MOTOROLA
SEMICONDUCTOR
TECHNICAL DATA

T-33-05

2N3924

The RF Line

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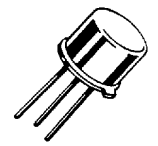
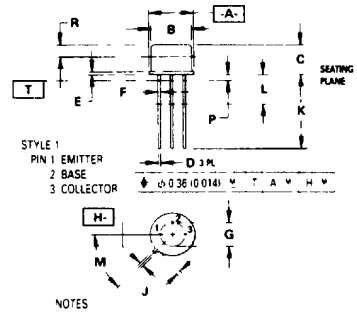
NPN SILICON RF POWER TRANSISTOR

. . . optimized Annular transistor for large-signal power-amplifier and driver applications to 300 MHz.

- Designed for 13.6 Volt Operation
- High Output Power — 4.0 W Min @ f = 175 MHz
- Multiple-Emitter Construction for Excellent High-Frequency Performance
- Guaranteed Safe Operating Area
  $V_{CEO(sus)}$ Measured at I_C = 200 mAdc

NPN SILICON
RF POWER TRANSISTOR





NOTES
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M 1982
2. CONTROLLING DIMENSION: INCH
3. DIMENSION J MEASURED FROM DIMENSION A MAXIMUM
4. DIMENSION B SHALL NOT VARY MORE THAN 0.25 (0.010) IN ZONE R. THIS ZONE CONTROLLED FOR AUTOMATIC HANDLING
5. DIMENSION F APPLIES BETWEEN DIMENSION P AND L. DIMENSION D APPLIES BETWEEN DIMENSION L AND K MINIMUM. LEAD DIAMETER IS UNCONTROLLED IN DIMENSION P AND BEYOND DIMENSION K MINIMUM

DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	8.51	9.39	0.335	0.370
B	7.75	8.50	0.305	0.335
C	6.10	6.60	0.240	0.260
D	0.41	0.53	0.016	0.021
E	0.23	1.04	0.009	0.041
F	0.41	0.48	0.016	0.019
G	5.08 BSC		0.200 BSC	
H	0.72	0.86	0.028	0.034
J	0.74	1.14	0.029	0.045
K	12.70	19.05	0.500	0.750
L	6.35	—	0.250	—
M	45 BSC		45 BSC	
P	—	1.27	—	0.050
R	2.54	—	0.100	—

CASE 79-04
TO-205AD
(TO-39)

***MAXIMUM RATINGS** (T_A = 25°C unless otherwise noted)

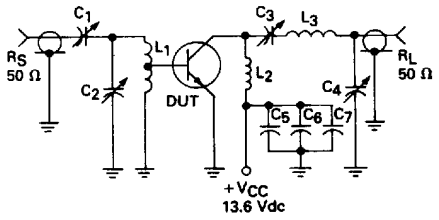
Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CEO}	18	Vdc
Collector-Base Voltage	V_{CB}	36	Vdc
Emitter-Base Voltage	V_{EB}	4.0	Vdc
Collector Current	I_C	0.5	Adc
Power Dissipation @ T_C = 25°C Derate above 25°C	P_D	7.0 40	Watts mW/°C
Operating and Storage Junction Temperature Range	T_J, T_{stg}	−65 to +200	°C

*Indicates JEDEC Registered Data

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)

Characteristic		Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS						
Collector-Emitter Sustaining Voltage (Figure 2) (I_C = 200 mAdc)		$V_{CEO(sus)}$	18	—	—	Vdc
Collector-Base Breakdown Voltage (I_C = 0.25 mAdc, I_E = 0)		$V_{(BR)CBO}$	36	—	—	Vdc
Emitter-Base Breakdown Voltage (I_E = 1.0 mAdc, I_C = 0)		$V_{(BR)EBO}$	4.0	—	—	Vdc
Collector Cutoff Current (V_{CB} = 15 Vdc, I_E = 0) (V_{CB} = 15 Vdc, I_E = 0, T_A = 150°C)		I_{CBO}	— —	— —	0.1 5.0	mAdc
DYNAMIC CHARACTERISTICS						
Current-Gain — Bandwidth Product (I_C = 100 mAdc, V_{CE} = 13.6 Vdc, f = 100 MHz		f_T	—	350	—	MHz
Output Capacitance (V_{CB} = 13.6 Vdc, I_E = 0, f = 100 kHz		C_{ob}	—	12.5	20	pF
FUNCTIONAL TESTS						
Power Input	Test Circuit Figure 1	P_{in}	—	—	1.0	Watt
Common-Emitter Amplifier Power Gain	V_{CE} = 13.6 Vdc, R_S = 50 ohms, R_L = 50 ohms, f = 175 MHz	G_{pe}	6.0	7.3	—	dB
Collector Efficiency	P_{out} = 4.0 Watts	η	70	—	—	%

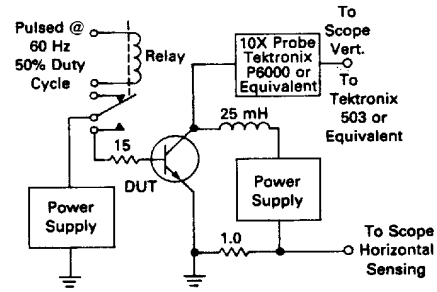
FIGURE 1 — 175 MHz TEST CIRCUIT



C_1, C_2, C_4 ..... 5–50 pF (Air variable)
C_3 .....7–100 pF (Air variable)
C_5 .....470 pF (Disc ceramic)
C_6 .....0.01 μF (Disc ceramic)
C_7 .....0.001 μF (Disc ceramic)

L_1 — 1½ turns #14 AWG tinned wire; ⅜" ID Air wound; winding length 3/16"; base tapped 1 turn from ground
L_2 — RFC
L_3 — 2 turns #14 AWG tinned wire; ¼" ID Air wound; winding length 3/16"

FIGURE 2 — PULSE TEST CIRCUIT



CLASS C DESIGN DATA FOR V_{CE} = 13.6 Vdc, T_C = 25°C
(Emitter Grounded Directly to the Chassis — No Tuned-Emitter Techniques Used)

T-33-05

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FIGURE 3 — POWER OUTPUT versus FREQUENCY

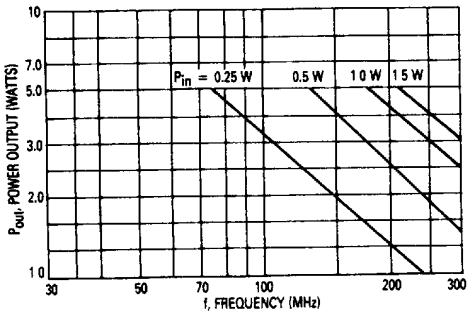

FIGURE 4 — POWER OUTPUT versus POWER INPUT

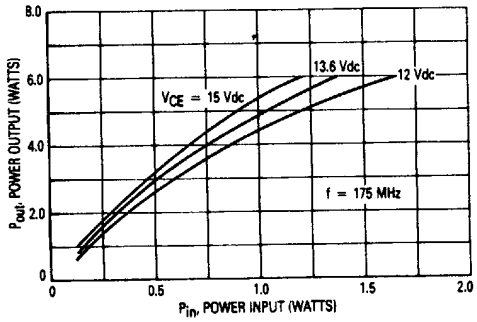

FIGURE 5 — PARALLEL EQUIVALENT INPUT RESISTANCE

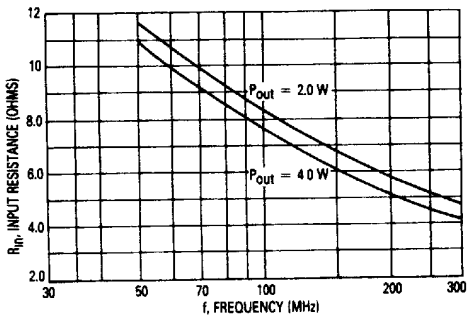

FIGURE 6 — PARALLEL EQUIVALENT INPUT CAPACITANCE

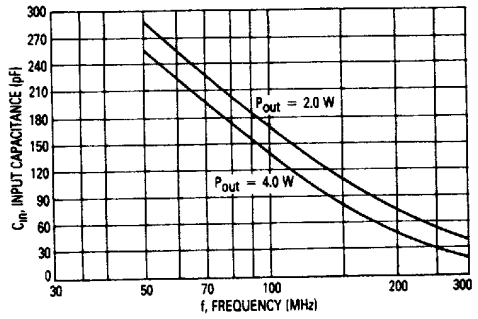

FIGURE 7 — PARALLEL EQUIVALENT OUTPUT CAPACITANCE