

NEC

查询UPA814供应商

DATA SHEET

捷多邦, 专业PCB打样工厂, 24小时加急出货

NPN SILICON RF TWIN TRANSISTOR μ PA814TC

NPN SILICON EPITAXIAL TRANSISTOR (WITH BUILT-IN 2 \times 2SC5195) FLAT-LEAD 6-PIN THIN-TYPE ULTRA SUPER MINIMOLD

FEATURES

- Low voltage operation, low phase distortion
- Low noise: NF = 1.5 dB TYP. @ $V_{CE} = 3$ V, $I_c = 7$ mA, $f = 2$ GHz
NF = 1.7 dB TYP. @ $V_{CE} = 1$ V, $I_c = 3$ mA, $f = 2$ GHz
- Flat-lead 6-pin thin-type ultra super minimold package.
- Built-in 2 transistors (2 \times 2SC5195)

ORDERING INFORMATION

Part Number	Package	Quantity	Supplying Form
μ PA814TC	Flat-lead 6-pin thin-type ultra super minimold	Loose products (50 pcs)	Embossed tape 8 mm wide. Pin 6 (Q1 Base), Pin 5 (Q1 Emitter), Pin 4 (Q2 Emitter) face to perforation side of the tape.
μ PA814TC-T1		Taping products (3 kp/reel)	

Remark To order evaluation samples, please contact your local NEC sales office. (Part number for sample order: μ PA814TC. Unit sample quantity is 50 pcs.)

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

Parameter	Symbol	Ratings	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	100	mA
Total Power Dissipation	P_T Note	200 in 1 element 230 in 2 elements	mW
Junction Temperature	T_j	150	$^\circ\text{C}$
Storage Temperature	T_{stg}	-65 to +150	$^\circ\text{C}$

Note Mounted on 1.08 cm² \times 1.0 mm glass epoxy substrate.

Caution Electro-static sensitive devices

The information in this document is subject to change without notice. Before using this document, please confirm that this is the latest version.
Not all devices/types available in every country. Please check with local NEC representative for availability and additional information.



ELECTRICAL CHARACTERISTICS (T_A = +25 °C)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Collector Cutoff Current	I _{CB0}	V _{CB} = 5 V, I _E = 0	–	–	0.1	μA
Emitter Cutoff Current	I _{EB0}	V _{EB} = 1 V, I _C = 0	–	–	0.1	μA
DC Current Gain	h _{FE}	V _{CE} = 1 V, I _C = 3 mA ^{Note 1}	80	–	160	
Gain Bandwidth Product (1)	f _T	V _{CE} = 1 V, I _C = 3 mA, f = 2 GHz	4.0	4.5	–	GHz
Gain Bandwidth Product (2)	f _T	V _{CE} = 3 V, I _C = 20 mA, f = 2 GHz	–	9.0	–	GHz
Feedback Capacitance	C _{re}	V _{CB} = 1 V, I _E = 0, f = 1 MHz ^{Note 2}	–	0.75	0.85	pF
Insertion Power Gain (1)	S _{21e} ²	V _{CE} = 1 V, I _C = 3 mA, f = 2 GHz	2.5	3.5	–	dB
Insertion Power Gain (2)	S _{21e} ²	V _{CE} = 3 V, I _C = 20 mA, f = 2 GHz	–	6.5	–	dB
Noise Figure (1)	NF	V _{CE} = 1 V, I _C = 3 mA, f = 2 GHz	–	1.7	2.5	dB
Noise Figure (2)	NF	V _{CE} = 3 V, I _C = 7 mA, f = 2 GHz	–	1.5	–	dB

Notes 1. Pulse Measurement: PW ≤ 350 μs, Duty Cycle ≤ 2 %

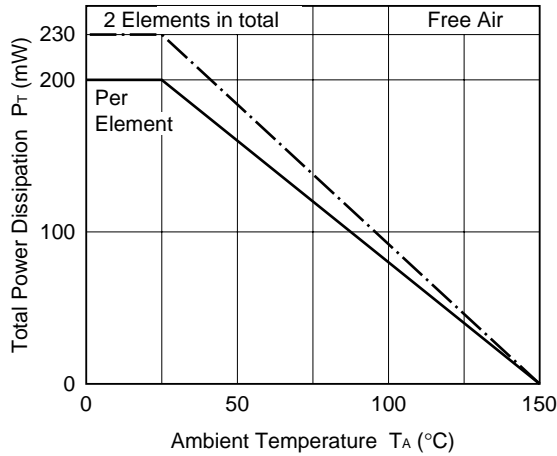
2. Measured with 3-pin bridge, emitter and case should be connected to guard pin of bridge.

h_{FE} CLASSIFICATION

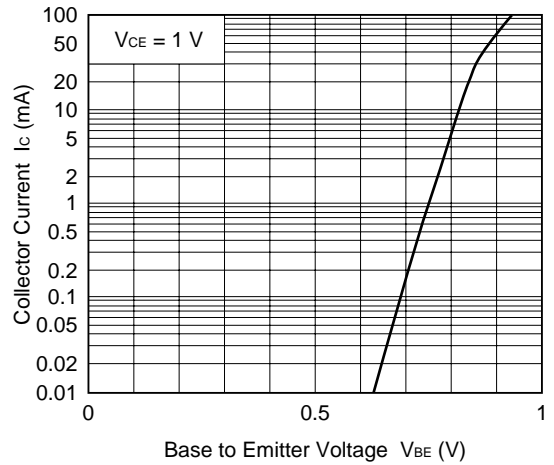
Rank	KB
Marking	87
h _{FE} Value	80 to 160

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

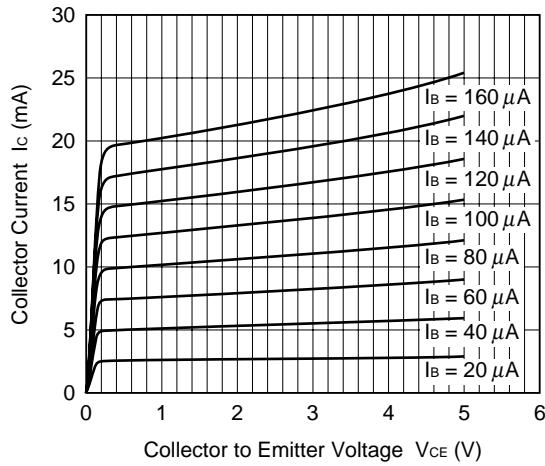
TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE



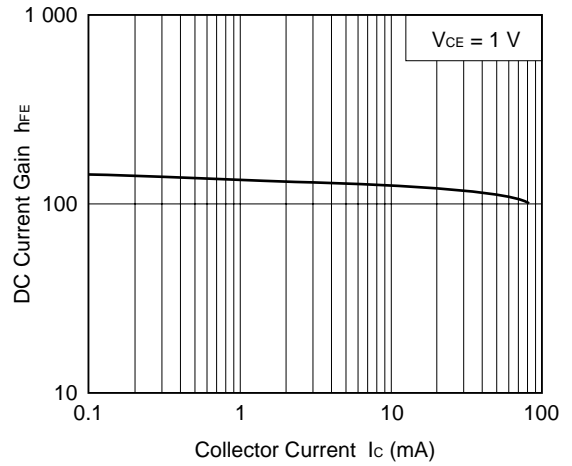
COLLECTOR CURRENT vs. BASE TO EMITTER VOLTAGE



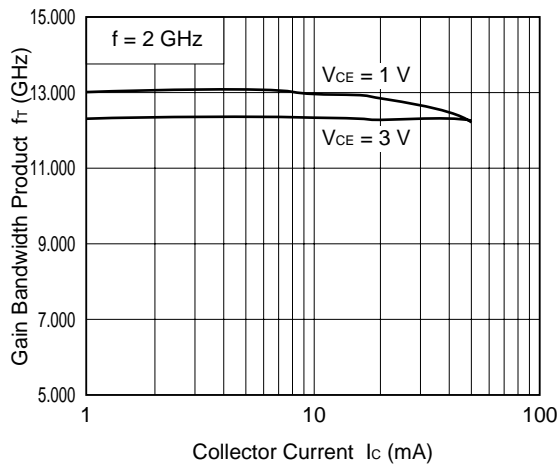
COLLECTOR CURRENT vs. COLLECTOR TO EMITTER VOLTAGE



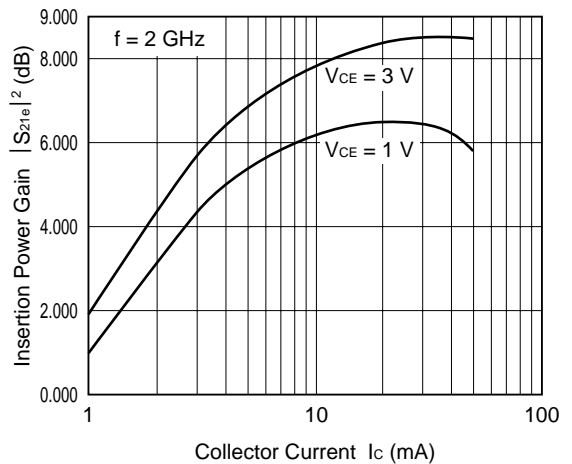
DC CURRENT GAIN vs. COLLECTOR CURRENT



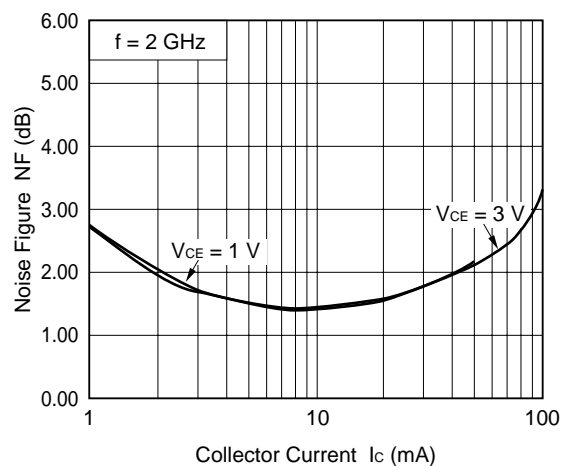
GAIN BANDWIDTH PRODUCT vs. COLLECTOR CURRENT



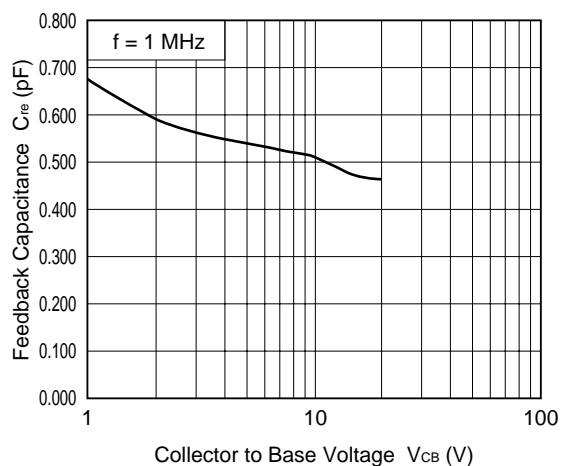
INSERTION POWER GAIN vs. COLLECTOR CURRENT



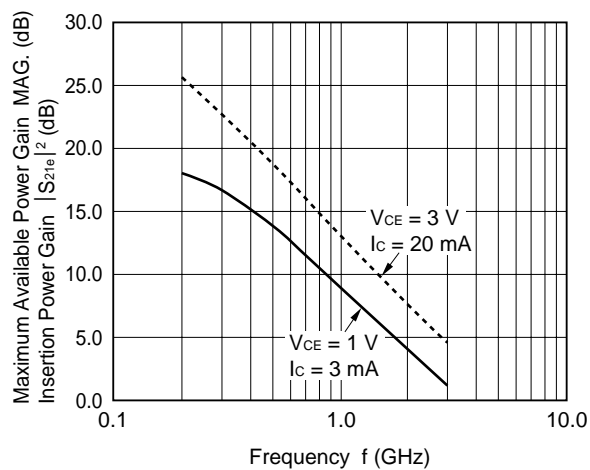
NOISE FIGURE vs. COLLECTOR CURRENT



FEEDBACK CAPACITANCE vs. COLLECTOR TO BASE VOLTAGE



INSERTION POWER GAIN/MAXIMUM AVAILABLE GAIN vs. FREQUENCY



S-PARAMETERS Q1

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

FREQUENCY GHz	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
0.1	0.960	-25.7	4.063	158.9	0.038	60.5	0.987	-15.6
0.2	0.923	-49.3	3.709	140.2	0.091	58.0	0.940	-29.1
0.3	0.882	-71.6	3.426	123.2	0.125	40.8	0.895	-42.6
0.4	0.842	-93.2	3.142	106.4	0.154	27.9	0.832	-54.9
0.5	0.793	-113.1	2.878	90.9	0.170	15.4	0.766	-65.6
0.6	0.760	-130.8	2.618	76.8	0.191	3.5	0.711	-75.3
0.7	0.728	-148.3	2.409	63.4	0.200	-8.4	0.661	-85.2
0.8	0.705	-164.7	2.225	50.8	0.202	-18.7	0.621	-94.1
0.9	0.686	-179.6	2.044	39.0	0.207	-27.5	0.587	-103.0
1.0	0.672	165.9	1.911	27.4	0.208	-36.9	0.557	-111.1
1.1	0.666	152.4	1.784	16.2	0.206	-45.7	0.529	-120.5
1.2	0.658	139.2	1.674	5.5	0.208	-52.1	0.506	-128.4
1.3	0.657	127.2	1.581	-4.8	0.206	-60.7	0.489	-137.0
1.4	0.653	114.3	1.489	-15.1	0.197	-67.3	0.469	-145.3
1.5	0.662	102.9	1.423	-25.1	0.197	-73.4	0.457	-154.4
1.6	0.660	91.8	1.353	-35.0	0.193	-79.3	0.441	-163.1
1.7	0.663	81.1	1.283	-44.2	0.190	-84.9	0.434	-172.4
1.8	0.668	70.1	1.225	-54.3	0.183	-90.4	0.421	178.8
1.9	0.674	59.9	1.172	-63.4	0.181	-96.5	0.413	168.8
2.0	0.674	49.2	1.113	-72.8	0.176	-101.7	0.401	159.7
2.1	0.664	38.0	1.044	-81.6	0.162	-106.5	0.389	150.5
2.2	0.649	32.3	1.020	-88.1	0.165	-104.5	0.402	141.0
2.3	0.674	23.1	0.999	-97.4	0.170	-109.8	0.394	129.2
2.4	0.686	14.2	0.965	-106.1	0.172	-113.1	0.394	118.6
2.5	0.694	4.6	0.930	-114.6	0.173	-116.6	0.391	107.5
2.6	0.702	-3.9	0.894	-123.2	0.179	-120.2	0.393	96.3
2.7	0.710	-12.3	0.868	-131.1	0.185	-123.3	0.390	84.9
2.8	0.713	-20.8	0.835	-139.2	0.191	-127.8	0.394	73.4
2.9	0.719	-28.8	0.812	-146.9	0.201	-131.1	0.392	62.5
3.0	0.725	-36.9	0.786	-154.6	0.214	-135.9	0.397	50.8

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

FREQUENCY GHz	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
0.1	0.887	-36.8	9.965	151.2	0.057	55.1	0.949	-24.7
0.2	0.803	-69.5	8.512	128.8	0.084	46.0	0.825	-44.8
0.3	0.735	-96.2	7.273	110.0	0.103	30.6	0.715	-62.0
0.4	0.674	-120.6	6.176	93.2	0.116	21.0	0.604	-76.0
0.5	0.630	-141.4	5.379	78.7	0.124	10.2	0.516	-88.2
0.6	0.598	-159.6	4.665	65.7	0.133	2.1	0.455	-98.9
0.7	0.580	-175.9	4.115	53.9	0.135	-4.9	0.404	-107.6
0.8	0.567	169.3	3.700	42.9	0.146	-13.5	0.358	-117.6
0.9	0.559	155.3	3.338	32.2	0.149	-17.3	0.326	-127.2
1.0	0.554	142.3	3.053	21.9	0.151	-23.7	0.299	-135.5
1.1	0.555	130.3	2.814	12.3	0.157	-30.8	0.273	-145.1
1.2	0.555	118.7	2.602	2.5	0.162	-35.8	0.251	-154.5
1.3	0.557	108.0	2.428	-6.7	0.163	-41.4	0.238	-164.0
1.4	0.563	96.8	2.273	-16.2	0.165	-47.0	0.221	-173.5
1.5	0.567	86.7	2.142	-25.1	0.172	-51.5	0.212	176.3
1.6	0.572	76.8	2.021	-34.4	0.178	-58.0	0.198	165.2
1.7	0.580	67.0	1.906	-43.0	0.180	-62.6	0.192	154.6
1.8	0.588	57.4	1.816	-52.3	0.185	-67.8	0.181	143.7
1.9	0.595	48.2	1.727	-60.8	0.190	-74.2	0.177	132.0
2.0	0.599	38.3	1.637	-69.8	0.196	-79.1	0.171	119.7
2.1	0.600	27.7	1.530	-77.9	0.190	-85.3	0.153	109.1
2.2	0.574	22.1	1.491	-84.1	0.207	-86.6	0.172	103.9
2.3	0.602	14.6	1.456	-92.9	0.216	-93.9	0.183	88.2
2.4	0.614	6.1	1.402	-101.6	0.222	-100.0	0.183	76.0
2.5	0.622	-2.2	1.349	-109.8	0.231	-106.0	0.189	62.4
2.6	0.635	-10.2	1.300	-118.0	0.241	-111.7	0.196	51.4
2.7	0.641	-18.1	1.260	-125.7	0.247	-117.4	0.204	39.8
2.8	0.647	-26.0	1.217	-133.7	0.253	-124.7	0.213	29.6
2.9	0.654	-34.0	1.177	-141.9	0.263	-129.7	0.216	18.0
3.0	0.661	-41.2	1.138	-149.8	0.273	-136.9	0.228	8.6

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

FREQUENCY GHz	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
0.1	0.821	-47.3	14.957	145.0	0.057	44.0	0.907	-32.4
0.2	0.700	-86.4	11.919	120.1	0.072	44.0	0.712	-57.7
0.3	0.632	-114.9	9.574	100.9	0.086	28.5	0.572	-77.3
0.4	0.575	-139.3	7.790	85.1	0.094	20.6	0.467	-91.9
0.5	0.544	-159.2	6.555	71.5	0.103	13.5	0.385	-104.7
0.6	0.527	-176.0	5.581	59.6	0.110	8.6	0.331	-115.6
0.7	0.515	168.5	4.887	49.0	0.116	3.1	0.283	-126.9
0.8	0.518	154.8	4.319	38.8	0.127	-4.1	0.251	-137.8
0.9	0.508	142.6	3.882	28.7	0.128	-7.2	0.225	-148.7
1.0	0.514	130.6	3.534	19.2	0.137	-13.6	0.202	-159.8
1.1	0.514	119.4	3.240	9.9	0.143	-20.0	0.189	-171.8
1.2	0.516	108.8	2.985	0.7	0.151	-24.1	0.175	-177.4
1.3	0.527	98.6	2.770	-8.1	0.157	-30.4	0.165	164.9
1.4	0.532	88.7	2.594	-17.2	0.166	-36.6	0.157	152.7
1.5	0.539	79.3	2.439	-25.8	0.173	-41.8	0.154	140.7
1.6	0.546	69.9	2.290	-34.6	0.183	-48.1	0.150	127.1
1.7	0.552	60.9	2.165	-43.3	0.189	-54.3	0.150	114.4
1.8	0.561	51.7	2.044	-51.9	0.197	-60.5	0.149	102.5
1.9	0.570	42.9	1.941	-60.0	0.204	-66.6	0.156	90.2
2.0	0.578	33.6	1.842	-68.8	0.211	-72.8	0.155	77.0
2.1	0.580	23.4	1.722	-76.9	0.209	-79.0	0.147	61.7
2.2	0.556	17.7	1.676	-83.0	0.228	-81.4	0.155	62.5
2.3	0.582	10.4	1.634	-91.6	0.239	-89.5	0.177	50.0
2.4	0.593	2.3	1.572	-99.9	0.247	-96.3	0.188	38.4
2.5	0.598	-5.8	1.510	-107.9	0.254	-103.2	0.198	27.7
2.6	0.611	-13.6	1.452	-116.2	0.262	-109.6	0.209	18.6
2.7	0.622	-20.9	1.409	-124.2	0.270	-115.8	0.221	9.0
2.8	0.625	-28.4	1.353	-131.7	0.280	-123.5	0.230	0.1
2.9	0.636	-36.0	1.312	-139.2	0.285	-129.7	0.244	-9.9
3.0	0.642	-43.2	1.263	-147.1	0.293	-136.5	0.250	-18.1

V_{CE} = 1 V, I_C = 7 mA

FREQUENCY GHz	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
0.1	0.763	-55.4	18.417	140.5	0.048	37.3	0.880	-39.3
0.2	0.636	-97.5	13.905	114.4	0.064	37.5	0.629	-66.6
0.3	0.573	-126.9	10.779	95.6	0.081	28.0	0.504	-87.2
0.4	0.527	-151.1	8.532	80.6	0.085	22.1	0.394	-102.7
0.5	0.507	-169.7	7.116	68.1	0.089	17.9	0.319	-116.0
0.6	0.499	174.3	6.038	56.7	0.104	14.7	0.276	-127.5
0.7	0.493	160.1	5.251	46.6	0.108	6.5	0.237	-140.4
0.8	0.493	147.6	4.614	36.6	0.117	0.9	0.211	-153.4
0.9	0.493	135.7	4.140	26.9	0.124	-2.9	0.193	-165.7
1.0	0.495	124.2	3.753	17.7	0.133	-9.3	0.175	-178.7
1.1	0.499	113.9	3.441	8.8	0.141	-14.4	0.169	167.5
1.2	0.508	103.9	3.169	-0.3	0.152	-20.2	0.158	155.1
1.3	0.514	94.0	2.932	-9.0	0.160	-26.7	0.156	143.4
1.4	0.520	84.7	2.739	-17.7	0.169	-31.6	0.155	130.1
1.5	0.527	75.9	2.578	-26.0	0.178	-37.6	0.156	118.3
1.6	0.534	66.5	2.405	-34.7	0.186	-44.9	0.158	105.2
1.7	0.540	58.0	2.276	-43.1	0.195	-50.9	0.165	94.0
1.8	0.550	49.0	2.154	-51.6	0.205	-56.7	0.166	81.4
1.9	0.562	40.5	2.056	-60.0	0.211	-63.7	0.176	70.5
2.0	0.569	31.2	1.940	-68.3	0.218	-70.1	0.180	58.7
2.1	0.575	21.4	1.807	-76.5	0.217	-76.5	0.178	45.0
2.2	0.546	15.6	1.761	-82.3	0.237	-79.8	0.176	44.2
2.3	0.569	8.6	1.714	-91.0	0.248	-87.5	0.202	35.2
2.4	0.580	0.9	1.646	-99.3	0.259	-95.3	0.216	24.5
2.5	0.593	-7.2	1.586	-107.2	0.266	-101.8	0.229	15.3
2.6	0.607	-14.9	1.520	-115.3	0.272	-108.5	0.239	6.4
2.7	0.613	-22.7	1.467	-123.3	0.282	-115.7	0.251	-2.9
2.8	0.619	-30.1	1.419	-130.8	0.289	-122.6	0.260	-11.0
2.9	0.625	-37.4	1.376	-138.6	0.297	-129.2	0.270	-19.9
3.0	0.633	-44.6	1.326	-146.0	0.307	-136.1	0.277	-27.5

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

FREQUENCY		S ₁₁		S ₂₁		S ₁₂		S ₂₂	
GHz	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	
0.1	0.692	-65.1	22.317	135.2	0.055	39.5	0.816	-45.5	
0.2	0.570	-110.8	15.772	108.7	0.058	40.5	0.557	-77.0	
0.3	0.527	-139.5	11.779	90.7	0.073	33.7	0.423	-96.5	
0.4	0.501	-162.6	9.207	76.6	0.077	27.3	0.333	-114.3	
0.5	0.480	-179.7	7.550	65.0	0.083	23.3	0.269	-129.3	
0.6	0.478	165.9	6.376	53.9	0.093	20.3	0.232	-143.4	
0.7	0.473	152.6	5.504	44.4	0.103	11.7	0.206	-157.7	
0.8	0.478	141.1	4.860	34.7	0.113	6.4	0.188	-171.7	
0.9	0.479	129.8	4.350	25.7	0.123	1.4	0.179	175.4	
1.0	0.483	119.4	3.932	16.6	0.131	-3.0	0.168	161.8	
1.1	0.492	109.4	3.598	7.8	0.142	-10.5	0.169	148.4	
1.2	0.495	99.8	3.308	-0.9	0.153	-15.0	0.166	136.8	
1.3	0.504	90.5	3.062	-9.5	0.161	-22.5	0.168	123.9	
1.4	0.511	81.2	2.859	-18.0	0.171	-28.3	0.170	113.2	
1.5	0.519	72.6	2.675	-26.2	0.181	-34.0	0.176	101.2	
1.6	0.528	63.7	2.522	-35.0	0.194	-40.9	0.181	89.6	
1.7	0.533	55.4	2.368	-43.1	0.200	-47.0	0.187	80.1	
1.8	0.545	46.5	2.236	-51.7	0.211	-54.4	0.193	68.5	
1.9	0.555	38.2	2.133	-59.8	0.218	-61.9	0.204	59.1	
2.0	0.562	29.3	2.012	-68.1	0.226	-68.2	0.209	48.0	
2.1	0.569	19.6	1.875	-76.0	0.227	-73.9	0.212	34.5	
2.2	0.544	13.9	1.825	-81.9	0.245	-78.6	0.207	34.2	
2.3	0.567	7.4	1.780	-90.4	0.258	-86.6	0.234	25.0	
2.4	0.579	-0.9	1.707	-98.8	0.266	-93.8	0.248	15.9	
2.5	0.588	-8.6	1.639	-106.5	0.274	-101.1	0.262	7.2	
2.6	0.597	-16.0	1.580	-114.4	0.286	-108.0	0.271	-1.6	
2.7	0.608	-23.4	1.529	-121.9	0.292	-114.4	0.283	-9.5	
2.8	0.612	-30.9	1.474	-129.6	0.301	-122.1	0.292	-17.5	
2.9	0.622	-38.3	1.431	-137.4	0.307	-128.4	0.302	-26.0	
3.0	0.628	-45.4	1.369	-145.2	0.317	-136.4	0.311	-33.4	

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

FREQUENCY GHz	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
0.1	0.947	-23.1	4.158	160.7	0.048	48.9	0.994	-13.7
0.2	0.925	-44.9	3.843	143.3	0.071	61.8	0.960	-24.9
0.3	0.897	-65.3	3.578	127.5	0.096	45.2	0.926	-36.3
0.4	0.856	-86.0	3.324	111.5	0.114	30.9	0.873	-47.6
0.5	0.814	-105.0	3.092	96.6	0.132	18.9	0.830	-57.2
0.6	0.776	-123.1	2.848	82.6	0.147	7.3	0.784	-66.3
0.7	0.739	-139.9	2.618	69.7	0.157	-2.6	0.738	-75.0
0.8	0.714	-156.0	2.439	57.1	0.162	-12.3	0.702	-83.8
0.9	0.695	-171.3	2.274	45.3	0.164	-22.4	0.673	-91.8
1.0	0.675	174.0	2.120	33.9	0.168	-31.2	0.644	-99.8
1.1	0.661	159.6	1.984	23.0	0.167	-39.2	0.615	-107.5
1.2	0.654	146.5	1.868	12.2	0.168	-45.7	0.596	-115.3
1.3	0.653	133.5	1.764	1.9	0.164	-54.2	0.582	-123.3
1.4	0.643	121.0	1.668	-8.1	0.163	-60.0	0.565	-130.7
1.5	0.648	108.8	1.582	-18.2	0.161	-66.2	0.549	-139.0
1.6	0.645	97.2	1.508	-27.9	0.157	-72.2	0.534	-146.8
1.7	0.646	86.0	1.435	-37.4	0.155	-77.9	0.526	-155.5
1.8	0.649	74.9	1.370	-46.9	0.149	-82.4	0.514	-163.3
1.9	0.653	64.1	1.313	-56.0	0.148	-88.0	0.500	-172.2
2.0	0.658	53.1	1.249	-65.6	0.145	-92.2	0.489	179.5
2.1	0.644	41.6	1.172	-74.5	0.134	-96.2	0.479	171.2
2.2	0.626	35.7	1.147	-81.0	0.138	-93.8	0.483	162.2
2.3	0.650	26.4	1.119	-90.4	0.143	-98.4	0.477	151.7
2.4	0.661	16.8	1.083	-99.0	0.148	-101.4	0.470	141.9
2.5	0.666	7.6	1.045	-107.4	0.152	-104.7	0.463	132.2
2.6	0.680	-1.3	1.009	-116.5	0.160	-107.5	0.458	121.9
2.7	0.683	-9.8	0.976	-124.0	0.166	-112.1	0.452	111.5
2.8	0.689	-18.4	0.944	-132.2	0.176	-114.9	0.449	100.8
2.9	0.696	-26.8	0.918	-140.5	0.188	-119.3	0.444	89.9
3.0	0.696	-34.8	0.885	-148.2	0.198	-124.5	0.441	79.0

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

FREQUENCY GHz	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
0.1	0.889	-32.4	10.231	153.9	0.037	53.4	0.975	-19.4
0.2	0.823	-60.3	8.946	133.3	0.060	56.4	0.869	-36.1
0.3	0.751	-84.7	7.811	115.2	0.082	41.3	0.781	-50.5
0.4	0.686	-108.6	6.798	98.7	0.089	25.6	0.688	-62.5
0.5	0.634	-128.7	6.003	84.3	0.103	19.4	0.608	-72.0
0.6	0.595	-146.9	5.276	71.2	0.110	8.7	0.546	-81.7
0.7	0.565	-164.0	4.697	59.3	0.113	-0.4	0.498	-89.3
0.8	0.549	-179.5	4.238	48.0	0.121	-7.2	0.455	-97.0
0.9	0.531	166.1	3.833	37.4	0.122	-12.3	0.419	-104.4
1.0	0.522	152.6	3.515	27.3	0.125	-19.3	0.392	-112.1
1.1	0.517	139.8	3.244	17.3	0.130	-24.2	0.368	-119.4
1.2	0.514	127.3	3.010	7.8	0.134	-30.6	0.348	-126.2
1.3	0.516	115.6	2.806	-1.6	0.136	-36.0	0.329	-134.0
1.4	0.516	104.6	2.631	-10.7	0.144	-40.0	0.316	-141.4
1.5	0.523	93.4	2.477	-19.9	0.145	-46.0	0.301	-149.7
1.6	0.527	83.4	2.349	-29.0	0.150	-50.9	0.285	-157.3
1.7	0.532	73.3	2.222	-37.8	0.154	-56.5	0.273	-166.3
1.8	0.540	63.1	2.102	-46.7	0.159	-61.0	0.258	-174.1
1.9	0.545	53.6	2.005	-55.3	0.162	-66.7	0.248	176.8
2.0	0.553	43.2	1.900	-64.2	0.168	-71.6	0.235	168.9
2.1	0.554	32.2	1.773	-72.7	0.165	-78.1	0.216	162.3
2.2	0.527	27.0	1.729	-78.9	0.179	-79.1	0.234	153.4
2.3	0.553	18.9	1.692	-87.7	0.190	-85.8	0.223	140.5
2.4	0.566	10.6	1.631	-96.3	0.196	-92.1	0.213	129.6
2.5	0.574	1.6	1.570	-104.5	0.206	-98.1	0.206	118.4
2.6	0.585	-6.0	1.518	-112.8	0.208	-103.7	0.202	106.2
2.7	0.596	-14.3	1.464	-120.6	0.221	-109.3	0.200	95.4
2.8	0.601	-22.5	1.410	-128.9	0.231	-116.0	0.197	83.3
2.9	0.608	-30.2	1.366	-136.9	0.239	-122.0	0.192	71.2
3.0	0.618	-37.7	1.321	-144.8	0.250	-128.0	0.193	58.6

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

FREQUENCY GHz	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
0.1	0.838	-37.6	14.548	149.6	0.053	64.2	0.956	-23.0
0.2	0.748	-71.0	12.165	126.9	0.060	49.9	0.806	-43.7
0.3	0.663	-97.5	10.184	108.0	0.073	35.0	0.678	-58.9
0.4	0.585	-121.7	8.478	91.7	0.078	26.5	0.570	-70.8
0.5	0.549	-141.4	7.327	77.9	0.090	19.5	0.491	-80.7
0.6	0.513	-160.0	6.307	65.6	0.097	11.3	0.432	-88.5
0.7	0.487	-175.7	5.563	54.4	0.101	5.7	0.388	-96.8
0.8	0.477	169.1	4.951	44.0	0.108	-1.1	0.345	-104.1
0.9	0.467	155.2	4.469	34.0	0.113	-4.7	0.316	-111.5
1.0	0.462	142.5	4.062	24.2	0.117	-10.8	0.291	-118.7
1.1	0.465	130.6	3.732	14.8	0.122	-16.1	0.269	-126.7
1.2	0.465	118.9	3.449	5.6	0.129	-23.1	0.251	-133.8
1.3	0.470	108.3	3.202	-3.3	0.137	-27.3	0.234	-141.8
1.4	0.468	97.0	2.996	-12.1	0.142	-31.0	0.221	-149.1
1.5	0.481	87.2	2.823	-20.9	0.148	-38.0	0.206	-158.1
1.6	0.484	77.2	2.654	-29.6	0.156	-43.9	0.194	-166.1
1.7	0.493	67.9	2.511	-38.3	0.161	-49.3	0.181	-176.0
1.8	0.500	58.3	2.378	-46.9	0.167	-54.8	0.169	-175.5
1.9	0.511	48.7	2.259	-55.2	0.174	-62.4	0.158	-165.4
2.0	0.517	39.3	2.140	-63.8	0.180	-67.2	0.144	-155.3
2.1	0.525	28.5	1.997	-72.3	0.180	-73.1	0.125	-149.2
2.2	0.494	23.0	1.940	-78.2	0.196	-75.6	0.143	-141.8
2.3	0.520	16.0	1.899	-86.8	0.206	-82.8	0.139	-125.0
2.4	0.533	7.4	1.828	-95.2	0.215	-89.8	0.134	-110.9
2.5	0.544	-0.6	1.759	-103.4	0.223	-96.3	0.130	-96.8
2.6	0.555	-8.6	1.697	-111.6	0.234	-102.2	0.129	-82.8
2.7	0.563	-16.3	1.636	-119.4	0.240	-108.9	0.130	-68.5
2.8	0.570	-24.1	1.580	-127.1	0.247	-115.9	0.135	-56.2
2.9	0.578	-31.8	1.529	-135.1	0.259	-121.9	0.133	-43.3
3.0	0.591	-39.1	1.481	-143.0	0.265	-128.9	0.141	-31.4

V_{CE} = 3 V, I_c = 7 mA

FREQUENCY GHz	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
0.1	0.790	-44.5	19.152	145.1	0.046	45.7	0.922	-30.3
0.2	0.662	-82.5	15.213	120.2	0.052	46.4	0.720	-51.5
0.3	0.569	-109.8	12.134	101.4	0.061	35.5	0.579	-67.0
0.4	0.505	-134.1	9.855	86.0	0.068	29.5	0.472	-78.4
0.5	0.472	-154.0	8.325	72.8	0.075	22.4	0.392	-88.0
0.6	0.447	-170.8	7.035	61.7	0.088	15.8	0.343	-96.3
0.7	0.434	173.5	6.154	51.0	0.091	10.1	0.298	-103.7
0.8	0.425	158.8	5.474	40.8	0.101	5.5	0.267	-111.1
0.9	0.426	146.6	4.902	31.3	0.107	2.9	0.241	-118.9
1.0	0.422	134.0	4.457	22.0	0.114	-3.7	0.220	-126.6
1.1	0.427	123.1	4.087	13.0	0.122	-9.3	0.200	-134.6
1.2	0.432	111.7	3.759	4.0	0.127	-16.0	0.181	-142.0
1.3	0.438	102.0	3.494	-4.6	0.139	-22.2	0.170	-151.3
1.4	0.444	91.7	3.254	-13.2	0.145	-27.7	0.155	-159.5
1.5	0.453	82.5	3.054	-21.5	0.155	-33.6	0.145	-169.9
1.6	0.460	73.0	2.882	-30.4	0.163	-39.8	0.133	-179.5
1.7	0.465	63.4	2.726	-38.4	0.170	-45.8	0.125	-168.7
1.8	0.475	54.4	2.576	-47.1	0.176	-51.6	0.113	-158.3
1.9	0.486	45.7	2.452	-55.1	0.184	-58.0	0.107	-145.8
2.0	0.495	36.4	2.313	-63.9	0.191	-64.4	0.094	-131.9
2.1	0.502	25.0	2.163	-71.8	0.192	-70.8	0.075	-119.1
2.2	0.474	19.7	2.091	-77.8	0.210	-73.8	0.093	-118.7
2.3	0.497	13.3	2.042	-86.3	0.221	-81.8	0.098	-97.5
2.4	0.511	5.4	1.966	-94.4	0.230	-88.4	0.099	-79.8
2.5	0.520	-2.9	1.890	-102.5	0.239	-95.8	0.104	-63.4
2.6	0.535	-10.4	1.821	-110.7	0.249	-101.5	0.110	-49.7
2.7	0.540	-18.1	1.759	-118.2	0.257	-108.6	0.115	-35.6
2.8	0.551	-25.6	1.701	-126.3	0.264	-115.9	0.125	-24.4
2.9	0.560	-33.1	1.646	-134.1	0.272	-122.6	0.131	-12.8
3.0	0.570	-40.2	1.586	-141.6	0.281	-129.3	0.140	-1.9

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

FREQUENCY GHz	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
0.1	0.722	-53.2	23.778	140.2	0.036	28.8	0.877	-36.5
0.2	0.574	-92.1	17.719	114.4	0.050	51.4	0.634	-58.6
0.3	0.487	-122.0	13.652	96.0	0.057	42.0	0.490	-73.9
0.4	0.443	-145.7	10.827	81.6	0.063	33.1	0.392	-84.5
0.5	0.420	-164.7	8.987	69.1	0.070	26.4	0.322	-93.9
0.6	0.408	178.8	7.626	58.3	0.082	22.3	0.273	-102.3
0.7	0.399	164.8	6.596	48.4	0.088	15.4	0.240	-110.6
0.8	0.399	151.2	5.825	38.6	0.095	10.7	0.208	-118.1
0.9	0.396	139.7	5.211	29.4	0.104	6.6	0.189	-126.0
1.0	0.401	127.6	4.721	20.5	0.112	0.7	0.166	-134.0
1.1	0.404	117.0	4.323	11.7	0.121	-6.0	0.153	-144.7
1.2	0.409	106.5	3.975	3.0	0.132	-11.1	0.137	-152.6
1.3	0.415	97.4	3.693	-5.4	0.139	-18.6	0.127	-164.2
1.4	0.422	87.1	3.435	-13.9	0.151	-23.5	0.114	-173.7
1.5	0.431	78.5	3.227	-22.2	0.159	-29.8	0.106	-172.8
1.6	0.438	69.3	3.041	-30.7	0.169	-36.5	0.098	-161.5
1.7	0.449	60.7	2.861	-38.8	0.175	-43.0	0.095	-147.3
1.8	0.458	51.7	2.717	-47.3	0.183	-49.3	0.086	-133.6
1.9	0.470	43.2	2.581	-55.2	0.191	-56.2	0.085	-116.8
2.0	0.479	34.1	2.435	-63.5	0.200	-63.0	0.079	-99.3
2.1	0.489	23.2	2.273	-71.7	0.201	-68.7	0.065	-79.0
2.2	0.460	17.6	2.196	-77.3	0.219	-73.0	0.076	-87.0
2.3	0.483	11.4	2.145	-85.7	0.229	-81.1	0.094	-65.7
2.4	0.498	3.6	2.063	-94.0	0.238	-87.9	0.103	-51.6
2.5	0.508	-4.3	1.984	-101.9	0.247	-95.1	0.114	-38.1
2.6	0.522	-12.0	1.907	-109.9	0.253	-102.3	0.125	-27.1
2.7	0.528	-19.3	1.849	-117.4	0.264	-109.4	0.132	-15.2
2.8	0.536	-26.6	1.774	-125.2	0.274	-115.4	0.144	5.6
2.9	0.546	-34.1	1.723	-132.9	0.282	-122.6	0.152	-6.1
3.0	0.557	-41.0	1.664	-140.8	0.293	-129.7	0.161	-13.7

V_{CE} = 3 V, I_c = 20 mA

FREQUENCY GHz	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
0.1	0.530	-72.5	33.013	129.6	0.033	36.3	0.749	-47.3
0.2	0.432	-119.8	21.688	103.7	0.032	41.7	0.470	-72.0
0.3	0.375	-144.7	15.711	87.4	0.051	49.1	0.351	-85.4
0.4	0.365	-168.1	12.066	74.7	0.051	40.1	0.266	-97.1
0.5	0.356	176.7	9.884	63.6	0.066	36.3	0.216	-107.4
0.6	0.355	162.4	8.331	53.8	0.074	31.7	0.179	-116.4
0.7	0.356	149.9	7.150	44.6	0.081	24.6	0.153	-126.1
0.8	0.362	138.4	6.310	35.5	0.093	17.7	0.132	-135.7
0.9	0.365	127.8	5.626	26.9	0.103	12.5	0.119	-148.1
1.0	0.370	117.9	5.072	18.3	0.113	6.7	0.104	-158.7
1.1	0.377	108.1	4.642	9.7	0.125	0.0	0.097	-170.0
1.2	0.383	98.9	4.267	1.5	0.136	-7.0	0.088	-176.6
1.3	0.392	90.1	3.944	-6.7	0.146	-12.2	0.086	-160.8
1.4	0.399	81.0	3.674	-15.0	0.156	-19.0	0.081	-146.1
1.5	0.408	72.3	3.435	-22.9	0.167	-26.1	0.081	-130.6
1.6	0.416	64.2	3.225	-31.2	0.177	-32.8	0.083	-116.1
1.7	0.428	56.0	3.054	-39.4	0.184	-39.8	0.089	-101.3
1.8	0.439	47.6	2.891	-47.3	0.194	-46.2	0.091	-86.8
1.9	0.451	39.5	2.738	-55.3	0.202	-54.0	0.103	-72.4
2.0	0.461	30.4	2.589	-63.6	0.210	-60.3	0.107	-57.9
2.1	0.473	20.4	2.410	-71.5	0.210	-66.6	0.109	-38.7
2.2	0.442	14.4	2.332	-77.0	0.230	-71.6	0.099	-45.1
2.3	0.461	8.7	2.275	-85.3	0.242	-79.6	0.127	-35.1
2.4	0.479	1.3	2.188	-93.4	0.253	-87.0	0.141	-23.6
2.5	0.493	-6.8	2.100	-101.2	0.261	-94.4	0.153	-14.1
2.6	0.506	-13.2	2.034	-108.9	0.272	-101.4	0.169	-4.8
2.7	0.514	-20.8	1.960	-116.5	0.280	-107.9	0.180	-3.7
2.8	0.523	-28.6	1.875	-124.3	0.286	-115.7	0.192	-13.2
2.9	0.532	-35.6	1.817	-132.0	0.294	-122.4	0.204	-21.8
3.0	0.543	-42.4	1.750	-139.3	0.302	-130.0	0.211	-29.7

S-PARAMETERS Q2

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

FREQUENCY		S ₁₁		S ₂₁		S ₁₂		S ₂₂	
GHz	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	
0.1	0.938	-27.8	3.796	156.3	0.046	64.1	0.979	-16.7	
0.2	0.913	-53.3	3.447	136.6	0.110	53.6	0.923	-32.2	
0.3	0.857	-76.0	3.127	118.3	0.145	38.4	0.859	-46.5	
0.4	0.794	-98.1	2.809	100.5	0.172	24.0	0.794	-59.2	
0.5	0.745	-118.1	2.555	84.8	0.192	11.6	0.732	-70.3	
0.6	0.710	-135.9	2.301	70.4	0.205	2.2	0.676	-80.3	
0.7	0.670	-152.6	2.094	56.9	0.209	-9.6	0.630	-89.8	
0.8	0.652	-168.3	1.920	44.2	0.217	-19.7	0.596	-98.7	
0.9	0.634	177.1	1.774	32.6	0.219	-26.9	0.563	-107.7	
1.0	0.616	163.1	1.647	21.0	0.217	-34.6	0.538	-116.2	
1.1	0.606	149.9	1.542	10.2	0.216	-41.7	0.518	-125.0	
1.2	0.603	137.2	1.448	-0.6	0.215	-48.3	0.499	-132.9	
1.3	0.597	125.1	1.372	-10.4	0.209	-54.7	0.486	-141.6	
1.4	0.591	113.4	1.303	-20.2	0.205	-59.7	0.477	-149.8	
1.5	0.593	102.2	1.240	-29.9	0.204	-64.7	0.469	-158.7	
1.6	0.591	91.0	1.181	-39.3	0.200	-69.1	0.458	-167.0	
1.7	0.594	80.4	1.139	-48.4	0.199	-72.5	0.454	-176.2	
1.8	0.593	69.8	1.095	-57.2	0.198	-75.9	0.447	-175.7	
1.9	0.597	59.5	1.051	-66.2	0.199	-79.8	0.443	166.4	
2.0	0.595	49.1	1.013	-74.5	0.202	-82.3	0.439	157.4	
2.1	0.598	39.4	0.982	-83.0	0.206	-85.7	0.432	148.3	
2.2	0.599	29.7	0.950	-91.3	0.212	-89.1	0.427	138.7	
2.3	0.605	20.4	0.924	-99.2	0.221	-92.4	0.426	129.2	
2.4	0.604	10.8	0.897	-107.1	0.232	-96.1	0.425	119.4	
2.5	0.604	1.4	0.872	-114.7	0.246	-99.7	0.421	109.3	
2.6	0.611	-7.9	0.853	-122.4	0.259	-104.1	0.425	99.3	
2.7	0.612	-16.7	0.834	-129.7	0.275	-108.6	0.422	89.4	
2.8	0.609	-25.5	0.814	-137.0	0.294	-113.2	0.424	79.2	
2.9	0.609	-34.5	0.804	-144.0	0.311	-119.6	0.420	69.1	
3.0	0.612	-43.5	0.785	-151.0	0.332	-125.1	0.424	58.9	

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

FREQUENCY		S ₁₁		S ₂₁		S ₁₂		S ₂₂	
GHz	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	
0.1	0.863	-40.1	9.504	147.9	0.059	60.3	0.931	-26.1	
0.2	0.761	-74.8	7.893	123.9	0.100	45.3	0.788	-49.4	
0.3	0.682	-101.5	6.533	104.4	0.121	31.5	0.662	-67.1	
0.4	0.602	-125.7	5.440	87.6	0.130	22.2	0.549	-81.2	
0.5	0.560	-145.3	4.653	73.3	0.140	13.8	0.472	-92.8	
0.6	0.525	-163.1	4.027	60.5	0.149	7.4	0.414	-102.6	
0.7	0.501	-179.1	3.532	49.1	0.157	0.7	0.370	-111.8	
0.8	0.485	166.3	3.157	38.3	0.162	-6.1	0.333	-120.4	
0.9	0.476	152.9	2.856	27.8	0.169	-11.3	0.307	-129.2	
1.0	0.466	140.3	2.611	17.8	0.175	-16.5	0.284	-137.6	
1.1	0.465	128.8	2.409	8.0	0.184	-22.4	0.267	-146.5	
1.2	0.460	117.0	2.239	-1.4	0.193	-27.1	0.255	-154.6	
1.3	0.464	107.0	2.098	-10.3	0.199	-33.1	0.243	-163.0	
1.4	0.464	96.2	1.974	-19.6	0.209	-37.6	0.231	-170.5	
1.5	0.468	86.1	1.877	-28.5	0.217	-43.3	0.224	179.9	
1.6	0.465	75.9	1.774	-37.2	0.227	-48.8	0.215	171.5	
1.7	0.469	66.7	1.699	-46.1	0.239	-53.7	0.212	162.3	
1.8	0.470	57.3	1.621	-54.7	0.247	-59.4	0.206	154.0	
1.9	0.475	48.2	1.565	-62.9	0.258	-65.4	0.203	144.3	
2.0	0.476	38.9	1.497	-71.2	0.267	-71.2	0.197	135.3	
2.1	0.481	29.7	1.446	-79.4	0.278	-76.9	0.190	125.9	
2.2	0.479	20.9	1.398	-87.8	0.291	-83.1	0.188	116.4	
2.3	0.485	12.3	1.357	-95.7	0.302	-88.9	0.186	106.4	
2.4	0.486	3.6	1.318	-103.8	0.316	-95.0	0.187	96.6	
2.5	0.489	-4.6	1.286	-111.5	0.327	-101.0	0.187	86.4	
2.6	0.492	-12.9	1.249	-119.2	0.340	-107.6	0.187	76.1	
2.7	0.495	-21.7	1.215	-127.2	0.350	-113.5	0.187	65.9	
2.8	0.496	-29.5	1.194	-134.8	0.368	-119.8	0.192	56.6	
2.9	0.500	-37.8	1.170	-142.4	0.377	-126.5	0.192	46.2	
3.0	0.501	-45.8	1.143	-149.9	0.391	-133.3	0.196	36.7	

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

FREQUENCY GHz	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
0.1	0.821	-45.3	11.908	145.4	0.060	47.9	0.909	-31.9
0.2	0.720	-81.8	9.558	120.1	0.089	43.4	0.731	-57.4
0.3	0.628	-109.8	7.710	100.4	0.106	30.6	0.589	-76.3
0.4	0.564	-134.0	6.290	84.0	0.125	21.8	0.479	-91.9
0.5	0.519	-153.8	5.316	70.4	0.125	15.7	0.400	-104.1
0.6	0.496	-171.3	4.554	57.9	0.137	9.8	0.342	-114.5
0.7	0.482	173.5	3.975	47.0	0.145	1.2	0.298	-125.6
0.8	0.470	160.0	3.548	36.5	0.152	-3.0	0.267	-135.0
0.9	0.460	147.2	3.200	26.3	0.161	-6.9	0.241	-143.8
1.0	0.454	135.4	2.918	16.5	0.173	-12.6	0.217	-153.2
1.1	0.454	123.8	2.690	7.0	0.185	-18.5	0.203	-163.4
1.2	0.448	113.0	2.492	-2.4	0.195	-24.4	0.187	-172.0
1.3	0.450	102.6	2.334	-11.4	0.204	-29.9	0.177	179.0
1.4	0.446	92.3	2.188	-20.3	0.213	-35.5	0.167	170.5
1.5	0.447	81.9	2.058	-29.3	0.225	-41.0	0.160	160.9
1.6	0.434	73.3	1.957	-37.5	0.236	-47.1	0.152	153.3
1.7	0.440	65.1	1.883	-45.9	0.251	-53.2	0.147	142.6
1.8	0.445	55.6	1.791	-54.8	0.261	-58.8	0.139	133.5
1.9	0.445	46.8	1.732	-63.2	0.273	-65.1	0.137	124.1
2.0	0.444	37.7	1.654	-71.7	0.284	-71.8	0.130	114.1
2.1	0.448	28.9	1.600	-79.9	0.296	-78.2	0.126	103.5
2.2	0.447	20.5	1.545	-88.4	0.311	-84.9	0.123	93.4
2.3	0.447	11.2	1.501	-96.2	0.321	-91.0	0.121	83.2
2.4	0.448	2.9	1.457	-104.4	0.333	-97.8	0.121	73.1
2.5	0.449	-5.1	1.419	-112.3	0.348	-104.7	0.120	62.2
2.6	0.452	-13.4	1.380	-120.6	0.360	-110.9	0.119	51.1
2.7	0.453	-21.2	1.348	-128.1	0.373	-117.5	0.120	39.7
2.8	0.454	-29.8	1.315	-136.0	0.383	-124.7	0.122	30.6
2.9	0.452	-37.9	1.284	-143.7	0.398	-131.6	0.120	19.9
3.0	0.457	-46.5	1.253	-151.8	0.408	-138.7	0.117	10.7

V_{CE} = 1 V, I_c = 7 mA

FREQUENCY GHz	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
0.1	0.785	-49.4	13.974	142.9	0.064	46.7	0.905	-36.9
0.2	0.667	-88.5	10.890	116.8	0.080	44.1	0.688	-64.3
0.3	0.588	-117.3	8.604	97.4	0.104	31.5	0.544	-84.0
0.4	0.530	-141.8	6.904	81.8	0.109	24.2	0.437	-100.5
0.5	0.498	-161.0	5.797	68.3	0.123	17.8	0.357	-114.7
0.6	0.479	-177.7	4.939	56.5	0.129	12.1	0.306	-126.2
0.7	0.464	167.7	4.306	45.7	0.141	5.5	0.265	-138.4
0.8	0.454	154.1	3.828	35.5	0.153	-0.5	0.232	-149.5
0.9	0.445	141.7	3.427	25.5	0.159	-4.4	0.210	-159.9
1.0	0.440	130.0	3.131	15.9	0.173	-9.8	0.191	-170.4
1.1	0.440	118.7	2.877	6.5	0.182	-15.3	0.178	179.1
1.2	0.435	108.2	2.665	-2.6	0.194	-20.7	0.163	169.0
1.3	0.438	98.2	2.483	-11.6	0.206	-26.5	0.153	158.9
1.4	0.434	88.0	2.332	-20.3	0.221	-32.9	0.141	149.5
1.5	0.429	78.2	2.195	-29.1	0.231	-38.7	0.136	138.5
1.6	0.420	70.1	2.077	-37.3	0.244	-44.6	0.129	129.6
1.7	0.427	61.7	1.991	-45.7	0.258	-50.7	0.127	119.6
1.8	0.429	52.3	1.902	-54.4	0.269	-56.8	0.120	108.3
1.9	0.429	43.6	1.832	-62.6	0.285	-63.7	0.121	98.5
2.0	0.431	34.6	1.755	-71.1	0.296	-70.5	0.114	88.9
2.1	0.431	25.9	1.689	-79.3	0.308	-77.2	0.114	76.8
2.2	0.433	17.6	1.634	-87.6	0.322	-84.1	0.113	66.4
2.3	0.433	9.5	1.585	-95.6	0.336	-90.5	0.114	55.3
2.4	0.433	1.1	1.542	-103.6	0.350	-97.0	0.114	45.6
2.5	0.431	-7.1	1.497	-111.7	0.363	-104.5	0.115	34.0
2.6	0.435	-15.0	1.459	-119.7	0.375	-111.1	0.117	24.1
2.7	0.435	-23.5	1.422	-127.5	0.390	-118.1	0.120	13.7
2.8	0.437	-31.4	1.385	-135.3	0.400	-125.4	0.122	5.3
2.9	0.436	-39.5	1.360	-143.0	0.412	-132.3	0.121	-7.2
3.0	0.440	-47.8	1.320	-150.8	0.422	-139.8	0.117	-15.6

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

FREQUENCY GHz	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
0.1	0.755	-54.6	16.151	140.1	0.072	58.9	0.869	-40.4
0.2	0.632	-96.6	12.139	113.2	0.072	37.9	0.634	-70.9
0.3	0.552	-125.6	9.369	94.3	0.092	32.3	0.494	-92.8
0.4	0.501	-149.2	7.397	79.1	0.104	26.9	0.388	-110.3
0.5	0.472	-167.6	6.182	66.2	0.112	20.3	0.319	-125.3
0.6	0.452	175.9	5.227	54.9	0.124	15.4	0.277	-138.7
0.7	0.444	161.2	4.548	44.3	0.132	8.3	0.238	-151.0
0.8	0.437	148.5	4.007	34.2	0.150	2.6	0.213	-163.8
0.9	0.434	136.8	3.612	24.6	0.161	-1.1	0.193	-175.2
1.0	0.428	125.3	3.279	15.2	0.173	-6.1	0.178	173.0
1.1	0.425	115.1	3.021	6.0	0.185	-12.6	0.166	161.5
1.2	0.423	104.2	2.789	-3.0	0.198	-17.9	0.156	150.8
1.3	0.425	94.6	2.599	-11.8	0.213	-24.5	0.150	139.6
1.4	0.425	84.4	2.439	-20.5	0.226	-30.2	0.142	129.0
1.5	0.419	74.9	2.291	-29.1	0.237	-36.8	0.135	118.5
1.6	0.412	66.9	2.175	-37.1	0.253	-42.3	0.132	108.8
1.7	0.416	58.6	2.079	-45.6	0.267	-49.4	0.131	98.2
1.8	0.418	49.6	1.987	-54.1	0.280	-55.8	0.128	86.6
1.9	0.419	41.4	1.905	-62.3	0.295	-62.8	0.126	76.7
2.0	0.418	32.5	1.820	-70.7	0.309	-69.6	0.123	66.4
2.1	0.419	23.6	1.761	-78.9	0.320	-76.6	0.124	55.6
2.2	0.418	15.8	1.695	-87.2	0.333	-83.5	0.123	44.1
2.3	0.420	7.5	1.646	-95.1	0.348	-90.2	0.129	36.0
2.4	0.420	-0.9	1.597	-103.2	0.364	-97.4	0.129	25.4
2.5	0.418	-9.1	1.554	-111.2	0.377	-104.5	0.131	15.8
2.6	0.422	-16.9	1.513	-119.0	0.387	-111.3	0.132	6.3
2.7	0.423	-25.1	1.475	-126.7	0.402	-118.7	0.135	-3.3
2.8	0.423	-33.1	1.433	-134.6	0.415	-126.2	0.140	-12.1
2.9	0.423	-40.9	1.407	-142.5	0.425	-132.8	0.140	-23.6
3.0	0.426	-49.2	1.362	-150.1	0.434	-140.2	0.132	-33.2

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

FREQUENCY GHz	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
0.1	0.938	-24.8	3.849	157.9	0.043	49.6	0.991	-15.0
0.2	0.916	-48.7	3.524	139.5	0.091	57.5	0.950	-28.2
0.3	0.872	-70.5	3.241	122.1	0.117	42.2	0.903	-40.5
0.4	0.813	-91.9	2.949	105.1	0.139	28.5	0.840	-52.5
0.5	0.773	-111.1	2.716	89.6	0.161	16.9	0.787	-62.7
0.6	0.727	-128.8	2.463	75.5	0.172	5.0	0.738	-72.5
0.7	0.689	-145.8	2.253	62.0	0.174	-5.7	0.693	-81.2
0.8	0.660	-161.5	2.068	49.5	0.183	-14.6	0.658	-89.6
0.9	0.640	-176.4	1.923	37.6	0.183	-23.2	0.633	-98.1
1.0	0.621	169.1	1.787	26.2	0.182	-30.2	0.607	-106.2
1.1	0.609	155.8	1.673	15.4	0.182	-36.6	0.586	-114.4
1.2	0.596	142.3	1.573	4.7	0.179	-43.5	0.569	-122.5
1.3	0.591	129.9	1.483	-5.3	0.177	-49.4	0.557	-130.0
1.4	0.580	117.2	1.407	-15.4	0.174	-54.3	0.545	-138.3
1.5	0.563	105.4	1.319	-24.7	0.170	-58.7	0.537	-146.2
1.6	0.570	96.0	1.276	-33.8	0.171	-63.1	0.529	-154.5
1.7	0.573	84.9	1.225	-43.2	0.171	-65.7	0.522	-162.6
1.8	0.576	73.6	1.180	-52.4	0.172	-69.2	0.514	-171.0
1.9	0.578	63.2	1.134	-60.9	0.174	-72.1	0.509	-179.5
2.0	0.578	52.6	1.091	-69.7	0.180	-74.9	0.505	171.8
2.1	0.577	42.4	1.057	-78.3	0.183	-78.0	0.494	163.7
2.2	0.581	32.4	1.018	-86.7	0.188	-80.6	0.491	154.2
2.3	0.582	22.8	0.992	-94.6	0.198	-83.5	0.484	145.5
2.4	0.584	12.9	0.962	-102.7	0.209	-86.9	0.480	136.4
2.5	0.586	3.3	0.937	-110.5	0.224	-91.5	0.477	127.0
2.6	0.590	-5.5	0.913	-118.2	0.238	-95.3	0.474	117.4
2.7	0.590	-15.2	0.886	-125.8	0.255	-100.4	0.471	107.6
2.8	0.592	-24.3	0.865	-133.1	0.271	-106.4	0.465	98.3
2.9	0.591	-33.7	0.849	-140.7	0.288	-111.7	0.460	88.8
3.0	0.590	-42.9	0.813	-147.6	0.303	-117.3	0.451	79.7

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

FREQUENCY GHz	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
0.1	0.879	-35.6	9.731	150.7	0.059	60.5	0.952	-22.6
0.2	0.787	-66.0	8.255	127.9	0.079	50.0	0.829	-42.0
0.3	0.695	-91.2	6.996	108.9	0.098	38.0	0.721	-57.0
0.4	0.619	-114.9	5.911	92.0	0.110	24.7	0.622	-69.2
0.5	0.566	-134.1	5.133	77.7	0.117	18.3	0.540	-77.9
0.6	0.520	-152.1	4.427	64.8	0.127	9.5	0.486	-87.2
0.7	0.489	-168.4	3.946	53.0	0.136	3.8	0.441	-95.2
0.8	0.466	176.4	3.521	42.0	0.141	-2.7	0.406	-103.0
0.9	0.450	162.3	3.196	31.5	0.146	-7.2	0.379	-110.3
1.0	0.439	149.4	2.919	21.4	0.153	-13.1	0.357	-117.3
1.1	0.435	136.9	2.695	11.6	0.161	-17.3	0.338	-125.0
1.2	0.427	124.7	2.507	2.3	0.168	-24.0	0.328	-132.1
1.3	0.428	113.7	2.347	-7.0	0.172	-28.7	0.314	-139.3
1.4	0.420	101.6	2.196	-16.1	0.183	-34.4	0.300	-146.3
1.5	0.412	92.7	2.069	-24.4	0.190	-37.9	0.294	-153.9
1.6	0.416	82.8	1.971	-33.5	0.201	-44.3	0.284	-161.9
1.7	0.423	72.9	1.887	-42.2	0.208	-49.4	0.279	-170.2
1.8	0.427	62.7	1.800	-50.6	0.218	-55.0	0.269	-177.2
1.9	0.430	53.3	1.732	-59.3	0.228	-60.4	0.265	174.5
2.0	0.432	43.7	1.656	-67.7	0.238	-65.3	0.257	166.5
2.1	0.435	34.4	1.599	-75.8	0.249	-71.6	0.251	158.2
2.2	0.437	25.5	1.542	-84.3	0.262	-77.4	0.248	149.9
2.3	0.441	16.7	1.495	-92.1	0.270	-83.7	0.240	141.0
2.4	0.446	7.6	1.448	-100.4	0.283	-89.3	0.235	132.3
2.5	0.445	-0.7	1.405	-108.0	0.295	-95.3	0.230	123.4
2.6	0.452	-9.3	1.367	-116.4	0.310	-101.7	0.225	113.5
2.7	0.457	-18.0	1.335	-124.2	0.320	-107.6	0.222	103.5
2.8	0.459	-26.1	1.297	-131.8	0.334	-114.9	0.218	94.9
2.9	0.467	-35.4	1.259	-139.7	0.344	-120.9	0.208	86.1
3.0	0.463	-45.2	1.205	-146.0	0.349	-126.4	0.212	81.5

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

FREQUENCY		S ₁₁		S ₂₁		S ₁₂		S ₂₂	
GHz	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	
0.1	0.808	-42.2	13.924	145.1	0.033	53.1	0.917	-29.7	
0.2	0.684	-77.2	11.127	120.3	0.067	51.6	0.734	-50.5	
0.3	0.583	-104.3	8.948	101.0	0.086	38.5	0.607	-65.7	
0.4	0.504	-127.9	7.274	85.2	0.093	29.1	0.499	-77.8	
0.5	0.459	-146.7	6.148	71.8	0.102	23.9	0.423	-86.6	
0.6	0.426	-164.9	5.249	59.6	0.115	17.2	0.372	-95.2	
0.7	0.408	179.5	4.593	48.9	0.122	9.8	0.331	-102.4	
0.8	0.392	165.2	4.088	38.6	0.135	4.7	0.305	-109.9	
0.9	0.380	151.9	3.686	28.5	0.141	1.5	0.278	-116.9	
1.0	0.377	139.4	3.353	19.3	0.151	-6.0	0.259	-123.8	
1.1	0.372	127.3	3.080	9.9	0.162	-10.7	0.247	-131.4	
1.2	0.367	115.8	2.859	1.0	0.173	-16.9	0.228	-138.7	
1.3	0.373	105.2	2.659	-8.0	0.183	-22.0	0.218	-145.6	
1.4	0.370	94.9	2.501	-16.7	0.192	-27.2	0.211	-152.8	
1.5	0.366	85.5	2.354	-25.2	0.204	-33.5	0.203	-160.3	
1.6	0.368	75.5	2.223	-33.7	0.217	-39.5	0.198	-167.7	
1.7	0.371	66.7	2.118	-41.9	0.226	-45.3	0.189	-176.4	
1.8	0.375	57.4	2.020	-50.5	0.238	-51.1	0.182	176.8	
1.9	0.380	48.5	1.944	-58.6	0.251	-58.0	0.179	167.8	
2.0	0.381	39.2	1.862	-67.0	0.264	-63.7	0.171	160.4	
2.1	0.386	30.1	1.792	-75.0	0.273	-69.9	0.164	151.8	
2.2	0.389	21.8	1.725	-83.3	0.286	-76.6	0.159	142.1	
2.3	0.394	12.8	1.676	-91.1	0.295	-83.0	0.154	133.5	
2.4	0.398	5.1	1.624	-99.2	0.310	-89.8	0.150	124.4	
2.5	0.401	-3.6	1.576	-107.0	0.321	-96.2	0.145	113.9	
2.6	0.406	-12.0	1.528	-114.9	0.335	-102.6	0.140	104.9	
2.7	0.410	-20.5	1.493	-122.6	0.343	-109.7	0.136	94.6	
2.8	0.413	-28.7	1.450	-130.1	0.354	-116.5	0.131	85.5	
2.9	0.416	-36.9	1.406	-137.6	0.365	-122.5	0.127	78.4	
3.0	0.410	-45.1	1.370	-144.5	0.377	-128.6	0.137	71.2	

V_{CE} = 3 V, I_C = 7 mA

FREQUENCY		S ₁₁		S ₂₁		S ₁₂		S ₂₂	
GHz	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	
0.1	0.746	-47.0	17.115	141.2	0.053	60.5	0.880	-32.6	
0.2	0.606	-85.3	12.970	115.2	0.068	49.3	0.665	-56.6	
0.3	0.514	-112.9	10.078	96.5	0.076	33.8	0.523	-72.7	
0.4	0.441	-137.1	8.051	81.3	0.083	29.8	0.425	-83.4	
0.5	0.409	-155.3	6.726	68.5	0.091	27.9	0.348	-92.6	
0.6	0.379	-172.1	5.729	57.5	0.111	21.3	0.309	-100.9	
0.7	0.368	172.2	4.965	46.9	0.119	13.9	0.276	-108.1	
0.8	0.355	158.6	4.386	36.8	0.130	9.4	0.245	-115.6	
0.9	0.347	146.0	3.944	27.5	0.143	5.5	0.226	-122.8	
1.0	0.343	134.0	3.591	18.2	0.154	-0.5	0.210	-129.7	
1.1	0.341	122.4	3.296	9.3	0.165	-6.4	0.195	-137.2	
1.2	0.340	111.9	3.056	0.4	0.179	-12.6	0.183	-144.1	
1.3	0.339	101.7	2.844	-8.1	0.189	-19.2	0.173	-151.6	
1.4	0.342	91.7	2.663	-16.9	0.203	-24.0	0.166	-159.0	
1.5	0.345	81.9	2.518	-25.3	0.214	-30.2	0.159	-167.9	
1.6	0.347	72.2	2.370	-33.8	0.227	-37.2	0.150	-175.1	
1.7	0.347	63.6	2.265	-42.0	0.239	-43.5	0.145	175.5	
1.8	0.350	54.6	2.149	-50.4	0.250	-49.8	0.137	169.2	
1.9	0.355	45.9	2.067	-58.0	0.263	-57.3	0.132	159.2	
2.0	0.356	37.1	1.975	-66.3	0.275	-63.6	0.127	151.8	
2.1	0.359	28.3	1.905	-74.2	0.285	-69.6	0.122	142.4	
2.2	0.363	20.0	1.831	-82.4	0.299	-76.6	0.117	133.0	
2.3	0.366	11.9	1.778	-90.2	0.310	-83.0	0.113	122.3	
2.4	0.370	3.6	1.721	-98.2	0.325	-89.8	0.107	114.0	
2.5	0.370	-4.8	1.668	-105.8	0.336	-96.6	0.107	102.3	
2.6	0.380	-12.5	1.624	-113.8	0.349	-103.2	0.105	91.0	
2.7	0.382	-20.9	1.586	-121.5	0.362	-109.9	0.103	79.5	
2.8	0.383	-28.2	1.544	-129.1	0.373	-116.6	0.102	70.5	
2.9	0.387	-35.9	1.510	-136.7	0.386	-123.7	0.100	59.0	
3.0	0.390	-43.5	1.476	-144.3	0.395	-130.4	0.101	49.6	

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

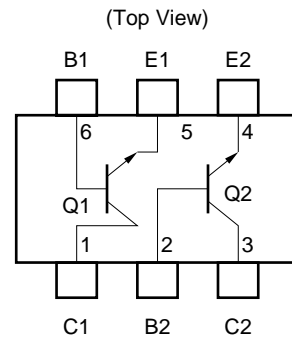
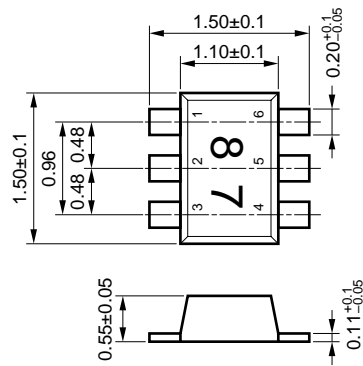
FREQUENCY GHz	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
0.1	0.675	-57.8	20.393	137.1	0.028	51.2	0.827	-39.8
0.2	0.540	-94.0	14.596	110.5	0.061	49.7	0.595	-61.8
0.3	0.445	-122.1	11.009	92.3	0.067	38.2	0.456	-77.1
0.4	0.389	-144.5	8.636	78.1	0.083	32.5	0.360	-89.4
0.5	0.354	-162.6	7.143	65.9	0.091	32.6	0.293	-98.4
0.6	0.340	179.9	6.043	55.1	0.104	25.0	0.258	-106.0
0.7	0.331	166.0	5.231	45.0	0.117	19.3	0.227	-113.4
0.8	0.326	152.4	4.627	35.4	0.132	13.2	0.208	-120.7
0.9	0.324	140.1	4.144	26.4	0.145	8.1	0.185	-128.5
1.0	0.320	128.6	3.763	17.3	0.154	2.3	0.167	-135.3
1.1	0.320	117.7	3.449	8.5	0.168	-4.4	0.159	-143.7
1.2	0.320	107.4	3.192	-0.1	0.182	-10.8	0.146	-150.7
1.3	0.323	97.9	2.978	-8.7	0.196	-16.5	0.141	-160.5
1.4	0.322	87.7	2.786	-16.9	0.207	-22.4	0.132	-166.1
1.5	0.324	78.5	2.613	-25.3	0.222	-29.2	0.126	-176.8
1.6	0.328	69.4	2.482	-33.6	0.231	-35.7	0.118	176.1
1.7	0.331	60.8	2.359	-41.8	0.248	-42.6	0.117	166.1
1.8	0.333	51.8	2.239	-50.0	0.259	-48.9	0.108	158.3
1.9	0.335	43.4	2.152	-57.9	0.273	-55.9	0.105	148.3
2.0	0.337	34.7	2.062	-66.1	0.284	-62.1	0.097	141.0
2.1	0.341	25.9	1.981	-74.0	0.297	-69.4	0.093	130.8
2.2	0.345	18.1	1.907	-82.0	0.310	-75.9	0.090	117.9
2.3	0.350	9.9	1.851	-89.7	0.322	-82.8	0.086	106.6
2.4	0.353	1.7	1.791	-97.6	0.336	-89.9	0.084	97.2
2.5	0.353	-6.1	1.736	-105.2	0.347	-96.6	0.083	84.0
2.6	0.363	-14.2	1.689	-113.1	0.360	-103.1	0.081	72.6
2.7	0.364	-21.8	1.636	-120.4	0.376	-110.5	0.083	61.5
2.8	0.368	-29.4	1.601	-128.3	0.381	-117.3	0.084	50.4
2.9	0.370	-37.3	1.570	-135.8	0.394	-124.0	0.081	38.2
3.0	0.375	-44.7	1.525	-143.4	0.408	-131.2	0.087	28.7

V_{CE} = 3 V, I_c = 20 mA

FREQUENCY GHz	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
0.1	0.547	-72.1	26.784	127.6	0.023	40.3	0.711	-50.2
0.2	0.394	-113.5	17.186	101.7	0.050	50.8	0.453	-73.7
0.3	0.343	-140.4	12.367	85.5	0.058	45.8	0.331	-89.5
0.4	0.315	-162.7	9.511	72.7	0.075	42.3	0.259	-100.0
0.5	0.300	-179.9	7.764	61.8	0.087	37.6	0.212	-110.0
0.6	0.292	165.5	6.526	51.5	0.104	30.7	0.180	-118.9
0.7	0.289	153.0	5.630	42.4	0.119	25.8	0.155	-126.7
0.8	0.284	140.4	4.958	33.2	0.133	20.8	0.135	-134.6
0.9	0.287	129.7	4.435	24.4	0.144	13.7	0.127	-144.7
1.0	0.289	119.1	4.020	15.9	0.162	8.1	0.114	-152.0
1.1	0.289	108.9	3.687	7.2	0.174	-0.1	0.107	-162.0
1.2	0.289	98.9	3.404	-1.0	0.191	-6.7	0.100	-170.6
1.3	0.294	90.3	3.166	-9.3	0.203	-13.7	0.091	179.4
1.4	0.296	81.2	2.966	-17.3	0.219	-19.9	0.085	170.0
1.5	0.298	72.3	2.798	-25.6	0.232	-26.6	0.086	161.1
1.6	0.301	63.3	2.633	-33.8	0.245	-33.8	0.079	150.5
1.7	0.305	55.6	2.491	-41.8	0.260	-40.6	0.081	138.8
1.8	0.307	46.6	2.385	-49.8	0.272	-47.8	0.074	127.9
1.9	0.314	38.6	2.272	-57.7	0.287	-54.9	0.074	116.5
2.0	0.312	30.6	2.180	-65.6	0.301	-61.3	0.071	103.9
2.1	0.316	22.5	2.090	-73.5	0.312	-69.3	0.069	90.4
2.2	0.320	14.5	2.015	-81.4	0.324	-75.7	0.068	78.7
2.3	0.326	6.7	1.956	-88.9	0.338	-82.5	0.071	67.0
2.4	0.329	-1.5	1.890	-96.7	0.351	-89.5	0.073	55.9
2.5	0.332	-9.1	1.832	-104.3	0.364	-96.8	0.077	41.7
2.6	0.340	-17.0	1.780	-112.1	0.376	-103.8	0.080	32.5
2.7	0.341	-24.7	1.736	-119.6	0.387	-110.6	0.083	17.3
2.8	0.341	-31.8	1.682	-127.0	0.399	-118.0	0.087	10.8
2.9	0.344	-39.6	1.650	-134.3	0.410	-125.2	0.091	-0.7
3.0	0.349	-46.6	1.604	-141.9	0.424	-132.3	0.096	-8.6

PACKAGE DIMENSIONS

FLAT-LEAD 6 PIN THIN-TYPE ULTRA SUPER MINIMOLD (UNIT: mm)



PIN CONNECTIONS

- | | |
|-------------------|-----------------|
| 1. Collector (Q1) | 4. Emitter (Q2) |
| 2. Emitter (Q1) | 5. Base (Q2) |
| 3. Collector (Q2) | 6. Base (Q1) |

[MEMO]

[MEMO]

- **The information in this document is subject to change without notice. Before using this document, please confirm that this is the latest version.**
 - No part of this document may be copied or reproduced in any form or by any means without the prior written consent of NEC Corporation. NEC Corporation assumes no responsibility for any errors which may appear in this document.
 - NEC Corporation does not assume any liability for infringement of patents, copyrights or other intellectual property rights of third parties by or arising from use of a device described herein or any other liability arising from use of such device. No license, either express, implied or otherwise, is granted under any patents, copyrights or other intellectual property rights of NEC Corporation or others.
 - Descriptions of circuits, software, and other related information in this document are provided for illustrative purposes in semiconductor product operation and application examples. The incorporation of these circuits, software, and information in the design of the customer's equipment shall be done under the full responsibility of the customer. NEC Corporation assumes no responsibility for any losses incurred by the customer or third parties arising from the use of these circuits, software, and information.
 - While NEC Corporation has been making continuous effort to enhance the reliability of its semiconductor devices, the possibility of defects cannot be eliminated entirely. To minimize risks of damage or injury to persons or property arising from a defect in an NEC semiconductor device, customers must incorporate sufficient safety measures in its design, such as redundancy, fire-containment, and anti-failure features.
 - NEC devices are classified into the following three quality grades:
"Standard", "Special", and "Specific". The Specific quality grade applies only to devices developed based on a customer designated "quality assurance program" for a specific application. The recommended applications of a device depend on its quality grade, as indicated below. Customers must check the quality grade of each device before using it in a particular application.
 - Standard: Computers, office equipment, communications equipment, test and measurement equipment, audio and visual equipment, home electronic appliances, machine tools, personal electronic equipment and industrial robots
 - Special: Transportation equipment (automobiles, trains, ships, etc.), traffic control systems, anti-disaster systems, anti-crime systems, safety equipment and medical equipment (not specifically designed for life support)
 - Specific: Aircraft, aerospace equipment, submersible repeaters, nuclear reactor control systems, life support systems or medical equipment for life support, etc.
- The quality grade of NEC devices is "Standard" unless otherwise specified in NEC's Data Sheets or Data Books. If customers intend to use NEC devices for applications other than those specified for Standard quality grade, they should contact an NEC sales representative in advance.