NEC's NPN SILICON HIGH FREQUENCY TRANSISTOR

NE66719

FEATURES

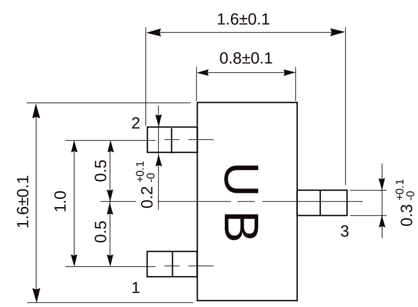
- **HIGH GAIN BANDWIDTH:** f_T = 21 GHz
- **LOW NOISE FIGURE:** NF = 1.1 dB at 2 GHz
- **HIGH MAXIMUM GAIN:** 20 dB at f = 2 GHz

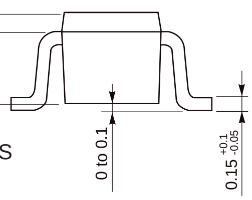
DESCRIPTION

NEC's NE66719 is fabricated using NEC's UHS0 25 GHz f_T wafer process. This device is ideal for oscillator or low noise amplifier applications at 2 GHz and above.

OUTLINE DIMENSIONS (Units in mm)

PACKAGE OUTLINE 19





PIN CONNECTIONS
1. Emitter
2. Base
3. Collector

ELECTRICAL CHARACTERISTICS (T_A = 25°C)

		PART NUMBER EIAJ[1] REGISTERED NUMBER PACKAGE OUTLINE	NE66719 2SC55667 19			
	SYMBOLS	PARAMETERS AND CONDITIONS	UNITS	MIN	TYP	MAX
DC	I_{CBO}	Collector Cutoff Current at V_{CB} = 5V, I_E = 0	nA			100
	I_{EBO}	Emitter Cutoff Current at V_{EB} = 1 V, I_C = 0	nA			100
	h_{FE}	Forward Current Gain[2] at V_{CE} = 2 V, I_C = 5 mA		50	70	100
RF	f_T	Gain Bandwidth at V_{CE} = 2 V, I_C = 20 mA, f = 2 GHz	GHz	18	21	
	MAG	Maximum Available Power Gain[4] at V_{CE} = 2 V, I_C = 20 mA, f = 2 GHz	dB		12.5	
	MSG	Maximum Stable Gain[5] at V_{CE} = 2 V, I_C = 20 mA, f = 2 GHz	dB		13.5	
	$\|S_{21e}\|^2$	Insertion Power Gain at V_{CE} = 1 V, I_C = 10 mA, f = 2 GHz	dB	9.0	11.0	
	$\|S_{21e}\|^2$	Insertion Power Gain at V_{CE} = 2 V, I_C = 20 mA, f = 2 GHz	dB	9.5	11.5	
	NF	Noise Figure at V_{CE} = 2 V, I_C = 5 mA, f = 2 GHz, $Z_S = Z_{OPT}$	dB		1.1	1.5
	IP_3	Third Order Intercept Point at V_{CE} = 2 V, I_C = 20 mA, f = 2 GHz			22	
	Cre	Feedback Capacitance[3] at V_{CB} = 2 V, I_C = 0, f = 1 MHz	pF		0.24	0.30

Notes:
1. Electronic Industrial Association of Japan.
2. Pulsed measurement, pulse width ≤ 350 µs, duty cycle ≤ 2 %.
3. Capacitance is measured by capacitance meter (automatic balance bridge method) when emitter pin is connected to the guard pin.
4. MAG = $\left|\frac{S_{21}}{S_{12}}\right| \left(K-\sqrt{(K^2-1)}\right)$
5. MSG = $\left|\frac{S_{21}}{S_{12}}\right|$

ABSOLUTE MAXIMUM RATINGS[1] (T_A = 25°C)

SYMBOLS	PARAMETERS	UNITS	RATINGS
V_{CBO}	Collector to Base Voltage	V	15
V_{CEO}	Collector to Emitter Voltage	V	3.3
V_{EBO}	Emitter to Base Voltage	V	1.5
I_C	Collector Current	mA	35
P_T	Total Power Dissipation[2]	mW	115
T_J	Junction Temperature	°C	150
T_{STG}	Storage Temperature	°C	-65 to +150

Note:
1. Operation in excess of any one of these parameters may result in permanent damage.
2. Mounted on 1.08 cm^2 x 1.0 mm (t) glass epoxy substrate.

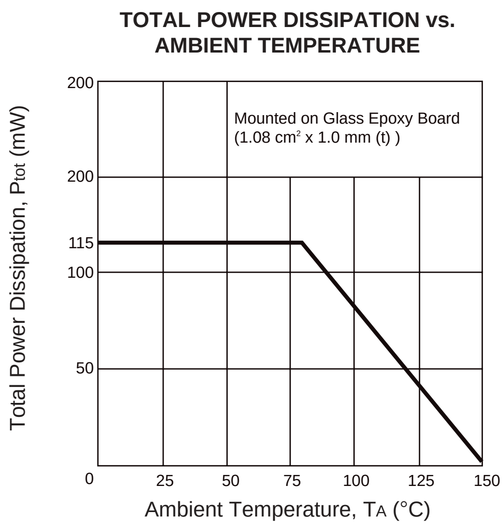
ORDERING INFORMATION

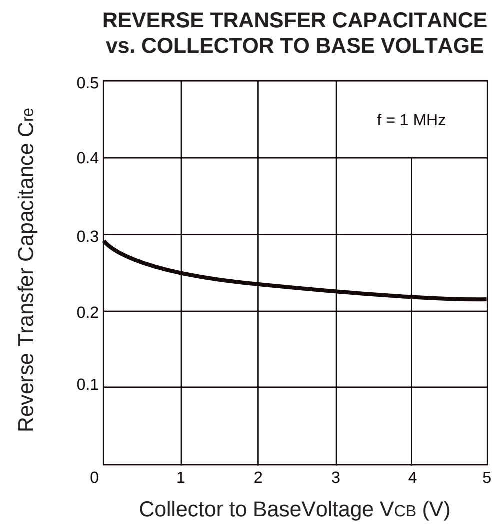
PART NUMBER	QUANTITY	PACKAGING
NE66719	Bulk	8 mm wide embossed taping
NE66719-T1	3k pcs/reel	Pin 3 (collector) faces the perforation

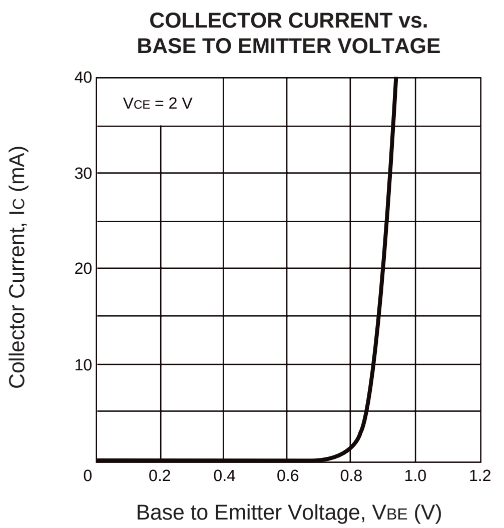
TYPICAL NOISE PARAMETERS (T_A = 25°C)

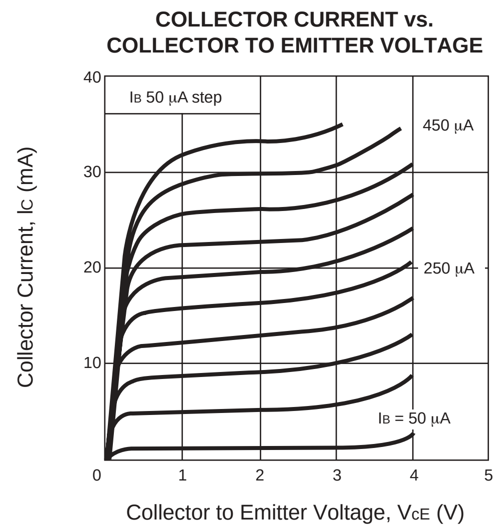
FREQ. (GHz)	NF_{MIN} (dB)	G_A (dB)	Γ_{OPT} MAG	Γ_{OPT} ANG	Rn/50
V_{CE} = 2 V, I_C = 3 mA					
0.8	0.83	18.1	0.37	22.9	0.22
1.0	0.86	16.3	0.36	29.3	0.21
1.5	0.93	13.2	0.31	46.7	0.19
1.8	0.97	11.9	0.26	60.0	0.16
2.0	1.00	11.1	0.23	70.8	0.15
2.5	1.07	9.6	0.16	107.0	0.12
V_{CE} = 2 V, I_C = 5 mA					
0.8	0.88	18.5	0.24	19.6	0.19
1.0	0.91	16.7	0.23	26.6	0.18
1.5	0.96	13.5	0.18	41.2	0.17
1.8	1.00	12.2	0.14	54.6	0.15
2.0	1.02	11.4	0.11	68.2	0.14
2.5	1.08	9.8	0.06	128.5	0.12
V_{CE} = 2 V, I_C = 7 mA					
0.8	1.07	19.1	0.13	35.5	0.17
1.0	1.09	17.0	0.12	11.3	0.17
1.5	1.13	13.8	0.06	27.3	0.16
1.8	1.16	12.5	0.03	75.9	0.14
2.0	1.17	11.7	0.02	119.0	0.14
2.5	1.22	9.9	0.07	-115.5	0.14
V_C = 2 V, I_C = 10 mA					
0.8	1.25	19.1	0.04	-59.8	0.16
1.0	1.27	17.4	0.03	117.5	0.15
1.5	1.31	13.9	0.04	-75.8	0.16
1.8	1.34	12.5	0.07	-88.8	0.16
2.0	1.35	11.7	0.09	-112.4	0.15
2.5	1.40	10.1	0.16	-112.0	0.15
V_C = 2 V, I_C = 20 mA					
0.8	1.69	19.2	0.15	-146.7	0.16
1.0	1.70	17.3	0.18	-138.6	0.16
1.5	1.74	14.0	0.22	-126.0	0.18
1.8	1.77	12.6	0.24	-121.9	0.19
2.0	1.78	11.8	0.24	-119.9	0.20
2.5	1.83	10.2	0.27	-115.1	0.22

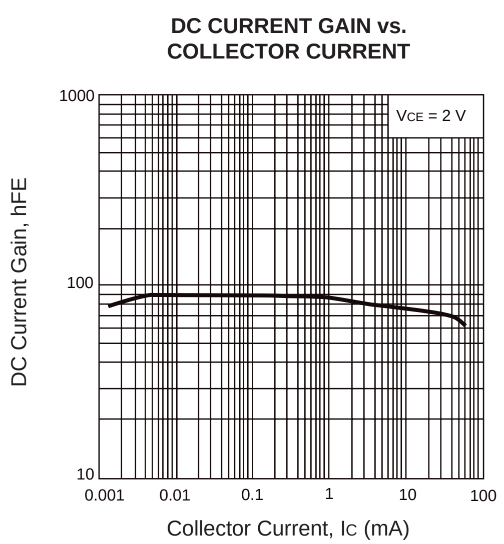
TYPICAL PERFORMANCE CURVES (T_A = 25°C)

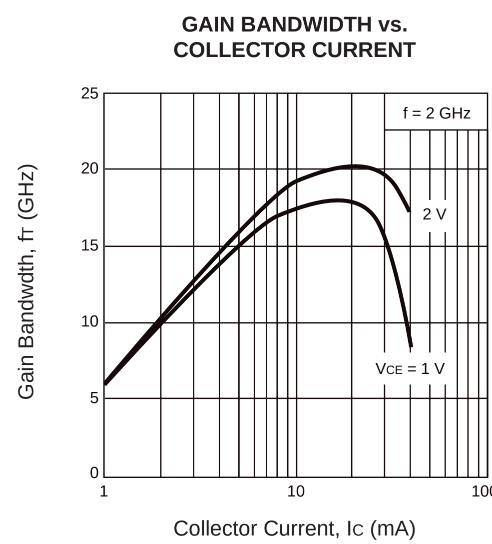






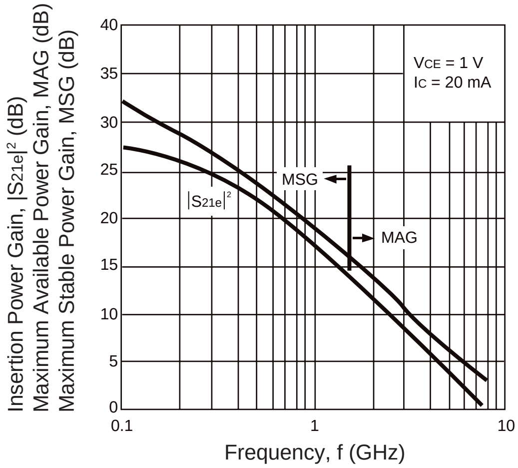




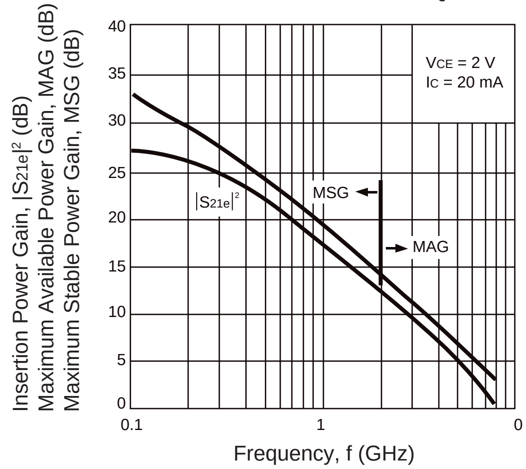


TYPICAL PERFORMANCE CURVES (TA = 25°C)

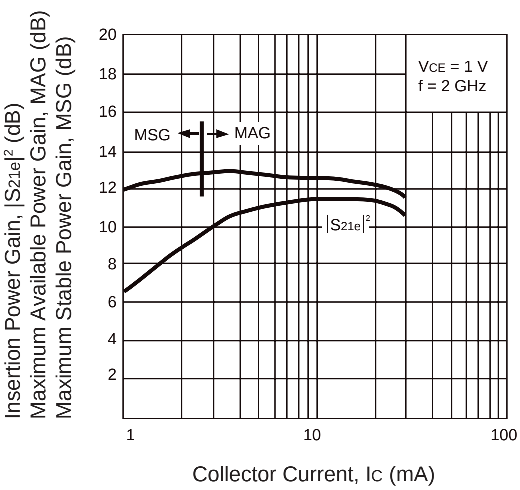
INSERTION POWER GAIN, MAXIMUM AVAILABLE POWER GAIN, MAXIMUM STABLE POWER GAIN vs. FREQUENCY



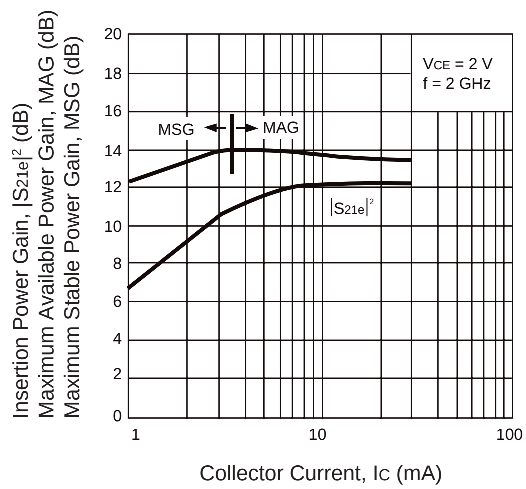
INSERTION POWER GAIN, MAXIMUM AVAILABLE POWER GAIN, MAXIMUM STABLE POWER GAIN vs. FREQUENCY



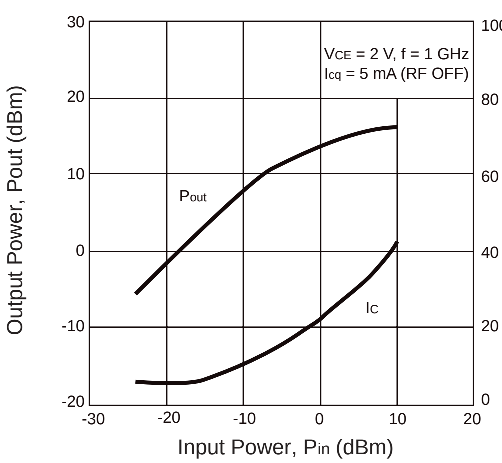
INSERTION POWER GAIN, MAXIMUM AVAILABLE POWER GAIN, MAXIMUM STABLE POWER GAIN vs. COLLECTOR CURRENT



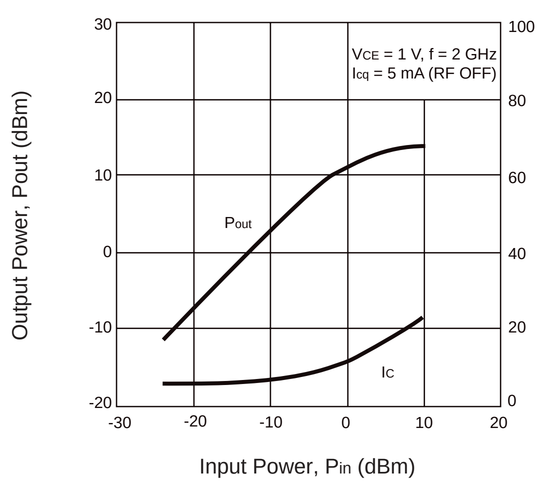
INSERTION POWER GAIN, MAXIMUM AVAILABLE POWER GAIN, MAXIMUM STABLE POWER GAIN vs. COLLECTOR CURRENT



OUTPUT POWER, COLLECTOR CURRENT vs. INPUT POWER

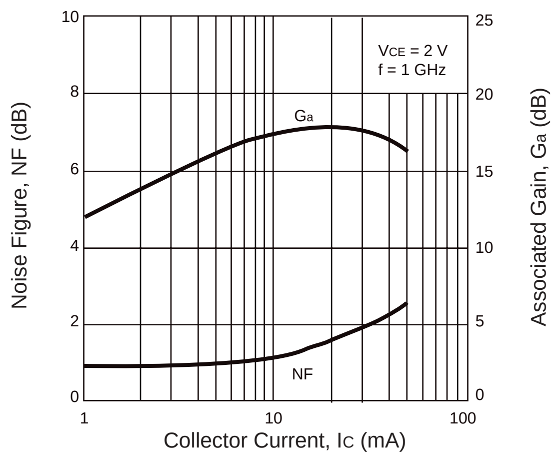


OUTPUT POWER, COLLECTOR CURRENT vs. INPUT POWER

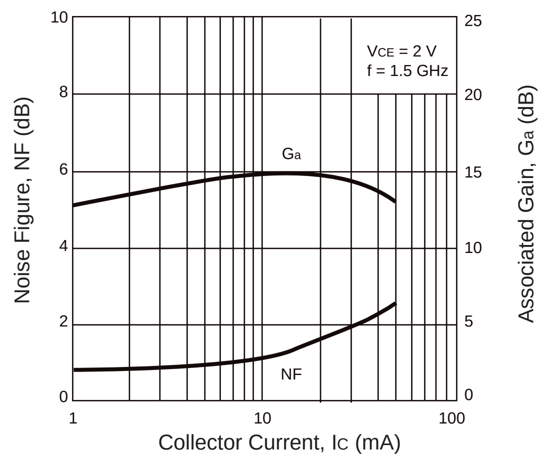


TYPICAL PERFORMANCE CURVES (TA = 25°C)

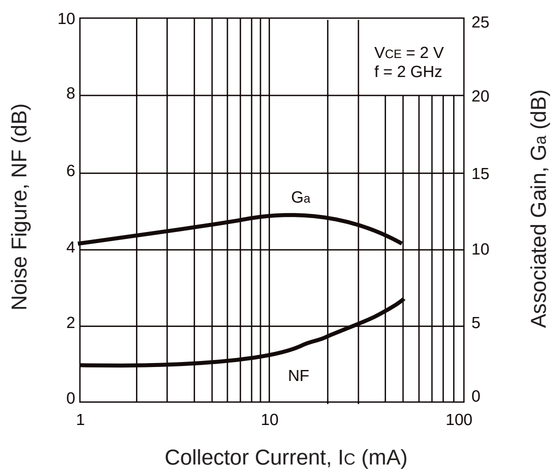
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



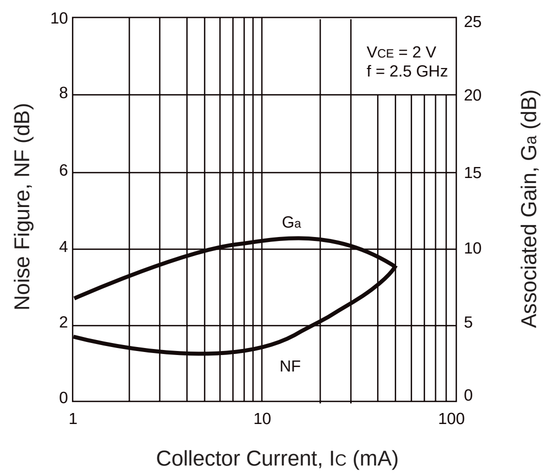
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



Remark The graphs indicate nominal characteristics.

TYPICAL SCATTERING PARAMETERS (T_A = 25°C)

V_{DS} = 1 V, I_C = 5 mA, Z_O = 50 Ω

FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.822	-12.2	12.268	167.4	0.016	83.6	0.970	-8.8
0.2	0.793	-21.9	11.711	156.4	0.030	76.8	0.933	-17.5
0.3	0.738	-31.8	10.871	146.2	0.043	71.4	0.878	-25.2
0.4	0.678	-39.8	10.101	136.6	0.054	67.3	0.816	-32.0
0.5	0.614	-48.4	9.228	128.3	0.062	64.0	0.753	-37.6
0.6	0.553	-54.5	8.389	121.1	0.070	61.5	0.692	-42.4
0.7	0.501	-60.3	7.694	115.3	0.077	59.8	0.637	-46.3
0.8	0.449	-65.5	7.051	110.0	0.083	58.9	0.592	-49.7
0.9	0.409	-70.1	6.534	104.8	0.089	58.1	0.552	-52.7
1.0	0.369	-75.3	6.062	100.4	0.094	57.9	0.516	-55.3
1.1	0.340	-79.2	5.677	96.3	0.100	57.6	0.486	-57.8
1.2	0.312	-83.2	5.310	92.4	0.105	57.5	0.460	-60.0
1.3	0.285	-88.5	4.979	88.7	0.110	57.4	0.435	-62.1
1.4	0.261	-92.3	4.694	85.3	0.116	57.4	0.413	-64.5
1.5	0.241	-97.8	4.421	82.2	0.122	57.4	0.396	-66.6
1.6	0.223	-101.6	4.224	79.1	0.128	57.5	0.379	-68.8
1.7	0.210	-107.6	4.011	76.1	0.134	57.6	0.364	-70.9
1.8	0.187	-113.6	3.825	73.3	0.140	57.6	0.350	-73.1
1.9	0.180	-119.9	3.653	70.4	0.147	57.2	0.337	-75.5
2.0	0.170	-127.5	3.513	67.5	0.154	57.3	0.326	-78.1
2.1	0.167	-134.5	3.392	65.1	0.160	57.4	0.315	-80.6
2.2	0.162	-140.7	3.255	62.8	0.167	57.1	0.306	-83.5
2.3	0.160	-146.2	3.142	59.9	0.174	57.0	0.298	-86.4
2.4	0.163	-154.2	3.041	57.4	0.182	56.7	0.289	-89.7
2.5	0.165	-158.4	2.938	55.2	0.189	56.2	0.280	-93.3
2.6	0.167	-163.3	2.853	52.7	0.197	55.8	0.275	-97.1
2.7	0.174	-169.0	2.774	50.6	0.204	55.4	0.269	-101.3
2.8	0.175	-173.8	2.687	48.2	0.212	54.8	0.265	-105.0
2.9	0.178	-179.0	2.616	46.0	0.220	54.1	0.259	-108.6
3.0	0.182	173.3	2.548	43.9	0.229	53.6	0.253	-113.3
4.0	0.339	139.7	2.015	21.3	0.321	43.7	0.301	-166.8
5.0	0.530	117.8	1.546	-0.8	0.398	30.5	0.451	154.0
6.0	0.623	103.9	1.261	-14.3	0.443	17.7	0.585	130.4
7.0	0.713	90.6	0.996	-30.5	0.476	5.6	0.693	112.1
8.0	0.772	85.2	0.828	-33.0	0.495	-2.3	0.752	99.3

TYPICAL SCATTERING PARAMETERS (T_A = 25°C)

V_{DS} = 2 V, I_C = 5 mA, Z_O = 50 Ω

FREQUENCY	S11		S21		S12		S22	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.845	-9.9	11.956	168.4	0.014	86.8	0.978	-7.7
0.2	0.821	-19.3	11.451	158.1	0.027	79.0	0.947	-15.3
0.3	0.769	-27.8	10.734	148.4	0.039	73.5	0.901	-22.3
0.4	0.712	-35.8	10.039	139.3	0.049	69.2	0.846	-28.4
0.5	0.654	-43.2	9.282	131.4	0.057	66.3	0.789	-33.6
0.6	0.596	-48.8	8.499	124.2	0.065	63.6	0.734	-38.0
0.7	0.539	-53.8	7.844	118.2	0.071	62.1	0.682	-41.8
0.8	0.492	-58.6	7.217	113.2	0.077	60.9	0.637	-45.0
0.9	0.450	-62.4	6.715	107.9	0.083	60.4	0.600	-47.6
1.0	0.409	-66.4	6.309	103.5	0.088	59.9	0.564	-50.1
1.1	0.378	-70.4	5.886	99.4	0.093	59.7	0.533	-52.4
1.2	0.347	-73.8	5.532	95.4	0.098	59.5	0.507	-54.5
1.3	0.322	-77.2	5.212	91.8	0.103	59.5	0.484	-56.6
1.4	0.295	-80.9	4.914	88.4	0.109	59.5	0.461	-58.6
1.5	0.272	-84.3	4.645	85.0	0.114	59.6	0.443	-60.5
1.6	0.254	-87.4	4.437	81.8	0.120	59.7	0.426	-62.3
1.7	0.233	-91.3	4.220	79.0	0.126	59.9	0.411	-64.2
1.8	0.212	-96.3	4.028	76.0	0.131	60.0	0.397	-66.2
1.9	0.200	-100.3	3.851	73.2	0.138	59.9	0.384	-68.2
2.0	0.183	-106.4	3.710	70.5	0.145	60.0	0.373	-70.4
2.1	0.177	-113.6	3.579	67.9	0.151	60.2	0.361	-72.5
2.2	0.168	-118.9	3.441	65.6	0.158	60.1	0.352	-75.2
2.3	0.163	-121.6	3.319	62.9	0.165	59.9	0.344	-77.6
2.4	0.160	-130.8	3.222	60.4	0.172	59.7	0.335	-80.3
2.5	0.156	-137.4	3.120	58.1	0.179	59.4	0.324	-83.4
2.6	0.157	-140.2	3.031	55.8	0.187	59.2	0.319	-86.8
2.7	0.158	-146.1	2.945	53.5	0.194	58.7	0.312	-90.3
2.8	0.154	-153.9	2.861	51.3	0.202	58.3	0.306	-93.3
2.9	0.151	-158.8	2.781	49.1	0.210	57.6	0.299	-96.5
3.0	0.156	-167.1	2.705	46.8	0.219	57.1	0.290	-100.5
4.0	0.297	149.1	2.171	24.0	0.316	47.7	0.312	-152.1
5.0	0.504	123.2	1.700	1.0	0.401	34.0	0.448	163.8
6.0	0.605	107.5	1.371	-13.7	0.453	20.3	0.587	136.6
7.0	0.704	93.5	1.082	-30.8	0.488	7.3	0.701	116.1
8.0	0.767	87.3	0.877	-33.9	0.506	-1.2	0.760	102.0

TYPICAL SCATTERING PARAMETERS (T_A = 25°C)

V_{DS} = 2 V, I_C = 20 mA, Z_O = 50 Ω

FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.660	-16.7	21.907	161.6	0.012	80.0	0.931	-11.7
0.2	0.585	-28.5	19.701	146.5	0.024	76.1	0.852	-22.2
0.3	0.505	-39.1	17.100	134.4	0.033	73.2	0.761	-30.0
0.4	0.444	-46.6	14.863	124.2	0.041	70.8	0.678	-35.3
0.5	0.381	-53.2	12.907	116.5	0.048	70.0	0.607	-38.9
0.6	0.328	-57.1	11.320	110.0	0.055	69.3	0.551	-41.6
0.7	0.287	-60.5	10.052	105.0	0.062	69.3	0.505	-43.4
0.8	0.255	-63.8	9.004	100.7	0.069	69.3	0.470	-44.9
0.9	0.228	-66.4	8.170	96.5	0.076	69.2	0.442	-46.2
1.0	0.202	-69.7	7.508	93.0	0.083	69.1	0.419	-47.4
1.1	0.181	-72.3	6.927	89.8	0.090	69.0	0.399	-48.7
1.2	0.161	-74.2	6.421	86.5	0.097	68.8	0.382	-50.0
1.3	0.148	-77.6	5.974	83.8	0.104	68.4	0.367	-51.3
1.4	0.135	-82.0	5.611	81.0	0.111	68.0	0.352	-52.8
1.5	0.117	-83.8	5.262	78.5	0.119	67.6	0.341	-54.4
1.6	0.106	-87.9	4.994	75.9	0.126	67.2	0.330	-55.9
1.7	0.098	-94.4	4.720	73.7	0.134	66.7	0.320	-57.4
1.8	0.085	-101.7	4.482	71.2	0.142	66.2	0.309	-59.2
1.9	0.074	-108.3	4.274	68.8	0.150	65.4	0.301	-61.2
2.0	0.070	-118.5	4.102	66.4	0.158	64.9	0.293	-63.4
2.1	0.071	-131.9	3.958	64.3	0.166	64.3	0.284	-65.5
2.2	0.066	-145.1	3.794	62.5	0.174	63.6	0.277	-68.1
2.3	0.071	-147.6	3.648	60.1	0.182	62.9	0.271	-70.7
2.4	0.079	-160.0	3.531	58.0	0.190	62.0	0.263	-73.6
2.5	0.079	-168.3	3.406	56.0	0.198	61.1	0.253	-76.9
2.6	0.087	-169.9	3.301	53.8	0.207	60.2	0.248	-80.5
2.7	0.094	-176.2	3.212	52.2	0.215	59.4	0.241	-84.3
2.8	0.098	176.4	3.110	50.1	0.223	58.4	0.235	-87.7
2.9	0.102	170.7	3.024	48.1	0.231	57.4	0.228	-91.3
3.0	0.111	161.5	2.945	46.0	0.240	56.5	0.219	-95.6
4.0	0.279	137.1	2.345	26.1	0.329	44.7	0.238	-155.9
5.0	0.484	117.4	1.854	5.5	0.402	31.3	0.375	159.4
6.0	0.577	104.4	1.555	-8.8	0.446	18.6	0.515	135.1
7.0	0.684	92.6	1.265	-26.0	0.480	6.6	0.641	116.5
8.0	0.757	86.6	1.058	-31.5	0.499	-1.5	0.709	103.3

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