The RF Line

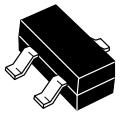
NPN Silicon High-Frequency Transistor

MMBR901LT1, T3 MRF9011LT1

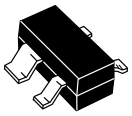
Designed primarily for use in high–gain, low–noise small–signal amplifiers for operation up to 2.5 GHz. Also usable in applications requiring fast switching times.

- 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

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	mAdc
Power Dissipation @ T_C = 75°C (1)	MMBR901LT1, T3; MRF9011LT1	$P_{D(max)}$	0.300	Watt
Derate above 25°C			4.00	mW/°C
Storage Temperature Range	All	T_{stg}	–55 to +150	°C
Maximum Junction Temperature		$T_{J(max)}$	150	°C

THERMAL CHARACTERISTICS

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

DEVICE MARKING

MRF9011LT1 = 01	MMBR901LT1, T3 = 7A

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

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

Characteristic		Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS						
Collector–Emitter Breakdown Voltage (I_C = 1.0 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)		$V_{(BR)EBO}$	2.0	—	—	Vdc
Collector Cutoff Current (V_{CB} = 15 Vdc, I_E = 0)		I_{CBO}	—	—	50	nAdc
ON CHARACTERISTICS						
DC Current Gain (I_C = 5.0 mAdc, V_{CE} = 5.0 Vdc)	MMBR901LT1, T3 MRF9011LT1	h_{FE}	50 30	— 80	200 200	—
DYNAMIC CHARACTERISTICS						
Current–Gain — Bandwidth Product (I_C = 15 mAdc, V_{CE} = 10 Vdc, f = 1.0 GHz)	MRF9011LT1	f_T	—	3.8	—	GHz
Collector–Base Capacitance (V_{CB} = 10 Vdc, I_E = 0, f = 1.0 MHz)	MRF9011LT1	C_{cb}	—	0.55	1.0	pF
FUNCTIONAL TESTS						
Power Gain at Minimum Noise Figure (V_{CE} = 10 Vdc, I_C = 5.0 mA, f = 1.0 GHz)	MRF9011LT1	G_{NFmin}	—	13.5	—	dB
Minimum Noise Figure (Figure 3) (V_{CE} = 10 Vdc, I_C = 5.0 mA, f = 1.0 GHz)	MRF9011LT1	NF_{min}	—	1.8	—	dB
Insertion Gain in 50 Ω System (V_{CE} = 10 Vdc, I_C = 5.0 mA, f = 1.0 GHz)	MRF9011LT1	$\|S_{21}\|^2$	9.0	10.2	—	dB
Minimum Noise Figure (Figure 3) (V_{CE} = 6.0 Vdc, I_C = 5.0 mA, f = 1.0 GHz) (V_{CE} = 10 Vdc, I_C = 5.0 mA, f = 1.0 GHz)	MMBR901LT1, T3	NF_{min}	—	1.9	—	dB
SMALL–SIGNAL CHARACTERISTICS						
Output Capacitance (V_{CB} = 10 Vdc, I_C = 5.0 mAdc, f = 1.0 GHz)	MMBR901LT1	C_{obo}	—	—	1.0	pF
Common–Emitter Amplifier Gain (V_{CC} = 6.0 Vdc, I_C = 5.0 mAdc, f = 1.0 GHz)	MMBR901LT1	G_{pe}	—	12	—	dB

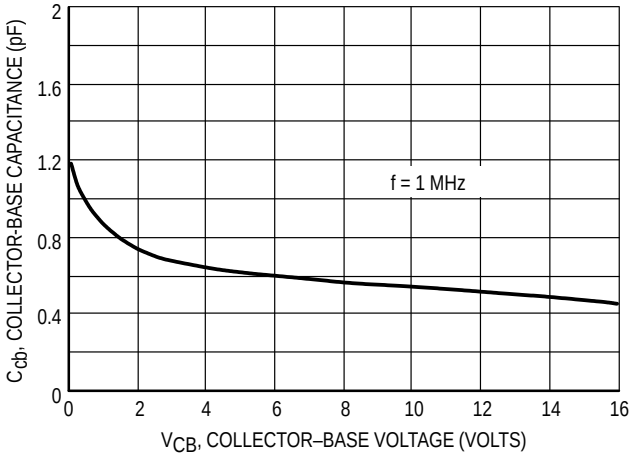


Figure 1. Collector–Base Capacitance versus Collector–Base Voltage

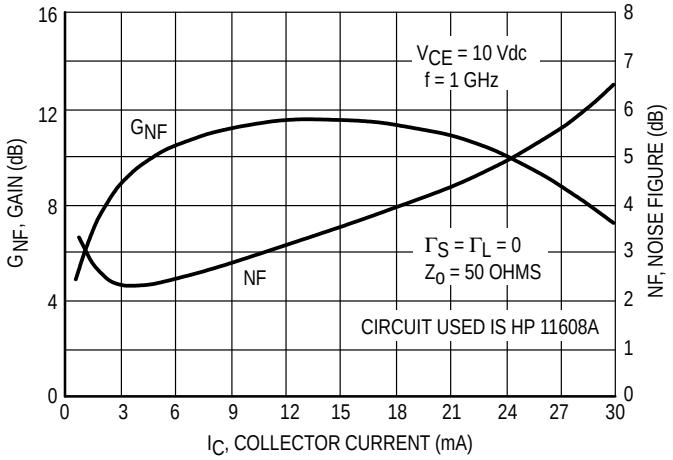


Figure 2. Gain and Noise Figure versus Collector Current

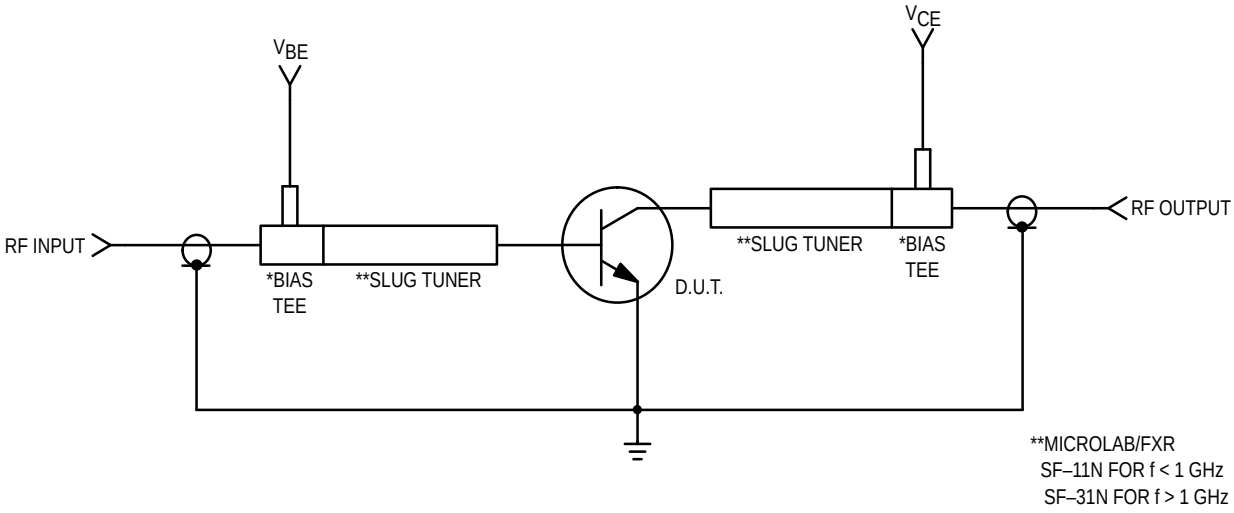


Figure 3. MRF9011LT1 Functional Circuit Schematic

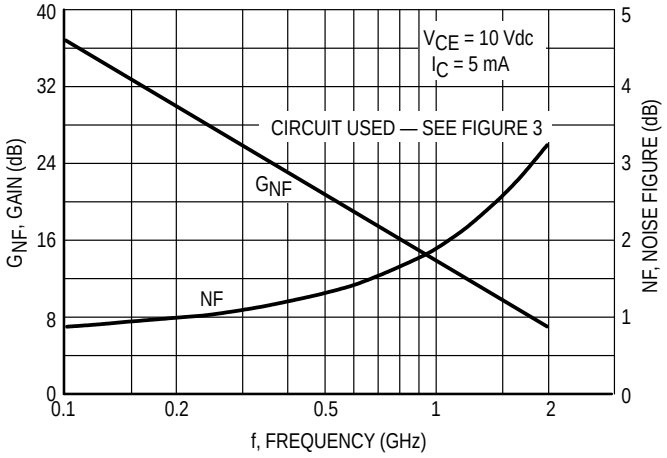


Figure 4. Gain and Noise Figure versus Frequency

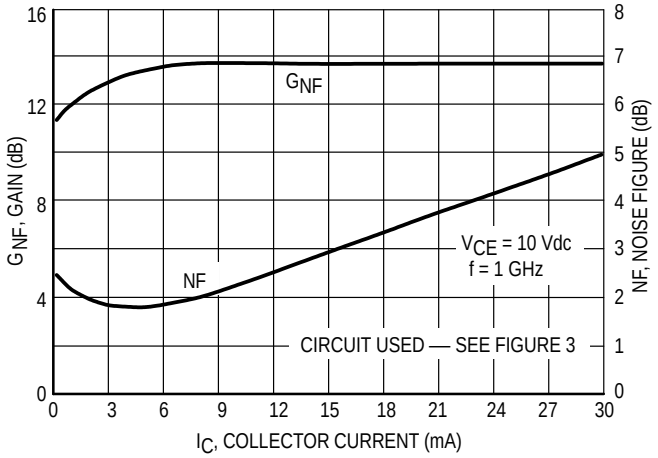


Figure 5. Gain and Noise Figure versus Collector Current

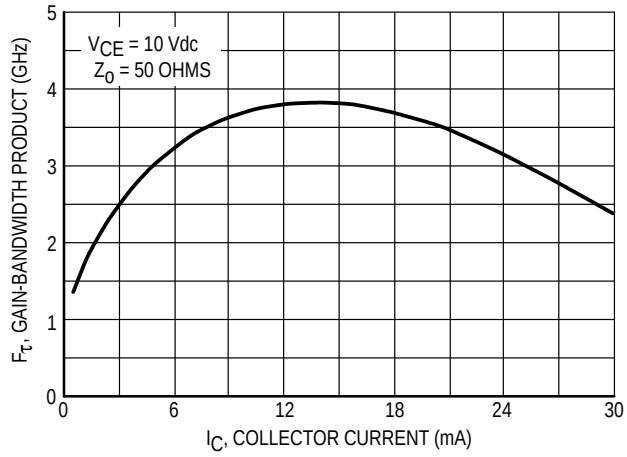


Figure 6. Gain–Bandwidth Product versus Collector Current

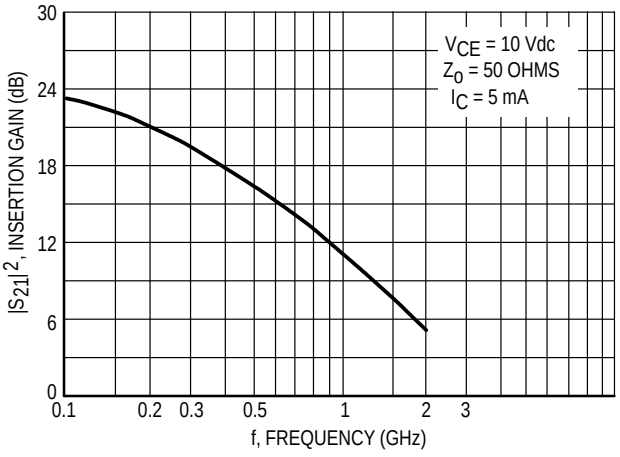


Figure 7. Insertion Gain versus Frequency

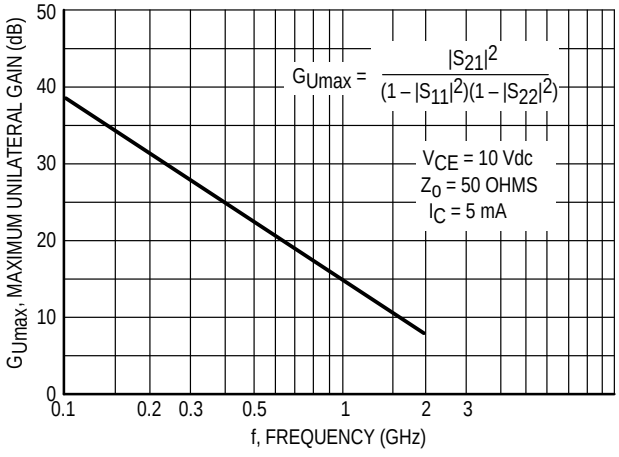
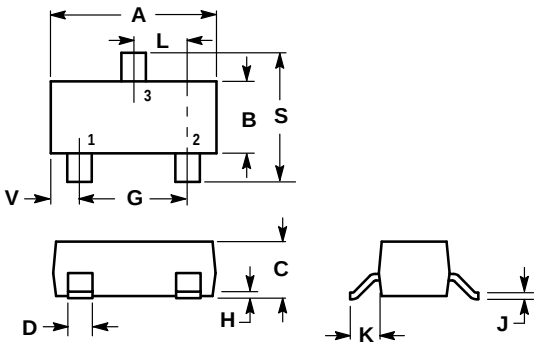


Figure 8. Maximum Unilateral Gain versus Frequency

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

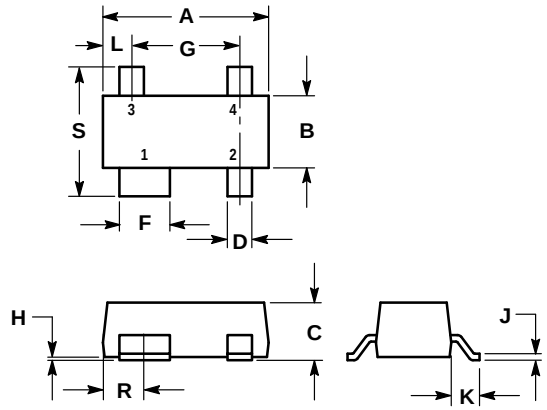


NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.

	INCHES		MILLIMETERS	
DIM	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.

	MILLIMETERS		INCHES	
DIM	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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