MRF648

The RF Line

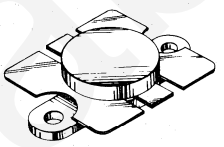
60 W – 470 MHz

CONTROLLED Q
RF POWER
TRANSISTOR
NPN SILICON

NPN SILICON RF POWER TRANSISTOR

. . . designed for 12.5 Volt UHF large-signal amplifier applications in industrial and commercial FM equipment operating to 512 MHz.

- Specified 12.5 Volt, 470 MHz Characteristics –
  Output Power = 60 Watts
  Minimum Gain = 4.4 dB
  Efficiency = 55%
- Characterized with Series Equivalent Large-Signal Impedance Parameters
- Built-In Matching Network for Broadband Operation
- Tested for Load Mismatch Stress at all Phase Angles with 20:1 VSWR @ 16-Volt High Line and 20% Overdrive

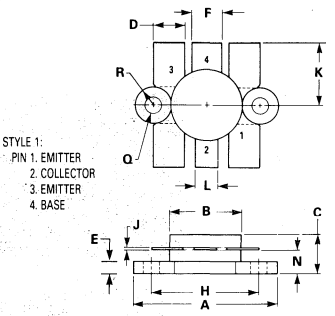


MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CEO}	16	Vdc
Collector-Base Voltage	V_{CBO}	36	Vdc
Emitter-Base Voltage	V_{EBO}	4.0	Vdc
Collector Current — Continuous	I_C	11.0	Adc
Total Device Dissipation @ T_C = 25°C Derate above 25°C	P_D	175 1.0	Watts W/°C
Storage Temperature Range	T_{stg}	–65 to +150	°C

THERMAL CHARACTERISTICS

Thermal Resistance, Junction to Case	$R_{\theta JC}$	1.0	°C/W



NOTE:
FLANGE IS ISOLATED IN ALL STYLES.

DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	24.38	25.14	0.960	0.990
B	12.45	12.95	0.490	0.510
C	5.97	7.62	0.235	0.300
D	5.33	5.58	0.210	0.220
E	2.16	3.04	0.085	0.120
F	5.08	5.33	0.200	0.210
H	18.29	18.54	0.720	0.730
J	0.10	0.15	0.004	0.006
K	10.29	11.17	0.405	0.440
L	3.81	4.06	0.150	0.160
N	3.81	4.31	0.150	0.170
Q	2.92	3.30	0.115	0.130
R	3.05	3.30	0.120	0.130
U	11.94	12.57	0.470	0.495

CASE 316-01

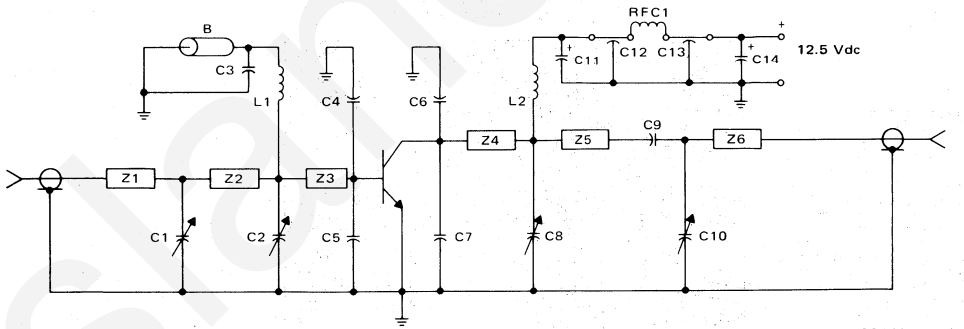
ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted.)

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Collector-Emitter Breakdown Voltage (I_C = 50 mAdc, I_B = 0)	$V_{(BR)CEO}$	16	–	–	Vdc
Collector-Emitter Breakdown Voltage (I_C = 50 mAdc, V_{BE} = 0)	$V_{(BR)CES}$	36	–	–	Vdc
Emitter-Base Breakdown Voltage (I_E = 5.0 mAdc, I_C = 0)	$V_{(BR)EBO}$	4.0	–	–	Vdc
Collector Cutoff Current (V_{CE} = 15 Vdc, V_{BE} = 0, T_C = 25°C)	I_{CES}	–	–	15	mAdc
ON CHARACTERISTICS					
DC Current Gain (I_C = 6.0 Adc, V_{CE} = 5.0 Vdc)	h_{FE}	20	70	150	–
DYNAMIC CHARACTERISTICS					
Output Capacitance (V_{CB} = 12.5 Vdc, I_E = 0, f = 1.0 MHz)	C_{ob}	–	130	150	pF
FUNCTIONAL TESTS					
Common-Emitter Amplifier Power Gain (V_{CC} = 12.5 Vdc, P_{out} = 60 W, f = 470 MHz)	G_{pe}	4.4	5.0	–	dB
Input Power (V_{CC} = 12.5 Vdc, P_{out} = 60 W, f = 470 MHz)	P_{in}	–	19	22	Watts
Collector Efficiency (V_{CC} = 12.5 Vdc, P_{out} = 60 W, f = 470 MHz)	η	55	65	–	%
Output Mismatch Stress (V_{CC} = 16 Vdc, P_{in} = 26 W, f = 470 MHz, VSWR = 20:1, All Phase Angles)	ψ*	No Degradation in Output Power			

Notes:

* ψ = Mismatch stress factor—the electrical criterion established to verify the device resistance to load mismatch failure. The mismatch stress test is accomplished in the standard test fixture (Figure 1) terminated in a 20:1 minimum load mismatch at all phase angles.

FIGURE 1 – TEST CIRCUIT SCHEMATIC



C1, C2, C8, C10	1-20 pF Johanson	C12, C13	680 pF Feedthrough	Z2	1.39" X 0.190" Microstrip
C3	200 pF Unelco	B	Ferroxcube Bead 56-590-65-3B	Z3, Z4	(0.2 X 0.2)/0.25 Alumina
C4, C5	33 pF 100mil ATC	L1	10 Turns #26 AWG 0.1" I.D. X 0.23"	Z5	1.30" X 0.190" Microstrip
C6, C7	36 pF 100mil ATC	L2	10 Turns #20 AWG 0.1" I.D. X 0.50"	Z6	**0.330" X 0.190" Microstrip**
C9	100 pF 100mil ATC	RFC1	Ferroxcube VK200-19-4B	Board	62.5mil Glass Teflon, ϵ_R = 2.55, λ = 0.0018, Dimension: 5.0" X 3.0" X 0.06"
C11, C14	1.0 μF 35 V Tantalum	Z1	0.46" X 0.190" Microstrip		

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FIGURE 2 – POWER OUTPUT versus POWER INPUT

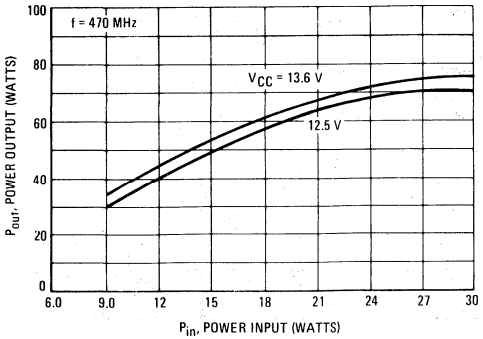


FIGURE 3 – POWER OUTPUT versus FREQUENCY

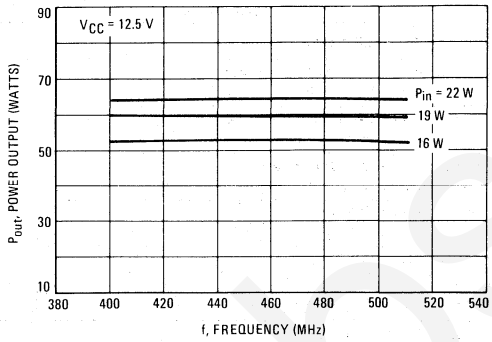


FIGURE 4 – POWER OUTPUT versus SUPPLY VOLTAGE

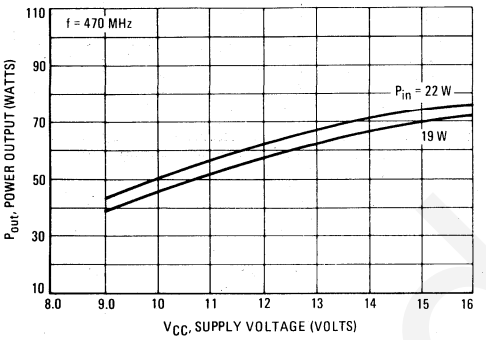


FIGURE 5 – POWER SATURATION PROFILE

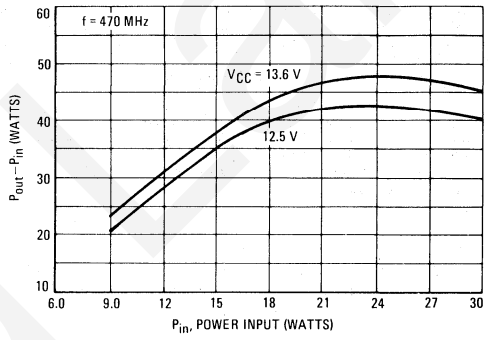
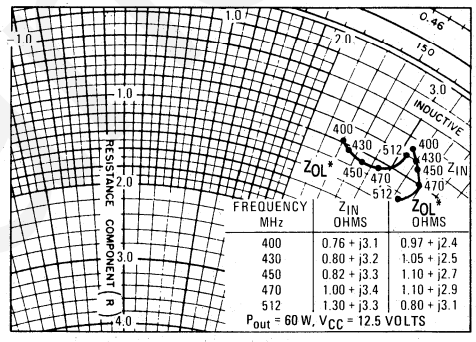


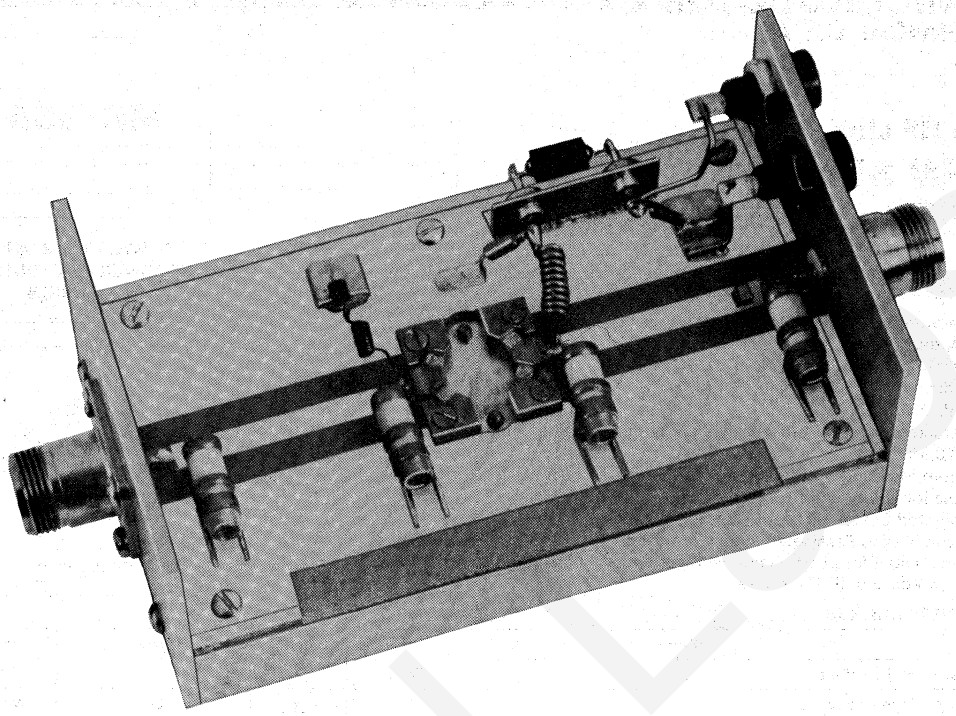
FIGURE 6 – SERIES EQUIVALENT INPUT-OUTPUT IMPEDANCE



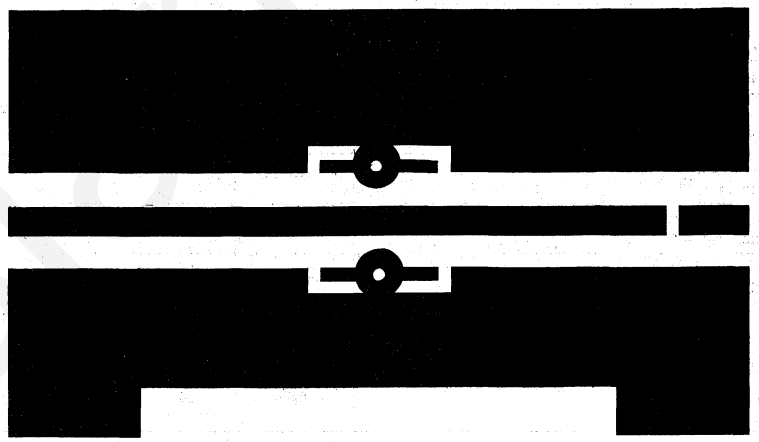
FREQUENCY MHz	Z_{IN} OHMS	Z_{OL}* OHMS
400	0.76 + j3.1	0.97 + j2.4
430	0.80 + j3.2	1.05 + j2.5
450	0.82 + j3.3	1.10 + j2.7
470	1.00 + j3.4	1.10 + j2.9
512	1.30 + j3.3	0.80 + j3.1

P_{out} = 60 W, V_{CC} = 12.5 VOLTS

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



TEST CIRCUIT TEST FIXTURE



NOTE: The Printed Circuit Board shown is 75% of the original.