

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	

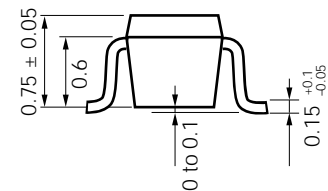
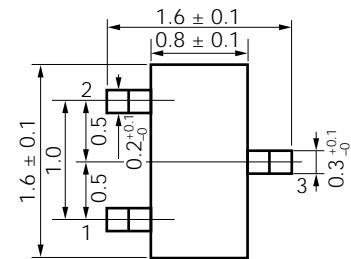
* Please contact with responsible NEC person, if you require evaluation sample. Unit sample quantity shall be 50 pcs.

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

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	$^\circ\text{C}$
Storage Temperature	T_{stg}	-55 to +125	$^\circ\text{C}$

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

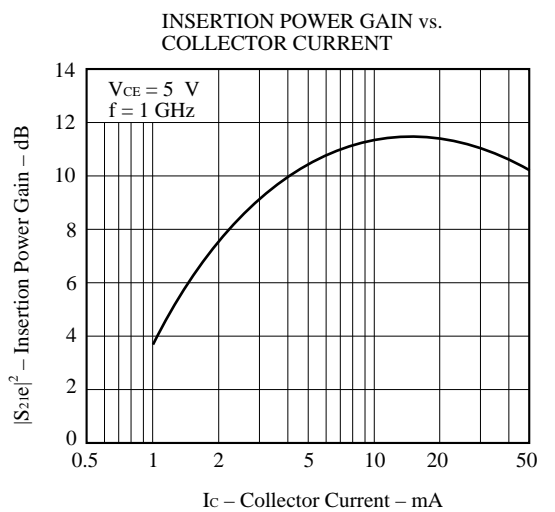
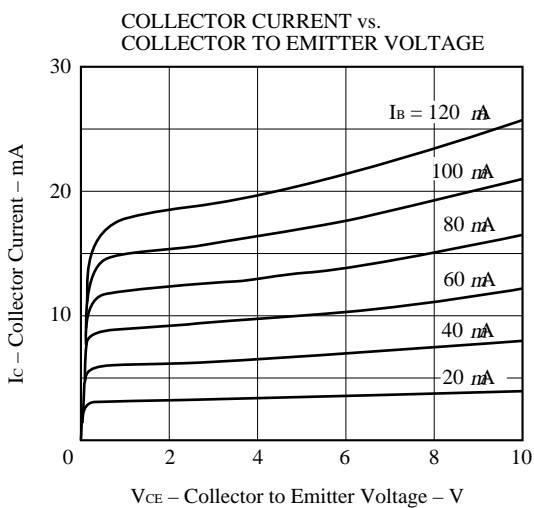
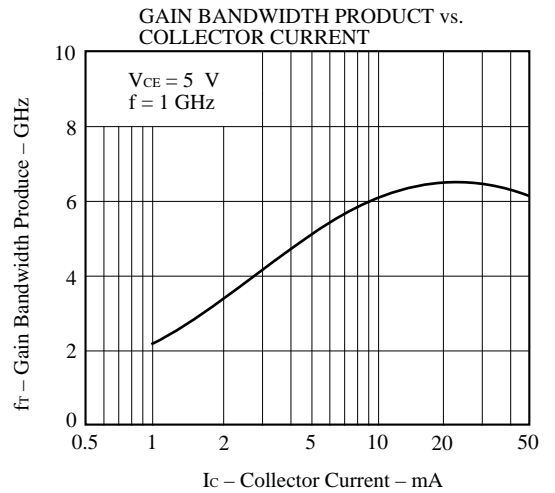
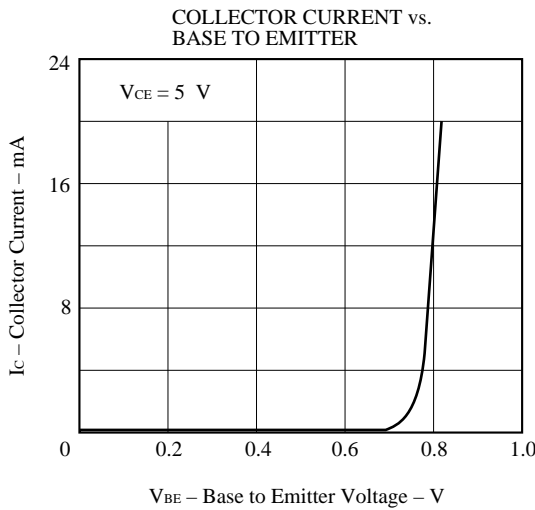
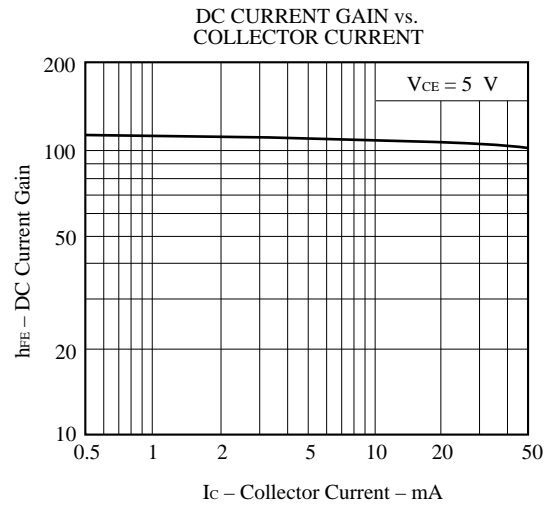
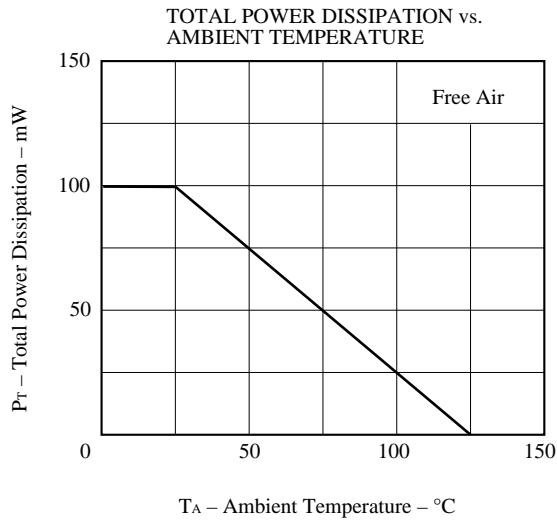
*1 Pulse Measurement PW ≤ 350 μs, Duty Cycle ≤ 2 %

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

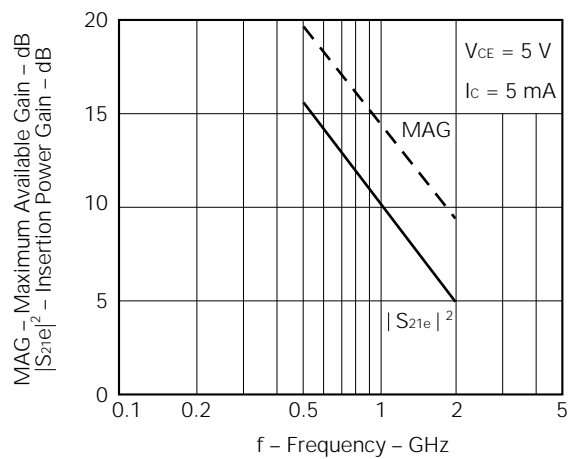
h_{FE} Classification

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

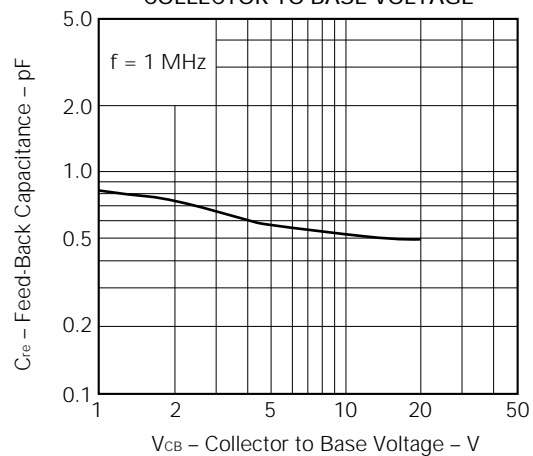
TYPICAL CHARACTERISTICS (T_A = 25 °C)



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]

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Anti-radioactive design is not implemented in this product.