	V_{DS}=10V, I_D=0.1μA	−0.2		−1.5	V
Forward Transfer Admittance	$\|Y_{fs}\|$	V_{DS}=10V, V_{gs}=0, f=1KHz	4.0	15		mS
Input Capacitance	Ciss	V_{DS}=10V, V_{gs}=0, f=1MHz		13		pF
Feedback Capacitance	Crss	V_{gd}=10V, I_D=0				
		f=1MHz		3		pF
Noise Figure	NF1	V_{DS}=10V, R_g=1kΩ				
		I_D=0.5mA, f=10Hz		5	10	dB
	NF2	V_{DS}=10V, R_g=1kΩ				
		I_D=0.5mA, f=1KHz		1	2	dB

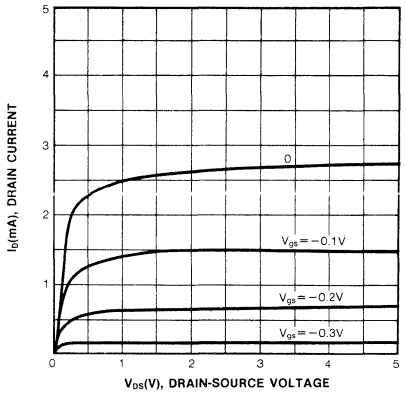
I_{DSS} CLASSIFICATION

Classification	Y	G	L
I_{DSS}(mA)	1.2-3.0	2.6-6.5	6.0-14

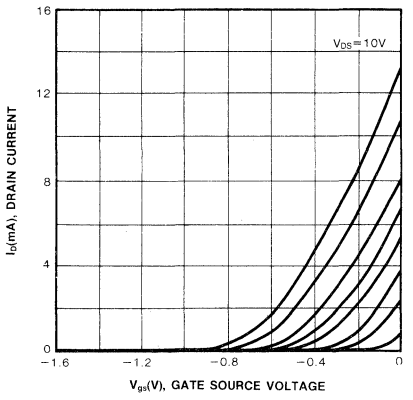
STATIC CHARACTERISTIC



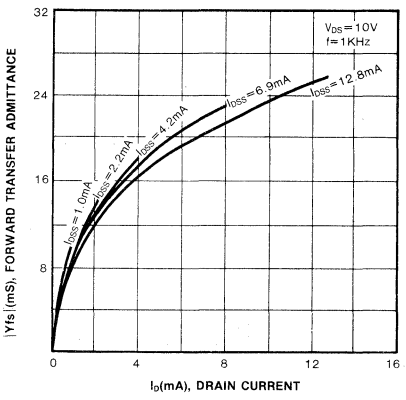
I_D-V_{DS}



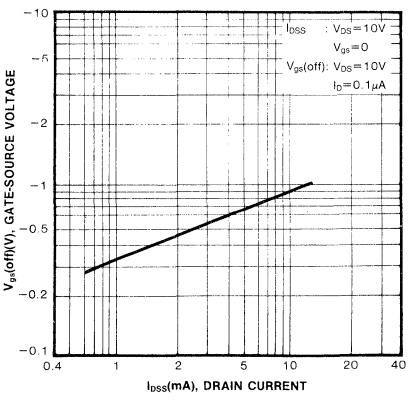
I_D-V_{gs}



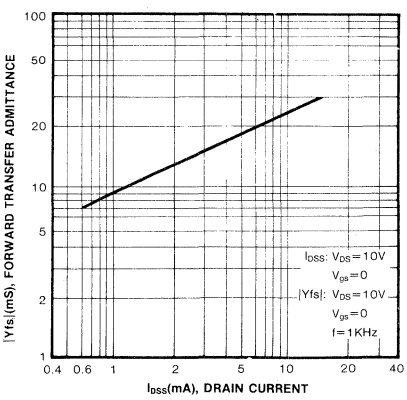
|Yfs|-I_D



$V_{gs(off)}$-I_{DSS}

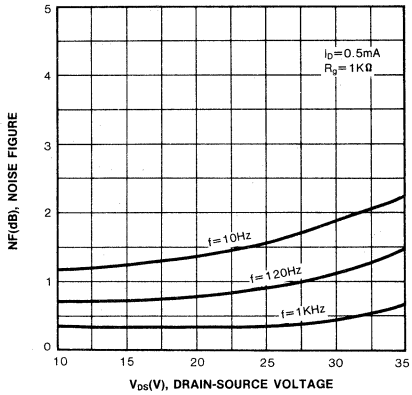


|Yfs|-I_{DSS}

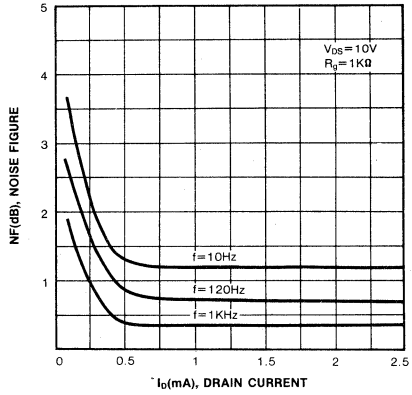


3

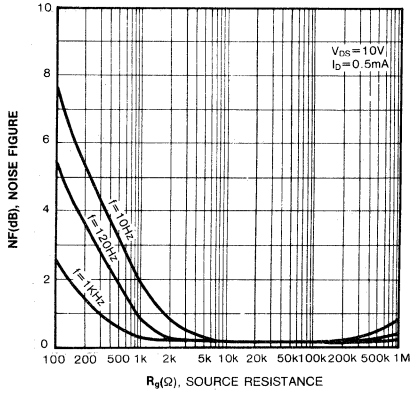
NF-V_{DS}



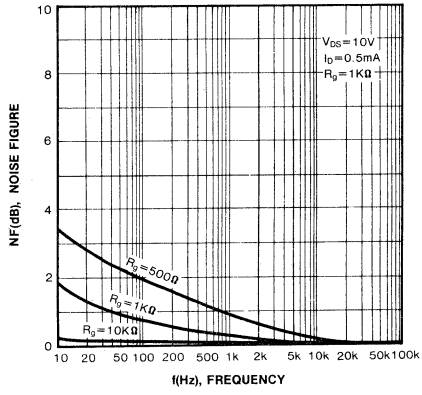
NF-I_D



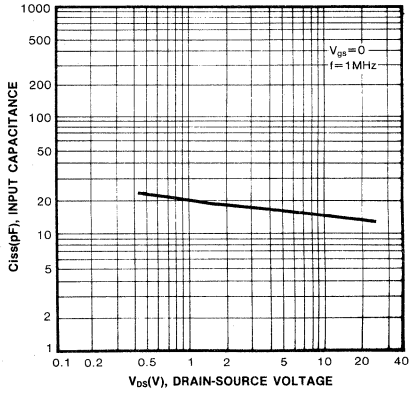
NF-R_g



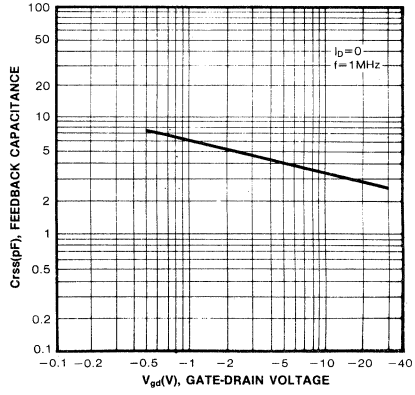
NF-f



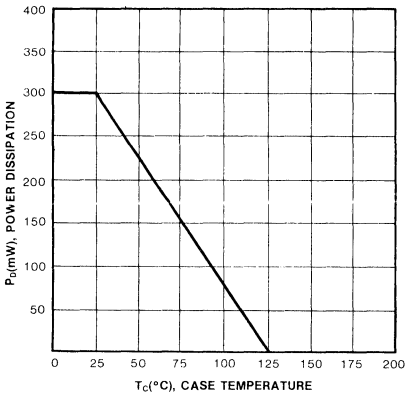
Ciss-V_{DS}



Crss-V_{GD}



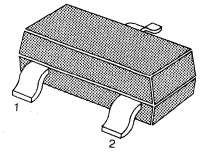
POWER DERATING



AF IMPEDANCE CONVERTER

- BUILT-IN DIODE BETWEEN G AND S
- LOW NV

SOT-23



1. Drain 2. Source 3. Gate

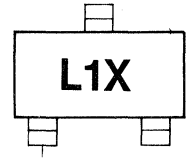
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Drain Source Voltage	V_{DSO}	20	V
Drain Gate Voltage	V_{DGO}	20	V
Drain Source Current	I_{DSO}	2	mA
Drain Gate Current	I_{DGO}	2	mA
Gate Source Current	I_{GSO}	2	mA
Power Dissipation	P_D	200	mW
Operate Temperature	T_{OPR}	−20~80	°C
Storage Temperature	T_{STG}	−55~100	°C

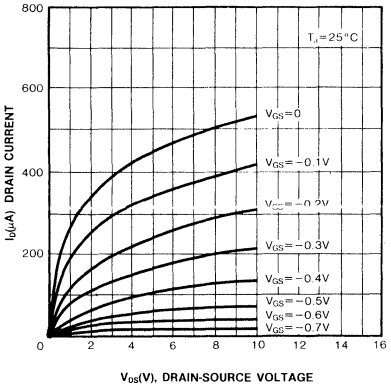
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Drain Current	I_{DSS}	V_{DS}=4.5V, V_{GS}=0 R_S=2.2kohm ± 1%	130	200	470	μA
Transconductance	gm	V_{DS}=4.5V, V_{GS}=0 R_S=2.2kohm±1%, f=1kHz	0.9	1.6		mS
		C_G=10pF, A curve			4	μV
Voltage Gain	G_V1	V_{DS}=4.5V, R_S=2.2kohm ± 1% C_G=10pF, E_G=10mV, f=70Hz	−1			dB
Voltage Gain	G_V2	V_{DS}=12V, R_S=2.2kohm±1% C_G=10pF, E_G=10mV, f=70Hz	0			dB
Voltage Gain	G_V3	V_{DS}=1.5V, R_S=2.2kohm±1% C_G=10pF, E_G=10mV, f=70Hz	−4			dB

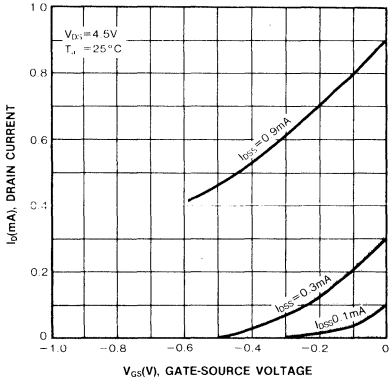
Marking



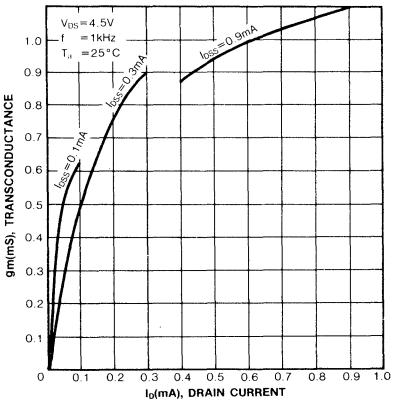
I_D-V_{DS}



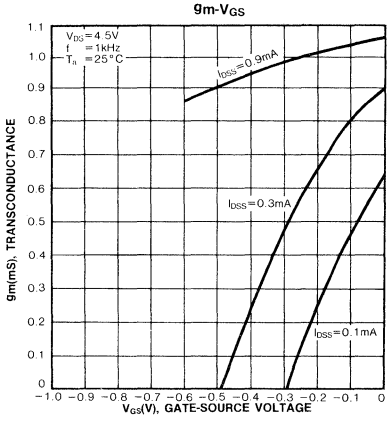
I_D-V_{GS}



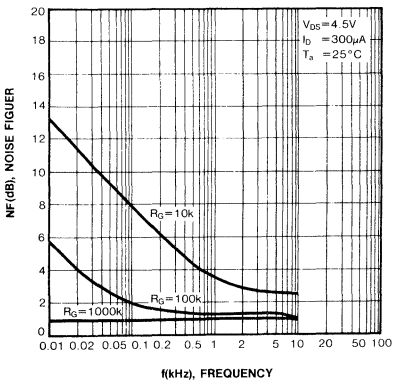
g_m-I_D



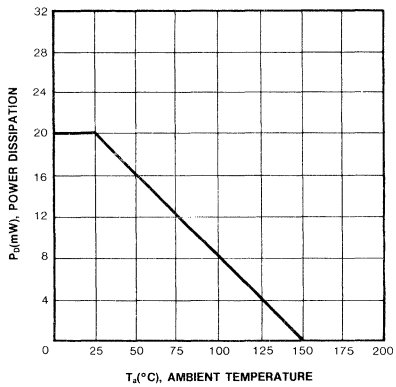
g_m-V_{GS}



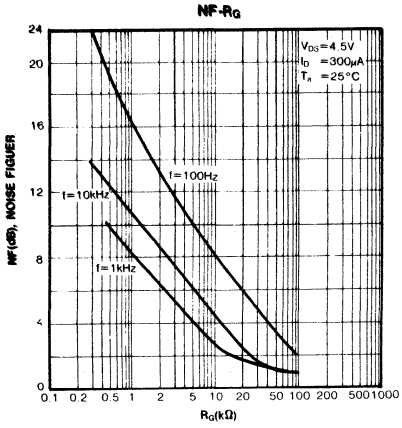
NF-f

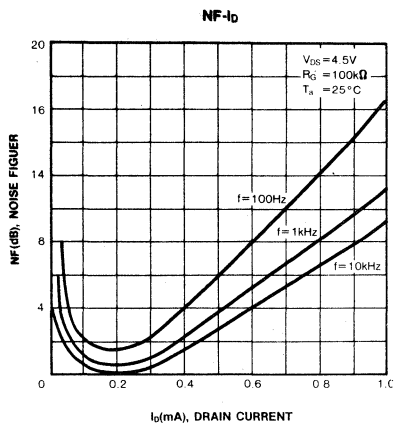


P_D-T_A



3

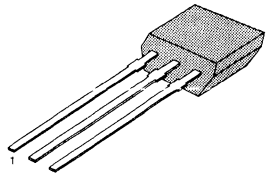

NF-RG
VDS=4.5V
ID =300μA
Ta =25°C
f=100Hz
f=10kHz
f=1kHz
NF(dB), NOISE FIGUER
RG(kΩ)


NF-ID
VDS=4.5V
RG =100kΩ
Ta =25°C
f=100Hz
f=1kHz
f=10kHz
NF(dB), NOISE FIGUER
ID(mA), DRAIN CURRENT

FM TUNER
VHF AMPLIFIER

- **NF = 2.5 dB (TYP)**
- **$|Y_{FS}|$ = 9.0 mS (TYP)**

TO-92S



1. Drain 2. Source 3. Gate

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Gate-Drain Voltage	V_{GDO}	−18	V
Gate Current	I_G	10	mA
Power Dissipation	P_D	200	mW
Junction Temperature	T_j	150	°C
Storage Temperature	Tstg	−55∼150	°C

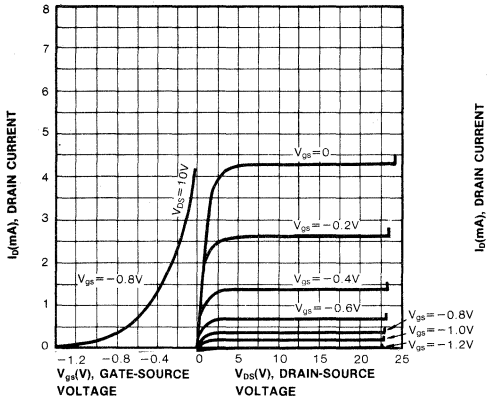
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Gate Cut-off Current	I_{GSS}	V_{GS}=−0.5V, V_{DS}=0			−10	nA
Gate-Drain Breakdown Voltage	$V(BR)_{GDO}$	I_G=−100μA, Drain	−18			V
Drain Current	I_{DSS}	V_{DS}=10V, V_{GS}=0	1.0		10	mA
Gate-Source Cuf-off Voltage	V_{GS}(off)	V_{DS}=10V, I_D=1μA	0.4		4.0	V
Forward Transfer Admittance	$\|Y_{FS}\|$	V_{DS}=10V, V_{GS}=0, f=1kHz		9		mS
Reverse Transfer Capacitance	C_{rss}	V_{GD}=10V, f=1MHz			0.15	pF
Power Gain	C_{PS}	V_{DD}=10V, f=100MHz		18		dB
Noise Figuer	NF	V_{DD}=10V, f=100MHz		2.5	3.5	dB

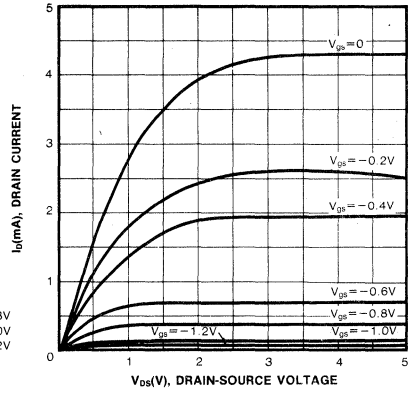
I_{DSS} CLASSIFICATION

Classification	O	Y	G
I_{DSS}	1.0-3.0	2.5-6.0	5.0-10

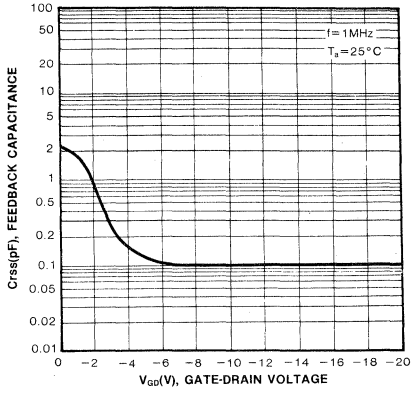
STATIC CHARACTERISTIC



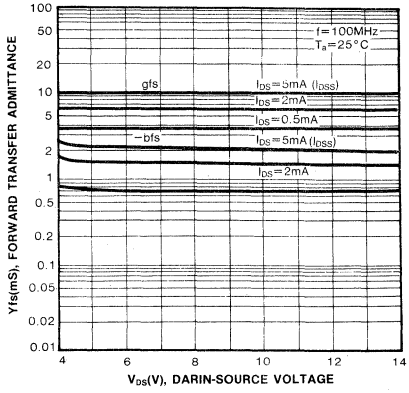
I_D-V_{DS}



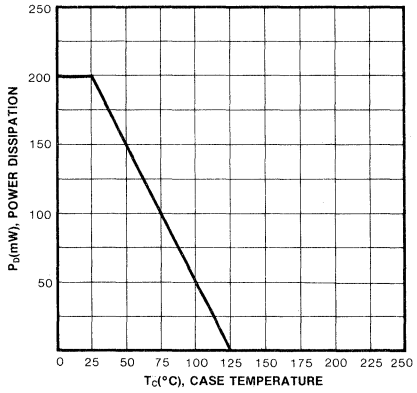
Crss-V_{GD}



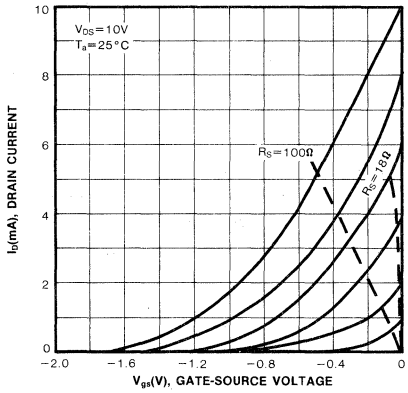
Yfs -V_{DS}



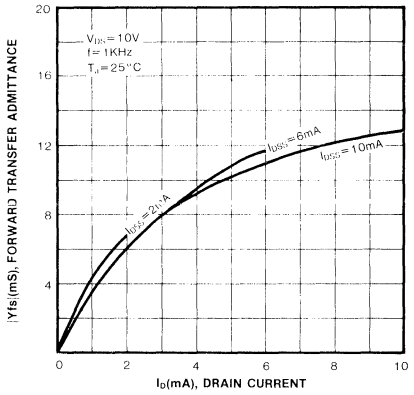
POWER DERATING



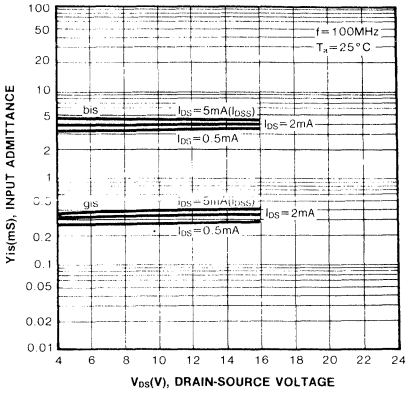
I_D-V_{gs}



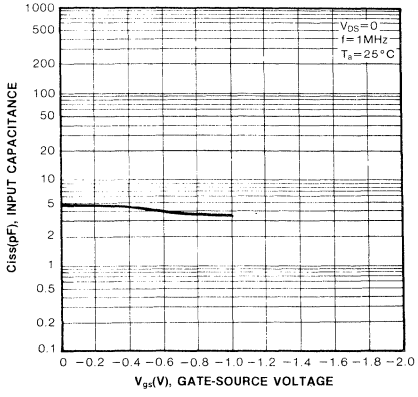
|Yfs|-I_D



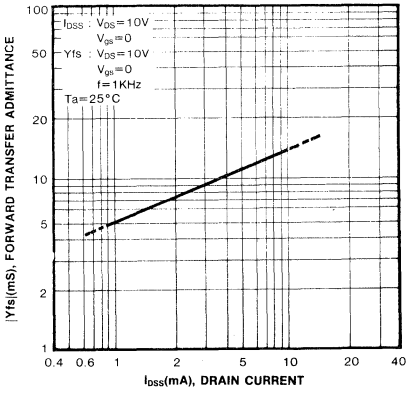
Yis-V_{DS}



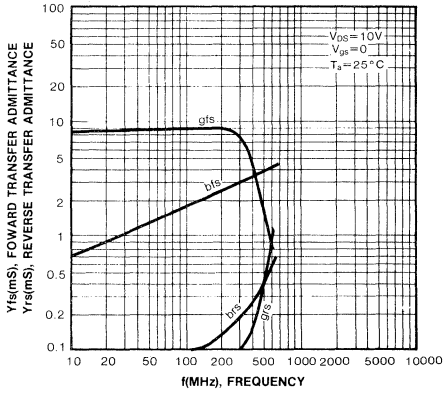
Ciss-V_{gs}



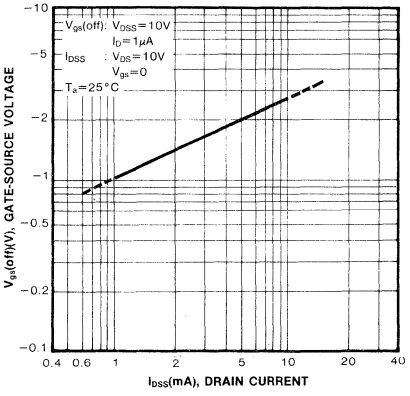
|Yfs|-I_{DSS}



Yfs, Yrs-f



$V_{gs(off)}$-I_{DSS}



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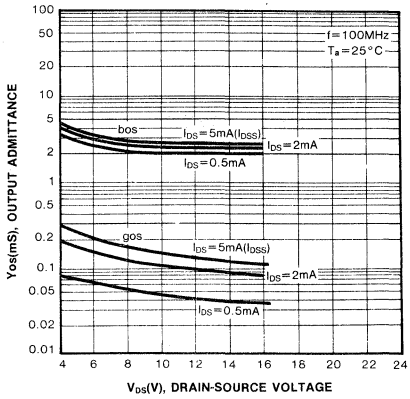
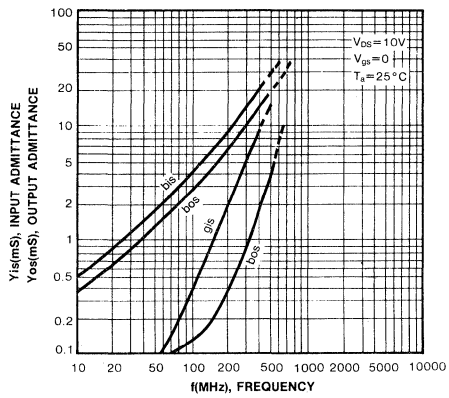
Yos-V_{DS}



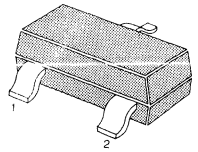
Yis, Yos-f



FM TUNER
VHF AMPLIFIER

- **NF = 2.5 dB (TYP)**
- **$|Y_{FS}|$ = 9.0 mS (TYP)**

SOT-23



1. Drain 2. Gate 3. Source

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Gate-Drain Voltage	V_{GDO}	−18	V
Gate Current	I_G	10	mA
Power Dissipation	P_D	200	mW
Junction Temperature	T_j	150	°C
Storage Temperature	Tstg	−55∼150	°C

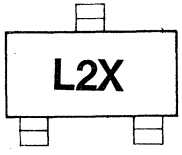
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Gate Cut-off Current	I_{GSS}	V_{GS}=−0.5V, V_{DS}=0			−10	nA
Gate-Drain Breakdown Voltage	$V(BR)_{GDO}$	I_G=−100μA, Drain	−18			V
Drain Current	I_{DSS}	V_{DS}=10V, V_{GS}=0	1.0		10	mA
Gate-Source Cuf-off Voltage	V_{GS}(off)	V_{DS}=10V, I_D=1μA	0.4		4.0	V
Forward Transfer Admittance	$\|Y_{FS}\|$	V_{DS}=10V, V_{GS}=0, f=1kHz		9		mS
Reverse Transfer Capacitance	C_{rss}	V_{GD}=10V, f=1MHz			0.15	pF
Power Gain	C_{PS}	V_{DD}=10V, f=100MHz		18		dB
Noise Figuer	NF	V_{DD}=10V, f=100MHz		2.5	3.5	dB

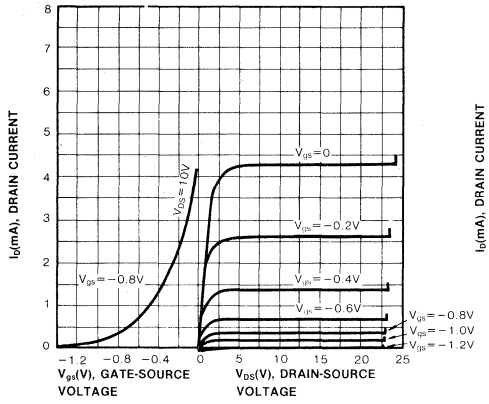
I_{DSS} CLASSIFICATION

Classification	O	Y	G
I_{DSS}	1.0-3.0	2.5-6.0	5.0-10

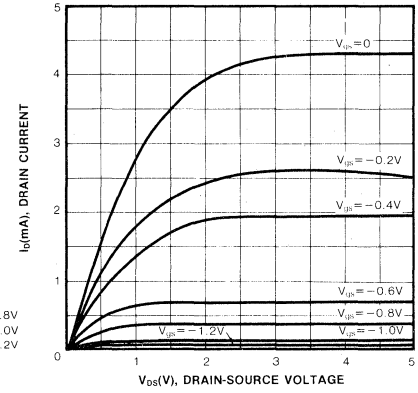
Marking



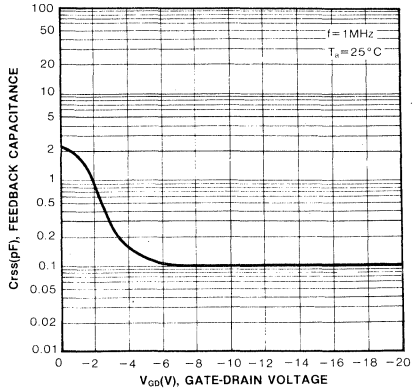
STATIC CHARACTERISTIC



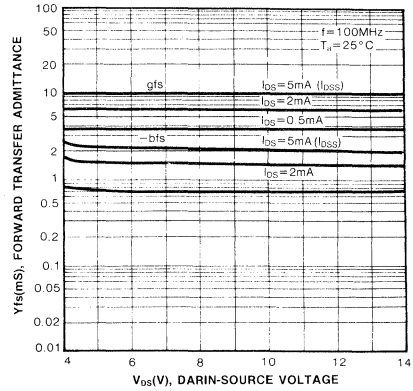
I_D-V_{DS}



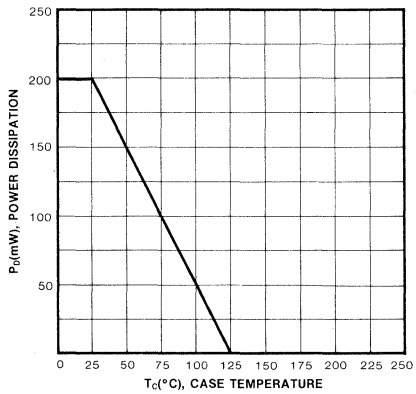
Crss-V_{GD}



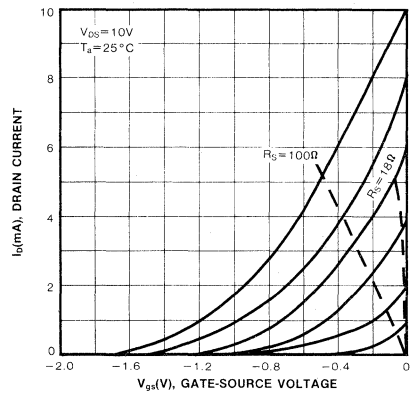
Yfs -V_{DS}



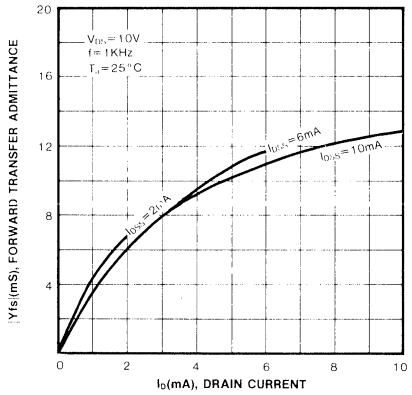
POWER DERATING



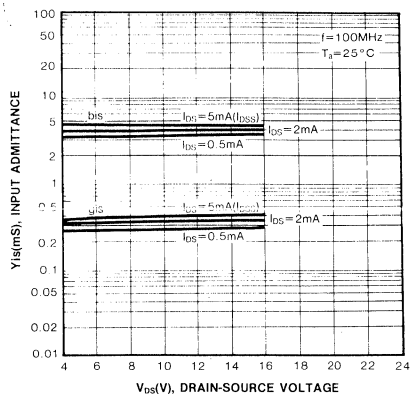
I_D-V_{gs}



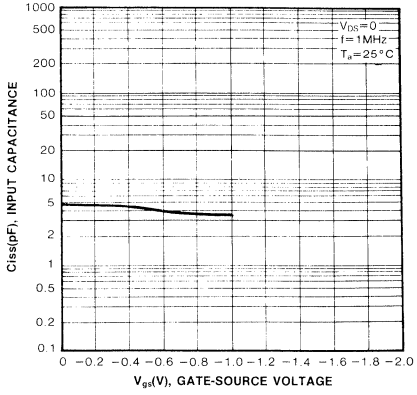
Yfs -I_D



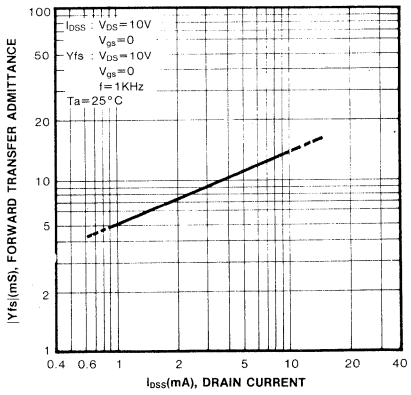
Yis-V_{DS}



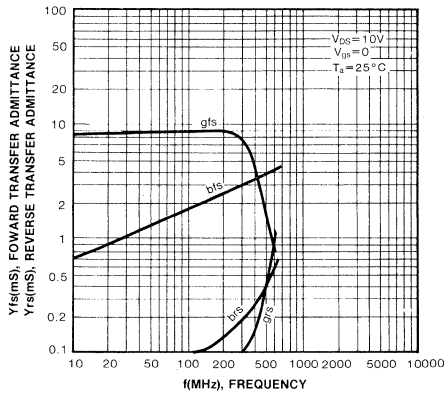
Ciss-V_{gs}



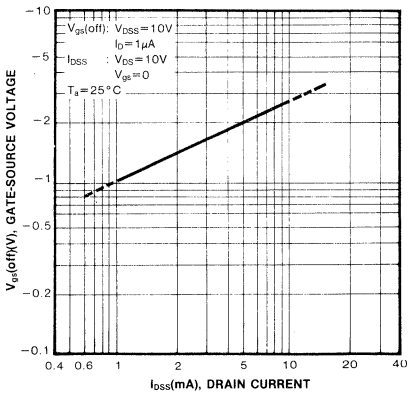
|Yfs|-I_{DSS}



Yfs, Yrs-f



$V_{gs(off)}$-I_{DSS}



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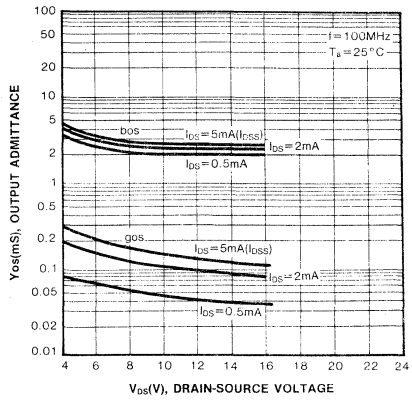
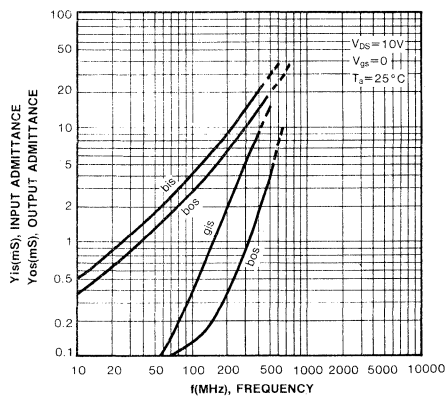
Yos-V_{DS}



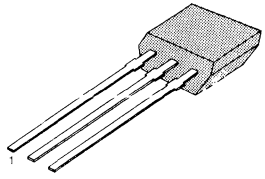
Yis, Yos-f



CAPACITOR MICROPHONE APPLICATIONS

- **Especially Suited for use in Audio, Telephone Capacitor Microphones**
- **Excellent Voltage Characteristic**
- **Excellent Transient Characteristic**

TO-92S



1. Source 2. Gate 3. Drain

ABSOLUTE MAXIMUM RATINGS (Ta=25°C)

Characteristic	Symbol	Rating	Unit
Gate Drain Voltage	V_{GDO}	−20	V
Gate Current	I_G	10	mA
Drain Current	I_D	1	mA
Power Dissipation	P_D	100	mW
Junctin Temperature	T_J	150	°C
Storage Temperature	T_{STG}	−55∼150	°C

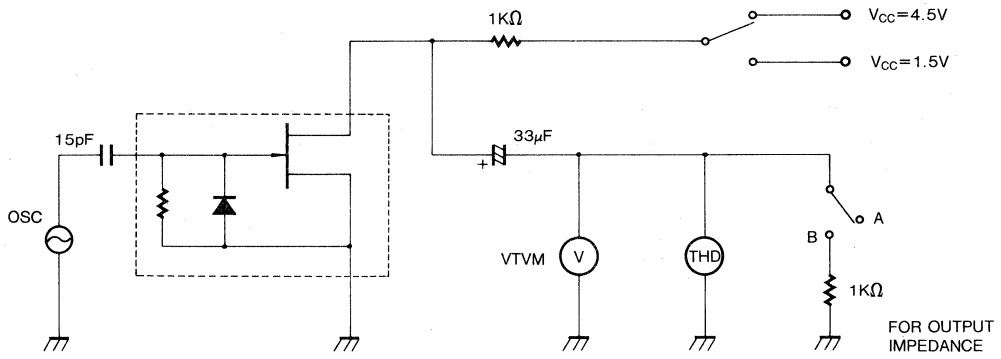
ELECTRICAL CHARACTERISTICS (Ta=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Gate Drain Breakdown Voltage	BV_{GDO}	$I_G=-100\mu A$	−20			V
Gate Source Cut off Voltage	$V_{GS}(off)$	$V_{DS}=5V$, $I_B=1\mu A$		−0.6	−1.5	V
Drain Current	I_{DSS}	$V_{DS}=5V$, $V_{GS}=0$	100		80	uA
Forward Transfer Admittance	$\|Y_{FS}\|$	$V_{DS}=5V$, $V_{GS}=0$, f=1KHz	0.4	1.2		mS
Input Capacitance	C_{ISS}	$V_{DS}=5V$, $V_{GS}=0$, f=1MHz		3.5		pF
Output Capacitance	C_{RSS}	$V_{DS}=5V$, $V_{GS}=0$, f=1MHz		0.65		pF

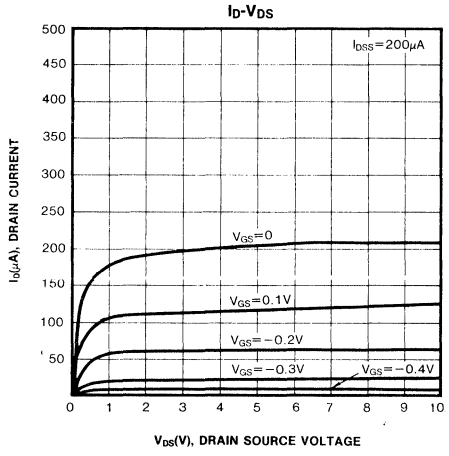
I_{DSS} CLASSIFICATION

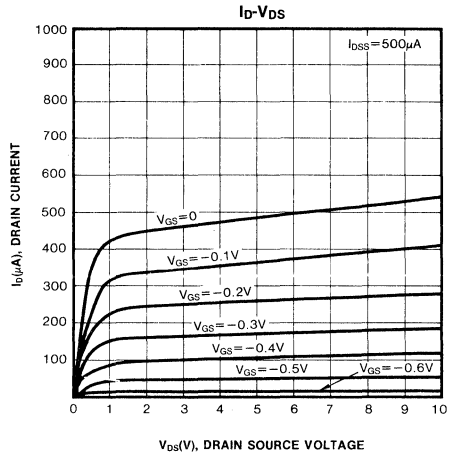
Classification	A	B	C	D	E
I_{DSS}(uA)	100∼170	150∼240	210∼350	320∼480	440∼800

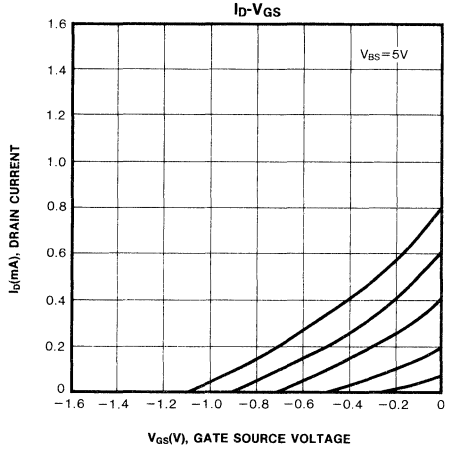
SPECIFIED TEST CIRCUIT (Ta = 25°C)

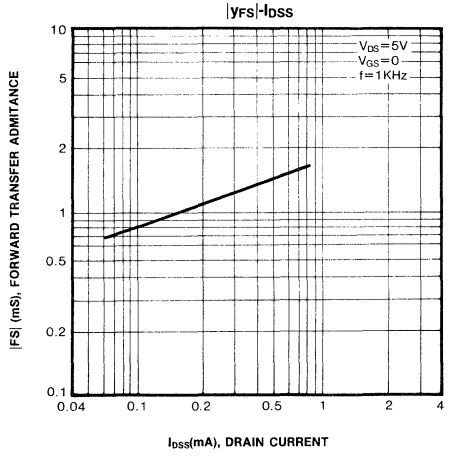


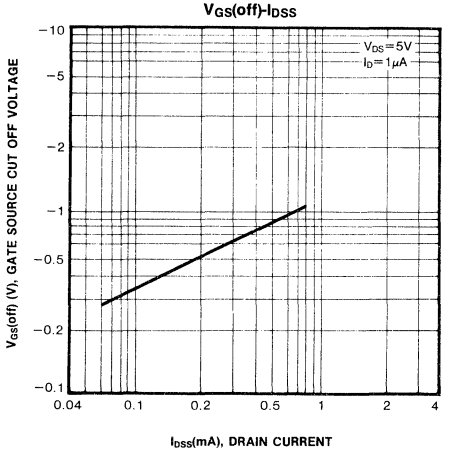
Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Voltage Gain	G_V	V_{IN}=10mV, f=1KHz		−3		dB
Reduced Voltage Characteristic	$\Delta G_V V$	V_{IN}=10mV, f=1KHz V_{CC}=4.5V→1.5V		−1.2	−3.5	dB
Frequency Characteristic	$\Delta G_V F$	f=1KHz to 110Hz			−1	dB
Input Resistance	Z_{IN}	f=1KHz	25			MΩ
Output Resistance	Z_O	f=1KHz			700	Ω
Total Harmonic Distortion	THD	V_{IN}=30mV, f=1KHz		1		%
Output Noise Voltage	V_{NO}	V_{IN}=0, A CURVE			−110	d_B

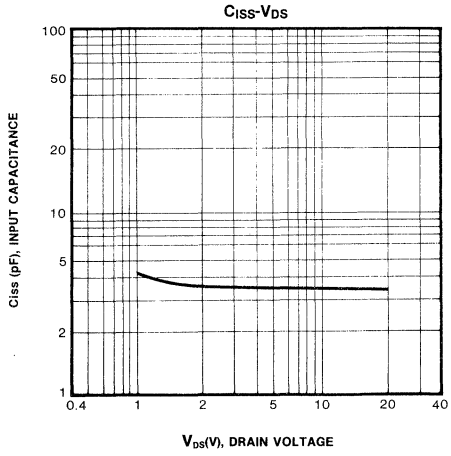

I_D-V_{DS}
I_{DSS}=200μA
V_{GS}=0
V_{GS}=0.1V
V_{GS}=−0.2V
V_{GS}=−0.3V
V_{GS}=−0.4V
I_D(μA), DRAIN CURRENT
V_{DS}(V), DRAIN SOURCE VOLTAGE


I_D-V_{DS}
I_{DSS}=500μA
V_{GS}=0
V_{GS}=−0.1V
V_{GS}=−0.2V
V_{GS}=−0.3V
V_{GS}=−0.4V
V_{GS}=−0.5V
V_{GS}=−0.6V
I_D(μA), DRAIN CURRENT
V_{DS}(V), DRAIN SOURCE VOLTAGE


I_D-V_{GS}
V_{BS}=5V
I_D(mA), DRAIN CURRENT
V_{GS}(V), GATE SOURCE VOLTAGE

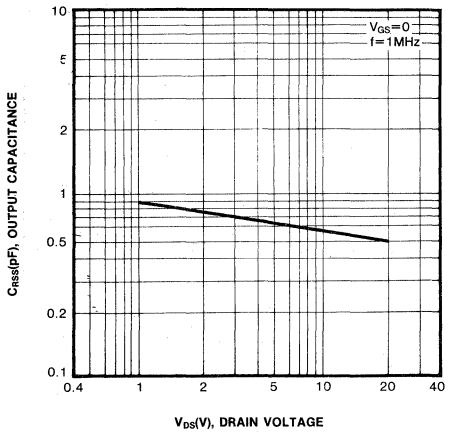

|y_{FS}|-I_{DSS}
V_{DS}=5V
V_{GS}=0
f=1KHz
|FS| (mS), FORWARD TRANSFER ADMITANCE
I_{DSS}(mA), DRAIN CURRENT


$V_{GS(off)}$-I_{DSS}
V_{DS}=5V
I_D=1μA
$V_{GS(off)}$ (V), GATE SOURCE CUT OFF VOLTAGE
I_{DSS}(mA), DRAIN CURRENT

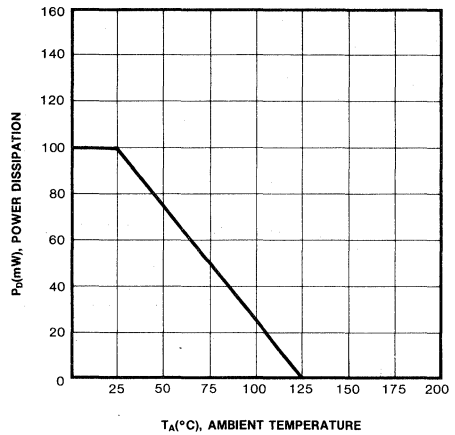

C_{ISS}-V_{DS}
Ciss (pF), INPUT CAPACITANCE
V_{DS}(V), DRAIN VOLTAGE

3

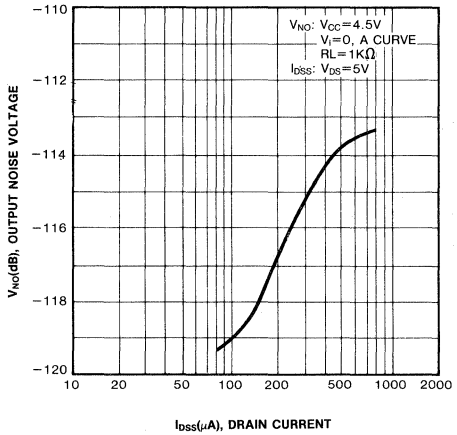
C_{RSS}-V_{DS}



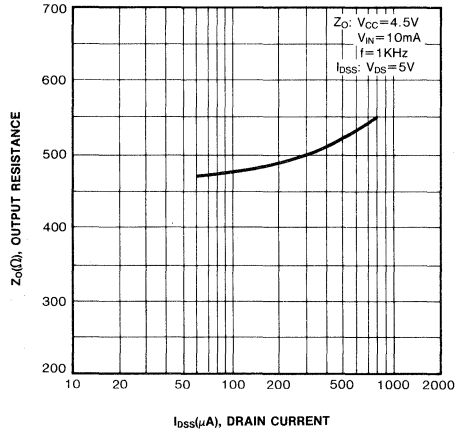
P_D-T_A



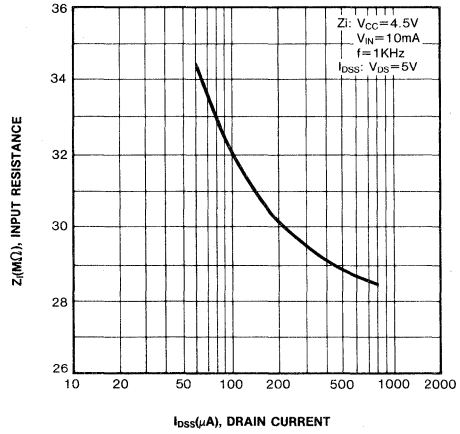
V_{NO}-I_{DSS}



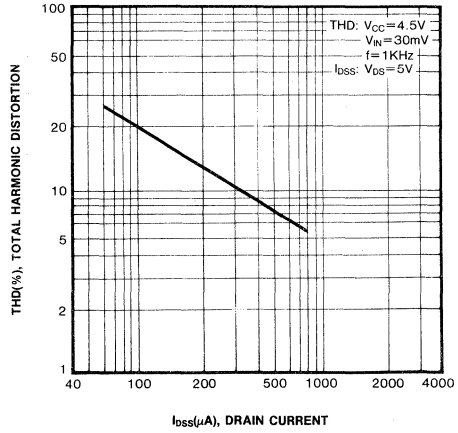
Z_O-I_{DSS}



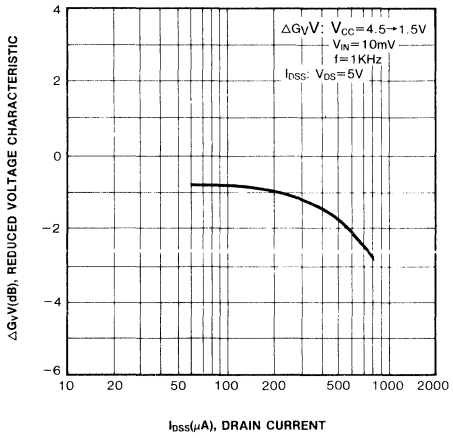
Z_I-I_{DSS}



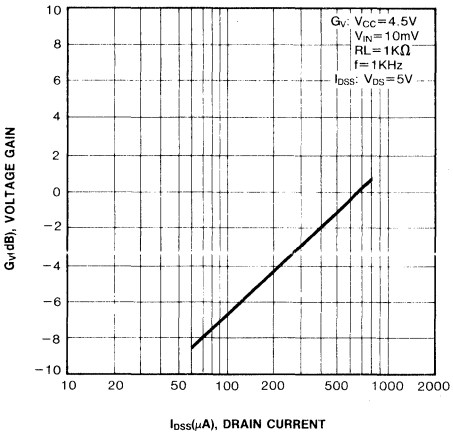
THD-I_{DSS}



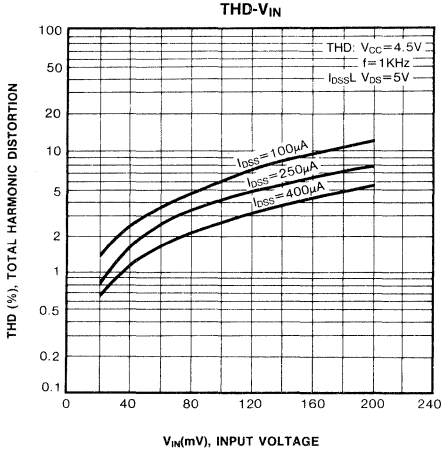
△GV-IDSS



GV-IDSS



THD-VIN

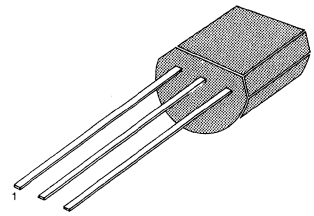


3

SWITCHING APPLICATION (Bias Resistor Built In)

- Switching circuit, Inverter, Interface circuit Driver circuit
- Built in bias Resistor (R_1=4.7KΩ, R_2=4.7KΩ)
- Complement to KSR2001

TO-92



1. Emitter 2. Collector 3. Base

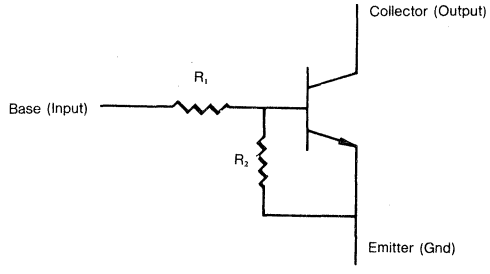
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	50	V
Collector-Emitter Voltage	V_{CEO}	50	V
Emitter-Base Voltage	V_{EBO}	10	V
Collector Current	I_C	100	mA
Collector Dissipation	P_C	300	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

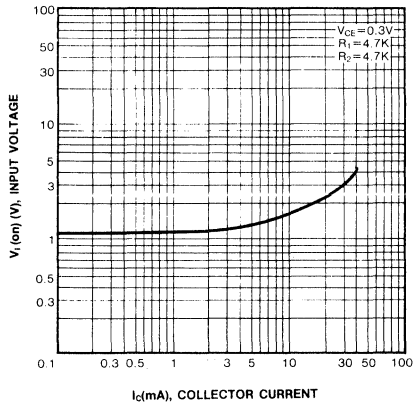
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=10μA I_E=0	50			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=100μA, I_B=0	50			V
Collector Cutoff Current	I_{CBO}	V_{CB}=40V, I_E=0			0.1	μA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=10mA	20			
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=10mA, I_B=0.5mA			0.3	V
Current Gain-Bandwidth Product	f_T	V_{CE}=5mA, I_C=10V		250		MHz
Output Capacitance	Cob	V_{CB}=10V, I_E=0 f=1.0MHz		3.7		pF
Input Off Voltage	Vi(off)	V_{CE}=5V, I_C=100μA	0.5			V
Input On Voltage	Vi(on)	V_{CE}=0.3V, I_C=20mA			3	V
Input Resistor	R_1		3.2	4.7	6.2	KΩ
Resistor Ratio	R_1/R_2		0.9	1	1.1	

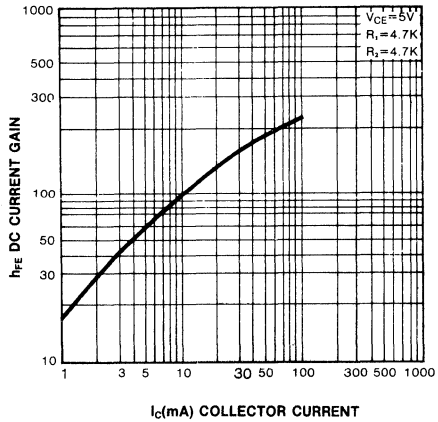
Equivalent Circuit



INPUT ON VOLTAGE

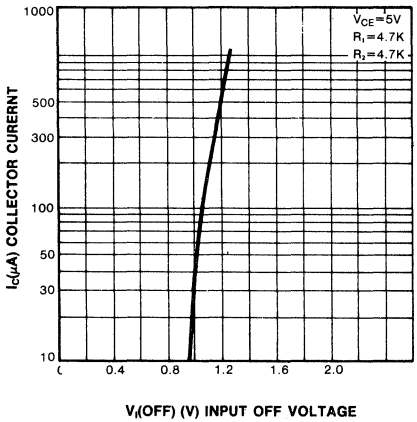


DC CURRENT GAIN

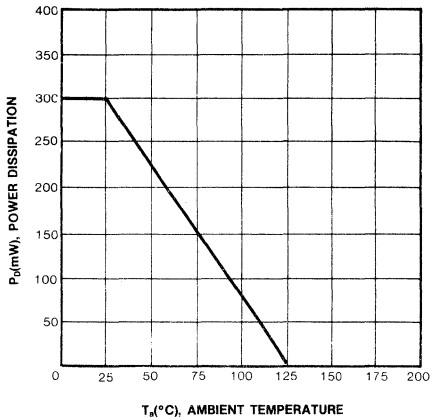


3

INPUT OFF VOLTAGE



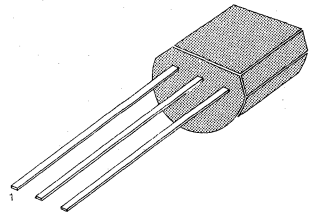
POWER DERATING



SWITCHING APPLICATION (Bias Resistor Built In)

- Switching circuit, Inverter, Interface circuit Driver circuit
- Built in bias Resistor (R_1=10KΩ, R_2=10KΩ)
- Complement to KSR2002

TO-92



1. Emitter 2. Collector 3. Base

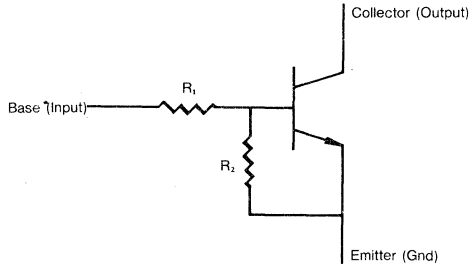
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	50	V
Collector-Emitter Voltage	V_{CEO}	50	V
Emitter-Base Voltage	V_{EBO}	10	V
Collector Current	I_C	100	mA
Collector Dissipation	P_C	300	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ 150	°C

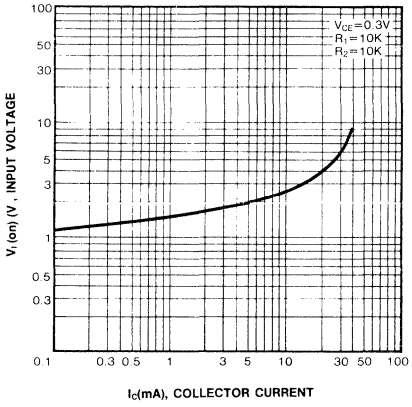
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=10μA, I_E=0	50			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=100μA, I_B=0	50			V
Collector Cutoff Current	I_{CBO}	V_{CB}=40V, I_E=0			0.1	μA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=5mA	30			
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=10mA, I_B=0.5mA			0.3	V
Current Gain-Bandwidth Product	f_T	V_{CE}=5mA, I_C=10V		250		MHz
Output Capacitance	Cob	V_{CB}=10V, I_E=0 f=1.0MHz		3.7		pF
Input Off Voltage	Vi(off)	V_{CE}=5V, I_C=100μA	0.5			V
Input On Voltage	Vi(on)	V_{CE}=0.3V, I_C=10mA			3	V
Input Resistor	R_1		7	10	13	KΩ
Resistor Ratio	R_1/R_2		0.9	1	1.1	

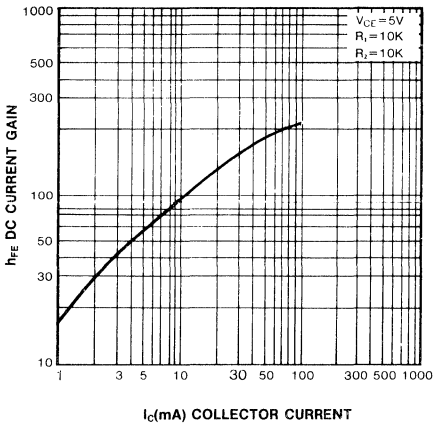
Equivalent Circuit



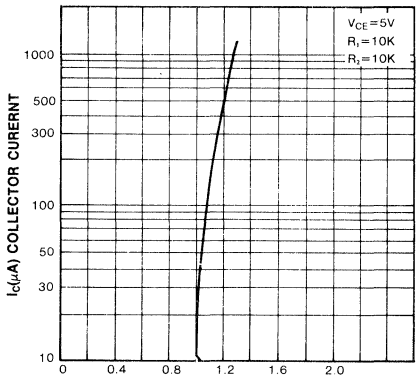
INPUT ON VOLTAGE



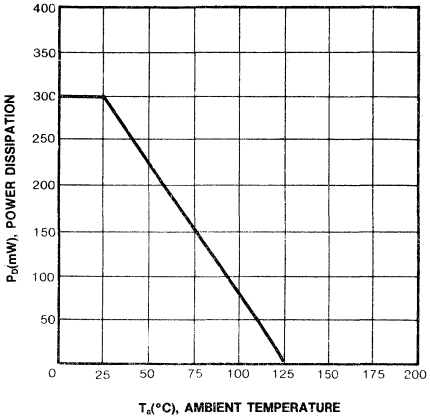
DC CURRENT GAIN



INPUT OFF VOLTAGE



POWER DERATING

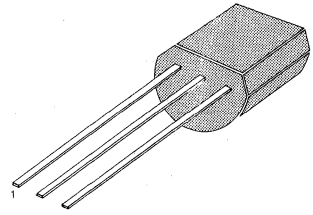


3

SWITCHING APPLICATION (Bias Resistor Built In)

- Switching circuit, Inverter, Interface circuit Driver circuit
- Built in bias Resistor (R_1=22KΩ, R_2=22KΩ)
- Complement to KSR2003

TO-92



1. Emitter 2. Collector 3. Base

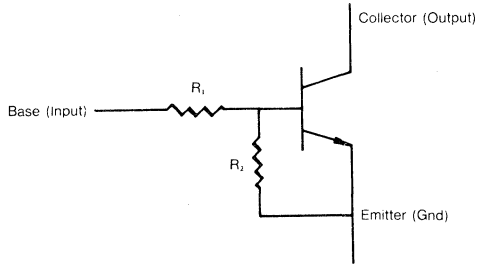
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	50	V
Collector-Emitter Voltage	V_{CEO}	50	V
Emitter-Base Voltage	V_{EBO}	10	V
Collector Current	I_C	100	mA
Collector Dissipation	P_C	300	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

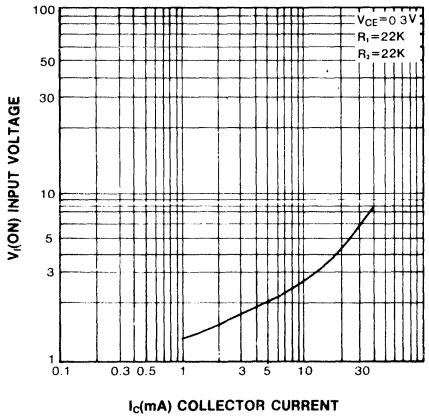
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=10μA, I_E=0	50			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=100μA, I_B=0	50			V
Collector Cutoff Current	I_{CBO}	V_{CB}=40V, I_E=0			0.1	μA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=5mA	56			
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=10mA, I_B=0.5mA			0.3	V
Current Gain-Bandwidth Product	f_T	V_{CE}=5mA, I_C=10V		250		MHz
Output Capacitance	Cob	V_{CB}=10V, I_E=0 f=1.0MHz		3.7		pF
Input Off Voltage	Vi(off)	V_{CE}=5V, I_C=100μA	0.5			V
Input On Voltage	Vi(on)	V_{CE}=0.3V, I_C=5mA			3.0	V
Input Resistor	R_1		15	22	29	KΩ
Resistor Ratio	R_1/R_2		0.9	1	1.1	

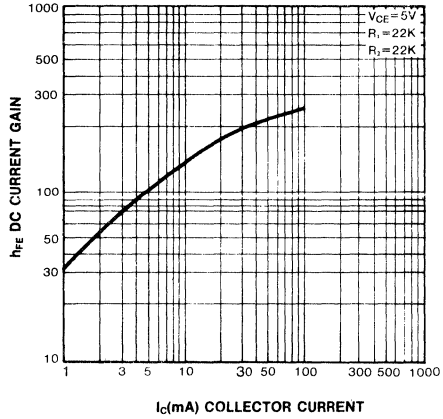
Equivalent Circuit



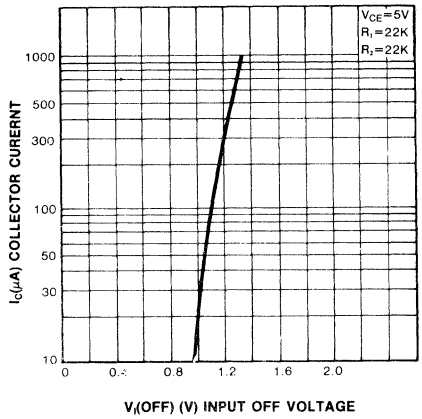
INPUT ON VOLTAGE



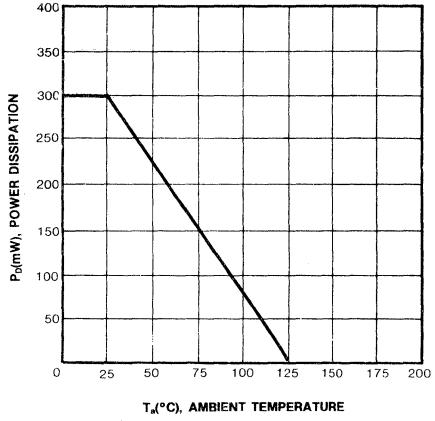
DC CURRENT GAIN



INPUT OFF VOLTAGE



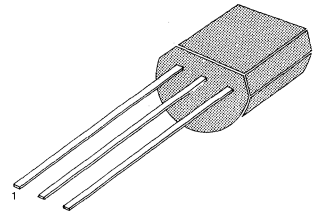
POWER DERATING



SWITCHING APPLICATION (Bias Resistor Built In)

- Switching circuit, Inverter, Interface circuit Driver circuit
- Built in bias Resistor(R_1=47KΩ, R_2=47KΩ)
- Complement to KSR2004

TO-92



1. Emitter 2. Collector 3. Base

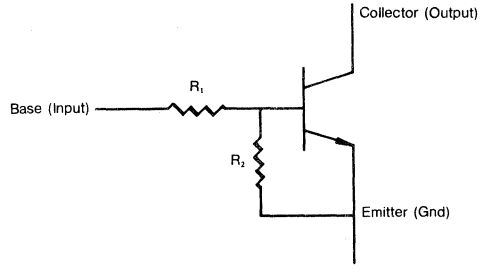
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	50	V
Collector-Emitter Voltage	V_{CEO}	50	V
Emitter-Base Voltage	V_{EBO}	10	V
Collector Current	I_C	100	mA
Collector Dissipation	P_C	300	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ 150	°C

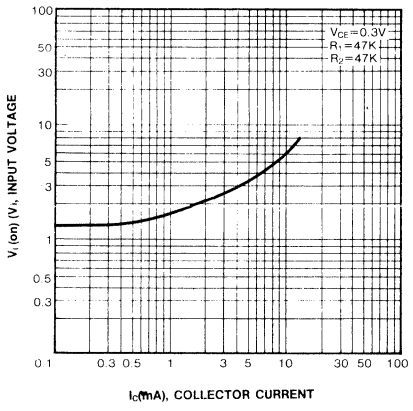
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=10μA, I_E=0	50			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=100μA, I_B=0	50			V
Collector Cutoff Current	I_{CBO}	V_{CB}=40V, I_E=0			0.1	μA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=5mA	68			
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=10mA, I_B=0.5mA			0.3	V
Current Gain-Bandwidth Product	f_T	V_{CE}=5mA, I_C=10V		250		MHz
Output Capacitance	Cob	V_{CB}=10V, I_E=0 f=1.0MHz		3.7		pF
Input Off Voltage	Vi(off)	V_{CE}=5V, I_C=100μA	0.5			V
Input On Voltage	Vi(on)	V_{CE}=0.3V, I_C=2mA			3	V
Input Resistor	R_1		32	47	62	KΩ
Resistor Ratio	R_1/R_2		0.9	1	1.1	

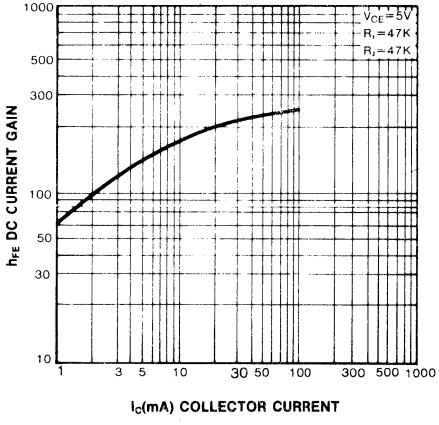
Equivalent Circuit



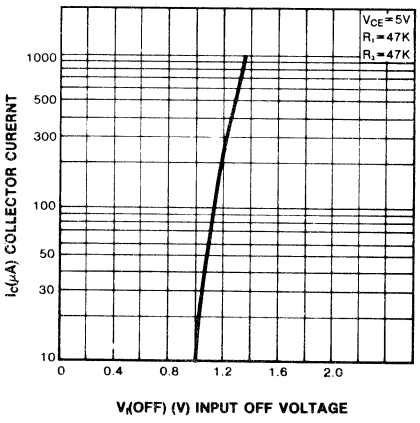
INPUT ON VOLTAGE



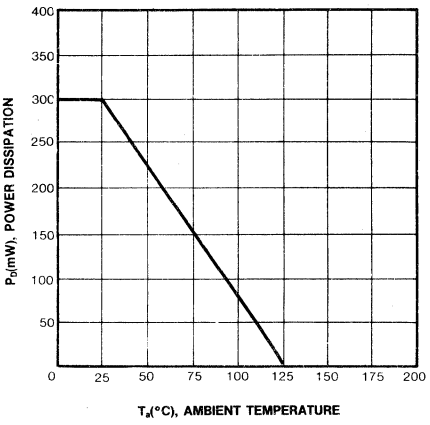
DC CURRENT GAIN



INPUT OFF VOLTAGE



POWER DERATING

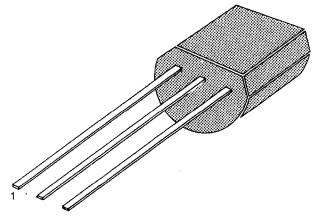


3

SWITCHING APPLICATION (Bias Resistor Built In)

- **Switching Circuit, Inverter, Interface circuit Driver circuit**
- **Built in bias Resistor (R_1=4.7KΩ, R_2=10KΩ)**
- **Complement to KSR2005**

TO-92



1. Emitter 2. Collector 3. Base

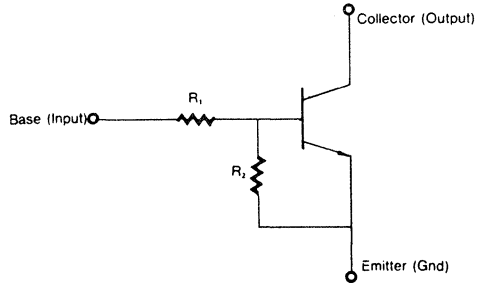
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	50	V
Collector-Emitter Voltage	V_{CEO}	50	V
Emitter-Base Voltage	V_{EBO}	10	V
Collector Current	I_C	100	mA
Collector Dissipation	P_C	300	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

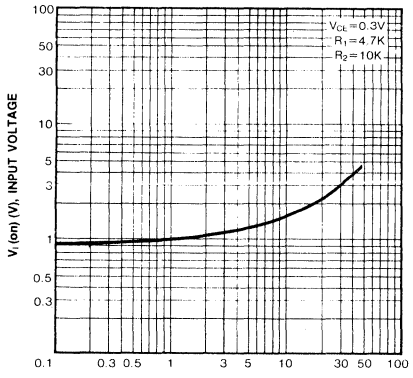
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=10μA, I_E=0	50			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=100μA, I_B=0	50			V
Collector Cutoff Current	I_{CBO}	V_{CB}=40V, I_E=0			0.1	μA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=5mA	30			
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=10mA, I_B=0.5mA			0.3	V
Output Capacitance	Cob	V_{CB}=10V, I_E=0 f=1MHz		3.7		pF
Current Gain-Bandwidth Product	f_T	V_{CE}=10V, I_C=5mA		250		MHz
Input Off Voltage	Vi(off)	V_{CE}=5V, I_C=100μA	0.3			V
Input On Voltage	Vi(on)	V_{CE}=0.3V, I_C=20mA			2.5	V
Input Resistor	R_1		3.2	4.7	6.2	KΩ
Resistor Ratio	R_1/R_2		0.42	0.47	0.52	

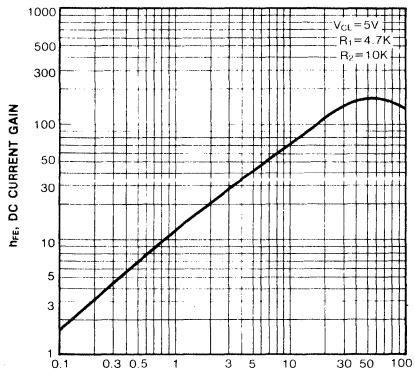
Equivalent Circuit



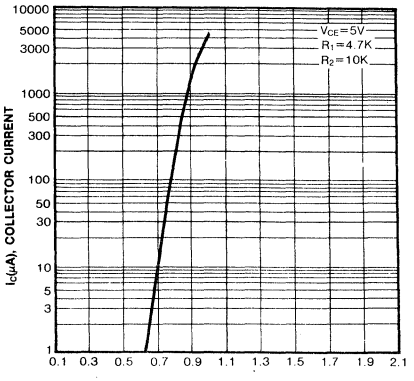
INPUT ON VOLTAGE



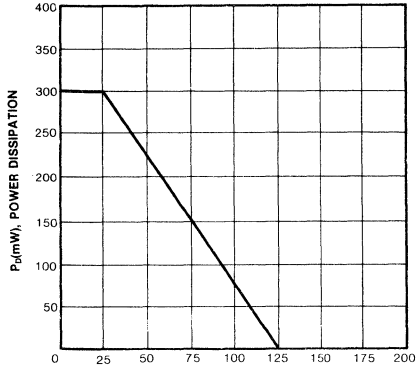
DC CURRENT GAIN



INPUT OFF VOLTAGE



POWER DERATING

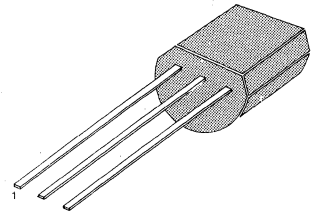


3

SWITCHING APPLICATION (Bias Resistor Built In)

- **Switching Circuit, Inverter, Interface circuit Driver circuit**
- **Built in bias Resistor (R_1=10KΩ, R_2=47KΩ)**
- **Complement to KSR2006**

TO-92



1. Emitter 2. Collector 3. Base

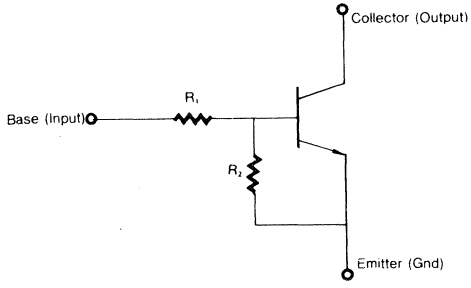
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	50	V
Collector-Emitter Voltage	V_{CEO}	50	V
Emitter-Base Voltage	V_{EBO}	10	V
Collector Current	I_C	100	mA
Collector Dissipation	P_C	300	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

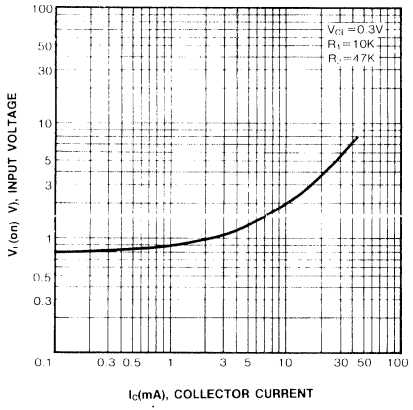
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=10μA, I_E=0	50			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=100μA, I_B=0	50			V
Collector Cutoff Current	I_{CBO}	V_{CB}=40V, I_E=0			0.1	μA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=5mA	68			
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=10mA, I_B=0.5mA			0.3	V
Output Capacitance	Cob	V_{CB}=10V, I_E=0 f=1MHz		3.7		pF
Current Gain-Bandwidth Product	f_T	V_{CE}=10V, I_C=5mA		250		MHz
Input Off Voltage	Vi(off)	V_{CE}=5V, I_C=100μA	0.3			V
Input On Voltage	Vi(on)	V_{CE}=0.3V, I_C=1mA			1.4	V
Input Resistor	R_1		7	10	13	KΩ
Resistor Ratio	R_1/R_2		0.19	0.21	0.24	

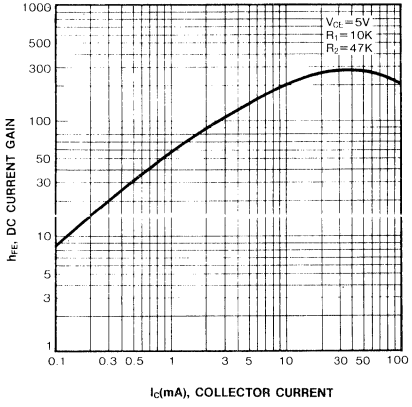
Equivalent Circuit



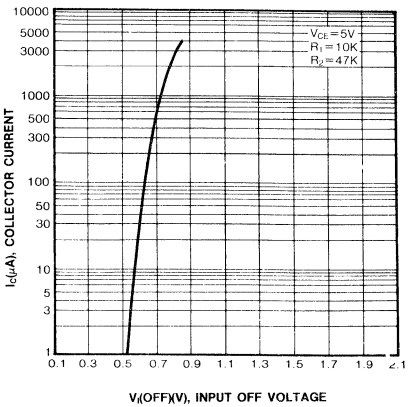
INPUT ON VOLTAGE



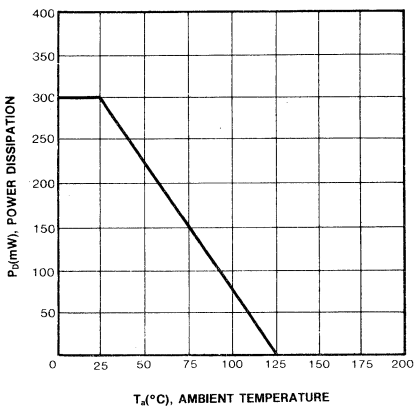
DC CURRENT GAIN



INPUT OFF VOLTAGE



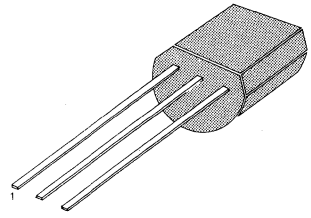
POWER DERATING



SWITCHING APPLICATION (Bias Resistor Built In)

- **Switching Circuit, Inverter, Interface circuit Driver circuit**
- **Built in bias Resistor (R_1=22KΩ, R_2=47KΩ)**
- **Complement to KSR2007**

TO-92



1. Emitter 2. Collector 3. Base

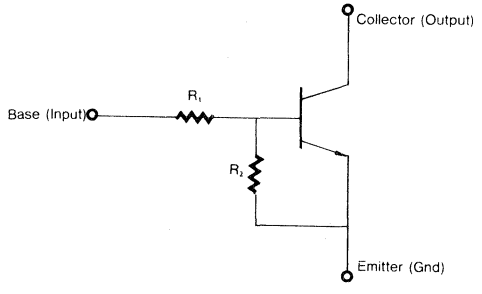
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	50	V
Collector-Emitter Voltage	V_{CEO}	50	V
Emitter-Base Voltage	V_{EBO}	10	V
Collector Current	I_C	100	mA
Collector Dissipation	P_C	300	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ 150	°C

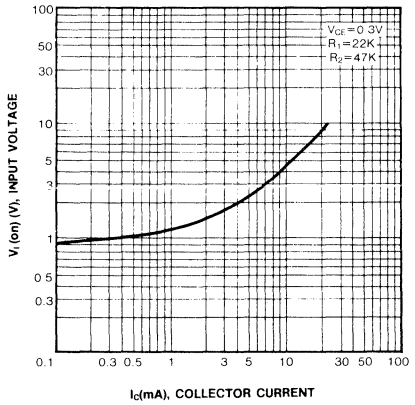
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=10μA, I_E=0	50			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=100μA, I_B=0	50			V
Collector Cutoff Current	I_{CBO}	V_{CB}=40V, I_E=0			0.1	μA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=5mA	68			
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=10mA, I_B=0.5mA			0.3	V
Output Capacitance	Cob	V_{CB}=10V, I_E=0 f=1MHz		3.7		pF
Current Gain-Bandwidth Product	f_T	V_{CE}=5mA, I_C=10V		250		MHz
Input Off Voltage	Vi(off)	V_{CE}=5V, I_C=100μA	0.4			V
Input On Voltage	Vi(on)	V_{CE}=0.3V, I_C=2mA			2.5	V
Input Resistor	R_1		15	22	29	KΩ
Resistor Ratio	R_1/R_2		0.42	0.47	0.52	

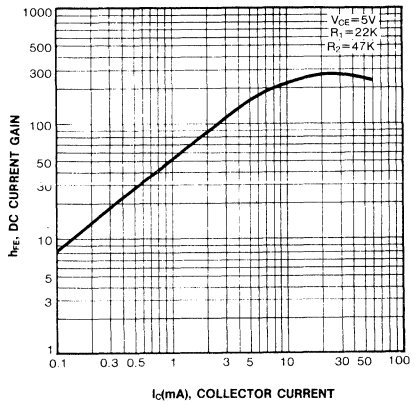
Equivalent Circuit



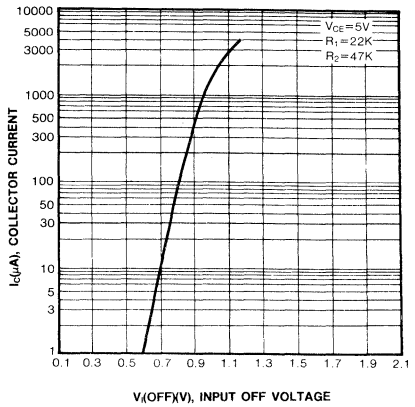
INPUT ON VOLTAGE



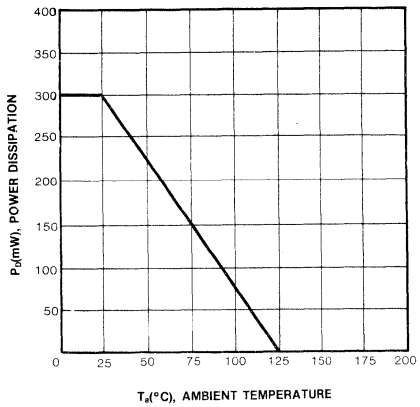
DC CURRENT GAIN



INPUT OFF VOLTAGE



POWER DERATING

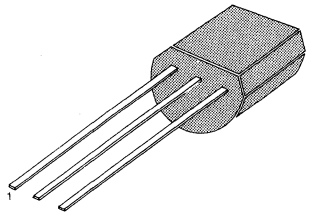


3

SWITCHING APPLICATION (Bias Resistor Built In)

- **Switching circuit, Inverter, Interface circuit Driver circuit**
- **Built in bias Resistor (R_1=47KΩ, R_2=22KΩ)**
- **Complement to KSR2008**

TO-92



1. Emitter 2. Collector 3. Base

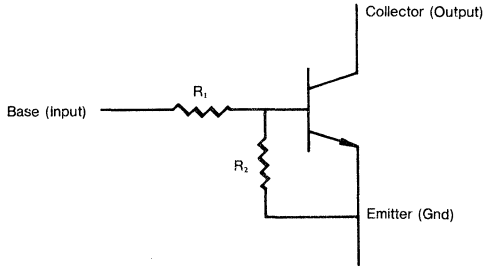
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	50	V
Collector-Emitter Voltage	V_{CEO}	50	V
Emitter-Base Voltage	V_{EBO}	10	V
Collector Current	I_C	100	mA
Collector Dissipation	P_C	300	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ 150	°C

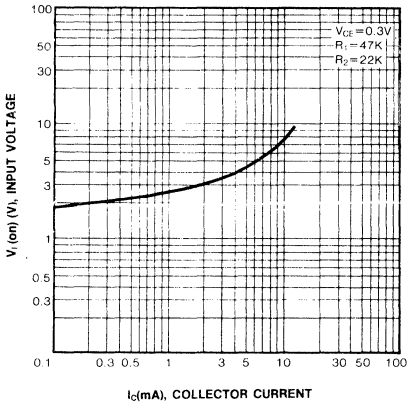
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=10μA, I_E=0	50			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=100μA, I_B=0	50			V
Collector Cutoff Current	I_{CBO}	V_{CB}=40V, I_E=0			0.1	μA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=5mA	56			
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=10mA, I_B=0.5mA			0.3	V
Current Gain-Bandwidth Product	f_T	V_{CE}=5mA, I_C=10V		250		MHz
Output Capacitance	Cob	V_{CB}=10V, I_E=0 f=1.0MHz		3.7		pF
Input Off Voltage	Vi(off)	V_{CE}=5V, I_C=100μA	0.8			V
Input On Voltage	Vi(on)	V_{CE}=0.3V, I_C=2mA			4	V
Input Resistor	R_1		32	47	62	KΩ
Resistor Ratio	R_1/R_2		1.9	2.1	2.4	

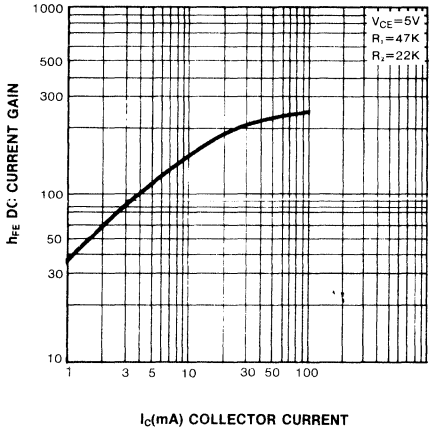
Equivalent Circuit



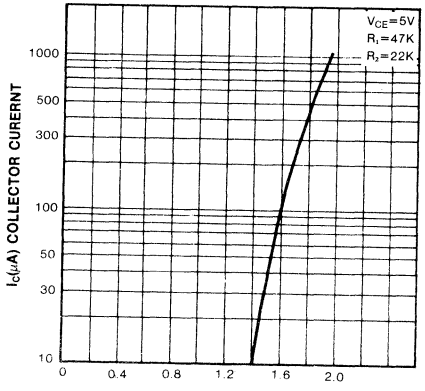
INPUT ON VOLTAGE



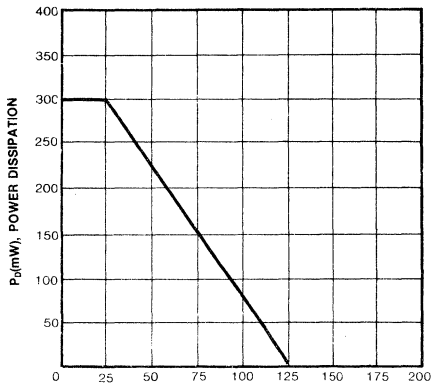
DC CURRENT GAIN



INPUT OFF VOLTAGE



POWER DERATING

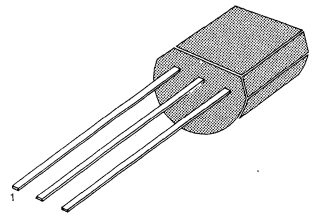


3

SWITCHING APPLICATION (Bias Resistor Built In)

- Switching Circuit, Inverter, Interface circuit
  Driver circuit
- Built in bias Resistor (R=4.7KΩ)
- Complement to KSR2009

TO-92



1. Emitter 2. Collector 3. Base

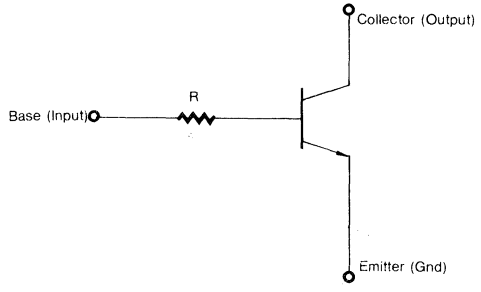
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	40	V
Collector-Emitter Voltage	V_{CEO}	40	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	100	mA
Collector Dissipation	P_C	300	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ 150	°C

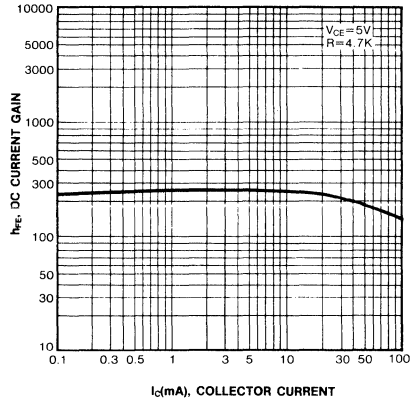
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=100μA, I_E=0	40			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=1mA, I_B=0	40			V
Collector Cutoff Current	I_{CBO}	V_{CB}=30V, I_E=0			0.1	μA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=1mA	100		600	
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=10mA, I_B=1mA			0.3	V
Output Capacitance	Cob	V_{CB}=10V, I_E=0 f=1MHz		3.70		pF
Current Gain-Bandwidth Product	f_T	V_{CE}=10V, I_C=5mA		250		MHz
Input Resistor	R		3.2	4.7	6.2	KΩ

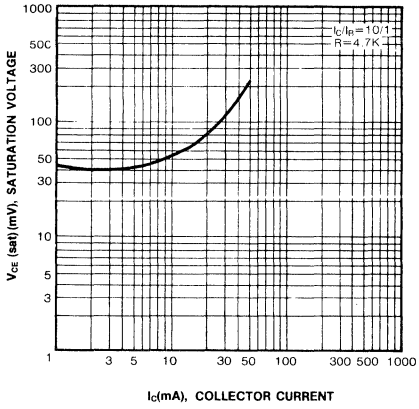
Equivalent Circuit



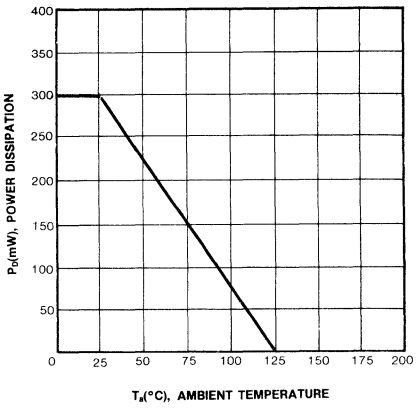
DC CURRENT GAIN



COLLECTOR-EMITTER SATURATION VOLTAGE



POWER DERATING

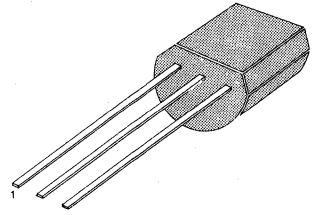


3

SWITCHING APPLICATION (Bias Resistor Built In)

- Switching Circuit, Inverter, Interface circuit Driver circuit
- Built in bias Resistor (R=10KΩ)
- Complement to KSR2010

TO-92



1. Emitter 2. Collector 3. Base

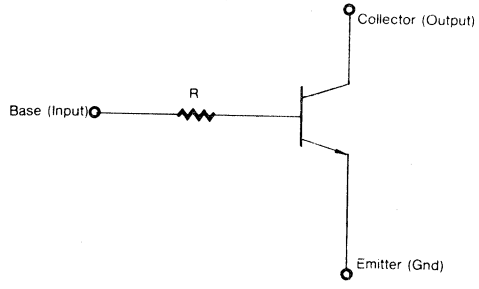
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	40	V
Collector-Emitter Voltage	V_{CEO}	40	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	100	mA
Collector Dissipation	P_C	300	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ 150	°C

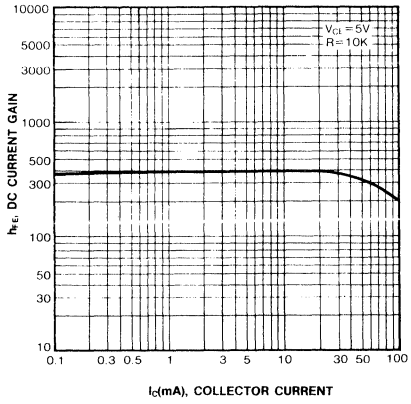
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=100μA, I_E=0	40			V
Emitter-Emitter Breakdown Voltage	BV_{CEO}	I_E=1mA, I_B=0	40			V
Collector Cutoff Current	I_{CBO}	V_{CB}=30V, I_E=0			0.1	μA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=1mA	100		600	
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=10mA, I_B=1mA			0.3	V
Output Capacitance	Cob	V_{CB}=10V, I_E=0 f=1MHz		3.7		pF
Current Gain-Bandwidth Product	f_T	V_{CE}=10V, I_C=5mA		250		MHz
Input Resistor	R		7	10	13	KΩ

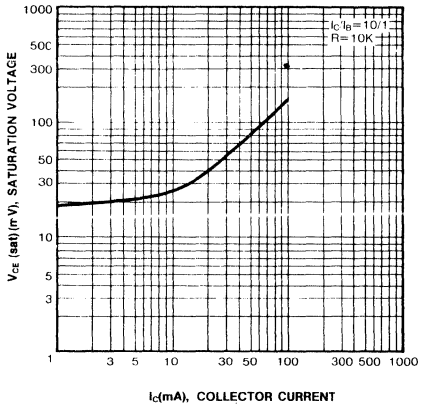
Equivalent Circuit



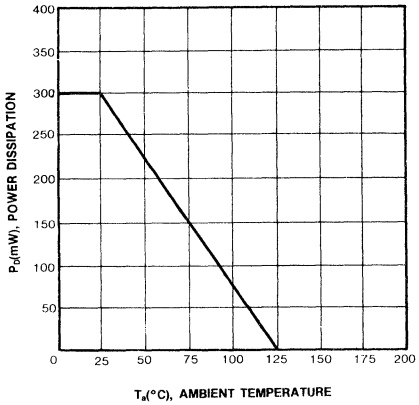
DC CURRENT GAIN



COLLECTOR-EMITTER SATURATION VOLTAGE



POWER DERATING

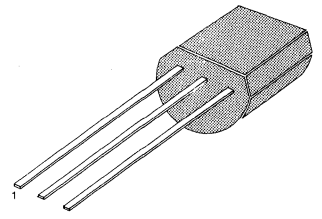


3

SWITCHING APPLICATION (Bias Resistor Built In)

- Switching Circuit, Inverter, Interface circuit Driver circuit
- Built in bias Resistor (R=22KΩ)
- Complement to KSR2011

TO-92



1. Emitter 2. Collector 3. Base

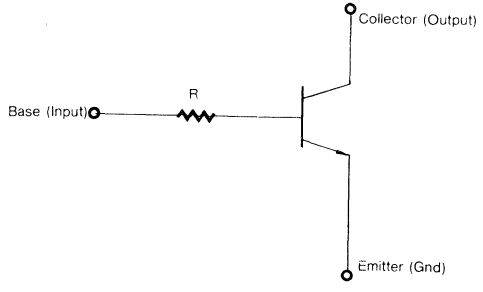
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	40	V
Collector-Emitter Voltage	V_{CEO}	40	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	100	mA
Collector Dissipation	P_C	300	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=100μA, I_E=0	40			V
Emitter-Emitter Breakdown Voltage	BV_{CEO}	I_E=1mA, I_B=0	40			V
Collector Cutoff Current	I_{CBO}	V_{CB}=30V, I_E=0			0.1	μA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=1mA	100		600	
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=10mA, I_B=1mA			0.3	V
Output Capacitance	Cob	V_{CB}=10V, I_E=0 f=1MHz		3.7		pF
Current Gain-Bandwidth Product	f_T	V_{CE}=10V, I_C=5mA		250		MHz
Input Resistor	R		15	22	29	KΩ

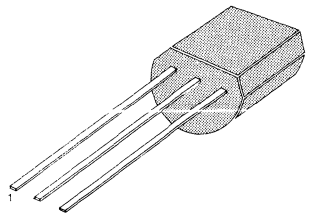
Equivalent Circuit



SWITCHING APPLICATION (Bias Resistor Built In)

- Switching Circuit, Inverter, Interface circuit Driver circuit
- Built in bias Resistor (R=47KΩ)
- Complement to KSR2012

TO-92



1. Emitter 2. Collector 3. Base

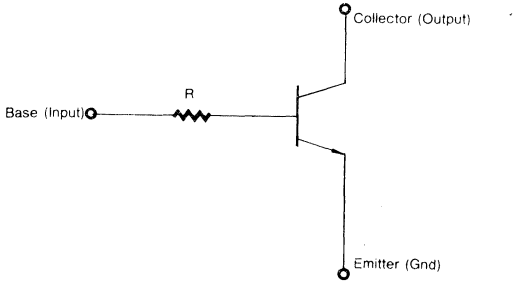
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	40	V
Collector-Emitter Voltage	V_{CEO}	40	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	100	mA
Collector Dissipation	P_C	300	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=100μA, I_E=0	40			V
Emitter-Emitter Breakdown Voltage	BV_{CEO}	I_E=1mA, I_B=0	40			V
Collector Cutoff Current	I_{CBO}	V_{CB}=30V, I_E=0			0.1	μA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=1mA	100		600	
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=10mA, I_B=1mA			0.3	V
Output Capacitance	Cob	V_{CB}=10V, I_E=0 f=1MHz		3.7		pF
Current Gain-Bandwidth Product	f_T	V_{CE}=10V, I_C=5mA		250		MHz
Input Resistor	R		32	47	62	KΩ

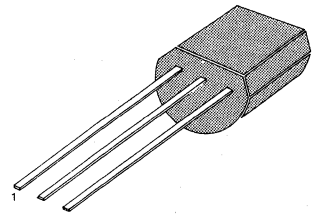
Equivalent Circuit



SWITCHING APPLICATION (Bias Resistor Built In)

- Switching circuit, Inverter, Interface circuit Driver circuit
- Built in bias Resistor(R_1 = 2.2KΩ, R_2 = 47KΩ)
- Complement to KSR2013

TO-92



1. Emitter 2. Collector 3. Base

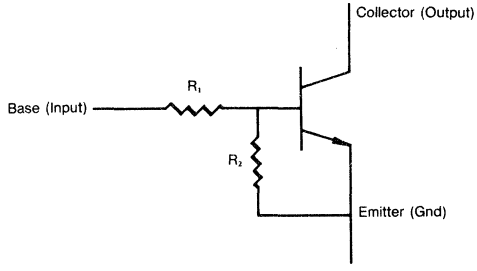
ABSOLUTE MAXIMUM RATINGS (T_a = 25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	50	V
Collector-Emitter Voltage	V_{CEO}	50	V
Emitter-Base Voltage	V_{EBO}	10	V
Collector Current	I_C	100	mA
Collector Dissipation	P_C	300	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ 150	°C

ELECTRICAL CHARACTERISTICS (T_a = 25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CEO}	I_C=10μA, I_E=0	50			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=100μA, I_B=0	50			V
Collector Cutoff Current	I_{CBO}	V_{CB}=40V, I_E=0			0.1	μA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=5mA	68			
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=10mA, I_B=0.5mA			0.3	V
Current Gain-Bandwidth Product	f_T	V_{CE}=5mA, I_C=10V		250		MHz
Output Capacitance	Cob	V_{CB}=10V, I_E=0 f=1.0MHz		3.7		pF
Input Off Voltage	Vi(off)	V_{CE}=5V, I_C=100μA	0.5			V
Input On Voltage	Vi(on)	V_{CE}=0.2V, I_C=5mA			1.1	V
Input Resistor	R_1		1.5	2.2	2.9	KΩ
Resistor Ratio	R_1/R_2		0.042	0.047	0.052	

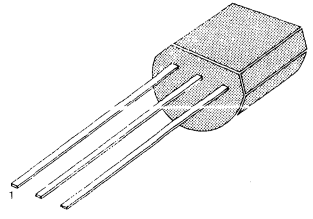
Equivalent Circuit



SWITCHING APPLICATION (Bias Resistor Built In)

- Switching circuit, Inverter, Interface circuit Driver circuit
- Built in bias Resistor(R_1=4.7KΩ, R_2=47KΩ)
- Complement to KSR2014

TO-92



1. Emitter 2. Collector 3. Base

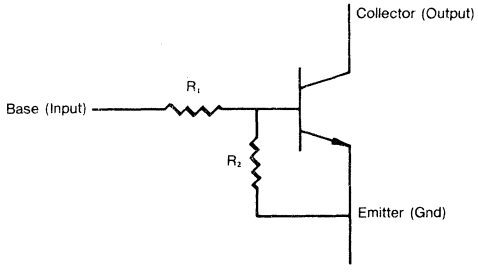
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	50	V
Collector-Emitter Voltage	V_{CEO}	50	V
Emitter-Base Voltage	V_{EBO}	10	V
Collector Current	I_C	100	mA
Collector Dissipation	P_C	300	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CEO}	I_C=10μA, I_E=0	50			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=100μA, I_B=0	50			V
Collector Cutoff Current	I_{CBO}	V_{CB}=40V, I_E=0			0.1	μA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=5mA	68			
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=10mA, I_B=0.5mA			0.3	V
Current Gain-Bandwidth Product	f_T	V_{CE}=5mA, I_C=10V		250		MHz
Output Capacitance	Cob	V_{CB}=10V, I_E=0 f=1.0MHz		3.7		pF
Input Off Voltage	Vi(off)	V_{CE}=5V, I_C=100μA	0.5			V
Input On Voltage	Vi(on)	V_{CE}=0.2V, I_C=5mA			1.3	V
Input Resistor	R_1		3.2	4.7	6.2	KΩ
Resistor Ratio	R_1/R_2		0.09	0.1	0.11	

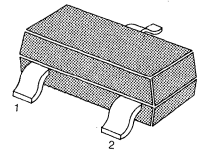
Equivalent Circuit



SWITCHING APPLICATION (Bias Resistor Built In)

- **Switching Circuit, Inverter, Interface circuit Driver circuit**
- **Built in bias Resistor (R_1=4.7KΩ R_2=4.7KΩ)**
- **Complement to KSR2101**

SOT-23



1. Base 2. Emitter 3. Collector

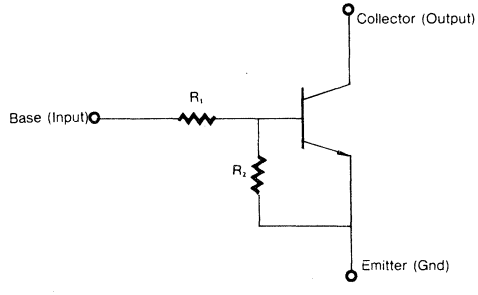
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	50	V
Collector-Emitter Voltage	V_{CEO}	50	V
Emitter-Base Voltage	V_{EBO}	10	V
Collector Current	I_C	100	mA
Collector Dissipation	P_C	200	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

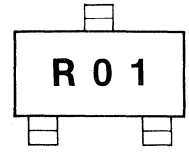
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=10μA, I_E=0	50			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=100μA, I_B=0	50			V
Collector Cutoff Current	I_{CBO}	V_{CB}=40V, I_E=0			0.1	μA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=10mA	20			
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=10mA, I_B=0.5mA			0.3	V
Current Gain-Bandwidth Product	f_T	V_{CE}=5mA, I_C=10V		250		MHz
Output Capacitance	Cob	V_{CB}=10V, I_E=0 f=1.0MHz		3.7		pF
Input Off Voltage	Vi(off)	V_{CE}=5V, I_C=100μA	0.5			V
Input On Voltage	Vi(on)	V_{CE}=0.3V, I_C=20mA			3	V
Input Resistor	R_1		3.2	4.7	6.2	KΩ
Resistor Ratio	R_1/R_2		0.9	1	1.1	

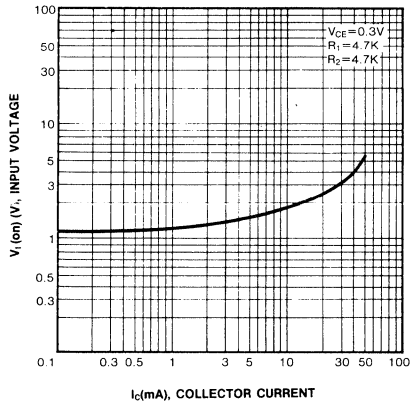
Equivalent Circuit



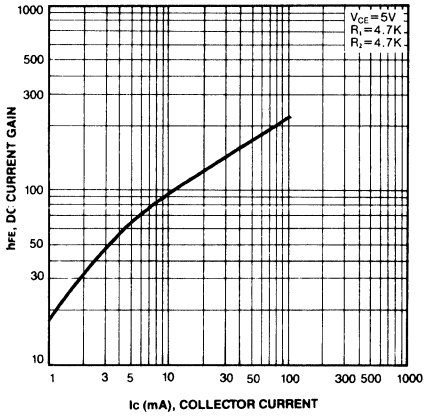
Marking



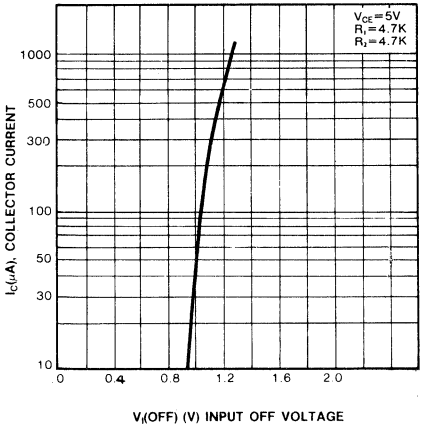
INPUT ON VOLTAGE



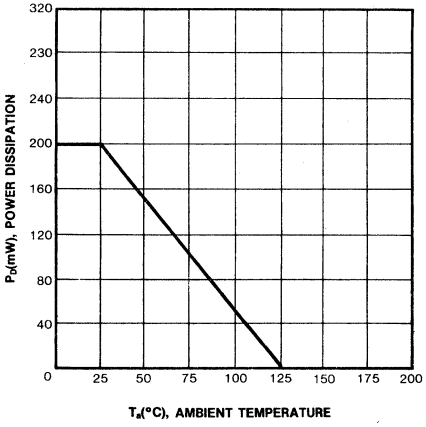
DC CURRENT GAIN



INPUT OFF VOLTAGE



POWER DERATING

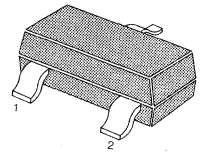


3

SWITCHING APPLICATION (Bias Resistor Built In)

- **Switching Circuit, Inverter, Interface circuit Driver circuit**
- **Built in bias Resistor (R_1=10KΩ, R_2=10KΩ)**
- **Complement to KSR2102**

SOT-23



1. Base 2. Emitter 3. Collector

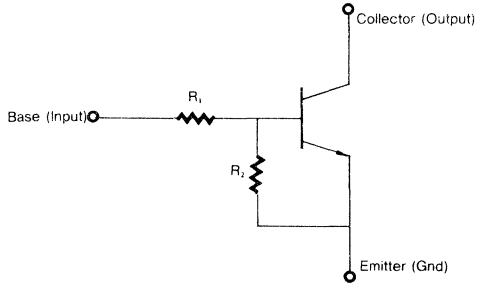
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	50	V
Collector-Emitter Voltage	V_{CEO}	50	V
Emitter-Base Voltage	V_{EBO}	10	V
Collector Current	I_C	100	mA
Collector Dissipation	P_C	200	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

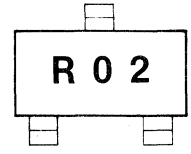
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=10μA, I_E=0	50			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=100μA, I_B=0	50			V
Collector Cutoff Current	I_{CBO}	V_{CB}=40V, I_E=0			0.1	μA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=5mA	30			
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=10mA, I_B=0.5mA			0.3	V
Current Gain-Bandwidth Product	f_T	V_{CE}=5mA, I_C=10V		250		MHz
Output Capacitance	Cob	V_{CB}=10V, I_E=0 f=1.0MHz		3.7		pF
Input Off Voltage	Vi(off)	V_{CE}=5V, I_C=100μA	0.5			V
Input On Voltage	Vi(on)	V_{CE}=0.3V, I_C=10mA			3	V
Input Resistor	R_1		7	10	13	KΩ
Resistor Ratio	R_1/R_2		0.9	1	1.1	

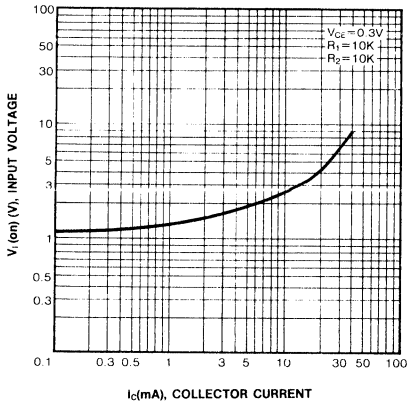
Equivalent Circuit



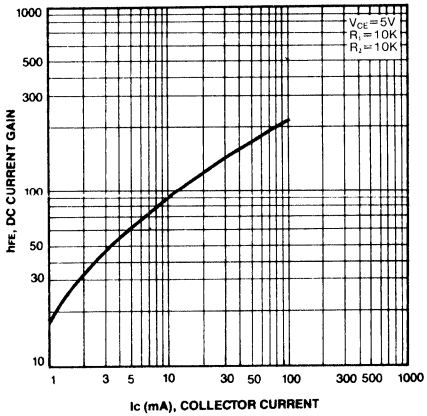
Marking



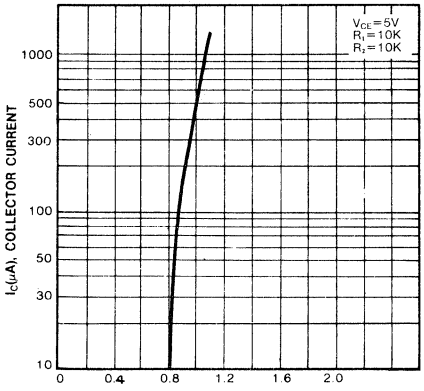
INPUT ON VOLTAGE



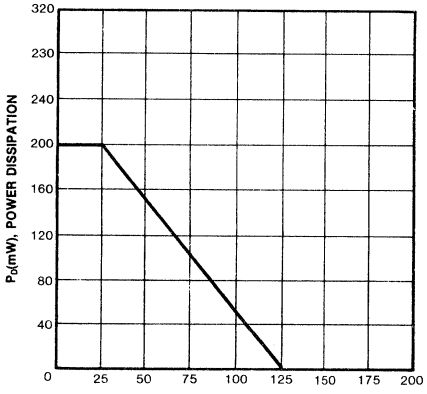
DC CURRENT GAIN



INPUT OFF VOLTAGE



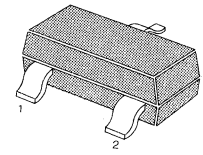
POWER DERATING



SWITCHING APPLICATION (Bias Resistor Built In)

- **Switching Circuit, Inverter, Interface circuit Driver circuit**
- **Built in bias Resistor (R_1=22KΩ, R_2=22KΩ)**
- **Complement to KSR2103**

SOT-23



1. Base 2. Emitter 3. Collector

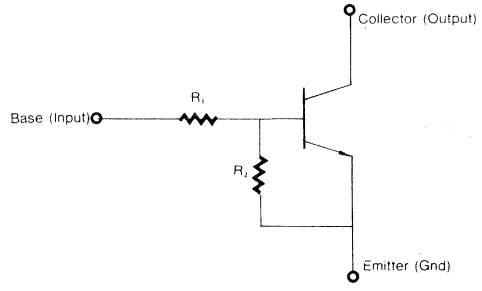
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	50	V
Collector-Emitter Voltage	V_{CEO}	50	V
Emitter-Base Voltage	V_{EBO}	10	V
Collector Current	I_C	100	mA
Collector Dissipation	P_C	200	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

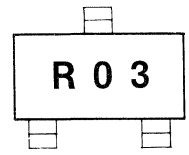
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=10μA, I_E=0	50			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=100μA, I_B=0	50			V
Collector Cutoff Current	I_{CBO}	V_{CB}=40V, I_E=0			0.1	μA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=5mA	56			
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=10mA, I_B=0.5mA			0.3	V
Current Gain-Bandwidth Product	f_T	V_{CE}=5mA, I_C=10V		250		MHz
Output Capacitance	Cob	V_{CB}=10V, I_E=0 f=1.0MHz		3.7		pF
Input Off Voltage	Vi(off)	V_{CE}=5V, I_C=100μA	0.5			V
Input On Voltage	Vi(on)	V_{CE}=0.3V, I_C=5mA			3.0	V
Input Resistor	R_1		15	22	29	KΩ
Resistor Ratio	R_1/R_2		0.9	1	1.1	

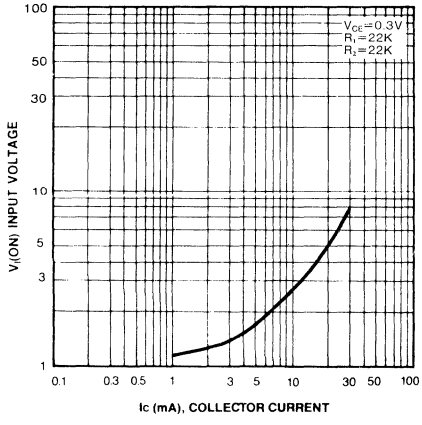
Equivalent Circuit



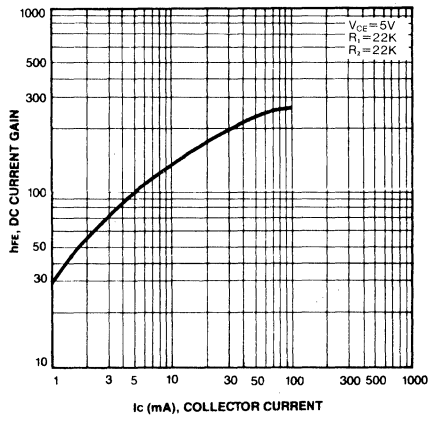
Marking



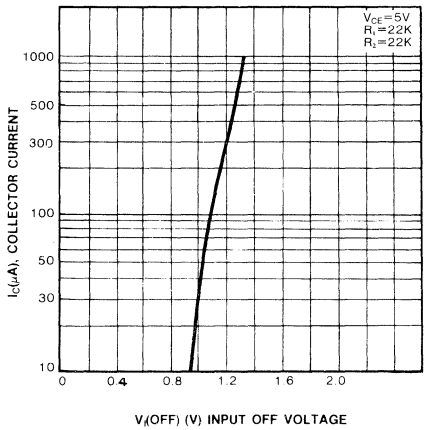
INPUT ON VOLTAGE



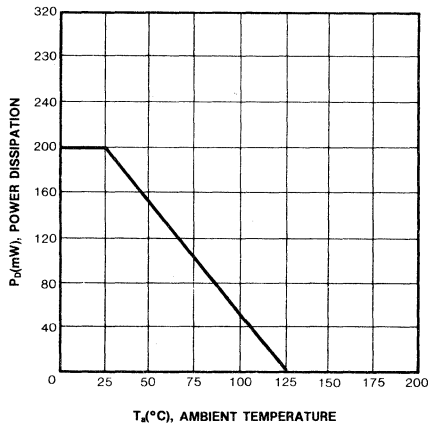
DC CURRENT GAIN



INPUT OFF VOLTAGE



POWER DERATING

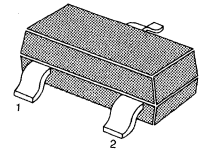


3

SWITCHING APPLICATION (Bias Resistor Built In)

- **Switching Circuit, Inverter, Interface circuit Driver circuit**
- **Built in bias Resistor (R_1=47KΩ, R_2=47KΩ)**
- **Complement to KSR2104**

SOT-23



1. Base 2. Emitter 3. Collector

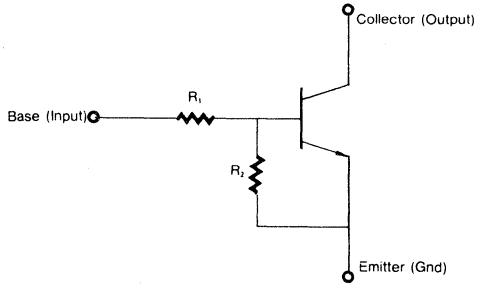
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	50	V
Collector-Emitter Voltage	V_{CEO}	50	V
Emitter-Base Voltage	V_{EBO}	10	V
Collector Current	I_C	100	mA
Collector Dissipation	P_C	200	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

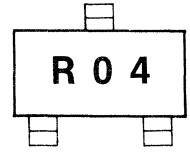
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=10μA, I_E=0	50			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=100μA, I_B=0	50			V
Collector Cutoff Current	I_{CBO}	V_{CB}=40V, I_E=0			0.1	μA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=5mA	68			
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=10mA, I_B=0.5mA			0.3	V
Current Gain-Bandwidth Product	f_T	V_{CE}=5mA, I_C=10V		250		MHz
Output Capacitance	Cob	V_{CB}=10V, I_E=0 f=1.0MHz		3.7		pF
Input Off Voltage	Vi(off)	V_{CE}=5V, I_C=100μA	0.5			V
Input On Voltage	Vi(on)	V_{CE}=0.3V, I_C=2mA			3	V
Input Resistor	R_1		32	47	62	KΩ
Resistor Ratio	R_1/R_2		0.9	1	1.1	

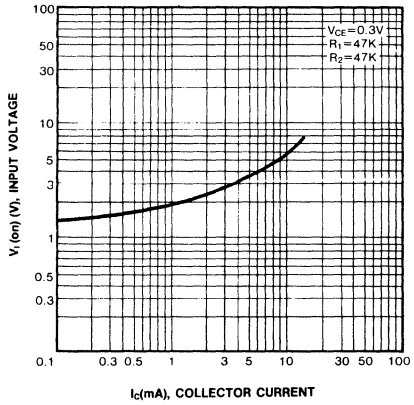
Equivalent Circuit



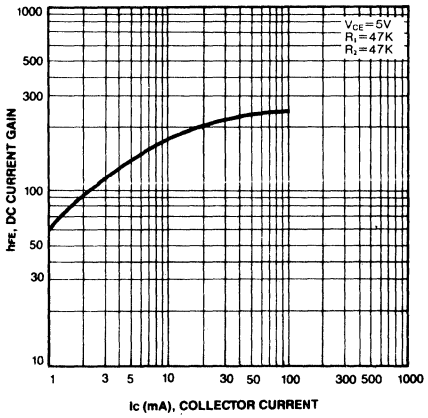
Marking



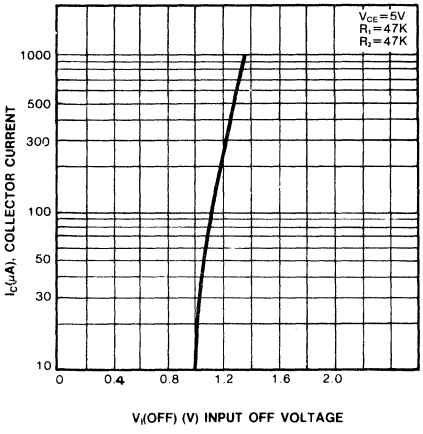
INPUT ON VOLTAGE



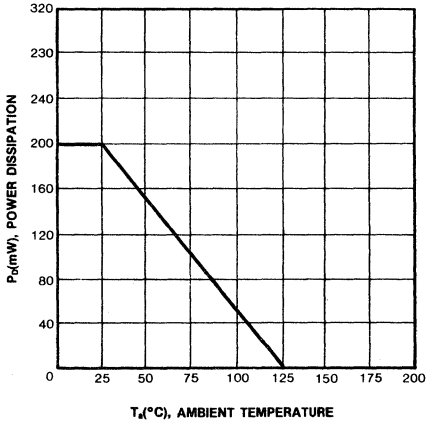
DC CURRENT GAIN



INPUT OFF VOLTAGE



POWER DERATING

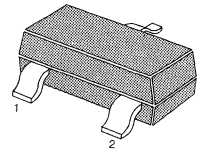


3

SWITCHING APPLICATION (Bias Resistor Built In)

- Switching Circuit, Inverter, Interface circuit Driver circuit
- Built in bias Resistor (R_1=4.7KΩ, R_2=10KΩ)
- Complement to KSR2105

SOT-23



1. Base 2. Emitter 3. Collector

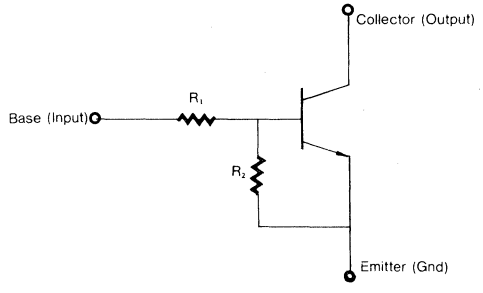
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	50	V
Collector-Emitter Voltage	V_{CEO}	50	V
Emitter-Base Voltage	V_{EBO}	10	V
Collector Current (max)	I_C	100	mA
Collector Dissipation	P_C	200	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

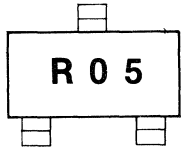
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=10μA, I_E=0	50			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=100μA, I_B=0	50			V
Collector Cutoff Current	I_{CBO}	V_{CB}=40V, I_E=0			0.1	μA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=5mA	30			
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=10mA, I_B=0.5mA			0.3	V
Output Capacitance	Cob	V_{CB}=10V, I_E=0 f=1MHz		3.7		pF
Current Gain-Bandwidth Product	f_T	V_{CE}=10V, I_C=5mA		250		MHz
Input Off Voltage	Vi(off)	V_{CE}=5V, I_C=100μA	0.3			V
Input On Voltage	Vi(on)	V_{CE}=0.3V, I_C=20mA			2.5	V
Input Resistor	R_1		3.2	4.7	6.2	KΩ
Resistor Ratio	R_1/R_2		0.42	0.47	0.52	

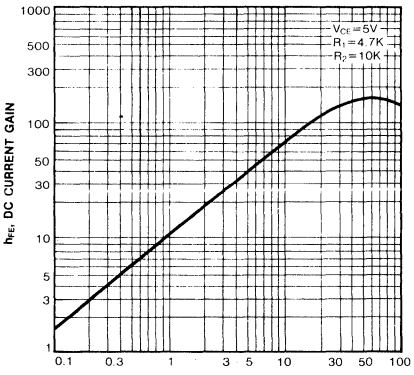
Equivalent Circuit



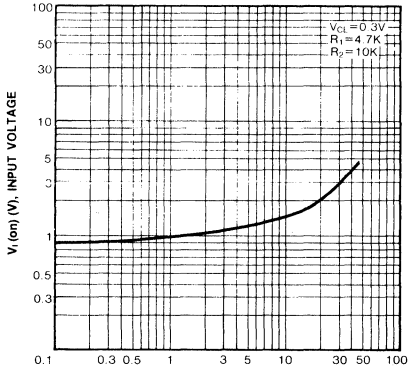
Marking



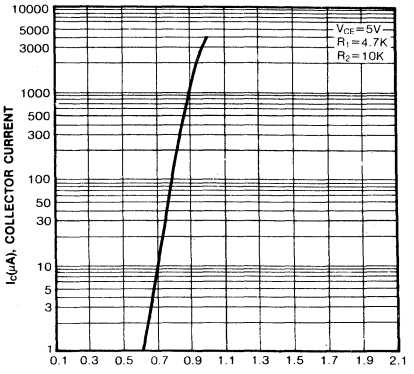
DC CURRENT GAIN



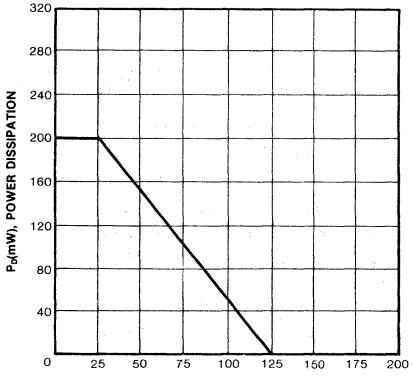
INPUT ON VOLTAGE



INPUT OFF VOLTAGE



POWER DERATING

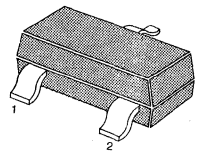


3

SWITCHING APPLICATION (Bias Resistor Built In)

- **Switching Circuit, Inverter, Interface circuit Driver circuit**
- **Built in bias Resistor (R_1=10KΩ, R_2=47KΩ)**
- **Complement to KSR2106**

SOT-23



1. Base 2. Emitter 3. Collector

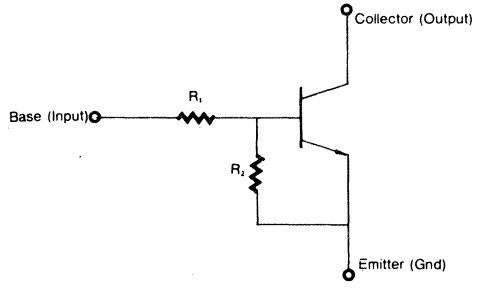
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	50	V
Collector-Emitter Voltage	V_{CEO}	50	V
Emitter-Base Voltage	V_{EBO}	10	V
Collector Current	I_C	100	mA
Collector Dissipation	P_C	200	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

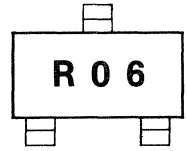
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=10μA, I_E=0	50			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=100μA, I_B=0	50			V
Collector Cutoff Current	I_{CBO}	V_{CB}=40V, I_E=0			0.1	μA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=5mA	68			
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=10mA, I_B=0.5mA			0.3	V
Output Capacitance	Cob	V_{CB}=10V, I_E=0 f=1MHz		3.7		pF
Current Gain-Bandwidth Product	f_T	V_{CE}=10V, I_C=5mA		250		MHz
Input Off Voltage	Vi(off)	V_{CE}=5V, I_C=100μA	0.3			V
Input On Voltage	Vi(on)	V_{CE}=0.3V, I_C=1mA			1.4	V
Input Resistor	R_1		7	10	13	KΩ
Resistor Ratio	R_1/R_2		0.19	0.21	0.24	

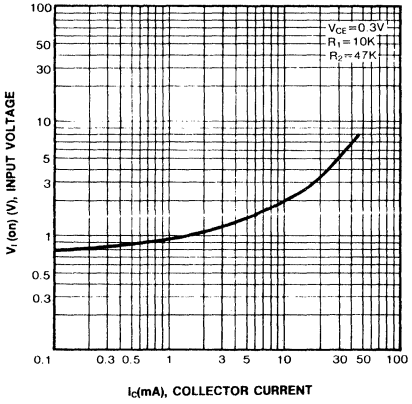
Equivalent Circuit



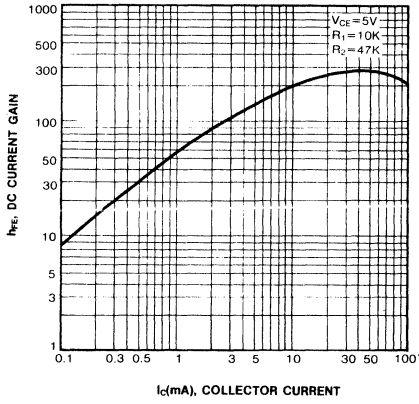
Marking



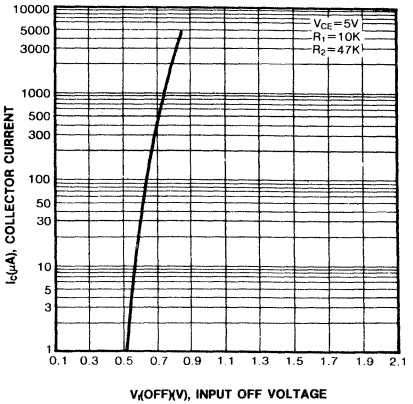
INPUT ON VOLTAGE



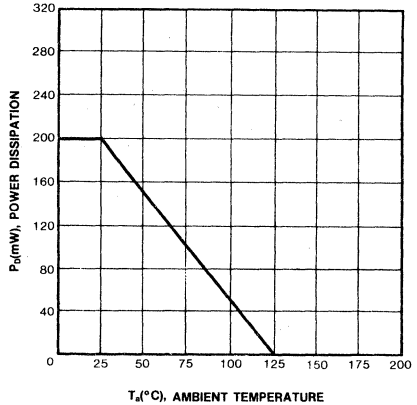
DC CURRENT GAIN



INPUT OFF VOLTAGE



POWER DERATING

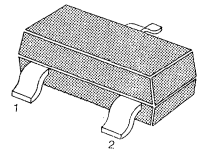


3

SWITCHING APPLICATION (Bias Resistor Built In)

- **Switching Circuit, Inverter, Interface circuit Driver circuit**
- **Built in bias Resistor (R_1=22KΩ, R_2=47KΩ)**
- **Complement to KSR2107**

SOT-23



1. Base 2. Emitter 3. Collector

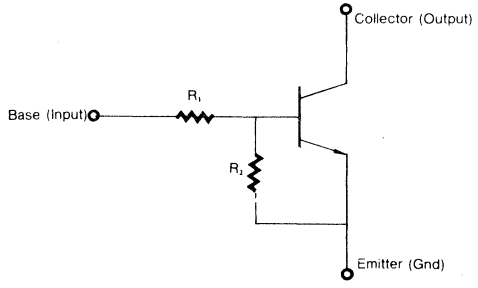
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	50	V
Collector-Emitter Voltage	V_{CEO}	50	V
Emitter-Base Voltage	V_{EBO}	10	V
Collector Current	I_C	100	mA
Collector Dissipation	P_C	200	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ 150	°C

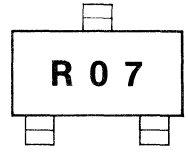
ELECTRICAL CHARACTERISTICS (T_a=25°C)

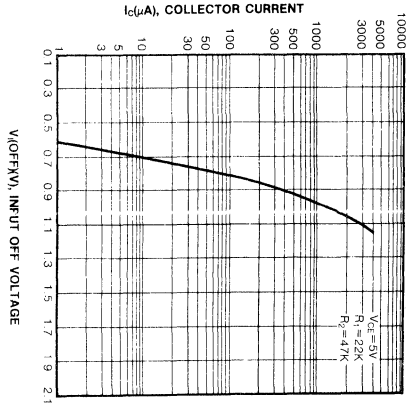
Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=10μA, I_E=0	50			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=100μA, I_B=0	50			V
Collector Cutoff Current	I_{CBO}	V_{CB}=40V, I_E=0			0.1	μA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=5mA	68			
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=10mA, I_B=0.5mA			0.3	V
Output Capacitance	Cob	V_{CB}=10V, I_E=0 f=1MHz		3.7		pF
Current Gain-Bandwidth Product	f_T	V_{CE}=5mA, I_C=10V		250		MHz
Input Off Voltage	Vi(off)	V_{CE}=5V, I_C=100μA	0.4			V
Input On Voltage	Vi(on)	V_{CE}=0.3V, I_C=2mA			2.5	V
Input Resistor	R_1		15	22	29	KΩ
Resistor Ratio	R_1/R_2		0.42	0.47	0.52	

Equivalent Circuit

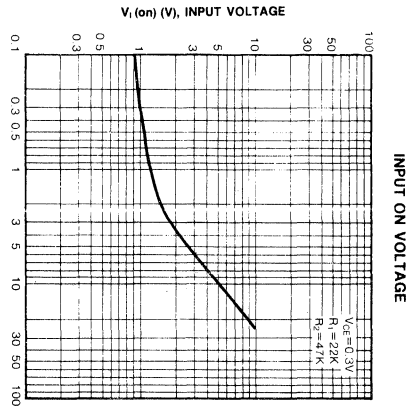


Marking

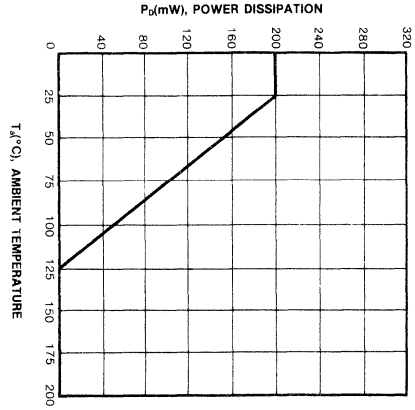




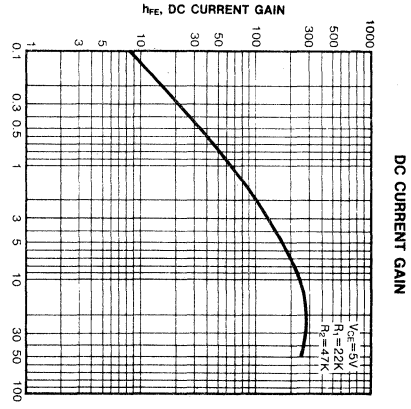
INPUT OFF VOLTAGE



INPUT ON VOLTAGE



POWER DERATING



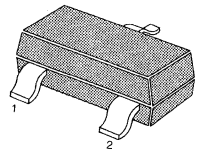
DC CURRENT GAIN

3

SWITCHING APPLICATION (Bias Resistor Built In)

- Switching Circuit, Inverter, Interface circuit
  Driver circuit
- Built in bias Resistor (R_1=47KΩ, R_2=22KΩ)
- Complement to KSR2108

SOT-23



1. Base 2. Emitter 3. Collector

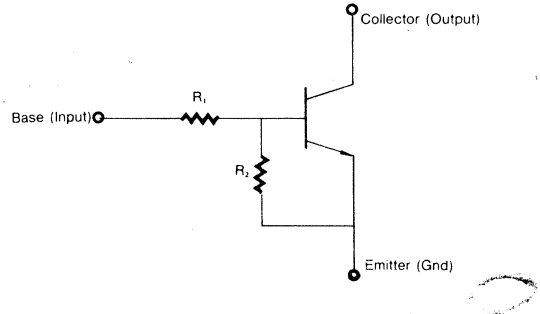
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	50	V
Collector-Emitter Voltage	V_{CEO}	50	V
Emitter-Base Voltage	V_{EBO}	10	V
Collector Current	I_C	100	mA
Collector Dissipation	P_C	200	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

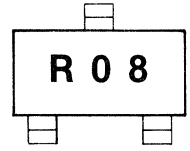
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=10μA, I_E=0	50			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=100μA, I_B=0	50			V
Collector Cutoff Current	I_{CBO}	V_{CB}=40V, I_E=0			0.1	μA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=5mA	56			
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=10mA, I_B=0.5mA			0.3	V
Current Gain-Bandwidth Product	f_T	V_{CE}=5mA, I_C=10V		250		MHz
Output Capacitance	Cob	V_{CB}=10V, I_E=0 f=1.0MHz		3.7		pF
Input Off Voltage	Vi(off)	V_{CE}=5V, I_C=100μA	0.8			V
Input On Voltage	Vi(on)	V_{CE}=0.3V, I_C=2mA			4	V
Input Resistor	R_1		32	47	62	KΩ
Resistor Ratio	R_1/R_2		1.9	2.1	2.4	

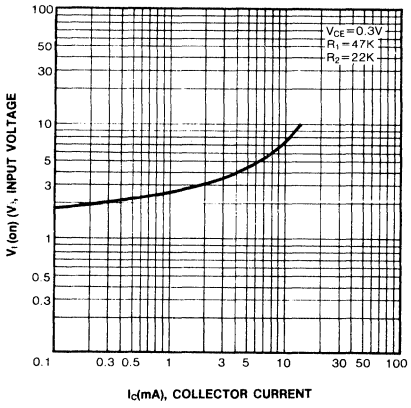
Equivalent Circuit



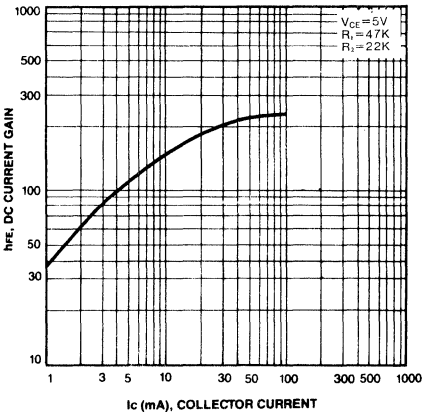
Marking



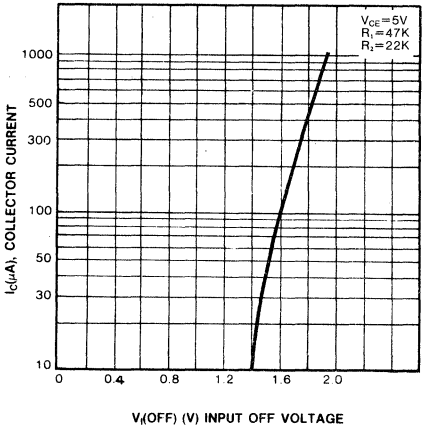
INPUT ON VOLTAGE



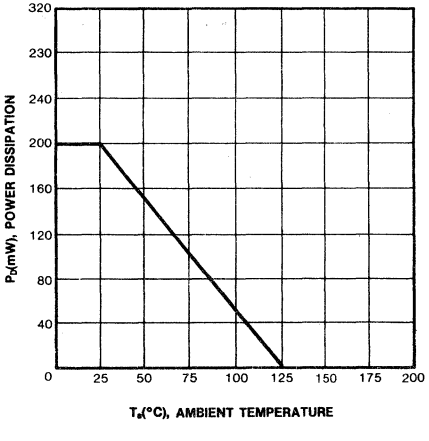
DC CURRENT GAIN



INPUT OFF VOLTAGE



POWER DERATING

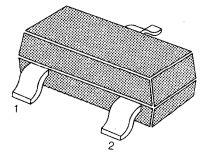


3

SWITCHING APPLICATION (Bias Resistor Built In)

- **Switching Circuit, Inverter, Interface circuit Driver circuit**
- **Built in bias Resistor (R=4.7KΩ)**
- **Complement to KSR2109**

SOT-23



1. Base 2. Emitter 3. Collector

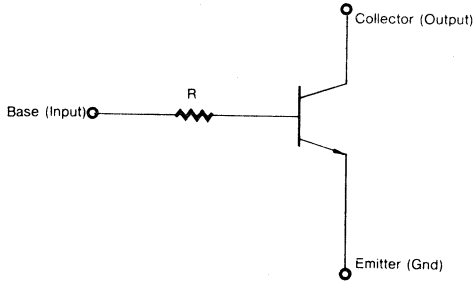
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	40	V
Collector-Emitter Voltage	V_{CEO}	40	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	100	mA
Collector Dissipation	P_C	200	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

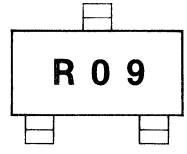
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=100μA, I_E=0	40			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=1mA, I_B=0	40			V
Collector Cutoff Current	I_{CBO}	V_{CB}=30V, I_E=0			0.1	μA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=1mA	100		600	
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=10mA, I_B=1mA			0.3	V
Output Capacitance	Cob	V_{CB}=10V, I_E=0 f=1MHz		3.70		pF
Current Gain-Bandwidth Product	f_T	V_{CE}=10V, I_C=5mA		250		MHz
Input Resistor	R		3.2	4.7	6.2	KΩ

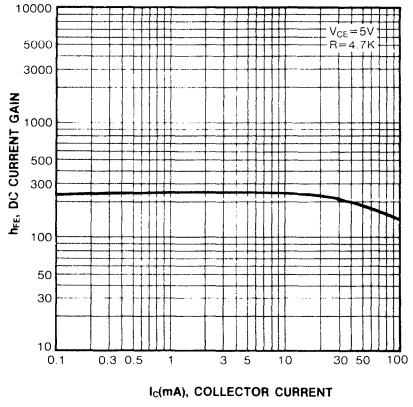
Equivalent Circuit



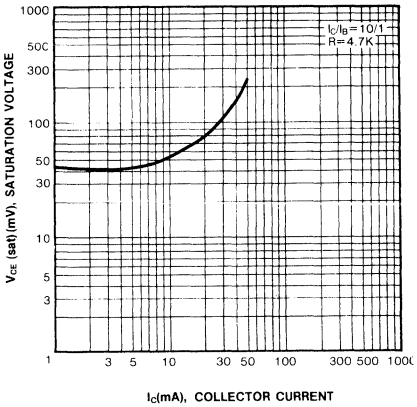
Marking



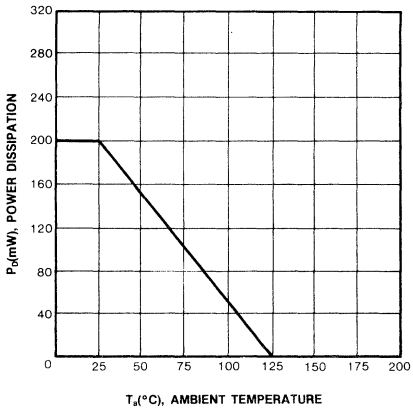
DC CURRENT GAIN



COLLECTOR-EMITTER SATURATION VOLTAGE



POWER DERATING

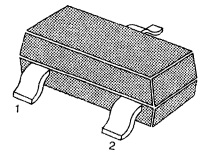


3

SWITCHING APPLICATION (Bias Resistor Built In)

- **Switching Circuit, Inverter, Interface circuit Driver circuit**
- **Built in bias Resistor (R=10KΩ)**
- **Complement to KSR2110**

SOT-23



1. Base 2. Emitter 3. Collector

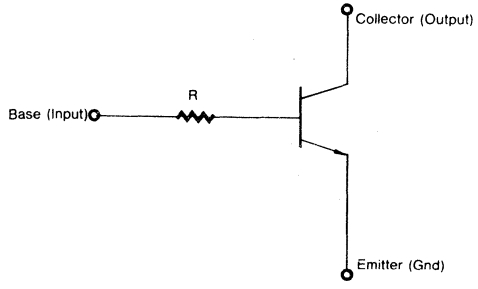
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	40	V
Collector-Emitter Voltage	V_{CEO}	40	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	100	mA
Collector Dissipation	P_C	200	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

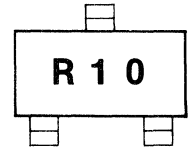
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=100μA, I_E=0	40			V
Emitter-Emitter Breakdown Voltage	BV_{CEO}	I_E=1mA, I_B=0	40			V
Collector Cutoff Current	I_{CBO}	V_{CB}=30V, I_E=0			0.1	μA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=1mA	100		600	
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=10mA, I_B=1mA			0.3	V
Output Capacitance	Cob	V_{CB}=10V, I_E=0 f=1MHz		3.7		pF
Current Gain-Bandwidth Product	f_T	V_{CE}=10V, I_C=5mA		250		MHz
Input Resistor	R		7	10	13	KΩ

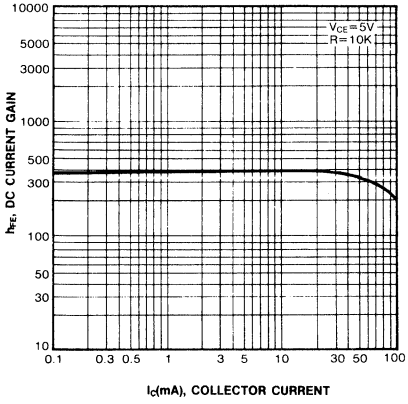
Equivalent Circuit



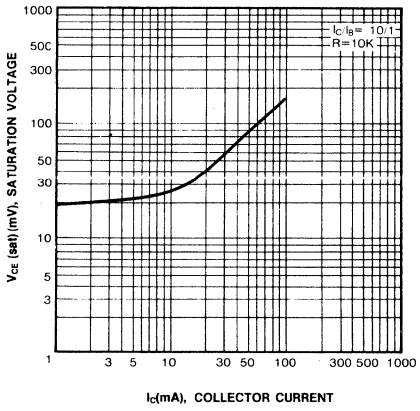
Marking



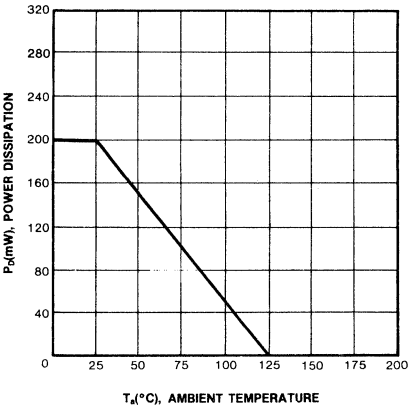
DC CURRENT GAIN



COLLECTOR-EMITTER SATURATION VOLTAGE



POWER DERATING

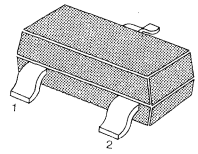


3

SWITCHING APPLICATION (Bias Resistor Built In)

- Switching Circuit, Inverter, Interface circuit
  Driver circuit
- Built in bias Resistor (R=22KΩ)
- Complement to KSR2111

SOT-23



1. Base 2. Emitter 3. Collector

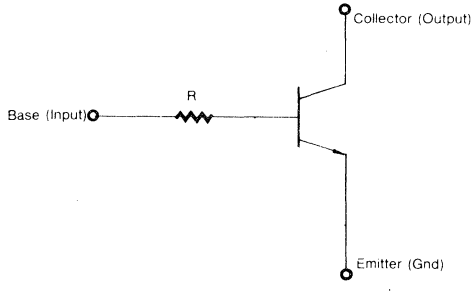
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	40	V
Collector-Emitter Voltage	V_{CEO}	40	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	100	mA
Collector Dissipation	P_C	200	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

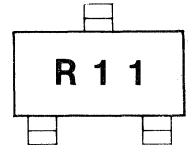
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=100μA, I_E=0	40			V
Emitter-Emitter Breakdown Voltage	BV_{CEO}	I_E=1mA, I_B=0	40			V
Collector Cutoff Current	I_{CBO}	V_{CB}=30V, I_E=0			0.1	μA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=1mA	100		600	
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=10mA, I_B=1mA			0.3	V
Output Capacitance	Cob	V_{CB}=10V, I_E=0 f=1MHz		3.7		pF
Current Gain-Bandwidth Product	f_T	V_{CE}=10V, I_C=5mA		250		MHz
Input Resistor	R		15	22	29	KΩ

Equivalent Circuit



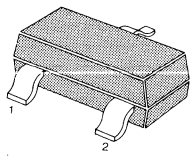
Marking



SWITCHING APPLICATION (Bias Resistor Built In)

- Switching Circuit, Inverter, Interface circuit Driver circuit
- Built in bias Resistor (R=47KΩ)
- Complement to KSR2112

SOT-23



1. Base 2. Emitter 3. Collector

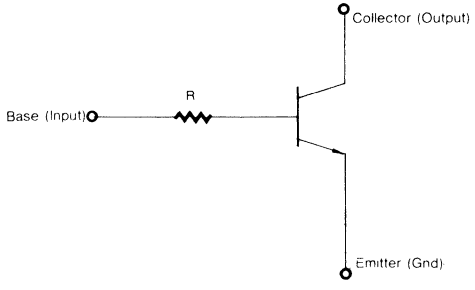
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	40	V
Collector-Emitter Voltage	V_{CEO}	40	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	100	mA
Collector Dissipation	P_C	200	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

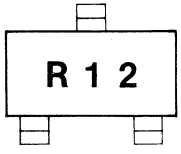
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=100μA, I_E=0	40			V
Emitter-Emitter Breakdown Voltage	BV_{CEO}	I_E=1mA, I_B=0	40			V
Collector Cutoff Current	I_{CBO}	V_{CB}=30V, I_E=0			0.1	μA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=1mA	100		600	
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=10mA, I_B=1mA			0.3	V
Output Capacitance	Cob	V_{CB}=10V, I_E=0 f=1MHz		3.7		pF
Current Gain-Bandwidth Product	f_T	V_{CE}=10V, I_C=5mA		250		MHz
Input Resistor	R		32	47	62	KΩ

Equivalent Circuit



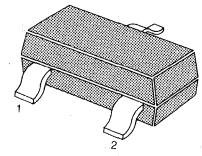
Marking



SWITCHING APPLICATION (Bias Resistor Built In)

- Switching circuit, Inverter, Interface circuit Driver circuit
- Built in bias Resistor(R_1=2.2KΩ, R_2=47KΩ)
- Complement to KSR2113

SOT-23



1. Base 2. Emitter 3. Collector

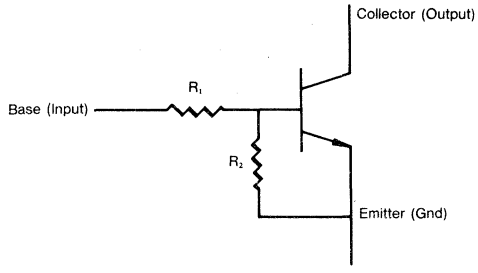
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	50	V
Collector-Emitter Voltage	V_{CEO}	50	V
Emitter-Base Voltage	V_{EBO}	10	V
Collector Current	I_C	100	mA
Collector Dissipation	P_C	300	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

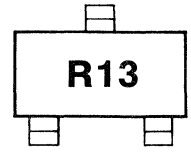
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CEO}	I_C=10μA, I_E=0	50			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=100μA, I_B=0	50			V
Collector Cutoff Current	I_{CBO}	V_{CB}=40V, I_E=0			0.1	μA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=5mA	68			
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=10mA, I_B=0.5mA			0.3	V
Current Gain-Bandwidth Product	f_T	V_{CE}=5mA, I_C=10V		250		MHz
Output Capacitance	Cob	V_{CB}=10V, I_E=0 f=1.0MHz		3.7		pF
Input Off Voltage	Vi(off)	V_{CE}=5V, I_C=100μA	0.5			V
Input On Voltage	Vi(on)	V_{CE}=0.2V, I_C=5mA			1.1	V
Input Resistor	R_1		1.5	2.2	2.9	KΩ
Resistor Ratio	R_1/R_2		0.042	0.047	0.052	

Equivalent Circuit



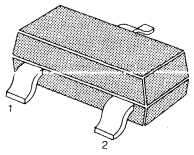
Marking



SWITCHING APPLICATION (Bias Resistor Built In)

- Switching circuit, Inverter, Interface circuit Driver circuit
- Built in bias Resistor(R_1=4.7KΩ, R_2=47KΩ)
- Complement to KSR2114

SOT-23



1. Base 2. Emitter 3. Collector

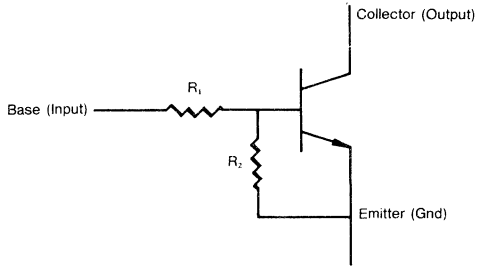
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	50	V
Collector-Emitter Voltage	V_{CEO}	50	V
Emitter-Base Voltage	V_{EBO}	10	V
Collector Current	I_C	100	mA
Collector Dissipation	P_C	300	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ 150	°C

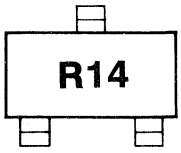
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CEO}	I_C=10μA, I_E=0	50			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=100μA, I_B=0	50			V
Collector Cutoff Current	I_{CBO}	V_{CB}=40V, I_E=0			0.1	μA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=5mA	68			
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=10mA, I_B=0.5mA			0.3	V
Current Gain-Bandwidth Product	f_T	V_{CE}=5mA, I_C=10V		250		MHz
Output Capacitance	Cob	V_{CB}=10V, I_E=0 f=1.0MHz		3.7		pF
Input Off Voltage	Vi(off)	V_{CE}=5V, I_C=100μA	0.5			V
Input On Voltage	Vi(on)	V_{CE}=0.2V, I_C=5mA			1.3	V
Input Resistor	R_1		3.2	4.7	6.2	KΩ
Resistor Ratio	R_1/R_2		0.09	0.1	0.11	

Equivalent Circuit



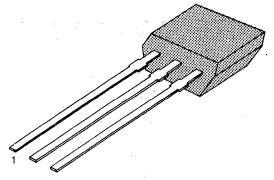
Marking



SWITCHING APPLICATION (Bias Resistor Built In)

- Switching circuit, Inverter, Interface circuit Driver circuit
- Built in bias Resistor (R_1=4.7KΩ, R_2=4.7KΩ)
- Complement to KSR2201

TO-92S



1. Emitter 2. Collector 3. Base

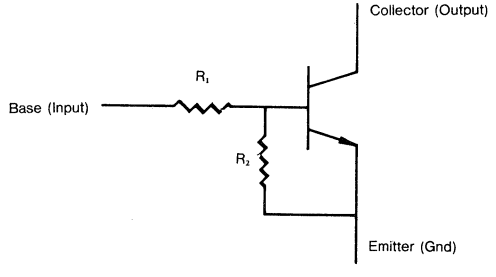
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	50	V
Collector-Emitter Voltage	V_{CEO}	50	V
Emitter-Base Voltage	V_{EBO}	10	V
Collector Current	I_C	100	mA
Collector Dissipation	P_C	300	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

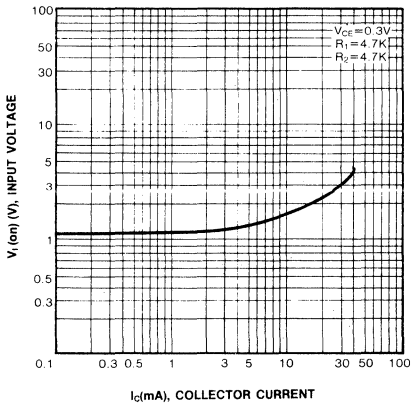
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CEO}	I_C=10μA I_E=0	50			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=100μA, I_B=0	50			V
Collector Cutoff Current	I_{CBO}	V_{CB}=40V, I_E=0			0.1	μA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=10mA	20			
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=10mA, I_B=0.5mA			0.3	V
Current Gain-Bandwidth Product	f_T	V_{CE}=5mA, I_C=10V		250		MHz
Output Capacitance	Cob	V_{CB}=10V, I_E=0 f=1.0MHz		3.7		pF
Input Off Voltage	Vi(off)	V_{CE}=5V, I_C=100μA	0.5			V
Input On Voltage	Vi(on)	V_{CE}=0.3V, I_C=20mA			3	V
Input Resistor	R_1		3.2	4.7	6.2	KΩ
Resistor Ratio	R_1/R_2		0.9	1	1.1	

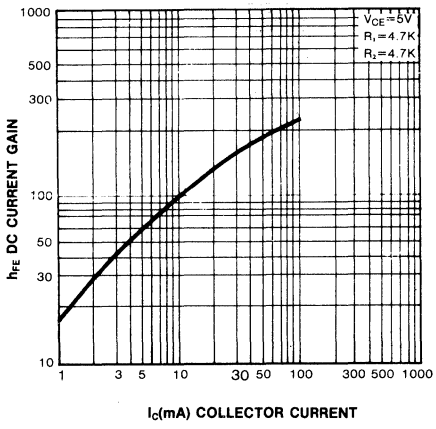
Equivalent Circuit



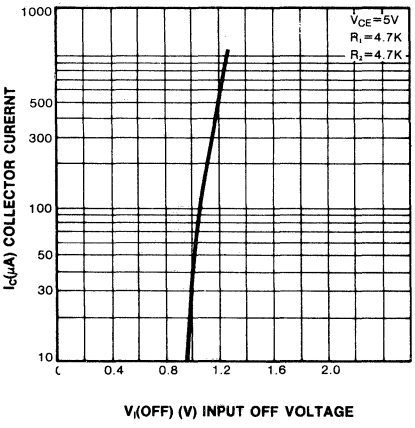
INPUT ON VOLTAGE



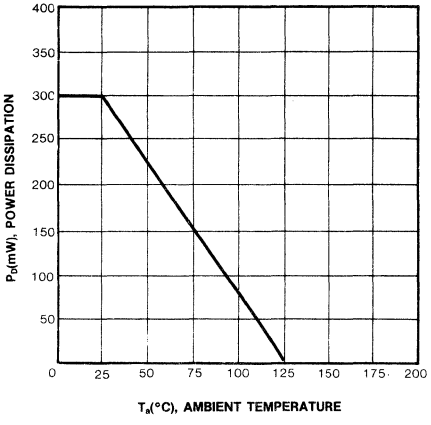
DC CURRENT GAIN



INPUT OFF VOLTAGE



POWER DERATING

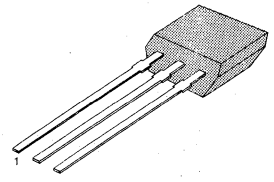


3

SWITCHING APPLICATION (Bias Resistor Built In)

- Switching circuit, Inverter, Interface circuit Driver circuit
- Built in bias Resistor (R_1=10KΩ, R_2=10KΩ)
- Complement to KSR2202

TO-92S



1. Emitter 2. Collector 3. Base

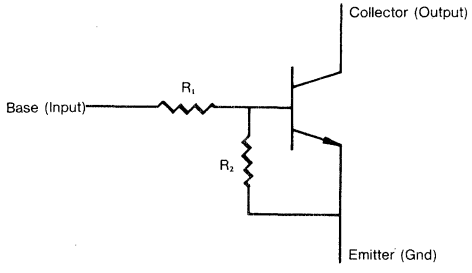
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	50	V
Collector-Emitter Voltage	V_{CEO}	50	V
Emitter-Base Voltage	V_{EBO}	10	V
Collector Current	I_C	100	mA
Collector Dissipation	P_C	300	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

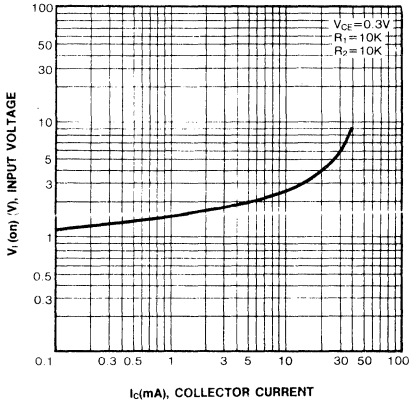
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CEO}	I_C=10μA, I_E=0	50			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=100μA, I_B=0	50			V
Collector Cutoff Current	I_{CBO}	V_{CB}=40V, I_E=0			0.1	μA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=5mA	30			
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=10mA, I_B=0.5mA			0.3	V
Current Gain-Bandwidth Product	f_T	V_{CE}=5mA, I_C=10V		250		MHz
Output Capacitance	Cob	V_{CB}=10V, I_E=0 f=1.0MHz		3.7		pF
Input Off Voltage	Vi(off)	V_{CE}=5V, I_C=100μA	0.5			V
Input On Voltage	Vi(on)	V_{CE}=0.3V, I_C=10mA			3	V
Input Resistor	R_1		7	10	13	KΩ
Resistor Ratio	R_1/R_2		0.9	1	1.1	

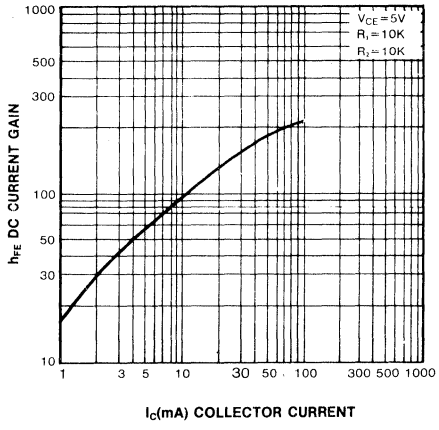
Equivalent Circuit



INPUT ON VOLTAGE

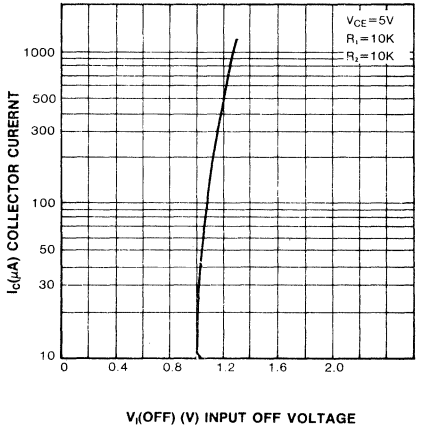


DC CURRENT GAIN

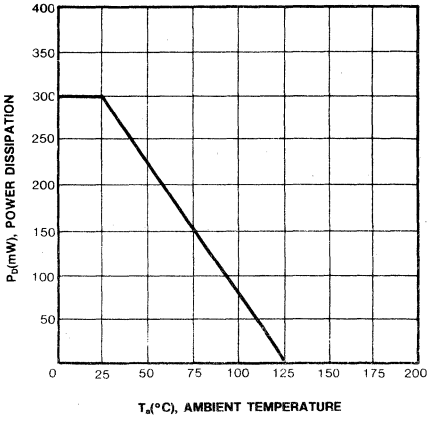


3

INPUT OFF VOLTAGE



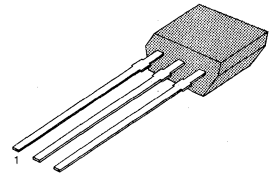
POWER DERATING



SWITCHING APPLICATION (Bias Resistor Built In)

- Switching circuit, Inverter, Interface circuit Driver circuit
- Built in bias Resistor (R_1=22KΩ, R_2=22KΩ)
- Complement to KSR2203

TO-92S



1. Emitter 2. Collector 3. Base

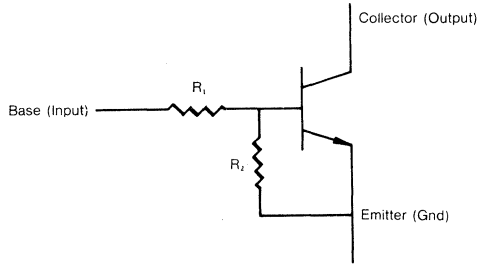
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	50	V
Collector-Emitter Voltage	V_{CEO}	50	V
Emitter-Base Voltage	V_{EBO}	10	V
Collector Current	I_C	100	mA
Collector Dissipation	P_C	300	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

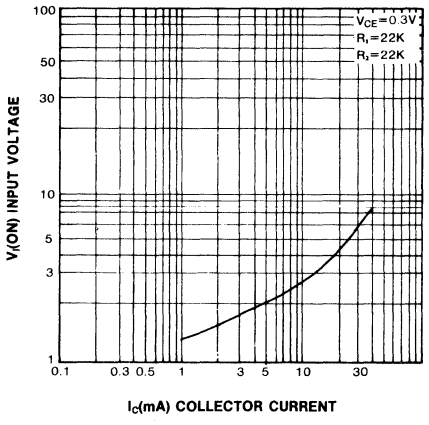
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CEO}	I_C=10μA, I_E=0	50			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=100μA, I_B=0	50			V
Collector Cutoff Current	I_{CBO}	V_{CB}=40V, I_E=0			0.1	μA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=5mA	56			
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=10mA, I_B=0.5mA			0.3	V
Current Gain-Bandwidth Product	f_T	V_{CE}=5mA, I_C=10V		250		MHz
Output Capacitance	Cob	V_{CB}=10V, I_E=0 f=1.0MHz		3.7		pF
Input Off Voltage	Vi(off)	V_{CE}=5V, I_C=100μA	0.5			V
Input On Voltage	Vi(on)	V_{CE}=0.3V, I_C=5mA			3.0	V
Input Resistor	R_1		15	22	29	KΩ
Resistor Ratio	R_1/R_2		0.9	1	1.1	

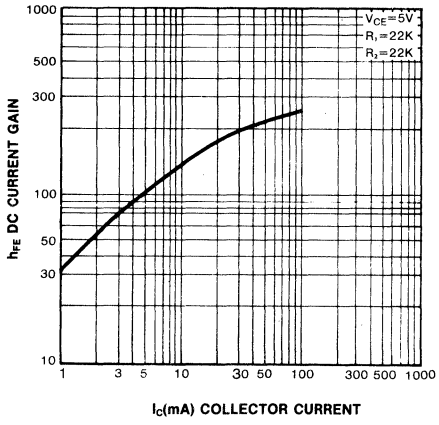
Equivalent Circuit



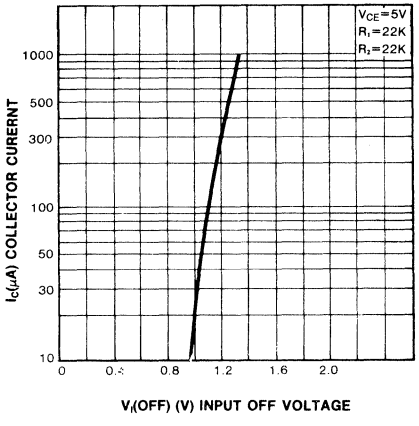
INPUT ON VOLTAGE



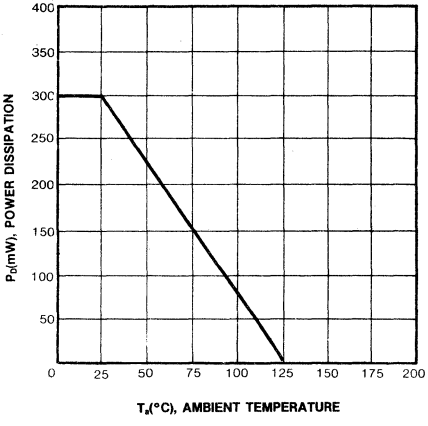
DC CURRENT GAIN



INPUT OFF VOLTAGE



POWER DERATING

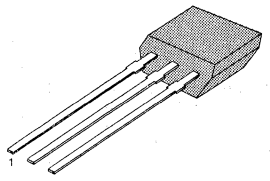


3

SWITCHING APPLICATION (Bias Resistor Built In)

- Switching circuit, Inverter, Interface circuit Driver circuit
- Built in bias Resistor(R_1=47KΩ, R_2=47KΩ)
- Complement to KSR2204

TO-92S



1. Emitter 2. Collector 3. Base

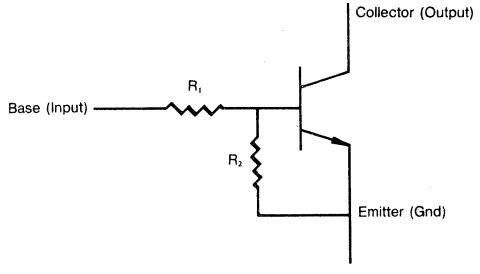
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	50	V
Collector-Emitter Voltage	V_{CEO}	50	V
Emitter-Base Voltage	V_{EBO}	10	V
Collector Current	I_C	100	mA
Collector Dissipation	P_C	300	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

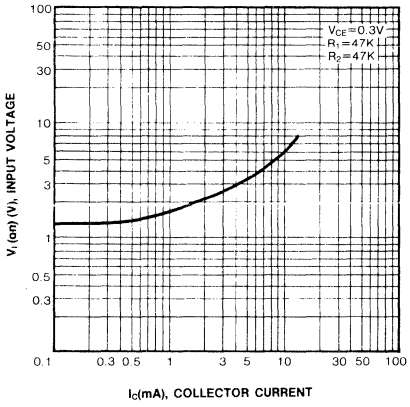
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CEO}	I_C=10μA, I_E=0	50			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=100μA, I_B=0	50			V
Collector Cutoff Current	I_{CBO}	V_{CB}=40V, I_E=0			0.1	μA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=5mA	68			
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=10mA, I_B=0.5mA			0.3	V
Current Gain-Bandwidth Product	f_T	V_{CE}=5mA, I_C=10V		250		MHz
Output Capacitance	Cob	V_{CB}=10V, I_E=0 f=1.0MHz		3.7		pF
Input Off Voltage	Vi(off)	V_{CE}=5V, I_C=100μA	0.5			V
Input On Voltage	Vi(on)	V_{CE}=0.3V, I_C=2mA			3	V
Input Resistor	R_1		32	47	62	KΩ
Resistor Ratio	R_1/R_2		0.9	1	1.1	

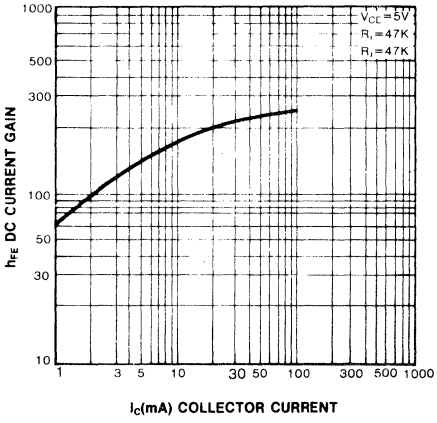
Equivalent Circuit



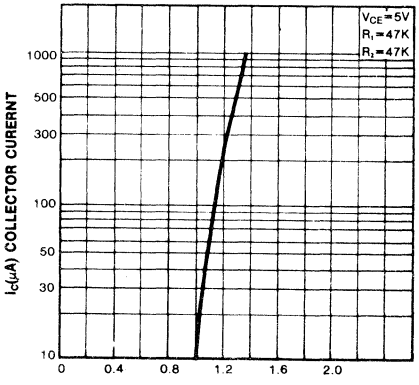
INPUT ON VOLTAGE



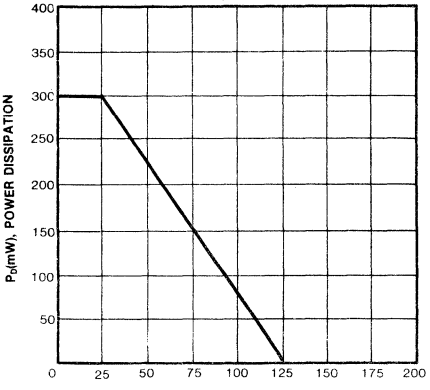
DC CURRENT GAIN



INPUT OFF VOLTAGE



POWER DERATING

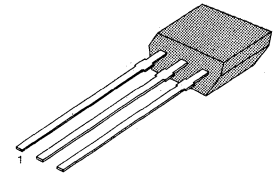


3

SWITCHING APPLICATION (Bias Resistor Built In)

- **Switching Circuit, Inverter, Interface circuit Driver circuit**
- **Built in bias Resistor (R_1=4.7KΩ, R_2=10KΩ)**
- **Complement to KSR2205**

TO-92S



1. Emitter 2. Collector 3. Base

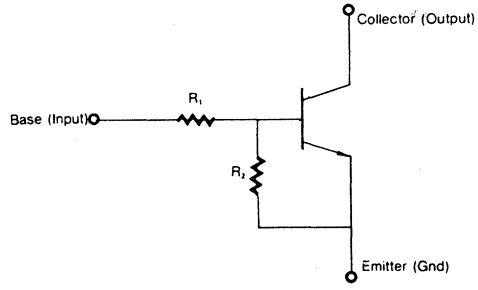
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	50	V
Collector-Emitter Voltage	V_{CEO}	50	V
Emitter-Base Voltage	V_{EBO}	10	V
Collector Current	I_C	100	mA
Collector Dissipation	P_C	300	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

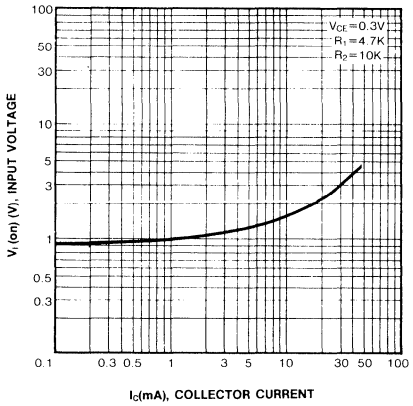
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CEO}	I_C=10μA, I_E=0	50			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=100μA, I_B=0	50			V
Collector Cutoff Current	I_{CBO}	V_{CB}=40V, I_E=0			0.1	μA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=5mA	30			
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=10mA, I_B=0.5mA			0.3	V
Output Capacitance	Cob	V_{CB}=10V, I_E=0 f=1MHz		3.7		pF
Current Gain-Bandwidth Product	f_T	V_{CE}=10V, I_C=5mA		250		MHz
Input Off Voltage	Vi(off)	V_{CE}=5V, I_C=100μA	0.3			V
Input On Voltage	Vi(on)	V_{CE}=0.3V, I_C=20mA			2.5	V
Input Resistor	R_1		3.2	4.7	6.2	KΩ
Resistor Ratio	R_1/R_2		0.42	0.47	0.52	

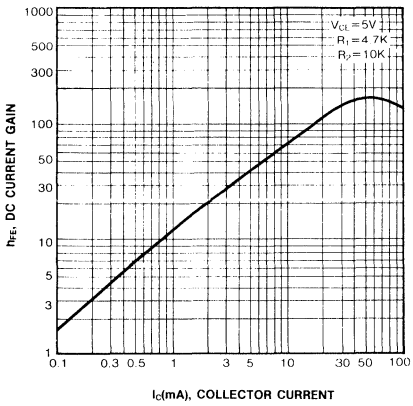
Equivalent Circuit



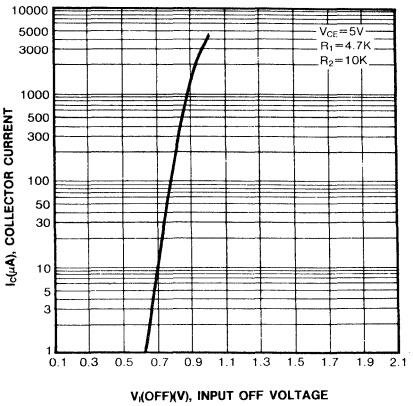
INPUT ON VOLTAGE



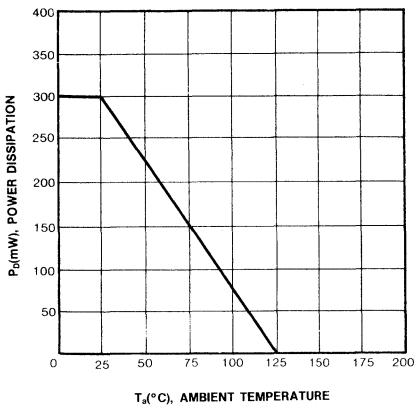
DC CURRENT GAIN



INPUT OFF VOLTAGE



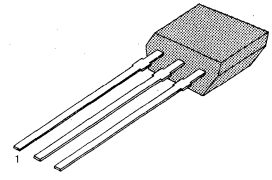
POWER DERATING



SWITCHING APPLICATION (Bias Resistor Built In)

- **Switching Circuit, Inverter, Interface circuit Driver circuit**
- **Built in bias Resistor (R_1=10KΩ, R_2=47KΩ)**
- **Complement to KSR2206**

TO-92S



1. Emitter 2. Collector 3. Base

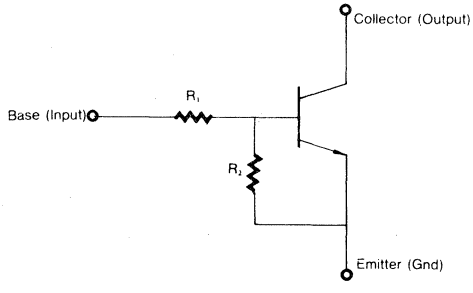
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	50	V
Collector-Emitter Voltage	V_{CEO}	50	V
Emitter-Base Voltage	V_{EBO}	10	V
Collector Current	I_C	100	mA
Collector Dissipation	P_C	300	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

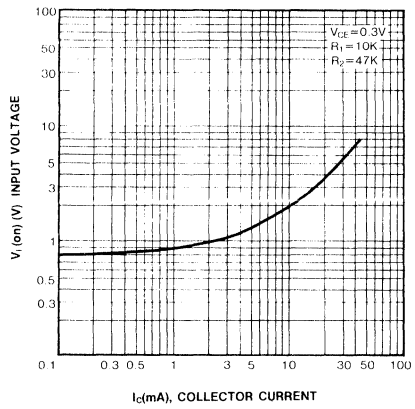
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CEO}	I_C=10μA, I_E=0	50			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=100μA, I_B=0	50			V
Collector Cutoff Current	I_{CBO}	V_{CB}=40V, I_E=0			0.1	μA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=5mA	68			
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=10mA, I_B=0.5mA			0.3	V
Output Capacitance	Cob	V_{CB}=10V, I_E=0 f=1MHz		3.7		pF
Current Gain-Bandwidth Product	f_T	V_{CE}=10V, I_C=5mA		250		MHz
Input Off Voltage	Vi(off)	V_{CE}=5V, I_C=100μA	0.3			V
Input On Voltage	Vi(on)	V_{CE}=0.3V, I_C=1mA			1.4	V
Input Resistor	R_1		7	10	13	KΩ
Resistor Ratio	R_1/R_2		0.19	0.21	0.24	

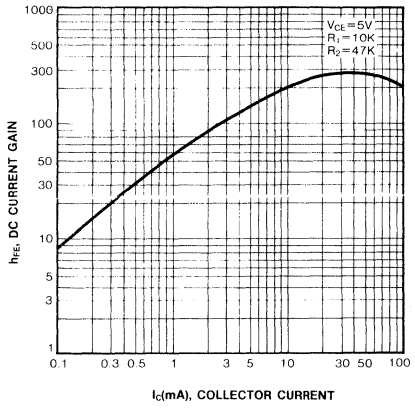
Equivalent Circuit



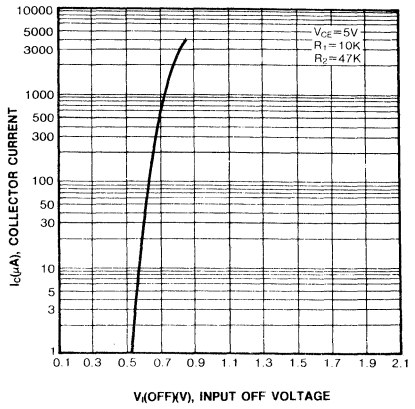
INPUT ON VOLTAGE



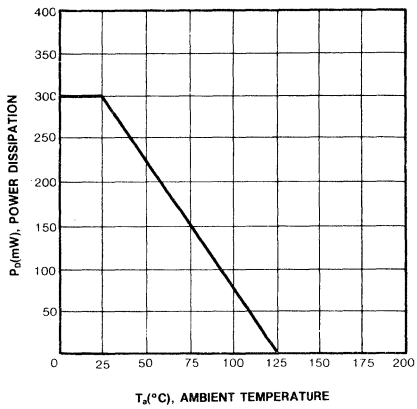
DC CURRENT GAIN



INPUT OFF VOLTAGE



POWER DERATING

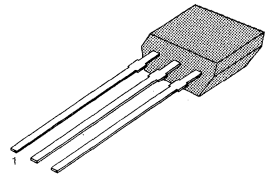


3

SWITCHING APPLICATION (Bias Resistor Built In)

- **Switching Circuit, Inverter, Interface circuit Driver circuit**
- **Built in bias Resistor (R_1=22KΩ, R_2=47KΩ)**
- **Complement to KSR2207**

TO-92S



1. Emitter 2. Collector 3. Base

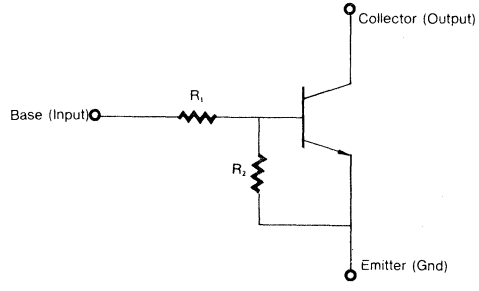
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	50	V
Collector-Emitter Voltage	V_{CEO}	50	V
Emitter-Base Voltage	V_{EBO}	10	V
Collector Current	I_C	100	mA
Collector Dissipation	P_C	300	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

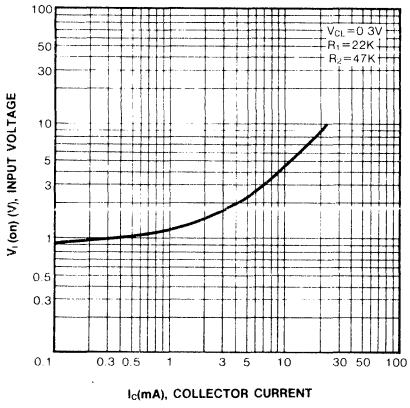
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CEO}	I_C=10μA, I_E=0	50			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=100μA, I_B=0	50			V
Collector Cutoff Current	I_{CBO}	V_{CB}=40V, I_E=0			0.1	μA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=5mA	68			
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=10mA, I_B=0.5mA			0.3	V
Output Capacitance	Cob	V_{CB}=10V, I_E=0 f=1MHz		3.7		pF
Current Gain-Bandwidth Product	f_T	V_{CE}=5mA, I_C=10V		250		MHz
Input Off Voltage	Vi(off)	V_{CE}=5V, I_C=100μA	0.4			V
Input On Voltage	Vi(on)	V_{CE}=0.3V, I_C=2mA			2.5	V
Input Resistor	R_1		15	22	29	KΩ
Resistor Ratio	R_1/R_2		0.42	0.47	0.52	

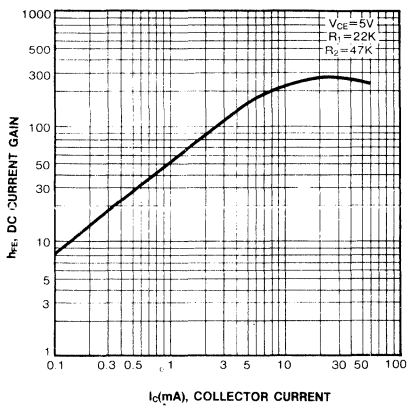
Equivalent Circuit



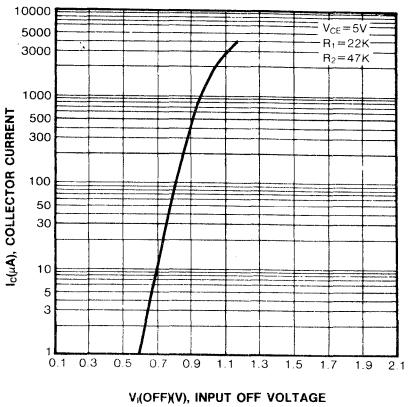
INPUT ON VOLTAGE



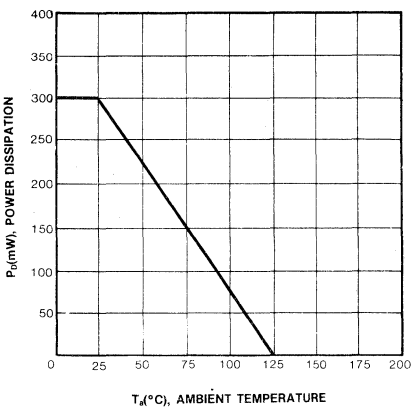
DC CURRENT GAIN



INPUT OFF VOLTAGE



POWER DERATING

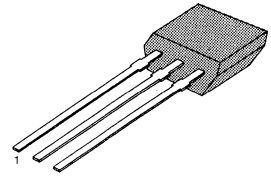


3

SWITCHING APPLICATION (Bias Resistor Built In)

- **Switching circuit, Inverter, Interface circuit Driver circuit**
- **Built in bias Resistor (R_1=47KΩ, R_2=22KΩ)**
- **Complement to KSR2208**

TO-92S



1. Emitter 2. Collector 3. Base

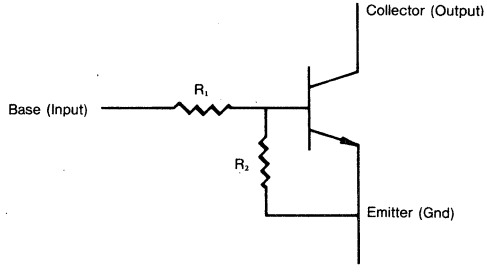
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	50	V
Collector-Emitter Voltage	V_{CEO}	50	V
Emitter-Base Voltage	V_{EBO}	10	V
Collector Current	I_C	100	mA
Collector Dissipation	P_C	300	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

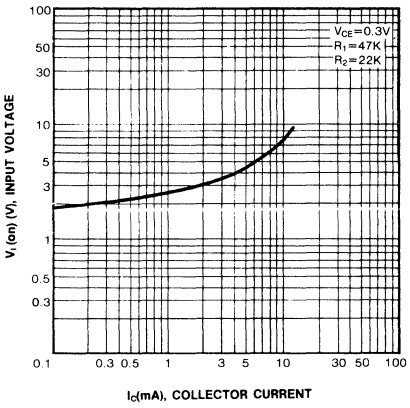
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CEO}	I_C=10μA, I_E=0	50			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=100μA, I_B=0	50			V
Collector Cutoff Current	I_{CBO}	V_{CB}=40V, I_E=0			0.1	μA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=5mA	56			
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=10mA, I_B=0.5mA			0.3	V
Current Gain-Bandwidth Product	f_T	V_{CE}=5mA, I_C=10V		250		MHz
Output Capacitance	Cob	V_{CB}=10V, I_E=0 f=1.0MHz		3.7		pF
Input Off Voltage	Vi(off)	V_{CE}=5V, I_C=100μA	0.8			V
Input On Voltage	Vi(on)	V_{CE}=0.3V, I_C=2mA			4	V
Input Resistor	R_1		32	47	62	KΩ
Resistor Ratio	R_1/R_2		1.9	2.1	2.4	

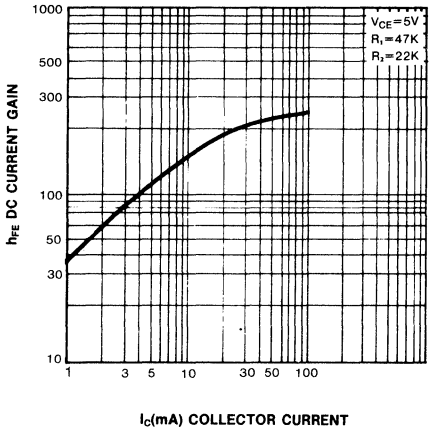
Equivalent Circuit



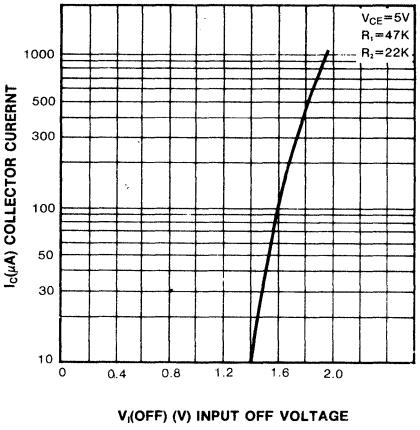
INPUT ON VOLTAGE



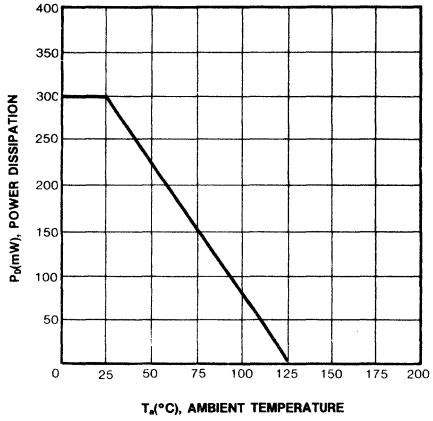
DC CURRENT GAIN



INPUT OFF VOLTAGE



POWER DERATING

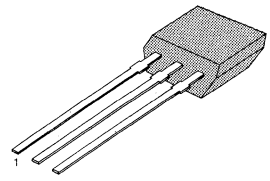


3

SWITCHING APPLICATION (Bias Resistor Built In)

- Switching Circuit, Inverter, Interface circuit Driver circuit
- Built in bias Resistor (R=4.7KΩ)
- Complement to KSR2209

TO-92S



1. Emitter 2. Collector 3. Base

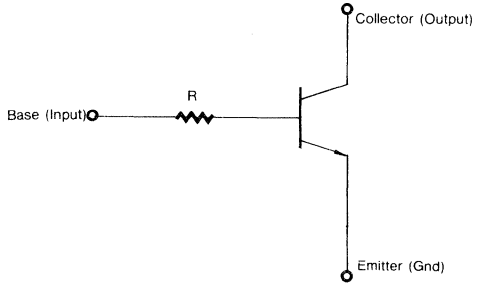
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	40	V
Collector-Emitter Voltage	V_{CEO}	40	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	100	mA
Collector Dissipation	P_C	300	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

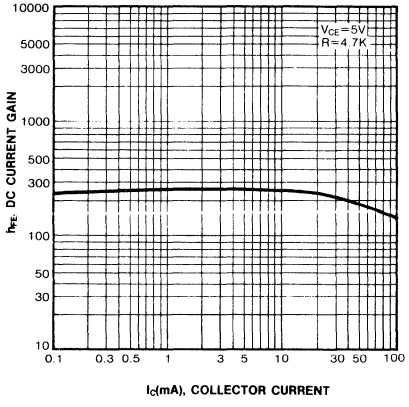
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CEO}	I_C=100μA, I_E=0	40			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=1mA, I_B=0	40			V
Collector Cutoff Current	I_{CBO}	V_{CB}=30V, I_E=0			0.1	μA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=1mA	100		600	
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=10mA, I_B=1mA			0.3	V
Output Capacitance	Cob	V_{CB}=10V, I_E=0 f=1MHz		3.70		pF
Current Gain-Bandwidth Product	f_T	V_{CE}=10V, I_C=5mA		250		MHz
Input Resistor	R		3.2	4.7	6.2	KΩ

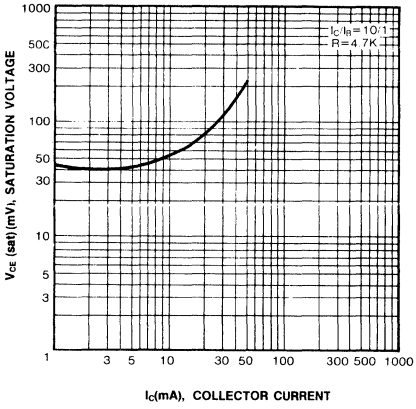
Equivalent Circuit



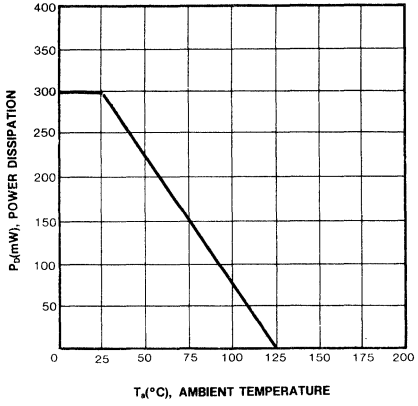
DC CURRENT GAIN



COLLECTOR-EMITTER SATURATION VOLTAGE



POWER DERATING

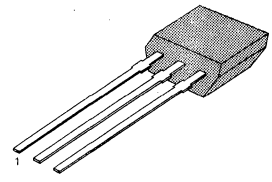


3

SWITCHING APPLICATION (Bias Resistor Built In)

- Switching Circuit, Inverter, Interface circuit
  Driver circuit
- Built in bias Resistor (R=10KΩ)
- Complement to KSR2210

TO-92S



1. Emitter 2. Collector 3. Base

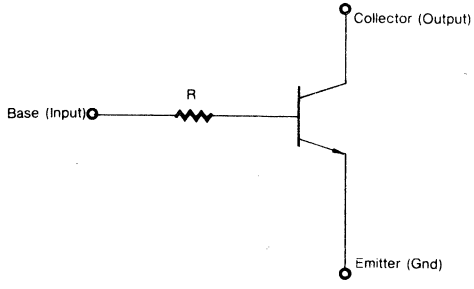
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	40	V
Collector-Emitter Voltage	V_{CEO}	40	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	100	mA
Collector Dissipation	P_C	300	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

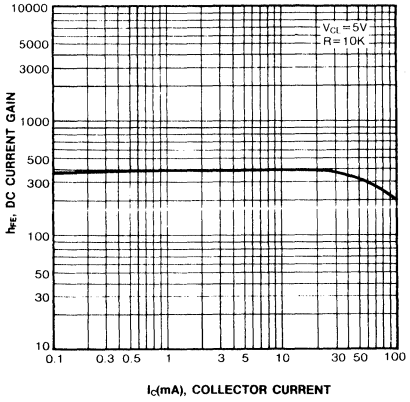
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=100μA, I_E=0	40			V
Emitter-Emitter Breakdown Voltage	BV_{CEO}	I_E=1mA, I_B=0	40			V
Collector Cutoff Current	I_{CBO}	V_{CB}=30V, I_E=0			0.1	μA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=1mA	100		600	
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=10mA, I_B=1mA			0.3	V
Output Capacitance	Cob	V_{CB}=10V, I_E=0 f=1MHz		3.7		pF
Current Gain-Bandwidth Product	f_T	V_{CE}=10V, I_C=5mA		250		MHz
Input Resistor	R		7	10	13	KΩ

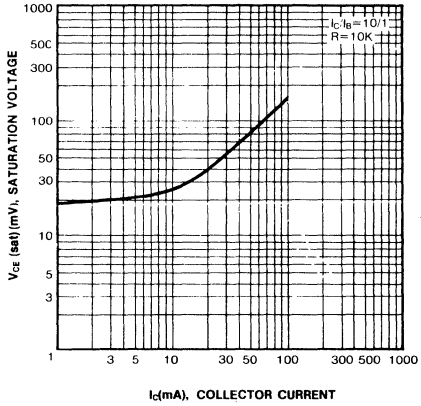
Equivalent Circuit



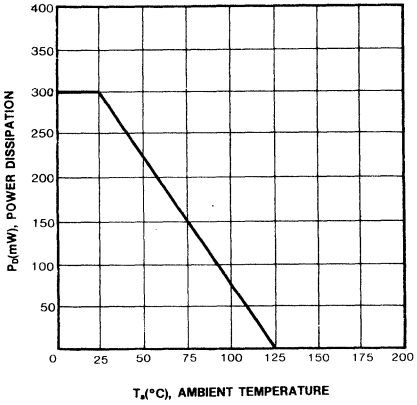
DC CURRENT GAIN



COLLECTOR-EMITTER SATURATION VOLTAGE



POWER DERATING

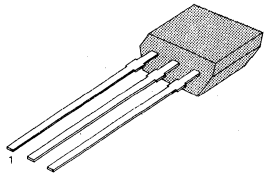


3

SWITCHING APPLICATION (Bias Resistor Built In)

- Switching Circuit, Inverter, Interface circuit Driver circuit
- Built in bias Resistor (R=22KΩ)
- Complement to KSR2211

TO-92S



1. Emitter 2. Collector 3. Base

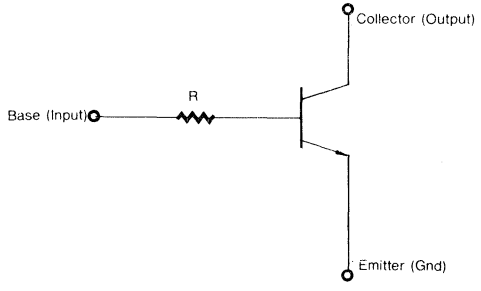
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	40	V
Collector-Emitter Voltage	V_{CEO}	40	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	100	mA
Collector Dissipation	P_C	300	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=100μA, I_E=0	40			V
Emitter-Emitter Breakdown Voltage	BV_{CEO}	I_E=1mA, I_B=0	40			V
Collector Cutoff Current	I_{CBO}	V_{CB}=30V, I_E=0			0.1	μA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=1mA	100		600	
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=10mA, I_B=1mA			0.3	V
Output Capacitance	Cob	V_{CB}=10V, I_E=0 f=1MHz		3.7		pF
Current Gain-Bandwidth Product	f_T	V_{CE}=10V, I_C=5mA		250		MHz
Input Resistor	R		15	22	29	KΩ

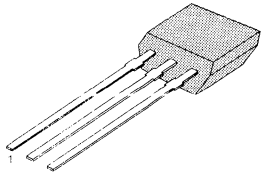
Equivalent Circuit



SWITCHING APPLICATION (Bias Resistor Built In)

- Switching Circuit, Inverter, Interface circuit Driver circuit
- Built in bias Resistor (R=47KΩ)
- Complement to KSR2212

TO-92S



1. Emitter 2. Collector 3. Base

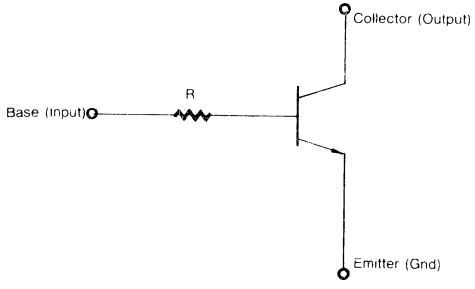
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	40	V
Collector-Emitter Voltage	V_{CEO}	40	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	100	mA
Collector Dissipation	P_C	300	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=100μA, I_E=0	40			V
Emitter-Emitter Breakdown Voltage	BV_{CEO}	I_E=1mA, I_B=0	40			V
Collector Cutoff Current	I_{CBO}	V_{CB}=30V, I_E=0			0.1	μA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=1mA	100		600	
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=10mA, I_B=1mA			0.3	V
Output Capacitance	Cob	V_{CB}=10V, I_E=0 f=1MHz		3.7		pF
Current Gain-Bandwidth Product	f_T	V_{CE}=10V, I_C=5mA		250		MHz
Input Resistor	R		32	47	62	KΩ

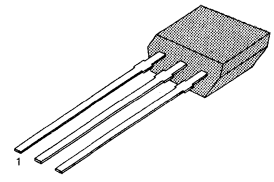
Equivalent Circuit



SWITCHING APPLICATION (Bias Resistor Built In)

- Switching circuit, Inverter, Interface circuit Driver circuit
- Built in bias Resistor(R_1= 2.2KΩ, R_2=47KΩ)
- Complement to KSR2213

TO-92S



1. Emitter 2. Collector 3. Base

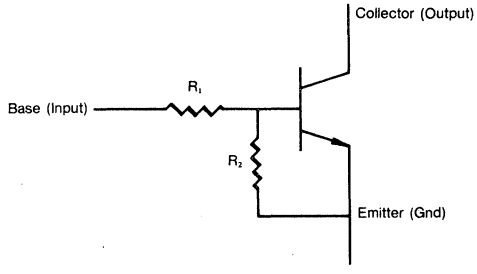
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	50	V
Collector-Emitter Voltage	V_{CEO}	50	V
Emitter-Base Voltage	V_{EBO}	10	V
Collector Current	I_C	100	mA
Collector Dissipation	P_C	300	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CEO}	I_C=10μA, I_E=0	50			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=100μA, I_B=0	50			V
Collector Cutoff Current	I_{CBO}	V_{CB}=40V, I_E=0			0.1	μA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=5mA	68			
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=10mA, I_B=0.5mA			0.3	V
Current Gain-Bandwidth Product	f_T	V_{CE}=5mA, I_C=10V		250		MHz
Output Capacitance	Cob	V_{CB}=10V, I_E=0 f=1.0MHz		3.7		pF
Input Off Voltage	Vi(off)	V_{CE}=5V, I_C=100μA	0.5			V
Input On Voltage	Vi(on)	V_{CE}=0.2V, I_C=5mA			1.1	V
Input Resistor	R_1		1.5	2.2	2.9	KΩ
Resistor Ratio	R_1/R_2		0.042	0.047	0.052	

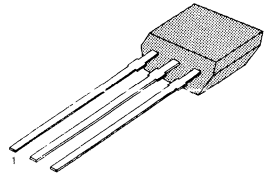
Equivalent Circuit



SWITCHING APPLICATION (Bias Resistor Built In)

- Switching circuit, Inverter, Interface circuit Driver circuit
- Built in bias Resistor(R_1=4.7KΩ, R_2=47KΩ)
- Complement to KSR2214

TO-92S



1. Emitter 2. Collector 3. Base

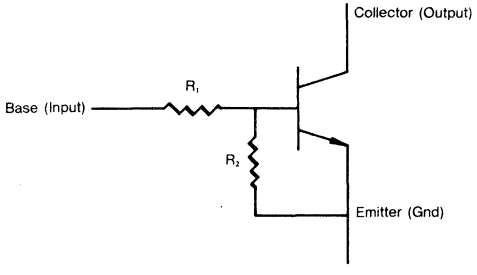
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	50	V
Collector-Emitter Voltage	V_{CEO}	50	V
Emitter-Base Voltage	V_{EBO}	10	V
Collector Current	I_C	100	mA
Collector Dissipation	P_C	300	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CEO}	I_C=10μA, I_E=0	50			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=100μA, I_B=0	50			V
Collector Cutoff Current	I_{CBO}	V_{CB}=40V, I_E=0			0.1	μA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=5mA	68			
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=10mA, I_B=0.5mA			0.3	V
Current Gain-Bandwidth Product	f_T	V_{CE}=5mA, I_C=10V		250		MHz
Output Capacitance	Cob	V_{CB}=10V, I_E=0 f=1.0MHz		3.7		pF
Input Off Voltage	Vi(off)	V_{CE}=5V, I_C=100μA	0.5			V
Input On Voltage	Vi(on)	V_{CE}=0.2V, I_C=5mA			1.3	V
Input Resistor	R_1		3.2	4.7	6.2	KΩ
Resistor Ratio	R_1/R_2		0.09	0.1	0.11	

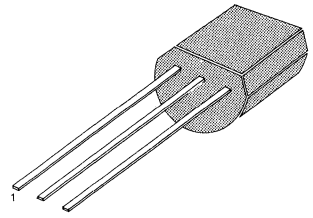
Equivalent Circuit



SWITCHING APPLICATION (Bias Resistor Built In)

- **Switching circuit, Inverter, Interface circuit Driver circuit**
- **Built in bias Resistor (R_1=4.7KΩ, R_2=4.7KΩ)**
- **Complement to KSR1001**

TO-92



1. Emitter 2. Collector 3. Base

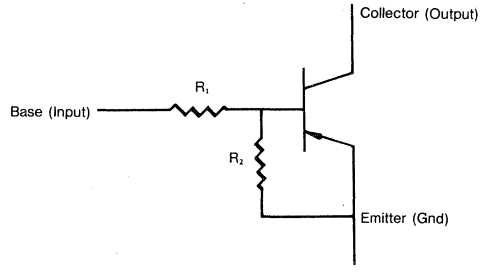
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−50	V
Collector-Emitter Voltage	V_{CEO}	−50	V
Emitter-Base Voltage	V_{EBO}	−10	V
Collector Current	I_C	−100	mA
Collector Dissipation	P_C	300	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

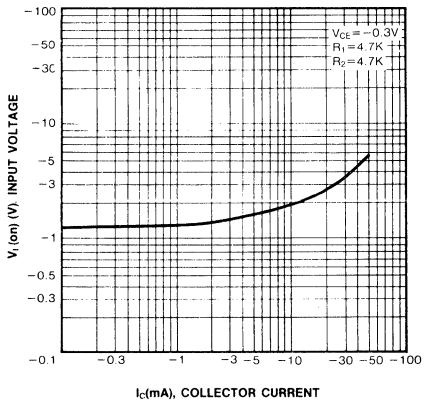
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=−10μA, I_E=0	−50			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=−100μA, I_B=0	−50			V
Collector Cutoff Current	I_{CBO}	V_{CB}=−40V, I_E=0			−0.1	μA
DC Current Gain	h_{FE}	V_{CE}=−5V, I_C=−10mA	20			
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=−10mA, I_B=−0.5mA			−0.3	V
Current Gain-Bandwidth Product	f_T	V_{CE}=−5mA, I_C=−10V		200		MHz
Output Capacitance	Cob	V_{CB}=−10V, I_E=0 f=1.0MHz		5.5		pF
Input Off Voltage	Vi(off)	V_{CE}=−5V, I_C=−100μA	−0.5			V
Input On Voltage	Vi(on)	V_{CE}=−0.3V, I_C=−20mA			−3	V
Input Resistor	R_1		3.2	4.7	6.2	KΩ
Resistor Ratio	R_1/R_2		0.9	1	1.1	

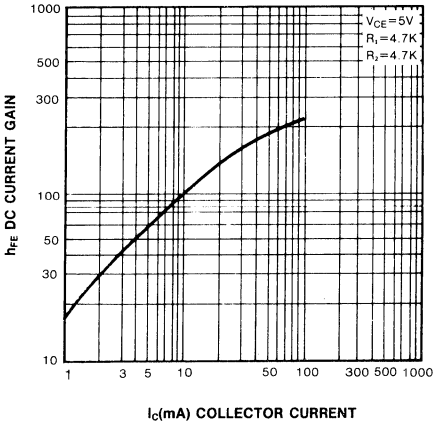
Equivalent Circuit



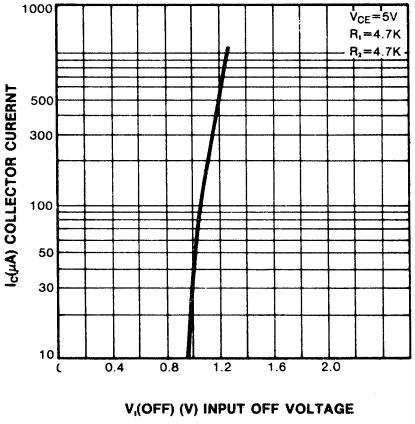
INPUT ON VOLTAGE



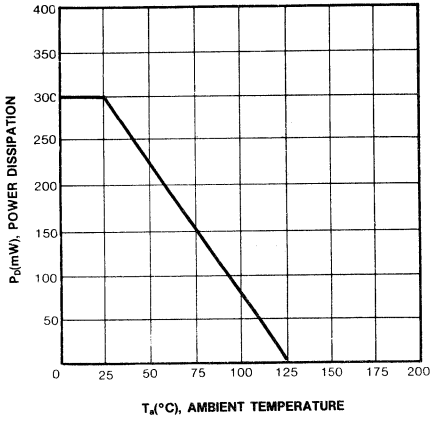
DC CURRENT GAIN



INPUT OFF VOLTAGE



POWER DERATING

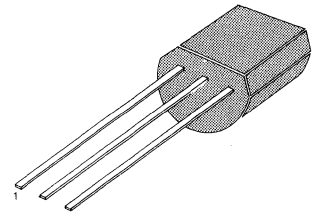


3

SWITCHING APPLICATION (Bias Resistor Built In)

- **Switching circuit, Inverter, Interface circuit Driver circuit**
- **Built in bias Resistor** (R_1=10KΩ, R_2=10KΩ)
- **Complement to KSR1002**

TO-92



1. Emitter 2. Base 3. Collector

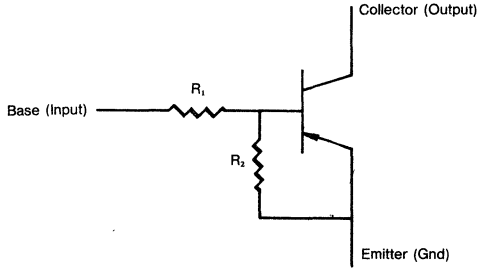
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−50	V
Collector-Emitter Voltage	V_{CEO}	−50	V
Emitter-Base Voltage	V_{EBO}	−10	V
Collector Current	I_C	−100	mA
Collector Dissipation	P_C	300	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

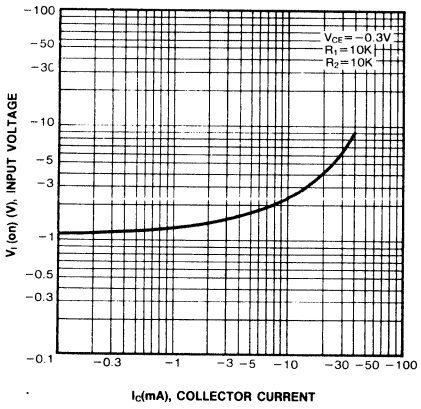
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=−10μA, I_E=0	−50			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=−100μA, I_B=0	−50			V
Collector Cutoff Current	I_{CBO}	V_{CB}=−40V, I_E=0			−0.1	μA
DC Current Gain	h_{FE}	V_{CE}=−5V, I_C=−5mA	30			
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=−10mA, I_B=−0.5mA			−0.3	V
Current Gain-Bandwidth Product	f_T	V_{CE}=−5mA, I_C=−10V		200		MHz
Output Capacitance	Cob	V_{CB}=−10V, I_E=0 f=1.0MHz		5.5		pF
Input Off Voltage	Vi(off)	V_{CE}=−5V, I_C=−100μA	−0.5			V
Input On Voltage	Vi(on)	V_{CE}=−0.3V, I_C=−10mA			−3	V
Input Resistor	R_1		7	10	13	KΩ
Resistor Ratio	R_1/R_2		0.9	1	1.1	

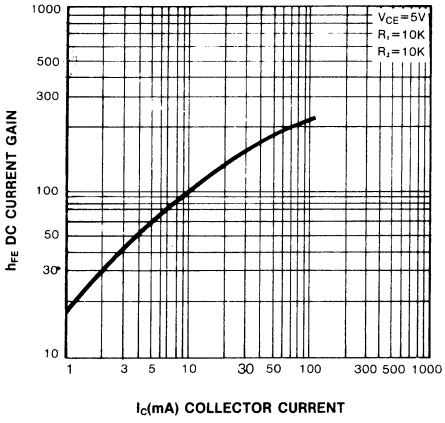
Equivalent Circuit



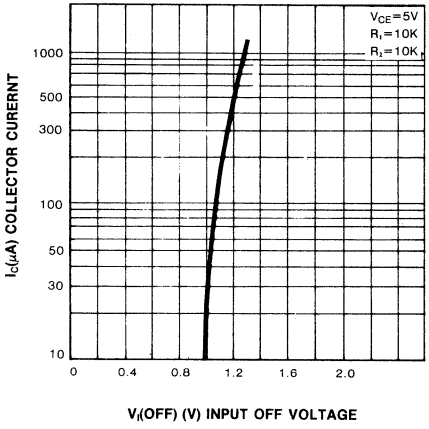
INPUT ON VOLTAGE



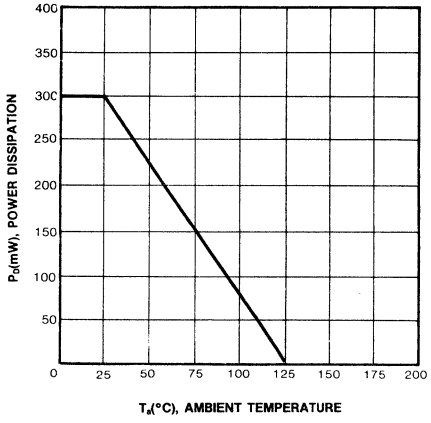
DC CURRENT GAIN



INPUT OFF VOLTAGE



POWER DERATING

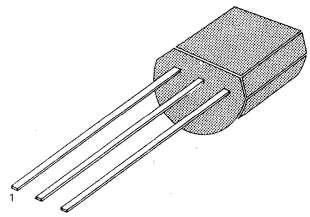


3

SWITCHING APPLICATION (Bias Resistor Built In)

- **Switching circuit, Inverter, Interface circuit Driver circuit**
- **Built in bias Resistor(R_1=22KΩ, R_2=22KΩ)**
- **Complement to KSR1003**

TO-92



1. Emitter 2. Collector 3. Base

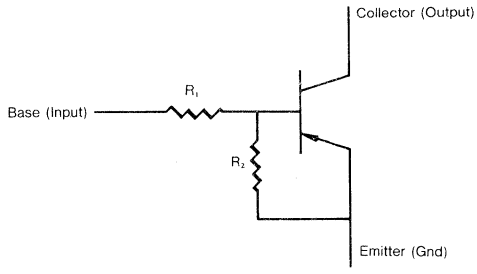
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−50	V
Collector-Emitter Voltage	V_{CEO}	−50	V
Emitter-Base Voltage	V_{EBO}	−10	V
Collector Current	I_C	−100	mA
Collector Dissipation	P_C	300	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

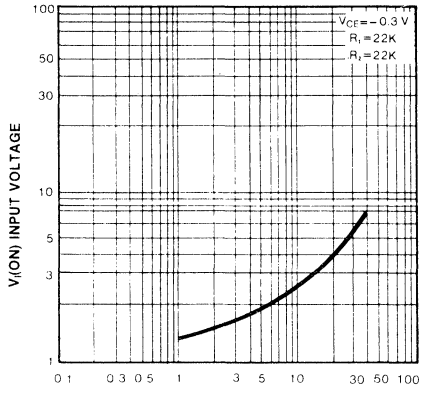
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=−10μA, I_E=0	−50			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=−100μA, I_B=0	−50			V
Collector Cutoff Current	I_{CBO}	V_{CB}=−40V, I_E=0			−0.1	μA
DC Current Gain	h_{FE}	V_{CE}=−5V, I_C=−5mA	56			
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=−10mA, I_B=−0.5mA			−0.3	V
Current Gain-Bandwidth Product	f_T	V_{CE}=−5mA, I_C=−10V		200		MHz
Output Capacitance	Cob	V_{CB}=−10V, I_E=0 f=1.0MHz		5.5		pF
Input Off Voltage	Vi(off)	V_{CE}=−5V, I_C=−100μA	−0.5			V
Input On Voltage	Vi(on)	V_{CE}=−0.3V, I_C=−5mA			−3.0	V
Input Resistor	R_1		15	22	29	KΩ
Resistor Ratio	R_1/R_2		0.9	1	1.1	

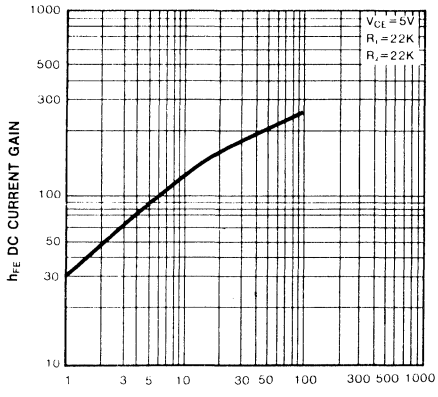
Equivalent Circuit



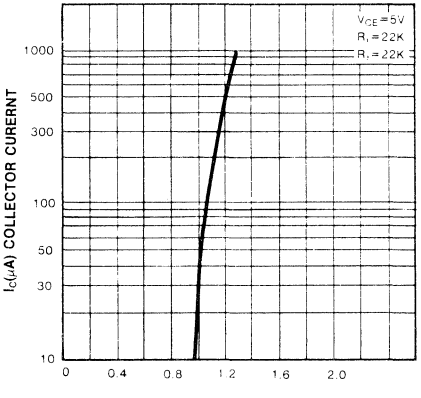
INPUT ON VOLTAGE



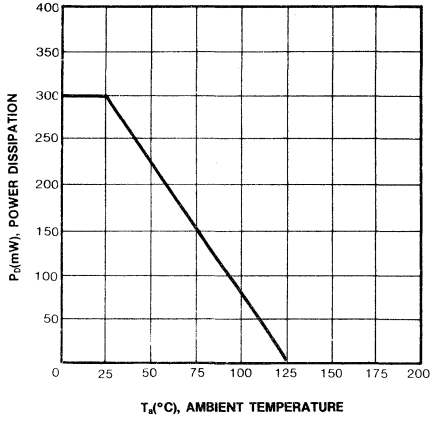
DC CURRENT GAIN



INPUT OFF VOLTAGE



POWER DERATING

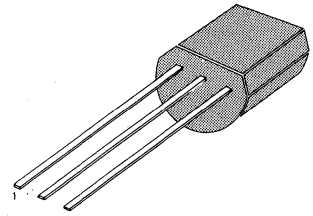


3

SWITCHING APPLICATION (Bias Resistor Built In)

- **Switching circuit, Inverter, Interface circuit Driver circuit**
- **Built in bias Resistor (R_1=47KΩ, R_2=47KΩ)**
- **Complement to KSR1004**

TO-92



1. Emitter 2. Collector 3. Base

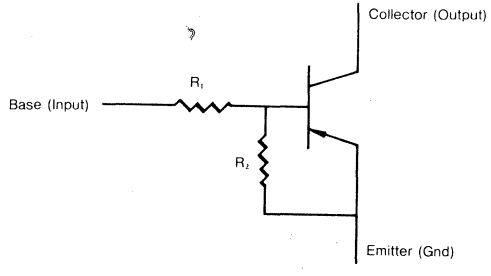
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−50	V
Collector-Emitter Voltage	V_{CEO}	−50	V
Emitter-Base Voltage	V_{EBO}	−10	V
Collector Current	I_C	−100	mA
Collector Dissipation	P_C	300	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

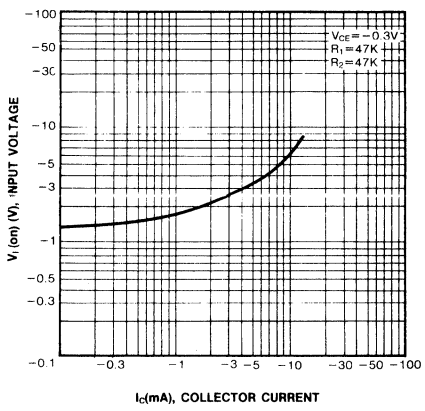
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=−10μA, I_E=0	−50			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=−100μA, I_B=0	−50			V
Collector Cutoff Current	I_{CBO}	V_{CB}=−40V, I_E=0			−0.1	μA
DC Current Gain	h_{FE}	V_{CE}=−5V, I_C=−5mA	68			
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=−10mA, I_B=−0.5mA			−0.3	V
Current Gain-Bandwidth Product	f_T	V_{CE}=−5mA, I_C=−10V		200		MHz
Output Capacitance	Cob	V_{CB}=−10V, I_E=0 f=1.0MHz		5.5		pF
Input Off Voltage	Vi(off)	V_{CE}=−5V, I_C=−100μA	−0.5			V
Input On Voltage	Vi(on)	V_{CE}=−0.3V, I_C=− 2mA			−3	V
Input Resistor	R_1		32	47	62	KΩ
Resistor Ratio	R_1/R_2		0.9	1	1.1	

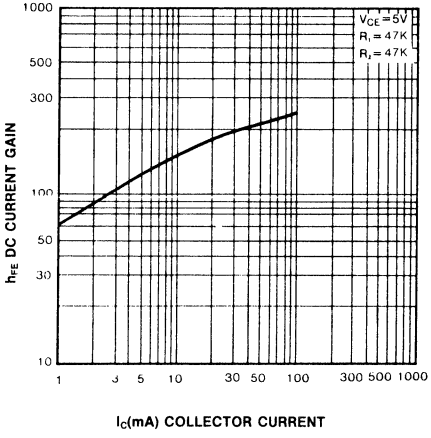
Equivalent Circuit



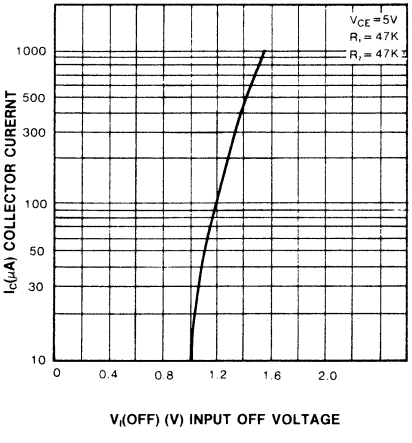
INPUT ON VOLTAGE



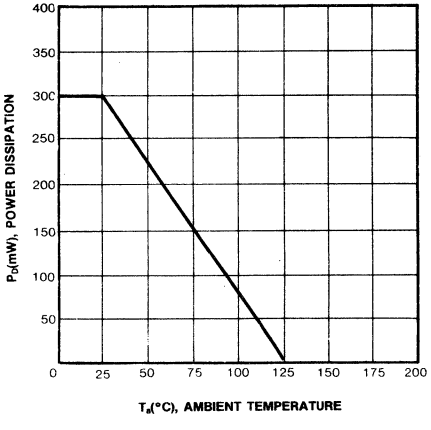
DC CURRENT GAIN



INPUT OFF VOLTAGE



POWER DERATING

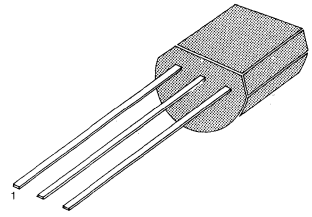


3

SWITCHING APPLICATION (Bias Resistor Built In)

- Switching Circuit, Inverter, Interface circuit
  Driver circuit
- Built in bias Resistor (R_1=4.7KΩ, R_2=10KΩ)
- Complement to KSR1005

TO-92



1. Emitter 2. Collector 3. Base

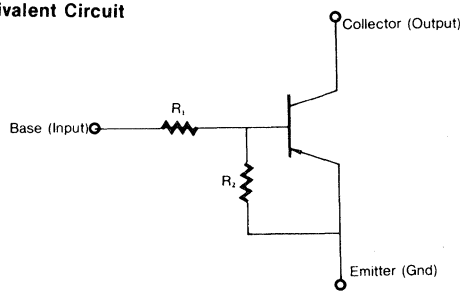
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−50	V
Collector-Emitter Voltage	V_{CEO}	−50	V
Emitter-Base Voltage	V_{EBO}	−10	V
Collector Current	I_C	−100	mA
Collector Dissipation	P_C	300	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

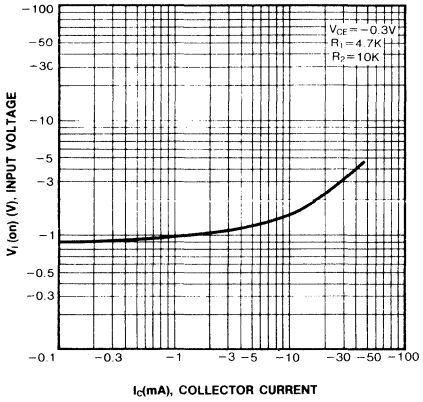
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=−10μA, I_E=0	−50			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=−100μA, I_B=0	−50			V
Collector Cutoff Current	I_{CBO}	V_{CB}=−40V, I_E=0			−0.1	μA
DC Current Gain	h_{FE}	V_{CE}=−5V, I_C=−5mA	30			
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=−10mA, I_B=−0.5mA			−0.3	V
Current Gain-Bandwidth Product	Cob	V_{CB}=−10V, I_E=0 f=1MHz		5.5		pF
Current Gain-Bandwidth Product	f_T	V_{CE}=−10V, I_C=−5mA		200		MHz
Input Off Voltage	Vi(off)	V_{CE}=−5V, I_C=−100μA	−0.3			V
Input On Voltage	Vi(on)	V_{CE}=−0.3V, I_C=−20mA			−2.5	V
Input Resistor	R_1		3.2	4.7	6.2	KΩ
Resistor Ratio	R_1/R_2		0.42	0.47	0.52	

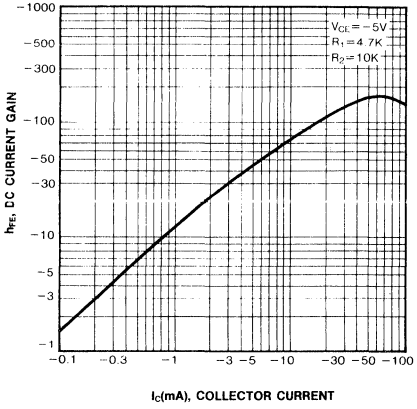
Equivalent Circuit



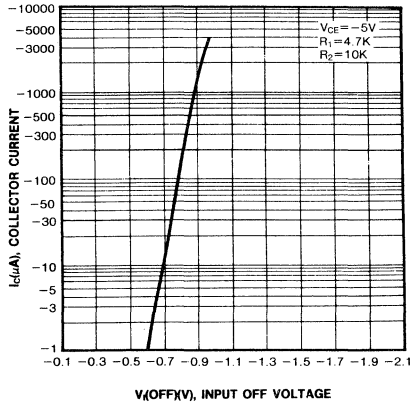
INPUT ON VOLTAGE



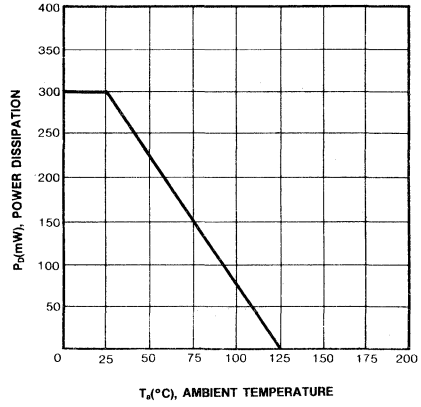
DC CURRENT GAIN



INPUT OFF VOLTAGE



POWER DERATING

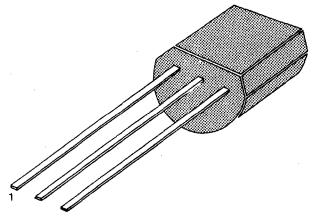


3

SWITCHING APPLICATION (Bias Resistor Built In)

- **Switching Circuit, Inverter, Interface circuit Driver circuit**
- **Built in bias Resistor (R_1=10KΩ, R_2=47KΩ)**
- **Complement to KSR1006**

TO-92



1. Emitter 2. Collector 3. Base

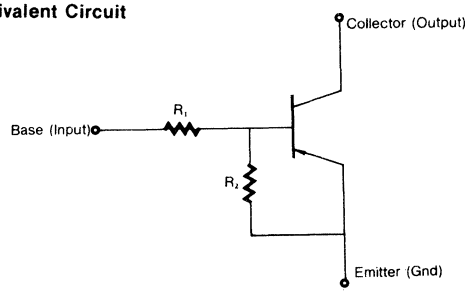
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−50	V
Collector-Emitter Voltage	V_{CEO}	−50	V
Emitter-Base Voltage	V_{EBO}	−10	V
Collector Current	I_C	−100	mA
Collector Dissipation	P_C	300	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

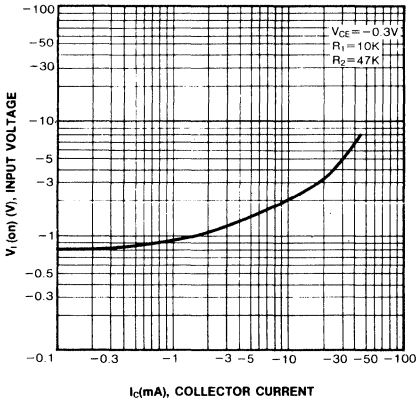
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=−10μA, I_E=0	−50			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=−100μA, I_B=0	−50			V
Collector Cutoff Current	I_{CBO}	V_{CB}=−40V, I_E=0			−0.1	μA
DC Current Gain	h_{FE}	V_{CE}=−5V, I_C=−5mA	68			
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=−10mA, I_B=−0.5mA			−0.3	V
Output Capacitance	Cob	V_{CB}=−10V, I_E=0 f=1MHz		5.5		pF
Current Gain-Bandwidth Product	f_T	V_{CE}=−10V, I_C=−5mA		200		MHz
Input Off Voltage	Vi(off)	V_{CE}=−5V, I_C=−100μA	−0.3			V
Input On Voltage	Vi(on)	V_{CE}=−0.3V, I_C=−1mA			−1.4	V
Input Resistor	R_1		7	10	13	KΩ
Resistor Ratio	R_1/R_2		0.19	0.21	0.24	

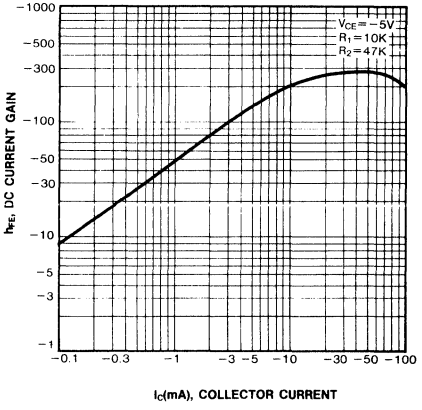
Equivalent Circuit



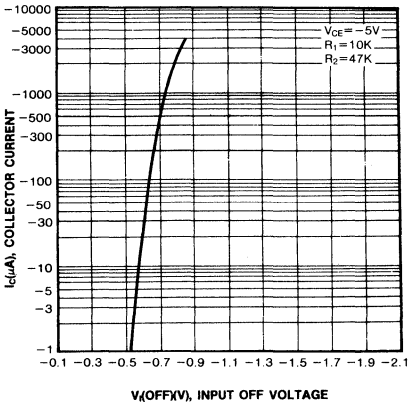
INPUT ON VOLTAGE



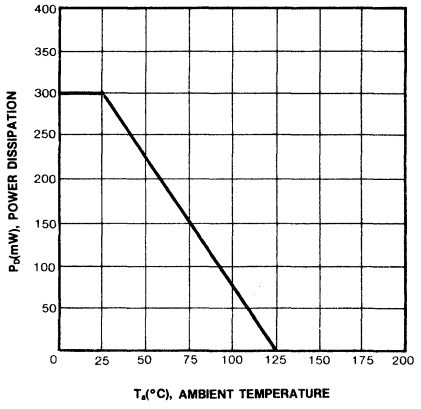
DC CURRENT GAIN



INPUT OFF VOLTAGE



POWER DERATING

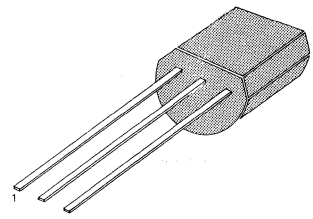


3

SWITCHING APPLICATION (Bias Resistor Built In)

- **Switching Circuit, Inverter, Interface circuit Driver circuit**
- **Built in bias Resistor (R_1=22KΩ R_2=47KΩ)**
- **Complement to KSR1007**

TO-92



1. Emitter 2. Collector 3. Base

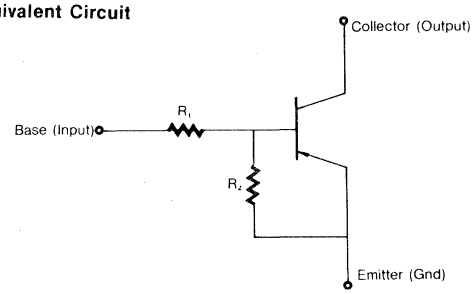
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−50	V
Collector-Emitter Voltage	V_{CEO}	−50	V
Emitter-Base Voltage	V_{EBO}	−10	V
Collector Current	I_C	−100	mA
Collector Dissipation	P_C	300	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

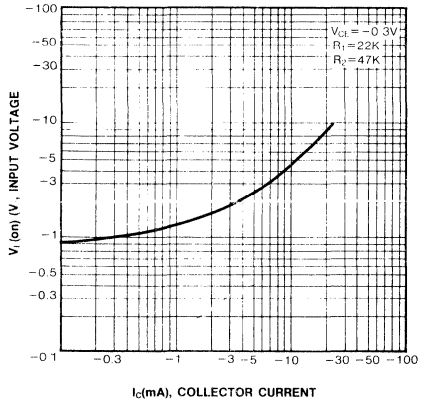
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=−10μA, I_E=0	−50			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=−100μA, I_B=0	−50			V
Collector Cutoff Current	I_{CBO}	V_{CB}=−40V, I_E=0			−0.1	μA
DC Current Gain	h_{FE}	V_{CE}=−5V, I_C=−5mA	68			
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=−10mA, I_B=−0.5mA			−0.3	V
Current Gain-Bandwidth Product	Cob	V_{CB}=−10V, I_E=0 f=1MHz		5.5		pF
Current Gain-Bandwidth Product	f_T	V_{CE}=−10V, I_C=−5mA		200		MHz
Input Off Voltage	Vi(off)	V_{CE}=−5V, I_C=−100μA	−0.4			V
Input On Voltage	Vi(on)	V_{CE}=−0.3V, I_C=−2mA			−2.5	V
Input Resistor	R_1		15	22	29	KΩ
Resistor Ratio	R_1/R_2		0.42	0.47	0.52	

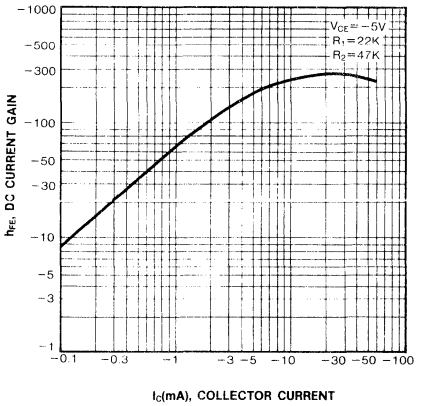
Equivalent Circuit



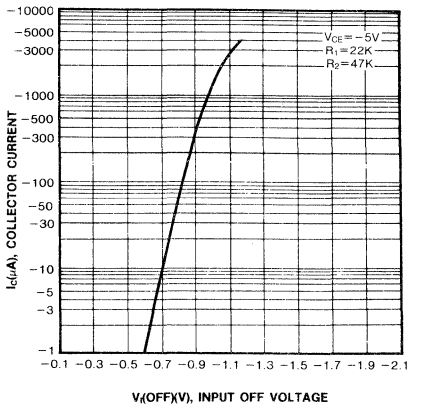
INPUT ON VOLTAGE



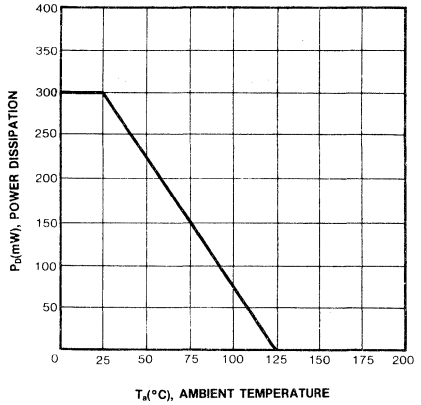
DC CURRENT GAIN



INPUT OFF VOLTAGE



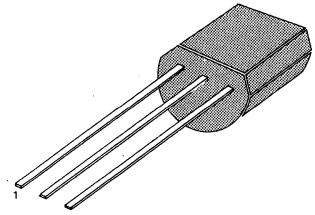
POWER DERATING



SWITCHING APPLICATION (Bias Resistor Built In)

- Switching circuit, Inverter, Interface circuit Driver circuit
- Built in bias Resistor (R_1=47KΩ, R_2=22KΩ)
- Complement to KSR1008

TO-92



1. Emitter 2. Collector 3. Base

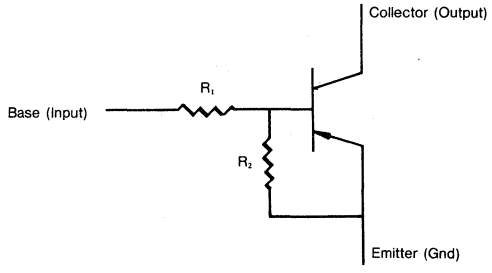
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−50	V
Collector-Emitter Voltage	V_{CEO}	−50	V
Emitter-Base Voltage	V_{EBO}	−10	V
Collector Current	I_C	−100	mA
Collector Dissipation	P_C	300	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

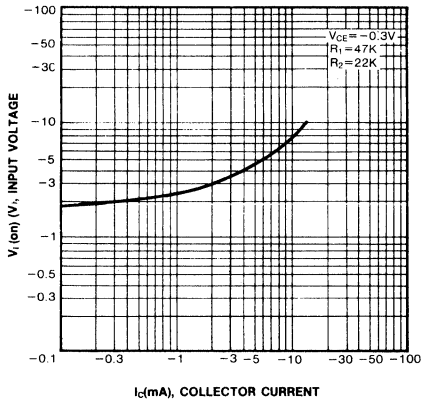
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=−10μA, I_E=0	−50			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=−100μA, I_B=0	−50			V
Collector Cutoff Current	I_{CBO}	V_{CB}=−40V, I_E=0			−0.1	μA
DC Current Gain	h_{FE}	V_{CE}=−5V, I_C=−5mA	56			
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=−10mA, I_B=−0.5mA			−0.3	V
Current Gain-Bandwidth Product	f_T	V_{CE}=−5mA, I_C=−10V		200		MHz
Output Capacitance	Cob	V_{CB}=−10V, I_E=0 f=1.0MHz		5.5		pF
Input Off Voltage	Vi(off)	V_{CE}=−5V, I_C=−100μA	−0.8			V
Input On Voltage	Vi(on)	V_{CE}=−0.3V, I_C=−2mA			−4	V
Input Resistor	R_1		32	47	62	KΩ
Resistor Ratio	R_1/R_2		1.9	2.1	2.4	

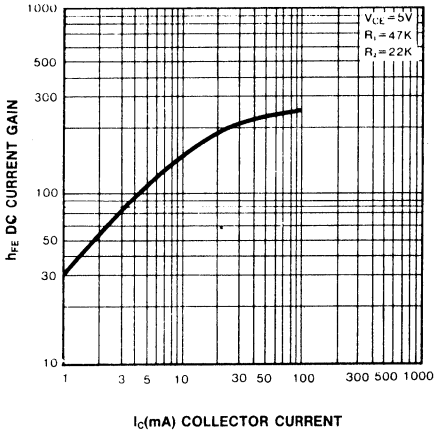
Equivalent Circuit



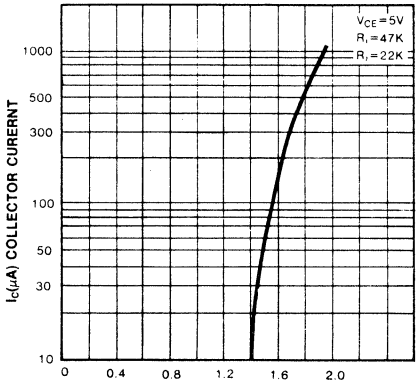
INPUT ON VOLTAGE



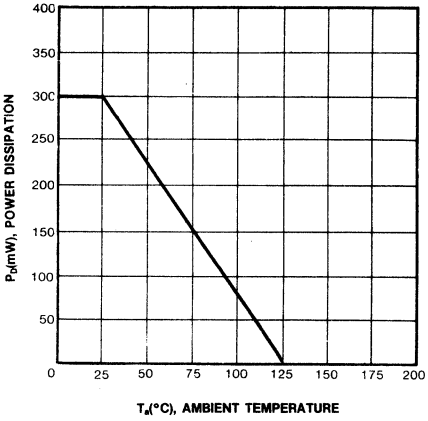
DC CURRENT GAIN



INPUT OFF VOLTAGE



POWER DERATING

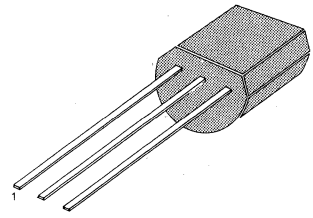


3

SWITCHING APPLICATION (Bias Resistor Built In)

- Switching Circuit, Inverter, Interface circuit Driver circuit
- Built in bias Resistor (R=4.7KΩ)
- Complement to KSR1009

TO-92



1. Emitter 2. Collector 3. Base

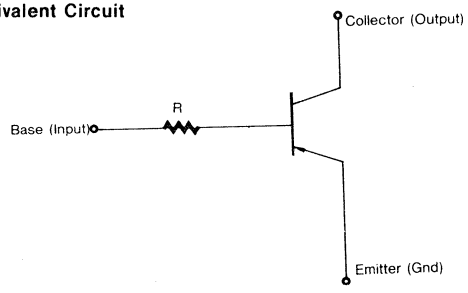
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−40	V
Collector-Emitter Voltage	V_{CEO}	−40	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current	I_C	−100	mA
Collector Dissipation	P_C	300	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

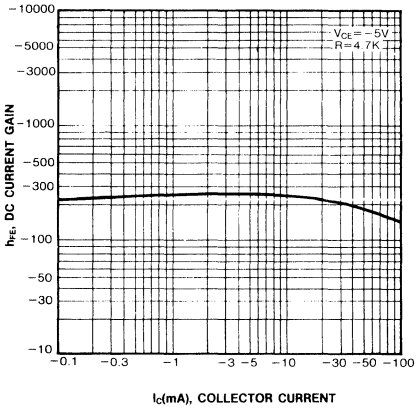
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=−100μA, I_E=0	−40			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=−1mA, I_B=0	−40			V
Collector Cutoff Current	I_{CBO}	V_{CB}=−30V, I_E=0			−0.1	μA
DC Current Gain	h_{FE}	V_{CE}=−5V, I_C=−1mA	100		600	
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=−10mA, I_B=−1mA			−0.3	V
Output Capacitance	Cob	V_{CB}=−10V, I_E=0 f=1MHz		5.5		pF
Current Gain-Bandwidth Product	f_T	V_{CE}=−10V, I_C=−5mA		200		MHz
Input Resistor	R_1		3.2	4.7	6.2	KΩ

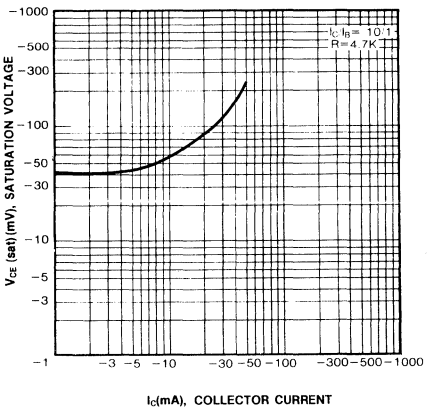
Equivalent Circuit



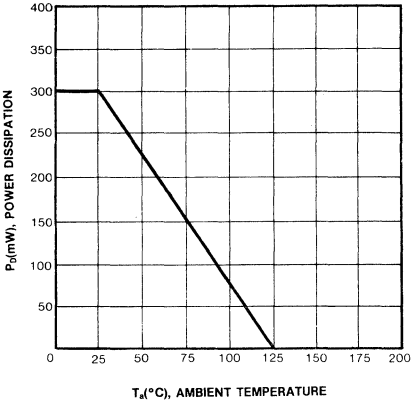
DC CURRENT GAIN



COLLECTOR-EMITTER SATURATION VOLTAGE



POWER DERATING

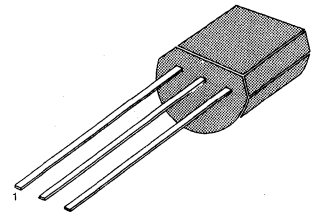


3

SWITCHING APPLICATION (Bias Resistor Built In)

- **Switching Circuit, Inverter, Interface circuit Driver circuit**
- **Built in bias Resistor (R=10K)**
- **Complement to KSR1010**

TO-92



1. Emitter 2. Collector 3. Base

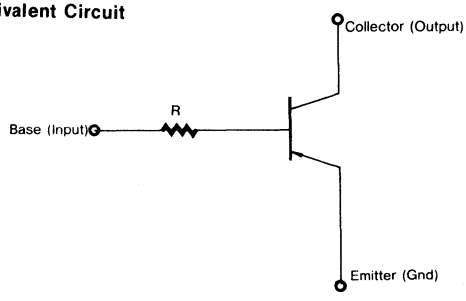
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−40	V
Collector-Emitter Voltage	V_{CEO}	−40	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current	I_C	−100	mA
Collector Dissipation	P_C	300	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

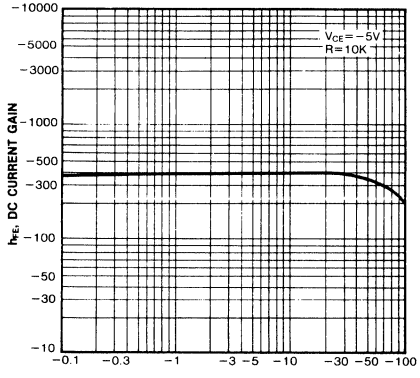
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=−100μA, I_E=0	−40			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_E=−1mA, I_B=0	−40			V
Collector Cutoff Current	I_{CBO}	V_{CB}=−30V, I_E=0			−0.1	μA
DC Current Gain	h_{FE}	V_{CE}=−5V, I_C=−1mA	100		600	
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=−10mA, I_B=−1mA			0.3	V
Output Capacitance	Cob	V_{CB}=−10V, I_E=0 f=1MHz		5.5		pF
Current Gain-Bandwidth Product	f_T	V_{CE}=−10V, I_C=−5mA		200		MHz
Input Resistor	R		7	10	13	KΩ

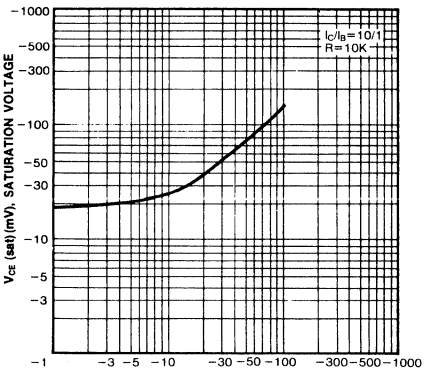
Equivalent Circuit



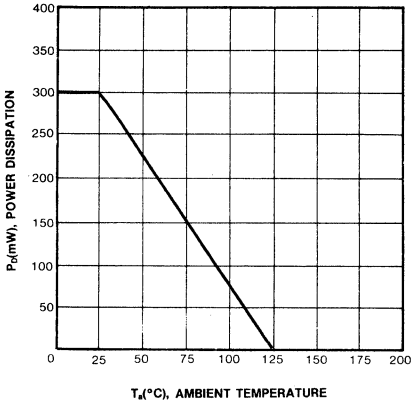
DC CURRENT GAIN



COLLECTOR-EMITTER SATURATION VOLTAGE



POWER DERATING

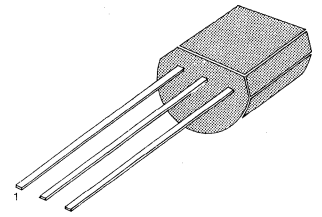


3

SWITCHING APPLICATION (Bias Resistor Built In)

- **Switching Circuit, Inverter, Interface circuit Driver circuit**
- **Built in bias Resistor (R=22KΩ)**
- **Complement to KSR1011**

TO-92



1. Emitter 2. Collector 3. Base

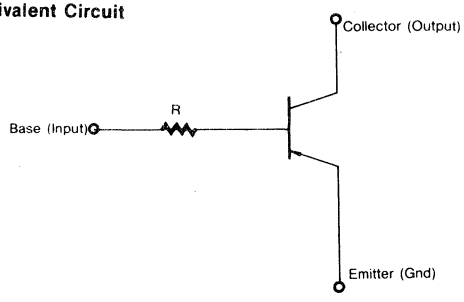
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−40	V
Collector-Emitter Voltage	V_{CEO}	−40	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current	I_C	−100	mA
Collector Dissipation	P_C	300	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=−100μA, I_E=0	−40			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_E=−1mA, I_B=0	−40			V
Collector Cutoff Current	I_{CBO}	V_{CB}=−30V, I_E=0			−0.1	μA
DC Current Gain	h_{FE}	V_{CE}=−5V, I_C=−1mA	100		600	
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=−10mA, I_B=−1mA			−0.3	V
Output Capacitance	Cob	V_{CB}=−10V, I_E=0 f=1MHz		5.5		pF
Current Gain-Bandwidth Product	f_T	V_{CE}=−10V, I_C=−5mA		200		MHz
Input Resistor	R		15	22	29	KΩ

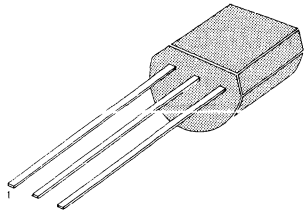
Equivalent Circuit



SWITCHING APPLICATION (Bias Resistor Built In)

- Switching Circuit, Inverter, Interface circuit Driver circuit
- Built in bias Resistor (R=47KΩ)
- Complement to KSR1012

TO-92



1. Emitter 2. Collector 3. Base

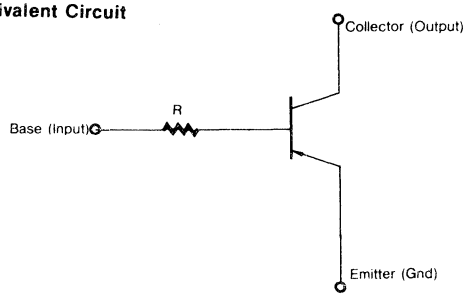
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−40	V
Collector-Emitter Voltage	V_{CEO}	−40	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current	I_C	−100	mA
Collector Dissipation	P_C	300	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=−100μA, I_E=0	−40			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=−1mA, I_B=0	−40			V
Collector Cutoff Current	I_{CBO}	V_{CB}=−30V, I_E=0			−0.1	μA
DC Current Gain	h_{FE}	V_{CE}=−5V, I_C=−1mA	100		600	
Collector Emitter Saturation Voltage	V_{CE}(sat)	I_C=−10mA, I_B=−1mA			−0.3	V
Output Capacitance	Cob	V_{CB}=−10V, I_E=0 f=1MHz		5.5		pF
Current Gain Bandwidth Product	f_T	V_{CE}=−10V, I_C=−5mA,		200		MHz
Input Resistor	R		32	47	62	KΩ

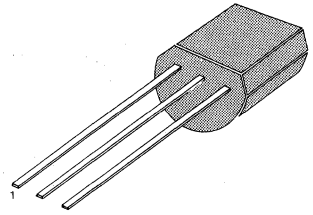
Equivalent Circuit



SWITCHING APPLICATION (Bias Resistor Built In)

- Switching circuit, Inverter, Interface circuit Driver circuit
- Built in bias Resistor (R_1=2.2KΩ, R_2=47KΩ)
- Complement to KSR1013

TO-92



1. Emitter 2. Collector 3. Base

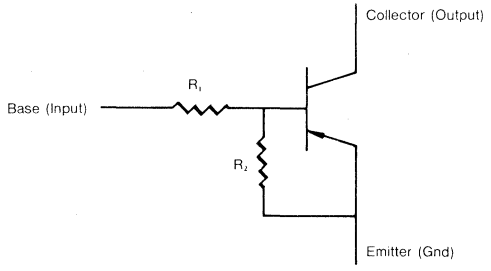
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−50	V
Collector-Emitter Voltage	V_{CEO}	−50	V
Emitter-Base Voltage	V_{EBO}	−10	V
Collector Current	I_C	−100	mA
Collector Dissipation	P_C	300	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=−10μA, I_E=0	−50			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=−100μA, I_B=0	−50			V
Collector Cutoff Current	I_{CBO}	V_{CB}=−40V, I_E=0			−0.1	μA
DC Current Gain	h_{FE}	V_{CE}=−5V, I_C=−5mA	68			
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=−10mA, I_B=−0.5mA			−0.3	V
Current Gain-Bandwidth Product	f_T	V_{CE}=−5mA, I_C=−10V		200		MHz
Output Capacitance	Cob	V_{CB}=−10V, I_E=0 f=1.0MHz		5.5		pF
Input Off Voltage	Vi(off)	V_{CE}=−5V, I_C=−100μA	−0.5			V
Input On Voltage	Vi(on)	V_{CE}=−0.2V, I_C=−10mA			−1.1	V
Input Resistor	R_1		1.5	2.2	2.9	KΩ
Resistor Ratio	R_1/R_2		0.042	0.047	0.052	

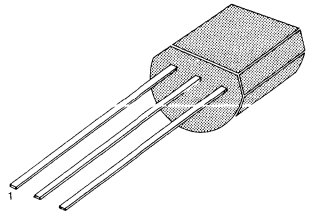
Equivalent Circuit



SWITCHING APPLICATION (Bias Resistor Built In)

- Switching circuit, Inverter, Interface circuit Driver circuit
- Built in bias Resistor (R_1 = 4.7KΩ, R_2 = 47KΩ)
- Complement to KSR1014

TO-92



1. Emitter 2. Collector 3. Base

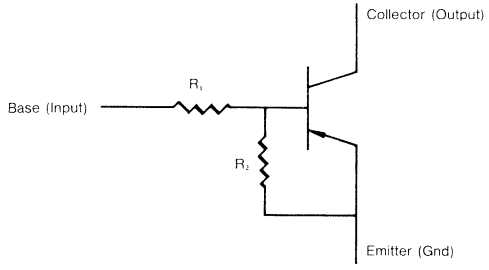
ABSOLUTE MAXIMUM RATINGS (T_a = 25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−50	V
Collector-Emitter Voltage	V_{CEO}	−50	V
Emitter-Base Voltage	V_{EBO}	−10	V
Collector Current	I_C	−100	mA
Collector Dissipation	P_C	300	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ 150	°C

ELECTRICAL CHARACTERISTICS (T_a = 25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C = −10μA, I_E = 0	−50			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C = −100μA, I_B = 0	−50			V
Collector Cutoff Current	I_{CBO}	V_{CB} = −40V, I_E = 0			−0.1	μA
DC Current Gain	h_{FE}	V_{CE} = −5V, I_C = −5mA	68			
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C = −10mA, I_B = −0.5mA			−0.3	V
Current Gain-Bandwidth Product	f_T	V_{CE} = −5mA, I_C = −10V		200		MHz
Output Capacitance	Cob	V_{CB} = −10V, I_E = 0 f = 1.0MHz		5.5		pF
Input Off Voltage	Vi(off)	V_{CE} = −5V, I_C = −100μA	−0.5			V
Input On Voltage	Vi(on)	V_{CE} = −0.2V, I_C = −5mA			−1.3	V
Input Resistor	R_1		3.2	4.7	6.2	KΩ
Resistor Ratio	R_1/R_2		0.09	0.1	0.11	

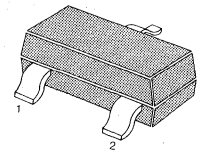
Equivalent Circuit



SWITCHING APPLICATION (Bias Resistor Built In)

- **Switching Circuit, Inverter, Interface circuit Driver circuit**
- **Built in bias Resistor (R_1=4.7KΩ, R_2=4.7KΩ)**
- **Complement to KSR1101**

SOT-23



1. Base 2. Emitter 3. Collector

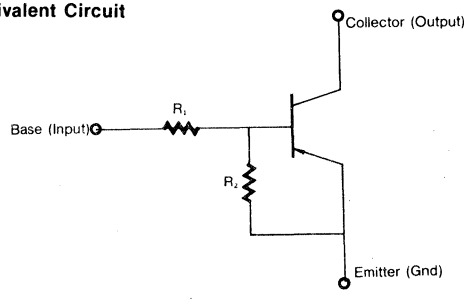
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−50	V
Collector-Emitter Voltage	V_{CEO}	−50	V
Emitter-Base Voltage	V_{EBO}	−10	V
Collector Current	I_C	−100	mA
Collector Dissipation	P_C	200	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

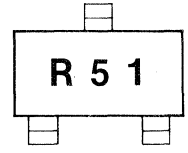
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=−10μA, I_E=0	−50			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=−100μA, I_B=0	−50			V
Collector Cutoff Current	I_{CBO}	V_{CB}=−40V, I_E=0			−0.1	μA
DC Current Gain	h_{FE}	V_{CE}=−5V, I_C=−10mA	20			
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=−10mA, I_B=−0.5mA			−0.3	V
Current Gain-Bandwidth Product	f_T	V_{CE}=−5mA, I_C=−10V		200		MHz
Output Capacitance	Cob	V_{CB}=−10V, I_E=0 f=1.0MHz		5.5		pF
Input Off Voltage	Vi(off)	V_{CE}=−5V, I_C=−100μA	−0.5			V
Input On Voltage	Vi(on)	V_{CE}=−0.3V, I_C=−20mA			−3	V
Input Resistor	R_1		3.2	4.7	6.2	KΩ
Resistor Ratio	R_1/R_2		0.9	1	1.1	

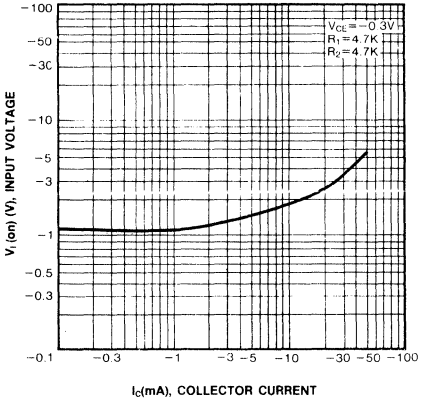
Equivalent Circuit



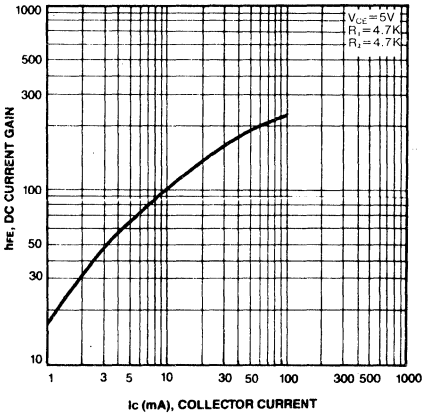
Marking



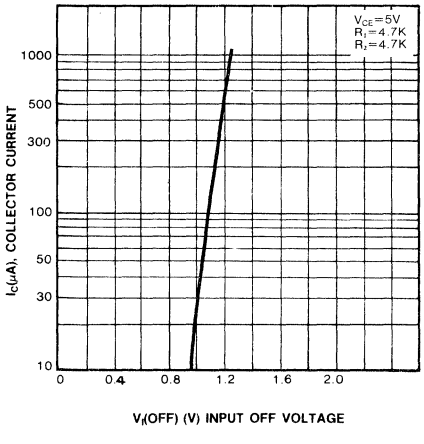
INPUT ON VOLTAGE



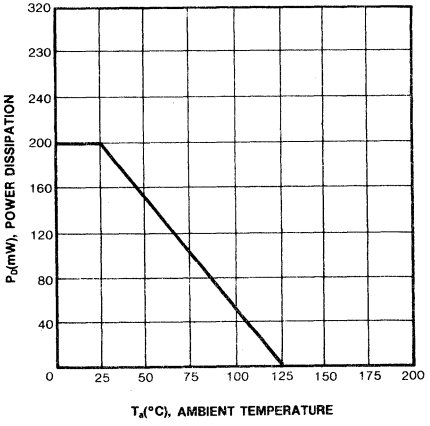
DC CURRENT GAIN



INPUT OFF VOLTAGE



POWER DERATING

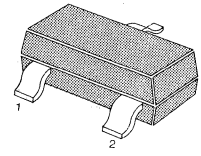


3

SWITCHING APPLICATION (Bias Resistor Built In)

- **Switching Circuit, Inverter, Interface circuit Driver circuit**
- **Built in bias Resistor (R_1=10KΩ, R_2=10KΩ)**
- **Complement to KSR1102**

SOT-23



1. Base 2. Emitter 3. Collector

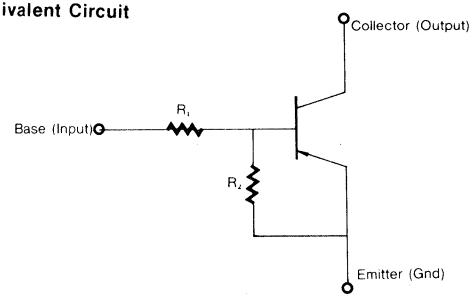
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−50	V
Collector-Emitter Voltage	V_{CEO}	−50	V
Emitter-Base Voltage	V_{EBO}	−10	V
Collector Current	I_C	−100	mA
Collector Dissipation	P_C	200	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

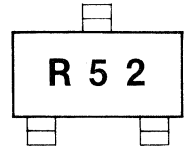
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=−10μA, I_E=0	−50			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=−100μA, I_B=0	−50			V
Collector Cutoff Current	I_{CBO}	V_{CB}=−40V, I_E=0			−0.1	μA
DC Current Gain	h_{FE}	V_{CE}=−5V, I_C=−5mA	30			
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=−10mA, I_B=−0.5mA			−0.3	V
Current Gain-Bandwidth Product	f_T	V_{CE}=−5mA, I_C=−10V		200		MHz
Output Capacitance	Cob	V_{CB}=−10V, I_E=0 f=1.0MHz		5.5		pF
Input Off Voltage	Vi(off)	V_{CE}=−5V, I_C=−100μA	−0.5			V
Input On Voltage	Vi(on)	V_{CE}=−0.3V, I_C=−10mA			−3	V
Input Resistor	R_1		7	10	13	KΩ
Resistor Ratio	R_1/R_2		0.9	1	1.1	

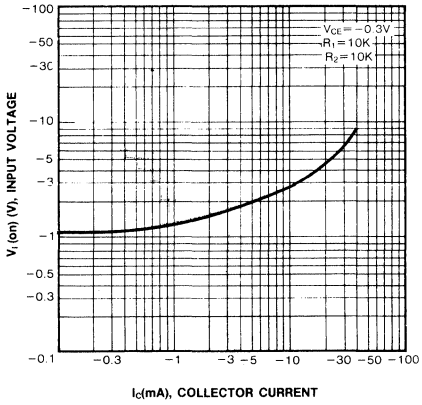
Equivalent Circuit



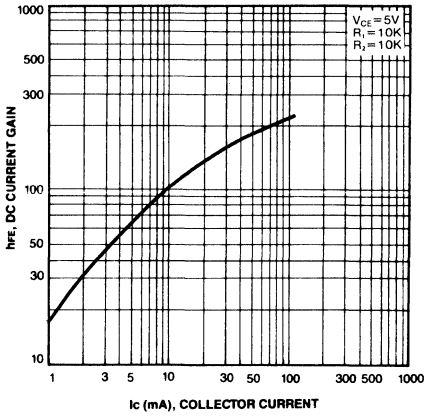
Marking



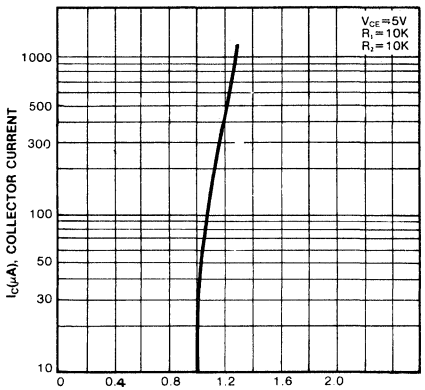
INPUT ON VOLTAGE



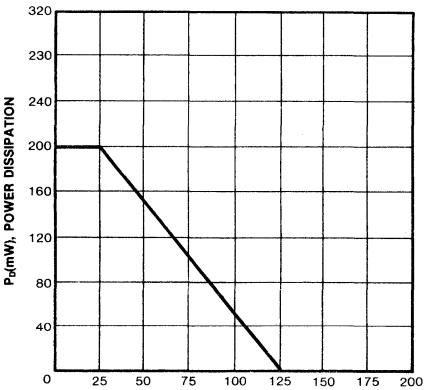
DC CURRENT GAIN



INPUT OFF VOLTAGE



POWER DERATING

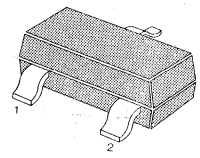


3

SWITCHING APPLICATION (Bias Resistor Built In)

- **Switching Circuit, Inverter, Interface circuit Driver circuit**
- **Built in bias Resistor (R_1=22KΩ, R_2=22KΩ)**
- **Complement to KSR1103**

SOT-23



1. Base 2. Emitter 3. Collector

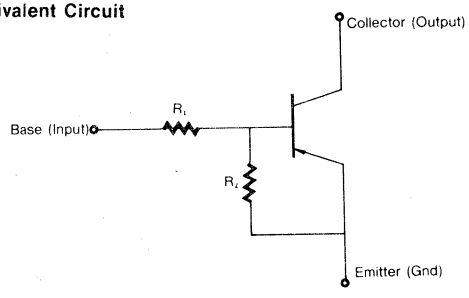
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−50	V
Collector-Emitter Voltage	V_{CEO}	−50	V
Emitter-Base Voltage	V_{EBO}	−10	V
Collector Current	I_C	−100	mA
Collector Dissipation	P_C	200	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

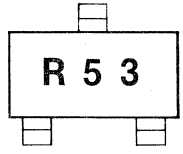
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=−10μA, I_E=0	−50			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=−100μA, I_B=0	−50			V
Collector Cutoff Current	I_{CBO}	V_{CB}=−40V, I_E=0			−0.1	μA
DC Current Gain	h_{FE}	V_{CE}=−5V, I_C=−5mA	56			
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=−10mA, I_B=−0.5mA			−0.3	V
Current Gain-Bandwidth Product	f_T	V_{CE}=−5mA, I_C=−10V		200		MHz
Output Capacitance	Cob	V_{CB}=−10V, I_E=0 f=1.0MHz		5.5		pF
Input Off Voltage	Vi(off)	V_{CE}=−5V, I_C=−100μA	−0.5			V
Input On Voltage	Vi(on)	V_{CE}=−0.3V, I_C=−5mA			−3.0	V
Input Resistor	R_1		15	22	29	KΩ
Resistor Ratio	R_1/R_2		0.9	1	1.1	

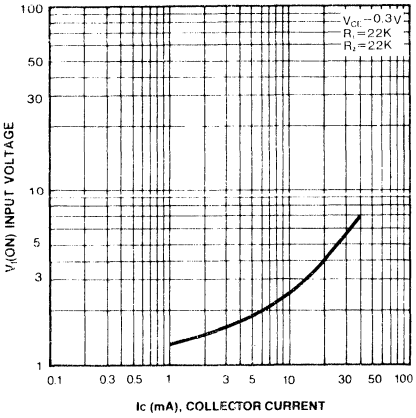
Equivalent Circuit



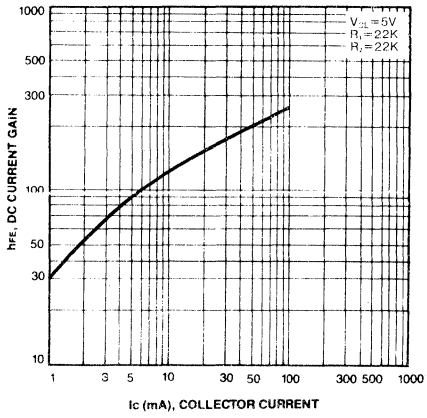
Marking



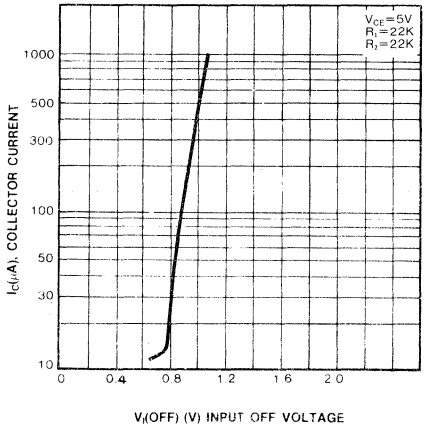
INPUT ON VOLTAGE



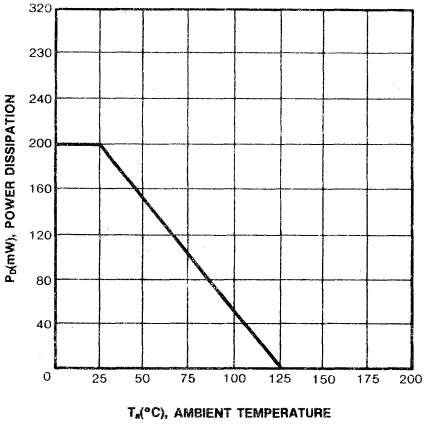
DC CURRENT GAIN



INPUT OFF VOLTAGE



POWER DERATING

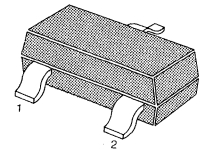


3

SWITCHING APPLICATION (Bias Resistor Built In)

- Switching Circuit, Inverter, Interface circuit
  Driver circuit
- Built in bias Resistor (R_1=47KΩ, R_2=47KΩ)
- Complement to KSR1104

SOT-23



1. Base 2. Emitter 3. Collector

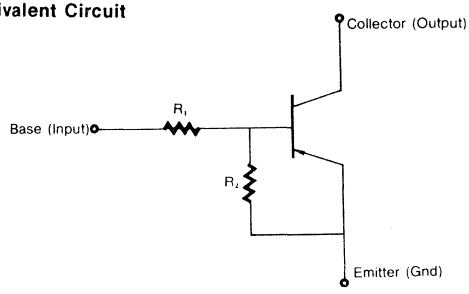
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−50	V
Collector-Emitter Voltage	V_{CEO}	−50	V
Emitter-Base Voltage	V_{EBO}	−10	V
Collector Current	I_C	−100	mA
Collector Dissipation	P_C	200	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

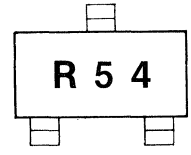
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=−10μA, I_E=0	−50			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=−100μA, I_B=0	−50			V
Collector Cutoff Current	I_{CBO}	V_{CB}=−40V, I_E=0			−0.1	μA
DC Current Gain	h_{FE}	V_{CE}=−5V, I_C=−5mA	68			
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=−10mA, I_B=−0.5mA			−0.3	V
Current Gain-Bandwidth Product	f_T	V_{CE}=−5mA, I_C=−10V		200		MHz
Output Capacitance	Cob	V_{CB}=−10V, I_E=0 f=1.0MHz		5.5		pF
Input Off Voltage	Vi(off)	V_{CE}=−5V, I_C=−100μA	−0.5			V
Input On Voltage	Vi(on)	V_{CE}=−0.3V, I_C=−2mA			−3	V
Input Resistor	R_1		32	47	62	KΩ
Resistor Ratio	R_1/R_2		0.9	1	1.1	

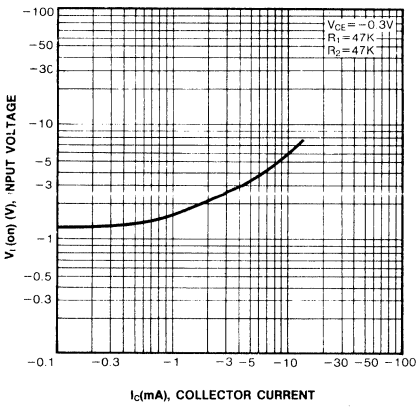
Equivalent Circuit



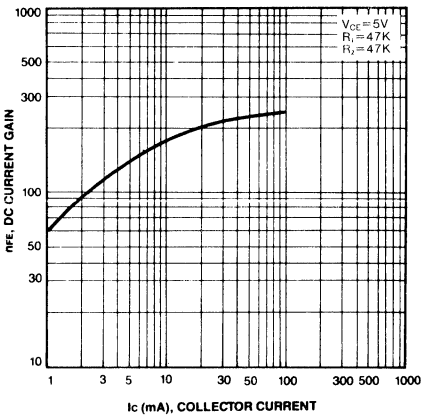
Marking



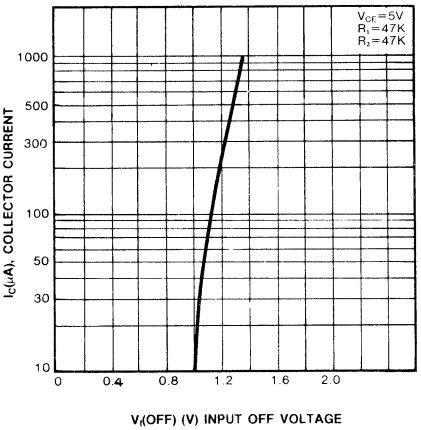
INPUT ON VOLTAGE



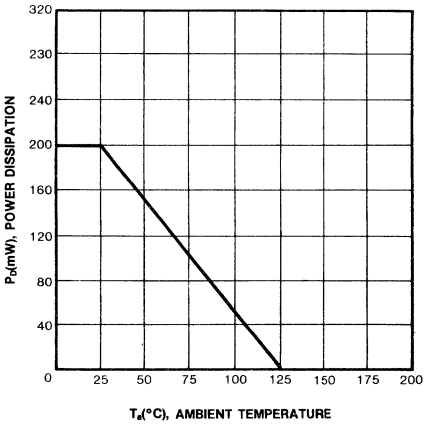
DC CURRENT GAIN



INPUT OFF VOLTAGE



POWER DERATING

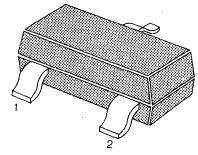


3

SWITCHING APPLICATION (Bias Resistor Built In)

- Switching Circuit, Inverter, Interface circuit
  Driver circuit
- Built in bias Resistor (R_1=4.7KΩ, R_2=10KΩ)
- Complement to KSR1105

SOT-23



1. Base 2. Emitter 3. Collector

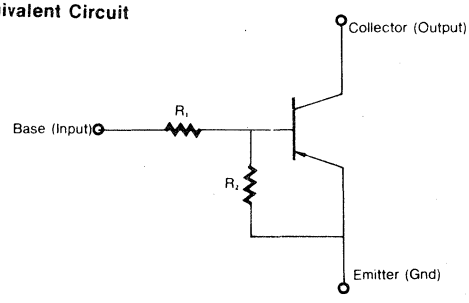
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−50	V
Collector-Emitter Voltage	V_{CEO}	−50	V
Emitter-Base Voltage	V_{EBO}	−10	V
Collector Current	I_C	−100	mA
Collector Dissipation	P_C	200	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

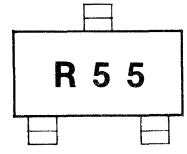
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=−10μA, I_E=0	−50			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=−100μA, I_B=0	−50			V
Collector Cutoff Current	I_{CBO}	V_{CB}=−40V, I_E=0			−0.1	μA
DC Current Gain	h_{FE}	V_{CE}=−5V, I_C=−5mA	30			
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=−10mA, I_B=−0.5mA			−0.3	V
Current Gain-Bandwidth Product	Cob	V_{CB}=−10V, I_E=0 f=1MHz		5.5		pF
Current Gain-Bandwidth Product	f_T	V_{CE}=−10V, I_C=−5mA		200		MHz
Input Off Voltage	Vi(off)	V_{CE}=−5V, I_C=−100μA	−0.3			V
Input On Voltage	Vi(on)	V_{CE}=−0.3V, I_C=−20mA			−2.5	V
Input Resistor	R_1		3.2	4.7	6.2	KΩ
Resistor Ratio	R_1/R_2		0.42	0.47	0.52	

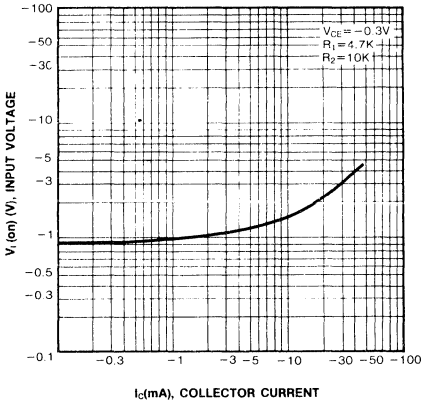
Equivalent Circuit



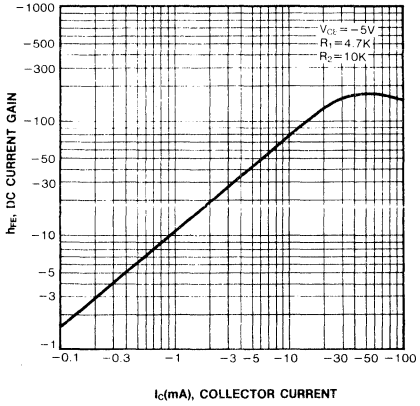
Marking



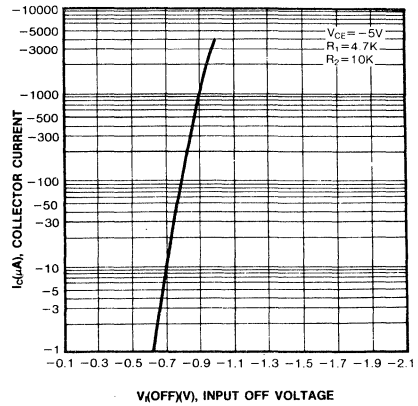
INPUT ON VOLTAGE



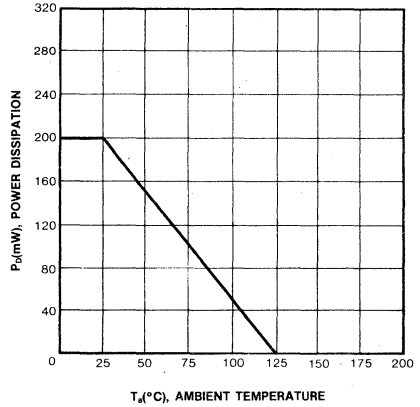
DC CURRENT GAIN



INPUT OFF VOLTAGE



POWER DERATING

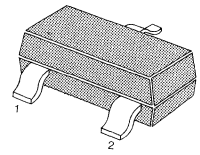


3

SWITCHING APPLICATION (Bias Resistor Built In)

- **Switching Circuit, Inverter, Interface circuit Driver circuit**
- **Built in bias Resistor (R_1=10KΩ, R_2=47KΩ)**
- **Complement to KSR1106**

SOT-23



1. Base 2. Emitter 3. Collector

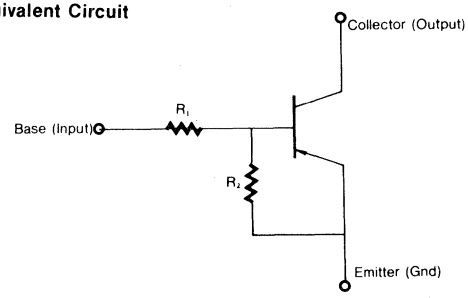
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−50	V
Collector-Emitter Voltage	V_{CEO}	−50	V
Emitter-Base Voltage	V_{EBO}	−10	V
Collector Current	I_C	−100	mA
Collector Dissipation	P_C	200	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

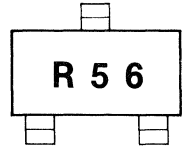
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=−10μA, I_E=0	−50			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=−100μA, I_B=0	−50			V
Collector Cutoff Current	I_{CBO}	V_{CB}=−40V, I_E=0			−0.1	μA
DC Current Gain	h_{FE}	V_{CE}=−5V, I_C=−5mA	68			
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=−10mA, I_B=−0.5mA			−0.3	V
Output Capacitance	Cob	V_{CB}=−10V, I_E=0 f=1MHz		5.5		pF
Current Gain-Bandwidth Product	f_T	V_{CE}=−10V, I_C=−5mA		200		MHz
Input Off Voltage	Vi(off)	V_{CE}=−5V, I_C=−100μA	−0.3			V
Input On Voltage	Vi(on)	V_{CE}=−0.3V, I_C=−1mA			−1.4	V
Input Resistor	R_1		7	10	13	KΩ
Resistor Ratio	R_1/R_2		0.19	0.21	0.24	

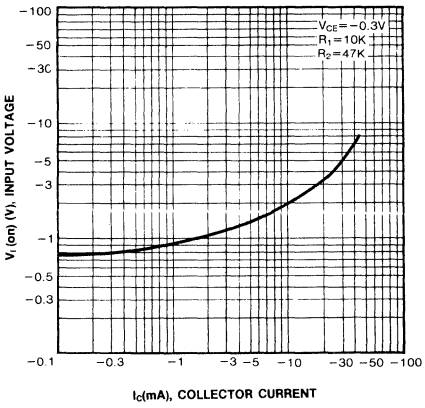
Equivalent Circuit



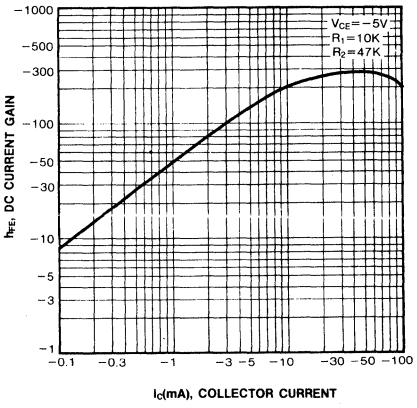
Marking



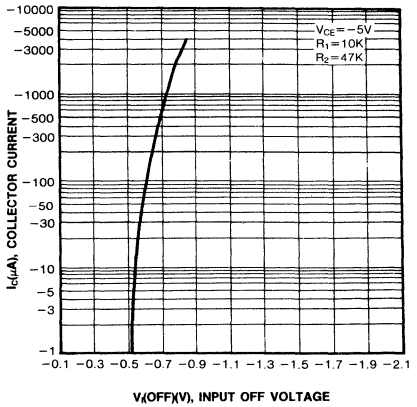
INPUT ON VOLTAGE



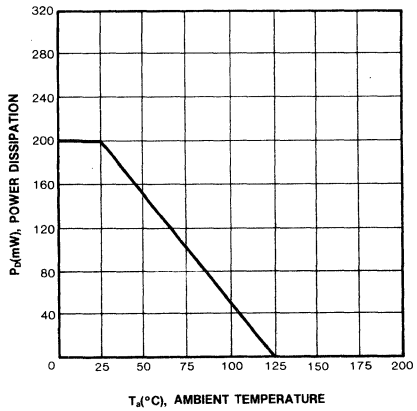
DC CURRENT GAIN



INPUT OFF VOLTAGE



POWER DERATING

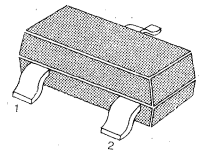


3

SWITCHING APPLICATION (Bias Resistor Built In)

- **Switching Circuit, Inverter, Interface circuit Driver circuit**
- **Built in bias Resistor (R_1=22KΩ, R_2=47KΩ)**
- **Complement to KSR1107**

SOT-23



1. Base 2. Emitter 3. Collector

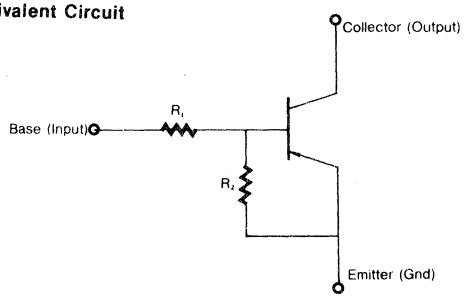
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−50	V
Collector-Emitter Voltage	V_{CEO}	−50	V
Emitter-Base Voltage	V_{EBO}	−10	V
Collector Current	I_C	−100	mA
Collector Dissipation	P_C	200	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

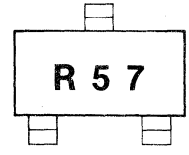
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=−10μA, I_E=0	−50			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=−100μA, I_B=0	−50			V
Collector Cutoff Current	I_{CBO}	V_{CB}=−40V, I_E=0			−0.1	μA
DC Current Gain	h_{FE}	V_{CE}=−5V, I_C=−5mA	68			
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=−10mA, I_B=−0.5mA			−0.3	V
Current Gain-Bandwidth Product	Cob	V_{CB}=−10V, I_E=0 f=1MHz		5.5		pF
Current Gain-Bandwidth Product	f_T	V_{CE}=−10V, I_C=−5mA		200		MHz
Input Off Voltage	Vi(off)	V_{CE}=−5V, I_C=−100μA	−0.4			V
Input On Voltage	Vi(on)	V_{CE}=−0.3V, I_C=−2mA			−2.5	V
Input Resistor	R_1		15	22	29	KΩ
Resistor Ratio	R_1/R_2		0.42	0.47	0.52	

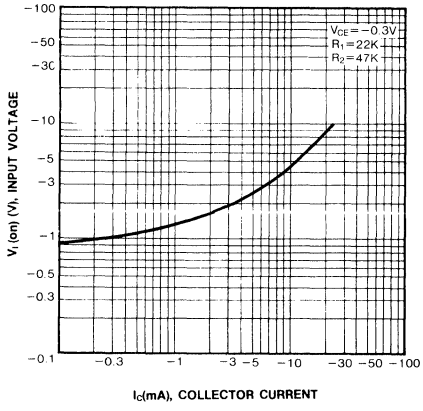
Equivalent Circuit



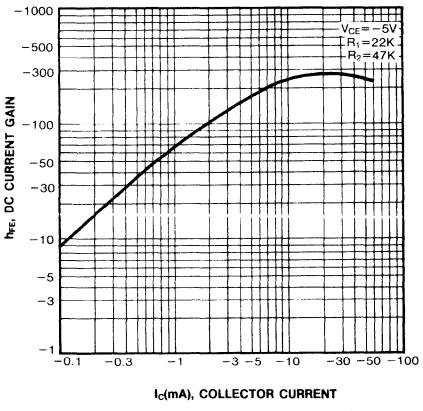
Marking



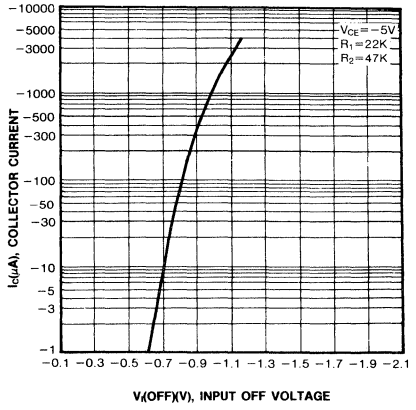
INPUT ON VOLTAGE



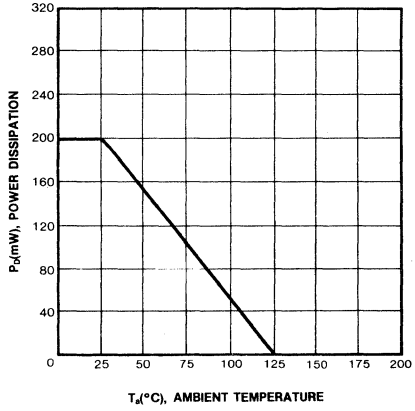
DC CURRENT GAIN



INPUT OFF VOLTAGE



POWER DERATING

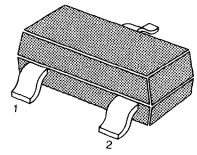


3

SWITCHING APPLICATION (Bias Resistor Built In)

- **Switching Circuit, Inverter, Interface circuit Driver circuit**
- **Built in bias Resistor (R_1=47KΩ, R_2=22KΩ)**
- **Complement to KSR1108**

SOT-23



1. Base 2. Emitter 3. Collector

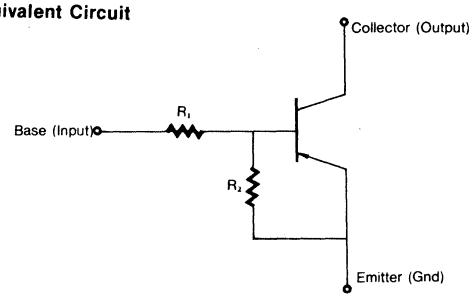
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−50	V
Collector-Emitter Voltage	V_{CEO}	−50	V
Emitter-Base Voltage	V_{EBO}	−10	V
Collector Current	I_C	−100	mA
Collector Dissipation	P_C	200	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

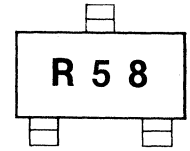
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=−10μA, I_E=0	−50			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=−100μA, I_B=0	−50			V
Collector Cutoff Current	I_{CBO}	V_{CB}=−40V, I_E=0			−0.1	μA
DC Current Gain	h_{FE}	V_{CE}=−5V, I_C=−5mA	56			
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=−10mA, I_B=−0.5mA			−0.3	V
Current Gain-Bandwidth Product	f_T	V_{CE}=−5mA, I_C=−10V		200		MHz
Output Capacitance	Cob	V_{CB}=−10V, I_E=0 f=1.0MHz		5.5		pF
Input Off Voltage	Vi(off)	V_{CE}=−5V, I_C=−100μA	−0.8			V
Input On Voltage	Vi(on)	V_{CE}=−0.3V, I_C=−2mA			−4	V
Input Resistor	R_1		32	47	62	KΩ
Resistor Ratio	R_1/R_2		1.9	2.1	2.4	

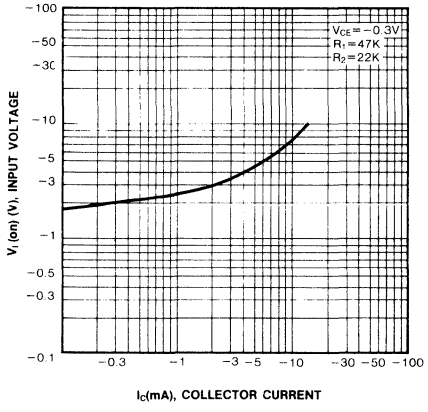
Equivalent Circuit



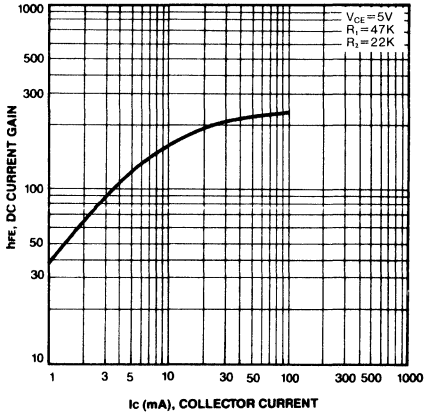
Marking



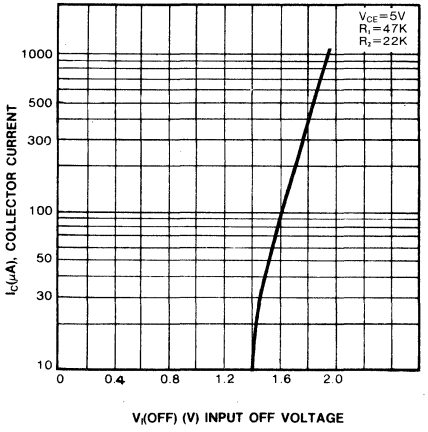
INPUT ON VOLTAGE



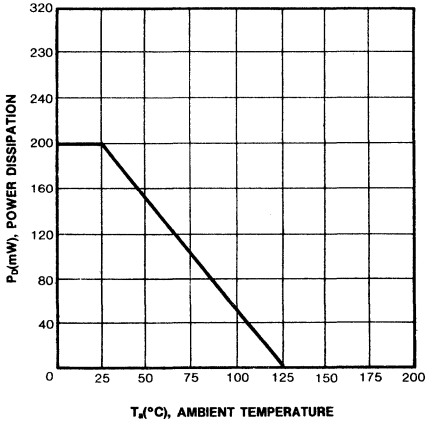
DC CURRENT GAIN



INPUT OFF VOLTAGE



POWER DERATING

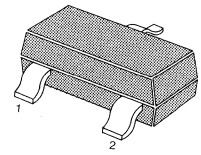


3

SWITCHING APPLICATION (Bias Resistor Built In)

- **Switching Circuit, Inverter, Interface circuit Driver circuit**
- **Built in bias Resistor (R=4.7KΩ)**
- **Complement to KSR1109**

SOT-23



1. Base 2. Emitter 3. Collector

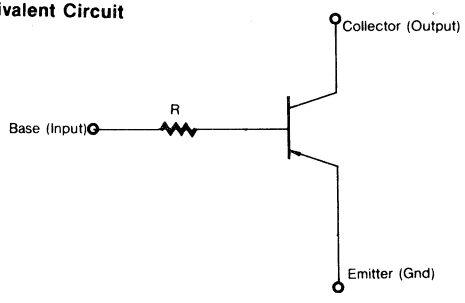
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−40	V
Collector-Emitter Voltage	V_{CEO}	−40	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current	I_C	−100	mA
Collector Dissipation	P_C	200	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

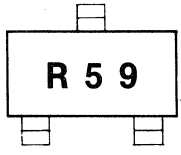
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=−100μA, I_E=0	−40			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=−1mA, I_B=0	−40			V
Collector Cutoff Current	I_{CBO}	V_{CB}=−30V, I_E=0			−0.1	μA
DC Current Gain	h_{FE}	V_{CE}=−5V, I_C=−1mA	100		600	
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=−10mA, I_B=−1mA			−0.3	V
Output Capacitance	Cob	V_{CB}=−10V, I_E=0 f=1MHz		5.5		pF
Current Gain-Bandwidth Product	f_T	V_{CE}=−10V, I_C=−5mA		200		MHz
Input Resistor	R_1		3.2	4.7	6.2	KΩ

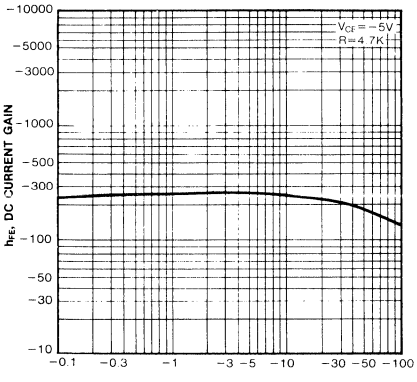
Equivalent Circuit



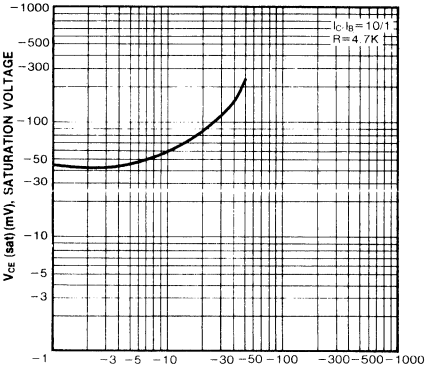
Marking



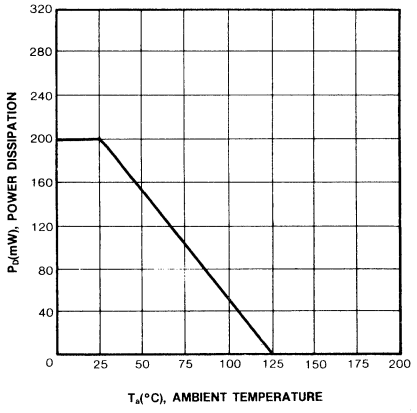
DC CURRENT GAIN



COLLECTOR-EMITTER SATURATION VOLTAGE



POWER DERATING

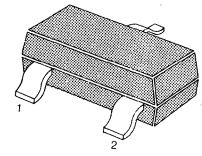


3

SWITCHING APPLICATION (Bias Resistor Built In)

- **Switching Circuit, Inverter, Interface circuit Driver circuit**
- **Built in bias Resistor (R=10KΩ)**
- **Complement to KSR1110**

SOT-23



1. Base 2. Emitter 3. Collector

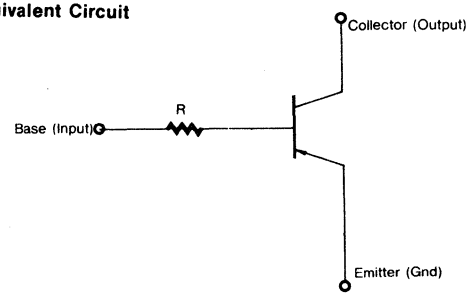
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−40	V
Collector-Emitter Voltage	V_{CEO}	−40	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current	I_C	−100	mA
Collector Dissipation	P_C	200	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

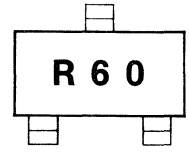
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=−100μA, I_E=0	−40			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_E=−1mA, I_B=0	−40			V
Collector Cutoff Current	I_{CBO}	V_{CB}=−30V, I_E=0			−0.1	μA
DC Current Gain	h_{FE}	V_{CE}=−5V, I_C=−1mA	100		600	
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=−10mA, I_B=−1mA			0.3	V
Output Capacitance	Cob	V_{CB}=−10V, I_E=0 f=1MHz		5.5		pF
Current Gain-Bandwidth Product	f_T	V_{CE}=−10V, I_C=−5mA		200		MHz
Input Resistor	R		7	10	13	KΩ

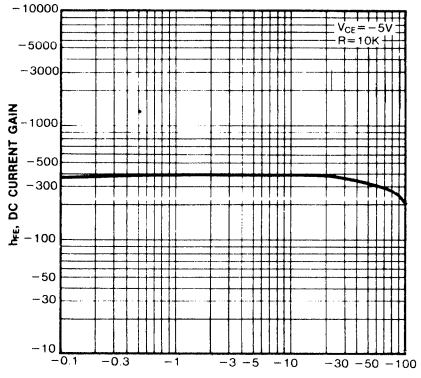
Equivalent Circuit



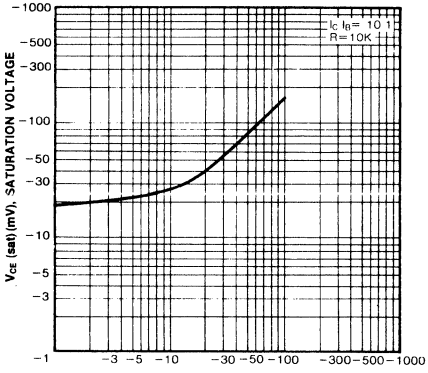
Marking



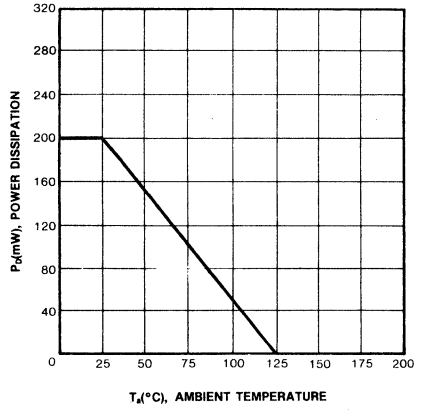
DC CURRENT GAIN



COLLECTOR-EMITTER SATURATION VOLTAGE



POWER DERATING

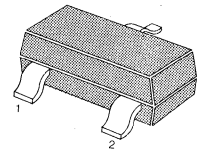


3

SWITCHING APPLICATION (Bias Resistor Built In)

- Switching Circuit, Inverter, Interface circuit Driver circuit
- Built in bias Resistor (R=22KΩ)
- Complement to KSR1111

SOT-23



1. Base 2. Emitter 3. Collector

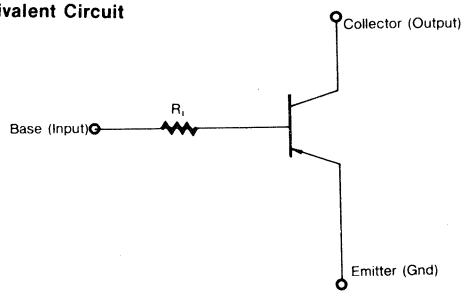
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−40	V
Collector-Emitter Voltage	V_{CEO}	−40	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current	I_C	−100	mA
Collector Dissipation	P_C	200	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

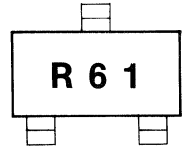
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=−100μA, I_E=0	−40			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_E=−1mA, I_B=0	−40			V
Collector Cutoff Current	I_{CBO}	V_{CB}=−30V, I_E=0			−0.1	μA
DC Current Gain	h_{FE}	V_{CE}=−5V, I_C=−1mA	100		600	
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=−10mA, I_B=−1mA			−0.3	V
Output Capacitance	Cob	V_{CB}=−10V, I_E=0 f=1MHz		5.5		pF
Current Gain-Bandwidth Product	f_T	V_{CE}=−10V, I_C=−5mA		200		MHz
Input Resistor	R		15	22	29	KΩ

Equivalent Circuit



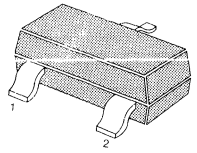
Marking



SWITCHING APPLICATION (Bias Resistor Built In)

- Switching Circuit, Inverter, Interface circuit
  Driver circuit
- Built in bias Resistor (R=47KΩ)
- Complement to KSR1112

SOT-23



1. Base 2. Emitter 3. Collector

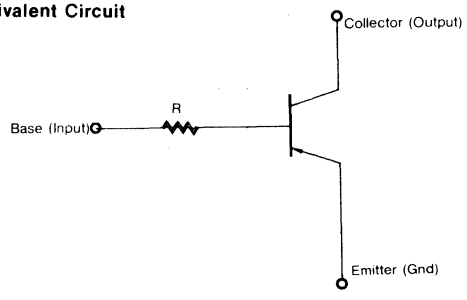
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−40	V
Collector-Emitter Voltage	V_{CEO}	−40	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current	I_C	−100	mA
Collector Dissipation	P_C	200	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

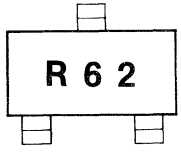
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=−100μA, I_E=0	−40			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=−1mA, I_B=0	−40			V
Collector Cutoff Current	I_{CBO}	V_{CB}=−30V, I_E=0			−0.1	μA
DC Current Gain	h_{FE}	V_{CE}=−5V, I_C=−1mA	100		600	
Collector Emitter Saturation Voltage	V_{CE}(sat)	I_C=−10mA, I_B=−1mA			−0.3	V
Output Capacitance	Cob	V_{CB}=−10V, I_E=0 f=1MHz		5.5		pF
Current Gain Bandwidth Product	f_T	V_{CE}=−10V, I_C=−5mA,		200		MHz
Input Resistor	R		32	47	62	KΩ

Equivalent Circuit



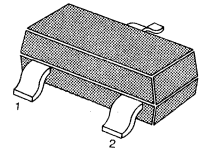
Marking



SWITCHING APPLICATION (Bias Resistor Built In)

- Switching circuit, Inverter, Interface circuit Driver circuit
- Built in bias Resistor (R_1=2.2KΩ, R_2=47KΩ)
- Complement to KSR1113

SOT-23



1. Base 2. Emitter 3. Collector

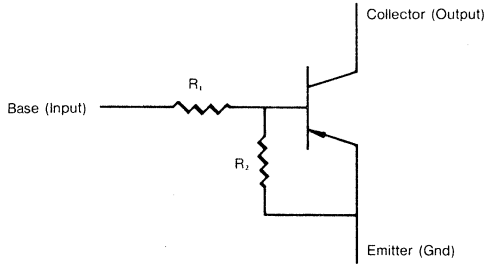
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−50	V
Collector-Emitter Voltage	V_{CEO}	−50	V
Emitter-Base Voltage	V_{EBO}	−10	V
Collector Current	I_C	−100	mA
Collector Dissipation	P_C	300	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

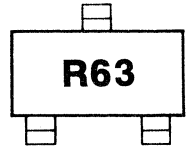
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=−10μA, I_E=0	−50			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=−100μA, I_B=0	−50			V
Collector Cutoff Current	I_{CBO}	V_{CB}=−40V, I_E=0			−0.1	μA
DC Current Gain	h_{FE}	V_{CE}=−5V, I_C=−5mA	68			
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=−10mA, I_B=−0.5mA			−0.3	V
Current Gain-Bandwidth Product	f_T	V_{CE}=−5mA, I_C=−10V		200		MHz
Output Capacitance	Cob	V_{CB}=−10V, I_E=0 f=1.0MHz		5.5		pF
Input Off Voltage	Vi(off)	V_{CE}=−5V, I_C=−100μA	−0.5			V
Input On Voltage	Vi(on)	V_{CE}=−0.2V, I_C=−10mA			−1.1	V
Input Resistor	R_1		1.5	2.2	2.9	KΩ
Resistor Ratio	R_1/R_2		0.042	0.047	0.052	

Equivalent Circuit



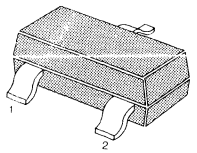
Marking



SWITCHING APPLICATION (Bias Resistor Built In)

- Switching circuit, Inverter, Interface circuit Driver circuit
- Built in bias Resistor (R_1 = 4.7KΩ, R_2 = 47KΩ)
- Complement to KSR1114

SOT-23



1. Base 2. Emitter 3. Collector

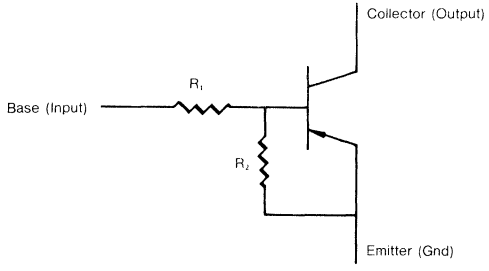
ABSOLUTE MAXIMUM RATINGS (T_a = 25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−50	V
Collector-Emitter Voltage	V_{CEO}	−50	V
Emitter-Base Voltage	V_{EBO}	−10	V
Collector Current	I_C	−100	mA
Collector Dissipation	P_C	300	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

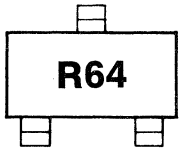
ELECTRICAL CHARACTERISTICS (T_a = 25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=−10μA, I_E=0	−50			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=−100μA, I_B=0	−50			V
Collector Cutoff Current	I_{CBO}	V_{CB}=−40V, I_E=0			−0.1	μA
DC Current Gain	h_{FE}	V_{CE}=−5V, I_C=−5mA	68			
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=−10mA, I_B=−0.5mA			−0.3	V
Current Gain-Bandwidth Product	f_T	V_{CE}=−5mA, I_C=−10V		200		MHz
Output Capacitance	Cob	V_{CB}=−10V, I_E=0 f=1.0MHz		5.5		pF
Input Off Voltage	Vi(off)	V_{CE}=−5V, I_C=−100μA	−0.5			V
Input On Voltage	Vi(on)	V_{CE}=−0.2V, I_C=−5mA			−1.3	V
Input Resistor	R_1		3.2	4.7	6.2	KΩ
Resistor Ratio	R_1/R_2		0.09	0.1	0.11	

Equivalent Circuit



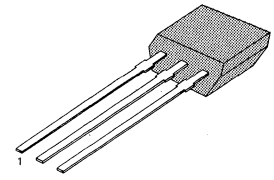
Marking



SWITCHING APPLICATION (Bias Resistor Built In)

- **Switching circuit, Inverter, Interface circuit Driver circuit**
- **Built in bias Resistor (R_1=4.7KΩ, R_2=4.7KΩ)**
- **Complement to KSR1201**

TO-92S



1. Emitter 2. Collector 3. Base

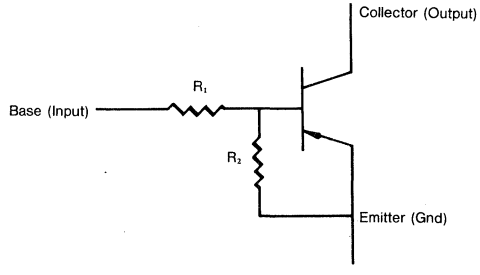
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−50	V
Collector-Emitter Voltage	V_{CEO}	−50	V
Emitter-Base Voltage	V_{EBO}	−10	V
Collector Current	I_C	−100	mA
Collector Dissipation	P_C	300	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

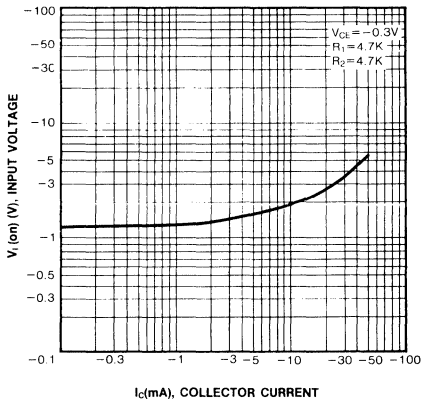
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CEO}	I_C=−10μA, I_E=0	−50			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=−100μA, I_B=0	−50			V
Collector Cutoff Current	I_{CBO}	V_{CB}=−40V, I_E=0			−0.1	μA
DC Current Gain	h_{FE}	V_{CE}=−5V, I_C=−10mA	20			
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=−10mA, I_B=−0.5mA			−0.3	V
Current Gain-Bandwidth Product	f_T	V_{CE}=−5mA, I_C=−10V		200		MHz
Output Capacitance	Cob	V_{CB}=−10V, I_E=0 f=1.0MHz		5.5		pF
Input Off Voltage	Vi(off)	V_{CE}=−5V, I_C=−100μA	−0.5			V
Input On Voltage	Vi(on)	V_{CE}=−0.3V, I_C=−20mA			−3	V
Input Resistor	R_1		3.2	4.7	6.2	KΩ
Resistor Ratio	R_1/R_2		0.9	1	1.1	

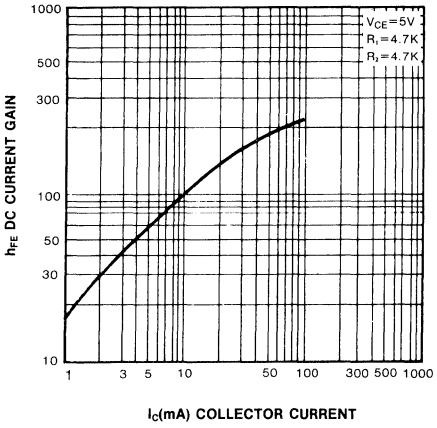
Equivalent Circuit



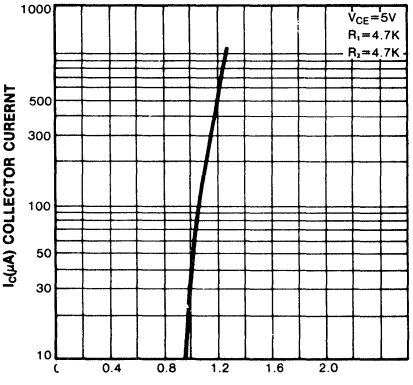
INPUT ON VOLTAGE



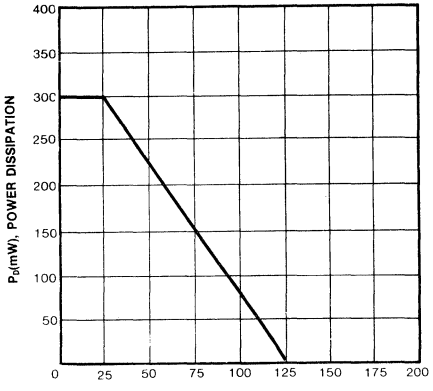
DC CURRENT GAIN



INPUT OFF VOLTAGE



POWER DERATING

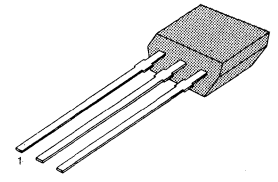


3

SWITCHING APPLICATION (Bias Resistor Built In)

- **Switching circuit, Inverter, Interface circuit Driver circuit**
- **Built in bias Resistor** ($R_1 = 10K\Omega$, $R_2 = 10K\Omega$)
- **Complement to KSR1202**

TO-92S



1. Emitter 2. Collector 3. Base

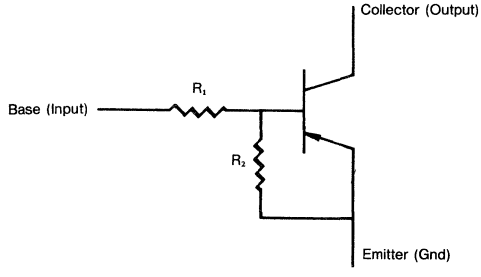
ABSOLUTE MAXIMUM RATINGS ($T_a = 25°C$)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−50	V
Collector-Emitter Voltage	V_{CEO}	−50	V
Emitter-Base Voltage	V_{EBO}	−10	V
Collector Current	I_C	−100	mA
Collector Dissipation	P_C	300	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

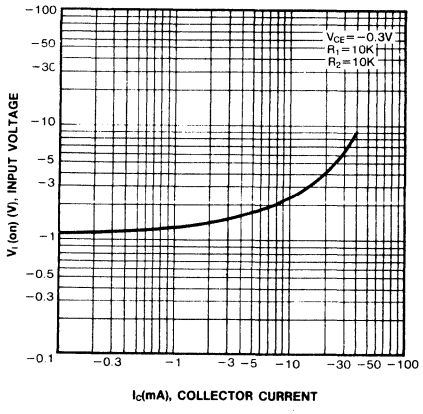
ELECTRICAL CHARACTERISTICS ($T_a = 25°C$)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	$I_C = -10\mu A$, $I_E = 0$	−50			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	$I_C = -100\mu A$, $I_B = 0$	−50			V
Collector Cutoff Current	I_{CBO}	$V_{CB} = -40V$, $I_E = 0$			−0.1	μA
DC Current Gain	h_{FE}	$V_{CE} = -5V$, $I_C = -5mA$	30			
Collector-Emitter Saturation Voltage	$V_{CE}(sat)$	$I_C = -10mA$, $I_B = -0.5mA$			−0.3	V
Current Gain-Bandwidth Product	f_T	$V_{CE} = -5mA$, $I_C = -10V$		200		MHz
Output Capacitance	Cob	$V_{CB} = -10V$, $I_E = 0$ f=1.0MHz		5.5		pF
Input Off Voltage	Vi(off)	$V_{CE} = -5V$, $I_C = -100\mu A$	−0.5			V
Input On Voltage	Vi(on)	$V_{CE} = -0.3V$, $I_C = -10mA$			−3	V
Input Resistor	R_1		7	10	13	KΩ
Resistor Ratio	R_1/R_2		0.9	1	1.1	

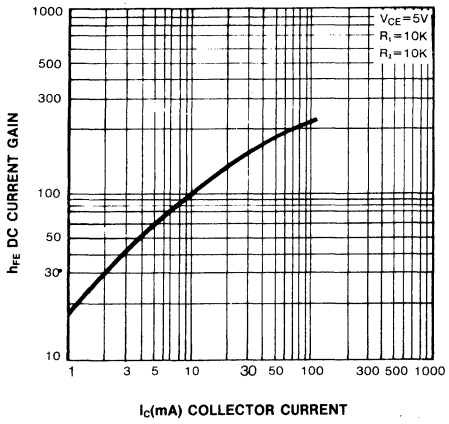
Equivalent Circuit



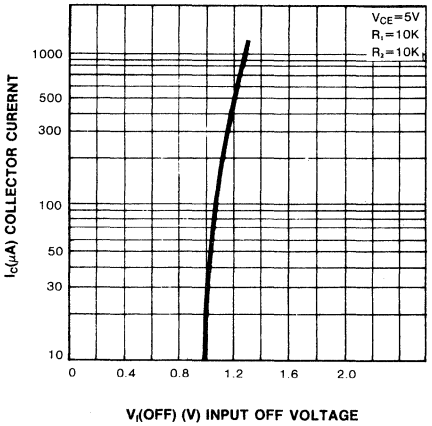
INPUT ON VOLTAGE



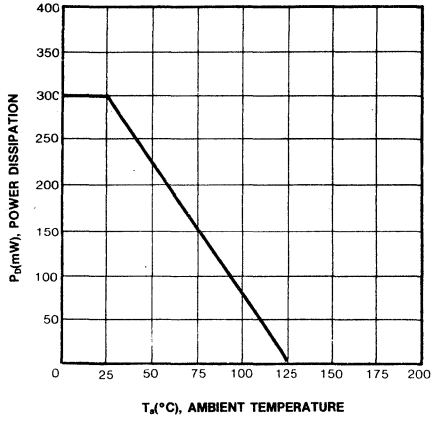
DC CURRENT GAIN



INPUT OFF VOLTAGE



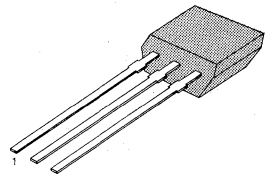
POWER DERATING



SWITCHING APPLICATION (Bias Resistor Built In)

- **Switching circuit, Inverter, Interface circuit Driver circuit**
- **Built in bias Resistor(R_1=22KΩ, R_2=22KΩ)**
- **Complement to KSR1203**

TO-92S



1. Emitter 2. Collector 3. Base

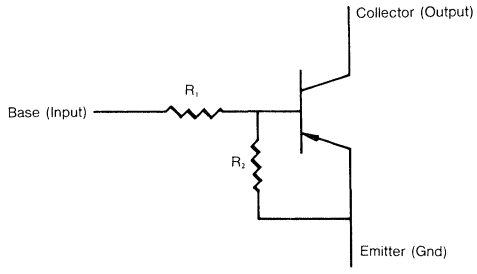
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−50	V
Collector-Emitter Voltage	V_{CEO}	−50	V
Emitter-Base Voltage	V_{EBO}	−10	V
Collector Current	I_C	−100	mA
Collector Dissipation	P_C	300	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

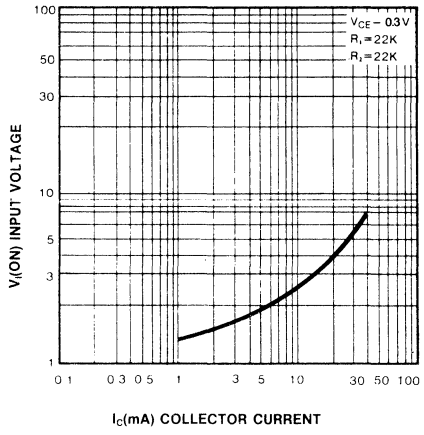
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=−10μA, I_E=0	−50			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=−100μA, I_B=0	−50			V
Collector Cutoff Current	I_{CBO}	V_{CB}=−40V, I_E=0			−0.1	μA
DC Current Gain	h_{FE}	V_{CE}=−5V, I_C=−5mA	56			
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=−10mA, I_B=−0.5mA			−0.3	V
Current Gain-Bandwidth Product	f_T	V_{CE}=−5mA, I_C=−10V		200		MHz
Output Capacitance	Cob	V_{CB}=−10V, I_E=0 f=1.0MHz		5.5		pF
Input Off Voltage	Vi(off)	V_{CE}=−5V, I_C=−100μA	−0.5			V
Input On Voltage	Vi(on)	V_{CE}=−0.3V, I_C=−5mA			−3.0	V
Input Resistor	R_1		15	22	29	KΩ
Resistor Ratio	R_1/R_2		0.9	1	1.1	

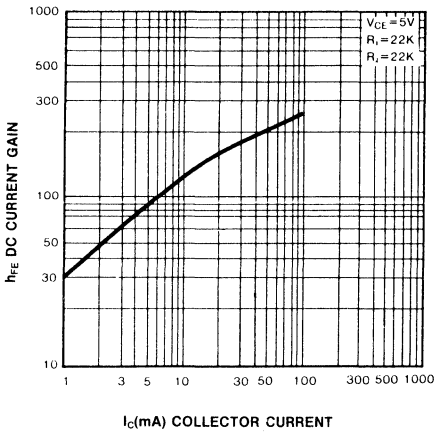
Equivalent Circuit



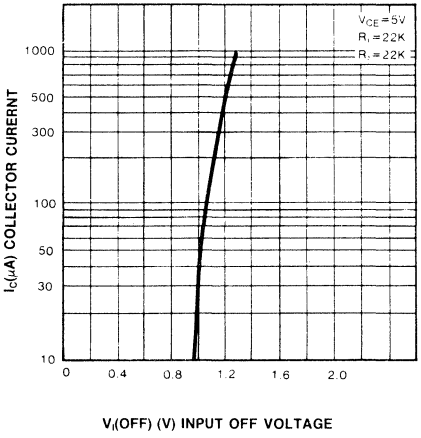
INPUT ON VOLTAGE



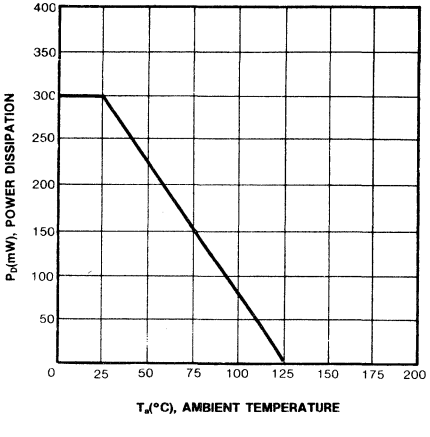
DC CURRENT GAIN



INPUT OFF VOLTAGE



POWER DERATING

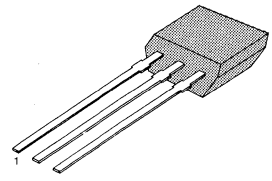


3

SWITCHING APPLICATION (Bias Resistor Built In)

- Switching circuit, Inverter, Interface circuit Driver circuit
- Built in bias Resistor (R_1=47KΩ, R_2=47KΩ)
- Complement to KSR1204

TO-92S



1. Emitter 2. Collector 3. Base

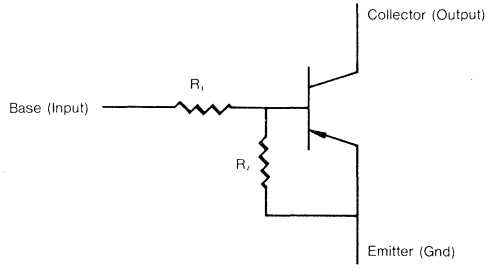
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−50	V
Collector-Emitter Voltage	V_{CEO}	−50	V
Emitter-Base Voltage	V_{EBO}	−10	V
Collector Current	I_C	−100	mA
Collector Dissipation	P_C	300	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

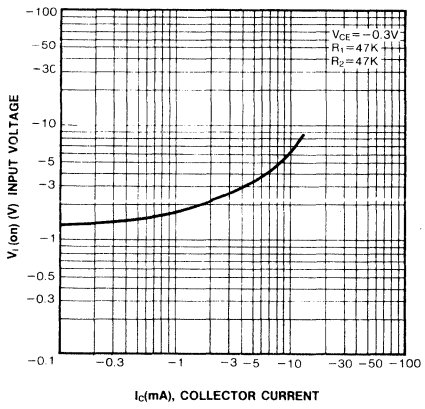
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=−10μA, I_E=0	−50			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=−100μA, I_B=0	−50			V
Collector Cutoff Current	I_{CBO}	V_{CB}=−40V, I_E=0			−0.1	μA
DC Current Gain	h_{FE}	V_{CE}=−5V, I_C=−5mA	68			
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=−10mA, I_B=−0.5mA			−0.3	V
Current Gain-Bandwidth Product	f_T	V_{CE}=−5mA, I_C=−10V		200		MHz
Output Capacitance	Cob	V_{CB}=−10V, I_E=0 f=1.0MHz		5.5		pF
Input Off Voltage	Vi(off)	V_{CE}=−5V, I_C=−100μA	−0.5			V
Input On Voltage	Vi(on)	V_{CE}=−0.3V, I_C=− 2mA			−3	V
Input Resistor	R_1		32	47	62	KΩ
Resistor Ratio	R_1/R_2		0.9	1	1.1	

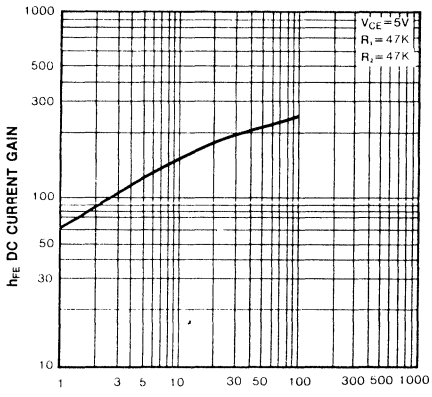
Equivalent Circuit



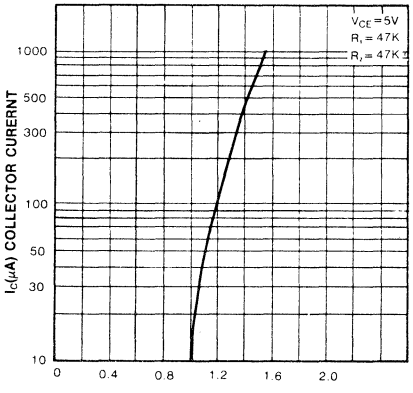
INPUT ON VOLTAGE



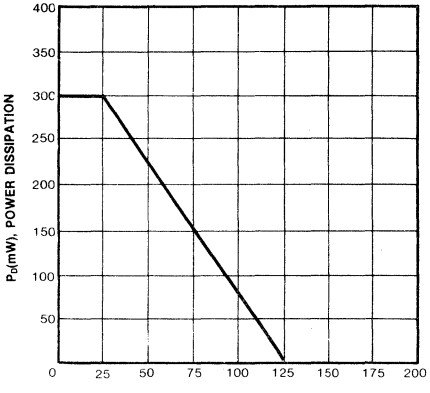
DC CURRENT GAIN



INPUT OFF VOLTAGE



POWER DERATING

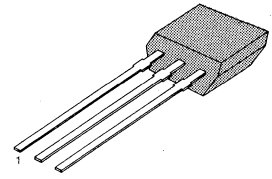


3

SWITCHING APPLICATION (Bias Resistor Built In)

- Switching Circuit, Inverter, Interface circuit Driver circuit
- Built in bias Resistor (R_1=4.7KΩ, R_2=10KΩ)
- Complement to KSR1205

TO-92S



1. Emitter 2. Collector 3. Base

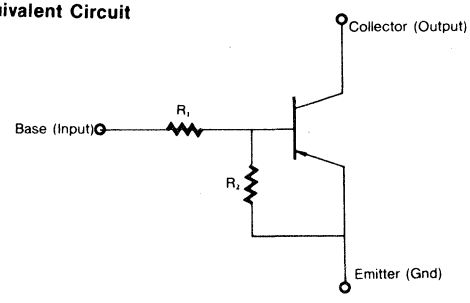
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−50	V
Collector-Emitter Voltage	V_{CEO}	−50	V
Emitter-Base Voltage	V_{EBO}	−10	V
Collector Current	I_C	−100	mA
Collector Dissipation	P_C	300	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

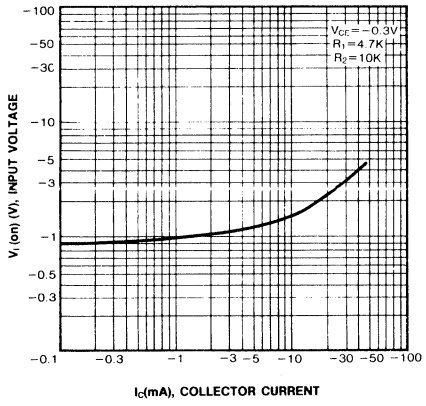
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=−10μA, I_E=0	−50			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=−100μA, I_B=0	−50			V
Collector Cutoff Current	I_{CBO}	V_{CB}=−40V, I_E=0			−0.1	μA
DC Current Gain	h_{FE}	V_{CE}=−5V, I_C=−5mA	30			
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=−10mA, I_B=−0.5mA			−0.3	V
Current Gain-Bandwidth Product	Cob	V_{CB}=−10V, I_E=0 f=1MHz		5.5		pF
Current Gain-Bandwidth Product	f_T	V_{CE}=−10V, I_C=−5mA		200		MHz
Input Off Voltage	Vi(off)	V_{CE}=−5V, I_C=−100μA	−0.3			V
Input On Voltage	Vi(on)	V_{CE}=−0.3V, I_C=−20mA			−2.5	V
Input Resistor	R_1		3.2	4.7	6.2	KΩ
Resistor Ratio	R_1/R_2		0.42	0.47	0.52	

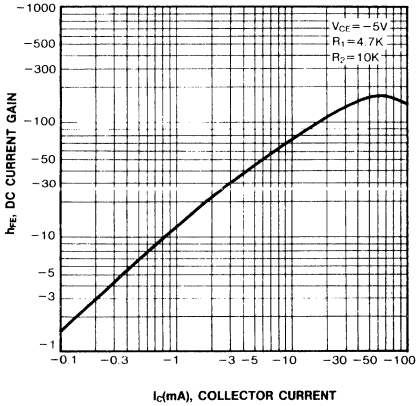
Equivalent Circuit



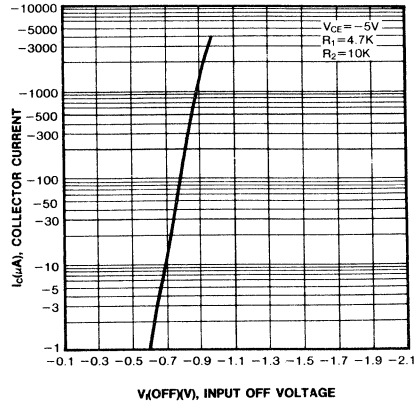
INPUT ON VOLTAGE



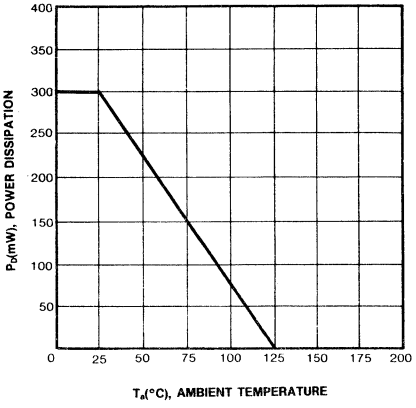
DC CURRENT GAIN



INPUT OFF VOLTAGE



POWER DERATING

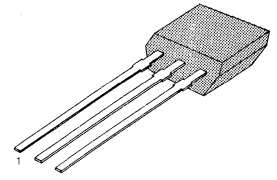


3

SWITCHING APPLICATION (Bias Resistor Built In)

- **Switching Circuit, Inverter, Interface circuit Driver circuit**
- **Built in bias Resistor (R_1=10KΩ, R_2=47KΩ)**
- **Complement to KSR1206**

TO-92S



1. Emitter 2. Collector 3. Base

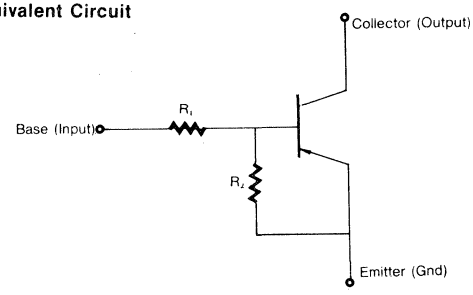
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−50	V
Collector-Emitter Voltage	V_{CEO}	−50	V
Emitter-Base Voltage	V_{EBO}	−10	V
Collector Current	I_C	−100	mA
Collector Dissipation	P_C	300	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

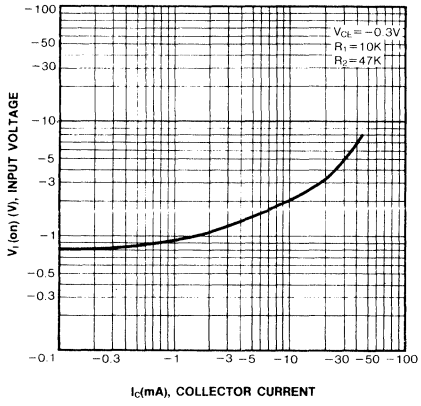
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=−10μA, I_E=0	−50			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=−100μA, I_B=0	−50			V
Collector Cutoff Current	I_{CBO}	V_{CB}=−40V, I_E=0			−0.1	μA
DC Current Gain	h_{FE}	V_{CE}=−5V, I_C=−5mA	68			
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=−10mA, I_B=−0.5mA			−0.3	V
Output Capacitance	Cob	V_{CB}=−10V, I_E=0 f=1MHz		5.5		pF
Current Gain-Bandwidth Product	f_T	V_{CE}=−10V, I_C=−5mA		200		MHz
Input Off Voltage	Vi(off)	V_{CE}=−5V, I_C=−100μA	−0.3			V
Input On Voltage	Vi(on)	V_{CE}=−0.3V, I_C=−1mA			−1.4	V
Input Resistor	R_1		7	10	13	KΩ
Resistor Ratio	R_1/R_2		0.19	0.21	0.24	

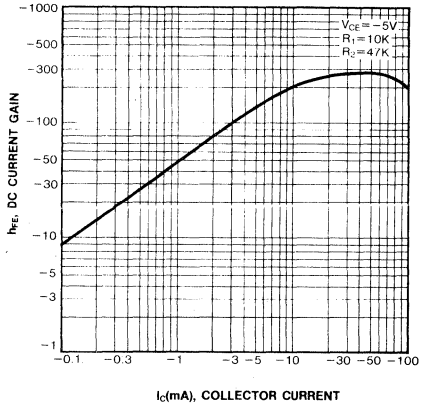
Equivalent Circuit



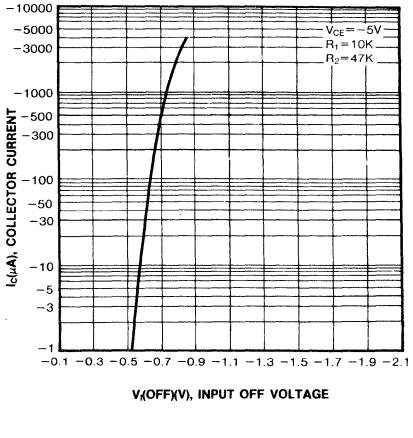
INPUT ON VOLTAGE



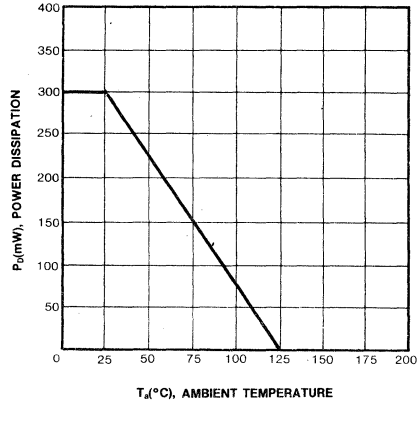
DC CURRENT GAIN



INPUT OFF VOLTAGE



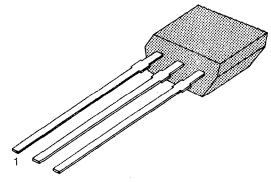
POWER DERATING



SWITCHING APPLICATION (Bias Resistor Built In)

- **Switching Circuit, Inverter, Interface circuit Driver circuit**
- **Built in bias Resistor (R_1=22KΩ R_2=47KΩ)**
- **Complement to KSR1207**

TO-92S



1. Emitter 2. Collector 3. Base

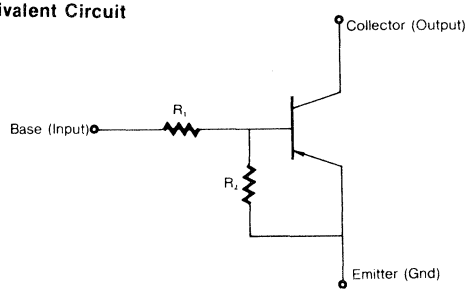
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−50	V
Collector-Emitter Voltage	V_{CEO}	−50	V
Emitter-Base Voltage	V_{EBO}	−10	V
Collector Current	I_C	−100	mA
Collector Dissipation	P_C	300	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

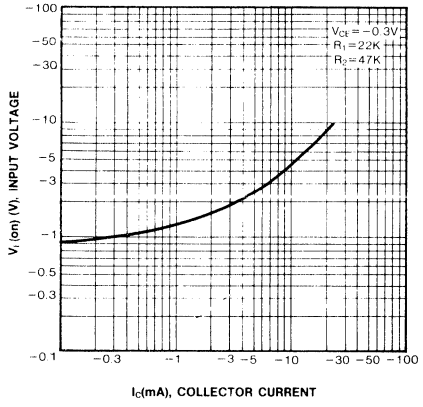
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=−10μA, I_E=0	−50			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=−100μA, I_B=0	−50			V
Collector Cutoff Current	I_{CBO}	V_{CB}=−40V, I_E=0			−0.1	μA
DC Current Gain	h_{FE}	V_{CE}=−5V, I_C=−5mA	68			
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=−10mA, I_B=−0.5mA			−0.3	V
Current Gain-Bandwidth Product	Cob	V_{CB}=−10V, I_E=0 f=1MHz		5.5		pF
Current Gain-Bandwidth Product	f_T	V_{CE}=−10V, I_C=−5mA		200		MHz
Input Off Voltage	Vi(off)	V_{CE}=−5V, I_C=−100μA	−0.4			V
Input On Voltage	Vi(on)	V_{CE}=−0.3V, I_C=−2mA			−2.5	V
Input Resistor	R_1		15	22	29	KΩ
Resistor Ratio	R_1/R_2		0.42	0.47	0.52	

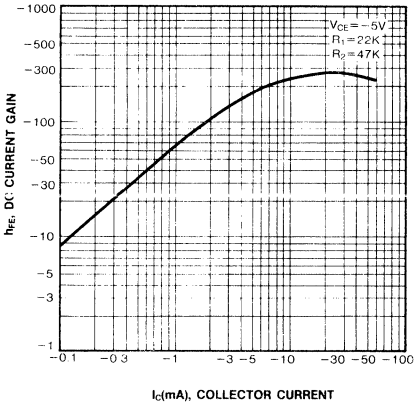
Equivalent Circuit



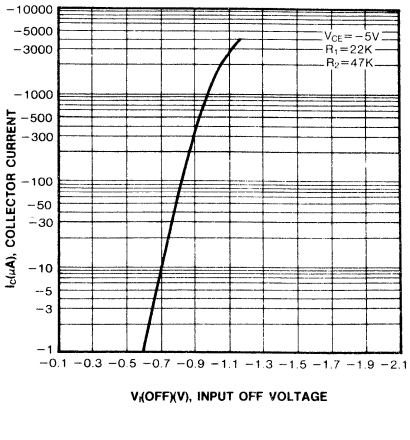
INPUT ON VOLTAGE



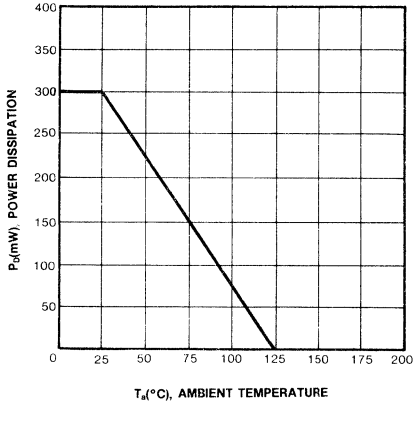
DC CURRENT GAIN



INPUT OFF VOLTAGE



POWER DERATING

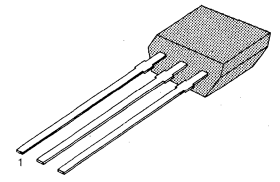


3

SWITCHING APPLICATION (Bias Resistor Built In)

- **Switching circuit, Inverter, Interface circuit Driver circuit**
- **Built in bias Resistor (R_1=47KΩ, R_2=22KΩ)**
- **Complement to KSR1208**

TO-92S



1. Emitter 2. Collector 3. Base

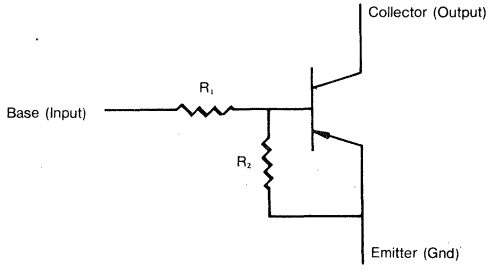
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−50	V
Collector-Emitter Voltage	V_{CEO}	−50	V
Emitter-Base Voltage	V_{EBO}	−10	V
Collector Current	I_C	−100	mA
Collector Dissipation	P_C	300	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

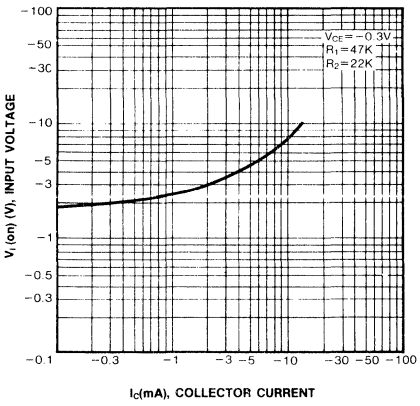
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=−10μA, I_E=0	−50			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=−100μA, I_B=0	−50			V
Collector Cutoff Current	I_{CBO}	V_{CB}=−40V, I_E=0			−0.1	μA
DC Current Gain	h_{FE}	V_{CE}=−5V, I_C=−5mA	56			
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=−10mA, I_B=−0.5mA			−0.3	V
Current Gain-Bandwidth Product	f_T	V_{CE}=−5mA, I_C=−10V		200		MHz
Output Capacitance	Cob	V_{CB}=−10V, I_E=0 f=1.0MHz		5.5		pF
Input Off Voltage	Vi(off)	V_{CE}=−5V, I_C=−100μA	−0.8			V
Input On Voltage	Vi(on)	V_{CE}=−0.3V, I_C=−2mA			−4	V
Input Resistor	R_1		32	47	62	KΩ
Resistor Ratio	R_1/R_2		1.9	2.1	2.4	

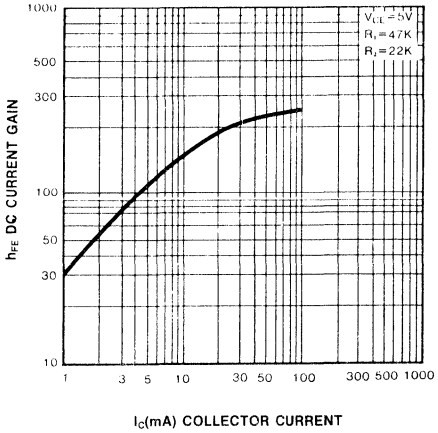
Equivalent Circuit



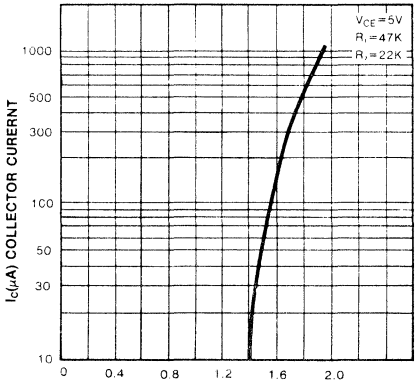
INPUT ON VOLTAGE



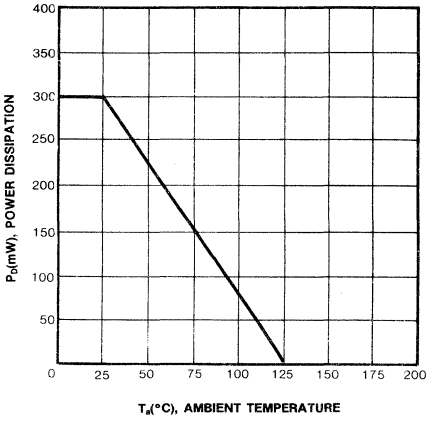
DC CURRENT GAIN



INPUT OFF VOLTAGE



POWER DERATING

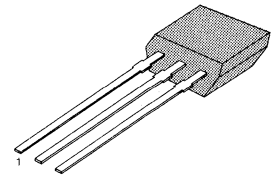


3

SWITCHING APPLICATION (Bias Resistor Built In)

- **Switching Circuit, Inverter, Interface circuit Driver circuit**
- **Built in bias Resistor (R=4.7KΩ)**
- **Complement to KSR1209**

TO-92S



1. Emitter 2. Collector 3. Base

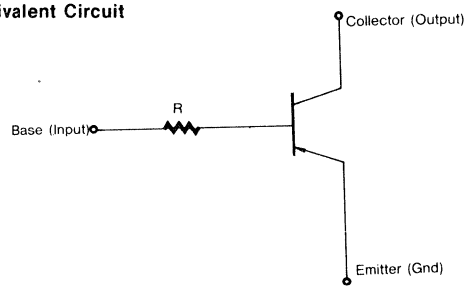
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−40	V
Collector-Emitter Voltage	V_{CEO}	−40	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current	I_C	−100	mA
Collector Dissipation	P_C	300	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

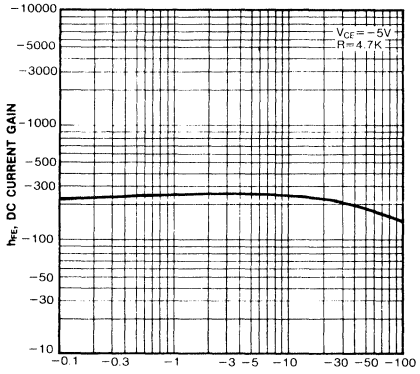
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=−100μA, I_E=0	−40			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=−1mA, I_B=0	−40			V
Collector Cutoff Current	I_{CBO}	V_{CB}=−30V, I_E=0			−0.1	μA
DC Current Gain	h_{FE}	V_{CE}=−5V, I_C=−1mA	100		600	
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=−10mA, I_B=−1mA			−0.3	V
Output Capacitance	Cob	V_{CB}=−10V, I_E=0 f=1MHz		5.5		pF
Current Gain-Bandwidth Product	f_T	V_{CE}=−10V, I_C=−5mA		200		MHz
Input Resistor	R_1		3.2	4.7	6.2	KΩ

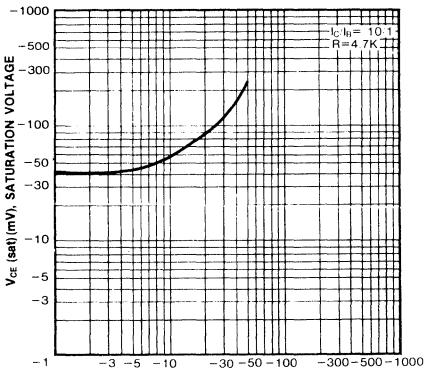
Equivalent Circuit



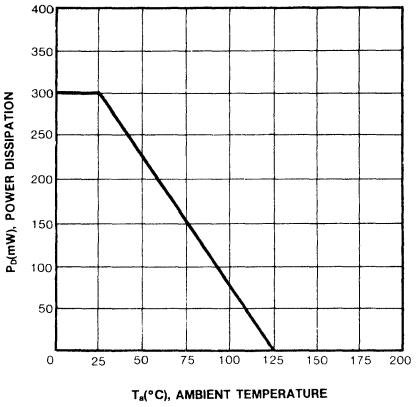
DC CURRENT GAIN



COLLECTOR-EMITTER SATURATION VOLTAGE



POWER DERATING

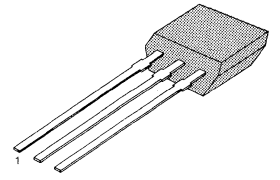


3

SWITCHING APPLICATION (Bias Resistor Built In)

- **Switching Circuit, Inverter, Interface circuit Driver circuit**
- **Built in bias Resistor (R=10KΩ)**
- **Complement to** KSR1210

TO-92S



1. Emitter 2. Collector 3. Base

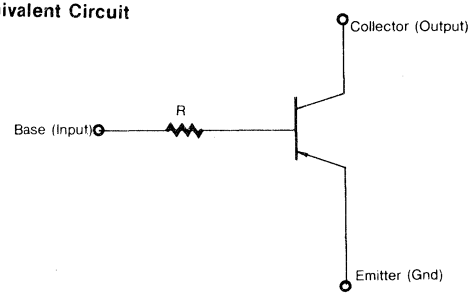
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−40	V
Collector-Emitter Voltage	V_{CEO}	−40	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current	I_C	−100	mA
Collector Dissipation	P_C	300	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

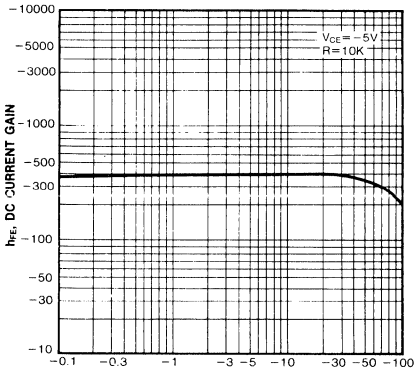
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=−100μA, I_E=0	−40			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_E=−1mA, I_B=0	−40			V
Collector Cutoff Current	I_{CBO}	V_{CB}=−30V, I_E=0			−0.1	μA
DC Current Gain	h_{FE}	V_{CE}=−5V, I_C=−1mA	100		600	
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=−10mA, I_B=−1mA			0.3	V
Output Capacitance	Cob	V_{CB}=−10V, I_E=0 f=1MHz		5.5		pF
Current Gain-Bandwidth Product	f_T	V_{CE}=−10V, I_C=−5mA		200		MHz
Input Resistor	R		7	10	13	KΩ

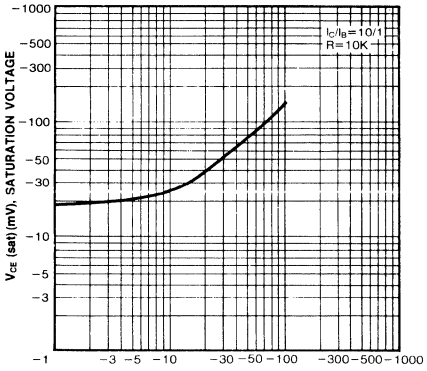
Equivalent Circuit



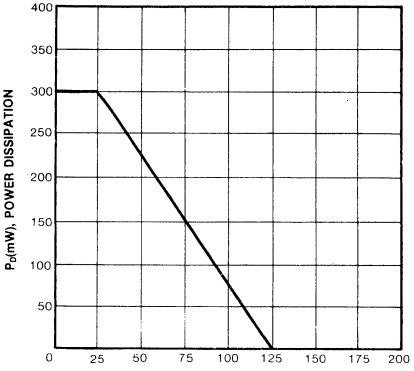
DC CURRENT GAIN



COLLECTOR-EMITTER SATURATION VOLTAGE



POWER DERATING

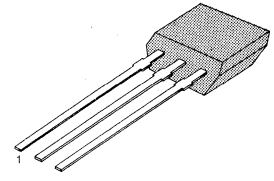


3

SWITCHING APPLICATION (Bias Resistor Built In)

- **Switching Circuit, Inverter, Interface circuit Driver circuit**
- **Built in bias Resistor (R=22KΩ)**
- **Complement to KSR1211**

TO-92S



1. Emitter 2. Collector 3. Base

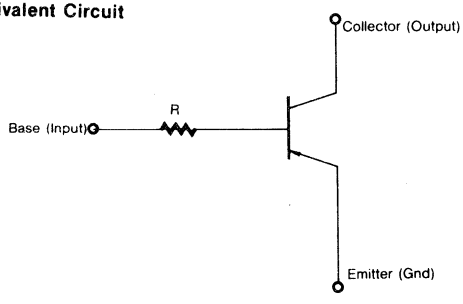
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−40	V
Collector-Emitter Voltage	V_{CEO}	−40	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current	I_C	−100	mA
Collector Dissipation	P_C	300	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=−100μA, I_E=0	−40			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_E=−1mA, I_B=0	−40			V
Collector Cutoff Current	I_{CBO}	V_{CB}=−30V, I_E=0			−0.1	μA
DC Current Gain	h_{FE}	V_{CE}=−5V, I_C=−1mA	100		600	
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=−10mA, I_B=−1mA			−0.3	V
Output Capacitance	Cob	V_{CB}=−10V, I_E=0 f=1MHz		5.5		pF
Current Gain-Bandwidth Product	f_T	V_{CE}=−10V, I_C=−5mA		200		MHz
Input Resistor	R		15	22	29	KΩ

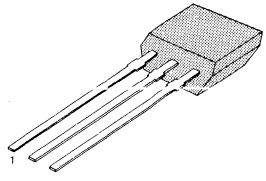
Equivalent Circuit



SWITCHING APPLICATION (Bias Resistor Built In)

- Switching Circuit, Inverter, Interface circuit
  Driver circuit
- Built in bias Resistor (R=47KΩ)
- Complement to KSR1212

TO-92S



1. Emitter 2. Collector 3. Base

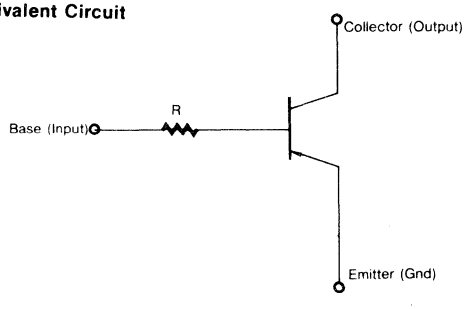
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−40	V
Collector-Emitter Voltage	V_{CEO}	−40	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current	I_C	−100	mA
Collector Dissipation	P_C	300	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=−100μA, I_E=0	−40			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=−1mA, I_B=0	−40			V
Collector Cutoff Current	I_{CBO}	V_{CB}=−30V, I_E=0			−0.1	μA
DC Current Gain	h_{FE}	V_{CE}=−5V, I_C=−1mA	100		600	
Collector Emitter Saturation Voltage	V_{CE}(sat)	I_C=−10mA, I_B=−1mA			−0.3	V
Output Capacitance	Cob	V_{CB}=−10V, I_E=0 f=1MHz		5.5		pF
Current Gain Bandwidth Product	f_T	V_{CE}=−10V, I_C=−5mA,		200		MHz
Input Resistor	R		32	47	62	KΩ

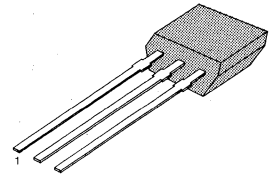
Equivalent Circuit



SWITCHING APPLICATION (Bias Resistor Built In)

- Switching circuit, Inverter, Interface circuit Driver circuit
- Built in bias Resistor (R_1=2.2KΩ, R_2=47KΩ)
- Complement to KSR1213

TO-92S



1. Emitter 2. Collector 3. Base

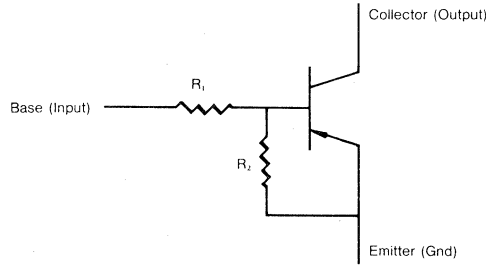
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−50	V
Collector-Emitter Voltage	V_{CEO}	−50	V
Emitter-Base Voltage	V_{EBO}	−10	V
Collector Current	I_C	−100	mA
Collector Dissipation	P_C	300	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=−10μA, I_E=0	−50			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=−100μA, I_B=0	−50			V
Collector Cutoff Current	I_{CBO}	V_{CB}=−40V, I_E=0			−0.1	μA
DC Current Gain	h_{FE}	V_{CE}=−5V, I_C=−5mA	68			
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=−10mA, I_B=−0.5mA			−0.3	V
Current Gain-Bandwidth Product	f_T	V_{CE}=−5mA, I_C=−10V		200		MHz
Output Capacitance	Cob	V_{CB}=−10V, I_E=0 f=1.0MHz		5.5		pF
Input Off Voltage	Vi(off)	V_{CE}=−5V, I_C=−100μA	−0.5			V
Input On Voltage	Vi(on)	V_{CE}=−0 2V, I_C=−10mA			−1.1	V
Input Resistor	R_1		1.5	2.2	2.9	KΩ
Resistor Ratio	R_1/R_2		0.042	0.047	0.052	

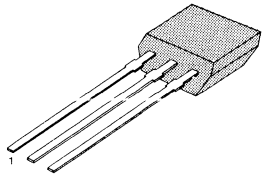
Equivalent Circuit



SWITCHING APPLICATION (Bias Resistor Built In)

- Switching circuit, Inverter, Interface circuit Driver circuit
- Built in bias Resistor (R_1 = 4.7KΩ, R_2 = 47KΩ)
- Complement to KSR1214

TO-92S



1. Emitter 2. Collector 3. Base

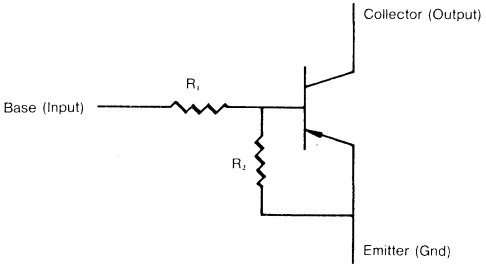
ABSOLUTE MAXIMUM RATINGS (T_a = 25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−50	V
Collector-Emitter Voltage	V_{CEO}	−50	V
Emitter-Base Voltage	V_{EBO}	−10	V
Collector Current	I_C	−100	mA
Collector Dissipation	P_C	300	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

ELECTRICAL CHARACTERISTICS (T_a = 25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C = −10μA, I_E = 0	−50			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C = −100μA, I_B = 0	−50			V
Collector Cutoff Current	I_{CBO}	V_{CB} = −40V, I_E = 0			−0.1	μA
DC Current Gain	h_{FE}	V_{CE} = −5V, I_C = −5mA	68			
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C = −10mA, I_B = −0.5mA			−0.3	V
Current Gain-Bandwidth Product	f_T	V_{CE} = −5mA, I_C = −10V		200		MHz
Output Capacitance	Cob	V_{CB} = −10V, I_E = 0 f = 1.0MHz		5.5		pF
Input Off Voltage	Vi(off)	V_{CE} = −5V, I_C = −100μA	−0.5			V
Input On Voltage	Vi(on)	V_{CE} = −0.2V, I_C = −5mA			−1.3	V
Input Resistor	R_1		3.2	4.7	6.2	KΩ
Resistor Ratio	R_1/R_2		0.09	0.1	0.11	

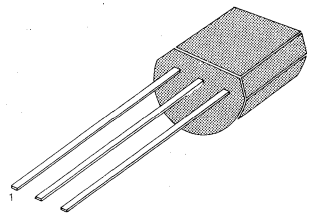
Equivalent Circuit



GENERAL PURPOSE TRANSISTOR

- **Collector-Emitter Voltage: V_{CEO}=40V**
- **Collector Dissipation: P_C (max)=625mW**

TO-92



1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

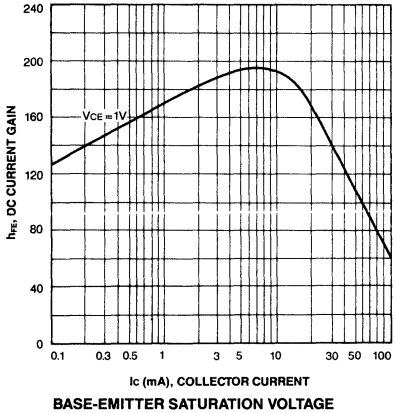
Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	60	V
Collector-Emitter Voltage	V_{CEO}	40	V
Emitter-Base Voltage	V_{EBO}	6	V
Collector Current	I_C	200	mA
Collector Dissipation	P_C	625	mW
Junction Temperature	T_j	150	°C
Storage Temperature	Tstg	−55~150	°C

ELECTRICAL CHARACTERISTICS (T_a=25°C)

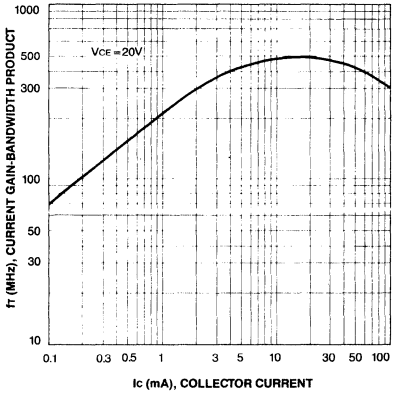
Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=10μA, I_E=0	60			V
*Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=1mA, I_B=0	40			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=10μA, I_C=0	6			V
Collector Cut-off Current	I_{CEX}	V_{CE}=30V, V_{EB}=3V			50	nA
Base Cut-off Current	I_{BL}	V_{CE}=30V, V_{EB}=3V			50	nA
*DC Current Gain	h_{FE}					
:2N3903		V_{CE}=1V, I_C=0.1mA	20			
2N3904			40			
2N3903		V_{CE}=1V, I_C=1mA	35			
2N3904			70			
2N3903		V_{CE}=1V, I_C=10mA	50		150	
2N3904			100		300	
2N3903		V_{CE}=1V, I_C=50mA	30			
2N3904			60			
2N3903		V_{CE}=1V, I_C=100mA	15			
2N3904			30			
*Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=10mA, I_B=1mA			0.2	V
		I_C=50mA, I_B=5mA			0.3	V
*Base-Emitter Saturation Voltage	V_{BE} (sat)	I_C=10mA, I_B=1mA	0.65		0.85	V
		I_C=50mA, I_B=5mA			0.95	V
Output Capacitance	C_{OB}	V_{CB}=5V, I_E=0 f=1MHz			4	pF
Current Gain Bandwidth Product	f_T	V_{CE}=20V, I_C=10mA				
:2N3903		f=100MHz	250			MHz
2N3904			300			MHz
Turn On Time	t_{ON}	V_{CC}=3V, V_{BE}=0.5V I_C=10mA, I_{B1}=1mA			70	ns
Turn Off Time	t_{OFF}	V_{CC}=3V, I_C=10mA				
:2N3903		I_{B1}=I_{B2}=1mA			225	ns
2N3904					250	ns

*Pulse Test: Pulse Width≤300μs, Duty Cycle≤2%

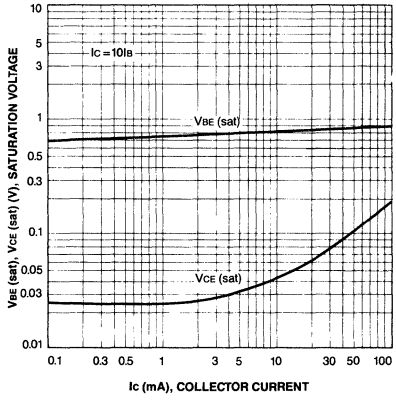
DC CURRENT GAIN



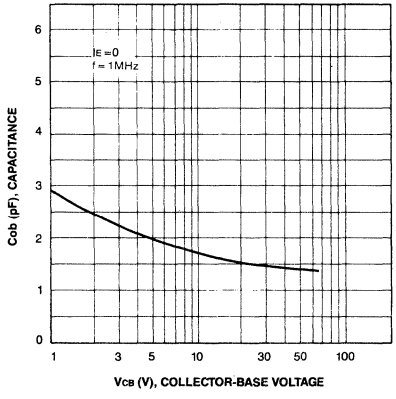
CURRENT GAIN-BANDWIDTH PRODUCT



BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



OUTPUT CAPACITANCE

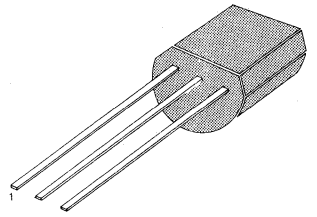


3

GENERAL PURPOSE TRANSISTOR

- **Collector-Emitter Voltage: V_{CEO}=40V**
- **Collector Dissipation: P_C (max)=625mW**

TO-92



1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−40	V
Collector-Emitter Voltage	V_{CEO}	−40	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current	I_C	−200	mA
Collector Dissipation	P_C	−625	mW
Junction Temperature	T_j	150	°C
Storage Temperature	Tstg	−55~150	°C

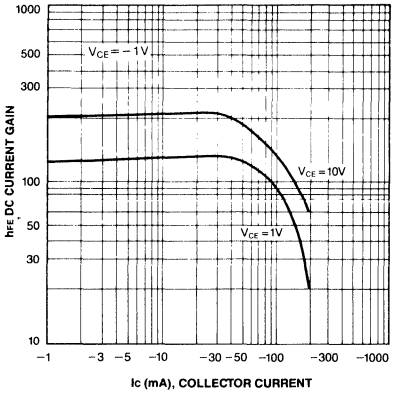
- Refer to 2N3906 for graphs

ELECTRICAL CHARACTERISTICS (T_a=25°C)

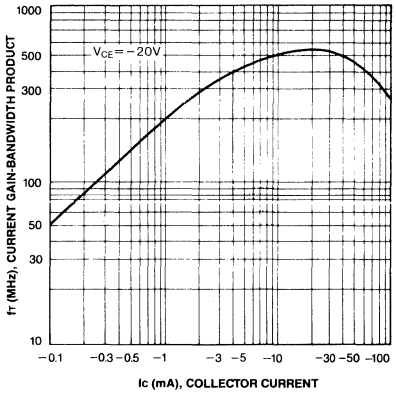
Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=−10μA, I_E=0	−40			V
*Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=−1mA, I_B=0	−40			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=−10μA, I_C=0	−6			V
Collector Cut-off Current	I_{CEX}	V_{CE}=−30V, V_{EB}=−3V			−50	nA
Base Cut-off Current	I_{BL}	V_{CE}=−30V, V_{EB}=−3V			−50	nA
*DC Current Gain	h_{FE}					
:2N3905		V_{CE}=−1V, I_C=−0.1mA	30			
2N3906			60			
2N3905		V_{CE}=−1V, I_C=−1mA	40			
2N3906			80			
2N3905		V_{CE}=−1V, I_C=−10mA	50		150	
2N3906			100		300	
2N3905		V_{CE}=−1V, I_C=−50mA	30			
2N3906			60			
2N3905		V_{CE}=−1V, I_C=100mA	15			
2N3906			30			
*Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=−10mA, I_B=−1mA			−0.25	V
		I_C−50mA, I_B=−5mA			−0.4	V
*Base-Emitter Saturation Voltage	V_{BE} (sat)	I_C=−10mA, I_B=−1mA	−0.65		−0.85	V
		I_C=−50mA, I_B=−5mA			−0.95	V
Output Capacitance	C_{OB}	V_{CB}=−5V, I_E=0 f=100KHz			4.5	pF
Current Gain Bandwidth Product	f_T	V_{CE}=−20V, I_C=−10mA				
:2N3905		f=100MHz	200			MHz
2N3906			250			MHz
Turn On Time	t_{ON}	V_{CC}=−3V, V_{BE}=−0.5V I_C=−10mA, I_B1=−1mA			70	ns
Turn Off Time	t_{OFF}	V_{CC}=−3V, I_C=−10mA				
:2N3905		I_B1=I_B2=1−mA			260	ns
2N3906					300	ns

*Pulse Test: Pulse Width≤300μs, Duty Cycle≤2%

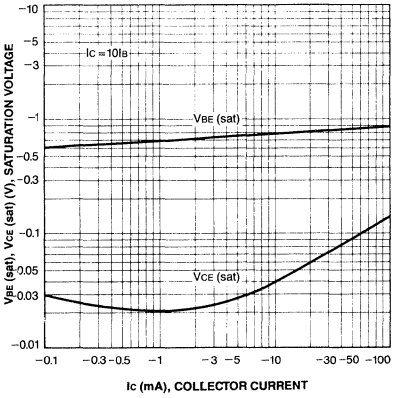
DC CURRENT GAIN



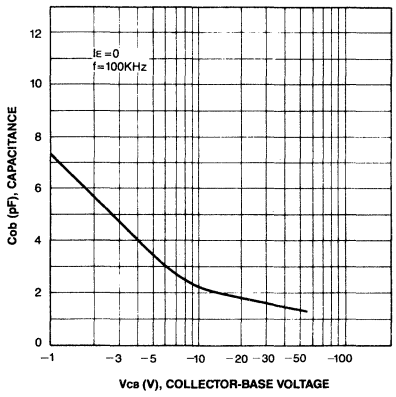
CURRENT GAIN-BANDWIDTH PRODUCT



BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



OUTPUT CAPACITANCE

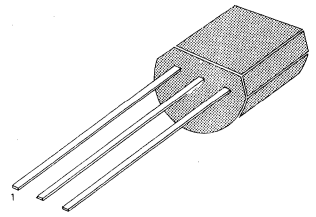


3

GENERAL PURPOSE TRANSISTOR

- **Collector-Emitter Voltage: V_{CEO} = 2N4123: 30V**
  2N4124: 25V
- **Collector Dissipation: P_C (max) = 625mW**

TO-92



1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a = 25°C)

Characteristic		Symbol	Rating	Unit
Collector-Base Voltage	:2N4123	V_{CBO}	40	V
	2N4124		30	V
Collector-Emitter Voltage	:2N4123	V_{CEO}	30	V
	2N4124		25	V
Emitter-Base Voltage		V_{EBO}	5	V
Collector Current		I_C	200	mA
Collector Dissipation		P_C	625	mW
Junction Temperature		T_J	150	°C
Storage Temperature		T_{STG}	−55~150	°C

• Refer to 2N3904 for graphs

ELECTRICAL CHARACTERISTICS (T_a = 25°C)

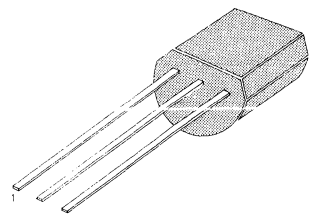
Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=10μA, I_E=0				
:2N4123			40			V
2N4124			30			V
*Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=1mA, I_B=0				
:2N4123			30			V
2N4124			25			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=10μA, I_C=0	5			V
Collector Cut-off Current	I_{CBO}	V_{CB}=20V, I_C=0			50	nA
Emitter Cut-off Current	I_{EBO}	V_{BE}=3V, I_C=0			50	nA
*DC Current Gain	h_{FE}					
:2N4123		V_{CE}=1V, I_C=0.2mA	50		150	
2N4124			120		360	
2N4123		V_{CE}=1V, I_C=50mA	25			
2N4124			60			
*Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=50mA, I_B=5mA			0.3	V
*Base-Emitter Saturation Voltage	V_{BE} (sat)	I_C=50mA, I_B=5mA			0.95	V
Output Capacitance	C_{OB}	V_{CB}=5V, I_E=0 f=1MHz			4	pF
Collector-Base Capacitance	C_{CB}	V_{CB}=5V, I_E=0 f=100KHz			4	pF
Current Gain Bandwidth Product	f_T	V_{CE}=20V, I_C=10mA				
:2N4123		f=100MHz	250			MHz
2N4124			300			MHz

*Pulse Test: Pulse Width≤300μs. Duty Cycle≤2%

AMPLIFIER TRANSISTOR

- **Collector-Emitter Voltage: V_{CEO} = 2N4125: 30V**
  2N4126: 25V
- **Collector Dissipation: P_C (max)=625mW**

TO-92



1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a =25°C)

Characteristic		Symbol	Rating	Unit
Collector-Base Voltage	:2N4125	V_{CBO}	−30	V
	2N4126		−25	V
Collector-Emitter Voltage	:2N4125	V_{CEO}	−30	V
	2N4126		−25	V
Emitter-Base Voltage		V_{EBO}	−4	V
Collector Current		I_C	−200	mA
Collector Dissipation		P_C	625	mW
Junction Temperature		T_J	150	°C
Storage Temperature		T_{STG}	−55~150	°C

ELECTRICAL CHARACTERISTICS (T_a =25°C)

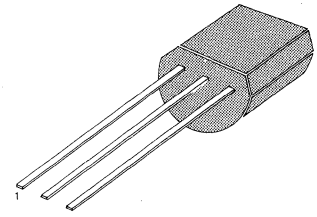
Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=−10μA, I_E=−0				
:2N4125			−30			V
2N4126			−25			V
*Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=−1mA, I_B=0				
:2N4125			−30			V
2N4126			−25			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=−10μA, I_C=0	−4			V
Collector Cut-off Current	I_{CBO}	V_{CB}=−20V, V_C=0			−50	nA
Emitter Cut-off Current	I_{EBO}	V_{BE}=3V, I_C=0			−50	nA
*DC Current Gain	h_{FE}					
:2N4125		V_{CE}=−1V, I_C=−2mA	50		150	
2N4126			120		360	
2N4125		V_{CE}=−1V, I_C=−50mA	25			
2N4126			60			
*Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=−50mA, I_B=−5mA			−0.4	V
*Base-Emitter Saturation Voltage	V_{BE} (sat)	I_C=−50mA, I_B=−5mA			−0.95	V
Current Gain Bandwidth Product	f_T	V_{CE}=−20V, I_C=−10				
:2N4125		f=100MHz	200			MHz
2N4126			250			MHz
Collector-Base Capacitance	C_{CB}	V_{CB}=5V, I_E=0 f=1MHz			4.5	pF
Noise figure	N_F	I_C=−100μA, V_{CE}=−5V R_G=1KΩ Noise Bandwidth= 10Hz to 15.7KHz				
:2N4125					5	dB
2N4126					4	dB

*Pulse Test: Pulse Width≤300μs, Duty Cycle≤2%

GENERAL PURPOSE TRANSISTOR

- **Collector-Emitter Voltage: V_{CEO}=40V**
- **Collector Dissipation: P_C (max)=625mW**

TO-92



1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

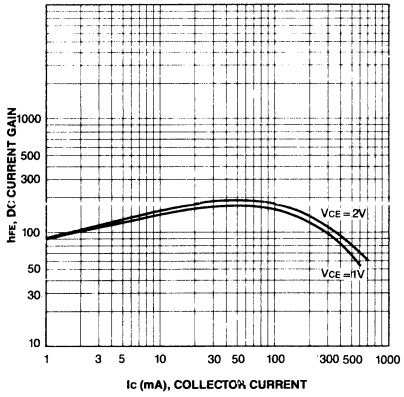
Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	60	V
Collector-Emitter Voltage	V_{CEO}	40	V
Emitter-Base Voltage	V_{EBO}	6	V
Collector Current	I_C	600	mA
Collector Dissipation	P_C	625	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ 150	°C

ELECTRICAL CHARACTERISTICS (T_a=25°C)

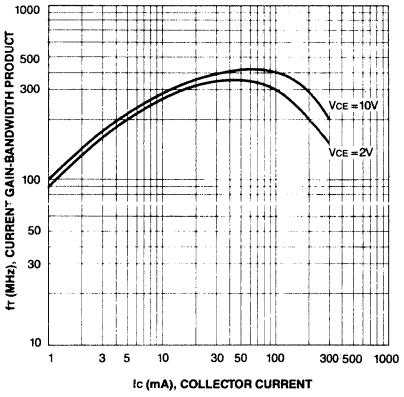
Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=100μA, I_E=0	60			V
*Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=1mA, I_B=0	40			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=100μA, I_C=0	6			V
Collector Cut-off Current	I_{CEX}	V_{CE}=35V, V_{EB}=0.4V			100	nA
*DC Current Gain	h_{FE}					
:2N4401		V_{CE}=1V, I_C=0.1mA	20			
2N4400		V_{CE}=1V, I_C=1mA	20			
2N4401			40			
2N4400		V_{CE}=1V, I_C=10mA	40			
2N4401			80			
2N4400		V_{CE}=1V, I_C=150mA	50		150	
2N4401			100		300	
2N4400		V_{CE}=2V, I_C=500mA	20			
2N4401			40			
*Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=150mA, I_B=15mA			0.4	V
		I_C50mA, I_B=50mA			0.75	V
*Base-Emitter Saturation Voltage	V_{BE} (sat)	I_C=150mA, I_B=15mA	0.75		0.95	V
		I_C=500mA, I_B=50mA			1.2	V
Output Capacitance	C_{CB}	V_{CB}=5V, I_E=0 f=100MHz			6.5	pF
Current Gain Bandwidth Product	f_T	V_{CE}=10V, I_C=20mA				
:2N4400		f=100MHz	200			MHz
2N4401			250			MHz
Turn On Time	t_{ON}	V_{CC}=30V, V_{BE}=2V I_C=150mA, I_B1=15mA			35	ns
Turn Off Time	t_{OFF}	V_{CC}=30V, I_C=150mA I_B1=I_B2=15mA			255	ns

*Pulse Test: Pulse Width≤300μs, Duty Cycle≤2%

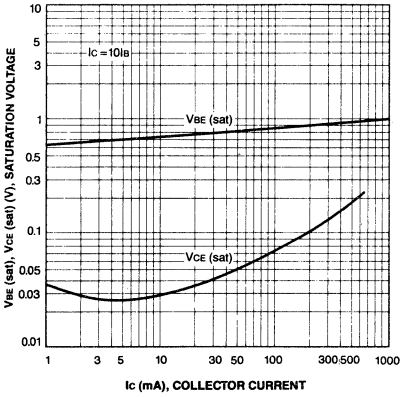
DC CURRENT GAIN



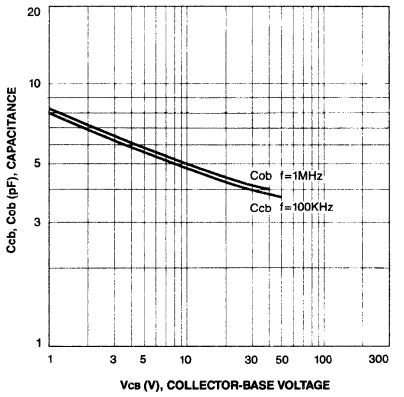
CURRENT GAIN-BANDWIDTH PRODUCT



COLLECTOR-EMITTER SATURATION VOLTAGE
BASE-EMITTER SATURATION VOLTAGE



COLLECTOR-BASE CAPACITANCE
OUTPUT CAPACITANCE

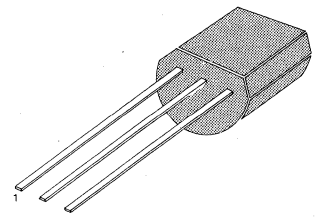


3

GENERAL PURPOSE TRANSISTOR

- **Collector-Emitter Voltage: V_{CEO}=40V**
- **Collector Dissipation: P_C (max)=625mW**

TO-92



1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−40	V
Collector-Emitter Voltage	V_{CEO}	−40	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current	I_C	−600	mA
Collector Dissipation	P_C	625	mW
Junction Temperature	T_j	150	°C
Storage Temperature	Tstg	−55~150	°C

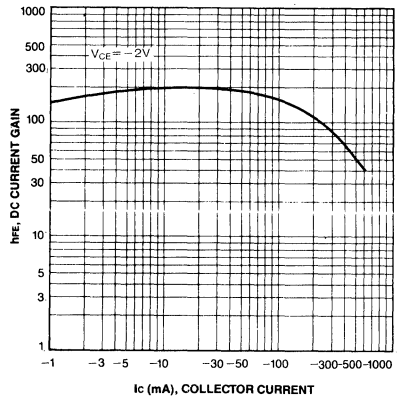
- Refer to 2N4403 for graphs

ELECTRICAL CHARACTERISTICS (T_a=25°C)

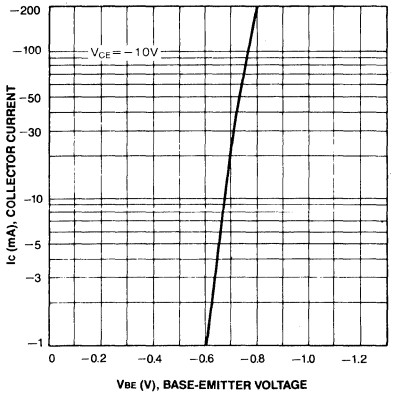
Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=−100μA, I_E=0	−40			V
*Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=−1mA, I_B=0	−40			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=−100μA, I_C=0	−5			V
Collector Cut-off Current	I_{CEX}	V_{CE}=−35V, V_{EB}=−0.4V			−100	nA
Base Cut-off Current	I_{BEV}	V_{CE}=−35V, VEB=−0.4V			−100	nA
*DC Current Gain	h_{FE}					
:2N4403		V_{CE}=−1V, I_C=−0.1mA	30			
2N4402		V_{CE}=−1V, I_C=−1mA	30			
2N4403			60			
2N4402		V_{CE}=−1V, I_C=−10mA	50			
2N4403			100			
2N4402		*V_{CE}=−2V, I_C=−150mA	50		150	
2N4403			100		300	
2N4402/2N4403		*V_{CE}=−2V, I_C=−500mA	20			
*Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=−150mA, I_B=−15mA			−0.4	V
		I_C−500mA, I_B=−50mA			−0.75	V
*Base-Emitter Saturation Voltage	V_{BE} (sat)	I_C=−150mA, I_B=−15mA	−0.75		−0.95	V
		I_C=−500mA, I_B=−50mA			−1.3	V
Collector-Base Capacitance	C_{CB}	V_{CB}=−10V, I_E=0, f=140KHz			8.5	pF
Current Gain Bandwidth Product	f_T	V_{CE}=−10V, I_C=−20mA				
:2N4402		f=100MHz	150			MHz
2N4403			200			MHz
Turn On Time	t_{ON}	V_{CC}=−30V, V_{BE}=−2V			35	ns
		I_C=−150mA, I_B1=−15mA				
Turn Off Time	t_{OFF}	V_{CC}=−30V, I_C=−150mA			255	ns
		I_B1=I_B2=−15mA				

*Pulse Test: Pulse Width≤300μs, Duty Cycle≤2%

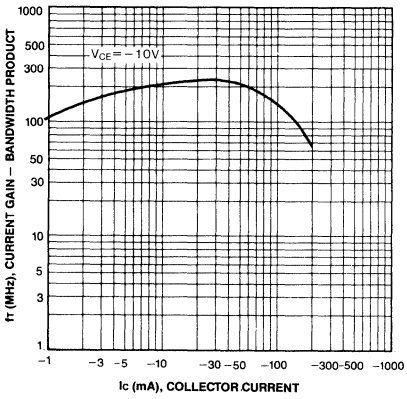
DC CURRENT GAIN



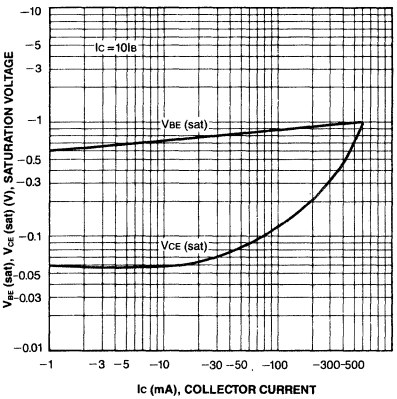
BASE-EMITTER ON VOLTAGE



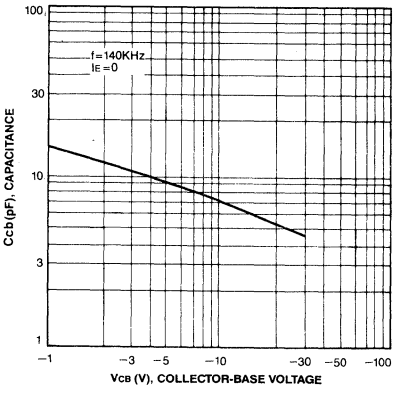
CURRENT GAIN-BANDWIDTH PRODUCT



BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



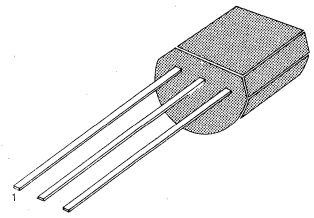
COLLECTOR-BASE CAPACITANCE



AMPLIFIER TRANSISTOR

- **Collector-Emitter Voltage: V_{CEO} =50V**
- **Collector Dissipation: P_C (max)=625mW**

TO-92



1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a =25°C)

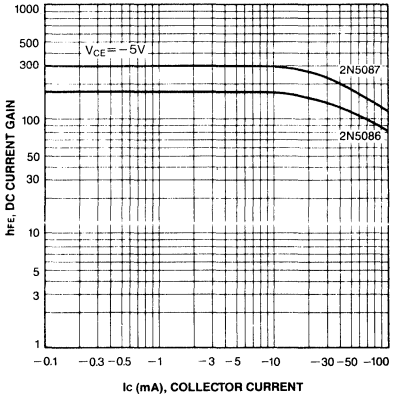
Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−50	V
Collector-Emitter Voltage	V_{CEO}	−50	V
Emitter-Base Voltage	V_{EBO}	−3	V
Collector Current	I_C	−50	mA
Collector Dissipation	P_C	−625	mW
Junction Temperature	T_J	150	°C
Storage Temperature	Tstg	−55 ~ 150	°C

ELECTRICAL CHARACTERISTICS (T_a =25°C)

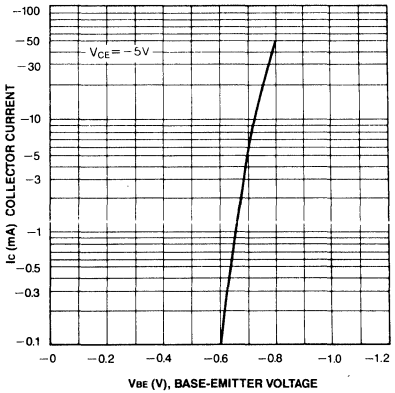
Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=−100μA, I_E=0	−50			V
*Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=−1mA, I_B=0	−50			V
Collector Cut-off Current	I_{CBO}	V_{CB}=−10V, I_E=0			−10	nA
		V_{CB}=−35V, I_E=0			−50	nA
Base Cut-off Current	I_{EBO}	V_{BE}=−3V, I_C=0			−50	nA
DC Current Gain	h_{FE}					
:2N5086		V_{CE}=−5V, I_C=−100μA	150		500	
2N5087			250		800	
2N5086		V_{CE}=−5V, I_C=−1mA	150			
2N5087			250			
2N5086		*V_{CE}=−5V, I_C=−10mA	150			
2N5087			250			
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=−10mA, I_B=−1mA			−0.3	V
Base-Emitter On Voltage	V_{BE} (on)	I_C=−1mA, V_{CE}=−5V			−0.85	V
Collector-Base Capacitance	C_{CB}	V_{CB}=−5V, I_E=0 f=100KHz			4	pF
Current Gain bandwidth Product	f_T	V_{CE}=−5V, I_C=−500μA f=20MHz	40			MHz
Noise Figures	N_F	V_{CE}=−5V, I_C=−20μA R_S=10KΩ f=10Hz to 15.7KHz				
2N5086					3	dB
2N5087					2	dB
		V_{CE}=−5V, I_C=−100μA R_S=3KΩ, f=1KHz				
2N5086					3	dB
2N5087					2	dB

*Pulse Test: Pulse Width≤300μs, Duty Cycle≤2%

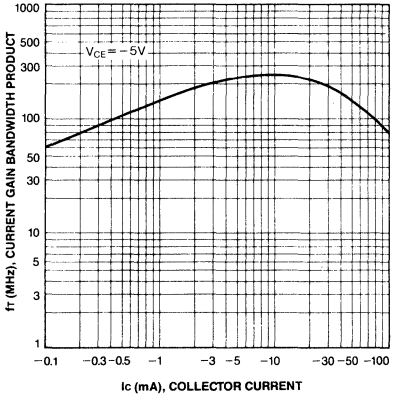
DC CURRENT GAIN



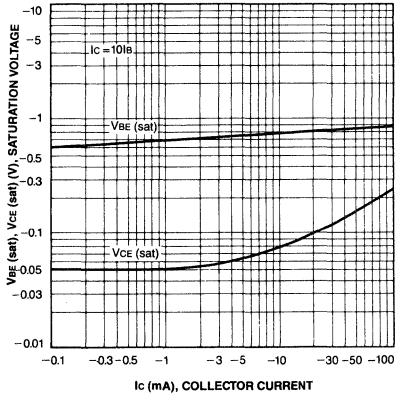
BASE-EMITTER ON VOLTAGE



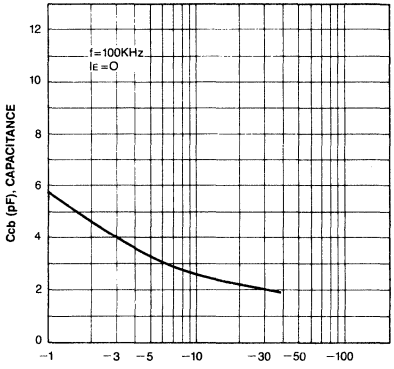
CURRENT GAIN BANDWIDTH PRODUCT



BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



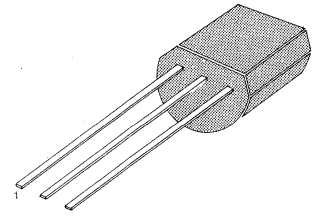
COLLECTOR-BASE CAPACITANCE



AMPLIFIER TRANSISTOR

- **Collector-Emitter Voltage: V_{CEO} = 2N5088: 30V**
  2N5089: 25V
- **Collector Dissipation: P_C (max)=625mW**

TO-92



1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a =25°C)

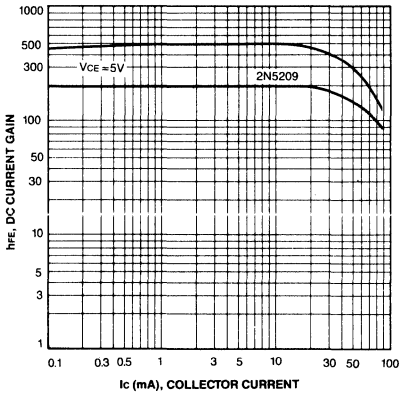
Characteristic	Symbol	Rating	Unit
Collector-Base Voltage :2N5088	V_{CBO}		
2N5089		30	V
Collector-Emitter Voltage :2N5088	V_{CEO}	30	V
2N5089		25	V
Emitter-Base Voltage	V_{EBO}	4.5	V
Collector Current	I_C	50	mA
Collector Dissipation	P_C	625	mW
Junction Temperature	T_J	150	°C
Storage Temperature	T_{STG}	−55∼150	°C

ELECTRICAL CHARACTERISTICS (T_a =25°C)

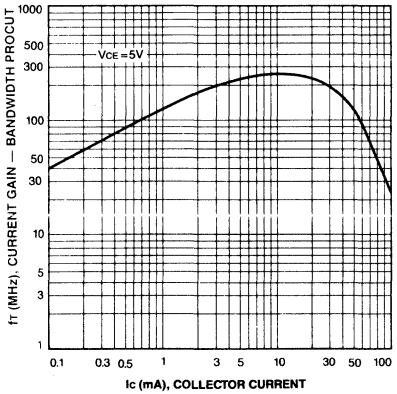
Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
*Collector-Base Breakdown Voltage	BV_{CBO}	I_C=100μA, I_E=0				
:2N5088			35			V
2N5089			30			V
*Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=1mA, I_B=0				
:2N5088			30			V
2N5089			25			V
Collector Cut-off Current	I_{CBO}					
2N5088		V_{CB}=20V, I_E=0			50	nA
2N5089		V_{CB}=15V, I_E=0			50	nA
Base Cut-off Current	I_{EBO}	V_{BE}=3V, I_C=0			50	nA
		V_{BE}=4.5V, I_C=0			100	nA
DC Current Gain	h_{FE}					
:2N5088		V_{CE}=5V, I_C=100μA	300		900	
2N5089			400		1,200	
2N5088		V_{CE}=5V, I_C=1mA	350			
2N5089			450			
2N5088		*V_{CE}=5V, I_C=10mA	300			
2N5089			400			
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=10mA, I_B=1mA			0.5	V
*Base-Emitter Saturation Voltage	V_{BE} (on)	I_C=10mA, V_{CE}=5V			0.8	V
Collector-Base Capacitance	C_{CB}	V_{CB}=5V, I_E=0 f=100KHz			4	pF
Current Gain Bandwidth Product	f_T	V_{CE}=5V, I_C=500μA f=20MHz	50			MHz
Noise Figure	N_F	V_{CE}=5V, I_C=100μA R_S=10KΩ f=10Hz to 15.7KHz				
:2N5088					3	dB
2N5089					2	dB

*Pulse Test: Pulse Width≤300μs, Duty Cycle≤2%

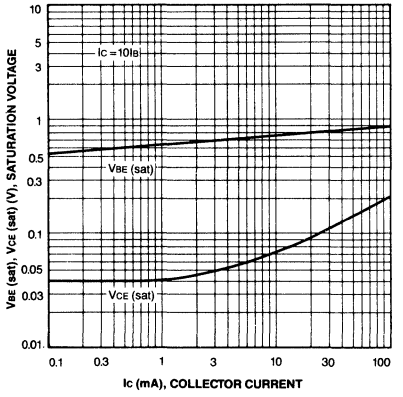
DC CURRENT GAIN



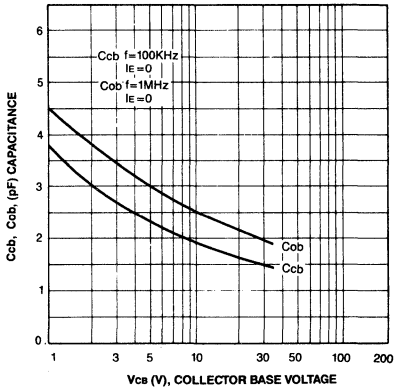
CURRENT GAIN BANDWIDTH PRODUCT



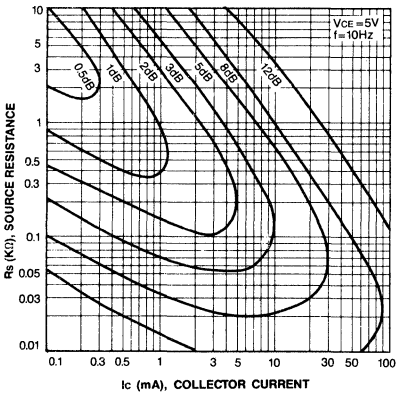
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



OUTPUT CAPACITANCE
COLLECTOR-BASE CAPACITANCE



NOISE FIGURE

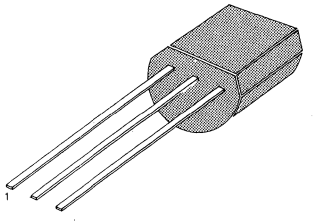


3

AMPLIFIER TRANSISTOR

- **Collector-Emitter Voltage: V_{CEO}=50V**
- **Collector Dissipation: P_C (max)=625mW**

TO-92



1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	50	V
Collector-Emitter Voltage	V_{CEO}	50	V
Emitter-Base Voltage	V_{EBO}	4.5	V
Collector Current	I_C	50	mA
Collector Dissipation	P_C	625	mW
Junction Temperature	T_j	150	°C
Storage Temperature	Tstg	−55~150	°C

- Refer to 2N5088 for graphs

ELECTRICAL CHARACTERISTICS (T_a=25°C)

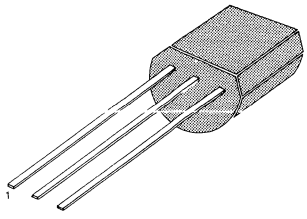
Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=100μA, I_E=0	50			V
*Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=1mA, I_B=0	50			V
Collector Cut-off Current	I_{CBO}	V_{CB}=35V, I_E=0			50	nA
Emitter Cut-off Current	I_{EBO}	V_{Be}=3V, I_C=0			50	nA
DC Current Gain	h_{FE}					
:2N5029		V_{CE}=5V, I_C=100μA	100		300	
2N5210			200		600	
2N5209		V_{CE}=5V, I_C=1mA	150			
2N5210			250			
2N5209		*V_{CE}=5V, I_C=10mA	150			
2N5210			250			
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=10mA, I_B=1mA			0.7	V
Base-Emitter On Voltage	V_{BE} (on)	I_C=1mA, V_{CE}=5V			0.85	V
Collector-Base Capacitance	C_{CB}	V_{CB}=5V, I_E=0 f=100KHz			4	pF
Current Gain Bandwidth Product	f_T	V_{CE}=5V, I_C=500μA f=20MHz	30			MHz
Noise Figure	N_F	V_{CE}5V, I_C=20μA R_S=22KΩ f=10Hz to 15.7KHz				
:2N5209					3	dB
2N5210					2	dB
		V_{CE}=5V, I_C=20μA R_S=10KΩ, f=1KHz				
2N5209					4	dB
2N5210					3	dB

*Pulse Test: Pulse Width≤300μs, Duty Cycle≤2%

AMPLIFIER TRANSISTOR

- **Collector-Base Voltage: V_{CEO} =120V**
- **Collector Dissipation: P_C (max)=625mW**

TO-92



1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a =25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−130	V
Collector-Emitter Voltage	V_{CEO}	−120	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current	I_C	−600	mA
Collector Dissipation	P_C	625	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

* Refer to 2N5401 for graphs

ELECTRICAL CHARACTERISTICS (T_a =25°C)

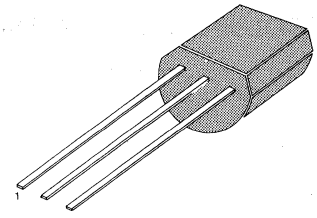
Characterstic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=−100μA, I_E=0	−130			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=−1mA, I_B=0	−120			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=−10μA, I_C=0	−5			V
Collector Cut-off Current	I_{CBO}	V_{CB}=−100V, I_E=0			−100	nA
Emitter Cut-off Current	I_{EBO}	V_{EB}=−3V, I_C=0			−50	nA
*DC Current Gain	h_{FE}	I_C=−1mA, V_{CE}=−5V	30			
		I_C=−10mA, V_{CE}=−5V	40		180	
		I_C=−50mA, V_{CE}=−5V	40			
*Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=−10mA, I_B=−1mA			−0.2	V
		I_C=−50mA, I_B=−5mA			−0.5	V
*Base-Emitter Saturation Voltage	V_{BE}(sat)	I_C=−10mA, I_B=−1mA			−1	V
		I_C=−50mA, I_B=−5mA			−1	V
Current Gain Banwidth Product	f_T	I_C=−10mA, V_{CE}=−10V f=100MHz	100		400	MHz
Output Capacitance	C_{ob}	V_{CB}=−10V, I_E=0 f=1MHz			6	pF
Noise Figure	NF	I_C=−250μA, V_{CE}=−5V R_S=1KΩ f=10Hz to 15.7KHz			8	dB

* Pulse Test: Pulse Width=300μs, Duty Cycle=2%

AMPLIFIER TRANSISTOR

- **Collector-Emitter Voltage: V_{CEO} =150V**
- **Collector Dissipation: P_C (max)=625mW**

TO-92



1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a =25°C)

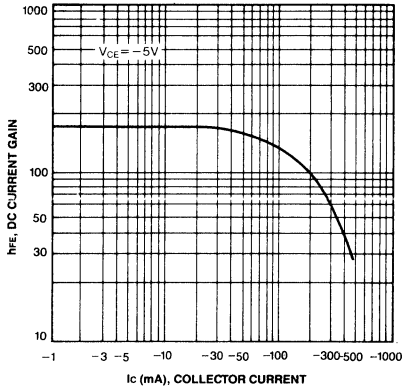
Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−160	V
Collector-Emitter Voltage	V_{CEO}	−150	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current	I_C	−600	mA
Collector Dissipation	P_C	625	mW
Junction Temperature	T_j	150	°C
Storage Temperature	Tstg	−55 ~ 150	°C

ELECTRICAL CHARACTERISTICS (T_a =25°C)

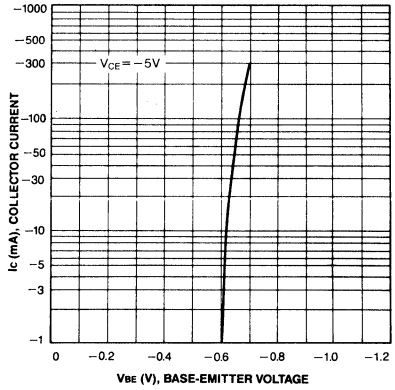
Characterstic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=−100μA, I_E=0	−160			V
*Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=−1mA, I_B=0	−150			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=−10μA, I_C=0	−5			V
Collector Cut-off Current	I_{CBO}	V_{CB}=−120V, I_E=0			−50	nA
Emitter Cut-off Current	I_{EBO}	V_{EB}=−3V, I_C=0			−50	nA
*DC Current Gain	h_{FE}	I_C=−1mA, V_{CE}=−5V	30			
		I_C=−10mA, V_{CE}=−5V	60		240	
		I_C=−50mA, V_{CE}=−5V	50			
*Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=−10mA, I_B=−1mA			−0.2	V
		I_C=−50mA, I_B=−5mA			−0.5	V
*Base-Emitter Saturation Voltage	V_{BE}(sat)	I_C=−10mA, I_B=−1mA			−1	V
		I_C=−50mA, I_B=−5mA			−1	V
Current Gain Banwidth Product	f_T	I_C=−10mA, V_{CE}=−10V f=100MHz	100		400	MHz
Output Capacitance	C_{ob}	V_{CB}=−10V, I_E=0 f=1MHz			6	pF
Noise Figure	NF	I_C=−250μA, V_{CE}=−5V R_S=1KΩ f=10Hz to 15.7KHz			8	dB

* Pulse Test: Pulse Width=300μs, Duty Cycle=2%

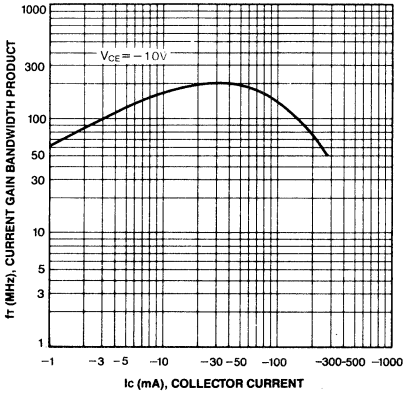
DC CURRENT GAIN



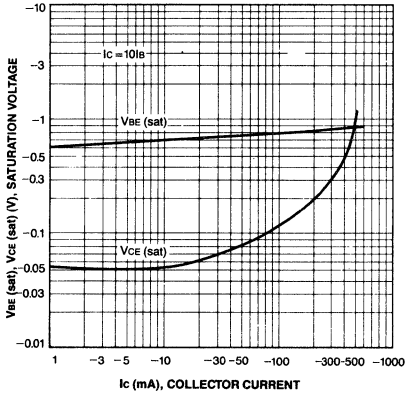
BASE-EMITTER ON VOLTAGE



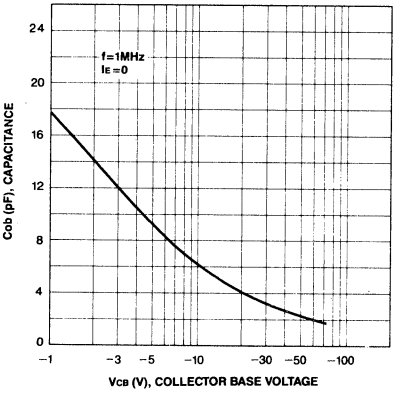
CURRENT GAIN-BANDWIDTH PRODUCT



BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



OUTPUT CAPACITANCE



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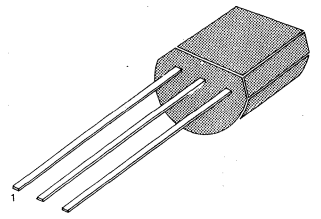
AMPLIFIER TRANSISTOR

- **Collector-Emitter Voltage: V_{CEO}=140V**
- **Collector Dissipation: P_C (max)=625mW**

TO-92



1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	160	V
Collector-Emitter Voltage	V_{CEO}	140	V
Emitter-Base Voltage	V_{EBO}	6	V
Collector Current	I_C	600	mA
Collector Dissipation	P_C	625	mW
Junction Temperature	T_j	150	°C
Storage Temperature	Tstg	−55~150	°C

- Refer to 2N5551 for graphs

ELECTRICAL CHARACTERISTICS (T_a=25°C)

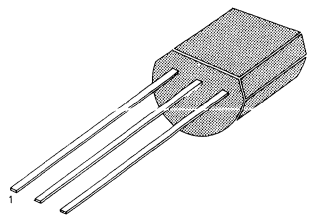
Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=100μA, I_E=0	160			V
*Collector-Emitter Saturation Voltage	BV_{CEO}	I_C=1mA, I_B=0	140			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=10μA, I_C=0	6			V
Collector Cut-off Current	I_{CBO}	V_{CB}=100V, I_E=0			100	nA
Emitter Cut-off Current	I_{EBO}	V_{BE}=4V, I_C=0			50	nA
*DC Current Gain	h_{FE}	I_C=1mA, V_{CE}=5V	60			
		I_C=10mA, V_{CE}=5V	60		250	
		I_C=50mA, V_{CE}=5V	20			
* Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=10mA, I_B=1mA			0.15	V
		I_C=50mA, I_B=5mA			0.25	V
*Base-Emitter Saturation Voltage	V_{BE} (sat)	I_C=10mA, I_B=1mA			1	V
		I_C=50mA, I_B=5mA			1.2	V
Current Gain Bandwidth Product	f_T	I_C=10mA, V_{CE}=10V f=100MHz	100		300	MHz
Output Capacitance	Cob	V_{CB}=10V, I_E=0 f=1MHz			6	pF
Noise Figure	NF	I_C=250μA, V_{CE}=5V R_S=1KΩ f=10Hz to 15.7KHz			10	dB

*Pulse Test: Pulse Width=300μS, Duty Cycle=2%

AMPLIFIER TRANSISTOR

- **Collector-Emitter Voltage: V_{CEO}=160V**
- **Collector Dissipation: P_C(max)=625mW**

TO-92



1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

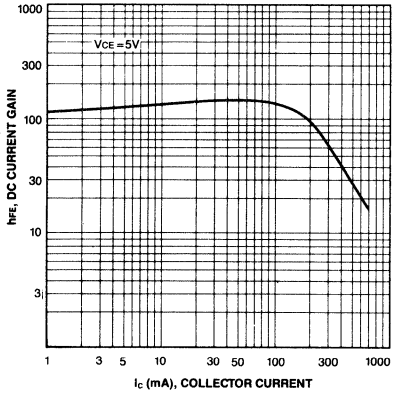
Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	180	V
Collector-Emitter Voltage	V_{CEO}	160	V
Emitter-Base Voltage	V_{EBO}	6	V
Collector Current	I_C	600	mA
Collector Dissipation	P_C	625	mW
Junction Temperature	T_J	150	°C
Storage Temperature	Tstg	−55 ~ 150	°C

ELECTRICAL CHARACTERISTICS (T_a=25°C)

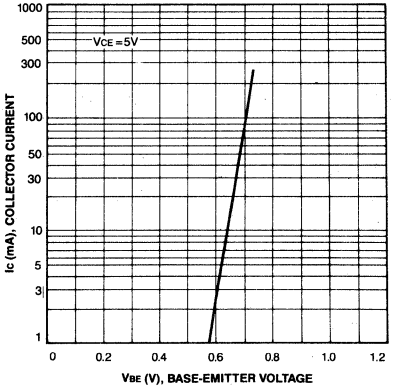
Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=100μA, I_E=0	180			V
*Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=1mA, I_B=0	160			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=10μA, I_C=0	6			V
Collector Cut-off Current	I_{CBO}	V_{CB}=120V, I_E=0			50	nA
Emitter Cut-off Current	I_{EBO}	V_{BE}=4V, I_C=0			50	nA
*DC Current Gain	h_{FE}	I_C=1mA, V_{CE}=5V	80			
		I_C=10mA, V_{CE}=5V	80		250	
		I_C=50mA, V_{CE}=5V	30			
*Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=10mA, I_B=1mA			0.15	V
		I_C=50mA, I_B=5mA			0.2	V
*Base-Emitter Saturation Voltage	V_{BE} (sat)	I_C=10mA, I_B=1mA			1	V
		I_C=50mA, I_B=5mA			1	V
Current Gain Bandwidth Product	f_T	I_C=10mA, V_{CE}=10V f=100MHz	100		300	MHz
Output Capacitance	Cob	V_{CB}=10V, I_E=0 f=1MHz			6	pF
Noise Figure	NF	I_C=250μA, V_{CE}=5V R_S=1KΩ f=10Hz to 15.7KHz			8	dB

*Pulse Test: Pulse Width=300μS, Duty Cycle=2%

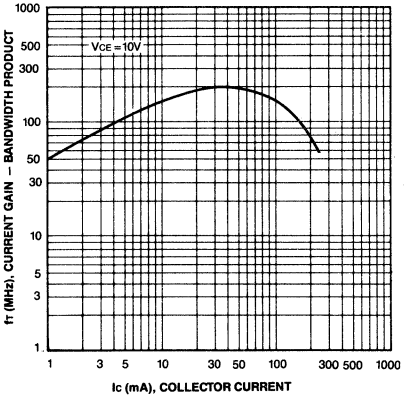
DC CURRENT GAIN



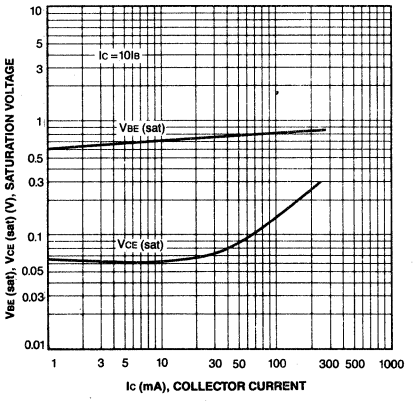
BASE-EMITTER ON VOLTAGE



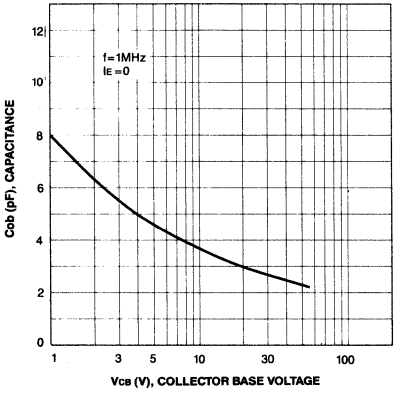
CURRENT GAIN-BANDWIDTH PRODUCT



BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



OUTPUT CAPACITANCE

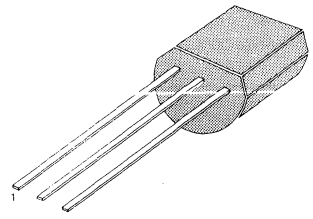


NPN EPITAXIAL SILICON DARLINGTON TRANSISTOR

DARLINGTON TRANSISTOR

- **Collector-Emitter Voltage: V_{CEO}=40V**
- **Collector Dissipation: P_C (max)=625mW**

TO-92



1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

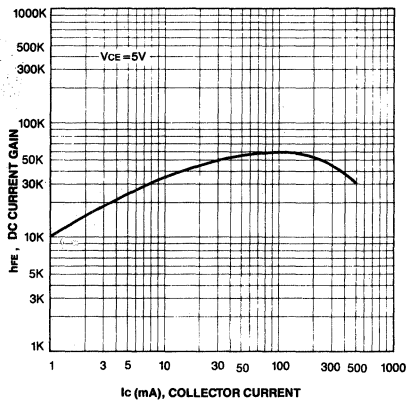
Characteristic	Symbol	Rating	Unit
Collector-Emitter Voltage	V_{CEO}	40	V
Collector-Base Voltage	V_{CBO}	40	V
Emitter-Base Voltage	V_{EBO}	12	V
Collector Current	I_C	500	mA
Collector Dissipation	P_C	625	mW
Junction Temperature	T_j	150	°C
Storage Temperature	Tstg	−55 ~ 150	°C

ELECTRICAL CHARACTERISTICS (T_a=25°C)

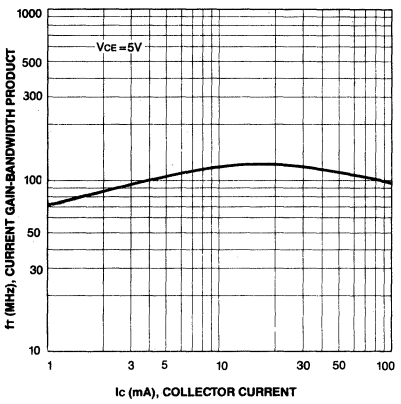
Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
*Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=10mA, I_B=0	40			V
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=100μA, I_E=0	40			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=10μA, I_C=0	12			V
Collector Cut-off Current	I_{CBO}	V_{CB}=30V, I_E=0			50	nA
Collector Cut-off Current	I_{CEO}	V_{CE}=25V, I_B=0			1	μA
Emitter Cut-off Current	I_{EBO}	V_{BE}=10V, I_C=0			50	nA
*DC Current Gain	h_{FE}	I_C=10mA, V_{CE}=5V	10K		100K	
		I_C=100mA, V_{CE}=5V	20K		200K	
		I_C=500mA, V_{CE}=5V	14K		140K	
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=50mA, I_B=0.5mA		0.71	1.2	V
		I_C=500mA, I_B=0.5mA		0.9	1.5	V
Base-Emitter Saturation Voltage	V_{BE} (sat)	I_C=500mA, I_B=0.5mA		1.52	2	V
Base-Emitter On Voltage	V_{BE} (on)	I_C=50mA, V_{CE}=5V		1.24	1.75	V
Output Capacitance	Cob	V_{CB}=10V, I_E=0 f=1MHz		5.4	7	pF
Noise Figure	NF	I_C=1mA, V_{CE}=5V R_S=100KΩ f=10KHz to 15.7 KHz		3	10	dB

*Pulse Test: Pulse Width=300μS, Duty Cycle=2%

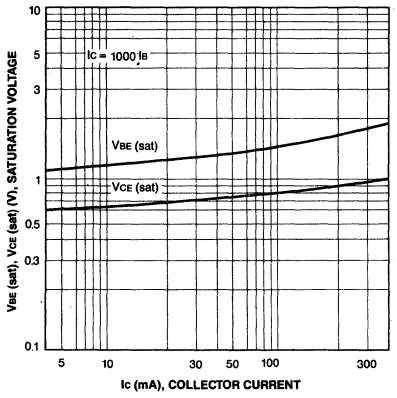
DC CURRENT GAIN



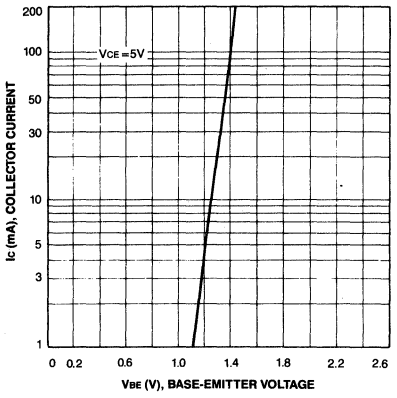
CURRENT GAIN-BANDWIDTH PRODUCT



BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



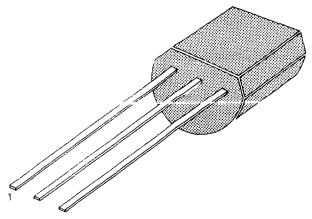
BASE-EMITTER ON VOLTAGE



AMPLIFIER TRANSISTOR

- **Collector-Emitter Voltage: V_{CEO} =50V**
- **Collector Dissipation: P_C (max)=625mW**

TO-92



1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a =25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	60	V
Collector-Emitter Voltage	V_{CEO}	50	V
Emitter-Base Voltage	V_{EBO}	6	V
Collector Current	I_C	200	mA
Collector Dissipation	P_C	625	mW
Junction Temperature	T_J	150	°C
Storage Temperature	Tstg	−55~150	°C

- Refer to 2N5088 for graphs

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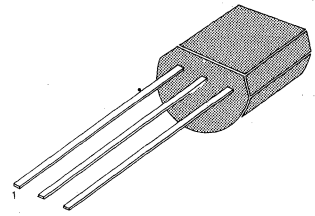
ELECTRICAL CHARACTERISTICS (T_a =25°C)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=100μA, I_E=0	60			V
*Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=1mA, I_B=0	50			V
Collector Cut-off Current	I_{CBO}	V_{CB}=30V, I_E=0			10	nA
Collector Cut-off Current	I_{CEO}	V_{CE}=30V, I_B=0			25	nA
Base Cut-off Current	I_{EBO}	V_{BE}=5V, I_C=0			10	nA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=10μA	250			
		V_{CE}=5V, I_C=100μA	250		650	
		V_{CE}=5V, I_C=1mA	250			
		V_{CE}=5V, I_C=10mA	250			
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=10mA, I_B=0.5mA			0.2	V
		I_C=100mA, I_B=5mA			0.6	V
Base-Emitter On Voltage	V_{BE} (on)	I_C=1mA, V_{CE}=5V	0.56		0.66	V
Output Capacitance	C_{OB}	V_{CB}=10V, I_E=0 f=1MHz			3	pF
Current Gain Bandwidth Product	f_T	V_{CE}=5V, I_C=1mA f=100MHz	100		700	MHz
Noise Figure/Noise Voltage Level	N_F/N_V	V_{CE}=5V, I_C=100μA (1) R_S=10KΩ, B_W=1Hz f=100Hz				
:2N6428					3/18.1	dB/nV
2N6428A					2/16.2	dB/nV
		(2) R_S=50KΩ, B_W=15.7KHz f=10Hz—10KHz				
2N6428					6/5.7	dB/nV
2N6428A					4/4.6	dB/nV
		(3) R_S=500Ω, B_W=1Hz f=10Hz				
2N6428					3.5/4.3	dB/nV
2N6428A					3/4.1	dB/nV

HIGH VOLTAGE TRANSISTOR

- **Collector-Emitter Voltage: V_{CEO}=250V**
- **Collector Dissipation: P_C (max)=625mW**

TO-92



1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

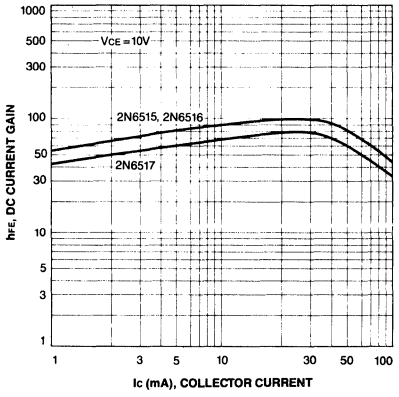
Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	250	V
Collector-Emitter Voltage	V_{CEO}	250	V
Emitter-Base Voltage	V_{EBO}	6	V
Collector Current	I_C	500	mA
Collector Dissipation	P_C	625	mW
Junction Temperature	T_j	150	°C
Storage Temperature	Tstg	−55 ~ 150	°C

ELECTRICAL CHARACTERISTICS (T_a=25°C)

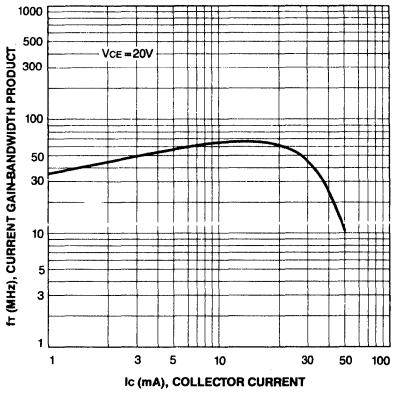
Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
*Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=1mA, I_B=0	250			V
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=100μA, I_E=0	250			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=10μA, I_C=0	6			V
Collector Cut-off Current	I_{CBO}	V_{CB}=150V, I_E=0			50	nA
Emitter Cut-off Current	I_{EBO}	V_{BE}=5V, I_C=0			50	nA
*DC Current Gain	h_{FE}	I_C=1mA, V_{CE}=10V	35			
		I_C=10mA, V_{CE}=10V	50			
		I_C=30mA, V_{CE}=10V	50		300	
		I_C=50mA, V_{CE}=10V	45		220	
		I_C=100mA, V_{CE}=10V	25			
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=10mA, I_B=1mA			0.3	V
		I_C=20mA, I_B=2mA			0.35	V
		I_C=30mA, I_B=3mA			0.5	V
		I_C=50mA, I_B=5mA			1	V
Base-Emitter Saturation Voltage	V_{BE} (sat)	I_C=10mA, I_B=1mA			0.75	V
		I_C=20mA, I_B=2mA			0.85	V
		I_C=30mA, I_B=3mA			0.9	V
Collector-Base Capacitance	Ccb	V_{CB}=20V, I_E=0 f=1MHz			6	pF
*Current Gain Bandwidth Product	f_T	I_C=10mA, V_{CE}=20V f=20MHz	40		200	MHz
Base Emitter On Voltage	V_{BE} (on)	I_C=100mA, V_{CE}=10V			2	V

*Pulse Test: Pulse Width=300μS, Duty Cycle=2%

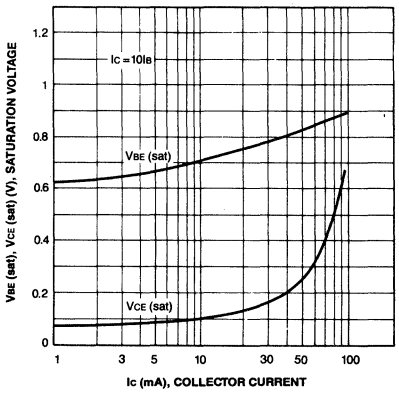
DC CURRENT GAIN



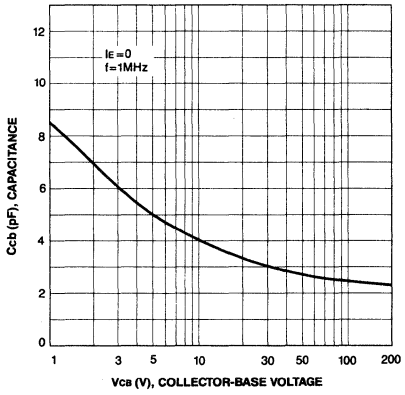
CURRENT GAIN BANDWIDTH PRODUCT



COLLECTOR EMITTER SATURATION VOLTAGE
BASE EMITTER SATURATION VOLTAGE



COLLECTOR-BASE CAPACITANCE



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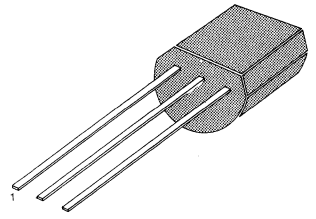
HIGH VOLTAGE TRANSISOTR

- **Collector-Emitter Voltage: V_{CEO} =300V**
- **Collector Dissipation: P_C (max)=625mW**

TO-92



1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a =25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	300	V
Collector-Emitter Voltage	V_{CEO}	300	V
Emitter-Base Voltage	V_{EBO}	6	V
Collector Current	I_C	500	mA
Collector Dissipation	P_C	625	mW
Junction Temperature	T_J	150	°C
Storage Temperature	Tstg	−55~150	°C

- Refer to 2N6515 for graphs

ELECTRICAL CHARACTERISTICS (T_a =25°C)

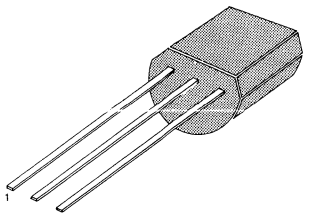
Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
* Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=1mA, I_B=0	300			V
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=100μA, I_E=0	300			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=10μA, I_C=0	6			V
Collector Cut-off Current	I_{CBO}	V_{CB}=200V, I_E=0			50	nA
Emitter Cut-off Current	I_{EBO}	V_{EB}=5V, I_C=0			50	nA
*DC Current Gain	h_{FE}	I_C=1mA, V_{CE}=10V	30			
		I_C=10mA, V_{CE}=10V	45			
		I_C=30mA, V_{CE}=10V	45		270	
		I_C=50mA, V_{CE}=10V	40		200	
		I_C=100mA, V_{CE}=10V	20			
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=10mA, I_B=1mA			0.3	V
		I_C=20mA, I_B=2mA			0.35	V
		I_C=30mA, I_B=3mA			0.5	V
		I_C=50mA, I_B=5mA			1	V
Base-Emitter Saturation Voltage	V_{BE} (sat)	I_C=10mA, I_B=1mA			0.75	
		I_C=20mA, I_B=2mA			0.85	
		I_C=30mA, I_B=3mA			0.9	
Collect-Base Capacitance	Ccb	V_{CB}=20V, I_E=0 f=1MHz			6	pF
*Current Gain Bandwidth Product	f_T	I_C=10mA, V_{CE}=20V f=20MHz	40		200	MHz
Base Emitter On Voltage	V_{BE} (on)	I_C=100mA, V_{CE}=10V			2	v

* Pulse Test: Pulse Width= 300μs, Duty Cycle= 2%

HIGH VOLTAGE TRANSISOTR

- **Collector-Emitter Voltage: V_{CEO}=350V**
- **Collector Dissipation: P_C (max)=625mW**

TO-92



1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	350	V
Collector-Emitter Voltage	V_{CEO}	350	V
Emitter-Base Voltage	V_{EBO}	6	V
Collector Current	I_C	500	mA
Collector Dissipation	P_C	625	mW
Junction Temperature	T_j	150	°C
Storage Temperature	Tstg	−55 ~ 150	°C

- Refer to 2N6515 for graphs

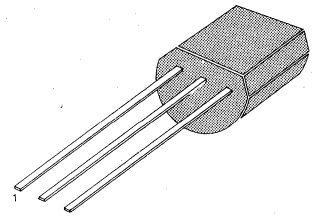
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
*Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=1mA, I_B=0	350			V
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=100μA, I_E=0	350			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=10μA, I_C=0	6			V
Collector Cut-off Current	I_{CBO}	V_{CB}=250V, I_E=0			50	nA
Emitter Cut-off Current	I_{EBO}	V_{EB}=5V, I_C=0			50	nA
*DC Current Gain	h_{FE}	I_C=1mA, V_{CE}=10V	20			
		I_C=10mA, V_{CE}=10V	30			
		I_C=30mA, V_{CE}=10V	30		200	
		I_C=50mA, V_{CE}=10V	20		200	
		I_C=100mA, V_{CE}=10V	15			
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=10mA, I_B=1mA			0.3	V
		I_C=20mA, I_B=2mA			0.35	V
		I_C=30mA, I_B=3mA			0.5	V
		I_C=50mA, I_B=5mA			1	V
Base-Emitter Saturation Voltage	V_{BE} (sat)	I_C=10mA, I_B=1mA			0.75	V
		I_C=20mA, I_B=2mA			0.85	V
		I_C=30mA, I_B=3mA			0.9	V
Collect-Base Capacitance	Ccb	V_{CB}=20V, I_E=0 f=1MHz			6	pF
*Current Gain Bandwidth Product	f_T	I_C=10mA, V_{CE}=20V f=20MHz	40		200	MHz
Base Emitter On Voltage	V_{BE} (on)	I_C=100mA, V_{CE}=10V			2	V

* Pulse Test: Pulse Width= 300μs, Duty Cycle=2%

HIGH VOLTAGE TRANSISTOR

TO-92



1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−250	V
Collector-Emitter Voltage	V_{CEO}	−250	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current	I_C	−500	mA
Base Current	I_B	−250	mA
Collector Dissipation	P_C	0.625	W
Derate above 25°C		5	mW/°C
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55∼150	°C

- Refer to 2N6520 for graphs

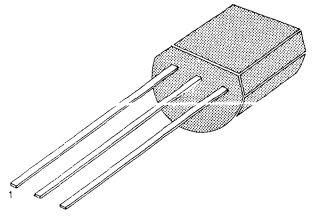
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Max	Unit
Collector Base Breakdown Voltag	BV_{CBO}	I_C=−100μA, I_E=0	−250		V
*Collector Emitter Breakdown Voltage	BV_{CEO}	I_C=−1mA, I_B=0	−250		V
Emitter Base Breakdown Voltage	BV_{EBO}	I_E=−10μA, I_C=0	−5		V
Collector Cutoff Current	I_{CBO}	V_{CB}=−150V, I_E=0		−50	nA
Emitter Cutoff Current	I_{EBO}	V_{EB}=−4V, I_C=0		−50	nA
*DC Current Gain	h_{FE}	V_{CE}=−10V, I_C=−1mA	35		
		V_{CE}=−10V, I_C=−10mA	50		
		V_{CE}=−10V, I_C=−30mA	50	300	
		V_{CE}=−10V, I_C=−50mA	45	220	
		V_{CE}=−10V, I_C=−100mA	25		
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=−10mA, I_B=−1mA		−0.30	V
		I_C=−20mA, I_B=−2mA		−0.35	V
		I_C=−30mA, I_B=−3mA		−0.50	V
		I_C=−50mA, I_B=−5mA		−1	V
Base-Emitter Saturation Voltage	V_{BE} (sat)	I_C=−10mA, I_B=−1mA		−0.75	V
		I_C=−20mA, I_B=−2mA		−0.85	V
		I_C=−30mA, I_B=−3mA		−0.90	V
Base Emitter On Voltage	V_{BE} (on)	V_{CE}=−10V, I_C=−100mA		−2	V
*Current Gain Bandwidth Product	f_T	V_{CE}=−20V, I_C=−10mA, f=20MHz	40	200	MHz
Collector Base Capacitance	Ccb	V_{CB}=−20V, I_E=0, f=1MHz		6	pF
Emitter Base Capacitance	Ceb	V_{EB}=−0.5V, I_C=0, f=1MHz		100	pF
Turn On Time	ton	V_{BE} (off)=−2V, V_{CC}=−100V I_C=−50mA, I_{B1}=−10mA		200	ns
Turn Off Time	toff	V_{CC}=−100V, I_C=−50mA I_{B1}=I_{B2}=−10mA		3.5	ns

* Pulse Test: PW=300μs, Duty Cycle=2%

HIGH VOLTAGE TRANSISTOR

TO-92



1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−300	V
Collector-Emitter Voltage	V_{CEO}	−300	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current	I_C	−500	mA
Base Current	I_B	−250	mA
Collector Dissipation	P_C	0.625	W
Derate above 25°C		5	mW/°C
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

• Refer to 2N6520 for graphs

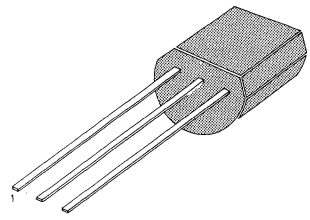
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Max	Unit
Collector Base Breakdown Voltag	BV_{CBO}	I_C=−100μA, I_E=0	−300		V
*Collector Emitter Breakdown Voltage	BV_{CEO}	I_C=−1mA, I_B=0	−300		V
Emitter Base Breakdown Voltage	BV_{EBO}	I_E=−10μA, I_C=0	−5		V
Collector Cutoff Current	I_{CBO}	V_{CB}=−200V, I_E=0		−50	nA
Emitter Cutoff Current	I_{EBO}	V_{EB}=−4V, I_C=0		−50	nA
*DC Current Gain	h_{FE}	V_{CE}=−10V, I_C=−1mA	30		
		V_{CE}=−10V, I_C=−10mA	45		
		V_{CE}=−10V, I_C=−30mA	45	270	
		V_{CE}=−10V, I_C=−50mA	40	200	
		V_{CE}=−10V, I_C=−100mA	20		
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=−10mA, I_B=−1mA		−0.30	V
		I_C=−20mA, I_B=−2mA		−0.35	V
		I_C=−30mA, I_B=−3mA		−0.50	V
		I_C=−50mA, I_B=−5mA		−1	V
Base-Emitter Saturation Voltage	V_{BE} (sat)	I_C=−10mA, I_B=−1mA		−0.75	V
		I_C=−20mA, I_B=−2mA		−0.85	V
		I_C=−30mA, I_B=−3mA		−0.90	V
Base Emitter On Voltage	V_{BE} (on)	V_{CE}=−10V, I_C=−100mA		−2	V
*Current Gain Bandwidth Product	f_T	V_{CE}=−20V, I_C=−10mA, f=20MHz	40	200	MHz
Collector Base Capacitance	Ccb	V_{CB}=−20V, I_E=0, f=1MHz		6	pF
Emitter Base Capacitance	Ceb	V_{EB}=−0.5V, I_C=0, f=1MHz		100	pF
Turn On Time	ton	V_{BE} (off)=−2V, V_{CC}=−100V I_C=−50mA, I_B1=−10mA		200	ns
Turn Off Time	toff	V_{CC}=−100V, I_C=−50mA I_B1=I_B2=−10mA		3.5	ns

* Pulse Test: PW=300μs, Duty Cycle=2%

HIGH VOLTAGE TRANSISTOR

TO-92



1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

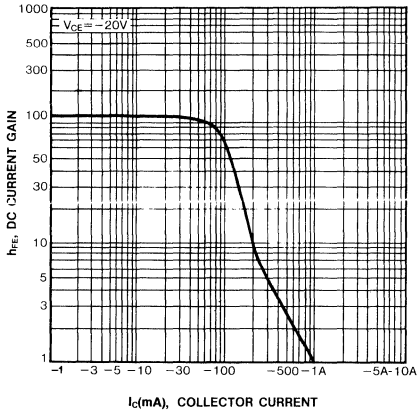
Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−350	V
Collector-Emitter Voltage	V_{CEO}	−350	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current	I_C	−500	mA
Base Current	I_B	−250	mA
Collector Dissipation	P_C	0.625	W
Derate above 25°C		5	mW/°C
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

ELECTRICAL CHARACTERISTICS (T_a=25°C)

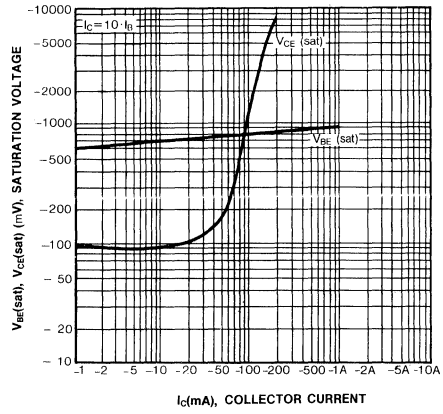
Characteristic	Symbol	Test Condition	Min	Max	Unit
Collector Base Breakdown Voltag	BV_{CBO}	I_C=−100μA, I_E=0	−350		V
*Collector Emitter Breakdown Voltage	BV_{CEO}	I_C=−1mA, I_B=0	−350		V
Emitter Base Breakdown Voltage	BV_{EBO}	I_E=−10μA, I_C=0	−5		V
Collector Cutoff Current	I_{CBO}	V_{CB}=−250V, I_E=0		−50	nA
Emitter Cutoff Current	I_{EBO}	V_{EB}=−4V, I_C=0		−50	nA
*DC Current Gain	h_{FE}	V_{CE}=−10V, I_C=−1mA	20		
		V_{CE}=−10V, I_C=−10mA	30		
		V_{CE}=−10V, I_C=−30mA	30	200	
		V_{CE}=−10V, I_C=−50mA	20	200	
		V_{CE}=−10V, I_C=−100mA	15		
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=−10mA, I_B=−1mA		−0.30	V
		I_C=−20mA, I_B=−2mA		−0.35	V
		I_C=−30mA, I_B=−3mA		−0.50	V
		I_C=−50mA, I_B=−5mA		−1	V
Base-Emitter Saturation Voltage	V_{BE} (sat)	I_C=−10mA, I_B=−1mA		−0.75	V
		I_C=−20mA, I_B=−2mA		−0.85	V
		I_C=−30mA, I_B=−3mA		−0.90	V
Base Emitter On Voltage	V_{BE} (on)	V_{CE}=−10V, I_C=−100mA		−2	V
*Current Gain Bandwidth Product	f_T	V_{CE}=−20V, I_C=−10mA, f=20MHz	40	200	MHz
Collector Base Capacitance	Ccb	V_{CB}=−20V, I_E=0, f=1MHz		6	pF
Emitter Base Capacitance	Ceb	V_{EB}=−0.5V, I_C=0, f=1MHz		100	pF
Turn On Time	ton	V_{BE} (off)=−2V, V_{CC}=−100V I_C=−50mA, I_B1=−10mA		200	ns
Turn Off Time	toff	V_{CC}=−100V, I_C=−50mA I_B1=I_B2=−10mA		3.5	ns

* Pulse Test: PW=300μs, Duty Cycle=2%

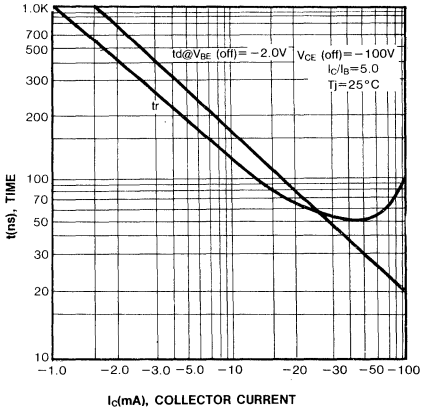
DC CURRENT GAIN



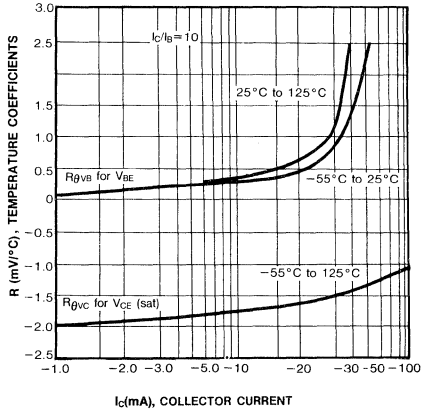
BASE EMITTER SATURATION VOLTAGE
COLLECTOR - EMITTER SATURATION VOLTAGE



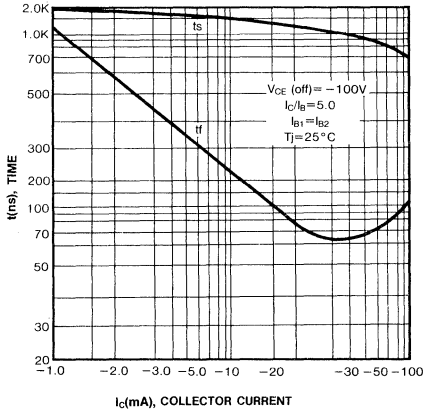
TURN-ON TIME



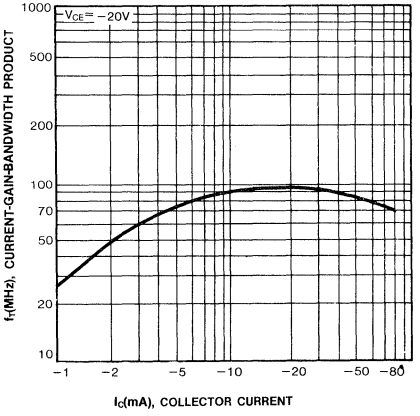
TEMPERATURE COEFFICIENTS



TURN-OFF TIME

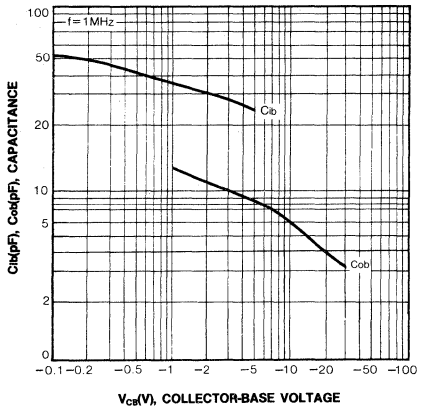


CURRENT GAIN-BANDWIDTH PRODUCT



3

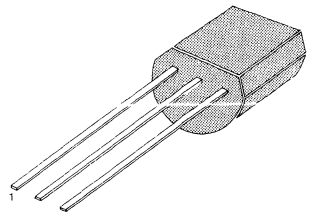
CAPACITANCE



SWITCHING AND AMPLIFIER APPLICATIONS

- LOW NOISE: BC239

TO-92



1. Collector 2. Base 3. Emitter

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Emitter Voltage	V_{CES}		
:BC237		50	V
:BC238/239		30	V
Collector-Emitter Voltage	V_{CEO}		
:BC237		45	V
:BC238/239		25	V
Emitter-Base Voltage	V_{EBO}		
:BC237		6	V
:BC238/239		5	V
Collector Current (DC)	I_C	100	mA
Collector Dissipation	P_C	500	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55∼150	°C

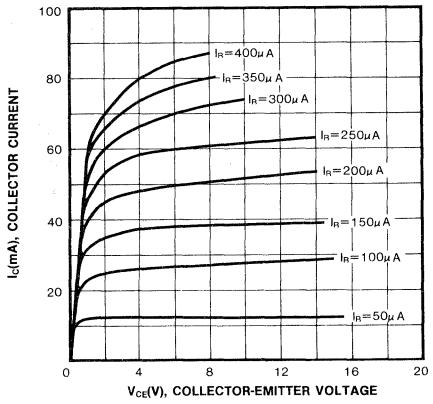
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Emitter Breakdown Voltage	BV_{CEO}	I_C=2mA, I_B=0				
:BC237			45			V
:BC238/239			25			V
Emitter Base Breakdown Voltage	BV_{EBO}	I_E=1μA, I_C=0				
:BC237			6			V
:BC238/239			5			V
Collector Cutoff Current	I_{CES}					
:BC237		V_{CE}=50V, I_B=0		0.2	15	nA
:BC238/239		V_{CE}=30V, I_B=0		0.2	15	nA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=2mA	120		800	
Collector Emitter Saturation Voltage	V_{CE}(sat)	I_C=10mA, I_B=0.5mA		0.07	0.2	V
		I_C=100mA, I_B=5mA		0.2	0.6	V
Collector Base Saturation Voltage	V_{BE}(sat)	I_C=10mA, I_B=0.5mA		0.73	0.83	V
		I_C=100mA, I_B=5mA		0.87	1.05	V
Base Emitter On Voltage	V_{BE}(on)	V_{CE}=5V, I_C=2mA	0.55	0.62	0.7	V
Current Gain Bandwidth Product	f_T	V_{CE}=3V, I_C=0.5mA, f=100MHz		85		MHz
		V_{CE}=5V, I_C=10mA, f=100MHz	150	250		MHz
Collector Base Capacitance	C_{CBO}	V_{CB}=10V, f=1MHz		3.5	6	pF
Emitter Base Capacitance	C_{EBO}	V_{EB}=0.5V, f=1MHz		8		pF
Noise Figure :BC237/238	NF	V_{CE}=5V, I_C=0.2mA,		2	10	dB
:BC239		f=1KHz R_g=2kohm			4	dB
:BC239	NF	V_{CE}=5V, I_C=0.2mA			4	dB
		R_g=2kohm, f=30∼15KHz				

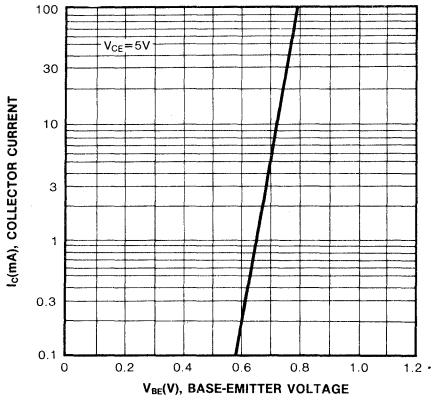
h_{FE} CLASSIFICATION

Classification	A	B	C
h_{FE}	120-220	180-460	380-800

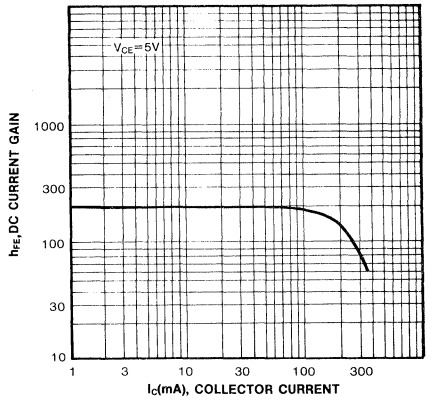
STATIC CHARACTERISTIC



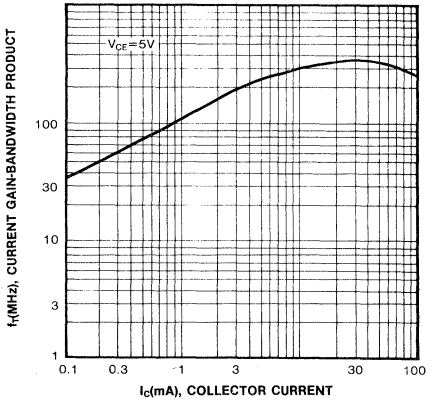
TRANSFER CHARACTERISTIC



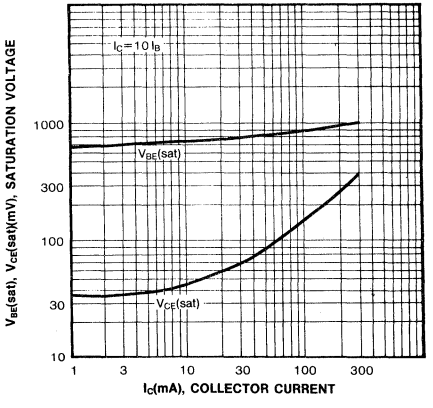
DC CURRENT GAIN



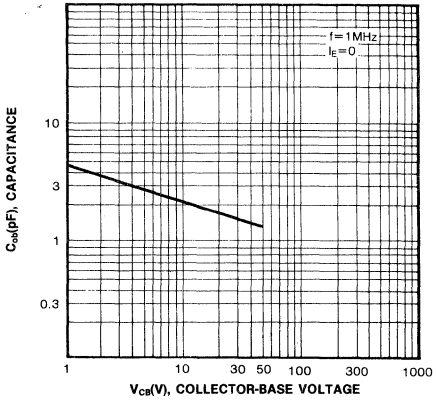
CURRENT GAIN BANDWIDTH PRODUCT



BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



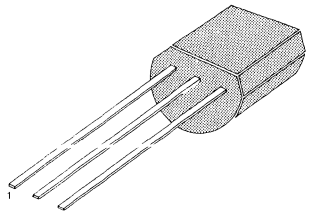
OUTPUT CAPACITANCE



SWITCHING AND AMPLIFIER APPLICATIONS

- LOW NOISE: BC309

TO-92



1.Collector 2. Base 3. Emitter

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Emitter Voltage	V_{CES}		
:BC307		−50	V
:BC308/309		−30	V
Collector-Emitter Voltage	V_{CEO}		
:BC307		−45	V
:BC308/309		−25	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current (DC)	I_C	−100	mA
Collector Dissipation	P_C	500	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

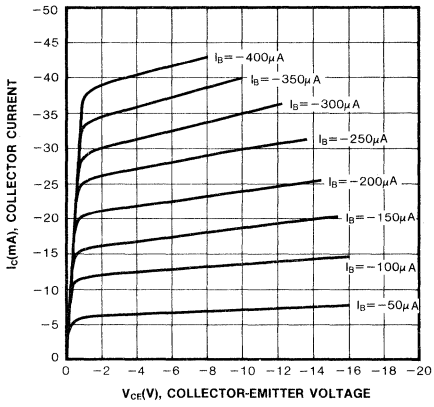
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Emitter Breakdown Voltage	BV_{CEO}	I_C=−2mA, I_B=0				
:BC307			−45			V
:BC308/309			−25			V
Collector Emitter Breakdown Voltage	BV_{CES}	I_C=−10μA, I_B=0				
:BC307			−50			V
:BC308/309			−30			V
Emitter Base Breakdown Voltage	BV_{EBO}	I_E=−10μA, I_C=0	−5			V
Collector Cutoff Current	I_{CES}					
:BC307		V_{CE}=−45V, I_B=0		−2	−15	nA
:BC308/309		V_{CE}=−25V, I_B=0		−2	−15	nA
DC Current Gain	h_{FE}	V_{CE}=−5V, I_C=−2mA	120		800	
Collector Emitter Saturation Voltage	V_{CE}(sat)	I_C=−10mA, I_B=−0.5mA			−0.3	V
		I_C=−100mA, I_B=−5mA		−0.5		V
Collector Base Saturation Voltage	V_{BE}(sat)	I_C=−10mA, I_B=−0.5mA		−0.7		V
		I_C=−100mA, I_B=−5mA		−0.85		V
Base Emitter On Voltage	V_{BE}(on)	V_{CE}=−5V, I_C=−2mA	−0.55	−0.62	−0.7	V
Current Gain Bandwidth Product	f_T	V_{CE}=−5V, I_C=−10mA, f=50MHz		130		MHz
Collector Base Capacitance	C_{CBO}	V_{CB}=−10V, f=1MHz			6	pF
Emitter Base Capacitance	C_{EBO}	V_{EB}=−0.5V, f=1MHz		12		pF
Noise Figure :BC307/308	NF	V_{CE}=−5V, I_C=−0.2mA			10	dB
:BC309		R_g=2kohm, f=1KHz			4	dB
:BC309	NF	V_{CE}=−5V, I_C=−0.2mA		2	4	dB
		R_g=2kohm, f=30~15KHz				

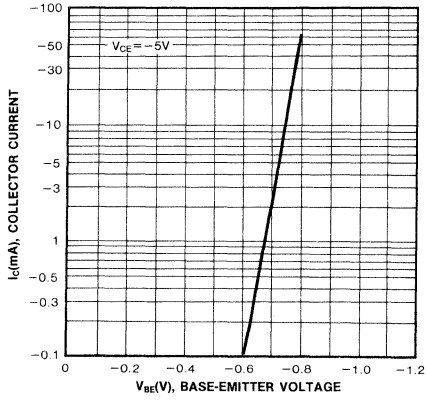
h_{FE} CLASSIFICATION

Classification	A	B	C
h_{FE}	120-220	180-460	380-800

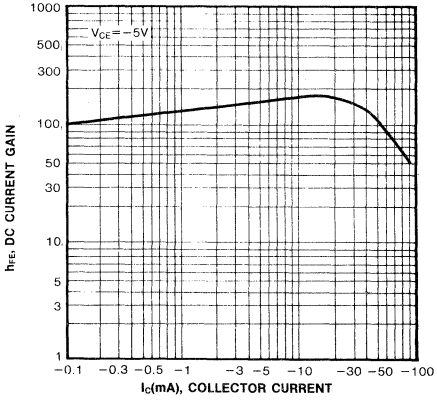
STATIC CHARACTERISTIC



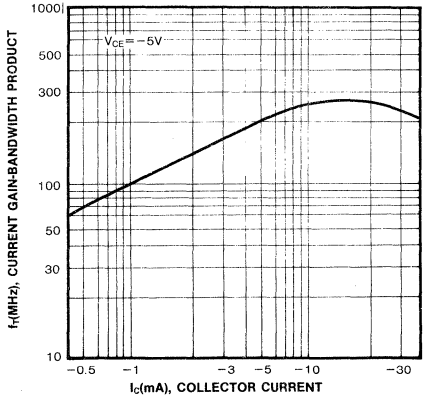
BASE-EMITTER ON VOLTAGE



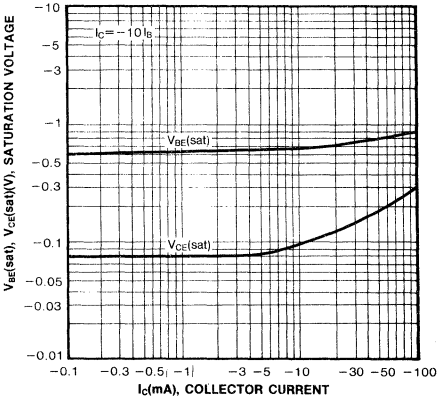
DC CURRENT GAIN



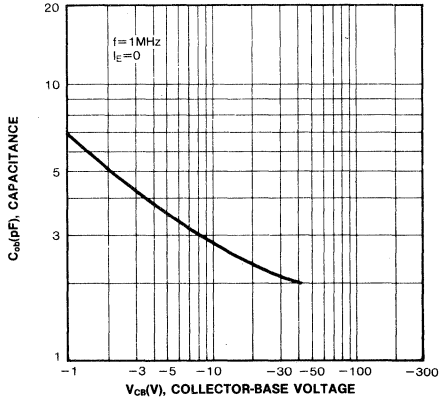
CURRENT GAIN-BANDWIDTH PRODUCT



BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



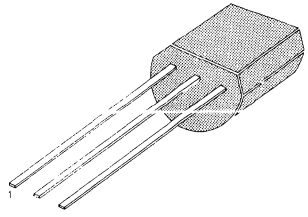
COLLECTOR OUTPUT CAPACITANCE



SWITCHING AND AMPLIFIER APPLICATIONS

- SUITABLE FOR AF-DRIVER STAGES AND LOW POWER OUTPUT STAGES
- Complement to BC337/BC338

TO-92



1. Collector 2. Base 3. Emitter

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector Emitter Voltage	V_{CES}		
:BC327		−50	V
:BC328		−30	V
Collector Emitter Voltage	V_{CEO}		
:BC327		−45	V
:BC328		−25	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current (DC)	I_C	−800	mA
Collector Dissipation	P_C	625	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55∼150	°C

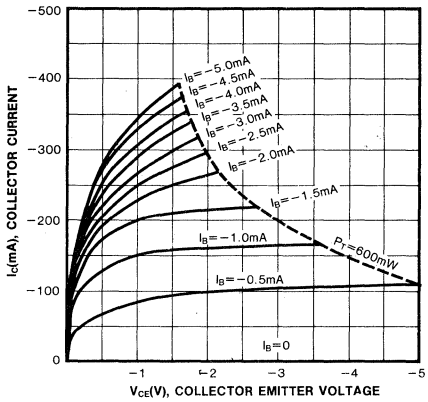
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Emitter Breakdown Voltage	BV_{CEO}	I_C=−10mA, I_B=0				
:BC327			−45			V
:BC328			−25			V
Collector Emitter Breakdown Voltage	BV_{CES}	I_C=−0.1mA, I_B=0				
:BC327			−50			V
:BC328			−30			V
Emitter Base Breakdown Voltage	BV_{EBO}	I_E=−0.1mA, I_C=0	−5			V
Collector Cutoff Current	I_{CES}					
:BC327		V_{CE}=−45V, I_B=0		−2	−100	nA
:BC328		V_{CE}=−25V, I_B=0		−2	−100	nA
DC Current Gain	h_{FE}	V_{CE}=−1V, I_C=−100mA	100		630	
	$h_{FE}2$	V_{CE}=−1V, I_C=−30mA	60			
Collector Emitter Saturation Voltage	V_{CE}(sat)	I_C=−500mA, I_B=−50mA			−0.7	V
Base Emitter On Voltage	V_{BE}(on)	V_{CE}=−1V, I_C=−300mA			−1.2	V
Current Gain Bandwidth Product	f_T	V_{CE}=−5V, I_C=−10mA, f=50MHz		100		MHz
Collector Base Capacitance	C_{CBO}	V_{CB}=−10V, f=1MHz		12		pF

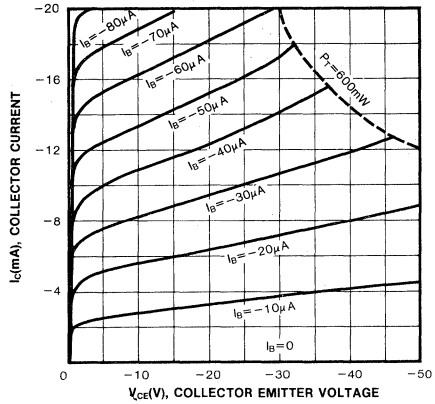
h_{FE} CLASSIFICATION

Classification	16	25	40
h_{FE}	100-250	160-400	250-630
$h_{FE}2$	60-	100-	170-

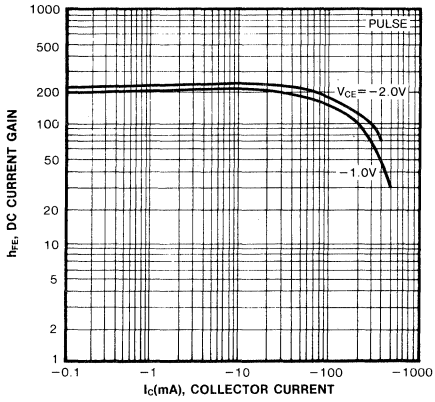
COLLECTOR CURRENT vs.
COLLECTOR EMITTER VOLTAGE



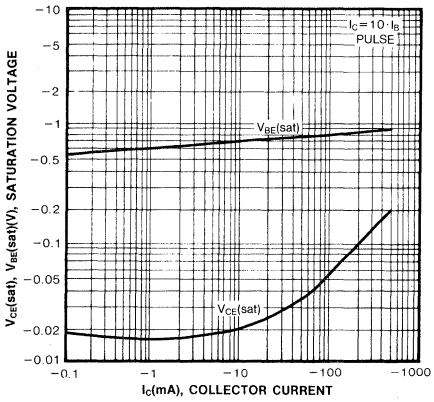
COLLECTOR CURRENT vs.
COLLECTOR EMITTER VOLTAGE



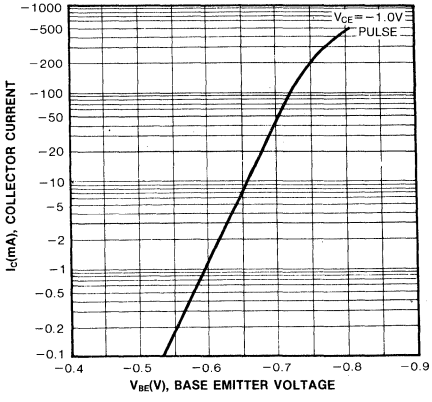
DC CURRENT GAIN vs.
COLLECTOR CURRENT



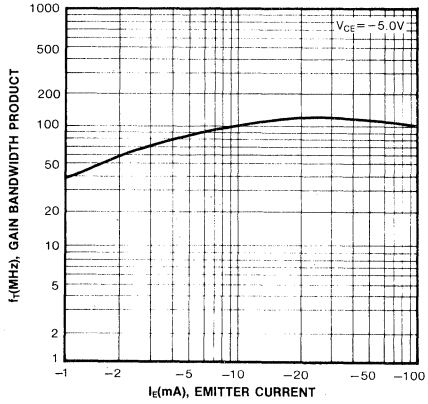
BASE AND COLLECTOR SATURATION
VOLTAGE vs. COLLECTOR CURRENT



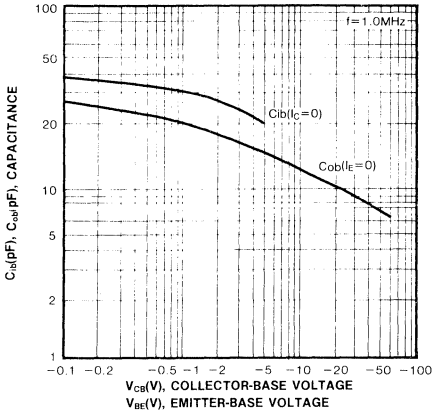
COLLECTOR CURRENT vs.
BASE EMITTER VOLTAGE



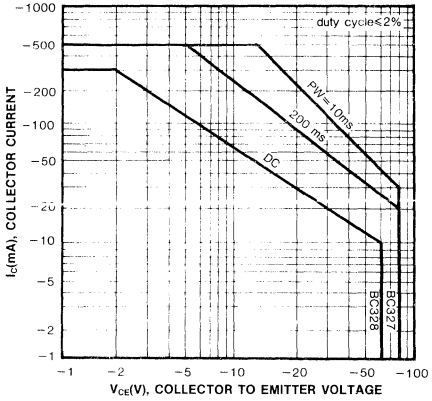
GAIN BANDWIDTH PRODUCT vs.
EMITTER CURRENT



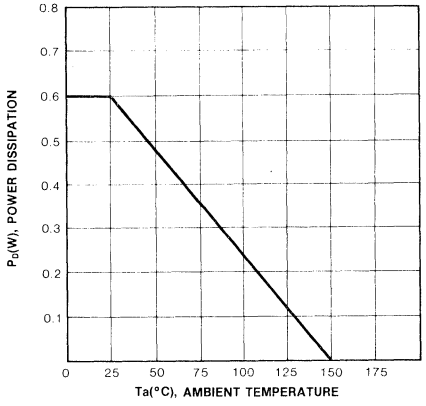
INPUT AND OUTPUT CAPACITANCE vs. REVERSE VOLTAGE



SAFE OPERATING AREA



POWER DERATING

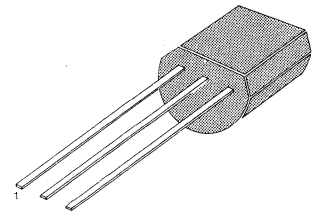


3

SWITCHING AND AMPLIFIER APPLICATIONS

- SUITABLE FOR AF-DRIVER STAGES AND LOW POWER OUTPUT STAGES
- Complement to BC327/BC328

TO-92



1. Collector 2. Base 3. Emitter

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector Emitter Voltage	V_{CES}		
:BC337		50	V
:BC338		30	V
Collector Emitter Voltage	V_{CEO}		
:BC337		45	V
:BC338		25	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current (DC)	I_C	800	mA
Collector Dissipation	P_C	625	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55∼150	°C

ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Emitter Breakdown Voltage	BV_{CEO}	I_C=10mA, I_B=0				
:BC337			45			V
:BC338			25			V
Collector Emitter Breakdown Voltage	BV_{CES}	I_C=0.1mA, I_B=0				
:BC337			50			V
:BC338			30			V
Emitter Base Breakdown Voltage	BV_{EBO}	I_E=0.1mA, I_C=0	5			V
Collector Cutoff Current	I_{CES}					
:BC337		V_{CE}=45V, I_B=0		2	100	nA
:BC338		V_{CE}=25V, I_B=0		2	100	nA
DC Current Gain	h_{FE}	V_{CE}=1V, I_C=100mA	100		630	
	$h_{FE}2$	V_{CE}=1V, I_C=300mA	60			
Collector Emitter Saturation Voltage	V_{CE}(sat)	I_C=500mA, I_B=50mA			0.7	V
Base Emitter On Voltage	V_{BE}(on)	V_{CE}=1V, I_C=300mA			1.2	V
Current Gain Bandwidth Product	f_T	V_{CE}=5V, I_C=10mA, f=50MHz		100		MHz
Collector Base Capacitance	C_{CBO}	V_{CB}=10V, f=1MHz		12		pF

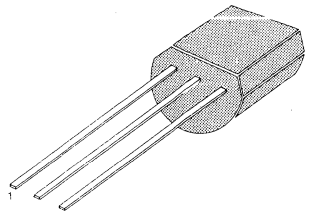
h_{FE} CLASSIFICATION

Classification	16	25	40
h_{FE}	100-250	160-400	250-630
$h_{FE}2$	60-	100-	170-

SWITCHING AND AF AMPLIFIER

- HIGH VOLTAGE: BC546, V_{CEO}=65V
- LOW NOISE: BC549, BC550
- Complement to BC556 ... BC 560

TO-92



1.Collector 2. Base 3. Emitter

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector Base Voltage	V_{CBO}		
:BC546		80	V
:BC547/550		50	V
:BC548/549		30	V
Collector Emitter Voltage	V_{CEO}		
:BC546		65	V
:BC547/550		45	V
:BC548/549		30	V
Emitter-Base Voltage	V_{EBO}		V
:BC546/547		6	V
:BC548/549/550		5	V
Collector Current (DC)	I_C	100	mA
Collector Dissipation	P_C	500	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−65∼150	°C

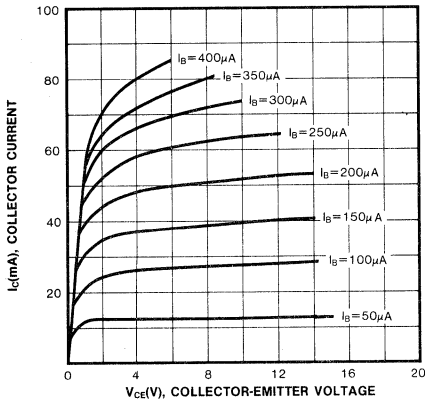
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Cutoff Current	I_{CBO}	V_{CB}=30V, I_E=0			15	nA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=2mA	110		800	
Collector Emitter Saturation Voltage	V_{CE}(sat)	I_C=10mA, I_B=0.5mA		90	250	mV
		I_C=100mA, I_B=5mA		200	600	mV
Collector Base Saturation Voltage	V_{BE}(sat)	I_C=10mA, I_B=0.5mA		700		mV
		I_C=100mA, I_B=5mA		900		mV
Base Emitter On Voltage	V_{BE}(on)	V_{CE}=5V, I_C=2mA	580	660	700	mV
		V_{CE}=5V, I_C=10mA			720	mV
Current Gain Bandwidth Product	f_T	V_{CE}=5V, I_C=10mA, f=100MHz		300		MHz
Collector Base Capacitance	C_{CBO}	V_{CB}=10V, f=1MHz		3.5	6	pF
Emitter Base Capacitance	C_{EBO}	V_{EB}=0.5V, f=1MHz		9		pF
Noise Figure :BC546/547/548	NF	V_{CE}=5V, I_C=200μA,		2	10	dB
:BC549/550		f=1KHz R_g=2kohm		1.2	4	dB
:BC549	NF	V_{CE}=5V, I_C=200μA		1.4	4	dB
:BC550		R_g=2kohm, f=30∼15000Hz		1.4	3	dB

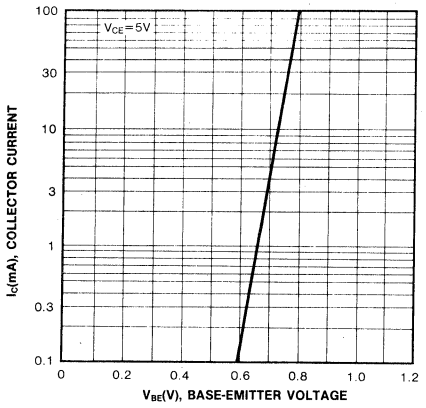
h_{FE} CLASSIFICATION

Classification	A	B	C
h_{FE}	110-220	200-450	420-800

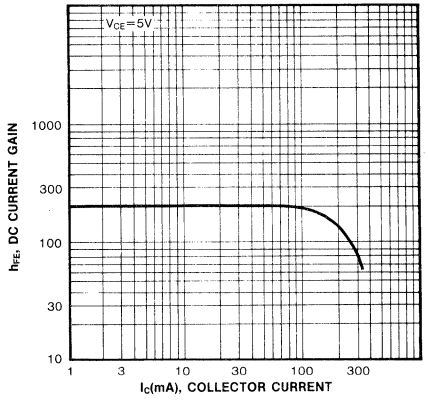
STATIC CHARACTERISTIC



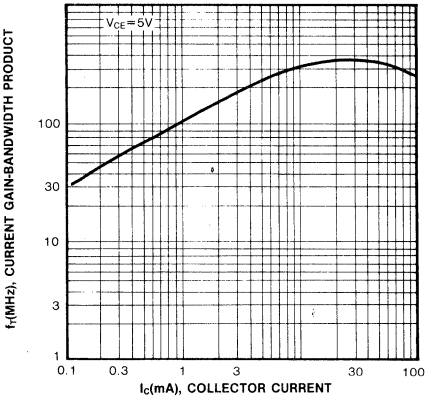
TRANSFER CHARACTERISTIC



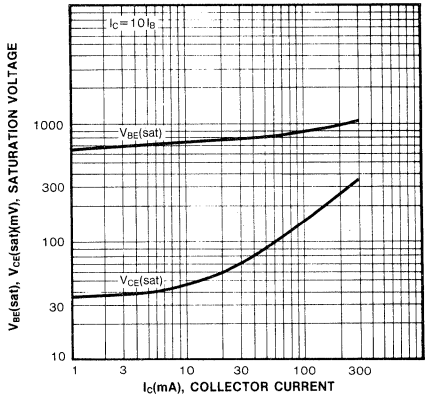
DC CURRENT GAIN



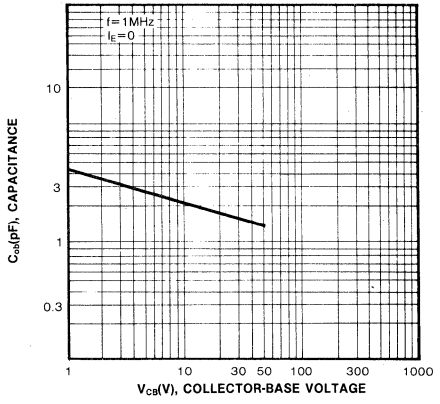
CURRENT GAIN BANDWIDTH PRODUCT



BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



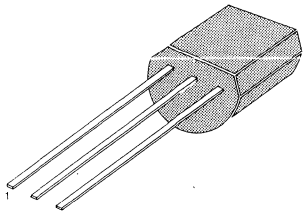
OUTPUT CAPACITANCE



SWITCHING AND AF AMPLIFIER

- HIGH VOLTAGE: BC556, $V_{CEO} = -65V$
- LOW NOISE: BC559, BC560
- Complement to BC546 ... BC 550

TO-92



1. Collector 2. Base 3. Emitter

ABSOLUTE MAXIMUM RATINGS ($T_a = 25°C$)

Characteristic	Symbol	Rating	Unit
Collector Base Capacitance	V_{CBO}		
:BC556		−80	V
:BC557/560		−50	V
:BC558/559		−30	V
Collector Emitter Voltage	V_{CEO}		
:BC556		−65	V
:BC557/560		−45	V
:BC558/559		−30	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current (DC)	I_C	−100	mA
Collector Dissipation	P_C	500	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−65∼150	°C

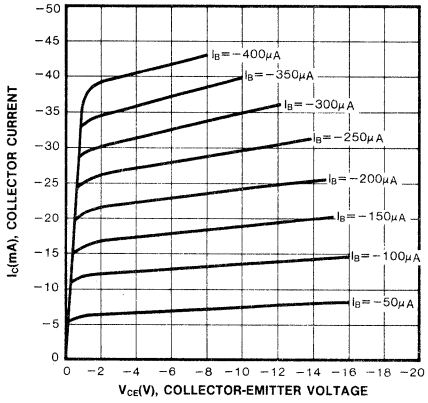
ELECTRICAL CHARACTERISTICS ($T_a = 25°C$)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Cutoff Current	I_{CBO}	$V_{CB}=-30V$, $I_E=0$			−15	nA
DC Current Gain	h_{FE}	$V_{CE}=-5V$, $I_C=2mA$	110		800	
Collector Emitter Saturation Voltage	$V_{CE}(sat)$	$I_C=-10mA$, $I_B=-0.5mA$		−90	−300	mV
		$I_C=-100mA$, $I_B=-5mA$		−250	−650	mV
Collector Base Saturation Voltage	$V_{BE}(sat)$	$I_C=-10mA$, $I_B=-0.5mA$		−700		mV
		$I_C=-100mA$, $I_B=-5mA$		−900		mV
Base Emitter On Voltage	$V_{BE}(on)$	$V_{CE}=-5V$, $I_C=-2mA$	−600	−660	−750	mV
		$V_{CE}=-5V$, $I_C=-10mA$			−800	mV
Current Gain Bandwidth Product	f_T	$V_{CE}=-5V$, $I_C=-10mA$, f=100MHz		150		MHz
Collector Base Capacitance	C_{CBO}	$V_{CB}=-10V$, f=1MHz			6	pF
Noise Figure :BC556/557/558	NF	$V_{CE}=-5V$, $I_C=-200\mu A$,		2	10	dB
:BC559/560		f=1KHz R_g=2kohm		1	4	dB
:BC559	NF	$V_{CE}=-5V$, $I_C=-200\mu A$		1.2	4	dB
:BC560		R_g=2kohm, f=30∼15000Hz		1.2	2	dB

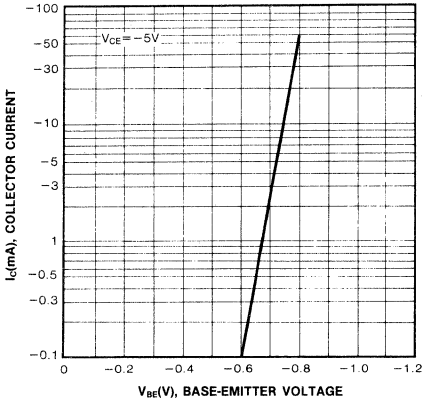
h_{FE} CLASSIFICATION

Classification	A	B	C
h_{FE}	110-220	200-450	420-800

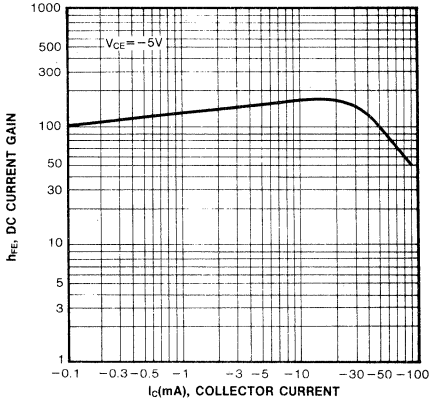
STATIC CHARACTERISTIC



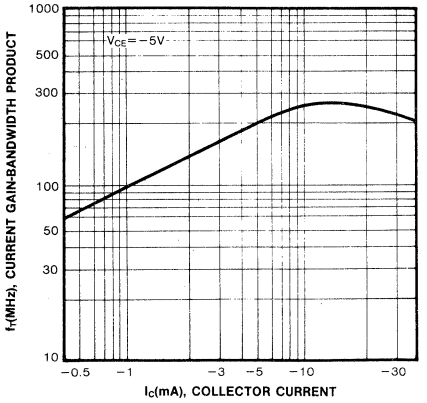
BASE-EMITTER VOLTAGE



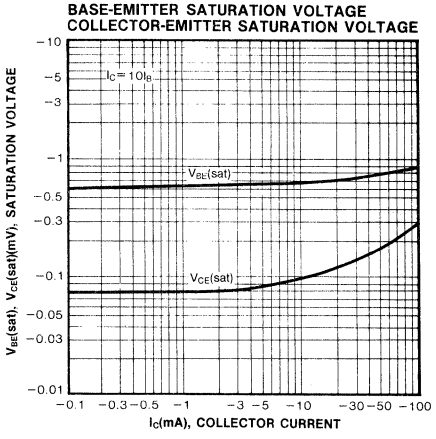
DC CURRENT GAIN



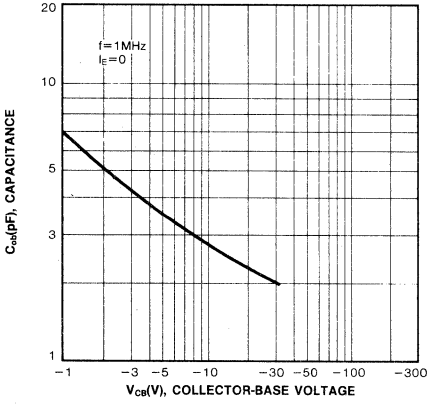
CURRENT GAIN-BANDWIDTH PRODUCT



BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



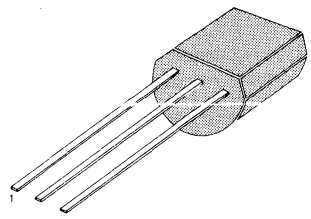
COLLECTOR OUTPUT CAPACITANCE



SWITCHING AND AMPLIFIER APPLICATIONS

- **Complement to BC635/638/640**

TO-92



1. Emitter 2. Collector 3. Base

ABSOLUTE MAXIMUM RATINGS ($T_a = 25°C$)

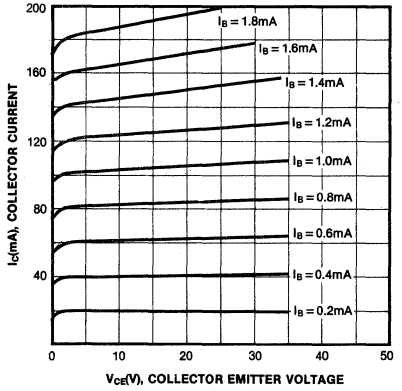
Characteristic	Symbol	Rating	Unit
Collector Emitter Voltage: BC635	V_{CER}	45	V
at R_{BE} = 1Kohm : BC637		60	V
: BC639		100	V
Collector Emitter Voltage: BC635	V_{CES}	45	V
: BC637		60	V
: BC639		100	V
Collector Emitter Voltage: BC635	V_{CEO}	45	V
: BC637		60	V
: BC639		80	V
Emitter Base Voltage	V_{EBO}	5	V
Collector Current	I_C	1	A
Peak Collector Current	I_{CP}	1.5	A
Base Current	I_B	100	mA
Collector Dissipation	P_c	1	W
Junction Temperature	T_j	150	°C
Storage Temperature	T_{stg}	−65~150	°C

* PW = 5mS, Duty Cycle = 10%

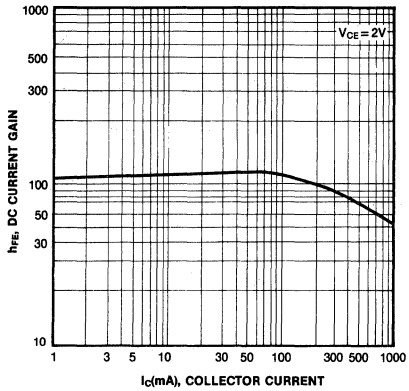
ELECTRICAL CHARACTERISTICS ($T_a = 25°C$)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Emitter Breakdown Voltage	BV_{CEO}	I_C=10mA, I_B=0				
:BC635			45			V
:BC736			60			V
:BC639			80			V
Collector Cutoff Current	I_{CBO}	V_{CB}=30V, I_E=0			0.1	μA
Emitter Cutoff Current	I_{EBO}	V_{EB}=5V, I_C=0			0.1	μA
DC Current Gain	h_{FE}	V_{CE}=2V, I_C=5mA	25			
:BC635		V_{CE}=2V, I_C=150mA	40		250	
:BC637/BC639			40		160	
		V_{CE}=2V, I_C=500mA	25			
Collector Emitter Saturation Voltage	V_{CE}(sat)	I_C=500mA, I_B=50mA			0.5	V
Base Emitter On Voltage	V_{BE}(on)	V_{CE}=2V, I_C=500mA			1	V
Current Gain Bandwidth Product	f_T	V_{CE}=5V, I_C=10mA, f=50MHz		100		MHz

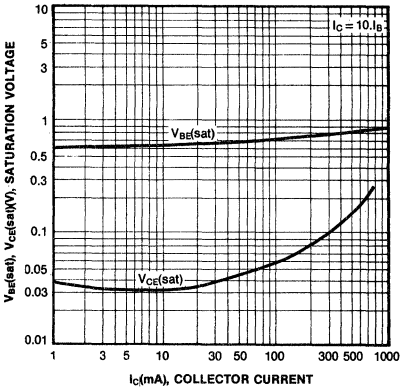
STATIC CHARACTERISTIC



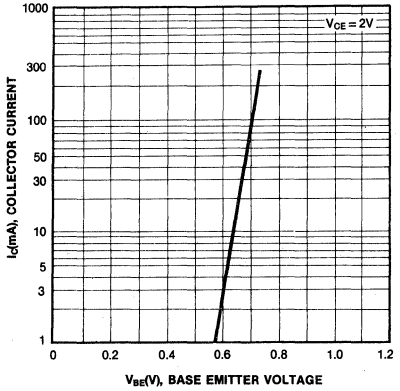
DC CURRENT GAIN



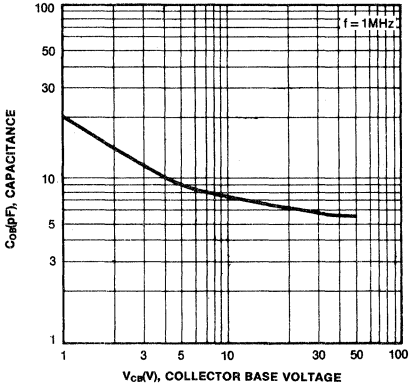
BASE EMITTER SATURATION VOLTAGE
COLLECTOR EMITTER SATURATION VOLTAGE



BASE EMITTER ON VOLTAGE



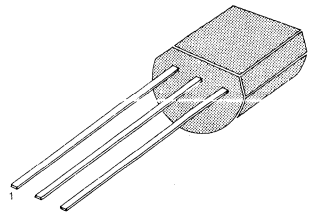
COLLECTOR OUTPUT CAPACITANCE



SWITCHING AND AMPLIFIER APPLICATIONS

- **Complement to BC635/637/639**

TO-92



1. Emitter 2. Collector 3. Base

ABSOLUTE MAXIMUM RATINGS ($T_a = 25°C$)

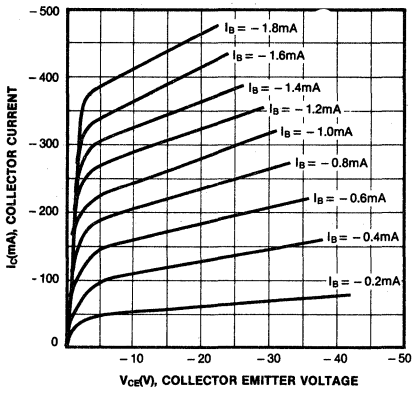
Characteristic	Symbol	Rating	Unit
Collector Emitter Voltage: BC636	V_{CER}	−45	V
at R_{BE} = 1Kohm : BC638		−60	V
: BC640		−100	V
Collector Emitter Voltage: BC636	V_{CES}	−45	V
: BC638		−60	V
: BC640		−100	V
Collector Emitter Voltage: BC636	V_{CEO}	−45	V
: BC638		−60	V
: BC640		−80	V
Emitter Base Voltage	V_{EBO}	−5	V
Collector Current	I_C	−1	A
Peak Collector Current	I_{CP}	−1.5	A
Base Current	I_B	−100	mA
Collector Dissipation	P_c	1	W
Junction Temperature	T_j	150	°C
Storage Temperature	T_{stg}	−65~150	°C

ELECTRICAL CHARACTERISTICS ($T_a = 25°C$)

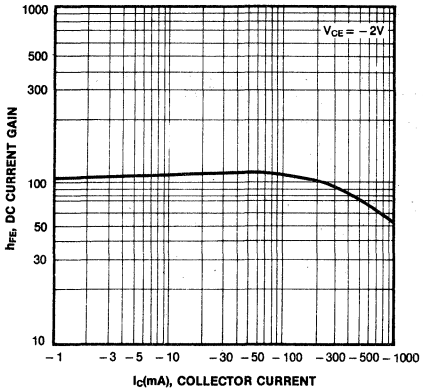
Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Emitter Breakdown Voltage	BV_{CEO}	I_C=−10mA, I_B=0				
:BC636			−45			V
:BC638			−60			V
:BC640			−80			V
Collector Cutoff Current	I_{CBO}	V_{CB}=−30V, I_E=0			−0.1	μA
Emitter Cutoff Current	I_{EBO}	V_{EB}=−5V, I_C=0			−0.1	μA
DC Current Gain	h_{FE}	V_{CE}=−2V, I_C=−5mA	25			
:BC636		V_{CE}=−2V, I_C=−150mA	40		250	
:BC638/BC640			40		160	
		V_{CE}=−2V, I_C=−500mA	25			
Collector Emitter Saturation Voltage	V_{CE}(sat)	I_C=−500mA, I_B=−50mA			−0.5	V
Base Emitter On Voltage	V_{BE}(on)	V_{CE}=−2V, I_C=−500mA			−1	V
Current Gain Bandwidth Product	f_T	V_{CE}=−5V, I_C=−10mA, f=50MHz		100		MHz

3

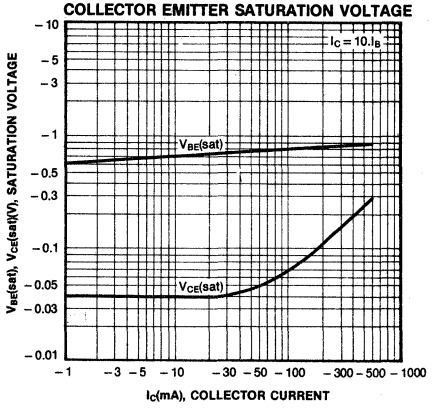
STATIC CHARACTERISTIC



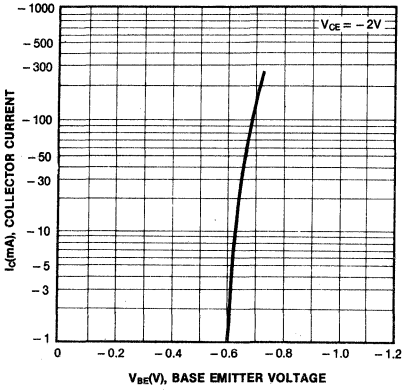
DC CURRENT GAIN



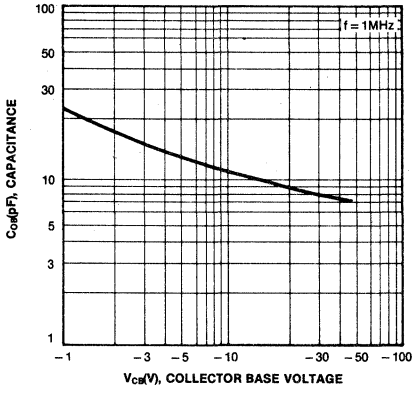
BASE EMITTER SATURATION VOLTAGE
COLLECTOR EMITTER SATURATION VOLTAGE



BASE EMITTER ON VOLTAGE



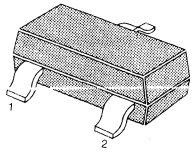
COLLECTOR OUTPUT CAPACITANCE



SWITCHING AND AMPLIFIER APPLICATIONS

- SUITABLE FOR AF-DRIVER STAGES AND LOW POWER OUTPUT STAGES
- Complement to BC817/BC818

SOT-23



1. Base 2. Emitter 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector Emitter Voltage: BC807	V_{CES}	−50	V
BC808		−30	V
Collector Emitter Voltage: BC807	V_{CEO}	−45	V
BC808		−25	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current (DC)	I_C	−800	mA
Collector Dissipation	P_C	−310	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−65~150	°C

ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Emitter Breakdown Voltage	BV_{CEO}	I_C=−10mA, I_B=0				
:BC807			−45			V
:BC808			−25			V
Collector Emitter Breakdown Voltage	BV_{CES}	I_C=−0.1mA, I_B=0				
:BC807			−50			V
:BC808			−30			V
Emitter Base Breakdown Voltage	BV_{EBO}	I_E=−0.1mA, I_C=0	−5			V
Collector Cutoff Current	I_{CES}	V_{CE}=−25V, I_B=0			−100	nA
Emitter Cutoff Current	I_{EBO}	V_{EB}=−4V, I_C=0			−100	nA
DC Current Gain	h_{FE}	V_{CE}=−1V, I_C=−100mA	100		630	
	$h_{FE}2$	V_{CE}=−1V, I_C=−300mA	60			
Collector Emitter Saturation Voltage	V_{CE}(sat)	I_C=−500mA, I_B=−50mA			−0.7	V
Base Emitter On Voltage	V_{BE}(on)	V_{CE}=−1V, I_C=−300mA			−1.2	V
Current Gain Bandwidth Product	f_T	V_{CE}=−5V, I_C=−10mA, f=50MHz		100		MHz
Collector Base Capacitance	C_{CBO}	V_{CB}=−10V, f=1MHz			12	pF

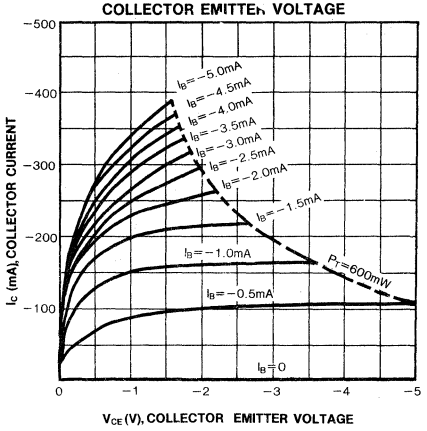
h_{FE} CLASSIFICATION

Classification	16	25	40
h_{FE}	100-250	160-400	250-630
$h_{FE}2$	60-	100-	170-

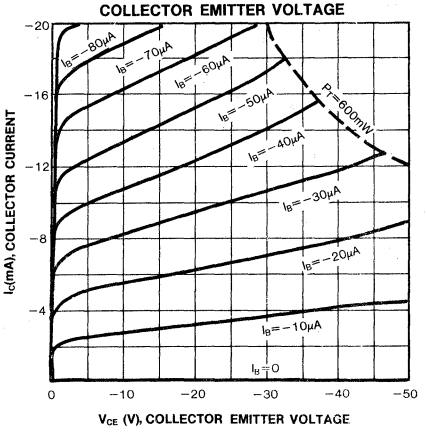
MARKING CODE

TYPE	807-16	807-25	807-40	808-16	808-25	808-40
MARKING	9FA	9FB	9FC	9GA	9GB	9GC

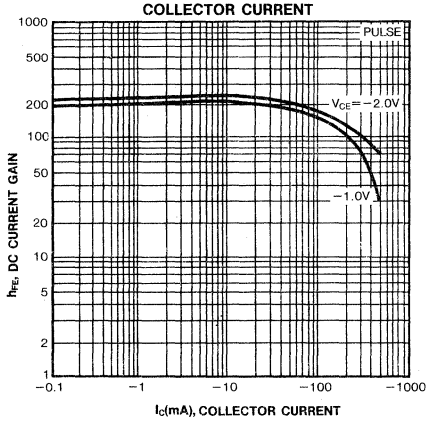
COLLECTOR CURRENT vs.
COLLECTOR EMITTER VOLTAGE



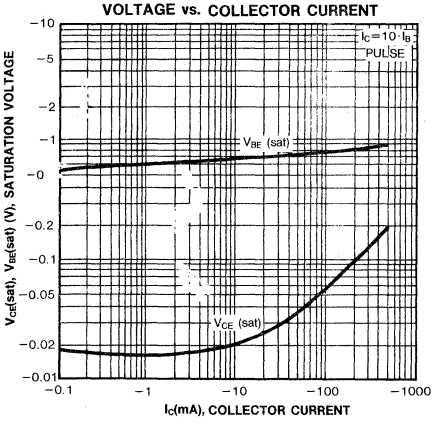
COLLECTOR CURRENT vs.
COLLECTOR EMITTER VOLTAGE



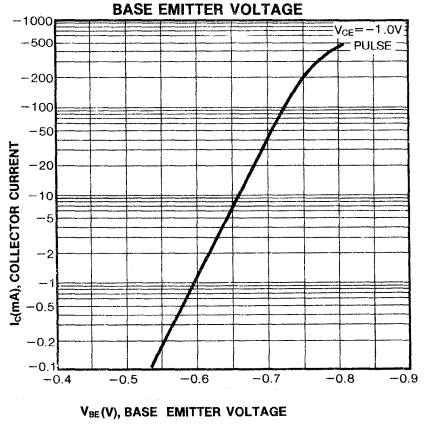
DC CURRENT GAIN vs.
COLLECTOR CURRENT



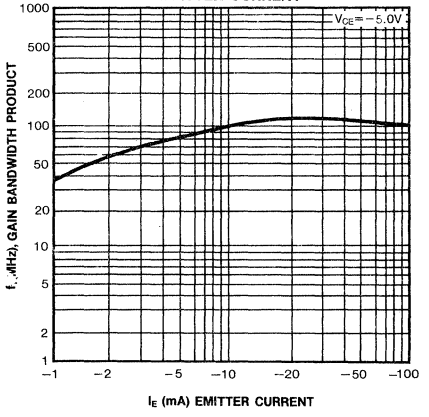
BASE AND COLLECTOR SATURATION
VOLTAGE vs. COLLECTOR CURRENT



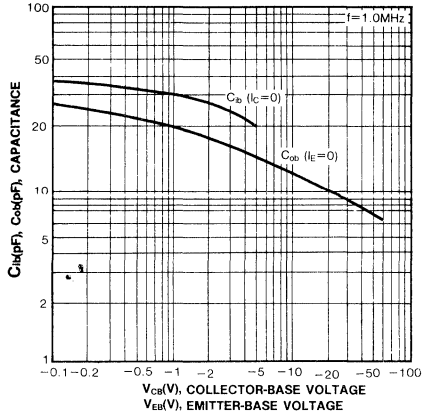
COLLECTOR CURRENT vs.
BASE EMITTER VOLTAGE



GAIN BANDWIDTH PRODUCT vs.
EMITTER CURRENT



INPUT AND OUTPUT CAPACITANCE vs.
REVERSE VOLTAGE

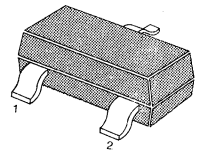


3

SWITCHING AND AMPLIFIER APPLICATIONS

- SUITABLE FOR AF-DRIVER STAGES AND LOW POWER OUTPUT STAGES
- Complement to BC807/BC808

SOT-23



1. Base 2. Emitter 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector Emitter Voltage: BC817	V_{CES}	50	V
BC818		30	V
Collector Emitter Voltage: BC817	V_{CEO}	45	V
BC818		25	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current (DC)	I_C	800	mA
Collector Dissipation	P_C	310	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−65∼150	°C

ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Emitter Breakdown Voltage	BV_{CEO}	I_C=10mA, I_B=0				
:BC817			45			V
:BC818			25			V
Collector Emitter Breakdown Voltage	BV_{CES}	I_C=0.1mA, I_B=0				
:BC817			50			V
:BC818			30			V
Emitter Base Breakdown Voltage	BV_{EBO}	I_E=0.1mA, I_C=0	5			V
Collector Cutoff Current	I_{CES}	V_{CE}=25V, I_B=0			100	nA
Emitter Cutoff Current	I_{EBO}	V_{EB}=4V, I_C=0			100	nA
DC Current Gain	h_{FE}	V_{CE}=1V, I_C=100mA	100		630	
	$h_{FE}2$	V_{CE}=1V, I_C=300mA	60			
Collector Emitter Saturation Voltage	V_{CE}(sat)	I_C=500mA, I_B=50mA			0.7	V
Base Emitter On Voltage	V_{BE}(on)	V_{CE}=1V, I_C=300mA			1.2	V
Current Gain Bandwidth Product	f_T	V_{CE}=5V, I_C=10mA, f=50MHz		100		MHz
Collector Base Capacitance	C_{CBO}	V_{CB}=10V, f=1MHz			12	pF

h_{FE} CLASSIFICATION

Classification	16	25	40
h_{FE}	100-250	160-400	250-630
$h_{FE}2$	60-	100-	170-

MARKING CODE

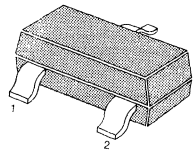
TYPE	817-16	817-25	817-40	818-16	818-25	818-40
MARKING	8FA	8FB	8FC	8GA	8GB	8GC

NPN EPITAXIAL SILICON TRANSISTOR

SWITCHING AND AF AMPLIFIER APPLICATIONS

- SUITABLE FOR AUTOMATIC INSERTION IN THICK AND THIN-FILM CIRCUITS
- LOW NOISE: BC849, BC850
- Complement to BC856 ... BC860

SOT-23



1. Base 2. Emitter 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector Base Voltage	V_{CBO}		
:BC846		80	V
:BC847/850		50	V
:BC848/849		30	V
Collector Emitter Voltage	V_{CEO}		
:BC846		65	V
:BC847/850		45	V
:BC848/849		30	V
Emitter-Base Voltage	V_{EBO}		
:BC846/847		6	V
:BC848/849/850		5	V
Collector Current (DC)	I_C	100	mA
Collector Dissipation	P_C	310	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−65∼150	°C

ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Cutoff Current	I_{CBO}	V_{CB}=30V, I_E=0			15	nA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=2mA	110		800	
Collector Emitter Saturation Voltage	V_{CE}(sat)	I_C=10mA, I_B=0.5mA		90	250	mV
		I_C=100mA, I_B=5mA		200	600	mV
Collector Base Saturation Voltage	V_{BE}(sat)	I_C=10mA, I_B=0.5mA		700		mV
		I_C=100mA, I_B=5mA		900		mV
Base Emitter On Voltage	V_{BE}(on)	V_{CE}=5V, I_C=2mA	580	660	700	mV
		V_{CE}=5V, I_C=10mA			720	mV
Current Gain Bandwidth Product	f_T	V_{CE}=5V, I_C=10mA, f=100MHz		300		MHz
Collector Base Capacitance	C_{CBO}	V_{CB}=10V, f=1MHz		3.5	6	pF
Emitter Base Capacitance	C_{EBO}	V_{EB}=0.5V, f=1MHz		9		pF
Noise Figure :BC846/847/848	NF	V_{CE}=5V, I_C=200μA,		2	10	dB
:BC849/850		f=1KHz R_g=2kohm		1.2	4	dB
:BC849	NF	V_{CE}=5V, I_C=200μA		1.4	4	dB
:BC850		R_g=2kohm, f=30∼15000Hz		1.4	3	dB

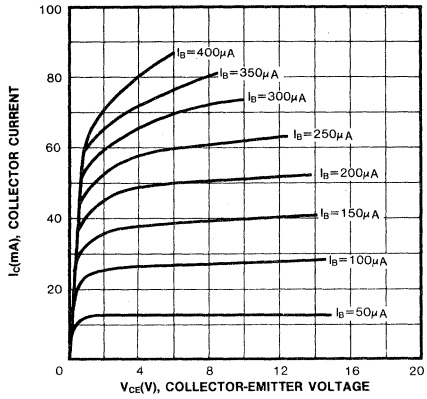
h_{FE} CLASSIFICATION

Classification	A	B	C
h_{FE}	110-220	200-450	420-800

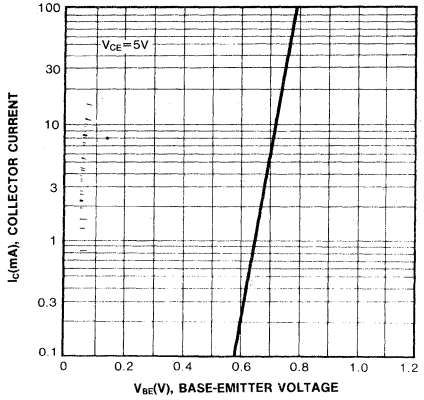
MARKING CODE

TYPE	846A	846B	846C	847A	847B	847C	848A	848B	848C	849A	849B	849C	850A	850B	850C
MARK	8AA	8AB	8AC	8BA	8BB	8BC	8CA	8CB	8CC	8DA	8DB	8DC	8EA	8EB	8EC

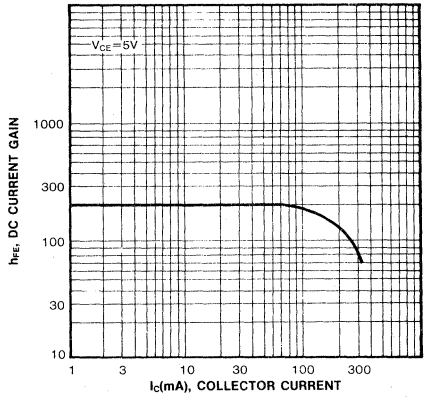
STATIC CHARACTERISTIC



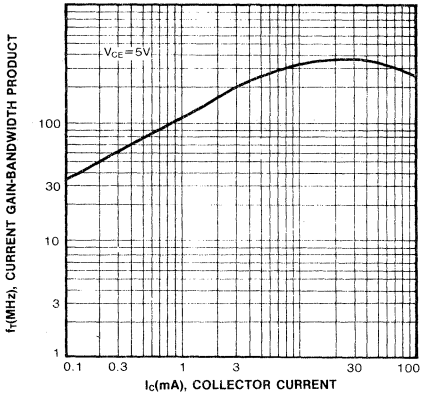
TRANSFER CHARACTERISTIC



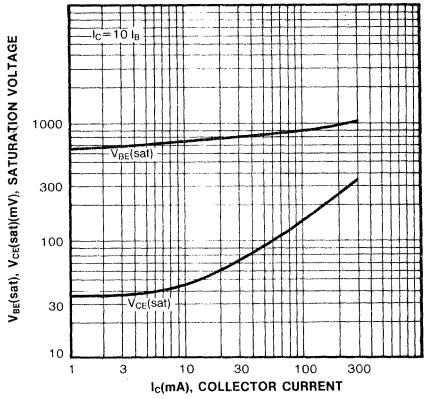
DC CURRENT GAIN



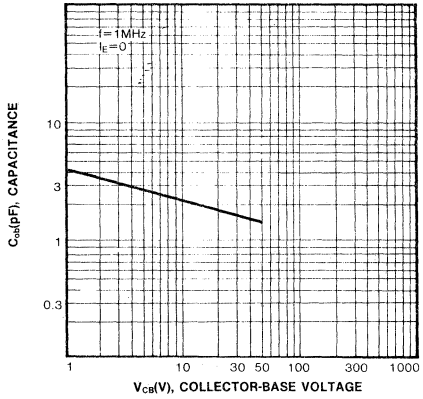
CURRENT GAIN BANDWIDTH PRODUCT



BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



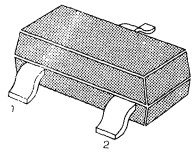
OUTPUT CAPACITANCE



SWITCHING AND AF AMPLIFIER APPLICATIONS

- SUITABLE FOR AUTOMATIC INSERTION IN THICK AND THIN-FILM CIRCUITS
- LOW NOISE: BC859, BC860
- Complement to BC846 ... BC850

SOT-23



1. Base 2. Emitter 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector Base Voltage	V_{CBO}		
:BC856		−80	V
:BC857/860		−50	V
:BC858/859		−30	V
Collector Emitter Voltage	V_{CEO}		
:BC856		−65	V
:BC857/860		−45	V
:BC858/859		−30	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current (DC)	I_C	−100	mA
Collector Dissipation	P_C	310	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−65~150	°C

ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Cutoff Current	I_{CBO}	V_{CB}=−30V, I_E=0			−15	nA
DC Current Gain	h_{FE}	V_{CE}=−5V, I_C=−2mA	110		800	
Collector Emitter Saturation Voltage	V_{CE}(sat)	I_C=−10mA, I_B=−0.5mA		−90	−300	mV
		I_C=−100mA, I_B=−5mA		−250	−650	mV
Collector Base Saturation Voltage	V_{BE}(sat)	I_C=−10mA, I_B=−0.5mA		−700		mV
		I_C=−100mA, I_B=−5mA		−900		mV
Base Emitter On Voltage	V_{BE}(on)	V_{CE}=−5V, I_C=−2mA	−600	−660	−750	mV
		V_{CE}=−5V, I_C=−10mA			−800	mV
Current Gain Bandwidth Product	f_T	V_{CE}=−5V, I_C=−10mA, f=100MHz		150		MHz
Collector Base Capacitance	C_{CBO}	V_{CB}=−10V, f=1MHz			6	pF
Noise Figure :BC856/857/858	NF	V_{CE}=−5V, I_C=−200μA,		2	10	dB
:BC859/860		f=1KHz R_g=2kohm		1	4	dB
:BC859	NF	V_{CE}=−5V, I_C=−200μA		1.2	4	dB
:BC860		R_g=2kohm, f=30~15000Hz		1.2	2	dB

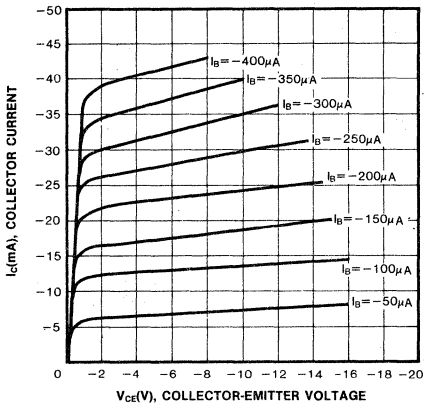
h_{FE} CLASSIFICATION

Classification	A	B	C
h_{FE}	110-220	200-450	420-800

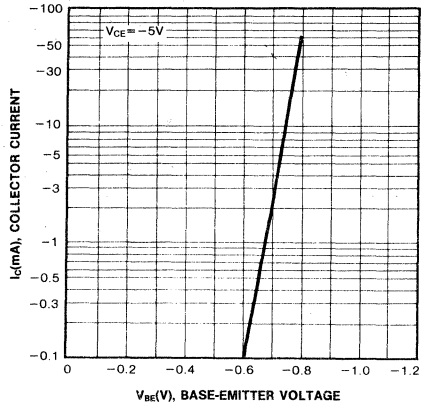
MARKING CODE

TYPE	856A	856B	856C	857A	857B	857C	858A	858B	858C	859A	859B	859C	860A	860B	860C
MARK.	9AA	9AB	9AC	9BA	9BB	9BC	9CA	9CB	9CC	9DA	9DB	9DC	9EA	9EB	9EC

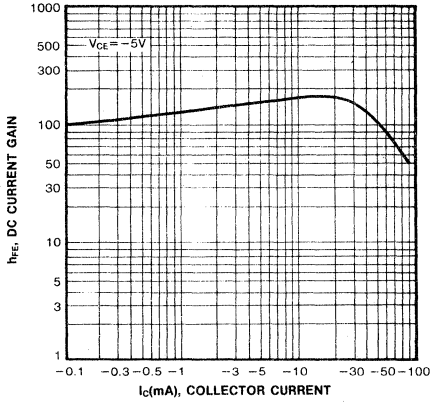
STATIC CHARACTERISTIC



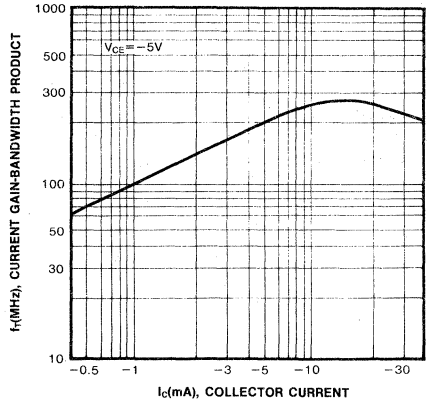
BASE-EMITTER VOLTAGE



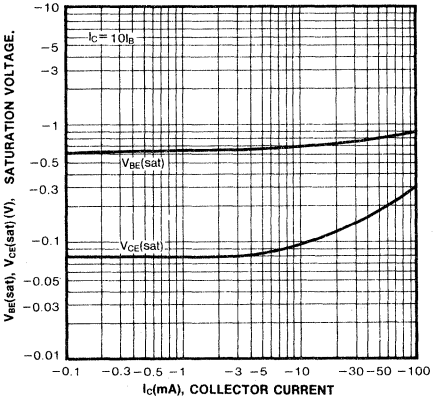
DC CURRENT GAIN



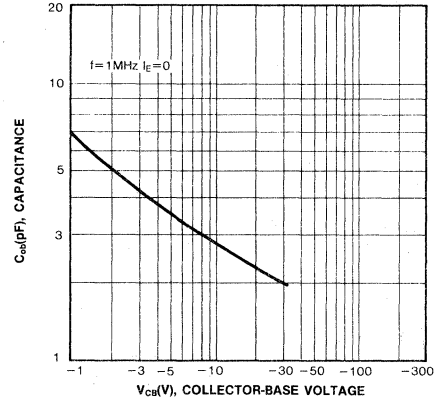
CURRENT GAIN-BANDWIDTH PRODUCT



BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE

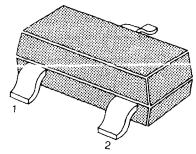


COLLECTOR OUTPUT CAPACITANCE



GENERAL PURPOSE TRANSISTOR

SOT-23



1. Base 2. Emitter 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−30	V
Collector-Emitter Voltage	V_{CEO}	−20	V
Emitter-Base Voltage	V_{EBO}	−5.0	V
Collector Current	I_C	−100	mA
Collector Dissipation	P_C	350	mW
Storage Temperature	Tstg	150	°C

• Refer to MMBT5086 for graphs

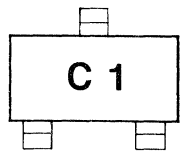
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=−10μA, I_E=0	−30			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=−2mA, I_B=0	−20			V
Collector-Emitter Breakdown Voltage	BV_{CES}	I_C=−100μA, V_{EB}=0	−30			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=−10μA, I_C=0	−5			V
Collector Cut-off Current	I_{CBO}	V_{CB}=−20V, I_E=0			−100	nA
DC Current Gain	h_{FE}					
:BCW29		V_{CE}=−5V, I_C=−2mA	120		260	
BCW30			215		500	
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=−10mA, I_B=−0.5mA			−0.3	V
Base-Emitter On Voltage	V_{BE} (on)	V_{CE}=−5V, I_C=−2mA	−0.6		−0.75	V
Output Capacitance	C_{OB}	V_{CB}=−10V, I_E=0 f=1MHz			7	pF
Noise Figures	N_F	I_C=−0.2mA, V_{CE}=−5V R_G=2KΩ, f=1KHz			10	dB

MARKING CODE

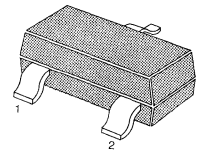
TYPE	BCW29	BCW30
MARK.	C1	C2

Marking



GENERAL PURPOSE TRANSISTOR

SOT-23



1. Base 2. Emitter 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	30	V
Collector-Emitter Voltage	V_{CEO}	20	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	100	mA
Collector Dissipation	P_C	350	mW
Storage Temperature	Tstg	150	°C

• Refer to MMBT5088 for graphs

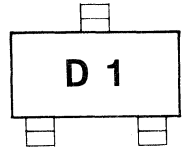
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=10μA, I_E=0	30			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=2mA, I_B=0	20			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=10μA, I_C=0	5			V
DC Current Gain	h_{FE}					
:BCW31		V_{CE}=5V, I_C=2.0mA	110		220	
BCW32			200		450	
BCW33			420		800	
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=10mA, I_B=0.5mA			0.25	V
Base-Emitter On Voltage	V_{BE} (on)	V_{CE}=5V, I_C=2mA	0.55		0.7	V
Output Capacitance	C_{OB}	V_{CB}=10V, I_E=0 f=1MHz			4	pF
Noise Figure	N_F	V_{CE}5V, I_C=0.2mA R_S=2KΩ, f=1KHz			10	dB

MARKING CODE

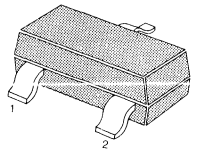
TYPE	BCW31	BCW32	BCW33
MARK.	D1	D2	D3

Marking



GENERAL PURPOSE TRANSISTOR

SOT-23



1. Base 2. Emitter 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	32	V
Collector-Emitter Voltage	V_{CEO}	32	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	100	mA
Collector Dissipation	P_C	350	mW
Storage Temperature	Tstg	150	°C

• Refer to MMBT3904 for graphs

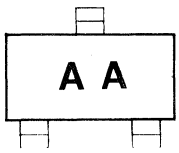
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Conditions	Min	Max	Unit
Collector-Emitter Breakdown Voltage	BV_{CBO}	I_C=2mA, I_B=0	32		V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=1μA, I_C=0	5		V
Collector Cut-off Current	I_{CES}	V_{CB}=32V, V_{BE}=0		20	nA
Emitter Cut-off Current	I_{EBO}	V_{EB}=4V, I_C=0		20	nA
DC Current Gain	h_{FE}				
:BCW60B		V_{CE}=5V, I_C=10μA	20		
BCW60C			40		
BCW60D			100		
:BCW60A		V_{CE}=5V, I_C=2mA	120	220	
BCW60B			180	310	
BCW60C			250	460	
BCW60D			380	630	
:BCW60A		V_{CE}=1V, I_C=50mA	60		
BCW60B			70		
BCW60C			90		
BCW60D			100		
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=50mA, I_B=1.25mA		0.55	V
		I_C=10mA, I_B=0.25mA		0.35	V
Base-Emitter Saturation Voltage	V_{BE} (sat)	I_C=50mA, I_B=1.25mA	0.7	1.05	V
		I_C=10mA, I_B=0.25mA	0.6	0.85	V
Base-Emitter On Voltage	V_{BE} (on)	V_{CE}=5V, I_C=2mA	0.55	0.75	V
Output Capacitance	C_{OB}	V_{CB}=10V, I_E=0 f=1MHz		4.5	pF
Current Gain-Bandwidth Product	f_T	I_C=10mA, V_{CE}=5V f=100MHz	125		MHz
Noise Figure	N_F	I_C=0.2mA, V_{CE}=5V R_G=2KΩ, f=1KHz		6	dB
Turn On Time	t_{ON}	I_C=10mA, I_B1=1mA		150	ns
Turn Off Time	t_{OFF}	V_{BB}=3.6V, I_B2=1mA R1=R2=5KΩ, R_L=990Ω		800	ns

MARKING CODE

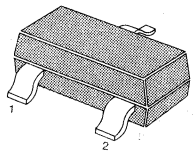
TYPE	BCW60A	BCW60B	BCW60C	BCW60D
MARK.	AA	AB	AC	AD

Marking



GENERAL PURPOSE TRANSISTOR

SOT-23



1. Base 2. Emitter 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−32	V
Collector-Emitter Voltage	V_{CEO}	−32	V
Emitter-Base Voltage	V_{EBO}	−5.0	V
Collector Current	I_C	−100	mA
Collector Dissipation	P_C	350	mW
Storage Temperature	Tstg	150	°C

• Refer to MMBT5086 for graphs

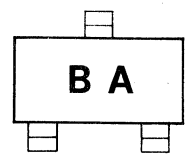
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Conditions	Min	Max	Unit
Collector-Emitter Breakdown Voltage	BV_{CBO}	I_C=−2mA, I_B=0	−32		V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=−1μA, I_C=0	−5		V
Collector Cut-off Current	I_{CES}	V_{CB}=−32V, V_{BE}=0		−20	nA
DC Current Gain	h_{FE}				
:BCW61B		V_{CE}=−5V, I_C=−10μA	20		
BCW61C			40		
BCW61D			100		
:BCW61A		V_{CE}=−5V, I_C=−2mA	120	220	
BCW61B			140	310	
BCW61C			250	460	
BCW61D			380	630	
:BCW61A		V_{CE}=−5V, I_C=−50mA	60		
BCW61B			80		
BCW61C			100		
BCW61D			100		
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=−50mA, I_B=−1.25mA		−0.55	V
		I_C=−10mA, I_B=−0.25mA		−0.25	V
Base-Emitter Saturation Voltage	V_{BE} (sat)	I_C=−50mA, I_B=−1.25mA	0.68	1.05	V
		I_C=−10mA, I_B=−0.25mA	0.6	0.85	V
Base-Emitter On Voltage	V_{BE} (on)	V_{CE}=−5V, I_C=−2mA	0.6	0.75	V
Output Capacitance	C_{OB}	V_{CB}=−10V, I_E=0 f=1MHz		6	pF
Noise Figure	N_F	I_C=−0.2mA, V_{CE}=−5V R_G=2KΩ, f=1KHz		6	dB
Turn On Time	t_{ON}	I_C=−10mA, I_{B1}=−1mA		150	ns
Turn Off Time	t_{OFF}	V_{BB}=−3.6V, I_{B2}=−1mA R1=R2=5KΩ, R_L=990Ω		800	ns

MARKING CODE

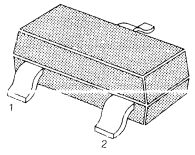
TYPE	BCW61A	BCW61B	BCW61C	BCW61D
MARK.	BA	BB	BC	BD

Marking



GENERAL PURPOSE TRANSISTOR

SOT-23



1. Base 2. Emitter 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Emitter Voltage	V_{CEO}	−45	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current	I_C	−100	mA
Collector Dissipation	P_C	350	mW
Storage Temperature	Tstg	150	°C

• Refer to MMBT5086 for graphs

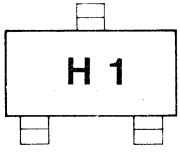
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Conditions	Min	Max	Unit
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=−2mA, I_B=0	−45		V
Collector-Emitter Breakdown Voltage	BV_{CES}	I_C=−100μA, V_{EB}=0	−50		V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=−10μA, I_C=0	−5		V
Collector Cut-off Current	I_{CBO}	V_{CB}=−20V, I_E=0		−100	nA
DC Current Gain	h_{FE}				
:BCW69		V_{CE}=−5V, I_C=−2mA	120	260	
BCW70			215	500	
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=−10mA, I_B=−0.5mA		−0.3	V
Base-Emitter On Voltage	V_{BE} (on)	V_{CE}=−5V, I_C=−2mA	−0.6	−0.75	V
Output Capacitance	C_{OB}	V_{CB}=−10V, I_E=0 f=1MHz		7	pF
Noise Figure	N_F	I_C=−0.2mA, V_{CE}=−5V R_G=2KΩ, f=1KHz		10	dB

MARKING CODE

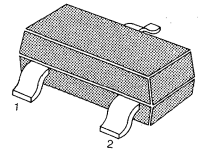
TYPE	BCW69	BCW70
MARK.	H1	H2

Marking



GENERAL PURPOSE TRANSISTOR

SOT-23



1. Base 2. Emitter 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	50	V
Collector-Emitter Voltage	V_{CEO}	45	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	100	mA
Collector Dissipation	P_C	350	mW
Storage Temperature	Tstg	150	°C

• Refer to MMBT5088 for graphs

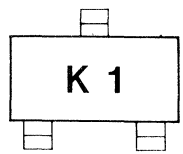
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=10μA, I_E=0	50			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=2mA, I_B=0	45			V
Collector-Emitter Breakdown Voltage	BV_{CES}	I_C=2mA, V_{EB}=0	45			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=10μA, I_C=0	5			V
Collector Cut-off Current	I_{CBO}	V_{CB}=20V, I_E=0			100	nA
DC Current Gain	h_{FE}					
:BCW71		V_{CE}=5V, I_C=2mA	110		220	
BCW72			200		450	
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=10mA, I_B=0.5mA			0.25	V
		I_C=50mA, I_B=2.5mA		0.21		V
Base-Emitter Saturation Voltage	V_{BE} (sat)	I_C=50mA, I_B=2.5mA		0.85		V
Base-Emitter On Voltage	V_{BE} (on)	V_{CE}=5V, I_C=2mA	0.6		0.75	V
Current Gain Bandwidth Product	f_T	V_{CE}=5V, I_C=10mA f=35MHz		300		MHz
Output Capacitance	C_{OB}	V_{CB}=10V, I_E=0 f=1MHz			4	pF
Noise Figure	N_F	I_C=2.0mA, V_{CE}=5V R_S=2KΩ, f=1KHz			10	dB

MARKING CODE

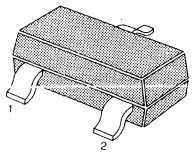
TYPE	BCW71	BCW72
MARK.	K1	K2

Marking



GENERAL PURPOSE TRANSISTOR

SOT-23



1. Base 2. Emitter 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

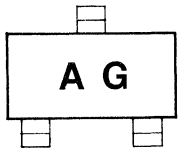
Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	45	V
Collector-Emitter Voltage	V_{CEO}	45	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	200	mA
Collector Dissipation	P_C	350	mW
Storage Temperature	Tstg	150	°C

• Refer to MMBT5088 for graphs

ELECTRICAL CHARACTERISTICS (T_a=25°C)

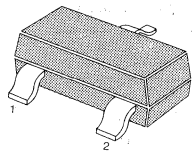
Characteristic	Symbol	Test Condition	Min	Max	Unit
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=2mA, I_B=0	45		V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=1μA, I_C=0	5		V
Collector Cutoff Current	I_{CES}	V_{CE}=32V, V_{BE}=0		20	nA
Emitter Cutoff Current	I_{EBO}	V_{EB}=4V, I_C=0		20	nA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=2mA	120	220	
		V_{CE}=1V, I_C=50mA	60		
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=10mA, I_B=0.25mA		0.35	V
		I_C=50mA, I_B=1.25mA		0.55	V
Base-Emitter Saturation Voltage	V_{BE} (sat)	I_C=10mA, I_B=0.25mA	0.6	0.85	V
		I_C=50mA, I_B=1.25mA	0.7	1.05	V
Base-Emitter On Voltage	V_{BE} (on)	I_C=2mA, V_{CE}=5V	0.55	0.75	V
Current Gain-Bandwidth Product	f_T	V_{CE}=5V, I_C=10mA f=100MHz	125		MHz
Output Capacitance	Cob	V_{CB}=10V, I_E=0 f=1MHz		4.5	pF
Noise Figure	NF	I_C=0.2mA, V_{CE}=5V f=1KHz, R_S=2KΩ		6	dB
Turn On Time	ton	I_C=10mA, I_{B1}=1mA		150	ns
Turn Off Time	toff	I_{B2}=1mA, V_{BB}=3.6V R_L=990Ω, R_1=R_2=5KΩ		800	ns

Marking



GENERAL PURPOSE TRANSISTOR

SOT-23



1. Base 2. Emitter 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

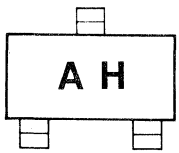
Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	45	V
Collector-Emitter Voltage	V_{CEO}	45	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	200	mA
Collector Dissipation	P_C	350	mW
Storage Temperature	Tstg	150	°C

• Refer to MMBT3904 for graphs

ELECTRICAL CHARACTERISTICS (T_a=25°C)

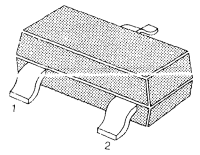
Characteristic	Symbol	Test Condition	Min	Max	Unit
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=2.0mA, I_B=0	45		V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=1.0μA, I_C=0	5		V
Collector Cutoff Current	I_{CES}	V_{CE}=32V V_{BE}=0		20	nA
Emitter Cutoff Current	I_{EBO}	V_{EB}=4V, I_C=0		20	nA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=10μA	20		
		V_{CE}=5V, I_C=2.0mA	180	310	
		V_{CE}=1V, I_C=50mA	70		
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=10mA, I_B=0.25mA		0.35	V
		I_C=50mA, I_B=1.25mA		0.55	V
Base-Emitter Saturation Voltage	V_{BE} (sat)	I_C=10mA, I_B=0.25mA	0.6	0.85	V
		I_C=50mA, I_B=1.25mA	0.7	1.05	V
Base-Emitter On Voltage	V_{BE} (on)	I_C=2.0mA, V_{CE}=5V	0.55	0.75	V
Current Gain-Bandwidth Product	f_T	I_C=10mA, V_{CE}=5V f=100 MHz	125		MHz
Output Capacitance	Cob	V_{CB}=10V, I_E=0 f=1MHz		4.5	pF
Noise Figure	NF	V_{CE}=5V, I_C=0.2mA R_S=2KΩ, f=1KHz		6	dB
Turn On Time	ton	I_C=10mA, I_{B1}=1.0mA		150	ns
Turn Off Time	toff	V_{BB}=3.6V, I_{B2}=1.0mA R_1=R_2=5KΩ, R_L=990Ω		800	ns

Marking



GENERAL PURPOSE TRANSISTOR

SOT-23



1. Base 2. Emitter 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

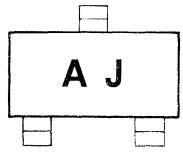
Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	45	V
Collector-Emitter Voltage	V_{CEO}	45	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	200	mA
Collector Dissipation	P_C	350	mW
Storage Temperature	Tstg	150	°C

• Refer to MMBT3904 for graphs

ELECTRICAL CHARACTERISTICS (T_a=25°C)

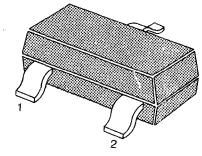
Characteristic	Symbol	Test Condition	Min	Max	Unit
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=2.0mA, I_B=0	45		V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=1.0μA, I_C=0	5		V
Collector Cutoff Current	I_{CES}	V_{CE}=32V V_{BE}=0		20	nA
Emitter Cutoff Current	I_{EBO}	V_{EB}=4V, I_C=0		20	nA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=10μA	40		
		V_{CE}=5V I_C=2.0mA	250	460	
		V_{CE}=1V, I_C=50mA	90		
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=10mA, I_B=0.25mA		0.35	V
		I_C=50mA, I_B=1.25mA		0.55	V
Base-Emitter Saturation Voltage	V_{BE} (sat)	I_C=10mA, I_B=0.25mA	0.6	0.85	V
		I_C=50mA, I_B=1.25mA	0.7	1.05	V
Base-Emitter On Voltage	V_{BE} (on)	I_C=2.0mA, V_{CE}=5V	0.55	0.75	V
Current Gain-Bandwidth Product	f_T	I_C=10mA, V_{CE}=5V f=100MHz	125		MHz
Output Capacitance	Cob	V_{CB}=10V, I_E=0 f=1MHz		4.5	pF
Noise Figure	NF	V_{CE}=5V, I_C=0.2mA R_S=2KΩ, f=1KHz		6	dB
Turn On Time	ton	I_C=10mA, I_{B1}=1.0mA		150	ns
Turn Off Time	toff	V_{BB}=3.6V, I_{B2}=1.0mA R_1=R_2=5KΩ, R_L=990Ω		800	ns

Marking



GENERAL PURPOSE TRANSISTOR

SOT-23



1. Base 2. Emitter 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

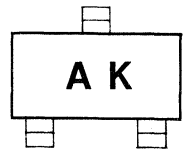
Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	45	V
Collector-Emitter Voltage	V_{CEO}	45	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	200	mA
Collector Dissipation	P_C	350	mW
Storage Temperature	Tstg	150	°C

• Refer to MMBT3904 for graphs

ELECTRICAL CHARACTERISTICS (T_a=25°C)

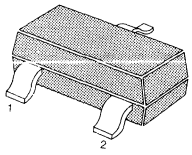
Characteristic	Symbol	Test Condition	Min	Max	Unit
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=2.0mA, I_E=0	45		V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=1.0μA, I_C=0	5		V
Collector Cutoff Current	I_{CES}	V_{CE}=32V, V_{BE}=0		20	nA
Emitter Cutoff Current	I_{EBO}	V_{EB}=4V, I_C=0		20	nA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=10μA	100		
		V_{CE}=5V, I_C=2.0mA	380	630	
		V_{CE}=1V, I_C=50mA	100		
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=10mA, I_B=0.25mA		0.35	V
		I_C=50mA, I_B=1.25mA		0.55	V
Base-Emitter Saturation Voltage	V_{BE} (sat)	I_C=10mA, I_B=0.25mA	0.6	0.85	V
		I_C=50mA, I_B=1.25mA	0.7	1.05	V
Base-Emitter On Voltage	V_{BE} (on)	I_C=2.0mA, V_{CE}=5V	0.55	0.75	V
Current Gain-Bandwidth Product	f_T	I_C=10mA, V_{CE}=5V f=100MHz	125		MHz
Output Capacitance	Cob	V_{CB}=10V, I_E=0 f=1MHz		4.5	pF
Noise Figure	NF	V_{CE}=5V, I_C=0.2mA R_S=2KΩ, f=1KHz		6	dB
Turn On Time	ton	I_C=10mA, I_{B1}=1.0mA		150	ns
Turn Off Time	toff	V_{BB}=3.6V, I_{B2}=1.0mA R_1=R_2=5KΩ, R_L=990Ω		800	ns

Marking



GENERAL PURPOSE TRANSISTOR

SOT-23



1. Base 2. Emitter 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

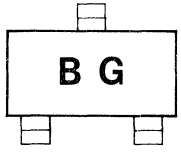
Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−45	V
Collector-Emitter Voltage	V_{CEO}	−45	V
Emitter-Base Voltage	V_{EBO}	−5.0	V
Collector Current	I_C	−100	mA
Collector Dissipation	P_C	350	mW
Storage Temperature	Tstg	150	°C

• Refer to MMBT5086 for graphs

ELECTRICAL CHARACTERISTICS (T_a=25°C)

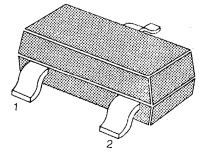
Characterstic	Symbol	Test Condition	Min	Max	Unit
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=−2mA, I_B=0	−45		V
Emitter-Base Saturation Voltage	BV_{EBO}	I_E=−1μA, I_C=0	−5		V
Collector Cutoff Current	I_{CES}	V_{CE}=−32V, V_{BE}=0		−20	nA
DC Current Gain	h_{FE}	V_{CE}=−5V, I_C=−2mA	120	220	
		V_{CE}=−1V, I_C=−50mA	60		
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=−10mA, I_B=−0.25mA		−0.25	V
		I_C=−50mA, I_B=−1.25mA		−0.55	V
Base-Emitter Saturation Voltage	V_{BE}(sat)	I_C=−10mA, I_B=−0.25mA	−0.6	−0.85	V
		I_C=−50mA, I_B=−1.25mA	−0.68	−1.05	V
Base-Emitter On Voltage	V_{BE}(on)	I_C=−2mA, V_{CE}=−5V	−0.6	−0.75	V
Output Capacitance	C_{ob}	V_{CB}=−10V, I_E=0 f=1MHz		6	pF
Noise Figure	NF	I_C=0.2mA, V_{CE}=5V R_S=2KΩ, f=1KHz		6	dB
Turn On Time	ton	I_C=−10mA, I_{B1}=−1mA		150	ns
Turn Off Time	toff	I_{B2}=−1mA, V_{BB}=3.6V R_L=990Ω		800	ns

Marking



GENERAL PURPOSE TRANSISTOR

SOT-23



1. Base 2. Emitter 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

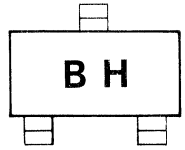
Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	–45	V
Collector-Emitter Voltage	V_{CEO}	–45	V
Emitter-Base Voltage	V_{EBO}	–5	V
Collector Current	I_C	–100	mA
Collector Dissipation	P_C	350	mW
Storage Temperature	Tstg	150	°C

• Refer to MMBT5086 for graphs

ELECTRICAL CHARACTERISTICS (T_a=25°C)

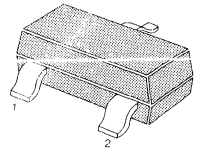
Characterstic	Symbol	Test Condition	Min	Max	Unit
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=−2mA, I_B=0	−45		V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=−1μA, I_C=0	−5		V
Collector Cutoff Current	I_{CES}	V_{CE}=−32V, V_{BE}=0		−20	nA
DC Current Gain	h_{FE}	V_{CE}=−5V, I_C=−10μA	30		
		V_{CE}=−5V, I_C=−2mA	140	310	
		V_{CE}=−1V, I_C=−50mA	80		
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=−10mA, I_B=−0.25mA		−0.25	V
		I_C=−50mA, I_B=−1.25mA		−0.55	V
Base-Emitter Saturation Voltage	V_{BE}(sat)	I_C=−10mA, I_B=−0.25mA	−0.6	−0.85	V
		I_C=−50mA, I_B=−1.25mA	−0.68	−1.05	V
Base-Emitter On Voltage	V_{BE}(on)	I_C=−2mA, V_{CE}=−5V	−0.6	−0.75	V
Output Capacitance	C_{ob}	V_{CB}=−10V, I_E=0 f=1MHz		6	pF
Noise Figure	NF	I_C=−0.2mA, V_{CE}=−5V f=1KHz, R_S=2KΩ		6	dB
Turn On Time	ton	I_C=−10mA, I_{B1}=−1mA		150	ns
Turn Off Time	toff	I_{B2}=−1mA, V_{BB}=−3.6V R_L=990Ω		800	ns

Marking



GENERAL PURPOSE TRANSISTOR

SOT-23



1. Base 2. Emitter 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

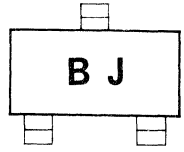
Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−45	V
Collector-Emitter Voltage	V_{CEO}	−45	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current	I_C	−100	mA
Collector Dissipation	P_C	350	mW
Storage Temperature	Tstg	150	°C

• Refer to MMBT5086 for graphs

ELECTRICAL CHARACTERISTICS (T_a=25°C)

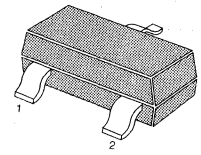
Characterstic	Symbol	Test Condition	Min	Max	Unit
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=−2mA, I_B=0	−45		V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=−1μA, I_C=0	−5		V
Collector Cutoff Current	I_{CES}	V_{CE}=−32V, V_{BE}=0		−20	nA
DC Current Gain	h_{FE}	V_{CE}=−5V, I_C=−10μA	40		
		V_{CE}=−5V, I_C=−2mA	250	460	
		V_{CE}=−1V, I_C=−50mA	100		
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=−10mA, I_B=−0.25mA		−0.25	V
		I_C=−50mA, I_B=−1.25mA		−0.55	V
Base-Emitter Saturation Voltage	V_{BE}(sat)	I_C=−10mA, I_B=−0.25mA	−0.6	−0.85	V
		I_C=−50mA, I_B=−1.25mA	−0.68	−1.05	V
Base-Emitter On Voltage	V_{DE}(on)	I_C=−2mA, V_{CE}=−5V	−0.6	−0.75	V
Output Capacitance	C_{ob}	V_{CB}=−10V, I_E=0 f=1MHz		6	pF
Noise Figure	NF	I_C=−0.2mA, V_{CE}=−5V f=1KHz, R_S=2KΩ		6	dB
Turn On Time	ton	I_C=−10mA, I_{B1}=−1mA		150	ns
Turn Off Time	toff	I_{B2}=−1mA, V_{BB}=−3.6V R_L=990Ω		800	ns

Marking



GENERAL PURPOSE TRANSISTOR

SOT-23



1. Base 2. Emitter 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

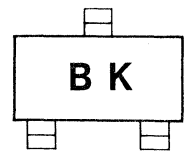
Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−45	V
Collector-Emitter Voltage	V_{CEO}	−45	V
Emitter-Base Voltage	V_{EBO}	−5.0	V
Collector Current	I_C	−100	mA
Collector Dissipation	P_C	350	mW
Storage Temperature	Tstg	150	°C

• Refer to MMBT5086 for graphs

ELECTRICAL CHARACTERISTICS (T_a=25°C)

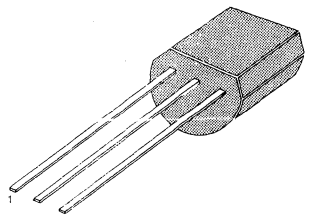
Characterstic	Symbol	Test Condition	Min	Max	Unit
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=−2mA, I_B=0	−45		V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=−1μA, I_C=0	−5		V
Collector Cutoff Current	I_{CES}	V_{CE}=−32V, V_{BE}=0		−20	nA
DC Current Gain	h_{FE}	V_{CE}=−5V, I_C=−10μA	100		
		V_{CE}=−5V, I_C=−2mA	380	630	
		V_{CE}=−1V, I_C=−50mA	110		
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=−10mA, I_B=−0.25mA		−0.25	V
		I_C=−50mA, I_B=−1.25mA		−0.55	V
Base-Emitter Saturation Voltage	V_{BE}(sat)	I_C=−10mA, I_B=−0.25mA	−0.6	−0.85	V
		I_C=−50mA, I_B=−1.25mA	−0.68	−1.05	V
Base-Emitter On Voltage	V_{BE}(on)	I_C=−2mA, V_{CE}=−5V	−0.6	−0.75	V
Output Capacitance	C_{ob}	V_{CB}=−10V, I_E=0 f=1MHz		6	pF
Noise Figure	NF	I_C=−0.2mA, V_{CE}=−5V R_S=2KΩ, f=1KHz		6	dB
Turn On Time	ton	I_C=−10mA, I_{B1}=−1mA		150	ns
Turn Off Time	toff	I_{B2}=−1mA, V_{BB}=−3.6V R_L=990Ω		800	ns

Marking



AM/FM IF AMPLIFIER, INPUT STAGES

TO-92



1. Collector 2. Base 3. Emitter

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

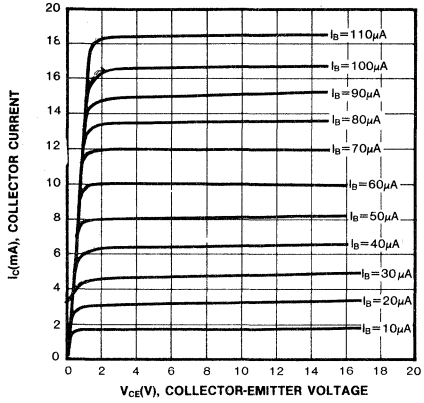
Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	30	V
Collector-Emitter Voltage	V_{CEO}	20	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	30	mA
Collector Dissipation	P_C	220	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55∼150	°C

ELECTRICAL CHARACTERISTICS (T_a=25°C)

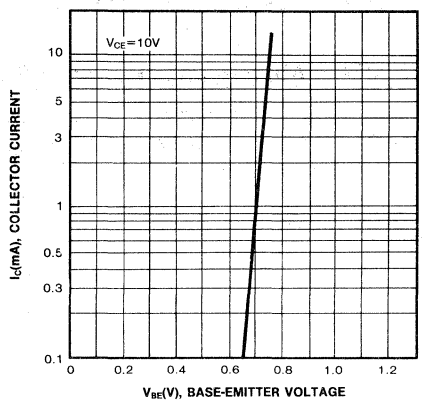
Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector Base Breakdown Voltage	BV_{CBO}	I_C=10μA, I_E=0	30			V
Collector Emitter Breakdown Voltage	BV_{CEO}	I_C=1mA, I_B=0	20			V
Emitter Base Breakdown Voltage	BV_{EBO}	I_E=10μA, I_C=0	5			V
DC Current Gain	h_{FE}	V_{CE}=10V, I_C=1mA	67	115	222	
Base Emitter On Voltage	V_{BE}(on)	V_{CE}=10V, I_C=1mA		0.68		V
Current Gain Bandwidth Product	f_T	V_{CE}=10V, I_C=1mA		260		MHz
Noise Figure	NF	V_{CE}=10V, I_C=1mA f=200KHz, gs=2mS		1.5		dB
	NF	V_{CE}=10V, I_C=1mA f=1MHz, gs=1.5mS		1.2		dB
Feedback Capacitance	Cre	V_{CE}=10V, I_C=1mA, f=450KHz		0.85		pF

3

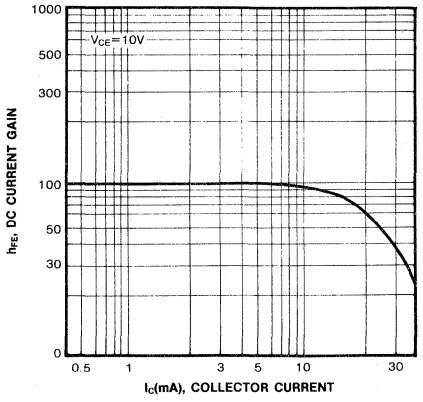
STATIC CHARACTERISTIC



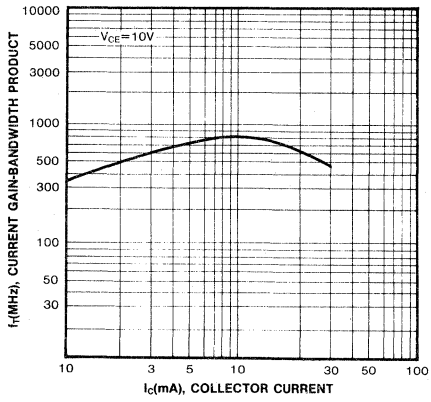
BASE-EMITTER ON VOLTAGE



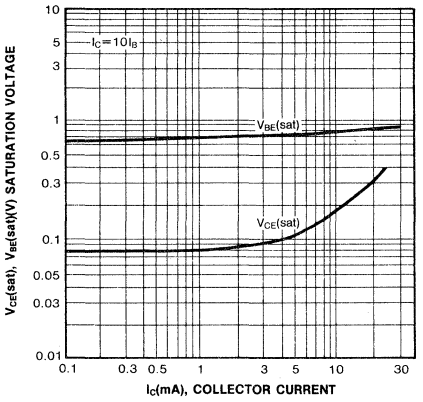
DC CURRENT GAIN



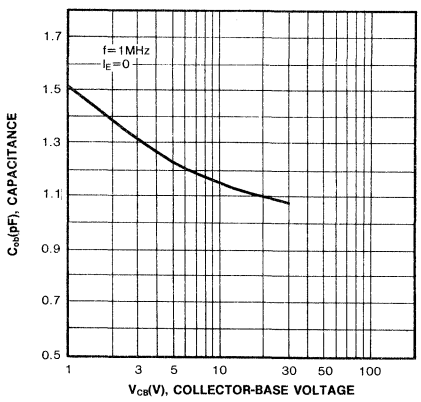
CURRENT GAIN-BANDWIDTH PRODUCT



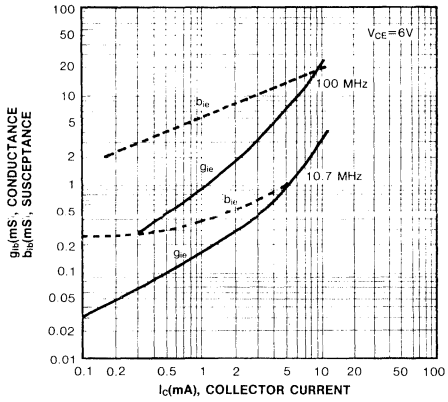
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



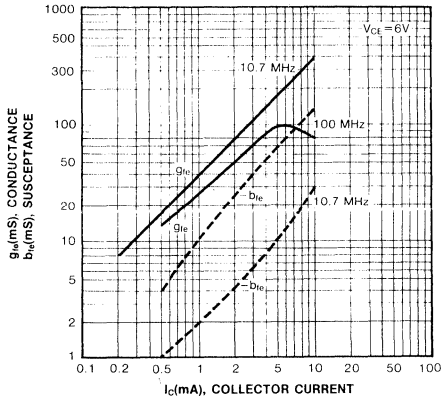
COLLECTOR OUTPUT CAPACITANCE



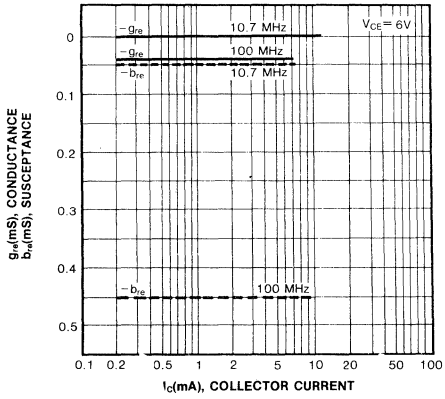
INPUT ADMITTANCE (yie)
vs. COLLECTOR CURRENT



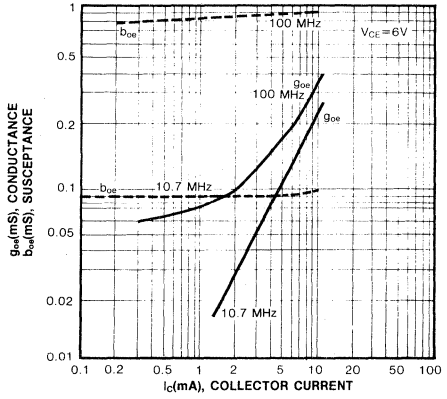
FORWARD TRANSFER ADMITTANCE (yfe)
vs. COLLECTOR CURRENT



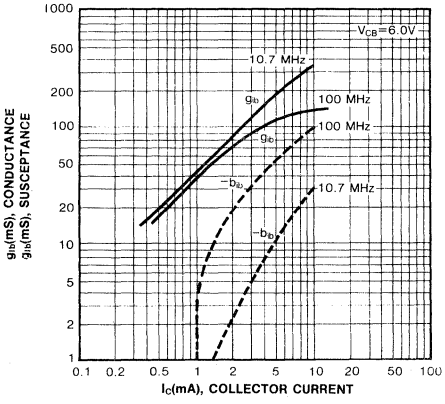
REVERSE TRANSFER ADMITTANCE (yre)
vs. COLLECTOR CURRENT



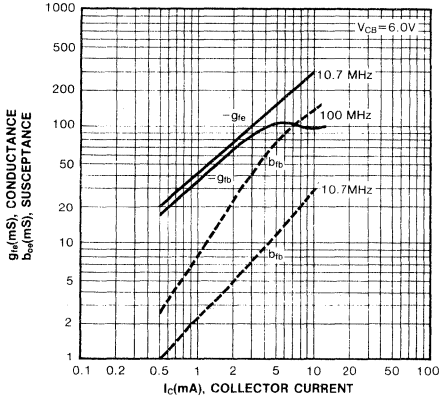
OUTPUT ADMITTANCE (yoe)
vs. COLLECTOR CURRENT



INPUT ADMITTANCE (yib)
vs. COLLECTOR CURRENT

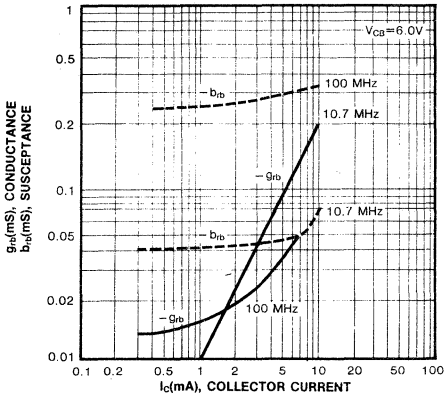


FORWARD TRANSFER ADMITTANCE (yfb)
vs. COLLECTOR CURRENT

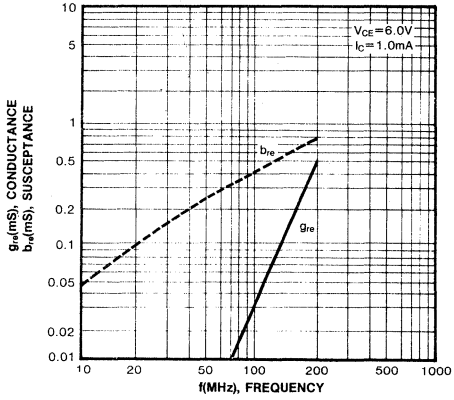


3

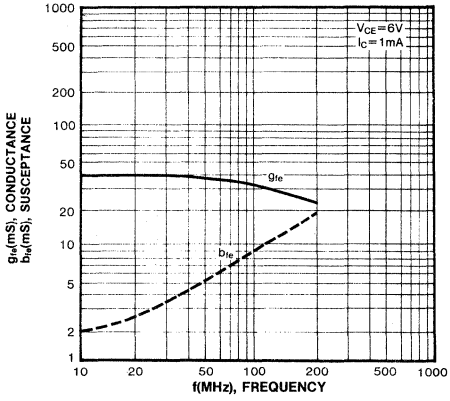
REVERSE TRANSFER ADMITTANCE (yrb) vs. COLLECTOR CURRENT



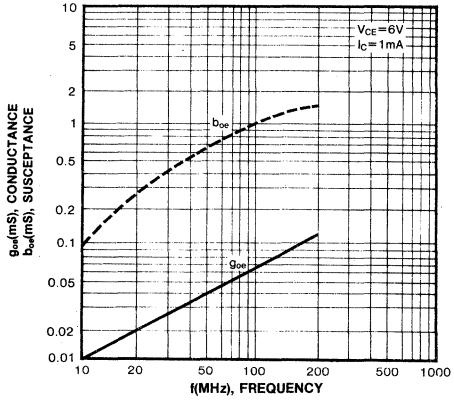
REVERS TRANSFER ADMITTANCE (yre) vs. FREQUENCY



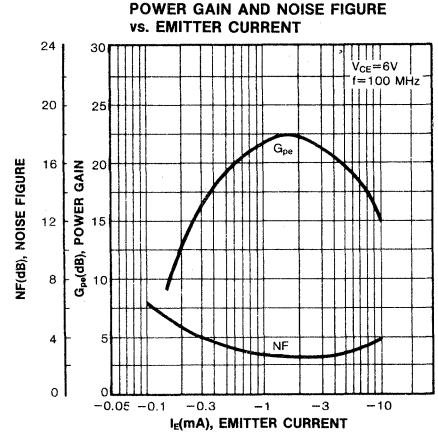
FORWARD TRANSFER ADMITTANCE (yfe) vs. FREQUENCY



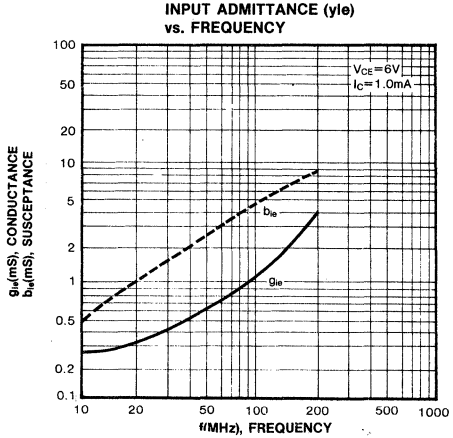
OUTPUT ADMITANCE (yoe) vs. FREQUENCY



POWER GAIN AND NOISE FIGURE vs. EMITTER CURRENT



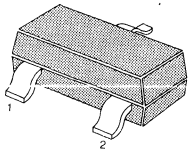
INPUT ADMITTANCE (yie) vs. FREQUENCY



PNP EPITAXIAL SILICON TRANSISTOR

DRIVER TRANSISTOR

SOT-23



1. Base 2. Emitter 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−50	V
Collector-Emitter Voltage	V_{CEO}	−45	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current	I_C	−50	mA
Collector Dissipation	P_C	350	mW
Storage Temperature	Tstg	150	°C

• Refer to MMBT5086 for graphs

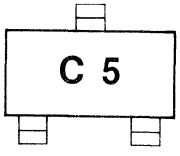
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Conditions	Min	Max	Unit
Collector-Emitter Breakdown Voltage	BV_{CBO}	I_C=−100μA, I_E=0	−50		V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=−1mA, I_B=0	−45		V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=−10μA, I_C=0	−5		V
Collector Cut-off Current	I_{CBO}	V_{CB}=−40V, I_E=0		−50	nA
Emitter Cut-off Current	I_{EBO}	V_{EB}=−5V, I_C=0		−50	nA
DC Current Gain	h_{FE}	V_{CE}=−3V, I_C=−0.1mA	150		
:MMBA811C5		V_{CE}=−3V, I_C=−0.5mA	135	270	
MMBA811C6			200	400	
MMBA811C7			300	600	
MMBA811C8			450	900	
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=−20mA, I_B=−2mA		−0.3	V
Current Gain Bandwidth Product	f_T	V_{CE}=−6V, I_C=−1mA f=100MHz	75		MHz

MARKING CODE

TYPE	MMBA811C5	MMBA811C6	MMBA811C7	MMBA811C8
MARK.	C5	C6	C7	C8

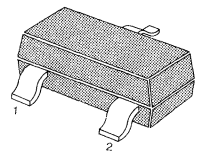
Marking



PNP EPITAXIAL SILICON TRANSISTOR

GENERAL PURPOSE TRANSISTOR

SOT-23



1. Base 2. Emitter 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−50	V
Collector-Emitter Voltage	V_{CEO}	−40	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current	I_C	−100	mA
Collector Dissipation	P_C	350	mW
Storage Temperature	Tstg	150	°C

• Refer to MMBT5086 for graphs

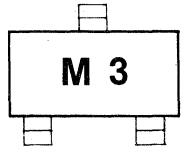
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Conditions	Min	Max	Unit
Collector Cut-off Current	I_{CBO}	V_{CB}=−40V, I_E=0		−100	nA
Emitter Cut-off Current	I_{EBO}	V_{EB}=−5V, I_C=0		−100	nA
DC Current Gain	h_{FE}				
:MMBA812M3		V_{CE}=−6V, I_C=−1mA	60	120	
MMBA812M4			90	180	
MMBA812M5			135	270	
MMBA812M6			200	400	
MMBA812M7			300	600	
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=−30mA, I_B=−3mA		−0.5	V
Base-Emitter On Voltage	V_{BE} (on)	V_{CE}=−6V, I_C=−1mA		−0.8	V

MARKING CODE

TYPE	MMBA812M3	MMBA812M4	MMBA812M5	MMBA812M6	MMBA812M7
MARK.	M3	M4	M5	M6	M7

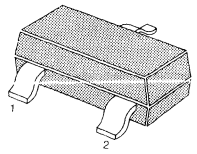
Marking



NPN EPITAXIAL SILICON TRANSISTOR

AM/FM RF AMPLIFIER TRANSISTOR

SOT-23



1. Base 2. Emitter 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	50	V
Collector-Emitter Voltage	V_{CEO}	25	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	50	mA
Collector Dissipation	P_C	350	mW
Storage Temperature	Tstg	150	°C

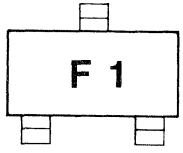
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector Cut-off Current	I_{CBO}	V_{CB}=15V, I_E=0			100	nA
DC Current Gain	h_{FE}					
:MMBC1009F1		V_{CE}=3V, I_C=0.5mA	30		60	
MMBC1009F2			40		80	
MMBC1009F3			60		120	
MMBC1009F4			90		180	
MMBC1009F5			135		270	
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=10mA, I_B=1mA			0.3	V
Current Gain-Bandwidth Product	f_T	I_C=1mA, V_{CED}=6V f=100MHz	150			MHz
Output Capacitance	C_{OB}	V_{CB}=6V, I_E=0 f=1MHz		2		pF
Noise Figure	N_F	V_{CE}=6V, I_C=0.5mA f=1MHz, R_G=500Ω		2.5		dB

MARKING CODE

TYPE	MMBC1009F1	MMBC1009F2	MMBC1009F3	MMBC1009F4	MMBC1009F5
MARK.	F1	F2	F3	F4	F5

Marking

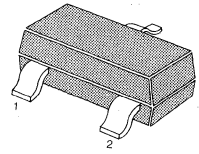


MMBC1622D6/D7/D8

NPN EPITAXIAL SILICON TRANSISTOR

AMPLIFIER TRANSISTOR

SOT-23



1. Base 2. Emitter 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	40	V
Collector-Emitter Voltage	V_{CEO}	35	V
Emitter-Base Voltage	V_{EBO}	5.0	V
Collector Current	I_C	100	mA
Collector Dissipation	P_C	350	mW
Storage Temperature	Tstg	150	°C

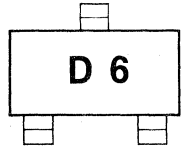
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Conditions	Min	Max	Unit
Collector Cut-off Current	I_{CBO}	V_{CB}=25V, I_E=0		50	nA
Emitter Cut-off Current	I_{EBO}	V_{EB}=5V, I_C=0		50	nA
DC Current Gain	h_{FE}	V_{CE}=3V, I_C=0.1mA	150		
:MMBC1622D6		V_{CE}=3V, I_C=0.5mA	200	400	
MMBC1622D7			300	600	
MMBC1622D8			450	900	
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=100mA, I_B=10mA		0.3	V
Base-Emitter On Voltage	V_{BE} (on)	V_{CE}=3V, I_C=0.5mA	0.55	0.65	V
Current Gain-Bandwidth Product	f_T	I_C=1mA, V_{CED}=6V f=100MHz	100		MHz

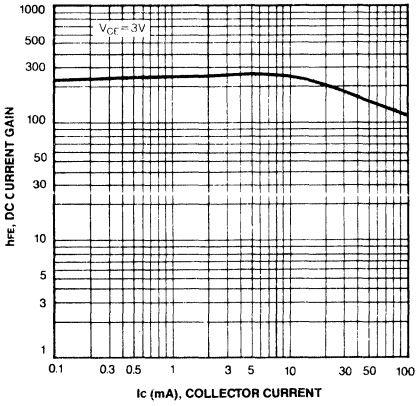
MARKING CODE

TYPE	MMBC1622D6	MMBC1622D7	MMBC1622D8
MARK.	D6	D7	D8

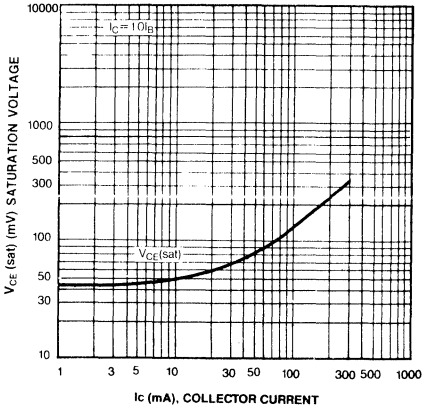
Marking



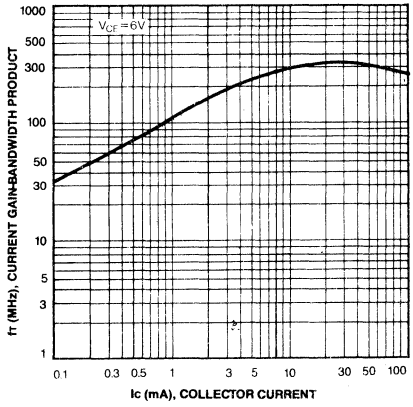
DC CURRENT GAIN



COLLECTOR-EMITTER SATURATION VOLTAGE



CURRENT GAIN BANDWIDTH PRODUCT



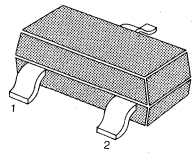
3

MMBC1623L3/L4/L5/L6/L7

NPN EPITAXIAL SILICON TRANSISTOR

AMPLIFIER TRANSISTOR

SOT-23



1. Base 2. Emitter 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	50	V
Collector-Emitter Voltage	V_{CEO}	40	V
Emitter-Base Voltage	V_{EBO}	5.0	V
Collector Current	I_C	100	mA
Collector Dissipation	P_C	350	mW
Storage Temperature	Tstg	150	°C

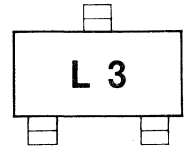
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Conditions	Min	Max	Unit
Collector Cut-off Current	I_{CBO}	V_{CB}=40V, I_E=0		100	nA
Emitter Cut-off Current	I_{EBO}	V_{EB}=5V, I_C=0		100	nA
DC Current Gain	h_{FE}				
:MMBC1623L3		V_{CE}=6V, I_C=1.0mA	60	120	
MMBC1623L4			90	180	
MMBC1623L5			135	270	
MMBC1623L6			200	400	
MMBC1623L7			300	600	
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=100mA, I_B=10mA		0.3	V
Base-Emitter Saturation Voltage	V_{BE} (sat)	I_C=100mA, I_B=10mA		1.0	V
Base-Emitter on Voltage	V_{BE} (on)	V_{CE}=6V, I_C=1.0mA	0.6	0.7	V
Current Gain-Bandwidth Product	f_T	I_C=10mA, V_{CED}=6V f=100MHz	200		MHz

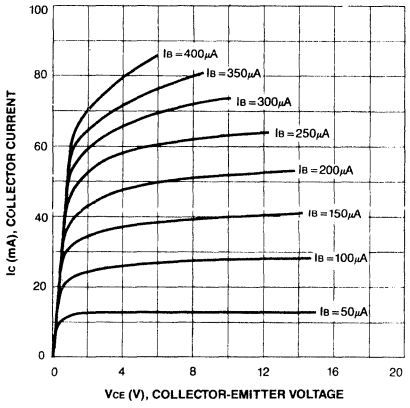
MARKING CODE

TYPE	MMBC1623L3	MMBC1623L4	MMBC1623L5	MMBC1623L6	MMBC1623L7
MARK.	L3	L4	L5	L6	L7

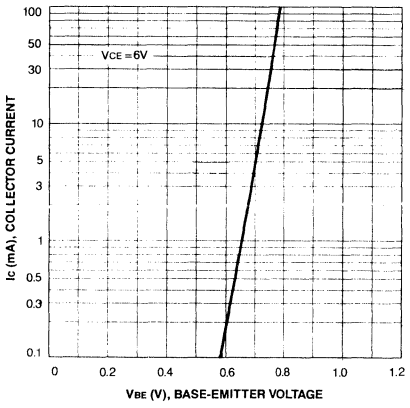
Marking



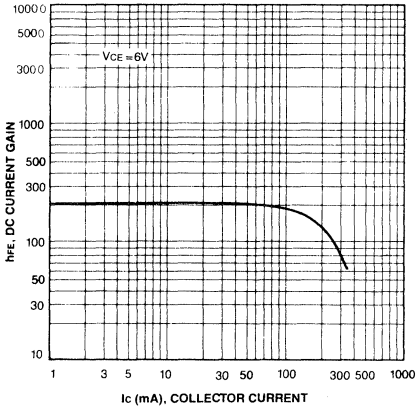
STATIC CHARACTERISTIC



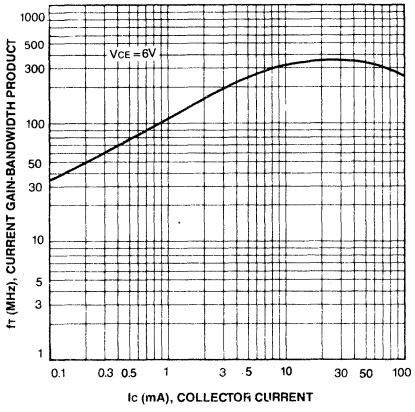
TRANSFER CHARACTERISTIC



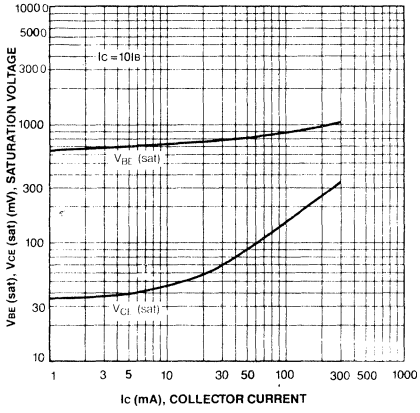
DC CURRENT GAIN



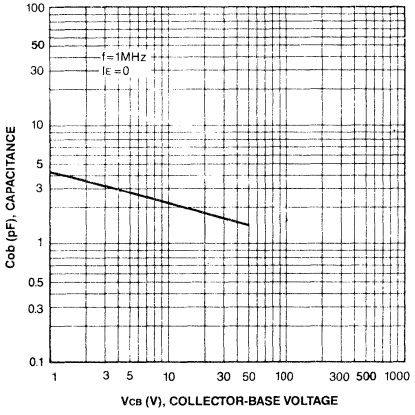
CURRENT GAIN BANDWIDTH PRODUCT



BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE

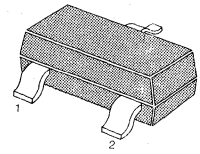


OUTPUT CAPACITANCE



RF AMPLIFIER TRANSISTOR

SOT-23



1. Base 2. Emitter 3. Collector

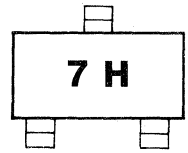
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	20	V
Collector-Emitter Voltage	V_{CEO}	12	V
Emitter-Base Voltage	V_{EBO}	2.5	V
Collector Current	I_C	50	mA
Collector Dissipation (T_a=25°C)	P_C	350	mW
Derate above 25°C		2.8	mW/°C
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

ELECTRICAL CHARACTERISTICS (T_a=25°C)

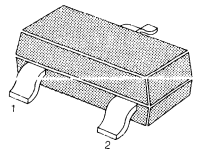
Characteristic	Symbol	Test Condition	Min	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=0.01mA, I_E=0	20		V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=3mA, I_B=0	12		V
Emitter Base Breakdown Voltage	BV_{EBO}	I_E=0.01mA, I_C=0	2.5		V
Collector Cutoff Current	I_{CBO}	V_{CB}=15V, I_E=0		0.02	μA
DC Current Gain	h_{FE}	V_{CE}=1V, I_C=3mA	25		
Collector Emitter Saturation Voltage	V_{CE} (sat)	I_C=10mA, I_B=1mA		0.4	V
Base-Emitter Saturation Voltage	V_{BE} (sat)	I_C=10mA, I_B=1mA		1	V
Current Gain Bandwidth Product	f_T	V_{CE}=6V, I_C=5mA, f=100MHz	900		MHz
Collector Base Capacitance	Ccb	V_{CB}=10V, I_E=0, f=0.1MHz to 1MHz		1	pF
Small Signal Current Gain	hfe	V_{CE}=6V, I_C=2mA, f=1KHz	25		
Noise Figure	NF	V_{CE}=6V, I_C=1.5mA, f=200MHz Rs=50Ω		4.5	dB
Common Emitter Amplifier Power Gain	Gpe	V_{CE}=6V, I_C=5mA, f=200MHz	15		dB

Marking



GENERAL PURPOSE TRANSISTOR

SOT-23



1. Base 2. Emitter 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

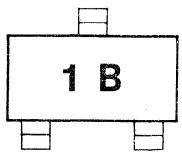
Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	60	V
Collector-Emitter Voltage	V_{CEO}	30	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	600	mA
Collector Dissipation	P_C	350	mW
Storage Temperature	Tstg	150	°C

ELECTRICAL CHARACTERISTICS (T_a=25°C)

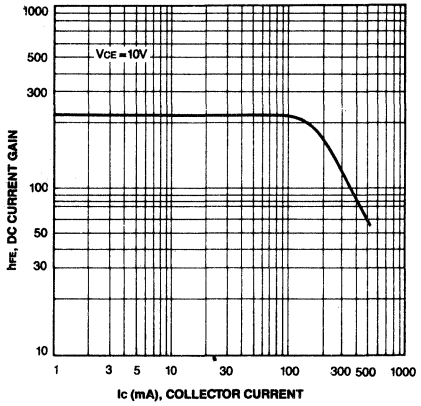
Characteristic	Symbol	Test Condition	Min	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=10μA, I_E=0	60		V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=10mA, I_B=0	30		V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=10μA, I_C=0	5		V
Collector Cutoff Current	I_{CEX}	V_{CE}=60V, V_{BE}=3V		10	nA
Collector Cutoff Current	I_{CBO}	V_{CB}=50V, I_E=0		0.01	μA
DC Current Gain	h_{FE}	V_{CE}=10V, I_C=0.1mA	35		
		V_{CE}=10V, I_C=1.0mA	50		
		V_{CE}=10V, I_C=10mA	75		
		*V_{CE}=10V, I_C=150mA	100	300	
		*V_{CE}=10V, I_C=500mA	30		
*Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=150mA, I_B=15mA		0.4	V
		I_C=500mA, I_B=50mA		1.6	V
*Base-Emitter Saturation Voltage	V_{BE} (sat)	I_C=150mA, I_B=15mA		1.3	V
		I_C=500mA, I_B=50mA		2.6	V
Current Gain-Bandwidth Product	f_T	I_C=20mA, V_{CE}=20V f=100MHz	250		MHz
Output Capacitance	Cob	V_{CB}=10V, I_E=0 f=1.0MHz		8.0	pF
Turn On Time	ton	V_{CC}=30V, V_{BE}=0.5V I_C=150mA, I_{B1}=15mA		35	ns
Turn Off Time	toff	V_{CC}=30V, I_C=150mA I_{B1}=I_{B2}=15mA		285	ns

*Pulse test: Pulse Width=300μs, Duty Cycle=2%

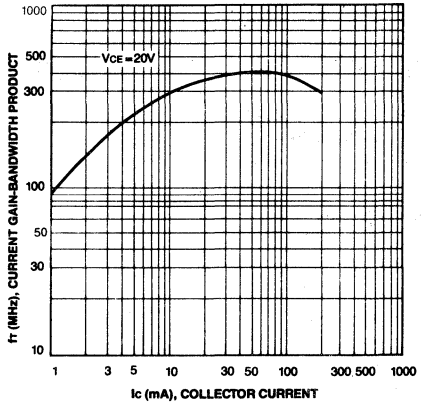
Marking



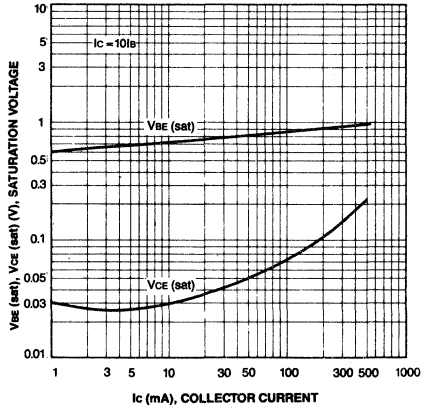
DC CURRENT GAIN



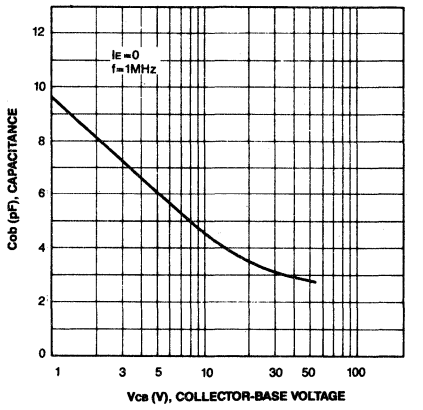
CURRENT GAIN-BANDWIDTH PRODUCT



COLLECTOR-EMITTER SATURATION VOLTAGE
BASE-EMITTER SATURATION VOLTAGE

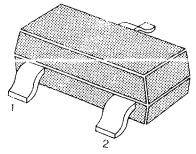


OUTPUT CAPACITANCE



GENERAL PURPOSE TRANSISTOR

SOT-23



1. Base 2. Emitter 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector Base Voltage	V_{CBO}	75	V
Collector-Emitter Voltage	V_{CEO}	40	V
Emitter-Base Voltage	V_{EBO}	6	V
Collector Current	I_C	600	mA
Collector Dissipation	P_C	350	mW
Storage Temperature	Tstg	150	°C

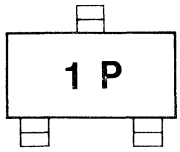
• Refer to MMBT2222 for graphs

ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=10μA, I_E=0	75		V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=10mA, I_B=0	40		V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=10μA, I_C=0	6		V
Collector Cutoff Current	I_{CBO}	V_{CB}=60V, I_E=0		0.01	μA
*DC Current Gain	h_{FE}	V_{CE}=10V, I_C=0.1mA	35		
		V_{CE}=10V, I_C=1mA	50		
		V_{CE}=10V, I_C=10mA	75		
		V_{CE}=10V, I_C=150mA	100	300	
		V_{CE}=10V, I_C=500mA	40		
*Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=150mA, I_B=15mA		0.3	V
		I_C=500mA, I_B=50mA		1.0	V
*Base-Emitter Saturation Voltage	V_{BE} (sat)	I_C=150mA, I_B=15mA	0.6	1.2	V
		I_C=500mA, I_B=50mA		2.0	V
Current Gain-Bandwidth Product	f_T	I_C=20mA, V_{CE}=20V f=100MHz	300		MHz
Collector-Base Capacitance	Cob	V_{CB}=10V, I_E=0 f=1MHz		8	pF
Noise Figure	NF	I_C=100μA, V_{CE}=10V R_S=1KΩ, f=1KHz	4	4	dB
Turn On Time	ton	V_{CC}=30V, I_C=150mA V_{BE}=0.5V, I_{B1}=15mA		35	ns
Turn Off Time	toff	V_{CC}=30V, I_C=150mA I_{B1}=I_{B2}=15mA		285	ns

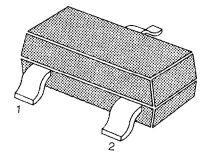
*Pulse test: Pulse Width=300μs, Duty Cycle=2%

Marking



LOW NOISE TRANSISTOR

SOT-23



1. Base 2. Emitter 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

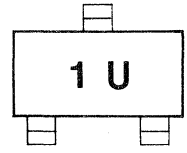
Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	60	V
Collector-Emitter Voltage	V_{CEO}	60	V
Emitter-Base Voltage	V_{EBO}	6	V
Collector Current	I_C	50	mA
Collector Dissipation	P_C	350	mW
Storage Temperature	Tstg	150	°C

• Refer to MMBT5088 for graphs

ELECTRICAL CHARACTERISTICS (T_a=25°C)

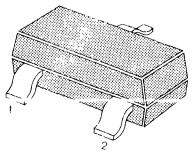
Characteristic	Symbol	Test Condition	Min	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=10μA, I_E=0	60		V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=10mA, I_B=0	60		V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=10μA, I_C=0	5		V
Collector Cutoff Current	I_{CBO}	V_{CB}=45V, I_E=0		10	nA
Emitter Cutoff Current	I_{EBO}	V_{EB}=5V, I_C=0		10	nA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=1mA	250		
		V_{CE}=5V, I_C=10mA		800	
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=1mA, I_B=0.1mA		0.35	V
Base-Emitter On Voltage	V_{BE} (on)	I_C=1mA, V_{CE}=5V		0.95	V
Output Capacitance	Cob	V_{CB}=5.0V, I_E=0 f=1MHz,		6	pF
Noise Figure	NF	I_C=10μA, V_{CE}=5V R_S=10KΩ, f=1KHz		3	dB

Marking



GENERAL PURPOSE TRANSISTOR

SOT-23



1. Base 2. Emitter 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

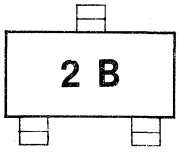
Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−60	V
Collector-Emitter Voltage	V_{CEO}	−40	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current	I_C	−600	mA
Collector Dissipation	P_C	350	mW
Storage Temperature	Tstg	150	°C

ELECTRICAL CHARACTERISTICS (T_a=25°C)

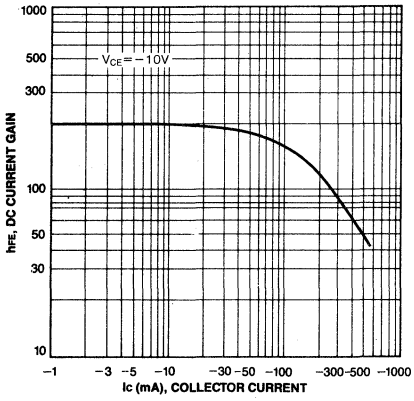
Characterstic	Symbol	Test Condition	Min	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=−10μA, I_E=0	−60		V
*Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=−10mA, I_B=0	−40		V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=−10μA, I_C=0	−5		V
Collector Cutoff Current	I_{CEX}	V_{CE}=−30V, V_{BE}=−0.5V		−50	nA
Collector Cutoff Current	I_{CBO}	V_{CB}=−50V, I_E=0		−0.02	μA
DC Current Gain	h_{FE}	V_{CE}=−10V, I_C=−0.1mA	35		
		V_{CE}=−10V, I_C=−1.0mA	50		
		V_{CE}=−10V, I_C=−10mA	75		
		*V_{CE}=−10V, I_C=−150mA	100	300	
		*V_{CE}=−10V, I_C=−500mA	30		
*Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=−150mA, I_B=−15mA		−0.4	V
		I_C=−500mA, I_B=−50mA		−1.6	V
*Base-Emitter Saturation Voltage	V_{BE}(sat)	I_C=−150mA, I_B=−15mA		−1.3	V
		I_C=−500mA, I_B=−50mA		−2.6	V
Current Gain-Bandwidth Product	f_T	I_C=−50mA, V_{CE}=−20V f=100MHz	200		MHz
Output Capacitance	C_{ob}	V_{CB}=−10V, I_E=0 f=1.0MHz		8.0	pF
Turn On Time	ton	V_{CC}=−30V, I_C=−150mA I_{B1}=−15mA		45	ns
Turn Off Time	toff	V_{CC}=−6V, I_C=−150mA I_{B1}=I_{B2}=−15mA		100	ns

*Pulse Test: Pulse Width=300μs, Duty Cycle=2%

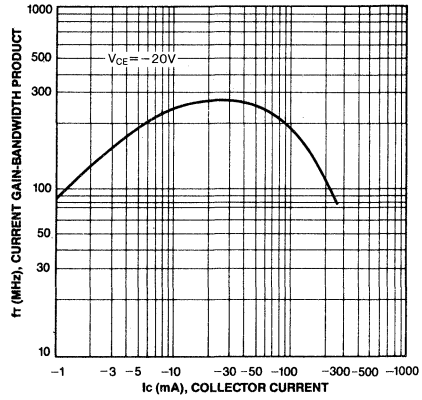
Marking



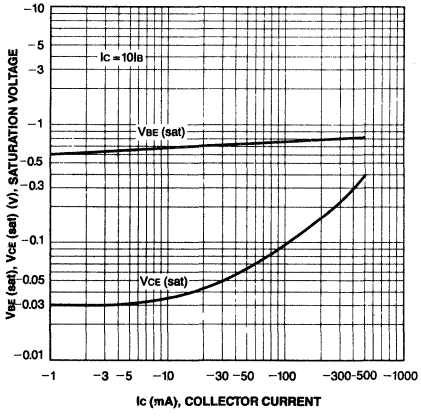
DC CURRENT GAIN



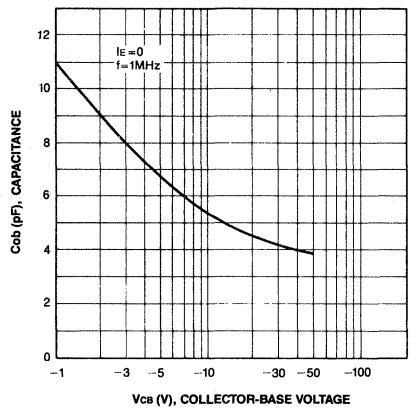
CURRENT GAIN-BANDWIDTH PRODUCT



COLLECTOR-EMITTER SATURATION VOLTAGE
BASE-EMITTER SATURATION VOLTAGE

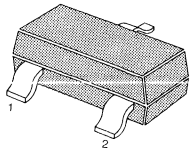


OUTPUT CAPACITANCE



GENERAL PURPOSE TRANSISTOR

SOT-23



1. Base 2. Emitter 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−60	V
Collector-Emitter Voltage	V_{CEO}	−60	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current	I_C	−600	mA
Collector Dissipation	P_C	350	mW
Storage Temperature	Tstg	150	°C

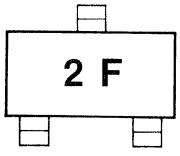
*Refer to MMBT2907 for graphs

ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characterstic	Symbol	Test Condition	Min	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=−10μA, I_E=0	−60		V
*Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=−10mA, I_B=0	−60		V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=−10μA, I_C=0	−5		V
Collector Cutoff Current	I_{CBO}	V_{CB}=−50V, I_E=0		−0.01	μA
DC Current Gain	h_{FE}	V_{CE}=−10V, I_E=−0.1mA	75		
		V_{CE}=−10V, I_C=−1.0mA	100		
		V_{CE}=−10V, I_C=−10mA	100		
		*V_{CE}=−10V, I_C=−150mA	100	300	
		*V_{CE}=−10V, I_C=−500mA	50		
*Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=−150mA, I_B=−15mA		−0.4	V
		I_C=−500mA, I_B=−50mA		−1.6	V
*Base-Emitter Saturation Voltage	V_{BE}(sat)	I_C=−150mA, I_B=−15mA		−1.3	V
		I_C=−500mA, I_B=−50mA		−2.6	V
Current Gain-Bandwidth Product	f_T	I_C=−50mA, V_{CE}=−20V f=100MHz	200		MHz
Output Capacitance	C_{ob}	V_{CB}=−10V, I_E=0 f=1.0MHz		8	pF
Turn On Time	ton	V_{CC}=−30V, I_C=−150mA I_{B1}=−15mA		50	ns
Turn Off Time	toff	V_{CC}=−6V, I_C=−150mA I_{B1}=1_{B2}=−15mA		110	ns

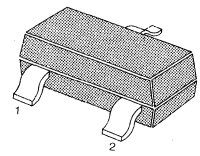
*Pulse Test: Pulse Width=300μs, Duty Cycle=2%

Marking



GENERAL PURPOSE TRANSISTOR

SOT-23



1. Base 2. Emitter 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−60	V
Collector-Emitter Voltage	V_{CEO}	−40	V
Emitter-Base Voltage	V_{EBO}	−6	V
Collector Current	I_C	−200	mA
Collector Dissipation	P_C	350	mW
Storage Temperature	Tstg	150	°C

ELECTRICAL CHARACTERISTICS (T_a=25°C)

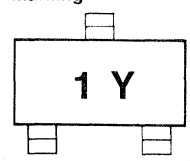
Characteristic	Symbol	Test Conditions	Min	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=10μA, I_E=0	60		V
*Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=1mA, I_B=0	40		V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=10μA, I_C=0	6		V
Collector Cut-off Current	I_{CEX}	V_{CE}=30V, V_{EB}=3V		50	nA
*DC Current Gain	h_{FE}				
:MMBT3903		V_{CE}=1V, I_C=0.1mA	20		
MMBT3904			40		
MMBT3903		V_{CE}=1V, I_C=1mA	35		
MMBT3904			70		
MMBT3903		V_{CE}=1V, I_C=10mA	50	150	
MMBT3904			100	300	
MMBT3903		V_{CE}=1V, I_C=50mA	30		
MMBT3904			60		
MMBT3903		V_{CE}=1V, I_C=100mA	15		
MMBT3904			30		
*Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=10mA, I_B=1mA		0.2	V
		I_C=50mA, I_B=5mA		0.3	V
*Base-Emitter Saturation Voltage	V_{BE} (sat)	I_C=10mA, I_B=1mA	0.65	0.85	V
		I_C=50mA, I_B=5mA		0.95	V
Output Capacitance	C_{OB}	V_{CB}=5V, I_E=0 f=1MHz		4	pF
Current Gain Bandwidth Product	f_T	V_{CE}=20V, I_C=10mA			
:MMBT3903		f=100MHz	250		MHz
MMBT3904			300		MHz
Noise Figures	N_F	I_C100μA, V_{CE}=5V R_S=1KΩ			
:MMBT3903		f=10Hz to 15.7KHz		6	dB
MMBT3904				5	dB
Turn On Time	t_{ON}	V_{CC}=3V, V_{BE}=0.5V I_C=10mA, I_{B1}=1mA		70	ns
Turn Off Time	t_{OFF}	V_{CC}=3V, I_C=10mA			
:MMBT3903		I_{B1}=I_{B2}=1mA		225	ns
MMBT3904				250	ns

*Pulse Test: Pulse Width≤300μs, Duty Cycle≤2%

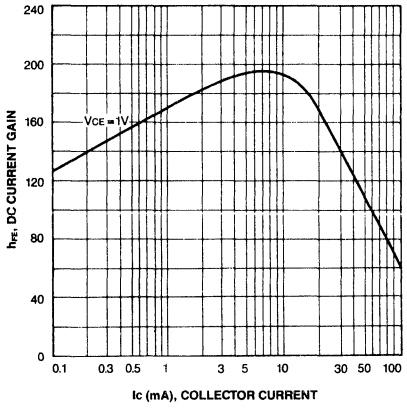
MARKING CODE

TYPE	MMBT3903	MMBT3904
MARK.	1Y	1A

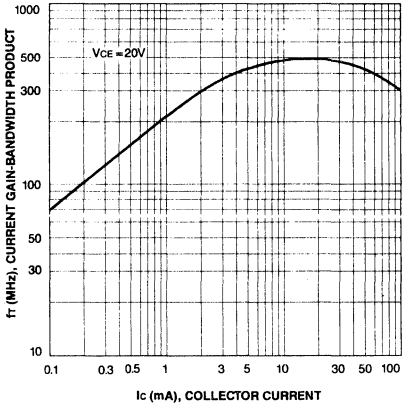
Marking



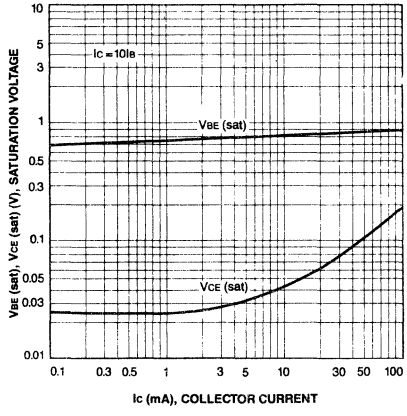
DC CURRENT GAIN



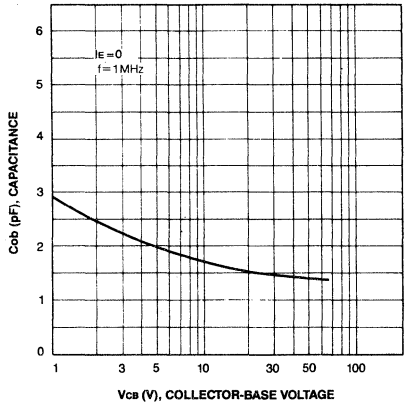
CURRENT GAIN-BANDWIDTH PRODUCT



BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



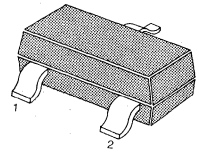
OUTPUT CAPACITANCE



3

GENERAL PURPOSE TRANSISTOR

SOT-23



1. Base 2. Emitter 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

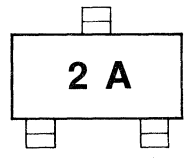
Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−40	V
Collector-Emitter Voltage	V_{CEO}	−40	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current	I_C	−200	mA
Collector Dissipation	P_C	350	mW
Storage Temperature	Tstg	150	°C

ELECTRICAL CHARACTERISTICS (T_a=25°C)

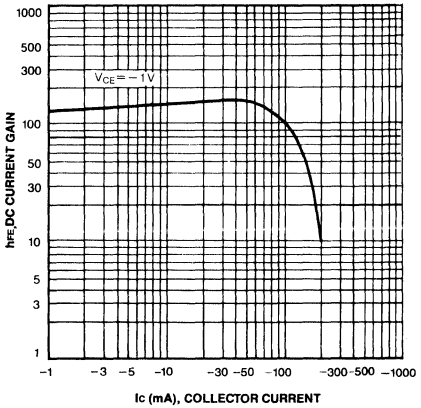
Characterstic	Symbol	Test Condition	Min	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=−10μA, I_E=0	−40		V
*Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=−1.0mA, I_B=0	−40		V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=−10μA, I_C=0	−5		V
Collector Cutoff Current	I_{CEX}	V_{CE}=−30V, V_{EB}=−3V		−50	nA
*DC Current Gain	h_{FE}	V_{CE}=−1V, I_C=−0.1mA	60		
		V_{CE}=−1V, I_C=−1mA	80		
		V_{CE}=−1V, I_C=−10mA	100	300	
		V_{CE}=−1V, I_C=−50mA	60		
		V_{CE}=−1V, I_C=−100mA	30		
*Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=−10mA, I_B=−1mA		−0.25	V
		I_C=−50mA, I_B=−5.0mA		−0.4	V
*Base-Emitter Saturatin Voltage	V_{BE}(sat)	I_C=−10mA, I_B=−1.0mA	−0.65	−0.85	V
		I_C=−50mA, I_B=−5.0mA		−0.95	V
Current Gain-Bandwith Product	f_T	I_C=−10mA, V_{CE}=−20V f=100MHz	250		MHz
Output Capacitance	C_{ob}	V_{CB}=−5V, I_E=0 f=1.0MHz		4.5	pF
Noise Figure	NF	I_C=−100μA, V_{CE}=−5V R_S=1KΩ f=10Hz to 15.7KHz		4	dB
Turn On Time	ton	V_{CC}=−3V, V_{BE}=−0.5V I_C=−10mA, I_{B1}=−1mA		70	ns
Turn Off Time	toff	V_{CC}=−3V, I_C=−10mA I_{B1}=I_{B2}=−1mA		300	ns

*Pulse Test: Pulse Width=300μs, Duty Cycle=2%

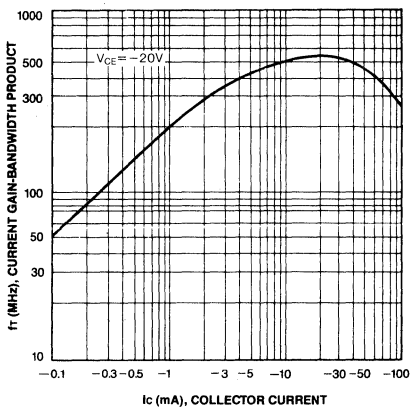
Marking



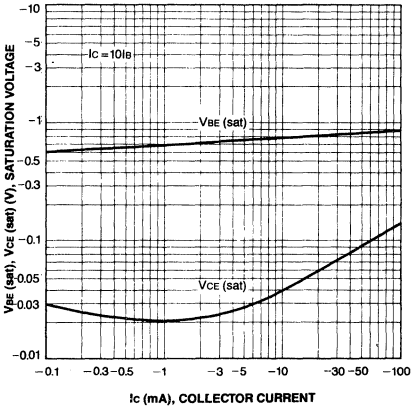
DC CURRENT GAIN



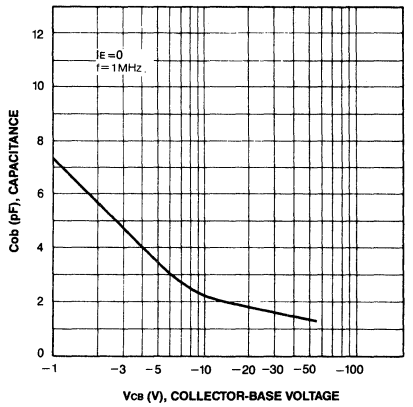
CURRENT GAIN-BANDWIDTH PRODUCT



BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



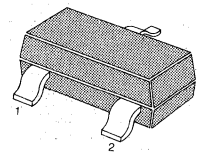
OUTPUT CAPACITANCE



3

GENERAL PURPOSE TRANSISTOR

SOT-23



1. Base 2. Emitter 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

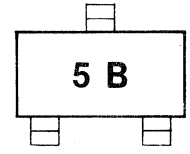
Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	40	V
Collector-Emitter Voltage	V_{CEO}	30	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	200	mA
Collector Dissipation	P_C	350	mW
Storage Temperature	Tstg	150	°C
Thermal Resistance Junction to Ambient	Rth(j-a)	357	°C/W

ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=10μA, I_E=0	40		V
* Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=1mA, I_E=0	30		V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=10μA, I_C=0	5		V
Collector Cutoff Current	I_{CBO}	V_{CB}=20V, I_E=0		50	nA
Emitter Cutoff Current	I_{EBO}	V_{BE}=3V, I_C=0		50	nA
* DC Current Gain	h_{FE}	V_{CE}=1V, I_C=2mA	50	150	
		V_{CE}=1V, I_C=50mA	25		
* Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=50mA, I_B=5mA		0.3	V
* Base-Emitter Saturation Voltage	V_{BE} (sat)	I_C=50mA, I_B=5mA		0.95	V
Current Gain-Bandwidth Product	f_T	V_{CE}=20V, I_C=10mA, f=100MHz	250		MHz
Collector Output Capacitance	Cob	V_{CB}=5V, I_E=0, f=100MHz		4	pF
Collector Input Capacitance	Cib	V_{BE}=0.5V, I_C=0, f=100KHz		8	pF
Collector-Base Capacitance	Ccb	V_{CB}=5V, I_E=0, f=100KHz		4	pF
Noise Figure	NF	V_{CE}=5V, I_C=100μA, Rs=1kΩ		6	dB
		Noise Bandwidth=10Hz to 15.7KHz			

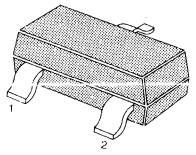
* Pulse Test: PW=300μs, Duty Cycle=2%

Marking



GENERAL PURPOSE TRANSISTOR

SOT-23



1. Base 2. Emitter 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	30	V
Collector-Emitter Voltage	V_{CEO}	25	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	200	mA
Collector Dissipation	P_C	350	mW
Storage Temperature	Tstg	150	°C

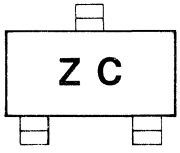
• Refer to MMBT3904 for graphs

ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=10μA, I_E=0	30		V
*Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=1.0mA, I_B=0	25		V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=10μA, I_C=0	5		V
Collector Cutoff Current	I_{CBO}	V_{CB}=20V, I_E=0		50	nA
Emitter Cutoff Current	I_{EBO}	V_{EB}=3V, I_C=0		50	nA
*DC Current Gain	h_{FE}	V_{CE}=1V, I_C=2mA	120	360	
		V_{CE}=1V, I_C=50mA	60		
*Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=50mA, I_B=5.0mA		0.3	V
*Base-Emitter Saturation Voltage	V_{BE} (sat)	I_C=50mA, I_B=5.0mA		0.95	V
Current Gain-Bandwidth Product	f_T	I_C=10mA, V_{CE}=20V f=100MHz	300		MHz
Output Capacitance	Cob	V_{CB}=5V, I_E=0 f=1.0MHz		4	pF
Noise Figure	NF	I_C=100μA, V_{CE}=5V R_S=1KΩ f=10Hz to 15.7KHz		5	dB

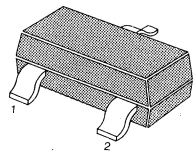
* Pulse Test: Pulse Width=300μs, Duty Cycle=2%

Marking



GENERAL PURPOSE TRANSISTOR

SOT-23



1. Base 2. Emitter 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−30	V
Collector-Emitter Voltage	V_{CEO}	−30	V
Emitter-Base Voltage	V_{EBO}	−4	V
Collector Current	I_C	−200	mA
Collector Dissipation	P_C	350	mW
Storage Temperature	Tstg	150	°C

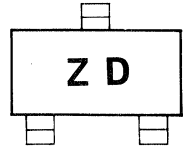
• Refer to MMBT 3906 for graphs

ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characterstic	Symbol	Test Condition	Min	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=−10μA, I_E=0	−30		V
*Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=−1mA, I_E=0	−30		V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=−10μA, I_C=0	−4		V
Collector Cutoff Current	I_{CBO}	V_{CB}=−20V, I_E=0		−50	nA
Emitter Cutoff Current	I_{EBO}	V_{EB}=−3V, I_C=0		−50	nA
*DC Current Gain	h_{FE}	V_{CE}=−1V, I_C=−2.0mA	50	150	
		V_{CE}=−1V, I_C−50mA	25		
*Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=−50mA, I_B=−5.0mA		−0.4	V
*Base-Emitter Saturation Voltage	V_{BE}(sat)	I_C=−50mA, I_B=−5.0mA		−0.95	V
Current Gain-Bandwidth Product	f_T	I_C=−10mA, V_{CE}=−20V f=100MHz	200		MHz
Collector Base Capacitance	C_{cb}	V_{CB}=−5V, I_E=0 f=100KHz		4.5	pF
Noise Figure	NF	I_C=−100μA, V_{CE}=−5V R_S=1KΩ, f=10Hz to 15.7KHz		5	dB

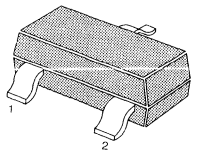
*Pulse Test: Pulse Width=300μs, Duty Cycle=2%

Marking



GENERAL PURPOSE TRANSISTOR

SOT-23



1. Base 2. Emitter 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

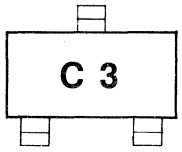
Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−25	V
Collector-Emitter Voltage	V_{CEO}	−25	V
Emitter-Base Voltage	V_{EBO}	−4	V
Collector Current	I_C	−200	mA
Collector Dissipation	P_C	350	mW
Storage Temperature	Tstg	150	°C
Thermal Resistance Junction to Ambient	Rth(j-a)	357	°C/W

ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=−10μA, I_E=0	−25		V
*Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=−1mA, I_E=0	−25		V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=−10μA, I_C=0	−4		
Collector Cutoff Current	I_{CBO}	V_{CB}=−20V, I_E=0		−50	nA
Emitter Cutoff Current	I_{EBO}	V_{BE}=−3V, I_C=0		−50	nA
*DC Current Gain	h_{FE}	V_{CE}=−1V, I_C=−2mA	120	360	
		V_{CE}=−1V, I_C=−50mA	60		
*Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=−50mA, I_B=−5mA		−0.4	V
*Base-Emitter Saturation Voltage	V_{BE} (sat)	I_C=−50mA, I_B=−5mA		−0.95	V
Current Gain-Bandwidth Product	f_T	V_{CE}=−20V, I_C=−10mA, f=100MHz	250		MHz
Collector Input Capacitance	Cib	V_{BE}=−0.5V, I_C=0, f=1MHz		10	pF
Collector-Base Capacitance	Ccb	V_{CB}=−5V, I_E=0, f=1MHz		4.5	pF
Noise Figure	NF	V_{CE}=−5V, I_C=−100μA, Rs=1kΩ Noise Bandwidth=10Hz to 15.7KHz		4	dB

* Pulse Test: PW=300μs, Duty Cycle=2%

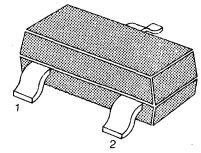
Marking



MMBT4401 NPN EPITAXIAL SILICON TRANSISTOR

SWITCHING TRANSISTOR

SOT-23



1. Base 2. Emitter 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

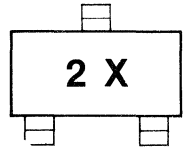
Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	60	V
Collector-Emitter Voltage	V_{CEO}	40	V
Emitter-Base Voltage	V_{EBO}	6	V
Collector Current	I_C	600	mA
Collector Dissipation	P_C	350	mW
Storage Temperature	Tstg	150	°C

ELECTRICAL CHARACTERISTICS (T_a=25°C)

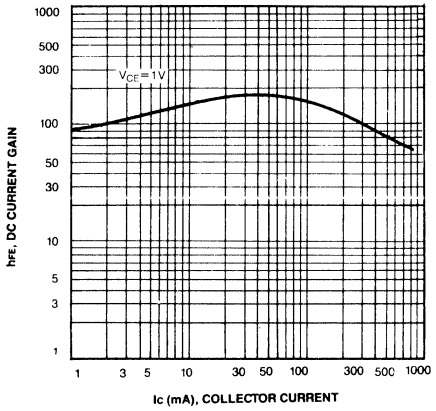
Characteristic	Symbol	Test Condition	Min	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=100μA, I_E=0	60		V
*Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=1.0mA, I_B=0	40		V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=100μA, I_C=0	6		V
Base Cutoff Current	I_{BEV}	V_{CE}=35V, V_{EB}=0.4V		100	nA
Collector Cutoff Current	I_{CEX}	V_{CE}=35V, V_{BE}=0.4V		100	nA
*DC Current Gain	h_{FE}	V_{CE}=1V, I_C=0.1mA	20		
		V_{CE}=1V, I_C=1mA	40		
		V_{CE}=1V, I_C=10mA	80		
		V_{CE}=1V, I_C=150mA	100	300	
		V_{CE}=2V, I_C=500mA	40		
*Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=150mA, I_B=15mA		0.4	V
		I_C=500mA, I_B=50mA		0.75	V
*Base-Emitter Saturation Voltage	V_{BE} (sat)	I_C=150mA, I_B=15mA	0.75	0.95	V
		I_C=500mA, I_B=50mA		1.2	V
Current Gain-Bandwidth Product	f_T	I_C=20mA, V_{CE}=10V f=100MHz	250		MHz
Collector Base Capacitance	Ccb	V_{CB}=5V, I_E=0 f=100KHz		6.5	pF
Turn On Time	ton	V_{CC}=30V, V_{BE}=2V I_C=150mA, I_{B1}=15mA		35	ns
Turn Off Time	toff	V_{CC}=30V, I_C=150mA I_{B1}=I_{B2}=15mA		255	ns

*Pulse Test: Pulse Width=300μs, Duty Cycle=2%

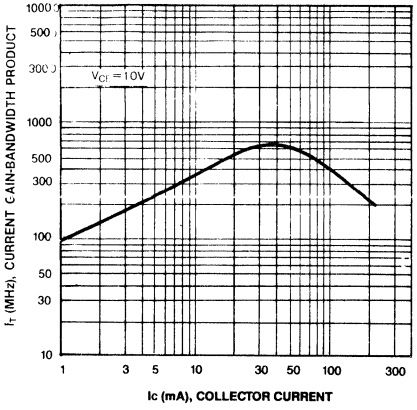
Marking



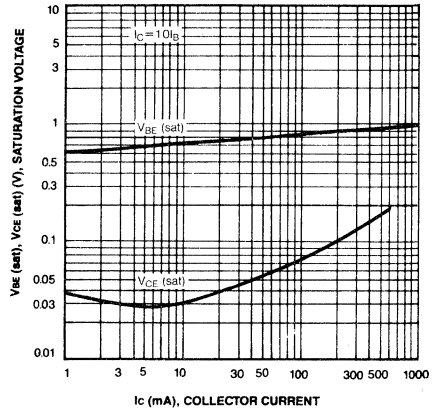
DC CURRENT GAIN



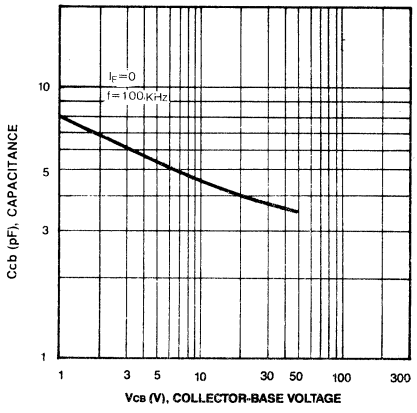
CURRENT GAIN-BANDWIDTH PRODUCT



COLLECTOR-EMITTER SATURATION VOLTAGE
BASE-EMITTER SATURATION VOLTAGE



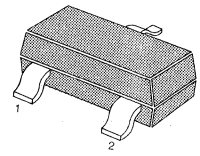
COLLECTOR-BASE CAPACITANCE



3

SWITCHING TRANSISTOR

SOT-23



1. Base 2. Emitter 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

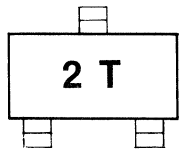
Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−40	V
Collector-Emitter Voltage	V_{CEO}	−40	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current	I_C	−600	mA
Collector Dissipation	P_C	350	mW
Storage Temperature	Tstg	150	°C

ELECTRICAL CHARACTERISTICS (T_a=25°C)

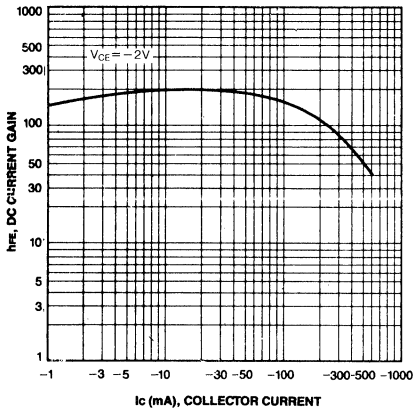
Characterstic	Symbol	Test Condition	Min	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=−0.1mA, I_E=0	−40		V
*Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=−1.0mA, I_B=0	−40		V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=−0.1mA, I_C=0	−5		V
Base Cutoff Current	I_{BEV}	V_{CE}=−35V, V_{BE}=−0.4V		−0.1	μA
Collector Cutoff Current	I_{CEX}	V_{CE}=−35V, V_{BE}=−0.4V		−0.1	μA
DC Current Gain	h_{FE}	V_{CE}=−1V, I_C=−0.1mA	30		
		V_{CE}=−1V, I_C=−1.0mA	60		
		V_{CE}=−1V, I_C=−10mA	100		
		*V_{CE}=−2V, I_C=−150mA	100	300	
		*V_{CE}=−2V, I_C=−500mA	20		
*Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=−150mA, I_B=−15mA		−0.4	V
		I_C=−500mA, I_B=−50mA		−0.75	V
*Base-Emitter Saturation Voltage	V_{BE}(sat)	I_C=−150mA, I_B=−15mA	−0.75	−0.95	V
		I_C=−500mA, I_B=−50mA		−1.3	V
Current Gain-Bandwidth Product	f_T	I_C=−20mA, V_{CE}=−10V f=100MHz	200		MHz
Collector-Base Capacitance	C_{cb}	V_{CB}=−10V, I_E=0 f=140kHz		8.5	pF
Turn On Time	ton	V_{CC}=−30V, V_{BE}=−2V I_C=−150mA, I_{B1}=−15mA		35	ns
Turn Off Time	toff	V_{CC}=−30V, I_C=−150mA I_{B1}=I_{B2}=−15mA		255	ns

*Pulse Test: Pulse Width=300μs, Duty Cycle=2%

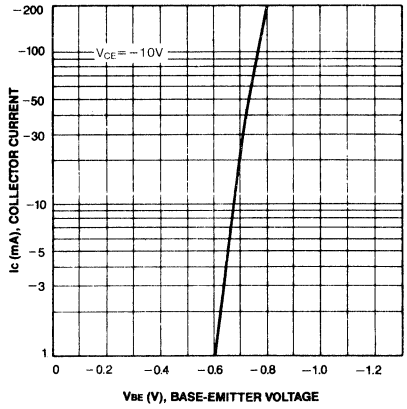
Marking



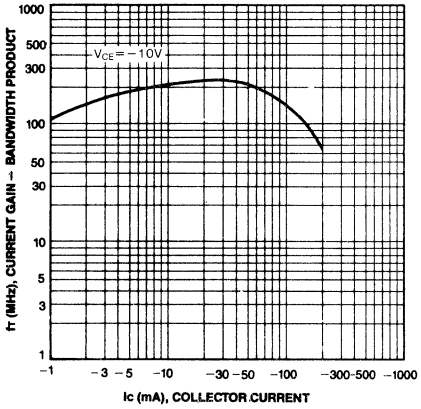
DC CURRENT GAIN



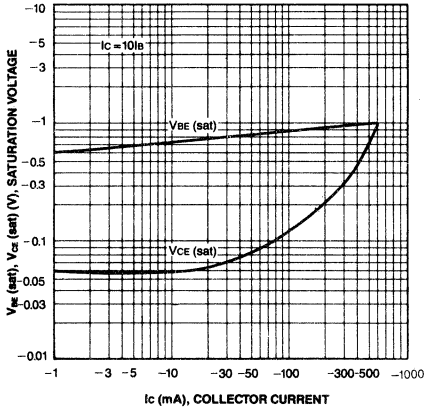
BASE-EMITTER ON VOLTAGE



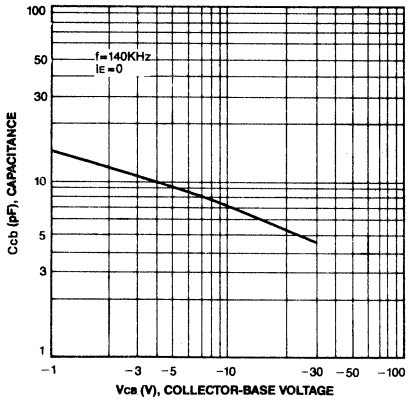
CURRENT GAIN-BANDWIDTH PRODUCT



BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



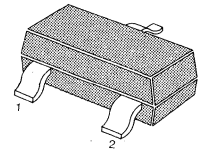
COLLECTOR-BASE CAPACITANCE



MMBT5086/5087 PNP EPITAXIAL SILICON TRANSISTOR

LOW NOISE TRANSISTOR

SOT-23



1. Base 2. Emitter 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−50	V
Collector-Emitter Voltage	V_{CEO}	−50	V
Emitter-Base Voltage	V_{EBO}	−3	V
Collector Current	I_C	−50	mA
Collector Dissipation	P_C	350	mW
Storage Temperature	Tstg	150	°C

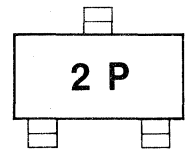
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Conditions	Min	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=−100μA, I_E=0	−50		V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=−1mA, I_B=0	−50		V
Collector Cut-off Current	I_{CBO}	V_{CB}=−20V, I_E=0		−50	nA
DC Current Gain	h_{FE}				
:MMBT5086		V_{CE}=−5V, I_C=−100μA	150	500	
MMBT5087			250	800	
MMBT5086		V_{CE}=−5V, I_C=−1mA	150		
MMBT5087			250		
MMBT5086		V_{CE}=−5V, I_C=−10mA	150		
MMBT5087			250		
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=−10mA, I_B=−1mA		−0.3	V
Base-Emitter Saturation Voltage	V_{BE} (sat)	I_C=−10mA, I_B=−1mA		−0.85	V
Current Gain Bandwidth Product	f_T	V_{CE}=−5V, I_C=−500μA f=20MHz	40		MHz
Collector Output Capacitance	C_{OB}	V_{CB}=−5V, I_E=0 f=100KHz		4	pF
Noise Figure	N_F	I_C=−100μA, V_{CE}=−5V			
:MMBT5086		R_G=3KΩ, f=1KHz		3	dB
MMBT5087				2	dB
MMBT5087		V_{CE}=−5V, I_C=−20mA R_S=10KΩ f=10Hz to 15.7KHz		2	dB

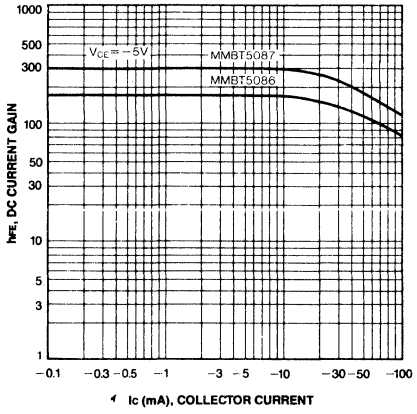
MARKING CODE

TYPE	MMBT5086	MMBT5087
MARK.	2P	2Q

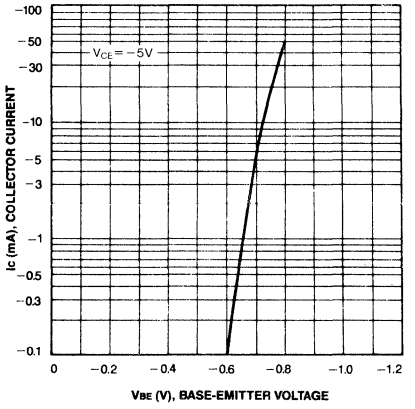
Marking



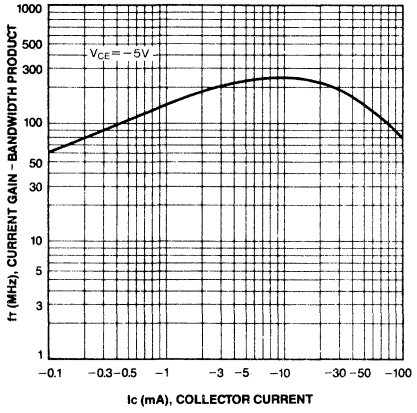
DC CURRENT GAIN



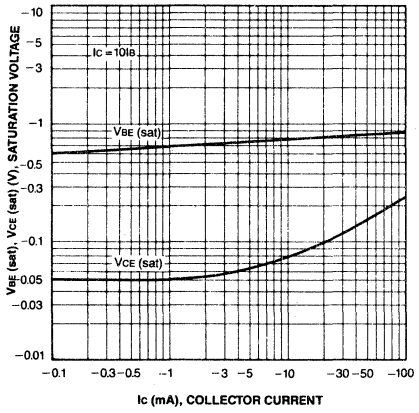
BASE-EMITTER ON VOLTAGE



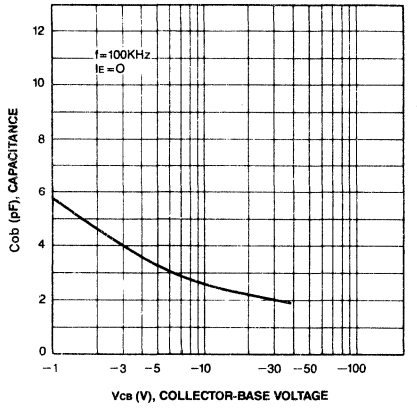
CURRENT GAIN BANDWIDTH PRODUCT



BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE

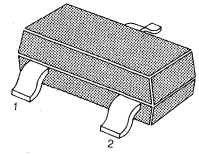


OUTPUT CAPACITANCE



LOW NOISE TRANSISTOR

SOT-23



1. Base 2. Emitter 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}		
:MMBT5088		35	V
MMBT5089		30	V
Collector-Emitter Voltage	V_{CEO}		
:MMBT5088		30	V
:MMBT5089		25	V
Emitter-Base Voltage	V_{EBO}	4.5	V
Collector Current	I_C	50	mA
Collector Dissipation	P_C	350	mW
Storage Temperature	T_{STG}	150	°C

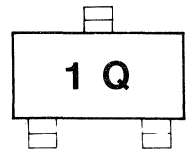
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Conditions	Min	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=100μA, I_E=0			
:MMBT5088			35		V
MMBT5089			30		V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=1mA, I_B=0			
:MMBT5088			30		V
MMBT5089			25		V
Collector Cut-off Carrent	I_{CBO}				
:MMBT5088		V_{CB}=20V, I_E=0		50	nA
MMBT5089		V_{CB}=15V, I_E=0		50	nA
Emitter Cut-off Current	I_{EBO}	V_{BE}=3V, I_C=0		50	nA
DC Current Gain	h_{FE}				
:MMBT5088		V_{CE}=5V, I_C=100μA	300	900	
MMBT5089			400	1,200	
MMBT5088		V_{CE}=5V, I_C=1mA	350		
MMBT5089			450		
MMBT5088		V_{CE}=5V, I_C=10mA	300		
MMBt5089			400		
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=10mA, I_B=1mA		0.5	V
Base-Emitter Saturation Voltage	V_{BE} (sat)	I_C=10mA, I_B=1mA		0.8	V
Current Gain Bandwidth Product	f_T	V_{CE}=5V, I_C=500μA f=20MHz	50		MHz
Collector-Base Capacitance	C_{CB}	V_{CB}=5V, I_E=0 f=100KHz		4	pF
Noise Figure	N_F	I_C=100μA, V_{CE}=5V R_G=10KΩ			
:MMBT5089		f=10Hz to 15.7KHz		3	dB
MMBT5089				2	dB

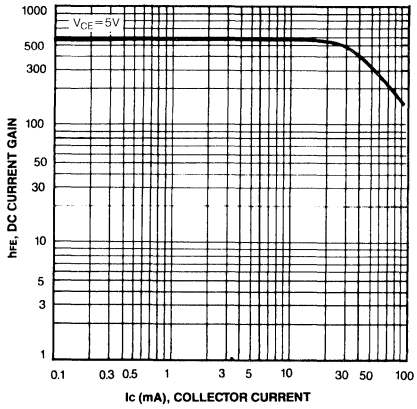
MARKING CODE

TYPE	MMBT5088	MMBT5089
MARK.	1Q	1R

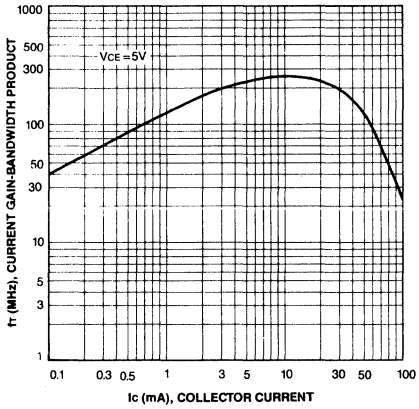
Marking



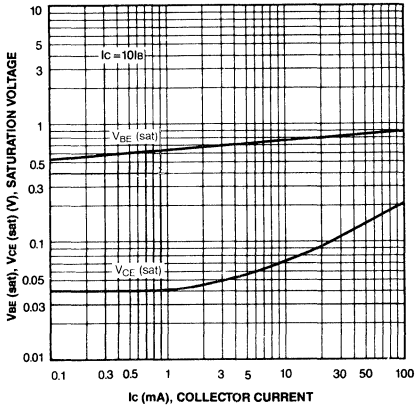
DC CURRENT GAIN



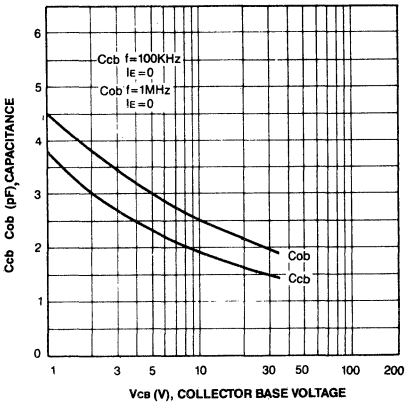
CURRENT GAIN BANDWIDTH PRODUCT



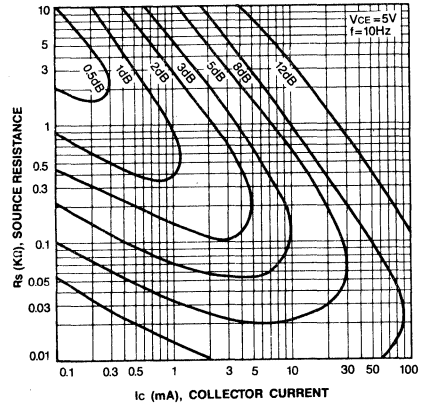
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



OUTPUT CAPACITANCE
COLLECTOR-BASE CAPACITANCE



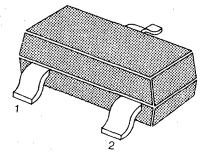
NOISE FIGURE



3

HIGH VOLTAGE TRANSISTOR

SOT-23



1. Base 2. Emitter 3. Collector

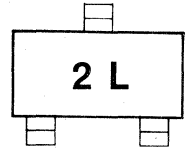
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−160	V
Collector-Emitter Voltage	V_{CEO}	−150	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current	I_C	−500	mA
Collector Dissipation	P_C	350	mW
Storage Temperature	Tstg	150	°C

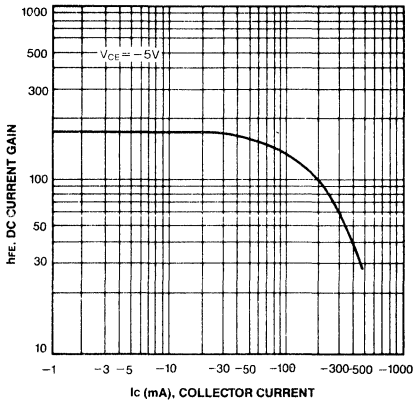
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characterstic	Symbol	Test Condition	Min	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=−100μA, I_E=0	−160		V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=−1.0mA, I_B=0	−150		V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=−10μA, I_C=0	−5		V
Collector Cutoff Current	I_{CBO}	V_{CB}=−100V, I_E=0		−50	nA
DC Current Gain	h_{FE}	V_{CE}=−5V, I_C=−1.0mA	50		
		V_{CE}=−5V, I_C=−10mA	60	240	
		V_{CE}=−5V, I_C=−50mA	50		
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=−10mA, I_B=−1.0mA		−0.2	V
		I_C=−50mA, I_B=−5mA		−0.5	V
Base-Emitter Saturatin Voltage	V_{BE}(sat)	I_C=−10mA, I_B=−1.0mA		−1.0	V
		I_C=−50mA, I_B=−5mA		−1.0	V
Current Gain-Bandwith Product	f_T	I_C=−10mA, V_{CE}=−10V f=100MHz	100	300	MHz
Output Capacitance	C_{ob}	V_{CB}=−10V, I_E=0 f=1.0MHz		6.0	pF
Noise Figure	NF	V_{CE}=−5V, I_C=−200μA R_S=10KΩ f=10Hz to 15.7KHz		8.0	dB

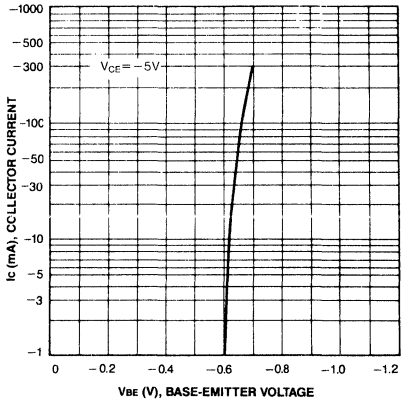
Marking



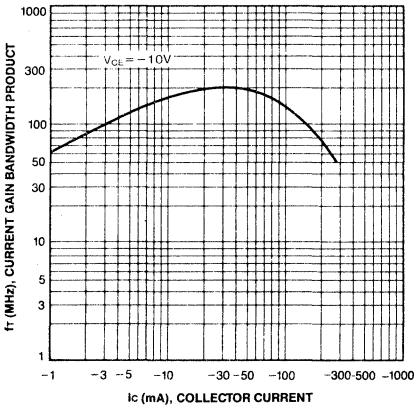
DC CURRENT GAIN



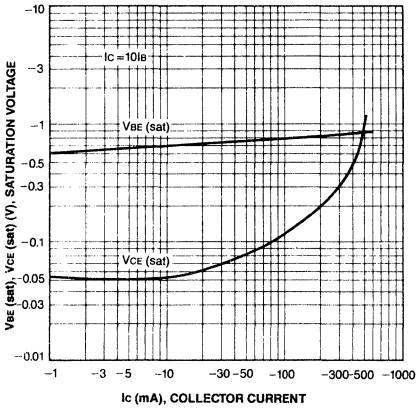
BASE-EMITTER ON VOLTAGE



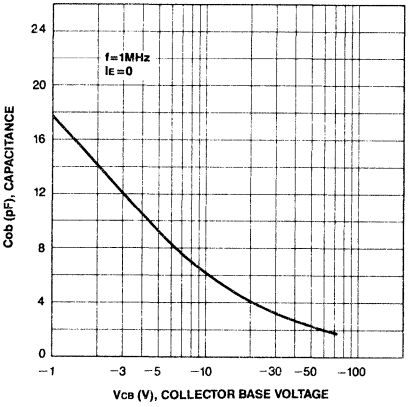
CURRENT GAIN-BANDWIDTH PRODUCT



BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



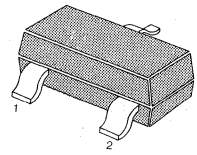
OUTPUT CAPACITANCE



3

HIGH VOLTAGE TRANSISTOR

SOT-23



1. Base 2. Emitter 3. Collector

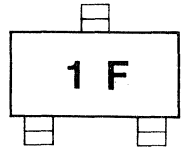
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	160	V
Collector-Emitter Voltage	V_{CEO}	140	V
Emitter-Base Voltage	V_{EBO}	6	V
Collector Current	I_C	600	mA
Collector Dissipation	P_C	350	mW
Storage Temperature	Tstg	150	°C

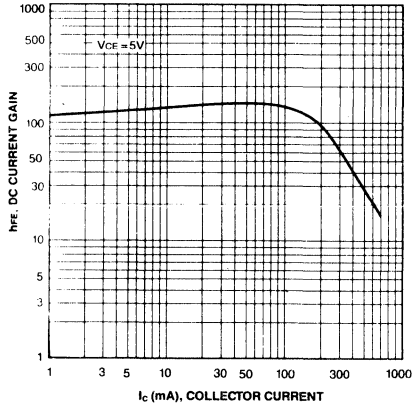
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=10μA, I_E=0	160		V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=1mA, I_B=0	140		V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=10μA, I_C=0	6		V
Collector Cutoff Current	I_{CBO}	V_{CB}=100V, I_E=0		100	nA
Emitter Cutoff Current	I_{EBO}	V_{EB}=4V, I_C=0		50	nA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=1.0mA	60		
		V_{CE}=5V, I_C=10mA	60	250	
		V_{CE}=5V, I_C=50mA	20		
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=10mA, I_B=1mA		0.15	V
		I_C=50mA, I_B=5mA		0.25	V
Base-Emitter Saturation Voltage	V_{BE} (sat)	I_C=10mA, I_B=1mA		1.0	V
		I_C=50mA, I_B=5mA		1.2	V
Current Gain-Bandwidth Product	f_T	I_C=10mA, V_{CE}=10V f=100MHz	100	300	MHz
Output Capacitance	Cob	V_{CB}=10V, I_E=0 f=1.0MHz		6.0	pF

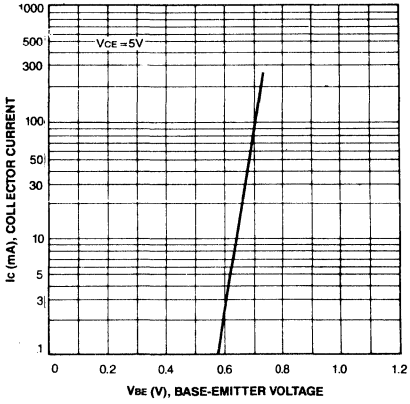
Marking



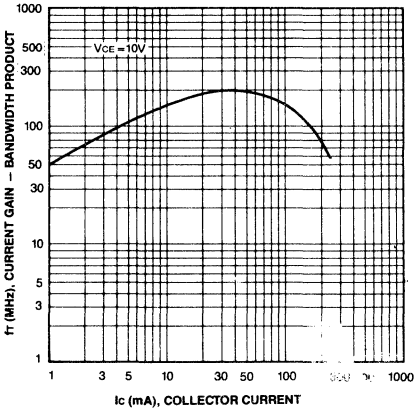
DC CURRENT GAIN



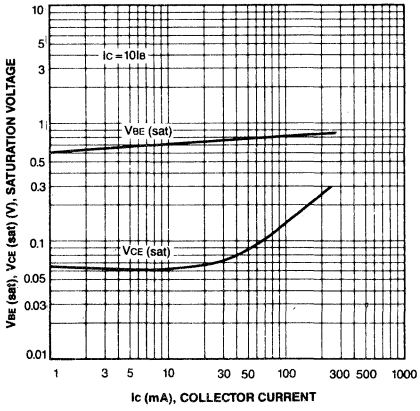
BASE-EMITTER ON VOLTAGE



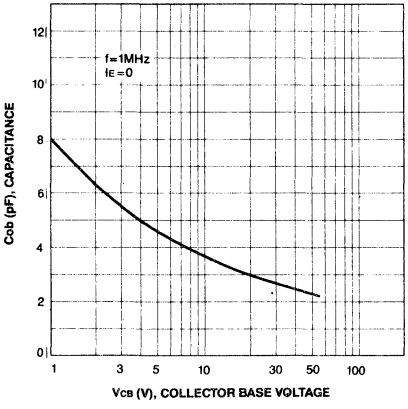
CURRENT GAIN-BANDWIDTH PRODUCT



BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



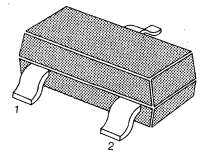
OUTPUT CAPACITANCE



3

DARLINGTON TRANSISTOR

SOT-23



1. Base 2. Emitter 3. Collector

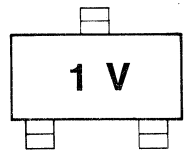
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	40	V
Collector-Emitter Voltage	V_{CEO}	40	V
Emitter-Base Voltage	V_{EBO}	12	V
Collector Current	I_C	500	mA
Collector Dissipation	P_C	350	mW
Storage Temperature	Tstg	150	°C

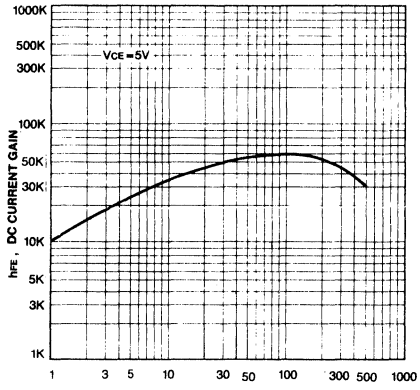
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=100μA, I_E=0	40		V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=10mA, I_B=0	40		V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=10μA, I_C=0	12		V
Collector Cutoff Current	I_{CBO}	V_{CB}=30V, I_E=0		50	nA
Collector Cutoff Current	I_{CEO}	V_{CE}=25V, I_B=0		1	μA
Emitter Cutoff Current	I_{EBO}	V_{BE}=10V, I_C=0		50	nA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=10mA	10,000	100,000	
		V_{CE}=5V, I_C=100mA	20,000	200,000	
		V_{CE}=5V, I_C=500mA	14,000	140,000	
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=50mA I_B=0.5mA		1.2	V
		I_C=500mA, I_B=0.5mA		1.5	V
Base-Emitter Saturation Voltage	V_{BE} (sat)	I_C=500mA, I_B=0.5mA		2.0	V
Base-Emitter On Voltage	V_{BE} (on)	I_C=50mA, V_{CE}=5V		1.75	V
Output Capacitance	Cob	V_{CB}=10V, I_E=0 f=1MHz		7	pF
Noise Figure	NF	I_C=1mA, V_{CE}=5V R_S=100KΩ f=1KHz to 15.7KHz		10	dB

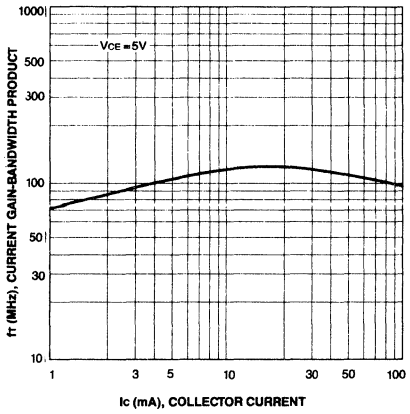
Marking



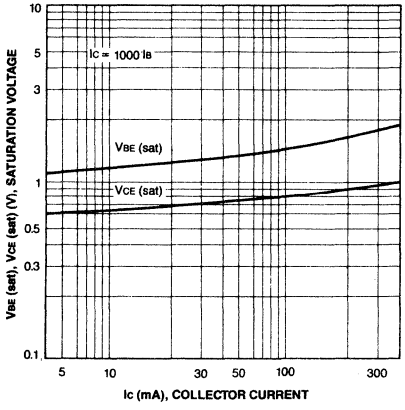
DC CURRENT GAIN



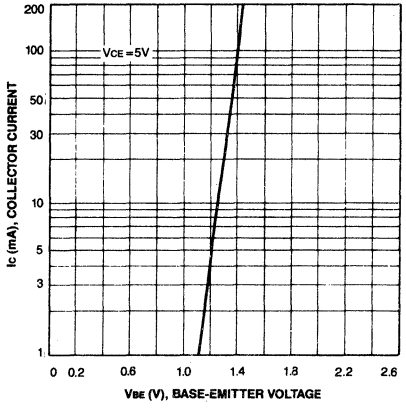
CURRENT GAIN-BANDWIDTH PRODUCT



BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



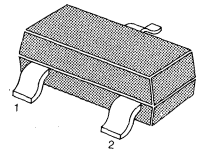
BASE-EMITTER ON VOLTAGE



3

AMPLIFIER TRANSISTOR

SOT-23



1. Base 2. Emitter 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}		
:MMBT6428		60	V
MMBT6429		55	V
Collector-Emitter Voltage	V_{CEO}		
:MMBT6428		50	V
MMBT6429		45	V
Emitter-Base Voltage	V_{EBO}	6	V
Collector Current	I_C	200	mA
Collector Dissipation	P_C	350	mW
Storage Temperature	T_{STG}	150	°C

- Refer to MMBT5088 for graphs

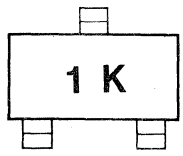
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Conditions	Min	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=100μA, I_E=0			
:MMBT6428			60		V
MMBT6429			55		V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=1mA, I_B=0			
:MMBT6428			50		V
MMBT6429			45		V
Collector Cut-off Current	I_{CBO}	V_{CE}=30V, I_E=0		0.01	μA
Collector Cut-off Current	I_{CEO}	V_{CE}=30V, I_B=0		0.1	μA
Emitter Cut-off Current	I_{EBO}	V_{CE}=5V, I_C=0		0.01	μA
DC Current Gain	h_{FE}				
:MMBT6428		V_{CE}=5V, I_C=0.01mA	250		
MMBT6429			500		
MMBT6428		V_{CE}=5V, I_C=0.1mA	250	650	
MMBT6429			500	1,250	
MMBT6428		V_{CE}=5V, I_C=1.0mA	250		
MMBT6429			500		
MMBT6428		V_{CE}=5V, I_C=10mA	250		
MMBT6429			500		
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=10mA, I_B=0.5mA		0.2	V
		I_C=100mA, I_B=5mA		0.6	V
Base-Emitter On Voltage	V_{BE} (on)	V_{CE}=5V, I_C=1mA	0.56	0.66	V
Output Capacitance	C_{OB}	V_{CB}=10V, I_E=0 F=1MHz		3	pF
Current Gain Bandwidth Product	f_T	V_{CE}=5V, I_C=1mA f=100MHz	100	700	MHz

MARKING CODE

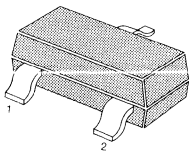
TYPE	MMBT6428	MMBT6429
MARK.	1K	1L

Marking



DRIVER TRANSISTOR

SOT-23



1. Base 2. Emitter 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}		
:MMBTA05		60	V
MMBTA06		80	V
Collector-Emitter Voltage	V_{CEO}		
:MMBTA05		60	V
MMBTA06		80	V
Emitter-Base Voltage	V_{EBO}	4	V
Collector Current	I_C	500	mA
Collector-Dissipation	P_C	350	mW
Storage Temperature	T_{STG}	150	°C
Thermal Resistance Junction to Ambient	R_{TH} (j-a)	357	°C/W

- Refer to MPSA05 for graphs

ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Conditions	Min	Max	Unit
*Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=1mA, I_B=0			
:MMBTA05			60		V
MMBTA06			80		
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=100μA, I_C=0	4		V
Collector Cut-off Current	I_{CBO}				
:MMBTA05		V_{CB}=60V, I_E=0		0.1	μA
MMBTA06		V_{CB}=80V, I_E=0		0.1	μA
Collector Cut-off Current	I_{CEO}	V_{CE}=60V, I_B=0		0.1	μA
DC Current Gain	h_{FE}	V_{CE}=1V, I_C=10mA	50		
		V_{CE}=1V, I_C=100mA	50		
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=100mA, I_B=10mA		0.25	V
Base-Emitter On Voltage	V_{BE} (on)	V_{CE}=1V, I_C=100mA		1.2	V
Current Gain Bandwidth Product	f_T	V_{CE}=2V, I_C=10mA f=100MHz	100		MHz

*Pulse Test: PW=300μs, Duty Cycle=2%

MARKING CODE

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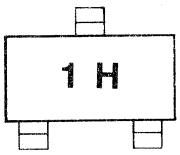
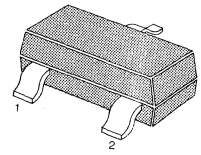
MARK.	1H	1G

Marking



DARLINGTON AMPLIFIER TRANSISTOR

SOT-23



1. Base 2. Emitter 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	30	V
Collector-Emitter Voltage	V_{CES}	30	V
Emitter-Base Voltage	V_{EBO}	10	V
Collector Current	I_C	300	mA
Collector Dissipation	P_C	350	mW
Storage Temperature	Tstg	150	°C

• Refer to MMBT6427 for graphs

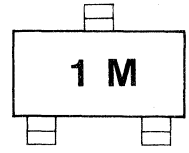
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Conditions	Min	Max	Unit
Collector-Emitter Breakdown Voltage	BV_{CES}	I_C=100μA, I_B=0	30		V
Collector Cut-off Current	I_{CBO}	V_{CB}=30V, I_E=0		100	nA
Emitter Cut-off Current	I_{EBO}	V_{BE}=10V, I_C=0		100	nA
DC Current Gain	h_{FE}				
:MMBTA13		V_{CE}=5V, I_C=10mA	5,000		
MMBTA14			10,000		
MMBTA13		V_{CE}=5V, I_C=100mA	10,000		
MMBTA14			20,000		
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=100mA, I_B=0.1mA		1.5	V
Base-Emitter On Voltage	V_{BE} (on)	V_{CE}=5V, I_C=100mA		2.0	V
Current Gain Bandwidth Product	f_T	V_{CE}=5V, I_C=10mA f=100MHz	125		MHz

MARKING CODE

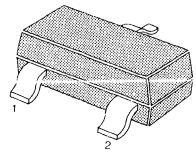
TYPE	MMBTA13	MMBTA14
MARK.	1M	1N

Marking



GENERAL PURPOSE TRANSISTOR

SOT-23



1. Base 2. Emitter 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

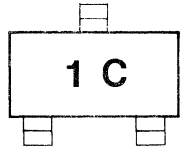
Characteristic	Symbol	Rating	Unit
Collector-Emitter Voltage	V_{CEO}	40	V
Emitter-Base Voltage	V_{EBO}	4	V
Collector Current	I_C	100	mA
Collector Dissipation	P_C	350	mW
Storage Temperature	Tstg	150	°C

• Refer to MMBT3904 for graphs

ELECTRICAL CHARACTERISTICS (T_a=25°C)

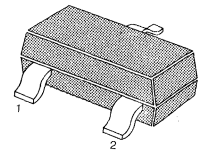
Characteristic	Symbol	Test Condition	Min	Max	Unit
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=1.0mA, I_B=0	40		V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=100μA, I_C=0	4		V
Collector Cutoff Current	I_{CBO}	V_{CB}=30V, I_E=0		100	nA
DC Current Gain	h_{FE}	V_{CE}=10V, I_C=5mA	40	400	
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=10mA, I_B=1.0mA		0.25	V
Current Gain-Bandwidth Product	f_T	I_C=5 0mA, V_{CE}=10V f=100MHz	125		MHz
Output Capacitance	Cob	V_{CB}=10V, I_E=0 f=100KHz		4	pF

Marking



HIGH VOLTAGE TRANSISTOR

SOT-23



1. Base 2. Emitter 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}		
:MMBTA42		300	V
MMBTA43		200	V
Collector-Emitter Voltage	V_{CEO}		
:MMBTA42		300	V
MMBTA43		200	V
Emitter-Base Voltage	V_{EBO}	6	V
Collector Current	I_C	500	mA
Collector Dissipation	P_C	350	mW
Storage Temperature	T_{STG}	150	°C
Thermal Temperature Junction to Ambient	R_{TH} (j-a)	357	°C/W

ELECTRICAL CHARACTERISTICS (T_a=25°C)

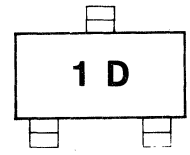
Characteristic	Symbol	Test Conditions	Min	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=100μA, I_E=0			
:MMBTA42			300		V
MMBTA43			200		V
*Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=1mA, I_B=0			
:MMBTA42			300		V
MMBTA43			200		V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=100μA, I_C=0	6		V
Collector Cut-off Current	I_{CBO}	V_{CE}=200V, I_E=0		0.1	μA
Emitter Cut-off Current	I_{EBO}	V_{CE}=5V, I_C=0		0.1	μA
*DC Current Gain	h_{FE}	V_{CE}=10V, I_C=1mA	25		
		V_{CE}=10V, I_C=10mA	40		
		V_{CE}=10V, I_C=30mA	40		
*Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=20mA, I_B=2mA		0.5	V
*Base-Emitter Saturation Voltage	V_{BE} (sat)	I_C=20mA, I_B=2mA		0.9	V
Collector-Base Capacitance	C_{CB}	V_{CB}=20V, I_E=0			
:MMBTA42		f=1MHz		3	pF
MMBTA43				4	pF
Current Gain bandwidth Product	f_T	V_{CE}=20V, I_C=10mA f=100MHz	50		MHz

*Pulse Etst: PW=300μs, Duty Cycle=2%

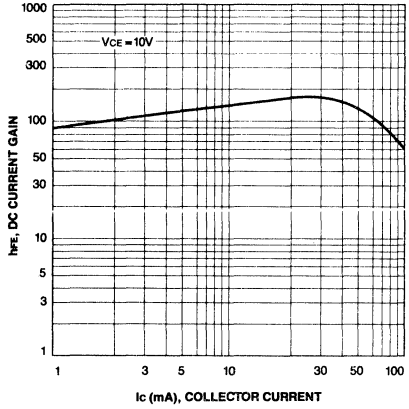
MARKING CODE

TYPE	MMBTA42	MMBTA43
MARK.	1D	1E

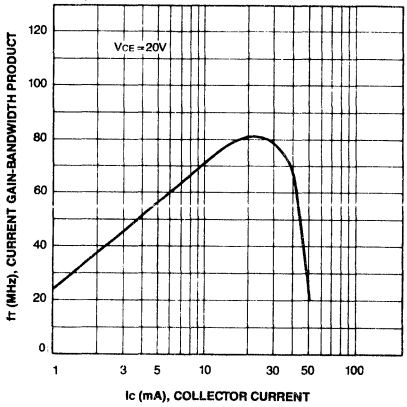
Marking



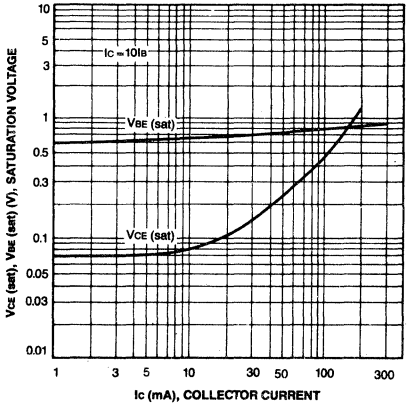
DC CURRENT GAIN



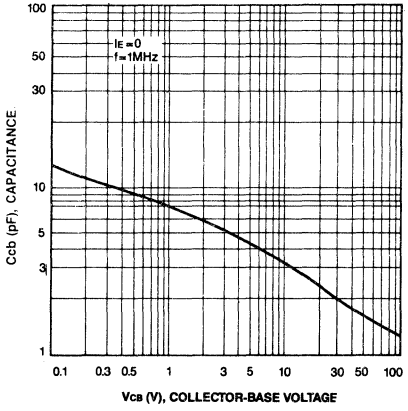
CURRENT GAIN-BANDWIDTH PRODUCT



COLLECTOR-EMITTER SATURATION VOLTAGE
BASE-EMITTER SATURATION VOLTAGE



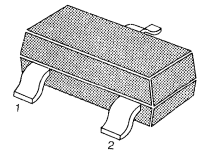
COLLECTOR-BASE CAPACITANCE



3

DRIVER TRANSISTOR

SOT-23



1. Base 2. Emitter 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}		
:MMBTA55		−60	V
MMBTA56		−80	V
Collector-Emitter Voltage	V_{CEO}		
:MMBTA05		−60	V
MMBTA06		−80	V
Emitter-Base Voltage	V_{EBO}	−4	V
Collector Current	I_C	−500	mA
Collector Dissipation	P_C	350	mW
Storage Temperature	T_{STG}	150	°C
Thermal Resistance Junction to Ambient	R_{TH} (j-a)	357	°C/W

- Refer to MPSA55 for graphs

ELECTRICAL CHARACTERISTICS (T_a=25°C)

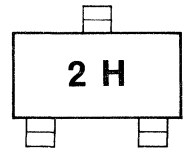
Characteristic	Symbol	Test Conditions	Min	Max	Unit
*Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=−1mA, I_B=0			
:MMBTA55			−60		V
MMBTA56			−80		
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=−100μA, I_C=0	−4		V
Collector Cut-off Current	I_{CBO}	V_{CB}=−60V, I_E=0		−0.1	μA
Collector Cut-off Current	I_{CEO}				
:MMBTA55		V_{CE}=−60V, I_B=0		−0.1	μA
MMBTA56		V_{CE}=−80V, I_B=0		−0.1	μA
DC Current Gain	h_{FE}	V_{CE}=−1V, I_C=−10mA	50		
		V_{CE}=−1V, I_C=−100mA	50		
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=−100mA, I_B=−10mA		−0.25	V
Base-Emitter On Voltage	V_{BE} (on)	V_{CE}=−1V, I_C=−100mA		−1.2	V
Current Gain Bandwidth Product	f_T	V_{CE}=−1V, I_C=−100mA f=100MHz	50		MHz

*PUlse Test: PW=300μs, Duty Cycle=2%

MARKING CODE

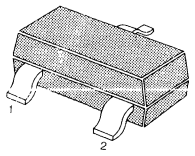
TYPE	MMBTA55	MMBTA56
MARK.	2H	2G

Marking



DARLINGTON TRANSISTOR

SOT-23



1. Base 2. Emitter 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−30	V
Collector-Emitter Voltage	V_{CES}	−30	V
Emitter-Base Voltage	V_{EBO}	−10	V
Collector Current	I_C	−500	mA
Collector Dissipation	P_C	350	mW
Storage Temperature	Tstg	150	°C

ELECTRICAL CHARACTERISTICS (T_a=25°C)

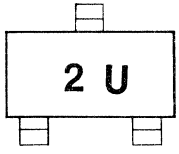
Characteristic	Symbol	Test Conditions	Min	Max	Unit
Collector-Emitter Breakdown Voltage	BV_{CES}	I_C=−100μA, I_B=0	−30		V
Collector Cut-off Current	I_{CBO}	V_{CB}=−30V, I_E=0		−100	nA
Emitter Cut-off Current	I_{EBO}	V_{BE}=−10V, I_C=0		−100	nA
*DC Current Gain	h_{FE}				
:MMBTA63		V_{CE}=−5V, I_C=−10mA	5,000		
MMBTA64			10,000		
MMBTA63		V_{CE}=−5V, I_C=−100mA	10,000		
MMBTA64			20,000		
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=−100mA, I_B=−0.1mA		−1.5	V
Base-Emitter On Voltage	V_{BE} (on)	V_{CE}=−5V, I_C=−100mA		−2.0	V
Current Gain Bandwidth Product	f_T	V_{CE}=−5V, I_C=−10mA f=100MHz	125		MHz

*Pulse Test: Pulse Width=300μs, Duty Cycle=2%

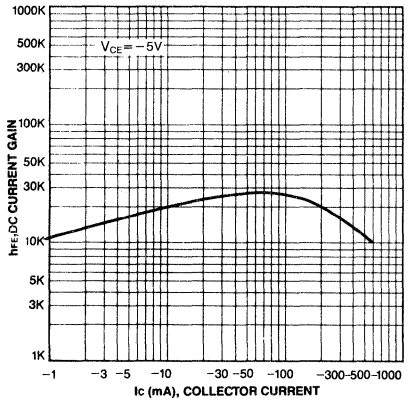
MARKING CODE

TYPE	MMBTA63	MMBTA64
MARK.	2U	2V

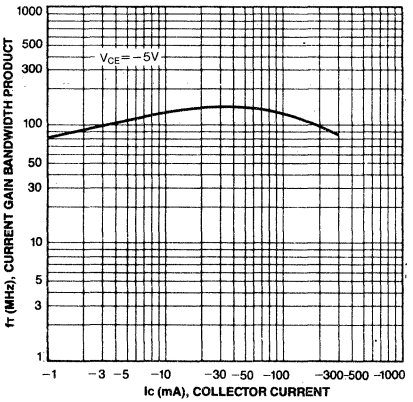
Marking



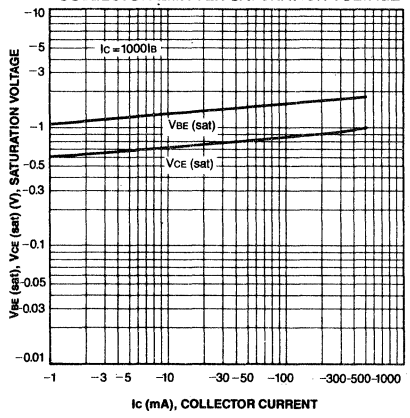
DC CURRENT GAIN



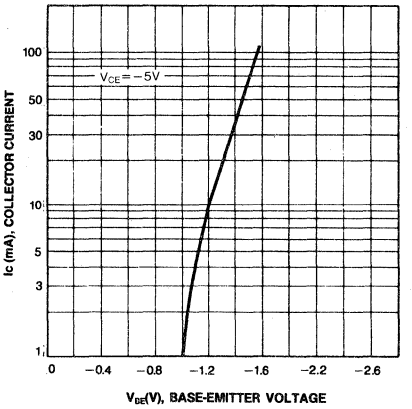
CURRENT GAIN-BANDWIDTH PRODUCT



BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE

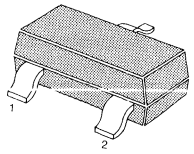


BASE EMITTER ON VOLTAGE



AMPLIFIER TRANSISTOR

SOT-23



1. Base 2. Emitter 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

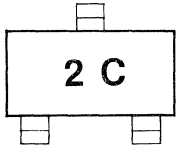
Characteristic	Symbol	Rating	Unit
Collector-Emitter Voltage	V_{CEO}	−40	V
Emitter-Base Voltage	V_{EBO}	−4	V
Collector Current	I_C	−100	mA
Collector Dissipation	P_C	350	mW
Storage Temperature	Tstg	150	°C

• Refer to MMBT5086 for graphs

ELECTRICAL CHARACTERISTICS (T_a=25°C)

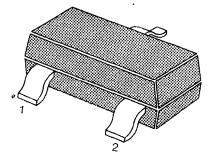
Characterstic	Symbol	Test Condition	Min	Max	Unit
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=−1.0mA, I_B=0	−40		V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=−100μA, I_C=0	−4		V
Collector Cutoff Current	I_{CBO}	V_{CE}=−30V, I_E=0		−100	nA
DC Current Gain	h_{FE}	V_{CE}=−10V, I_C=−5.0mA	40	400	
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=−10mA, I_a=−1.0mA		−0.25	V
Current Gain-Bandwidth Product	f_T	I_C=−5.0mA, V_{CE}=−10V f=100MHz	125		MHz
Output Capacitance	C_{ob}	V_{CB}=−10V, I_E=0 f=100KHz		4.0	pF

Marking



HIGH VOLTAGE TRANSISTOR

SOT-23



1. Base 2. Emitter 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}		
:MMBTA92		−300	V
MMBTA93		−200	V
Collector-Emitter Voltage	V_{CEO}		
:MMBTA92		−300	V
MMBTA93		−200	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current	I_C	−500	mA
Collector Dissipation	P_C	350	mW
Storage Temperature	T_{STG}	150	°C
Thermal Temperature Junction to Ambient	R_{TH} (j-a)	357	°C/W

• Refer to MPSA92/93 for graphs

ELECTRICAL CHARACTERISTICS (T_a=25°C)

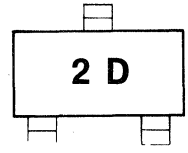
Characteristic	Symbol	Test Conditions	Min	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=−100μA, I_E=0			
:MMBTA92			−300		V
MMBTA93			−200		V
*Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=−1mA, I_B=0			
:MMBTA92			−300		V
MMBTA93			−200		V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=−100μA, I_C=0	−5		V
Collector Cut-off Current	I_{CBO}				
:MMBTA92		V_{CB}=−200V, I_E=0		−0.25	mA
MMBTA93		V_{CB}=−160V, I_E=0		−0.25	μA
Emitter Cut-off Current	I_{EBO}	V_{CE}=−3V, I_C=0		−0.1	μA
*DC Current Gain	h_{FE}	V_{CE}=−10V, I_C=−1mA	25		
		V_{CE}=−10V, I_C=−10mA	40		
		V_{CE}=−10V, I_C=−30mA	25		
*Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=−20mA, I_B=−2mA		−0.5	V
*Base-Emitter Saturation Voltage	V_{BE} (sat)	I_C=−20mA, I_B=−2mA		−0.9	V
Collector-Base Capacitance	C_{CB}	V_{CB}=−20V, I_E=0			
:MMBTA92		f=1MHz		6	pF
MMBTA93				8	pF
Current Gain Bandwith Product	f_T	V_{CE}=−20V, I_C=−10mA	50		MHz
		f=100MHz			

*Pulse Test: PW=300μs, Duty Cycle=2%

MARKING CODE

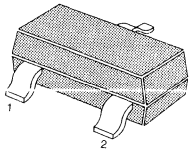
TYPE	MMBTA92	MMBTA93
MARK.	2D	2E

Marking



VHF/UHF TRANSISTOR

SOT-23



1. Base 2. Emitter 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

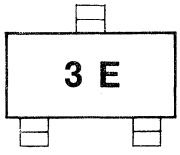
Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	30	V
Collector-Emitter Voltage	V_{CEO}	25	V
Emitter-Base Voltage	V_{EBO}	3	V
Collector Dissipation	P_C	350	mW
Storage Temperature	Tstg	150	°C
Thermal Resistance Junction to Ambient	Rth(j-a)	357	°C/W

• Refer to MPSH10/11 for graphs

ELECTRICAL CHARACTERISTICS (T_a=25°C)

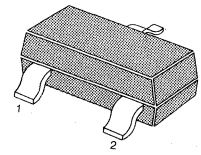
Characteristic	Symbol	Test Condition	Min	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=100μA, I_E=0	30		V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=1mA, I_B=0	25		V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=10μA, I_C=0	3		V
Collector Cutoff Current	I_{CBO}	V_{CB}=25V, I_E=0		100	nA
Emitter Cutoff Current	I_{EBO}	V_{BE}=2V, I_C=0		100	nA
DC Current Gain	h_{FE}	V_{CE}=10V, I_C=4mA	60		
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=4mA, I_B=0.4mA		0.5	V
Base-Emitter On Voltage	V_{BE}	V_{CE}=10V, I_C=4mA		0.95	V
Current Gain-Bandwidth Product	f_T	V_{CE}=10V, I_C=4mA, f=100MHz	650		MHz
Collector-Base Capacitance	Ccb	V_{CB}=10V, I_E=0, f=1MHz		0.7	pF
Common-Base Feedback Capacitance	Crb	V_{CB}=10V, I_E=0, f=1MHz		0.65	pF
Collector Base Time Constant	Cc·rbb'	V_{CB}=10V, I_C=4mA, f=31.8MHz		9	ps

Marking



VHF MIXER TRANSISTOR

SOT-23



1. Base 2. Emitter 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	40	V
Collector-Emitter Voltage	V_{CEO}	30	V
Emitter-Base Voltage	V_{EBO}	4	V
Collector Current	I_C	100	mA
Collector Dissipation	P_C	350	mW
Storage Temperature	Tstg	150	°C
Thermal Resistance Junction to Ambient	$R_{th(j-a)}$	357	°C/W

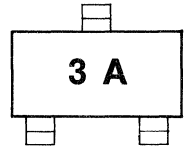
- Refer to MPSH24 for graphs

ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=100μA, I_E=0	40			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=1mA, I_B=0	30			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=10μA, I_C=0	4			V
Collector Cutoff Current	I_{CBO}	V_{CB}=15V, I_E=0			50	nA
DC Current Gain	h_{FE}	V_{CE}=10V, I_C=8mA	30			
*Current Gain-Bandwidth Product	f_T	V_{CE}=10V, I_C=8mA f=100MHz	400	620		MHz
Collector-Base Capacitance	Ccb	V_{CB}=10V, I_E=0, f=1MHz		0.25	0.36	pF
Conversion Gain (213MHz to 45MHz)	C_G	I_C=8mA, V_{CC}=20V Oscillator Injection=150mV	19	24		dB
(60MHz to 45MHz)			24	29		dB

* Pulse Test: PW=300μs, Duty Cycle=2%

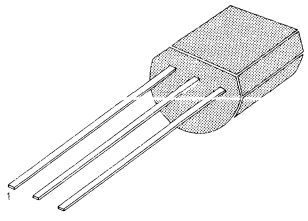
Marking



GENERAL PURPOSE TRANSISTOR

- **Collector-Emitter Voltage: V_{CEO} =30V**
- **Collector Dissipation: P_C (max)=625mW**

TO-92



1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a =25°C)

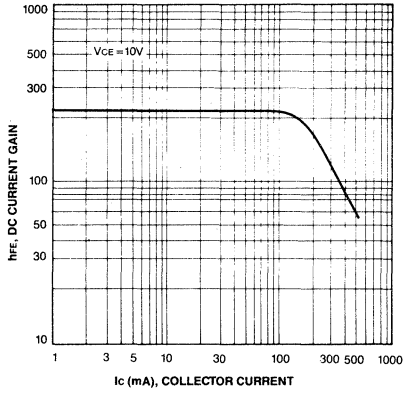
Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	60	V
Collector-Emitter Voltage	V_{CEO}	30	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	600	mA
Collector Dissipation	P_C	625	mW
Junction Temperature	T_j	150	°C
Storage Temperature	Tstg	−55 ~ 150	°C

ELECTRICAL CHARACTERISTICS (T_a =25°C)

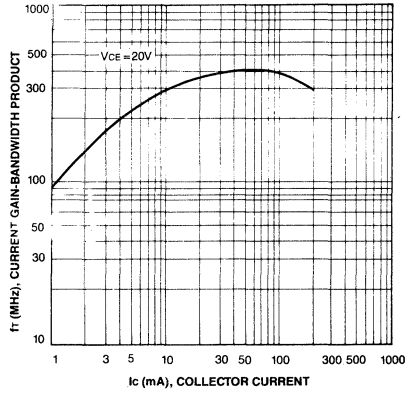
Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C =10μA, I_E =0	60			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C =10mA, I_B =0	30			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E =10μA, I_C =0	5			V
Collector Cut-off Current	I_{CBO}	V_{CB} =50V, I_E =0			10	nA
DC Current Gain	h_{FE}	I_C =0.1mA, V_{CE} =10V	35			
		I_C =1mA, V_{CE} =10V	50			
		I_C =10mA, V_{CE} =10V	75			
		*I_C =150mA, V_{CE} =10V	100		300	
		*I_C =500mA, V_{CE} =10V	30			
*Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C =150mA, I_B =15mA			0.4	V
		I_C =500mA, I_B =50mA			1.6	V
*Base-Emitter Saturation Voltage	V_{BE} (sat)	I_C =150mA, I_B =15mA			1.3	V
		I_C =500mA, I_B =50mA			2.6	V
Output Capacitance	Cob	V_{CB} =10V, I_E =0, f=1MHz			8	pF
Current Gain Bandwidth Product	f_T	I_C =20mA, V_{CE} =20V f=100MHz	250			MHz
Turn On Time	ton	V_{CC} =30V, V_{BE} =0.5V I_C =150mA, I_{B1} =15mA			35	ns
Turn Off Time	toff	V_{CC} =30V, I_C =150mA I_{B1} =1_{B2} =15mA			285	ns

* Pulse Test: Pulse Width=300μs, Duty Cycle=2%
Also available as a PN2222

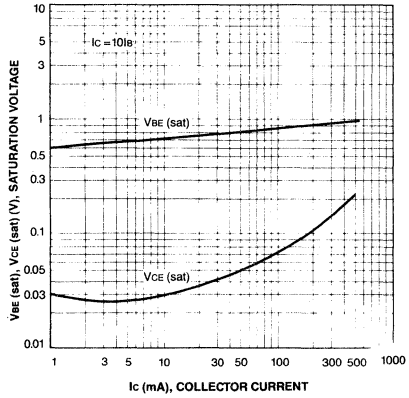
DC CURRENT GAIN



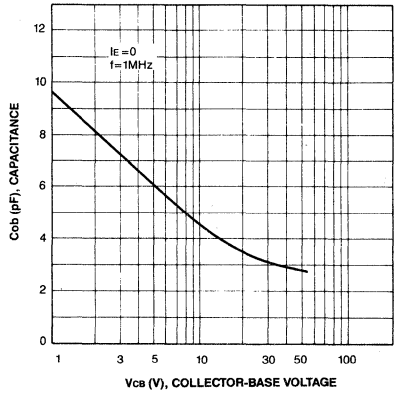
CURRENT GAIN-BANDWIDTH PRODUCT



COLLECTOR-EMITTER SATURATION VOLTAGE
BASE-EMITTER SATURATION VOLTAGE



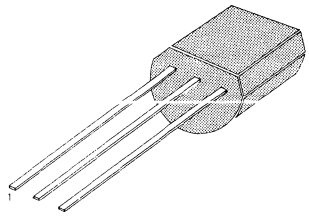
OUTPUT CAPACITANCE



GENERAL PURPOSE TRANSISTOR

- **Collector-Emitter Voltage: V_{CEO}=40V**
- **Collector Dissipation: P_C (max)=625mW**

TO-92



1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	75	V
Collector-Emitter Voltage	V_{CEO}	40	V
Emitter-Base Voltage	V_{EBO}	6	V
Collector Current	I_C	600	mA
Collector Dissipation	P_C	625	mW
Junction Temperature	T_j	150	°C
Storage Temperature	Tstg	−55 ~ 150	°C

*Refer to MPS2222 for graphs

ELECTRICAL CHARACTERISTICS (T_a=25°C)

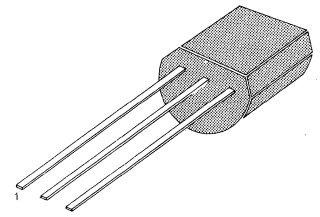
Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=10μA, I_E=0	75			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=10mA, I_B=0	40			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=10μA, I_C=0	6			V
Collector Cut-off Current	I_{CBO}	V_{CB}=60V, I_E=0			0.01	μA
Emitter Cutoff Current	I_{EBO}	V_{EB}=3V, I_C=0			10	nA
DC Current Gain	h_{FE}	I_C=0.1mA, V_{CE}=10V	35			
		I_C=1mA, V_{CE}=10V	50			
		I_C=10mA, V_{CE}=10V	75			
		*I_C=150mA, V_{CE}=10V	100		300	
		*I_C=500mA, V_{CE}=10V	40			
*Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=150mA, I_B=15mA			0.3	V
		I_C=500mA, I_B=50mA			1	V
*Base-Emitter Saturation Voltage	V_{BE} (sat)	I_C=150mA, I_B=15mA		0.6	1.2	V
		I_C=500mA, I_B=50mA			2	V
Current Gain Bandwidth Product	f_T	I_C=20mA, V_{CE}=20V f=100MHz	300			MHz
Output Capacitance	Cob	V_{CB}=10V, I_E=0, f=1MHz			8	pF
Turn On Time	ton	V_{CC}=30V, I_C=150mA I_{B1}=15mA, V_{BE} (off)=0.5V			35	ns
Turn Off Time	toff	V_{CC}=30V, I_C=150mA I_{B1}=I_{B2}=15mA			285	ns
Noise Figure	NF	I_C=100μA, V_{CE}=10V R_S=1KΩ, f=1KHz			4	dB

* Pulse Test: Pulse Width=300μs, Duty Cycle = 2%
Also available as a PN2222A

GENERAL PURPOSE TRANSISITOR

- **Collector-Emitter Voltage: V_{CEO}=40V**
- **Collector Dissipation: P_C (max)=625mW**

TO-92



1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−60	V
Collector-Emitter Voltage	V_{CEO}	−40	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current	I_C	−600	mA
Collector Dissipation	P_C	625	mW
Junction Temperature	T_j	150	°C
Storage Temperature	Tstg	−55~150	°C

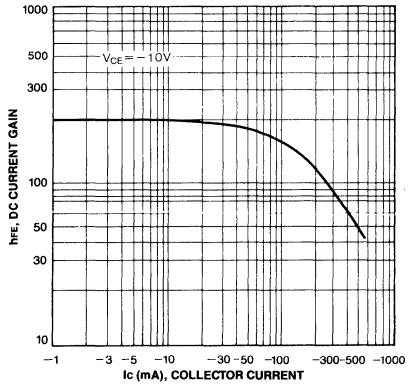
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=−10μA, I_E=0	−60			V
*Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=−10mA, I_B=0	−40			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=−10μA, I_C=0	−5			V
Collector Cut-off Current	I_{CBO}	V_{CB}=−50V, I_E=0			−20	nA
DC Current Gain	h_{FE}	I_C=−0.1mA, V_{CE}=−10V	35			
		I_C=−1mA, V_{CE}=−10V	50			
		I_C=−10mA, V_{CE}=−10V	75			
		*I_C=−150mA, V_{CE}=−10V	100		300	
		*I_C=−500mA, V_{CE}=−10V	30			
*Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=−150mA, I_B=−15mA			−0.4	V
		I_C=−500mA, I_B=−50mA			−1.6	V
*Base-Emitter Saturation Voltage	V_{BE}(sat)	I_C=−150mA, I_B=−15mA			−1.3	V
		I_C=−500mA, I_B=−50mA			−2.6	V
Output Capacitance	C_{ob}	V_{CB}=−10V, I_E=0 f=1MHz			8	pF
*Current Gain Bandwidth Product	f_T	I_C=−50mA, V_{CE}=−20V f=100MHz	200			MHz
Turn On Time	t_{on}	V_{CC}=−30V, I_C=−150mA I_{B1}=−15mA			45	ns
Turn Off Time	toff	V_{CC}=−6V, I_C=−150mA I_{B1}=I_{B2}=−15mA			100	ns

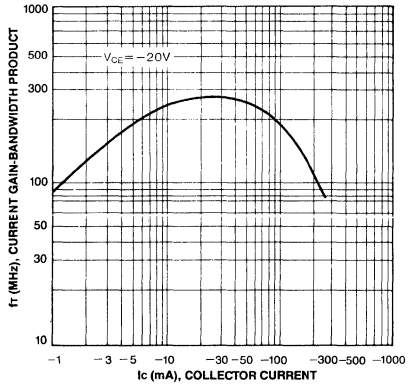
*Pulse Test: Pulse Width=300μs, Duty Cycle=2%

Also available as a PN2907

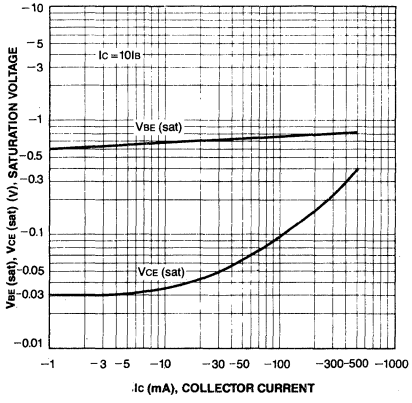
DC CURRENT GAIN



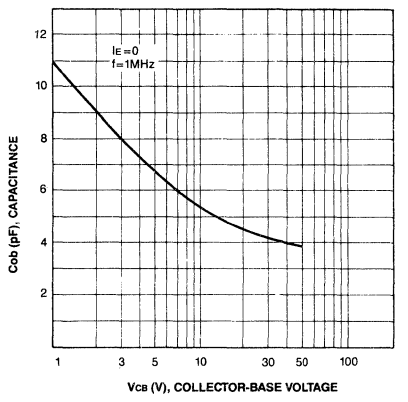
CURRENT GAIN-BANDWIDTH PRODUCT



COLLECTOR-EMITTER SATURATION VOLTAGE
BASE-EMITTER SATURATION VOLTAGE



OUTPUT CAPACITANCE



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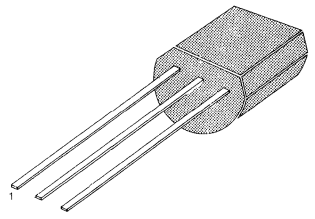
GENERAL PURPOSE TRANSISITOR

- **Collector-Emitter Voltage: V_{CEO}=60V**
- **Collector Dissipation: P_C (max)=625mW**

TO-92



1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−60	V
Collector-Emitter Voltage	V_{CEO}	−60	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current	I_C	−600	mA
Collector Dissipation	P_C	625	mW
Junction Temperature	T_j	150	°C
Storage Temperature	Tstg	−55~150	°C

- Refer to MPS2907 for grophs

ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=−10μA, I_E=0	−60			V
*Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=−10mA, I_B=0	−60			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=−10μA, I_C=0	−5			V
Collector Cut-off Current	I_{CBO}	V_{CB}=−50V, I_E=0			−10	nA
DC Current Gain	h_{FE}	I_C=−0.1mA, V_{CE}=−10V	75			
		I_C=−1mA, V_{CE}=−10V	100			
		I_C=−10mA, V_{CE}=−10V	100			
		*I_C=−150mA, V_{CE}=−10V	100		300	
		*I_C=−500mA, V_{CE}=−10V	50			
*Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=−150mA, I_B=−15mA			−0.4	V
		I_C=−500mA, I_B=−50mA			−1.6	V
*Base-Emitter Saturation Voltage	V_{BE}(sat)	I_C=−150mA, I_B=−15mA			−1.3	V
		I_C=−500mA, I_B=−50mA			−2.6	V
Output Capacitance	C_{ob}	V_{CB}=−10V, I_E=0 f=1MHz			8	pF
*Current Gain Bandwidth Product	f_T	I_C=−50mA, V_{CE}=−20V f=100MHz	200			MHz
Turn On Time	t_{on}	V_{CC}=−30V, I_C=−150mA I_{B1}=−15mA			45	ns
Turn Off Time	toff	V_{CC}=−6V, I_C=−150mA I_{B1}=I_{B2}=−15mA			100	ns

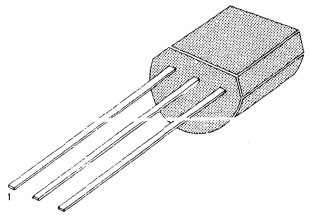
*Pulse Test: Pulse Width=300μs, Duty Cycle=2%

Also available as a PN2907A

AMPLIFIER TRANSISTOR

- **Collector-Emitter Voltage: V_{CEO} = MPS 3702: 25V**
  MPS3703: 30V
- **Collector Dissipation: P_C (max)=625mW**

TO-92



1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a =25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}		
:MPS3702		−40	V
MPS3703		−50	V
Collector-Emitter Voltage	V_{CEO}		
:MPS3702		−25	V
MPS3703		−30	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current	I_C	−600	mA
Collector Dissipation	P_C	625	mW
Junction Temperature	T_J	150	°C
Storage Temperature	T_{STG}	−55∼150	°C

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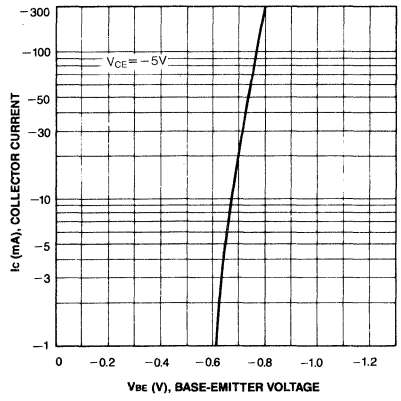
ELECTRICAL CHARACTERISTICS (T_a =25°C)

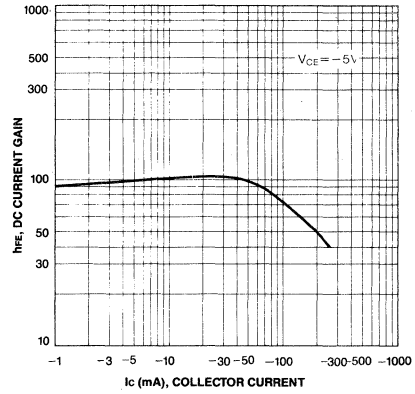
Characteristic	Symbol	Test Conditions	Min	Max	Unit
*Collector-Base Breakdown Voltage	BV_{CBO}	I_C=−100μA, I_E=0			
:MPS3702			−40		V
MPS3703			−50		V
*Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=−10mA, I_B=0			
:MPS3702			−25		V
MPS3703			−30		
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=−100μA, I_C=0	−5		V
Collector Cut-off Current	I_{CBO}	V_{CB}=−20V, I_E=0		−100	nA
Emitter Cut-off Current	I_{EBO}	V_{BE}=−3V, I_C=0		−100	nA
*DC Current Gain	h_{FE}	V_{CE}=−5V, I_C=−50mA			
:MPS3702			60	300	
MPS3703			30	150	
*Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=−50mA, I_B=−5mA		−0.25	V
*Base-Emitter On Voltage	V_{BE} (on)	V_{CE}=−5V, I_C=−50mA	−0.6	−1	V
Current Gain Bandwidth Product	f_T	V_{CE}=−5V, I_C=−50mA f=20MHz	100		MHz
Output Capacitance	C_{OB}	V_{CB}=−10V, I_E=0 f=1MHz		12	pF

*Pulse Test: PW=300μs, Duty Cycle=2%

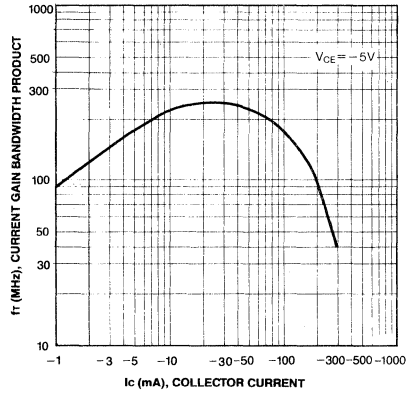
BASE-EMITTER ON VOLTAGE



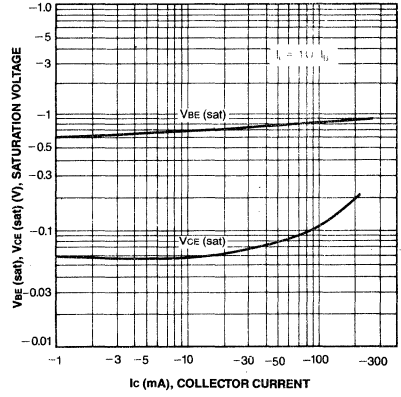
DC CURRENT GAIN



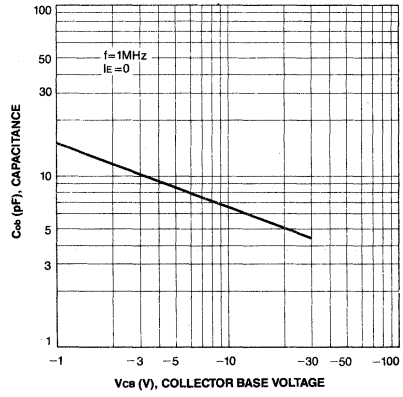
CURRENT GAIN BANDWIDTH PRODUCT



BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



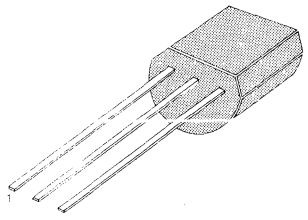
OUTPUT CAPACITANCE



GENERAL PURPOSE TRANSISTOR

- **Collector-Emitter Voltage: V_{CEO}=30V**
- **Collector Dissipation: P_C (max)=625mW**

TO-92



1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	50	V
Collector-Emitter Voltage	V_{CEO}	30	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	600	mA
Collector Dissipation	P_C	625	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

- Refer to 2N4400 for graphs

ELECTRICAL CHARACTERISTICS (T_a=25°C)

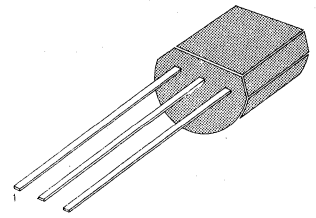
Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=100μA, I_E=0	50			V
*Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=10mA, I_B=0	30			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=100μA, I_C=0	5			V
Emitter Cut-off Current	I_{EBO}	V_{BE}=3V, I_C=0			100	nA
Collector Cut-off Current	I_{CBO}	V_{CB}=20V, I_E=0			100	nA
*DC Current Gain	h_{FE}	V_{CE}=2V, I_C=50mA				
:MPS3704			100		300	
:MPS3705			50		150	
*Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=100mA, I_B=5mA			0.6	V
Output Capacitance	C_{ob}	V_{CB}=10V, I_E=0 f=1MHz			12	pF
Current Gain Bandwidth Product	f_T	I_C=50mA, V_{CE}=2V f=200MHz	100			Mhz
*Base-Emitter On Voltage	V_{BE}(on)	I_C=100mA, V_{CE}=2V	0.5		1	V

*Pulse Test: Pulse Width=300μs, Duty Cycle=2%

GENERAL PURPOSE TRANSISTOR

- **Collector-Emitter Voltage: V_{CEO}=20V**
- **Collector Dissipation: P_C (max)=625mW**

TO-92



1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	40	V
Collector-Emitter Voltage	V_{CEO}	20	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	600	mA
Collector Dissipation	P_C	625	mW
Junction Temperature	T_J	150	°C
Storage Temperature	Tstg	−55~150	°C

- Refer to 2N4400 for graphs

ELECTRICAL CHARACTERISTICS (T_a=25°C)

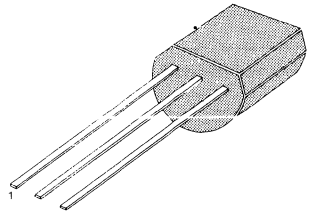
Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=100μA, I_E=0	40			V
*Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=10mA, I_B=0	20			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=100μA, I_C=0	5			V
Emitter Cut-off Current	I_{EBO}	V_{BE}=3V, I_C=0			100	nA
Collector Cut-off Current	I_{CBO}	V_{CB}=20V, I_E=0			100	nA
*DC Current Gain	h_{FE}	I_C=50mA, V_{CE}=2V	30		600	
* Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=100mA, I_B=5mA			1	V
Output Capacitance	Cob	V_{CB}=10V, I_E=0 f=1MHz			12	pF
Current Gain Bandwidth Product	f_T	I_C=50mA, V_{CE}=2V f=20MHz	100			MHz
* Base-Emitter On Voltage	V_{BE} (on)	I_C=100mA, V_{CE}=2V	0.5		1	V

* Pulse Test: Pulse Width=300μs, Duty Cycle=2%

AMPLIFIER TRANSISTOR

- **Collector-Emitter Voltage: V_{CEO} =60V**
- **Collector Dissipation: P_C (max)=625mW**

TO-92



1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a =25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−60	V
Collector-Emitter Voltage	V_{CEO}	−60	V
Collector-Emitter Voltage	V_{CES}	−60	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Dissipation	P_C	625	mW
Junction Temperature	T_j	150	°C
Storage Temperature	T_{stg}	−55~150	°C

ELECTRICAL CHARACTERISTICS (T_a =25°C)

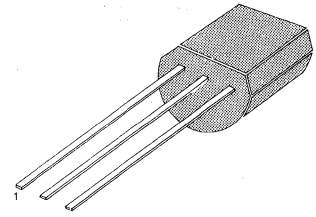
Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=−10μA, I_E=0	−60			V
*Collector-Emitter Sustaining Voltage	BV_{CEO}(sus)	I_C=−5mA, I_B=0	−60			V
Collector-Emitter Breakdown Voltage	BV_{CES}	I_C=−10μA, V_{BE}=0	−60			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=−10μA, I_C=0	−5			V
Collector Cut-off Current	I_{CBO}	V_{CB}=−40V, I_E=0			−10	nA
Emitter Cut-off Current	I_{EBO}	V_{BE}=−3V, I_C=0			−20	nA
DC Current Gain	h_{FE}	I_C=−100μA, V_{CE}=−5V	100		300	
		I_C=−1mA, V_{CE}=−5V	100			
		I_C=−10mA, V_{CE}=−5V	100			
*Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=−10mA, I_B=−0.5mA			−0.25	V
*Base-Emitter Saturation Voltage	V_{BE}(sat)	I_C=−10mA, I_B=−0.5mA			−0.9	V
Output Capacitance	C_{ob}	V_{CB}=−5V, I_E=0 f=1MHz			6	pF
Noise Figure	NF	I_C=−20μA, V_{CE}=−5V R_S=10KΩ, f=1KHz			3	dB
		I_C=−250μA, V_{CE}=−5V R_S=1KΩ, f=1KHz			3	dB

* Pulse Test: Pulse Width≤300μs, Duty Cycle≤2%

AMPLIFIER TRANSISTOR

- **Collector-Emitter Voltage: V_{CEO} =40V**
- **Collector Dissipation: P_C (max)=625mW**

TO-92



1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a =25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−40	V
Collector-Emitter Voltage	V_{CEO}	−40	V
Collector-Emitter Voltage	V_{CES}	−40	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Dissipation	P_C	625	mW
Junction Temperature	T_j	150	°C
Storage Temperature	T_{stg}	−55~150	°C

ELECTRICAL CHARACTERISTICS (T_a =25°C)

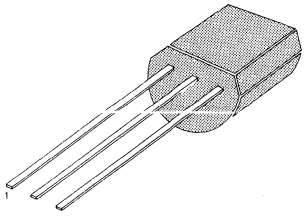
Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=−10μA, I_E=0	−40			V
*Collector-Emitter Sustaining Voltage	BV_{CEO}(sus)	I_C=−5mA, I_B=0	−40			V
Collector-Emitter Breakdown Voltage	BV_{CES}	I_C=−5mA, V_{BE}=0	−40			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=−10μA, I_C=0	−5			V
Collector Cut-off Current	I_{CBO}	V_{CB}=−50V, I_E=0			−10	nA
Emitter Cut-off Current	I_{EBO}	V_{BE}=−3V, I_C=0			−20	nA
DC Current Gain	h_{FE}	I_C=−100μA, V_{CE}=−5V	250		700	
		I_C=−1mA, V_{CE}=−5V	250			
		I_C=−10mA, V_{CE}=−5V	250			
*Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=−10mA, I_B=−0.5mA			−0.25	V
*Base-Emitter Saturation Voltage	V_{BE}(sat)	I_C=−10mA, I_B=−0.5mA			−0.9	V
Output Capacitance	C_{ob}	V_{CB}=−5V, I_E=0 f=1MHz			6	pF
Noise Figure	NF	I_C=−20μA, V_{CE}=−5V R_S=10KΩ, f=1KHz			2	dB
		I_C=−250μA, V_{CE}=−5V R_S=1KΩ, f=1KHz			2	dB

*Pulse Test: Pulse Width=300μs, Duty Cycle=2%

AMPLIFIER TRANSISTOR

- **Collector-Emitter Voltage: V_{CEO}=60V**
- **Collector Dissipation: P_C (max)=625mW**

TO-92



1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−60	V
Collector-Emitter Voltage	V_{CEO}	−60	V
Collector-Emitter Voltage	V_{CES}	−60	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Dissipation	P_C	625	mW
Junction Temperature	T_j	150	°C
Storage Temperature	T_{stg}	−55~150	°C

ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=−10μA, I_E=0	−60			V
*Collector-Emitter Sustaining Voltage	BV_{CEO}(sus)	I_C=−5mA, I_B=0	−60			V
Collector-Emitter Breakdown Voltage	BV_{CES}	I_C=−5mA, V_{BE}=0	−60			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=−10mA, I_C=0	−5			V
Collector Cut-off Current	I_{CBO}	V_{CB}=−40V, I_E=0			−10	nA
Emitter Cut-off Current	I_{EBO}	V_{BE}−3V, I_C=0			−20	nA
DC Current Gain	h_{FE}	I_C=−100μA, V_{CE}=−5V	250		700	
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=−10mA, I_B=−0.5mA			−0.25	V
*Base-Emitter Saturation Voltage	V_{BE}(sat)	I_C=−10mA, I_B=−0.5mA			−0.9	V
Output Capacitance	C_{ob}	V_{CB}=−5V, I_E=0 f=1MHz			6	pF
Noise Figure	NF	I_C=−20μA, V_{CE}=−5V R_S=10KΩ, f=1KHz			2	dB
		I_C=250μA, V_{CE}=−5V R_S=1KΩ, f=1KHz			2	dB

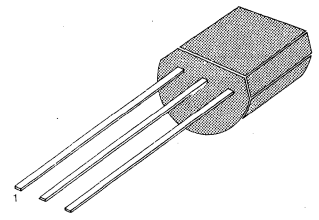
*Pulse Test: Pulse Width=300μS, Duty Cycle=2%

3

AMPLIFIER TRANSISTOR

- **Collector-Emitter Voltage: V_{CEO}=25V**
- **Collector Dissipation: P_C (max)=625mW**

TO-92



1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	25	V
Collector-Emitter Voltage	V_{CEO}	25	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	100	mA
Collector Dissipation	P_C	625	mW
Junction Temperature	T_J	150	°C
Storage Temperature	Tstg	−55~150	°C

- Refer to MPSA10 for graphs

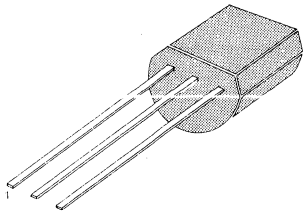
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=10mA, I_B=0	25			V
Collector Cut-off Current	I_{CBO}	V_{CB}=25V, I_E=0			100	nA
Collector Cut-off Current	I_{CES}	V_{CE}=25V, V_{BE}=0			100	nA
Emitter Cut-off Current	I_{EBO}	V_{BE}=5V, I_C=0			100	nA
*DC Current Gain	h_{FE}	I_C=10mA, V_{CE}=10V	100		500	
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=10mA, I_B=1mA			0.25	V
Base-Emitter Saturation Voltage	V_{BE} (sat)	I_C=10mA, I_B=1mA		0.75		V
Current Gain Bandwidth Product	f_T	I_C=2mA, V_{CE}=5V		120		MHz
Base Emitter On Voltage	V_{BE} (on)	I_C=10mA, V_{CE}=10V	0.5		1.2	V

* Pulse Test: Pulse Width= 300μs, Duty Cycle=2%

HIGH FREQUENCY TRANSISTOR

TO-92



1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector Base Voltage	V_{CBO}	20	V
Collector-Emitter Voltage	V_{CEO}	12	V
Emitter-Base Voltage	V_{EBO}	2.5	V
Collector Current	I_C	50	mA
Collector Dissipation (T_a=25°C)	P_C	200	mW
Derate above 25°C		1.14	mW/°C
Collector Dissipation (T_c=25°C)	P_C	300	mW
Derate above 25°C		1.71	mW/°C
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55∼150	°C

ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Max	Unit
Collector Emitter Sustaining Voltage	V_{CEO} (sus)	I_C=3mA, I_B=0	12		V
Collector Base Breakdown Voltage	BV_{CBO}	I_C=0.001mA, I_E=0	20		V
Emitter Base Breakdown Voltage	BV_{EBO}	I_E=0.01mA, I_C=0	2.5		V
Collector Cutoff Current	I_{CBO}	V_{CB}=15V, I_E=0		0.02	μA
		V_{CB}=15V, I_E=0, T_a=150°C		1	μA
DC Current Gain	h_{FE}	V_{CE}=1V, I_C=3mA	25	250	
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=10mA, I_B=1mA		0.4	V
Base-Emitter Saturation Voltage	V_{BE} (sat)	I_C=10mA, I_B=1mA		1	V
Current Gain Bandwidth Product	f_T	V_{CE}=6V, I_C=5mA, f=100MHz	900	2000	MHz
Collector Base Capacitance	Ccb	V_{CB}=10V, I_E=0, f=0.1 to 1MHz		1	pF
Small Signal Current Gain	hfe	V_{CE}=6V, I_C=2mA, f=1KHz	25	300	
Collector Base Time Constant	Cc·rbb	V_{CB}=6V, I_E=2mA, f=31.9MHz	3	14	ps
Noise Figure	NF	V_{CE}=6V, I_C=1.5mA, f=200MHz Rs=50Ω		4.5	dB
Common Emitter Amplifier Power Gain	Gpe	V_{CE}=6V, I_C=5mA, f=200MHz	15		dB

AMPLIFIER TRANSISTOR

- **Collector-Emitter Voltage: V_{CEO}=30V**
- **Collector Dissipation: P_C (max)=625mW**

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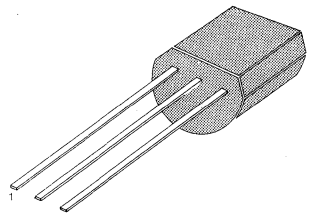

1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Emitter Voltage	V_{CEO}	30	V
Collector-Base Voltage	V_{CBO}	40	V
Emitter-Base Voltage	V_{EBO}	4	V
Collector Current	I_C	100	mA
Collector Dissipation	P_C	625	mW
Junction Temperature	T_J	150	°C
Storage Temperature	Tstg	−55 ~ 150	°C

• Refer to 2N3904 for graphs

ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=500μA, I_B=0	30			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=10μA, I_C=0	4			V
Collector Cut-off Current	I_{CBO}	V_{CB}=30V, I_E=0			50	nA
DC Current Gain	h_{FE}	I_C=2mA, V_{CE}=10V	90		180	
		*I_C=100mA, V_{CE}=10V	60			
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=50mA, I_B=5mA			0.5	V
Output Capacitance	Cob	V_{CB}=10V, I_E=0 f=100KHz			3.5	pF

*Pulse Test: Pulse Width=300μs, Duty Cycle=2%

AMPLIFIER TRANSISTOR

- **Collector-Emitter Voltage: V_{CEO} = 40V**
- **Collector Dissipation: P_C (max) = 625mW**

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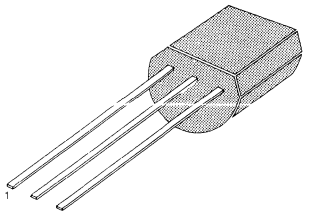

1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a = 25°C)

Characteristic	Symbol	Rating	Unit
Collector-Emitter Voltage	V_{CEO}	−40	V
Collector-Base Voltage	V_{CBO}	−40	V
Emitter-Base Voltage	V_{EBO}	−4	V
Collector Current	I_C	−100	mA
Collector Dissipation	P_C	625	mW
Junction Temperature	T_j	150	°C
Storage Temperature	Tstg	−55 ~ 150	°C

- Refer to 2N3906 for graphs

ELECTRICAL CHARACTERISTICS (T_a = 25°C)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C = −500μA, I_B = 0	−40			V
Emitter-Base Brekdown Voltage	BV_{EBO}	I_E = −10μA, I_C = 0	−4			V
Collector Cut-off Current	I_{EBO}	V_{CB} = −30V, I_E = 0			−50	nA
DC Current Gain	h_{FE}	I_C = −2mA, V_{CE} = −10V	90		180	
		*I_C = −100mA, V_{CE} = −10V	60			
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C = −50mA, I_B = −5mA			0.5	V
Output Capacitanc	C_{ob}	V_{CB} = −10V, I_E = 0 f = 100KHz			3.5	pF

*Pulse Test: Pulse Width = 300μs, Duty Cycle = 2%

AMPLIFIER TRANSISTOR

- **Collector-Emitter Voltage: V_{CEO}=25V**
- **Collector Dissipation: P_C (max)=625mW**

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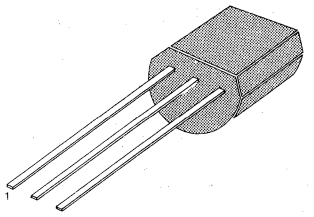

1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	40	V
Collector-Emitter Voltage	V_{CEO}	25	V
Emitter-Base Voltage	V_{EBO}	4	V
Collector Current	I_C	100	mA
Collector Dissipation	P_C	625	mW
Junction Temperature	T_j	150	°C
Storage Temperature	Tstg	−55~150	°C

* Refer to 2N3904 for graphs

ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=0.5mA, I_B=0	25			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=10μA, I_C=0	4			V
Collector Cut-off Current	I_{CBO}	V_{CB}=30V, I_E=0			50	nA
		V_{CB}=20V, I_E=0			50	nA
DC Current Gaim	h_{FE}					
:MPS6520		I_C=100μA, V_{CE}=10V	100			
:MPS6521			150			
:MPS6520		I_C=2mA, V_{CE}=10V	200		400	
:MPS6521			300		600	
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=50mA, I_B=5mA			0.5	V
Output Capacitance	C_{ob}	V_{CB}=10V, I_E=0 f=100KHz			3.5	pF
Noise Figure	NF	I_C=10μA, V_{CE}=5V R_S=10KΩ f=10Hz to 10KHz			3	dB

AMPLIFIER TRANSISTOR

- **Collector-Emitter Voltage: V_{CEO}=25V**
- **Collector Dissipation: P_C (max)=625mW**

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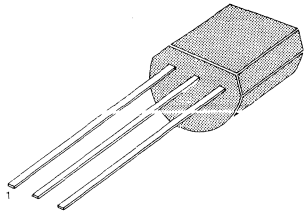


1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−25	V
Collector-Emitter Voltage	V_{CEO}	−25	V
Emitter-Base Voltage	V_{EBO}	−4	V
Collector Current	I_C	−100	mA
Collector Dissipation	P_C	625	mW
Junction Temperature	T_J	150	°C
Storage Temperature	Tstg	−55~150	°C

* Refer to 2N3906 for graphs

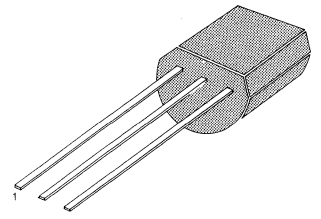
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=−0.5mA, I_B=0	−25			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=−10μA, I_C=0	−4			V
Collector Cut-off Current	I_{CBO}	V_{CB}=−30V, I_E=0			−50	nA
		V_{CB}=−20V, I_E=0			−50	nA
DC Current Gain	h_{FE}					
:MPS6522		I_C=−100mA, V_{CE}=−10V	100			
:MPS6523			150			
:MPS6522		I_C=−2mA, V_{CE}=−10V	200		400	
:MPS6523			300		600	
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=−50mA, I_B=−5mA			−0.5	V
Output Capacitance	C_{ob}	V_{CB}=−10V, I_E=0, f=100KHz			3.5	pF
Noise Figure	NF	I_C=−10μA, V_{CE}=−5V			3	dB
		R_S=10KΩ				
		f=10Hz to 10KHz				

AUDIO TRANSISTOR

- **Collector-Emitter Voltage: V_{CEO} =25V**
- **Collector Dissipation: P_C (max)=625mW**

TO-92



1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a =25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	25	V
Collector-Emitter Voltage	V_{CEO}	25	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	500	mA
Collector Dissipation	P_C	625	mW
Junction Temperature	T_j	150	°C
Storage Temperature	Tstg	−55 ~ 150	°C

ELECTRICAL CHARACTERISTICS (T_a =25°C)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
*Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C =10mA, I_B =0	25			V
Collector-Base Breakdown Voltage	BV_{CBO}	I_C =100μA, I_E =0	25			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E =100μA, I_C =0	5			V
Collector Cut-off Current	I_{CEO}	V_{CE} =25V, I_B =0			100	nA
Collector Cut-off Current	I_{CBO}	V_{CB} =20V, I_E =0			100	nA
Emitter Cut-off Current	I_{EBO}	V_{EB} =4V, I_C =0			100	nA
*DC Durrent Gain	h_{FE}	I_C = 10mA, V_{CE} = 1V	35			
		I_C =100mA, V_{CE} =1V	50			
		I_C =500mA, V_{CE} =1V	50		200	
*Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C =500mA, I_B =50mA			0.5	V
Current Gain Bandwidth Product	f_T	I_C =10mA, V_{CE} =10V f=30MHz	60			MHz
*Base-Emitter On Voltage	V_{BE} (on)	I_C =500mA, V_{CE} =1V			1.2	V
Output Capacitance	Cob	V_{CB} =10V, I_E =0 f=100KHz			30	pF

* Pulse Test: Pulse Width = 300μs, Duty Cycle = 2%

AUDIO TRANSISTOR

- **Collector-Emitter Voltage: V_{CEO} =25V**
- **Collector Dissipation: P_C (max)=625mW**
- **Complement to MPS6560**

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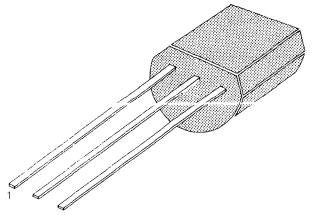


1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a =25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−25	V
Collector-Emitter Voltage	V_{CEO}	−25	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current	I_C	−500	mA
Collector Dissipation	P_C	625	mW
Junction Temperature	T_j	150	°C
Storage Temperature	Tstg	−55~150	°C

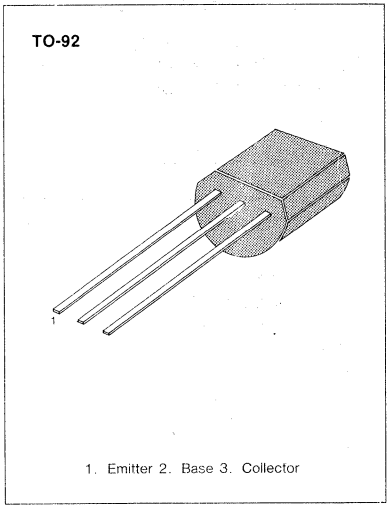
ELECTRICAL CHARACTERISTICS (T_a =25°C)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
*Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=−10mA, I_B=0	−25			V
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=−100μA, I_E=0	−25			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=−100μA, I_C=0	−5			V
Collector Cut-off Current	I_{CEO}	V_{CE}=−25V, I_B=0			−100	nA
Collector Cut-off Current	I_{CBO}	V_{EB}=−20V, I_C=0			−100	nA
Emitter Cut-off Current	I_{EBO}	V_{EB}=−4V, I_C=0			−100	nA
*DC Durrent Gain	h_{FE}	I_C=−10mA, V_{CE}=−1V	35			
		I_C=−100mA, V_{CE}=−1V	50			
		I_C=−500mA, V_{CE}=−1V	50		200	
*Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=−500mA, I_B=−50mA			−0.5	V
Current Gain Bandwidth Product	f_T	I_C=−10mA, V_{CE}=−10V f=30MHz	60			MHz
*Base-Emitter On Voltage	V_{BE}(on)	I_C=−500mA, V_{CE}=−1V			−1.2	V
Output Capacitance	C_{ob}	V_{CB}=−10V, I_E=0 f=100KHz			30	pF

* Pulse Test: Width = 300μs, Duty Cycle = 2%

AMPLIFIER TRANSISTOR

- **Collector-Emitter Voltage: V_{CEO} = MPS6601: 25V**
  MPS6602: 40V
- **Collector Dissipation: P_C (max)=625mW**



1. Emitter 2. Base 3. Collector

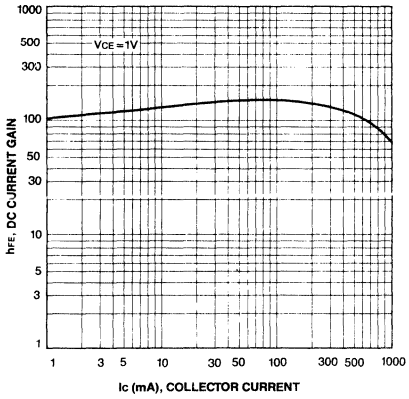
ABSOLUTE MAXIMUM RATINGS (T_a =25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}		
:MPS6601		25	V
MPS6602		40	V
Collector-Emitter Voltage	V_{CEO}		
:MPS6601		25	V
MPS6602		40	V
Emitter-Base Voltage	V_{EBO}	4	V
Collector Current	I_C	1,000	mA
Collector Dissipation	P_C	625	mW
Junction Temperature	T_J	150	°C
Storage Temperature	T_{STG}	−55~150	°C

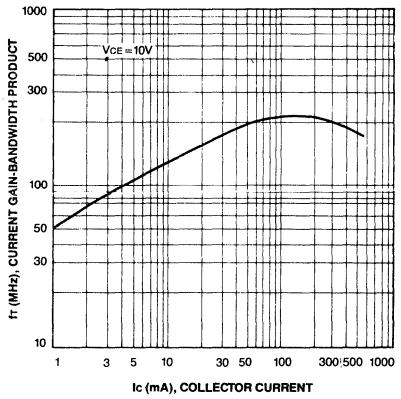
ELECTRICAL CHARACTERISTICS (T_a =25°C)

Characteristic	Symbol	Test Conditions	Min	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=100μA, I_E=0			
:MPS6601			25		V
MPS6602			40		V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=1mA, I_B=0			
:MPS6601			25		V
MPS6602			40		V
Collector Cut-off Current	I_{CBO}				
:MPS6601		V_{CB}=25V, I_E=0		100	nA
MPS6602		V_{CB}=30V, I_E=0		100	nA
Collector Cut-off Current	I_{EBO}				
:MPS6601		V_{CB}=25V, I_E=0		100	nA
MPS6602		V_{CB}=30V, I_E=0		100	nA
DC Current Gain	h_{FE}	V_{CE}=1V, I_C=100mA	50		
		V_{CE}=5V, I_C=500mA	50		
		V_{CE}=5V, I_C=1000mA	30		
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=1000mA, I_B=100mA		0.6	V
Current Gain Bandwidth Product	f_T	V_{CE}=10V, I_C=50mA f=30MHz	100		MHz
Output Capacitance	C_{OB}	V_{CB}=10V, I_E=0 f=100KHz		30	pF

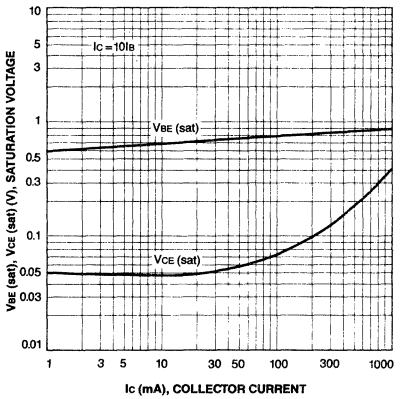
DC CURRENT GAIN



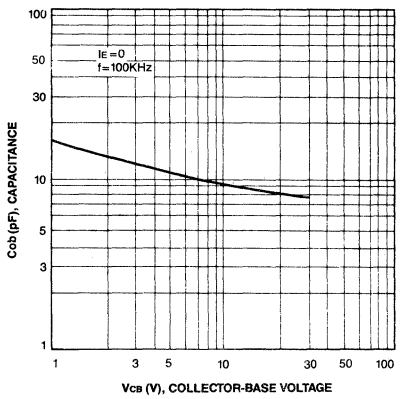
CURRENT GAIN-BANDWIDTH PRODUCT



BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



OUTPUT CAPACITANCE



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AMPLIFIER TRANSISTOR

- **Collector-Emitter Voltage: V_{CEO} =25V**
- **Collector Dissipation: P_C (max)=625mW**

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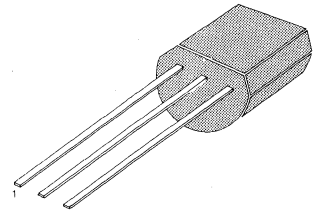


1. Emitter 2. Base 3. Collector

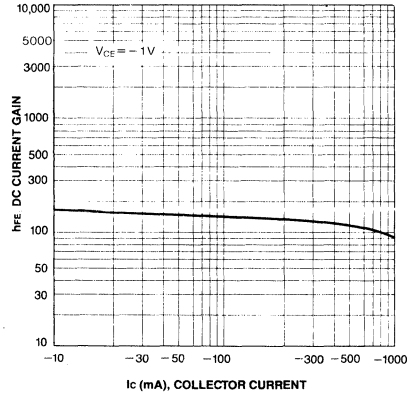
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Emitter Voltage	V_{CEO}	−25	V
Collector-Base Voltage	V_{CBO}	−25	V
Emitter-Base Voltage	V_{EBO}	−4	V
Collector Current	I_C	−1	A
Collector Dissipation	P_C	625	mW
Junction Temperature	T_j	150	°C
Storage Temperature	Tstg	−55~150	°C

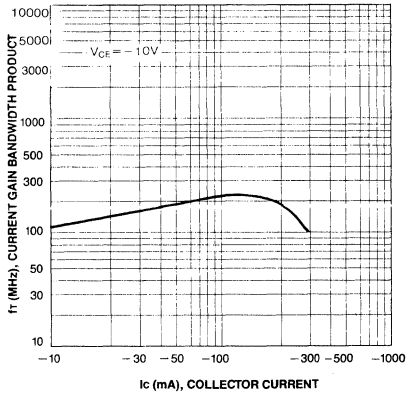
ELECTRICAL CHARACTERISTICS (T_a =25°C)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=−1mA, I_B=0	−25			V
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=−100μA, I_E=0	−25			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=−10μA, I_C=0	−4			V
Collector Cut-off Current	I_{CBO}	V_{CB}=−25V, I_E=0			−100	nA
Collector Cut-off Current	I_{CEO}	V_{CE}=−25V, I_B=0			−100	nA
DC Current Gain	h_{FE}	I_C=−100mA, V_{CE}=−1V	50			
		I_C=−500mA, V_{CE}=−1V	50			
		I_C=−1A, V_{CE}=−1V	30			
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=−1A, I_B=−100mA			−0.6	V
Output Capactiance	C_{ob}	V_{CB}=−10V, I_E=0 f=100KHz			30	pF
Base-Emitter On Voltage	V_{BE}(on)	I_C=−500mA, V_{CE}=−1V			−1.2	V
Current Gain Bandwidth Product	f_T	I_C=−50mA, V_{CE}=−10V f=30MHz	100			MHz
Turn On Time	ton	V_{CC}=−40V, I_C=−500mA I_{B1}=−50mA			55	ns
Turn Off Time	toff	V_{CC}=−40V, I_C=−500mA I_{B1}=50mA			300	ns

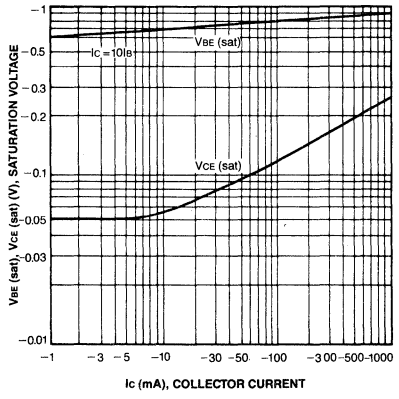
DC CURRENT GAIN



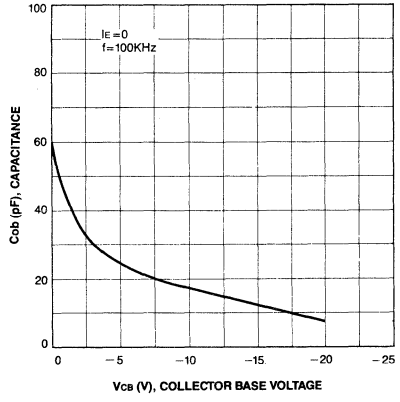
CURRENT GAIN BANDWIDTH PRODUCT



COLLECTOR-EMITTER SATURATION VOLTAGE
BASE-EMITTER SATURATION VOLTAGE



OUTPUT CAPACITANCE

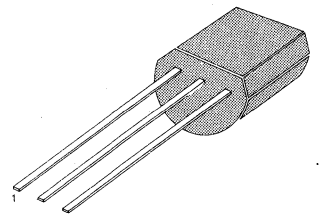


3

AMPLIFIER TRANSISTOR

- **Collector-Emitter Voltage: V_{CEO} = 40V**
- **Collector Dissipation: P_C (max) = 625mW**

TO-92



1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a = 25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	60	V
Collector-Emitter Voltage	V_{CEO}	40	V
Emitter-Base Voltage	V_{EBO}	6	V
Collector Current	I_C	200	mA
Collector Dissipation	P_C	625	mW
Junction Temperature	T_j	150	°C
Storage Temperature	Tstg	−55 ~ 150	°C

* Refer to 2N5088 for graphs

ELECTRICAL CHARACTERISTICS (T_a = 25°C)

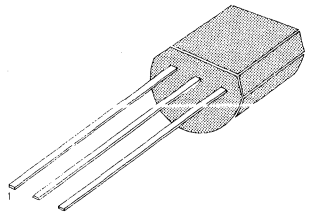
Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
*Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C = 10mA, I_B = 0	40			V
Collector Cut-off Current	I_{CBO}	V_{CB} = 40V, I_E = 0			30	nA
		V_{CB} = 60V, I_E = 0			10	μA
Emitter Cut-off Current	I_{EBO}	V_{BE} = 6V, I_C = 0			20	nA
*DC Current Gain	h_{FE}	I_C = 100μA, V_{CE} = 5V	250		700	
Output Capacitance	Cob	V_{CB} = 5V, I_E = 0 f=1MHz	1		4	pF
*Base-Emitter On Voltage	V_{BE} (on)	I_C = 100μA, V_{CE} = 5V	0.45		0.65	V
Noise Figure	NF	I_C = 100μA, V_{CE} = 5V R_S = 10KΩ, f=10Hz			2	dB

* Pulse Test: Pulse Width = 300μs, Duty Cycle = 2%

AMPLIFIER TRANSISTOR

- **Collector-Emitter Voltage: V_{CEO} = MPS8098: 60V**
  MPS8099: 80V
- **Collector Dissipation: P_C (max)=625mW**

TO-92



1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}		
:MPS8098		60	V
MPS8099		80	V
Collector-Emitter Voltage	V_{CEO}		
:MPS8098		60	V
MPS8099		80	V
Emitter-Base Voltage	V_{EBO}	6	V
Collector Current	I_C	500	mA
Collector Dissipation	P_C	625	mW
Junction Temperature	T_J	150	°C
Storage Temperature	T_{STG}	−55~150	°C

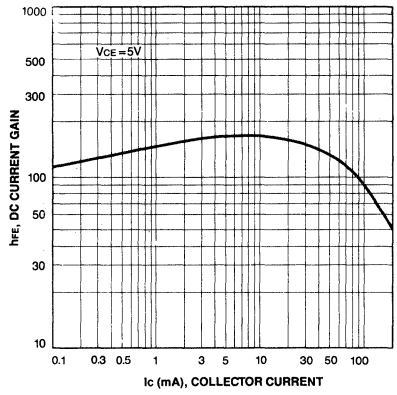
3

ELECTRICAL CHARACTERISTICS (T_a=25°C)

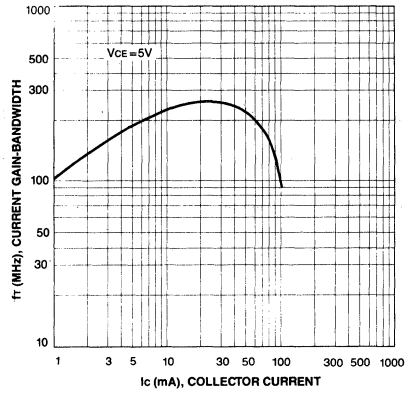
Characteristic	Symbol	Test Conditions	Min	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=100μA, I_E=0			
:MPS8098			60		V
MPS8099			80		V
*Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=10mA, I_B=0			
:MPS8098			60		V
MPS8099			80		V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=10μA, I_C=0	6		V
Collector Cut-off Current	I_{CBO}				
:MPS8098		V_{CB}=60V, I_E=0		100	nA
MPS8099		V_{CB}=80V, I_E=0		100	nA
Collector Cut-off Current	I_{CEO}	V_{CE}=60V, I_B=0		100	nA
Emitter Cut-off Current	I_{EBO}	V_{EB}=6V, I_C=0		100	nA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=1mA	100	300	
		V_{CE}=5V, I_C=10mA	100		
		V_{CE}=5V, I_C=100mA	75		
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=100mA, I_B=5mA		0.4	V
		I_C=100mA, I_B=10mA		0.3	V
*Base-Emitter On Voltage	V_{BE} (on)				
:MPS8098		V_{CE}=5V, I_C=1mA	0.5	0.7	V
MPS8099		V_{CE}=5V, I_C=10mA	0.6	0.8	V
Current Gain Bandwidth Product	f_T	V_{CE}=5V, I_C=10mA f=100MHz	150		MHz
Output Capacitance	C_{OB}	V_{CB}=5V, I_E=0 f=1MHz		6	pF

*Pulse Test: PW=300μs, Duty Cycle=2%

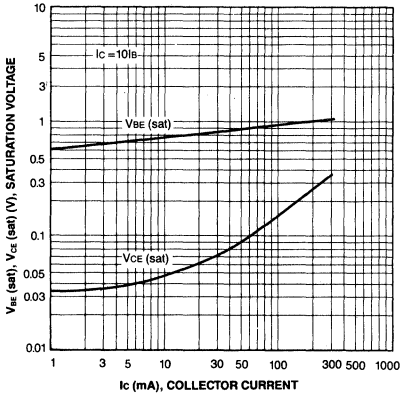
DC CURRENT GAIN



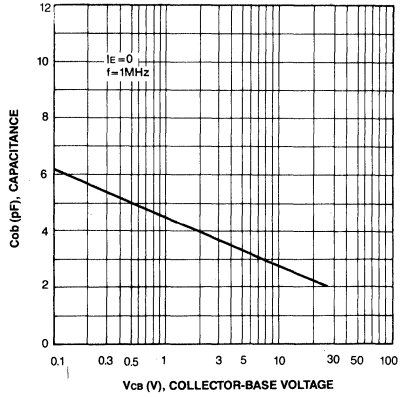
CURRENT GAIN-BANDWIDTH PRODUCT



COLLECTOR-EMITTER SATURATION VOLTAGE
BASE-EMITTER SATURATION VOLTAGE

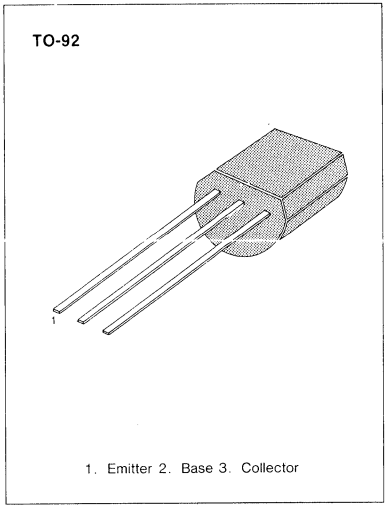


OUTPUT CAPACITANCE



AMPLIFIER TRANSISTOR

- **Collector-Emitter Voltage:** V_{CEO}=MPS8598: 60V
  MPS8599: 80V
- **Collector Dissipation: P_C (max)=625mW**



ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

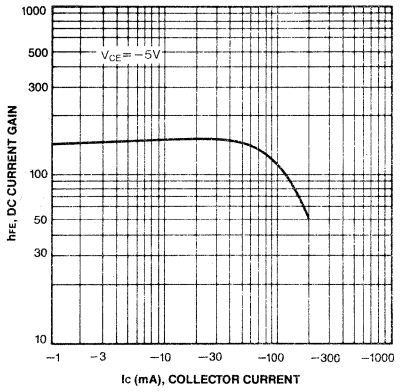
Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}		
:MPS8598		−60	V
MPS8599		−80	V
Collector-Emitter Voltage	V_{CEO}		
:MPS8598		−60	V
MPS8599		−80	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current	I_C	−500	mA
Collector Dissipation	P_C	625	mW
Junction Temperature	T_J	150	°C
Storage Temeprature	T_{STG}	−55∼150	°C

ELECTRICAL CHARACTERISTICS (T_a=25°C)

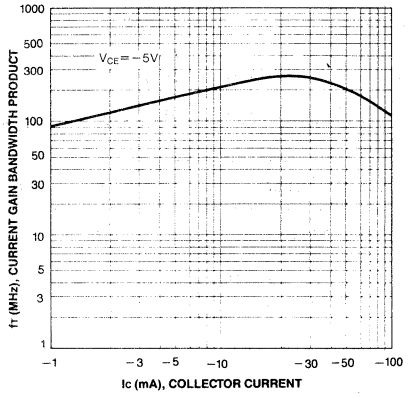
Characteristic	Symbol	Test Conditions	Min	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=−100μA, I_E=0			
:MPS8598			−60		V
MPS8599			−80		V
*Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=−10mA, I_B=0			
:MPS8598			−60		V
MPS8599			−80		V
Emitter-Base Breakdown Voltage	BE_{EBO}	I_E=−10μA, I_C=0	−5		V
Collector Cut-off Current	I_{CBO}				
:MPS8598		V_{CB}=−60V, I_E=0		−100	nA
MPS8599		V_{CB}=−80V, I_E=0		−100	nA
Collector Cut-off Current	I_{CEO}	V_{CE}=−60V, I_B=0		−100	nA
Emitter Cut-off Current	I_{EBO}	V_{EB}=−4V, I_C=0		−100	nA
*DC Current Gain	h_{FE}	V_{CE}=−5V, I_C=−1mA	100	300	
		V_{CE}=−5V, I_C=−10mA	100		
		V_{CE}=−5V, I_C=−100mA	75		
*Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=−100mA, I_B=−5mA		−0.4	V
		I_C=−100mA, I_B=−10mA		−0.3	V
*Base-Emitter On Voltage	V_{BE} (on)				
:MPS8598		V_{CE}=−5V, I_C=−1mA	−0.5	−0.7	V
MPS8599		V_{CE}=−5V, I_C=−10mA	−0.6	−0.8	V
Current Gain Bandwidth Product	f_T	V_{CE}=−5v, I_C=−10mA f=100MHz	150		MHz
Output Capacitance	C_{OB}	V_{CB}=−5V, I_E=0 f=1MHz		8	pF

*Pulse Test: PW=300μs, Duty Cycle=2%

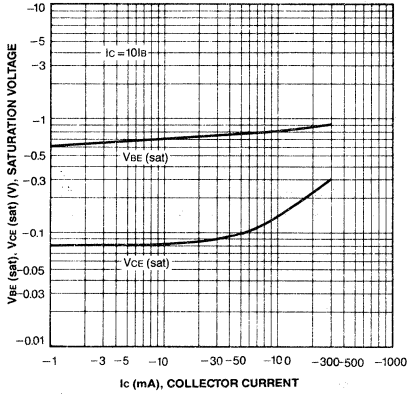
DC CURRENT GAIN



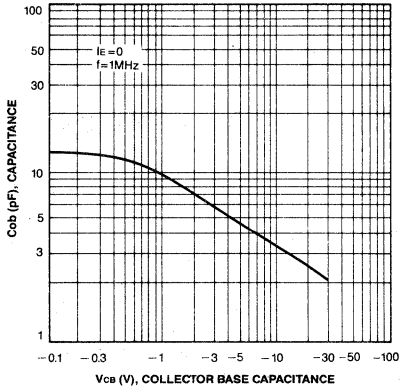
CURRENT GAIN BANDWIDTH PRODUCT



COLLECTOR EMITTER SATURATION VOLTAGE
BASE-EMITTER SATURATION VOLTAGE



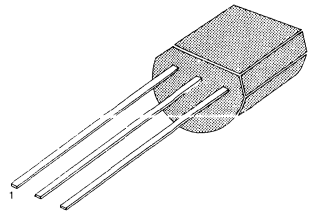
OUTPUT CAPACITANCE



AMPLIFIER TRANSISTOR

- **Collector-Emitter Voltage: V_{CEO} = MPSA05: 60V**
  MPSA06: 80V
- **Collector Dissipation: P_C (max)=625mW**

TO-92



1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}		
:MPSA05		60	V
MPSA06		80	V
Collector-Emitter Voltage	V_{CEO}		
:MPSA05		60	V
MPSA06		80	V
Emitter-Base Voltage	V_{EBO}	4	V
Collector Current	I_C	500	mA
Collector Dissipation	P_C	625	mW
Junction Temperature	T_J	150	°C
Storage Temperature	T_{STG}	−55∼150	°C

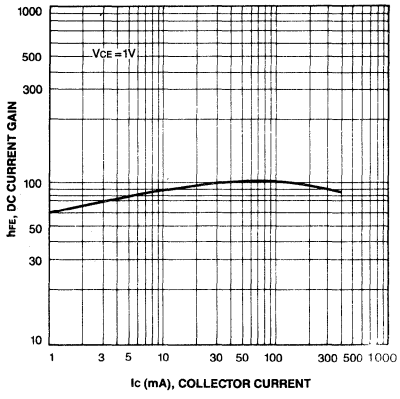
3

ELECTRICAL CHARACTERISTICS (T_a=25°C)

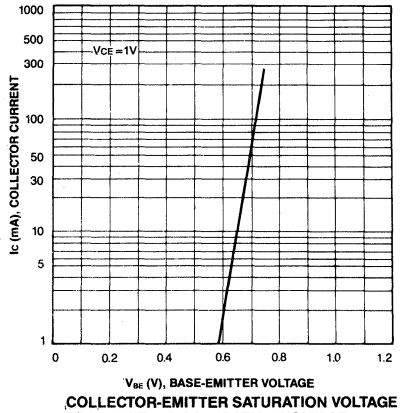
Characteristic	Symbol	Test Conditions	Min	Max	Unit
*Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=1mA, I_B=0			
:MPSA05			60		V
MPSA06			80		
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=100μA, I_C=0	4		V
Collector Cut-off Current	I_{CBO}				
:MPSA05		V_{CB}=60V, I_E=0		0.1	μA
MPSA06		V_{CB}=80V, I_E=0		0.1	μA
Collector Cut-off Current	I_{CEO}	V_{CE}=60V, I_B=0		0.1	μA
DC Current Gain	h_{FE}	V_{CE}=1V, I_C=10mA	50		
		V_{CE}=1V, I_C=100mA	50		
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=100mA, I_B=10mA		0.25	V
Base-Emitter On Voltage	V_{BE} (on)	V_{CE}=1V, I_C=100mA		1.2	V
Current Gain Bandwidth Product	f_T	V_{CE}=2V, I_C=10mA f=100MHz	100		MHz

*Pulse Test: PW=300μs, Duty Cycle=2%

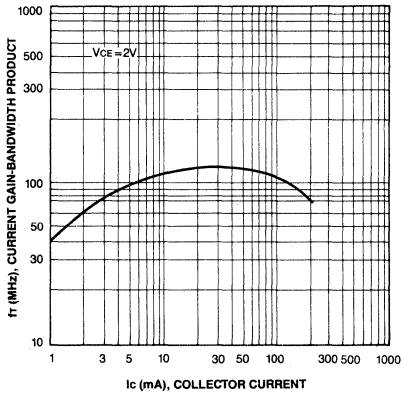
DC CURRENT GAIN



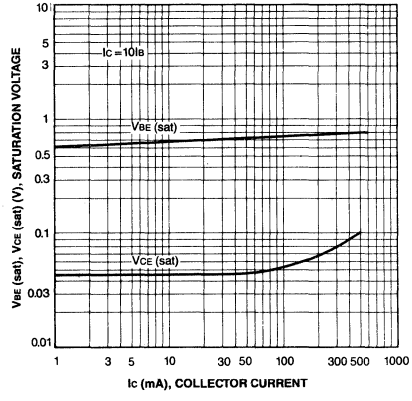
BASE-EMITTER ON VOLTAGE



CURRENT GAIN-BANDWIDTH PRODUCT



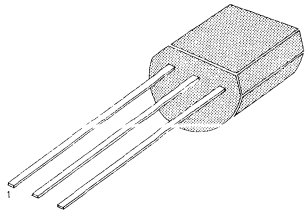
COLLECTOR-EMITTER SATURATION VOLTAGE
BASE-EMITTER SATURATION VOLTAGE



AMPLIFIER TRANSISTOR

- **Collector-Emitter Voltage: V_{CEO} = 40V**
- **Collector Dissipation: P_C (max) = 625mW**

TO-92



1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a = 25°C)

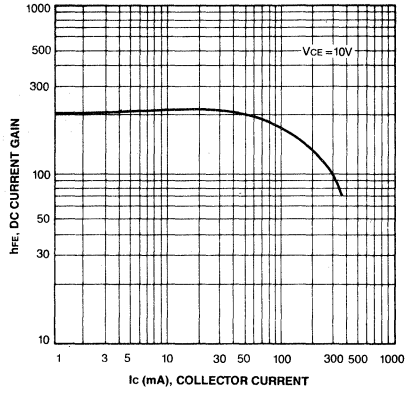
Characteristic	Symbol	Rating	Unit
Collector-Emitter Voltage	V_{CEO}	40	V
Emitter-Base Voltage	V_{EBO}	4	V
Collector Current	I_C	100	mA
Collector Dissipation	P_C	625	mW
Junction Temperature	T_J	150	°C
Storage Temperature	Tstg	−55 ~ 150	°C

ELECTRICAL CHARACTERISTICS (T_a = 25°C)

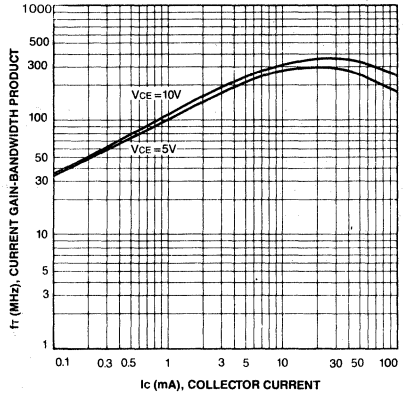
Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C = 1mA, I_B = 0	40			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E = 100μA, I_C = 0	4			V
Collector Cut-off Current	I_{CBO}	V_{CB} = 30V, I_E = 0			100	nA
DC Current Gain	h_{FE}	I_C = 5mA, V_{CE} = 10V	40		400	
Current Gain Bandwidth Product	f_T	I_C = 5mA, V_{CE} = 10V f = 100MHz	125			MHz
Output Capacitance	Cob	V_{CB} = 10V, I_E = 0 f = 100KHz			4	pF

3

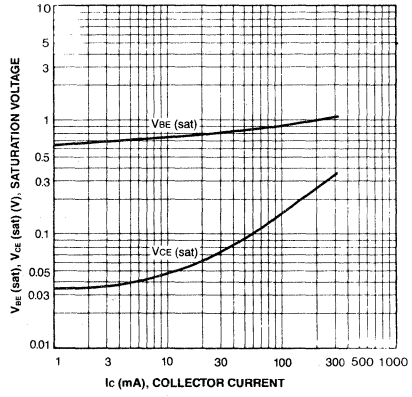
DC CURRENT GAIN



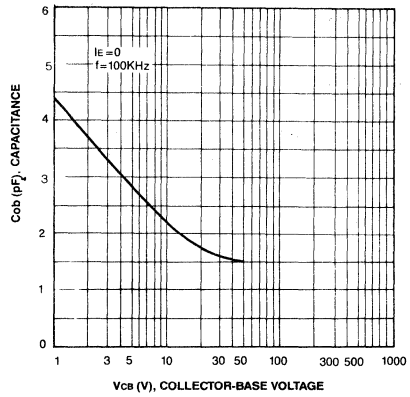
CURRENT GAIN-BANDWIDTH



COLLECTOR-EMITTER SATURATION VOLTAGE
BASE-EMITTER SATURATION VOLTAGE



OUTPUT CAPACITANCE

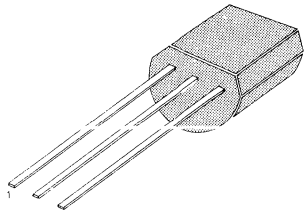


NPN EPITAXIAL SILICON DARLINGTON TRANSISTOR

DARLINGTON TRANSISTOR

- **Collector-Emitter Voltage: V_{CES}=20V**
- **Collector Dissipation: P_C (max)=625mW**

TO-92



1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Emitter Voltage	V_{CES}	20	V
Emitter-Base Voltage	V_{EBO}	10	V
Collector Dissipation	P_C	625	mW
Junction Temperature	T_j	150	°C
Storage Temperature	Tstg	−55~150	°C

- Refer to 2N6427 for graphs

ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Emitter Breakdown Voltage	BV_{CES}	I_C=100μA, I_B=0	20			V
Collector Cut-off Current	I_{CBO}	V_{CB}=15V, I_E=0			100	nA
Collector Cut-off Current	I_{CES}	V_{CE}=15V, I_B=0			100	nA
Emitter Cutoff Current	I_{EBO}	V_{BE}=10V, I_C=0			100	nA
DC Current Gain	h_{FE}	I_C=10mA, V_{CE}=5V	20K			
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=10mA, I_B=0.01mA			1	V
Base-Emitter On Voltage	V_{BE} (on)	I_C=10mA, V_{CE}=5V			1.4	V

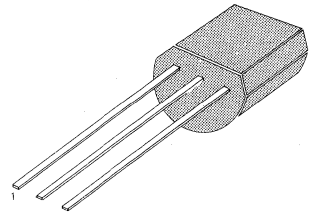
MPSA13/14

NPN EPITAXIAL SILICON DARLINGTON TRANSISTOR

DARLINGTON TRANSISTOR

- **Collector-Emitter Voltage: V_{CES}=30V**
- **Collector Dissipation: P_C (max)=625mW**

TO-92



1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	30	V
Collector-Emitter Voltage	V_{CES}	30	V
Emitter-Base Voltage	V_{EBO}	10	V
Collector Current	I_C	500	mA
Collector Dissipation	P_C	625	mW
Junction Temperature	T_j	150	°C
Storage Temperature	Tstg	−55~150	°C

- Refer to 2N6427 for graphs

ELECTRICAL CHARACTERISTICS (T_a=25°C)

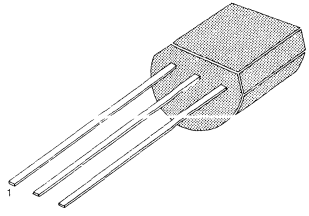
Characteristic	Symbol	Test Conditions	Min	Max	Unit
Collector-Emitter Breakdown Voltage	BV_{CES}	I_C=100μA, I_B=0	30		V
Collector Cut-off Current	I_{CBO}	V_{CB}=30V, I_E=0		100	nA
Emitter Cut-off Current	I_{EBO}	V_{BE}=10V, I_C=0		100	nA
*DC Current Gain	h_{FE}				
:MPSA13		V_{CE}=5V, I_C=10mA	5,000		
MPSA14			10,000		
MPSA13		V_{CE}=5V, I_C=100mA	10,000		
MPSA14			20,000		
*Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=100mA, I_B=0.1mA		1.5	V
*Base-Emitter On Voltage	V_{BE} (on)	V_{CE}=5V, I_C=100mA		2.0	V
Current Gain Bandwidth Product	f_T	V_{CE}=5V, I_C=10mA f=100MHz	125		MHz

*Pulse Test: Pulse Width=300μs, Duty Cycle=2%

AMPLIFIER TRANSISTOR

- **Collector-Emitter Voltage: V_{CEO} = 40V**
- **Collector Dissipation: P_C (max) = 625mW**

TO-92



1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a = 25°C)

Characteristic	Symbol	Rating	Unit
Collector-Emitter Voltage	V_{CEO}	40	V
Emitter-Base Voltage	V_{EBO}	4	V
Collector Current	I_C	100	mA
Collector Dissipation	P_C	625	mW
Junction Temperature	T_J	150	°C
Storage Temperature	Tstg	−55 ~ 150	°C

- Refer to MPSA10 for graphs

ELECTRICAL CHARACTERISTICS (T_a = 25°C)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
*Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C = 1mA, I_B = 0	40			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E = 100μA, I_C = 0	4			V
Collector Cut-off Current	I_{CBO}	V_{CB} = 30V, I_E = 0			100	nA
*DC Current Gain	h_{FE}	I_C = 5mA, V_{CE} = 10V	40		400	
*Current Gain Bandwidth Product	f_T	I_C = 5mA, V_{CE} = 10V f = 100MHz	125			MHz
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C = 10mA, I_B = 1mA			0.25	V
Output Capacitance	Cob	V_{CB} = 10V, I_E = 0 f = 100KHz			4	pF

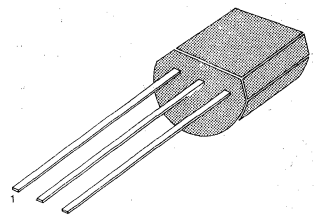
* Pulse Test: Pulse Width = 300μs, Duty Cycle = 2%

NPN EPITAXIAL SILICON DARLINGTON TRANSISTOR

DARLINGTON TRANSISTOR

- **Collector-Emitter Voltage: V_{CES} = MPSA25: 40V**
  MPSA26: 50V
  MPSA27: 60V
- **Collector Dissipation: P_C (max)=625mW**

TO-92



1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

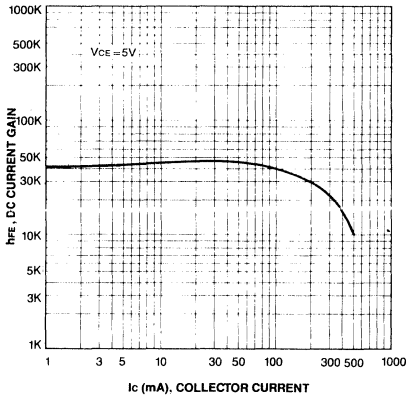
Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CES}		
:MPSA25		40	V
MPSA26		50	V
MPSA27		60	
Emitter-Base Voltage	V_{EBO}	10	V
Collector Current	I_C	500	mA
Collector Dissipation	P_C	625	mW
Junction Temperature	T_J	150	°C
Storage Temeprature	T_{STG}	−55~150	°C

ELECTRICAL CHARACTERISTICS (T_a=25°C)

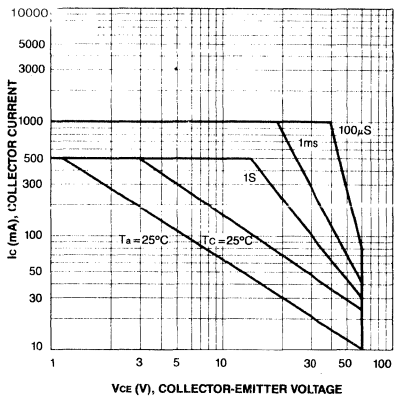
Characteristic	Symbol	Test Conditions	Min	Max	Unit
Collector-Base Breakdown Voltage	BV_{CES}	I_C=100μA, I_E=0			
:MPSA25			40		V
MPSA26			50		V
MPSA27			60		V
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=100μA, I_E=0			
:MPSA25			40		V
MPSA26			50		V
MPSA27			60		V
Collector Cut-off Current	I_{CBO}				
:MPSA25		V_{CE}=30V, I_E=0		100	nA
MPSA26		V_{CE}=40V, I_E=0		100	nA
MPSA27		V_{CE}=50V, I_E=0		100	nA
Emitter Cut-off Current	I_{EBO}	V_{CE}=10V, I_B=0		100	nA
*DC Current Gain	h_{FE}	V_{CE}=5V, I_C=10mA	10K		
		V_{CE}=5V, I_C=100mA	10K		
*Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=100mA, I_B=0.1mA		1.5	V
*Base-Emitter On Voltage	V_{BE} (on)	V_{CE}=5V, I_C=100mA		2	V

*Pulse Test: PW=300μs, Duty Cycle=2%

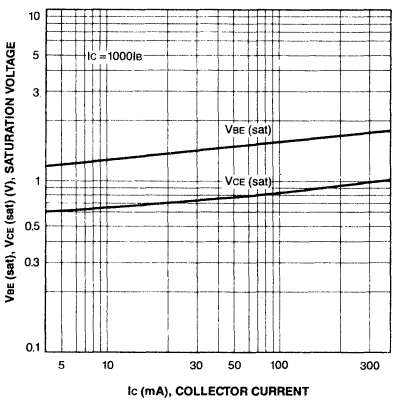
DC CURRENT GAIN



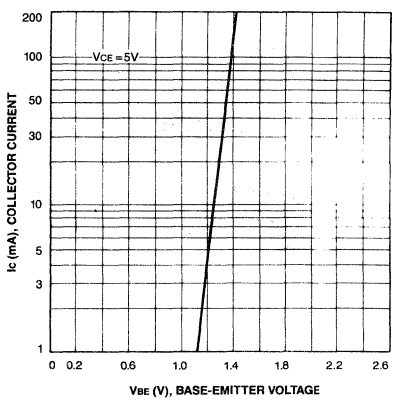
SAFE OPERATING AREA



BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



BASE-EMITTER ON VOLTAGE

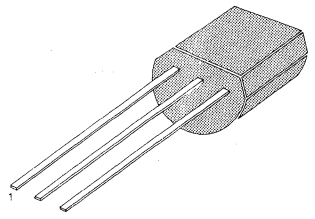


3

HIGH VOLTAGE TRANSISTOR

- **Collector-Emitter Voltage: V_{CEO} = MPSA42: 300V**
  MPSA43: 200V
- **Collector Dissipation: P_C (max)=625mW**

TO-92



1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

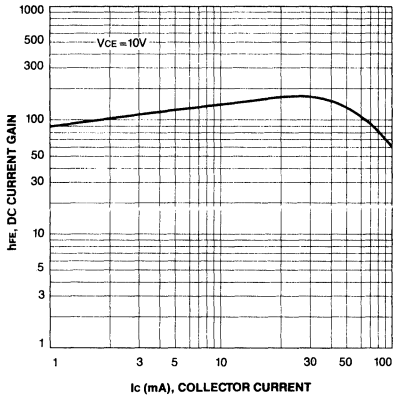
Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}		
:MPSA42		300	V
MPSA43		200	V
Collector-Emitter Voltage	V_{CEO}		
:MPSA42		300	V
MPSA43		200	V
Emitter-Base Voltage	V_{EBO}	6	V
Collector Current	I_C	500	mA
Collector Dissipation	P_C	625	mW
Junction Temperature	T_J	150	°C
Storage Temperature	T_{STG}	−55∼150	°C

ELECTRICAL CHARACTERISTICS (T_a=25°C)

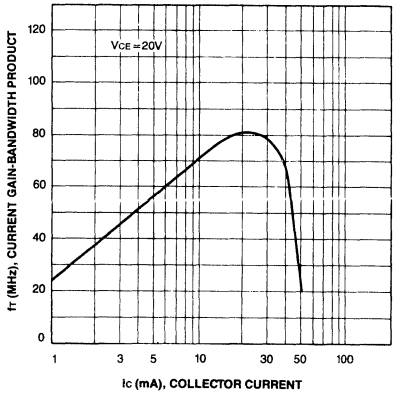
Characteristic	Symbol	Test Conditions	Min	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=100μA, I_B=0			
:MPSA42			300		V
MPSA43			200		V
*Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=1mA, I_B=0			
:MPSA42			300		V
MPSA43			200		V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=100μA, I_C=0	6		V
Collector Cut-off Current	I_{CBO}				
:MPSA42		V_{CB}=200V, I_E=0		100	nA
MPSA43		V_{CB}=160V, I_E=0		100	nA
Emitter Cut-off Current	I_{EBO}				
:MPSA42		V_{BE}=6V, I_C=0		100	nA
MPSA43		V_{BE}=4V, I_C=0		100	nA
*DC Current Gain	h_{FE}	V_{CE}=10V, I_C=1mA	25		
		V_{CE}=10V, I_C=10mA	40		
		V_{CE}=10V, I_C=30mA	40		
*Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=20mA, I_B=2mA		0.5	V
*Base-Emitter Saturation Voltage	V_{BE} (sat)	I_C=20mA, I_B=2mA		0.9	V
Collector-Base Capacitance	C_{CB}	V_{CB}=20V, I_E=0			
:MPSA42		f=1MHz		3	pF
MPSA43				4	pF
Current Gain Bandwidth Product	f_T	V_{CE}=20V, I_C=10mA	50		MHz
		f=100MHz			

*Pulse Test: PW=300μs, Duty Cycle=2%

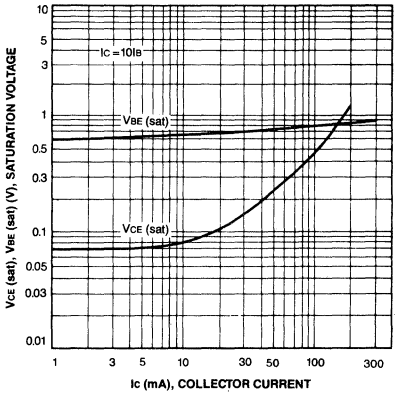
DC CURRENT GAIN



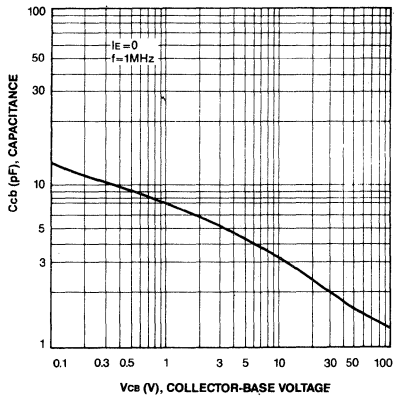
CURRENT GAIN-BANDWIDTH PRODUCT



COLLECTOR-EMITTER SATURATION VOLTAGE
BASE-EMITTER SATURATION VOLTAGE



COLLECTOR-BASE CAPACITANCE

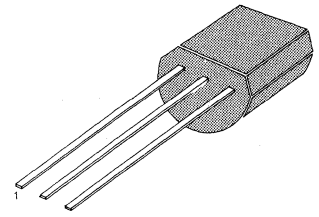


3

HIGH VOLTAGE TRANSISTOR

- **Collector-Emitter Voltage: V_{CEO} = MPSA44: 400V**
  MPSA45: 350V
- **Collector Dissipation: Pc(max) = 625mW**

TO-92



1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

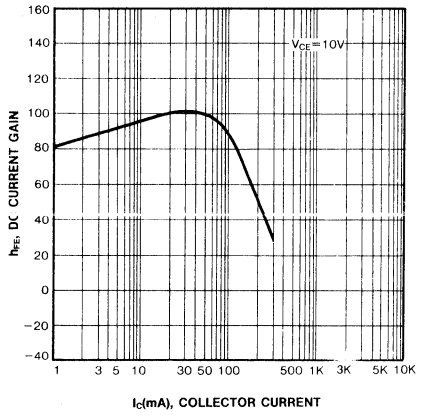
Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}		
:MPSA44		500	V
MPSA45		400	V
Collector-Emitter Voltage	V_{CEO}		
:MPSA44		400	V
MPSA45		350	V
Emitter-Base Voltage	V_{EBO}	6	V
Collector Current	I_C	300	mA
Collector Dissipation (T_A=25°C)	P_C	625	mW
Collector Dissipation (T_C=25°C)	P_C	1.5	W
Junction Temperature	T_J	150	°C
Storage Temeprature	T_{STG}	−55~150	°C

ELECTRICAL CHARACTERISTICS (T_a=25°C)

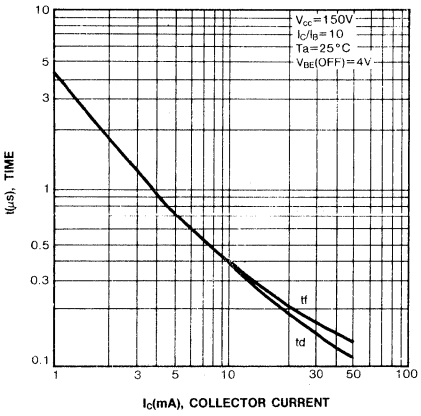
Characteristic	Symbol	Test Conditions	Min	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=100μA, I_E=0			
:MPSA44			500		V
MPSA45			400		V
*Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=1mA, I_B=0			
:MPSA44			400		V
MPSA45			350		V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=100μA, I_C=0	6		V
Collector Cut-off Current	I_{CBO}				
:MPSA44		V_{CB}=400V, I_E=0		0.1	μA
MPSA45		V_{CB}=320V, I_E=0		0.1	μA
Collector Cut-off Current	I_{CES}				
:MPSA44		V_{CE}=400V, I_B=0		0.5	μA
MPSA45		V_{CE}=320V, I_B=0		0.5	μA
Emitter Cut-off Current	I_{EBO}	V_{EB}=4V, I_C=0		0.1	μA
*DC Current Gain	h_{FE}	V_{CE}=10V, I_C=1mA	40		
		V_{CE}=10V, I_C=10mA	50	200	
		V_{CE}=10V, I_C=50mA	45		
		V_{CE}=10V, I_C=100mA	40		
*Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=1mA, I_B=0.1mA		0.4	V
		I_C=10mA, I_B=1mA		0.5	V
		I_C=50mA, I_B=5mA		0.75	V
*Base-Emitter Saturation Voltage	V_{BE} (sat)	I_C=10mA, I_B=1mA		0.75	V
Output Capacitance	C_{OB}	V_{CB}=20V, I_E=0 f=1MHz		7	pF

*Pulse Test: PW=300μs, Duty Cycle=2%

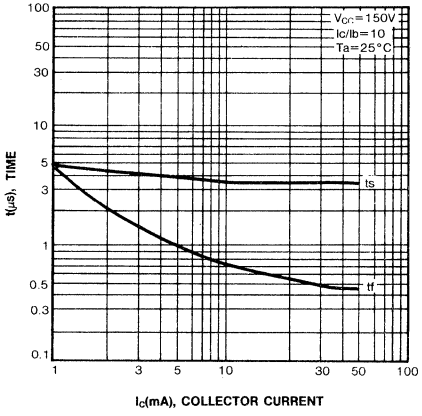
DC CURRENT GAIN



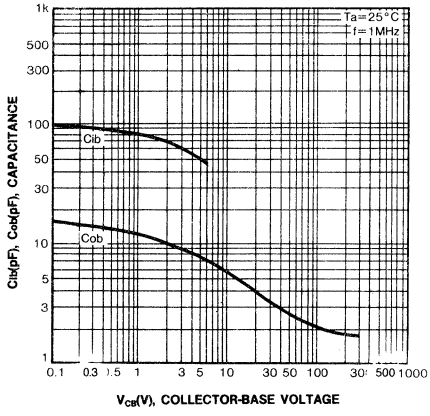
TURN-ON SWITCHING TIMES



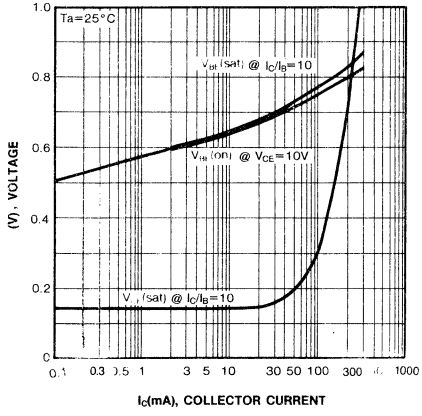
TURN-OFF SWITCHING TIMES



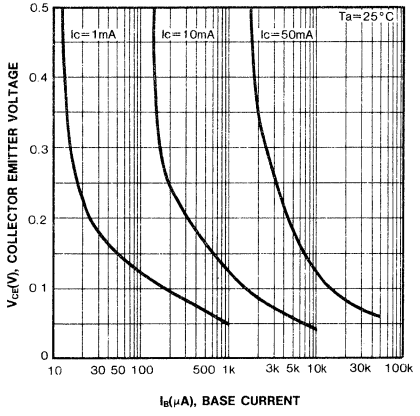
CAPACITANCE



ON VOLTAGE

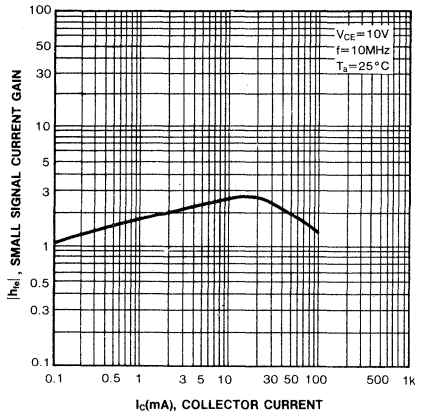


COLLECTOR SATURATION REGION

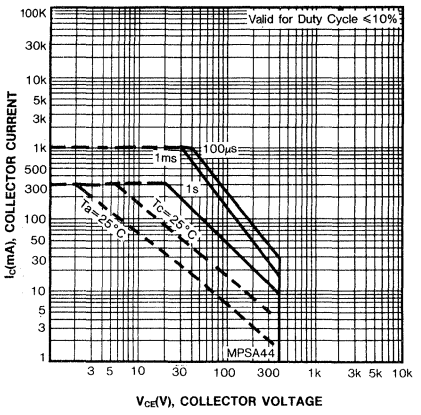


3

HIGH FREQUENCY CURRENT GAIN



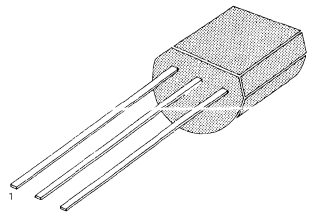
SAFE OPERATING AREA



AMPLIFIER TRANSISTOR

- **Collector-Emitter Voltage: V_{CEO} = MPSA55: 60V**
  MPSA56: 80V
- **Collector Dissipation: P_C (max)=625mW**

TO-92



1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a =25°C)

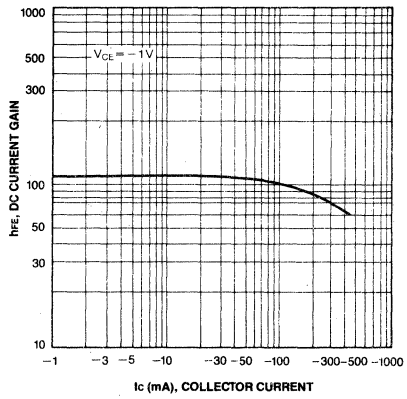
Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}		
:MPSA55		−60	V
MPSA56		−80	V
Collector-Emitter Voltage	V_{CEO}		
:MPSA55		−60	V
MPSA56		−80	V
Emitter-Base Voltage	V_{EBO}	−4	V
Collector Current	I_C	−500	mA
Collector Dissipation	P_C	625	mW
Junction Temperature	T_J	150	°C
Storage Temperature	T_{STG}	−55~150	°C

ELECTRICAL CHARACTERISTICS (T_a =25°C)

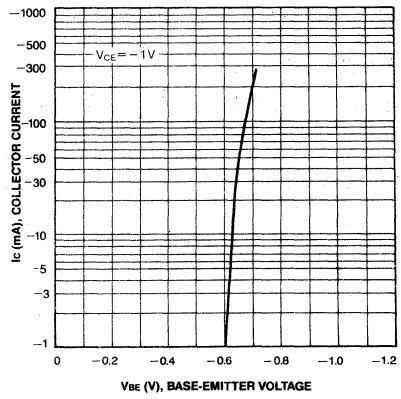
Characteristic	Symbol	Test Conditions	Min	Max	Unit
*Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=−1mA, I_B=0			
:MPSA55			−60		V
MPSA56			−80		
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=−100μA, I_C=0	−4		V
Collector Cut-off Current	I_{CBO}				
:MPSA55		V_{CB}=−60V, I_E=0		−0.1	μA
MPSA56		V_{CB}=−80V, I_E=0		−0.1	μA
Collector Cut-off Current	I_{CEO}	V_{CE}=−60V, I_B=0		−0.1	μA
DC Current Gain	h_{FE}	V_{CE}=−1V, I_C=−10mA	50		
		V_{CE}=−1V, I_C=−100mA	50		
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=−100mA, I_B=−10mA		−0.25	V
Base-Emitter On Voltage	V_{BE} (on)	V_{CE}=−1V, I_C=−100mA		−1.2	V
Current Gain Bandwidth Product	f_T	V_{CE}=−2V, I_C=−10mA f=100MHz	50		MHz

*Pulse Test: PW=300μs, Duty Cycle=2%

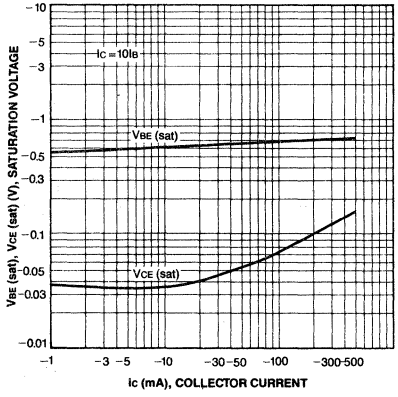
DC CURRENT GAIN



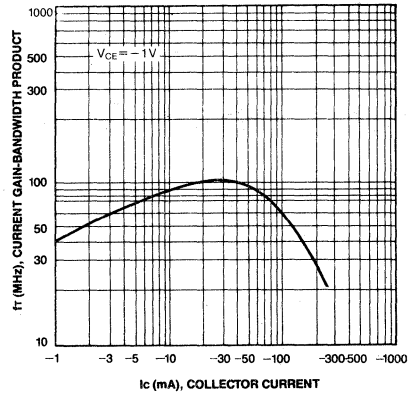
BASE-EMITTER ON VOLTAGE



COLLECTOR-EMITTER SATURATION VOLTAGE
BASE-EMITTER SATURATION VOLTAGE



CURRENT GAIN-BANDWIDTH PRODUCT

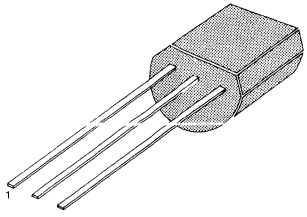


PNP EPITAXIAL SILICON DARLINGTON TRANSISTOR

DARLINGTON TRANSISTOR

- **Collector-Emitter Voltage: V_{CES} = MPSA62: 20V**
  MPSA63/64: 30V
- **Collector Dissipation: P_C (max)=625mW**

TO-92



1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}		
:MPSA62		−20	V
MPSA63/MPSA64		−30	V
Collector-Base Voltage	V_{CBO}		
:MPSA62		−20	V
MPSA63/MPSA64		−30	V
Emitter-Base Voltage	V_{EBO}	−10	V
Collector Current	I_C	−500	mA
Collector Dissipation	P_C	625	mW
Junction Temperature	T_J	150	°C
Storage Temperature	T_{STG}	−55∼150	°C

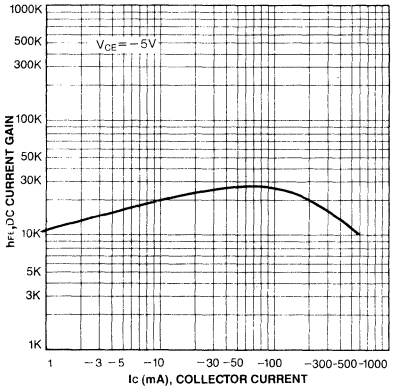
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Conditions	Min	Max	Unit
Collector-Emitter Breakdown Voltage	BV_{CES}	I_C=−100μA, I_B=0			
:MPSA62			−20		V
MPSA63/MPSA64			−30		V
Collector Cut-off Current	I_{CBO}				
:MPSA62		V_{CB}=−15V, I_E=0		−100	nA
MPSA63/MPSA64		V_{CB}=−30V, I_E=0		−100	nA
Emitter Cut-off Current	I_{EBO}	V_{BE}=−10V, I_C=0		−100	nA
*DC Current Gain	h_{FE}				
:MPSA62		V_{CE}=−5V, I_C=−10mA	20K		
MPSA63			5K		
MPSA64			10K		
MPSA63		V_{CE}=−5V, I_C=−100mA	10K		
MPSA64			20K		
*Collector-Emitter Saturation Voltage	V_{CE} (sat)				
:MPSA62		I_C=−10mA, I_B=−0.01mA		−1.0	V
MPSA63/MPSA64		I_C=−100mA, I_B=−0.1mA		−1.5	V
*Base-Emitter On Voltage	V_{BE} (on)				
:MPSA62		V_{CE}=−5V, I_C=−10mA		−1.4	V
MPSA63/MPSA64		V_{CE}=−5V, I_C=−100mA		−2	V
Current Gain Bandwidth Product	f_T	V_{CE}=−5v, I_C=−100mA	125		MHz
:MPSA63/MPSA64		f=100MHz			

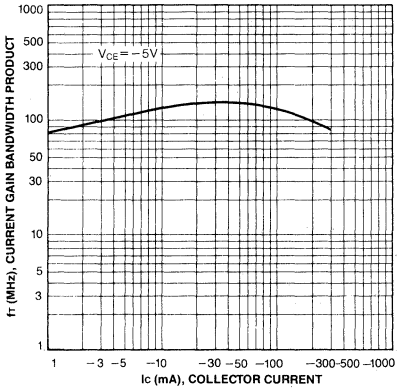
*Pulse Test: PW=300μs, Duty Cycle=2%

PNP EPITAXIAL SILICON DARLINGTON TRANSISTOR

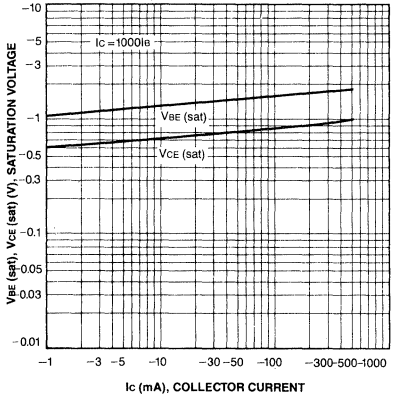
DC CURRENT GAIN



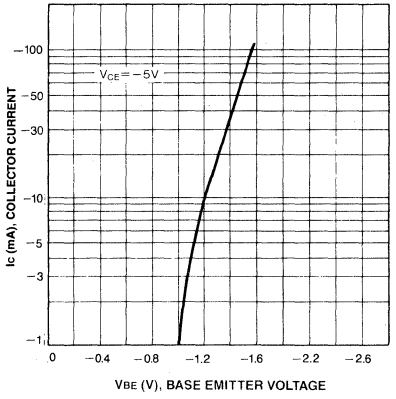
CURRENT GAIN-BANDWIDTH PRODUCT



BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



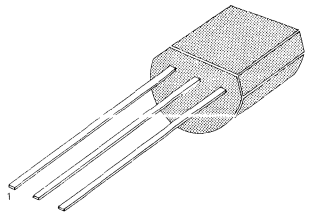
BASE EMITTER ON VOLTAGE



AMPLIFIER TRANSISTOR

- **Collector-Emitter Voltage: V_{CEO} =40V**
- **Collector Dissipation: P_C (max)=625mW**

TO-92



1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a =25°C)

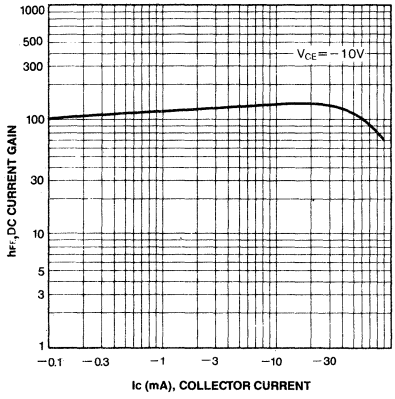
Characteristic	Symbol	Rating	Unit
Collector-Emitter Voltage	V_{CEO}	−40	V
Emitter-Base Voltage	V_{EBO}	−4	V
Collector Current	I_C	−100	mA
Collector Dissipation	P_C	625	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 ~ 150	°C

ELECTRICAL CHARACTERISTICS (T_a =25°C)

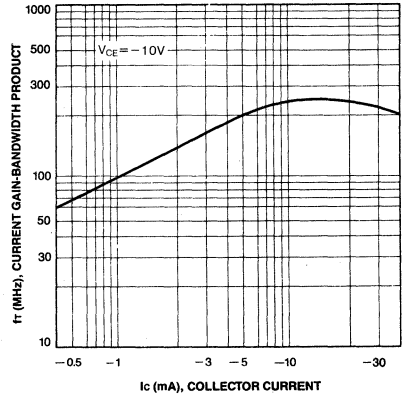
Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C = − 1mA, I_B =0	−40			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E = − 100μA, I_C =0	−4			V
Collector Cut-off Current	I_{CBO}	V_{CB} = − 30V, I_E =0			−100	nA
DC Current Gain	h_{FE}	I_C = − 5mA, V_{CE} = − 10V	40		400	
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C = − 10mA, I_B = − 1mA			−0.25	V
Current Gain Bandwidth Product	f_T	I_C = − 5mA, V_{CE} = − 10V f=100MHz	125			MHz
Output Capacitance	Cob	V_{CB} = − 10V, I_E = 0 f=100KHz			4	pF

3

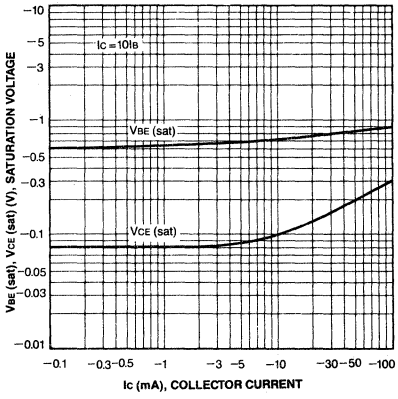
DC CURRENT GAIN



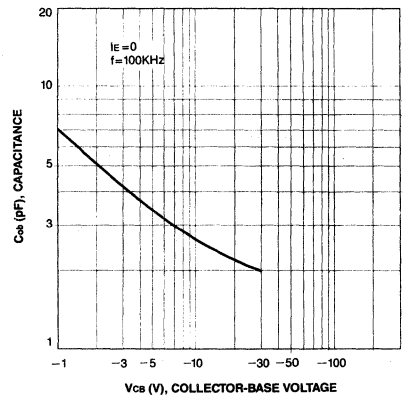
CURRENT GAIN-BANDWIDTH PRODUCT



BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



OUTPUT CAPACITANCE

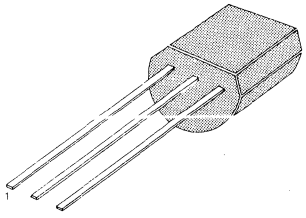


PNP EPITAXIAL SILICON DARLINGTON TRANSISTOR

DARLINGTON TRANSISTOR

- **Collector-Emitter Voltage: V_{CES} = MPSA75: 40V**
  MPSA76: 50V
  MPSA77: 60V
- **Collector Dissipation: P_C (max)=625mW**

TO-92



1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

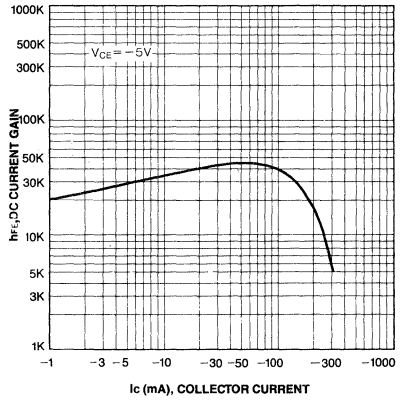
Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CES}		
:MPSA75		−40	V
MPSA76		−50	V
MPSA77		−60	
Emitter-Base Voltage	V_{EBO}	−10	V
Collector Current	I_C	−500	mA
Collector Dissipation	P_C	625	mW
Junction Temperature	T_J	150	°C
Storage Temperature	T_{STG}	−55~150	°C

3

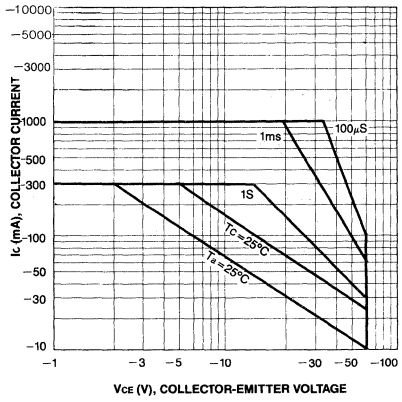
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Conditions	Min	Max	Unit
Collector-Base Breakdown Voltage	BV_{CEO}	I_C=−100μA, I_B=0			
:MPSA75			−40		V
MPSA76			−50		V
MPSA77			−60		V
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=−100μA, I_E=0			
:MPSA75			−40		V
MPSA76			−50		V
MPSA77			−60		V
Collector Cut-off Current	I_{CBO}				
:MPSA75		V_{CE}=−30V, I_E=0		−100	nA
MPSA76		V_{CE}=−40V, I_E=0		−100	nA
MPSA77		V_{CE}=−50V, I_E=0		−100	nA
Emitter Cut-off Current	I_{EBO}	V_{CE}=−10V, I_B=0		−100	nA
Collector Cut-off Current	I_{CES}				
:MPSA75		V_{CE}=−30V, I_E=0		−500	nA
MPSA76		V_{CE}=−40V, I_E=0		−500	nA
MPSA77		V_{CE}=−50V, I_E=0		−500	nA
DC Current Gain	h_{FE}	V_{CE}=−5V, I_C=−10mA	10K		
		V_{CE}=−5V, I_C=−100mA	10K		
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=−100mA, I_B=−0.1mA		−1.5	V
Base-Emititer On Voltage	V_{BE} (on)	V_{CE}=−5V, I_C=−100mA		−2	V

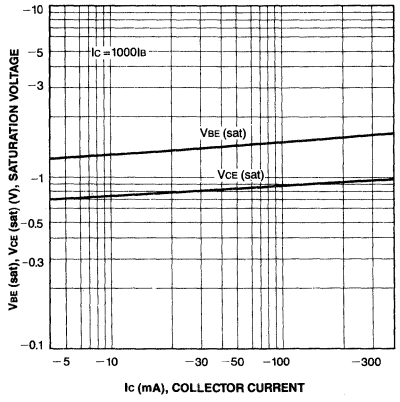
DC CURRENT GAIN



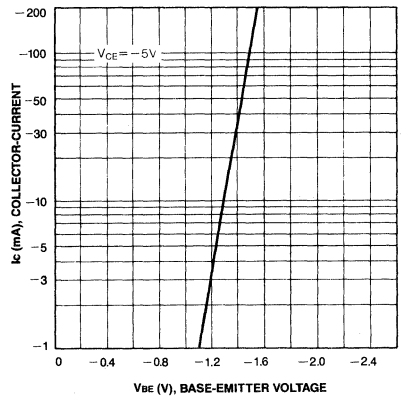
SAFE OPERATING AREA



BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE

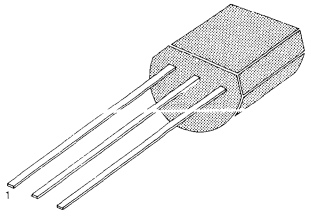


BASE-EMITTER ON VOLTAGE



HIGH VOLTAGE TRANSISTOR

TO-92



1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

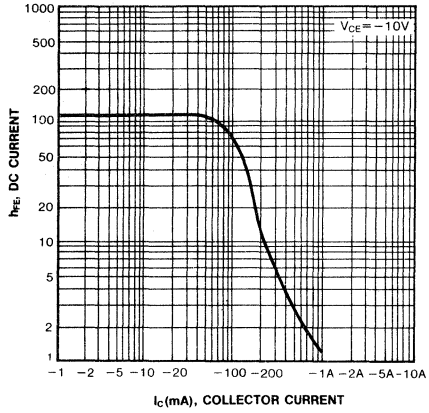
Characteristic	Symbol	Rating	Unit
Collector-Base Voltage : MPSA92	V_{CBO}	−300	V
: MPSA93		−200	V
Collector-Emitter Voltage: MPSA92	V_{CEO}	−300	V
: MPSA93		−200	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current	I_C	−500	mA
Collector Dissipation (T_a=25°C)	P_C	625	mW
Derate above 25°C		5	mW/°C
Collector Dissipation (T_c=25°C)	P_C	1.5	W
Derate above 25°C		12	mW/°C
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

ELECTRICAL CHARACTERISTICS (T_a=25°C)

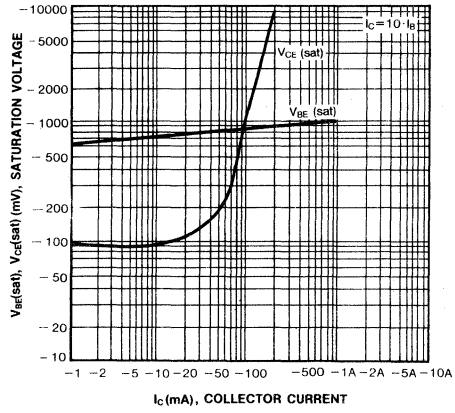
Characteristic	Symbol	Test Condition	Min	Max	Unit
Collector Base Breakdown Voltage : MPSA92	BV_{CBO}	I_C=−100μA, I_E=0	−300		V
: MPSA93			−200		V
*Collector Emitter Breakdown Voltage : MPSA92	BV_{CEO}	I_C=−1mA, I_B=0	−300		V
: MPSA93			−200		V
Emitter Base Breakdown Voltage	BV_{EBO}	I_E=−100μA, I_C=0	−5		V
Collector Cutoff Current : MPSA92	I_{CBO}	V_{CB}=−200V, I_E=0		−0.25	μA
: MPSA93		V_{CB}=−160V, I_E=0		−0.25	μA
Emitter Cutoff Current	I_{EBO}	V_{EB}=−3V, I_C=0		−0.10	μA
* DC Current Gain	h_{FE}	V_{CE}=−10V, I_C=−1mA	25		
		V_{CE}=−10V, I_C=−10mA	40		
		V_{CE}=−10V, I_C=−30mA	25		
*Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=−20mA, I_B=−2mA		−0.50	V
*Base-Emitter Saturation Voltage	V_{BE} (sat)	I_C=−20mA, I_B=−2mA		−0.90	V
Current Gain Bandwidth Product	f_T	V_{CE}=−20V, I_C=−10mA f=100MHz	50		MHz
Collector Base Capacitance : MPSA92	Ccb	V_{CB}=−20V, I_E=0		6	pF
: MPSA93		f=1MHz		8	pF

* Pulse Test: PW=300μs, Duty Cycle=2%

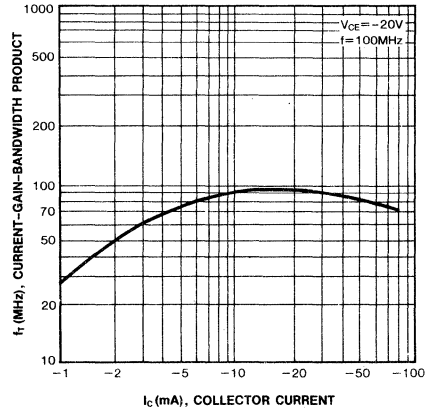
DC CURRENT GAIN



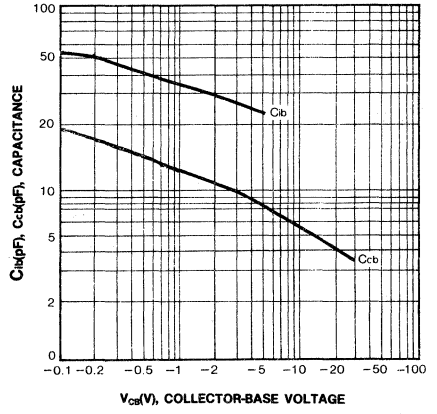
SATURATION VOLTAGES



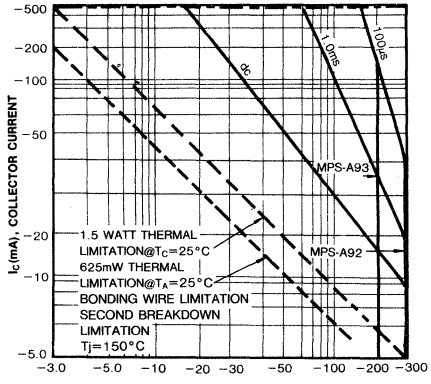
CURRENT-GAIN-BANDWIDTH PRODUCT



CAPACITANCE

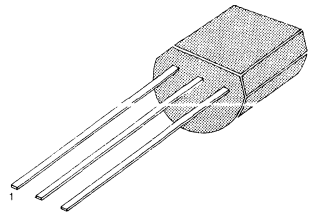


ACTIVE-REGION SAFE OPERATING AREA



VHF/UHF TRANSISTOR

TO-92



1. Base 2. Emitter 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector Base Voltage	V_{CBO}	30	V
Collector-Emitter Voltage	V_{CEO}	25	V
Emitter-Base Voltage	V_{EBO}	3.0	V
Collector Dissipation (T_a=25°C)	P_C	350	mW
Derate above 25°C		2.8	mW/°C
Collector Dissipation (T_C=25°C)	P_C	1.0	W
Derate above 25°C		8.0	mW/°C
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C
Thermal Resistance, Junction to Case	Rth(j-c)	125	°C/W
Thermal Resistance, Junction to Ambient	Rth(j-a)	357	°C/W

3

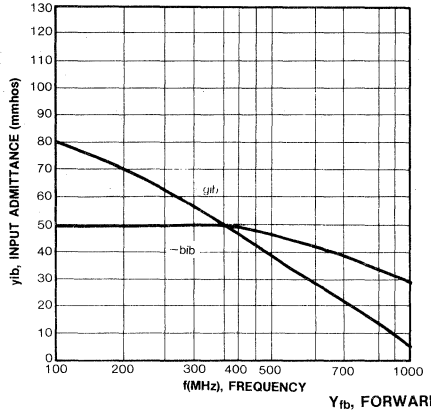
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=100μA, I_E=0	30		V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=1mA, I_B=0	25		V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=10μA, I_C=0	3.0		V
Collector Cutoff Current	I_{CBO}	V_{CB}=25V, I_E=0		100	nA
Emitter Cutoff Current	I_{EBO}	V_{EB}=2V, I_C=0		100	nA
DC Current Gain	h_{FE}	V_{CE}=10V, I_C=4mA	60		
Collector Emitter Saturation Voltage	V_{CE} (sat)	I_C=4mA, I_B=0.4mA		0.5	V
Base-Emitter On Voltage	V_{BE} (on)	V_{CE}=10V, I_C=4mA		0.95	V
Current Gain Bandwidth Product	f_T	V_{CE}=10V, I_C=4mA, f=100MHz	650		MHz
Collector Base Capacitance	Ccb	V_{CB}=10V, I_E=0, f=1MHz		0.7	pF
Collector Base Feedback Capacitance	Crb	V_{CB}=10V, I_E=0, f=1MHz			
MPSH10			0.35	0.65	pF
MPSH11			0.6	0.9	pF
Collector Base Time Constant	Cc·rbb'	V_{CB}=10V, I_C=4mA, f=31.8MHz		9.0	ps

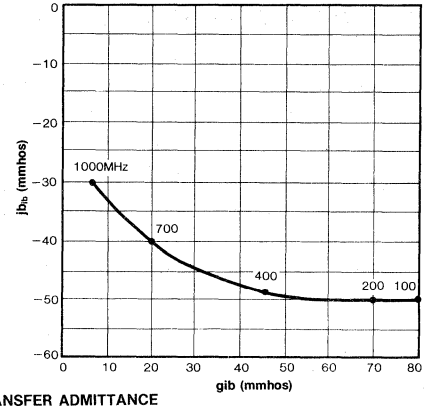
COMMON-BASE y PARAMETERS vs FREQUENCY
(V_{CB} = 10V, I_C = 4mA, T_a = 25°C)

Y_{ib}, INPUT ADMITTANCE

RECTANGULAR FORM

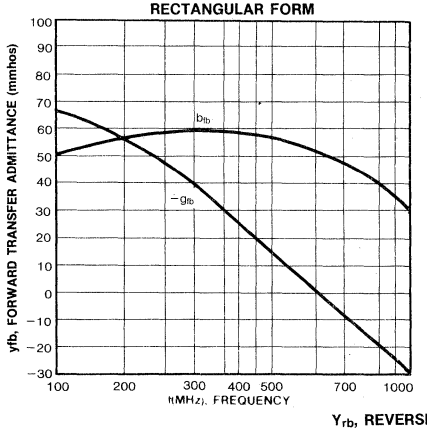


POLAR FORM

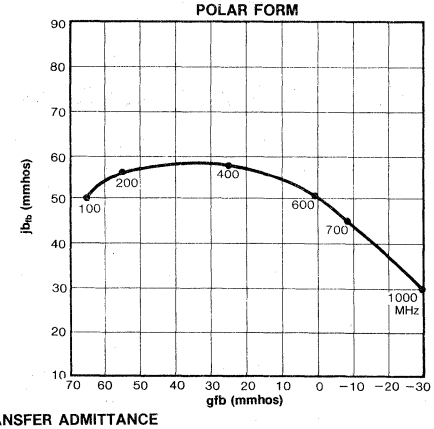


Y_{fb}, FORWARD TRANSFER ADMITTANCE

RECTANGULAR FORM

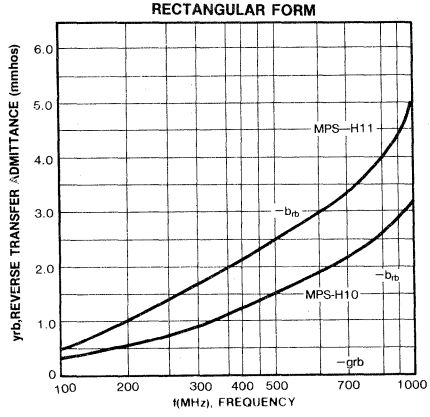


POLAR FORM

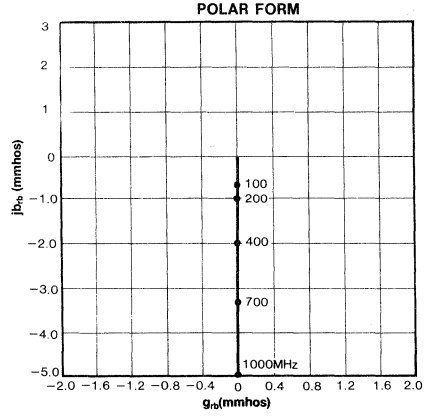


Y_{rb}, REVERSE TRANSFER ADMITTANCE

RECTANGULAR FORM

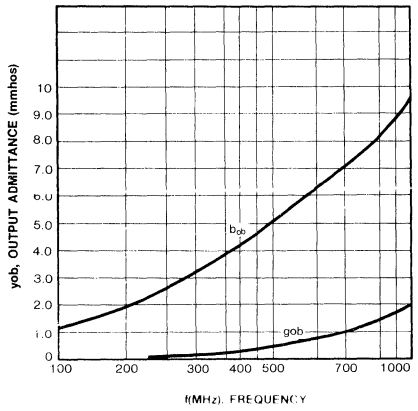


POLAR FORM

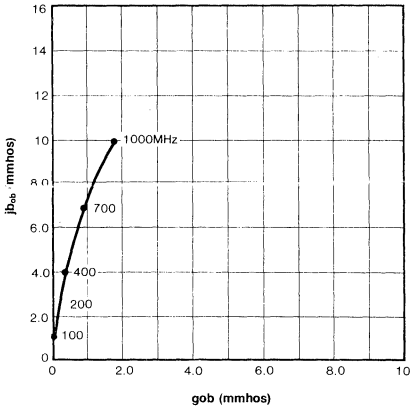


Y_{ob}, OUTPUT ADMITTANCE

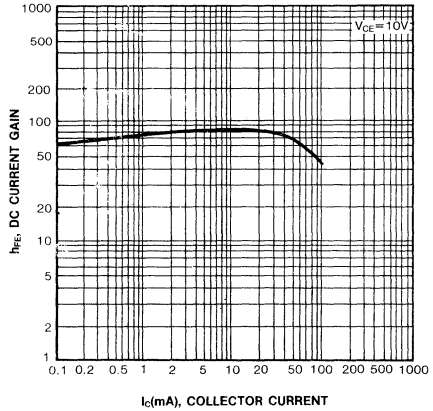
RECTANGULAR FORM



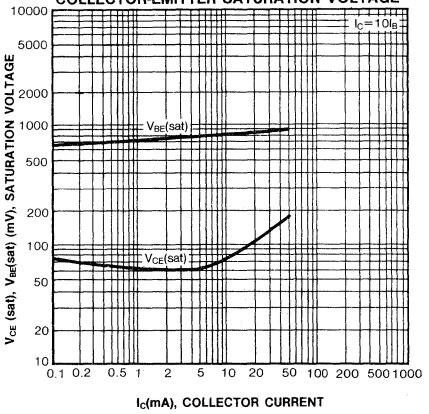
POLAR FORM



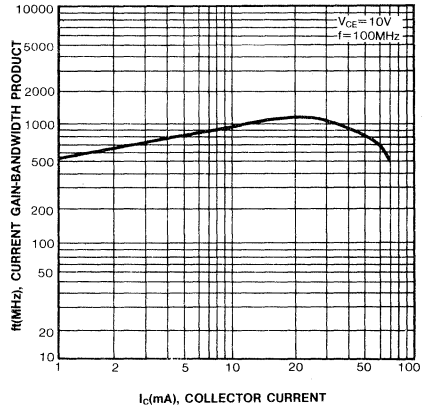
DC CURRENT GAIN



BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



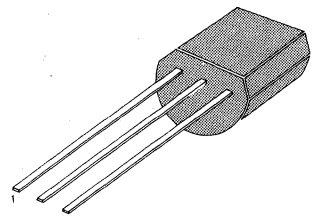
CURRENT GAIN BANDWIDTH PRODUCT



3

CATV TRANSISTOR

TO-92



1. Base 2. Emitter 3. Collector

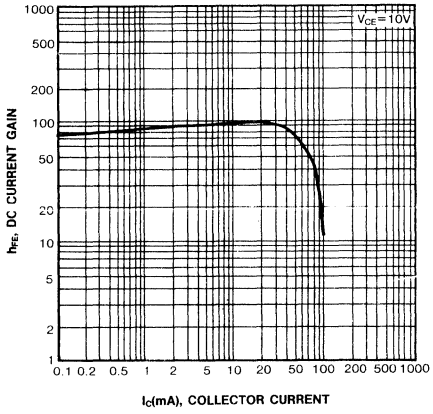
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	20	V
Collector-Emitter Voltage	V_{CEO}	15	V
Emitter-Base Voltage	V_{EBO}	3.0	V
Collector Dissipation (T_a=25°C)	P_C	625	mW
Derate above 25°C		5.0	mW/°C
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C
Thermal Resistance, Junction to Ambient	Rth(j-a)	200	°C/W

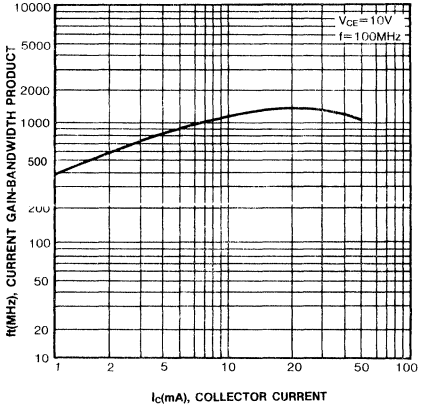
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=100μA, I_E=0	20			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=1mA, I_B=0	15			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=10μA, I_C=0	3.0			V
Collector Cutoff Current	I_{CBO}	V_{CB}=15V, I_E=0			100	nA
DC Current Gain	h_{FE}	V_{CE}=10V, I_C=5mA	25		250	
Collector Emitter Saturation Voltage	V_{CE} (sat)	I_C=10mA, I_B=1mA			0.5	V
Current Gain Bandwidth Product	f_T	V_{CE}=10V, I_C=5mA f=100MHz	800			MHz
Collector-Base Capacitance	Ccb	V_{CB}=10V, I_E=0, f=1MHz	0.3		0.9	pF
Small Signal Current Gain	hfe	V_{CE}=10V, I_C=5mA f=1KHz	30			
Noise Figure	NF	V_{CC}=12V, I_C=5mA R_S=50Ω, f=200MHz			6.0	dB
Amplifier Power Gain	Gpe	V_{CC}=12V, I_C=5mA R_S=50Ω, f=200MHz		24		dB

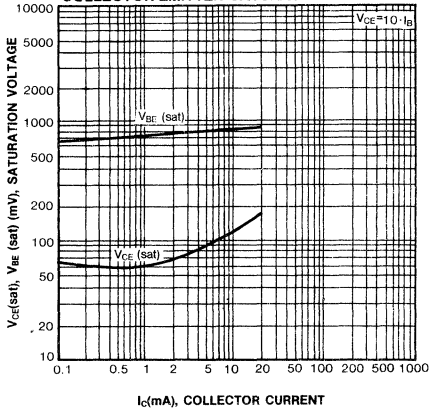
DC CURRENT GAIN



CURRENT GAIN BANDWIDTH PRODUCT



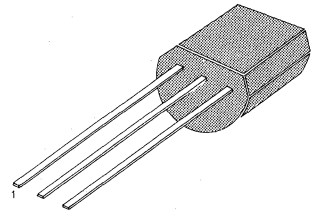
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



3

VHF TRANSISTOR

TO-92



1. Base 2. Emitter 3. Collector

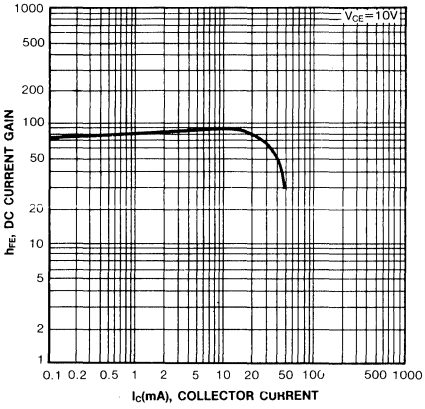
ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	40	V
Collector-Emitter Voltage	V_{CEO}	30	V
Emitter-Base Voltage	V_{EBO}	4.0	V
Collector Current	I_C	100	mA
Collector Dissipation (T_a=25°C)	P_C	350	mW
Derate above 25°C		2.81	mW/°C
Collector Dissipation (T_C=25°C)	P_C	1.0	W
Derate above 25°C		8.0	mW/°C
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C
Thermal Resistance, Junction to Case	Rth(j-c)	83.3	°C/W
Thermal Resistance, Junction to Ambient	Rth(j-a)	357	°C/W

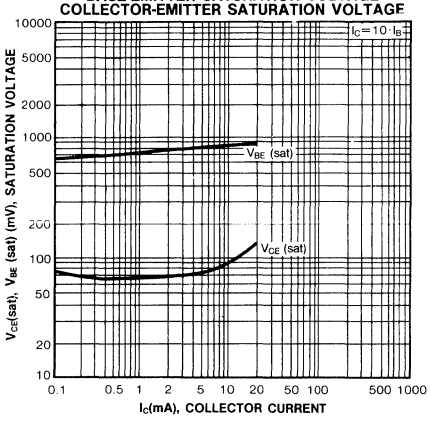
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=100μA, I_E=0	40			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=1mA, I_B=0	30			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=10μA, I_C=0	4.0			V
Collector Cutoff Current	I_{CBO}	V_{CB}=15V, I_E=0			50	nA
DC Current Gain	h_{FE}	V_{CE}=10V, I_C=4mA	25			
Current Gain Bandwidth Product	f_T	V_{CE}=10V, I_C=4mA f=100MHz	400	620		MHz
Collector-Base Capacitance	Ccb	V_{CB}=10V, I_E=0, f=1MHz		0.5	0.65	pF
Collector Base Time Constant	Cc·rbb'	V_{CB}=10V, I_E=4mA f=31.8MHz		10		ps
Conversion Gain (213 to 45 MHz)	G_{CE}	V_{CE}=10V, I_C=4mA Oscillator injection=200mV	18	23		dB

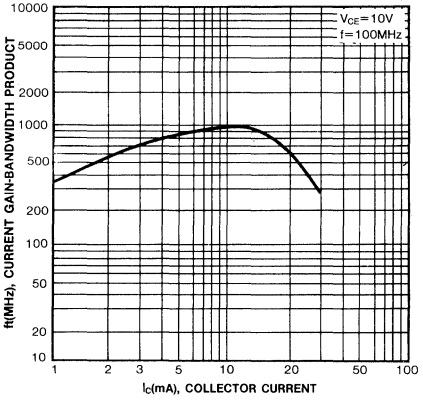
DC CURRENT GAIN



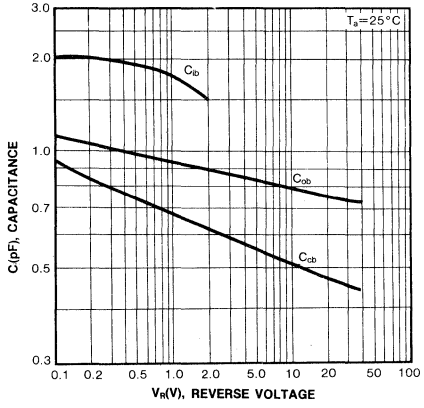
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



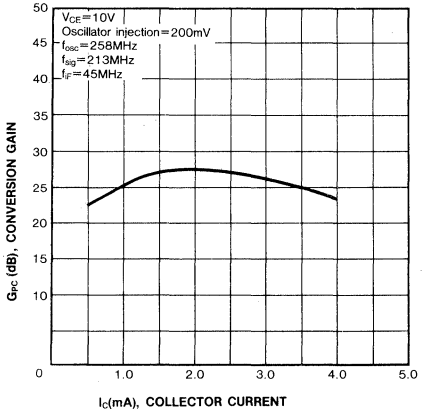
CURRENT GAIN BANDWIDTH·PRODUCT



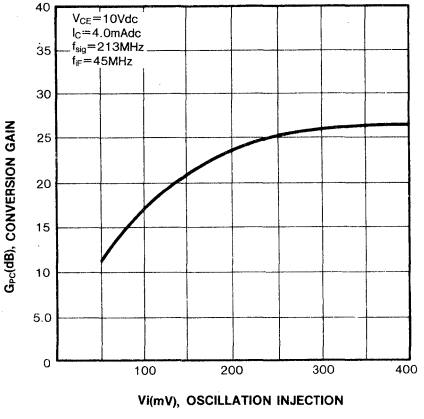
CAPACITANCES



CONVERSION GAIN CHARACTERISTICS
VARIATION WITH COLLECTOR CURRENT



CONVERSION GAIN CHARACTERISTICS
VARIATION WITH INJECTION LEVEL



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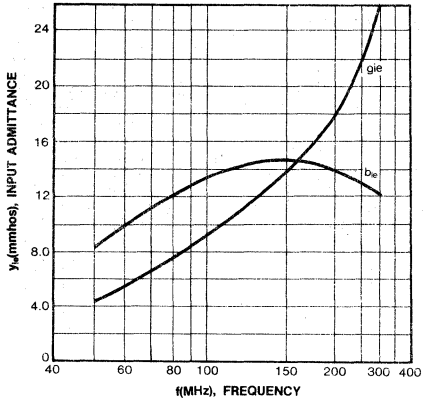
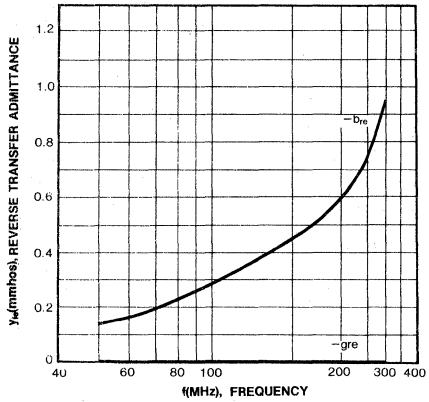
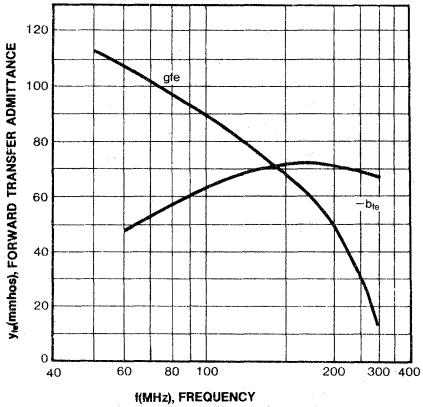
COMMON-EMITTER y PARAMETERS
(I_C = 4.0mA, V_{CE} = 10V, T_a = 25°C)
INPUT ADMITTANCE



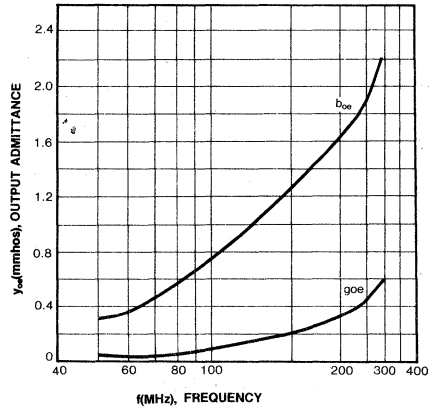
COMMON-EMITTER y PARAMETERS
(I_C = 4.0mA, V_{CE} = 10V, T_a = 25°C)
REVERSE TRANSFER ADMITTANCE



COMMON-EMITTER y PARAMETERS
(I_C = 4.0mA, V_{CE} = 10V, T_a = 25°C)
FORWARD TRANSFER ADMITTANCE

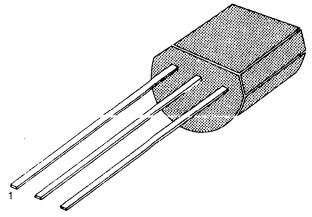


COMMON-EMITTER y PARAMETERS
(I_C = 4.0mA, V_{VE} = 10V, T_a = 25°C)



VHF TRANSISTOR

TO-92



1. Base 2. Emitter 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	40	V
Collector-Emitter Voltage	V_{CEO}	30	V
Emitter-Base Voltage	V_{EBO}	4.0	V
Collector Current	I_C	100	mA
Collector Dissipation (T_a=25°C)	P_C	350	mW
Derate above 25°C		2.8	mW/°C
Junction Temperature	Tj	135	°C
Storage Temperature	Tstg	−55~135	°C
Thermal Resistance, Junction to Ambient	Rth(j-a)	357	°C/W

ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=100μA, I_E=0	40			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=1mA, I_B=0	30			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=10μA, I_C=0	4.0			V
Collector Cutoff Current	I_{CBO}	V_{CB}=15V, I_E=0			50	nA
DC Current Gain	h_{FE}	V_{CE}=10V, I_C=8mA	30			
Current Gain Bandwidth Product	f_T	V_{CE}=10V, I_C=8mA f=100MHz	400	620		MHz
Collector-Base Capacitance	Ccb	V_{CB}=10V, I_E=0, f=1MHz		0.25	0.36	pF
Conversion Gain (213 to 45 MHz)	G_{CE}	V_{CC}=20V, I_C=8mA Oscillator injection=150mV	19	24		dB
Conversion Gain (60 to 45 MHz)	G_{CE}	V_{CC}=20V, I_C=8mA Oscillator injection=150mV	24	29		dB

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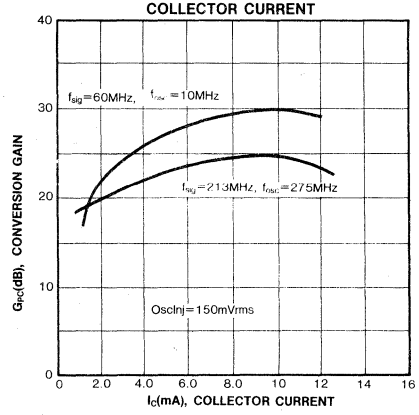
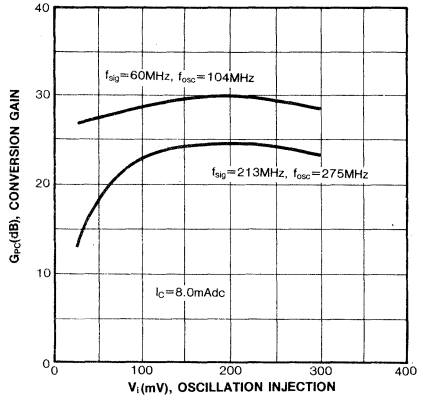
CONVERSION GAIN CHARACTERISTICS
(V_{CC} = 20V, Rs = R_L = 50Ω, f_{if} = 44MHz, B.W = 6MHz)

CONVERSION GAIN versus COLLECTOR CURRENT

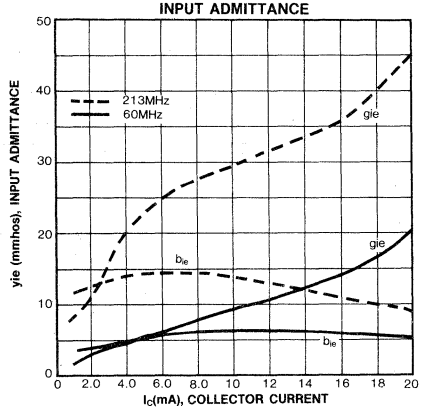


CONVERSION GAIN versus INJECTION LEVEL

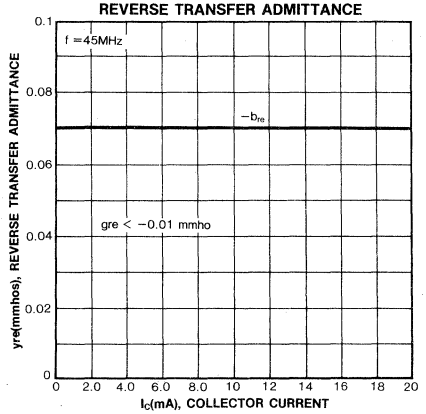


COMMON-BASE y PARAMETERS
(V_{CE} = 15V, T_a = 25°C)

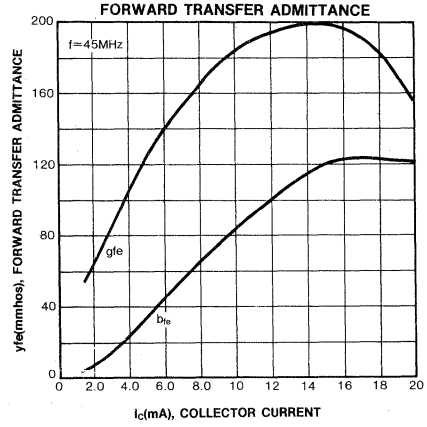
INPUT ADMITTANCE



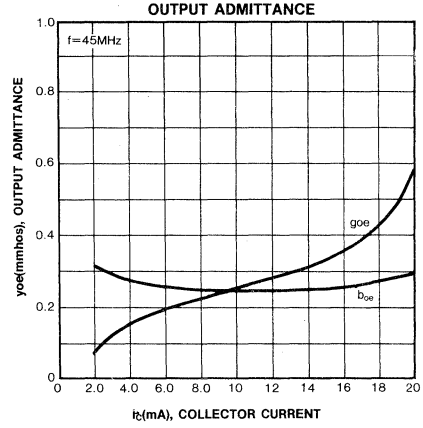
REVERSE TRANSFER ADMITTANCE



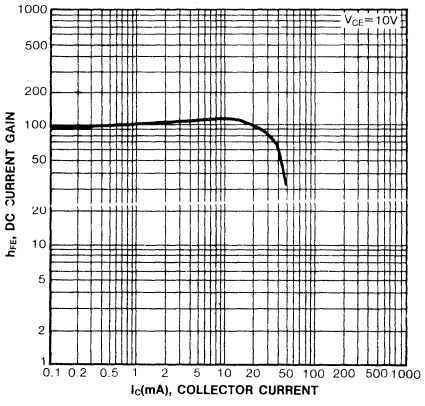
FORWARD TRANSFER ADMITTANCE



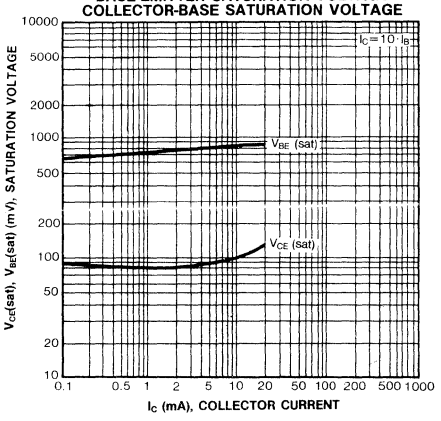
OUTPUT ADMITTANCE



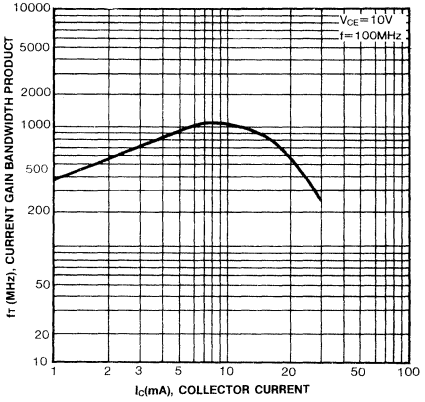
DC CURRENT GAIN



BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-BASE SATURATION VOLTAGE



CURRENT GAIN BANDWIDTH PRODUCT



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AMPLIFIER TRANSISTOR

- **Collector-Emitter Voltage: V_{CEO}=120V**
- **Collector Dissipation: P_C (max)=625mW**

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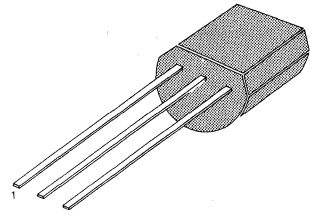


1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

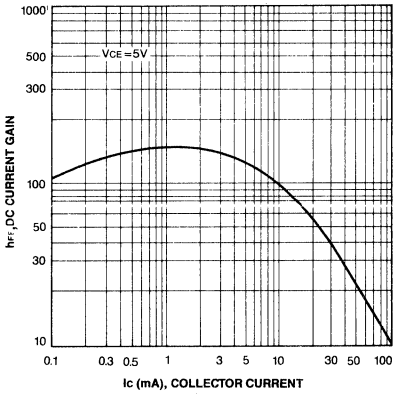
Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	140	V
Collector-Emitter Voltage	V_{CEO}	120	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	150	mA
Collector Dissipation	P_C	625	mW
Junction Temperature	T_j	150	°C
Storage Temperature	Tstg	−55 ~ 150	°C

ELECTRICAL CHARACTERISTICS (T_a=25°C)

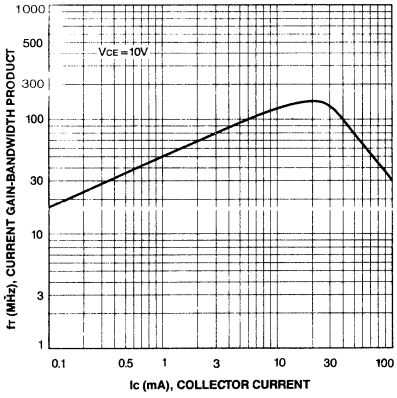
Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
*Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=1mA, I_B=0	120			V
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=100μA, I_E=0	140			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=10μA, I_C=0	5			V
Collector Cut-off Current	I_{CBO}	V_{CB}=75V, I_E=0			1	μA
Emitter Cut-off Current	I_{EBO}	V_{BE}=4V, I_C=0			100	nA
*DC Current Gain	h_{FE}	I_C=10mA, V_{CE}=5V	50		300	
Collector-Emitter Saturation Voltage	V_{CE} (sat)	I_C=10mA, I_B=1mA			0.2	V
		I_C=50mA, I_B=5mA			0.3	V
Base-Emitter Saturation Voltage	V_{BE} (sat)	I_C=10mA, I_B=1mA			1.2	V
		*I_C=50mA, I_B=5mA			1.4	V
Collector-Base Capacitance	Ccb	V_{CB}=10V, I_E=0 f=1MHz			8	pF
*Current Gain Bandwidth Product	f_T	I_C=10mA, V_{CE}=10V f=100MHz	60			MHz

* Pulse Test: Pulse Width=300μs, Duty Cycle=2%

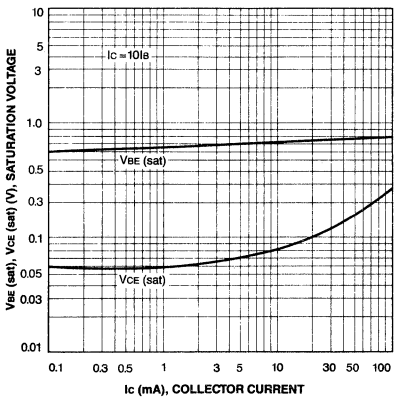
DC CURRENT GAIN



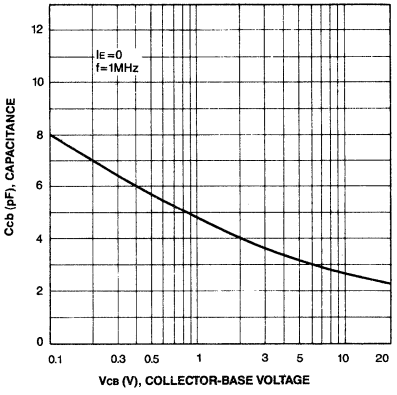
CURRENT GAIN-BANDWIDTH PRODUCT



BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



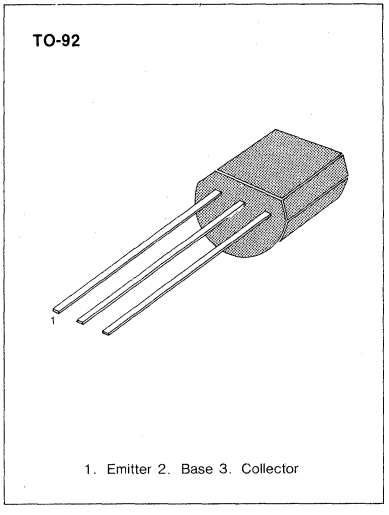
COLLECTOR-BASE CAPACITANCE



3

AMPLIFIER TRANSISTOR

- **Collector-Emitter Voltage: V_{CEO}=100V**
- **Collector Dissipation: P_C (max)=625mW**



1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−100	V
Collector-Emitter Voltage	V_{CEO}	−100	V
Emitter-Base Voltage	V_{EBO}	−4	V
Collector Current	I_C	−600	mA
Collector Dissipation	P_C	625	mW
Junction Temperature	T_J	150	°C
Storage Temperature	T_{stg}	−55 ~ 150	°C

- Refer to 2N5401 for graphs

ELECTRICAL CHARACTERISTICS (T_a=25°C)

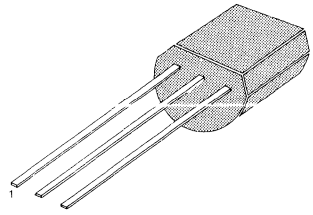
Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
*Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=−1mA, I_B=0	−100			V
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=−100μA, I_E=0	−100			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=−10μA. I_C=0	−4			V
Collector Cut-off Current	I_{CBO}	V_{CB}=−50V, I_E=0			−1	μA
Emitter Cut-off Current	I_{EBO}	V_{EB}=−3V, I_C=0			−100	nA
*DC Current Gain	h_{FE}	I_C=−50mA, V_{CE}=−5V	40		250	
*Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=−10mA, I_B=−1mA			−0.25	V
		I_C=−50mA, I_B=−5mA			−0.3	V
*Base-Emitter Saturation Voltage	V_{BE}(sat)	I_C=−10mA, I_B=−1mA			−1.2	V
		I_C=−50mA, I_B=−5mA			−1.2	V
Output Capacitance	C_{ob}	V_{CB}=−10V, I_E=0 f=1MHz			8	pF
Current Gain Bandwidth Product	f_T	I_C=−10mA, V_{CE}=−10V f=100MHz	60			MHz

* Pulse Test: Pulse Width=300μs, Duty Cycle=2%

2W OUTPUT AMPLIFIER OF PORTABLE RADIOS IN CLASS B PUSH-PULL OPERATION.

- **Complimentary to SS8550**
- **Collector Current I_C=1.5A**
- **Collector Dissipation P_C=2W (T_C=25°C)**

TO-92



1. Emitter 2. Base 3. Collector

3

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	40	V
Collector-Emitter Voltage	V_{CEO}	25	V
Emitter-Base Voltage	V_{EBO}	6	V
Collector Current	I_C	1.5	A
Collector Dissipation	P_C	1	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−65~150	°C

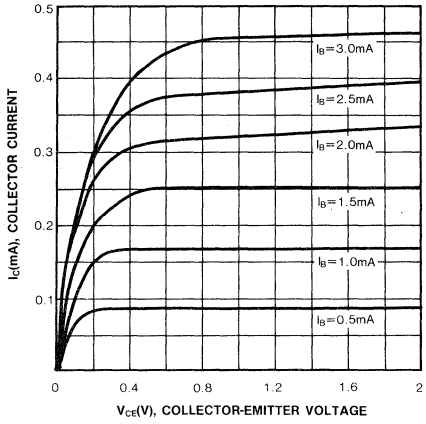
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=100μA, I_E=0	40			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=2mA, I_B=0	25			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=100μA, I_C=0	6			V
Collector Cutoff Current	I_{CBO}	V_{CB}=35V, I_E=0			100	nA
Emitter Cutoff Current	I_{EBO}	V_{EB}=6V, I_C=0			100	nA
DC Current Gain	$h_{FE}1$	V_{CE}=1V, I_C=5mA	45	135		
	$h_{FE}2$	V_{CE}=1V, I_C=100mA	85	160	300	
	$h_{FE}3$	V_{CE}=1V, I_C=800mA	40	110		
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=800mA, I_B=80mA		0.28	0.5	V
Base-Emitter Saturation Voltage	V_{BE}(sat)	I_C=800mA, I_B=80mA		0.98	1.2	V
Base-Emitter Voltage	V_{BE}	V_{CE}=1V, I_C=10mA		0.66	1	V
Output Capacitance	C_{ob}	V_{CB}=10V, I_E=0 f=1MHz		9.0		pF
Current Gain-Bandwidth Product	f_T	V_{CE}=10V, I_C=50mA	100	190		MHz

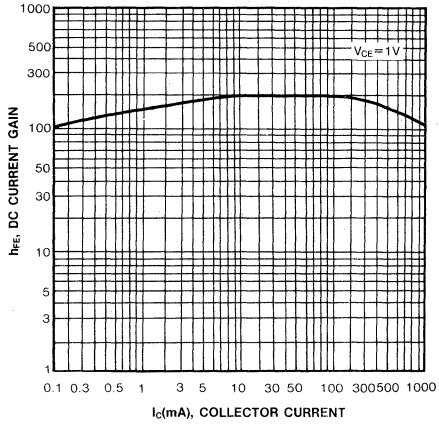
h_{FE} (2) CLASSIFICATION

Classification	B	C	D
h_{FE} (2)	85-160	120-200	160-300

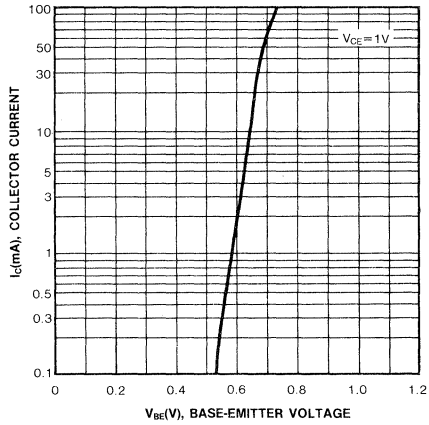
STATIC CHARACTERISTIC



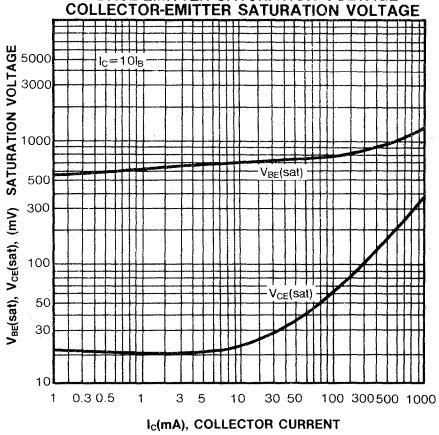
DC CURRENT GAIN



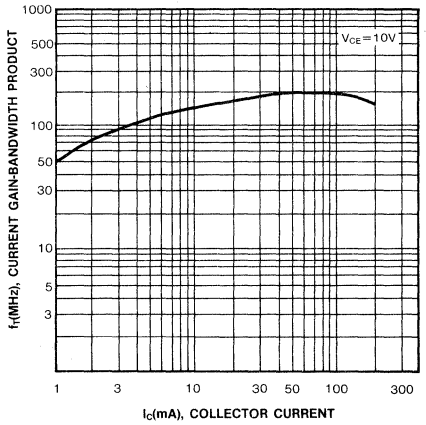
BASE-EMITTER ON VOLTAGE



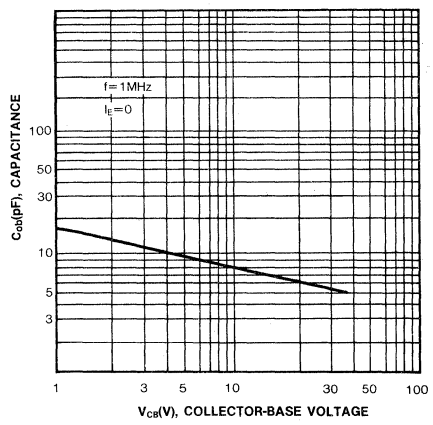
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



CURRENT GAIN-BANDWIDTH PRODUCT



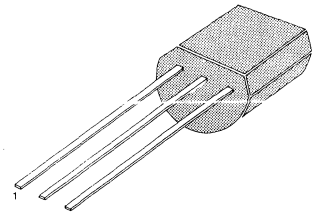
COLLECTOR OUTPUT CAPACITANCE



2W OUTPUT AMPLIFIER OF PORTABLE RADIOS IN CLASS B PUSH-PULL OPERATION.

- **Complimentary to SS8050**
- **Collector Current $I_C = -1.5A$**
- **Collector Dissipation $P_C = 2W$ ($T_C = 25°C$)**

TO-92



1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS ($T_a = 25°C$)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−40	V
Collector-Emitter Voltage	V_{CEO}	−25	V
Emitter-Base Voltage	V_{EBO}	−6	V
Collector Current	I_C	−1.5	A
Collector Dissipation	P_C	1	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−65∼150	°C

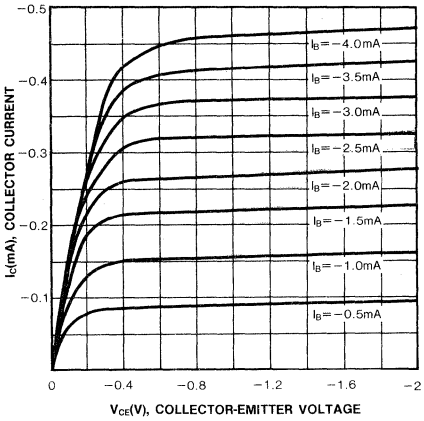
ELECTRICAL CHARACTERISTICS ($T_a = 25°C$)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	$I_C = -100\mu A$, $I_E = 0$	−40			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	$I_C = -2mA$, $I_B = 0$	−25			V
Emitter-Base Breakdown Voltage	BV_{EBO}	$I_E = -100\mu A$, $I_C = 0$	−6			V
Collector Cutoff Current	I_{CBO}	$V_{CB} = -35V$, $I_E = 0$			−100	nA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = -6V$, $I_C = 0$			−100	nA
DC Current Gain	$h_{FE}1$	$V_{CE} = -1V$, $I_C = -5mA$	45	170		
	$h_{FE}2$	$V_{CE} = -1V$, $I_C = -100mA$	85	160	300	
	$h_{FE}3$	$V_{CE} = -1V$, $I_C = -800mA$	40	80		
Collector-Emitter Saturation Voltage	$V_{CE}(sat)$	$I_C = -800mA$, $I_B = -80mA$		−0.28	−0.5	V
Base-Emitter Saturation Voltage	$V_{BE}(sat)$	$I_C = -800mA$, $I_B = -80mA$		−0.98	−1.2	V
Base Emitter Voltage	V_{BE}	$V_{CE} = -1V$, $I_C = -10mA$		−0.66	−1.0	V
Output Capacitance	Cob	$V_{CB} = -10V$, $I_E = 0$ $f = 1MHz$		15		pF
Current Gain-Bandwidth Product	f_T	$V_{CE} = -10V$, $I_C = -50mA$	100	200		MHz

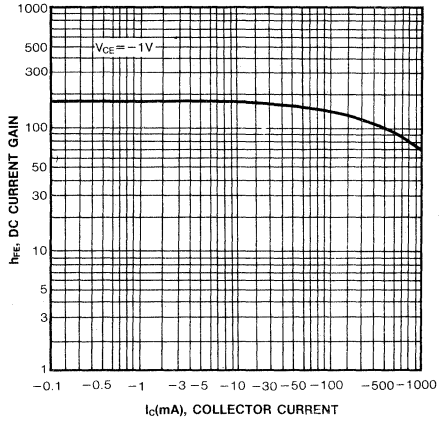
h_{FE} (2) CLASSIFICATION

Classification	B	C	D
h_{FE} (2)	85-160	120-200	160-300

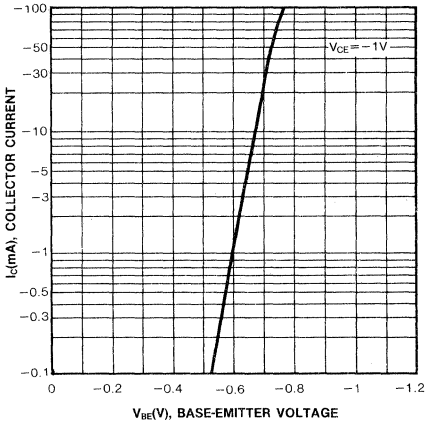
STATIC CHARACTERISTIC



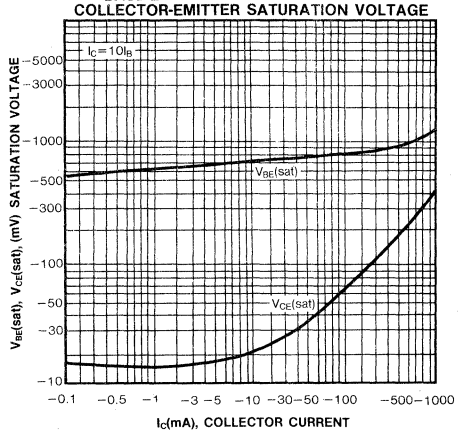
DC CURRENT GAIN



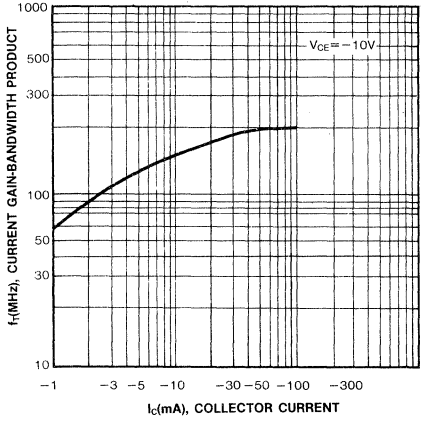
BASE-EMITTER ON VOLTAGE



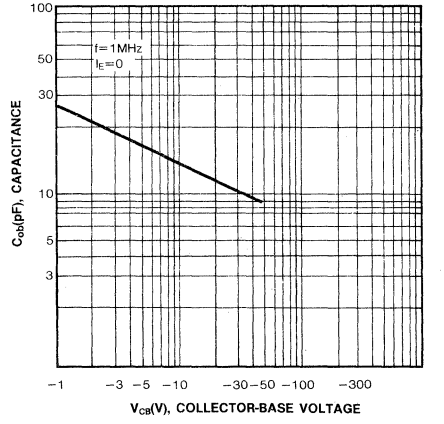
BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



CURRENT GAIN-BANDWIDTH PRODUCT

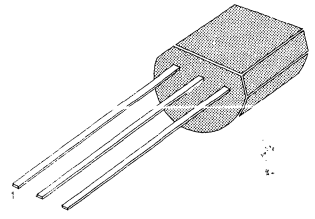


COLLECTOR OUTPUT CAPACITANCE



AM CONVERTER, AM/FM IF AMPLIFIER GENERAL PURPOSE TRANSISTOR

TO-92



1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	50	V
Collector-Emitter Voltage	V_{CEO}	30	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	30	mA
Collector Dissipation	P_C	400	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

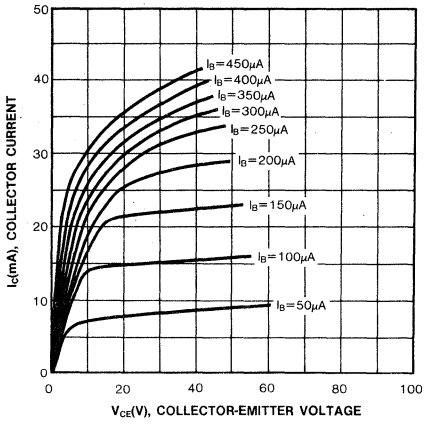
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=100μA, I_E=0	50			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=1mA, I_B=0	30			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=100μA, I_C=0	5			V
Collector Cutoff Current	I_{CBO}	V_{CB}=50V, I_E=0			100	nA
Emitter Cutoff Current	I_{EBO}	V_{EB}=5V, I_C=0			100	nA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=1mA	28	90	198	
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=10mA, I_B=1mA		0.08	0.3	V
Base-Emitter Voltage	V_{BE}	V_{CE}=5V, I_C=1mA	0.65	0.7	0.75	V
Output Capacitance	Cob	V_{CB}=10V, I_E=0 f=1MHz		1.5		pF
Current Gain-Bandwidth Product	f_T	V_{CE}=5V, I_C=1mA	150	370		MHz
Noise Figure	NF	V_{CE}=5V, I_C=1.0mA f=1MHz, Rs=500Ω		2.0	4.0	dB

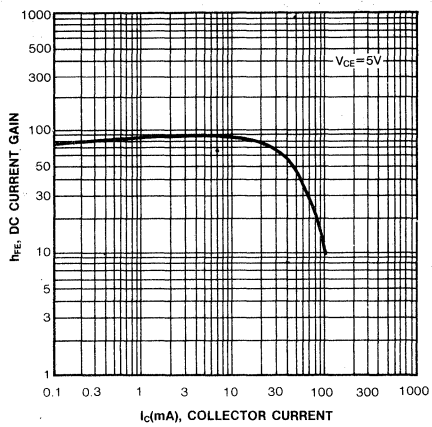
h_{FE} CLASSIFICATION

Classification	D	E	F	G	H	I
h_{FE}	28-45	39-60	54-80	72-108	97-146	132-198

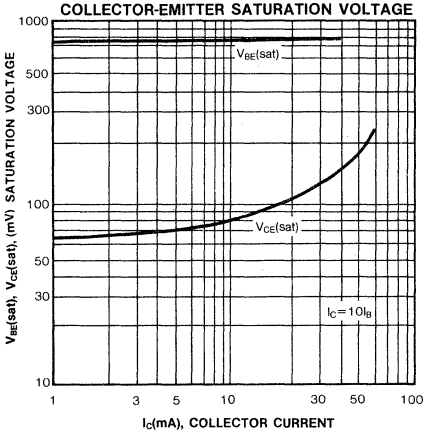
STATIC CHARACTERISTIC



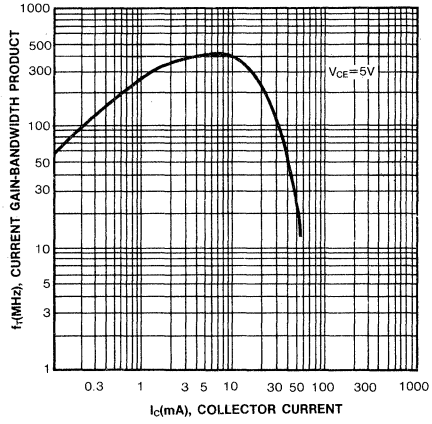
DC CURRENT GAIN



BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



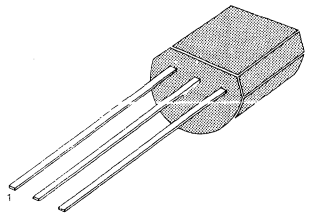
CURRENT GAIN-BANDWIDTH PRODUCT



1W OUTPUT AMPLIFIER OF POTABLE RADIOS IN CLASS B PUSH-PULL OPERATION.

- **High total power dissipation. (PT=625mW)**
- **High Collector Current. (I_C=−500mA)**
- **Complementary to SS9013**
- **Excellent h_{FE} linearity.**

TO-92



1. Emitter 2. Base 3. Collector

3

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−40	V
Collector-Emitter Voltage	V_{CEO}	−20	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current	I_C	−500	mA
Collector Dissipation	P_C	625	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55∼150	°C

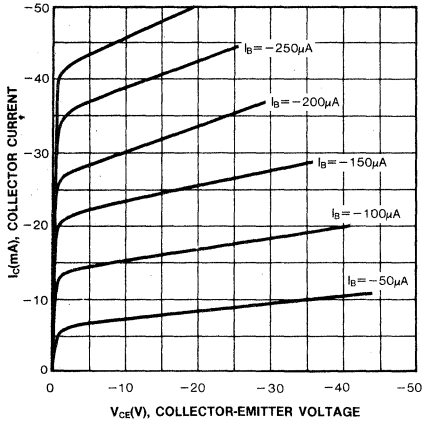
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=−100μA, I_E=0	−40			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=−1mA, I_B=0	−20			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=−100μA, I_C=0	−5			V
Collector Cutoff Current	I_{CBO}	V_{CB}=−25V, I_E=0			−100	nA
Emitter Cutoff Current	I_{EBO}	V_{EB}=−3V, I_C=0			−100	nA
DC Current Gain	$h_{FE}1$	V_{CE}=−1V, I_C=−50mA	64	120	202	
	$h_{FE}2$	V_{CE}=−1V, I_C=−500mA	40	90		
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=−500mA, I_B=−50mA		−0.18	−0.6	V
Base-Emitter Saturation Voltage	V_{BE}(sat)	I_C=−500mA, I_B=−50mA		−0.95	−1.2	V
Base-Emitter On Voltage	V_{BE}(on)	V_{CE}=−1V, I_C=−10mA	−0.6	−0.67	−0.7	V

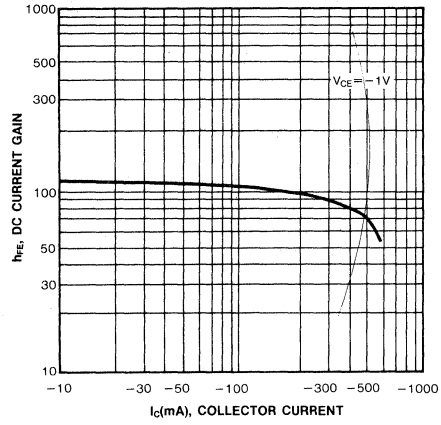
h_{FE} (1) CLASSIFICATION

Classification	D	E	F	G	H
h_{FE} (1)	64-91	78-112	96-135	112-166	144-202

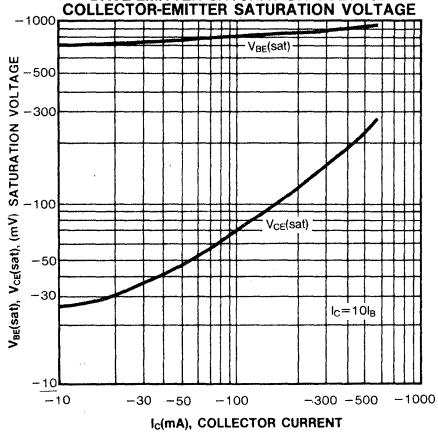
STATIC CHARACTERISTIC



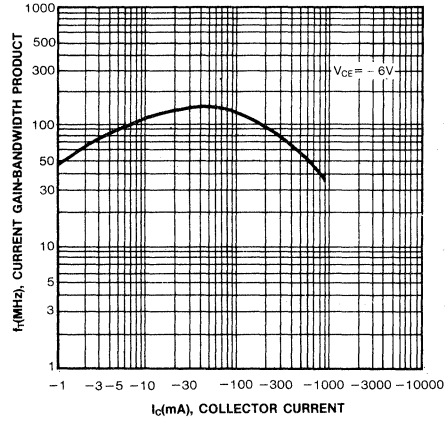
DC CURRENT GAIN



BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



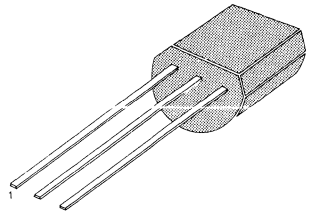
CURRENT GAIN-BANDWIDTH PRODUCT



1W OUTPUT AMPLIFIER OF POTABLE RADIOS IN CLASS B PUSH-PULL OPERATION.

- **High total power dissipation. (PT=625mW)**
- **High Collector Current. (I_C=500mA)**
- **Complementary to SS9012**
- **Excellent h_{FE} linearity.**

TO-92



1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	40	V
Collector-Emitter Voltage	V_{CEO}	20	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	500	mA
Collector Dissipation	P_C	625	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55∼150	°C

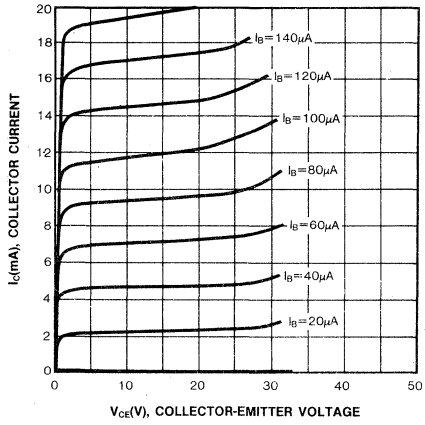
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=100μA, I_E=0	40			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=1mA, I_B=0	20			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=100μA, I_C=0	5			V
Collector Cutoff Current	I_{CBO}	V_{CB}=25V, I_E=0			100	nA
Emitter Cutoff Current	I_{EBO}	V_{EB}=3V, I_C=0			100	nA
DC Current Gain	$h_{FE}1$	V_{CE}=1V, I_C=50mA	64	120	202	
	$h_{FE}2$	V_{CE}=1V, I_C=500mA	40	120		
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=500mA, I_B=50mA		0.16	0.6	V
Base-Emitter Saturation Voltage	V_{BE}(sat)	I_C=500mA, I_B=50mA		0.91	1.2	V
Base-Emitter On Voltage	V_{BE}(on)	V_{CE}=1V, I_C=10mA	0.6	0.67	0.7	V

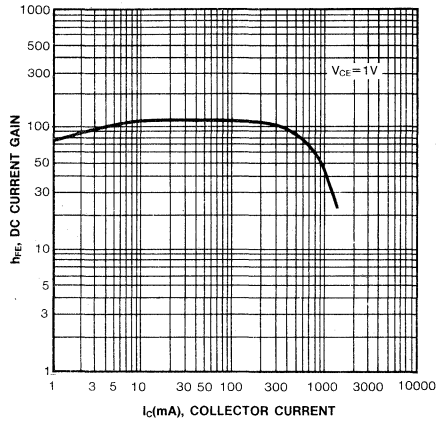
h_{FE} (1) CLASSIFICATION

Classification	D	E	F	G	H
h_{FE} (1)	64-91	78-112	96-135	112-166	144-202

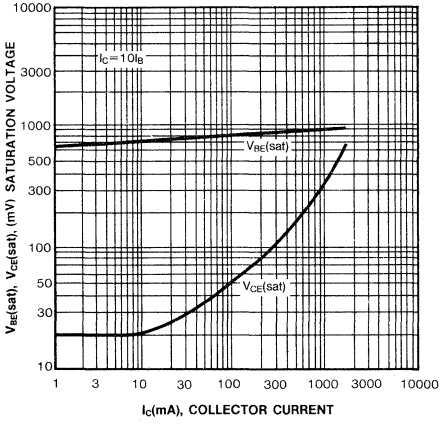
STATIC CHARACTERISTIC



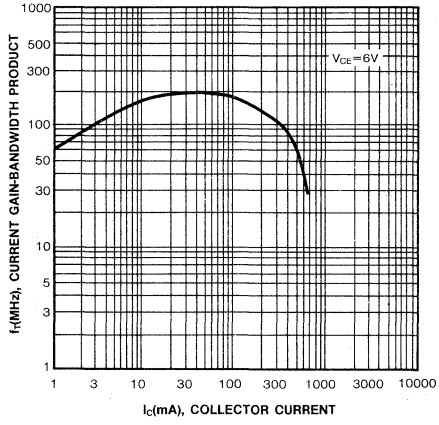
DC CURRENT GAIN



BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



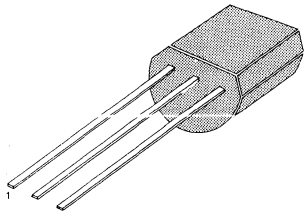
CURRENT GAIN-BANDWIDTH PRODUCT



PRE-AMPLIFIER, LOW LEVEL & LOW NOISE

- **High total power dissipation. (PT=450mW)**
- **High h_{FE} and good linearity**
- **Complementary to SS9015**

TO-92



1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	50	V
Collector-Emitter Voltage	V_{CEO}	45	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	100	mA
Collector Dissipation	P_C	450	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

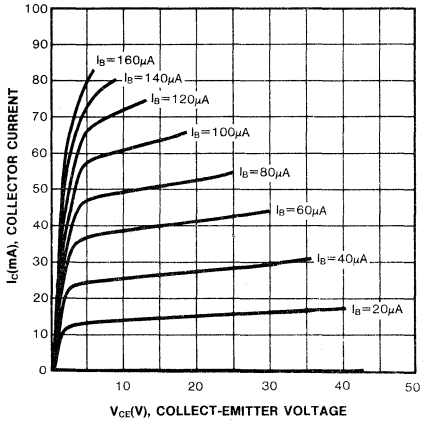
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=100μA, I_E=0	50			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=1mA, I_B=0	45			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=100μA, I_C=0	5			V
Collector Cutoff Current	I_{CBO}	V_{CB}=50V, I_E=0			50	nA
Emitter Cutoff Current	I_{EBO}	V_{EB}=5V, I_C=0			50	nA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=1mA	60	280	1000	
Collector-Base Saturation Voltage	V_{CE}(sat)	I_C=100mA, I_B=5mA		0.14	0.3	V
Base-Emitter Saturation Voltage	V_{BE}(sat)	I_C=100mA, I_B=5mA		0.84	1.0	V
Base-Emitter On Voltage	V_{BE}(on)	V_{CE}=5V, I_C=2mA	0.58	0.63	0.7	V
Output Capacitance	Cob	V_{CB}=10V, I_E=0 f=1MHz		2.2	3.5	pF
Current Gain-Bandwidth Product	f_T	V_{CE}=5V, I_C=10mA	150	270		MHz
Noise Figure	NF	V_{CE}=5V, I_C=0.2mA f=1KHz, Rs=2KΩ		0.9	10	dB

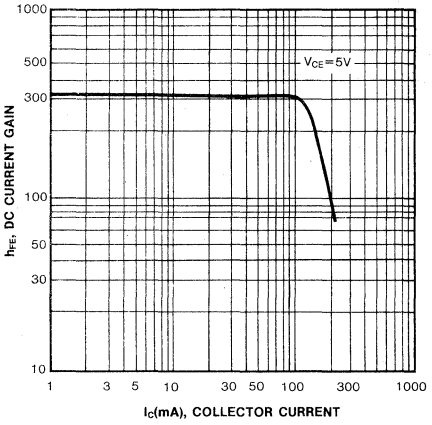
h_{FE} CLASSIFICATION

Classification	A	B	C	D
h_{FE}	60-150	100-300	200-600	400-1000

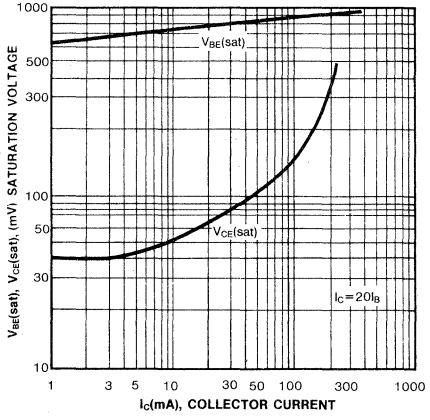
STATIC CHARACTERISTIC



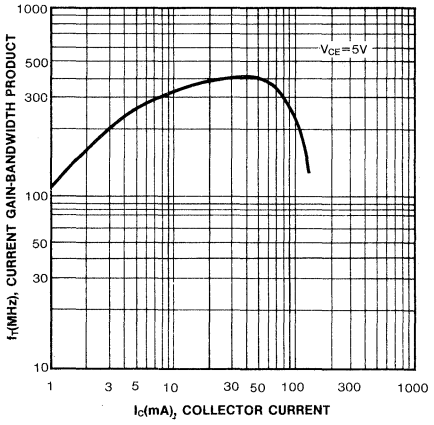
DC CURRENT GAIN



BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



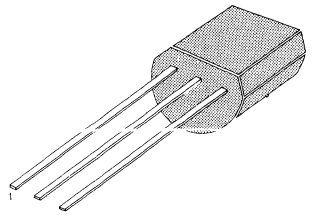
CURRENT GAIN-BANDWIDTH PRODUCT



LOW FREQUENCY, LOW NOISE AMPLIFIER

- **Complement to SS9014**

TO-92



1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	−50	V
Collector-Emitter Voltage	V_{CEO}	−45	V
Emitter-Base Voltage	V_{EBO}	−5	V
Collector Current	I_C	−100	mA
Collector Dissipation	P_C	450	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

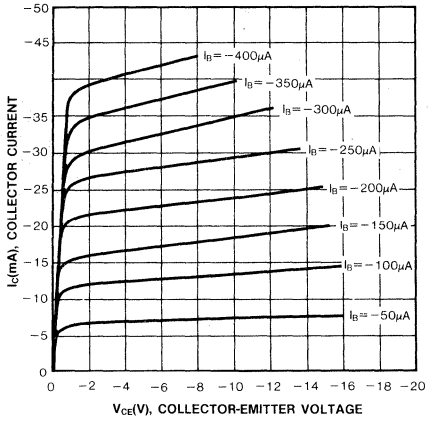
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=−100μA, I_E=0	−50			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=−1mA, I_B=0	−45			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=−100μA, I_C=0	−5			V
Collector Cutoff Current	I_{CBO}	V_{CB}=−50V, I_E=0			−50	nA
Emitter Cutoff Current	I_{EBO}	V_{EB}=−5V, I_C=0			−50	nA
DC Current Gain	h_{FE}	V_{CE}=−5V, I_C=−1mA	60	200	600	
Collector-Base Saturation Voltage	V_{CE}(sat)	I_C=−100mA, I_B=−5mA		−0.2	−0.7	V
Base-Emitter Saturation Voltage	V_{BE}(sat)	I_C=−100mA, I_B=−5mA		−0.82	−1.0	V
Base-Emitter On Voltage	V_{BE}(on)	V_{CE}=−5V, I_C=−2mA	−0.6	−0.65	−0.75	V
Output Capacitance	Cob	V_{CB}=−10V, I_E=0 f=1MHz		4.5	7.0	pF
Current Gain-Bandwidth Product	f_T	V_{CE}=−5V, I_C=−10mA	100	190		MHz
Noise Figure	NF	V_{CE}=−5V, I_C=−0.2mA f=1KHz, R_S=1KΩ		0.7	10	dB

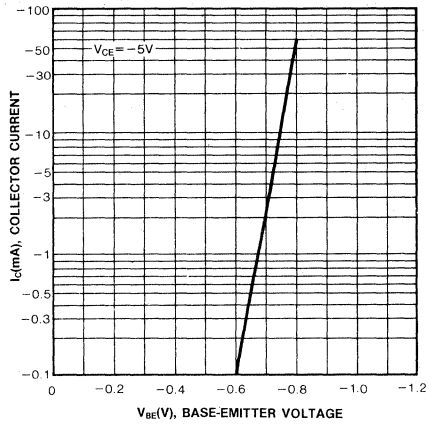
h_{FE} CLASSIFICATION

Classification	A	B	C
h_{FE}	60-150	100-300	200-600

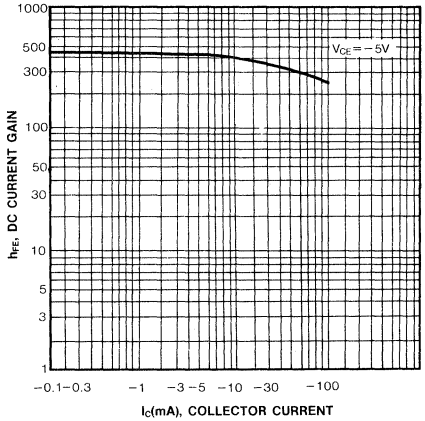
STATIC CHARACTERISTIC



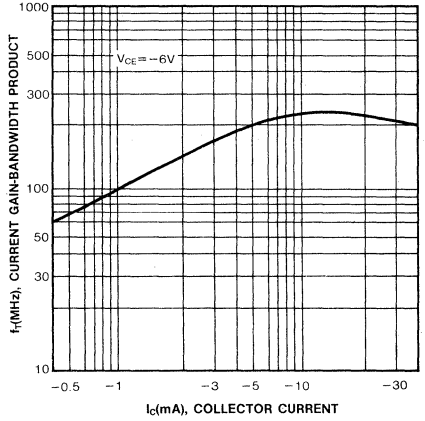
BASE-EMITTER ON VOLTAGE



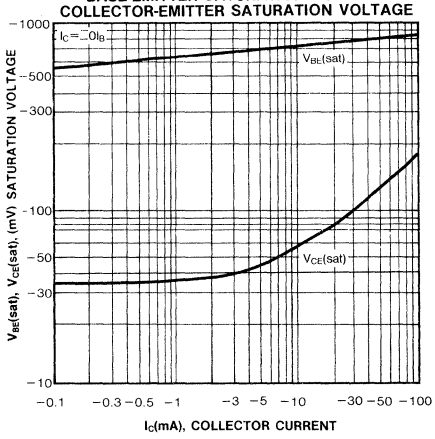
DC CURRENT GAIN



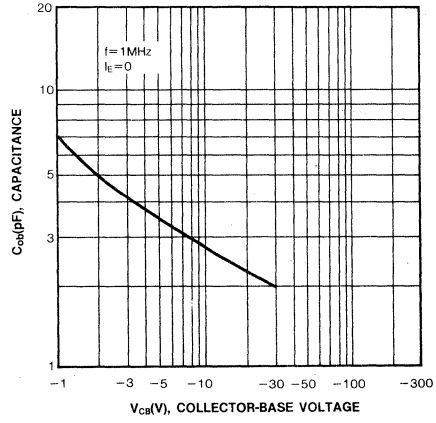
CURRENT GAIN-BANDWIDTH PRODUCT



BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



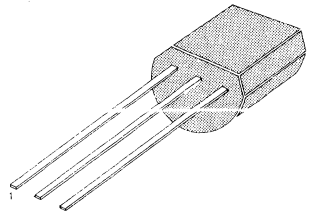
COLLECTOR OUTPUT CAPACITANCE



AM CONVERTER, FM/RF AMPLIFIER OF LOW NOISE.

- **High total power dissipation. (PT=400mW)**

TO-92



1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	30	V
Collector-Emitter Voltage	V_{CEO}	20	V
Emitter-Base Voltage	V_{EBO}	4	V
Collector Current	I_C	25	mA
Collector Dissipation	P_C	400	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

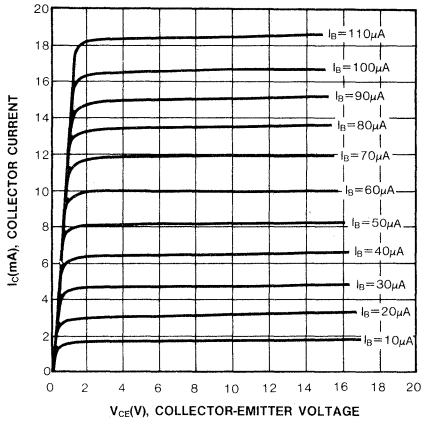
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=100μA, I_E=0	30			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=1mA, I_B=0	20			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=100μA, I_C=0	4			V
Collector Cutoff Current	I_{CBO}	V_{CB}=30V, I_E=0			100	nA
Emitter Cutoff Current	I_{EBO}	V_{EB}=3V, I_C=0			100	nA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=1mA	28	90	198	
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=10mA, I_B=1mA		0.1	0.3	V
Base-Emitter On Voltage	V_{BE} (on)	V_{CE}=5V, I_C=1mA		0.72		V
Output Capacitance	Cob	V_{CB}=10V, I_E=0 f=1MHz		1.2	1.6	pF
Current Gain-Bandwidth Product	f_T	V_{CE}=5V, I_C=1mA	400	620		MHz
Noise Figure	NF	V_{CE}=5V, I_C=1.0mA f=100MHz, R_S=50Ω		3.0	5.0	dB

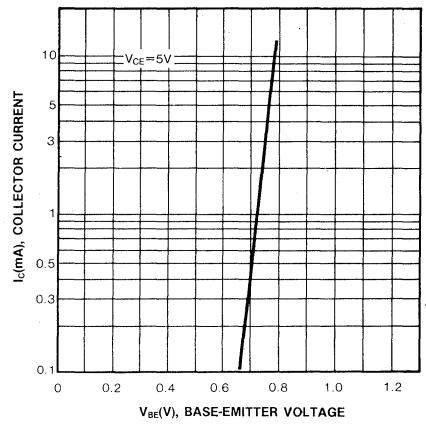
h_{FE} CLASSIFICATION

Classification	D	E	F	G	H	I
h_{FE}	28-45	39-60	54-80	72-108	97-146	132-198

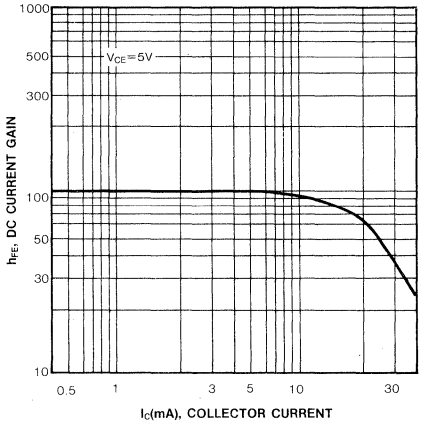
STATIC CHARACTERISTIC



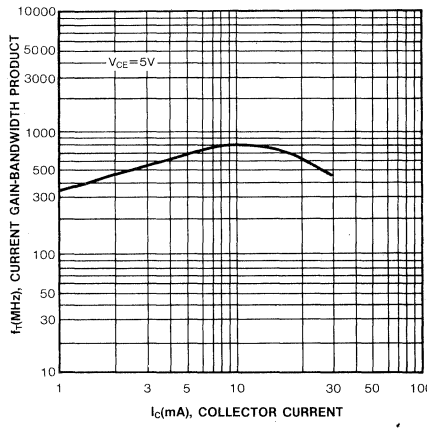
BASE-EMITTER ON VOLTAGE



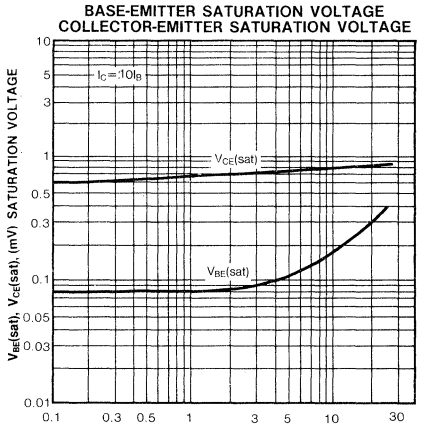
DC CURRENT GAIN



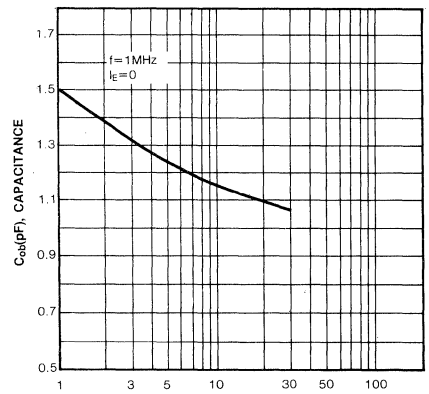
CURRENT GAIN-BANDWIDTH PRODUCT



BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



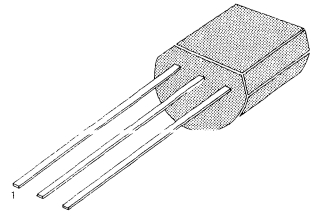
COLLECTOR OUTPUT CAPACITANCE



AM/FM IF AMPLIFIER, LOCAL OSCILLATOR OF FM/VHF TUNER

- **High Current Gain Bandwidth Product f_T=1,100 MHz (Typ)**

TO-92



1. Emitter 2. Base 3. Collector

ABSOLUTE MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Rating	Unit
Collector-Base Voltage	V_{CBO}	30	V
Collector-Emitter Voltage	V_{CEO}	15	V
Emitter-Base Voltage	V_{EBO}	5	V
Collector Current	I_C	50	mA
Collector Dissipation	P_C	400	mW
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55~150	°C

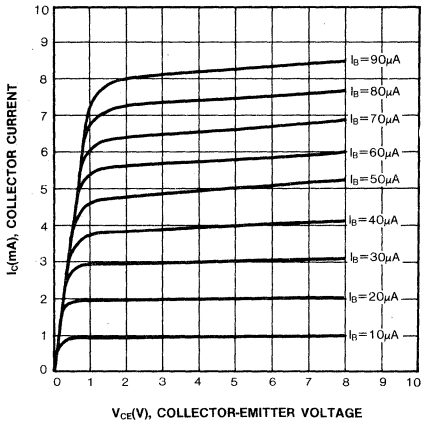
ELECTRICAL CHARACTERISTICS (T_a=25°C)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
Collector-Base Breakdown Voltage	BV_{CBO}	I_C=100μA, I_E=0	30			V
Collector-Emitter Breakdown Voltage	BV_{CEO}	I_C=1.0mA, I_B=0	15			V
Emitter-Base Breakdown Voltage	BV_{EBO}	I_E=100μA, I_C=0	5			V
Collector Cutoff Current	I_{CBO}	V_{CB}=12V, I_E=0			50	nA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=1.0mA	28	100	198	
Collector-Emitter Saturation Voltage	V_{CE}(sat)	I_C=10mA, I_B=1mA			0.5	V
Output Capacitance	C_{ob}	V_{CB}=10V, I_E=0 f=1MHz		1.3	1.7	pF
Current Gain-Bandwidth Product	f_T	V_{CE}=5V, I_C=5mA	700	1100		MHz

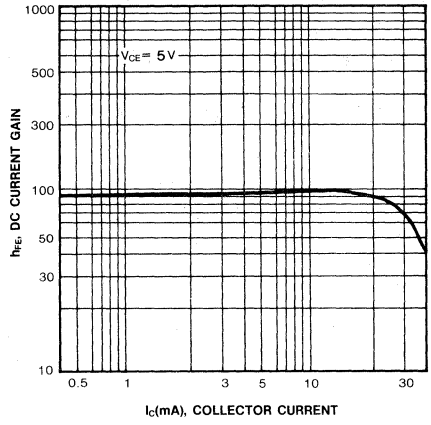
h_{FE} CLASSIFICATION

Classification	D	E	F	G	H	I
h_{FE}	28-45	39-60	54-80	72-108	97-146	132-198

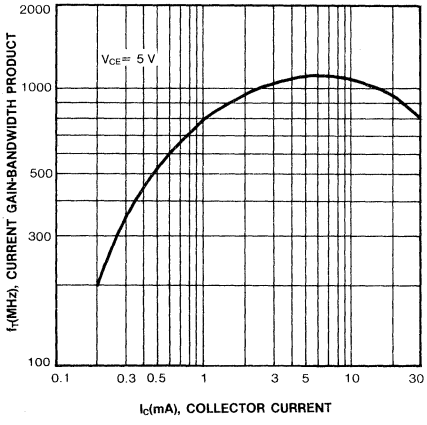
STATIC CHARACTERISTIC



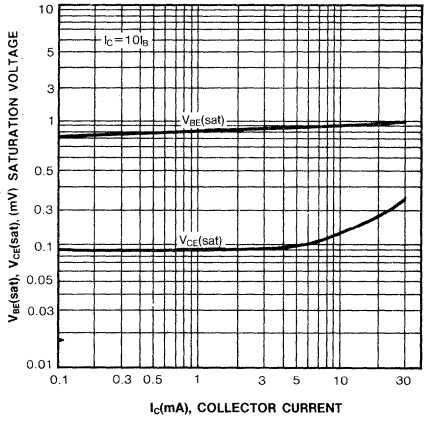
DC CURRENT GAIN



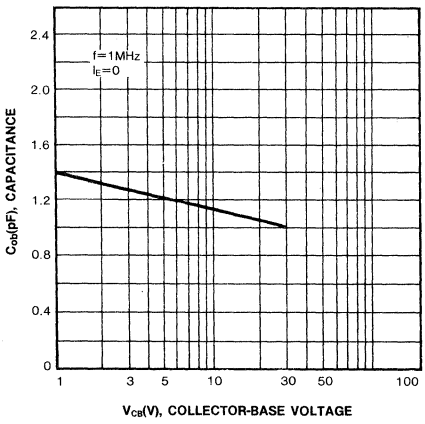
CURRENT GAIN-BANDWIDTH PRODUCT



BASE-EMITTER SATURATION VOLTAGE
COLLECTOR-EMITTER SATURATION VOLTAGE



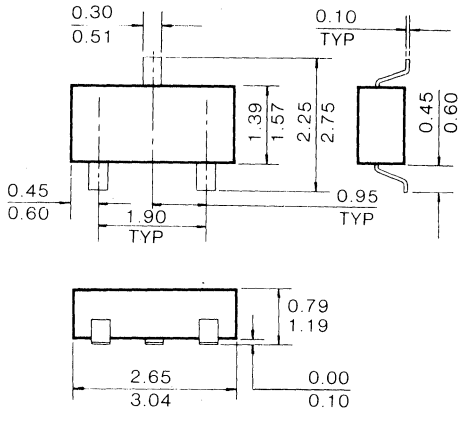
OUTPUT CAPACITANCE



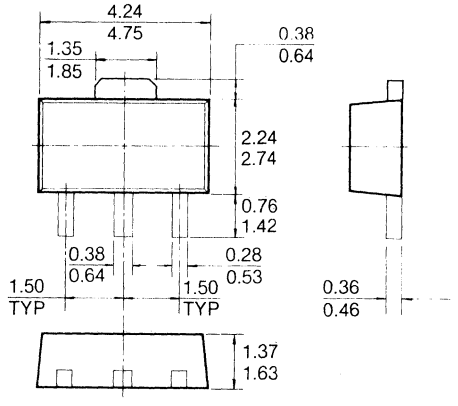
4

PACKAGE DIMENSIONS

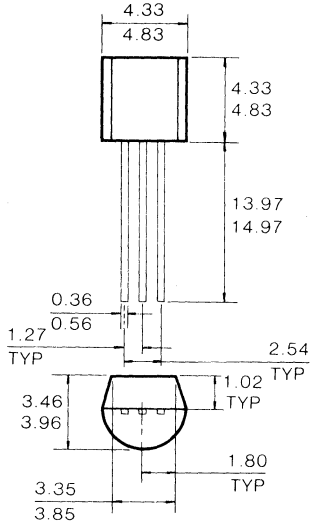
SOT-23 **Unit: mm**



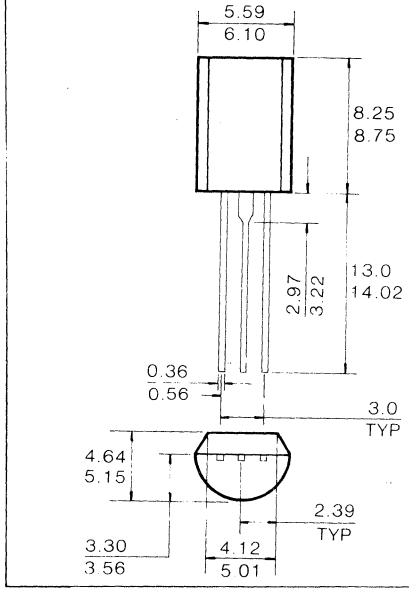
SOT-89 **Unit: mm**



TO-92 **Unit:mm**



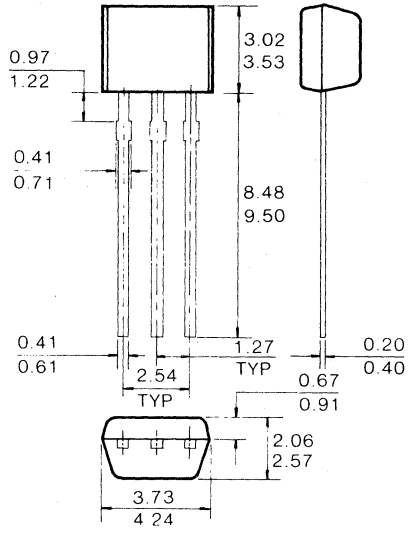
TO-92L **Unit:mm**



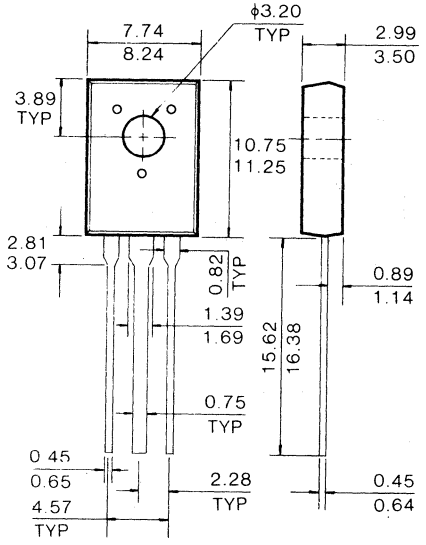
4

PACKAGE DIMENSIONS

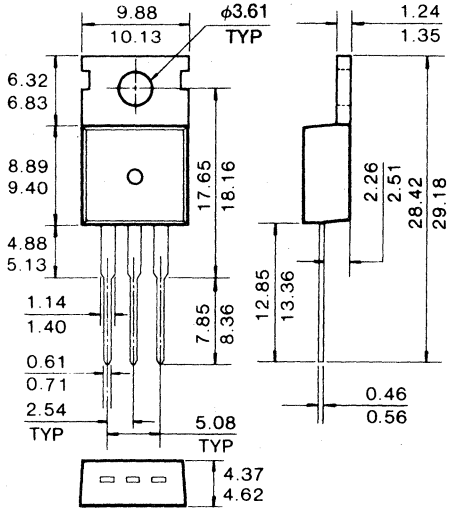
TO-92S Unit:mm



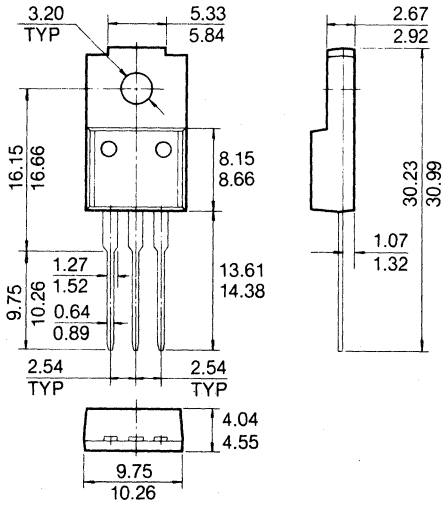
TO-126 Unit:mm



TO-220 Unit: mm

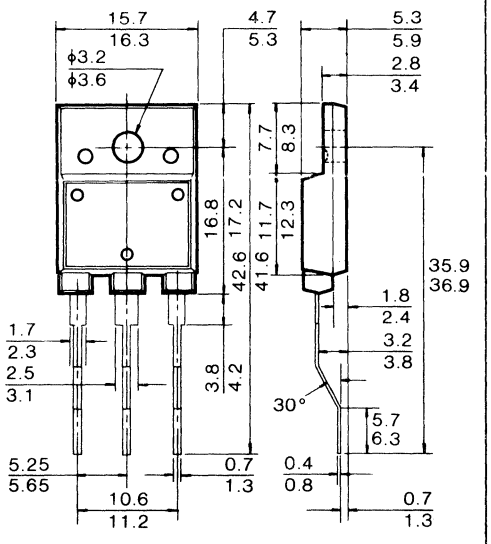


TO-220 F Unit:mm

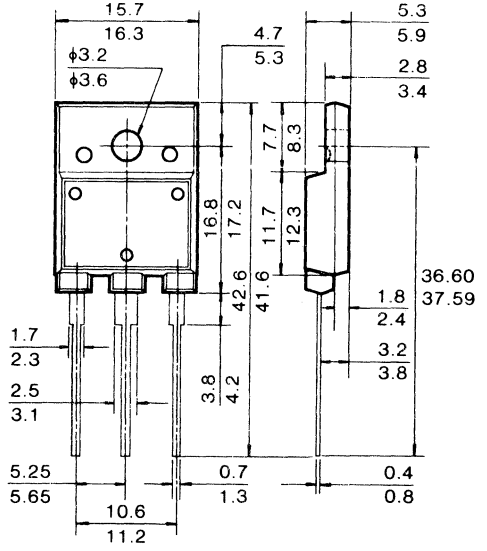


PACKAGE DIMENSIONS

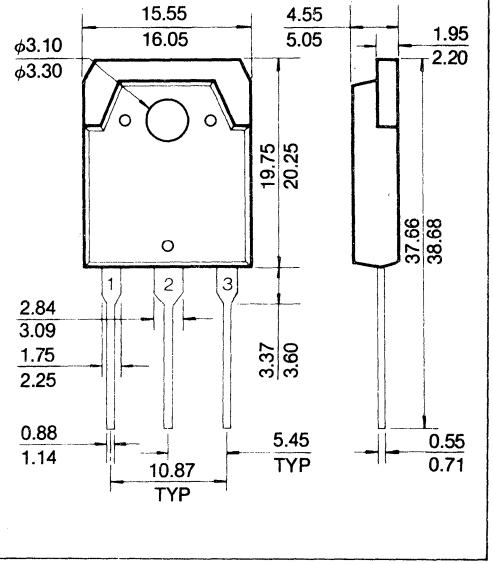
TO-3PF (1) **Unit:mm**



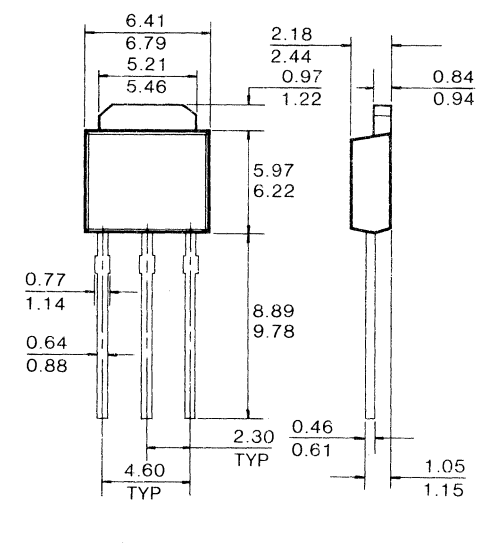
TO-3PF (2) **Unit:mm**



TO-3P **Unit: mm**



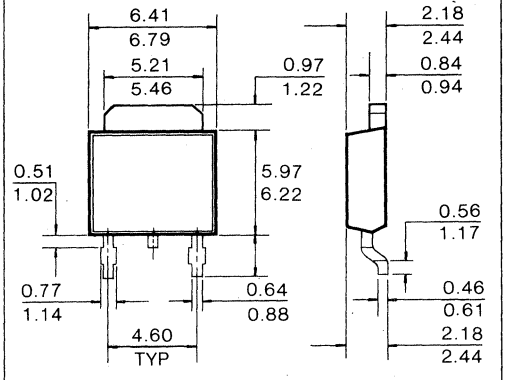
I-PACK **Unit:mm**



4

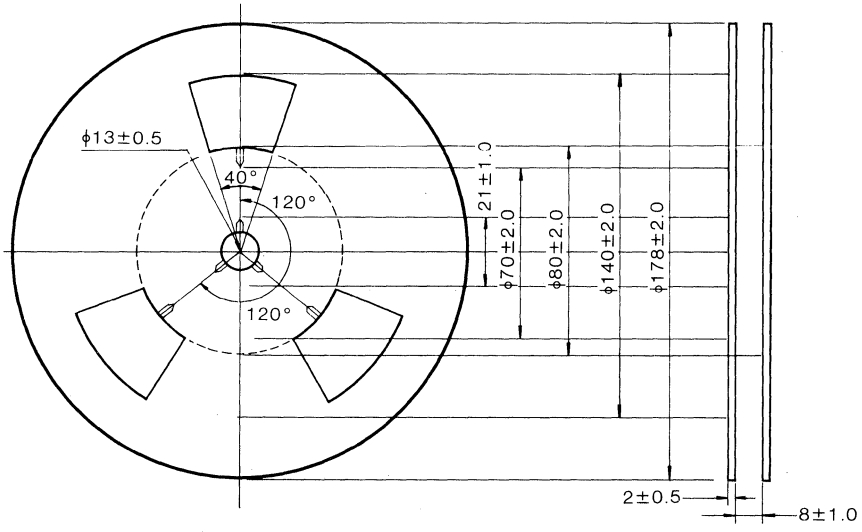
PACKAGE DIMENSIONS

D-PACK **Unit:mm**



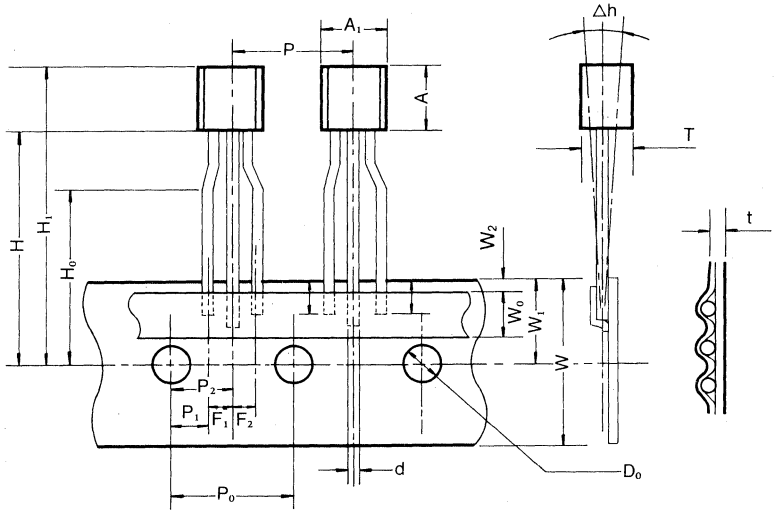
CARRIER TAPE REELS

Unit: mm



TO-92/TO-92S/TO-92L TAPING SPECIFICATION

Unit: mm

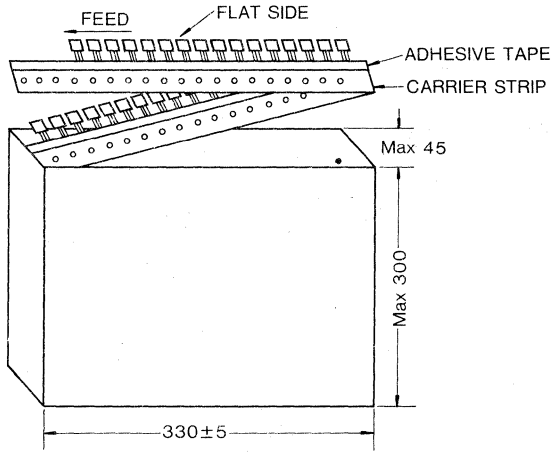


P	12.7 ± 0.5
P_0	12.7 ± 0.2
P_1	3.85 ± 0.5
P_2	6.35 ± 0.5
W	$18^{+1.0}_{-0.5}$
W_0	6 ± 0.5
W_1	9 ± 0.5
W_2	Max. 1.0
H	Max. 21
H_1	Max. 27
H0	16 ± 0.5
D_0	4 ± 0.2
t	0.65 ± 0.2
△h	C ± 1
d	0.46
T	3.56
L_1	Min. 2.5
A_1	$4.53^{+0.3}_{-0.2}$
A	$4.53^{+0.3}_{-0.2}$
F_1	$2.5^{+0.4}_{-0.1}$
F_2	$2.5^{+0.4}_{-0.1}$

4

TO-92 AMMO PACK

Unit: mm



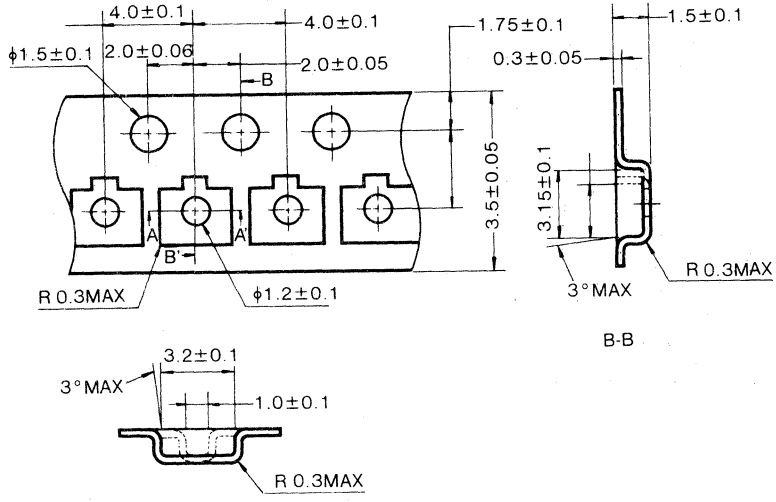
FLAT SIDE OF TRANSISTOR and ADHESIVE TAPE VISIBLE

SAMSUNG's AMMO PACK is equivalent to styles A,B,C,D of reel pack depending on which box-flat is opened and which end of the box the devices are fed from.

1 AMMO PACK contains 2000 pcs Transistors.

EMBOSSED CARRIER Specification for SOT-23

Unit: mm



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