

DATA SHEET

NEC

NPN SILICON RF TRANSISTOR 2SC5616

NPN SILICON RF TRANSISTOR FOR HIGH-FREQUENCY LOW NOISE AMPLIFIER 3-PIN LEAD-LESS MINIMOLD

FEATURES

- Low voltage operation, low phase distortion
- Ideal for OSC applications
- 3-pin lead-less minimold package (1005 PKG)

ORDERING INFORMATION

Part Number	Quantity	Supplying Form
2SC5616	50 pcs (Non reel)	• 8 mm wide embossed taping
2SC5616-T3	10 kpcs/reel	• Pin 2 (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.

ABSOLUTE MAXIMUM RATINGS (T_A = +25°C)

Parameter	Symbol	Ratings	Unit
Collector to Base Voltage	V _{CBO}	9.0	V
Collector to Emitter Voltage	V _{CEO}	6.0	V
Emitter to Base Voltage	V _{EBO}	2.0	V
Collector Current	I _c	100	mA
Total Power Dissipation	P _{tot} ^{Note}	140	mW
Junction Temperature	T _j	150	°C
Storage Temperature	T _{stg}	-65 to +150	°C

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

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.

ELECTRICAL CHARACTERISTICS (T_A = +25°C)

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
DC Characteristics						
Collector Cut-off Current	I _{CBO}	V _{CB} = 5 V, I _E = 0 mA	–	–	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 = 3 mA	80	–	145	–
RF Characteristics						
Gain Bandwidth Product (1)	f _T	V _{CE} = 1 V, I _C = 3 mA, f = 2 GHz	4.0	5.0	–	GHz
Gain Bandwidth Product (2)	f _T	V _{CE} = 3 V, I _C = 20 mA, f = 2 GHz	–	9.5	–	GHz
Insertion Power Gain (1)	S _{21e} ²	V _{CE} = 1 V, I _C = 3 mA, f = 2 GHz	3.0	4.0	–	dB
Insertion Power Gain (2)	S _{21e} ²	V _{CE} = 3 V, I _C = 20 mA, f = 2 GHz	–	8.0	–	dB
Noise Figure (1)	NF	V _{CE} = 1 V, I _C = 3 mA, f = 2 GHz, Z _S = Z _{opt}	–	1.9	2.5	dB
Noise Figure (2)	NF	V _{CE} = 3 V, I _C = 7 mA, f = 2 GHz, Z _S = Z _{opt}	–	1.7	–	dB
Reverse Transfer Capacitance	C _{re} ^{Note 2}	V _{CB} = 1 V, I _E = 0 mA, f = 1 MHz	–	0.7	0.8	pF

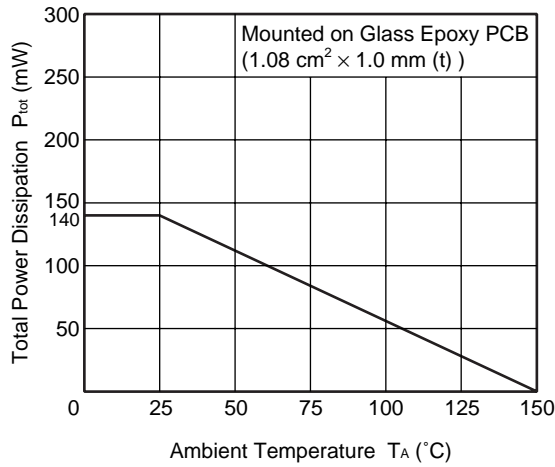
- Notes** 1. Pulse measurement: PW ≤ 350 μs, Duty Cycle ≤ 2%
 2. Collector to base capacitance when the emitter grounded

h_{FE} CLASSIFICATION

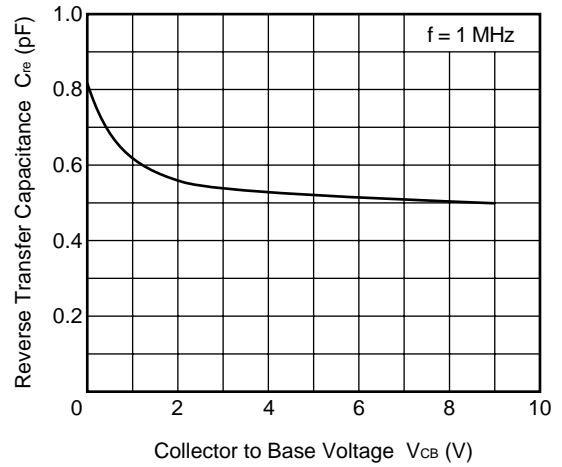
Rank	EB	FB
Marking	T1	T2
h _{FE} Value	80 to 110	100 to 145

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

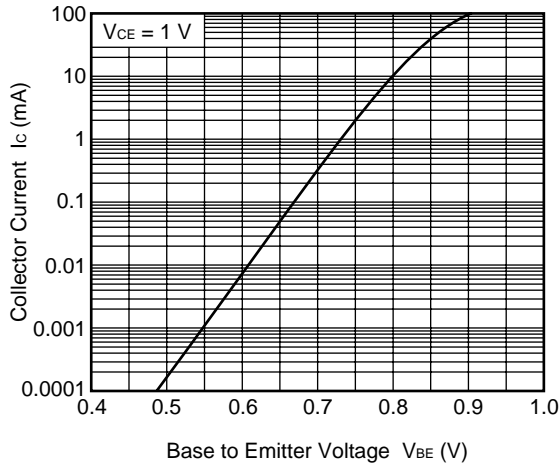
TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE



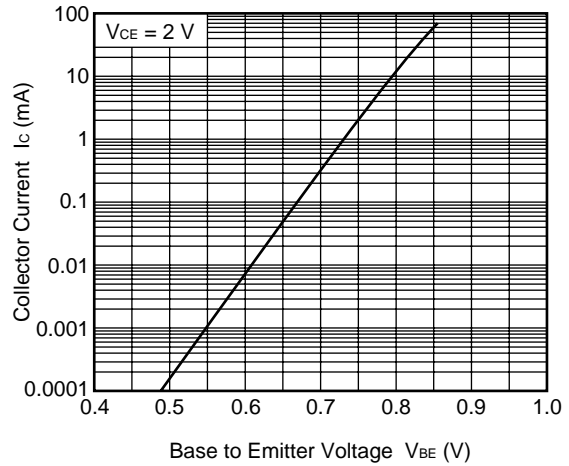
REVERSE TRANSFER CAPACITANCE vs. COLLECTOR TO BASE VOLTAGE



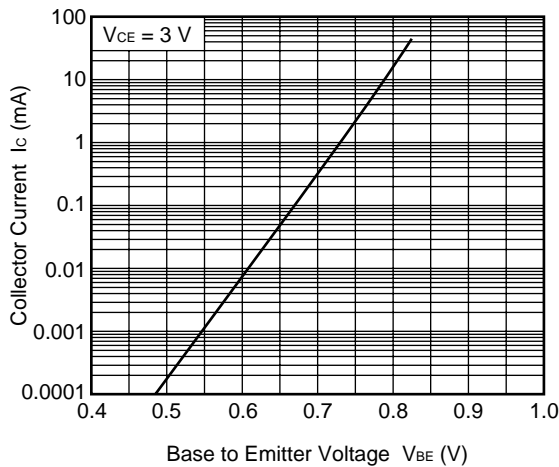
COLLECTOR CURRENT vs. BASE TO EMITTER VOLTAGE



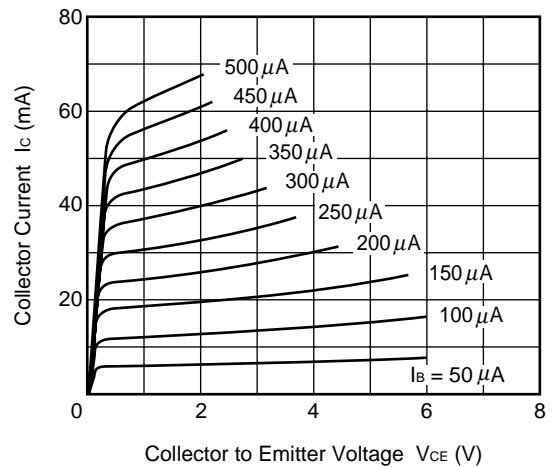
COLLECTOR CURRENT vs. BASE TO EMITTER VOLTAGE



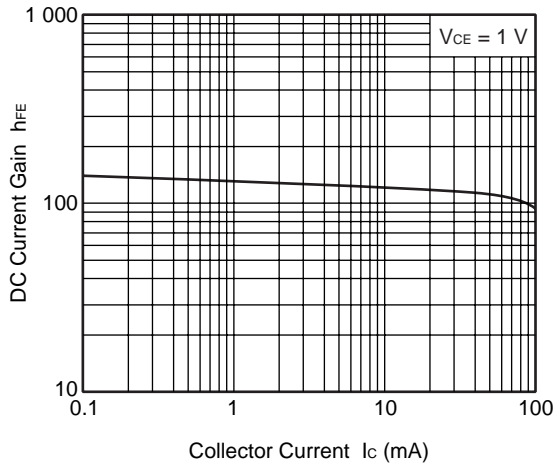
COLLECTOR CURRENT vs. BASE TO EMITTER VOLTAGE



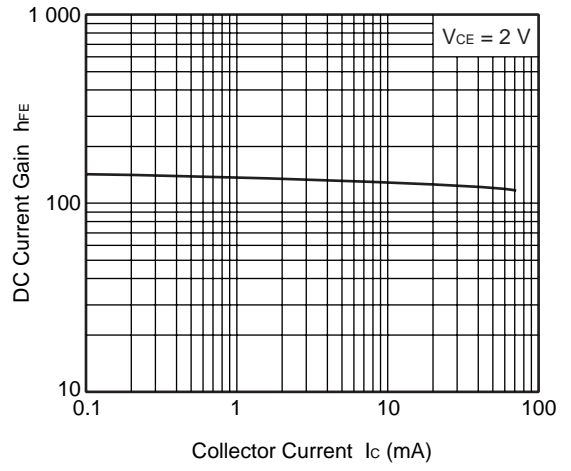
COLLECTOR CURRENT vs. COLLECTOR TO EMITTER VOLTAGE



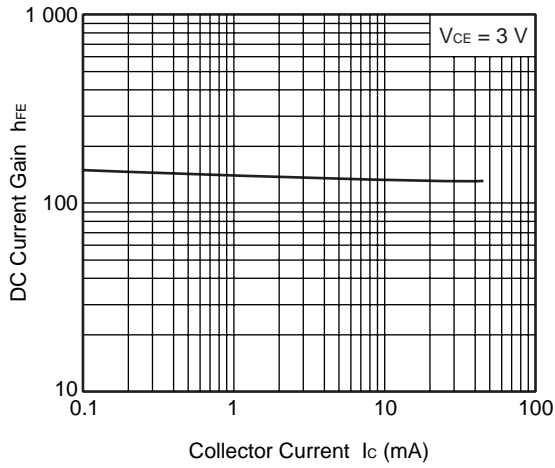
DC CURRENT GAIN vs.
COLLECTOR CURRENT



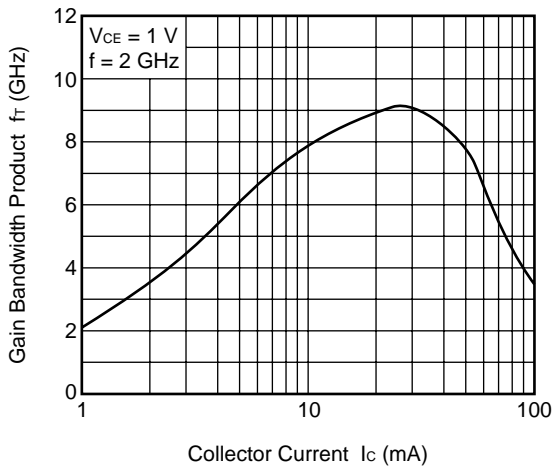
DC CURRENT GAIN vs.
COLLECTOR CURRENT



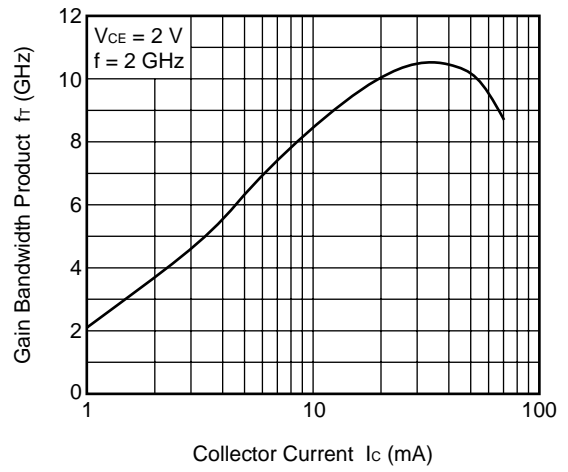
DC CURRENT GAIN vs.
COLLECTOR CURRENT



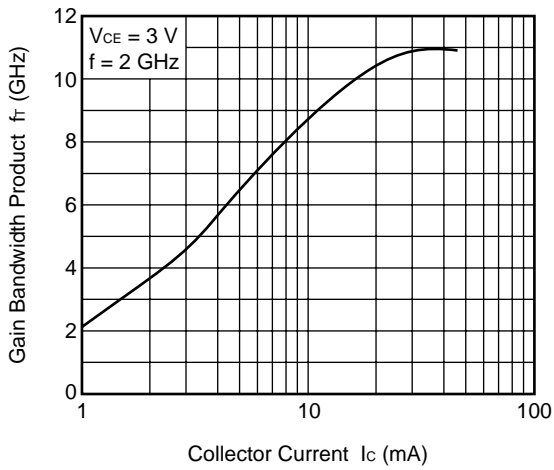
GAIN BANDWIDTH PRODUCT
vs. COLLECTOR CURRENT



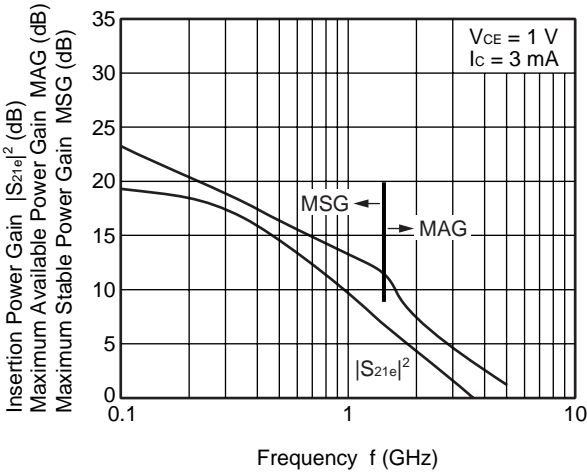
GAIN BANDWIDTH PRODUCT
vs. COLLECTOR CURRENT



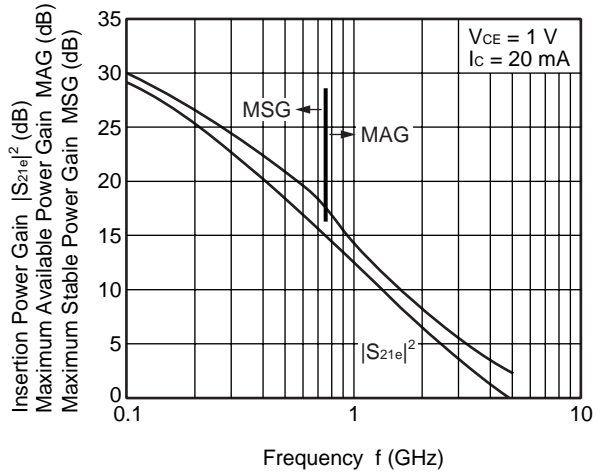
GAIN BANDWIDTH PRODUCT
vs. COLLECTOR CURRENT



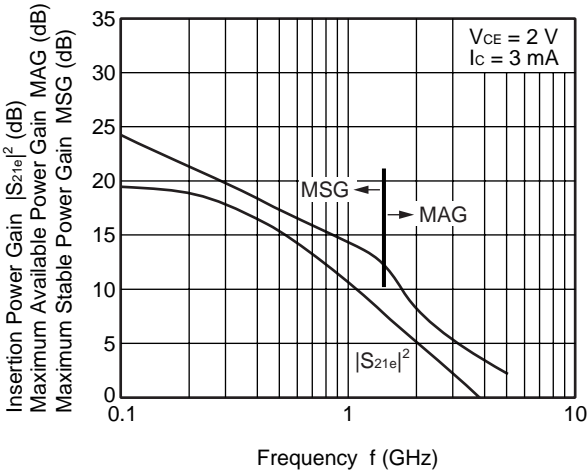
INSERTION POWER GAIN, MAG, MSG vs. FREQUENCY



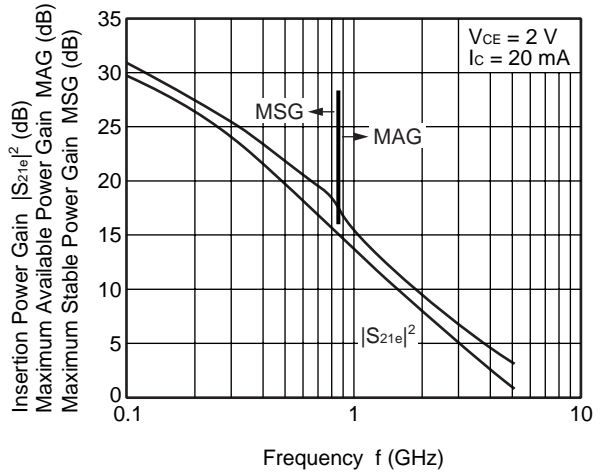
INSERTION POWER GAIN, MAG, MSG vs. FREQUENCY



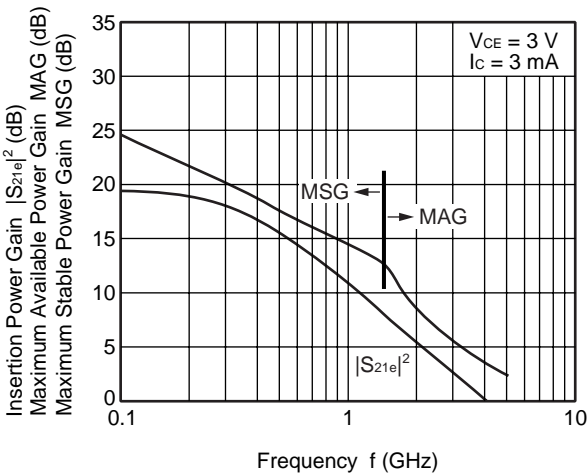
INSERTION POWER GAIN, MAG, MSG vs. FREQUENCY



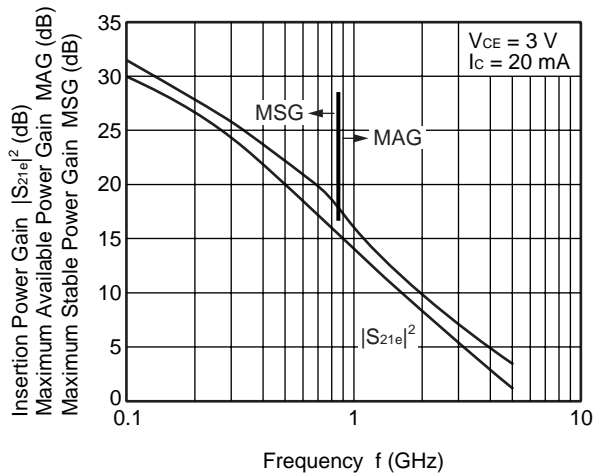
INSERTION POWER GAIN, MAG, MSG vs. FREQUENCY



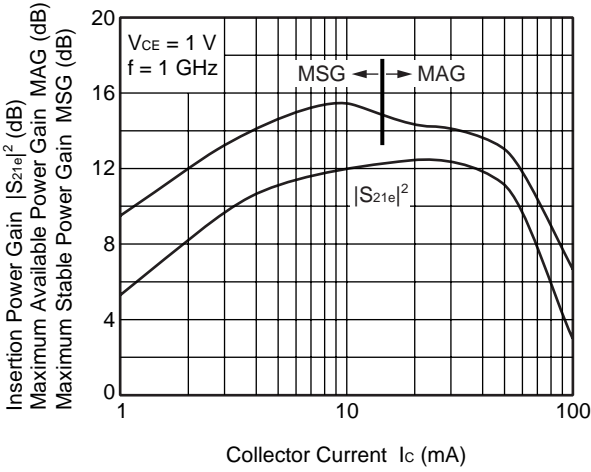
INSERTION POWER GAIN, MAG, MSG vs. FREQUENCY



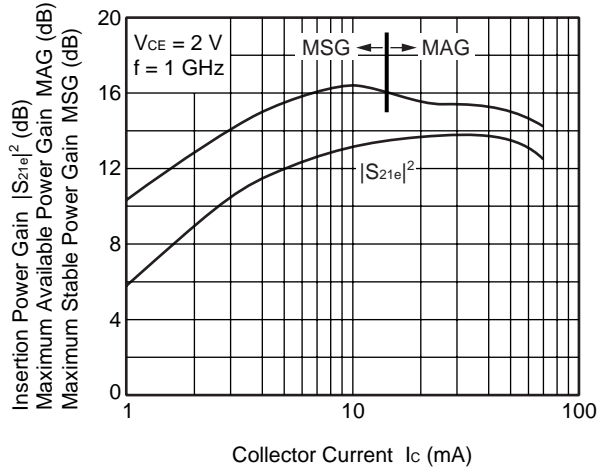
INSERTION POWER GAIN, MAG, MSG vs. FREQUENCY



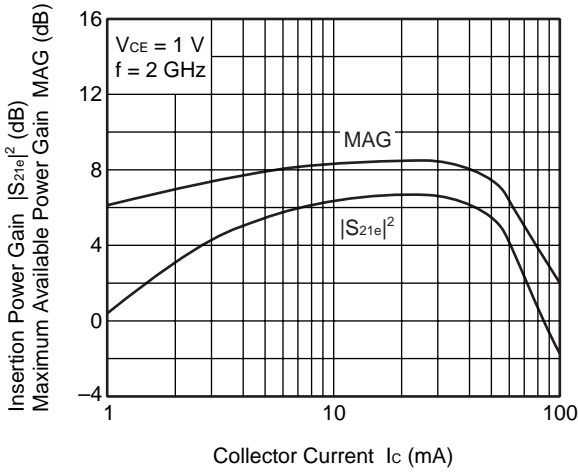
INSERTION POWER GAIN, MAG, MSG
vs. COLLECTOR CURRENT



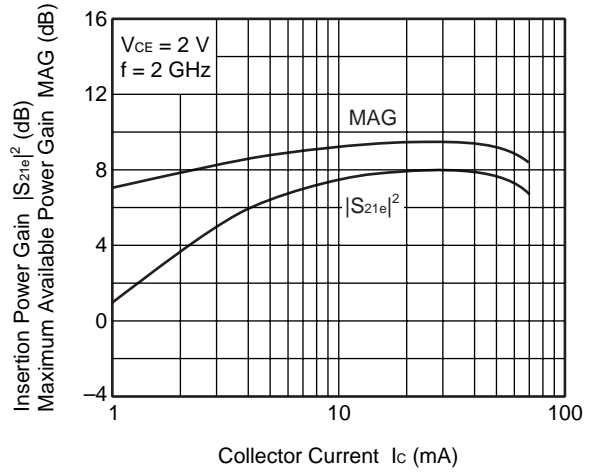
INSERTION POWER GAIN, MAG, MSG
vs. COLLECTOR CURRENT



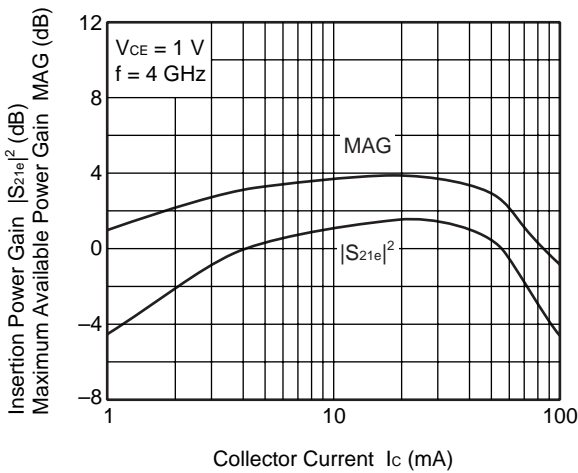
INSERTION POWER GAIN, MAG
vs. COLLECTOR CURRENT



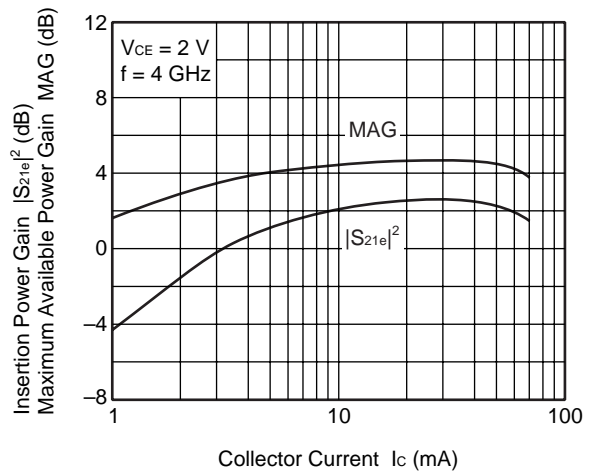
INSERTION POWER GAIN, MAG
vs. COLLECTOR CURRENT



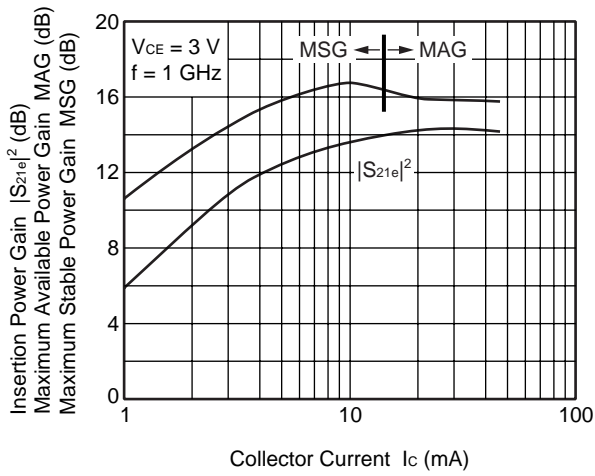
INSERTION POWER GAIN, MAG
vs. COLLECTOR CURRENT



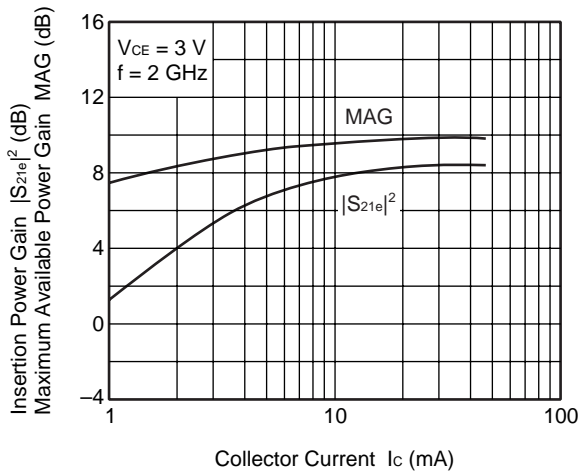
INSERTION POWER GAIN, MAG
vs. COLLECTOR CURRENT



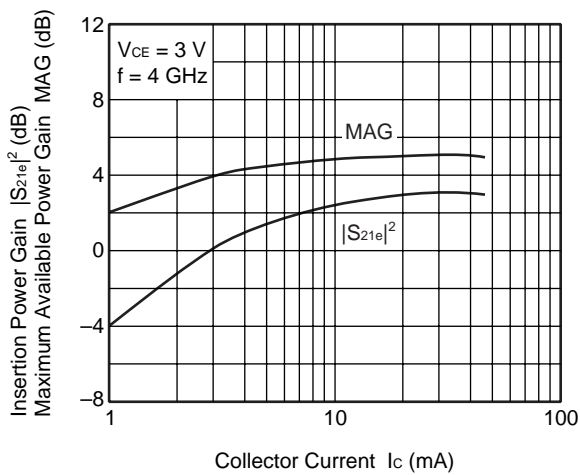
INSERTION POWER GAIN, MAG, MSG
vs. COLLECTOR CURRENT



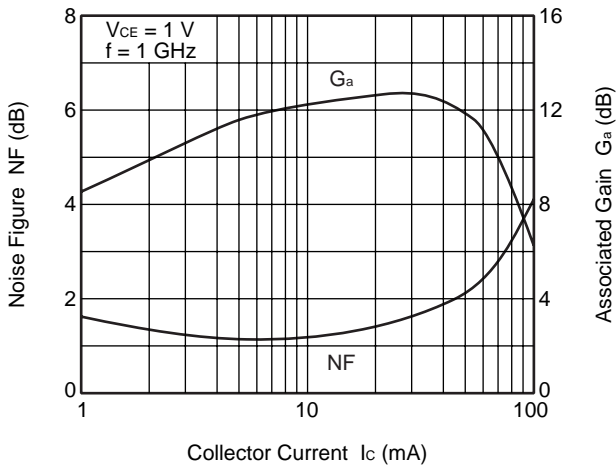
INSERTION POWER GAIN, MAG
vs. COLLECTOR CURRENT



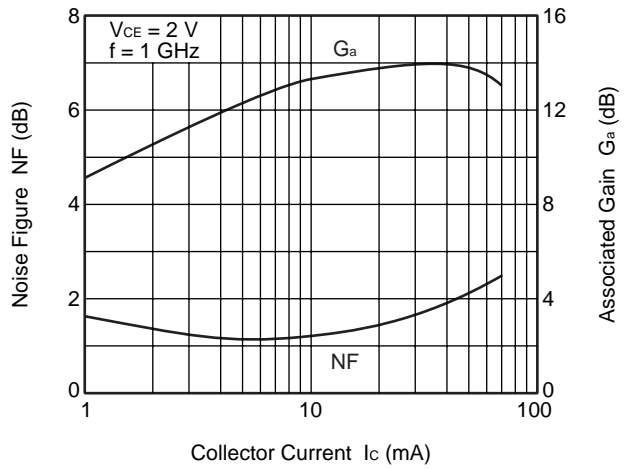
INSERTION POWER GAIN, MAG
vs. COLLECTOR CURRENT



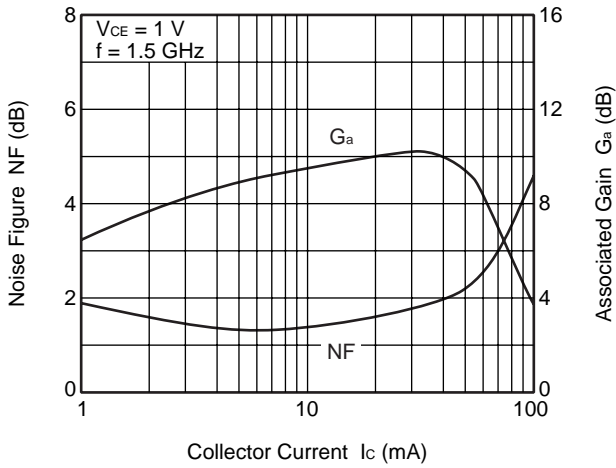
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



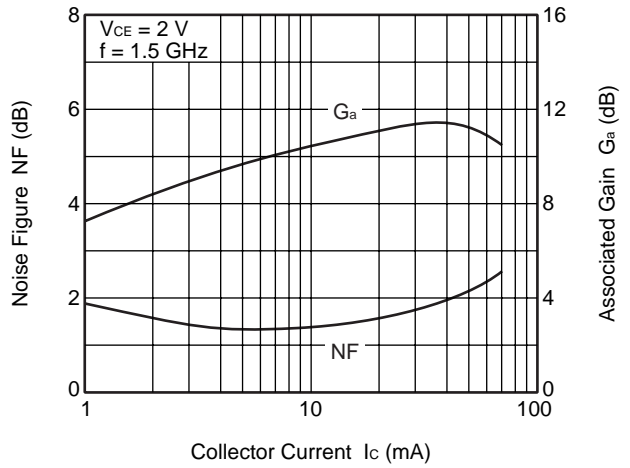
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



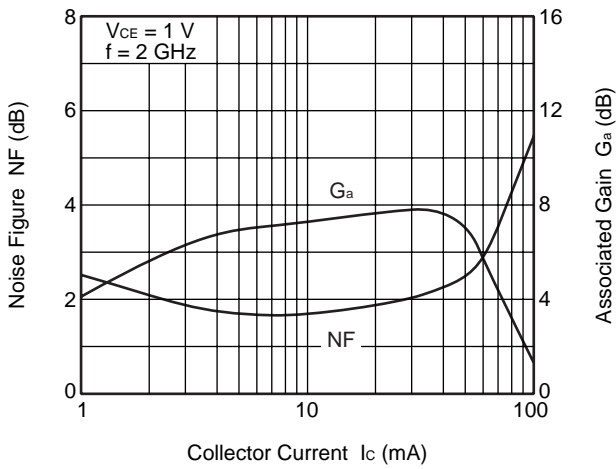
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



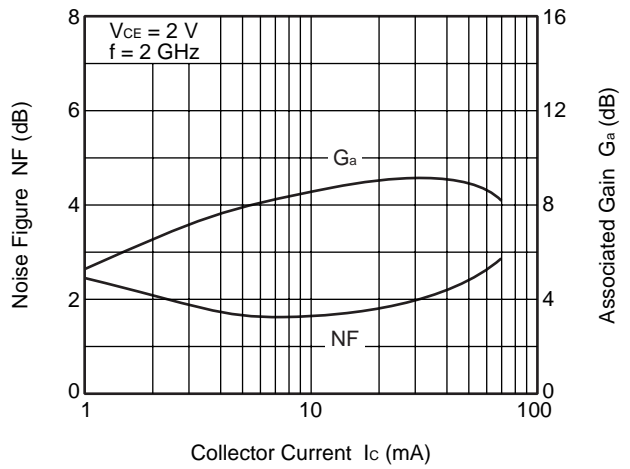
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



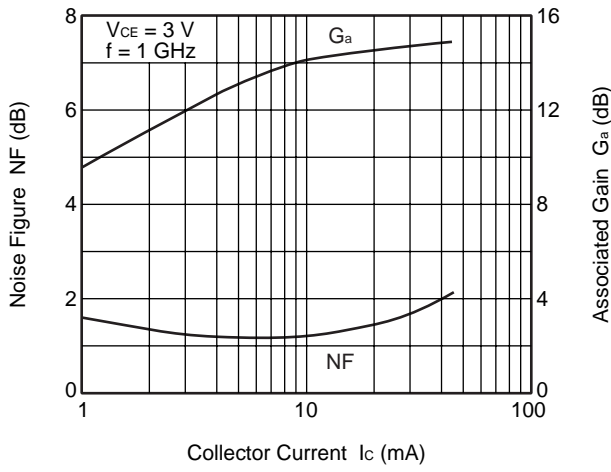
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



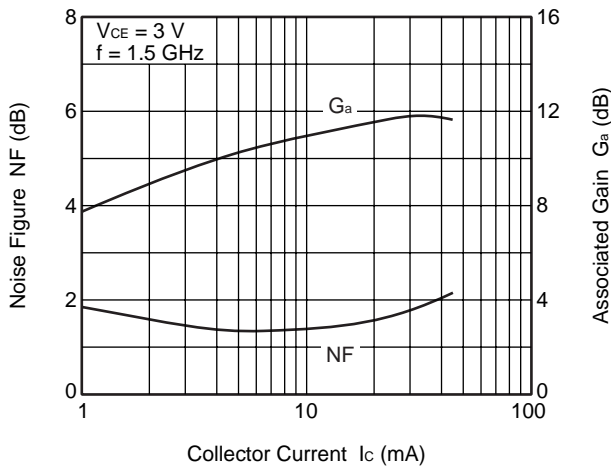
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



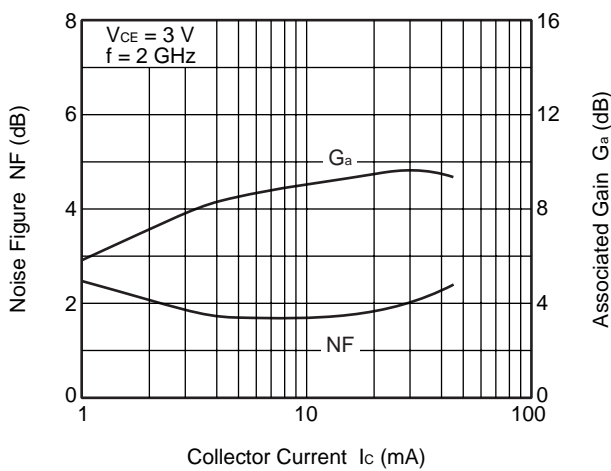
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



Remark The graphs indicate nominal characteristics.

S-PARAMETERS

V_{CE} = 1 V, I_C = 1 mA, Z₀ = 50 Ω

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.962	-16.8	3.445	167.5	0.044	78.1	0.986	-8.0
0.2	0.932	-34.7	3.395	154.8	0.088	69.4	0.951	-15.8
0.3	0.895	-50.7	3.209	143.2	0.123	60.1	0.902	-22.6
0.4	0.851	-65.5	2.961	132.9	0.151	52.1	0.845	-28.5
0.5	0.808	-79.1	2.742	123.4	0.171	44.9	0.788	-33.4
0.6	0.767	-91.8	2.516	115.1	0.186	38.7	0.736	-37.8
0.7	0.736	-103.3	2.316	107.5	0.197	33.7	0.689	-41.2
0.8	0.712	-112.9	2.136	101.1	0.203	29.3	0.648	-44.2
0.9	0.693	-122.1	1.972	94.9	0.207	25.6	0.613	-47.1
1.0	0.680	-130.0	1.827	89.4	0.208	22.5	0.585	-49.6
1.1	0.670	-137.5	1.708	84.3	0.208	19.7	0.561	-52.0
1.2	0.660	-143.9	1.592	79.9	0.207	17.5	0.540	-54.3
1.3	0.657	-149.5	1.493	75.7	0.204	15.6	0.522	-57.0
1.4	0.651	-154.9	1.409	71.7	0.201	14.2	0.510	-59.6
1.5	0.647	-159.7	1.330	67.7	0.197	13.1	0.499	-62.3
1.6	0.648	-164.4	1.267	64.0	0.193	12.4	0.490	-64.9
1.7	0.646	-168.7	1.201	60.4	0.189	12.0	0.483	-67.8
1.8	0.646	-172.6	1.144	57.3	0.185	11.8	0.480	-70.6
1.9	0.647	-176.2	1.095	54.3	0.180	12.3	0.475	-73.4
2.0	0.648	-179.7	1.054	51.7	0.175	12.6	0.472	-76.4
2.1	0.647	176.4	1.009	48.6	0.170	13.7	0.472	-79.2
2.2	0.649	173.2	0.976	45.9	0.165	14.9	0.471	-82.3
2.3	0.652	169.6	0.941	43.7	0.161	16.3	0.472	-85.1
2.4	0.655	166.5	0.905	41.2	0.158	18.2	0.472	-88.1
2.5	0.660	163.2	0.871	39.0	0.155	20.3	0.474	-90.8
2.6	0.665	159.9	0.839	37.0	0.153	22.6	0.478	-94.0
2.7	0.670	157.1	0.809	34.7	0.152	25.3	0.481	-96.5
2.8	0.676	154.3	0.784	33.1	0.154	28.4	0.486	-99.5
2.9	0.680	152.0	0.766	31.1	0.155	32.0	0.486	-101.6
3.0	0.685	149.3	0.742	29.5	0.157	35.0	0.487	-104.5
4.0	0.728	131.6	0.585	21.5	0.242	49.8	0.488	-134.2
5.0	0.739	116.2	0.513	16.5	0.354	43.5	0.513	-171.0

$V_{CE} = 1\text{ V}$, $I_C = 3\text{ mA}$, $Z_0 = 50\ \Omega$

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.881	-27.4	9.268	160.7	0.043	73.3	0.950	-16.8
0.2	0.817	-54.9	8.451	143.4	0.077	61.1	0.845	-31.1
0.3	0.748	-76.3	7.359	129.8	0.100	51.5	0.732	-42.0
0.4	0.682	-94.9	6.278	119.1	0.115	44.7	0.628	-50.2
0.5	0.640	-109.8	5.443	110.5	0.124	40.0	0.545	-56.2
0.6	0.609	-122.2	4.743	103.6	0.130	36.7	0.477	-61.0
0.7	0.588	-133.0	4.186	97.5	0.135	34.6	0.424	-64.8
0.8	0.577	-141.6	3.755	92.6	0.139	33.4	0.382	-68.3
0.9	0.569	-149.1	3.381	88.2	0.141	32.6	0.348	-71.3
1.0	0.567	-155.8	3.074	84.2	0.144	32.3	0.321	-74.3
1.1	0.564	-161.7	2.825	80.5	0.146	32.3	0.299	-77.2
1.2	0.561	-166.5	2.608	77.2	0.148	32.5	0.281	-80.0
1.3	0.566	-170.6	2.425	74.2	0.151	32.8	0.267	-82.9
1.4	0.562	-174.6	2.267	71.2	0.153	33.4	0.256	-85.9
1.5	0.562	-178.4	2.125	68.3	0.156	34.1	0.248	-89.1
1.6	0.566	178.3	2.008	65.5	0.159	34.8	0.242	-92.1
1.7	0.567	175.0	1.897	62.7	0.162	35.6	0.238	-95.3
1.8	0.567	171.9	1.800	60.4	0.166	36.3	0.236	-98.2
1.9	0.569	169.1	1.713	57.9	0.169	37.2	0.235	-101.3
2.0	0.571	166.3	1.639	55.7	0.173	38.0	0.234	-104.2
2.1	0.572	163.3	1.567	53.2	0.177	38.9	0.236	-107.2
2.2	0.572	160.8	1.510	50.7	0.181	39.6	0.237	-110.1
2.3	0.577	158.0	1.459	48.9	0.185	40.2	0.241	-112.7
2.4	0.581	155.1	1.401	46.6	0.189	40.8	0.244	-115.4
2.5	0.585	152.6	1.350	44.7	0.194	41.2	0.247	-117.8
2.6	0.588	150.1	1.304	42.7	0.199	41.4	0.252	-120.3
2.7	0.595	147.9	1.259	40.8	0.204	41.8	0.255	-122.4
2.8	0.602	145.7	1.220	38.9	0.211	42.4	0.260	-124.9
2.9	0.608	143.8	1.193	37.0	0.216	43.3	0.261	-126.7
3.0	0.610	141.8	1.155	35.5	0.220	43.4	0.263	-129.1
4.0	0.660	129.2	0.906	22.8	0.290	43.0	0.279	-156.3
5.0	0.695	116.2	0.749	11.9	0.364	36.9	0.337	171.7

$V_{CE} = 1\text{ V}$, $I_C = 5\text{ mA}$, $Z_0 = 50\ \Omega$

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.807	-37.7	13.991	155.2	0.039	70.5	0.909	-24.2
0.2	0.721	-70.8	11.837	135.0	0.068	56.4	0.749	-42.8
0.3	0.648	-94.7	9.637	121.1	0.084	48.1	0.607	-55.6
0.4	0.597	-113.1	7.897	111.2	0.094	43.8	0.498	-64.7
0.5	0.566	-127.6	6.641	103.7	0.100	41.4	0.417	-71.6
0.6	0.547	-138.9	5.683	97.8	0.106	40.3	0.358	-77.4
0.7	0.538	-148.2	4.939	92.8	0.111	40.1	0.313	-82.2
0.8	0.532	-155.7	4.397	88.7	0.116	40.4	0.278	-87.0
0.9	0.530	-162.0	3.936	84.9	0.120	40.8	0.251	-91.4
1.0	0.534	-167.2	3.559	81.5	0.125	41.5	0.230	-95.8
1.1	0.534	-172.0	3.261	78.4	0.130	42.2	0.214	-100.2
1.2	0.536	-176.3	2.997	75.5	0.135	42.7	0.201	-104.3
1.3	0.538	-179.6	2.785	73.0	0.141	43.5	0.192	-108.7
1.4	0.538	177.1	2.595	70.4	0.146	44.1	0.186	-112.7
1.5	0.540	173.9	2.428	67.9	0.152	44.7	0.182	-116.7
1.6	0.543	170.8	2.292	65.4	0.157	45.1	0.181	-120.3
1.7	0.547	168.0	2.159	62.9	0.164	45.6	0.180	-123.9
1.8	0.547	165.3	2.050	60.8	0.170	46.0	0.180	-127.1
1.9	0.548	163.0	1.947	58.6	0.176	46.4	0.183	-130.1
2.0	0.551	160.7	1.860	56.7	0.182	46.6	0.185	-132.9
2.1	0.551	157.6	1.779	54.3	0.189	46.9	0.188	-135.4
2.2	0.553	155.3	1.714	52.1	0.195	47.0	0.192	-138.0
2.3	0.557	152.9	1.655	50.4	0.201	47.0	0.197	-139.9
2.4	0.562	150.3	1.589	48.3	0.207	46.9	0.201	-142.1
2.5	0.564	148.0	1.530	46.5	0.214	46.6	0.205	-144.0
2.6	0.569	145.9	1.478	44.7	0.220	46.5	0.210	-145.9
2.7	0.575	143.9	1.426	42.8	0.226	46.2	0.213	-147.5
2.8	0.579	141.8	1.381	41.1	0.233	46.1	0.218	-149.4
2.9	0.584	140.4	1.349	39.3	0.239	46.2	0.220	-150.8
3.0	0.587	138.5	1.308	37.8	0.245	45.8	0.222	-152.9
4.0	0.637	127.6	1.029	25.1	0.311	41.6	0.244	-177.9
5.0	0.673	115.7	0.849	13.2	0.374	34.5	0.310	155.3

$V_{CE} = 1\text{ V}$, $I_C = 7\text{ mA}$, $Z_0 = 50\ \Omega$

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.752	-45.1	17.733	150.5	0.038	67.9	0.869	-30.5
0.2	0.652	-83.0	14.076	128.9	0.061	53.9	0.673	-51.7
0.3	0.592	-107.9	11.018	115.6	0.073	47.9	0.524	-65.5
0.4	0.551	-125.2	8.741	106.6	0.081	45.2	0.420	-75.6
0.5	0.528	-138.7	7.259	99.8	0.088	44.4	0.349	-83.4
0.6	0.520	-148.9	6.151	94.6	0.094	44.6	0.298	-90.3
0.7	0.516	-157.2	5.328	90.1	0.100	45.2	0.261	-96.3
0.8	0.516	-163.6	4.719	86.5	0.106	46.1	0.233	-102.4
0.9	0.517	-169.2	4.212	83.0	0.112	46.9	0.213	-108.2
1.0	0.517	-174.0	3.801	79.9	0.119	47.8	0.198	-113.9
1.1	0.523	-178.1	3.478	77.2	0.125	48.4	0.188	-119.1
1.2	0.525	178.5	3.201	74.6	0.132	49.0	0.180	-124.2
1.3	0.527	175.3	2.967	72.3	0.138	49.5	0.175	-129.1
1.4	0.529	172.5	2.763	69.9	0.145	50.0	0.173	-133.5
1.5	0.531	169.4	2.586	67.6	0.152	50.2	0.173	-137.6
1.6	0.535	166.8	2.438	65.2	0.160	50.4	0.173	-141.0
1.7	0.538	164.0	2.295	62.9	0.167	50.6	0.175	-144.4
1.8	0.539	161.8	2.174	61.0	0.174	50.6	0.177	-147.2
1.9	0.539	159.5	2.067	58.9	0.182	50.7	0.181	-149.6
2.0	0.541	157.4	1.974	57.3	0.189	50.5	0.185	-151.9
2.1	0.543	154.7	1.885	54.9	0.197	50.6	0.189	-153.8
2.2	0.544	152.4	1.817	52.6	0.204	50.5	0.193	-155.8
2.3	0.551	150.0	1.756	51.0	0.211	50.0	0.199	-157.3
2.4	0.555	148.0	1.682	49.2	0.217	49.6	0.203	-159.0
2.5	0.557	145.4	1.620	47.4	0.224	49.1	0.207	-160.4
2.6	0.558	143.6	1.565	45.7	0.232	48.7	0.212	-162.1
2.7	0.569	141.6	1.508	44.0	0.239	48.0	0.215	-163.6
2.8	0.571	139.9	1.462	42.3	0.246	47.6	0.220	-164.9
2.9	0.576	138.3	1.429	40.5	0.252	47.5	0.221	-166.6
3.0	0.578	136.6	1.385	39.0	0.258	46.8	0.223	-168.1
4.0	0.626	126.7	1.088	26.4	0.323	40.8	0.251	168.8
5.0	0.664	115.4	0.901	14.4	0.382	33.3	0.315	145.7

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

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.692	-55.9	21.845	145.2	0.035	63.3	0.816	-37.7
0.2	0.584	-96.5	16.106	122.9	0.053	53.1	0.591	-61.6
0.3	0.539	-121.0	12.120	110.4	0.063	48.9	0.447	-76.5
0.4	0.513	-137.4	9.458	102.4	0.071	48.3	0.355	-87.5
0.5	0.505	-149.2	7.762	96.5	0.078	48.8	0.296	-96.6
0.6	0.500	-158.3	6.533	91.8	0.085	49.6	0.256	-104.8
0.7	0.501	-165.2	5.644	87.8	0.092	50.9	0.228	-112.0
0.8	0.506	-171.0	4.973	84.4	0.100	51.9	0.209	-119.2
0.9	0.506	-175.7	4.427	81.4	0.107	52.9	0.196	-125.8
1.0	0.510	-179.7	3.993	78.6	0.115	53.7	0.187	-132.1
1.1	0.516	176.7	3.649	76.1	0.123	54.1	0.182	-137.8
1.2	0.520	173.7	3.360	73.7	0.131	54.4	0.179	-143.0
1.3	0.523	171.1	3.110	71.7	0.138	54.8	0.178	-147.5
1.4	0.524	168.4	2.895	69.5	0.146	54.8	0.180	-151.6
1.5	0.528	165.9	2.707	67.3	0.154	54.9	0.182	-155.2
1.6	0.530	163.5	2.553	65.1	0.163	54.7	0.185	-158.1
1.7	0.534	161.0	2.400	62.9	0.171	54.7	0.188	-160.8
1.8	0.536	158.5	2.277	61.1	0.179	54.3	0.192	-163.2
1.9	0.537	156.7	2.163	59.2	0.187	54.0	0.196	-164.9
2.0	0.538	154.8	2.064	57.6	0.196	53.5	0.201	-166.6
2.1	0.537	152.1	1.966	55.3	0.204	53.4	0.205	-168.0
2.2	0.539	150.0	1.891	53.1	0.212	52.9	0.210	-169.7
2.3	0.546	147.5	1.829	51.7	0.219	52.4	0.215	-170.7
2.4	0.550	145.6	1.754	49.7	0.226	51.7	0.219	-172.0
2.5	0.551	143.2	1.692	48.1	0.233	51.0	0.223	-173.1
2.6	0.556	141.4	1.635	46.3	0.241	50.4	0.228	-174.4
2.7	0.562	139.5	1.577	44.6	0.248	49.6	0.231	-175.5
2.8	0.568	138.1	1.527	42.9	0.256	48.9	0.236	-176.7
2.9	0.571	136.7	1.488	41.4	0.262	48.6	0.237	-178.1
3.0	0.574	134.9	1.446	40.0	0.268	47.8	0.238	-179.6
4.0	0.619	125.5	1.135	27.5	0.332	40.6	0.268	159.1
5.0	0.658	114.9	0.940	15.5	0.388	32.4	0.332	138.3

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

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.541	-82.4	29.059	134.1	0.029	56.6	0.686	-53.6
0.2	0.489	-124.8	18.739	112.8	0.041	54.4	0.448	-81.3
0.3	0.489	-144.9	13.350	102.6	0.050	55.1	0.336	-98.5
0.4	0.482	-156.7	10.170	96.3	0.058	56.7	0.276	-111.6
0.5	0.488	-165.8	8.250	91.5	0.067	58.6	0.242	-122.4
0.6	0.489	-171.9	6.906	87.8	0.076	59.8	0.223	-131.7
0.7	0.494	-176.8	5.933	84.5	0.085	60.6	0.211	-139.6
0.8	0.502	179.1	5.211	81.8	0.095	61.3	0.205	-146.7
0.9	0.505	175.3	4.640	79.1	0.104	61.9	0.203	-152.7
1.0	0.509	172.4	4.176	76.8	0.114	62.0	0.203	-158.0
1.1	0.513	169.4	3.803	74.4	0.123	61.9	0.204	-162.4
1.2	0.519	167.2	3.507	72.3	0.132	61.7	0.207	-166.3
1.3	0.523	164.9	3.242	70.4	0.141	61.5	0.210	-169.5
1.4	0.525	162.7	3.018	68.4	0.150	61.1	0.214	-172.4
1.5	0.527	160.5	2.816	66.6	0.160	60.6	0.219	-174.8
1.6	0.531	158.3	2.653	64.5	0.169	60.0	0.223	-176.7
1.7	0.535	156.3	2.499	62.6	0.178	59.5	0.228	-178.6
1.8	0.535	154.3	2.367	60.9	0.188	58.7	0.232	179.9
1.9	0.536	152.7	2.249	59.1	0.196	58.0	0.237	178.7
2.0	0.538	150.8	2.146	57.5	0.206	57.3	0.241	177.7
2.1	0.540	148.3	2.044	55.5	0.214	56.6	0.245	176.7
2.2	0.541	146.6	1.970	53.4	0.223	56.0	0.250	175.5
2.3	0.547	144.2	1.898	52.0	0.231	55.2	0.254	174.9
2.4	0.551	142.2	1.824	50.3	0.238	54.3	0.259	173.9
2.5	0.553	140.1	1.757	48.6	0.246	53.3	0.262	173.1
2.6	0.558	138.6	1.701	47.1	0.254	52.4	0.266	172.0
2.7	0.562	136.7	1.637	45.4	0.262	51.4	0.269	171.1
2.8	0.565	135.1	1.586	43.8	0.270	50.5	0.274	170.1
2.9	0.569	133.8	1.544	42.4	0.277	49.9	0.275	169.1
3.0	0.573	132.5	1.499	40.9	0.283	48.9	0.275	167.6
4.0	0.616	124.2	1.179	28.8	0.347	40.2	0.308	148.5
5.0	0.653	114.0	0.975	17.1	0.398	31.4	0.370	130.3

$V_{CE} = 2\text{ V}$, $I_C = 1\text{ mA}$, $Z_0 = 50\ \Omega$

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.970	-15.5	3.413	168.4	0.037	81.2	0.989	-6.5
0.2	0.939	-31.8	3.395	157.1	0.072	71.5	0.962	-12.9
0.3	0.904	-46.6	3.244	146.4	0.101	62.7	0.923	-18.7
0.4	0.860	-60.7	3.030	136.4	0.126	55.2	0.876	-23.7
0.5	0.825	-73.8	2.833	127.4	0.145	48.4	0.827	-27.9
0.6	0.784	-85.8	2.616	119.3	0.159	42.4	0.781	-31.6
0.7	0.752	-97.3	2.423	111.8	0.169	37.4	0.739	-34.6
0.8	0.726	-107.2	2.251	105.6	0.175	33.0	0.702	-37.3
0.9	0.706	-116.4	2.089	99.5	0.179	29.3	0.670	-39.8
1.0	0.689	-124.8	1.942	93.8	0.181	26.1	0.642	-42.0
1.1	0.676	-132.4	1.819	88.9	0.181	23.4	0.618	-44.1
1.2	0.665	-139.0	1.699	84.4	0.181	21.1	0.598	-46.2
1.3	0.661	-144.9	1.596	80.3	0.179	19.3	0.581	-48.6
1.4	0.654	-150.7	1.508	76.1	0.176	17.9	0.567	-50.7
1.5	0.649	-155.7	1.424	72.3	0.173	17.0	0.557	-53.1
1.6	0.648	-160.6	1.359	68.6	0.170	16.3	0.546	-55.5
1.7	0.646	-165.1	1.288	65.0	0.166	16.1	0.538	-58.0
1.8	0.647	-169.3	1.225	61.8	0.162	16.2	0.533	-60.4
1.9	0.642	-173.0	1.173	59.0	0.158	16.7	0.527	-62.9
2.0	0.645	-176.5	1.130	56.4	0.154	17.4	0.523	-65.5
2.1	0.643	179.4	1.080	53.2	0.149	18.7	0.521	-68.2
2.2	0.644	175.9	1.045	50.4	0.146	20.2	0.518	-71.1
2.3	0.645	172.2	1.010	48.4	0.142	21.9	0.518	-73.5
2.4	0.651	168.5	0.966	45.8	0.139	24.1	0.517	-76.3
2.5	0.653	165.1	0.931	43.4	0.138	26.4	0.518	-78.9
2.6	0.657	162.1	0.901	41.3	0.137	29.3	0.519	-81.7
2.7	0.662	158.8	0.864	39.0	0.137	32.4	0.521	-84.2
2.8	0.667	155.9	0.836	37.0	0.140	35.7	0.524	-87.0
2.9	0.671	153.2	0.819	35.1	0.141	39.6	0.523	-88.8
3.0	0.676	150.8	0.794	33.6	0.144	42.6	0.522	-91.7
4.0	0.715	132.3	0.618	24.4	0.235	56.7	0.512	-119.4
5.0	0.731	116.5	0.540	18.3	0.353	49.3	0.512	-156.0

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

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.891	-24.5	9.340	162.7	0.034	75.0	0.961	-13.6
0.2	0.832	-48.9	8.708	146.5	0.064	64.0	0.874	-25.4
0.3	0.758	-69.3	7.729	133.4	0.084	55.0	0.775	-34.5
0.4	0.697	-86.5	6.706	123.0	0.099	48.4	0.680	-41.3
0.5	0.646	-101.2	5.873	114.3	0.108	43.6	0.600	-46.2
0.6	0.609	-114.1	5.172	107.3	0.114	40.2	0.535	-49.9
0.7	0.583	-125.1	4.601	101.1	0.119	38.1	0.483	-52.6
0.8	0.567	-134.4	4.134	96.1	0.123	36.8	0.440	-55.0
0.9	0.556	-142.5	3.737	91.6	0.125	35.9	0.404	-57.0
1.0	0.550	-149.4	3.403	87.5	0.128	35.7	0.376	-58.9
1.1	0.545	-155.5	3.131	83.8	0.130	35.6	0.353	-60.8
1.2	0.543	-160.8	2.898	80.5	0.133	35.8	0.333	-62.5
1.3	0.542	-165.5	2.692	77.5	0.135	36.2	0.318	-64.5
1.4	0.540	-169.9	2.518	74.4	0.137	36.8	0.305	-66.6
1.5	0.542	-173.6	2.360	71.5	0.140	37.6	0.295	-68.8
1.6	0.543	-177.6	2.234	68.7	0.143	38.3	0.287	-71.2
1.7	0.543	178.8	2.105	66.0	0.146	39.4	0.280	-73.6
1.8	0.545	175.5	1.999	63.5	0.150	40.1	0.275	-76.1
1.9	0.544	172.5	1.900	61.0	0.153	41.1	0.272	-78.6
2.0	0.546	169.8	1.817	59.0	0.157	41.9	0.269	-81.1
2.1	0.546	166.7	1.736	56.3	0.160	42.9	0.267	-83.9
2.2	0.548	163.7	1.675	54.0	0.164	43.6	0.267	-86.6
2.3	0.553	160.6	1.616	52.1	0.169	44.4	0.268	-89.2
2.4	0.556	157.9	1.551	49.8	0.173	45.0	0.268	-91.9
2.5	0.560	155.2	1.490	47.8	0.178	45.6	0.270	-94.3
2.6	0.564	152.4	1.442	45.8	0.183	46.0	0.272	-97.0
2.7	0.570	150.2	1.391	43.6	0.188	46.5	0.274	-99.1
2.8	0.576	148.0	1.344	41.9	0.194	47.1	0.278	-101.7
2.9	0.580	146.1	1.314	40.0	0.199	48.0	0.277	-103.4
3.0	0.584	143.9	1.273	38.3	0.204	48.4	0.278	-106.1
4.0	0.639	130.6	0.988	25.2	0.276	48.3	0.273	-133.0
5.0	0.679	117.4	0.814	13.6	0.356	42.2	0.304	-169.2

$V_{CE} = 2\text{ V}$, $I_C = 5\text{ mA}$, $Z_0 = 50\ \Omega$

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.840	-32.9	14.170	157.9	0.033	73.2	0.927	-19.4
0.2	0.734	-62.2	12.402	138.6	0.057	60.3	0.791	-34.8
0.3	0.656	-85.0	10.379	125.1	0.073	52.1	0.660	-45.1
0.4	0.595	-103.1	8.605	115.0	0.082	47.5	0.553	-52.4
0.5	0.554	-117.9	7.302	107.3	0.089	44.8	0.471	-57.3
0.6	0.532	-129.7	6.295	101.2	0.094	43.5	0.409	-61.1
0.7	0.516	-139.9	5.510	96.0	0.099	43.1	0.360	-64.0
0.8	0.505	-148.2	4.907	91.7	0.104	43.3	0.322	-66.5
0.9	0.501	-155.2	4.404	87.9	0.109	43.7	0.292	-69.0
1.0	0.501	-161.1	3.990	84.4	0.113	44.4	0.267	-71.2
1.1	0.502	-166.4	3.655	81.3	0.118	45.0	0.247	-73.7
1.2	0.502	-171.0	3.373	78.3	0.122	45.5	0.231	-75.9
1.3	0.504	-174.9	3.123	75.8	0.128	46.3	0.218	-78.6
1.4	0.504	-178.5	2.915	73.1	0.132	46.9	0.207	-81.2
1.5	0.505	177.9	2.726	70.6	0.138	47.7	0.199	-84.1
1.6	0.507	174.9	2.575	68.0	0.143	48.1	0.193	-87.0
1.7	0.510	171.6	2.427	65.6	0.149	48.8	0.189	-90.1
1.8	0.513	168.9	2.301	63.4	0.155	49.1	0.186	-93.0
1.9	0.512	166.4	2.188	61.3	0.161	49.6	0.184	-96.0
2.0	0.514	164.0	2.089	59.5	0.167	49.9	0.183	-98.9
2.1	0.514	160.9	1.993	57.1	0.173	50.2	0.184	-101.8
2.2	0.515	158.3	1.918	54.8	0.179	50.4	0.185	-105.0
2.3	0.522	155.7	1.851	53.1	0.185	50.4	0.187	-107.5
2.4	0.525	153.1	1.775	51.1	0.191	50.4	0.190	-110.4
2.5	0.530	150.8	1.710	49.1	0.197	50.3	0.192	-112.8
2.6	0.535	148.1	1.651	47.3	0.203	50.1	0.195	-115.3
2.7	0.539	146.3	1.590	45.4	0.210	50.1	0.197	-117.3
2.8	0.548	144.5	1.539	43.6	0.216	49.9	0.201	-119.8
2.9	0.551	142.7	1.505	41.7	0.222	50.3	0.201	-121.6
3.0	0.556	140.8	1.457	40.3	0.227	49.9	0.203	-124.1
4.0	0.609	129.3	1.131	27.1	0.295	46.3	0.205	-152.4
5.0	0.655	117.6	0.933	14.9	0.364	39.3	0.252	173.3

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

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.773	-38.7	18.060	153.7	0.031	70.3	0.896	-24.2
0.2	0.664	-72.6	14.946	133.1	0.052	58.2	0.723	-41.7
0.3	0.587	-96.4	11.999	119.6	0.064	51.5	0.578	-52.8
0.4	0.538	-114.8	9.686	110.2	0.073	48.7	0.470	-60.1
0.5	0.504	-128.7	8.095	103.1	0.078	47.6	0.394	-65.2
0.6	0.488	-140.0	6.906	97.7	0.084	47.4	0.336	-69.4
0.7	0.480	-149.3	6.004	93.0	0.090	47.8	0.293	-72.6
0.8	0.478	-156.5	5.317	89.2	0.096	48.5	0.260	-75.8
0.9	0.476	-162.7	4.756	85.8	0.101	49.5	0.233	-78.9
1.0	0.477	-168.1	4.297	82.7	0.108	50.3	0.212	-81.9
1.1	0.480	-172.7	3.928	79.8	0.114	50.9	0.195	-85.1
1.2	0.484	-176.7	3.625	77.2	0.120	51.4	0.181	-88.5
1.3	0.486	179.8	3.356	74.8	0.126	52.1	0.171	-92.0
1.4	0.488	176.7	3.128	72.4	0.132	52.5	0.163	-95.6
1.5	0.488	173.6	2.925	70.1	0.139	53.0	0.157	-99.2
1.6	0.493	170.7	2.757	67.7	0.146	53.1	0.154	-102.7
1.7	0.495	167.7	2.594	65.5	0.153	53.4	0.151	-106.3
1.8	0.497	165.2	2.458	63.5	0.160	53.5	0.150	-109.6
1.9	0.498	163.1	2.339	61.5	0.167	53.7	0.150	-113.0
2.0	0.499	160.6	2.232	59.7	0.173	53.5	0.151	-116.0
2.1	0.500	157.8	2.128	57.4	0.181	53.5	0.154	-118.9
2.2	0.504	155.6	2.049	55.2	0.188	53.5	0.156	-121.9
2.3	0.508	152.9	1.976	53.7	0.194	53.2	0.160	-124.4
2.4	0.512	150.5	1.894	51.7	0.200	52.9	0.163	-127.0
2.5	0.518	148.0	1.822	49.9	0.207	52.5	0.166	-129.2
2.6	0.520	145.9	1.761	48.1	0.214	52.1	0.170	-131.6
2.7	0.528	143.9	1.697	46.2	0.221	51.6	0.172	-133.5
2.8	0.531	142.3	1.643	44.6	0.228	51.2	0.177	-135.8
2.9	0.537	140.6	1.603	42.9	0.234	51.2	0.177	-137.6
3.0	0.541	139.0	1.554	41.4	0.239	50.7	0.179	-139.7
4.0	0.594	128.7	1.207	28.6	0.306	45.3	0.191	-168.2
5.0	0.640	117.4	0.997	16.1	0.369	37.9	0.245	160.8

$V_{CE} = 2\text{ V}$, $I_C = 10\text{ mA}$, $Z_0 = 50\ \Omega$

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.696	-47.5	22.566	148.8	0.029	68.0	0.852	-30.0
0.2	0.584	-84.7	17.440	127.1	0.046	56.5	0.643	-49.5
0.3	0.526	-109.3	13.439	114.3	0.056	52.1	0.495	-60.9
0.4	0.480	-127.2	10.598	105.7	0.064	51.0	0.393	-68.4
0.5	0.466	-139.9	8.759	99.5	0.070	51.6	0.324	-74.0
0.6	0.459	-149.9	7.406	94.7	0.077	52.2	0.275	-78.7
0.7	0.455	-157.9	6.399	90.5	0.084	53.3	0.238	-82.8
0.8	0.455	-164.4	5.656	87.1	0.091	54.2	0.210	-87.1
0.9	0.455	-169.7	5.051	83.9	0.098	55.0	0.188	-91.3
1.0	0.461	-174.4	4.558	81.1	0.105	55.8	0.171	-95.6
1.1	0.466	-178.3	4.155	78.6	0.112	56.3	0.158	-100.1
1.2	0.469	178.2	3.835	76.1	0.119	56.7	0.148	-104.6
1.3	0.471	175.1	3.548	73.9	0.127	56.9	0.141	-109.1
1.4	0.475	172.3	3.305	71.7	0.134	57.3	0.136	-113.7
1.5	0.477	169.4	3.087	69.6	0.142	57.3	0.133	-118.1
1.6	0.480	166.8	2.909	67.4	0.149	57.2	0.133	-122.0
1.7	0.485	164.2	2.737	65.2	0.157	57.2	0.132	-126.0
1.8	0.485	161.7	2.593	63.4	0.165	57.0	0.133	-129.5
1.9	0.488	159.7	2.464	61.5	0.172	56.8	0.136	-132.6
2.0	0.488	157.6	2.350	59.8	0.180	56.4	0.139	-135.5
2.1	0.490	155.0	2.242	57.7	0.188	56.1	0.143	-137.9
2.2	0.492	153.1	2.158	55.5	0.195	55.8	0.147	-140.4
2.3	0.498	150.4	2.081	54.1	0.202	55.3	0.151	-142.5
2.4	0.502	148.2	1.991	52.1	0.209	54.7	0.155	-144.5
2.5	0.507	145.8	1.921	50.5	0.216	54.1	0.159	-146.4
2.6	0.508	144.0	1.853	48.8	0.223	53.5	0.163	-148.3
2.7	0.517	142.2	1.785	47.1	0.231	52.8	0.167	-149.8
2.8	0.522	140.3	1.727	45.4	0.238	52.3	0.171	-151.8
2.9	0.528	138.9	1.684	43.8	0.244	52.1	0.173	-153.3
3.0	0.529	137.2	1.631	42.3	0.250	51.3	0.174	-155.3
4.0	0.584	127.9	1.268	29.7	0.316	44.7	0.193	177.4
5.0	0.631	117.0	1.046	17.1	0.375	36.6	0.254	150.1

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

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.545	-67.4	31.108	138.4	0.025	61.1	0.738	-42.2
0.2	0.466	-111.1	21.106	116.9	0.036	57.0	0.493	-64.1
0.3	0.437	-132.9	15.274	106.0	0.045	57.4	0.360	-76.1
0.4	0.424	-147.5	11.747	99.2	0.053	58.8	0.280	-84.8
0.5	0.425	-157.5	9.558	94.2	0.061	60.4	0.230	-91.9
0.6	0.427	-165.0	8.026	90.3	0.069	61.7	0.196	-98.8
0.7	0.432	-170.7	6.909	86.8	0.078	62.6	0.172	-105.2
0.8	0.437	-176.1	6.077	84.0	0.086	63.1	0.155	-111.9
0.9	0.440	179.9	5.414	81.5	0.095	63.5	0.143	-118.6
1.0	0.448	176.7	4.861	79.1	0.104	63.8	0.136	-125.1
1.1	0.451	173.6	4.442	76.7	0.112	63.8	0.131	-131.2
1.2	0.454	170.8	4.084	74.6	0.121	63.6	0.128	-137.0
1.3	0.459	168.5	3.781	72.7	0.130	63.3	0.128	-142.3
1.4	0.463	166.0	3.520	70.7	0.138	63.0	0.129	-146.7
1.5	0.466	163.7	3.284	68.8	0.147	62.7	0.132	-150.7
1.6	0.470	161.4	3.092	66.8	0.155	62.1	0.135	-153.8
1.7	0.475	159.2	2.909	64.9	0.164	61.7	0.138	-156.8
1.8	0.476	157.1	2.757	63.1	0.173	61.0	0.142	-159.3
1.9	0.478	155.1	2.614	61.4	0.181	60.6	0.147	-161.1
2.0	0.479	153.7	2.497	59.8	0.189	59.8	0.151	-163.0
2.1	0.482	150.8	2.377	57.9	0.198	59.2	0.156	-164.2
2.2	0.484	148.8	2.290	55.9	0.206	58.6	0.161	-165.8
2.3	0.489	146.8	2.200	54.4	0.214	57.9	0.166	-166.8
2.4	0.491	144.4	2.111	52.7	0.221	57.0	0.171	-168.0
2.5	0.498	142.5	2.032	51.0	0.228	56.2	0.175	-169.1
2.6	0.502	140.5	1.964	49.3	0.236	55.2	0.180	-170.6
2.7	0.507	139.0	1.891	47.8	0.244	54.4	0.183	-171.7
2.8	0.513	137.4	1.829	46.3	0.251	53.6	0.188	-172.9
2.9	0.519	136.2	1.782	44.7	0.258	53.1	0.189	-174.3
3.0	0.521	134.7	1.728	43.3	0.264	52.1	0.192	-175.9
4.0	0.571	126.4	1.341	31.0	0.329	44.0	0.222	160.4
5.0	0.619	116.5	1.103	19.0	0.385	35.3	0.285	138.2

$V_{CE} = 3\text{ V}$, $I_C = 1\text{ mA}$, $Z_0 = 50\ \Omega$

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.971	-15.2	3.406	169.0	0.033	80.3	0.991	-6.1
0.2	0.944	-30.9	3.381	157.9	0.066	72.0	0.965	-12.1
0.3	0.912	-45.2	3.246	147.3	0.094	63.9	0.929	-17.4
0.4	0.868	-59.0	3.031	137.7	0.118	56.3	0.886	-22.2
0.5	0.830	-71.8	2.850	128.7	0.136	49.6	0.839	-26.1
0.6	0.789	-83.9	2.643	120.7	0.150	43.7	0.797	-29.7
0.7	0.759	-95.1	2.457	113.3	0.160	38.7	0.756	-32.6
0.8	0.732	-105.1	2.287	107.1	0.167	34.3	0.720	-35.2
0.9	0.709	-114.3	2.122	101.0	0.170	30.6	0.689	-37.6
1.0	0.692	-122.6	1.976	95.5	0.173	27.5	0.662	-39.6
1.1	0.679	-130.2	1.852	90.5	0.173	24.8	0.639	-41.8
1.2	0.666	-137.1	1.735	86.1	0.173	22.5	0.618	-43.6
1.3	0.662	-143.1	1.631	81.9	0.171	20.7	0.602	-45.9
1.4	0.654	-148.8	1.539	77.8	0.169	19.3	0.588	-47.9
1.5	0.647	-153.9	1.454	74.0	0.166	18.3	0.576	-50.3
1.6	0.647	-159.0	1.388	70.2	0.162	17.7	0.566	-52.5
1.7	0.645	-163.7	1.316	66.6	0.159	17.6	0.557	-54.9
1.8	0.644	-167.9	1.253	63.4	0.155	17.7	0.553	-57.3
1.9	0.642	-172.0	1.200	60.4	0.151	18.4	0.547	-59.7
2.0	0.643	-175.5	1.153	57.8	0.147	19.1	0.543	-62.1
2.1	0.638	-179.6	1.103	54.6	0.143	20.4	0.538	-64.8
2.2	0.640	176.6	1.066	51.8	0.139	22.0	0.537	-67.3
2.3	0.644	172.8	1.032	49.7	0.136	23.8	0.535	-69.8
2.4	0.647	169.4	0.987	47.0	0.134	26.2	0.534	-72.4
2.5	0.648	166.0	0.950	44.6	0.132	28.6	0.534	-75.1
2.6	0.652	162.5	0.920	42.6	0.132	31.6	0.534	-78.0
2.7	0.656	159.5	0.884	40.3	0.133	34.6	0.536	-80.2
2.8	0.662	156.7	0.854	38.4	0.135	37.9	0.540	-83.1
2.9	0.665	154.0	0.838	36.5	0.137	41.9	0.538	-84.9
3.0	0.669	151.4	0.810	34.9	0.139	45.1	0.538	-87.7
4.0	0.711	132.5	0.632	25.6	0.233	59.0	0.523	-114.4
5.0	0.726	116.8	0.548	19.3	0.352	51.3	0.515	-150.8

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

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.898	-23.5	9.356	163.3	0.032	77.9	0.964	-12.7
0.2	0.834	-46.7	8.762	147.5	0.060	65.4	0.884	-23.7
0.3	0.766	-66.5	7.828	134.7	0.080	56.2	0.791	-32.2
0.4	0.702	-83.5	6.834	124.3	0.094	49.7	0.699	-38.6
0.5	0.647	-98.4	6.007	115.6	0.103	44.9	0.620	-43.2
0.6	0.610	-110.9	5.297	108.6	0.109	41.6	0.556	-46.7
0.7	0.582	-121.9	4.724	102.4	0.114	39.5	0.505	-49.1
0.8	0.563	-131.3	4.266	97.4	0.118	38.0	0.462	-51.2
0.9	0.550	-139.6	3.855	92.8	0.121	37.1	0.427	-53.1
1.0	0.544	-146.8	3.515	88.7	0.123	36.8	0.399	-54.6
1.1	0.539	-153.2	3.237	84.8	0.126	36.8	0.376	-56.2
1.2	0.535	-158.7	2.992	81.6	0.128	36.8	0.356	-57.8
1.3	0.534	-163.4	2.781	78.5	0.130	37.3	0.340	-59.6
1.4	0.533	-167.8	2.602	75.6	0.132	37.9	0.327	-61.4
1.5	0.531	-172.0	2.442	72.6	0.135	38.5	0.316	-63.5
1.6	0.533	-175.8	2.312	69.8	0.138	39.4	0.307	-65.6
1.7	0.534	-179.6	2.178	67.0	0.141	40.5	0.300	-67.8
1.8	0.534	177.1	2.069	64.5	0.145	41.2	0.294	-70.0
1.9	0.533	174.2	1.969	62.0	0.148	42.3	0.290	-72.3
2.0	0.536	171.3	1.883	59.9	0.152	43.1	0.287	-74.8
2.1	0.537	167.9	1.801	57.3	0.155	44.2	0.285	-77.3
2.2	0.537	165.0	1.734	54.9	0.159	45.0	0.283	-79.9
2.3	0.542	161.9	1.670	53.0	0.163	45.6	0.284	-82.4
2.4	0.546	159.1	1.601	50.8	0.168	46.3	0.283	-84.9
2.5	0.548	156.2	1.543	48.7	0.172	46.9	0.284	-87.3
2.6	0.554	153.6	1.489	46.9	0.178	47.5	0.286	-90.0
2.7	0.560	151.3	1.433	44.8	0.183	48.0	0.288	-92.0
2.8	0.567	148.9	1.387	43.0	0.189	48.6	0.290	-94.6
2.9	0.572	147.1	1.357	40.9	0.194	49.5	0.289	-96.3
3.0	0.573	144.9	1.315	39.4	0.198	49.9	0.290	-98.8
4.0	0.632	131.3	1.020	26.3	0.271	50.3	0.277	-124.6
5.0	0.670	118.0	0.837	14.2	0.353	44.0	0.296	-161.6

$V_{CE} = 3\text{ V}$, $I_C = 5\text{ mA}$, $Z_0 = 50\ \Omega$

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.828	-30.1	14.143	158.6	0.030	72.6	0.935	-18.0
0.2	0.744	-58.9	12.493	140.1	0.055	61.4	0.807	-32.2
0.3	0.665	-81.0	10.568	126.6	0.069	53.2	0.681	-42.0
0.4	0.598	-99.4	8.827	116.5	0.079	48.7	0.576	-48.7
0.5	0.555	-114.1	7.528	108.6	0.086	46.0	0.494	-53.2
0.6	0.524	-126.2	6.493	102.5	0.091	44.6	0.431	-56.6
0.7	0.510	-136.1	5.689	97.2	0.096	44.0	0.382	-59.0
0.8	0.500	-144.9	5.076	92.9	0.100	44.2	0.344	-61.1
0.9	0.490	-152.1	4.552	89.1	0.105	44.6	0.312	-62.9
1.0	0.490	-158.5	4.132	85.5	0.109	45.1	0.288	-64.7
1.1	0.489	-163.8	3.789	82.2	0.114	45.8	0.267	-66.6
1.2	0.488	-168.4	3.496	79.4	0.118	46.5	0.250	-68.3
1.3	0.492	-172.6	3.245	76.7	0.123	47.1	0.236	-70.4
1.4	0.491	-176.3	3.029	74.2	0.128	47.8	0.225	-72.6
1.5	0.492	179.8	2.833	71.6	0.134	48.5	0.216	-75.0
1.6	0.495	176.8	2.677	69.0	0.139	49.1	0.209	-77.6
1.7	0.497	173.3	2.521	66.6	0.145	49.7	0.203	-80.3
1.8	0.498	170.5	2.389	64.4	0.150	50.0	0.199	-82.8
1.9	0.500	168.1	2.271	62.3	0.156	50.5	0.197	-85.6
2.0	0.501	165.5	2.170	60.4	0.162	50.8	0.195	-88.4
2.1	0.501	162.2	2.070	58.0	0.168	51.2	0.195	-91.3
2.2	0.504	159.9	1.994	55.8	0.173	51.4	0.194	-94.3
2.3	0.509	157.0	1.920	54.0	0.179	51.5	0.196	-96.8
2.4	0.511	154.6	1.841	52.0	0.185	51.5	0.197	-99.7
2.5	0.516	151.8	1.773	50.1	0.191	51.4	0.199	-102.1
2.6	0.520	149.6	1.712	48.3	0.197	51.3	0.201	-104.7
2.7	0.527	147.2	1.648	46.4	0.203	51.2	0.203	-106.7
2.8	0.531	145.5	1.593	44.5	0.211	51.2	0.206	-109.4
2.9	0.538	143.6	1.558	42.8	0.216	51.4	0.206	-111.1
3.0	0.542	141.9	1.510	41.4	0.221	51.2	0.206	-113.6
4.0	0.600	130.3	1.172	28.3	0.290	47.8	0.199	-141.7
5.0	0.645	118.4	0.963	15.6	0.360	40.9	0.234	-178.9

$V_{CE} = 3\text{ V}$, $I_C = 7\text{ mA}$, $Z_0 = 50\ \Omega$

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.767	-36.5	18.127	154.7	0.030	70.2	0.905	-22.4
0.2	0.675	-68.7	15.159	134.5	0.050	59.6	0.741	-38.8
0.3	0.592	-92.5	12.290	121.0	0.061	52.9	0.600	-49.0
0.4	0.534	-110.4	9.969	111.6	0.070	49.8	0.492	-55.7
0.5	0.503	-124.8	8.390	104.3	0.076	48.4	0.415	-60.2
0.6	0.479	-136.1	7.160	98.9	0.082	48.2	0.356	-63.6
0.7	0.471	-146.0	6.228	94.1	0.088	48.7	0.313	-66.2
0.8	0.465	-153.1	5.527	90.4	0.093	49.3	0.278	-68.6
0.9	0.462	-160.0	4.946	86.9	0.099	50.2	0.250	-70.9
1.0	0.464	-165.4	4.475	83.6	0.104	50.9	0.228	-73.1
1.1	0.466	-170.4	4.099	80.6	0.110	51.7	0.210	-75.6
1.2	0.468	-174.5	3.773	78.1	0.116	52.2	0.195	-78.0
1.3	0.471	-177.9	3.494	75.6	0.122	52.7	0.183	-80.8
1.4	0.470	178.4	3.258	73.3	0.129	53.3	0.174	-83.7
1.5	0.472	175.3	3.046	70.9	0.135	53.6	0.167	-86.8
1.6	0.476	172.2	2.871	68.5	0.142	53.9	0.162	-89.8
1.7	0.478	169.5	2.707	66.3	0.148	54.2	0.157	-93.1
1.8	0.482	166.7	2.560	64.3	0.155	54.2	0.155	-96.2
1.9	0.481	164.4	2.434	62.2	0.162	54.5	0.154	-99.4
2.0	0.482	162.0	2.325	60.5	0.168	54.4	0.154	-102.6
2.1	0.485	159.0	2.218	58.2	0.175	54.5	0.155	-105.4
2.2	0.486	156.6	2.131	56.1	0.182	54.3	0.157	-108.8
2.3	0.490	154.3	2.058	54.5	0.188	54.1	0.159	-111.3
2.4	0.495	151.6	1.968	52.5	0.195	53.8	0.161	-114.2
2.5	0.501	149.1	1.895	50.7	0.201	53.4	0.164	-116.7
2.6	0.505	146.7	1.834	48.9	0.208	53.1	0.166	-119.2
2.7	0.512	145.0	1.761	47.1	0.215	52.7	0.170	-121.2
2.8	0.518	143.1	1.707	45.4	0.222	52.4	0.173	-123.8
2.9	0.522	141.8	1.669	43.7	0.228	52.4	0.173	-125.4
3.0	0.527	139.8	1.615	42.2	0.233	51.9	0.174	-127.7
4.0	0.583	129.7	1.252	29.4	0.301	46.9	0.175	-157.8
5.0	0.631	118.3	1.027	16.9	0.365	39.4	0.222	167.5

$V_{CE} = 3\text{ V}$, $I_C = 10\text{ mA}$, $Z_0 = 50\ \Omega$

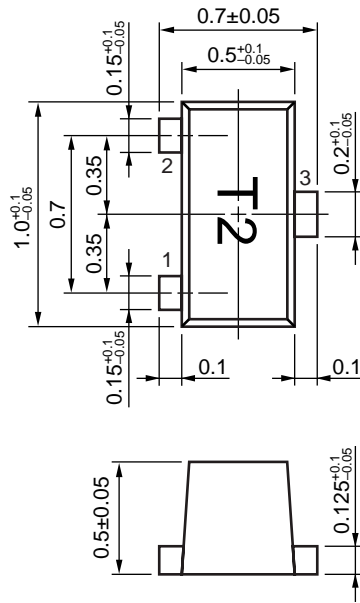
Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.711	-44.3	22.659	150.1	0.028	68.4	0.864	-27.8
0.2	0.599	-80.2	17.820	128.6	0.045	57.9	0.664	-45.9
0.3	0.520	-104.1	13.842	115.7	0.054	53.3	0.516	-56.4
0.4	0.482	-122.0	10.993	107.0	0.062	52.2	0.413	-63.1
0.5	0.458	-135.4	9.113	100.6	0.068	52.3	0.342	-67.8
0.6	0.444	-146.3	7.722	95.7	0.075	52.9	0.291	-71.5
0.7	0.440	-154.4	6.687	91.5	0.081	53.8	0.252	-74.5
0.8	0.439	-161.2	5.903	88.1	0.088	54.6	0.222	-77.8
0.9	0.441	-166.9	5.283	84.9	0.095	55.7	0.199	-80.9
1.0	0.444	-171.9	4.759	82.1	0.102	56.4	0.180	-84.1
1.1	0.447	-175.9	4.348	79.4	0.109	57.0	0.166	-87.6
1.2	0.450	-179.8	4.003	77.0	0.116	57.3	0.153	-91.0
1.3	0.455	177.0	3.706	74.8	0.123	57.5	0.144	-95.0
1.4	0.456	174.1	3.452	72.6	0.130	57.8	0.137	-98.8
1.5	0.458	171.3	3.223	70.4	0.137	57.9	0.133	-102.9
1.6	0.461	168.4	3.036	68.2	0.145	57.9	0.130	-106.7
1.7	0.465	165.7	2.861	66.1	0.153	57.9	0.128	-110.5
1.8	0.468	163.2	2.710	64.2	0.160	57.6	0.128	-114.2
1.9	0.469	161.1	2.573	62.4	0.167	57.5	0.129	-117.7
2.0	0.471	158.8	2.458	60.6	0.175	57.2	0.130	-121.0
2.1	0.472	156.1	2.339	58.5	0.182	57.0	0.133	-123.8
2.2	0.475	154.2	2.250	56.5	0.190	56.6	0.136	-126.9
2.3	0.480	151.5	2.171	54.9	0.196	56.1	0.140	-129.2
2.4	0.484	149.2	2.077	53.1	0.204	55.6	0.144	-131.8
2.5	0.488	147.0	2.002	51.4	0.210	55.0	0.147	-134.0
2.6	0.492	145.1	1.934	49.7	0.218	54.5	0.150	-136.2
2.7	0.500	143.0	1.864	47.9	0.225	53.9	0.154	-138.0
2.8	0.504	141.4	1.800	46.3	0.232	53.3	0.158	-140.4
2.9	0.509	139.7	1.755	44.6	0.238	53.1	0.159	-141.8
3.0	0.514	138.1	1.700	43.2	0.244	52.4	0.160	-144.1
4.0	0.570	129.0	1.320	30.6	0.310	46.1	0.171	-174.3
5.0	0.619	118.1	1.083	18.0	0.371	38.0	0.227	155.1

$V_{CE} = 3\text{ V}$, $I_C = 20\text{ mA}$, $Z_0 = 50\ \Omega$

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.559	-62.7	31.577	140.0	0.023	64.9	0.759	-39.1
0.2	0.472	-103.8	21.776	118.5	0.036	58.1	0.516	-59.2
0.3	0.432	-127.4	15.929	107.4	0.044	58.1	0.378	-69.9
0.4	0.416	-142.5	12.278	100.4	0.052	59.1	0.294	-77.2
0.5	0.407	-153.2	10.002	95.2	0.060	60.6	0.240	-82.8
0.6	0.405	-161.5	8.399	91.2	0.068	61.6	0.202	-88.1
0.7	0.410	-168.2	7.250	87.7	0.076	62.6	0.175	-93.0
0.8	0.413	-173.3	6.369	84.9	0.084	63.3	0.155	-98.6
0.9	0.418	-177.6	5.681	82.2	0.092	63.8	0.140	-104.2
1.0	0.423	178.8	5.113	79.8	0.101	64.1	0.129	-109.8
1.1	0.429	175.5	4.666	77.5	0.109	64.1	0.121	-115.7
1.2	0.432	172.2	4.281	75.2	0.118	64.0	0.115	-121.6
1.3	0.438	170.1	3.967	73.5	0.126	63.7	0.113	-127.1
1.4	0.440	167.7	3.694	71.5	0.134	63.5	0.112	-132.3
1.5	0.442	165.1	3.445	69.6	0.143	63.1	0.113	-136.9
1.6	0.447	163.1	3.248	67.6	0.151	62.6	0.114	-140.7
1.7	0.451	160.4	3.055	65.7	0.160	62.2	0.117	-144.6
1.8	0.454	158.3	2.892	64.0	0.168	61.7	0.120	-147.6
1.9	0.455	156.7	2.743	62.3	0.176	61.2	0.124	-150.1
2.0	0.456	154.5	2.616	60.8	0.184	60.3	0.128	-152.3
2.1	0.458	152.1	2.492	58.8	0.193	59.9	0.133	-154.0
2.2	0.459	150.1	2.396	56.8	0.201	59.3	0.137	-156.0
2.3	0.465	148.0	2.306	55.3	0.208	58.5	0.142	-157.3
2.4	0.472	145.5	2.211	53.6	0.215	57.7	0.147	-158.8
2.5	0.474	143.6	2.131	52.1	0.223	56.9	0.151	-160.2
2.6	0.477	141.3	2.059	50.2	0.231	56.1	0.156	-161.8
2.7	0.488	139.7	1.984	48.6	0.238	55.1	0.160	-163.0
2.8	0.491	138.2	1.915	47.1	0.245	54.4	0.164	-164.7
2.9	0.496	137.2	1.867	45.4	0.252	54.0	0.166	-165.9
3.0	0.499	135.4	1.806	44.1	0.258	53.0	0.168	-167.8
4.0	0.554	127.4	1.399	31.8	0.324	45.2	0.194	165.4
5.0	0.607	117.7	1.147	19.8	0.380	36.5	0.257	141.1

★ PACKAGE DIMENSIONS

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



(Bottom View)

PIN CONNECTIONS

- 1. Emitter
- 2. Base
- 3. Collector

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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

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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