DATA SHEET

NEC

NPN SILICON RF TWIN TRANSISTOR

μPA851TD

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

FEATURES

- Low voltage operation
- 2 different built-in transistors (2SC5737, 2SC5736)

  Q1: Low noise transistor

  NF = 1.5 dB TYP. @ V_{CE} = 1 V, I_C = 3 mA, f = 2 GHz

  Q2: Low phase distortion transistor suited for OSC applications

  f_T = 5.0 GHz TYP., $|S_{21e}|^2$ = 4.5 dB TYP. @ V_{CE} = 1 V, I_C = 5 mA, f = 2 GHz
- 6-pin lead-less minimold package

BUILT-IN TRANSISTORS

	Q1	Q2
3-pin thin-type ultra super minimold part No.	2SC5737	2SC5736

ORDERING INFORMATION

Part Number	Quantity	Supplying Form
μPA851TD	50 pcs (Non reel)	• 8 mm wide embossed taping
μPA851TD-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.

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.

Document No. PU10056EJ01V0DS (1st edition)
Date Published December 2001 CP(K)
Printed in Japan

© NEC Compound Semiconductor Devices 2001

ABSOLUTE MAXIMUM RATINGS (T_A = +25°C)

Parameter	Symbol	Ratings		Unit
		Q1	Q2	
Collector to Base Voltage	V_{CBO}	5	15	V
Collector to Emitter Voltage	V_{CEO}	3	5	V
Emitter to Base Voltage	V_{EBO}	2	3	V
Collector Current	I_C	30	100	mA
Total Power Dissipation	P_{tot} Note	90	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 $cm^2 \times$ 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} = 1 V, I_C = 10 mA	70	110	140	–
Gain Bandwidth Product	f_T	V_{CE} = 1 V, I_C = 10 mA, f = 2 GHz	10.0	12.0	–	GHz
Insertion Power Gain	$\|S_{21e}\|^2$	V_{CE} = 1 V, I_C = 10 mA, f = 2 GHz	7.0	9.0	–	dB
Noise Figure	NF	V_{CE} = 1 V, I_C = 3 mA, f = 2 GHz, $Z_S = Z_{opt}$	–	1.5	2.0	dB
Reverse Transfer Capacitance	C_{re} Note 2	V_{CB} = 0.5 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 = 5 mA	100	112	145	–
Gain Bandwidth Product (1)	f_T	V_{CE} = 1 V, I_C = 5 mA, f = 2 GHz	4.5	5.0	–	GHz
Gain Bandwidth Product (2)	f_T	V_{CE} = 1 V, I_C = 15 mA, f = 2 GHz	5.5	6.5	–	GHz
Insertion Power Gain (1)	$\|S_{21e}\|^2$	V_{CE} = 1 V, I_C = 5 mA, f = 2 GHz	3.5	4.5	–	dB
Insertion Power Gain (2)	$\|S_{21e}\|^2$	V_{CE} = 1 V, I_C = 15 mA, f = 2 GHz	4.5	6.0	–	dB
Noise Figure	NF	V_{CE} = 1 V, I_C = 5 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	0.45	0.59	0.75	pF

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

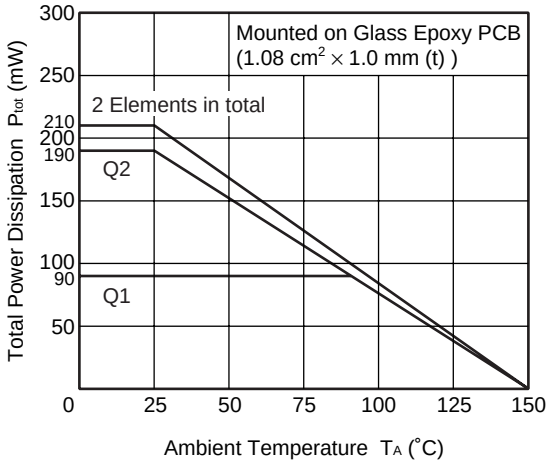
2. Collector to base capacitance when the emitter grounded

h_{FE} CLASSIFICATION

Rank	FB
Marking	vH
h_{FE} Value of Q1	70 to 140
h_{FE} Value of Q2	100 to 145

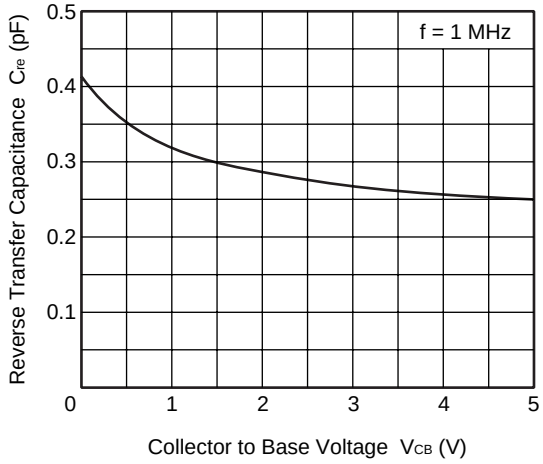
TYPICAL CHARACTERISTICS (Unless otherwise specified, T_A = +25°C)

TOTAL POWER DISSIPATION
vs. AMBIENT TEMPERATURE



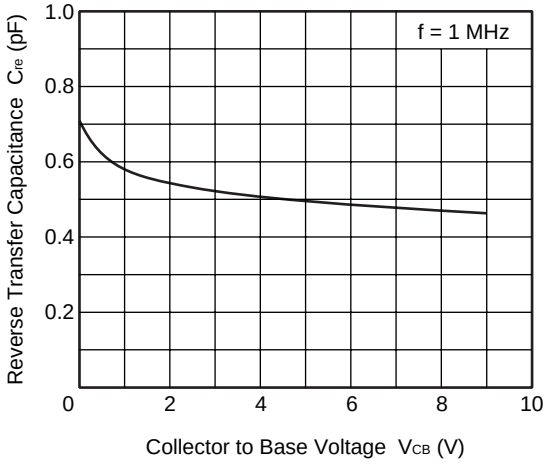
Q1

REVERSE TRANSFER CAPACITANCE
vs. COLLECTOR TO BASE VOLTAGE



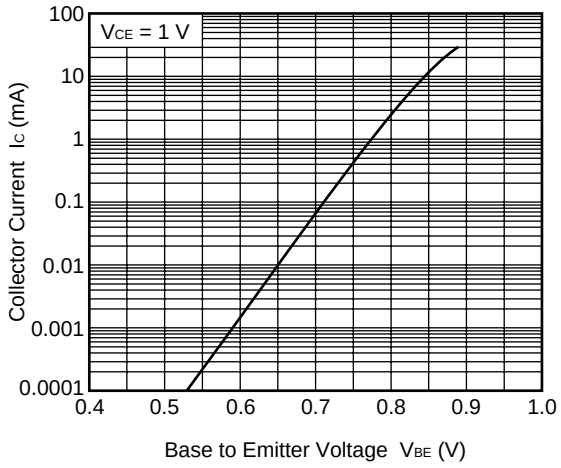
Q2

REVERSE TRANSFER CAPACITANCE
vs. COLLECTOR TO BASE VOLTAGE



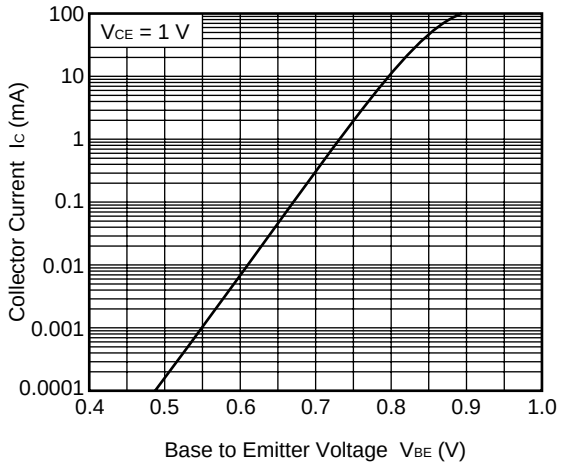
Q1

COLLECTOR CURRENT vs.
BASE TO EMITTER VOLTAGE

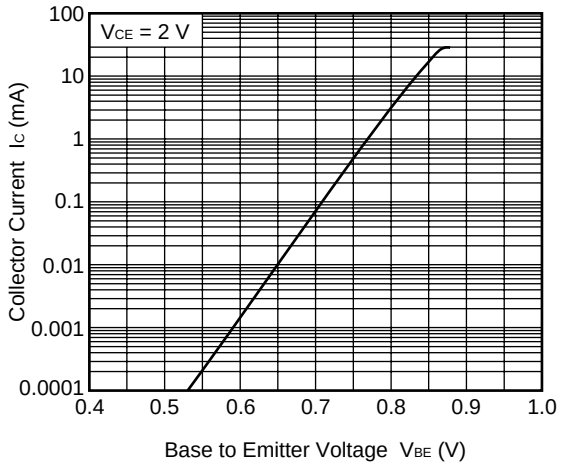


Q2

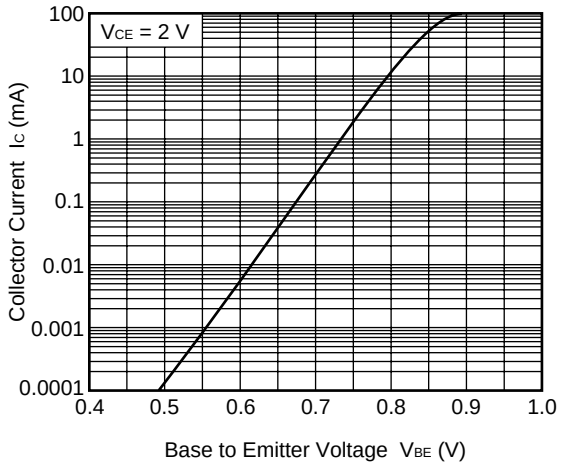
COLLECTOR CURRENT vs.
BASE TO EMITTER VOLTAGE



COLLECTOR CURRENT vs.
BASE TO EMITTER VOLTAGE

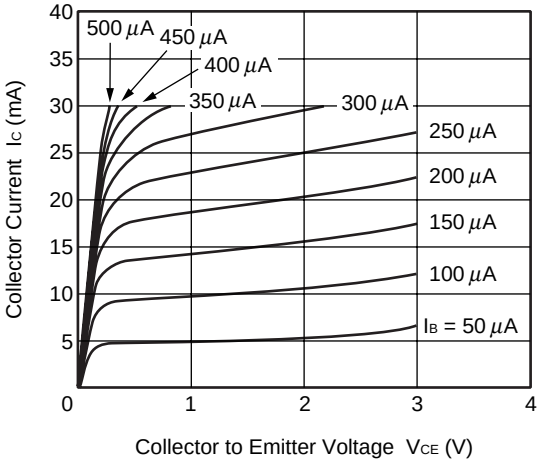


COLLECTOR CURRENT vs.
BASE TO EMITTER VOLTAGE



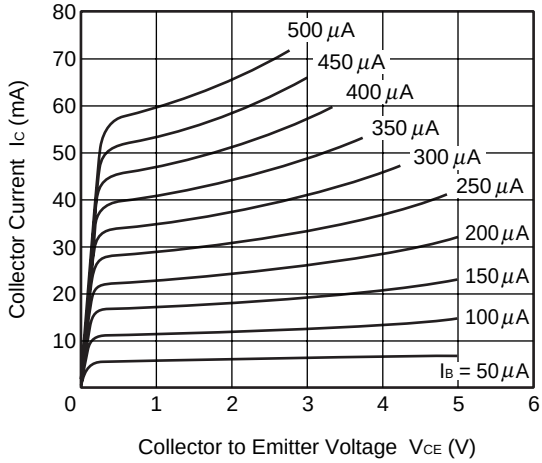
Q1

COLLECTOR CURRENT vs.
COLLECTOR TO EMITTER VOLTAGE



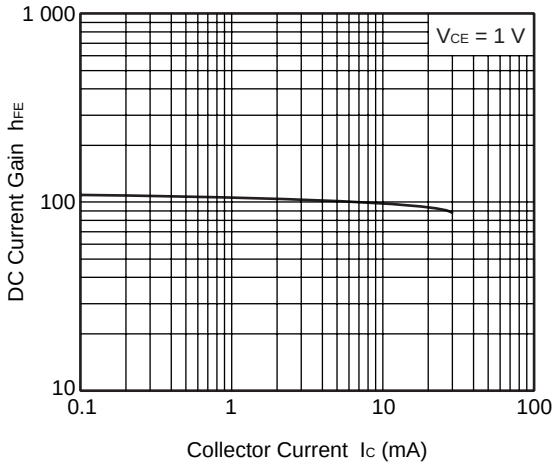
Q2

COLLECTOR CURRENT vs.
COLLECTOR TO EMITTER VOLTAGE



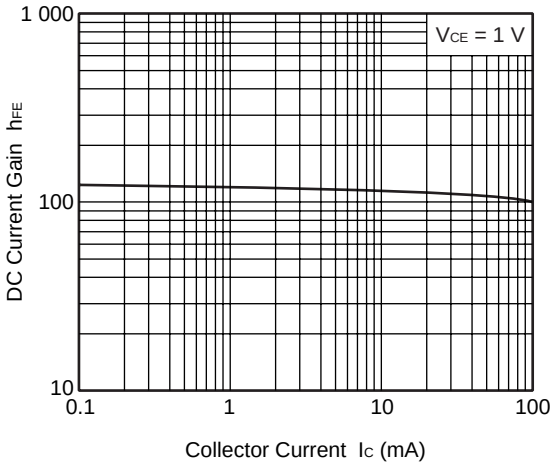
Q1

DC CURRENT GAIN vs.
COLLECTOR CURRENT

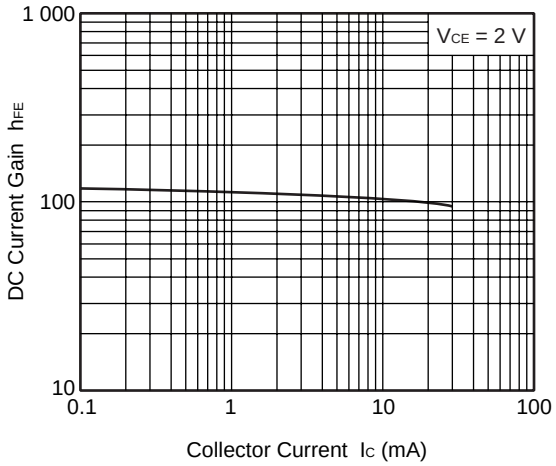


Q2

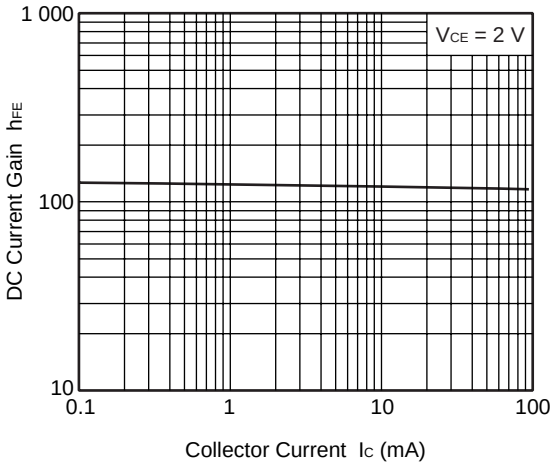
DC CURRENT GAIN vs.
COLLECTOR CURRENT



DC CURRENT GAIN vs.
COLLECTOR CURRENT

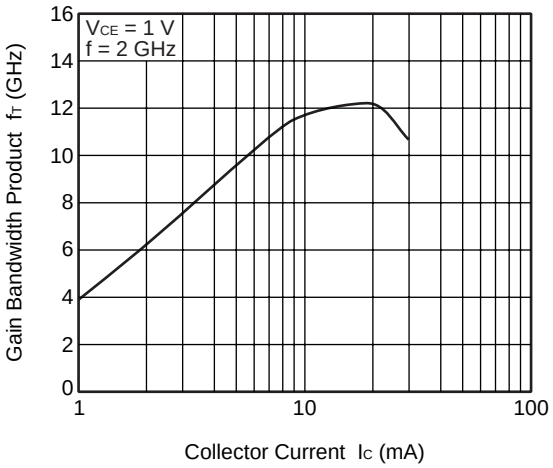


DC CURRENT GAIN vs.
COLLECTOR CURRENT



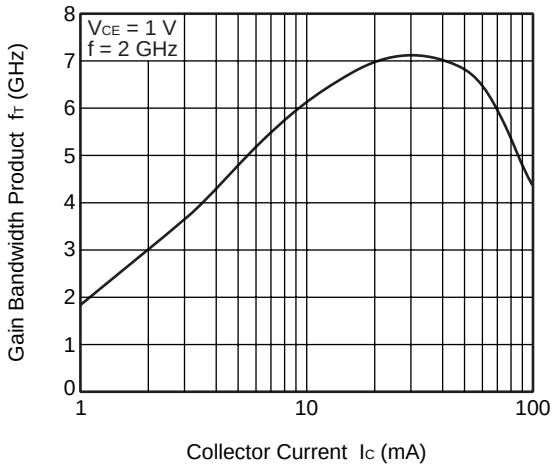
Q1

GAIN BANDWIDTH PRODUCT
vs. COLLECTOR CURRENT

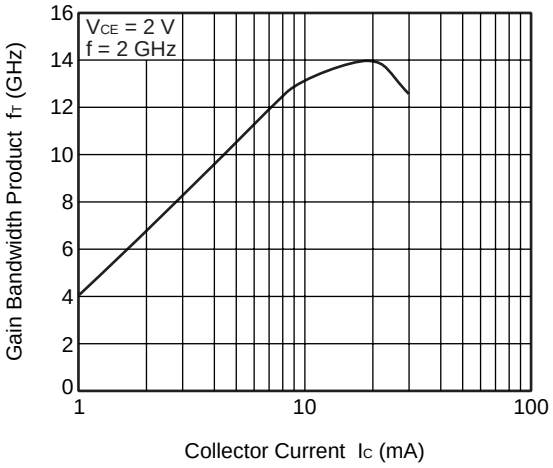


Q2

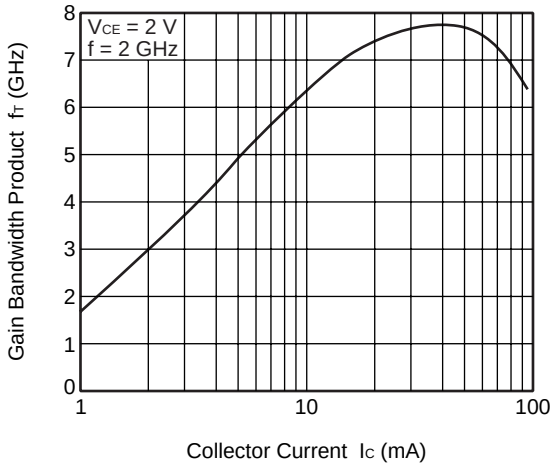
GAIN BANDWIDTH PRODUCT
vs. COLLECTOR CURRENT



GAIN BANDWIDTH PRODUCT
vs. COLLECTOR CURRENT

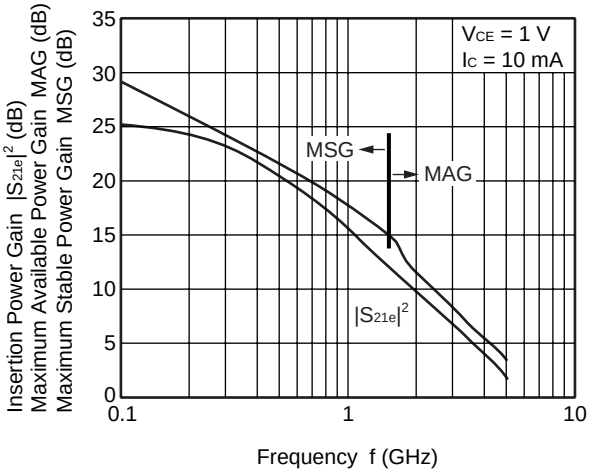


GAIN BANDWIDTH PRODUCT
vs. COLLECTOR CURRENT



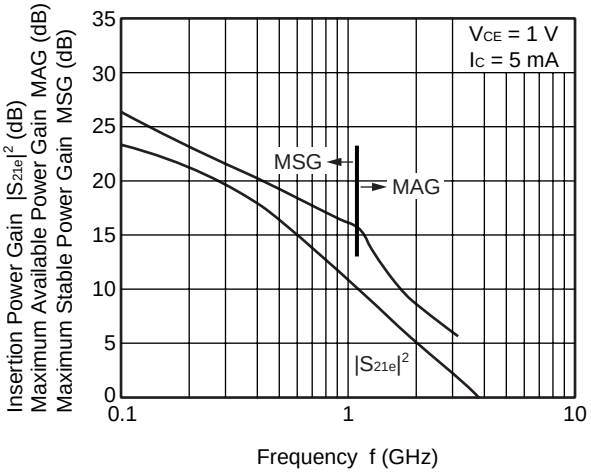
Q1

INSERTION POWER GAIN,
MAG, MSG vs. FREQUENCY

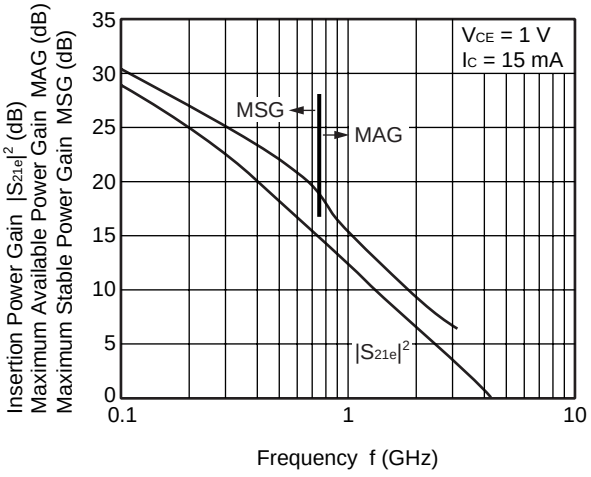


Q2

INSERTION POWER GAIN,
MAG, MSG vs. FREQUENCY

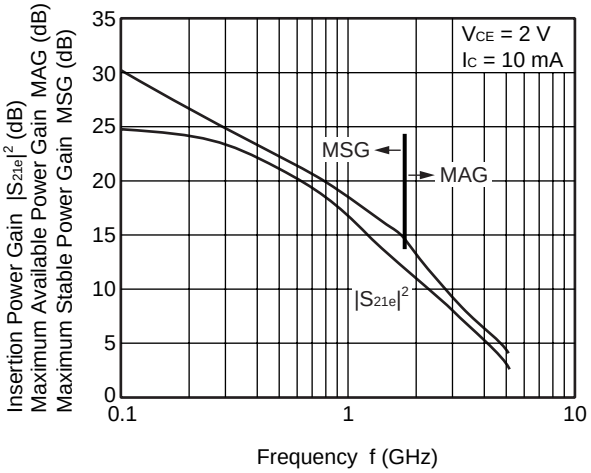


INSERTION POWER GAIN,
MAG, MSG vs. FREQUENCY



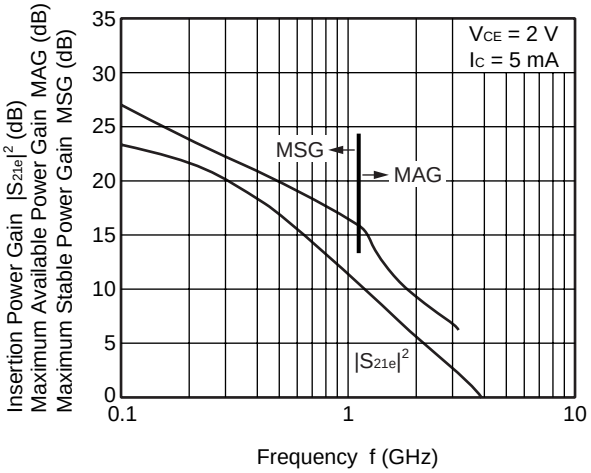
Q1

INSERTION POWER GAIN,
MAG, MSG vs. FREQUENCY

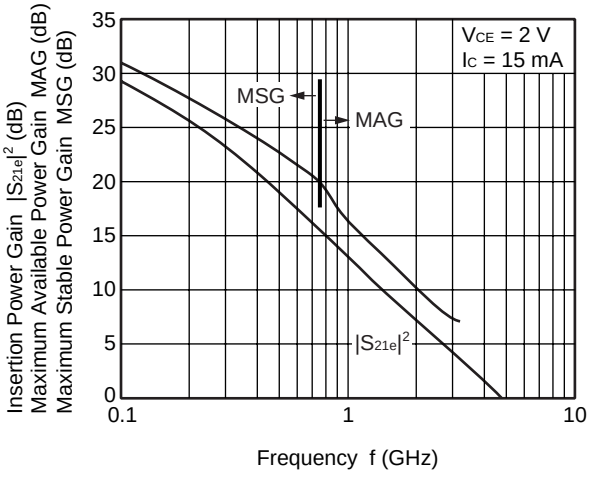


Q2

INSERTION POWER GAIN,
MAG, MSG vs. FREQUENCY

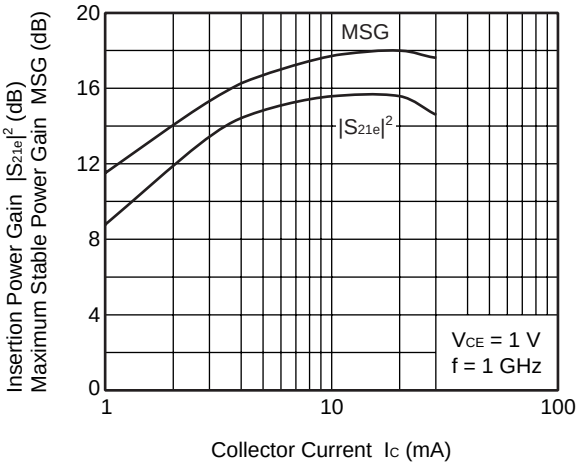


INSERTION POWER GAIN,
MAG, MSG vs. FREQUENCY



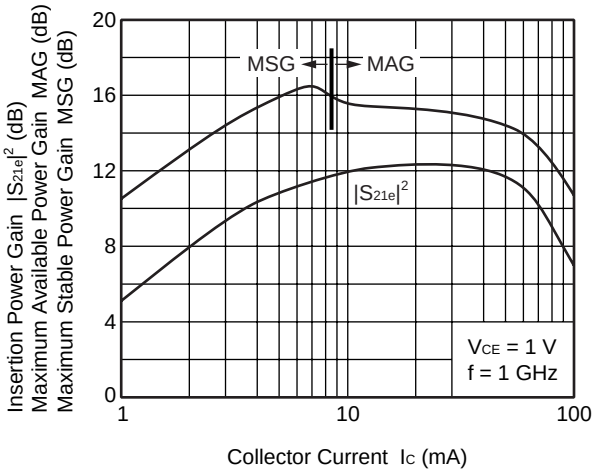
Q1

INSERTION POWER GAIN, MSG
vs. COLLECTOR CURRENT

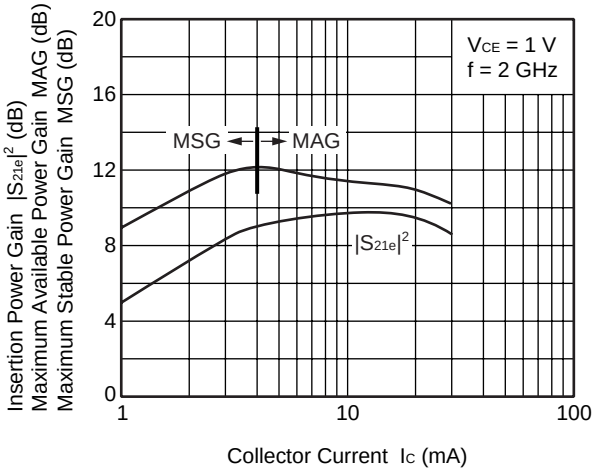


Q2

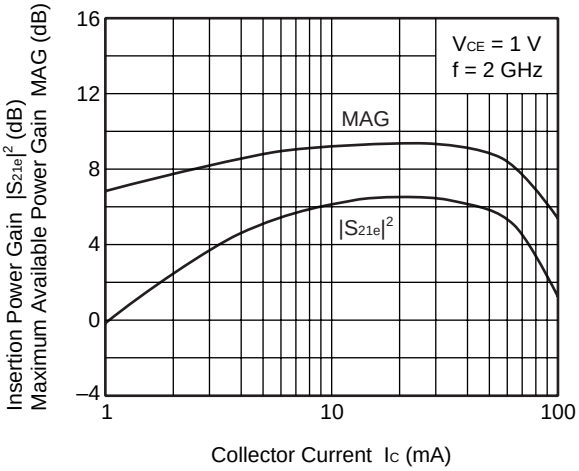
INSERTION POWER GAIN, MAG, MSG
vs. COLLECTOR CURRENT



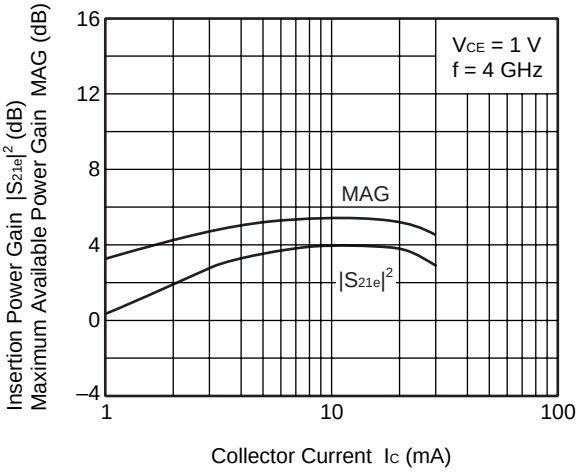
INSERTION POWER GAIN, MAG, MSG
vs. COLLECTOR CURRENT



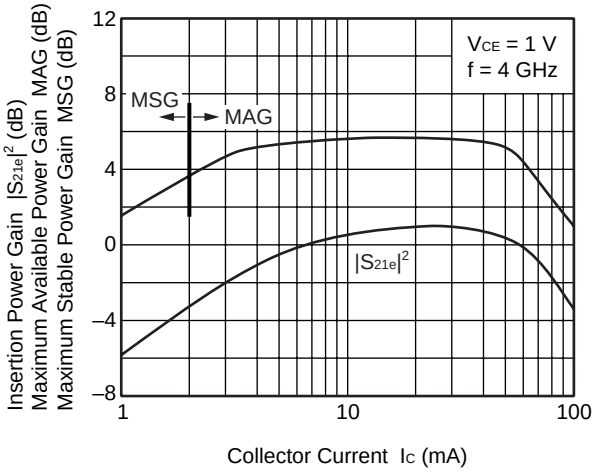
INSERTION POWER GAIN, MAG
vs. COLLECTOR CURRENT



INSERTION POWER GAIN, MAG
vs. COLLECTOR CURRENT

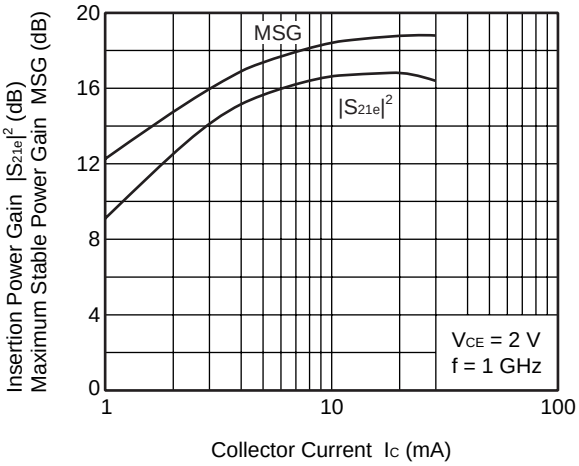


INSERTION POWER GAIN, MAG, MSG
vs. COLLECTOR CURRENT



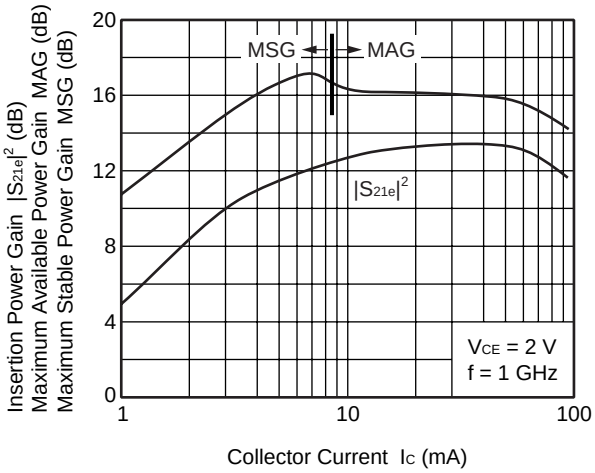
Q1

INSERTION POWER GAIN, MSG
vs. COLLECTOR CURRENT

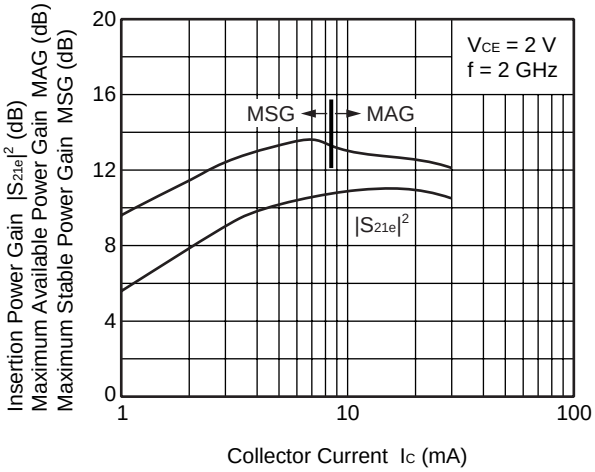


Q2

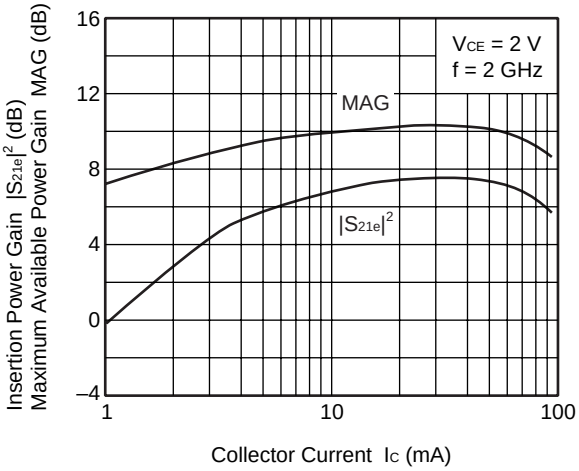
INSERTION POWER GAIN, MAG, MSG
vs. COLLECTOR CURRENT



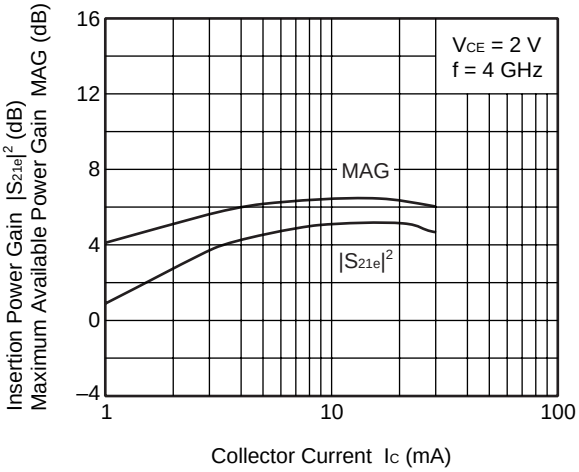
INSERTION POWER GAIN, MAG, MSG
vs. COLLECTOR CURRENT



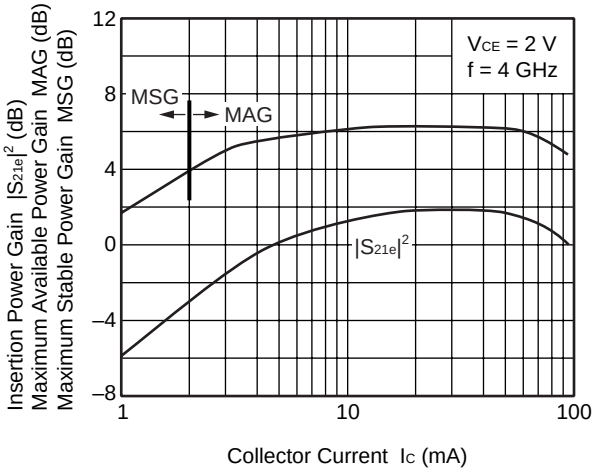
INSERTION POWER GAIN, MAG
vs. COLLECTOR CURRENT



INSERTION POWER GAIN, MAG
vs. COLLECTOR CURRENT

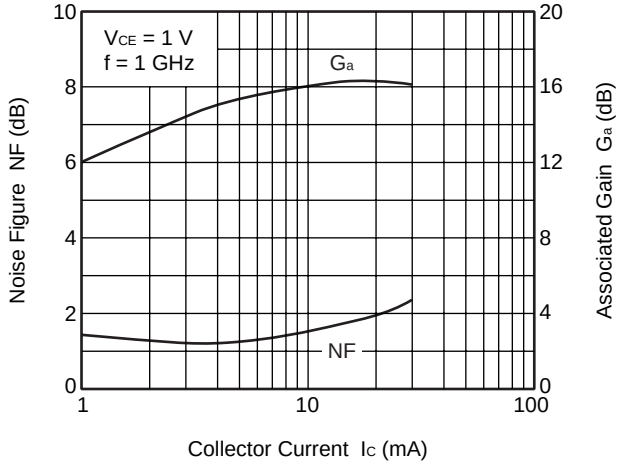


INSERTION POWER GAIN, MAG, MSG
vs. COLLECTOR CURRENT



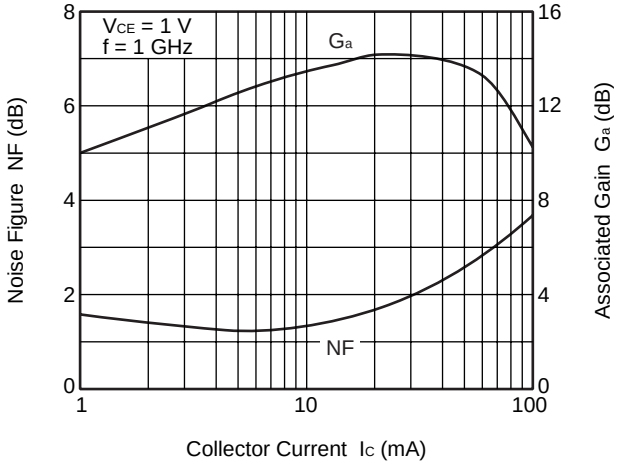
Q1

NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT

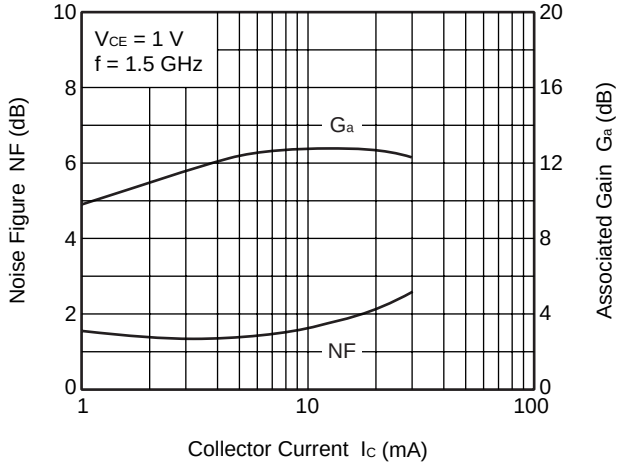


Q2

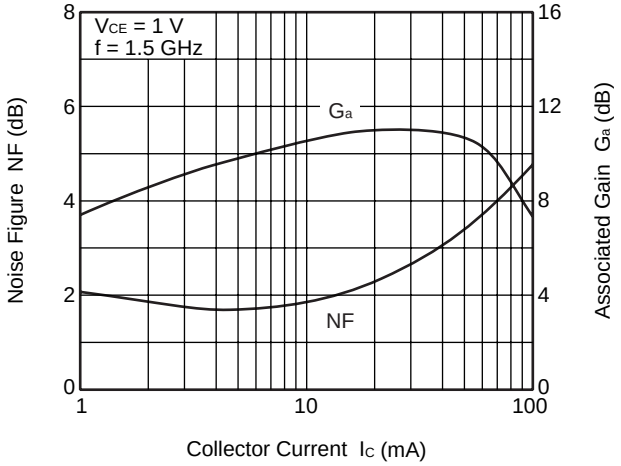
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



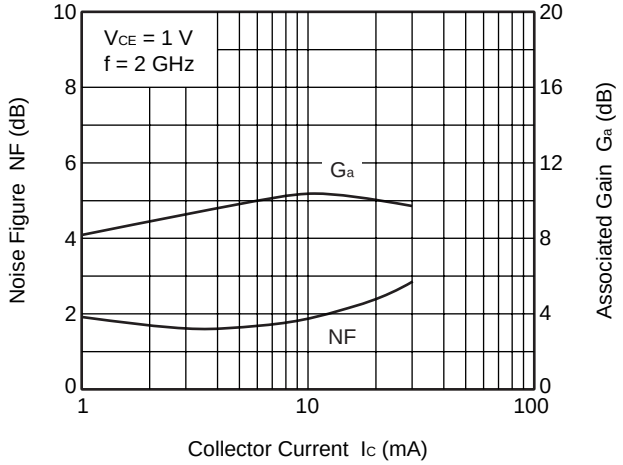
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



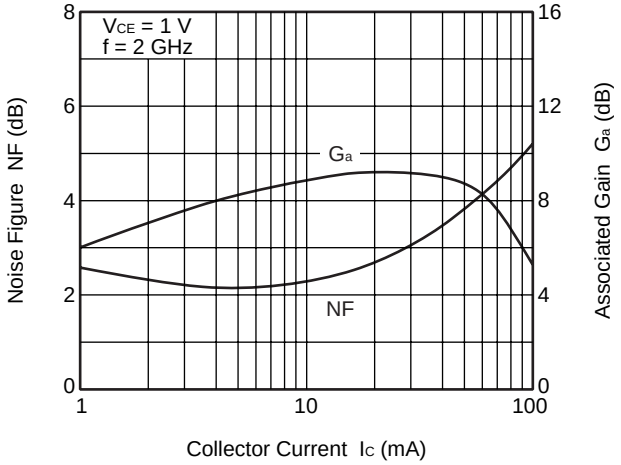
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT

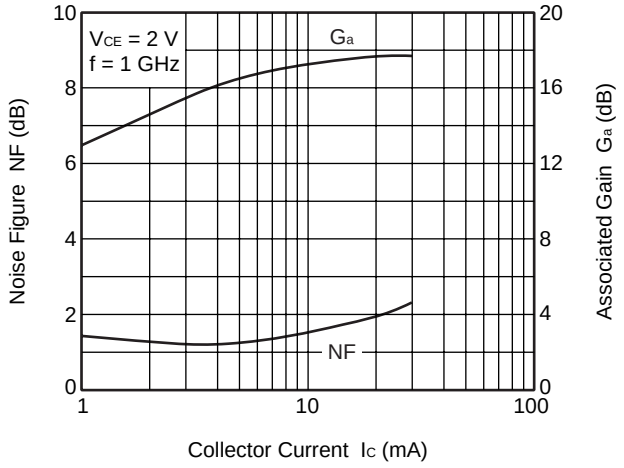


NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



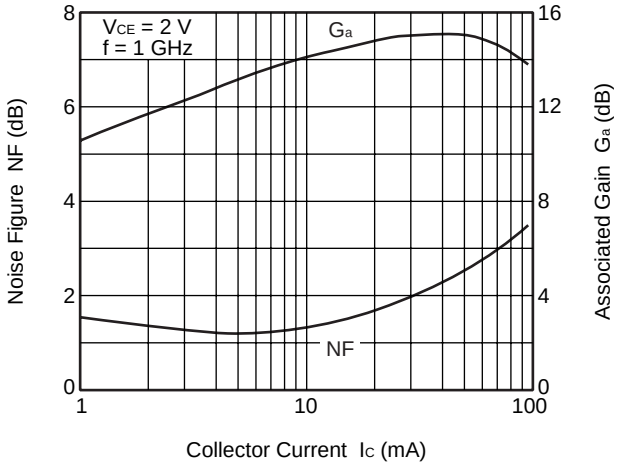
Q1

NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT

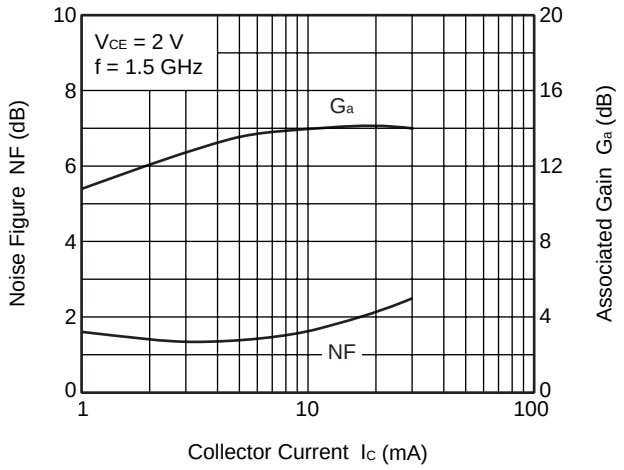


Q2

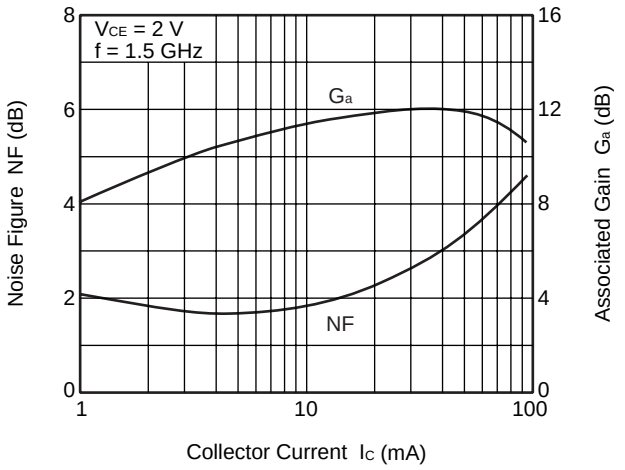
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



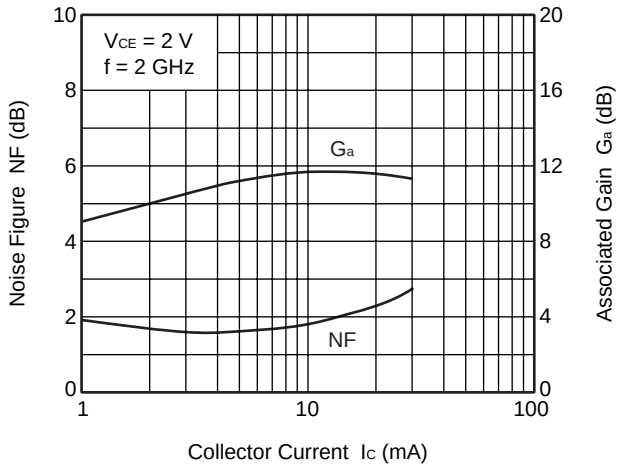
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



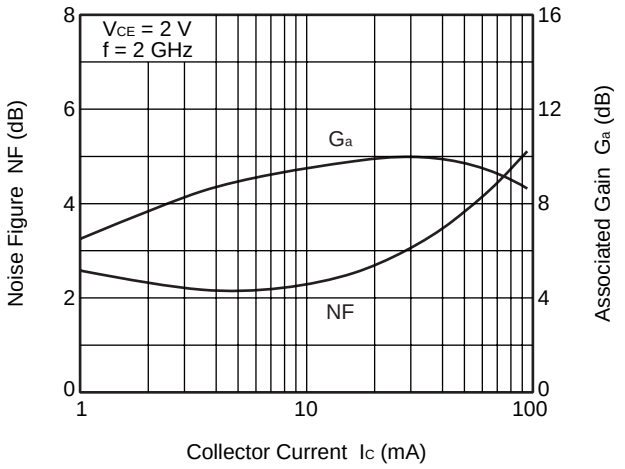
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



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, Z_O = 50 Ω

Frequency	S_{11}		S_{21}		S_{12}		S_{22}	
(GHz)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.961	−8.4	3.504	171.5	0.024	80.6	0.996	−4.3
0.2	0.961	−15.5	3.429	166.5	0.049	79.5	0.984	−8.6
0.3	0.921	−24.3	3.361	160.1	0.074	75.1	0.975	−12.7
0.4	0.914	−32.7	3.329	153.0	0.096	70.1	0.952	−17.1
0.5	0.894	−40.6	3.294	146.8	0.118	65.1	0.933	−21.2
0.6	0.854	−48.3	3.179	139.9	0.138	60.1	0.892	−25.5
0.7	0.821	−56.5	3.093	134.1	0.155	55.8	0.864	−29.3
0.8	0.782	−64.0	2.979	127.8	0.169	51.5	0.821	−33.2
0.9	0.743	−71.7	2.853	122.7	0.182	47.5	0.787	−36.9
1.0	0.714	−79.5	2.743	117.4	0.192	43.9	0.744	−40.4
1.1	0.682	−87.0	2.625	112.0	0.201	40.4	0.716	−43.8
1.2	0.658	−94.6	2.525	106.9	0.209	37.5	0.681	−46.9
1.3	0.633	−101.3	2.402	102.5	0.215	34.2	0.658	−49.9
1.4	0.607	−108.3	2.298	97.6	0.219	31.4	0.627	−52.5
1.5	0.583	−114.2	2.193	93.8	0.223	29.1	0.609	−55.1
1.6	0.567	−120.7	2.097	89.7	0.225	26.7	0.581	−57.2
1.7	0.556	−126.5	2.014	86.2	0.226	24.6	0.563	−59.4
1.8	0.536	−132.0	1.926	82.2	0.226	23.0	0.540	−60.9
1.9	0.528	−136.4	1.849	79.5	0.226	21.4	0.526	−63.0
2.0	0.525	−141.8	1.769	76.1	0.226	20.2	0.508	−64.4
2.1	0.524	−146.5	1.713	73.4	0.226	19.0	0.497	−66.4
2.2	0.521	−150.5	1.666	70.9	0.225	18.0	0.484	−67.7
2.3	0.517	−154.4	1.604	67.9	0.224	17.1	0.479	−69.7
2.4	0.513	−158.8	1.557	66.0	0.223	16.1	0.466	−70.9
2.5	0.513	−162.4	1.498	63.5	0.221	15.5	0.461	−72.7
2.6	0.511	−166.4	1.457	60.4	0.220	13.9	0.455	−74.6
2.7	0.510	−169.2	1.422	58.4	0.219	13.4	0.449	−76.1
2.8	0.507	−173.0	1.377	56.0	0.218	12.6	0.443	−77.0
2.9	0.504	−175.7	1.342	54.1	0.219	12.9	0.433	−78.4
3.0	0.499	−179.3	1.304	51.9	0.217	12.7	0.423	−79.5
4.0	0.515	146.5	1.036	30.8	0.211	15.9	0.367	−101.8
5.0	0.556	113.6	0.823	12.1	0.243	19.4	0.373	−129.5

V_{CE} = 1 V, I_C = 3 mA, Z_O = 50 Ω

Frequency	S_{11}		S_{21}		S_{12}		S_{22}	
(GHz)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.878	−13.6	8.711	168.3	0.024	82.5	0.978	−8.4
0.2	0.871	−26.1	8.365	159.1	0.047	74.9	0.944	−16.6
0.3	0.808	−39.5	7.891	150.1	0.067	68.6	0.903	−24.0
0.4	0.773	−52.1	7.470	140.8	0.085	62.2	0.841	−31.1
0.5	0.726	−63.9	7.046	132.9	0.100	57.0	0.785	−37.3
0.6	0.665	−74.3	6.469	125.4	0.112	52.4	0.712	−43.0
0.7	0.620	−84.9	6.014	119.3	0.121	48.8	0.659	−47.9
0.8	0.576	−94.2	5.541	113.2	0.128	45.7	0.598	−52.4
0.9	0.541	−103.6	5.127	108.5	0.135	43.1	0.552	−56.7
1.0	0.517	−112.2	4.764	103.9	0.140	41.1	0.505	−60.5
1.1	0.491	−120.7	4.409	99.4	0.144	39.5	0.472	−64.1
1.2	0.477	−128.3	4.137	95.4	0.148	38.3	0.438	−67.7
1.3	0.465	−134.9	3.852	91.9	0.152	36.9	0.416	−70.6
1.4	0.451	−142.0	3.610	88.1	0.154	35.8	0.388	−73.6
1.5	0.442	−148.1	3.396	85.3	0.157	35.3	0.373	−75.8
1.6	0.438	−154.2	3.198	82.1	0.159	34.7	0.348	−78.2
1.7	0.438	−158.9	3.034	79.7	0.162	34.2	0.336	−80.3
1.8	0.430	−164.5	2.874	76.6	0.164	34.0	0.316	−82.1
1.9	0.426	−167.7	2.751	74.5	0.167	33.7	0.306	−84.2
2.0	0.435	−171.9	2.605	71.9	0.170	33.8	0.291	−85.8
2.1	0.439	−175.3	2.501	69.7	0.172	33.5	0.285	−88.2
2.2	0.438	−178.2	2.417	67.9	0.175	33.6	0.273	−89.5
2.3	0.436	179.1	2.317	65.4	0.178	33.5	0.270	−91.8
2.4	0.439	175.2	2.238	63.9	0.180	33.5	0.261	−92.9
2.5	0.440	172.4	2.144	62.1	0.183	33.5	0.258	−94.8
2.6	0.443	169.6	2.067	59.6	0.186	32.8	0.252	−96.2
2.7	0.442	167.3	2.020	58.0	0.189	32.8	0.248	−97.8
2.8	0.445	164.3	1.949	56.1	0.192	32.5	0.242	−98.7
2.9	0.444	162.5	1.894	54.5	0.197	32.8	0.236	−100.6
3.0	0.442	159.0	1.832	52.8	0.200	32.7	0.227	−101.7
4.0	0.478	132.4	1.395	34.7	0.239	31.9	0.213	−133.1
5.0	0.524	105.6	1.101	17.6	0.293	24.4	0.251	−161.8

V_{CE} = 1 V, I_C = 5 mA, Z_O = 50 Ω

Frequency	S_{11}		S_{21}		S_{12}		S_{22}	
(GHz)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.835	–18.0	12.432	165.7	0.023	77.9	0.962	–11.7
0.2	0.798	–34.1	11.680	153.8	0.045	71.8	0.906	–22.3
0.3	0.718	–50.7	10.667	143.3	0.062	65.1	0.838	–31.6
0.4	0.673	–64.9	9.750	133.1	0.077	58.9	0.753	–39.9
0.5	0.621	–78.5	8.900	124.8	0.088	54.2	0.680	–46.6
0.6	0.559	–90.1	7.952	117.6	0.097	50.4	0.600	–52.9
0.7	0.518	–101.3	7.232	111.9	0.104	48.0	0.541	–58.0
0.8	0.482	–111.3	6.549	106.3	0.109	46.0	0.482	–62.7
0.9	0.461	–121.1	5.965	102.0	0.115	44.6	0.438	–67.1
1.0	0.446	–129.7	5.476	98.0	0.119	43.6	0.398	–71.4
1.1	0.431	–137.6	5.020	94.1	0.124	42.9	0.370	–75.3
1.2	0.425	–145.0	4.670	90.5	0.128	42.6	0.341	–79.3
1.3	0.420	–151.2	4.327	87.6	0.132	41.8	0.323	–82.4
1.4	0.415	–157.8	4.033	84.3	0.135	41.5	0.301	–85.9
1.5	0.410	–162.8	3.787	81.8	0.139	41.5	0.288	–88.2
1.6	0.412	–168.1	3.553	79.0	0.143	41.3	0.269	–91.2
1.7	0.415	–172.5	3.357	76.9	0.147	41.1	0.259	–93.6
1.8	0.414	–177.4	3.178	74.3	0.151	41.2	0.243	–96.0
1.9	0.409	–179.9	3.037	72.4	0.154	41.2	0.237	–98.4
2.0	0.419	176.4	2.869	70.1	0.159	41.3	0.224	–100.7
2.1	0.426	173.8	2.749	68.1	0.163	41.1	0.221	–103.5
2.2	0.426	171.4	2.652	66.4	0.167	41.2	0.211	–105.3
2.3	0.425	168.8	2.549	64.2	0.172	41.1	0.210	–107.8
2.4	0.428	165.6	2.456	62.9	0.176	41.0	0.202	–109.2
2.5	0.431	163.5	2.349	61.2	0.180	40.9	0.201	–111.5
2.6	0.435	160.6	2.267	58.9	0.185	40.4	0.196	–113.0
2.7	0.435	158.7	2.204	57.3	0.189	40.1	0.193	–115.0
2.8	0.437	156.2	2.129	55.7	0.193	39.6	0.188	–116.0
2.9	0.437	154.3	2.067	54.2	0.200	39.6	0.184	–118.4
3.0	0.434	151.5	1.997	52.6	0.204	39.4	0.176	–120.1
4.0	0.475	127.5	1.506	35.5	0.252	35.9	0.194	–153.6
5.0	0.517	102.6	1.186	19.3	0.308	25.6	0.250	–178.6

V_{CE} = 1 V, I_C = 7 mA, Z_O = 50 Ω

Frequency	S_{11}		S_{21}		S_{12}		S_{22}	
(GHz)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.774	–20.9	15.184	163.6	0.021	78.7	0.946	–14.0
0.2	0.742	–40.3	13.955	150.1	0.043	70.1	0.872	–26.5
0.3	0.656	–58.3	12.422	138.8	0.059	62.6	0.785	–36.9
0.4	0.607	–74.1	11.049	128.3	0.071	57.3	0.689	–45.8
0.5	0.556	–88.6	9.870	119.8	0.081	53.0	0.609	–52.7
0.6	0.500	–100.8	8.697	113.1	0.088	50.4	0.528	–59.1
0.7	0.468	–112.4	7.821	107.7	0.094	48.7	0.472	–64.3
0.8	0.438	–122.5	7.013	102.4	0.099	47.6	0.417	–69.3
0.9	0.423	–132.2	6.352	98.6	0.105	46.5	0.377	–73.9
1.0	0.415	–140.6	5.789	95.0	0.110	46.2	0.340	–78.7
1.1	0.405	–147.9	5.296	91.3	0.114	45.9	0.316	–82.8
1.2	0.405	–154.8	4.903	88.1	0.119	45.9	0.292	–87.4
1.3	0.404	–160.3	4.538	85.3	0.124	45.5	0.277	–90.6
1.4	0.401	–166.3	4.214	82.3	0.128	45.4	0.259	–94.7
1.5	0.401	–171.1	3.956	80.0	0.133	45.4	0.249	–97.3
1.6	0.404	–175.9	3.705	77.5	0.137	45.4	0.232	–100.8
1.7	0.410	–179.5	3.503	75.4	0.142	45.3	0.226	–103.3
1.8	0.408	176.2	3.312	73.1	0.146	45.4	0.212	–106.4
1.9	0.405	173.5	3.162	71.4	0.151	45.4	0.208	–109.1
2.0	0.418	170.5	2.984	69.1	0.156	45.5	0.197	–111.9
2.1	0.423	168.0	2.858	67.2	0.161	45.2	0.196	–114.8
2.2	0.424	166.0	2.758	65.7	0.166	45.1	0.188	–117.0
2.3	0.424	163.7	2.647	63.5	0.171	45.0	0.187	–119.6
2.4	0.429	160.9	2.551	62.3	0.175	44.8	0.181	–121.3
2.5	0.430	158.9	2.437	60.6	0.181	44.6	0.181	–123.6
2.6	0.434	156.2	2.355	58.4	0.185	43.9	0.176	–125.2
2.7	0.435	154.4	2.289	57.1	0.191	43.6	0.175	–127.4
2.8	0.437	152.2	2.211	55.3	0.196	43.0	0.170	–128.8
2.9	0.435	150.6	2.142	53.9	0.202	42.8	0.168	–131.3
3.0	0.437	147.5	2.071	52.4	0.207	42.4	0.161	–133.7
4.0	0.477	125.2	1.553	35.9	0.259	37.6	0.196	–165.1
5.0	0.520	101.3	1.218	20.1	0.316	26.1	0.260	173.2

V_{CE} = 1 V, I_C = 10 mA, Z_O = 50 Ω

Frequency	S_{11}		S_{21}		S_{12}		S_{22}	
(GHz)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.724	–24.8	18.069	161.1	0.022	77.2	0.925	–16.7
0.2	0.681	–47.1	16.226	146.0	0.041	67.7	0.830	–31.1
0.3	0.591	–67.7	13.997	134.1	0.055	61.2	0.727	–42.5
0.4	0.542	–84.4	12.159	123.5	0.066	56.5	0.622	–51.8
0.5	0.498	–99.6	10.637	115.3	0.074	52.9	0.540	–58.9
0.6	0.451	–112.2	9.261	109.0	0.081	51.0	0.462	–65.5
0.7	0.428	–123.6	8.230	103.9	0.086	50.2	0.408	–70.9
0.8	0.408	–133.7	7.343	99.2	0.092	49.4	0.359	–76.3
0.9	0.399	–142.7	6.616	95.5	0.097	49.0	0.323	–81.3
1.0	0.395	–150.4	6.012	92.1	0.103	49.1	0.293	–86.7
1.1	0.393	–157.3	5.480	89.0	0.108	49.2	0.273	–91.1
1.2	0.396	–163.5	5.054	85.9	0.113	49.3	0.253	–96.3
1.3	0.396	–168.6	4.671	83.4	0.118	49.0	0.242	–99.8
1.4	0.400	–173.9	4.336	80.4	0.123	49.0	0.227	–104.5
1.5	0.400	–178.2	4.066	78.5	0.128	49.1	0.220	–107.2
1.6	0.405	177.5	3.804	76.0	0.133	49.1	0.207	–111.4
1.7	0.412	174.6	3.586	74.2	0.138	48.9	0.202	–114.1
1.8	0.412	170.4	3.392	71.9	0.144	49.1	0.191	–117.9
1.9	0.410	168.0	3.243	70.3	0.149	48.9	0.189	–120.4
2.0	0.418	165.6	3.056	68.2	0.155	48.9	0.180	–124.0
2.1	0.426	163.3	2.923	66.4	0.161	48.5	0.181	–126.7
2.2	0.428	161.7	2.820	65.0	0.166	48.4	0.174	–129.5
2.3	0.427	159.6	2.706	62.8	0.172	48.1	0.176	–132.0
2.4	0.431	156.7	2.611	61.6	0.177	47.7	0.170	–134.0
2.5	0.434	155.0	2.495	60.1	0.182	47.4	0.171	–136.1
2.6	0.440	152.4	2.404	58.0	0.187	46.8	0.167	–137.9
2.7	0.437	150.9	2.340	56.5	0.193	46.3	0.167	–140.1
2.8	0.442	148.7	2.257	55.0	0.199	45.6	0.162	–141.8
2.9	0.440	147.1	2.190	53.7	0.205	45.2	0.162	–144.4
3.0	0.440	144.4	2.117	52.1	0.210	44.7	0.156	–147.0
4.0	0.479	123.5	1.580	36.0	0.265	38.8	0.205	–174.6
5.0	0.523	100.3	1.240	20.6	0.322	26.4	0.274	166.6

V_{CE} = 1 V, I_C = 20 mA, Z_O = 50 Ω

Frequency	S_{11}		S_{21}		S_{12}		S_{22}	
(GHz)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.608	–35.8	22.647	156.5	0.020	69.4	0.869	–22.4
0.2	0.565	–63.1	19.141	138.2	0.039	63.6	0.736	–40.2
0.3	0.486	–88.1	15.689	125.8	0.049	57.8	0.610	–52.9
0.4	0.452	–106.0	13.073	115.8	0.058	55.3	0.501	–62.8
0.5	0.432	–121.3	11.093	108.2	0.065	53.2	0.424	–70.1
0.6	0.407	–133.7	9.495	102.6	0.072	53.0	0.357	–77.5
0.7	0.397	–144.1	8.346	98.2	0.077	52.9	0.312	–83.4
0.8	0.394	–152.7	7.372	94.0	0.083	53.3	0.273	–90.1
0.9	0.396	–160.6	6.613	91.0	0.089	53.2	0.248	–96.0
1.0	0.403	–166.5	5.971	87.9	0.095	53.5	0.228	–102.7
1.1	0.401	–172.0	5.424	85.1	0.101	53.9	0.216	–107.9
1.2	0.410	–177.1	4.996	82.3	0.107	54.0	0.205	–114.2
1.3	0.415	179.3	4.607	80.2	0.113	53.9	0.199	–117.9
1.4	0.420	174.9	4.267	77.5	0.119	53.9	0.191	–123.4
1.5	0.422	171.5	3.999	75.8	0.125	53.9	0.188	–126.2
1.6	0.429	167.8	3.738	73.5	0.131	53.9	0.181	–131.2
1.7	0.436	165.7	3.522	71.8	0.137	53.6	0.180	–133.6
1.8	0.438	162.3	3.330	69.8	0.143	53.5	0.174	–138.3
1.9	0.433	160.4	3.183	68.2	0.149	53.2	0.174	–140.6
2.0	0.445	158.4	3.000	66.2	0.155	52.9	0.170	–144.7
2.1	0.450	156.5	2.871	64.4	0.162	52.4	0.173	–146.9
2.2	0.452	155.0	2.763	63.1	0.168	52.1	0.169	–149.9
2.3	0.452	153.0	2.657	61.0	0.174	51.6	0.172	–152.0
2.4	0.455	151.0	2.558	60.0	0.180	51.1	0.168	–154.1
2.5	0.460	149.3	2.443	58.5	0.186	50.6	0.171	–155.9
2.6	0.464	147.2	2.354	56.5	0.192	49.8	0.168	–157.7
2.7	0.460	145.6	2.295	55.2	0.197	49.2	0.169	–159.6
2.8	0.464	143.7	2.216	53.5	0.203	48.3	0.166	–161.6
2.9	0.464	142.2	2.150	52.4	0.210	47.8	0.167	–163.7
3.0	0.464	140.0	2.076	50.8	0.216	47.1	0.163	–166.8
4.0	0.502	120.8	1.545	35.1	0.273	39.9	0.226	172.9
5.0	0.541	98.2	1.211	20.2	0.330	26.4	0.298	158.0

V_{CE} = 2 V, I_C = 1 mA, Z_O = 50 Ω

Frequency	S_{11}		S_{21}		S_{12}		S_{22}	
(GHz)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.946	–7.0	3.466	172.3	0.019	87.8	0.998	–3.5
0.2	0.966	–13.6	3.390	167.9	0.041	80.9	0.989	–7.0
0.3	0.934	–21.4	3.330	162.2	0.061	76.9	0.983	–10.3
0.4	0.925	–29.0	3.308	155.7	0.081	72.4	0.964	–14.1
0.5	0.910	–36.1	3.293	150.0	0.099	68.0	0.950	–17.5
0.6	0.875	–43.1	3.205	143.5	0.117	63.5	0.917	–21.2
0.7	0.845	–50.5	3.139	138.2	0.132	59.6	0.896	–24.6
0.8	0.809	–57.5	3.042	132.2	0.145	55.4	0.859	–28.1
0.9	0.769	–64.6	2.931	127.3	0.158	51.7	0.828	–31.4
1.0	0.741	–71.7	2.838	122.2	0.168	48.2	0.791	–34.4
1.1	0.710	–78.9	2.733	117.0	0.177	44.9	0.766	–37.6
1.2	0.681	–86.1	2.648	112.0	0.184	42.0	0.733	–40.4
1.3	0.656	–92.7	2.527	107.6	0.191	38.7	0.714	–43.2
1.4	0.629	–99.3	2.434	102.8	0.196	35.9	0.683	–45.6
1.5	0.602	–105.4	2.328	98.9	0.200	33.6	0.667	–48.1
1.6	0.583	–111.7	2.237	94.8	0.202	31.2	0.640	–50.1
1.7	0.568	–117.4	2.156	91.3	0.204	29.1	0.623	–52.3
1.8	0.548	–123.2	2.067	87.3	0.205	27.3	0.599	–53.8
1.9	0.534	–127.6	1.986	84.5	0.206	25.7	0.583	–55.6
2.0	0.532	–133.3	1.904	81.0	0.206	24.5	0.566	–56.8
2.1	0.528	–138.1	1.844	78.2	0.207	23.2	0.554	–58.9
2.2	0.521	–142.2	1.794	75.7	0.206	22.3	0.541	–59.9
2.3	0.513	–146.4	1.727	72.8	0.206	21.4	0.535	–61.6
2.4	0.507	–151.0	1.681	70.8	0.205	20.4	0.522	–63.0
2.5	0.503	–155.0	1.616	68.4	0.203	19.7	0.516	–64.5
2.6	0.503	–159.0	1.575	65.3	0.203	18.2	0.511	–66.3
2.7	0.499	–162.1	1.537	63.2	0.202	17.7	0.504	–67.8
2.8	0.497	–166.0	1.489	60.7	0.201	16.9	0.498	–68.5
2.9	0.493	–168.8	1.444	58.8	0.203	17.3	0.489	–69.5
3.0	0.485	–173.0	1.406	56.6	0.201	17.0	0.478	–70.6
4.0	0.491	150.8	1.120	35.1	0.200	20.7	0.412	–90.2
5.0	0.533	116.2	0.889	15.8	0.235	24.2	0.402	–115.8

V_{CE} = 2 V, I_C = 3 mA, Z_O = 50 Ω

Frequency	S_{11}		S_{21}		S_{12}		S_{22}	
(GHz)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.899	–12.1	8.488	169.7	0.019	84.5	0.984	–6.7
0.2	0.889	–22.1	8.219	161.7	0.039	76.8	0.958	–13.3
0.3	0.830	–33.1	7.859	153.5	0.056	71.9	0.928	–19.3
0.4	0.803	–44.3	7.532	145.0	0.073	66.2	0.878	–25.2
0.5	0.760	–54.6	7.205	137.6	0.087	61.4	0.834	–30.5
0.6	0.699	–63.9	6.714	130.3	0.099	56.8	0.770	–35.5
0.7	0.652	–73.5	6.322	124.3	0.108	53.5	0.722	–39.9
0.8	0.603	–82.1	5.886	118.4	0.115	50.1	0.665	–43.9
0.9	0.564	–90.8	5.494	113.6	0.122	47.6	0.620	–47.6
1.0	0.532	–99.1	5.140	108.9	0.128	45.4	0.574	–50.9
1.1	0.502	–107.2	4.793	104.4	0.133	43.6	0.541	–54.1
1.2	0.481	–115.1	4.524	100.1	0.137	42.2	0.505	–57.1
1.3	0.464	–121.9	4.219	96.5	0.140	40.6	0.483	–59.6
1.4	0.445	–129.3	3.973	92.7	0.143	39.5	0.452	–62.1
1.5	0.430	–135.2	3.751	89.8	0.147	38.7	0.435	–64.0
1.6	0.419	–141.5	3.539	86.4	0.149	38.1	0.409	–66.1
1.7	0.416	–147.0	3.366	83.9	0.152	37.3	0.395	–67.7
1.8	0.405	–153.0	3.195	80.8	0.154	37.1	0.375	–69.0
1.9	0.398	–156.6	3.052	78.6	0.156	36.7	0.363	–70.8
2.0	0.404	–161.9	2.896	76.0	0.159	36.6	0.346	–71.9
2.1	0.406	–165.5	2.786	73.7	0.162	36.4	0.338	–74.0
2.2	0.405	–168.9	2.685	71.9	0.165	36.5	0.326	–74.9
2.3	0.404	–172.1	2.582	69.4	0.168	36.3	0.321	–76.7
2.4	0.405	–175.9	2.489	67.9	0.170	36.2	0.311	–77.5
2.5	0.405	–179.3	2.387	66.0	0.173	36.2	0.306	–79.2
2.6	0.407	177.2	2.310	63.5	0.175	35.6	0.301	–80.3
2.7	0.405	174.9	2.249	61.9	0.179	35.5	0.295	–81.6
2.8	0.405	171.7	2.169	59.9	0.182	35.2	0.290	–82.1
2.9	0.406	169.4	2.101	58.4	0.186	35.5	0.282	–83.4
3.0	0.403	165.8	2.038	56.5	0.189	35.4	0.273	–84.2
4.0	0.437	136.6	1.557	38.2	0.228	34.9	0.233	–110.9
5.0	0.486	108.0	1.225	20.9	0.281	27.8	0.245	–141.1

V_{CE} = 2 V, I_C = 5 mA, Z_O = 50 Ω

Frequency	S_{11}		S_{21}		S_{12}		S_{22}	
(GHz)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.839	–14.1	11.944	167.5	0.019	80.9	0.971	–8.9
0.2	0.830	–27.6	11.355	157.5	0.038	75.6	0.931	–17.4
0.3	0.756	–41.5	10.589	148.1	0.053	68.9	0.882	–25.0
0.4	0.714	–53.8	9.885	138.6	0.067	63.4	0.813	–32.0
0.5	0.664	–65.6	9.207	130.6	0.079	58.7	0.751	–37.7
0.6	0.597	–75.8	8.378	123.3	0.088	54.9	0.675	–43.1
0.7	0.549	–86.0	7.729	117.5	0.095	52.4	0.621	–47.4
0.8	0.504	–95.6	7.074	111.8	0.101	50.1	0.561	–51.5
0.9	0.470	–104.8	6.490	107.4	0.107	48.3	0.516	–55.2
1.0	0.446	–113.3	6.003	103.2	0.112	47.2	0.472	–58.6
1.1	0.423	–121.7	5.544	99.0	0.116	46.2	0.441	–61.8
1.2	0.408	–129.7	5.178	95.3	0.120	45.6	0.409	–64.9
1.3	0.397	–136.4	4.804	92.2	0.124	44.6	0.388	–67.4
1.4	0.386	–143.5	4.496	88.7	0.128	44.1	0.362	–70.0
1.5	0.380	–149.3	4.229	86.1	0.132	43.9	0.348	–72.0
1.6	0.377	–155.5	3.978	83.2	0.135	43.6	0.325	–74.1
1.7	0.377	–160.5	3.769	81.0	0.139	43.3	0.313	–75.9
1.8	0.370	–166.1	3.569	78.2	0.143	43.3	0.295	–77.4
1.9	0.364	–169.3	3.407	76.3	0.146	43.2	0.285	–79.4
2.0	0.372	–173.3	3.226	73.9	0.150	43.2	0.270	–80.6
2.1	0.379	–176.8	3.093	71.8	0.154	43.1	0.265	–82.9
2.2	0.378	–180.0	2.980	70.2	0.158	43.1	0.254	–83.9
2.3	0.377	177.8	2.861	67.9	0.163	43.0	0.250	–86.0
2.4	0.378	174.1	2.758	66.6	0.166	42.8	0.241	–86.8
2.5	0.381	171.3	2.638	64.9	0.170	42.8	0.238	–88.8
2.6	0.385	168.3	2.548	62.5	0.174	42.2	0.233	–89.8
2.7	0.386	166.2	2.479	61.0	0.178	42.0	0.228	–91.2
2.8	0.388	163.2	2.389	59.2	0.182	41.4	0.223	–91.7
2.9	0.386	161.3	2.316	57.7	0.188	41.6	0.217	–93.3
3.0	0.385	158.0	2.240	56.1	0.192	41.3	0.208	–94.2
4.0	0.425	131.8	1.694	39.0	0.239	38.5	0.191	–126.6
5.0	0.476	105.0	1.325	22.6	0.296	28.7	0.223	–157.5

V_{CE} = 2 V, I_C = 7 mA, Z_O = 50 Ω

Frequency	S_{11}		S_{21}		S_{12}		S_{22}	
(GHz)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.805	–16.7	14.517	166.0	0.018	80.4	0.961	–10.6
0.2	0.780	–31.7	13.607	154.4	0.036	73.4	0.907	–20.5
0.3	0.699	–47.1	12.452	144.1	0.051	67.3	0.843	–28.9
0.4	0.652	–60.6	11.390	134.3	0.063	62.0	0.761	–36.4
0.5	0.598	–73.5	10.393	126.0	0.073	57.6	0.690	–42.4
0.6	0.530	–84.2	9.318	119.0	0.081	54.5	0.612	–47.9
0.7	0.487	–95.1	8.489	113.5	0.088	52.7	0.555	–52.1
0.8	0.446	–104.6	7.695	107.9	0.093	51.0	0.497	–56.2
0.9	0.419	–114.0	7.017	103.8	0.098	49.8	0.453	–59.9
1.0	0.400	–122.8	6.442	99.9	0.103	49.1	0.413	–63.5
1.1	0.382	–131.1	5.929	96.2	0.108	48.6	0.384	–66.6
1.2	0.376	–138.7	5.500	92.7	0.112	48.4	0.355	–70.0
1.3	0.368	–145.5	5.107	89.7	0.117	47.7	0.337	–72.5
1.4	0.362	–152.2	4.760	86.5	0.121	47.5	0.313	–75.4
1.5	0.356	–157.8	4.465	84.2	0.126	47.4	0.301	–77.3
1.6	0.357	–163.6	4.196	81.5	0.130	47.3	0.280	–79.7
1.7	0.360	–168.2	3.966	79.5	0.134	47.0	0.270	–81.6
1.8	0.354	–173.5	3.758	76.8	0.138	47.1	0.253	–83.5
1.9	0.352	–176.3	3.587	75.1	0.142	46.9	0.246	–85.5
2.0	0.363	–180.0	3.387	72.8	0.147	47.1	0.232	–87.0
2.1	0.367	176.6	3.250	70.8	0.152	46.8	0.228	–89.6
2.2	0.369	174.2	3.127	69.3	0.156	46.8	0.218	–90.8
2.3	0.368	171.7	3.002	67.1	0.161	46.6	0.215	–93.1
2.4	0.371	168.5	2.893	66.0	0.166	46.4	0.207	–94.0
2.5	0.375	166.1	2.764	64.3	0.170	46.2	0.205	–96.0
2.6	0.378	163.2	2.666	62.1	0.175	45.6	0.200	–97.0
2.7	0.376	161.3	2.599	60.6	0.179	45.3	0.196	–98.8
2.8	0.380	158.8	2.502	58.9	0.184	44.7	0.191	–99.3
2.9	0.379	156.6	2.425	57.6	0.191	44.7	0.186	–101.2
3.0	0.378	153.2	2.346	55.9	0.195	44.2	0.178	–102.4
4.0	0.422	129.2	1.762	39.4	0.246	40.1	0.177	–137.7
5.0	0.472	103.7	1.373	23.5	0.303	29.1	0.222	–167.1

V_{CE} = 2 V, I_C = 10 mA, Z_O = 50 Ω

Frequency	S_{11}		S_{21}		S_{12}		S_{22}	
(GHz)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.757	–18.6	17.288	164.0	0.017	79.7	0.949	–12.5
0.2	0.730	–36.4	15.936	151.1	0.035	71.7	0.879	–23.8
0.3	0.638	–53.4	14.259	140.2	0.048	65.7	0.798	–33.0
0.4	0.585	–68.3	12.756	129.9	0.059	60.9	0.706	–40.9
0.5	0.532	–81.3	11.422	121.7	0.068	57.1	0.628	–46.9
0.6	0.470	–93.0	10.109	115.0	0.075	54.9	0.550	–52.4
0.7	0.432	–103.8	9.097	109.6	0.081	53.4	0.494	–56.6
0.8	0.398	–113.9	8.189	104.6	0.086	52.5	0.439	–60.6
0.9	0.379	–123.8	7.416	100.7	0.092	51.7	0.398	–64.3
1.0	0.367	–132.2	6.779	97.0	0.097	51.5	0.361	–68.0
1.1	0.355	–140.6	6.207	93.5	0.102	51.4	0.335	–71.3
1.2	0.351	–147.9	5.767	90.4	0.107	51.2	0.309	–74.9
1.3	0.348	–154.3	5.316	87.7	0.111	50.9	0.293	–77.5
1.4	0.347	–160.2	4.956	84.7	0.116	50.7	0.273	–80.7
1.5	0.344	–165.8	4.648	82.4	0.121	50.7	0.262	–82.8
1.6	0.345	–171.1	4.359	80.0	0.126	50.6	0.244	–85.5
1.7	0.350	–175.2	4.119	78.0	0.131	50.4	0.236	–87.5
1.8	0.351	179.5	3.895	75.7	0.136	50.4	0.220	–89.7
1.9	0.346	177.2	3.718	73.9	0.140	50.3	0.215	–92.0
2.0	0.358	174.3	3.513	71.8	0.146	50.3	0.202	–93.8
2.1	0.363	171.3	3.363	69.9	0.151	49.9	0.199	–96.6
2.2	0.366	169.3	3.238	68.5	0.156	49.8	0.190	–98.1
2.3	0.363	166.6	3.107	66.3	0.161	49.6	0.188	–100.6
2.4	0.367	163.6	2.991	65.3	0.166	49.2	0.181	–101.7
2.5	0.370	161.7	2.858	63.7	0.171	49.0	0.180	–103.9
2.6	0.375	158.8	2.757	61.6	0.176	48.3	0.175	–105.0
2.7	0.375	157.4	2.679	60.1	0.181	47.9	0.172	–106.9
2.8	0.377	154.5	2.585	58.5	0.186	47.2	0.167	–107.5
2.9	0.376	152.8	2.509	57.2	0.193	47.0	0.164	–109.8
3.0	0.377	149.9	2.424	55.6	0.198	46.5	0.156	–111.2
4.0	0.422	126.9	1.809	39.6	0.251	41.3	0.171	–147.7
5.0	0.472	102.4	1.411	24.0	0.309	29.4	0.226	–174.9

V_{CE} = 2 V, I_C = 20 mA, Z_O = 50 Ω

Frequency	S_{11}		S_{21}		S_{12}		S_{22}	
(GHz)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.693	–23.2	20.755	161.5	0.018	76.8	0.924	–15.1
0.2	0.646	–44.1	18.601	146.4	0.034	69.2	0.833	–28.1
0.3	0.554	–63.5	16.123	134.7	0.045	64.2	0.733	–38.2
0.4	0.502	–79.4	14.027	124.5	0.055	59.7	0.630	–46.3
0.5	0.457	–94.1	12.284	116.5	0.062	57.1	0.551	–52.1
0.6	0.407	–106.1	10.702	110.1	0.069	55.8	0.474	–57.3
0.7	0.383	–117.8	9.538	105.3	0.074	55.1	0.420	–61.5
0.8	0.356	–128.4	8.513	100.5	0.080	54.7	0.370	–65.4
0.9	0.346	–137.6	7.666	97.1	0.085	54.4	0.333	–69.2
1.0	0.344	–145.8	6.969	93.8	0.091	54.4	0.301	–73.2
1.1	0.337	–153.3	6.358	90.7	0.096	54.5	0.279	–76.6
1.2	0.339	–160.1	5.876	87.6	0.102	54.6	0.257	–80.6
1.3	0.341	–165.1	5.440	85.1	0.107	54.2	0.244	–83.4
1.4	0.343	–171.1	5.040	82.3	0.112	54.1	0.227	–87.0
1.5	0.345	–175.7	4.720	80.4	0.118	54.2	0.219	–89.2
1.6	0.348	179.7	4.413	78.0	0.123	54.1	0.203	–92.2
1.7	0.355	176.3	4.170	76.3	0.128	53.9	0.197	–94.5
1.8	0.356	171.7	3.950	74.0	0.134	53.8	0.184	–97.3
1.9	0.354	169.7	3.765	72.5	0.139	53.5	0.180	–99.8
2.0	0.364	167.1	3.555	70.4	0.145	53.3	0.169	–102.2
2.1	0.371	164.7	3.399	68.6	0.151	53.0	0.168	–105.2
2.2	0.371	163.0	3.275	67.2	0.156	52.7	0.160	–107.1
2.3	0.372	161.1	3.140	65.2	0.162	52.3	0.160	–109.9
2.4	0.374	158.2	3.027	64.1	0.167	51.9	0.154	–111.0
2.5	0.380	156.5	2.892	62.6	0.173	51.5	0.154	–113.5
2.6	0.383	153.7	2.786	60.5	0.178	50.7	0.149	–114.7
2.7	0.383	152.3	2.707	59.2	0.183	50.2	0.147	–116.9
2.8	0.387	150.0	2.611	57.6	0.189	49.4	0.143	–117.7
2.9	0.384	148.5	2.536	56.2	0.195	49.0	0.140	–120.2
3.0	0.386	145.6	2.448	54.8	0.201	48.5	0.133	–122.3
4.0	0.431	124.7	1.820	39.2	0.256	42.2	0.165	–158.8
5.0	0.478	100.9	1.416	24.1	0.314	29.5	0.228	177.0

S-PARAMETERS Q2

V_{CE} = 1 V, I_C = 1 mA, Z_O = 50 Ω

Frequency	S_{11}		S_{21}		S_{12}		S_{22}	
(GHz)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.958	–18.6	3.742	165.9	0.039	77.6	0.986	–7.5
0.2	0.926	–38.0	3.515	153.0	0.073	67.5	0.952	–14.9
0.3	0.893	–55.7	3.311	141.8	0.102	57.2	0.903	–21.1
0.4	0.866	–71.9	3.080	130.4	0.124	48.6	0.849	–26.6
0.5	0.826	–86.5	2.803	120.8	0.139	41.0	0.797	–31.0
0.6	0.800	–99.0	2.559	112.4	0.150	34.6	0.750	–34.9
0.7	0.777	–110.6	2.326	104.6	0.157	29.2	0.710	–38.2
0.8	0.760	–120.5	2.139	97.7	0.159	24.5	0.678	–41.3
0.9	0.750	–129.0	1.962	91.8	0.160	20.5	0.651	–44.3
1.0	0.743	–136.3	1.807	86.2	0.159	17.2	0.627	–47.2
1.1	0.738	–142.7	1.677	81.2	0.157	14.4	0.609	–50.2
1.2	0.736	–148.4	1.556	76.9	0.153	12.1	0.595	–53.2
1.3	0.731	–153.0	1.457	72.4	0.149	10.4	0.583	–56.4
1.4	0.732	–157.3	1.363	68.3	0.144	9.0	0.574	–59.7
1.5	0.732	–161.3	1.284	64.6	0.139	8.1	0.568	–63.2
1.6	0.732	–164.9	1.213	60.7	0.133	7.8	0.563	–66.7
1.7	0.730	–168.0	1.147	57.3	0.127	8.0	0.560	–70.5
1.8	0.731	–171.2	1.086	54.1	0.121	8.7	0.559	–74.0
1.9	0.732	–174.0	1.032	51.2	0.115	10.3	0.558	–77.6
2.0	0.736	–176.7	0.988	48.3	0.109	12.4	0.558	–81.3
2.1	0.736	–179.6	0.944	45.6	0.104	15.2	0.559	–84.8
2.2	0.738	177.8	0.909	42.7	0.099	19.0	0.562	–88.6
2.3	0.737	175.1	0.869	40.2	0.096	23.2	0.566	–92.1
2.4	0.739	172.3	0.839	37.6	0.094	28.2	0.569	–95.6
2.5	0.744	169.6	0.807	35.7	0.094	33.6	0.571	–99.2
2.6	0.747	167.1	0.768	33.5	0.096	39.0	0.574	–102.7
2.7	0.747	164.3	0.737	31.4	0.100	44.4	0.578	–105.9
2.8	0.752	161.9	0.717	29.1	0.106	49.3	0.584	–109.6
2.9	0.755	159.7	0.699	27.2	0.114	54.2	0.585	–112.4
3.0	0.757	157.2	0.674	25.7	0.122	57.6	0.587	–116.1
4.0	0.785	139.3	0.513	18.1	0.253	59.2	0.589	–155.9
5.0	0.765	125.8	0.458	8.6	0.365	33.2	0.500	160.0

V_{CE} = 1 V, I_C = 3 mA, Z_O = 50 Ω

Frequency	S_{11}		S_{21}		S_{12}		S_{22}	
(GHz)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.886	–31.6	9.729	158.8	0.037	72.9	0.950	–15.0
0.2	0.820	–59.4	8.474	141.6	0.064	58.8	0.847	–27.2
0.3	0.762	–82.6	7.325	128.3	0.082	48.1	0.735	–35.9
0.4	0.724	–101.4	6.289	116.7	0.093	40.7	0.640	–41.9
0.5	0.691	–116.7	5.390	108.2	0.099	35.7	0.565	–46.0
0.6	0.673	–128.5	4.686	101.1	0.102	32.2	0.508	–49.1
0.7	0.663	–138.3	4.114	95.2	0.105	29.9	0.463	–51.4
0.8	0.655	–146.1	3.673	89.9	0.105	28.6	0.429	–53.8
0.9	0.651	–152.6	3.305	85.4	0.105	27.7	0.402	–56.1
1.0	0.652	–158.4	2.994	81.3	0.105	27.5	0.380	–58.5
1.1	0.655	–163.1	2.748	77.6	0.105	27.9	0.364	–61.1
1.2	0.655	–167.2	2.529	74.2	0.105	28.5	0.351	–63.8
1.3	0.654	–170.6	2.346	70.8	0.105	29.8	0.341	–66.8
1.4	0.656	–173.5	2.184	67.7	0.105	30.9	0.334	–70.0
1.5	0.659	–176.3	2.048	64.7	0.106	32.7	0.330	–73.4
1.6	0.660	–179.0	1.926	61.8	0.107	34.4	0.327	–76.9
1.7	0.661	178.7	1.815	59.0	0.108	36.5	0.326	–80.5
1.8	0.661	176.5	1.720	56.5	0.110	38.5	0.326	–84.0
1.9	0.662	174.5	1.633	54.1	0.112	40.6	0.329	–87.6
2.0	0.666	172.5	1.557	51.5	0.114	43.0	0.330	–91.0
2.1	0.666	170.1	1.490	49.2	0.118	45.0	0.334	–94.4
2.2	0.667	168.1	1.433	46.5	0.122	47.2	0.338	–98.0
2.3	0.667	165.9	1.376	44.2	0.126	49.0	0.344	–101.1
2.4	0.669	163.7	1.328	41.9	0.131	50.5	0.349	–104.6
2.5	0.673	161.6	1.276	40.0	0.136	52.0	0.353	–107.7
2.6	0.678	159.5	1.226	37.8	0.142	53.3	0.360	–111.0
2.7	0.680	157.4	1.174	35.5	0.149	54.5	0.365	–113.9
2.8	0.685	155.5	1.143	33.4	0.157	55.4	0.372	–117.1
2.9	0.686	153.9	1.114	31.2	0.164	56.8	0.375	–119.8
3.0	0.690	151.7	1.079	29.4	0.172	57.3	0.379	–123.0
4.0	0.736	137.7	0.808	15.3	0.272	53.0	0.411	–161.4
5.0	0.751	125.9	0.630	1.1	0.364	31.4	0.397	157.5

V_{CE} = 1 V, I_C = 5 mA, Z_O = 50 Ω

Frequency	S_{11}		S_{21}		S_{12}		S_{22}	
(GHz)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.816	–42.6	14.761	152.7	0.034	69.3	0.904	–21.3
0.2	0.734	–76.6	11.896	133.0	0.056	53.4	0.745	–36.6
0.3	0.677	–101.7	9.670	119.7	0.067	44.4	0.606	–45.6
0.4	0.652	–120.1	7.910	108.8	0.074	39.4	0.505	–51.2
0.5	0.632	–133.7	6.596	101.6	0.078	36.9	0.432	–54.7
0.6	0.622	–144.0	5.625	95.5	0.081	35.7	0.380	–57.4
0.7	0.620	–152.1	4.883	90.5	0.083	35.7	0.340	–59.5
0.8	0.620	–158.5	4.330	86.0	0.085	36.3	0.311	–61.7
0.9	0.620	–164.1	3.869	82.2	0.087	37.0	0.288	–64.1
1.0	0.624	–168.3	3.488	78.7	0.089	38.2	0.270	–66.7
1.1	0.627	–172.2	3.190	75.4	0.092	39.5	0.257	–69.5
1.2	0.630	–175.4	2.930	72.6	0.094	41.0	0.246	–72.5
1.3	0.631	–178.1	2.715	69.6	0.097	42.7	0.239	–76.0
1.4	0.635	179.3	2.525	66.9	0.100	44.2	0.234	–79.4
1.5	0.637	177.1	2.364	64.4	0.103	45.9	0.231	–83.2
1.6	0.640	174.8	2.221	61.7	0.107	47.3	0.230	–87.0
1.7	0.640	173.1	2.097	59.3	0.111	48.9	0.230	–90.9
1.8	0.642	171.1	1.986	57.0	0.116	50.1	0.232	–94.6
1.9	0.642	169.2	1.881	54.7	0.121	51.6	0.236	–98.1
2.0	0.646	167.8	1.798	52.3	0.126	52.7	0.240	–101.5
2.1	0.644	165.5	1.716	50.1	0.132	53.9	0.245	–104.8
2.2	0.647	163.5	1.653	47.8	0.137	54.7	0.250	–108.3
2.3	0.647	161.6	1.587	45.4	0.143	55.5	0.257	–111.4
2.4	0.648	159.6	1.527	43.3	0.149	56.0	0.263	–114.6
2.5	0.653	157.7	1.472	41.3	0.156	56.3	0.269	–117.5
2.6	0.653	156.1	1.413	39.5	0.163	56.6	0.276	–120.6
2.7	0.661	154.0	1.359	37.3	0.170	56.9	0.281	–123.3
2.8	0.663	152.4	1.323	35.2	0.178	57.0	0.289	–126.2
2.9	0.667	151.0	1.288	33.1	0.185	57.5	0.292	–128.7
3.0	0.668	149.0	1.247	31.3	0.192	57.3	0.297	–131.6
4.0	0.716	136.8	0.940	16.5	0.282	50.7	0.341	–169.3
5.0	0.743	125.9	0.721	0.8	0.364	30.4	0.352	152.8

V_{CE} = 1 V, I_C = 7 mA, Z_O = 50 Ω

Frequency	S_{11}		S_{21}		S_{12}		S_{22}	
(GHz)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.757	–51.9	18.689	147.7	0.033	66.1	0.861	–26.5
0.2	0.675	–90.0	14.141	127.0	0.050	50.9	0.663	–43.2
0.3	0.637	–115.0	11.007	114.2	0.058	43.6	0.518	–52.1
0.4	0.616	–131.9	8.780	104.3	0.063	40.9	0.420	–57.3
0.5	0.603	–144.0	7.230	97.8	0.067	40.1	0.354	–60.5
0.6	0.598	–153.1	6.114	92.4	0.070	40.2	0.307	–63.2
0.7	0.599	–159.8	5.272	87.9	0.074	41.4	0.273	–65.5
0.8	0.603	–165.5	4.643	84.0	0.077	42.7	0.247	–67.9
0.9	0.605	–170.1	4.155	80.5	0.080	44.0	0.227	–70.6
1.0	0.610	–173.8	3.742	77.2	0.083	45.7	0.212	–73.7
1.1	0.617	–177.1	3.419	74.4	0.087	47.2	0.201	–77.1
1.2	0.621	–179.7	3.140	71.8	0.091	48.7	0.192	–80.6
1.3	0.622	177.7	2.907	69.0	0.096	50.2	0.186	–84.5
1.4	0.622	175.7	2.697	66.6	0.100	51.4	0.183	–88.5
1.5	0.627	173.9	2.527	64.1	0.105	52.6	0.182	–92.7
1.6	0.630	171.5	2.373	61.6	0.110	53.7	0.183	–96.8
1.7	0.629	170.0	2.239	59.2	0.116	54.7	0.185	–100.8
1.8	0.634	168.0	2.119	57.2	0.121	55.5	0.188	–104.6
1.9	0.632	166.5	2.011	55.1	0.128	56.3	0.193	–108.2
2.0	0.639	165.1	1.914	52.9	0.134	56.9	0.198	–111.5
2.1	0.636	163.2	1.831	50.8	0.140	57.6	0.203	–114.6
2.2	0.638	161.5	1.761	48.5	0.146	58.0	0.210	–118.0
2.3	0.639	159.5	1.693	46.2	0.153	58.2	0.217	–120.7
2.4	0.639	157.8	1.629	44.1	0.159	58.2	0.224	–123.7
2.5	0.643	155.9	1.571	42.3	0.166	58.1	0.230	–126.3
2.6	0.646	154.2	1.508	40.4	0.173	58.2	0.237	–129.1
2.7	0.650	152.2	1.456	38.4	0.181	58.0	0.243	–131.4
2.8	0.654	150.6	1.413	36.1	0.189	57.8	0.251	–134.3
2.9	0.654	149.4	1.377	34.1	0.196	57.9	0.255	–136.5
3.0	0.657	147.4	1.331	32.4	0.203	57.5	0.259	–139.3
4.0	0.705	136.2	1.010	17.5	0.288	49.7	0.311	–175.7
5.0	0.736	126.0	0.770	1.5	0.364	29.7	0.331	148.7

V_{CE} = 1 V, I_C = 10 mA, Z_O = 50 Ω

Frequency	S_{11}		S_{21}		S_{12}		S_{22}	
(GHz)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.696	–65.1	23.163	141.8	0.029	62.2	0.801	–32.9
0.2	0.615	–105.2	16.266	120.6	0.043	49.1	0.571	–50.7
0.3	0.598	–128.5	12.161	108.9	0.049	44.7	0.429	–59.1
0.4	0.590	–143.7	9.506	100.1	0.054	44.0	0.340	–64.1
0.5	0.582	–153.8	7.734	94.4	0.058	45.1	0.282	–67.5
0.6	0.585	–161.5	6.512	89.6	0.062	46.4	0.242	–70.4
0.7	0.589	–166.9	5.592	85.7	0.067	48.2	0.213	–73.2
0.8	0.595	–171.8	4.925	82.0	0.071	49.9	0.192	–76.5
0.9	0.596	–175.5	4.393	79.0	0.076	51.4	0.175	–79.9
1.0	0.603	–178.7	3.951	76.1	0.081	52.9	0.163	–83.8
1.1	0.609	178.6	3.606	73.2	0.086	54.3	0.154	–88.2
1.2	0.613	176.3	3.310	70.9	0.091	55.4	0.148	–92.5
1.3	0.614	174.1	3.060	68.3	0.097	56.5	0.145	–97.2
1.4	0.618	172.3	2.845	66.0	0.102	57.4	0.144	–102.0
1.5	0.623	170.6	2.662	63.7	0.108	58.2	0.145	–106.5
1.6	0.625	168.8	2.495	61.5	0.114	58.8	0.148	–110.9
1.7	0.625	167.3	2.355	59.2	0.121	59.3	0.151	–114.9
1.8	0.629	165.6	2.228	57.3	0.127	59.6	0.156	–118.6
1.9	0.629	164.2	2.111	55.2	0.134	60.0	0.162	–121.8
2.0	0.633	162.7	2.013	53.1	0.141	60.1	0.168	–124.8
2.1	0.630	160.9	1.924	51.1	0.148	60.3	0.175	–127.4
2.2	0.635	159.4	1.849	48.7	0.155	60.4	0.182	–130.4
2.3	0.630	157.5	1.782	46.7	0.161	60.2	0.189	–132.7
2.4	0.634	155.8	1.714	44.6	0.168	59.9	0.197	–135.2
2.5	0.637	154.1	1.652	42.9	0.175	59.6	0.203	–137.4
2.6	0.641	152.4	1.589	41.0	0.183	59.1	0.211	–139.9
2.7	0.644	150.8	1.530	39.0	0.191	58.7	0.216	–142.0
2.8	0.648	149.2	1.491	36.9	0.199	58.1	0.224	–144.3
2.9	0.648	147.9	1.449	34.9	0.206	58.1	0.228	–146.5
3.0	0.651	146.1	1.403	33.3	0.213	57.4	0.233	–148.8
4.0	0.699	135.7	1.064	18.4	0.294	48.5	0.292	176.6
5.0	0.731	126.0	0.816	2.4	0.365	29.0	0.316	144.0

V_{CE} = 1 V, I_C = 15 mA, Z_O = 50 Ω

Frequency	S_{11}		S_{21}		S_{12}		S_{22}	
(GHz)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.602	–81.5	27.947	134.6	0.025	57.3	0.717	–40.7
0.2	0.576	–121.8	18.068	114.5	0.036	48.6	0.472	–58.9
0.3	0.569	–141.8	13.057	104.1	0.041	48.0	0.342	–67.2
0.4	0.572	–154.8	10.041	96.2	0.047	49.4	0.266	–72.4
0.5	0.576	–163.0	8.113	91.4	0.052	51.7	0.219	–76.3
0.6	0.576	–169.1	6.806	87.0	0.057	53.6	0.186	–80.2
0.7	0.583	–173.3	5.842	83.7	0.063	55.4	0.162	–84.2
0.8	0.591	–177.1	5.128	80.4	0.068	57.2	0.145	–89.0
0.9	0.594	179.7	4.564	77.5	0.074	58.3	0.133	–94.0
1.0	0.600	177.1	4.098	74.8	0.080	59.6	0.125	–99.5
1.1	0.607	174.8	3.740	72.3	0.086	60.5	0.120	–105.3
1.2	0.611	172.7	3.436	70.1	0.092	61.1	0.118	–111.0
1.3	0.612	171.1	3.172	67.6	0.099	61.8	0.118	–116.4
1.4	0.616	169.4	2.947	65.4	0.105	62.1	0.120	–121.3
1.5	0.621	167.8	2.759	63.3	0.112	62.7	0.124	–125.9
1.6	0.623	166.1	2.582	61.1	0.119	62.7	0.128	–129.9
1.7	0.623	164.7	2.439	59.1	0.126	62.8	0.134	–133.4
1.8	0.625	163.6	2.312	57.2	0.133	62.7	0.140	–136.3
1.9	0.626	162.0	2.190	55.3	0.141	62.6	0.147	–138.8
2.0	0.629	160.9	2.086	53.2	0.148	62.4	0.153	–141.0
2.1	0.628	159.2	1.994	51.3	0.155	62.3	0.160	–142.9
2.2	0.629	157.5	1.919	49.1	0.162	62.1	0.168	–145.1
2.3	0.629	155.9	1.844	47.0	0.169	61.8	0.175	–146.7
2.4	0.633	154.1	1.776	44.9	0.177	61.1	0.183	–148.6
2.5	0.634	152.5	1.714	43.3	0.184	60.6	0.189	–150.3
2.6	0.637	150.8	1.646	41.5	0.191	59.9	0.196	–152.2
2.7	0.640	149.1	1.588	39.4	0.200	59.4	0.202	–153.9
2.8	0.644	147.9	1.543	37.4	0.207	58.6	0.210	–155.7
2.9	0.645	146.9	1.503	35.6	0.215	58.2	0.214	–157.5
3.0	0.648	144.8	1.454	33.8	0.222	57.4	0.219	–159.5
4.0	0.695	135.1	1.104	19.0	0.300	47.7	0.282	168.7
5.0	0.731	125.6	0.847	2.8	0.366	28.4	0.310	139.0

V_{CE} = 1 V, I_C = 20 mA, Z_O = 50 Ω

Frequency	S_{11}		S_{21}		S_{12}		S_{22}	
(GHz)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.559	–95.3	30.733	129.9	0.024	56.8	0.654	–46.5
0.2	0.556	–132.9	18.918	110.7	0.031	49.6	0.409	–64.8
0.3	0.561	–150.1	13.456	101.0	0.037	51.1	0.290	–73.2
0.4	0.567	–161.0	10.257	94.0	0.043	53.8	0.224	–79.3
0.5	0.573	–168.0	8.266	89.5	0.049	56.9	0.183	–84.1
0.6	0.575	–173.1	6.907	85.6	0.055	58.3	0.156	–89.3
0.7	0.583	–177.0	5.925	82.4	0.061	60.1	0.136	–94.7
0.8	0.590	179.7	5.190	79.2	0.067	61.5	0.124	–100.9
0.9	0.594	176.9	4.627	76.5	0.074	62.3	0.115	–107.2
1.0	0.601	174.5	4.146	74.1	0.080	63.2	0.110	–113.9
1.1	0.606	172.5	3.779	71.7	0.087	63.7	0.108	–120.4
1.2	0.611	170.8	3.478	69.4	0.094	64.1	0.109	–126.3
1.3	0.615	169.1	3.213	67.1	0.101	64.6	0.111	–131.6
1.4	0.616	167.7	2.985	65.0	0.108	64.7	0.115	–136.1
1.5	0.621	166.4	2.792	62.9	0.115	64.8	0.120	–140.0
1.6	0.623	164.8	2.619	60.9	0.122	64.6	0.126	–143.5
1.7	0.625	163.5	2.469	58.8	0.129	64.6	0.132	–146.4
1.8	0.627	162.2	2.340	56.9	0.136	64.3	0.139	–148.6
1.9	0.628	161.0	2.214	55.1	0.144	63.9	0.146	–150.5
2.0	0.630	159.9	2.111	53.2	0.152	63.6	0.153	–151.9
2.1	0.629	158.0	2.017	51.2	0.159	63.3	0.160	–153.4
2.2	0.631	156.5	1.941	49.1	0.167	62.9	0.167	–154.9
2.3	0.631	154.9	1.867	46.9	0.174	62.4	0.174	–156.1
2.4	0.633	153.2	1.800	44.9	0.181	61.8	0.181	–157.5
2.5	0.637	151.6	1.735	43.2	0.189	61.0	0.187	–158.9
2.6	0.639	150.0	1.668	41.5	0.197	60.3	0.195	–160.3
2.7	0.641	148.3	1.607	39.6	0.205	59.6	0.201	–161.7
2.8	0.645	147.1	1.559	37.6	0.213	58.7	0.208	–163.3
2.9	0.645	145.7	1.523	35.7	0.219	58.3	0.211	–164.7
3.0	0.649	144.1	1.471	33.9	0.227	57.3	0.216	–166.6
4.0	0.696	134.6	1.122	19.2	0.303	47.2	0.283	163.7
5.0	0.732	125.4	0.857	3.1	0.367	27.9	0.309	135.6

V_{CE} = 2 V, I_C = 1 mA, Z_O = 50 Ω

Frequency	S_{11}		S_{21}		S_{12}		S_{22}	
(GHz)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.962	–17.3	3.376	166.8	0.034	79.0	0.990	–6.3
0.2	0.941	–35.0	3.205	155.3	0.064	69.5	0.964	–12.5
0.3	0.909	–51.3	3.047	144.6	0.090	59.8	0.926	–17.9
0.4	0.882	–66.7	2.879	133.7	0.112	51.2	0.883	–22.8
0.5	0.845	–80.9	2.649	124.3	0.127	43.8	0.839	–26.9
0.6	0.818	–93.3	2.437	115.9	0.137	37.2	0.798	–30.4
0.7	0.795	–104.8	2.238	108.2	0.144	31.8	0.761	–33.7
0.8	0.779	–115.0	2.072	101.3	0.148	26.9	0.731	–36.6
0.9	0.766	–123.8	1.911	95.1	0.149	22.6	0.705	–39.4
1.0	0.756	–131.4	1.766	89.4	0.148	19.1	0.684	–42.3
1.1	0.751	–138.2	1.644	84.3	0.146	16.0	0.665	–45.1
1.2	0.747	–144.1	1.529	79.8	0.143	13.4	0.651	–48.0
1.3	0.743	–149.1	1.433	75.2	0.139	11.5	0.639	–51.0
1.4	0.742	–153.8	1.339	71.1	0.135	10.0	0.629	–54.3
1.5	0.741	–158.0	1.263	67.2	0.129	9.0	0.622	–57.5
1.6	0.742	–161.9	1.199	63.3	0.123	8.4	0.616	–60.9
1.7	0.738	–165.3	1.132	59.9	0.117	8.5	0.611	–64.5
1.8	0.739	–168.4	1.074	56.7	0.111	9.3	0.610	–68.0
1.9	0.737	–171.3	1.022	53.6	0.105	10.7	0.608	–71.6
2.0	0.745	–174.3	0.981	50.8	0.099	13.1	0.605	–75.3
2.1	0.743	–177.2	0.934	47.9	0.093	16.4	0.605	–78.6
2.2	0.744	179.9	0.901	45.0	0.088	20.4	0.604	–82.6
2.3	0.743	177.0	0.863	42.5	0.084	25.4	0.607	–86.0
2.4	0.746	174.1	0.832	40.0	0.083	31.0	0.609	–89.7
2.5	0.748	171.4	0.797	37.9	0.083	37.2	0.610	–93.0
2.6	0.751	168.6	0.762	35.6	0.085	44.0	0.612	–96.0
2.7	0.753	166.0	0.731	33.5	0.090	50.2	0.614	–99.2
2.8	0.758	163.4	0.707	31.4	0.097	55.3	0.619	–102.9
2.9	0.758	161.3	0.691	29.5	0.105	60.6	0.620	–105.7
3.0	0.762	158.6	0.666	27.9	0.114	64.1	0.617	–109.4
4.0	0.784	139.8	0.509	20.2	0.251	63.6	0.603	–149.2
5.0	0.768	125.9	0.455	10.3	0.365	35.7	0.494	165.1

V_{CE} = 2 V, I_C = 3 mA, Z_O = 50 Ω

Frequency	S_{11}		S_{21}		S_{12}		S_{22}	
(GHz)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.893	–28.9	9.692	160.3	0.032	74.8	0.958	–12.8
0.2	0.825	–55.2	8.579	143.9	0.057	60.4	0.869	–23.7
0.3	0.774	–77.5	7.524	131.0	0.073	50.4	0.770	–31.4
0.4	0.733	–96.2	6.543	119.5	0.084	43.1	0.681	–36.9
0.5	0.696	–111.1	5.640	111.0	0.090	38.0	0.610	–40.5
0.6	0.672	–123.3	4.944	103.7	0.094	34.4	0.553	–43.2
0.7	0.660	–133.4	4.358	97.7	0.096	31.9	0.509	–45.4
0.8	0.652	–142.1	3.903	92.3	0.097	30.4	0.474	–47.4
0.9	0.646	–149.0	3.518	87.7	0.097	29.4	0.448	–49.3
1.0	0.644	–154.7	3.191	83.5	0.097	29.4	0.426	–51.5
1.1	0.647	–159.9	2.927	79.7	0.097	29.7	0.409	–53.7
1.2	0.646	–164.0	2.700	76.4	0.097	30.3	0.394	–56.1
1.3	0.644	–167.9	2.505	72.8	0.097	31.6	0.384	–58.7
1.4	0.649	–170.9	2.331	69.8	0.097	32.8	0.376	–61.5
1.5	0.650	–173.9	2.188	66.8	0.097	34.6	0.369	–64.6
1.6	0.653	–176.8	2.057	63.9	0.098	36.6	0.364	–67.8
1.7	0.651	–179.2	1.942	61.0	0.099	38.8	0.362	–71.2
1.8	0.654	178.5	1.841	58.5	0.101	40.9	0.361	–74.4
1.9	0.654	176.2	1.744	56.0	0.103	43.5	0.361	–77.7
2.0	0.656	174.4	1.664	53.6	0.106	45.8	0.361	–81.1
2.1	0.655	171.9	1.592	51.1	0.109	48.2	0.363	–84.4
2.2	0.659	169.8	1.533	48.5	0.113	50.4	0.365	–87.9
2.3	0.658	167.6	1.470	46.2	0.117	52.4	0.369	–91.1
2.4	0.661	165.3	1.414	43.8	0.122	54.1	0.372	–94.4
2.5	0.665	163.1	1.361	41.7	0.127	55.5	0.375	–97.6
2.6	0.664	160.9	1.306	39.8	0.133	57.0	0.380	–100.9
2.7	0.669	158.8	1.258	37.4	0.141	58.3	0.383	–103.8
2.8	0.674	157.0	1.220	35.2	0.149	59.4	0.389	–107.1
2.9	0.678	155.2	1.189	33.1	0.156	60.6	0.390	–109.7
3.0	0.680	153.1	1.149	31.2	0.163	61.3	0.393	–113.1
4.0	0.727	138.9	0.859	16.5	0.266	56.6	0.406	–152.1
5.0	0.745	126.7	0.659	1.2	0.360	33.9	0.381	164.3

V_{CE} = 2 V, I_C = 5 mA, Z_O = 50 Ω

Frequency	S_{11}		S_{21}		S_{12}		S_{22}	
(GHz)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.826	–38.4	14.897	154.6	0.029	71.0	0.919	–18.3
0.2	0.740	–70.7	12.288	135.7	0.050	55.7	0.778	–31.8
0.3	0.684	–95.3	10.137	122.4	0.061	46.7	0.648	–39.8
0.4	0.648	–114.2	8.401	111.5	0.068	41.6	0.549	–44.7
0.5	0.623	–128.3	7.045	104.0	0.072	38.8	0.478	–47.6
0.6	0.610	–138.9	6.036	97.7	0.074	37.7	0.425	–49.6
0.7	0.606	–147.8	5.250	92.7	0.077	37.6	0.385	–51.2
0.8	0.603	–154.9	4.646	88.0	0.079	38.1	0.355	–52.8
0.9	0.604	–160.4	4.169	84.3	0.081	38.5	0.332	–54.5
1.0	0.606	–165.1	3.764	80.6	0.082	39.9	0.313	–56.5
1.1	0.610	–169.3	3.450	77.4	0.085	41.2	0.298	–58.7
1.2	0.613	–172.7	3.171	74.4	0.087	42.7	0.286	–61.1
1.3	0.613	–175.8	2.937	71.4	0.090	44.4	0.277	–63.8
1.4	0.618	–178.1	2.729	68.7	0.093	46.1	0.270	–66.8
1.5	0.617	179.1	2.556	66.1	0.096	47.9	0.266	–70.0
1.6	0.623	177.0	2.402	63.5	0.099	49.5	0.262	–73.5
1.7	0.624	175.0	2.268	61.0	0.103	51.0	0.260	–77.0
1.8	0.623	173.0	2.146	58.7	0.108	52.4	0.261	–80.4
1.9	0.625	171.3	2.036	56.6	0.113	54.0	0.262	–83.9
2.0	0.631	169.6	1.942	54.2	0.117	55.3	0.263	–87.4
2.1	0.627	167.5	1.854	52.0	0.122	56.5	0.266	–90.6
2.2	0.632	165.5	1.785	49.6	0.128	57.4	0.269	–94.3
2.3	0.630	163.6	1.712	47.3	0.134	58.3	0.274	–97.5
2.4	0.634	161.4	1.649	45.0	0.140	58.8	0.278	–100.8
2.5	0.636	159.5	1.590	43.1	0.146	59.3	0.282	–103.9
2.6	0.637	157.5	1.523	41.1	0.153	59.7	0.287	–107.1
2.7	0.644	155.6	1.465	38.9	0.161	59.9	0.292	–110.0
2.8	0.647	154.0	1.423	36.7	0.168	60.1	0.298	–113.1
2.9	0.649	152.5	1.388	34.7	0.176	60.7	0.299	–115.7
3.0	0.653	150.4	1.344	32.8	0.183	60.6	0.303	–119.0
4.0	0.703	138.2	1.010	17.4	0.274	53.9	0.327	–158.5
5.0	0.736	127.3	0.767	1.2	0.359	32.7	0.330	160.0

V_{CE} = 2 V, I_C = 7 mA, Z_O = 50 Ω

Frequency	S_{11}		S_{21}		S_{12}		S_{22}	
(GHz)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.773	–45.9	18.641	150.4	0.028	69.5	0.887	–22.4
0.2	0.684	–82.3	14.568	130.3	0.045	53.9	0.710	–37.1
0.3	0.633	–106.8	11.562	117.3	0.053	45.6	0.571	–44.8
0.4	0.606	–124.9	9.349	107.0	0.059	42.7	0.472	–49.1
0.5	0.592	–137.8	7.732	100.2	0.063	41.7	0.406	–51.5
0.6	0.583	–147.7	6.571	94.7	0.066	41.6	0.357	–53.1
0.7	0.582	–155.2	5.677	90.1	0.069	42.4	0.322	–54.5
0.8	0.584	–161.4	5.019	86.0	0.072	43.7	0.295	–56.0
0.9	0.587	–166.5	4.485	82.3	0.075	44.9	0.274	–57.7
1.0	0.590	–170.5	4.039	79.1	0.078	46.5	0.257	–59.7
1.1	0.595	–174.0	3.690	76.1	0.081	48.2	0.244	–62.1
1.2	0.599	–176.9	3.397	73.5	0.085	49.5	0.233	–64.6
1.3	0.599	–179.5	3.151	70.7	0.089	51.1	0.225	–67.6
1.4	0.604	178.2	2.923	68.3	0.093	52.6	0.219	–70.9
1.5	0.607	176.2	2.733	65.8	0.098	54.0	0.215	–74.3
1.6	0.610	174.1	2.570	63.3	0.102	55.2	0.213	–78.1
1.7	0.611	171.9	2.423	60.9	0.107	56.3	0.212	–81.8
1.8	0.612	170.3	2.296	58.7	0.113	57.3	0.213	–85.5
1.9	0.613	168.8	2.177	56.6	0.118	58.1	0.214	–89.2
2.0	0.618	167.3	2.075	54.4	0.124	58.9	0.217	–92.6
2.1	0.616	164.9	1.983	52.3	0.130	59.6	0.220	–96.2
2.2	0.618	163.3	1.906	49.9	0.136	60.1	0.225	–99.8
2.3	0.619	161.3	1.830	47.8	0.142	60.5	0.230	–102.9
2.4	0.621	159.5	1.764	45.6	0.149	60.6	0.235	–106.1
2.5	0.626	157.7	1.697	43.7	0.156	60.7	0.239	–109.2
2.6	0.625	155.8	1.628	41.8	0.163	60.7	0.245	–112.5
2.7	0.630	154.1	1.566	39.8	0.170	60.6	0.249	–115.2
2.8	0.636	152.4	1.527	37.6	0.178	60.4	0.256	–118.3
2.9	0.639	150.9	1.484	35.6	0.185	60.6	0.258	–120.8
3.0	0.640	149.1	1.437	33.8	0.192	60.3	0.262	–123.9
4.0	0.693	137.7	1.084	18.3	0.279	52.7	0.293	–163.7
5.0	0.730	127.3	0.819	1.6	0.358	32.1	0.308	156.6

V_{CE} = 2 V, I_C = 10 mA, Z_O = 50 Ω

Frequency	S_{11}		S_{21}		S_{12}		S_{22}	
(GHz)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.692	–59.2	23.828	144.5	0.025	63.4	0.830	–28.3
0.2	0.614	–97.0	17.217	123.6	0.038	51.3	0.617	–43.7
0.3	0.578	–121.7	13.057	111.4	0.045	46.4	0.475	–50.7
0.4	0.568	–137.9	10.306	102.3	0.050	45.8	0.385	–54.2
0.5	0.561	–148.5	8.410	96.3	0.054	46.7	0.326	–56.0
0.6	0.560	–157.0	7.104	91.5	0.058	47.6	0.284	–57.5
0.7	0.566	–163.4	6.121	87.4	0.062	49.5	0.254	–58.7
0.8	0.569	–168.4	5.386	83.7	0.066	51.2	0.231	–60.3
0.9	0.570	–172.7	4.806	80.5	0.070	52.6	0.213	–62.2
1.0	0.576	–176.0	4.324	77.6	0.075	54.3	0.198	–64.7
1.1	0.583	–178.9	3.944	74.9	0.080	55.7	0.187	–67.4
1.2	0.586	178.6	3.631	72.5	0.085	56.8	0.178	–70.5
1.3	0.588	176.4	3.357	69.9	0.090	58.0	0.171	–74.1
1.4	0.593	174.5	3.118	67.6	0.095	58.9	0.167	–77.8
1.5	0.597	172.4	2.919	65.3	0.101	59.8	0.165	–81.9
1.6	0.600	170.7	2.737	63.1	0.107	60.5	0.163	–86.0
1.7	0.599	169.1	2.580	60.8	0.112	61.0	0.164	–90.2
1.8	0.601	167.6	2.443	58.8	0.119	61.5	0.165	–94.2
1.9	0.601	166.1	2.315	56.8	0.126	61.8	0.169	–98.0
2.0	0.608	164.6	2.210	54.7	0.132	62.1	0.172	–101.6
2.1	0.604	162.7	2.108	52.7	0.138	62.4	0.177	–104.8
2.2	0.607	161.1	2.028	50.4	0.145	62.5	0.182	–108.6
2.3	0.608	159.3	1.947	48.3	0.151	62.4	0.188	–111.6
2.4	0.611	157.4	1.876	46.2	0.158	62.1	0.193	–114.9
2.5	0.612	155.9	1.807	44.5	0.165	61.9	0.198	–117.7
2.6	0.615	154.0	1.732	42.6	0.172	61.5	0.205	–120.7
2.7	0.619	152.4	1.667	40.5	0.180	61.3	0.209	–123.3
2.8	0.624	150.7	1.621	38.5	0.188	60.8	0.216	–126.2
2.9	0.625	149.5	1.581	36.4	0.195	60.8	0.218	–128.7
3.0	0.630	147.8	1.527	34.7	0.202	60.1	0.223	–131.4
4.0	0.680	137.1	1.153	19.5	0.284	51.5	0.262	–170.9
5.0	0.724	127.6	0.875	2.9	0.358	31.6	0.286	152.3

V_{CE} = 2 V, I_C = 15 mA, Z_O = 50 Ω

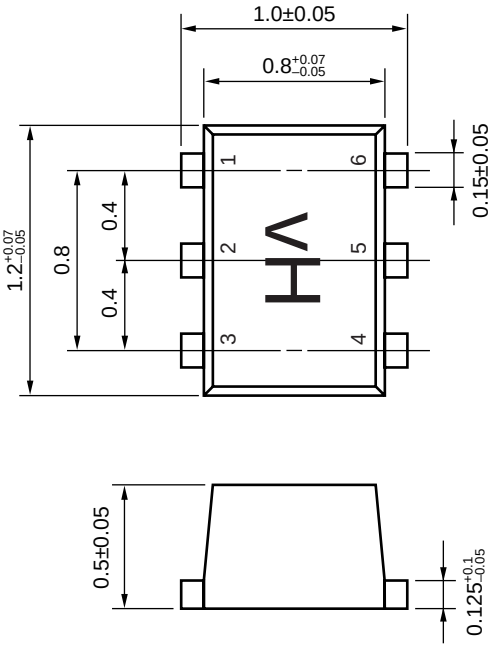
Frequency	S_{11}		S_{21}		S_{12}		S_{22}	
(GHz)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.611	–73.3	29.151	137.7	0.023	63.5	0.755	–34.8
0.2	0.552	–113.9	19.480	117.1	0.032	51.5	0.519	–50.2
0.3	0.543	–135.1	14.247	106.3	0.038	49.6	0.385	–56.2
0.4	0.542	–149.1	11.025	98.3	0.043	50.9	0.307	–59.2
0.5	0.545	–158.4	8.948	93.1	0.048	53.2	0.256	–60.7
0.6	0.543	–164.9	7.513	88.8	0.053	54.7	0.222	–62.1
0.7	0.553	–170.0	6.447	85.2	0.058	56.7	0.196	–63.7
0.8	0.556	–174.4	5.668	81.8	0.063	58.3	0.177	–65.8
0.9	0.562	–177.7	5.042	79.0	0.069	59.6	0.161	–68.1
1.0	0.568	179.6	4.533	76.3	0.075	60.7	0.149	–71.3
1.1	0.575	177.1	4.138	73.8	0.080	61.8	0.140	–75.0
1.2	0.578	174.8	3.797	71.5	0.086	62.5	0.133	–79.1
1.3	0.581	172.8	3.509	69.0	0.092	63.2	0.128	–83.6
1.4	0.584	171.4	3.258	66.9	0.098	63.5	0.126	–88.4
1.5	0.589	169.9	3.051	64.7	0.105	64.0	0.125	–93.2
1.6	0.594	168.0	2.864	62.6	0.111	64.2	0.125	–98.1
1.7	0.594	166.6	2.699	60.5	0.118	64.3	0.128	–102.7
1.8	0.596	165.2	2.559	58.6	0.124	64.4	0.131	–106.8
1.9	0.598	163.8	2.421	56.7	0.131	64.4	0.136	–110.6
2.0	0.599	162.5	2.308	54.8	0.138	64.3	0.140	–114.1
2.1	0.599	160.8	2.204	52.8	0.145	64.2	0.145	–117.2
2.2	0.602	159.0	2.121	50.6	0.153	64.0	0.151	–120.7
2.3	0.601	157.6	2.036	48.5	0.159	63.7	0.158	–123.4
2.4	0.604	155.9	1.961	46.5	0.166	63.1	0.164	–126.3
2.5	0.608	154.4	1.892	44.8	0.173	62.6	0.170	–128.9
2.6	0.611	152.6	1.814	42.9	0.181	62.0	0.176	–131.6
2.7	0.612	150.8	1.748	40.9	0.188	61.6	0.182	–133.8
2.8	0.618	149.3	1.698	38.9	0.196	60.9	0.189	–136.5
2.9	0.619	148.5	1.653	37.1	0.203	60.6	0.192	–138.6
3.0	0.622	146.5	1.602	35.2	0.210	59.9	0.196	–141.3
4.0	0.674	136.7	1.208	20.1	0.289	50.5	0.245	–179.6
5.0	0.722	127.5	0.917	3.2	0.358	30.6	0.277	146.1

V_{CE} = 2 V, I_C = 20 mA, Z_O = 50 Ω

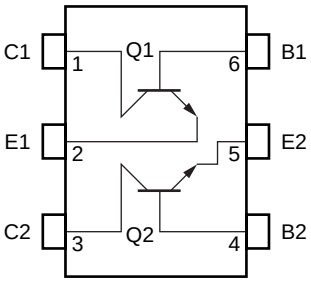
Frequency	S_{11}		S_{21}		S_{12}		S_{22}	
(GHz)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.558	–85.5	32.559	133.1	0.021	60.1	0.696	–39.5
0.2	0.529	–125.0	20.682	113.2	0.029	51.9	0.454	–54.4
0.3	0.525	–144.2	14.836	103.3	0.035	52.5	0.332	–59.8
0.4	0.531	–155.7	11.364	95.9	0.040	55.4	0.261	–62.5
0.5	0.537	–163.8	9.183	91.3	0.045	57.3	0.217	–64.1
0.6	0.539	–169.7	7.683	87.3	0.051	59.3	0.186	–65.7
0.7	0.548	–173.9	6.607	84.0	0.057	60.9	0.163	–67.6
0.8	0.553	–177.5	5.796	80.9	0.063	62.6	0.146	–70.5
0.9	0.558	179.5	5.156	78.1	0.069	63.5	0.133	–73.6
1.0	0.565	177.1	4.629	75.7	0.075	64.3	0.123	–77.6
1.1	0.573	174.8	4.222	73.1	0.081	64.8	0.115	–82.2
1.2	0.577	172.9	3.881	71.0	0.087	65.4	0.109	–87.0
1.3	0.580	171.2	3.586	68.6	0.094	65.7	0.106	–92.4
1.4	0.584	169.6	3.331	66.5	0.100	66.0	0.105	–98.0
1.5	0.587	168.0	3.116	64.4	0.107	66.1	0.105	–103.2
1.6	0.592	166.5	2.922	62.4	0.114	66.2	0.108	–108.5
1.7	0.592	165.3	2.755	60.3	0.121	66.1	0.111	–113.2
1.8	0.594	164.0	2.609	58.5	0.128	65.9	0.115	–117.2
1.9	0.595	162.4	2.470	56.6	0.135	65.6	0.120	–121.0
2.0	0.599	161.4	2.356	54.6	0.142	65.3	0.126	–124.0
2.1	0.596	159.6	2.251	52.6	0.149	65.1	0.132	–127.0
2.2	0.602	158.2	2.163	50.5	0.157	64.8	0.139	–129.9
2.3	0.599	156.6	2.077	48.5	0.163	64.3	0.146	–132.3
2.4	0.601	154.9	2.001	46.5	0.170	63.7	0.153	–134.6
2.5	0.605	153.3	1.927	44.9	0.178	63.0	0.158	–136.9
2.6	0.609	151.8	1.852	43.1	0.185	62.3	0.165	–139.4
2.7	0.613	150.0	1.787	41.0	0.193	61.7	0.170	–141.4
2.8	0.616	148.7	1.734	39.0	0.201	60.8	0.177	–143.8
2.9	0.617	147.5	1.690	37.0	0.208	60.6	0.180	–145.9
3.0	0.619	145.8	1.632	35.4	0.214	59.6	0.185	–148.3
4.0	0.672	136.4	1.234	20.3	0.292	49.8	0.240	174.8
5.0	0.723	127.3	0.936	3.3	0.358	30.1	0.273	142.7

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)

- **The information in this document is current as of December, 2001. The information is subject to change without notice. For actual design-in, refer to the latest publications of NEC's data sheets or data books, etc., for the most up-to-date specifications of NEC semiconductor products. Not all products and/or types are available in every country. Please check with an NEC sales representative for availability and additional information.**
- No part of this document may be copied or reproduced in any form or by any means without prior written consent of NEC. NEC assumes no responsibility for any errors that may appear in this document.
- NEC does not assume any liability for infringement of patents, copyrights or other intellectual property rights of third parties by or arising from the use of NEC semiconductor products listed in this document or any other liability arising from the use of such products. No license, express, implied or otherwise, is granted under any patents, copyrights or other intellectual property rights of NEC or others.
- Descriptions of circuits, software and other related information in this document are provided for illustrative purposes in semiconductor product operation and application examples. The incorporation of these circuits, software and information in the design of customer's equipment shall be done under the full responsibility of customer. NEC assumes no responsibility for any losses incurred by customers or third parties arising from the use of these circuits, software and information.
- While NEC endeavours to enhance the quality, reliability and safety of NEC semiconductor products, customers agree and acknowledge that the possibility of defects thereof cannot be eliminated entirely. To minimize risks of damage to property or injury (including death) to persons arising from defects in NEC semiconductor products, customers must incorporate sufficient safety measures in their design, such as redundancy, fire-containment, and anti-failure features.
- 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).

M8E 00.4-0110

►**Business issue**

NEC Compound Semiconductor Devices, Ltd.
5th Sales Group, Sales Division TEL: +81-3-3798-6372 FAX: +81-3-3798-6783 E-mail: salesinfo@csd-nec.com

NEC Compound Semiconductor Devices Hong Kong Limited
Hong Kong Head Office TEL: +852-3107-7303 FAX: +852-3107-7309
Taipei Branch Office TEL: +886-2-8712-0478 FAX: +886-2-2545-3859
Korea Branch Office TEL: +82-2-528-0301 FAX: +82-2-528-0302

NEC Electron Devices European Operations http://www.nec.de/
TEL: +49-211-6503-101 FAX: +49-211-6503-487

California Eastern Laboratories, Inc. http://www.cel.com/
TEL: +1-408-988-3500 FAX: +1-408-988-0279

►**Technical issue**

NEC Compound Semiconductor Devices, Ltd. http://www.csd-nec.com/
Sales Engineering Group, Sales Division
E-mail: techinfo@csd-nec.com FAX: +81-44-435-1918