MOTOROLA
SEMICONDUCTOR
TECHNICAL DATA

The RF Line

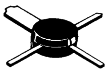
NPN Silicon High Frequency Transistors

MRF542
MRF548

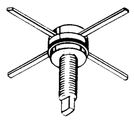
HIGH FREQUENCY TRANSISTORS NPN SILICON

. . . designed primarily for high frequency common base amplifiers used in medium and high resolution color video display monitors.

- High Collector-Base Breakdown Voltage $V_{(BR)CBO}$ = 120 V (Min)
- Stripline Opposed Base Construction
- Common Base Insertion Gain = 5.5 dB (Typ)
- Package Options for Low Cost (MRF542), High Power Dissipation (MRF548)
- **Die Source Same as MRF544**
- Emitter Ballasted for Improved Ruggedness



MRF542
CASE 317D-01
PLASTIC



MRF548
CASE 244A-01
(TO-117)
CERAMIC

MAXIMUM RATINGS

Rating		Symbol	Value	Unit
Collector-Emitter Voltage		V_{CEO}	70	Vdc
Collector-Base Voltage		V_{CBO}	120	Vdc
Emitter-Base Voltage		V_{EBO}	3	Vdc
Collector-Current — Continuous		I_C	400	mAdc
Operating Junction Temperature	MRF542 MRF548	T_J	150 200	°C °C
Total Device Dissipation @ T_C = 75°C (1,2)	MRF542 MRF548	P_D	3 5	Watts
Derate above 75°C	MRF542/548		40	mW/°C
Storage Temperature Range		T_{stg}	−65 to +150	°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	25	°C/W

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

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Collector-Emitter Breakdown Voltage (I_C = 1 mAdc, I_B = 0)	$V_{(BR)CEO}$	70	—	—	Vdc
Collector-Base Breakdown Voltage (I_C = 0.1 mAdc, I_E = 0)	$V_{(BR)CBO}$	120	—	—	Vdc
Emitter-Base Breakdown Voltage (I_E = 0.1 mAdc, I_C = 0)	$V_{(BR)EBO}$	3	—	—	Vdc
Collector Cutoff Current (V_{CE} = 80 Vdc, V_{BE} = 0, T_C = 25°C)	I_{CES}	—	—	100	μAdc
Collector Cutoff Current (V_{CB} = 80 Vdc, I_E = 0)	I_{CBO}	—	—	20	μAdc
ON CHARACTERISTICS					
DC Current Gain (I_C = 50 mAdc, V_{CE} = 10 Vdc)	h_{FE}	15	—	—	—
DYNAMIC CHARACTERISTICS					
Output Capacitance (V_{CB} = 10 Vdc, I_E = 0, f = 1 MHz)	C_{ob}	—	2.9	—	pF
Collector-Base Capacitance (V_{CB} = 10 Vdc, I_E = 0, f = 1 MHz)	C_{cb}	—	2	2.5	pF
Input Capacitance (V_{EB} = 3 Vdc, f = 1 MHz)	C_{ib}	—	12.5	—	pF
FUNCTIONAL TESTS					
Common Base Gain (V_{CB} = 10 V, I_C = 100 mA, f = 250 MHz)	$\|S_{21}\|^2$	4.5	5.5	—	dB

(1) T_C, Case temperature measured on collector lead immediately adjacent to body of package.
(2) The MRF542 PowerMacro must be properly mounted for reliable operation. AN938, "Mounting Techniques in PowerMacro Transistor," discusses methods of mounting and heatsinking.

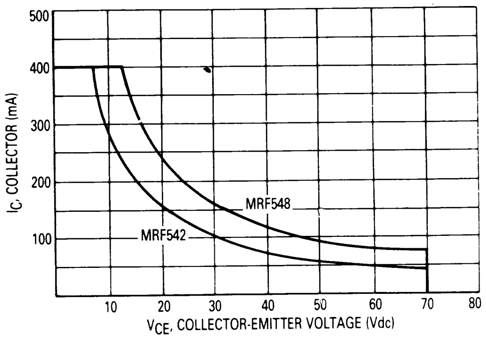


Figure 1. Safe Operating Area

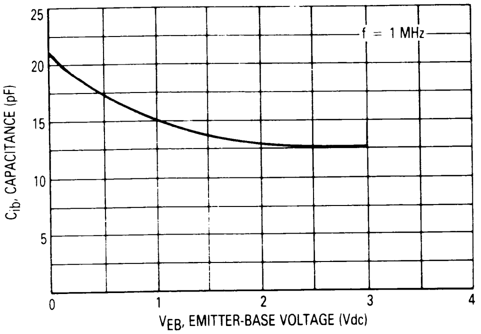


Figure 2. Input Capacitance versus Voltage

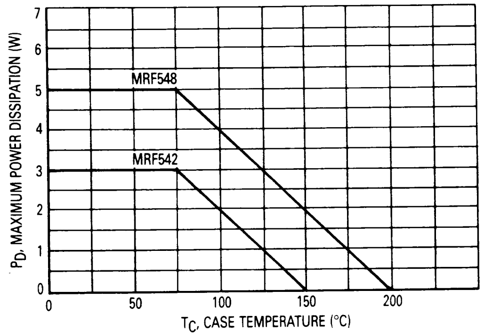


Figure 3. Power Dissipation versus Temperature

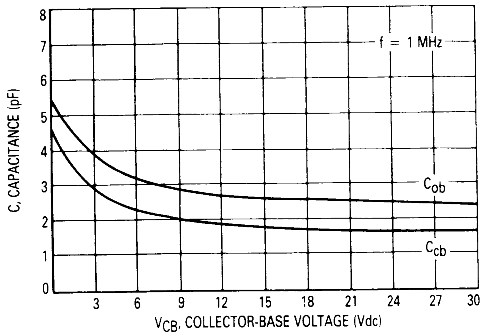
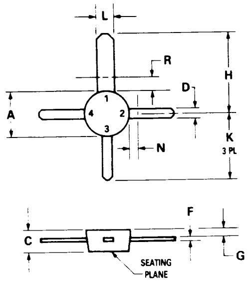


Figure 4. Junction Capacitance versus Voltage

OUTLINE DIMENSIONS

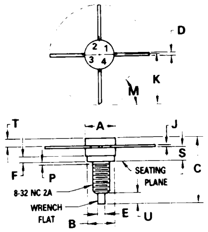


DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.44	5.21	0.175	0.205
C	1.90	2.54	0.075	0.100
D	0.84	0.99	0.033	0.039
F	0.20	0.30	0.008	0.012
G	0.63	1.01	0.025	0.040
H	8.84	9.72	0.348	0.383
K	7.24	8.13	0.285	0.320
L	2.46	2.64	0.097	0.104
N	—	1.65	—	0.065
R	—	3.25	—	0.128

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

NOTE:
DIMENSION D NOT APPLICABLE IN ZONES N AND R.

CASE 317D-01
PLASTIC



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	7.06	7.26	0.278	0.286
B	6.20	6.50	0.244	0.256
C	15.24	16.51	0.600	0.650
D	0.66	0.86	0.026	0.034
E	1.40	1.65	0.055	0.065
F	1.52	—	0.060	—
J	0.10	0.15	0.004	0.006
K	11.17	—	0.440	—
M	45° NOM		45° NOM	
P	—	1.27	—	0.050
S	2.74	3.35	0.108	0.132
T	1.40	1.78	0.055	0.070
U	2.92	3.68	0.115	0.145

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

CASE 244A-01
CERAMIC
(TO-117)

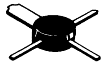
MOTOROLA
SEMICONDUCTOR
TECHNICAL DATA

The RF Line

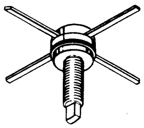
PNP Silicon High Frequency Transistors

MRF543
MRF549

HIGH FREQUENCY
TRANSISTORS
PNP SILICON



MRF543
CASE 317D-01
PLASTIC



MRF549
CASE 244A-01
(TO-117)
CERAMIC

. . . designed primarily for high frequency common base amplifiers used in medium and high resolution color video display monitors.

- High Collector-Base Breakdown Voltage $V_{(BR)CBO}$ = 100 V (Min)
- Stripline Opposed Base Construction
- Common Base Insertion Gain = 5.5 dB (Typ)
- Package Options for Low Cost (MRF543), High Power Dissipation (MRF549)
- **Die Source Same As MRF545**
- Emitter Ballasted for Improved Ruggedness

MAXIMUM RATINGS (Note 1)

Rating		Symbol	Value	Unit
Collector-Emitter Voltage		V_{CEO}	70	Vdc
Collector-Base Voltage		V_{CBO}	100	Vdc
Emitter-Base Voltage		V_{EBO}	3	Vdc
Collector-Current — Continuous		I_C	400	mAdc
Operating Junction Temperature	MRF543 MRF549	T_J	150 200	°C °C
Total Device Dissipation @ T_C = 75°C (2,3) Derate above 75°C	MRF543 MRF549 MRF543/549	P_D	3 5 40	Watts mW/°C
Storage Temperature Range		T_{stg}	−65 to +150	°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	25	°C/W

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted. Note 1.)

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Collector-Emitter Breakdown Voltage (I_C = 1 mAdc, I_B = 0)	$V_{(BR)CEO}$	70	—	—	Vdc
Collector-Base Breakdown Voltage (I_C = 0.1 mAdc, I_E = 0)	$V_{(BR)CBO}$	100	—	—	Vdc
Emitter-Base Breakdown Voltage (I_E = 0.1 mAdc, I_C = 0)	$V_{(BR)EBO}$	3	—	—	Vdc
Collector Cutoff Current (V_{CE} = 80 Vdc, V_{BE} = 0, T_C = 25°C)	I_{CES}	—	—	100	μAdc
Collector Cutoff Current (V_{CB} = 80 Vdc, I_E = 0)	I_{CBO}	—	—	20	μAdc
ON CHARACTERISTICS					
DC Current Gain (I_C = 50 mAdc, V_{CE} = 10 Vdc)	h_{FE}	15	—	—	—
DYNAMIC CHARACTERISTICS					
Output Capacitance (V_{CB} = 10 Vdc, I_E = 0, f = 1 MHz)	C_{ob}	—	2.8	—	pF
Collector-Base Capacitance (V_{CB} = 10 Vdc, I_E = 0, f = 1 MHz)	C_{cb}	—	2	2.5	pF
Input Capacitance (V_{EB} = 3 Vdc, f = 1 MHz)	C_{ib}	—	10.5	—	pF
FUNCTIONAL TESTS					
Common Base Gain (V_{CB} = 10 V, I_C = 100 mA, f = 250 MHz)	$\lvert S_{21}\rvert^2$	4.5	5.5	—	dB

Notes 1. Voltages and currents for PNP transistors are given for magnitude information only. Polarity is assumed to be opposite that of an NPN transistor.
2. T_C, Case temperature for MRF543 measured on collector lead immediately adjacent to body of package.
3. The MRF543 PowerMacro must be properly mounted for reliable operation. AN938, "Mounting Techniques in PowerMacro Transistor," discusses methods of mounting and heatsinking.

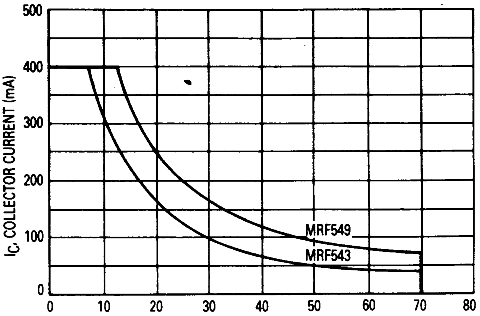


Figure 1. Safe Operating Area

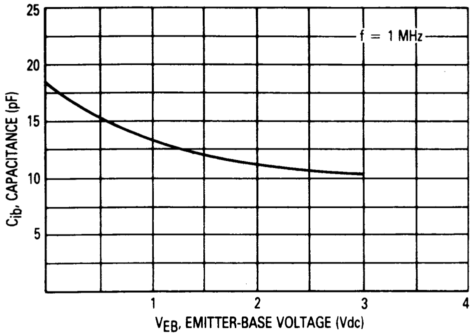


Figure 2. Input Capacitance versus Voltage

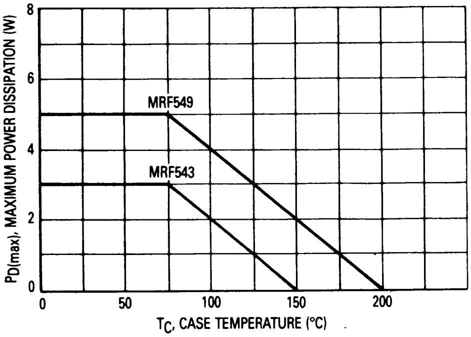


Figure 3. Power Dissipation versus Temperature

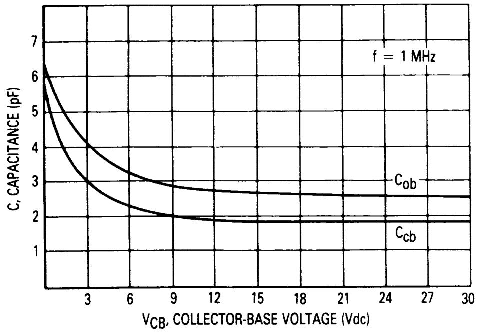
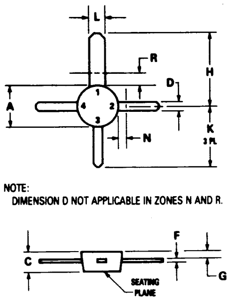


Figure 4. Junction Capacitance versus Voltage

OUTLINE DIMENSIONS

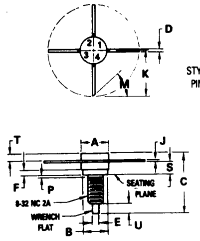


NOTE:
DIMENSION D NOT APPLICABLE IN ZONES N AND R.

CASE 317D-01
PLASTIC

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

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.44	5.21	0.175	0.205
C	1.90	2.54	0.075	0.100
D	0.84	0.99	0.033	0.039
F	0.20	0.30	0.008	0.012
G	0.63	1.01	0.025	0.040
H	8.84	9.72	0.348	0.383
K	7.24	8.13	0.285	0.320
L	2.46	2.64	0.097	0.104
N	—	1.65	—	0.065
R	—	3.25	—	0.128



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

CASE 244A-01
CERAMIC
(TO-117)

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	7.06	7.26	0.278	0.286
B	6.20	6.50	0.244	0.256
C	15.24	16.51	0.600	0.650
D	0.66	0.86	0.026	0.034
E	1.40	1.65	0.055	0.065
F	1.52	—	0.060	—
J	0.10	0.15	0.004	0.006
K	11.17	—	0.440	—
M	45° NOM		45° NOM	
P	—	1.27	—	0.050
S	2.74	3.35	0.108	0.132
T	1.40	1.78	0.055	0.070
U	2.92	3.68	0.115	0.145

MOTOROLA
SEMICONDUCTOR
TECHNICAL DATA

MRF544
MRFC544

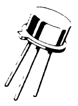
The RF Line

NPN Silicon High Frequency Transistors

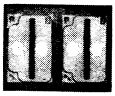
f_T = 1400 MHz (Typ)
@ 50 mA
HIGH FREQUENCY
TRANSISTORS

. . . designed for high-frequency and medium and high resolution color video display monitors.

- Emitter Ballasting for Improved Ruggedness
- High Power Gain — $G_{U(max)}$ = 16.5 dB (Typ) @ f = 500 MHz
- Ion Implanted
- High Collector Base Breakdown Voltage — $V_{(BR)CBO}$, 120 V (Min)
- High f_T — 1400 MHz
- State-of-the-Art Technology Fine Line Geometry
- Gold Top Metallization
- Silicon Nitride Passivation



MRF544
CASE 79-02
TO-205AD
(TO-39)



CHIP
MRFC544

3

MAXIMUM RATINGS

Rating	Symbol	MRFC544	MRF544	Unit
Collector-Emitter Voltage	V_{CEO}	70	70	Vdc
Collector-Base Voltage	V_{CBO}	120	120	Vdc
Emitter-Base Voltage	V_{EBO}	3	3	Vdc
Collector-Current — Continuous	I_C	400	400	mAdc
Total Device Dissipation @ T_C = 75°C Derate above 75°C	P_D	5 T_{Jmax} = 200°C	3.5 28	Watts mW/°C
Storage Temperature Range	T_{stg}	−65 to +200	−65 to +200	°C

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

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Collector-Emitter Breakdown Voltage (I_C = 1 mAdc, I_B = 0)	$V_{(BR)CEO}$	70	—	—	Vdc
Collector-Base Breakdown Voltage (I_C = 100 μAdc, I_E = 0)	$V_{(BR)CBO}$	120	—	—	Vdc
Emitter-Base Breakdown Voltage (I_E = 100 μAdc, I_C = 0)	$V_{(BR)EBO}$	3	—	—	Vdc
Collector Cutoff Current (V_{CE} = 80 Vdc, V_{BE} = 0, T_C = 25°C)	I_{CES}	—	—	100	μAdc
Collector Cutoff Current (V_{CB} = 80 Vdc, I_E = 0)	I_{CBO}	—	—	20	μAdc
ON CHARACTERISTICS					
DC Current Gain (I_C = 50 mA, V_{CE} = 5 Vdc)	h_{FE}	15	—	—	—
DYNAMIC CHARACTERISTICS					
Output Capacitance (V_{CB} = 10 Vdc, I_E = 0, f = 1 MHz)	C_{ob}	—	3	—	pF
Junction Capacitance (V_{CB} = 10 Vdc, I_E = 0, f = 1 MHz)	C_{cb}	—	1.8	2.5	pF
Input Capacitance (V_{EB} = 3 Vdc, I_C = 0, f = 1 MHz)	C_{ib}	—	9	—	pF
Current Gain-Bandwidth Product (I_C = 50 mA, V_{CE} = 10 V, f = 250 MHz)	f_T	1000	1400	—	MHz
FUNCTIONAL TESTS					
Maximum Available Gain (I_C = 50 mA, V_{CE} = 10 V, f = 250 MHz)	G_{max}	—	16.5	—	dB
Insertion Gain (I_C = 50 mA, V_{CE} = 10 V, f = 250 MHz)	$\|S_{21}\|^2$	—	13	—	dB

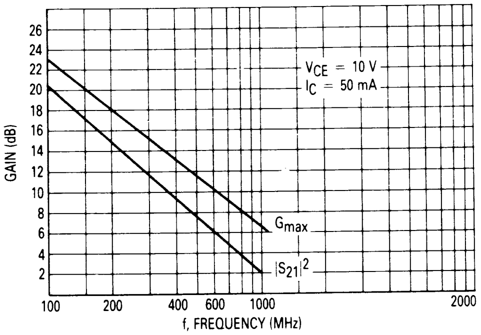


Figure 1. Power Gain versus Frequency

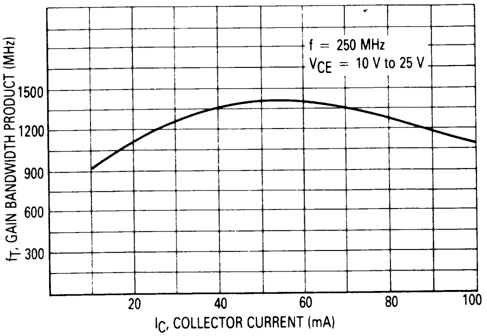


Figure 2. Gain-Bandwidth Product versus Collector Current

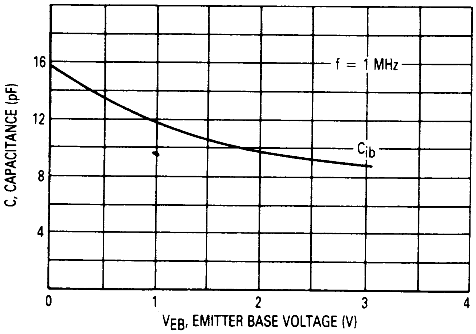


Figure 3. C_{ib} Input Capacitance versus Voltage

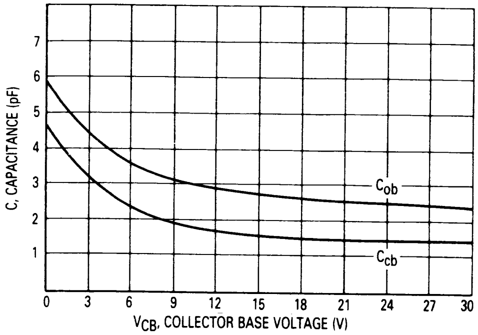


Figure 4. Junction Capacitance versus Voltage

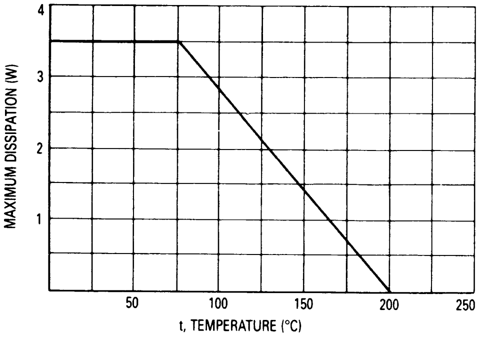


Figure 5. Dissipation versus Temperature

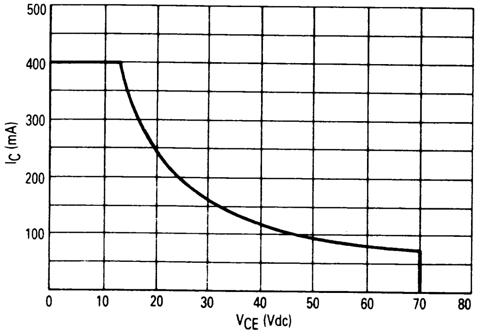


Figure 6. Safe Operating Area

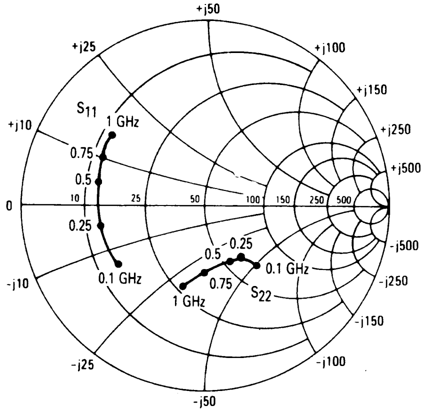


Figure 7. Input/Output Reflection Coefficient versus Frequency (GHz)
V_{CE} = 10 V I_C = 50 mA

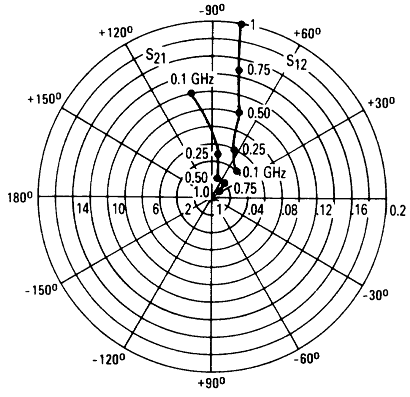


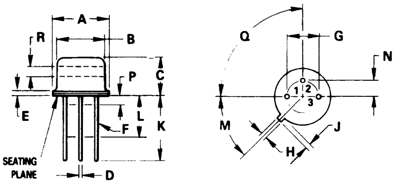
Figure 8. Forward/Reverse Transmission Coefficients versus Frequency (GHz)
V_{CE} = 10 V I_C = 50 mA

COMMON EMITTER S-PARAMETERS

V_{CE} (Volts)	I_C (mA)	f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}	
			$\lvert S_{11} \rvert$	$\angle\phi$	$\lvert S_{21} \rvert$	$\angle\phi$	$\lvert S_{12} \rvert$	$\angle\phi$	$\lvert S_{22} \rvert$	$\angle\phi$
10	25	100	0.59	−138	11.71	106	0.04	50	0.48	−43
		250	0.59	−167	4.64	85	0.06	61	0.38	−50
		500	0.61	174	2.30	67	0.10	75	0.37	−66
		750	0.66	166	1.52	53	0.15	80	0.42	−89
		1000	0.66	157	1.17	43	0.20	82	0.50	−104
	50	100	0.58	−147	12.38	102	0.04	50	0.43	−48
		250	0.58	−171	4.85	83	0.06	63	0.34	−52
		500	0.60	170	2.43	66	0.10	74	0.33	−67
		750	0.64	163	1.61	52	0.15	78	0.39	−91
		1000	0.64	155	1.24	43	0.21	79	0.46	−105
	80	100	0.60	−151	12.15	101	0.03	49	0.39	−47
		250	0.60	−173	4.76	81	0.05	64	0.34	−55
		500	0.62	170	2.35	65	0.10	74	0.35	−72
		750	0.66	162	1.53	50	0.14	78	0.43	−96
		1000	0.65	154	1.16	40	0.20	78	0.51	−108
25	25	100	0.59	−133	12.77	110	0.03	44	0.53	−34
		250	0.59	−164	5.06	86	0.05	62	0.46	−42
		500	0.60	177	2.48	67	0.08	78	0.45	−60
		750	0.64	168	1.59	52	0.12	84	0.50	−83
		1000	0.66	159	1.20	43	0.17	87	0.57	−99
	50	100	0.56	−142	13.25	103	0.03	49	0.50	−35
		250	0.56	−169	5.21	82	0.05	64	0.44	−42
		500	0.58	172	2.60	64	0.09	76	0.43	−59
		750	0.62	163	1.68	50	0.13	82	0.48	−82
		1000	0.63	155	1.28	40	0.18	83	0.55	−97
	80	100	0.58	−143	13.87	102	0.03	52	0.54	−33
		250	0.57	−172	5.19	80	0.05	63	0.47	−39
		500	0.59	170	2.55	62	0.08	77	0.46	−58
		750	0.64	162	1.65	48	0.13	82	0.50	−81
		1000	0.64	154	1.24	37	0.18	83	0.57	−97

OUTLINE DIMENSIONS

TO-39
CASE 79-02



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

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	8.89	9.40	0.350	0.370
B	8.00	8.51	0.315	0.335
C	6.10	6.60	0.240	0.260
D	0.406	0.533	0.016	0.021
E	0.229	3.18	0.009	0.125
F	0.406	0.483	0.016	0.019
G	4.83	5.33	0.190	0.210
H	0.711	0.864	0.028	0.034
J	0.737	1.02	0.029	0.040
K	12.70	—	0.500	—
L	6.35	—	0.250	—
M	45° NOM		45° NOM	
P	—	1.27	—	0.050
Q	90° NOM		90° NOM	
R	2.54	—	0.100	—

All JEDEC Dimensions and Notes Apply.

MOTOROLA
SEMICONDUCTOR
TECHNICAL DATA

MRF545
MRFC545

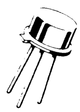
The RF Line

PNP Silicon
High Frequency Transistors

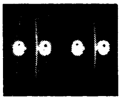
. . . designed for high-frequency and medium and high resolution color video display monitors.

- Emitter Ballasting for Improved Ruggedness
- High Power Gain — $G_{U(max)}$ = 15.5 dB (Typ) @ f = 250 MHz
- Ion Implanted
- High Collector Base Breakdown Voltage — $V_{(BR)CBO}$, 100 V (Min)
- High f_T — 1250 MHz (Typ)
- State-of-the-Art Technology
  - Fine Line Geometry
  - Gold Top Metallization
  - Silicon Nitride Passivation

f_T = 1250 MHz (TYP.)
@ 50 mA
HIGH FREQUENCY
TRANSISTORS
PNP SILICON



MRF545
CASE 79-02
TO-205AD
(TO-39)



CHIP
MRFC545

MAXIMUM RATINGS (Note 1)

Rating	Symbol	MRFC545	MRF545	Unit
Collector-Emitter Voltage	V_{CEO}	70	70	Vdc
Collector-Base Voltage	V_{CBO}	100	100	Vdc
Emitter-Base Voltage	V_{EBO}	3	3	Vdc
Collector-Current — Continuous	I_C	400	400	mAdc
Operating Junction Temperature	T_J	200	200	°C
Total Device Dissipation @ T_C = 75°C Derate above 75°C	P_D	5 T_{Jmax} = 200°C	3.5 28	Watts mW/°C
Storage Temperature Range	T_{stg}	−65 to +200	−65 to +200	°C

Note 1. Voltages and currents for PNP transistors are given for magnitude information only. Polarity is assumed to be opposite that of an NPN transistor.

ELECTRICAL CHARACTERISTICS (Note 1, T_C = 25°C unless otherwise noted.)

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Collector-Emitter Breakdown Voltage (I_C = 1 mAdc, I_B = 0)	$V_{(BR)CEO}$	70	—	—	Vdc
Collector-Base Breakdown Voltage (I_C = 0.1 mAdc, I_E = 0)	$V_{(BR)CBO}$	100	—	—	Vdc
Emitter-Base Breakdown Voltage (I_E = 0.1 mAdc, I_C = 0)	$V_{(BR)EBO}$	3	—	—	Vdc
Collector Cutoff Current (V_{CE} = 80 Vdc, V_{BE} = 0, T_C = 25°C)	I_{CES}	—	—	100	μAdc
Collector Cutoff Current (V_{CB} = 80 Vdc, I_E = 0)	I_{CBO}	—	—	20	μAdc
ON CHARACTERISTICS					
DC Current Gain (I_C = 50 mAdc, V_{CE} = 10 Vdc)	h_{FE}	15	—	—	—
DYNAMIC CHARACTERISTICS					
Output Capacitance (V_{CB} = 10 Vdc, I_E = 0, f = 1 MHz)	C_{ob}	—	3.2	—	pF
Junction Capacitance (V_{CB} = 10 Vdc, I_E = 0, f = 1 MHz)	C_{cb}	—	2	2.5	pF
Input Capacitance (V_{EB} = 3 Vdc, I_C = 0, f = 1 MHz)	C_{ib}	—	10	—	pF
Current Gain-Bandwidth Product (I_C = 50 mA, V_{CE} = 25 V, f = 250 MHz)	f_T	1000	1250	—	MHz
FUNCTIONAL TESTS					
Maximum Available Gain (I_C = 50 mA, V_{CE} = 25 V, f = 250 MHz)	G_{max}	—	15.5	—	dB
Insertion Gain (I_C = 50 mA, V_{CE} = 25 V, f = 250 MHz)	$\|S_{21}\|^2$	—	12.7	—	dB

Note 1. Voltages and currents for PNP transistors are given for magnitude information only.
Polarity is assumed to be opposite that of an NPN transistor.

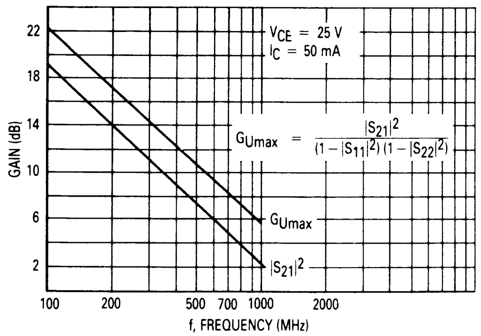


Figure 1. Power Gain versus Frequency

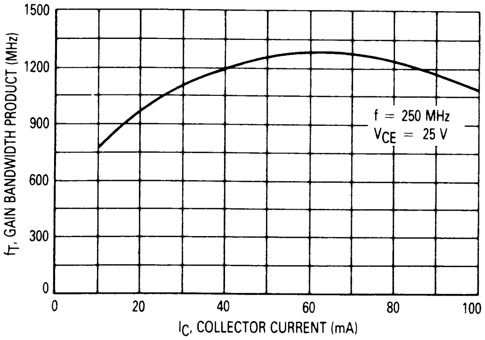


Figure 2. Gain-Bandwidth Product versus Collector Current

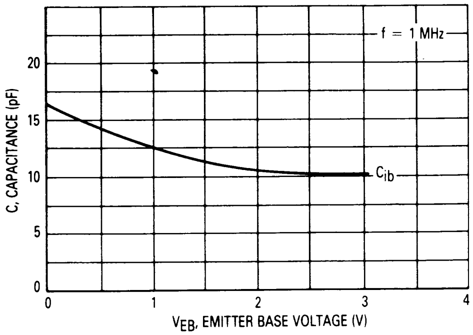


Figure 3. Input Capacitance versus Voltage

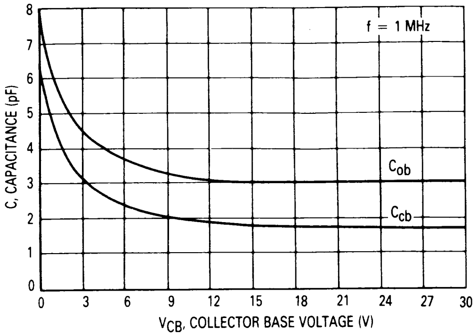


Figure 4. Junction Capacitance versus Voltage

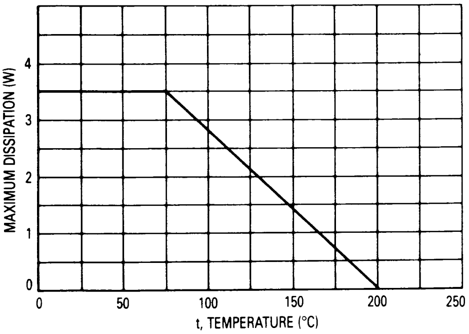


Figure 5. Dissipation versus Temperature

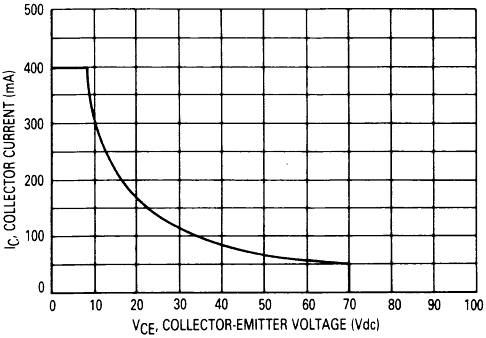
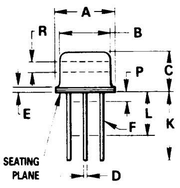
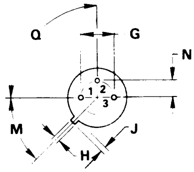


Figure 6. Safe Operating Area

OUTLINE DIMENSIONS





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

CASE 79-02
TO-205AD
(TO-39)

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	8.89	9.40	0.350	0.370
B	8.00	8.51	0.315	0.335
C	6.10	6.60	0.240	0.260
D	0.406	0.533	0.016	0.021
E	0.229	3.18	0.009	0.125
F	0.406	0.483	0.016	0.019
G	4.83	5.33	0.190	0.210
H	0.711	0.864	0.028	0.034
J	0.737	1.02	0.029	0.040
K	12.70	—	0.500	—
L	6.35	—	0.250	—
M	45° NOM		45° NOM	
P	—	1.27	—	0.050
Q	90° NOM		90° NOM	
R	2.54	—	0.100	—

All JEDEC Dimensions and Notes Apply.

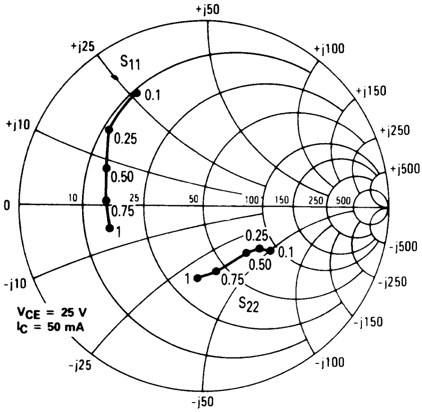


Figure 7. Input/Output Reflection Coefficient versus Frequency (GHz)

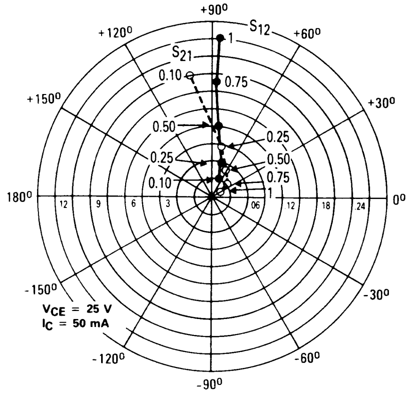


Figure 8. Forward/Reverse Transmission Coefficients versus Frequency

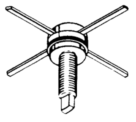
COMMON EMITTER S-PARAMETERS

V_{CE} (Volts)	I_C (mA)	f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}	
			$\|S_{11}\|$	∠φ	$\|S_{21}\|$	∠φ	$\|S_{12}\|$	∠φ	$\|S_{22}\|$	∠φ
10	25	100	0.60	−161	8.7	101	0.03	57	0.47	−34
		250	0.61	−180	3.6	81	0.06	74	0.42	−39
		500	0.66	163	1.9	62	0.12	88	0.38	−56
		750	0.72	154	1.3	50	0.19	91	0.40	−87
		1000	0.75	143	1.0	41	0.29	89	0.46	−102
	50	100	0.61	−169	8.8	99	0.03	64	0.43	−36
		250	0.62	177	3.7	80	0.06	79	0.38	−40
		500	0.66	161	1.9	63	0.13	88	0.35	−56
		750	0.72	153	1.3	50	0.20	89	0.36	−86
		1000	0.74	142	1.0	41	0.29	87	0.42	−102
	100	100	0.67	−178	5.6	94	0.03	68	0.40	−26
		250	0.70	170	2.3	74	0.07	81	0.36	−37
		500	0.71	155	1.2	54	0.16	89	0.39	−61
		750	0.76	142	0.9	42	0.27	87	0.40	−92
		1000	0.82	128	0.7	37	0.39	81	0.43	−117
25	25	100	0.55	−155	9.9	102	0.03	58	0.49	−32
		250	0.57	−176	4.2	82	0.06	72	0.43	−36
		500	0.61	165	2.1	64	0.11	87	0.38	−50
		750	0.68	156	1.4	51	0.18	90	0.41	−79
		1000	0.70	144	1.1	43	0.27	89	0.45	−96
	50	100	0.53	−162	10.6	101	0.03	62	0.44	−35
		250	0.55	−180	4.4	82	0.06	75	0.39	−38
		500	0.59	162	2.3	65	0.12	85	0.34	−50
		750	0.65	154	1.5	51	0.19	88	0.36	−78
		1000	0.67	143	1.2	43	0.27	86	0.40	−95
	100	100	0.48	−169	9.3	98	0.03	68	0.43	−27
		250	0.53	174	3.9	79	0.07	79	0.37	−33
		500	0.54	159	2.1	61	0.15	85	0.40	−52
		750	0.60	146	1.5	47	0.24	85	0.39	−77
		1000	0.65	132	1.1	37	0.34	81	0.41	−99

MOTOROLA
SEMICONDUCTOR
TECHNICAL DATA

MRF546

HIGH FREQUENCY
TRANSISTOR
NPN SILICON



CASE 244A-01

The RF Line

NPN Silicon High Frequency Transistor

. . . designed for high current, high frequency common base amplifiers used in medium and high resolution color video display monitors.

- Stripline Opposed Base Construction
- **Die Source 2X Common Base MRF548**
- Common Base Insertion Gain = 6 dB (Typ)
- High Collector-Base Breakdown Voltage $V_{(BR)CBO}$ = 120 Vdc (Min)
- Emitter Ballasted For Improved Ruggedness
- Gold Top Metallization
- Silicon Nitride Passivation

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CEO}	70	Vdc
Collector-Base Voltage	V_{CBO}	120	Vdc
Emitter-Base Voltage	V_{EBO}	3	Vdc
Collector-Current — Continuous	I_C	600	mAdc
Operating Junction Temperature	T_J	200	°C
Total Device Dissipation @ T_C = 75°C Derate above 75°C	P_D	9 72	Watts mW/°C
Storage Temperature Range	T_{stg}	−65 to +150	°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	13.9	°C/W

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

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Collector-Emitter Breakdown Voltage (I_C = 2 mAdc, I_B = 0)	$V_{(BR)CEO}$	70	—	—	Vdc
Collector-Base Breakdown Voltage (I_C = 0.2 mAdc, I_E = 0)	$V_{(BR)CBO}$	120	—	—	Vdc
Emitter-Base Breakdown Voltage (I_E = 0.2 mAdc, I_C = 0)	$V_{(BR)EBO}$	3	—	—	Vdc
Collector Cutoff Current (V_{CE} = 80 Vdc, V_{BE} = 0, T_C = 25°C)	I_{CES}	—	—	200	μAdc
Collector Cutoff Current (V_{CB} = 80 Vdc, I_E = 0)	I_{CBO}	—	—	40	μAdc
ON CHARACTERISTICS					
DC Current Gain (I_C = 100 mAdc, V_{CE} = 10 Vdc)	h_{FE}	15	—	200	—
DYNAMIC CHARACTERISTICS					
Output Capacitance (V_{CB} = 10 Vdc, I_E = 0, f = 1 MHz)	C_{ob}	—	5	—	pF
Collector-Base Capacitance (V_{CB} = 10 Vdc, I_E = 0, f = 1 MHz)	C_{cb}	—	3.6	4.5	pF
Input Capacitance (V_{EB} = 3 Vdc, f = 1 MHz)	C_{ib}	—	26	—	pF
FUNCTIONAL TESTS					
Common Base Gain (V_{CB} = 10 V, I_C = 200 mA, f = 250 MHz)	$\|S_{21}\|^2$	4.5	6	—	dB

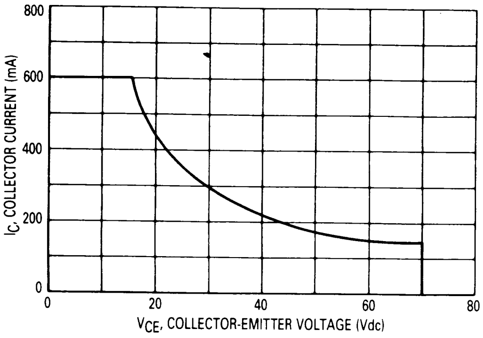


Figure 1. Safe Operating Area

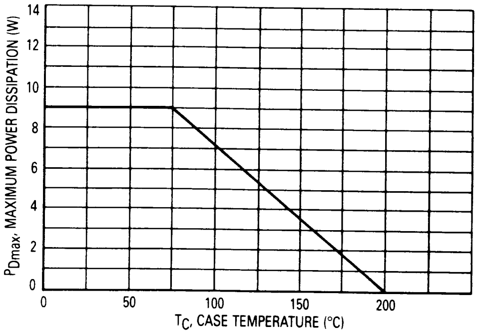


Figure 2. Power Dissipation versus Temperature

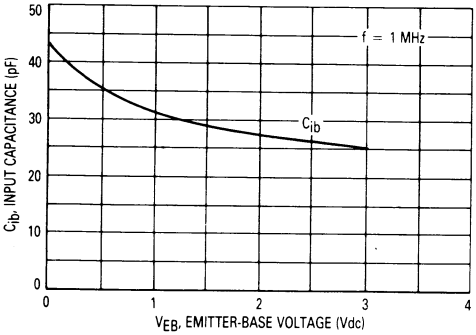


Figure 3. Input Capacitance versus Voltage

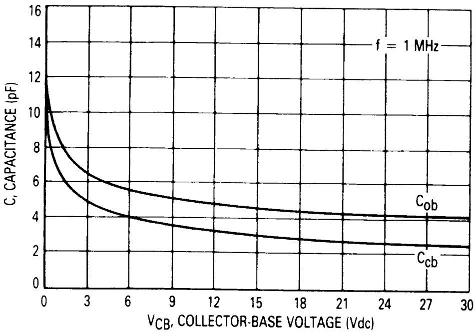
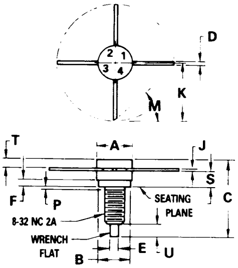


Figure 4. Junction Capacitance versus Voltage

OUTLINE DIMENSIONS



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

CASE 244A-01

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	7.06	7.26	0.278	0.286
B	6.20	6.50	0.244	0.256
C	15.24	16.51	0.600	0.650
D	0.66	0.86	0.026	0.034
E	1.40	1.65	0.055	0.065
F	1.52	—	0.060	—
J	0.10	0.15	0.004	0.006
K	11.17	—	0.440	—
M	45° NOM		45° NOM	
P	—	1.27	—	0.050
S	2.74	3.35	0.108	0.132
T	1.40	1.78	0.055	0.070
U	2.92	3.68	0.115	0.145

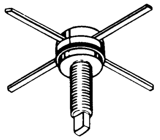
MOTOROLA
SEMICONDUCTOR
TECHNICAL DATA

MRF547

The RF Line

PNP Silicon
High Frequency Transistor

HIGH FREQUENCY
TRANSISTOR
PNP SILICON



CASE 244A-01

. . . designed for high-current, high-frequency common base amplifiers used in medium and high resolution color video display monitors.

- Stripline Opposed Base Construction
- **Die Source 2X Common Base MRF549**
- Common Base Insertion Gain = 5.5 dB (Typ)
- High Collector-Base Breakdown Voltage $V_{(BR)CBO}$ = 100 Vdc (Min)
- Emitter Ballasted For Improved Ruggedness
- Gold Top Metallization
- Silicon Nitride Passivation

MAXIMUM RATINGS (Note 1)

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CEO}	70	Vdc
Collector-Base Voltage	V_{CBO}	100	Vdc
Emitter-Base Voltage	V_{EBO}	3	Vdc
Collector Current — Continuous	I_C	600	mAdc
Operating Junction Temperature	T_J	200	°C
Total Device Dissipation @ T_C = 75°C Derate above 75°C	P_D	9 72	Watts mW/°C
Storage Temperature Range	T_{stg}	−65 to +150	°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	13.9	°C/W

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted. Note 1.)

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Collector-Emitter Breakdown Voltage (I_C = 2 mAdc, I_B = 0)	$V_{(BR)CEO}$	70	—	—	Vdc
Collector-Base Breakdown Voltage (I_C = 0.2 mAdc, I_E = 0)	$V_{(BR)CBO}$	100	—	—	Vdc
Emitter-Base Breakdown Voltage (I_E = 0.2 mAdc, I_C = 0)	$V_{(BR)EBO}$	3	—	—	Vdc
Collector Cutoff Current (V_{CE} = 80 Vdc, V_{BE} = 0, T_C = 25°C)	I_{CES}	—	—	200	μAdc
Collector Cutoff Current (V_{CB} = 80 Vdc, I_E = 0)	I_{CBO}	—	—	40	μAdc
ON CHARACTERISTICS					
DC Current Gain (I_C = 100 mAdc, V_{CE} = 10 Vdc)	h_{FE}	15	—	—	—
DYNAMIC CHARACTERISTICS					
Output Capacitance (V_{CB} = 10 Vdc, I_E = 0, f = 1 MHz)	C_{ob}	—	5.1	—	pF
Collector-Base Capacitance (V_{CB} = 10 Vdc, I_E = 0, f = 1 MHz)	C_{cb}	—	3.6	4.5	pF
Input Capacitance (V_{EB} = 3 Vdc, f = 1 MHz)	C_{ib}	—	20	—	pF
FUNCTIONAL TESTS					
Common Base Gain (V_{CB} = 10 V, I_C = 200 mA, f = 250 MHz)	$\|S_{21}\|^2$	4.5	5.5	—	dB

Note 1. Voltages and currents for PNP transistors are given for magnitude information only. Polarity is assumed to be opposite that of an NPN transistor.

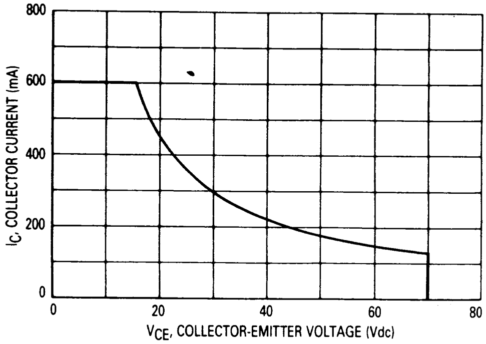


Figure 1. Safe Operating Area

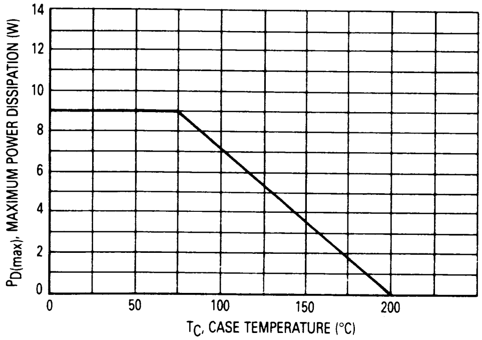


Figure 2. Power Dissipation versus Temperature

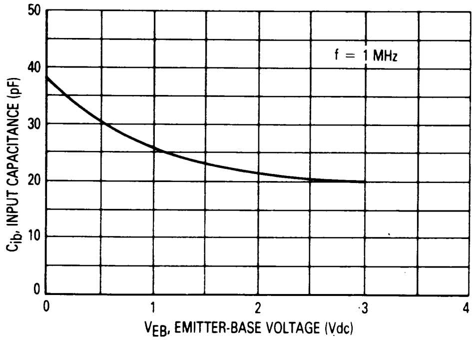


Figure 3. Input Capacitance versus Voltage

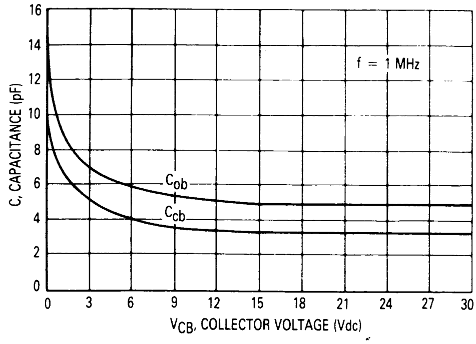
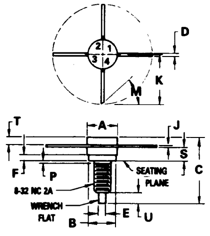


Figure 4. Junction Capacitance versus Voltage

OUTLINE DIMENSIONS



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

CASE 244A-01
CERAMIC

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	7.06	7.26	0.278	0.286
B	6.20	6.50	0.244	0.256
C	15.24	16.51	0.600	0.650
D	0.66	0.86	0.026	0.034
E	1.40	1.65	0.055	0.065
F	1.52	—	0.060	—
J	0.10	0.15	0.004	0.006
K	11.17	—	0.440	—
M	45° NOM		45° NOM	
P	—	1.27	—	0.050
S	2.74	3.35	0.108	0.132
T	1.40	1.78	0.055	0.070
U	2.92	3.68	0.115	0.145

MRF553

The RF Line

NPN SILICON RF LOW POWER TRANSISTOR

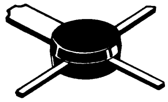
. . . designed primarily for wideband large signal predriver stages in the VHF frequency range.

- Specified @ 12.5 V, 175 MHz Characteristics
  Output Power = 1.5 W
  Minimum Gain = 11.5 dB
  Efficiency 60% (Typ)
- Cost Effective PowerMacro Package
- Electroless Tin Plated Leads for Improved Solderability

1.5 W 175 MHz

RF LOW POWER TRANSISTOR

NPN SILICON



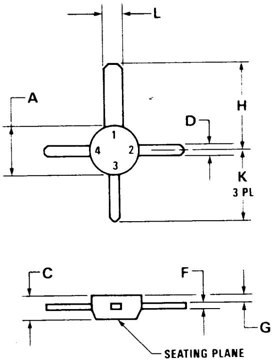
MAXIMUM RATINGS

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	500	mAdc
Total Device Dissipation @ T_C = 75°C (1,2) Derate above 75°C	P_D	3.0 40	Watts mW/°C
Storage Temperature Range	T_{stg}	−65 to +150	°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	25	°C/W

(1) T_C, Case temperature measured on collector lead immediately adjacent to body of package.
(2) The MRF553 PowerMacro must be properly mounted for reliable operation. AN938, "Mounting Techniques for PowerMacro Transistor," discusses methods of mounting and heatsinking.



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

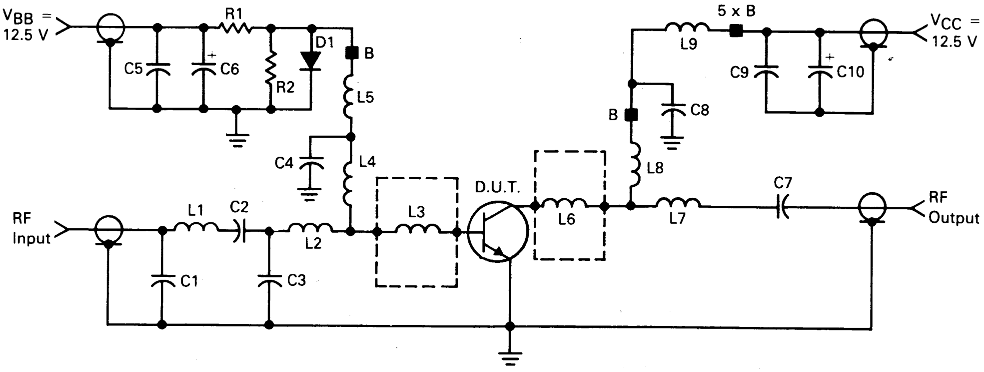
DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	4.44	5.21	0.175	0.205
C	1.90	2.54	0.075	0.100
D	0.84	0.99	0.033	0.039
F	0.20	0.30	0.008	0.012
G	0.63	1.01	0.025	0.040
H	8.84	9.72	0.348	0.383
K	7.24	8.13	0.285	0.320
L	2.46	2.64	0.097	0.104

CASE 317D-01

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

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Collector-Emitter Breakdown Voltage (I_C = 10 mAdc, I_B = 0)	$V_{(BR)CEO}$	16	—	—	Vdc
Collector-Emitter Breakdown Voltage (I_C = 5.0 mAdc, V_{BE} = 0)	$V_{(BR)CES}$	36	—	—	Vdc
Collector-Base Breakdown Voltage (I_C = 5.0 mAdc, I_E = 0)	$V_{(BR)CBO}$	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 = 25°C)	I_{CES}	—	—	5.0	mAdc
ON CHARACTERISTICS					
DC Current Gain (I_C = 250 mAdc, V_{CE} = 5.0 Vdc)	h_{FE}	30	—	200	—
DYNAMIC CHARACTERISTICS					
Output Capacitance (V_{CB} = 10 Vdc, I_E = 0, f = 1.0 MHz)	C_{ob}	—	12	20	pF
FUNCTIONAL TESTS					
Common-Emitter Amplifier Power Gain Figure 1,2 (V_{CC} = 12.5 Vdc, P_{out} = 1.5 W, f = 175 MHz)	G_{pe}	11.5	13	—	dB
Collector Efficiency Figure 1,2 (V_{CC} = 12.5 Vdc, P_{out} = 1.5 W, f = 175 MHz)	η	50	60	—	%
Load Mismatch Stress (V_{CC} = 12.5 Vdc, P_{out} = 1.5 W, f = 175 MHz, VSWR ≥ 10:1 All Phase Angles)	ψ	No Degradation in Output Power			—

FIGURE 1 — 140–175 MHz BROADBAND CIRCUIT SCHEMATIC



C1 — 36 pF Mini Underwood
C2 — 47 pF Mini Underwood
C3 — 91 pF Mini Underwood
C4 — 68 pF Mini Underwood
C5, C9 — 1.0 μF Erie Red Cap Capacitor
C6, C10 — 0.1 μF, 35 V Tantulum
C7 — 470 pF Chip Capacitor
C8 — 2200 pF Chip Capacitor
R1 — 4.7 kΩ, 1/4 W
R2 — 100 Ω, 1/4 W
D1 — 1N4148 Diode

L1 — 3 Turns, #18 AWG, 0.210″ ID, 3/16″ Length
L2, L4, L7 — 0.62″, #18 AWG Wire Bent into "V"
L3, L6 — 60 x 125 x 250 Mils Copper Pad on 27 Mils Thick Alumina Substrate
L5 — 12 μH Molded Choke
L8 — 7 Turns, #18 AWG, 0.170″ ID, 7/16″ Length
L9 — 1.0″, #18 AWG Wire with 5 Ferrite Beads
B — Ferrite Bead
Board Material — Glass Teflon, ϵ_r = 2.56, t = 0.0625″ (See Photomaster, Figure 3)

FIGURE 2 — 140–175 MHZ BROADBAND CIRCUIT

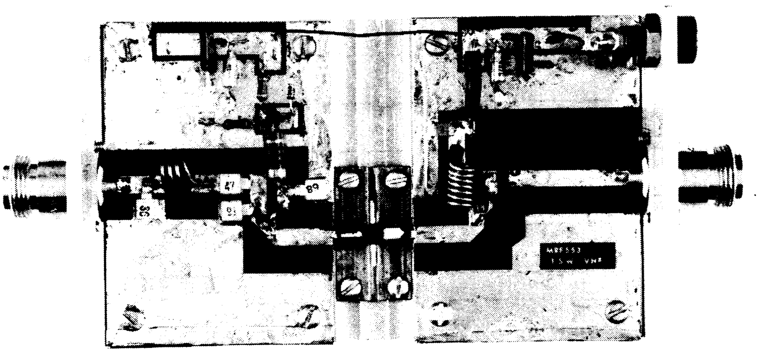
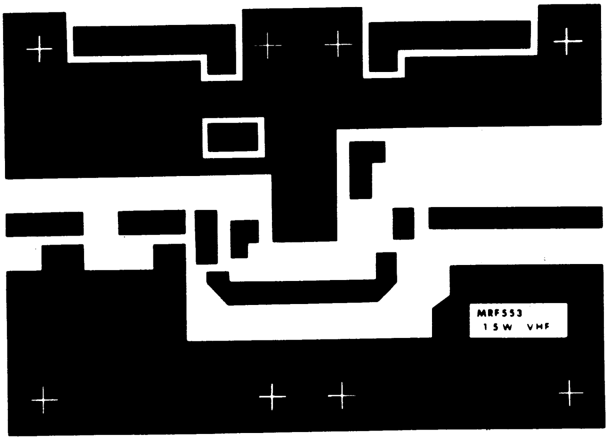


FIGURE 3 — 140–175 MHz TEST CIRCUIT PHOTOMASTER



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

FIGURE 4 — TYPICAL PERFORMANCE IN BROADBAND CIRCUIT

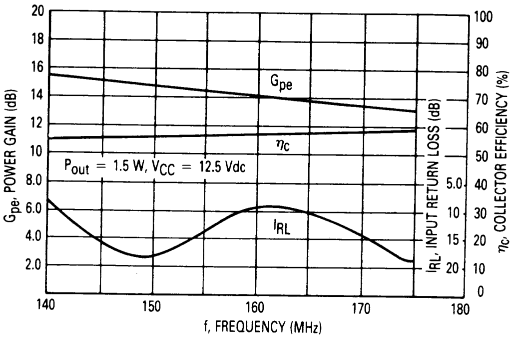


FIGURE 5 — Z_{in} AND Z_{OL} versus COLLECTOR VOLTAGE, INPUT POWER, AND OUTPUT POWER

f Frequency MHz	Z_{in} Ohms						Z_{OL}* Ohms					
	V_{CC} = 7.5 V; P_{in}			V_{CC} = 12.5 V; P_{in}			V_{CC} = 7.5 V; P_{out}			V_{CC} = 12.5 V; P_{out}		
	100 mW	200 mW	300 mW	50 mW	100 mW	150 mW	1.0 W	1.6 W	2.2 W	1.1 W	2.0 W	2.6 W
140	1.65–j3.6	2.0–j2.6	2.3–j1.2	1.7–j4.1	1.8–j3.1	1.9–j2.7	9.9–j11.1	10.6–j5.1	10–j4.9	28.3–j21.5	16–j20.5	16.3–j16.5
175	2.5–j5.6	2.3–j5.9	2.8–j4.0	2.3–j4.6	2.4–j1.2	2.4–j5.7	12.1–j14.9	7.2–j9.8	8.1–j5.4	30.8–j23.3	11.4–j20.9	11.1–j14.3

f Frequency MHz	Z_{in} Ohms						Z_{OL}* Ohms					
	V_{CC} = 7.5 V; P_{in}			V_{CC} = 12.5 V; P_{in}			V_{CC} = 7.5 V; P_{out}			V_{CC} = 12.5 V; P_{out}		
	50 mW	100 mW	200 mW	25 mW	50 mW	100 mW	1.25 W	1.5 W	2.0 W	1.5 W	2.25 W	3.0 W
90	2.5–j9.3	2.5–j6.4	2.5–j4.4	1.6–j10.7	2.5–j7.1	2.2–j1.3	31.8–j9.2	32–j8.9	30.2–j10.7	45.8–j7.2	45.2–j3.9	40–j4.5

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

FIGURE 6 — POWER OUTPUT versus POWER INPUT

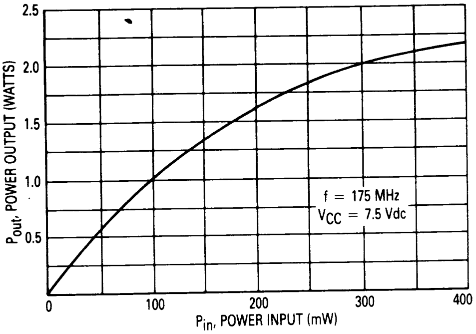


FIGURE 7 — POWER OUTPUT versus POWER INPUT

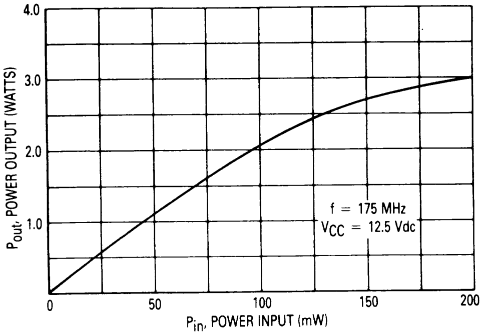


FIGURE 8 — POWER OUTPUT versus FREQUENCY

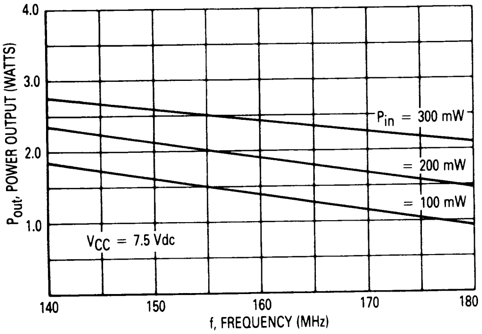


FIGURE 9 — POWER OUTPUT versus FREQUENCY

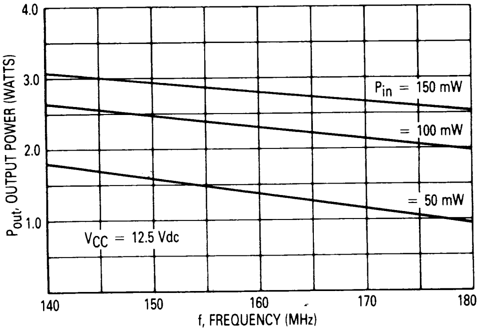


FIGURE 10 — POWER OUTPUT versus COLLECTOR VOLTAGE

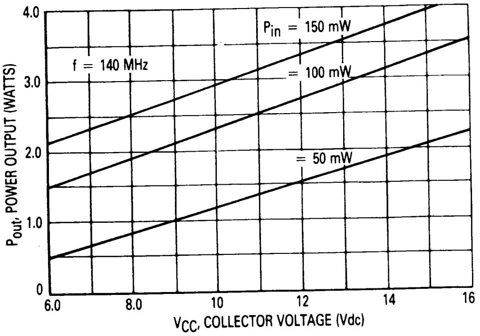
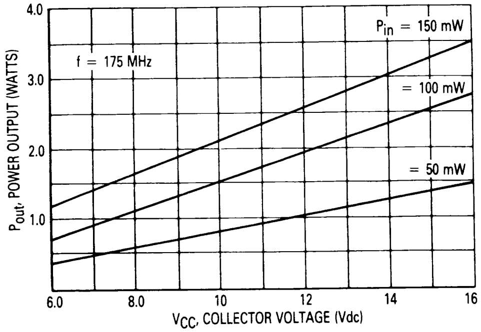


FIGURE 11 — POWER OUTPUT versus COLLECTOR VOLTAGE



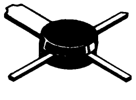
MOTOROLA
SEMICONDUCTOR
TECHNICAL DATA

MRF555

The RF Line

NPN Silicon
RF Low Power Transistor

1.5 W 470 MHz
RF LOW POWER
TRANSISTOR
NPN SILICON



CASE 317D-01

. . . designed primarily for wideband large signal predriver stages in the UHF frequency range.

- Specified @ 12.5 V, 470 MHz Characteristics @ P_{out} = 1.5 W
  Common Emitter Power Gain = 12.5 dB (Typ)
  Efficiency 60% (Typ)
- Cost Effective PowerMacro Package
- Electroless Tin Plated Leads for Improved Solderability

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	Vdc
Collector-Current — Continuous	I_C	400	mAdc
Operating Junction Temperature	T_J	150	°C
Total Device Dissipation @ T_C = 75°C (1,2) Derate above 75°C	P_D	3 40	Watts mW/°C
Storage Temperature Range	T_{stg}	−65 to +150	°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	25	°C/W

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

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Collector-Emitter Breakdown Voltage (I_C = 5 mAdc, I_B = 0)	$V_{(BR)CEO}$	16	—	—	Vdc
Collector-Emitter Breakdown Voltage (I_C = 5 mAdc, V_{BE} = 0)	$V_{(BR)CES}$	36	—	—	Vdc
Emitter-Base Breakdown Voltage (I_E = 0.1 mAdc, I_C = 0)	$V_{(BR)EBO}$	4	—	—	Vdc
Collector Cutoff Current (V_{CE} = 15 Vdc, V_{BE} = 0, T_C = 25°C)	I_{CES}	—	—	0.1	mAdc
ON CHARACTERISTICS					
DC Current Gain (I_C = 100 mAdc, V_{CE} = 5 Vdc)	h_{FE}	50	90	200	—
DYNAMIC CHARACTERISTICS					
Output Capacitance (V_{CB} = 15 Vdc, I_E = 0, f = 1 MHz)	C_{ob}	—	3.5	5	pF
FUNCTIONAL TESTS (f = 470 MHz)					
Common-Emitter Power Gain (V_{CC} = 12.5 Vdc, P_{out} = 1.5 W)	G_{pe}	11	12.5	—	dB
Collector Efficiency (V_{CC} = 12.5 Vdc, P_{out} = 1.5 W)	η_c	50	60	—	%
Load Mismatch Stress (V_{CC} = 15.5 Vdc, P_{in} = 125 mW, VSWR ≥ 10:1 all phase angles)	ψ	No Degradation in Output Power			

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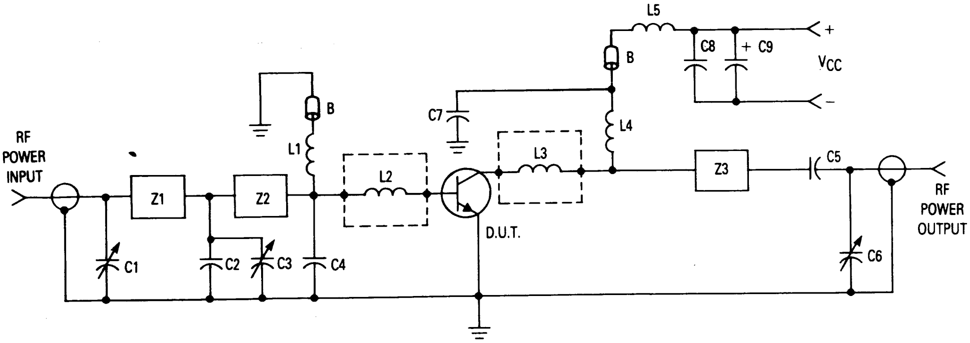
(1) T_C, Case temperature, measured on collector lead immediately adjacent to body of package.
(2) The MRF555 PowerMacro must be properly mounted for reliable operation. AN938, "Mounting Techniques in PowerMacro Transistor," discusses methods of mounting and heatsinking.



*C1, C3, C6 — 0.8–11 pF Johanson	L1 — 5 Turns #21 AWG, 5/32″ I.D.
C2 — 15 pF Clamped Mica, Mini-Underwood	L2, L3 — 60 x 125 x 250 Mils Copper Pad on 27 Mil Thick Alumina Substrate
C4 — 36 pF Clamped Mica, Mini-Underwood	L4, L5 — 7 Turns #21 AWG 5/32″ I.D
C5 — 470 pF Ceramic Chip Capacitor	Z1 — 1.29″ x 0.16″ Microstrip
C7 — 91 pF Clamped Mica, Mini-Underwood	Z2 — 0.70″ x 0.16″ Microstrip
C8 — 68 pF Clamped Mica, Mini-Underwood	Z3 — 2.18″ x 016″ Microstrip
C9 — 1 μF, 25 V Tantalum	PCB — 1/16″ Glass Teflon, 1 oz. cu. clad, double sided, ϵ_r = 2.5
B — Bead, Ferroxcube 56-590-65/3B	(See Figure 5 — Photomaster)

*Fixed tuned for broadband response.

Figure 1. 400–512 MHz Broadband Circuit

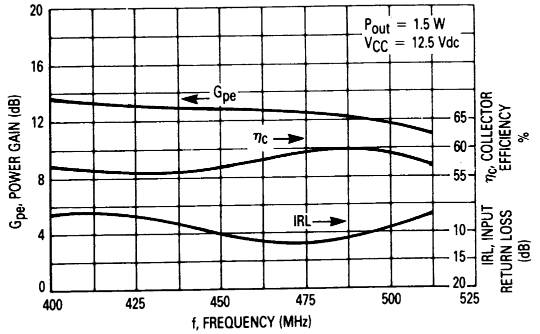


Figure 2. Performance in Broadband Circuit

f Frequency MHz	Z_{in} Ohms		Z_{OL}* Ohms	
	V_{CC} = 7.5 V	V_{CC} = 12.5 V	V_{CC} = 7.5 V	V_{CC} = 12.5 V
	P_{in} = 100 mW	P_{in} = 50 mW	P_{out} 400 MHz = 1.5 W P_{out} 450 MHz = 1.35 W P_{out} 512 MHz = 1.05 W	P_{out} 400 MHz = 1.9 W P_{out} 450 MHz = 1.45 W P_{out} 512 MHz = 0.9 W
400	2.9 − j2.7	1.9 − j3.1	18.0 − j13.4	12.2 − j19.7
450	2.2 − j0.8	2.6 − j4.0	21.6 − j9.9	20.2 − j18.6
512	3.5 − j1.2	2.6 − j2.6	20.1 − j1.0	23.4 − j23.0

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

Figure 3. Z_{in} and Z_{OL} versus Collector Voltage, Input Power and Output Power

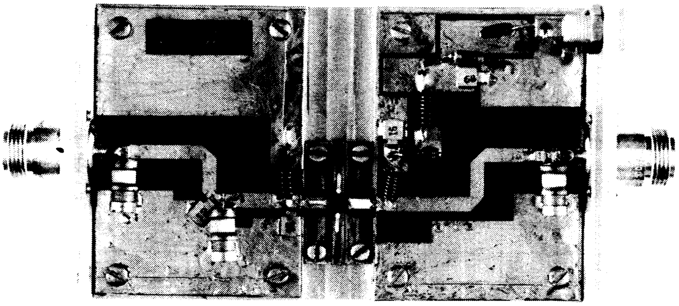
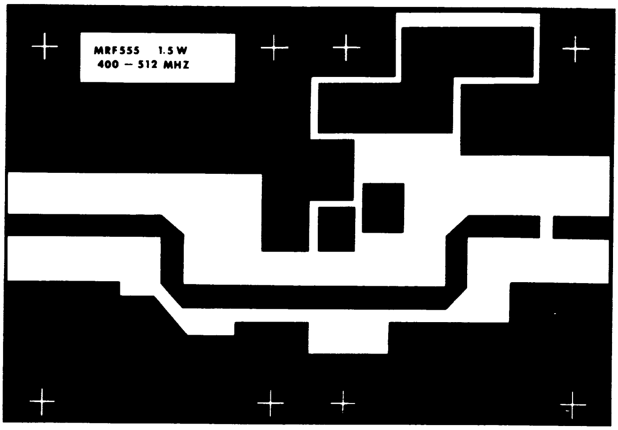


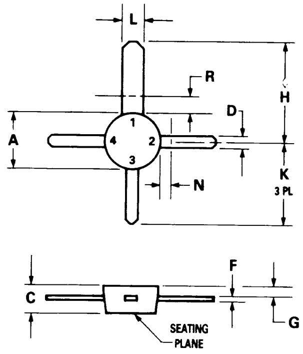
Figure 4. 400–512 MHz Broadband Circuit



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

Figure 5. 400–512 MHz Broadband Circuit Photomaster

OUTLINE DIMENSIONS



CASE 317D-01

NOTE:
DIMENSION D NOT APPLICABLE IN ZONES N AND R.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.44	5.21	0.175	0.205
C	1.90	2.54	0.075	0.100
D	0.84	0.99	0.033	0.039
F	0.20	0.30	0.008	0.012
G	0.63	1.01	0.025	0.040
H	8.84	9.72	0.348	0.383
K	7.24	8.13	0.285	0.320
L	2.46	2.64	0.097	0.104
N	—	1.65	—	0.065
R	—	3.25	—	0.128

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

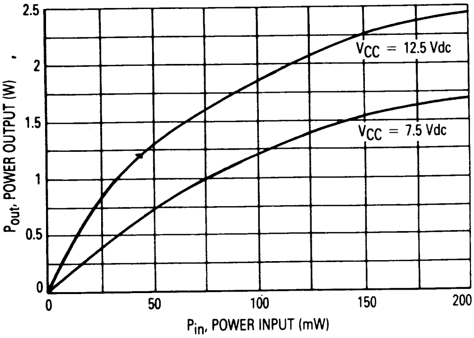


Figure 6. Power Output versus Power Input

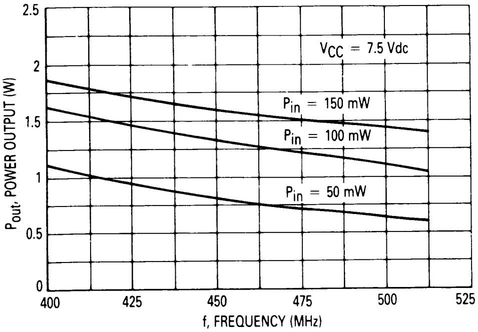


Figure 7. Power Output versus Frequency

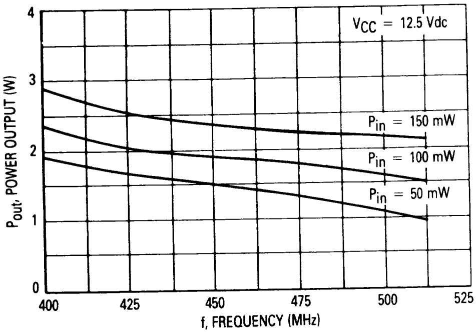


Figure 8. Power Output versus Frequency

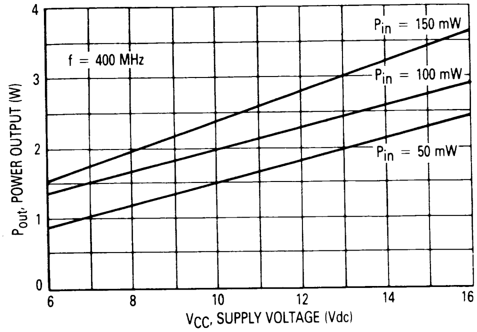


Figure 9. Power Output versus Supply Voltage

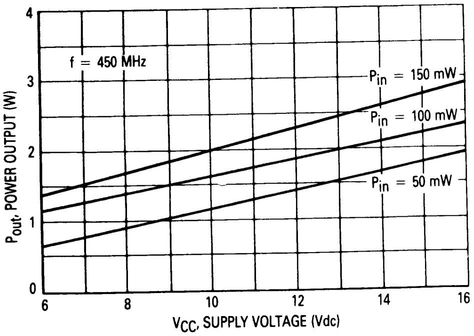


Figure 10. Power Output versus Supply Voltage

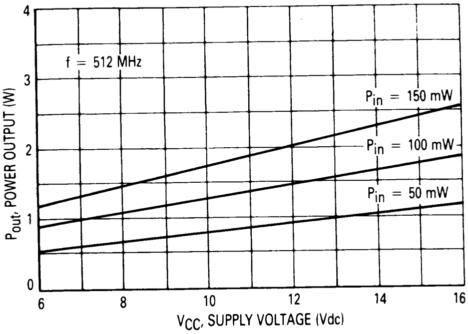


Figure 11. Power Output versus Supply Voltage

MOTOROLA
SEMICONDUCTOR
TECHNICAL DATA

MRF557

The RF Line

NPN SILICON RF LOW POWER TRANSISTOR

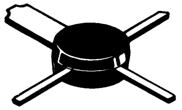
. . . designed primarily for wideband large signal predriver stages in the 800 MHz frequency range.

- Specified @ 12.5 V, 870 MHz Characteristics
  Output Power = 1.5 W
  Minimum Gain = 8.0 dB
  Efficiency 60% (Typ)
- Cost Effective PowerMacro Package
- Electroless Tin Plated Leads for Improved Solderability

1.5 W 870 MHz

RF LOW POWER TRANSISTOR

NPN SILICON



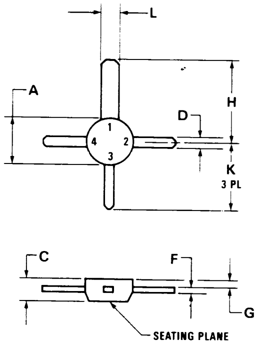
MAXIMUM RATINGS

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	400	mAdc
Total Device Dissipation @ T_C = 75°C (1,2) Derate above 75°C	P_D	3.0 40	Watts mW/°C
Storage Temperature Range	T_{stg}	−65 to +150	°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	25	°C/W

(1) T_C, Case temperature measured on collector lead immediately adjacent to body of package.
(2) The MRF557 PowerMacro must be properly mounted for reliable operation. AN938, "Mounting Techniques in PowerMacro Transistor," discusses methods of mounting and heatsinking.



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

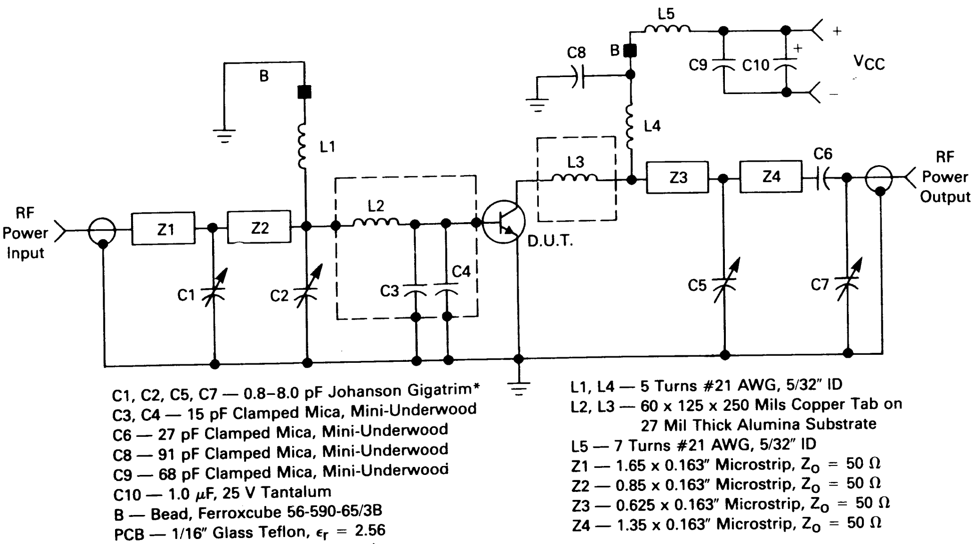
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.44	5.21	0.175	0.205
C	1.90	2.54	0.075	0.100
D	0.84	0.99	0.033	0.039
F	0.20	0.30	0.008	0.012
G	0.63	1.01	0.025	0.040
H	8.84	9.72	0.348	0.383
K	7.24	8.13	0.285	0.320
L	2.46	2.64	0.097	0.104

CASE 317D-01

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

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Collector-Emitter Breakdown Voltage (I_C = 5.0 mAdc, I_B = 0)	$V_{(BR)CEO}$	16	—	—	Vdc
Collector-Emitter Breakdown Voltage (I_C = 5.0 mAdc, V_{BE} = 0)	$V_{(BR)CES}$	36	—	—	Vdc
Emitter-Base Breakdown Voltage (I_E = 0.1 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}	—	—	0.1	mAdc
ON CHARACTERISTICS					
DC Current Gain (I_C = 100 mAdc, V_{CE} = 5.0 Vdc)	h_{FE}	50	90	200	—
DYNAMIC CHARACTERISTICS					
Output Capacitance (V_{CB} = 15 Vdc, I_E = 0, f = 1.0 MHz)	C_{ob}	—	3.5	5.0	pF
FUNCTIONAL TESTS					
Common-Emitter Amplifier Power Gain Figures 1, 2 (V_{CC} = 12.5 Vdc, P_{out} = 1.5 W, f = 870 MHz)	G_{pe}	8.0	9.0	—	dB
Collector Efficiency Figures 1, 2 (V_{CC} = 12.5 Vdc, P_{out} = 1.5 W, f = 870 MHz)	η_C	55	60	—	%
Load Mismatch Stress Figures 1, 2 (V_{CC} = 15.5 Vdc, P_{in} = 225 mW, f = 870 MHz, VSWR ≥ 10:1 all phase angles)	ψ	No Degradation in Output Power			

FIGURE 1 — 800-880 MHz BROADBAND CIRCUIT



C1, C2, C5, C7 — 0.8-8.0 pF Johanson Gigatrim*
C3, C4 — 15 pF Clamped Mica, Mini-Underwood
C6 — 27 pF Clamped Mica, Mini-Underwood
C8 — 91 pF Clamped Mica, Mini-Underwood
C9 — 68 pF Clamped Mica, Mini-Underwood
C10 — 1.0 µF, 25 V Tantalum
B — Bead, Ferroxcube 56-590-65/3B
PCB — 1/16″ Glass Teflon, ϵ_r = 2.56
(See Photomaster Figure 3)

L1, L4 — 5 Turns #21 AWG, 5/32″ ID
L2, L3 — 60 x 125 x 250 Mils Copper Tab on
27 Mil Thick Alumina Substrate
L5 — 7 Turns #21 AWG, 5/32″ ID
Z1 — 1.65 x 0.163″ Microstrip, Z_o = 50 Ω
Z2 — 0.85 x 0.163″ Microstrip, Z_o = 50 Ω
Z3 — 0.625 x 0.163″ Microstrip, Z_o = 50 Ω
Z4 — 1.35 x 0.163″ Microstrip, Z_o = 50 Ω

*Fixed tuned for broadband response.

FIGURE 2 — 800–880 MHz BROADBAND CIRCUIT

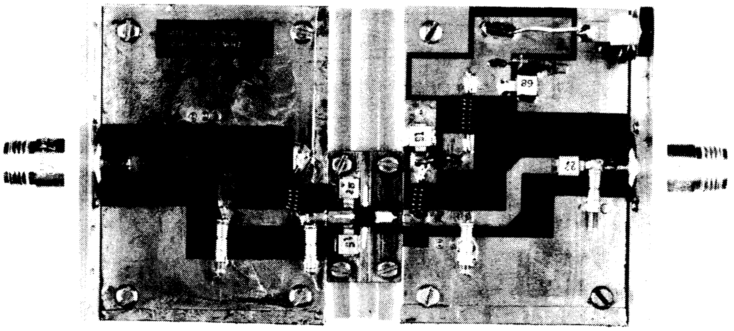
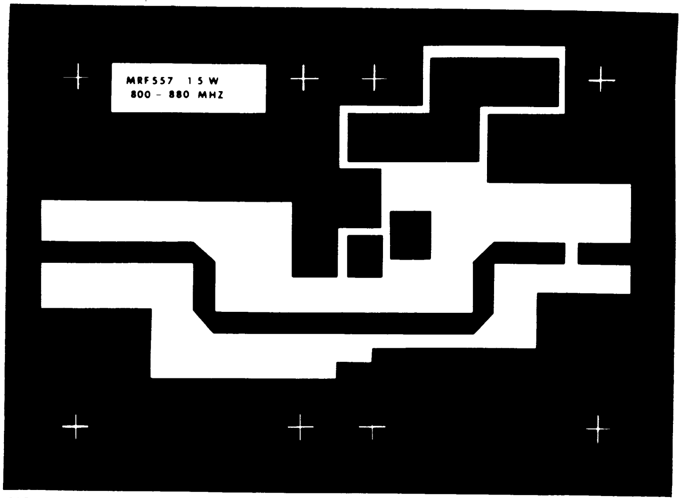


FIGURE 3 — 800–880 MHz TEST CIRCUIT PHOTOMASTER



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

FIGURE 4 — PERFORMANCE IN BROADBAND CIRCUIT

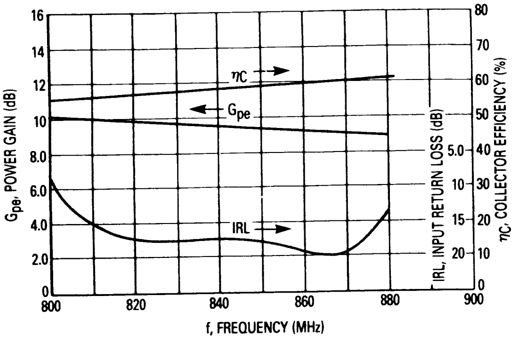


FIGURE 5 — Z_{in} and Z_{ol} versus COLLECTOR VOLTAGE, INPUT POWER AND OUTPUT POWER

f FREQUENCY MHz	Z_{in} Ohms V_{CC} = 7.5 V P_{in} = 300 mW	Z_{in} Ohms V_{CC} = 12.5 V P_{in} = 200 mW	Z_{OL}* Ohms V_{CC} = 7.5 V P_{out} 806 MHz = 1.7 W P_{out} 870 MHz = 1.4 W P_{out} 960 MHz = 1.0 W	Z_{OL}* Ohms V_{CC} = 12.5 V P_{out} 806 MHz = 2.1 W P_{out} 870 MHz = 1.8 W P_{out} 960 MHz = 1.1 W
806	2.4 + j3.9	2.4 + j3.1	14.7 − j4.4	13.6 − j12.8
870	2.5 + j4.6	2.7 + j3.7	17.2 − j8.6	16 − j13.2
960	6.1 + j7.4	6.8 + j8.3	40 − j8.3	38 − j10.5

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

FIGURE 6 — POWER OUTPUT versus POWER INPUT

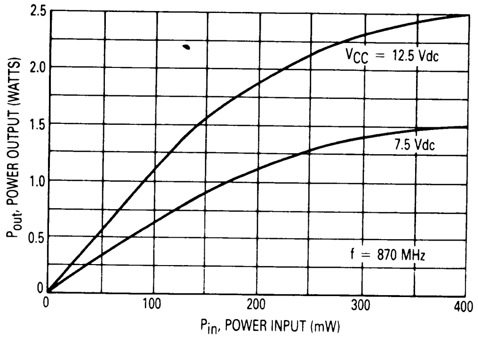


FIGURE 7 — POWER OUTPUT versus FREQUENCY

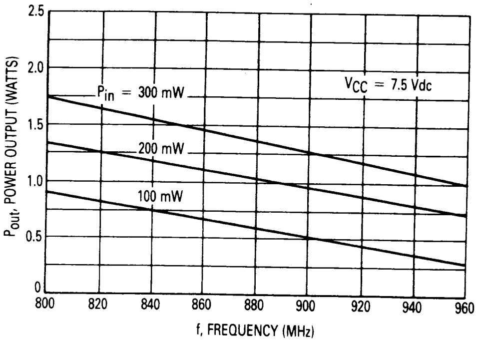


FIGURE 8 — POWER OUTPUT versus FREQUENCY

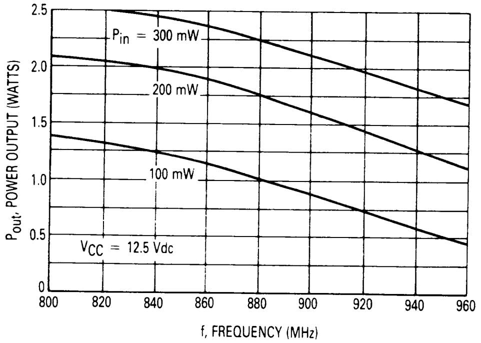


FIGURE 9 — POWER OUTPUT versus SUPPLY VOLTAGE

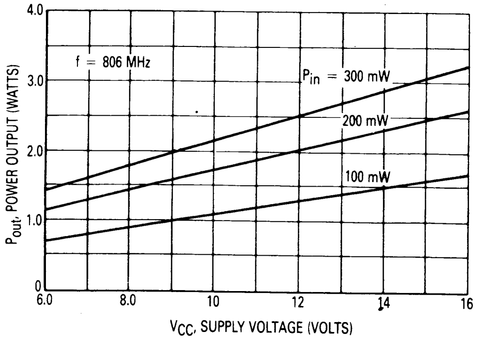


FIGURE 10 — POWER OUTPUT versus SUPPLY VOLTAGE

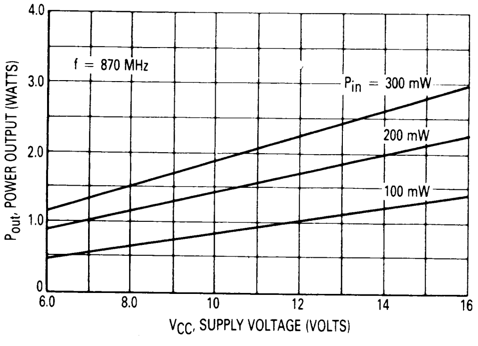
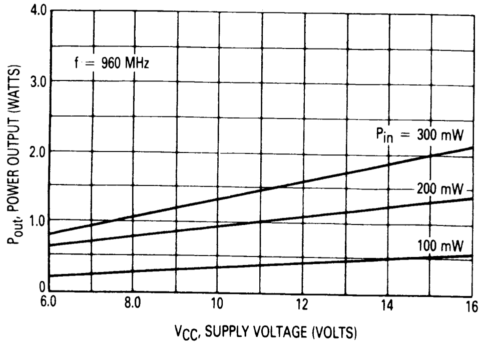


FIGURE 11 — POWER OUTPUT versus SUPPLY VOLTAGE



MOTOROLA
SEMICONDUCTOR
TECHNICAL DATA

MRF559

The RF Line

0.5 W — 870 MHz

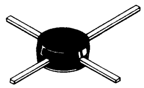
HIGH FREQUENCY TRANSISTOR

NPN SILICON

NPN SILICON HIGH FREQUENCY TRANSISTOR

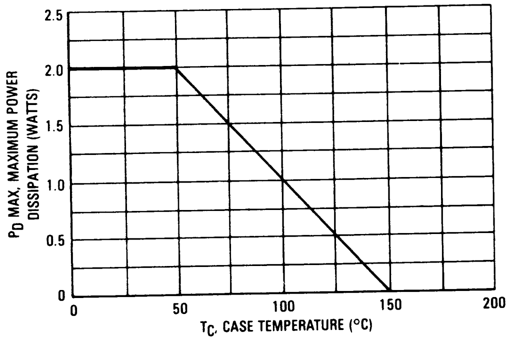
. . . designed for UHF linear and large-signal amplifier applications.

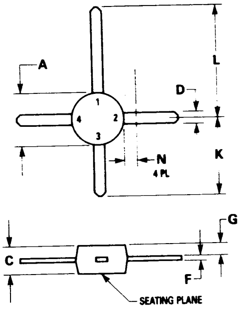
- Specified 12.5 Volt, 870 MHz Characteristics —
  Output Power = 0.5 Watts
  Minimum Gain = 8.0 dB
  Efficiency = 50%
- S Parameter Data From 250 MHz to 1.5 GHz
- 1.0 dB Compression > +20 dBm Typ
- Ideally Suited for Broadband, Class A, Low-Noise Applications
- Recommended As Driver for MHW808 and MHW820, 806–870 MHz Power Modules



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}	3.0	Vdc
Collector-Current — Continuous	I_C	150	mAdc
Total Device Dissipation @ $T_C = 50°C$ Derate above 50°C	P_D	2.0 20	Watts mW/°C
Storage Temperature Range	T_{stg}	-65 to +150	°C


POWER DISSIPATION



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

NOTE:
DIMENSION D NOT APPLICABLE IN ZONE N.

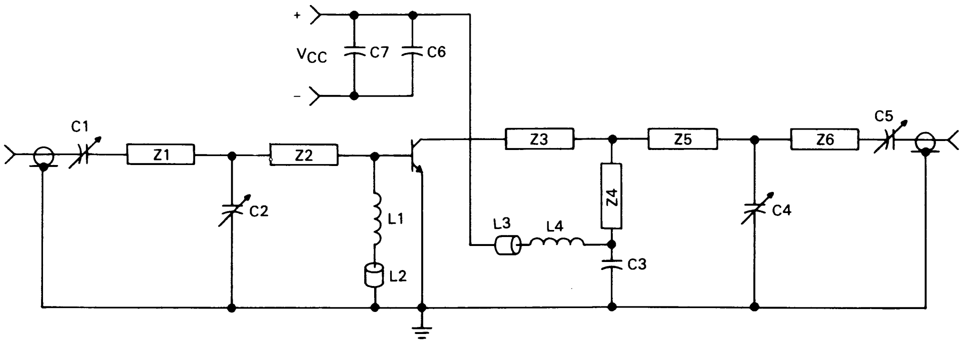
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.44	5.21	0.175	0.205
C	1.90	2.54	0.075	0.100
D	0.84	0.99	0.033	0.039
F	0.20	0.30	0.008	0.012
G	0.76	1.14	0.030	0.045
K	7.24	8.13	0.285	0.320
L	10.54	11.43	0.415	0.450
N	—	1.65	—	0.065

CASE 317-01

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

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Collector-Emitter Breakdown Voltage (I_C = 5.0 mAdc, $I_B \approx 0$)	$V_{(BR)CEO}$	18	—	—	Vdc
Collector-Base Breakdown Voltage (I_C = 100 μAdc, I_E = 0)	$V_{(BR)CBO}$	36	—	—	Vdc
Emitter-Base Breakdown Voltage (I_E = 100 μAdc, I_C = 0)	$V_{(BR)EBO}$	3.0	—	—	Vdc
Collector Cutoff Current (V_{CE} = 15 Vdc, V_{BE} = 0)	I_{CES}	—	—	1.0	mAdc
ON CHARACTERISTICS					
DC Current Gain (I_C = 50 mAdc, V_{CE} = 10 Vdc)	h_{FE}	30	90	200	—
DYNAMIC CHARACTERISTICS					
Current-Gain — Bandwidth Product (I_C = 100 mAdc, V_{CE} = 10 Vdc, f = 200 MHz)	f_T	—	3000	—	MHz
Output Capacitance (V_{CB} = 12.5 Vdc, I_E = 0, f = 1.0 MHz)	C_{ob}	—	2.0	2.5	pF
FUNCTIONAL TESTS					
Common-Emitter Amplifier Power Gain f = 870 MHz (V_{CC} = 12.5 Vdc, P_{out} = 0.5 W) f = 512 MHz	G_{PE}	8.0 —	9.5 13	— —	dB
Collector Efficiency f = 870 MHz (V_{CC} = 12.5 Vdc, P_{out} = 0.5 W) f = 512 MHz	η	50 —	65 60	— —	%
TYPICAL PERFORMANCE @ V_{CC} = 7.5 V					
Common-Emitter Amplifier Power Gain f = 870 MHz (V_{CC} = 7.5 Vdc, P_{out} = 0.5 W) f = 512 MHz	G_{PE}	— —	6.5 10	— —	dB
Collector Efficiency f = 870 MHz (V_{CC} = 7.5 Vdc, P_{out} = 0.5 W) f = 512 MHz	η	— —	70 65	— —	%

FIGURE 1 — 870 MHz TEST FIXTURE



C1, C2, C4, C5 — 1.0-10 pF Johanson
C3, C6 — 0.001 μF Chip Capacitor
C7 — 1.0 μF Tantulam
L1, L4 — 4 Turns #26 AWG, 0.3 cm ID, 0.4 cm Long
L2, L3 — Ferrite Bead
Microstrip Elements — ϵ_r = 1.0

Z1 — 50 Ω 1.5 cm
Z2 — 30 Ω 2.5 cm
Z3 — 50 Ω 2.0 cm
Z4 — 50 Ω 1.2 cm
Z5, Z6 — 50 Ω 1.25 cm

FIGURE 2 — OUTPUT POWER versus INPUT POWER
f = 512 MHz

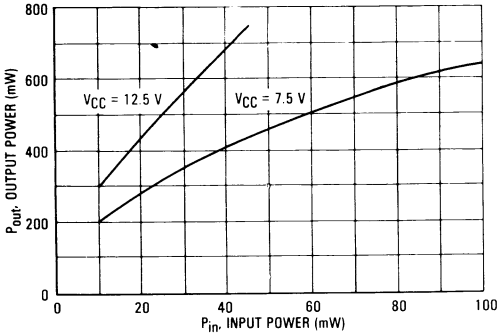


FIGURE 3 — OUTPUT POWER versus FREQUENCY
V_{CC} = 7.5 V

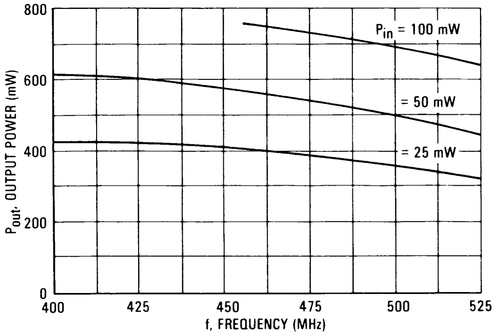


FIGURE 4 — OUTPUT POWER versus COLLECTOR VOLTAGE
f = 512 MHz

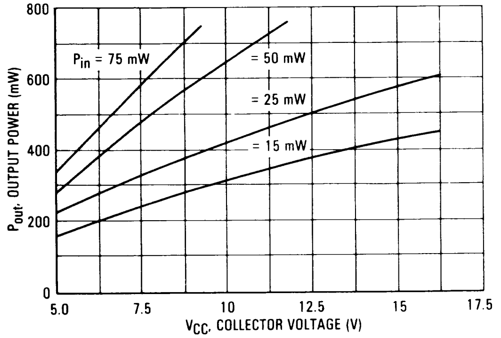


FIGURE 5 — OUTPUT POWER versus FREQUENCY
V_{CC} = 12.5 V

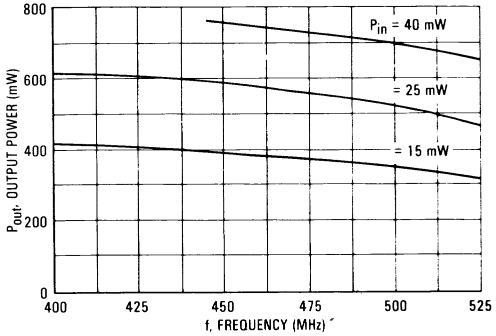


FIGURE 6 — Z_{in} AND Z_{OL} versus COLLECTOR VOLTAGE, INPUT POWER, AND OUTPUT POWER

f FREQUENCY MHz	Z_{in} OHMS			Z_{OL}* OHMS					
	V_{CC} = 7.5-12.5 V			V_{CC} = 7.5 V			V_{CC} = 12.5 V		
	15 mW	25 mW	50 mW	0.25 W	0.50 W	0.75 W	0.25 W	0.50 W	0.75 W
400	4.3 - j13.3	4.9 - j11.0	5.7 - j8.7	31 - j49	44 - j34	42 - j4.9	20 - j68	42 - j60	52 - j54
440	3.9 - j8.8	4.5 - j8.7	5.4 - j6.9	27 - j42	39 - j30	40 - j6.9	19 - j62	37 - j54	49 - j50
480	3.5 - j4.4	4.1 - j6.5	5.0 - j4.3	24 - j36	36 - j25	39 - j9.0	18 - j56	33 - j48	47 - j46
520	3.2 - j2.2	3.8 - j4.3	4.7 - j1.7	22 - j30	34 - j20	37 - j12	17 - j52	31 - j44	47 - j42

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

FIGURE 7 — OUTPUT POWER versus INPUT POWER
f = 870 MHz

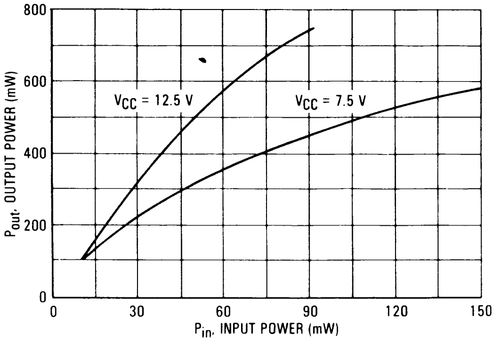


FIGURE 8 — OUTPUT POWER versus FREQUENCY
V_{CC} = 7.5 V

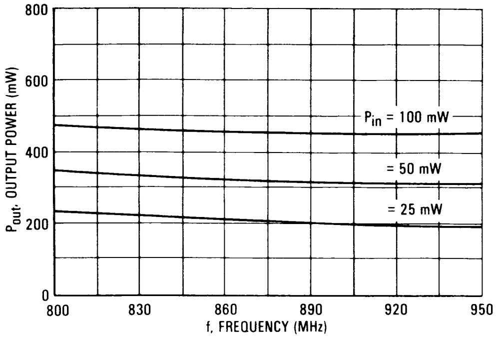


FIGURE 9 — OUTPUT POWER versus COLLECTOR VOLTAGE
f = 870 MHz

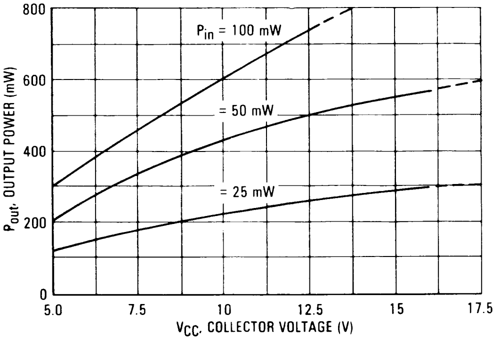


FIGURE 10 — OUTPUT POWER versus FREQUENCY
V_{CC} = 12.5 V

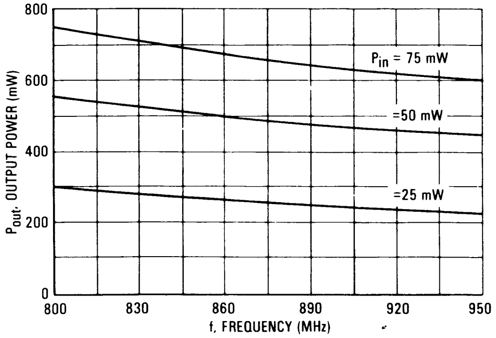
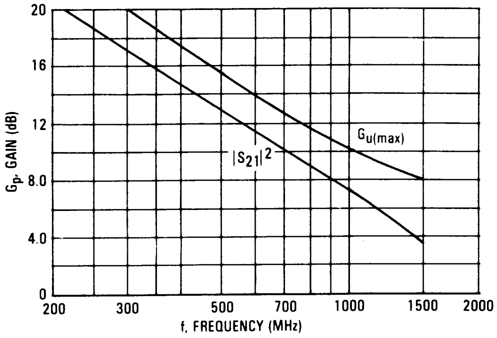


FIGURE 11 — Z_{in} AND Z_{OL} versus COLLECTOR VOLTAGE, INPUT POWER, AND OUTPUT POWER

f FREQUENCY MHz	Z_{in} OHMS			Z_{OL}* OHMS					
	V_{CC} = 7.5-12.5 V			V_{CC} = 7.5 V			V_{CC} = 12.5 V		
	25 mW	50 mW	100 mW	0.25 W	0.50 W	0.75 W	0.25 W	0.50 W	0.75 W
800	2.9 + j2.2	3.8 + j4.4	4.7 + j6.5	15.0 – j36.8	22.7 – j30.6	27.1 – j22.6	14.6 – j43.6	17.2 – j39.7	23.4 – j37.7
850	3.2 + j3.5	3.8 + j5.2	4.8 + j7.4	15.7 – j35.3	23.9 – j28.7	27.3 – j21.5	16.3 – j40.8	17.8 – j39.5	23.7 – j36.8
900	3.8 + j5.7	4.4 + j7.0	5.4 + j8.7	16.4 – j33.7	25.1 – j27.0	27.5 – j20.5	17.3 – j38.2	18.3 – j39.3	23.9 – j36.0
950	4.1 + j7.4	4.5 + j8.8	5.5 + j10.1	17.0 – j32.2	26.3 – j25.2	27.6 – j19.4	17.2 – j36.1	20.1 – j38.5	24.5 – j35.6

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

FIGURE 12 — GAIN versus FREQUENCY
V_{CE} = 10 V, I_C = 50-100 mA



$$G_{u(max)} = \frac{|S_{21}|^2}{(1-|S_{11}|^2)\ (1-|S_{22}|^2)}$$

FIGURE 13 — GAIN versus COLLECTOR CURRENT
V_{CE} = 10 V

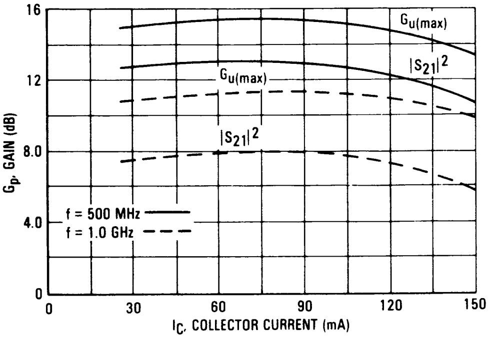


FIGURE 14 — NOISE FIGURE AND ASSOCIATED GAIN versus COLLECTOR CURRENT
V_{CE} = 10 V

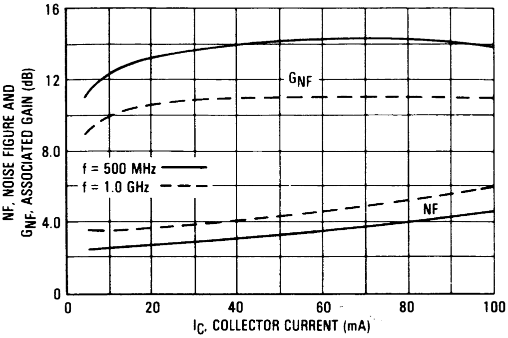


FIGURE 15 — CURRENT GAIN BANDWIDTH PRODUCT versus COLLECTOR CURRENT
V_{CE} = 10 V

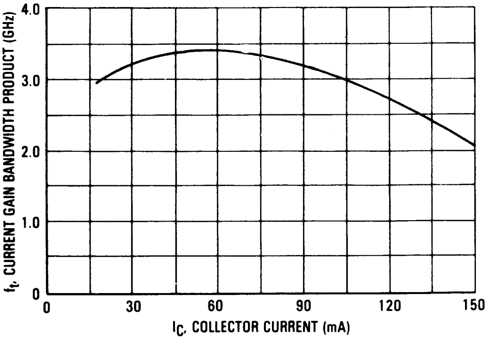


FIGURE 16 — OUTPUT CAPACITANCE versus COLLECTOR BASE VOLTAGE

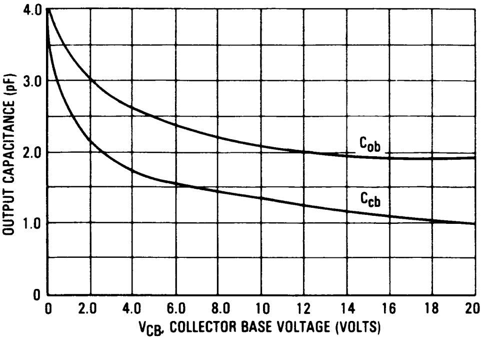


FIGURE 17 — COMMON EMITTER SCATTERING PARAMETERS

V_{CE} (Volts)	I_C (mA)	f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}	
			$\|S_{11}\|$	$\angle\phi$	$\|S_{21}\|$	$\angle\phi$	$\|S_{12}\|$	$\angle\phi$	$\|S_{22}\|$	$\angle\phi$
5.0	10	250	0.72	-161	6.20	93	0.057	30	0.30	-91
		500	0.73	179	3.16	76	0.069	43	0.27	-94
		1000	0.76	158	1.62	55	0.105	63	0.27	-119
		1500	0.82	142	1.08	41	0.155	70	0.41	-137
	25	250	0.70	-173	7.17	89	0.045	47	0.26	-123
		500	0.70	172	3.63	75	0.073	60	0.20	-128
		1000	0.74	152	1.90	54	0.134	67	0.21	-157
		1500	0.79	136	1.32	39	0.196	66	0.32	-167
	50	250	0.72	-178	7.63	89	0.038	56	0.27	-139
		500	0.72	170	3.85	77	0068	67	0.23	-141
		1000	0.75	153	2.01	59	0.129	72	0.23	-162
		1500	0.81	137	1.40	46	0.188	70	0.32	-164
	100	250	0.73	179	7.34	88	0.036	61	0.26	-143
		500	0.74	169	3.70	77	0.067	71	0.22	-144
		1000	0.76	153	1.94	59	0.130	74	0.24	-166
		1500	0.81	138	1.36	46	0.191	71	0.32	-167
	150	250	0.78	176	5.19	92	0.033	64	0.22	-131
		500	0.78	167	2.76	78	0.065	74	0.21	-131
		1000	0.80	151	1.49	58	0.129	77	0.24	-155
		1500	0.85	135	1.05	45	0.191	73	0.35	-161
10	10	250	0.69	-157	7.03	94	0.050	33	0.34	-67
		500	0.70	-178	3.59	77	0.060	46	0.32	-69
		1000	0.74	160	1.84	55	0.094	67	0.29	-94
		1500	0.81	142	1.20	41	0.148	76	0.42	-121
	25	250	0.67	-168	8.30	91	0.039	46	0.24	-93
		500	0.68	176	4.25	77	0.060	60	0.21	-89
		1000	0.72	158	2.19	57	0.109	71	0.19	-114
		1500	0.78	142	1.47	44	0.165	74	0.31	-134
	50	250	0.68	-174	8.88	90	0.035	55	0.21	-110
		500	0.68	172	4.49	77	0.060	67	0.18	-104
		1000	0.72	155	2.31	59	0.113	74	0.17	-128
		1500	0.77	139	1.58	46	0.169	74	0.28	-140
	100	250	0.68	-178	8.49	89	0.03	61	0.19	-104
		500	0.69	170	4.32	76	0.06	71	0.17	-97
		1000	0.72	153	2.25	58	0.12	76	0.17	-123
		1500	0.78	137	1.53	44	0.18	75	0.28	-137
	150	250	0.72	178	6.53	91	0.029	64	0.22	-71
		500	0.73	169	3.37	77	0.056	75	0.24	-75
		1000	0.76	152	1.79	57	0.112	80	0.22	-105
		1500	0.83	137	1.22	43	0.175	79	0.34	-129

FIGURE 18 — TUNABLE TEST FIXTURE

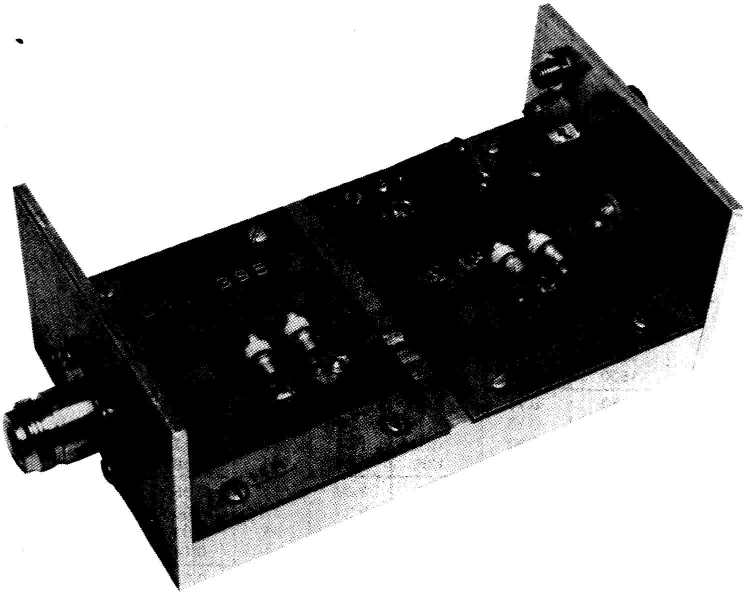
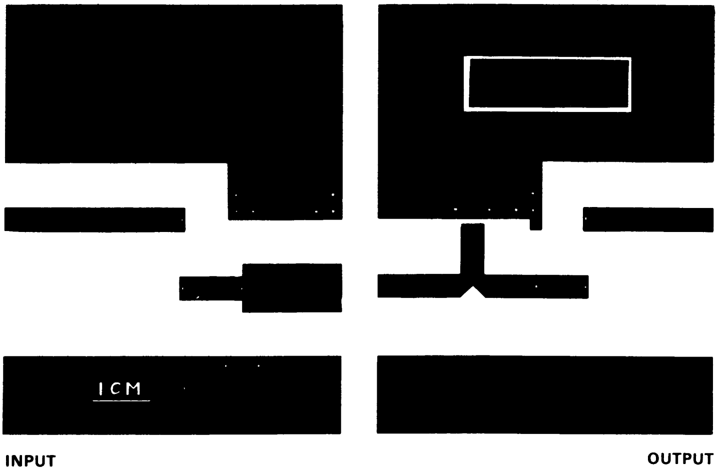


FIGURE 19 — PRINTED CIRCUIT BOARD LAYOUT



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