

The RF Line UHF Linear Power Transistor

The TP5002S is an NPN gold metallized transistor using diffused ballast resistors for reliability and ruggedness. The TP5002S was specifically designed as a low power driver with high gain and can be operated in Class A, B or C.

- 380–512 MHz
- 1.5 W — P_{out}
- 24 V — V_{CC}
- High Gain — 13 dB Min, Class A @ 470 MHz

TP5002S

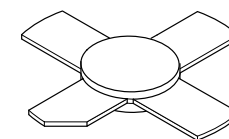
1.5 W, 380 to 512 MHz
UHF LINEAR
POWER TRANSISTOR
NPN SILICON

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector–Base Voltage	V _{CBO}	45	Vdc
Emitter–Base Voltage	V _{EBO}	3.5	Vdc
Total Device Dissipation @ T _C = 25°C Derate above 25°C	P _D	7.0 0.045	Watts W/°C
Operating Junction Temperature	T _J	200	°C
Storage Temperature Range	T _{stg}	–65 to +200	°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case (T _C = 70°C)	R _{θJC}	21	°C/W



CASE 249–06, STYLE 1
(.280 SOE S)

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted.)

Characteristic	Symbol	Min	Typ	Max	Unit
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OFF CHARACTERISTICS

Collector–Base Breakdown Voltage (I _C = 2.0 mA, I _E = 0)	V _{(BR)CBO}	45	—	—	Vdc
Emitter–Base Breakdown Voltage (I _E = 2.0 mA, I _C = 0)	V _{(BR)EBO}	4.0	—	—	Vdc
Collector Cutoff Current (V _{CB} = 24 V, I _E = 0)	I _{CBO}	—	—	0.5	mAdc

ON CHARACTERISTICS

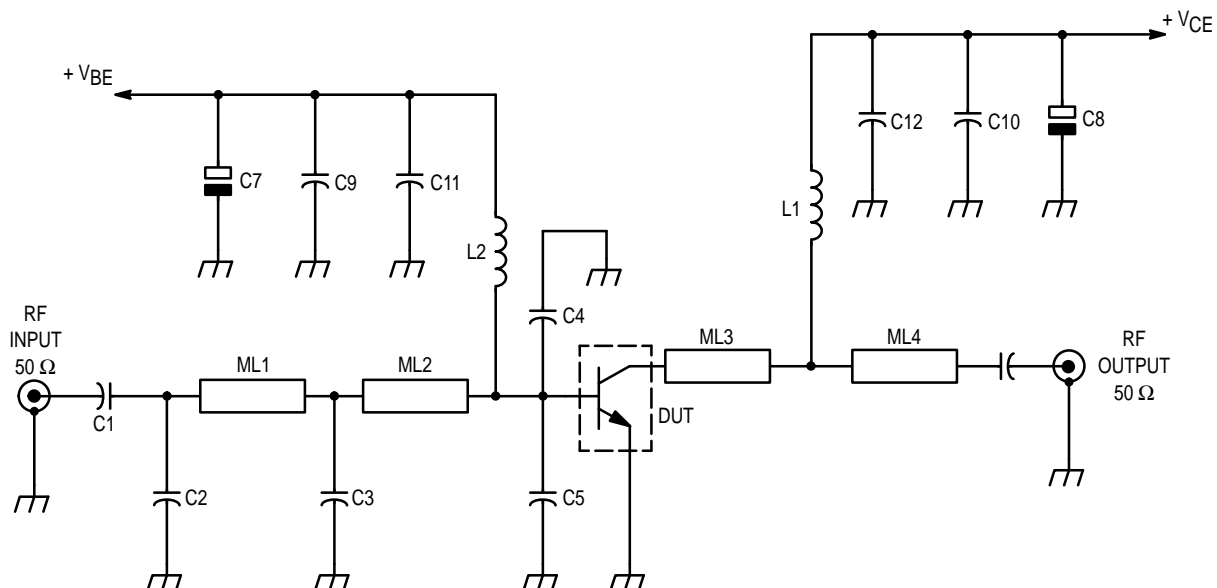
DC Current Gain (I _C = 100 mA, V _{CE} = 5.0 V)	h _{FE}	15	—	120	—
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DYNAMIC CHARACTERISTICS

Output Capacitance (V _{CB} = 28 V, I _E = 0, f = 1.0 MHz)	C _{ob}	—	—	4.5	pF
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FUNCTIONAL TESTS

Common–Emitter Amplifier Power Gain (V _{CE} = 23 V, P _{out} = 1.5 W, f = 470 MHz, I _C = 200 mA)	G _{PE}	13	—	—	dB
Saturated Output Power (V _{CE} = 23 V, f = 470 MHz, I _C = 200 mA)	P _{sat}	—	2.2	—	W



C1, C6 — 220 pF 0805 681C Sprague
 C2 — 8.2 pF ATC100A8R2DP50
 C3 — 10 pF ATC100A100DP50
 C4, C5 — 27 pF ATC100A8R2DP50
 C7 — 10 μ F 35 V
 C8 — 100 μ F 63 V
 C9, C10 — 1.0 nF 0805 681C Sprague
 C11, C12 — 220 pF 0805 681C Sprague

L1 — Hairpin wire 1.1 mm L = 33 mm
 L2 — 4 turns, ID 2.5 mm, 0.5 mm wire
 ML1 — Microstrip Line W = 2.5 mm $Z_0 = 70 \Omega$, L = 6% λ_g at 470 MHz
 ML2 — Microstrip Line W = 2.5 mm $Z_0 = 70 \Omega$, L = 3% λ_g at 470 MHz
 ML3 — Microstrip Line W = 2.5 mm $Z_0 = 70 \Omega$, L = 5% λ_g at 470 MHz
 ML4 — Microstrip Line W = 2.5 mm $Z_0 = 70 \Omega$, L = 3% λ_g at 470 MHz
 Board Material: 1/16 In. Teflon Glass, $\epsilon_r = 2.55$, h = 1.59 mm
 Note: λ_g is the wavelength in the microstrip circuit

Figure 1. 400–500 MHz Broadband Amplifier

FREQUENCY (MHz)	400	410	420	430	440	450	460	470	480	490	500
RE(Z _{in}) Ω	2.5	2.5	2.5	2.3	2.4	2.3	2.2	2.2	2.1	2.1	2.0
IM(Z _{in}) Ω	2.0	2.2	2.7	3.2	3.5	3.8	3.9	4.0	4.2	4.9	5.0
RE(Z _{load}) Ω	33.4	35.5	36.5	37.0	38.4	39.5	40.4	41.4	42.4	43.4	44.4
IM(Z _{load}) Ω	48.3	48.9	49.4	49.9	50.8	50.9	51.3	51.7	52.2	52.6	53.0

Table 1. Impedance Data
V_{CC} = 23 Volts
I_C = 200 mA
P_{out} = 1.5 Watts

TYPICAL CHARACTERISTICS

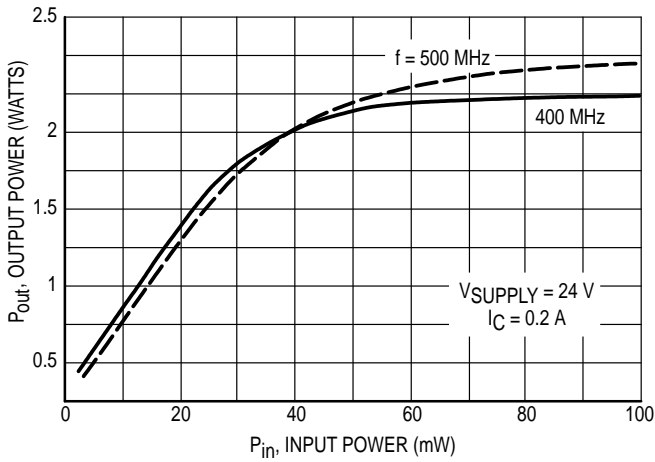


Figure 2. Output Power versus Input Power

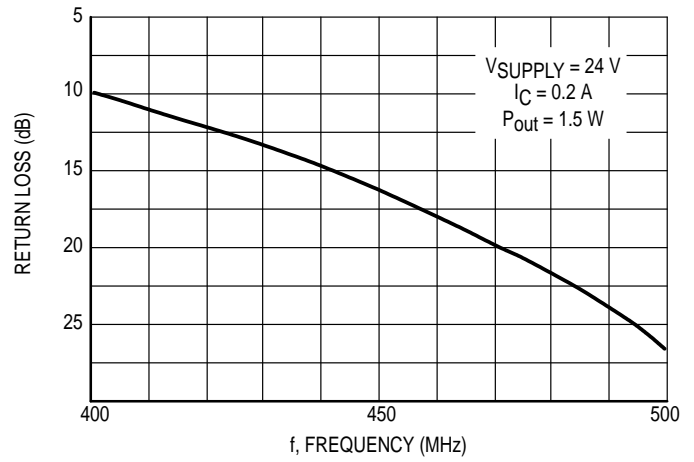


Figure 3. Return Loss versus Frequency

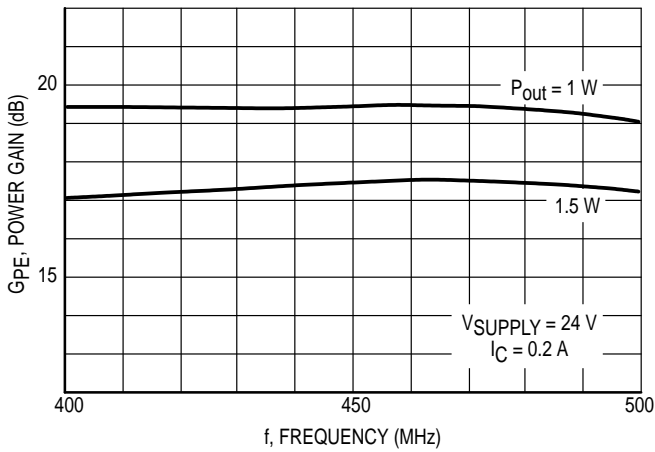


Figure 4. Power Gain versus Frequency

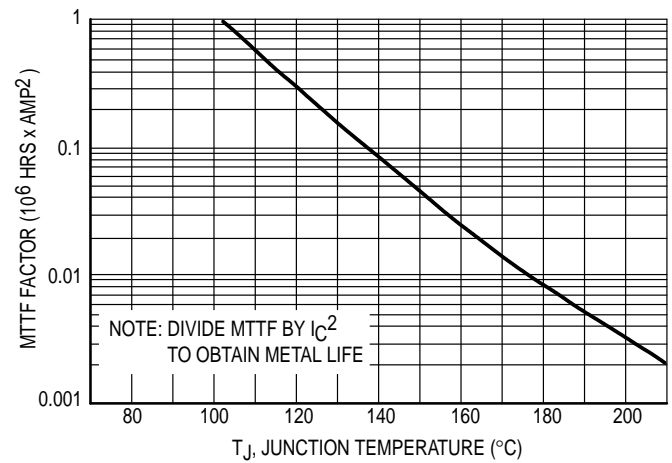
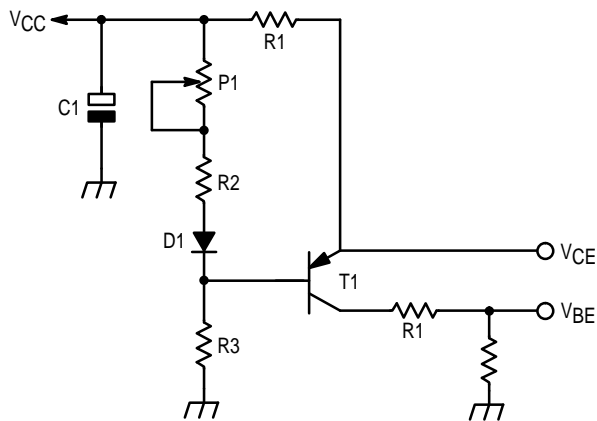


Figure 5. MTTF Factor versus Junction Temperature



- | | |
|-------------------------|--------------------------|
| C1 — 100 μ F 63 V | R3 — 10 k Ω 1/4 W |
| D1 — 1N4148 | R4 — 50 Ω 1/4 W |
| P1 — 1.0 k Ω | R5 — 100 Ω 1/4 W |
| R1 — 10 Ω 1/2 W | T1 — BD136 |
| R2 — 180 Ω 1/4 W | |

Figure 6. Class A Bias Circuit

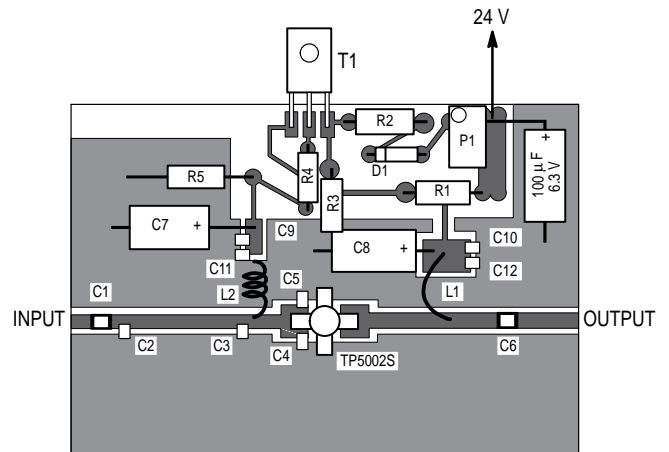
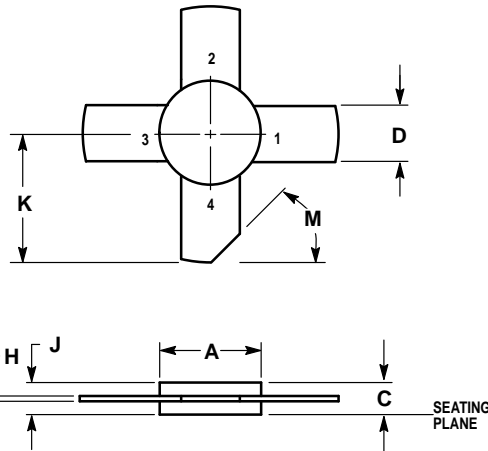


Figure 7. Component Layout

PACKAGE DIMENSIONS



NOTES:


1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. SEATING PLANE = GROUND AND IS CONNECTED TO PIN 1 AND 3.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.271	0.286	6.88	7.26
C	0.112	0.136	2.84	3.45
D	0.215	0.235	5.46	5.97
H	0.055	0.065	1.40	1.65
J	0.003	0.007	0.08	0.18
K	0.435	—	11.05	—
M	45° REF		45° REF	

STYLE 1:

- PIN 1. EMITTER
2. BASE
3. EMITTER
4. COLLECTOR

CASE 249-06 ISSUE H

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TP5002S/D

