

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

FEATURES

- Ideal for 3 GHz or higher OSC applications
- Low noise, high gain
 $f_T = 21.0 \text{ GHz TYP.}$, $|S_{21e}|^2 = 11.5 \text{ dB TYP. @ } V_{CE} = 2 \text{ V, } I_C = 20 \text{ mA, } f = 2 \text{ GHz}$
 $NF = 1.1 \text{ dB TYP. @ } V_{CE} = 2 \text{ V, } I_C = 5 \text{ mA, } f = 2 \text{ GHz, } Z_S = Z_{opt}$
- 3-pin lead-less minimold package (1005 PKG)

ORDERING INFORMATION

Part Number	Quantity	Supplying Form
2SC5674	50 pcs (Non reel)	• 8 mm wide embossed taping • Pin 2 (Base) face the perforation side of the tape
2SC5674-T3	10 kpcs/reel	

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

ABSOLUTE MAXIMUM RATINGS ($T_A = +25^\circ\text{C}$)

Parameter	Symbol	Ratings	Unit
Collector to Base Voltage	V_{CBO}	15	V
Collector to Emitter Voltage	V_{CEO}	3.3	V
Emitter to Base Voltage	V_{EBO}	1.5	V
Collector Current	I_C	35	mA
Total Power Dissipation	P_{tot}^{Note}	115	mW
Junction Temperature	T_j	150	$^\circ\text{C}$
Storage Temperature	T_{stg}	-65 to +150	$^\circ\text{C}$

Note Mounted on $1.08 \text{ cm}^2 \times 1.0 \text{ mm (t)}$ 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)

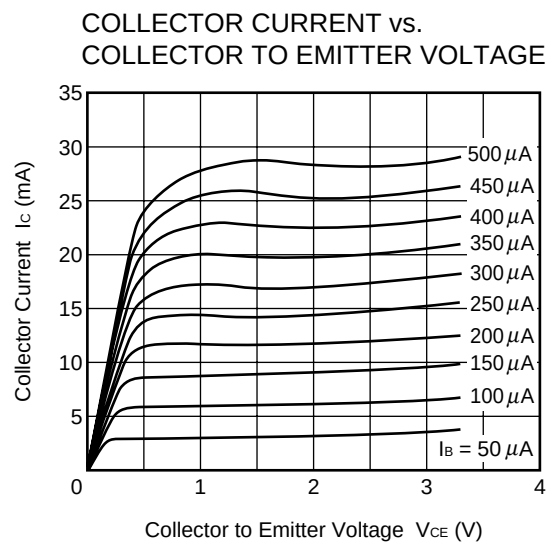
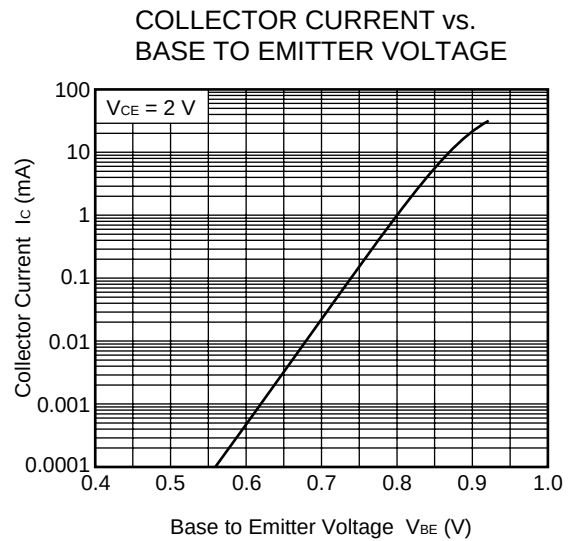
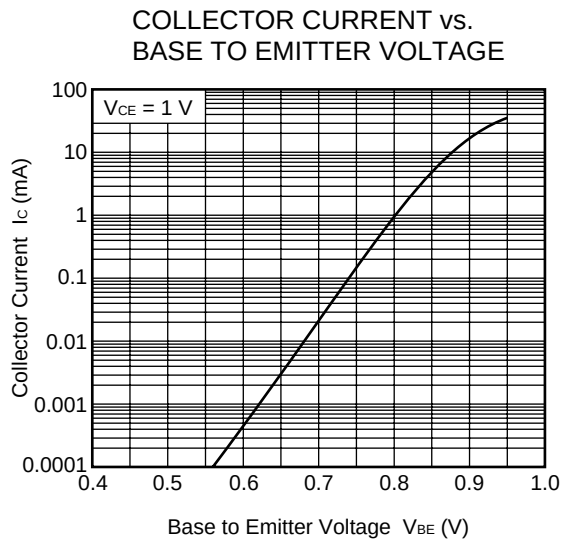
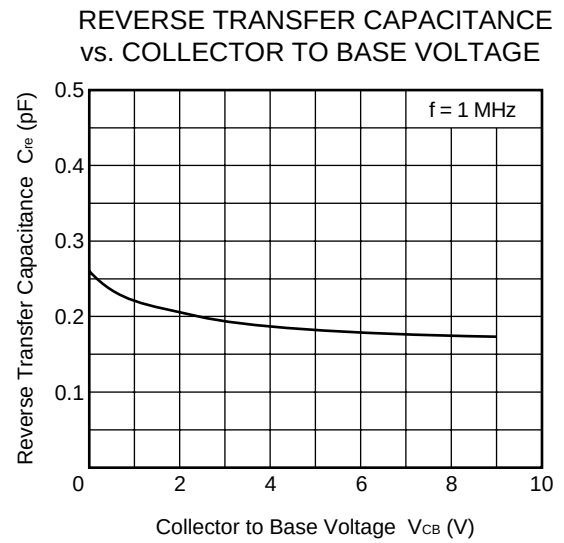
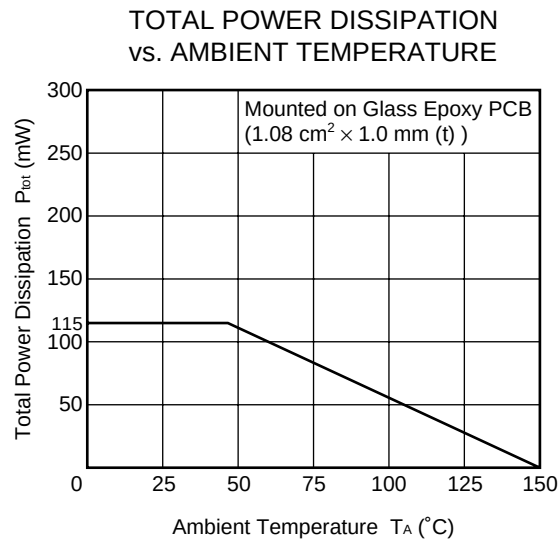
Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
DC Characteristics						
Collector Cut-off Current	I _{CBO}	V _{CB} = 5 V, I _E = 0 mA	–	–	100	nA
Emitter Cut-off Current	I _{EBO}	V _{EB} = 1 V, I _C = 0 mA	–	–	100	nA
DC Current Gain	h _{FE} ^{Note 1}	V _{CE} = 2 V, I _C = 5 mA	50	–	100	–
RF Characteristics						
Gain Bandwidth Product	f _T	V _{CE} = 2 V, I _C = 20 mA, f = 2 GHz	18.0	21.0	–	GHz
Insertion Power Gain (1)	S _{21e} ²	V _{CE} = 1 V, I _C = 10 mA, f = 2 GHz	9.0	11.0	–	dB
Insertion Power Gain (2)	S _{21e} ²	V _{CE} = 2 V, I _C = 20 mA, f = 2 GHz	9.5	11.5	–	dB
Noise Figure	NF	V _{CE} = 2 V, I _C = 5 mA, f = 2 GHz, Z _S = Z _{opt}	–	1.1	1.5	dB
Reverse Transfer Capacitance	C _{re} ^{Note 2}	V _{CB} = 2 V, I _E = 0 mA, f = 1 MHz	–	0.24	0.3	pF

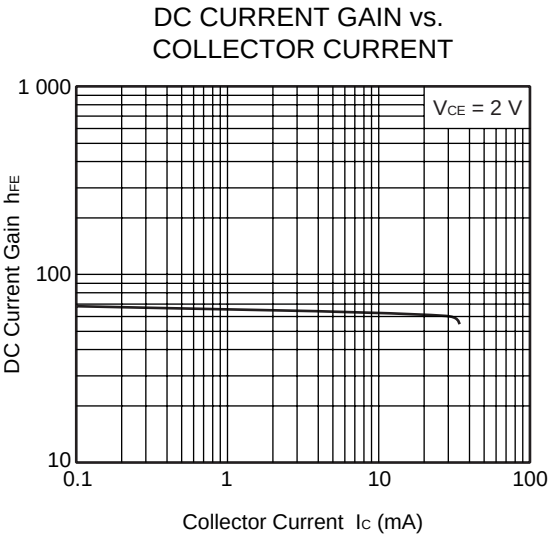
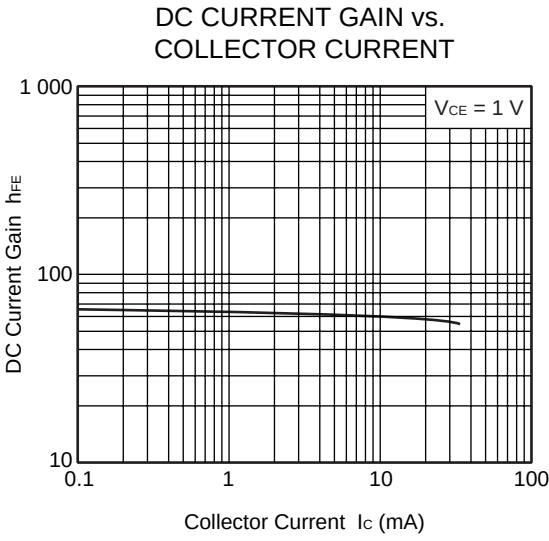
- Notes** **1.** Pulse measurement: PW ≤ 350 μs, Duty Cycle ≤ 2%
2. Collector to base capacitance when the emitter grounded

h_{FE} CLASSIFICATION

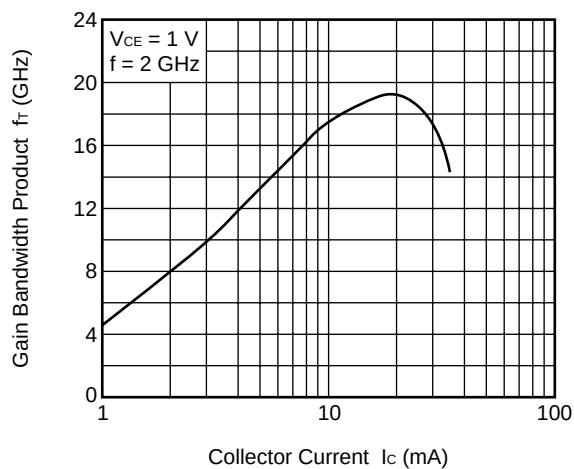
Rank	FB
Marking	C5
h _{FE} Value	50 to 100

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

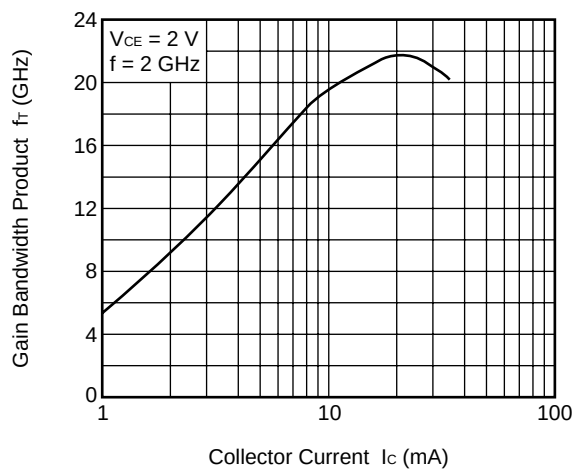




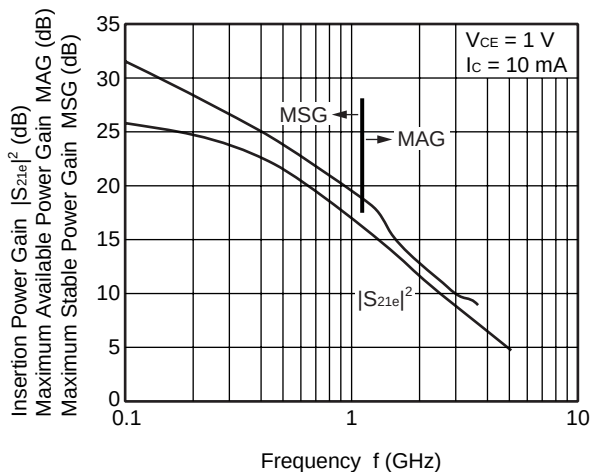
GAIN BANDWIDTH PRODUCT
vs. COLLECTOR CURRENT



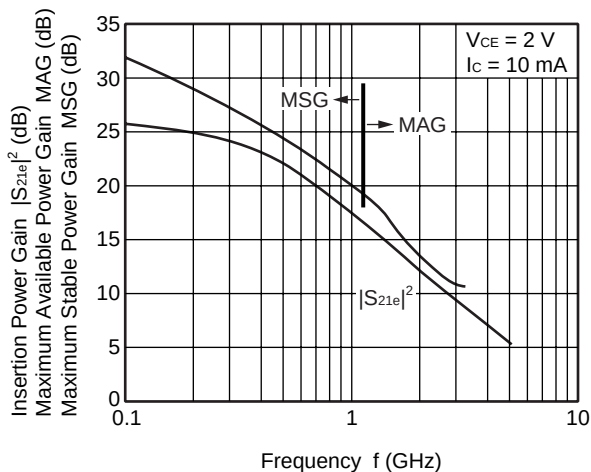
GAIN BANDWIDTH PRODUCT
vs. COLLECTOR CURRENT



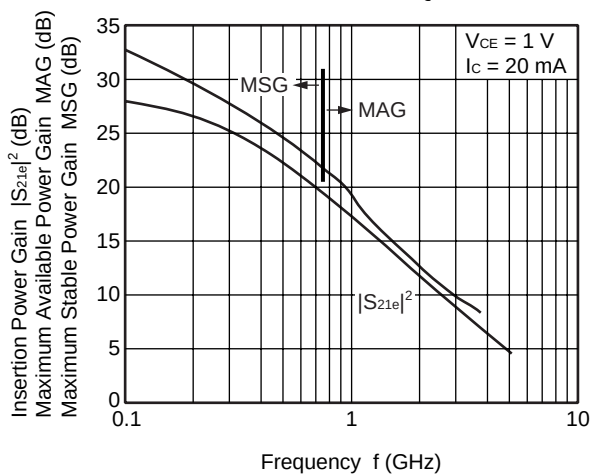
INSERTION POWER GAIN,
MAG, MSG vs. FREQUENCY



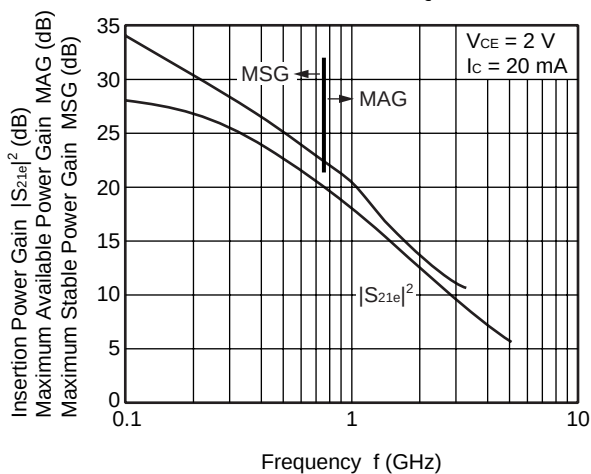
INSERTION POWER GAIN,
MAG, MSG vs. FREQUENCY



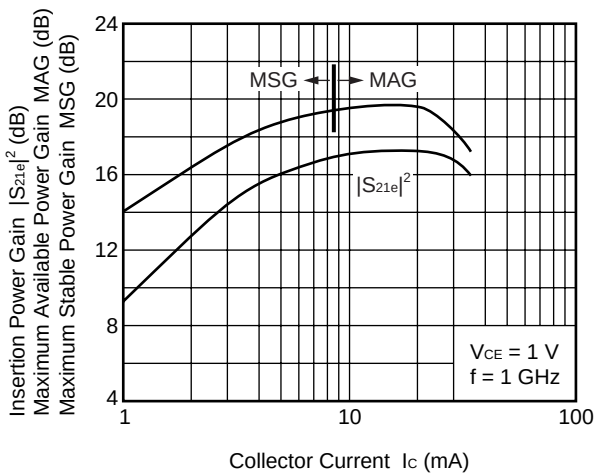
INSERTION POWER GAIN,
MAG, MSG vs. FREQUENCY



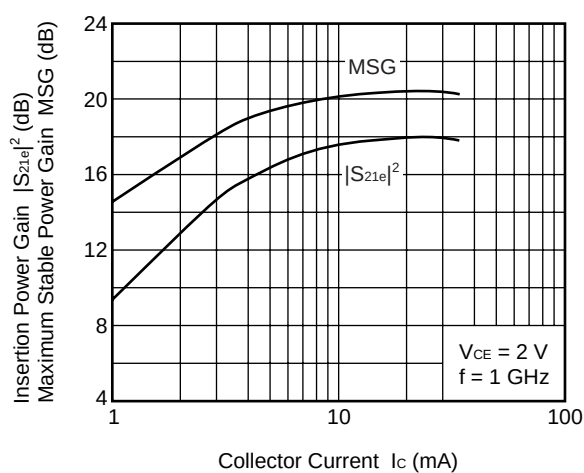
INSERTION POWER GAIN,
MAG, MSG vs. FREQUENCY



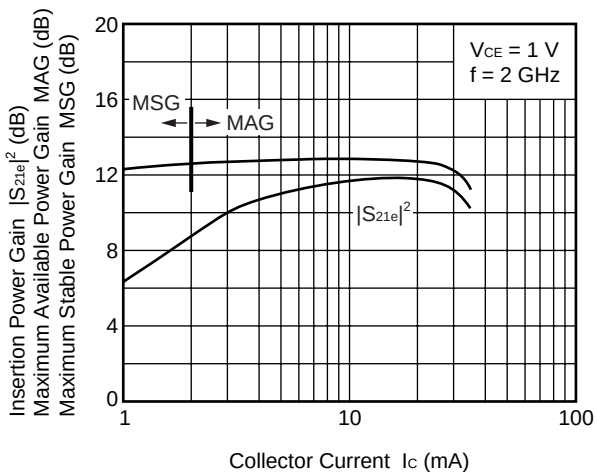
INSERTION POWER GAIN, MAG, MSG
vs. COLLECTOR CURRENT



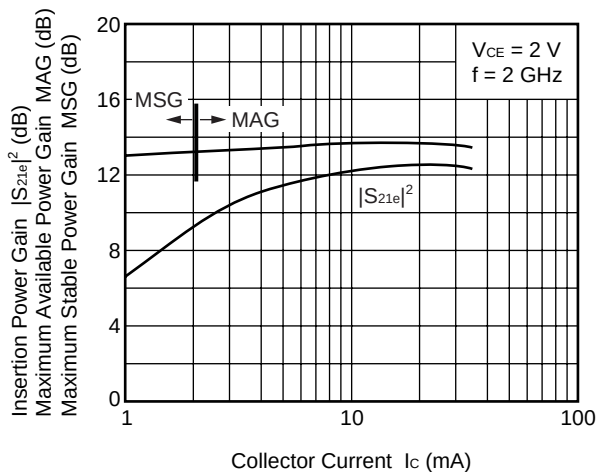
INSERTION POWER GAIN, MSG
vs. COLLECTOR CURRENT



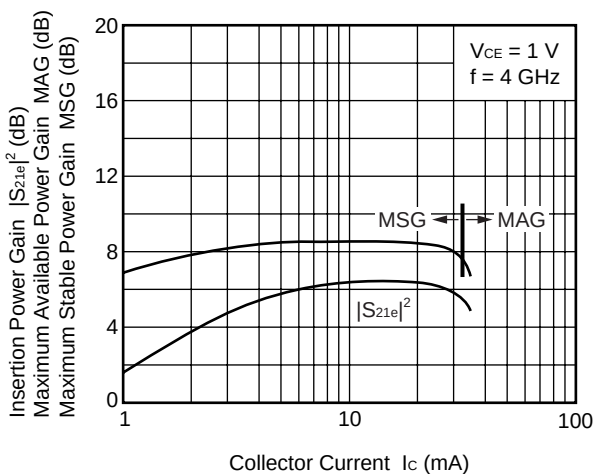
INSERTION POWER GAIN, MAG, MSG
vs. COLLECTOR CURRENT



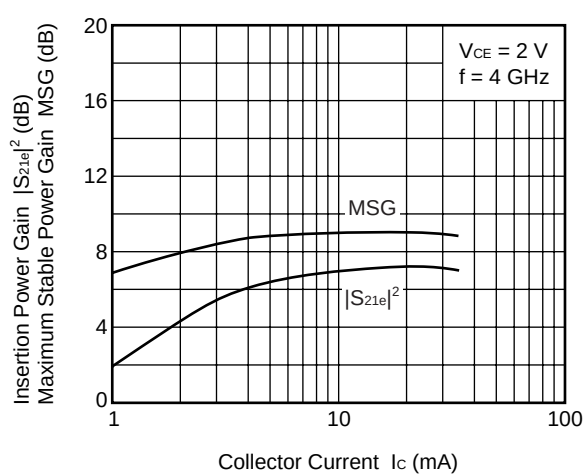
INSERTION POWER GAIN, MAG, MSG
vs. COLLECTOR CURRENT



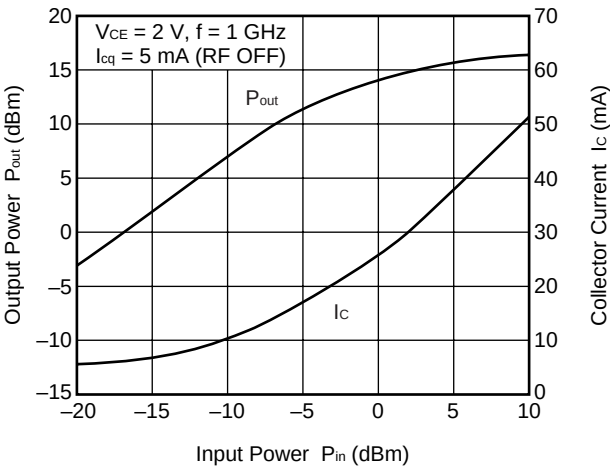
INSERTION POWER GAIN, MAG, MSG
vs. COLLECTOR CURRENT



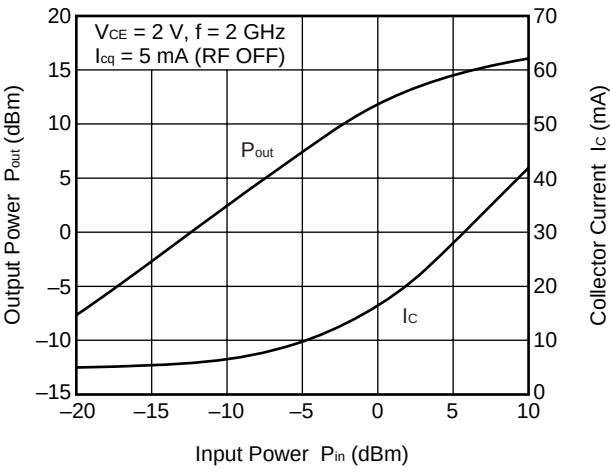
INSERTION POWER GAIN, MSG
vs. COLLECTOR CURRENT



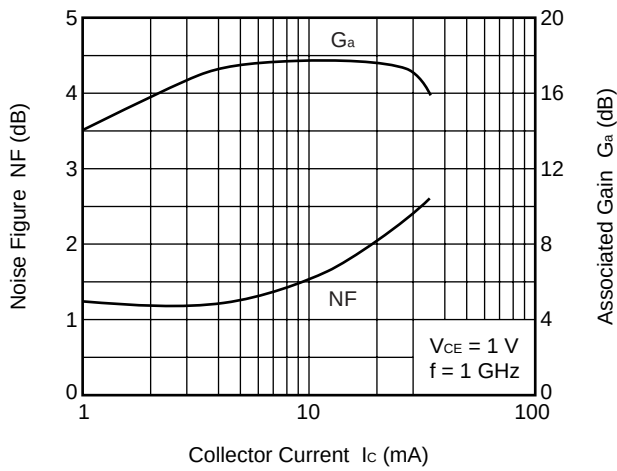
OUTPUT POWER, COLLECTOR
CURRENT vs. INPUT POWER



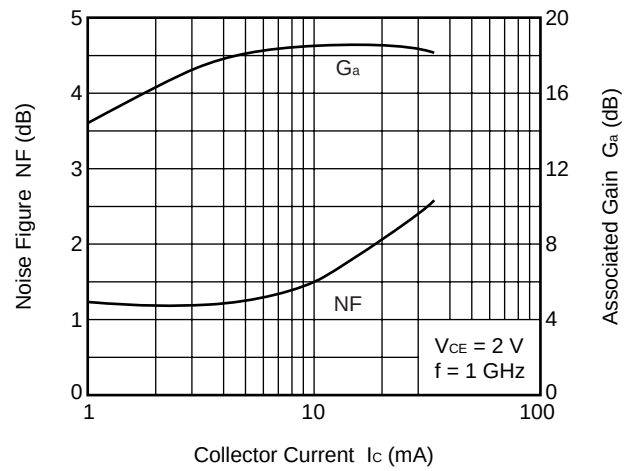
OUTPUT POWER, COLLECTOR
CURRENT vs. INPUT POWER



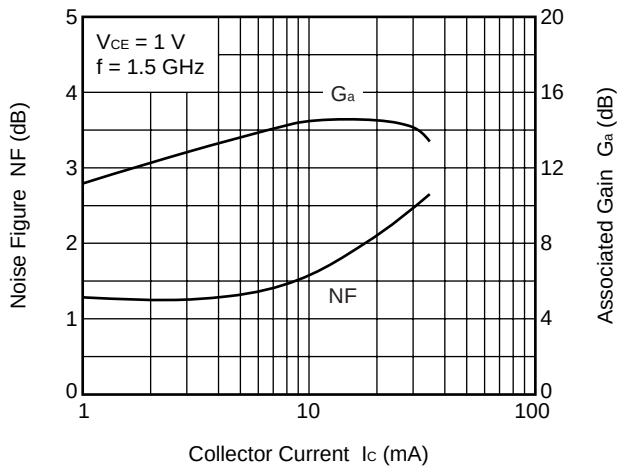
NOISE FIGURE, ASSOCIATED GAIN
vs. COLLECTOR CURRENT



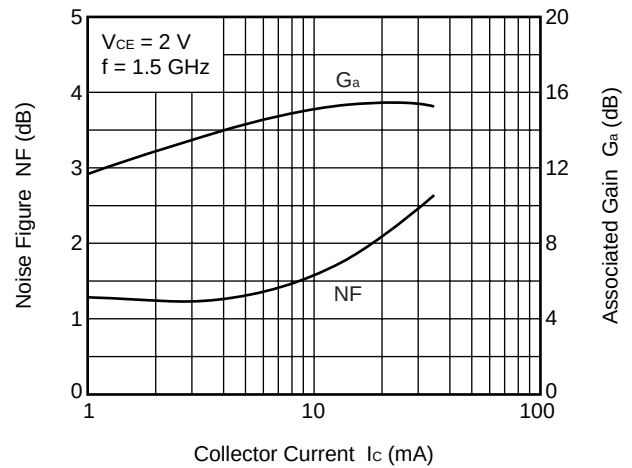
NOISE FIGURE, ASSOCIATED GAIN
vs. COLLECTOR CURRENT



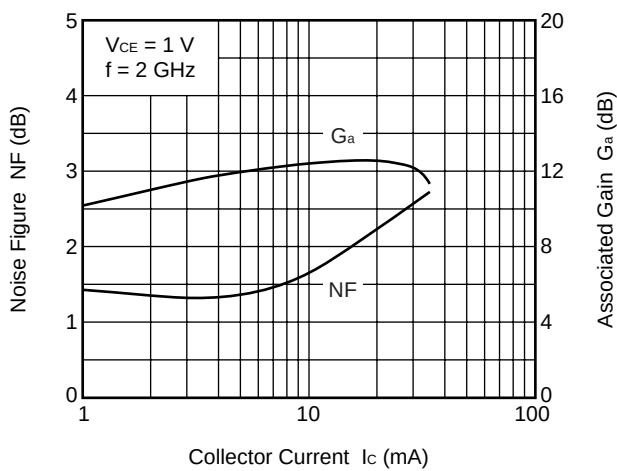
NOISE FIGURE, ASSOCIATED GAIN
vs. COLLECTOR CURRENT



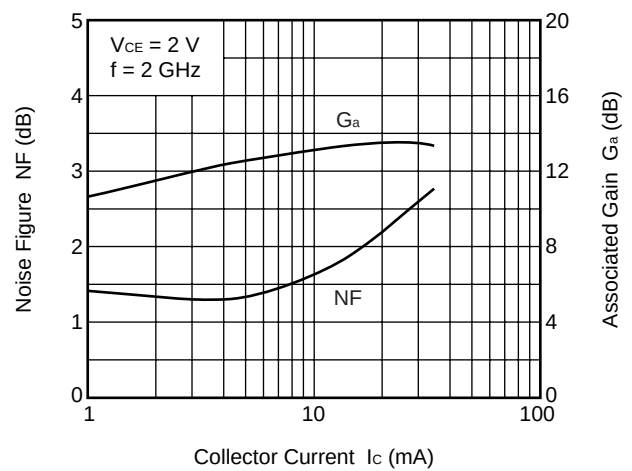
NOISE FIGURE, ASSOCIATED GAIN
vs. COLLECTOR CURRENT



NOISE FIGURE, ASSOCIATED GAIN
vs. COLLECTOR CURRENT



NOISE FIGURE, ASSOCIATED GAIN
vs. COLLECTOR CURRENT



Remark The graphs indicate nominal characteristics.

S-PARAMETERS

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

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.937	-6.1	3.495	173.1	0.015	82.3	0.993	-4.4
0.2	0.933	-12.4	3.435	167.8	0.031	81.4	0.987	-8.8
0.3	0.921	-18.6	3.405	161.4	0.046	76.2	0.975	-13.1
0.4	0.904	-24.7	3.362	155.4	0.060	72.1	0.957	-17.5
0.5	0.878	-30.7	3.307	149.4	0.073	67.9	0.938	-21.7
0.6	0.853	-36.7	3.239	143.7	0.084	64.0	0.916	-25.9
0.7	0.824	-42.6	3.171	138.4	0.095	60.1	0.890	-29.8
0.8	0.791	-48.4	3.073	132.8	0.103	56.4	0.864	-33.7
0.9	0.759	-54.1	2.971	127.5	0.111	52.9	0.837	-37.4
1.0	0.728	-60.0	2.896	122.3	0.117	49.7	0.813	-41.0
1.1	0.700	-65.7	2.810	117.2	0.121	46.8	0.785	-44.5
1.2	0.670	-71.3	2.711	112.5	0.124	44.2	0.759	-47.8
1.3	0.644	-76.8	2.614	108.1	0.127	41.9	0.735	-51.2
1.4	0.620	-81.8	2.525	103.6	0.128	40.1	0.714	-54.4
1.5	0.594	-87.2	2.445	99.5	0.128	38.6	0.694	-57.5
1.6	0.573	-92.4	2.366	95.5	0.128	37.6	0.675	-60.5
1.7	0.556	-97.5	2.289	91.6	0.127	36.8	0.657	-63.5
1.8	0.538	-102.4	2.204	87.9	0.125	36.7	0.643	-66.2
1.9	0.519	-107.3	2.142	84.2	0.123	36.9	0.629	-69.1
2.0	0.507	-111.7	2.070	80.7	0.120	37.5	0.618	-71.7
2.1	0.492	-116.6	2.013	77.5	0.117	38.3	0.608	-74.5
2.2	0.482	-121.3	1.954	74.3	0.115	39.8	0.598	-77.3
2.3	0.472	-126.2	1.890	71.5	0.113	41.6	0.594	-79.7
2.4	0.466	-130.7	1.832	68.7	0.112	44.2	0.587	-82.2
2.5	0.458	-135.5	1.774	65.8	0.112	47.0	0.581	-84.6
2.6	0.454	-139.8	1.722	63.3	0.112	50.4	0.578	-87.4
2.7	0.451	-144.6	1.671	60.2	0.114	53.8	0.577	-89.6
2.8	0.450	-148.8	1.628	57.5	0.118	57.5	0.577	-92.2
2.9	0.449	-153.1	1.588	55.2	0.123	61.5	0.574	-93.7
3.0	0.447	-157.2	1.543	52.9	0.127	64.9	0.570	-96.2
4.0	0.499	167.3	1.213	32.8	0.247	74.0	0.561	-122.3
5.0	0.589	138.8	0.967	15.4	0.387	60.6	0.584	-157.9

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

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.848	-9.4	8.836	170.1	0.015	79.5	0.980	-7.0
0.2	0.823	-19.1	8.544	161.2	0.029	78.3	0.956	-13.8
0.3	0.785	-28.1	8.208	152.5	0.042	73.0	0.919	-20.1
0.4	0.745	-36.5	7.803	144.4	0.053	68.2	0.875	-25.9
0.5	0.692	-44.4	7.361	136.9	0.063	64.4	0.825	-31.1
0.6	0.643	-51.7	6.917	130.3	0.071	61.1	0.776	-35.7
0.7	0.596	-58.7	6.507	124.4	0.078	58.7	0.730	-39.8
0.8	0.546	-65.4	6.058	118.7	0.083	56.6	0.685	-43.5
0.9	0.505	-71.5	5.655	113.6	0.088	55.1	0.646	-46.9
1.0	0.468	-77.8	5.327	108.8	0.092	53.8	0.611	-49.8
1.1	0.434	-83.6	4.998	104.3	0.096	53.2	0.577	-52.6
1.2	0.406	-89.1	4.703	100.4	0.099	52.8	0.548	-55.0
1.3	0.381	-94.9	4.435	96.7	0.102	52.7	0.523	-57.6
1.4	0.360	-100.1	4.191	93.1	0.105	52.9	0.502	-59.9
1.5	0.341	-105.6	3.984	89.8	0.108	53.3	0.483	-62.3
1.6	0.322	-111.0	3.796	86.7	0.111	54.0	0.466	-64.9
1.7	0.310	-116.0	3.616	83.6	0.114	54.6	0.450	-67.1
1.8	0.300	-120.6	3.445	80.9	0.118	55.6	0.440	-69.2
1.9	0.289	-126.2	3.310	78.1	0.121	56.3	0.430	-71.4
2.0	0.282	-130.4	3.167	75.6	0.124	57.4	0.422	-73.5
2.1	0.274	-135.4	3.042	73.0	0.128	58.2	0.413	-75.9
2.2	0.269	-140.4	2.933	70.3	0.132	59.1	0.408	-78.2
2.3	0.267	-144.8	2.827	68.2	0.137	59.8	0.406	-80.2
2.4	0.263	-149.6	2.724	66.1	0.141	60.6	0.401	-82.3
2.5	0.262	-153.7	2.627	63.8	0.147	61.4	0.398	-84.4
2.6	0.262	-158.6	2.540	61.8	0.152	62.2	0.396	-86.7
2.7	0.263	-162.5	2.459	59.3	0.158	62.8	0.396	-88.6
2.8	0.266	-167.0	2.384	57.1	0.164	63.6	0.397	-90.7
2.9	0.271	-170.4	2.320	55.2	0.171	64.5	0.395	-92.0
3.0	0.274	-173.8	2.251	53.3	0.177	65.0	0.393	-94.2
4.0	0.352	159.8	1.774	35.7	0.268	64.2	0.389	-117.7
5.0	0.473	138.4	1.456	17.5	0.369	54.7	0.420	-152.1

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

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.778	-11.2	12.853	167.5	0.014	82.8	0.964	-8.9
0.2	0.734	-24.0	12.154	156.5	0.028	75.7	0.925	-17.4
0.3	0.680	-34.6	11.355	146.1	0.039	71.1	0.867	-24.6
0.4	0.620	-44.2	10.465	137.2	0.049	67.3	0.804	-31.0
0.5	0.562	-52.5	9.580	129.3	0.057	64.4	0.740	-36.1
0.6	0.508	-60.1	8.786	122.7	0.064	62.1	0.682	-40.5
0.7	0.458	-67.2	8.064	117.0	0.070	60.8	0.629	-44.2
0.8	0.414	-73.9	7.357	111.5	0.075	59.7	0.583	-47.3
0.9	0.373	-80.2	6.766	106.9	0.080	59.5	0.545	-49.9
1.0	0.342	-86.5	6.276	102.7	0.084	59.2	0.511	-52.4
1.1	0.316	-92.7	5.844	98.7	0.089	59.2	0.481	-54.6
1.2	0.292	-98.5	5.455	95.2	0.093	59.4	0.455	-56.8
1.3	0.272	-104.5	5.091	92.2	0.098	59.7	0.432	-58.9
1.4	0.256	-110.1	4.787	89.0	0.102	60.2	0.415	-61.0
1.5	0.244	-116.1	4.521	86.1	0.107	60.6	0.399	-63.0
1.6	0.233	-121.9	4.291	83.2	0.112	61.1	0.385	-65.3
1.7	0.225	-127.3	4.068	80.7	0.117	61.7	0.374	-67.4
1.8	0.218	-132.0	3.871	78.3	0.122	62.2	0.364	-69.4
1.9	0.211	-138.2	3.701	75.7	0.127	62.6	0.356	-71.5
2.0	0.208	-143.1	3.536	73.4	0.132	63.0	0.349	-73.5
2.1	0.203	-148.2	3.390	71.2	0.137	63.3	0.343	-75.8
2.2	0.203	-153.6	3.255	68.8	0.143	63.6	0.340	-78.1
2.3	0.202	-157.8	3.137	66.8	0.149	63.8	0.338	-80.2
2.4	0.202	-162.7	3.018	64.9	0.155	63.9	0.335	-82.2
2.5	0.204	-167.2	2.910	62.8	0.161	64.1	0.333	-84.3
2.6	0.206	-171.0	2.815	61.4	0.167	64.1	0.332	-86.7
2.7	0.210	-175.2	2.717	59.2	0.174	64.2	0.331	-88.5
2.8	0.214	-178.9	2.642	57.0	0.181	64.4	0.333	-90.5
2.9	0.220	178.2	2.559	55.4	0.188	64.6	0.331	-91.9
3.0	0.225	175.5	2.487	53.6	0.194	64.8	0.330	-94.0
4.0	0.308	154.3	1.957	37.4	0.280	61.1	0.326	-118.0
5.0	0.430	136.6	1.622	20.2	0.367	51.9	0.352	-152.5

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

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.709	-12.9	15.965	165.5	0.013	81.4	0.953	-10.4
0.2	0.664	-27.9	14.778	152.9	0.026	75.8	0.897	-20.0
0.3	0.596	-39.5	13.487	141.6	0.037	71.0	0.824	-27.8
0.4	0.534	-49.4	12.133	132.3	0.046	67.4	0.748	-34.2
0.5	0.472	-58.2	10.902	124.5	0.053	65.2	0.678	-39.0
0.6	0.418	-65.8	9.812	117.9	0.060	63.9	0.617	-43.1
0.7	0.371	-72.9	8.891	112.5	0.065	62.9	0.565	-46.2
0.8	0.331	-80.0	8.051	107.4	0.071	62.9	0.521	-48.8
0.9	0.299	-86.7	7.331	103.2	0.076	62.8	0.484	-51.3
1.0	0.272	-92.8	6.752	99.1	0.081	63.0	0.454	-53.3
1.1	0.246	-99.4	6.253	95.6	0.087	63.2	0.426	-55.4
1.2	0.230	-105.3	5.806	92.4	0.092	63.3	0.403	-57.1
1.3	0.215	-112.1	5.422	89.6	0.097	63.8	0.384	-59.1
1.4	0.204	-117.8	5.074	86.5	0.103	64.0	0.368	-61.0
1.5	0.194	-124.5	4.782	84.0	0.108	64.4	0.354	-63.0
1.6	0.188	-131.1	4.528	81.5	0.114	64.7	0.342	-65.1
1.7	0.183	-136.1	4.287	79.1	0.120	65.0	0.333	-67.3
1.8	0.178	-142.7	4.072	76.9	0.126	65.3	0.324	-69.3
1.9	0.180	-148.2	3.888	74.5	0.131	65.5	0.317	-71.4
2.0	0.176	-152.3	3.713	72.3	0.137	65.5	0.312	-73.5
2.1	0.174	-158.5	3.560	70.3	0.143	65.3	0.307	-75.7
2.2	0.176	-163.7	3.415	68.0	0.149	65.6	0.304	-78.1
2.3	0.177	-167.6	3.286	66.3	0.156	65.4	0.303	-80.1
2.4	0.178	-171.6	3.160	64.5	0.162	65.2	0.300	-82.5
2.5	0.184	-176.3	3.046	62.4	0.169	65.0	0.299	-84.4
2.6	0.185	179.5	2.944	61.0	0.176	64.9	0.298	-86.8
2.7	0.190	175.8	2.841	58.8	0.183	64.7	0.298	-88.6
2.8	0.196	172.5	2.758	56.9	0.190	64.7	0.300	-90.8
2.9	0.203	170.2	2.676	55.3	0.197	64.7	0.298	-92.2
3.0	0.205	167.9	2.596	53.6	0.203	64.4	0.297	-94.3
4.0	0.290	150.3	2.040	38.0	0.286	59.7	0.293	-118.8
5.0	0.412	135.1	1.698	21.7	0.368	50.4	0.318	-154.0

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

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.630	-15.0	19.342	163.2	0.014	77.0	0.936	-12.1
0.2	0.579	-31.5	17.482	149.0	0.025	75.3	0.863	-22.8
0.3	0.508	-44.0	15.492	137.0	0.035	71.2	0.774	-31.0
0.4	0.444	-54.9	13.621	127.5	0.043	68.1	0.690	-37.2
0.5	0.382	-63.7	12.006	119.8	0.050	66.6	0.616	-41.8
0.6	0.335	-71.6	10.634	113.6	0.057	66.1	0.556	-45.2
0.7	0.295	-79.2	9.538	108.5	0.062	66.1	0.506	-47.8
0.8	0.259	-86.2	8.556	103.8	0.068	66.0	0.465	-50.0
0.9	0.231	-93.5	7.757	99.9	0.074	66.2	0.431	-52.1
1.0	0.212	-100.3	7.102	96.2	0.080	66.5	0.404	-53.8
1.1	0.193	-107.5	6.556	93.0	0.086	66.7	0.379	-55.5
1.2	0.183	-114.5	6.084	90.0	0.092	66.8	0.359	-57.2
1.3	0.172	-121.9	5.646	87.3	0.098	67.0	0.342	-59.0
1.4	0.162	-127.9	5.283	84.6	0.104	67.2	0.328	-60.8
1.5	0.160	-135.0	4.966	82.3	0.110	67.3	0.316	-62.8
1.6	0.156	-142.0	4.694	79.9	0.117	67.4	0.306	-64.9
1.7	0.153	-147.8	4.438	77.6	0.123	67.5	0.297	-67.1
1.8	0.152	-153.2	4.217	75.6	0.130	67.4	0.290	-69.3
1.9	0.155	-158.6	4.025	73.4	0.136	67.4	0.285	-71.4
2.0	0.156	-164.0	3.836	71.5	0.142	67.3	0.280	-73.5
2.1	0.155	-169.6	3.677	69.4	0.149	66.9	0.276	-76.0
2.2	0.160	-173.9	3.524	67.4	0.156	66.8	0.274	-78.3
2.3	0.161	-178.3	3.390	65.7	0.162	66.5	0.273	-80.5
2.4	0.166	178.3	3.263	64.0	0.169	66.1	0.272	-82.8
2.5	0.170	174.4	3.138	62.1	0.176	65.8	0.271	-85.0
2.6	0.176	170.4	3.030	60.7	0.183	65.5	0.270	-87.3
2.7	0.180	167.1	2.928	58.6	0.190	65.0	0.271	-89.2
2.8	0.188	163.9	2.840	56.8	0.197	64.9	0.272	-91.3
2.9	0.194	162.3	2.752	55.3	0.205	64.7	0.271	-92.9
3.0	0.198	159.9	2.672	53.7	0.210	64.3	0.270	-95.0
4.0	0.280	146.5	2.099	38.7	0.292	58.6	0.266	-120.3
5.0	0.401	133.0	1.744	22.9	0.370	49.2	0.292	-156.5

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

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.483	-23.8	25.106	158.9	0.013	82.1	0.889	-15.4
0.2	0.414	-41.5	21.485	141.9	0.023	74.6	0.781	-27.9
0.3	0.343	-57.0	18.120	129.1	0.032	71.5	0.672	-36.2
0.4	0.290	-68.5	15.280	119.7	0.039	71.0	0.580	-41.6
0.5	0.244	-79.7	13.082	112.6	0.046	70.1	0.510	-45.2
0.6	0.211	-88.5	11.365	106.9	0.053	70.3	0.455	-47.8
0.7	0.184	-98.0	10.037	102.4	0.060	70.6	0.412	-49.6
0.8	0.165	-108.2	8.918	98.2	0.066	70.9	0.377	-51.3
0.9	0.152	-117.6	8.035	94.8	0.073	71.1	0.351	-52.8
1.0	0.144	-126.5	7.320	91.6	0.080	71.0	0.328	-54.3
1.1	0.137	-135.6	6.720	88.7	0.087	71.1	0.309	-55.8
1.2	0.135	-143.2	6.211	86.3	0.094	71.0	0.293	-57.3
1.3	0.138	-151.1	5.744	84.0	0.101	71.1	0.280	-59.1
1.4	0.136	-157.7	5.361	81.5	0.108	70.8	0.270	-61.0
1.5	0.141	-163.5	5.045	79.3	0.115	70.5	0.260	-63.2
1.6	0.144	-169.2	4.744	77.2	0.122	70.4	0.253	-65.5
1.7	0.147	-174.2	4.482	75.0	0.129	70.1	0.246	-67.9
1.8	0.151	-178.3	4.255	73.2	0.136	69.8	0.240	-70.3
1.9	0.158	176.4	4.061	71.2	0.143	69.3	0.237	-72.7
2.0	0.163	173.5	3.866	69.3	0.151	68.9	0.235	-75.2
2.1	0.164	169.8	3.702	67.5	0.158	68.4	0.232	-77.7
2.2	0.172	165.2	3.542	65.5	0.165	68.0	0.231	-80.6
2.3	0.177	163.5	3.412	63.9	0.172	67.5	0.231	-82.9
2.4	0.180	160.7	3.279	62.3	0.179	66.8	0.231	-85.6
2.5	0.186	158.3	3.152	60.6	0.186	66.3	0.230	-87.9
2.6	0.191	155.2	3.048	59.4	0.194	65.9	0.230	-90.4
2.7	0.198	152.6	2.940	57.4	0.201	65.3	0.232	-92.5
2.8	0.205	150.8	2.849	55.7	0.209	64.7	0.234	-94.8
2.9	0.212	149.7	2.762	54.2	0.216	64.5	0.234	-96.4
3.0	0.217	148.5	2.680	52.7	0.222	63.9	0.233	-98.6
4.0	0.295	139.4	2.097	38.4	0.302	57.0	0.234	-125.9
5.0	0.410	128.1	1.742	23.2	0.376	47.0	0.266	-163.7

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

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.946	-5.2	3.472	173.3	0.014	85.7	0.993	-3.9
0.2	0.938	-11.7	3.412	168.4	0.027	81.3	0.989	-8.2
0.3	0.924	-17.5	3.393	162.2	0.040	77.4	0.977	-12.0
0.4	0.909	-23.1	3.352	156.5	0.053	73.2	0.961	-16.1
0.5	0.886	-28.7	3.296	150.9	0.065	69.0	0.945	-20.2
0.6	0.864	-34.5	3.239	145.4	0.075	65.2	0.925	-24.0
0.7	0.836	-40.0	3.180	140.1	0.084	61.7	0.902	-27.7
0.8	0.802	-45.7	3.089	134.7	0.092	58.0	0.878	-31.4
0.9	0.772	-51.4	2.996	129.5	0.099	54.9	0.854	-35.1
1.0	0.747	-56.8	2.929	124.5	0.104	51.9	0.831	-38.4
1.1	0.715	-62.1	2.849	119.5	0.109	49.1	0.806	-41.7
1.2	0.688	-67.5	2.757	114.9	0.112	46.6	0.780	-44.9
1.3	0.661	-72.9	2.670	110.5	0.113	44.6	0.756	-48.0
1.4	0.638	-77.9	2.584	106.0	0.115	42.8	0.737	-51.1
1.5	0.611	-83.0	2.498	102.0	0.115	41.5	0.717	-54.0
1.6	0.590	-88.0	2.433	98.0	0.114	40.7	0.698	-57.0
1.7	0.572	-92.9	2.355	94.1	0.114	40.3	0.683	-59.8
1.8	0.551	-97.5	2.271	90.4	0.112	40.3	0.668	-62.5
1.9	0.533	-102.2	2.209	86.8	0.110	40.6	0.654	-65.4
2.0	0.518	-106.9	2.138	83.3	0.107	41.7	0.642	-67.9
2.1	0.504	-111.6	2.081	80.0	0.105	43.0	0.632	-70.6
2.2	0.491	-116.3	2.020	76.9	0.103	45.1	0.623	-73.2
2.3	0.481	-120.9	1.958	74.0	0.102	47.5	0.618	-75.6
2.4	0.470	-125.5	1.899	71.2	0.101	50.4	0.610	-78.1
2.5	0.464	-130.0	1.840	68.4	0.102	53.8	0.605	-80.5
2.6	0.456	-134.4	1.786	65.9	0.103	57.9	0.600	-83.0
2.7	0.452	-138.9	1.738	62.8	0.106	61.7	0.598	-85.2
2.8	0.451	-143.3	1.692	59.9	0.111	65.5	0.599	-87.5
2.9	0.451	-147.7	1.650	57.6	0.117	69.6	0.596	-89.2
3.0	0.445	-151.8	1.605	55.3	0.123	72.9	0.591	-91.7
4.0	0.487	171.2	1.263	34.8	0.252	79.3	0.582	-117.1
5.0	0.580	141.8	1.010	16.5	0.398	63.8	0.600	-153.2

$V_{CE} = 2\text{ V}$, $I_C = 3\text{ mA}$, $Z_0 = 50\ \Omega$

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.859	-8.6	8.821	170.6	0.012	86.1	0.982	-6.3
0.2	0.838	-17.5	8.538	162.2	0.026	79.0	0.962	-12.5
0.3	0.798	-25.8	8.243	153.8	0.037	74.4	0.930	-18.2
0.4	0.759	-33.4	7.888	146.0	0.048	69.9	0.889	-23.5
0.5	0.710	-40.6	7.471	138.9	0.056	66.2	0.844	-28.4
0.6	0.662	-47.3	7.063	132.3	0.064	63.2	0.800	-32.6
0.7	0.616	-54.0	6.660	126.5	0.070	60.8	0.755	-36.2
0.8	0.567	-60.0	6.232	120.8	0.075	58.7	0.713	-39.7
0.9	0.527	-65.8	5.830	115.7	0.080	57.3	0.676	-42.8
1.0	0.487	-71.5	5.507	111.0	0.084	56.4	0.642	-45.5
1.1	0.454	-76.7	5.197	106.5	0.087	55.7	0.609	-48.1
1.2	0.425	-81.9	4.907	102.6	0.090	55.3	0.581	-50.5
1.3	0.396	-86.9	4.621	98.9	0.093	55.3	0.556	-52.8
1.4	0.374	-91.6	4.370	95.3	0.096	55.6	0.535	-55.0
1.5	0.352	-96.7	4.157	92.0	0.099	56.2	0.516	-57.2
1.6	0.333	-102.0	3.980	88.8	0.102	57.1	0.499	-59.3
1.7	0.319	-106.4	3.797	85.9	0.105	57.9	0.484	-61.6
1.8	0.305	-111.0	3.622	83.0	0.108	59.0	0.472	-63.6
1.9	0.293	-116.2	3.483	80.2	0.111	59.7	0.463	-65.6
2.0	0.284	-120.2	3.335	77.6	0.115	60.9	0.453	-67.5
2.1	0.270	-124.6	3.208	75.1	0.118	61.8	0.446	-69.7
2.2	0.265	-129.8	3.092	72.4	0.122	62.9	0.440	-71.9
2.3	0.259	-134.6	2.978	70.2	0.127	63.7	0.437	-73.8
2.4	0.252	-138.5	2.871	68.1	0.132	64.6	0.432	-75.9
2.5	0.251	-143.2	2.773	65.8	0.137	65.5	0.428	-77.7
2.6	0.248	-147.7	2.684	63.9	0.143	66.4	0.426	-80.0
2.7	0.248	-152.2	2.595	61.5	0.149	67.2	0.426	-81.8
2.8	0.249	-156.7	2.527	59.2	0.155	68.0	0.427	-83.8
2.9	0.252	-160.2	2.454	57.3	0.162	69.1	0.425	-85.0
3.0	0.252	-163.9	2.381	55.5	0.168	69.6	0.423	-87.2
4.0	0.326	166.6	1.882	37.6	0.264	68.8	0.417	-109.7
5.0	0.449	143.8	1.556	19.1	0.371	58.8	0.442	-143.5

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

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.780	-10.1	12.853	168.2	0.013	78.9	0.971	-7.8
0.2	0.750	-21.2	12.161	157.8	0.024	77.1	0.936	-15.5
0.3	0.701	-30.7	11.482	148.0	0.035	72.7	0.885	-22.0
0.4	0.646	-39.7	10.643	139.2	0.044	69.0	0.826	-27.8
0.5	0.586	-47.5	9.810	131.5	0.051	66.5	0.769	-32.5
0.6	0.533	-54.2	9.042	124.9	0.058	64.1	0.714	-36.4
0.7	0.483	-60.5	8.335	119.2	0.063	62.9	0.663	-39.8
0.8	0.436	-66.3	7.656	113.9	0.068	61.9	0.619	-42.5
0.9	0.396	-72.1	7.056	109.2	0.073	61.5	0.582	-45.2
1.0	0.362	-77.2	6.563	104.9	0.077	61.4	0.549	-47.3
1.1	0.332	-82.5	6.136	101.0	0.082	61.4	0.518	-49.3
1.2	0.307	-87.6	5.720	97.5	0.086	61.7	0.493	-51.2
1.3	0.283	-92.6	5.358	94.4	0.090	62.2	0.471	-53.0
1.4	0.265	-97.2	5.038	91.1	0.094	62.7	0.454	-54.8
1.5	0.251	-102.4	4.778	88.3	0.099	63.1	0.437	-56.7
1.6	0.233	-107.9	4.526	85.5	0.104	63.9	0.423	-58.7
1.7	0.224	-112.7	4.291	82.9	0.108	64.5	0.412	-60.6
1.8	0.212	-117.5	4.097	80.4	0.113	65.1	0.401	-62.4
1.9	0.206	-123.2	3.921	77.8	0.118	65.6	0.393	-64.2
2.0	0.198	-127.7	3.747	75.6	0.123	66.2	0.386	-66.0
2.1	0.191	-133.0	3.597	73.3	0.128	66.5	0.380	-68.1
2.2	0.187	-138.0	3.463	71.0	0.133	66.9	0.376	-70.3
2.3	0.182	-143.1	3.330	69.1	0.139	67.1	0.374	-72.2
2.4	0.181	-147.4	3.208	67.2	0.145	67.3	0.370	-74.1
2.5	0.181	-152.4	3.091	65.1	0.151	67.6	0.368	-76.0
2.6	0.182	-156.5	2.984	63.5	0.157	67.8	0.365	-78.0
2.7	0.181	-161.7	2.887	61.3	0.164	67.9	0.366	-79.8
2.8	0.185	-166.2	2.811	59.1	0.171	68.3	0.367	-81.8
2.9	0.190	-169.3	2.722	57.5	0.177	68.6	0.366	-83.0
3.0	0.192	-173.1	2.644	55.7	0.184	68.8	0.365	-85.1
4.0	0.272	162.0	2.087	39.4	0.272	65.7	0.356	-107.4
5.0	0.400	143.2	1.747	22.2	0.365	56.2	0.374	-141.1

$V_{CE} = 2 \text{ V}$, $I_C = 7 \text{ mA}$, $Z_0 = 50 \Omega$

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.737	-12.1	15.891	166.3	0.012	85.3	0.961	-9.1
0.2	0.683	-24.6	14.814	154.5	0.024	77.0	0.912	-17.6
0.3	0.624	-34.6	13.658	143.7	0.033	72.1	0.848	-24.7
0.4	0.561	-43.6	12.397	134.6	0.041	69.6	0.779	-30.4
0.5	0.502	-51.3	11.229	126.8	0.048	67.3	0.714	-34.9
0.6	0.446	-58.0	10.179	120.4	0.054	65.9	0.656	-38.5
0.7	0.400	-64.0	9.262	114.8	0.060	65.2	0.605	-41.3
0.8	0.357	-69.8	8.414	109.8	0.065	64.9	0.562	-43.7
0.9	0.320	-75.1	7.691	105.5	0.070	65.0	0.526	-45.8
1.0	0.290	-80.5	7.111	101.4	0.075	65.0	0.495	-47.5
1.1	0.264	-86.0	6.594	97.8	0.080	65.2	0.469	-49.3
1.2	0.244	-90.5	6.140	94.7	0.085	65.4	0.446	-50.9
1.3	0.224	-96.6	5.723	91.7	0.090	66.0	0.425	-52.5
1.4	0.206	-101.0	5.377	88.7	0.095	66.4	0.409	-54.2
1.5	0.194	-107.0	5.072	86.2	0.100	66.8	0.396	-55.9
1.6	0.186	-111.8	4.803	83.6	0.106	67.1	0.384	-57.7
1.7	0.174	-117.3	4.552	81.1	0.111	67.6	0.374	-59.5
1.8	0.167	-122.3	4.323	78.9	0.117	67.8	0.364	-61.3
1.9	0.161	-128.9	4.144	76.6	0.122	68.1	0.358	-63.1
2.0	0.154	-133.6	3.953	74.6	0.127	68.4	0.352	-64.9
2.1	0.153	-139.4	3.790	72.5	0.133	68.4	0.347	-67.0
2.2	0.149	-144.7	3.644	70.3	0.139	68.5	0.343	-69.2
2.3	0.150	-149.6	3.502	68.5	0.145	68.5	0.341	-70.9
2.4	0.146	-154.5	3.369	66.7	0.152	68.3	0.339	-73.0
2.5	0.148	-160.0	3.248	64.8	0.158	68.4	0.336	-74.8
2.6	0.152	-164.2	3.142	63.1	0.165	68.4	0.335	-76.9
2.7	0.153	-169.4	3.035	61.1	0.171	68.3	0.335	-78.7
2.8	0.158	-173.7	2.949	59.1	0.179	68.2	0.337	-80.7
2.9	0.163	-176.9	2.858	57.5	0.185	68.4	0.335	-81.9
3.0	0.167	-179.8	2.777	55.9	0.191	68.3	0.334	-84.1
4.0	0.249	159.0	2.185	40.4	0.276	64.1	0.325	-106.6
5.0	0.373	141.5	1.838	24.0	0.364	54.7	0.337	-140.7

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

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.661	-13.1	19.319	164.2	0.012	79.4	0.947	-10.4
0.2	0.611	-27.6	17.603	150.9	0.022	76.0	0.884	-19.9
0.3	0.540	-38.6	15.816	139.4	0.032	71.5	0.805	-27.2
0.4	0.475	-47.5	14.041	130.1	0.039	70.2	0.727	-32.8
0.5	0.416	-54.8	12.453	122.4	0.045	68.7	0.658	-36.9
0.6	0.363	-61.4	11.129	116.2	0.051	68.3	0.600	-39.9
0.7	0.322	-67.1	10.012	110.8	0.057	68.0	0.551	-42.2
0.8	0.282	-73.1	9.034	106.1	0.062	68.1	0.510	-44.2
0.9	0.253	-77.9	8.203	102.1	0.068	68.1	0.479	-45.8
1.0	0.227	-83.3	7.538	98.5	0.073	68.5	0.450	-47.2
1.1	0.205	-88.6	6.965	95.1	0.079	68.5	0.425	-48.6
1.2	0.186	-94.2	6.461	92.2	0.084	68.9	0.406	-50.0
1.3	0.171	-100.2	6.012	89.6	0.090	69.1	0.388	-51.5
1.4	0.157	-105.8	5.639	86.9	0.096	69.4	0.375	-53.0
1.5	0.150	-111.7	5.300	84.5	0.102	69.5	0.362	-54.7
1.6	0.142	-117.5	5.016	82.1	0.108	69.7	0.352	-56.4
1.7	0.135	-123.5	4.744	79.9	0.114	70.0	0.343	-58.3
1.8	0.129	-129.5	4.507	77.7	0.120	70.0	0.335	-60.0
1.9	0.127	-136.1	4.312	75.5	0.126	70.0	0.329	-61.8
2.0	0.124	-142.0	4.113	73.6	0.132	70.0	0.324	-63.7
2.1	0.122	-147.2	3.942	71.6	0.138	69.8	0.319	-65.8
2.2	0.122	-153.7	3.778	69.5	0.145	69.8	0.316	-68.0
2.3	0.123	-159.9	3.640	67.8	0.151	69.4	0.315	-69.9
2.4	0.123	-164.7	3.503	66.2	0.157	69.1	0.313	-71.9
2.5	0.126	-169.3	3.372	64.3	0.164	68.9	0.311	-73.8
2.6	0.128	-174.8	3.256	62.9	0.171	68.7	0.310	-75.8
2.7	0.133	-179.3	3.151	60.8	0.178	68.4	0.311	-77.7
2.8	0.138	177.1	3.053	59.0	0.185	68.3	0.312	-79.7
2.9	0.143	175.2	2.959	57.6	0.192	68.3	0.310	-81.0
3.0	0.147	171.6	2.874	56.0	0.198	67.9	0.310	-83.0
4.0	0.231	155.1	2.262	41.1	0.281	63.0	0.298	-105.9
5.0	0.357	139.8	1.905	25.2	0.364	53.5	0.308	-140.6

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

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.511	-16.9	25.195	160.5	0.010	71.8	0.916	-12.8
0.2	0.463	-32.9	21.916	144.6	0.020	76.4	0.825	-23.5
0.3	0.391	-45.1	18.816	132.4	0.029	73.1	0.727	-30.7
0.4	0.331	-54.2	16.102	122.9	0.035	72.7	0.641	-35.4
0.5	0.281	-61.4	13.920	115.7	0.042	72.4	0.573	-38.5
0.6	0.239	-67.8	12.190	109.9	0.048	72.3	0.519	-40.5
0.7	0.207	-73.2	10.815	105.3	0.054	72.3	0.476	-42.0
0.8	0.180	-80.0	9.639	101.1	0.060	72.7	0.442	-43.2
0.9	0.156	-85.8	8.715	97.6	0.066	73.0	0.414	-44.4
1.0	0.140	-92.2	7.951	94.3	0.073	73.2	0.392	-45.4
1.1	0.125	-99.5	7.316	91.3	0.079	73.2	0.372	-46.5
1.2	0.116	-106.8	6.767	88.9	0.085	72.9	0.356	-47.8
1.3	0.109	-114.0	6.280	86.4	0.092	73.1	0.342	-49.1
1.4	0.099	-120.3	5.872	84.0	0.098	73.0	0.332	-50.5
1.5	0.097	-129.7	5.518	81.9	0.105	72.8	0.322	-52.2
1.6	0.096	-138.1	5.195	79.6	0.111	72.7	0.313	-53.8
1.7	0.095	-145.2	4.911	77.8	0.118	72.7	0.306	-55.8
1.8	0.094	-151.6	4.672	75.8	0.125	72.5	0.300	-57.6
1.9	0.097	-159.2	4.462	73.8	0.131	72.2	0.295	-59.5
2.0	0.097	-165.4	4.249	72.1	0.138	72.0	0.291	-61.4
2.1	0.100	-170.8	4.070	70.2	0.144	71.4	0.287	-63.6
2.2	0.105	-177.2	3.897	68.3	0.151	71.2	0.286	-65.9
2.3	0.108	179.4	3.748	66.7	0.158	70.7	0.285	-68.0
2.4	0.112	175.0	3.607	65.1	0.165	70.2	0.284	-70.2
2.5	0.116	171.2	3.472	63.4	0.172	69.7	0.282	-72.2
2.6	0.120	167.2	3.350	62.2	0.179	69.4	0.281	-74.4
2.7	0.127	163.6	3.240	60.2	0.186	68.8	0.283	-76.4
2.8	0.134	161.6	3.140	58.5	0.193	68.6	0.283	-78.3
2.9	0.140	159.9	3.043	57.1	0.200	68.2	0.283	-79.8
3.0	0.144	157.9	2.955	55.6	0.207	67.8	0.282	-81.8
4.0	0.227	148.1	2.322	41.4	0.288	61.8	0.270	-105.7
5.0	0.350	136.4	1.957	26.0	0.367	52.0	0.277	-142.1

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



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

► **Technical issue**

NEC Compound Semiconductor Devices, Ltd. <http://www.csd-nec.com/>

Sales Engineering Group, Sales Division
 E-mail: techinfo@csd-nec.com FAX: +81-44-435-1918