

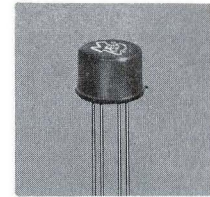
GROWN-DIFFUSED SILICON TETRODE TRANSISTOR



Typical 20db Power Gain at 70 MC

High Gain at High Temperature

Designed for High Frequency • IF Amplifiers
RF Amplifiers • Video Amplifiers • Oscillators

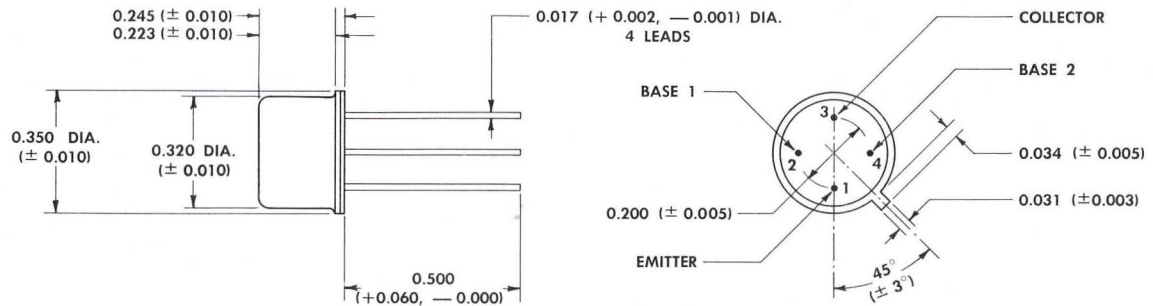


ACTUAL SIZE

TYPE 3N35
BULLETIN NO. DL-5 961, AUGUST, 1958
REPLACES BULLETIN NO. DL-5 784, AUGUST, 1957

mechanical data

Welded case with glass-to-metal hermetic seal between case and leads. Unit weight is 1 gram. These units meet JETEC outline TO-12 dimensions.



ALL CONNECTIONS INSULATED FROM CASE

ALL DIMENSIONS IN INCHES

maximum ratings at T_j = 25°C

Emitter Current	20 mA
Collector Current	20 mA
Base No. 1 Current	5 mA
Base No. 2 Current	5 mA
Collector Dissipation (Derate 1 mW/°C for Advanced Temperatures)	125 mW

junction temperature

Maximum Range -65°C to +150°C

design characteristics at T_j = 25°C (except as indicated)

dc measurements		conditions		min	design center	max	unit	
I _{CBO}	Collector Cutoff Current at 150°C	V _{CB} = 20V	I _E = 0	I _{B2} = 0	—	0.005	0.4	μA
BV _{CB0}	Breakdown Voltage	V _{CB} = 20V	I _E = 0	I _{B2} = 0	—	—	40	μA
BV _{EBO}	Breakdown Voltage	I _C = 50μA	I _{B2} = 0	I _E = 0	30	60	—	V
BV _{CEO}	Breakdown Voltage	I _C = 50μA	I _{B2} = 0	I _E = 0	1	—	—	V
R _{CS}	Saturation Resistance	I _C = 1mA	I _{B2} = 0	I _{B1} = 0	30	45	—	V
R _{B1-RB2}	Base-to-Base Resistance	I _C = 5mA	I _{B2} = 0	I _{B1} = 1.0mA	—	150	300	Ohm
		I _B = 100μA	—	—	—	10K	—	Ohm
low frequency measurements								
h _{fe} *	Current Transfer Ratio	V _C = 20V	I _E = -1.3mA	I _{B2} = -100μA	10	25	—	
		f = 1000 cps						
c _{ob}	Output Capacity	V _C = 20V	I _E = -1.3mA	I _{B2} = -100μA	—	1.5	—	μμf
c _H	Header Capacity	f = 1Mc			—	0.4	—	μμf
high frequency measurements								
h _{fe} *	Current Transfer Ratio	V _C = 20V		I _E = -1.3mA I _{B2} = -100μA	1.0	1.6	—	
r _{ies} *	Series Input Resistance				20	50	90	Ohm
r _{oep}	Parallel Output Resistance				4K	7K	15K	Ohm
c _{oep}	Parallel Output Capacitance				—	2	3	μμf
f _{αb} *	Alpha Cutoff Frequency				—	150	—	Mc
NF	Noise Figure			—	9	14	db	
PG _e †	Power Gain			—	20	—	db	

* Short Circuit Parameter
† See Page 4

LICENSED UNDER BELL SYSTEM PATENTS

SEMICONDUCTOR-COMPONENTS DIVISION

TEXAS INSTRUMENTS
INCORPORATED
POST OFFICE BOX 312 • DALLAS, TEXAS

TYPE 3N35 N-P-N SILICON TETRODE

DESIGN NOTES AND BIBLIOGRAPHY

1. Power Gain $PG_e = 20 \log h_{fe} + 10 \log \frac{R_{oep}}{4 R_{ies}}$
2. Formulae for conversion from series to parallel
 - a. $R_{iep} = (1 + Q^2) R_{ies}$
 - b. $C_{iep} = Q^2 / (1 + Q^2) C_{ies}$
 - c. $C_{ies} = \frac{1}{\omega Q R_{ies}}$
3. Input Q Range = 0.9 to 1.9 Typical Value = 1.4
4. Thermal Resistance
$$\Theta_T = \frac{T_j - T_a}{P_t}$$
Typical Value = 0.6°C/mW

Where T_j = Operating Junction Temperature

T_a = Air Ambient

P_t = Total Power Dissipated

Θ_T = Total Thermal Resistance

Reference: B. Riech, "Transistor Thermal Resistance Measurement," *Electronic Design*, 12-1-56.

qualification testing

Each unit is heat cycled from -65°C to $+175^\circ\text{C}$ for ten cycles, and then humidity cycled at temperature from -65°C to $+75^\circ\text{C}$ in air at 95% relative humidity for four cycles. The hermetic seal is tested by subjecting immersed units to hydraulic pressure. Each unit is thoroughly tested to determine the electrical design characteristics. Production samples are life tested periodically to determine the effects of storage and dissipation and ensure maximum attainable reliability.

References to High Frequency Tetrode.

R. L. Wallace, L. G. Schimpf, E. Dickten, "A Junction-Transistor Tetrode for High Frequency Use," *Proceedings of the IRE*, Vol. XL, pp. 1395-1400, November, 1952.

Boyd Cornelison and Willis A. Adcock, "Transistors by Grown-Diffused Technique," *Wescon Meeting*, August 21, 1957.

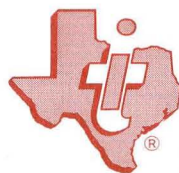
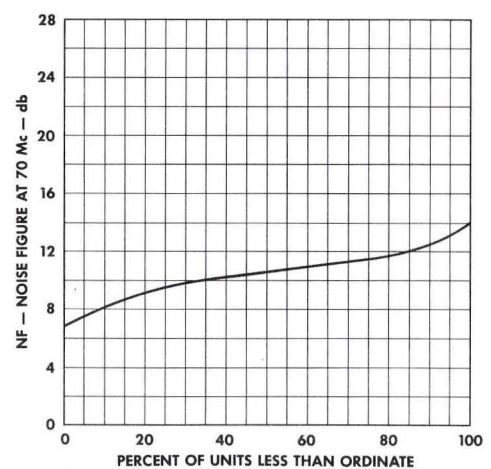
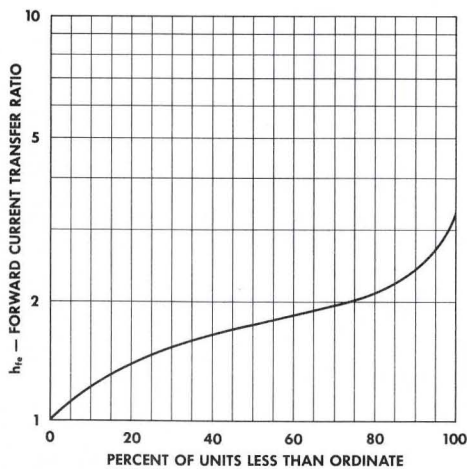
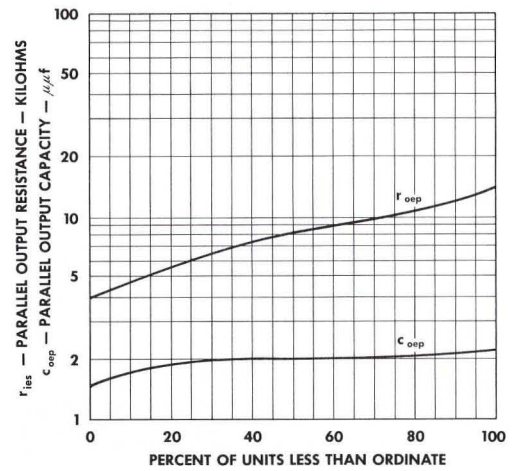
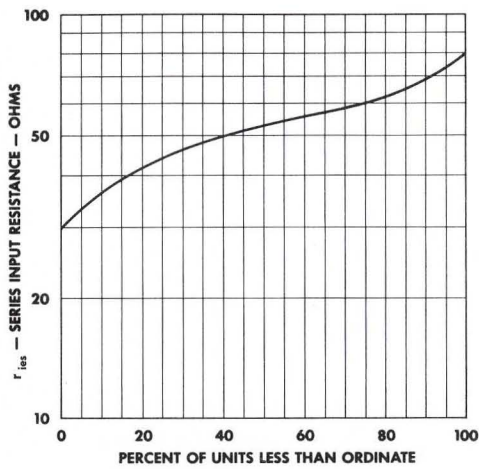
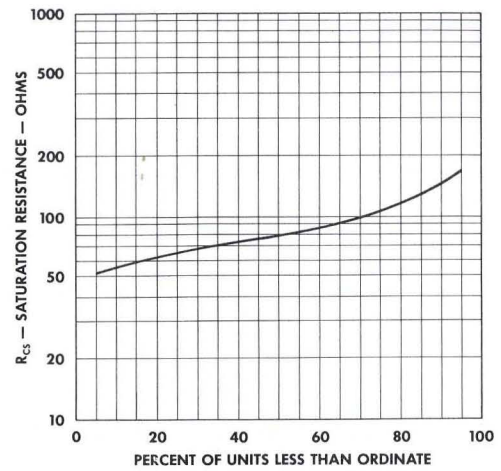
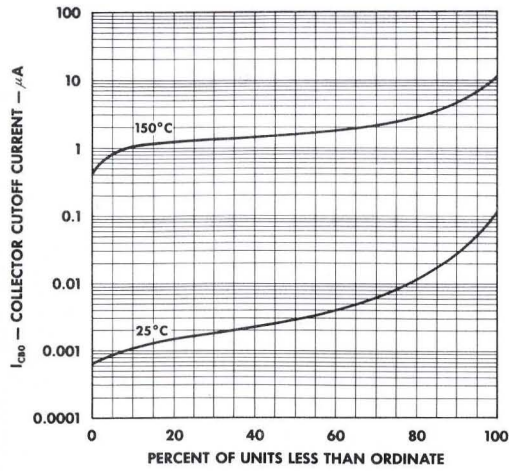
William C. Brower and Charles E. Earhart, "70 Megacycle Silicon Transistor," *Third Annual Electron Devices Meeting of the IRE*, Washington, D.C., November 1, 1957. Reprinted in *Semiconductor Products*, March-April, 1958.

Roger R. Webster, "Silicon Tetrode Transistors for the 5-40 Mc Region," *National Conference on Aeronautical Electronics*, Dayton, Ohio, May 14, 1956.

Roger R. Webster and R. F. Stewart, "Some Circuit Applications of Silicon Tetrodes," *Wescon Meeting*, August 24, 1956.

TYPE 3N35 N-P-N SILICON TETRODE

TYPICAL PRODUCTION DISTRIBUTIONS



TYPE 3N35 N-P-N SILICON TETRODE

TYPICAL CHARACTERISTICS

