

# DATA SHEET

# NEC

## NPN SILICON RF TRANSISTOR 2SC5618

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

#### FEATURES

- NF = 1.5 dB TYP. @  $V_{CE} = 1\text{ V}$ ,  $I_c = 3\text{ mA}$ ,  $f = 2\text{ GHz}$
- NF = 1.4 dB TYP. @  $V_{CE} = 2\text{ V}$ ,  $I_c = 3\text{ mA}$ ,  $f = 2\text{ GHz}$
- 3-pin lead-less minimold package

#### ORDERING INFORMATION

Part Number	Quantity	Supplying Form
2SC5618	50 pcs (Non reel)	• 8 mm wide embossed taping
2SC5618-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 ( $T_A = +25^\circ\text{C}$ )

Parameter	Symbol	Ratings	Unit
Collector to Base Voltage	$V_{CBO}$	5.0	V
Collector to Emitter Voltage	$V_{CEO}$	3.0	V
Emitter to Base Voltage	$V_{EBO}$	2.0	V
Collector Current	$I_c$	30	mA
Total Power Dissipation	$P_{tot}$ <sup>Note</sup>	90	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<sub>A</sub> = +25°C)**

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
DC Characteristics						
Collector Cut-off Current	I <sub>CBO</sub>	V <sub>CB</sub> = 5 V, I <sub>E</sub> = 0 mA	–	–	100	nA
Emitter Cut-off Current	I <sub>EBO</sub>	V <sub>EB</sub> = 1 V, I <sub>C</sub> = 0 mA	–	–	100	nA
DC Current Gain	h <sub>FE</sub> <sup>Note 1</sup>	V <sub>CE</sub> = 2 V, I <sub>C</sub> = 20 mA	70	–	130	–
RF Characteristics						
Gain Bandwidth Product (1)	f <sub>T</sub>	V <sub>CE</sub> = 2 V, I <sub>C</sub> = 20 mA, f = 2 GHz	9.0	14.0	–	GHz
Gain Bandwidth Product (2)	f <sub>T</sub>	V <sub>CE</sub> = 1 V, I <sub>C</sub> = 10 mA, f = 2 GHz	7.0	12.0	–	GHz
Insertion Power Gain (1)	S <sub>21e</sub>   <sup>2</sup>	V <sub>CE</sub> = 2 V, I <sub>C</sub> = 20 mA, f = 2 GHz	8.5	10.0	–	dB
Insertion Power Gain (2)	S <sub>21e</sub>   <sup>2</sup>	V <sub>CE</sub> = 1 V, I <sub>C</sub> = 10 mA, f = 2 GHz	6.0	9.0	–	dB
Noise Figure (1)	NF	V <sub>CE</sub> = 2 V, I <sub>C</sub> = 3 mA, f = 2 GHz, Z <sub>S</sub> = Z <sub>opt</sub>	–	1.4	2.0	dB
Noise Figure (2)	NF	V <sub>CE</sub> = 1 V, I <sub>C</sub> = 3 mA, f = 2 GHz, Z <sub>S</sub> = Z <sub>opt</sub>	–	1.5	2.0	dB
Reverse Transfer Capacitance	C <sub>re</sub> <sup>Note 2</sup>	V <sub>CB</sub> = 2 V, I <sub>E</sub> = 0 mA, f = 1 MHz	–	0.4	0.8	pF

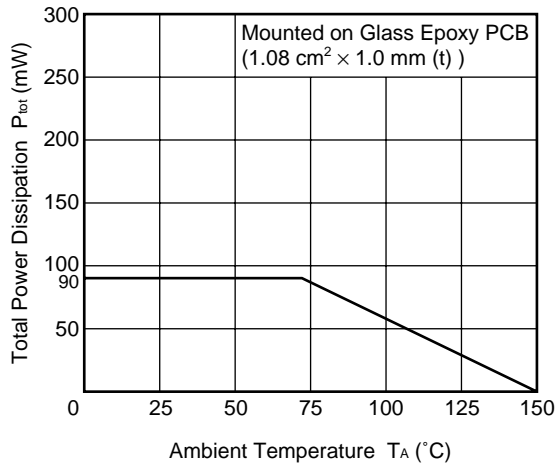
- Notes** 1. Pulse measurement: PW ≤ 350 μs, Duty Cycle ≤ 2%  
 2. Collector to base capacitance when the emitter grounded

**h<sub>FE</sub> CLASSIFICATION**

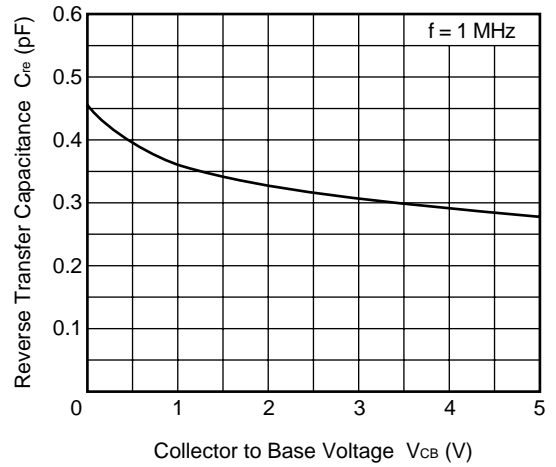
Rank	EB	FB
Marking	W1	W2
h <sub>FE</sub> Value	70 to 100	90 to 130

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

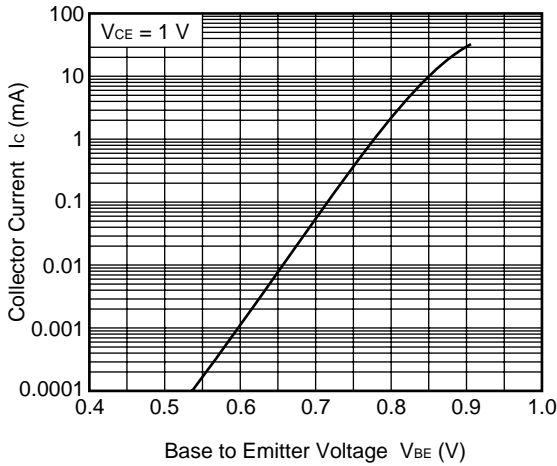
TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE



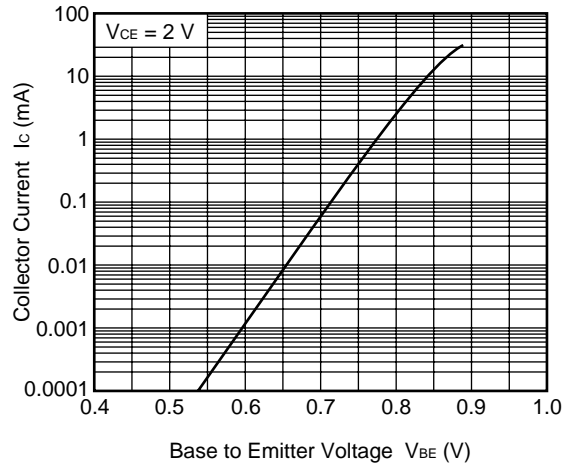
REVERSE TRANSFER CAPACITANCE vs. COLLECTOR TO BASE VOLTAGE



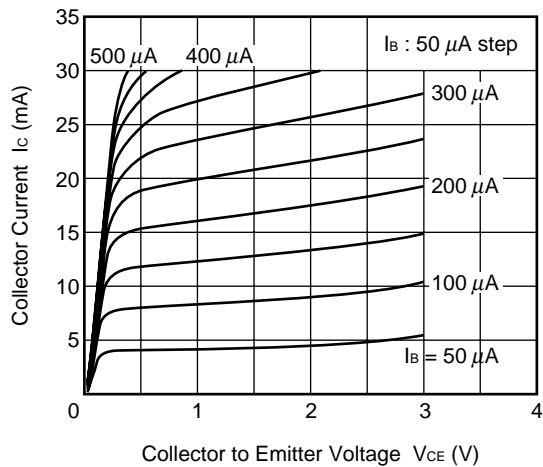
COLLECTOR CURRENT vs. BASE TO EMITTER VOLTAGE



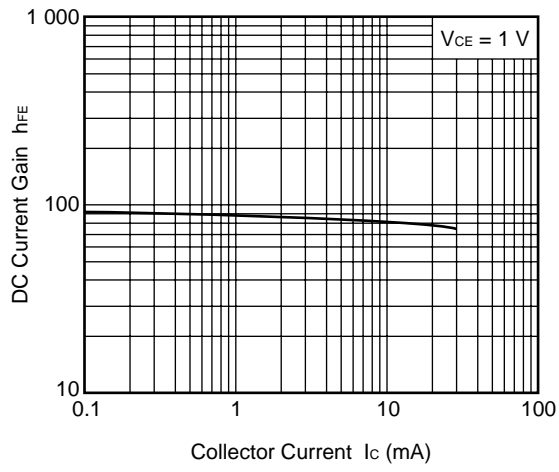
COLLECTOR CURRENT vs. BASE TO EMITTER VOLTAGE



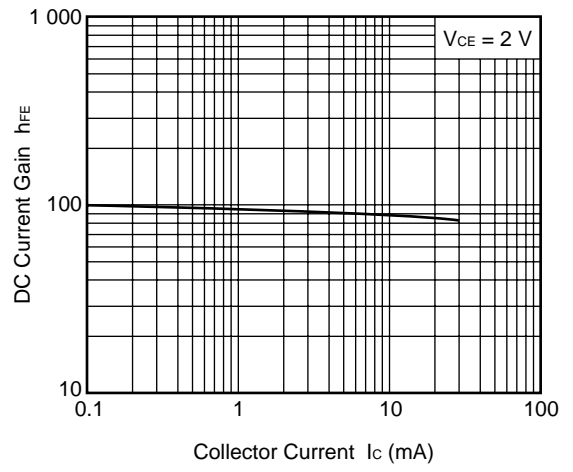
COLLECTOR CURRENT vs. COLLECTOR TO EMITTER VOLTAGE



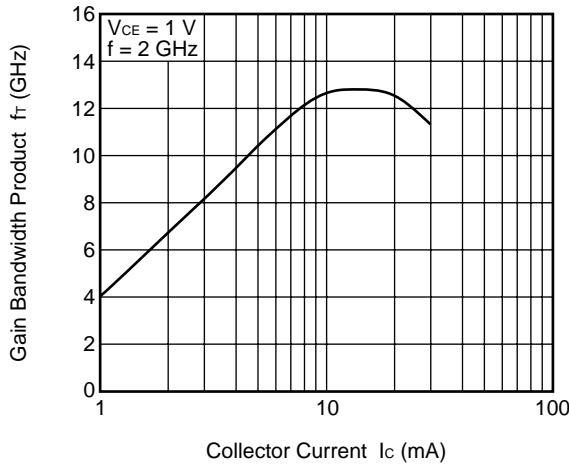
DC CURRENT GAIN vs.  
COLLECTOR CURRENT



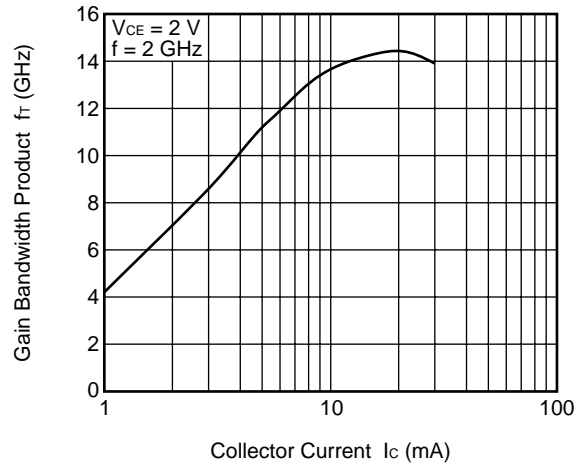
DC CURRENT GAIN vs.  
COLLECTOR CURRENT



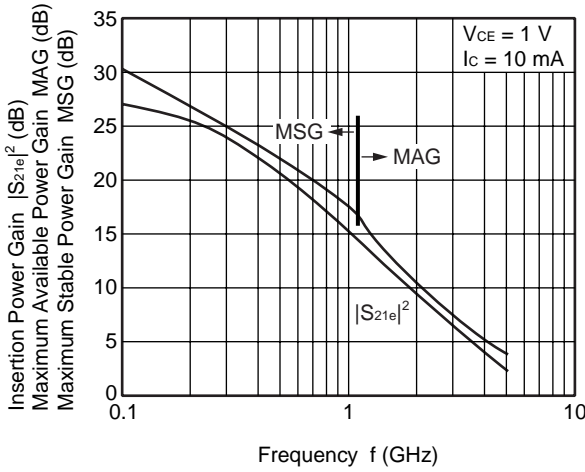
GAIN BANDWIDTH PRODUCT vs. COLLECTOR CURRENT



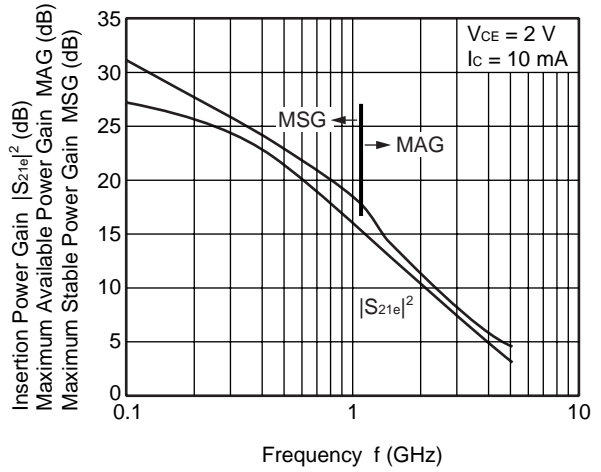
GAIN BANDWIDTH PRODUCT vs. COLLECTOR CURRENT



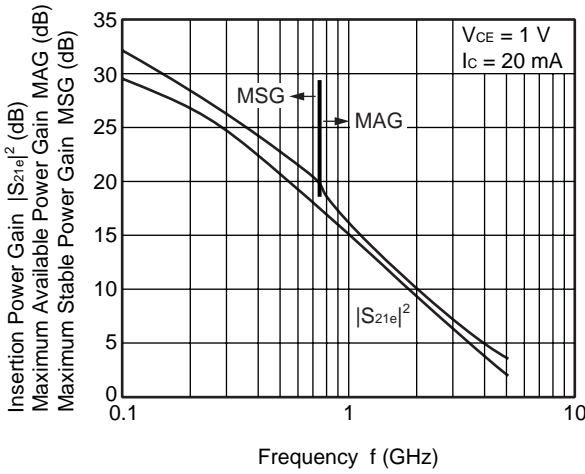
INSERTION POWER GAIN, MAG, MSG vs. FREQUENCY



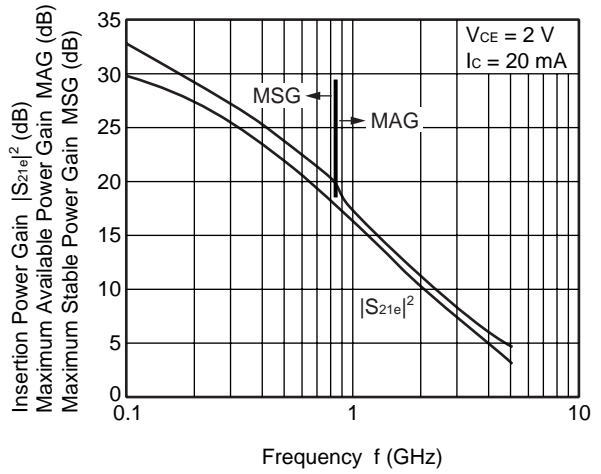
INSERTION POWER GAIN, MAG, MSG vs. FREQUENCY



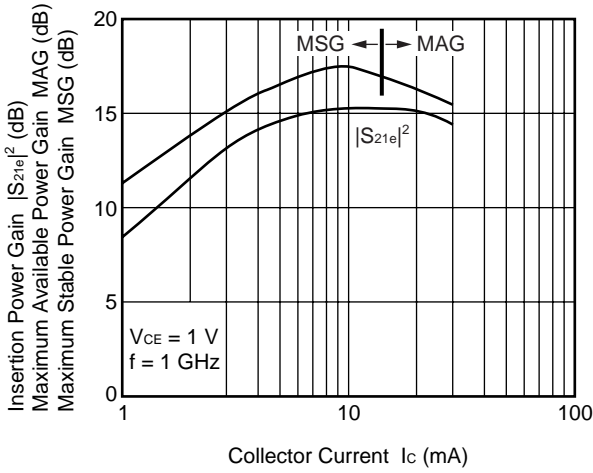
INSERTION POWER GAIN, MAG, MSG vs. FREQUENCY



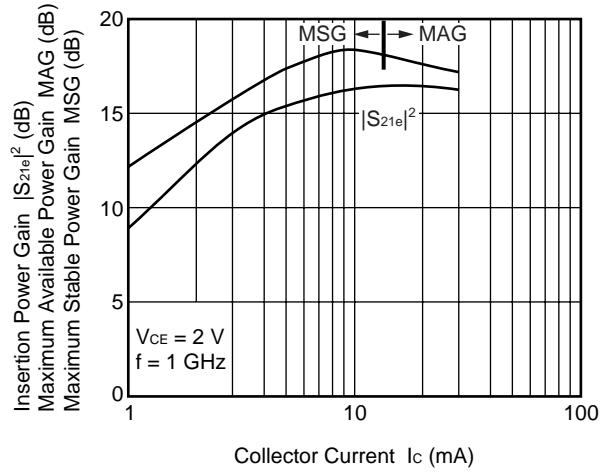
INSERTION POWER GAIN, MAG, MSG vs. FREQUENCY



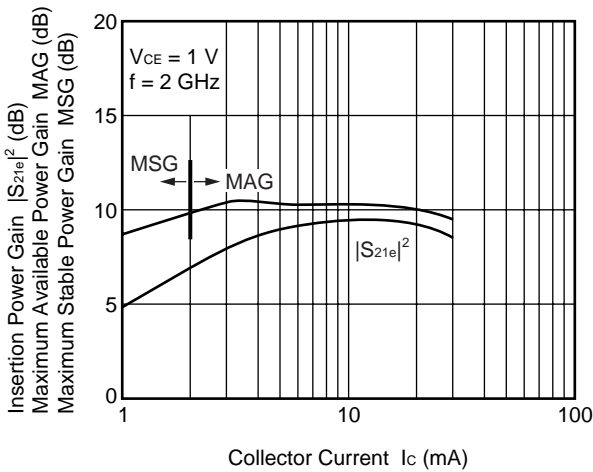
INSERTION POWER GAIN, MAG, MSG vs. COLLECTOR CURRENT



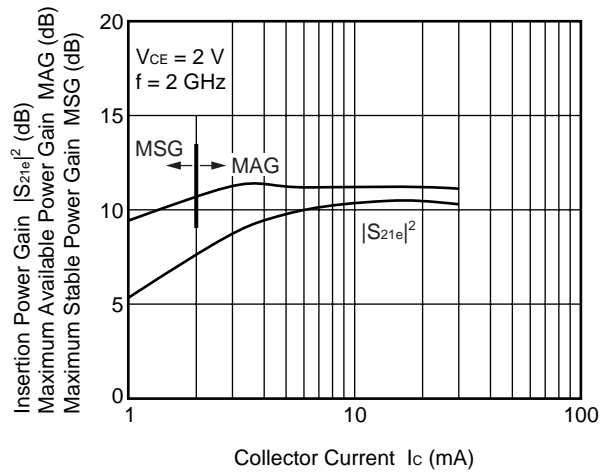
INSERTION POWER GAIN, MAG, MSG vs. COLLECTOR CURRENT



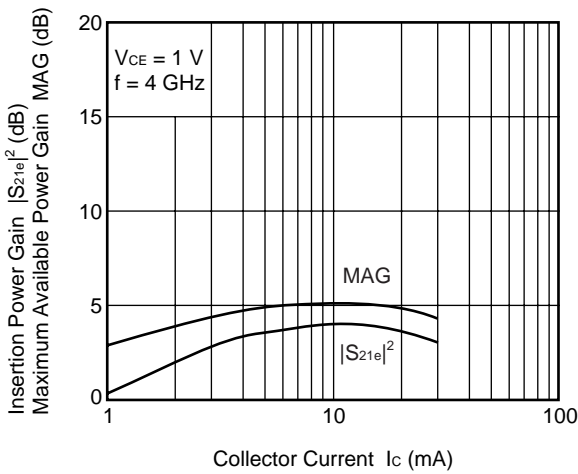
INSERTION POWER GAIN, MAG, MSG vs. COLLECTOR CURRENT



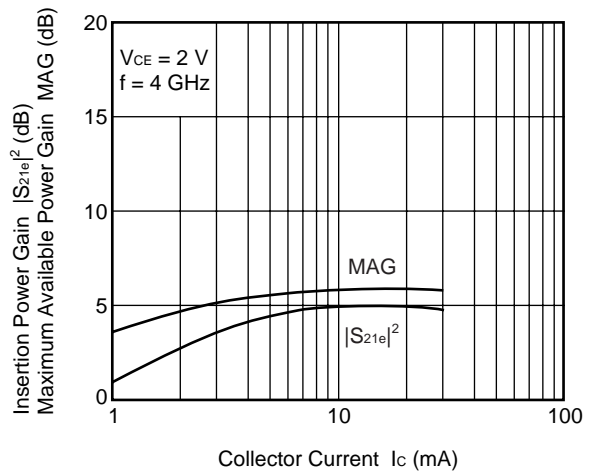
INSERTION POWER GAIN, MAG, MSG vs. COLLECTOR CURRENT



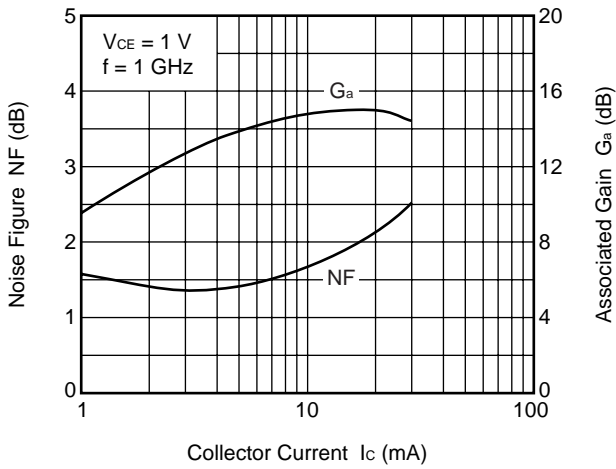
INSERTION POWER GAIN, MAG vs. COLLECTOR CURRENT



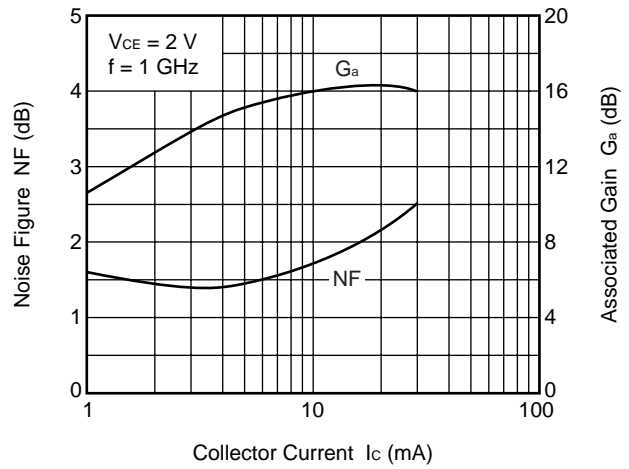
INSERTION POWER GAIN, MAG vs. COLLECTOR CURRENT



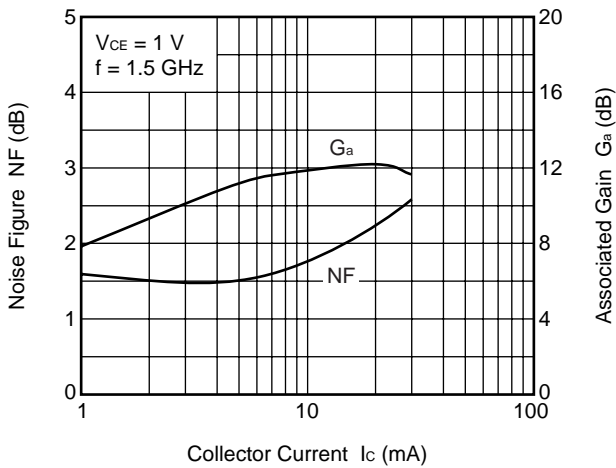
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



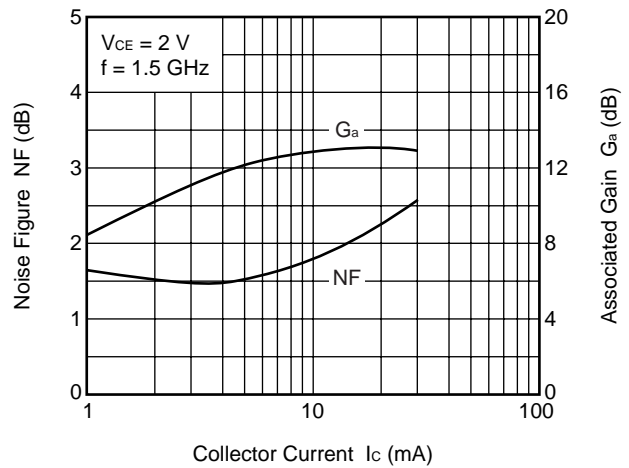
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



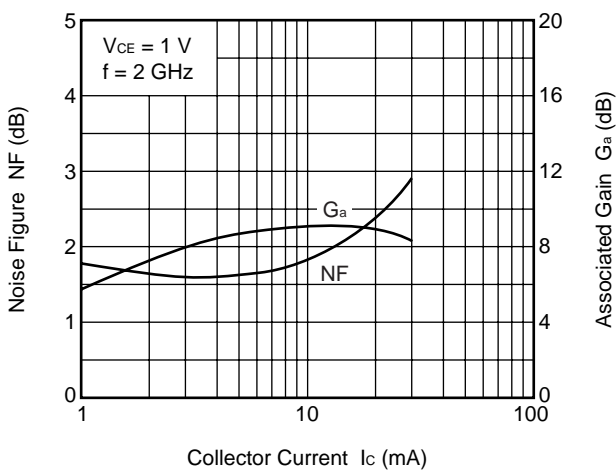
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



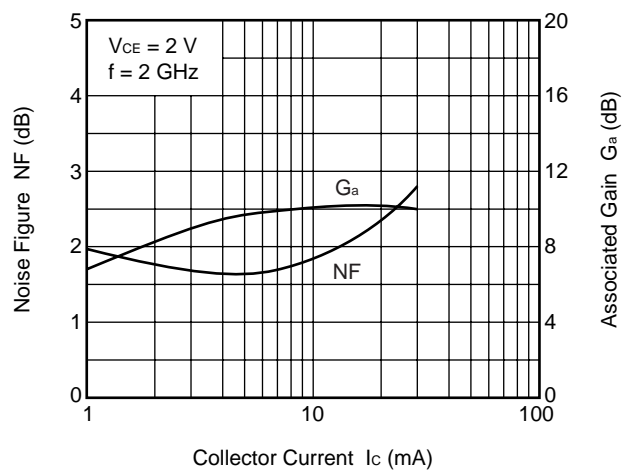
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



**Remark** The graphs indicate nominal characteristics.

S-PARAMETERS

V<sub>CE</sub> = 1 V, I<sub>C</sub> = 1 mA, Z<sub>0</sub> = 50 Ω

Frequency (GHz)	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.971	-8.1	3.566	171.3	0.027	81.0	0.996	-4.3
0.2	0.964	-15.7	3.474	165.9	0.052	79.6	0.982	-9.1
0.3	0.927	-24.6	3.380	159.0	0.078	74.5	0.971	-13.4
0.4	0.916	-33.3	3.330	151.6	0.101	69.3	0.942	-18.2
0.5	0.891	-40.9	3.277	145.0	0.124	64.4	0.920	-22.4
0.6	0.841	-48.6	3.145	137.9	0.143	59.5	0.875	-26.8
0.7	0.808	-56.4	3.043	132.2	0.160	55.5	0.846	-30.5
0.8	0.765	-63.4	2.920	125.9	0.174	51.4	0.800	-34.3
0.9	0.723	-70.7	2.786	120.9	0.186	47.8	0.766	-37.8
1.0	0.692	-77.7	2.669	115.6	0.196	44.6	0.723	-41.1
1.1	0.654	-84.7	2.554	110.4	0.205	41.4	0.696	-44.2
1.2	0.627	-91.5	2.461	105.7	0.212	38.9	0.662	-47.0
1.3	0.599	-98.3	2.338	101.3	0.218	36.1	0.642	-49.7
1.4	0.568	-104.7	2.241	96.6	0.222	33.6	0.609	-52.1
1.5	0.545	-110.7	2.141	92.9	0.227	31.6	0.593	-54.4
1.6	0.522	-117.1	2.052	88.9	0.229	29.6	0.563	-56.4
1.7	0.511	-122.8	1.976	85.6	0.231	27.9	0.547	-58.5
1.8	0.487	-128.7	1.894	81.6	0.232	26.4	0.521	-59.9
1.9	0.475	-133.2	1.824	78.9	0.232	25.1	0.506	-61.9
2.0	0.475	-139.3	1.750	75.6	0.233	24.2	0.486	-63.4
2.1	0.469	-144.3	1.694	72.9	0.233	23.3	0.473	-65.4
2.2	0.465	-148.5	1.651	70.4	0.232	22.5	0.457	-66.8
2.3	0.458	-152.9	1.588	67.3	0.232	21.9	0.450	-69.0
2.4	0.453	-157.7	1.548	65.4	0.230	21.1	0.437	-70.3
2.5	0.455	-162.1	1.493	63.0	0.230	20.7	0.431	-72.4
2.6	0.454	-166.1	1.451	59.9	0.228	19.3	0.426	-74.1
2.7	0.455	-169.4	1.416	58.0	0.228	19.0	0.420	-75.9
2.8	0.455	-172.9	1.372	55.6	0.227	18.4	0.413	-77.0
2.9	0.455	-176.0	1.336	53.6	0.229	19.0	0.405	-78.6
3.0	0.450	-179.8	1.300	51.6	0.227	19.0	0.394	-79.7
4.0	0.482	150.1	1.044	32.6	0.229	24.6	0.348	-99.2
5.0	0.566	128.8	0.891	17.6	0.268	28.8	0.305	-125.4



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

Frequency (GHz)	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.883	-14.4	9.519	167.2	0.025	80.6	0.967	-9.5
0.2	0.866	-28.0	9.012	156.4	0.049	74.3	0.921	-18.9
0.3	0.790	-42.0	8.353	146.6	0.069	67.3	0.868	-27.0
0.4	0.744	-54.7	7.772	136.7	0.086	61.2	0.793	-34.6
0.5	0.683	-66.2	7.206	128.4	0.100	56.1	0.727	-40.6
0.6	0.612	-76.5	6.513	121.1	0.111	52.3	0.650	-46.1
0.7	0.564	-86.0	5.991	115.2	0.119	49.7	0.596	-50.4
0.8	0.517	-94.6	5.468	109.5	0.126	47.5	0.537	-54.5
0.9	0.477	-103.5	5.016	105.0	0.133	45.7	0.494	-58.3
1.0	0.451	-111.5	4.637	100.7	0.138	44.6	0.450	-61.5
1.1	0.423	-119.5	4.290	96.5	0.143	43.6	0.421	-64.6
1.2	0.407	-126.9	4.019	92.8	0.148	43.1	0.389	-67.7
1.3	0.393	-133.4	3.742	89.6	0.152	42.1	0.370	-70.2
1.4	0.379	-140.3	3.506	86.1	0.156	41.7	0.343	-72.7
1.5	0.370	-146.4	3.308	83.4	0.160	41.5	0.330	-74.6
1.6	0.363	-152.7	3.116	80.3	0.165	41.2	0.306	-76.8
1.7	0.363	-158.0	2.961	78.0	0.168	40.9	0.294	-78.7
1.8	0.354	-163.9	2.811	75.0	0.172	40.9	0.274	-80.7
1.9	0.349	-167.1	2.688	73.0	0.176	40.8	0.265	-83.0
2.0	0.358	-172.3	2.549	70.5	0.181	40.9	0.248	-84.9
2.1	0.363	-176.0	2.447	68.4	0.185	40.8	0.242	-87.6
2.2	0.366	-179.3	2.366	66.6	0.189	40.9	0.228	-89.5
2.3	0.365	177.7	2.274	64.1	0.194	40.8	0.224	-92.2
2.4	0.369	173.5	2.199	62.6	0.198	40.7	0.215	-93.8
2.5	0.375	170.7	2.105	60.9	0.202	40.7	0.212	-96.7
2.6	0.380	167.4	2.034	58.4	0.206	40.0	0.207	-98.0
2.7	0.382	164.9	1.984	56.9	0.211	39.9	0.204	-100.5
2.8	0.387	162.1	1.914	54.9	0.215	39.6	0.197	-101.5
2.9	0.387	160.4	1.860	53.6	0.221	39.9	0.193	-104.1
3.0	0.388	157.2	1.803	51.9	0.226	39.7	0.184	-105.3
4.0	0.434	136.1	1.401	35.4	0.274	38.0	0.169	-133.8
5.0	0.520	121.2	1.190	21.7	0.328	32.4	0.158	-175.1

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

Frequency (GHz)	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.823	-19.6	14.258	163.1	0.023	76.9	0.934	-13.8
0.2	0.779	-38.1	13.039	149.3	0.046	70.4	0.856	-26.5
0.3	0.675	-55.3	11.517	137.8	0.062	63.1	0.766	-36.6
0.4	0.612	-69.7	10.235	127.2	0.075	58.4	0.668	-45.0
0.5	0.549	-82.9	9.077	118.8	0.085	54.6	0.589	-51.2
0.6	0.484	-93.9	7.976	112.2	0.092	52.4	0.510	-56.7
0.7	0.441	-104.1	7.156	106.9	0.099	51.1	0.456	-60.9
0.8	0.403	-113.5	6.422	101.8	0.105	50.3	0.403	-65.2
0.9	0.378	-122.7	5.818	98.1	0.111	49.8	0.365	-68.7
1.0	0.364	-130.7	5.305	94.4	0.118	49.7	0.329	-72.5
1.1	0.347	-138.7	4.871	90.9	0.123	49.6	0.306	-75.7
1.2	0.341	-145.6	4.515	87.6	0.129	49.7	0.281	-79.3
1.3	0.336	-151.8	4.189	85.0	0.134	49.2	0.267	-81.8
1.4	0.330	-158.4	3.909	82.0	0.140	49.2	0.246	-85.0
1.5	0.327	-163.4	3.671	79.6	0.146	49.4	0.236	-86.9
1.6	0.327	-169.3	3.449	77.0	0.152	49.3	0.217	-90.1
1.7	0.333	-173.7	3.266	74.9	0.157	49.1	0.210	-92.3
1.8	0.328	-179.2	3.092	72.5	0.163	49.1	0.193	-95.4
1.9	0.328	178.1	2.956	70.7	0.169	49.0	0.188	-98.2
2.0	0.338	174.4	2.795	68.4	0.175	49.0	0.174	-101.6
2.1	0.344	171.6	2.681	66.5	0.181	48.6	0.172	-105.0
2.2	0.349	168.4	2.587	64.9	0.187	48.6	0.162	-107.8
2.3	0.351	166.1	2.484	62.6	0.193	48.3	0.162	-111.5
2.4	0.356	162.9	2.397	61.4	0.199	48.0	0.155	-113.7
2.5	0.361	160.7	2.294	59.8	0.204	47.8	0.155	-117.2
2.6	0.368	157.7	2.214	57.7	0.210	47.1	0.150	-119.1
2.7	0.372	156.1	2.158	56.2	0.215	46.7	0.150	-122.1
2.8	0.376	153.3	2.082	54.5	0.222	46.0	0.144	-123.7
2.9	0.377	151.9	2.020	53.1	0.229	45.9	0.144	-127.1
3.0	0.378	149.4	1.956	51.7	0.234	45.5	0.136	-129.5
4.0	0.426	131.6	1.507	36.0	0.290	41.0	0.150	-160.8
5.0	0.511	118.5	1.273	22.9	0.346	33.2	0.173	158.0

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

Frequency (GHz)	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.767	-24.3	17.973	159.9	0.022	78.5	0.905	-17.4
0.2	0.694	-46.3	15.883	143.9	0.042	67.6	0.797	-32.2
0.3	0.587	-65.4	13.504	131.7	0.056	61.6	0.686	-43.2
0.4	0.525	-81.0	11.608	121.2	0.067	57.7	0.579	-51.9
0.5	0.467	-94.6	10.043	113.2	0.075	55.3	0.499	-57.8
0.6	0.410	-106.0	8.675	107.1	0.083	54.2	0.425	-63.4
0.7	0.377	-116.7	7.713	102.3	0.089	54.0	0.375	-67.4
0.8	0.348	-126.2	6.862	97.7	0.096	53.8	0.328	-71.9
0.9	0.336	-135.5	6.172	94.4	0.102	53.6	0.296	-75.6
1.0	0.326	-143.1	5.610	91.1	0.109	53.8	0.266	-80.0
1.1	0.318	-150.4	5.124	88.0	0.115	54.0	0.247	-83.5
1.2	0.317	-157.1	4.733	85.0	0.122	54.2	0.227	-87.7
1.3	0.314	-162.4	4.384	82.6	0.128	53.9	0.216	-90.4
1.4	0.315	-168.7	4.082	79.8	0.135	53.9	0.199	-94.4
1.5	0.317	-173.4	3.832	77.7	0.142	54.0	0.193	-96.5
1.6	0.317	-178.7	3.594	75.3	0.148	53.8	0.176	-100.6
1.7	0.325	177.7	3.395	73.4	0.155	53.5	0.172	-103.0
1.8	0.327	172.8	3.218	71.1	0.161	53.4	0.158	-107.4
1.9	0.323	170.6	3.075	69.4	0.168	53.2	0.156	-110.6
2.0	0.334	167.1	2.903	67.3	0.175	53.0	0.145	-115.2
2.1	0.341	164.7	2.781	65.5	0.182	52.5	0.145	-118.9
2.2	0.347	162.5	2.684	64.0	0.188	52.3	0.138	-122.8
2.3	0.348	160.2	2.576	61.8	0.195	51.7	0.140	-126.5
2.4	0.354	157.3	2.488	60.7	0.201	51.4	0.135	-129.4
2.5	0.360	155.5	2.376	59.2	0.207	50.9	0.137	-132.8
2.6	0.367	153.0	2.294	57.2	0.213	50.2	0.134	-135.2
2.7	0.369	151.3	2.233	55.7	0.219	49.7	0.135	-138.4
2.8	0.376	149.0	2.153	54.1	0.226	48.9	0.130	-140.6
2.9	0.377	148.0	2.091	52.7	0.233	48.6	0.132	-143.7
3.0	0.379	145.5	2.025	51.3	0.239	48.0	0.125	-147.1
4.0	0.425	129.2	1.554	36.3	0.299	42.3	0.155	-175.2
5.0	0.509	116.7	1.310	23.5	0.355	33.5	0.194	147.6

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

Frequency (GHz)	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.686	-31.4	22.299	156.2	0.021	77.4	0.860	-21.8
0.2	0.601	-55.9	18.761	137.7	0.038	66.2	0.721	-38.9
0.3	0.492	-77.4	15.302	125.4	0.050	60.2	0.594	-50.3
0.4	0.436	-93.6	12.698	115.3	0.060	58.5	0.486	-59.0
0.5	0.393	-108.4	10.732	108.0	0.067	57.5	0.411	-64.7
0.6	0.350	-120.2	9.197	102.5	0.075	57.2	0.344	-70.4
0.7	0.327	-130.3	8.080	98.2	0.082	57.7	0.301	-74.4
0.8	0.314	-140.0	7.158	94.2	0.089	58.0	0.262	-79.5
0.9	0.306	-148.6	6.424	91.1	0.096	58.0	0.236	-83.6
1.0	0.304	-155.9	5.812	88.2	0.104	58.2	0.212	-88.9
1.1	0.302	-162.3	5.294	85.4	0.111	58.4	0.198	-92.8
1.2	0.305	-168.0	4.879	82.8	0.118	58.6	0.183	-98.0
1.3	0.305	-172.9	4.506	80.5	0.125	58.3	0.176	-101.0
1.4	0.308	-178.2	4.181	77.9	0.132	58.1	0.163	-106.1
1.5	0.312	177.9	3.936	76.0	0.140	58.0	0.159	-108.3
1.6	0.317	173.3	3.688	73.7	0.147	57.8	0.147	-113.7
1.7	0.324	170.7	3.483	72.0	0.154	57.4	0.145	-116.3
1.8	0.327	165.7	3.298	69.9	0.161	57.1	0.135	-122.1
1.9	0.325	163.5	3.149	68.3	0.168	56.7	0.136	-125.4
2.0	0.337	161.0	2.974	66.3	0.176	56.2	0.128	-131.3
2.1	0.346	159.1	2.848	64.6	0.183	55.6	0.132	-134.7
2.2	0.348	157.5	2.744	63.2	0.191	55.2	0.127	-139.4
2.3	0.350	155.5	2.637	61.1	0.198	54.6	0.131	-142.9
2.4	0.356	152.9	2.544	60.1	0.204	54.1	0.127	-146.0
2.5	0.364	151.2	2.431	58.5	0.211	53.4	0.132	-148.9
2.6	0.371	148.8	2.348	56.6	0.217	52.6	0.129	-151.5
2.7	0.372	147.3	2.282	55.2	0.224	51.9	0.132	-154.2
2.8	0.379	145.5	2.205	53.6	0.231	51.1	0.129	-157.0
2.9	0.380	144.4	2.139	52.3	0.238	50.6	0.132	-159.5
3.0	0.382	142.1	2.070	51.1	0.245	49.9	0.127	-163.5
4.0	0.427	127.2	1.585	36.2	0.306	43.2	0.167	173.4
5.0	0.512	115.7	1.331	23.8	0.362	33.6	0.217	140.7

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

Frequency (GHz)	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.484	-48.9	29.552	147.4	0.019	68.5	0.739	-30.9
0.2	0.429	-82.6	22.187	126.4	0.033	64.3	0.553	-50.9
0.3	0.359	-108.0	16.755	115.0	0.041	62.9	0.422	-62.0
0.4	0.336	-124.9	13.327	106.4	0.049	63.1	0.331	-70.3
0.5	0.324	-137.8	10.970	100.2	0.058	63.4	0.272	-75.4
0.6	0.309	-148.6	9.266	95.8	0.066	64.0	0.223	-81.8
0.7	0.308	-157.2	8.062	92.5	0.074	64.7	0.193	-86.3
0.8	0.303	-164.5	7.101	88.9	0.082	65.0	0.167	-93.2
0.9	0.310	-171.3	6.344	86.5	0.090	64.9	0.152	-98.4
1.0	0.317	-175.9	5.722	83.9	0.098	64.8	0.139	-106.0
1.1	0.319	179.4	5.196	81.6	0.107	64.8	0.133	-110.9
1.2	0.325	175.3	4.786	79.2	0.115	64.5	0.126	-118.0
1.3	0.329	172.1	4.413	77.3	0.123	63.9	0.124	-121.1
1.4	0.337	168.5	4.092	74.9	0.130	63.5	0.119	-128.0
1.5	0.340	165.3	3.845	73.2	0.139	63.1	0.118	-130.0
1.6	0.347	161.7	3.598	71.1	0.146	62.6	0.113	-137.4
1.7	0.354	159.7	3.394	69.6	0.154	62.0	0.114	-139.7
1.8	0.359	156.1	3.214	67.6	0.162	61.3	0.111	-147.3
1.9	0.357	154.7	3.070	66.0	0.169	60.7	0.115	-149.7
2.0	0.366	153.0	2.896	64.2	0.178	60.1	0.113	-156.7
2.1	0.378	151.3	2.773	62.6	0.186	59.2	0.119	-158.9
2.2	0.379	149.8	2.672	61.3	0.193	58.5	0.118	-163.7
2.3	0.382	148.3	2.563	59.2	0.201	57.7	0.125	-166.0
2.4	0.389	146.1	2.474	58.3	0.207	56.9	0.123	-169.2
2.5	0.395	144.6	2.363	56.8	0.215	56.3	0.130	-170.8
2.6	0.403	143.1	2.279	55.0	0.222	55.2	0.128	-173.6
2.7	0.403	141.7	2.214	53.8	0.229	54.3	0.133	-175.3
2.8	0.409	139.9	2.141	52.3	0.235	53.4	0.131	-178.2
2.9	0.410	139.0	2.079	51.1	0.243	52.8	0.136	-179.9
3.0	0.414	136.9	2.012	49.7	0.249	52.0	0.134	176.0
4.0	0.453	123.9	1.533	35.3	0.312	44.0	0.180	159.6
5.0	0.534	113.2	1.291	23.2	0.367	33.8	0.241	131.6

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

Frequency (GHz)	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.976	-8.2	3.527	172.1	0.022	84.4	0.999	-3.5
0.2	0.974	-14.0	3.453	167.1	0.044	81.3	0.987	-7.5
0.3	0.939	-22.0	3.367	160.9	0.065	76.4	0.978	-11.3
0.4	0.926	-29.7	3.329	153.8	0.086	71.5	0.954	-15.2
0.5	0.903	-36.9	3.287	147.8	0.105	67.0	0.939	-18.9
0.6	0.862	-43.8	3.180	141.1	0.123	62.3	0.901	-22.7
0.7	0.829	-51.1	3.092	135.7	0.138	58.7	0.876	-26.0
0.8	0.790	-57.6	2.982	129.7	0.150	54.8	0.834	-29.2
0.9	0.746	-64.1	2.862	124.8	0.163	51.4	0.806	-32.4
1.0	0.714	-70.9	2.759	119.8	0.172	48.3	0.765	-35.3
1.1	0.678	-77.7	2.652	114.6	0.180	45.2	0.741	-38.2
1.2	0.647	-84.1	2.566	110.0	0.187	42.8	0.708	-40.6
1.3	0.619	-90.4	2.446	105.6	0.194	39.9	0.689	-43.1
1.4	0.588	-96.5	2.356	101.0	0.198	37.6	0.659	-45.2
1.5	0.560	-102.6	2.256	97.3	0.203	35.6	0.644	-47.4
1.6	0.537	-108.4	2.166	93.3	0.206	33.6	0.614	-49.2
1.7	0.521	-114.1	2.092	90.0	0.208	31.8	0.599	-51.1
1.8	0.494	-119.8	2.008	86.1	0.209	30.4	0.574	-52.5
1.9	0.483	-124.4	1.934	83.3	0.210	29.1	0.558	-54.3
2.0	0.472	-130.5	1.859	80.1	0.211	28.2	0.537	-55.3
2.1	0.467	-135.7	1.804	77.2	0.212	27.2	0.524	-57.3
2.2	0.460	-140.3	1.756	74.8	0.211	26.6	0.508	-58.4
2.3	0.453	-144.6	1.694	71.6	0.212	25.9	0.501	-60.2
2.4	0.445	-149.6	1.648	69.7	0.211	25.1	0.488	-61.5
2.5	0.443	-154.2	1.587	67.3	0.210	24.7	0.480	-63.3
2.6	0.440	-158.7	1.547	64.3	0.210	23.3	0.476	-65.0
2.7	0.439	-162.0	1.510	62.3	0.209	23.2	0.469	-66.6
2.8	0.439	-166.0	1.463	59.7	0.209	22.6	0.463	-67.4
2.9	0.436	-169.4	1.424	57.7	0.211	23.2	0.452	-68.7
3.0	0.430	-173.2	1.385	55.8	0.210	23.3	0.442	-69.7
4.0	0.457	154.5	1.112	36.5	0.215	29.3	0.389	-86.6
5.0	0.540	131.5	0.948	21.3	0.256	33.9	0.331	-108.2

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

Frequency (GHz)	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.901	-13.2	9.534	168.2	0.021	78.2	0.973	-7.8
0.2	0.884	-24.6	9.106	158.5	0.042	76.2	0.935	-15.7
0.3	0.810	-36.7	8.526	149.3	0.059	69.8	0.891	-22.6
0.4	0.768	-48.2	8.030	139.9	0.075	64.2	0.827	-29.0
0.5	0.713	-58.8	7.496	132.0	0.087	59.6	0.770	-34.2
0.6	0.641	-67.5	6.859	124.8	0.097	55.8	0.696	-38.9
0.7	0.585	-76.6	6.363	119.0	0.106	53.4	0.647	-42.5
0.8	0.534	-84.5	5.859	113.1	0.112	51.0	0.590	-46.1
0.9	0.492	-92.6	5.387	108.7	0.119	49.2	0.547	-49.0
1.0	0.458	-100.3	5.011	104.3	0.124	48.0	0.503	-51.8
1.1	0.426	-107.6	4.652	100.1	0.130	47.0	0.474	-54.3
1.2	0.403	-114.8	4.368	96.3	0.134	46.4	0.441	-56.5
1.3	0.385	-121.4	4.069	93.1	0.139	45.4	0.421	-58.4
1.4	0.364	-128.3	3.830	89.5	0.143	44.9	0.394	-60.3
1.5	0.349	-134.6	3.616	86.7	0.148	44.7	0.380	-61.8
1.6	0.337	-141.0	3.411	83.7	0.151	44.3	0.355	-63.2
1.7	0.334	-146.9	3.245	81.3	0.155	44.1	0.343	-64.8
1.8	0.322	-153.5	3.080	78.2	0.159	44.0	0.322	-65.8
1.9	0.318	-156.7	2.944	76.3	0.163	43.9	0.311	-67.6
2.0	0.322	-162.3	2.795	73.8	0.167	44.0	0.293	-68.6
2.1	0.325	-167.0	2.686	71.7	0.172	43.9	0.284	-70.7
2.2	0.328	-170.3	2.597	69.8	0.176	43.9	0.271	-71.6
2.3	0.326	-174.3	2.495	67.4	0.180	43.9	0.266	-73.8
2.4	0.328	-178.4	2.411	66.0	0.184	43.7	0.256	-74.7
2.5	0.330	178.0	2.304	64.1	0.188	43.8	0.251	-77.0
2.6	0.338	174.5	2.234	61.8	0.192	43.2	0.245	-77.8
2.7	0.337	171.5	2.176	60.1	0.196	43.1	0.240	-79.8
2.8	0.341	168.4	2.096	58.3	0.201	42.6	0.234	-80.2
2.9	0.343	166.8	2.035	56.8	0.207	42.9	0.228	-82.1
3.0	0.343	163.4	1.974	55.1	0.211	42.8	0.219	-82.4
4.0	0.391	140.1	1.534	38.6	0.258	41.5	0.183	-105.5
5.0	0.478	124.1	1.296	24.8	0.313	36.3	0.130	-140.9

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

Frequency (GHz)	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.849	-17.3	14.332	164.5	0.019	84.6	0.947	-11.2
0.2	0.804	-32.8	13.240	151.9	0.038	72.3	0.880	-21.8
0.3	0.705	-47.5	11.913	141.0	0.053	66.1	0.805	-30.3
0.4	0.641	-60.8	10.727	130.8	0.065	61.6	0.714	-37.4
0.5	0.574	-72.7	9.646	122.6	0.075	57.9	0.640	-42.6
0.6	0.502	-82.2	8.564	115.7	0.083	55.5	0.563	-47.1
0.7	0.451	-91.4	7.731	110.4	0.090	54.4	0.511	-50.3
0.8	0.408	-100.4	6.974	105.3	0.095	53.4	0.456	-53.4
0.9	0.374	-108.7	6.341	101.4	0.102	52.6	0.418	-56.0
1.0	0.351	-116.7	5.810	97.6	0.107	52.4	0.380	-58.5
1.1	0.329	-124.7	5.338	94.1	0.113	52.2	0.355	-60.8
1.2	0.313	-131.9	4.969	90.7	0.118	52.4	0.328	-63.0
1.3	0.306	-138.4	4.609	88.0	0.124	51.9	0.312	-64.8
1.4	0.295	-145.9	4.307	84.8	0.129	51.9	0.289	-66.7
1.5	0.288	-151.8	4.052	82.6	0.135	51.9	0.279	-68.0
1.6	0.284	-158.2	3.809	80.0	0.140	51.7	0.258	-69.5
1.7	0.288	-163.6	3.605	78.0	0.146	51.6	0.250	-71.0
1.8	0.278	-169.6	3.421	75.4	0.151	51.6	0.231	-72.3
1.9	0.277	-173.0	3.265	73.5	0.156	51.5	0.224	-74.4
2.0	0.290	-177.4	3.095	71.4	0.162	51.5	0.208	-75.7
2.1	0.296	178.5	2.962	69.4	0.168	51.2	0.202	-78.4
2.2	0.298	175.9	2.860	67.9	0.174	51.1	0.191	-79.5
2.3	0.298	173.0	2.749	65.7	0.180	50.9	0.187	-82.4
2.4	0.303	169.5	2.651	64.4	0.185	50.6	0.179	-83.3
2.5	0.310	166.7	2.537	62.8	0.190	50.3	0.176	-86.4
2.6	0.315	163.5	2.448	60.8	0.195	49.6	0.171	-87.1
2.7	0.317	161.5	2.380	59.2	0.201	49.2	0.167	-89.7
2.8	0.323	158.6	2.300	57.5	0.207	48.6	0.161	-90.0
2.9	0.324	156.9	2.230	56.0	0.214	48.5	0.157	-92.6
3.0	0.326	153.9	2.158	54.6	0.219	48.2	0.148	-93.2
4.0	0.375	134.9	1.660	39.0	0.274	44.2	0.130	-124.7
5.0	0.465	121.2	1.400	26.0	0.329	36.8	0.107	-176.8



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

Frequency (GHz)	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.781	-21.4	18.207	161.6	0.019	80.8	0.921	-14.2
0.2	0.725	-39.6	16.322	146.8	0.036	70.3	0.828	-26.5
0.3	0.616	-56.5	14.168	135.0	0.049	64.7	0.731	-35.7
0.4	0.549	-70.2	12.343	124.5	0.059	60.9	0.629	-42.8
0.5	0.482	-82.7	10.808	116.7	0.067	58.1	0.553	-47.4
0.6	0.416	-92.8	9.422	110.4	0.075	57.1	0.478	-51.5
0.7	0.375	-102.5	8.418	105.5	0.081	56.8	0.428	-54.2
0.8	0.336	-111.7	7.516	100.7	0.087	56.4	0.378	-57.0
0.9	0.313	-120.9	6.785	97.4	0.093	56.2	0.345	-59.3
1.0	0.298	-128.7	6.187	93.9	0.100	56.2	0.311	-61.7
1.1	0.284	-136.7	5.652	90.9	0.106	56.4	0.290	-63.9
1.2	0.277	-143.9	5.238	87.8	0.112	56.5	0.266	-66.2
1.3	0.272	-150.2	4.861	85.3	0.118	56.2	0.254	-67.9
1.4	0.269	-157.4	4.519	82.6	0.124	56.2	0.234	-69.8
1.5	0.265	-162.7	4.254	80.4	0.130	56.2	0.226	-71.2
1.6	0.265	-169.2	3.988	78.0	0.137	56.1	0.208	-72.9
1.7	0.269	-173.4	3.772	76.1	0.143	55.9	0.201	-74.4
1.8	0.268	-179.3	3.574	73.9	0.149	55.6	0.185	-76.1
1.9	0.266	178.2	3.408	72.1	0.155	55.6	0.179	-78.6
2.0	0.280	174.4	3.225	70.1	0.161	55.3	0.165	-80.1
2.1	0.286	171.0	3.087	68.3	0.168	54.9	0.161	-83.3
2.2	0.289	168.5	2.978	66.8	0.174	54.6	0.150	-84.8
2.3	0.289	165.8	2.859	64.7	0.181	54.2	0.148	-88.4
2.4	0.296	162.5	2.756	63.6	0.186	53.7	0.141	-89.5
2.5	0.302	160.3	2.636	62.0	0.192	53.4	0.139	-93.1
2.6	0.310	157.5	2.540	60.1	0.198	52.6	0.134	-94.0
2.7	0.312	155.6	2.479	58.5	0.204	52.1	0.132	-97.0
2.8	0.318	153.5	2.386	57.1	0.210	51.4	0.126	-97.5
2.9	0.320	151.9	2.315	55.7	0.218	51.1	0.123	-100.7
3.0	0.321	149.3	2.242	54.2	0.223	50.6	0.115	-101.9
4.0	0.373	131.9	1.717	39.3	0.281	45.3	0.110	-139.2
5.0	0.460	119.4	1.444	26.5	0.337	37.0	0.112	163.5

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

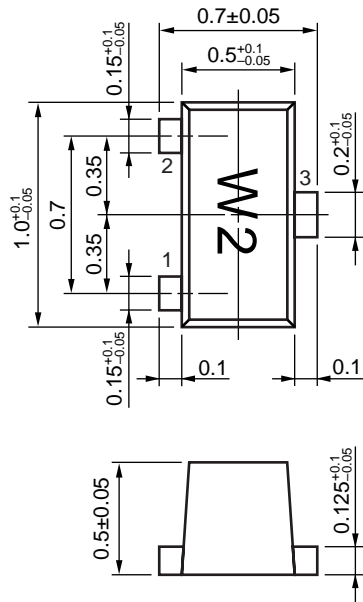
Frequency (GHz)	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.712	-25.5	22.714	158.0	0.017	74.0	0.884	-17.4
0.2	0.638	-47.2	19.532	141.0	0.033	68.1	0.764	-31.5
0.3	0.520	-66.1	16.216	128.9	0.044	63.9	0.648	-40.9
0.4	0.453	-80.7	13.709	118.8	0.053	61.1	0.542	-47.6
0.5	0.396	-93.9	11.746	111.3	0.061	60.0	0.467	-51.6
0.6	0.342	-104.5	10.099	105.6	0.068	59.6	0.397	-55.1
0.7	0.311	-115.2	8.920	101.3	0.074	60.1	0.353	-57.3
0.8	0.283	-124.6	7.918	97.0	0.081	60.1	0.310	-59.9
0.9	0.271	-133.7	7.104	93.9	0.088	60.2	0.281	-62.0
1.0	0.262	-141.7	6.456	91.0	0.094	60.3	0.252	-64.5
1.1	0.254	-149.2	5.882	88.0	0.101	60.5	0.236	-66.6
1.2	0.252	-156.2	5.437	85.4	0.108	60.6	0.215	-69.1
1.3	0.251	-162.3	5.029	83.2	0.115	60.3	0.206	-70.9
1.4	0.253	-168.4	4.674	80.5	0.121	60.2	0.189	-73.2
1.5	0.254	-173.1	4.383	78.7	0.128	60.1	0.183	-74.4
1.6	0.255	-179.5	4.118	76.3	0.135	59.7	0.167	-76.7
1.7	0.263	177.3	3.890	74.7	0.142	59.3	0.162	-78.4
1.8	0.263	171.9	3.682	72.5	0.149	59.1	0.147	-80.6
1.9	0.261	169.8	3.513	70.9	0.155	58.8	0.144	-83.4
2.0	0.275	166.4	3.318	69.0	0.162	58.4	0.130	-85.6
2.1	0.284	164.4	3.178	67.3	0.169	57.8	0.128	-89.6
2.2	0.287	161.7	3.063	65.9	0.176	57.5	0.119	-91.7
2.3	0.288	159.8	2.942	63.8	0.182	56.9	0.118	-95.8
2.4	0.296	157.0	2.834	62.8	0.188	56.3	0.112	-97.4
2.5	0.303	154.9	2.710	61.4	0.195	55.8	0.112	-101.9
2.6	0.312	152.5	2.614	59.4	0.201	54.9	0.107	-103.1
2.7	0.312	151.0	2.540	58.1	0.207	54.3	0.106	-106.9
2.8	0.318	148.7	2.451	56.5	0.214	53.4	0.100	-107.4
2.9	0.320	147.6	2.378	55.2	0.221	53.0	0.100	-111.6
3.0	0.324	145.3	2.302	53.9	0.227	52.4	0.091	-113.6
4.0	0.372	129.6	1.759	39.4	0.287	46.2	0.102	-154.4
5.0	0.459	118.0	1.475	27.0	0.342	37.3	0.127	150.6

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

Frequency (GHz)	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.534	-36.7	31.060	150.4	0.016	70.9	0.796	-24.0
0.2	0.457	-66.2	24.217	130.4	0.029	67.6	0.624	-39.8
0.3	0.357	-88.3	18.723	118.6	0.036	65.5	0.495	-47.9
0.4	0.317	-104.4	15.065	109.7	0.044	65.3	0.398	-52.8
0.5	0.288	-118.2	12.526	103.4	0.052	65.1	0.337	-54.9
0.6	0.258	-130.8	10.611	98.7	0.060	65.9	0.282	-57.3
0.7	0.245	-140.8	9.265	95.3	0.067	66.7	0.249	-58.2
0.8	0.238	-150.4	8.174	91.6	0.074	66.6	0.217	-60.3
0.9	0.237	-158.4	7.304	89.1	0.082	66.6	0.197	-62.0
1.0	0.241	-164.8	6.593	86.6	0.089	66.5	0.175	-64.6
1.1	0.240	-170.9	5.995	84.2	0.097	66.6	0.165	-66.7
1.2	0.244	-176.3	5.536	81.9	0.104	66.5	0.150	-69.6
1.3	0.249	-180.0	5.107	79.9	0.112	65.9	0.145	-71.6
1.4	0.257	175.3	4.743	77.5	0.119	65.4	0.131	-74.2
1.5	0.259	171.4	4.455	75.9	0.127	65.2	0.129	-75.7
1.6	0.266	167.0	4.165	73.9	0.134	64.7	0.115	-78.5
1.7	0.274	164.7	3.935	72.4	0.141	63.9	0.113	-80.4
1.8	0.280	159.9	3.725	70.3	0.148	63.5	0.101	-83.7
1.9	0.278	158.4	3.548	68.8	0.155	62.9	0.100	-87.5
2.0	0.289	156.1	3.351	67.0	0.163	62.2	0.088	-91.1
2.1	0.297	154.8	3.206	65.5	0.170	61.5	0.088	-96.2
2.2	0.302	153.4	3.088	64.2	0.177	60.9	0.081	-99.8
2.3	0.305	151.8	2.964	62.1	0.184	60.2	0.082	-105.2
2.4	0.310	149.1	2.856	61.3	0.190	59.4	0.077	-107.6
2.5	0.318	148.0	2.733	59.9	0.197	58.8	0.079	-113.3
2.6	0.326	146.0	2.632	58.0	0.204	57.8	0.075	-115.0
2.7	0.328	144.7	2.564	56.9	0.211	56.9	0.076	-120.0
2.8	0.334	143.0	2.468	55.3	0.217	55.9	0.071	-121.5
2.9	0.336	142.0	2.397	54.2	0.225	55.4	0.072	-126.4
3.0	0.338	139.7	2.316	52.8	0.231	54.7	0.066	-130.2
4.0	0.387	126.6	1.762	38.8	0.292	47.4	0.095	-172.2
5.0	0.474	116.2	1.478	26.7	0.347	37.7	0.141	138.8

PACKAGE DIMENSIONS

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



(Bottom View)

PIN CONNECTIONS

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

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