

NPN SILICON EPITAXIAL TRANSISTOR
3 PINS ULTRA SUPER MINI MOLD

DESCRIPTION

The 2SC5004 is a low supply voltage transistor designed for UHF OSC/MIX.

It is suitable for a high density surface mount assembly since the transistor has been applied ultra super mini mold package.

FEATURES

- High f_t : 5.0 GHz TYP. (@ $V_{CE} = 5\text{ V}$, $I_c = 5\text{ mA}$, $f = 1\text{ GHz}$)
- Low C_{re} : 0.9 pF TYP. (@ $V_{CB} = 5\text{ V}$, $I_E = 0$, $f = 1\text{ MHz}$)
- Ultra Super Mini Mold Package. (1.6 mm × 0.8 mm)

ORDERING INFORMATION

PART NUMBER	QUANTITY	PACKING STYLE
2SC5004	50 pcs./unit	Embossed tape 8 mm wide. Pin 3 (Collector) face to perforation side of the tape.
2SC5004 - T1	3 kpcs./Reel	

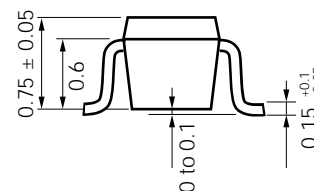
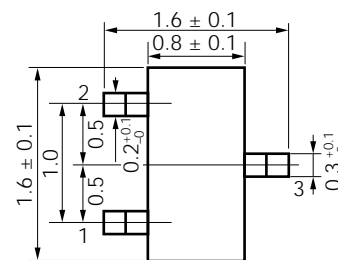
* Please contact with responsible NEC person, if you require evaluation sample. Unit sample quantity shall be 50 pcs.

ABSOLUTE MAXIMUM RATINGS ($T_A = 25\text{ °C}$)

Collector to Base Voltage	V_{CBO}	20	V
Collector to Emitter Voltage	V_{CEO}	12	V
Emitter to Base Voltage	V_{EBO}	3	V
Collector Current	I_c	60	mA
Total Power Dissipation	P_T	100	mW
Junction Temperature	T_j	125	°C
Storage Temperature	T_{stg}	-55 to +125	°C

PACKAGE DIMENSIONS

in millimeters



PIN CONNECTIONS

1. Emitter
2. Base
3. Collector

ELECTRICAL CHARACTERISTICS (T_A = 25 °C)

CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITION
Collector Cutoff Current	I _{CBO}			0.1	μA	V _{CB} = 15 V, I _E = 0
Emitter Cutoff Current	I _{EBO}			0.1	μA	V _{EB} = 1 V, I _C = 0
Collector Saturation Voltage	V _{CE (sat)}			0.5	V	h _{FE} = 10, I _C = 5 mA
DC Current Gain	h _{FE}	60		120		V _{CE} = 5 V, I _C = 5 mA *1
Gain Bandwidth Product	f _T	3.0	5.0		GHz	V _{CE} = 5 V, I _C = 5 mA
Feed-back Capacitance	C _{re}		0.9	1.2	pF	V _{CB} = 5 V, I _E = 0, f = 1 MHz *2
Insertion Power Gain	S _{21e} ²	5.0			dB	V _{CE} = 5 V, I _C = 5 mA, f = 1 GHz

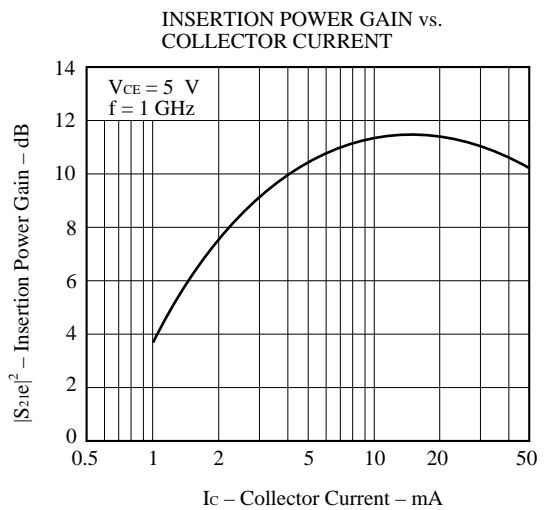
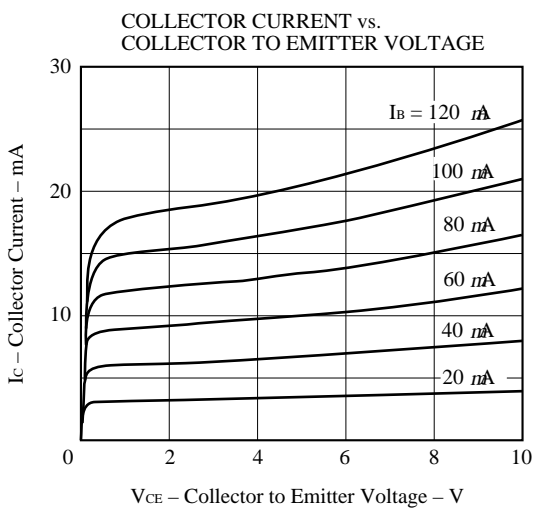
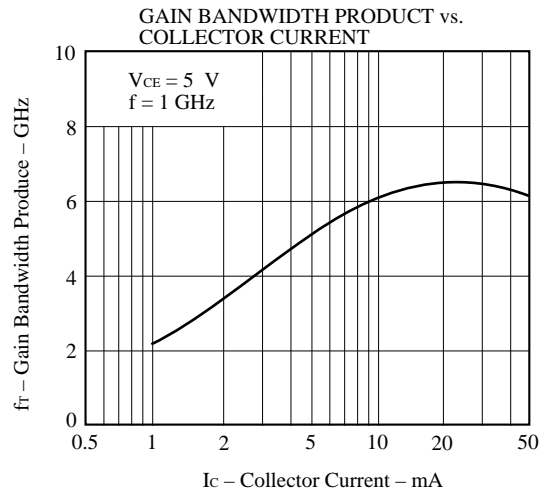
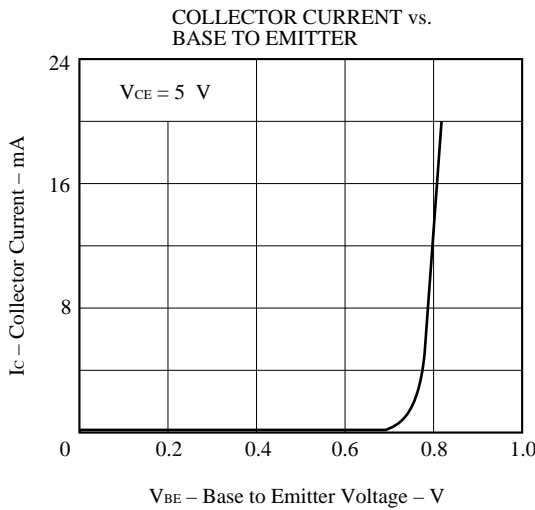
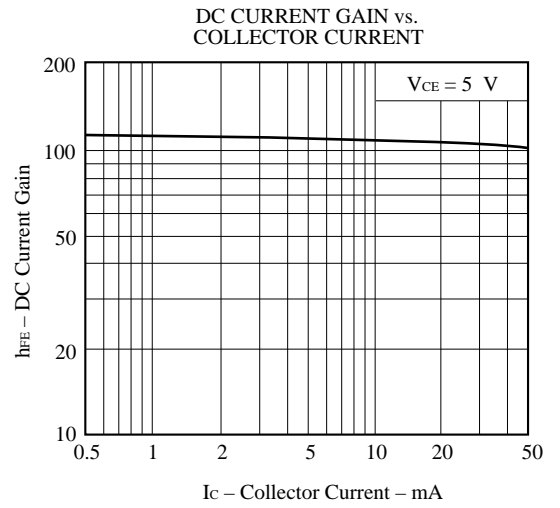
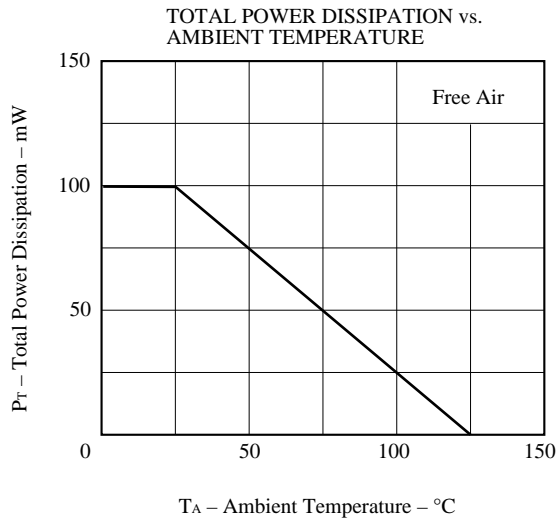
*1 Pulse Measurement PW ≤ 350 μs, Duty Cycle ≤ 2 %

*2 The emitter terminal and the case shall be connected to the guard terminal of the three-terminal capacitance bridge.

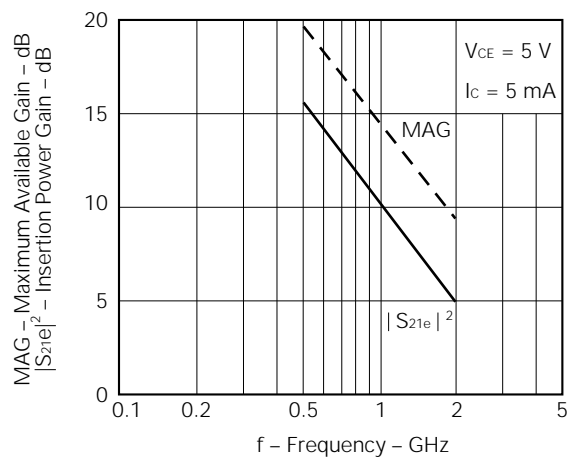
h_{FE} Classification

Rank	FB
Marking	77
h _{FE}	60 to 120

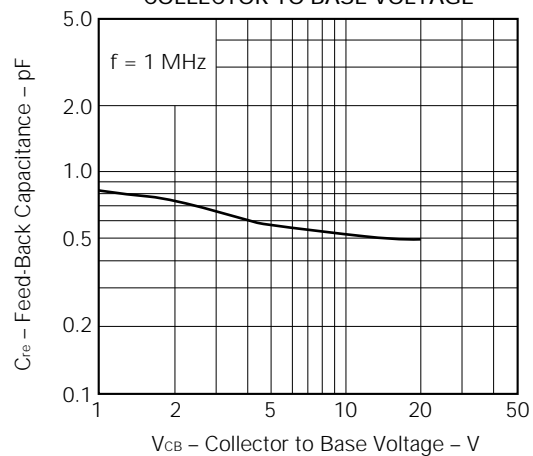
TYPICAL CHARACTERISTICS (T_A = 25 °C)



MAXIMUM AVAILABLE GAIN,
INSERTION POWER GAIN vs. FREQUENCY



FEED-BACK CAPACITANCE vs.
COLLECTOR TO BASE VOLTAGE



S-PARAMETER

V_{CE} = 5 V, I_c = 5 mA, Z_o = 50 Ω

FREQUENCY	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG
100.00	.840	-29.2	8.993	151.3	.031	68.1	.915	-17.9
200.00	.719	-57.1	8.284	129.5	.050	52.7	.771	-29.5
300.00	.624	-83.3	7.527	112.2	.062	44.8	.648	-35.5
400.00	.549	-104.8	6.560	98.3	.070	39.1	.565	-38.1
500.00	.503	-122.6	5.797	86.3	.077	35.1	.508	-40.2
600.00	.472	-135.8	4.992	76.6	.084	32.4	.467	-41.0
700.00	.454	-147.1	4.460	68.0	.091	30.3	.440	-42.1
800.00	.443	-156.5	3.972	59.8	.097	27.5	.415	-43.3
900.00	.440	-164.4	3.601	52.4	.104	25.5	.399	-44.2
1000.00	.436	-171.5	3.284	45.2	.111	23.0	.381	-46.1
1100.00	.437	-177.2	3.029	38.6	.119	20.8	.370	-46.9
1200.00	.441	176.7	2.815	31.8	.127	18.0	.359	-49.4
1300.00	.443	171.7	2.608	25.5	.135	15.8	.348	-50.9
1400.00	.449	167.0	2.452	19.3	.142	12.9	.340	-53.6
1500.00	.453	162.5	2.303	13.1	.149	9.9	.328	-56.0
1600.00	.462	158.5	2.184	7.2	.158	7.1	.321	-58.2
1700.00	.465	154.3	2.075	1.0	.166	4.0	.312	-61.3
1800.00	.473	150.9	1.974	-4.6	.175	1.1	.304	-63.8
1900.00	.481	147.1	1.883	-10.5	.184	-2.3	.297	-67.5
2000.00	.491	143.7	1.795	-16.0	.193	-5.4	.290	-70.4
2100.00	.499	140.4	1.730	-21.9	.202	-9.0	.283	-74.4
2200.00	.506	137.6	1.661	-27.3	.211	-12.3	.274	-78.3
2300.00	.518	134.5	1.608	-33.2	.220	-15.9	.269	-82.1
2400.00	.523	131.7	1.543	-38.7	.229	-19.3	.260	-87.0
2500.00	.535	129.3	1.497	-43.8	.239	-22.8	.254	-91.1
2600.00	.541	126.4	1.446	-49.5	.250	-27.0	.250	-97.0
2700.00	.549	124.3	1.402	-54.6	.259	-30.5	.244	-102.0
2800.00	.563	121.6	1.360	-60.1	.269	-34.3	.242	-107.8
2900.00	.568	119.6	1.312	-65.1	.279	-38.2	.236	-113.8
3000.00	.582	117.1	1.282	-70.4	.290	-42.2	.237	-119.5

V_{CE} = 5 V, I_c = 3 mA, Z_o = 50 Ω

FREQUENCY	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG
100.00	.907	-23.5	5.717	154.7	.033	70.9	.953	-13.3
200.00	.825	-45.3	5.461	135.7	.056	56.2	.855	-23.5
300.00	.747	-67.1	5.224	119.6	.074	45.2	.752	-30.1
400.00	.673	-86.6	4.779	105.9	.083	36.9	.676	-33.8
500.00	.615	-104.4	4.452	93.4	.092	31.0	.616	-36.9
600.00	.569	-118.5	3.938	82.6	.097	26.2	.570	-38.7
700.00	.535	-131.4	3.630	72.9	.102	22.8	.538	-40.2
800.00	.511	-142.6	3.298	63.7	.106	19.5	.509	-41.9
900.00	.497	-152.1	3.039	55.6	.112	17.1	.491	-43.3
1000.00	.487	-160.2	2.798	47.7	.116	14.9	.471	-45.1
1100.00	.483	-167.4	2.590	40.7	.121	12.5	.456	-46.5
1200.00	.482	-174.5	2.420	33.4	.126	10.6	.444	-48.7
1300.00	.481	179.7	2.250	26.8	.132	8.0	.433	-50.6
1400.00	.485	174.3	2.133	20.2	.137	6.0	.424	-53.4
1500.00	.486	168.9	2.001	13.8	.143	3.9	.412	-55.9
1600.00	.494	164.3	1.906	7.5	.150	1.6	.405	-58.4
1700.00	.497	159.7	1.805	1.0	.157	-1.0	.396	-61.1
1800.00	.502	155.7	1.728	-4.6	.163	-3.1	.389	-63.9
1900.00	.510	151.5	1.654	-11.0	.171	-5.8	.381	-67.3
2000.00	.517	147.5	1.578	-16.7	.178	-8.2	.374	-70.6
2100.00	.525	143.9	1.525	-22.6	.188	-10.9	.368	-74.0
2200.00	.532	140.9	1.460	-28.3	.196	-13.8	.360	-78.0
2300.00	.543	137.4	1.418	-34.0	.206	-16.9	.355	-81.7
2400.00	.548	134.2	1.360	-39.7	.214	-20.5	.347	-86.4
2500.00	.558	131.7	1.320	-44.9	.224	-23.4	.341	-90.5
2600.00	.566	128.2	1.276	-50.7	.235	-27.0	.338	-95.6
2700.00	.573	126.1	1.236	-55.7	.244	-29.9	.332	-100.4
2800.00	.585	123.1	1.199	-61.4	.256	-33.7	.328	-105.6
2900.00	.590	120.7	1.158	-66.4	.263	-37.0	.325	-110.9
3000.00	.603	118.2	1.132	-71.7	.278	-40.9	.325	-116.4

S-PARAMETER

V_{CE} = 5 V, I_c = 1 mA, Z_o = 50 Ω

FREQUENCY	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG
100.00	.992	-15.7	1.958	161.4	.036	76.2	.987	-7.1
200.00	.949	-32.2	2.005	144.3	.066	62.4	.956	-13.9
300.00	.912	-47.8	2.034	129.7	.093	50.4	.906	-19.4
400.00	.862	-63.1	1.954	116.5	.110	40.2	.864	-23.7
500.00	.821	-77.5	1.939	104.7	.125	30.8	.822	-27.7
600.00	.774	-90.6	1.780	92.7	.135	22.4	.786	-30.8
700.00	.732	-103.0	1.733	82.1	.141	15.5	.757	-33.7
800.00	.698	-115.2	1.665	71.5	.144	9.1	.728	-36.4
900.00	.667	-126.1	1.607	62.3	.146	4.4	.705	-38.7
1000.00	.644	-136.5	1.549	53.0	.147	-8	.685	-41.3
1100.00	.624	-145.4	1.475	44.7	.146	-4.3	.671	-43.6
1200.00	.614	-154.2	1.415	36.4	.146	-8.3	.656	-46.2
1300.00	.603	-161.6	1.340	28.8	.144	-11.1	.647	-48.8
1400.00	.600	-168.6	1.287	21.5	.144	-13.7	.637	-51.8
1500.00	.593	-175.4	1.218	14.2	.142	-15.8	.628	-54.6
1600.00	.596	178.7	1.174	7.6	.142	-17.1	.621	-57.6
1700.00	.592	172.6	1.129	.5	.141	-18.5	.611	-60.8
1800.00	.594	167.6	1.083	-5.8	.141	-19.1	.606	-63.9
1900.00	.599	162.0	1.043	-12.4	.144	-19.8	.597	-67.5
2000.00	.600	157.2	1.003	-18.4	.147	-20.3	.595	-71.1
2100.00	.608	152.4	.973	-24.6	.151	-20.8	.588	-74.9
2200.00	.611	148.5	.934	-30.4	.156	-21.2	.583	-78.9
2300.00	.620	144.2	.913	-36.2	.163	-21.8	.577	-83.0
2400.00	.621	140.2	.875	-41.8	.171	-23.1	.573	-87.4
2500.00	.630	136.9	.851	-47.0	.182	-24.1	.566	-91.6
2600.00	.636	132.9	.825	-52.6	.193	-26.2	.563	-96.5
2700.00	.641	130.0	.802	-57.5	.204	-28.3	.558	-101.4
2800.00	.648	126.5	.777	-62.8	.217	-30.7	.557	-106.5
2900.00	.652	123.5	.752	-67.6	.229	-33.7	.552	-111.6
3000.00	.663	120.6	.735	-72.5	.245	-36.8	.553	-116.9

V_{CE} = 3 V, I_c = 5 mA, Z_o = 50 Ω

FREQUENCY	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG
100.00	.830	-30.0	8.873	149.7	.035	67.5	.900	-20.9
200.00	.705	-61.3	8.192	127.6	.056	51.3	.738	-34.1
300.00	.615	-88.8	7.362	110.0	.071	42.2	.604	-41.4
400.00	.548	-111.0	6.349	96.2	.078	37.2	.516	-44.4
500.00	.508	-128.6	5.561	84.3	.086	33.3	.457	-47.2
600.00	.483	-141.3	4.779	74.6	.093	30.4	.411	-48.4
700.00	.471	-152.1	4.244	66.0	.100	28.4	.383	-49.6
800.00	.462	-161.0	3.773	57.9	.107	25.7	.356	-51.0
900.00	.460	-168.4	3.421	50.4	.115	23.6	.337	-52.1
1000.00	.459	-175.2	3.114	43.4	.123	20.4	.319	-54.3
1100.00	.461	179.2	2.875	36.9	.130	18.7	.305	-55.4
1200.00	.464	173.5	2.664	30.1	.138	15.8	.296	-58.1
1300.00	.468	168.8	2.469	23.7	.147	13.2	.283	-60.0
1400.00	.475	164.3	2.325	17.3	.156	10.2	.275	-63.3
1500.00	.479	160.0	2.175	11.3	.163	7.2	.263	-66.1
1600.00	.487	156.1	2.076	5.1	.172	4.1	.255	-69.0
1700.00	.491	152.0	1.957	-1.0	.180	.9	.247	-72.8
1800.00	.500	148.8	1.869	-6.6	.190	-2.2	.238	-75.6
1900.00	.507	145.2	1.783	-12.7	.198	-5.5	.232	-80.3
2000.00	.516	141.9	1.703	-18.3	.207	-8.8	.225	-84.2
2100.00	.525	138.7	1.642	-24.1	.218	-12.4	.220	-89.2
2200.00	.532	136.1	1.569	-29.6	.226	-16.0	.213	-94.2
2300.00	.544	132.8	1.522	-35.3	.237	-19.6	.208	-98.8
2400.00	.548	130.2	1.459	-40.8	.245	-23.4	.203	-105.2
2500.00	.559	127.8	1.417	-46.0	.255	-26.8	.199	-110.7
2600.00	.567	124.8	1.368	-51.6	.264	-31.2	.200	-117.4
2700.00	.574	122.7	1.326	-56.7	.274	-34.7	.196	-124.1
2800.00	.585	120.1	1.283	-62.2	.284	-38.8	.199	-130.9
2900.00	.592	118.1	1.241	-67.1	.293	-42.6	.200	-137.8
3000.00	.604	115.7	1.212	-72.3	.304	-46.7	.204	-143.7

S-PARAMETER

V_{CE} = 3 V, I_c = 3 mA, Z_o = 50 Ω

FREQUENCY	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG
100.00	.910	-23.7	5.615	154.6	.038	70.8	.943	-15.4
200.00	.815	-48.0	5.419	134.2	.065	53.8	.832	-27.0
300.00	.737	-70.9	5.156	117.7	.084	42.7	.718	-34.6
400.00	.664	-91.2	4.674	103.8	.094	34.8	.635	-38.8
500.00	.609	-109.6	4.337	91.1	.102	28.8	.571	-42.4
600.00	.569	-123.6	3.814	80.2	.108	24.3	.520	-44.4
700.00	.539	-136.4	3.496	70.6	.113	20.9	.486	-46.3
800.00	.521	-147.1	3.165	61.6	.119	17.4	.455	-48.2
900.00	.510	-156.1	2.913	53.5	.124	15.1	.434	-49.7
1000.00	.502	-164.3	2.676	45.6	.129	12.0	.414	-52.0
1100.00	.498	-171.1	2.473	38.6	.134	10.1	.398	-53.4
1200.00	.499	-177.7	2.310	31.4	.139	7.3	.386	-56.1
1300.00	.499	-176.7	2.152	24.6	.145	5.4	.373	-57.9
1400.00	.505	171.4	2.032	18.0	.152	2.8	.363	-61.1
1500.00	.506	166.5	1.906	11.6	.157	.2	.352	-63.9
1600.00	.515	162.0	1.817	5.2	.164	-1.8	.345	-66.8
1700.00	.516	157.3	1.725	-1.1	.170	-4.5	.336	-70.1
1800.00	.522	153.7	1.646	-7.1	.178	-6.8	.328	-73.1
1900.00	.531	149.5	1.577	-13.4	.186	-9.6	.321	-77.3
2000.00	.538	145.8	1.504	-19.0	.194	-12.2	.313	-81.0
2100.00	.547	142.2	1.449	-24.9	.202	-15.1	.307	-85.4
2200.00	.552	139.3	1.391	-30.6	.210	-18.1	.301	-89.8
2300.00	.563	135.7	1.350	-36.4	.221	-21.1	.297	-94.2
2400.00	.568	132.8	1.293	-42.0	.229	-24.4	.291	-99.7
2500.00	.580	130.1	1.257	-47.2	.238	-27.7	.287	-104.4
2600.00	.585	126.9	1.214	-53.0	.248	-31.2	.285	-110.4
2700.00	.593	124.7	1.177	-58.1	.258	-34.6	.282	-115.7
2800.00	.604	121.8	1.141	-63.6	.270	-38.4	.283	-121.9
2900.00	.609	119.5	1.102	-68.6	.278	-42.1	.281	-127.9
3000.00	.621	117.0	1.077	-73.8	.289	-45.8	.285	-133.6

V_{CE} = 3 V, I_c = 1 mA, Z_o = 50 Ω

FREQUENCY	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG
100.00	.985	-16.6	1.985	159.3	.041	75.7	.985	-8.0
200.00	.945	-33.5	1.998	142.9	.077	60.9	.947	-15.6
300.00	.908	-49.9	2.025	127.8	.106	49.0	.892	-21.8
400.00	.855	-65.6	1.942	114.4	.127	37.8	.842	-26.7
500.00	.812	-80.4	1.913	102.3	.143	28.8	.795	-31.0
600.00	.766	-93.7	1.755	90.0	.152	20.1	.754	-34.5
700.00	.726	-106.2	1.705	79.4	.159	13.3	.722	-37.6
800.00	.693	-118.6	1.635	68.7	.162	6.9	.692	-40.4
900.00	.664	-129.4	1.571	59.3	.163	1.9	.667	-42.9
1000.00	.644	-139.6	1.509	50.0	.166	-3.7	.645	-45.8
1100.00	.627	-148.2	1.438	41.7	.165	-7.4	.630	-48.3
1200.00	.617	-157.0	1.375	33.4	.163	-11.0	.616	-51.3
1300.00	.607	-164.2	1.299	25.8	.162	-14.3	.603	-53.9
1400.00	.604	-171.0	1.247	18.5	.162	-17.1	.593	-57.3
1500.00	.600	-177.5	1.183	11.1	.159	-19.6	.583	-60.3
1600.00	.604	176.6	1.140	4.4	.158	-21.5	.575	-63.7
1700.00	.600	170.6	1.093	-2.6	.157	-23.4	.566	-67.2
1800.00	.604	165.7	1.048	-8.9	.157	-23.7	.561	-70.6
1900.00	.608	160.5	1.012	-15.5	.158	-25.0	.553	-74.5
2000.00	.611	155.8	.973	-21.4	.160	-25.4	.549	-78.5
2100.00	.620	151.0	.942	-27.7	.165	-26.5	.543	-82.7
2200.00	.622	147.2	.905	-33.3	.170	-26.9	.537	-87.0
2300.00	.631	143.0	.884	-39.3	.176	-28.0	.532	-91.5
2400.00	.632	139.2	.846	-44.9	.183	-29.2	.528	-96.4
2500.00	.642	135.9	.824	-50.0	.192	-30.0	.523	-101.0
2600.00	.647	132.0	.799	-55.6	.202	-32.3	.522	-106.4
2700.00	.652	129.1	.774	-60.5	.214	-34.4	.519	-111.8
2800.00	.660	125.6	.752	-65.8	.226	-36.9	.518	-117.2
2900.00	.664	122.9	.726	-70.5	.238	-39.7	.516	-122.5
3000.00	.674	119.9	.709	-75.2	.254	-42.7	.517	-128.2

[MEMO]

No part of this document may be copied or reproduced in any form or by any means without the prior written consent of NEC Corporation. NEC Corporation assumes no responsibility for any errors which may appear in this document.

NEC Corporation does not assume any liability for infringement of patents, copyrights or other intellectual property rights of third parties by or arising from use of a device described herein or any other liability arising from use of such device. No license, either express, implied or otherwise, is granted under any patents, copyrights or other intellectual property rights of NEC Corporation or others.

While NEC Corporation has been making continuous effort to enhance the reliability of its semiconductor devices, the possibility of defects cannot be eliminated entirely. To minimize risks of damage or injury to persons or property arising from a defect in an NEC semiconductor device, customer must incorporate sufficient safety measures in its design, such as redundancy, fire-containment, and anti-failure features.

NEC devices are classified into the following three quality grades:

"Standard", "Special", and "Specific". The Specific quality grade applies only to devices developed based on a customer designated "quality assurance program" for a specific application. The recommended applications of a device depend on its quality grade, as indicated below. Customers must check the quality grade of each device 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: Aircrafts, aerospace equipment, submersible repeaters, nuclear reactor control systems, life support systems or medical equipment for life support, etc.

The quality grade of NEC devices in "Standard" unless otherwise specified in NEC's Data Sheets or Data Books. If customers intend to use NEC devices for applications other than those specified for Standard quality grade, they should contact NEC Sales Representative in advance.

Anti-radioactive design is not implemented in this product.