MRF5812
BF433*

*European Part Number

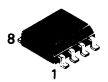
**SURFACE MOUNT
LOW POWER
TRANSISTOR
NPN SILICON**

The RF Line

NPN Silicon RF Low Power Transistor

. . . designed for high current, low power amplifiers up to 2 GHz.

- High Current Gain-Bandwidth Product — f_T = 5.5 GHz (Typ) @ I_C = 75 mA
- Low Noise — 2 dB (Typ) @ 500 MHz
- Low Intermodulation Distortion
- High Gain — 15.5 dB (Typ) @ 500 MHz
- Low Cost SORF Plastic Surface Mount Package
- State-of-the-Art Technology
  - Fine Line Geometry
  - Gold Top Metal and Wires
  - Silicon Nitride Passivated
  - Ion Implanted Arsenic Emitters
- Die Same as MRF581,A



**CASE 751-02
SORF
(SO-8)**

3

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CEO}	15	Vdc
Collector-Base Voltage	V_{CBO}	30	Vdc
Emitter-Base Voltage	V_{EBO}	2.5	Vdc
Collector-Current — Continuous	I_C	200	mAdc
Total Device Dissipation @ T_C = 80°C (1) Derate above 80°C	P_D	1.5 22.2	Watts mW/°C
Total Device Dissipation @ T_A = 25°C Derate above 25°C	P_D	1.5 11.8	Watts mW/°C
Operating Junction and Storage Temperature Range	T_J, T_{stg}	−65 to +150	°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	45	°C/W
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	85	°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)	$V_{(BR)CEO}$	15	—	—	Vdc
Collector-Emitter Breakdown Voltage (I_C = 5 mAdc, V_{BE} = 0)	$V_{(BR)CES}$	30	—	—	Vdc
Emitter-Base Breakdown Voltage (I_E = 0.1 mAdc, I_C = 0)	$V_{(BR)EBO}$	2.5	—	—	Vdc
Collector Cutoff Current (V_{CB} = 15 Vdc, V_{BE} = 0, T_C = 25°C)	I_{CBO}	—	—	0.1	mAdc
ON CHARACTERISTICS					
DC Current Gain (I_C = 50 mAdc, V_{CE} = 10 Vdc)	h_{FE}	30	90	200	—

(1) Case temperature is measured on the collector lead where the lead contacts the printed circuit board closest to the body of the package.

(continued)

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

Characteristic	Symbol	Min	Typ	Max	Unit
DYNAMIC CHARACTERISTICS					
Collector Base Capacitance (V_{CB} = 10 Vdc, I_E = 0, f = 1 MHz)	C_{cb}	—	1.2	2	pF
Current-Gain Bandwidth Product (1) (I_C = 75 mAdc, V_{CE} = 10 Vdc, f = 1 GHz)	f_T	—	5.5	—	GHz
FUNCTIONAL TESTS					
Noise Figure (Optimum) (I_C = 50 mAdc, V_{CE} = 10 Vdc, f = 0.5 GHz) Figure 4	NF	—	2	—	dB
Noise Figure (50 Ohm Insertion) (I_C = 50 mAdc, V_{CE} = 10 Vdc, f = 0.5 GHz) Figure 5	NF	—	2.5	3	dB
Power Gain Associated with Noise Figure (I_C = 50 mAdc, V_{CE} = 10 Vdc, f = 0.5 GHz) Figure 5	G_{NF}	13	15.5	—	dB
Maximum Unilateral Gain (1) (I_C = 75 mAdc, V_{CE} = 10 Vdc, f = 0.5 GHz)	G_{Umax}	—	17	—	dB
Intermodulation Distortion (2) Figure 1 (V_{CE} = 10 V, I_C = 75 mA, V_{out} = +50 dBmV)	IMD(d3)	—	−65	—	dB

Notes: (1) Characterized on HP8542 Automatic Network Analyzer. $G_{Umax} = \frac{|S_{21}|^2}{(1 - |S_{11}|^2)(1 - |S_{22}|^2)}$

(2) 2 Tones, f1 = 497 MHz, f2 = 503 MHz, 3rd Order Single Tone Reference.

3

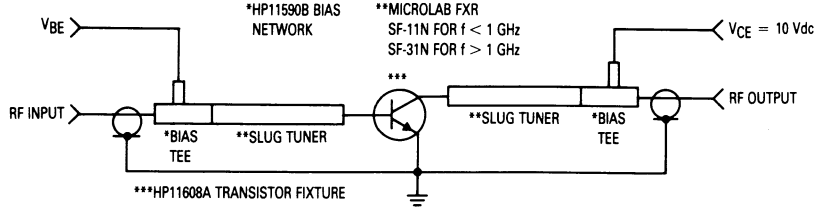


Figure 1. Functional Circuit Schematic

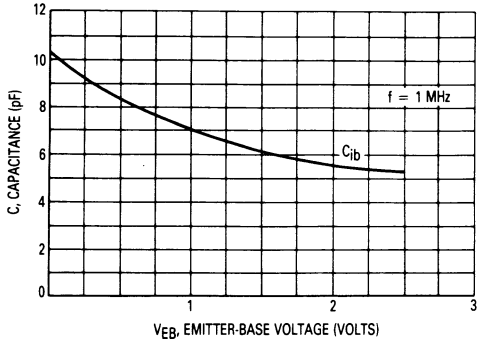


Figure 2. C_{ib} Input Capacitance versus Voltage

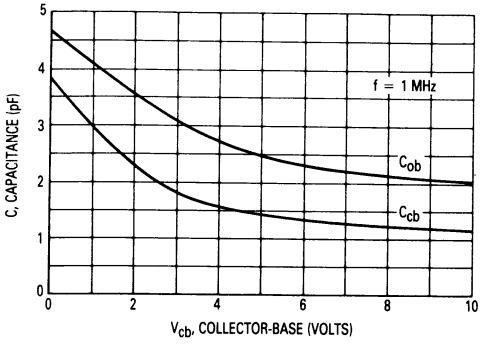


Figure 3. C_{cb}, C_{ob} Collector-Base Capacitance versus Voltage

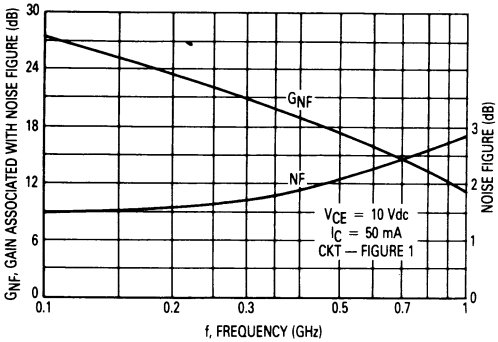


Figure 4. Noise Figure and Gain Associated with Noise Figure versus Frequency

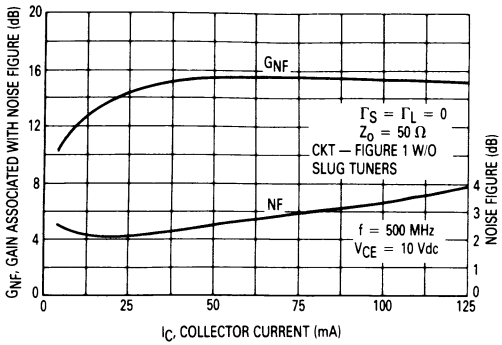


Figure 5. Noise Figure and Gain Associated with Noise Figure versus Collector Current

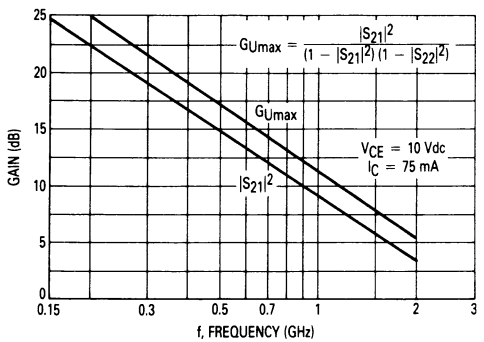


Figure 6. G_{Umax} — Maximum Unilateral Gain, $|S_{21}|^2$ versus Frequency

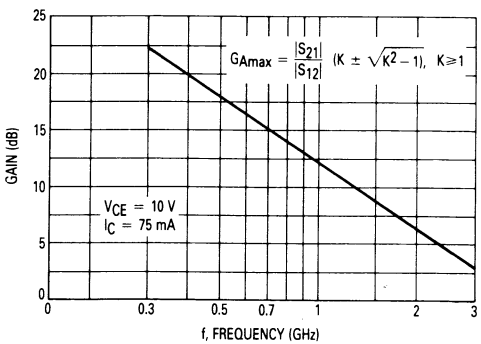


Figure 7. G_{Amax}, Maximum Available Gain versus Frequency

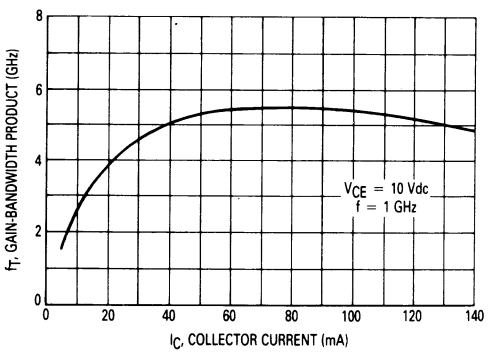


Figure 8. Gain-Bandwidth Product versus Collector Current

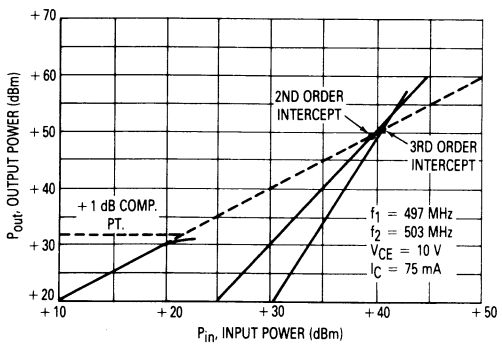
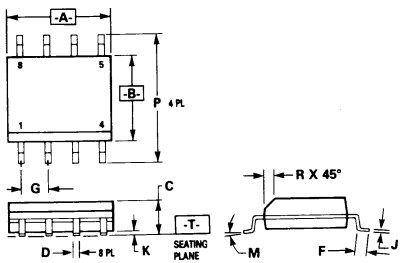


Figure 9. 2nd and 3rd Order Intercept Points and 1 dB Compression Point

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	25	100	0.66	−123	18.3	118	0.04	43	0.53	−79
		300	0.66	−167	7	92	0.06	44	0.31	−120
		500	0.65	178	4.3	81	0.08	52	0.28	−133
		1000	0.62	154	2.2	63	0.13	61	0.28	−141
		2000	0.57	109	1.3	39	0.28	57	0.31	−148
		3000	0.55	68	1	23	0.41	41	0.34	−164
	50	100	0.64	−133	20.2	114	0.04	44	0.51	−93
		300	0.65	−171	7.6	91	0.06	50	0.34	−137
		500	0.65	175	4.6	81	0.08	56	0.31	−148
		1000	0.61	152	2.3	63	0.13	63	0.28	−149
		2000	0.56	109	1.3	39	0.28	57	0.3	−150
		3000	0.52	70	1	23	0.41	39	0.29	−169
	75	100	0.64	−137	20.8	113	0.04	44	0.5	−99
		300	0.66	−173	7.7	91	0.06	52	0.35	−142
		500	0.64	174	4.7	82	0.08	59	0.32	−154
		1000	0.61	151	2.4	65	0.14	64	0.3	−164
		2000	0.54	107	1.4	42	0.3	55	0.27	−167
		3000	0.52	69	1.1	24	0.42	37	0.25	−172
	100	100	0.64	−140	20.8	112	0.03	44	0.5	−103
		300	0.65	−174	7.6	90	0.06	53	0.36	−145
		500	0.64	173	4.7	81	0.08	60	0.33	−156
		1000	0.61	151	2.4	65	0.15	64	0.31	−166
		2000	0.54	107	1.4	42	0.3	54	0.27	−169
		3000	0.52	65	1.1	24	0.42	37	0.25	−174
10	25	100	0.65	−112	20.2	121	0.04	46	0.56	−62
		300	0.63	−162	8	93	0.05	46	0.29	−93
		500	0.62	−178	5	82	0.07	52	0.25	−102
		1000	0.6	157	2.5	63	0.11	63	0.26	−112
		2000	0.55	112	1.4	39	0.25	61	0.35	−125
		3000	0.55	69	1	23	0.39	47	0.4	−145
	50	100	0.63	−122	22.9	117	0.03	46	0.5	−74
		300	0.62	−167	8.8	92	0.05	51	0.28	−112
		500	0.6	178	5.3	82	0.07	58	0.24	−122
		1000	0.58	154	2.7	64	0.12	65	0.23	−129
		2000	0.51	111	1.5	40	0.26	59	0.28	−132
		3000	0.5	70	1.2	24	0.39	44	0.34	−144
	75	100	0.63	−126	23.8	116	0.03	45	0.49	−80
		300	0.63	−168	9	92	0.05	51	0.28	−120
		500	0.62	177	5.5	82	0.07	58	0.24	−130
		1000	0.58	154	2.8	65	0.12	65	0.23	−137
		2000	0.52	111	1.5	41	0.26	58	0.27	−135
		3000	0.5	70	1.2	24	0.39	42	0.32	−145
	100	100	0.62	−128	23.8	114	0.03	46	0.46	−82
		300	0.62	−169	8.9	91	0.05	54	0.26	−120
		500	0.6	176	5.4	81	0.07	61	0.23	−130
		1000	0.57	152	2.8	64	0.12	66	0.21	−136
		2000	0.51	109	1.5	40	0.27	59	0.26	−134
		3000	0.5	68	1.2	24	0.39	43	0.32	−145
15	25	100	0.66	−106	21	123	0.03	47	0.57	−54
		300	0.63	−159	8.5	94	0.05	46	0.3	−77
		500	0.61	−177	5.2	82	0.06	52	0.26	−84
		1000	0.58	156	2.6	62	0.11	64	0.28	−96
		2000	0.54	110	1.4	36	0.23	63	0.39	−115
		3000	0.56	68	1	22	0.37	49	0.46	−137
	50	100	0.62	−114	24	119	0.03	46	0.51	−64
		300	0.6	−163	9.2	93	0.05	51	0.26	−92
		500	0.58	−179	5.7	81	0.07	58	0.22	−100
		1000	0.56	154	2.9	63	0.12	66	0.23	−109
		2000	0.52	109	1.5	39	0.25	60	0.32	−118
		3000	0.52	67	1.1	22	0.37	46	0.39	−137
	75	100	0.62	−118	24.6	117	0.03	46	0.48	−67
		300	0.59	−165	9.4	92	0.05	53	0.24	−96
		500	0.58	179	5.7	81	0.07	60	0.21	−104
		1000	0.56	154	2.9	63	0.12	66	0.22	−111
		2000	0.5	109	1.5	38	0.25	60	0.31	−118
		3000	0.52	67	1.1	22	0.37	46	0.38	−136
	100	100	0.62	−121	24.8	116	0.03	46	0.46	−68
		300	0.6	−165	9.3	91	0.05	53	0.23	−96
		500	0.58	179	5.7	81	0.07	61	0.2	−102
		1000	0.56	155	2.9	63	0.12	65	0.22	−109
		2000	0.5	111	1.5	39	0.25	62	0.32	−117
		3000	0.5	68	1.1	23	0.37	47	0.39	−136

Figure 10. Common Emitter S-Parameters

OUTLINE DIMENSIONS



NOTES:
1. DIMENSIONS A AND B ARE DATUMS AND T IS A DATUM SURFACE.
2. POSITIONAL TOLERANCE FOR D DIMENSION (8 PLACES):
   ⌖ | 0.25 (0.010) Ⓜ | T | B Ⓢ | A Ⓢ
3. POSITIONAL TOLERANCE FOR P DIMENSION (4 PLACES):
   ⌖ | 0.25 (0.010) Ⓜ | B Ⓜ
4. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
5. CONTROLLING DIMENSION: MILLIMETER.
6. DIMENSION A AND B DO NOT INCLUDE MOLD PROTRUSION.
7. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.

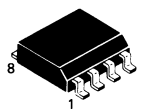
	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	4.80	5.00	0.189	0.196
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.054	0.068
D	0.35	0.49	0.014	0.019
F	0.40	1.25	0.016	0.049
G	1.27 BSC		0.050 BSC	
J	0.19	0.25	0.008	0.009
K	0.10	0.25	0.004	0.009
M	0°	7°	0°	7°
P	5.80	6.20	0.229	0.244
R	0.25	0.50	0.010	0.019

STYLE 1:
PIN 1. EMITTER
2. COLLECTOR
3. COLLECTOR
4. EMITTER
5. EMITTER
6. BASE
7. BASE
8. EMITTER

CASE 751-02
SORF
(SO-8)

MRF8372

**750 mW 870 MHz
RF LOW POWER
TRANSISTOR
NPN SILICON**



**CASE 751-02
SORF
(SO-8)**

The RF Line

NPN Silicon RF Low Power Transistor

. . . designed primarily for wideband large signal predriver stages in 800 MHz and UHF frequency ranges.

- Specified @ 12.5 V, 870 MHz Characteristics
  - Output Power = 750 mW
  - Common Emitter Power Gain = 10 dB (Typ)
  - Efficiency 60% (Typ)
- Low Cost SORF Plastic Surface Mounted Package
- State-of-the-Art Technology
  - Fine Line Geometry
  - Gold Top Metal and Wires
  - Silicon Nitride Passivated
  - Ion Implanted Arsenic Emitters

3

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	200	mAdc
Total Device Dissipation @ T_C = 80°C (1) Derate above 80°C	P_D	1.5 22.2	Watts mW/°C
Total Device Dissipation @ T_A = 25°C Derate above 25°C	P_D	1.5 11.8	Watts mW/°C
Operating Junction and Storage Temperature Range	T_J, T_{stg}	−65 to +150	°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	45	°C/W
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	85	°C/W

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

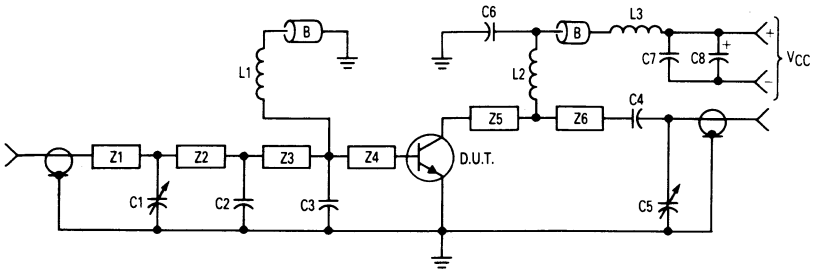
Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Collector-Emitter Breakdown Voltage (I_C = 5 mAdc, I_B = 0)	$V_{(BR)CEO}$	16	—	—	Vdc
Collector-Emitter Breakdown Voltage (I_C = 5 mAdc, V_{BE} = 0)	$V_{(BR)CES}$	36	—	—	Vdc
Emitter-Base Breakdown Voltage (I_E = 0.1 mAdc, I_C = 0)	$V_{(BR)EBO}$	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 = 50 mAdc, V_{CE} = 10 Vdc)	h_{FE}	30	90	200	—

(1) Case temperature is measured on the collector lead where the lead contacts the printed circuit board closest to the body of the package.

(continued)

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

Characteristic	Symbol	Min	Typ	Max	Unit
DYNAMIC CHARACTERISTICS					
Output Capacitance (V_{CB} = 15 Vdc, I_E = 0, f = 1 MHz)	C_{ob}	—	1.8	2.5	pF
FUNCTIONAL TESTS					
Common-Emitter Amplifier Power Gain Figures 1, 3 (V_{CC} = 12.5 Vdc, P_{out} = 0.75 W, f = 870 MHz)	G_{pe}	8	10	—	dB
Collector Efficiency Figures 1, 3 (V_{CC} = 12.5 Vdc, P_{out} = 0.75 W, f = 870 MHz)	η	55	60	—	%



C1,C5 — 0.8–8 pF Johanson Gigatrim
C2,C3 — 10 pF Ceramic Chip Capacitor
C6 — 91 pF Clamped Mica, Mini-Underwood
C4 — 47 pF Ceramic Chip Capacitor
C7 — 91 pF Clamped Mica, Mini-Underwood
C8 — 1 μF 25 V Tantalum
B — Bead, Ferroxcube 56-590-65/3B

L1,L2 — 4 Turns, #21 AWG, 5/32" ID
L3 — 7 Turns, #21 AWG, 5/32" ID
Z1,Z2 — 1" x 0.078" Microstrip, Z_O = 50 Ohms
Z3 — 0.25" x 0.078" Microstrip, Z_O = 50 Ohms
Z4 — 0.15" x 0.078" Microstrip, Z_O = 50 Ohms
Z5 — 0.30" x 0.078" Microstrip, Z_O = 50 Ohms
Z6 — 1.63" x 0.078" Microstrip, Z_O = 50 Ohms
PCB — 1/32" Glass Teflon, ϵ_r = 2.56

Figure 1. 800–900 MHz Broadband Circuit

800/900 MHz BAND DATA

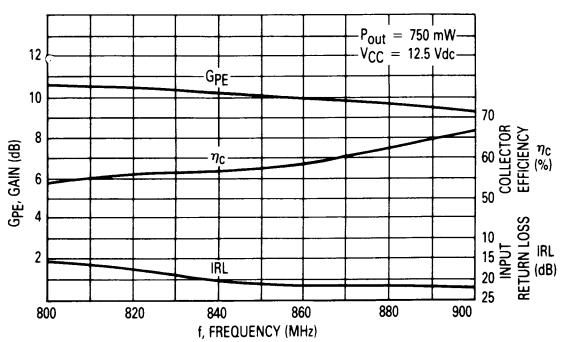


Figure 2. Typical Broadband Performance

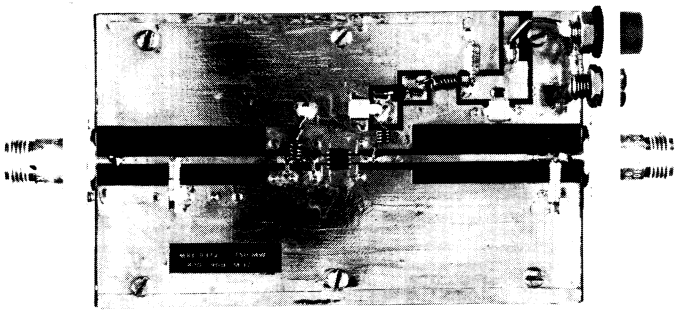
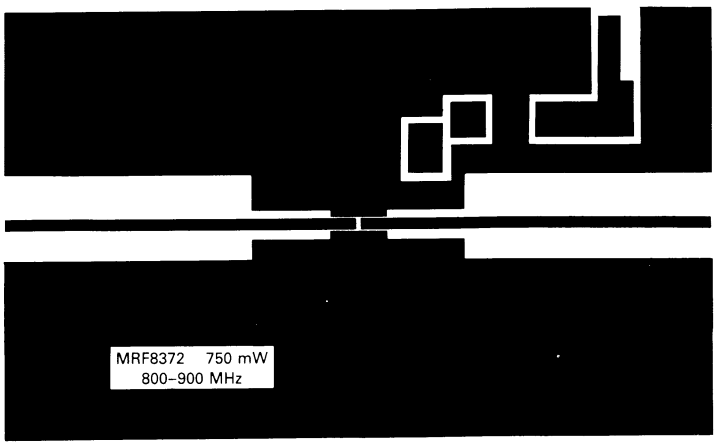


Figure 3. 800–900 Broadband Circuit



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

Figure 4. 800–900 MHz Broadband Circuit Photomaster

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} = 150 mW	P_{in} = 100 mW	P_{out} 806 MHz = 820 mW P_{out} 870 MHz = 635 mW P_{out} 960 MHz = 530 mW	P_{out} 806 MHz = 1.05 mW P_{out} 870 MHz = 855 mW P_{out} 960 MHz = 580 mW
806	8.0 + j1.9	4.0 + j1.2	24.7 − j19.2	20.9 − j31.0
870	5.2 + j3.5	6.0 + j1.9	36.9 − j20.5	32.1 − j26.6
960	6.8 + j4.0	6.1 + j2.5	39.3 − j18.5	36.3 − j25.7

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

Figure 5. Z_{in} and Z_{OL} versus Collector Voltage, Input Power and Output Power

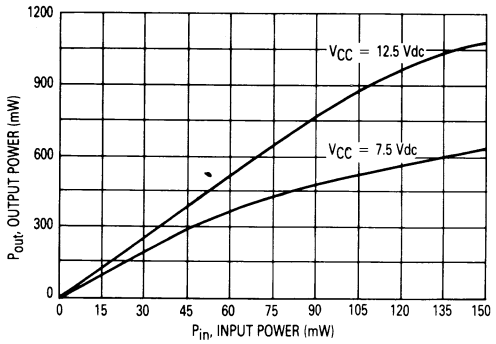


Figure 6. Output Power versus Input Power
f = 870 MHz

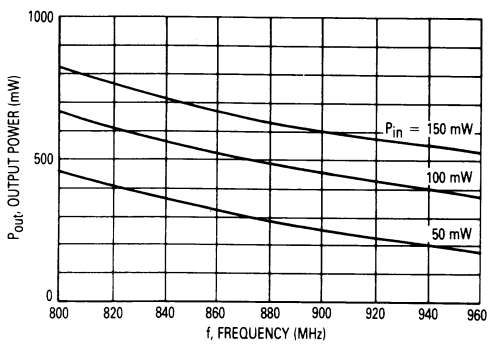


Figure 7. Output Power versus Frequency
V_{CC} = 7.5 Vdc

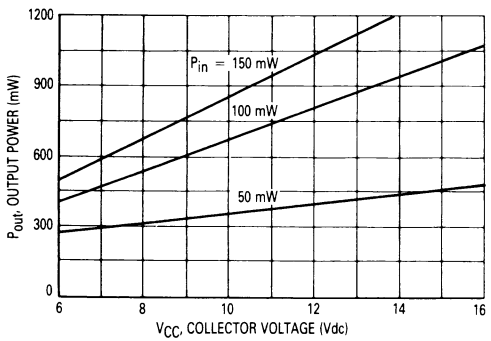


Figure 8. Output Power versus Collector Voltage
f = 870 MHz

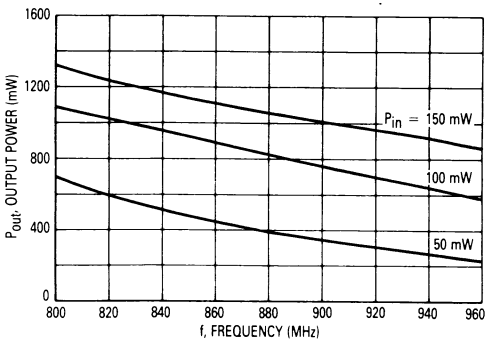
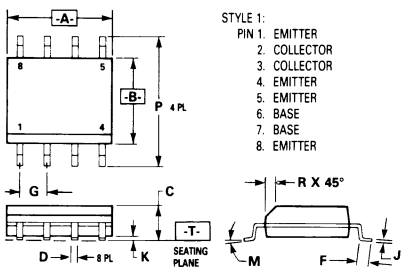


Figure 9. Output Power versus Frequency
V_{CC} = 12.5 Vdc

3

OUTLINE DIMENSIONS



STYLE 1:
PIN 1. EMITTER
2. COLLECTOR
3. COLLECTOR
4. EMITTER
5. EMITTER
6. BASE
7. BASE
8. EMITTER

NOTES:
1. DIMENSIONS A AND B ARE DATUMS AND T IS A DATUM SURFACE.
2. POSITIONAL TOLERANCE FOR D DIMENSION (8 PLACES): ⌖ 0.25 (0.010) Ⓜ T B Ⓢ A Ⓢ
3. POSITIONAL TOLERANCE FOR P DIMENSION (4 PLACES): ⌖ 0.25 (0.010) Ⓜ B Ⓜ
4. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
5. CONTROLLING DIMENSION: MILLIMETER.
6. DIMENSION A AND B DO NOT INCLUDE MOLD PROTRUSION.
7. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	4.80	5.00	0.189	0.196
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.054	0.068
D	0.35	0.49	0.014	0.019
F	0.40	1.25	0.016	0.049
G	1.27 BSC		0.050 BSC	
J	0.19	0.25	0.008	0.009
K	0.10	0.25	0.004	0.009
M	0°	7°	0°	7°
P	5.80	6.20	0.229	0.244
R	0.25	0.50	0.010	0.019

CASE 751-02
SORF
(SO-8)

MRF9011
BF431*
MRF9011L
BF431L*

*European Part Numbers

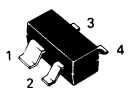
SURFACE MOUNTED HIGH FREQUENCY TRANSISTOR NPN SILICON

The RF Line

NPN Silicon High-Frequency Transistor

. . . designed primarily for use in high-gain, low-noise small-signal amplifiers for operation up to 2.5 GHz. Also usable in applications requiring fast switching times.

- High Current-Gain-Bandwidth Product — f_T = 3.8 GHz (Typ) @ I_C = 15 mAdc
- Low Noise Figure @ f = 1 GHz — $NF_{(matched)}$ = 1.8 dB (Typ)
- High Power Gain — $G_{pe(matched)}$ = 13.5 dB (Typ) @ f = 1 GHz
- Guaranteed RF Parameters
- Surface Mounted SOT-143 Offers Improved RF Performance
  - Lower Package Parasitics
  - High Gain
- Available In Both Standard Profile (MRF9011) and Low Profile (MRF9011L)
- Tape and Reel Packaging Options



CASE 318B-01
SOT-143

3

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CEO}	15	Vdc
Collector-Base Voltage	V_{CBO}	25	Vdc
Emitter-Base Voltage	V_{EBO}	2	Vdc
Collector-Current — Continuous	I_C	30	mAdc
Total Device Dissipation @ T_C = 25°C Derate above 25°C	P_D	0.30 3.3	Watt mW/°C
Storage Temperature Range	T_{stg}	−65 to +150	°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	300	°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)	$V_{(BR)CEO}$	15	—	—	Vdc
Collector-Base Breakdown Voltage (I_C = 0.1 mAdc, I_E = 0)	$V_{(BR)CBO}$	25	—	—	Vdc
Emitter-Base Breakdown Voltage (I_E = 0.1 mAdc, I_C = 0)	$V_{(BR)EBO}$	2	—	—	Vdc
Collector Cutoff Current (V_{CB} = 15 Vdc, I_E = 0)	I_{CBO}	—	—	50	nAdc
ON CHARACTERISTICS					
DC Current Gain (I_C = 5 mAdc, V_{CE} = 5 Vdc)	h_{FE}	30	80	200	—

(continued)

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

Characteristic		Symbol	Min	Typ	Max	Unit
DYNAMIC CHARACTERISTICS						
Current-Gain-Bandwidth Product (I_C = 15 mAdc, V_{CE} = 10 Vdc, f = 1 GHz)	Figure 6	f_T	—	3.8	—	GHz
Collector-Base Capacitance (V_{CB} = 10 Vdc, I_E = 0, f = 1 MHz)	Figure 1	C_{cb}	—	0.55	1	pF
FUNCTIONAL TESTS						
Power Gain at Minimum Noise Figure (V_{CE} = 10 Vdc, I_C = 5 mA, f = 1 GHz)	Figure 5	G_{NFmin}	—	13.5	—	dB
Noise Figure (V_{CE} = 10 Vdc, I_C = 5 mA, f = 1 GHz)	Figure 5	NF_{min}	—	1.8	—	dB
Power Gain in 50 Ω System (V_{CE} = 10 Vdc, I_C = 5 mA, f = 1 GHz)	Figure 2	G_{NF}	9	10.2	—	dB
Noise Figure (V_{CE} = 10 Vdc, I_C = 5 mA, f = 1 GHz)	Figure 2	NF	—	2.3	3	dB

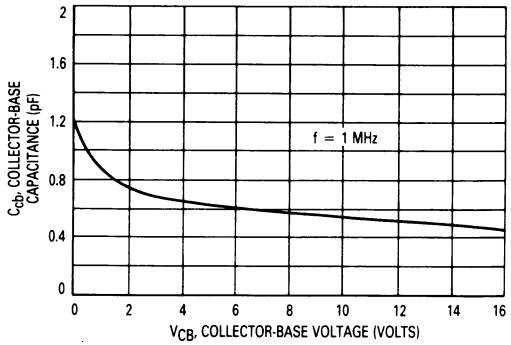


Figure 1. Collector-Base Capacitance versus Collector-Base Voltage

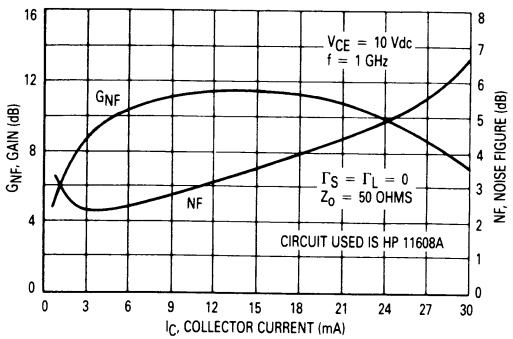


Figure 2. Gain and Noise Figure versus Collector Current

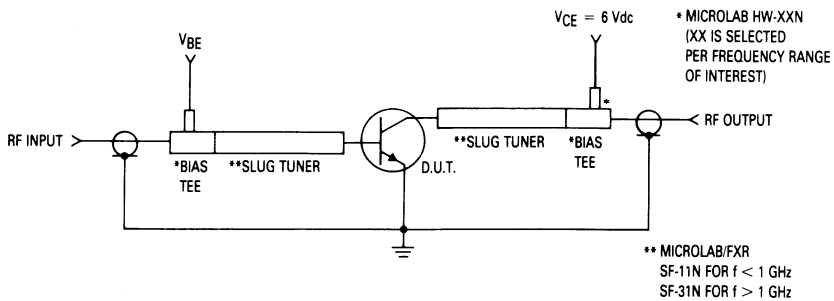


Figure 3. Functional Circuit Schematic

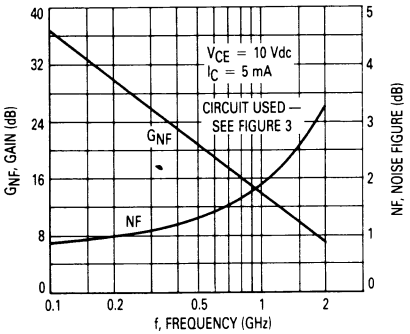


Figure 4. Gain and Noise Figure versus Frequency

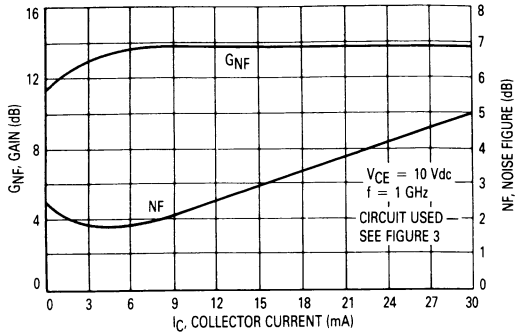


Figure 5. Gain and Noise Figure versus Collector Current

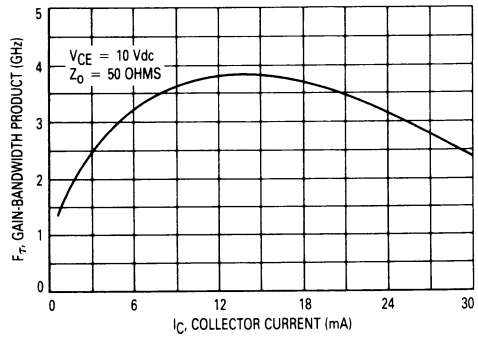


Figure 6. Gain-Bandwidth Product versus Collector Current

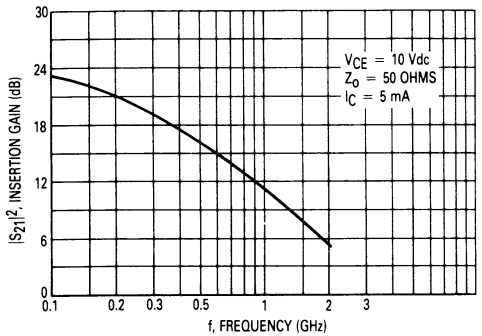


Figure 7. Insertion Gain versus Frequency

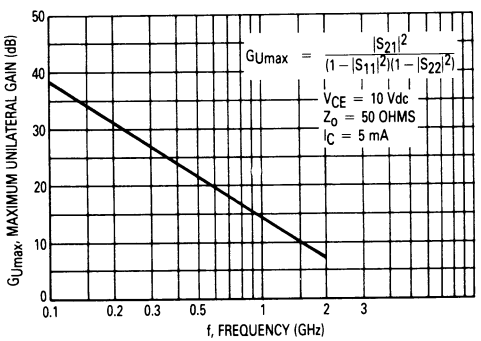
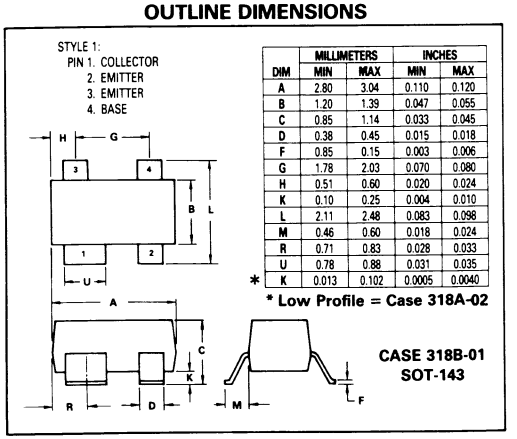


Figure 8. Maximum Unilateral Gain versus Frequency

OUTLINE DIMENSIONS



DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	2.80	3.04	0.110	0.120
B	1.20	1.39	0.047	0.055
C	0.85	1.14	0.033	0.045
D	0.38	0.45	0.015	0.018
F	0.85	0.15	0.003	0.006
G	1.78	2.03	0.070	0.080
H	0.51	0.60	0.020	0.024
K	0.10	0.25	0.004	0.010
L	2.11	2.48	0.083	0.098
M	0.46	0.60	0.018	0.024
R	0.71	0.83	0.028	0.033
U	0.78	0.88	0.031	0.035
* K	0.013	0.102	0.0005	0.0040

*** Low Profile = Case 318A-02**

CASE 318B-01
SOT-143

COMMON EMITTER S-PARAMETERS

V_{CE} (Vdc)	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	5	100	0.85	−41	13.64	153	0.03	65	0.93	−17
		200	0.78	−76	10.77	134	0.05	54	0.80	−29
		500	0.71	−131	6.10	102	0.08	35	0.55	−42
		1000	0.66	−169	3.22	77	0.08	33	0.45	−48
		2000	0.60	152	1.65	47	0.11	46	0.47	−63
	10	100	0.72	−59	20.01	145	0.03	62	0.87	−23
		200	0.70	−100	14.31	123	0.04	49	0.67	−36
		500	0.66	−150	7.03	94	0.06	38	0.44	−43
		1000	0.63	179	3.57	73	0.07	45	0.37	−46
		2000	0.58	147	1.79	46	0.11	57	0.41	−60
	15	100	0.65	−75	23.44	138	0.02	57	0.81	−27
		200	0.66	−118	15.56	116	0.04	46	0.59	−38
		500	0.65	−159	7.10	90	0.05	42	0.40	−40
		1000	0.63	174	3.57	71	0.06	52	0.35	−43
		2000	0.59	144	1.77	45	0.11	62	0.40	−58
	20	100	0.61	−89	24.32	133	0.02	51	0.77	−28
		200	0.66	−130	15.11	111	003	43	0.55	−35
		500	0.66	−166	6.68	88	0.04	46	0.41	−34
		1000	0.65	171	3.32	69	0.06	56	0.39	−39
		2000	0.61	143	1.65	43	0.10	65	0.44	−56
	30	100	0.63	−132	13.18	118	0.02	47	0.72	−15
		200	0.68	−157	7.07	104	0.02	44	0.66	−16
		500	0.69	−177	3.23	90	0.03	55	0.62	−24
		1000	0.70	165	1.78	71	0.05	65	0.59	−38
		2000	0.66	138	0.93	42	0.09	79	0.62	−62
10	5	100	0.85	−38	13.67	155	0.03	70	0.93	−14
		200	0.80	−71	10.97	136	0.05	56	0.83	−24
		500	0.70	−126	6.35	104	0.07	37	0.60	−35
		1000	0.65	−166	3.39	78	0.07	36	0.51	−40
		2000	0.58	154	1.74	48	0.10	50	0.54	−55
	10	100	0.75	−55	20.12	147	0.02	66	0.88	−19
		200	0.71	−94	14.60	125	0.04	50	0.72	−30
		500	0.65	−145	7.33	96	0.05	39	0.50	−35
		1000	0.62	−177	3.74	74	0.06	46	0.45	−38
		2000	0.57	149	1.88	47	0.10	60	0.49	−53
	15	100	0.68	−68	23.53	140	0.02	61	0.85	−22
		200	0.67	−110	15.90	119	0.03	49	0.65	−31
		500	0.64	−155	7.45	92	0.04	42	0.47	−32
		1000	0.62	177	3.74	71	0.06	53	0.44	−35
		2000	0.58	146	1.90	45	0.09	65	0.50	−51
	20	100	0.64	−79	24.77	135	0.02	56	0.81	−23
		200	0.64	−122	15.81	114	0.03	46	0.62	−29
		500	0.64	−161	7.10	89	0.04	46	0.48	−28
		1000	0.62	174	3.53	70	0.05	56	0.46	−33
		2000	0.59	145	1.75	44	0.09	68	0.53	−50
	30	100	0.61	−114	16.25	123	0.01	48	0.79	−15
		200	0.63	−147	9.10	107	0.02	49	0.71	−15
		500	0.65	−172	4.22	90	0.03	53	0.66	−22
		1000	0.66	168	2.27	71	0.05	63	0.63	−33
		2000	0.63	140	1.15	41	0.08	79	0.67	−53

MRF9331
BF432*
MRF9331L
BF432L*

*European Part Numbers

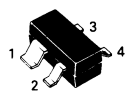
The RF Line

NPN Silicon High-Frequency Transistor

. . . designed primarily for use in low power amplifiers to 1 GHz. Ideal for pagers and other battery operated systems where low power consumption is critical.

- Low Power Consumption Characterized for I_E = 0.1 to 1 mA
- High Current-Gain-Bandwidth Product — f_T = 5 GHz (Typ) @ I_C = 1 mAdc
- Low Noise Figure and High Power Gain @ f = 1 GHz — NF(matched) = 2.5 dB (Typ) & GNF(matched) = 12.5 dB (Typ)
- Guaranteed RF Parameters
- Surface Mounted SOT-143 Offers Improved RF Performance
  Lower Package Parasitics
  High Gain
- Available In Both Standard Profile (MRF9331) and Low Profile (MRF9331L)
- Tape and Reel Packaging Options

SURFACE MOUNTED HIGH FREQUENCY TRANSISTOR NPN SILICON



CASE 318A-02
SOT-143

3

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CEO}	8	Vdc
Collector-Base Voltage	V_{CBO}	15	Vdc
Emitter-Base Voltage	V_{EBO}	2	Vdc
Collector-Current — Continuous	I_C	1	mAdc
Total Device Dissipation @ T_C = 25°C Derate above 25°C	P_D	50 1	mW mW/°C
Storage Temperature Range	T_{stg}	−65 to +150	°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	500	°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 = 0.1 mAdc, I_B = 0)	$V_{(BR)CEO}$	8	—	—	Vdc
Collector-Base Breakdown Voltage (I_C = 0.01 mAdc, I_E = 0)	$V_{(BR)CBO}$	15	—	—	Vdc
Emitter-Base Leakage Current (V_{EB} = 2 Vdc, I_C = 0)	I_{EBO}	—	—	0.1	mAdc
Collector Cutoff Current (V_{CB} = 5 Vdc, I_E = 0)	I_{CBO}	—	—	50	nAdc
ON CHARACTERISTICS					
DC Current Gain (I_C = 0.5 mAdc, V_{CE} = 1 Vdc)	h_{FE}	30	80	200	—

(continued)

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

Characteristic		Symbol	Min	Typ	Max	Unit
DYNAMIC CHARACTERISTICS						
Current-Gain-Bandwidth Product (I_C = 1 mAdc, V_{CE} = 1 Vdc, f = 1 GHz)	Figure 2	f_T	3.5	5	—	GHz
Collector-Base Capacitance (V_{CB} = 1 Vdc, I_E = 0, f = 1 MHz)	Figure 1	C_{cb}	—	0.21	0.3	pF
FUNCTIONAL TESTS						
Power Gain at Minimum Noise Figure (V_{CE} = 1 Vdc, I_C = 0.5 mA, f = 1 GHz)	Figure 5, 3	G_{NFmin}	—	12.5	—	dB
Noise Figure (V_{CE} = 1 Vdc, I_C = 0.5 mA, f = 1 GHz)	Figure 5, 3	NF_{min}	—	2.5	—	dB

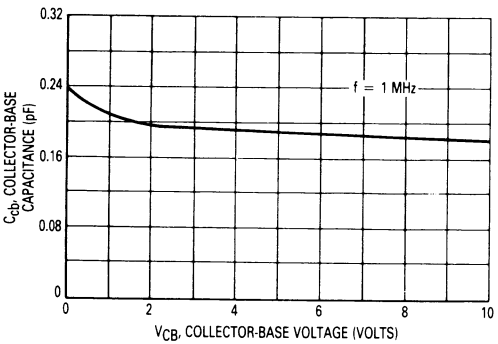


Figure 1. Collector-Base Capacitance versus Collector-Base Voltage

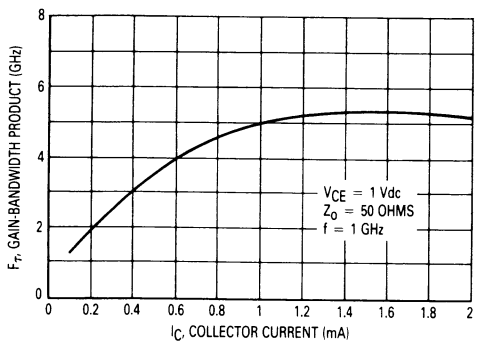


Figure 2. Current Gain-Bandwidth Product versus Collector Current

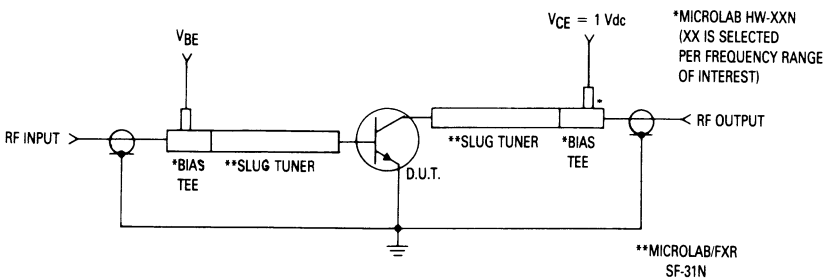


Figure 3. Functional Circuit Schematic

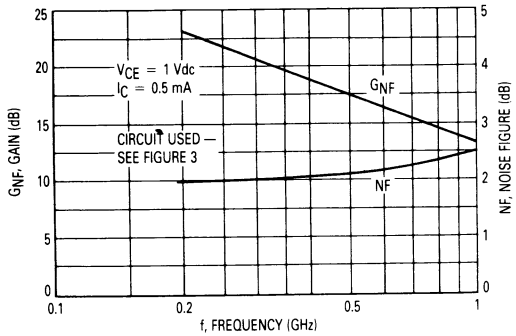


Figure 4. Gain and Noise Figure versus Frequency

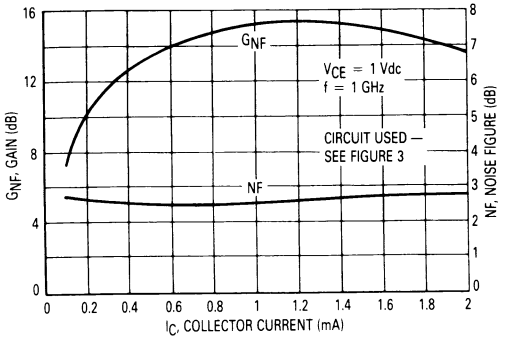


Figure 5. Gain and Noise Figure versus Collector Current

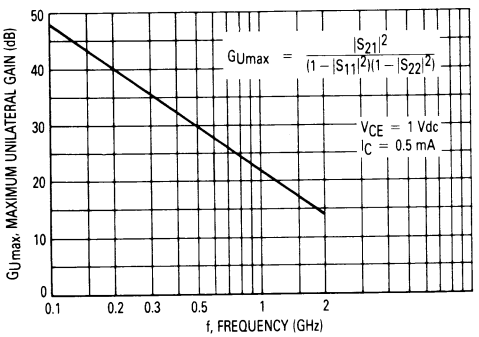
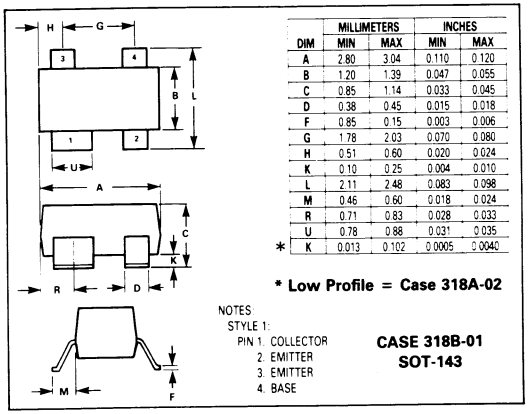


Figure 6. Maximum Unilateral Gain versus Frequency

OUTLINE DIMENSIONS



DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	2.80	3.04	0.110	0.120
B	1.20	1.39	0.047	0.055
C	0.85	1.14	0.033	0.045
D	0.38	0.45	0.015	0.018
F	0.85	0.15	0.003	0.006
G	1.78	2.03	0.070	0.080
H	0.51	0.60	0.020	0.024
K	0.10	0.25	0.004	0.010
L	2.11	2.48	0.083	0.098
M	0.46	0.60	0.018	0.024
R	0.71	0.83	0.028	0.033
U	0.78	0.88	0.031	0.035
* K	0.013	0.102	0.0005	0.0040

*** Low Profile = Case 318A-02**

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

CASE 318B-01
SOT-143

COMMON EMITTER S-PARAMETERS

V_{CE} (Vdc)	I_C (mA)	f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}	
			$\|S_{11}\|$	$\angle\phi$	$\|S_{21}\|$	$\angle\phi$	$\|S_{12}\|$	$\angle\phi$	$\|S_{22}\|$	$\angle\phi$
1	0.1	100	0.99	−1	0.35	174	0.01	87	1	−1
		200	1	−3	0.35	171	0.03	86	1	−4
		500	0.97	−9	0.34	156	0.07	81	1	−9
		1000	0.98	−19	0.38	134	0.13	72	1	−21
		2000	0.98	−36	0.45	103	0.22	59	1	−38
	0.25	100	0.99	−1	0.77	175	0.01	86	1	−1
		200	1	−4	0.77	173	0.03	86	1	−4
		500	0.96	−11	0.73	160	0.06	79	0.99	−11
		1000	0.96	−23	0.75	140	0.13	70	0.98	−23
		2000	0.94	−42	0.77	110	0.21	56	0.93	−42
	0.5	100	0.99	−2	1.43	174	0.01	86	1	−1
		200	0.99	−5	1.42	172	0.03	84	1	−5
		500	0.95	−13	1.33	158	0.06	77	0.99	−12
		1000	0.92	−28	1.3	137	0.13	67	0.95	−25
		2000	0.83	−51	1.2	107	0.19	54	0.91	−43

COMMON EMITTER S-PARAMETERS (Continued)

V_{CE} (Vdc)	I_C (mA)	f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}	
			$\|S_{11}\|$	$\angle\phi$	$\|S_{21}\|$	$\angle\phi$	$\|S_{12}\|$	$\angle\phi$	$\|S_{22}\|$	$\angle\phi$
1	1	100	0.97	−3	2.68	173	0.01	85	1	−2
		200	0.97	−8	2.68	169	0.03	83	1	−6
		500	0.91	−19	2.42	152	0.06	74	0.96	−15
		1000	0.82	−37	2.22	128	0.11	62	0.89	−29
		2000	0.63	−59	1.74	97	0.17	53	0.8	−46
	2	100	0.93	−6	4.55	169	0.01	84	0.99	−4
		200	0.92	−13	4.3	163	0.03	81	0.98	−9
		500	0.81	−29	3.8	142	0.06	69	0.91	−19
		1000	0.62	−52	3.1	115	0.1	59	0.81	−31
		2000	0.4	−66	2	85	0.14	55	0.75	−44
3	0.1	100	0.99	−1	0.34	175	0.01	88	1	−1
		200	1	−3	0.34	172	0.03	86	1	−3
		500	0.99	−8	0.32	157	0.06	81	1	−9
		1000	0.99	−18	0.36	137	0.11	73	1	−20
		2000	1	−34	0.43	107	0.2	61	1	−37
	0.25	100	0.99	−1	0.76	175	0.01	86	1	−1
		200	1	−4	0.76	173	0.03	86	1	−4
		500	0.98	−10	0.72	161	0.06	80	1	−10
		1000	0.98	−21	0.75	143	0.11	72	0.99	−22
		2000	0.97	−40	0.75	113	0.19	59	0.98	−39
	0.5	100	0.99	−2	1.4	175	0.01	86	1	−1
		200	0.99	−5	1.42	172	0.03	84	1	−4
		500	0.96	−12	1.3	159	0.06	78	0.99	−11
		1000	0.93	−25	1.3	141	0.11	68	0.96	−23
		2000	0.87	−47	1.2	111	0.18	57	0.93	−41
	1	100	0.97	−3	2.67	174	0.01	85	1	−2
		200	0.98	−7	2.67	170	0.02	84	1	−6
		500	0.93	−17	2.42	154	0.06	76	0.97	−14
		1000	0.84	−34	2.29	133	0.1	65	0.91	−26
		2000	0.67	−55	1.82	101	0.16	56	0.85	−43
	2	100	0.95	−5	4.64	172	0.01	85	1	−3
		200	0.94	−10	4.62	166	0.02	81	0.99	−8
		500	0.85	−25	4	147	0.05	72	0.94	−17
		1000	0.69	−44	3.4	122	0.09	63	0.84	−29
		2000	0.48	−61	2.3	91	0.13	57	0.78	−42
5	0.1	100	1	0	0.36	175	0.01	85	1	−1
		200	1	−3	0.34	172	0.02	87	1	−3
		500	0.99	−8	0.32	158	0.06	82	1	−9
		1000	1	−17	0.36	138	0.11	74	1	−19
		2000	0.94	−35	0.42	108	0.2	63	1	−36
	0.25	100	1	−1	0.76	176	0.01	86	1	−1
		200	1	−3	0.76	174	0.02	86	1	−4
		500	0.97	−9	0.71	161	0.06	80	1	−10
		1000	0.97	−20	0.74	143	0.11	73	0.99	−21
		2000	0.97	−38	0.75	115	0.18	61	0.99	−38
	0.5	100	0.99	−1	1.4	175	0.01	86	1	−1
		200	1	−5	1.41	173	0.02	85	1	−4
		500	0.98	−12	1.3	159	0.06	79	0.99	−11
		1000	0.93	−25	1.3	141	0.1	70	0.97	−23
		2000	0.87	−45	1.2	111	0.17	58	0.94	−40
	1	100	0.98	−3	2.7	174	0.01	86	1	−2
		200	0.98	−7	2.7	170	0.02	84	1	−5
		500	0.93	−17	2.42	155	0.5	76	0.97	−13
		1000	0.85	−33	2.3	134	0.09	66	0.92	−26
		2000	0.67	−55	2	103	0.15	57	0.85	−42
	2	100	0.95	−4	4.6	172	0.01	86	1	−3
		200	0.94	−10	4.6	166	0.02	83	1	−7
		500	0.86	−24	3.9	148	0.5	73	0.94	−16
		1000	0.7	−43	3.4	123	0.9	64	0.86	−28
		2000	0.5	−60	2.3	92	0.13	59	0.8	−40