

The RF Line

NPN Silicon

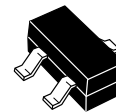
High-Frequency Transistor

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.

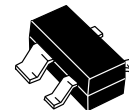
- High Current-Gain — Bandwidth Product
- Low Noise Figure @ $f = 1.0$ GHz —
 $NF_{(matched)} = 1.8$ dB (Typ) (MRF9011LT1)
 $= 1.9$ dB (Typ) (MMBR901LT1, T3)
- High Power Gain —
 $G_{pe(matched)} = 13.5$ dB (Typ) @ $f = 1.0$ GHz (MRF9011LT1)
 $= 12.0$ dB (Typ) @ $f = 1.0$ GHz (MMBR901LT1, T3)
- Guaranteed RF Parameters (MRF9011LT1)
- Surface Mounted SOT-23 & SOT-143 Offer Improved RF Performance
 Lower Package Parasitics
 High Gain
- Available in tape and reel packaging options:
 T1 suffix = 3,000 units per reel
 T3 suffix = 10,000 units per reel

MMBR901LT1, T3
MRF9011LT1

$I_C = 30$ mA
SURFACE MOUNTED
HIGH-FREQUENCY
TRANSISTOR
NPN SILICON



CASE 318-08, STYLE 6
SOT-23
LOW PROFILE, MMBR901LT1, T3



CASE 318A-05, STYLE 1
SOT-143
LOW PROFILE, MRF9011LT1

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}	2.0	Vdc
Collector Current — Continuous	I_C	30	mA _{dc}
Power Dissipation @ $T_C = 75^\circ\text{C}$ (1) Derate above 25°C	$P_{D(max)}$	0.300 4.00	Watt mW/ $^\circ\text{C}$
Storage Temperature Range	T_{stg}	-55 to +150	$^\circ\text{C}$
Maximum Junction Temperature	$T_{J(max)}$	150	$^\circ\text{C}$

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Storage Temperature	T_{stg}	150	$^\circ\text{C}$
Thermal Resistance, Junction to Case MRF9011LT1, MMBR901LT1, T3	$R_{\theta JC}$	200	$^\circ\text{C/W}$

DEVICE MARKING

MRF9011LT1 = 01	MMBR901LT1, T3 = 7A
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NOTE:

1. Case temperature measured on collector lead immediately adjacent to body of package.

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

Characteristic	Symbol	Min	Typ	Max	Unit
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OFF CHARACTERISTICS

Collector–Emitter Breakdown Voltage ($I_C = 1.0\text{ mA}$, $I_B = 0$)	$V_{(BR)CEO}$	15	—	—	Vdc
Collector–Base Breakdown Voltage ($I_C = 0.1\text{ mA}$, $I_E = 0$)	$V_{(BR)CBO}$	25	—	—	Vdc
Emitter–Base Breakdown Voltage ($I_E = 0.1\text{ mA}$, $I_C = 0$)	$V_{(BR)EBO}$	2.0	—	—	Vdc
Collector Cutoff Current ($V_{CB} = 15\text{ Vdc}$, $I_E = 0$)	I_{CBO}	—	—	50	nAdc

ON CHARACTERISTICS

DC Current Gain ($I_C = 5.0\text{ mA}$, $V_{CE} = 5.0\text{ Vdc}$)	MMBR901LT1, T3 MRF9011LT1	h_{FE}	50 30	— 80	200 200	—
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DYNAMIC CHARACTERISTICS

Current–Gain — Bandwidth Product ($I_C = 15\text{ mA}$, $V_{CE} = 10\text{ Vdc}$, $f = 1.0\text{ GHz}$)	MRF9011LT1	f_T	—	3.8	—	GHz
Collector–Base Capacitance ($V_{CB} = 10\text{ Vdc}$, $I_E = 0$, $f = 1.0\text{ MHz}$)	MRF9011LT1	C_{cb}	—	0.55	1.0	pF

FUNCTIONAL TESTS

Power Gain at Minimum Noise Figure ($V_{CE} = 10\text{ Vdc}$, $I_C = 5.0\text{ mA}$, $f = 1.0\text{ GHz}$)	MRF9011LT1	GN_{Fmin}	—	13.5	—	dB
Minimum Noise Figure (Figure 3) ($V_{CE} = 10\text{ Vdc}$, $I_C = 5.0\text{ mA}$, $f = 1.0\text{ GHz}$)	MRF9011LT1	NF_{min}	—	1.8	—	dB
Insertion Gain in 50 Ω System ($V_{CE} = 10\text{ Vdc}$, $I_C = 5.0\text{ mA}$, $f = 1.0\text{ GHz}$)	MRF9011LT1	$ S_{21} ^2$	9.0	10.2	—	dB
Minimum Noise Figure (Figure 3) ($V_{CE} = 6.0\text{ Vdc}$, $I_C = 5.0\text{ mA}$, $f = 1.0\text{ GHz}$) ($V_{CE} = 10\text{ Vdc}$, $I_C = 5.0\text{ mA}$, $f = 1.0\text{ GHz}$)	MMBR901LT1, T3	NF_{min}	—	1.9	—	dB

SMALL–SIGNAL CHARACTERISTICS

Output Capacitance ($V_{CB} = 10\text{ Vdc}$, $I_C = 5.0\text{ mA}$, $f = 1.0\text{ GHz}$)	MMBR901LT1	C_{obo}	—	—	1.0	pF
Common–Emitter Amplifier Gain ($V_{CC} = 6.0\text{ Vdc}$, $I_C = 5.0\text{ mA}$, $f = 1.0\text{ GHz}$)	MMBR901LT1	G_{pe}	—	12	—	dB

MRF9011LT1

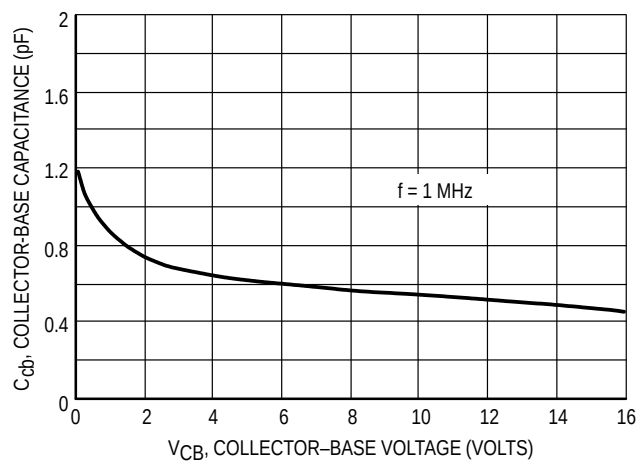


Figure 1. Collector-Base Capacitance versus Collector-Base Voltage

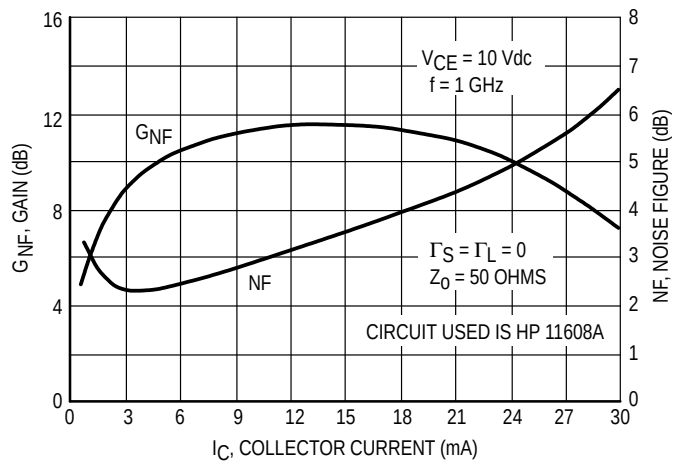


Figure 2. Gain and Noise Figure versus Collector Current

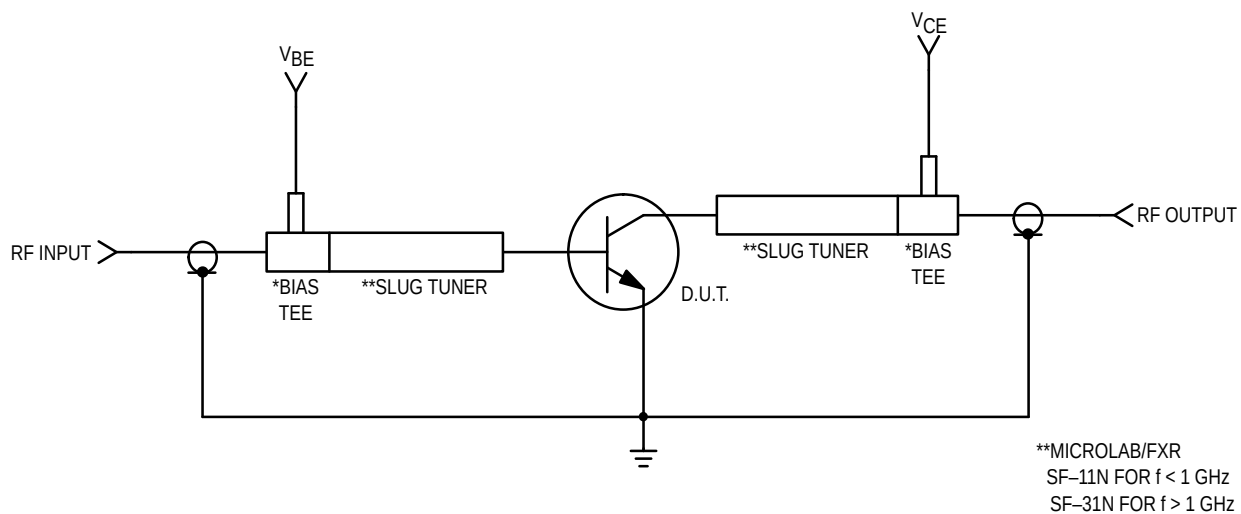


Figure 3. MRF9011LT1 Functional Circuit Schematic

MRF9011LT1

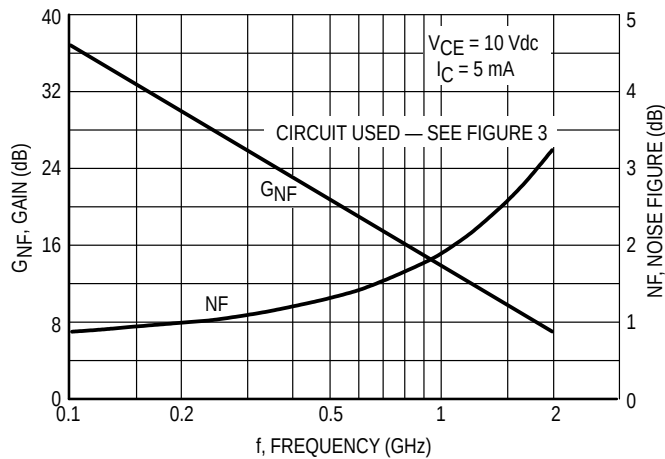


Figure 4. Gain and Noise Figure versus Frequency

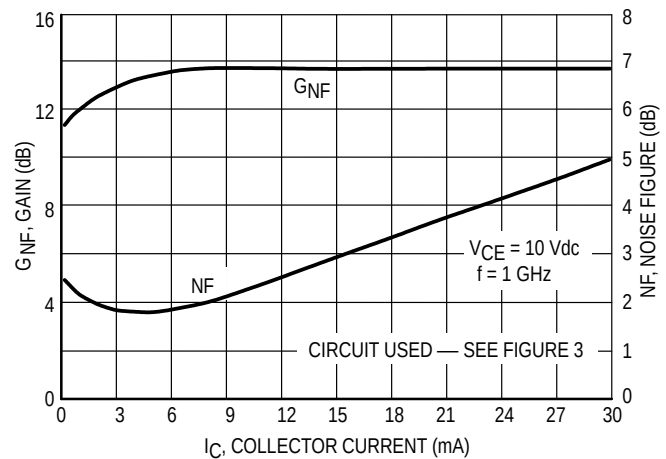


Figure 5. Gain and Noise Figure versus Collector Current

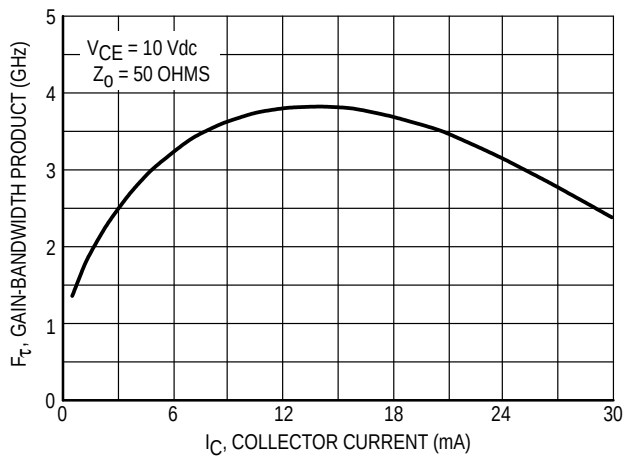


Figure 6. Gain-Bandwidth Product versus Collector Current

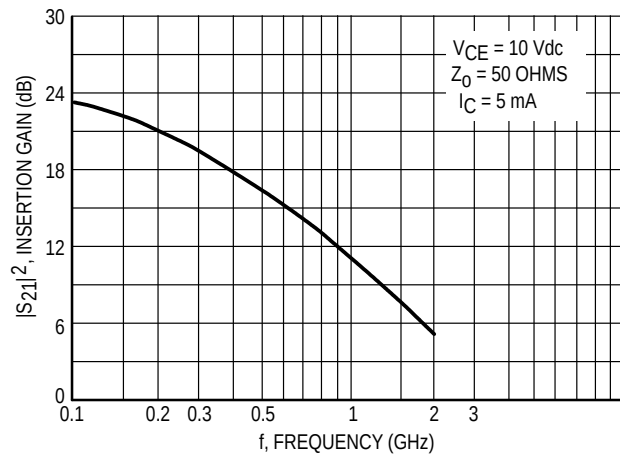


Figure 7. Insertion Gain versus Frequency

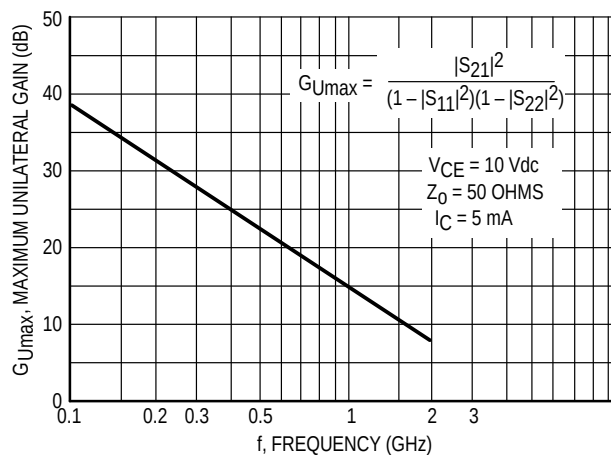
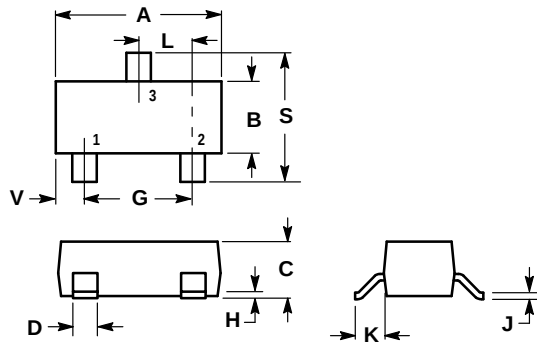


Figure 8. Maximum Unilateral Gain versus Frequency

V _{CE} (Vdc)	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
5.0	5.0	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	5.0	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	79	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

Table 1. MRF9011LT1 Common Emitter S-Parameters

PACKAGE DIMENSIONS

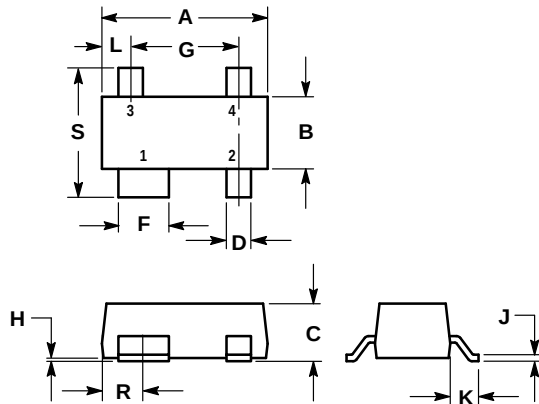


- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 2. CONTROLLING DIMENSION: INCH.
 3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.1102	0.1197	2.80	3.04
B	0.0472	0.0551	1.20	1.40
C	0.0350	0.0440	0.89	1.11
D	0.0150	0.0200	0.37	0.50
G	0.0701	0.0807	1.78	2.04
H	0.0005	0.0040	0.013	0.100
J	0.0034	0.0070	0.085	0.177
K	0.0140	0.0285	0.35	0.69
L	0.0350	0.0401	0.89	1.02
S	0.0830	0.1039	2.10	2.64
V	0.0177	0.0236	0.45	0.60

- STYLE 6:
 PIN 1. BASE
 2. EMITTER
 3. COLLECTOR

**CASE 318-08
 ISSUE AF
 MMBR901LT1, T3**



- NOTES:
4. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 5. CONTROLLING DIMENSION: MILLIMETER.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	2.80	3.04	0.110	0.120
B	1.20	1.39	0.047	0.055
C	0.84	1.14	0.033	0.045
D	0.39	0.50	0.015	0.020
F	0.79	0.93	0.031	0.037
G	1.78	2.03	0.070	0.080
H	0.013	0.10	0.0005	0.004
J	0.08	0.15	0.003	0.006
K	0.46	0.60	0.018	0.024
L	0.445	0.60	0.0175	0.024
R	0.72	0.83	0.028	0.033
S	2.11	2.48	0.083	0.098

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

**CASE 318A-05
 ISSUE R
 MRF9011LT1**

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MMBR901LT1/D