NEC

NPN SILICON RF TRANSISTOR
2SC5652

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

FEATURES

- 1006 package employed (1.0 × 0.6 × 0.5 mm)
- NF = 1.5 dB TYP., $|S_{21e}|^2$ = 8.5 dB TYP. @ V_{CE} = 3 V, I_C = 10 mA, f = 2 GHz

ORDERING INFORMATION

Part Number	Quantity	Supplying Form
2SC5652	50 pcs (Non reel)	• 8 mm wide paper carrier taping
2SC5652-T1	10 kpcs/reel	• Pin 3 (Collector) face the perforation side of the tape

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

ABSOLUTE MAXIMUM RATINGS (T_A = +25°C)

Parameter	Symbol	Ratings	Unit
Collector to Base Voltage	V_{CBO}	9	V
Collector to Emitter Voltage	V_{CEO}	6	V
Emitter to Base Voltage	V_{EBO}	2	V
Collector Current	I_C	30	mA
Total Power Dissipation	P_{tot} Note	150	mW
Junction Temperature	T_j	150	°C
Storage Temperature	T_{stg}	−65 to +150	°C

Note Mounted on 1.08 cm^2 × 1.0 mm (t) glass epoxy substrate

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

Document No. P15245EJ1V0DS00 (1st edition)
Date Published December 2000 NS CP(K)
Printed in Japan

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_{BE} = 1 V, I_C = 0 mA	–	–	100	nA
DC Current Gain	h_{FE} Note 1	V_{CE} = 3 V, I_C = 10 mA	75	–	140	–
RF Characteristics						
Gain Bandwidth Product	f_T	V_{CE} = 3 V, I_C = 10 mA, f = 2 GHz	10.0	12.0	–	GHz
Insertion Power Gain	$\|S_{21e}\|^2$	V_{CE} = 3 V, I_C = 10 mA, f = 2 GHz	7.0	8.5	–	dB
Noise Figure	NF	V_{CE} = 3 V, I_C = 10 mA, f = 2 GHz, $Z_S = Z_{opt}$	–	1.5	2.5	dB
Reverse Transfer Capacitance	C_{re} Note 2	V_{CB} = 3 V, I_E = 0 mA, f = 1 MHz	–	0.4	0.7	pF

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

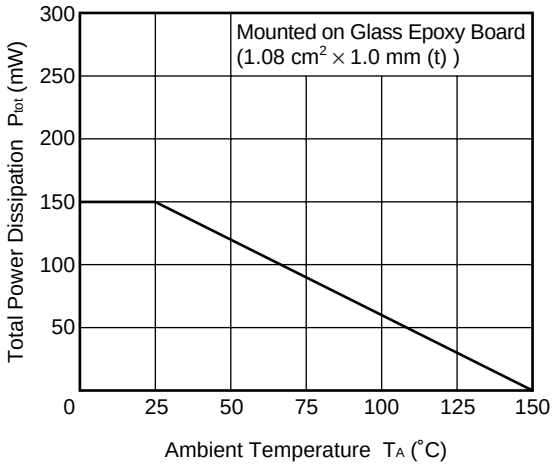
2. Collector to base capacitance measured using capacitance meter (self-balancing bridge method) when the emitter is connected to the guard pin

h_{FE} CLASSIFICATION

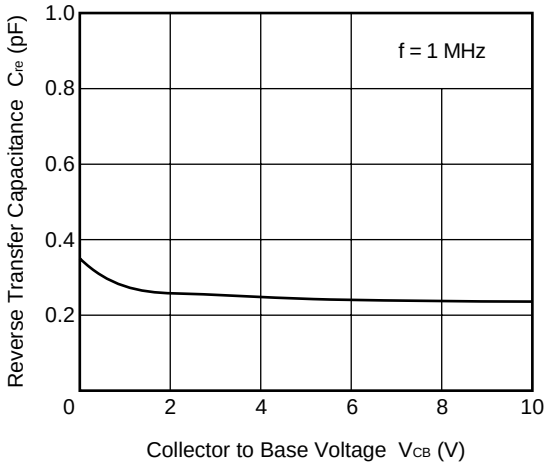
Rank	EB	FB
Marking	E	
h_{FE} Value	75 to 110	95 to 140

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

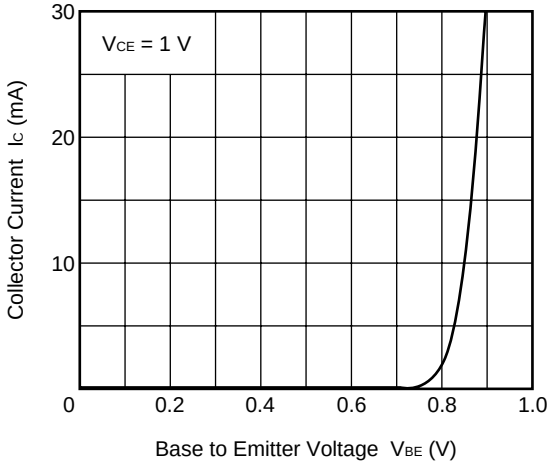
TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE



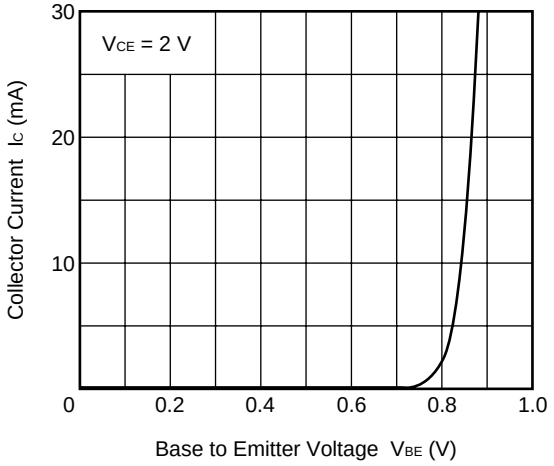
REVERSE TRANSFER CAPACITANCE vs. COLLECTOR TO BASE VOLTAGE



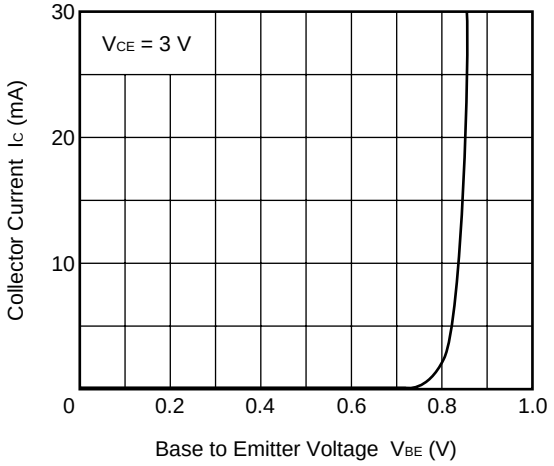
COLLECTOR CURRENT vs. BASE TO EMITTER VOLTAGE



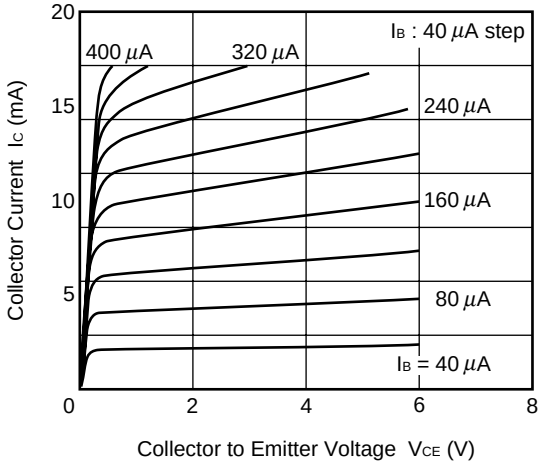
COLLECTOR CURRENT vs. BASE TO EMITTER VOLTAGE



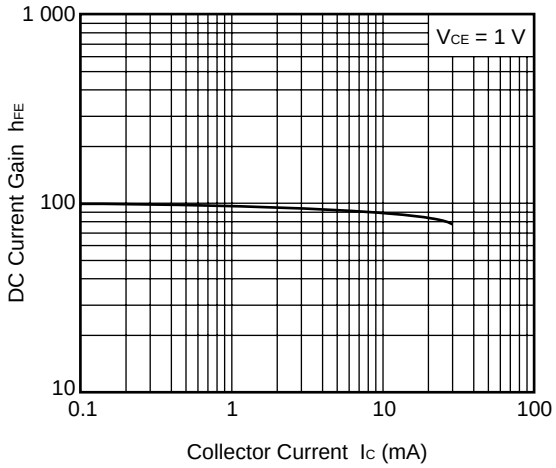
COLLECTOR CURRENT vs. BASE TO EMITTER VOLTAGE



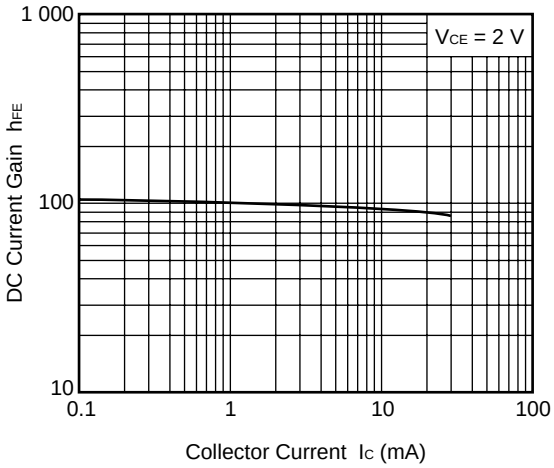
COLLECTOR CURRENT vs. COLLECTOR TO EMITTER VOLTAGE



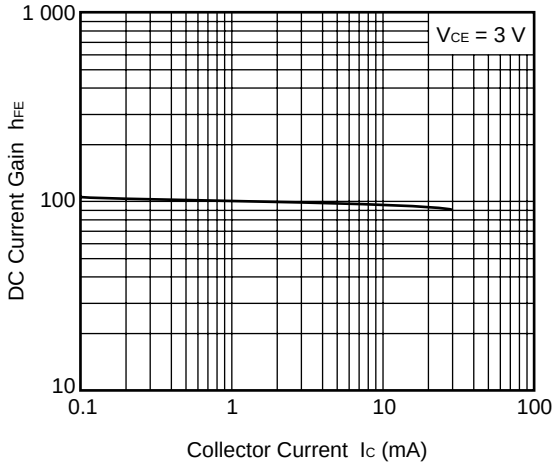
DC CURRENT GAIN vs.
COLLECTOR CURRENT



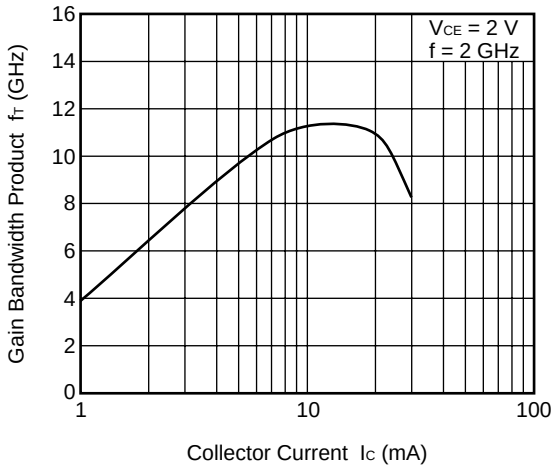
DC CURRENT GAIN vs.
COLLECTOR CURRENT



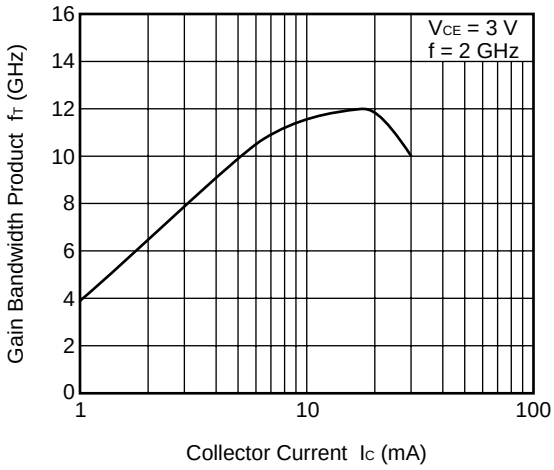
DC CURRENT GAIN vs.
COLLECTOR CURRENT



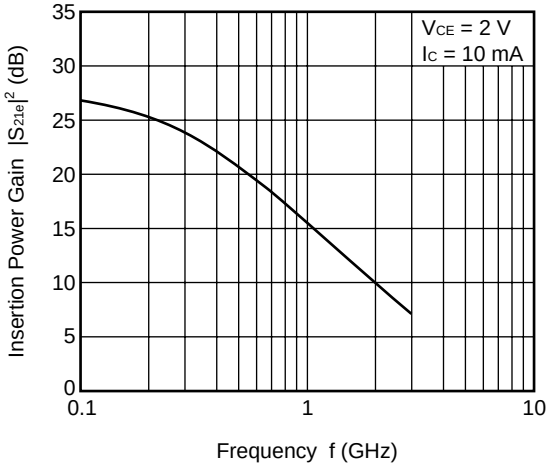
GAIN BANDWIDTH PRODUCT vs. COLLECTOR CURRENT



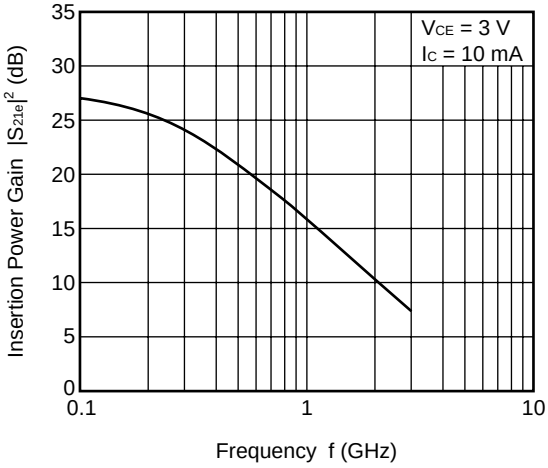
GAIN BANDWIDTH PRODUCT vs. COLLECTOR CURRENT



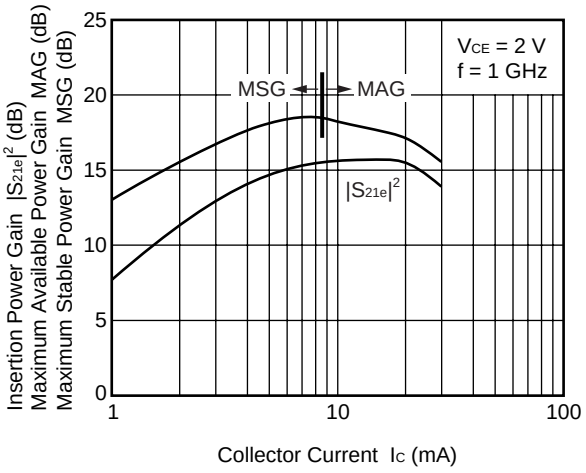
INSERTION POWER GAIN vs. FREQUENCY



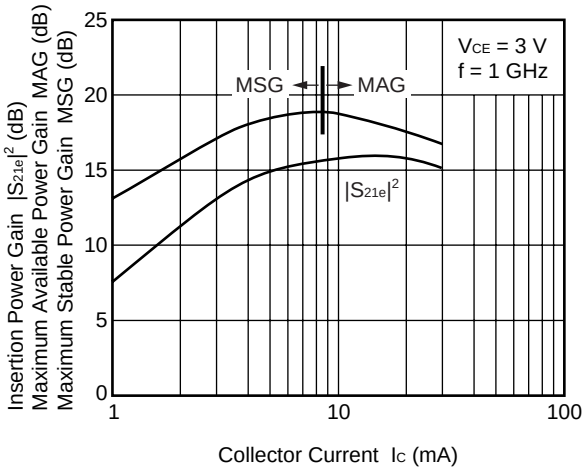
INSERTION POWER GAIN vs. FREQUENCY



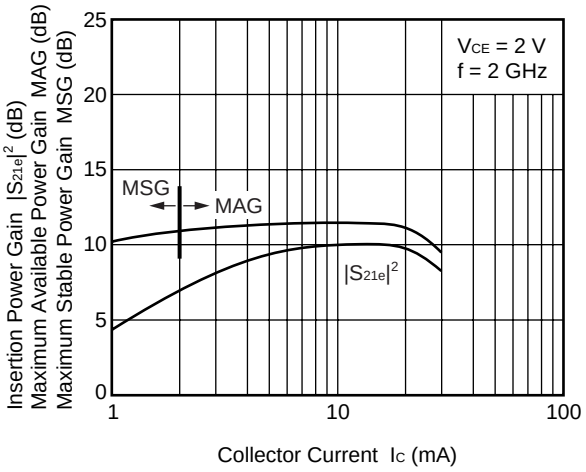
INSERTION POWER GAIN, MAG, MSG
vs. COLLECTOR CURRENT



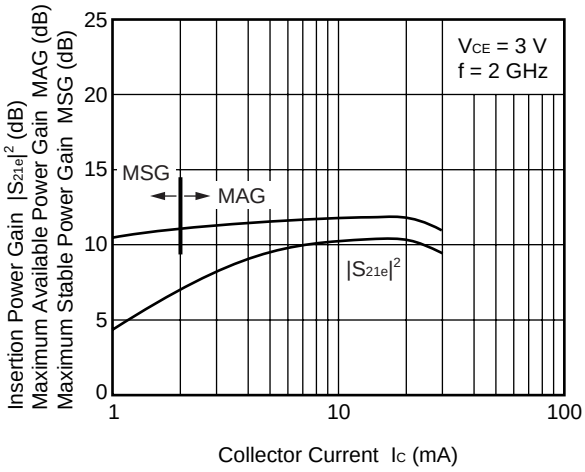
INSERTION POWER GAIN, MAG, MSG
vs. COLLECTOR CURRENT



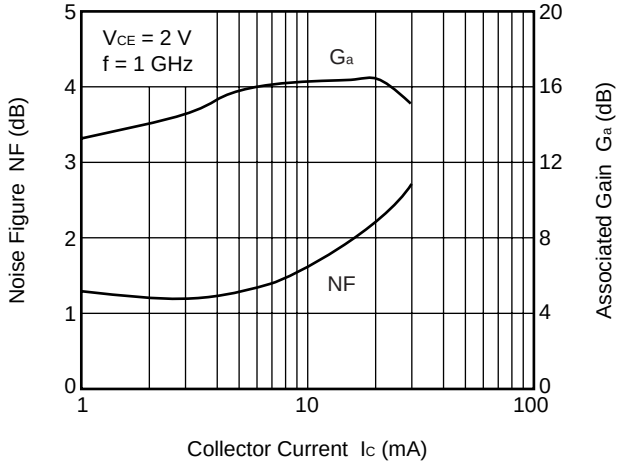
INSERTION POWER GAIN, MAG, MSG
vs. COLLECTOR CURRENT



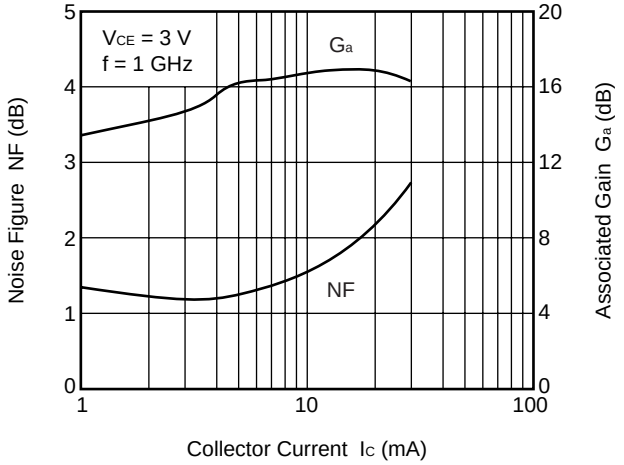
INSERTION POWER GAIN, MAG, MSG
vs. COLLECTOR CURRENT



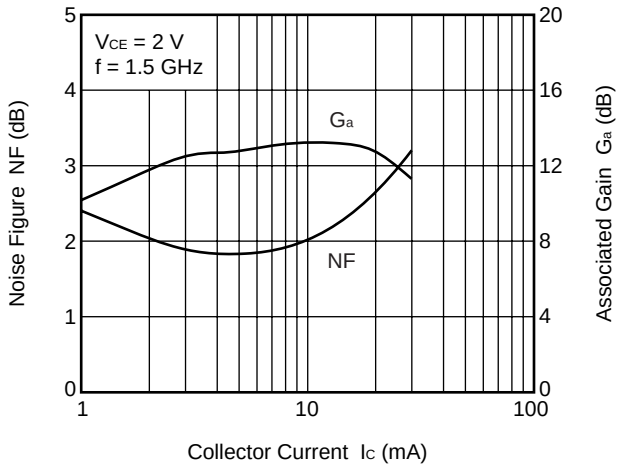
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



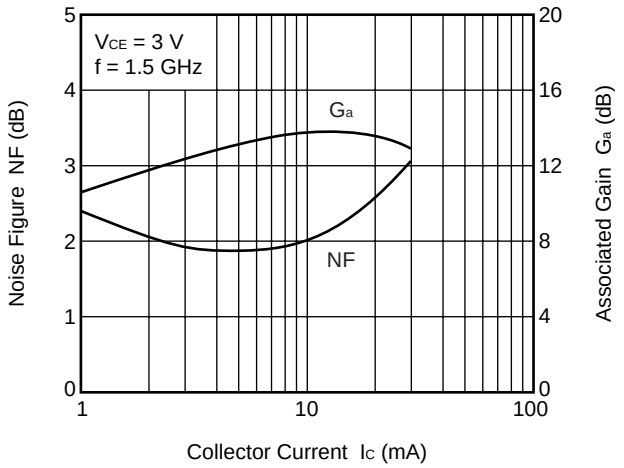
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



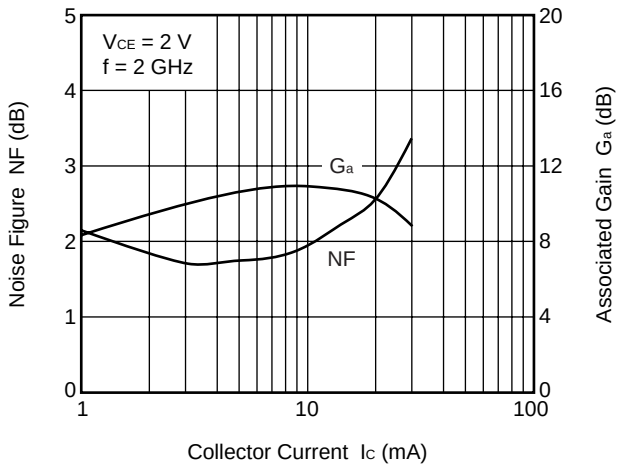
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



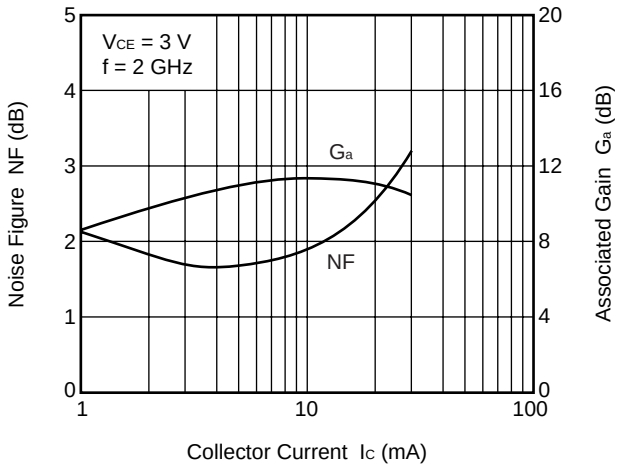
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



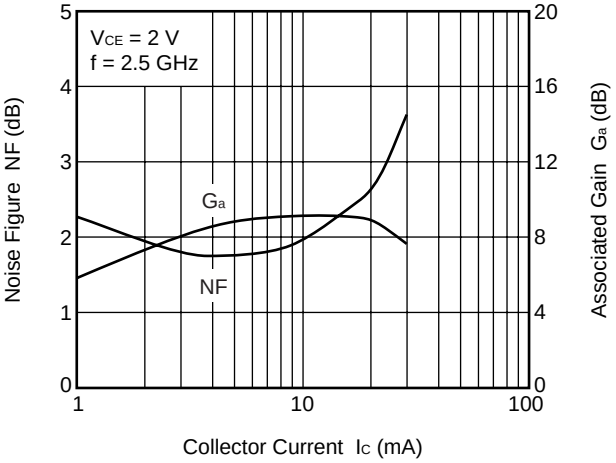
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



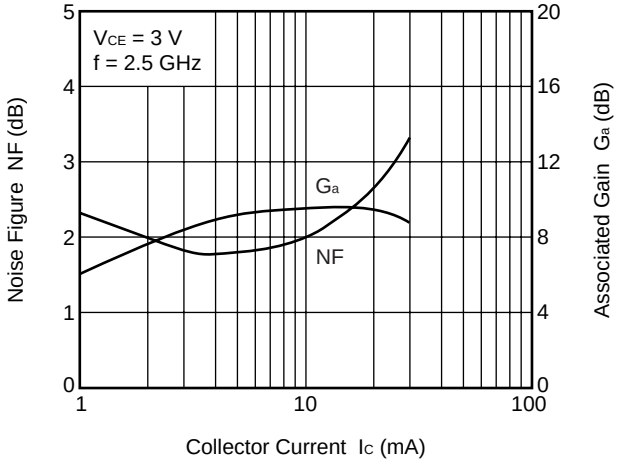
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



NOISE FIGURE, ASSOCIATED GAIN
vs. COLLECTOR CURRENT



NOISE FIGURE, ASSOCIATED GAIN
vs. COLLECTOR CURRENT



Remark The graphs indicate nominal characteristics.

S-PARAMETERS

Note When $K \geq 1$, the MAG (Maximum Available Gain) is used. $MAG = \left|\frac{S_{21}}{S_{12}}\right| (K - \sqrt{(K^2 - 1)})$

When $K < 1$, the MSG (Maximum Stable Gain) is used. $MSG = \left|\frac{S_{21}}{S_{12}}\right|$

V_{CE} = 2 V, I_C = 1 mA, Z_O = 50 Ω

Frequency	S_{11}		S_{21}		S_{12}		S_{22}		K	MAG/MSG Note
(GHz)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)		(dB)
0.1	0.964	−6.3	3.332	171.3	0.018	88.0	0.998	−3.3	0.050	22.76
0.2	0.950	−14.2	3.240	165.4	0.034	80.8	0.990	−6.6	0.113	19.80
0.3	0.930	−20.9	3.115	159.9	0.050	76.5	0.972	−9.7	0.147	17.97
0.4	0.915	−27.8	3.070	153.9	0.064	71.9	0.954	−13.0	0.187	16.79
0.5	0.888	−34.7	2.984	147.6	0.078	67.8	0.932	−16.0	0.233	15.85
0.6	0.856	−40.5	2.860	141.7	0.089	64.5	0.908	−18.7	0.281	15.05
0.7	0.829	−46.0	2.763	136.3	0.100	61.2	0.881	−21.2	0.331	14.42
0.8	0.793	−51.4	2.648	131.7	0.108	58.5	0.857	−23.5	0.375	13.88
0.9	0.762	−56.5	2.522	127.2	0.116	56.0	0.836	−25.5	0.416	13.37
1.0	0.735	−61.0	2.410	122.9	0.123	53.9	0.815	−27.4	0.460	12.94
1.1	0.714	−65.3	2.302	119.0	0.128	52.0	0.794	−29.0	0.500	12.54
1.2	0.685	−69.6	2.222	115.3	0.132	50.3	0.777	−30.4	0.546	12.26
1.3	0.662	−73.3	2.120	111.6	0.136	49.0	0.765	−31.7	0.587	11.92
1.4	0.640	−76.5	2.042	108.5	0.139	48.0	0.751	−32.9	0.630	11.67
1.5	0.618	−79.9	1.963	105.7	0.142	47.1	0.739	−33.7	0.670	11.41
1.6	0.602	−83.0	1.893	102.6	0.145	46.5	0.728	−34.5	0.710	11.17
1.7	0.583	−85.7	1.816	100.0	0.147	46.0	0.720	−35.2	0.752	10.92
1.8	0.562	−88.3	1.794	97.7	0.149	45.9	0.706	−36.0	0.791	10.80
1.9	0.547	−91.2	1.707	95.2	0.151	45.5	0.702	−36.4	0.827	10.52
2.0	0.526	−93.5	1.656	92.9	0.154	45.7	0.693	−36.7	0.874	10.32
2.1	0.509	−96.0	1.623	90.2	0.156	46.1	0.685	−37.1	0.907	10.17
2.2	0.492	−98.4	1.588	88.2	0.157	46.6	0.672	−37.6	0.955	10.06
2.3	0.477	−101.1	1.558	85.9	0.158	47.3	0.665	−38.0	0.987	9.94
2.4	0.461	−103.1	1.513	84.1	0.159	47.6	0.656	−38.4	1.035	8.63
2.5	0.442	−106.0	1.498	81.9	0.161	48.2	0.643	−39.1	1.073	8.03
2.6	0.427	−108.6	1.464	80.1	0.163	48.4	0.632	−40.0	1.117	7.46
2.7	0.413	−111.3	1.441	77.8	0.164	49.1	0.626	−41.0	1.141	7.15
2.8	0.398	−114.2	1.420	76.2	0.166	49.9	0.618	−41.7	1.173	6.81
2.9	0.385	−117.5	1.393	74.7	0.168	50.6	0.606	−42.1	1.208	6.43
3.0	0.370	−120.2	1.361	72.9	0.169	51.3	0.592	−43.7	1.263	5.97
4.0	0.329	−156.4	1.170	54.8	0.214	61.7	0.504	−56.0	1.312	4.03
5.0	0.344	−173.4	1.034	42.0	0.289	65.8	0.409	−74.9	1.239	2.60

V_{CE} = 2 V, I_C = 3 mA, Z_O = 50 Ω

Frequency	S_{11}		S_{21}		S_{12}		S_{22}		K	MAG/MSG
(GHz)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)		(dB)
0.1	0.875	–12.8	9.545	166.3	0.017	80.3	0.986	–6.6	0.164	27.49
0.2	0.845	–24.0	8.966	156.8	0.031	77.3	0.950	–12.6	0.181	24.55
0.3	0.789	–34.5	8.280	147.6	0.044	70.8	0.895	–17.7	0.278	22.71
0.4	0.736	–44.1	7.720	139.3	0.055	66.2	0.842	–22.1	0.351	21.45
0.5	0.679	–53.3	7.078	131.6	0.064	62.9	0.789	–25.4	0.421	20.42
0.6	0.622	–60.3	6.463	124.9	0.072	60.3	0.741	–28.0	0.503	19.56
0.7	0.574	–66.4	5.924	119.2	0.078	58.9	0.696	–29.8	0.575	18.82
0.8	0.532	–71.8	5.463	114.7	0.083	57.8	0.658	–31.2	0.641	18.18
0.9	0.498	–77.0	5.015	111.0	0.088	57.2	0.630	–32.3	0.693	17.56
1.0	0.466	–81.3	4.641	107.0	0.093	57.1	0.605	–33.3	0.749	16.99
1.1	0.440	–85.0	4.298	103.7	0.097	56.9	0.585	–33.7	0.802	16.46
1.2	0.415	–88.7	4.043	100.7	0.101	57.0	0.568	–34.1	0.848	16.03
1.3	0.393	–91.6	3.780	97.6	0.105	57.4	0.556	–34.4	0.892	15.56
1.4	0.376	–94.2	3.565	95.1	0.109	57.9	0.545	–34.7	0.928	15.14
1.5	0.359	–96.6	3.363	93.0	0.113	58.4	0.537	–34.9	0.962	14.73
1.6	0.346	–98.5	3.195	90.7	0.118	58.9	0.531	–34.8	0.988	14.34
1.7	0.333	–100.4	3.032	88.7	0.122	59.5	0.525	–34.5	1.015	13.20
1.8	0.318	–102.2	2.910	86.8	0.126	60.1	0.517	–34.5	1.041	12.39
1.9	0.306	–104.1	2.767	85.0	0.131	60.4	0.515	–34.4	1.060	11.74
2.0	0.293	–106.0	2.653	83.2	0.137	61.2	0.510	–34.0	1.076	11.19
2.1	0.282	–107.0	2.556	81.1	0.142	61.8	0.504	–33.7	1.096	10.68
2.2	0.273	–108.7	2.474	79.6	0.146	62.6	0.499	–33.7	1.108	10.28
2.3	0.261	–110.8	2.396	77.7	0.151	63.2	0.493	–33.7	1.120	9.89
2.4	0.250	–112.3	2.310	76.2	0.156	63.6	0.488	–33.6	1.138	9.45
2.5	0.238	–114.2	2.254	74.7	0.162	64.0	0.479	–33.7	1.148	9.11
2.6	0.231	–116.6	2.184	73.3	0.167	64.0	0.470	–34.2	1.161	8.74
2.7	0.220	–118.4	2.128	71.6	0.172	64.4	0.466	–34.7	1.166	8.45
2.8	0.210	–121.0	2.079	70.2	0.178	64.8	0.459	–35.1	1.171	8.18
2.9	0.204	–123.5	2.022	69.2	0.183	64.9	0.451	–35.2	1.180	7.86
3.0	0.193	–127.0	1.966	67.7	0.189	65.0	0.440	–36.4	1.194	7.52
4.0	0.209	–163.5	1.608	53.5	0.258	65.7	0.355	–45.0	1.152	5.58
5.0	0.256	–174.3	1.388	41.8	0.331	62.1	0.267	–54.5	1.113	4.18

V_{CE} = 2 V, I_C = 5 mA, Z_O = 50 Ω

Frequency	S_{11}		S_{21}		S_{12}		S_{22}		K	MAG/MSG
(GHz)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)		(dB)
0.1	0.794	–17.1	14.282	162.6	0.017	82.5	0.972	–8.9	0.148	29.26
0.2	0.757	–31.4	12.936	150.3	0.029	74.4	0.908	–16.7	0.255	26.46
0.3	0.675	–43.5	11.477	139.5	0.040	68.1	0.828	–22.3	0.384	24.55
0.4	0.608	–54.3	10.249	130.6	0.049	64.7	0.754	–26.4	0.473	23.20
0.5	0.541	–63.4	9.054	122.7	0.056	62.3	0.691	–29.0	0.569	22.06
0.6	0.486	–70.5	8.030	116.5	0.062	61.7	0.639	–30.6	0.652	21.09
0.7	0.441	–76.8	7.204	111.2	0.068	61.3	0.595	–31.7	0.726	20.25
0.8	0.399	–81.9	6.512	107.1	0.073	61.4	0.561	–32.4	0.794	19.50
0.9	0.372	–86.3	5.901	103.7	0.078	61.8	0.537	–32.5	0.844	18.77
1.0	0.345	–90.2	5.415	100.4	0.084	62.2	0.517	–32.8	0.892	18.11
1.1	0.328	–93.6	4.983	97.5	0.089	62.6	0.499	–32.8	0.933	17.50
1.2	0.305	–96.6	4.634	95.1	0.093	63.1	0.488	–32.9	0.969	16.95
1.3	0.290	–99.1	4.308	92.3	0.099	63.7	0.480	–32.9	0.999	16.40
1.4	0.277	–101.0	4.034	90.2	0.104	64.3	0.473	–32.6	1.025	14.92
1.5	0.263	–103.0	3.798	88.4	0.109	64.8	0.469	–32.4	1.045	14.12
1.6	0.255	–104.4	3.596	86.3	0.114	65.3	0.466	–32.3	1.058	13.51
1.7	0.247	–105.5	3.399	84.7	0.120	65.6	0.464	–31.9	1.073	12.88
1.8	0.235	–107.0	3.239	83.0	0.126	66.2	0.461	–31.6	1.084	12.34
1.9	0.225	–108.1	3.082	81.3	0.131	66.4	0.460	–31.2	1.097	11.80
2.0	0.216	–109.2	2.949	79.8	0.138	66.8	0.456	–30.7	1.105	11.34
2.1	0.208	–110.2	2.838	77.9	0.144	67.2	0.453	–30.3	1.110	10.94
2.2	0.201	–111.6	2.732	76.5	0.149	67.7	0.450	–30.3	1.118	10.54
2.3	0.192	–113.0	2.633	75.0	0.155	68.0	0.447	–30.1	1.125	10.15
2.4	0.187	–113.6	2.538	73.7	0.161	68.0	0.442	–30.0	1.133	9.76
2.5	0.177	–115.8	2.471	72.2	0.167	68.2	0.436	–30.1	1.134	9.47
2.6	0.171	–117.9	2.388	71.0	0.174	68.1	0.429	–30.2	1.141	9.11
2.7	0.164	–119.0	2.326	69.6	0.179	68.1	0.424	–30.9	1.146	8.82
2.8	0.155	–121.9	2.263	68.2	0.186	68.2	0.419	–31.3	1.145	8.55
2.9	0.151	–124.1	2.201	67.3	0.192	68.0	0.411	–31.5	1.149	8.24
3.0	0.145	–127.2	2.133	66.0	0.198	67.9	0.402	–32.5	1.160	7.90
4.0	0.178	–166.2	1.726	53.2	0.271	66.3	0.317	–40.0	1.119	5.94
5.0	0.235	–174.9	1.486	42.2	0.343	61.2	0.235	–45.5	1.086	4.58

V_{CE} = 2 V, I_C = 7 mA, Z_O = 50 Ω

Frequency	S_{11}		S_{21}		S_{12}		S_{22}		K	MAG/MSG
(GHz)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)		(dB)
0.1	0.735	–20.5	18.019	159.6	0.016	82.0	0.956	–11.0	0.174	30.63
0.2	0.675	–36.9	15.830	145.2	0.027	72.3	0.870	–19.6	0.329	27.63
0.3	0.581	–50.2	13.497	133.7	0.037	68.1	0.771	–25.0	0.464	25.63
0.4	0.514	–61.1	11.686	124.6	0.045	64.9	0.690	–28.5	0.573	24.15
0.5	0.447	–70.4	10.112	117.3	0.052	63.9	0.625	–30.4	0.670	22.93
0.6	0.397	–77.5	8.839	111.3	0.057	63.6	0.576	–31.1	0.755	21.87
0.7	0.357	–83.1	7.821	106.5	0.063	64.2	0.537	–31.5	0.826	20.93
0.8	0.325	–88.2	7.029	102.9	0.069	64.7	0.507	–31.7	0.880	20.10
0.9	0.301	–92.5	6.330	99.9	0.074	65.5	0.487	–31.6	0.924	19.30
1.0	0.279	–96.1	5.777	96.8	0.080	65.8	0.470	–31.5	0.965	18.60
1.1	0.265	–98.8	5.292	94.2	0.085	66.4	0.457	–31.3	0.996	17.92
1.2	0.250	–101.6	4.906	91.9	0.091	66.8	0.449	–31.2	1.022	16.42
1.3	0.235	–104.2	4.544	89.4	0.097	67.4	0.444	–31.0	1.045	15.43
1.4	0.224	–105.3	4.262	87.6	0.102	67.9	0.439	–30.7	1.061	14.69
1.5	0.216	–107.1	3.996	85.9	0.108	68.3	0.436	–30.5	1.075	14.00
1.6	0.208	–108.5	3.777	84.0	0.114	68.6	0.436	–30.3	1.081	13.46
1.7	0.202	–108.2	3.570	82.5	0.120	68.9	0.435	–29.7	1.092	12.88
1.8	0.192	–109.5	3.395	80.9	0.126	69.2	0.433	–29.3	1.100	12.37
1.9	0.186	–110.6	3.226	79.4	0.133	69.3	0.434	–29.0	1.105	11.89
2.0	0.176	–111.1	3.082	77.9	0.140	69.5	0.433	–28.5	1.108	11.44
2.1	0.172	–111.8	2.964	76.2	0.146	69.8	0.431	–28.1	1.110	11.06
2.2	0.166	–113.2	2.848	75.1	0.151	70.0	0.427	–28.0	1.117	10.66
2.3	0.158	–113.8	2.744	73.5	0.158	70.2	0.426	–27.9	1.119	10.30
2.4	0.153	–114.8	2.642	72.3	0.164	70.0	0.422	–27.8	1.125	9.92
2.5	0.147	–115.7	2.565	70.9	0.171	70.0	0.417	–27.9	1.126	9.60
2.6	0.142	–118.7	2.479	69.8	0.178	69.8	0.411	–28.0	1.128	9.27
2.7	0.136	–119.1	2.411	68.4	0.183	69.7	0.406	–28.5	1.133	8.97
2.8	0.128	–122.5	2.345	67.3	0.190	69.6	0.401	–29.1	1.131	8.70
2.9	0.126	–125.6	2.278	66.2	0.197	69.4	0.393	–29.2	1.135	8.40
3.0	0.122	–128.3	2.212	65.1	0.203	69.1	0.385	–30.3	1.140	8.09
4.0	0.164	–168.5	1.778	52.7	0.277	66.5	0.300	–37.2	1.105	6.11
5.0	0.227	–175.3	1.524	42.2	0.349	60.9	0.223	–40.6	1.076	4.73

V_{CE} = 2 V, I_C = 10 mA, Z_O = 50 Ω

Frequency	S_{11}		S_{21}		S_{12}		S_{22}		K	MAG/MSG
(GHz)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)		(dB)
0.1	0.666	–24.3	22.220	156.0	0.015	78.9	0.935	–13.2	0.247	31.60
0.2	0.582	–43.5	18.687	139.6	0.026	70.6	0.821	–22.3	0.415	28.65
0.3	0.482	–57.4	15.332	127.7	0.034	67.8	0.709	–27.2	0.565	26.52
0.4	0.417	–68.7	12.871	119.0	0.041	66.2	0.626	–29.7	0.679	24.98
0.5	0.361	–78.0	10.922	112.1	0.048	66.2	0.566	–30.5	0.770	23.61
0.6	0.319	–84.4	9.429	106.8	0.053	66.5	0.522	–30.7	0.849	22.47
0.7	0.286	–90.0	8.274	102.4	0.060	67.4	0.488	–30.5	0.908	21.43
0.8	0.259	–95.1	7.380	99.1	0.065	68.2	0.463	–30.1	0.954	20.52
0.9	0.242	–99.3	6.609	96.5	0.071	69.1	0.448	–29.7	0.988	19.66
1.0	0.225	–103.0	6.019	93.7	0.078	69.5	0.434	–29.6	1.016	18.12
1.1	0.214	–105.3	5.517	91.4	0.084	69.9	0.425	–29.2	1.036	17.01
1.2	0.203	–107.8	5.091	89.3	0.090	70.2	0.418	–29.1	1.057	16.09
1.3	0.189	–109.7	4.718	87.0	0.096	70.6	0.417	–28.8	1.073	15.27
1.4	0.182	–111.0	4.411	85.4	0.102	71.2	0.414	–28.5	1.083	14.61
1.5	0.174	–112.3	4.123	83.8	0.108	71.2	0.413	–28.2	1.094	13.94
1.6	0.170	–113.0	3.893	82.0	0.115	71.5	0.414	–27.9	1.096	13.42
1.7	0.166	–112.8	3.681	80.6	0.121	71.4	0.415	–27.6	1.101	12.90
1.8	0.158	–113.4	3.493	79.2	0.128	71.7	0.414	–27.2	1.105	12.40
1.9	0.152	–114.1	3.315	77.8	0.134	71.6	0.416	–27.0	1.108	11.93
2.0	0.148	–113.8	3.164	76.5	0.141	71.6	0.415	–26.4	1.110	11.49
2.1	0.143	–114.3	3.035	74.7	0.148	71.8	0.415	–26.1	1.111	11.10
2.2	0.139	–115.3	2.923	73.7	0.154	71.9	0.412	–26.0	1.113	10.74
2.3	0.133	–115.7	2.812	72.2	0.161	71.9	0.411	–25.9	1.115	10.37
2.4	0.129	–116.5	2.708	71.1	0.167	71.6	0.409	–25.7	1.119	10.01
2.5	0.123	–119.1	2.628	69.7	0.174	71.6	0.403	–25.9	1.117	9.71
2.6	0.121	–120.9	2.537	68.7	0.181	71.1	0.397	–26.0	1.121	9.36
2.7	0.115	–121.2	2.462	67.3	0.187	71.0	0.393	–26.7	1.125	9.05
2.8	0.108	–125.2	2.397	66.3	0.194	70.7	0.388	–27.1	1.122	8.80
2.9	0.104	–127.5	2.326	65.3	0.201	70.4	0.381	–27.2	1.126	8.49
3.0	0.103	–131.4	2.255	64.2	0.207	70.0	0.373	–28.4	1.130	8.18
4.0	0.157	–171.4	1.812	52.4	0.281	66.8	0.289	–34.9	1.094	6.22
5.0	0.220	–177.0	1.550	42.0	0.353	60.8	0.214	–36.7	1.070	4.81

V_{CE} = 2 V, I_C = 20 mA, Z_O = 50 Ω

Frequency	S_{11}		S_{21}		S_{12}		S_{22}		K	MAG/MSG
(GHz)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)		(dB)
0.1	0.495	–35.3	29.293	147.9	0.015	78.2	0.871	–17.5	0.359	33.01
0.2	0.396	–59.9	22.267	128.8	0.022	70.2	0.711	–26.1	0.596	30.02
0.3	0.312	–76.8	17.007	117.4	0.029	69.9	0.595	–28.5	0.769	27.71
0.4	0.268	–89.2	13.678	109.9	0.036	70.1	0.525	–28.7	0.866	25.82
0.5	0.237	–99.6	11.279	104.3	0.042	71.0	0.480	–28.0	0.937	24.25
0.6	0.210	–107.5	9.584	99.7	0.049	72.0	0.449	–27.0	0.993	22.93
0.7	0.194	–112.6	8.298	96.1	0.056	73.2	0.427	–26.2	1.034	20.62
0.8	0.178	–117.9	7.364	93.4	0.062	73.7	0.412	–25.7	1.061	19.24
0.9	0.172	–121.9	6.574	91.4	0.069	74.4	0.403	–25.3	1.079	18.09
1.0	0.164	–126.1	5.961	88.9	0.076	74.7	0.396	–25.1	1.090	17.14
1.1	0.159	–127.4	5.440	87.0	0.082	74.8	0.391	–24.9	1.104	16.25
1.2	0.153	–129.3	5.010	85.2	0.089	75.0	0.389	–25.0	1.113	15.47
1.3	0.148	–131.9	4.629	83.0	0.095	75.1	0.390	–24.8	1.121	14.75
1.4	0.142	–133.6	4.325	81.6	0.102	75.2	0.389	–24.7	1.124	14.14
1.5	0.135	–133.7	4.047	80.2	0.108	75.1	0.391	–24.6	1.130	13.53
1.6	0.135	–133.7	3.813	78.7	0.115	75.0	0.393	–24.5	1.128	13.02
1.7	0.130	–133.8	3.600	77.4	0.122	75.0	0.396	–24.4	1.129	12.51
1.8	0.123	–134.2	3.411	76.0	0.129	74.9	0.397	–24.1	1.131	12.02
1.9	0.122	–134.5	3.241	74.7	0.136	74.6	0.400	–24.0	1.128	11.59
2.0	0.117	–135.3	3.091	73.5	0.143	74.5	0.400	–23.7	1.128	11.17
2.1	0.113	–135.4	2.965	71.9	0.150	74.5	0.401	–23.5	1.126	10.79
2.2	0.110	–135.5	2.852	70.9	0.157	74.5	0.400	–23.5	1.127	10.43
2.3	0.105	–137.1	2.742	69.4	0.164	74.3	0.399	–23.5	1.127	10.07
2.4	0.102	–137.6	2.638	68.4	0.170	73.9	0.396	–23.5	1.130	9.71
2.5	0.100	–139.9	2.559	67.2	0.178	73.7	0.392	–23.6	1.127	9.42
2.6	0.099	–142.5	2.473	66.1	0.185	73.1	0.387	–23.9	1.126	9.10
2.7	0.095	–143.5	2.397	64.9	0.191	73.0	0.382	–24.5	1.131	8.78
2.8	0.091	–148.2	2.326	63.8	0.199	72.6	0.378	–25.2	1.129	8.50
2.9	0.092	–151.0	2.264	63.0	0.205	72.1	0.370	–25.4	1.130	8.23
3.0	0.092	–154.6	2.188	61.8	0.212	71.6	0.362	–26.5	1.137	7.89
4.0	0.166	176.1	1.757	50.4	0.288	67.6	0.277	–33.5	1.097	5.95
5.0	0.231	174.9	1.505	40.3	0.362	61.1	0.202	–35.2	1.069	4.58

V_{CE} = 3 V, I_C = 1 mA, Z_O = 50 Ω

Frequency	S_{11}		S_{21}		S_{12}		S_{22}		K	MAG/MSG
(GHz)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)		(dB)
0.1	0.963	–6.0	3.249	171.7	0.018	83.0	0.999	–3.2	0.134	22.45
0.2	0.948	–13.7	3.179	165.7	0.032	81.4	0.991	–6.2	0.109	19.99
0.3	0.932	–20.2	3.058	160.5	0.047	76.4	0.975	–9.2	0.153	18.18
0.4	0.918	–26.7	3.011	154.7	0.060	72.7	0.957	–12.1	0.185	17.00
0.5	0.892	–33.4	2.929	148.5	0.073	68.6	0.938	–15.0	0.229	16.03
0.6	0.862	–39.1	2.817	142.7	0.084	65.2	0.915	–17.7	0.280	15.24
0.7	0.836	–44.8	2.725	137.3	0.094	62.0	0.891	–20.0	0.324	14.61
0.8	0.803	–49.8	2.617	132.8	0.102	59.3	0.867	–22.3	0.368	14.07
0.9	0.772	–54.9	2.501	128.4	0.110	57.0	0.849	–24.2	0.404	13.57
1.0	0.743	–59.4	2.394	124.1	0.116	54.9	0.826	–26.0	0.455	13.16
1.1	0.723	–63.8	2.288	120.2	0.121	53.0	0.809	–27.6	0.492	12.75
1.2	0.694	–67.8	2.210	116.6	0.125	51.4	0.792	–29.0	0.538	12.47
1.3	0.672	–71.2	2.114	112.8	0.129	50.0	0.781	–30.2	0.581	12.13
1.4	0.648	–74.7	2.040	109.6	0.132	49.1	0.766	–31.3	0.624	11.88
1.5	0.628	–78.1	1.959	106.9	0.135	48.2	0.755	–32.3	0.662	11.62
1.6	0.609	–81.1	1.886	103.9	0.138	47.7	0.746	–33.0	0.702	11.37
1.7	0.590	–83.7	1.812	101.3	0.140	47.1	0.738	–33.6	0.746	11.13
1.8	0.571	–86.5	1.790	99.0	0.142	46.9	0.725	–34.3	0.779	11.01
1.9	0.553	–89.0	1.707	96.6	0.144	46.6	0.720	–34.9	0.822	10.74
2.0	0.535	–91.6	1.655	94.3	0.147	47.0	0.712	–35.2	0.860	10.53
2.1	0.518	–93.9	1.621	91.6	0.148	47.3	0.703	–35.5	0.901	10.39
2.2	0.498	–96.5	1.588	89.8	0.149	47.9	0.694	–35.9	0.941	10.28
2.3	0.483	–98.7	1.556	87.4	0.150	48.5	0.685	–36.3	0.982	10.16
2.4	0.467	–101.1	1.513	85.6	0.152	48.9	0.677	–36.7	1.026	9.01
2.5	0.449	–103.6	1.496	83.3	0.153	49.5	0.664	–37.4	1.067	8.31
2.6	0.434	–106.2	1.461	81.5	0.155	49.8	0.655	–38.3	1.110	7.73
2.7	0.416	–108.9	1.440	79.3	0.156	50.7	0.649	–39.1	1.138	7.39
2.8	0.400	–111.7	1.420	77.6	0.158	51.6	0.641	–39.9	1.168	7.06
2.9	0.385	–115.0	1.392	76.3	0.160	52.4	0.629	–40.1	1.211	6.62
3.0	0.373	–117.8	1.362	74.4	0.161	53.2	0.615	–41.5	1.264	6.19
4.0	0.322	–153.7	1.177	56.5	0.205	64.3	0.534	–53.3	1.301	4.29
5.0	0.338	–171.5	1.039	43.7	0.281	68.7	0.441	–71.3	1.219	2.85

V_{CE} = 3 V, I_C = 3 mA, Z_O = 50 Ω

Frequency	S_{11}		S_{21}		S_{12}		S_{22}		K	MAG/MSG
(GHz)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)		(dB)
0.1	0.872	–11.8	9.466	166.4	0.016	82.1	0.989	–6.1	0.147	27.66
0.2	0.852	–22.9	8.899	157.5	0.029	76.9	0.955	–11.7	0.189	24.85
0.3	0.795	–33.1	8.234	148.5	0.042	71.6	0.905	–16.5	0.273	22.92
0.4	0.750	–42.6	7.706	140.4	0.052	67.1	0.854	–20.7	0.340	21.70
0.5	0.689	–51.1	7.097	132.7	0.061	63.6	0.804	–23.8	0.419	20.67
0.6	0.635	–57.9	6.501	126.1	0.068	61.2	0.757	–26.1	0.498	19.80
0.7	0.590	–64.2	5.968	120.5	0.074	59.7	0.715	–28.0	0.564	19.07
0.8	0.543	–69.3	5.513	115.9	0.079	58.6	0.681	–29.4	0.630	18.42
0.9	0.507	–74.4	5.071	111.9	0.084	58.2	0.653	–30.5	0.684	17.80
1.0	0.474	–78.5	4.693	108.0	0.089	57.9	0.627	–31.3	0.744	17.24
1.1	0.449	–82.1	4.362	104.7	0.093	57.8	0.606	–32.1	0.796	16.73
1.2	0.424	–85.5	4.094	101.7	0.096	57.7	0.591	–32.4	0.841	16.28
1.3	0.401	–88.3	3.834	98.7	0.100	58.2	0.580	–32.7	0.883	15.82
1.4	0.381	–90.8	3.616	96.3	0.104	58.7	0.570	–33.0	0.920	15.40
1.5	0.364	–93.4	3.416	94.1	0.108	59.2	0.561	–33.1	0.955	15.00
1.6	0.351	–95.5	3.245	91.7	0.112	59.8	0.556	–33.0	0.979	14.60
1.7	0.338	–97.2	3.079	89.6	0.117	60.4	0.550	–33.0	1.007	13.70
1.8	0.321	–98.9	2.953	87.9	0.121	60.9	0.542	–32.9	1.033	12.77
1.9	0.309	–100.7	2.808	86.0	0.125	61.4	0.541	–32.7	1.053	12.09
2.0	0.296	–101.7	2.695	84.2	0.131	62.1	0.535	–32.6	1.072	11.51
2.1	0.283	–103.3	2.597	82.0	0.135	62.9	0.531	–32.2	1.087	11.03
2.2	0.273	–105.0	2.514	80.6	0.140	63.8	0.525	–32.1	1.101	10.62
2.3	0.263	–106.7	2.431	79.0	0.144	64.4	0.520	–32.1	1.114	10.21
2.4	0.252	–107.8	2.347	77.5	0.149	64.7	0.515	–32.1	1.132	9.77
2.5	0.239	–109.7	2.288	75.8	0.154	65.3	0.506	–32.2	1.142	9.42
2.6	0.230	–111.6	2.217	74.5	0.160	65.4	0.499	–32.5	1.153	9.05
2.7	0.219	–113.2	2.162	72.7	0.165	65.9	0.493	–33.2	1.161	8.75
2.8	0.208	–115.8	2.110	71.5	0.170	66.2	0.489	–33.7	1.164	8.48
2.9	0.201	–118.0	2.054	70.4	0.175	66.4	0.480	–33.6	1.175	8.15
3.0	0.193	–121.7	1.996	69.0	0.181	66.5	0.470	–34.8	1.187	7.82
4.0	0.195	–159.3	1.635	54.9	0.249	67.7	0.388	–43.0	1.145	5.86
5.0	0.243	–170.9	1.416	43.3	0.322	64.4	0.305	–52.3	1.100	4.51

V_{CE} = 3 V, I_C = 5 mA, Z_O = 50 Ω

Frequency	S_{11}		S_{21}		S_{12}		S_{22}		K	MAG/MSG
(GHz)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)		(dB)
0.1	0.806	–15.5	14.217	162.9	0.016	83.9	0.973	–8.5	0.141	29.62
0.2	0.758	–30.0	12.986	151.0	0.028	74.7	0.916	–15.5	0.260	26.73
0.3	0.683	–41.7	11.536	140.4	0.038	69.5	0.839	–20.9	0.374	24.85
0.4	0.619	–52.3	10.350	131.4	0.047	65.6	0.770	–24.8	0.467	23.47
0.5	0.553	–61.0	9.182	123.7	0.053	63.3	0.708	–27.4	0.561	22.35
0.6	0.493	–67.7	8.163	117.4	0.060	62.5	0.658	–28.9	0.648	21.37
0.7	0.452	–73.3	7.328	112.1	0.065	62.1	0.617	–29.9	0.720	20.53
0.8	0.408	–78.6	6.643	108.1	0.070	62.2	0.584	–30.4	0.784	19.76
0.9	0.378	–82.8	6.025	104.8	0.075	62.5	0.561	–30.8	0.837	19.05
1.0	0.350	–86.5	5.521	101.3	0.080	63.0	0.539	–31.0	0.887	18.39
1.1	0.331	–89.4	5.089	98.4	0.085	63.3	0.524	–31.1	0.926	17.77
1.2	0.311	–92.6	4.725	96.0	0.089	63.9	0.512	–31.1	0.962	17.23
1.3	0.293	–94.5	4.388	93.2	0.094	64.4	0.505	–31.1	0.995	16.68
1.4	0.281	–96.8	4.130	91.0	0.099	65.1	0.498	–31.0	1.015	15.44
1.5	0.266	–98.5	3.881	89.2	0.104	65.6	0.492	–30.9	1.040	14.49
1.6	0.257	–99.9	3.672	87.3	0.110	66.1	0.491	–30.6	1.052	13.85
1.7	0.246	–100.6	3.474	85.6	0.115	66.5	0.490	–30.3	1.068	13.22
1.8	0.235	–101.7	3.312	83.8	0.120	67.0	0.485	–30.2	1.080	12.67
1.9	0.228	–103.2	3.146	82.2	0.126	67.2	0.486	–29.9	1.089	12.16
2.0	0.217	–103.5	3.009	80.8	0.132	67.7	0.482	–29.4	1.098	11.67
2.1	0.208	–104.6	2.895	78.8	0.138	68.2	0.480	–29.1	1.104	11.26
2.2	0.202	–105.2	2.789	77.6	0.143	68.7	0.476	–29.0	1.113	10.86
2.3	0.191	–106.6	2.693	76.0	0.149	69.0	0.474	–28.9	1.116	10.50
2.4	0.186	–107.7	2.591	74.7	0.154	69.2	0.469	–28.7	1.126	10.09
2.5	0.176	–109.0	2.522	73.2	0.160	69.4	0.463	–28.8	1.128	9.79
2.6	0.169	–111.1	2.440	72.1	0.166	69.2	0.455	–29.0	1.137	9.42
2.7	0.161	–111.5	2.371	70.6	0.172	69.4	0.452	–29.8	1.140	9.12
2.8	0.151	–114.6	2.309	69.4	0.178	69.5	0.448	–30.1	1.140	8.86
2.9	0.147	–116.6	2.243	68.5	0.184	69.3	0.439	–30.0	1.146	8.53
3.0	0.141	–119.7	2.174	67.2	0.190	69.2	0.431	–31.3	1.154	8.20
4.0	0.163	–160.6	1.764	54.5	0.262	68.1	0.350	–38.5	1.112	6.25
5.0	0.219	–170.0	1.518	43.6	0.333	63.3	0.272	–44.4	1.079	4.88

V_{CE} = 3 V, I_C = 7 mA, Z_O = 50 Ω

Frequency	S_{11}		S_{21}		S_{12}		S_{22}		K	MAG/MSG
(GHz)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)		(dB)
0.1	0.743	–18.3	17.979	160.0	0.015	79.7	0.961	–10.2	0.222	30.73
0.2	0.683	–34.7	15.880	146.1	0.026	73.9	0.880	–18.2	0.323	27.81
0.3	0.595	–47.6	13.619	134.7	0.035	68.7	0.787	–23.5	0.461	25.89
0.4	0.526	–58.5	11.860	125.7	0.043	65.8	0.710	–26.8	0.564	24.42
0.5	0.462	–67.1	10.286	118.4	0.049	64.4	0.647	–28.5	0.661	23.18
0.6	0.406	–73.7	9.014	112.4	0.055	64.4	0.599	–29.4	0.747	22.14
0.7	0.367	–79.2	7.999	107.5	0.061	64.6	0.560	–29.8	0.816	21.20
0.8	0.330	–83.6	7.192	103.7	0.066	65.2	0.531	–29.9	0.875	20.39
0.9	0.307	–87.7	6.480	100.8	0.071	65.9	0.511	–29.8	0.917	19.58
1.0	0.285	–91.3	5.907	97.6	0.077	66.5	0.495	–29.8	0.954	18.86
1.1	0.268	–93.7	5.422	95.1	0.082	67.1	0.482	–29.6	0.989	18.20
1.2	0.251	–96.6	5.025	92.8	0.087	67.5	0.473	–29.6	1.014	16.88
1.3	0.239	–98.5	4.670	90.3	0.093	68.0	0.468	–29.4	1.036	15.87
1.4	0.226	–99.4	4.368	88.4	0.098	68.6	0.464	–29.1	1.053	15.06
1.5	0.217	–101.1	4.089	86.8	0.104	68.9	0.461	–29.1	1.069	14.35
1.6	0.209	–102.3	3.871	84.9	0.110	69.3	0.461	–28.7	1.074	13.82
1.7	0.202	–102.4	3.656	83.4	0.115	69.6	0.460	–28.4	1.085	13.23
1.8	0.192	–103.1	3.478	81.8	0.121	70.0	0.458	–28.0	1.094	12.71
1.9	0.185	–103.6	3.302	80.2	0.127	70.1	0.460	–27.8	1.098	12.23
2.0	0.178	–104.0	3.155	78.9	0.134	70.3	0.459	–27.3	1.102	11.78
2.1	0.170	–104.1	3.026	77.2	0.140	70.7	0.457	–27.0	1.106	11.36
2.2	0.167	–105.4	2.914	76.0	0.146	71.0	0.454	–26.9	1.109	11.00
2.3	0.158	–106.2	2.811	74.4	0.152	71.1	0.453	–26.8	1.112	10.64
2.4	0.152	–106.4	2.702	73.3	0.158	71.1	0.449	–26.7	1.120	10.24
2.5	0.145	–108.0	2.626	72.0	0.164	71.2	0.444	–26.8	1.119	9.95
2.6	0.140	–108.9	2.539	70.9	0.170	71.0	0.438	–26.9	1.124	9.59
2.7	0.134	–109.6	2.467	69.5	0.176	70.9	0.433	–27.4	1.128	9.29
2.8	0.126	–113.4	2.396	68.4	0.183	70.9	0.430	–27.9	1.125	9.03
2.9	0.121	–115.0	2.331	67.5	0.189	70.6	0.422	–28.0	1.130	8.72
3.0	0.117	–117.4	2.262	66.3	0.195	70.3	0.414	–29.1	1.136	8.40
4.0	0.148	–162.2	1.823	54.2	0.267	68.3	0.332	–35.9	1.098	6.43
5.0	0.207	–170.3	1.563	43.5	0.339	62.8	0.257	–40.2	1.070	5.03

V_{CE} = 3 V, I_C = 10 mA, Z_O = 50 Ω

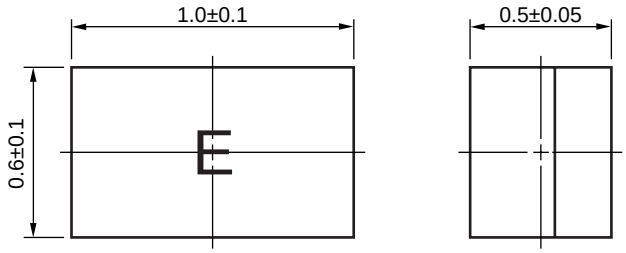
Frequency	S_{11}		S_{21}		S_{12}		S_{22}		K	MAG/MSG
(GHz)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)		(dB)
0.1	0.674	–22.2	22.305	156.6	0.014	80.6	0.942	–12.3	0.235	32.03
0.2	0.591	–40.7	18.909	140.6	0.025	72.5	0.834	–20.9	0.405	28.87
0.3	0.498	–54.1	15.574	128.8	0.032	69.2	0.727	–25.6	0.556	26.82
0.4	0.430	–65.3	13.158	120.1	0.039	67.0	0.647	–28.0	0.667	25.25
0.5	0.370	–73.9	11.182	113.1	0.046	67.0	0.587	–28.9	0.761	23.89
0.6	0.324	–80.0	9.688	107.6	0.051	67.2	0.544	–29.0	0.840	22.75
0.7	0.291	–84.7	8.502	103.3	0.057	68.0	0.511	–28.8	0.902	21.74
0.8	0.261	–89.2	7.599	100.0	0.063	68.8	0.487	–28.5	0.949	20.84
0.9	0.243	–93.1	6.816	97.3	0.069	69.6	0.471	–28.2	0.981	19.97
1.0	0.226	–96.3	6.205	94.6	0.075	70.0	0.458	–28.0	1.006	18.70
1.1	0.214	–98.2	5.666	92.3	0.080	70.5	0.449	–27.8	1.033	17.37
1.2	0.202	–100.3	5.248	90.2	0.086	70.7	0.442	–27.7	1.051	16.46
1.3	0.190	–102.4	4.856	87.8	0.092	71.2	0.440	–27.4	1.065	15.66
1.4	0.181	–103.5	4.529	86.1	0.098	71.6	0.437	–27.1	1.077	14.94
1.5	0.174	–104.3	4.255	84.7	0.104	71.8	0.438	–27.1	1.083	14.36
1.6	0.169	–104.3	4.012	82.9	0.110	72.0	0.438	–26.6	1.089	13.79
1.7	0.165	–104.8	3.786	81.5	0.116	72.2	0.439	–26.2	1.095	13.25
1.8	0.157	–104.2	3.593	80.0	0.123	72.4	0.439	–26.2	1.099	12.75
1.9	0.153	–104.4	3.411	78.7	0.129	72.2	0.441	–25.8	1.101	12.29
2.0	0.148	–104.7	3.253	77.4	0.136	72.4	0.440	–25.3	1.103	11.84
2.1	0.140	–104.7	3.121	75.7	0.142	72.5	0.440	–25.1	1.104	11.45
2.2	0.136	–105.7	3.001	74.6	0.148	72.6	0.438	–24.9	1.108	11.08
2.3	0.131	–105.5	2.893	73.2	0.154	72.8	0.437	–24.9	1.108	10.73
2.4	0.127	–105.7	2.783	72.1	0.161	72.5	0.434	–24.8	1.112	10.35
2.5	0.121	–107.2	2.698	70.8	0.167	72.5	0.429	–24.9	1.112	10.05
2.6	0.116	–109.0	2.608	69.8	0.174	72.1	0.424	–25.0	1.114	9.71
2.7	0.112	–108.5	2.533	68.5	0.180	72.0	0.420	–25.7	1.117	9.41
2.8	0.106	–111.8	2.461	67.5	0.186	71.9	0.416	–26.2	1.115	9.15
2.9	0.102	–113.4	2.389	66.6	0.193	71.5	0.408	–26.2	1.119	8.83
3.0	0.097	–117.2	2.313	65.4	0.199	71.2	0.401	–27.3	1.126	8.50
4.0	0.136	–164.3	1.862	53.9	0.272	68.4	0.320	–33.9	1.089	6.53
5.0	0.201	–171.4	1.593	43.6	0.343	62.5	0.247	–36.6	1.063	5.13

V_{CE} = 3 V, I_C = 20 mA, Z_O = 50 Ω

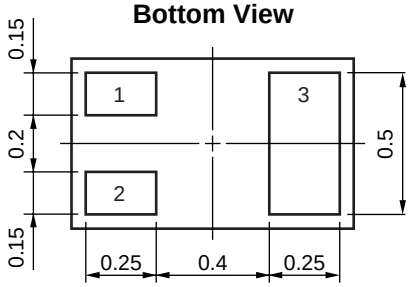
Frequency	S_{11}		S_{21}		S_{12}		S_{22}		K	MAG/MSG
(GHz)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)		(dB)
0.1	0.500	–32.1	30.089	148.9	0.013	76.5	0.887	–16.1	0.371	33.49
0.2	0.415	–54.9	23.098	130.4	0.021	72.2	0.734	–24.5	0.573	30.39
0.3	0.324	–68.2	17.774	118.8	0.028	71.0	0.621	–26.9	0.751	28.06
0.4	0.277	–80.5	14.345	111.3	0.035	71.1	0.551	–27.3	0.844	26.18
0.5	0.239	–89.2	11.883	105.4	0.041	71.6	0.506	–26.7	0.918	24.63
0.6	0.209	–95.5	10.109	100.9	0.047	72.6	0.474	–25.8	0.973	23.30
0.7	0.189	–100.9	8.779	97.3	0.053	73.7	0.452	–25.1	1.014	21.43
0.8	0.171	–105.6	7.789	94.6	0.060	74.2	0.436	–24.6	1.039	19.93
0.9	0.163	–109.5	6.941	92.3	0.066	74.8	0.427	–24.2	1.059	18.71
1.0	0.152	–113.1	6.291	90.0	0.073	75.1	0.419	–24.0	1.074	17.71
1.1	0.147	–114.3	5.744	88.1	0.079	75.2	0.414	–23.8	1.085	16.82
1.2	0.141	–115.7	5.297	86.3	0.085	75.3	0.412	–23.7	1.096	16.04
1.3	0.132	–118.1	4.892	84.2	0.092	75.6	0.413	–23.7	1.102	15.32
1.4	0.129	–118.3	4.569	82.6	0.098	75.8	0.413	–23.7	1.106	14.69
1.5	0.123	–118.0	4.277	81.3	0.105	75.6	0.415	–23.6	1.111	14.09
1.6	0.122	–118.0	4.034	79.8	0.111	75.5	0.417	–23.5	1.107	13.60
1.7	0.118	–117.5	3.797	78.6	0.118	75.5	0.420	–23.3	1.112	13.05
1.8	0.113	–117.1	3.604	77.2	0.124	75.5	0.421	–23.1	1.111	12.59
1.9	0.108	–116.3	3.419	75.9	0.131	75.2	0.424	–23.0	1.112	12.13
2.0	0.106	–116.3	3.262	74.8	0.138	75.1	0.425	–22.7	1.110	11.71
2.1	0.102	–116.6	3.123	73.1	0.145	75.1	0.425	–22.4	1.110	11.32
2.2	0.100	–117.4	3.003	72.2	0.151	75.1	0.424	–22.6	1.110	10.97
2.3	0.096	–116.6	2.886	71.0	0.158	75.0	0.424	–22.5	1.110	10.61
2.4	0.094	–115.6	2.777	69.9	0.164	74.7	0.422	–22.4	1.113	10.24
2.5	0.087	–117.5	2.692	68.6	0.171	74.5	0.418	–22.7	1.112	9.93
2.6	0.087	–120.7	2.603	67.6	0.178	73.9	0.412	–22.8	1.113	9.61
2.7	0.082	–119.8	2.522	66.6	0.184	73.8	0.409	–23.5	1.117	9.30
2.8	0.078	–124.4	2.449	65.4	0.191	73.4	0.405	–24.1	1.114	9.03
2.9	0.077	–126.8	2.380	64.6	0.197	73.0	0.397	–24.2	1.117	8.74
3.0	0.074	–131.7	2.301	63.5	0.204	72.5	0.390	–25.3	1.122	8.40
4.0	0.136	–174.8	1.846	52.5	0.279	69.0	0.308	–32.1	1.085	6.43
5.0	0.200	–176.7	1.588	42.5	0.351	62.6	0.237	–34.3	1.058	5.09

PACKAGE DIMENSIONS

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



Bottom View



PIN CONNECTIONS

1. Emitter
2. Base
3. Collector

[MEMO]

[MEMO]

- **The information in this document is current as of December, 2000. The information is subject to change without notice. For actual design-in, refer to the latest publications of NEC's data sheets or data books, etc., for the most up-to-date specifications of NEC semiconductor products. Not all products and/or types are available in every country. Please check with an NEC sales representative for availability and additional information.**
- No part of this document may be copied or reproduced in any form or by any means without prior written consent of NEC. NEC assumes no responsibility for any errors that may appear in this document.
- NEC does not assume any liability for infringement of patents, copyrights or other intellectual property rights of third parties by or arising from the use of NEC semiconductor products listed in this document or any other liability arising from the use of such products. No license, express, implied or otherwise, is granted under any patents, copyrights or other intellectual property rights of NEC or others.
- Descriptions of circuits, software and other related information in this document are provided for illustrative purposes in semiconductor product operation and application examples. The incorporation of these circuits, software and information in the design of customer's equipment shall be done under the full responsibility of customer. NEC assumes no responsibility for any losses incurred by customers or third parties arising from the use of these circuits, software and information.
- While NEC endeavours to enhance the quality, reliability and safety of NEC semiconductor products, customers agree and acknowledge that the possibility of defects thereof cannot be eliminated entirely. To minimize risks of damage to property or injury (including death) to persons arising from defects in NEC semiconductor products, customers must incorporate sufficient safety measures in their design, such as redundancy, fire-containment, and anti-failure features.
- NEC semiconductor products are classified into the following three quality grades:
  "Standard", "Special" and "Specific". The "Specific" quality grade applies only to semiconductor products developed based on a customer-designated "quality assurance program" for a specific application. The recommended applications of a semiconductor product depend on its quality grade, as indicated below. Customers must check the quality grade of each semiconductor product before using it in a particular application.

  "Standard": Computers, office equipment, communications equipment, test and measurement equipment, audio and visual equipment, home electronic appliances, machine tools, personal electronic equipment and industrial robots

  "Special": Transportation equipment (automobiles, trains, ships, etc.), traffic control systems, anti-disaster systems, anti-crime systems, safety equipment and medical equipment (not specifically designed for life support)

  "Specific": Aircraft, aerospace equipment, submersible repeaters, nuclear reactor control systems, life support systems and medical equipment for life support, etc.

  The quality grade of NEC semiconductor products is "Standard" unless otherwise expressly specified in NEC's data sheets or data books, etc. If customers wish to use NEC semiconductor products in applications not intended by NEC, they must contact an NEC sales representative in advance to determine NEC's willingness to support a given application.

  (Note)

  (1) "NEC" as used in this statement means NEC Corporation and also includes its majority-owned subsidiaries.

  (2) "NEC semiconductor products" means any semiconductor product developed or manufactured by or for NEC (as defined above).

M8E 00.4