

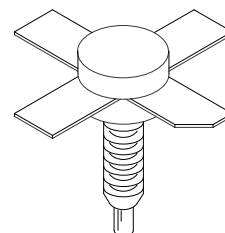
## The RF Line UHF Power Transistor

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 $25^\circ\text{C}$	$P_D$	22 0.125	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 ( $T_C = 70^\circ\text{C}$ )	$R_{\theta JC}$	8	$^\circ\text{C}/\text{W}$

### ELECTRICAL CHARACTERISTICS

Characteristic	Symbol	Min	Typ	Max	Unit
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### 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
<b>ON CHARACTERISTICS</b>					
DC Current Gain ( $I_C = 250 \text{ mA}$ , $V_{CE} = 5 \text{ V}$ )	$h_{FE}$	20	–	90	–
<b>DYNAMIC CHARACTERISTICS</b>					
Output Capacitance ( $V_{CB} = 24 \text{ V}$ , $I_E = 0$ , $f = 1 \text{ MHz}$ )	$C_{ob}$	–	–	15	pF
<b>FUNCTIONAL TESTS</b>					
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)	$\psi$	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

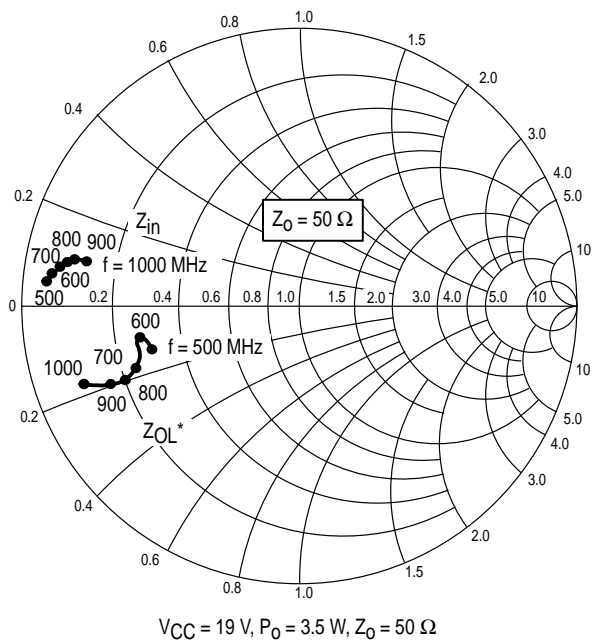
**TYPICAL CHARACTERISTICS**
**Table 1. Common Emitter S–Parameters**

$V_{CE}$ (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

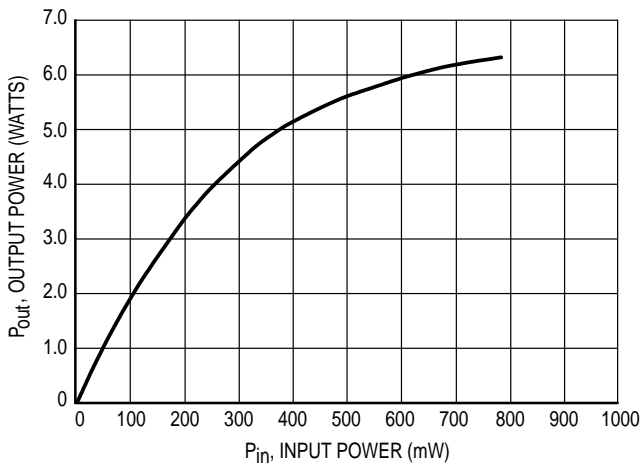
**Table 2.  $Z_{in}$  and  $Z_{OL}^*$  versus Frequency**
 $V_{CC} = 19 \text{ V}$ ,  $P_C = 3.5 \text{ W}$ 

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

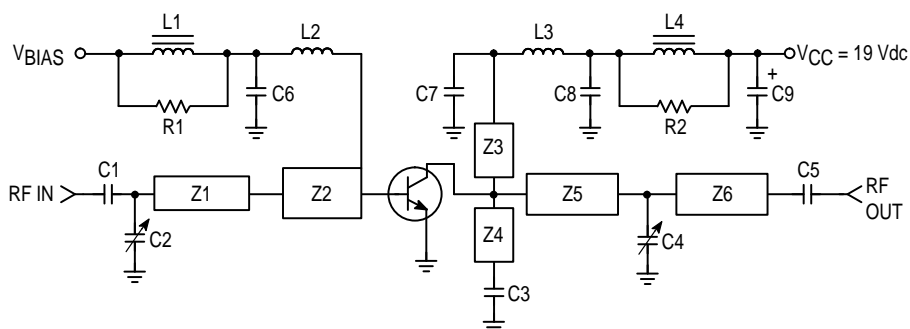
 $Z_{OL}^*$  = Conjugate of the optimum load impedance into which the device output operates at a given frequency, output power and voltage.



**Figure 1. Series Equivalent Input/Output Impedance**

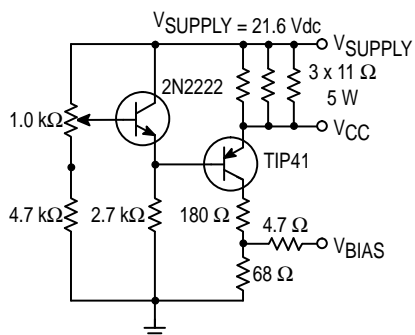


**Figure 2. Power Input versus Power Output**



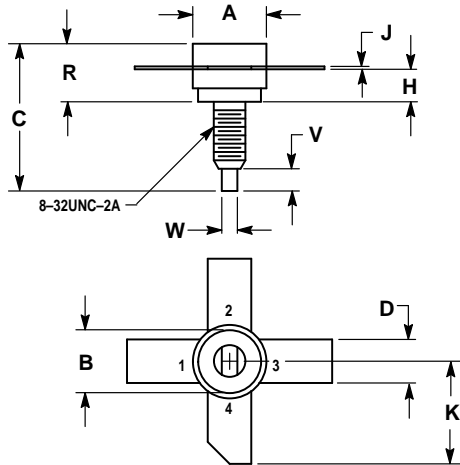
C1, C3, C5, C6, C7	500 pF, ATC	L4	8T, 20 Gauge on 275 Mil Ferrite Toroid
C2, C4	0.8 – 10 pF, JFD	R1, R2	15 Ω, 1/4 Watt
C9	0.1 μF, 50 V, Ceramic	Z1	50 Ω, Microstripline, $\ell = 0.110 \lambda$
L1	7T, 20 Gauge on 200 Mil Ferrite Toroid	Z2	10 Ω, Microstripline, $\ell = 0.162 \lambda$
L2	8T, 20 Gauge, 100 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

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