

**MOTOROLA SEMICONDUCTOR TECHNICAL DATA**

T-33-07

**MRF475**

**The RF Line**

**NPN SILICON RF POWER TRANSISTOR**

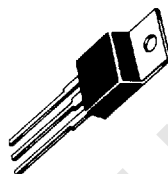
... designed primarily for use in single sideband linear amplifier output applications in citizens band and other communications equipment operating to 30 MHz.

- Characterized for Single Sideband and Large-Signal Amplifier Applications Utilizing Low-Level Modulation
- Specified 13.6 V, 30 MHz Characteristics —  
 Output Power = 12 W (PEP)  
 Minimum Efficiency = 40% (SSB)  
 Output Power = 12 W (CW)  
 Minimum Efficiency = 50% (CW)  
 Minimum Power Gain = 10 dB (PEP & CW)
- Common Collector Configuration

12 W (PEP) — 12 W (CW) — 30 MHz

**RF POWER TRANSISTOR**

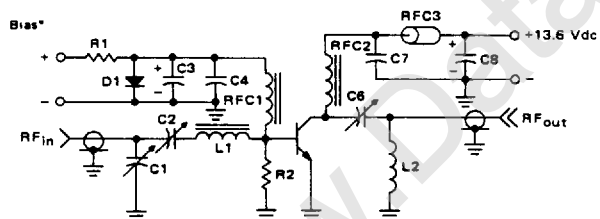
**NPN SILICON**



**MAXIMUM RATINGS**

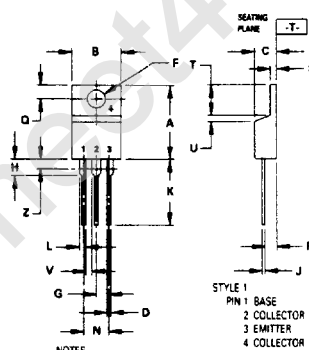
Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V <sub>CEO</sub>	18	Vdc
Collector-Base Voltage	V <sub>CBO</sub>	48	Vdc
Emitter-Base Voltage	V <sub>EBO</sub>	4.0	Vdc
Collector Current — Continuous	I <sub>C</sub>	4.0	Adc
Total Device Dissipation @ T <sub>C</sub> = 50°C Derate above 50°C	P <sub>D</sub>	10	Watts
		0.1	W/°C
Operating and Storage Junction Temperature Range	T <sub>J</sub> , T <sub>stg</sub>	-65 to +150	°C

**FIGURE 1 — COMMON-EMITTER TEST CIRCUIT**



Adjust for I<sub>CQ</sub> = 20 mA

- |  |  |
|--|--|
| C1, 2, 6 — ARCO 466 Trimmer Capacitors           | RFC1 — 10 μH Molded Choke  |
| C3 — 1000 μF, 3.0 Vdc Electrolytic               | RFC2 — 15 Turns #20 AWG Wire on 5.6 kΩ, 1.0 Watt Carbon Resistor |
| C4, 7 — 0.1 μF Disc Ceramics                     | RFC3 — 5 Ferroxcube, #56-590-65/3B, Beads on #18 AWG Wire        |
| C8 — 100 μF, 15 Vdc Electrolytic                 | D1 — 1N4997  |
| R1 — 10 Ω, 5.0 Watt Resistor                     |  |
| R2 — 10 Ω, 1.0 Watt Resistor                     |  |
| L1 — 2.2 μH Molded Choke                         |  |
| L2 — 4 Turns #18 AWG Wire, 1/2" I.D., 5/16" Long |  |



- NOTES
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982
  2. CONTROLLING DIMENSION INCH
  3. DIM Z DEFINES A ZONE WHERE ALL BODY AND LEAD IRREGULARITIES ARE ALLOWED

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	14.48	15.75	0.570	0.620
B	9.86	10.28	0.390	0.405
C	4.07	4.82	0.160	0.190
D	0.84	0.89	0.033	0.035
F	3.61	3.73	0.142	0.147
G	2.42	2.66	0.095	0.105
H	2.80	3.93	0.110	0.155
J	0.36	0.55	0.014	0.022
K	12.70	14.27	0.500	0.562
L	1.15	1.39	0.045	0.055
N	4.82	5.33	0.190	0.210
O	2.54	3.04	0.100	0.120
R	2.04	2.70	0.080	0.110
S	1.15	1.39	0.045	0.055
T	5.97	6.47	0.235	0.255
U	0.00	1.27	0.000	0.050
V	1.15	—	0.045	—
Z	—	2.04	—	0.080

CASE 221A-04  
TO-220AB

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**ELECTRICAL CHARACTERISTICS** (T<sub>C</sub> = 25°C unless otherwise noted.)

Characteristic	Symbol	Min	Typ	Max	Unit	
<b>OFF CHARACTERISTICS</b>						
Collector-Emitter Breakdown Voltage (I <sub>C</sub> = 20 mA, I <sub>B</sub> = 0)	V(BR)CEO	18	—	—	Vdc	
Collector-Emitter Breakdown Voltage (I <sub>C</sub> = 50 mA, V <sub>BE</sub> = 0)	V(BR)CES	48	—	—	Vdc	
Emitter-Base Breakdown Voltage (I <sub>E</sub> = 5.0 mA, I <sub>C</sub> = 0)	V(BR)EBO	4.0	—	—	Vdc	
Collector Cutoff Current (V <sub>CB</sub> = 25 Vdc, I <sub>E</sub> = 0)	I <sub>CBO</sub>	—	—	1.0	mA	
<b>ON CHARACTERISTICS</b>						
DC Current Gain (I <sub>C</sub> = 500 mA, V <sub>CE</sub> = 5.0 Vdc)	h <sub>FE</sub>	30	60	—	—	
<b>DYNAMIC CHARACTERISTICS</b>						
Output Capacitance (V <sub>CB</sub> = 13.6 Vdc, I <sub>E</sub> = 0, f = 1.0 MHz)	C <sub>ob</sub>	—	125	145	pF	
<b>FUNCTIONAL TESTS (SSB)</b>						
Common-Emitter Amplifier Power Gain (V <sub>CC</sub> = 13.6 Vdc, P <sub>out</sub> = 12 W (PEP), f <sub>1</sub> = 30 MHz, f <sub>2</sub> = 30 001 MHz, I <sub>CQ</sub> = 20 mA)	G <sub>PE</sub>	10	12	—	dB	
Collector Efficiency (V <sub>CC</sub> = 13.6 Vdc, P <sub>out</sub> = 12 W (PEP), f <sub>1</sub> = 30 MHz, f <sub>2</sub> = 30 001 MHz, I <sub>CQ</sub> = 20 mA)	η	40	—	—	%	
Intermodulation Distortion (1) (V <sub>CC</sub> = 13.6 Vdc, P <sub>out</sub> = 12 W (PEP), f <sub>1</sub> = 30 MHz, f <sub>2</sub> = 30 001 MHz, I <sub>CQ</sub> = 20 mA)	IMD	—	—	-30	dB	
<b>FUNCTIONAL TESTS (CW)</b>						
Common-Emitter Amplifier Power Gain (V <sub>CC</sub> = 13.6 Vdc, P <sub>out</sub> = 4.0 W, f = 30 MHz)	G <sub>PE</sub>	10	12	—	dB	
Collector Efficiency (V <sub>CC</sub> = 13.6 Vdc, P <sub>out</sub> = 4.0 W, f = 30 MHz)	η	50	—	—	%	
Percentage Up Modulation (1) (4.0 W Carrier)	—	—	100	—	%	
<b>IMPEDANCE CHARACTERISTICS</b>						
Series Equivalent Input	V <sub>CC</sub> = 13.6 Vdc P <sub>o</sub> = 12 W (PEP) f = 30 MHz, I <sub>CQ</sub> = 20 mA	Z <sub>in</sub>	—	4.5-j2.4	—	Ohms
Series Equivalent Output		Z <sub>out</sub>	—	5.1-j3.2	—	Ohms
Parallel Equivalent Input		Z <sub>in</sub>	—	5.8/10.9	—	Ω/pF
Parallel Equivalent Output		Z <sub>out</sub>	—	7.1/11.3	—	Ω/pF

(1) To proposed EIA method of measurement Reference peak envelope power

(2) Percentage Up-Modulation is measured in the test circuit (Figure 1) by setting the Carrier Power (P<sub>c</sub>) to 4.0 Watts with V<sub>CC</sub> = 13.6 Vdc and noting the power input. Then the Peak Envelope Power (PEP) is noted after doubling the original power input to simulate driver modulation

$$\text{Percentage Up Modulation} = \left[ \left( \frac{\text{PEP}}{P_c} \right) - 1 \right] \cdot 100$$

FIGURE 2 - OUTPUT POWER versus INPUT POWER

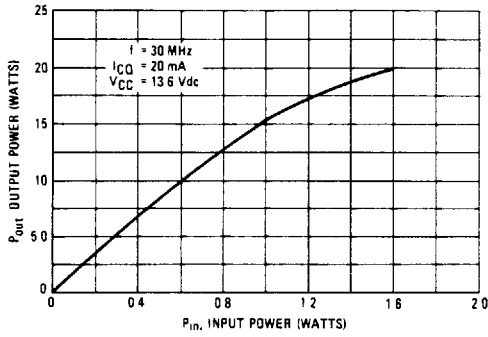


FIGURE 3 - INTERMODULATION DISTORTION versus OUTPUT POWER

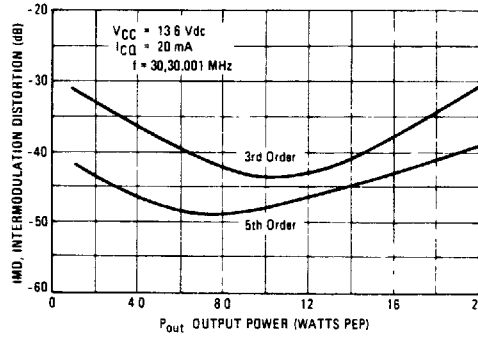


FIGURE 4 - OUTPUT POWER versus SUPPLY VOLTAGE

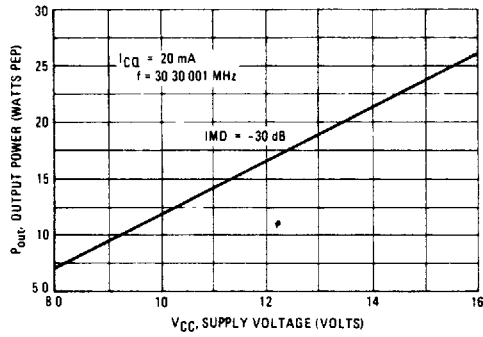


FIGURE 5 - OUTPUT CAPACITANCE versus FREQUENCY

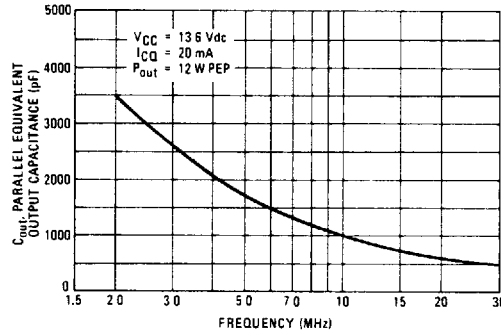


FIGURE 6 - OUTPUT RESISTANCE versus FREQUENCY

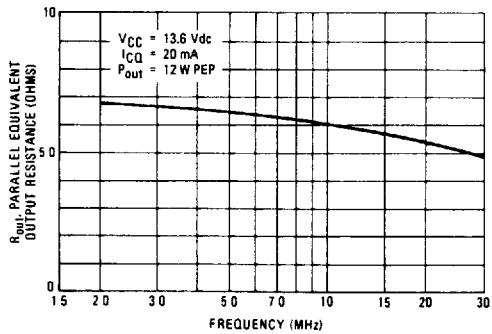
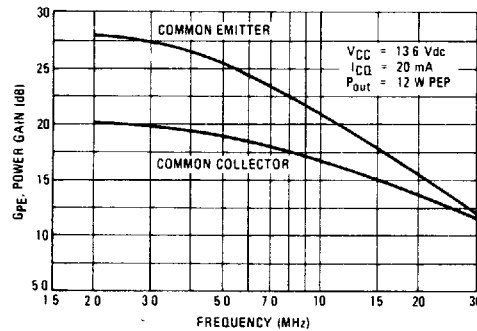
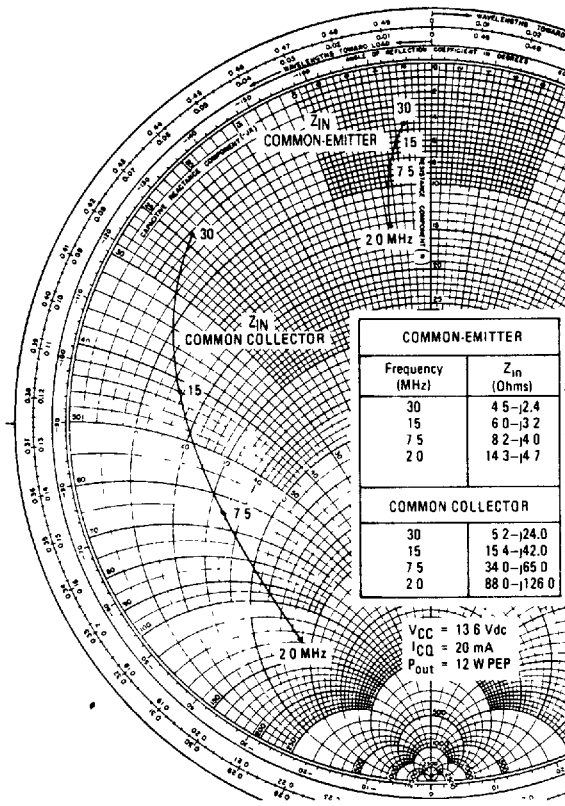


FIGURE 7 - POWER GAIN versus FREQUENCY



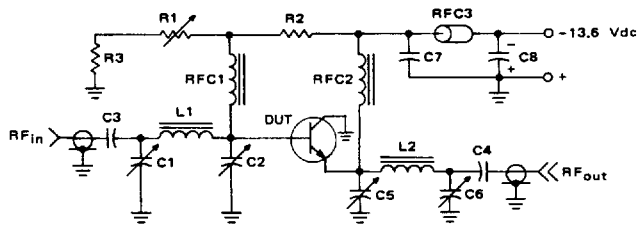
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FIGURE 8 - SERIES EQUIVALENT INPUT IMPEDANCE



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FIGURE 9 - COMMON-COLLECTOR TEST CIRCUIT



- C1, 5 - ARCO 466 Trimmer Capacitors
- C2 - ARCO 463 Trimmer Capacitor
- C3, 4, 7 - 0.1  $\mu\text{F}$  Ceramic Disc
- C6 - ARCO 469 Trimmer Capacitor
- C8 - 100  $\mu\text{F}$  15 Vdc Electrolytic
- R1 - 250  $\Omega$ , 2.0 W Potentiometer
- R2 - 5.1  $\Omega$ , 1/2 W Resistor
- R3 - 51  $\Omega$ , 2.0 W Resistor
- L1 - 0.33  $\mu\text{H}$  Molded Choke
- L2 - 4 Turns #18 AWG Wire, 1/8" I.D., 5/16" Long
- RFC1 - 18  $\mu\text{H}$  Molded Choke
- RFC2 - 15 Turns #20 AWG Wire on 100  $\Omega$ , 1.0 W Carbon Resistor
- RFC3 - Ferraxcube, #56-590-65/3B, Beads on #18 AWG Wire