HSG1001

SiGeHBT
High Frequency Low Noise Amplifier

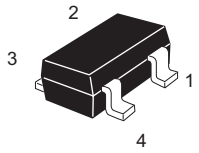
REJ03G0195-0100Z
Rev.1.00
Apr.08.2004

Features

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

Outline

CMPAK-4



1. Emitter
2. Collector
3. Emitter
4. Base

Note: Marking is "VD-".

Absolute Maximum Ratings

(Ta = 25°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	Pc	100	mW
	Pc[Note1]	250	mW
Junction temperature	Tj	150	°C
Storage temperature	Tstg	–55 to +150	°C

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

Electrical Characteristics

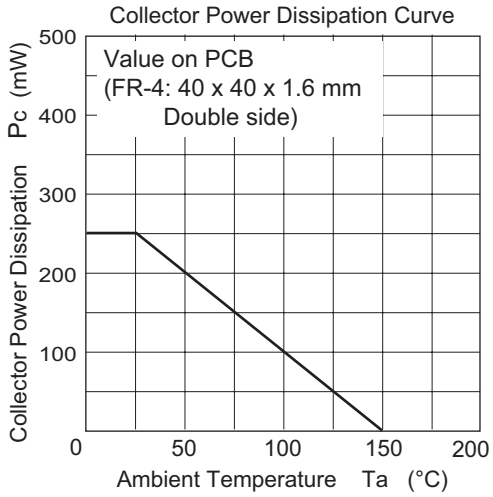
(Ta = 25°C)

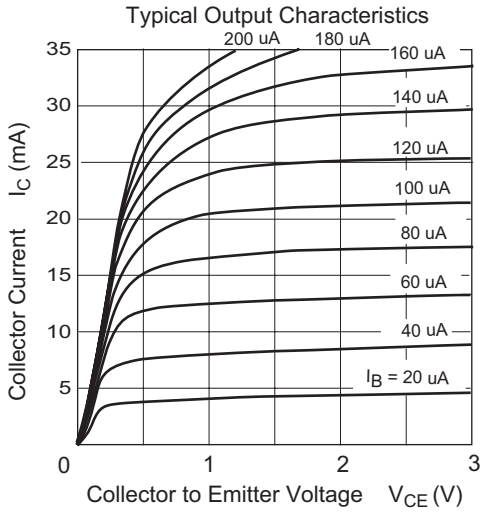
Item	Symbol	Min	Typ	Max	Unit	Test conditions
DC current transfer ratio	h_{FE}	100	200	300	—	V_{CE} = 2 V, I_C = 5 mA
Reverse Transfer Capacitance	C_{re}	—	0.08	—	pF	V_{CB} = 2 V, I_E = 0, f = 1 MHz
Transition Frequency	f_T	—	35	—	GHz	V_{CE} = 2 V, I_C = fT peak, f = 1 GHz
Insertion power gain	$\|S21\|^2$	—	19	—	dB	V_{CE} = 2 V, I_C = 5 mA, f = 1.8 GHz
		—	17	—		V_{CE} = 2 V, I_C = 5 mA, f = 2.4 GHz
		—	11	—		V_{CE} = 2 V, I_C = 10 mA, f = 5.8 GHz
Maximum Stable Gain[Note1]	MSG	—	22	—	dB	V_{CE} = 2 V, I_C = 5 mA, f = 1.8 GHz
		—	21	—		V_{CE} = 2 V, I_C = 5 mA, f = 2.4 GHz
		—	15	—		V_{CE} = 2 V, I_C = 10 mA, f = 5.8 GHz
Power Gain	PG	—	19.5	—	dB	V_{CE} = 2 V, I_C = 5 mA, f = 1.8 GHz
		—	18	—		V_{CE} = 2 V, I_C = 5 mA, f = 2.4 GHz
		8.5	11.5	—		V_{CE} = 2 V, I_C = 10 mA, f = 5.8 GHz
Noise figure	NF	—	0.75	—	dB	V_{CE} = 2 V, I_C = 5 mA, f = 1.8 GHz
		—	0.85	—		V_{CE} = 2 V, I_C = 5 mA, f = 2.4 GHz
		—	1.3	1.9		V_{CE} = 2 V, I_C = 10 mA, f = 5.8 GHz
Maximum Available Gain[Note2]	MAG	—	13	—	dB	V_{CE} = 2 V, I_C = 10 mA, f = 5.8 GHz

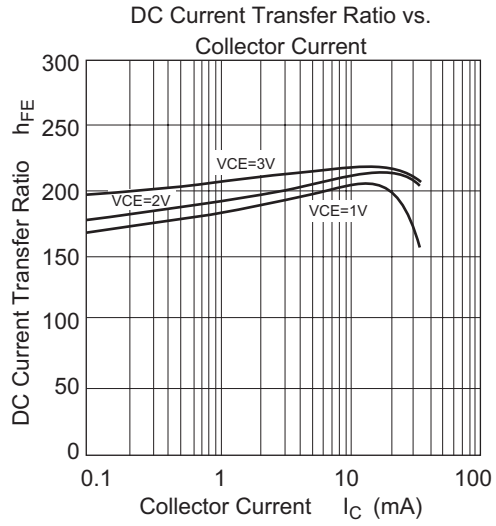
Notes: 1. MSG = $|S_{21}| / |S_{12}|$

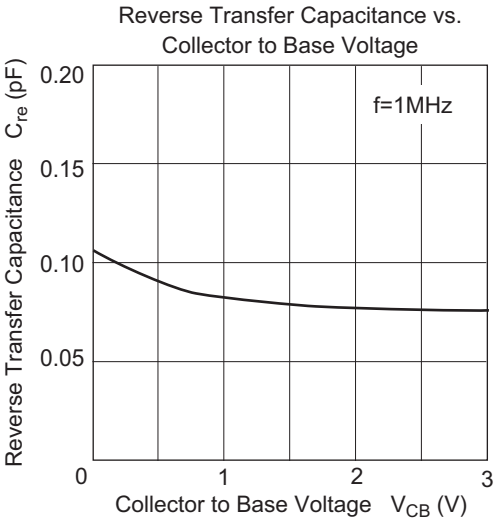
2. MAG = $|S_{21}| / |S_{12}|(K-(K^2-1)^{1/2})$

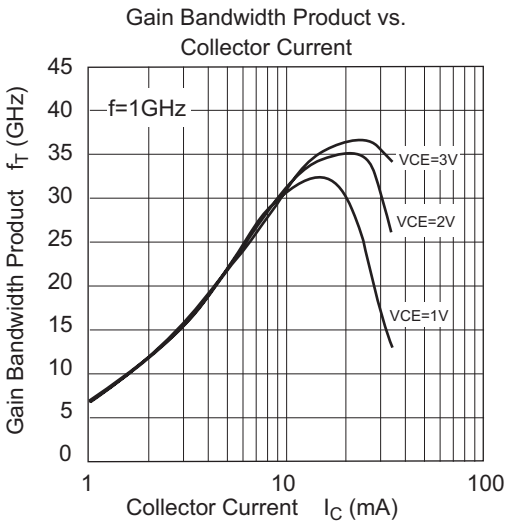
Main Characteristics

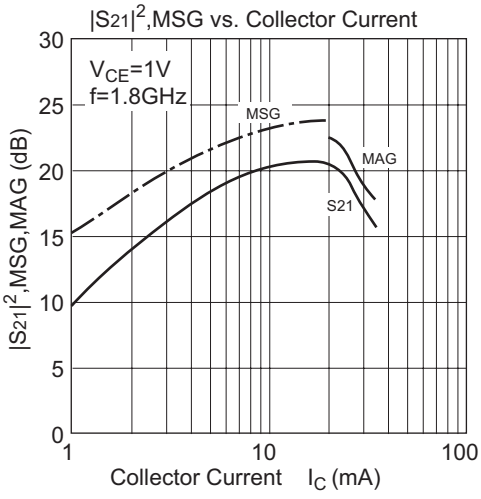


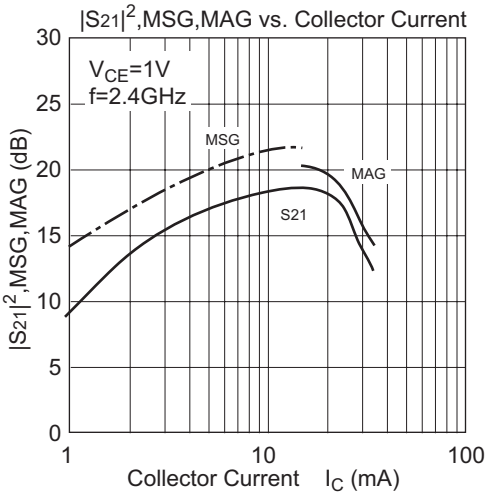


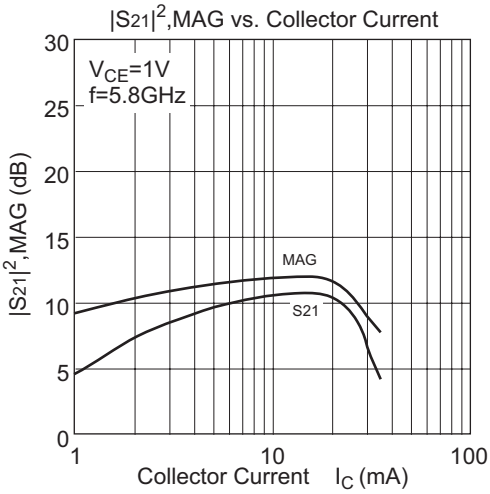


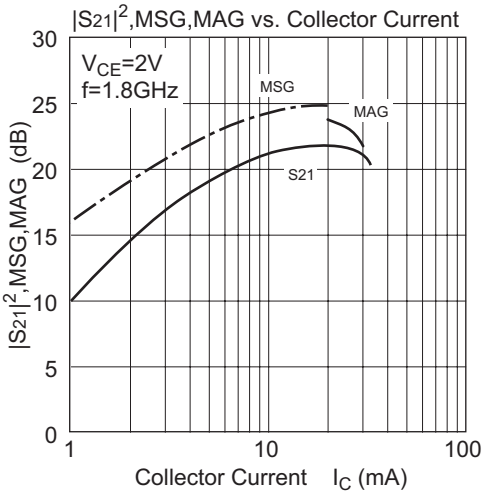


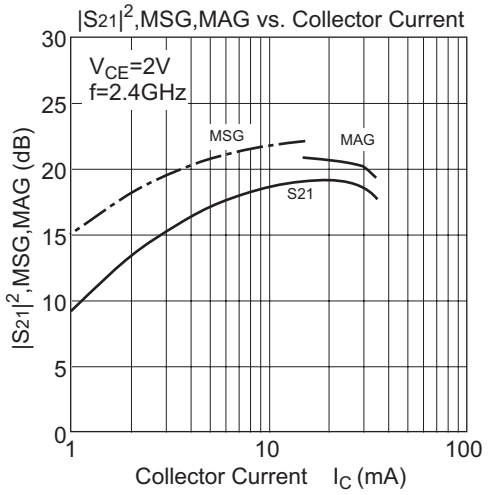


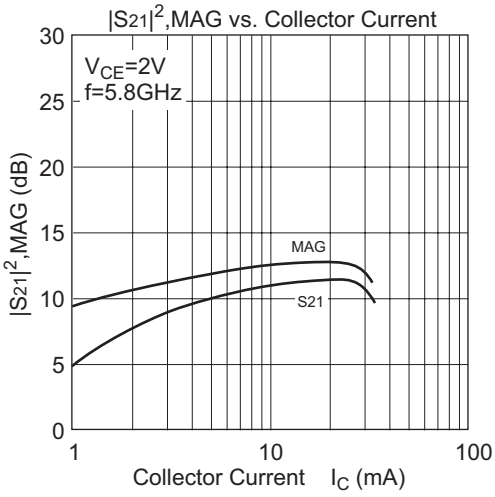


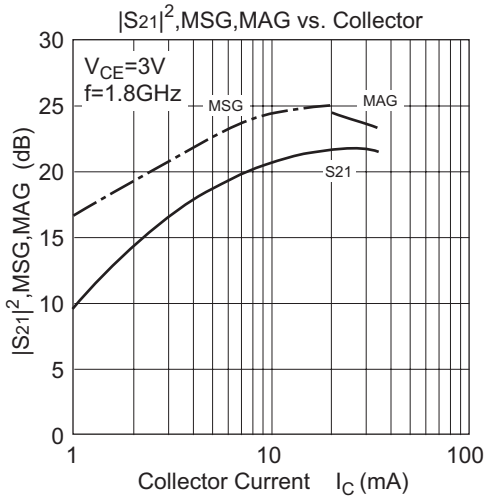

|S21|2,MSG,MAG vs. Collector Current
VCE=1V
f=2.4GHz
MSG
MAG
S21
|S21|2,MSG,MAG (dB)
Collector Current IC (mA)

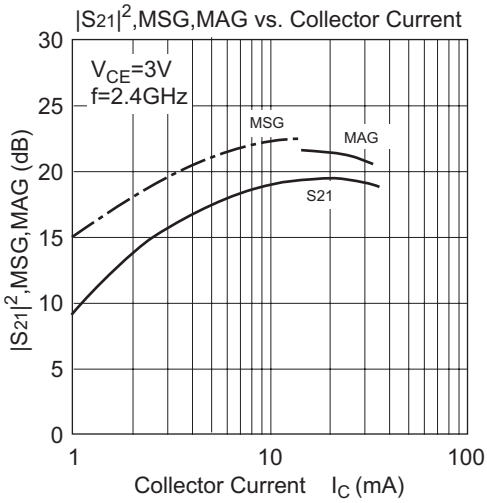

|S21|2,MAG vs. Collector Current
VCE=1V
f=5.8GHz
MAG
S21
|S21|2,MAG (dB)
Collector Current IC (mA)

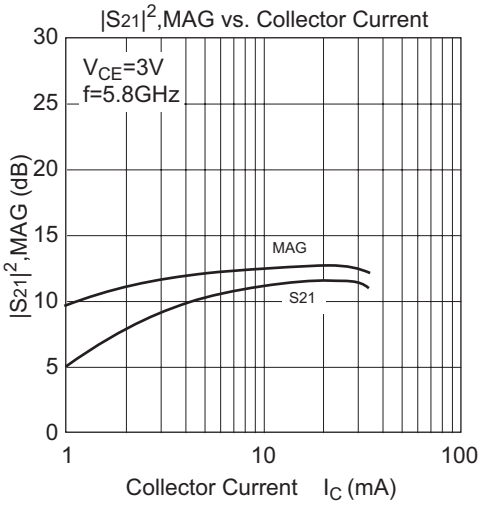

|S21|2,MSG,MAG vs. Collector Current
VCE=2V
f=1.8GHz
MSG
MAG
S21
|S21|2,MSG,MAG (dB)
Collector Current IC (mA)

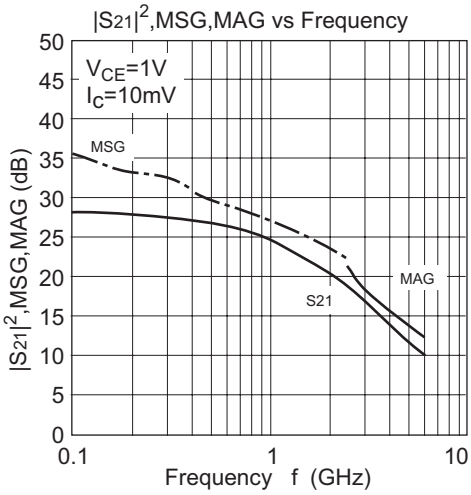

|S21|2,MSG,MAG vs. Collector Current
VCE=2V
f=2.4GHz
MSG
MAG
S21
|S21|2,MSG,MAG (dB)
Collector Current IC (mA)

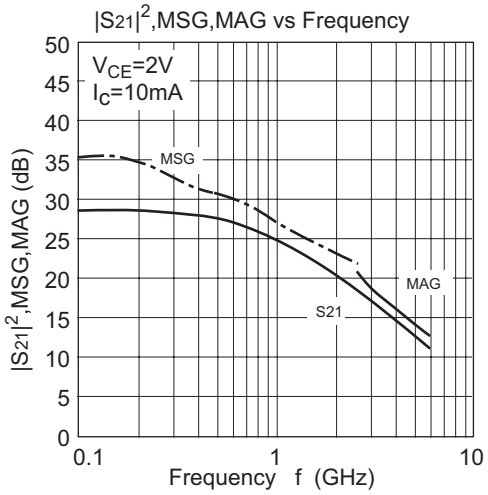

|S21|2,MAG vs. Collector Current
VCE=2V
f=5.8GHz
MAG
S21
|S21|2,MAG (dB)
Collector Current IC (mA)

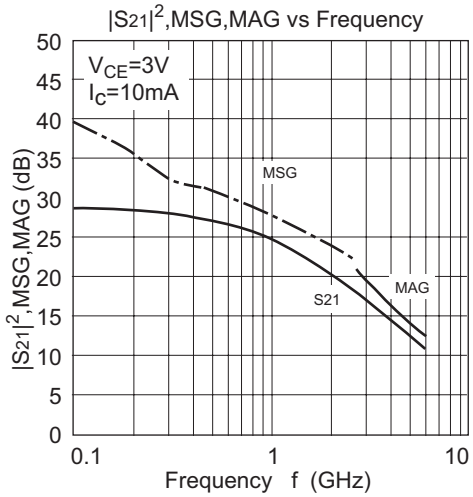

|S21|2,MSG,MAG vs. Collector
VCE=3V
f=1.8GHz
MSG
MAG
S21
|S21|2,MSG,MAG (dB)
Collector Current IC (mA)


|S21|2,MSG,MAG vs. Collector Current
VCE=3V
f=2.4GHz
MSG
MAG
S21
|S21|2,MSG,MAG (dB)
Collector Current IC (mA)

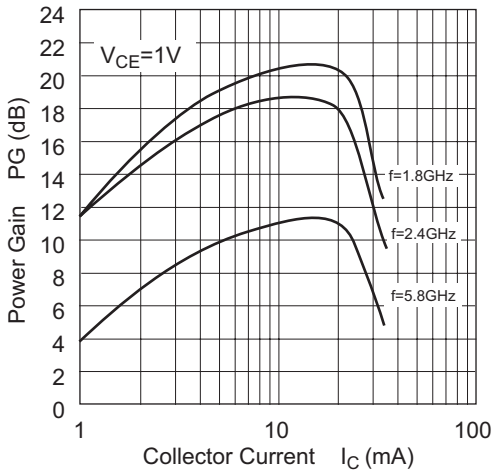

|S21|2,MAG vs. Collector Current
VCE=3V
f=5.8GHz
MAG
S21
|S21|2,MAG (dB)
Collector Current IC (mA)


|S21|2,MSG,MAG vs Frequency
VCE=1V
IC=10mV
MSG
MAG
S21
|S21|2,MSG,MAG (dB)
Frequency f (GHz)

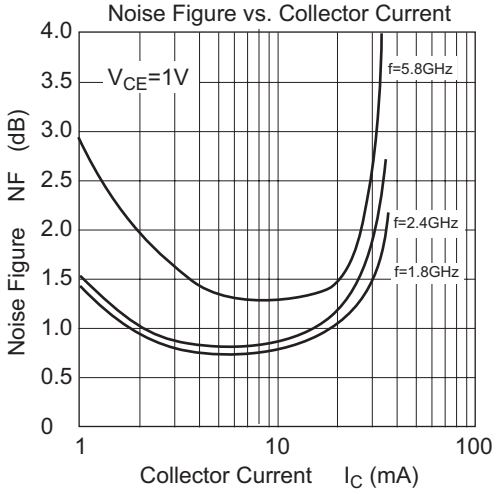

|S21|2,MSG,MAG vs Frequency
VCE=2V
IC=10mA
MSG
MAG
S21
|S21|2,MSG,MAG (dB)
Frequency f (GHz)


|S21|2,MSG,MAG vs Frequency
VCE=3V
IC=10mA
MSG
MAG
S21
|S21|2,MSG,MAG (dB)
Frequency f (GHz)

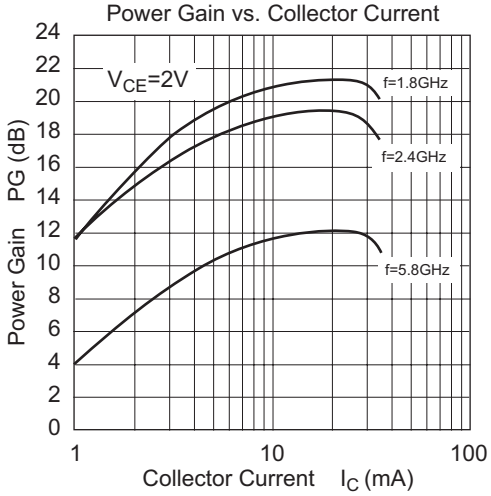
Power Gain vs. Collector Current



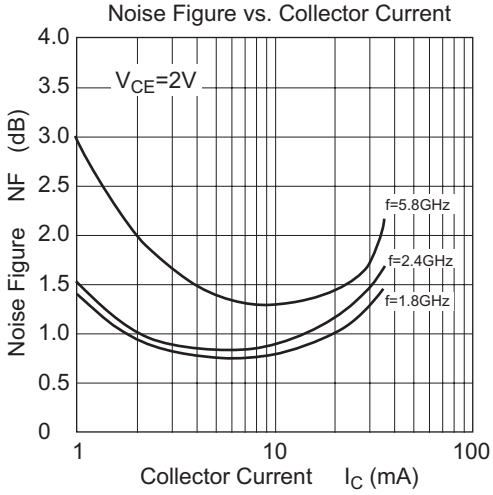
Noise Figure vs. Collector Current



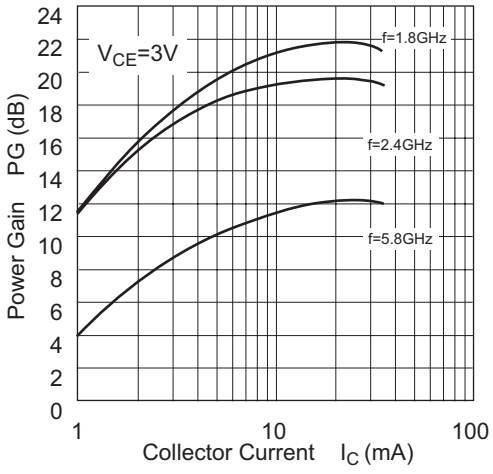
Power Gain vs. Collector Current



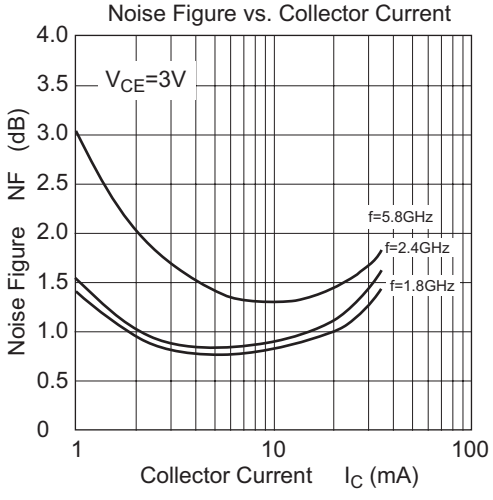
Noise Figure vs. Collector Current

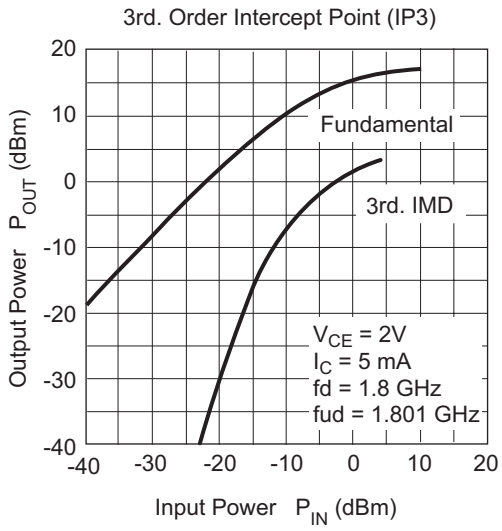


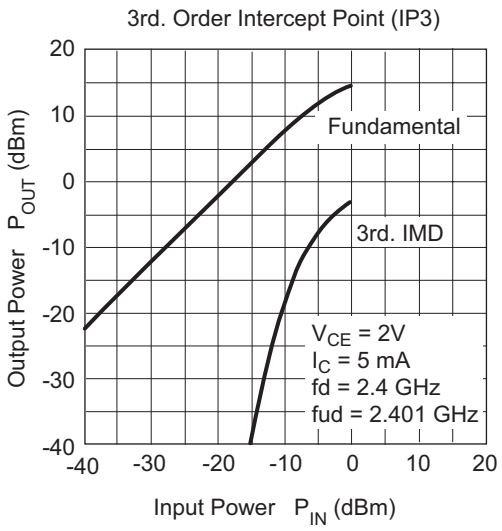
Power Gain vs. Collector Current

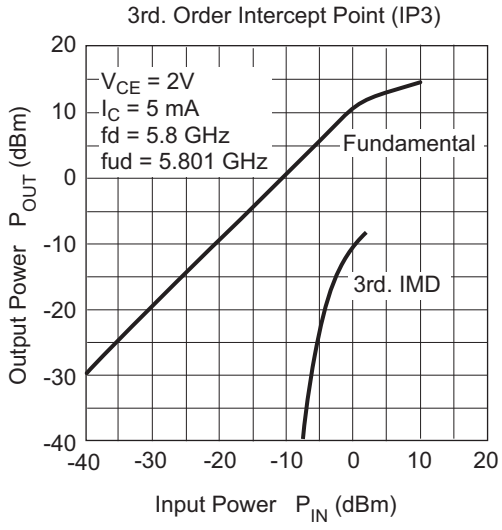


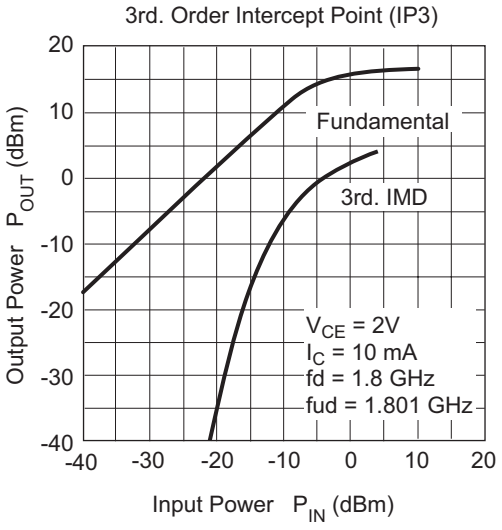
Noise Figure vs. Collector Current

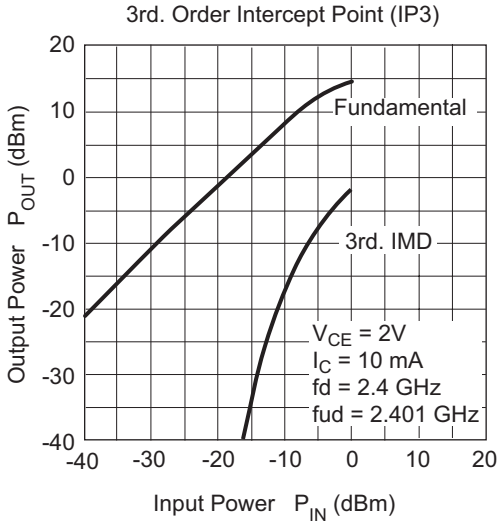


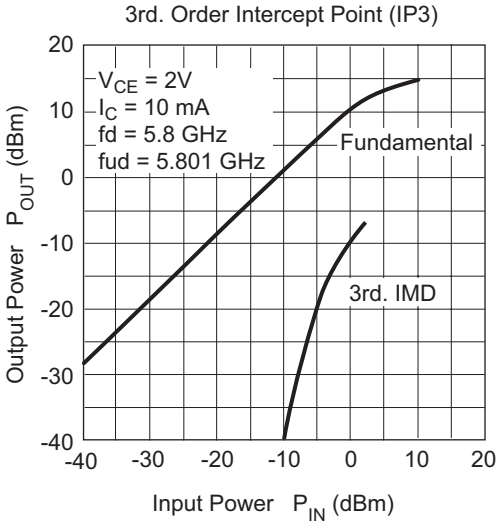

3rd. Order Intercept Point (IP3)
Output Power P_{OUT} (dBm)
Input Power P_{IN} (dBm)
Fundamental
3rd. IMD
V_{CE} = 2V
I_C = 5 mA
fd = 1.8 GHz
fud = 1.801 GHz

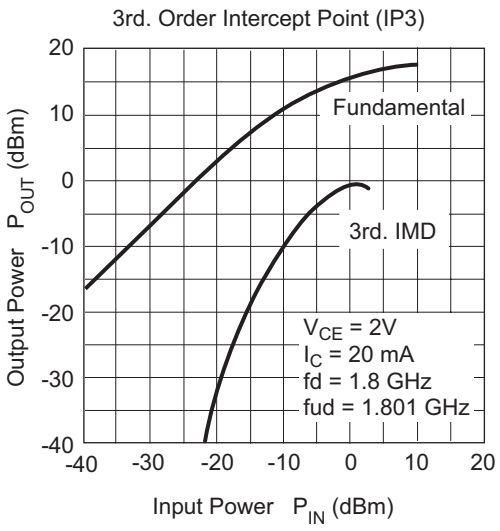

3rd. Order Intercept Point (IP3)
Output Power P_{OUT} (dBm)
Input Power P_{IN} (dBm)
Fundamental
3rd. IMD
V_{CE} = 2V
I_C = 5 mA
fd = 2.4 GHz
fud = 2.401 GHz

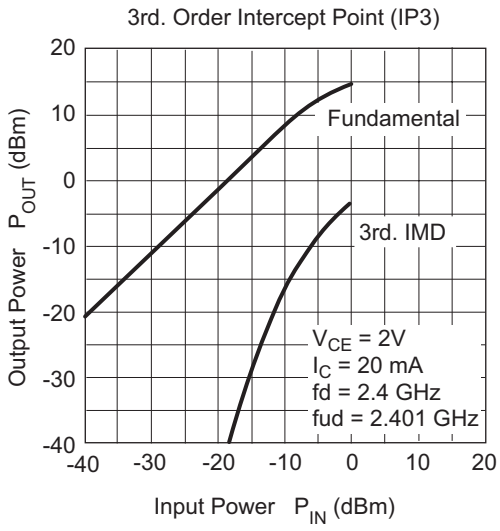

3rd. Order Intercept Point (IP3)
Output Power P_{OUT} (dBm)
Input Power P_{IN} (dBm)
V_{CE} = 2V
I_C = 5 mA
fd = 5.8 GHz
fud = 5.801 GHz
Fundamental
3rd. IMD

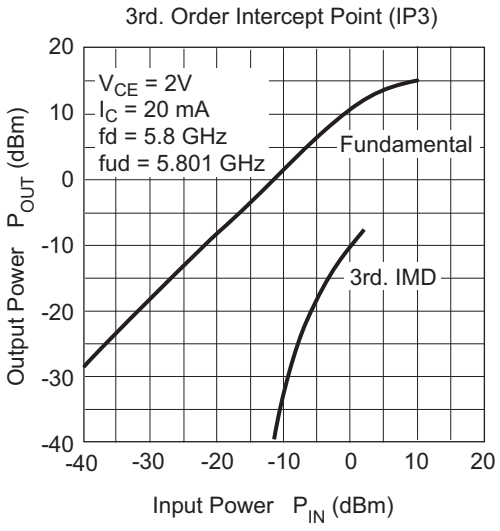

3rd. Order Intercept Point (IP3)
Output Power P_{OUT} (dBm)
Input Power P_{IN} (dBm)
Fundamental
3rd. IMD
V_{CE} = 2V
I_C = 10 mA
fd = 1.8 GHz
fud = 1.801 GHz


3rd. Order Intercept Point (IP3)
Output Power P_{OUT} (dBm)
Input Power P_{IN} (dBm)
Fundamental
3rd. IMD
V_{CE} = 2V
I_C = 10 mA
fd = 2.4 GHz
fud = 2.401 GHz

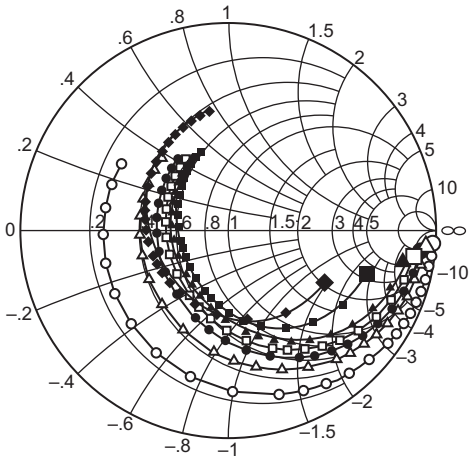

3rd. Order Intercept Point (IP3)
Output Power P_{OUT} (dBm)
Input Power P_{IN} (dBm)
V_{CE} = 2V
I_C = 10 mA
fd = 5.8 GHz
fud = 5.801 GHz
Fundamental
3rd. IMD


3rd. Order Intercept Point (IP3)
Output Power P_{OUT} (dBm)
Input Power P_{IN} (dBm)
Fundamental
3rd. IMD
V_{CE} = 2V
I_C = 20 mA
fd = 1.8 GHz
fud = 1.801 GHz


3rd. Order Intercept Point (IP3)
Output Power P_{OUT} (dBm)
Input Power P_{IN} (dBm)
Fundamental
3rd. IMD
V_{CE} = 2V
I_C = 20 mA
fd = 2.4 GHz
fud = 2.401 GHz


3rd. Order Intercept Point (IP3)
Output Power P_{OUT} (dBm)
Input Power P_{IN} (dBm)
V_{CE} = 2V
I_C = 20 mA
fd = 5.8 GHz
fud = 5.801 GHz
Fundamental
3rd. IMD

S11 Parameter vs. Frequency

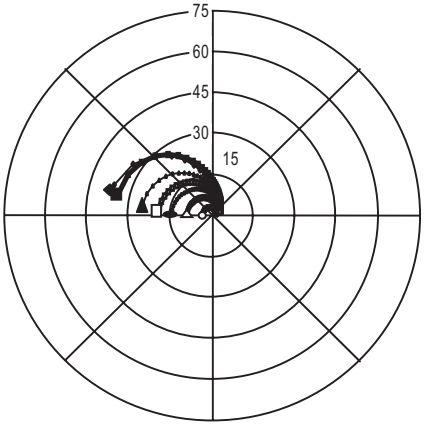


Condition: VCE = 1 V , Zo = 50 Ω
100 to 1000 MHz (100 MHz step)
1000 to 2000 MHz (200 MHz step)
2000 to 6000 MHz (400 MHz step)

IC = 1 mA
IC = 3 mA
IC = 5 mA
IC = 7 mA
IC = 10 mA
IC = 20 mA
IC = 30 mA

S21 Parameter vs. Frequency

Scale: 15 / div.

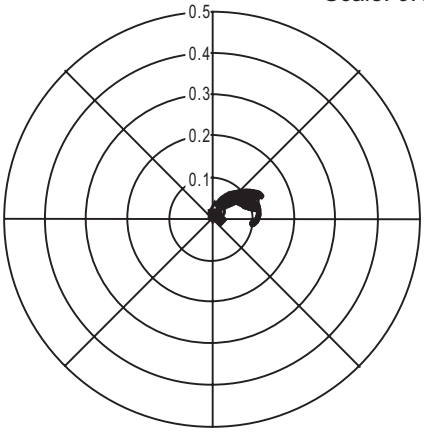


Condition: VCE = 1 V , Zo = 50 Ω
100 to 6000 MHz (100 MHz step)

IC = 1 mA
IC = 3 mA
IC = 5 mA
IC = 7 mA
IC = 10 mA
IC = 20 mA
IC = 30 mA

S12 Parameter vs. Frequency

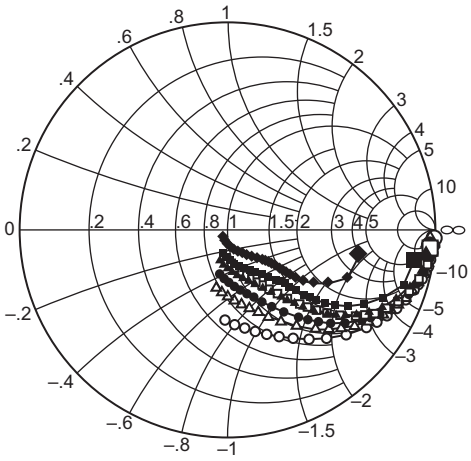
Scale: 0.1 / div.



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

IC = 1 mA
IC = 3 mA
IC = 5 mA
IC = 7 mA
IC = 10 mA
IC = 20 mA
IC = 30 mA

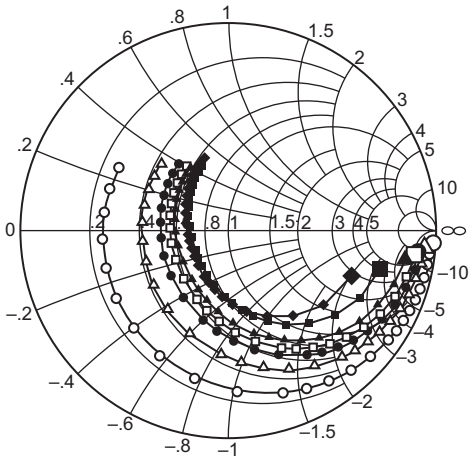
S22 Parameter vs. Frequency



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 = 3 mA
IC = 5 mA
IC = 7 mA
IC = 10 mA
IC = 20 mA
IC = 30 mA

S_{11} Parameter vs. Frequency

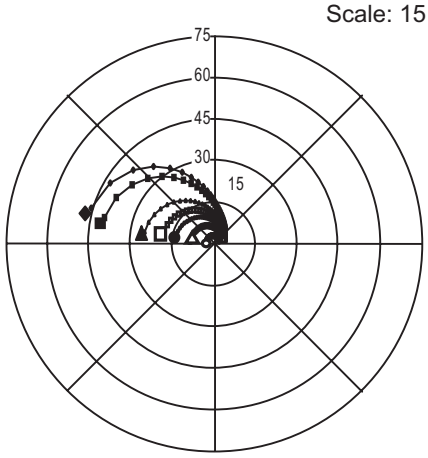


Condition: VCE = 2 V , Zo = 50 Ω
100 to 1000 MHz (100 MHz step)
1000 to 2000 MHz (200 MHz step)
2000 to 6000 MHz (400 MHz step)

IC = 1 mA	IC = 10 mA
IC = 3 mA	IC = 20 mA
IC = 5 mA	IC = 30 mA
IC = 7 mA	

S_{21} Parameter vs. Frequency

Scale: 15 / div.

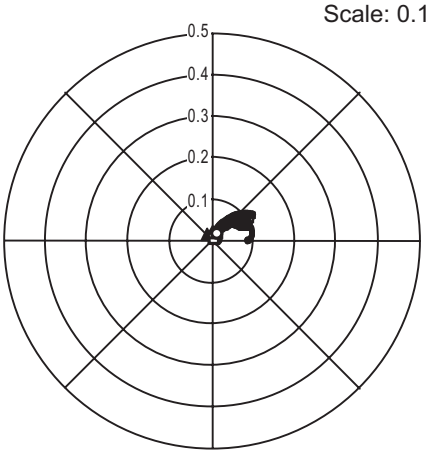


Condition: VCE = 2 V , Zo = 50 Ω
100 to 6000 MHz (100 MHz step)

IC = 1 mA	IC = 10 mA
IC = 3 mA	IC = 20 mA
IC = 5 mA	IC = 30 mA
IC = 7 mA	

S_{12} Parameter vs. Frequency

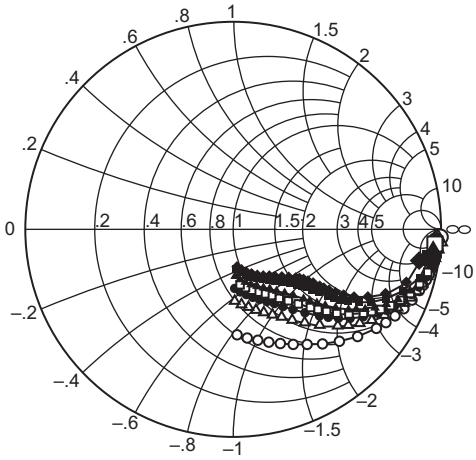
Scale: 0.1 / div.



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	

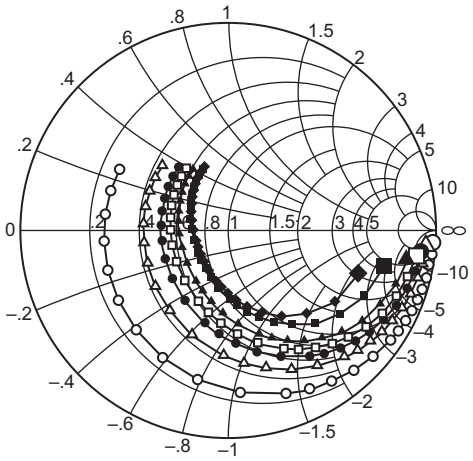
S_{22} Parameter vs. Frequency



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

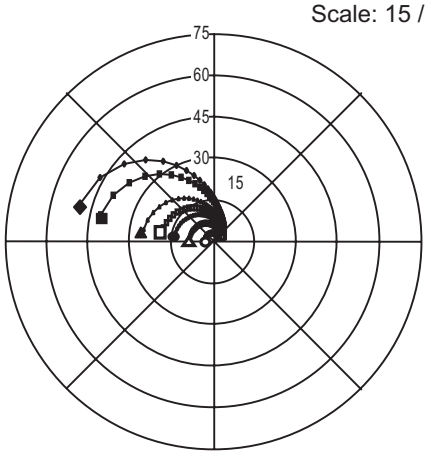


Condition: VCE = 3 V , Zo = 50 Ω
100 to 1000 MHz (100 MHz step)
1000 to 2000 MHz (200 MHz step)
2000 to 6000 MHz (400 MHz step)

IC = 1 mA
IC = 3 mA
IC = 5 mA
IC = 7 mA
IC = 10 mA
IC = 20 mA
IC = 30 mA

S21 Parameter vs. Frequency

Scale: 15 / div.

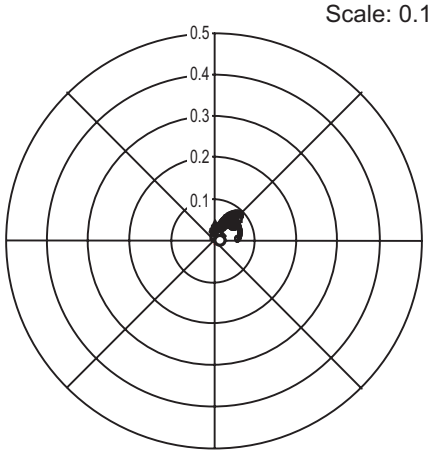


Condition: VCE = 3 V , Zo = 50 Ω
100 to 6000 MHz (100 MHz step)

IC = 1 mA
IC = 3 mA
IC = 5 mA
IC = 7 mA
IC = 10 mA
IC = 20 mA
IC = 30 mA

S12 Parameter vs. Frequency

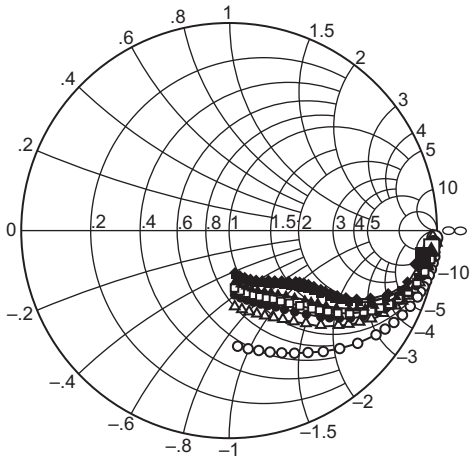
Scale: 0.1 / div.



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

IC = 1 mA
IC = 3 mA
IC = 5 mA
IC = 7 mA
IC = 10 mA
IC = 20 mA
IC = 30 mA

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)

IC = 1 mA
IC = 3 mA
IC = 5 mA
IC = 7 mA
IC = 10 mA
IC = 20 mA
IC = 30 mA

S Parameter

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

	S11		S21		S12		S22	
f (MHz)	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 V, I_C = 3 mA, Z_O = 50 Ω)

	S11		S21		S12		S22	
f (MHz)	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 V, I_C = 5 mA, Z_O = 50 Ω)

	S11		S21		S12		S22	
f (MHz)	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 V, I_C = 7 mA, Z_O = 50 Ω)

	S11		S21		S12		S22	
f (MHz)	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)

	S11		S21		S12		S22	
f (MHz)	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)

	S11		S21		S12		S22	
f (MHz)	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)

	S11		S21		S12		S22	
f (MHz)	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 V, I_C = 1 mA, Z_O = 50 Ω)

	S11		S21		S12		S22	
f (MHz)	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 V, I_C = 3 mA, Z_O = 50 Ω)

	S11		S21		S12		S22	
f (MHz)	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 V, I_C = 5 mA, Z_O = 50 Ω)

	S11		S21		S12		S22	
f (MHz)	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 V, I_C = 7 mA, Z_O = 50 Ω)

	S11		S21		S12		S22	
f (MHz)	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)

	S11		S21		S12		S22	
f (MHz)	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 V, I_C = 20 mA, Z_O = 50 Ω)

	S11		S21		S12		S22	
f (MHz)	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)

	S11		S21		S12		S22	
f (MHz)	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 V, I_C = 1 mA, Z_O = 50 Ω)

	S11		S21		S12		S22	
f (MHz)	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 V, I_C = 3 mA, Z_O = 50 Ω)

	S11		S21		S12		S22	
f (MHz)	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 V, I_C = 5 mA, Z_O = 50 Ω)

	S11		S21		S12		S22	
f (MHz)	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 V, I_C = 7 mA, Z_O = 50 Ω)

	S11		S21		S12		S22	
f (MHz)	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)

	S11		S21		S12		S22	
f (MHz)	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)

	S11		S21		S12		S22	
f (MHz)	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

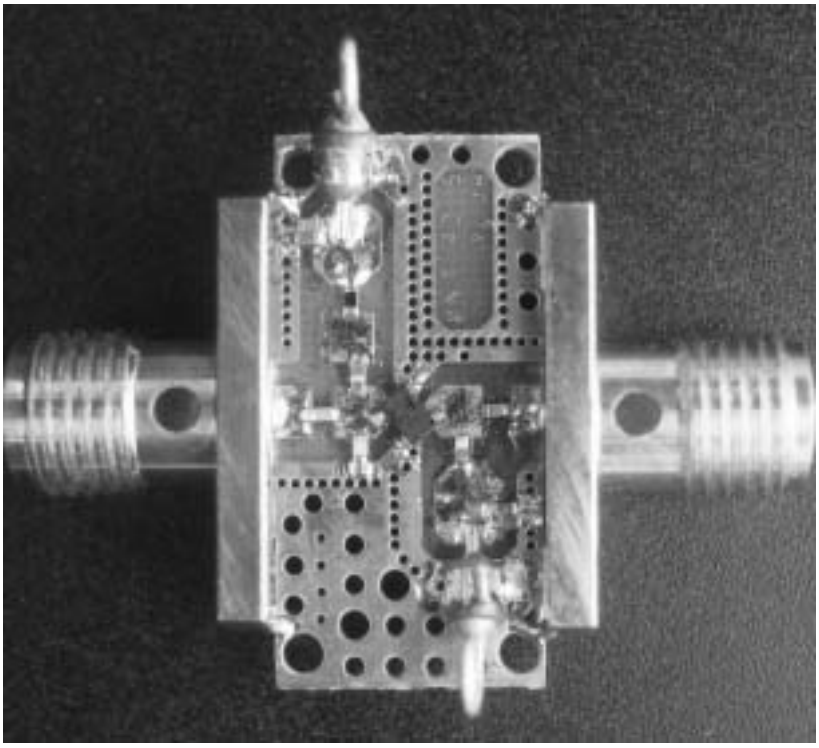
S Parameter

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

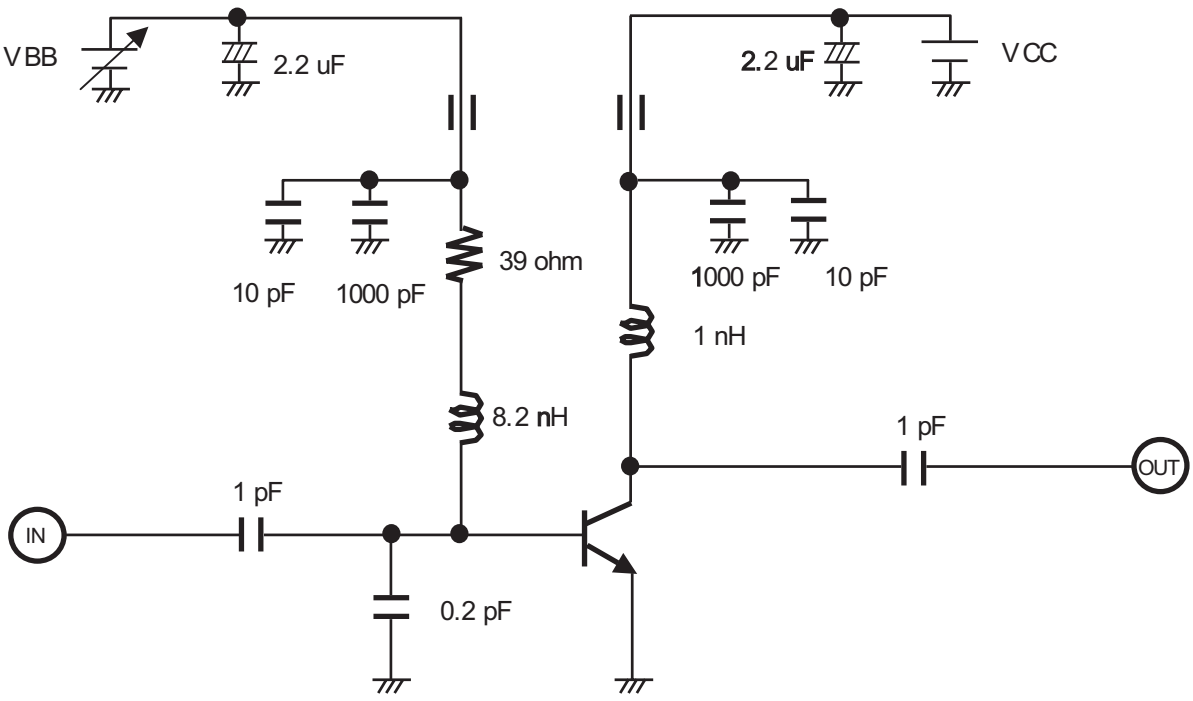
	S11		S21		S12		S22	
f (MHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100	0.660	-18.4	50.17	164.6	0.0059	144.0	0.926	-10.0
200	0.619	-33.3	47.07	151.0	0.0078	69.5	0.897	-15.9
300	0.551	-46.2	42.69	139.5	0.0105	59.6	0.826	-21.5
400	0.487	-57.6	38.24	130.3	0.0127	68.2	0.757	-25.3
500	0.428	-67.1	34.07	122.6	0.0143	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



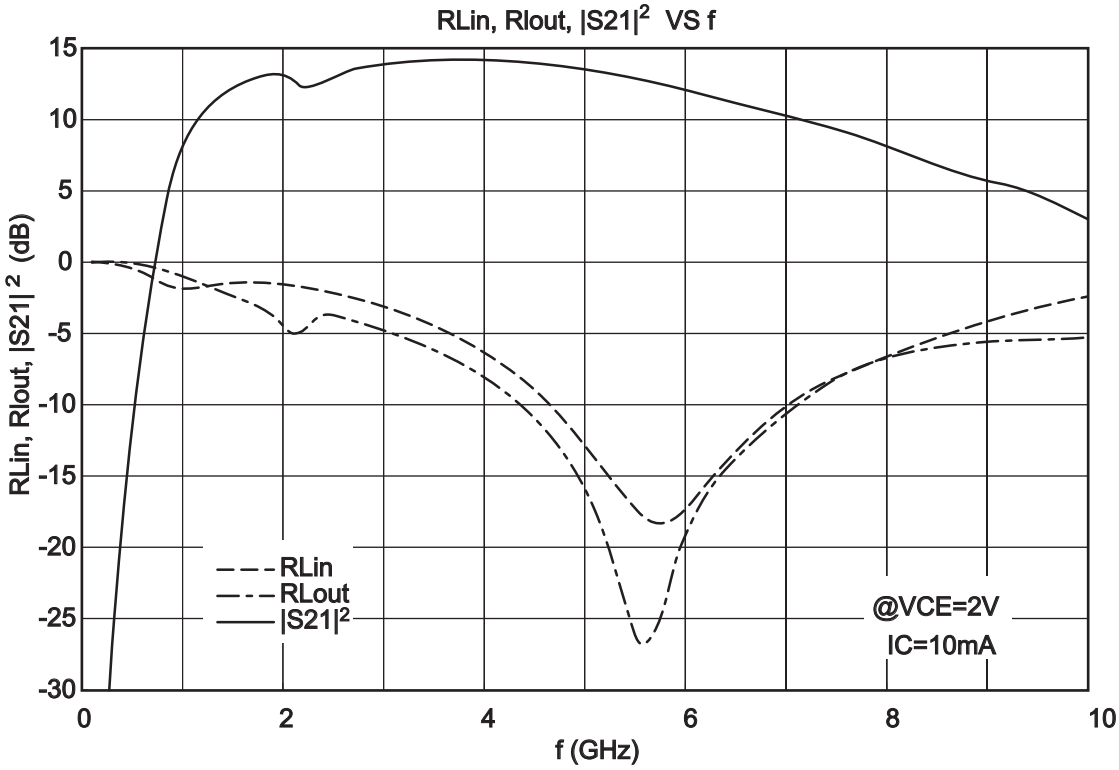
Circuit

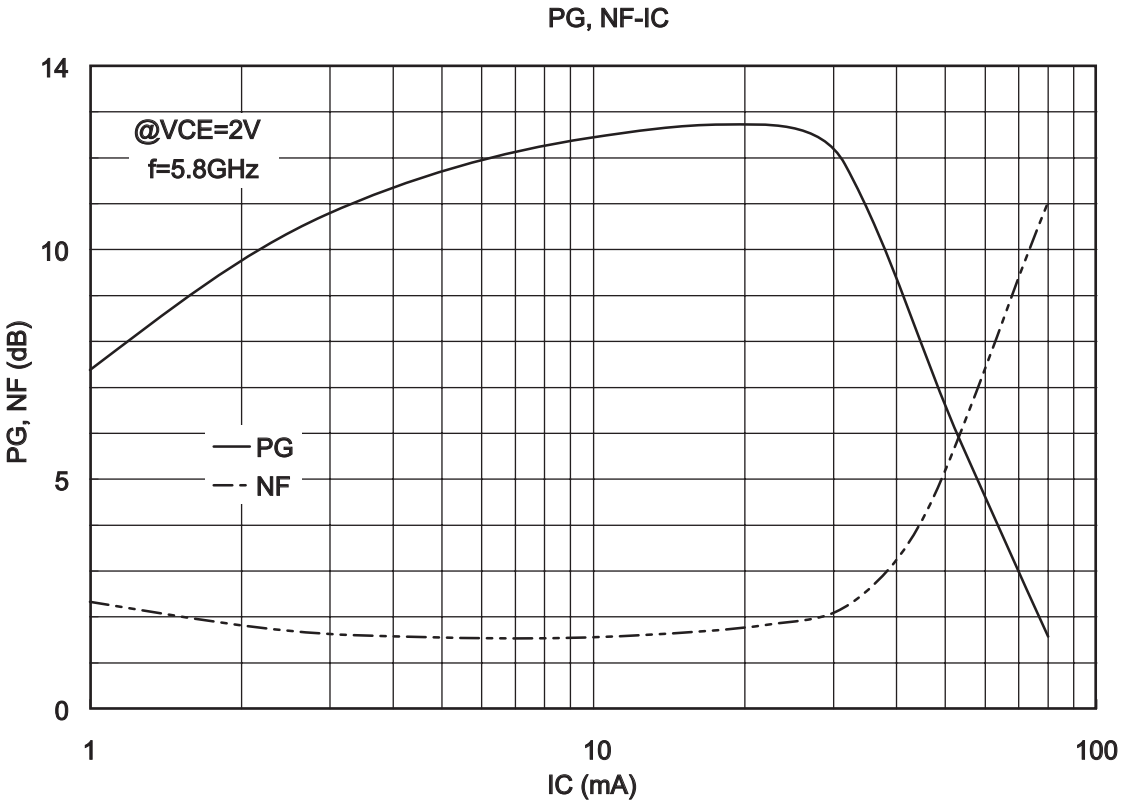


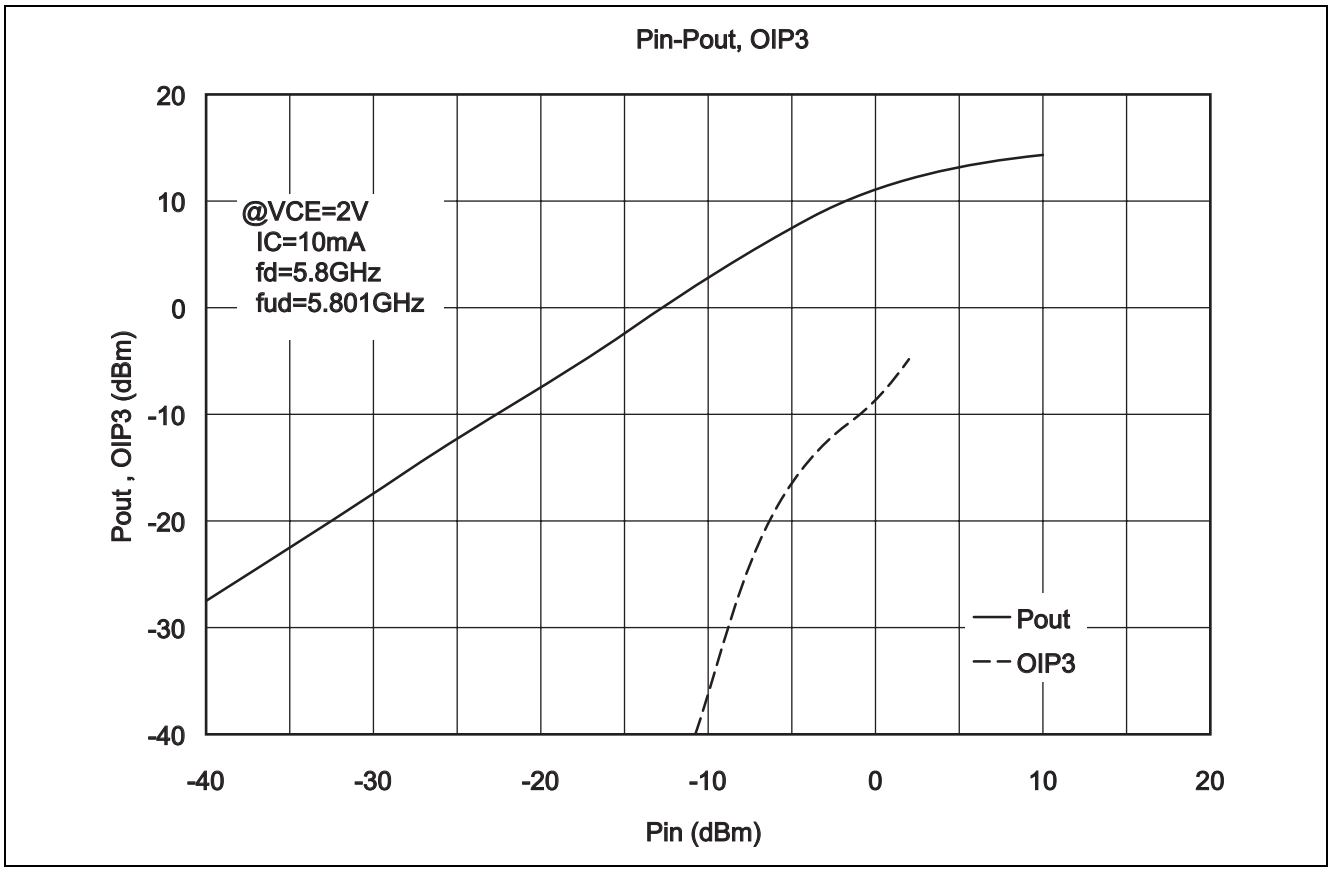
Electrical Characteristics on Evaluation Board

(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


RLin, Rlout, |S21|2 VS f
RLin, Rlout, |S21|2 (dB)
15
10
5
0
-5
-10
-15
-20
-25
-30
0
2
4
6
8
10
f (GHz)
RLin
RLout
|S21|2
@VCE=2V
IC=10mA

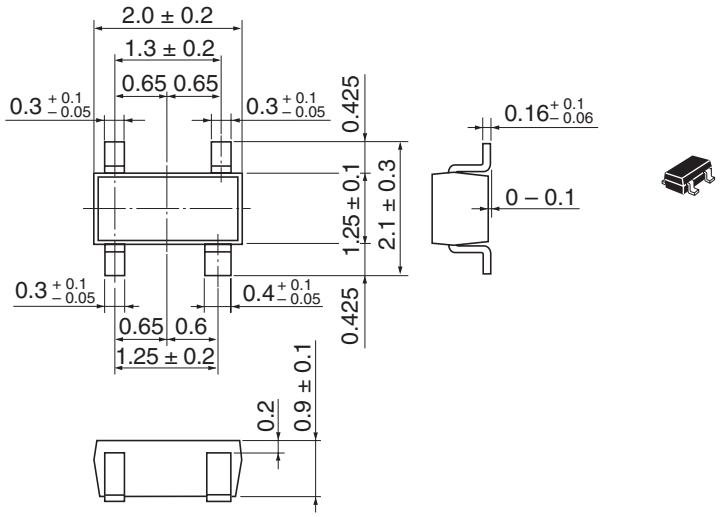

PG, NF-IC
PG, NF (dB)
14
10
5
0
1
10
100
IC (mA)
@VCE=2V
f=5.8GHz
PG
NF


Pin-Pout, OIP3
20
10
0
-10
-20
-30
-40
Pout , OIP3 (dBm)
@VCE=2V
IC=10mA
fd=5.8GHz
fud=5.801GHz
Pout
OIP3
-40
-30
-20
-10
0
10
20
Pin (dBm)

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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