RCA SEMICONDUCTOR PRODUCTS HANDBOOK HB-10

SEMICONDUCTOR DEVICE SECTION

This Section contains data on semiconductor devices such as transistors and silicon rectifiers.

For further Technical Information, write to
Commercial Engineering
Semiconductor & Materials Division
Radio Corporation of America
Somerville, New Jersey

RCA
SEMICONDUCTOR PRODUCTS
HANDBOOK HB-10

This Handbook of data on semiconductor devices has been compiled to meet the requirements of electronic-equipment design engineers primarily but will prove helpful to anyone having need for technical information which can be kept up to date. Its convenient loose-leaf form permits the revision of data on existing types and the addition of data on new types as they are made available.

The material is arranged in Sections divided by tabbed separators to facilitate quick reference. The Sections are as follows:

General

Semiconductor Devices

The General Section contains a Table of Contents for the complete Handbook, an Index of Types arranged in numerical-alphabetical-numerical sequence, and other useful information concerning semiconductor devices. The Data Section contains maximum ratings, characteristics, typical operation, and characteristics curves for semiconductor devices.

Commercial Engineering
SEMICONDUCTOR & MATERIALS DIVISION
RADIO CORPORATION OF AMERICA
Somerville, New Jersey (U.S.A.)

Printed in U.S.A.

9-59

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Somerville, New Jersey (U.S.A.)

RCA SEMICONDUCTOR PRODUCTS HANDBOOK HB-10

GENERAL SECTION

The information in this Section, in general, applies to all classes of RCA semiconductor devices. It includes such material as the Table of Contents, Index of Types arranged in numerical-alphabetical-numerical sequence, as well as other general information of interest to the equipment designer.

For further Technical Information, write to
Commercial Engineering
Semiconductor & Materials Division
Radio Corporation of America
Somerville, New Jersey

Table of Contents

Sheets in the RCA Semiconductor Products Handbook are arranged in the Table of Contents in order of appearance in each section. The Index of Types, which follows the Table of Contents, lists type numbers in numerical-alphabetical-numerical sequence.

The Table of Contents and Index of Types may be used to determine:

(1) location of individual sheets
(2) completeness of Handbook
(3) arrangement of Handbook sheets

Reference is to front of sheet unless otherwise indicated. Date appearing on sheet is identified by month and year (e.g., 6-66)

GENERAL SECTION

▲For combination subscribers (HB-3 & HB-10) sheet is filed in the front of the HB-3 Handbook set.

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SEMICONDUCTOR DEVICE SECTION

RADIO CORPORATION OF AMERICA
Electronic Components and Devices Harrison, N. J.

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S = Semiconductor Device

• Discontinued type. Data retained in Handbook for reference purposes only.

Reference is to front of sheet only. Data appearing on sheet is identified by month and year only (e.g., 2-66).

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RADIO CORPORATION OF AMERICA
Electron Tube Division Harrison, N. J.

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RADIO CORPORATION OF AMERICA
Electron Tube Division Harrison, N. J.

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DISCONTINUED TYPES

The following types have been discontinued. To indicate this fact for your future reference please place a large dot (●) after these types in the "Type" column of the "Index of Types" sheets.

40116 40116R

AUDIO-FREQUENCY APPLICATIONS

Small-Signal -- Class A Types

Germanium PNP

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Germanium NPN

2N1010

Silicon NPN

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2N720A	2N2405	2N2897	2N3242	40232	40399	3N99[a]
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Germanium PNP

Dissipation up to 50 W

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2N176	2N376	2N1183A	2N1184B	2N2870[c]	40051[c]	40239
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2N173	2N277	2N441	2N443	2N1100	2N1412	2N1906
2N174	2N278	2N442	2N1099	2N1358	2N1905	

Germanium PNP		**Silicon PNP**				
2N647	2N649	40319	40362			

Silicon NPN

Dissipation up to 5 W

2N1479	2N1700	40264[c]	40315	40321	40327	40349
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[a] N-Channel Depletion Type.
[b] High-Power Extended Frequency Range Type.
[c] High-Fidelity Power-Amplifier Type.

For types designed to meet Military Specifications, see *RCA* M

RADIO-FREQUENCY APPLICATIONS

Small-Signal UHF & VHF Types

Germanium PNP

2N384	2N1066	2N1178	2N1179	2N1225	2N1396	2N1397
2N1023	2N1177					

Germanium NPN

2N2482

Silicon NPN

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Germanium PNP

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Silicon NPN

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Germanium PNP

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Silicon NPN

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[d] Frequency Multiplier Type.

litary-Specifications Types sheet.

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Silicon NPN
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Silicon NPN
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Dissipation up to 5 W

Silicon NPN Medium-Voltage Type (< 100 V)
2N697 2N718A 2N1613 2N3119

Silicon NPN High-Voltage Type (> 100 V)
2N720A 2N1893

Dissipation 5 to 50 W

Germanium PNP Medium-Voltage Types (< 100 V)
2N1183 2N1183B 2N1184 2N1184A 2N1184B 2N2869 2N2870
2N1183A

Silicon NPN Medium-Voltage Types (< 100 V)
2N1479 2N1485 2N1701 2N3053 2N3230 40250 40347
2N1481 2N1700 2N2270 2N3054 40082 40278 40348
2N1483

Silicon NPN High-Voltage Types (> 100 V)
2N1480 2N1484 2N2102 2N3231 2N3441 2N3879 40349
2N1482 2N1486 2N2405 2N3262 2N3878 40346

Silicon NPN Very-High-Voltage Types (> 250 V)
2N3439 2N3440 2N3583 2N3584 2N3585 40255 40256

Dissipation 50 W and higher

Germanium PNP Medium-Voltage Types (< 100 V)
2N173 2N277 2N441 2N443 2N1100 2N1412 2N1905
2N174 2N278 2N442 2N1099 2N1358

Germanium PNP High-Voltage Type (> 100 V)
2N1906

Silicon NPN Medium-Voltage Types (< 100 V)
2N1487 2N1489 2N1702 2N2015 2N3055 2N3772 40251
2N1488 2N1490 2N1703 2N2338 2N3771

Silicon NPN High-Voltage Types (> 100 V)
2N2016 2N3263 2N3264 2N3265 2N3266 2N3442 2N3773

For types designed to meet Military Specificatio

or RCA Transistors

Types for: DC-to-DC Converters -- Inverters -- Choppers -- Relay Controls

Voltage and Current Regulators -- Servo Amplifiers

Germanium PNP

2N173	2N278	2N443	2N1183	2N1183B	2N1184A	2N1358
2N174	2N441	2N1099	2N1183A	2N1184	2N1184B	2N1412
2N277	2N442	2N1100				

Silicon NPN

2N1487	2N1700	2N2015	2N3055	2N3266	2N3442	3N98[a]
2N1488	2N1701	2N2016	2N3263	2N3439	2N3583	3N99[a]
2N1489	2N1702	2N2338	2N3264	2N3440	2N3584	40255
2N1490	2N1703	2N3054	2N3265	2N3441	2N3585	40256

Differential and Operational Amplifier Types

Silicon NPN

2N1613	2N2270	2N3440	40256	40346	3N98[a]	3N99[a]
2N2102	2N3439	40255				

COMPUTER APPLICATIONS

Memory Driver Types

Germanium PNP

2N1384

Silicon NPN

2N2476	2N2477	2N3261	2N3262	2N3512	40283

Logic Types

Germanium PNP Low and Medium-Speed

2N395	2N397	2N414	2N1300	2N1305	2N1384	2N1854
2N396	2N404	2N581	2N1301	2N1307	2N1683	40269
2N396A	2N404A	2N582	2N1303	2N1309	2N1853	

Germanium NPN Low and Medium-Speed

2N388	2N585	2N1091	2N1304	2N1308	2N1605	2N1605A
2N388A	2N1090	2N1302	2N1306			

Silicon NPN High-Speed

2N706	2N709	2N2205	2N2938	40217	40219	40221
2N706A	2N834	2N2369A	2N3011	40218	40220	40222
2N708	2N914	2N2475	2N3261			

High Voltage Types for Direct ON-OFF Control (Neon or incandescent-Lamp Indicators, Relays, Counters, etc.)

2N398	2N398A	2N398B

[a] N-Channel Depletion Type.

s, see *RCA Military-Specifications Types* sheet.

Selection Guide Contents

TRANSISTORS

Refer to Handbook Data Sheets on the following RCA Products:

SILICON CONTROLLED RECTIFIERS
SILICON RECTIFIERS —
Diffused Junction, Stacks, Bridges
TUNNEL DIODES
TUNNEL RECTIFIERS
TEMPERATURE-COMPENSATION DIODE (Page No. 15)
TELEVISION DAMPER DIODE

FOOTNOTES, ABBREVIATIONS AND SYMBOLS FOR TRANSISTORS

■ f_{hfb}
* I_{CEO}
▲ $V_{CEO(sus)}$
‡ Free-air temperature
● f_T
$P_{o\ min}$ W
⊕ V_{CER}
+ V_{CEV}
★ BV_{CEO}
●● Two transistors and a diode internally connected to form a Darlington circuit. The diode is connected across the output transistor.
▲▲ V_{CBV}
f_{hfe} (kc/s)
† Pulsed

DEP - Double Diffused Epitaxial Planar
DF - Drift Field
DJ - Diffused Junction
EX - Epitaxial
EXP - Epitaxial Planar
GB - Graded Base
HO - Hometaxial-base construction
OV - Overlay construction
P - Planar
TD - Triple Diffused
TDP - Epitaxial

C_{iss} - Small-Signal, Short-Circuit, Input Capacitance
C_{rss} - Small-Signal, Short-Circuit, Reverse Transfer Capacitance
g_{fs} - Forward Transconductance
I_D - Drain Current
$I_{DS(off)}$ - Drain-to-Source Off Current
P_T - Transistor Dissipation
R_{gs} - Gate-to-Source Leakage Resistance
T - Operating Temperature
V_{DS} - Drain-to-Source Voltage

Note: Type listings in the following charts which do not indicate package designations should be referred to the data sheets for the specific types involved.

TRANSISTORS
— Audio Frequency —

RCA Type	Structure	Package	MAX. RATINGS			CHARACTERISTICS			
			P_T @ 25°C	V_{CB}	I_C	h_{fe} (typ.) @ I_C		I_{CBO} (max.)	f_T (typ.)
			mW	V	mA	h_{fe}	mA	μA	Mc/s
SMALL-SIGNAL TYPES (Class A)									P_T: to 150 mW
Germanium PNP									
2N175	Alloy	TO-40	20	10	2	65	0.5	12	0.85■
2N220	Alloy	TO-1	20	10	2	65	0.5	12	0.85■
2N591	Alloy	TO-1	50	32	20	70	2.0	7	0.7■
2N2613	Alloy	TO-1	100	30	50	200	0.5	5	10■
2N2614	Alloy	TO-1	100	40	50	160	1	5	10■
40263	Alloy	TO-1	120	20	50	160	1	-	10■
2N104	Alloy	TO-40	150	30	50	44	1	10	0.7■
2N215	Alloy	TO-1	150	30	50	44	1	10	0.7■
2N405	Alloy	TO-40	150	20	35	35	1	14	0.65■
2N406	Alloy	TO-1	150	20	35	35	1	14	0.65■
Germanium NPN									
2N1010	Alloy	TO-1	20	10	2	35	0.3	10	2.0■
Silicon NPN									P_T: to 5 W
40231	P		500	18	100	80	2	0.5	60
40232	P		500	18	100	175	2	0.5	60
40233	P		500	18	100	175	2	0.25	60
40234	P		500	18	100	80	2	0.25	60
2N3241	P		500	30	100	175	10	0.1	60
2N3242	P		500	30	200	175	10	0.01	60
2N718A	TDP	TO-18	1.8 W	75	–	35 min.	5	0.01	100
2N720A	TDP	TO-18	1.8 W	120	–	30 min.	1.0	0.01	100
2N2895	TDP	TO-18	1.8 W	120	1 A	50 min.	5	0.002	120 min.

Audio Frequency Cont'd

Type	Structure	Package	MAX. RATINGS P_T @25°C mW	V_{CB} V	I_C mA	CHARACTERISTICS h_{fe} (typ.) @ I_C h_{fe}	mA	I_{CBO} (max.) μA	f_T (typ.) Mc/s
SMALL-SIGNAL TYPES (Class A)									**P_T: to 5 W**
Silicon NPN									
2N2896	TDP	TO-18	1.8 W	140	1 A	50 min.	5	0.01	120 min.
2N2897	TDP	TO-18	1.8 W	60	1 A	50 min.	5	0.05	100 min.
40084	TDP	TO-18	1.8 W	60	1 A	5 min.	50	0.25	100 min.
2N2102	TDP	TO-5	5.0 W	120	1 A	40 min.	1	0.002	120 min.
2N2270	TDP	TO-5	5.0 W	60	1 A	30 min.	5	0.1	60 min.
2N2405	TDP	TO-5	5.0 W	120	1 A	30 min.	1	0.01	120 min.
2N3053	TDP	TO-5	5.0 W	60	0.7A	5 min.	50	0.25	100 min.
LARGE-SIGNAL TYPES (Classes A & B)									**P_T: to 50 W**
Germanium PNP						**h_{FE}**			
2N407	Alloy	TO-40	150	20	70	65	50	14	-
2N408	Alloy	TO-1	150	20	70	65	50	14	-
LARGE-SIGNAL TYPES (Classes A & B)									**P_T: to 150 W**
Germanium PNP									
2N109	Alloy	TO-40	0.165	35	0.15	75	0.05	14	1■
2N217	Alloy	TO-1	0.165	35	0.15	75	0.05	14	1■
40395	Alloy	TO-1	0.22	-	0.5	-		0.01	1■
40329	Alloy	TO-1	0.25	-	0.10	90	0.025	14	1.5
2N270	Alloy	TO-7	0.25	25	0.075	70	0.15	16	1
2N2953	Alloy	TO-1	0.30	30	0.15	350	0.01	5	1
40253	Alloy	TO-1	0.65	25	0.50	75	0.4	14	1

Audio Frequency Cont'd

Type	Structure	Package	MAX. RATINGS P_T @25°C	V_{CB}	I_C	CHARACTERISTICS h_{FE}(typ.) @ I_C		I_{CBO} (max.)	f_T (typ.)
			W	V	A	h_{FE}	A	μA	Mc/s
LARGE-SIGNAL TYPES (Classes A & B)									**P_T: to 150 W**
Germanium PNP									
2N1183	Alloy	TO-8	7.5	45	3	40	0.4	30	0.5■ min.
2N1183A	Alloy	TO-8	7.5	60	3	40	0.4	30	0.5■ min.
2N1183B	Alloy	TO-8	7.5	80	3	40	0.4	30	0.5■ min.
2N1184	Alloy	TO-8	7.5	45	3	80	0.4	30	0.5■ min.
2N1184A	Alloy	TO-8	7.5	60	3	80	0.4	30	0.5■ min.
2N1184B	Alloy	TO-8	7.5	80	3	80	0.4	30	0.5■ min.
2N176	Alloy	TO-3	10	40	3	63	0.5	3 mA	-
2N351	Alloy	TO-3	10	40	3	65	0.7	3 mA	-
2N376	Alloy	TO-3	10	40	3	78	0.7	3 mA	-
2N301	See 2N2869/2N301								
2N301A	See 2N2870/2N301A								
2N2147	DF	TO-3	12.5	75	5	150	1	1 mA	4.0
2N2148	DF	TO-3	12.5	60	5	80	1	100	3.0
40022	Alloy	TO-3	12.5	32	5	50	1	500	0.3
40050	Alloy	TO-3	12.5	40	5	90	1	500	0.5
40051	Alloy	TO-3	12.5	50	5	90	1	1 mA	0.5
40254	Alloy	TO-3	12.5	32	5	70	1	3 mA	0.3
2N2869/ 2N301	Alloy	TO-3	30	60	10	90	1	500	0.45
2N2870/ 2N301A	Alloy	TO-3	30	80	10	90	1	500	0.45
2N1905	DF	TO-3	50	60	10	90	1	500	7.5
2N1906	DF	TO-3	50	100	10	125	5	500	7.5

Audio Frequency Cont'd

Type	Structure	Package	MAX. RATINGS P_T @25°C W	V_{CB} V	I_C A	CHARACTERISTICS h_{FE}(typ.) @ I_C h_{FE}	A	I_{CBO} (max.) μA	f_T (typ.) Mc/s
LARGE-SIGNAL TYPES (Classes A & B)									P_T: to 150 W
Germanium PNP									
2N173	Alloy	TO-36	150	60	15	25	12	100 (typ.)	-
2N174	Alloy	TO-36	150	80	15	20	12	100 (typ.)	-
2N277	Alloy	TO-36	150	40	15	25	12	100 (typ.)	-
2N278	Alloy	TO-36	150	50	15	25	12	100 (typ.)	-
2N441	Alloy	TO-36	150	40	15	20	12	100 (typ.)	-
2N442	Alloy	TO-36	150	50	15	20	12	100 (typ.)	-
2N443	Alloy	TO-36	150	60	15	20	12	100 (typ.)	-
2N1099	Alloy	TO-36	150	80	15	25	12	100 (typ.)	-
2N1100	Alloy	TO-36	150	100	15	20	12	100 (typ.)	-
2N1358	Alloy	TO-36	150	80	15	55 typ.	1.2	200	-
2N1412	Alloy	TO-36	150	100	15	20 typ.	12	100 (typ.)	-
Germanium NPN									P_T: to 50 W
2N647	Alloy	TO-1	0.1	25	0.05	70 typ.	0.050	-	-
2N649	Alloy	TO-1	0.1	20	0.05	65 typ.	0.050	-	-
Silicon NPN									
40084	P	TO-18	1.8	60	1.0	50	0.15	0.25	100 min.
2N699	P	TO-5	2	120	-	40	0.15	2	50
2N1711	TD	TO-5	3	75	1.0	100	0.15	0.01	70 min.

Audio Frequency Cont'd

Type	Structure	Package	MAX. RATINGS P_T @25°C W	V_{CB} V	I_C A	CHARACTERISTICS h_{FE}(min.) @ I_C h_{FE}	A	I_{CBO} (max.) μA	f_T (typ.) Mc/s
LARGE-SIGNAL TYPES (Classes A & B)									P_T: to 50 W
Silicon NPN									
40264	DJ		4	300	0.05	60 typ.	0.1	100	25
40360	DJ	TO-5	5	-	0.7	40	0.01	-	100
40361	DJ	TO-5	5	-	0.7	70	0.05	-	100
2N1700	HO	TO-5	5	60	1	20	0.1	75	-
40347	HO	TO-5	5	60	1	20	0.45	1*	-
2N1479	HO	TO-5	5	60	1.5	20	0.2	10	-
2N1481	HO	TO-5	5	60	1.5	35	0.2	10	-
40348	HO	TO-5	5	90	1	30	0.3	1*	-
2N1480	HO	TO-5	5	100	1.5	20	0.2	10	-
2N1482	HO	TO-5	5	100	1.5	35	0.2	10	-
40349	HO	TO-5	5	160	1	25	0.15	10*	-
2N3585	TD	TO-66	5	500	2	40	0.1	5 mA	10 min.
40309	TDP	TO-5	5	18▲	0.7	70	0.05	0.25	100
40311	TDP	TO-5	5	30▲	0.7	70	0.05	0.25	100
40314	TDP	TO-5	5	40▲	0.7	35	0.01	0.25	100
40315	TDP	TO-5	5	35▲	0.7	70	0.05	0.25	100
40317	TDP	TO-5	5	40▲	0.7	40	0.01	0.25	100
40320	TDP	TO-5	5	40▲	0.7	40	0.01	0.25	-
40321	TDP	TO-5	5	300▲	1	25	0.02	100	-
40323	TDP	TO-5	5	18▲	0.7	70	0.05	0.25	100
40326	TDP	TO-5	5	40▲	0.7	40	0.01	0.25	-
40327	TDP	TO-5	5	300▲	1	40	0.01	5	-
40250V1	DJ		5.8‡	50	4	25	1.5	1	1
2N3584	DJ	TO-66	7.5	375	2	40	0.1	5 mA	10 min.
2N3583	DJ	TO-66	15	250	2	40	0.1	10 mA	10 min.

Audio Frequency Cont'd

Type	Structure	Package	MAX. RATINGS P_T @ 25°C W	V_{CB} V	I_C A	CHARACTERISTICS h_{FE}(min.) @ I_C h_{FE}	A	I_{CBO} (max.) μA	f_T (typ.) Mc/s
LARGE-SIGNAL TYPES (Classes A & B)									**P_T: to 50 W**
Silicon NPN									
2N1483	HO	TO-8	25	60	3	20	0.75	15	-
2N1484	HO	TO-8	25	100	3	20	0.75	15	-
2N1485	HO	TO-8	25	60	3	35	0.75	15	-
2N1486	HO	TO-8	25	100	3	35	0.75	15	-
2N1701	HO	TO-8	25	60	2.5	20	0.3	100	-
2N3054	HO	TO-66	25	90	4	25	0.5	-	1.0
40250	HO	TO-66	29	40▲	4	25	1.5	1 mA	1
40310	HO	TO-66	29	35▲	4	20	1.0	10	0.75
40312	HO	TO-66	29	60	4	20	1.0	10	0.75
40316	HO	TO-66	29	40	4	20	1.0	10	0.75
40324	HO	TO-66	29	35	4	20	1.0	10	0.75
40364	DJ	TO-66	35	-	7	20	2.5	-	15
40313	TD	TO-66	35	300	2	40	0.1	5 mA	-
40318	TD	TO-66	35	300	2	50	0.5	-	-
40322	TD	TO-66	35	300	2	75	0.5	-	-
40328	TD	TO-66	35	300	2	20	0.2	-	-
LARGE-SIGNAL TYPES (Classes A & B)									**P_T: 50 to 150 W**
Silicon NPN									
2N1487	HO	TO-3	75	40	6	15	1.5	25	-
2N1488	HO	TO-3	75	55	6	15	1.5	25	-
2N1489	HO	TO-3	75	40	6	25	1.5	25	-
2N1490	HO	TO-3	75	55	6	25	1.5	25	-
2N1702	HO	TO-3	75	40	5	15	0.8	200	-
2N1703	HO	TO-36	75	40	5	15	0.8	200	-

Audio Frequency Cont'd

Type	Structure	Package	MAX. RATINGS P_T @25°C W	V_{CB} V	I_C A	CHARACTERISTICS h_{FE}(min.) @ I_C h_{FE}	A	I_{CBO} (max.) μA	f_T (typ.) Mc/s
LARGE-SIGNAL TYPES (Classes A & B)									P_T: 50 to 150 W
Silicon NPN									
2N3263	EX		75	90	25	25	15	4 mA	20 min.
2N3264	EX		75	60	25	20	15	10 mA	20 min.
40363	DJ	TO-3	115	-	15	20	4	-	0.7
2N3055	HO	TO-3	115	60	15	20	4	-	0.5
2N3442	HO	TO-3	117	140	10	-	-	5 mA	-
40251	HO	TO-3	117	40▲	15	15	8	5 mA	0.5
40325	HO	TO-3	117	35	15	12	8	5 mA	-
2N3265	EX	TO-63	125	90	25	25	15	4 mA	20 min.
2N3266	EX	TO-63	125	60	25	20	15	10 mA	20 min.
2N2015	HO	TO-36	150	50	10	15	5	50	-
2N2016	HO	TO-36	150	65	10	15	5	50	-
2N2338	HO	TO-36	150	40	7.5	15	3	200	-
Silicon PNP									P_T: to 5 W
40319	DEP	TO-5	5	40	-0.7	35	0.2	0.25	0.75
40362	DJ	TO-5	5	-	-0.7	35	-0.05	-	100

— Radio Frequency —

Type	Structure	Package	MAX. RATINGS			CHARACTERISTICS			
			P_T @55°C	V_{CB}	I_C	$V_{CE(sat)}$ (max.) @ I_C		I_{CBO} (max.)	T (max.)
			W	V	A	V	A	μA	°C
TELEVISION DEFLECTION TYPES									**P_T: to 10 W**
Germanium PNP									
2N3730	GB	TO-3	10	-200	-3	-2	-0.7	-200	85
2N3731	GB	TO-3	5	-320	-10	-1.5	-6	-200	85
2N3732	GB	TO-3	3	-100	-3	-2	-0.7	-200	85

Type	Structure	Package	MAX. RATINGS			CHARACTERISTICS			
			P_T @25°C	V_{CE}	I_C	$V_{CE(sat)}$ (max.) @ I_C		I_{CBO} (max.)	T (max.)
			W	V	A	V	A	μA	°C
TELEVISION VIDEO OUTPUT TYPES									**P_T: to 1 W**
Silicon NPN									
40354	EXP		0.5	150	0.04	5	0.03	0.2	175
40355	EXP		1	150	0.04	5	0.03	0.2	175

Radio Frequency Cont'd

RCA Type	Package	MAX. RATINGS				CHARACTERISTICS				
						Typical			Max	
		V_{DS}	I_D	P_T	T	R_{gs}	g_{fs}	$I_{DS_{off}}$	C_{rss}	C_{iss}
		V	mA	mW	°C	Ω	μmhos	pA	pF	pF
INSULATED-GATE FIELD EFFECT TRANSISTORS										
Silicon N-Channel Depletion Types										
3N98	TO-72	32	15	150	85	10^{15}	1500	50	0.5	7.0
3N99	TO-72	32	15	150	85	10^{15}	2000	50	0.5	7.0

RCA Type	Structure	Package	CHARACTERISTICS					
			G_p (Typ.) @ Operating Frequency		f_{hfb} (Typ.)	h_{fe} (Typ.) @ I_C		V_{CB} (max.)
			Mc/s	dB	Mc/s	h_{fe}	mA	V
UHF & VHF SMALL-SIGNAL TYPES						f_T: to 1200 Mc/s		
Silicon NPN								
2N3478	EXP		470	12 NF = 5	900●	9.0	2	30
2N2857	EXP	TO-72	450	12.5 min. NF = 4	1000● min.	50 min.	2	30
40294 40296	High-Reliability Version of 2N2857, controlled & tested for critical aerospace and military applications.							
40404	EXP	TO-52	43 to 86	11.5	For Frequency Multiplier Doubler Service			40
40405	EXP	TO-52	120 to 240	6.5				40
40235	EXP		216	18.1	1200●	For TV Tuner Use		35
2N918	EXP	TO-72	200	18	600● min.	-	-	30
2N3600	EXP	TO-72	200	17 min. NF = 4.5 max.	850● min.	8.5 min.	5	30

Radio Frequency Cont'd

Type	Structure	Package	CHARACTERISTICS					
			G_p (Typ.) @ Operating Frequency		f_{hfb} (Typ.)	h_{fe} (Typ.) @ I_c		V_{CB} (max.)
			Mc/s	dB	Mc/s	h_{fe}	mA	V
UHF & VHF SMALL-SIGNAL TYPES								f_T: to 1200 Mc/s
Silicon NPN								
2N3933	EXP	TO-72	200	14 min. NF = 4 max.	750● min.	7.5 min.	2	40
2N2708	EXP	TO-72	200	12 NF = 7.5 max.	700● min.	30 min.	2	35
40295	High-Reliability Version of 2N2708, controlled & tested for critical aerospace and military applications.							
2N917	EXP	TO-72	200	11.5	500● min.	-	-	30
2N3932	EXP	TO-72	200	11.5 min. NF = 45 max.	750● min.	7.5 min.	2	30
40242	P		100	38.5 NF = 2.5	For FM RF stages			35
40238	P		45	28	900●	For TV IF Amp. Service		35
40239	P		45	28	900●			35
40240	P		45	28	900●			35
Germanium PNP								
2N1178	DF	TO-45	120	Local Oscillator Service	140	48	1	30
2N1179	DF	TO-45	100	17	140	80	1	30
2N1177	DF	TO-45	100	14	140	100	1	30
2N1023	DF	TO-44	50	24	120	60	1.5	40
2N1066	DF	TO-33	50	24	30	60	1.5	40
2N1397	DF	TO-33	50	24	120	90	1.5	40
2N384	DF	TO-44	50	21	100	60	1.5	40

Radio Frequency Cont'd

Type	Structure	Package	CHARACTERISTICS					
			G_p (Typ.) @ Operating Frequency		f_{hfb} (Typ.)	h_{fe} (Typ.) @ I_c		V_{CB} (max.)
			Mc/s	dB	Mc/s	h_{fe}	mA	V
UHF & VHF SMALL-SIGNAL TYPES								f_T: to 1200 Mc/s
Germanium PNP								
2N1225	DF	TO-33	50	21	100	60	1.5	40
2N1396	DF	TO-33	50	21	100	90	1.5	40
IF, RF, & VIDEO AMPLIFIER TYPES								f: to 30 Mc/s
Germanium PNP								
2N370	DF	TO-7	20	17	30	100	1	24
2N1226	DF	TO-33	12.5	22	30	60	1.5	60
2N274	DF	TO-44	12.5	22	30	60	1.5	40
2N1224	DF	TO-33	12.5	22	30	60	1.5	40
2N1395	DF	TO-33	12.5	22	30	90	1.5	40
2N1180	DF	TO-45	10.7	36	100	80	1.5	30
2N1631	DF	TO-40	1.5	47.7	45	80	1.0	34
2N1632	DF	TO-1	1.5	47.7	45	80	1	34
2N1637	DF	TO-1	1.5	47.7	45	80	1	34
40262	DF	TO-1	0.455	56	30	150	1	50
2N139	Alloy	TO-40	0.455	37	4.7	48	1	16
2N218	Alloy	TO-1	0.455	37	4.7	48	1	16
2N409	Alloy	TO-40	0.455	37.8	6.7	48	1	13
2N410	Alloy	TO-1	0.455	37.8	6.7	48	1	13
2N1524	DF	TO-1	0.455	54.4	33	60	1	24
2N1525	DF	TO-40	0.455	54.4	33	60	1	24
2N1638	DF	TO-1	0.262	61.5	40	75	1	34

Radio Frequency Cont'd

Type	Structure	Package	CHARACTERISTICS					
			G_p (Typ.) @ Operating Frequency		f_{hfb} (Typ.)	h_{fe} (Typ.) @ I_c		V_{CB} (max.)
			Mc/s	dB	Mc/s	h_{fe}	mA	V
IF, RF, & VIDEO AMPLIFIER TYPES								f: to 30 Mc/s
Silicon NPN								
40080	TDP	TO-5	27	0.1	For CB Transmitters			
40081	TDF	TO-5	27	0.4				
40082	TDP	TO-39	27	3.0				
40245	P		10.7	33.2	For FM IF Amplifier Stages			35
40246	P		10.7	33.2				35
CONVERTER, OSCILLATOR, & MIXER TYPES								f: to 216 Mc/s
Germanium PNP								
2N1178	DF	TO-45	120	Local Oscillator Service	140	40	1	30
2N1179	DF	TO-45	100	17	140	80	1	30
2N371	DF	TO-7	23	Local Oscillator Service	30	80	1	24
2N372	DF	TO-7	10	26.2	30	80	1	24
40261	DF	TO-1	1.5	53	40	80	1	50
2N1526	DF	TO-1	1.5	48.9	33	130	1	24
2N1527	DF	TO-40	1.5	48.9	33	130	1	24
2N1639	DF	TO-1	1.5	37	45	75	1	34
2N140	Alloy	TO-40	1	32	10	75	0.6	16
2N219	Alloy	TO-1	1	32	10	75	0.6	16
2N411	Alloy	TO-40	1	32	10	75	0.6	13
2N412	Alloy	TO-1	1	32	10	75	0.6	13
Silicon NPN								
40236	P		216	19	For TV Tuner Applications			35
40237	P		216	-				35

Radio Frequency Cont'd

RCA Type	Structure	Package	CHARACTERISTICS					
			G_p (Typ.) @ Operating Frequency		f_{hfb} (Typ.)	h_{fe} (Typ.) @ I_C		V_{CB} (max.)
			Mc/s	dB	Mc/s	h_{fe}	mA	V
CONVERTER, OSCILLATOR, & MIXER TYPES f: to 216 Mc/s								
Silicon NPN								
40243	P		100	37.6	For FM Mixer Stages			35
40244	P		120	Local Oscillator Service	For FM Oscillator Stages			35
Germanium Compensating Diode								
1N2326	V_R(max.) = -1.0 V		I_F(max.) = 100 mA		E_{FWD} @ 25° C = 135 mV			

RCA Type	Structure	Package	CHARACTERISTICS			MAX. RATINGS	
			P_O (min) @ Operating Frequency		f_T (Typ.)	V_{CBO}	P_T
			Mc/s	W	Mc/s	V	W
UHF & VHF LARGE-SIGNAL (Power) TYPES f_T: to 550 Mc/s							
Silicon NPN							
2N3733	OV	TO-60	400	10	400	65	23
2N3375	OV	TO-60	400	3	500	65	11.6
40306	High Reliability Version of 2N3375						
40279	Ultra High Reliability Version of 2N3375						
2N3866	OV	TO-39	400	1	800	55	5
2N3632	OV	TO-60	260	10 Typ.	400	65	23
40307	High Reliability Version of 2N3632						
2N3553	OV	TO-39	260	2.5 Typ.	500	65	7
40305	High Reliability Version of 2N3553						

Radio Frequency Cont'd

Type	Structure	Package	CHARACTERISTICS			MAX. RATINGS	
			P_O (min.) @ Operating Frequency		f_T (Typ.)	V_{CBO}	P_T
			Mc/s	W	Mc/s	V	W
UHF & VHF LARGE-SIGNAL (Power) TYPES f_T: to 550 Mc/s							
Silicon NPN							
40282	EXP	TO-60	175	12	350	36	23.2
40281	EXP	TO-60	175	4	400	36	11.6
40280	OV	TO-39	175	1	550	36	7
40292	OV	TO-60	135	6	300	-	23.2
40290	OV	TO-39	135	2	500	-	7
40291	OV	TO-60	135	2	500	-	11.6
2N1493	TDP	TO-5	70	0.5 Typ.	180 min.	100	3
2N1492	TDP	TO-5	70	0.1 Typ.	180 min.	60	3
2N1491	TDP	TO-5	70	0.01 Typ.	180 min.	30	3
2N3435	Like 2N1492 but with V_{CB} = 80 V						
40341	OV	TO-60	50	30	-	80	70
40340	OV	TO-60	50	25	-	60	70
2N3229	TDP	TO-60	50	15	200	105	17.5
2N2876	TDP	TO-60	50	10	200	80	17.5
2N2631	TDP	TP-39	50	7.5	200	80	8.75
2N3118	TDP	TO-5	50	1	250	-	4
2N699	TDP	TO-5	-	-	50 min.	120	2
Frequency Multiplier						f: 1000 Mc/s	
Doubler							
2N4012	OV	TO-60	800	3	500	65	11.6
Tripler							
2N4012	OV	TO-60	1000	2.5	500	65	11.6

— Computer Switching —

Type	Structure	Package	CHARACTERISTICS f_T (min.)	h_{FE}(min) @ I_C		C_{ob} (max.)	MAX. RATINGS P_T	V_{CB}
			Mc/s	h_{FE}	mA	pF	mW	V
HIGH-VOLTAGE TYPES								V_{CB}: to 105 V
Germanium PNP								
2N398	Alloy	TO-5	-	20	5	-	50	105
2N398A	Alloy	TO-5	-	20	5	-	150	105
2N398B	Alloy	TO-5	1■	20	5	-	250	105
2N586	Alloy	TO-7	-	30	250	-	250	45
MEDIUM-SPEED TYPES								f_T: to 50 Mc/s
Germanium PNP								
2N395	Alloy	TO-5	3■	20	10	20	150	30
2N1303	Alloy	TO-5	3■	20	10	20	150	30
40269	Alloy	TO-5	4■	50	12	-	150	25
2N404	Alloy	TO-5	4■	24	24	20	150	25
2N404A	Alloy	TO-5	4■	24	24	20	150	40
2N581	Alloy	TO-5	4■	20	20	20	150	18
2N396	Alloy	TO-5	5■	30	10	20	150	30
2N396A	Alloy	TO-5	5■	30	10	20	200	30
2N1305	Alloy	TO-5	5■	40	10	20	150	30
2N414	Alloy	TO-5	8■ typ.	80	1	11	150	30
2N397	Alloy	TO-5	10■	40	10	20	150	30
2N1307	Alloy	TO-5	10■	60	10	20	150	30
2N582	Alloy	TO-5	14■	40	24	20	150	25
2N1309	Alloy	TO-5	15■	80	10	20	150	30
2N1384	DF	TO-11	20	20	200	-	240	30
2N1300	Mesa	TO-5	25	30	10	12	150	13
2N1301	Mesa	TO-5	35	30	10	12	150	13
2N1853	Mesa	TO-5		30	6	-	150	18
2N1854	Mesa	TO-5	40	40	20	12	150	18
2N1683	Mesa	TO-5	50	50	10	12	150	13

Computer Switching Cont'd

Type	Structure	Package	CHARACTERISTICS f_T (min.)	h_{FE}(min.) @ I_C h_{FE}	mA	C_{ob} (max.) pF	MAX. RATINGS P_T mW	V_{CB} V
MEDIUM-SPEED TYPES								f_T: to 50 Mc/s
Germanium NPN								
2N585	Alloy	TO-5	3■	20	20	25	120	25
2N1302	Alloy	TO-5	3■	20	10	20	150	25
2N1605	Alloy	TO-5	4■	24	24	20	150	25
2N1605A	Alloy	TO-5	4■	24	24	20	200	40
2N1090	Alloy	TO-5	5■	30	20	25	120	25
2N388	Alloy	TO-5	5■	30	200	20	150	25
2N388A	Alloy	TO-5	5■	30	200	20	150	40
2N1304	Alloy	TO-5	5■	40	10	20	150	25
2N1091	Alloy	TO-5	10■	40	20	25	120	25
2N1306	Alloy	TO-5	10■	60	10	20	120	25
2N1308	Alloy	TO-5	15■	80	10	20	150	25
HIGH-SPEED TYPES								f_T: to 600 Mc/s
Silicon NPN								
2N706	Mesa	TO-18	200	20	10	6	300	25
40217	Electrically identical to 2N706 but with TO-52 pkg.							
2N706A	Mesa	TO-18	200	20	10	-	300	25
40218	Electrically identical to 2N706A but with TO-52 pkg.							
2N2205	EXP	TO-18	200	20	10	6	300	25
40222	Electrically identical to 2N2205 but with TO-52 pkg.							
2N2476	EXP	TO-5	250	20	150	10	600	60
2N2477	EXP	TO-5	250	40	150	10	600	60
2N914	EXP	TO-18	300	30	10	6	360	40
40221	Electrically identical to 2N914 but with TO-52 pkg.							
2N708	P	TO-18	-	30	10	6	360	40
40219	Electrically identical to 2N708 but with TO-52 pkg.							
2N834	EXP	TO-18	350	25	10	4	300	30 V_{CES}

Computer Switching Cont'd

Type	Structure	Package	CHARACTERISTICS f_T (min.)	h_{FE}(min.) @ I_C		C_{ob} (max.)	MAX. RATINGS P_T	V_{CB}
			Mc/s	h_{FE}	mA	pF	mW	V
HIGH-SPEED TYPES								f_T: to 600 Mc/s
Silicon NPN								
40220	Electrically identical to 2N834 but with TO-52 pkg.							
2N3512	EXP	TO-5	375	10	500	10	800	60
40283	EXP	TO-46	375	10	500	10	400	60
2N3011	EXP	TO-18	400	30	10	4	360	30
2N2369A	EXP	TO-18	400	40	10	4	360	-25
2N709	EXP	TO-18	600	15	30	3	300	15
2N2475	EXP	TO-18	600	20	50	3	300	15
2N2938	EXP	TO-52	600	25	10	4	300	25
2N3261	EXP	TO-52	600	40	10	3.5	300	40

— Power Switching —

Type	Structure	Package	P_T (max.) @25°C	V_{CE}	CHARACTERISTICS $V_{CE(sus)}$ (min.)	h_{FE}(min.) @ I_C		$V_{CE(sat)}$ (max.) @ I_C		f_T (typ) f_{hfb} (typ)
			W	V	V	h_{FE}	A	V	A	Mc/s
MEDIUM-POWER TYPES										P_T: to 5 W
Silicon NPN										
2N718A	TDP	TO-18	1.8	50⊕	-	40+	0.15	1.2	0.05	60 min.
2N720A	TDP	TO-18	1.8	100⊕	80+	40+	0.15	1.5	0.15	50 min.
2N697	DJ	TO-5	2	40⊕	-	40	0.15	1.5	0.15	100
2N1613	TDP	TO-5	3	50+	-	35	0.01	1.5+	0.15	60 min.

Power Switching Cont'd

RCA Type	Structure	Package	P_T (max.) @25°C	V_{CE}	CHARACTERISTICS					
					$V_{CE(sus)}$ (min.)	h_{FE}(min.) @ I_C		$V_{CE(sat)}$ (max.) @ I_C		f_T (typ) f_{hfb} (typ)
			W	V	V	h_{FE}	A	V	A	Mc/s
MEDIUM-POWER TYPES										**P_T: to 5 W**
Silicon NPN										
2N1893	TDP	TO-5	3	80*	80†	40	0.15	1.2	0.05	50 min.
2N3119	TDP	TO-5	4	100	80	40	0.01	0.5	0.1	250 min.
40082	TDP	TO-39	5	60	-	-	-	-	-	-
2N3053	TDP	TO-5	5	60	40	50	0.15	1.4	0.15	100 min.
2N1479	HO	TO-5	5	60	40	20	0.2	1.4	0.2	*1.5*
2N1481	HO	TO-5	5	60	40	35	0.2	1.4	0.2	*1.5*
2N1700	HO	TO-5	5	60	40	20	0.1	1.0	0.1	-
40347	HO	TO-5	5	60	40	20	0.45	1	0.45	-
2N2270	TDP	TO-5	5	60	45	35	0.001	0.9	0.15	60 min.
40360	DJ	TO-5	5	70	-	40	0.01	1.4	0.15	100
40361	DJ	TO-5	5	70⊕	70	70	0.05	1.4	0.15	100
2N2102	TDP	TO-5	5	80	65	35	0.01	0.5	0.15	60 min.
40348	HO	TO-5	5	90	65	30	0.3	0.75	0.3	-
2N2405	TDP	TO-5	5	90*	90	60	0.15	0.2	0.05	120 min.
2N1480	HO	TO-5	5	100	55	20	0.2	1.4	0.2	*1.5*
2N1482	HO	TO-5	5	100	55	35	0.2	1.4	0.2	*1.5*
40349	HO	TO-5	5	160	140	24	0.15	0.5	0.15	-
2N3440	TD	TO-5	5	-	250	40	0.02	0.5	0.02	20 min.
2N3439	TD	TO-5	5	-	350	40	0.02	0.5	0.02	20 min.
Germanium PNP										**P_T: to 50 W**
2N1183	Alloy	TO-8	7.5	45	-	20	0.4	0.5	0.4	*0.5 min.*
2N1184	Alloy	TO-8	7.5	45	-	40	0.4	0.5	0.4	*0.5 min.*

Power Switching Cont'd

Type	Structure	Package	P_T (max.) @25°C	V_{CE}	CHARACTERISTICS					
					$V_{CE(sus)}$ (min.)	h_{FE}(min.) @ I_C		$V_{CE(sat)}$ (max.) @ I_C		f_T (typ) f_{hfb} (typ)
			W	V	V	h_{FE}	A	V	A	Mc/s
MEDIUM-POWER TYPES										P_T: to 50 W
Germanium PNP										
2N1183A	Alloy	TO-8	7.5	60	-	20	0.4	0.5	0.4	*0.5 min.*
2N1184A	Alloy	TO-8	7.5	60	-	40	0.4	0.5	0.4	*0.5 min.*
2N1183B	Alloy	TO-8	7.5	80	-	20	0.4	0.5	0.4	*0.5 min.*
2N1184B	Alloy	TO-8	7.5	80	-	40	0.4	0.5	0.4	*0.5 min.*
2N2869	Alloy	TO-3	30	50	-	50	1	0.75	10	0.45
2N2870	Alloy	TO-3	30	50	-	50	1	0.75	10	0.45
2N1905	DF	TO-3	50	40*	-	50	1	1	1	7.5
2N1906	DF	TO-3	50	40*	-	75	5	1	5	7.5
Silicon NPN										P_T: to 25 W
40250V1	DJ		5.8	40	40	25	1.5	1.5	1.5	1
2N3262	TDP	TO-39	8.75	100	80	40	0.5	0.6	1	-
40255	TD		10	-	350	40	0.02	0.5	0.05	20 min.
40256	TD		10	-	250	40	0.02	0.5	0.05	20 min.
●● 2N3231	EXP		25	100	80	2000	2.0	1.4	2	40 min.
2N1483	HO	TO-8	25	60	40	20	0.75	2	0.75	*1.25*
2N1485	HO	TO-8	25	60	40	35	0.75	0.75	0.75	*1.25*
2N1701	HO	TO-8	25	60	40	20	0.3	1.5	0.3	-
2N3054	HO	TO-66	25	90	55	20	0.5	1.0	0.5	1.2 min.
Silicon NPN										P_T: to 50 W
2N1484	HO	TO-8	25	100	55	20	0.75	2	0.75	*1.25*
2N1486	HO	TO-8	25	100	55	35	0.75	0.75	0.75	*1.25*
●● 2N3230	EXP		25	80	60	2000	2	1.4	2	40 min.

Power Switching Cont'd

Type	Structure	Package	P_T (max.) @25°C	V_{CE}	CHARACTERISTICS					
					$V_{CE(sus)}$ (min.)	h_{FE}(min.) @ I_C		$V_{CE(sat)}$ (max.) @ I_C		f_T (typ) f_{hfb} (typ)
			W	V	V	h_{FE}	A	V	A	Mc/s
MEDIUM-POWER TYPES										P_T: to 50 W
Silicon NPN										
2N3441	HO	TO-66	25	160	140	20	0.5	1	0.5	-
40250	HO	TO-66	29	50	40	25	1.5	1.5	1.5	-
2N3583	TD	TO-66	35	-	175	10	1	-	-	10 min.
2N3584	TD	TO-66	35	-	250	25	1	0.75	1	10 min.
2N3585	TD	TO-66	35	-	300	25	1	0.75	1	10 min.
2N3878	EX	TO-66	35	65⊕	50 max.	50	0.5	•2	4	40
2N3879	EX	TO-66	35	90⊕	75 max.	40	0.5	1.2	4	40
HIGH-POWER TYPES										P_T: to 150 W
Germanium PNP										
2N277	Alloy	TO-36	150	40▲▲	-	35	5	0.7	12	10♦
2N441	Alloy	TO-36	150	40▲▲	-	20	5	0.7	12	10♦
2N278	Alloy	TO-36	150	50▲▲	-	35	5	0.7	12	10♦
2N442	Alloy	TO-36	150	50▲▲	-	20	5	0.7	12	10♦
2N173	Alloy	TO-36	150	60▲▲	-	35	5	0.7	12	10♦
2N174	Alloy	TO-36	150	60▲▲	-	25	5	0.7	12	10♦
2N443	Alloy	TO-36	150	60▲▲	-	20	5	0.7	12	10♦
2N1099	Alloy	TO-36	150	80▲▲	-	35	5	0.3	12	10♦
2N1100	Alloy	TO-36	150	100▲▲	-	25	5	0.3	12	10♦
2N1358	Alloy	TO-36	150	80▲▲	-	25	0.5	0.7	12	100♦
2N1412	Alloy	TO-36	150	100▲▲	-	25	0.5	0.7	12	10♦
Silicon NPN										
2N1487	HO	TO-3	75	60	40	15	1.5	3	1.5	1
2N1489	HO	TO-3	75	60	40	25	1.5	3	1.5	1
2N1702	HO	TO-3	75	60	40	15	0.8	3.2	0.8	-
2N1703	HO	TO-36	75	60	40	15	0.8	3.2	0.8	-

Power Switching Cont'd

RCA Type	Structure	Package	P_T (max.) @25°C	V_{CE}	CHARACTERISTICS					
					$V_{CE(sus)}$ (min.)	h_{FE}(min.) @ I_C		$V_{CE(sat)}$ (max.) @ I_C		f_T (typ) f_{hfb} (typ)
			W	V	V	h_{FE}	A	V	A	Mc/s
HIGH-POWER TYPES										P_T: to 150 W
Silicon NPN										
2N1488	HO	TO-3	75	100	55	15	1.5	3	1.5	*1*
2N1490	HO	TO-3	75	100	55	25	1.5	1	1.5	*1*
2N3263	EX		84	80	60	25	15	0.75	15	20 min.
2N3264	EX		84	120	60	20	15	1.2	15	20 min.
2N3055	HO	TO-3	115	100	60	20	4.0	1.1	4	0.7 min.
2N3442	HO	TO-3	117	160	140	-	-	1.0	0.3	0.8
40251	HO	TO-3	117	50	40	15	8.0	1.5	8	0.5
2N3265	EX	TO-63	125	150	90	25	15	0.75	15	20 min.
2N3266	EX	TO-63	125	120	60	20	15	1.2	15	20 min.
2N3771	HO	TO-3	150	50+	40	15†	8	2†	15	-
2N2338	HO	TO-36	150	60	40	15	3.0	1.5	3	-
2N2015	HO	TO-36	150	100	50	15	5.0	1.25	5	25♦
2N3772	HO	TO-3	150	100+	60	15†	10	1.4†	10	-
2N2016	HO	TO-36	150	130	65	15	5.0	1.25	5	25♦
2N3773	HO	TO-3	150	160+	140	15†	15	1.4†	8	-
DIFFERENTIAL & OPERATIONAL AMPLIFIER TYPES										
Silicon NPN										
2N1613	TDP	TO-5	3	50	-	35	0.01	1.5	0.15	60 min.
2N2270	TDP	TO-5	5	60	45	35	0.001	0.9	0.15	60 min.
2N2102	TDP	TO-5	5	80	65	35	0.01	0.5	0.15	60 min.
2N3439	TD	TO-5	5	-	350	40	0.02	0.5	0.02	20 min.
2N3440	TD	TO-5	5	-	250	40	0.02	0.5	0.02	20 min.

Power Switching Cont'd

Type	Structure	Package	P_T (max.) @25°C	V_{CE}	CHARACTERISTICS					
					$V_{CE(sus)}$ (min.)	h_{FE}(min.) @ I_C		$V_{CE(sat)}$ (max.) @ I_C		f_T (typ) f_{hfb} (typ)
			W	V	V	h_{FE}	A	V	A	Mc/s
DIFFERENTIAL & OPERATIONAL AMPLIFIER TYPES										
Silicon NPN										
40346	TDP	TO-5	5	-	-	25	0.01	0.5	0.01	-
40255	TD		10	-	35	40	0.02	0.5	0.02	20 min.
40256	TD		10	-	250	40	0.02	0.5	0.02	20 min.

Type	Package	MAX. RATINGS				CHARACTERISTICS				
						Typical			Max.	
		V_{DS}	I_D	P_T	T	R_{gs}	g_{fs}	$I_{DS_{off}}$	C_{rss}	C_{iss}
		V	mA	mW	°C	Ω	μmhos	pA	pF	pF
INSULATED-GATE FIELD-EFFECT TYPES										
Silicon N-Channel Depletion Types										
3N98	TO-72	32	15	150	85	10^{15}	1500	50	0.5	7.0
3N99	TO-72	32	15	150	85	10^{15}	2000	50	0.5	7.0

RCA Military-Specification Types

TRANSISTORS

Type	*MIL-S-19500/ Specification*	*Type*	*MIL-S-19500/ Specification*
JAN-2N174	13B	JAN-2N1307	126B
JAN-2N220	1	JAN-2N1308	126B
JAN-2N274	26 (Sig C)	JAN-2N1309	126B
JAN-2N384	27D	JAN-2N1412	76B (Navy)
JAN-2N388	65A	JAN-2N1479	207A (EL)
JAN-2N396A	64C	JAN-2N1480	207A (EL)
JAN-2N398	174 (Navy)	JAN-2N1481	207A (EL)
JAN-2N404	20B	JAN-2N1482	207A (EL)
JAN-2N706	120A	JAN-2N1483	108A (EL)
JAN-2N962	258 (Navy)	JAN-2N1484	180A (EL)
JAN-2N964	258 (Navy)	JAN-2N1485	180A (EL)
JAN-2N1183	143A (EL)	JAN-2N1486	180A (EL)
JAN-2N1183A	143A (EL)	JAN-2N1487	208A (EL)
JAN-2N1183B	143A (EL)	JAN-2N1488	208A (EL)
JAN-2N1184	143A (EL)	JAN-2N1489	208A (EL)
JAN-2N1184A	143A (EL)	JAN-2N1490	208A (EL)
JAN-2N1184B	143A (EL)	JAN-2N1493	247 (EL)
JAN-2N1224	189 (Sig C)	JAN-2N1853	171A (Navy)
JAN-2N1225	189 (Sig C)	JAN-2N1854	172A (Navy)
JAN-2N1302	126B	JAN-2N2015	248A (EL)
JAN-2N1303	126B	JAN-2N2016	248A (EL)
JAN-2N1304	126B	JAN-2N2273	244A (Sig C)
JAN-2N1305	126B	JAN-2N2708	302 (EL)
JAN-2N1306	126B		

SILICON RECTIFIERS

Type	*Specification*
JAN-1N538	MIL-S-19500/202A
JAN-1N540	MIL-S-19500/202A
JAN-1N547	MIL-S-19500/202A
USAF-1N1183	MIL-E-1/1135 (USAF)
JAN-1N1184	MIL-S-19500/297
USAF-1N1184	MIL-E-1/1135 (USAF)
JAN-1N1184R	MIL-S-19500/297
USAF-1N1185	MIL-E-1/1135 (USAF)
JAN-1N1186	MIL-S-19500/297
USAF-1N1186	MIL-E-1/1135 (USAF)
JAN-1N1186R	MIL-S-19500/297
USAF-1N1187	MIL-E-1/1135 (USAF)
JAN-1N1188	MIL-S-19500/297
USAF-1N1188	MIL-E-1/1135 (USAF)
JAN-1N1188R	MIL-S-19500/297

SILICON RECTIFIERS Cont'd.

USAF-1N1189	MIL-E-1/1135 (USAF)
JAN-1N1190	MIL-S-19500/297
USAF-1N1190	MIL-E-1/1135 (USAF)
JAN-1N1190R	MIL-S-19500/297
USAF-1N1199	MIL-E-1/1108 (USAF)
USAF-1N1200	MIL-E-1/1108 (USAF)
USAF-1N1201	MIL-E-1/1108 (USAF)
USAF-1N1202	MIL-E-1/1108 (USAF)
USAF-1N1203	MIL-E-1/1108 (USAF)
JAN-1N1204	MIL-S-19500/260
USAF-1N1204	MIL-E-1/1108 (USAF)
JAN-1N1204R	MIL-S-19500/260
USAF-1N1205	MIL-E-1/1108 (USAF)
USAF-1N1206	MIL-E-1/1108 (USAF)

Copies of transistor and rectifier specification sheets may be obtained by directing requests to *Specifications* Division, Naval Supply Depot, 5801 Tabor Avenue, Philadelphia 20, Pa., Attn: CDS

Information on Prices

Information on prices of RCA electronic components and devices described in this Handbook may be obtained from your local RCA Distributor or from your RCA Equipment Sales Representative, who may be reached at the following RCA Equipment Sales Offices:

East: *Maplewood*
2075 Millburn Ave., Maplewood, N.J. 07040 (201) 485-3900

Syracuse
731 James St., Rm. 206, Syracuse, N.Y. 13203 (315) 474-5591

Needham
64 "A" St., Needham Heights, Mass. 02194 (617) 444-7200

Mid-East: *Washington*
1725 K Street, N.W., Washington, D.C. 20006 (202) 337-8500

Mid-Atlantic: *Haddonfield*
605 Marlton Pike, Haddonfield, N.J. 08034 (609) 428-4802

Riviera Beach
2828 Broadway, Riviera Beach, Fla. 33404 (305) 842-1577

Central: *Chicago*
446 East Howard Ave., Des Plaines, Ill. 60018 (312) 827-0033

Detroit
28840 Southfield Road Lathrup Village, Michigan 48037 (313) 353-9770

Minneapolis
5805 Excelsior Blvd., Minneapolis, Minn. 55416 (612) 929-0676

Mid-Central: *Indianapolis*
2511 East 46th St., Bldg. Q2, Atkinson Sq., Indianapolis, Ind. 46205 (317) 546-4001

West: *Hollywood*
6363 Sunset Blvd., Hollywood, Calif. 90028 (213) 461-9171

Los Altos
4546 El Camino Real, Suits P, Los Altos, Calif. 94022 (415) 948-8996

Dallas
210-C Court Terrace, Exchange Park North, Dallas, Texas 75235 (214) 351-5361

San Diego
7969 Engineer Road, Suite 216 San Diego, Calif. 92111 (714) 279-0420

DISTRIBUTOR SALES

Home Office: *Harrison*
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East: *New York*
36 W. 49th St., New York, N.Y. 10020 (212) 689-7200

North East: *Needham*
80 A Street, Needham Heights, Mass. 02109 (617) 444-8492

Information on Prices

Mid-East: *Washington*
1725 K Street, N.W. Washington, D.C. 20006 (202) 337-8500

South East: *Atlanta*
1121 Rhodes Haverty Bldg.,
134 Peachtree St., N.W., Atlanta, Ga. 30303 (404) 524-7703

Central: *Chicago*
446 East Howard Ave., Des Plaines, Ill. 60018 (312) 827-0033

East Central: *Cleveland*
1600 Keith Bldg., 1621 Euclid Ave., (216) 241-3450
Cleveland, Ohio 44115

West Central: *Kansas City*
7711 State Line, Suite 112 (816) 363-6462
Kansas City, Mo. 64114

West: *Hollywood*
6363 Sunset Blvd., Hollywood, Calif. 90028 (213) 461-9171

South West: *Dallas*
210-C Court Terrace, Exchange Park North (214) 351-5361
Dallas, Texas 75235

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East: *Maplewood*
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West: *Hollywood*
6363 Sunset Blvd., Hollywood, Calif. 90028 (213) 461-9171

INTERNATIONAL SALES

U.S.A. *Clark*
Central & Terminal Avenues, Clark, N.J. 07066 (201) 382-1000
Cable: RADIOINTER

Canada *Montreal*
1001 Lenoir St., Montreal 30, Quebec (514) 933-7551
Cable: VICTORADIO

Europe: *Geneva*
118 Rue du Rhone, Geneva, Switzerland 35 75 00 to 09
Cable: RADIOCORP

Far East: *Hong Kong*
415 Prince's Bldg., Chater Road, Hong Kong
Cable: RADIOINTER

RADIO CORPORATION OF AMERICA
Electronic Components and Devices Harrison, N. J.

Symbols, Terms, and Definitions

Used in Data for RCA Silicon Controlled-Rectifiers

i_F	**Instantaneous Forward Current** — The instantaneous value of the current flowing from anode to cathode in the device.
i_{FBO}	**Instantaneous Forward Leakage Current** — Instantaneous forward leakage current with the gate open.
$i_{FM(surge)}$	**Peak Surge Current** — The maximum instantaneous value of forward current which may be superimposed on the average forward current during one forward half-cycle when the device is operating within its specified maximum voltage, average-forward-current, gate-power, and temperature ratings in a single-phase circuit with 60-cps supply and resistive load. The peak surge current may be repeated after sufficient time has elapsed for the device to return to pre-surge thermal equilibrium conditions.
i_{GKM}	**Peak Forward Gate Current** — The maximum instantaneous value of the current which may flow between gate and cathode.
i_{HOO}	**Holding Current** — The instantaneous value of forward current i_F below which a controlled-rectifier with its gate open returns to its forward blocking state.
i_{RBO}	**Instantaneous Reverse Leakage Current** — Instantaneous reverse leakage current with the gate open.
I_{FAV}	**Average Forward Current** — The average (dc) value of the current flowing from anode to cathode in the device.
I_{FBOAV}	**Maximum Average Forward Blocking Current** — The maximum full-cycle average value of forward blocking current through a controlled-rectifier when the gate is open.
I_{GT}	**Maximum DC Gate Current** — The gate current required to trigger a controlled-rectifier operating at a specified temperature when the anode is at a potential of +6 volts with respect to the cathode.
I_{RBOAV}	**Maximum Average Reverse Blocking Current** — The maximum full-cycle average value of reverse blocking current through a controlled-rectifier when the gate is open.
P_{GM}	**Peak Gate Power** — The maximum instantaneous power dissipated between gate and cathode.
P_{GAV}	**Average Gate Power** — The average power dissipated between gate and cathode.

Symbols, Terms, and Definitions

Used in Data for RCA Silicon Controlled-Rectifiers

V_{BOO}	**Forward Breakover Voltage** — The value of positive anode voltage at which a controlled-rectifier switches into the conducting state when the gate is open.
V_F	**Instantaneous Forward Voltage Drop** — The instantaneous voltage drop across a controlled-rectifier at a given instantaneous forward current i_F.
V_{FBOM}	**Instantaneous Forward Blocking Voltage** — Instantaneous forward blocking voltage of a controlled-rectifier when the gate is open.
$V_{FBOM(rep)}$	**Peak Forward Blocking Voltage** — The maximum instantaneous value of positive (forward-blocking) voltage which may be applied repetitively to the anode when the gate is open.
V_{GKM} or V_{KGM}	**Peak Gate Voltage** (Forward V_{GKM} or Reverse V_{KGM}) — The maximum instantaneous value of voltage which may be applied between gate and cathode when the anode is open.
V_{RBOM}	**Instantaneous Reverse Blocking Voltage** — Instantaneous reverse blocking voltage of a controlled-rectifier when the gate is open.
$V_{RM(non-rep)}$	**Transient Peak Reverse Voltage (Non-repetitive)** — The maximum value of negative (reverse-blocking) voltage which may be applied to the anode for not more than 5 milliseconds when the gate is open.
$V_{RM(rep)}$	**Peak Reverse Voltage (Repetitive)** — The maximum instantaneous value of negative (reverse-blocking) voltage which may be applied repetitively to the anode when the gate is open.
V_{FAV}	**Maximum Average Forward Voltage Drop** — The average value over one complete cycle of the forward voltage drop across a controlled-rectifier operating at its maximum-average-forward-current rating in a single-phase circuit with 60-cps supply and resistive load.
V_{GT}	**Gate-Trigger Voltage** — The gate-to-cathode voltage required to trigger a controlled-rectifier at a specified temperature when the anode is at a potential of +6 volts with respect to the cathode.
θ_{JC}	**Thermal Resistance, Junction-to-case** — The thermal resistance in °C per watt, between the junction and any of the six major surfaces on the perimeter of the hexagonal flange.

RADIO CORPORATION OF AMERICA
Semiconductor & Materials Division Somerville, N. J.

Symbols, Terms, and Definitions
Used in Data for RCA Tunnel Diodes and Tunnel Rectifiers

The following symbols, terms, and definitions for tunnel diodes and tunnel rectifiers (backward diodes) are used in this Handbook starting with data sheets dated 6-64.

These symbols conform with those published in the standard entitled "Semiconductor Tunnel (Esaki) Diodes and Backward Diodes" issued by the Institute of Electrical and Electronic Engineers (No. 253, dated December, 1963).

Static (DC) Parameters

See accompanying *Typical Tunnel Diode Static Characteristic Curve*

Inflection Point - The point on the forward current-voltage characteristic at which the slope of the characteristic reaches its most negative value.

Peak Point - The point on the forward current-voltage characteristic corresponding to the lowest positive (forward) voltage at which $dI/dV = 0$.

Projected Peak Point - The point on the forward current characteristic where the current is equal to the peak-point current and where the voltage is greater than the valley-point voltage.

Valley Point - The point on the forward current-voltage characteristic corresponding to the second lowest positive (forward) voltage at which $dI/dV = 0$.

I_I **Inflection-Point Current** - The current at the inflection point.

I_P **Peak-Point Current** - The current at the peak point.

I_V **Valley-Point Current** - The current at the valley point.

V_I **Inflection-Point Voltage** - The voltage at which the inflection point occurs.

V_P **Peak-Point Voltage** - The voltage at which the peak point occurs.

V_{PP} **Projected Peak-Point Voltage** - The voltage at which the projected peak point occurs.

V_V **Valley-Point Voltage** - The voltage at which the valley point occurs.

Equivalent Circuit (Dynamic) Parameters

See accompanying *Tunnel Diode and Tunnel Rectifier Equivalent Circuit*

C_j **Junction Capacitance** - The small-signal capacitance associated with the P-N junction alone, at a specified bias and frequency.

C_p **Case Capacitance** - The residual capacitance between the diode terminals when the P-N junction is open-circuited.

Symbols, Terms, and Definitions

Used in Data for RCA Tunnel Diodes and Tunnel Rectifiers

C_{tv} **Valley-Point Terminal Capacitance** - Terminal capacitance at the valley point where $C_{tv} = C_j\ (V_V) + C_p$.

f_c **Characteristic Frequency (Figure-of-Merit)** - The maximum value of the gain bandwidth index for a diode as the bias voltage is varied.

f_r **Resistive Cutoff Frequency** - The frequency at which the negative real part of the terminal impedance of the tunnel diode goes to zero under specified conditions of bias.

$$f_r = \frac{1}{2\pi\,|r_j|\,C_j}\sqrt{\frac{|r_j|}{r_s} - 1}$$

f_{max} **Maximum Frequency of Oscillation** - The maximum value of the resistive cutoff frequency for a diode as the bias voltage is varied.

g_j **Junction Resistance** - The reciprocal of the junction resistance.

L **Series Inductance** - The self inductance of a diode in a specified circuit.

L_{ex} **Excess Series Inductance** - The inductance introduced in a circuit when a specified standard conductor is replaced by a diode.

r_j **Junction Resistance** - The incremental resistance reduced by the series resistance.

Note: For sufficiently high forward or reverse bias, the junction resistance tends toward zero.

r_s **Series Resistance** - That portion of the small-signal terminal resistance of a P-N junction diode (under specified conditions of bias and frequency) which is external to the junction.

Y_t **Terminal Admittance** - The admittance of the diode given by

$$Y_t = j\omega C_p + \left(r_s + j\omega L + \frac{1}{g_j + j\omega C_j}\right)^{-1}$$

under conditions such that the equivalent circuit is valid.

Large-Signal Characteristics

I_p/C_{tv} **Speed Index** - The quotient of peak current to terminal capacitance at the valley point and is an indication of switching speed and high-frequency capabilities.

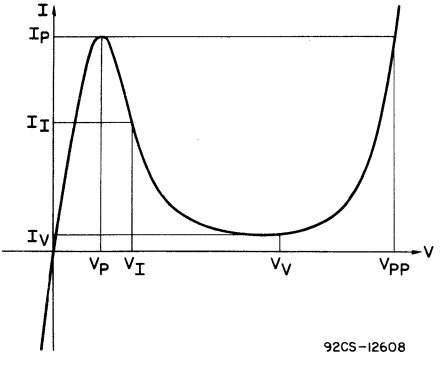
Symbols, Terms, and Definitions
Used in Data for RCA Tunnel Diodes and Tunnel Rectifiers

t_{sw} **Characteristic Switching Time** - The time required for the terminal voltage of a tunnel diode to increase from 10% to 90% of the total voltage range between the peak-point voltage (V_P) and the projected peak-point voltage (V_{PP}) when the tunnel diode is initially biased at the peak from a constant-current source infinitesimally greater than the peak-point current (I_P).

Note: The maximum rate-of-rise of diode voltage in the measurement of characteristic switching time is approximately equal to

$$(dv/dt)_{max} \approx I_P/C_{tv}$$

TYPICAL TUNNEL DIODE STATIC CHARACTERISTIC



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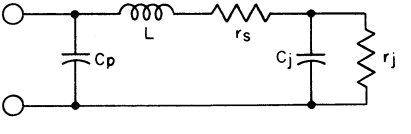
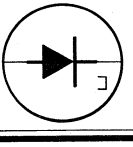
TUNNEL DIODE AND-TUNNEL RECTIFIER EQUIVALENT CIRCUIT



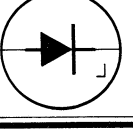
92CS-12609

GRAPHIC SYMBOLS

TUNNEL DIODE



TUNNEL RECTIFIER



Transistor-Dissipation Rating Chart

Pulse or Switching Service

$$Y = \frac{T_{J_{MAX}} - T_o}{P_{MAX}\ R_{T_{MAX}}}$$

P_{MAX} = MAXIMUM TRANSISTOR DISSIPATION (WATTS)

d = DUTY FACTOR = $t_o \times$ PULSE-REPETITION RATE (PULSES/SECOND)

t_o = PULSE DURATION (SECONDS)

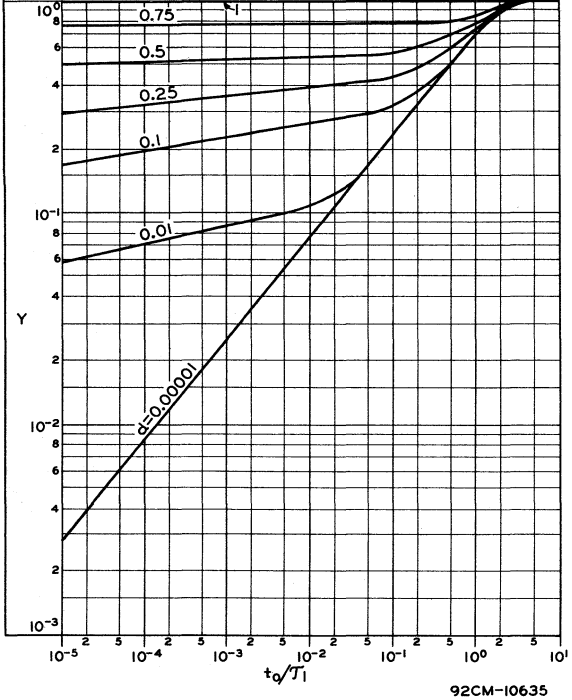
T_1 = THERMAL TIME CONSTANT (SECONDS)*

$T_{J_{MAX}}$ = MAXIMUM JUNCTION OR STORAGE TEMPERATURE (°C)*

$R_{T_{MAX}}$ = MAXIMUM THERMAL RESISTANCE, COLLECTOR JUNCTION-TO-EITHER FREE AMBIENT AIR, CASE, OR MOUNTING FLANGE (°C/WATT)*

T_o = OPERATING TEMPERATURE (°C) MEASURED AT SAME POINT (FREE AMBIENT AIR, CASE, OR MOUNTING FLANGE) AS $R_{T_{MAX}}$

*FOR VALUE, SEE DATA FOR SPECIFIC TRANSISTOR TYPE OR ACCOMPANYING TABLE I.



92CM-10635

Transistor-Dissipation Rating Chart

Pulse or Switching Service

EXAMPLES OF USE

Example 1:

Determine the maximum transistor dissipation (P_{MAX}) in a switching application for the RCA-2N1092 with the following conditions: pulse duration of 2 milliseconds, pulse-repetition rate of 50 pulses/second, and operating case temperature of 100° C.

From above conditions:

t_o = 2 milliseconds = 2×10^{-3} second
Pulse-repetition rate (PRR) = 5×10^{1} pulses/second
T_o = 100° C

From Table I:

$T_{J_{MAX}}$ = 175° C
τ_1 = 8 milliseconds = 8×10^{-3} second
$R_{T_{MAX}}$ = 75 °C/watt

Then:

$t_o/\tau_1 = 2 \times 10^{-3}/8 \times 10^{-3} = 2.5 \times 10^{-1}$
$d = t_o \times PRR = (2 \times 10^{-3})(5 \times 10^{1}) = 10^{-1} = 0.1$

Entering the Chart with $t_o/\tau_1 = 2.5 \times 10^{-1}$ and $d = 0.1$, read $Y = 3.9 \times 10^{-1} = 0.39$. Solving for P_{MAX} in the equation:

$$P_{MAX} = \frac{T_{J_{MAX}} - T_o}{Y\, R_{T_{MAX}}}$$

$$P_{MAX} = \frac{175 - 100}{(0.39)(75)} = 2.56 \text{ watts}$$

Example 2:

Determine the maximum transistor case temperature (T_o) and the maximum rise in junction temperature ($\Delta T_{J_{MAX}}$) in a switching application for the RCA-2N1092 with the following conditions: pulse duration of 1 millisecond, pulse-repetition rate of 10 pulses/second, and a required maximum transistor dissipation of 3 watts.

From above conditions:

t_o = 1 millisecond = 10^{-3} second
Pulse-repetition rate (PRR) = 10^{1} pulses/second
P_{MAX} = 3 watts

Transistor-Dissipation Rating Chart

Pulse or Switching Service

From Table I:

$T_{J_{MAX}} = 175^{o}$ C

$\tau_1 = 8$ milliseconds $= 8 \times 10^{-3}$ second

$R_{T_{MAX}} = 75\ ^{o}$C/watt

Then:

$t_o/\tau_1 = 10^{-3}/8 \times 10^{-3} = 1.25 \times 10^{-1}$

$d = t_o \times PRR = (10^{-3})(10^{1}) = 10^{-2} = 0.01$

Entering the Chart with $t_o/\tau_1 = 1.25 \times 10^{-1}$ and $d = 0.01$, read $Y = 2.5 \times 10^{-1}$. Solving for T_o in the equation:

$$T_o = T_{J_{MAX}} - P_{MAX}\ Y\ R_{T_{MAX}}$$

$$T_o = 175 - (3)(2.5 \times 10^{-1})(75) = 119^{o}\ C$$

Solving for $\Delta T_{J_{MAX}}$ in the equation:

$$\Delta T_{J_{MAX}} = T_{J_{MAX}} - T_o$$

$$\Delta T_{J_{MAX}} = 175 - 119 = 56^{o}\ C$$

TABLE I

RCA TRANSISTOR TYPE	MAXIMUM JUNCTION OR STORAGE TEMPERATURE $T_{J_{MAX}}$ (^{o}C)	THERMAL TIME CONSTANT τ_1 (msec)	MAXIMUM THERMAL RESISTANCE $R_{T_{MAX}}$ (^{o}C/WATT) COLLECTOR JUNCTION TO: FREE AMBIENT AIR	CASE	MOUNTING FLANGE
2N109	85	12	400	–	–
2N139	85	10	750	–	–
2N140	85	10	750	–	–
2N217	85	12	400	–	–
2N218	85	10	750	–	–
2N219	85	10	750	–	–
2N269	85	10	500	–	–
2N270	85	12	320	–	–
2N274	100	12	620	310	–
2N384	100	10	620	310	–
2N398	85	12	750	–	–
2N404	85	10	500	–	–
2N578	85	15	500	–	–
2N579	85	15	500	–	–

Transistor-Dissipation Rating Chart

Pulse or Switching Service

RCA TRANSISTOR TYPE	MAXIMUM JUNCTION OR STORAGE TEMPERATURE T_{JMAX} (°C)	THERMAL TIME CONSTANT τ_1 (msec)	MAXIMUM THERMAL RESISTANCE $R_{T_{MAX}}$ (°C/WATT) COLLECTOR JUNCTION TO: FREE AMBIENT AIR	CASE	MOUNTING FLANGE
2N580	85	15	500	–	–
2N581	85	10	500	–	–
2N582	85	10	500	–	–
2N583	85	10	500	–	–
2N584	85	10	500	–	–
2N585	85	12	500	–	–
2N586	85	12	240	–	–
2N643	85	10	500	–	–
2N644	85	10	500	–	–
2N645	85	10	500	–	–
2N1023	100	10	620	310	–
2N1066	100	10	620	310	–
2N1067	175	8	100	30	–
2N1068	175	8	100	15	–
2N1069	175	10	–	–	3
2N1070	175	10	–	–	3
2N1090	85	12	500	–	–
2N1091	85	12	500	–	–
2N1092	175	8	225	75	–
2N1183	100	8	75	10	–
2N1183-A	100	8	75	10	–
2N1183-B	100	8	75	10	–
2N1184	100	8	75	10	–
2N1184-A	100	8	75	10	–
2N1184-B	100	8	75	10	–
2N1224	100	10	620	310	–
2N1225	100	10	620	310	–
2N1226	100	10	620	310	–
2N1300	85	10	400	–	–
2N1301	85	10	400	–	–
2N1395	100	10	620	310	–
2N1396	100	10	620	310	–
2N1397	100	10	620	310	–

For transistor types not listed in Table I above, refer to the data sheets for the specific type for the required values.

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Semiconductor & Materials Division Somerville, N. J.

Symbols and Terms

Used in Data for RCA Transistors

Listed in alphabetical sequence are transistor symbols with their associated terms as used in the data sheets in this Handbook. Most of these symbols listed conform with those published in the standards issued by the Department of Defense (MIL-S-19500C, dated 19 January, 1962, Appendix B), the Electronic Industries Association (RS-245, July, 1961), and the Institute of Electrical and Electronics Engineers (56 IRE 28 S1, dated 1956).

BV_{CBO}	DC collector-to-base breakdown voltage, emitter open
BV_{CBX}	DC collector-to-base breakdown voltage, with reverse bias between emitter and base
BV_{CEO}	DC collector-to-emitter breakdown voltage, base open
$BV_{CEO(sus)}$	DC collector-to-emitter breakdown sustaining voltage, base open
BV_{CER}	DC collector-to-emitter breakdown voltage, with specified external base-to-emitter resistance (R_{BE})
BV_{CES}	DC collector-to-emitter breakdown voltage, with base and emitter terminals short-circuited
BV_{CEX}	DC collector-to-emitter breakdown voltage, with reverse bias between base and emitter
BV_{EBO}	DC emitter-to-base breakdown voltage, collector open
$C_{b'c}$	Collector-to-base feedback capacitance
C_{ib}	Input capacitance (common-base circuit)
C_{ob}	Output capacitance (common-base circuit)
f	Frequency
f_{hfb}	Small-signal, short-circuit forward-current transfer-ratio cutoff frequency (common-base circuit)
f_{hfe}	Small-signal, short-circuit forward-current transfer-ratio cutoff frequency (common-emitter circuit)
f_T	Gain-bandwidth product
G_{pe}	Small-signal power gain (common-emitter circuit)
g_m	Transconductance
h_{fb}	Small-signal, short-circuit forward-current transfer ratio (common-base circuit)
h_{FE}	DC forward-current transfer ratio (common-emitter circuit)
h_{fe}	Small-signal, short-circuit forward-current transfer ratio (common-emitter circuit)

Symbols and Terms

Used in Data for RCA Transistors

$\lvert h_{fe} \rvert$	Magnitude of small-signal, short-circuit forward-current transfer ratio (common-emitter circuit)
h_{ib}	Small-signal, short-circuit input impedance (common-base circuit)
$h_{ie(real)}$	Real part of small-signal, short-circuit input impedance (common-emitter circuit)
h_{ob}	Small-signal, open-circuit output conductance (common-base circuit)
h_{rb}	Small-signal, open-circuit voltage-transfer (feedback) ratio (common-base circuit)
I_B	DC base current
I_{B_1}	Turn-on dc base current
I_{B_2}	Turn-off dc base current
I_C	DC collector current
I_{CBO}	DC collector-cutoff current, emitter open
$I_{CBO(sat)}$	DC collector-cutoff saturation current, emitter open
I_{CEO}	DC collector-cutoff current, base open
I_{CES}	DC collector current, with base and emitter terminals short-circuited
I_{CEX}	DC collector current, with bias between base and emitter
I_E	DC emitter current
I_{EBO}	DC emitter-cutoff current, collector open
NF	Noise figure
P_i	Power input
P_o	Power output
P_T	Transistor dissipation
$r_{bb'}$	Base spreading resistance or extrinsic base-lead resistance
$r_{b'C_c}$	Collector-to-base time constant
$r_{CE(sat)}$	Collector-to-emitter saturation resistance
R_{BE}	External base-to-emitter resistance
R_G	Generator resistance
R_L	Load resistance

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Electronic Components and Devices Harrison, N. J.

Symbols and Terms
Used in Data for RCA Transistors

τ_l	Thermal time constant
T_A	Ambient temperature
T_C	Case temperature
T_{FA}	Free-air temperature
T_J	Junction temperature
T_{MF}	Mounting-flange temperature
T_{opr}	Operating temperature
T_{stg}	Storage temperature
t_d	Delay time
t_f	Fall time
t_{on}	Turn-on time
t_{off}	Turn-off time
t_r	Rise time
t_s	Storage time
θ_{JA}	Thermal resistance, junction-to-ambient
θ_{JC}	Thermal resistance, junction-to-case
θ_{JFA}	Thermal resistance, junction-to-free-air
θ_{JMF}	Thermal resistance, junction-to-mounting-flange
V_{BB}	DC base supply voltage
V_{BE}	DC base-to-emitter voltage
$V_{BE(sat)}$	DC base-to-emitter saturation voltage
V_{CB}	DC collector-to-base voltage
V_{CBO}	DC collector-to-base voltage, emitter open
V_{CBX}	DC collector-to-base voltage, with reverse bias between emitter and base
V_{CC}	DC collector supply voltage
V_{CE}	DC collector-to-emitter voltage
$V_{CE(sat)}$	DC collector-to-emitter saturation voltage
V_{CEO}	DC collector-to-emitter voltage, base open
$V_{CEO(sus)}$	DC collector-to-emitter sustaining voltage, base open
V_{CER}	DC collector-to-emitter voltage, with specified external base-to-emitter resistance (R_{BE})

Symbols and Terms

Used in Data for RCA Transistors

V_{CERL}	DC collector-to-emitter voltage, with specified external base-to-emitter resistance, (R_{BE}) and specified load resistance (R_L)
$V_{CER(sus)}$	DC collector-to-emitter sustaining voltage, with specified external base-to-emitter resistance (R_{BE})
V_{CES}	DC collector-to-emitter voltage, with base and emitter terminals short-circuited
V_{CEX}	DC collector-to-emitter voltage, with reverse bias between base and emitter
V_{EB}	DC emitter-to-base voltage
V_{EBF}	DC emitter-to-base floating potential
V_{EBO}	DC emitter-to-base voltage, collector open

NOTE

A number of semiconductor-device symbols, terms, and definitions are currently being reconsidered for change by cognizant industry and professional groups.

When such changes are made the new standard symbols, terms, and definitions will be utilized in our data and in the list shown above.

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Small-Signal Current Gain (Current Transfer Ratio). The quotient of the change of output current with ac output circuit shorted divided by the change in input current producing the change in output current. The current components are understood to be small enough so that linear relations hold between them.

Large-Signal DC Current Gain. The quotient of the dc output current with the dc output circuit shorted divided by the dc input current producing the dc output current.

Circuit-Stability Factor. The quotient of the change of dc collector current divided by the change in collector saturation current producing the change in dc collector current.

Collector Saturation Current. The temperature-sensitive dc collector current that flows when a dc collector-to-base voltage greater than -0.2 volt is applied with emitter circuit open.

Class A Amplifier. An amplifier in which the bias of the input electrode and the alternating input signal are such that output current flows at all times.

Class B Amplifier. An amplifier in which the bias of the input electrode is such that the output current is approximately zero when no alternating input signal is applied, and such that when an alternating input signal is applied, the output current flows approximately one-half cycle.

Collector Transition Capacitance. The capacitance across the collector-to-base transition region. (A transition region is a region between two homogeneous semiconductor regions, in which the impurity concentration changes).

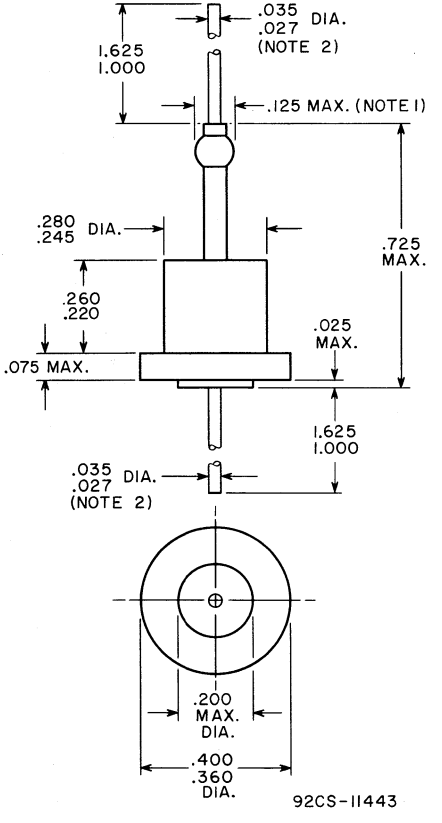
Unilateralization. Unilateralization is a special case of neutralization in that the feedback parameters are completely balanced out. In the case of transistors, these feedback parameters include a resistive component in addition to a capacitive component. Unilateralization changes a bilateral network into a unilateral network.

Alpha-Cutoff Frequency. Frequency at which the forward current gain drops to 0.707 times its low-frequency (1-kc) value.

Outline DO-1

JEDEC No. DO-1

All Dimensions in Inches

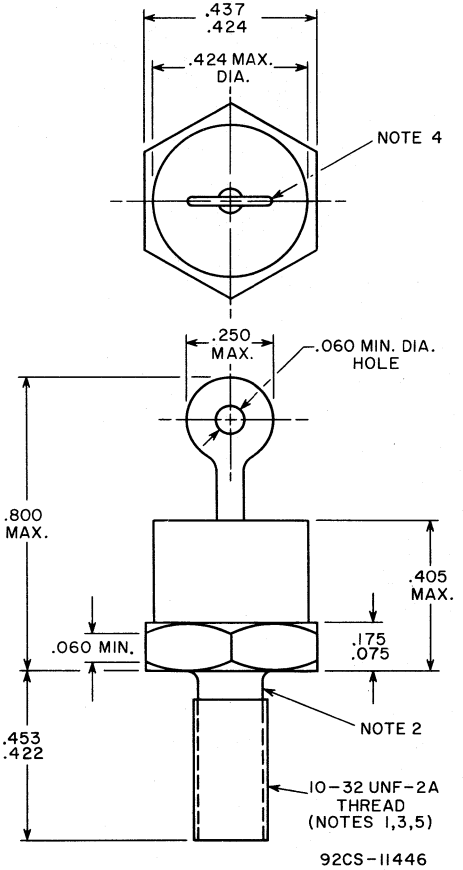


NOTE 1: DIMENSION TO ALLOW FOR PINCH OR SEAL DEFORMATION ANYWHERE ALONG TABULATION (OPTIONAL).

NOTE 2: DIMENSION TO BE CONTROLLED FROM FREE END OF LEAD TO WITHIN 0.188 INCH FROM THE POINT OF ATTACHMENT TO THE BODY. WITHIN THE 0.188 INCH DIMENSION, THE DIAMETER MAY VARY TO ALLOW FOR LEAD FINISHES AND IRREGULARITIES.

Outline DO-4

JEDEC No. DO-4
All Dimensions in Inches



NOTE 1: UNIT MUST NOT BE DAMAGED BY TORQUE OF 15 INCH-POUNDS APPLIED TO 10-32 UNF-2B NUT ASSEMBLED ON THREAD.

NOTE 2: DIAMETER OF UNTHREADED PORTION 0.189 INCH MAXIMUM, 0.163 INCH MINIMUM.

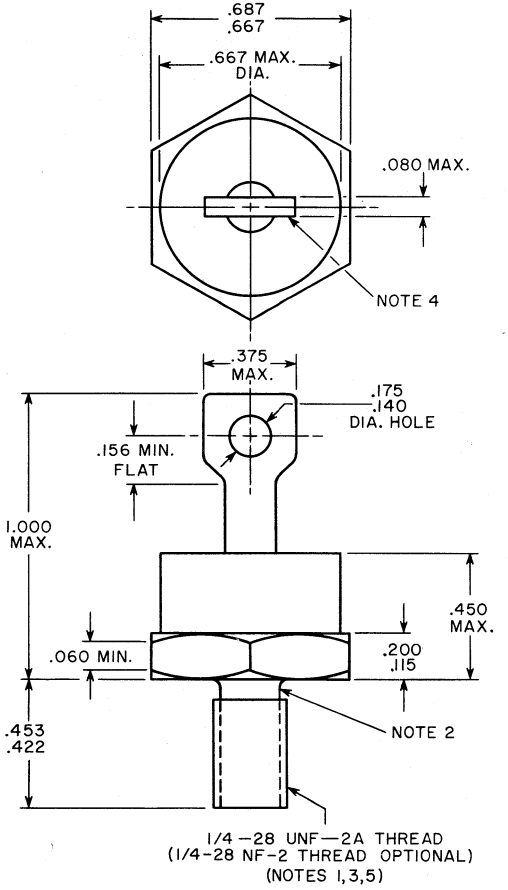
NOTE 3: COMPLETE THREADS TO EXTEND TO WITHIN 2-1/2 THREADS OF HEAD.

NOTE 4: ANGULAR ORIENTATION OF THIS TERMINAL IS UNDEFINED.

NOTE 5: MAXIMUM PITCH DIAMETER OF PLATED THREADS SHALL BE BASIC PITCH DIAMETER (0.1697 INCH) REFERENCE (SCREW THREAD STANDARDS FOR FEDERAL SERVICES, 1957) HANDBOOK H28 1957 P1.

Outline DO-5

JEDEC No. DO-5
All Dimensions in Inches



92CS−11448

NOTE 1: UNIT MUST NOT BE DAMAGED BY TORQUE OF 30 INCH-POUNDS APPLIED TO 1/4-28 UNF-2B NUT ASSEMBLED ON THREAD.

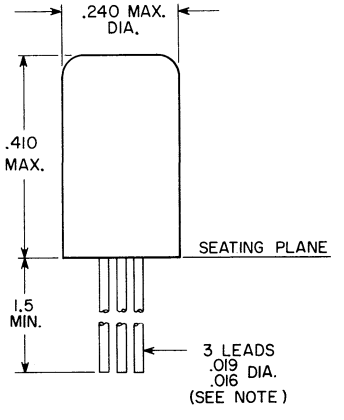
NOTE 2: DIAMETER OF UNTHREADED PORTION 0.249 INCH MAXIMUM, 0.220 INCH MINIMUM.

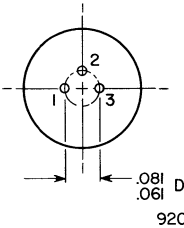
NOTE 3: COMPLETE THREADS TO EXTEND TO WITHIN 2-1/2 THREADS OF HEAD.

NOTE 4: ANGULAR ORIENTATION OF THIS TERMINAL IS UNDEFINED.

NOTE 5: MAXIMUM PITCH DIAMETER OF PLATED THREADS SHALL BE BASIC PITCH DIAMETER (0.2268 INCH) REFERENCE (SCREW THREAD STANDARDS FOR FEDERAL SERVICES, 1957) HANDBOOK H28 1957 P1.

JEDEC No. TO-1
All Dimensions in Inches



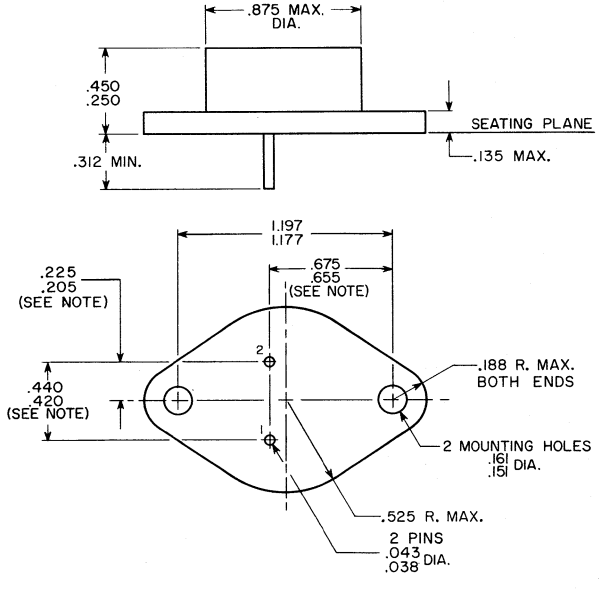


92CS-11449

NOTE: THE SPECIFIED LEAD DIAMETER APPLIES IN ZONE BETWEEN 0.050 INCH AND 0.250 INCH FROM THE SEATING PLANE. BETWEEN 0.250 INCH AND 1.5 INCHES, A MAXIMUM DIAMETER OF 0.021 INCH IS HELD. OUTSIDE OF THESE ZONES, THE LEAD DIAMETER IS NOT CONTROLLED.

Outline TO-3

JEDEC No. TO-3
All Dimensions in Inches

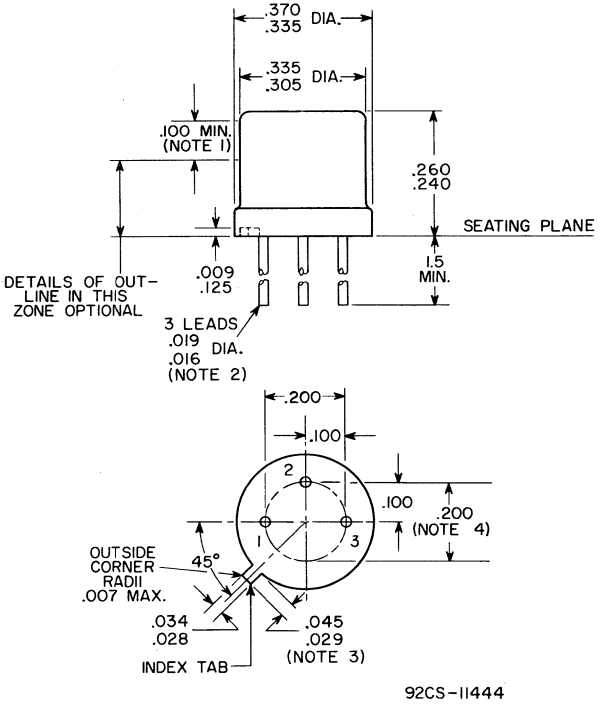


92CS-11455

NOTE: THESE DIMENSIONS SHOULD BE MEASURED AT POINTS 0.050 INCH TO 0.055 INCH BELOW SEATING PLANE. WHEN GAUGE IS NOT USED, MEASUREMENT WILL BE MADE AT SEATING PLANE.

JEDEC No. TO-5

All Dimensions in Inches



92CS-11444

THIS DEVICE IS FOR SOCKETED, SINGLE-SIDED-CIRCUIT BOARD, WIRE-IN AND SIMILAR APPLICATIONS. WHERE USED IN DOUBLE-SIDED OR EYELETED-CIRCUIT BOARD, OR SIMILAR APPLICATIONS WHERE SOLDER BRIDGING MAY OCCUR, A DIELECTRIC WASHER OR OTHER STAND-OFF DEVICE MAY BE NECESSARY.

NOTE 1: THIS ZONE IS CONTROLLED FOR AUTOMATIC HANDLING. THE VARIATION IN ACTUAL DIAMETER WITHIN THE ZONE SHALL NOT EXCEED 0.010 INCH.

NOTE 2: THE SPECIFIED LEAD DIAMETER APPLIES IN THE ZONE BETWEEN 0.050 INCH AND 0.250 INCH FROM THE SEATING PLANE. BETWEEN 0.250 INCH AND 1.5 INCHES, A MAXIMUM DIAMETER OF 0.021 INCH IS HELD. OUTSIDE OF THESE ZONES, THE LEAD DIAMETER IS NOT CONTROLLED.

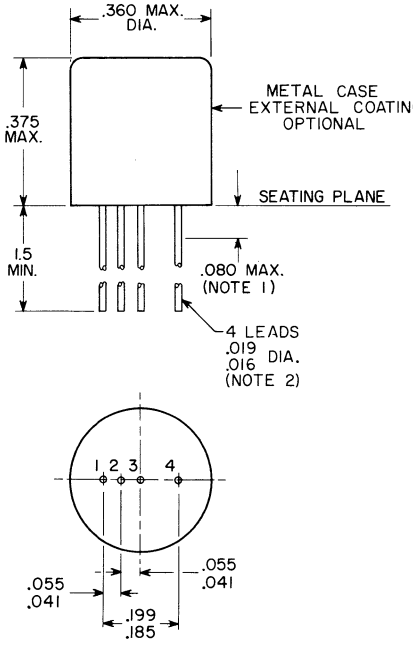
NOTE 3: MEASURED FROM MAXIMUM DIAMETER OF THE ACTUAL DEVICE.

NOTE 4: LEADS HAVING MAXIMUM DIAMETER (0.019 INCH) MEASURED IN GAUGING PLANE 0.054 INCH + 0.001 INCH – 0.000 INCH BELOW THE SEATING PLANE OF THE DEVICE SHALL BE WITHIN 0.007 INCH OF THEIR TRUE LOCATIONS RELATIVE TO A MAXIMUM-WIDTH TAB.

NOTE 5: THE DEVICE MAY BE MEASURED BY DIRECT METHODS OR BY THE GAUGE AND GAUGING PROCEDURE DESCRIBED ON THE SHEET "GAUGE GS-1."

JEDEC No. TO-7

All Dimensions in Inches



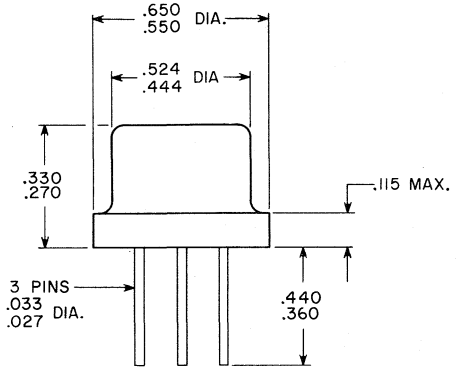
92CS-11447

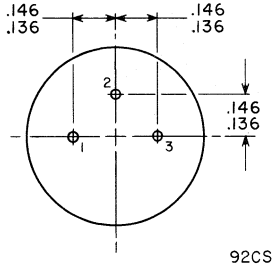
NOTE 1: EXTERNALLY COATED DEVICES SHALL NOT HAVE COATING ON THE LEADS BEYOND THIS ZONE.

NOTE 2: THE SPECIFIED LEAD DIAMETER APPLIES IN THE ZONE BETWEEN 0.050 INCH AND 0.250 INCH FROM THE SEATING PLANE. BETWEEN 0.250 INCH AND 1.5 INCHES, A MAXIMUM DIAMETER OF 0.021 INCH IS HELD. OUTSIDE OF THESE ZONES, THE LEAD DIAMETER IS NOT CONTROLLED.

Outline TO-8

JEDEC No.TO-8
All Dimensions in Inches



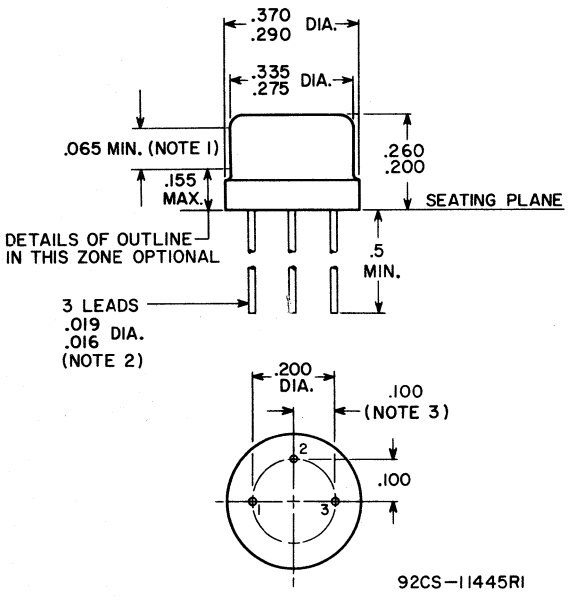


92CS-11442

Outline TO-9

JEDEC No. TO-9

Dimensions in Inches



THIS DEVICE IS FOR SOCKETED, SINGLE-SIDED-CIRCUIT BOARD, WIRE-IN AND SIMILAR APPLICATIONS. WHERE USED IN DOUBLE-SIDED OR EYELETED-CIRCUIT BOARD, OR SIMILAR APPLICATIONS WHERE SOLDER BRIDGING MAY OCCUR, A DIELECTRIC WASHER OR OTHER STAND-OFF DEVICE MAY BE NECESSARY.

NOTE 1: THE VARIATION IN ACTUAL DIAMETER WITHIN THE ZONE SHALL NOT EXCEED 0.010 INCH.

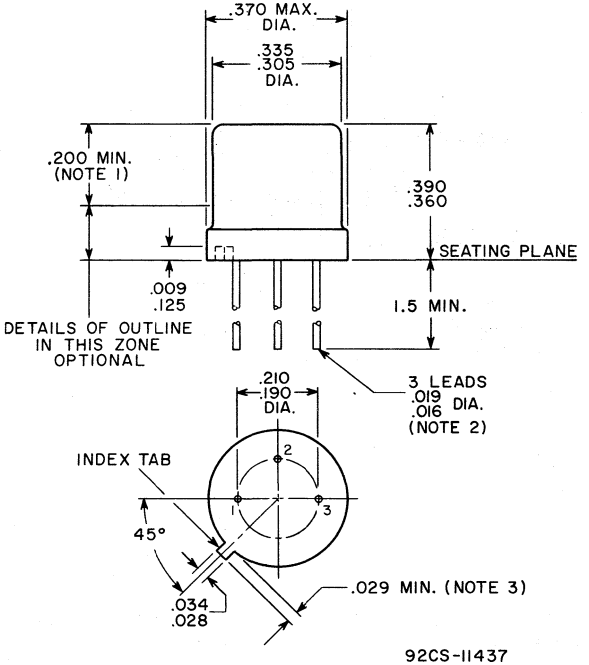
NOTE 2: THE SPECIFIED LEAD DIAMETER APPLIES IN THE ZONE BETWEEN 0.050 INCH AND 0.250 INCH FROM THE SEATING PLANE. BETWEEN 0.250 INCH AND 0.5 INCH, A MAXIMUM DIAMETER OF 0.021 INCH IS HELD. OUTSIDE OF THESE ZONES, THE LEAD DIAMETER IS NOT CONTROLLED.

NOTE 3: LEADS HAVING MAXIMUM DIAMETER (0.019 INCH) MEASURED IN GAUGING PLANE 0.054 INCH + 0.001 INCH − 0.000 INCH BELOW THE SEATING PLANE OF THE DEVICE SHALL BE WITHIN 0.007 INCH OF THEIR TRUE POSITIONS RELATIVE TO EACH OTHER.

Outline TO-11

JEDEC No.TO-11

Dimensions in Inches



92CS-11437

THIS DEVICE IS FOR SOCKETED, SINGLE-SIDED-CIRCUIT BOARD, WIRE-IN AND SIMILAR APPLICATIONS. WHERE USED IN DOUBLE-SIDED OR EYELETED-CIRCUIT BOARD, OR SIMILAR APPLICATIONS WHERE SOLDER BRIDGING MAY OCCUR, A DIELECTRIC WASHER OR OTHER STAND-OFF DEVICE MAY BE NECESSARY.

NOTE 1: THIS ZONE IS CONTROLLED FOR AUTOMATIC HANDLING. THE VARIATION IN ACTUAL DIAMETER WITHIN THE ZONE SHALL NOT EXCEED 0.010 INCH.

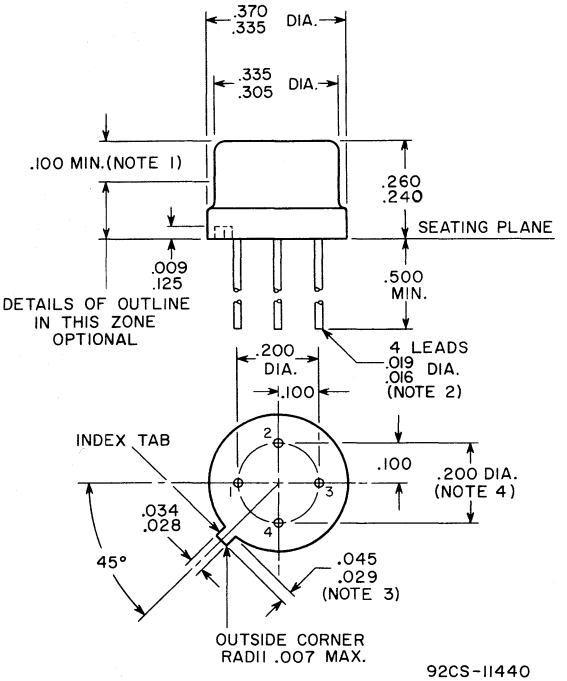
NOTE 2: THE SPECIFIED LEAD DIAMETER APPLIES IN THE ZONE BETWEEN 0.050 INCH AND 0.250 INCH FROM THE SEATING PLANE. BETWEEN 0.250 INCH AND 1.5 INCHES, A MAXIMUM DIAMETER OF 0.021 INCH IS HELD. OUTSIDE OF THESE ZONES, THE LEAD DIAMETER IS NOT CONTROLLED.

NOTE 3: MEASURED FROM MAXIMUM DIAMETER OF THE ACTUAL DEVICE.

Outline TO-12

JEDEC No.TO-12

All Dimensions in Inches



92CS-11440

THIS DEVICE IS FOR SOCKETED, SINGLE-SIDED-CIRCUIT BOARD, WIRE-IN AND SIMILAR APPLICATIONS. WHERE USED IN DOUBLE-SIDED OR EYELETED-CIRCUIT BOARD, OR SIMILAR APPLICATIONS WHERE SOLDER BRIDGING MAY OCCUR, A DIELECTRIC WASHER OR OTHER STAND-OFF DEVICE MAY BE NECESSARY.

NOTE 1: THIS ZONE IS CONTROLLED FOR AUTOMATIC HANDLING. THE VARIATION IN ACTUAL DIAMETER WITHIN THE ZONE SHALL NOT EXCEED 0.010 INCH.

NOTE 2: THE SPECIFIED LEAD DIAMETER APPLIES IN THE ZONE BETWEEN 0.050 INCH AND 0.250 INCH FROM THE SEATING PLANE. BETWEEN 0.250 INCH AND 0.500 INCH, A MAXIMUM DIAMETER OF 0.021 INCH IS HELD. OUTSIDE OF THESE ZONES, THE LEAD DIAMETER IS NOT CONTROLLED.

NOTE 3: MEASURED FROM MAXIMUM DIAMETER OF THE ACTUAL DEVICE.

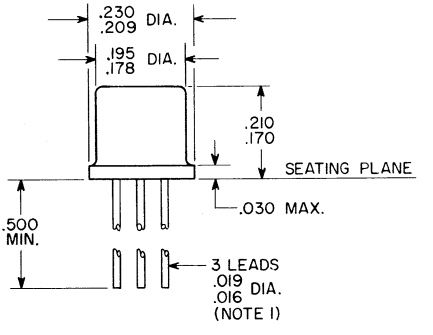
Outline TO-12

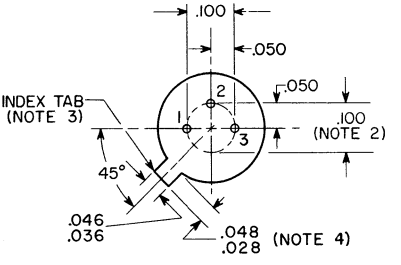
NOTE 4: LEADS HAVING MAXIMUM DIAMETER (0.019 INCH) MEASURED IN GAUGING PLANE 0.054 INCH + 0.001 INCH – 0.000 INCH BELOW THE SEATING PLANE OF THE DEVICE SHALL BE WITHIN 0.007 INCH OF THEIR TRUE LOCATIONS RELATIVE TO A MAXIMUM-WIDTH TAB.

NOTE 5: THE DEVICE MAY BE MEASURED BY DIRECT METHODS OR BY THE GAUGE AND GAUGING PROCEDURE DESCRIBED ON THE SHEET "GAUGE GS-1."

JEDEC No. TO-18

All Dimensions in Inches





92CS-11456

NOTE 1: THE SPECIFIED LEAD DIAMETER APPLIES IN THE ZONE BETWEEN 0.050 INCH AND 0.250 INCH FROM THE SEATING PLANE. BETWEEN 0.250 INCH AND THE END OF THE LEAD, A MAXIMUM DIAMETER OF 0.021 INCH IS HELD. OUTSIDE THESE ZONES, THE LEAD DIAMETER IS NOT CONTROLLED.

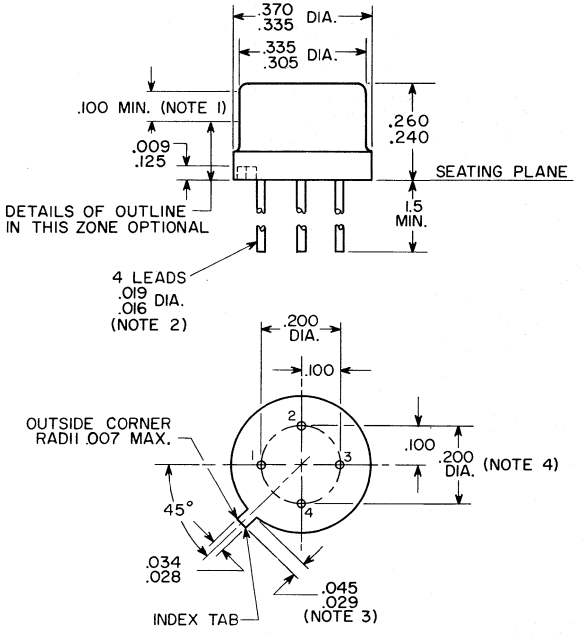
NOTE 2: LEADS HAVING MAXIMUM DIAMETER (0.019 INCH) MEASURED IN GAUGING PLANE 0.054 INCH + 0.001 INCH - 0.000 INCH BELOW THE SEATING PLANE OF THE DEVICE SHALL BE WITHIN 0.007 INCH OF THEIR TRUE LOCATIONS RELATIVE TO A MAXIMUM-WIDTH TAB AND TO THE MAXIMUM 0.230 INCH DIAMETER MEASURED WITH A SUITABLE GAUGE. WHEN GAUGE IS NOT USED, MEASUREMENT WILL BE MADE AT SEATING PLANE.

NOTE 3: INDEX TAB FOR VISUAL ORIENTATION ONLY.

NOTE 4: MEASURED FROM MAXIMUM DIAMETER OF ACTUAL DEVICE.

Outline TO-33

JEDEC No. TO-33
All Dimensions in Inches



92CS-11457

THIS DEVICE IS FOR SOCKETED, SINGLE-SIDED-CIRCUIT BOARD, WIRE-IN AND SIMILAR APPLICATIONS. WHERE USED IN DOUBLE-SIDED OR EYELETED-CIRCUIT BOARD, OR SIMILAR APPLICATIONS WHERE SOLDER BRIDGING MAY OCCUR, A DIELECTRIC WASHER OR OTHER STAND-OFF DEVICE MAY BE NECESSARY.

NOTE 1: THIS ZONE IS CONTROLLED FOR AUTOMATIC HANDLING. THE VARIATION IN ACTUAL DIAMETER WITHIN THE ZONE SHALL NOT EXCEED 0.010 INCH.

NOTE 2: THE SPECIFIED LEAD DIAMETER APPLIES IN THE ZONE BETWEEN 0.050 INCH AND 0.250 INCH FROM THE SEATING PLANE. BETWEEN 0.250 INCH AND 1.5 INCHES, A MAXIMUM DIAMETER OF 0.021 INCH IS HELD. OUTSIDE THESE ZONES, THE LEAD DIAMETER IS NOT CONTROLLED.

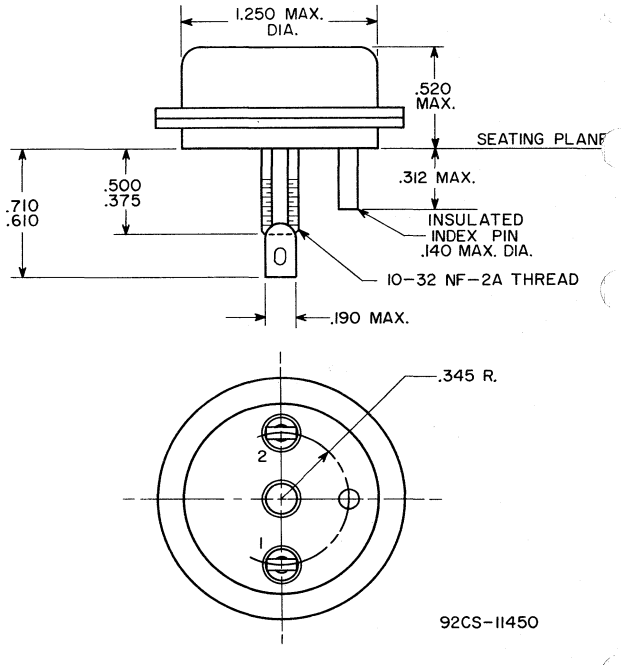
NOTE 3: MEASURED FROM MAXIMUM DIAMETER OF THE ACTUAL DEVICE.

NOTE 4: LEADS HAVING MAXIMUM DIAMETER (0.019 INCH) MEASURED IN GAUGING PLANE 0.054 INCH + 0.001 INCH - 0.000 INCH BELOW THE SEATING PLANE OF THE DEVICE SHALL BE WITHIN 0.007 INCH OF THEIR TRUE LOCATIONS RELATIVE TO A MAXIMUM-WIDTH TAB.

NOTE 5: THE DEVICE MAY BE MEASURED BY DIRECT METHODS OR BY THE GAUGE AND GAUGING PROCEDURE DESCRIBED ON THE SHEET "GAUGE GS-1."

Outline TO-36

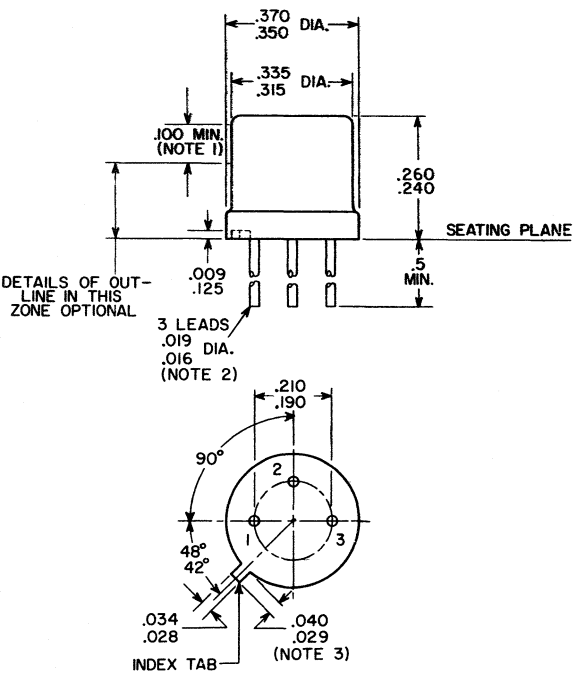
JEDEC No. TO-36
All Dimensions in Inches



OUTLINE TO-39

JEDEC No. TO-39

Dimensions in Inches



92CS-12350

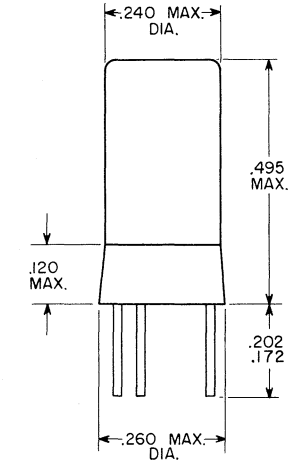
THIS DEVICE IS FOR SOCKETED, SINGLE-SIDED-CIRCUIT BOARD, WIRE-IN AND SIMILAR APPLICATIONS. WHERE USED IN DOUBLE-SIDED OR EYELETED-CIRCUIT BOARD, OR SIMILAR APPLICATIONS WHERE SOLDER BRIDGING MAY OCCUR, A DIELECTRIC WASHER OR OTHER STAND-OFF DEVICE MAY BE NECESSARY.

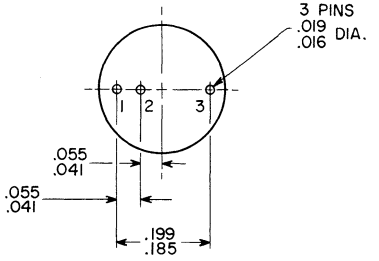
NOTE 1: THE ZONE IS CONTROLLED FOR AUTOMATIC HANDLING. THE VARIATION IN ACTUAL DIAMETER WITHIN THE ZONE SHALL NOT EXCEED 0.010 INCH.

NOTE 2: THE SPECIFIED LEAD DIAMETER APPLIES IN THE ZONE BETWEEN 0.050 INCH AND 0.250 INCH FROM THE SEATING PLANE. BETWEEN 0.250 INCH AND 0.5 INCH, A MAXIMUM DIAMETER OF 0.021 INCH IS HELD. OUTSIDE OF THESE ZONES, THE LEAD DIAMETER IS NOT CONTROLLED.

NOTE 3: MEASURED FROM MAXIMUM DIAMETER OF THE ACTUAL DEVICE.

JEDEC No. TO-40
All Dimensions in Inches



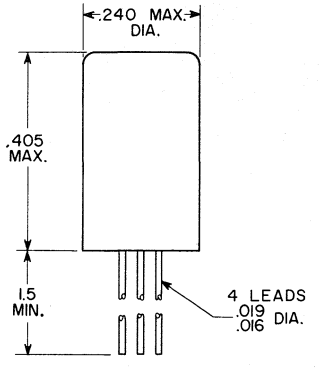


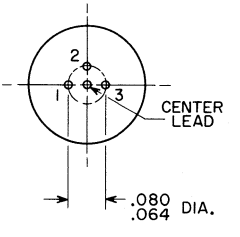
92CS-11451

Outline TO-44

JEDEC No. TO-44

All Dimensions in Inches

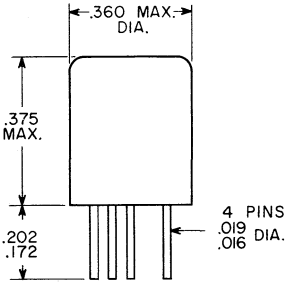


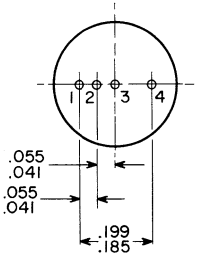


92CS-11452

JEDEC No. TO-45

All Dimensions in Inches

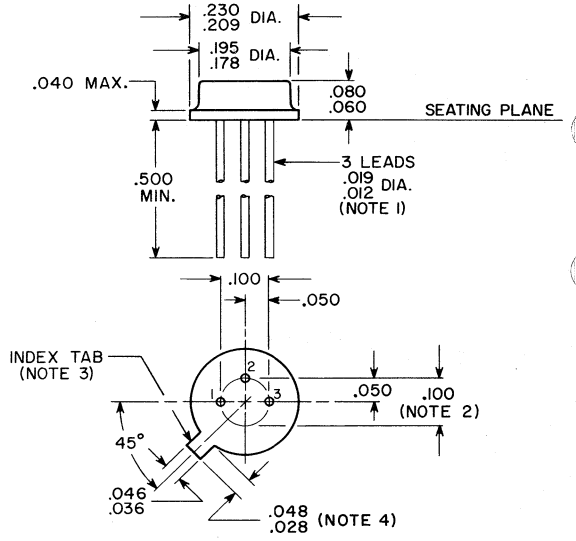




92CS-11453

Outline TO-46

JEDEC No. TO-46
All Dimensions in Inches



92CS-11438

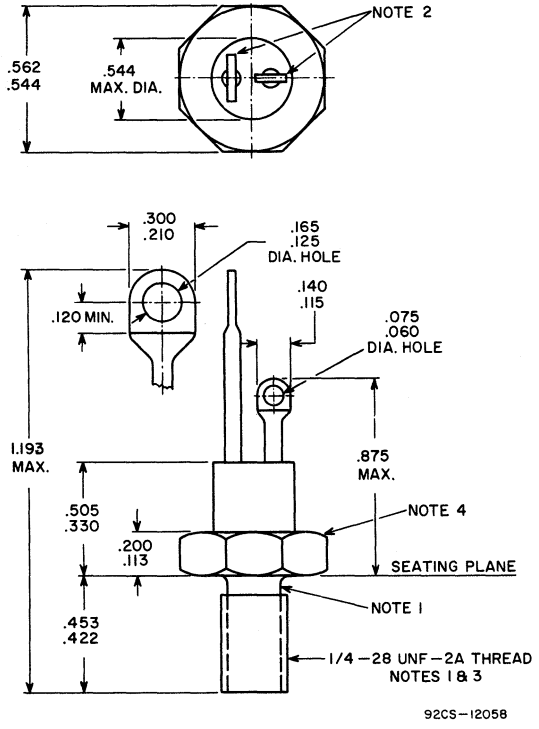
NOTE 1: THE SPECIFIED LEAD DIAMETER APPLIES IN THE ZONE BETWEEN 0.050 INCH AND 0.250 INCH FROM THE SEATING PLANE. BETWEEN 0.250 INCH AND THE END OF THE LEAD, A MAXIMUM DIAMETER OF 0.021 INCH IS HELD. OUTSIDE OF THESE ZONES, THE LEAD DIAMETER IS NOT CONTROLLED.

NOTE 2: LEADS HAVING MAXIMUM DIAMETER (0.019 INCH) MEASURED IN GAUGING PLANE 0.054 INCH + 0.001 INCH - 0.000 INCH BELOW THE SEATING PLANE OF THE DEVICE SHALL BE WITHIN 0.007 INCH OF THEIR TRUE LOCATIONS RELATIVE TO A MAXIMUM-WIDTH TAB AND TO THE MAXIMUM 0.230 INCH DIAMETER MEASURED WITH A SUITABLE GAUGE. WHEN GAUGE IS NOT USED, MEASUREMENT WILL BE MADE AT SEATING PLANE.

NOTE 3: INDEX TAB FOR VISUAL ORIENTATION ONLY.

NOTE 4: MEASURED FROM MAXIMUM DIAMETER OF ACTUAL DEVICE.

JEDEC No. TO-48



DIMENSIONS IN INCHES

Note 1: Complete threads to extend to within 2 1/2 threads of head. Diameter of unthreaded portion 0.249 inch maximum, 0.220 inch minimum.

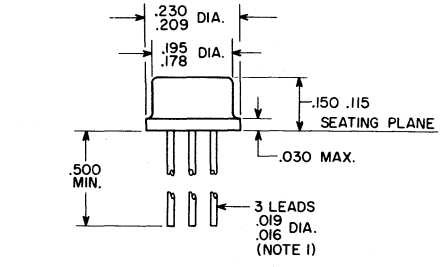
Note 2: Angular orientation of these terminals is undefined. Square or radius on end of terminal is optional.

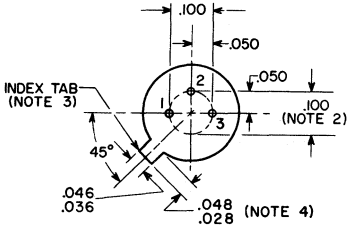
Note 3: 1/4-28 UNF-2A. Maximum pitch diameter of plated threads shall be basic pitch diameter 0.2268 inch, minimum pitch diameter 0.2225 inch. Reference (Screw Thread Standards for Federal Services, 1957) Handbook H28, 1957 PI.

Note 4: A chamfer (or undercut) on one or both ends of hexagonal portion is optional.

Outline TO-52

JEDEC No.TO-52





92CS-12342

DIMENSIONS IN INCHES

Note 1: The specified lead diameter applies in the zone between 0.050 inch and 0.250 inch from the seating plane. Between 0.250 inch and 0.500 inch of the lead, a maximum diameter of 0.021 inch is held. Outside these zones, the lead diameter is not controlled.

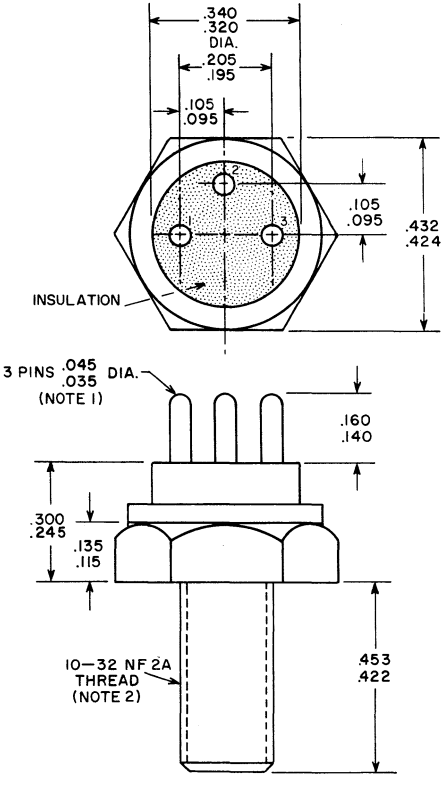
Note 2: Leads having maximum diameter (0.019 inch) measured in gauging plane 0.054 inch + 0.001 inch - 0.000-inch below the seating plane of the device shall be within 0.007 inch of their true locations relative to a maximum-width tab.

Note 3: Index tab for visual orientation only.

Note 4: Measured from maximum diameter of actual device.

Note 5: The device may be measured by direct methods or by the gauge and gauging procedure described on the sheet "Gauge GS-2".

JEDEC No. TO-60



92CS-12045R4

DIMENSIONS IN INCHES

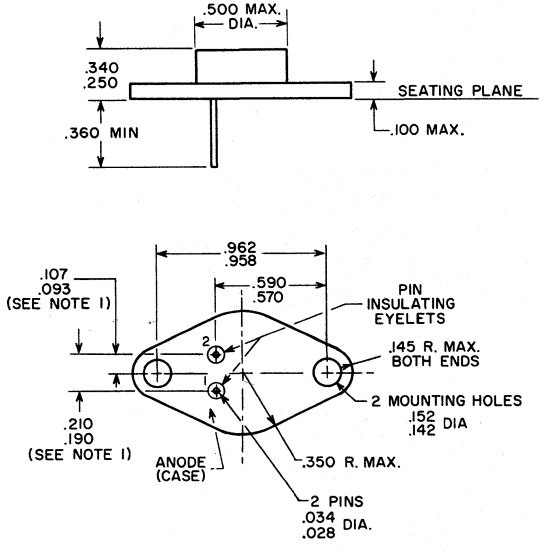
Note 1: The pin spacing permits insertion in any socket having a pin-circle diameter of 0.200 inch and contacts which will accommodate pins having a diameter of 0.035 inch minimum, 0.450 inch maximum.

Note 2: The torque applied to a 10-32 hex nut assembled on the thread during installation should not exceed 12-inch pounds.

Note 3: This device may be operated in any position.

Outline TO-66

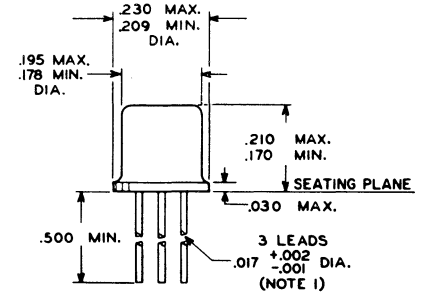
JEDEC No. TO-66

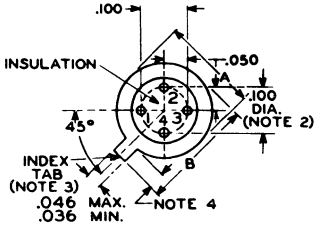


DIMENSIONS IN INCHES

Note 1: These dimensions should be measured at points .050 to .055 below seating plane. When gauge is not used, measurement will be made at seating plane.

JEDEC No. TO-72





92CS-11941

DIMENSIONS IN INCHES

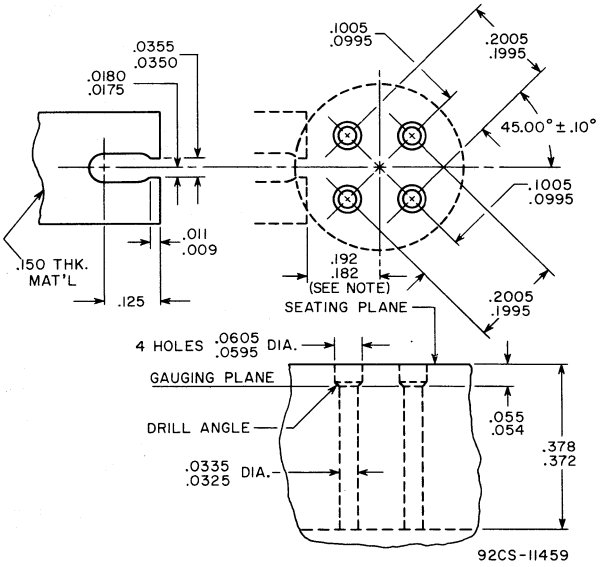
Note 1: The specified lead diameter applies in the zone between 0.050" and 0.250" from the seating plane. From 0.250" to the end of the lead a maximum diameter of 0.021" is held. Outside of these zones, the lead diameter is not controlled.

Note 2: Maximum diameter leads at a gauging plane 0.054" + 0.001" - 0.000" below seating plane to be within 0.007" of their true location relative to maximum width tab and to the maximum 0.230" diameter measured with a suitable gauge. When gauge is not used, measurement will be made at seating plane.

Note 3: For visual orientation only.

Note 4: Tab length to be 0.028" minimum - 0.048" maximum, and will be determined by subtracting diameter A from dimension B.

JEDEC No.GS-1
Dimensions in Inches



NOTE: THE LOCATION OF THE TAB LOCATOR WITHIN THE LIMITS INDICATED WILL BE DETERMINED BY THE TAB AND FLANGE DIMENSION OF THE DEVICE BEING CHECKED.

Gauging Procedure

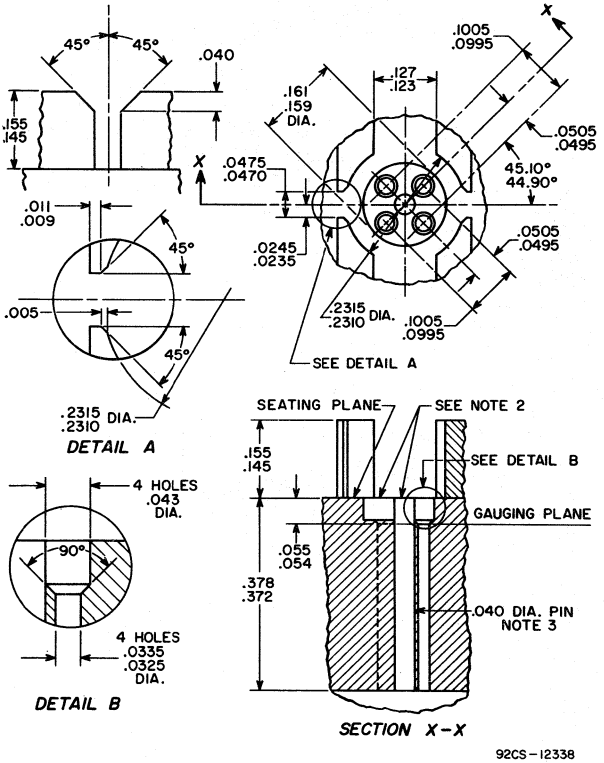
THE DEVICE BEING MEASURED SHALL BE INSERTED UNTIL ITS SEATING PLANE IS 0.125 INCH ± 0.010 INCH FROM THE SEATING SURFACE OF THE GAUGE. A FORCE OF 8.0 ± 0.5 OZ. SHALL THEN BE APPLIED PARALLEL AND SYMMETRICAL TO THE DEVICE'S CYLINDRICAL AXIS. WHEN EXAMINED VISUALLY AFTER THE FORCE APPLICATION (THE FORCE NEED NOT BE REMOVED) THE SEATING PLANE OF THE DEVICE SHALL BE SEATED AGAINST THE GAUGE.

THE USE OF A PIN STRAIGHTENER PRIOR TO INSERTION IN THE GAUGE IS PERMISSIBLE.

A SPACER MAY BE USED TO OBTAIN THE 0.125 INCH DISTANCE FROM THE GAUGE SEAT PRIOR TO FORCE APPLICATION.

Gauge GS-2

JEDEC No. GS-2
Dimensions in Inches



NOTE 1: FOR GAUGING PROCEDURE SEE *GAUGE GS-1*.

NOTE 2: THESE SURFACES TO BE PARALLEL AND IN THE SAME PLANE WITHIN ± .001 INCH.

NOTE 3: PIN, PRESSED IN.

RECTIFIER CIRCUITS AND CHARACTERISTICS CHART

EXAMPLE 1 - Required Power Supply (Resistive load):

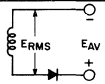
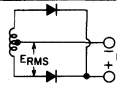
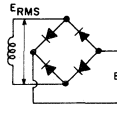
Single-phase, half-wave circuit
DC Output Volts (E_{AV}) = 150
Total DC Output Amperes (I_{AV}) = 19

Check Chart for:	Col.		
AC Input Volts (E_{RMS})	3	= 2.22xE_{AV}	= 333
Peak Reverse Volts	6	= 3.14xE_{AV}	= 472
Current Rating Per Rectifier Cell:			
Average Amperes (I_{AV})	5		= 19
RMS Amperes (Res.load)	5	= 1.57xI_{AV}	= 30
Peak Amperes (Res.load)	5	= 3.14xI_{AV}	= 60

EXAMPLE 2 - Required Power Supply (Resistive load):

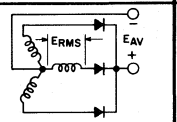
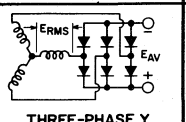
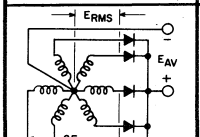
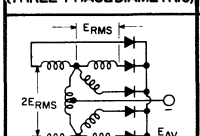
Single-phase, full-wave bridge circuit
AC Input Volts (E_{RMS}) = 30
Total DC Output Amperes (I_{AV}) = 65

Check Chart for:	Col.		
DC Output Volts (E_{AV})	2&3	= E_{RMS}/1.11	= 27
Peak Reverse Volts	6	= 1.41xE_{RMS}	= 42
Current Rating Per Rectifier Cell:			
Average Amperes (I_{AV})	5	= .5xI_{AV}	= 32.5
RMS Amperes (Res.load)	5	= .785xI_{AV}	= 51
Peak Amperes (Res.load)	5	= 1.57xI_{AV}	= 102

1 CIRCUIT (Rectifier forward voltage, reverse current, source reactance=zero)	2 DC OUTPUT VOLTS: AV	Peak	Waveform	% Ripple	3 AC INPUT VOLTS (RMS) For resistive or inductive load: Phase	Line-to-Line	4 TOTAL DC OUTPUT CURRENT (Load)	5 CURRENT RATING PER RECTIFIER CELL: Waveform	AV	For resistive load: RMS	Peak	Ratio: Pk/AV	For inductive load or high-inductance choke-input filter: RMS	Peak	Ratio: Pk/AV	6 PEAK REVERSE VOLTS PER CELL (PRV)
 SINGLE-PHASE HALF-WAVE	E_{AV}	3.14 x E_{AV}		121	E_{RMS} 2.22xE_{AV}		I_{AV}		I_{AV}	1.57 x I_{AV}	3.14 x I_{AV}	3.14	-	-	-	3.14x E_{AV} 1.41x E_{RMS}
 SINGLE-PHASE FULL-WAVE	E_{AV}	1.57 x E_{AV}		48	E_{RMS} 1.11x E_{AV} to center tap	2xE_{RMS}; 2.22x E_{AV}	I_{AV}		.5 x I_{AV}	.785 x I_{AV}	1.57 x I_{AV}	3.14	.707 x I_{AV}	1.00 x I_{AV}	2.00	3.14x E_{AV} 2.82x E_{RMS}
 SINGLE-PHASE FULL-WAVE BRIDGE	E_{AV}	1.57 x E_{AV}		48	E_{RMS} 1.11xE_{AV}		I_{AV}		.5 x I_{AV}	.785 x I_{AV}	1.57 x I_{AV}	3.14	.707 x I_{AV}	1.00 x I_{AV}	2.00	1.57x E_{AV} 1.41x E_{RMS}

RADIO CORPORATION OF AMERICA
Semiconductor & Materials Division Somerville, N. J.

RECTIFIER CIRCUITS AND CHARACTERISTICS CHART

1 CIRCUIT — Rectifier forward voltage, reverse current, source reactance=zero	2 DC OUTPUT VOLTS				3 AC INPUT VOLTS (RMS) — For resistive or inductive load		4 TOTAL DC OUTPUT CURRENT (Load)	5 CURRENT RATING PER RECTIFIER CELL							6 PEAK REVERSE VOLTS PER CELL (PRV)
										For resistive load			For inductive load or high-inductance choke-input filter			
	AV	Peak	Waveform	% Ripple	Phase	Line-to-Line		Waveform	AV	RMS	Peak	Ratio: Pk/AV	RMS	Peak	Ratio: Pk/AV	
 THREE-PHASE Y HALF-WAVE	E_{AV}	1.21 x E_{AV}		18.3	E_{RMS} .855x E_{AV} to neutral	1.73x E_{RMS} 1.48x E_{AV}	I_{AV}		.333 x I_{AV}	.587 x I_{AV}	1.21 x I_{AV}	3.63	.578 x I_{AV}	1.00 x I_{AV}	3.00	2.09x E_{AV} 2.45x E_{RMS}
 THREE-PHASE Y FULL-WAVE BRIDGE	E_{AV}	1.05 x E_{AV}		4.3	E_{RMS} .428x E_{AV} to neutral	1.73x E_{RMS} .74x E_{AV}	I_{AV}		.333 x I_{AV}	.579 x I_{AV}	1.05 x I_{AV}	3.15	.578 x I_{AV}	1.00 x I_{AV}	3.00	1.05x E_{AV} 2.45x E_{RMS}
 SIX-PHASE STAR (THREE-PHASE DIAMETRIC)	E_{AV}	1.05 x E_{AV}		4.3	E_{RMS} .74x E_{AV} to neutral	2xE_{RMS} 1.48x E_{AV} no load	I_{AV}		.167 x I_{AV}	.409 x I_{AV}	1.05 x I_{AV}	6.30	.408 x I_{AV}	1.00 x I_{AV}	6.00	2.09x E_{AV} 2.83x E_{RMS}
 THREE-PHASE DOUBLE Y AND INTERPHASE TRANSFORMER	E_{AV}	1.05 x E_{AV}		4.3	E_{RMS} .855x E_{AV} to neutral	2xE_{RMS} 1.71x E_{AV} no load	I_{AV}		.167 x I_{AV}	.293 x I_{AV}	.525 x I_{AV}	3.15	.289 x I_{AV}	.50 x I_{AV}	3.00	2.09x E_{AV} 2.45x E_{RMS}

AV = Average Pk = Peak

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