



# SILICON TRANSISTOR

## NE68519 / 2SC5010

JEITA  
Part No.

### NPN SILICON EPITAXIAL TRANSISTOR 3 PINS ULTRA SUPER MINI MOLD

#### DESCRIPTION

The NE68519 / 2SC5010 is an NPN epitaxial silicon transistor designed for use in low noise and small signal amplifiers from VHF band to L band. Low noise figure, high gain, and high current capability achieve a very wide dynamic range and excellent linearity. This is achieved by direct nitride passivated base surface process (NEST3 process) which is a proprietary fabrication technique.

#### FEATURES

- Low Voltage Use.
- High  $f_T$  : 12.0 GHz TYP. (@  $V_{CE} = 3$  V,  $I_C = 10$  mA,  $f = 2$  GHz)
- Low  $C_{re}$  : 0.4 pF TYP. (@  $V_{CE} = 3$  V,  $I_E = 0$ ,  $f = 1$  MHz)
- Low NF : 1.5 dB TYP. (@  $V_{CE} = 3$  V,  $I_C = 3$  mA,  $f = 2$  GHz)
- High  $IS_{21el}^2$ : 8.5 dB TYP. (@  $V_{CE} = 3$  V,  $I_C = 10$  mA,  $f = 2$  GHz)
- Ultra Super Mini Mold Package.

#### ORDERING INFORMATION

PART NUMBER	QUANTITY	PACKING STYLE
NE68519-A 2SC5010-A	50 pcs/Unit.	Embossed tape 8 mm wide. Pin3(Collector) face to perforation side of the tape.
NE68519-T1-A 2SC5010-T1-A	3 kpcs/Reel.	

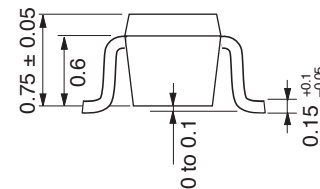
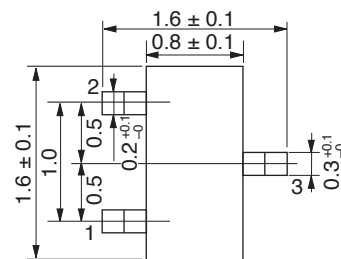
\* Please contact a sales representative, if you require evaluation sample. Unit sample quantity shall be 50 pcs.

#### ABSOLUTE MAXIMUM RATINGS ( $T_A = 25$ °C)

Collector to Base Voltage	$V_{CBO}$	9	V
Collector to Emitter Voltage	$V_{CEO}$	6	V
Emitter to Base Voltage	$V_{EBO}$	2	V
Collector Current	$I_C$	30	mA
Total Power Dissipation	$P_T$	125	mW
Junction Temperature	$T_j$	150	°C
Storage Temperature	$T_{stg}$	-65 to +150	°C

#### PACKAGE DIMENSIONS

in millimeters



1. Emitter
2. Base
3. Collector

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

CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITIONS
Collector Cutoff Current	I <sub>CB0</sub>			0.1	μA	V <sub>CB</sub> = 5 V, I <sub>E</sub> = 0
Emitter Cutoff Current	I <sub>EB0</sub>			0.1	μA	V <sub>EB</sub> = 1 V, I <sub>C</sub> = 0
DC Current Gain	h <sub>FE</sub>	75		150		V <sub>CE</sub> = 3 V, I <sub>C</sub> = 10 mA* <sup>1</sup>
Gain Bandwidth Product	f <sub>T</sub>		12.0		GHz	V <sub>CE</sub> = 3 V, I <sub>C</sub> = 10 mA, f = 2 GHz
Feed-Back Capacitance	C <sub>re</sub>		0.4	0.7	pF	V <sub>CE</sub> = 3 V, I <sub>E</sub> = 0, f = 1 MHz* <sup>2</sup>
Insertion Power Gain	IS <sub>21el</sub> <sup>2</sup>	7.0	8.5		dB	V <sub>CE</sub> = 3 V, I <sub>C</sub> = 10 mA, f = 2 GHz
Noise Figure	NF		1.5	2.5	dB	V <sub>CE</sub> = 3 V, I <sub>C</sub> = 3 mA, f = 2 GHz

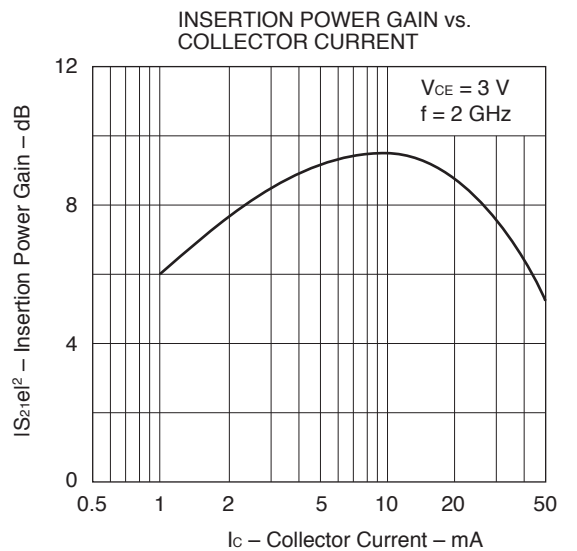
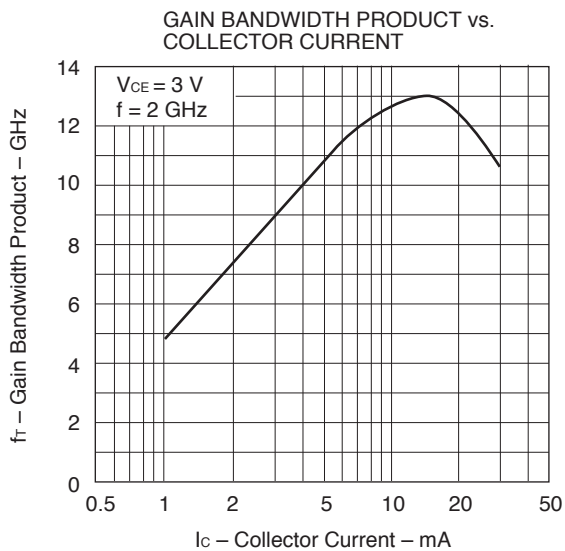
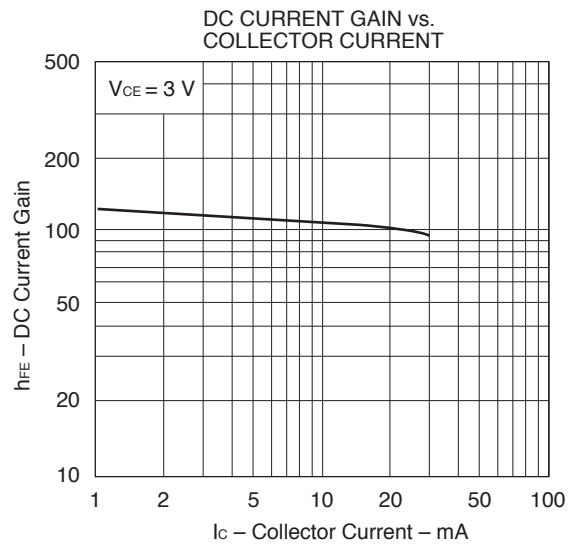
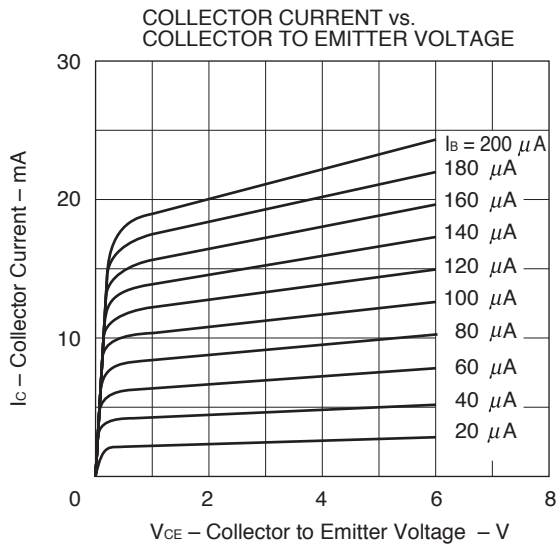
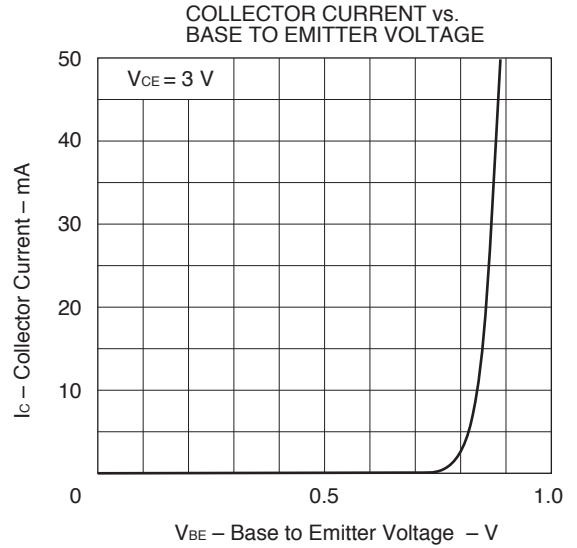
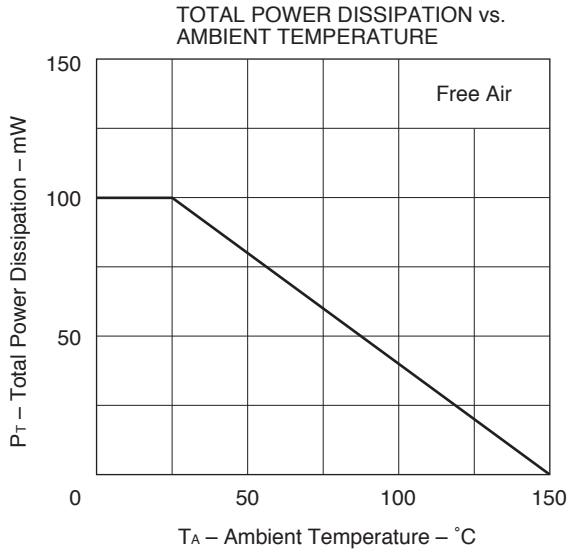
\*1 Pulse Measurement PW ≤ 350 μs, Duty Cycle ≤ 2 %

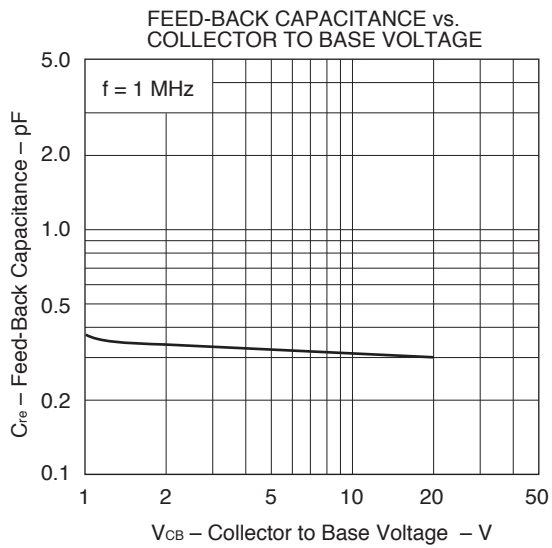
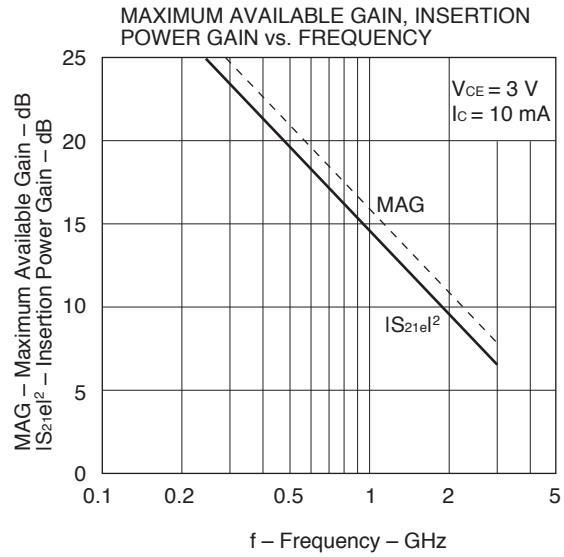
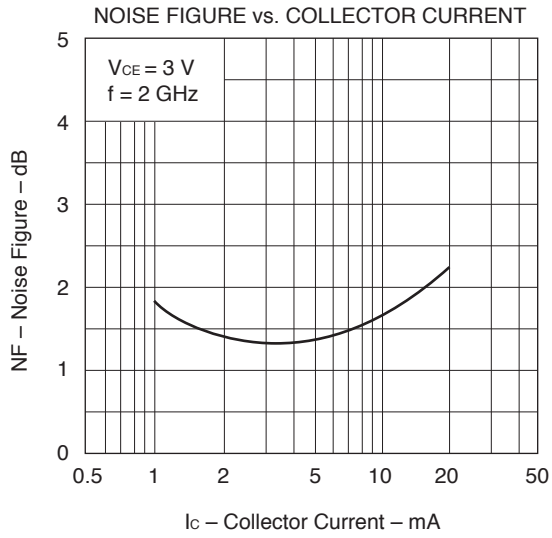
\*2 The emitter terminal and the case shall be connected to the guard terminal of the three-terminal capacitance bridge.

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

Rank	FB
Marking	83
h <sub>FE</sub>	75 to 150

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





**S-PARAMETER**

V<sub>CE</sub> = 3 V, I<sub>c</sub> = 10 mA, Z<sub>O</sub> = 50 Ω

FREQUENCY MHz	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100.00	.735	-18.7	15.465	157.7	.017	78.5	.931	-15.0
200.00	.640	-37.8	14.330	142.1	.030	69.7	.810	-25.9
300.00	.534	-55.7	13.115	129.2	.040	66.3	.700	-32.4
400.00	.438	-71.4	11.574	118.3	.048	64.5	.612	-36.2
500.00	.364	-84.9	10.235	109.9	.057	63.7	.547	-38.2
600.00	.311	-96.6	8.943	103.1	.064	63.3	.499	-39.4
700.00	.268	-107.0	7.935	97.7	.072	62.8	.461	-40.4
800.00	.241	-116.9	7.105	92.7	.080	62.7	.430	-40.9
900.00	.218	-126.4	6.425	88.7	.088	62.6	.405	-41.7
1000.00	.204	-135.9	5.864	84.8	.095	62.0	.386	-42.2
1100.00	.192	-144.5	5.397	81.4	.103	61.0	.370	-42.8
1200.00	.186	-153.7	4.992	78.1	.111	60.9	.354	-43.6
1300.00	.183	-161.8	4.628	75.1	.119	60.5	.341	-44.5
1400.00	.184	-169.5	4.348	72.3	.127	59.4	.328	-45.4
1500.00	.185	-176.7	4.072	69.2	.134	58.4	.317	-46.8
1600.00	.189	176.4	3.851	66.6	.142	57.7	.305	-48.0
1700.00	.196	169.9	3.643	63.8	.151	56.9	.294	-49.1
1800.00	.201	164.8	3.457	61.3	.158	55.9	.285	-50.6
1900.00	.208	159.7	3.311	59.0	.166	55.1	.271	-52.2
2000.00	.219	155.1	3.156	56.6	.176	53.7	.261	-54.0
2100.00	.228	150.6	3.024	54.1	.183	52.3	.249	-55.6
2200.00	.239	147.1	2.904	51.5	.190	51.4	.239	-57.7
2300.00	.248	143.3	2.790	49.3	.199	50.3	.229	-59.8
2400.00	.259	139.9	2.685	46.8	.207	49.0	.218	-62.0
2500.00	.270	136.9	2.593	44.7	.215	47.9	.206	-64.6
2600.00	.281	133.7	2.511	42.2	.223	46.4	.197	-67.1
2700.00	.293	131.6	2.425	40.2	.230	45.5	.185	-70.1
2800.00	.305	128.7	2.354	37.9	.237	43.9	.174	-73.8
2900.00	.316	126.3	2.283	35.6	.246	43.0	.162	-77.0
3000.00	.329	124.5	2.220	33.5	.253	41.5	.151	-81.1

V<sub>CE</sub> = 3 V, I<sub>c</sub> = 7 mA, Z<sub>O</sub> = 50 Ω

FREQUENCY MHz	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100.00	.855	-14.2	10.699	164.8	.019	80.2	.968	-10.6
200.00	.787	-28.4	10.334	151.4	.035	73.3	.902	-19.8
300.00	.715	-41.9	9.924	140.1	.048	68.5	.825	-27.0
400.00	.631	-54.9	9.183	130.2	.059	63.4	.743	-32.5
500.00	.561	-66.5	8.559	121.7	.068	60.9	.678	-36.5
600.00	.495	-77.0	7.749	113.9	.077	58.8	.621	-39.4
700.00	.434	-86.4	7.090	107.6	.084	57.5	.572	-41.9
800.00	.387	-95.8	6.490	101.5	.092	56.4	.531	-43.4
900.00	.346	-104.1	5.972	96.6	.099	55.5	.496	-45.1
1000.00	.313	-113.2	5.531	91.8	.105	55.0	.467	-46.4
1100.00	.287	-121.1	5.117	87.8	.113	54.3	.442	-47.3
1200.00	.266	-129.5	4.767	83.8	.119	54.0	.420	-48.4
1300.00	.251	-137.5	4.442	80.3	.126	53.3	.399	-49.7
1400.00	.242	-145.6	4.192	77.1	.133	52.8	.381	-50.5
1500.00	.232	-153.7	3.936	73.7	.140	52.3	.364	-51.9
1600.00	.228	-161.2	3.730	70.7	.147	51.7	.349	-53.1
1700.00	.227	-169.2	3.537	67.6	.155	50.8	.336	-54.4
1800.00	.226	-176.4	3.355	64.9	.161	50.1	.321	-55.8
1900.00	.230	177.5	3.210	62.1	.169	49.6	.307	-57.3
2000.00	.236	170.8	3.066	59.5	.177	48.7	.296	-59.0
2100.00	.243	164.7	2.944	56.7	.183	47.7	.282	-60.6
2200.00	.250	159.6	2.825	54.0	.190	47.0	.269	-62.6
2300.00	.258	154.8	2.725	51.8	.198	46.0	.259	-64.6
2400.00	.267	150.0	2.623	49.1	.205	45.0	.247	-66.7
2500.00	.277	145.9	2.534	46.8	.212	44.0	.235	-68.8
2600.00	.288	141.7	2.455	44.2	.221	43.1	.225	-71.3
2700.00	.300	138.8	2.370	41.9	.228	42.0	.211	-73.9
2800.00	.312	135.3	2.305	39.5	.234	41.0	.200	-77.3
2900.00	.321	132.0	2.230	37.1	.243	40.0	.189	-80.7
3000.00	.335	129.5	2.172	34.9	.250	38.7	.179	-84.3

**S-PARAMETER**

V<sub>CE</sub> = 3 V, I<sub>c</sub> = 5 mA, Z<sub>o</sub> = 50 Ω

FREQUENCY MHz	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100.00	.900	-11.4	8.160	166.3	.019	80.5	.976	-9.1
200.00	.845	-23.9	8.072	154.4	.036	74.9	.927	-17.4
300.00	.788	-35.4	7.948	144.3	.051	68.4	.864	-24.2
400.00	.723	-46.6	7.529	135.0	.063	63.7	.795	-29.8
500.00	.657	-57.7	7.230	127.4	.074	60.9	.733	-34.2
600.00	.595	-67.8	6.685	119.6	.081	57.5	.678	-37.7
700.00	.528	-77.3	6.274	113.0	.089	56.1	.627	-40.7
800.00	.475	-86.7	5.874	106.5	.097	54.5	.583	-42.7
900.00	.425	-95.3	5.482	101.0	.103	53.4	.545	-44.7
1000.00	.384	-104.3	5.150	95.7	.110	52.3	.514	-46.4
1100.00	.347	-112.0	4.796	91.2	.118	51.5	.486	-47.5
1200.00	.321	-120.5	4.512	87.0	.123	51.3	.460	-48.8
1300.00	.298	-128.4	4.221	83.1	.129	50.4	.438	-50.3
1400.00	.283	-136.2	3.994	79.4	.137	49.6	.418	-51.4
1500.00	.268	-144.2	3.770	75.8	.143	49.4	.400	-52.8
1600.00	.258	-151.8	3.568	72.7	.149	48.6	.382	-54.2
1700.00	.254	-159.7	3.400	69.4	.155	48.3	.368	-55.2
1800.00	.249	-167.2	3.229	66.6	.162	47.3	.353	-56.7
1900.00	.250	-173.7	3.101	63.5	.169	46.8	.337	-58.4
2000.00	.253	179.0	2.957	60.8	.176	46.1	.324	-59.8
2100.00	.257	172.5	2.845	58.0	.183	45.4	.310	-61.7
2200.00	.263	166.7	2.730	55.2	.189	44.6	.296	-63.6
2300.00	.269	161.3	2.640	52.7	.196	43.7	.284	-65.5
2400.00	.277	156.2	2.539	49.9	.203	43.1	.272	-67.6
2500.00	.285	151.5	2.456	47.4	.211	41.9	.261	-69.8
2600.00	.296	147.0	2.380	44.8	.217	41.0	.250	-72.2
2700.00	.305	143.5	2.301	42.4	.223	40.4	.237	-74.4
2800.00	.318	139.6	2.234	39.9	.231	39.3	.225	-77.6
2900.00	.327	136.1	2.164	37.5	.238	38.3	.214	-80.7
3000.00	.341	133.2	2.110	35.2	.244	37.3	.204	-84.1

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

FREQUENCY MHz	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100.00	.948	-9.1	5.295	168.1	.020	82.4	.987	-7.0
200.00	.912	-18.6	5.291	158.4	.038	76.4	.955	-13.8
300.00	.876	-27.7	5.354	149.7	.055	70.1	.914	-19.8
400.00	.831	-37.1	5.177	141.3	.069	66.3	.864	-25.2
500.00	.784	-46.0	5.109	135.2	.082	61.6	.816	-29.7
600.00	.737	-54.7	4.832	127.8	.092	57.9	.769	-33.6
700.00	.680	-62.9	4.667	121.7	.101	55.1	.721	-37.2
800.00	.635	-71.7	4.504	115.1	.108	52.6	.678	-39.9
900.00	.581	-80.0	4.335	109.5	.115	50.8	.636	-42.7
1000.00	.530	-89.2	4.226	103.5	.123	48.8	.602	-44.7
1100.00	.480	-97.5	4.038	98.3	.129	47.8	.570	-46.5
1200.00	.441	-105.8	3.879	93.3	.135	46.8	.544	-48.2
1300.00	.408	-113.4	3.680	88.8	.140	45.5	.517	-50.1
1400.00	.382	-121.2	3.528	84.7	.146	44.3	.493	-51.6
1500.00	.358	-128.9	3.359	80.5	.151	43.8	.471	-53.2
1600.00	.339	-136.3	3.200	76.9	.156	43.2	.451	-54.8
1700.00	.324	-144.4	3.076	73.1	.161	42.6	.432	-56.2
1800.00	.311	-151.7	2.932	70.0	.166	41.9	.416	-57.7
1900.00	.305	-158.8	2.825	66.6	.172	41.2	.398	-59.3
2000.00	.301	-166.7	2.712	63.4	.178	40.5	.384	-60.9
2100.00	.299	-173.5	2.614	60.4	.183	40.2	.367	-62.6
2200.00	.300	180.0	2.508	57.2	.189	39.5	.354	-64.4
2300.00	.303	173.7	2.434	54.5	.195	38.9	.340	-66.4
2400.00	.307	167.8	2.348	51.5	.201	38.2	.329	-68.3
2500.00	.311	162.3	2.276	49.0	.206	37.9	.313	-70.6
2600.00	.320	156.7	2.209	45.9	.212	37.0	.303	-72.5
2700.00	.327	152.5	2.140	43.5	.218	36.5	.290	-75.1
2800.00	.337	148.0	2.080	40.8	.223	35.7	.278	-77.8
2900.00	.346	143.7	2.019	38.2	.229	35.1	.267	-80.5
3000.00	.359	140.1	1.967	35.8	.235	34.3	.256	-83.7

**S-PARAMETER**

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

FREQUENCY MHz	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100.00	1.007	-5.9	1.878	172.3	.020	83.6	.998	-4.2
200.00	.988	-12.5	1.925	164.3	.040	80.5	.986	-8.2
300.00	.978	-18.3	2.006	157.9	.059	75.4	.975	-12.3
400.00	.953	-25.2	2.012	150.9	.077	71.4	.955	-16.2
500.00	.939	-30.9	2.031	145.7	.095	66.7	.937	-19.8
600.00	.921	-37.5	1.974	139.1	.110	62.8	.916	-23.3
700.00	.889	-43.2	1.942	133.9	.125	58.6	.893	-26.9
800.00	.871	-49.3	1.914	127.9	.139	54.9	.865	-30.0
900.00	.838	-55.6	1.875	122.8	.149	50.9	.836	-33.6
1000.00	.811	-62.4	1.917	117.8	.160	47.9	.807	-36.5
1100.00	.770	-69.7	1.925	112.5	.169	44.6	.781	-38.9
1200.00	.739	-76.5	1.961	107.7	.175	42.1	.755	-41.4
1300.00	.706	-83.5	1.927	102.7	.182	39.6	.729	-44.0
1400.00	.677	-90.1	1.923	98.4	.188	36.8	.704	-46.3
1500.00	.646	-97.2	1.886	93.2	.192	34.9	.679	-48.6
1600.00	.616	-103.7	1.849	89.2	.196	32.6	.656	-50.8
1700.00	.589	-111.3	1.843	84.4	.200	30.8	.635	-53.0
1800.00	.562	-118.1	1.786	80.4	.201	29.0	.616	-55.1
1900.00	.538	-125.1	1.786	76.1	.203	27.7	.593	-57.1
2000.00	.512	-133.6	1.762	71.8	.206	26.1	.575	-59.1
2100.00	.495	-140.2	1.729	68.0	.207	25.2	.557	-61.2
2200.00	.480	-147.6	1.689	63.9	.207	23.9	.540	-63.2
2300.00	.468	-154.5	1.676	60.4	.209	23.0	.522	-65.2
2400.00	.459	-161.6	1.630	56.7	.210	22.3	.511	-67.3
2500.00	.451	-168.1	1.600	53.4	.210	21.7	.494	-69.5
2600.00	.447	-175.0	1.576	49.7	.212	21.5	.481	-71.7
2700.00	.443	179.1	1.538	46.5	.213	21.1	.467	-74.0
2800.00	.445	173.0	1.509	43.4	.214	21.0	.457	-76.5
2900.00	.443	166.8	1.482	40.1	.216	20.6	.441	-79.1
3000.00	.449	161.9	1.453	37.3	.217	20.5	.432	-81.9

V<sub>CE</sub> = 1 V, I<sub>c</sub> = 5 mA, Z<sub>o</sub> = 50 Ω

FREQUENCY MHz	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100.00	.862	-14.2	8.672	160.8	.023	80.2	.956	-13.0
200.00	.795	-28.9	8.389	148.6	.042	70.5	.875	-24.2
300.00	.718	-43.2	8.162	137.5	.057	64.0	.778	-32.6
400.00	.638	-57.7	7.624	128.2	.070	59.5	.691	-39.0
500.00	.573	-71.2	7.259	119.8	.079	57.7	.618	-43.6
600.00	.510	-83.2	6.617	112.0	.088	55.2	.556	-47.2
700.00	.447	-95.3	6.154	105.2	.096	53.5	.504	-50.1
800.00	.402	-106.5	5.675	98.7	.103	52.8	.459	-52.2
900.00	.364	-117.0	5.254	93.5	.111	52.4	.423	-54.2
1000.00	.336	-127.2	4.875	88.6	.118	51.3	.393	-55.8
1100.00	.314	-136.0	4.517	84.4	.126	50.7	.366	-57.1
1200.00	.300	-144.9	4.206	80.3	.133	50.3	.343	-58.7
1300.00	.289	-153.1	3.922	76.7	.139	49.5	.323	-60.4
1400.00	.286	-160.7	3.699	73.4	.147	48.9	.303	-61.7
1500.00	.282	-167.9	3.473	69.9	.155	48.3	.286	-63.7
1600.00	.282	-174.7	3.293	66.9	.162	47.5	.271	-65.3
1700.00	.286	178.6	3.128	63.6	.170	46.8	.255	-67.1
1800.00	.288	172.9	2.962	60.9	.177	46.2	.242	-69.0
1900.00	.294	167.6	2.838	58.1	.186	45.3	.227	-71.6
2000.00	.303	162.2	2.707	55.2	.193	44.4	.214	-74.0
2100.00	.310	157.3	2.599	52.5	.201	43.5	.200	-76.5
2200.00	.318	152.9	2.487	49.6	.208	42.5	.189	-79.5
2300.00	.327	148.8	2.404	47.4	.215	41.5	.176	-83.1
2400.00	.336	144.9	2.312	44.6	.223	40.5	.166	-86.5
2500.00	.347	141.4	2.234	42.3	.231	39.5	.154	-90.9
2600.00	.359	137.6	2.165	39.6	.237	38.2	.146	-94.9
2700.00	.368	134.9	2.089	37.3	.245	37.3	.135	-100.8
2800.00	.381	131.9	2.028	34.8	.252	36.4	.126	-106.2
2900.00	.390	128.8	1.962	32.5	.260	35.1	.118	-113.3
3000.00	.403	126.6	1.913	30.2	.267	34.0	.113	-121.0

**S-PARAMETER**

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

FREQUENCY MHz	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100.00	.932	-10.9	5.529	165.7	.024	81.3	.977	-9.5
200.00	.886	-21.6	5.442	154.3	.045	73.7	.930	-18.3
300.00	.838	-32.2	5.475	144.7	.063	67.9	.869	-25.8
400.00	.788	-42.9	5.242	136.1	.079	61.7	.800	-32.3
500.00	.733	-53.6	5.156	129.6	.092	57.3	.739	-37.5
600.00	.682	-63.5	4.819	122.0	.102	53.8	.682	-41.9
700.00	.620	-73.4	4.644	115.5	.112	50.8	.628	-45.8
800.00	.573	-83.7	4.447	108.7	.119	49.1	.579	-48.8
900.00	.520	-93.9	4.276	103.0	.126	47.2	.535	-51.8
1000.00	.473	-104.2	4.118	96.8	.133	45.6	.498	-54.0
1100.00	.431	-113.9	3.894	91.7	.140	44.6	.467	-55.9
1200.00	.400	-123.4	3.708	86.7	.145	43.7	.439	-57.8
1300.00	.376	-131.6	3.495	82.4	.151	42.9	.412	-59.8
1400.00	.361	-139.7	3.333	78.7	.157	42.1	.389	-61.6
1500.00	.345	-147.7	3.151	74.5	.163	41.4	.368	-63.5
1600.00	.335	-155.3	3.003	71.0	.168	40.5	.347	-65.5
1700.00	.330	-163.1	2.872	67.3	.174	40.3	.329	-67.2
1800.00	.326	-169.9	2.735	64.3	.180	39.5	.313	-69.2
1900.00	.326	-176.4	2.628	61.1	.186	39.0	.297	-71.3
2000.00	.329	177.0	2.509	57.8	.194	38.1	.281	-73.7
2100.00	.333	171.0	2.419	54.9	.199	37.4	.266	-76.1
2200.00	.337	165.6	2.323	51.8	.205	36.7	.253	-78.5
2300.00	.344	160.5	2.251	49.2	.211	36.1	.239	-81.6
2400.00	.351	155.7	2.166	46.2	.218	35.5	.228	-84.2
2500.00	.359	151.3	2.097	43.7	.223	34.5	.214	-87.5
2600.00	.369	146.8	2.035	40.8	.230	33.8	.204	-91.0
2700.00	.378	143.2	1.966	38.4	.237	33.1	.193	-95.1
2800.00	.389	139.6	1.912	35.7	.242	32.0	.181	-99.7
2900.00	.399	135.9	1.853	33.2	.250	31.3	.172	-104.3
3000.00	.411	133.1	1.805	30.8	.256	30.2	.164	-109.4

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

FREQUENCY MHz	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100.00	1.006	-6.7	1.908	171.3	.025	84.6	.994	-5.1
200.00	.982	-13.7	1.949	162.2	.049	78.6	.982	-10.0
300.00	.970	-20.1	2.027	155.2	.072	73.9	.965	-14.8
400.00	.946	-27.6	2.024	147.2	.094	68.1	.938	-19.6
500.00	.924	-34.0	2.051	142.2	.114	63.6	.914	-23.9
600.00	.903	-41.0	1.977	135.3	.132	59.0	.887	-28.0
700.00	.867	-47.2	1.946	129.7	.148	54.6	.857	-32.2
800.00	.848	-54.0	1.915	123.4	.162	50.6	.822	-35.9
900.00	.811	-60.7	1.874	118.2	.173	46.2	.789	-39.8
1000.00	.783	-68.4	1.908	112.8	.184	43.0	.754	-43.2
1100.00	.741	-76.2	1.919	107.3	.193	39.9	.723	-46.0
1200.00	.707	-84.1	1.946	102.3	.201	37.1	.692	-48.6
1300.00	.675	-91.2	1.902	97.1	.207	34.5	.663	-51.5
1400.00	.647	-98.6	1.888	92.7	.212	31.8	.634	-54.1
1500.00	.617	-106.1	1.846	87.4	.216	29.5	.609	-56.8
1600.00	.589	-112.9	1.808	83.0	.220	27.1	.582	-59.4
1700.00	.565	-121.2	1.799	78.3	.223	25.4	.560	-61.8
1800.00	.542	-128.2	1.741	74.4	.224	23.6	.538	-64.1
1900.00	.523	-135.5	1.729	70.2	.226	22.4	.515	-66.4
2000.00	.502	-144.0	1.703	65.7	.228	20.7	.497	-68.6
2100.00	.489	-150.9	1.667	62.1	.228	19.7	.476	-71.1
2200.00	.479	-158.0	1.625	58.0	.229	18.6	.459	-73.4
2300.00	.470	-164.8	1.605	54.7	.230	17.6	.440	-76.0
2400.00	.466	-171.5	1.557	50.8	.230	16.7	.428	-78.3
2500.00	.461	-177.8	1.524	47.6	.230	16.0	.413	-81.1
2600.00	.462	175.8	1.497	44.0	.231	15.7	.399	-83.7
2700.00	.462	170.4	1.460	40.9	.231	15.5	.384	-86.7
2800.00	.465	164.8	1.433	37.8	.232	14.8	.372	-89.8
2900.00	.466	159.2	1.399	34.6	.233	14.7	.360	-92.9
3000.00	.474	154.9	1.374	31.8	.234	14.5	.351	-96.4



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