

NEC

SILICON TRANSISTOR  
2SC5004NPN 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  $f_r$  : 5.0 GHz TYP. (@  $V_{CE} = 5$  V,  $I_C = 5$  mA,  $f = 1$  GHz)
- Low  $C_{re}$  : 0.9 pF TYP. (@  $V_{CB} = 5$  V,  $I_E = 0$ ,  $f = 1$  MHz)
- Ultra Super Mini Mold Package. (1.6 mm  $\times$  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	

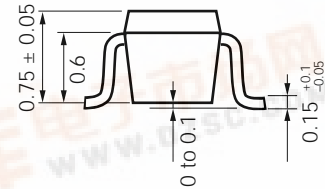
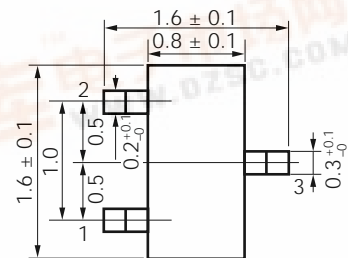
\* Please contact with responsible NEC person, if you require evaluation sample. Unit sample quantity shall be 50 pcs.

ABSOLUTE MAXIMUM RATINGS ( $T_A = 25$  °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<sub>A</sub> = 25 °C)**

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

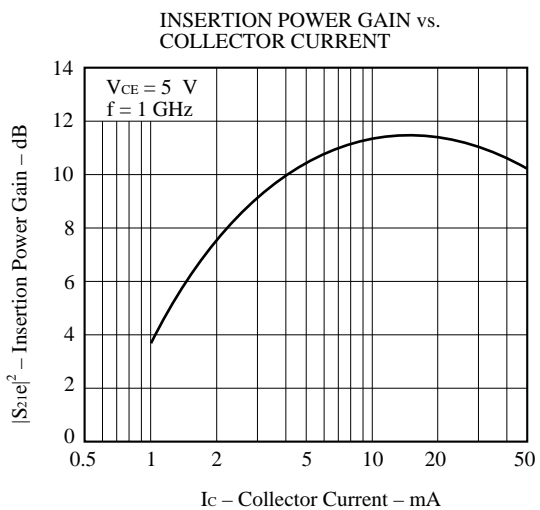
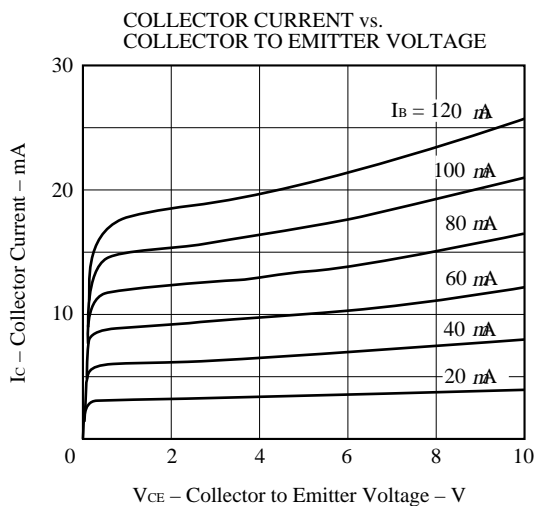
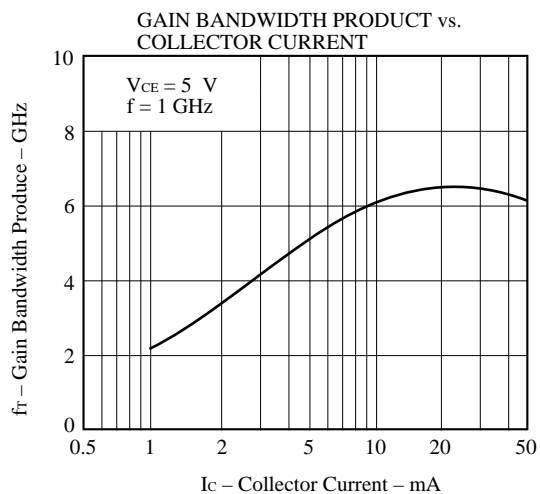
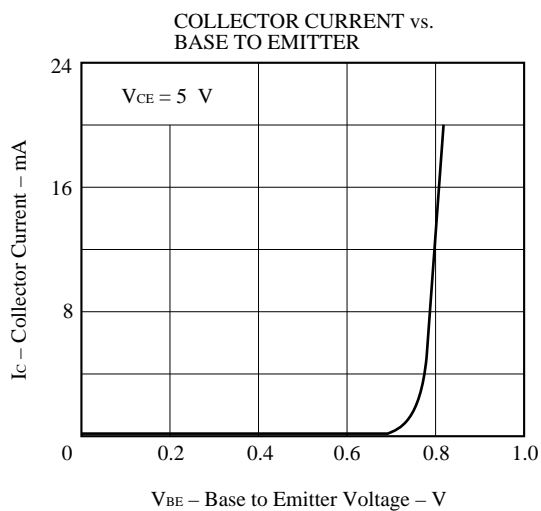
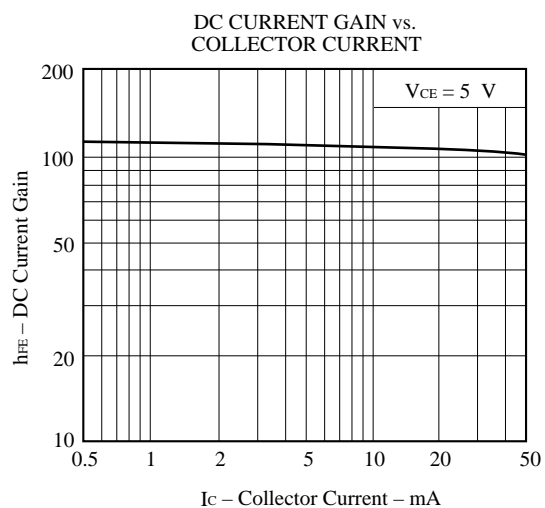
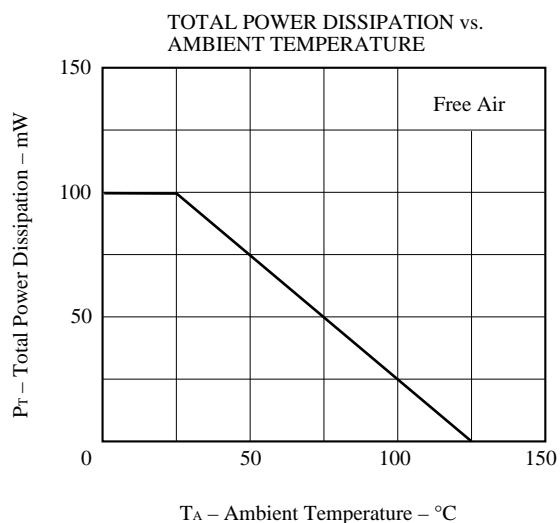
\*1 Pulse Measurement PW ≤ 350 μs, Duty Cycle ≤ 2 %

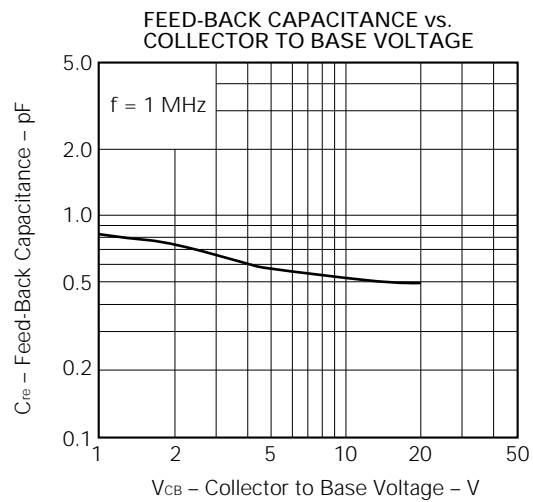
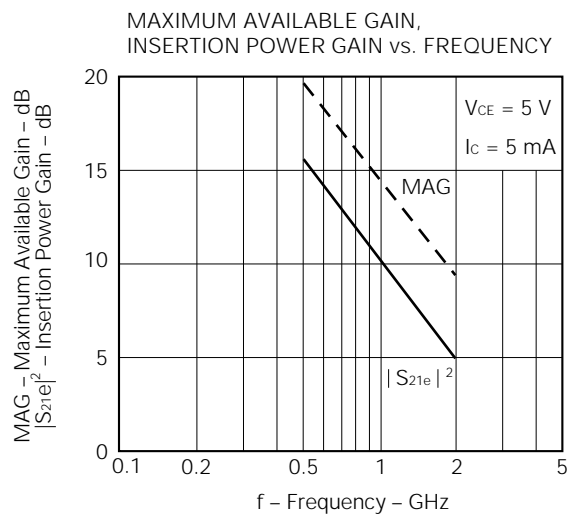
\*2 The emitter terminal and the case shall be connected to the guard terminal of the three-terminal capacitance bridge.

**h<sub>FE</sub> Classification**

Rank	FB
Marking	77
h <sub>FE</sub>	60 to 120

TYPICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ )





**S-PARAMETER** $V_{CE} = 5\text{ V}$ ,  $I_C = 5\text{ mA}$ ,  $Z_0 = 50\ \Omega$ 

FREQUENCY		S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG	
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	

 $V_{CE} = 5\text{ V}$ ,  $I_C = 3\text{ mA}$ ,  $Z_0 = 50\ \Omega$ 

FREQUENCY		S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG	
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** $V_{CE} = 5\text{ V}$ ,  $I_c = 1\text{ mA}$ ,  $Z_o = 50\ \Omega$ 

FREQUENCY		S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG	
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	

 $V_{CE} = 3\text{ V}$ ,  $I_c = 5\text{ mA}$ ,  $Z_o = 50\ \Omega$ 

FREQUENCY		S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG	
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** $V_{CE} = 3\text{ V}$ ,  $I_C = 3\text{ mA}$ ,  $Z_0 = 50\ \Omega$ 

FREQUENCY		S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG	
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	

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

FREQUENCY		S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG	
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]

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