NEC

NPN SILICON RF TWIN TRANSISTOR

μPA863TC

NPN SILICON RF TRANSISTOR (WITH 2 DIFFERENT ELEMENTS) IN A FLAT-LEAD 6-PIN THIN-TYPE ULTRA SUPER MINIMOLD

FEATURES

- Low voltage operation
- 2 different built-in transistors (2SC5436, 2SC5800)

  Q1: High gain transistor suited for buffer applications

  f_T = 12.0 GHz TYP., $|S_{21e}|^2$ = 9.0 dB TYP. @ V_{CE} = 1 V, I_C = 10 mA, f = 2 GHz

  Q2: Low phase distortion transistor suited for OSC applications

  f_T = 4.5 GHz TYP., $|S_{21e}|^2$ = 4.0 dB TYP. @ V_{CE} = 1 V, I_C = 5 mA, f = 2 GHz
- Flat-lead 6-pin thin-type ultra super minimold package

BUILT-IN TRANSISTORS

	Q1	Q2
3-pin thin-type ultra super minimold part No.	2SC5436	2SC5800

ORDERING INFORMATION

Part Number	Quantity	Supplying Form
μPA863TC	50 pcs (Non reel)	• 8 mm wide embossed taping • Pin 6 (Q1 Base), Pin 5 (Q2 Emitter), Pin 4 (Q2 Base) face the perforation side of the tape
μPA863TC-T1	3 kpcs/reel	

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

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

Document No. P15734EJ1V0DS00 (1st edition)
Date Published September 2001 NS CP(K)
Printed in Japan

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	5.5	V
Emitter to Base Voltage	V_{EBO}	2	1.5	V
Collector Current	I_C	30	100	mA
Total Power Dissipation	P_{tot} Note	90	200	mW
		230 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_{BE} = 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	$\lvert S_{21e} \rvert^2$	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, $Z_S = Z_{opt}$	–	1.3	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	–	–	600	nA
Emitter Cut-off Current	I_{EBO}	V_{BE} = 1 V, I_C = 0 mA	–	–	600	nA
DC Current Gain	h_{FE} Note 1	V_{CE} = 1 V, I_C = 5 mA	100	120	145	–
Gain Bandwidth Product (1)	f_T	V_{CE} = 1 V, I_C = 5 mA, f = 2 GHz	3.0	4.5	–	GHz
Gain Bandwidth Product (2)	f_T	V_{CE} = 1 V, I_C = 15 mA, f = 2 GHz	5.0	6.5	–	GHz
Insertion Power Gain (1)	$\lvert S_{21e} \rvert^2$	V_{CE} = 1 V, I_C = 5 mA, f = 2 GHz	3.0	4.0	–	dB
Insertion Power Gain (2)	$\lvert S_{21e} \rvert^2$	V_{CE} = 1 V, I_C = 15 mA, f = 2 GHz	4.5	5.5	–	dB
Noise Figure	NF	V_{CE} = 1 V, I_C = 10 mA, f = 2 GHz, $Z_S = Z_{opt}$	–	1.9	2.5	dB
Reverse Transfer Capacitance	C_{re} Note 2	V_{CB} = 0.5 V, I_E = 0 mA, f = 1 MHz	–	0.6	0.8	pF

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

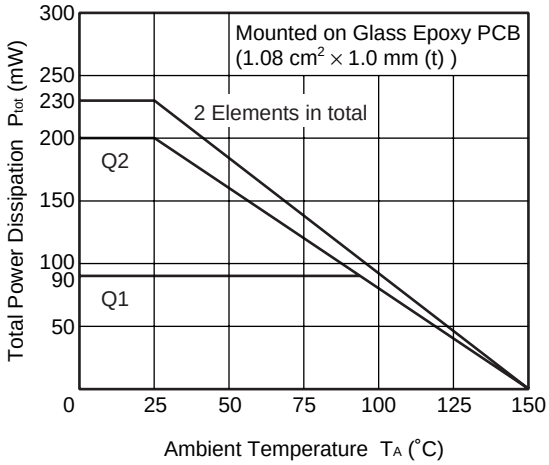
2. Collector to base capacitance when the emitter grounded

h_{FE} CLASSIFICATION

Rank	FB
Marking	5B
h_{FE} Value of Q1	70 to 140
h_{FE} Value of Q2	100 to 145

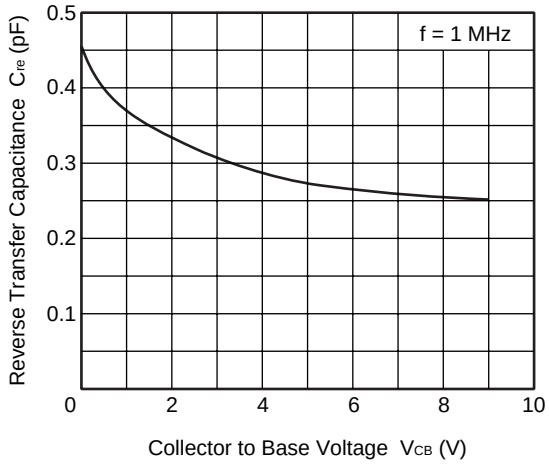
TYPICAL CHARACTERISTICS (Unless otherwise specified, T_A = +25°C)

TOTAL POWER DISSIPATION
vs. AMBIENT TEMPERATURE



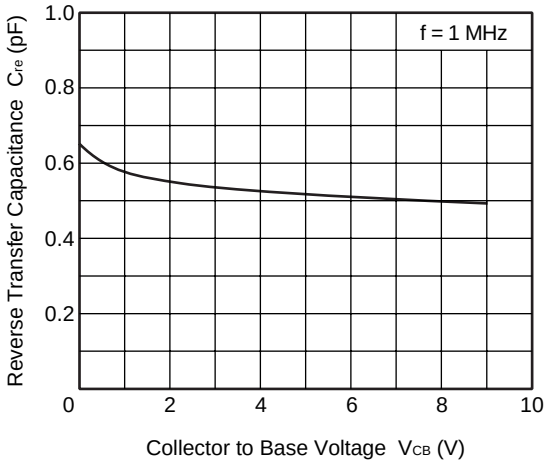
Q1

REVERSE TRANSFER CAPACITANCE
vs. COLLECTOR TO BASE VOLTAGE



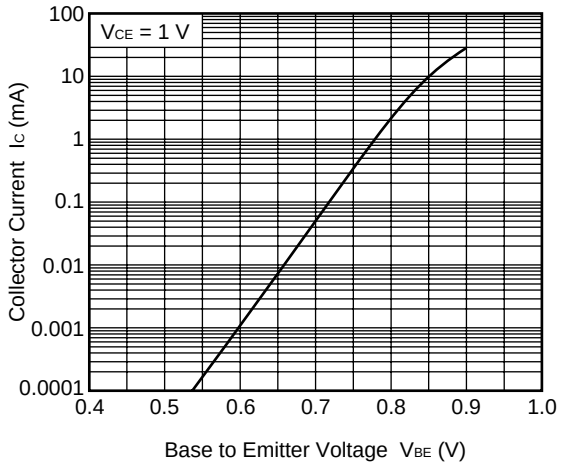
Q2

REVERSE TRANSFER CAPACITANCE
vs. COLLECTOR TO BASE VOLTAGE



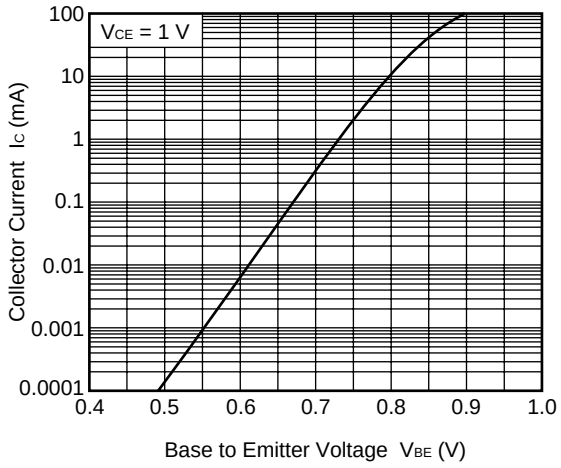
Q1

COLLECTOR CURRENT vs.
BASE TO EMITTER VOLTAGE

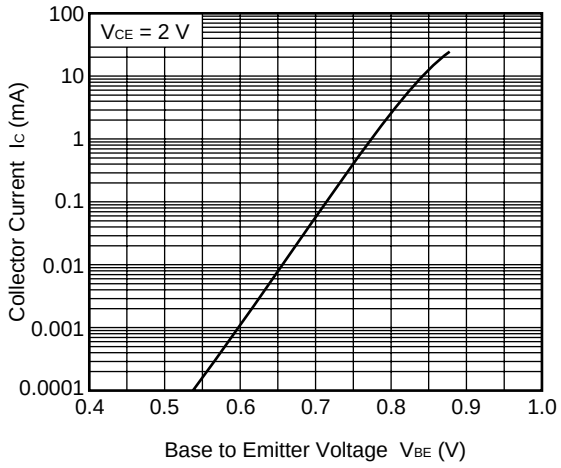


Q2

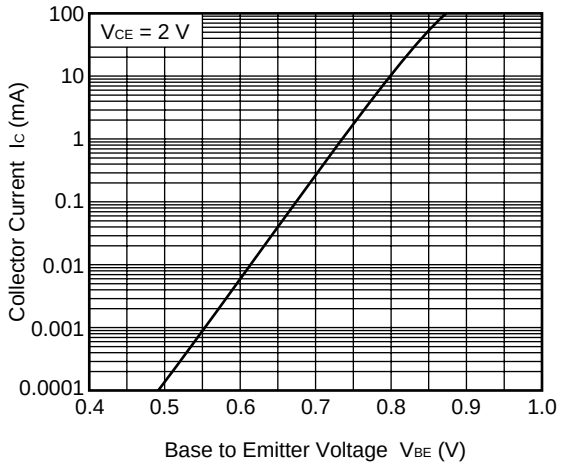
COLLECTOR CURRENT vs.
BASE TO EMITTER VOLTAGE



COLLECTOR CURRENT vs.
BASE TO EMITTER VOLTAGE

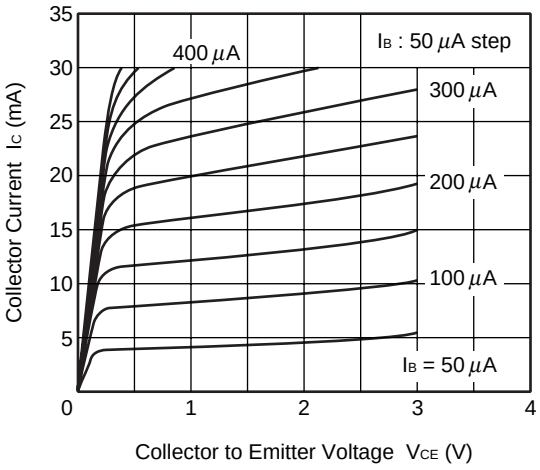


COLLECTOR CURRENT vs.
BASE TO EMITTER VOLTAGE



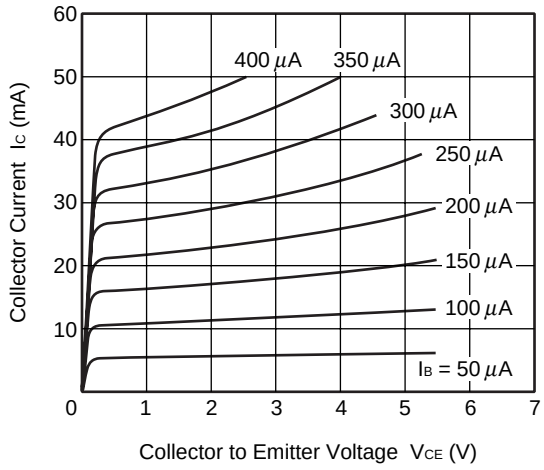
Q1

COLLECTOR CURRENT vs.
COLLECTOR TO EMITTER VOLTAGE



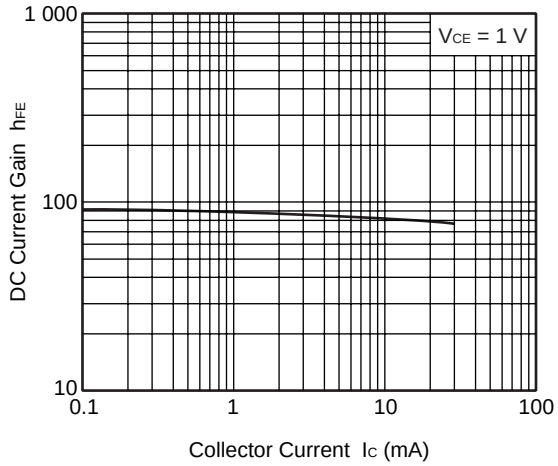
Q2

COLLECTOR CURRENT vs.
COLLECTOR TO EMITTER VOLTAGE



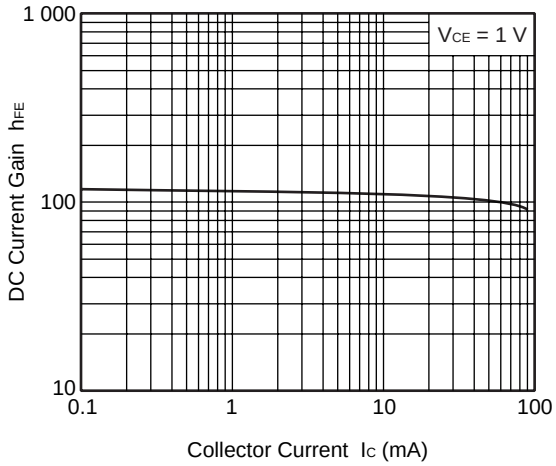
Q1

DC CURRENT GAIN vs.
COLLECTOR CURRENT

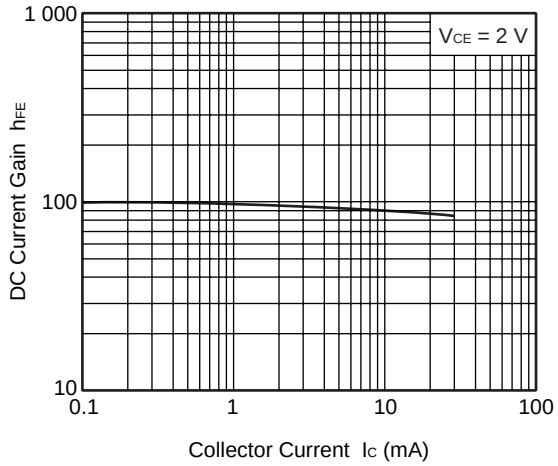


Q2

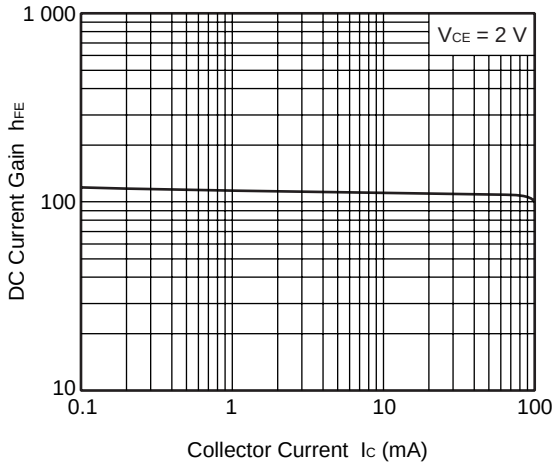
DC CURRENT GAIN vs.
COLLECTOR CURRENT



DC CURRENT GAIN vs.
COLLECTOR CURRENT

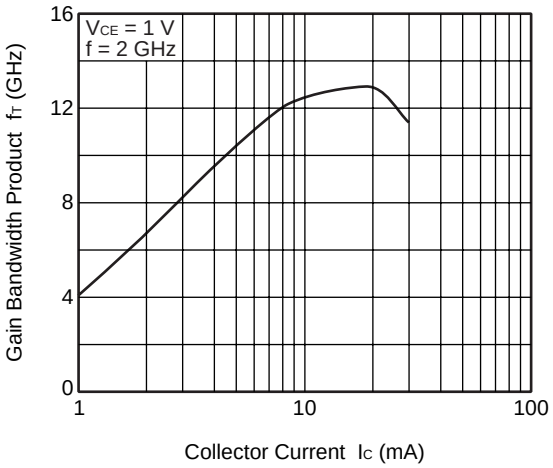


DC CURRENT GAIN vs.
COLLECTOR CURRENT



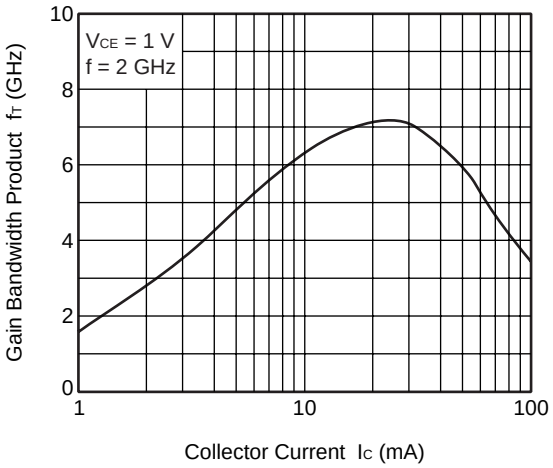
Q1

GAIN BANDWIDTH PRODUCT
vs. COLLECTOR CURRENT

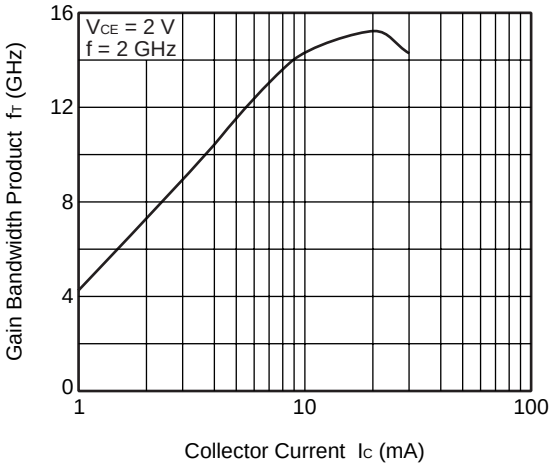


Q2

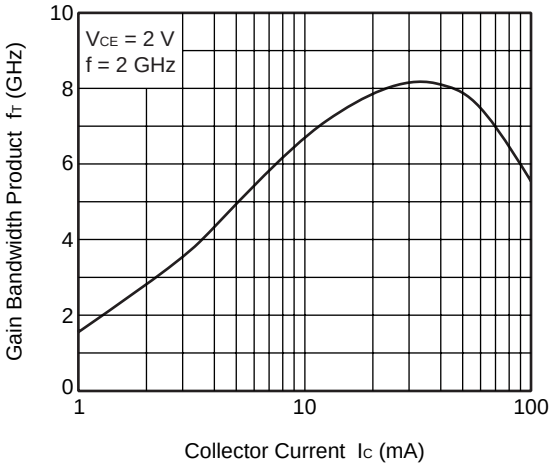
GAIN BANDWIDTH PRODUCT
vs. COLLECTOR CURRENT



GAIN BANDWIDTH PRODUCT
vs. COLLECTOR CURRENT

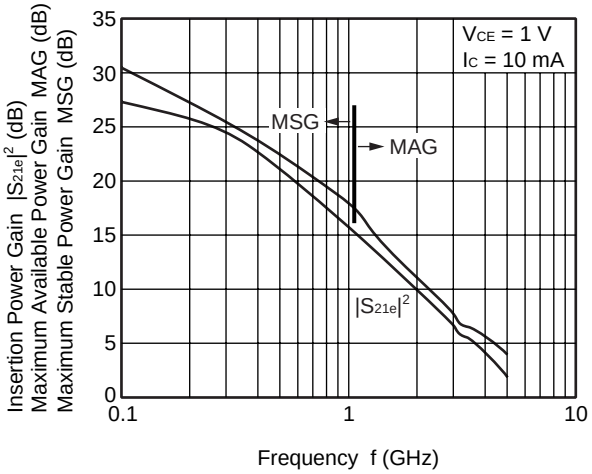


GAIN BANDWIDTH PRODUCT
vs. COLLECTOR CURRENT

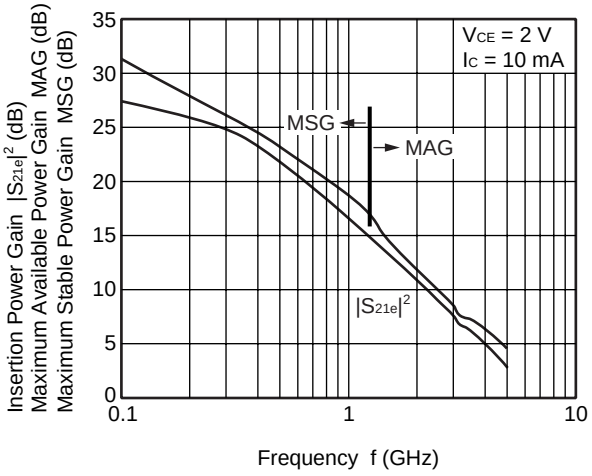


Q1

INSERTION POWER GAIN, MAG, MSG vs. FREQUENCY

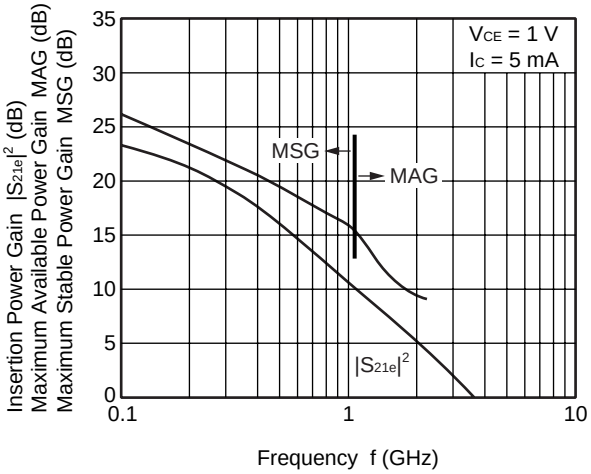


INSERTION POWER GAIN, MAG, MSG vs. FREQUENCY

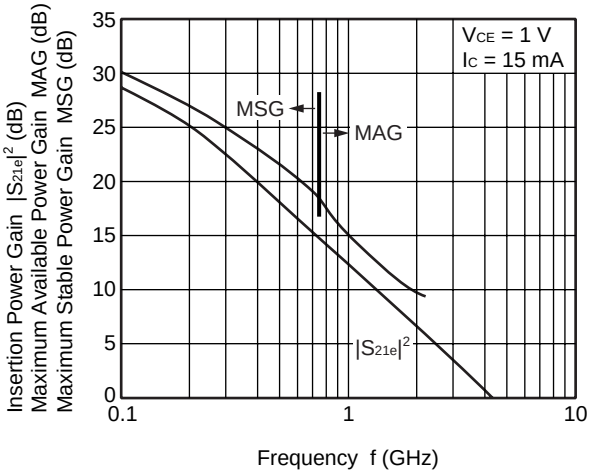


Q2

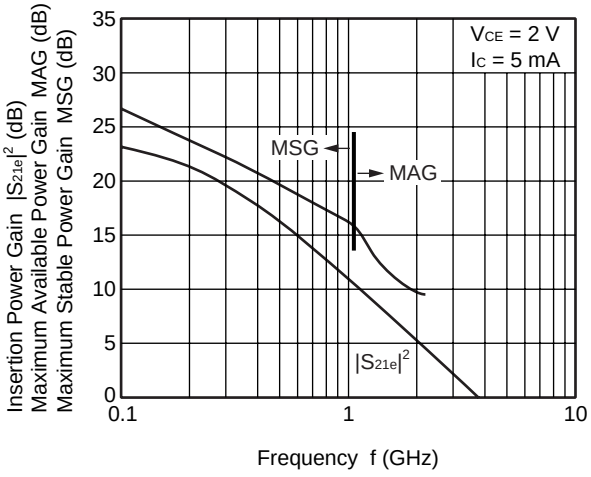
INSERTION POWER GAIN, MAG, MSG vs. FREQUENCY



INSERTION POWER GAIN, MAG, MSG vs. FREQUENCY

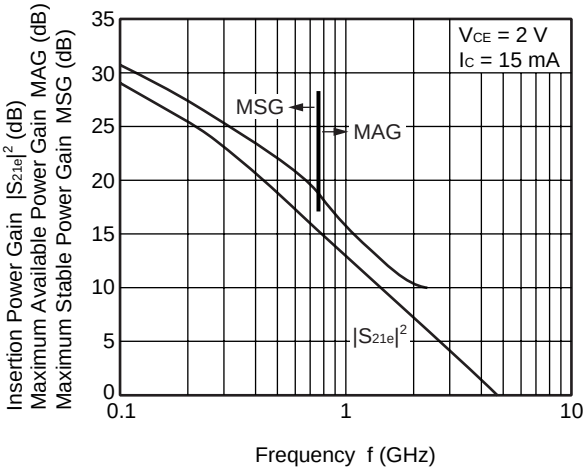


INSERTION POWER GAIN, MAG, MSG vs. FREQUENCY



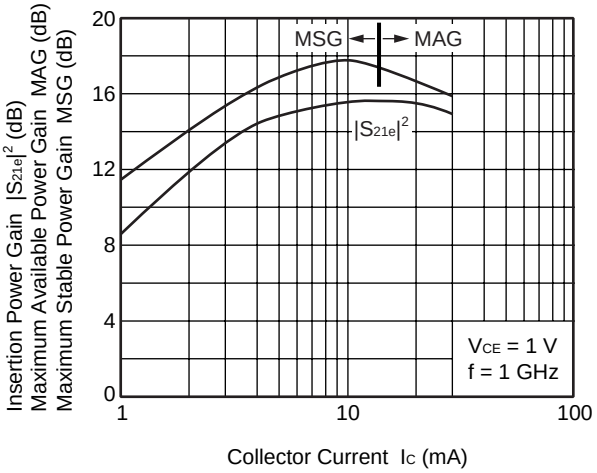
Q2

INSERTION POWER GAIN,
MAG, MSG vs. FREQUENCY



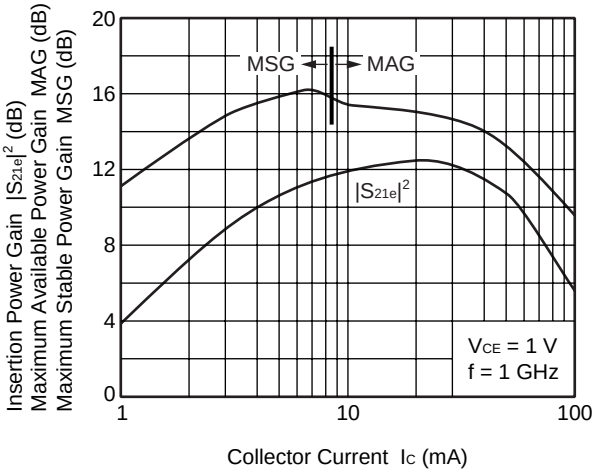
Q1

INSERTION POWER GAIN, MAG, MSG vs. COLLECTOR CURRENT

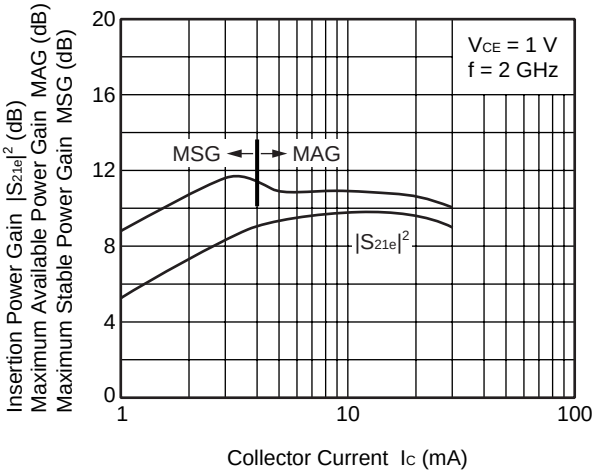


Q2

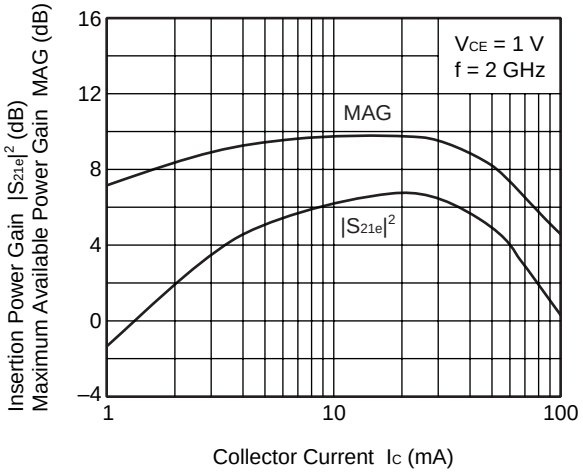
INSERTION POWER GAIN, MAG, MSG vs. COLLECTOR CURRENT



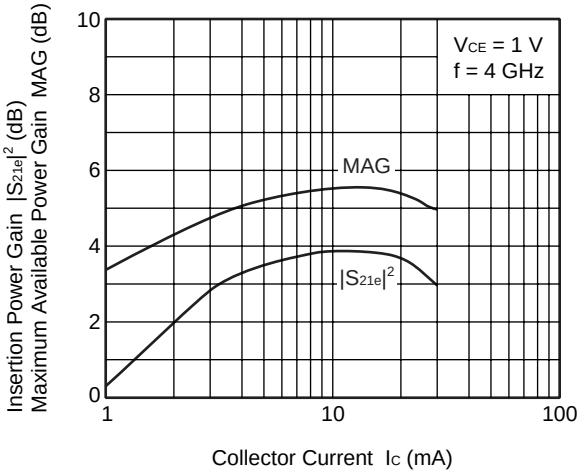
INSERTION POWER GAIN, MAG, MSG vs. COLLECTOR CURRENT



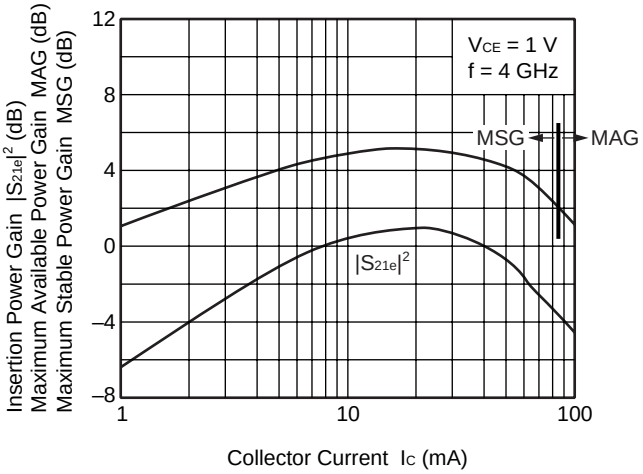
INSERTION POWER GAIN, MAG vs. COLLECTOR CURRENT



INSERTION POWER GAIN, MAG vs. COLLECTOR CURRENT

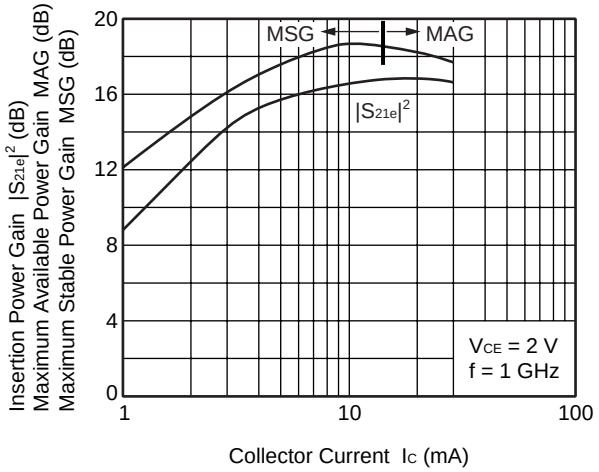


INSERTION POWER GAIN, MAG, MSG vs. COLLECTOR CURRENT



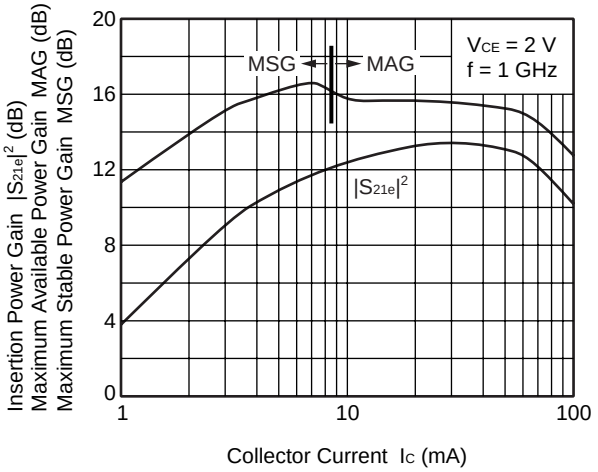
Q1

INSERTION POWER GAIN, MAG, MSG vs. COLLECTOR CURRENT

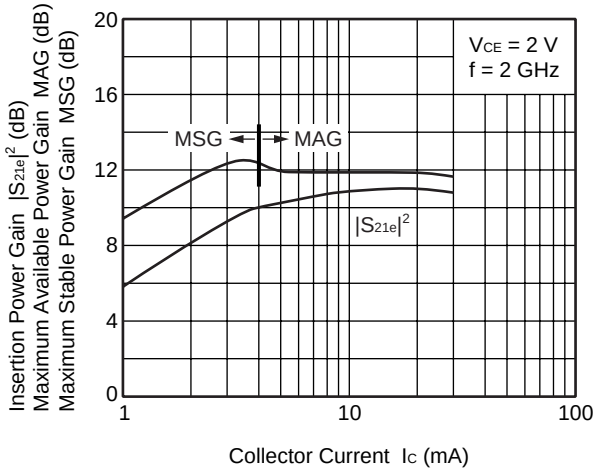


Q2

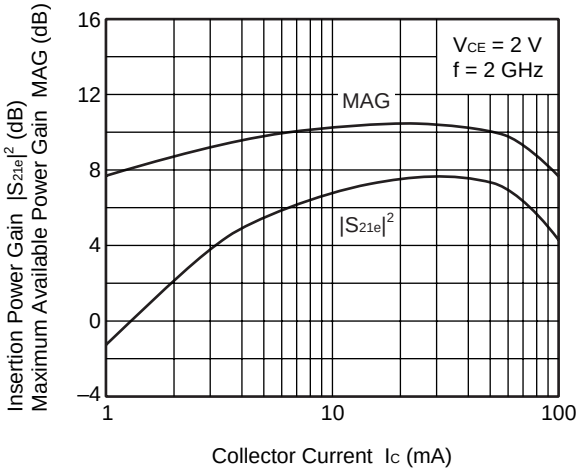
INSERTION POWER GAIN, MAG, MSG vs. COLLECTOR CURRENT



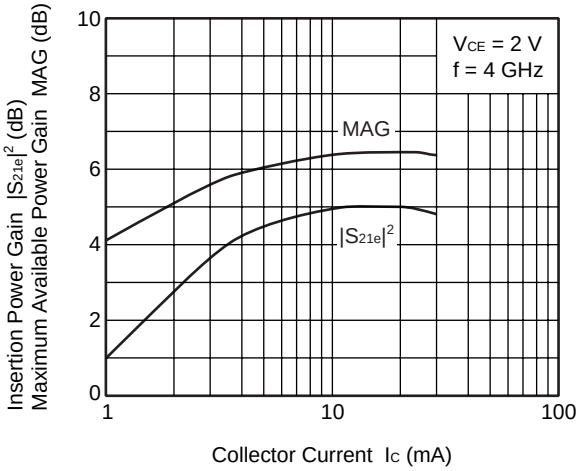
INSERTION POWER GAIN, MAG, MSG vs. COLLECTOR CURRENT



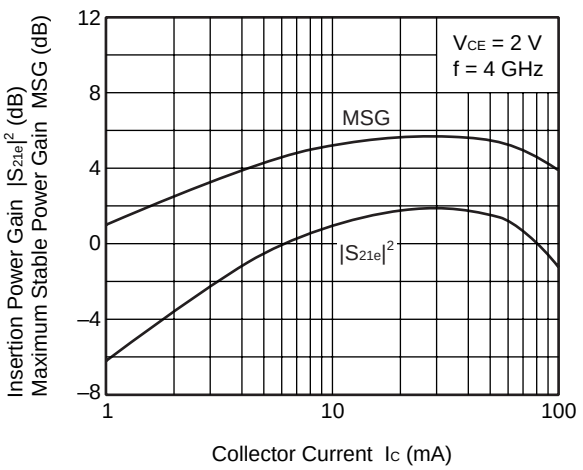
INSERTION POWER GAIN, MAG vs. COLLECTOR CURRENT



INSERTION POWER GAIN, MAG vs. COLLECTOR CURRENT

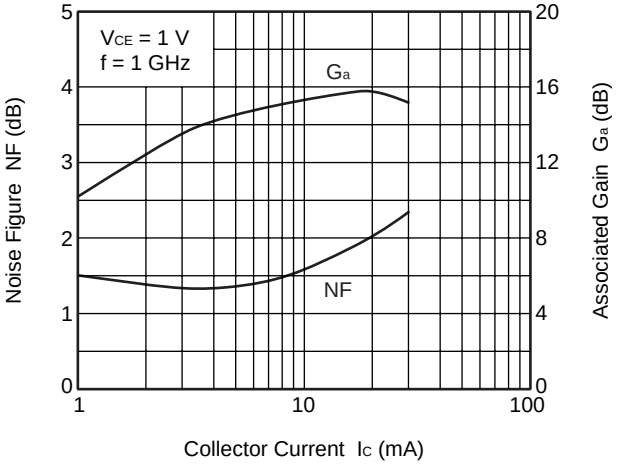


INSERTION POWER GAIN, MSG vs. COLLECTOR CURRENT



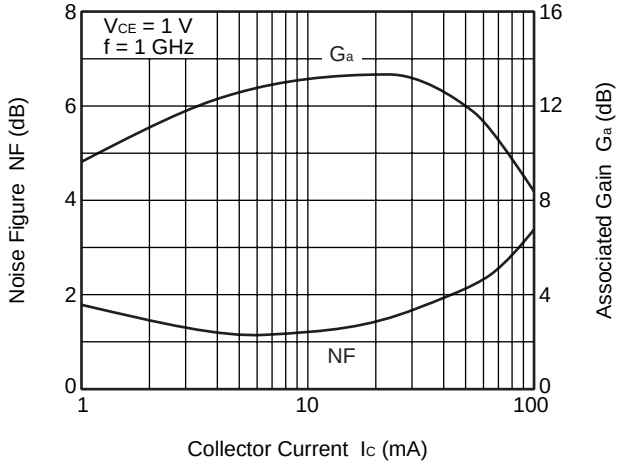
Q1

NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT

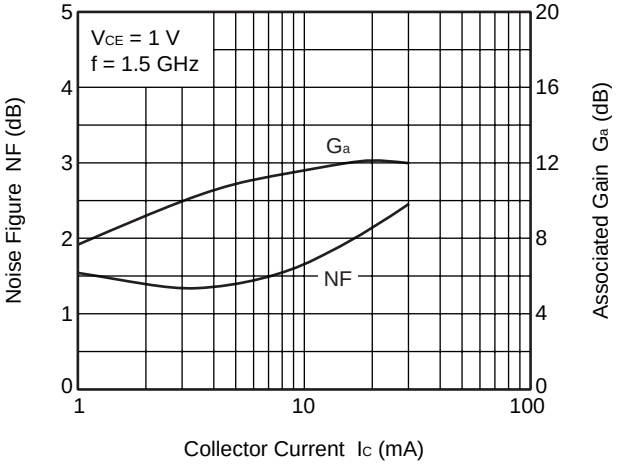


Q2

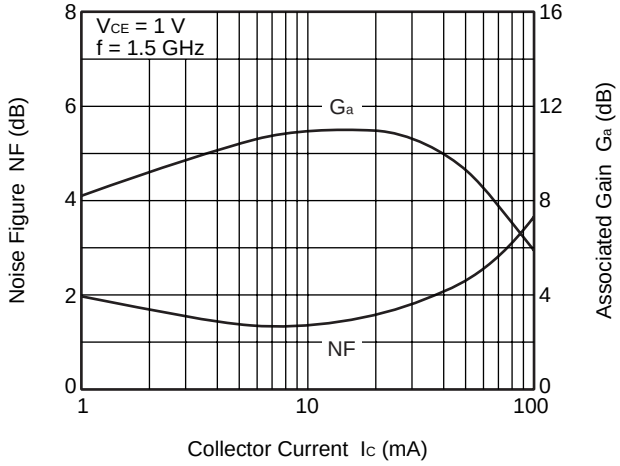
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



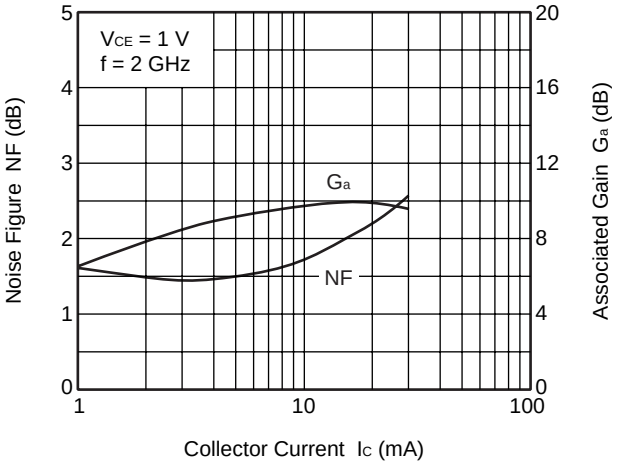
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



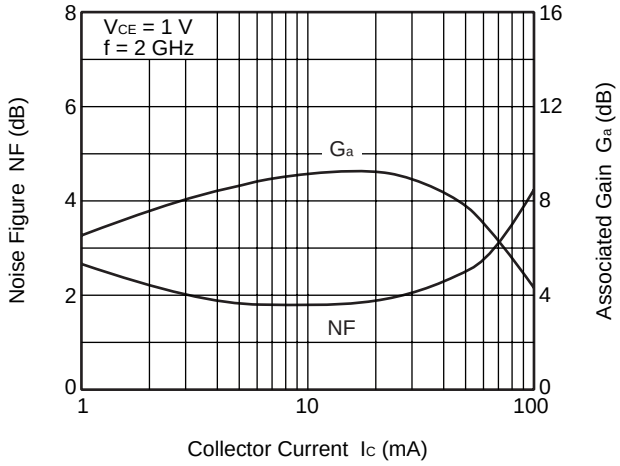
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT

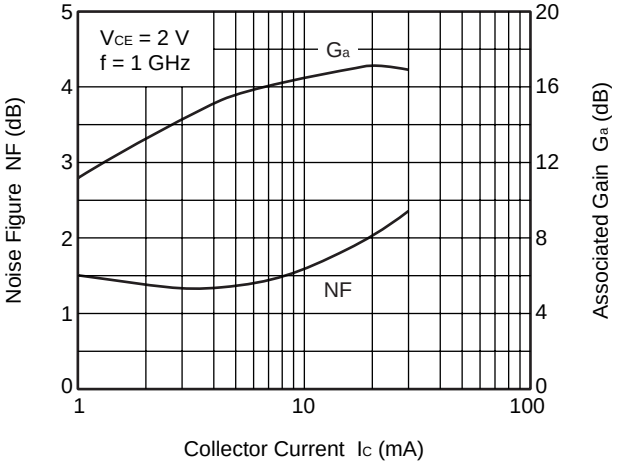


NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



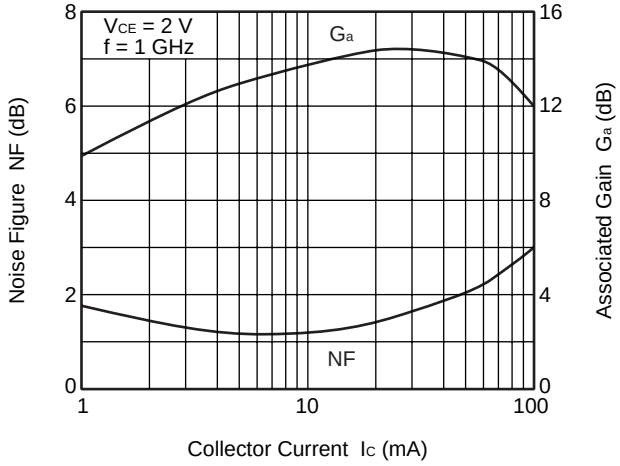
Q1

NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT

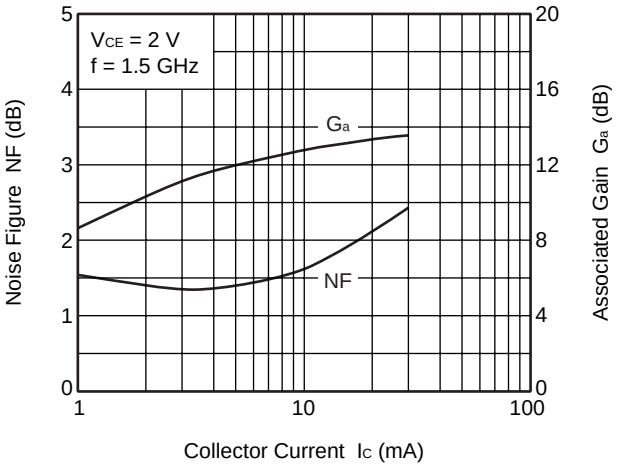


Q2

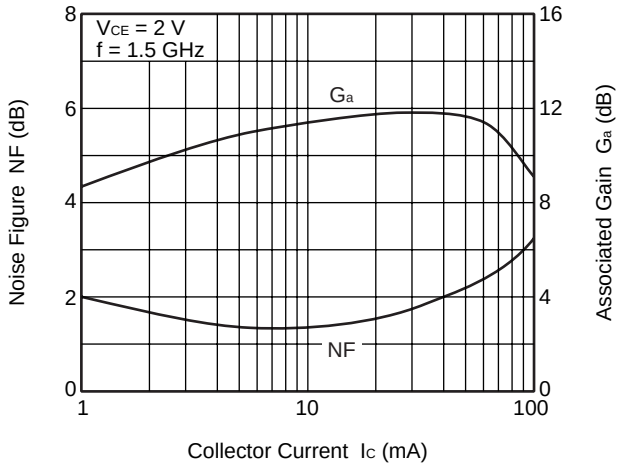
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



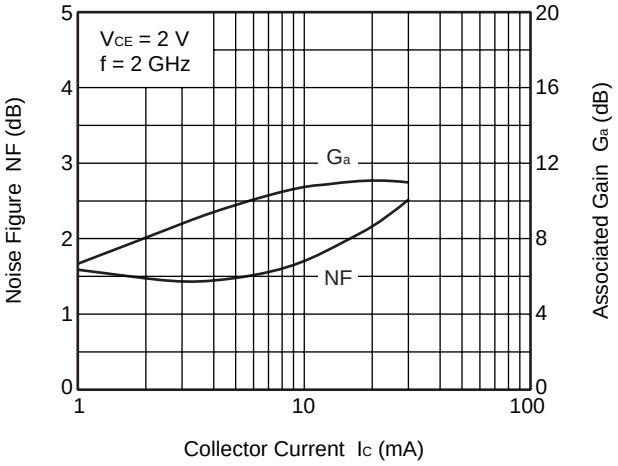
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



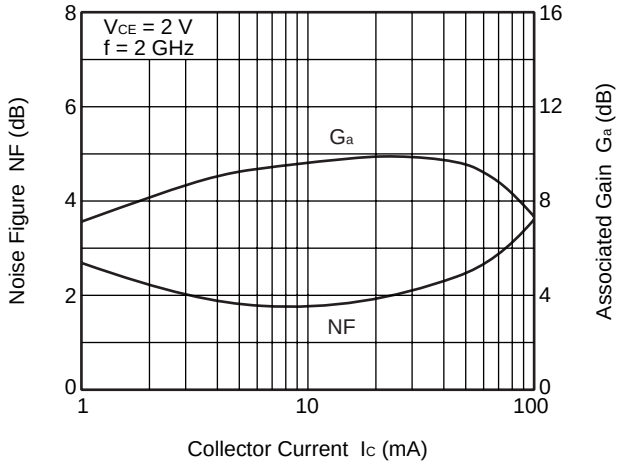
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



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	–9.2	3.473	171.0	0.025	81.9	0.988	–5.0
0.2	0.960	–16.7	3.379	165.6	0.051	79.4	0.977	–9.6
0.3	0.938	–24.8	3.391	158.3	0.076	73.7	0.958	–14.4
0.4	0.921	–32.8	3.303	150.9	0.100	68.6	0.938	–19.1
0.5	0.885	–40.6	3.206	144.4	0.120	63.7	0.912	–23.5
0.6	0.850	–48.4	3.116	138.0	0.140	59.1	0.880	–27.7
0.7	0.814	–56.2	2.996	131.3	0.156	54.8	0.847	–31.6
0.8	0.773	–63.5	2.908	125.5	0.171	50.7	0.815	–35.4
0.9	0.734	–70.9	2.794	119.8	0.184	47.0	0.782	–38.9
1.0	0.697	–78.2	2.693	114.3	0.195	43.4	0.750	–42.2
1.1	0.666	–85.3	2.580	109.4	0.205	40.1	0.718	–45.3
1.2	0.631	–92.5	2.480	104.4	0.212	36.9	0.687	–48.2
1.3	0.609	–99.8	2.396	99.7	0.219	33.9	0.660	–51.1
1.4	0.576	–106.8	2.300	95.1	0.225	31.2	0.630	–53.9
1.5	0.555	–114.2	2.217	90.6	0.230	28.6	0.605	–56.3
1.6	0.532	–120.8	2.124	86.4	0.234	26.3	0.579	–58.7
1.7	0.512	–128.0	2.041	82.1	0.237	24.0	0.556	–60.7
1.8	0.498	–135.4	1.979	78.9	0.238	21.9	0.531	–63.7
1.9	0.480	–142.2	1.899	74.6	0.241	19.9	0.511	–65.6
2.0	0.474	–148.4	1.833	71.0	0.242	18.2	0.492	–67.5
2.1	0.466	–155.5	1.763	67.3	0.242	16.8	0.473	–69.5
2.2	0.465	–161.1	1.718	64.2	0.240	15.6	0.455	–71.7
2.3	0.460	–166.4	1.651	61.1	0.240	14.4	0.441	–73.7
2.4	0.456	–171.6	1.593	57.9	0.239	13.3	0.428	–75.6
2.5	0.453	–177.2	1.551	54.9	0.237	12.2	0.412	–78.0
2.6	0.450	177.6	1.499	51.6	0.236	10.8	0.405	–80.6
2.7	0.449	172.0	1.459	49.2	0.235	9.8	0.396	–82.9
2.8	0.445	166.8	1.414	46.3	0.232	9.0	0.384	–85.4
2.9	0.442	161.5	1.363	43.8	0.230	8.0	0.372	–87.2
3.0	0.421	155.7	1.290	40.6	0.224	7.0	0.356	–90.6
4.0	0.553	125.3	1.038	19.6	0.226	9.6	0.312	–119.4
5.0	0.612	101.9	0.822	1.9	0.250	12.5	0.351	–156.4

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	0.902	–16.5	9.450	166.1	0.025	79.1	0.959	–10.0
0.2	0.865	–28.5	8.890	156.9	0.048	73.6	0.919	–19.2
0.3	0.812	–41.8	8.515	146.0	0.068	66.3	0.858	–27.9
0.4	0.752	–54.3	7.853	136.2	0.085	60.3	0.796	–35.3
0.5	0.686	–65.4	7.186	128.1	0.098	55.5	0.731	–41.6
0.6	0.626	–76.2	6.625	121.0	0.109	51.6	0.668	–47.1
0.7	0.571	–85.8	6.019	114.2	0.118	48.4	0.611	–51.8
0.8	0.523	–95.2	5.572	108.6	0.126	45.9	0.562	–55.9
0.9	0.485	–103.9	5.141	103.2	0.132	43.9	0.517	–59.4
1.0	0.451	–113.1	4.776	98.8	0.138	42.1	0.479	–62.9
1.1	0.425	–120.9	4.426	94.6	0.143	40.8	0.444	–66.0
1.2	0.406	–129.3	4.130	90.4	0.147	39.5	0.414	–68.8
1.3	0.392	–136.8	3.884	86.7	0.152	38.7	0.387	–71.9
1.4	0.376	–144.8	3.641	83.2	0.157	37.8	0.362	–74.8
1.5	0.369	–152.0	3.444	79.7	0.160	37.0	0.341	–77.6
1.6	0.362	–158.8	3.246	76.6	0.165	36.4	0.320	–80.3
1.7	0.361	–165.7	3.072	73.4	0.169	35.7	0.302	–82.6
1.8	0.363	–172.3	2.923	70.9	0.173	35.1	0.285	–86.2
1.9	0.362	–178.9	2.784	67.7	0.177	34.5	0.270	–88.8
2.0	0.365	176.5	2.660	65.0	0.181	33.9	0.255	–91.5
2.1	0.370	170.7	2.534	62.3	0.185	33.6	0.242	–94.6
2.2	0.380	166.8	2.442	59.8	0.189	33.3	0.230	–97.8
2.3	0.384	162.4	2.327	57.4	0.193	32.9	0.220	–101.1
2.4	0.385	158.7	2.233	54.9	0.198	32.4	0.213	–104.2
2.5	0.392	154.4	2.157	52.7	0.201	32.0	0.204	–108.2
2.6	0.393	150.1	2.071	50.0	0.206	31.2	0.200	–111.9
2.7	0.397	146.1	2.007	48.0	0.209	30.6	0.195	–116.0
2.8	0.399	141.7	1.939	45.8	0.213	30.0	0.192	–120.8
2.9	0.403	137.7	1.865	43.5	0.215	29.2	0.188	–125.2
3.0	0.390	132.7	1.759	41.4	0.215	28.3	0.183	–131.6
4.0	0.533	113.7	1.385	23.5	0.263	24.3	0.199	–171.3
5.0	0.589	95.2	1.091	7.6	0.304	17.2	0.286	162.4

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	0.834	–22.3	14.387	162.3	0.023	75.6	0.929	–14.4
0.2	0.777	–38.1	13.010	149.8	0.045	70.2	0.854	–26.8
0.3	0.695	–55.0	11.901	136.9	0.061	62.3	0.762	–37.5
0.4	0.620	–69.6	10.442	126.6	0.074	57.2	0.674	–45.9
0.5	0.549	–82.3	9.203	118.4	0.083	53.4	0.596	–52.5
0.6	0.491	–93.7	8.199	111.6	0.091	51.2	0.526	–58.2
0.7	0.443	–104.0	7.272	105.5	0.098	49.4	0.470	–62.7
0.8	0.407	–115.2	6.583	100.5	0.104	48.3	0.424	–66.8
0.9	0.381	–123.9	6.000	96.0	0.110	47.4	0.385	–70.3
1.0	0.357	–133.3	5.487	91.9	0.116	46.8	0.352	–73.8
1.1	0.344	–140.8	5.049	88.4	0.122	46.3	0.324	–76.9
1.2	0.334	–149.9	4.656	84.8	0.128	45.9	0.301	–80.1
1.3	0.329	–156.5	4.359	81.6	0.133	45.6	0.280	–83.3
1.4	0.325	–164.3	4.061	78.6	0.139	45.1	0.261	–86.9
1.5	0.327	–170.8	3.826	75.5	0.145	44.8	0.245	–90.2
1.6	0.327	–176.9	3.590	72.7	0.150	44.3	0.230	–93.7
1.7	0.330	177.2	3.391	70.0	0.156	43.8	0.217	–97.0
1.8	0.339	171.8	3.209	67.8	0.162	43.4	0.205	–101.4
1.9	0.343	165.8	3.053	65.0	0.168	42.7	0.195	–105.3
2.0	0.349	162.3	2.913	62.6	0.173	42.1	0.185	–109.2
2.1	0.360	158.0	2.769	60.2	0.179	41.7	0.177	–113.7
2.2	0.368	154.7	2.660	58.0	0.185	41.3	0.170	–118.1
2.3	0.376	151.1	2.536	55.9	0.190	40.7	0.166	–122.9
2.4	0.378	147.8	2.430	53.5	0.196	40.0	0.162	–127.1
2.5	0.384	144.3	2.341	51.6	0.201	39.4	0.159	–132.2
2.6	0.389	141.1	2.247	49.0	0.207	38.4	0.159	–136.5
2.7	0.394	137.6	2.176	47.1	0.212	37.6	0.160	–141.8
2.8	0.395	133.5	2.096	45.2	0.217	36.7	0.163	–147.1
2.9	0.402	129.9	2.015	43.2	0.220	35.8	0.167	–152.0
3.0	0.391	125.2	1.903	41.1	0.221	34.7	0.170	–158.7
4.0	0.532	110.1	1.487	24.5	0.277	27.6	0.222	167.2
5.0	0.586	92.9	1.169	9.4	0.320	18.3	0.315	148.7

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	0.762	–25.9	18.345	158.9	0.023	74.8	0.899	–17.8
0.2	0.699	–46.6	16.059	144.3	0.042	67.0	0.795	–32.7
0.3	0.606	–65.4	14.035	130.7	0.055	60.6	0.682	–44.5
0.4	0.529	–81.1	11.913	120.2	0.066	56.4	0.584	–53.1
0.5	0.463	–94.2	10.228	112.5	0.074	53.9	0.504	–59.7
0.6	0.413	–106.9	8.957	106.2	0.081	52.7	0.439	–65.1
0.7	0.374	–117.4	7.862	100.7	0.088	51.9	0.387	–69.6
0.8	0.350	–128.1	7.058	96.1	0.094	51.4	0.347	–73.7
0.9	0.331	–137.3	6.377	92.0	0.101	51.3	0.313	–77.4
1.0	0.317	–146.9	5.805	88.4	0.107	51.0	0.286	–81.0
1.1	0.312	–154.3	5.325	85.1	0.113	50.8	0.262	–84.5
1.2	0.307	–162.1	4.903	81.9	0.120	50.6	0.243	–88.0
1.3	0.310	–168.8	4.563	78.9	0.127	50.3	0.226	–91.6
1.4	0.308	–175.3	4.241	76.1	0.133	49.9	0.212	–95.9
1.5	0.315	178.6	3.989	73.3	0.140	49.5	0.200	–99.8
1.6	0.318	173.2	3.743	70.7	0.146	49.0	0.189	–104.1
1.7	0.326	168.3	3.536	68.2	0.153	48.5	0.180	–108.1
1.8	0.334	163.4	3.338	66.2	0.159	47.9	0.171	–113.3
1.9	0.342	158.3	3.174	63.6	0.166	47.1	0.165	–118.1
2.0	0.348	155.5	3.027	61.3	0.172	46.3	0.159	–123.0
2.1	0.359	151.3	2.872	59.1	0.179	45.8	0.154	–128.2
2.2	0.367	148.8	2.760	57.1	0.185	45.2	0.151	–133.4
2.3	0.376	146.0	2.625	55.0	0.191	44.4	0.150	–138.5
2.4	0.379	142.9	2.516	52.8	0.198	43.5	0.150	–143.1
2.5	0.386	139.6	2.424	50.9	0.204	42.7	0.150	–148.3
2.6	0.390	136.1	2.324	48.5	0.210	41.6	0.153	–152.4
2.7	0.398	133.2	2.251	46.7	0.215	40.8	0.157	–157.5
2.8	0.398	129.7	2.164	44.7	0.220	39.7	0.165	–162.1
2.9	0.402	126.4	2.078	42.9	0.224	38.6	0.171	–166.2
3.0	0.393	121.7	1.966	41.1	0.225	37.4	0.179	–172.2
4.0	0.533	108.3	1.533	24.9	0.284	28.9	0.244	158.6
5.0	0.588	91.9	1.199	10.3	0.327	18.9	0.338	143.1

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	0.702	–32.6	22.894	155.1	0.021	71.0	0.858	–22.2
0.2	0.606	–55.8	19.053	138.1	0.038	65.1	0.721	–39.3
0.3	0.509	–77.7	15.901	124.2	0.049	59.8	0.592	–51.7
0.4	0.441	–94.4	13.087	114.2	0.058	57.2	0.493	–60.4
0.5	0.387	–108.2	11.029	107.2	0.066	55.9	0.416	–66.7
0.6	0.351	–121.1	9.515	101.5	0.073	55.8	0.358	–72.1
0.7	0.326	–132.2	8.272	96.5	0.080	55.6	0.313	–76.7
0.8	0.312	–142.8	7.381	92.2	0.087	55.8	0.279	–80.9
0.9	0.301	–151.2	6.627	88.7	0.094	55.8	0.252	–84.8
1.0	0.295	–160.4	6.012	85.3	0.101	55.5	0.230	–88.9
1.1	0.294	–166.8	5.510	82.3	0.108	55.5	0.212	–92.8
1.2	0.296	–174.1	5.054	79.5	0.116	54.9	0.197	–96.9
1.3	0.302	–179.2	4.693	76.7	0.123	54.7	0.185	–101.3
1.4	0.304	174.4	4.362	74.1	0.130	54.2	0.174	–106.2
1.5	0.313	169.8	4.099	71.4	0.137	53.6	0.167	–110.9
1.6	0.318	164.7	3.835	69.1	0.144	52.9	0.160	–116.0
1.7	0.325	160.5	3.622	66.7	0.152	52.3	0.154	–120.9
1.8	0.335	156.7	3.415	64.8	0.159	51.6	0.150	–126.7
1.9	0.347	152.0	3.243	62.4	0.166	50.7	0.147	–132.1
2.0	0.353	149.6	3.094	60.3	0.173	49.7	0.145	–137.5
2.1	0.364	145.9	2.939	58.2	0.179	48.9	0.144	–142.9
2.2	0.372	144.0	2.823	56.2	0.186	48.2	0.144	–148.2
2.3	0.380	141.5	2.683	54.2	0.193	47.3	0.146	–153.2
2.4	0.384	138.7	2.568	52.1	0.200	46.3	0.148	–157.6
2.5	0.390	135.9	2.470	50.3	0.206	45.3	0.152	–162.2
2.6	0.394	132.4	2.369	47.9	0.213	44.1	0.157	–165.8
2.7	0.402	129.8	2.293	46.2	0.219	43.1	0.163	–170.3
2.8	0.404	126.5	2.207	44.3	0.224	41.9	0.173	–174.0
2.9	0.409	123.4	2.124	42.4	0.228	40.7	0.182	–177.2
3.0	0.400	119.0	2.003	40.7	0.229	39.4	0.193	177.8
4.0	0.541	107.0	1.558	25.0	0.290	29.9	0.265	152.7
5.0	0.594	91.0	1.216	10.7	0.333	19.3	0.359	139.2

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	0.513	–48.1	30.789	146.4	0.019	68.0	0.744	–31.2
0.2	0.426	–82.2	23.059	127.0	0.032	64.1	0.558	–51.5
0.3	0.366	–107.0	17.787	113.8	0.040	62.1	0.427	–64.1
0.4	0.329	–124.4	14.003	105.2	0.048	61.7	0.342	–72.5
0.5	0.309	–138.5	11.482	99.4	0.056	62.2	0.282	–78.6
0.6	0.301	–149.9	9.771	94.8	0.064	62.7	0.240	–84.3
0.7	0.292	–158.8	8.405	90.6	0.072	63.1	0.210	–89.4
0.8	0.295	–167.9	7.435	87.0	0.080	63.1	0.187	–94.5
0.9	0.297	–174.4	6.676	84.0	0.088	62.8	0.170	–99.3
1.0	0.302	178.8	6.017	81.0	0.096	62.3	0.157	–104.4
1.1	0.304	174.2	5.496	78.5	0.104	62.1	0.147	–109.4
1.2	0.312	169.0	5.037	75.9	0.112	61.3	0.140	–114.8
1.3	0.319	165.1	4.669	73.4	0.120	60.6	0.135	–120.2
1.4	0.326	160.6	4.333	71.0	0.129	59.8	0.131	–126.2
1.5	0.334	157.2	4.064	68.5	0.136	58.9	0.130	–131.7
1.6	0.341	153.6	3.801	66.4	0.144	58.0	0.129	–137.5
1.7	0.349	150.4	3.587	64.2	0.152	57.1	0.129	–143.0
1.8	0.360	147.4	3.380	62.4	0.159	56.1	0.131	–148.9
1.9	0.373	144.1	3.209	60.2	0.167	54.9	0.134	–154.3
2.0	0.379	141.8	3.058	58.2	0.175	53.8	0.136	–159.3
2.1	0.391	139.4	2.901	56.2	0.182	52.7	0.140	–164.1
2.2	0.399	137.4	2.781	54.4	0.189	51.8	0.144	–168.6
2.3	0.406	135.3	2.645	52.5	0.196	50.6	0.151	–172.7
2.4	0.410	133.2	2.531	50.4	0.204	49.4	0.156	–176.1
2.5	0.415	130.6	2.436	48.8	0.210	48.3	0.162	–179.4
2.6	0.419	127.7	2.335	46.4	0.218	46.8	0.169	178.0
2.7	0.427	125.4	2.262	44.7	0.224	45.7	0.178	174.6
2.8	0.429	122.3	2.173	42.9	0.229	44.5	0.189	172.2
2.9	0.433	119.6	2.089	41.2	0.233	43.1	0.200	170.1
3.0	0.423	115.4	1.972	39.6	0.235	41.7	0.213	166.4
4.0	0.559	105.1	1.533	24.3	0.297	31.0	0.292	146.1
5.0	0.611	89.6	1.194	10.6	0.339	19.8	0.384	134.6

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	0.968	–9.2	3.396	171.9	0.022	81.3	0.991	–4.2
0.2	0.963	–14.8	3.331	166.7	0.043	80.2	0.982	–8.2
0.3	0.946	–22.1	3.344	160.1	0.064	75.1	0.968	–12.2
0.4	0.931	–29.8	3.265	153.3	0.084	70.7	0.949	–16.2
0.5	0.904	–36.5	3.184	147.3	0.102	66.4	0.928	–19.9
0.6	0.870	–43.8	3.114	141.4	0.119	62.2	0.904	–23.6
0.7	0.838	–50.6	3.016	134.9	0.134	58.1	0.875	–27.0
0.8	0.801	–57.3	2.943	129.6	0.148	54.3	0.848	–30.3
0.9	0.760	–64.2	2.844	124.0	0.160	50.8	0.820	–33.5
1.0	0.724	–70.9	2.756	118.9	0.170	47.3	0.793	–36.4
1.1	0.694	–77.5	2.652	114.1	0.180	44.1	0.764	–39.3
1.2	0.657	–84.3	2.565	109.0	0.188	41.0	0.737	–41.8
1.3	0.631	–91.2	2.485	104.6	0.195	38.3	0.710	–44.3
1.4	0.600	–97.9	2.397	100.1	0.201	35.5	0.684	–47.0
1.5	0.573	–104.7	2.321	95.5	0.206	33.0	0.659	–49.3
1.6	0.548	–111.2	2.231	91.4	0.210	30.7	0.634	–51.4
1.7	0.526	–118.0	2.145	87.1	0.214	28.5	0.614	–53.1
1.8	0.507	–125.4	2.095	83.9	0.216	26.3	0.588	–55.7
1.9	0.486	–132.3	2.012	79.8	0.219	24.4	0.569	–57.5
2.0	0.474	–138.5	1.947	76.0	0.220	22.6	0.551	–59.2
2.1	0.463	–145.4	1.878	72.3	0.221	21.3	0.533	–61.1
2.2	0.459	–151.4	1.828	69.1	0.221	20.1	0.514	–62.7
2.3	0.450	–157.1	1.759	66.0	0.220	19.0	0.500	–64.5
2.4	0.444	–162.5	1.698	62.7	0.220	17.8	0.488	–66.2
2.5	0.439	–168.4	1.660	59.7	0.219	16.7	0.470	–68.3
2.6	0.432	–174.0	1.599	56.3	0.218	15.4	0.462	–70.6
2.7	0.429	–179.6	1.560	54.0	0.217	14.4	0.453	–72.4
2.8	0.421	174.7	1.517	51.1	0.216	13.6	0.440	–74.7
2.9	0.418	169.2	1.459	48.4	0.213	12.4	0.426	–76.2
3.0	0.395	163.0	1.383	45.3	0.208	11.6	0.409	–79.3
4.0	0.525	128.9	1.121	23.7	0.214	14.6	0.352	–103.9
5.0	0.588	104.0	0.886	5.1	0.243	17.2	0.362	–140.6

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	0.908	–14.9	9.530	166.9	0.020	78.6	0.966	–8.4
0.2	0.881	–24.5	9.004	158.8	0.041	75.6	0.932	–16.2
0.3	0.830	–36.6	8.712	148.8	0.058	69.0	0.882	–23.6
0.4	0.777	–47.9	8.116	139.5	0.073	63.5	0.825	–29.9
0.5	0.710	–57.7	7.526	131.7	0.085	58.8	0.769	–35.3
0.6	0.654	–67.5	6.984	124.7	0.096	55.2	0.711	–40.2
0.7	0.598	–76.0	6.421	118.0	0.104	52.2	0.658	–44.2
0.8	0.545	–84.7	5.984	112.4	0.112	49.6	0.612	–47.8
0.9	0.499	–92.8	5.563	107.1	0.118	47.6	0.570	–50.9
1.0	0.457	–100.9	5.161	102.3	0.124	46.0	0.531	–53.6
1.1	0.429	–108.5	4.819	98.3	0.129	44.5	0.496	–56.2
1.2	0.400	–116.6	4.501	94.1	0.134	43.4	0.466	–58.5
1.3	0.383	–124.1	4.242	90.5	0.138	42.3	0.440	–60.6
1.4	0.361	–131.5	3.988	86.9	0.143	41.5	0.414	–63.1
1.5	0.349	–139.6	3.786	83.3	0.147	40.6	0.392	–65.2
1.6	0.335	–146.5	3.568	80.3	0.152	40.0	0.371	–67.2
1.7	0.330	–153.6	3.386	77.1	0.156	39.4	0.352	–68.9
1.8	0.325	–161.2	3.225	74.5	0.160	38.8	0.333	–71.5
1.9	0.324	–168.2	3.074	71.4	0.165	38.1	0.317	–73.3
2.0	0.325	–173.5	2.942	68.7	0.169	37.6	0.301	–75.2
2.1	0.328	179.8	2.805	66.0	0.173	37.3	0.287	–77.2
2.2	0.333	175.4	2.702	63.5	0.176	37.0	0.273	–79.5
2.3	0.337	170.3	2.580	61.1	0.181	36.7	0.261	–81.8
2.4	0.339	165.9	2.479	58.5	0.184	36.1	0.251	–83.9
2.5	0.341	161.4	2.394	56.4	0.188	35.6	0.240	–86.8
2.6	0.345	156.4	2.300	53.6	0.193	34.9	0.234	–89.7
2.7	0.349	151.9	2.231	51.6	0.196	34.3	0.226	–92.7
2.8	0.349	147.5	2.149	49.5	0.200	33.6	0.219	–96.6
2.9	0.351	142.9	2.064	47.3	0.202	32.9	0.211	–100.0
3.0	0.341	137.4	1.954	45.0	0.202	32.0	0.200	–105.5
4.0	0.488	116.3	1.543	26.9	0.252	28.1	0.177	–145.1
5.0	0.552	97.1	1.214	10.3	0.296	20.6	0.244	178.1

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	0.852	–18.7	14.464	163.6	0.020	77.0	0.940	–11.8
0.2	0.800	–32.7	13.295	152.5	0.038	72.7	0.878	–22.3
0.3	0.727	–47.8	12.353	140.4	0.053	65.5	0.799	–31.4
0.4	0.648	–60.5	11.011	130.3	0.065	60.5	0.719	–38.6
0.5	0.572	–71.5	9.808	122.2	0.073	57.0	0.645	–44.2
0.6	0.513	–82.0	8.824	115.4	0.082	54.4	0.579	–48.8
0.7	0.456	–91.5	7.881	109.1	0.088	52.7	0.524	–52.6
0.8	0.411	–100.7	7.194	104.1	0.095	51.5	0.477	–55.8
0.9	0.376	–109.2	6.575	99.5	0.100	50.7	0.438	–58.5
1.0	0.345	–118.1	6.037	95.3	0.106	50.0	0.405	–61.0
1.1	0.325	–126.0	5.565	91.8	0.112	49.4	0.376	–63.2
1.2	0.307	–134.6	5.154	88.2	0.117	49.0	0.350	–65.3
1.3	0.297	–142.2	4.809	85.1	0.123	48.5	0.328	–67.5
1.4	0.285	–150.1	4.499	82.0	0.129	48.2	0.307	–69.9
1.5	0.283	–157.9	4.245	78.7	0.134	47.7	0.290	–72.3
1.6	0.279	–165.1	3.990	76.1	0.139	47.3	0.273	–74.4
1.7	0.280	–171.8	3.775	73.3	0.145	46.9	0.258	–76.5
1.8	0.283	–178.2	3.576	71.1	0.150	46.4	0.243	–79.4
1.9	0.289	175.2	3.404	68.5	0.157	45.8	0.230	–81.9
2.0	0.292	170.9	3.254	65.9	0.162	45.2	0.218	–84.3
2.1	0.301	165.3	3.094	63.6	0.167	44.8	0.206	–87.2
2.2	0.310	161.4	2.977	61.4	0.173	44.3	0.195	–90.3
2.3	0.316	157.6	2.835	59.2	0.178	43.7	0.187	–93.6
2.4	0.318	154.4	2.722	56.9	0.184	43.1	0.179	–96.7
2.5	0.325	149.9	2.625	55.0	0.189	42.5	0.172	–100.6
2.6	0.329	146.1	2.513	52.5	0.195	41.6	0.168	–104.3
2.7	0.334	142.2	2.437	50.7	0.199	40.8	0.163	–109.0
2.8	0.335	137.8	2.349	48.6	0.204	39.9	0.160	–114.3
2.9	0.341	134.0	2.255	46.7	0.208	38.9	0.158	–119.5
3.0	0.335	128.9	2.135	44.6	0.209	37.9	0.153	–127.3
4.0	0.480	112.5	1.670	27.8	0.266	31.1	0.171	–171.7
5.0	0.545	94.7	1.310	12.1	0.311	21.7	0.260	160.9

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	0.788	–21.2	18.584	160.6	0.019	73.9	0.915	–14.7
0.2	0.728	–39.3	16.528	147.2	0.036	70.2	0.827	–27.1
0.3	0.633	–55.8	14.772	134.2	0.048	63.7	0.726	–37.0
0.4	0.554	–69.8	12.776	123.9	0.058	59.8	0.635	–44.4
0.5	0.480	–81.4	11.099	116.1	0.066	57.1	0.557	–49.7
0.6	0.420	–92.6	9.789	109.7	0.073	55.8	0.492	–54.0
0.7	0.373	–102.4	8.647	104.0	0.080	54.9	0.440	–57.4
0.8	0.338	–112.0	7.795	99.4	0.086	54.5	0.398	–60.3
0.9	0.310	–121.0	7.076	95.2	0.092	54.2	0.362	–62.6
1.0	0.288	–130.9	6.448	91.5	0.098	53.9	0.333	–65.0
1.1	0.273	–138.8	5.923	88.3	0.104	53.6	0.308	–67.1
1.2	0.264	–147.6	5.477	84.9	0.110	53.3	0.287	–69.3
1.3	0.261	–154.7	5.093	82.2	0.117	53.0	0.269	–71.5
1.4	0.255	–162.5	4.751	79.3	0.123	52.6	0.251	–74.1
1.5	0.256	–169.8	4.467	76.4	0.129	52.2	0.237	–76.6
1.6	0.256	–176.5	4.197	73.9	0.136	51.7	0.223	–79.2
1.7	0.264	177.6	3.963	71.4	0.142	51.2	0.210	–81.8
1.8	0.269	171.9	3.747	69.3	0.148	50.6	0.198	–85.1
1.9	0.275	165.7	3.562	66.8	0.155	49.9	0.188	–88.3
2.0	0.283	162.3	3.394	64.6	0.161	49.2	0.177	–91.4
2.1	0.293	157.4	3.231	62.3	0.167	48.6	0.168	–95.1
2.2	0.303	154.1	3.108	60.3	0.173	48.1	0.159	–98.8
2.3	0.310	151.0	2.960	58.2	0.179	47.3	0.153	–103.1
2.4	0.313	147.8	2.835	56.1	0.185	46.5	0.147	–107.0
2.5	0.321	144.0	2.735	54.2	0.191	45.7	0.142	–111.9
2.6	0.325	140.5	2.617	51.8	0.197	44.7	0.141	–116.4
2.7	0.332	136.8	2.535	50.0	0.202	43.7	0.138	–122.1
2.8	0.335	132.9	2.443	48.2	0.208	42.8	0.139	–128.0
2.9	0.339	129.5	2.347	46.2	0.212	41.6	0.141	–133.8
3.0	0.333	124.4	2.218	44.4	0.213	40.4	0.142	–142.4
4.0	0.479	110.7	1.733	28.1	0.273	32.4	0.182	175.8
5.0	0.546	93.7	1.351	13.1	0.318	22.1	0.278	153.5

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	0.721	–26.0	23.344	157.1	0.018	71.0	0.880	–18.1
0.2	0.642	–47.0	19.960	141.5	0.033	68.8	0.762	–32.3
0.3	0.536	–65.5	17.100	127.9	0.044	62.8	0.644	–42.7
0.4	0.454	–80.1	14.274	117.9	0.052	60.5	0.547	–49.8
0.5	0.391	–92.5	12.140	110.7	0.059	58.8	0.470	–54.6
0.6	0.342	–104.4	10.565	104.8	0.066	58.5	0.410	–58.3
0.7	0.305	–114.8	9.214	99.6	0.073	58.3	0.363	–61.3
0.8	0.277	–125.2	8.252	95.4	0.079	58.3	0.327	–63.9
0.9	0.259	–134.5	7.432	91.6	0.086	58.2	0.297	–66.1
1.0	0.247	–144.4	6.759	88.2	0.093	58.1	0.273	–68.3
1.1	0.240	–152.3	6.194	85.3	0.100	57.8	0.252	–70.4
1.2	0.236	–160.8	5.700	82.3	0.106	57.4	0.235	–72.7
1.3	0.239	–167.1	5.299	79.9	0.113	57.2	0.219	–75.1
1.4	0.237	–174.9	4.927	77.1	0.120	56.7	0.205	–78.0
1.5	0.243	178.7	4.622	74.5	0.127	56.1	0.194	–81.0
1.6	0.248	173.0	4.339	72.1	0.134	55.5	0.182	–84.1
1.7	0.254	168.1	4.100	69.8	0.141	54.8	0.172	–87.3
1.8	0.265	163.0	3.869	67.9	0.148	54.1	0.162	–91.2
1.9	0.273	157.3	3.679	65.5	0.155	53.4	0.154	–95.2
2.0	0.279	154.9	3.511	63.4	0.161	52.4	0.145	–99.2
2.1	0.293	150.7	3.335	61.4	0.168	51.7	0.138	–103.8
2.2	0.302	148.4	3.199	59.4	0.174	51.0	0.132	–108.5
2.3	0.309	145.6	3.046	57.4	0.181	50.1	0.128	–113.7
2.4	0.315	142.5	2.921	55.3	0.187	49.1	0.125	–118.4
2.5	0.322	139.3	2.812	53.6	0.193	48.2	0.123	–123.9
2.6	0.326	135.8	2.696	51.2	0.200	47.0	0.123	–129.1
2.7	0.333	132.8	2.608	49.6	0.206	46.1	0.124	–135.4
2.8	0.337	129.2	2.514	47.6	0.211	44.9	0.129	–141.5
2.9	0.341	125.9	2.412	45.7	0.215	43.7	0.134	–147.4
3.0	0.335	120.9	2.280	44.0	0.217	42.5	0.139	–155.8
4.0	0.481	109.1	1.776	28.3	0.279	33.4	0.197	167.0
5.0	0.547	93.1	1.382	13.6	0.324	22.5	0.295	148.4

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	0.553	–38.3	32.555	149.3	0.015	70.7	0.792	–25.0
0.2	0.449	–65.8	25.226	130.9	0.028	68.1	0.623	–41.0
0.3	0.367	–87.5	19.898	117.5	0.036	64.9	0.492	–50.6
0.4	0.306	–104.4	15.851	108.6	0.044	64.7	0.403	–56.1
0.5	0.270	–118.4	13.132	102.5	0.051	64.6	0.339	–59.3
0.6	0.247	–131.4	11.207	97.6	0.058	64.7	0.293	–61.9
0.7	0.231	–142.5	9.657	93.4	0.065	65.0	0.258	–63.9
0.8	0.224	–152.4	8.577	89.9	0.073	65.1	0.232	–65.9
0.9	0.220	–161.1	7.689	86.8	0.080	65.0	0.211	–67.6
1.0	0.223	–169.9	6.966	83.8	0.088	64.6	0.194	–69.6
1.1	0.222	–176.0	6.341	81.3	0.095	64.2	0.179	–71.8
1.2	0.227	177.6	5.834	78.7	0.102	63.6	0.168	–74.3
1.3	0.234	172.6	5.411	76.2	0.110	63.0	0.157	–77.0
1.4	0.240	167.1	5.026	74.0	0.118	62.3	0.147	–80.6
1.5	0.250	162.6	4.713	71.6	0.125	61.4	0.139	–84.1
1.6	0.257	158.4	4.414	69.5	0.132	60.5	0.131	–88.2
1.7	0.265	154.4	4.159	67.3	0.140	59.7	0.125	–92.5
1.8	0.276	151.5	3.928	65.6	0.147	58.7	0.117	–97.5
1.9	0.289	147.2	3.737	63.5	0.155	57.6	0.113	–102.9
2.0	0.294	145.1	3.561	61.4	0.161	56.5	0.107	–108.5
2.1	0.307	142.0	3.383	59.4	0.169	55.6	0.104	–114.4
2.2	0.316	140.3	3.247	57.7	0.175	54.7	0.101	–120.6
2.3	0.324	138.1	3.088	55.8	0.182	53.6	0.100	–127.3
2.4	0.329	135.7	2.958	53.9	0.189	52.4	0.100	–132.8
2.5	0.338	133.0	2.847	52.1	0.196	51.4	0.101	–139.2
2.6	0.340	130.1	2.726	49.9	0.203	50.0	0.105	–144.5
2.7	0.350	127.6	2.638	48.2	0.208	48.9	0.110	–151.0
2.8	0.351	124.2	2.544	46.5	0.214	47.6	0.117	–156.6
2.9	0.356	121.1	2.440	44.7	0.219	46.4	0.126	–161.8
3.0	0.351	117.2	2.307	43.0	0.220	45.0	0.136	–169.7
4.0	0.494	107.1	1.787	27.9	0.284	34.8	0.208	159.0
5.0	0.558	91.8	1.393	13.6	0.329	23.2	0.310	143.6

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	0.952	–23.2	3.464	165.0	0.039	75.8	0.987	–7.5
0.2	0.932	–46.1	3.323	148.7	0.069	63.4	0.948	–14.3
0.3	0.908	–67.1	3.079	135.6	0.094	52.4	0.899	–19.9
0.4	0.868	–84.6	2.757	123.7	0.111	42.6	0.850	–24.5
0.5	0.840	–99.6	2.469	113.6	0.121	35.0	0.807	–28.4
0.6	0.819	–112.9	2.226	105.2	0.127	28.6	0.770	–31.9
0.7	0.802	–124.0	2.006	97.2	0.129	23.4	0.742	–34.9
0.8	0.788	–133.7	1.821	90.3	0.128	19.4	0.719	–37.8
0.9	0.781	–142.1	1.671	84.2	0.125	15.9	0.698	–40.8
1.0	0.778	–149.9	1.539	78.8	0.121	13.4	0.683	–43.9
1.1	0.771	–156.4	1.426	73.5	0.115	11.7	0.670	–47.2
1.2	0.771	–162.7	1.333	68.5	0.108	10.7	0.658	–50.6
1.3	0.774	–168.2	1.243	64.0	0.101	10.9	0.649	–54.1
1.4	0.771	–173.4	1.168	59.7	0.094	12.3	0.644	–57.9
1.5	0.773	–178.5	1.101	55.6	0.086	15.2	0.638	–61.8
1.6	0.775	177.1	1.045	51.8	0.080	19.8	0.635	–65.8
1.7	0.779	172.9	0.989	48.0	0.075	26.6	0.631	–70.1
1.8	0.780	168.4	0.940	44.3	0.072	35.0	0.629	–74.6
1.9	0.783	164.5	0.891	41.1	0.073	44.5	0.629	–79.4
2.0	0.787	160.5	0.852	37.5	0.078	53.7	0.629	–84.1
2.1	0.794	157.0	0.810	34.5	0.086	60.9	0.630	–88.9
2.2	0.797	153.6	0.775	32.5	0.098	66.3	0.632	–93.8
2.3	0.802	150.5	0.739	30.4	0.111	69.8	0.633	–98.8
2.4	0.804	147.5	0.704	28.1	0.127	71.7	0.636	–103.8
2.5	0.805	144.8	0.675	26.5	0.144	72.0	0.639	–108.6
2.6	0.805	142.0	0.646	24.3	0.161	71.1	0.642	–113.4
2.7	0.807	140.1	0.621	23.0	0.174	69.1	0.643	–117.9
2.8	0.812	138.2	0.595	21.4	0.183	68.8	0.648	–122.0
2.9	0.812	135.6	0.580	20.1	0.196	69.2	0.648	–126.4
3.0	0.820	133.2	0.560	19.9	0.213	68.8	0.652	–131.1
4.0	0.836	113.0	0.477	13.6	0.377	47.5	0.671	–178.4
5.0	0.847	100.5	0.457	7.3	0.441	26.6	0.725	140.3

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	0.885	–34.7	9.492	158.3	0.035	71.4	0.945	–14.6
0.2	0.819	–65.5	8.394	137.9	0.060	56.0	0.834	–25.9
0.3	0.764	–90.2	7.116	123.5	0.075	45.8	0.726	–32.8
0.4	0.719	–108.8	5.951	112.3	0.084	39.1	0.640	–37.4
0.5	0.689	–122.9	5.062	103.5	0.088	34.9	0.574	–40.2
0.6	0.671	–134.8	4.394	96.6	0.091	32.4	0.528	–42.8
0.7	0.663	–144.2	3.853	90.4	0.092	31.2	0.494	–44.5
0.8	0.652	–152.1	3.424	84.9	0.092	30.7	0.467	–46.5
0.9	0.647	–158.9	3.091	80.2	0.092	31.1	0.446	–48.6
1.0	0.648	–165.0	2.813	75.9	0.093	32.4	0.429	–51.0
1.1	0.646	–170.2	2.585	71.7	0.092	34.1	0.415	–53.5
1.2	0.649	–175.2	2.396	67.8	0.093	36.2	0.403	–56.5
1.3	0.651	–179.4	2.226	64.0	0.094	38.6	0.394	–59.6
1.4	0.651	176.5	2.081	60.4	0.096	41.4	0.387	–63.0
1.5	0.658	172.4	1.953	57.0	0.099	44.4	0.381	–66.7
1.6	0.662	169.0	1.849	53.6	0.102	47.2	0.377	–70.5
1.7	0.669	165.5	1.749	50.4	0.107	50.2	0.373	–74.7
1.8	0.670	161.9	1.659	47.0	0.112	52.7	0.371	–79.1
1.9	0.675	158.9	1.575	44.0	0.119	55.0	0.370	–83.7
2.0	0.684	155.4	1.505	40.6	0.126	57.1	0.371	–88.3
2.1	0.691	152.7	1.432	37.7	0.135	58.6	0.373	–93.1
2.2	0.693	149.9	1.371	35.2	0.144	59.8	0.375	–97.9
2.3	0.703	147.6	1.316	32.7	0.154	60.5	0.379	–102.9
2.4	0.707	145.1	1.254	30.1	0.165	60.8	0.385	–107.7
2.5	0.712	143.0	1.204	27.7	0.177	60.5	0.392	–112.4
2.6	0.716	140.7	1.150	25.0	0.189	59.7	0.400	–117.0
2.7	0.724	139.5	1.109	23.1	0.197	58.4	0.406	–121.3
2.8	0.732	137.7	1.065	20.9	0.203	58.0	0.414	–125.2
2.9	0.734	135.5	1.036	18.8	0.212	58.4	0.419	–129.6
3.0	0.743	133.4	0.999	17.1	0.224	58.4	0.425	–133.9
4.0	0.800	115.7	0.736	0.7	0.354	44.2	0.493	–178.7
5.0	0.843	102.3	0.578	–7.8	0.424	26.5	0.619	140.5

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	0.795	–43.5	14.399	152.4	0.035	68.5	0.899	–20.7
0.2	0.726	–80.0	11.772	130.2	0.053	52.6	0.734	–34.2
0.3	0.674	–105.5	9.387	116.0	0.063	44.8	0.602	–41.1
0.4	0.635	–122.9	7.583	105.9	0.069	40.5	0.511	–45.0
0.5	0.613	–135.9	6.305	98.1	0.073	39.2	0.447	–47.1
0.6	0.603	–146.7	5.395	92.2	0.076	38.9	0.402	–48.9
0.7	0.597	–155.0	4.690	86.8	0.079	39.6	0.370	–50.2
0.8	0.594	–161.6	4.142	82.1	0.082	41.0	0.346	–51.8
0.9	0.591	–167.4	3.722	77.9	0.085	42.5	0.327	–53.6
1.0	0.596	–172.4	3.372	74.2	0.088	44.3	0.311	–55.9
1.1	0.594	–177.1	3.091	70.5	0.092	46.2	0.299	–58.3
1.2	0.601	178.8	2.861	66.8	0.096	47.9	0.288	–61.3
1.3	0.605	175.1	2.651	63.6	0.101	49.7	0.279	–64.5
1.4	0.608	171.6	2.474	60.3	0.106	51.3	0.273	–68.2
1.5	0.611	168.1	2.322	57.2	0.112	52.9	0.267	–72.0
1.6	0.613	164.9	2.195	54.1	0.118	54.2	0.263	–76.1
1.7	0.624	162.0	2.073	51.1	0.124	55.4	0.260	–80.6
1.8	0.628	158.6	1.965	48.1	0.131	56.2	0.259	–85.4
1.9	0.632	156.0	1.865	45.3	0.139	57.1	0.258	–90.4
2.0	0.640	152.9	1.780	42.0	0.147	57.7	0.260	–95.3
2.1	0.649	150.4	1.698	39.3	0.156	58.1	0.263	–100.5
2.2	0.652	147.9	1.627	36.8	0.164	58.3	0.266	–105.6
2.3	0.661	145.8	1.561	34.4	0.173	58.1	0.271	–110.7
2.4	0.666	143.9	1.492	32.0	0.184	57.8	0.279	–115.6
2.5	0.672	141.7	1.434	29.6	0.194	57.1	0.286	–120.3
2.6	0.677	139.9	1.372	26.9	0.205	55.9	0.296	–124.8
2.7	0.685	138.6	1.322	25.0	0.211	54.6	0.304	–129.0
2.8	0.696	137.1	1.274	22.8	0.216	54.1	0.313	–132.9
2.9	0.699	135.2	1.244	20.5	0.224	54.3	0.319	–137.1
3.0	0.707	133.0	1.202	18.8	0.234	54.1	0.325	–141.2
4.0	0.778	116.5	0.890	0.3	0.345	41.6	0.405	176.4
5.0	0.836	103.5	0.677	–11.5	0.413	25.9	0.559	138.3

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	0.752	–51.4	18.241	148.0	0.033	64.7	0.856	–25.8
0.2	0.663	–91.2	13.998	124.7	0.048	51.0	0.655	–40.3
0.3	0.621	–116.6	10.735	111.1	0.055	45.6	0.516	–46.9
0.4	0.587	–132.7	8.506	102.0	0.061	43.7	0.427	–50.2
0.5	0.573	–144.3	7.006	95.0	0.065	44.0	0.368	–51.8
0.6	0.567	–154.3	5.951	89.6	0.069	44.7	0.327	–53.4
0.7	0.566	–161.5	5.152	84.7	0.074	46.3	0.298	–54.6
0.8	0.565	–167.4	4.538	80.5	0.079	48.1	0.276	–56.0
0.9	0.563	–172.4	4.069	76.6	0.084	49.6	0.258	–57.8
1.0	0.568	–177.0	3.681	73.2	0.089	51.3	0.244	–60.2
1.1	0.572	178.9	3.370	69.8	0.094	52.6	0.232	–62.7
1.2	0.574	175.2	3.112	66.4	0.100	53.8	0.223	–66.1
1.3	0.581	172.0	2.880	63.3	0.107	54.8	0.214	–69.6
1.4	0.583	168.6	2.687	60.2	0.113	55.8	0.209	–73.6
1.5	0.590	165.5	2.520	57.2	0.120	56.6	0.204	–78.0
1.6	0.593	162.5	2.381	54.4	0.127	57.2	0.201	–82.6
1.7	0.601	159.7	2.250	51.6	0.135	57.6	0.198	–87.7
1.8	0.605	156.6	2.130	48.5	0.143	57.9	0.198	–93.1
1.9	0.610	154.0	2.027	46.0	0.150	57.9	0.199	–98.4
2.0	0.621	151.1	1.930	42.8	0.159	58.0	0.202	–103.8
2.1	0.630	149.0	1.839	40.2	0.168	57.8	0.205	–109.4
2.2	0.632	146.6	1.762	37.8	0.176	57.6	0.211	–114.6
2.3	0.641	144.5	1.695	35.4	0.185	57.0	0.217	–119.9
2.4	0.645	142.4	1.621	33.1	0.195	56.5	0.225	–124.8
2.5	0.650	140.8	1.558	30.8	0.205	55.4	0.234	–129.3
2.6	0.657	139.0	1.489	28.2	0.215	54.1	0.245	–133.6
2.7	0.665	137.8	1.438	26.5	0.221	52.6	0.254	–137.6
2.8	0.676	136.4	1.388	24.0	0.225	52.1	0.263	–141.4
2.9	0.682	134.3	1.356	21.7	0.232	52.1	0.270	–145.4
3.0	0.687	132.7	1.312	20.1	0.242	51.8	0.276	–149.2
4.0	0.764	117.0	0.976	1.0	0.341	39.8	0.362	170.8
5.0	0.832	104.1	0.742	–11.8	0.407	25.2	0.525	135.7

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	0.662	–62.3	22.776	142.2	0.030	61.0	0.795	–32.1
0.2	0.598	–104.8	16.175	119.0	0.041	50.5	0.564	–47.2
0.3	0.571	–128.5	11.965	106.3	0.048	48.0	0.427	–53.3
0.4	0.547	–143.2	9.328	98.2	0.054	48.2	0.345	–56.2
0.5	0.538	–153.6	7.599	92.0	0.059	49.6	0.292	–57.5
0.6	0.536	–161.8	6.421	87.1	0.065	51.4	0.256	–59.1
0.7	0.542	–167.8	5.548	82.8	0.071	53.1	0.230	–60.3
0.8	0.539	–173.2	4.849	78.9	0.078	54.8	0.211	–61.8
0.9	0.540	–177.2	4.361	75.4	0.084	56.1	0.195	–64.0
1.0	0.546	178.6	3.945	72.2	0.091	57.2	0.182	–66.9
1.1	0.549	175.2	3.605	69.0	0.098	58.0	0.172	–69.9
1.2	0.554	171.6	3.327	65.9	0.105	58.6	0.163	–74.0
1.3	0.560	168.7	3.077	63.0	0.113	59.0	0.156	–78.3
1.4	0.564	165.7	2.869	60.1	0.121	59.3	0.153	–83.2
1.5	0.570	162.7	2.690	57.2	0.129	59.4	0.149	–88.6
1.6	0.577	160.1	2.538	54.5	0.136	59.3	0.147	–94.0
1.7	0.585	157.6	2.398	51.8	0.145	59.3	0.147	–100.0
1.8	0.587	154.8	2.267	49.0	0.153	58.9	0.149	–106.3
1.9	0.595	152.4	2.155	46.5	0.161	58.5	0.151	–112.3
2.0	0.602	149.3	2.053	43.5	0.170	58.2	0.156	–118.1
2.1	0.611	147.3	1.957	40.9	0.179	57.7	0.162	–123.8
2.2	0.615	145.2	1.879	38.6	0.188	57.1	0.169	–129.0
2.3	0.623	143.3	1.807	36.4	0.196	56.2	0.178	–134.1
2.4	0.628	141.6	1.728	34.1	0.205	55.4	0.187	–138.7
2.5	0.634	139.9	1.662	31.8	0.215	54.1	0.197	–142.7
2.6	0.639	138.1	1.588	29.4	0.224	52.7	0.208	–146.5
2.7	0.648	137.3	1.537	27.6	0.230	51.1	0.218	–150.0
2.8	0.660	135.7	1.484	25.4	0.234	50.5	0.228	–153.5
2.9	0.664	133.9	1.449	23.1	0.241	50.4	0.236	–157.2
3.0	0.673	131.9	1.405	21.2	0.250	49.9	0.242	–160.5
4.0	0.749	117.2	1.051	2.4	0.340	38.0	0.330	163.1
5.0	0.821	104.5	0.803	–11.7	0.401	24.4	0.498	131.8

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	0.525	–92.4	30.494	130.7	0.024	60.9	0.639	–45.6
0.2	0.514	–132.1	18.912	109.2	0.032	54.6	0.397	–61.1
0.3	0.515	–149.5	13.262	99.0	0.039	56.4	0.282	–67.0
0.4	0.509	–160.0	10.156	92.6	0.047	58.8	0.219	–70.4
0.5	0.509	–167.4	8.208	87.5	0.055	61.2	0.178	–72.6
0.6	0.513	–173.6	6.884	83.5	0.063	62.6	0.152	–76.0
0.7	0.518	–177.9	5.922	79.9	0.071	63.4	0.132	–79.0
0.8	0.520	177.9	5.173	76.5	0.080	64.1	0.118	–82.4
0.9	0.522	174.8	4.631	73.4	0.089	64.4	0.107	–87.3
1.0	0.530	171.6	4.172	70.4	0.097	64.4	0.100	–93.3
1.1	0.535	168.6	3.818	67.5	0.106	64.4	0.093	–99.5
1.2	0.541	166.0	3.518	64.6	0.115	63.9	0.091	–106.9
1.3	0.547	163.6	3.254	62.0	0.124	63.5	0.089	–114.3
1.4	0.551	161.1	3.033	59.3	0.133	63.0	0.092	–121.5
1.5	0.559	158.5	2.844	56.6	0.142	62.4	0.094	–129.1
1.6	0.565	156.2	2.678	54.1	0.151	61.7	0.099	–135.5
1.7	0.571	153.8	2.530	51.6	0.160	60.8	0.106	–141.9
1.8	0.577	151.4	2.393	49.0	0.168	59.9	0.114	–147.3
1.9	0.581	149.2	2.275	46.7	0.177	59.0	0.121	–152.4
2.0	0.590	146.8	2.164	43.7	0.186	58.2	0.131	–156.5
2.1	0.598	144.7	2.062	41.5	0.196	57.1	0.141	–160.5
2.2	0.605	142.7	1.979	39.3	0.204	56.1	0.151	–163.9
2.3	0.614	140.9	1.903	37.1	0.213	55.0	0.162	–167.0
2.4	0.617	139.3	1.822	34.9	0.222	53.8	0.173	–169.6
2.5	0.620	137.8	1.750	32.8	0.231	52.3	0.184	–172.0
2.6	0.629	136.2	1.676	30.3	0.240	50.6	0.195	–173.9
2.7	0.637	135.5	1.624	28.8	0.245	49.0	0.206	–176.0
2.8	0.649	134.2	1.566	26.4	0.249	48.2	0.217	–178.3
2.9	0.653	132.2	1.534	24.2	0.255	48.0	0.225	179.0
3.0	0.658	130.7	1.488	22.5	0.263	47.3	0.229	176.3
4.0	0.739	116.9	1.117	4.0	0.341	34.8	0.318	147.7
5.0	0.812	104.6	0.868	–10.4	0.394	22.4	0.481	123.7

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	0.954	–23.0	3.401	166.0	0.036	76.3	0.987	–6.9
0.2	0.938	–44.8	3.285	149.6	0.064	64.8	0.953	–13.2
0.3	0.915	–65.3	3.061	137.0	0.087	53.2	0.908	–18.5
0.4	0.877	–82.7	2.752	125.3	0.103	43.9	0.865	–23.1
0.5	0.846	–97.5	2.483	115.1	0.113	36.2	0.823	–26.7
0.6	0.821	–110.7	2.238	106.9	0.119	29.8	0.789	–30.1
0.7	0.805	–122.1	2.021	99.0	0.121	24.6	0.762	–33.0
0.8	0.791	–131.9	1.841	92.0	0.120	20.4	0.739	–35.8
0.9	0.784	–140.2	1.687	86.0	0.118	17.1	0.719	–38.6
1.0	0.778	–148.0	1.557	80.6	0.114	14.7	0.704	–41.7
1.1	0.774	–154.9	1.443	75.4	0.108	13.0	0.692	–44.7
1.2	0.771	–161.5	1.351	70.3	0.101	12.1	0.680	–48.1
1.3	0.773	–167.1	1.264	66.0	0.094	12.3	0.672	–51.5
1.4	0.772	–172.3	1.185	61.5	0.087	14.1	0.665	–55.2
1.5	0.773	–177.2	1.117	57.5	0.080	17.4	0.660	–58.9
1.6	0.774	178.0	1.062	53.6	0.073	22.3	0.657	–62.8
1.7	0.780	173.7	1.005	49.9	0.069	29.9	0.653	–66.9
1.8	0.779	169.1	0.955	46.4	0.067	39.3	0.651	–71.3
1.9	0.783	165.3	0.909	43.0	0.069	49.2	0.648	–75.9
2.0	0.786	161.0	0.867	39.4	0.075	58.4	0.649	–80.4
2.1	0.793	157.4	0.822	36.6	0.084	65.5	0.648	–85.2
2.2	0.793	154.2	0.789	34.5	0.096	70.7	0.649	–89.9
2.3	0.800	150.9	0.753	32.2	0.110	73.8	0.649	–94.9
2.4	0.800	148.0	0.716	29.8	0.126	75.5	0.653	–99.7
2.5	0.802	145.1	0.689	28.3	0.143	75.4	0.654	–104.5
2.6	0.804	142.3	0.656	26.1	0.160	74.2	0.655	–109.2
2.7	0.804	140.3	0.633	24.8	0.173	72.2	0.656	–113.5
2.8	0.809	138.6	0.607	23.1	0.182	71.6	0.660	–117.7
2.9	0.810	136.0	0.590	21.9	0.195	71.9	0.659	–122.0
3.0	0.817	133.4	0.570	21.7	0.213	71.5	0.662	–126.7
4.0	0.831	113.2	0.486	15.0	0.380	49.5	0.675	–174.2
5.0	0.842	100.7	0.468	8.2	0.445	28.0	0.720	143.3

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	0.878	–32.8	9.466	159.1	0.033	72.4	0.950	–13.5
0.2	0.821	–62.6	8.449	139.3	0.057	57.8	0.850	–23.8
0.3	0.773	–87.1	7.237	125.1	0.070	47.4	0.748	–30.5
0.4	0.721	–105.2	6.092	113.9	0.079	40.4	0.666	–34.8
0.5	0.689	–119.6	5.200	105.1	0.084	36.3	0.602	–37.6
0.6	0.670	–131.7	4.528	98.2	0.086	33.5	0.557	–39.9
0.7	0.656	–141.6	3.977	92.0	0.087	32.2	0.522	–41.5
0.8	0.649	–149.6	3.542	86.5	0.087	31.9	0.495	–43.5
0.9	0.641	–156.5	3.200	81.8	0.087	32.3	0.474	–45.4
1.0	0.641	–163.1	2.912	77.4	0.088	33.6	0.457	–47.6
1.1	0.638	–168.2	2.678	73.3	0.088	35.3	0.443	–50.1
1.2	0.642	–173.3	2.483	69.2	0.088	37.5	0.431	–52.8
1.3	0.644	–177.8	2.309	65.6	0.089	40.1	0.421	–55.8
1.4	0.644	178.0	2.158	62.0	0.091	43.1	0.415	–59.0
1.5	0.647	173.9	2.029	58.5	0.094	46.3	0.408	–62.4
1.6	0.651	170.2	1.919	55.2	0.097	49.4	0.403	–66.0
1.7	0.656	166.9	1.814	52.0	0.102	52.3	0.399	–70.0
1.8	0.663	162.9	1.721	48.6	0.107	55.0	0.396	–74.1
1.9	0.666	159.9	1.638	45.6	0.114	57.3	0.394	–78.5
2.0	0.672	156.7	1.560	42.2	0.121	59.7	0.394	–82.9
2.1	0.679	153.5	1.484	39.3	0.130	61.3	0.394	–87.5
2.2	0.684	150.9	1.426	36.9	0.139	62.5	0.396	–92.1
2.3	0.693	148.3	1.363	34.3	0.149	63.2	0.398	–97.0
2.4	0.695	146.0	1.302	31.7	0.160	63.4	0.403	–101.8
2.5	0.702	143.9	1.251	29.4	0.172	63.1	0.408	–106.4
2.6	0.706	141.4	1.196	26.5	0.184	62.3	0.415	–111.0
2.7	0.712	140.1	1.149	24.7	0.193	60.8	0.420	–115.2
2.8	0.722	138.5	1.105	22.5	0.199	60.5	0.427	–119.4
2.9	0.726	136.2	1.077	20.1	0.208	60.9	0.430	–123.6
3.0	0.732	134.0	1.037	18.7	0.221	60.9	0.436	–128.0
4.0	0.794	116.1	0.771	1.6	0.354	46.4	0.492	–173.4
5.0	0.839	102.8	0.595	–7.9	0.426	28.0	0.612	144.0

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	0.809	–40.7	14.445	153.7	0.031	66.0	0.910	–19.0
0.2	0.734	–76.3	12.020	132.0	0.050	54.3	0.757	–31.5
0.3	0.678	–101.4	9.665	117.7	0.060	46.1	0.629	–38.2
0.4	0.633	–119.1	7.866	107.6	0.066	42.0	0.539	–41.7
0.5	0.607	–132.3	6.561	99.8	0.069	40.4	0.477	–43.6
0.6	0.595	–143.5	5.632	93.8	0.073	40.0	0.432	–45.4
0.7	0.587	–151.9	4.903	88.3	0.075	40.7	0.400	–46.5
0.8	0.581	–159.1	4.333	83.6	0.078	42.0	0.376	–47.8
0.9	0.579	–164.9	3.897	79.4	0.081	43.6	0.356	–49.4
1.0	0.582	–170.2	3.533	75.6	0.084	45.5	0.340	–51.4
1.1	0.583	–174.9	3.240	71.9	0.088	47.4	0.327	–53.6
1.2	0.586	–179.4	3.000	68.3	0.092	49.2	0.316	–56.3
1.3	0.588	176.9	2.778	65.1	0.096	51.0	0.307	–59.2
1.4	0.592	173.3	2.595	61.8	0.101	52.9	0.300	–62.6
1.5	0.596	169.7	2.437	58.7	0.107	54.5	0.293	–66.0
1.6	0.599	166.4	2.304	55.6	0.113	55.9	0.288	–69.8
1.7	0.607	163.2	2.177	52.7	0.119	57.2	0.284	–73.9
1.8	0.612	159.9	2.062	49.6	0.126	58.2	0.282	–78.4
1.9	0.615	157.2	1.960	46.7	0.134	58.9	0.280	–83.1
2.0	0.626	154.1	1.866	43.6	0.142	59.7	0.280	–87.7
2.1	0.634	151.6	1.779	40.8	0.150	60.1	0.281	–92.7
2.2	0.638	149.1	1.707	38.5	0.159	60.2	0.283	–97.5
2.3	0.646	146.7	1.640	36.0	0.168	60.2	0.287	–102.5
2.4	0.651	144.8	1.567	33.5	0.178	59.9	0.292	–107.4
2.5	0.657	142.7	1.503	31.2	0.189	59.1	0.298	–112.2
2.6	0.663	140.8	1.440	28.6	0.199	58.1	0.306	–116.7
2.7	0.672	139.5	1.387	26.7	0.207	56.6	0.313	–121.1
2.8	0.681	138.1	1.339	24.3	0.211	56.2	0.321	–125.2
2.9	0.686	135.9	1.305	22.0	0.219	56.4	0.325	–129.4
3.0	0.695	134.0	1.263	20.3	0.230	56.3	0.331	–133.6
4.0	0.766	117.6	0.936	1.3	0.343	43.8	0.399	–177.3
5.0	0.834	104.1	0.710	–11.2	0.415	27.5	0.547	142.1

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	0.750	–48.3	18.478	149.4	0.029	65.5	0.870	–23.5
0.2	0.666	–86.4	14.439	126.5	0.044	52.5	0.682	–37.1
0.3	0.615	–111.7	11.202	112.9	0.052	46.9	0.545	–43.4
0.4	0.578	–128.7	8.918	103.6	0.058	44.7	0.457	–46.3
0.5	0.563	–140.7	7.370	96.4	0.062	45.0	0.397	–47.7
0.6	0.553	–151.0	6.260	91.0	0.066	45.8	0.356	–49.0
0.7	0.546	–158.5	5.415	86.1	0.071	47.4	0.327	–49.8
0.8	0.546	–165.0	4.769	81.8	0.075	48.9	0.305	–50.9
0.9	0.546	–170.1	4.296	78.0	0.080	50.7	0.287	–52.5
1.0	0.550	–174.9	3.887	74.5	0.085	52.3	0.272	–54.5
1.1	0.551	–178.9	3.555	71.1	0.090	53.9	0.260	–56.6
1.2	0.556	177.0	3.286	67.7	0.096	55.1	0.250	–59.5
1.3	0.560	173.6	3.042	64.8	0.102	56.1	0.241	–62.5
1.4	0.563	170.2	2.837	61.7	0.108	57.2	0.235	–66.1
1.5	0.567	166.8	2.662	58.7	0.115	58.1	0.228	–69.9
1.6	0.575	163.9	2.519	55.8	0.122	58.6	0.224	–73.9
1.7	0.581	161.1	2.378	53.1	0.130	59.1	0.220	–78.5
1.8	0.587	157.8	2.253	50.1	0.137	59.5	0.218	–83.5
1.9	0.590	155.4	2.141	47.5	0.145	59.6	0.217	–88.5
2.0	0.600	152.4	2.042	44.4	0.153	59.7	0.218	–93.6
2.1	0.608	150.1	1.946	41.8	0.162	59.6	0.220	–99.0
2.2	0.611	148.0	1.869	39.4	0.171	59.4	0.223	–104.2
2.3	0.621	145.8	1.790	37.1	0.180	58.9	0.227	–109.4
2.4	0.627	143.8	1.712	34.8	0.189	58.3	0.233	–114.4
2.5	0.632	142.1	1.646	32.5	0.199	57.3	0.240	–119.3
2.6	0.637	140.2	1.574	29.9	0.209	56.1	0.249	–123.8
2.7	0.646	139.2	1.522	28.1	0.215	54.5	0.257	–128.2
2.8	0.658	137.5	1.467	25.7	0.220	54.0	0.265	–132.3
2.9	0.663	135.6	1.431	23.3	0.226	54.1	0.270	–136.4
3.0	0.670	133.9	1.385	21.8	0.236	53.8	0.276	–140.4
4.0	0.749	118.2	1.039	2.3	0.339	41.9	0.349	177.5
5.0	0.822	105.0	0.785	–11.5	0.407	26.9	0.510	139.5

V_{CE} = 2 V, I_C = 10 mA, Z_O = 50 Ω

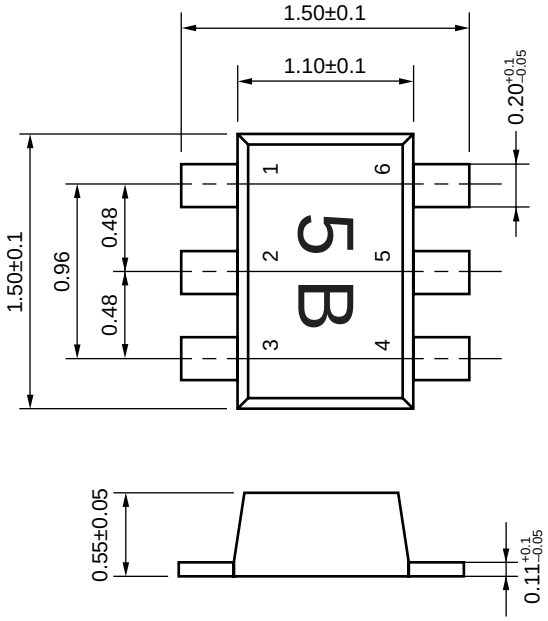
Frequency	S_{11}		S_{21}		S_{12}		S_{22}	
(GHz)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.674	–58.6	23.287	144.2	0.027	64.1	0.815	–29.1
0.2	0.598	–99.1	16.892	120.9	0.039	52.1	0.594	–43.4
0.3	0.557	–123.3	12.619	108.1	0.046	49.4	0.458	–48.9
0.4	0.531	–138.4	9.887	99.8	0.052	49.4	0.375	–51.2
0.5	0.518	–149.6	8.083	93.4	0.057	51.0	0.322	–52.0
0.6	0.517	–158.4	6.837	88.5	0.062	52.5	0.285	–53.2
0.7	0.516	–165.0	5.894	84.2	0.068	54.1	0.259	–53.8
0.8	0.517	–170.4	5.186	80.3	0.075	55.6	0.239	–54.8
0.9	0.517	–175.1	4.645	76.7	0.081	57.1	0.223	–56.4
1.0	0.520	–179.2	4.196	73.7	0.087	58.3	0.210	–58.6
1.1	0.525	177.0	3.840	70.5	0.094	59.1	0.199	–60.9
1.2	0.528	173.6	3.545	67.3	0.101	59.7	0.189	–64.2
1.3	0.534	170.4	3.280	64.4	0.108	60.1	0.181	–67.7
1.4	0.538	167.5	3.060	61.5	0.116	60.5	0.176	–71.8
1.5	0.546	164.5	2.868	58.7	0.123	60.8	0.170	–76.3
1.6	0.550	161.5	2.708	56.0	0.131	60.7	0.167	–81.1
1.7	0.558	159.2	2.556	53.5	0.139	60.7	0.164	–86.3
1.8	0.564	156.0	2.420	50.6	0.147	60.4	0.163	–92.1
1.9	0.569	153.8	2.303	48.2	0.156	60.0	0.163	–97.9
2.0	0.579	150.8	2.194	45.0	0.164	59.7	0.165	–103.6
2.1	0.587	148.8	2.087	42.7	0.173	59.3	0.169	–109.7
2.2	0.590	146.5	2.007	40.3	0.181	58.6	0.173	–115.1
2.3	0.599	144.5	1.926	38.1	0.190	57.9	0.179	–120.7
2.4	0.607	142.8	1.844	35.8	0.199	57.0	0.187	–125.7
2.5	0.610	141.1	1.769	33.6	0.209	55.9	0.195	–130.3
2.6	0.617	139.3	1.695	31.1	0.218	54.4	0.205	–134.7
2.7	0.629	138.5	1.640	29.3	0.224	52.8	0.214	–138.8
2.8	0.639	137.3	1.583	27.1	0.228	52.3	0.223	–142.8
2.9	0.643	135.1	1.547	24.7	0.234	52.2	0.228	–146.9
3.0	0.652	133.3	1.499	23.0	0.244	51.8	0.233	–150.5
4.0	0.733	118.6	1.125	3.7	0.336	39.9	0.312	170.0
5.0	0.812	105.7	0.858	–10.9	0.400	26.1	0.477	135.9

V_{CE} = 2 V, I_C = 20 mA, Z_O = 50 Ω

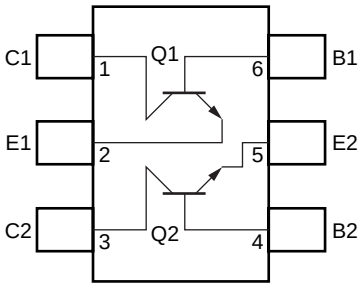
Frequency	S_{11}		S_{21}		S_{12}		S_{22}	
(GHz)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.528	–81.5	31.976	133.4	0.022	59.6	0.681	–40.7
0.2	0.487	–124.3	20.409	111.5	0.031	55.8	0.436	–54.6
0.3	0.475	–143.7	14.456	100.8	0.038	57.2	0.317	–58.8
0.4	0.472	–155.2	11.107	94.2	0.045	59.5	0.251	–60.4
0.5	0.472	–163.4	8.988	89.0	0.053	62.1	0.209	–61.0
0.6	0.477	–170.1	7.554	85.1	0.060	63.4	0.182	–62.5
0.7	0.479	–175.1	6.482	81.3	0.068	64.3	0.161	–63.6
0.8	0.482	–179.1	5.689	78.0	0.076	65.0	0.145	–65.0
0.9	0.485	177.4	5.099	74.9	0.085	65.3	0.133	–67.7
1.0	0.490	173.8	4.584	72.1	0.093	65.4	0.122	–71.3
1.1	0.495	171.2	4.194	69.2	0.102	65.4	0.113	–75.1
1.2	0.503	168.3	3.865	66.4	0.110	65.1	0.107	–80.6
1.3	0.506	165.7	3.575	63.8	0.118	64.6	0.101	–86.3
1.4	0.512	163.1	3.330	61.1	0.127	64.2	0.099	–93.0
1.5	0.520	160.5	3.120	58.6	0.136	63.7	0.097	–100.0
1.6	0.522	158.1	2.942	56.1	0.144	62.9	0.097	–107.2
1.7	0.530	155.9	2.777	53.6	0.153	62.3	0.098	–114.7
1.8	0.539	153.2	2.625	51.1	0.162	61.4	0.103	–122.0
1.9	0.543	150.9	2.496	48.8	0.170	60.5	0.107	–128.9
2.0	0.553	148.5	2.375	46.0	0.179	59.7	0.114	–135.0
2.1	0.561	146.4	2.266	43.6	0.188	58.7	0.122	–140.7
2.2	0.565	144.6	2.174	41.5	0.197	57.7	0.130	–145.6
2.3	0.578	142.4	2.091	39.2	0.205	56.7	0.139	–150.1
2.4	0.583	141.0	1.999	37.1	0.214	55.5	0.149	–154.1
2.5	0.586	139.6	1.922	35.0	0.224	54.0	0.160	–157.3
2.6	0.593	138.0	1.844	32.7	0.232	52.4	0.171	–160.1
2.7	0.603	137.3	1.782	31.0	0.238	50.7	0.182	–163.2
2.8	0.615	136.0	1.726	28.9	0.241	50.0	0.192	–166.4
2.9	0.620	134.1	1.686	26.5	0.247	49.8	0.199	–169.7
3.0	0.625	132.4	1.634	24.8	0.256	49.1	0.203	–172.8
4.0	0.713	118.7	1.231	5.8	0.336	36.9	0.285	154.7
5.0	0.798	106.3	0.954	–9.3	0.392	24.4	0.452	127.9

PACKAGE DIMENSIONS

FLAT-LEAD 6-PIN THIN-TYPE ULTRA SUPER 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 September, 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 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