

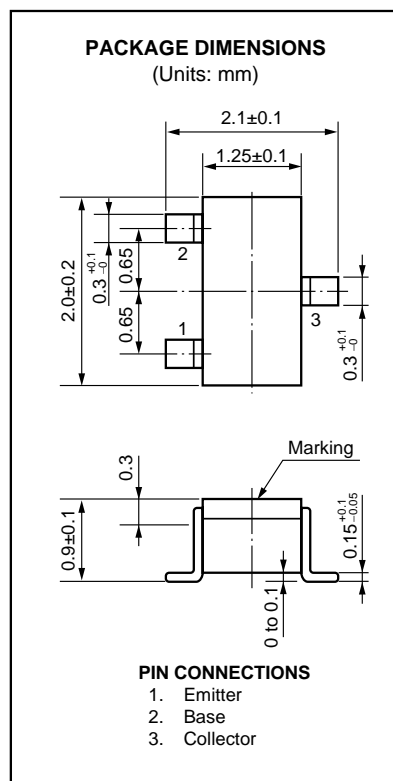
NPN SILICON EPITAXIAL TRANSISTOR  
3 PINS SUPER MINI MOLD

FEATURES

- Excellent Low NF in Low Frequency Band
- Low Voltage Use
- Low  $C_{ob}$  : 0.9 pF TYP.
- Low Noise Voltage : 90 mV TYP.
- Super Mini Mold Package. EIAJ : SC-70

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

Collector to Base Voltage	$V_{CBO}$	25	V
Collector to Emitter Voltage	$V_{CEO}$	13	V
Emitter to Base Voltage	$V_{EBO}$	3.0	V
Collector Current	$I_C$	50	mA
Total Power Dissipation	$P_T$	120	mW
Junction Temperature	$T_j$	125	$^\circ\text{C}$
Storage Temperature	$T_{stg}$	-55 to +125	$^\circ\text{C}$



ELECTRICAL CHARACTERISTICS ( $T_a = 25\text{ }^\circ\text{C}$ )

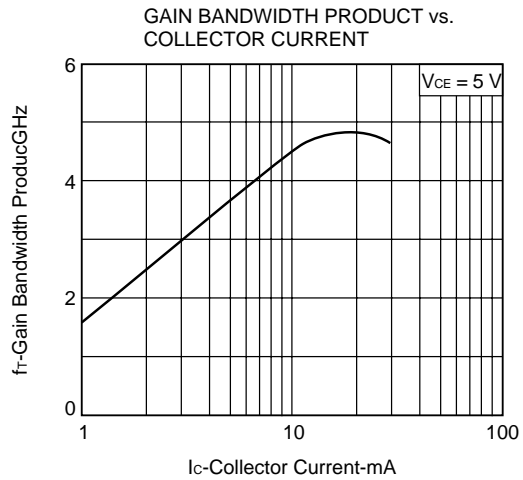
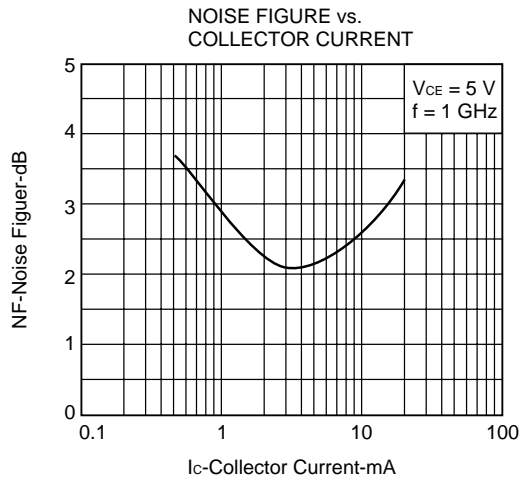
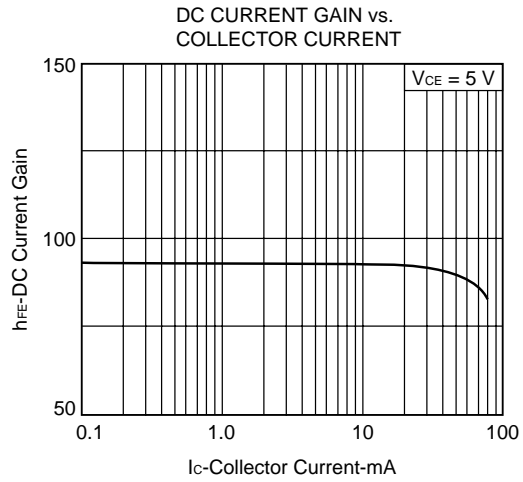
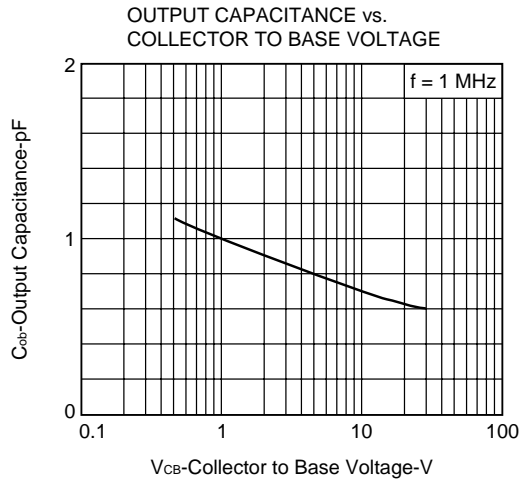
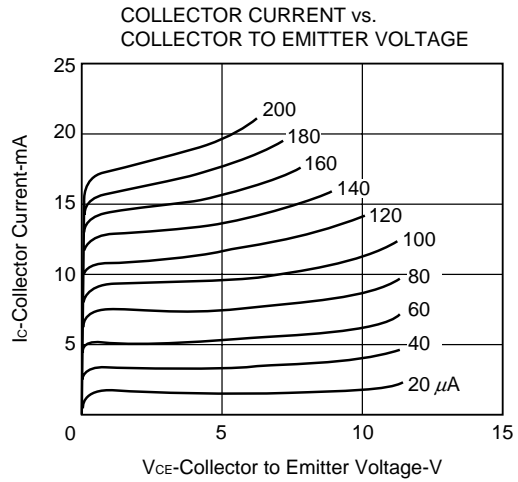
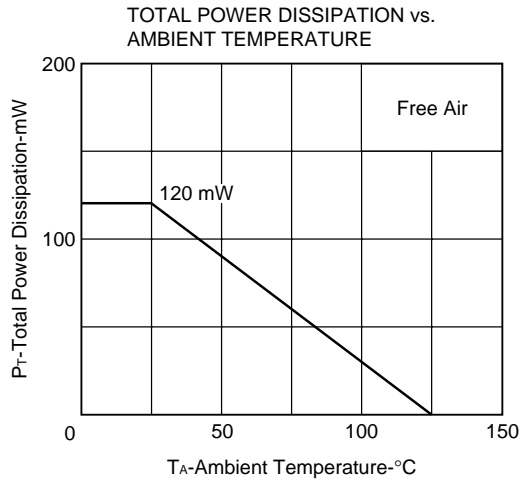
PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITIONS
Collector Cutoff Current	$I_{CBO}$			0.1	$\mu\text{A}$	$V_{CB} = 15\text{ V}, I_E = 0$
Emitter Cutoff Current	$I_{EBO}$			0.1	$\mu\text{A}$	$V_{EB} = 2\text{ V}, I_C = 0$
Collector to Base Saturation Voltage	$V_{CE(sat)}$			0.3	V	$h_{FE} = 10, I_C = 5\text{ mA}$
DC Current Gain	$h_{FE}$	60		150		$V_{CE} = 5\text{ V}, I_C = 5\text{ mA}$ *1
Gain Bandwidth Product	$f_T$	2.5	3.5		GHz	$V_{CE} = 5\text{ V}, I_C = 5\text{ mA}$
Collector Capacitance	$C_{ob}$		0.8	1.2	pF	$V_{CB} = 5\text{ V}, I_E = 0, f = 1\text{ MHz}$
Insertion Power Gain	$ S_{21e} ^2$	7.0	9.0		dB	$V_{CE} = 5\text{ V}, I_C = 5\text{ mA}, f = 1\text{ GHz}$
Noise Figure	NF		3.0		dB	$V_{CE} = 5\text{ V}, I_C = 5\text{ mA}, f = 1\text{ GHz}$
Noise Voltage	NV		90	200	mV	See Test Circuit

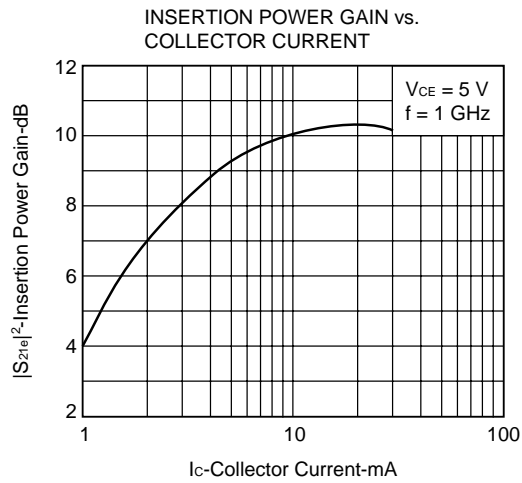
\*1 Pulse Measurement  $PW \leq 350\text{ }\mu\text{s}$ , Duty Cycle  $\leq 2\%$

hFE Classification

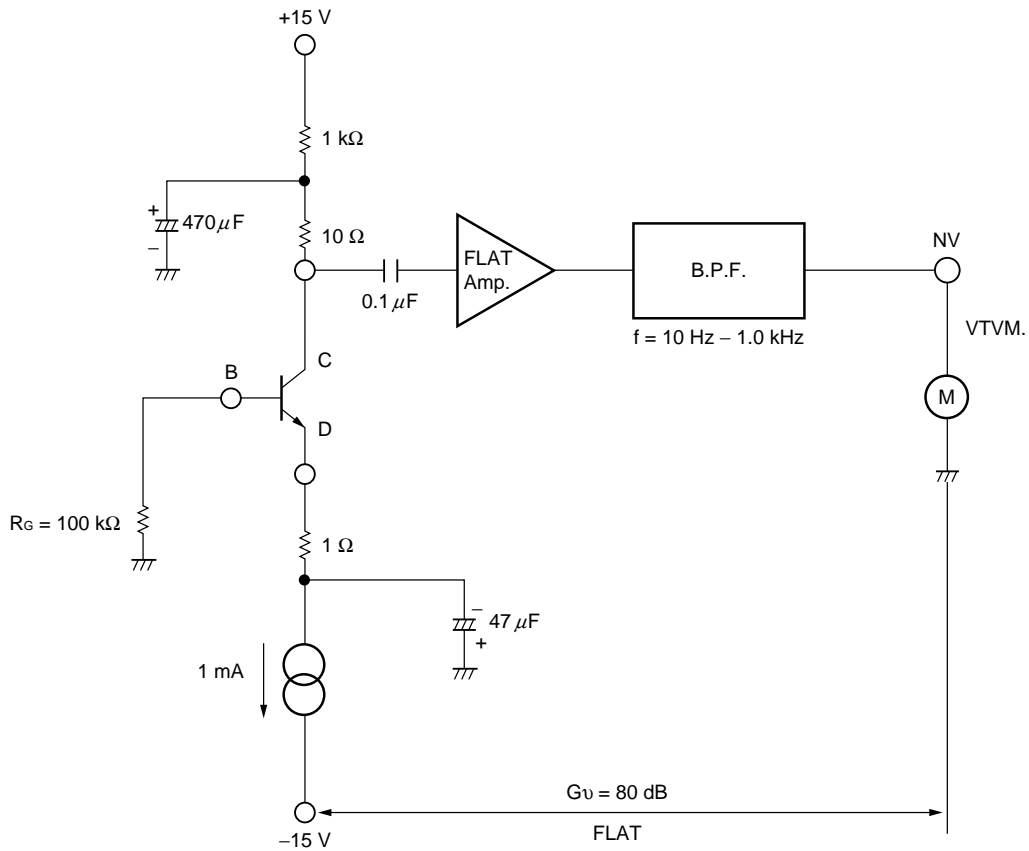
Rank	R13
Marking	R13
$h_{FE}$	60 to 150

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





**NOISE VOLTAGE TEST CIRCUIT**



$V_{CE} \approx 5 \text{ V}$ ,  $I_C = 1 \text{ mA}$ ,  $R_G = 100 \text{ k}\Omega$ ,  $G_V = 80 \text{ dB}$ , FLAT ( $f = 80 \text{ Hz}$  to  $1.0 \text{ kHz}$ )

**S-PARAMETER**

(V<sub>CE</sub> = 5 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	.825	-29.9	8.599	152.6	.032	69.6	.913	-18.0
200.00	.707	-57.5	7.843	133.7	.052	59.2	.764	-28.7
300.00	.609	-81.0	6.756	119.8	.064	52.2	.653	-34.1
400.00	.515	-103.6	5.998	107.7	.073	50.2	.577	-36.7
500.00	.462	-120.2	5.166	99.0	.080	49.9	.528	-37.8
600.00	.429	-133.1	4.492	92.1	.086	49.9	.493	-39.2
700.00	.408	-144.4	3.971	86.1	.094	50.3	.469	-40.3
800.00	.395	-153.1	3.540	81.0	.100	51.5	.452	-41.6
900.00	.387	-161.0	3.200	76.4	.107	52.3	.440	-43.4
1000.00	.381	-168.0	2.921	72.1	.116	52.9	.430	-44.8
1100.00	.382	-174.0	2.681	68.3	.124	53.3	.424	-46.6
1200.00	.379	-179.6	2.482	64.7	.132	53.6	.417	-48.2
1300.00	.379	175.3	2.319	61.0	.140	53.8	.410	-50.6
1400.00	.380	170.4	2.173	57.6	.148	54.3	.406	-52.7
1500.00	.384	165.9	2.055	54.5	.157	54.3	.402	-55.2
1600.00	.387	161.9	1.942	51.4	.166	54.3	.401	-57.3
1700.00	.392	157.6	1.840	48.2	.175	54.4	.397	-59.9
1800.00	.394	154.1	1.751	45.3	.185	54.2	.397	-62.6
1900.00	.398	150.6	1.686	42.5	.194	53.9	.393	-65.4
2000.00	.403	146.9	1.607	39.7	.203	53.6	.393	-68.0
2100.00	.407	143.8	1.549	37.0	.214	52.9	.391	-71.1
2200.00	.413	140.5	1.488	34.0	.225	52.5	.389	-74.2
2300.00	.419	137.5	1.442	31.6	.235	51.9	.389	-76.9
2400.00	.422	134.6	1.391	29.2	.246	51.3	.389	-80.2
2500.00	.428	131.7	1.349	26.7	.257	50.6	.390	-83.4
2600.00	.431	129.1	1.309	24.4	.268	49.8	.391	-86.2
2700.00	.434	126.2	1.272	22.0	.279	48.9	.388	-89.5
2800.00	.439	123.5	1.238	19.8	.290	48.0	.389	-92.7
2900.00	.446	120.8	1.205	17.7	.302	46.9	.392	-95.7
3000.00	.449	118.1	1.173	15.5	.313	46.1	.391	-99.0

(V<sub>CE</sub> = 5 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	.897	-22.4	5.520	157.8	.034	73.0	.951	-13.5
200.00	.812	-44.7	5.218	140.7	.059	60.4	.848	-23.6
300.00	.732	-64.1	4.687	127.6	.075	52.4	.756	-30.2
400.00	.639	-85.1	4.506	115.7	.085	47.9	.678	-33.9
500.00	.575	-101.5	4.069	106.2	.093	45.2	.624	-36.4
600.00	.524	-116.0	3.669	98.0	.100	44.0	.582	-38.4
700.00	.485	-128.8	3.347	90.8	.105	43.0	.554	-40.1
800.00	.462	-138.9	3.016	84.9	.109	43.4	.531	-41.7
900.00	.443	-147.9	2.752	79.5	.114	44.0	.515	-43.6
1000.00	.431	-156.2	2.540	74.8	.119	44.5	.503	-45.4
1100.00	.425	-163.2	2.345	70.4	.125	45.2	.494	-47.4
1200.00	.420	-169.7	2.182	66.4	.130	46.4	.485	-49.0
1300.00	.417	-175.4	2.041	62.2	.136	46.8	.478	-51.4
1400.00	.414	178.9	1.927	58.7	.142	48.2	.472	-53.6
1500.00	.417	173.7	1.815	55.1	.149	48.7	.468	-56.0
1600.00	.418	169.1	1.724	51.8	.156	49.4	.467	-58.4
1700.00	.422	164.3	1.641	48.5	.164	50.0	.461	-61.0
1800.00	.423	160.1	1.563	45.4	.171	50.3	.460	-63.7
1900.00	.426	156.1	1.495	42.5	.180	50.8	.457	-66.5
2000.00	.429	151.9	1.438	39.5	.189	51.2	.454	-69.4
2100.00	.434	148.5	1.384	36.5	.199	51.4	.453	-72.2
2200.00	.439	144.9	1.328	33.8	.210	51.2	.452	-75.4
2300.00	.444	141.4	1.289	31.1	.219	51.2	.451	-78.2
2400.00	.447	138.2	1.244	28.7	.231	51.0	.451	-81.3
2500.00	.453	135.1	1.206	26.2	.241	50.5	.451	-84.5
2600.00	.457	132.2	1.171	23.8	.252	50.1	.453	-87.6
2700.00	.462	129.0	1.138	21.5	.263	49.7	.450	-90.9
2800.00	.465	126.1	1.107	19.3	.274	48.6	.452	-94.0
2900.00	.470	123.1	1.075	17.1	.288	48.1	.454	-97.2
3000.00	.473	120.2	1.048	15.1	.301	47.4	.454	-100.6

**S-PARAMETER**

(V<sub>CE</sub> = 5 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	.959	-15.4	1.976	163.0	.037	78.4	.986	-7.6
200.00	.934	-30.3	1.937	150.1	.069	67.7	.954	-14.3
300.00	.894	-44.3	1.833	138.1	.096	58.6	.912	-20.4
400.00	.837	-59.6	1.886	127.6	.114	51.1	.863	-25.4
500.00	.795	-72.5	1.785	118.4	.128	44.4	.823	-29.2
600.00	.744	-85.9	1.732	109.5	.138	39.7	.785	-32.6
700.00	.696	-98.9	1.706	101.0	.144	35.4	.755	-35.6
800.00	.662	-109.3	1.595	93.5	.147	32.3	.729	-38.4
900.00	.624	-120.3	1.545	86.7	.148	29.4	.708	-41.2
1000.00	.600	-129.5	1.474	80.6	.149	28.2	.693	-43.7
1100.00	.580	-138.2	1.391	75.1	.148	27.2	.681	-46.1
1200.00	.561	-146.6	1.338	69.7	.148	26.7	.668	-48.4
1300.00	.550	-153.6	1.262	64.9	.147	26.7	.658	-51.4
1400.00	.538	-160.9	1.214	60.3	.145	27.4	.650	-53.8
1500.00	.534	-167.6	1.159	56.0	.144	28.5	.645	-56.9
1600.00	.530	-173.5	1.110	52.2	.143	30.4	.641	-59.4
1700.00	.525	-179.6	1.064	48.4	.143	32.5	.635	-62.3
1800.00	.526	175.2	1.018	44.8	.145	34.9	.635	-65.3
1900.00	.526	170.0	.981	41.7	.147	37.5	.632	-68.4
2000.00	.524	165.0	.952	38.3	.152	40.2	.627	-71.5
2100.00	.527	160.4	.914	35.4	.157	42.7	.625	-74.6
2200.00	.529	155.7	.882	32.4	.164	45.1	.621	-78.2
2300.00	.533	151.3	.857	29.9	.172	47.3	.622	-81.1
2400.00	.535	147.3	.827	27.5	.183	48.7	.622	-84.6
2500.00	.539	143.3	.802	25.3	.193	50.0	.621	-88.0
2600.00	.541	139.5	.781	23.0	.205	51.1	.621	-91.3
2700.00	.544	135.5	.759	21.0	.218	51.8	.619	-94.9
2800.00	.546	132.0	.741	19.2	.232	52.1	.619	-98.1
2900.00	.550	128.5	.719	17.5	.248	52.1	.619	-101.7
3000.00	.550	124.9	.702	16.0	.264	52.0	.617	-105.3

(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	.821	-31.6	8.542	151.6	.036	68.8	.898	-20.4
200.00	.694	-61.7	7.754	131.9	.058	56.8	.733	-32.5
300.00	.596	-86.5	6.608	117.7	.071	50.5	.613	-38.7
400.00	.511	-109.7	5.804	105.5	.079	48.7	.533	-41.6
500.00	.465	-125.9	4.962	97.0	.087	47.8	.481	-42.9
600.00	.439	-138.8	4.292	90.2	.095	48.1	.444	-44.4
700.00	.420	-149.5	3.782	84.4	.102	48.7	.420	-45.7
800.00	.411	-157.8	3.370	79.4	.110	49.8	.402	-47.1
900.00	.406	-165.4	3.037	74.7	.118	49.5	.388	-48.8
1000.00	.402	-172.0	2.768	70.6	.126	50.8	.379	-50.4
1100.00	.402	-177.8	2.550	66.9	.134	51.5	.371	-52.3
1200.00	.401	176.9	2.358	63.1	.143	51.7	.365	-54.2
1300.00	.403	172.0	2.205	59.4	.151	51.6	.359	-56.8
1400.00	.403	167.4	2.067	56.1	.160	52.3	.355	-58.9
1500.00	.408	163.3	1.953	52.9	.170	52.3	.350	-61.6
1600.00	.410	159.4	1.845	49.6	.179	52.3	.349	-64.1
1700.00	.415	155.3	1.755	46.6	.189	51.9	.345	-67.1
1800.00	.417	151.8	1.673	43.6	.198	51.5	.344	-69.5
1900.00	.422	148.4	1.595	40.8	.208	51.1	.343	-72.8
2000.00	.425	145.0	1.537	38.1	.219	50.8	.341	-75.6
2100.00	.430	141.9	1.481	35.0	.229	50.0	.340	-79.0
2200.00	.435	138.8	1.423	32.5	.241	49.6	.338	-82.4
2300.00	.441	135.7	1.377	30.0	.251	48.9	.338	-85.3
2400.00	.445	132.9	1.329	27.6	.261	48.2	.339	-88.6
2500.00	.449	130.2	1.288	25.2	.273	47.3	.340	-92.0
2600.00	.452	127.5	1.253	22.8	.283	46.6	.343	-95.3
2700.00	.458	124.7	1.218	20.6	.295	45.4	.341	-98.6
2800.00	.461	122.1	1.185	18.4	.306	44.5	.343	-102.0
2900.00	.466	119.6	1.153	16.3	.319	43.5	.346	-105.1
3000.00	.469	116.8	1.124	14.2	.329	42.5	.345	-108.6

**S-PARAMETER**

(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	.880	-24.7	5.495	155.5	.038	71.6	.943	-15.4
200.00	.800	-47.6	5.185	139.2	.067	59.3	.827	-26.6
300.00	.720	-67.8	4.623	125.7	.085	50.5	.724	-33.9
400.00	.628	-89.8	4.411	113.5	.095	46.1	.640	-37.9
500.00	.567	-106.7	3.961	104.0	.103	43.3	.583	-40.7
600.00	.521	-121.1	3.544	95.9	.109	41.9	.539	-42.8
700.00	.488	-133.7	3.211	88.8	.114	41.1	.509	-44.8
800.00	.467	-143.5	2.895	83.0	.119	41.3	.486	-46.5
900.00	.453	-152.5	2.636	77.6	.124	41.6	.468	-48.4
1000.00	.444	-160.4	2.431	72.9	.131	42.4	.456	-50.4
1100.00	.439	-166.9	2.244	68.5	.136	43.2	.447	-52.3
1200.00	.434	-173.2	2.085	64.6	.142	44.1	.437	-54.3
1300.00	.432	-178.8	1.951	60.5	.147	44.5	.429	-56.8
1400.00	.432	176.0	1.836	56.9	.154	45.7	.425	-59.0
1500.00	.434	171.0	1.733	53.3	.161	46.0	.419	-61.8
1600.00	.436	166.4	1.646	49.8	.168	46.7	.418	-64.2
1700.00	.440	161.7	1.568	46.5	.177	47.1	.412	-67.2
1800.00	.442	158.0	1.498	43.5	.185	47.5	.413	-70.0
1900.00	.445	154.0	1.431	40.7	.194	47.8	.410	-73.0
2000.00	.447	150.0	1.381	37.7	.204	48.1	.408	-76.1
2100.00	.453	146.6	1.324	34.8	.213	47.9	.407	-79.1
2200.00	.457	143.3	1.275	32.0	.224	47.7	.404	-82.5
2300.00	.462	139.8	1.236	29.3	.234	47.6	.404	-85.5
2400.00	.466	136.7	1.193	26.9	.244	47.4	.405	-88.8
2500.00	.470	133.5	1.156	24.5	.256	46.8	.406	-92.1
2600.00	.474	130.6	1.123	22.1	.266	46.6	.408	-95.5
2700.00	.479	127.4	1.093	19.9	.278	45.7	.406	-99.0
2800.00	.483	124.7	1.067	17.6	.290	44.8	.409	-102.2
2900.00	.487	121.8	1.036	15.5	.302	44.2	.411	-105.4
3000.00	.489	119.0	1.009	13.5	.316	43.4	.411	-109.0

(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	.958	-15.9	1.956	162.3	.041	78.7	.985	-8.5
200.00	.930	-31.7	1.926	148.8	.078	66.6	.945	-16.1
300.00	.885	-46.3	1.817	136.3	.109	56.9	.898	-22.7
400.00	.829	-62.1	1.875	125.5	.129	49.0	.844	-28.0
500.00	.784	-75.4	1.763	116.0	.144	42.6	.800	-32.1
600.00	.734	-89.0	1.710	106.9	.154	37.3	.757	-35.8
700.00	.687	-102.2	1.675	98.3	.160	33.2	.725	-39.0
800.00	.654	-112.7	1.565	90.9	.164	29.8	.698	-41.9
900.00	.619	-123.6	1.509	84.0	.165	27.0	.677	-44.8
1000.00	.595	-132.7	1.435	78.1	.165	25.8	.658	-47.4
1100.00	.579	-141.4	1.356	72.3	.165	24.4	.648	-50.1
1200.00	.561	-149.6	1.300	67.0	.163	24.0	.634	-52.6
1300.00	.552	-156.3	1.225	62.1	.161	23.7	.624	-55.5
1400.00	.541	-163.5	1.178	57.7	.160	24.1	.615	-58.3
1500.00	.540	-169.8	1.124	53.5	.159	25.6	.609	-61.3
1600.00	.535	-175.7	1.076	49.4	.158	27.0	.605	-64.2
1700.00	.532	178.4	1.036	45.7	.157	28.7	.601	-67.2
1800.00	.533	173.2	.988	42.3	.157	30.7	.599	-70.3
1900.00	.535	168.3	.951	39.1	.160	33.0	.596	-73.6
2000.00	.533	163.2	.923	36.0	.164	35.6	.592	-76.9
2100.00	.538	158.8	.887	33.0	.169	38.1	.590	-80.3
2200.00	.539	154.5	.858	30.0	.175	40.2	.585	-83.9
2300.00	.543	150.0	.832	27.5	.184	42.4	.587	-87.1
2400.00	.545	146.1	.803	25.2	.193	43.8	.586	-90.7
2500.00	.548	142.2	.779	23.0	.203	45.4	.587	-94.1
2600.00	.551	138.4	.759	20.8	.215	46.4	.587	-97.8
2700.00	.554	134.7	.738	18.9	.229	47.1	.585	-101.4
2800.00	.556	131.3	.722	17.3	.241	47.5	.584	-105.0
2900.00	.560	127.6	.700	15.6	.257	47.5	.586	-108.6
3000.00	.561	124.1	.682	14.1	.271	47.5	.584	-112.5

**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	.875	-28.8	5.383	153.3	.054	68.7	.915	-21.3
200.00	.768	-56.7	5.024	134.1	.089	54.1	.760	-36.1
300.00	.683	-79.9	4.387	119.8	.108	44.9	.633	-45.4
400.00	.603	-103.8	4.057	107.2	.119	40.5	.540	-50.6
500.00	.552	-121.1	3.566	97.8	.128	38.2	.477	-54.2
600.00	.521	-134.7	3.134	89.9	.135	37.0	.431	-57.2
700.00	.501	-146.4	2.803	83.1	.141	36.1	.399	-59.6
800.00	.488	-155.3	2.518	77.4	.146	36.6	.375	-62.0
900.00	.481	-163.2	2.281	72.2	.152	36.7	.358	-64.5
1000.00	.476	-170.1	2.097	67.5	.158	36.9	.345	-67.1
1100.00	.475	-176.0	1.936	63.3	.164	37.6	.336	-69.3
1200.00	.473	178.3	1.807	59.2	.171	38.1	.325	-72.1
1300.00	.473	173.3	1.689	55.2	.178	38.6	.319	-75.1
1400.00	.473	168.7	1.591	51.4	.186	39.3	.313	-77.9
1500.00	.478	164.3	1.509	47.9	.194	39.6	.311	-81.4
1600.00	.480	160.2	1.429	44.6	.201	39.8	.309	-84.2
1700.00	.482	156.1	1.359	41.4	.210	40.1	.306	-87.9
1800.00	.486	152.3	1.305	38.3	.219	40.3	.306	-91.1
1900.00	.489	148.9	1.250	35.5	.228	40.2	.306	-94.6
2000.00	.492	145.2	1.206	32.6	.238	40.1	.306	-98.6
2100.00	.496	142.0	1.158	29.7	.248	39.8	.306	-102.2
2200.00	.501	138.8	1.120	27.0	.259	39.8	.306	-105.8
2300.00	.507	135.7	1.087	24.4	.269	39.4	.309	-109.5
2400.00	.509	132.7	1.051	22.0	.279	38.8	.312	-113.2
2500.00	.514	130.0	1.023	19.7	.291	38.3	.315	-116.9
2600.00	.516	127.0	.994	17.4	.301	37.8	.318	-120.7
2700.00	.521	124.1	.967	15.4	.313	37.0	.321	-124.3
2800.00	.523	121.5	.944	13.3	.324	36.1	.324	-127.8
2900.00	.526	118.7	.920	11.3	.337	35.1	.328	-131.3
3000.00	.529	116.1	.900	9.4	.349	34.4	.332	-135.0

(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	.777	-40.1	8.180	146.3	.050	63.4	.849	-28.7
200.00	.656	-76.1	7.303	125.8	.076	50.6	.642	-44.9
300.00	.572	-103.7	6.019	111.1	.089	45.1	.505	-53.4
400.00	.514	-126.3	5.080	99.8	.099	43.2	.421	-57.6
500.00	.486	-141.4	4.275	91.6	.107	43.1	.367	-60.3
600.00	.472	-152.6	3.666	85.1	.116	44.0	.329	-62.9
700.00	.464	-161.6	3.212	79.5	.124	44.4	.303	-65.1
800.00	.459	-169.1	2.847	74.6	.133	45.2	.283	-67.2
900.00	.458	-175.5	2.567	70.0	.142	45.8	.271	-69.6
1000.00	.458	178.8	2.344	65.9	.151	46.3	.260	-72.0
1100.00	.459	173.8	2.156	62.2	.161	46.2	.253	-74.6
1200.00	.460	169.2	1.999	58.3	.170	46.7	.247	-77.2
1300.00	.460	164.9	1.871	54.6	.180	46.6	.241	-80.4
1400.00	.461	160.9	1.755	51.3	.191	46.4	.238	-83.4
1500.00	.467	157.1	1.659	48.1	.201	46.3	.236	-86.8
1600.00	.469	153.5	1.574	44.8	.212	46.0	.236	-89.7
1700.00	.474	149.7	1.501	41.6	.223	45.5	.234	-93.5
1800.00	.476	146.5	1.431	38.8	.233	45.0	.235	-96.7
1900.00	.480	143.4	1.368	36.0	.245	44.4	.234	-100.7
2000.00	.484	140.1	1.323	33.4	.255	43.7	.235	-104.3
2100.00	.487	137.2	1.273	30.5	.267	43.1	.238	-108.3
2200.00	.492	134.5	1.224	27.9	.279	42.3	.240	-112.1
2300.00	.496	131.4	1.190	25.4	.289	41.4	.240	-115.7
2400.00	.499	128.8	1.151	23.1	.300	40.5	.246	-119.3
2500.00	.503	126.2	1.119	20.8	.311	39.4	.248	-122.8
2600.00	.506	123.7	1.088	18.4	.322	38.6	.253	-126.7
2700.00	.509	121.0	1.060	16.4	.334	37.3	.256	-130.1
2800.00	.512	118.4	1.037	14.2	.345	36.2	.259	-133.6
2900.00	.516	116.0	1.009	12.2	.356	35.3	.264	-136.8
3000.00	.519	113.4	.986	10.2	.368	33.9	.267	-140.6

**S-PARAMETER**

(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	.954	-17.7	1.929	160.5	.059	76.3	.976	-11.1
200.00	.914	-35.8	1.909	144.6	.108	63.2	.920	-21.1
300.00	.862	-52.0	1.776	130.9	.146	51.8	.853	-29.4
400.00	.799	-69.5	1.819	119.1	.170	44.0	.783	-35.7
500.00	.749	-84.0	1.707	109.0	.188	36.7	.727	-40.8
600.00	.701	-98.0	1.626	99.3	.198	31.9	.678	-44.9
700.00	.658	-111.6	1.577	90.6	.204	27.2	.642	-48.6
800.00	.628	-122.1	1.464	83.0	.207	23.9	.612	-51.8
900.00	.599	-132.6	1.391	76.2	.207	21.6	.588	-55.2
1000.00	.582	-141.4	1.320	70.2	.207	19.3	.569	-58.3
1100.00	.571	-149.4	1.239	64.5	.206	18.0	.559	-61.3
1200.00	.558	-157.2	1.183	59.4	.203	17.2	.543	-64.2
1300.00	.554	-163.5	1.118	54.4	.201	16.7	.534	-67.6
1400.00	.545	-169.9	1.068	50.0	.198	16.9	.526	-70.7
1500.00	.547	-176.0	1.022	46.0	.196	17.3	.520	-74.4
1600.00	.545	178.6	.979	42.1	.194	18.1	.517	-77.7
1700.00	.546	173.2	.939	38.4	.193	19.7	.512	-81.2
1800.00	.548	168.4	.899	34.9	.192	21.1	.512	-84.8
1900.00	.549	164.0	.865	31.9	.194	23.0	.511	-88.6
2000.00	.550	159.2	.838	29.0	.196	24.9	.507	-92.3
2100.00	.556	155.1	.808	26.1	.200	27.0	.508	-96.0
2200.00	.558	150.9	.782	23.3	.205	29.1	.505	-100.3
2300.00	.563	147.0	.757	20.9	.212	31.0	.507	-103.9
2400.00	.566	143.2	.733	18.8	.219	32.4	.508	-107.8
2500.00	.570	139.5	.713	16.7	.229	33.5	.511	-111.9
2600.00	.573	136.1	.694	14.9	.240	34.8	.511	-115.7
2700.00	.575	132.5	.677	13.2	.252	35.5	.511	-119.7
2800.00	.578	129.1	.661	11.7	.264	36.3	.512	-123.5
2900.00	.583	125.7	.643	10.2	.278	36.5	.515	-127.4
3000.00	.583	122.4	.630	9.0	.293	36.6	.517	-131.5



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