

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

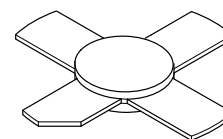
1.5 W, 380 to 512 MHz
UHF LINEAR
POWER TRANSISTOR
NPN SILICON

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector–Base Voltage	V_{CBO}	45	Vdc
Emitter–Base Voltage	V_{EBO}	3.5	Vdc
Total Device Dissipation @ $T_C = 25^\circ\text{C}$ Derate above 25°C	P_D	7.0 0.045	Watts W/ $^\circ\text{C}$
Operating Junction Temperature	T_J	200	$^\circ\text{C}$
Storage Temperature Range	T_{stg}	–65 to +200	$^\circ\text{C}$

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case ($T_C = 70^\circ\text{C}$)	$R_{\theta JC}$	21	$^\circ\text{C/W}$



CASE 249–06, STYLE 1
(.280 SOE S)

ELECTRICAL CHARACTERISTICS ($T_C = 25^\circ\text{C}$ unless otherwise noted.)

Characteristic	Symbol	Min	Typ	Max	Unit
----------------	--------	-----	-----	-----	------

OFF CHARACTERISTICS

Collector–Base Breakdown Voltage ($I_C = 2.0\text{ mA}$, $I_E = 0$)	$V_{(BR)CBO}$	45	—	—	Vdc
Emitter–Base Breakdown Voltage ($I_E = 2.0\text{ mA}$, $I_C = 0$)	$V_{(BR)EBO}$	4.0	—	—	Vdc
Collector Cutoff Current ($V_{CB} = 24\text{ V}$, $I_E = 0$)	I_{CBO}	—	—	0.5	mAdc

ON CHARACTERISTICS

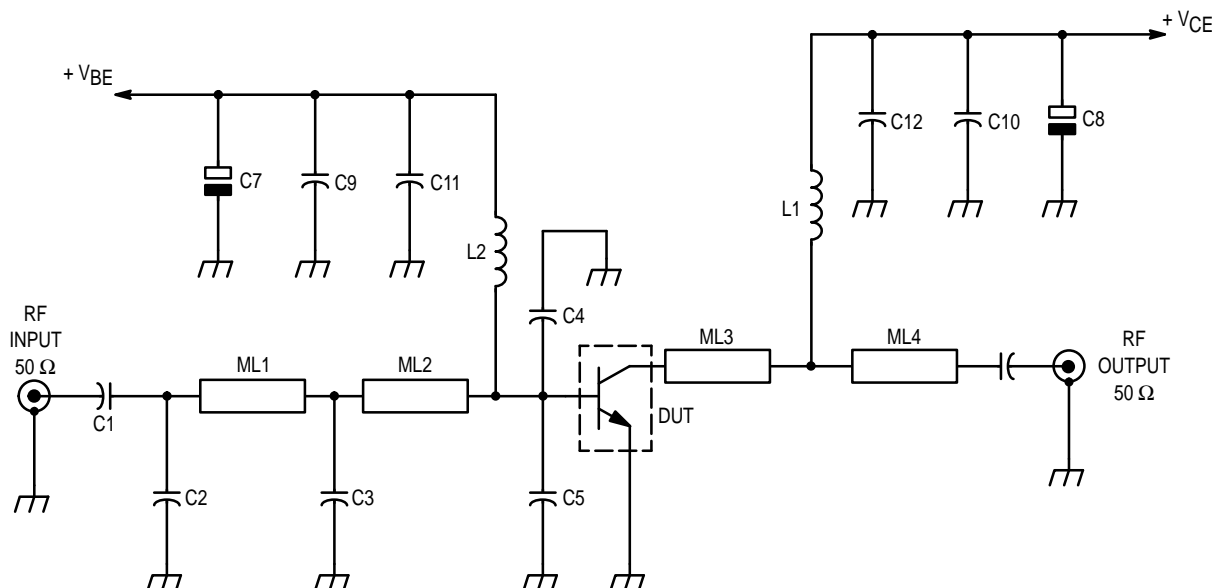
DC Current Gain ($I_C = 100\text{ mA}$, $V_{CE} = 5.0\text{ V}$)	h_{FE}	15	—	120	—
--	----------	----	---	-----	---

DYNAMIC CHARACTERISTICS

Output Capacitance ($V_{CB} = 28\text{ V}$, $I_E = 0$, $f = 1.0\text{ MHz}$)	C_{ob}	—	—	4.5	pF
---	----------	---	---	-----	----

FUNCTIONAL TESTS

Common–Emitter Amplifier Power Gain ($V_{CE} = 23\text{ V}$, $P_{out} = 1.5\text{ W}$, $f = 470\text{ MHz}$, $I_C = 200\text{ mA}$)	G_{PE}	13	—	—	dB
Saturated Output Power ($V_{CE} = 23\text{ V}$, $f = 470\text{ MHz}$, $I_C = 200\text{ mA}$)	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

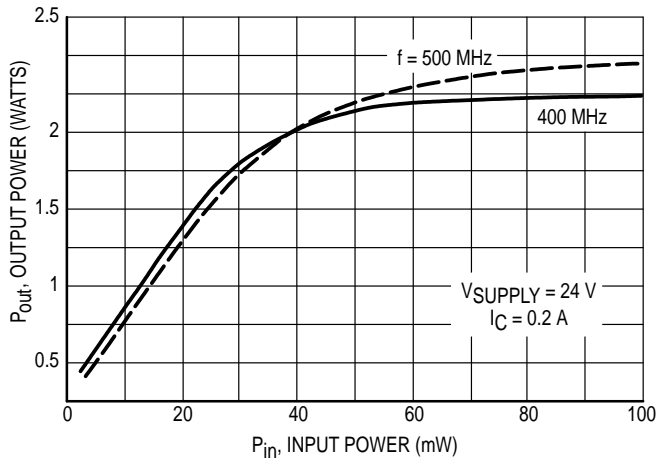


Figure 2. Output Power versus Input Power

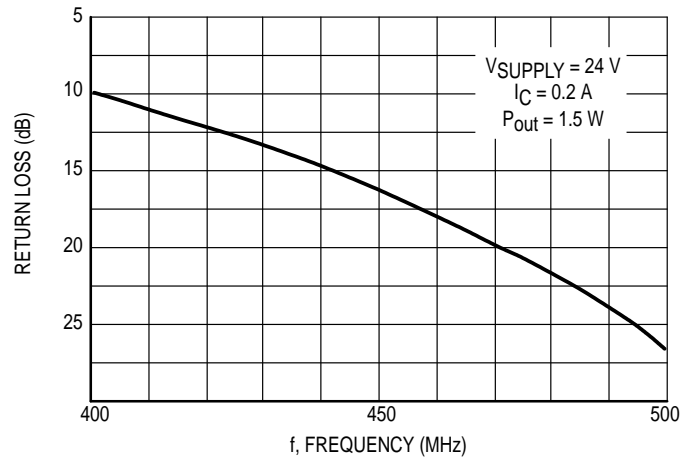


Figure 3. Return Loss versus Frequency

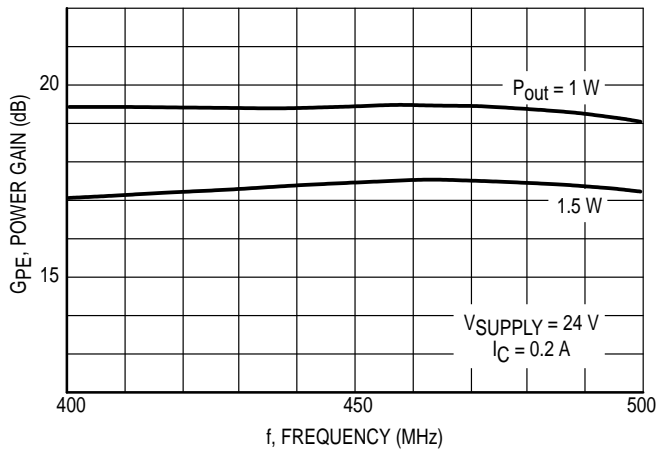


Figure 4. Power Gain versus Frequency

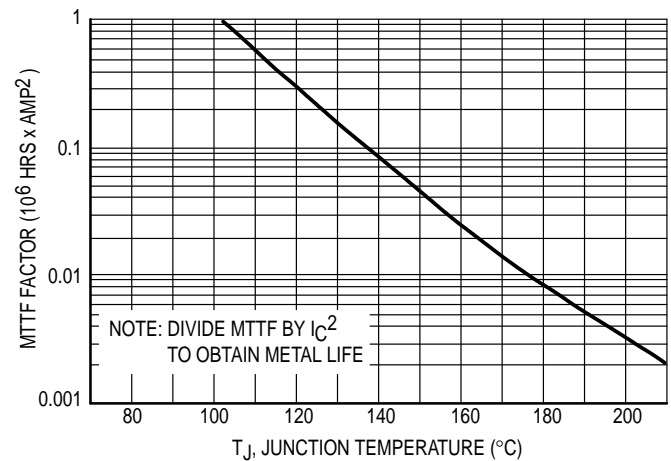


Figure 5. MTTF Factor versus Junction Temperature

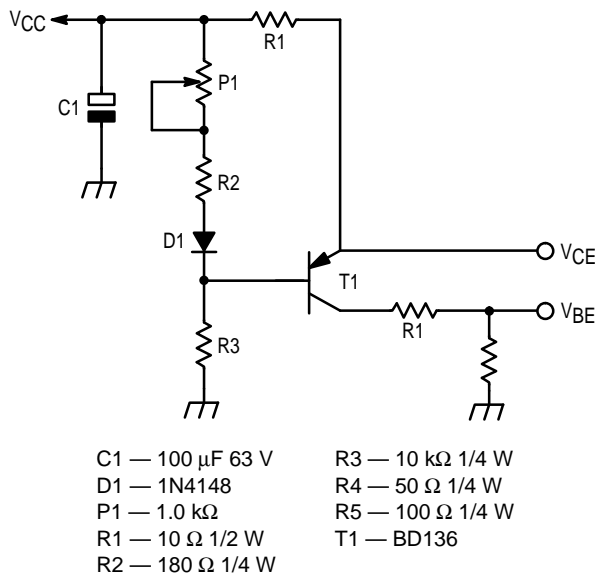


Figure 6. Class A Bias Circuit

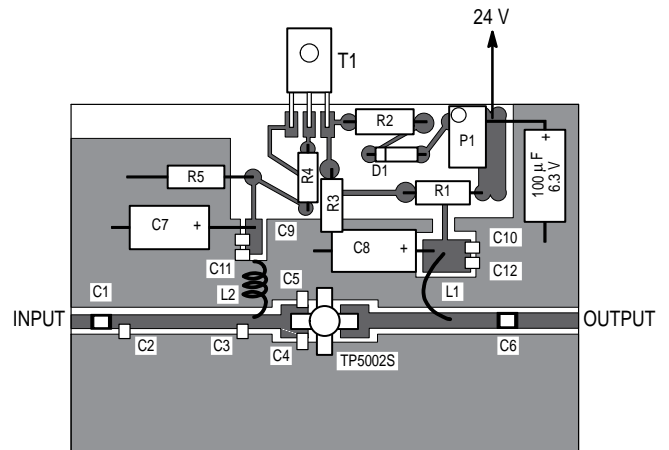
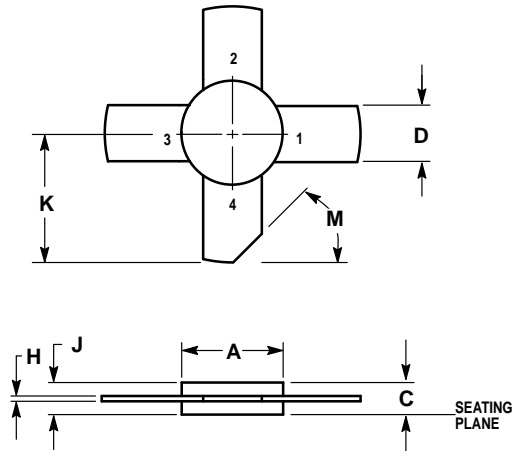


Figure 7. Component Layout

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
- BASE
- EMITTER
- COLLECTOR

CASE 249-06 ISSUE H

Motorola reserves the right to make changes without further notice to any products herein. Motorola makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does Motorola assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation consequential or incidental damages. "Typical" parameters can and do vary in different applications. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. Motorola does not convey any license under its patent rights nor the rights of others. Motorola products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the Motorola product could create a situation where personal injury or death may occur. Should Buyer purchase or use Motorola products for any such unintended or unauthorized application, Buyer shall indemnify and hold Motorola and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that Motorola was negligent regarding the design or manufacture of the part. Motorola and  are registered trademarks of Motorola, Inc. Motorola, Inc. is an Equal Opportunity/Affirmative Action Employer.

How to reach us:

USA/EUROPE: Motorola Literature Distribution;
P.O. Box 20912; Phoenix, Arizona 85036. 1-800-441-2447

JAPAN: Nippon Motorola Ltd.; Tatsumi-SPD-JLDC, Toshikatsu Otsuki,
6F Seibu-Butsuryu-Center, 3-14-2 Tatsumi Koto-Ku, Tokyo 135, Japan. 03-3521-8315

MFAX: RMFAX0@email.sps.mot.com - TOUCHTONE (602) 244-6609
INTERNET: http://Design-NET.com

HONG KONG: Motorola Semiconductors H.K. Ltd.; 8B Tai Ping Industrial Park,
51 Ting Kok Road, Tai Po, N.T., Hong Kong. 852-26629298



MOTOROLA



TP5002S/D

