

MOTOROLA

SEMICONDUCTOR

TECHNICAL DATA

The RF Line

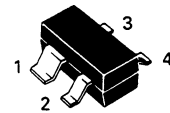
NPN Silicon High-Frequency Transistor

... 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

MRF9011 MRF9011L

**SURFACE MOUNTED
HIGH FREQUENCY
TRANSISTOR
NPN SILICON**



**CASE 318B-01
SOT-143**

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 @ $T_C = 25^\circ\text{C}$ Derate above 25°C	P_D	0.30 3.3	Watt mW/ $^\circ\text{C}$
Storage Temperature Range	T_{stg}	-55 to +150	$^\circ\text{C}$

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	300	$^\circ\text{C/W}$

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

Characteristic	Symbol	Min	Typ	Max	Unit
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OFF CHARACTERISTICS

Collector-Emitter Breakdown Voltage ($I_C = 1$ mAdc, $I_E = 0$)	$V_{(BR)CEO}$	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	—
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(continued)



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

Characteristic		Symbol	Min	Typ	Max	Unit
DYNAMIC CHARACTERISTICS						
Current-Gain-Bandwidth Product ($I_C = 15\text{ mAdc}$, $V_{CE} = 10\text{ Vdc}$, $f = 1\text{ GHz}$)	Figure 6	f_T	—	3.8	—	GHz
Collector-Base Capacitance ($V_{CB} = 10\text{ Vdc}$, $I_E = 0$, $f = 1\text{ MHz}$)	Figure 1	C_{cb}	—	0.55	1	pF

FUNCTIONAL TESTS

Power Gain at Minimum Noise Figure ($V_{CE} = 10\text{ Vdc}$, $I_C = 5\text{ mA}$, $f = 1\text{ GHz}$)	Figure 5	GNF_{min}	—	13.5	—	dB
Noise Figure ($V_{CE} = 10\text{ Vdc}$, $I_C = 5\text{ mA}$, $f = 1\text{ GHz}$)	Figure 5	NF_{min}	—	1.8	—	dB
Power Gain in $50\ \Omega$ System ($V_{CE} = 10\text{ Vdc}$, $I_C = 5\text{ mA}$, $f = 1\text{ GHz}$)	Figure 2	GNF	9	10.2	—	dB
Noise Figure ($V_{CE} = 10\text{ Vdc}$, $I_C = 5\text{ mA}$, $f = 1\text{ GHz}$)	Figure 2	NF	—	2.3	3	dB

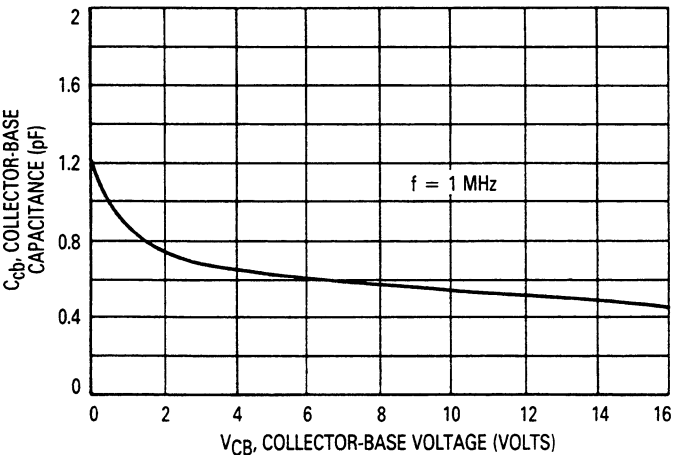


Figure 1. Collector-Base Capacitance versus Collector-Base Voltage

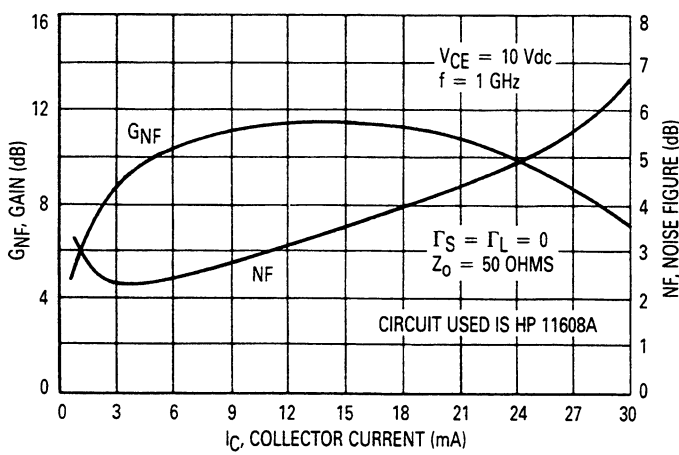


Figure 2. Gain and Noise Figure versus Collector Current

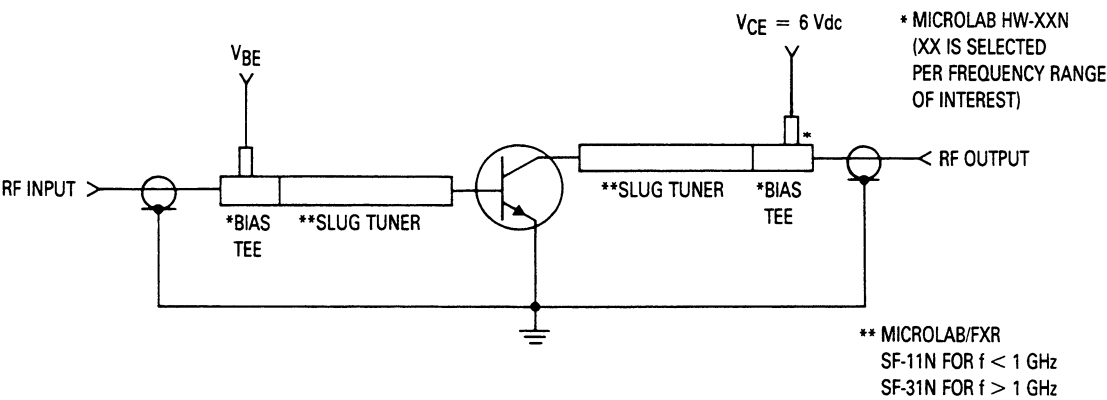


Figure 3. Functional Circuit Schematic

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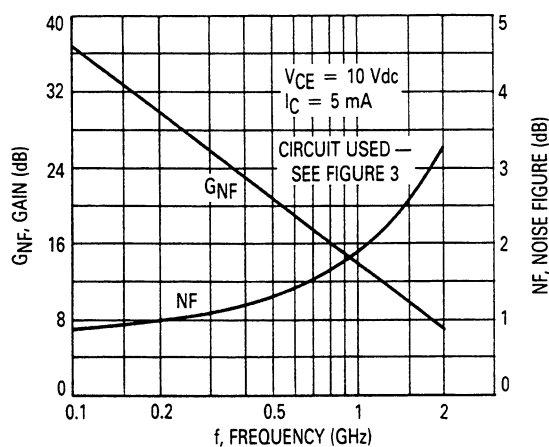


Figure 4. Gain and Noise Figure versus Frequency

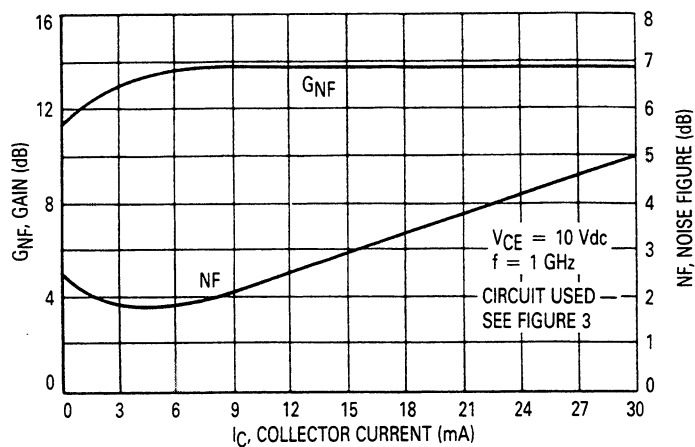


Figure 5. Gain and Noise Figure versus Collector Current

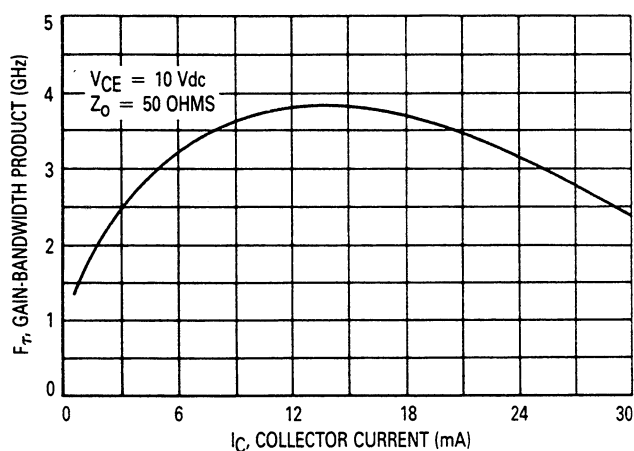


Figure 6. Gain-Bandwidth Product versus Collector Current

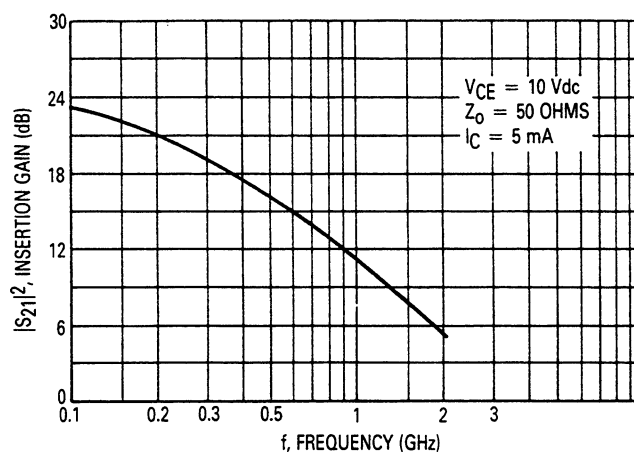


Figure 7. Insertion Gain versus Frequency

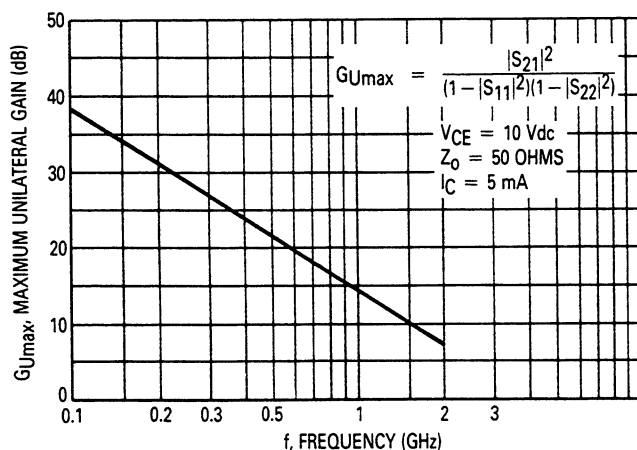
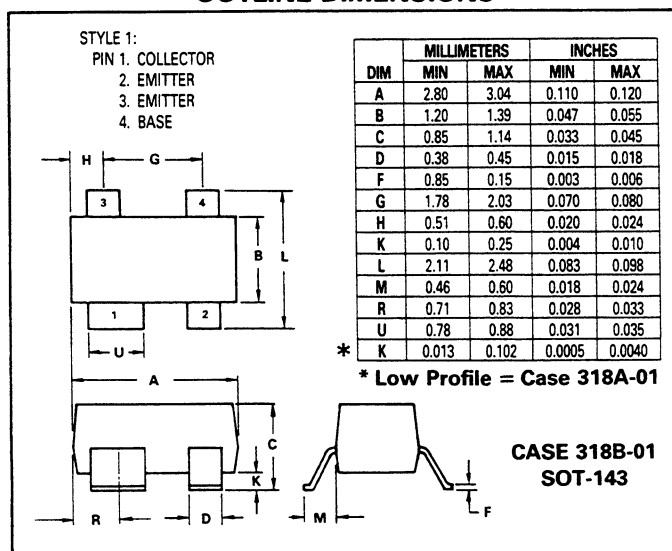


Figure 8. Maximum Unilateral Gain versus Frequency

OUTLINE DIMENSIONS



COMMON EMITTER S-PARAMETERS

VCE (Vdc)	IC (mA)	f (MHz)	S11		S21		S12		S22	
			S11	$\angle \phi$	S21	$\angle \phi$	S12	$\angle \phi$	S22	$\angle \phi$
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	0.03	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



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