

DATA SHEET

NEC

NPN SILICON GERMANIUM RF TRANSISTOR 2SC5761

NPN SiGe RF TRANSISTOR FOR LOW NOISE · HIGH-GAIN AMPLIFICATION FLAT-LEAD 4-PIN THIN-TYPE SUPER MINIMOLD

FEATURES

- Ideal for low noise · high-gain amplification
NF = 0.9 dB TYP., $G_a = 16.0$ dB TYP. @ $V_{CE} = 2$ V, $I_c = 5$ mA, $f = 2$ GHz
- Maximum stable power gain: MSG = 20.0 dB TYP. @ $V_{CE} = 2$ V, $I_c = 20$ mA, $f = 2$ GHz
- SiGe technology ($f_T = 60$ GHz, $f_{max} = 60$ GHz)
- Flat-lead 4-pin thin-type super minimold package

ORDERING INFORMATION

Part Number	Quantity	Supplying Form
2SC5761	50 pcs (Non reel)	• 8 mm wide embossed taping • Pin 1 (Emitter), Pin 2 (Collector) face the perforation side of the tape
2SC5761-T2	3 kpcs/reel	

Remark To order evaluation samples, consult your NEC sales representative.
Unit sample quantity is 50 pcs.

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

Parameter	Symbol	Ratings	Unit
Collector to Base Voltage	V_{CBO}	8.0	V
Collector to Emitter Voltage	V_{CEO}	2.3	V
Emitter to Base Voltage	V_{EBO}	1.2	V
Collector Current	I_c	35	mA
Total Power Dissipation	P_{tot} ^{Note}	80	mW
Junction Temperature	T_j	150	$^\circ\text{C}$
Storage Temperature	T_{stg}	-65 to +150	$^\circ\text{C}$

Note Mounted on $1.08 \text{ cm}^2 \times 1.0 \text{ mm}$ (t) glass epoxy substrate

THERMAL RESISTANCE

Parameter	Symbol	Value	Unit
Junction to Case Resistance	$R_{th\ j-c}$	150	$^\circ\text{C/W}$

Because this product uses high-frequency technology, avoid excessive static electricity, etc.

The information in this document is subject to change without notice. Before using this document, please confirm that this is the latest version.
Not all devices/types available in every country. Please check with local NEC representative for availability and additional information.

ELECTRICAL CHARACTERISTICS (T_A = +25°C)

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
DC Characteristics						
Collector Cut-off Current	I _{CBO}	V _{CB} = 5 V, I _E = 0 mA	–	–	200	nA
Emitter Cut-off Current	I _{EBO}	V _{BE} = 0.5 V, I _C = 0 mA	–	–	200	nA
DC Current Gain	h _{FE} ^{Note 1}	V _{CE} = 2 V, I _C = 5 mA	200	–	400	–
RF Characteristics						
Reverse Transfer Capacitance	C _{re} ^{Note 2}	V _{CB} = 2 V, I _E = 0 mA, f = 1 MHz	–	0.17	0.22	pF
Noise Figure	NF	V _{CE} = 2 V, I _C = 5 mA, f = 2 GHz, Z _S = Z _{opt}	–	0.9	1.1	dB
Associated Gain	G _a	V _{CE} = 2 V, I _C = 5 mA, f = 2 GHz, Z _S = Z _{opt}	–	16.0	–	dB
Maximum Stable Power Gain	MSG ^{Note 3}	V _{CE} = 2 V, I _C = 20 mA, f = 2 GHz	18.0	20.0	–	dB
Insertion Power Gain	S _{21e} ²	V _{CE} = 2 V, I _C = 20 mA, f = 2 GHz	16.0	18.0	–	dB
Gain 1 dB Compression Output Power	P _{O(1dB)}	V _{CE} = 2 V, I _C = 20 mA, f = 2 GHz	–	12.0	–	dBm
3rd Order Intermodulation Distortion Output Intercept Point	OIP ₃	V _{CE} = 2 V, I _C = 20 mA, f = 2 GHz	–	22.0	–	dBm

Notes 1. Pulse measurement: PW ≤ 350 μs, Duty Cycle ≤ 2%

2. Collector to base capacitance measured using capacitance meter (self-balancing bridge method) when the emitter is connected to the guard pin

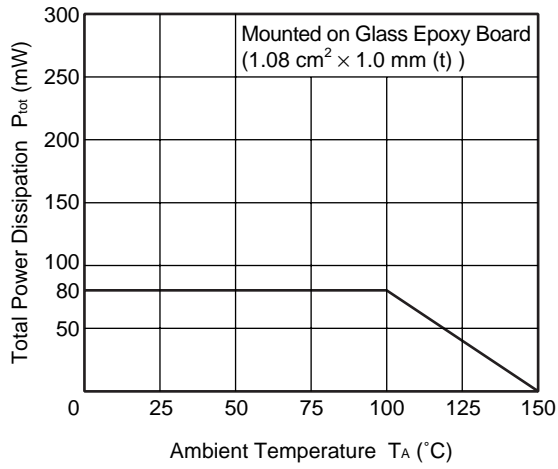
3. $MSG = \left| \frac{S_{21}}{S_{12}} \right|$

h_{FE} CLASSIFICATION

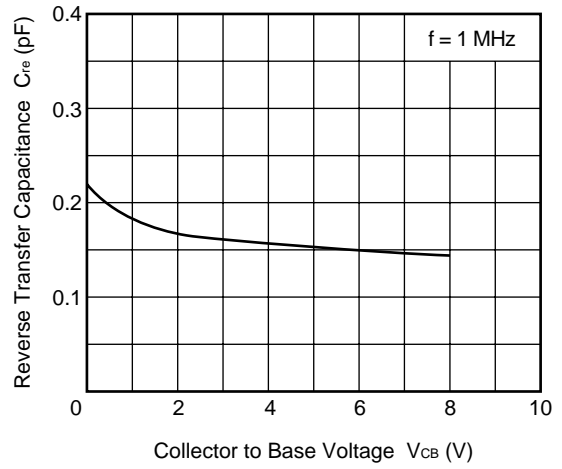
Rank	FB
Marking	T16
h _{FE} Value	200 to 400

TYPICAL CHARACTERISTICS (Unless otherwise specified, $T_A = +25^\circ\text{C}$)

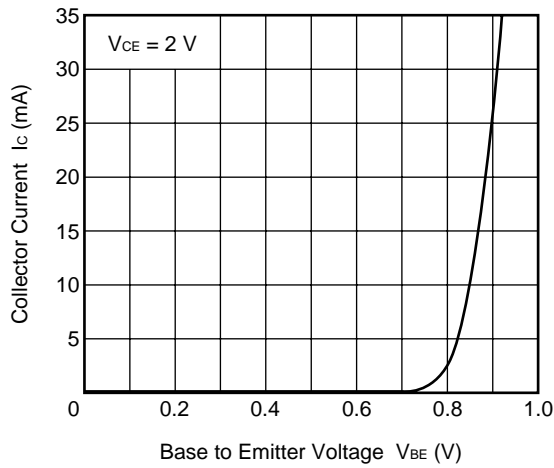
TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE



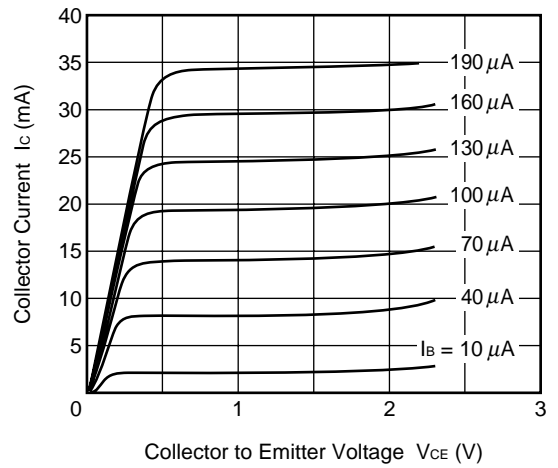
REVERSE TRANSFER CAPACITANCE vs. COLLECTOR TO BASE VOLTAGE



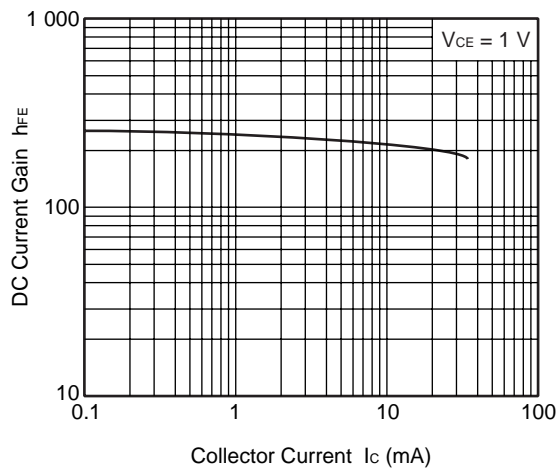
COLLECTOR CURRENT vs. BASE TO EMITTER VOLTAGE



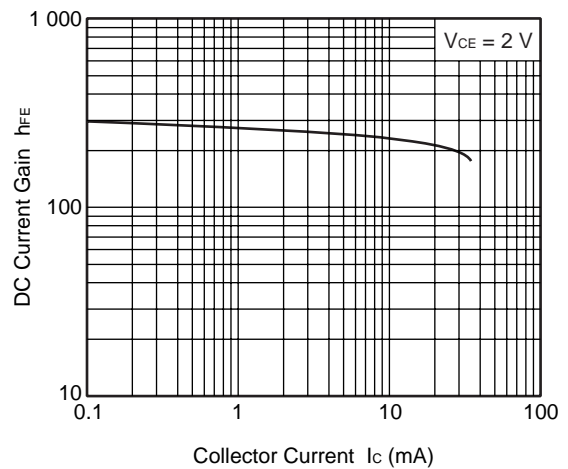
COLLECTOR CURRENT vs. COLLECTOR TO EMITTER VOLTAGE



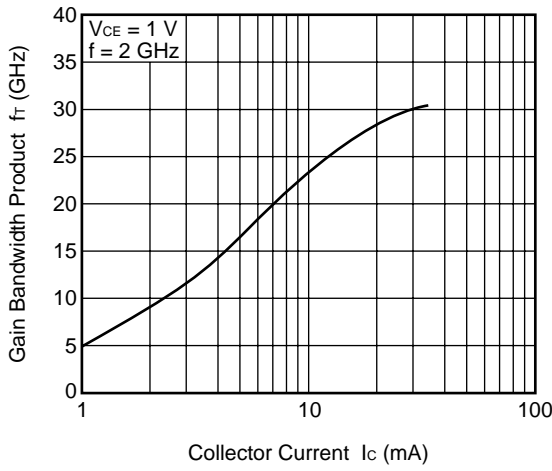
DC CURRENT GAIN vs. COLLECTOR CURRENT



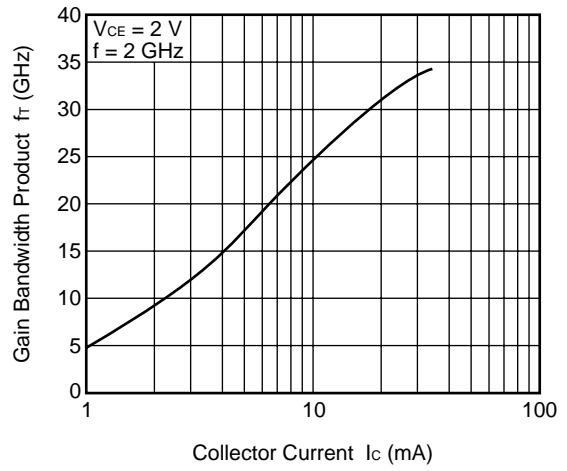
DC CURRENT GAIN vs. COLLECTOR CURRENT



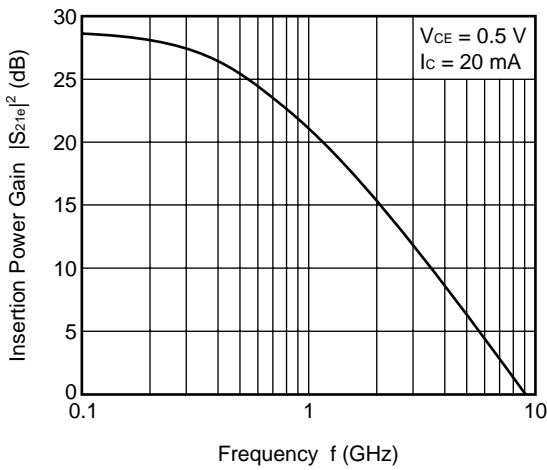
GAIN BANDWIDTH PRODUCT vs. COLLECTOR CURRENT



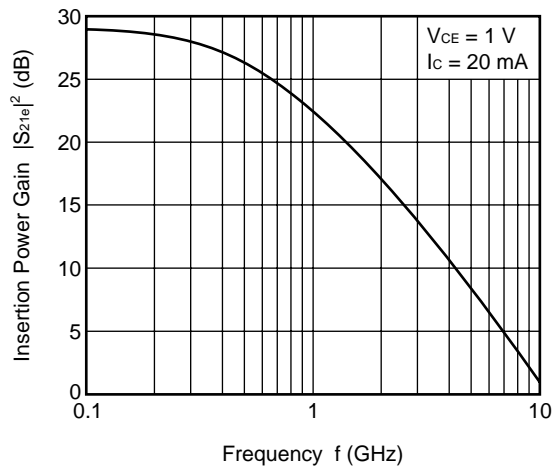
GAIN BANDWIDTH PRODUCT vs. COLLECTOR CURRENT



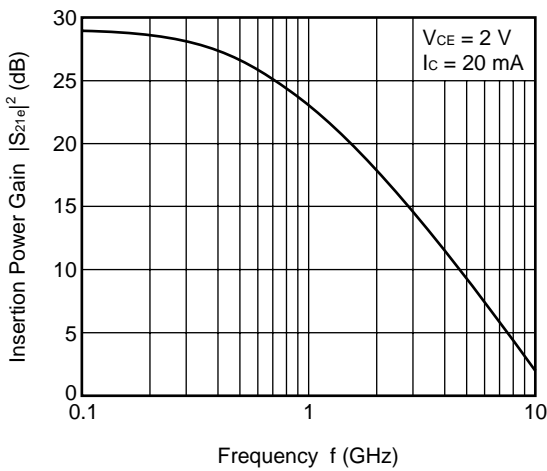
INSERTION POWER GAIN vs. FREQUENCY



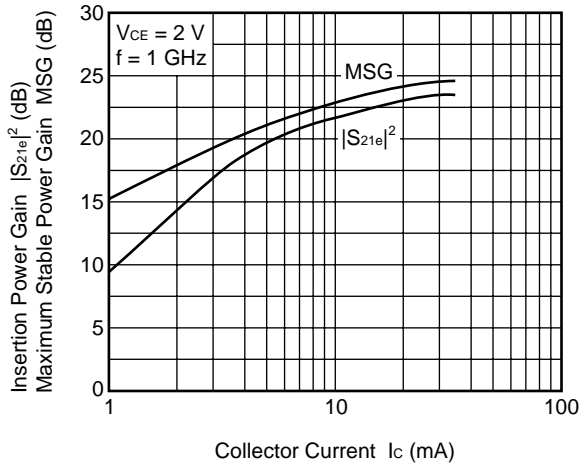
INSERTION POWER GAIN vs. FREQUENCY



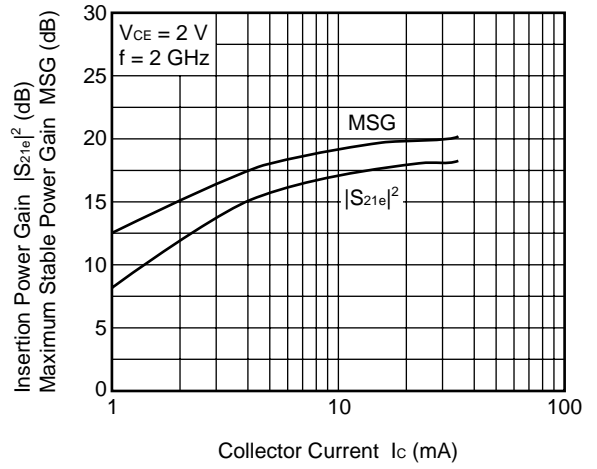
INSERTION POWER GAIN vs. FREQUENCY



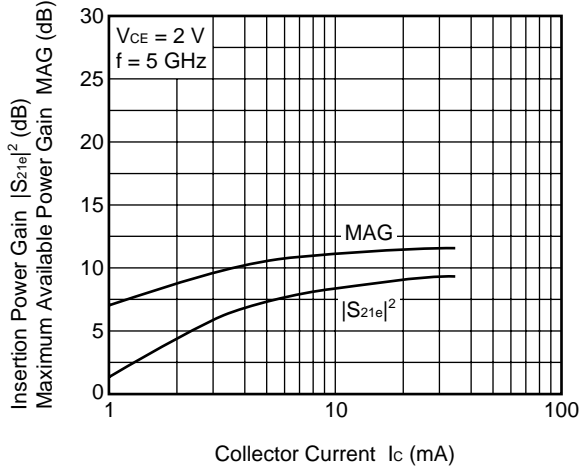
INSERTION POWER GAIN, MSG
vs. COLLECTOR CURRENT



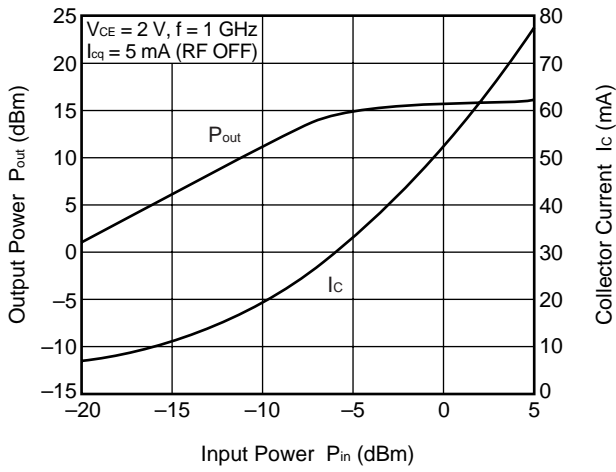
INSERTION POWER GAIN, MSG
vs. COLLECTOR CURRENT



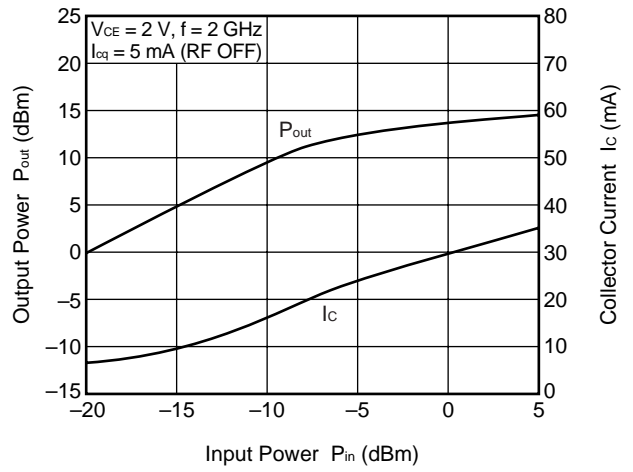
INSERTION POWER GAIN, MAG
vs. COLLECTOR CURRENT



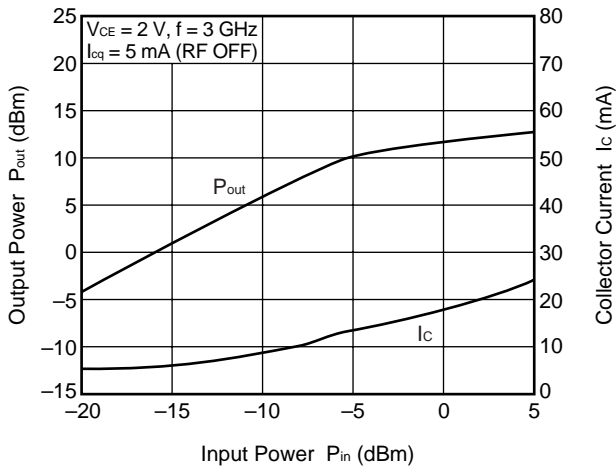
OUTPUT POWER, COLLECTOR CURRENT vs. INPUT POWER



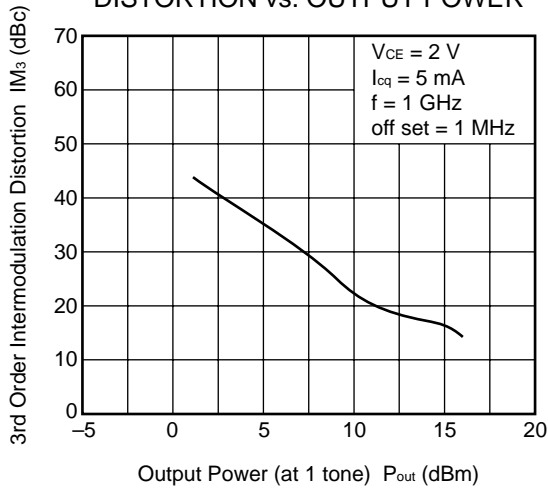
OUTPUT POWER, COLLECTOR CURRENT vs. INPUT POWER



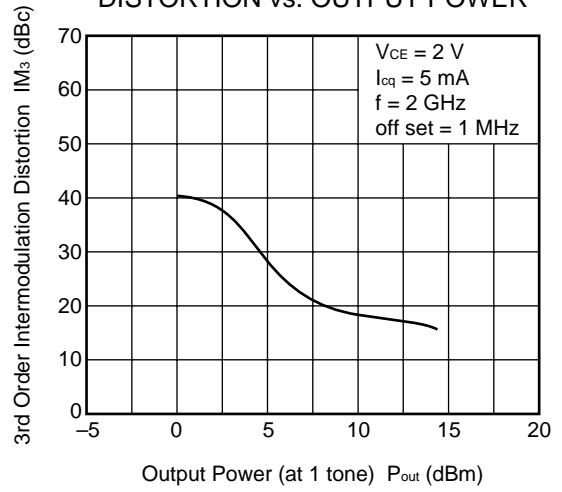
OUTPUT POWER, COLLECTOR CURRENT vs. INPUT POWER



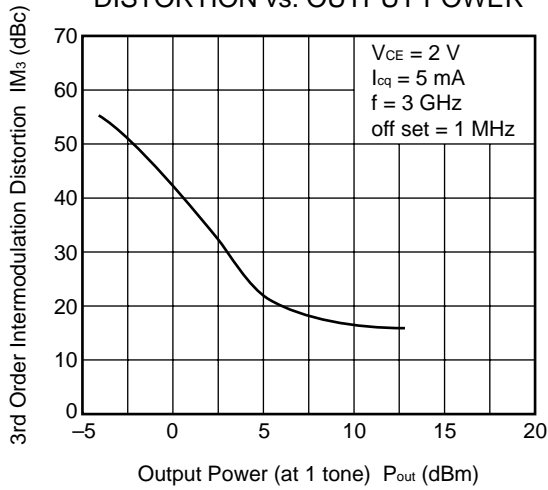
3RD ORDER INTERMODULATION DISTORTION vs. OUTPUT POWER



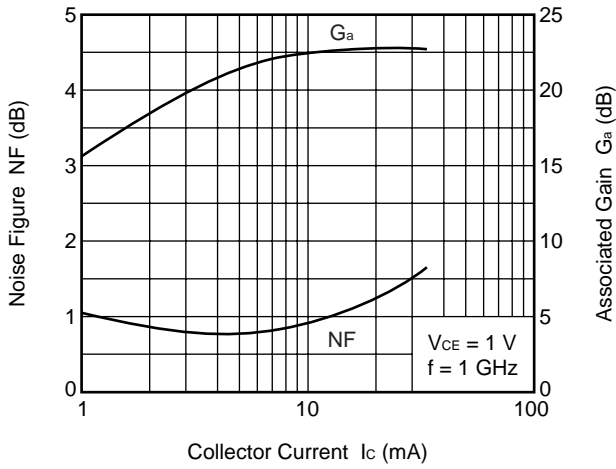
3RD ORDER INTERMODULATION DISTORTION vs. OUTPUT POWER



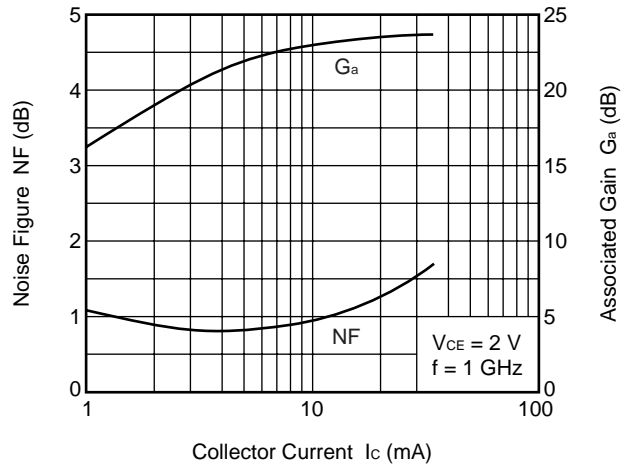
3RD ORDER INTERMODULATION DISTORTION vs. OUTPUT POWER



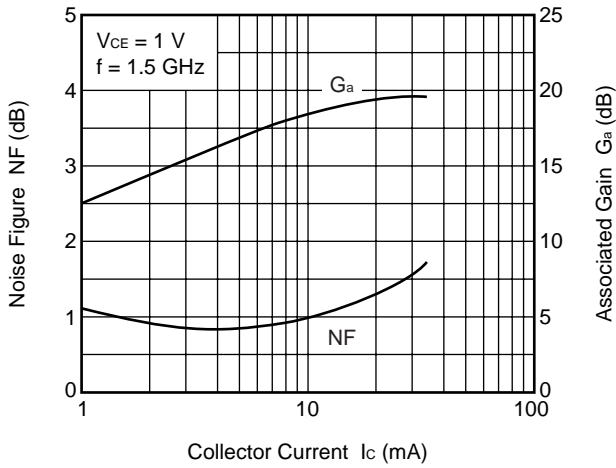
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



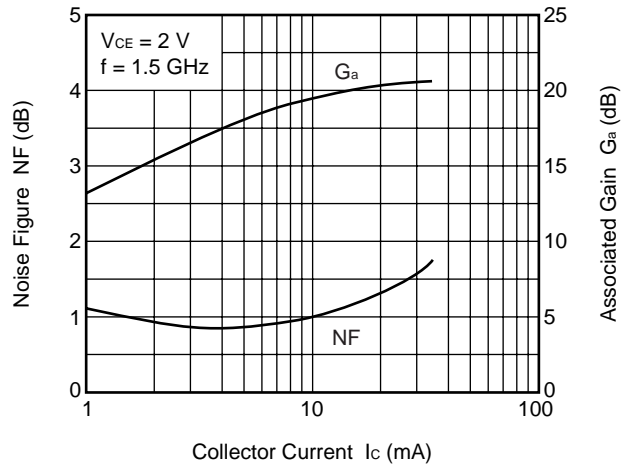
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



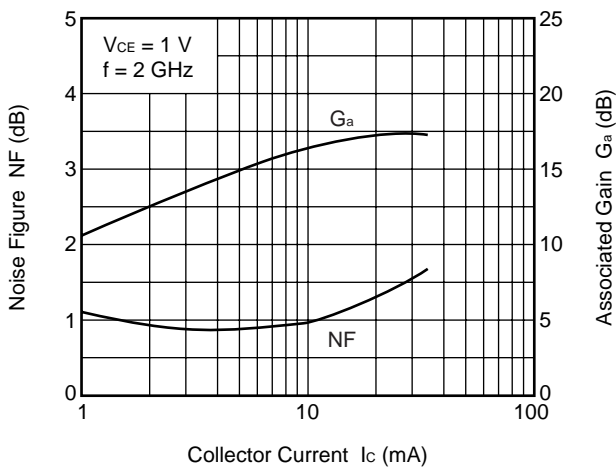
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



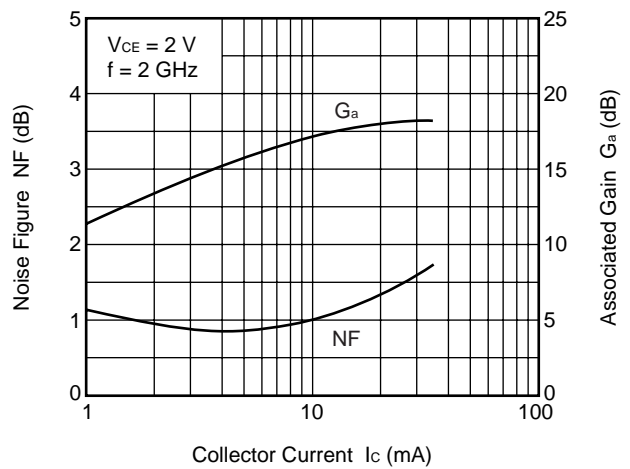
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



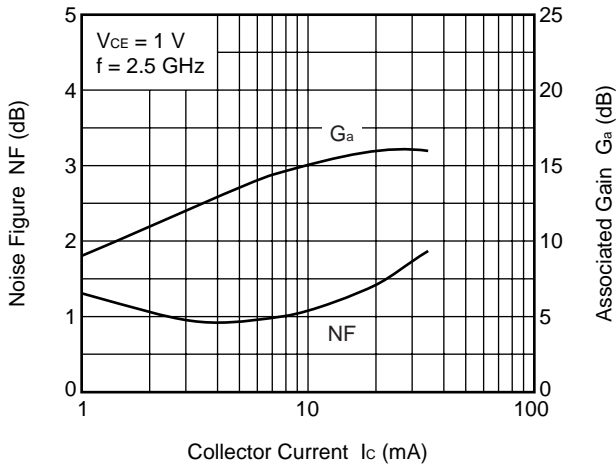
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



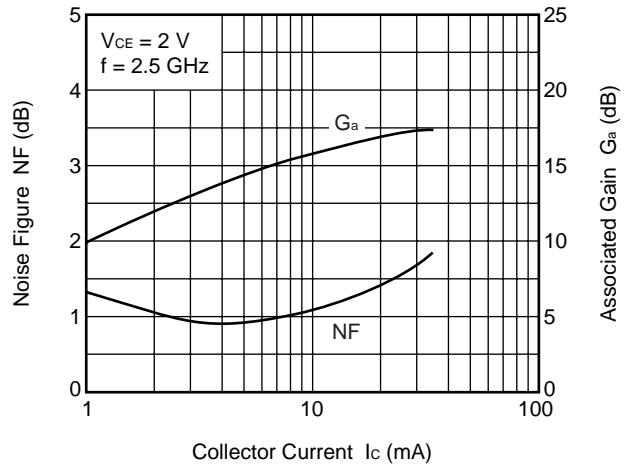
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



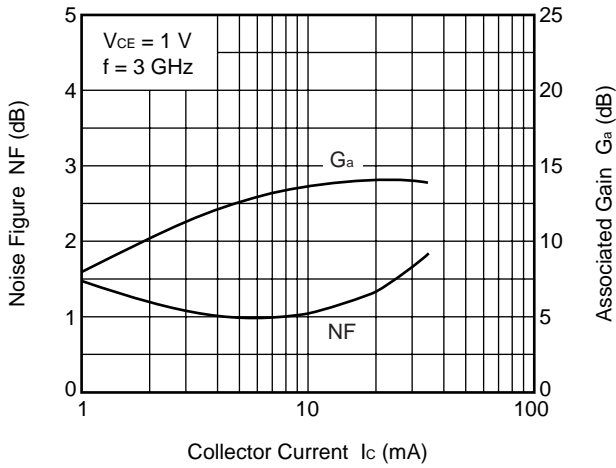
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



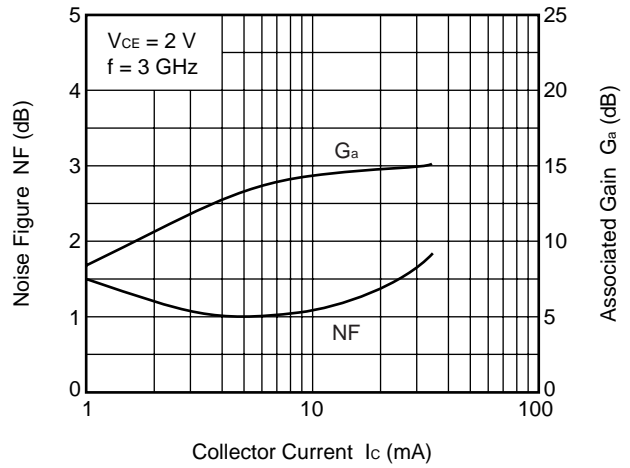
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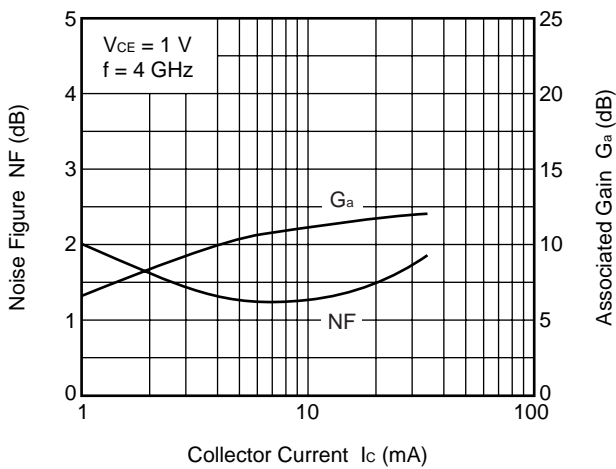
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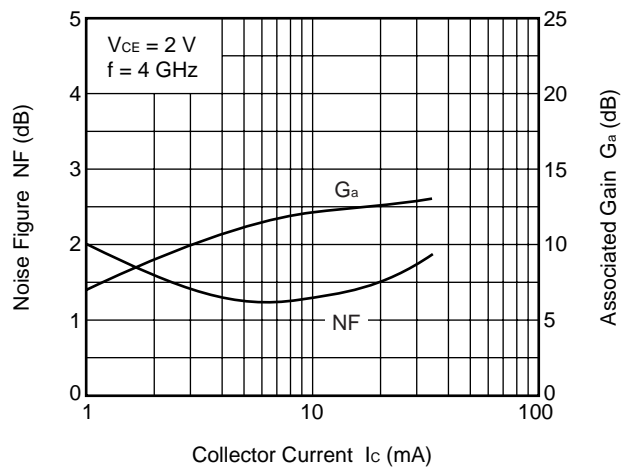
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



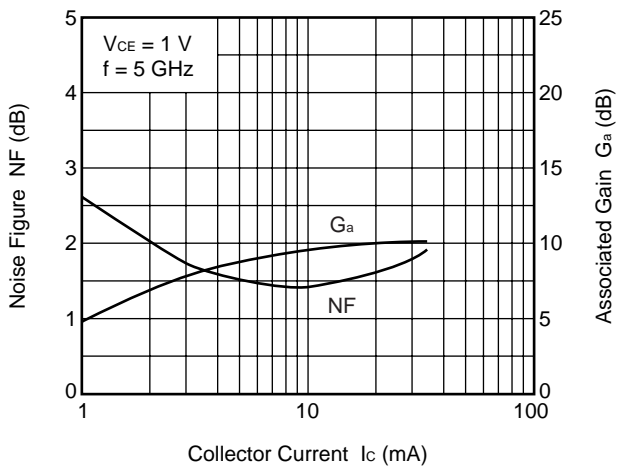
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



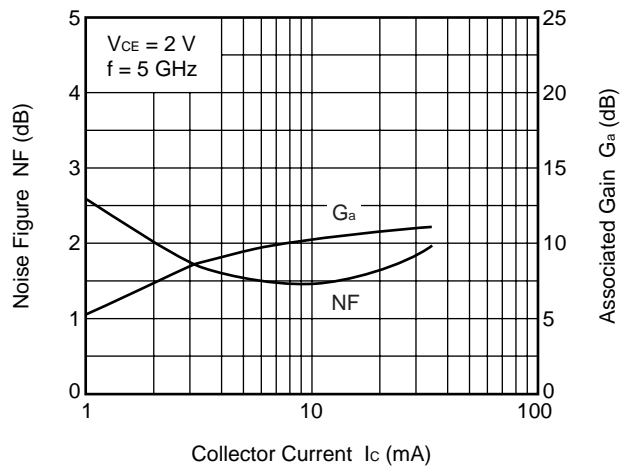
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



Remark The graphs indicate nominal characteristics.

S-PARAMETERS

Note When $K \geq 1$, the MAG (Maximum Available Power Gain) is used. $MAG = \left| \frac{S_{21}}{S_{12}} \right| (K - \sqrt{K^2 - 1})$

When $K < 1$, the MSG (Maximum Stable Power Gain) is used. $MSG = \left| \frac{S_{21}}{S_{12}} \right|$

$V_{CE} = 0.5 \text{ V}$, $I_c = 1 \text{ mA}$, $Z_o = 50 \Omega$

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂		K	MAG/MSG (dB) ^{Note}
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)		
0.1	0.983	-5.5	3.233	174.9	0.016	86.7	0.996	-4.2	0.007	23.14
0.2	0.986	-11.8	3.301	169.4	0.030	81.1	0.977	-8.6	0.041	20.46
0.3	0.975	-17.4	3.248	165.0	0.043	75.5	0.957	-12.2	0.083	18.80
0.4	0.973	-23.6	3.240	159.5	0.056	71.2	0.933	-16.1	0.103	17.61
0.5	0.964	-29.2	3.171	154.8	0.069	67.4	0.913	-19.4	0.124	16.62
0.6	0.948	-35.6	3.113	149.7	0.081	63.6	0.887	-22.8	0.145	15.84
0.7	0.936	-41.3	3.068	145.7	0.093	59.7	0.867	-25.6	0.164	15.20
0.8	0.916	-47.4	3.021	141.1	0.103	56.0	0.841	-28.8	0.187	14.68
0.9	0.905	-53.6	2.959	136.3	0.113	52.6	0.818	-31.8	0.203	14.16
1.0	0.887	-59.8	2.914	131.7	0.122	49.0	0.794	-34.5	0.227	13.78
1.1	0.873	-66.1	2.866	127.3	0.131	45.4	0.771	-37.4	0.244	13.40
1.2	0.856	-71.9	2.793	123.4	0.139	42.1	0.745	-40.0	0.265	13.04
1.3	0.848	-77.8	2.758	119.5	0.146	38.6	0.723	-42.8	0.275	12.76
1.4	0.828	-84.2	2.702	114.8	0.153	35.4	0.699	-45.5	0.302	12.46
1.5	0.817	-90.2	2.634	110.5	0.160	32.3	0.680	-48.1	0.315	12.16
1.6	0.798	-96.4	2.598	106.2	0.166	29.0	0.657	-50.9	0.341	11.95
1.7	0.783	-102.4	2.544	102.3	0.171	25.9	0.638	-53.8	0.357	11.71
1.8	0.762	-108.5	2.474	98.0	0.176	22.9	0.617	-56.1	0.390	11.49
1.9	0.753	-114.9	2.420	93.9	0.180	20.0	0.597	-58.7	0.401	11.29
2.0	0.739	-121.2	2.377	89.6	0.183	17.2	0.578	-61.3	0.422	11.13
2.1	0.729	-126.9	2.313	86.2	0.185	14.4	0.559	-63.8	0.442	10.97
2.2	0.722	-133.4	2.247	82.3	0.186	11.6	0.539	-66.3	0.460	10.82
2.3	0.712	-139.3	2.192	78.4	0.186	8.7	0.523	-68.7	0.484	10.70
2.4	0.703	-145.4	2.133	74.5	0.187	5.7	0.504	-71.2	0.513	10.58
2.5	0.700	-151.3	2.072	71.1	0.186	2.9	0.489	-73.5	0.531	10.46
2.6	0.692	-157.2	2.007	67.8	0.185	0.3	0.476	-75.5	0.562	10.36
2.7	0.669	-163.4	1.921	64.5	0.181	-1.8	0.463	-77.5	0.627	10.26
2.8	0.632	-165.4	1.846	62.9	0.180	-2.1	0.456	-79.0	0.717	10.12
2.9	0.660	-168.2	1.852	60.2	0.184	-5.0	0.440	-82.2	0.669	10.03
3.0	0.672	-173.8	1.804	56.9	0.182	-7.7	0.421	-84.4	0.678	9.95
4.0	0.713	148.4	1.345	29.4	0.157	-23.1	0.325	-108.7	0.951	9.32
5.0	0.762	122.8	1.027	5.5	0.127	-30.6	0.316	-144.4	1.275	5.93
6.0	0.792	107.2	0.815	-11.3	0.104	-28.8	0.365	-169.5	1.667	4.15
7.0	0.830	93.3	0.662	-27.8	0.099	-24.4	0.437	167.2	1.697	3.36
8.0	0.858	82.2	0.540	-40.9	0.101	-19.0	0.534	144.2	1.621	2.64
9.0	0.865	73.1	0.442	-50.9	0.109	-19.1	0.595	132.5	1.655	1.33
10.0	0.888	66.9	0.367	-62.1	0.120	-22.9	0.674	114.9	1.367	1.24

$V_{CE} = 0.5 \text{ V}$, $I_c = 3 \text{ mA}$, $Z_0 = 50 \Omega$

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂		K	MAG/MSG (dB)
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)		
0.1	0.963	-8.1	8.698	174.1	0.017	86.1	0.984	-6.8	-0.004	27.20
0.2	0.946	-17.4	8.800	165.4	0.029	78.5	0.958	-13.8	0.065	24.77
0.3	0.927	-25.7	8.560	159.3	0.042	71.8	0.926	-19.9	0.107	23.08
0.4	0.908	-34.3	8.395	152.5	0.054	66.1	0.886	-25.9	0.147	21.89
0.5	0.879	-42.1	8.050	146.5	0.066	61.4	0.850	-31.4	0.176	20.88
0.6	0.852	-50.3	7.738	140.6	0.075	57.1	0.807	-36.7	0.201	20.11
0.7	0.825	-57.9	7.462	135.5	0.084	53.0	0.770	-41.3	0.224	19.47
0.8	0.793	-66.0	7.194	130.1	0.092	49.0	0.727	-46.0	0.255	18.95
0.9	0.767	-73.4	6.877	124.9	0.099	45.5	0.691	-50.5	0.280	18.42
1.0	0.741	-81.0	6.626	119.9	0.105	42.1	0.652	-54.6	0.310	18.01
1.1	0.719	-88.7	6.352	115.3	0.110	38.8	0.617	-58.8	0.331	17.61
1.2	0.697	-95.7	6.062	111.1	0.115	35.9	0.582	-62.4	0.359	17.23
1.3	0.685	-102.4	5.839	106.9	0.119	33.2	0.550	-66.4	0.378	16.92
1.4	0.660	-109.4	5.608	102.6	0.122	30.5	0.520	-70.3	0.410	16.61
1.5	0.647	-116.1	5.366	98.4	0.126	27.9	0.494	-74.0	0.431	16.30
1.6	0.630	-122.9	5.161	94.5	0.128	25.6	0.465	-78.1	0.460	16.05
1.7	0.617	-129.2	4.946	91.0	0.131	23.3	0.443	-81.9	0.484	15.77
1.8	0.603	-135.9	4.749	87.1	0.133	21.2	0.418	-85.4	0.514	15.53
1.9	0.594	-141.9	4.560	83.6	0.135	19.3	0.399	-89.2	0.537	15.29
2.0	0.586	-148.6	4.392	80.0	0.136	17.3	0.377	-93.0	0.564	15.09
2.1	0.582	-154.2	4.220	77.0	0.137	15.6	0.360	-96.8	0.586	14.89
2.2	0.581	-159.7	4.043	73.8	0.137	13.8	0.342	-100.8	0.611	14.70
2.3	0.577	-165.5	3.895	70.5	0.137	12.2	0.327	-104.4	0.638	14.53
2.4	0.574	-171.1	3.748	67.2	0.137	10.6	0.309	-108.3	0.670	14.38
2.5	0.578	-176.2	3.607	64.4	0.137	8.9	0.296	-112.1	0.692	14.21
2.6	0.579	178.6	3.461	61.8	0.136	7.5	0.283	-115.3	0.721	14.06
2.7	0.570	173.2	3.296	59.1	0.134	6.5	0.271	-118.6	0.777	13.90
2.8	0.544	170.7	3.160	57.8	0.134	7.0	0.265	-120.3	0.844	13.72
2.9	0.565	169.0	3.145	55.4	0.137	5.2	0.260	-125.1	0.811	13.60
3.0	0.577	164.4	3.044	52.8	0.137	3.8	0.245	-129.9	0.831	13.48
4.0	0.648	135.2	2.194	30.5	0.134	-4.2	0.207	-172.9	1.034	11.02
5.0	0.708	114.3	1.651	10.5	0.129	-9.0	0.268	156.8	1.197	8.41
6.0	0.747	101.2	1.327	-4.5	0.127	-10.7	0.318	142.7	1.306	6.86
7.0	0.784	89.3	1.097	-20.1	0.132	-15.0	0.377	129.6	1.293	5.94
8.0	0.819	79.5	0.921	-32.9	0.133	-17.8	0.462	117.4	1.262	5.33
9.0	0.827	71.3	0.783	-44.4	0.136	-22.3	0.499	111.9	1.305	4.28
10.0	0.857	65.5	0.667	-57.1	0.139	-28.0	0.567	99.4	1.184	4.21

V_{CE} = 0.5 V, I_c = 5 mA, Z_O = 50 Ω

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂		K	MAG/MSG (dB)
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)		
0.1	0.938	-10.0	12.919	172.7	0.016	82.6	0.973	-8.9	0.048	29.19
0.2	0.909	-22.0	12.902	162.2	0.029	77.4	0.939	-18.0	0.074	26.43
0.3	0.882	-31.7	12.386	155.1	0.041	68.4	0.895	-25.9	0.147	24.77
0.4	0.852	-42.2	11.967	147.3	0.052	62.8	0.845	-33.4	0.180	23.61
0.5	0.812	-51.4	11.292	140.6	0.062	57.9	0.796	-40.2	0.219	22.59
0.6	0.775	-60.7	10.664	134.1	0.070	53.6	0.742	-46.6	0.251	21.81
0.7	0.741	-69.5	10.128	128.6	0.077	49.4	0.696	-52.2	0.285	21.17
0.8	0.707	-78.3	9.586	123.1	0.083	45.9	0.647	-57.9	0.318	20.62
0.9	0.674	-86.5	9.035	117.7	0.089	42.5	0.604	-63.1	0.357	20.08
1.0	0.648	-94.7	8.561	112.7	0.093	39.8	0.563	-68.0	0.388	19.63
1.1	0.627	-102.6	8.084	108.3	0.097	36.9	0.525	-72.9	0.418	19.21
1.2	0.606	-109.9	7.637	104.2	0.100	34.5	0.490	-77.3	0.450	18.82
1.3	0.596	-116.9	7.290	100.1	0.103	32.3	0.459	-82.2	0.474	18.49
1.4	0.575	-124.1	6.903	96.3	0.106	30.3	0.430	-86.8	0.510	18.13
1.5	0.565	-130.6	6.548	92.3	0.109	28.4	0.408	-91.2	0.534	17.81
1.6	0.554	-137.4	6.238	88.6	0.111	26.6	0.383	-96.3	0.565	17.51
1.7	0.546	-143.8	5.952	85.3	0.113	24.9	0.365	-101.0	0.591	17.23
1.8	0.536	-150.2	5.680	81.9	0.114	23.4	0.345	-105.6	0.623	16.96
1.9	0.534	-156.1	5.398	78.6	0.116	22.0	0.330	-110.3	0.646	16.66
2.0	0.529	-162.7	5.171	75.5	0.118	20.5	0.315	-115.0	0.676	16.43
2.1	0.530	-167.7	4.939	72.9	0.119	19.5	0.302	-119.6	0.701	16.20
2.2	0.533	-172.8	4.723	69.7	0.120	18.3	0.290	-124.5	0.722	15.96
2.3	0.531	-177.7	4.527	66.8	0.120	17.0	0.280	-129.3	0.752	15.76
2.4	0.534	177.0	4.340	63.8	0.120	16.0	0.270	-134.1	0.780	15.57
2.5	0.542	172.5	4.159	61.3	0.121	14.7	0.263	-139.0	0.799	15.36
2.6	0.544	167.9	3.993	58.9	0.121	13.9	0.254	-142.9	0.831	15.19
2.7	0.544	163.0	3.799	56.5	0.120	13.2	0.247	-147.5	0.873	14.99
2.8	0.522	160.3	3.641	55.3	0.121	13.8	0.242	-149.4	0.931	14.79
2.9	0.538	158.7	3.606	52.9	0.124	12.4	0.246	-154.1	0.905	14.63
3.0	0.551	155.0	3.492	50.7	0.124	11.3	0.239	-160.0	0.922	14.49
4.0	0.630	129.7	2.500	30.2	0.131	4.1	0.258	160.1	1.062	11.28
5.0	0.696	111.0	1.874	11.9	0.134	-1.6	0.332	138.4	1.161	9.04
6.0	0.736	99.0	1.511	-2.0	0.137	-5.2	0.376	126.7	1.221	7.58
7.0	0.773	87.6	1.252	-16.8	0.145	-12.0	0.424	115.2	1.203	6.64
8.0	0.809	78.0	1.062	-29.1	0.145	-16.7	0.494	105.4	1.184	6.05
9.0	0.815	70.1	0.916	-40.0	0.148	-22.1	0.512	100.8	1.232	5.02
10.0	0.843	64.6	0.784	-52.7	0.149	-28.9	0.565	90.0	1.169	4.73

$V_{CE} = 0.5 \text{ V}$, $I_c = 7 \text{ mA}$, $Z_O = 50 \Omega$

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂		K	MAG/MSG (dB)
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)		
0.1	0.909	-12.5	16.227	171.7	0.015	87.2	0.965	-10.7	-0.039	30.36
0.2	0.882	-25.7	16.048	159.9	0.029	74.2	0.922	-21.3	0.110	27.43
0.3	0.845	-36.7	15.269	151.8	0.040	66.6	0.869	-30.6	0.167	25.77
0.4	0.806	-48.4	14.509	143.3	0.050	60.7	0.809	-39.3	0.205	24.60
0.5	0.760	-58.6	13.522	136.2	0.059	55.6	0.750	-46.9	0.254	23.58
0.6	0.717	-68.6	12.584	129.5	0.066	51.3	0.692	-54.1	0.295	22.77
0.7	0.680	-78.3	11.802	123.8	0.073	47.2	0.641	-60.4	0.334	22.10
0.8	0.645	-87.4	11.053	118.3	0.077	44.1	0.590	-66.7	0.375	21.55
0.9	0.615	-95.9	10.295	113.0	0.082	41.3	0.547	-72.6	0.412	20.99
1.0	0.590	-104.4	9.666	108.2	0.085	39.0	0.505	-78.0	0.450	20.53
1.1	0.572	-112.6	9.057	103.9	0.089	36.5	0.469	-83.3	0.483	20.08
1.2	0.556	-119.8	8.496	99.8	0.092	34.6	0.437	-88.4	0.517	19.66
1.3	0.546	-126.9	8.047	96.0	0.094	32.8	0.410	-93.7	0.544	19.32
1.4	0.529	-134.2	7.588	92.4	0.097	31.4	0.385	-99.0	0.582	18.95
1.5	0.525	-140.4	7.164	88.6	0.099	29.8	0.366	-103.9	0.605	18.58
1.6	0.514	-147.2	6.811	85.2	0.101	28.3	0.345	-109.6	0.640	18.28
1.7	0.510	-153.3	6.454	82.1	0.103	27.1	0.331	-114.7	0.666	17.96
1.8	0.506	-159.6	6.136	79.0	0.105	25.7	0.316	-119.9	0.696	17.66
1.9	0.505	-164.9	5.821	76.0	0.107	24.7	0.306	-124.9	0.720	17.35
2.0	0.505	-171.2	5.546	72.9	0.109	23.6	0.295	-130.2	0.748	17.08
2.1	0.506	-175.5	5.312	70.4	0.110	22.7	0.287	-135.1	0.771	16.84
2.2	0.513	179.5	5.054	67.5	0.111	21.7	0.280	-140.3	0.793	16.58
2.3	0.514	174.6	4.835	64.6	0.113	20.7	0.276	-145.2	0.817	16.33
2.4	0.517	169.9	4.627	61.9	0.114	19.9	0.269	-150.1	0.844	16.10
2.5	0.525	165.9	4.438	59.6	0.114	18.8	0.267	-154.9	0.863	15.89
2.6	0.533	161.9	4.246	57.4	0.115	18.1	0.262	-159.2	0.886	15.68
2.7	0.532	156.9	4.046	55.2	0.115	17.6	0.259	-163.8	0.928	15.47
2.8	0.515	154.7	3.872	53.9	0.116	18.3	0.254	-165.7	0.973	15.23
2.9	0.528	153.5	3.837	51.7	0.119	17.1	0.262	-169.6	0.952	15.09
3.0	0.541	149.9	3.713	49.7	0.120	16.0	0.260	-175.0	0.966	14.92
4.0	0.625	127.1	2.643	30.3	0.132	8.5	0.302	150.2	1.067	11.44
5.0	0.692	109.2	1.975	12.8	0.137	1.8	0.379	131.7	1.142	9.30
6.0	0.731	97.5	1.594	-0.8	0.143	-2.7	0.420	120.6	1.185	7.87
7.0	0.770	86.7	1.320	-15.2	0.151	-10.3	0.464	109.2	1.170	6.92
8.0	0.806	77.0	1.125	-26.8	0.152	-15.8	0.524	100.1	1.155	6.31
9.0	0.812	69.3	0.979	-37.9	0.154	-22.1	0.536	95.0	1.191	5.39
10.0	0.840	64.0	0.842	-49.8	0.154	-29.2	0.580	84.6	1.145	5.06

$V_{CE} = 0.5 \text{ V}$, $I_c = 10 \text{ mA}$, $Z_o = 50 \Omega$

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂		K	MAG/MSG (dB)
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)		
0.1	0.878	-14.3	20.091	170.1	0.016	82.1	0.950	-12.7	0.063	30.90
0.2	0.838	-29.8	19.618	157.0	0.028	73.4	0.899	-25.5	0.125	28.40
0.3	0.798	-43.0	18.363	147.9	0.039	64.4	0.835	-36.2	0.191	26.72
0.4	0.749	-55.7	17.133	138.9	0.048	58.1	0.765	-46.1	0.246	25.51
0.5	0.701	-67.0	15.716	131.4	0.056	53.3	0.698	-54.8	0.300	24.45
0.6	0.655	-77.6	14.416	124.6	0.062	49.4	0.636	-62.8	0.346	23.65
0.7	0.618	-88.0	13.327	118.8	0.067	45.7	0.583	-69.7	0.391	22.96
0.8	0.585	-97.7	12.341	113.5	0.071	43.1	0.532	-76.5	0.436	22.39
0.9	0.558	-106.4	11.374	108.4	0.075	41.0	0.492	-83.1	0.476	21.80
1.0	0.537	-114.9	10.594	103.7	0.078	38.9	0.454	-89.0	0.518	21.30
1.1	0.523	-123.2	9.843	99.6	0.081	37.1	0.421	-95.1	0.555	20.84
1.2	0.509	-130.1	9.186	95.9	0.084	35.5	0.394	-100.7	0.591	20.39
1.3	0.505	-137.0	8.648	92.2	0.086	34.2	0.371	-106.5	0.619	20.00
1.4	0.492	-144.0	8.126	88.8	0.089	33.0	0.351	-112.4	0.657	19.61
1.5	0.488	-150.3	7.640	85.2	0.091	31.8	0.336	-117.8	0.684	19.22
1.6	0.487	-156.6	7.233	81.9	0.094	30.8	0.321	-123.9	0.713	18.88
1.7	0.484	-162.5	6.843	79.1	0.096	29.8	0.313	-129.2	0.740	18.54
1.8	0.484	-168.2	6.484	76.1	0.098	28.8	0.303	-134.8	0.767	18.21
1.9	0.486	-173.2	6.143	73.2	0.100	27.7	0.298	-139.8	0.789	17.88
2.0	0.490	-179.3	5.832	70.5	0.102	26.8	0.292	-145.0	0.813	17.57
2.1	0.492	176.6	5.577	68.2	0.104	26.2	0.288	-149.9	0.836	17.30
2.2	0.503	172.4	5.293	65.4	0.105	25.3	0.286	-154.9	0.852	17.01
2.3	0.504	168.0	5.057	62.7	0.107	24.5	0.286	-159.6	0.875	16.74
2.4	0.508	163.5	4.846	60.2	0.108	23.8	0.283	-164.2	0.900	16.51
2.5	0.516	159.7	4.635	57.9	0.110	22.8	0.285	-168.6	0.916	16.26
2.6	0.523	156.0	4.429	55.6	0.111	22.3	0.283	-172.6	0.937	16.01
2.7	0.525	152.0	4.215	53.8	0.111	21.9	0.283	-176.8	0.972	15.78
2.8	0.512	149.4	4.029	52.5	0.113	22.5	0.279	-178.8	1.010	14.91
2.9	0.525	148.3	3.993	50.4	0.116	21.3	0.289	178.5	0.987	15.36
3.0	0.538	145.1	3.866	48.4	0.117	20.1	0.291	173.6	0.997	15.18
4.0	0.622	124.2	2.745	29.8	0.133	12.2	0.348	143.5	1.071	11.51
5.0	0.690	107.4	2.044	13.1	0.140	4.5	0.425	127.0	1.128	9.47
6.0	0.729	96.4	1.657	0.2	0.148	-0.7	0.464	116.3	1.157	8.09
7.0	0.768	85.5	1.368	-13.5	0.157	-9.1	0.506	104.9	1.143	7.11
8.0	0.804	76.2	1.172	-24.9	0.157	-15.0	0.559	96.1	1.132	6.51
9.0	0.810	68.5	1.025	-35.5	0.160	-21.6	0.565	90.8	1.165	5.61
10.0	0.836	63.5	0.886	-47.3	0.159	-29.3	0.604	80.3	1.134	5.24

$V_{CE} = 0.5 \text{ V}$, $I_c = 20 \text{ mA}$, $Z_o = 50 \Omega$

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂		K	MAG/MSG (dB)
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)		
0.1	0.812	-20.9	26.831	166.4	0.015	74.2	0.904	-17.8	0.163	32.43
0.2	0.745	-41.6	25.435	150.5	0.028	68.7	0.832	-35.0	0.183	29.57
0.3	0.691	-57.7	23.040	139.9	0.038	59.7	0.748	-49.1	0.261	27.85
0.4	0.638	-73.0	20.794	130.3	0.045	53.9	0.667	-61.4	0.327	26.62
0.5	0.586	-85.9	18.447	122.5	0.051	49.5	0.595	-71.9	0.395	25.57
0.6	0.551	-97.8	16.501	115.9	0.056	46.5	0.536	-81.6	0.449	24.72
0.7	0.522	-108.7	14.938	110.4	0.060	44.2	0.488	-89.8	0.504	23.98
0.8	0.501	-118.6	13.596	105.3	0.063	42.5	0.446	-97.9	0.556	23.34
0.9	0.483	-127.3	12.356	100.7	0.066	41.1	0.415	-105.6	0.603	22.72
1.0	0.475	-135.5	11.358	96.5	0.069	40.1	0.388	-112.5	0.644	22.15
1.1	0.469	-143.3	10.446	92.8	0.072	38.9	0.367	-119.4	0.682	21.61
1.2	0.463	-149.7	9.680	89.6	0.075	38.2	0.351	-125.8	0.719	21.12
1.3	0.465	-155.8	9.044	86.1	0.077	37.4	0.338	-131.9	0.747	20.68
1.4	0.463	-162.1	8.459	83.2	0.080	36.8	0.330	-138.3	0.779	20.22
1.5	0.464	-167.4	7.910	79.9	0.083	36.0	0.325	-143.5	0.804	19.79
1.6	0.465	-173.0	7.444	76.9	0.086	35.3	0.321	-149.5	0.831	19.39
1.7	0.469	-177.9	7.018	74.3	0.088	34.6	0.320	-154.4	0.852	19.01
1.8	0.474	176.9	6.636	71.8	0.091	33.6	0.319	-159.4	0.873	18.63
1.9	0.480	172.7	6.248	69.3	0.094	33.0	0.321	-163.6	0.891	18.25
2.0	0.490	167.8	5.927	66.7	0.096	32.0	0.322	-168.0	0.908	17.91
2.1	0.492	164.6	5.652	64.6	0.098	31.6	0.325	-172.0	0.925	17.59
2.2	0.502	160.8	5.353	62.1	0.101	30.7	0.327	-176.0	0.940	17.26
2.3	0.505	157.4	5.116	59.6	0.103	30.1	0.332	-179.6	0.955	16.96
2.4	0.515	153.5	4.883	57.1	0.105	29.5	0.335	176.7	0.970	16.68
2.5	0.524	150.6	4.670	55.1	0.107	28.4	0.341	173.4	0.980	16.41
2.6	0.532	147.1	4.459	53.0	0.109	27.8	0.342	170.0	0.996	16.13
2.7	0.536	143.5	4.236	51.2	0.110	27.2	0.346	166.6	1.022	14.96
2.8	0.525	141.1	4.059	50.1	0.112	27.9	0.344	164.7	1.051	14.21
2.9	0.537	140.6	4.014	48.0	0.115	26.7	0.354	163.3	1.029	14.38
3.0	0.550	137.7	3.886	46.2	0.117	25.6	0.359	159.4	1.035	14.08
4.0	0.631	119.9	2.746	28.7	0.137	16.0	0.429	135.4	1.075	11.36
5.0	0.701	104.4	2.036	13.0	0.146	7.4	0.504	121.2	1.106	9.46
6.0	0.739	94.0	1.652	1.0	0.154	1.2	0.539	111.1	1.127	8.13
7.0	0.774	83.4	1.365	-12.3	0.164	-7.9	0.576	99.6	1.119	7.09
8.0	0.809	74.5	1.173	-22.8	0.165	-14.5	0.624	91.0	1.107	6.53
9.0	0.812	67.2	1.033	-32.6	0.167	-21.3	0.624	85.5	1.140	5.63
10.0	0.838	62.3	0.894	-43.8	0.166	-29.4	0.655	74.9	1.120	5.21

$V_{CE} = 1\text{ V}$, $I_C = 1\text{ mA}$, $Z_o = 50\ \Omega$

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂		K	MAG/MSG (dB)
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)		
0.1	0.994	-4.9	3.302	175.5	0.013	88.2	0.997	-3.8	-0.019	24.00
0.2	0.983	-11.5	3.357	170.0	0.026	81.4	0.979	-7.9	0.038	21.15
0.3	0.974	-16.5	3.311	165.6	0.037	76.0	0.958	-11.3	0.090	19.57
0.4	0.974	-22.4	3.307	160.6	0.048	72.0	0.935	-14.6	0.106	18.39
0.5	0.965	-27.7	3.242	156.1	0.059	68.0	0.917	-17.7	0.133	17.41
0.6	0.952	-33.6	3.187	151.3	0.069	64.9	0.894	-20.6	0.145	16.64
0.7	0.941	-39.1	3.146	147.4	0.079	61.3	0.874	-23.2	0.165	16.01
0.8	0.924	-45.1	3.098	143.0	0.088	57.7	0.851	-26.0	0.185	15.47
0.9	0.911	-50.8	3.046	138.5	0.097	54.6	0.831	-28.7	0.204	14.97
1.0	0.896	-56.8	3.006	134.1	0.105	51.2	0.808	-31.2	0.225	14.58
1.1	0.881	-62.9	2.959	130.0	0.113	47.7	0.788	-33.8	0.242	14.20
1.2	0.866	-68.4	2.893	126.2	0.120	44.6	0.764	-36.0	0.264	13.84
1.3	0.857	-74.3	2.859	122.3	0.126	41.3	0.744	-38.4	0.275	13.56
1.4	0.838	-80.5	2.813	117.8	0.133	38.3	0.722	-40.9	0.299	13.26
1.5	0.826	-86.2	2.749	113.8	0.139	35.3	0.705	-43.3	0.313	12.97
1.6	0.810	-91.9	2.713	109.6	0.144	32.2	0.682	-45.8	0.340	12.75
1.7	0.795	-98.2	2.666	105.7	0.149	29.3	0.666	-48.4	0.351	12.52
1.8	0.775	-104.1	2.603	101.6	0.153	26.3	0.646	-50.6	0.383	12.31
1.9	0.762	-110.2	2.549	97.7	0.157	23.6	0.626	-52.7	0.401	12.09
2.0	0.750	-116.4	2.502	93.5	0.160	20.9	0.607	-55.0	0.422	11.94
2.1	0.738	-122.0	2.445	90.1	0.162	18.2	0.590	-57.5	0.440	11.79
2.2	0.731	-128.5	2.383	86.2	0.163	15.3	0.571	-59.6	0.457	11.65
2.3	0.719	-134.3	2.332	82.3	0.164	12.5	0.558	-61.9	0.483	11.52
2.4	0.710	-140.5	2.275	78.5	0.165	9.7	0.537	-63.9	0.511	11.40
2.5	0.704	-146.4	2.212	75.1	0.165	7.0	0.523	-66.1	0.531	11.28
2.6	0.694	-152.4	2.145	71.8	0.163	4.5	0.510	-68.1	0.563	11.19
2.7	0.671	-158.8	2.053	68.4	0.160	2.3	0.497	-69.9	0.630	11.08
2.8	0.634	-160.9	1.979	66.8	0.159	2.1	0.491	-71.4	0.718	10.95
2.9	0.662	-163.8	1.982	64.1	0.163	-0.9	0.474	-74.2	0.673	10.85
3.0	0.673	-169.5	1.932	60.7	0.162	-3.6	0.456	-76.2	0.682	10.77
4.0	0.714	151.3	1.454	33.4	0.140	-17.9	0.356	-97.6	0.952	10.16
5.0	0.760	124.8	1.119	9.2	0.114	-23.6	0.328	-130.9	1.291	6.66
6.0	0.793	108.4	0.886	-7.9	0.098	-19.8	0.365	-157.4	1.628	4.92
7.0	0.827	94.4	0.724	-24.8	0.098	-15.0	0.426	177.2	1.621	4.06
8.0	0.857	82.9	0.591	-38.2	0.104	-11.3	0.517	152.0	1.494	3.37
9.0	0.863	73.8	0.484	-48.9	0.115	-12.7	0.582	139.0	1.500	2.06
10.0	0.886	67.2	0.404	-60.0	0.127	-18.1	0.663	120.4	1.250	2.02

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

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂		K	MAG/MSG (dB)
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)		
0.1	0.966	-7.9	8.766	174.5	0.014	85.0	0.987	-6.1	0.012	27.84
0.2	0.951	-15.9	8.863	166.4	0.025	79.2	0.964	-12.2	0.068	25.47
0.3	0.930	-23.3	8.646	160.7	0.035	73.1	0.931	-17.6	0.111	23.88
0.4	0.915	-31.3	8.501	154.4	0.046	67.8	0.898	-22.9	0.143	22.68
0.5	0.893	-38.4	8.203	148.7	0.056	63.4	0.865	-27.5	0.177	21.67
0.6	0.863	-46.1	7.917	143.1	0.064	59.5	0.826	-32.1	0.201	20.89
0.7	0.839	-53.2	7.678	138.3	0.073	55.7	0.791	-36.1	0.225	20.25
0.8	0.808	-60.5	7.429	133.1	0.079	51.9	0.752	-40.1	0.258	19.73
0.9	0.783	-67.6	7.140	128.0	0.086	48.7	0.719	-44.0	0.282	19.21
1.0	0.756	-74.9	6.909	123.1	0.091	45.5	0.682	-47.6	0.311	18.81
1.1	0.734	-82.1	6.656	118.8	0.096	42.2	0.649	-51.2	0.333	18.41
1.2	0.711	-88.6	6.367	114.6	0.100	39.5	0.615	-54.3	0.361	18.02
1.3	0.698	-95.2	6.180	110.6	0.104	36.7	0.585	-57.7	0.378	17.73
1.4	0.670	-102.2	5.939	106.3	0.108	34.2	0.555	-61.0	0.412	17.40
1.5	0.656	-108.4	5.713	102.3	0.111	31.8	0.530	-64.1	0.434	17.11
1.6	0.637	-114.9	5.516	98.4	0.114	29.4	0.501	-67.5	0.463	16.84
1.7	0.620	-121.5	5.317	94.7	0.117	27.3	0.479	-70.9	0.485	16.59
1.8	0.605	-128.0	5.110	90.9	0.119	25.1	0.454	-73.8	0.515	16.34
1.9	0.597	-134.1	4.915	87.4	0.121	23.3	0.433	-76.8	0.534	16.09
2.0	0.582	-140.6	4.748	83.8	0.122	21.4	0.411	-80.0	0.565	15.89
2.1	0.576	-146.2	4.588	80.9	0.123	19.8	0.392	-83.1	0.588	15.71
2.2	0.572	-152.4	4.397	77.6	0.124	18.0	0.372	-86.3	0.613	15.51
2.3	0.567	-158.1	4.247	74.1	0.124	16.4	0.356	-89.2	0.640	15.34
2.4	0.563	-163.7	4.096	71.0	0.124	14.8	0.337	-92.4	0.670	15.18
2.5	0.566	-169.3	3.941	68.1	0.124	13.2	0.321	-95.5	0.691	15.02
2.6	0.565	-174.6	3.799	65.3	0.124	11.8	0.307	-97.9	0.719	14.87
2.7	0.554	179.6	3.619	62.7	0.122	10.7	0.293	-100.5	0.775	14.71
2.8	0.526	176.8	3.468	61.3	0.122	11.3	0.287	-101.7	0.844	14.52
2.9	0.545	175.1	3.450	59.0	0.125	9.4	0.277	-106.1	0.815	14.40
3.0	0.558	170.2	3.344	56.3	0.125	8.0	0.259	-109.7	0.832	14.27
4.0	0.629	138.9	2.434	33.7	0.124	0.5	0.185	-148.9	1.034	11.79
5.0	0.690	117.2	1.847	13.5	0.121	-3.8	0.224	172.7	1.195	9.16
6.0	0.735	103.6	1.482	-1.8	0.122	-5.4	0.273	154.9	1.281	7.65
7.0	0.777	91.1	1.224	-17.7	0.129	-9.6	0.335	139.6	1.245	6.78
8.0	0.814	80.9	1.032	-31.1	0.132	-12.7	0.425	125.0	1.203	6.21
9.0	0.825	72.3	0.870	-43.0	0.136	-17.4	0.471	119.1	1.226	5.18
10.0	0.853	66.7	0.740	-55.8	0.141	-23.5	0.544	105.5	1.116	5.13

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

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂		K	MAG/MSG (dB)
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)		
0.1	0.938	-8.2	12.963	173.3	0.013	81.7	0.980	-7.6	0.083	30.08
0.2	0.913	-19.6	12.982	163.7	0.024	77.5	0.949	-15.6	0.086	27.29
0.3	0.888	-28.1	12.543	157.1	0.034	70.4	0.909	-22.3	0.147	25.62
0.4	0.864	-37.6	12.190	149.8	0.044	65.1	0.863	-28.9	0.183	24.40
0.5	0.828	-46.0	11.581	143.5	0.053	60.4	0.818	-34.6	0.222	23.39
0.6	0.791	-54.6	11.032	137.3	0.060	56.4	0.770	-40.1	0.254	22.64
0.7	0.759	-62.6	10.533	132.0	0.067	52.7	0.726	-45.0	0.286	21.96
0.8	0.723	-70.7	10.034	126.6	0.072	49.2	0.680	-49.7	0.323	21.43
0.9	0.693	-78.6	9.504	121.4	0.078	46.2	0.639	-54.2	0.354	20.88
1.0	0.664	-86.2	9.077	116.5	0.082	43.5	0.599	-58.3	0.388	20.46
1.1	0.639	-94.0	8.622	112.1	0.086	40.6	0.562	-62.5	0.417	20.03
1.2	0.615	-100.7	8.173	108.0	0.089	38.3	0.526	-66.2	0.452	19.63
1.3	0.603	-107.7	7.830	104.0	0.092	36.1	0.494	-70.0	0.474	19.31
1.4	0.579	-114.7	7.464	100.1	0.095	34.2	0.464	-74.0	0.508	18.97
1.5	0.564	-121.4	7.100	96.1	0.098	32.4	0.439	-77.6	0.535	18.62
1.6	0.548	-127.9	6.788	92.5	0.100	30.5	0.412	-81.5	0.568	18.33
1.7	0.537	-134.4	6.500	89.1	0.102	28.9	0.392	-85.4	0.592	18.05
1.8	0.527	-140.9	6.205	85.7	0.104	27.4	0.369	-89.1	0.621	17.77
1.9	0.520	-147.3	5.917	82.5	0.105	26.1	0.350	-92.8	0.647	17.49
2.0	0.512	-153.5	5.683	79.3	0.107	24.6	0.332	-96.8	0.675	17.25
2.1	0.510	-158.6	5.455	76.7	0.108	23.7	0.316	-100.6	0.698	17.03
2.2	0.512	-164.6	5.225	73.5	0.109	22.3	0.300	-104.7	0.721	16.81
2.3	0.511	-169.8	5.015	70.4	0.110	21.2	0.286	-108.6	0.746	16.58
2.4	0.509	-175.4	4.815	67.5	0.111	20.1	0.271	-112.8	0.778	16.38
2.5	0.515	179.9	4.630	64.9	0.111	18.9	0.260	-117.0	0.797	16.19
2.6	0.519	175.0	4.436	62.4	0.111	18.0	0.248	-120.4	0.825	16.00
2.7	0.513	169.6	4.237	60.2	0.111	17.4	0.237	-124.2	0.871	15.81
2.8	0.492	166.7	4.052	58.8	0.112	18.0	0.232	-125.7	0.923	15.58
2.9	0.508	165.1	4.027	56.6	0.115	16.5	0.231	-130.7	0.898	15.44
3.0	0.521	161.1	3.896	54.2	0.116	15.4	0.217	-136.1	0.916	15.28
4.0	0.603	133.9	2.816	33.5	0.123	8.6	0.201	177.3	1.055	12.16
5.0	0.674	113.9	2.129	14.7	0.127	2.8	0.269	149.0	1.144	9.93
6.0	0.719	101.2	1.712	0.3	0.133	-0.9	0.317	135.1	1.196	8.43
7.0	0.760	89.6	1.419	-14.7	0.142	-7.6	0.369	122.7	1.172	7.50
8.0	0.800	79.6	1.206	-27.4	0.143	-12.3	0.447	111.7	1.146	6.93
9.0	0.808	71.5	1.034	-39.0	0.147	-18.3	0.474	106.8	1.177	5.93
10.0	0.842	65.7	0.888	-51.9	0.149	-25.0	0.534	95.5	1.091	5.91

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

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂		K	MAG/MSG (dB)
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)		
0.1	0.907	-9.8	16.368	172.4	0.014	82.1	0.974	-9.0	0.084	30.61
0.2	0.886	-22.3	16.274	161.6	0.025	75.8	0.936	-18.2	0.121	28.21
0.3	0.853	-32.4	15.544	154.2	0.034	68.9	0.889	-26.1	0.162	26.65
0.4	0.820	-42.7	14.920	146.2	0.043	63.1	0.834	-33.5	0.214	25.45
0.5	0.777	-52.0	14.038	139.6	0.051	58.7	0.780	-40.1	0.254	24.43
0.6	0.735	-61.2	13.175	133.1	0.057	54.8	0.724	-46.2	0.295	23.63
0.7	0.700	-69.9	12.462	127.5	0.063	51.1	0.677	-51.5	0.332	22.96
0.8	0.662	-78.4	11.748	122.1	0.068	47.7	0.625	-56.7	0.376	22.40
0.9	0.628	-86.4	11.010	116.9	0.072	45.2	0.583	-61.8	0.411	21.85
1.0	0.600	-94.3	10.409	112.0	0.075	43.0	0.541	-66.1	0.450	21.40
1.1	0.578	-102.4	9.808	107.8	0.079	40.3	0.504	-70.6	0.482	20.94
1.2	0.555	-109.3	9.237	103.9	0.082	38.5	0.468	-74.6	0.519	20.52
1.3	0.544	-116.2	8.783	100.0	0.084	36.9	0.438	-78.8	0.544	20.18
1.4	0.524	-123.2	8.324	96.3	0.087	35.3	0.410	-83.2	0.580	19.81
1.5	0.513	-129.8	7.884	92.6	0.090	33.8	0.388	-87.2	0.606	19.44
1.6	0.500	-136.5	7.504	89.1	0.091	32.4	0.362	-91.7	0.639	19.14
1.7	0.491	-143.0	7.160	85.9	0.094	31.1	0.345	-96.1	0.664	18.83
1.8	0.485	-149.2	6.816	82.7	0.096	29.8	0.325	-100.4	0.693	18.52
1.9	0.479	-155.5	6.479	79.7	0.098	28.8	0.310	-104.6	0.719	18.20
2.0	0.477	-161.7	6.209	76.5	0.100	27.6	0.294	-109.1	0.744	17.95
2.1	0.477	-166.5	5.936	74.1	0.101	26.8	0.282	-113.6	0.768	17.69
2.2	0.480	-172.1	5.664	71.2	0.102	25.8	0.270	-118.3	0.792	17.45
2.3	0.480	-177.1	5.437	68.3	0.104	24.9	0.260	-122.8	0.814	17.20
2.4	0.484	177.7	5.211	65.5	0.105	23.9	0.249	-127.6	0.838	16.98
2.5	0.489	173.2	5.005	63.1	0.106	23.0	0.242	-132.3	0.859	16.76
2.6	0.497	168.8	4.796	60.8	0.106	22.3	0.233	-136.4	0.879	16.54
2.7	0.494	163.4	4.557	58.6	0.107	21.7	0.225	-141.1	0.923	16.31
2.8	0.475	160.4	4.363	57.3	0.108	22.3	0.220	-142.7	0.969	16.07
2.9	0.491	159.5	4.329	55.2	0.111	21.1	0.224	-147.4	0.942	15.90
3.0	0.504	155.7	4.198	53.0	0.112	20.1	0.216	-153.6	0.957	15.74
4.0	0.589	130.8	3.017	33.3	0.124	12.8	0.233	163.1	1.061	12.33
5.0	0.664	112.0	2.276	15.2	0.131	6.1	0.310	140.0	1.124	10.24
6.0	0.710	100.0	1.837	1.6	0.139	1.4	0.357	127.5	1.158	8.82
7.0	0.753	88.5	1.525	-13.0	0.148	-6.2	0.406	115.5	1.137	7.88
8.0	0.791	78.6	1.298	-25.4	0.150	-11.8	0.474	105.5	1.126	7.22
9.0	0.801	71.2	1.123	-36.3	0.153	-18.3	0.492	100.7	1.149	6.32
10.0	0.836	65.6	0.966	-48.9	0.154	-25.5	0.543	89.8	1.080	6.24

$V_{CE} = 1\text{ V}$, $I_C = 10\text{ mA}$, $Z_0 = 50\ \Omega$

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂		K	MAG/MSG (dB)
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)		
0.1	0.881	-12.7	20.303	171.2	0.013	84.9	0.966	-10.7	0.019	31.95
0.2	0.851	-25.8	19.968	159.2	0.024	75.5	0.920	-21.3	0.122	29.25
0.3	0.812	-36.8	18.872	150.9	0.033	67.9	0.862	-30.4	0.186	27.62
0.4	0.768	-48.6	17.858	142.5	0.041	61.3	0.798	-38.7	0.246	26.41
0.5	0.719	-58.4	16.542	135.2	0.048	56.8	0.735	-46.0	0.302	25.37
0.6	0.673	-68.3	15.332	128.7	0.054	53.3	0.674	-52.9	0.345	24.56
0.7	0.636	-77.5	14.299	123.0	0.059	49.9	0.623	-58.6	0.388	23.86
0.8	0.596	-86.6	13.340	117.6	0.063	47.2	0.569	-64.2	0.436	23.29
0.9	0.563	-95.0	12.395	112.5	0.066	44.8	0.527	-69.7	0.477	22.71
1.0	0.538	-103.1	11.609	107.8	0.070	43.0	0.486	-74.5	0.518	22.22
1.1	0.518	-111.2	10.849	103.7	0.073	41.0	0.449	-79.2	0.554	21.74
1.2	0.501	-118.1	10.169	100.0	0.075	39.6	0.417	-83.7	0.589	21.31
1.3	0.492	-125.0	9.617	96.3	0.078	38.3	0.390	-88.3	0.617	20.93
1.4	0.473	-132.1	9.063	92.9	0.080	37.0	0.364	-93.1	0.655	20.52
1.5	0.468	-138.3	8.553	89.2	0.083	35.9	0.344	-97.6	0.679	20.13
1.6	0.457	-145.1	8.110	86.0	0.085	34.8	0.323	-102.8	0.713	19.79
1.7	0.453	-151.5	7.694	83.1	0.087	34.0	0.309	-107.6	0.737	19.45
1.8	0.450	-157.9	7.319	80.1	0.090	32.8	0.292	-112.5	0.764	19.12
1.9	0.450	-163.4	6.950	77.1	0.092	32.0	0.282	-117.2	0.785	18.80
2.0	0.448	-169.7	6.635	74.2	0.094	31.1	0.270	-122.3	0.810	18.50
2.1	0.450	-174.1	6.327	71.9	0.096	30.5	0.262	-127.1	0.831	18.21
2.2	0.456	-179.2	6.020	69.0	0.097	29.5	0.254	-132.3	0.852	17.92
2.3	0.459	176.0	5.779	66.4	0.099	28.7	0.248	-137.1	0.871	17.67
2.4	0.463	171.2	5.532	63.8	0.101	27.9	0.242	-142.2	0.891	17.40
2.5	0.473	166.8	5.308	61.4	0.102	27.0	0.239	-147.1	0.906	17.17
2.6	0.478	162.8	5.072	59.3	0.103	26.4	0.233	-151.5	0.929	16.92
2.7	0.480	158.2	4.844	57.2	0.104	25.9	0.229	-156.3	0.961	16.70
2.8	0.463	155.0	4.631	56.0	0.105	26.5	0.224	-158.1	1.000	16.30
2.9	0.478	154.3	4.579	54.0	0.109	25.2	0.232	-162.0	0.976	16.25
3.0	0.490	150.7	4.433	51.9	0.110	24.2	0.229	-168.0	0.988	16.05
4.0	0.582	128.2	3.182	33.1	0.126	16.2	0.271	153.8	1.061	12.52
5.0	0.660	110.2	2.397	15.8	0.135	8.6	0.352	134.1	1.105	10.52
6.0	0.704	98.5	1.934	2.6	0.144	3.1	0.397	122.3	1.133	9.07
7.0	0.747	87.5	1.608	-11.6	0.154	-5.3	0.445	110.4	1.114	8.15
8.0	0.788	78.0	1.370	-23.4	0.155	-11.4	0.507	100.8	1.102	7.51
9.0	0.795	70.4	1.197	-34.1	0.158	-18.3	0.519	95.7	1.127	6.63
10.0	0.832	64.9	1.032	-46.3	0.159	-25.9	0.563	85.0	1.070	6.51

$V_{CE} = 1\text{ V}$, $I_C = 20\text{ mA}$, $Z_0 = 50\ \Omega$

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂		K	MAG/MSG (dB)
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)		
0.1	0.814	-16.0	28.021	168.6	0.013	84.6	0.946	-14.1	0.049	33.50
0.2	0.768	-33.0	27.009	154.4	0.023	71.8	0.881	-27.6	0.186	30.78
0.3	0.716	-46.9	24.816	144.6	0.030	64.0	0.802	-38.9	0.253	29.16
0.4	0.661	-60.1	22.742	135.4	0.037	58.9	0.722	-48.9	0.321	27.85
0.5	0.606	-71.4	20.480	127.7	0.043	54.4	0.649	-57.3	0.393	26.75
0.6	0.559	-82.3	18.537	121.1	0.048	51.6	0.583	-65.0	0.449	25.90
0.7	0.521	-92.4	16.964	115.7	0.052	49.3	0.529	-71.8	0.501	25.17
0.8	0.492	-102.0	15.551	110.5	0.055	47.5	0.478	-78.2	0.552	24.51
0.9	0.465	-110.7	14.234	105.8	0.058	45.9	0.439	-84.3	0.597	23.89
1.0	0.447	-119.0	13.171	101.4	0.061	44.8	0.403	-89.7	0.640	23.34
1.1	0.435	-127.4	12.196	97.7	0.064	43.4	0.372	-95.4	0.676	22.80
1.2	0.424	-134.0	11.347	94.2	0.067	42.7	0.346	-100.7	0.711	22.30
1.3	0.419	-140.7	10.625	90.8	0.069	42.0	0.325	-106.2	0.741	21.86
1.4	0.411	-147.7	9.967	87.7	0.072	41.3	0.307	-111.9	0.772	21.40
1.5	0.409	-153.5	9.359	84.4	0.075	40.6	0.294	-117.0	0.795	20.97
1.6	0.409	-159.9	8.830	81.4	0.077	39.7	0.281	-123.0	0.820	20.57
1.7	0.407	-165.6	8.357	78.8	0.080	39.0	0.273	-128.3	0.842	20.18
1.8	0.410	-171.5	7.908	76.1	0.083	38.3	0.265	-133.7	0.863	19.80
1.9	0.414	-176.3	7.472	73.5	0.085	37.5	0.262	-138.6	0.880	19.42
2.0	0.420	178.1	7.123	70.9	0.088	36.7	0.257	-143.8	0.897	19.10
2.1	0.422	174.2	6.799	68.9	0.090	36.1	0.255	-148.7	0.913	18.77
2.2	0.433	169.5	6.450	66.4	0.092	35.3	0.254	-153.6	0.928	18.44
2.3	0.437	165.6	6.171	63.7	0.095	34.5	0.255	-158.3	0.942	18.15
2.4	0.445	161.2	5.898	61.4	0.097	33.8	0.255	-163.0	0.955	17.84
2.5	0.455	157.6	5.655	59.3	0.099	32.8	0.257	-167.4	0.967	17.58
2.6	0.464	154.3	5.409	57.2	0.100	32.2	0.256	-171.4	0.980	17.31
2.7	0.468	150.2	5.157	55.2	0.102	31.6	0.258	-176.0	1.004	16.66
2.8	0.456	147.1	4.930	54.1	0.104	32.1	0.253	-177.8	1.032	15.67
2.9	0.466	146.7	4.863	52.2	0.107	30.9	0.264	179.9	1.013	15.86
3.0	0.480	143.6	4.708	50.4	0.109	29.7	0.267	174.8	1.020	15.49
4.0	0.573	124.2	3.366	32.6	0.130	20.5	0.333	144.5	1.058	12.68
5.0	0.652	107.8	2.529	16.4	0.140	11.6	0.416	127.8	1.087	10.76
6.0	0.701	96.8	2.049	3.9	0.150	5.2	0.462	116.6	1.099	9.43
7.0	0.742	86.3	1.696	-9.6	0.161	-4.2	0.506	105.0	1.088	8.41
8.0	0.785	77.0	1.451	-20.7	0.162	-10.8	0.561	95.6	1.077	7.82
9.0	0.795	69.3	1.272	-31.1	0.165	-18.1	0.569	89.9	1.094	6.99
10.0	0.822	64.1	1.103	-42.9	0.165	-26.2	0.604	79.2	1.076	6.57

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

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂		K	MAG/MSG (dB)
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)		
0.1	0.989	-4.9	3.268	175.6	0.011	84.8	0.997	-3.5	0.041	24.55
0.2	0.988	-10.7	3.337	170.4	0.022	81.9	0.980	-7.3	0.039	21.85
0.3	0.981	-15.5	3.282	166.3	0.032	76.8	0.961	-10.4	0.081	20.14
0.4	0.976	-21.3	3.283	161.6	0.042	72.2	0.939	-13.5	0.111	18.96
0.5	0.969	-26.4	3.219	157.1	0.051	68.8	0.921	-16.2	0.134	17.97
0.6	0.957	-32.0	3.171	152.6	0.060	65.7	0.898	-18.9	0.148	17.21
0.7	0.946	-37.2	3.133	148.9	0.069	62.4	0.881	-21.2	0.166	16.57
0.8	0.929	-42.8	3.089	144.8	0.077	59.0	0.860	-23.8	0.188	16.05
0.9	0.918	-48.4	3.040	140.4	0.084	56.2	0.839	-26.2	0.203	15.57
1.0	0.903	-54.2	3.011	136.1	0.092	52.8	0.820	-28.5	0.226	15.16
1.1	0.890	-60.0	2.975	132.1	0.099	49.6	0.801	-30.8	0.243	14.80
1.2	0.877	-65.3	2.908	128.4	0.105	46.6	0.779	-32.8	0.264	14.43
1.3	0.868	-71.0	2.881	124.7	0.111	43.3	0.760	-35.1	0.274	14.16
1.4	0.850	-77.0	2.840	120.4	0.117	40.5	0.740	-37.2	0.299	13.87
1.5	0.836	-82.7	2.775	116.4	0.122	37.5	0.725	-39.4	0.316	13.56
1.6	0.819	-88.4	2.751	112.3	0.127	34.6	0.705	-41.8	0.340	13.37
1.7	0.804	-94.2	2.704	108.4	0.132	31.8	0.689	-44.1	0.357	13.12
1.8	0.784	-100.0	2.644	104.4	0.135	29.1	0.671	-46.0	0.387	12.91
1.9	0.774	-106.1	2.601	100.6	0.139	26.4	0.654	-48.1	0.399	12.71
2.0	0.758	-112.0	2.566	96.4	0.142	23.8	0.636	-50.3	0.425	12.56
2.1	0.748	-117.9	2.508	93.0	0.144	21.3	0.621	-52.3	0.439	12.41
2.2	0.737	-124.1	2.449	89.3	0.145	18.5	0.604	-54.4	0.462	12.27
2.3	0.725	-130.0	2.400	85.4	0.146	15.6	0.588	-56.5	0.489	12.16
2.4	0.717	-136.3	2.345	81.6	0.147	12.9	0.572	-58.5	0.512	12.04
2.5	0.710	-142.1	2.283	78.2	0.147	10.2	0.556	-60.4	0.537	11.91
2.6	0.701	-148.2	2.218	74.9	0.146	7.8	0.544	-62.1	0.567	11.82
2.7	0.675	-154.5	2.131	71.5	0.143	5.8	0.532	-63.9	0.638	11.74
2.8	0.637	-156.6	2.048	70.0	0.142	5.6	0.526	-65.0	0.730	11.58
2.9	0.663	-159.6	2.053	67.4	0.146	2.6	0.509	-67.7	0.688	11.49
3.0	0.675	-165.5	2.001	63.9	0.145	-0.1	0.491	-69.8	0.695	11.38
4.0	0.709	154.1	1.518	36.4	0.126	-13.4	0.391	-88.9	0.990	10.80
5.0	0.757	126.7	1.175	12.2	0.104	-16.9	0.350	-119.8	1.335	7.07
6.0	0.789	109.8	0.933	-5.3	0.092	-11.8	0.375	-146.8	1.650	5.33
7.0	0.826	95.4	0.764	-22.1	0.097	-6.8	0.427	-173.5	1.546	4.59
8.0	0.857	83.7	0.628	-36.1	0.107	-4.5	0.510	159.4	1.392	3.94
9.0	0.863	74.5	0.514	-46.7	0.120	-7.6	0.577	145.0	1.376	2.66
10.0	0.885	67.7	0.428	-58.7	0.133	-13.7	0.655	125.5	1.158	2.66

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

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂		K	MAG/MSG (dB)
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)		
0.1	0.971	-6.9	8.712	174.8	0.011	85.6	0.990	-5.3	0.012	28.97
0.2	0.953	-14.4	8.833	167.1	0.021	77.9	0.965	-11.0	0.102	26.18
0.3	0.937	-21.6	8.626	161.9	0.031	72.2	0.936	-15.8	0.138	24.47
0.4	0.919	-28.9	8.513	155.8	0.040	68.6	0.903	-20.5	0.157	23.31
0.5	0.900	-35.5	8.235	150.4	0.049	64.3	0.873	-24.6	0.192	22.27
0.6	0.872	-42.8	7.975	145.0	0.056	60.9	0.837	-28.7	0.210	21.53
0.7	0.850	-49.6	7.750	140.3	0.063	57.3	0.806	-32.2	0.232	20.88
0.8	0.821	-56.5	7.536	135.5	0.069	53.8	0.770	-35.8	0.261	20.37
0.9	0.796	-63.1	7.265	130.4	0.075	50.8	0.738	-39.2	0.289	19.84
1.0	0.769	-70.0	7.057	125.8	0.080	47.7	0.706	-42.3	0.316	19.43
1.1	0.747	-76.9	6.819	121.4	0.085	44.6	0.674	-45.4	0.339	19.04
1.2	0.721	-83.2	6.551	117.5	0.089	42.0	0.642	-48.0	0.370	18.66
1.3	0.707	-89.6	6.367	113.4	0.093	39.3	0.614	-51.1	0.386	18.37
1.4	0.684	-96.1	6.155	109.2	0.097	37.1	0.586	-53.9	0.414	18.04
1.5	0.665	-102.5	5.919	105.2	0.100	34.7	0.561	-56.6	0.438	17.74
1.6	0.646	-108.6	5.739	101.2	0.102	32.5	0.533	-59.6	0.468	17.49
1.7	0.627	-115.1	5.548	97.7	0.105	30.4	0.511	-62.6	0.489	17.23
1.8	0.608	-121.3	5.350	93.9	0.107	28.4	0.487	-64.9	0.523	16.99
1.9	0.598	-127.8	5.157	90.5	0.109	26.4	0.467	-67.5	0.540	16.74
2.0	0.582	-133.9	4.995	86.9	0.111	24.7	0.445	-70.2	0.571	16.54
2.1	0.575	-139.5	4.828	83.8	0.112	23.1	0.426	-72.7	0.592	16.35
2.2	0.571	-145.6	4.647	80.6	0.112	21.4	0.405	-75.4	0.616	16.17
2.3	0.562	-151.7	4.500	77.2	0.113	19.6	0.388	-77.8	0.645	16.01
2.4	0.558	-157.6	4.347	74.0	0.113	18.2	0.369	-80.4	0.672	15.84
2.5	0.556	-163.2	4.196	71.1	0.114	16.7	0.353	-82.9	0.697	15.68
2.6	0.555	-168.6	4.044	68.5	0.113	15.4	0.339	-84.8	0.724	15.53
2.7	0.541	-174.8	3.860	65.8	0.112	14.3	0.323	-86.8	0.783	15.37
2.8	0.514	-177.6	3.705	64.3	0.112	14.8	0.318	-87.8	0.846	15.18
2.9	0.532	-179.5	3.679	62.1	0.115	13.0	0.305	-91.7	0.821	15.04
3.0	0.544	175.6	3.573	59.4	0.115	11.5	0.285	-94.3	0.841	14.93
4.0	0.616	142.4	2.619	36.6	0.115	4.7	0.190	-125.6	1.036	12.40
5.0	0.679	119.6	2.001	15.8	0.114	1.2	0.198	-168.1	1.191	9.79
6.0	0.723	105.4	1.611	0.1	0.118	-0.3	0.241	169.5	1.265	8.27
7.0	0.768	92.8	1.330	-15.9	0.126	-4.4	0.304	151.0	1.213	7.43
8.0	0.810	82.0	1.123	-29.7	0.131	-7.8	0.395	133.4	1.151	6.97
9.0	0.819	73.8	0.946	-41.9	0.137	-13.0	0.451	126.2	1.172	5.87
10.0	0.853	67.4	0.802	-55.3	0.143	-19.3	0.527	111.6	1.038	6.28

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

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂		K	MAG/MSG (dB)
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)		
0.1	0.947	-8.6	12.943	173.8	0.012	83.3	0.981	-6.9	0.045	30.43
0.2	0.920	-17.9	12.994	164.7	0.021	76.4	0.951	-13.9	0.122	27.88
0.3	0.895	-25.6	12.589	158.4	0.030	70.5	0.914	-19.8	0.171	26.20
0.4	0.870	-34.3	12.293	151.6	0.038	66.3	0.872	-25.7	0.194	25.07
0.5	0.838	-42.4	11.760	145.4	0.046	61.6	0.830	-30.7	0.235	24.06
0.6	0.803	-50.3	11.230	139.4	0.053	58.1	0.785	-35.6	0.264	23.28
0.7	0.772	-57.9	10.771	134.4	0.059	54.7	0.746	-39.7	0.294	22.62
0.8	0.736	-65.3	10.325	129.2	0.064	51.3	0.702	-44.0	0.331	22.09
0.9	0.706	-72.8	9.821	124.0	0.069	48.6	0.663	-47.9	0.360	21.54
1.0	0.675	-80.1	9.408	119.2	0.073	45.9	0.624	-51.4	0.396	21.12
1.1	0.648	-87.3	8.980	114.9	0.077	43.4	0.590	-54.9	0.424	20.69
1.2	0.626	-93.9	8.532	110.9	0.080	41.0	0.554	-58.0	0.457	20.31
1.3	0.611	-100.5	8.202	107.0	0.082	38.9	0.523	-61.3	0.480	19.98
1.4	0.583	-107.4	7.840	103.0	0.085	37.1	0.494	-64.5	0.515	19.63
1.5	0.569	-113.7	7.488	99.1	0.088	35.3	0.468	-67.6	0.540	19.30
1.6	0.551	-120.6	7.191	95.5	0.090	33.6	0.440	-70.8	0.570	19.02
1.7	0.534	-126.8	6.890	92.1	0.092	32.1	0.420	-74.2	0.597	18.72
1.8	0.519	-133.1	6.604	88.8	0.094	30.6	0.396	-77.0	0.629	18.46
1.9	0.511	-139.1	6.321	85.5	0.096	29.3	0.377	-80.1	0.652	18.17
2.0	0.499	-145.9	6.064	82.2	0.098	28.0	0.356	-83.2	0.683	17.92
2.1	0.497	-151.3	5.841	79.4	0.099	27.0	0.339	-86.3	0.704	17.71
2.2	0.497	-157.4	5.588	76.4	0.100	25.7	0.321	-89.6	0.728	17.48
2.3	0.490	-162.8	5.384	73.3	0.101	24.5	0.306	-92.7	0.756	17.27
2.4	0.491	-168.6	5.189	70.4	0.102	23.4	0.289	-96.0	0.780	17.06
2.5	0.493	-173.9	4.990	67.8	0.102	22.3	0.275	-99.4	0.804	16.87
2.6	0.496	-178.7	4.791	65.3	0.103	21.5	0.262	-101.9	0.830	16.68
2.7	0.492	175.4	4.582	63.0	0.103	20.9	0.248	-104.9	0.872	16.49
2.8	0.467	172.4	4.380	61.6	0.104	21.6	0.243	-105.9	0.928	16.26
2.9	0.484	170.7	4.347	59.4	0.107	20.1	0.237	-110.7	0.902	16.09
3.0	0.494	166.2	4.209	57.0	0.108	18.9	0.220	-114.9	0.921	15.93
4.0	0.578	137.2	3.068	36.0	0.116	12.5	0.166	-160.8	1.057	12.76
5.0	0.653	116.3	2.337	16.9	0.122	7.2	0.219	162.1	1.141	10.55
6.0	0.703	103.3	1.885	2.4	0.128	3.4	0.267	145.3	1.178	9.11
7.0	0.748	91.3	1.567	-13.0	0.138	-3.3	0.324	131.4	1.142	8.25
8.0	0.789	81.0	1.329	-26.3	0.142	-8.2	0.406	118.6	1.118	7.63
9.0	0.802	72.6	1.137	-38.1	0.147	-14.3	0.442	113.7	1.130	6.70
10.0	0.836	67.1	0.974	-51.3	0.150	-21.2	0.506	101.5	1.045	6.82

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

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂		K	MAG/MSG (dB)
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)		
0.1	0.913	-9.4	16.298	172.9	0.012	80.2	0.973	-8.0	0.117	31.16
0.2	0.887	-20.3	16.280	162.7	0.021	76.4	0.938	-16.1	0.127	28.93
0.3	0.860	-29.4	15.639	155.8	0.029	69.1	0.895	-23.1	0.187	27.27
0.4	0.828	-39.0	15.101	148.2	0.037	64.6	0.844	-29.7	0.222	26.10
0.5	0.791	-47.1	14.264	141.7	0.045	60.1	0.794	-35.3	0.272	25.05
0.6	0.749	-55.8	13.491	135.5	0.050	56.4	0.742	-40.7	0.309	24.29
0.7	0.710	-63.7	12.819	130.2	0.056	53.1	0.697	-45.3	0.347	23.62
0.8	0.672	-71.7	12.143	124.9	0.060	50.1	0.649	-49.9	0.386	23.07
0.9	0.639	-79.4	11.436	119.8	0.064	47.7	0.608	-54.1	0.421	22.51
1.0	0.609	-86.9	10.865	115.0	0.067	45.4	0.566	-57.8	0.460	22.07
1.1	0.583	-94.5	10.270	110.7	0.071	43.2	0.529	-61.7	0.491	21.62
1.2	0.561	-101.2	9.709	107.0	0.074	41.3	0.495	-64.9	0.526	21.19
1.3	0.544	-107.7	9.261	103.2	0.076	39.6	0.465	-68.5	0.553	20.84
1.4	0.522	-114.9	8.814	99.4	0.079	38.1	0.435	-72.0	0.587	20.50
1.5	0.509	-121.3	8.368	95.6	0.081	36.6	0.411	-75.3	0.614	20.13
1.6	0.491	-127.7	8.001	92.1	0.083	35.5	0.385	-78.9	0.647	19.82
1.7	0.479	-134.3	7.631	88.9	0.085	34.1	0.365	-82.5	0.674	19.51
1.8	0.468	-140.8	7.284	85.7	0.087	33.0	0.343	-85.9	0.703	19.21
1.9	0.464	-147.0	6.953	82.5	0.090	31.9	0.326	-89.3	0.725	18.90
2.0	0.457	-153.8	6.658	79.5	0.091	30.9	0.308	-93.0	0.753	18.63
2.1	0.454	-158.9	6.401	76.8	0.093	30.0	0.293	-96.7	0.775	18.39
2.2	0.456	-164.4	6.108	74.1	0.094	29.1	0.278	-100.5	0.798	18.12
2.3	0.453	-170.0	5.873	71.2	0.096	28.2	0.265	-104.2	0.821	17.88
2.4	0.455	-175.4	5.640	68.3	0.097	27.3	0.251	-108.3	0.845	17.65
2.5	0.462	179.5	5.420	66.0	0.098	26.2	0.241	-112.2	0.863	17.44
2.6	0.465	174.8	5.196	63.6	0.099	25.5	0.229	-115.7	0.888	17.22
2.7	0.463	169.1	4.950	61.2	0.099	25.0	0.217	-119.6	0.928	16.99
2.8	0.443	166.2	4.743	60.1	0.100	25.7	0.211	-120.6	0.973	16.75
2.9	0.459	165.0	4.697	57.9	0.104	24.4	0.210	-126.1	0.949	16.57
3.0	0.470	160.7	4.554	55.9	0.105	23.3	0.198	-131.7	0.965	16.39
4.0	0.558	134.1	3.305	35.8	0.118	16.5	0.182	179.6	1.065	12.93
5.0	0.638	114.6	2.509	17.6	0.126	9.9	0.253	149.7	1.124	10.85
6.0	0.687	101.9	2.032	3.5	0.134	5.1	0.302	135.1	1.153	9.43
7.0	0.737	90.4	1.685	-11.4	0.145	-2.5	0.356	122.4	1.118	8.57
8.0	0.781	80.3	1.440	-24.2	0.148	-8.2	0.430	111.2	1.095	8.01
9.0	0.792	72.2	1.241	-35.9	0.152	-14.9	0.456	106.4	1.114	7.07
10.0	0.829	66.7	1.069	-48.8	0.154	-22.1	0.512	95.1	1.041	7.17

$V_{CE} = 2\text{ V}$, $I_C = 10\text{ mA}$, $Z_O = 50\ \Omega$

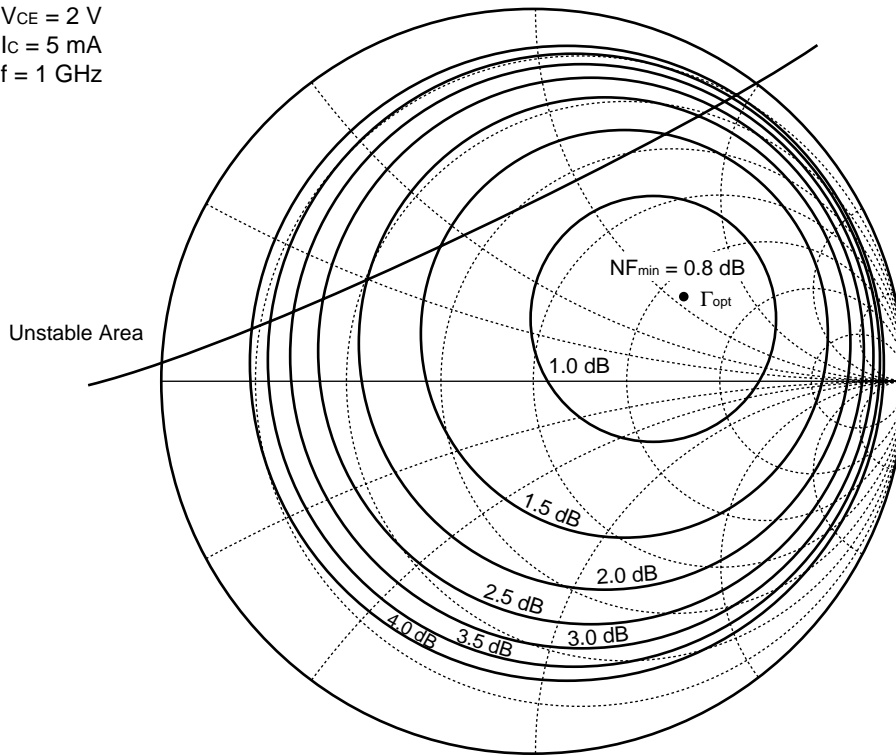
Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂		K	MAG/MSG (dB)
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)		
0.1	0.883	-10.3	20.184	171.8	0.012	77.9	0.963	-9.3	0.163	32.34
0.2	0.849	-22.9	19.969	160.6	0.020	74.8	0.921	-18.6	0.161	29.90
0.3	0.816	-33.3	19.002	152.9	0.028	68.0	0.870	-26.6	0.213	28.26
0.4	0.774	-43.4	18.106	144.7	0.036	63.0	0.811	-33.9	0.267	27.06
0.5	0.730	-52.5	16.892	137.9	0.042	58.5	0.752	-40.2	0.319	26.03
0.6	0.683	-61.7	15.771	131.5	0.047	55.2	0.696	-46.1	0.361	25.23
0.7	0.645	-70.3	14.820	126.0	0.052	52.0	0.645	-51.0	0.404	24.52
0.8	0.605	-78.9	13.893	120.6	0.056	49.5	0.594	-55.8	0.447	23.96
0.9	0.573	-86.6	12.981	115.6	0.059	47.5	0.551	-60.3	0.486	23.39
1.0	0.543	-94.3	12.217	110.9	0.063	45.6	0.511	-64.2	0.527	22.90
1.1	0.519	-102.2	11.455	106.8	0.065	43.7	0.474	-68.2	0.562	22.43
1.2	0.497	-109.0	10.787	103.0	0.068	42.4	0.440	-71.8	0.598	21.99
1.3	0.484	-116.0	10.231	99.4	0.071	41.0	0.411	-75.7	0.626	21.62
1.4	0.465	-123.0	9.687	95.8	0.073	40.0	0.384	-79.5	0.660	21.22
1.5	0.452	-129.1	9.142	92.2	0.076	38.9	0.362	-83.1	0.689	20.82
1.6	0.440	-135.9	8.715	89.0	0.078	37.7	0.338	-87.2	0.719	20.49
1.7	0.433	-142.2	8.281	85.9	0.080	36.9	0.320	-91.2	0.743	20.14
1.8	0.425	-148.8	7.880	82.9	0.082	35.7	0.301	-95.1	0.770	19.81
1.9	0.423	-154.5	7.498	80.0	0.084	35.1	0.287	-99.0	0.792	19.48
2.0	0.419	-161.3	7.171	77.2	0.086	34.2	0.271	-103.1	0.817	19.19
2.1	0.418	-166.1	6.870	74.8	0.088	33.6	0.260	-107.3	0.836	18.91
2.2	0.422	-171.7	6.553	72.1	0.090	32.8	0.247	-111.8	0.858	18.63
2.3	0.424	-176.8	6.286	69.3	0.092	32.0	0.238	-116.2	0.876	18.36
2.4	0.428	177.9	6.037	66.7	0.093	31.1	0.228	-120.8	0.895	18.10
2.5	0.436	173.3	5.795	64.4	0.095	30.2	0.220	-125.3	0.910	17.86
2.6	0.442	169.0	5.554	62.3	0.096	29.4	0.210	-129.6	0.931	17.62
2.7	0.443	163.6	5.289	60.1	0.097	29.0	0.202	-134.3	0.965	17.38
2.8	0.427	160.5	5.068	58.8	0.098	29.6	0.196	-135.6	1.000	17.11
2.9	0.438	159.6	5.009	56.9	0.102	28.3	0.200	-140.9	0.980	16.92
3.0	0.452	155.9	4.860	54.9	0.103	27.3	0.192	-147.4	0.991	16.73
4.0	0.546	131.6	3.515	35.8	0.120	19.7	0.209	166.5	1.060	13.18
5.0	0.626	113.0	2.671	18.1	0.130	12.2	0.288	141.9	1.105	11.16
6.0	0.680	101.0	2.162	4.7	0.139	6.5	0.338	128.4	1.122	9.79
7.0	0.729	89.7	1.794	-10.0	0.151	-1.9	0.390	116.2	1.095	8.88
8.0	0.774	79.7	1.539	-22.2	0.153	-8.2	0.459	105.7	1.080	8.32
9.0	0.786	71.7	1.333	-33.6	0.157	-15.1	0.477	100.8	1.094	7.43
10.0	0.824	66.2	1.150	-46.2	0.158	-22.8	0.527	89.8	1.036	7.45

$V_{CE} = 2\text{ V}$, $I_C = 20\text{ mA}$, $Z_0 = 50\ \Omega$

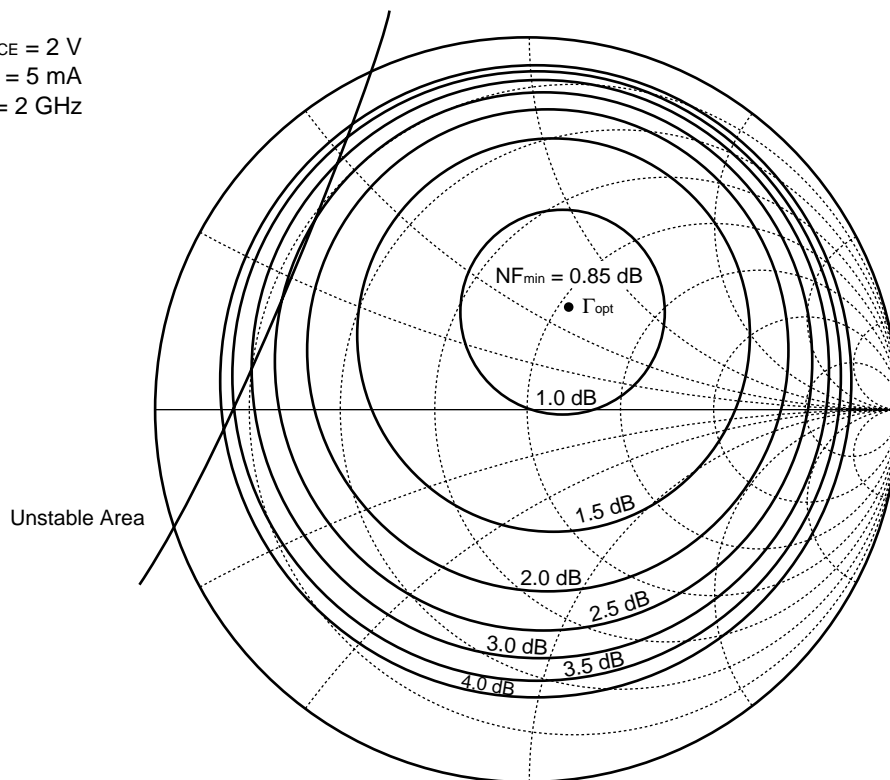
Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂		K	MAG/MSG (dB)
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)		
0.1	0.825	-14.4	27.857	169.6	0.011	78.9	0.942	-11.9	0.147	33.96
0.2	0.763	-28.9	27.111	156.4	0.019	72.0	0.885	-23.5	0.219	31.50
0.3	0.724	-41.0	25.162	147.3	0.026	64.9	0.815	-33.2	0.285	29.81
0.4	0.667	-53.0	23.340	138.5	0.032	60.3	0.741	-41.9	0.345	28.57
0.5	0.612	-63.1	21.255	131.1	0.038	56.9	0.672	-48.9	0.411	27.48
0.6	0.565	-73.1	19.424	124.6	0.042	54.2	0.608	-55.6	0.462	26.65
0.7	0.526	-82.2	17.895	119.0	0.046	51.7	0.554	-61.0	0.514	25.90
0.8	0.490	-91.3	16.523	113.9	0.049	50.1	0.502	-66.3	0.562	25.28
0.9	0.460	-99.6	15.211	109.1	0.052	48.5	0.461	-71.3	0.607	24.63
1.0	0.436	-107.8	14.149	104.7	0.055	47.5	0.421	-75.6	0.649	24.09
1.1	0.420	-115.9	13.131	100.9	0.058	46.3	0.388	-80.1	0.684	23.56
1.2	0.402	-123.0	12.250	97.4	0.061	45.5	0.359	-84.1	0.721	23.05
1.3	0.398	-129.4	11.536	93.9	0.063	44.7	0.334	-88.5	0.745	22.63
1.4	0.382	-137.1	10.845	90.8	0.066	44.3	0.311	-93.1	0.779	22.17
1.5	0.377	-143.1	10.204	87.5	0.069	43.4	0.294	-97.3	0.800	21.72
1.6	0.370	-149.6	9.656	84.6	0.071	42.7	0.276	-102.3	0.827	21.32
1.7	0.371	-156.1	9.146	81.9	0.074	42.0	0.264	-107.0	0.845	20.94
1.8	0.369	-162.1	8.689	79.1	0.076	41.3	0.250	-111.9	0.868	20.58
1.9	0.370	-167.2	8.233	76.7	0.079	40.5	0.241	-116.5	0.883	20.18
2.0	0.372	-173.7	7.846	74.1	0.081	39.9	0.232	-121.4	0.901	19.85
2.1	0.374	-178.2	7.491	71.9	0.084	39.3	0.225	-126.3	0.918	19.52
2.2	0.384	177.1	7.124	69.4	0.086	38.6	0.219	-131.4	0.931	19.20
2.3	0.390	172.5	6.833	66.8	0.088	37.6	0.215	-136.5	0.942	18.89
2.4	0.395	167.5	6.541	64.4	0.090	37.1	0.211	-141.6	0.957	18.60
2.5	0.403	163.8	6.281	62.3	0.092	36.0	0.210	-146.7	0.968	18.34
2.6	0.413	159.5	6.018	60.2	0.094	35.3	0.205	-151.2	0.981	18.07
2.7	0.418	155.2	5.742	58.2	0.095	34.8	0.203	-156.6	1.003	17.47
2.8	0.406	152.0	5.492	57.2	0.097	35.3	0.197	-158.0	1.029	16.46
2.9	0.415	151.4	5.412	55.2	0.101	34.1	0.207	-161.9	1.013	16.60
3.0	0.429	148.3	5.245	53.5	0.103	33.0	0.206	-168.2	1.019	16.23
4.0	0.528	127.7	3.786	35.5	0.123	23.9	0.258	153.6	1.056	13.43
5.0	0.616	110.4	2.874	19.0	0.135	15.1	0.346	134.2	1.080	11.54
6.0	0.669	99.1	2.326	6.3	0.146	8.4	0.396	121.9	1.092	10.17
7.0	0.720	88.3	1.933	-7.9	0.158	-0.8	0.447	109.8	1.072	9.25
8.0	0.765	78.7	1.661	-19.5	0.160	-7.8	0.508	99.9	1.061	8.65
9.0	0.777	70.8	1.446	-30.4	0.164	-15.1	0.521	94.4	1.076	7.77
10.0	0.814	65.4	1.259	-42.7	0.164	-23.4	0.563	83.5	1.035	7.70

EQUAL NF CIRCLE

$V_{CE} = 2\text{ V}$
 $I_c = 5\text{ mA}$
 $f = 1\text{ GHz}$



$V_{CE} = 2\text{ V}$
 $I_c = 5\text{ mA}$
 $f = 2\text{ GHz}$



NOISE PARAMETERS

V_{CE} = 1 V, I_c = 3 mA

f (GHz)	NF _{min} (dB)	G _a (dB)	Γ _{opt}		Rn/50
			MAG.	ANG.	
0.8	0.59	20.4	0.51	24.6	0.23
0.9	0.62	19.4	0.51	27.9	0.23
1.0	0.64	18.6	0.50	31.5	0.23
1.5	0.78	15.7	0.44	52.0	0.20
1.8	0.87	14.5	0.40	66.8	0.18
1.9	0.89	14.1	0.39	72.2	0.17
2.0	0.92	13.8	0.37	77.9	0.16
2.5	1.06	12.3	0.33	110.2	0.12

V_{CE} = 2 V, I_c = 3 mA

f (GHz)	NF _{min} (dB)	G _a (dB)	Γ _{opt}		Rn/50
			MAG.	ANG.	
0.8	0.47	21.4	0.50	23.9	0.23
0.9	0.50	20.5	0.50	26.9	0.23
1.0	0.53	19.7	0.49	30.2	0.23
1.5	0.68	16.8	0.44	49.5	0.20
1.8	0.77	15.5	0.40	63.6	0.18
1.9	0.80	15.1	0.39	68.7	0.17
2.0	0.83	14.8	0.38	74.0	0.16
2.5	0.98	13.3	0.34	104.4	0.12

V_{CE} = 1 V, I_c = 5 mA

f (GHz)	NF _{min} (dB)	G _a (dB)	Γ _{opt}		Rn/50
			MAG.	ANG.	
0.8	0.82	21.6	0.45	20.8	0.22
0.9	0.83	20.6	0.45	23.7	0.21
1.0	0.84	19.8	0.44	26.8	0.21
1.5	0.88	17.0	0.38	46.5	0.18
1.8	0.91	15.7	0.33	61.3	0.16
1.9	0.92	15.4	0.32	66.8	0.15
2.0	0.93	15.0	0.30	72.5	0.15
2.5	0.97	13.5	0.27	104.8	0.11

V_{CE} = 2 V, I_c = 5 mA

f (GHz)	NF _{min} (dB)	G _a (dB)	Γ _{opt}		Rn/50
			MAG.	ANG.	
0.8	0.75	22.7	0.43	21.1	0.21
0.9	0.76	21.8	0.43	23.8	0.21
1.0	0.77	21.0	0.42	26.7	0.21
1.5	0.81	18.0	0.37	44.8	0.19
1.8	0.84	16.7	0.33	58.5	0.17
1.9	0.85	16.3	0.32	63.6	0.16
2.0	0.85	16.0	0.31	68.8	0.15
2.5	0.90	14.4	0.26	98.9	0.12

V_{CE} = 1 V, I_c = 10 mA

f (GHz)	NF _{min} (dB)	G _a (dB)	Γ _{opt}		Rn/50
			MAG.	ANG.	
0.8	0.98	23.1	0.29	16.9	0.19
0.9	0.99	22.2	0.29	19.9	0.19
1.0	1.00	21.3	0.28	22.9	0.19
1.5	1.04	18.3	0.23	40.3	0.17
1.8	1.06	16.9	0.19	54.9	0.15
1.9	1.07	16.5	0.18	60.8	0.15
2.0	1.07	16.1	0.17	67.2	0.14
2.5	1.11	14.4	0.14	110.5	0.12

V_{CE} = 2 V, I_c = 10 mA

f (GHz)	NF _{min} (dB)	G _a (dB)	Γ _{opt}		Rn/50
			MAG.	ANG.	
0.8	0.84	24.2	0.30	17.6	0.19
0.9	0.85	23.3	0.30	20.0	0.19
1.0	0.86	22.4	0.30	22.5	0.19
1.5	0.90	19.4	0.24	39.3	0.17
1.8	0.93	18.0	0.20	53.2	0.15
1.9	0.94	17.6	0.19	58.7	0.15
2.0	0.95	17.2	0.18	64.6	0.14
2.5	1.00	15.5	0.16	101.5	0.12

V_{CE} = 1 V, I_c = 20 mA

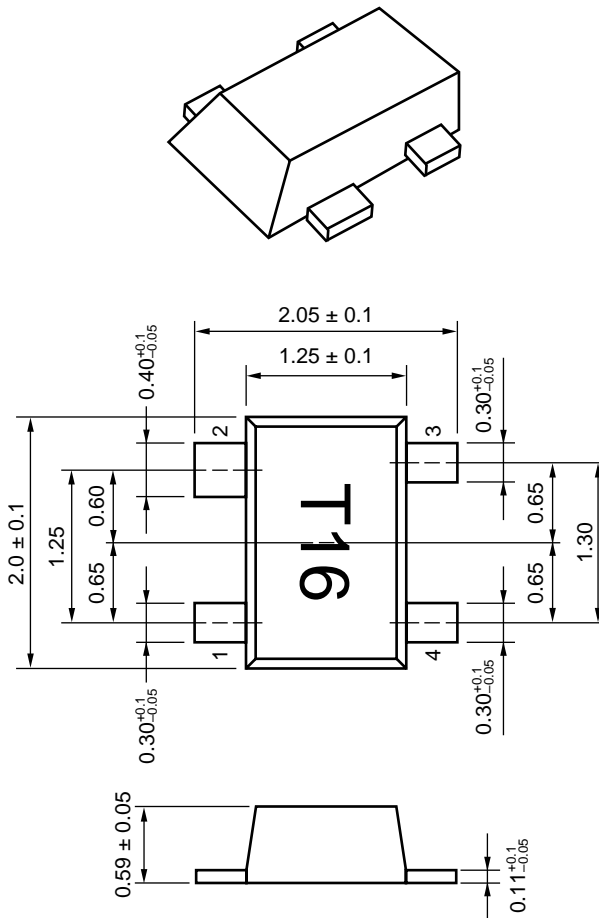
f (GHz)	NF _{min} (dB)	G _a (dB)	Γ _{opt}		Rn/50
			MAG.	ANG.	
0.8	1.02	24.0	0.12	14.4	0.17
0.9	1.04	23.0	0.12	8.8	0.17
1.0	1.05	22.1	0.11	6.0	0.17
1.5	1.11	19.0	0.06	29.4	0.16
1.8	1.14	17.6	0.03	68.6	0.15
1.9	1.15	17.2	0.02	85.1	0.15
2.0	1.16	16.7	0.02	103.1	0.15
2.5	1.22	15.0	0.07	-148.9	0.14

V_{CE} = 2 V, I_c = 20 mA

f (GHz)	NF _{min} (dB)	G _a (dB)	Γ _{opt}		Rn/50
			MAG.	ANG.	
0.8	1.18	25.3	0.12	10.8	0.18
0.9	1.19	24.4	0.12	9.9	0.18
1.0	1.19	23.5	0.12	10.0	0.18
1.5	1.24	20.4	0.07	27.6	0.17
1.8	1.26	19.0	0.04	54.7	0.16
1.9	1.27	18.6	0.03	67.0	0.16
2.0	1.28	18.1	0.02	80.9	0.15
2.5	1.32	16.4	0.05	179.5	0.14

PACKAGE DIMENSIONS

FLAT-LEAD 4-PIN THIN-TYPE SUPER MINIMOLD (UNIT: mm)



PIN CONNECTIONS

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

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