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The RF Line

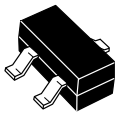
NPN Silicon High-Frequency Transistors

MMBR571LT1
MRF5711LT1

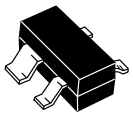
Designed for low noise, wide dynamic range front–end amplifiers and low–noise VCO's. Available in a surface–mountable plastic packages. This Motorola series of small–signal plastic transistors offers superior quality and performance at low cost.

- High Gain–Bandwidth Product
  f_T = 8.0 GHz (Typ) @ 50 mA
- Low Noise Figure
  NF_{min} = 1.6 dB (Typ) @ f = 1.0 GHz (MRF5711LT1, MRF571)
- High Gain
  G_{NF} = 17 dB (Typ) @ 30 mA/500 MHz (MMBR571LT1)
- High Power Gain
  $G_{pe\ (matched)}$ = 13.5 dB (Typ) (MRF5711LT1)
- 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

I_C = 80 mA
LOW NOISE
HIGH–FREQUENCY
TRANSISTORS



CASE 318–08, STYLE 6
SOT–23
LOW PROFILE
MMBR571LT1



CASE 318A–05, STYLE 1
SOT–143
LOW PROFILE
MRF5711LT1

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector–Emitter Voltage	V_{CEO}	10	Vdc
Collector–Base Voltage	V_{CBO}	20	Vdc
Emitter–Base Voltage	V_{EBO}	3.0	Vdc
Collector Current — Continuous	I_C	80	mA
Total Device Dissipation @ T_{case} = 75°C Derate linearly above T_{case} = 75°C @	$P_{D(max)}$	0.33 4.44	W mW/°C
Operating and Storage Temperature	T_{stg}	–55 to +150	°C

THERMAL CHARACTERISTICS

Rating	Symbol	Max	Unit
Thermal Resistance, Junction to Case MRF5711LT1, MMBR571LT1	$R_{\theta JC}$	225	°C/W
Maximum Junction Temperature	T_{Jmax}	150	°C

DEVICE MARKING

MMBR571LT1 = 7X MRF5711LT1 = 02

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

ARCHIVE INFORMATION

MOTOROLA

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 mA, I_B = 0)			$V_{(BR)CEO}$	10	12	—	Vdc
Collector–Base Breakdown Voltage (I_C = 0.1 mA, I_E = 0)			$V_{(BR)CBO}$	20	—	—	Vdc
Emitter–Base Breakdown Voltage (I_E = 50 μAdc, I_C = 0)			$V_{(BR)EBO}$	2.5	—	—	Vdc
Collector Cutoff Current (V_{CB} = 8.0 Vdc, I_E = 0)			I_{CBO}	—	—	10	μAdc
ON CHARACTERISTICS							
DC Current Gain (I_C = 30 mAdc, V_{CE} = 5.0 Vdc)			h_{FE}	50	—	300	—
DYNAMIC CHARACTERISTICS							
Collector–Base Capacitance			C_{cb}				pF
(V_{CB} = 10 Vdc, I_E = 0, f = 1.0 MHz)	MMBR571LT1			—	0.7	1.0	
(V_{CB} = 6.0 Vdc, I_E = 0, f = 1.0 MHz)	MRF5711LT1,			—	0.75	1.0	
Current Gain–Bandwidth Produc			f_T				GHz
(V_{CE} = 5.0 Vdc, I_C = 50 mAdc, f = 1.0 GHz)	MMBR571LT1			—	8.0	—	
(V_{CE} = 8.0 Vdc, I_C = 50 mAdc, f = 1.0 GHz)	MRF5711LT1			—	8.0	—	
FUNCTIONAL TESTS							
Gain @ Noise Figure			G_{NF}				dB
(I_C = 10 mAdc, V_{CE} = 5.0 Vdc)	MMBR571LT1	f = 0.5 GHz		—	16.5	—	
		f = 1.0 GHz		—	10.5	—	
(I_C = 10 mA, V_{CE} = 6.0 Vdc)	MRF5711LT1	f = 1.0 GHz		—	13.5	—	
Noise Figure			NF				dB
(I_C = 10 mAdc, V_{CE} = 5.0 Vdc)	MMBR571LT1	f = 0.5 GHz		—	2.0	—	
		f = 1.0 GHz		—	2.6	—	
(I_C = 10 mAdc, V_{CE} = 6.0 Vdc)	MRF5711LT1	f = 1.0 GHz		—	2.2	—	
Noise Figure			NF_{min}	—	1.6	—	dB
(V_{CE} = 6.0 V, I_C = 10 mA, f = 1.0 GHz)	MRF5711LT1						
Power Gain in 50 Ω System (V_{CE} = 6.0 V, I_C = 10 mA, f = 1.0 GHz)							
	MRF5711LT1		$\|S_{21}\|^2$	9.0	10	—	dB

TYPICAL CHARACTERISTICS
MMBR571LT1

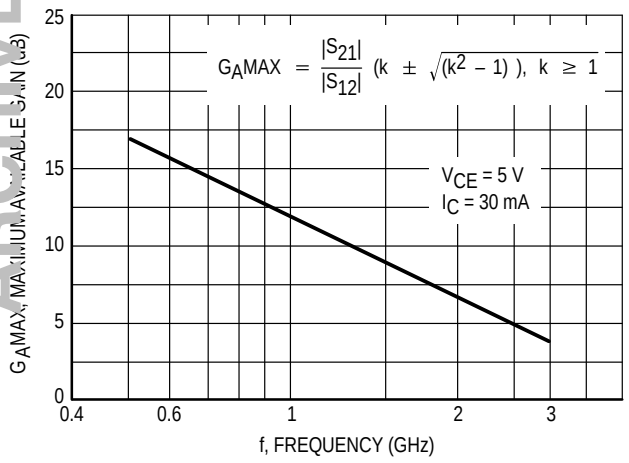


Figure 1. Maximum Available Gain versus Frequency

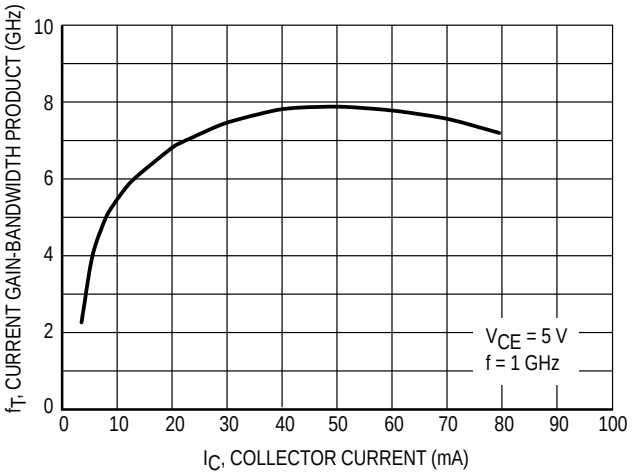


Figure 2. Current Gain–Bandwidth versus Collector Current @ 1.0 GHz

TYPICAL CHARACTERISTICS
MMBR571LT1

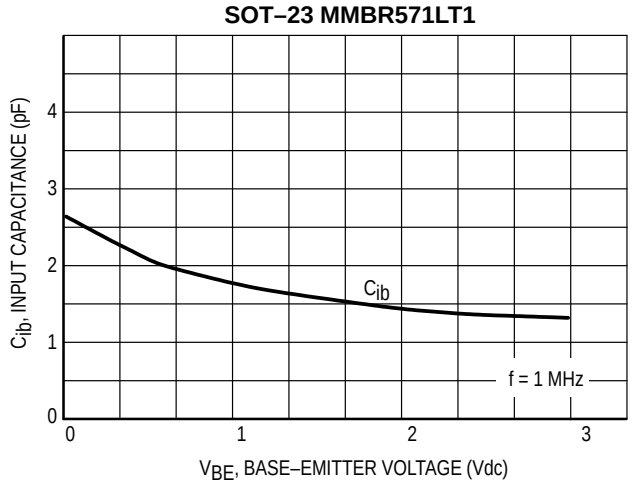


Figure 3. Input Capacitance versus Emitter Base Voltage

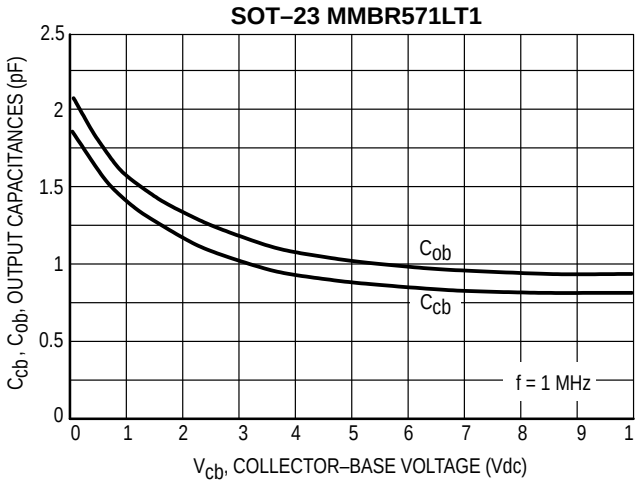


Figure 4. Output Capacitances versus Collector–Base Voltage

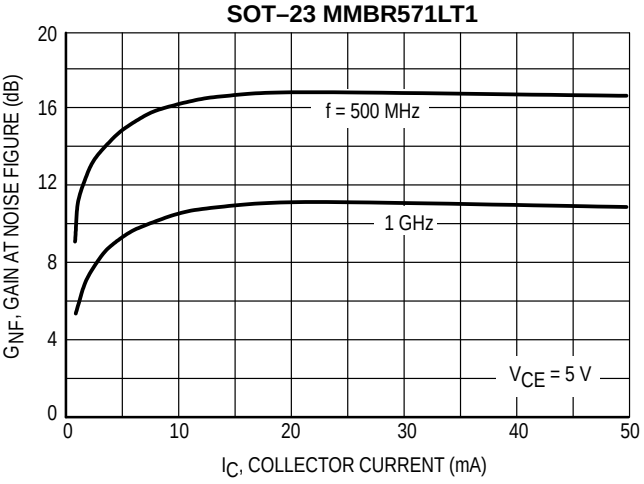


Figure 5. Gain at Noise Figure versus Collector Current

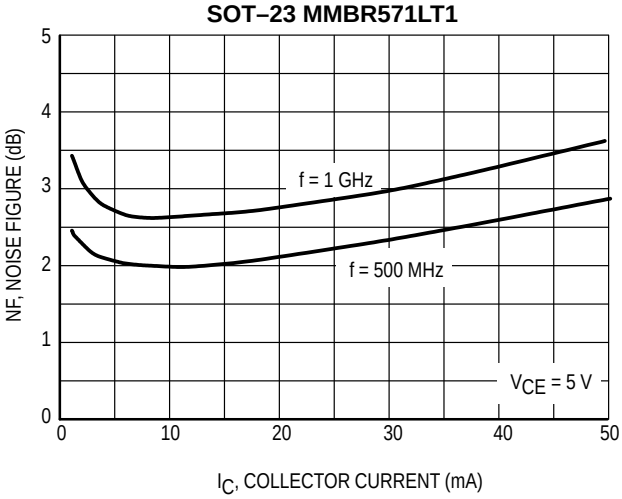


Figure 6. Noise Figure versus Collector Current

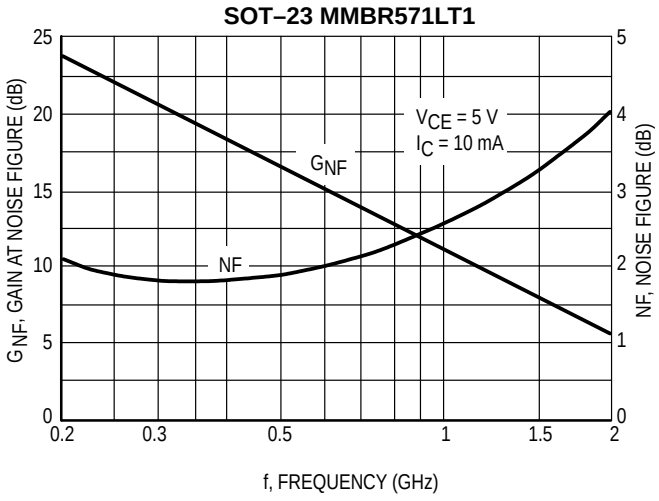


Figure 7. Gain at Noise Figure and Noise Figure versus Frequency

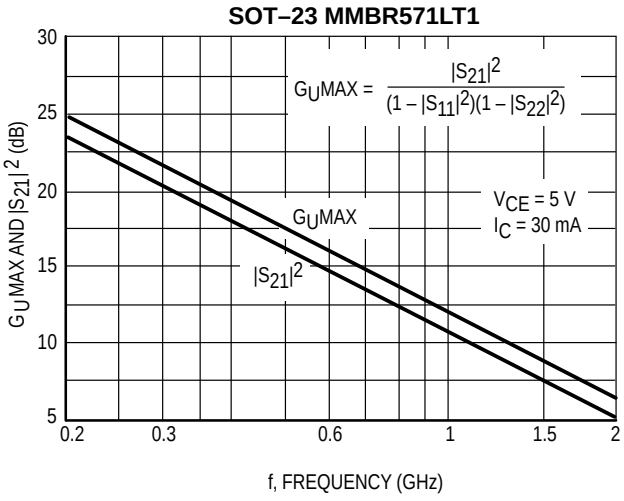


Figure 8. Maximum Unilateral Gain and Insertion Gain versus Frequency

TYPICAL CHARACTERISTICS
MRF5711LT1

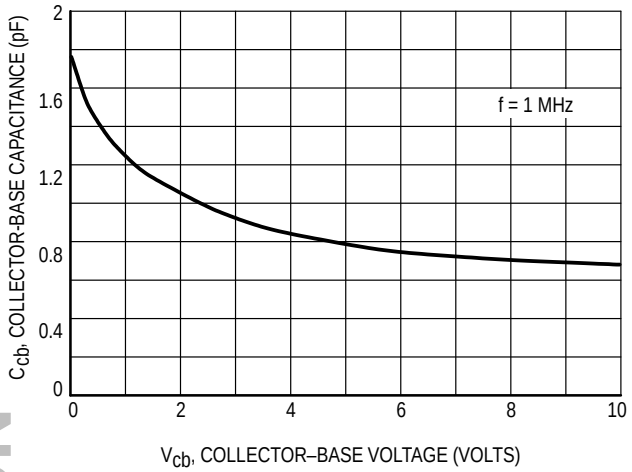


Figure 9. Collector–Base Capacitance versus Collector–Base Voltage

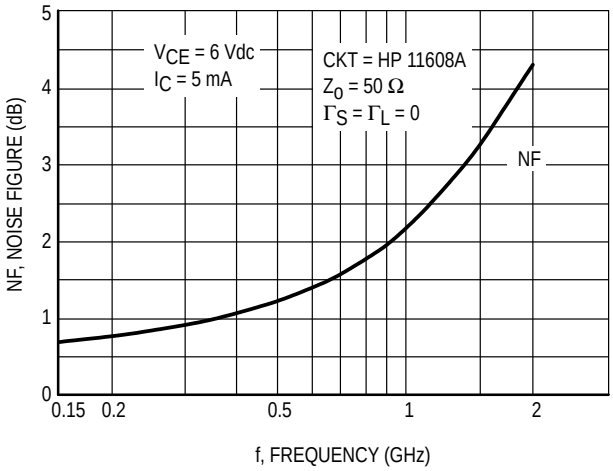


Figure 10. 50 Ω Noise Figure versus Frequency

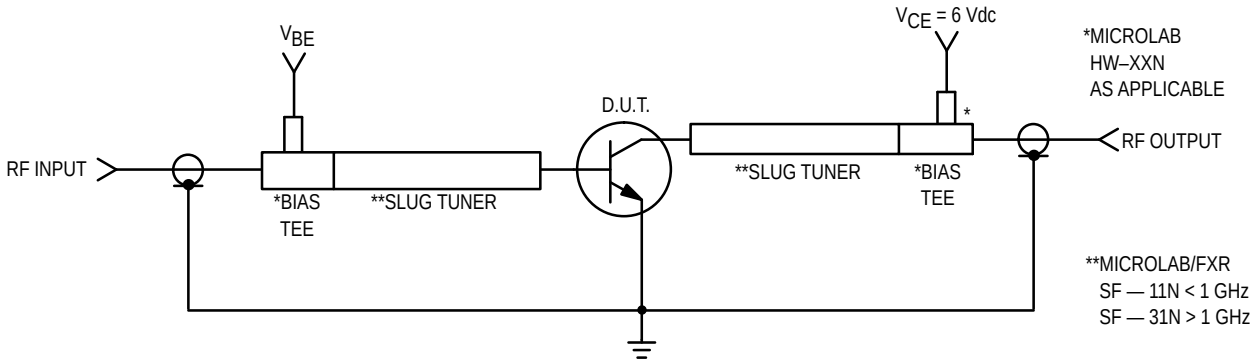


Figure 11. Functional Circuit Schematic

TYPICAL CHARACTERISTICS
MRF5711LT1

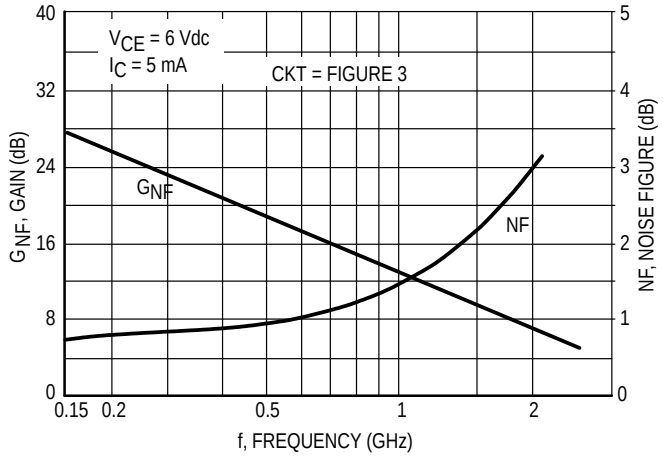


Figure 12. Gain and Noise Figure versus Frequency

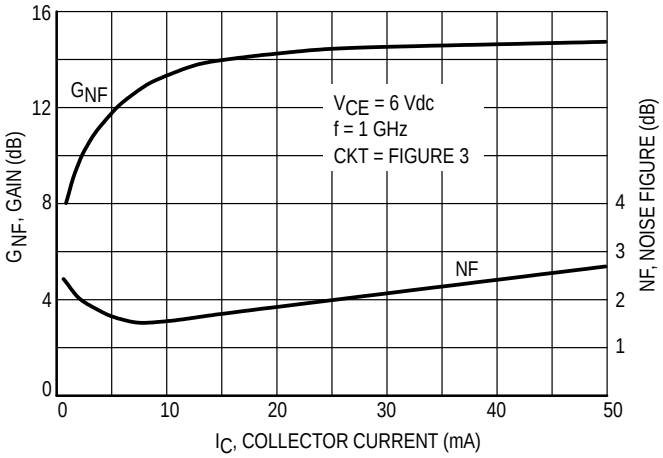


Figure 13. Gain and Noise Figure versus Collector Current

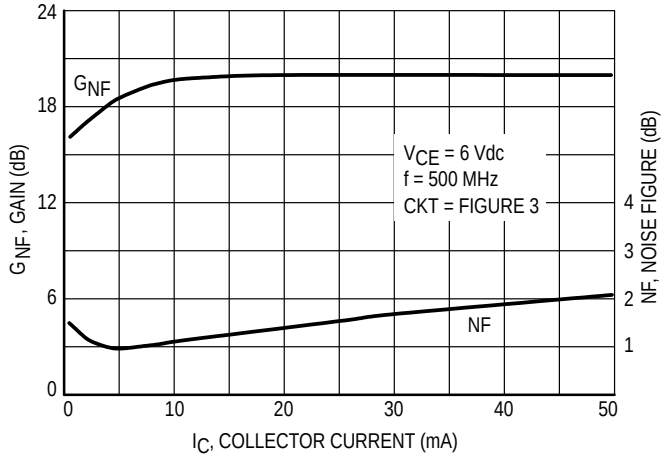


Figure 14. Gain and Noise Figure versus Collector Current

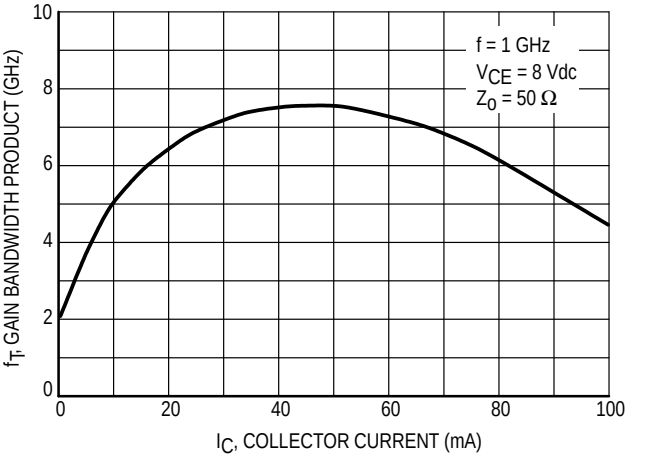


Figure 15. Gain Bandwidth Product versus Collector Current

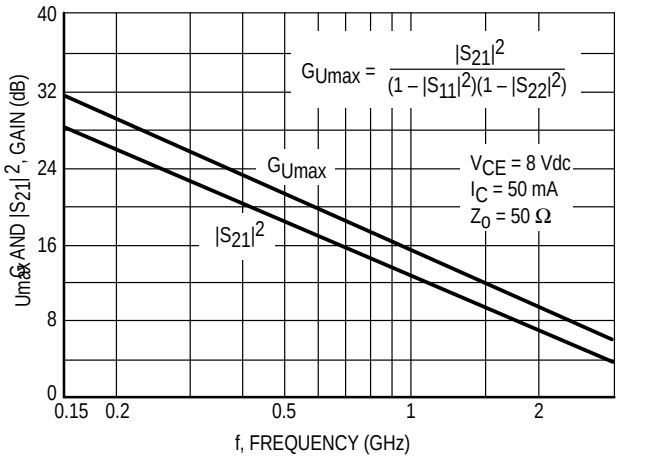


Figure 16. G_{Umax} and $|S_{21}|^2$ versus Frequency

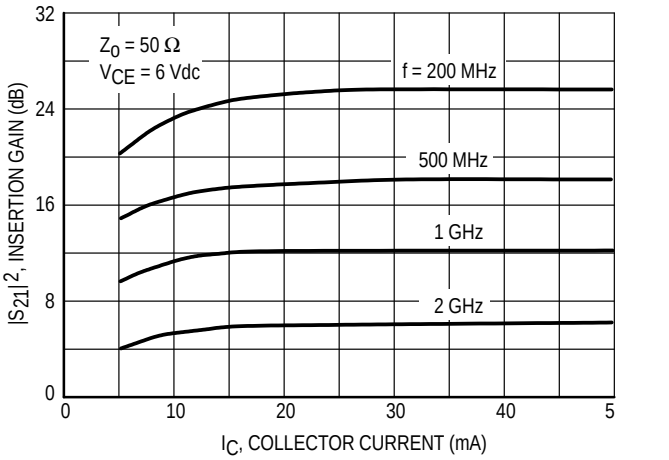


Figure 17. Insertion Gain versus Collector Current

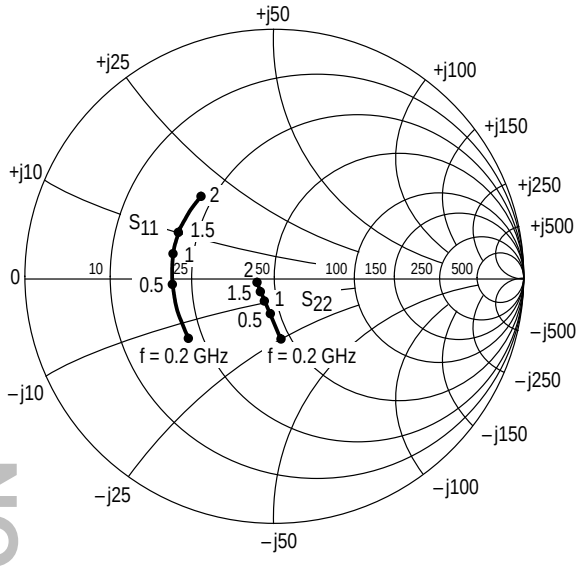


Figure 18. Input/Output Reflection Coefficients versus Frequency
V_{CE} = 5.0 V, I_C = 30 mA

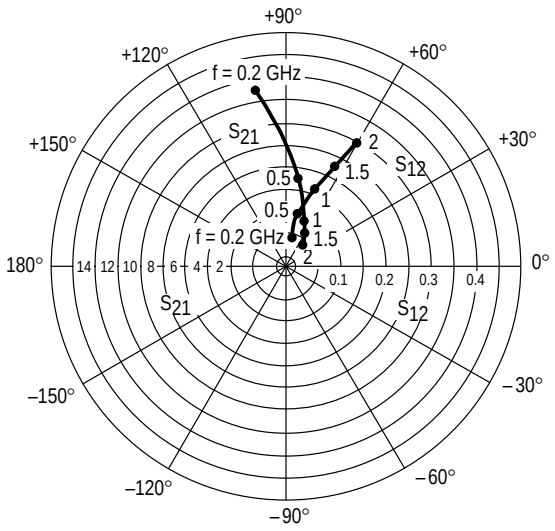
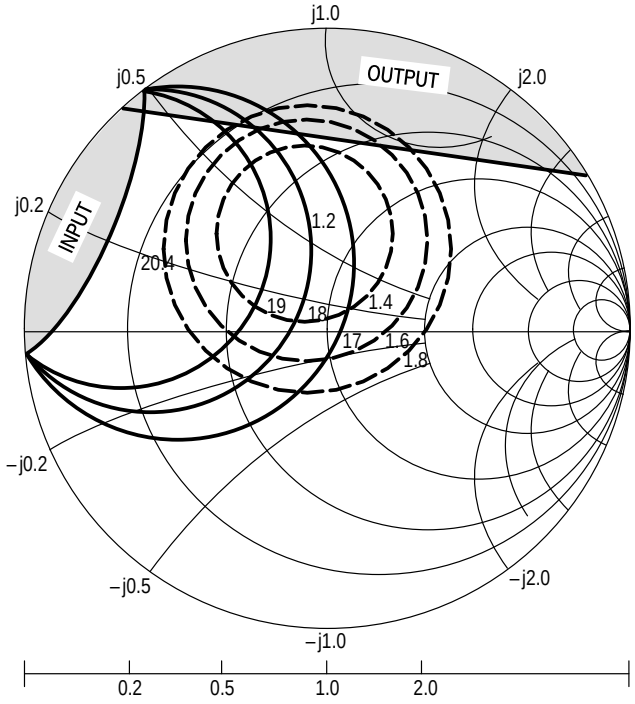


Figure 19. Forward/Reverse Transmission Coefficients versus Frequency
V_{CE} = 5.0 V, I_C = 30 mA

V_{CE} (Volts)	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	200	0.68	–82	8.41	126	0.07	53	0.61	–45
		500	0.52	–142	4.62	93	0.10	46	0.35	–60
		1000	0.50	179	2.57	72	0.14	53	0.26	–71
		1500	0.51	161	1.82	57	0.19	58	0.24	–77
		2000	0.52	143	1.48	45	0.24	59	0.22	–86
	15	200	0.46	–125	13.65	108	0.05	60	0.35	–73
		500	0.43	–169	6.03	86	0.09	66	0.17	–94
		1000	0.44	168	3.20	72	0.16	67	0.14	–111
		1500	0.45	152	2.21	58	0.22	64	0.11	–118
		2000	0.46	137	1.80	48	0.29	59	0.10	–131
	30	200	0.42	–148	14.79	102	0.04	68	0.26	–87
		500	0.41	–177	6.31	84	0.09	72	0.14	–115
		1000	0.42	165	3.35	71	0.16	70	0.12	–135
		1500	0.44	151	2.29	59	0.23	65	0.11	–144
		2000	0.44	135	1.84	48	0.30	60	0.10	–157
	50	200	0.41	–159	15.14	98	0.04	73	0.21	–96
		500	0.42	179	6.38	83	0.09	75	0.13	–124
		1000	0.43	163	3.35	70	0.16	71	0.12	–143
		1500	0.44	148	2.32	58	0.23	66	0.10	–151
		2000	0.45	134	1.84	48	0.30	60	0.09	–163

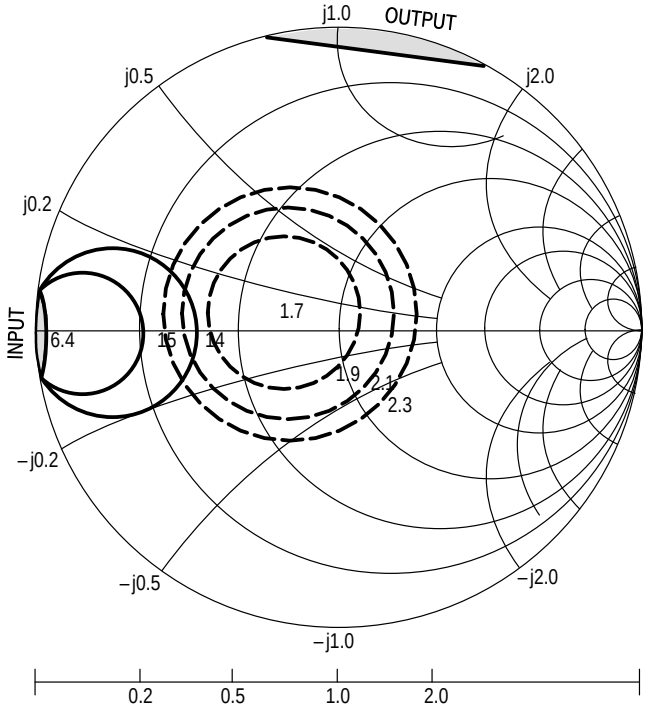
Table 1. MMBR571LT1 Common Emitter S–Parameters



V_{CE} = 5 V
I_C = 10 mA
= Area of Instability

f (GHz)	NF OPT	ΓMS NF OPT		Rn	K
0.5	1.20 dB	0.36	104°	7	0.63

Figure 20. MRF5711LT1 Constant Gain and Noise Figure Contours (f = 0.5 GHz)



V_{CE} = 5 V
I_C = 10 mA
= Area of Instability

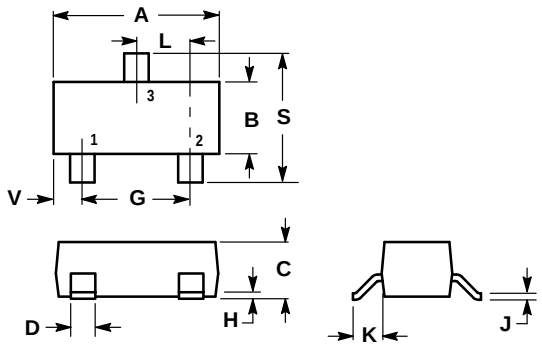
f (GHz)	NF OPT	ΓMS NF OPT		Rn	K
1.0	1.70 dB	0.20	162°	8	0.94

Figure 21. MRF5711LT1 Constant Gain and noise Figure Contours (f = 1.0 GHz)

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
6.0	5.0	200	0.79	−90	10.9	128	0.06	46	0.70	−45
		500	0.72	−144	5.7	96	0.08	28	0.42	−66
		1000	0.69	−177	3.0	75	0.09	28	0.31	−77
		1500	0.66	164	2.0	59	0.10	32	0.34	−89
		2000	0.65	147	1.6	47	0.12	38	0.32	−94
	10	200	0.72	−115	15.2	118	0.05	41	0.55	−66
		500	0.69	−160	6.9	92	0.06	34	0.30	−92
		1000	0.67	174	3.6	74	0.08	42	0.21	−108
		1500	0.64	159	2.4	60	0.10	46	0.23	−114
		2000	0.64	143	1.8	49	0.12	50	0.20	−116
	50	200	0.67	−159	20	102	0.02	48	0.33	−111
		500	0.67	179	8.2	85	0.04	58	0.33	−142
		1000	0.66	174	3.8	72	0.07	65	0.21	−158
		1500	0.63	151	2.7	61	0.10	64	0.22	−158
		2000	0.58	138	2.1	51	0.14	62	0.17	−165
8.0	5.0	200	0.80	−87	11.1	130	0.06	47	0.71	−42
		500	0.72	−141	5.9	97	0.08	30	0.44	−60
		1000	0.70	−177	3.1	75	0.09	28	0.33	−68
		1500	0.66	166	2.1	60	0.10	32	0.35	−80
		2000	0.61	149	1.6	47	0.12	39	0.35	−85
	10	200	0.72	−113	15.6	119	0.05	42	0.56	−61
		500	0.68	−159	7.2	92	0.06	34	0.31	−82
		1000	0.66	175	3.7	74	0.08	41	0.21	−92
		1500	0.64	160	2.5	61	0.09	47	0.23	−101
		2000	0.60	144	2.0	49	0.13	50	0.21	−103
	50	200	0.66	−156	20.9	103	0.02	48	0.31	−101
		500	0.65	−179	8.6	85	0.04	58	0.19	−128
		1000	0.64	164	4.3	72	0.07	65	0.16	−144
		1500	0.61	153	2.9	61	0.10	65	0.17	−142
		2000	0.58	137	2.3	51	0.13	64	0.14	−145

Table 2. MRF5711LT1 Common Emitter S–Parameters

PACKAGE DIMENSIONS

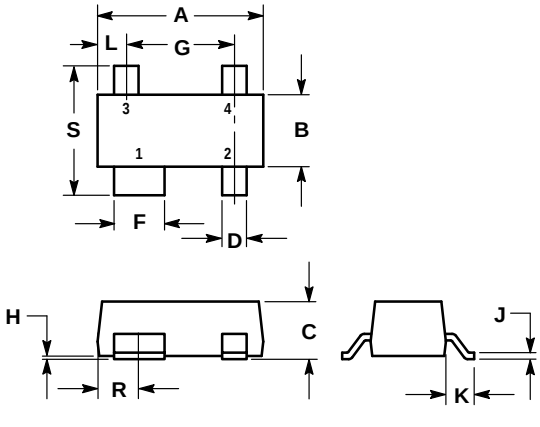


NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. MAXIUMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.

	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
MMBR571LT1



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
MRF5711LT1

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