

DATA SHEET

NEC

NPN SILICON RF TWIN TRANSISTOR μ PA854TD

NPN SILICON RF TRANSISTOR (WITH 2 DIFFERENT ELEMENTS) IN A 6-PIN LEAD-LESS MINIMOLD

FEATURES

- Low voltage operation
- 2 different built-in transistors (2SC5435, 2SC5745)
 - Q1: High gain transistor
 $f_T = 12.0 \text{ GHz TYP.}$, $|S_{21e}|^2 = 8.5 \text{ dB TYP. @ } V_{CE} = 3 \text{ V, } I_C = 10 \text{ mA, } f = 2 \text{ GHz}$
 - Q2: Low phase distortion transistor suited for OSC operation
 $f_T = 5.5 \text{ GHz TYP.}$, $|S_{21e}|^2 = 4.5 \text{ dB TYP. @ } V_{CE} = 1 \text{ V, } I_C = 10 \text{ mA, } f = 2 \text{ GHz}$
- 6-pin lead-less minimold package

BUILT-IN TRANSISTORS

	Q1	Q2
3-pin thin-type ultra super minimold part No.	2SC5435	2SC5745

ORDERING INFORMATION

Part Number	Quantity	Supplying Form
μ PA854TD	50 pcs (Non reel)	• 8 mm wide embossed taping • Pin 1 (Q1 Collector), Pin 6 (Q1 Base) face the perforation side of the tape
μ PA854TD-T3	10 kpcs/reel	

Remark To order evaluation samples, contact your nearby sales office.
The unit sample quantity is 50 pcs.

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 Compound Semiconductor Devices representative for availability and additional information.

ABSOLUTE MAXIMUM RATINGS (T_A = +25°C)

Parameter	Symbol	Ratings		Unit
		Q1	Q2	
Collector to Base Voltage	V _{CBO}	9	15	V
Collector to Emitter Voltage	V _{CEO}	6	5.5	V
Emitter to Base Voltage	V _{EBO}	2	1.5	V
Collector Current	I _C	30	100	mA
Total Power Dissipation	P _{tot} ^{Note}	180	190	mW
		210 in 2 elements		
Junction Temperature	T _j	150		°C
Storage Temperature	T _{stg}	−65 to +150		°C

Note Mounted on 1.08 cm² × 1.0 mm (t) glass epoxy PCB

ELECTRICAL CHARACTERISTICS (T_A = +25°C)

(1) Q1

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Collector Cut-off Current	I _{CBO}	V _{CB} = 5 V, I _E = 0 mA	—	—	100	nA
Emitter Cut-off Current	I _{EBO}	V _{EB} = 1 V, I _C = 0 mA	—	—	100	nA
DC Current Gain	h _{FE} ^{Note 1}	V _{CE} = 3 V, I _C = 10 mA	75	110	150	—
Gain Bandwidth Product	f _T	V _{CE} = 3 V, I _C = 10 mA, f = 2 GHz	10.0	12.0	—	GHz
Insertion Power Gain	S _{21e} ²	V _{CE} = 3 V, I _C = 10 mA, f = 2 GHz	7.0	8.5	—	dB
Noise Figure	NF	V _{CE} = 3 V, I _C = 3 mA, f = 2 GHz, Z _S = Z _{opt}	—	1.5	2.5	dB
Reverse Transfer Capacitance	C _{re} ^{Note 2}	V _{CB} = 3 V, I _E = 0 mA, f = 1 MHz	—	0.4	0.7	pF

(2) Q2

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Collector Cut-off Current	I _{CBO}	V _{CB} = 5 V, I _E = 0 mA	—	—	100	nA
Emitter Cut-off Current	I _{EBO}	V _{EB} = 1 V, I _C = 0 mA	—	—	100	nA
DC Current Gain	h _{FE} ^{Note 1}	V _{CE} = 1 V, I _C = 10 mA	100	—	145	—
Gain Bandwidth Product	f _T	V _{CE} = 1 V, I _C = 10 mA, f = 2 GHz	4.0	5.5	—	GHz
Insertion Power Gain	S _{21e} ²	V _{CE} = 1 V, I _C = 10 mA, f = 2 GHz	3.0	4.5	—	dB
Noise Figure	NF	V _{CE} = 1 V, I _C = 10 mA, f = 2 GHz, Z _S = Z _{opt}	—	2.0	3.0	dB
Reverse Transfer Capacitance	C _{re} ^{Note 2}	V _{CB} = 0.5 V, I _E = 0 mA, f = 1 MHz	0.65	0.75	0.85	pF

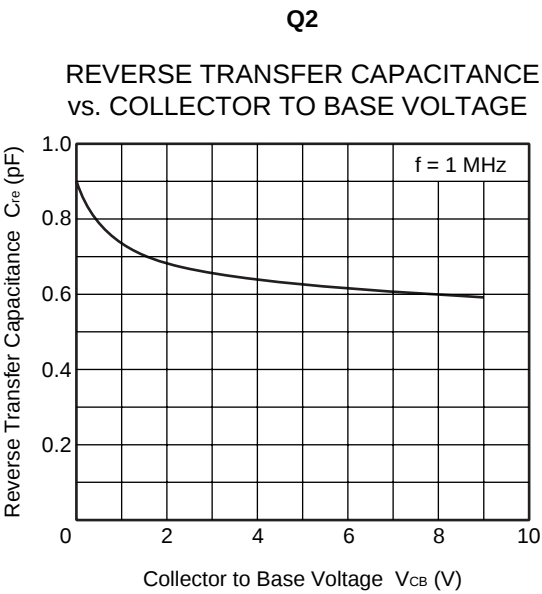
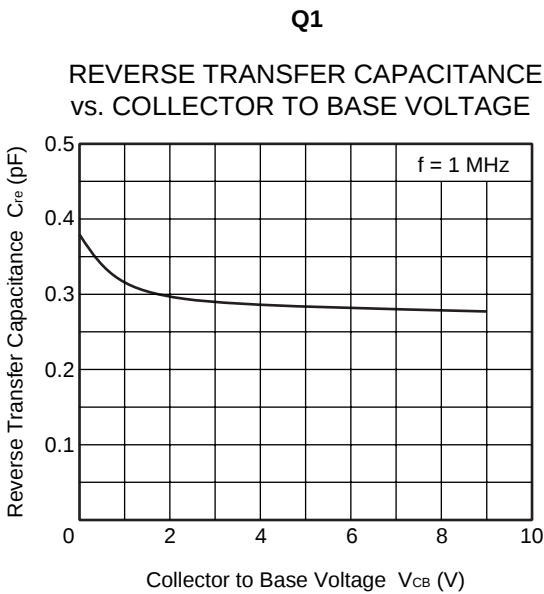
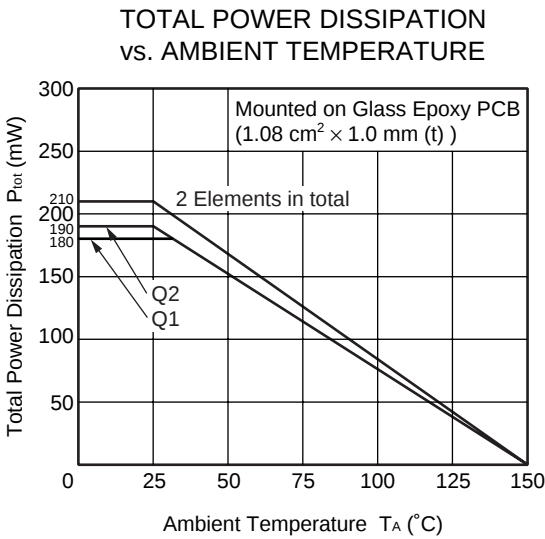
Notes 1. Pulse measurement: PW ≤ 350 μs, Duty Cycle ≤ 2%

2. Collector to base capacitance when the emitter grounded

h_{FE} CLASSIFICATION

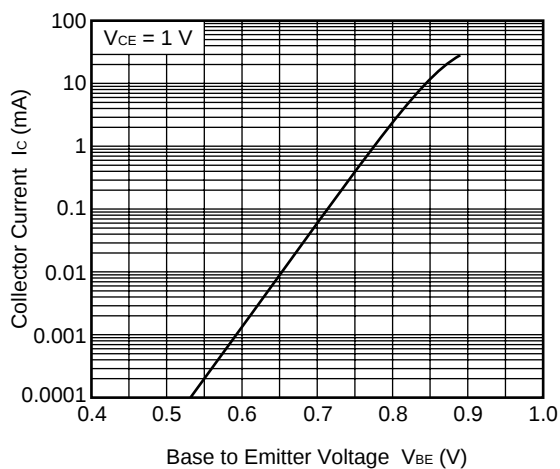
Rank	FB
Marking	vL
h_{FE} Value of Q1	75 to 150
h_{FE} Value of Q2	100 to 145

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



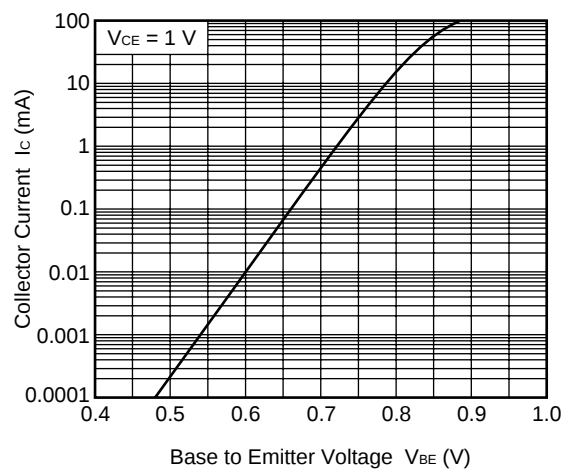
Q1

COLLECTOR CURRENT vs.
BASE TO EMITTER VOLTAGE

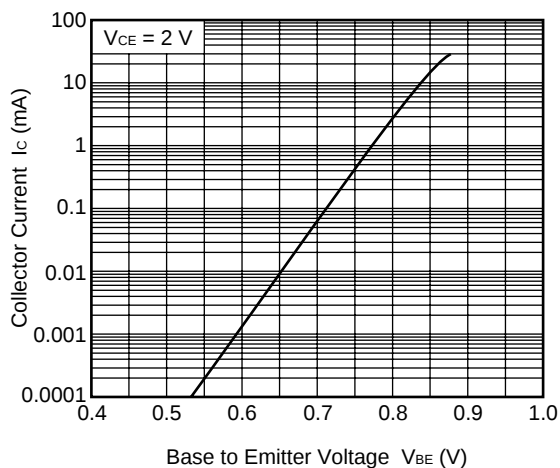


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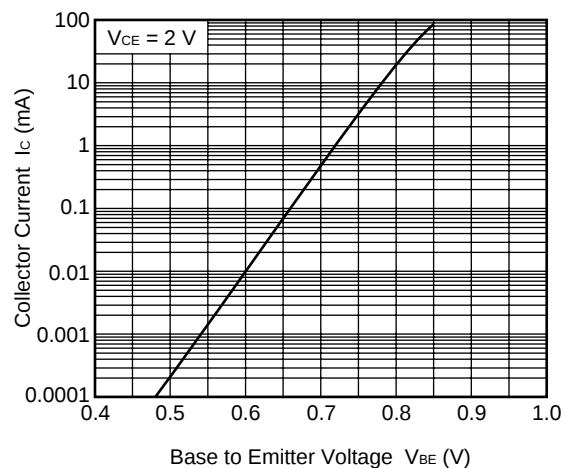
COLLECTOR CURRENT vs.
BASE TO EMITTER VOLTAGE



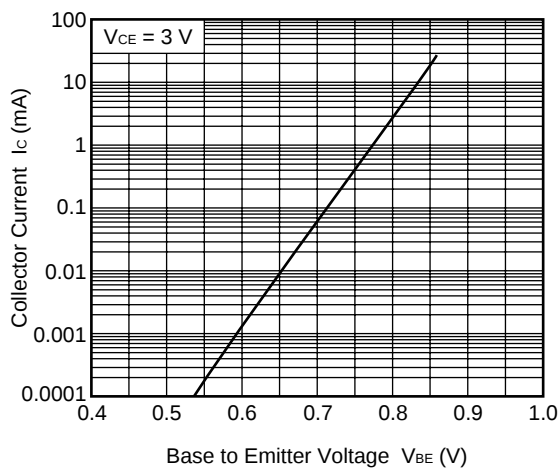
COLLECTOR CURRENT vs.
BASE TO EMITTER VOLTAGE



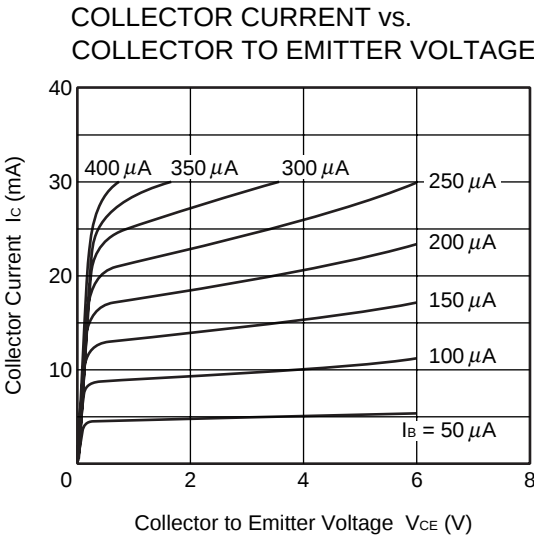
COLLECTOR CURRENT vs.
BASE TO EMITTER VOLTAGE



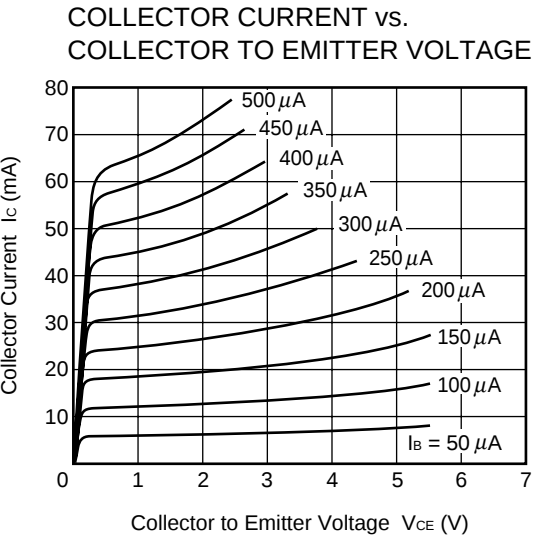
COLLECTOR CURRENT vs.
BASE TO EMITTER VOLTAGE



Q1

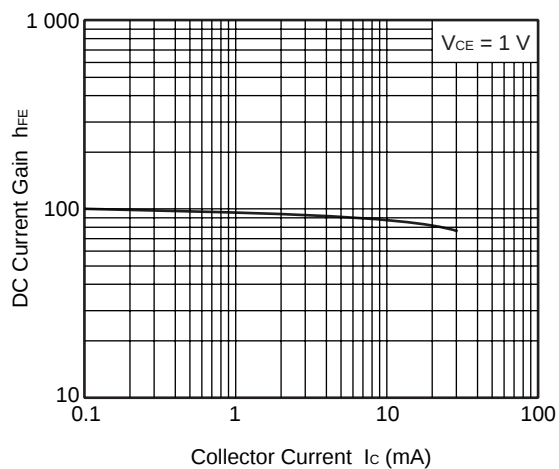


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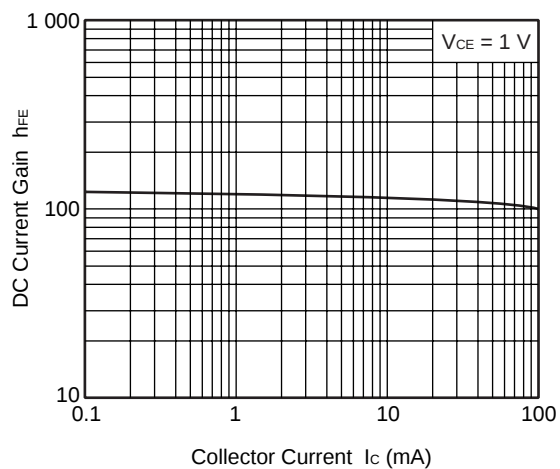
Q1

DC CURRENT GAIN vs.
COLLECTOR CURRENT

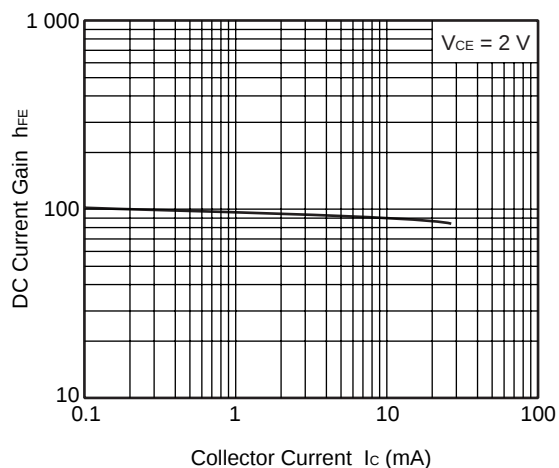


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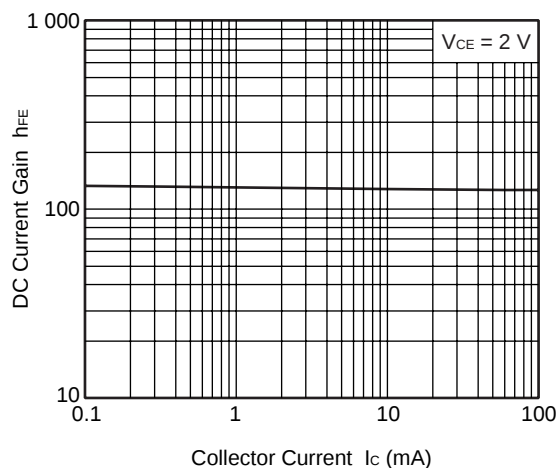
DC CURRENT GAIN vs.
COLLECTOR CURRENT



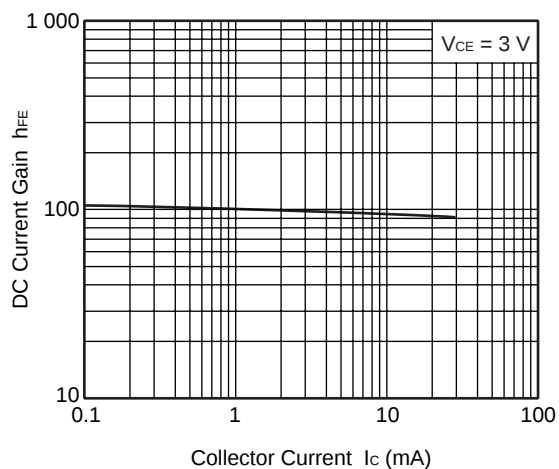
DC CURRENT GAIN vs.
COLLECTOR CURRENT



DC CURRENT GAIN vs.
COLLECTOR CURRENT

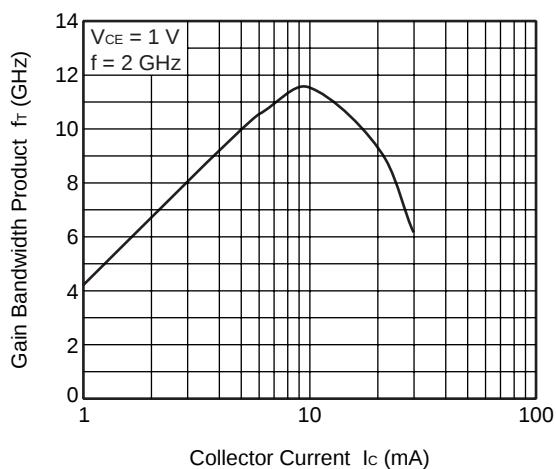


DC CURRENT GAIN vs.
COLLECTOR CURRENT



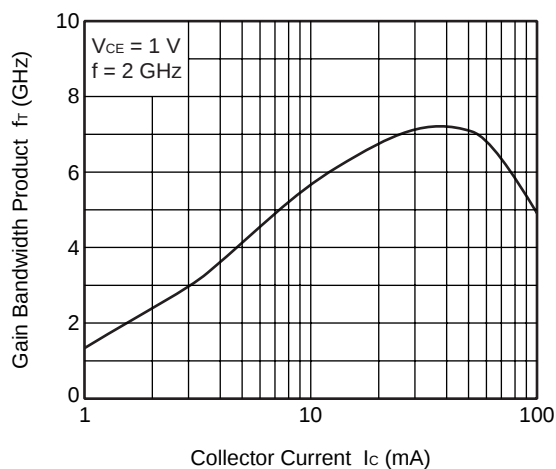
Q1

GAIN BANDWIDTH PRODUCT
vs. COLLECTOR CURRENT

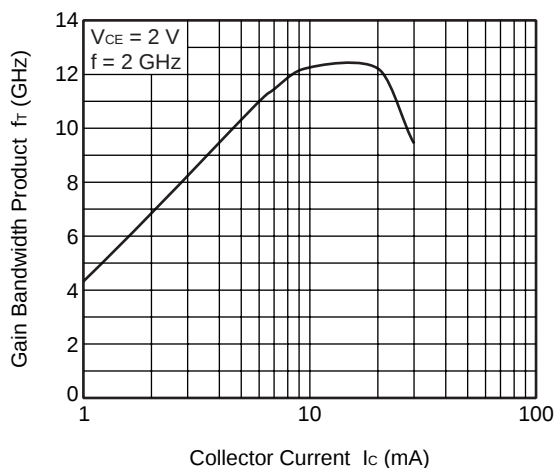


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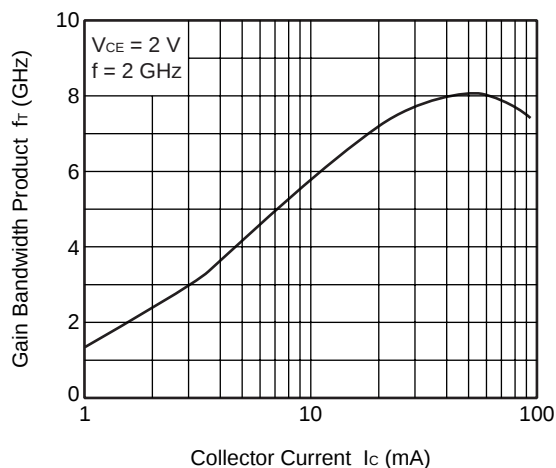
GAIN BANDWIDTH PRODUCT
vs. COLLECTOR CURRENT



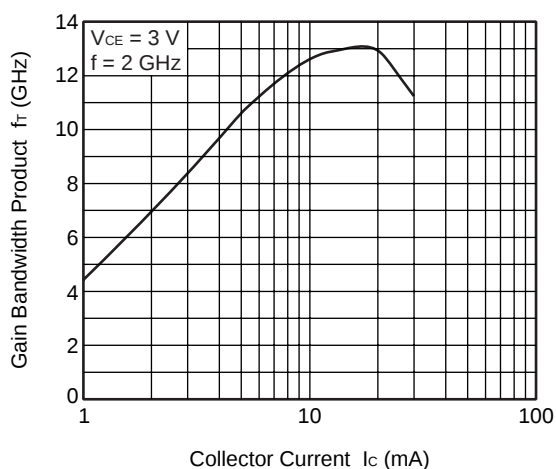
GAIN BANDWIDTH PRODUCT
vs. COLLECTOR CURRENT



GAIN BANDWIDTH PRODUCT
vs. COLLECTOR CURRENT

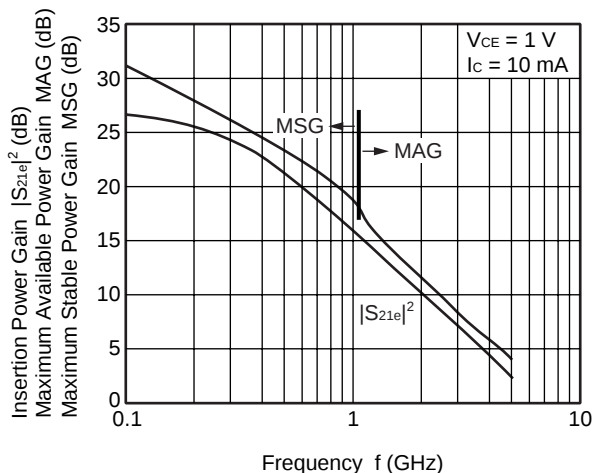


GAIN BANDWIDTH PRODUCT
vs. COLLECTOR CURRENT



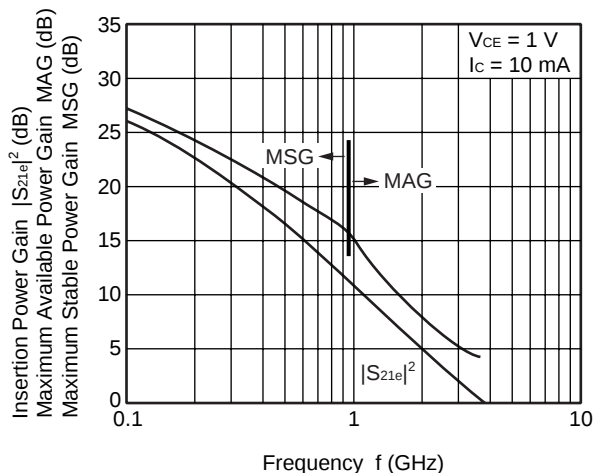
Q1

INSERTION POWER GAIN,
MAG, MSG vs. FREQUENCY

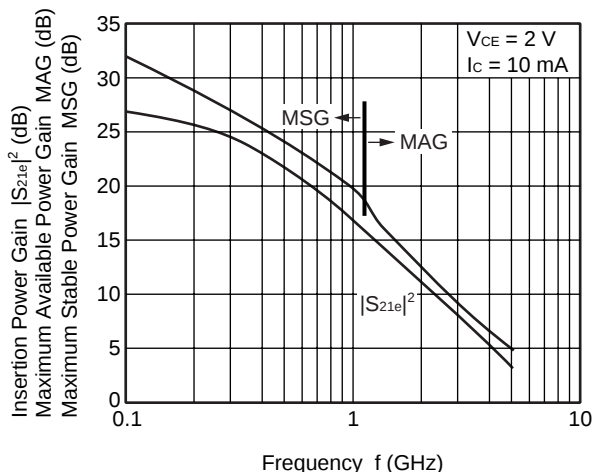


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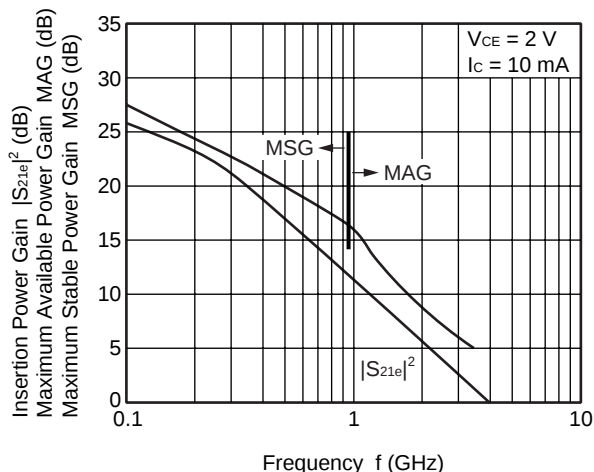
INSERTION POWER GAIN,
MAG, MSG vs. FREQUENCY



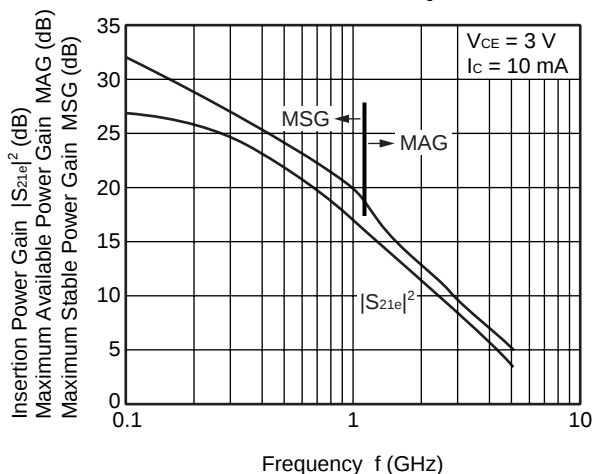
INSERTION POWER GAIN,
MAG, MSG vs. FREQUENCY



INSERTION POWER GAIN,
MAG, MSG vs. FREQUENCY

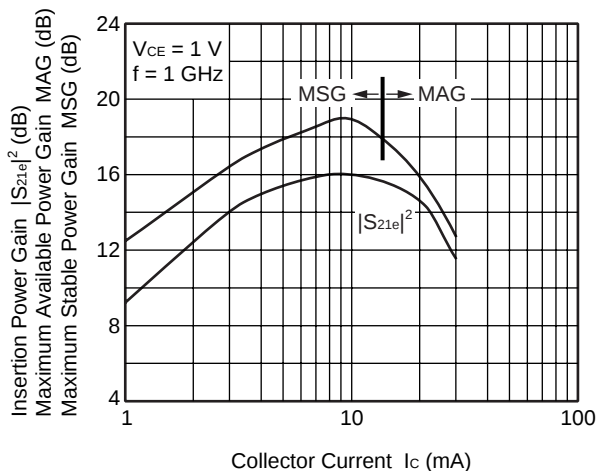


INSERTION POWER GAIN,
MAG, MSG vs. FREQUENCY



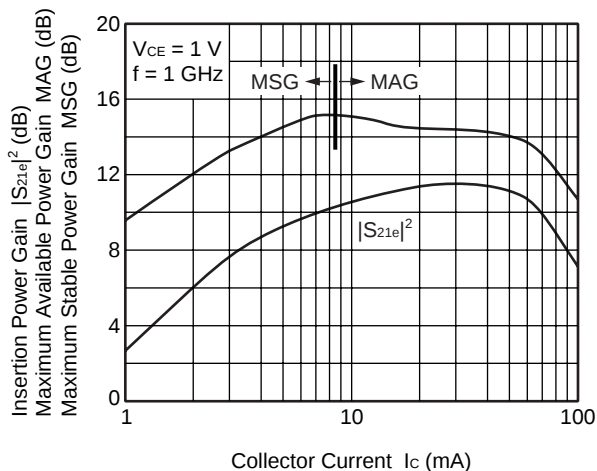
Q1

INSERTION POWER GAIN, MAG, MSG
vs. COLLECTOR CURRENT

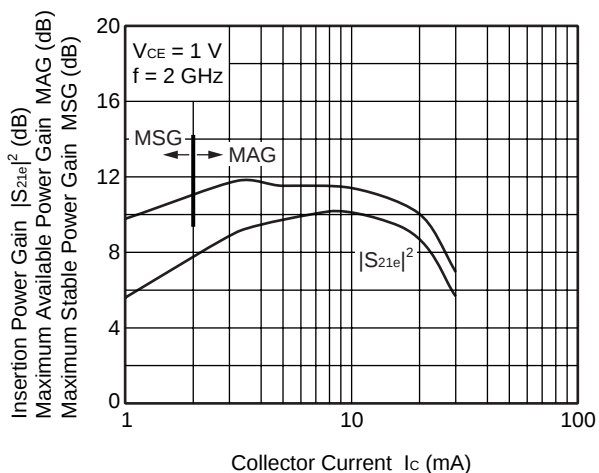


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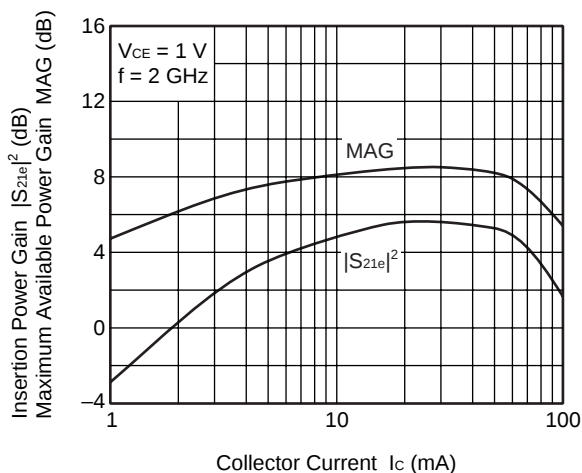
INSERTION POWER GAIN, MAG, MSG
vs. COLLECTOR CURRENT



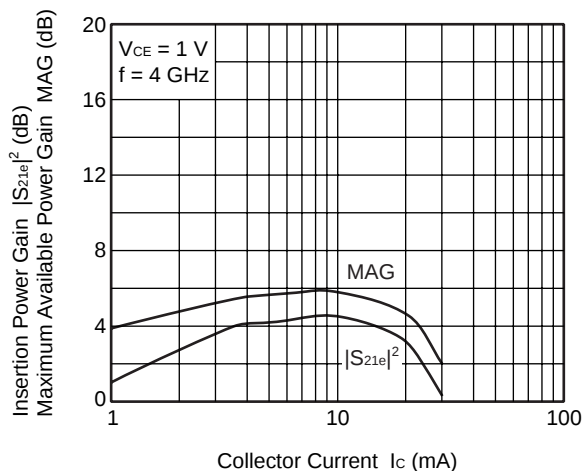
INSERTION POWER GAIN, MAG, MSG
vs. COLLECTOR CURRENT



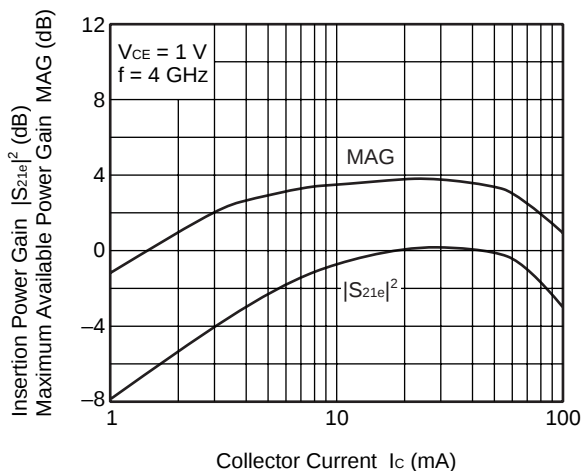
INSERTION POWER GAIN, MAG
vs. COLLECTOR CURRENT



INSERTION POWER GAIN, MAG
vs. COLLECTOR CURRENT

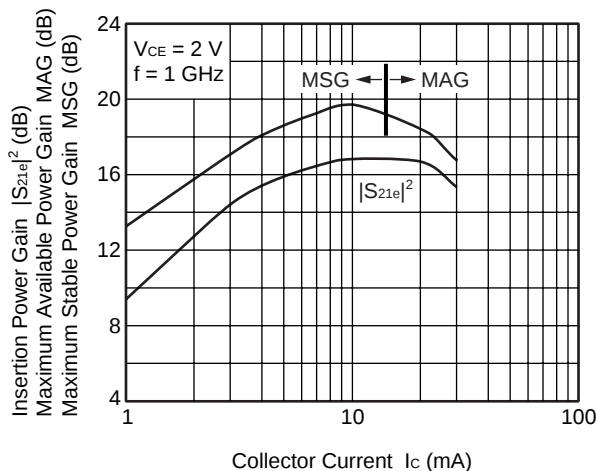


INSERTION POWER GAIN, MAG
vs. COLLECTOR CURRENT



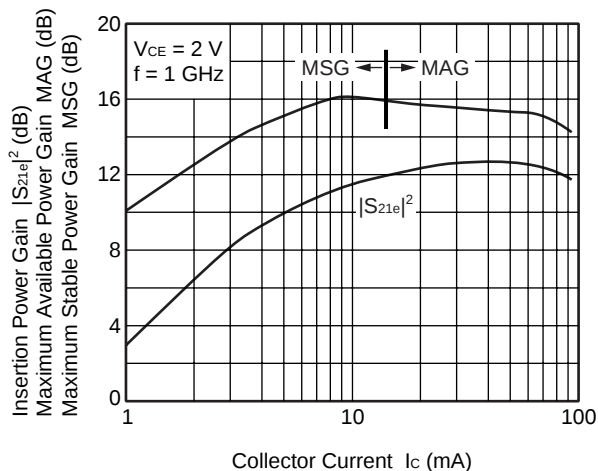
Q1

INSERTION POWER GAIN, MAG, MSG
vs. COLLECTOR CURRENT

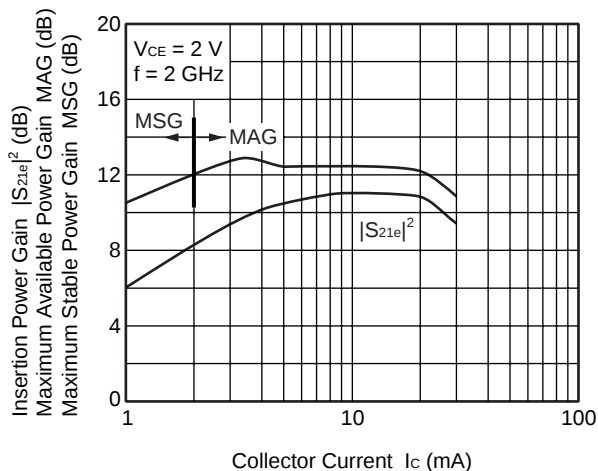


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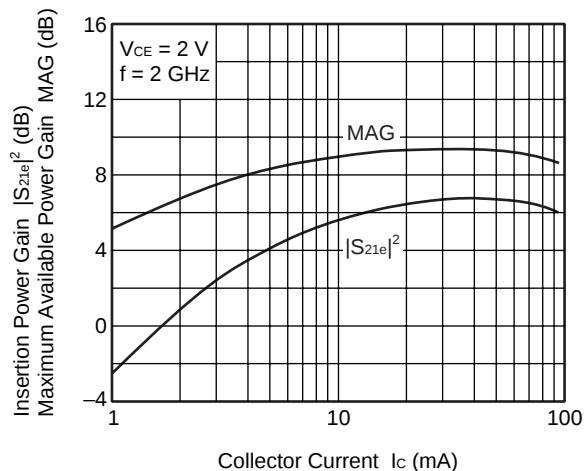
INSERTION POWER GAIN, MAG, MSG
vs. COLLECTOR CURRENT



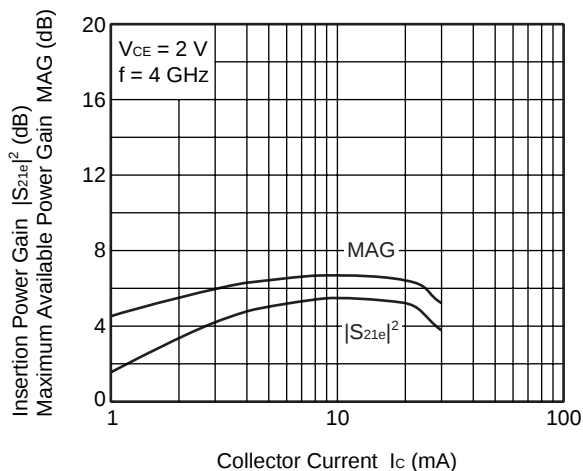
INSERTION POWER GAIN, MAG, MSG
vs. COLLECTOR CURRENT



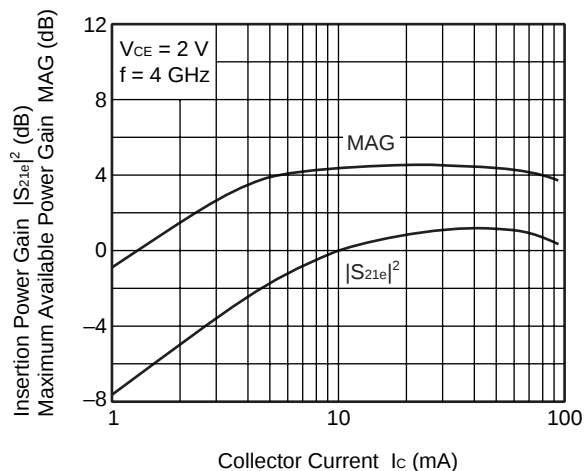
INSERTION POWER GAIN, MAG
vs. COLLECTOR CURRENT



INSERTION POWER GAIN, MAG
vs. COLLECTOR CURRENT

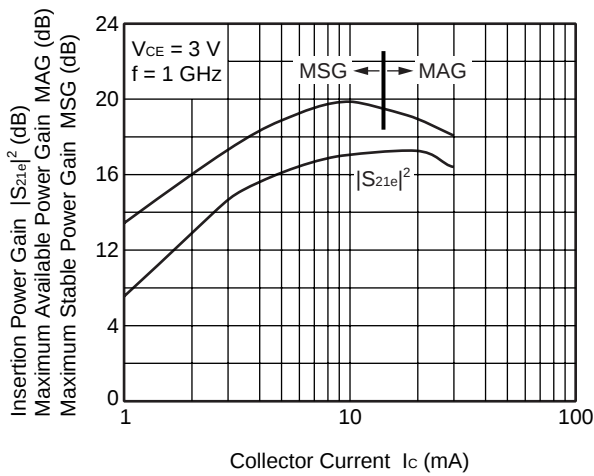


INSERTION POWER GAIN, MAG
vs. COLLECTOR CURRENT

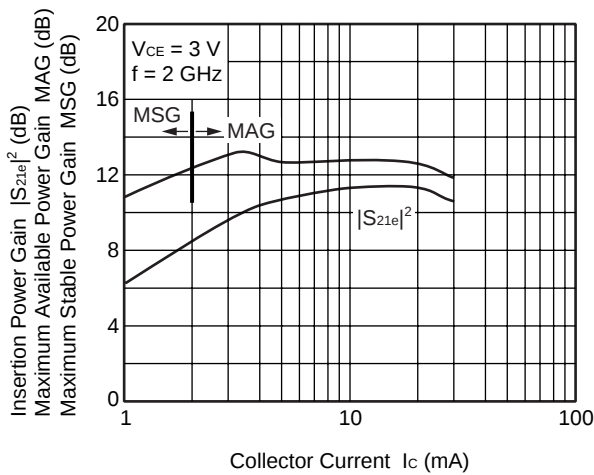


Q1

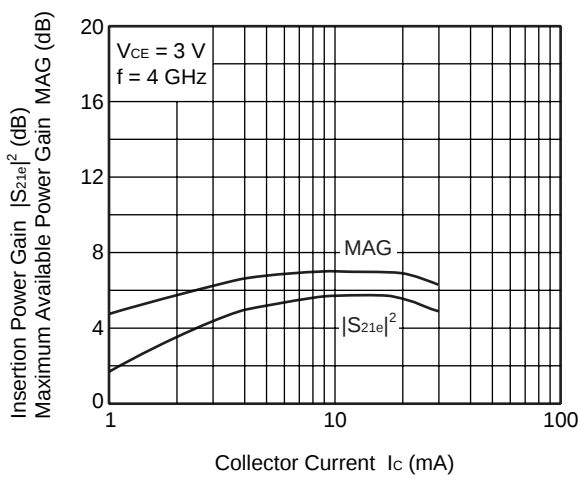
INSERTION POWER GAIN, MAG, MSG
vs. COLLECTOR CURRENT



INSERTION POWER GAIN, MAG, MSG
vs. COLLECTOR CURRENT

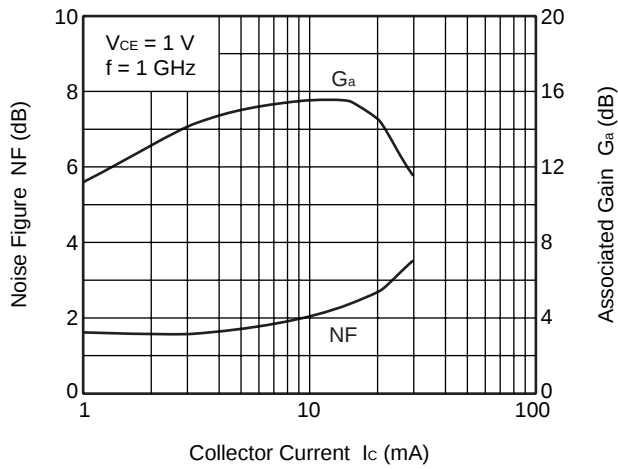


INSERTION POWER GAIN, MAG
vs. COLLECTOR CURRENT



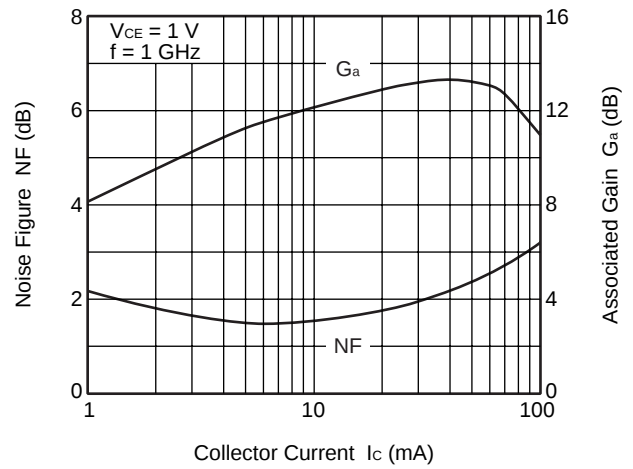
Q1

NOISE FIGURE, ASSOCIATED GAIN
vs. COLLECTOR CURRENT

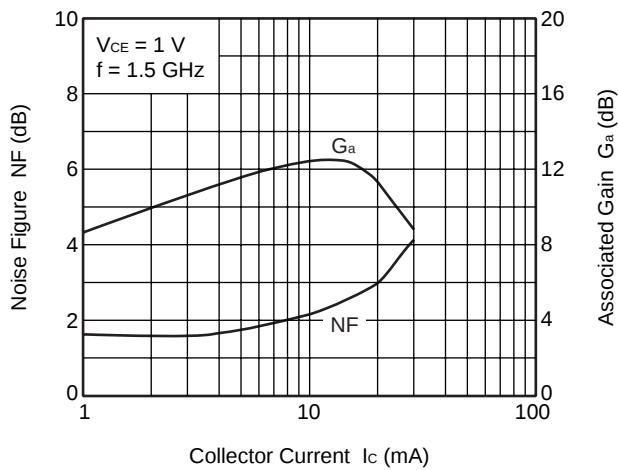


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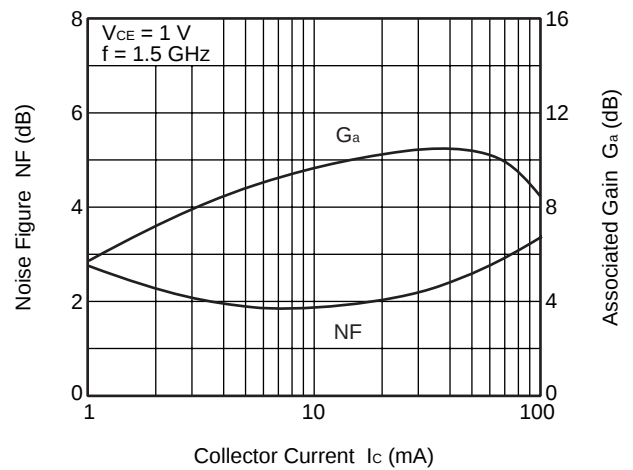
NOISE FIGURE, ASSOCIATED GAIN
vs. COLLECTOR CURRENT



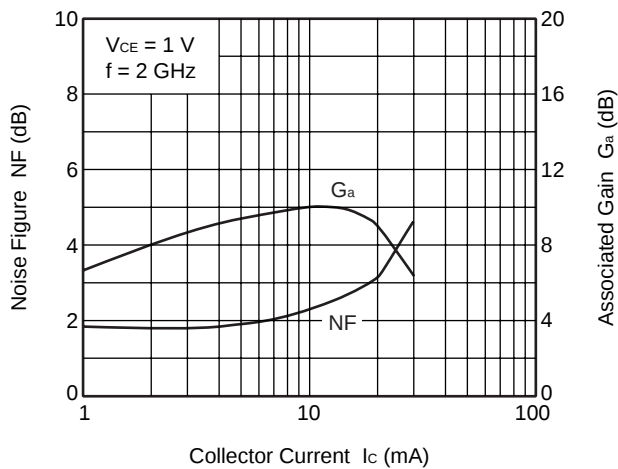
NOISE FIGURE, ASSOCIATED GAIN
vs. COLLECTOR CURRENT



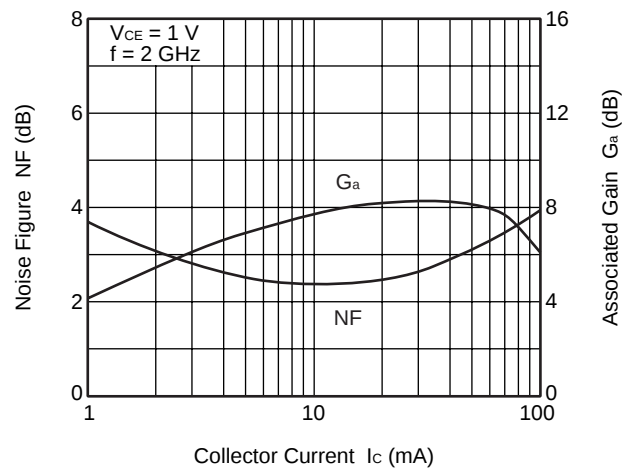
NOISE FIGURE, ASSOCIATED GAIN
vs. COLLECTOR CURRENT



NOISE FIGURE, ASSOCIATED GAIN
vs. COLLECTOR CURRENT

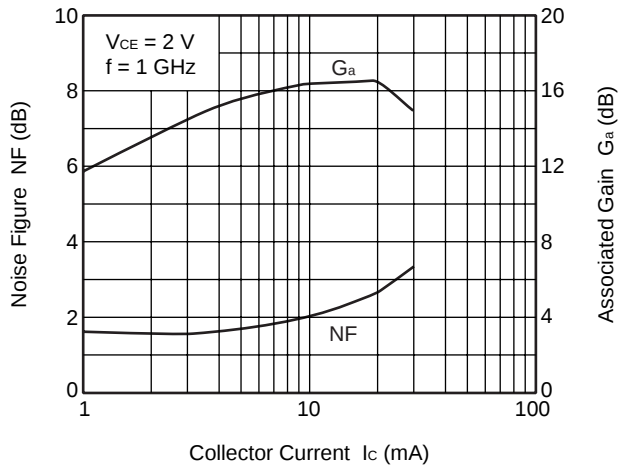


NOISE FIGURE, ASSOCIATED GAIN
vs. COLLECTOR CURRENT



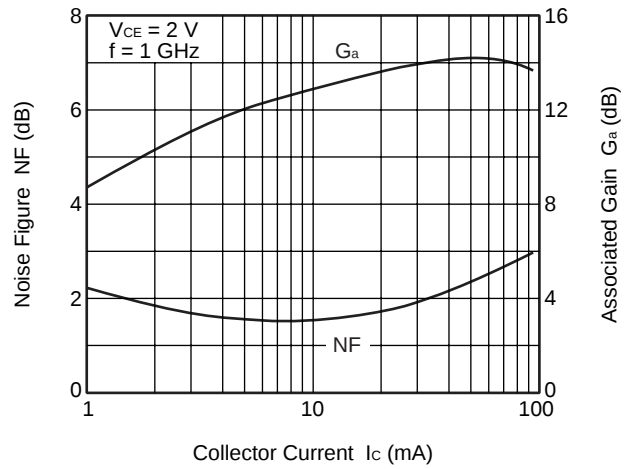
Q1

NOISE FIGURE, ASSOCIATED GAIN
vs. COLLECTOR CURRENT

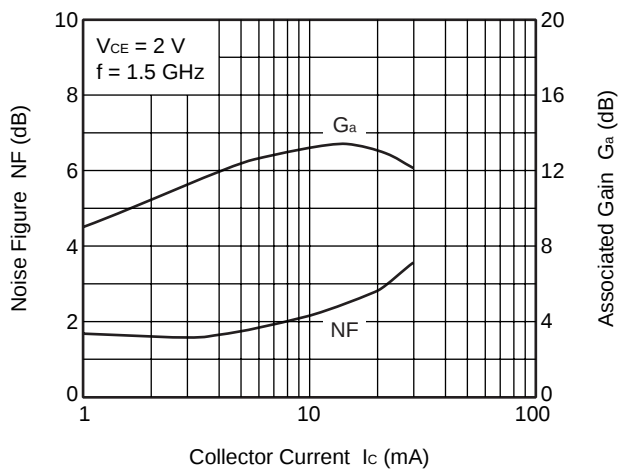


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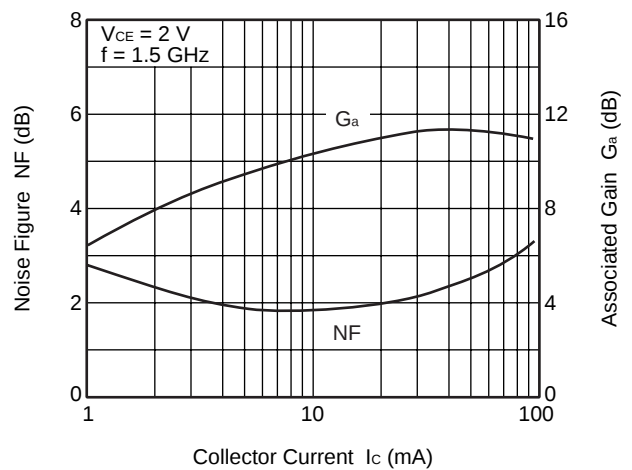
NOISE FIGURE, ASSOCIATED GAIN
vs. COLLECTOR CURRENT



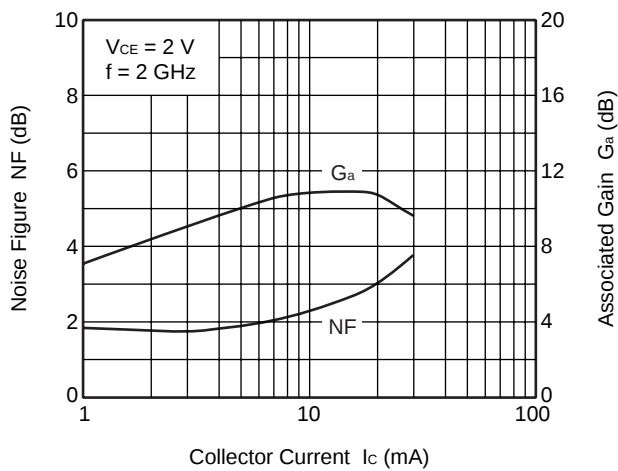
NOISE FIGURE, ASSOCIATED GAIN
vs. COLLECTOR CURRENT



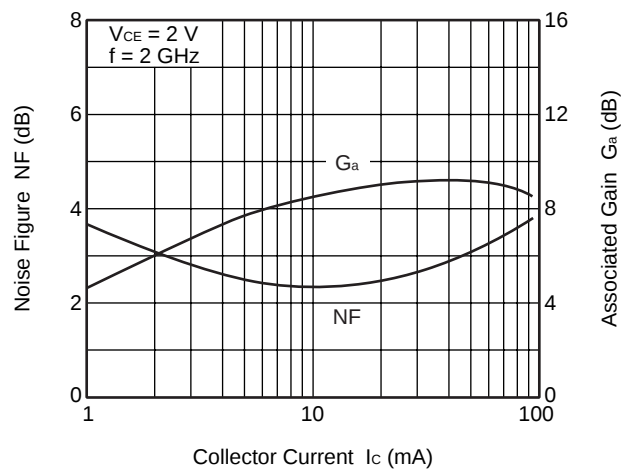
NOISE FIGURE, ASSOCIATED GAIN
vs. COLLECTOR CURRENT



NOISE FIGURE, ASSOCIATED GAIN
vs. COLLECTOR CURRENT

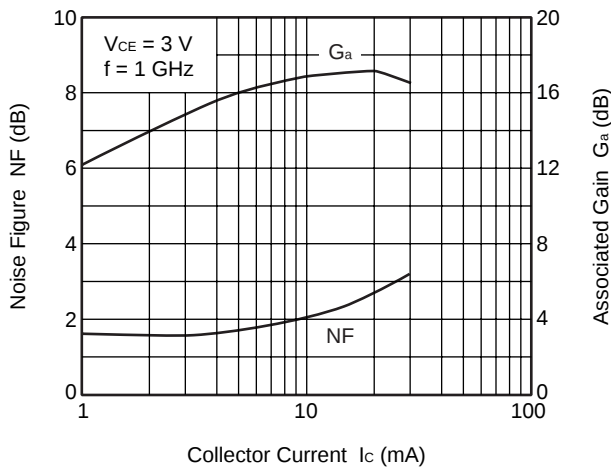


NOISE FIGURE, ASSOCIATED GAIN
vs. COLLECTOR CURRENT

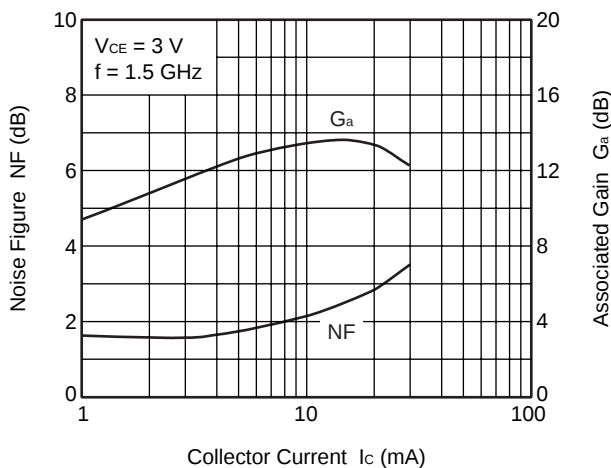


Q1

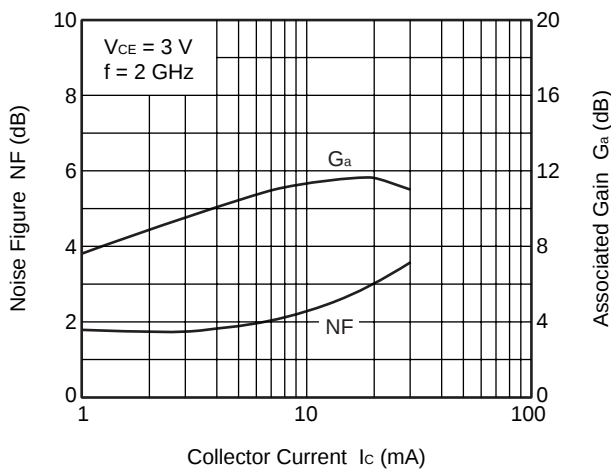
NOISE FIGURE, ASSOCIATED GAIN
vs. COLLECTOR CURRENT



NOISE FIGURE, ASSOCIATED GAIN
vs. COLLECTOR CURRENT



NOISE FIGURE, ASSOCIATED GAIN
vs. COLLECTOR CURRENT



Remark The graphs indicate nominal characteristics.

S-PARAMETERS Q1

V_{CE} = 1 V, I_C = 1 mA, Z₀ = 50 Ω

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.952	-7.1	3.547	172.9	0.020	86.6	0.992	-3.7
0.2	0.943	-14.4	3.539	167.2	0.040	80.9	0.989	-7.3
0.3	0.931	-21.5	3.494	161.1	0.060	76.6	0.971	-10.6
0.4	0.905	-28.3	3.407	154.8	0.079	72.0	0.951	-14.3
0.5	0.880	-35.8	3.352	148.4	0.096	67.8	0.929	-17.9
0.6	0.845	-43.0	3.274	142.1	0.112	63.4	0.900	-21.6
0.7	0.809	-50.3	3.172	136.6	0.127	59.1	0.870	-25.0
0.8	0.770	-57.2	3.067	130.7	0.140	55.3	0.837	-28.4
0.9	0.731	-64.5	2.965	125.0	0.152	51.5	0.807	-31.9
1.0	0.692	-71.4	2.864	119.5	0.161	48.1	0.775	-34.9
1.1	0.658	-78.5	2.756	114.6	0.169	44.8	0.746	-37.8
1.2	0.626	-85.5	2.640	110.0	0.177	42.1	0.717	-40.4
1.3	0.596	-92.3	2.536	105.5	0.182	39.4	0.693	-42.8
1.4	0.571	-98.7	2.420	101.1	0.186	36.9	0.669	-45.3
1.5	0.549	-104.8	2.325	96.9	0.190	34.8	0.648	-47.3
1.6	0.530	-110.8	2.237	93.2	0.193	32.8	0.628	-49.2
1.7	0.513	-116.9	2.141	89.7	0.195	31.1	0.609	-50.9
1.8	0.498	-122.2	2.059	86.1	0.196	29.5	0.592	-52.3
1.9	0.487	-127.6	1.976	83.4	0.197	28.2	0.577	-53.6
2.0	0.472	-132.0	1.907	80.2	0.198	27.0	0.562	-54.7
2.1	0.468	-137.5	1.844	77.5	0.198	26.1	0.552	-56.3
2.2	0.456	-141.5	1.769	74.8	0.198	25.3	0.538	-57.2
2.3	0.455	-147.0	1.721	72.3	0.199	24.5	0.533	-58.3
2.4	0.447	-150.7	1.663	69.8	0.200	23.9	0.518	-59.2
2.5	0.445	-155.3	1.611	67.5	0.200	23.5	0.512	-60.4
2.6	0.437	-158.8	1.570	65.5	0.200	22.7	0.505	-62.0
2.7	0.437	-162.3	1.517	63.2	0.200	22.3	0.499	-62.7
2.8	0.433	-166.1	1.469	61.3	0.199	22.1	0.491	-64.2
2.9	0.426	-169.4	1.409	58.1	0.200	21.3	0.472	-65.2
3.0	0.419	-173.8	1.381	55.7	0.200	21.3	0.465	-68.0
4.0	0.436	149.3	1.136	34.9	0.208	23.7	0.424	-88.2
5.0	0.503	118.2	0.905	16.8	0.232	24.5	0.397	-112.6

V_{CE} = 1 V, I_C = 3 mA, Z₀ = 50 Ω

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.853	-13.4	9.491	169.0	0.019	83.5	0.980	-7.6
0.2	0.839	-25.7	9.175	158.6	0.038	75.3	0.952	-14.8
0.3	0.791	-37.4	8.690	149.4	0.054	69.5	0.897	-21.0
0.4	0.735	-48.4	8.100	140.7	0.068	64.1	0.841	-27.0
0.5	0.673	-59.7	7.538	132.5	0.080	59.6	0.778	-32.1
0.6	0.617	-69.9	6.973	125.3	0.089	55.5	0.717	-36.6
0.7	0.565	-79.4	6.435	119.2	0.097	52.3	0.660	-40.3
0.8	0.516	-88.6	5.919	113.5	0.103	49.9	0.608	-43.7
0.9	0.475	-97.9	5.470	108.4	0.109	47.9	0.564	-46.8
1.0	0.440	-106.4	5.081	103.7	0.113	46.2	0.525	-49.7
1.1	0.417	-114.8	4.728	99.6	0.118	44.9	0.493	-52.1
1.2	0.397	-122.6	4.398	95.9	0.122	44.2	0.463	-54.3
1.3	0.384	-130.3	4.113	92.2	0.125	43.4	0.441	-56.2
1.4	0.371	-137.5	3.859	89.0	0.129	42.8	0.421	-58.2
1.5	0.364	-143.4	3.637	85.8	0.132	42.3	0.404	-59.7
1.6	0.357	-149.6	3.441	83.0	0.135	42.1	0.389	-61.0
1.7	0.355	-155.0	3.252	80.4	0.138	41.9	0.375	-62.3
1.8	0.352	-159.9	3.090	77.7	0.141	41.8	0.362	-63.2
1.9	0.352	-164.5	2.940	75.6	0.145	41.9	0.353	-64.2
2.0	0.345	-168.5	2.810	73.2	0.148	41.7	0.340	-64.8
2.1	0.355	-172.8	2.697	71.1	0.151	41.8	0.334	-66.0
2.2	0.349	-176.2	2.578	69.3	0.154	41.9	0.321	-66.3
2.3	0.360	179.9	2.488	67.3	0.158	41.9	0.317	-67.1
2.4	0.357	177.4	2.396	65.4	0.162	41.9	0.304	-68.2
2.5	0.362	174.0	2.305	63.6	0.166	42.0	0.300	-69.1
2.6	0.359	171.4	2.235	62.4	0.169	42.0	0.294	-70.9
2.7	0.367	169.1	2.155	60.6	0.173	42.0	0.287	-70.9
2.8	0.366	165.8	2.079	59.2	0.177	41.8	0.282	-73.1
2.9	0.359	164.2	1.983	56.7	0.181	41.2	0.267	-74.4
3.0	0.358	159.3	1.937	54.8	0.185	41.3	0.267	-77.6
4.0	0.403	131.3	1.524	36.4	0.230	39.4	0.251	-102.6
5.0	0.486	107.7	1.201	21.1	0.275	32.1	0.242	-133.9

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

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.783	-18.8	14.076	165.6	0.018	80.3	0.964	-10.8
0.2	0.747	-34.7	13.183	152.2	0.036	72.3	0.907	-20.3
0.3	0.673	-49.8	12.003	141.1	0.049	65.6	0.823	-27.8
0.4	0.607	-62.9	10.741	131.5	0.060	61.0	0.742	-34.4
0.5	0.537	-76.1	9.603	123.1	0.068	57.1	0.663	-39.4
0.6	0.481	-87.4	8.612	116.2	0.075	54.3	0.594	-43.5
0.7	0.437	-98.0	7.754	110.7	0.081	52.7	0.535	-46.7
0.8	0.398	-108.0	6.998	105.4	0.086	51.5	0.486	-49.5
0.9	0.372	-118.1	6.348	100.9	0.091	50.6	0.444	-52.1
1.0	0.351	-127.1	5.824	96.9	0.095	50.1	0.410	-54.6
1.1	0.338	-135.6	5.367	93.4	0.100	49.8	0.383	-56.7
1.2	0.332	-143.4	4.940	90.4	0.104	49.8	0.359	-58.8
1.3	0.326	-151.0	4.598	87.4	0.109	49.7	0.342	-60.4
1.4	0.325	-156.9	4.286	84.5	0.113	49.6	0.326	-62.2
1.5	0.322	-162.3	4.028	81.7	0.117	49.5	0.313	-63.7
1.6	0.324	-167.9	3.798	79.3	0.122	49.6	0.303	-64.9
1.7	0.327	-172.4	3.582	77.0	0.126	49.6	0.291	-66.2
1.8	0.326	-176.7	3.393	74.6	0.131	49.6	0.282	-67.0
1.9	0.330	179.2	3.224	72.8	0.135	49.6	0.275	-68.1
2.0	0.326	176.0	3.078	70.5	0.140	49.6	0.264	-68.5
2.1	0.338	172.5	2.946	68.7	0.144	49.6	0.260	-69.7
2.2	0.336	170.4	2.817	67.1	0.148	49.7	0.248	-70.0
2.3	0.347	167.5	2.713	65.3	0.153	49.5	0.245	-70.8
2.4	0.345	165.2	2.609	63.6	0.159	49.4	0.234	-72.1
2.5	0.352	162.6	2.509	62.1	0.163	49.3	0.231	-72.9
2.6	0.351	160.3	2.432	60.8	0.168	49.3	0.224	-75.0
2.7	0.358	158.5	2.340	59.2	0.173	49.0	0.219	-74.9
2.8	0.359	155.9	2.260	57.8	0.178	48.6	0.215	-77.6
2.9	0.352	154.4	2.158	55.6	0.183	47.8	0.202	-79.5
3.0	0.353	150.0	2.104	53.8	0.188	47.8	0.205	-83.1
4.0	0.402	125.3	1.631	36.5	0.239	43.3	0.203	-111.7
5.0	0.486	104.8	1.283	22.1	0.288	33.9	0.212	-147.2

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

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.731	-22.4	17.662	162.6	0.018	78.1	0.946	-13.2
0.2	0.666	-42.3	16.079	147.1	0.033	70.1	0.866	-24.3
0.3	0.585	-59.7	14.117	135.1	0.045	63.9	0.761	-32.4
0.4	0.515	-74.0	12.267	125.3	0.054	59.6	0.666	-38.8
0.5	0.451	-88.1	10.693	117.2	0.061	57.0	0.584	-43.3
0.6	0.402	-100.5	9.403	110.6	0.067	55.3	0.515	-46.9
0.7	0.369	-111.7	8.357	105.7	0.072	54.5	0.460	-49.5
0.8	0.341	-122.4	7.466	100.9	0.077	54.0	0.414	-52.0
0.9	0.326	-132.1	6.722	96.9	0.082	53.8	0.378	-54.2
1.0	0.313	-141.7	6.135	93.3	0.087	54.0	0.348	-56.6
1.1	0.309	-149.3	5.624	90.1	0.092	53.9	0.325	-58.5
1.2	0.309	-156.8	5.163	87.3	0.097	54.2	0.304	-60.5
1.3	0.309	-163.3	4.802	84.6	0.102	54.2	0.290	-62.1
1.4	0.311	-168.8	4.464	82.0	0.107	54.2	0.278	-63.8
1.5	0.312	-173.7	4.191	79.4	0.112	54.3	0.267	-65.3
1.6	0.316	-178.2	3.945	77.1	0.117	54.2	0.259	-66.6
1.7	0.320	178.1	3.712	75.0	0.122	54.2	0.249	-67.9
1.8	0.320	174.4	3.516	72.8	0.127	54.2	0.241	-68.7
1.9	0.327	170.6	3.333	71.1	0.132	54.1	0.236	-69.8
2.0	0.324	168.0	3.181	69.1	0.137	53.9	0.227	-70.2
2.1	0.338	165.7	3.047	67.3	0.142	53.9	0.224	-71.4
2.2	0.334	162.9	2.914	65.8	0.147	53.8	0.212	-71.5
2.3	0.348	160.7	2.803	64.2	0.153	53.6	0.210	-72.5
2.4	0.345	159.0	2.694	62.5	0.158	53.3	0.199	-73.9
2.5	0.353	156.7	2.591	61.0	0.163	53.0	0.197	-74.8
2.6	0.353	154.3	2.509	59.9	0.169	52.8	0.192	-77.4
2.7	0.359	153.2	2.414	58.3	0.174	52.4	0.186	-77.2
2.8	0.361	150.8	2.330	57.2	0.179	51.8	0.183	-80.3
2.9	0.354	149.1	2.223	55.0	0.185	50.9	0.171	-82.7
3.0	0.355	145.1	2.167	53.2	0.191	50.7	0.175	-86.6
4.0	0.404	122.9	1.674	36.3	0.244	45.0	0.183	-117.4
5.0	0.490	103.1	1.316	22.5	0.294	34.8	0.204	-154.4

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

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.648	-29.0	21.750	159.0	0.017	76.3	0.924	-16.1
0.2	0.574	-52.1	18.960	141.4	0.030	67.2	0.810	-28.7
0.3	0.489	-71.7	15.944	128.7	0.040	62.5	0.686	-36.9
0.4	0.426	-88.0	13.412	119.2	0.048	59.7	0.584	-42.6
0.5	0.373	-103.3	11.427	111.5	0.054	58.2	0.504	-46.3
0.6	0.340	-116.3	9.904	105.5	0.060	57.8	0.440	-49.0
0.7	0.319	-127.6	8.699	101.1	0.065	57.4	0.391	-51.0
0.8	0.302	-138.3	7.716	96.8	0.071	57.6	0.351	-52.9
0.9	0.297	-147.7	6.924	93.2	0.076	57.8	0.320	-54.9
1.0	0.294	-156.2	6.289	90.0	0.081	58.1	0.294	-57.0
1.1	0.298	-163.2	5.752	87.1	0.086	58.3	0.275	-58.8
1.2	0.302	-168.7	5.272	84.8	0.092	58.6	0.258	-60.8
1.3	0.306	-175.1	4.878	82.1	0.097	58.6	0.247	-62.4
1.4	0.310	-179.3	4.535	79.7	0.103	58.6	0.238	-64.3
1.5	0.313	176.2	4.245	77.4	0.109	58.5	0.229	-65.8
1.6	0.320	172.7	4.002	75.3	0.114	58.4	0.223	-67.1
1.7	0.324	169.6	3.760	73.3	0.120	58.4	0.215	-68.4
1.8	0.327	166.6	3.562	71.2	0.125	58.1	0.209	-69.4
1.9	0.333	163.7	3.377	69.6	0.131	57.9	0.205	-70.6
2.0	0.332	161.1	3.223	67.6	0.136	57.7	0.197	-70.8
2.1	0.343	158.8	3.086	66.0	0.142	57.4	0.195	-72.2
2.2	0.340	156.9	2.947	64.5	0.147	57.1	0.184	-72.3
2.3	0.356	155.6	2.839	62.9	0.153	56.8	0.183	-73.4
2.4	0.353	153.7	2.728	61.4	0.159	56.3	0.173	-75.0
2.5	0.360	151.8	2.621	60.0	0.164	56.0	0.172	-76.1
2.6	0.360	149.9	2.540	58.9	0.170	55.6	0.166	-79.0
2.7	0.367	148.7	2.445	57.5	0.175	55.0	0.161	-79.1
2.8	0.368	146.5	2.360	56.3	0.181	54.3	0.159	-82.4
2.9	0.360	145.3	2.250	54.3	0.187	53.3	0.149	-85.4
3.0	0.361	141.2	2.191	52.6	0.193	53.0	0.154	-89.3
4.0	0.411	120.5	1.687	35.9	0.248	46.5	0.169	-122.4
5.0	0.496	101.9	1.322	22.3	0.298	35.7	0.200	-159.8

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

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.465	-48.9	26.851	149.0	0.016	74.9	0.815	-23.4
0.2	0.402	-84.3	20.632	128.1	0.026	63.2	0.639	-37.0
0.3	0.351	-109.5	15.878	115.8	0.033	60.8	0.504	-42.6
0.4	0.330	-127.2	12.668	107.4	0.040	61.1	0.415	-45.5
0.5	0.320	-142.0	10.429	101.3	0.045	61.7	0.354	-46.6
0.6	0.313	-152.8	8.867	96.4	0.051	62.6	0.309	-47.3
0.7	0.315	-161.6	7.698	92.8	0.057	63.4	0.276	-47.9
0.8	0.318	-169.6	6.765	89.3	0.063	63.8	0.249	-48.8
0.9	0.324	-175.5	6.024	86.4	0.069	64.1	0.230	-50.1
1.0	0.330	179.0	5.444	83.8	0.075	64.4	0.213	-52.0
1.1	0.339	174.7	4.967	81.3	0.081	64.5	0.202	-53.8
1.2	0.348	171.3	4.529	79.1	0.087	64.5	0.192	-56.2
1.3	0.356	167.3	4.195	76.9	0.093	64.5	0.186	-58.0
1.4	0.361	164.9	3.897	74.8	0.099	64.3	0.181	-60.2
1.5	0.367	161.8	3.642	72.6	0.105	64.1	0.177	-62.0
1.6	0.373	159.5	3.426	70.6	0.111	63.7	0.174	-63.6
1.7	0.376	157.3	3.218	68.8	0.117	63.4	0.171	-65.3
1.8	0.380	155.1	3.046	66.8	0.123	63.0	0.167	-66.4
1.9	0.385	153.2	2.890	65.3	0.129	62.7	0.166	-68.1
2.0	0.385	151.0	2.757	63.5	0.135	62.2	0.160	-68.5
2.1	0.398	149.9	2.640	61.9	0.141	61.7	0.161	-70.4
2.2	0.395	148.0	2.528	60.4	0.147	61.4	0.152	-70.7
2.3	0.406	147.1	2.432	59.0	0.153	60.8	0.152	-72.1
2.4	0.404	145.6	2.339	57.5	0.159	60.3	0.144	-74.4
2.5	0.410	144.5	2.250	56.2	0.165	59.7	0.145	-75.8
2.6	0.411	142.5	2.179	55.1	0.171	59.3	0.141	-79.3
2.7	0.416	141.9	2.100	53.8	0.177	58.6	0.136	-79.2
2.8	0.419	139.9	2.025	52.6	0.183	57.8	0.136	-83.7
2.9	0.408	138.8	1.931	50.7	0.189	56.7	0.127	-87.2
3.0	0.411	135.4	1.881	49.0	0.196	56.3	0.133	-91.9
4.0	0.459	116.0	1.452	32.2	0.253	48.5	0.160	-127.9
5.0	0.536	99.1	1.141	19.5	0.304	36.9	0.204	-164.6

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

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.965	-7.3	3.547	173.5	0.018	87.6	0.993	-3.2
0.2	0.946	-13.5	3.554	168.1	0.035	82.3	0.992	-6.3
0.3	0.930	-19.9	3.510	162.4	0.051	77.9	0.976	-9.0
0.4	0.911	-26.3	3.439	156.4	0.068	73.6	0.960	-12.3
0.5	0.887	-33.4	3.397	150.3	0.083	69.7	0.941	-15.4
0.6	0.855	-40.2	3.321	144.3	0.097	65.6	0.917	-18.7
0.7	0.821	-46.7	3.230	139.1	0.110	61.5	0.890	-21.8
0.8	0.786	-53.4	3.137	133.3	0.122	57.8	0.860	-24.8
0.9	0.746	-60.4	3.039	127.8	0.132	54.1	0.835	-27.8
1.0	0.708	-67.1	2.949	122.5	0.141	50.9	0.805	-30.7
1.1	0.672	-73.9	2.848	117.7	0.149	47.8	0.779	-33.2
1.2	0.642	-80.6	2.738	113.1	0.156	45.1	0.753	-35.5
1.3	0.611	-87.1	2.639	108.8	0.161	42.5	0.731	-37.8
1.4	0.585	-93.2	2.524	104.4	0.166	40.1	0.708	-40.0
1.5	0.562	-99.3	2.430	100.2	0.169	38.0	0.689	-41.9
1.6	0.540	-105.3	2.344	96.5	0.172	36.0	0.669	-43.7
1.7	0.523	-111.0	2.250	92.9	0.174	34.3	0.650	-45.3
1.8	0.506	-116.6	2.161	89.4	0.175	32.8	0.634	-46.6
1.9	0.493	-121.8	2.076	86.6	0.177	31.5	0.620	-47.9
2.0	0.476	-126.5	2.007	83.4	0.178	30.4	0.606	-49.0
2.1	0.468	-132.1	1.939	80.7	0.178	29.5	0.596	-50.4
2.2	0.455	-136.0	1.864	78.1	0.178	28.7	0.582	-51.1
2.3	0.452	-141.5	1.811	75.5	0.179	28.1	0.579	-52.0
2.4	0.446	-145.2	1.753	73.1	0.180	27.5	0.564	-53.0
2.5	0.442	-150.1	1.699	70.7	0.180	27.2	0.558	-54.0
2.6	0.432	-153.3	1.655	69.0	0.181	26.6	0.551	-55.4
2.7	0.432	-157.3	1.598	66.7	0.181	26.2	0.545	-56.1
2.8	0.425	-161.2	1.548	64.7	0.181	25.9	0.536	-57.5
2.9	0.419	-164.3	1.485	61.5	0.181	25.2	0.518	-58.5
3.0	0.410	-169.1	1.455	59.1	0.182	25.3	0.509	-61.0
4.0	0.421	152.7	1.199	38.3	0.193	28.8	0.466	-79.4
5.0	0.485	119.8	0.957	19.6	0.221	29.8	0.430	-101.8

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

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.875	-11.4	9.429	169.8	0.018	86.2	0.984	-6.3
0.2	0.845	-23.2	9.182	160.1	0.032	77.3	0.961	-12.4
0.3	0.804	-34.0	8.752	151.4	0.046	71.7	0.914	-17.7
0.4	0.751	-44.0	8.224	143.1	0.059	66.4	0.864	-22.7
0.5	0.693	-54.3	7.717	135.3	0.070	62.2	0.811	-27.2
0.6	0.636	-63.9	7.192	128.2	0.078	58.4	0.756	-31.1
0.7	0.585	-72.7	6.672	122.2	0.086	55.1	0.704	-34.4
0.8	0.531	-81.2	6.180	116.4	0.092	52.7	0.656	-37.3
0.9	0.490	-90.1	5.735	111.2	0.097	50.6	0.616	-40.0
1.0	0.449	-98.2	5.358	106.5	0.102	49.0	0.576	-42.4
1.1	0.422	-106.3	5.003	102.4	0.106	47.8	0.545	-44.4
1.2	0.398	-114.0	4.659	98.7	0.110	46.9	0.516	-46.2
1.3	0.380	-121.6	4.379	95.1	0.114	46.1	0.495	-47.8
1.4	0.365	-128.6	4.100	91.7	0.117	45.5	0.475	-49.5
1.5	0.353	-135.1	3.879	88.5	0.120	45.1	0.457	-50.8
1.6	0.345	-141.3	3.676	85.6	0.123	44.8	0.442	-51.9
1.7	0.339	-147.0	3.478	83.0	0.126	44.6	0.428	-53.0
1.8	0.333	-152.0	3.303	80.3	0.129	44.5	0.417	-53.8
1.9	0.331	-157.7	3.144	78.2	0.132	44.5	0.407	-54.6
2.0	0.325	-161.6	3.010	75.7	0.135	44.4	0.395	-55.1
2.1	0.332	-166.5	2.886	73.7	0.138	44.5	0.388	-56.2
2.2	0.324	-169.5	2.761	71.7	0.142	44.6	0.376	-56.4
2.3	0.334	-173.8	2.663	69.8	0.145	44.7	0.373	-57.0
2.4	0.330	-176.8	2.564	67.9	0.149	44.7	0.361	-57.7
2.5	0.336	179.5	2.468	66.2	0.153	44.9	0.357	-58.5
2.6	0.332	176.4	2.394	64.8	0.156	44.9	0.349	-59.8
2.7	0.340	174.1	2.306	63.0	0.160	44.9	0.344	-59.8
2.8	0.338	170.6	2.227	61.6	0.163	44.9	0.339	-61.4
2.9	0.332	168.5	2.123	59.0	0.167	44.4	0.323	-62.4
3.0	0.329	163.7	2.071	57.1	0.171	44.4	0.321	-65.2
4.0	0.371	133.9	1.630	39.0	0.215	43.1	0.293	-86.6
5.0	0.459	109.6	1.290	23.4	0.262	35.9	0.264	-114.5

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

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.812	-16.7	14.092	166.6	0.016	84.9	0.970	-8.9
0.2	0.760	-31.0	13.350	154.1	0.030	73.8	0.924	-17.1
0.3	0.690	-44.5	12.274	143.6	0.042	68.2	0.851	-23.4
0.4	0.623	-56.5	11.100	134.3	0.052	63.6	0.779	-29.0
0.5	0.554	-68.7	10.037	125.9	0.060	59.9	0.708	-33.3
0.6	0.494	-79.0	9.066	119.0	0.067	57.2	0.643	-36.8
0.7	0.445	-89.0	8.205	113.4	0.072	55.5	0.588	-39.5
0.8	0.401	-98.6	7.428	108.2	0.078	54.2	0.539	-41.7
0.9	0.370	-108.4	6.770	103.5	0.082	53.2	0.500	-43.8
1.0	0.342	-117.2	6.233	99.5	0.087	52.8	0.466	-45.7
1.1	0.324	-125.9	5.760	95.8	0.091	52.3	0.439	-47.3
1.2	0.316	-133.7	5.318	92.9	0.095	52.3	0.415	-48.9
1.3	0.305	-141.5	4.958	89.7	0.099	52.1	0.397	-50.1
1.4	0.299	-148.1	4.628	86.8	0.103	52.0	0.382	-51.5
1.5	0.296	-154.5	4.343	84.1	0.107	52.0	0.369	-52.6
1.6	0.296	-160.2	4.107	81.6	0.112	52.1	0.357	-53.6
1.7	0.294	-165.2	3.873	79.3	0.116	52.0	0.346	-54.5
1.8	0.295	-169.9	3.673	76.9	0.120	52.1	0.337	-55.1
1.9	0.297	-174.4	3.484	75.1	0.124	52.1	0.330	-55.9
2.0	0.291	-178.1	3.328	72.9	0.128	52.1	0.320	-56.2
2.1	0.304	177.7	3.185	71.1	0.132	52.2	0.315	-57.2
2.2	0.301	175.1	3.050	69.4	0.137	52.2	0.304	-57.1
2.3	0.314	172.1	2.938	67.7	0.141	52.2	0.302	-57.8
2.4	0.310	170.1	2.825	66.0	0.146	52.0	0.291	-58.5
2.5	0.319	167.1	2.717	64.5	0.151	52.0	0.288	-59.3
2.6	0.316	164.4	2.630	63.2	0.155	52.0	0.281	-60.7
2.7	0.324	162.5	2.533	61.7	0.160	51.7	0.277	-60.4
2.8	0.324	159.5	2.442	60.4	0.164	51.4	0.271	-62.3
2.9	0.317	158.0	2.333	58.0	0.169	50.6	0.257	-63.6
3.0	0.316	153.6	2.272	56.2	0.175	50.6	0.257	-66.7
4.0	0.366	127.8	1.762	39.2	0.225	46.8	0.239	-91.2
5.0	0.456	106.2	1.391	24.5	0.274	37.5	0.219	-123.8

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

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.725	-19.1	17.802	163.8	0.015	80.7	0.958	-11.0
0.2	0.685	-37.4	16.382	149.5	0.029	72.5	0.890	-20.4
0.3	0.607	-53.1	14.584	138.0	0.039	66.6	0.798	-27.3
0.4	0.533	-66.2	12.825	128.3	0.048	62.2	0.712	-32.7
0.5	0.464	-79.3	11.315	120.1	0.054	59.8	0.635	-36.4
0.6	0.410	-90.2	10.021	113.5	0.060	58.2	0.569	-39.2
0.7	0.370	-101.1	8.952	108.4	0.065	56.9	0.517	-41.4
0.8	0.333	-111.3	8.035	103.5	0.070	56.7	0.472	-43.1
0.9	0.310	-121.5	7.261	99.4	0.075	56.3	0.436	-44.8
1.0	0.292	-130.5	6.641	95.7	0.079	56.3	0.405	-46.4
1.1	0.285	-139.2	6.104	92.5	0.084	56.3	0.382	-47.8
1.2	0.279	-146.9	5.613	89.7	0.089	56.3	0.362	-49.3
1.3	0.277	-154.8	5.219	86.9	0.094	56.4	0.348	-50.4
1.4	0.277	-160.9	4.862	84.2	0.098	56.4	0.335	-51.8
1.5	0.277	-166.2	4.553	81.8	0.103	56.3	0.324	-52.8
1.6	0.279	-171.3	4.297	79.4	0.108	56.5	0.315	-53.8
1.7	0.282	-175.9	4.045	77.3	0.112	56.4	0.305	-54.7
1.8	0.284	-179.7	3.836	75.1	0.117	56.4	0.298	-55.3
1.9	0.288	176.4	3.635	73.4	0.122	56.4	0.292	-56.0
2.0	0.286	172.6	3.469	71.3	0.127	56.2	0.283	-56.2
2.1	0.297	169.8	3.321	69.6	0.131	56.1	0.280	-57.3
2.2	0.294	166.9	3.171	68.0	0.136	56.1	0.270	-57.0
2.3	0.307	164.9	3.059	66.4	0.141	55.9	0.268	-57.7
2.4	0.306	162.7	2.941	64.8	0.146	55.7	0.257	-58.4
2.5	0.313	160.6	2.825	63.3	0.151	55.5	0.255	-59.3
2.6	0.313	157.8	2.737	62.1	0.156	55.3	0.248	-60.8
2.7	0.318	156.6	2.635	60.6	0.161	54.9	0.244	-60.6
2.8	0.319	153.8	2.536	59.4	0.166	54.4	0.239	-62.8
2.9	0.312	152.3	2.423	57.2	0.172	53.6	0.226	-64.1
3.0	0.315	148.1	2.362	55.5	0.177	53.5	0.227	-67.5
4.0	0.367	124.5	1.825	39.0	0.230	48.3	0.214	-94.0
5.0	0.455	104.3	1.438	24.9	0.280	38.3	0.202	-129.6

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

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.670	-23.0	22.008	160.6	0.014	77.1	0.939	-13.3
0.2	0.595	-45.4	19.593	144.3	0.027	71.1	0.845	-23.9
0.3	0.510	-62.4	16.792	132.0	0.035	64.8	0.734	-30.8
0.4	0.439	-77.2	14.296	122.3	0.043	62.3	0.640	-35.7
0.5	0.380	-91.1	12.312	114.7	0.048	61.0	0.563	-38.7
0.6	0.336	-103.6	10.745	108.5	0.054	60.2	0.501	-40.8
0.7	0.306	-115.0	9.495	103.8	0.059	59.9	0.452	-42.2
0.8	0.281	-125.5	8.443	99.4	0.064	60.0	0.412	-43.5
0.9	0.269	-135.7	7.598	95.8	0.069	60.0	0.382	-44.7
1.0	0.258	-145.3	6.916	92.4	0.074	60.3	0.355	-46.2
1.1	0.259	-152.9	6.330	89.5	0.079	60.3	0.336	-47.3
1.2	0.260	-160.4	5.811	87.0	0.085	60.5	0.318	-48.7
1.3	0.262	-166.8	5.394	84.4	0.090	60.6	0.307	-49.8
1.4	0.267	-172.3	5.015	82.0	0.095	60.5	0.296	-51.2
1.5	0.269	-177.0	4.702	79.5	0.100	60.4	0.287	-52.2
1.6	0.274	178.4	4.422	77.5	0.105	60.4	0.280	-53.2
1.7	0.277	174.7	4.161	75.5	0.110	60.3	0.272	-54.1
1.8	0.280	171.1	3.940	73.5	0.115	60.0	0.266	-54.8
1.9	0.287	168.2	3.736	71.9	0.121	59.9	0.262	-55.6
2.0	0.284	165.3	3.564	70.0	0.126	59.6	0.254	-55.7
2.1	0.296	162.6	3.410	68.3	0.131	59.5	0.252	-56.8
2.2	0.294	160.5	3.258	66.8	0.136	59.3	0.242	-56.5
2.3	0.308	158.9	3.140	65.3	0.141	58.9	0.240	-57.3
2.4	0.304	156.9	3.017	63.8	0.147	58.5	0.230	-57.9
2.5	0.314	154.9	2.897	62.5	0.152	58.2	0.229	-59.0
2.6	0.313	152.8	2.804	61.2	0.157	57.9	0.222	-60.7
2.7	0.321	151.4	2.699	59.7	0.163	57.3	0.218	-60.5
2.8	0.321	148.9	2.602	58.5	0.168	56.8	0.214	-62.7
2.9	0.315	147.6	2.484	56.5	0.173	55.9	0.202	-64.3
3.0	0.317	143.3	2.421	54.9	0.179	55.6	0.204	-67.9
4.0	0.367	121.7	1.856	38.6	0.233	49.6	0.195	-96.6
5.0	0.457	103.0	1.462	24.9	0.284	39.0	0.190	-134.7

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

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.486	-36.9	29.425	153.6	0.013	79.1	0.883	-18.0
0.2	0.419	-65.2	23.883	133.9	0.023	68.4	0.737	-29.6
0.3	0.345	-87.4	19.002	121.4	0.029	65.7	0.608	-35.0
0.4	0.300	-104.1	15.432	112.6	0.035	64.8	0.516	-37.7
0.5	0.272	-120.6	12.867	106.0	0.041	65.2	0.451	-38.7
0.6	0.254	-133.4	11.011	100.8	0.046	65.3	0.402	-39.2
0.7	0.250	-145.0	9.606	97.0	0.052	65.7	0.365	-39.4
0.8	0.243	-155.2	8.466	93.4	0.058	66.4	0.336	-39.9
0.9	0.247	-163.0	7.570	90.3	0.063	66.5	0.314	-40.6
1.0	0.251	-170.3	6.858	87.5	0.069	66.7	0.294	-41.7
1.1	0.257	-176.3	6.251	85.0	0.074	66.7	0.281	-42.7
1.2	0.268	179.4	5.716	83.0	0.080	66.7	0.268	-44.2
1.3	0.273	174.3	5.300	80.7	0.086	66.5	0.261	-45.3
1.4	0.280	171.0	4.916	78.5	0.092	66.3	0.253	-46.8
1.5	0.284	167.4	4.605	76.4	0.097	66.1	0.248	-48.0
1.6	0.292	164.5	4.327	74.4	0.103	65.7	0.244	-49.2
1.7	0.295	161.9	4.068	72.6	0.108	65.4	0.238	-50.3
1.8	0.299	159.5	3.851	70.7	0.114	65.0	0.234	-51.0
1.9	0.307	156.5	3.650	69.2	0.119	64.6	0.231	-52.1
2.0	0.306	154.9	3.481	67.3	0.125	64.1	0.225	-52.1
2.1	0.319	152.8	3.334	65.8	0.130	63.8	0.224	-53.6
2.2	0.315	151.1	3.185	64.4	0.136	63.4	0.216	-53.2
2.3	0.329	150.6	3.067	63.0	0.142	62.9	0.216	-54.2
2.4	0.325	148.9	2.944	61.6	0.148	62.3	0.206	-55.0
2.5	0.335	147.6	2.832	60.3	0.153	61.9	0.206	-56.1
2.6	0.335	145.5	2.741	59.3	0.159	61.4	0.200	-58.1
2.7	0.340	144.9	2.639	58.0	0.164	60.7	0.197	-58.0
2.8	0.342	142.7	2.544	56.8	0.169	60.1	0.193	-60.5
2.9	0.333	141.9	2.424	54.9	0.175	58.9	0.182	-62.2
3.0	0.337	138.0	2.363	53.2	0.182	58.5	0.184	-66.3
4.0	0.387	118.4	1.811	37.2	0.237	51.5	0.179	-97.7
5.0	0.476	101.3	1.424	23.9	0.289	40.1	0.182	-138.2

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

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.951	-6.6	3.571	173.3	0.017	87.1	0.996	-2.9
0.2	0.948	-13.1	3.558	168.3	0.033	82.6	0.993	-5.9
0.3	0.935	-19.4	3.515	162.8	0.048	78.4	0.975	-8.6
0.4	0.911	-25.8	3.442	156.8	0.064	74.1	0.962	-11.7
0.5	0.890	-32.5	3.406	150.9	0.079	70.1	0.944	-14.6
0.6	0.858	-39.1	3.337	145.0	0.092	66.2	0.920	-17.8
0.7	0.825	-45.5	3.248	139.8	0.105	62.3	0.895	-20.6
0.8	0.789	-52.2	3.160	134.1	0.116	58.6	0.867	-23.6
0.9	0.752	-59.0	3.066	128.7	0.126	55.1	0.842	-26.6
1.0	0.714	-65.4	2.974	123.4	0.135	51.8	0.815	-29.3
1.1	0.680	-72.1	2.876	118.7	0.142	48.8	0.789	-31.8
1.2	0.646	-78.7	2.769	114.2	0.149	46.2	0.765	-34.1
1.3	0.615	-85.0	2.668	109.8	0.155	43.5	0.743	-36.2
1.4	0.591	-91.5	2.557	105.4	0.159	41.2	0.719	-38.4
1.5	0.566	-97.4	2.463	101.2	0.163	39.1	0.701	-40.3
1.6	0.546	-103.3	2.378	97.6	0.165	37.2	0.682	-42.0
1.7	0.525	-109.1	2.282	94.0	0.168	35.5	0.663	-43.5
1.8	0.507	-114.2	2.195	90.5	0.169	34.0	0.647	-44.8
1.9	0.494	-119.7	2.110	87.7	0.170	32.7	0.634	-46.2
2.0	0.477	-124.1	2.041	84.4	0.172	31.5	0.618	-47.2
2.1	0.467	-129.8	1.973	81.8	0.172	30.6	0.609	-48.6
2.2	0.453	-133.9	1.895	79.1	0.172	30.0	0.596	-49.3
2.3	0.451	-139.2	1.841	76.7	0.173	29.3	0.593	-50.2
2.4	0.442	-143.2	1.782	74.2	0.174	28.8	0.578	-51.1
2.5	0.438	-148.1	1.728	71.9	0.174	28.5	0.573	-52.1
2.6	0.429	-151.4	1.679	70.0	0.175	28.0	0.565	-53.2
2.7	0.429	-155.5	1.627	67.6	0.175	27.7	0.560	-53.8
2.8	0.422	-159.5	1.573	65.8	0.175	27.5	0.551	-55.0
2.9	0.414	-162.7	1.509	62.4	0.175	26.8	0.531	-56.0
3.0	0.405	-167.3	1.480	60.1	0.176	26.9	0.523	-58.6
4.0	0.413	153.8	1.219	39.3	0.189	30.5	0.479	-76.4
5.0	0.479	120.3	0.974	20.6	0.218	31.4	0.441	-98.5

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

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.875	-11.6	9.462	170.0	0.016	80.1	0.985	-6.1
0.2	0.851	-22.5	9.220	160.5	0.031	77.7	0.963	-11.8
0.3	0.810	-32.9	8.796	152.0	0.044	72.2	0.918	-16.7
0.4	0.758	-42.6	8.287	143.8	0.056	67.3	0.872	-21.7
0.5	0.699	-52.5	7.800	136.0	0.066	63.1	0.820	-25.7
0.6	0.641	-61.9	7.283	129.0	0.075	59.2	0.767	-29.6
0.7	0.590	-70.5	6.773	123.1	0.083	56.1	0.718	-32.7
0.8	0.538	-78.8	6.291	117.4	0.088	53.7	0.670	-35.5
0.9	0.491	-87.3	5.841	112.1	0.094	51.6	0.629	-38.1
1.0	0.453	-95.1	5.459	107.4	0.099	50.1	0.592	-40.3
1.1	0.424	-103.3	5.101	103.3	0.103	48.8	0.561	-42.3
1.2	0.398	-111.0	4.754	99.7	0.106	48.0	0.532	-44.1
1.3	0.377	-118.4	4.479	96.0	0.110	47.2	0.511	-45.5
1.4	0.362	-125.3	4.192	92.7	0.113	46.5	0.491	-47.1
1.5	0.349	-131.7	3.968	89.4	0.116	46.1	0.474	-48.4
1.6	0.341	-138.1	3.758	86.5	0.120	45.8	0.459	-49.5
1.7	0.333	-144.2	3.555	83.9	0.123	45.6	0.445	-50.5
1.8	0.327	-149.3	3.383	81.1	0.126	45.4	0.433	-51.2
1.9	0.323	-154.9	3.217	79.0	0.129	45.4	0.423	-52.0
2.0	0.317	-158.8	3.078	76.5	0.132	45.5	0.412	-52.3
2.1	0.322	-163.8	2.952	74.5	0.135	45.5	0.405	-53.4
2.2	0.315	-167.3	2.826	72.5	0.138	45.6	0.394	-53.5
2.3	0.323	-171.9	2.729	70.6	0.141	45.6	0.391	-54.2
2.4	0.321	-174.5	2.623	68.7	0.145	45.8	0.378	-54.8
2.5	0.326	-178.5	2.528	67.0	0.149	45.9	0.375	-55.5
2.6	0.323	178.3	2.453	65.7	0.152	45.9	0.367	-56.8
2.7	0.329	175.8	2.363	63.9	0.155	45.8	0.362	-56.8
2.8	0.327	172.6	2.277	62.4	0.159	45.8	0.356	-58.3
2.9	0.322	170.4	2.176	59.9	0.163	45.2	0.340	-59.2
3.0	0.318	165.6	2.124	58.0	0.167	45.4	0.338	-61.9
4.0	0.360	135.1	1.668	40.0	0.211	44.3	0.306	-82.3
5.0	0.449	110.0	1.323	24.2	0.258	37.1	0.272	-109.0

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

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.800	-14.8	14.185	166.6	0.016	81.3	0.972	-8.5
0.2	0.762	-29.9	13.456	154.6	0.029	74.6	0.928	-16.1
0.3	0.699	-43.3	12.386	144.2	0.040	68.8	0.859	-22.2
0.4	0.632	-54.5	11.241	135.0	0.050	64.4	0.790	-27.6
0.5	0.560	-66.3	10.196	126.7	0.058	60.6	0.721	-31.6
0.6	0.500	-76.5	9.233	119.8	0.064	58.2	0.657	-35.0
0.7	0.451	-86.0	8.357	114.2	0.070	56.2	0.602	-37.4
0.8	0.404	-95.3	7.591	108.9	0.075	55.0	0.554	-39.6
0.9	0.369	-104.6	6.941	104.4	0.079	54.2	0.516	-41.6
1.0	0.339	-113.4	6.384	100.2	0.084	53.6	0.482	-43.4
1.1	0.321	-122.2	5.896	96.7	0.088	53.2	0.454	-44.8
1.2	0.309	-130.1	5.456	93.6	0.092	53.1	0.431	-46.3
1.3	0.298	-137.9	5.089	90.4	0.096	53.0	0.414	-47.5
1.4	0.292	-144.9	4.753	87.5	0.101	52.9	0.399	-48.8
1.5	0.285	-150.8	4.461	84.7	0.105	52.9	0.386	-49.8
1.6	0.284	-157.1	4.214	82.2	0.109	52.9	0.375	-50.8
1.7	0.283	-162.3	3.973	79.9	0.113	52.9	0.363	-51.6
1.8	0.282	-167.1	3.771	77.6	0.117	53.0	0.354	-52.2
1.9	0.283	-171.9	3.576	75.8	0.121	53.0	0.347	-52.9
2.0	0.280	-175.6	3.416	73.6	0.125	52.9	0.337	-53.1
2.1	0.290	-179.7	3.275	71.7	0.129	53.0	0.333	-54.1
2.2	0.289	177.4	3.131	70.0	0.133	53.0	0.322	-53.9
2.3	0.298	173.9	3.016	68.4	0.138	53.0	0.320	-54.6
2.4	0.297	171.5	2.900	66.7	0.143	52.8	0.308	-55.2
2.5	0.304	168.7	2.789	65.2	0.147	52.8	0.306	-56.0
2.6	0.302	165.9	2.700	64.0	0.152	52.7	0.299	-57.3
2.7	0.309	164.1	2.600	62.4	0.156	52.4	0.294	-57.3
2.8	0.310	161.1	2.507	61.1	0.160	52.1	0.289	-58.9
2.9	0.303	159.6	2.393	58.8	0.166	51.3	0.275	-60.0
3.0	0.304	154.7	2.335	56.9	0.171	51.3	0.274	-63.0
4.0	0.353	128.4	1.811	40.1	0.221	47.7	0.251	-85.9
5.0	0.441	106.4	1.435	25.2	0.270	38.6	0.224	-117.1

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

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.736	-18.2	17.762	164.3	0.014	81.1	0.961	-10.3
0.2	0.696	-35.5	16.431	150.3	0.028	71.8	0.898	-19.2
0.3	0.619	-50.5	14.686	138.8	0.038	67.4	0.810	-25.7
0.4	0.544	-63.0	12.978	129.3	0.046	63.4	0.727	-31.0
0.5	0.473	-75.5	11.479	121.2	0.052	60.7	0.652	-34.6
0.6	0.418	-86.5	10.202	114.6	0.058	59.0	0.588	-37.3
0.7	0.373	-96.5	9.131	109.4	0.063	57.7	0.535	-39.3
0.8	0.334	-106.4	8.216	104.5	0.068	57.3	0.491	-41.0
0.9	0.310	-116.3	7.430	100.4	0.073	57.0	0.456	-42.5
1.0	0.288	-125.7	6.799	96.6	0.077	57.0	0.425	-44.0
1.1	0.277	-134.5	6.255	93.3	0.082	56.7	0.402	-45.2
1.2	0.271	-142.6	5.762	90.5	0.087	56.9	0.381	-46.6
1.3	0.266	-150.7	5.365	87.7	0.091	56.8	0.366	-47.6
1.4	0.265	-156.6	4.988	85.1	0.096	56.9	0.353	-48.9
1.5	0.262	-162.8	4.679	82.5	0.101	57.0	0.342	-49.9
1.6	0.266	-168.0	4.408	80.2	0.105	57.1	0.333	-50.8
1.7	0.268	-172.8	4.153	78.0	0.110	56.9	0.324	-51.6
1.8	0.270	-177.0	3.940	75.8	0.114	57.0	0.316	-52.1
1.9	0.272	178.7	3.734	74.1	0.119	56.9	0.310	-52.9
2.0	0.272	175.5	3.565	72.1	0.124	56.8	0.301	-53.0
2.1	0.282	171.9	3.415	70.4	0.128	56.7	0.298	-54.0
2.2	0.275	169.3	3.262	68.8	0.133	56.6	0.288	-53.8
2.3	0.292	166.7	3.145	67.2	0.138	56.4	0.286	-54.4
2.4	0.290	164.8	3.021	65.6	0.143	56.2	0.275	-55.0
2.5	0.298	162.1	2.906	64.1	0.148	56.1	0.273	-55.8
2.6	0.297	159.4	2.812	63.0	0.153	55.9	0.267	-57.1
2.7	0.302	158.0	2.709	61.5	0.158	55.6	0.263	-56.8
2.8	0.304	155.1	2.610	60.3	0.162	55.2	0.257	-58.7
2.9	0.298	154.0	2.490	58.1	0.168	54.2	0.244	-59.9
3.0	0.299	149.4	2.429	56.4	0.173	54.1	0.244	-63.2
4.0	0.352	125.5	1.873	39.9	0.225	49.2	0.226	-88.1
5.0	0.443	104.8	1.478	25.7	0.275	39.2	0.204	-122.3

$V_{CE} = 3\text{ V}$, $I_C = 10\text{ mA}$, $Z_o = 50\ \Omega$

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.676	-22.3	22.003	161.3	0.014	82.7	0.944	-12.5
0.2	0.612	-42.9	19.679	145.3	0.025	71.9	0.855	-22.6
0.3	0.526	-59.1	16.963	133.1	0.034	66.5	0.749	-29.2
0.4	0.451	-73.0	14.543	123.5	0.042	63.2	0.658	-33.9
0.5	0.386	-86.6	12.577	115.7	0.047	61.7	0.583	-36.7
0.6	0.340	-98.4	10.996	109.6	0.053	60.8	0.521	-38.8
0.7	0.306	-109.1	9.727	104.9	0.058	60.4	0.473	-40.0
0.8	0.278	-119.8	8.676	100.4	0.063	60.5	0.433	-41.2
0.9	0.263	-130.2	7.819	96.7	0.068	60.4	0.402	-42.4
1.0	0.250	-139.7	7.112	93.3	0.073	60.8	0.375	-43.6
1.1	0.246	-148.1	6.522	90.4	0.078	60.8	0.356	-44.7
1.2	0.246	-155.8	5.980	87.9	0.083	61.0	0.337	-46.0
1.3	0.247	-163.1	5.562	85.3	0.088	61.0	0.326	-47.0
1.4	0.250	-168.6	5.172	82.9	0.093	61.0	0.315	-48.3
1.5	0.252	-173.7	4.838	80.5	0.098	60.8	0.306	-49.2
1.6	0.256	-178.4	4.560	78.3	0.103	60.8	0.298	-50.1
1.7	0.259	-177.6	4.292	76.4	0.108	60.6	0.291	-51.0
1.8	0.264	-173.8	4.069	74.3	0.113	60.4	0.284	-51.6
1.9	0.268	-169.8	3.851	72.7	0.118	60.3	0.279	-52.3
2.0	0.267	-167.1	3.675	70.8	0.123	60.1	0.272	-52.4
2.1	0.280	-164.5	3.517	69.1	0.128	59.9	0.269	-53.4
2.2	0.277	-161.9	3.364	67.6	0.133	59.7	0.260	-53.0
2.3	0.289	-160.6	3.234	66.2	0.138	59.4	0.259	-53.8
2.4	0.288	-158.7	3.110	64.7	0.144	59.0	0.248	-54.3
2.5	0.295	-156.7	2.991	63.3	0.149	58.7	0.247	-55.2
2.6	0.296	-154.1	2.893	62.1	0.154	58.5	0.240	-56.7
2.7	0.302	-152.9	2.786	60.6	0.159	57.9	0.237	-56.3
2.8	0.303	-150.5	2.686	59.5	0.164	57.5	0.231	-58.4
2.9	0.297	-149.2	2.563	57.4	0.170	56.4	0.219	-59.7
3.0	0.299	-144.6	2.496	55.7	0.176	56.1	0.220	-63.4
4.0	0.350	-122.8	1.917	39.7	0.229	50.4	0.205	-90.2
5.0	0.444	-103.5	1.513	25.9	0.280	39.6	0.190	-127.2

$V_{CE} = 3\text{ V}$, $I_C = 20\text{ mA}$, $Z_o = 50\ \Omega$

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.524	-31.2	29.776	154.7	0.013	79.3	0.896	-16.9
0.2	0.445	-59.6	24.547	135.5	0.022	69.8	0.758	-28.0
0.3	0.363	-80.1	19.730	122.9	0.029	66.8	0.631	-33.4
0.4	0.308	-95.6	16.104	113.9	0.035	65.3	0.540	-36.1
0.5	0.269	-112.0	13.477	107.4	0.040	65.7	0.475	-37.1
0.6	0.247	-124.7	11.550	102.1	0.046	65.9	0.424	-37.7
0.7	0.233	-136.9	10.103	98.2	0.051	66.0	0.387	-37.9
0.8	0.225	-147.7	8.906	94.4	0.057	66.7	0.357	-38.3
0.9	0.226	-156.8	7.971	91.4	0.062	66.8	0.334	-38.9
1.0	0.226	-164.9	7.224	88.5	0.068	67.0	0.314	-39.9
1.1	0.232	-172.0	6.593	86.0	0.073	67.0	0.300	-40.9
1.2	0.239	-176.8	6.038	84.0	0.079	67.0	0.287	-42.1
1.3	0.245	-177.6	5.595	81.6	0.084	66.9	0.279	-43.1
1.4	0.253	-174.0	5.198	79.5	0.090	66.6	0.271	-44.5
1.5	0.258	-170.1	4.867	77.4	0.095	66.3	0.265	-45.6
1.6	0.265	-166.8	4.569	75.4	0.101	65.9	0.261	-46.6
1.7	0.270	-163.8	4.302	73.6	0.106	65.5	0.255	-47.6
1.8	0.273	-161.0	4.071	71.7	0.112	65.3	0.250	-48.3
1.9	0.280	-158.5	3.855	70.3	0.117	64.8	0.247	-49.3
2.0	0.279	-156.3	3.676	68.4	0.122	64.4	0.241	-49.3
2.1	0.291	-154.3	3.521	66.9	0.128	64.0	0.240	-50.6
2.2	0.289	-152.4	3.365	65.5	0.134	63.6	0.232	-50.1
2.3	0.302	-151.6	3.239	64.2	0.139	63.2	0.231	-51.1
2.4	0.299	-150.2	3.110	62.8	0.145	62.6	0.222	-51.7
2.5	0.309	-148.8	2.989	61.4	0.150	62.1	0.221	-52.7
2.6	0.308	-146.5	2.894	60.4	0.156	61.7	0.215	-54.3
2.7	0.313	-146.2	2.788	59.1	0.161	61.1	0.212	-53.8
2.8	0.314	-143.9	2.685	58.0	0.166	60.4	0.207	-56.2
2.9	0.309	-142.6	2.562	55.9	0.172	59.3	0.195	-57.7
3.0	0.311	-138.8	2.494	54.4	0.178	59.0	0.197	-61.8
4.0	0.364	-119.3	1.908	38.6	0.233	52.0	0.186	-91.3
5.0	0.454	-101.8	1.502	25.3	0.284	40.8	0.178	-131.4

S-PARAMETERS Q2

V_{CE} = 1 V, I_C = 1 mA, Z₀ = 50 Ω

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.954	-27.3	3.559	163.5	0.049	74.8	0.978	-9.3
0.2	0.920	-50.9	3.308	146.1	0.091	60.9	0.925	-17.3
0.3	0.885	-72.7	2.962	131.9	0.120	48.9	0.862	-23.7
0.4	0.848	-90.9	2.618	120.1	0.139	39.3	0.801	-28.8
0.5	0.820	-105.9	2.305	109.6	0.151	31.6	0.749	-32.8
0.6	0.794	-118.4	2.056	101.4	0.157	25.5	0.707	-36.3
0.7	0.782	-129.3	1.849	93.5	0.159	20.5	0.674	-39.5
0.8	0.772	-138.0	1.654	86.8	0.159	16.3	0.649	-42.7
0.9	0.766	-145.7	1.504	80.9	0.156	13.1	0.630	-46.2
1.0	0.762	-152.2	1.377	75.6	0.153	10.3	0.618	-49.5
1.1	0.762	-157.8	1.268	70.6	0.147	8.3	0.605	-53.3
1.2	0.761	-162.6	1.175	66.3	0.141	6.7	0.599	-56.9
1.3	0.761	-167.0	1.089	61.9	0.135	5.8	0.593	-60.8
1.4	0.759	-170.9	1.014	57.9	0.128	5.6	0.591	-64.8
1.5	0.763	-174.3	0.952	54.4	0.120	5.9	0.591	-68.7
1.6	0.766	-177.5	0.895	51.0	0.113	7.1	0.591	-72.8
1.7	0.771	180.0	0.845	48.1	0.106	9.3	0.591	-76.8
1.8	0.774	177.0	0.802	45.4	0.099	12.3	0.595	-80.8
1.9	0.775	174.7	0.758	42.9	0.094	16.5	0.597	-84.5
2.0	0.779	172.3	0.721	40.4	0.090	21.8	0.601	-88.5
2.1	0.779	170.1	0.682	38.6	0.088	27.8	0.603	-92.4
2.2	0.783	167.7	0.652	36.4	0.088	34.3	0.607	-96.4
2.3	0.784	165.6	0.625	34.4	0.091	41.1	0.610	-100.1
2.4	0.786	163.4	0.600	33.0	0.095	47.0	0.615	-103.9
2.5	0.785	161.4	0.573	31.1	0.102	52.6	0.617	-107.8
2.6	0.786	159.2	0.552	30.2	0.110	56.8	0.621	-111.8
2.7	0.784	157.2	0.528	28.9	0.120	59.9	0.622	-115.6
2.8	0.785	155.0	0.514	28.3	0.131	62.5	0.625	-119.1
2.9	0.782	152.4	0.492	27.5	0.144	63.7	0.625	-123.3
3.0	0.785	150.1	0.475	26.4	0.157	64.8	0.626	-127.1
4.0	0.796	130.0	0.402	23.3	0.299	56.2	0.654	-166.1
5.0	0.789	118.9	0.414	18.9	0.382	37.8	0.630	158.7

V_{CE} = 1 V, I_C = 3 mA, Z₀ = 50 Ω

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.892	-38.7	9.055	156.6	0.046	70.7	0.930	-18.0
0.2	0.822	-70.5	7.760	136.2	0.078	53.2	0.799	-31.4
0.3	0.772	-95.7	6.385	121.4	0.096	42.3	0.677	-40.3
0.4	0.733	-114.4	5.303	110.7	0.105	35.1	0.579	-45.9
0.5	0.707	-128.1	4.464	101.8	0.111	30.5	0.509	-49.6
0.6	0.694	-139.1	3.858	95.3	0.113	27.4	0.456	-52.9
0.7	0.688	-148.0	3.376	89.2	0.114	25.4	0.419	-55.7
0.8	0.683	-155.1	2.979	84.2	0.114	24.4	0.391	-58.5
0.9	0.683	-161.1	2.675	79.6	0.113	23.9	0.370	-61.5
1.0	0.683	-166.2	2.424	75.6	0.113	24.1	0.356	-64.6
1.1	0.686	-170.6	2.217	71.8	0.112	24.7	0.344	-68.0
1.2	0.685	-174.4	2.039	68.3	0.111	25.6	0.337	-71.4
1.3	0.689	-177.6	1.887	64.9	0.111	27.0	0.333	-75.0
1.4	0.689	179.3	1.755	61.6	0.110	28.8	0.332	-78.8
1.5	0.693	176.7	1.641	58.7	0.110	30.8	0.332	-82.4
1.6	0.696	174.1	1.542	55.9	0.111	33.0	0.334	-86.1
1.7	0.703	172.4	1.456	53.4	0.112	35.4	0.337	-89.8
1.8	0.705	170.1	1.383	50.9	0.114	38.0	0.341	-93.3
1.9	0.706	168.6	1.310	48.9	0.116	40.5	0.346	-96.7
2.0	0.713	166.8	1.250	46.5	0.120	42.9	0.351	-100.2
2.1	0.711	165.0	1.191	44.5	0.123	45.4	0.356	-103.6
2.2	0.717	163.2	1.141	41.9	0.128	47.5	0.362	-107.1
2.3	0.716	161.5	1.094	39.9	0.134	49.6	0.368	-110.5
2.4	0.717	159.8	1.051	37.9	0.141	51.3	0.375	-113.8
2.5	0.716	158.0	1.011	36.0	0.147	53.1	0.380	-117.3
2.6	0.721	156.3	0.977	34.2	0.154	54.4	0.389	-120.5
2.7	0.720	154.6	0.934	32.2	0.163	55.2	0.394	-123.9
2.8	0.719	153.0	0.907	30.6	0.171	56.0	0.401	-127.0
2.9	0.719	150.5	0.872	29.2	0.180	56.2	0.405	-130.7
3.0	0.723	148.8	0.844	27.1	0.190	56.6	0.411	-134.0
4.0	0.757	130.9	0.638	13.2	0.296	50.6	0.486	-169.9
5.0	0.777	120.0	0.527	5.7	0.372	36.1	0.525	157.5

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

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.824	-48.0	13.346	151.1	0.044	66.4	0.884	-25.3
0.2	0.752	-84.5	10.655	129.4	0.069	49.9	0.702	-42.0
0.3	0.708	-110.6	8.326	115.1	0.081	40.3	0.558	-52.2
0.4	0.678	-127.8	6.706	105.4	0.087	35.3	0.456	-58.6
0.5	0.660	-140.2	5.536	97.7	0.091	32.9	0.386	-63.0
0.6	0.656	-149.9	4.720	92.0	0.094	32.0	0.337	-66.9
0.7	0.653	-157.7	4.098	86.7	0.096	31.7	0.301	-70.2
0.8	0.649	-163.5	3.597	82.4	0.098	32.2	0.276	-73.8
0.9	0.652	-168.6	3.219	78.5	0.099	33.2	0.257	-77.4
1.0	0.653	-172.8	2.907	75.0	0.102	34.2	0.244	-81.1
1.1	0.657	-176.5	2.657	71.7	0.103	35.6	0.235	-85.0
1.2	0.659	-179.9	2.441	68.6	0.106	36.8	0.230	-89.0
1.3	0.663	-177.6	2.253	65.6	0.108	38.5	0.227	-92.9
1.4	0.664	174.7	2.095	62.7	0.111	40.2	0.228	-96.7
1.5	0.667	172.6	1.963	60.0	0.115	41.8	0.229	-100.5
1.6	0.671	170.4	1.841	57.6	0.118	43.4	0.233	-103.9
1.7	0.676	168.8	1.742	55.2	0.122	45.0	0.237	-107.3
1.8	0.679	166.8	1.650	53.0	0.126	46.5	0.242	-110.6
1.9	0.681	165.5	1.567	51.0	0.131	47.9	0.247	-113.4
2.0	0.685	163.8	1.493	48.7	0.136	49.2	0.253	-116.4
2.1	0.684	162.4	1.424	46.9	0.142	50.3	0.259	-119.4
2.2	0.689	160.8	1.367	44.5	0.148	51.3	0.265	-122.3
2.3	0.688	159.1	1.310	42.5	0.155	52.2	0.272	-125.1
2.4	0.690	157.5	1.264	40.4	0.162	52.8	0.279	-128.0
2.5	0.691	156.0	1.214	38.4	0.168	53.6	0.285	-130.9
2.6	0.694	154.5	1.177	36.7	0.175	54.1	0.293	-133.5
2.7	0.690	152.7	1.127	34.9	0.183	54.2	0.299	-136.5
2.8	0.690	151.4	1.096	33.1	0.191	54.4	0.307	-139.1
2.9	0.690	149.2	1.054	31.5	0.199	54.2	0.313	-142.3
3.0	0.694	147.7	1.021	29.3	0.208	54.1	0.320	-145.0
4.0	0.733	131.0	0.769	13.5	0.299	47.6	0.409	-176.9
5.0	0.765	120.7	0.618	3.1	0.368	34.6	0.468	153.6

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

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.775	-57.2	16.568	147.2	0.041	64.9	0.845	-31.0
0.2	0.702	-94.9	12.497	124.8	0.062	47.4	0.634	-50.1
0.3	0.669	-120.3	9.470	111.2	0.072	40.4	0.484	-61.3
0.4	0.646	-136.1	7.481	102.1	0.077	37.1	0.386	-68.7
0.5	0.636	-147.5	6.115	95.3	0.081	36.0	0.321	-74.2
0.6	0.632	-156.3	5.199	90.1	0.085	36.1	0.276	-79.3
0.7	0.632	-162.9	4.501	85.3	0.088	36.7	0.244	-84.0
0.8	0.633	-168.4	3.949	81.4	0.091	38.1	0.222	-88.7
0.9	0.635	-172.9	3.521	77.7	0.094	39.3	0.206	-93.5
1.0	0.640	-176.6	3.180	74.5	0.098	40.6	0.196	-98.1
1.1	0.644	-180.0	2.898	71.5	0.102	42.1	0.190	-102.8
1.2	0.646	177.0	2.661	68.7	0.105	43.6	0.187	-107.2
1.3	0.651	174.7	2.458	65.9	0.109	44.9	0.186	-111.4
1.4	0.652	172.3	2.283	63.3	0.114	46.1	0.189	-115.2
1.5	0.655	170.3	2.143	60.7	0.119	47.5	0.191	-118.8
1.6	0.660	168.2	2.007	58.5	0.124	48.5	0.196	-122.0
1.7	0.665	166.8	1.901	56.3	0.129	49.6	0.200	-124.9
1.8	0.666	165.0	1.802	54.1	0.135	50.5	0.206	-127.6
1.9	0.667	163.5	1.709	52.2	0.140	51.2	0.211	-130.2
2.0	0.672	162.1	1.629	50.1	0.146	51.9	0.217	-132.8
2.1	0.671	160.9	1.553	48.4	0.153	52.4	0.222	-134.9
2.2	0.674	159.3	1.491	46.0	0.159	52.8	0.229	-137.5
2.3	0.673	157.7	1.429	43.9	0.167	53.3	0.235	-139.8
2.4	0.673	156.4	1.379	42.0	0.173	53.6	0.242	-142.1
2.5	0.675	154.7	1.326	39.9	0.181	53.9	0.248	-144.6
2.6	0.679	153.2	1.287	38.2	0.187	54.0	0.256	-146.4
2.7	0.676	151.6	1.234	36.3	0.195	53.8	0.262	-149.0
2.8	0.679	150.2	1.200	34.6	0.203	53.7	0.268	-151.0
2.9	0.676	148.0	1.158	33.0	0.210	53.1	0.276	-153.8
3.0	0.681	146.5	1.121	30.8	0.219	52.8	0.282	-156.1
4.0	0.722	131.0	0.850	14.4	0.303	45.7	0.373	-176.0
5.0	0.759	120.8	0.676	2.7	0.366	33.6	0.438	150.1

V_{CE} = 1 V, I_C = 10 mA, Z_o = 50 Ω

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.720	-65.4	20.099	142.6	0.039	61.6	0.796	-37.9
0.2	0.663	-106.0	14.329	120.1	0.055	46.4	0.562	-59.6
0.3	0.631	-129.9	10.488	107.2	0.063	41.2	0.417	-72.3
0.4	0.620	-144.1	8.222	99.2	0.068	39.7	0.327	-81.4
0.5	0.618	-154.5	6.671	92.9	0.073	40.1	0.270	-88.8
0.6	0.618	-162.1	5.630	88.3	0.077	41.4	0.232	-95.9
0.7	0.619	-168.1	4.856	84.0	0.082	42.7	0.206	-102.4
0.8	0.618	-172.6	4.253	80.4	0.086	44.3	0.190	-109.0
0.9	0.624	-176.8	3.791	77.1	0.091	45.6	0.179	-115.1
1.0	0.629	179.8	3.417	74.3	0.096	47.0	0.174	-120.8
1.1	0.635	176.9	3.115	71.3	0.101	48.2	0.172	-126.0
1.2	0.635	174.4	2.861	68.8	0.106	49.3	0.172	-130.5
1.3	0.640	172.0	2.639	66.2	0.112	50.3	0.174	-134.7
1.4	0.642	169.8	2.452	63.7	0.118	51.2	0.178	-137.9
1.5	0.645	167.8	2.294	61.3	0.124	51.9	0.182	-141.0
1.6	0.650	166.0	2.150	59.2	0.130	52.6	0.187	-143.6
1.7	0.654	164.8	2.035	57.1	0.136	53.1	0.191	-145.9
1.8	0.656	163.1	1.929	55.1	0.142	53.6	0.196	-147.9
1.9	0.656	161.7	1.830	53.2	0.149	53.9	0.202	-149.8
2.0	0.658	160.4	1.747	51.1	0.155	54.3	0.207	-151.6
2.1	0.660	159.2	1.665	49.5	0.162	54.3	0.212	-153.3
2.2	0.663	157.8	1.600	47.2	0.169	54.4	0.217	-155.2
2.3	0.665	156.2	1.537	45.3	0.177	54.5	0.223	-156.9
2.4	0.664	154.8	1.484	43.4	0.184	54.3	0.229	-158.5
2.5	0.665	153.4	1.427	41.4	0.192	54.3	0.234	-160.4
2.6	0.664	152.3	1.383	40.1	0.198	54.2	0.240	-161.7
2.7	0.665	150.8	1.329	38.2	0.206	53.7	0.246	-163.7
2.8	0.663	149.5	1.294	36.6	0.214	53.4	0.252	-165.3
2.9	0.662	147.4	1.248	35.0	0.221	52.7	0.259	-167.5
3.0	0.668	145.9	1.210	32.8	0.230	52.2	0.264	-169.2
4.0	0.709	130.9	0.918	15.9	0.306	44.1	0.353	167.8
5.0	0.752	121.2	0.735	3.3	0.365	32.3	0.417	144.6

V_{CE} = 1 V, I_C = 20 mA, Z_o = 50 Ω

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.617	-85.6	26.053	134.1	0.032	56.7	0.695	-52.0
0.2	0.596	-125.3	16.791	112.7	0.044	46.5	0.452	-78.5
0.3	0.596	-146.0	11.822	101.7	0.051	45.7	0.332	-95.0
0.4	0.597	-157.1	9.113	95.1	0.057	46.9	0.268	-108.0
0.5	0.597	-165.1	7.322	89.7	0.063	48.9	0.232	-119.0
0.6	0.602	-170.8	6.144	85.8	0.070	50.9	0.212	-128.8
0.7	0.605	-175.5	5.283	81.8	0.076	52.3	0.201	-137.1
0.8	0.610	-179.1	4.617	78.9	0.083	53.7	0.197	-144.3
0.9	0.613	177.4	4.107	76.1	0.090	54.8	0.197	-150.4
1.0	0.617	174.6	3.704	73.5	0.097	55.5	0.199	-155.3
1.1	0.625	172.1	3.371	70.9	0.104	56.3	0.203	-159.5
1.2	0.628	169.9	3.092	68.6	0.110	56.6	0.207	-163.0
1.3	0.632	168.2	2.855	66.3	0.117	56.9	0.212	-165.8
1.4	0.634	166.2	2.650	64.0	0.125	57.3	0.217	-168.0
1.5	0.638	164.7	2.481	61.9	0.132	57.4	0.221	-170.2
1.6	0.641	162.9	2.326	60.0	0.139	57.3	0.226	-171.9
1.7	0.643	161.9	2.200	58.2	0.147	57.3	0.230	-173.5
1.8	0.645	160.3	2.082	56.2	0.154	57.2	0.234	-174.9
1.9	0.649	159.3	1.979	54.7	0.161	57.0	0.238	-176.1
2.0	0.652	158.2	1.891	52.7	0.169	56.8	0.241	-177.4
2.1	0.648	156.9	1.802	51.2	0.177	56.4	0.245	-178.8
2.2	0.654	155.7	1.731	49.0	0.184	56.0	0.249	-180.0
2.3	0.653	154.3	1.664	47.2	0.192	55.7	0.252	-178.8
2.4	0.652	153.1	1.606	45.4	0.200	55.0	0.256	-177.7
2.5	0.653	151.6	1.547	43.6	0.208	54.7	0.259	-176.2
2.6	0.656	150.2	1.501	41.9	0.214	54.2	0.263	-175.4
2.7	0.653	148.7	1.444	40.1	0.223	53.4	0.267	-173.9
2.8	0.653	147.5	1.403	38.5	0.230	52.8	0.271	-172.8
2.9	0.652	145.4	1.356	36.9	0.237	51.8	0.276	-171.4
3.0	0.655	144.2	1.317	34.8	0.245	51.0	0.279	-170.0
4.0	0.699	130.3	1.007	18.2	0.315	41.5	0.356	153.5
5.0	0.741	121.2	0.808	5.1	0.365	30.3	0.408	135.2

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

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.966	-25.3	3.445	164.7	0.042	77.7	0.982	-7.9
0.2	0.925	-48.0	3.237	148.0	0.078	62.9	0.939	-14.9
0.3	0.888	-69.0	2.922	134.3	0.106	51.3	0.887	-20.6
0.4	0.856	-86.8	2.611	122.8	0.124	41.9	0.831	-25.3
0.5	0.823	-101.9	2.323	112.4	0.136	34.4	0.785	-29.0
0.6	0.799	-114.8	2.084	104.1	0.142	28.3	0.746	-32.3
0.7	0.784	-125.5	1.880	96.4	0.145	23.2	0.715	-35.3
0.8	0.774	-134.6	1.691	89.7	0.145	19.3	0.691	-38.3
0.9	0.764	-142.7	1.538	83.8	0.143	16.0	0.673	-41.4
1.0	0.759	-149.4	1.408	78.5	0.140	13.4	0.658	-44.5
1.1	0.757	-155.4	1.300	73.5	0.135	11.5	0.647	-48.0
1.2	0.757	-160.6	1.205	69.0	0.130	10.1	0.638	-51.4
1.3	0.758	-165.2	1.118	64.6	0.124	9.4	0.632	-55.1
1.4	0.755	-169.2	1.042	60.7	0.118	9.4	0.629	-58.9
1.5	0.760	-172.9	0.978	57.0	0.111	10.0	0.625	-62.6
1.6	0.759	-176.2	0.918	53.8	0.105	11.5	0.625	-66.4
1.7	0.765	-179.0	0.869	50.9	0.099	13.8	0.624	-70.2
1.8	0.766	178.0	0.827	48.1	0.094	17.3	0.624	-73.9
1.9	0.768	175.7	0.783	45.7	0.089	21.8	0.624	-77.6
2.0	0.770	173.2	0.745	43.3	0.086	27.3	0.627	-81.4
2.1	0.769	171.0	0.707	41.6	0.085	33.1	0.628	-85.2
2.2	0.774	168.6	0.679	39.1	0.086	39.5	0.629	-88.9
2.3	0.775	166.5	0.648	37.3	0.090	46.0	0.630	-92.6
2.4	0.775	164.2	0.621	35.6	0.095	51.4	0.634	-96.3
2.5	0.775	162.1	0.595	33.9	0.102	56.5	0.634	-100.2
2.6	0.774	160.1	0.575	32.9	0.110	60.4	0.636	-103.7
2.7	0.774	157.9	0.549	31.4	0.120	63.2	0.635	-107.4
2.8	0.774	155.8	0.532	30.9	0.132	65.4	0.638	-110.9
2.9	0.770	153.1	0.510	30.1	0.143	66.5	0.633	-114.9
3.0	0.773	150.9	0.495	28.4	0.157	67.4	0.634	-118.8
4.0	0.782	130.4	0.415	24.1	0.297	58.6	0.645	-158.3
5.0	0.779	119.1	0.421	19.4	0.382	39.6	0.616	164.7

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

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.903	-34.7	8.906	158.5	0.039	74.2	0.945	-15.2
0.2	0.834	-64.8	7.810	139.3	0.070	56.4	0.832	-26.9
0.3	0.779	-89.4	6.552	124.6	0.087	45.4	0.722	-34.8
0.4	0.738	-107.9	5.519	113.8	0.097	38.0	0.629	-40.0
0.5	0.706	-122.2	4.686	104.8	0.103	33.2	0.560	-43.3
0.6	0.690	-133.7	4.069	98.1	0.106	30.2	0.508	-46.1
0.7	0.680	-143.3	3.584	91.8	0.107	27.9	0.469	-48.4
0.8	0.676	-150.7	3.174	86.7	0.107	26.8	0.441	-50.9
0.9	0.672	-157.4	2.846	82.0	0.107	26.3	0.418	-53.3
1.0	0.671	-162.6	2.584	78.0	0.107	26.3	0.402	-56.0
1.1	0.675	-167.7	2.368	74.1	0.106	26.9	0.389	-58.9
1.2	0.674	-171.4	2.181	70.7	0.106	28.0	0.380	-61.7
1.3	0.676	-174.8	2.013	67.2	0.105	29.5	0.373	-65.0
1.4	0.679	-178.2	1.879	63.9	0.105	31.2	0.370	-68.4
1.5	0.680	179.2	1.757	60.9	0.105	33.2	0.368	-71.7
1.6	0.682	176.3	1.650	58.2	0.106	35.3	0.368	-75.3
1.7	0.689	174.3	1.559	55.7	0.107	37.7	0.368	-78.6
1.8	0.689	172.0	1.479	53.0	0.109	40.3	0.370	-82.1
1.9	0.692	170.0	1.399	50.7	0.112	42.8	0.373	-85.6
2.0	0.696	168.1	1.336	48.4	0.115	45.2	0.375	-88.9
2.1	0.696	166.5	1.270	46.5	0.119	47.5	0.379	-92.3
2.2	0.700	164.4	1.218	43.9	0.123	49.7	0.383	-95.8
2.3	0.702	162.8	1.165	41.8	0.130	51.8	0.386	-99.1
2.4	0.704	161.0	1.124	39.7	0.136	53.5	0.391	-102.5
2.5	0.705	159.1	1.078	37.6	0.142	55.2	0.394	-105.9
2.6	0.706	157.6	1.045	36.0	0.149	56.7	0.400	-109.0
2.7	0.705	155.8	1.002	34.1	0.157	57.4	0.403	-112.5
2.8	0.706	154.1	0.968	32.5	0.166	58.4	0.408	-115.7
2.9	0.704	151.8	0.929	30.7	0.175	58.6	0.411	-119.5
3.0	0.707	149.8	0.900	28.7	0.184	59.0	0.415	-122.8
4.0	0.744	131.5	0.674	14.1	0.291	53.2	0.472	-160.4
5.0	0.768	120.7	0.552	5.8	0.370	38.1	0.507	164.3

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

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.847	-42.0	12.951	154.1	0.039	70.8	0.910	-20.8
0.2	0.767	-76.3	10.756	133.3	0.063	53.3	0.752	-35.5
0.3	0.716	-101.9	8.625	118.9	0.076	43.6	0.617	-44.4
0.4	0.674	-119.7	7.037	108.8	0.083	38.0	0.515	-49.9
0.5	0.652	-132.9	5.863	100.8	0.087	35.3	0.443	-53.3
0.6	0.643	-143.6	5.033	94.8	0.090	34.0	0.391	-56.3
0.7	0.638	-152.0	4.387	89.4	0.092	33.4	0.353	-58.7
0.8	0.636	-158.5	3.863	84.9	0.094	33.8	0.325	-61.2
0.9	0.635	-164.2	3.457	80.8	0.096	34.3	0.303	-63.8
1.0	0.638	-168.9	3.130	77.3	0.098	35.3	0.288	-66.6
1.1	0.639	-173.0	2.859	73.9	0.100	36.6	0.276	-69.7
1.2	0.641	-176.3	2.631	70.7	0.101	37.9	0.267	-72.9
1.3	0.644	-179.5	2.430	67.7	0.104	39.6	0.261	-76.3
1.4	0.647	177.6	2.259	64.8	0.107	41.2	0.259	-79.8
1.5	0.649	175.2	2.114	62.0	0.109	42.8	0.257	-83.2
1.6	0.655	172.9	1.984	59.7	0.113	44.4	0.258	-86.7
1.7	0.659	171.2	1.875	57.2	0.117	46.0	0.259	-90.0
1.8	0.659	169.0	1.780	54.9	0.121	47.6	0.262	-93.4
1.9	0.664	167.5	1.686	52.8	0.125	49.2	0.265	-96.5
2.0	0.666	165.7	1.608	50.5	0.130	50.4	0.268	-99.6
2.1	0.666	164.2	1.530	48.7	0.135	51.7	0.272	-102.7
2.2	0.671	162.7	1.468	46.4	0.141	52.6	0.276	-106.1
2.3	0.671	160.9	1.408	44.2	0.148	53.6	0.280	-109.1
2.4	0.672	159.5	1.357	42.1	0.154	54.3	0.286	-112.2
2.5	0.673	157.7	1.303	40.1	0.161	55.2	0.290	-115.3
2.6	0.673	156.2	1.261	38.5	0.167	55.6	0.297	-118.3
2.7	0.674	154.4	1.211	36.5	0.175	55.8	0.301	-121.7
2.8	0.674	152.9	1.176	34.8	0.183	56.2	0.306	-124.5
2.9	0.674	150.5	1.129	33.0	0.191	55.9	0.312	-128.1
3.0	0.678	149.1	1.095	30.7	0.200	55.9	0.316	-131.0
4.0	0.720	132.3	0.822	14.2	0.292	50.0	0.388	-166.3
5.0	0.758	121.6	0.652	2.9	0.364	36.7	0.445	161.2

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

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.787	-48.2	16.146	150.8	0.037	67.9	0.878	-25.4
0.2	0.713	-85.0	12.789	129.1	0.057	51.6	0.691	-42.1
0.3	0.667	-110.5	9.922	115.1	0.069	43.1	0.546	-51.7
0.4	0.641	-127.4	7.982	105.7	0.074	39.3	0.444	-57.7
0.5	0.625	-140.0	6.575	98.3	0.078	37.6	0.374	-61.7
0.6	0.617	-149.7	5.595	93.0	0.082	37.5	0.323	-65.2
0.7	0.614	-157.1	4.865	87.9	0.085	37.9	0.287	-68.1
0.8	0.613	-163.2	4.277	83.8	0.088	38.8	0.261	-71.2
0.9	0.615	-168.4	3.821	80.1	0.091	40.0	0.240	-74.5
1.0	0.619	-172.5	3.452	76.8	0.094	41.3	0.226	-77.9
1.1	0.623	-176.5	3.152	73.6	0.098	42.7	0.215	-81.5
1.2	0.624	-179.5	2.894	70.8	0.101	43.9	0.208	-85.3
1.3	0.628	177.5	2.671	67.9	0.105	45.3	0.203	-89.1
1.4	0.630	174.9	2.486	65.1	0.109	46.7	0.202	-92.7
1.5	0.633	172.9	2.324	62.6	0.114	47.9	0.201	-96.4
1.6	0.638	170.7	2.182	60.3	0.118	49.1	0.203	-99.9
1.7	0.642	169.2	2.064	58.0	0.123	50.1	0.204	-103.1
1.8	0.643	167.2	1.956	55.8	0.128	51.1	0.207	-106.4
1.9	0.646	165.7	1.854	53.9	0.133	52.0	0.211	-109.3
2.0	0.650	163.9	1.768	51.7	0.139	52.8	0.215	-112.2
2.1	0.650	162.7	1.682	49.8	0.145	53.5	0.219	-115.0
2.2	0.654	160.9	1.616	47.6	0.151	54.1	0.224	-118.0
2.3	0.653	159.6	1.550	45.6	0.159	54.6	0.228	-120.6
2.4	0.656	158.1	1.493	43.5	0.165	54.9	0.234	-123.5
2.5	0.657	156.3	1.436	41.5	0.172	55.3	0.238	-126.4
2.6	0.658	155.1	1.390	39.8	0.179	55.5	0.244	-128.8
2.7	0.655	153.5	1.336	37.9	0.186	55.3	0.249	-131.8
2.8	0.658	152.0	1.298	36.2	0.194	55.4	0.255	-134.3
2.9	0.657	149.7	1.250	34.3	0.202	54.9	0.261	-137.6
3.0	0.662	148.2	1.211	32.2	0.210	54.7	0.266	-140.1
4.0	0.706	132.1	0.911	15.2	0.294	48.2	0.345	-172.8
5.0	0.749	122.1	0.720	2.7	0.361	35.6	0.410	157.6

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

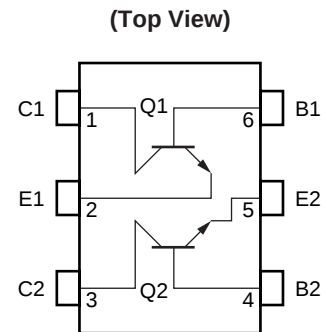
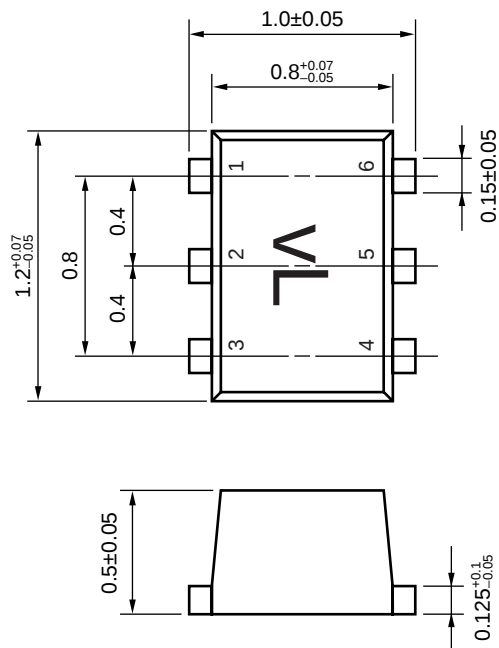
Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.750	-54.7	19.640	147.0	0.034	65.3	0.841	-30.7
0.2	0.663	-94.2	14.787	124.9	0.052	50.7	0.627	-49.4
0.3	0.633	-119.4	11.146	111.5	0.061	43.4	0.478	-60.1
0.4	0.609	-135.3	8.835	102.9	0.067	41.7	0.379	-67.0
0.5	0.599	-146.8	7.212	96.1	0.071	41.4	0.313	-71.9
0.6	0.594	-155.5	6.107	91.1	0.076	42.0	0.267	-76.7
0.7	0.592	-162.4	5.292	86.5	0.079	42.9	0.234	-80.8
0.8	0.595	-167.5	4.640	82.7	0.084	44.5	0.210	-85.3
0.9	0.597	-172.2	4.146	79.4	0.088	45.6	0.193	-89.8
1.0	0.602	-176.0	3.742	76.3	0.093	46.8	0.181	-94.3
1.1	0.607	-179.6	3.413	73.4	0.097	48.2	0.172	-99.1
1.2	0.609	177.6	3.133	70.7	0.102	49.2	0.168	-103.5
1.3	0.614	175.0	2.889	68.0	0.107	50.3	0.165	-107.9
1.4	0.618	172.7	2.689	65.5	0.113	51.2	0.165	-111.9
1.5	0.619	170.6	2.513	63.2	0.118	52.1	0.166	-115.7
1.6	0.623	168.7	2.358	60.9	0.124	52.8	0.169	-119.0
1.7	0.628	167.2	2.230	58.8	0.129	53.5	0.171	-122.1
1.8	0.631	165.4	2.115	56.7	0.135	54.1	0.175	-124.9
1.9	0.633	164.1	2.002	54.9	0.141	54.4	0.179	-127.6
2.0	0.637	162.7	1.913	52.9	0.148	54.8	0.183	-130.0
2.1	0.635	161.3	1.823	51.2	0.154	55.0	0.187	-132.3
2.2	0.640	159.9	1.748	49.0	0.161	55.1	0.191	-134.8
2.3	0.639	158.6	1.677	47.0	0.168	55.3	0.196	-137.0
2.4	0.640	156.9	1.618	45.1	0.175	55.3	0.202	-139.3
2.5	0.640	155.6	1.556	43.1	0.182	55.3	0.206	-141.7
2.6	0.642	153.9	1.508	41.3	0.189	55.2	0.212	-143.6
2.7	0.642	152.4	1.449	39.5	0.197	54.8	0.217	-146.3
2.8	0.643	151.1	1.408	37.7	0.204	54.7	0.222	-148.2
2.9	0.642	148.9	1.358	36.1	0.211	53.9	0.228	-151.0
3.0	0.646	147.4	1.314	33.9	0.220	53.6	0.233	-153.0
4.0	0.693	132.4	0.994	16.7	0.297	46.3	0.316	178.6
5.0	0.743	122.4	0.789	3.5	0.359	34.4	0.384	152.4

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

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.665	-69.1	25.836	140.2	0.030	64.2	0.762	-41.4
0.2	0.593	-110.6	17.854	118.0	0.044	49.3	0.521	-63.6
0.3	0.575	-133.6	12.908	106.0	0.051	46.6	0.380	-76.8
0.4	0.567	-147.4	10.035	98.6	0.057	46.7	0.296	-86.7
0.5	0.562	-157.2	8.093	92.8	0.063	48.4	0.243	-94.8
0.6	0.568	-164.1	6.831	88.5	0.069	50.1	0.209	-102.9
0.7	0.572	-169.7	5.881	84.5	0.074	51.4	0.186	-110.7
0.8	0.574	-174.0	5.147	81.6	0.080	52.8	0.171	-118.0
0.9	0.576	-178.1	4.581	78.3	0.087	53.8	0.163	-125.1
1.0	0.584	178.8	4.127	75.7	0.093	54.7	0.159	-131.3
1.1	0.589	175.9	3.764	73.0	0.099	55.5	0.158	-137.1
1.2	0.592	173.5	3.451	70.6	0.106	56.0	0.159	-141.9
1.3	0.597	171.2	3.188	68.3	0.112	56.5	0.161	-146.1
1.4	0.599	169.3	2.960	65.9	0.119	56.9	0.164	-149.4
1.5	0.602	167.6	2.770	63.8	0.126	57.1	0.167	-152.5
1.6	0.607	165.7	2.595	61.7	0.133	57.3	0.171	-155.0
1.7	0.612	164.5	2.454	59.8	0.139	57.3	0.175	-157.2
1.8	0.614	162.8	2.326	58.0	0.146	57.4	0.178	-159.1
1.9	0.617	161.6	2.207	56.2	0.153	57.3	0.182	-160.9
2.0	0.620	160.5	2.105	54.3	0.160	57.1	0.185	-162.5
2.1	0.618	159.4	2.007	52.8	0.168	56.8	0.189	-164.2
2.2	0.621	157.8	1.925	50.6	0.175	56.6	0.192	-165.7
2.3	0.622	156.5	1.847	48.7	0.183	56.4	0.196	-167.1
2.4	0.620	155.1	1.783	46.9	0.190	55.9	0.200	-168.6
2.5	0.622	153.8	1.714	45.0	0.197	55.6	0.203	-170.2
2.6	0.624	152.3	1.663	43.4	0.204	55.2	0.207	-171.3
2.7	0.624	150.9	1.599	41.5	0.212	54.5	0.211	-172.9
2.8	0.624	149.6	1.553	40.0	0.219	54.0	0.216	-174.4
2.9	0.622	147.5	1.497	38.2	0.226	53.1	0.221	-176.1
3.0	0.626	146.3	1.456	36.3	0.234	52.4	0.224	-177.6
4.0	0.675	132.0	1.102	19.2	0.304	43.8	0.305	162.6
5.0	0.727	123.0	0.880	5.7	0.357	32.4	0.365	141.9

PACKAGE DIMENSIONS

6-PIN LEAD-LESS MINIMOLD (UNIT: mm)



PIN CONNECTIONS

1. Collector (Q1)
2. Emitter (Q1)
3. Collector (Q2)
4. Base (Q2)
5. Emitter (Q2)
6. Base (Q1)

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- NEC semiconductor products are classified into the following three quality grades:
 "Standard", "Special" and "Specific". The "Specific" quality grade applies only to semiconductor products developed based on a customer-designated "quality assurance program" for a specific application. The recommended applications of a semiconductor product depend on its quality grade, as indicated below. Customers must check the quality grade of each semiconductor product before using it in a particular application.
 "Standard": Computers, office equipment, communications equipment, test and measurement equipment, audio and visual equipment, home electronic appliances, machine tools, personal electronic equipment and industrial robots
 "Special": Transportation equipment (automobiles, trains, ships, etc.), traffic control systems, anti-disaster systems, anti-crime systems, safety equipment and medical equipment (not specifically designed for life support)
 "Specific": Aircraft, aerospace equipment, submersible repeaters, nuclear reactor control systems, life support systems and medical equipment for life support, etc.
 The quality grade of NEC semiconductor products is "Standard" unless otherwise expressly specified in NEC's data sheets or data books, etc. If customers wish to use NEC semiconductor products in applications not intended by NEC, they must contact an NEC sales representative in advance to determine NEC's willingness to support a given application.
 (Note)
 (1) "NEC" as used in this statement means NEC Corporation, NEC Compound Semiconductor Devices, Ltd. and also includes its majority-owned subsidiaries.
 (2) "NEC semiconductor products" means any semiconductor product developed or manufactured by or for NEC (as defined above).

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► **Business issue**

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► **Technical issue**

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