MRF321

The RF Line

10 W – 400 MHz

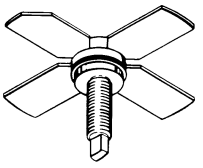
RF POWER
TRANSISTOR

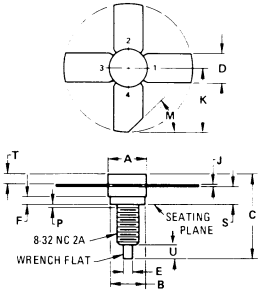
NPN SILICON

NPN SILICON RF POWER TRANSISTOR

. . . designed primarily for wideband large-signal driver and predriver amplifier stages in the 200–500 MHz frequency range.

- Guaranteed Performance at 400 MHz and 28 Vdc
  Output Power = 10 Watts
  Minimum Gain = 12 dB
  Efficiency = 50%
- 100% Tested for Load Mismatch at All Phase Angles with 30:1 VSWR
- Gold Metallization System for High Reliability
- Computer-Controlled Wirebonding Gives Consistent Input Impedance





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

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	7.06	7.26	0.278	0.286
B	6.20	6.50	0.244	0.256
C	14.99	16.51	0.590	0.650
D	5.46	5.97	0.215	0.235
E	1.40	1.65	0.055	0.065
F	1.52	–	0.060	–
J	0.08	0.18	0.003	0.007
K	11.05	–	0.435	–
M	45° NOM		45° NOM	
P	–	1.27	–	0.050
S	3.00	3.25	0.118	0.128
T	1.40	1.78	0.055	0.070
U	2.92	3.68	0.115	0.145

CASE 244-04

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CEO}	33	Vdc
Collector-Base Voltage	V_{CBO}	60	Vdc
Emitter-Base Voltage	V_{EBO}	4.0	Vdc
Collector Current — Continuous — Peak	I_C	1.1 1.5	Adc
Total Device Dissipation @ $T_A = 25^oC$ (1) Derate above 25^oC	P_D	27 160	Watts $mW/^oC$
Storage Temperature Range	T_{stg}	−65 to +150	^oC

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

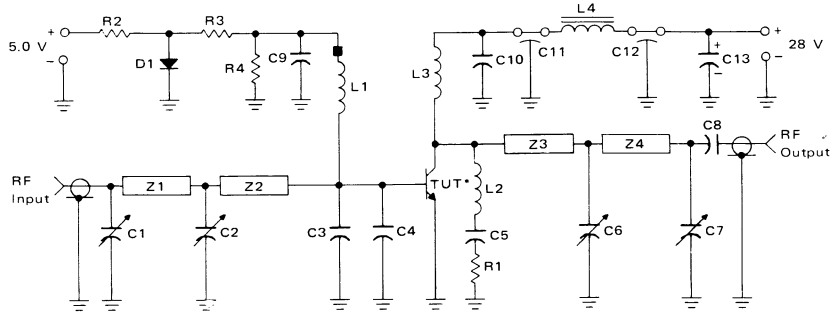
THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	6.4	$^oC/W$

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

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Collector-Emitter Breakdown Voltage (I_C = 20 mAdc, I_B = 0)	$V_{(BR)CEO}$	33	–	–	Vdc
Collector-Emitter Breakdown Voltage (I_C = 20 mAdc, V_{BE} = 0)	$V_{(BR)CES}$	60	–	–	Vdc
Collector-Base Breakdown Voltage (I_C = 20 mAdc, I_E = 0)	$V_{(BR)CBO}$	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}	–	–	1.0	mAdc
ON CHARACTERISTICS					
DC Current Gain (I_C = 500 mA, V_{CE} = 5.0 Vdc)	h_{FE}	20	–	80	–
DYNAMIC CHARACTERISTICS					
Output Capacitance (V_{CB} = 28 Vdc, I_E = 0, f = 1.0 MHz)	C_{ob}	–	10	12	pF
FUNCTIONAL TESTS (FIGURE 1)					
Common-Emitter Amplifier Power Gain (V_{CC} = 28 Vdc, P_{out} = 10 W, f = 400 MHz)	G_{PE}	12	13	–	dB
Collector Efficiency (V_{CC} = 28 Vdc, P_{out} = 10 W, f = 400 MHz)	η	50	60	–	%
Load Mismatch (V_{CC} = 28 Vdc, P_{out} = 10, f = 400 MHz, VSWR = 30:1 all phase angles)	ψ	No Degradation in Output Power			

FIGURE 1 – 400 MHz TEST CIRCUIT



C1, C2, C3 – 1.0–20 pF Johanson Trimmer (JMC 5501)
C3, C4 – 47 pF ATC Chip Capacitor
C5, C10 – 0.1 μF Erie Redcap
C7 – 0.5–10 pF Johanson Trimmer (JMC 5201)
C8 – 0.018 μF Vitramon Chip Capacitor
C9 – 200 pF UNELCO Capacitor
C11, C12 – 680 pF Feedthru
C13 – 1 μF, 50 Volt Tantalum Capacitor

R1 – 5.1 Ω, 1/4 Watt
R2 – 120 Ω, 1 Watt
R3 – 20 Ω, 1/2 Watt
R4 – 47 Ω, 1/2 Watt

L1 – 0.33 μH Molded Choke with Ferroxcube Bead (Ferroxcube 56-590-65/4B) on Ground End of Coil
L2 – 4 Turns #20 Enamel, 1/8" ID
L3 – 6 Turns #20 Enamel, 1/4" ID
L4 – Ferroxcube VK200-19/4B

Z1 – Microstrip 0.1" W x 1.35" L
Z2 – Microstrip 0.1" W x 0.55" L
Z3 – Microstrip 0.1" W x 0.8" L
Z4 – Microstrip 0.1" W x 1.75" L

D1 – 1N4001

Board – Glass Teflon, ϵ_R = 2.56, t = 0.062"

Input/Output Connectors – Type N

*Transistor Under Test

FIGURE 2 – OUTPUT POWER versus FREQUENCY

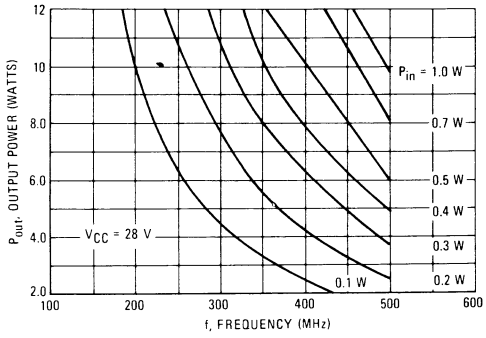


FIGURE 3 – OUTPUT POWER versus INPUT POWER

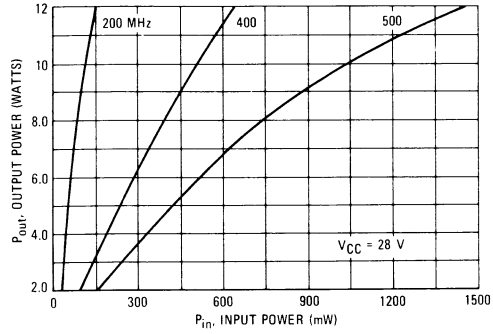


FIGURE 4 – OUTPUT POWER versus SUPPLY VOLTAGE

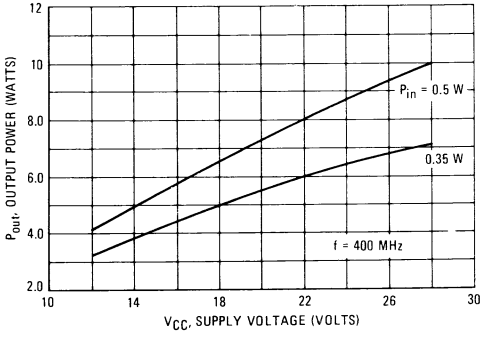


FIGURE 5 – POWER GAIN versus FREQUENCY

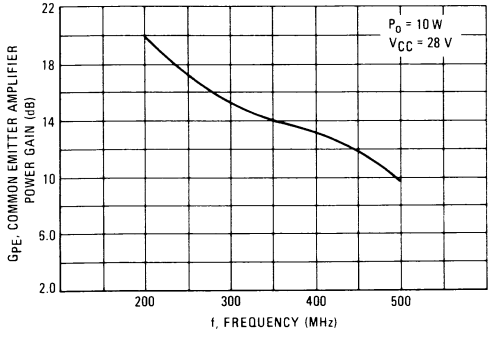


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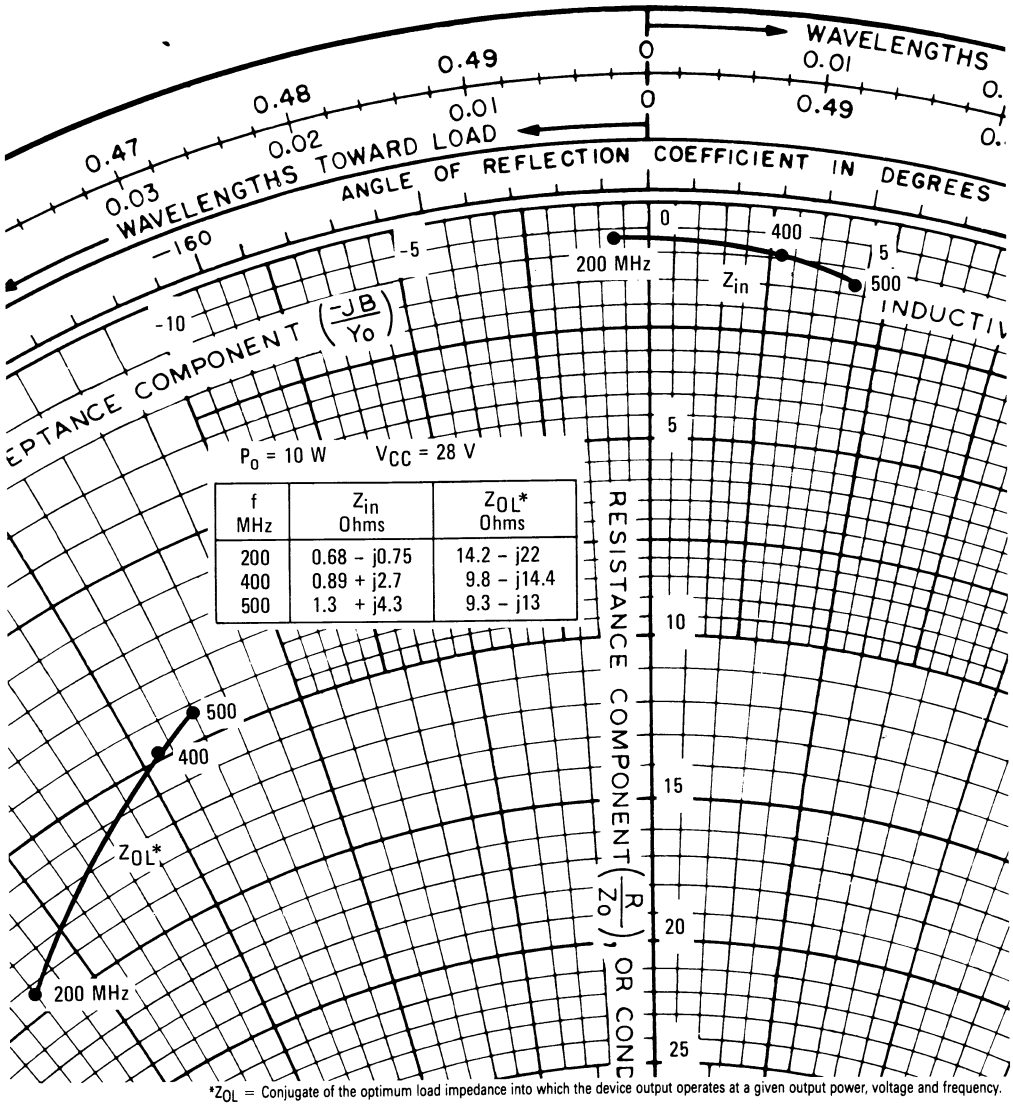
FIGURE 6 – SERIES EQUIVALENT IMPEDANCE



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

MRF323

The RF Line

20 W – 400 MHz

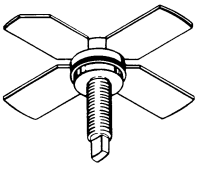
RF POWER TRANSISTOR

NPN SILICON

NPN SILICON RF POWER TRANSISTOR

. . . designed primarily for wideband large-signal driver and predriver amplifier stages in the 200-500 MHz frequency range.

- Guaranteed Performance at 400 MHz and 28 V
  Output Power = 20 Watts
  Minimum Gain = 10 dB
  Efficiency = 50%
- 100% Tested for Load Mismatch at all Phase Angles with 30:1 VSWR
- Gold Metallization System for High Reliability
- Computer-Controlled Wirebonding Gives Consistent Input Impedance



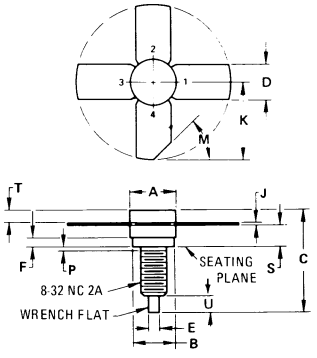
MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CEO}	33	Vdc
Collector-Base Voltage	V_{CBO}	60	Vdc
Emitter-Base Voltage	V_{EBO}	4.0	Vdc
Collector Current — Continuous — Peak	I_C	2.2 3.0	Adc
Total Device Dissipation @ $T_C = 25^oC$ (1) Derate above 25^oC	P_D	55 310	Watts mW/^{o}C
Storage Temperature Range	T_{stg}	−65 to +150	^{o}C

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

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	3.2	^{o}C/W



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

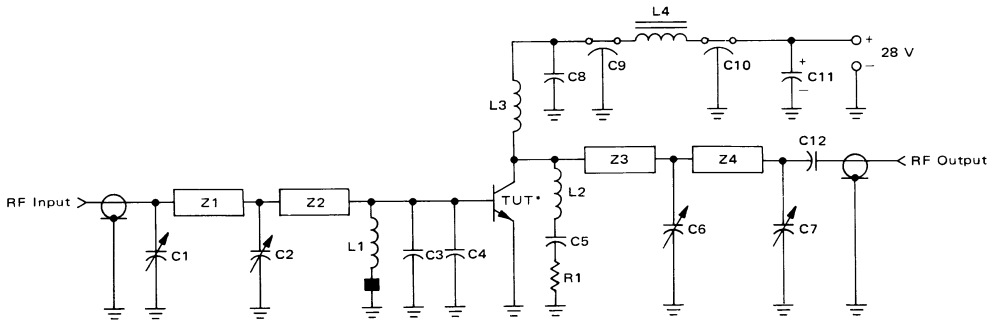
DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	7.06	7.26	0.278	0.286
B	6.20	6.50	0.244	0.256
C	14.99	16.51	0.590	0.650
D	5.46	5.97	0.215	0.235
E	1.40	1.65	0.055	0.065
F	1.52	–	0.060	–
J	0.08	0.18	0.003	0.007
K	11.05	–	0.435	–
M	45° NOM		45° NOM	
P	–	1.27	–	0.050
S	3.00	3.25	0.118	0.128
T	1.40	1.78	0.055	0.070
U	2.92	3.68	0.115	0.145

CASE 244-04

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

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Collector-Emitter Breakdown Voltage (I_C = 20 mAdc, I_B = 0)	$V_{(BR)CEO}$	33	–	–	Vdc
Collector-Emitter Breakdown Voltage (I_C = 20 mAdc, V_{BE} = 0)	$V_{(BR)CES}$	60	–	–	Vdc
Collector-Base Breakdown Voltage (I_C = 20 mAdc, I_E = 0)	$V_{(BR)CBO}$	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 = 1.0 Adc, V_{CE} = 5.0 Vdc)	h_{FE}	20	–	80	–
DYNAMIC CHARACTERISTICS					
Output Capacitance (V_{CB} = 28 Vdc, I_E = 0, f = 1.0 MHz)	C_{ob}	–	20	24	pF
FUNCTIONAL TESTS (Figure 1)					
Common-Emitter Amplifier Power Gain (V_{CC} = 28 Vdc, P_{out} = 20 W, f = 400 MHz)	G_{PE}	10	11	–	dB
Collector Efficiency (V_{CC} = 28 Vdc, P_{out} = 20 W, f = 400 MHz)	η	50	60	–	%
Load Mismatch (V_{CC} = 28 V, P_{out} = 20 W, f = 400 MHz, VSWR = 30:1 all phase angles)	ψ	No Degradation in Output Power			

FIGURE 1 – 400 MHz TEST CIRCUIT



C1, C2, C6 – 1.0-20 pF Johanson Trimmer (JMC 5501)
C3, C4 – 47 pF ATC Chip Capacitor
C5, C8 – 0.1 μF Erie Redcap
C7 – 0.5-10 pF Johanson Trimmer (JMC 5201)
C9, C10 – 680 pF Feedthru
C11 – 1.0 μF 50 Volt Tantalum
C12 – 0.018 μF Vitramon Chip Capacitor
R1 – 5.1 Ω 1/4 Watt
L1 – 0.33 μH Molded Choke with Ferroxcube Bead (Ferroxcube 56-590-65/4B) on Ground End

L2 – 6 Turns #20 Enamel, ¼" ID, Closewound
L3 – 4 Turns #20 Enamel, 1/8" ID, Closewound
L4 – Ferroxcube VK200 – 19/4B
Z1 – Microstrip 0.1" W x 1.35" L
Z2 – Microstrip 0.1" W x 0.55" L
Z3 – Microstrip 0.1" W x 0.8" L
Z4 – Microstrip 0.1" W x 1.75" L
Board – Glass Teflon ϵ_R = 2.56 t = 0.062"
Input/Output Connectors – Type N
*Transistor Under Test

FIGURE 2 – OUTPUT POWER versus FREQUENCY

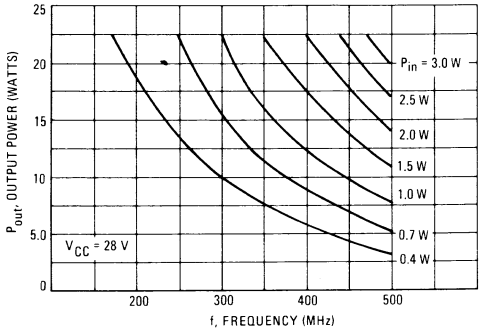


FIGURE 3 – OUTPUT POWER versus INPUT POWER

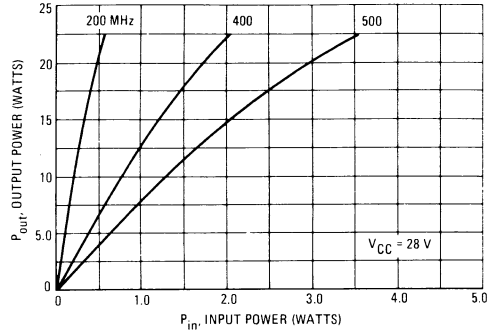


FIGURE 4 – OUTPUT POWER versus SUPPLY VOLTAGE

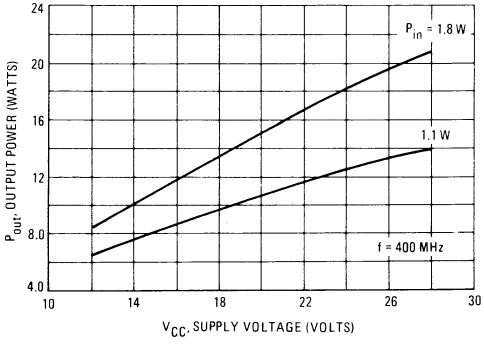


FIGURE 5 – POWER GAIN versus FREQUENCY

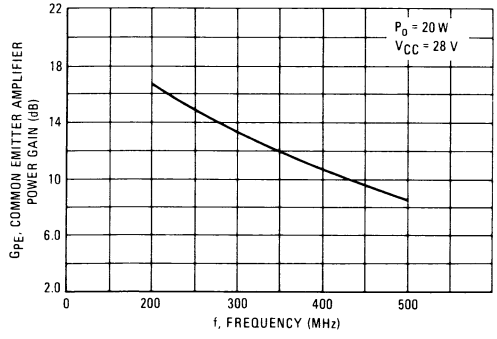


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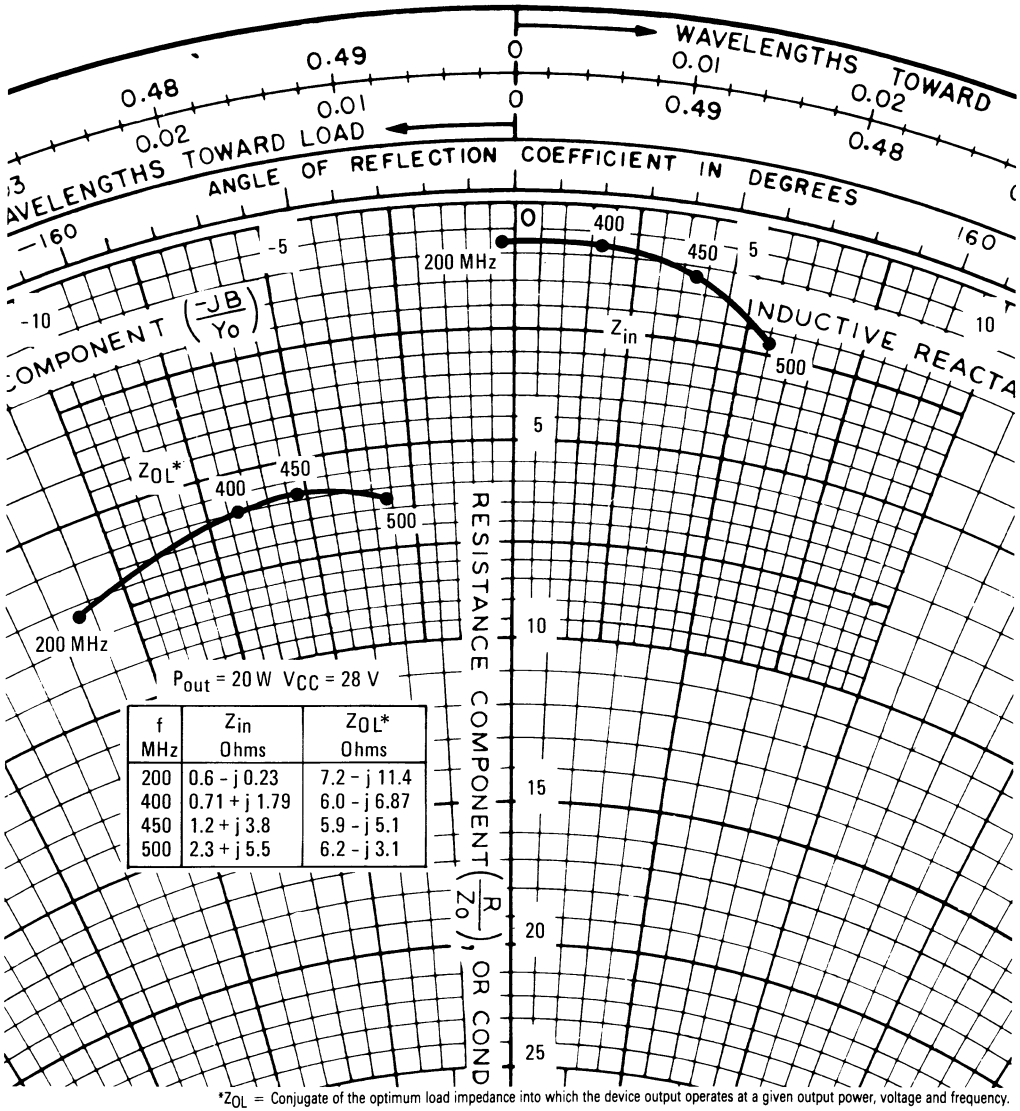
FIGURE 6 – SERIES EQUIVALENT IMPEDANCE



f MHz	Z_{in} Ohms	Z_{OL}* Ohms
200	0.6 - j 0.23	7.2 - j 11.4
400	0.71 + j 1.79	6.0 - j 6.87
450	1.2 + j 3.8	5.9 - j 5.1
500	2.3 + j 5.5	6.2 - j 3.1

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

MRF325

The RF Line

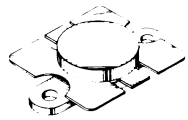
30 W – 225-400 MHz
CONTROLLED "Q"
BROADBAND RF POWER
TRANSISTOR

NPN SILICON

NPN SILICON RF POWER TRANSISTOR

. . . designed primarily for wideband large-signal output and driver amplifier stages in the 100-500 MHz frequency range.

- Specified 28 Volt, 400 MHz Characteristics –
  Output Power = 30 Watts
  Minimum Gain = 8.5 dB
  Efficiency = 54% (Min)
- Built-In Matching Network for Broadband Operation Using Internal Matching Techniques
- 100% Tested for Load Mismatch at all Phase Angles with 30:1 VSWR
- Gold Metallization for High Reliability Applications



3

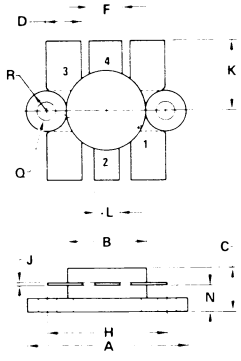
MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CEO}	33	Vdc
Collector-Base Voltage	V_{CBO}	60	Vdc
Emitter-Base Voltage	V_{EBO}	4.0	Vdc
Collector Current — Continuous — Peak	I_C	3.4 4.5	Adc
Total Device Dissipation @ T_C = 25°C (1) Derate above 25°C	P_D	82 0.47	Watts W/°C
Storage Temperature Range	T_{stg}	−65 to +150	°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	2.13	°C/W

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



STYLE 1:
PIN 1. EMITTER
2. COLLECTOR
3. EMITTER
4. BASE
FLANGE-ISOLATED

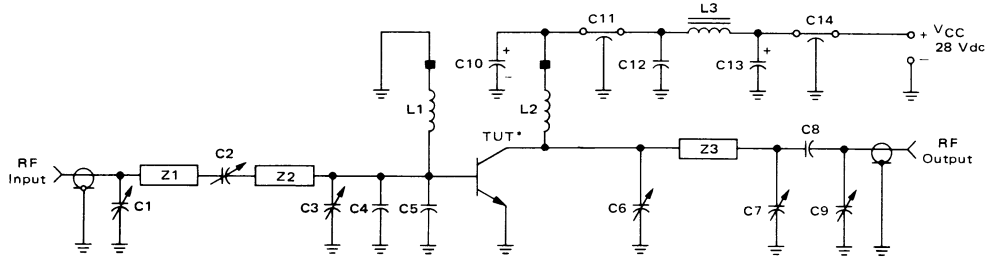
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	24.38	25.15	0.960	0.990
B	12.45	12.95	0.490	0.510
C	5.97	7.62	0.235	0.300
D	5.33	5.59	0.210	0.220
F	5.08	5.33	0.200	0.210
H	18.29	18.54	0.720	0.730
J	0.10	0.15	0.004	0.006
K	10.29	–	0.405	–
L	3.81	4.06	0.150	0.160
N	3.81	4.32	0.150	0.170
Q	2.92	3.30	0.115	0.130
R	3.05	3.30	0.120	0.130

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 = 30 mAdc, I_B = 0)	$V_{(BR)CEO}$	33	–	–	Vdc
Collector-Emitter Breakdown Voltage (I_C = 30 mAdc, V_{BE} = 0)	$V_{(BR)CES}$	60	–	–	Vdc
Emitter-Base Breakdown Voltage (I_E = 3.0 mAdc, I_C = 0)	$V_{(BR)EBO}$	4.0	–	–	Vdc
Collector-Base Breakdown Voltage (I_C = 30 mAdc, I_E = 0)	$V_{(BR)CBO}$	60	–	–	Vdc
Collector Cutoff Current (V_{CB} = 30 Vdc, I_E = 0)	I_{CBO}	–	–	3.0	mAdc
ON CHARACTERISTICS					
DC Current Gain (I_C = 1.5 Adc, V_{CE} = 5.0 Vdc)	h_{FE}	20	–	80	–
DYNAMIC CHARACTERISTICS					
Output Capacitance (V_{CB} = 28 Vdc, I_E = 0, f = 1.0 MHz)	C_{ob}	–	30	40	pF
FUNCTIONAL TESTS (Figure 1)					
Common-Emitter Amplifier Power Gain (V_{CC} = 28 Vdc, P_{out} = 30 W, f = 400 MHz)	G_{PE}	8.5	9.5	–	dB
Collector Efficiency (V_{CC} = 28 Vdc, P_{out} = 30 W, f = 400 MHz)	η	50	60	–	%
Load Mismatch (V_{CC} = 28 Vdc, P_{out} = 30 W, f = 400 MHz, VSWR = 30:1 all angles)	ψ	No Degradation in Output Power			

FIGURE 1 – 400 MHz TEST CIRCUIT



C1, C9 – 1.0–10 pF Johanson Capacitor (JMC 5201)
C2, C3, C6, C7 – 1.0–20 pF Johanson Capacitor (JMC 5501)
C4, C5 – 36 pF ATC 100-mil Chip Capacitor
C8 – 100 pF UNELCO
C10, C13 – 1.0 μF 50 V Tantalum
C11, C14 – 680 pF Feedthru
C12 – 0.1 μF Erie Redcap
L1 – 8 Turns #26 AWG Enameled, 1/16" ID Closewound with Ferroxcube Bead (#56-590-65/4B) on Ground End
L2 – 14 Turns, #22 AWG Enameled, Closewound on a 470 Ω, 2 Watt Resistor with Ferroxcube Bead (#56-590-65/4B) on Cold End of L2
L3 – Ferroxcube VK200-19/4B Ferrite Choke
Z1 – Microstrip 0.19" W x 0.88" L
Z2 – Microstrip 0.28" W x 1.0" L
Z3 – Microstrip 0.31" W x 1.25" L
Board – Glass Teflon $\in$R = 2.56, t = 0.062"
Input/Output Connectors – Type N

TUT Socket Lead Frame Etched from 80-mil-Thick Copper
*Transistor Under Test

FIGURE 2 – OUTPUT POWER versus INPUT POWER

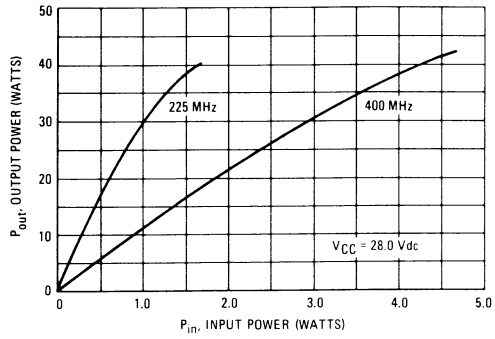


FIGURE 3 – OUTPUT POWER versus SUPPLY VOLTAGE – 225 MHz

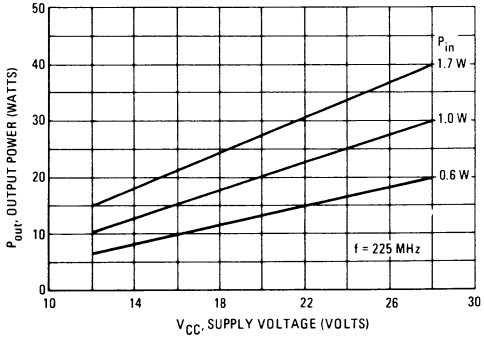


FIGURE 4 – OUTPUT POWER versus SUPPLY VOLTAGE – 400 MHz

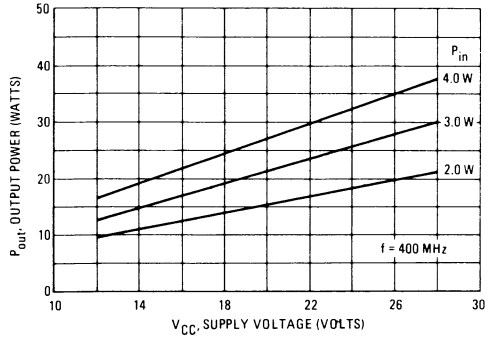
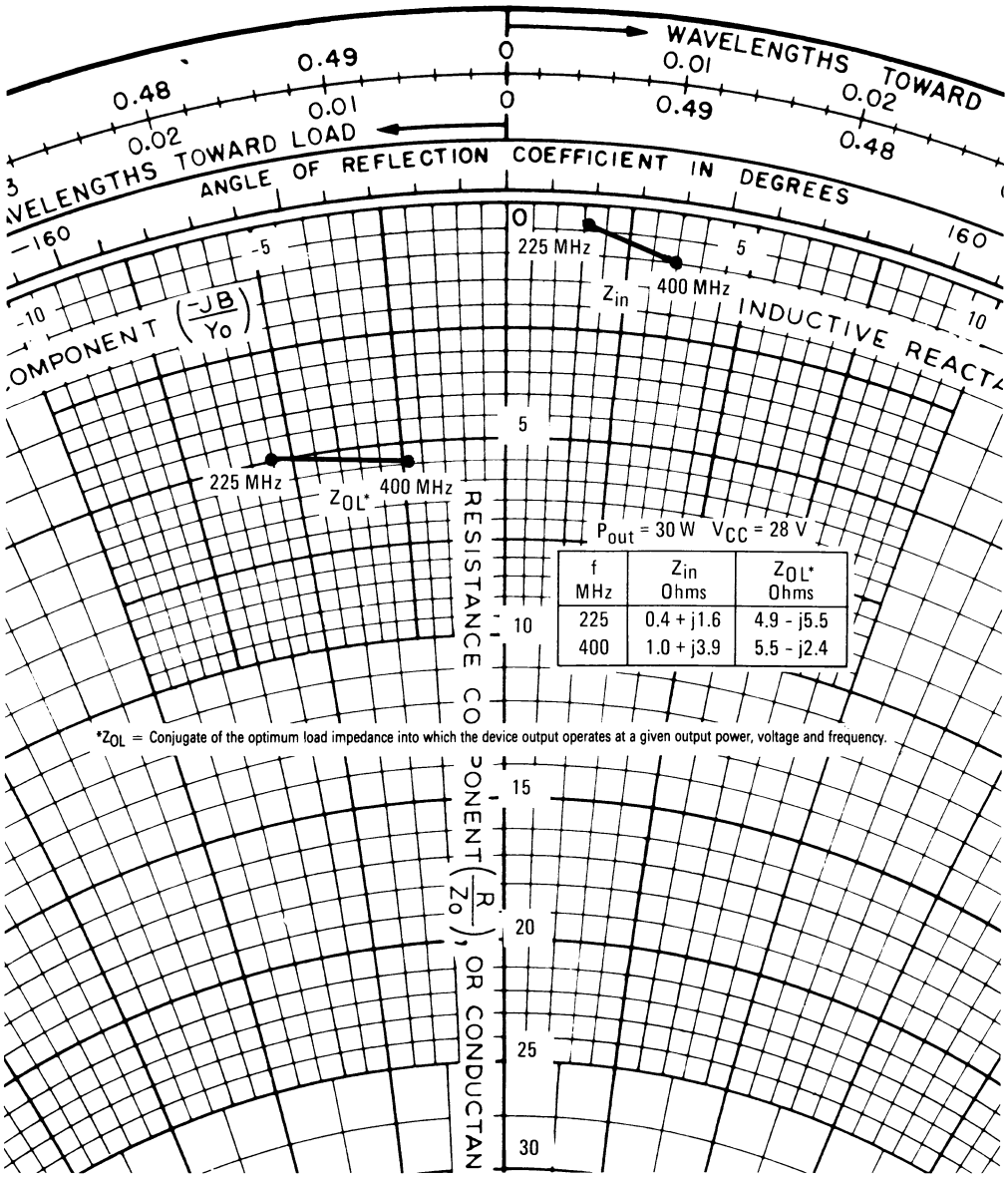


FIGURE 5 – SERIES EQUIVALENT IMPEDANCE



f MHz	Zin Ohms	ZOL* Ohms
225	0.4 + j1.6	4.9 - j5.5
400	1.0 + j3.9	5.5 - j2.4

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

3

MRF326

The RF Line

40 W – 225–400 MHz

CONTROLLED "Q"
BROADBAND RF POWER
TRANSISTOR

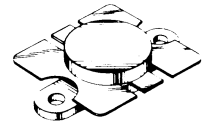
NPN SILICON

NPN SILICON RF POWER TRANSISTOR

. . . designed primarily for wideband large-signal output amplifier stages in the 100-500 MHz frequency range.

- Guaranteed Performance @ 400 MHz, 28 Vdc

  Output Power = 40 Watts
  Minimum Gain = 9.0 dB
- Built-In Matching Network for Broadband Operation
- 100% Tested for Load Mismatch at all Phase Angles with 30:1 VSWR
- Gold Metallization System for High Reliability Applications



3

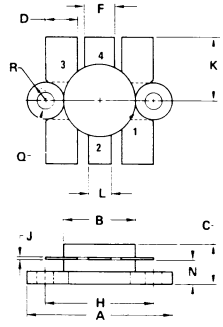
MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CEO}	33	Vdc
Collector-Base Voltage	V_{CBO}	60	Vdc
Emitter-Base Voltage	V_{EBO}	4.0	Vdc
Collector Current — Continuous Peak	I_C	4.5 6.0	Adc
Total Device Dissipation @ T_C = 25°C (1) Derate above 25°C	P_D	110 0.63	Watts W/°C
Storage Temperature Range	T_{stg}	−65 to +150	°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	1.6	°C/W

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



STYLE 1:
PIN 1. EMITTER
2. COLLECTOR
3. EMITTER
4. BASE
FLANGE-ISOLATED

DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	24.38	25.15	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	5.59	0.210	0.220
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	–	0.405	–
L	3.81	4.06	0.150	0.160
N	3.81	4.32	0.150	0.170
Q	2.92	3.30	0.115	0.130
R	3.05	3.30	0.120	0.130

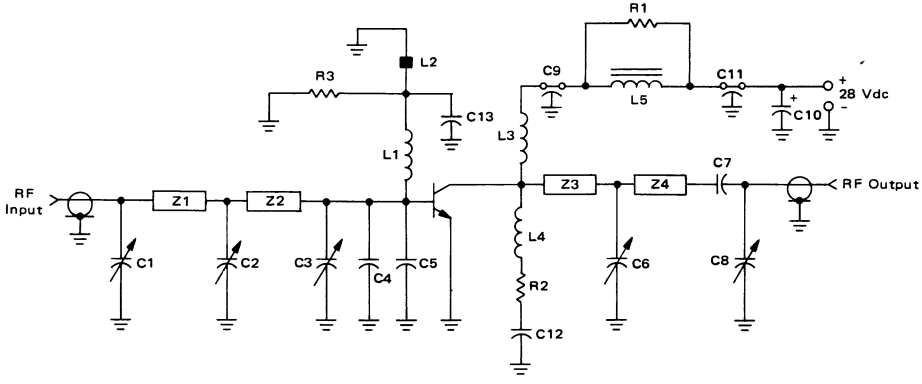
CASE 316-01

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

Characteristics	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Collector-Emitter Breakdown Voltage (I_C = 40 mAdc, I_B = 0)	$V_{(BR)CEO}$	33	–	–	Vdc
Collector-Emitter Breakdown Voltage (I_C = 40 mAdc, V_{BE} = 0)	$V_{(BR)CES}$	60	–	–	Vdc
Emitter-Base Breakdown Voltage (I_E = 4.0 mAdc, I_C = 0)	$V_{(BR)EBO}$	4.0	–	–	Vdc
Collector-Base Breakdown Voltage (I_C = 40 mAdc, I_E = 0)	$V_{(BR)CBO}$	60	–	–	Vdc
Collector Cutoff Current (V_{CB} = 30 Vdc, I_E = 0)	I_{CBO}	–	–	4.0	mAdc
ON CHARACTERISTICS					
DC Current Gain (I_C = 2.0 Adc, V_{CE} = 5.0 Vdc)	h_{FE}	20	50	80	–
DYNAMIC CHARACTERISTICS					
Output Capacitance (V_{CB} = 28 Vdc, I_E = 0, f = 1.0 MHz)	C_{ob}	–	45	60	pF
FUNCTIONAL TESTS (Figure 1)					
Common-Emitter Amplifier Power Gain (V_{CC} = 28 Vdc, P_{out} = 40 W, f = 400 MHz, I_C Max = 2.85 Adc)	G_{PE}	9.0	11	–	dB
Collector Efficiency (V_{CC} = 28 Vdc, P_{out} = 40 W, f = 400 MHz, I_C Max = 2.85 Adc)	η	50	–	–	%
Load Mismatch (V_{CC} = 28 Vdc, P_{out} = 40 W CW, f = 400 MHz, VSWR = 30:1 all phase angles)	Ψ	No Degradation in Power Output			

3

FIGURE 1 – 400 MHz TEST AMPLIFIER



C1 – 1.0-10 pF Johanson, Capacitor (JMC 5201)
C2, C3, C6, C8 – 1.0-20 pF Johanson Capacitor
C4, C5 – 36 pF ATC "B" Style Chip Capacitor
C7, C9, C13 – 100 pF UNELCO Capacitor
C11 – 680 pF Feedthru
C10 – 1.0 μF 50 V Tantalum
C12 – 0.1 μF Erie Redcap
L1 – 8 Turns #26 AWG Enameled, 1/16" ID Closewound
L2, L5 – Ferroxcube VK200-19/4B Ferrite Choke
L3 – 8 Turns #20 AWG Enameled, 1/4" ID Closewound
L4 – 4 Turns #26 AWG 0.1" ID
R1 – 10 Ohm 2.0 W Carbon
R2, R3 – 10 Ohm 1.0 W Carbon
Z1 – Microstrip 0.19" W x 1.28" L
Z2 – Microstrip 0.28" W x 1.0" L
Z3 – Microstrip 0.31" W x 1.0" L
Z4 – Microstrip 0.31" W x 0.9" L
Board – Glass Teflon ϵ_R = 2.56 t = 0.062"
Input/Output Connectors – Type N UG58 A/U

FIGURE 2 – OUTPUT POWER versus INPUT POWER

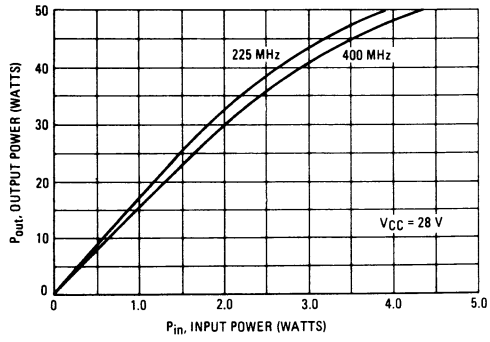


FIGURE 3 – OUTPUT POWER versus SUPPLY VOLTAGE
f = 225 MHz

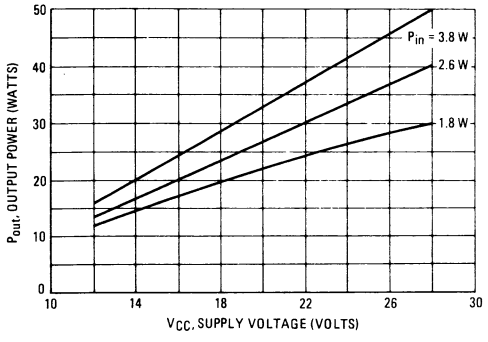


FIGURE 4 – OUTPUT POWER versus SUPPLY VOLTAGE
f = 400 MHz

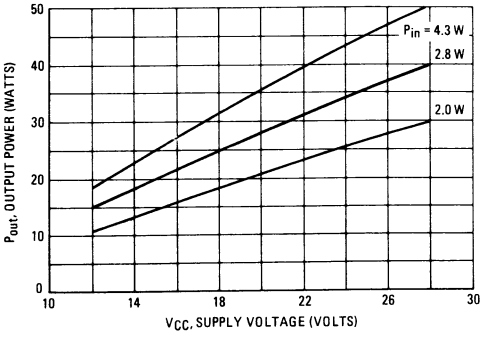


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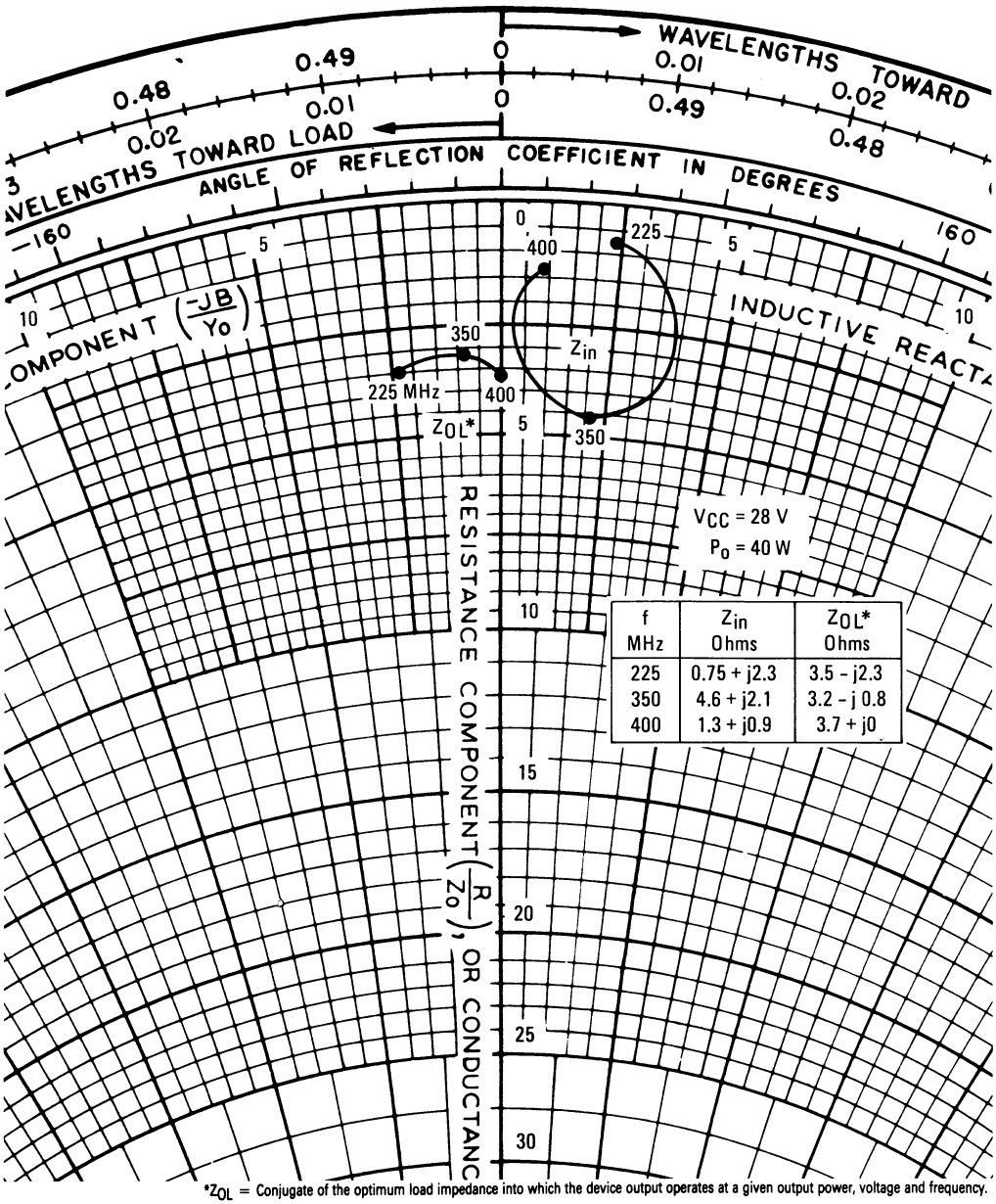
FIGURE 5 – SERIES EQUIVALENT INPUT-OUTPUT IMPEDANCE



f MHz	Zin Ohms	ZOL* Ohms
225	0.75 + j2.3	3.5 - j2.3
350	4.6 + j2.1	3.2 - j 0.8
400	1.3 + j0.9	3.7 + j0

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

3

MRF327

The RF Line

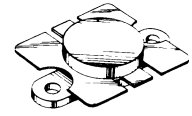
80 W — 100-500 MHz

CONTROLLED "Q"
BROADBAND RF POWER
TRANSISTOR
NPN SILICON

NPN SILICON RF POWER TRANSISTOR

. . . designed primarily for wideband large-signal output amplifier stages in the 100-500 MHz frequency range.

- Guaranteed Performance @ 400 MHz, 28 Vdc
  Output Power = 80 Watts over 225–400 MHz Band
  Minimum Gain = 7.3 dB @ 400 MHz
- Built-in Matching Network for Broadband Operation Using Double Match Technique
- 100% Tested for Load Mismatch at all Phase Angles with 30:1 VSWR
- Gold Metallization System for High Reliability Applications
- Characterized for 100–500 MHz



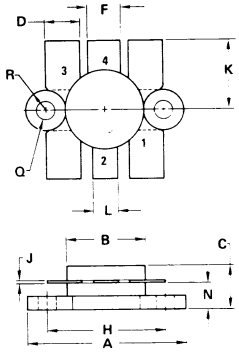
MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CEO}	33	Vdc
Collector-Base Voltage	V_{CBO}	60	Vdc
Emitter-Base Voltage	V_{EBO}	4.0	Vdc
Collector Current — Continuous — Peak	I_C	9.0 12.0	Adc
Total Device Dissipation @ T_C = 25°C (1) Derate above 25°C	P_D	250 1.43	Watts W/°C
Storage Temperature Range	T_{stg}	−65 to +150	°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	0.7	°C/W

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



STYLE 1:
PIN 1. EMITTER
2. COLLECTOR
3. EMITTER
4. BASE
FLANGE-ISOLATED

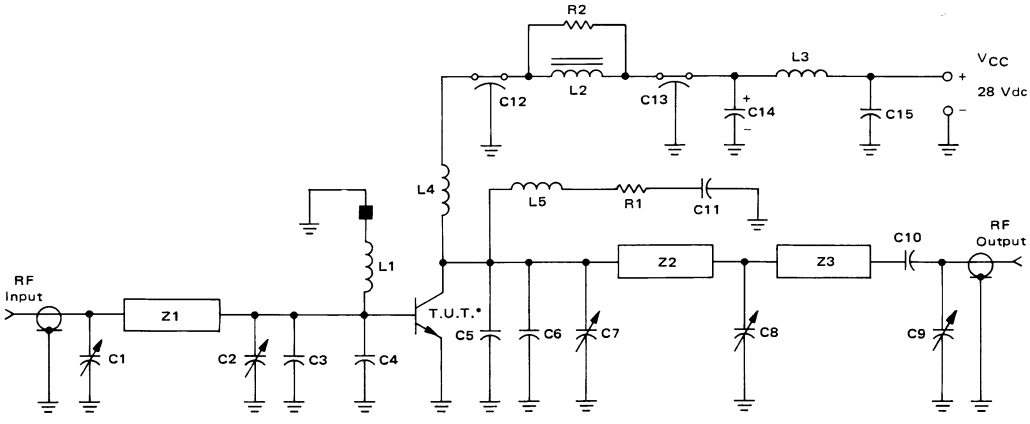
DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	24.38	25.15	0.960	0.990
B	12.45	12.95	0.490	0.510
C	5.97	7.62	0.235	0.300
D	5.33	5.59	0.210	0.220
F	5.08	5.33	0.200	0.210
H	18.29	18.54	0.720	0.730
J	0.10	0.15	0.004	0.006
K	10.29	–	0.405	–
L	3.81	4.06	0.150	0.160
N	3.81	4.32	0.150	0.170
Q	2.92	3.30	0.115	0.130
R	3.05	3.30	0.120	0.130

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 = 80 mAdc, I_B = 0)	$V_{(BR)CEO}$	33	–	–	Vdc
Collector-Emitter Breakdown Voltage (I_C = 80 mAdc, V_{BE} = 0)	$V_{(BR)CES}$	60	–	–	Vdc
Emitter-Base Breakdown Voltage (I_E = 8.0 mAdc, I_C = 0)	$V_{(BR)EBO}$	4.0	–	–	Vdc
Collector-Base Breakdown Voltage (I_C = 80 mAdc, I_C = 0)	$V_{(BR)CBO}$	60	–	–	Vdc
Collector Cutoff Current (V_{CB} = 30 Vdc, I_E = 0)	I_{CBO}	–	–	5.0	mAdc
ON CHARACTERISTICS					
DC Current Gain (I_C = 4.0 Adc, V_{CE} = 5.0 Vdc)	h_{FE}	20	–	80	–
DYNAMIC CHARACTERISTICS					
Output Capacitance (V_{CB} = 28 Vdc, I_E = 0, f = 1.0 MHz)	C_{ob}	–	100	145	pF
FUNCTIONAL TESTS (Figure 1)					
Common-Emitter Amplifier Power Gain (V_{CC} = 28 Vdc, P_{out} = 80 W, f = 400 MHz)	G_{PE}	7.3	9.0	–	dB
Collector Efficiency (V_{CC} = 28 Vdc, P_{out} = 80 W, f = 400 MHz)	η	50	60	–	%
Load Mismatch (V_{CC} = 28 V, P_{out} = 80 W, f = 400 MHz, VSWR 30:1 all phase angles)	ψ	No Degradation in Output Power			

FIGURE 1 – 400 MHz TEST CIRCUIT



C1, C2, C7, C8, C9 – 1.0-20 pF Piston Trimmer (Johanson JMC 5501)
C3, C4 – 36 pF ATC 100 mil Chip Capacitor
C5, C6 – 43 pF ATC 100-mil Chip Capacitor
C10 – 100 pF UNELCO
C11, C15 – 0.1 μF Erie Redcap
C12, C13 – 680 pF Feedthru
C14 – 1.0 μF 50 V Tantalum
L1 – 4 Turns #22 AWG Enameled, 3/16" ID Closewound with Ferroxcube Bead (#56-590-65/4B) on Ground End of Coil
L2 – Ferroxcube VK200-19/4B Ferrite Choke
L3 – 7 Turns #18 AWG, 11/16" Long, Wound on a 100 kΩ 2 Watt Resistor
L4 – 6 Turns #20 AWG Enameled, 3/16" ID Closewound
L5 – 4 Turns #22 AWG Enameled, 1/8" ID Closewound
Z1 – Microstrip 0.2" W x 1.5" L
Z2 – Microstrip 0.17" W x 1.16" L
Z3 – Microstrip 0.17" W x 0.63" L
R1, R2 – 10 Ω 2 Watt
Board – Glass Teflon ∈R = 2.56, t = 0.062"
Input/Output Connectors Type N
T.U.T. Socket Lead Frame Etched from 80 mil Thick Copper
*Transistor Under Test

3

FIGURE 2 – POWER GAIN versus FREQUENCY

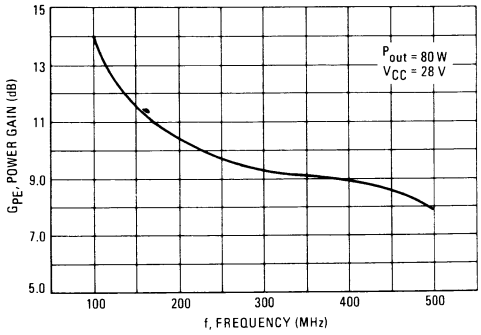


FIGURE 3 – OUTPUT POWER versus FREQUENCY

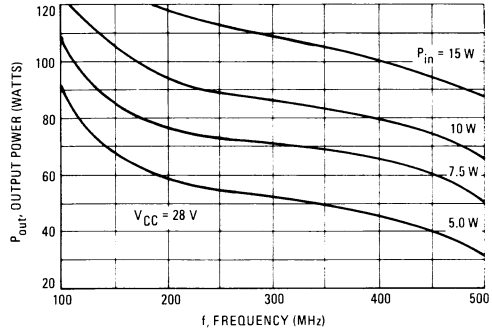


FIGURE 4 – OUTPUT POWER versus SUPPLY VOLTAGE
f = 225 MHz

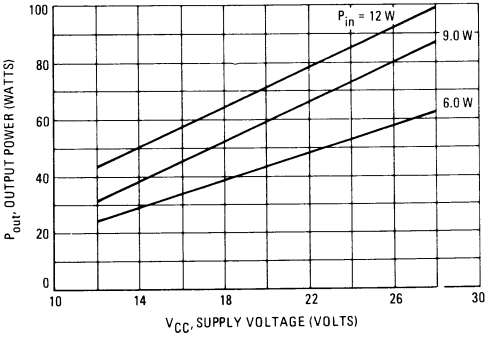


FIGURE 5 – OUTPUT POWER versus SUPPLY VOLTAGE
f = 400 MHz

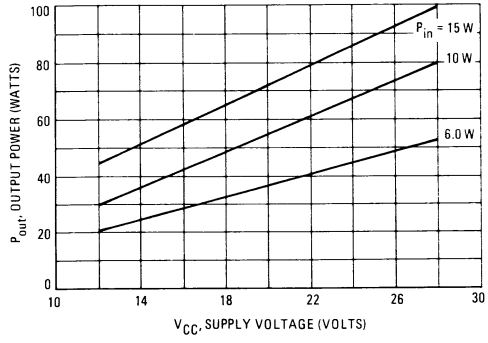


FIGURE 6 – OUTPUT POWER versus INPUT POWER

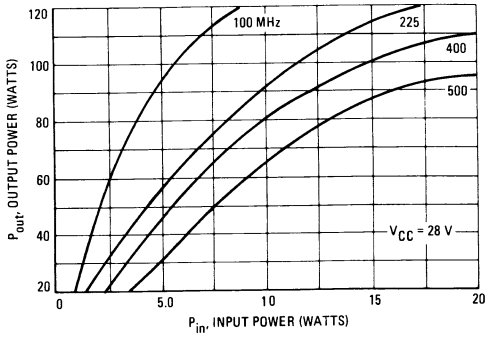
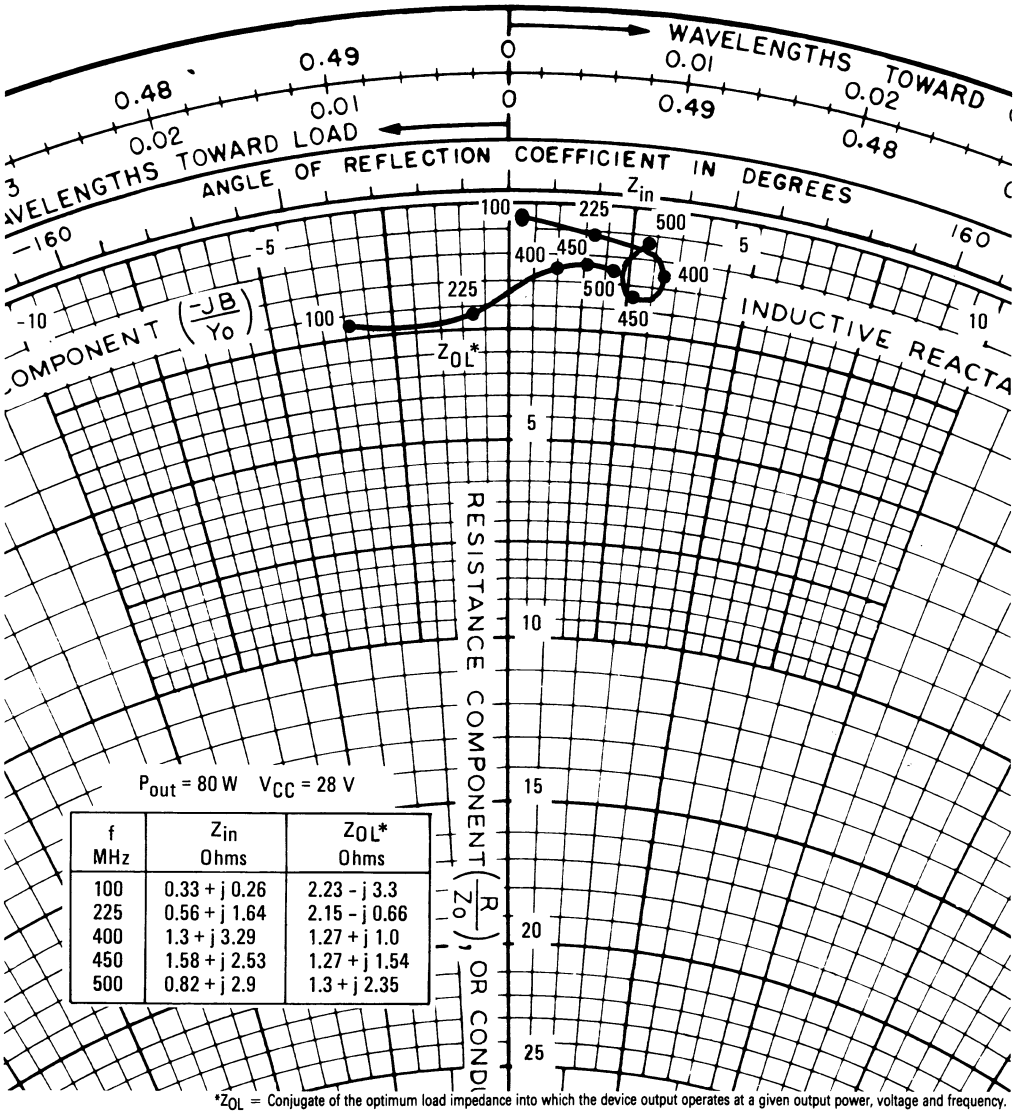


FIGURE 7 – SERIES EQUIVALENT INPUT-OUTPUT IMPEDANCE



f MHz	Z_{in} Ohms	Z_{OL}* Ohms
100	0.33 + j 0.26	2.23 - j 3.3
225	0.56 + j 1.64	2.15 - j 0.66
400	1.3 + j 3.29	1.27 + j 1.0
450	1.58 + j 2.53	1.27 + j 1.54
500	0.82 + j 2.9	1.3 + j 2.35

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

3

MRF329

The RF Line

100 W – 100–500 MHz

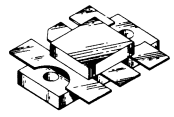
CONTROLLED "Q"
BROADBAND RF POWER
TRANSISTOR

NPN SILICON

NPN SILICON RF POWER TRANSISTOR

. . . designed primarily for wideband large-signal output and driver amplifier stages in the 100–500 MHz frequency range.

- Specified 28 Volt, 400 MHz Characteristics –
  Output Power = 100 Watts
  Minimum Gain = 7.0 dB
  Efficiency = 50% (Min)
- Built-In Matching Network for Broadband Operation Using Double Match Technique
- 100% Tested for Load Mismatch at All Phase Angles With 3:1 VSWR
- Gold Metallization System for High Reliability
- Replacement for MRF328



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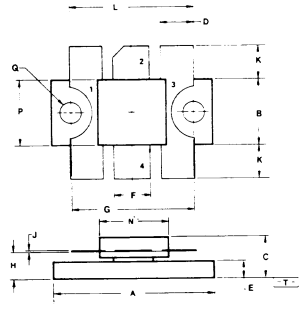
MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CEO}	30	Vdc
Collector-Base Voltage	V_{CBO}	60	Vdc
Emitter-Base Voltage	V_{EBO}	4.0	Vdc
Collector Current — Continuous — Peak	I_C	9.0 12.0	Adc
Total Device Dissipation @ $T_C = 25^oC$ (1) Derate above 25^oC	P_D	270 1.54	Watts $W/^oC$
Storage Temperature Range	T_{stg}	−65 to +150	^oC

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case (2)	$R_{\theta JC}$	0.65	$^oC/W$

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



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

NOTES:
1. DIMENSIONS A AND B ARE DATUMS.
2. POSITIONAL TOLERANCE FOR MOUNTING HOLES: ⌖ ø 0.13(0.005) Ⓜ T A Ⓜ B Ⓜ
3. -T- IS SEATING PLANE.
4. DIM "D" FOUR PLACES; DIM "F" TWO PLACES.
5. DIMENSIONING AND TOLERANCING PER ANSI Y14.5, 1973.

DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	24.51	25.02	0.965	0.985
B	9.91	10.41	0.390	0.410
C	6.73	7.24	0.265	0.285
D	4.83	5.33	0.190	0.210
E	2.42	2.92	0.095	0.115
F	5.47	5.96	0.215	0.235
G	18.42 BSC		0.725 BSC	
H	3.94	4.44	0.155	0.175
J	0.10	0.15	0.004	0.006
K	4.95	5.21	0.195	0.205
L	18.80	19.55	0.740	0.770
N	10.54	10.80	0.415	0.425
P	9.91	10.16	0.390	0.400
Q	3.05	3.42	0.120	0.135

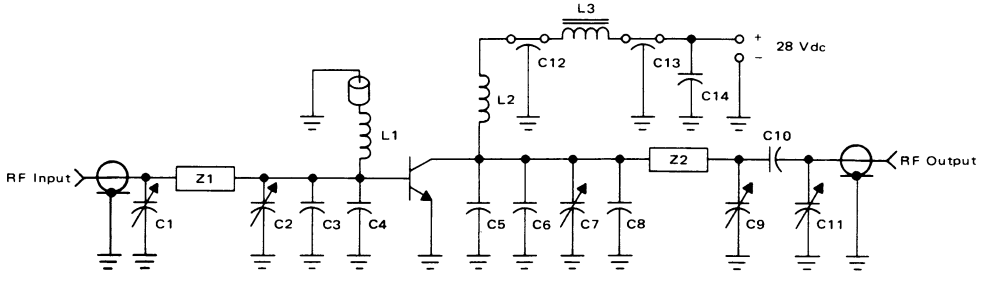
CASE 333-03

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

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Collector-Emitter Breakdown Voltage (I_C = 80 mAdc, I_B = 0)	$V_{(BR)CEO}$	30	–	–	Vdc
Collector-Emitter Breakdown Voltage (I_C = 80 mAdc, V_{BE} = 0)	$V_{(BR)CES}$	60	–	–	Vdc
Emitter-Base Breakdown Voltage (I_E = 8.0 mAdc, I_C = 0)	$V_{(BR)EBO}$	4.0	–	–	Vdc
Collector-Base Breakdown Voltage (I_C = 80 mAdc, I_E = 0)	$V_{(BR)CBO}$	60	–	–	Vdc
Collector Cutoff Current (V_{CB} = 30 Vdc, I_E = 0)	I_{CBO}	–	–	5.0	mAdc
ON CHARACTERISTICS					
DC Current Gain (I_C = 4.0 Adc, V_{CE} = 5.0 Vdc)	h_{FE}	20	–	80	–
DYNAMIC CHARACTERISTICS					
Output Capacitance (V_{CB} = 28 Vdc, I_E = 0, f = 1.0 MHz)	C_{ob}	–	95	125	pF
FUNCTIONAL TESTS (Figure 1)					
Common-Emitter Amplifier Power Gain (V_{CC} = 28 Vdc, P_{out} = 100 W, f = 400 MHz)	G_{PE}	7.0	9.7	–	dB
Collector Efficiency (V_{CC} = 28 Vdc, P_{out} = 100 W, f = 400 MHz)	η	50	60	–	%
Load Mismatch (V_{CC} = 28 Vdc, P_{out} = 100 W, f = 400 MHz VSWR = 3:1 all angles)	ψ	No Degradation in Output Power			

3

FIGURE 1 – 400 MHz TEST CIRCUIT



C1, C2, C7, C9 – 1.0–20 pF Johanson (JMC 5501)
C3, C4 – 36 pF 100 mil Chip Cap (ATC)
C5, C6 – 50 pF 100 mil Chip Cap (ATC)
C8 – 30 pF 100 mil Chip Cap (ATC)
C10 – 2-150 pF 100 mil Chip Caps in Parallel (ATC)
C11 – 1.0-10 pF Johanson (JMC 5201)
C12, C13 – 1000 pF UNELCO Feedthru
C14 – 0.1 μF Erie Redcap

L1 – 0.15 μH Molded Choke with Ferrite Bead (Ferroxcube #56-590-65/4B) on Ground End
L2 – 4 Turns #18 AWG, 1/4" ID
L3 – Ferroxcube VK200-19/4B

Z1 – Microstrip Line 2300 mils L X 210 mils W
Z2 – Microstrip Line 2300 mils L X 280 mils W

Board – Glass Teflon, t = 0.062", ϵ_r = 2.56

FIGURE 2 — OUTPUT POWER versus INPUT POWER

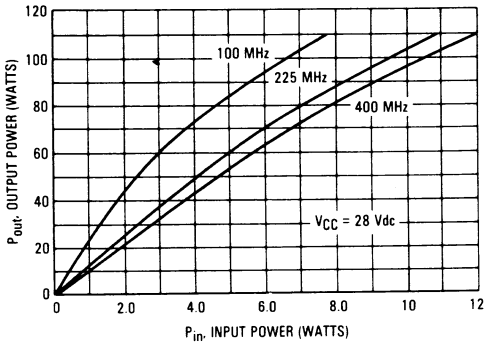


FIGURE 3 — OUTPUT POWER versus FREQUENCY

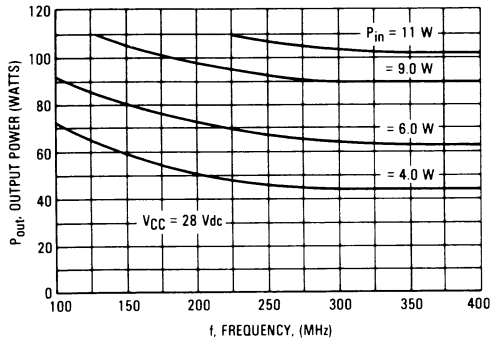


FIGURE 4 — OUTPUT POWER versus SUPPLY VOLTAGE (225 MHz)

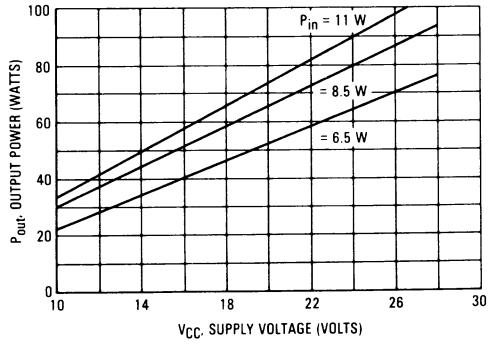


FIGURE 5 — OUTPUT POWER versus SUPPLY VOLTAGE (400 MHz)

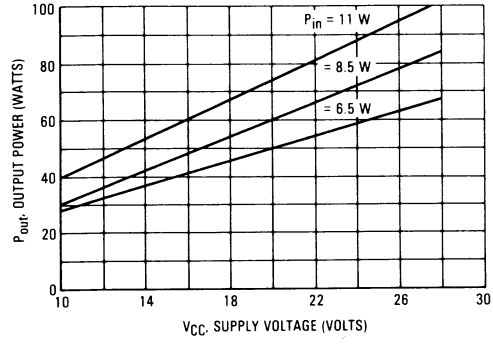


FIGURE 6 — POWER GAIN versus FREQUENCY

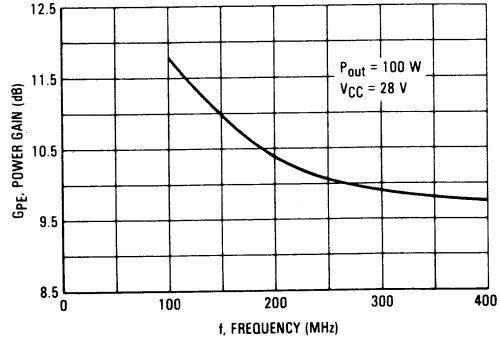
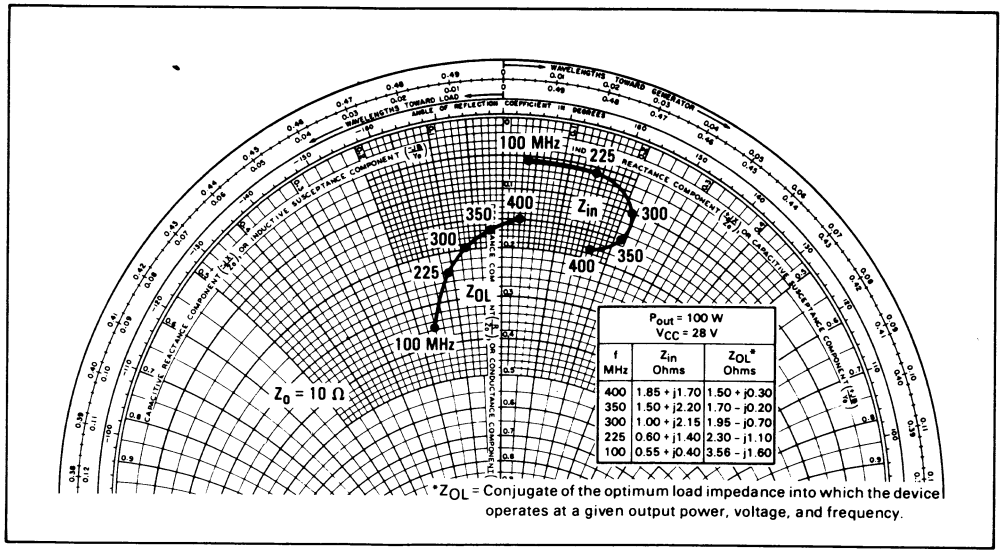


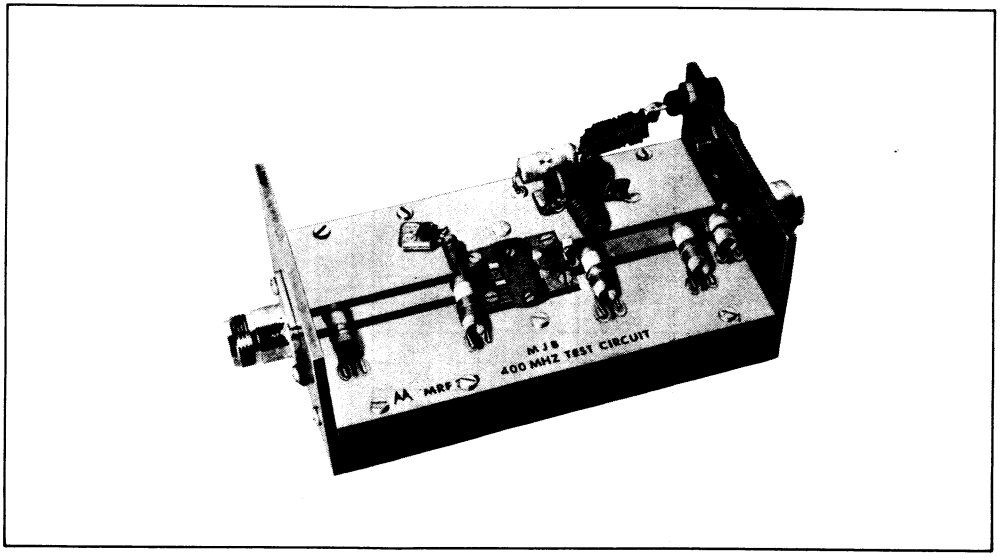
FIGURE 7 — SERIES EQUIVALENT INPUT/ OUTPUT IMPEDANCE



P_{out} = 100 W, V_{CC} = 28 V		
f MHz	Z_{in} Ohms	Z_{OL}^* Ohms
400	1.85 + j1.70	1.50 + j0.30
350	1.50 + j2.20	1.70 - j0.20
300	1.00 + j2.15	1.95 - j0.70
225	0.60 + j1.40	2.30 - j1.10
100	0.55 + j0.40	3.56 - j1.60

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

FIGURE 8 — TEST FIXTURE



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