MRF5583

The RF Line
PNP Silicon High-Frequency Transistor

. . . designed for amplifier, oscillator or frequency multiplier applications in industrial equipment. Suitable for use as a Class A, B or C output driver or pre-driver stages in VHF and UHF.

- Low Cost SORF Plastic Surface Mount Package
- Guaranteed RF Specification — $|S_{21}|^2$
- S-Parameter Characterization
- Tape and Reel Packaging Options Available

I_C = −500 mA
SURFACE MOUNT
HIGH-FREQUENCY
TRANSISTOR
PNP SILICON

CASE 751, STYLE 1
(SO-8)

2

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CEO}	−30	V
Collector-Base Voltage	V_{CBO}	−30	V
Emitter-Base Voltage	V_{EBO}	−3.0	V
Collector Current — Continuous	I_C	−500	mA
Operating and Storage Junction Temperature Range	T_J, T_{stg}	−55 to +150	°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Total Device Dissipation @ T_A = 25°C Derate above 25°C	P_D	1.0 8.0	Watt mW/°C
Storage Temperature	T_{stg}	150	°C
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	125	°C/W

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted.)

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Collector-Emitter Breakdown Voltage (I_C = −10 mA)	$V_{(BR)CEO}$	−30	—	—	V
Collector-Base Breakdown Voltage (I_C = −10 μA)	$V_{(BR)CBO}$	−30	—	—	V
Emitter-Base Breakdown Voltage (I_E = −100 μA)	$V_{(BR)EBO}$	−3	—	—	V
Collector Cutoff Current (V_{CB} = −20 V)	I_{CBO}	—	—	−1.0	μA
Emitter Cutoff Current (V_{EB} = −2.0 V)	I_{EBO}	—	—	−0.5	μA
ON CHARACTERISTICS					
DC Current Gain (I_C = −40 mA, V_{CE} = −2.0 V) (I_C = −100 mA, V_{CE} = −2.0 V) (I_C = −300 mA, V_{CE} = −5.0 V)	h_{FE}	20 25 15	— — —	— 100 —	—
Collector-Emitter Saturation Voltage (I_C = −100 mA, I_B = −10 mA)	$V_{CE(sat)}$	—	—	0.8	V
Base-Emitter On Voltage (I_C = −100 mA, V_{CE} = −2.0 V)	$V_{BE(on)}$	—	—	1.8	V
SMALL-SIGNAL CHARACTERISTICS					
Current-Gain — Bandwidth Product (I_C = −35 mA, V_{CE} = −15 V, f = 100 MHz)	f_T	—	2100	—	MHz
Insertion Gain (V_{CE} = −15 V, I_C = −35 mA, f = 250 MHz)	$\|S_{21}\|^2$	12.5	15.5	—	dB

V_{CE} (Volts)	I_C (mA)	f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}	
			$\|S_{11}\|$	$\angle\phi$	$\|S_{21}\|$	$\angle\phi$	$\|S_{12}\|$	$\angle\phi$	$\|S_{22}\|$	$\angle\phi$
−15	−35	10	0.47	−57	64.7	155	0.01	60	0.83	−26
		30	0.59	−116	42.2	126	0.02	44	0.56	−58
		50	0.63	−140	28.8	113	0.02	39	0.39	−74
		70	0.64	−151	21.4	105	0.02	42	0.30	−82
		100	0.65	−161	15.4	97	0.02	45	0.24	−80
		300	0.67	179	5.23	79	0.05	58	0.13	−109
		500	0.67	168	3.11	66	0.07	60	0.20	−114
		700	0.67	160	2.24	57	0.09	60	0.24	−116
		1000	0.66	146	1.54	44	0.13	60	0.30	−123

Table 1. Common Emitter S-Parameters

MPS571
MMBR571LT1
MRF5711LT1

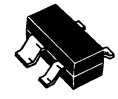
The RF Line.

NPN Silicon High-Frequency Transistors

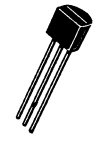
. . . designed for low noise, wide dynamic range front-end amplifiers and low-noise VCO's. Available in a surface-mountable plastic package, as well as the popular TO-226AA (TO-92) package. This Motorola series of small-signal plastic transistors offers superior quality and performance at low cost.

- High Gain-Bandwidth Product
  f_T = 8.0 GHz (Typ) @ 50 mA (MMBR571LT1)
  f_T = 7.5 GHz (Typ) @ 50 mA (MRF5711LT1)
- Low Noise Figure
  NF = 2.0 dB (Typ) @ f = 500 MHz (MMBR571LT1)
  $NF_{(matched)}$ = 1.6 dB (Typ) @ f = 1.0 GHz (MRF5711LT1)
- 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

I_C = 80 mA
LOW NOISE
HIGH-FREQUENCY
TRANSISTORS



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



CASE 29-04, STYLE 2
TO-226AA
(TO-92)
MPS571

CASE 318-07, STYLE 6
SOT-23
LOW PROFILE
MMBR571LT1

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CEO}	10	Vdc
Collector-Base Voltage	V_{CBO}	20	Vdc
Emitter-Base Voltage MPS571, MMBR571LT1 MRF5711LT1	V_{EBO}	3.0 2.5	Vdc
Collector Current — Continuous MPS571, MMBR571LT1 MRF5711LT1	I_C	 80 70	mA
Power Dissipation @ T_A = 25°C MPS571 MMBR571LT1	P_D	625 200 (Free Air)	mW
Total Device Dissipation @ T_A = 25°C Derate above 25°C MRF5711LT1	P_D	0.58 4.64	Watts mW/°C
Total Device Dissipation (1) @ T_C = 75°C Derate above 75°C MRF5711LT1	P_D	0.58 7.73	Watts mW/°C
Storage Temperature MPS571, MMBR571LT1 MRF5711LT1	T_{stg}	−55 to +150 −65 to +150	°C

THERMAL CHARACTERISTICS

Rating	Symbol	Max	Unit
Thermal Resistance, Junction to Ambient MRF5711LT1	$R_{\theta JA}$	216	°C/W
Thermal Resistance, Junction to Case MRF5711LT1	$R_{\theta JC}$	130	°C/W

DEVICE MARKING

MMBR571LT1 = 7X MRF5711LT1 = 02

ELECTRICAL CHARACTERISTICS (T_C = 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)	MPS571, 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 Product	MPS571	f_T	—	6.0	—	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)	MPS571 f = 0.5 GHz		—	14	—	
	f = 1.0 GHz		—	9.0	—	
	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)	MPS571 f = 0.5 GHz		—	2.0	—	
	f = 1.0 GHz		—	2.6	—	
	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		$\|S_{21}\|^2$	9.0	10	—	dB
(V_{CE} = 6.0 V, I_C = 10 mA, f = 1.0 GHz)						

TYPICAL CHARACTERISTICS
MPS571, MMBR571LT1

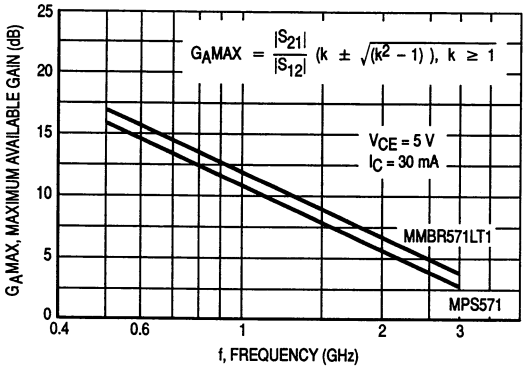


Figure 1. Maximum Available Gain versus Frequency

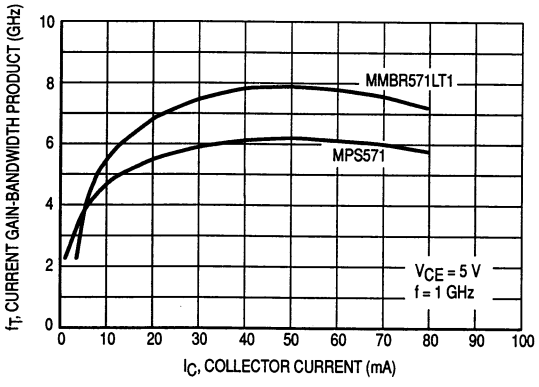


Figure 2. Current Gain-Bandwidth versus Collector Current @ 1.0 GHz

TYPICAL CHARACTERISTICS
MPS571, MMBR571LT1

TO-92 MPS571

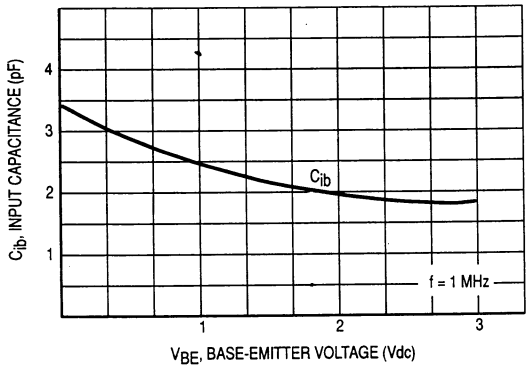


Figure 3. Input Capacitance versus Emitter Base Voltage

SOT-23 MMBR571LT1

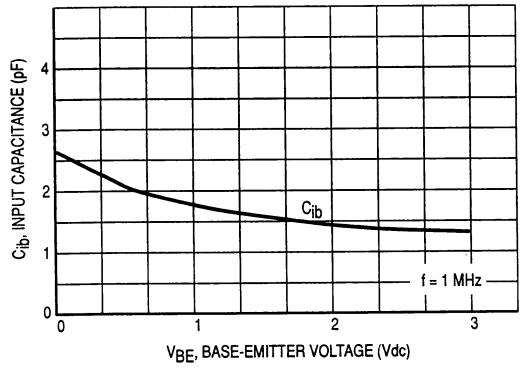


Figure 4. Input Capacitance versus Emitter Base Voltage

TO-92 MPS571

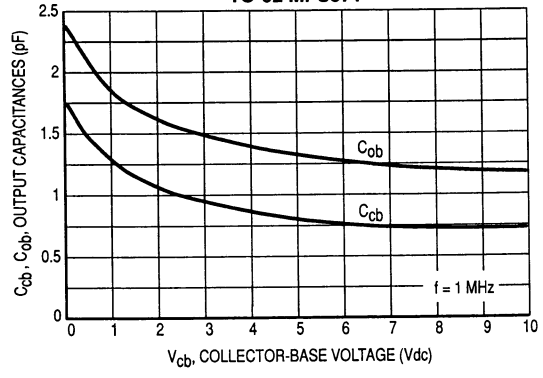


Figure 5. Output Capacitances versus Collector-Base Voltage

SOT-23 MMBR571LT1

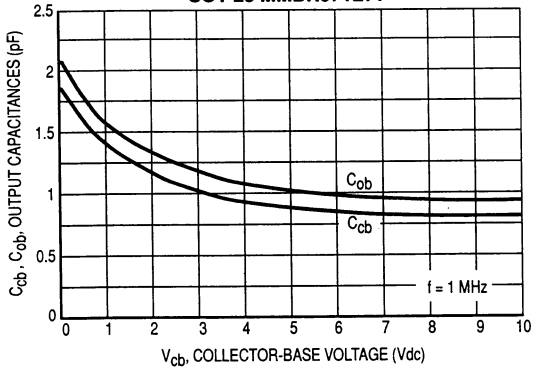


Figure 6. Output Capacitances versus Collector-Base Voltage

TO-92 MPS571

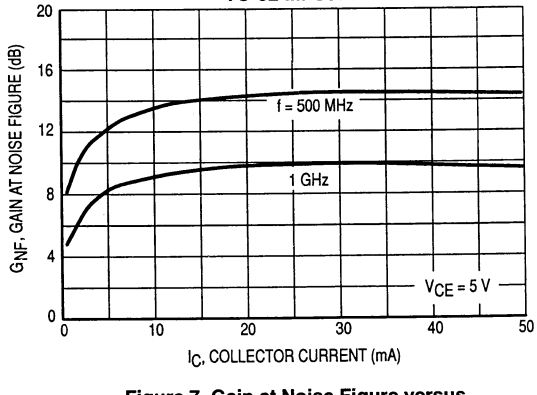


Figure 7. Gain at Noise Figure versus Collector Current

SOT-23 MMBR571LT1

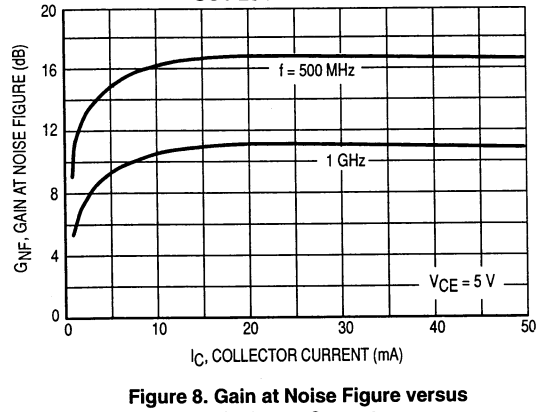


Figure 8. Gain at Noise Figure versus Collector Current

TYPICAL CHARACTERISTICS
MPS571, MMBR571LT1

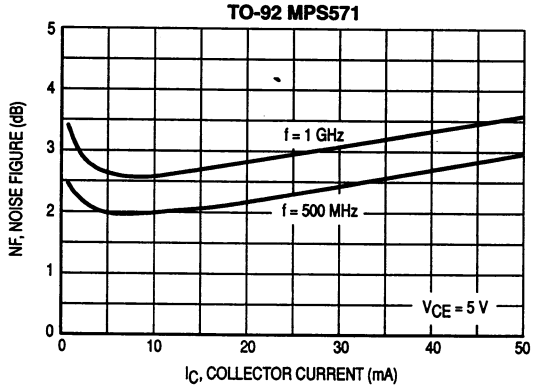


Figure 9. Noise Figure versus Collector Current

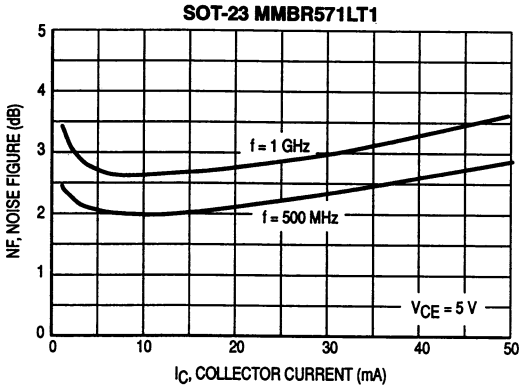


Figure 10. Noise Figure versus Collector Current

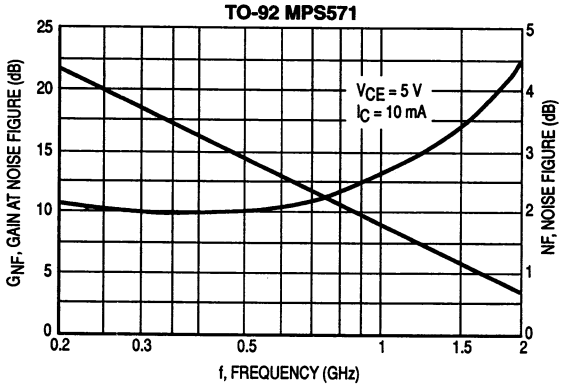


Figure 11. Gain at Noise Figure and Noise Figure versus Frequency

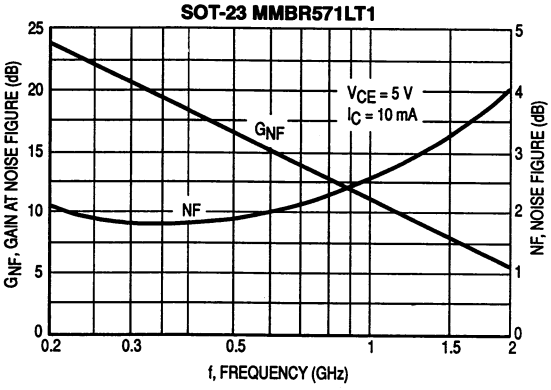


Figure 12. Gain at Noise Figure and Noise Figure versus Frequency

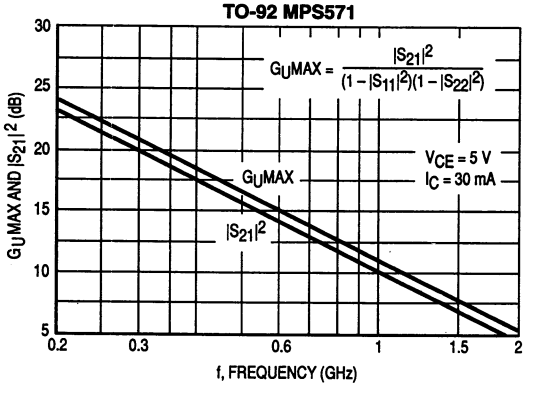


Figure 13. Maximum Unilateral Gain and Insertion Gain versus Frequency

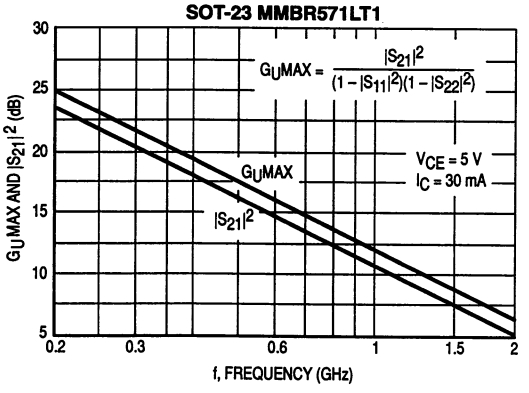


Figure 14. Maximum Unilateral Gain and Insertion Gain versus Frequency

TYPICAL CHARACTERISTICS
MRF5711LT1

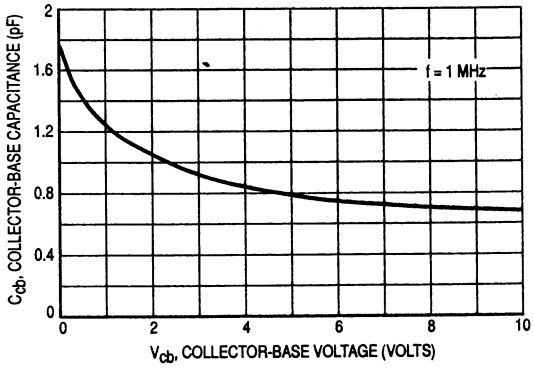


Figure 15. Collector-Base Capacitance versus Collector-Base Voltage

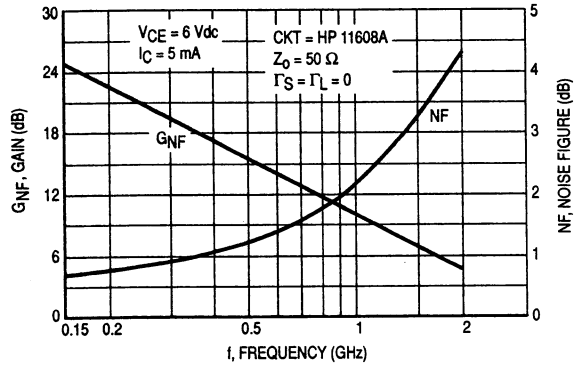


Figure 16. Gain and Noise Figure versus Frequency

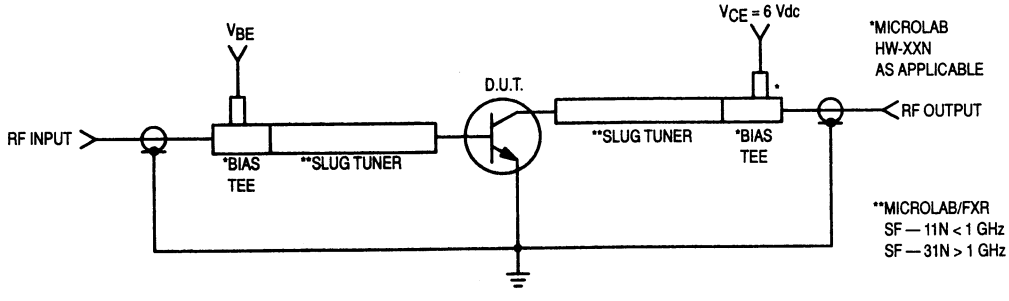


Figure 17. Functional Circuit Schematic

TYPICAL CHARACTERISTICS
MRF5711LT1

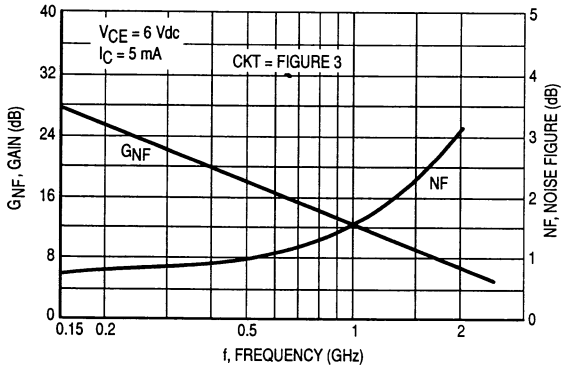


Figure 18. Gain and Noise Figure versus Frequency

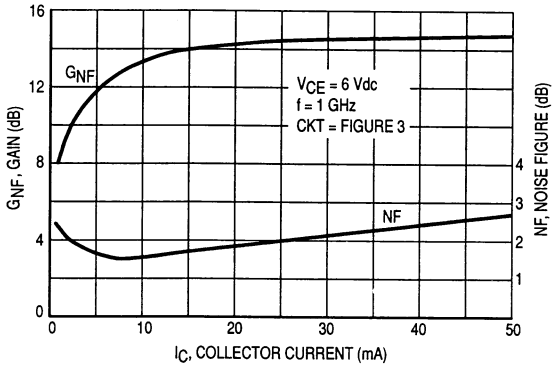


Figure 19. Gain and Noise Figure versus Collector Current

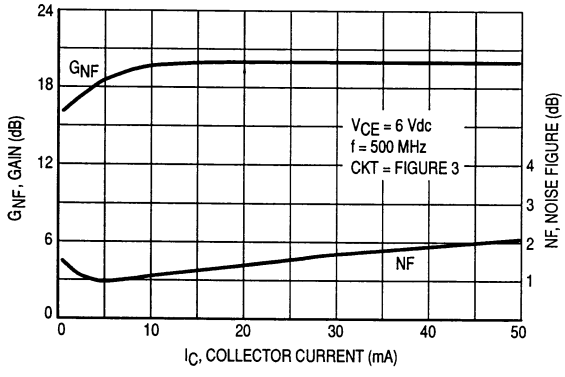


Figure 20. Gain and Noise Figure versus Collector Current

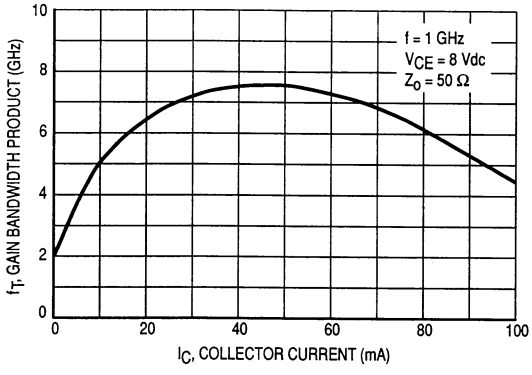


Figure 21. Gain Bandwidth Product versus Collector Current

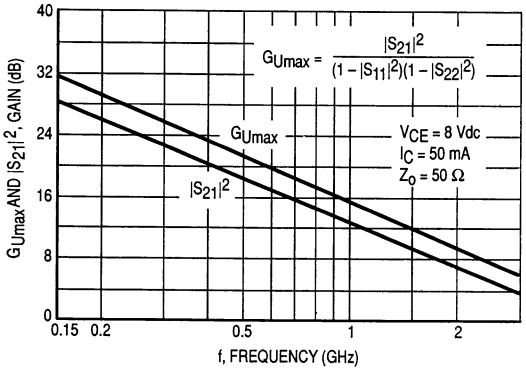


Figure 22. G_{Umax} and $|S_{21}|^2$ versus Frequency

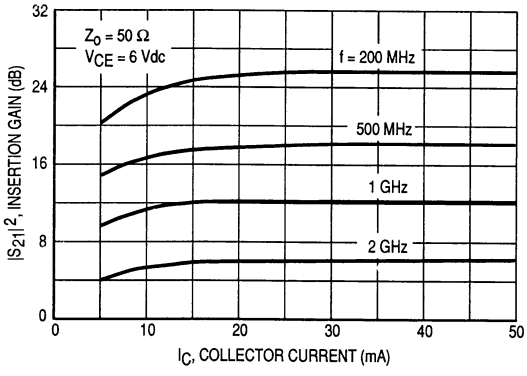


Figure 23. Insertion Gain versus Collector Current

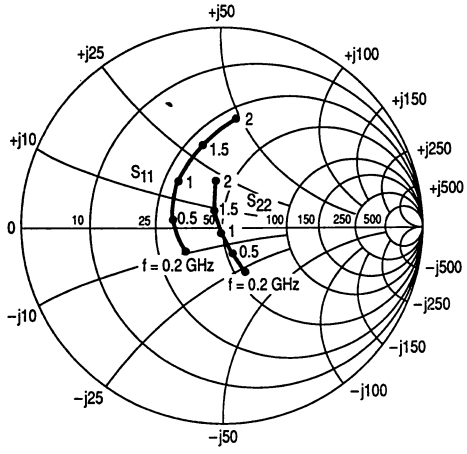


Figure 24. Input/Output Reflection Coefficients versus Frequency
V_{CE} = 5.0 V, I_C = 30 mA

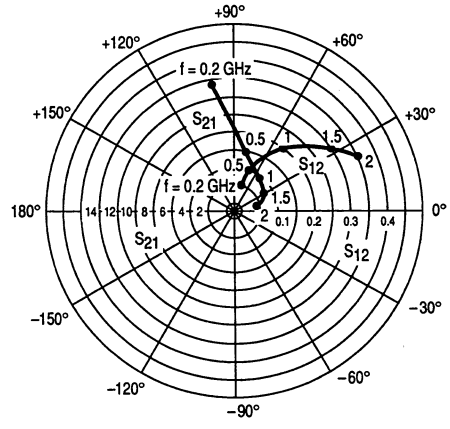


Figure 25. Forward/Reverse Transmission Coefficients versus Frequency
V_{CE} = 5.0 V, I_C = 30 mA

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V_{CE} (Volts)	I_C (mA)	f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}	
			$\lvert S_{11}\rvert$	$\angle\phi$	$\lvert S_{21}\rvert$	$\angle\phi$	$\lvert S_{12}\rvert$	$\angle\phi$	$\lvert S_{22}\rvert$	$\angle\phi$
5.0	5.0	200	0.62	−80	8.22	122	0.07	56	0.63	−44
		500	0.40	−148	4.52	87	0.11	50	0.36	−58
		1000	0.39	155	2.51	54	0.16	48	0.23	−78
		1500	0.46	122	1.86	32	0.23	42	0.15	−114
		2000	0.59	100	1.50	14	0.31	33	0.14	173
	15	200	0.33	−121	12.88	105	0.05	67	0.37	−59
		500	0.28	−175	5.62	79	0.10	65	0.18	−67
		1000	0.32	143	2.99	53	0.19	55	0.08	−94
		1500	0.40	117	2.14	32	0.27	42	0.07	171
		2000	0.55	95	1.74	17	0.35	30	0.198	117
	30	200	0.23	−143	13.65	99	0.05	75	0.26	−62
		500	0.23	169	5.75	76	0.11	70	0.13	−68
		1000	0.30	130	3.05	50	0.21	55	0.04	−136
		1500	0.41	106	2.11	28	0.29	38	0.12	130
		2000	0.56	85	1.70	11	0.36	23	0.26	102
	50	200	0.21	−158	13.96	96	0.05	79	0.21	−61
		500	0.23	162	5.82	75	0.11	72	0.11	−66
		1000	0.30	128	3.09	49	0.21	56	0.03	−149
		1500	0.41	105	2.11	28	0.29	39	0.12	127
		2000	0.56	84	1.70	11	0.36	23	0.27	100

Table 1. MPS571 Common Emitter S-Parameters

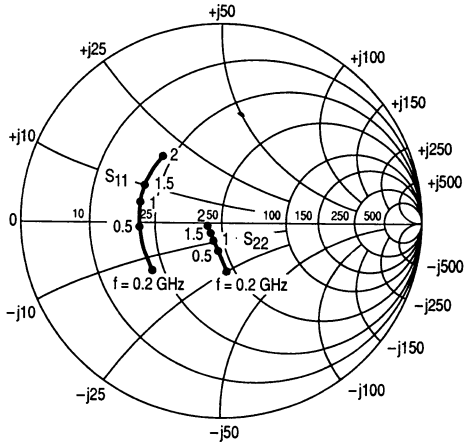


Figure 26. Input/Output Reflection Coefficients versus Frequency
V_{CE} = 5.0 V, I_C = 30 mA

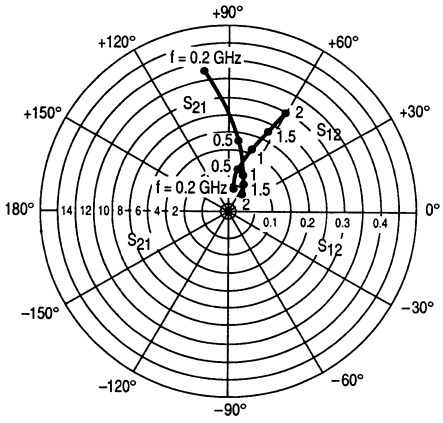
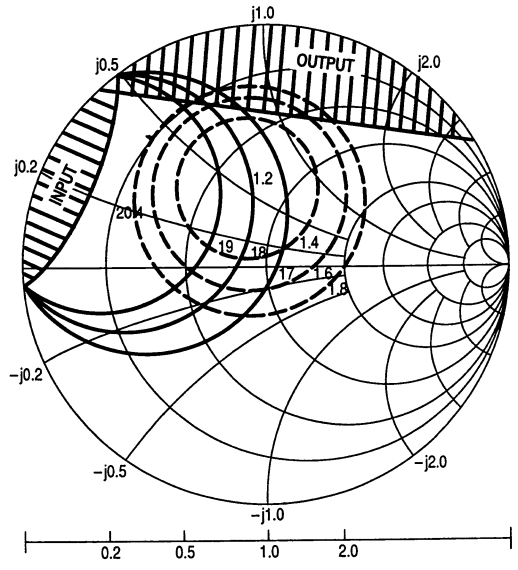


Figure 27. Forward/Reverse Transmission Coefficients versus Frequency
V_{CE} = 5.0 V, I_C = 30 mA

2

V_{CE} (Volts)	I_C (mA)	f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}	
			$\lvert S_{11}\rvert$	$\angle\phi$	$\lvert S_{21}\rvert$	$\angle\phi$	$\lvert S_{12}\rvert$	$\angle\phi$	$\lvert S_{22}\rvert$	$\angle\phi$
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

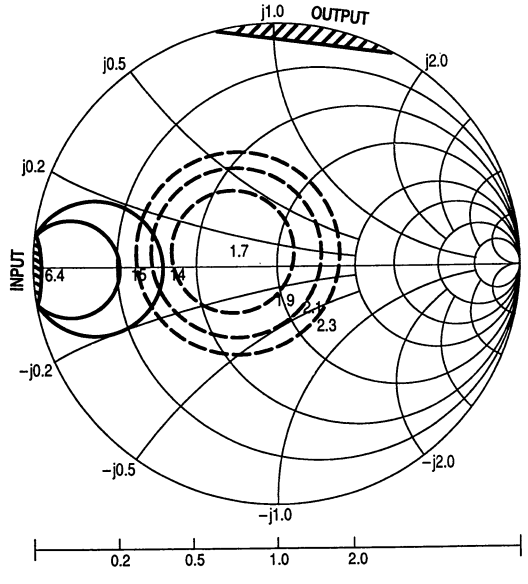
Table 2. MMBR571LT1 Common Emitter S-Parameters



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 28. 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 29. 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}	
			$\|S_{11}\|$	$\angle\phi$	$\|S_{21}\|$	$\angle\phi$	$\|S_{12}\|$	$\angle\phi$	$\|S_{22}\|$	$\angle\phi$
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 3. MRF5711LT1 Common Emitter S-Parameters

MRF5943

The RF Line
NPN Silicon High-Frequency Transistor

. . . designed for amplifier, oscillator or frequency multiplier applications in industrial equipment. Suitable for use as a Class A, B or C output driver or pre-driver stages in VHF and UHF.

- Low Cost SORF Plastic Surface Mount Package
- Guaranteed RF Specification — $|S_{21}|^2$
- S-Parameter Characterization
- Tape and Reel Packaging Options Available

I_C = 400 mA
SURFACE MOUNT
HIGH-FREQUENCY
TRANSISTOR
NPN SILICON

CASE 751, STYLE 1
(SO-8)

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MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CEO}	30	Vdc
Collector-Base Voltage	V_{CBO}	40	Vdc
Emitter-Base Voltage	V_{EBO}	3.5	Vdc
Collector Current — Continuous	I_C	400	mAdc
Operating and Storage Junction Temperature Range	T_J, T_{stg}	−55 to +150	°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Total Device Dissipation @ T_A = 25°C Derate above 25°C	P_D	1.0 8.0	Watt mW/°C
Storage Temperature	T_{stg}	150	°C
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	125	°C/W

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

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Collector-Emitter Breakdown Voltage (I_C = 5.0 mA)	$V_{(BR)CEO}$	30	—	—	V
Collector-Base Breakdown Voltage (I_C = 100 μA)	$V_{(BR)CBO}$	40	—	—	V
Emitter-Base Breakdown Voltage (I_E = 100 μA)	$V_{(BR)EBO}$	3.5	—	—	V
Collector Cutoff Current (V_{CE} = 20 V)	I_{CEO}	—	—	50	μA
Collector Cutoff Current (V_{CB} = 15 V)	I_{CBO}	—	—	10	μA
ON CHARACTERISTICS					
DC Current Gain (I_C = 50 mA, V_{CE} = 15 V)	h_{FE}	25	—	300	—
Collector-Emitter Saturation Voltage (I_C = 100 mA, I_B = 10 mA)	$V_{CE(sat)}$	—	—	0.2	V
Base-Emitter Saturation Voltage (I_C = 100 mA, I_B = 10 mA)	$V_{BE(sat)}$	—	—	1.0	V
SMALL-SIGNAL CHARACTERISTICS					
Current-Gain — Bandwidth Product (I_C = 35 mA, V_{CE} = 15 V, f = 100 MHz)	f_T	—	1550	—	MHz
Insertion Gain (V_{CE} = 15 V, I_C = 35 mA, f = 250 MHz)	$\|S_{21}\|^2$	12	15	—	dB

V_{CE} (Volts)	I_C (mA)	f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}	
			$\|S_{11}\|$	$\angle\phi$	$\|S_{21}\|$	$\angle\phi$	$\|S_{12}\|$	$\angle\phi$	$\|S_{22}\|$	$\angle\phi$
15	35	10	0.37	−63	53.7	157	0.01	59	0.91	−18
		30	0.52	−120	36.5	128	0.01	48	0.64	−38
		50	0.58	−142	25.4	113	0.02	45	0.47	−44
		70	0.59	−154	19	105	0.02	46	0.38	−44
		100	0.60	−162	13.6	97	0.02	49	0.32	−43
		300	0.64	178	4.6	77	0.05	59	0.28	−49
		500	0.65	168	2.8	64	0.07	60	0.32	−62
		700	0.65	159	2.0	53	0.09	63	0.38	−76
		1000	0.64	144	1.4	38	0.13	63	0.46	−93

Table 1. Common Emitter S-Parameters