

**MM4049**  
**MMC4049**  
**MRF534**  
**MRF536**

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**The RF Line**

**PNP SILICON HIGH-FREQUENCY TRANSISTORS**

... designed for use as a high-frequency current mode switch. Because of the extremely high Current-Gain — Bandwidth this transistor also makes an excellent RF amplifier and oscillator.

- High Current-Gain — Bandwidth Product —  
 $f_T = 4.0 \text{ GHz (Min) @ } I_C = 20 \text{ mAdc} \text{ — MM4049, MRF534}$   
 $f_T = 5.0 \text{ GHz (Min) @ } I_C = 20 \text{ mAdc} \text{ — MRF536}$
- Low Collector-Base Capacitance —  
 $C_{cb} = 1.25 \text{ pF (Max) @ } V_{CB} = 5.0 \text{ Vdc}$

$I_C = -30 \text{ mA}$   
**HIGH FREQUENCY TRANSISTORS**  
 PNP SILICON

		MMC4049	MM4049	MRF534	MRF536		
							
		Chip	Case 20-03 TO-206AF Style 10	Case 22-03 TO-206AA Style 1	Case 317-01 Macro-X Style 2		
<b>MAXIMUM RATINGS</b>		Symbol	Values			Unit	
Collector-Emitter Voltage	$V_{CEO}$	10	10	- 10	- 10	Vdc	
Collector-Base Voltage	$V_{CBO}$	15	15	- 15	15	Vdc	
Emitter-Base Voltage	$V_{EBO}$	4.5	4.5	- 4.5	- 4.5	Vdc	
Collector Current — Continuous	$I_C$	30	-30	30	-30	mAdc	
Total Device Dissipation @ $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	300	200	300	300	mW	
		$T_J \text{ max} = 200^\circ\text{C}$	1.14	1.71	2.40	mW/ $^\circ\text{C}$	
Operating and Storage Junction Temperature Junction	$T_J, T_{stg}$	-65 to +200	-65 to +200	-65 to +200	-65 to +150	$^\circ\text{C}$	

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## ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25 C unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit	
<b>OFF CHARACTERISTICS</b>						
Collector-Emitter Breakdown Voltage (I <sub>C</sub> = 2.0 mA, I <sub>B</sub> = 0)	V <sub>(BR)CEO</sub>	10	—	—	Vdc	
Collector-Base Breakdown Voltage (I <sub>C</sub> = 100 μA, I <sub>E</sub> = 0)	V <sub>(BR)CBO</sub>	15	—	—	Vdc	
Emitter-Base Breakdown Voltage (I <sub>E</sub> = 100 μA, I <sub>C</sub> = 0)	V <sub>(BR)EBO</sub>	4.5	—	—	Vdc	
Collector Cutoff Current (V <sub>CB</sub> = 10 Vdc, I <sub>E</sub> = 0)	I <sub>CBO</sub>	—	—	10	nAdc	
<b>ON CHARACTERISTICS</b>						
DC Current Gain (I <sub>C</sub> = 25 mA, V <sub>CE</sub> = 2.0 Vdc)	h <sub>FE</sub>	20	—	200	—	
<b>DYNAMIC CHARACTERISTICS</b>						
Current-Gain — Bandwidth Product (I <sub>C</sub> = 20 mA, V <sub>CE</sub> = 5.0 Vdc, f = 500 MHz)	MRF534, MM4049 MRF536	f <sub>T</sub>	4.0 5.0	— —	— —	GHz
Collector-Base Capacitance (V <sub>CB</sub> = 5.0 Vdc, I <sub>E</sub> = 0, f = 1.0 MHz)		C <sub>cb</sub>	—	1.3	—	pF
<b>FUNCTIONAL TESTS</b>						
Maximum Available Gain (I <sub>C</sub> = 15 mA, V <sub>CE</sub> = 5.0 Vdc, f = 500 MHz)	MRF534	MAG	10	12	—	dB
(I <sub>C</sub> = 15 mA, V <sub>CE</sub> = 5.0 Vdc, f = 500 MHz)	MM4049		11.5	13	—	
(I <sub>C</sub> = 15 mA, V <sub>CE</sub> = 5.0 Vdc, f = 1.0 GHz)	MRF536		8.5	10	—	

FIGURE 1 — CURRENT-GAIN — BANDWIDTH PRODUCT versus CURRENT

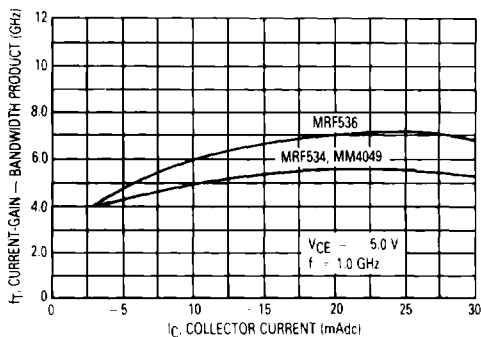


FIGURE 2 — MAXIMUM AVAILABLE GAIN versus COLLECTOR CURRENT

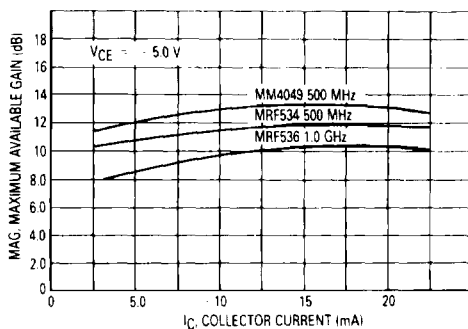
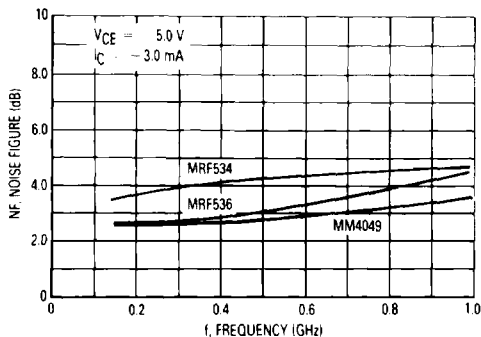


FIGURE 3 — NOISE FIGURE versus FREQUENCY



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## MRF534 COMMON-EMITTER S-PARAMETERS

V <sub>CE</sub> (Volts)	I <sub>C</sub> (mA)	f (MHz)	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
			S <sub>11</sub>	∠	S <sub>21</sub>	∠	S <sub>12</sub>	∠	S <sub>22</sub>	∠
5.0	5.0	200	0.734	22	3.70	126	0.066	66	0.507	39
		400	0.580	28	2.56	108	0.116	65	0.409	48
		600	0.444	37	2.09	95	0.158	62	0.403	52
		800	0.400	47	1.80	86	0.195	56	0.364	56
		1000	0.366	47	1.55	79	0.234	51	0.348	69
	10	200	0.645	27	5.36	124	0.058	69	0.394	43
		400	0.503	33	3.44	106	0.109	71	0.316	52
		600	0.376	43	2.68	93	0.153	69	0.323	52
		800	0.333	54	2.24	84	0.192	65	0.290	55
		1000	0.295	54	1.91	77	0.233	61	0.276	71
	20	200	0.586	28	5.90	122	0.053	70	0.338	52
		400	0.454	34	3.73	105	0.099	73	0.259	60
600		0.329	46	2.87	93	0.143	72	0.267	58	
800		0.289	59	2.38	85	0.181	68	0.240	59	
1000		0.248	58	2.04	77	0.221	65	0.235	75	
10	5.0	200	0.752	21	4.28	125	0.066	70	0.550	28
		400	0.624	26	2.77	107	0.123	68	0.495	38
		600	0.512	34	2.19	94	0.168	65	0.503	44
		800	0.476	44	1.86	86	0.207	60	0.464	51
		1000	0.447	45	1.60	79	0.246	55	0.443	64
	10	200	0.685	24	5.47	123	0.060	71	0.442	33
		400	0.553	28	3.46	105	0.113	71	0.385	42
		600	0.433	37	2.68	93	0.156	68	0.397	46
		800	0.391	49	2.25	85	0.194	63	0.362	51
		1000	0.359	47	1.92	78	0.233	59	0.342	65
	20	200	0.621	26	6.38	121	0.055	71	0.372	40
		400	0.488	31	3.97	104	0.103	72	0.316	48
600		0.365	41	3.04	93	0.145	70	0.332	50	
800		0.323	52	2.51	85	0.182	66	0.301	54	
1000		0.290	50	2.13	79	0.219	63	0.288	68	

## MM4049 COMMON-EMITTER S-PARAMETERS

V <sub>CE</sub> (Volts)	I <sub>C</sub> (mA)	f (MHz)	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
			S <sub>11</sub>	∠	S <sub>21</sub>	∠	S <sub>12</sub>	∠	S <sub>22</sub>	∠
5.0	5.0	200	0.634	31	6.37	120	0.060	69	0.711	23
		400	0.469	34	3.95	93	0.107	65	0.602	30
		600	0.379	40	2.90	77	0.147	62	0.587	33
		800	0.368	51	2.32	65	0.183	56	0.550	36
		1000	0.381	54	1.93	55	0.223	50	0.528	44
	10	200	0.523	29	7.79	112	0.056	72	0.632	23
		400	0.418	28	3.74	89	0.104	68	0.543	29
		600	0.344	34	3.20	74	0.146	65	0.542	32
		800	0.345	46	2.54	64	0.184	58	0.513	34
		1000	0.366	50	2.09	54	0.225	52	0.493	42
	20	200	0.454	25	8.43	106	0.065	73	0.584	21
		400	0.390	23	4.67	85	0.105	70	0.513	27
600		0.325	30	3.31	72	0.148	66	0.620	30	
800		0.327	44	2.61	62	0.188	59	0.497	32	
1000		0.351	48	2.15	52	0.231	52	0.476	41	
10	5.0	200	0.731	25	5.83	121	0.053	70	0.736	18
		400	0.589	30	3.65	95	0.096	67	0.654	26
		600	0.502	38	2.71	79	0.132	64	0.645	29
		800	0.496	49	2.21	68	0.164	57	0.612	33
		1000	0.499	54	1.83	58	0.198	51	0.592	42
	10	200	0.643	25	7.37	114	0.051	71	0.668	18
		400	0.542	27	4.28	90	0.094	69	0.600	25
		600	0.466	34	3.10	76	0.132	65	0.603	28
		800	0.465	46	2.49	66	0.166	59	0.577	31
		1000	0.476	51	2.05	57	0.202	53	0.557	40
	20	200	0.570	23	8.44	109	0.049	73	0.621	18
		400	0.496	24	4.73	88	0.093	71	0.562	24
600		0.427	31	3.38	75	0.131	67	0.572	27	
800		0.427	43	2.69	66	0.165	60	0.551	30	
1000		0.445	47	2.21	57	0.203	54	0.532	38	

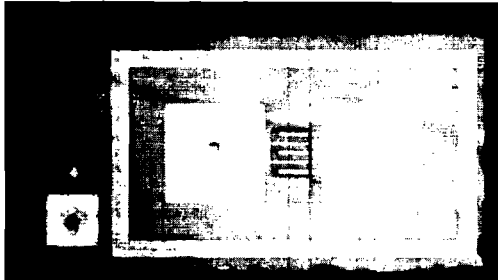
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## MRF536 COMMON-EMITTER S-PARAMETERS

VCE (Volts)	IC (mA)	f (MHz)	S11		S21		S12		S22	
			S11	$\phi$	S21	$\phi$	S12	$\phi$	S22	$\phi$
5.0	5.0	400	0.401	74	5.38	108	0.090	54	0.490	48
		800	0.181	102	3.03	86	0.138	51	0.350	64
		1200	0.136	157	2.13	70	0.181	48	0.320	70
		1600	0.151	175	1.68	59	0.210	45	0.270	80
		2000	0.160	148	1.44	52	0.240	41	0.269	100
	10	400	0.289	94	6.58	103	0.076	56	0.379	56
		800	0.140	137	3.55	84	0.122	55	0.266	73
		1200	0.174	169	2.46	70	0.165	53	0.238	77
		1600	0.196	154	1.93	60	0.196	50	0.198	87
		2000	0.227	130	1.65	51	0.230	46	0.202	110
	20	400	0.233	118	7.28	99	0.066	60	0.296	65
		800	0.163	169	3.88	82	0.110	59	0.204	84
1200		0.233	156	2.65	69	0.153	57	0.179	84	
1600		0.253	144	2.06	59	0.185	55	0.143	96	
2000		0.290	123	1.75	50	0.220	51	0.160	121	
10	5.0	400	0.478	54	5.14	109	0.086	58	0.535	39
		800	0.279	66	2.90	88	0.141	53	0.420	55
		1200	0.166	97	2.08	73	0.184	48	0.388	62
		1600	0.151	123	1.67	64	0.209	44	0.330	72
		2000	0.110	158	1.44	55	0.243	39	0.313	90
	10	400	0.356	67	6.59	105	0.075	59	0.418	47
		800	0.182	84	3.59	86	0.125	56	0.311	62
		1200	0.119	141	2.53	73	0.166	52	0.284	67
		1600	0.131	166	2.00	62	0.193	49	0.230	76
		2000	0.135	154	1.72	55	0.226	45	0.222	98
	20	400	0.260	85	7.66	101	0.066	61	0.328	53
		800	0.124	122	4.09	84	0.111	59	0.236	69
		1200	0.148	172	2.83	72	0.152	56	0.216	71
		1600	0.172	158	2.22	62	0.182	54	0.172	80
		2000	0.201	130	1.88	54	0.214	50	0.171	104

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### MMC4049 CHIP TOPOGRAPHY



Nominal Chip Size: 12 x 22 mils  
 Front Metalization: Aluminum  
 Back Metalization: Aluminum  
 Emitter/Base Bond Pad: 4.0 x 4.0 mils  
 #Emitter Fingers: 2  
 #Base Fingers: 3