

DATA SHEET

NEC

NPN SILICON RF TRANSISTOR 2SC5604

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

FEATURES

- High-gain transistor for buffer amplifier : $|S_{21e}|^2 = 10.0$ dB TYP. @ $V_{CE} = 1$ V, $I_c = 5$ mA, $f = 2$ GHz
- $f_T = 25$ GHz "UHS0" (Ultra High Speed Process) technology adopted
- 3-pin lead-less minimold package (1005 PKG)

ORDERING INFORMATION

Part Number	Quantity	Supplying Form
2SC5604	50 pcs (Non reel)	• 8 mm wide embossed taping
2SC5604-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}	15	V
Collector to Emitter Voltage	V _{CEO}	6.0	V
Emitter to Base Voltage	V _{EBO}	2.0	V
Collector Current	I _c	35	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	–	–	200	nA
Emitter Cut-off Current	I _{EBO}	V _{EB} = 1 V, I _C = 0 mA	–	–	200	nA
DC Current Gain	h _{FE} ^{Note 1}	V _{CE} = 1 V, I _C = 5 mA	60	90	120	–
RF Characteristics						
Gain Bandwidth Product	f _T	V _{CE} = 1 V, I _C = 5 mA, f = 2 GHz	12.0	13.5	–	GHz
Insertion Power Gain	S _{21e} ²	V _{CE} = 1 V, I _C = 5 mA, f = 2 GHz	8.5	10.0	–	dB
Noise Figure	NF	V _{CE} = 1 V, I _C = 5 mA, f = 2 GHz, Z _S = Z _{opt}	–	1.3	2.5	dB
Reverse Transfer Capacitance	C _{re} ^{Note 2}	V _{CB} = 0.5 V, I _E = 0 mA, f = 1 MHz	–	0.25	0.5	pF

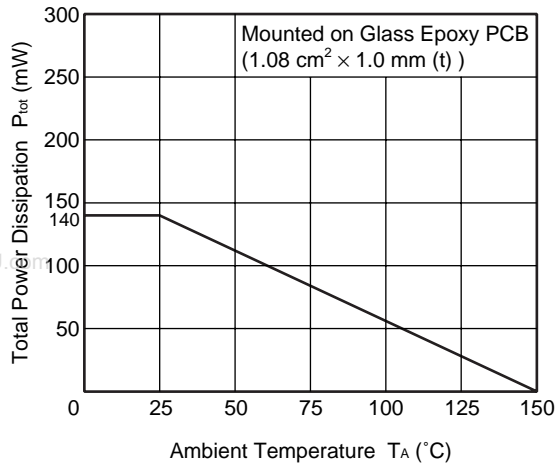
- Notes** 1. Pulse measurement: PW ≤ 350 μs, Duty Cycle ≤ 2%
 2. Collector to base capacitance when the emitter grounded

h_{FE} CLASSIFICATION

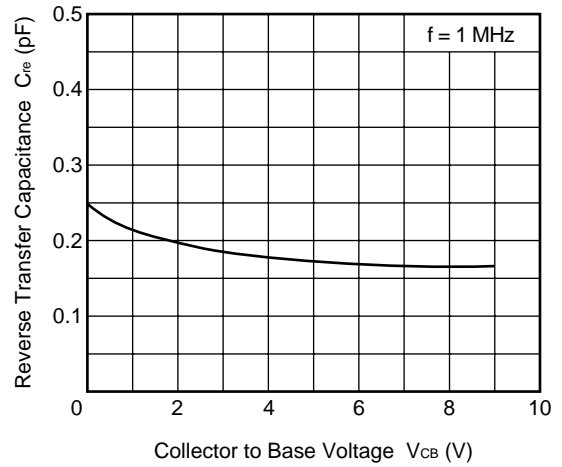
Rank	FB
Marking	E5
h _{FE} Value	60 to 120

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

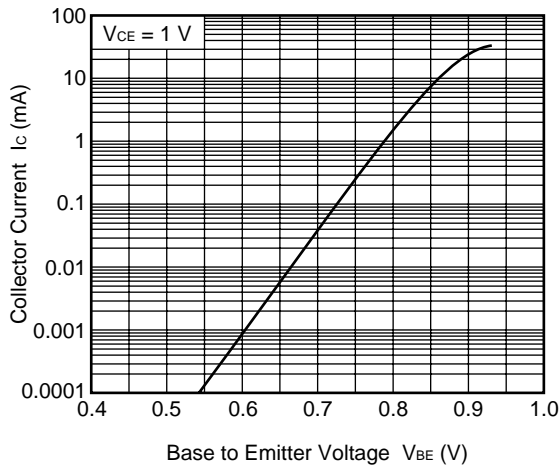
TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE



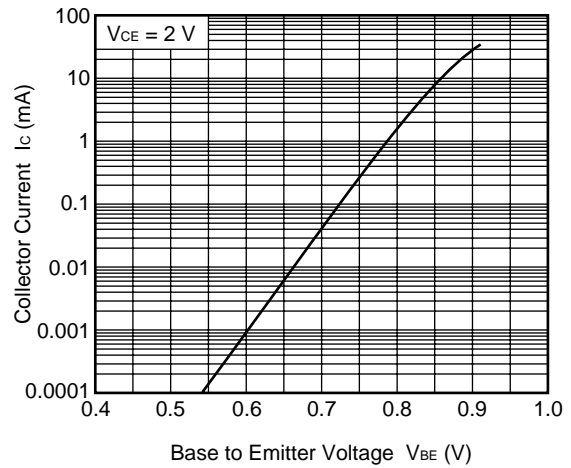
REVERSE TRANSFER CAPACITANCE vs. COLLECTOR TO BASE VOLTAGE



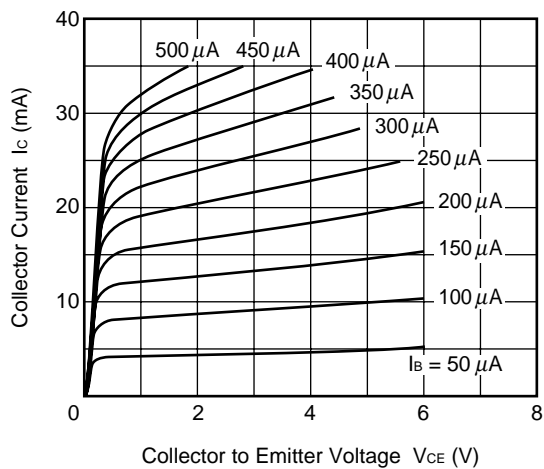
COLLECTOR CURRENT vs. BASE TO EMITTER VOLTAGE



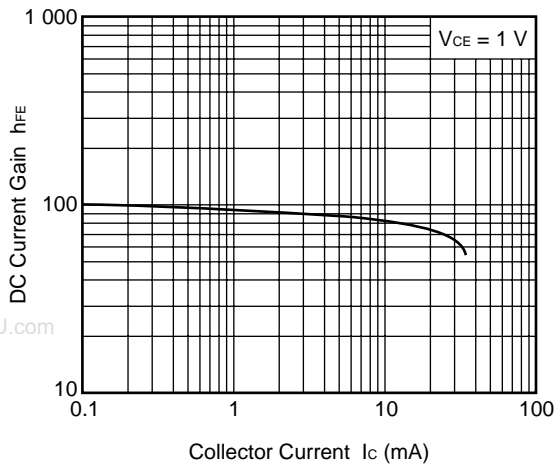
COLLECTOR CURRENT vs. BASE TO EMITTER VOLTAGE



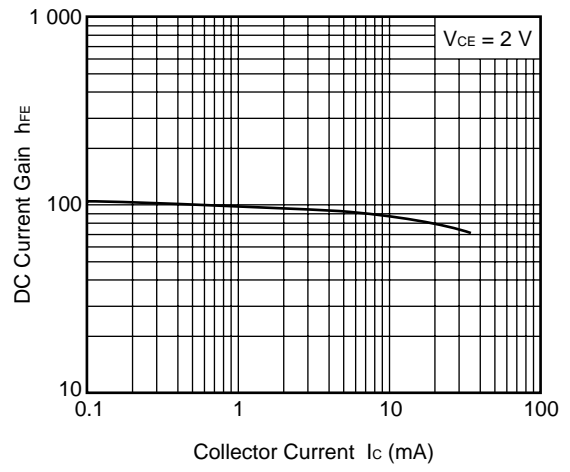
COLLECTOR CURRENT vs. COLLECTOR TO EMITTER VOLTAGE



DC CURRENT GAIN vs.
COLLECTOR CURRENT

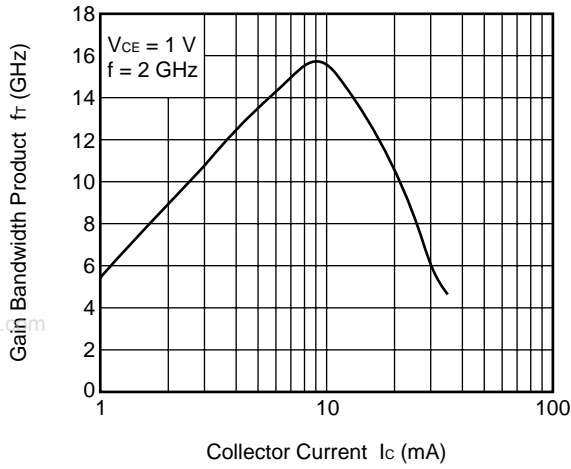


DC CURRENT GAIN vs.
COLLECTOR CURRENT

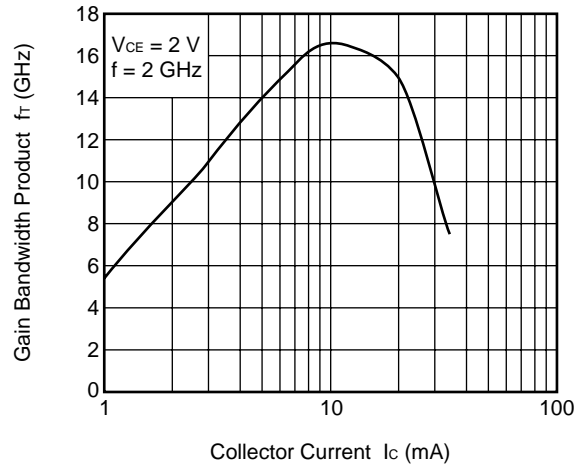


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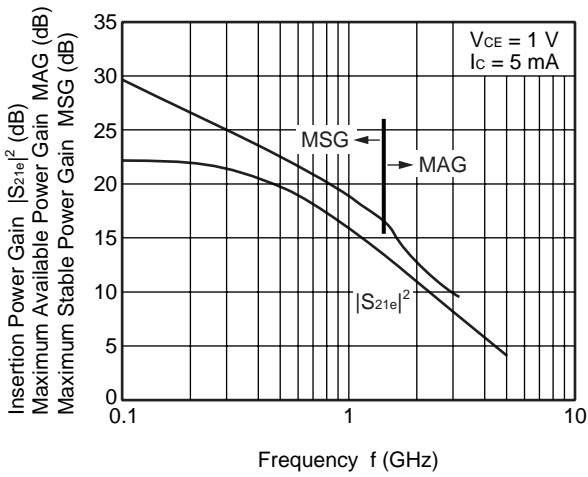
GAIN BANDWIDTH PRODUCT vs. COLLECTOR CURRENT



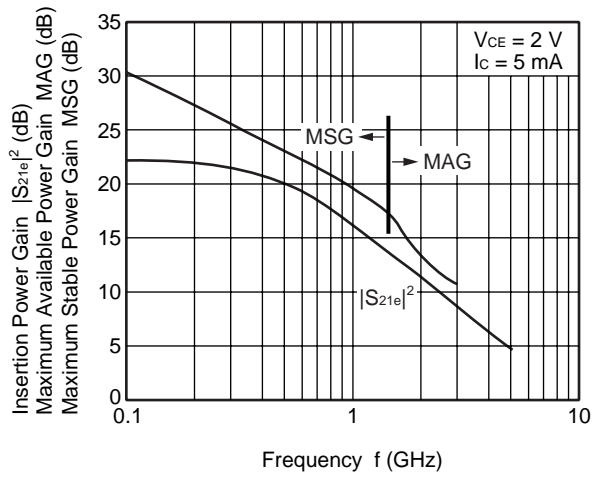
GAIN BANDWIDTH PRODUCT vs. COLLECTOR CURRENT



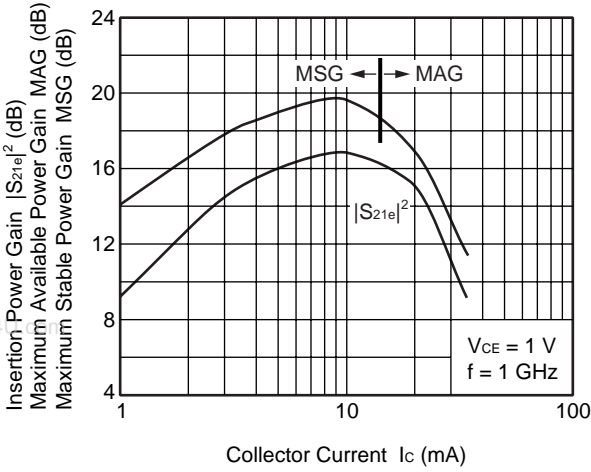
INSERTION POWER GAIN, MAG, MSG vs. FREQUENCY



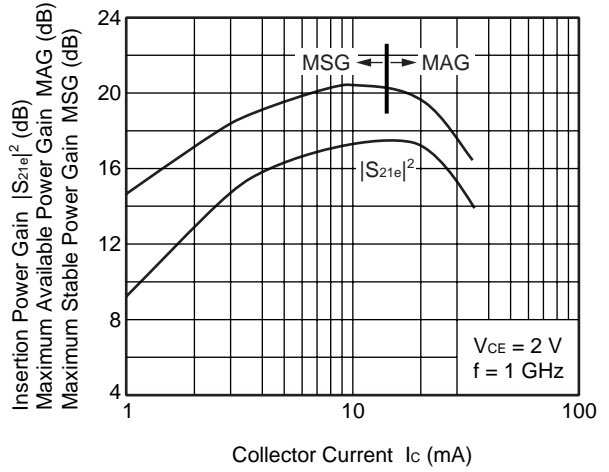
INSERTION POWER GAIN, MAG, MSG vs. FREQUENCY



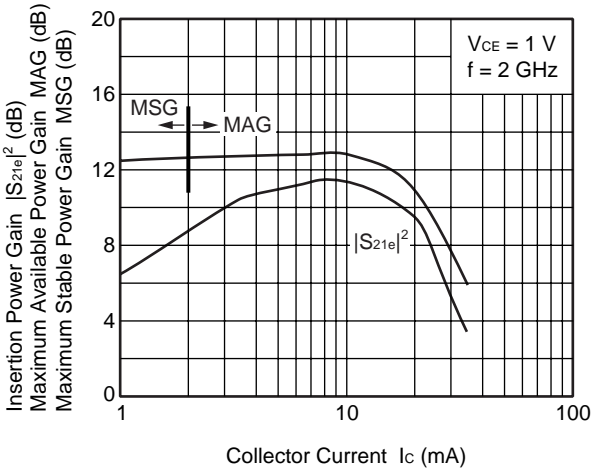
INSERTION POWER GAIN, MAG, MSG vs. COLLECTOR CURRENT



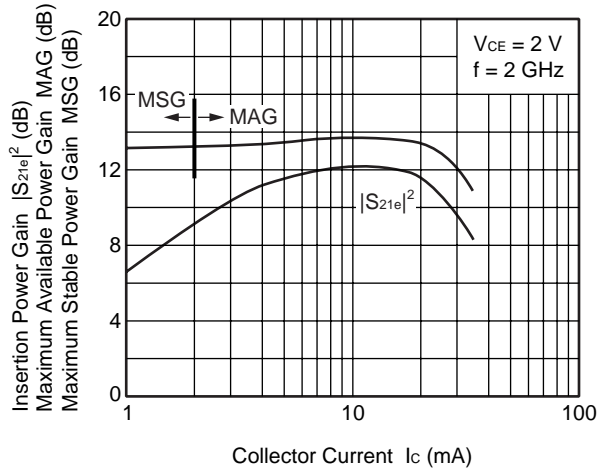
INSERTION POWER GAIN, MAG, MSG vs. COLLECTOR CURRENT



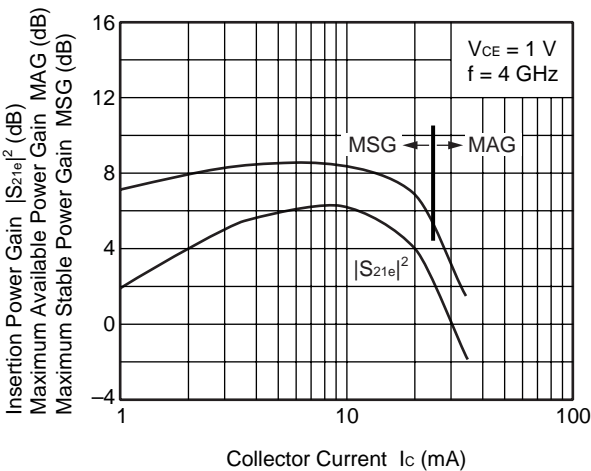
INSERTION POWER GAIN, MAG, MSG vs. COLLECTOR CURRENT



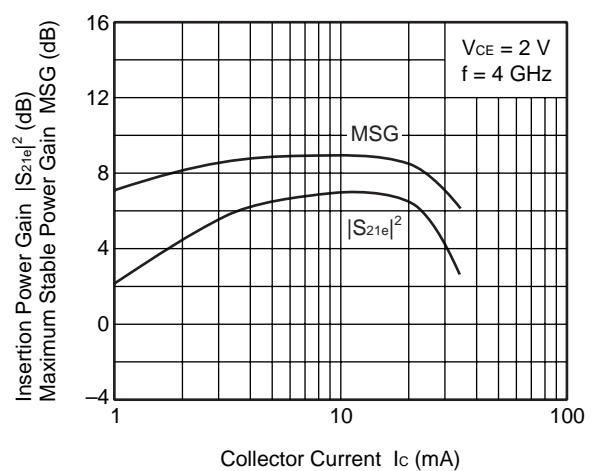
INSERTION POWER GAIN, MAG, MSG vs. COLLECTOR CURRENT



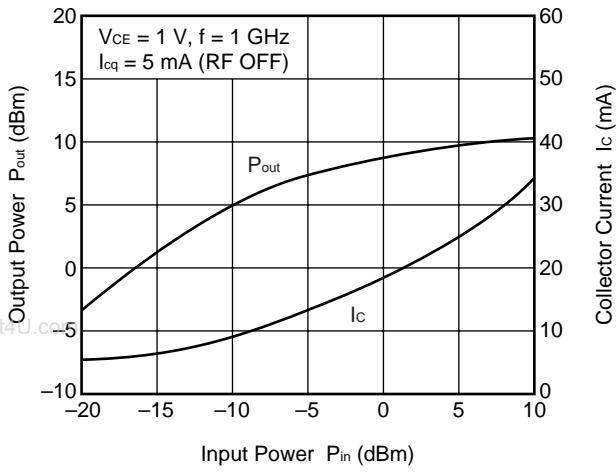
INSERTION POWER GAIN, MAG, MSG vs. COLLECTOR CURRENT



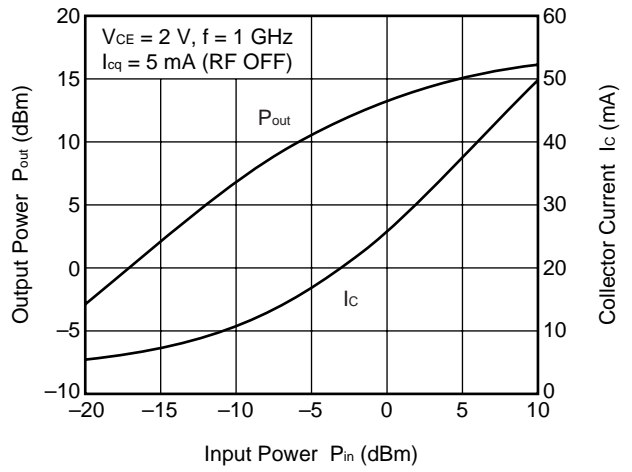
INSERTION POWER GAIN, MSG vs. COLLECTOR CURRENT



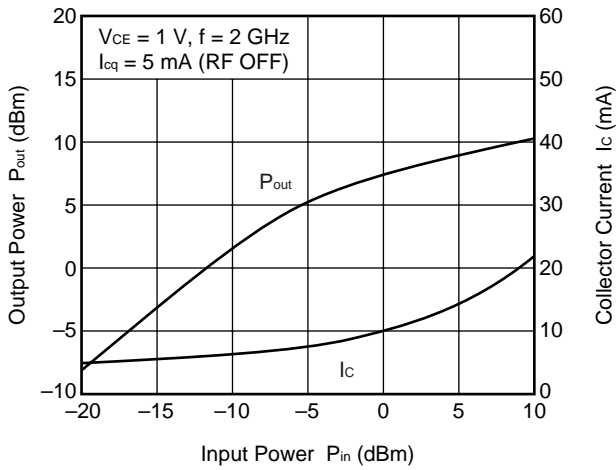
OUTPUT POWER, COLLECTOR CURRENT vs. INPUT POWER



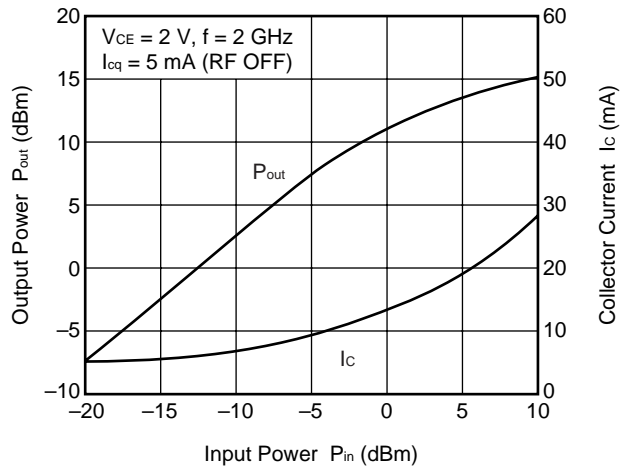
OUTPUT POWER, COLLECTOR CURRENT vs. INPUT POWER



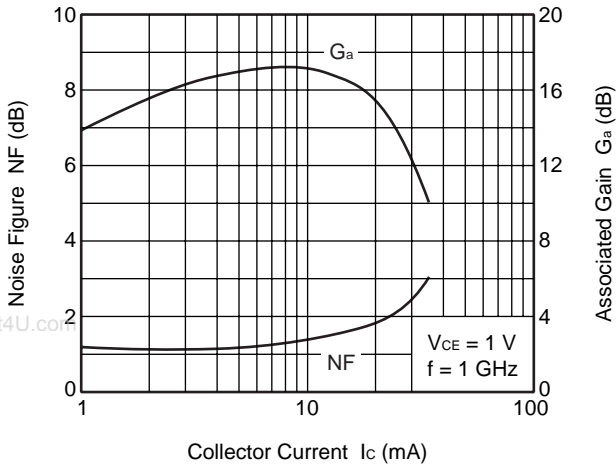
OUTPUT POWER, COLLECTOR CURRENT vs. INPUT POWER



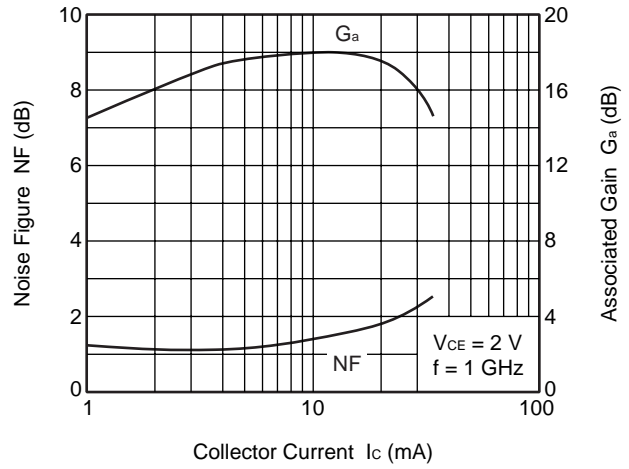
OUTPUT POWER, COLLECTOR CURRENT vs. INPUT POWER



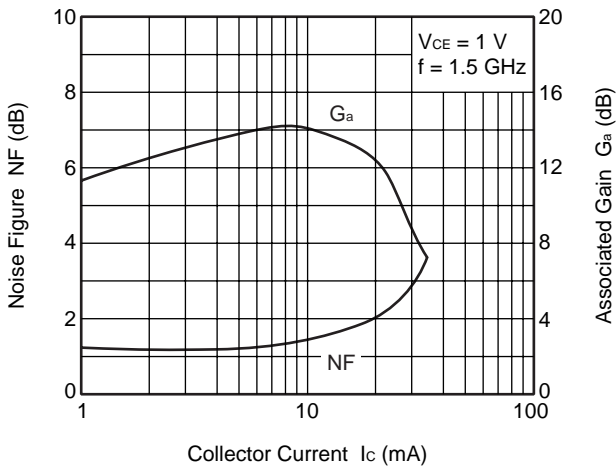
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



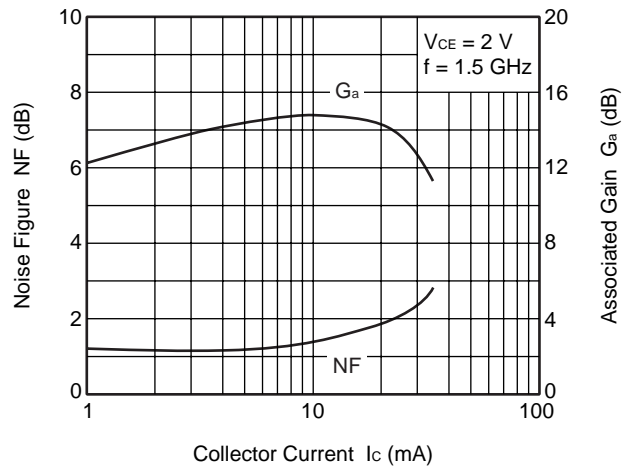
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



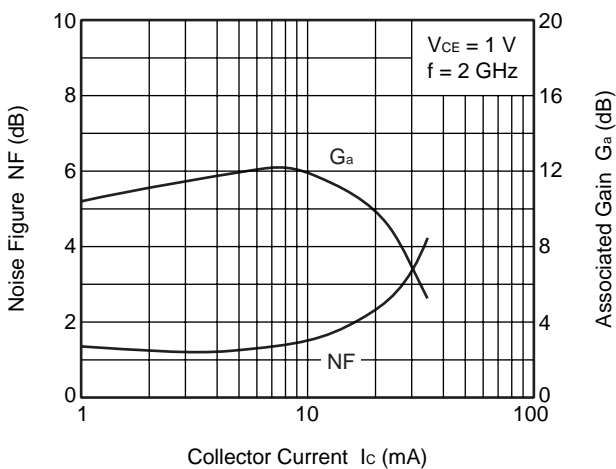
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



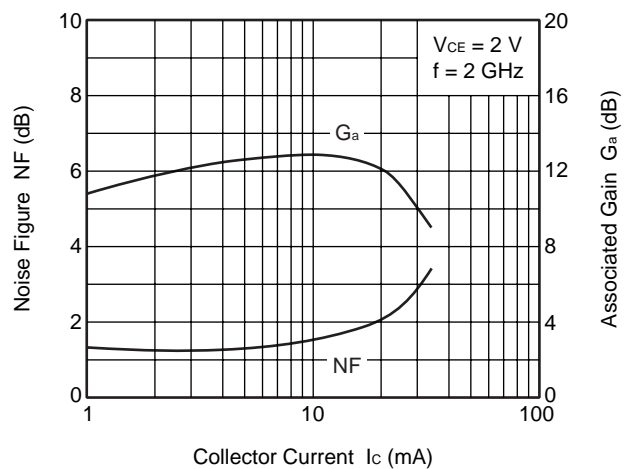
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



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 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	0.957	-5.6	3.360	174.1	0.014	84.5	0.995	-4.1
0.2	0.954	-11.6	3.416	168.4	0.030	81.3	0.987	-8.4
0.3	0.942	-17.4	3.404	162.3	0.044	77.3	0.975	-12.4
0.4	0.920	-22.8	3.330	156.4	0.058	73.1	0.960	-16.6
0.5	0.898	-28.7	3.290	150.5	0.070	69.1	0.942	-20.6
0.6	0.869	-34.5	3.218	144.8	0.081	64.7	0.919	-24.7
0.7	0.841	-40.6	3.150	139.1	0.092	61.1	0.895	-28.4
0.8	0.811	-46.1	3.073	134.1	0.100	57.6	0.869	-32.2
0.9	0.783	-51.7	2.996	128.7	0.108	54.3	0.843	-35.8
1.0	0.751	-57.5	2.904	123.5	0.113	51.2	0.818	-39.2
1.1	0.722	-62.8	2.821	118.6	0.118	48.2	0.792	-42.6
1.2	0.692	-68.1	2.729	113.9	0.122	45.7	0.766	-45.7
1.3	0.666	-73.2	2.630	109.8	0.124	43.4	0.742	-48.9
1.4	0.641	-78.2	2.546	105.3	0.125	41.5	0.719	-51.9
1.5	0.617	-83.1	2.457	101.2	0.126	40.2	0.700	-54.8
1.6	0.595	-87.8	2.390	97.1	0.125	39.0	0.680	-57.8
1.7	0.573	-92.4	2.305	93.2	0.125	38.6	0.663	-60.5
1.8	0.554	-96.8	2.224	89.5	0.123	38.1	0.648	-63.3
1.9	0.537	-101.0	2.158	86.0	0.121	38.6	0.636	-65.8
2.0	0.523	-105.4	2.097	83.0	0.118	39.1	0.623	-68.4
2.1	0.506	-109.7	2.033	79.5	0.116	40.2	0.613	-71.1
2.2	0.492	-113.6	1.983	76.4	0.114	41.4	0.605	-73.7
2.3	0.479	-118.6	1.933	73.8	0.112	43.3	0.599	-75.9
2.4	0.467	-123.2	1.870	70.8	0.111	45.8	0.591	-78.4
2.5	0.455	-127.7	1.812	67.9	0.110	48.6	0.586	-80.8
2.6	0.449	-132.2	1.766	65.3	0.111	51.8	0.582	-83.6
2.7	0.444	-137.0	1.715	62.4	0.112	55.3	0.580	-85.5
2.8	0.439	-141.6	1.668	59.8	0.116	58.9	0.581	-88.0
2.9	0.436	-146.2	1.642	57.2	0.120	63.1	0.577	-89.6
3.0	0.434	-150.8	1.592	54.8	0.124	66.6	0.573	-92.0
4.0	0.491	172.6	1.246	34.6	0.242	77.2	0.560	-116.8
5.0	0.573	145.9	1.002	17.4	0.390	65.0	0.570	-151.4

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

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.896	-9.6	8.706	170.9	0.014	82.2	0.984	-6.7
0.2	0.859	-18.7	8.714	161.3	0.028	79.0	0.957	-13.3
0.3	0.823	-27.5	8.408	152.5	0.041	73.8	0.922	-19.3
0.4	0.773	-35.5	7.930	144.5	0.052	68.8	0.876	-24.8
0.5	0.722	-43.3	7.498	137.0	0.061	64.8	0.827	-29.7
0.6	0.664	-50.7	7.011	130.2	0.069	61.4	0.779	-34.1
0.7	0.613	-58.0	6.571	123.9	0.075	59.0	0.732	-37.7
0.8	0.566	-64.2	6.157	118.5	0.080	56.9	0.689	-41.1
0.9	0.522	-70.4	5.757	113.4	0.085	55.6	0.649	-44.0
1.0	0.484	-76.4	5.392	108.6	0.089	54.6	0.613	-46.7
1.1	0.453	-82.0	5.066	104.4	0.092	54.1	0.581	-49.1
1.2	0.420	-87.2	4.761	100.3	0.095	53.7	0.551	-51.2
1.3	0.397	-92.5	4.482	96.8	0.098	53.7	0.527	-53.5
1.4	0.373	-97.1	4.244	93.3	0.101	54.0	0.506	-55.6
1.5	0.356	-101.7	4.028	90.0	0.104	54.7	0.489	-57.6
1.6	0.339	-106.9	3.843	86.8	0.107	55.4	0.473	-59.5
1.7	0.322	-111.8	3.649	83.6	0.110	56.4	0.458	-61.5
1.8	0.309	-115.6	3.484	81.0	0.113	57.4	0.447	-63.6
1.9	0.298	-119.8	3.335	78.4	0.116	58.5	0.439	-65.4
2.0	0.289	-123.6	3.202	76.1	0.120	59.5	0.431	-67.4
2.1	0.276	-127.8	3.074	73.4	0.124	60.6	0.425	-69.5
2.2	0.267	-132.6	2.971	70.8	0.128	61.6	0.421	-71.7
2.3	0.262	-137.5	2.870	68.9	0.132	62.4	0.418	-73.5
2.4	0.255	-142.5	2.756	66.6	0.137	63.3	0.415	-75.6
2.5	0.248	-147.3	2.664	64.4	0.142	64.1	0.413	-77.5
2.6	0.248	-151.9	2.584	62.1	0.148	64.9	0.411	-79.8
2.7	0.247	-156.9	2.499	59.9	0.154	65.6	0.412	-81.6
2.8	0.248	-160.9	2.419	57.9	0.161	66.4	0.413	-83.8
2.9	0.252	-165.5	2.369	55.8	0.167	67.5	0.411	-85.2
3.0	0.255	-169.9	2.296	53.8	0.173	68.1	0.410	-87.4
4.0	0.347	163.6	1.804	36.5	0.266	67.7	0.398	-109.9
5.0	0.456	145.0	1.490	19.4	0.374	59.0	0.413	-142.5

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

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.827	-11.3	12.845	168.0	0.014	79.3	0.970	-8.6
0.2	0.779	-24.0	12.516	155.9	0.027	77.3	0.926	-16.8
0.3	0.724	-34.8	11.692	145.6	0.038	70.8	0.868	-23.8
0.4	0.655	-44.1	10.668	136.5	0.047	66.7	0.803	-29.5
0.5	0.590	-52.6	9.776	128.5	0.054	64.2	0.740	-34.2
0.6	0.528	-60.1	8.884	121.8	0.061	62.1	0.681	-38.1
0.7	0.475	-67.8	8.110	115.5	0.067	60.7	0.630	-40.9
0.8	0.429	-73.9	7.443	110.7	0.071	60.0	0.585	-43.7
0.9	0.390	-80.2	6.836	106.0	0.076	59.9	0.547	-45.8
1.0	0.356	-86.3	6.322	101.7	0.080	59.8	0.515	-47.7
1.1	0.327	-91.9	5.867	97.9	0.084	60.1	0.486	-49.5
1.2	0.303	-97.7	5.480	94.5	0.089	60.3	0.462	-50.9
1.3	0.286	-102.6	5.109	91.4	0.093	60.9	0.441	-52.7
1.4	0.269	-108.0	4.808	88.4	0.097	61.6	0.423	-54.4
1.5	0.256	-112.7	4.533	85.5	0.102	62.3	0.410	-56.1
1.6	0.244	-118.1	4.292	82.7	0.107	62.9	0.398	-57.8
1.7	0.235	-123.1	4.075	79.9	0.112	63.7	0.387	-59.6
1.8	0.225	-127.4	3.880	77.7	0.116	64.3	0.379	-61.3
1.9	0.218	-131.3	3.701	75.3	0.121	65.1	0.373	-63.1
2.0	0.212	-135.6	3.543	73.3	0.127	65.6	0.367	-65.0
2.1	0.204	-140.9	3.396	70.9	0.132	66.1	0.364	-67.0
2.2	0.200	-145.8	3.271	68.6	0.138	66.4	0.360	-69.2
2.3	0.195	-150.8	3.155	66.9	0.144	66.8	0.360	-71.0
2.4	0.193	-156.0	3.026	64.8	0.150	67.0	0.358	-73.2
2.5	0.193	-161.9	2.924	62.8	0.156	67.2	0.358	-75.1
2.6	0.194	-166.3	2.830	61.0	0.163	67.5	0.357	-77.4
2.7	0.198	-170.6	2.735	59.1	0.169	67.5	0.359	-79.2
2.8	0.202	-174.7	2.644	57.1	0.177	67.6	0.360	-81.5
2.9	0.207	-179.2	2.586	55.2	0.183	68.2	0.359	-82.9
3.0	0.212	177.4	2.508	53.4	0.189	68.3	0.359	-85.2
4.0	0.311	157.7	1.965	37.6	0.278	65.2	0.344	-107.9
5.0	0.421	142.8	1.641	21.1	0.374	56.6	0.355	-140.3

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

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.784	-13.7	15.963	165.7	0.014	74.8	0.959	-10.1
0.2	0.716	-28.7	15.216	152.0	0.026	75.1	0.897	-19.3
0.3	0.642	-40.1	13.858	140.6	0.036	70.3	0.823	-26.6
0.4	0.568	-50.4	12.303	131.1	0.044	66.6	0.746	-32.2
0.5	0.500	-59.1	11.016	123.1	0.051	64.9	0.676	-36.4
0.6	0.440	-66.9	9.843	116.5	0.056	63.4	0.617	-39.7
0.7	0.388	-74.6	8.855	110.7	0.062	63.1	0.567	-42.0
0.8	0.349	-81.0	8.045	106.2	0.067	62.9	0.526	-44.1
0.9	0.312	-87.3	7.328	101.9	0.072	63.1	0.490	-45.8
1.0	0.286	-94.1	6.724	98.0	0.077	63.6	0.462	-47.2
1.1	0.262	-99.8	6.217	94.4	0.082	64.0	0.438	-48.6
1.2	0.243	-106.0	5.772	91.2	0.087	64.6	0.416	-49.8
1.3	0.231	-111.6	5.362	88.5	0.092	65.1	0.399	-51.3
1.4	0.219	-116.7	5.044	85.7	0.097	65.6	0.385	-52.7
1.5	0.207	-121.9	4.741	83.1	0.102	66.3	0.373	-54.3
1.6	0.202	-127.7	4.493	80.5	0.108	66.6	0.363	-55.9
1.7	0.195	-133.5	4.242	78.0	0.114	67.2	0.354	-57.6
1.8	0.189	-137.0	4.040	75.8	0.119	67.6	0.347	-59.3
1.9	0.185	-142.0	3.851	73.7	0.125	68.1	0.343	-61.2
2.0	0.181	-145.5	3.681	71.9	0.131	68.2	0.338	-63.1
2.1	0.176	-151.4	3.528	69.5	0.137	68.6	0.336	-65.2
2.2	0.174	-156.0	3.394	67.5	0.143	68.6	0.333	-67.4
2.3	0.176	-161.4	3.270	65.8	0.150	68.6	0.334	-69.3
2.4	0.174	-166.7	3.135	63.9	0.156	68.6	0.332	-71.5
2.5	0.176	-172.4	3.024	62.0	0.163	68.7	0.333	-73.6
2.6	0.179	-176.1	2.925	60.1	0.170	68.4	0.333	-75.9
2.7	0.184	179.7	2.825	58.2	0.177	68.3	0.335	-77.8
2.8	0.188	175.2	2.736	56.4	0.184	68.3	0.337	-80.0
2.9	0.195	172.0	2.670	54.6	0.191	68.6	0.335	-81.6
3.0	0.203	169.2	2.588	52.9	0.197	68.5	0.336	-84.0
4.0	0.303	153.8	2.028	37.8	0.285	64.3	0.321	-107.2
5.0	0.412	140.5	1.698	21.7	0.377	55.4	0.328	-139.9

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

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.708	-17.3	19.449	162.9	0.013	79.4	0.940	-11.9
0.2	0.628	-33.9	17.950	147.2	0.025	73.7	0.858	-22.0
0.3	0.551	-47.5	15.796	135.0	0.033	69.6	0.768	-29.3
0.4	0.467	-58.3	13.650	125.4	0.041	67.3	0.682	-34.4
0.5	0.405	-67.6	11.949	117.5	0.047	66.0	0.611	-37.8
0.6	0.350	-75.9	10.493	111.3	0.053	65.3	0.555	-40.3
0.7	0.308	-84.1	9.334	106.0	0.058	65.5	0.510	-41.8
0.8	0.273	-91.2	8.400	101.8	0.064	66.1	0.473	-43.3
0.9	0.245	-98.3	7.604	97.9	0.069	66.7	0.443	-44.6
1.0	0.228	-105.5	6.942	94.3	0.075	67.3	0.418	-45.5
1.1	0.211	-112.6	6.388	91.2	0.080	67.7	0.397	-46.7
1.2	0.199	-119.0	5.917	88.2	0.086	68.2	0.380	-47.8
1.3	0.190	-124.9	5.492	85.7	0.092	68.7	0.365	-49.1
1.4	0.182	-130.7	5.152	83.0	0.097	69.1	0.354	-50.5
1.5	0.177	-136.1	4.825	80.7	0.103	69.4	0.344	-52.0
1.6	0.176	-142.0	4.572	78.1	0.110	69.7	0.336	-53.5
1.7	0.173	-147.7	4.314	75.8	0.116	70.2	0.329	-55.3
1.8	0.171	-151.6	4.102	73.8	0.122	70.3	0.324	-57.1
1.9	0.171	-156.4	3.909	71.9	0.128	70.5	0.320	-59.0
2.0	0.168	-159.7	3.736	70.2	0.135	70.6	0.317	-61.0
2.1	0.166	-165.4	3.568	68.0	0.141	70.6	0.315	-63.2
2.2	0.168	-169.7	3.438	65.9	0.148	70.4	0.315	-65.5
2.3	0.171	-174.8	3.312	64.4	0.155	70.3	0.316	-67.5
2.4	0.172	-179.4	3.174	62.5	0.162	70.1	0.315	-69.9
2.5	0.176	176.0	3.059	60.7	0.168	69.9	0.316	-72.0
2.6	0.180	172.2	2.960	58.8	0.176	69.6	0.316	-74.4
2.7	0.186	168.7	2.857	57.0	0.183	69.3	0.319	-76.5
2.8	0.193	164.9	2.758	55.3	0.191	69.1	0.320	-78.9
2.9	0.203	162.2	2.697	53.5	0.198	69.2	0.320	-80.6
3.0	0.209	159.8	2.613	51.8	0.204	68.9	0.321	-83.1
4.0	0.309	148.8	2.046	37.2	0.292	63.8	0.307	-107.0
5.0	0.418	137.6	1.709	21.8	0.382	54.6	0.314	-140.3

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

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.523	-35.3	23.126	154.7	0.013	72.7	0.839	-16.6
0.2	0.440	-63.1	19.270	134.8	0.025	67.9	0.710	-27.8
0.3	0.375	-84.2	15.583	121.6	0.032	66.4	0.601	-33.5
0.4	0.322	-101.3	12.681	112.5	0.038	65.6	0.523	-36.3
0.5	0.293	-116.0	10.676	105.6	0.044	66.4	0.467	-37.6
0.6	0.273	-127.8	9.130	100.2	0.050	67.2	0.428	-38.5
0.7	0.264	-138.3	7.966	95.6	0.056	68.3	0.398	-39.0
0.8	0.261	-147.2	7.067	92.0	0.062	69.3	0.375	-39.7
0.9	0.259	-154.5	6.348	88.5	0.068	70.4	0.357	-40.6
1.0	0.262	-160.6	5.746	85.5	0.074	71.4	0.343	-41.5
1.1	0.265	-166.3	5.269	82.6	0.080	71.8	0.331	-42.8
1.2	0.269	-171.0	4.857	79.9	0.087	72.2	0.321	-44.2
1.3	0.274	-174.2	4.497	77.6	0.094	72.6	0.313	-46.0
1.4	0.278	-178.1	4.198	75.2	0.100	72.9	0.306	-47.7
1.5	0.281	178.5	3.936	72.8	0.107	73.3	0.301	-49.9
1.6	0.287	175.3	3.720	70.4	0.114	73.3	0.297	-52.0
1.7	0.292	172.2	3.506	68.1	0.122	73.6	0.294	-54.4
1.8	0.293	169.4	3.323	66.2	0.129	73.5	0.291	-56.9
1.9	0.296	166.9	3.160	64.1	0.136	73.6	0.290	-59.3
2.0	0.300	164.7	3.017	62.3	0.144	73.4	0.290	-62.0
2.1	0.302	160.9	2.881	60.0	0.151	73.2	0.291	-64.9
2.2	0.309	159.2	2.775	57.9	0.159	73.0	0.292	-67.8
2.3	0.317	156.0	2.670	56.3	0.167	72.5	0.294	-70.4
2.4	0.322	153.7	2.553	54.3	0.175	72.1	0.296	-73.4
2.5	0.330	150.8	2.460	52.5	0.182	71.7	0.299	-76.1
2.6	0.334	149.0	2.372	50.8	0.191	71.1	0.300	-79.0
2.7	0.344	146.5	2.285	48.8	0.199	70.8	0.305	-81.6
2.8	0.352	144.9	2.209	47.1	0.208	70.2	0.308	-84.4
2.9	0.360	143.3	2.155	45.3	0.216	70.2	0.310	-86.6
3.0	0.367	141.5	2.086	43.5	0.223	69.7	0.312	-89.5
4.0	0.453	133.1	1.613	29.3	0.317	62.4	0.311	-117.7
5.0	0.543	122.0	1.319	14.3	0.412	51.3	0.338	-154.2

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

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.962	-5.0	3.306	174.3	0.013	79.0	0.998	-3.9
0.2	0.959	-10.9	3.373	168.9	0.027	81.0	0.989	-7.8
0.3	0.944	-16.4	3.358	163.2	0.039	78.0	0.980	-11.6
0.4	0.926	-21.7	3.304	157.4	0.051	73.8	0.964	-15.4
0.5	0.907	-27.1	3.263	151.8	0.062	70.2	0.949	-19.1
0.6	0.880	-32.7	3.198	146.2	0.073	66.2	0.928	-22.9
0.7	0.850	-38.4	3.141	140.7	0.081	62.6	0.906	-26.5
0.8	0.823	-43.6	3.075	135.8	0.089	59.2	0.883	-30.0
0.9	0.796	-49.2	3.000	130.5	0.096	56.0	0.858	-33.4
1.0	0.767	-54.6	2.917	125.5	0.101	53.2	0.835	-36.7
1.1	0.736	-59.7	2.840	120.7	0.106	50.2	0.811	-39.9
1.2	0.707	-64.8	2.753	116.1	0.108	47.8	0.786	-42.8
1.3	0.681	-69.7	2.658	111.9	0.111	45.7	0.763	-45.9
1.4	0.659	-74.6	2.576	107.5	0.111	44.0	0.741	-48.7
1.5	0.634	-79.2	2.497	103.4	0.112	42.7	0.724	-51.6
1.6	0.612	-83.8	2.431	99.4	0.111	41.8	0.704	-54.3
1.7	0.587	-88.4	2.350	95.3	0.110	41.6	0.688	-57.1
1.8	0.569	-92.6	2.272	91.8	0.109	41.5	0.674	-59.7
1.9	0.552	-97.0	2.208	88.2	0.107	42.1	0.661	-62.2
2.0	0.540	-100.9	2.149	85.2	0.104	43.1	0.648	-64.6
2.1	0.520	-105.2	2.085	81.7	0.102	44.7	0.638	-67.3
2.2	0.503	-109.2	2.034	78.5	0.100	46.6	0.630	-69.8
2.3	0.492	-113.9	1.982	76.1	0.099	49.1	0.624	-71.9
2.4	0.476	-118.4	1.919	72.9	0.099	52.2	0.617	-74.3
2.5	0.464	-122.9	1.864	70.1	0.099	55.7	0.611	-76.7
2.6	0.456	-127.4	1.817	67.3	0.100	59.6	0.607	-79.4
2.7	0.450	-132.2	1.765	64.4	0.103	63.5	0.606	-81.4
2.8	0.444	-136.7	1.721	61.8	0.107	67.6	0.606	-83.9
2.9	0.440	-141.0	1.694	59.3	0.113	71.9	0.602	-85.3
3.0	0.434	-146.2	1.643	56.8	0.119	75.5	0.599	-87.8
4.0	0.485	176.2	1.292	36.0	0.248	82.9	0.587	-112.3
5.0	0.563	148.9	1.037	18.6	0.403	68.5	0.591	-146.8

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

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.894	-9.0	8.718	171.2	0.011	81.4	0.988	-6.0
0.2	0.871	-17.2	8.705	162.1	0.025	79.1	0.963	-12.0
0.3	0.836	-25.3	8.432	153.7	0.036	74.0	0.932	-17.5
0.4	0.785	-33.0	7.982	145.9	0.046	70.0	0.891	-22.5
0.5	0.739	-40.3	7.573	138.6	0.054	66.2	0.845	-27.0
0.6	0.682	-47.3	7.115	131.9	0.061	63.3	0.801	-31.1
0.7	0.634	-53.9	6.705	125.7	0.067	60.6	0.757	-34.5
0.8	0.588	-59.6	6.298	120.5	0.072	58.9	0.716	-37.5
0.9	0.544	-65.2	5.918	115.3	0.076	57.8	0.678	-40.3
1.0	0.504	-71.1	5.548	110.5	0.080	56.8	0.644	-42.7
1.1	0.470	-76.4	5.232	106.2	0.083	56.3	0.613	-44.9
1.2	0.438	-81.1	4.923	102.2	0.086	56.2	0.586	-46.8
1.3	0.410	-85.8	4.638	98.8	0.089	56.3	0.561	-48.9
1.4	0.389	-90.4	4.398	95.3	0.091	57.0	0.541	-50.8
1.5	0.366	-94.7	4.179	91.8	0.094	57.7	0.524	-52.7
1.6	0.348	-98.8	3.992	88.8	0.097	58.5	0.507	-54.4
1.7	0.331	-103.6	3.803	85.5	0.100	59.8	0.494	-56.4
1.8	0.315	-107.1	3.629	82.8	0.103	60.8	0.483	-58.2
1.9	0.302	-111.0	3.474	80.2	0.106	62.3	0.474	-59.9
2.0	0.291	-114.6	3.338	77.8	0.109	63.4	0.465	-61.8
2.1	0.277	-119.0	3.213	75.1	0.113	64.8	0.461	-63.7
2.2	0.268	-122.5	3.105	72.6	0.117	65.9	0.456	-65.7
2.3	0.261	-127.6	3.000	70.7	0.122	66.9	0.454	-67.5
2.4	0.251	-132.7	2.884	68.4	0.127	68.0	0.450	-69.5
2.5	0.244	-136.9	2.785	66.1	0.132	68.9	0.448	-71.4
2.6	0.241	-141.8	2.702	63.9	0.138	69.8	0.447	-73.7
2.7	0.240	-147.1	2.617	61.8	0.144	70.7	0.448	-75.2
2.8	0.236	-151.0	2.533	59.6	0.151	71.5	0.450	-77.4
2.9	0.238	-155.9	2.483	57.5	0.158	72.8	0.448	-78.7
3.0	0.240	-160.5	2.408	55.5	0.164	73.5	0.447	-80.9
4.0	0.328	170.3	1.895	38.2	0.262	72.8	0.436	-102.5
5.0	0.440	150.4	1.578	20.6	0.378	63.5	0.447	-134.0

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

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.839	-10.9	12.822	168.6	0.012	85.1	0.977	-7.7
0.2	0.793	-21.7	12.536	157.2	0.024	76.3	0.937	-15.0
0.3	0.744	-31.5	11.783	147.2	0.034	72.9	0.886	-21.3
0.4	0.673	-40.3	10.822	138.3	0.042	68.5	0.825	-26.5
0.5	0.610	-48.2	9.959	130.5	0.049	66.2	0.766	-30.7
0.6	0.551	-55.2	9.112	123.7	0.055	63.8	0.711	-34.2
0.7	0.496	-61.7	8.366	117.5	0.060	62.6	0.664	-36.9
0.8	0.449	-67.5	7.704	112.7	0.064	61.8	0.621	-39.2
0.9	0.408	-73.1	7.087	107.9	0.068	62.1	0.584	-41.3
1.0	0.374	-78.8	6.562	103.6	0.073	62.0	0.554	-42.9
1.1	0.343	-83.5	6.107	99.7	0.077	62.4	0.526	-44.5
1.2	0.318	-88.6	5.701	96.4	0.080	62.9	0.503	-45.9
1.3	0.297	-93.0	5.331	93.3	0.085	63.4	0.483	-47.4
1.4	0.280	-97.5	5.033	90.2	0.088	64.3	0.465	-48.9
1.5	0.261	-101.6	4.734	87.3	0.093	65.1	0.451	-50.3
1.6	0.248	-106.3	4.509	84.6	0.097	65.9	0.440	-51.8
1.7	0.235	-111.1	4.271	81.8	0.102	66.9	0.429	-53.5
1.8	0.223	-115.0	4.072	79.5	0.107	67.6	0.422	-55.1
1.9	0.215	-118.3	3.891	77.1	0.111	68.5	0.415	-56.7
2.0	0.208	-122.4	3.726	75.0	0.116	69.2	0.409	-58.4
2.1	0.194	-127.4	3.573	72.6	0.122	69.9	0.405	-60.3
2.2	0.193	-132.2	3.442	70.3	0.127	70.3	0.403	-62.3
2.3	0.186	-136.7	3.324	68.7	0.133	70.8	0.402	-64.0
2.4	0.179	-141.9	3.188	66.6	0.139	71.1	0.401	-66.0
2.5	0.176	-147.3	3.078	64.5	0.145	71.5	0.400	-67.9
2.6	0.175	-151.9	2.981	62.6	0.152	71.8	0.399	-69.8
2.7	0.178	-157.3	2.883	60.7	0.158	72.1	0.401	-71.7
2.8	0.177	-162.5	2.788	58.8	0.166	72.3	0.403	-73.8
2.9	0.182	-167.3	2.731	56.9	0.172	73.0	0.402	-75.1
3.0	0.184	-171.2	2.646	55.1	0.178	73.1	0.401	-77.4
4.0	0.284	165.2	2.082	39.2	0.270	70.4	0.386	-98.5
5.0	0.399	148.9	1.753	22.5	0.375	61.4	0.394	-129.7

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

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.778	-12.2	15.991	166.4	0.011	76.0	0.967	-8.9
0.2	0.734	-25.7	15.301	153.3	0.023	76.7	0.913	-17.1
0.3	0.663	-36.3	14.061	142.4	0.032	72.1	0.847	-23.6
0.4	0.590	-45.1	12.607	133.0	0.039	68.9	0.776	-28.7
0.5	0.524	-53.0	11.359	125.2	0.045	66.9	0.711	-32.3
0.6	0.461	-60.1	10.189	118.6	0.051	65.6	0.655	-35.4
0.7	0.409	-67.0	9.210	112.7	0.056	64.9	0.608	-37.4
0.8	0.366	-72.2	8.401	108.1	0.061	64.7	0.567	-39.3
0.9	0.329	-77.8	7.669	103.8	0.065	65.4	0.535	-40.7
1.0	0.299	-83.4	7.044	99.8	0.070	65.9	0.506	-42.0
1.1	0.273	-88.4	6.536	96.4	0.074	66.4	0.482	-43.2
1.2	0.253	-93.1	6.062	93.2	0.079	66.9	0.461	-44.1
1.3	0.237	-98.2	5.656	90.4	0.084	67.6	0.444	-45.5
1.4	0.220	-103.3	5.308	87.6	0.088	68.2	0.429	-46.6
1.5	0.208	-106.8	4.994	85.0	0.093	69.0	0.419	-48.1
1.6	0.198	-112.5	4.738	82.4	0.099	69.6	0.409	-49.5
1.7	0.191	-117.3	4.486	79.9	0.104	70.4	0.400	-51.1
1.8	0.180	-121.2	4.263	77.7	0.109	70.8	0.394	-52.6
1.9	0.174	-125.2	4.070	75.4	0.115	71.3	0.390	-54.3
2.0	0.168	-129.4	3.898	73.6	0.120	71.6	0.384	-56.0
2.1	0.159	-134.4	3.729	71.3	0.126	72.1	0.382	-57.9
2.2	0.155	-138.8	3.596	69.2	0.132	72.2	0.380	-60.0
2.3	0.153	-144.5	3.463	67.7	0.138	72.3	0.380	-61.7
2.4	0.146	-150.5	3.328	65.6	0.145	72.4	0.379	-63.8
2.5	0.147	-156.5	3.207	63.7	0.151	72.5	0.379	-65.7
2.6	0.147	-161.0	3.104	62.0	0.158	72.6	0.378	-67.8
2.7	0.151	-166.7	3.000	60.2	0.165	72.6	0.381	-69.6
2.8	0.154	-171.3	2.900	58.3	0.173	72.6	0.383	-71.7
2.9	0.160	-175.2	2.839	56.6	0.179	73.0	0.382	-73.1
3.0	0.164	-179.6	2.751	54.9	0.186	73.0	0.382	-75.4
4.0	0.266	161.2	2.168	39.6	0.276	69.2	0.366	-96.9
5.0	0.380	147.5	1.826	23.7	0.375	60.3	0.368	-127.7

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

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.721	-14.8	19.529	163.9	0.010	79.4	0.955	-10.4
0.2	0.655	-29.7	18.228	149.1	0.022	75.8	0.883	-19.2
0.3	0.577	-41.5	16.224	137.3	0.030	72.1	0.801	-25.7
0.4	0.499	-50.9	14.168	127.6	0.036	68.7	0.722	-30.3
0.5	0.430	-58.7	12.481	120.0	0.042	68.1	0.655	-33.4
0.6	0.375	-65.4	11.033	113.8	0.048	67.3	0.601	-35.5
0.7	0.328	-72.1	9.853	108.2	0.052	67.5	0.557	-36.9
0.8	0.289	-77.8	8.883	104.0	0.058	68.3	0.522	-38.2
0.9	0.262	-83.5	8.073	100.1	0.063	68.9	0.493	-39.2
1.0	0.234	-89.4	7.381	96.4	0.068	69.5	0.469	-40.0
1.1	0.215	-94.9	6.803	93.3	0.073	70.0	0.449	-41.0
1.2	0.197	-100.6	6.300	90.3	0.078	70.5	0.432	-41.8
1.3	0.185	-105.5	5.867	87.8	0.083	71.0	0.417	-43.0
1.4	0.173	-111.2	5.504	85.1	0.089	71.7	0.405	-44.1
1.5	0.165	-116.0	5.169	82.8	0.094	72.2	0.396	-45.5
1.6	0.160	-120.8	4.891	80.5	0.100	72.6	0.388	-46.9
1.7	0.151	-127.0	4.623	77.9	0.106	73.1	0.381	-48.4
1.8	0.145	-131.4	4.387	75.9	0.112	73.3	0.376	-49.9
1.9	0.143	-135.7	4.193	74.0	0.118	73.7	0.373	-51.6
2.0	0.141	-139.2	4.012	72.2	0.123	73.8	0.369	-53.4
2.1	0.133	-145.4	3.832	70.0	0.130	74.0	0.367	-55.4
2.2	0.132	-150.4	3.693	68.0	0.136	73.9	0.366	-57.5
2.3	0.132	-155.5	3.557	66.5	0.143	73.9	0.366	-59.3
2.4	0.133	-162.2	3.414	64.6	0.149	73.9	0.366	-61.4
2.5	0.133	-168.6	3.290	62.9	0.156	73.7	0.367	-63.4
2.6	0.133	-172.1	3.182	61.1	0.163	73.5	0.366	-65.6
2.7	0.139	-178.6	3.069	59.3	0.171	73.4	0.369	-67.5
2.8	0.143	178.3	2.967	57.7	0.178	73.2	0.371	-69.7
2.9	0.152	174.2	2.903	55.9	0.185	73.5	0.371	-71.3
3.0	0.158	171.6	2.815	54.2	0.191	73.3	0.371	-73.7
4.0	0.262	157.1	2.214	39.6	0.281	68.8	0.354	-95.3
5.0	0.381	145.1	1.872	23.6	0.377	59.5	0.354	-126.2

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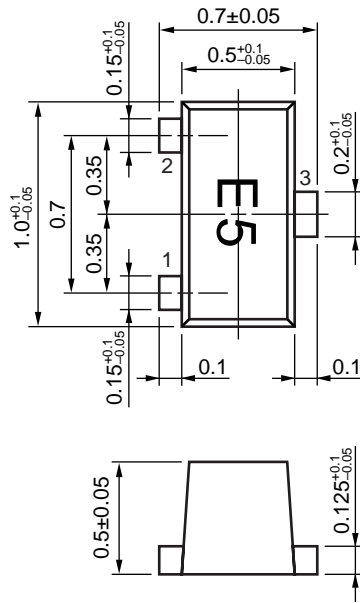
$V_{CE} = 2\text{ V}$, $I_C = 20\text{ mA}$, $Z_0 = 50\ \Omega$

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.573	-23.3	25.317	158.5	0.010	71.9	0.916	-12.8
0.2	0.487	-42.2	22.018	140.2	0.020	73.6	0.809	-22.2
0.3	0.402	-56.9	18.439	127.4	0.026	71.4	0.709	-27.5
0.4	0.327	-68.4	15.333	118.2	0.032	70.5	0.630	-30.4
0.5	0.279	-78.4	13.076	111.1	0.037	71.5	0.572	-31.8
0.6	0.237	-87.9	11.294	105.4	0.043	71.4	0.530	-32.6
0.7	0.210	-97.3	9.941	100.8	0.048	72.9	0.498	-33.0
0.8	0.186	-106.0	8.868	97.1	0.053	73.6	0.472	-33.6
0.9	0.170	-113.2	7.977	93.6	0.059	74.4	0.452	-34.2
1.0	0.161	-122.0	7.258	90.4	0.065	75.2	0.437	-34.8
1.1	0.155	-129.3	6.647	87.6	0.070	75.8	0.423	-35.7
1.2	0.152	-136.3	6.146	84.9	0.076	76.2	0.411	-36.6
1.3	0.151	-143.1	5.689	82.7	0.082	76.5	0.402	-37.8
1.4	0.150	-147.6	5.337	80.3	0.088	76.9	0.395	-39.1
1.5	0.146	-153.7	5.002	78.0	0.094	77.4	0.388	-40.6
1.6	0.152	-158.2	4.726	75.8	0.101	77.5	0.384	-42.2
1.7	0.154	-163.0	4.470	73.5	0.107	77.8	0.379	-43.9
1.8	0.154	-167.3	4.239	71.6	0.114	77.8	0.375	-45.8
1.9	0.156	-169.9	4.037	69.8	0.120	78.0	0.374	-47.7
2.0	0.156	-174.0	3.855	68.2	0.127	77.9	0.372	-49.7
2.1	0.159	-178.4	3.683	66.0	0.134	77.8	0.371	-52.0
2.2	0.161	178.2	3.548	64.0	0.141	77.6	0.372	-54.3
2.3	0.165	173.6	3.415	62.5	0.148	77.3	0.374	-56.4
2.4	0.172	169.8	3.272	60.7	0.155	77.1	0.374	-58.7
2.5	0.176	165.3	3.154	58.9	0.163	76.8	0.376	-61.0
2.6	0.183	163.4	3.049	57.2	0.171	76.5	0.376	-63.4
2.7	0.191	160.6	2.941	55.5	0.178	76.0	0.380	-65.7
2.8	0.198	157.8	2.846	53.8	0.187	75.8	0.383	-68.1
2.9	0.208	155.4	2.777	52.0	0.194	76.1	0.383	-69.9
3.0	0.214	154.1	2.694	50.4	0.200	75.6	0.384	-72.4
4.0	0.315	147.0	2.110	36.1	0.296	69.6	0.372	-95.9
5.0	0.432	137.0	1.764	20.3	0.398	59.2	0.377	-128.4

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★ PACKAGE DIMENSIONS

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



(Bottom View)

PIN CONNECTIONS

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

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