MOTOROLA
SEMICONDUCTOR
TECHNICAL DATA

TP5002, TP5002S

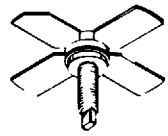
2

1.5 W — 380 to 512 MHz UHF LINEAR POWER TRANSISTORS NPN SILICON

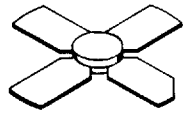
The RF Line
UHF Linear Power Transistors

The TP5002/S are NPN gold metallized transistors using diffused ballast resistors for reliability and ruggedness. They are specifically designed as low power drivers, having 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



CASE 244C-01, STYLE 1
(.280 SOE)
TP5002



CASE 249A-01, STYLE 1
(.280 SOE S)
TP5002S

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 0.045	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)	$R_{\theta JC}$	21	°C/W

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

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Collector-Base Breakdown Voltage (I_C = 2 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 V)	h_{FE}	15	—	120	—
DYNAMIC CHARACTERISTICS					
Output Capacitance (V_{CB} = 28 V, I_E = 0, f = 1 MHz)	C_{ob}	—	—	4.5	pF
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

TP5002, TP5002S

TYPICAL CHARACTERISTICS

T-33-05

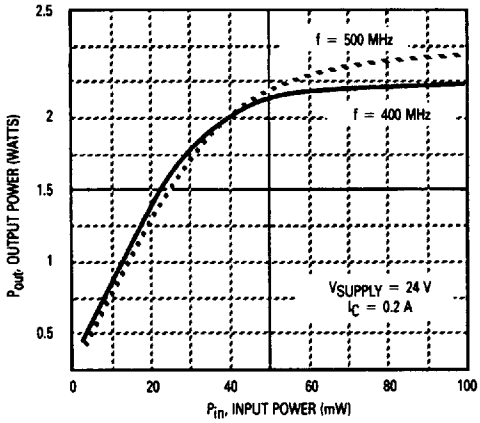


Figure 1. Output Power versus Input Power

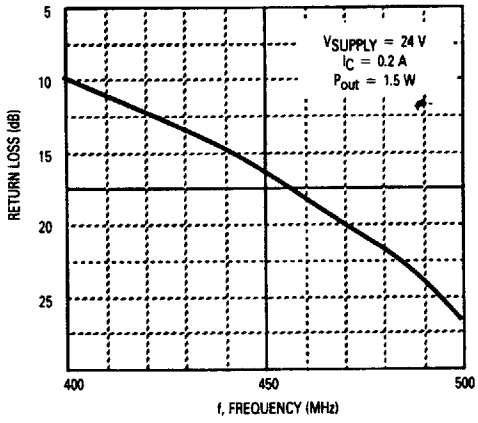


Figure 2. Return Loss versus Frequency

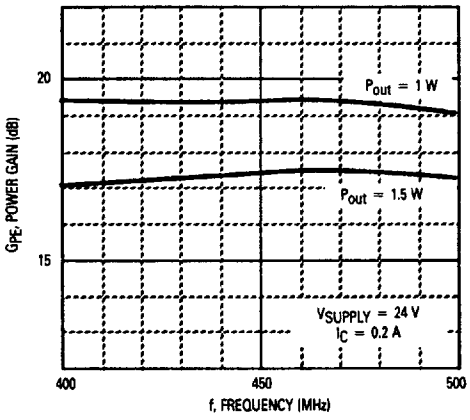


Figure 3. Power Gain versus Frequency

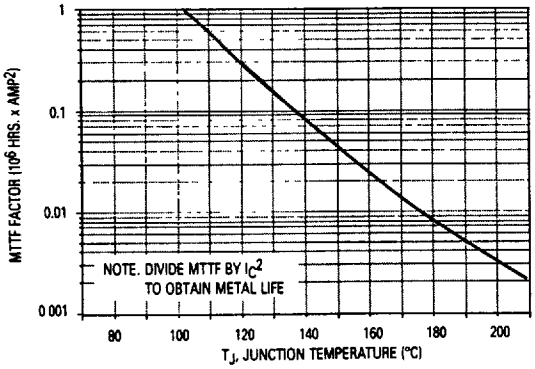
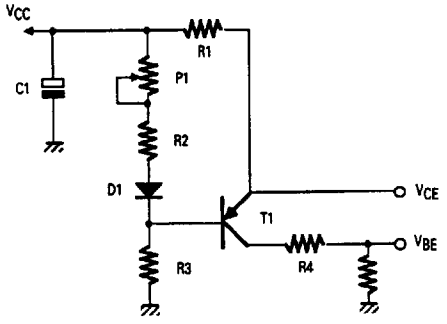


Figure 4. MTTF Factor versus Junction Temperature



R1 — 10 Ω 1/2 W
R2 — 180 Ω 1/4 W
R3 — 10 kΩ 1/4 W
R4 — 50 Ω 1/4 W
R5 — 100 Ω 1/4 W
P1 — 1 kΩ
T1 — BD136
D1 — 1N4148
C1 — 100 μF 63 V

Figure 5. Class A Bias Circuit

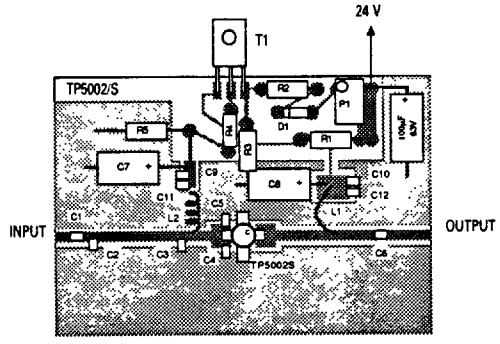
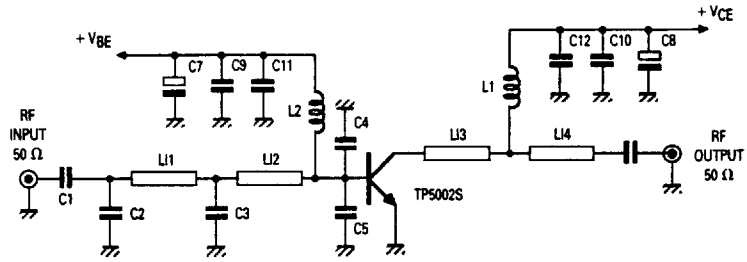


Figure 6. Component Layout



C1, C6 — 220 pF 0805 681C Sprague
C2 — 8.2 pF ATC100A8R2DP50
C3 — 10 pF ATC100A100DP50
C4, C5 — 27 pF ATC100A8R2DP50
C7 — 10 μF 35 V
C8 — 100 μF 63 V
C9, C10 — 1 nF 0805 681C Sprague
C11, C12 — 220 pF 0805 681C Sprague

LI1 — Microstrip Line W = 2.5 mm Z_O = 70 Ω, L = 6% λg at 470 MHz
LI2 — Microstrip Line W = 2.5 mm Z_O = 70 Ω, L = 3% λg at 470 MHz
LI3 — Microstrip Line W = 2.5 mm Z_O = 70 Ω, L = 5% λg at 470 MHz
LI4 — Microstrip Line W = 2.5 mm Z_O = 70 Ω, L = 3% λg at 470 MHz

Board Material: 1/16 in. Teflon Glass, ϵ_r = 2.55, h = 1 59 mm

L1 — Hairpin wire 1.1 mm L = 33 mm
L2 — 4 turns, ID 2.5 mm, 0.5 mm wire

Figure 7. 400–500 MHz Broadband Amplifier

FREQUENCY (MHz)	400	410	420	430	440	450	460	470	480	490	500
RE(Zin)Ω	2.5	2 5	2.5	2.3	2.4	2.3	2.2	2.2	2.1	2.1	2.0
IM(Zin)Ω	2.0	2.2	2.7	3 2	3.5	3.8	3.9	4.0	4 2	4 9	5.0
RE(Zload)Ω	33.4	35 5	36.5	37 0	38 4	39.5	40.4	41.4	42 4	43 4	44.4
IM(Zload)Ω	48.3	48 9	49 4	49 9	50 8	50 9	51.3	51.7	52.2	52.6	53.0

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

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