

HSG1001

SiGeHBT High Frequency Low Noise Amplifier

REJ03G0195-0100Z

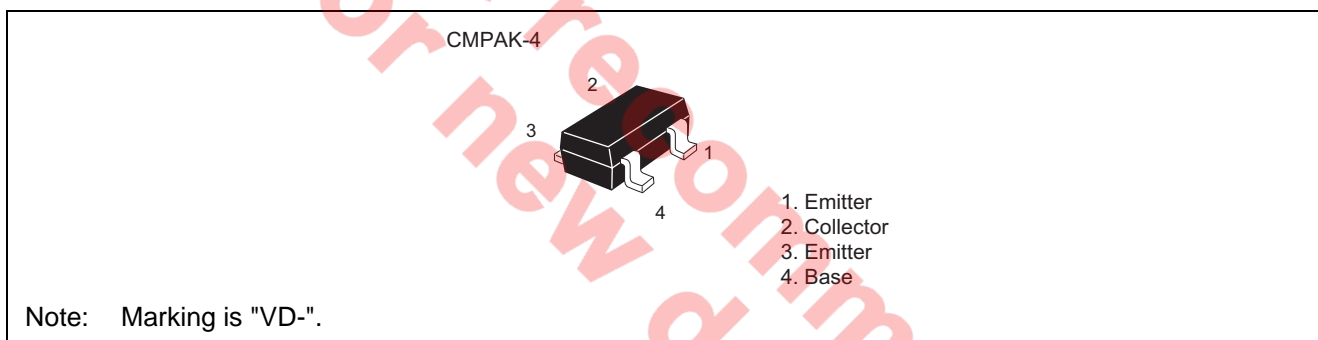
Rev.1.00

Apr.08.2004

Features

- High power gain and low noise figure ;
- $MSG = 22 \text{ dB typ.}$, $NF = 0.75 \text{ dB typ.}$ at $V_{CE} = 2 \text{ V}$, $I_C = 5 \text{ mA}$, $f = 1.8 \text{ GHz}$
 $MSG = 21 \text{ dB typ.}$, $NF = 0.85 \text{ dB typ.}$ at $V_{CE} = 2 \text{ V}$, $I_C = 5 \text{ mA}$, $f = 2.4 \text{ GHz}$
 $MSG = 15 \text{ dB typ.}$, $NF = 1.3 \text{ dB typ.}$ at $V_{CE} = 2 \text{ V}$, $I_C = 10 \text{ mA}$, $f = 5.8 \text{ GHz}$
- Transition Frequency
 $f_T = 35 \text{ GHz typ.}$ at $f = 1 \text{ GHz}$
- $V_{CEO} = 3.5 \text{ V}$
- Ideal for 2.4 GHz / 5 GHz Band WLAN and Cordless phone applications.

Outline



Absolute Maximum Ratings

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

Item	Symbol	Ratings	Unit
Collector to base voltage	V_{CBO}	8	V
Collector to emitter voltage	V_{CEO}	3.5	V
Emitter to base voltage	V_{EBO}	1.2	V
Collector current	I_C	35	mA
Collector power dissipation	P_C	100	mW
	P_C^{Note1}	250	mW
Junction temperature	T_j	150	$^\circ\text{C}$
Storage temperature	T_{stg}	-55 to +150	$^\circ\text{C}$

Notes: 1. Value on PCB (FR-4 : 40 x 40 x 1.6mm Double side)

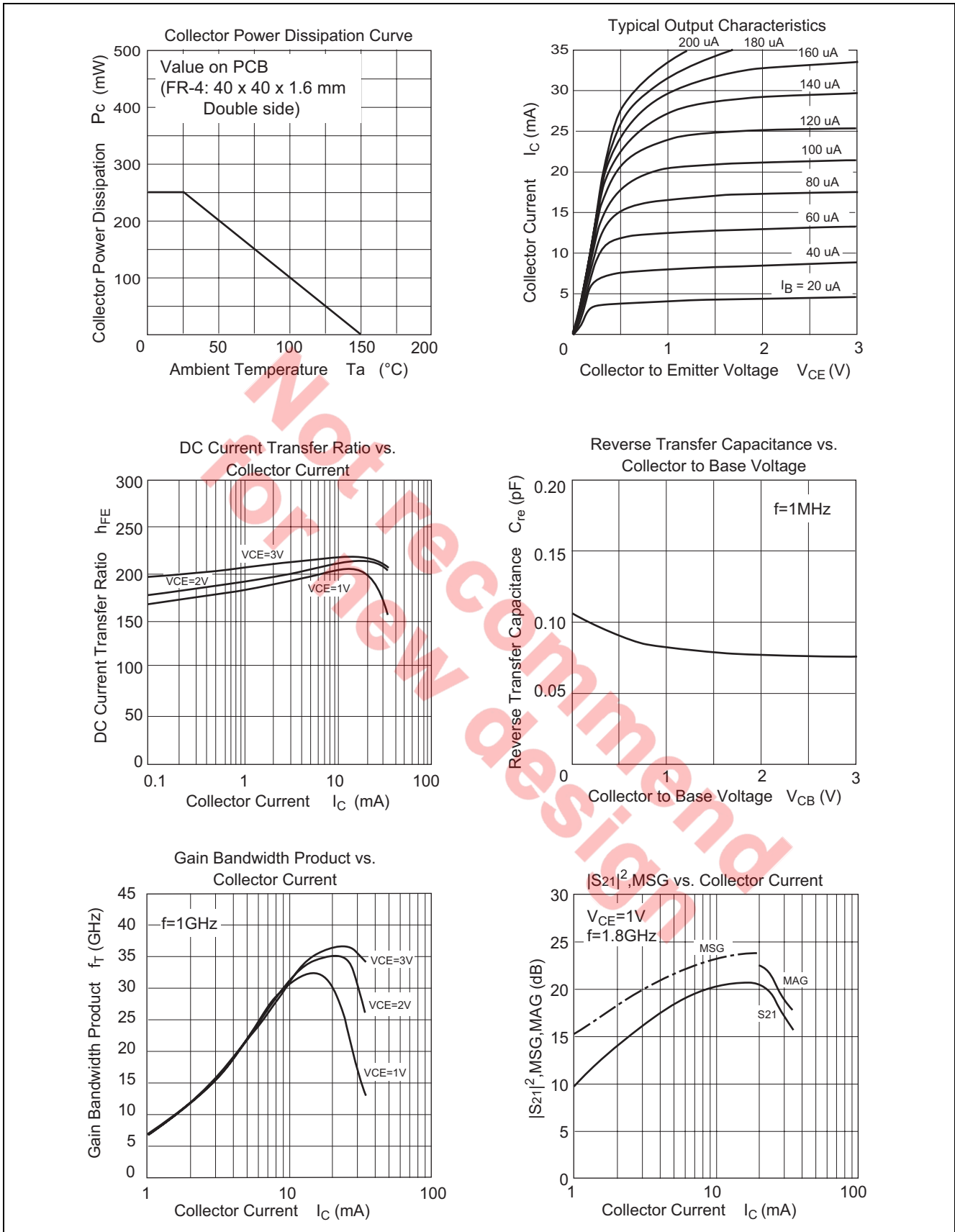
Electrical Characteristics

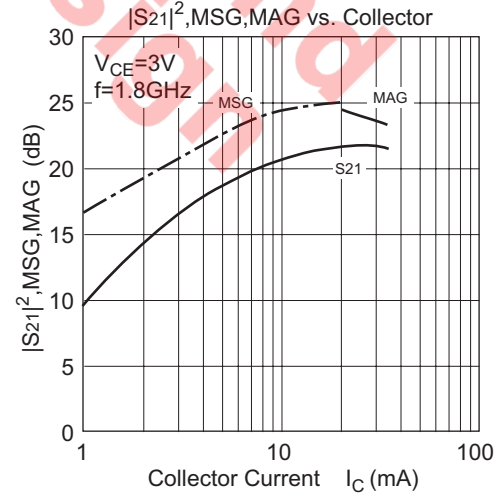
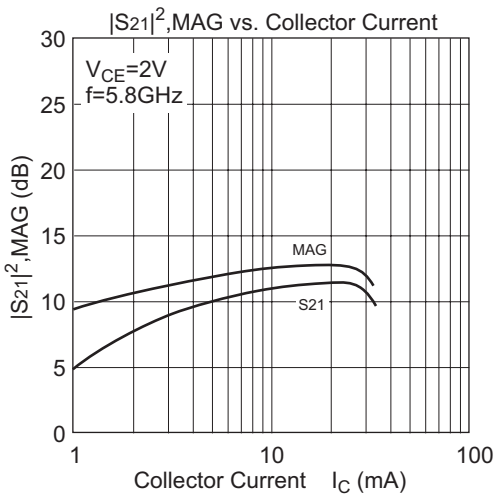
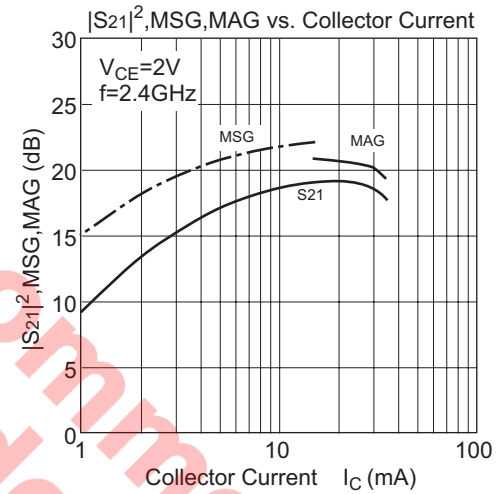
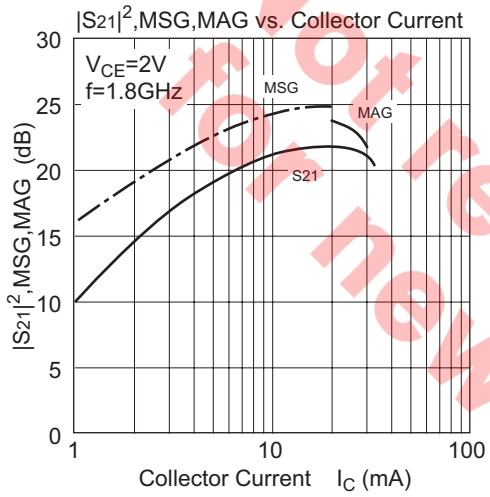
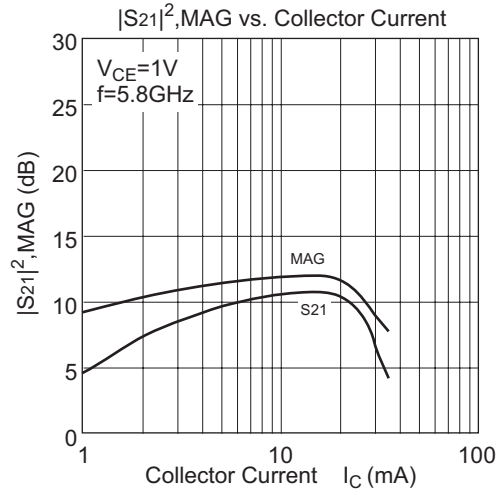
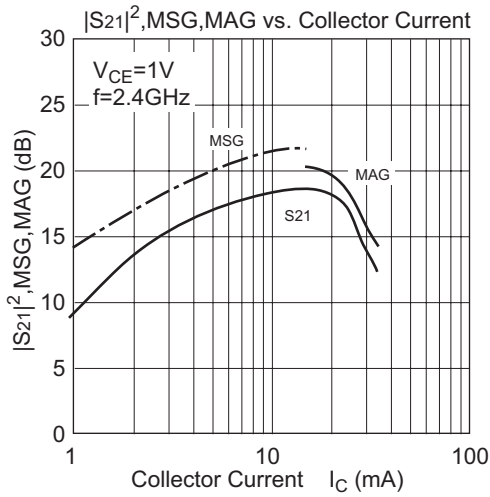
(Ta = 25°C)

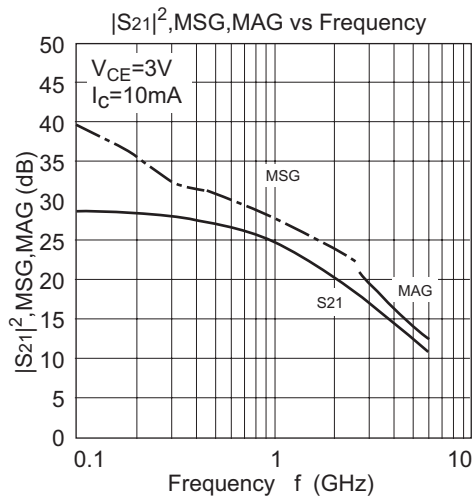
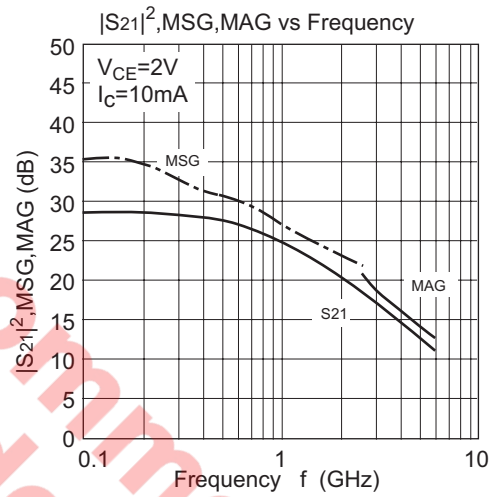
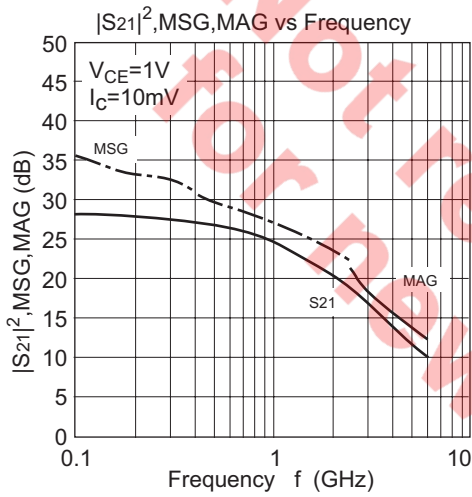
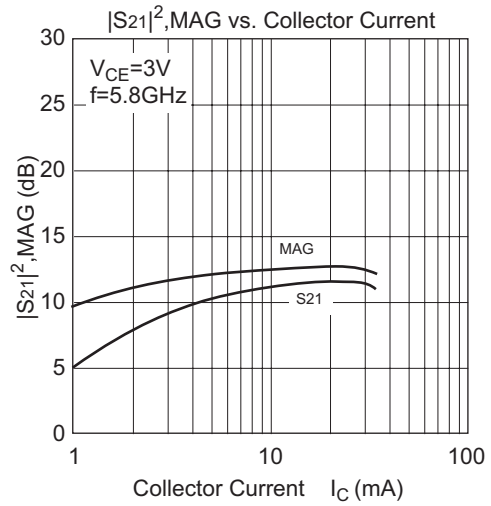
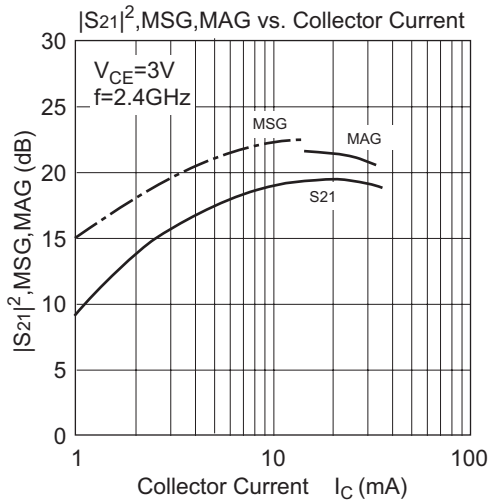
Item	Symbol	Min	Typ	Max	Unit	Test conditions
DC current transfer ratio	h_{FE}	100	200	300	—	$V_{CE} = 2\text{ V}$, $I_C = 5\text{ mA}$
Reverse Transfer Capacitance	C_{re}	—	0.08	—	pF	$V_{CB} = 2\text{ V}$, $I_E = 0$, $f = 1\text{ MHz}$
Transition Frequency	f_T	—	35	—	GHz	$V_{CE} = 2\text{ V}$, $I_C = f_T\text{ peak}$, $f = 1\text{ GHz}$
Insertion power gain	$ S_{21} ^2$	—	19	—	dB	$V_{CE} = 2\text{ V}$, $I_C = 5\text{ mA}$, $f = 1.8\text{ GHz}$
		—	17	—		$V_{CE} = 2\text{ V}$, $I_C = 5\text{ mA}$, $f = 2.4\text{ GHz}$
		—	11	—		$V_{CE} = 2\text{ V}$, $I_C = 10\text{ mA}$, $f = 5.8\text{ GHz}$
Maximum Stable Gain ^{Note1}	MSG	—	22	—	dB	$V_{CE} = 2\text{ V}$, $I_C = 5\text{ mA}$, $f = 1.8\text{ GHz}$
		—	21	—		$V_{CE} = 2\text{ V}$, $I_C = 5\text{ mA}$, $f = 2.4\text{ GHz}$
		—	15	—		$V_{CE} = 2\text{ V}$, $I_C = 10\text{ mA}$, $f = 5.8\text{ GHz}$
Power Gain	PG	—	19.5	—	dB	$V_{CE} = 2\text{ V}$, $I_C = 5\text{ mA}$, $f = 1.8\text{ GHz}$
		—	18	—		$V_{CE} = 2\text{ V}$, $I_C = 5\text{ mA}$, $f = 2.4\text{ GHz}$
		8.5	11.5	—		$V_{CE} = 2\text{ V}$, $I_C = 10\text{ mA}$, $f = 5.8\text{ GHz}$
Noise figure	NF	—	0.75	—	dB	$V_{CE} = 2\text{ V}$, $I_C = 5\text{ mA}$, $f = 1.8\text{ GHz}$
		—	0.85	—		$V_{CE} = 2\text{ V}$, $I_C = 5\text{ mA}$, $f = 2.4\text{ GHz}$
		—	1.3	1.9		$V_{CE} = 2\text{ V}$, $I_C = 10\text{ mA}$, $f = 5.8\text{ GHz}$
Maximum Available Gain ^{Note2}	MAG	—	13	—	dB	$V_{CE} = 2\text{ V}$, $I_C = 10\text{ mA}$, $f = 5.8\text{ GHz}$

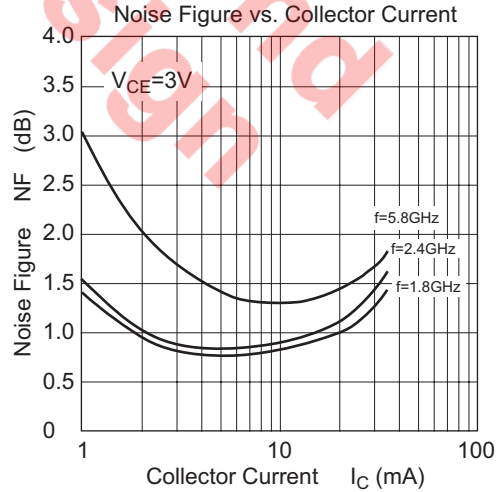
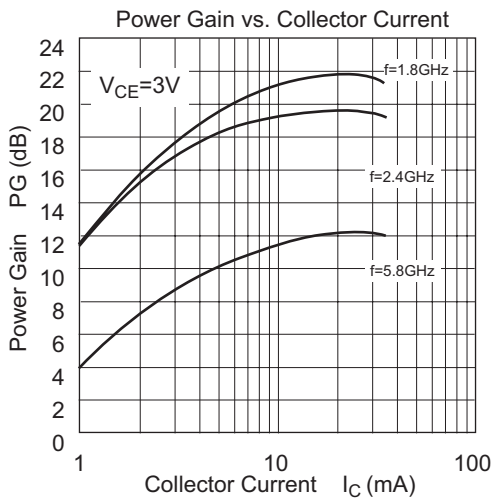
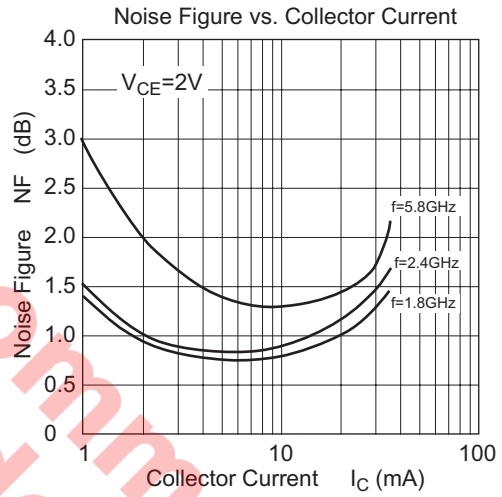
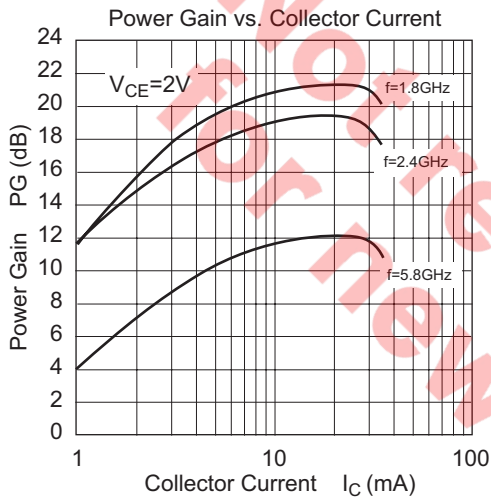
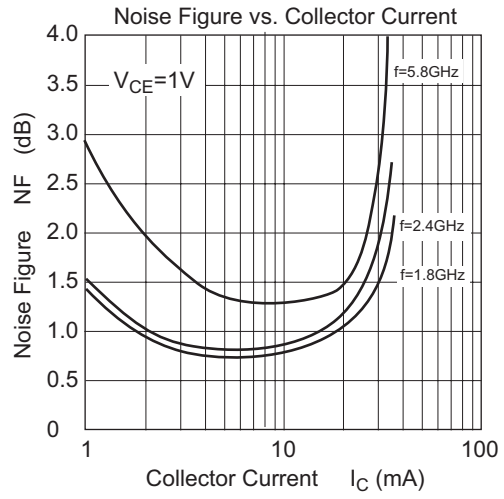
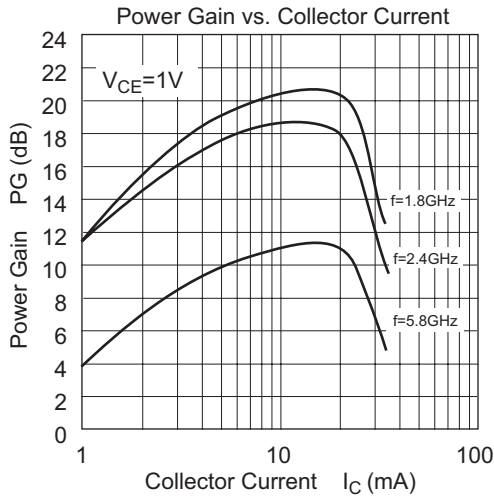
Notes: 1. $MSG = |S_{21}| / |S_{12}|$ 2. $MAG = |S_{21}| / |S_{12}|(K - (K^2 - 1)^{1/2})$

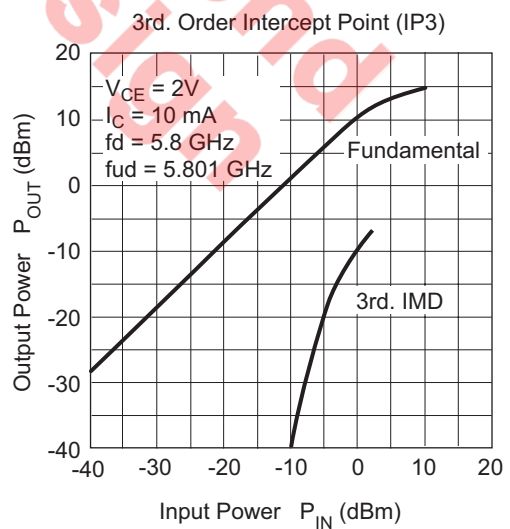
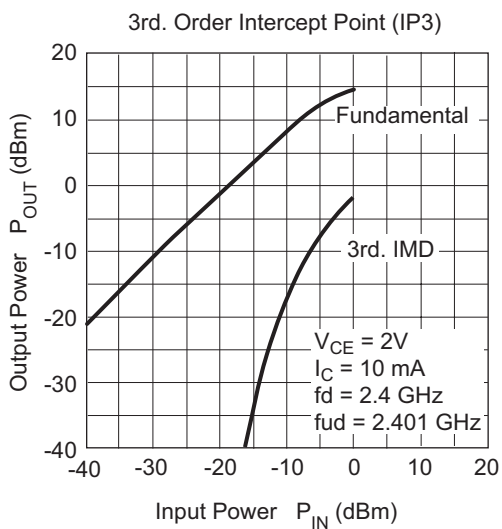
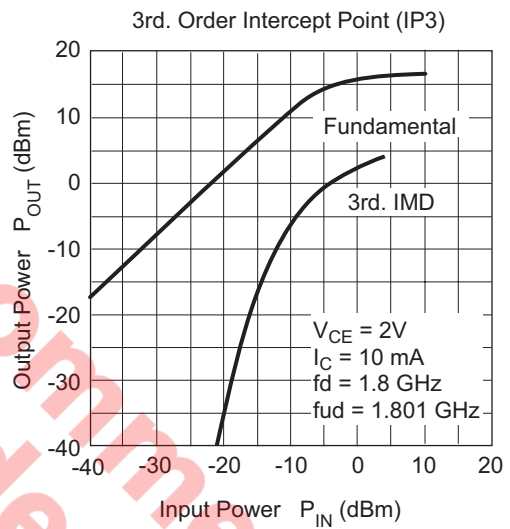
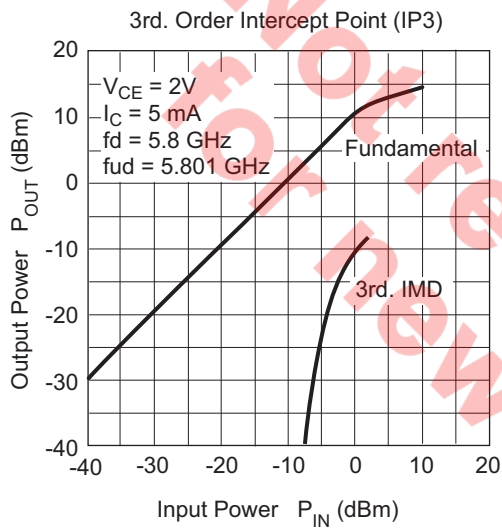
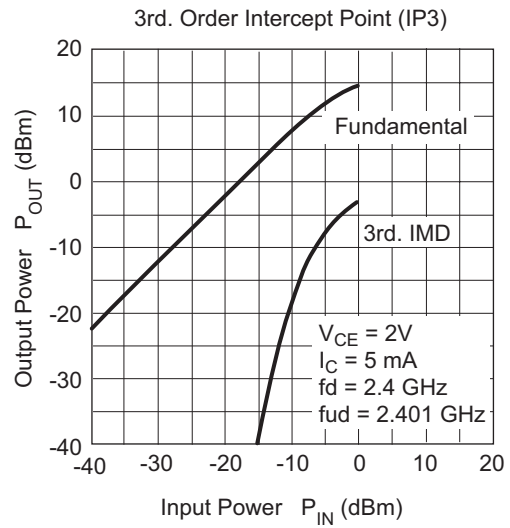
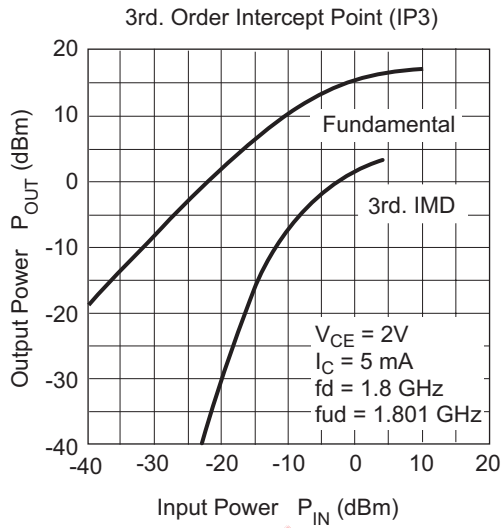
Main Characteristics

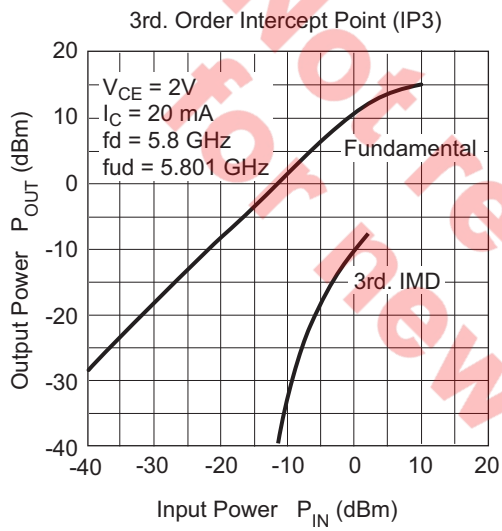
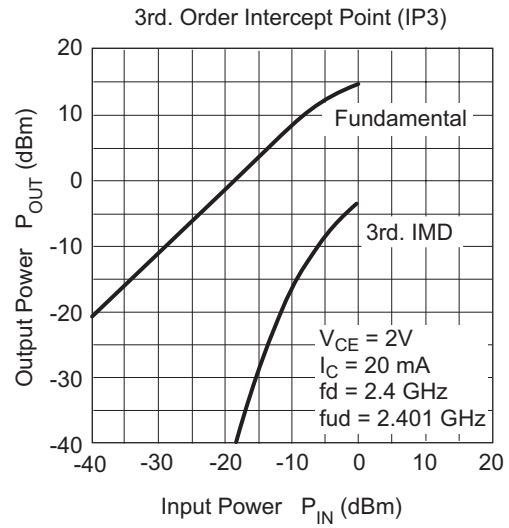
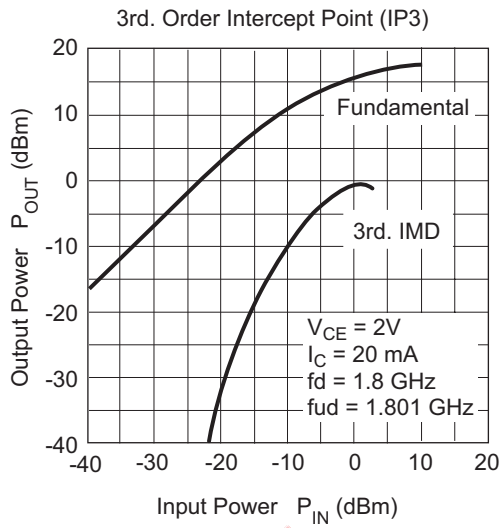




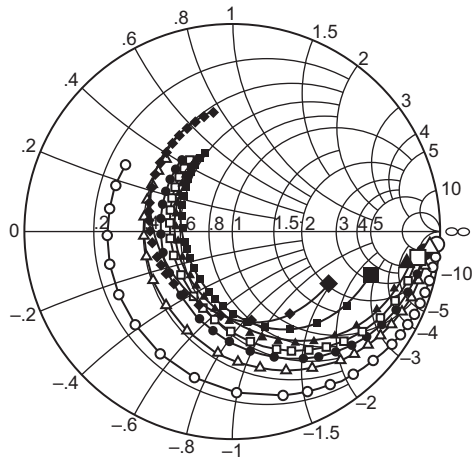








S11 Parameter vs. Frequency

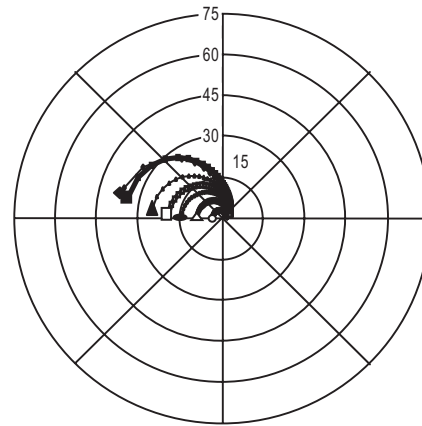


Condition: VCE = 1 V , Zo = 50 Ω
 100 to 1000 MHz (100 MHz step)
 1000 to 2000 MHz (200 MHz step)
 2000 to 6000 MHz (400 MHz step)

- | | |
|---------------|----------------|
| ○—○ IC = 1 mA | ▲—▲ IC = 10 mA |
| △—△ IC = 3 mA | ■—■ IC = 20 mA |
| ●—● IC = 5 mA | ◆—◆ IC = 30 mA |
| □—□ IC = 7 mA | |

S21 Parameter vs. Frequency

Scale: 15 / div.

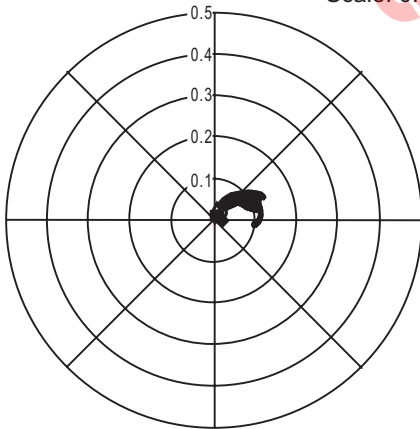


Condition: VCE = 1 V , Zo = 50 Ω
 100 to 6000 MHz (100 MHz step)

- | | |
|---------------|----------------|
| ○—○ IC = 1 mA | ▲—▲ IC = 10 mA |
| △—△ IC = 3 mA | ■—■ IC = 20 mA |
| ●—● IC = 5 mA | ◆—◆ IC = 30 mA |
| □—□ IC = 7 mA | |

S12 Parameter vs. Frequency

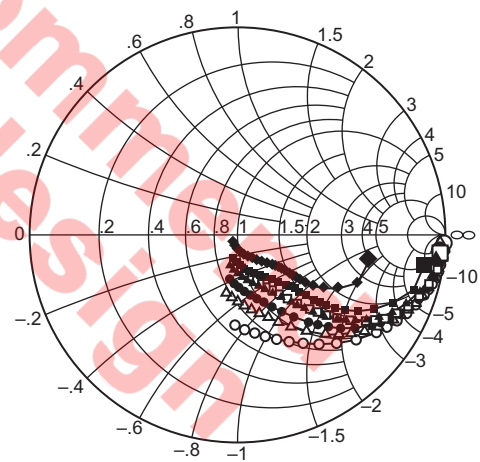
Scale: 0.1 / div.



Condition: VCE = 1 V , Zo = 50 Ω
 100 to 6000 MHz (100 MHz step)

- | | |
|---------------|----------------|
| ○—○ IC = 1 mA | ▲—▲ IC = 10 mA |
| △—△ IC = 3 mA | ■—■ IC = 20 mA |
| ●—● IC = 5 mA | ◆—◆ IC = 30 mA |
| □—□ IC = 7 mA | |

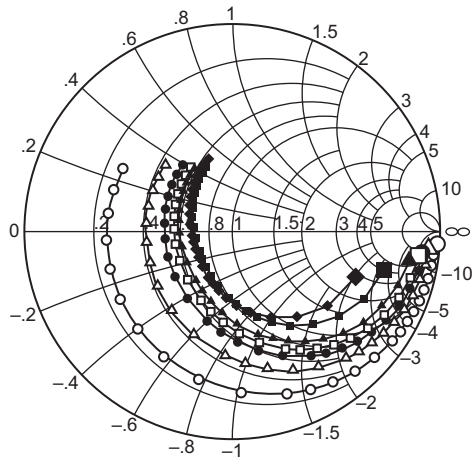
S22 Parameter vs. Frequency



Condition: VCE = 1 V , Zo = 50 Ω
 100 to 1000 MHz (100 MHz step)
 1000 to 2000 MHz (200 MHz step)
 2000 to 6000 MHz (400 MHz step)

- | | |
|---------------|----------------|
| ○—○ IC = 1 mA | ▲—▲ IC = 10 mA |
| △—△ IC = 3 mA | ■—■ IC = 20 mA |
| ●—● IC = 5 mA | ◆—◆ IC = 30 mA |
| □—□ IC = 7 mA | |

S11 Parameter vs. Frequency

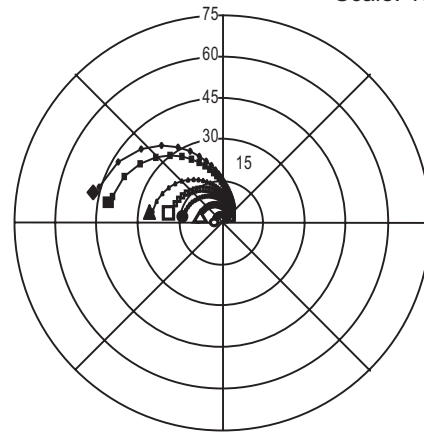


Condition: VCE = 2 V , Zo = 50 Ω
 100 to 1000 MHz (100 MHz step)
 1000 to 2000 MHz (200 MHz step)
 2000 to 6000 MHz (400 MHz step)

- | | |
|---------------|----------------|
| ○—○ IC = 1 mA | ▲—▲ IC = 10 mA |
| △—△ IC = 3 mA | ■—■ IC = 20 mA |
| ●—● IC = 5 mA | ◆—◆ IC = 30 mA |
| □—□ IC = 7 mA | |

S21 Parameter vs. Frequency

Scale: 15 / div.

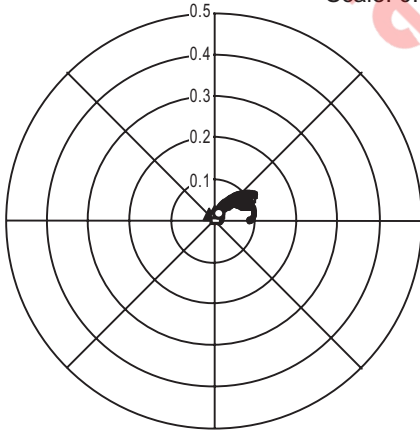


Condition: VCE = 2 V , Zo = 50 Ω
 100 to 6000 MHz (100 MHz step)

- | | |
|---------------|----------------|
| ○—○ IC = 1 mA | ▲—▲ IC = 10 mA |
| △—△ IC = 3 mA | ■—■ IC = 20 mA |
| ●—● IC = 5 mA | ◆—◆ IC = 30 mA |
| □—□ IC = 7 mA | |

S12 Parameter vs. Frequency

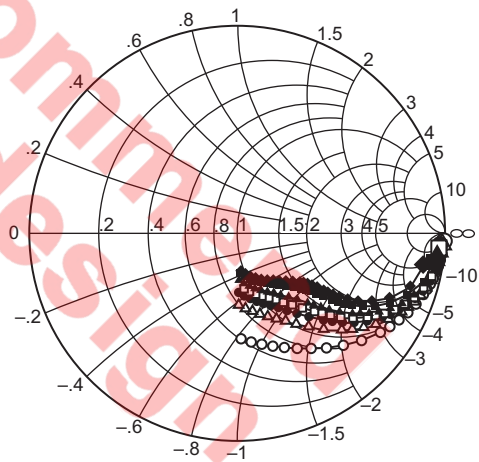
Scale: 0.1 / div.



Condition: VCE = 2 V , Zo = 50 Ω
 100 to 6000 MHz (100 MHz step)

- | | |
|---------------|----------------|
| ○—○ IC = 1 mA | ▲—▲ IC = 10 mA |
| △—△ IC = 3 mA | ■—■ IC = 20 mA |
| ●—● IC = 5 mA | ◆—◆ IC = 30 mA |
| □—□ IC = 7 mA | |

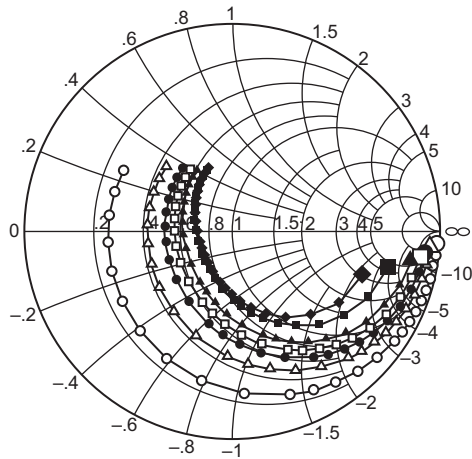
S22 Parameter vs. Frequency



Condition: VCE = 2 V , Zo = 50 Ω
 100 to 1000 MHz (100 MHz step)
 1000 to 2000 MHz (200 MHz step)
 2000 to 6000 MHz (400 MHz step)

- | | |
|---------------|----------------|
| ○—○ IC = 1 mA | ▲—▲ IC = 10 mA |
| △—△ IC = 3 mA | ■—■ IC = 20 mA |
| ●—● IC = 5 mA | ◆—◆ IC = 30 mA |
| □—□ IC = 7 mA | |

S11 Parameter vs. Frequency

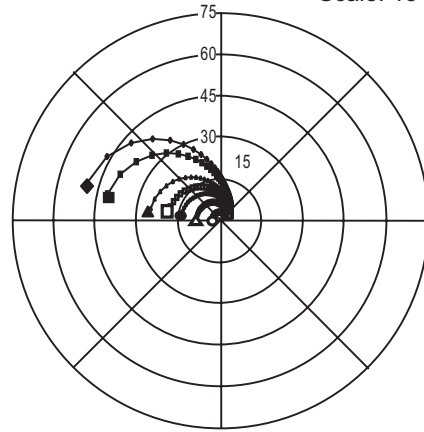


Condition: VCE = 3 V , Zo = 50 Ω
 100 to 1000 MHz (100 MHz step)
 1000 to 2000 MHz (200 MHz step)
 2000 to 6000 MHz (400 MHz step)



S21 Parameter vs. Frequency

Scale: 15 / div.

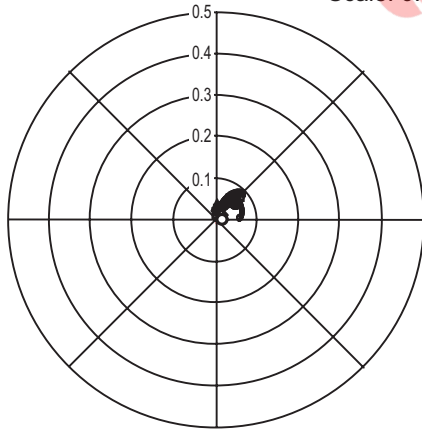


Condition: VCE = 3 V , Zo = 50 Ω
 100 to 6000 MHz (100 MHz step)



S12 Parameter vs. Frequency

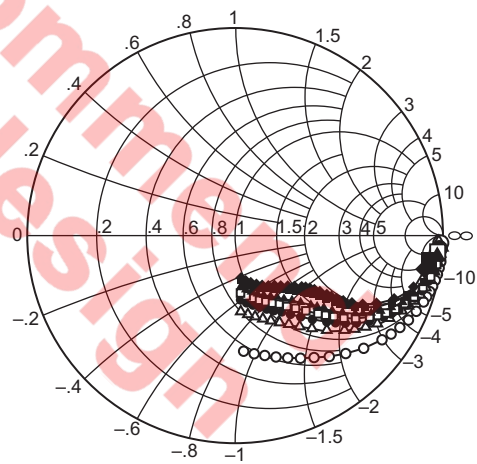
Scale: 0.1 / div.



Condition: VCE = 3 V , Zo = 50 Ω
 100 to 6000 MHz (100 MHz step)



S22 Parameter vs. Frequency



Condition: VCE = 3 V , Zo = 50 Ω
 100 to 1000 MHz (100 MHz step)
 1000 to 2000 MHz (200 MHz step)
 2000 to 6000 MHz (400 MHz step)



S Parameter

 $(V_{CE} = 1 \text{ V}, I_C = 1 \text{ mA}, Z_O = 50 \Omega)$

f (MHz)	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100	0.984	-3.8	3.19	176.5	0.0084	110.0	0.993	-2.3
200	0.981	-7.1	3.20	172.9	0.0100	79.3	0.998	-4.1
300	0.974	-10.1	3.19	169.7	0.0178	88.7	0.992	-6.2
400	0.973	-14.0	3.19	166.7	0.0216	82.4	0.986	-8.2
500	0.968	-17.6	3.20	163.6	0.0275	77.1	0.981	-10.2
600	0.962	-21.0	3.20	160.8	0.0320	76.0	0.974	-12.2
700	0.958	-24.6	3.16	157.7	0.0385	72.5	0.966	-14.2
800	0.951	-28.0	3.14	154.6	0.0427	69.6	0.958	-16.1
900	0.945	-31.7	3.17	152.5	0.0477	67.5	0.948	-17.9
1000	0.936	-35.4	3.16	148.8	0.0519	65.7	0.937	-19.8
1100	0.927	-38.9	3.15	145.9	0.0566	62.8	0.929	-21.6
1200	0.915	-42.7	3.15	142.4	0.0614	60.3	0.917	-23.4
1300	0.907	-46.3	3.11	139.5	0.0656	58.2	0.906	-25.3
1400	0.897	-49.9	3.09	136.7	0.0708	56.1	0.895	-27.0
1500	0.885	-53.8	3.08	133.8	0.0746	53.1	0.884	-28.8
1600	0.871	-57.7	3.08	130.8	0.0780	50.7	0.871	-30.5
1700	0.860	-61.4	3.06	127.8	0.0822	48.5	0.859	-32.3
1800	0.849	-65.1	3.02	124.9	0.0856	45.9	0.847	-33.9
1900	0.836	-69.0	2.99	122.1	0.0885	44.0	0.834	-35.7
2000	0.824	-73.1	2.98	119.3	0.0920	41.8	0.821	-37.4
2200	0.799	-80.8	2.91	113.5	0.0972	37.5	0.796	-40.7
2400	0.775	-88.8	2.86	107.8	0.1015	33.1	0.770	-43.9
2600	0.750	-96.8	2.79	102.3	0.1060	29.2	0.743	-47.0
2800	0.727	-104.9	2.72	96.9	0.1085	25.5	0.717	-50.1
3000	0.704	-112.9	2.66	91.3	0.1105	21.6	0.693	-52.9
3200	0.685	-120.9	2.58	86.1	0.1123	18.5	0.670	-55.9
3400	0.666	-128.8	2.50	81.0	0.1125	14.6	0.648	-58.7
3600	0.651	-136.5	2.42	76.1	0.1123	11.1	0.626	-61.4
3800	0.638	-143.8	2.35	71.3	0.1115	9.1	0.607	-64.1
4000	0.629	-151.2	2.28	66.6	0.1111	5.9	0.590	-66.8
4200	0.619	-158.4	2.21	62.1	0.1102	4.1	0.574	-69.4
4400	0.615	-165.2	2.14	57.6	0.1084	2.0	0.558	-72.0
4600	0.609	-172.0	2.07	53.3	0.1064	0.0	0.544	-74.7
4800	0.606	-178.3	2.00	49.1	0.1057	-1.8	0.530	-77.2
5000	0.605	175.5	1.94	44.9	0.1029	-3.0	0.518	-79.8
5200	0.605	169.4	1.88	40.8	0.1013	-4.0	0.505	-82.4
5400	0.606	163.9	1.82	37.0	0.0995	-5.2	0.495	-85.2
5600	0.607	158.5	1.76	33.1	0.0975	-5.9	0.485	-87.9
5800	0.608	153.2	1.71	29.3	0.0959	-6.6	0.474	-90.7
6000	0.610	148.1	1.66	25.6	0.0946	-6.4	0.463	-93.5

S Parameter

 $(V_{CE} = 1 \text{ V}, I_C = 3 \text{ mA}, Z_O = 50 \Omega)$

f (MHz)	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100	0.953	-5.1	9.08	174.8	0.0065	86.8	0.979	-3.3
200	0.946	-10.3	9.05	169.8	0.0084	84.6	0.992	-6.4
300	0.931	-14.9	8.96	165.2	0.0145	79.1	0.982	-9.4
400	0.924	-20.4	8.89	160.7	0.0206	81.0	0.969	-12.3
500	0.908	-25.4	8.81	156.4	0.0256	73.3	0.956	-15.4
600	0.892	-30.4	8.69	152.3	0.0309	72.5	0.939	-18.2
700	0.877	-35.2	8.49	148.2	0.0353	66.7	0.922	-21.0
800	0.856	-39.9	8.33	144.2	0.0393	64.0	0.901	-23.7
900	0.838	-45.2	8.29	140.8	0.0424	60.9	0.879	-26.1
1000	0.815	-49.9	8.12	136.6	0.0475	58.3	0.857	-28.6
1100	0.792	-54.7	7.95	132.9	0.0496	55.9	0.837	-30.9
1200	0.767	-59.6	7.83	128.9	0.0540	54.1	0.813	-33.1
1300	0.745	-64.1	7.62	125.5	0.0564	51.8	0.792	-35.2
1400	0.723	-68.7	7.43	122.1	0.0590	49.8	0.771	-37.1
1500	0.698	-73.5	7.27	118.7	0.0613	47.1	0.748	-39.2
1600	0.674	-78.2	7.12	115.3	0.0637	45.4	0.727	-40.9
1700	0.653	-82.7	6.93	112.1	0.0663	43.5	0.706	-42.6
1800	0.632	-87.2	6.74	109.1	0.0681	41.8	0.687	-44.3
1900	0.612	-91.6	6.57	106.0	0.0694	40.5	0.666	-46.0
2000	0.592	-96.3	6.40	103.1	0.0700	39.1	0.648	-47.6
2200	0.558	-105.0	6.06	97.5	0.0735	36.0	0.612	-50.5
2400	0.527	-113.9	5.75	92.1	0.0753	33.9	0.579	-53.3
2600	0.499	-122.6	5.45	87.0	0.0782	31.6	0.547	-56.0
2800	0.478	-131.2	5.18	82.2	0.0789	29.2	0.520	-58.6
3000	0.459	-139.6	4.91	77.5	0.0817	27.8	0.496	-60.9
3200	0.446	-147.7	4.66	73.0	0.0821	26.2	0.471	-63.4
3400	0.436	-155.7	4.44	68.7	0.0833	24.9	0.450	-65.7
3600	0.428	-163.1	4.22	64.7	0.0848	23.9	0.430	-67.9
3800	0.423	-170.0	4.02	60.9	0.0855	23.3	0.412	-70.2
4000	0.422	-176.6	3.85	57.0	0.0870	22.1	0.398	-72.6
4200	0.423	177.0	3.69	53.3	0.0877	21.4	0.383	-74.9
4400	0.425	170.9	3.53	49.6	0.0894	20.3	0.370	-77.3
4600	0.428	165.1	3.39	46.1	0.0909	19.7	0.357	-79.8
4800	0.432	159.8	3.26	42.7	0.0924	19.3	0.346	-82.2
5000	0.437	154.7	3.13	39.2	0.0942	18.7	0.334	-84.7
5200	0.443	149.6	3.02	35.8	0.0956	17.8	0.323	-87.3
5400	0.449	145.1	2.91	32.5	0.0983	16.9	0.313	-90.0
5600	0.455	140.7	2.81	29.3	0.0990	16.5	0.303	-92.5
5800	0.461	136.4	2.72	26.0	0.1011	15.6	0.293	-95.3
6000	0.468	132.4	2.63	22.8	0.1038	14.6	0.284	-98.1

S Parameter

 $(V_{CE} = 1 \text{ V}, I_C = 5 \text{ mA}, Z_O = 50 \Omega)$

f (MHz)	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100	0.926	-6.5	14.38	173.3	0.0091	85.9	0.973	-4.3
200	0.913	-13.1	14.25	167.1	0.0097	99.7	0.982	-8.2
300	0.895	-19.2	14.00	161.3	0.0151	73.8	0.966	-12.1
400	0.874	-25.8	13.73	155.7	0.0209	73.7	0.946	-15.9
500	0.848	-32.1	13.46	150.6	0.0255	69.9	0.924	-19.6
600	0.822	-38.2	13.13	145.6	0.0290	69.7	0.896	-22.8
700	0.795	-43.8	12.66	140.9	0.0331	63.8	0.867	-26.1
800	0.765	-49.5	12.29	136.3	0.0364	60.2	0.837	-29.0
900	0.735	-55.6	12.01	132.1	0.0390	57.2	0.806	-31.6
1000	0.703	-60.9	11.59	127.7	0.0417	56.3	0.777	-34.1
1100	0.672	-66.3	11.18	123.7	0.0445	54.1	0.749	-36.4
1200	0.639	-71.7	10.83	119.6	0.0469	50.4	0.720	-38.4
1300	0.611	-76.5	10.41	115.9	0.0494	50.0	0.694	-40.4
1400	0.585	-81.6	10.01	112.5	0.0516	48.7	0.669	-42.3
1500	0.557	-86.6	9.66	109.1	0.0530	47.2	0.644	-43.9
1600	0.532	-91.6	9.31	105.8	0.0552	44.8	0.621	-45.4
1700	0.510	-96.3	8.96	102.8	0.0564	44.4	0.599	-46.9
1800	0.489	-101.0	8.63	99.9	0.0578	43.2	0.579	-48.3
1900	0.469	-105.7	8.32	97.1	0.0587	42.0	0.559	-49.6
2000	0.451	-110.5	8.03	94.3	0.0604	41.3	0.541	-51.0
2200	0.422	-119.6	7.48	89.2	0.0632	39.7	0.508	-53.4
2400	0.396	-128.7	6.99	84.4	0.0656	38.8	0.478	-55.7
2600	0.379	-137.7	6.55	79.9	0.0681	37.0	0.449	-57.9
2800	0.364	-146.4	6.15	75.6	0.0709	35.7	0.426	-60.2
3000	0.355	-154.7	5.79	71.5	0.0720	34.5	0.404	-62.1
3200	0.349	-162.8	5.46	67.5	0.0745	34.6	0.384	-64.6
3400	0.346	-170.4	5.17	63.7	0.0763	33.5	0.366	-66.9
3600	0.344	-177.6	4.90	60.1	0.0790	32.3	0.347	-68.8
3800	0.345	176.2	4.65	56.7	0.0806	31.9	0.334	-70.9
4000	0.350	170.1	4.44	53.2	0.0841	31.1	0.321	-73.3
4200	0.355	164.3	4.24	49.9	0.0860	30.3	0.308	-75.8
4400	0.360	159.0	4.05	46.6	0.0888	29.5	0.296	-78.2
4600	0.367	153.9	3.88	43.3	0.0910	28.7	0.285	-80.9
4800	0.373	149.2	3.72	40.2	0.0942	27.7	0.274	-83.3
5000	0.381	144.5	3.58	37.0	0.0968	26.5	0.264	-85.9
5200	0.390	140.2	3.44	33.9	0.0995	25.4	0.253	-88.8
5400	0.396	136.3	3.32	30.8	0.1026	24.5	0.244	-91.5
5600	0.404	132.5	3.20	27.8	0.1051	23.6	0.235	-94.2
5800	0.411	128.8	3.09	24.8	0.1081	22.2	0.225	-97.3
6000	0.420	125.3	2.99	21.8	0.1106	21.1	0.216	-100.4

S Parameter

 $(V_{CE} = 1 \text{ V}, I_C = 7 \text{ mA}, Z_O = 50 \Omega)$

f (MHz)	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100	0.901	-8.2	19.13	172.0	0.0032	20.3	0.977	-5.2
200	0.879	-15.9	18.87	164.7	0.0102	82.9	0.975	-9.9
300	0.852	-23.3	18.38	157.9	0.0143	69.5	0.950	-14.5
400	0.827	-30.5	17.86	151.6	0.0206	75.7	0.922	-18.7
500	0.792	-37.9	17.31	145.7	0.0229	69.9	0.889	-22.9
600	0.755	-44.8	16.68	140.1	0.0277	64.0	0.852	-26.3
700	0.719	-51.1	15.91	135.0	0.0305	62.1	0.815	-29.7
800	0.682	-57.4	15.24	130.0	0.0332	58.3	0.779	-32.6
900	0.645	-63.9	14.67	125.5	0.0349	56.8	0.742	-35.0
1000	0.608	-69.5	13.98	121.0	0.0387	54.2	0.709	-37.5
1100	0.575	-75.2	13.31	116.9	0.0404	52.3	0.678	-39.4
1200	0.541	-80.8	12.73	112.9	0.0419	51.1	0.648	-41.2
1300	0.511	-85.8	12.11	109.4	0.0441	50.2	0.620	-43.0
1400	0.485	-90.9	11.54	106.1	0.0458	49.9	0.595	-44.4
1500	0.459	-96.1	11.03	102.9	0.0478	48.1	0.572	-45.9
1600	0.436	-101.2	10.54	99.8	0.0486	47.2	0.550	-47.1
1700	0.415	-106.0	10.08	97.0	0.0506	46.5	0.530	-48.4
1800	0.398	-110.8	9.65	94.3	0.0526	45.6	0.510	-49.5
1900	0.381	-115.7	9.25	91.7	0.0538	45.4	0.492	-50.7
2000	0.367	-120.6	8.88	89.2	0.0550	44.7	0.475	-51.8
2200	0.343	-130.0	8.21	84.5	0.0577	43.6	0.446	-53.8
2400	0.326	-139.3	7.62	80.1	0.0601	42.6	0.419	-55.9
2600	0.314	-148.3	7.10	75.9	0.0631	41.5	0.395	-58.0
2800	0.306	-157.2	6.64	72.0	0.0661	40.6	0.374	-60.0
3000	0.302	-165.2	6.23	68.2	0.0695	40.1	0.355	-61.9
3200	0.301	-173.1	5.87	64.5	0.0713	39.8	0.336	-64.1
3400	0.302	179.5	5.54	61.0	0.0747	38.7	0.320	-66.4
3600	0.304	172.8	5.23	57.6	0.0780	37.8	0.304	-68.2
3800	0.308	166.9	4.97	54.5	0.0803	37.4	0.292	-70.3
4000	0.315	161.4	4.73	51.2	0.0830	36.0	0.281	-72.8
4200	0.323	156.2	4.51	48.1	0.0869	35.3	0.269	-75.4
4400	0.331	151.4	4.31	44.9	0.0899	34.1	0.258	-78.1
4600	0.339	146.9	4.13	41.9	0.0932	32.8	0.247	-80.6
4800	0.347	142.6	3.96	38.9	0.0965	31.7	0.237	-83.4
5000	0.355	138.5	3.81	35.9	0.0998	30.4	0.227	-86.1
5200	0.364	134.6	3.66	32.9	0.1029	29.2	0.218	-89.1
5400	0.372	131.1	3.53	29.9	0.1060	27.8	0.208	-91.9
5600	0.380	127.6	3.40	27.0	0.1094	26.2	0.199	-95.1
5800	0.389	124.3	3.29	24.1	0.1121	24.8	0.190	-98.4
6000	0.398	121.0	3.18	21.2	0.1154	23.8	0.181	-101.3

S Parameter

(V_{CE} = 1 V, I_C = 10 mA, Z_O = 50 Ω)

f (MHz)	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100	0.852	-10.4	25.12	170.4	0.0070	154.3	0.965	-7.3
200	0.832	-19.6	24.69	161.6	0.0119	85.7	0.958	-12.0
300	0.796	-28.4	23.83	153.6	0.0132	77.5	0.924	-17.3
400	0.756	-37.2	22.85	146.3	0.0173	72.5	0.881	-22.1
500	0.710	-45.4	21.78	139.6	0.0232	64.5	0.837	-26.6
600	0.665	-53.3	20.63	133.4	0.0251	63.4	0.792	-30.1
700	0.622	-60.3	19.37	127.9	0.0278	59.8	0.747	-33.2
800	0.577	-67.1	18.24	122.7	0.0303	58.1	0.705	-35.8
900	0.536	-73.7	17.23	118.1	0.0332	55.7	0.668	-38.0
1000	0.501	-79.7	16.18	113.8	0.0352	53.6	0.632	-39.9
1100	0.467	-85.5	15.22	109.9	0.0365	54.2	0.601	-41.5
1200	0.436	-91.3	14.37	106.2	0.0387	51.7	0.572	-42.9
1300	0.409	-96.2	13.55	102.9	0.0397	52.0	0.546	-44.3
1400	0.385	-101.8	12.81	99.8	0.0418	51.5	0.523	-45.4
1500	0.364	-107.1	12.15	96.9	0.0429	50.7	0.500	-46.5
1600	0.345	-112.4	11.53	94.2	0.0447	50.2	0.482	-47.3
1700	0.329	-117.3	10.96	91.6	0.0462	50.0	0.464	-48.4
1800	0.315	-122.4	10.45	89.2	0.0476	49.5	0.447	-49.4
1900	0.303	-127.3	9.97	86.8	0.0498	49.7	0.433	-50.2
2000	0.292	-132.5	9.54	84.6	0.0509	49.0	0.417	-51.0
2200	0.277	-142.2	8.76	80.3	0.0541	48.3	0.392	-52.8
2400	0.267	-151.7	8.10	76.2	0.0574	48.4	0.369	-54.6
2600	0.262	-160.7	7.52	72.5	0.0611	46.9	0.348	-56.4
2800	0.261	-169.2	7.02	68.8	0.0646	46.7	0.331	-58.3
3000	0.263	-177.0	6.57	65.3	0.0673	44.9	0.314	-60.2
3200	0.267	175.6	6.17	61.9	0.0710	44.9	0.297	-62.6
3400	0.272	168.9	5.82	58.6	0.0744	43.4	0.282	-64.8
3600	0.277	162.8	5.49	55.5	0.0772	42.7	0.269	-66.8
3800	0.283	157.6	5.21	52.5	0.0807	41.4	0.258	-69.0
4000	0.292	152.8	4.96	49.5	0.0839	40.3	0.247	-71.6
4200	0.301	148.2	4.73	46.5	0.0883	39.1	0.236	-74.3
4400	0.309	144.1	4.52	43.5	0.0907	37.7	0.226	-77.0
4600	0.319	140.0	4.33	40.6	0.0949	36.6	0.217	-79.7
4800	0.328	136.2	4.15	37.7	0.0984	35.2	0.207	-82.5
5000	0.337	132.5	3.98	34.8	0.1019	33.7	0.198	-85.5
5200	0.348	129.2	3.83	31.9	0.1056	31.6	0.187	-88.8
5400	0.355	126.1	3.69	29.1	0.1092	30.5	0.179	-92.1
5600	0.364	122.9	3.56	26.3	0.1124	28.9	0.171	-95.2
5800	0.373	119.8	3.43	23.5	0.1155	27.3	0.162	-98.6
6000	0.382	117.0	3.32	20.6	0.1187	25.8	0.153	-102.4

S Parameter

(V_{CE} = 1 V, I_C = 20 mA, Z_O = 50 Ω)

f (MHz)	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100	0.700	-17.6	34.51	166.2	0.0036	93.1	0.909	-9.2
200	0.661	-33.4	33.62	153.9	0.0097	71.5	0.887	-17.5
300	0.602	-47.4	31.82	142.9	0.0122	67.0	0.816	-23.7
400	0.547	-59.7	29.64	133.6	0.0162	67.9	0.748	-28.6
500	0.490	-71.3	27.12	125.6	0.0187	60.4	0.687	-32.4
600	0.443	-81.0	24.81	119.1	0.0210	57.5	0.632	-35.0
700	0.403	-89.4	22.55	113.7	0.0234	58.4	0.586	-37.0
800	0.367	-97.2	20.69	109.0	0.0253	57.6	0.545	-38.5
900	0.340	-104.1	19.13	104.9	0.0272	57.8	0.513	-39.5
1000	0.317	-111.0	17.58	101.3	0.0299	57.5	0.485	-40.3
1100	0.298	-117.6	16.30	98.0	0.0302	58.0	0.460	-40.9
1200	0.280	-123.9	15.19	95.1	0.0314	56.5	0.439	-41.5
1300	0.266	-129.5	14.19	92.4	0.0340	57.4	0.422	-42.1
1400	0.256	-135.6	13.30	89.9	0.0360	58.4	0.405	-42.6
1500	0.247	-141.4	12.52	87.5	0.0378	56.9	0.390	-43.1
1600	0.241	-146.9	11.82	85.3	0.0400	57.2	0.377	-43.3
1700	0.236	-152.2	11.17	83.1	0.0416	57.3	0.365	-44.0
1800	0.234	-157.5	10.60	81.1	0.0432	56.7	0.354	-44.5
1900	0.231	-162.4	10.08	79.1	0.0453	56.2	0.344	-45.4
2000	0.231	-166.8	9.61	77.2	0.0467	56.1	0.334	-46.0
2200	0.233	-175.5	8.78	73.6	0.0511	55.3	0.316	-47.3
2400	0.237	176.8	8.08	70.1	0.0549	54.5	0.300	-49.0
2600	0.244	169.8	7.48	66.8	0.0587	53.3	0.284	-50.7
2800	0.253	163.5	6.96	63.6	0.0637	52.2	0.271	-52.6
3000	0.260	158.0	6.51	60.5	0.0667	51.1	0.258	-54.6
3200	0.271	152.9	6.10	57.4	0.0706	50.7	0.245	-57.0
3400	0.280	148.2	5.75	54.4	0.0743	50.0	0.233	-59.3
3600	0.289	143.9	5.42	51.5	0.0777	48.2	0.221	-61.3
3800	0.297	140.3	5.14	48.8	0.0820	47.1	0.212	-63.7
4000	0.307	137.0	4.89	46.0	0.0858	45.3	0.203	-66.6
4200	0.317	133.6	4.66	43.1	0.0900	43.9	0.193	-69.7
4400	0.327	130.5	4.45	40.3	0.0938	42.1	0.184	-72.6
4600	0.337	127.5	4.26	37.6	0.0976	40.5	0.175	-75.5
4800	0.345	124.7	4.08	34.9	0.1018	38.5	0.167	-78.9
5000	0.354	121.8	3.92	32.1	0.1059	37.4	0.158	-82.0
5200	0.364	119.1	3.76	29.4	0.1090	35.6	0.148	-85.5
5400	0.372	116.6	3.62	26.6	0.1131	33.8	0.140	-89.2
5600	0.382	114.0	3.50	23.9	0.1172	31.9	0.132	-92.7
5800	0.389	111.6	3.38	21.2	0.1208	30.1	0.123	-96.9
6000	0.399	109.1	3.26	18.5	0.1243	28.2	0.115	-101.0

S Parameter

(V_{CE} = 1 V, I_C = 30 mA, Z_O = 50 Ω)

f (MHz)	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100	0.531	-28.6	36.92	162.7	0.0057	61.8	0.641	-10.4
200	0.487	-55.2	33.95	146.9	0.0102	52.5	0.624	-21.6
300	0.440	-77.9	29.87	134.0	0.0146	57.5	0.549	-27.4
400	0.412	-97.6	25.87	123.9	0.0164	54.1	0.488	-31.1
500	0.392	-114.0	22.27	115.8	0.0200	52.6	0.441	-33.5
600	0.384	-127.3	19.28	109.5	0.0221	53.2	0.403	-34.7
700	0.379	-137.7	16.92	104.6	0.0236	53.7	0.372	-35.2
800	0.379	-146.9	14.95	100.1	0.0256	53.5	0.350	-35.4
900	0.380	-154.2	13.40	96.3	0.0270	55.7	0.332	-35.7
1000	0.382	-160.7	12.13	93.1	0.0297	53.8	0.315	-36.0
1100	0.384	-166.2	11.06	90.0	0.0316	55.0	0.300	-36.1
1200	0.388	-171.5	10.12	87.3	0.0333	53.8	0.289	-36.2
1300	0.392	-175.8	9.34	84.8	0.0352	55.5	0.279	-36.5
1400	0.395	-179.8	8.70	82.5	0.0376	56.1	0.270	-36.8
1500	0.399	-176.4	8.12	80.2	0.0391	55.6	0.260	-37.2
1600	0.403	-172.9	7.60	78.0	0.0417	56.1	0.252	-37.4
1700	0.407	-169.8	7.15	76.0	0.0437	55.4	0.244	-37.9
1800	0.412	-166.8	6.76	74.0	0.0449	55.3	0.237	-38.5
1900	0.415	-163.9	6.40	72.1	0.0478	55.3	0.230	-39.0
2000	0.421	-161.3	6.07	70.2	0.0498	55.0	0.223	-39.8
2200	0.429	-156.2	5.52	66.6	0.0537	54.4	0.211	-41.2
2400	0.439	-151.7	5.05	63.2	0.0581	53.6	0.199	-42.8
2600	0.448	-147.5	4.65	59.8	0.0629	52.4	0.187	-44.7
2800	0.459	-143.7	4.32	56.6	0.0665	52.0	0.175	-46.7
3000	0.467	-140.0	4.02	53.4	0.0706	49.5	0.165	-48.9
3200	0.477	-136.5	3.76	50.3	0.0756	48.5	0.154	-51.3
3400	0.485	-133.2	3.53	47.2	0.0794	47.3	0.144	-53.8
3600	0.492	-130.0	3.32	44.3	0.0830	46.0	0.133	-55.7
3800	0.500	-127.2	3.14	41.4	0.0872	45.1	0.125	-59.0
4000	0.510	-124.3	2.98	38.5	0.0923	43.0	0.116	-62.4
4200	0.517	-121.6	2.83	35.6	0.0954	41.3	0.108	-66.1
4400	0.525	-119.0	2.70	32.7	0.0999	39.7	0.100	-69.9
4600	0.533	-116.3	2.58	29.9	0.1036	38.3	0.091	-73.7
4800	0.539	-113.7	2.47	27.1	0.1071	36.3	0.083	-78.1
5000	0.546	-111.2	2.37	24.2	0.1109	35.2	0.075	-82.6
5200	0.554	-108.7	2.27	21.4	0.1150	32.7	0.067	-87.9
5400	0.559	-106.2	2.18	18.6	0.1188	30.9	0.059	-93.5
5600	0.566	-103.8	2.10	15.9	0.1226	29.4	0.051	-100.4
5800	0.571	-101.4	2.03	13.1	0.1266	27.5	0.044	-108.6
6000	0.578	-99.0	1.95	10.3	0.1300	25.4	0.037	-119.6

S Parameter

 $(V_{CE} = 2\text{ V}, I_C = 1\text{ mA}, Z_O = 50\ \Omega)$

f (MHz)	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100	0.987	-3.3	3.18	176.7	0.0025	47.3	0.995	-1.9
200	0.979	-6.9	3.18	173.1	0.0083	94.0	0.997	-3.8
300	0.976	-9.9	3.18	170.0	0.0132	83.2	0.994	-5.8
400	0.973	-13.7	3.18	167.2	0.0190	80.7	0.989	-7.6
500	0.969	-17.1	3.19	164.2	0.0238	81.3	0.984	-9.4
600	0.965	-20.5	3.19	161.4	0.0287	76.5	0.977	-11.2
700	0.958	-23.9	3.15	158.4	0.0328	72.7	0.971	-13.0
800	0.952	-27.3	3.14	155.3	0.0372	70.5	0.964	-14.8
900	0.947	-30.9	3.17	153.3	0.0411	68.4	0.956	-16.5
1000	0.938	-34.4	3.16	149.8	0.0453	65.8	0.946	-18.2
1100	0.929	-38.0	3.15	146.9	0.0492	63.8	0.938	-19.9
1200	0.919	-41.6	3.16	143.5	0.0527	60.2	0.928	-21.6
1300	0.909	-45.1	3.12	140.6	0.0569	58.8	0.918	-23.4
1400	0.900	-48.7	3.10	137.9	0.0614	56.7	0.909	-25.0
1500	0.888	-52.4	3.09	135.0	0.0650	54.8	0.898	-26.7
1600	0.876	-56.2	3.10	132.0	0.0670	51.9	0.886	-28.1
1700	0.865	-59.8	3.07	129.2	0.0705	50.0	0.876	-29.8
1800	0.854	-63.5	3.03	126.3	0.0742	47.3	0.864	-31.4
1900	0.841	-67.2	3.01	123.5	0.0767	45.8	0.853	-33.0
2000	0.829	-71.2	3.00	120.8	0.0795	43.7	0.841	-34.7
2200	0.805	-78.8	2.93	115.1	0.0840	39.4	0.819	-37.7
2400	0.781	-86.6	2.88	109.5	0.0885	35.5	0.793	-40.7
2600	0.755	-94.5	2.82	104.1	0.0915	31.9	0.769	-43.6
2800	0.733	-102.5	2.76	98.7	0.0940	27.6	0.746	-46.4
3000	0.708	-110.4	2.70	93.2	0.0960	23.6	0.725	-49.1
3200	0.689	-118.3	2.62	88.0	0.0964	20.7	0.702	-52.0
3400	0.670	-126.1	2.55	82.9	0.0981	17.6	0.681	-54.6
3600	0.653	-133.7	2.47	78.0	0.0964	14.2	0.661	-57.1
3800	0.639	-141.0	2.39	73.3	0.0958	12.1	0.643	-59.7
4000	0.629	-148.4	2.32	68.6	0.0960	9.8	0.627	-62.3
4200	0.619	-155.7	2.26	64.1	0.0946	7.5	0.612	-64.7
4400	0.612	-162.5	2.18	59.7	0.0935	5.7	0.597	-67.4
4600	0.607	-169.3	2.12	55.3	0.0919	4.3	0.584	-69.7
4800	0.603	-175.8	2.05	51.1	0.0906	2.9	0.572	-72.2
5000	0.600	178.0	1.99	47.0	0.0881	2.0	0.560	-74.7
5200	0.599	171.8	1.93	42.9	0.0876	1.0	0.549	-77.2
5400	0.600	166.2	1.87	39.1	0.0857	0.3	0.539	-79.8
5600	0.601	160.7	1.81	35.2	0.0842	0.5	0.529	-82.3
5800	0.601	155.3	1.76	31.3	0.0827	-0.2	0.519	-84.9
6000	0.603	150.1	1.71	27.7	0.0823	0.7	0.509	-87.6

S Parameter

 $(V_{CE} = 2 \text{ V}, I_C = 3 \text{ mA}, Z_O = 50 \Omega)$

f (MHz)	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100	0.952	-4.7	9.06	174.9	0.0026	88.4	0.989	-3.2
200	0.948	-9.8	9.04	170.2	0.0089	81.3	0.994	-5.8
300	0.935	-14.3	8.95	165.7	0.0137	73.1	0.983	-8.3
400	0.926	-19.5	8.88	161.3	0.0164	81.0	0.972	-10.9
500	0.912	-24.4	8.82	157.2	0.0218	72.2	0.963	-13.7
600	0.897	-29.2	8.71	153.2	0.0264	72.3	0.948	-16.2
700	0.880	-33.8	8.52	149.2	0.0310	68.9	0.933	-18.8
800	0.862	-38.4	8.37	145.3	0.0338	64.5	0.916	-21.2
900	0.844	-43.4	8.34	142.0	0.0377	61.6	0.897	-23.4
1000	0.822	-47.9	8.17	137.9	0.0411	61.2	0.877	-25.6
1100	0.799	-52.6	8.01	134.2	0.0443	58.7	0.858	-27.7
1200	0.774	-57.3	7.90	130.3	0.0457	54.9	0.837	-29.7
1300	0.752	-61.7	7.70	126.9	0.0485	53.4	0.817	-31.5
1400	0.731	-66.1	7.52	123.6	0.0519	51.9	0.798	-33.4
1500	0.706	-70.7	7.37	120.2	0.0537	49.5	0.778	-35.2
1600	0.683	-75.3	7.22	116.9	0.0555	48.0	0.759	-36.7
1700	0.661	-79.7	7.04	113.7	0.0575	45.7	0.740	-38.4
1800	0.639	-84.0	6.85	110.6	0.0588	44.4	0.722	-39.9
1900	0.619	-88.3	6.69	107.7	0.0609	42.4	0.703	-41.4
2000	0.599	-92.9	6.53	104.7	0.0613	41.1	0.685	-42.8
2200	0.563	-101.3	6.19	99.2	0.0649	38.5	0.653	-45.6
2400	0.529	-110.0	5.88	93.8	0.0662	36.1	0.622	-48.0
2600	0.500	-118.6	5.59	88.7	0.0677	33.8	0.593	-50.4
2800	0.477	-127.1	5.31	83.9	0.0696	32.3	0.567	-52.7
3000	0.457	-135.3	5.05	79.2	0.0712	30.9	0.545	-54.8
3200	0.442	-143.5	4.80	74.8	0.0721	29.6	0.522	-57.1
3400	0.429	-151.5	4.57	70.5	0.0727	27.8	0.502	-59.2
3600	0.419	-158.9	4.35	66.4	0.0732	26.9	0.483	-61.2
3800	0.413	-166.0	4.16	62.6	0.0748	27.2	0.468	-63.2
4000	0.411	-172.7	3.98	58.8	0.0755	26.3	0.454	-65.4
4200	0.411	-179.3	3.81	55.1	0.0772	25.9	0.440	-67.7
4400	0.411	174.5	3.66	51.4	0.0780	24.7	0.428	-69.9
4600	0.414	168.6	3.52	47.9	0.0807	24.2	0.415	-72.2
4800	0.417	163.0	3.38	44.4	0.0819	24.0	0.405	-74.4
5000	0.421	157.6	3.25	41.0	0.0832	23.2	0.395	-76.6
5200	0.427	152.4	3.14	37.6	0.0847	22.7	0.383	-79.0
5400	0.431	147.9	3.02	34.3	0.0868	22.4	0.375	-81.4
5600	0.438	143.4	2.92	31.1	0.0891	22.1	0.366	-83.8
5800	0.443	139.0	2.82	27.9	0.0909	21.1	0.356	-86.3
6000	0.450	134.8	2.73	24.7	0.0934	20.9	0.347	-88.8

S Parameter

 $(V_{CE} = 2\text{ V}, I_C = 5\text{ mA}, Z_O = 50\ \Omega)$

f (MHz)	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100	0.923	-6.2	14.39	173.5	0.0092	34.3	0.979	-3.2
200	0.915	-12.3	14.26	167.6	0.0094	83.2	0.987	-7.1
300	0.896	-18.2	14.03	162.0	0.0144	73.0	0.974	-10.7
400	0.878	-24.5	13.78	156.6	0.0167	76.6	0.956	-14.0
500	0.855	-30.4	13.53	151.5	0.0207	68.8	0.935	-17.2
600	0.828	-36.3	13.22	146.7	0.0254	70.2	0.912	-20.1
700	0.803	-41.8	12.78	142.1	0.0285	65.0	0.887	-23.0
800	0.774	-47.2	12.41	137.6	0.0310	61.7	0.860	-25.6
900	0.743	-52.9	12.15	133.5	0.0340	60.5	0.833	-27.9
1000	0.712	-58.1	11.75	129.1	0.0364	58.8	0.806	-30.1
1100	0.682	-63.2	11.35	125.1	0.0403	56.0	0.781	-32.1
1200	0.650	-68.4	11.01	121.1	0.0400	53.8	0.754	-34.0
1300	0.621	-73.1	10.60	117.5	0.0421	51.7	0.729	-35.8
1400	0.594	-78.0	10.21	114.1	0.0452	50.4	0.707	-37.4
1500	0.566	-82.8	9.87	110.7	0.0464	48.2	0.684	-38.9
1600	0.540	-87.5	9.53	107.4	0.0478	47.9	0.663	-40.2
1700	0.517	-92.1	9.18	104.4	0.0498	46.6	0.644	-41.6
1800	0.495	-96.7	8.85	101.5	0.0508	45.0	0.624	-42.8
1900	0.475	-101.1	8.54	98.7	0.0516	44.5	0.606	-44.1
2000	0.455	-105.8	8.25	96.0	0.0528	43.6	0.589	-45.1
2200	0.423	-114.6	7.69	90.9	0.0556	41.7	0.558	-47.3
2400	0.395	-123.6	7.21	86.0	0.0569	41.1	0.530	-49.3
2600	0.373	-132.2	6.76	81.5	0.0599	38.9	0.504	-51.4
2800	0.357	-141.1	6.36	77.2	0.0616	39.1	0.482	-53.3
3000	0.345	-149.5	5.99	73.1	0.0633	38.3	0.461	-55.1
3200	0.338	-157.6	5.66	69.1	0.0662	37.4	0.443	-57.2
3400	0.332	-165.6	5.36	65.3	0.0680	36.9	0.425	-59.2
3600	0.328	-172.7	5.08	61.7	0.0695	35.7	0.409	-61.0
3800	0.327	-179.6	4.83	58.3	0.0719	35.8	0.396	-62.9
4000	0.330	174.2	4.61	54.9	0.0743	35.2	0.384	-65.0
4200	0.335	168.2	4.40	51.5	0.0772	34.1	0.372	-67.3
4400	0.340	162.6	4.22	48.2	0.0795	33.9	0.361	-69.5
4600	0.346	157.3	4.04	45.0	0.0817	32.9	0.351	-71.7
4800	0.352	152.4	3.88	41.9	0.0849	31.9	0.341	-73.9
5000	0.359	147.7	3.73	38.7	0.0868	31.3	0.331	-76.2
5200	0.366	143.2	3.60	35.6	0.0894	30.5	0.321	-78.6
5400	0.374	139.0	3.46	32.6	0.0931	29.4	0.312	-81.1
5600	0.381	135.1	3.35	29.6	0.0949	28.6	0.304	-83.5
5800	0.388	131.3	3.23	26.6	0.0978	27.0	0.294	-86.0
6000	0.396	127.5	3.13	23.6	0.1013	26.2	0.285	-88.5

S Parameter

 $(V_{CE} = 2 \text{ V}, I_C = 7 \text{ mA}, Z_O = 50 \Omega)$

f (MHz)	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100	0.901	-7.5	19.25	172.3	0.0048	41.5	0.974	-4.2
200	0.883	-14.7	18.98	165.3	0.0086	92.3	0.980	-8.6
300	0.861	-21.8	18.50	158.7	0.0140	76.1	0.959	-12.5
400	0.832	-29.0	18.00	152.6	0.0180	72.7	0.935	-16.4
500	0.800	-35.7	17.48	146.8	0.0204	72.8	0.906	-20.0
600	0.764	-42.3	16.87	141.4	0.0237	67.0	0.874	-23.1
700	0.732	-48.4	16.14	136.4	0.0266	63.1	0.842	-26.0
800	0.694	-54.3	15.49	131.4	0.0292	60.8	0.808	-28.6
900	0.657	-60.5	14.93	127.0	0.0309	57.9	0.776	-30.8
1000	0.621	-65.9	14.26	122.6	0.0339	55.5	0.746	-32.9
1100	0.587	-71.4	13.61	118.5	0.0361	55.7	0.717	-34.7
1200	0.550	-76.6	13.04	114.5	0.0369	53.0	0.691	-36.3
1300	0.521	-81.5	12.42	111.0	0.0385	53.1	0.664	-37.7
1400	0.493	-86.5	11.86	107.7	0.0405	52.1	0.642	-39.1
1500	0.467	-91.3	11.34	104.5	0.0417	50.7	0.620	-40.3
1600	0.441	-96.1	10.86	101.4	0.0442	48.4	0.598	-41.4
1700	0.421	-100.7	10.39	98.6	0.0451	48.5	0.580	-42.5
1800	0.401	-105.3	9.96	95.9	0.0462	47.0	0.562	-43.5
1900	0.383	-110.0	9.55	93.3	0.0473	46.9	0.545	-44.5
2000	0.366	-114.7	9.18	90.8	0.0483	47.1	0.530	-45.5
2200	0.339	-123.8	8.49	86.1	0.0511	46.2	0.503	-47.3
2400	0.319	-132.9	7.90	81.6	0.0536	45.7	0.477	-49.0
2600	0.303	-141.9	7.37	77.5	0.0564	45.3	0.455	-50.8
2800	0.292	-151.0	6.90	73.5	0.0592	43.7	0.435	-52.5
3000	0.286	-159.3	6.48	69.8	0.0618	43.3	0.418	-54.2
3200	0.283	-167.4	6.11	66.1	0.0645	42.8	0.400	-56.4
3400	0.282	-175.3	5.77	62.6	0.0664	42.1	0.385	-58.2
3600	0.283	177.6	5.45	59.2	0.0691	41.1	0.370	-60.0
3800	0.285	171.4	5.18	56.0	0.0716	41.4	0.359	-61.9
4000	0.292	165.6	4.94	52.8	0.0745	40.1	0.347	-64.0
4200	0.298	160.1	4.71	49.7	0.0778	38.8	0.336	-66.2
4400	0.305	154.9	4.51	46.6	0.0813	38.3	0.326	-68.6
4600	0.313	150.1	4.32	43.6	0.0839	36.8	0.316	-70.8
4800	0.320	145.7	4.15	40.6	0.0868	35.9	0.307	-73.2
5000	0.328	141.2	3.98	37.6	0.0904	35.0	0.298	-75.5
5200	0.337	137.3	3.84	34.6	0.0932	33.8	0.288	-78.2
5400	0.345	133.6	3.70	31.7	0.0962	32.5	0.279	-80.6
5600	0.353	130.1	3.57	28.8	0.0994	31.2	0.270	-83.0
5800	0.361	126.6	3.45	25.9	0.1027	29.9	0.262	-85.5
6000	0.370	123.2	3.34	23.0	0.1056	28.8	0.252	-88.1

S Parameter

(V_{CE} = 2 V, I_C = 10 mA, Z_O = 50 Ω)

f (MHz)	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100	0.864	-9.4	25.72	170.8	0.0082	99.3	0.968	-5.9
200	0.840	-18.0	25.13	162.4	0.0078	94.0	0.967	-10.4
300	0.804	-26.3	24.22	154.7	0.0121	80.8	0.937	-15.0
400	0.769	-34.7	23.24	147.6	0.0174	71.6	0.902	-19.2
500	0.725	-42.4	22.19	141.1	0.0196	68.5	0.863	-23.1
600	0.679	-49.7	21.06	135.0	0.0214	64.0	0.822	-26.1
700	0.636	-56.4	19.83	129.6	0.0247	62.5	0.782	-29.0
800	0.592	-62.7	18.72	124.4	0.0269	59.2	0.744	-31.2
900	0.551	-69.0	17.70	119.9	0.0270	58.5	0.707	-33.0
1000	0.514	-74.6	16.67	115.6	0.0296	55.8	0.678	-34.9
1100	0.478	-80.1	15.71	111.6	0.0319	54.7	0.649	-36.3
1200	0.446	-85.5	14.85	107.9	0.0334	54.7	0.622	-37.5
1300	0.417	-90.3	14.02	104.6	0.0348	54.6	0.597	-38.6
1400	0.392	-95.3	13.27	101.5	0.0368	54.4	0.577	-39.6
1500	0.367	-100.3	12.60	98.6	0.0378	53.4	0.556	-40.6
1600	0.347	-105.1	11.97	95.8	0.0390	53.4	0.538	-41.4
1700	0.329	-110.0	11.39	93.2	0.0414	52.8	0.521	-42.3
1800	0.313	-114.8	10.87	90.7	0.0428	52.3	0.505	-43.0
1900	0.299	-119.8	10.38	88.4	0.0440	52.2	0.491	-43.9
2000	0.286	-124.6	9.93	86.1	0.0444	51.2	0.477	-44.6
2200	0.267	-134.2	9.14	81.8	0.0486	51.2	0.454	-46.1
2400	0.254	-143.7	8.45	77.8	0.0512	50.7	0.432	-47.7
2600	0.244	-153.0	7.85	74.0	0.0541	49.6	0.412	-49.3
2800	0.240	-162.2	7.33	70.4	0.0579	48.6	0.395	-51.0
3000	0.239	-170.3	6.87	66.9	0.0611	48.2	0.380	-52.8
3200	0.241	-178.5	6.46	63.5	0.0630	47.2	0.365	-54.8
3400	0.244	174.3	6.10	60.2	0.0659	46.9	0.351	-56.6
3600	0.249	167.5	5.76	57.1	0.0687	46.0	0.337	-58.3
3800	0.254	162.1	5.47	54.1	0.0722	44.9	0.327	-60.4
4000	0.262	156.8	5.21	51.1	0.0761	44.2	0.318	-62.5
4200	0.270	151.9	4.97	48.1	0.0787	42.6	0.308	-64.8
4400	0.279	147.3	4.75	45.2	0.0831	41.5	0.297	-67.1
4600	0.288	142.9	4.55	42.3	0.0861	40.4	0.289	-69.6
4800	0.296	139.0	4.36	39.4	0.0898	38.9	0.280	-71.9
5000	0.305	135.1	4.19	36.6	0.0925	37.6	0.270	-74.4
5200	0.314	131.7	4.04	33.7	0.0960	36.3	0.261	-76.9
5400	0.323	128.4	3.89	30.9	0.0994	34.8	0.252	-79.5
5600	0.332	125.2	3.76	28.1	0.1020	33.4	0.244	-82.1
5800	0.341	122.0	3.63	25.3	0.1063	31.7	0.235	-84.7
6000	0.349	119.1	3.51	22.5	0.1093	30.2	0.226	-87.3

S Parameter

 $(V_{CE} = 2 \text{ V}, I_C = 20 \text{ mA}, Z_O = 50 \Omega)$

f (MHz)	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100	0.754	-14.4	40.97	166.9	0.0015	90.4	0.956	-8.3
200	0.711	-27.2	39.29	155.2	0.0059	77.2	0.928	-14.6
300	0.655	-38.7	36.61	144.9	0.0095	78.1	0.869	-20.0
400	0.593	-49.1	33.71	136.1	0.0141	65.4	0.808	-24.6
500	0.532	-58.5	30.77	128.4	0.0160	63.9	0.751	-27.9
600	0.477	-66.7	27.97	122.0	0.0184	63.2	0.700	-30.2
700	0.431	-74.1	25.44	116.6	0.0202	62.8	0.656	-32.1
800	0.390	-80.7	23.25	111.8	0.0222	60.3	0.619	-33.3
900	0.352	-87.0	21.35	107.7	0.0232	60.3	0.587	-34.4
1000	0.322	-93.0	19.67	104.0	0.0252	60.4	0.558	-35.2
1100	0.297	-98.8	18.21	100.7	0.0273	58.9	0.535	-35.8
1200	0.274	-104.5	16.94	97.6	0.0286	59.9	0.515	-36.3
1300	0.255	-109.9	15.80	94.9	0.0303	60.5	0.497	-36.9
1400	0.238	-115.4	14.81	92.3	0.0318	60.0	0.480	-37.3
1500	0.225	-121.2	13.93	89.9	0.0335	59.9	0.466	-37.9
1600	0.213	-126.7	13.14	87.6	0.0364	60.9	0.452	-38.4
1700	0.204	-132.3	12.43	85.5	0.0370	59.5	0.440	-38.9
1800	0.197	-137.8	11.80	83.4	0.0390	59.4	0.430	-39.5
1900	0.190	-143.3	11.22	81.4	0.0409	60.5	0.420	-40.1
2000	0.186	-148.8	10.69	79.6	0.0424	59.5	0.410	-40.8
2200	0.181	-159.3	9.77	75.9	0.0461	59.2	0.392	-42.1
2400	0.182	-169.0	8.99	72.5	0.0495	57.6	0.376	-43.6
2600	0.184	-177.8	8.33	69.2	0.0528	55.7	0.362	-45.1
2800	0.189	173.9	7.76	66.0	0.0561	55.8	0.347	-46.8
3000	0.197	166.9	7.25	62.9	0.0604	54.4	0.335	-48.6
3200	0.205	160.7	6.81	59.9	0.0639	53.7	0.322	-50.7
3400	0.215	154.7	6.42	56.9	0.0670	52.3	0.311	-52.7
3600	0.222	149.5	6.06	54.0	0.0701	50.9	0.299	-54.5
3800	0.230	145.4	5.74	51.4	0.0745	50.5	0.291	-56.6
4000	0.241	141.7	5.47	48.6	0.0783	48.9	0.282	-59.1
4200	0.251	138.0	5.21	45.8	0.0823	47.7	0.272	-61.4
4400	0.260	134.5	4.98	43.1	0.0858	45.6	0.263	-64.0
4600	0.271	131.3	4.77	40.4	0.0889	44.0	0.254	-66.5
4800	0.279	128.3	4.58	37.7	0.0929	42.6	0.246	-69.1
5000	0.289	125.3	4.40	35.0	0.0970	41.2	0.237	-71.6
5200	0.298	122.5	4.23	32.3	0.1003	39.3	0.228	-74.2
5400	0.307	119.9	4.08	29.6	0.1046	37.7	0.219	-77.1
5600	0.315	117.3	3.94	26.9	0.1070	36.1	0.212	-79.8
5800	0.325	114.8	3.80	24.3	0.1110	34.4	0.203	-82.7
6000	0.333	112.2	3.68	21.6	0.1145	32.4	0.194	-85.2

S Parameter

(V_{CE} = 2 V, I_C = 30 mA, Z_O = 50 Ω)

f (MHz)	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100	0.634	-20.1	46.46	164.2	0.0031	120.4	0.909	-9.7
200	0.582	-37.8	43.63	150.1	0.0084	76.9	0.871	-16.9
300	0.515	-52.6	39.60	138.2	0.0097	66.4	0.796	-22.8
400	0.453	-65.6	35.47	128.7	0.0129	62.4	0.725	-26.5
500	0.399	-77.0	31.56	121.0	0.0142	63.3	0.667	-29.1
600	0.356	-86.5	28.19	114.8	0.0165	63.3	0.619	-30.6
700	0.319	-95.0	25.27	109.8	0.0189	62.3	0.578	-31.6
800	0.290	-102.5	22.86	105.4	0.0207	61.5	0.547	-32.3
900	0.266	-109.9	20.87	101.7	0.0213	63.3	0.520	-32.8
1000	0.249	-117.3	19.09	98.4	0.0232	61.1	0.498	-33.1
1100	0.234	-123.8	17.59	95.4	0.0258	61.3	0.479	-33.4
1200	0.219	-130.4	16.30	92.7	0.0266	62.0	0.463	-33.6
1300	0.210	-136.3	15.17	90.3	0.0283	62.4	0.449	-34.1
1400	0.202	-142.4	14.19	87.9	0.0311	62.6	0.437	-34.4
1500	0.196	-148.8	13.32	85.8	0.0330	63.2	0.427	-34.9
1600	0.193	-154.4	12.54	83.7	0.0348	63.1	0.415	-35.2
1700	0.191	-159.7	11.84	81.7	0.0363	62.1	0.406	-35.7
1800	0.191	-165.0	11.23	79.8	0.0377	62.3	0.397	-36.2
1900	0.192	-169.7	10.67	78.0	0.0402	61.6	0.389	-37.0
2000	0.192	-174.4	10.16	76.2	0.0414	61.6	0.381	-37.5
2200	0.197	177.3	9.27	72.8	0.0449	60.7	0.367	-39.0
2400	0.204	169.9	8.53	69.6	0.0492	60.6	0.353	-40.5
2600	0.212	163.3	7.89	66.4	0.0534	59.8	0.340	-42.1
2800	0.221	157.3	7.34	63.4	0.0565	58.0	0.327	-44.0
3000	0.231	152.4	6.86	60.4	0.0608	56.6	0.317	-45.8
3200	0.241	147.9	6.44	57.5	0.0648	55.9	0.305	-48.1
3400	0.251	143.4	6.06	54.6	0.0674	54.2	0.295	-50.2
3600	0.260	139.5	5.72	51.8	0.0718	52.7	0.283	-51.9
3800	0.268	136.1	5.42	49.2	0.0758	51.7	0.275	-54.2
4000	0.278	133.1	5.16	46.5	0.0793	49.9	0.266	-56.8
4200	0.289	130.2	4.92	43.8	0.0830	48.5	0.257	-59.4
4400	0.298	127.4	4.70	41.0	0.0869	46.9	0.249	-62.0
4600	0.309	124.6	4.50	38.4	0.0901	45.2	0.240	-64.5
4800	0.316	122.1	4.31	35.7	0.0946	43.6	0.231	-67.2
5000	0.326	119.5	4.14	33.0	0.0980	42.1	0.222	-69.8
5200	0.335	117.1	3.99	30.4	0.1022	40.3	0.214	-72.7
5400	0.344	114.8	3.84	27.7	0.1060	38.6	0.205	-75.1
5600	0.352	112.3	3.71	25.1	0.1091	36.9	0.197	-78.1
5800	0.360	110.0	3.58	22.4	0.1129	34.6	0.189	-81.1
6000	0.368	107.7	3.46	19.7	0.1163	33.1	0.180	-83.9

S Parameter

 $(V_{CE} = 3 \text{ V}, I_C = 1 \text{ mA}, Z_O = 50 \Omega)$

f (MHz)	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100	0.985	-3.4	3.17	176.7	0.0066	141.1	0.992	-2.0
200	0.984	-6.7	3.18	173.2	0.0078	80.2	0.998	-3.6
300	0.976	-9.8	3.17	170.1	0.0157	85.7	0.994	-5.5
400	0.977	-13.5	3.18	167.3	0.0172	82.3	0.989	-7.2
500	0.972	-17.0	3.19	164.4	0.0216	74.9	0.985	-9.1
600	0.967	-20.2	3.19	161.6	0.0260	74.7	0.980	-10.8
700	0.962	-23.7	3.16	158.6	0.0313	73.3	0.973	-12.6
800	0.955	-27.0	3.14	155.6	0.0349	70.8	0.966	-14.3
900	0.949	-30.7	3.17	153.7	0.0385	69.3	0.958	-16.0
1000	0.941	-34.2	3.16	150.1	0.0430	65.7	0.951	-17.6
1100	0.931	-37.6	3.16	147.3	0.0471	63.7	0.942	-19.3
1200	0.922	-41.2	3.16	143.8	0.0508	61.6	0.933	-20.9
1300	0.912	-44.7	3.13	141.0	0.0546	59.5	0.924	-22.6
1400	0.903	-48.2	3.11	138.3	0.0581	57.7	0.914	-24.2
1500	0.891	-51.9	3.10	135.4	0.0615	55.2	0.903	-25.9
1600	0.878	-55.7	3.11	132.4	0.0646	53.1	0.893	-27.4
1700	0.868	-59.3	3.08	129.6	0.0674	50.5	0.882	-29.0
1800	0.856	-63.0	3.04	126.7	0.0705	48.5	0.871	-30.5
1900	0.845	-66.7	3.02	124.0	0.0727	46.7	0.861	-32.1
2000	0.832	-70.7	3.01	121.2	0.0752	43.9	0.849	-33.6
2200	0.807	-78.2	2.95	115.5	0.0800	39.7	0.827	-36.7
2400	0.782	-86.0	2.90	110.0	0.0836	35.9	0.802	-39.6
2600	0.758	-93.8	2.84	104.6	0.0868	32.1	0.778	-42.5
2800	0.734	-101.8	2.78	99.2	0.0897	28.7	0.756	-45.2
3000	0.710	-109.7	2.72	93.7	0.0910	25.0	0.734	-47.8
3200	0.690	-117.5	2.64	88.6	0.0921	21.7	0.713	-50.6
3400	0.671	-125.3	2.57	83.5	0.0919	18.5	0.694	-53.2
3600	0.654	-132.9	2.49	78.6	0.0926	15.4	0.673	-55.7
3800	0.639	-140.3	2.41	73.9	0.0911	12.9	0.656	-58.2
4000	0.629	-147.6	2.34	69.2	0.0900	10.7	0.641	-60.6
4200	0.620	-154.9	2.28	64.7	0.0892	8.8	0.625	-63.1
4400	0.613	-161.8	2.20	60.2	0.0881	7.2	0.612	-65.6
4600	0.606	-168.6	2.14	55.9	0.0867	5.8	0.600	-68.0
4800	0.602	-175.1	2.07	51.7	0.0850	3.8	0.587	-70.4
5000	0.600	178.6	2.01	47.6	0.0837	3.4	0.576	-72.8
5200	0.599	172.5	1.95	43.5	0.0820	2.5	0.564	-75.4
5400	0.599	166.8	1.88	39.7	0.0805	2.5	0.554	-77.9
5600	0.599	161.3	1.83	35.9	0.0795	2.3	0.545	-80.3
5800	0.600	155.9	1.78	32.1	0.0785	2.5	0.536	-83.0
6000	0.602	150.7	1.72	28.4	0.0776	3.2	0.527	-85.5

S Parameter

 $(V_{CE} = 3 \text{ V}, I_C = 3 \text{ mA}, Z_O = 50 \Omega)$

f (MHz)	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100	0.956	-4.8	9.00	175.0	0.0038	73.8	0.983	-3.1
200	0.950	-9.8	8.98	170.3	0.0090	76.9	0.993	-5.4
300	0.941	-14.1	8.91	165.9	0.0128	75.5	0.985	-8.0
400	0.930	-19.3	8.85	161.6	0.0183	82.1	0.975	-10.6
500	0.916	-24.1	8.79	157.5	0.0215	77.9	0.965	-13.2
600	0.902	-28.9	8.69	153.5	0.0250	70.8	0.952	-15.5
700	0.886	-33.4	8.50	149.5	0.0294	68.0	0.937	-18.0
800	0.867	-37.9	8.36	145.6	0.0326	65.3	0.919	-20.3
900	0.849	-42.9	8.34	142.4	0.0350	63.0	0.902	-22.4
1000	0.826	-47.4	8.18	138.3	0.0385	61.4	0.882	-24.5
1100	0.804	-52.0	8.02	134.6	0.0419	57.9	0.865	-26.6
1200	0.780	-56.6	7.91	130.7	0.0442	55.6	0.845	-28.5
1300	0.758	-61.1	7.72	127.3	0.0466	54.7	0.826	-30.3
1400	0.736	-65.5	7.54	124.0	0.0484	52.0	0.807	-32.1
1500	0.712	-70.0	7.40	120.6	0.0516	48.9	0.789	-33.8
1600	0.687	-74.6	7.25	117.3	0.0529	48.5	0.769	-35.3
1700	0.665	-78.9	7.07	114.1	0.0547	45.7	0.751	-37.0
1800	0.645	-83.2	6.89	111.1	0.0556	43.6	0.733	-38.3
1900	0.623	-87.5	6.72	108.1	0.0570	42.8	0.716	-39.8
2000	0.602	-92.0	6.56	105.2	0.0591	41.5	0.698	-41.2
2200	0.566	-100.4	6.23	99.6	0.0611	39.0	0.667	-43.7
2400	0.532	-109.0	5.92	94.2	0.0625	36.8	0.637	-46.2
2600	0.503	-117.5	5.63	89.2	0.0650	34.2	0.609	-48.5
2800	0.478	-126.0	5.35	84.4	0.0669	32.8	0.583	-50.7
3000	0.458	-134.2	5.09	79.7	0.0673	31.7	0.562	-52.8
3200	0.442	-142.4	4.84	75.2	0.0688	30.2	0.541	-54.9
3400	0.429	-150.1	4.61	70.9	0.0690	29.5	0.521	-57.1
3600	0.418	-157.8	4.39	66.9	0.0700	28.1	0.503	-59.1
3800	0.411	-164.9	4.19	63.1	0.0708	27.8	0.487	-61.0
4000	0.409	-171.6	4.02	59.2	0.0724	27.4	0.474	-63.2
4200	0.407	-178.3	3.85	55.5	0.0746	26.8	0.461	-65.3
4400	0.408	175.6	3.69	51.9	0.0745	26.6	0.449	-67.5
4600	0.410	169.6	3.55	48.4	0.0766	26.0	0.437	-69.6
4800	0.413	163.9	3.41	44.9	0.0778	25.3	0.427	-71.8
5000	0.417	158.5	3.28	41.5	0.0801	25.3	0.417	-74.1
5200	0.422	153.4	3.17	38.1	0.0817	24.5	0.406	-76.3
5400	0.427	148.7	3.05	34.9	0.0837	24.2	0.397	-78.7
5600	0.433	144.0	2.95	31.6	0.0854	23.6	0.389	-80.9
5800	0.439	139.7	2.86	28.4	0.0873	23.4	0.380	-83.4
6000	0.445	135.4	2.76	25.2	0.0895	22.7	0.372	-85.8

S Parameter

 $(V_{CE} = 3 \text{ V}, I_C = 5 \text{ mA}, Z_O = 50 \Omega)$

f (MHz)	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100	0.930	-6.3	14.29	173.6	0.0045	46.5	0.986	-3.6
200	0.918	-12.3	14.19	167.7	0.0087	92.6	0.985	-6.8
300	0.902	-18.0	13.97	162.2	0.0146	67.7	0.976	-10.2
400	0.883	-24.1	13.74	156.9	0.0156	76.6	0.955	-13.3
500	0.859	-30.0	13.50	151.9	0.0205	68.1	0.938	-16.5
600	0.834	-35.8	13.20	147.1	0.0252	68.1	0.916	-19.2
700	0.809	-41.1	12.77	142.5	0.0265	66.6	0.892	-22.0
800	0.781	-46.5	12.42	138.0	0.0302	62.5	0.866	-24.5
900	0.750	-52.3	12.18	134.0	0.0318	61.0	0.840	-26.7
1000	0.719	-57.3	11.78	129.6	0.0353	59.0	0.815	-28.8
1100	0.688	-62.4	11.39	125.6	0.0373	55.2	0.790	-30.8
1200	0.656	-67.5	11.06	121.6	0.0386	54.0	0.766	-32.6
1300	0.627	-72.2	10.65	117.9	0.0411	53.4	0.742	-34.2
1400	0.600	-76.9	10.26	114.6	0.0436	50.7	0.720	-35.8
1500	0.571	-81.7	9.92	111.2	0.0440	48.5	0.698	-37.3
1600	0.544	-86.5	9.58	107.9	0.0456	47.9	0.678	-38.5
1700	0.522	-90.8	9.24	104.9	0.0475	46.6	0.658	-39.8
1800	0.499	-95.4	8.91	102.0	0.0482	46.0	0.640	-41.0
1900	0.479	-99.9	8.60	99.2	0.0495	45.5	0.622	-42.2
2000	0.458	-104.5	8.31	96.4	0.0505	44.1	0.606	-43.3
2200	0.425	-113.2	7.75	91.3	0.0527	42.6	0.576	-45.4
2400	0.397	-122.1	7.26	86.5	0.0549	41.6	0.548	-47.3
2600	0.374	-130.9	6.81	82.0	0.0571	41.2	0.524	-49.2
2800	0.357	-139.6	6.42	77.7	0.0594	41.0	0.503	-51.1
3000	0.343	-147.9	6.05	73.5	0.0609	39.6	0.482	-52.9
3200	0.335	-156.0	5.71	69.6	0.0629	38.2	0.463	-55.0
3400	0.329	-164.1	5.41	65.8	0.0648	37.3	0.447	-56.8
3600	0.324	-171.3	5.13	62.2	0.0662	36.9	0.431	-58.6
3800	0.323	-178.1	4.88	58.8	0.0686	37.1	0.418	-60.4
4000	0.326	175.5	4.66	55.4	0.0713	36.3	0.407	-62.6
4200	0.330	169.4	4.45	52.0	0.0743	35.8	0.395	-64.6
4400	0.334	163.7	4.26	48.7	0.0761	34.9	0.385	-66.8
4600	0.340	158.4	4.09	45.5	0.0788	34.5	0.374	-68.8
4800	0.346	153.2	3.92	42.4	0.0814	33.3	0.364	-71.3
5000	0.353	148.5	3.77	39.3	0.0838	33.1	0.356	-73.3
5200	0.360	144.0	3.64	36.1	0.0865	31.7	0.345	-75.7
5400	0.367	139.9	3.50	33.1	0.0893	31.0	0.337	-78.1
5600	0.375	135.8	3.38	30.1	0.0917	29.9	0.329	-80.4
5800	0.382	131.9	3.27	27.1	0.0937	28.6	0.320	-82.8
6000	0.390	128.2	3.16	24.1	0.0979	27.7	0.311	-85.2

S Parameter

 $(V_{CE} = 3 \text{ V}, I_C = 7 \text{ mA}, Z_O = 50 \Omega)$

f (MHz)	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100	0.913	-7.3	19.12	172.4	0.0032	73.7	0.978	-4.6
200	0.890	-14.4	18.86	165.5	0.0089	71.7	0.980	-8.2
300	0.868	-21.3	18.41	159.1	0.0164	70.1	0.962	-12.0
400	0.841	-28.3	17.93	153.0	0.0171	77.0	0.938	-15.5
500	0.809	-35.0	17.43	147.3	0.0193	68.4	0.911	-19.0
600	0.772	-41.6	16.85	141.9	0.0226	65.1	0.880	-22.0
700	0.739	-47.4	16.13	136.9	0.0258	63.5	0.849	-24.8
800	0.702	-53.3	15.50	132.0	0.0281	60.6	0.817	-27.2
900	0.665	-59.5	14.95	127.6	0.0295	57.2	0.786	-29.4
1000	0.628	-64.8	14.30	123.1	0.0314	57.9	0.757	-31.3
1100	0.594	-70.1	13.65	119.1	0.0344	55.6	0.730	-33.1
1200	0.558	-75.3	13.09	115.1	0.0356	53.3	0.704	-34.6
1300	0.528	-80.2	12.48	111.5	0.0372	52.9	0.679	-36.0
1400	0.500	-85.0	11.92	108.2	0.0391	52.3	0.658	-37.3
1500	0.472	-89.8	11.41	105.0	0.0405	50.3	0.635	-38.6
1600	0.447	-94.6	10.93	102.0	0.0419	49.8	0.616	-39.5
1700	0.425	-99.1	10.46	99.1	0.0434	48.6	0.597	-40.6
1800	0.405	-103.7	10.03	96.4	0.0442	48.0	0.580	-41.6
1900	0.386	-108.2	9.62	93.8	0.0449	48.7	0.564	-42.5
2000	0.370	-113.0	9.25	91.3	0.0466	47.9	0.549	-43.5
2200	0.342	-121.9	8.56	86.6	0.0494	46.6	0.522	-45.2
2400	0.319	-131.1	7.96	82.1	0.0514	45.6	0.498	-46.9
2600	0.302	-140.0	7.43	78.0	0.0536	44.0	0.475	-48.8
2800	0.291	-149.0	6.96	74.1	0.0561	45.1	0.456	-50.4
3000	0.283	-157.4	6.54	70.3	0.0596	44.2	0.440	-52.1
3200	0.280	-165.5	6.17	66.6	0.0621	43.8	0.423	-54.0
3400	0.279	-173.5	5.83	63.0	0.0638	42.8	0.407	-55.9
3600	0.278	179.2	5.51	59.7	0.0661	42.3	0.392	-57.5
3800	0.280	172.9	5.23	56.6	0.0691	42.6	0.382	-59.4
4000	0.285	167.2	4.99	53.3	0.0717	41.5	0.371	-61.6
4200	0.291	161.4	4.76	50.2	0.0750	40.2	0.361	-63.7
4400	0.299	156.0	4.56	47.1	0.0775	39.3	0.351	-65.9
4600	0.307	151.2	4.37	44.1	0.0804	37.9	0.341	-68.1
4800	0.313	146.7	4.19	41.1	0.0842	37.4	0.332	-70.4
5000	0.322	142.3	4.03	38.1	0.0867	36.2	0.323	-72.5
5200	0.330	138.2	3.88	35.1	0.0901	35.1	0.314	-75.0
5400	0.338	134.5	3.74	32.2	0.0927	33.7	0.305	-77.4
5600	0.346	130.8	3.61	29.3	0.0952	32.5	0.296	-79.7
5800	0.354	127.3	3.49	26.4	0.0987	31.4	0.287	-82.3
6000	0.362	123.9	3.38	23.6	0.1023	30.0	0.279	-84.7

S Parameter

(V_{CE} = 3 V, I_C = 10 mA, Z_O = 50 Ω)

f (MHz)	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100	0.869	-9.2	25.72	170.8	0.0029	161.5	0.979	-6.0
200	0.847	-17.6	25.14	162.6	0.0068	89.6	0.971	-9.8
300	0.814	-25.7	24.24	155.0	0.0133	71.1	0.942	-14.3
400	0.778	-33.9	23.28	148.1	0.0152	73.5	0.906	-18.2
500	0.732	-41.5	22.26	141.5	0.0180	67.2	0.870	-21.9
600	0.686	-48.8	21.13	135.5	0.0209	64.6	0.830	-24.9
700	0.645	-55.3	19.92	130.1	0.0231	63.0	0.791	-27.6
800	0.601	-61.5	18.82	125.0	0.0250	59.1	0.755	-29.8
900	0.558	-67.8	17.81	120.4	0.0271	57.3	0.723	-31.6
1000	0.520	-73.2	16.80	116.1	0.0295	57.6	0.691	-33.2
1100	0.486	-78.5	15.83	112.2	0.0308	56.0	0.663	-34.6
1200	0.452	-83.8	14.98	108.5	0.0319	54.4	0.637	-35.8
1300	0.422	-88.7	14.14	105.1	0.0339	54.4	0.614	-36.9
1400	0.397	-93.6	13.40	102.0	0.0350	55.5	0.592	-37.9
1500	0.373	-98.4	12.72	99.1	0.0366	54.1	0.574	-38.9
1600	0.351	-103.3	12.09	96.3	0.0382	53.1	0.555	-39.5
1700	0.332	-107.9	11.51	93.7	0.0397	52.1	0.540	-40.4
1800	0.315	-112.8	10.98	91.2	0.0401	52.0	0.524	-41.1
1900	0.300	-117.5	10.49	88.9	0.0419	51.5	0.510	-41.9
2000	0.287	-122.3	10.04	86.6	0.0435	52.4	0.497	-42.7
2200	0.266	-131.7	9.24	82.3	0.0464	51.1	0.474	-44.2
2400	0.251	-141.4	8.55	78.3	0.0490	51.3	0.453	-45.8
2600	0.241	-150.6	7.95	74.5	0.0520	50.4	0.433	-47.3
2800	0.235	-159.8	7.42	70.9	0.0554	49.7	0.418	-48.9
3000	0.233	-168.4	6.96	67.4	0.0580	49.0	0.401	-50.5
3200	0.235	-176.3	6.54	64.0	0.0613	47.8	0.388	-52.6
3400	0.238	176.0	6.18	60.7	0.0641	47.2	0.374	-54.3
3600	0.241	169.1	5.84	57.6	0.0668	46.7	0.361	-55.9
3800	0.246	163.4	5.54	54.6	0.0705	46.2	0.350	-57.8
4000	0.255	158.2	5.28	51.6	0.0737	45.0	0.341	-60.0
4200	0.261	153.0	5.03	48.6	0.0770	43.8	0.331	-62.4
4400	0.270	148.1	4.81	45.7	0.0806	42.6	0.321	-64.5
4600	0.279	144.0	4.61	42.8	0.0838	41.7	0.313	-66.9
4800	0.288	139.9	4.42	40.0	0.0860	40.5	0.303	-69.1
5000	0.297	136.1	4.25	37.1	0.0901	39.0	0.294	-71.6
5200	0.306	132.5	4.10	34.3	0.0929	37.6	0.286	-74.0
5400	0.314	129.0	3.95	31.5	0.0967	36.4	0.276	-76.4
5600	0.323	125.8	3.81	28.7	0.0999	34.5	0.269	-78.8
5800	0.331	122.7	3.68	25.9	0.1027	33.1	0.260	-81.4
6000	0.340	119.6	3.56	23.1	0.1058	31.5	0.252	-83.8

S Parameter

(V_{CE} = 3 V, I_C = 20 mA, Z_O = 50 Ω)

f (MHz)	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100	0.769	-12.9	41.99	167.0	0.0051	69.9	0.940	-7.1
200	0.725	-25.6	39.96	155.7	0.0062	87.4	0.935	-13.7
300	0.670	-36.9	37.11	145.6	0.0097	72.9	0.877	-19.1
400	0.610	-47.0	34.14	136.9	0.0138	74.3	0.820	-23.3
500	0.546	-56.0	31.17	129.3	0.0172	66.1	0.765	-26.8
600	0.492	-63.9	28.37	122.9	0.0174	63.0	0.716	-28.9
700	0.443	-70.9	25.84	117.5	0.0200	61.9	0.673	-30.8
800	0.401	-77.4	23.62	112.6	0.0216	60.1	0.637	-32.0
900	0.363	-83.4	21.71	108.5	0.0226	60.9	0.604	-33.0
1000	0.331	-89.0	20.03	104.8	0.0249	60.8	0.578	-33.9
1100	0.305	-94.9	18.55	101.4	0.0258	59.1	0.554	-34.5
1200	0.280	-100.1	17.26	98.4	0.0274	59.7	0.533	-35.0
1300	0.259	-105.2	16.11	95.6	0.0289	60.4	0.515	-35.6
1400	0.241	-110.7	15.10	93.0	0.0310	61.0	0.500	-36.1
1500	0.226	-115.9	14.21	90.6	0.0330	60.1	0.485	-36.6
1600	0.213	-121.4	13.40	88.3	0.0344	59.7	0.472	-37.0
1700	0.202	-126.8	12.68	86.1	0.0354	60.6	0.461	-37.6
1800	0.194	-132.4	12.04	84.1	0.0378	59.3	0.450	-38.1
1900	0.187	-137.9	11.45	82.1	0.0392	60.2	0.440	-38.8
2000	0.181	-143.6	10.91	80.2	0.0414	59.6	0.430	-39.3
2200	0.174	-154.2	9.98	76.5	0.0442	58.6	0.413	-40.7
2400	0.172	-164.2	9.19	73.1	0.0477	58.6	0.398	-42.1
2600	0.173	-173.6	8.51	69.8	0.0515	56.9	0.381	-43.6
2800	0.177	177.6	7.93	66.6	0.0554	56.0	0.369	-45.5
3000	0.183	170.2	7.42	63.5	0.0582	54.8	0.356	-47.1
3200	0.192	163.2	6.96	60.5	0.0624	53.8	0.343	-49.2
3400	0.201	157.3	6.56	57.5	0.0656	53.6	0.332	-51.0
3600	0.208	151.7	6.19	54.7	0.0686	52.0	0.321	-52.8
3800	0.215	146.9	5.87	52.0	0.0719	50.9	0.312	-55.0
4000	0.225	143.1	5.60	49.2	0.0762	49.9	0.303	-57.3
4200	0.235	139.4	5.33	46.5	0.0801	48.1	0.294	-59.6
4400	0.245	135.8	5.10	43.7	0.0838	46.3	0.285	-62.0
4600	0.255	132.4	4.89	41.0	0.0869	45.2	0.276	-64.4
4800	0.264	129.3	4.69	38.4	0.0904	43.1	0.268	-66.9
5000	0.274	126.2	4.50	35.7	0.0947	42.3	0.259	-69.3
5200	0.284	123.5	4.34	33.0	0.0981	40.2	0.250	-71.9
5400	0.292	120.6	4.18	30.3	0.1019	38.7	0.242	-74.5
5600	0.301	118.1	4.04	27.7	0.1048	37.1	0.234	-77.0
5800	0.310	115.5	3.90	25.0	0.1079	35.3	0.225	-79.6
6000	0.319	113.0	3.77	22.3	0.1120	33.7	0.217	-82.2

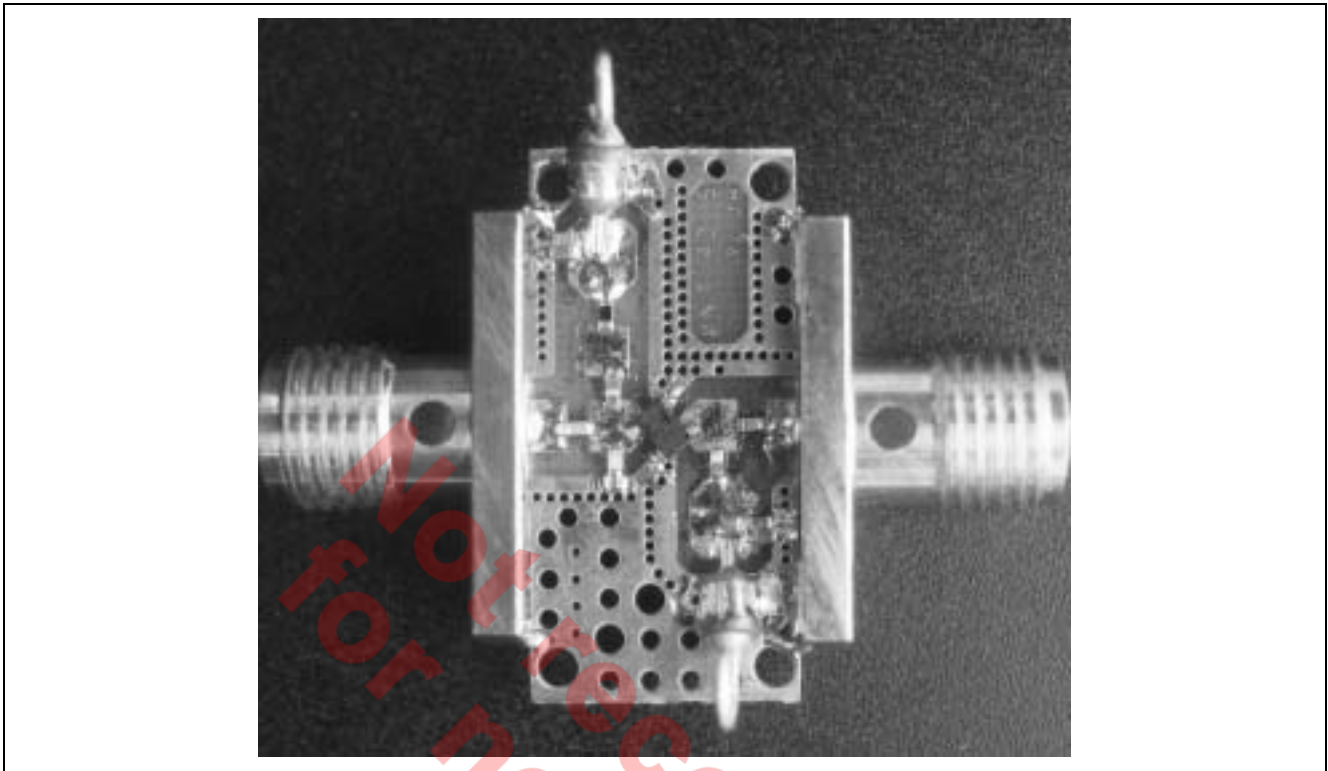
S Parameter

(V_{CE} = 3 V, I_C = 30 mA, Z_O = 50 Ω)

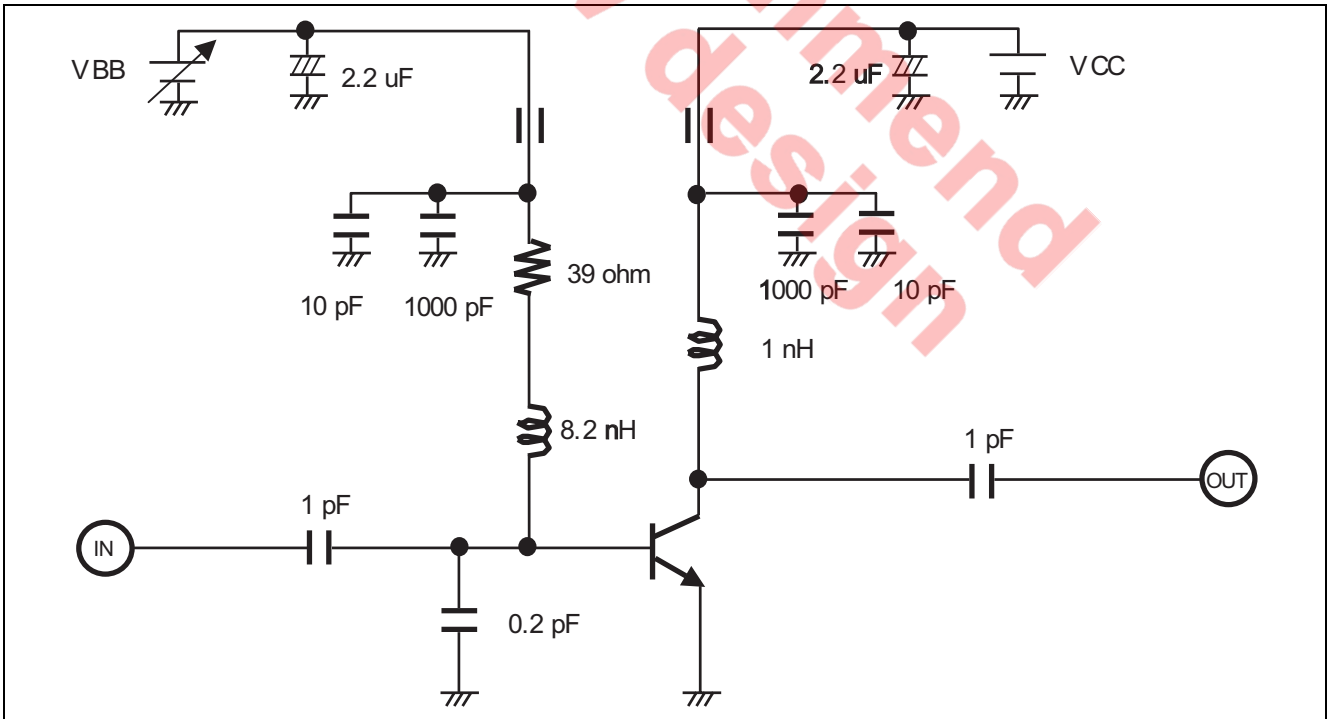
f (MHz)	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100	0.660	-18.4	50.17	164.6	0.0059	144.0	0.926	-10.0
200	0.619	-33.3	47.07	151.0	0.0078	69.5	0.897	-15.9
300	0.551	-46.2	42.69	139.5	0.0105	59.6	0.826	-21.5
400	0.487	-57.6	38.24	130.3	0.0127	68.2	0.757	-25.3
500	0.428	-67.1	34.07	122.6	0.0143	66.2	0.700	-28.0
600	0.377	-75.4	30.40	116.5	0.0162	65.2	0.651	-29.6
700	0.337	-82.8	27.27	111.4	0.0180	63.2	0.610	-30.7
800	0.301	-89.6	24.65	107.0	0.0199	63.8	0.577	-31.5
900	0.273	-96.0	22.44	103.2	0.0212	62.9	0.550	-32.0
1000	0.248	-102.6	20.55	99.9	0.0221	64.8	0.527	-32.3
1100	0.228	-108.8	18.93	96.9	0.0247	62.0	0.507	-32.8
1200	0.211	-115.2	17.54	94.1	0.0250	64.0	0.491	-33.1
1300	0.198	-120.4	16.31	91.6	0.0285	63.4	0.476	-33.5
1400	0.186	-126.8	15.25	89.3	0.0303	63.6	0.464	-33.8
1500	0.177	-133.0	14.31	87.1	0.0316	63.8	0.451	-34.4
1600	0.170	-139.0	13.47	85.0	0.0336	64.8	0.441	-34.6
1700	0.165	-144.9	12.73	83.0	0.0351	63.0	0.432	-35.2
1800	0.161	-151.1	12.06	81.1	0.0363	62.4	0.422	-35.7
1900	0.158	-156.5	11.46	79.3	0.0386	63.1	0.414	-36.4
2000	0.158	-162.3	10.91	77.5	0.0405	63.0	0.406	-37.0
2200	0.159	-172.3	9.96	74.1	0.0441	62.0	0.391	-38.3
2400	0.163	178.5	9.16	70.9	0.0476	61.1	0.377	-40.0
2600	0.170	170.7	8.48	67.7	0.0520	60.8	0.364	-41.6
2800	0.178	163.4	7.89	64.7	0.0554	59.7	0.352	-43.1
3000	0.187	157.5	7.38	61.8	0.0593	57.1	0.340	-45.0
3200	0.197	152.0	6.93	58.8	0.0628	56.7	0.328	-47.1
3400	0.208	147.1	6.52	55.9	0.0666	55.1	0.317	-49.3
3600	0.216	142.6	6.16	53.2	0.0695	53.7	0.306	-51.0
3800	0.224	138.8	5.84	50.7	0.0731	52.7	0.299	-53.1
4000	0.235	135.8	5.56	47.9	0.0775	51.4	0.290	-55.7
4200	0.245	132.5	5.30	45.3	0.0812	49.5	0.281	-57.9
4400	0.254	129.5	5.06	42.6	0.0849	48.3	0.273	-60.6
4600	0.265	126.8	4.85	40.0	0.0887	46.3	0.264	-63.0
4800	0.274	124.1	4.65	37.3	0.0922	44.8	0.256	-65.4
5000	0.283	121.4	4.47	34.7	0.0957	43.2	0.247	-67.9
5200	0.292	119.1	4.30	32.0	0.0996	41.5	0.238	-70.6
5400	0.301	116.6	4.15	29.4	0.1036	39.7	0.230	-73.2
5600	0.310	114.1	4.01	26.8	0.1066	37.9	0.222	-75.8
5800	0.319	111.8	3.87	24.2	0.1104	35.8	0.213	-78.3
6000	0.328	109.5	3.74	21.5	0.1138	34.2	0.204	-81.1

HSG1001 5.8GHz Evaluation Board

Evaluation Board Pattern Layout



Circuit

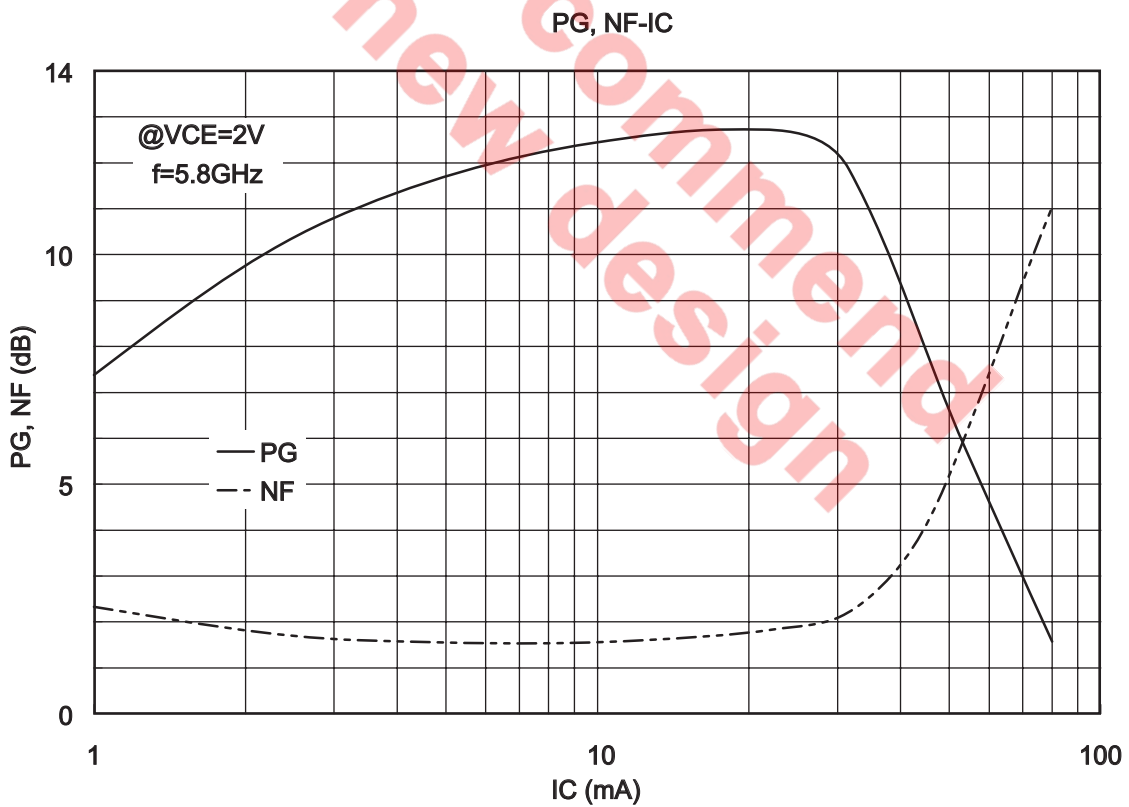
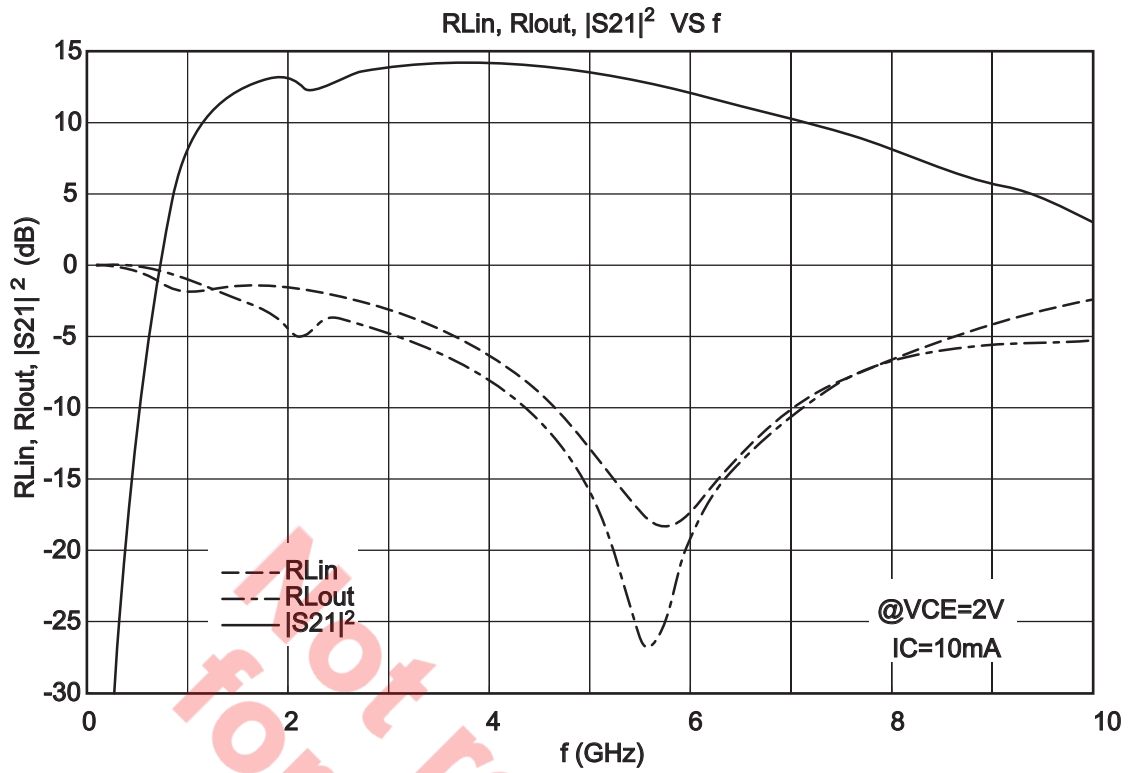


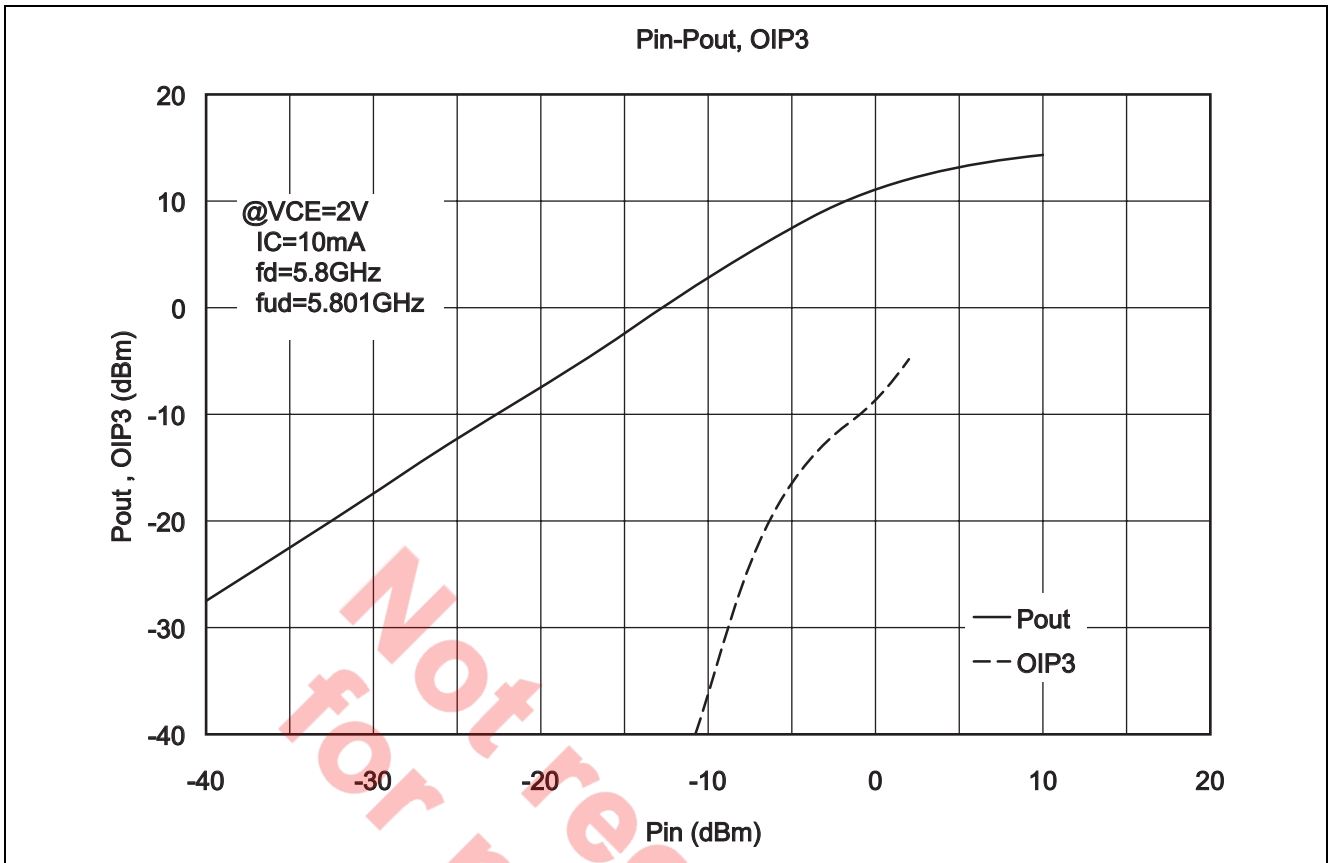
Electrical Characteristics on Evaluation Board

(VCC = 2V, IC = 10mA, Ta = 25°C)

Item	Symbol	Data	Unit	Test Condition
Noise Figure	NF	1.55	dB	f = 5.8GHz
Power Gain	PG	12.5	dB	f = 5.8GHz
Input Return Loss	RLin	18.4	dB	f = 5.8GHz
Output Return Loss	RLout	23.3	dB	f = 5.8GHz
1dB Gain Compression	P1dB	+10.5	dBm	f = 5.8GHz
Third order intercept point	OIP3	+24	dBm	fd = 5.8GHz, fud = 5.801GHz

Not recommend
for new design

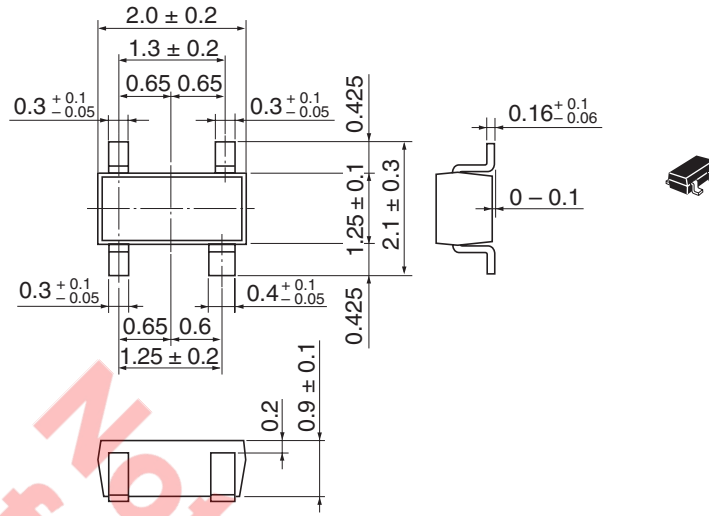




Not recommended for new design

Package Dimensions

As of January, 2003
Unit: mm



Package Code	CMPAK-4(T)
JEDEC	—
JEITA	Conforms
Mass (reference value)	0.006 g

Ordering Information

Part Name	Quantity	Shipping Container
HSG1001VD-	3000 pcs	φ178 mm Taping Reel

Note: For some grades, production may be terminated. Please contact the Renesas sales office to check the state of production before ordering the product.

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