

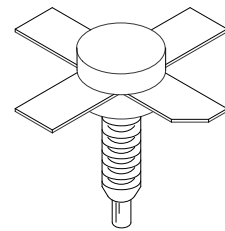
The RF Line UHF Power Transistor

Designed primarily for wideband, large-signal output and driver amplifier stages to 1000 MHz.

- Designed for Class A Linear Power Amplifiers
- Specified 19 Volt, 1000 MHz Characteristics:
Output Power — 3.5 Watts
Power Gain — 10 dB, Small-Signal
- Built-In Matching Network for Broadband Operation
- Gold Metallization for Improved Reliability
- Diffused Ballast Resistors

MRA1000-3.5L

10 dB, 1000 MHz
3.5 W
BROADBAND
UHF POWER TRANSISTOR



CASE 145D-02, STYLE 1
(.380 SOE)

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CEO}	28	Vdc
Collector-Base Voltage	V_{CBO}	50	Vdc
Emitter-Base Voltage	V_{EBO}	3.5	Vdc
Total Device Dissipation @ $T_C = 25^\circ\text{C}$ Derate above 25°C	P_D	22 0.125	Watts $\text{W}/^\circ\text{C}$
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 ($T_C = 70^\circ\text{C}$)	$R_{\theta JC}$	8	$^\circ\text{C}/\text{W}$

ELECTRICAL CHARACTERISTICS

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

OFF CHARACTERISTICS

Collector-Emitter Breakdown Voltage ($I_C = 10\text{ mA}$, $I_B = 0$)	$V_{(BR)CEO}$	28	—	—	Vdc
Collector-Emitter Breakdown Voltage ($I_C = 10\text{ mA}$, $V_{BE} = 0$)	$V_{(BR)CES}$	50	—	—	Vdc
Collector-Base Breakdown Voltage ($I_C = 10\text{ mA}$, $I_E = 0$)	$V_{(BR)CBO}$	50	—	—	Vdc
Emitter-Base Breakdown Voltage ($I_E = 5\text{ mA}$, $I_C = 0$)	$V_{(BR)EBO}$	3.5	—	—	Vdc
Collector Cutoff Current ($V_{CB} = 30\text{ V}$, $I_E = 0$)	I_{CBO}	—	—	10	mAdc

(continued)



ELECTRICAL CHARACTERISTICS — continued

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

ON CHARACTERISTICS

DC Current Gain ($I_C = 250 \text{ mA}$, $V_{CE} = 5 \text{ V}$)	h_{FE}	20	–	90	–
---	----------	----	---	----	---

DYNAMIC CHARACTERISTICS

Output Capacitance ($V_{CB} = 24 \text{ V}$, $I_E = 0$, $f = 1 \text{ MHz}$)	C_{ob}	–	–	15	μF
--	----------	---	---	----	---------------

FUNCTIONAL TESTS

Common-Emitter Amplifier Small-Signal Gain ($V_{CE} = 19 \text{ V}$, $P_{in} = 1 \text{ mW}$, $f = 1 \text{ GHz}$, $I_C = 600 \text{ mA}$)	G_{SS}	10	–	–	dB
Load Mismatch ($V_{CE} = 19 \text{ V}$, $I_C = 600 \text{ mA}$, $P_{out} = 3.5 \text{ W}$, $f = 1 \text{ GHz}$, Load VSWR = $\infty:1$, All Phase Angles)	ψ	No Degradation in Output Power			
Overdrive ($V_{CE} = 19 \text{ V}$, $I_C = 600 \text{ mA}$, $f = 1 \text{ GHz}$) (No degradation)	P_{inover}	–	–	1.75	W

TYPICAL CHARACTERISTICS

Table 1. Common Emitter S-Parameters

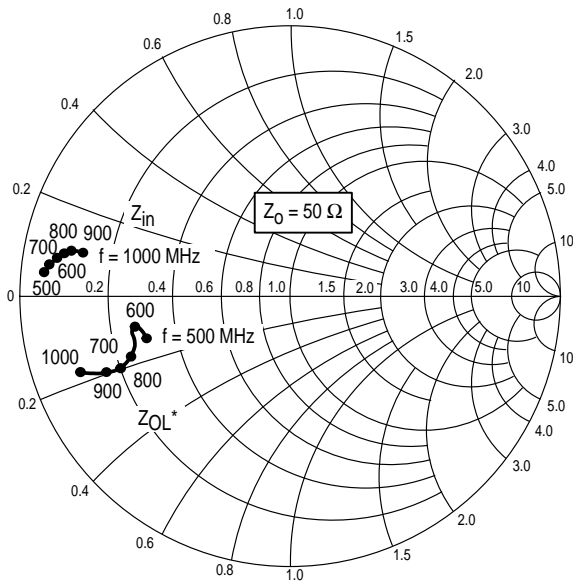
V_{CE} (Volts)	I_C (mA)	f (GHz)	S_{11}		S_{21}		S_{12}		S_{22}	
			Mag	$\angle \phi$	Mag	$\angle \phi$	Mag	$\angle \phi$	Mag	$\angle \phi$
19	600	0.5	0.91	174	1.78	53	0.03	23	0.55	-164
		0.6	0.9	173	1.64	47	0.03	21	0.58	-170
		0.7	0.87	171	1.53	36	0.03	19	0.63	-159
		0.8	0.85	168	1.51	24	0.03	15	0.68	-157
		0.9	0.82	168	1.49	10	0.03	5	0.74	-158
		1	0.78	168	1.5	-7	0.03	-4	0.83	-160

Table 2. Z_{in} and Z_{OL}^* versus Frequency

$V_{CC} = 19 \text{ V}$, $P_C = 3.5 \text{ W}$

Freq. (MHz)	Z_{OL}^*		Z_{in} (Ohms)	
	Re	Im	Re	Im
500	14.6	-6.31	2.36	2.53
600	13.2	-4.07	2.74	3.18
700	11.7	-8.95	3.36	4.14
800	9.95	-9.65	4.12	5.13
900	7.72	-9.72	4.99	5.33
1000	4.67	-8.74	6.36	5.04

Z_{OL}^* = Conjugate of the optimum load impedance into which the device output operates at a given frequency, output power and voltage.



$V_{CC} = 19\text{ V}$, $P_o = 3.5\text{ W}$, $Z_o = 50\ \Omega$

Figure 1. Series Equivalent Input/Output Impedance

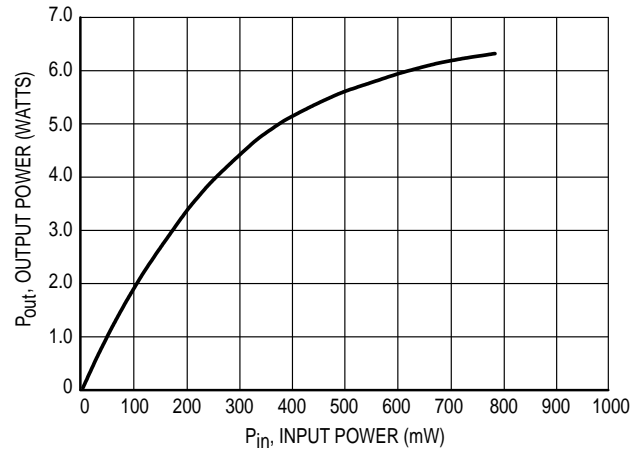
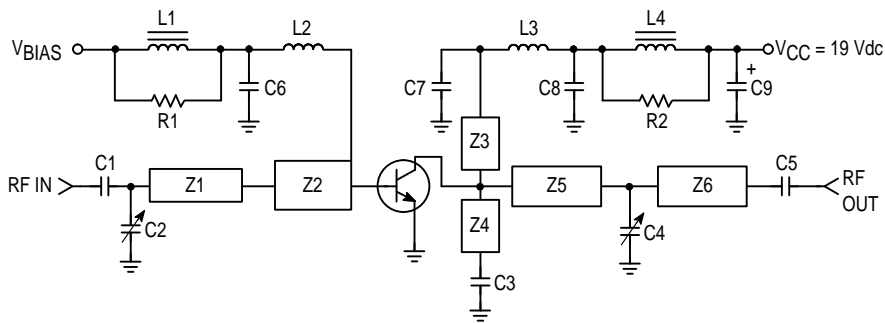


Figure 2. Power Input versus Power Output



- | | | | |
|--------------------|--|--------|---|
| C1, C3, C5, C6, C7 | 500 pF, ATC | L4 | 8T, 20 Gauge on 275 Mil Ferrite Toroid |
| C2, C4 | 0.8 – 10 pF, JFD | R1, R2 | 15 Ω , 1/4 Watt |
| C9 | 0.1 μ F, 50 V, Ceramic | Z1 | 50 Ω , Microstripline, $\ell = 0.110\ \lambda$ |
| L1 | 7T, 20 Gauge on 200 Mil Ferrite Toroid | Z2 | 10 Ω , Microstripline, $\ell = 0.162\ \lambda$ |
| L2 | 8T, 20 Gauge, 100 Mil Dia. | Z3, Z4 | 50 Ω , Microstripline, $\ell = 0.052\ \lambda$ |
| L3 | 11T, 20 Gauge, 100 Mil Dia. | Z5 | 24 Ω , Microstripline, $\ell = 0.080\ \lambda$ |
| | | Z6 | 50 Ω , Microstripline, $\ell = 0.125\ \lambda$ |

Figure 3. 1 GHz Test Circuit

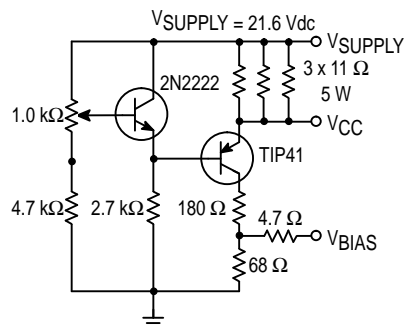
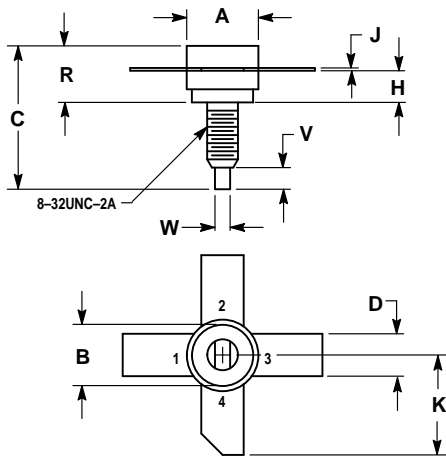


Figure 4. Bias Circuit

PACKAGE DIMENSIONS




- NOTES:
 1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 2. CONTROLLING DIMENSION: INCH.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.320	0.385	9.28	9.77
B	0.320	0.330	8.13	8.38
C	0.700	0.778	17.78	19.76
D	0.220	0.230	5.59	5.84
H	0.160	0.170	4.07	4.31
J	0.003	0.006	0.08	0.15
K	0.490	0.520	12.45	13.20
R	0.248	0.275	6.30	7.23
V	0.100	0.130	2.54	3.30
W	0.055	0.065	1.40	1.65

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

**CASE 145D-02
 ISSUE A**

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 which may be provided in Motorola data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. 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.

Mfax is a trademark of Motorola, Inc.

How to reach us:

USA/EUROPE/Locations Not Listed: Motorola Literature Distribution;
 P.O. Box 5405, Denver, Colorado 80217. 1-303-675-2140 or 1-800-441-2447

JAPAN: Nippon Motorola Ltd.: SPD, Strategic Planning Office, 4-32-1,
 Nishi-Gotanda, Shinagawa-ku, Tokyo 141, Japan. 81-3-5487-8488

Mfax™: RMFAX0@email.sps.mot.com – TOUCHTONE 1-602-244-6609
 – US & Canada ONLY 1-800-774-1848
 – <http://sps.motorola.com/mfax>

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

INTERNET: <http://motorola.com/sps>



MRA1000-3.5L/D