

To our customers,

Old Company Name in Catalogs and Other Documents

On April 1st, 2010, NEC Electronics Corporation merged with Renesas Technology Corporation, and Renesas Electronics Corporation took over all the business of both companies. Therefore, although the old company name remains in this document, it is a valid Renesas Electronics document. We appreciate your understanding.

Renesas Electronics website: <http://www.renesas.com>

April 1st, 2010
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (<http://www.renesas.com>)

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NPN SILICON RF TWIN TRANSISTOR

μ PA861TD

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

FEATURES

- Low voltage operation
- 2 different built-in transistors (2SC5436, 2SC5786)
 - Q1: High-gain transistor
 - $f_T = 12.0 \text{ GHz TYP.}, |S_{21e}|^2 = 9.0 \text{ dB TYP. @ } V_{CE} = 1 \text{ V, } I_C = 10 \text{ mA, } f = 2 \text{ GHz}$
 - Q2: Low phase distortion transistor suitable for 3 GHz or higher OSC applications
 - $f_T = 20.0 \text{ GHz TYP.}, |S_{21e}|^2 = 13.0 \text{ dB TYP. @ } V_{CE} = 1 \text{ V, } I_C = 20 \text{ mA, } f = 2 \text{ GHz}$
 - $NF = 1.4 \text{ dB TYP. @ } V_{CE} = 1 \text{ V, } I_C = 5 \text{ mA, } f = 2 \text{ GHz, } Z_S = Z_{opt}$
- 6-pin lead-less minimold package

BUILT-IN TRANSISTORS

	Q1	Q2
3-pin thin-type ultra super minimold part No.	2SC5436	2SC5786

ORDERING INFORMATION

Part Number	Quantity	Supplying Form
μ PA861TD	50 pcs (Non reel)	• 8 mm wide embossed taping
μ PA861TD-T3	10 kpcs/reel	• Pin 1 (Q1 Collector), Pin 6 (Q1 Base) face the perforation side of the tape

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.

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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}	5	9	V
Collector to Emitter Voltage	V _{CEO}	3	3	V
Emitter to Base Voltage	V _{EBO}	2	1.5	V
Collector Current	I _C	30	35	mA
Total Power Dissipation	P _{tot} ^{Note}	90	105	mW
		195 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

Not recommend
for new design

ELECTRICAL CHARACTERISTICS ($T_A = +25^\circ\text{C}$)

(1) Q1

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Collector Cut-off Current	I_{CBO}	$V_{CB} = 5\text{ V}, I_E = 0\text{ mA}$	—	—	100	nA
Emitter Cut-off Current	I_{EBO}	$V_{EB} = 1\text{ V}, I_C = 0\text{ mA}$	—	—	100	nA
DC Current Gain	h_{FE} ^{Note 1}	$V_{CE} = 1\text{ V}, I_C = 10\text{ mA}$	70	110	140	—
Gain Bandwidth Product	f_T	$V_{CE} = 1\text{ V}, I_C = 10\text{ mA}, f = 2\text{ GHz}$	10.0	12.0	—	GHz
Insertion Power Gain	$ S_{21e} ^2$	$V_{CE} = 1\text{ V}, I_C = 10\text{ mA}, f = 2\text{ GHz}$	7.0	9.0	—	dB
Noise Figure	NF	$V_{CE} = 1\text{ V}, I_C = 3\text{ mA}, f = 2\text{ GHz}, Z_S = Z_{opt}$	—	1.5	2.0	dB
Reverse Transfer Capacitance	C_{re} ^{Note 2}	$V_{CB} = 0.5\text{ V}, I_E = 0\text{ mA}, f = 1\text{ MHz}$	—	0.4	0.8	pF

(2) Q2

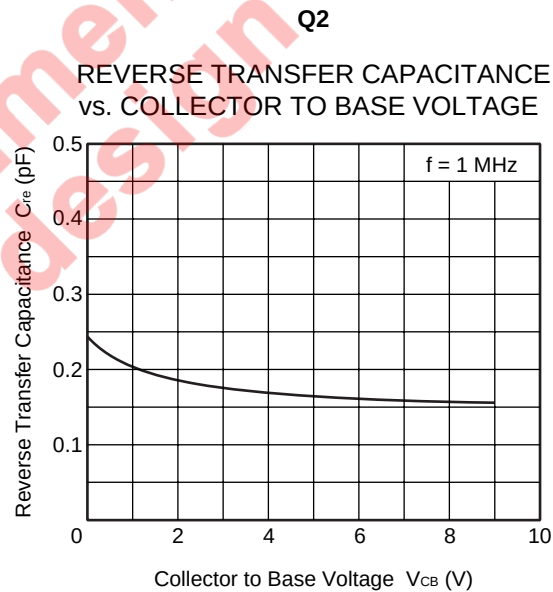
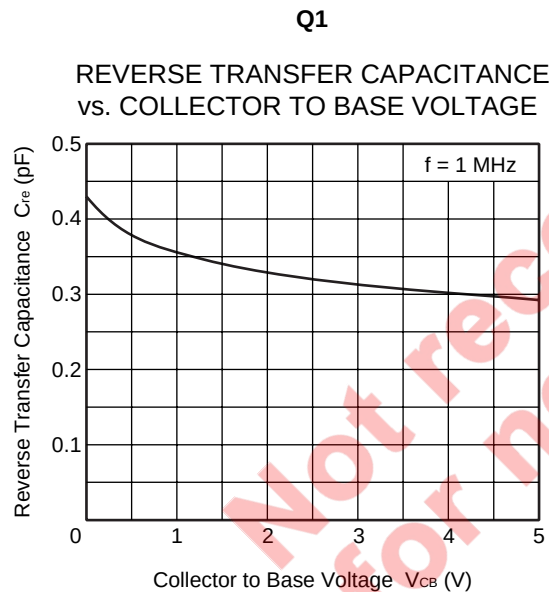
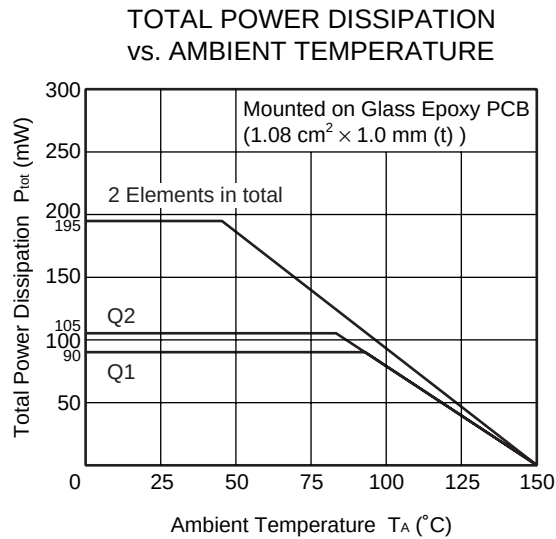
Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Collector Cut-off Current	I_{CBO}	$V_{CB} = 5\text{ V}, I_E = 0\text{ mA}$	—	—	100	nA
Emitter Cut-off Current	I_{EBO}	$V_{EB} = 1\text{ V}, I_C = 0\text{ mA}$	—	—	100	nA
DC Current Gain	h_{FE} ^{Note 1}	$V_{CE} = 1\text{ V}, I_C = 5\text{ mA}$	50	75	100	—
Gain Bandwidth Product	f_T	$V_{CE} = 1\text{ V}, I_C = 20\text{ mA}, f = 2\text{ GHz}$	17.0	20.0	—	GHz
Insertion Power Gain	$ S_{21e} ^2$	$V_{CE} = 1\text{ V}, I_C = 20\text{ mA}, f = 2\text{ GHz}$	11.0	13.0	—	dB
Noise Figure	NF	$V_{CE} = 1\text{ V}, I_C = 5\text{ mA}, f = 2\text{ GHz}, Z_S = Z_{opt}$	—	1.4	2.5	dB
Reverse Transfer Capacitance	C_{re} ^{Note 2}	$V_{CB} = 0.5\text{ V}, I_E = 0\text{ mA}, f = 1\text{ MHz}$	—	0.22	0.30	pF

- Notes** 1. Pulse measurement: $PW \leq 350\text{ }\mu\text{s}$, Duty Cycle $\leq 2\%$
 2. Collector to base capacitance when the emitter grounded

h_{FE} CLASSIFICATION

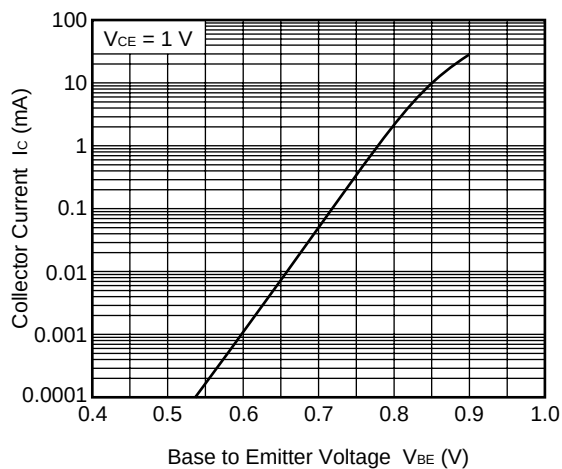
Rank	FB
Marking	vX
h_{FE} Value of Q1	70 to 140
h_{FE} Value of Q2	50 to 100

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



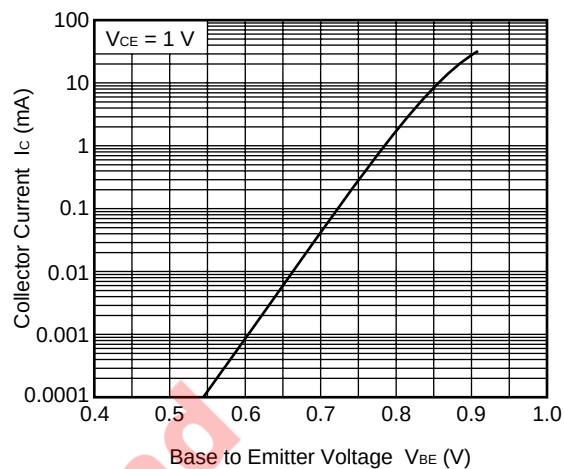
Q1

COLLECTOR CURRENT vs.
BASE TO EMITTER VOLTAGE

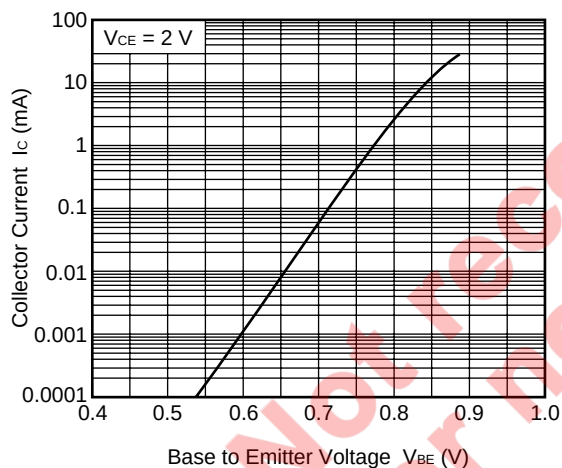


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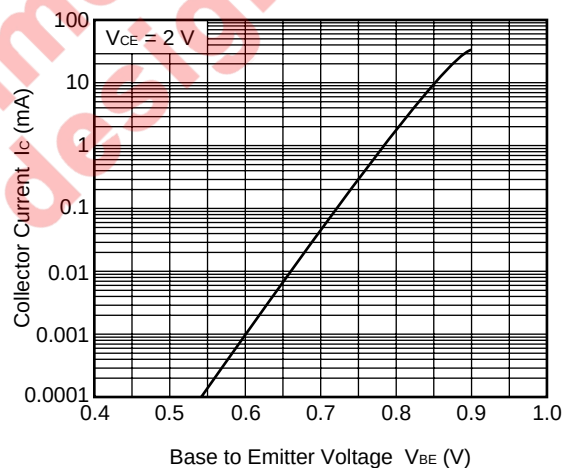
COLLECTOR CURRENT vs.
BASE TO EMITTER VOLTAGE



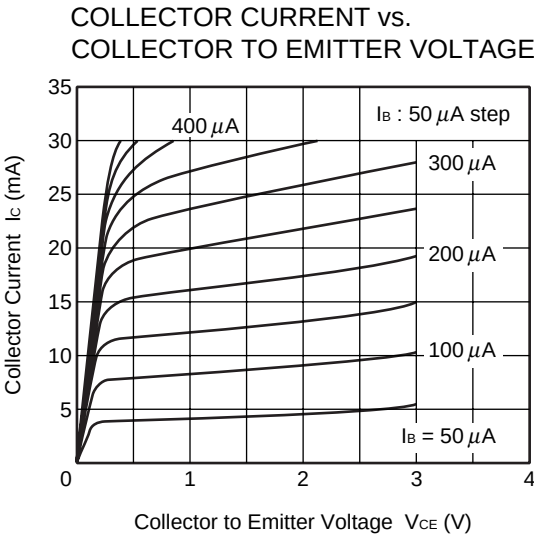
COLLECTOR CURRENT vs.
BASE TO EMITTER VOLTAGE



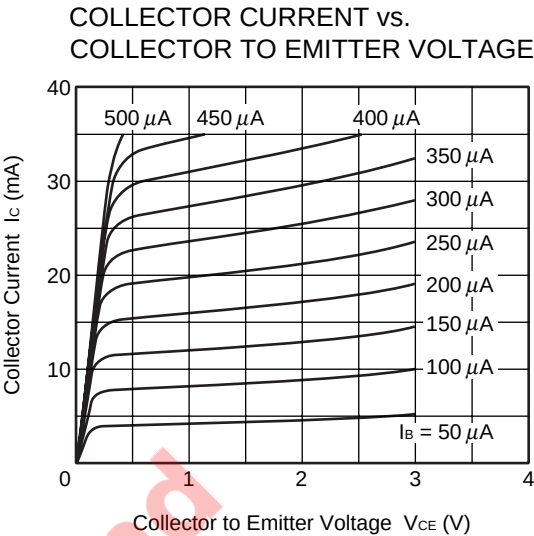
COLLECTOR CURRENT vs.
BASE TO EMITTER VOLTAGE



Q1



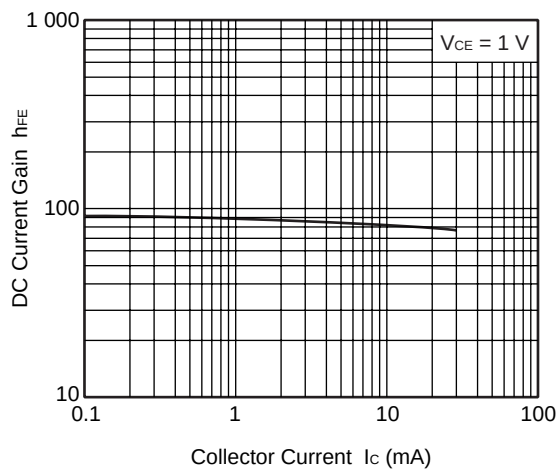
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Not recommended
for new design

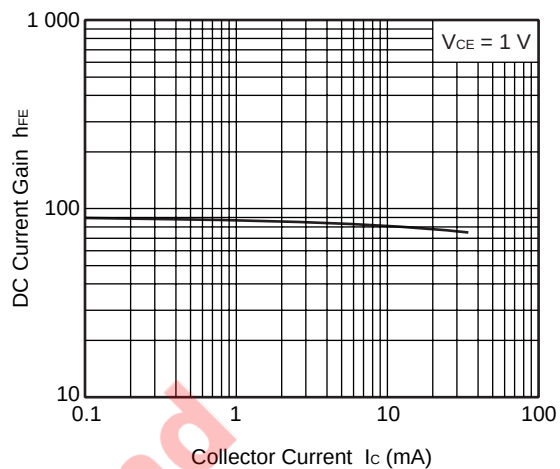
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DC CURRENT GAIN vs.
COLLECTOR CURRENT

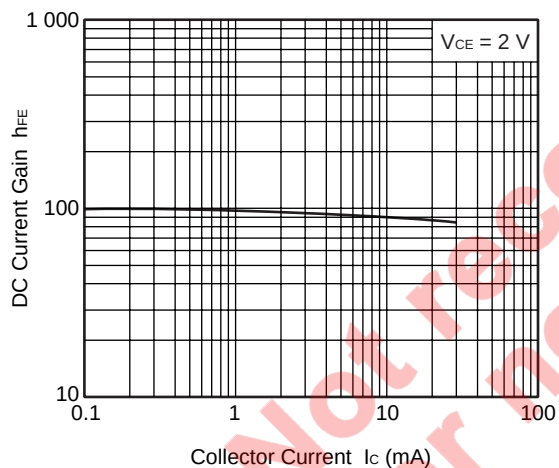


Q2

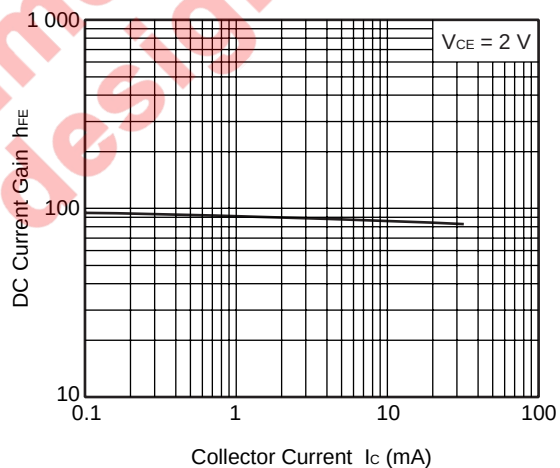
DC CURRENT GAIN vs.
COLLECTOR CURRENT



DC CURRENT GAIN vs.
COLLECTOR CURRENT

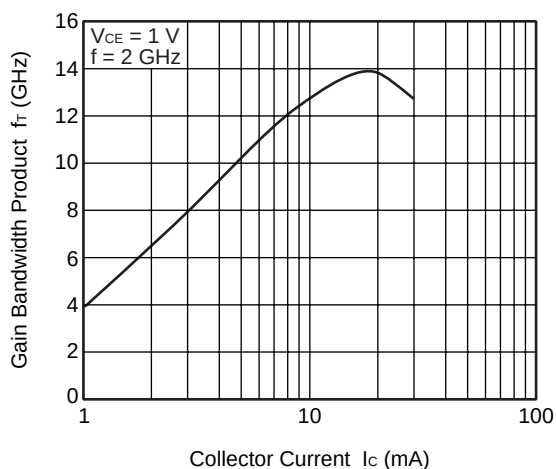


DC CURRENT GAIN vs.
COLLECTOR CURRENT



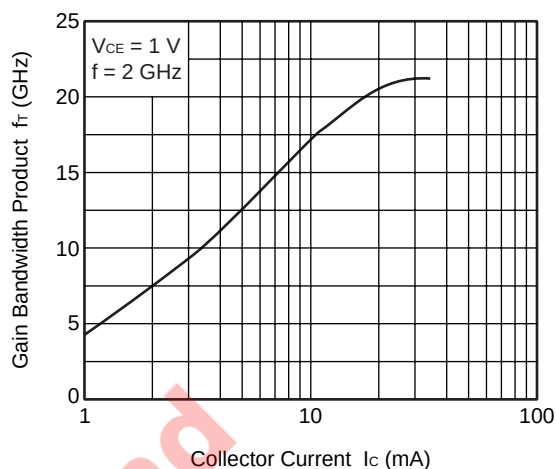
Q1

GAIN BANDWIDTH PRODUCT
vs. COLLECTOR CURRENT

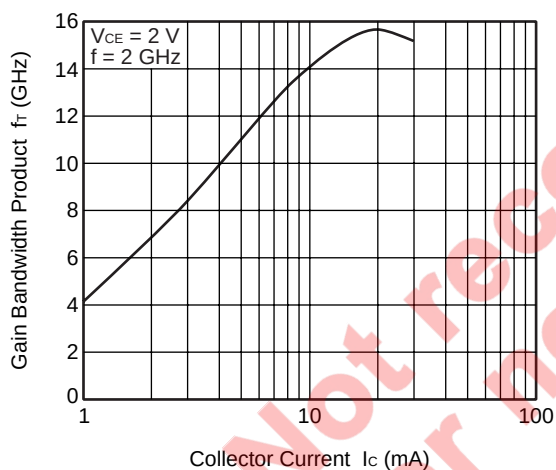


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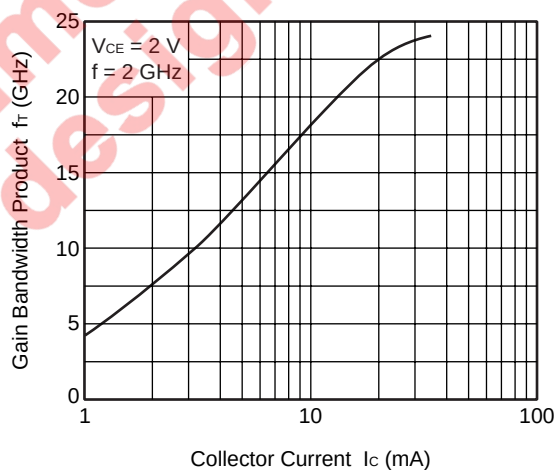
GAIN BANDWIDTH PRODUCT
vs. COLLECTOR CURRENT



GAIN BANDWIDTH PRODUCT
vs. COLLECTOR CURRENT

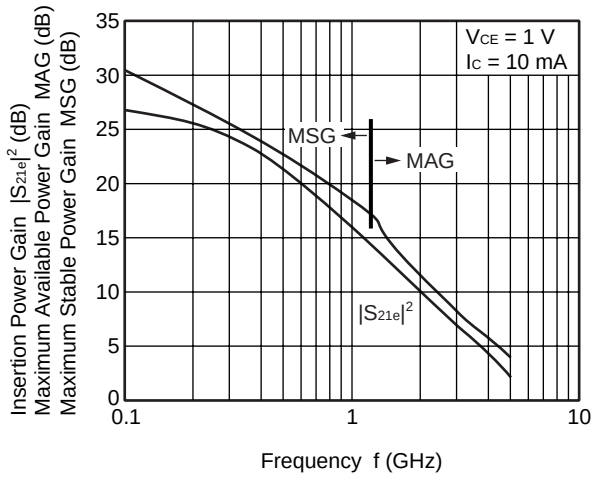


GAIN BANDWIDTH PRODUCT
vs. COLLECTOR CURRENT



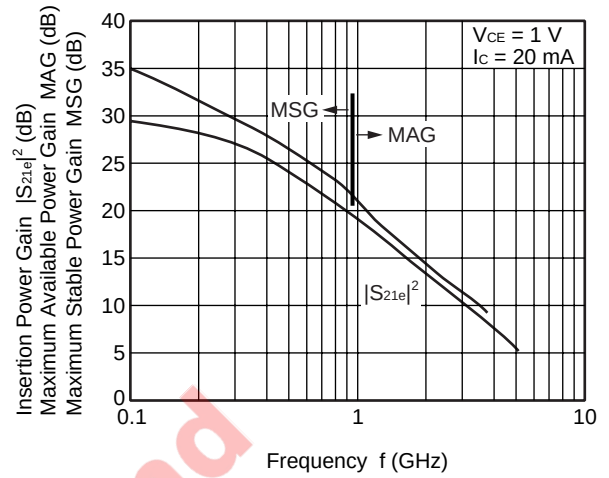
Q1

INSERTION POWER GAIN,
MAG, MSG vs. FREQUENCY

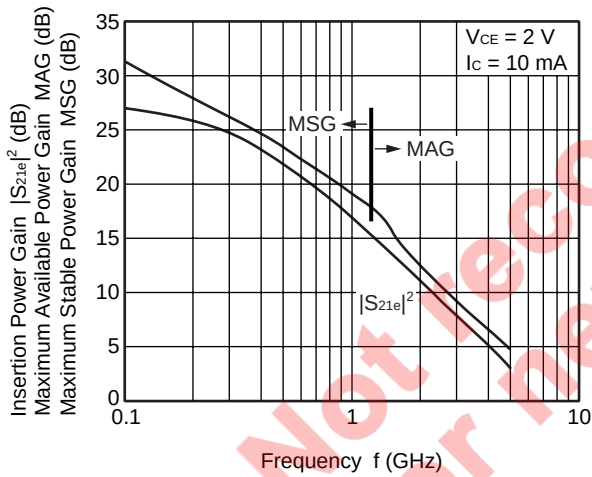


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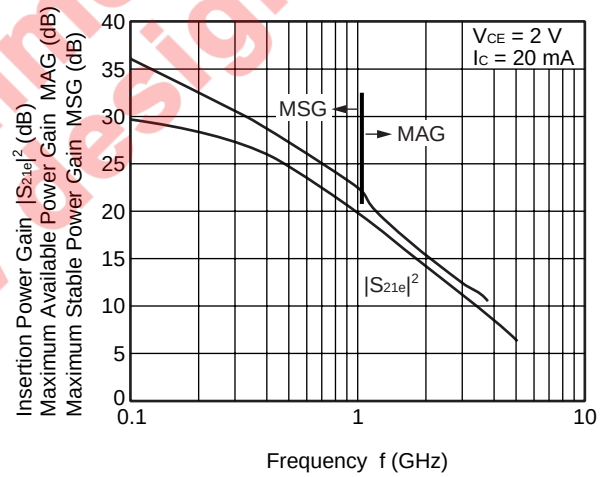
INSERTION POWER GAIN,
MAG, MSG vs. FREQUENCY



INSERTION POWER GAIN,
MAG, MSG vs. FREQUENCY

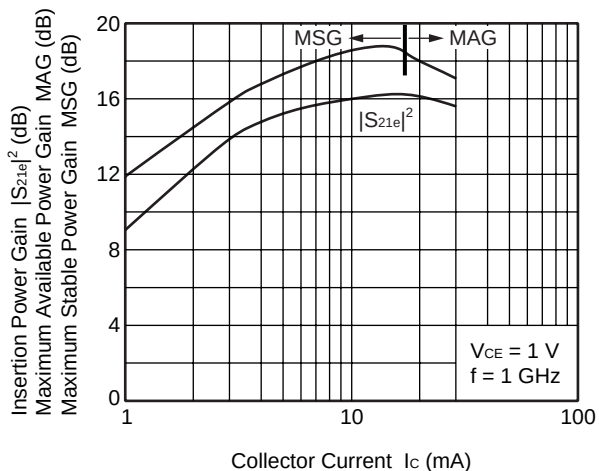


INSERTION POWER GAIN,
MAG, MSG vs. FREQUENCY



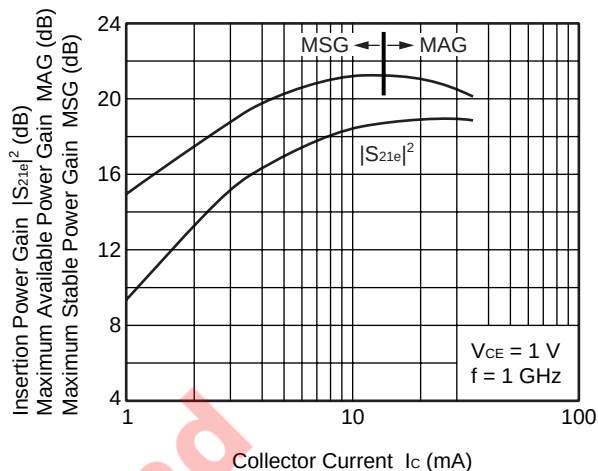
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INSERTION POWER GAIN, MAG, MSG
vs. COLLECTOR CURRENT

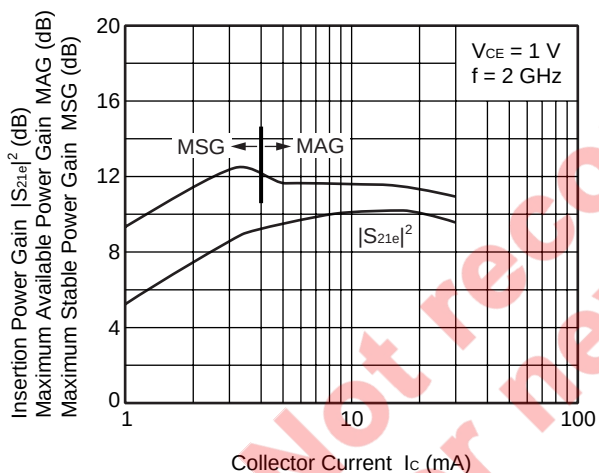


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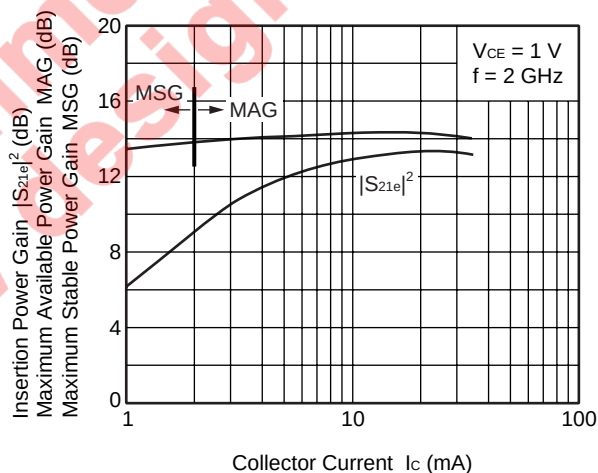
INSERTION POWER GAIN, MAG, MSG
vs. COLLECTOR CURRENT



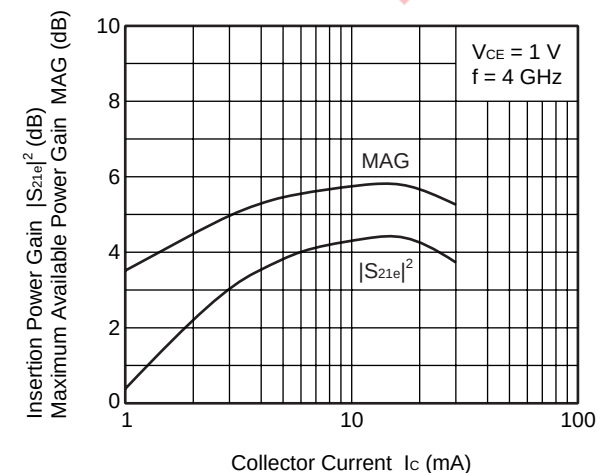
INSERTION POWER GAIN, MAG, MSG
vs. COLLECTOR CURRENT



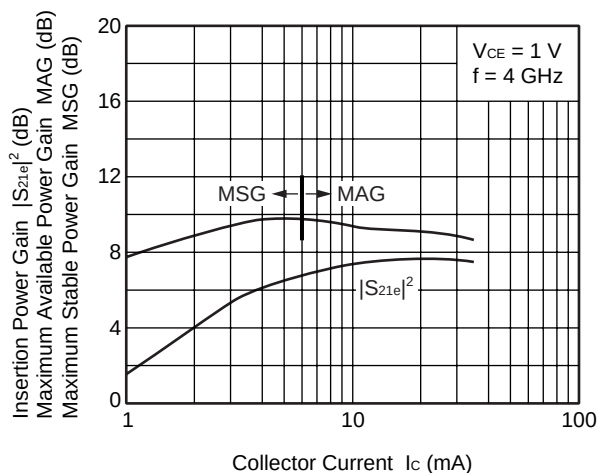
INSERTION POWER GAIN, MAG, MSG
vs. COLLECTOR CURRENT



INSERTION POWER GAIN, MAG
vs. COLLECTOR CURRENT

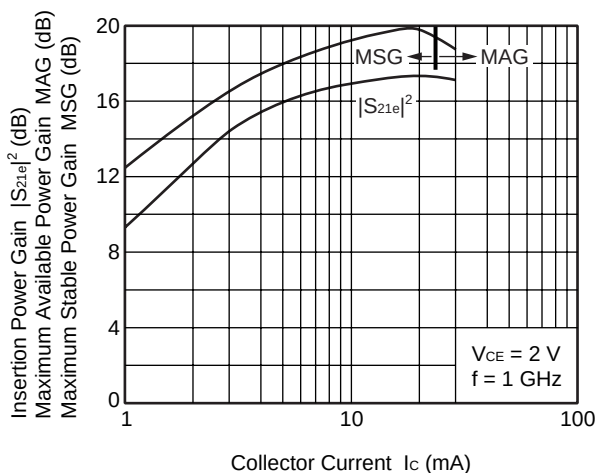


INSERTION POWER GAIN, MAG, MSG
vs. COLLECTOR CURRENT



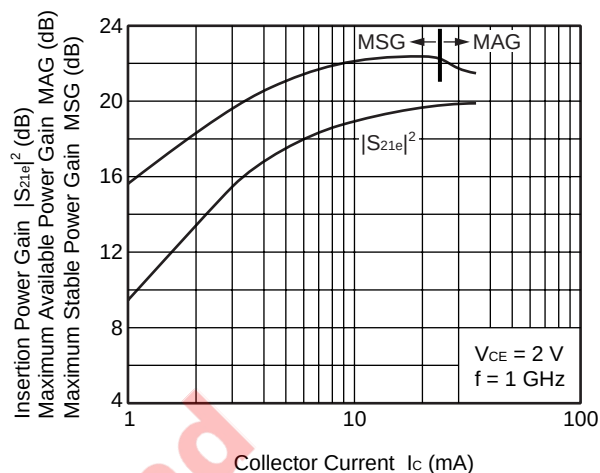
Q1

INSERTION POWER GAIN, MAG, MSG
vs. COLLECTOR CURRENT

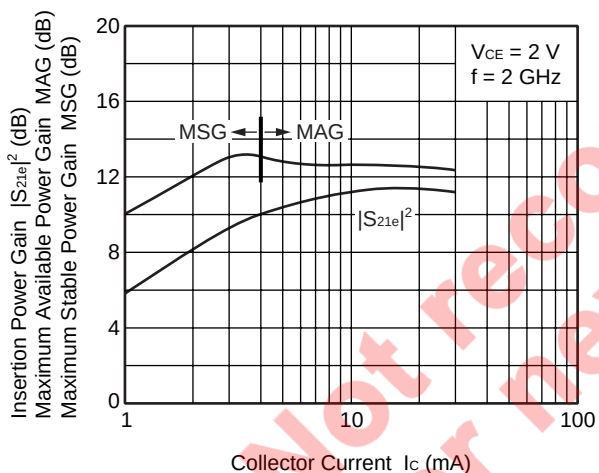


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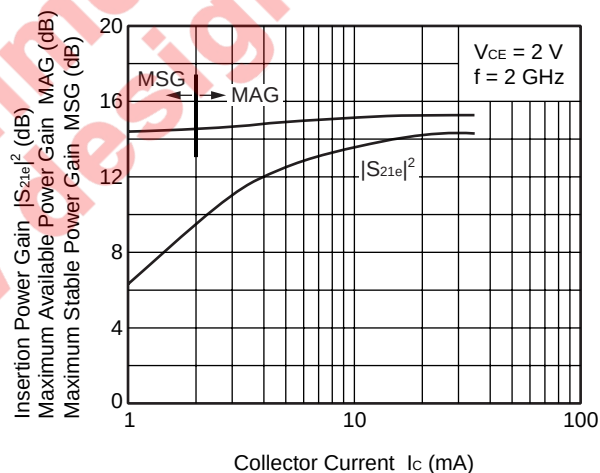
INSERTION POWER GAIN, MAG, MSG
vs. COLLECTOR CURRENT



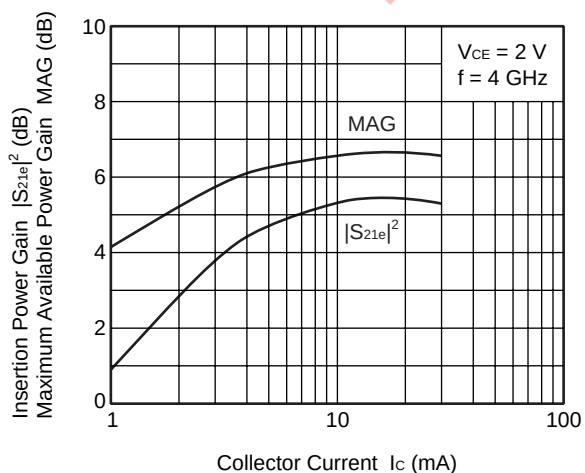
INSERTION POWER GAIN, MAG, MSG
vs. COLLECTOR CURRENT



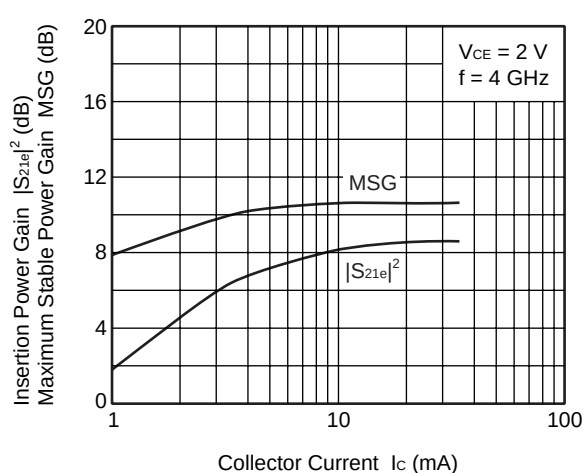
INSERTION POWER GAIN, MAG, MSG
vs. COLLECTOR CURRENT



INSERTION POWER GAIN, MAG
vs. COLLECTOR CURRENT

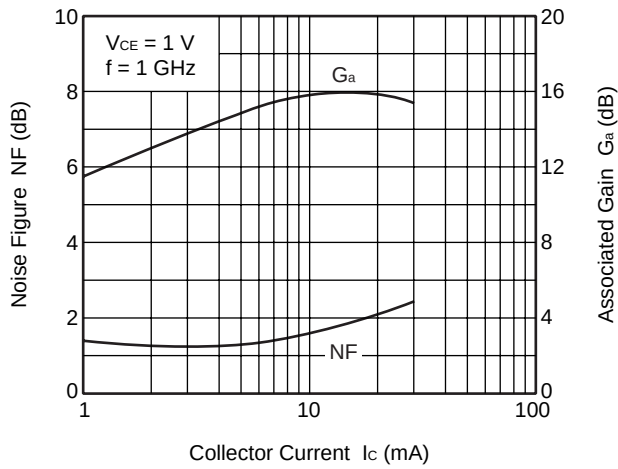


INSERTION POWER GAIN, MSG
vs. COLLECTOR CURRENT



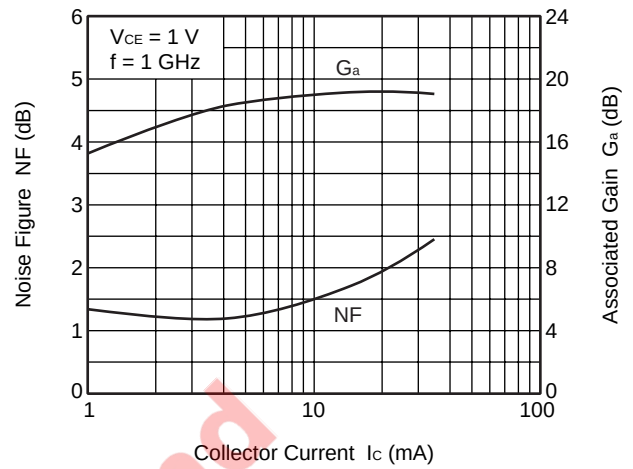
Q1

NOISE FIGURE, ASSOCIATED GAIN
vs. COLLECTOR CURRENT

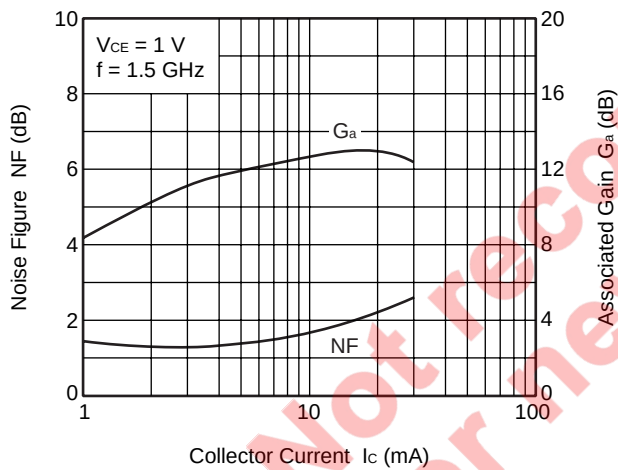


Q2

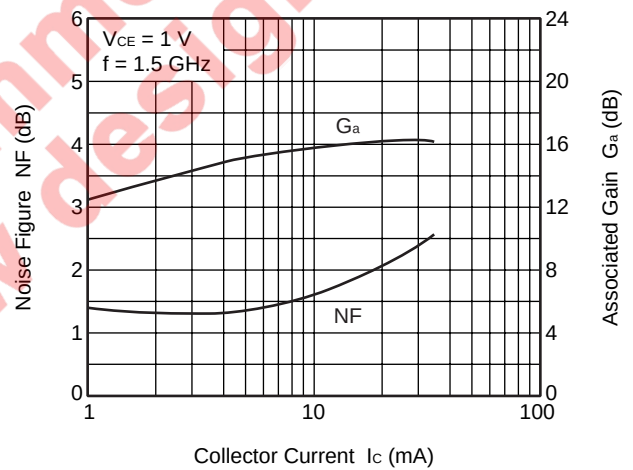
NOISE FIGURE, ASSOCIATED GAIN
vs. COLLECTOR CURRENT



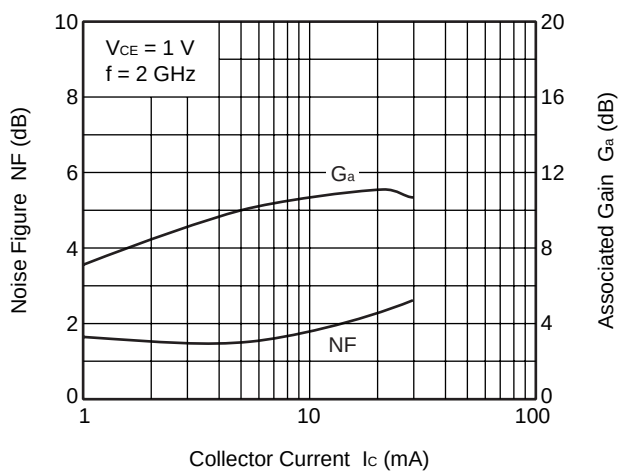
NOISE FIGURE, ASSOCIATED GAIN
vs. COLLECTOR CURRENT



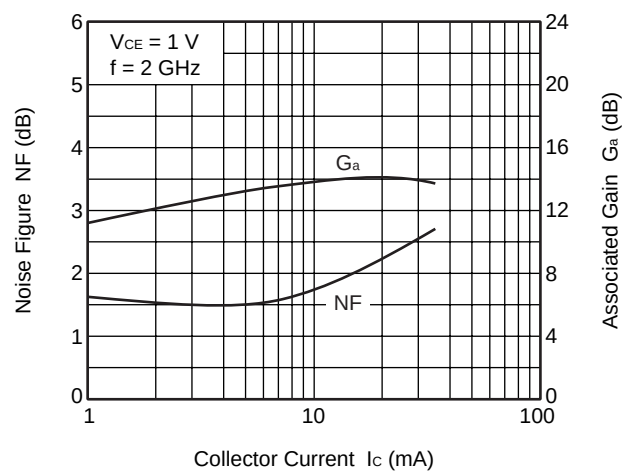
NOISE FIGURE, ASSOCIATED GAIN
vs. COLLECTOR CURRENT



NOISE FIGURE, ASSOCIATED GAIN
vs. COLLECTOR CURRENT

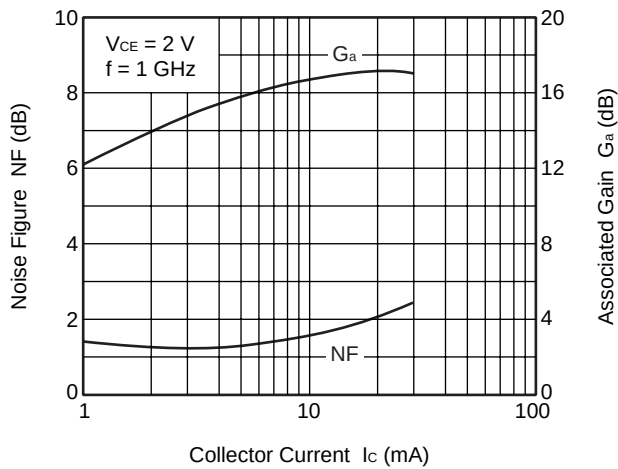


NOISE FIGURE, ASSOCIATED GAIN
vs. COLLECTOR CURRENT



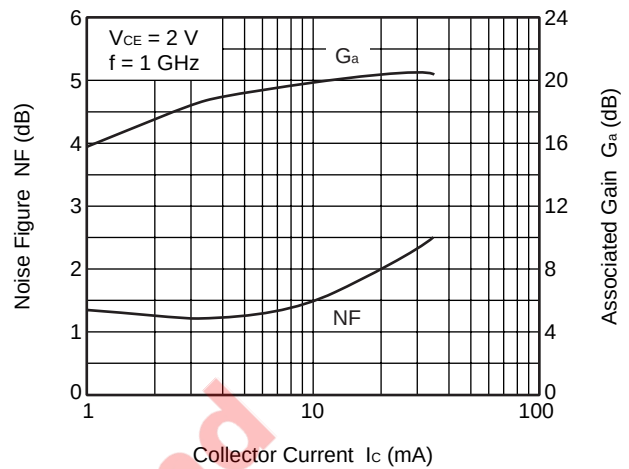
Q1

NOISE FIGURE, ASSOCIATED GAIN
vs. COLLECTOR CURRENT

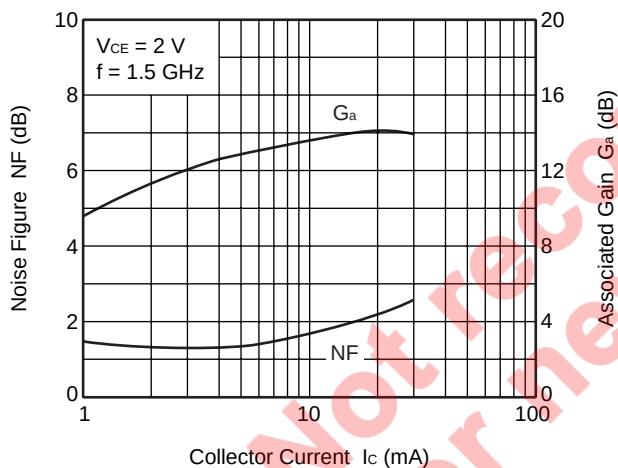


Q2

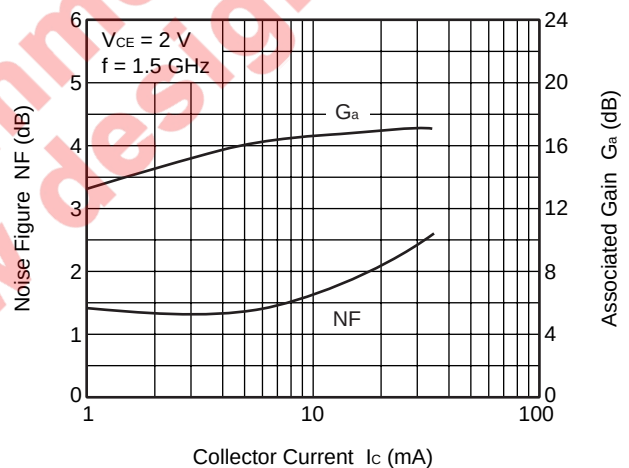
NOISE FIGURE, ASSOCIATED GAIN
vs. COLLECTOR CURRENT



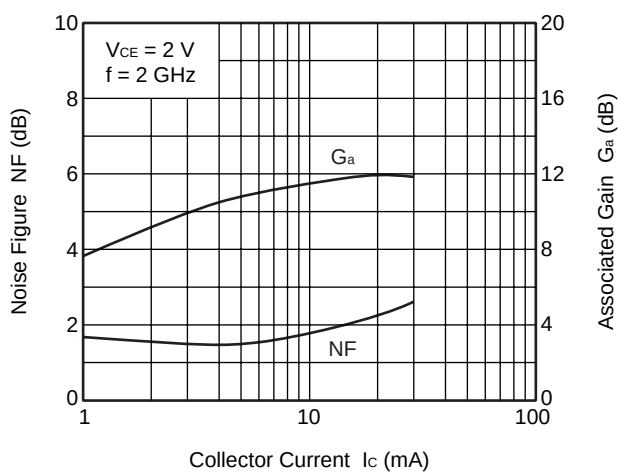
NOISE FIGURE, ASSOCIATED GAIN
vs. COLLECTOR CURRENT



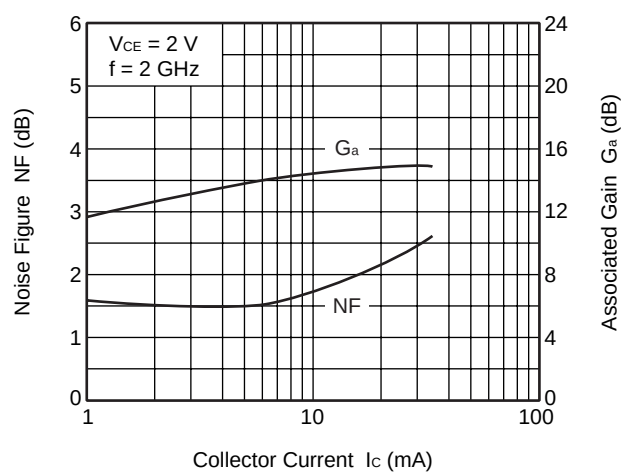
NOISE FIGURE, ASSOCIATED GAIN
vs. COLLECTOR CURRENT



NOISE FIGURE, ASSOCIATED GAIN
vs. COLLECTOR CURRENT



NOISE FIGURE, ASSOCIATED GAIN
vs. COLLECTOR CURRENT



Remark The graphs indicate nominal characteristics.

S-PARAMETERS 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	0.953	-9.4	3.604	172.6	0.024	87.4	0.992	-3.9
0.2	0.949	-16.5	3.622	166.4	0.048	80.4	0.983	-8.3
0.3	0.929	-24.4	3.536	160.4	0.071	74.7	0.968	-12.7
0.4	0.911	-33.0	3.494	153.1	0.093	69.7	0.944	-16.9
0.5	0.878	-41.3	3.396	146.7	0.113	64.9	0.918	-21.2
0.6	0.843	-49.5	3.304	140.2	0.131	60.1	0.886	-25.2
0.7	0.809	-57.6	3.187	134.3	0.148	55.6	0.853	-29.2
0.8	0.778	-65.3	3.088	128.2	0.162	51.2	0.815	-33.1
0.9	0.743	-73.7	2.966	122.4	0.173	47.2	0.779	-36.8
1.0	0.706	-81.2	2.850	117.0	0.183	43.4	0.743	-40.4
1.1	0.676	-88.7	2.728	111.9	0.190	39.9	0.709	-43.7
1.2	0.645	-96.0	2.604	106.8	0.197	36.8	0.679	-46.6
1.3	0.620	-103.0	2.476	102.5	0.201	33.7	0.650	-49.2
1.4	0.600	-109.7	2.371	98.2	0.205	31.1	0.623	-51.7
1.5	0.583	-116.3	2.260	94.4	0.208	28.8	0.601	-54.0
1.6	0.572	-122.3	2.160	90.5	0.210	26.6	0.580	-56.1
1.7	0.557	-127.7	2.067	86.9	0.211	24.8	0.562	-57.9
1.8	0.546	-133.5	1.979	83.3	0.211	23.3	0.545	-59.5
1.9	0.537	-138.7	1.897	80.5	0.211	21.7	0.529	-61.2
2.0	0.532	-143.7	1.824	77.2	0.211	20.6	0.513	-62.6
2.1	0.526	-148.1	1.752	74.5	0.209	19.4	0.502	-64.1
2.2	0.525	-152.4	1.687	71.5	0.208	18.6	0.489	-65.7
2.3	0.522	-156.3	1.643	69.0	0.207	17.7	0.479	-67.0
2.4	0.515	-160.1	1.580	66.7	0.206	16.8	0.468	-68.5
2.5	0.515	-164.2	1.531	64.1	0.205	16.4	0.459	-70.1
2.6	0.511	-167.7	1.486	62.2	0.203	15.3	0.456	-71.8
2.7	0.506	-171.3	1.441	59.8	0.202	14.8	0.448	-73.4
2.8	0.503	-175.1	1.391	57.6	0.201	14.3	0.442	-74.9
2.9	0.487	-177.6	1.347	55.4	0.200	14.0	0.432	-76.3
3.0	0.483	-179.3	1.295	53.6	0.199	13.8	0.425	-78.4
4.0	0.527	147.4	1.047	32.9	0.193	19.5	0.390	-99.9
5.0	0.572	117.8	0.831	15.6	0.223	23.6	0.388	-126.5

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	0.870	-14.4	9.420	168.6	0.023	84.3	0.972	-8.5
0.2	0.841	-28.3	9.168	158.1	0.044	74.5	0.936	-17.1
0.3	0.802	-41.3	8.615	149.1	0.064	67.4	0.884	-25.0
0.4	0.745	-54.5	8.091	139.3	0.079	61.6	0.820	-32.1
0.5	0.687	-66.5	7.456	131.5	0.093	56.2	0.756	-38.4
0.6	0.636	-77.7	6.864	124.4	0.103	52.0	0.690	-43.9
0.7	0.591	-88.3	6.327	118.1	0.111	48.4	0.631	-48.8
0.8	0.551	-98.4	5.831	112.2	0.118	45.7	0.577	-53.3
0.9	0.522	-108.1	5.364	107.1	0.123	43.3	0.531	-57.3
1.0	0.494	-116.6	4.968	102.3	0.128	41.5	0.488	-60.9
1.1	0.473	-124.8	4.605	98.3	0.131	40.1	0.452	-64.2
1.2	0.455	-132.6	4.280	94.4	0.134	39.0	0.423	-67.2
1.3	0.447	-139.2	3.993	91.1	0.137	38.1	0.398	-70.0
1.4	0.437	-146.0	3.748	87.9	0.140	37.4	0.375	-72.4
1.5	0.437	-151.7	3.519	84.9	0.143	37.0	0.357	-74.6
1.6	0.434	-156.4	3.315	82.1	0.145	36.6	0.340	-76.7
1.7	0.430	-161.6	3.140	79.5	0.148	36.4	0.326	-78.5
1.8	0.430	-166.2	2.974	76.8	0.151	36.5	0.312	-80.1
1.9	0.431	-170.3	2.828	74.7	0.153	36.4	0.300	-81.6
2.0	0.433	-174.2	2.701	72.3	0.156	36.3	0.289	-83.3
2.1	0.434	-177.7	2.575	70.2	0.158	36.4	0.279	-84.9
2.2	0.434	179.4	2.466	67.8	0.162	36.5	0.270	-86.5
2.3	0.435	176.4	2.387	66.0	0.164	36.7	0.262	-88.1
2.4	0.435	173.4	2.289	64.3	0.168	36.6	0.254	-89.8
2.5	0.438	170.7	2.202	62.2	0.171	36.8	0.248	-91.7
2.6	0.436	168.0	2.133	60.7	0.173	36.6	0.244	-93.5
2.7	0.437	164.8	2.061	58.8	0.177	36.4	0.239	-95.5
2.8	0.434	162.2	1.982	57.0	0.180	36.2	0.236	-97.3
2.9	0.425	160.3	1.912	55.5	0.183	36.0	0.230	-99.8
3.0	0.422	159.0	1.836	54.2	0.186	35.8	0.226	-102.2
4.0	0.481	133.1	1.430	36.1	0.226	36.4	0.229	-129.1
5.0	0.534	109.7	1.125	20.6	0.275	28.9	0.257	-158.3

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

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.800	-19.3	14.009	165.1	0.023	80.1	0.949	-12.1
0.2	0.747	-37.9	13.191	151.8	0.042	71.5	0.884	-24.0
0.3	0.689	-54.3	11.918	140.9	0.057	63.4	0.802	-33.8
0.4	0.627	-69.9	10.725	130.4	0.069	57.9	0.713	-42.0
0.5	0.564	-84.1	9.532	122.4	0.079	53.7	0.632	-48.8
0.6	0.519	-96.3	8.532	115.5	0.086	50.8	0.560	-54.6
0.7	0.482	-107.7	7.647	109.8	0.092	48.6	0.501	-59.5
0.8	0.452	-118.2	6.912	104.5	0.098	47.2	0.449	-64.0
0.9	0.435	-127.5	6.260	100.1	0.102	46.0	0.407	-68.1
1.0	0.419	-136.0	5.728	96.2	0.107	45.5	0.371	-72.1
1.1	0.410	-143.8	5.256	92.6	0.110	45.2	0.342	-75.7
1.2	0.399	-151.3	4.857	89.4	0.114	44.9	0.318	-79.0
1.3	0.400	-157.2	4.501	86.4	0.118	44.8	0.298	-82.0
1.4	0.398	-163.1	4.196	83.8	0.122	44.9	0.281	-84.8
1.5	0.403	-167.9	3.938	81.3	0.126	44.9	0.268	-87.4
1.6	0.404	-172.0	3.696	78.7	0.130	44.9	0.255	-89.8
1.7	0.407	-175.9	3.491	76.5	0.134	44.9	0.244	-92.0
1.8	0.407	-179.7	3.301	74.1	0.138	45.1	0.234	-94.0
1.9	0.410	176.8	3.132	72.3	0.143	45.2	0.225	-95.9
2.0	0.413	173.7	2.983	70.2	0.147	45.3	0.216	-98.1
2.1	0.417	170.8	2.844	68.3	0.151	45.3	0.209	-100.2
2.2	0.421	168.7	2.721	66.2	0.156	45.3	0.202	-102.3
2.3	0.419	165.9	2.633	64.6	0.160	45.3	0.197	-104.3
2.4	0.422	163.8	2.519	63.0	0.165	45.2	0.191	-106.4
2.5	0.424	161.2	2.426	61.2	0.169	45.1	0.187	-108.9
2.6	0.424	159.0	2.345	59.8	0.174	44.9	0.184	-111.0
2.7	0.425	156.1	2.263	58.1	0.179	44.4	0.181	-113.7
2.8	0.425	153.8	2.177	56.3	0.183	43.9	0.180	-115.9
2.9	0.416	152.1	2.097	55.1	0.188	43.3	0.178	-119.2
3.0	0.413	151.3	2.017	54.1	0.191	43.0	0.175	-122.0
4.0	0.475	128.4	1.553	36.9	0.241	40.5	0.205	-148.7
5.0	0.527	106.8	1.216	22.3	0.292	30.2	0.254	-175.5

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

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.728	-24.8	17.770	162.2	0.021	79.7	0.926	-15.3
0.2	0.674	-46.4	16.173	146.8	0.039	68.3	0.835	-29.3
0.3	0.608	-64.8	14.161	135.0	0.052	61.2	0.731	-40.2
0.4	0.541	-81.8	12.306	124.5	0.062	56.4	0.631	-49.0
0.5	0.487	-96.9	10.686	116.7	0.070	53.7	0.546	-55.8
0.6	0.449	-109.5	9.390	110.2	0.076	51.7	0.476	-61.7
0.7	0.422	-120.9	8.299	104.9	0.082	50.5	0.420	-66.6
0.8	0.405	-131.4	7.433	100.1	0.087	50.2	0.373	-71.3
0.9	0.397	-140.5	6.700	96.3	0.092	49.6	0.337	-75.7
1.0	0.388	-148.8	6.099	92.5	0.096	49.8	0.307	-80.0
1.1	0.384	-155.7	5.582	89.4	0.101	49.7	0.283	-84.0
1.2	0.381	-162.3	5.114	86.5	0.106	49.8	0.263	-87.7
1.3	0.385	-167.5	4.730	84.0	0.110	49.9	0.248	-91.2
1.4	0.390	-172.8	4.412	81.6	0.115	50.1	0.234	-94.4
1.5	0.392	-177.1	4.130	79.2	0.120	50.1	0.224	-97.2
1.6	0.397	179.6	3.878	76.9	0.125	50.2	0.214	-100.1
1.7	0.399	175.8	3.660	74.8	0.130	50.2	0.206	-102.7
1.8	0.400	172.7	3.456	72.7	0.135	50.3	0.198	-105.2
1.9	0.405	169.9	3.275	71.1	0.140	50.4	0.191	-107.4
2.0	0.412	167.0	3.121	69.0	0.145	50.2	0.185	-110.0
2.1	0.414	164.8	2.972	67.4	0.150	50.1	0.179	-112.5
2.2	0.418	162.9	2.843	65.3	0.155	50.1	0.174	-115.0
2.3	0.418	160.4	2.742	63.8	0.161	49.8	0.170	-117.5
2.4	0.418	158.2	2.628	62.3	0.166	49.5	0.166	-119.9
2.5	0.423	156.0	2.530	60.5	0.171	49.2	0.164	-122.7
2.6	0.421	154.0	2.445	59.2	0.176	48.9	0.163	-124.9
2.7	0.424	151.4	2.359	57.6	0.182	48.2	0.161	-127.9
2.8	0.423	149.5	2.269	56.0	0.187	47.6	0.162	-130.3
2.9	0.413	148.0	2.190	54.8	0.192	46.8	0.163	-133.7
3.0	0.410	147.0	2.101	53.8	0.195	46.4	0.161	-136.9
4.0	0.474	125.8	1.610	37.3	0.249	42.3	0.204	-160.5
5.0	0.528	105.5	1.256	23.0	0.300	30.8	0.263	175.7

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

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.653	-29.6	21.936	158.6	0.020	75.0	0.895	-19.0
0.2	0.584	-56.8	19.182	141.4	0.036	67.1	0.774	-35.2
0.3	0.519	-77.0	16.166	129.1	0.047	59.9	0.651	-47.0
0.4	0.461	-96.1	13.618	118.8	0.055	56.9	0.546	-56.0
0.5	0.423	-111.1	11.579	111.4	0.062	55.1	0.463	-62.8
0.6	0.397	-124.0	10.037	105.6	0.068	54.2	0.399	-68.7
0.7	0.385	-135.2	8.793	100.7	0.073	53.9	0.349	-73.8
0.8	0.375	-144.8	7.802	96.5	0.079	53.8	0.309	-79.0
0.9	0.375	-153.0	6.988	93.1	0.084	53.8	0.278	-83.7
1.0	0.371	-160.2	6.340	89.7	0.090	54.1	0.254	-88.7
1.1	0.372	-166.3	5.775	86.9	0.095	54.4	0.235	-93.1
1.2	0.374	-172.3	5.305	84.2	0.101	54.6	0.221	-97.5
1.3	0.381	-176.5	4.916	81.9	0.106	54.7	0.210	-101.5
1.4	0.385	178.8	4.558	79.6	0.111	54.8	0.200	-105.2
1.5	0.392	175.5	4.256	77.6	0.117	54.8	0.193	-108.3
1.6	0.394	172.4	4.001	75.4	0.123	54.8	0.186	-111.6
1.7	0.398	169.4	3.769	73.4	0.128	54.7	0.181	-114.5
1.8	0.402	167.0	3.558	71.5	0.134	54.8	0.175	-117.4
1.9	0.408	164.2	3.374	69.9	0.140	54.5	0.170	-119.9
2.0	0.412	161.7	3.210	68.1	0.145	54.3	0.166	-123.0
2.1	0.413	159.6	3.057	66.5	0.151	54.0	0.162	-125.7
2.2	0.419	157.9	2.927	64.3	0.157	53.7	0.159	-128.5
2.3	0.420	156.0	2.823	63.1	0.163	53.4	0.157	-131.3
2.4	0.422	154.0	2.704	61.6	0.168	52.9	0.154	-134.0
2.5	0.425	152.2	2.601	59.9	0.174	52.5	0.154	-136.8
2.6	0.424	150.3	2.512	58.7	0.179	51.9	0.153	-139.1
2.7	0.425	147.8	2.422	57.2	0.185	51.2	0.154	-142.0
2.8	0.424	145.8	2.336	55.5	0.191	50.5	0.156	-144.3
2.9	0.415	144.7	2.248	54.5	0.196	49.5	0.159	-147.5
3.0	0.413	143.7	2.161	53.6	0.199	49.0	0.159	-150.6
4.0	0.475	123.7	1.647	37.3	0.256	43.6	0.211	-170.0
5.0	0.528	104.4	1.283	23.6	0.307	31.2	0.277	169.0

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

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.494	-47.3	29.480	151.3	0.017	75.3	0.806	-26.8
0.2	0.422	-82.1	23.446	131.3	0.030	64.7	0.636	-46.5
0.3	0.389	-106.1	18.433	119.0	0.038	60.4	0.499	-59.1
0.4	0.371	-124.9	14.802	109.9	0.045	59.7	0.402	-68.2
0.5	0.361	-139.1	12.264	103.7	0.052	60.4	0.332	-75.3
0.6	0.358	-150.0	10.448	98.7	0.058	60.6	0.283	-81.8
0.7	0.361	-158.8	9.049	94.8	0.064	61.1	0.247	-87.9
0.8	0.365	-165.8	7.976	91.2	0.071	61.3	0.219	-94.2
0.9	0.372	-172.0	7.108	88.4	0.077	61.5	0.201	-100.1
1.0	0.375	-177.3	6.413	85.5	0.084	61.7	0.187	-106.4
1.1	0.383	178.2	5.834	83.2	0.090	62.0	0.178	-111.9
1.2	0.387	174.2	5.347	80.7	0.096	61.8	0.171	-117.1
1.3	0.396	171.2	4.930	78.8	0.103	61.6	0.168	-121.6
1.4	0.402	167.5	4.578	76.8	0.109	61.5	0.164	-125.7
1.5	0.407	165.2	4.280	74.9	0.115	61.3	0.162	-129.1
1.6	0.413	163.0	4.010	72.9	0.122	60.9	0.160	-132.7
1.7	0.416	160.9	3.780	71.2	0.129	60.6	0.159	-135.7
1.8	0.422	158.3	3.567	69.4	0.135	60.4	0.157	-139.0
1.9	0.425	156.5	3.377	68.0	0.141	59.8	0.155	-141.5
2.0	0.431	154.6	3.211	66.2	0.147	59.3	0.154	-144.6
2.1	0.434	153.1	3.059	64.8	0.154	58.7	0.153	-147.4
2.2	0.436	151.7	2.928	62.8	0.160	58.2	0.153	-150.1
2.3	0.440	149.9	2.824	61.6	0.166	57.6	0.153	-152.8
2.4	0.439	148.3	2.708	60.2	0.173	56.9	0.153	-155.3
2.5	0.441	146.6	2.603	58.6	0.179	56.2	0.155	-157.7
2.6	0.441	145.2	2.513	57.4	0.185	55.5	0.156	-159.7
2.7	0.443	143.2	2.422	55.9	0.191	54.6	0.159	-162.2
2.8	0.442	141.2	2.334	54.4	0.197	53.8	0.162	-163.9
2.9	0.433	139.9	2.247	53.4	0.202	52.5	0.168	-166.3
3.0	0.432	139.3	2.163	52.5	0.206	51.8	0.170	-169.0
4.0	0.493	120.8	1.641	36.7	0.265	44.9	0.228	-178.0
5.0	0.542	102.9	1.276	23.3	0.316	31.5	0.300	160.8

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

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.970	-8.2	3.571	173.1	0.020	87.7	0.993	-3.3
0.2	0.955	-15.0	3.595	167.6	0.041	81.3	0.986	-7.1
0.3	0.935	-22.1	3.514	162.1	0.061	76.0	0.974	-10.7
0.4	0.921	-30.1	3.485	155.1	0.080	71.6	0.955	-14.5
0.5	0.889	-37.6	3.402	149.1	0.098	66.9	0.934	-18.1
0.6	0.861	-45.3	3.329	143.1	0.114	62.6	0.907	-21.8
0.7	0.827	-52.8	3.227	137.4	0.129	58.4	0.879	-25.2
0.8	0.797	-60.2	3.143	131.7	0.143	54.3	0.846	-28.8
0.9	0.763	-68.0	3.036	126.1	0.154	50.4	0.813	-32.1
1.0	0.728	-75.1	2.936	120.8	0.163	46.8	0.780	-35.3
1.1	0.698	-82.4	2.822	115.7	0.171	43.2	0.749	-38.4
1.2	0.663	-89.6	2.715	110.6	0.177	40.1	0.720	-41.1
1.3	0.639	-96.6	2.586	106.5	0.182	37.1	0.693	-43.6
1.4	0.614	-103.2	2.482	102.1	0.186	34.5	0.668	-45.9
1.5	0.600	-109.6	2.375	98.3	0.189	32.1	0.646	-48.1
1.6	0.583	-115.4	2.272	94.4	0.191	29.9	0.625	-50.1
1.7	0.566	-121.2	2.181	90.7	0.194	28.0	0.608	-51.9
1.8	0.554	-126.8	2.091	87.2	0.194	26.5	0.590	-53.3
1.9	0.543	-131.9	2.006	84.3	0.194	24.9	0.575	-54.9
2.0	0.536	-137.2	1.937	81.1	0.194	23.7	0.559	-56.3
2.1	0.526	-141.9	1.857	78.3	0.193	22.6	0.546	-57.6
2.2	0.525	-146.3	1.791	75.3	0.193	21.7	0.533	-59.0
2.3	0.518	-150.4	1.744	72.8	0.192	20.8	0.523	-60.2
2.4	0.513	-154.2	1.676	70.5	0.191	20.0	0.511	-61.5
2.5	0.509	-158.5	1.625	67.8	0.190	19.4	0.503	-62.9
2.6	0.504	-162.2	1.579	66.0	0.188	18.5	0.498	-64.6
2.7	0.500	-166.1	1.529	63.6	0.187	18.0	0.491	-65.9
2.8	0.494	-170.1	1.476	61.2	0.186	17.5	0.485	-67.4
2.9	0.480	-172.5	1.429	59.0	0.186	17.3	0.473	-68.6
3.0	0.475	-174.6	1.374	57.2	0.185	17.2	0.465	-70.5
4.0	0.510	150.5	1.113	36.3	0.181	23.4	0.423	-90.1
5.0	0.555	119.5	0.882	18.5	0.214	27.9	0.409	-115.2

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

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.884	-13.4	9.448	169.7	0.020	83.2	0.978	-7.0
0.2	0.857	-25.3	9.247	159.9	0.039	76.2	0.947	-14.5
0.3	0.815	-36.8	8.759	151.4	0.055	69.5	0.903	-21.2
0.4	0.764	-48.7	8.310	142.2	0.070	64.2	0.847	-27.5
0.5	0.708	-59.6	7.737	134.6	0.082	59.4	0.790	-33.0
0.6	0.656	-70.2	7.203	127.6	0.092	55.3	0.730	-37.9
0.7	0.610	-80.1	6.675	121.4	0.100	51.7	0.676	-42.2
0.8	0.566	-89.5	6.189	115.6	0.107	48.8	0.623	-46.1
0.9	0.530	-98.9	5.737	110.5	0.112	46.5	0.577	-49.5
1.0	0.497	-107.3	5.341	105.8	0.117	44.6	0.535	-52.7
1.1	0.472	-115.3	4.967	101.6	0.120	43.2	0.499	-55.6
1.2	0.449	-123.3	4.629	97.5	0.124	42.0	0.468	-58.2
1.3	0.435	-130.5	4.329	94.2	0.127	40.9	0.441	-60.5
1.4	0.424	-137.4	4.074	91.0	0.130	40.3	0.418	-62.5
1.5	0.419	-143.3	3.834	88.0	0.132	39.7	0.399	-64.4
1.6	0.411	-148.8	3.613	85.1	0.135	39.2	0.381	-66.0
1.7	0.410	-154.0	3.430	82.3	0.138	39.1	0.366	-67.5
1.8	0.405	-158.7	3.247	79.6	0.140	39.0	0.352	-68.8
1.9	0.405	-163.2	3.088	77.5	0.143	38.8	0.339	-69.9
2.0	0.404	-167.7	2.950	75.1	0.146	38.9	0.327	-71.2
2.1	0.405	-171.1	2.814	73.0	0.148	39.0	0.317	-72.4
2.2	0.408	-174.8	2.698	70.7	0.151	39.1	0.308	-73.6
2.3	0.406	-178.1	2.609	68.9	0.154	39.1	0.299	-74.8
2.4	0.406	178.9	2.500	67.1	0.157	39.1	0.290	-76.0
2.5	0.406	175.6	2.409	65.0	0.160	39.2	0.283	-77.6
2.6	0.405	172.8	2.334	63.4	0.162	39.2	0.279	-79.0
2.7	0.404	169.7	2.250	61.6	0.166	39.0	0.272	-80.6
2.8	0.405	166.9	2.163	59.8	0.169	38.8	0.268	-82.1
2.9	0.393	164.7	2.088	58.3	0.173	38.5	0.261	-84.0
3.0	0.391	163.4	2.008	56.9	0.175	38.5	0.255	-86.0
4.0	0.448	135.7	1.562	39.0	0.215	39.4	0.239	-111.1
5.0	0.504	111.4	1.227	23.1	0.265	32.0	0.247	-141.4

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

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.820	-17.5	14.081	166.5	0.019	86.3	0.958	-10.2
0.2	0.769	-33.1	13.394	154.0	0.036	73.2	0.904	-20.1
0.3	0.708	-47.8	12.315	143.9	0.050	66.2	0.833	-28.6
0.4	0.645	-61.6	11.198	133.8	0.062	61.0	0.754	-35.8
0.5	0.582	-74.6	10.081	125.8	0.071	56.8	0.676	-41.7
0.6	0.529	-86.0	9.099	118.9	0.078	53.8	0.609	-46.6
0.7	0.484	-97.1	8.222	113.2	0.084	51.8	0.550	-50.8
0.8	0.450	-107.3	7.468	107.8	0.090	50.1	0.498	-54.6
0.9	0.425	-116.7	6.802	103.3	0.094	49.0	0.453	-57.9
1.0	0.405	-125.5	6.253	99.1	0.098	48.1	0.416	-61.2
1.1	0.387	-133.8	5.754	95.5	0.102	47.8	0.384	-63.9
1.2	0.375	-141.4	5.332	92.1	0.106	47.4	0.359	-66.3
1.3	0.369	-148.0	4.944	89.3	0.110	47.1	0.337	-68.8
1.4	0.366	-154.7	4.621	86.5	0.114	47.2	0.318	-70.8
1.5	0.369	-160.0	4.328	83.9	0.118	47.1	0.303	-72.8
1.6	0.368	-164.8	4.074	81.3	0.122	47.1	0.288	-74.5
1.7	0.369	-169.4	3.852	79.0	0.126	47.2	0.276	-76.0
1.8	0.369	-173.5	3.645	76.7	0.130	47.3	0.265	-77.5
1.9	0.370	-177.1	3.453	74.9	0.134	47.5	0.255	-78.7
2.0	0.374	179.4	3.293	72.8	0.138	47.4	0.245	-80.3
2.1	0.377	176.3	3.139	70.9	0.142	47.4	0.236	-81.8
2.2	0.381	173.4	3.007	68.8	0.146	47.4	0.229	-83.1
2.3	0.380	170.4	2.904	67.2	0.151	47.4	0.222	-84.6
2.4	0.379	168.2	2.781	65.5	0.155	47.3	0.215	-86.0
2.5	0.383	165.3	2.674	63.7	0.159	47.3	0.209	-88.0
2.6	0.384	163.3	2.584	62.4	0.163	47.0	0.205	-89.5
2.7	0.384	160.1	2.493	60.5	0.168	46.6	0.200	-91.6
2.8	0.384	157.6	2.397	58.9	0.173	46.1	0.197	-93.4
2.9	0.372	156.0	2.315	57.7	0.177	45.6	0.193	-96.2
3.0	0.374	154.9	2.223	56.6	0.180	45.3	0.188	-98.6
4.0	0.435	130.4	1.712	39.5	0.229	43.2	0.195	-127.5
5.0	0.494	108.4	1.338	24.7	0.281	33.0	0.225	-159.0

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

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.760	-21.4	17.929	163.7	0.016	78.7	0.939	-12.7
0.2	0.693	-40.4	16.605	149.5	0.034	71.0	0.863	-24.5
0.3	0.627	-56.5	14.782	138.3	0.046	64.2	0.770	-34.1
0.4	0.557	-71.9	13.050	127.9	0.055	59.8	0.677	-41.6
0.5	0.496	-85.8	11.472	120.1	0.063	56.7	0.596	-47.5
0.6	0.448	-98.3	10.172	113.5	0.070	54.7	0.525	-52.3
0.7	0.414	-109.6	9.052	108.2	0.075	53.5	0.469	-56.2
0.8	0.388	-119.9	8.146	103.2	0.080	52.7	0.419	-59.8
0.9	0.372	-129.7	7.356	99.2	0.085	52.1	0.380	-63.1
1.0	0.358	-137.9	6.720	95.4	0.090	52.0	0.347	-66.2
1.1	0.348	-145.7	6.156	92.2	0.094	52.1	0.320	-69.1
1.2	0.344	-153.6	5.662	89.2	0.098	51.9	0.298	-71.8
1.3	0.343	-159.3	5.257	86.6	0.103	52.1	0.280	-74.3
1.4	0.343	-165.2	4.897	84.1	0.108	52.0	0.264	-76.5
1.5	0.349	-169.9	4.582	81.8	0.113	52.1	0.252	-78.7
1.6	0.351	-174.3	4.301	79.4	0.117	52.2	0.239	-80.7
1.7	0.352	-178.2	4.066	77.2	0.122	52.2	0.230	-82.5
1.8	0.356	178.2	3.843	75.1	0.127	52.4	0.219	-84.1
1.9	0.361	175.2	3.642	73.5	0.131	52.3	0.211	-85.5
2.0	0.365	171.8	3.469	71.5	0.136	52.3	0.203	-87.4
2.1	0.365	169.1	3.302	69.7	0.141	52.1	0.196	-89.1
2.2	0.370	167.0	3.159	67.8	0.146	51.9	0.189	-90.8
2.3	0.371	164.3	3.051	66.2	0.151	51.8	0.183	-92.4
2.4	0.372	162.1	2.919	64.8	0.156	51.6	0.178	-94.3
2.5	0.376	159.8	2.810	63.0	0.161	51.3	0.173	-96.5
2.6	0.375	157.6	2.716	61.7	0.166	50.9	0.170	-98.4
2.7	0.375	155.1	2.619	60.1	0.171	50.4	0.167	-100.7
2.8	0.376	152.5	2.521	58.5	0.176	49.7	0.165	-102.9
2.9	0.367	150.9	2.426	57.3	0.181	48.9	0.162	-106.5
3.0	0.367	150.3	2.335	56.3	0.184	48.5	0.158	-109.3
4.0	0.429	127.9	1.781	39.8	0.237	44.9	0.181	-138.8
5.0	0.488	107.1	1.391	25.5	0.290	33.6	0.225	-169.2

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

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.679	-26.0	22.271	160.6	0.016	80.6	0.913	-15.6
0.2	0.607	-48.0	19.885	144.5	0.031	69.6	0.812	-29.3
0.3	0.538	-66.7	17.116	132.6	0.042	63.2	0.699	-39.4
0.4	0.471	-83.9	14.643	122.3	0.050	59.6	0.598	-46.9
0.5	0.417	-97.6	12.598	114.8	0.056	57.6	0.515	-52.5
0.6	0.381	-110.5	10.996	108.7	0.062	56.5	0.449	-57.0
0.7	0.356	-122.1	9.682	103.8	0.068	56.2	0.396	-60.9
0.8	0.343	-132.8	8.648	99.3	0.073	56.3	0.352	-64.4
0.9	0.334	-141.8	7.762	95.8	0.078	56.0	0.318	-67.7
1.0	0.328	-150.0	7.056	92.4	0.084	56.3	0.289	-71.1
1.1	0.325	-157.3	6.438	89.5	0.088	56.5	0.267	-74.2
1.2	0.325	-163.8	5.920	86.7	0.094	56.6	0.248	-77.1
1.3	0.329	-169.2	5.484	84.4	0.099	56.5	0.234	-79.9
1.4	0.333	-174.5	5.108	82.1	0.104	56.8	0.221	-82.4
1.5	0.339	-178.6	4.775	79.9	0.110	56.7	0.211	-84.7
1.6	0.342	178.2	4.472	77.8	0.115	56.6	0.201	-87.1
1.7	0.346	174.9	4.213	75.8	0.120	56.5	0.193	-89.3
1.8	0.350	171.5	3.992	73.9	0.126	56.6	0.185	-91.2
1.9	0.353	168.1	3.777	72.3	0.131	56.3	0.178	-93.0
2.0	0.361	165.8	3.597	70.4	0.136	56.1	0.171	-95.1
2.1	0.363	163.6	3.423	68.8	0.141	55.8	0.165	-97.2
2.2	0.366	161.6	3.277	66.8	0.147	55.5	0.160	-99.2
2.3	0.369	159.2	3.165	65.4	0.152	55.3	0.155	-101.3
2.4	0.371	157.5	3.026	63.9	0.158	54.8	0.151	-103.5
2.5	0.372	155.4	2.913	62.4	0.163	54.3	0.148	-105.9
2.6	0.372	153.2	2.808	61.0	0.169	53.9	0.146	-108.1
2.7	0.373	151.0	2.715	59.6	0.175	53.2	0.143	-111.0
2.8	0.373	148.4	2.606	57.9	0.180	52.4	0.143	-113.5
2.9	0.363	147.3	2.511	56.9	0.184	51.5	0.142	-117.3
3.0	0.366	146.4	2.417	55.9	0.188	50.9	0.140	-120.8
4.0	0.429	125.5	1.839	39.9	0.243	46.2	0.176	-148.9
5.0	0.487	106.1	1.431	26.1	0.296	33.9	0.231	-177.0

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

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.519	-37.7	30.702	153.9	0.015	74.3	0.849	-21.5
0.2	0.441	-67.6	25.245	135.0	0.026	67.6	0.695	-37.8
0.3	0.386	-89.7	20.293	122.7	0.034	63.5	0.561	-47.9
0.4	0.345	-109.1	16.546	113.3	0.041	62.3	0.460	-54.7
0.5	0.318	-124.2	13.819	106.9	0.047	62.3	0.386	-59.4
0.6	0.308	-136.4	11.836	101.7	0.053	62.8	0.330	-63.3
0.7	0.302	-147.0	10.290	97.6	0.059	63.0	0.289	-66.7
0.8	0.302	-156.0	9.102	93.9	0.065	63.4	0.255	-70.3
0.9	0.306	-163.0	8.124	90.9	0.071	63.3	0.230	-73.8
1.0	0.309	-169.9	7.343	88.0	0.077	63.6	0.209	-77.6
1.1	0.315	-175.2	6.687	85.6	0.083	63.8	0.194	-81.2
1.2	0.319	-180.0	6.141	83.3	0.089	63.5	0.181	-84.8
1.3	0.327	176.1	5.669	81.2	0.095	63.3	0.171	-88.3
1.4	0.334	172.1	5.270	79.2	0.101	63.2	0.164	-91.4
1.5	0.340	169.4	4.914	77.2	0.107	63.0	0.157	-94.4
1.6	0.345	166.5	4.599	75.3	0.113	62.6	0.151	-97.2
1.7	0.352	164.0	4.341	73.5	0.119	62.3	0.147	-99.9
1.8	0.354	161.6	4.104	71.8	0.125	62.0	0.141	-102.5
1.9	0.359	159.5	3.886	70.4	0.131	61.6	0.136	-104.6
2.0	0.363	157.1	3.698	68.6	0.137	61.1	0.132	-107.5
2.1	0.369	155.6	3.518	67.1	0.143	60.6	0.129	-110.1
2.2	0.373	154.1	3.364	65.2	0.149	60.1	0.126	-112.7
2.3	0.372	152.5	3.246	64.0	0.155	59.5	0.123	-115.5
2.4	0.376	150.8	3.106	62.6	0.161	58.8	0.120	-118.0
2.5	0.379	149.0	2.988	61.1	0.167	58.2	0.120	-121.1
2.6	0.380	147.3	2.886	59.9	0.172	57.5	0.118	-123.6
2.7	0.380	145.1	2.783	58.5	0.179	56.6	0.119	-126.9
2.8	0.379	143.3	2.674	56.9	0.184	55.8	0.120	-129.6
2.9	0.371	142.2	2.576	56.0	0.188	54.6	0.122	-133.7
3.0	0.371	141.6	2.479	55.2	0.193	54.0	0.122	-137.5
4.0	0.437	122.4	1.877	39.6	0.250	47.7	0.173	-161.2
5.0	0.496	104.4	1.457	26.2	0.303	34.5	0.240	174.4

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	0.939	-6.2	3.508	173.4	0.013	87.2	0.994	-3.3
0.2	0.938	-13.5	3.434	168.0	0.025	80.8	0.988	-6.8
0.3	0.923	-20.1	3.419	162.6	0.037	76.4	0.976	-10.1
0.4	0.910	-27.1	3.412	156.4	0.049	72.1	0.964	-13.5
0.5	0.885	-34.2	3.341	150.4	0.059	67.9	0.947	-16.8
0.6	0.861	-41.1	3.280	144.8	0.069	63.1	0.928	-20.2
0.7	0.835	-48.3	3.196	139.2	0.077	59.2	0.905	-23.2
0.8	0.811	-55.4	3.129	133.7	0.084	55.3	0.882	-26.4
0.9	0.786	-62.2	3.040	128.4	0.090	51.4	0.860	-29.5
1.0	0.760	-69.0	2.941	123.1	0.094	47.9	0.835	-32.4
1.1	0.734	-75.6	2.845	118.3	0.098	44.7	0.813	-35.2
1.2	0.710	-81.8	2.739	113.7	0.100	41.8	0.791	-38.0
1.3	0.691	-87.9	2.644	109.0	0.102	39.3	0.768	-40.7
1.4	0.675	-93.4	2.534	104.6	0.102	37.1	0.749	-43.3
1.5	0.658	-98.7	2.446	100.5	0.102	35.5	0.731	-46.1
1.6	0.642	-103.9	2.359	96.6	0.101	34.0	0.715	-48.7
1.7	0.629	-108.4	2.269	92.7	0.099	33.0	0.700	-51.4
1.8	0.618	-113.0	2.182	89.1	0.097	32.7	0.689	-54.0
1.9	0.605	-116.9	2.106	85.8	0.095	32.9	0.676	-56.6
2.0	0.599	-121.0	2.037	82.7	0.092	33.4	0.666	-59.2
2.1	0.585	-125.0	1.968	79.5	0.089	34.3	0.657	-61.8
2.2	0.579	-128.6	1.912	76.6	0.086	35.7	0.650	-64.4
2.3	0.568	-132.6	1.851	73.7	0.083	37.8	0.644	-66.9
2.4	0.564	-136.1	1.799	70.9	0.081	40.4	0.638	-69.3
2.5	0.560	-140.0	1.744	68.4	0.080	43.7	0.632	-72.0
2.6	0.555	-143.3	1.683	65.7	0.079	47.7	0.628	-74.7
2.7	0.548	-147.3	1.629	62.9	0.079	52.4	0.625	-76.9
2.8	0.550	-150.6	1.592	60.1	0.081	57.2	0.625	-79.4
2.9	0.546	-154.0	1.566	57.6	0.083	62.6	0.620	-81.1
3.0	0.542	-157.5	1.520	55.5	0.087	67.3	0.613	-83.8
4.0	0.578	174.3	1.180	35.0	0.194	80.8	0.567	-113.3
5.0	0.647	155.0	0.908	13.4	0.336	54.9	0.451	-155.8

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	0.846	-9.2	9.304	170.6	0.012	79.8	0.981	-5.6
0.2	0.823	-19.6	8.965	162.0	0.024	78.1	0.960	-11.2
0.3	0.788	-29.3	8.695	154.3	0.034	72.8	0.928	-16.4
0.4	0.755	-38.7	8.380	146.1	0.044	68.3	0.889	-21.2
0.5	0.706	-47.8	7.899	138.8	0.051	64.3	0.844	-25.5
0.6	0.664	-56.4	7.471	132.3	0.058	60.3	0.799	-29.3
0.7	0.620	-64.8	7.003	126.0	0.063	57.4	0.754	-32.8
0.8	0.581	-73.1	6.609	120.4	0.067	54.9	0.713	-35.7
0.9	0.546	-80.4	6.192	115.2	0.071	52.9	0.674	-38.4
1.0	0.516	-87.3	5.800	110.4	0.074	51.6	0.640	-40.9
1.1	0.492	-94.4	5.459	106.1	0.076	50.6	0.607	-43.1
1.2	0.468	-100.3	5.124	102.2	0.078	50.0	0.579	-45.0
1.3	0.449	-106.2	4.842	98.3	0.080	49.8	0.554	-47.1
1.4	0.437	-111.6	4.556	94.8	0.082	49.9	0.532	-49.0
1.5	0.427	-116.4	4.321	91.6	0.083	50.5	0.513	-50.9
1.6	0.417	-121.2	4.113	88.5	0.085	51.2	0.496	-53.0
1.7	0.406	-125.4	3.910	85.3	0.087	52.0	0.481	-55.0
1.8	0.399	-128.9	3.726	82.7	0.088	52.9	0.470	-57.0
1.9	0.391	-132.5	3.555	80.1	0.090	54.1	0.461	-59.1
2.0	0.388	-135.7	3.410	77.6	0.092	55.6	0.451	-61.1
2.1	0.378	-139.5	3.274	75.1	0.094	57.0	0.444	-63.1
2.2	0.374	-142.5	3.155	72.7	0.097	58.1	0.438	-65.3
2.3	0.370	-145.8	3.035	70.3	0.100	59.4	0.435	-67.2
2.4	0.367	-148.6	2.928	68.1	0.103	60.6	0.429	-69.3
2.5	0.366	-152.1	2.833	66.1	0.107	61.8	0.425	-71.3
2.6	0.361	-154.9	2.724	64.1	0.111	63.1	0.422	-73.5
2.7	0.358	-158.5	2.634	61.8	0.115	64.4	0.421	-75.4
2.8	0.361	-161.0	2.563	59.5	0.121	65.4	0.421	-77.6
2.9	0.360	-163.8	2.504	57.5	0.125	67.0	0.417	-79.0
3.0	0.361	-166.8	2.428	55.7	0.130	67.9	0.414	-81.3
4.0	0.428	172.6	1.871	37.8	0.213	68.9	0.365	-107.9
5.0	0.552	159.7	1.458	17.2	0.317	50.2	0.312	-145.9

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

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.766	-11.3	13.912	168.1	0.013	79.8	0.968	-7.4
0.2	0.736	-24.0	13.080	157.4	0.022	77.6	0.930	-14.6
0.3	0.681	-35.5	12.387	148.3	0.032	71.8	0.879	-20.8
0.4	0.635	-46.8	11.598	139.1	0.039	67.2	0.821	-26.2
0.5	0.574	-56.6	10.628	131.4	0.046	63.7	0.762	-30.6
0.6	0.529	-65.6	9.782	124.7	0.051	61.1	0.705	-34.3
0.7	0.483	-74.5	8.986	118.6	0.056	59.6	0.653	-37.3
0.8	0.445	-82.9	8.274	113.4	0.060	58.2	0.607	-39.8
0.9	0.416	-90.5	7.639	108.6	0.063	57.4	0.569	-42.0
1.0	0.391	-97.9	7.066	104.3	0.066	57.1	0.533	-44.1
1.1	0.372	-104.6	6.569	100.5	0.070	57.1	0.503	-45.7
1.2	0.356	-110.5	6.124	97.1	0.073	57.2	0.475	-47.4
1.3	0.345	-116.1	5.734	93.6	0.076	57.6	0.452	-48.9
1.4	0.337	-121.5	5.372	90.7	0.079	58.1	0.434	-50.6
1.5	0.330	-126.1	5.069	87.8	0.082	59.0	0.417	-52.3
1.6	0.325	-130.8	4.793	85.1	0.085	59.6	0.402	-54.0
1.7	0.316	-134.4	4.541	82.4	0.088	60.4	0.390	-55.8
1.8	0.313	-137.9	4.319	80.1	0.092	61.2	0.380	-57.5
1.9	0.311	-140.8	4.114	77.8	0.095	61.9	0.371	-59.3
2.0	0.309	-143.8	3.932	75.6	0.099	62.9	0.364	-61.0
2.1	0.303	-147.2	3.765	73.5	0.103	63.4	0.358	-62.9
2.2	0.300	-150.2	3.626	71.3	0.107	64.1	0.353	-65.0
2.3	0.296	-152.7	3.488	69.2	0.111	64.6	0.351	-66.9
2.4	0.295	-155.9	3.358	67.1	0.116	65.0	0.346	-68.9
2.5	0.293	-158.8	3.241	65.4	0.120	65.4	0.344	-70.8
2.6	0.293	-162.2	3.114	63.3	0.125	65.9	0.341	-72.8
2.7	0.294	-165.4	3.005	61.2	0.131	66.4	0.341	-74.6
2.8	0.295	-167.7	2.923	59.2	0.136	66.6	0.340	-76.7
2.9	0.296	-170.1	2.853	57.3	0.141	67.4	0.338	-78.1
3.0	0.295	-173.0	2.760	55.7	0.146	67.5	0.335	-80.1
4.0	0.372	170.5	2.118	39.1	0.223	65.1	0.284	-107.0
5.0	0.507	160.6	1.662	20.5	0.314	47.7	0.246	-143.8

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

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.697	-14.5	17.553	166.2	0.012	84.3	0.953	-8.9
0.2	0.654	-27.9	16.248	154.0	0.021	76.3	0.904	-17.2
0.3	0.601	-40.4	15.037	143.8	0.030	70.4	0.837	-24.0
0.4	0.545	-52.5	13.728	134.2	0.037	67.8	0.766	-29.6
0.5	0.482	-62.8	12.356	126.3	0.043	64.9	0.698	-33.7
0.6	0.436	-72.1	11.174	119.8	0.048	62.8	0.639	-37.1
0.7	0.394	-81.3	10.094	114.1	0.052	61.9	0.585	-39.8
0.8	0.364	-89.7	9.213	109.1	0.056	61.5	0.541	-42.0
0.9	0.339	-97.6	8.434	104.7	0.060	61.2	0.502	-43.7
1.0	0.320	-105.0	7.740	100.8	0.063	61.4	0.469	-45.3
1.1	0.306	-112.0	7.160	97.2	0.067	61.6	0.441	-46.7
1.2	0.294	-118.0	6.649	94.2	0.071	62.1	0.417	-48.0
1.3	0.286	-123.5	6.204	91.2	0.075	62.7	0.396	-49.5
1.4	0.282	-128.3	5.812	88.3	0.079	63.0	0.378	-51.0
1.5	0.278	-132.9	5.465	85.8	0.083	63.6	0.363	-52.5
1.6	0.277	-137.7	5.155	83.3	0.087	64.1	0.349	-54.1
1.7	0.275	-140.7	4.878	80.8	0.091	64.6	0.338	-55.7
1.8	0.269	-144.2	4.630	78.6	0.095	65.2	0.329	-57.3
1.9	0.269	-147.4	4.402	76.4	0.100	65.6	0.322	-59.1
2.0	0.272	-149.4	4.206	74.4	0.104	66.0	0.315	-60.9
2.1	0.266	-152.7	4.020	72.5	0.109	66.3	0.310	-62.7
2.2	0.263	-155.8	3.868	70.4	0.113	66.4	0.306	-64.8
2.3	0.260	-159.1	3.714	68.4	0.118	66.5	0.304	-66.5
2.4	0.259	-161.4	3.576	66.5	0.123	66.7	0.300	-68.7
2.5	0.262	-164.5	3.446	64.9	0.128	66.7	0.299	-70.5
2.6	0.260	-167.2	3.319	63.1	0.133	66.8	0.296	-72.7
2.7	0.258	-170.3	3.195	61.2	0.139	67.0	0.296	-74.4
2.8	0.262	-172.6	3.103	59.3	0.145	66.8	0.296	-76.5
2.9	0.263	-174.8	3.029	57.6	0.150	67.3	0.293	-77.7
3.0	0.266	-177.1	2.932	55.9	0.155	67.2	0.291	-79.9
4.0	0.346	168.6	2.243	40.3	0.230	63.1	0.241	-107.9
5.0	0.485	160.5	1.761	22.7	0.313	46.0	0.208	-144.4

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

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.611	-16.9	21.835	163.8	0.011	76.4	0.935	-10.6
0.2	0.565	-32.0	19.735	150.0	0.020	75.8	0.868	-20.1
0.3	0.497	-45.9	17.767	139.1	0.028	71.6	0.785	-27.3
0.4	0.445	-58.7	15.782	129.1	0.034	67.6	0.704	-32.9
0.5	0.388	-69.6	13.915	121.5	0.040	66.6	0.631	-36.7
0.6	0.345	-79.0	12.371	115.2	0.044	65.4	0.569	-39.6
0.7	0.309	-89.1	11.063	110.0	0.049	65.0	0.519	-41.8
0.8	0.286	-98.0	9.996	105.2	0.054	65.3	0.476	-43.6
0.9	0.268	-106.1	9.076	101.2	0.058	65.3	0.442	-44.9
1.0	0.257	-113.2	8.292	97.7	0.062	65.7	0.411	-46.3
1.1	0.250	-120.6	7.645	94.5	0.067	66.1	0.385	-47.5
1.2	0.245	-126.5	7.080	91.7	0.071	66.5	0.362	-48.6
1.3	0.239	-132.1	6.587	88.9	0.076	66.7	0.343	-49.9
1.4	0.239	-136.6	6.142	86.3	0.080	67.1	0.327	-51.2
1.5	0.238	-140.9	5.772	84.0	0.085	67.4	0.313	-52.6
1.6	0.238	-145.4	5.439	81.6	0.089	67.6	0.301	-54.2
1.7	0.236	-148.3	5.136	79.4	0.094	68.0	0.291	-55.7
1.8	0.237	-150.8	4.878	77.4	0.099	68.2	0.283	-57.3
1.9	0.236	-154.1	4.628	75.4	0.104	68.3	0.277	-59.1
2.0	0.237	-155.8	4.424	73.6	0.109	68.2	0.271	-60.8
2.1	0.233	-159.4	4.227	71.8	0.114	68.3	0.267	-62.6
2.2	0.233	-162.0	4.062	69.7	0.119	68.1	0.263	-64.8
2.3	0.232	-164.1	3.900	67.9	0.125	68.0	0.262	-66.6
2.4	0.233	-166.8	3.751	66.2	0.130	67.9	0.259	-68.7
2.5	0.234	-170.0	3.619	64.6	0.135	67.7	0.257	-70.5
2.6	0.234	-172.6	3.483	62.8	0.141	67.4	0.256	-72.8
2.7	0.233	-175.3	3.351	61.1	0.147	67.3	0.256	-74.5
2.8	0.238	-178.1	3.256	59.2	0.153	67.1	0.256	-76.6
2.9	0.240	-179.0	3.173	57.5	0.158	67.2	0.254	-77.9
3.0	0.243	178.2	3.069	56.0	0.164	66.8	0.252	-80.1
4.0	0.325	166.7	2.337	41.1	0.236	61.5	0.201	-109.7
5.0	0.463	160.2	1.834	24.5	0.314	44.4	0.174	-146.6

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

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.428	-23.4	29.961	159.0	0.010	83.9	0.884	-14.2
0.2	0.373	-41.7	25.683	142.5	0.018	74.9	0.782	-25.8
0.3	0.317	-58.5	21.883	130.7	0.025	72.6	0.675	-33.2
0.4	0.273	-73.0	18.582	120.9	0.031	71.5	0.585	-38.2
0.5	0.236	-85.5	15.880	113.9	0.036	71.2	0.513	-41.1
0.6	0.211	-96.8	13.809	108.3	0.041	71.2	0.457	-43.2
0.7	0.194	-108.3	12.158	103.6	0.047	71.4	0.411	-44.6
0.8	0.186	-118.2	10.857	99.6	0.052	71.7	0.374	-45.8
0.9	0.182	-126.0	9.781	96.2	0.057	71.7	0.344	-46.8
1.0	0.181	-133.6	8.877	93.2	0.062	71.9	0.318	-47.8
1.1	0.183	-140.6	8.151	90.5	0.068	71.9	0.297	-48.7
1.2	0.186	-145.8	7.525	88.1	0.073	72.3	0.278	-49.7
1.3	0.190	-150.9	6.978	85.6	0.079	71.9	0.262	-50.9
1.4	0.194	-153.9	6.493	83.4	0.084	71.9	0.248	-52.2
1.5	0.198	-157.2	6.097	81.3	0.090	71.8	0.237	-53.6
1.6	0.202	-160.9	5.728	79.3	0.095	71.5	0.227	-55.2
1.7	0.202	-163.3	5.406	77.2	0.101	71.4	0.218	-56.9
1.8	0.205	-165.7	5.122	75.5	0.106	71.0	0.212	-58.6
1.9	0.206	-167.7	4.860	73.8	0.112	71.0	0.207	-60.3
2.0	0.208	-168.6	4.642	72.1	0.118	70.5	0.202	-62.4
2.1	0.208	-172.3	4.432	70.4	0.123	70.1	0.199	-64.3
2.2	0.207	-174.4	4.256	68.7	0.129	69.8	0.197	-66.7
2.3	0.208	-176.5	4.083	66.9	0.135	69.3	0.195	-68.6
2.4	0.209	-179.0	3.925	65.3	0.141	68.7	0.194	-71.0
2.5	0.212	178.9	3.780	63.9	0.147	68.2	0.193	-73.0
2.6	0.214	176.6	3.637	62.3	0.153	67.6	0.192	-75.5
2.7	0.215	174.1	3.503	60.6	0.159	67.3	0.192	-77.5
2.8	0.218	172.0	3.399	59.0	0.165	66.7	0.192	-79.8
2.9	0.222	171.1	3.304	57.4	0.171	66.5	0.190	-81.1
3.0	0.224	168.9	3.195	55.9	0.176	65.9	0.190	-83.5
4.0	0.309	162.0	2.423	41.9	0.248	58.8	0.144	-119.6
5.0	0.444	157.3	1.886	26.8	0.317	41.7	0.131	-159.9

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

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.952	-6.1	3.476	173.7	0.011	87.4	0.996	-2.9
0.2	0.939	-12.5	3.416	168.6	0.021	81.5	0.990	-6.1
0.3	0.924	-19.1	3.414	163.5	0.031	76.6	0.979	-9.1
0.4	0.913	-25.7	3.403	157.4	0.041	73.1	0.968	-12.2
0.5	0.891	-32.4	3.339	151.8	0.050	69.1	0.954	-15.1
0.6	0.870	-38.9	3.286	146.4	0.058	64.7	0.937	-18.2
0.7	0.842	-46.0	3.213	140.9	0.066	60.8	0.918	-21.0
0.8	0.819	-52.7	3.152	135.6	0.072	57.2	0.897	-23.9
0.9	0.794	-59.3	3.075	130.4	0.077	53.5	0.878	-26.8
1.0	0.769	-65.8	2.983	125.3	0.081	50.1	0.856	-29.6
1.1	0.745	-72.3	2.888	120.4	0.084	47.1	0.836	-32.2
1.2	0.722	-78.0	2.790	116.2	0.086	44.3	0.814	-34.8
1.3	0.701	-83.9	2.699	111.6	0.087	41.9	0.795	-37.5
1.4	0.682	-89.5	2.591	107.3	0.087	40.0	0.777	-40.1
1.5	0.665	-94.8	2.505	103.2	0.087	38.5	0.761	-42.6
1.6	0.649	-99.9	2.425	99.3	0.085	37.4	0.746	-45.2
1.7	0.635	-104.5	2.334	95.2	0.084	36.9	0.732	-47.7
1.8	0.624	-108.9	2.249	91.7	0.082	36.9	0.721	-50.2
1.9	0.611	-113.1	2.173	88.3	0.079	37.5	0.710	-52.6
2.0	0.603	-116.8	2.104	85.3	0.077	38.6	0.698	-55.2
2.1	0.588	-121.1	2.038	82.1	0.074	40.1	0.690	-57.6
2.2	0.582	-125.0	1.982	79.1	0.071	42.5	0.684	-60.3
2.3	0.570	-128.8	1.918	76.2	0.069	45.5	0.678	-62.6
2.4	0.562	-132.3	1.860	73.5	0.068	49.1	0.672	-65.0
2.5	0.560	-136.4	1.810	70.8	0.068	53.6	0.666	-67.4
2.6	0.552	-139.8	1.745	68.2	0.068	59.0	0.661	-70.0
2.7	0.547	-143.6	1.693	65.5	0.070	64.3	0.659	-72.2
2.8	0.546	-146.8	1.655	62.7	0.073	69.6	0.659	-74.7
2.9	0.540	-150.4	1.629	60.1	0.077	75.2	0.654	-76.3
3.0	0.538	-153.7	1.579	58.0	0.082	79.8	0.649	-78.9
4.0	0.566	177.0	1.234	37.4	0.199	87.7	0.601	-107.0
5.0	0.638	157.6	0.955	15.3	0.345	59.3	0.479	-148.8

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

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.873	-8.6	9.284	171.0	0.011	89.2	0.985	-4.8
0.2	0.835	-17.7	8.953	163.0	0.020	78.4	0.966	-9.8
0.3	0.806	-26.9	8.719	155.7	0.029	74.3	0.939	-14.2
0.4	0.771	-35.2	8.437	147.8	0.037	69.7	0.905	-18.6
0.5	0.724	-43.8	8.004	140.8	0.044	66.2	0.867	-22.4
0.6	0.680	-51.6	7.599	134.4	0.050	62.5	0.827	-25.9
0.7	0.636	-59.9	7.170	128.4	0.055	59.7	0.787	-28.8
0.8	0.596	-67.1	6.784	122.8	0.059	57.4	0.748	-31.6
0.9	0.561	-74.4	6.399	117.6	0.062	55.4	0.713	-34.1
1.0	0.528	-81.0	6.017	112.8	0.064	54.3	0.680	-36.2
1.1	0.500	-87.5	5.679	108.5	0.066	53.4	0.651	-38.4
1.2	0.476	-93.5	5.347	104.7	0.068	52.8	0.624	-40.2
1.3	0.456	-99.1	5.065	100.6	0.070	52.8	0.600	-42.1
1.4	0.440	-104.2	4.769	97.2	0.071	53.2	0.579	-43.9
1.5	0.426	-109.1	4.541	93.9	0.073	53.9	0.561	-45.8
1.6	0.412	-113.8	4.318	90.7	0.074	54.8	0.545	-47.6
1.7	0.403	-117.6	4.117	87.6	0.076	56.0	0.531	-49.5
1.8	0.394	-121.7	3.927	84.9	0.078	57.3	0.521	-51.4
1.9	0.386	-124.8	3.755	82.3	0.079	58.8	0.510	-53.3
2.0	0.380	-128.3	3.604	79.9	0.081	60.3	0.501	-55.0
2.1	0.370	-131.6	3.460	77.4	0.083	62.0	0.495	-57.0
2.2	0.364	-134.9	3.340	75.0	0.086	63.5	0.489	-59.1
2.3	0.357	-138.1	3.214	72.6	0.089	64.8	0.485	-60.9
2.4	0.352	-141.3	3.105	70.4	0.092	66.4	0.480	-62.9
2.5	0.350	-144.5	2.998	68.4	0.096	68.0	0.476	-64.7
2.6	0.345	-147.7	2.887	66.3	0.100	69.3	0.473	-66.9
2.7	0.342	-151.3	2.787	64.0	0.105	70.8	0.472	-68.6
2.8	0.340	-153.8	2.715	61.7	0.110	72.1	0.472	-70.6
2.9	0.342	-156.9	2.657	59.7	0.115	73.8	0.469	-71.8
3.0	0.340	-159.7	2.574	57.8	0.119	74.6	0.465	-74.0
4.0	0.402	178.1	1.993	39.8	0.206	75.6	0.417	-98.5
5.0	0.538	165.0	1.576	18.6	0.319	55.8	0.358	-134.4

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

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.779	-10.5	13.917	168.8	0.010	85.6	0.973	-6.3
0.2	0.746	-22.0	13.213	158.7	0.019	75.8	0.942	-12.6
0.3	0.701	-31.9	12.534	150.2	0.027	73.7	0.897	-17.9
0.4	0.653	-41.9	11.812	141.3	0.034	69.1	0.846	-22.7
0.5	0.595	-51.1	10.927	133.6	0.040	66.4	0.795	-26.5
0.6	0.545	-59.1	10.101	127.1	0.044	63.3	0.742	-29.8
0.7	0.498	-67.4	9.326	121.2	0.049	61.8	0.695	-32.4
0.8	0.461	-74.8	8.643	115.8	0.052	60.9	0.653	-34.7
0.9	0.427	-82.1	8.006	111.0	0.055	60.0	0.616	-36.7
1.0	0.398	-88.4	7.437	106.7	0.058	59.8	0.583	-38.4
1.1	0.374	-95.0	6.931	102.8	0.061	59.9	0.555	-39.9
1.2	0.356	-101.0	6.476	99.4	0.064	60.2	0.528	-41.3
1.3	0.341	-106.4	6.077	95.9	0.067	60.8	0.507	-42.7
1.4	0.328	-110.9	5.698	92.8	0.069	61.4	0.488	-44.1
1.5	0.320	-115.6	5.390	90.1	0.072	62.4	0.473	-45.7
1.6	0.311	-120.3	5.108	87.3	0.075	63.2	0.458	-47.3
1.7	0.303	-124.2	4.840	84.6	0.078	64.2	0.445	-48.8
1.8	0.299	-127.3	4.603	82.2	0.082	65.0	0.436	-50.4
1.9	0.293	-130.9	4.391	79.9	0.085	66.1	0.428	-52.0
2.0	0.290	-133.8	4.206	77.7	0.088	67.0	0.421	-53.6
2.1	0.282	-137.2	4.027	75.5	0.092	67.9	0.415	-55.4
2.2	0.277	-140.0	3.880	73.4	0.096	68.5	0.410	-57.3
2.3	0.273	-143.2	3.726	71.3	0.100	69.0	0.408	-59.0
2.4	0.271	-146.0	3.589	69.3	0.104	69.9	0.404	-60.8
2.5	0.267	-149.3	3.468	67.5	0.109	70.4	0.400	-62.6
2.6	0.267	-152.4	3.336	65.6	0.114	70.9	0.398	-64.6
2.7	0.265	-154.8	3.221	63.6	0.119	71.6	0.398	-66.2
2.8	0.265	-158.0	3.132	61.6	0.125	72.0	0.398	-68.2
2.9	0.265	-160.6	3.055	59.7	0.130	72.8	0.395	-69.3
3.0	0.267	-163.6	2.962	58.1	0.134	73.1	0.393	-71.4
4.0	0.338	177.8	2.284	41.7	0.214	71.2	0.341	-94.9
5.0	0.485	168.0	1.819	22.8	0.311	53.3	0.296	-128.4

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

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.715	-12.6	17.576	167.0	0.009	82.2	0.962	-7.6
0.2	0.678	-24.4	16.393	155.5	0.018	78.5	0.920	-14.6
0.3	0.622	-35.9	15.295	145.9	0.025	72.7	0.862	-20.5
0.4	0.565	-46.2	14.103	136.5	0.032	69.3	0.799	-25.4
0.5	0.504	-55.6	12.794	128.9	0.037	66.8	0.738	-29.1
0.6	0.457	-63.9	11.622	122.3	0.041	65.3	0.684	-32.0
0.7	0.410	-71.8	10.579	116.6	0.046	64.0	0.635	-34.1
0.8	0.375	-79.4	9.702	111.5	0.049	64.0	0.593	-36.1
0.9	0.345	-86.3	8.914	107.1	0.053	63.8	0.558	-37.5
1.0	0.320	-92.9	8.205	103.2	0.056	64.1	0.525	-38.9
1.1	0.302	-99.7	7.608	99.7	0.060	64.5	0.499	-40.2
1.2	0.288	-105.5	7.081	96.4	0.063	64.9	0.476	-41.3
1.3	0.277	-111.2	6.629	93.4	0.066	65.5	0.455	-42.5
1.4	0.268	-115.4	6.199	90.6	0.070	66.0	0.437	-43.7
1.5	0.261	-119.9	5.843	87.9	0.074	66.9	0.423	-45.1
1.6	0.257	-124.9	5.515	85.5	0.077	67.2	0.410	-46.5
1.7	0.251	-128.4	5.237	82.9	0.081	68.1	0.399	-47.9
1.8	0.247	-131.3	4.963	80.7	0.085	68.7	0.391	-49.3
1.9	0.243	-134.8	4.726	78.6	0.089	69.3	0.384	-50.9
2.0	0.244	-137.4	4.522	76.7	0.093	69.8	0.377	-52.4
2.1	0.236	-140.6	4.328	74.7	0.098	70.1	0.372	-54.1
2.2	0.234	-143.5	4.163	72.6	0.102	70.5	0.367	-56.0
2.3	0.230	-146.3	3.999	70.7	0.106	70.8	0.366	-57.6
2.4	0.227	-148.8	3.848	68.8	0.111	71.0	0.363	-59.4
2.5	0.227	-152.6	3.713	67.1	0.116	71.2	0.360	-61.1
2.6	0.225	-155.1	3.567	65.4	0.121	71.4	0.358	-63.1
2.7	0.224	-158.3	3.440	63.5	0.127	71.6	0.358	-64.7
2.8	0.224	-161.1	3.348	61.5	0.132	71.7	0.358	-66.6
2.9	0.225	-163.8	3.264	59.8	0.137	72.3	0.355	-67.7
3.0	0.226	-166.3	3.162	58.2	0.142	72.3	0.353	-69.7
4.0	0.304	176.9	2.428	42.8	0.218	68.9	0.299	-93.1
5.0	0.457	168.5	1.940	24.8	0.308	51.7	0.261	-125.6

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

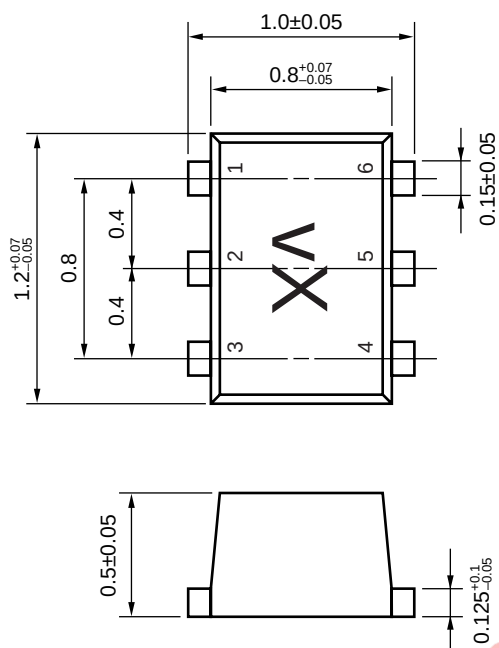
Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.637	-14.8	21.965	164.8	0.010	83.2	0.948	-8.9
0.2	0.587	-27.8	20.062	151.7	0.017	78.8	0.889	-17.0
0.3	0.526	-39.9	18.254	141.3	0.024	73.0	0.817	-23.2
0.4	0.471	-50.7	16.367	131.6	0.029	70.4	0.745	-27.9
0.5	0.408	-59.7	14.570	124.0	0.035	68.7	0.679	-31.1
0.6	0.365	-68.0	13.041	117.7	0.039	67.8	0.622	-33.6
0.7	0.324	-76.1	11.704	112.4	0.043	67.6	0.574	-35.4
0.8	0.292	-83.8	10.634	107.7	0.047	67.6	0.534	-36.8
0.9	0.270	-90.8	9.697	103.6	0.051	67.9	0.501	-38.0
1.0	0.250	-97.8	8.878	100.0	0.055	68.4	0.471	-39.1
1.1	0.236	-104.3	8.203	96.8	0.059	68.6	0.447	-40.0
1.2	0.226	-110.4	7.593	93.9	0.063	69.2	0.426	-40.8
1.3	0.219	-116.3	7.089	91.1	0.067	69.7	0.408	-41.8
1.4	0.215	-120.8	6.617	88.4	0.071	70.1	0.392	-42.8
1.5	0.212	-125.0	6.234	86.2	0.076	70.5	0.380	-44.1
1.6	0.207	-129.8	5.878	83.9	0.080	70.8	0.367	-45.3
1.7	0.204	-133.1	5.564	81.5	0.084	71.2	0.358	-46.7
1.8	0.203	-135.6	5.279	79.6	0.089	71.4	0.350	-48.0
1.9	0.201	-139.3	5.017	77.5	0.093	71.7	0.344	-49.5
2.0	0.202	-142.3	4.776	75.6	0.098	71.9	0.338	-51.0
2.1	0.194	-145.2	4.573	73.8	0.102	72.0	0.333	-52.7
2.2	0.195	-147.9	4.406	71.9	0.107	71.9	0.330	-54.6
2.3	0.193	-150.6	4.229	70.0	0.112	71.9	0.329	-56.1
2.4	0.190	-153.7	4.067	68.3	0.117	71.9	0.326	-58.0
2.5	0.191	-156.5	3.920	66.8	0.123	71.8	0.323	-59.6
2.6	0.189	-159.7	3.771	65.0	0.128	71.7	0.322	-61.6
2.7	0.190	-162.4	3.637	63.3	0.134	71.7	0.322	-63.2
2.8	0.189	-164.8	3.530	61.5	0.139	71.5	0.322	-65.0
2.9	0.193	-167.3	3.439	59.9	0.144	71.8	0.320	-66.2
3.0	0.194	-169.6	3.331	58.4	0.150	71.5	0.318	-68.2
4.0	0.275	176.0	2.552	43.6	0.223	67.1	0.262	-91.7
5.0	0.430	169.3	2.036	27.1	0.306	50.3	0.228	-123.4

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

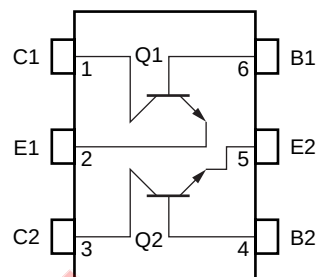
Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.465	-18.5	30.468	160.3	0.008	84.6	0.909	-11.5
0.2	0.412	-33.3	26.532	144.8	0.015	76.9	0.821	-21.2
0.3	0.352	-46.4	22.972	133.3	0.021	74.2	0.726	-27.4
0.4	0.299	-57.7	19.710	123.6	0.026	73.8	0.643	-31.4
0.5	0.248	-66.8	17.017	116.4	0.031	73.7	0.578	-33.7
0.6	0.219	-74.6	14.874	110.9	0.036	73.7	0.525	-35.2
0.7	0.191	-83.7	13.151	106.2	0.041	74.1	0.481	-36.1
0.8	0.176	-92.3	11.784	102.1	0.046	74.1	0.447	-36.8
0.9	0.162	-100.2	10.656	98.7	0.050	74.3	0.419	-37.4
1.0	0.152	-108.1	9.689	95.6	0.055	74.6	0.394	-38.0
1.1	0.149	-115.6	8.916	92.8	0.060	74.6	0.374	-38.6
1.2	0.145	-122.6	8.232	90.4	0.064	74.8	0.356	-39.1
1.3	0.142	-127.6	7.650	88.0	0.070	74.6	0.341	-39.9
1.4	0.143	-132.6	7.133	85.7	0.075	74.8	0.328	-40.8
1.5	0.146	-136.6	6.697	83.6	0.080	74.7	0.317	-41.9
1.6	0.147	-141.8	6.306	81.7	0.084	74.8	0.307	-43.2
1.7	0.148	-144.3	5.966	79.5	0.090	74.6	0.299	-44.3
1.8	0.148	-146.9	5.653	77.8	0.095	74.4	0.292	-45.6
1.9	0.148	-149.6	5.370	76.1	0.100	74.2	0.287	-47.1
2.0	0.150	-151.3	5.109	74.4	0.105	73.9	0.282	-48.7
2.1	0.147	-154.5	4.885	72.7	0.110	73.6	0.279	-50.3
2.2	0.149	-157.1	4.692	71.0	0.116	73.4	0.276	-52.2
2.3	0.148	-159.5	4.495	69.3	0.121	73.0	0.276	-53.8
2.4	0.149	-162.6	4.322	67.7	0.126	72.5	0.273	-55.7
2.5	0.149	-165.4	4.172	66.2	0.132	72.1	0.272	-57.5
2.6	0.146	-168.7	4.011	64.7	0.138	71.8	0.270	-59.5
2.7	0.148	-171.5	3.863	63.1	0.143	71.5	0.271	-61.2
2.8	0.151	-173.6	3.753	61.5	0.149	70.9	0.271	-63.0
2.9	0.154	-175.5	3.647	60.0	0.154	70.9	0.269	-64.2
3.0	0.158	-178.1	3.532	58.6	0.160	70.6	0.268	-66.2
4.0	0.243	173.1	2.692	44.9	0.231	64.6	0.209	-90.6
5.0	0.396	169.0	2.137	30.1	0.306	47.9	0.179	-122.2

PACKAGE DIMENSIONS

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



(Top View)



PIN CONNECTIONS

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

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► **Business issue**

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