

NPN EPITAXIAL SILICON TRANSISTOR FOR
MICROWAVE AMPLIFICATION

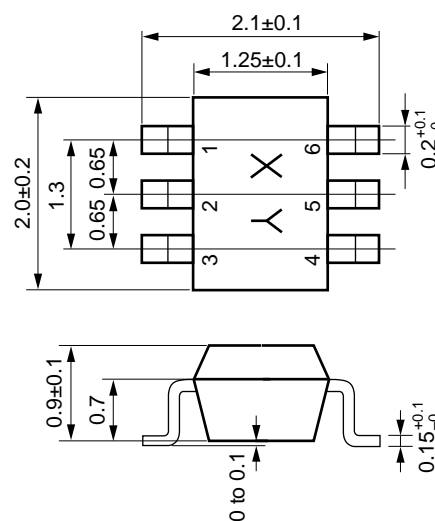
FEATURES

- High f_T
14 GHz TYP.
- High gain
 $|S_{21e}|^2 = 14$ dB TYP.
@ $f = 2$ GHz, $V_{CE} = 3$ V, $I_C = 10$ mA
- $NF = 1.3$ dB, @ $f = 2$ GHz, $V_{CE} = 3$ V, $I_C = 3$ mA
- 6-pin small mini mold package

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

PARAMETER	SYMBOL	RATING	UNIT
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	150	mW
Junction Temperature	T_J	150	°C
Storage Temperature	T_{stg}	-65 to +150	°C

PACKAGE DIMENSION (in mm)



PIN CONNECTIONS

- | | |
|------------|--------------|
| 1. Emitter | 4. Emitter |
| 2. Emitter | 5. Emitter |
| 3. Base | 6. Collector |

ELECTRICAL CHARACTERISTICS (T_A = 25 °C)

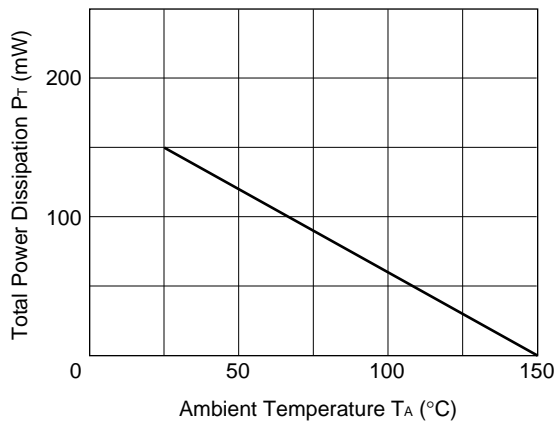
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Collector Cut-off Current	I _{CBO}	V _{CB} = 5 V, I _E = 0			0.1	μA
Emitter Cut-off Current	I _{EBO}	V _{EB} = 1 V, I _C = 0			0.1	μA
DC Current Gain	h _{FE}	V _{CE} = 3 V, I _C = 10 mA Note 1	80		160	
Gain Bandwidth Product	f _T	V _{CE} = 3 V, I _C = 10 mA, f = 2.0 GHz		14		GHz
Feed-back Capacitance	C _{re}	V _{CB} = 3 V, I _E = 0, f = 1 MHz Note 2		0.15	0.25	pF
Insertion Gain	S _{21e} ²	V _{CE} = 3 V, I _C = 10 mA, f = 2.0 GHz	12	14		dB
Noise Figure	NF	V _{CE} = 3 V, I _C = 3 mA, f = 2.0 GHz		1.3	2.3	dB

STANDARD SPECIFICATION	FB
Marking	T95
h _{FE}	80 to 160

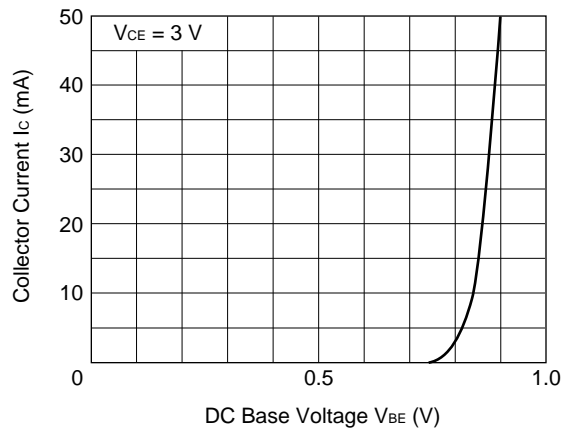
- Notes**
1. Pulse measurement: PW ≤ 350 μs, Duty cycle ≤ 2 %, Pulsed
 2. Measure by using 3-terminal bridge with emitter pin connected to guard terminal of bridge.

TYPICAL CHARACTERISTICS (T_A = 25 °C)

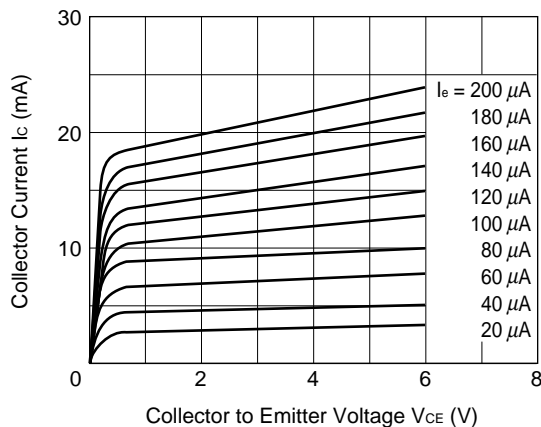
P_T - T_A CHARACTERISTICS



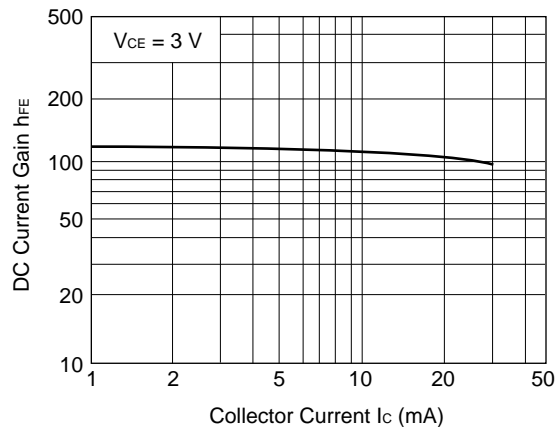
I_C - V_{BE} CHARACTERISTICS



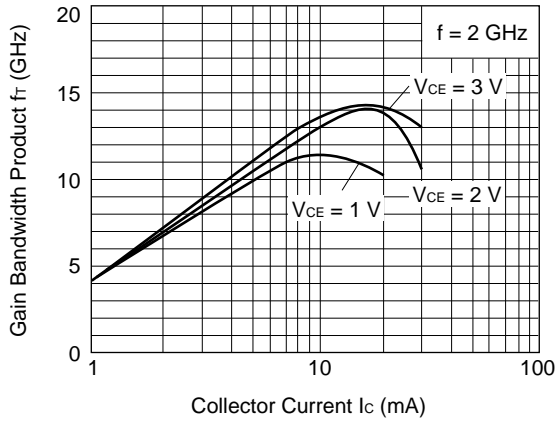
I_C - V_{CE} CHARACTERISTICS



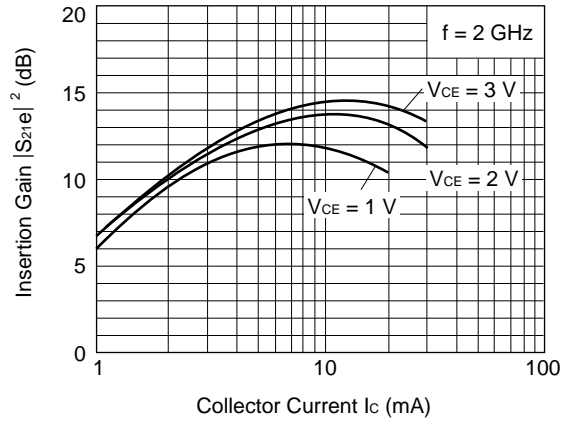
h_{FE} - I_C CHARACTERISTICS



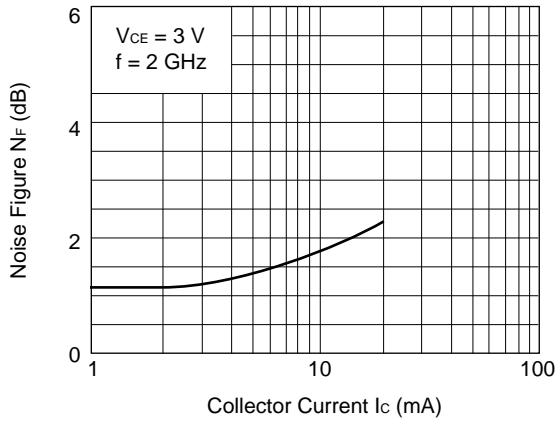
$f_T - I_C$ CHARACTERISTICS



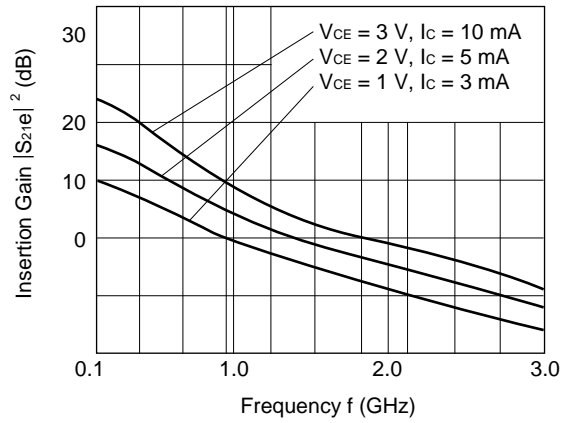
$|S_{21e}|^2 - I_C$ CHARACTERISTICS



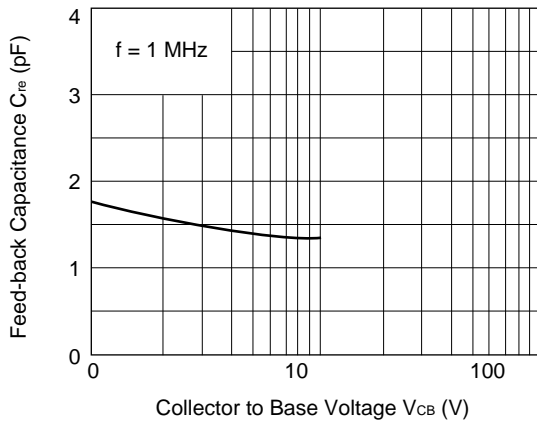
$N_F - I_C$ CHARACTERISTICS



$|S_{21e}|^2 - f$ CHARACTERISTICS



$C_{re} - V_{CB}$



S PARAMETER

V_{CE} = 1 V, I_c = 1 mA

FREQUENCY f (MHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100.00	0.963	-8.3	3.846	172.1	0.013	74.6	0.913	-7.1
200.00	0.950	-16.3	3.745	164.4	0.026	73.7	0.907	-12.4
300.00	0.930	-24.1	3.656	156.0	0.037	69.1	0.911	-17.6
400.00	0.910	-31.4	3.531	148.9	0.050	64.7	0.908	-23.0
500.00	0.888	-38.6	3.428	143.4	0.060	60.4	0.911	-27.4
600.00	0.866	-45.2	3.272	137.3	0.070	55.7	0.911	-31.7
700.00	0.845	-51.3	3.144	131.8	0.078	51.0	0.899	-35.6
800.00	0.824	-57.0	2.999	126.6	0.085	46.9	0.883	-38.7
900.00	0.803	-62.4	2.880	121.3	0.089	42.7	0.874	-41.9
1000.00	0.779	-67.8	2.769	116.8	0.097	39.8	0.853	-44.9
1100.00	0.757	-72.6	2.654	112.4	0.101	36.8	0.833	-46.9
1200.00	0.731	-77.3	2.546	108.0	0.105	33.2	0.820	-49.5
1300.00	0.706	-81.8	2.467	103.9	0.109	30.1	0.806	-52.5
1400.00	0.682	-86.1	2.376	100.5	0.112	27.3	0.789	-54.4
1500.00	0.656	-90.6	2.295	96.6	0.114	24.8	0.776	-56.8
1600.00	0.633	-95.2	2.249	93.2	0.116	22.4	0.765	-59.2
1700.00	0.609	-100.1	2.195	89.7	0.119	20.3	0.751	-61.0
1800.00	0.588	-105.2	2.151	85.9	0.120	17.9	0.744	-63.0
1900.00	0.566	-111.0	2.123	81.8	0.122	15.3	0.732	-65.6
2000.00	0.547	-117.5	2.093	77.8	0.124	12.9	0.714	-67.5
2100.00	0.530	-124.4	2.045	73.6	0.125	9.8	0.706	-69.7
2200.00	0.512	-131.6	1.994	68.7	0.123	7.2	0.685	-72.5
2300.00	0.496	-139.4	1.941	64.0	0.124	4.9	0.668	-75.5
2400.00	0.485	-146.6	1.875	59.7	0.121	2.7	0.653	-78.0
2500.00	0.475	-153.4	1.795	55.6	0.118	0.1	0.641	-81.6
2600.00	0.469	-159.7	1.717	51.6	0.115	-1.7	0.621	-85.2
2700.00	0.469	-165.0	1.652	48.0	0.113	-3.2	0.622	-88.2
2800.00	0.469	-169.9	1.586	45.1	0.110	-4.9	0.618	-92.4
2900.00	0.471	-173.9	1.510	41.9	0.107	-6.2	0.615	-95.9
3000.00	0.477	-177.5	1.466	38.6	0.103	-7.6	0.622	-99.2

V_{CE} = 1 V, I_c = 3 mA

FREQUENCY f (MHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100.00	0.906	-12.6	9.595	169.0	0.013	72.7	0.888	-9.8
200.00	0.879	-24.3	9.124	158.8	0.024	70.1	0.869	-17.6
300.00	0.837	-35.6	8.660	148.3	0.035	64.4	0.856	-24.7
400.00	0.796	-45.9	8.156	139.6	0.044	59.6	0.830	-32.8
500.00	0.755	-55.7	7.668	133	0.053	53.3	0.816	-37.1
600.00	0.718	-64.0	7.087	126.2	0.059	48.9	0.800	-42.1
700.00	0.683	-71.6	6.629	120.2	0.064	44.7	0.769	-46.3
800.00	0.649	-78.3	6.17	114.8	0.068	41.2	0.736	-48.9
900.00	0.619	-84.5	5.773	109.3	0.071	38.5	0.722	-51.8
1000.00	0.586	-91.1	5.405	104.9	0.075	35.7	0.690	-55.0
1100.00	0.557	-96.2	5.085	100.7	0.078	33.6	0.661	-56.3
1200.00	0.528	-101.4	4.789	96.6	0.080	31.6	0.648	-58.4
1300.00	0.500	-106.7	4.553	92.6	0.081	29.2	0.626	-61.6
1400.00	0.476	-111.7	4.320	89.5	0.082	27.6	0.607	-62.4
1500.00	0.452	-116.8	4.106	85.9	0.082	26.4	0.597	-64.5
1600.00	0.429	-122.6	3.954	82.5	0.084	25.1	0.584	-66.9
1700.00	0.410	-128.6	3.801	79.3	0.086	24.6	0.570	-68.1
1800.00	0.393	-135.0	3.661	75.7	0.086	23.8	0.563	-69.6
1900.00	0.377	-142.4	3.545	72.0	0.087	22.5	0.549	-72.4
2000.00	0.367	-150.0	3.42	68.4	0.088	21.9	0.530	-73.7
2100.00	0.361	-157.8	3.290	65.0	0.088	20.4	0.521	-75.7
2200.00	0.356	-165.9	3.156	60.9	0.089	19.3	0.502	-78.5
2300.00	0.356	-173.4	3.023	57.4	0.088	18.7	0.483	-81.3
2400.00	0.363	179.8	2.893	54.0	0.088	18.1	0.471	-83.6
2500.00	0.364	174.0	2.759	50.9	0.088	17.2	0.463	-87.6
2600.00	0.373	169.4	2.629	48.0	0.086	17.1	0.444	-91.3
2700.00	0.384	165.3	2.528	45.1	0.086	16.9	0.447	-94.1
2800.00	0.391	161.9	2.434	42.9	0.086	16.9	0.447	-98.8
2900.00	0.401	159.0	2.319	40.4	0.086	16.7	0.445	-102.2
3000.00	0.412	156.3	2.254	37.4	0.086	17.0	0.455	-105.3

S PARAMETER

V_{CE} = 1 V, I_c = 5 mA

FREQUENCY f (MHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100.00	0.854	-16.4	14.321	166.4	0.012	71.0	0.870	-12.1
200.00	0.814	-31.4	13.342	154.2	0.023	67.0	0.839	-21.6
300.00	0.756	-45.1	12.322	142.3	0.032	61.4	0.811	-30.2
400.00	0.707	-57.6	11.306	132.6	0.041	55.8	0.773	-38.7
500.00	0.651	-69.0	10.34	125.5	0.047	50.4	0.742	-43.7
600.00	0.611	-78.5	9.368	118.6	0.052	46.0	0.712	-48.6
700.00	0.575	-86.8	8.582	112.8	0.055	42.3	0.676	-52.4
800.00	0.538	-93.6	7.849	107.5	0.058	39.7	0.640	-54.9
900.00	0.509	-100.2	7.236	102.2	0.059	37.3	0.620	-56.9
1000.00	0.479	-107.2	6.681	98.2	0.063	36.4	0.588	-59.9
1100.00	0.454	-112.5	6.221	94.3	0.064	35.0	0.562	-60.9
1200.00	0.426	-117.9	5.802	90.5	0.066	33.8	0.547	-62.5
1300.00	0.403	-123.4	5.473	86.8	0.067	32.8	0.528	-65.0
1400.00	0.385	-129	5.168	83.8	0.069	31.9	0.510	-65.6
1500.00	0.364	-134.6	4.881	80.5	0.070	31.7	0.503	-67.2
1600.00	0.348	-140.9	4.658	77.3	0.071	31.4	0.493	-69.4
1700.00	0.335	-147.7	4.452	74.2	0.072	31.0	0.481	-70.0
1800.00	0.325	-154.7	4.259	70.9	0.074	30.5	0.477	-71.9
1900.00	0.317	-162.5	4.083	67.4	0.075	30.0	0.465	-74.3
2000.00	0.315	-170.3	3.923	64.2	0.077	29.7	0.447	-75.8
2100.00	0.318	-177.6	3.750	61.1	0.078	29.2	0.440	-77.5
2200.00	0.322	175.1	3.576	57.6	0.078	29.0	0.423	-80.3
2300.00	0.331	168.2	3.414	54.4	0.080	28.6	0.407	-83.2
2400.00	0.341	163.0	3.257	51.4	0.080	28.3	0.396	-85.7
2500.00	0.350	158.3	3.105	48.8	0.081	27.9	0.388	-90.0
2600.00	0.362	154.5	2.957	46.2	0.082	28.1	0.373	-94.0
2700.00	0.375	151.9	2.847	43.6	0.083	28.2	0.376	-96.9
2800.00	0.386	149.2	2.742	41.7	0.084	27.9	0.378	-101.9
2900.00	0.396	146.8	2.615	39.3	0.086	28.0	0.378	-105.6
3000.00	0.408	145.1	2.542	36.6	0.086	28.1	0.389	-108.5

V_{CE} = 1 V, I_c = 10 mA

FREQUENCY f (MHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100.00	0.744	-24.6	22.615	161.3	0.012	68.1	0.826	-16.3
200.00	0.682	-46.1	20.113	145.6	0.021	62.6	0.769	-28.7
300.00	0.610	-64.7	17.536	132.0	0.028	57.4	0.710	-38.7
400.00	0.551	-79.7	15.292	121.5	0.033	49.1	0.654	-47.6
500.00	0.502	-93.2	13.319	114.5	0.038	47.6	0.610	-52.1
600.00	0.469	-104.1	11.724	107.9	0.041	44.6	0.573	-56.1
700.00	0.443	-112.5	10.485	102.8	0.043	43.3	0.538	-59.0
800.00	0.416	-119.8	9.391	98.1	0.045	41.4	0.506	-60.3
900.00	0.392	-126.2	8.510	93.3	0.046	41.3	0.491	-61.4
1000.00	0.375	-133.6	7.749	89.8	0.049	41.5	0.463	-63.6
1100.00	0.357	-138.8	7.146	86.5	0.050	41.7	0.441	-64.0
1200.00	0.338	-144.3	6.605	83.2	0.054	42.0	0.433	-64.9
1300.00	0.324	-150.3	6.181	79.9	0.055	41.7	0.419	-66.9
1400.00	0.314	-156.1	5.801	77.1	0.057	41.4	0.405	-66.9
1500.00	0.302	-162.0	5.450	74.1	0.058	41.3	0.404	-68.1
1600.00	0.295	-168.6	5.169	71.3	0.061	42.0	0.397	-70.2
1700.00	0.293	-175.3	4.902	68.4	0.064	41.5	0.390	-71.1
1800.00	0.293	178.1	4.662	65.4	0.065	41.9	0.388	-72.3
1900.00	0.296	170.9	4.445	62.2	0.067	41.6	0.382	-74.8
2000.00	0.304	164.5	4.234	59.3	0.069	41.5	0.366	-76.1
2100.00	0.313	158.7	4.031	56.6	0.071	41.0	0.361	-77.9
2200.00	0.323	153.4	3.828	53.5	0.073	40.7	0.348	-80.9
2300.00	0.339	148.6	3.639	50.7	0.076	40.3	0.333	-83.9
2400.00	0.352	145.3	3.470	48.1	0.077	40.7	0.323	-86.7
2500.00	0.363	141.9	3.312	45.9	0.079	40.1	0.319	-91.7
2600.00	0.378	139.9	3.151	43.7	0.081	40.6	0.306	-96.4
2700.00	0.392	138.2	3.036	41.4	0.084	39.6	0.310	-99.6
2800.00	0.404	136.5	2.930	39.8	0.085	39.3	0.317	-105.0
2900.00	0.414	134.9	2.798	37.6	0.088	38.9	0.317	-108.9
3000.00	0.426	133.6	2.723	35.0	0.089	38.7	0.330	-112.1

S PARAMETER

V_{CE} = 1 V, I_c = 15 mA

FREQUENCY f (MHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100.00	0.653	-33.1	27.337	156.8	0.011	68.9	0.789	-18.9
200.00	0.584	-60.3	23.208	138.8	0.019	60.2	0.707	-32.8
300.00	0.515	-82.1	19.335	124.9	0.024	53.7	0.632	-42.7
400.00	0.469	-99.2	16.289	114.6	0.029	48.3	0.569	-54.0
500.00	0.435	-112.6	13.817	107.9	0.032	47.2	0.519	-54.2
600.00	0.416	-123.1	11.97	101.7	0.035	45.4	0.502	-56.7
700.00	0.398	-131.1	10.579	97.1	0.037	46.6	0.468	-59.8
800.00	0.378	-138	9.386	92.7	0.039	45.9	0.439	-58.5
900.00	0.362	-144.1	8.451	88.3	0.040	45.7	0.442	-59.7
1000.00	0.354	-151.1	7.653	85.3	0.043	46.9	0.411	-62.5
1100.00	0.339	-156.1	7.023	82.1	0.046	47.0	0.396	-61.2
1200.00	0.325	-161.5	6.475	79.1	0.048	47.6	0.396	-62.6
1300.00	0.317	-167.1	6.041	76.0	0.050	47.8	0.379	-64.9
1400.00	0.311	-172.3	5.649	73.3	0.053	47.4	0.373	-63.9
1500.00	0.304	-178.0	5.304	70.5	0.054	47.5	0.376	-65.7
1600.00	0.302	175.6	5.012	67.8	0.057	47.9	0.370	-67.9
1700.00	0.304	170	4.745	65.0	0.060	47.8	0.365	-68.2
1800.00	0.307	164.1	4.500	62.1	0.062	47.7	0.367	-69.8
1900.00	0.314	158.0	4.276	59.2	0.065	47.4	0.358	-72.4
2000.00	0.325	152.9	4.068	56.3	0.068	47.4	0.346	-73.3
2100.00	0.335	148.2	3.864	53.8	0.069	47.1	0.345	-75.4
2200.00	0.347	143.9	3.666	50.8	0.072	46.3	0.329	-78.7
2300.00	0.362	140.2	3.481	48.3	0.074	46.3	0.317	-81.4
2400.00	0.375	137.6	3.318	45.8	0.077	45.8	0.311	-84.5
2500.00	0.386	135.1	3.159	43.7	0.079	45.5	0.304	-89.9
2600.00	0.402	133.7	3.010	41.7	0.081	44.8	0.292	-94.3
2700.00	0.416	132.5	2.901	39.5	0.084	44.7	0.299	-97.8
2800.00	0.427	131.2	2.801	37.9	0.086	44.4	0.303	-104.0
2900.00	0.439	129.8	2.676	35.9	0.089	43.4	0.304	-107.7
3000.00	0.449	128.7	2.603	33.3	0.091	42.7	0.319	-111.0

V_{CE} = 2 V, I_c = 1 mA

FREQUENCY f (MHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100.00	0.965	-7.7	3.924	172.5	0.010	73.8	0.913	-6.6
200.00	0.953	-15.2	3.823	165.1	0.019	73.5	0.904	-11.6
300.00	0.935	-22.6	3.733	157.0	0.028	71.0	0.908	-16.1
400.00	0.916	-29.3	3.631	150.0	0.037	65.6	0.897	-23.3
500.00	0.897	-36.1	3.522	145.2	0.045	62.1	0.904	-24.6
600.00	0.877	-42.3	3.381	139.4	0.053	57.2	0.922	-28.6
700.00	0.859	-48.2	3.256	134.4	0.060	53.5	0.907	-31.9
800.00	0.839	-53.5	3.108	129.5	0.065	49.8	0.892	-33.9
900.00	0.820	-58.7	2.999	124.1	0.069	46.2	0.896	-37.6
1000.00	0.796	-64.0	2.901	119.7	0.075	43.1	0.874	-40.6
1100.00	0.775	-68.5	2.791	115.6	0.079	40.2	0.860	-41.7
1200.00	0.751	-72.9	2.674	111.4	0.081	36.9	0.852	-44.6
1300.00	0.726	-77.3	2.604	107.2	0.085	33.5	0.836	-47.6
1400.00	0.702	-81.4	2.514	104.0	0.087	31.4	0.824	-48.9
1500.00	0.677	-85.6	2.430	100.1	0.089	28.5	0.815	-51.4
1600.00	0.653	-89.9	2.383	96.7	0.090	26.4	0.800	-53.9
1700.00	0.629	-94.5	2.332	93.4	0.092	24.4	0.790	-55.2
1800.00	0.607	-99.3	2.289	89.9	0.093	22.6	0.788	-57.1
1900.00	0.584	-104.7	2.263	85.8	0.094	19.9	0.772	-59.7
2000.00	0.564	-110.6	2.237	82.0	0.095	17.7	0.759	-61.2
2100.00	0.545	-117.4	2.194	77.8	0.095	15.8	0.755	-63.4
2200.00	0.526	-124.3	2.145	73.0	0.095	13.1	0.732	-66.0
2300.00	0.508	-131.7	2.099	68.4	0.094	11.0	0.719	-68.6
2400.00	0.495	-139.3	2.032	64.0	0.092	9.1	0.706	-71.1
2500.00	0.481	-145.9	1.951	59.9	0.090	7.1	0.692	-74.6
2600.00	0.476	-152.2	1.869	55.8	0.087	5.0	0.673	-77.9
2700.00	0.471	-158.2	1.801	52.0	0.086	4.3	0.676	-80.9
2800.00	0.469	-162.9	1.733	49.1	0.083	2.7	0.669	-85.1
2900.00	0.472	-167.3	1.647	45.7	0.080	2.7	0.664	-88.4
3000.00	0.476	-171.4	1.602	42.3	0.077	1.6	0.672	-92.0

S PARAMETER

V_{CE} = 2 V, I_c = 3 mA

FREQUENCY		S ₁₁		S ₂₁		S ₁₂		S ₂₂	
f (MHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG	
100.00	0.911	-11.3	9.673	169.8	0.010	71.9	0.897	-8.5	
200.00	0.887	-21.9	9.244	160.1	0.018	70.9	0.879	-15.2	
300.00	0.850	-32.2	8.830	150.1	0.026	66.0	0.871	-21.4	
400.00	0.814	-41.3	8.390	141.6	0.034	60.2	0.849	-29.3	
500.00	0.776	-50.5	7.920	135.5	0.041	56.0	0.838	-31.9	
600.00	0.741	-58.3	7.389	129.0	0.046	52.4	0.835	-36.3	
700.00	0.708	-65.5	6.948	123.4	0.050	47.8	0.806	-39.9	
800.00	0.675	-71.6	6.492	118.1	0.053	44.6	0.778	-41.9	
900.00	0.645	-77.5	6.113	112.5	0.055	42.3	0.772	-45.1	
1000.00	0.610	-83.8	5.754	108.0	0.060	39.1	0.739	-48.0	
1100.00	0.583	-88.8	5.437	103.9	0.061	37.5	0.716	-48.7	
1200.00	0.552	-93.5	5.127	99.8	0.063	35.1	0.705	-51.0	
1300.00	0.523	-98.5	4.899	95.7	0.064	33.2	0.684	-53.8	
1400.00	0.497	-103.2	4.663	92.6	0.065	32.2	0.669	-54.5	
1500.00	0.470	-107.8	4.431	88.9	0.065	30.8	0.660	-56.4	
1600.00	0.445	-112.9	4.267	85.7	0.066	30.2	0.646	-58.7	
1700.00	0.421	-118.7	4.112	82.5	0.067	30.0	0.634	-59.7	
1800.00	0.402	-124.5	3.974	79.2	0.068	29.0	0.630	-61.1	
1900.00	0.382	-131.2	3.854	75.4	0.068	28.1	0.615	-63.6	
2000.00	0.368	-138.7	3.734	72.0	0.069	27.3	0.601	-64.6	
2100.00	0.356	-146.3	3.605	68.5	0.070	26.5	0.593	-66.4	
2200.00	0.348	-154.2	3.462	64.5	0.069	25.9	0.574	-68.9	
2300.00	0.344	-162.6	3.340	60.7	0.070	26.0	0.558	-71.1	
2400.00	0.346	-169.5	3.200	57.3	0.070	25.7	0.548	-73.4	
2500.00	0.347	-175.9	3.058	54.1	0.069	25.1	0.535	-76.9	
2600.00	0.354	178.6	2.919	50.9	0.068	25.5	0.517	-80.0	
2700.00	0.363	174.0	2.810	48.0	0.070	26.0	0.520	-83.0	
2800.00	0.370	170.2	2.709	45.7	0.070	25.9	0.516	-87.4	
2900.00	0.379	166.7	2.580	42.9	0.070	27.0	0.512	-90.6	
3000.00	0.390	163.8	2.511	40.0	0.070	26.7	0.523	-94.0	

V_{CE} = 2 V, I_c = 5 mA

FREQUENCY		S ₁₁		S ₂₁		S ₁₂		S ₂₂	
f (MHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG	
100.00	0.863	-14.2	14.231	167.6	0.009	73.5	0.883	-10.1	
200.00	0.829	-27.3	13.388	156.2	0.017	70.1	0.854	-18.2	
300.00	0.775	-39.8	12.53	144.8	0.025	62.3	0.834	-25.1	
400.00	0.726	-50.9	11.653	134.8	0.031	58.0	0.797	-34.7	
500.00	0.679	-61.2	10.679	128.6	0.036	53.6	0.770	-36.4	
600.00	0.638	-70.1	9.807	122.0	0.041	49.6	0.763	-40.6	
700.00	0.604	-77.9	9.125	116.6	0.044	46.2	0.727	-44.2	
800.00	0.570	-84.3	8.384	111.4	0.046	43.5	0.697	-45.1	
900.00	0.536	-90.2	7.775	105.7	0.047	41.5	0.690	-48.1	
1000.00	0.501	-97.3	7.215	101.4	0.050	39.5	0.653	-51.0	
1100.00	0.474	-102.2	6.753	97.5	0.051	39.1	0.633	-51.1	
1200.00	0.445	-107	6.294	93.6	0.052	38.0	0.624	-53.1	
1300.00	0.418	-112.0	5.954	89.8	0.054	36.6	0.600	-55.7	
1400.00	0.396	-117.3	5.634	86.8	0.055	36.1	0.588	-55.8	
1500.00	0.372	-122.3	5.328	83.5	0.056	35.9	0.582	-57.6	
1600.00	0.351	-128.1	5.089	80.3	0.056	36.0	0.568	-59.6	
1700.00	0.334	-134.5	4.875	77.2	0.059	35.6	0.559	-60.3	
1800.00	0.318	-141.0	4.672	74.0	0.060	36.6	0.559	-61.7	
1900.00	0.305	-148.6	4.493	70.6	0.060	35.3	0.543	-64.0	
2000.00	0.298	-156.9	4.327	67.3	0.061	35.3	0.531	-64.7	
2100.00	0.296	-164.7	4.145	64.2	0.063	35.2	0.527	-66.6	
2200.00	0.295	-172.5	3.970	60.6	0.063	35.5	0.507	-69.1	
2300.00	0.300	179.7	3.806	57.4	0.065	35.1	0.493	-71.0	
2400.00	0.309	173.5	3.644	54.3	0.066	36.2	0.484	-73.4	
2500.00	0.316	167.8	3.483	51.5	0.066	35.5	0.471	-77.2	
2600.00	0.329	163.7	3.324	48.7	0.068	35.4	0.455	-80.4	
2700.00	0.341	160.0	3.200	46.0	0.069	36.0	0.457	-83.3	
2800.00	0.352	156.9	3.083	44.0	0.069	36.4	0.455	-88.0	
2900.00	0.362	154.2	2.942	41.4	0.072	36.7	0.453	-91.3	
3000.00	0.374	152	2.859	38.6	0.073	36.8	0.464	-94.6	

S PARAMETER

V_{CE} = 2 V, I_c = 10 mA

FREQUENCY f (MHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100.00	0.760	-20.5	22.891	163.4	0.009	68.3	0.850	-13.1
200.00	0.707	-38.8	20.801	149.0	0.016	65.3	0.802	-23.2
300.00	0.635	-55.2	18.567	135.9	0.022	59.9	0.755	-31.3
400.00	0.573	-68.8	16.493	125.5	0.027	55.4	0.701	-41.4
500.00	0.525	-81.1	14.602	118.5	0.029	51.6	0.661	-42.3
600.00	0.487	-91.1	12.974	111.7	0.033	48.2	0.646	-45.6
700.00	0.454	-99.3	11.679	106.3	0.035	47.4	0.608	-48.6
800.00	0.423	-106.0	10.503	101.4	0.036	45.6	0.578	-48.3
900.00	0.394	-112.2	9.577	96.4	0.037	45.2	0.578	-50.4
1000.00	0.372	-119.9	8.728	92.8	0.040	45.4	0.541	-52.9
1100.00	0.350	-124.7	8.056	89.3	0.042	45.3	0.525	-52.1
1200.00	0.327	-130.0	7.452	85.9	0.044	45.0	0.522	-53.7
1300.00	0.309	-135.6	6.989	82.6	0.045	45.1	0.502	-55.7
1400.00	0.294	-141.1	6.557	79.8	0.046	46.3	0.494	-55.2
1500.00	0.278	-147.1	6.163	76.8	0.048	46.6	0.494	-57.0
1600.00	0.266	-153.7	5.857	74	0.050	46.6	0.484	-58.8
1700.00	0.258	-160.8	5.563	71.1	0.052	46.4	0.478	-59.2
1800.00	0.253	-168.0	5.301	68.2	0.054	47.4	0.480	-60.6
1900.00	0.250	-176.1	5.062	65.1	0.055	47.1	0.469	-62.8
2000.00	0.256	176.5	4.840	62.3	0.057	46.6	0.459	-63.4
2100.00	0.261	169.5	4.619	59.5	0.059	47.6	0.457	-65.1
2200.00	0.272	163	4.396	56.4	0.061	48.0	0.439	-67.8
2300.00	0.284	157.2	4.200	53.7	0.063	47.2	0.426	-69.7
2400.00	0.298	153.0	4.008	51.0	0.065	47.1	0.419	-72.2
2500.00	0.310	149.0	3.831	48.6	0.067	46.8	0.408	-76.2
2600.00	0.327	146.5	3.667	46.2	0.068	47.8	0.391	-79.6
2700.00	0.341	144.5	3.531	43.9	0.071	46.6	0.396	-82.8
2800.00	0.354	142.3	3.411	42.1	0.073	46.7	0.394	-87.9
2900.00	0.365	140.4	3.261	39.7	0.076	46.6	0.392	-91.4
3000.00	0.377	139.0	3.170	37.0	0.077	46.0	0.404	-94.9

V_{CE} = 2 V, I_c = 15 mA

FREQUENCY f (MHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100.00	0.679	-25.8	28.477	160.2	0.008	72.4	0.827	-15.3
200.00	0.616	-48.2	25.048	143.8	0.015	63.0	0.760	-26.4
300.00	0.543	-67.2	21.555	130	0.020	59.2	0.697	-34.5
400.00	0.485	-82.1	18.572	119.4	0.024	54.7	0.638	-45.2
500.00	0.443	-95.5	16.03	112.6	0.026	52.2	0.592	-44.4
600.00	0.413	-106.3	14.018	106.1	0.028	50.1	0.581	-46.9
700.00	0.388	-114.4	12.469	101.2	0.031	49.1	0.545	-49.5
800.00	0.362	-121.0	11.102	96.6	0.032	49.8	0.521	-48.2
900.00	0.340	-127.1	10.046	91.8	0.034	49.3	0.526	-50.1
1000.00	0.327	-135.1	9.107	88.7	0.037	50.3	0.490	-52.3
1100.00	0.308	-139.8	8.375	85.5	0.039	50.0	0.479	-51.0
1200.00	0.289	-145.3	7.719	82.2	0.039	51.0	0.480	-52.6
1300.00	0.276	-151.2	7.219	79.0	0.041	49.4	0.462	-54.7
1400.00	0.267	-156.7	6.754	76.5	0.044	51.9	0.458	-53.9
1500.00	0.255	-162.9	6.336	73.6	0.046	52.0	0.460	-55.6
1600.00	0.248	-169.6	5.997	70.9	0.047	52.5	0.452	-57.5
1700.00	0.246	-176.4	5.681	68.1	0.050	52.5	0.449	-57.7
1800.00	0.245	176.8	5.397	65.4	0.052	53.1	0.452	-59.1
1900.00	0.249	169.4	5.148	62.4	0.054	52.9	0.443	-61.5
2000.00	0.259	163.0	4.910	59.7	0.056	52.7	0.432	-62.1
2100.00	0.268	157.1	4.675	57.1	0.059	52.7	0.433	-63.8
2200.00	0.279	151.8	4.445	54.2	0.061	52.5	0.416	-66.5
2300.00	0.295	147.2	4.237	51.7	0.063	51.9	0.404	-68.4
2400.00	0.309	144.4	4.048	49.1	0.066	52.5	0.397	-71.0
2500.00	0.323	141.1	3.865	46.8	0.068	51.3	0.386	-75.4
2600.00	0.339	139.2	3.696	44.6	0.070	50.9	0.372	-79.0
2700.00	0.353	137.8	3.564	42.4	0.073	51.4	0.375	-82.1
2800.00	0.366	136.1	3.444	40.7	0.076	50.7	0.373	-87.7
2900.00	0.378	134.7	3.292	38.4	0.078	49.8	0.373	-91.2
3000.00	0.391	133.6	3.204	35.8	0.080	49.4	0.385	-94.8

S PARAMETER

V_{CE} = 3 V, I_c = 1 mA

FREQUENCY f (MHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100.00	0.966	-7.5	3.757	172.7	0.009	75.8	0.915	-6.3
200.00	0.956	-14.6	3.683	165.5	0.017	75.1	0.907	-11.1
300.00	0.938	-21.7	3.614	157.6	0.024	72.4	0.911	-15.3
400.00	0.923	-28.3	3.504	150.5	0.034	68.1	0.903	-21.7
500.00	0.904	-34.8	3.399	146.0	0.040	62.9	0.912	-23.6
600.00	0.885	-40.9	3.283	140.4	0.047	58.2	0.929	-27.4
700.00	0.869	-46.6	3.171	135.6	0.054	54.7	0.915	-30.6
800.00	0.850	-51.8	3.024	130.6	0.058	51.5	0.902	-32.6
900.00	0.833	-56.9	2.920	125.3	0.061	46.7	0.907	-36.2
1000.00	0.809	-62.0	2.842	121.0	0.068	44.7	0.887	-39.0
1100.00	0.789	-66.5	2.731	117.0	0.071	41.1	0.873	-40.0
1200.00	0.765	-70.8	2.627	112.7	0.074	38.4	0.867	-42.8
1300.00	0.741	-75.1	2.561	108.4	0.076	35.1	0.852	-45.8
1400.00	0.718	-79.3	2.475	105.3	0.079	32.4	0.841	-47.2
1500.00	0.692	-83.3	2.395	101.5	0.079	30.0	0.832	-49.6
1600.00	0.668	-87.4	2.345	98.1	0.081	27.6	0.819	-52.1
1700.00	0.645	-91.9	2.306	94.8	0.083	25.8	0.810	-53.3
1800.00	0.622	-96.6	2.266	91.2	0.084	24.5	0.807	-55.2
1900.00	0.601	-101.6	2.238	87.4	0.085	21.8	0.793	-57.7
2000.00	0.579	-107.7	2.219	83.4	0.085	19.3	0.782	-59.2
2100.00	0.560	-114.0	2.178	79.3	0.086	17.1	0.778	-61.3
2200.00	0.540	-121.0	2.139	74.4	0.085	14.8	0.757	-63.9
2300.00	0.520	-128.3	2.097	69.7	0.085	13.0	0.743	-66.5
2400.00	0.507	-135.6	2.036	65.4	0.082	11.1	0.733	-68.9
2500.00	0.492	-142.6	1.955	61.1	0.081	9.0	0.718	-72.4
2600.00	0.483	-148.9	1.876	56.9	0.078	7.9	0.698	-75.7
2700.00	0.479	-154.8	1.809	53.1	0.075	6.5	0.701	-78.4
2800.00	0.476	-159.9	1.736	50.0	0.074	5.5	0.695	-82.8
2900.00	0.475	-164.4	1.658	46.6	0.071	6.0	0.690	-86.1
3000.00	0.480	-168.4	1.610	43.1	0.067	4.2	0.699	-89.7

V_{CE} = 3 V, I_c = 3 mA

FREQUENCY f (MHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100.00	0.913	-10.8	9.727	170.1	0.009	74.5	0.901	-8.1
200.00	0.891	-21.0	9.304	160.6	0.016	72.6	0.883	-14.5
300.00	0.853	-31.0	8.914	150.8	0.024	65.6	0.877	-20.2
400.00	0.818	-39.9	8.480	142.2	0.031	62.3	0.854	-27.9
500.00	0.783	-48.7	8.034	136.4	0.036	56.5	0.846	-30.2
600.00	0.750	-56.4	7.520	129.9	0.041	53.3	0.845	-34.4
700.00	0.718	-63.3	7.095	124.4	0.045	48.8	0.819	-37.9
800.00	0.685	-69.3	6.629	119.1	0.048	46.0	0.792	-39.6
900.00	0.656	-75.2	6.256	113.4	0.050	43.9	0.789	-42.9
1000.00	0.620	-81.4	5.911	109.0	0.054	40.7	0.757	-45.7
1100.00	0.592	-86.1	5.585	104.9	0.054	38.8	0.735	-46.2
1200.00	0.561	-90.8	5.267	100.8	0.056	37.0	0.725	-48.6
1300.00	0.531	-95.5	5.035	96.8	0.058	34.7	0.704	-51.1
1400.00	0.506	-100.1	4.793	93.6	0.058	33.6	0.690	-51.9
1500.00	0.477	-104.7	4.567	90.1	0.059	33.2	0.682	-53.9
1600.00	0.451	-109.5	4.400	86.7	0.059	31.5	0.667	-56.0
1700.00	0.428	-115.1	4.240	83.5	0.060	31.8	0.657	-56.8
1800.00	0.406	-120.6	4.099	80.2	0.061	30.9	0.653	-58.3
1900.00	0.384	-127.0	3.979	76.5	0.062	30.8	0.639	-60.6
2000.00	0.368	-134.5	3.859	72.9	0.063	29.3	0.625	-61.4
2100.00	0.356	-141.8	3.729	69.5	0.063	29.7	0.622	-63.4
2200.00	0.345	-149.7	3.587	65.6	0.062	29.4	0.601	-65.6
2300.00	0.339	-158.2	3.465	61.8	0.063	29.4	0.587	-67.8
2400.00	0.339	-165.2	3.328	58.3	0.063	28.7	0.576	-70.1
2500.00	0.340	-171.8	3.181	55.0	0.063	28.5	0.563	-73.4
2600.00	0.346	-177.5	3.042	51.9	0.062	29.1	0.546	-76.5
2700.00	0.354	177.5	2.933	48.8	0.063	29.8	0.548	-79.2
2800.00	0.362	173.3	2.821	46.5	0.064	30.9	0.544	-83.7
2900.00	0.369	169.7	2.692	43.6	0.064	31.4	0.539	-87.0
3000.00	0.380	166.7	2.613	40.5	0.064	32.6	0.551	-90.5

S PARAMETER

V_{CE} = 3 V, I_c = 5 mA

FREQUENCY f (MHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100.00	0.868	-13.6	14.304	168	0.008	73.3	0.888	-9.5
200.00	0.836	-26.0	13.488	157.0	0.016	70.0	0.862	-16.9
300.00	0.787	-37.8	12.686	145.9	0.022	63.4	0.844	-23.5
400.00	0.739	-48.9	11.834	136.5	0.029	58.7	0.810	-31.9
500.00	0.692	-58.4	10.961	130.0	0.032	55.3	0.789	-34.2
600.00	0.652	-66.9	10.065	123.3	0.037	50.6	0.780	-38.3
700.00	0.615	-74.5	9.332	117.6	0.040	47.6	0.748	-41.6
800.00	0.577	-80.8	8.595	112.3	0.041	45.4	0.717	-42.7
900.00	0.547	-86.7	7.987	106.7	0.042	43.0	0.715	-45.7
1000.00	0.511	-93.5	7.433	102.6	0.045	41.8	0.677	-48.2
1100.00	0.482	-98.2	6.951	98.6	0.047	40.8	0.656	-48.3
1200.00	0.452	-102.8	6.498	94.7	0.048	39.4	0.647	-50.1
1300.00	0.425	-107.9	6.154	91	0.049	38.6	0.626	-52.5
1400.00	0.402	-112.7	5.820	88.0	0.050	37.6	0.614	-52.9
1500.00	0.376	-117.5	5.501	84.6	0.050	38.4	0.609	-54.5
1600.00	0.354	-122.9	5.268	81.6	0.052	38.1	0.595	-56.4
1700.00	0.335	-129.2	5.044	78.5	0.053	37.7	0.587	-57.0
1800.00	0.318	-135.3	4.835	75.4	0.055	38.5	0.585	-58.5
1900.00	0.302	-142.7	4.654	71.9	0.055	38.4	0.573	-60.6
2000.00	0.293	-150.7	4.493	68.7	0.056	38.9	0.560	-61.2
2100.00	0.287	-158.7	4.312	65.7	0.056	38.2	0.557	-62.9
2200.00	0.285	-166.8	4.132	62.0	0.058	38.8	0.538	-65.3
2300.00	0.288	-175.0	3.971	58.7	0.059	39.3	0.524	-67.1
2400.00	0.295	178.6	3.805	55.7	0.061	39.2	0.515	-69.4
2500.00	0.302	172.5	3.635	52.9	0.061	40.1	0.502	-72.8
2600.00	0.314	167.9	3.473	50.0	0.062	40.3	0.486	-75.9
2700.00	0.326	164.0	3.352	47.3	0.063	40.5	0.489	-78.8
2800.00	0.337	160.6	3.227	45.2	0.065	40.6	0.487	-83.4
2900.00	0.348	157.8	3.083	42.6	0.066	41.4	0.482	-86.6
3000.00	0.359	155.3	2.995	39.6	0.066	40.9	0.493	-90.4

V_{CE} = 3 V, I_c = 10 mA

FREQUENCY f (MHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100.00	0.770	-19.0	23.007	164.0	0.008	71.6	0.859	-12.3
200.00	0.720	-36.3	21.033	150.1	0.014	65.7	0.815	-21.4
300.00	0.651	-51.8	18.926	137.2	0.020	60.5	0.772	-29.0
400.00	0.591	-65.4	16.929	126.9	0.023	58.0	0.723	-38.1
500.00	0.538	-76.5	15.047	119.9	0.028	51.9	0.688	-39.5
600.00	0.497	-86.2	13.422	113.1	0.030	50.0	0.671	-42.7
700.00	0.463	-94.1	12.12	107.8	0.032	48.7	0.635	-45.4
800.00	0.429	-100.5	10.911	102.9	0.034	46.7	0.607	-45.5
900.00	0.403	-107.3	9.888	97.6	0.034	47.1	0.607	-47.6
1000.00	0.373	-113.7	9.117	94.1	0.037	47.7	0.571	-49.7
1100.00	0.351	-118.4	8.414	90.6	0.038	46.7	0.554	-49.0
1200.00	0.326	-123.5	7.788	87.2	0.040	47.4	0.550	-50.5
1300.00	0.306	-128.9	7.309	83.8	0.041	47.0	0.533	-52.4
1400.00	0.289	-134.2	6.86	81.1	0.043	48.2	0.525	-52.1
1500.00	0.271	-139.8	6.445	78.1	0.044	48.0	0.525	-53.7
1600.00	0.256	-146.1	6.125	75.3	0.046	48.5	0.515	-55.4
1700.00	0.246	-153.3	5.819	72.5	0.048	49.4	0.510	-55.7
1800.00	0.238	-160.4	5.547	69.7	0.049	49.4	0.510	-56.9
1900.00	0.233	-168.9	5.312	66.7	0.051	49.7	0.501	-59.1
2000.00	0.236	-176.9	5.081	63.8	0.053	50.3	0.490	-59.7
2100.00	0.240	175.4	4.848	61.1	0.056	50.7	0.490	-61.2
2200.00	0.248	168.4	4.625	58.0	0.056	50.8	0.472	-63.7
2300.00	0.262	162.0	4.422	55.3	0.059	50.3	0.460	-65.5
2400.00	0.274	157.6	4.233	52.6	0.061	50.6	0.452	-67.9
2500.00	0.287	153.4	4.048	50.2	0.063	50.4	0.441	-71.7
2600.00	0.304	150.2	3.878	47.7	0.064	51.0	0.425	-74.9
2700.00	0.319	147.9	3.739	45.2	0.066	50.6	0.428	-77.9
2800.00	0.330	145.6	3.604	43.5	0.069	49.5	0.425	-82.8
2900.00	0.343	143.7	3.449	41.0	0.072	49.9	0.423	-86.2
3000.00	0.355	142.1	3.352	38.3	0.073	49.9	0.434	-90.1

S PARAMETER

V_{CE} = 3 V, I_c = 15 mA

FREQUENCY f (MHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100.00	0.695	-23.5	28.64	161.2	0.008	70.9	0.837	-13.9
200.00	0.636	-44.1	25.451	145.4	0.013	66.1	0.779	-24.0
300.00	0.558	-62.4	22.15	131.7	0.018	61.3	0.723	-31.8
400.00	0.506	-77.0	19.259	121.3	0.022	54.9	0.669	-40.9
500.00	0.453	-88.8	16.721	114.4	0.024	53.0	0.628	-41.3
600.00	0.419	-99.1	14.679	107.9	0.027	51.4	0.612	-44.0
700.00	0.390	-107.2	13.085	102.9	0.028	51.2	0.578	-46.2
800.00	0.363	-113.5	11.684	98.2	0.030	50.2	0.553	-45.7
900.00	0.341	-119.5	10.582	93.3	0.031	49.9	0.558	-47.7
1000.00	0.320	-127.1	9.608	90.2	0.034	52.1	0.524	-49.2
1100.00	0.301	-131.8	8.839	87.0	0.036	51.6	0.512	-48.2
1200.00	0.281	-137.3	8.148	83.7	0.037	52.7	0.510	-49.4
1300.00	0.264	-142.8	7.617	80.6	0.039	51.8	0.494	-51.3
1400.00	0.253	-148.4	7.143	78.0	0.041	54.4	0.490	-50.7
1500.00	0.239	-154.1	6.694	75.2	0.043	54.1	0.493	-52.3
1600.00	0.230	-161.3	6.345	72.5	0.045	53.4	0.484	-54.0
1700.00	0.225	-168.5	6.013	69.9	0.046	54.5	0.481	-54.4
1800.00	0.222	-175.5	5.711	67.1	0.049	55.4	0.484	-55.8
1900.00	0.223	176.4	5.455	64.2	0.050	55.4	0.474	-57.7
2000.00	0.230	169.3	5.211	61.5	0.052	55.5	0.466	-58.3
2100.00	0.239	162.7	4.965	59.0	0.055	55.1	0.466	-60.1
2200.00	0.251	156.7	4.733	56.1	0.057	55.2	0.449	-62.4
2300.00	0.266	151.6	4.517	53.5	0.060	54.6	0.439	-64.4
2400.00	0.281	148.1	4.313	51.0	0.063	56.0	0.430	-66.8
2500.00	0.293	145.0	4.130	48.7	0.063	54.9	0.419	-70.8
2600.00	0.310	142.7	3.952	46.5	0.066	55.3	0.404	-74.0
2700.00	0.326	141.1	3.807	44.2	0.068	54.7	0.408	-77.2
2800.00	0.338	139.3	3.680	42.4	0.070	54.0	0.404	-82.2
2900.00	0.350	137.8	3.517	40.2	0.073	53.7	0.403	-85.7
3000.00	0.364	136.6	3.430	37.5	0.075	53.3	0.412	-89.3

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