

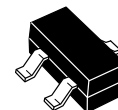
# The RF Line NPN Silicon High-Frequency Transistor

Designed for low noise, wide dynamic range front-end amplifiers and low-noise VCO's. Available in a surface-mountable plastic package. This Motorola small-signal plastic transistor offers superior quality and performance at low cost.

- High Gain-Bandwidth Product  
 $f_T = 7.0 \text{ GHz (Typ) @ 30 mA}$
- Low Noise Figure  
 $NF = 1.7 \text{ dB (Typ) @ 500 MHz}$
- High Gain  
 $G_{NF} = 17 \text{ dB (Typ) @ 10 mA/500 MHz}$
- State-of-the-Art Technology  
Fine Line Geometry  
Ion-Implanted Arsenic Emitters  
Gold Top Metallization and Wires  
Silicon Nitride Passivation
- Available in tape and reel packaging options:  
T1 suffix = 3,000 units per reel

**MMBR911LT1**

$I_C = 60 \text{ mA}$   
**LOW NOISE  
HIGH-FREQUENCY  
TRANSISTOR  
NPN SILICON**



**CASE 318-08, STYLE 6  
SOT-23  
LOW PROFILE**

## MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	$V_{CEO}$	12	Vdc
Collector-Base Voltage	$V_{CBO}$	20	Vdc
Emitter-Base Voltage	$V_{EBO}$	2.0	Vdc
Collector Current — Continuous	$I_C$	60	mA
Power Dissipation @ $T_{case} = 75^\circ\text{C}$ (1) Derate linearly above $T_{case} = 75^\circ\text{C}$	$P_{D(max)}$	333 4.44	mW mW/°C
Storage Temperature	$T_{stg}$	-55 to +150	°C
Maximum Junction Temperature	$T_{Jmax}$	150	°C

## THERMAL CHARACTERISTICS

Rating	Symbol	Value	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	225	°C/W

## DEVICE MARKING

MMBR911LT1 = 7P

### NOTE:

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

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

Characteristic	Symbol	Min	Typ	Max	Unit
<b>OFF CHARACTERISTICS</b>					
Collector–Emitter Breakdown Voltage ( $I_C = 1.0\text{ mA}$ , $I_B = 0$ )	$V_{(BR)CEO}$	12	—	—	Vdc
Collector–Base Breakdown Voltage ( $I_C = 0.1\text{ mA}$ , $I_E = 0$ )	$V_{(BR)CBO}$	20	—	—	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**

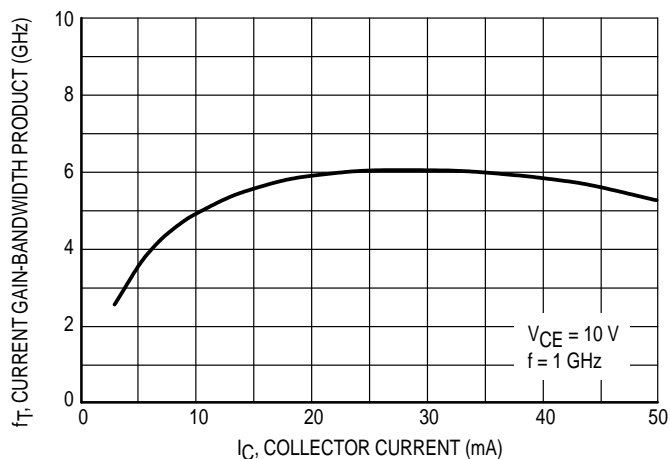
DC Current Gain ( $I_C = 30\text{ mAdc}$ , $V_{CE} = 10\text{ Vdc}$ )	$h_{FE}$	30	—	200	—
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**DYNAMIC CHARACTERISTICS**

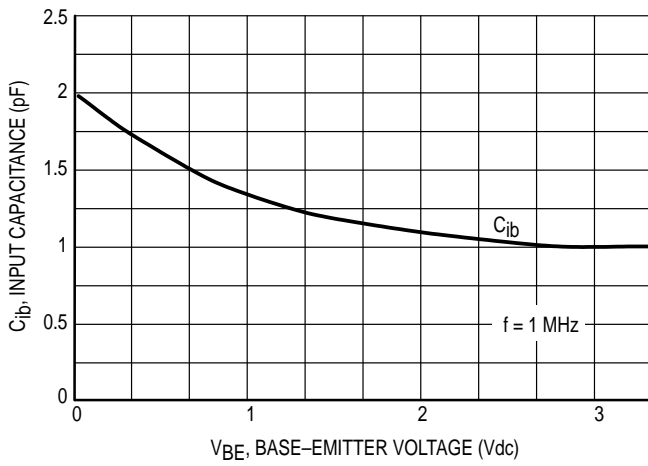
Collector–Base Capacitance ( $V_{CB} = 10\text{ Vdc}$ , $I_E = 0$ , $f = 1.0\text{ MHz}$ )	$C_{cb}$	—	—	1.0	pF
Current Gain–Bandwidth Product ( $V_{CE} = 10\text{ Vdc}$ , $I_C = 30\text{ mAdc}$ , $f = 1.0\text{ GHz}$ )	$f_T$	—	6.0	—	GHz

**FUNCTIONAL TESTS**

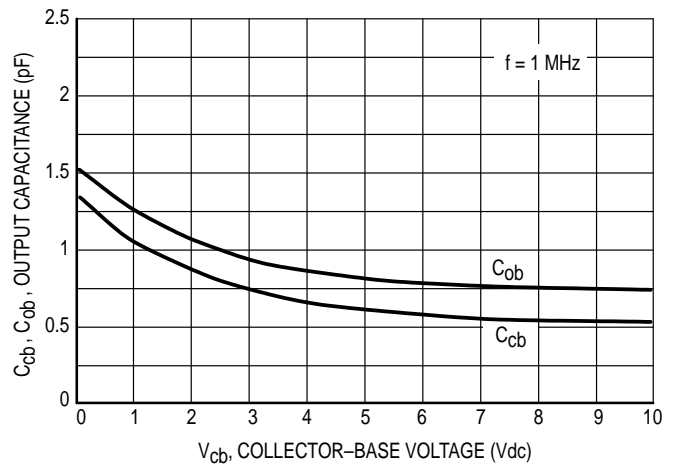
Gain @ Noise Figure ( $I_C = 10\text{ mAdc}$ , $V_{CE} = 10\text{ Vdc}$ )	$f = 0.5\text{ GHz}$	$G_{NF}$	—	17	—	dB
	$f = 1.0\text{ GHz}$		—	11	—	
Noise Figure ( $I_C = 10\text{ mAdc}$ , $V_{CE} = 10\text{ Vdc}$ )	$f = 0.5\text{ GHz}$	NF	—	2.0	—	dB
	$f = 1.0\text{ GHz}$		—	2.9	—	



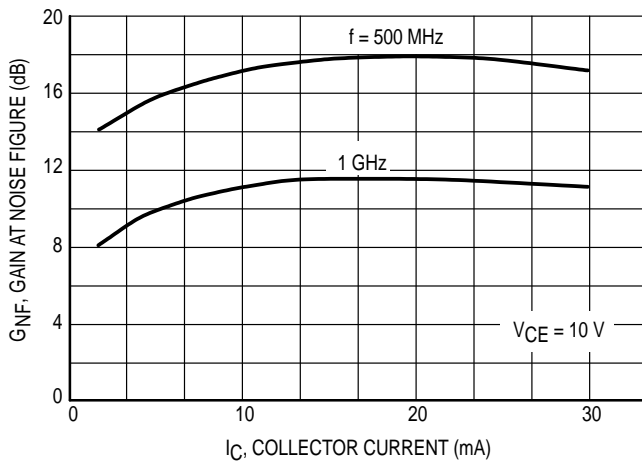
**Figure 1. Current Gain–Bandwidth versus Collector Current @ 1.0 GHz**



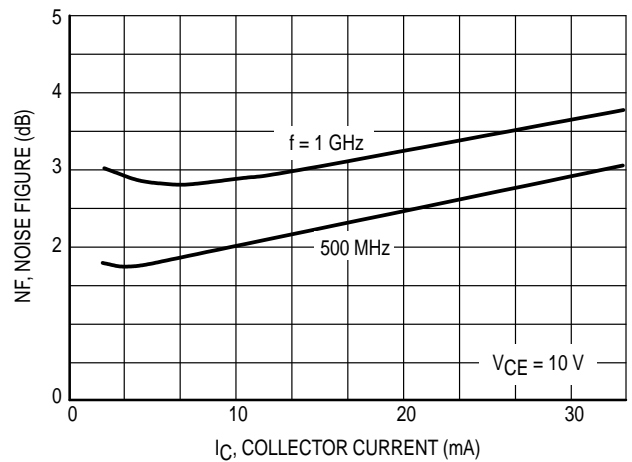
**Figure 2. Input Capacitance versus Base-Emitter Voltage**



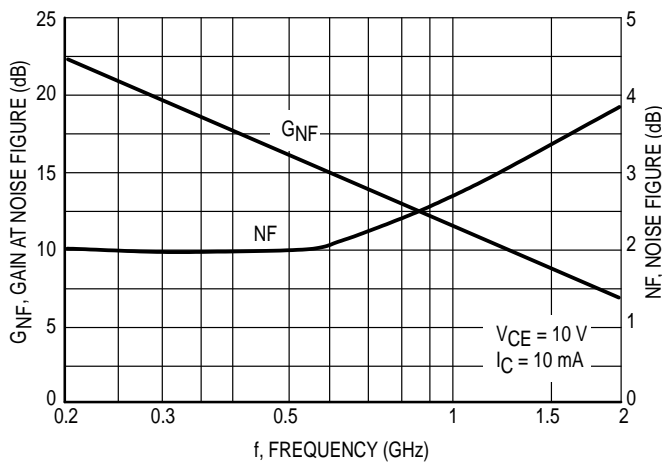
**Figure 3. Output Capacitances versus Collector-Base Voltage**



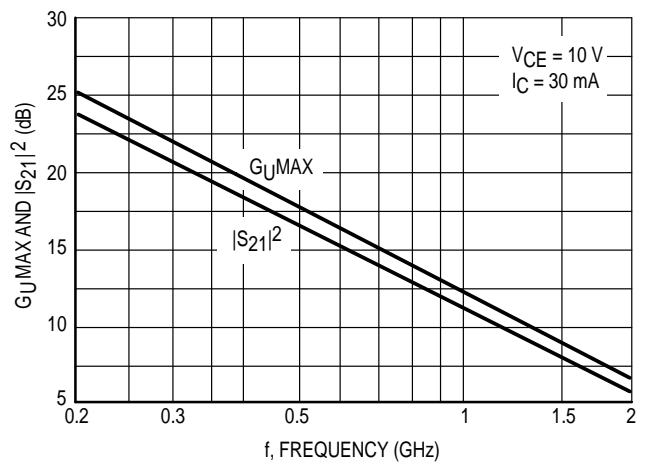
**Figure 4. Gain at Noise Figure versus Collector Current**



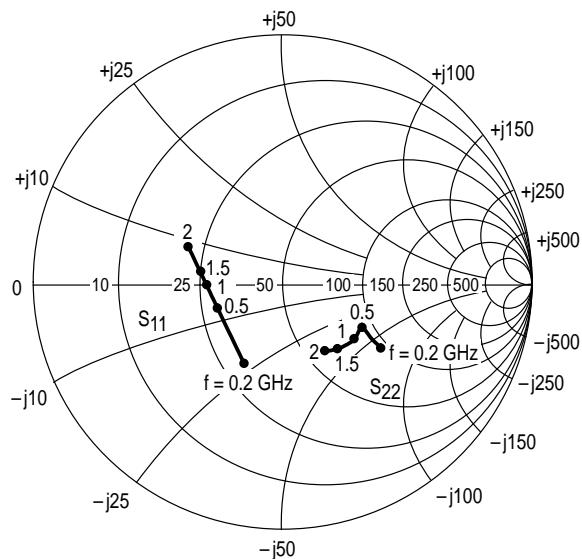
**Figure 5. Noise Figure versus Collector Current**



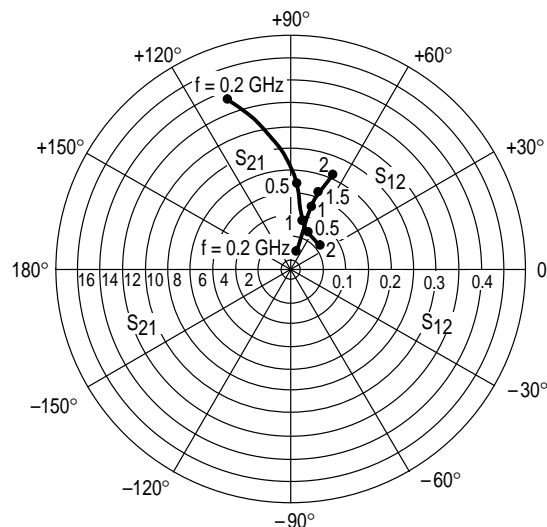
**Figure 6. Gain at Noise Figure and Noise Figure versus Frequency**



**Figure 7. Maximum Unilateral Gain and Insertion Gain versus Frequency**



**Figure 8. Input and Output Reflection Coefficients versus Frequency**  
**VCE = 10 V, IC = 30 mA**

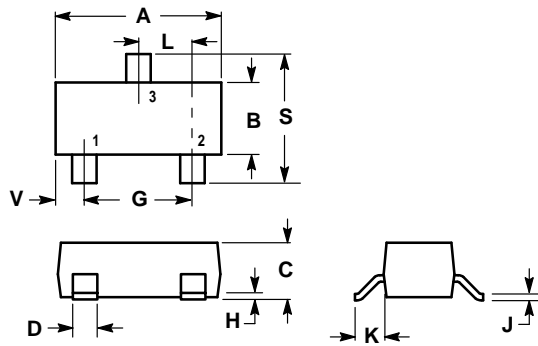


**Figure 9. Forward and Reverse Transmission Coefficients versus Frequency**  
**VCE = 10 V, IC = 30 mA**

VCE (Volts)	IC (mA)	f (MHz)	S11		S21		S12		S22	
			S11	∠φ	S21	∠φ	S12	∠φ	S22	∠φ
10	2.0	200	0.82	-45	4.14	145	0.06	66	0.88	-16
		500	0.60	-96	3.23	112	0.09	49	0.71	-27
		1000	0.47	-149	2.16	85	0.11	49	0.62	-34
		1500	0.46	-179	1.59	71	0.13	55	0.58	-43
		2000	0.47	162	1.35	57	0.16	62	0.56	-51
	5.0	200	0.66	-63	8.63	134	0.05	64	0.75	-25
		500	0.43	-117	5.29	100	0.07	58	0.55	-31
		1000	0.37	-163	3.05	82	0.11	63	0.48	-36
		1500	0.38	176	2.17	70	0.15	65	0.45	-44
		2000	0.40	160	1.81	57	0.19	65	0.43	-51
	10	200	0.49	-83	12.70	124	0.04	65	0.62	-30
		500	0.33	-134	6.42	94	0.07	66	0.44	-32
		1000	0.32	-171	3.53	80	0.12	70	0.41	-36
		1500	0.35	173	2.46	69	0.16	69	0.38	-45
		2000	0.37	159	2.04	58	0.20	66	0.35	-52
	20	200	0.36	-103	15.25	114	0.03	69	0.52	-32
		500	0.28	-149	6.95	90	0.06	72	0.39	-30
		1000	0.29	-176	3.73	78	0.12	73	0.37	-35
		1500	0.33	172	2.60	68	0.17	71	0.34	-43
		2000	0.36	158	2.14	58	0.21	67	0.32	-52
30	200	0.32	-114	15.64	109	0.03	71	0.48	-29	
	500	0.27	-156	6.92	88	0.06	73	0.38	-27	
	1000	0.29	-178	3.71	78	0.12	74	0.37	-33	
	1500	0.34	170	2.58	68	0.16	72	0.34	-44	
	2000	0.37	156	2.13	57	0.21	68	0.32	-51	

**Table 1. 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**

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**MMBR911LT1/D**