T-33-11

MOTOROLA
SEMICONDUCTOR
TECHNICAL DATA

MRF5177
MRF5177A

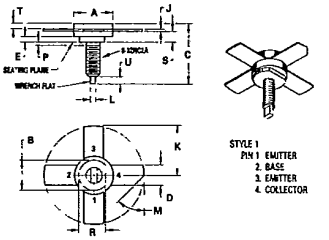
The RF Line

30 W, 400 MHz
RF POWER TRANSISTOR
NPN SILICON

NPN SILICON RF POWER TRANSISTOR

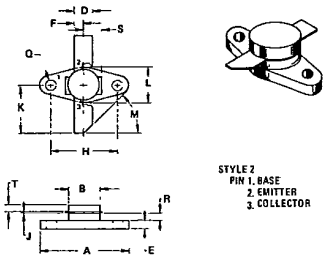
...designed for VHF/UHF power amplifier applications. This device is optimized for rugged performance in 225-400 MHz communications equipment.

- Performance @ 400 MHz, 28 Vdc —
  Power Output = 30 W (Min)
  Gain = 6.0 dB (Min)
- Isothermal Design for Rugged Performance —
  Tested at 30:1 VSWR through all phase angles



DIM	MILLIMETERS MIN	MAX	INCHES MIN	MAX
A	9.40	9.78	0.370	0.385
B	8.13	8.36	0.320	0.330
C	17.02	20.07	0.670	0.790
D	5.46	5.97	0.215	0.235
E	1.78	—	0.070	—
J	0.08	0.18	0.003	0.007
K	12.45	—	0.490	—
L	1.60	1.78	0.055	0.070
M	45° NOM		45° NOM	
P	—	1.27	—	0.050
R	7.59	7.80	0.299	0.307
S	4.01	4.52	0.158	0.178
T	2.11	2.54	0.083	0.100
U	2.43	3.35	0.096	0.132

CASE 145A-09
MRF5177A



DIM	MILLIMETERS MIN	MAX	INCHES MIN	MAX
A	21.08	21.59	0.830	0.850
B	9.27	9.78	0.365	0.385
D	5.59	5.84	0.220	0.230
E	2.03	2.41	0.080	0.095
F	2.79	2.92	0.110	0.115
H	15.11	15.37	0.595	0.605
J	0.10	0.15	0.004	0.006
K	13.08	13.59	0.515	0.535
L	9.91	10.41	0.390	0.410
M	45°	NOM	45°	NOM
Q	2.92	3.18	0.115	0.125
R	1.52	2.03	0.060	0.080
S	–	5.38	–	0.212
T	2.03	2.54	0.080	0.100

CASE 215
MRF5177

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MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CEO}	35	Vdc
Collector-Base Voltage	V_{CBO}	60	Vdc
Emitter-Base Voltage	V_{EBO}	4.0	Vdc
Collector Current — Continuous	I_C	4.0	Adc
Base Current	I_B	1.0	Adc
Total Device Dissipation @ $T_C = 25^oC$ (1) Derate Above 25^oC	P_D —	58 0.33	Watts $W/^oC$
Storage Temperature Range	T_{stg}	-65 to +200	^oC

(1) This device is designed for RF Power operation. The total device dissipation rating applies only when the device is operated as a Class C RF Amplifier.

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	3.0	$^oC/W$

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

Characteristic	Symbol	Min	Max	Unit
OFF CHARACTERISTICS				
Collector-Emitter Breakdown Voltage (I_C = 50 mAdc, I_B = 0)	$V_{(BR)CEO}$	35	–	Vdc
Collector-Emitter Breakdown Voltage (I_C = 50 mAdc, V_{BE} = 0)	$V_{(BR)CES}$	60	–	Vdc
Emitter-Base Breakdown Voltage (I_E = 2.0 mAdc, I_C = 0)	$V_{(BR)EBO}$	4.0	–	Vdc
Collector Cutoff Current (V_{CB} = 30 Vdc, I_E = 0)	I_{CBO}	–	2.0	mAdc
ON CHARACTERISTICS				
DC Current Gain (I_C = 100 mAdc, V_{CE} = 5.0 Vdc) (I_C = 4.0 Adc, V_{CE} = 5.0 Vdc)	h_{FE}	10 10	100 –	–
DYNAMIC CHARACTERISTICS				
Output Capactiance (V_{CB} = 28 Vdc, I_E = 0, f = 1.0 MHz)	C_{ob}	–	50	pF
FUNCTIONAL TESTS (Figures 1 and 9)				
Common-Emitter Amplifier Power Gain (P_{out} = 30 W, V_{CC} = 28 Vdc, f = 400 MHz)	G_{PE}	6.0	–	dB
Collector Efficiency (P_{out} = 30 W, V_{CC} = 28 Vdc, f = 400 MHz)	η	60	–	%
Saturated Power (P_{in} = 11 W, V_{CC} = 28 Vdc, f = 400 MHz)	P_{sat}	36	–	Watts
Electrical Ruggedness (P_{out} = 30 W, V_{CC} = 28 Vdc, f = 400 MHz, T_C = 50°C)	VSWR = 30:1 through all phase angles in a 3 second time interval, After which, devices will meet G_{PE} test limits.			

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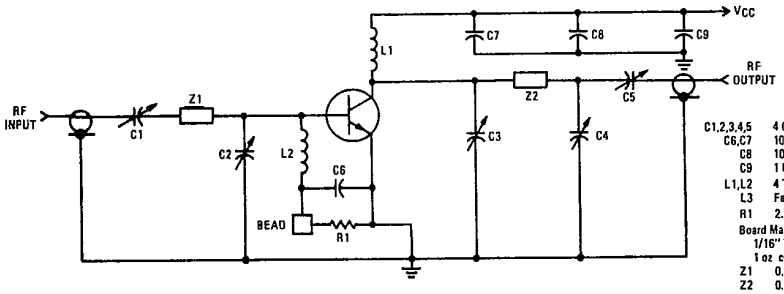
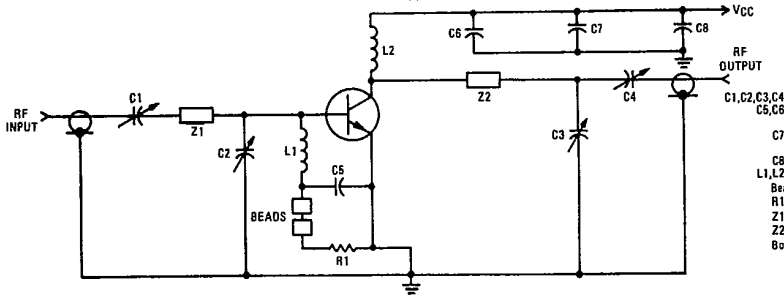
FIGURE 1 – 400 MHz TEST CIRCUIT
(Typical Performance Data for 300-500 MHz Operation)



C1,2,3,4,5 4.0-40 pF ARCO 422 or equivalent
C6,C7 100 pF ATC or equivalent
C8 10,000 pF ATC or equivalent
C9 1.0 µF, 35 V Tantalum
L1,L2 4 Turns, #20 AWG, 1/4" ID
L3 Ferrite Bead, Ferroxcube 56 590-65/3B
R1 2.7 ohms, 1/4 W, Carbon
Board Material:
1/16" Teflon Fiberglass
1 oz copper, two-sided
Z1 0.3" Width, x 2.7" Length
Z2 0.3" Width, x 2.7" Length

FIGURE 2 – 200-300 MHz TEST CIRCUIT
(Typical Performance Data)



C1,C2,C3,C4 7.0-100 pF ARCO 423 or equivalent
C5,C6 100 pF Porcelain Chip Capacitor (ATC-100 or equivalent)
C7 10,000 pF Porcelain Chip Capacitor (ATC-100 or equivalent)
C8 1.0 µF, 35-V Tantalum
L1,L2 7 Turns #20 AWG, 1/4" ID
Beads, Ferroxcube 56 590 65/3B
R1 2.7 ohms, 1/2 W, Carbon
Z1 0.3" Width x 3.31" Length
Z2 0.3" Width x 4.53" Length
Board Material:
1/16" Glass-Teflon
1 oz Copper, 2 sided

FIGURE 3 – OUTPUT POWER versus FREQUENCY

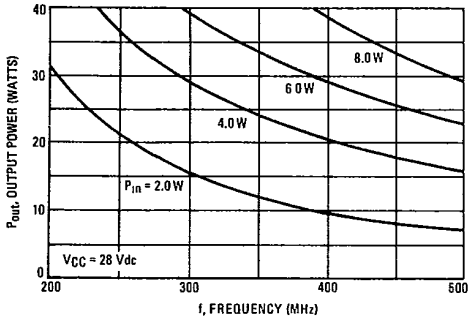


FIGURE 4 – OUTPUT POWER versus INPUT POWER

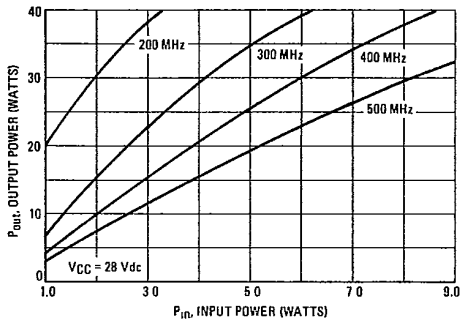


FIGURE 5 – OUTPUT POWER versus SUPPLY VOLTAGE

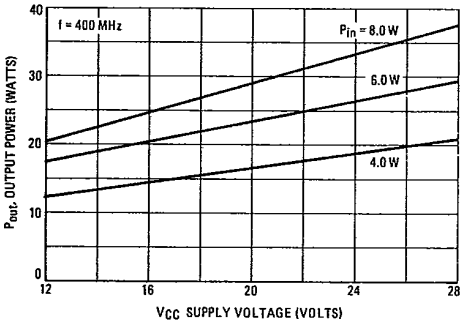


FIGURE 6 – OUTPUT POWER versus SUPPLY VOLTAGE

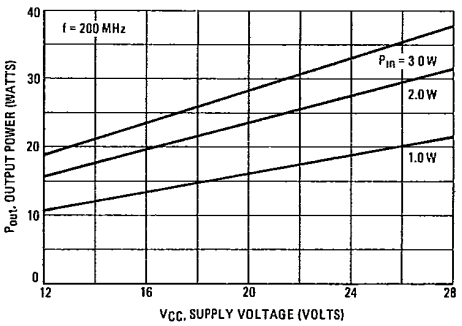


FIGURE 7 – RF POWER DERATING

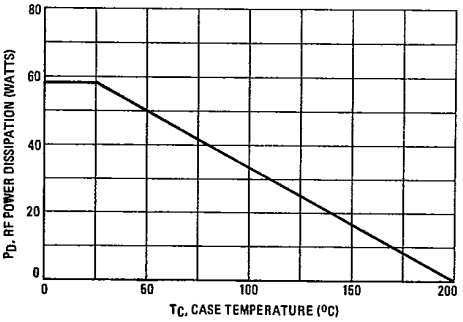
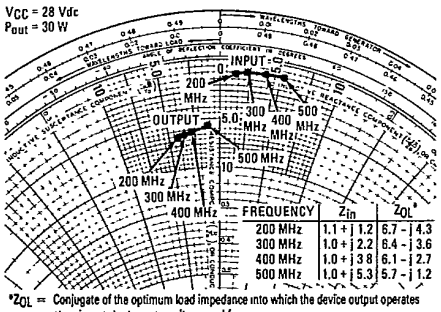


FIGURE 8 – SERIES EQUIVALENT IMPEDANCE



FREQUENCY	Z_{in}	Z_{OL}*
200 MHz	1.1 + j 1.2	6.7 – j 4.3
300 MHz	1.0 + j 2.2	6.4 – j 3.6
400 MHz	1.0 + j 3.8	6.1 – j 2.7
500 MHz	1.0 + j 5.3	5.7 – j 1.2

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