MRF226

The RF Line

13 W – 225 MHz

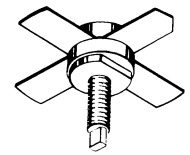
RF POWER TRANSISTOR

NPN SILICON

NPN SILICON RF POWER TRANSISTOR

. . . designed for 12.5 Volt large-signal power amplifier applications in communication equipment operating at 225 MHz.

- Specified 12.5 Volt, 225 MHz Characteristics —
  Output Power = 13 Watts
  Minimum Gain = 9.0 dB
  Efficiency = 50%
- Characterized With Series Equivalent Large-Signal Impedance Parameters
- Designed to Withstand Load Mismatch at all Phase Angles with 20:1 VSWR



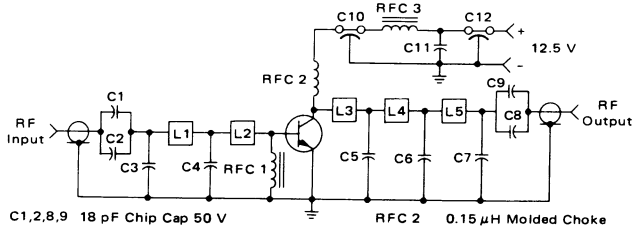
3

MAXIMUM RATINGS

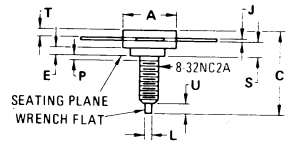
Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CEO}	18	Vdc
Collector-Base Voltage	V_{CBO}	36	Vdc
Emitter-Base Voltage	V_{EBO}	4.0	Vdc
Collector Current — Continuous	I_C	2.5	Adc
Total Device Dissipation @ $T_C = 25^oC$(1) Derate above 25^oC	P_D	45 257	Watts mW/^oC
Storage Temperature Range	T_{stg}	−65 to +150	^oC
Stud Torque (2)	—	6.5	In. Lb.

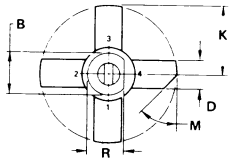
(1) These devices are designed for RF operation. The total device dissipation rating applies only when the devices are operated as Class C RF amplifiers.
(2) For repeated assembly, use 5 In. Lb.

FIGURE 1 – 225 MHz TEST CIRCUIT SCHEMATIC



C1,2,8,9	18 pF Chip Cap 50 V	RFC 2	0.15 μH Molded Choke
C3	15 pF UNELCO	L1	0.15 x 3.15 inch Microstrip
C4,5	80 pF UNELCO	L2	0.15 x 0.55 inch Microstrip
C6	25 pF UNELCO	L3	0.15 x 1.4 inch Microstrip
C7	7.0 pF UNELCO	L4	0.15 x 2.35 inch Microstrip
C10,12	680 pF Feedthru ALLEN BRADLEY	L5	0.15 x 0.5 inch Microstrip
C11	1.0 μF, 35 V Tantalum	Board is G10 3 x 5 x 0.062 inch	
RFC 1,3	Ferroxcube VK200	$\epsilon_R = 5$	





STYLE 1:
PIN 1. EMITTER
2. BASE
3. EMITTER
4. COLLECTOR

DIM	MILLIMETERS MIN	MAX	INCHES MIN	MAX
A	9.40	9.78	0.370	0.385
B	8.13	8.38	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	1.40	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	2.49	3.35	0.098	0.132

NOTE:
CASE 145-09 USE 8-32NC2A STUD

CASE 145A-09

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

Characteristic	Symbol	Min	Max	Unit
OFF CHARACTERISTICS				
Collector Emitter Breakdown Voltage (I_C = 15 mAdc, I_B = 0)	$V_{(BR)CEO}$	18	–	Vdc
Collector-Base Breakdown Voltage (I_C = 5.0 mAdc, I_E = 0)	$V_{(BR)CBO}$	36	–	Vdc
Emitter-Base Breakdown Voltage (I_E = 2.5 mAdc, I_C = 0)	$V_{(BR)EBO}$	4.0	–	Vdc
Collector Cutoff Current (V_{CB} = 15 Vdc, I_E = 0)	I_{CBO}	–	0.25	mAdc
ON CHARACTERISTICS				
DC Current Gain (I_C = 250 mAdc, V_{CE} = 5.0 Vdc)	h_{FE}	5.0	–	–
FUNCTIONAL TEST (Figure 1)				
Common-Emitter Amplifier Power Gain (P_{out} = 13 W, V_{CC} = 12.5 Vdc, f = 225 MHz)	G_{PE}	9.0	–	dB
Collector Efficiency (P_{out} = 13 W, V_{CC} = 12.5 Vdc, f = 225 MHz)	η	50	–	%

FIGURE 2 – OUTPUT POWER versus INPUT POWER

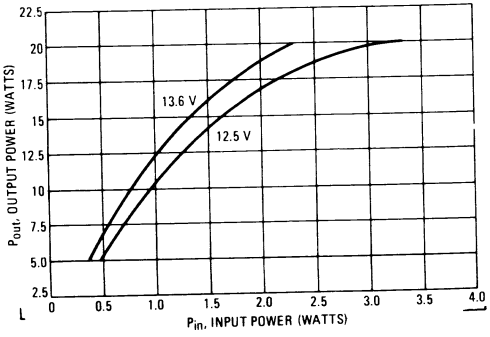
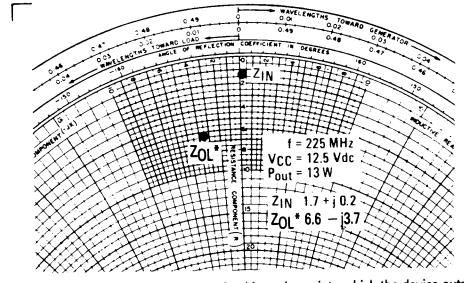


FIGURE 3 – SERIES EQUIVALENT IMPEDANCE



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

MRF227

The RF Line

3 W – 225 MHz
RF POWER
TRANSISTOR
NPN SILICON

NPN SILICON RF POWER TRANSISTOR

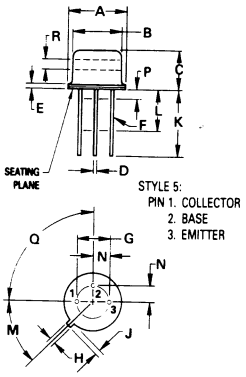
. . . designed for 12.5 Volt large-signal power amplifier applications in communication equipment operating at 225 MHz. Ideally suited for Class E citizens band radio.

- Specified 12.5 Volt, 225 MHz Characteristics –
  Output Power = 3.0 Watts
  Minimum Gain = 13.5 dB
  Efficiency = 60%
- Characterized With Series Equivalent Large-Signal Impedance Parameters
- Grounded Emitter TO-39 Package for High Gain and Excellent Heat Dissipation
- Replaces Medium Power Stud Mount Devices

3

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CEO}	16	Vdc
Collector-Base Voltage	V_{CBO}	36	Vdc
Collector Current – Continuous	I_C	600	mAdc
Total Power Dissipation @ $T_C = 25^oC$ Derate above 25^oC	P_D	8.0 46	Watts $mW/^oC$
Storage Temperature Range	T_{stg}	-65 to +200	^oC



DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	9.02	9.30	0.355	0.366
B	8.00	8.51	0.315	0.335
C	4.19	4.57	0.165	0.180
D	0.43	0.53	0.017	0.021
E	0.43	0.89	0.017	0.035
F	0.41	0.48	0.016	0.019
G	4.83	5.33	0.190	0.210
H	0.71	0.86	0.028	0.034
J	0.74	1.02	0.029	0.040
K	12.70	—	0.500	—
M	45°NOM		45°NOM	
N	2.54 TYP		0.100 TYP	
Q	90° NOM		90° NOM	

NOTE: The pin configuration on this version of the TO-39 package differs from the common isolated emitter type.

All JEDEC dimensions and notes apply.

CASE 79-03

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 = 1.0 mAdc, I_C = 0)	$V_{(BR)EBO}$	4.0	–	–	Vdc
Collector Cutoff Current (V_{CE} = 15 Vdc, V_{BE} = 0, T_C = 55°C)	I_{CES}	–	–	10	mAdc
Collector Cutoff Current (V_{CB} = 15 Vdc, I_E = 0)	I_{CBO}	–	–	1.0	mAdc
ON CHARACTERISTICS					
DC Current Gain (I_C = 100 mAdc, V_{CE} = 5.0 Vdc)	h_{FE}	20	–	200	–
DYNAMIC CHARACTERISTICS					
Output Capacitance (V_{CB} = 12.5 Vdc, I_E = 0, f = 1.0 MHz)	C_{ob}	–	–	15	pF
FUNCTIONAL TESTS					
Common-Emitter Amplifier Power Gain (P_{out} = 3.0 W, V_{CC} = 12.5 Vdc, f = 225 MHz)	G_{PE}	13.5	15	–	dB
Collector Efficiency (P_{out} = 3.0 W, V_{CC} = 12.5 Vdc, f = 225 MHz)	η	60	–	–	%

3

FIGURE 1 – 225 MHz TEST CIRCUIT

C1,C2,C3,C4 ARCO 420
C5 1000 pF, UNELCO
C6 0.047 pF, ERIE
C7 1.0 pF, TANTALUM
L1 #18 AWG, 1" Wire Length
L2 VK200-4 Ferroxcube
L3 1 Turn, #18 AWG, 1/4" ID x 2" Wire Length
L4 0.15 μH DELEVAN Molded Choke
Board – Glass Teflon, ϵ_R = 2.56, t = 0.062"
Input/Output Connectors – Type N

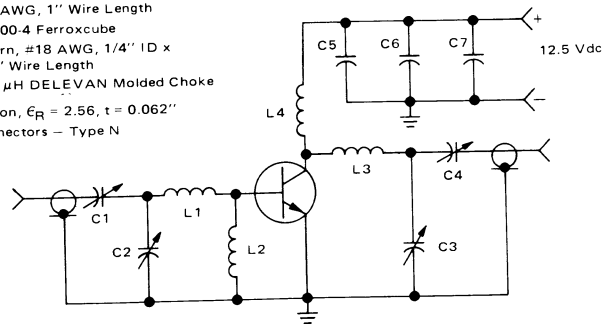


FIGURE 2 – INPUT POWER versus OUTPUT POWER – 12.5 V

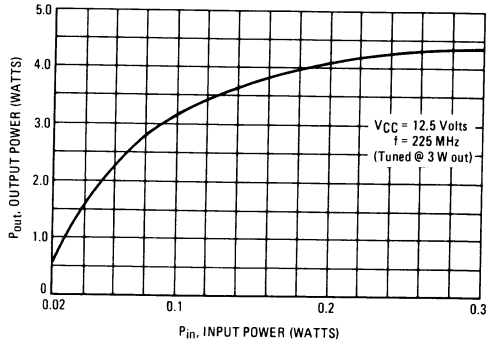


FIGURE 3 – INPUT POWER versus OUTPUT POWER – 13.6 V

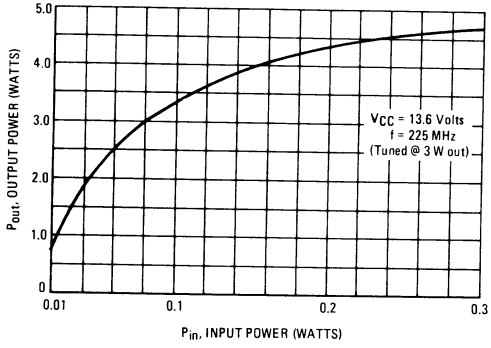


FIGURE 4 – INPUT POWER versus OUTPUT POWER – 7.5 V

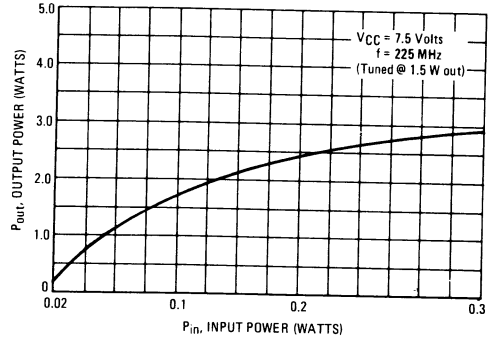


FIGURE 5 – OUTPUT POWER versus SUPPLY VOLTAGE

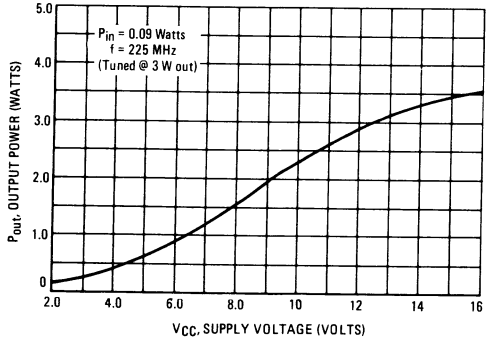
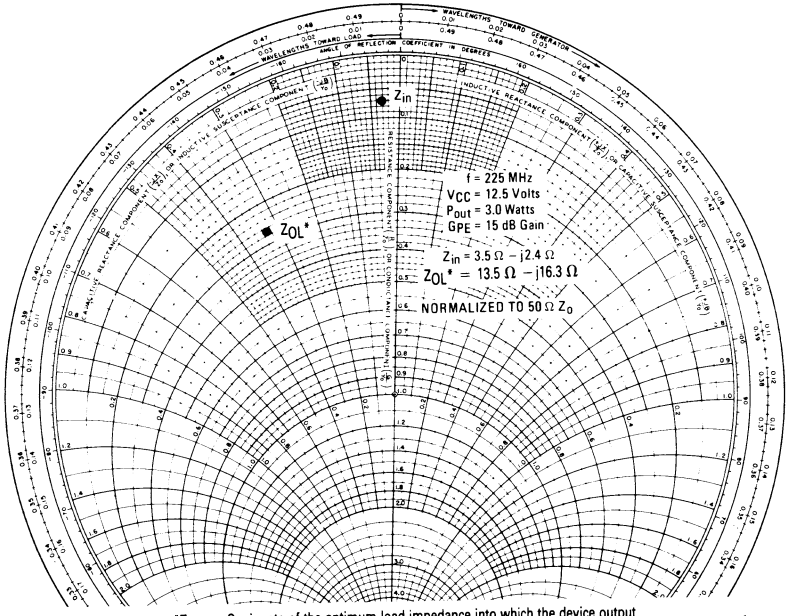


FIGURE 6 – SERIES EQUIVALENT IMPEDANCE



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

3

MRF229

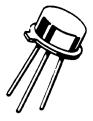
The RF Line

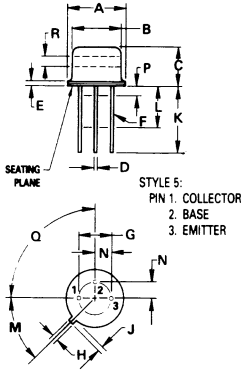
1.5 W — 90 MHz
RF POWER
TRANSISTOR
NPN SILICON

NPN SILICON RF POWER TRANSISTORS

. . . designed for 12.5 Volt, mid-band large-signal amplifier applications in industrial and commercial FM equipment operating in the 40 to 100 MHz range.

- Specified 12.5 Volt, 90 MHz Characteristics —
  Output Power = 1.5 Watts
  Minimum Gain = 10 dB
  Efficiency = 55%
- 100% Tested for Load Mismatch at all Phase Angles with 30:1 VSWR
- Characterized with Series Equivalent Large-Signal Impedance Parameters
- Characterized with Parallel Equivalent Large-Signal Impedance Parameters
- MRF229 — Emitter Connected to Case





DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	9.02	9.30	0.355	0.366
B	8.00	8.51	0.315	0.335
C	4.19	4.57	0.165	0.180
D	0.43	0.53	0.017	0.021
E	0.43	0.89	0.017	0.035
F	0.41	0.48	0.016	0.019
G	4.83	5.33	0.190	0.210
H	0.71	0.86	0.028	0.034
J	0.74	1.02	0.029	0.040
K	12.70	—	0.500	—
M	45°NOM		45°NOM	
N	2.54 TYP		0.100 TYP	
Q	90° NOM		90° NOM	

NOTE: The pin configuration on this version of the TO-39 package differs from the common isolated emitter type.

All JEDEC dimensions and notes apply.

CASE 79-03

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CEO}	18	Vdc
Collector-Base Voltage	V_{CBO}	36	Vdc
Emitter-Base Voltage	V_{EBO}	4.0	Vdc
Collector Current — Continuous	I_C	0.5	Adc
Total Device Dissipation @ $T_C = 25^oC$ (1) Derate above 25^oC	P_D	5.0 28.6	Watts $mW/^oC$
Storage Temperature Range	T_{stg}	-65 to +200	^oC

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	$R\theta JC$	35	$^oC/W$

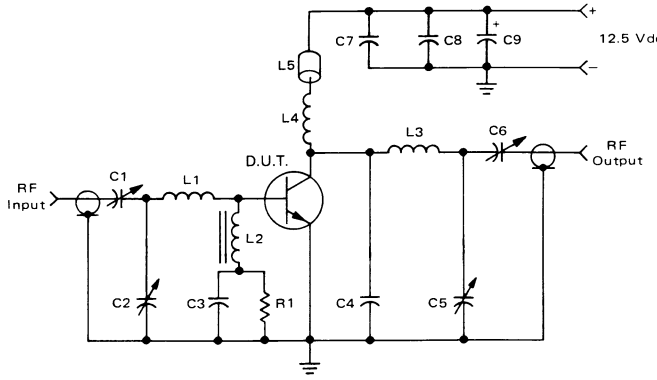
(1) These devices are designed for RF operation. The total device dissipation rating applies only when the devices are operated as Class C RF Amplifiers.

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

Characteristic	Symbol	Min	Max	Unit
OFF CHARACTERISTICS				
Collector-Emitter Breakdown Voltage (I_C = 25 mAdc, I_B = 0)	$V_{(BR)CEO}$	18	–	Vdc
Collector-Emitter Breakdown Voltage (I_C = 25 mAdc, V_{BE} = 0)	$V_{(BR)CES}$	36	–	Vdc
Emitter-Base Breakdown Voltage (I_E = 0.25 mAdc, I_C = 0)	$V_{(BR)EBO}$	4.0	–	Vdc
Collector Cutoff Current (V_{CB} = 15 Vdc, I_E = 0)	I_{CBO}	–	0.5	mAdc
ON CHARACTERISTICS				
DC Current Gain (I_C = 250 mAdc, V_{CE} = 5.0 Vdc)	h_{FE}	5.0	–	–
DYNAMIC CHARACTERISTICS				
Output Capacitance (V_{CB} = 12.5 Vdc, I_E = 0, f = 1.0 MHz)	C_{ob}	–	25	pF
FUNCTIONAL TESTS (Figure 1)				
Common-Emitter Amplifier Power Gain (V_{CC} = 12.5 Vdc, P_{out} = 1.5 W, f = 90 MHz)	G_{PE}	10	–	dB
Collector Efficiency (V_{CC} = 12.5 Vdc, P_{out} = 1.5 W, f = 90 MHz)	η	55	–	%
Load Mismatch (V_{CC} = 12.5 Vdc, P_{out} = 1.5 W, f = 90 MHz, $T_C \leq 25°C$)	–	No Degradation in Output Power		

3

FIGURE 1 – 90 MHz TEST CIRCUIT SCHEMATIC



C1	5.0-80 pF, ARCO 462	C9	20 μF, 15 Vdc TANTALUM
C2,C6	25-280 pF, ARCO 464	L1	2 Turns, #18 AWG, 3/8" I.D. 3/8" Long
C3	250 pF UNELCO	L2	2.5 Turns, #20 AWG, on Ferrite Bead. FERROXCUBE 56-590-65-3B
C4	10 pF UNELCO	L3	3 Turns, #18 AWG, 3/8" I.D., 1/2" Long
C5	9.0-180 pF, ARCO 463	L4	0.68 μH, 9230-16 MILLER Molded Choke
C7	1000 pF UNELCO	L5	Ferrite Bead, FERROXCUBE 56-590-65-3B
C8	0.47 μF ERIE Disc Ceramic	R1	4.7 OHM, 1/2 W, 10% Carbon

Input/Output Connectors – Type BNC

FIGURE 2 – OUTPUT POWER versus INPUT POWER

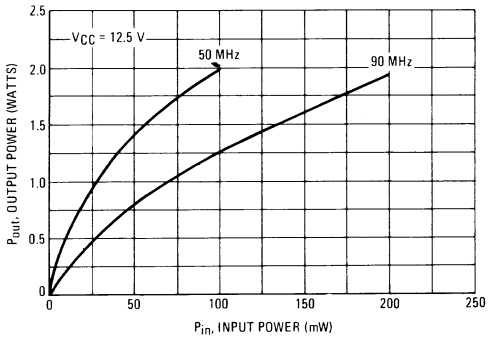


FIGURE 3 – OUTPUT POWER versus FREQUENCY

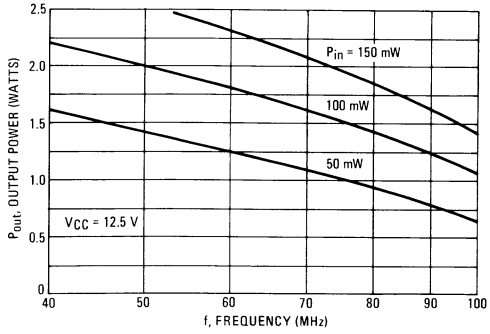


FIGURE 4 – OUTPUT POWER versus SUPPLY VOLTAGE

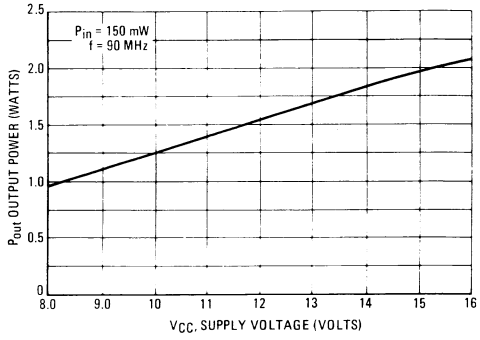
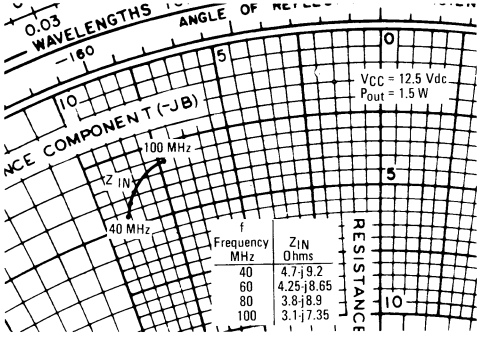
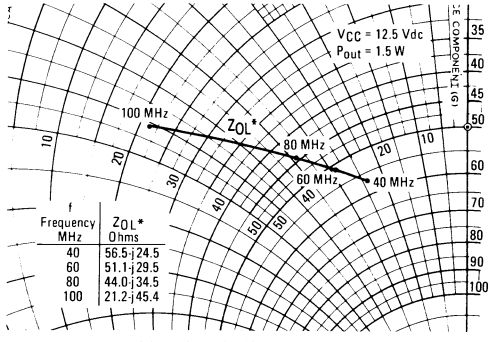


FIGURE 5

SERIES EQUIVALENT INPUT IMPEDANCE



SERIES EQUIVALENT OUTPUT IMPEDANCE



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

FIGURE 6 – PARALLEL EQUIVALENT INPUT RESISTANCE versus FREQUENCY

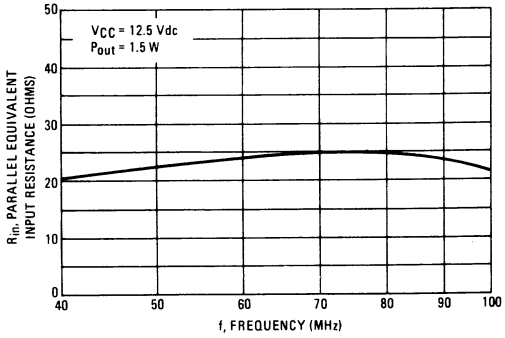


FIGURE 7 – PARALLEL EQUIVALENT INPUT CAPACITANCE versus FREQUENCY

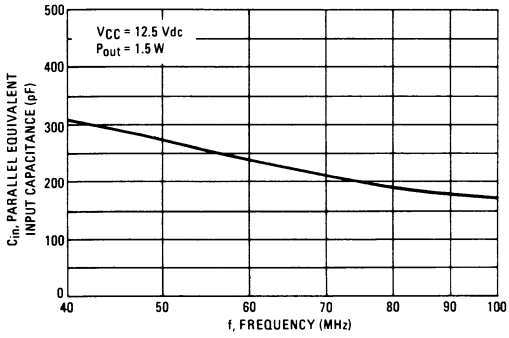


FIGURE 8 – PARALLEL EQUIVALENT OUTPUT RESISTANCE versus FREQUENCY

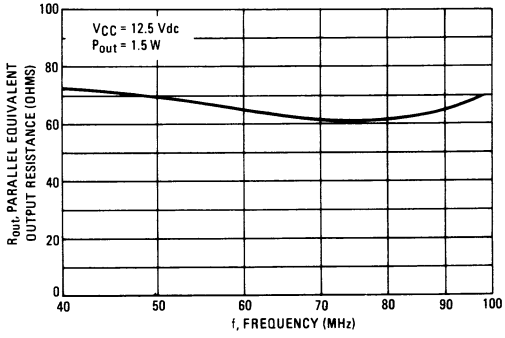
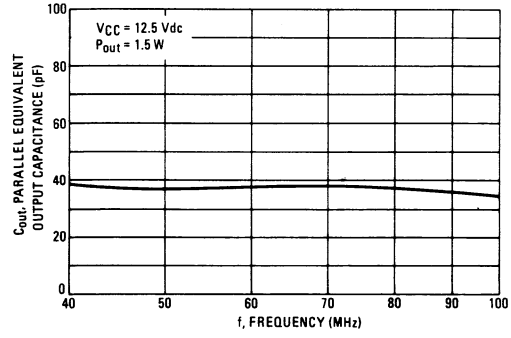


FIGURE 9 – PARALLEL EQUIVALENT OUTPUT CAPACITANCE versus FREQUENCY



MRF232

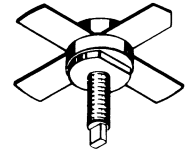
The RF Line

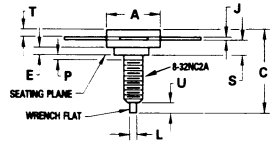
7.5 W – 90 MHz
RF POWER
TRANSISTOR
NPN SILICON

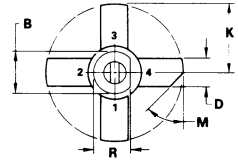
NPN SILICON RF POWER TRANSISTORS

. . . designed for 12.5 Volt, mid-band large-signal amplifier applications in industrial and commercial FM equipment operating in the 40 to 100 MHz range.

- Specified 12.5 Volt, 90 MHz Characteristics –
  Output Power = 7.5 Watts
  Minimum Gain = 9.0 dB
  Efficiency = 55%
- 100% Tested for Load Mismatch at all Phase Angles with 30:1 VSWR
- Characterized with Series Equivalent Large-Signal Impedance Parameters
- Characterized with Parallel Equivalent Large-Signal Impedance Parameters







STYLE 1:
PIN 1. EMITTER
2. BASE
3. EMITTER
4. COLLECTOR

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CEO}	18	Vdc
Collector-Base Voltage	V_{CBO}	36	Vdc
Emitter-Base Voltage	V_{EBO}	4.0	Vdc
Collector Current – Continuous	I_C	2.0	Adc
Total Device Dissipation @ $T_C = 25^oC$ (1) Derate above 25^oC	P_D	20 114	Watts $mW/^oC$
Storage Temperature Range	T_{stg}	–65 to +150	^oC
Stud Torque (2)	–	6.5	In. Lb.

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	8.75	$^oC/W$

(1) These devices are designed for RF operation. The total device dissipation rating applies only when the devices are operated as Class C RF Amplifiers.
(2) For repeated assembly use 5 In. Lb.

DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	9.40	9.78	0.370	0.385
B	8.13	8.38	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	.1.40	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	2.49	3.35	0.098	0.132

CASE 145A-09

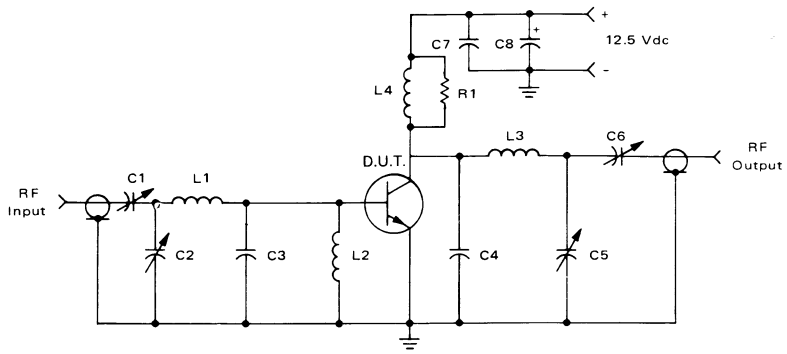
3

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)	$V_{(BR)CEO}$	18	–	Vdc
Collector-Emitter Breakdown Voltage (I_C = 50 mAdc, V_{BE} = 0)	$V_{(BR)CES}$	36	–	Vdc
Emitter-Base Breakdown Voltage (I_E = 2.5 mAdc, I_C = 0)	$V_{(BR)EBO}$	4.0	–	Vdc
Collector Cutoff Current (V_{CB} = 15 Vdc, I_E = 0)	I_{CBO}	–	1.0	mAdc
ON CHARACTERISTICS				
DC Current Gain (I_C = 500 mAdc, V_{CE} = 5.0 Vdc)	h_{FE}	10	–	–
DYNAMIC CHARACTERISTICS				
Output Capacitance (V_{CB} = 12.5 Vdc, I_E = 0, f = 1.0 MHz)	C_{ob}	–	55	pF
FUNCTIONAL TESTS (Figure 1)				
Common-Emitter Amplifier Power Gain (V_{CC} = 12.5 Vdc, P_{out} = 7.5 W, f = 90 MHz)	G_{PE}	9.0	–	dB
Collector Efficiency (V_{CC} = 12.5 Vdc, P_{out} = 7.5 W, f = 90 MHz)	η	55	–	%
Load Mismatch (V_{CC} = 12.5 Vdc, P_{out} = 7.5 W, f = 90 MHz, $T_C \leq 25°C$)	–	No Degradation in Output Power		

3

FIGURE 1 – 90 MHz TEST CIRCUIT SCHEMATIC



C1,C6	5.0-80 pF, ARCO 462	L1	3 Turns, #18 AWG, 3/8" I.D., 3/8" Long
C2,C5	9.0-180 pF, ARCO 463	L2	FERROXCUBE VK200-20-4B Ferrite Choke
C3,C4	100 pF UNELCO	L3	3 Turns, #18 AWG, 5/16" I.D., 3/8" Long
C7	1000 pF UNELCO	L4	10 Turns, #22 AWG, on R1
C8	4.7 μF, 15 Vdc, TANTALUM	R1	340 Ohm, 1 W Carbon
		Input/Output Connectors – Type BNC	

FIGURE 2 – OUTPUT POWER versus INPUT POWER

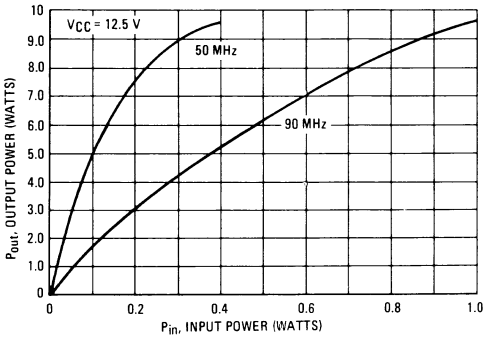


FIGURE 3 – OUTPUT POWER versus FREQUENCY

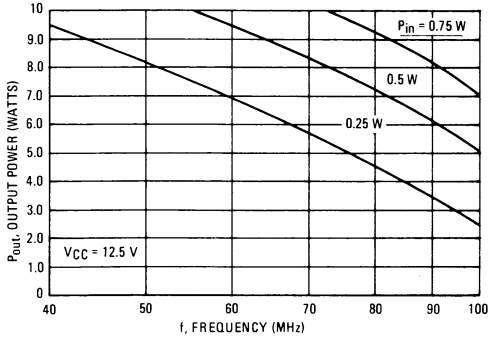


FIGURE 4 – OUTPUT POWER versus SUPPLY VOLTAGE

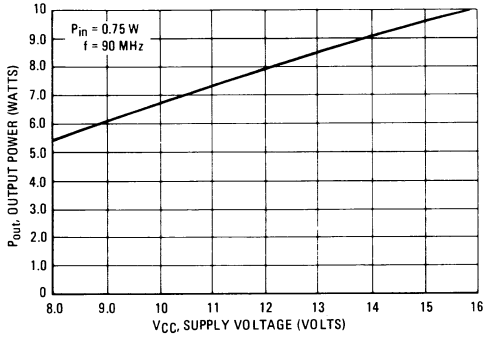
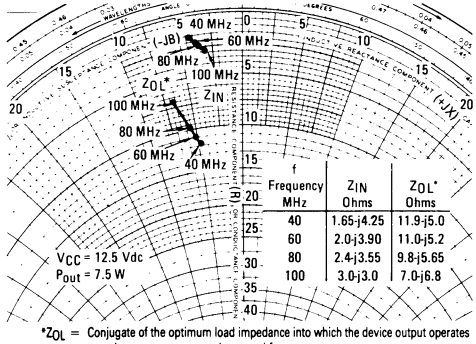


FIGURE 5 – SERIES EQUIVALENT IMPEDANCE



f Frequency MHz	ZIN Ohms	ZOL* Ohms
40	1.65-j4.25	11.9-j5.0
60	2.0-j3.90	11.0-j5.2
80	2.4-j3.55	9.8-j5.65
100	3.0-j3.0	7.0-j6.8

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

3

FIGURE 6 – PARALLEL EQUIVALENT INPUT RESISTANCE versus FREQUENCY

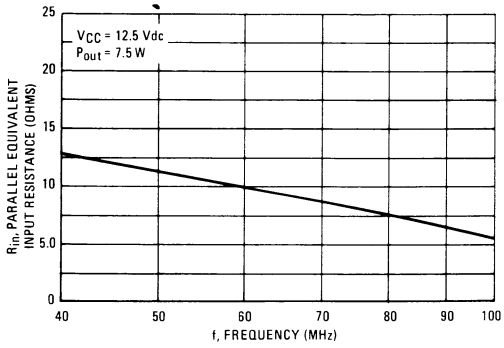


FIGURE 7 – PARALLEL EQUIVALENT INPUT CAPACITANCE versus FREQUENCY

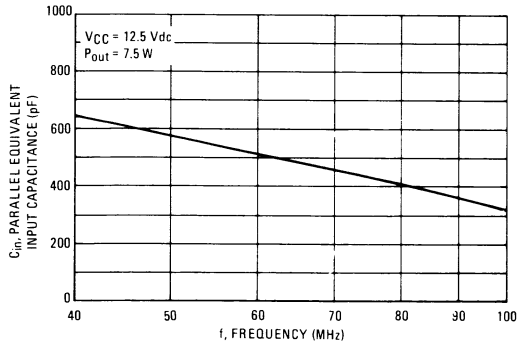


FIGURE 8 – PARALLEL EQUIVALENT OUTPUT RESISTANCE versus FREQUENCY

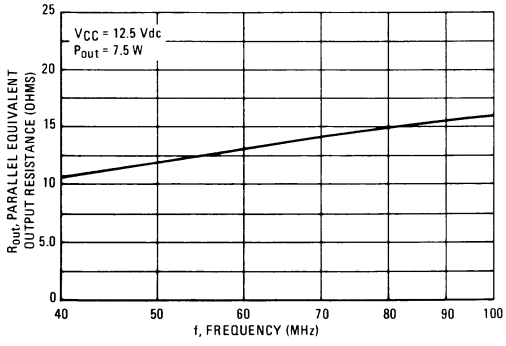
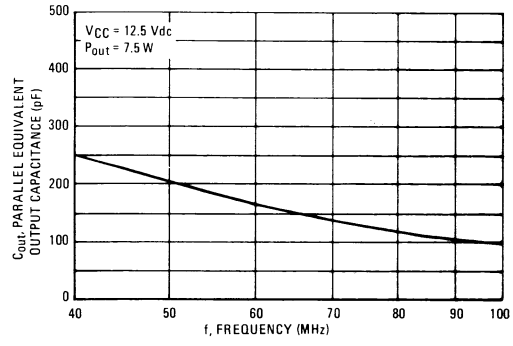


FIGURE 9 – PARALLEL EQUIVALENT OUTPUT CAPACITANCE versus FREQUENCY



MRF233

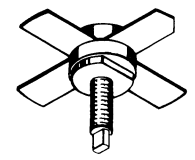
The RF Line

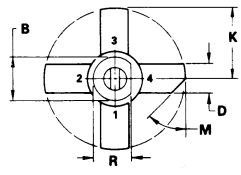
15 W – 90 MHz
RF POWER
TRANSISTOR
NPN SILICON

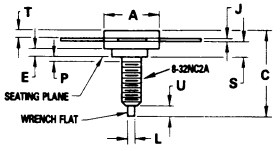
NPN SILICON RF POWER TRANSISTORS

. . . designed for 12.5 Volt, mid-band large-signal amplifier applications in industrial and commercial FM equipment operating in the 40 to 100 MHz range.

- Specified 12.5 Volt, 90 MHz Characteristics –
  Output Power = 15 Watts
  Minimum Gain = 10 dB
  Efficiency = 55%
- 100% Tested for Load Mismatch at all Phase Angles with 30:1 VSWR
- Characterized with Series Equivalent Large-Signal Impedance Parameters
- Characterized with Parallel Equivalent Large-Signal Impedance Parameters







STYLE 1:
PIN 1. EMITTER
2. BASE
3. EMITTER
4. COLLECTOR

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CEO}	18	Vdc
Collector-Base Voltage	V_{CBO}	36	Vdc
Emitter-Base Voltage	V_{EBO}	4.0	Vdc
Collector Current – Continuous	I_C	3.5	Adc
Total Device Dissipation @ $T_C = 25^oC$ (1) Derate Above 25^oC	P_D –	50 285	Watts $mW/^oC$
Storage Temperature Range	T_{stg}	–65 to +150	^oC
Stud Torque (2)	–	6.5	In-lb

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	3.5	$^oC/W$

(1) These devices are designed for RF operation. The total device dissipation rating applies only when the devices are operated as Class C RF amplifiers.
(2) For Repeated Assembly use 5 In. Lb.

DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	9.40	9.78	0.370	0.385
B	8.13	8.38	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	1.40	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	2.49	3.35	0.098	0.132

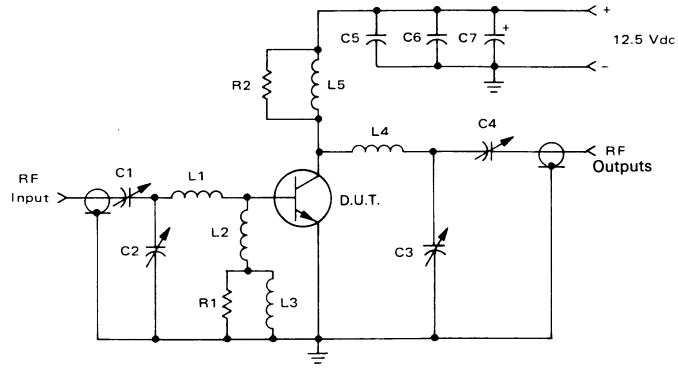
CASE 145A-09

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

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Collector-Emitter Breakdown Voltage (I_C = 100 mAdc, I_B = 0)	$V_{(BR)CEO}$	18	–	–	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_{CB} = 15 Vdc, I_E = 0)	I_{CBO}	–	–	1.0	mAdc
ON CHARACTERISTICS					
DC Current Gain (I_C = 1.0 Adc, V_{CE} = 5.0 Vdc)	h_{FE}	5.0	–	–	–
DYNAMIC CHARACTERISTICS					
Output Capacitance (V_{CB} = 12.5 Vdc, I_E = 0, f = 1.0 MHz)	C_{ob}	–	100	120	pF
FUNCTIONAL TESTS (Figure 1)					
Common-Emitter Amplifier Power Gain (V_{CC} = 12.5 Vdc, P_{out} = 15 W, f = 90 MHz)	G_{PE}	10	–	–	dB
Collector Efficiency (V_{CC} = 12.5 Vdc, P_{out} = 15 W, f = 90 MHz)	η	55	–	–	%
Load Mismatch (V_{CC} = 12.5 Vdc, P_{out} = 15 W, f = 90 MHz, $T_C \leq 25°C$)	–	No Degradation in Output Power			

3

FIGURE 1 – 90 MHz TEST CIRCUIT SCHEMATIC



C1,C3 9.0-180 pF, ARCO 463
C2,C4 25-280 pF ARCO 464
C5 1000 pF UNELCO
C6 0.01 μF ERIE Disc Ceramic
C7 1.0 μF, 35 Vdc TANTALUM
L1 2 Turns, #18 AWG, 3/8" I.D., 1/4" Long
L2 0.22 μH, 9230-04 MILLER Molded Choke
L3 2.2 μH, 9230-200 MILLER Molded Choke
L4 2 Turns, #18 AWG, 3/8" I.D., 3/8" Long
L5 10 Turns, #16 AWG, Wound On R2.
R1 15 Ohm, 1/2 W, 10% Carbon
R2 68 Ohm, 1 Watt, 10% Carbon
Input/Output Connectors – Type BNC

FIGURE 2 – OUTPUT POWER versus INPUT POWER

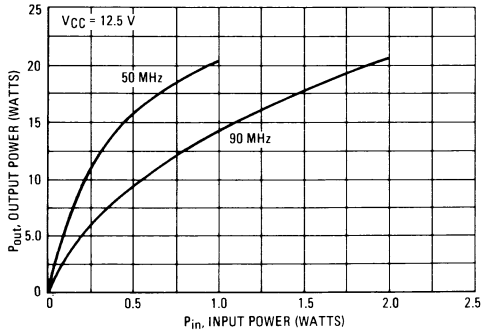


FIGURE 3 – OUTPUT POWER versus FREQUENCY

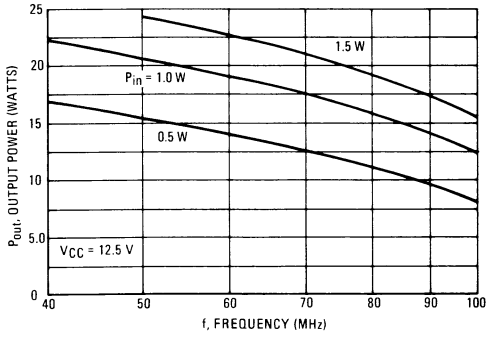


FIGURE 4 – OUTPUT POWER versus SUPPLY VOLTAGE

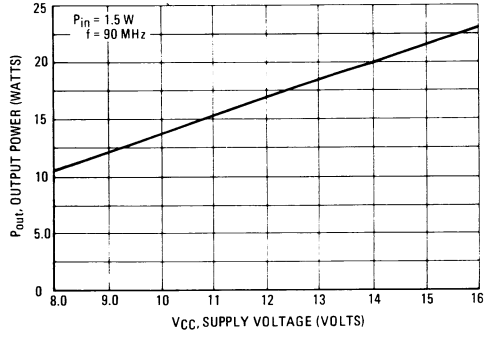
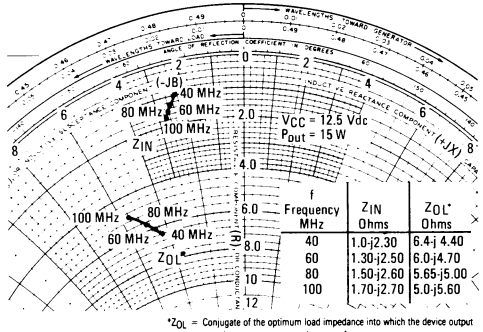


FIGURE 5 – SERIES EQUIVALENT IMPEDANCE



f Frequency MHz	ZIN Ohms	ZOL* Ohms
40	1.0-j2.30	6.4-j 4.40
60	1.30-j2.50	6.0-j4.70
80	1.50-j2.60	5.65-j5.00
100	1.70-j2.70	5.0-j5.60

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

3

FIGURE 6 – PARALLEL EQUIVALENT INPUT RESISTANCE versus FREQUENCY

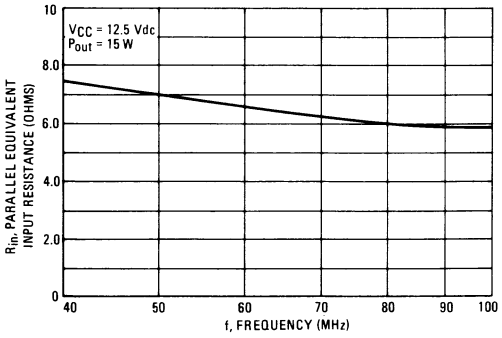


FIGURE 7 – PARALLEL EQUIVALENT INPUT CAPACITANCE versus FREQUENCY

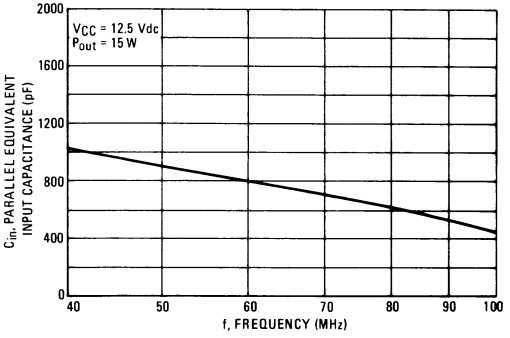


FIGURE 8 – PARALLEL EQUIVALENT OUTPUT RESISTANCE versus FREQUENCY

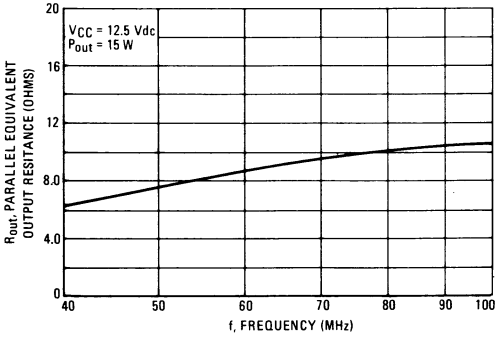
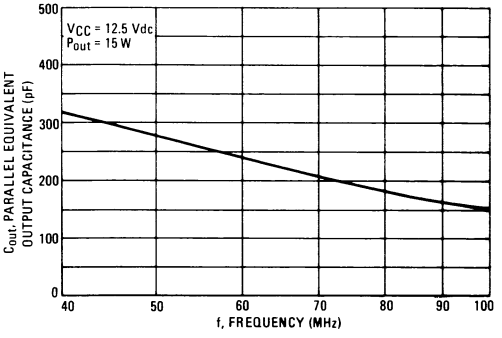


FIGURE 9 – PARALLEL EQUIVALENT OUTPUT CAPACITANCE versus FREQUENCY



MRF234

The RF Line

25 W — 90 MHz
RF POWER
TRANSISTOR
NPN SILICON

NPN SILICON RF POWER TRANSISTORS

. . . designed for 12.5 Volt, mid-band large-signal amplifier applications in industrial and commercial FM equipment operating in the 40 to 100 MHz range.

- Specified 12.5 Volt, 90 MHz Characteristics —
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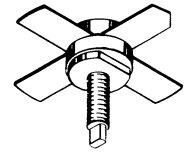

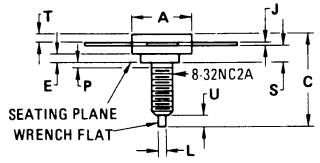

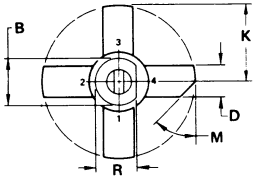

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3. EMITTER
4. COLLECTOR

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S	4.01	4.52	0.158	0.178
T	2.11	2.54	0.083	0.100
U	2.49	3.35	0.098	0.132

CASE 145A-09

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CEO}	18	Vdc
Collector-Base Voltage	V_{CBO}	36	Vdc
Emitter-Base Voltage	V_{EBO}	4.0	Vdc
Collector Current — Continuous	I_C	4.0	Adc
Total Device Dissipation @ $T_C = 25^oC$ (1) Derate above 25^oC	P_D	70 400	Watts mW/^oC
Storage Temperature Range	T_{stg}	−65 to+150	^oC
Stud Torque (2)	—	6.5	In. Lb.

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	2.5	$^oC/W$

(1) These devices are designed for RF operation. The total device dissipation rating applies only when the devices are operated as Class C RF Amplifiers.
(2) For repeated assembly use 5 In. Lb.

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Characteristic	Symbol	Min	Typ	Max	Unit
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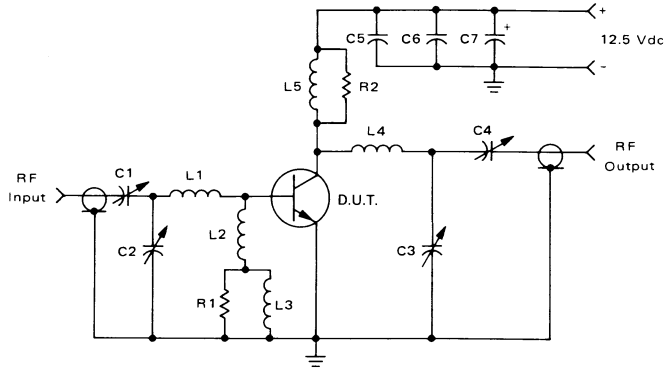
Collector-Emitter Breakdown Voltage (I_C = 200 mAdc, V_{BE} = 0)	$V_{(BR)CES}$	36	–	–	Vdc
Emitter-Base Breakdown Voltage (I_E = 5.0 mAdc, I_C = 0)	$V_{(BR)EBO}$	4.0	–	–	Vdc
Collector Cutoff Current (V_{CB} = 15 Vdc, I_E = 0)	I_{CBO}	–	–	1.0	mAdc
ON CHARACTERISTICS					
DC Current Gain (I_C = 1.0 Adc, V_{CE} = 5.0 Vdc)	h_{FE}	5.0	–	–	–
DYNAMIC CHARACTERISTICS					
Output Capacitance (V_{CB} = 12.5 Vdc, I_E = 0, f = 1.0 MHz)	C_{ob}	–	100	120	pF
FUNCTIONAL TESTS (Figure 1)					
Common-Emitter Amplifier Power Gain (V_{CC} = 12.5 Vdc, P_{out} = 25 W, f = 90 MHz)	G_{PE}	9.5	–	–	dB
Collector Efficiency (V_{CC} = 12.5 Vdc, P_{out} = 25 W, f = 90 MHz)	η	55	–	–	%
Load Mismatch (V_{CC} = 12.5 Vdc, P_{out} = 25 W, f = 90 MHz, $T_C \leq 25°C$	–	No Degradation in Output Power			

3

FIGURE 1 – 90 MHz TEST CIRCUIT SCHEMATIC



C1,C4	5.0-80 pF, ARCO 462
C2,C3	25-280 pF, ARCO 464
C5	1000 pF UNELCO
C6	0.047 µF, ERIE disc ceramic
C7	10 µF, 15 Vdc TANTALUM
L1	1 Turn, #16 AWG, 3/8" I.D., 1/8" Long
L2	0.22 µH, 9230-04 MILLER Molded Choke
L3	22 µH, 9230-52 MILLER Molded Choke
L4	2 Turns, #14 AWG, 3/8" I.D., 1/4" Long
L5	10 Turns, #18 AWG, 1/4" I.D., wound on R2
R1	15 Ohms, 1/2 W, 10%
R2	47 Ohm, 1 W Carbon
	Input/Output Connector – Type BNC

FIGURE 2 – OUTPUT POWER versus INPUT POWER

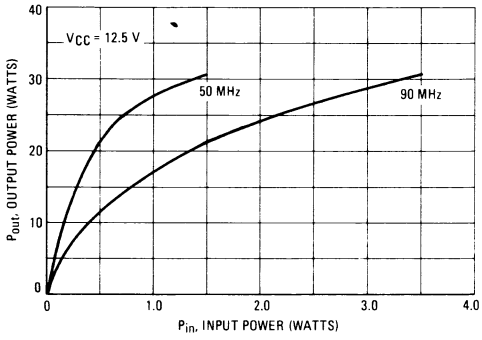


FIGURE 3 – OUTPUT POWER versus FREQUENCY

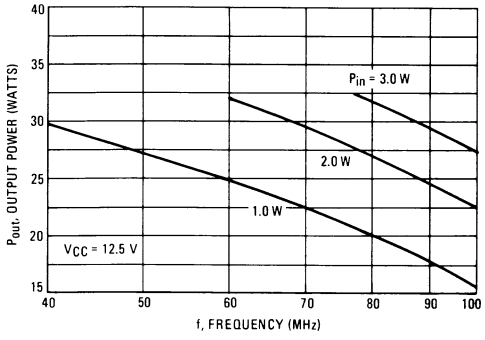


FIGURE 4 – OUTPUT POWER versus SUPPLY VOLTAGE

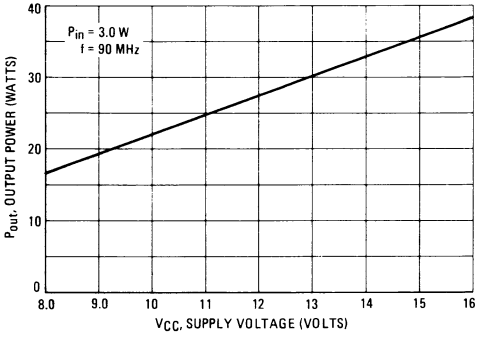
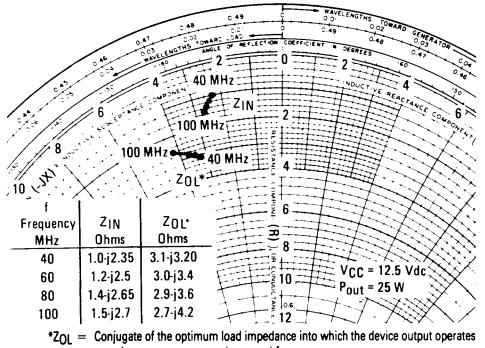


FIGURE 5 – SERIES EQUIVALENT IMPEDANCE



f Frequency MHz	ZIN Ohms	ZOL* Ohms
40	1.0-j2.35	3.1-j3.20
60	1.2-j2.5	3.0-j3.4
80	1.4-j2.65	2.9-j3.6
100	1.5-j2.7	2.7-j4.2

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

3

FIGURE 6 – PARALLEL EQUIVALENT INPUT RESISTANCE versus FREQUENCY

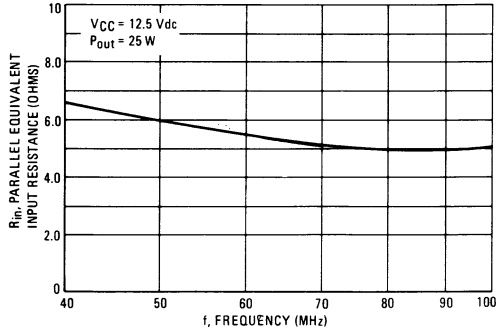


FIGURE 7 – PARALLEL EQUIVALENT INPUT CAPACITANCE versus FREQUENCY

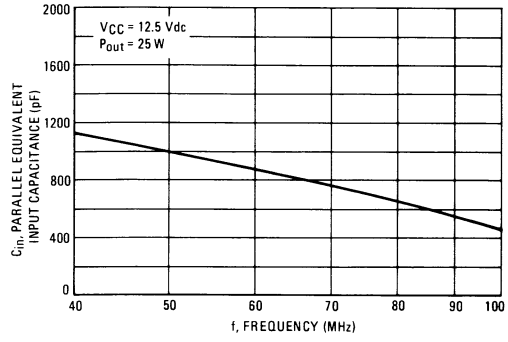


FIGURE 8 – PARALLEL EQUIVALENT OUTPUT RESISTANCE versus FREQUENCY

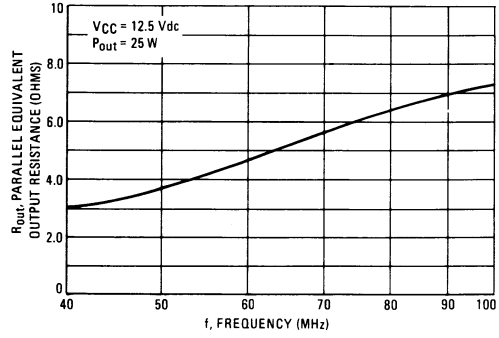
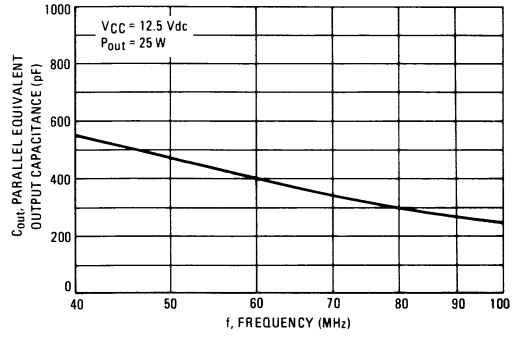


FIGURE 9 – PARALLEL EQUIVALENT OUTPUT CAPACITANCE versus FREQUENCY



MRF237

The RF Line

NPN SILICON RF POWER TRANSISTOR

. . . designed for 12.5 Volt large-signal power amplifier applications in communication equipment operating to 225 MHz.

- Specified 12.5 Volt, 175 MHz Characteristics —
  Output Power = 4.0 Watts
  Minimum Gain = 12 dB
  Efficiency = 50%
- Characterized With Series Equivalent Large-Signal Impedance Parameters
- Grounded Emitter TO-39 Package for High Gain and Excellent Heat Dissipation
- Replaces Medium Power Stud Mount Devices

4 W — 175 MHz
RF POWER TRANSISTOR
NPN SILICON

MAXIMUM RATINGS

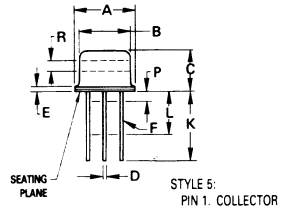
Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CEO}	18	Vdc
Collector-Base Voltage	V_{CBO}	36	Vdc
Emitter-Base Voltage	V_{EBO}	4.0	Vdc
Collector Current — Continuous	I_C	1.0	Adc
Total Power Dissipation @ $T_C = 25^oC$ Derate above 25^oC	P_D	8.0 45.7	Watts mW/^oC
Storage Temperature Range	T_{stg}	-65 to +200	^oC

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	22	$^oC/W$

ELECTRICAL CHARACTERISTICS ($T_C = 25^oC$ unless otherwise noted.)

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Collector-Emitter Breakdown Voltage (I_C = 10 mAdc, I_B = 0)	$V_{(BR)CEO}$	18	–	–	Vdc
Collector-Emitter Breakdown Voltage (I_C = 5.0 mAdc, V_{BE} = 0)	$V_{(BR)CES}$	36	–	–	Vdc
Emitter-Base Breakdown Voltage (I_E = 1.0 mAdc, I_C = 0)	$V_{(BR)EBO}$	4.0	–	–	Vdc
Collector Cutoff Current (V_{CB} = 15 Vdc, I_E = 0)	I_{CBO}	–	–	0.25	mAdc
ON CHARACTERISTICS					
DC Current Gain (I_C = 250 mAdc, V_{CE} = 5.0 Vdc)	h_{FE}	5.0	–	–	–
DYNAMIC CHARACTERISTICS					
Output Capacitance (V_{CB} = 15 Vdc, I_E = 0, f = 0.1 MHz)	C_{ob}	–	15	20	pF
FUNCTIONAL TESTS					
Common-Emitter Amplifier Power Gain (P_{out} = 4.0 W, V_{CC} = 12.5 Vdc, f = 175 MHz)	G_{PE}	12	14	–	dB
Collector Efficiency (P_{out} = 4.0 W, V_{CC} = 12.5 Vdc, f = 175 MHz)	η	50	62	–	%

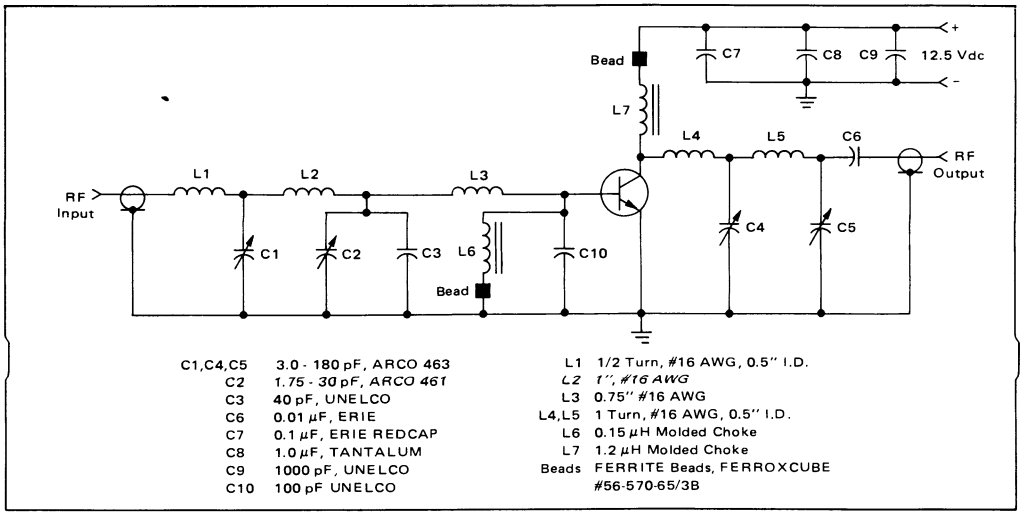


NOTE:
1. ALL RULES AND NOTES ASSOCIATED WITH TO-39 OUTLINE SHALL APPLY.

DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	9.02	9.30	0.355	0.366
B	8.00	8.51	0.315	0.335
C	4.19	.57	0.165	0.180
D	0.43	0.53	0.017	0.021
E	0.43	0.89	0.017	0.035
F	0.41	0.48	0.016	0.019
G	4.83	5.33	0.190	0.210
H	0.71	0.86	0.028	0.034
J	0.74	1.02	0.029	0.040
K	12.70	—	0.500	—
M	45°NOM		45°NOM	
N	2.54 TYP		0.100 TYP	
Q	90° NOM		90° NOM	

CASE 79-03

FIGURE 1 – 175 MHz TEST CIRCUIT SCHEMATIC



C1,C4,C5	3.0 - 180 pF, ARCO 463	L1	1/2 Turn, #16 AWG, 0.5" I.D.
C2	1.75 - 30 pF, ARCO 461	L2	1", #16 AWG
C3	40 pF, UNELCO	L3	0.75" #16 AWG
C6	0.01 μF, ERIE	L4,L5	1 Turn, #16 AWG, 0.5" I.D.
C7	0.1 μF, ERIE REDCAP	L6	0.15 μH Molded Choke
C8	1.0 μF, TANTALUM	L7	1.2 μH Molded Choke
C9	1000 pF, UNELCO	Beads	FERRITE Beads, FERROXCUBE
C10	100 pF UNELCO		#56-570-65/3B

FIGURE 2 – OUTPUT POWER versus INPUT POWER

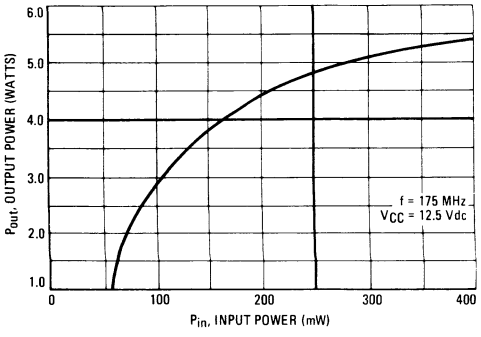


FIGURE 3 – OUTPUT POWER versus FREQUENCY

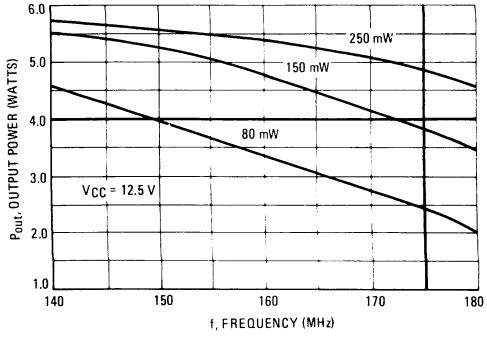


FIGURE 4 – OUTPUT POWER versus SUPPLY VOLTAGE

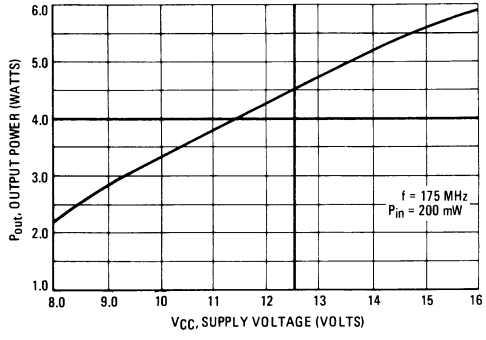
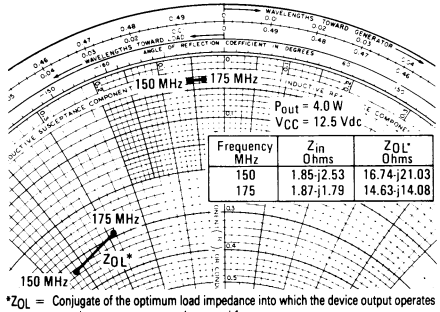


FIGURE 5 – SERIES EQUIVALENT IMPEDANCE



Frequency MHz	Z_{in} Ohms	Z_{OL}^* Ohms
150	1.85-j2.53	16.74-j21.03
175	1.87-j1.79	14.63-j14.08

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