

isc Silicon NPN RF Transistor

MMBR951L

DESCRIPTION

- Low Noise
- High Current-Gain Bandwidth Product

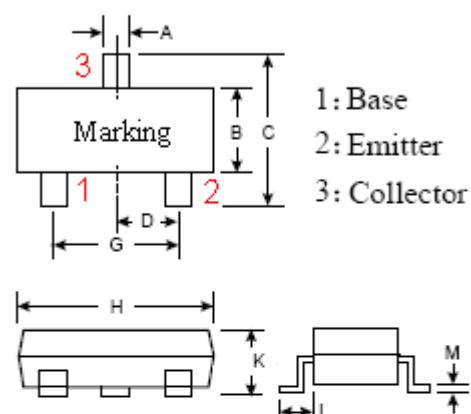
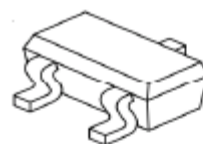
APPLICATIONS

- Designed for use in high gain , low noise small-signal amplifiers.

ABSOLUTE MAXIMUM RATINGS($T_a=25^{\circ}\text{C}$)

SYMBOL	PARAMETER	VALUE	UNIT
V_{CBO}	Collector-Base Voltage	20	V
V_{CEO}	Collector-Emitter Voltage	10	V
V_{EBO}	Emitter-Base Voltage	1.5	V
I_C	Collector Current-Continuous	100	mA
P_C	Collector Power Dissipation @ $T_C=75^{\circ}\text{C}$	0.322	W
T_J	Junction Temperature	150	$^{\circ}\text{C}$
T_{stg}	Storage Temperature Range	-55~150	$^{\circ}\text{C}$

SOT-23 package



DIM	mm	
	MIN	MAX
A	0.37	0.51
B	1.19	1.40
C	2.10	2.50
D	0.89	1.05
G	1.78	2.05
H	2.65	3.05
K	1.10	1.30
L	0.45	0.61
M	0.076	0.178

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ELECTRICAL CHARACTERISTICS

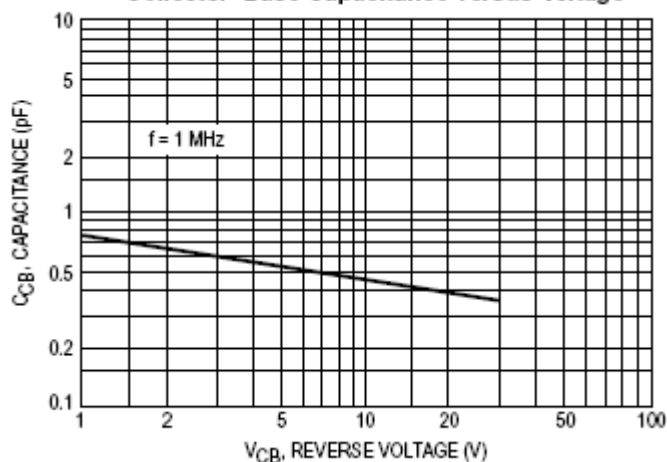
 $T_C=25^{\circ}\text{C}$ unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP.	MAX	UNIT
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	$I_C=0.1\text{mA}$; $I_B=0$	10			V
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage	$I_C=0.1\text{mA}$; $I_E=0$	20			V
I_{EBO}	Emitter Cutoff Current	$V_{EB}=1\text{V}$; $I_C=0$			0.1	μA
I_{CBO}	Collector Cutoff Current	$V_{CB}=10\text{V}$; $I_E=0$			0.1	μA
h_{FE}	DC Current Gain	$I_C=5\text{mA}$; $V_{CE}=6\text{V}$	50		200	
C_{OB}	Output Capacitance	$I_E=0$; $V_{CB}=10\text{V}$; $f=1\text{MHz}$		0.45	1.0	pF
f_T	Current-Gain—Bandwidth Product	$I_C=30\text{mA}$; $V_{CE}=6\text{V}$; $f=1\text{GHz}$		8		GHz
$ S_{21e} ^2$	Insertion Power Gain	$I_C=30\text{mA}$; $V_{CE}=6\text{V}$; $f=1.0\text{GHz}$		12.5		dB
$ S_{21e} ^2$	Insertion Power Gain	$I_C=30\text{mA}$; $V_{CE}=6\text{V}$; $f=2.0\text{GHz}$		7.0		dB
$GU_{\max}$	Maximum Unilateral Gain	$I_C=30\text{mA}$; $V_{CE}=8\text{V}$; $f=1.0\text{GHz}$		14		dB
$GU_{\max}$	Maximum Unilateral Gain	$I_C=30\text{mA}$; $V_{CE}=8\text{V}$; $f=2.0\text{GHz}$		8		dB
NF	Noise Figure	$I_C=5\text{mA}$; $V_{CE}=6\text{V}$; $f=1\text{GHz}$; $R_G=50\Omega$		1.9	2.8	dB

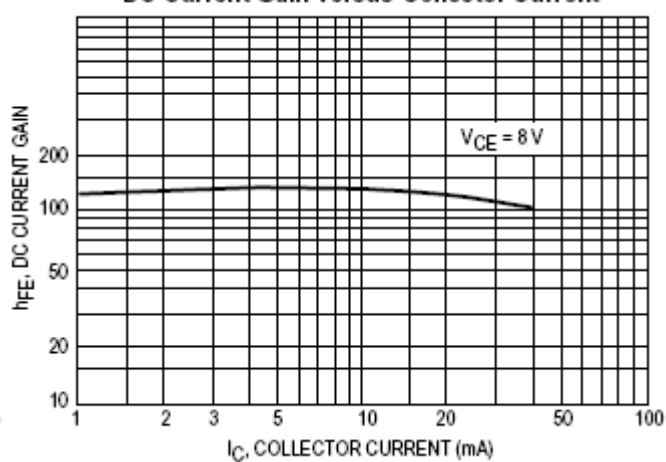
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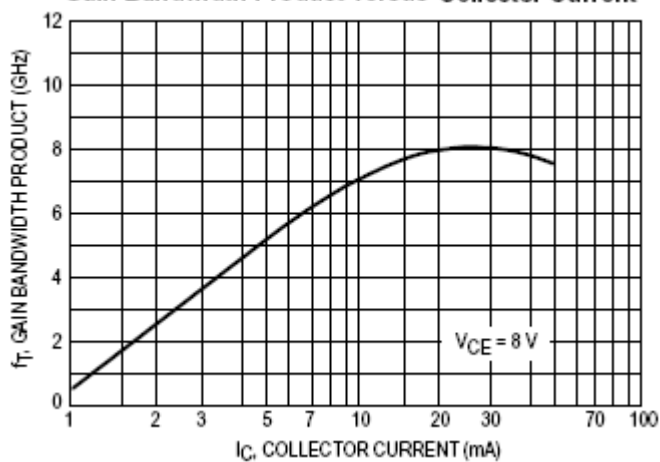
Collector-Base Capacitance versus Voltage



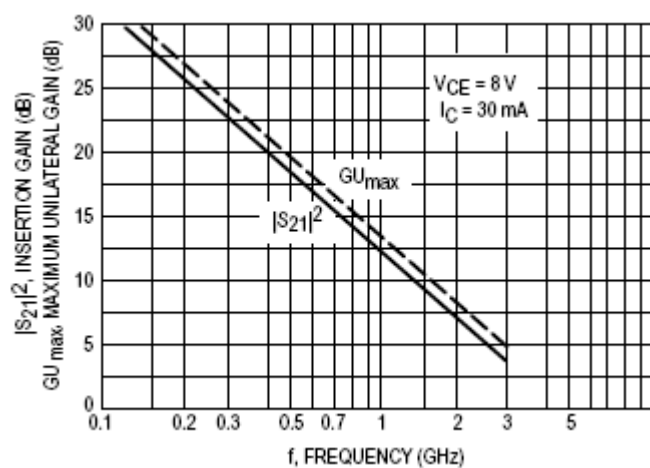
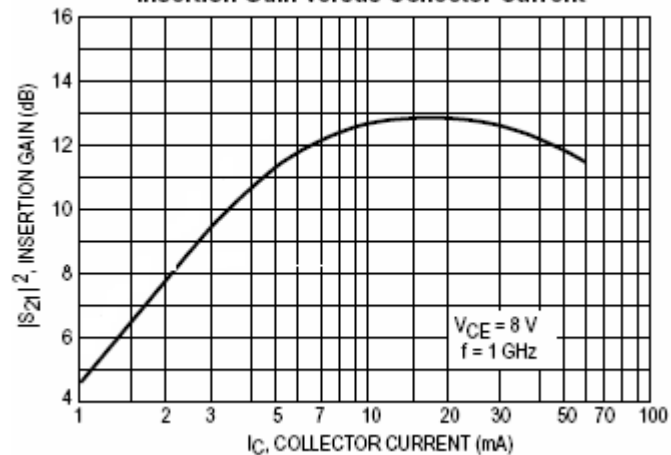
DC Current Gain versus Collector Current



Gain Bandwidth Product versus Collector Current



Insertion Gain versus Collector Current



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S-PARAMETER

 $V_{CE} = 6\text{ V}$, $I_C = 5\text{ mA}$

f (MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
100	0.82	-36.6	14.0	153	0.04	44.7	0.88	-18.2
500	0.50	-119	6.6	104	0.07	48.2	0.52	-40
1000	0.39	-162	3.5	81	0.11	55	0.43	-43
2000	0.32	150	1.9	57	0.21	66	0.42	-50
3000	0.36	110	1.4	40	0.31	66	0.40	-67

 $V_{CE} = 6\text{ V}$, $I_C = 10\text{ mA}$

f (MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
100	0.66	-54	22.6	142	0.03	60	0.78	-29
500	0.38	-138	7.8	96	0.07	55	0.40	-42
1000	0.32	-176	4.0	78	0.13	71	0.34	-47
2000	0.26	142	2.2	57	0.22	70	0.36	-46
3000	0.31	105	1.6	41	0.32	64	0.33	-62

 $V_{CE} = 6\text{ V}$, $I_C = 20\text{ mA}$

f (MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
100	0.49	-76	30	131	0.01	85	0.67	-37
500	0.32	-153	8.3	92	0.08	76	0.34	-39
1000	0.29	175	4.3	77	0.11	67	0.29	-44
2000	0.24	137	2.3	57	0.24	71	0.32	-48
3000	0.28	102	1.6	42	0.34	63	0.29	-60

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S-PARAMETER

 $V_{CE} = 6\text{ V}$, $I_C = 30\text{ mA}$

f (MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
100	0.40	-94	33	125	0.03	87	0.58	-42
500	0.30	-162	8.4	90	0.07	84	0.31	-35
1000	0.29	170	4.3	76	0.12	80	0.27	-39
2000	0.24	134	2.3	56	0.23	71	0.33	-48
3000	0.30	101	1.6	41	0.35	66	0.30	-60

 $V_{CE} = 6\text{ V}$, $I_C = 60\text{ mA}$

f (MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
100	0.38	-126	31	116	0.03	74	0.49	-37
500	0.37	-176	7.3	77.6	0.05	84	0.34	-26
1000	0.36	163	3.7	73.4	0.12	84	0.34	-37
2000	0.33	130	2.0	52	0.22	78	0.37	-48
3000	0.38	98	1.4	37	0.34	69	0.34	-62

 $V_{CE} = 8\text{ V}$, $I_C = 5\text{ mA}$

f (MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
100	0.83	-35	13.9	154	0.04	92	0.90	-19
500	0.51	-117	6.7	104	0.08	51	0.55	-38
1000	0.38	-160	3.6	82	0.10	72	0.44	-42
2000	0.31	151	1.9	58	0.20	73	0.46	-47
3000	0.35	110	1.4	41	0.32	71	0.43	-63

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S-PARAMETER

 $V_{CE} = 8\text{ V}$, $I_C = 10\text{ mA}$

f (MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
100	0.67	-52	23	143	0.02	96	0.81	-28
500	0.37	-135	7.9	97	0.07	64	0.43	-38
1000	0.30	-173	4.1	80	0.11	78	0.37	-41
2000	0.25	143	2.2	57	0.21	74	0.38	-47
3000	0.30	105	1.6	42	0.31	67	0.34	-60

 $V_{CE} = 8\text{ V}$, $I_C = 20\text{ mA}$

f (MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
100	0.51	-72	30	131	0.02	68	0.68	-35
500	0.31	-150	8.5	92	0.07	75	0.36	-36
1000	0.28	177	4.3	77	0.13	76	0.32	-39
2000	0.23	138	2.3	57	0.22	72	0.35	-45
3000	0.27	103	1.6	42	0.31	64	0.31	-58

 $V_{CE} = 8\text{ V}$, $I_C = 30\text{ mA}$

f (MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
100	0.42	-87	33	125	0.02	71	0.61	-38
500	0.31	-159	8.6	90	0.07	71	0.33	-33
1000	0.27	172	4.4	76	0.11	74	0.32	-39
2000	0.23	135	2.3	57	0.22	73	0.34	-42
3000	0.28	102	1.6	41	0.31	65	0.33	-55

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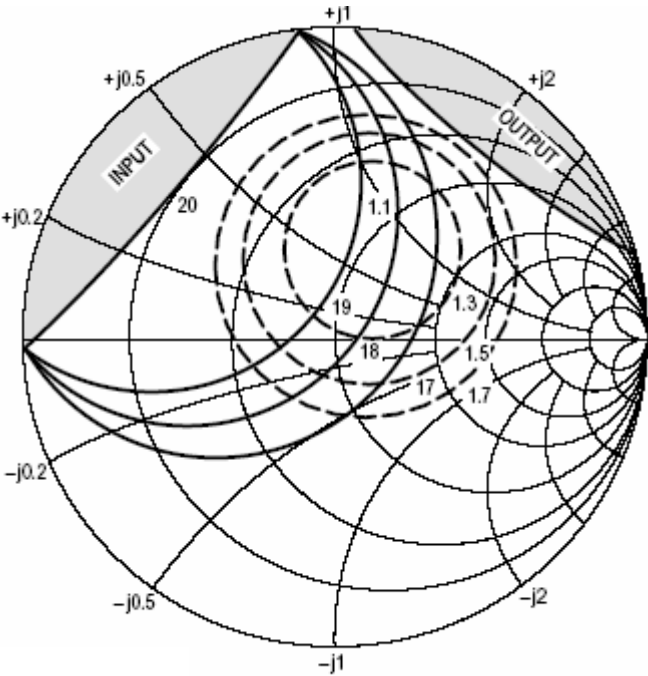
S-PARAMETER

V_{CE} = 8 V, I_C = 60 mA

f (MHz)	S ₁₁	∠S ₁₁	S ₂₁	∠S ₂₁	S ₁₂	∠S ₁₂	S ₂₂	∠S ₂₂
100	0.39	-119	32	117	0.02	31	0.52	-31
500	0.36	-174	7.4	87	0.06	84	0.37	-25
1000	0.35	164	3.8	74	0.11	78	0.35	-33
2000	0.32	131	2.0	53	0.22	81	0.42	-41
3000	0.37	100	1.4	38	0.33	70	0.40	-62

V_{CE} = 6.0 V
I_C = 5.0 mA
□ — AREA OF INSTABILITY

f (GHz)	NF OPT (dB)	Γ _{MS} NF OPT	R _n	K
0.5	1.13	0.35 ∠ 68°	9	0.68



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

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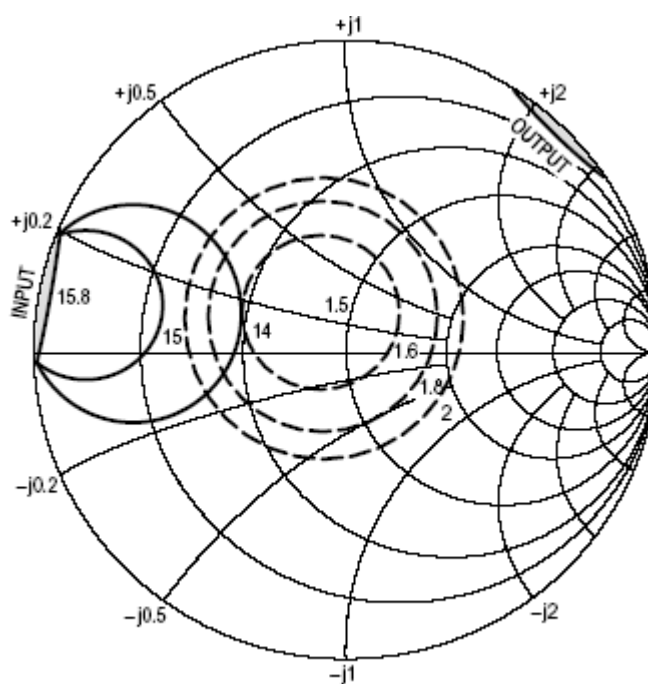
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$$V_{CE} = 6.0 \text{ V}$$

$$I_C = 5.0 \text{ mA}$$

□ — AREA OF INSTABILITY

f (GHz)	NF OPT (dB)	Γ_{MS} NF OPT	Rn	K
1.0	1.45	$0.16 \angle 124^\circ$	8	0.97



Constant Gain and Noise Figure Contours (f = 1.0 GHz)