

# MOTOROLA SEMICONDUCTOR TECHNICAL DATA

2

## The RF Line

### NPN SILICON RF POWER TRANSISTORS

... designed for 13.6 volt VHF large-signal class C and class AB linear power amplifier applications in commercial and industrial equipment.

- High Common Emitter Power Gain
- Specified 13.6 V, 160 MHz Performance:
  - Output Power = 40 Watts
  - Power Gain = 9.0 dB Min
  - Efficiency = 55% Min
- Load Mismatch Capability at Rated Voltage and RF Drive
- Silicon Nitride Passivated
- Low Intermodulation Distortion,  $d_3 = -30$  dB Typ

#### MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V <sub>CEO</sub>	16	Vdc
Collector-Base Voltage	V <sub>CBO</sub>	36	Vdc
Emitter-Base Voltage	V <sub>EBO</sub>	4.0	Vdc
Collector Current - Continuous	I <sub>C</sub>	8.0	Adc
Total Device Dissipation @ T <sub>C</sub> = 25°C (1)	P <sub>D</sub>	100	Watts
Derate above 25°C		0.57	W/°C
Storage Temperature Range	T <sub>stg</sub>	-65 to +150	°C

#### THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case (2)	R <sub>θJC</sub>	1.75	°C/W

(1) This device is designed for RF operation. The total device dissipation rating applies only when the device is operated as an RF amplifier.  
 (2) Thermal Resistance is determined under specified RF operating conditions by infrared measurement techniques.

**MRF240A**  
**CASE 211-07**

STYLE 1  
PH 1 EMITTER  
2 BASE  
3 EMITTER  
4 COLLECTOR

NOTES  
1. DIMENSIONING AND TOLERANCING PER ANS I Y14.5M 1982  
2. CONTROLLING DIMENSION INCH

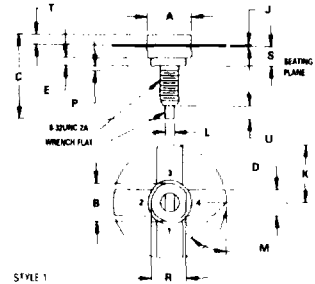
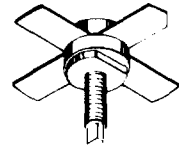
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	24.39	25.14	0.960	0.990
B	9.40	9.90	0.370	0.390
C	5.82	7.13	0.229	0.281
D	5.47	5.96	0.215	0.235
E	2.16	2.66	0.085	0.105
H	3.81	4.57	0.150	0.180
J	0.11	0.15	0.004	0.006
K	10.04	10.29	0.395	0.405
M	40	50	40	50
Q	2.88	3.30	0.113	0.130
R	6.23	6.47	0.245	0.255
S	20.07	20.57	0.790	0.810
U	18.29	18.54	0.720	0.730

## MRF240 MRF240A

40 W - 145-175 MHz

### RF POWER TRANSISTORS

NPN SILICON



STYLE 1  
PH 1 EMITTER  
2 BASE  
3 EMITTER  
4 COLLECTOR

NOTES  
1. DIMENSIONING AND TOLERANCING PER ANS I Y14.5M 1982  
2. CONTROLLING DIMENSION INCH

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	24.39	25.14	0.960	0.990
B	9.40	9.90	0.370	0.390
C	5.82	7.13	0.229	0.281
D	5.47	5.96	0.215	0.235
E	2.16	2.66	0.085	0.105
H	3.81	4.57	0.150	0.180
J	0.11	0.15	0.004	0.006
K	10.04	10.29	0.395	0.405
M	40	50	40	50
Q	2.88	3.30	0.113	0.130
R	6.23	6.47	0.245	0.255
S	20.07	20.57	0.790	0.810
U	18.29	18.54	0.720	0.730

**CASE 145A-09**  
**MRF240**

# MRF240, MRF240A

## ELECTRICAL CHARACTERISTICS ( $T_C = 25^\circ\text{C}$ unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
<b>OFF CHARACTERISTICS</b>					
Collector-Emitter Breakdown Voltage ( $I_C = 20 \text{ mAdc}$ , $I_B = 0$ )	$V_{(BR)CEO}$	16	—	—	Vdc
Collector-Emitter Breakdown Voltage ( $I_C = 20 \text{ mAdc}$ , $V_{BE} = 0$ )	$V_{(BR)CES}$	36	—	—	Vdc
Emitter-Base Breakdown Voltage ( $I_E = 5.0 \text{ mAdc}$ , $I_C = 0$ )	$V_{(BR)EBO}$	4.0	—	—	Vdc
Collector Cutoff Current ( $V_{CB} = 15 \text{ Vdc}$ , $I_E = 0$ )	$I_{CBO}$	—	—	10	mAdc

## ON CHARACTERISTICS

DC Current Gain ( $I_C = 4.0 \text{ Adc}$ , $V_{CE} = 5.0 \text{ Vdc}$ )	$h_{FE}$	10	70	150	—
---	----------	----	----	-----	---

## DYNAMIC CHARACTERISTICS

Output Capacitance ( $V_{CB} = 12.5 \text{ Vdc}$ , $I_E = 0$ , $f = 1.0 \text{ MHz}$ )	$C_{ob}$	—	90	125	pF
---	----------	---	----	-----	----

## FUNCTIONAL TESTS

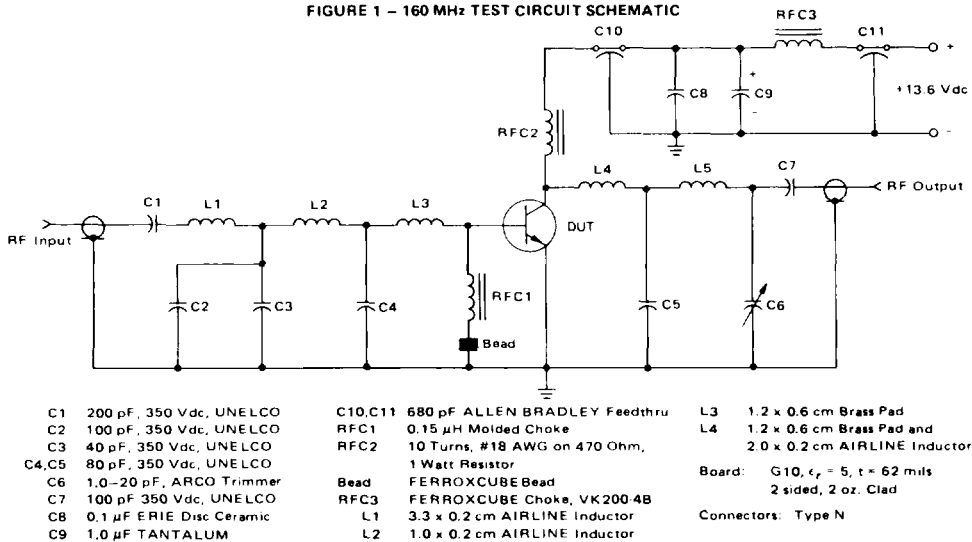
Common-Emitter Amplifier Power Gain ( $V_{CC} = 13.6 \text{ Vdc}$ , $P_{out} = 40 \text{ W}$ , $f = 160 \text{ MHz}$ )	$G_{PE}$	9.0	10	—	dB
Collector Efficiency ( $V_{CC} = 13.6 \text{ Vdc}$ , $P_{out} = 40 \text{ W}$ , $f = 160 \text{ MHz}$ )	$\eta$	55	—	—	%

## TYPICAL SSB PERFORMANCE

Intermodulation Distortion (1) ( $V_{CC} = 13.6 \text{ Vdc}$ , $P_{out} = 35 \text{ W (PEP)}$ , $f_1 = 146 \text{ MHz}$ , $f_2 = 146.002 \text{ MHz}$ , $I_{CQ} = 50 \text{ mAdc}$ )	IMD ( $d_3$ )	—	-30	—	dB
---	---------------	---	-----	---	----

(1) To MIL-STD-1311 Version A, Test Method 2204B, Two Tone, Reference Each Tone.

FIGURE 1 - 160 MHz TEST CIRCUIT SCHEMATIC



# MRF240, MRF240A

2

FIGURE 2 – POWER GAIN versus FREQUENCY

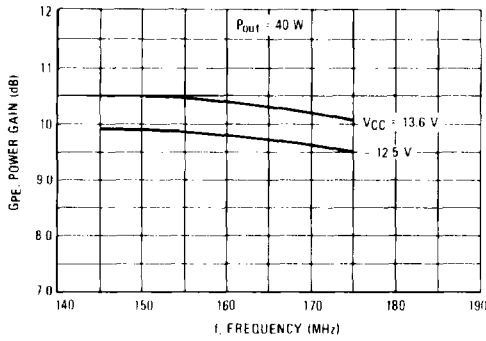


FIGURE 3 – OUTPUT POWER versus INPUT POWER

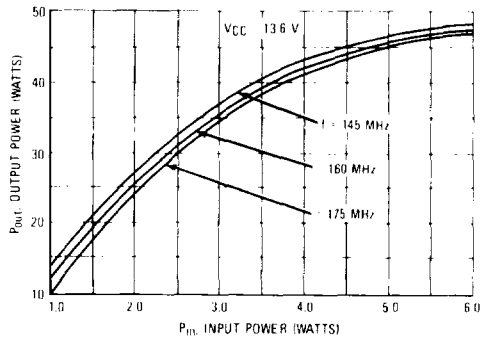


FIGURE 4 – OUTPUT POWER versus SUPPLY VOLTAGE  
145 MHz

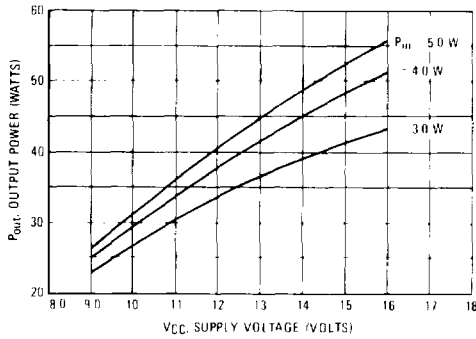


FIGURE 5 – OUTPUT POWER versus SUPPLY VOLTAGE  
160 MHz

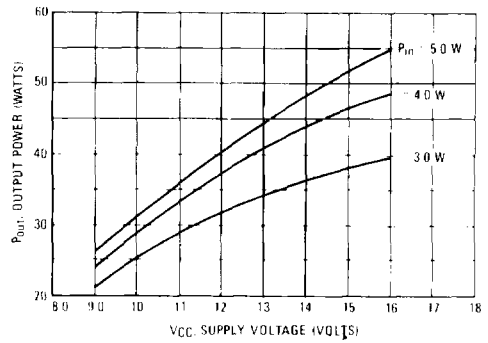
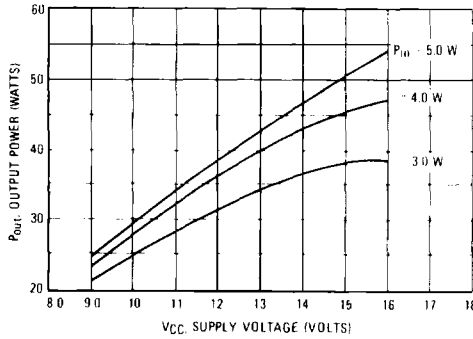


FIGURE 6 – OUTPUT POWER versus SUPPLY VOLTAGE  
175 MHz



# MRF240, MRF240A

FIGURE 7 – SERIES EQUIVALENT INPUT/OUTPUT IMPEDANCES

