

NEC

SILICON TRANSISTOR  
2SC5184

NPN EPITAXIAL SILICON TRANSISTOR IN SUPER MINI-MOLD PACKAGE FOR LOW-NOISE MICROWAVE AMPLIFICATION

FEATURES

- Low Noise
  - NF = 1.3 dB TYP. @  $V_{CE} = 2\text{ V}$ ,  $I_c = 3\text{ mA}$ ,  $f = 2\text{ GHz}$
  - NF = 1.3 dB TYP. @  $V_{CE} = 1\text{ V}$ ,  $I_c = 3\text{ mA}$ ,  $f = 2\text{ GHz}$
  - Super Mini-Mold package
- EIAJ: SC-70

ORDERING INFORMATION

PART NUMBER	QUANTITY	ARRANGEMENT
2SC5184-T1	3 000 units/reel	Embossed tape, 8 mm wide, Pin No. 3 (collector) facing the perforations
2SC5184-T2	3 000 units/reel	Embossed tape, 8 mm wide, Pins No. 1 (emitter) and No. 2 (base) facing the perforations

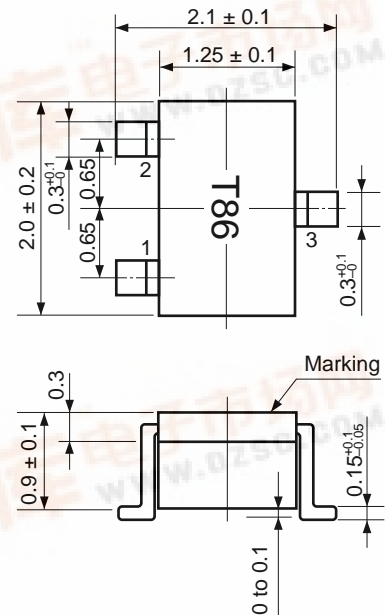
**Remark:** Contact your NEC sales representative to order samples for evaluation (available in batches of 50).

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

Collector to Base Voltage	$V_{CBO}$	5	V
Collector to Emitter Voltage	$V_{CEO}$	3	V
Emitter to Base Voltage	$V_{EBO}$	2	V
Collector Current	$I_c$	30	mA
Total Power Dissipation	$P_T$	90	mW
Junction Temperature	$T_j$	150	C
Storage Temperature	$T_{stg}$	-65 to +150	C

PACKAGE DIMENSIONS

(Units: mm)



PIN CONNECTIONS

1. Emitter
2. Base
3. Collector

**ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25 °C)**

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	CONDITIONS
Collector Cutoff Current	I <sub>CB0</sub>			100	nA	V <sub>CB</sub> = 5 V, I <sub>E</sub> = 0
Emitter Cutoff Current	I <sub>EB0</sub>			100	nA	V <sub>EB</sub> = 1 V, I <sub>C</sub> = 0
DC Current Gain	h <sub>FE</sub>	70		140		V <sub>CE</sub> = 2 V, I <sub>C</sub> = 20 mA <sup>*1</sup>
Insertion Power Gain (1)	S <sub>21e</sub>   <sup>2</sup>	7	8.5		dB	V <sub>CE</sub> = 2 V, I <sub>C</sub> = 20 mA, f = 2 GHz
Insertion Power Gain (2)	S <sub>21e</sub>   <sup>2</sup>	6	7.5		dB	V <sub>CE</sub> = 1 V, I <sub>C</sub> = 10 mA, f = 2 GHz
Noise Figure (1)	NF		1.3	2.0	dB	V <sub>CE</sub> = 2 V, I <sub>C</sub> = 3 mA, f = 2 GHz
Noise Figure (2)	NF		1.3	2.0	dB	V <sub>CE</sub> = 1 V, I <sub>C</sub> = 3 mA, f = 2 GHz
Gain Bandwidth Product (1)	f <sub>T</sub>	9	11		GHz	V <sub>CE</sub> = 2 V, I <sub>C</sub> = 20 mA, f = 2 GHz
Gain Bandwidth Product (2)	f <sub>T</sub>	7	9		GHz	V <sub>CE</sub> = 1 V, I <sub>C</sub> = 10 mA, f = 2 GHz
Feedback Capacitance	C <sub>re</sub>		0.4	0.8	pF	V <sub>CB</sub> = 2 V, I <sub>E</sub> = 0 mA, f = 1 MHz <sup>*2</sup>

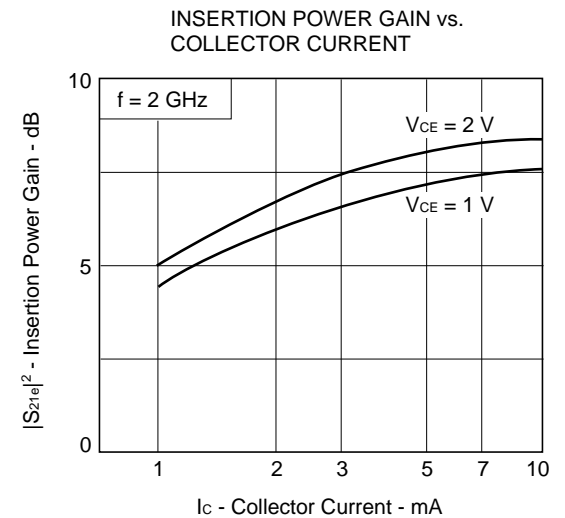
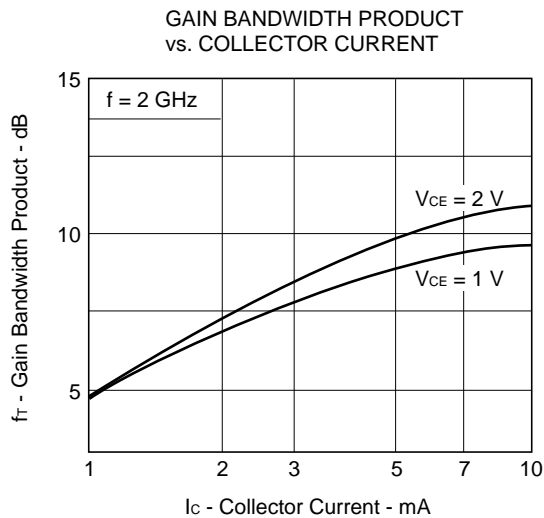
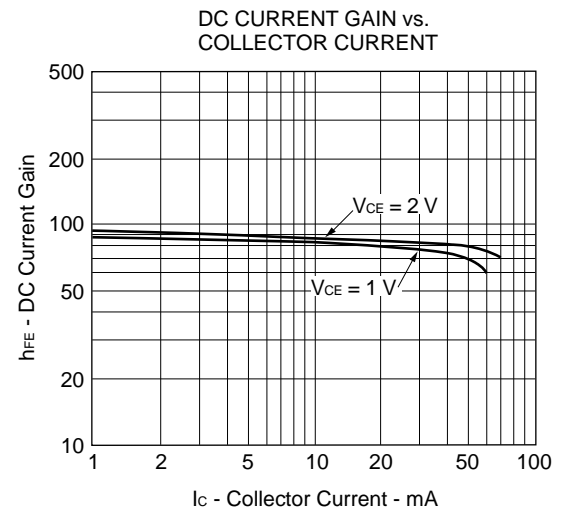
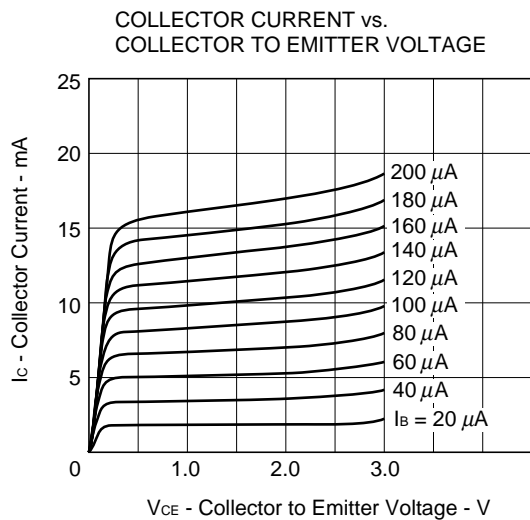
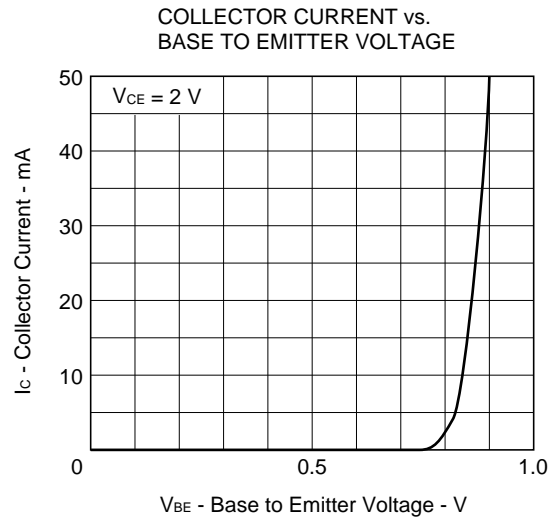
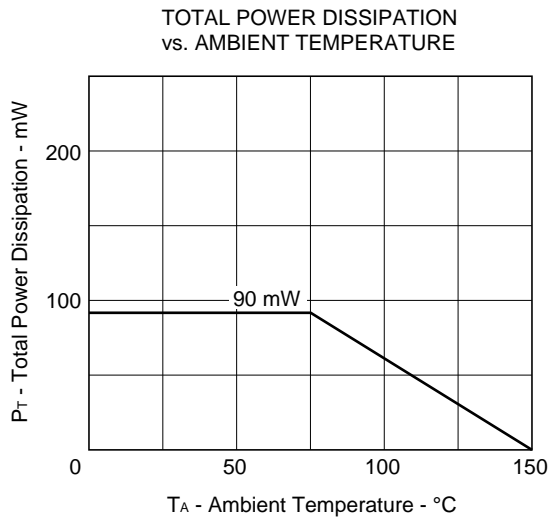
\*1 Measured with pulses: Pulse width ≤ 350 μs, duty cycle ≤ 2 %, pulsed.

\*2 Measured with a three-terminal bridge. The emitter and case terminal are connected to the guard terminal of the bridge.

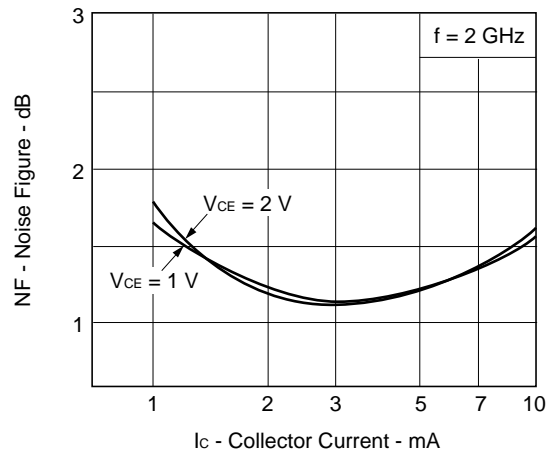
**h<sub>FE</sub> Class**

Class	FB
Marking	T86
h <sub>FE</sub>	70 to 140

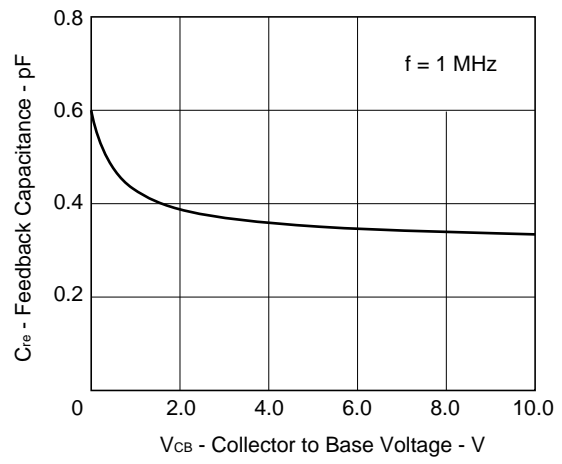
CHARACTERISTICS CURVES ( $T_A = 25\text{ }^\circ\text{C}$ )



NOISE FIGURE vs.  
COLLECTOR CURRENT



FEED-BACK CAPACITANCE vs.  
COLLECTOR TO BASE VOLTAGE



**S-PARAMETERS**

V<sub>CE</sub> = 1 V, I<sub>c</sub> = 1 mA, Z<sub>o</sub> = 50 Ω

FREQUENCY	S11		S21		S12		S22	
	MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG
100.0000	0.974	-6.9	2.031	170.7	0.029	84.1	0.993	-5.5
200.0000	0.971	-14.0	1.953	162.5	0.057	78.0	0.982	-10.9
300.0000	0.956	-20.5	1.928	154.8	0.083	72.3	0.960	-15.5
400.0000	0.926	-28.4	2.021	147.6	0.105	67.5	0.925	-20.7
500.0000	0.902	-34.5	1.911	141.1	0.126	62.9	0.902	-24.9
600.0000	0.861	-42.2	1.941	135.2	0.144	58.6	0.861	-28.6
700.0000	0.829	-49.5	1.930	129.2	0.158	54.4	0.826	-32.6
800.0000	0.793	-55.6	1.864	123.6	0.172	51.1	0.791	-35.6
900.0000	0.753	-63.1	1.917	118.6	0.182	48.2	0.758	-38.5
1000.0000	0.723	-68.8	1.839	114.1	0.191	45.7	0.731	-41.3
1100.0000	0.691	-76.3	1.838	109.3	0.200	43.4	0.703	-43.4
1200.0000	0.652	-82.9	1.833	104.4	0.204	41.6	0.675	-45.6
1300.0000	0.628	-88.7	1.742	100.1	0.209	39.4	0.652	-47.9
1400.0000	0.587	-95.8	1.756	95.7	0.213	38.4	0.629	-49.5
1500.0000	0.565	-101.4	1.686	92.0	0.215	37.0	0.610	-51.6
1600.0000	0.535	-107.4	1.654	88.1	0.217	36.0	0.591	-53.0
1700.0000	0.508	-113.5	1.624	84.7	0.218	35.3	0.574	-54.6
1800.0000	0.489	-118.6	1.565	81.2	0.220	35.0	0.559	-56.0
1900.0000	0.471	-124.6	1.530	78.4	0.221	34.5	0.545	-57.4
2000.0000	0.449	-130.5	1.509	75.2	0.222	34.6	0.532	-59.0

V<sub>CE</sub> = 1 V, I<sub>c</sub> = 3 mA, Z<sub>o</sub> = 50 Ω

FREQUENCY	S11		S21		S12		S22	
	MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG
100.0000	0.917	-11.2	5.682	164.5	0.027	81.0	0.966	-10.7
200.0000	0.879	-22.2	5.447	154.3	0.052	72.7	0.914	-20.4
300.0000	0.830	-31.8	5.165	144.7	0.072	66.6	0.845	-28.1
400.0000	0.755	-44.2	5.205	136.0	0.087	61.7	0.764	-34.6
500.0000	0.703	-52.5	4.838	129.3	0.101	58.1	0.705	-39.7
600.0000	0.625	-63.5	4.684	122.1	0.111	55.8	0.639	-43.1
700.0000	0.560	-73.9	4.522	115.3	0.121	54.2	0.587	-46.8
800.0000	0.506	-81.8	4.219	109.8	0.129	53.3	0.543	-49.0
900.0000	0.456	-90.8	4.031	104.7	0.137	52.9	0.508	-51.3
1000.0000	0.411	-98.6	3.796	100.0	0.143	52.3	0.478	-52.9
1100.0000	0.384	-105.7	3.574	95.9	0.152	51.9	0.451	-54.4
1200.0000	0.346	-113.0	3.377	91.7	0.158	51.7	0.428	-55.6
1300.0000	0.327	-119.7	3.166	88.4	0.165	51.6	0.408	-57.2
1400.0000	0.303	-126.4	3.011	85.2	0.171	51.8	0.390	-58.2
1500.0000	0.289	-132.4	2.850	82.4	0.179	51.9	0.375	-59.6
1600.0000	0.273	-138.2	2.707	79.6	0.185	51.9	0.361	-60.2
1700.0000	0.261	-144.4	2.588	77.1	0.193	51.9	0.348	-61.3
1800.0000	0.252	-150.1	2.468	74.4	0.200	52.1	0.338	-62.4
1900.0000	0.247	-156.0	2.364	72.2	0.207	52.4	0.329	-63.4
2000.0000	0.242	-161.8	2.274	69.8	0.214	52.4	0.319	-64.8

V<sub>CE</sub> = 1 V, I<sub>c</sub> = 7 mA, Z<sub>o</sub> = 50 Ω

FREQUENCY	S11		S21		S12		S22	
	MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG
100.0000	0.784	-18.0	11.844	157.9	0.026	77.0	0.906	-18.0
200.0000	0.700	-36.7	10.881	143.4	0.045	68.8	0.784	-32.0
300.0000	0.606	-51.4	9.746	131.7	0.060	64.3	0.664	-40.8
400.0000	0.490	-68.6	9.052	121.0	0.070	62.4	0.563	-46.7
500.0000	0.412	-80.3	8.022	113.0	0.081	61.4	0.496	-50.2
600.0000	0.343	-92.6	7.101	106.5	0.091	61.2	0.436	-52.6
700.0000	0.299	-103.1	6.348	101.0	0.100	62.0	0.393	-54.8
800.0000	0.265	-111.9	5.687	96.8	0.110	62.1	0.359	-55.8
900.0000	0.243	-120.0	5.170	93.2	0.119	62.3	0.336	-57.4
1000.0000	0.222	-127.7	4.735	89.7	0.130	62.2	0.317	-58.1
1100.0000	0.213	-135.2	4.360	86.9	0.140	62.3	0.298	-59.3
1200.0000	0.198	-142.5	4.033	83.9	0.150	62.7	0.283	-59.8
1300.0000	0.193	-149.8	3.756	81.5	0.159	62.2	0.268	-61.4
1400.0000	0.184	-156.2	3.508	79.0	0.169	61.9	0.257	-62.2
1500.0000	0.183	-162.3	3.310	76.8	0.179	61.8	0.248	-63.3
1600.0000	0.178	-168.3	3.127	74.6	0.189	61.4	0.239	-63.8
1700.0000	0.177	-173.9	2.963	72.7	0.199	61.0	0.231	-65.1
1800.0000	0.176	-179.6	2.814	70.6	0.208	60.9	0.224	-66.2
1900.0000	0.180	175.3	2.686	68.6	0.217	60.3	0.218	-67.3
2000.0000	0.182	170.6	2.573	66.9	0.228	60.0	0.211	-68.8

V<sub>CE</sub> = 1 V, I<sub>c</sub> = 10 mA, Z<sub>o</sub> = 50 Ω

FREQUENCY	S11		S21		S12		S22	
	MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG
100.0000	0.689	-24.5	14.893	153.4	0.024	76.0	0.865	-22.1
200.0000	0.583	-47.9	13.678	137.1	0.041	68.5	0.710	-37.1
300.0000	0.476	-65.2	11.837	124.5	0.054	65.2	0.579	-45.5
400.0000	0.372	-82.3	10.296	114.1	0.065	63.8	0.483	-50.8
500.0000	0.306	-94.2	8.800	106.9	0.076	65.2	0.421	-53.5
600.0000	0.259	-106.7	7.604	101.4	0.087	65.2	0.367	-55.4
700.0000	0.232	-117.0	6.695	96.9	0.098	65.5	0.331	-57.2
800.0000	0.211	-126.3	5.965	93.1	0.108	65.5	0.301	-58.0
900.0000	0.198	-134.5	5.386	90.1	0.118	65.6	0.282	-59.2
1000.0000	0.184	-142.3	4.901	87.1	0.128	66.0	0.265	-59.5
1100.0000	0.180	-149.3	4.500	84.5	0.140	65.8	0.251	-60.8
1200.0000	0.172	-156.7	4.155	82.0	0.151	65.5	0.239	-61.5
1300.0000	0.172	-163.4	3.851	79.5	0.161	65.1	0.226	-63.1
1400.0000	0.169	-169.2	3.602	77.3	0.170	64.6	0.218	-63.8
1500.0000	0.169	-175.2	3.400	75.4	0.183	64.2	0.210	-65.4
1600.0000	0.168	179.9	3.189	73.1	0.193	63.8	0.203	-66.0
1700.0000	0.168	174.6	3.032	71.4	0.203	63.2	0.195	-67.1
1800.0000	0.170	169.3	2.880	69.4	0.213	62.6	0.188	-68.3
1900.0000	0.175	165.1	2.748	67.6	0.224	62.0	0.184	-69.4
2000.0000	0.179	161.1	2.629	66.0	0.234	61.4	0.179	-71.4

$V_{CE} = 1\text{ V}$ ,  $I_c = 20\text{ mA}$ ,  $Z_o = 50\ \Omega$

FREQUENCY	S11		S21		S12		S22	
	MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG
100.0000	0.441	-76.4	18.515	138.3	0.021	73.8	0.753	-30.4
200.0000	0.358	-97.6	15.403	121.3	0.037	69.2	0.556	-46.5
300.0000	0.290	-111.1	12.655	110.9	0.049	69.0	0.429	-53.6
400.0000	0.242	-120.8	10.657	104.2	0.061	69.6	0.349	-58.2
500.0000	0.208	-129.8	9.000	99.0	0.073	70.4	0.301	-59.6
600.0000	0.196	-142.5	7.688	94.9	0.084	70.5	0.259	-61.2
700.0000	0.190	-150.3	6.712	91.3	0.096	70.5	0.234	-62.7
800.0000	0.185	-158.8	5.955	88.1	0.108	70.5	0.212	-63.2
900.0000	0.184	-164.7	5.338	85.6	0.120	69.9	0.200	-64.9
1000.0000	0.182	-171.1	4.863	82.9	0.132	69.7	0.189	-65.0
1100.0000	0.183	-176.2	4.468	80.7	0.144	69.3	0.179	-67.1
1200.0000	0.183	178.4	4.106	78.5	0.156	68.5	0.169	-68.2
1300.0000	0.187	173.6	3.806	76.3	0.168	68.2	0.160	-69.9
1400.0000	0.187	169.5	3.540	74.3	0.179	67.5	0.154	-71.5
1500.0000	0.193	165.5	3.337	72.1	0.190	66.9	0.149	-73.3
1600.0000	0.193	161.7	3.154	70.4	0.202	65.8	0.144	-74.4
1700.0000	0.196	158.0	2.980	68.7	0.214	65.3	0.138	-76.3
1800.0000	0.199	153.9	2.843	67.0	0.224	64.3	0.134	-78.3
1900.0000	0.205	151.4	2.699	65.2	0.235	63.7	0.130	-79.8
2000.0000	0.211	148.9	2.579	63.6	0.247	62.9	0.127	-82.4

$V_{CE} = 2\text{ V}$ ,  $I_c = 1\text{ mA}$ ,  $Z_o = 50\ \Omega$

FREQUENCY	S11		S21		S12		S22	
	MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG
100.0000	0.978	-6.8	2.018	171.8	0.025	83.3	0.995	-4.9
200.0000	0.975	-13.1	1.958	163.5	0.049	78.9	0.987	-9.7
300.0000	0.964	-19.1	1.937	156.3	0.071	74.1	0.970	-13.9
400.0000	0.932	-26.5	2.026	149.7	0.091	68.8	0.938	-18.4
500.0000	0.915	-32.1	1.917	143.3	0.110	64.8	0.920	-22.1
600.0000	0.876	-39.3	1.959	137.6	0.127	60.6	0.884	-25.5
700.0000	0.846	-46.0	1.945	132.0	0.140	57.0	0.852	-29.1
800.0000	0.812	-51.8	1.888	126.6	0.152	53.7	0.822	-31.8
900.0000	0.776	-58.9	1.940	121.9	0.162	50.9	0.791	-34.6
1000.0000	0.746	-64.1	1.862	117.6	0.170	48.7	0.766	-37.1
1100.0000	0.717	-71.2	1.875	112.8	0.177	46.4	0.740	-39.1
1200.0000	0.676	-77.5	1.874	108.0	0.184	44.3	0.714	-41.1
1300.0000	0.652	-83.0	1.785	103.9	0.189	42.2	0.693	-43.1
1400.0000	0.610	-89.8	1.802	99.6	0.192	41.0	0.669	-44.7
1500.0000	0.586	-95.2	1.731	96.0	0.195	39.6	0.653	-46.7
1600.0000	0.554	-101.0	1.709	92.0	0.197	39.0	0.634	-47.8
1700.0000	0.526	-106.7	1.681	88.6	0.198	38.3	0.616	-49.4
1800.0000	0.503	-111.9	1.624	85.1	0.200	37.8	0.602	-50.7
1900.0000	0.482	-117.8	1.594	82.1	0.201	37.5	0.591	-52.0
2000.0000	0.457	-123.4	1.572	79.0	0.202	37.6	0.575	-53.3

$V_{CE} = 2\text{ V}$ ,  $I_C = 3\text{ mA}$ ,  $Z_o = 50\ \Omega$

FREQUENCY	S11		S21		S12		S22	
	MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG
100.0000	0.916	-10.2	5.805	166.0	0.023	82.8	0.973	-9.3
200.0000	0.893	-20.0	5.495	155.8	0.045	74.6	0.931	-17.8
300.0000	0.850	-28.6	5.238	146.7	0.062	68.0	0.870	-24.4
400.0000	0.777	-39.7	5.292	138.5	0.077	64.1	0.798	-30.4
500.0000	0.731	-47.1	4.938	131.9	0.090	60.3	0.745	-34.8
600.0000	0.656	-57.0	4.818	125.0	0.101	58.5	0.684	-37.8
700.0000	0.592	-66.2	4.673	118.4	0.109	56.7	0.633	-41.0
800.0000	0.536	-73.3	4.389	113.0	0.117	55.5	0.591	-42.9
900.0000	0.481	-81.4	4.223	107.8	0.123	55.0	0.557	-44.8
1000.0000	0.435	-88.0	3.993	103.3	0.131	54.5	0.528	-46.2
1100.0000	0.400	-95.1	3.781	99.0	0.137	54.5	0.504	-47.6
1200.0000	0.357	-101.3	3.589	94.9	0.144	54.2	0.479	-48.5
1300.0000	0.333	-107.4	3.374	91.5	0.151	54.0	0.459	-49.8
1400.0000	0.302	-113.4	3.210	88.0	0.157	54.1	0.441	-50.5
1500.0000	0.284	-119.4	3.047	85.2	0.164	54.4	0.427	-51.7
1600.0000	0.264	-124.8	2.896	82.3	0.170	54.4	0.414	-52.3
1700.0000	0.247	-130.7	2.766	79.9	0.177	54.7	0.401	-53.2
1800.0000	0.233	-136.2	2.641	77.2	0.183	54.7	0.392	-54.0
1900.0000	0.225	-142.5	2.528	75.0	0.191	55.1	0.383	-54.8
2000.0000	0.215	-148.4	2.436	72.9	0.198	54.9	0.373	-55.8

$V_{CE} = 2\text{ V}$ ,  $I_C = 5\text{ mA}$ ,  $Z_o = 50\ \Omega$

FREQUENCY	S11		S21		S12		S22	
	MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG
100.0000	0.857	-13.2	9.113	162.6	0.023	78.8	0.948	-12.7
200.0000	0.811	-25.8	8.527	150.3	0.041	72.1	0.870	-23.3
300.0000	0.743	-36.6	7.907	139.9	0.057	66.2	0.781	-30.9
400.0000	0.642	-50.1	7.737	130.5	0.069	63.9	0.690	-36.6
500.0000	0.571	-59.3	7.109	123.0	0.079	61.7	0.627	-40.3
600.0000	0.483	-69.9	6.609	115.5	0.088	61.2	0.564	-42.6
700.0000	0.415	-79.3	6.140	109.1	0.096	60.5	0.517	-44.8
800.0000	0.363	-86.7	5.613	104.2	0.105	60.2	0.479	-45.9
900.0000	0.321	-93.7	5.182	99.9	0.113	60.2	0.451	-47.4
1000.0000	0.284	-100.3	4.803	95.9	0.121	60.5	0.427	-47.9
1100.0000	0.260	-106.6	4.448	92.6	0.130	60.6	0.406	-48.9
1200.0000	0.231	-112.8	4.149	89.2	0.137	60.4	0.388	-49.5
1300.0000	0.215	-119.2	3.875	86.4	0.146	60.7	0.372	-50.4
1400.0000	0.196	-125.0	3.635	83.8	0.155	60.7	0.359	-51.0
1500.0000	0.185	-131.8	3.428	81.3	0.163	60.7	0.348	-52.1
1600.0000	0.172	-137.4	3.244	78.9	0.171	60.7	0.337	-52.3
1700.0000	0.163	-144.2	3.090	76.6	0.180	60.5	0.327	-53.0
1800.0000	0.155	-150.5	2.938	74.6	0.188	60.3	0.319	-53.7
1900.0000	0.152	-157.2	2.810	72.6	0.196	60.3	0.313	-54.5
2000.0000	0.149	-164.1	2.692	70.7	0.205	60.0	0.305	-55.4



V<sub>CE</sub> = 2 V, I<sub>c</sub> = 10 mA, Z<sub>o</sub> = 50 Ω

FREQUENCY	S11		S21		S12		S22	
	MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG
100.0000	0.805	-16.8	12.051	160.5	0.021	76.4	0.923	-15.4
200.0000	0.733	-31.1	11.136	145.9	0.039	71.1	0.818	-27.3
300.0000	0.645	-43.8	10.084	134.6	0.052	66.7	0.711	-34.9
400.0000	0.531	-58.4	9.504	124.1	0.063	64.9	0.615	-39.8
500.0000	0.445	-68.3	8.484	116.3	0.073	64.6	0.550	-42.8
600.0000	0.366	-78.6	7.598	109.4	0.083	64.2	0.492	-44.5
700.0000	0.311	-87.2	6.839	103.8	0.092	63.5	0.451	-46.1
800.0000	0.269	-94.4	6.153	99.5	0.100	63.8	0.416	-46.7
900.0000	0.240	-101.0	5.628	95.7	0.110	63.6	0.393	-47.7
1000.0000	0.212	-107.4	5.139	92.4	0.119	64.0	0.374	-48.1
1100.0000	0.194	-113.9	4.750	89.4	0.128	63.9	0.355	-48.9
1200.0000	0.174	-120.4	4.399	86.5	0.137	64.1	0.341	-49.3
1300.0000	0.161	-127.7	4.097	84.0	0.146	63.5	0.326	-50.1
1400.0000	0.148	-134.2	3.836	81.6	0.155	64.4	0.316	-50.6
1500.0000	0.141	-141.3	3.613	79.2	0.164	64.2	0.307	-51.6
1600.0000	0.132	-147.6	3.403	77.2	0.174	63.5	0.298	-51.8
1700.0000	0.127	-154.8	3.231	75.1	0.182	63.3	0.290	-52.4
1800.0000	0.122	-161.7	3.069	73.1	0.192	63.0	0.283	-53.1
1900.0000	0.123	-169.0	2.919	71.1	0.201	62.6	0.277	-54.1
2000.0000	0.123	-175.7	2.802	69.5	0.210	62.2	0.271	-55.0

V<sub>CE</sub> = 2 V, I<sub>c</sub> = 20 mA, Z<sub>o</sub> = 50 Ω

FREQUENCY	S11		S21		S12		S22	
	MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG
100.0000	0.723	-20.3	15.896	156.6	0.021	78.2	0.890	-18.6
200.0000	0.629	-38.3	14.304	140.5	0.036	71.0	0.755	-31.2
300.0000	0.520	-53.2	12.506	128.1	0.048	67.3	0.633	-38.5
400.0000	0.403	-67.5	11.061	117.4	0.059	67.5	0.541	-42.4
500.0000	0.327	-76.9	9.540	110.0	0.069	66.7	0.480	-44.5
600.0000	0.266	-86.7	8.285	104.2	0.079	67.1	0.427	-45.6
700.0000	0.228	-95.0	7.319	99.5	0.088	67.3	0.393	-46.6
800.0000	0.196	-102.2	6.522	95.8	0.098	67.3	0.363	-46.7
900.0000	0.175	-109.0	5.905	92.5	0.107	67.2	0.343	-47.5
1000.0000	0.155	-116.2	5.381	89.5	0.117	67.0	0.329	-47.6
1100.0000	0.143	-123.2	4.958	86.8	0.128	67.2	0.313	-48.2
1200.0000	0.129	-130.1	4.574	84.3	0.137	67.2	0.301	-48.6
1300.0000	0.121	-138.7	4.251	81.9	0.147	66.8	0.289	-49.3
1400.0000	0.114	-145.5	3.961	79.8	0.157	66.7	0.281	-49.7
1500.0000	0.109	-153.5	3.732	77.7	0.166	66.5	0.273	-50.7
1600.0000	0.105	-160.3	3.520	75.7	0.176	65.7	0.266	-51.0
1700.0000	0.102	-168.2	3.341	74.0	0.186	65.3	0.259	-51.7
1800.0000	0.101	-176.1	3.172	72.0	0.196	64.8	0.253	-52.8
1900.0000	0.105	177.1	3.013	70.3	0.205	64.3	0.248	-53.5
2000.0000	0.108	171.3	2.886	68.6	0.215	64.0	0.242	-54.2

$V_{CE} = 2\text{ V}$ ,  $I_c = 20\text{ mA}$ ,  $Z_o = 50\ \Omega$

FREQUENCY	S11		S21		S12		S22	
	MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG
100.0000	0.474	-33.9	27.070	147.2	0.018	76.5	0.805	-24.1
200.0000	0.354	-57.5	20.499	127.1	0.031	74.3	0.624	-36.4
300.0000	0.270	-73.3	15.719	115.1	0.043	72.8	0.501	-42.1
400.0000	0.213	-85.2	12.575	107.5	0.054	71.2	0.424	-44.2
500.0000	0.173	-94.8	10.387	101.9	0.064	72.6	0.376	-44.6
600.0000	0.146	-105.1	8.873	97.6	0.074	73.1	0.337	-44.9
700.0000	0.129	-115.0	7.714	93.9	0.084	72.7	0.312	-45.2
800.0000	0.116	-124.7	6.794	91.0	0.095	72.0	0.294	-44.9
900.0000	0.104	-133.8	6.117	88.4	0.106	72.5	0.279	-45.8
1000.0000	0.097	-143.0	5.522	85.2	0.116	72.4	0.266	-44.9
1100.0000	0.093	-151.3	5.083	83.4	0.128	71.7	0.257	-45.7
1200.0000	0.091	-159.0	4.649	81.0	0.137	71.1	0.250	-46.1
1300.0000	0.090	-169.5	4.346	79.0	0.148	70.9	0.241	-46.9
1400.0000	0.089	-176.4	4.044	77.1	0.159	70.5	0.234	-47.2
1500.0000	0.091	177.3	3.797	75.6	0.169	69.5	0.229	-48.7
1600.0000	0.094	170.6	3.565	73.8	0.179	68.9	0.224	-49.5
1700.0000	0.095	165.4	3.378	71.8	0.190	68.2	0.218	-50.2
1800.0000	0.100	160.1	3.222	70.2	0.200	67.6	0.216	-50.7
1900.0000	0.106	156.6	3.080	68.4	0.210	66.9	0.210	-52.1
2000.0000	0.106	150.5	2.922	67.1	0.219	66.3	0.204	-52.9

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