

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 $1.08\text{ cm}^2 \times 1.0\text{ mm}$ 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 _{CBO}	V _{CB} = 5 V, I _E = 0	–	–	0.1	μ A
Emitter Cutoff Current	I _{EBO}	V _{EB} = 1 V, I _C = 0	–	–	0.1	μ A
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

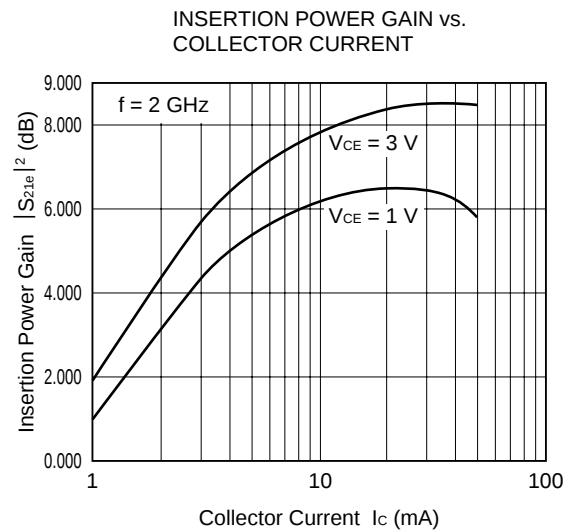
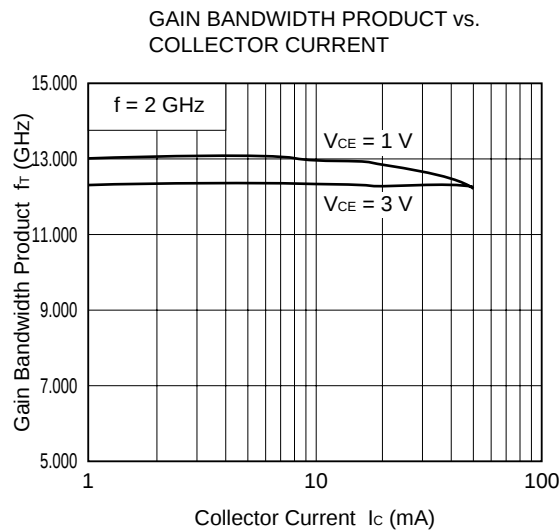
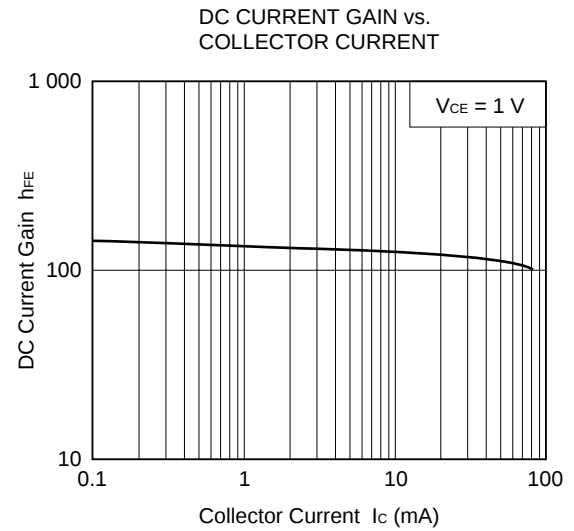
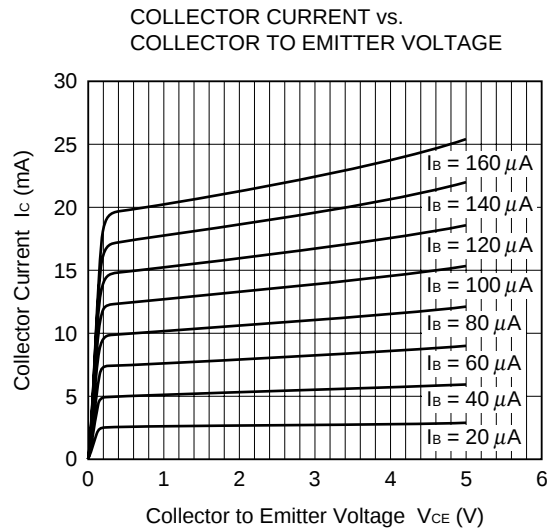
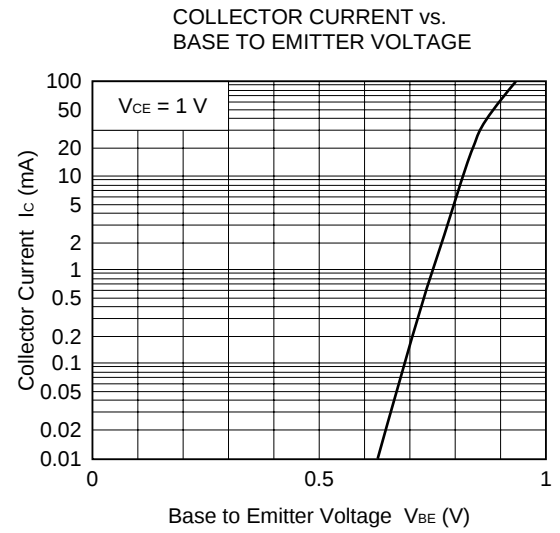
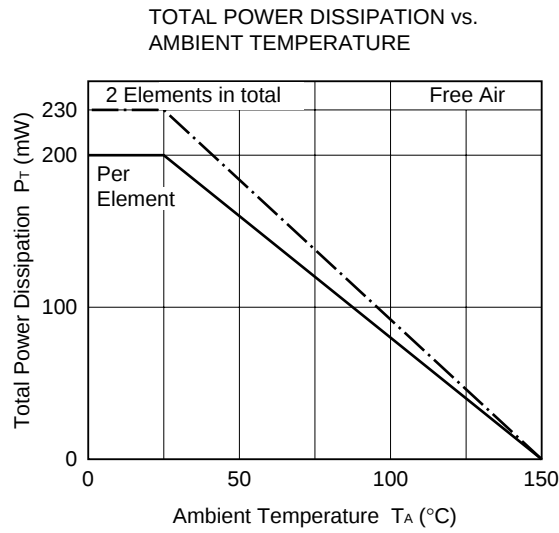
Notes 1. Pulse Measurement: PW ≤ 350 μ s, Duty Cycle ≤ 2 %

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

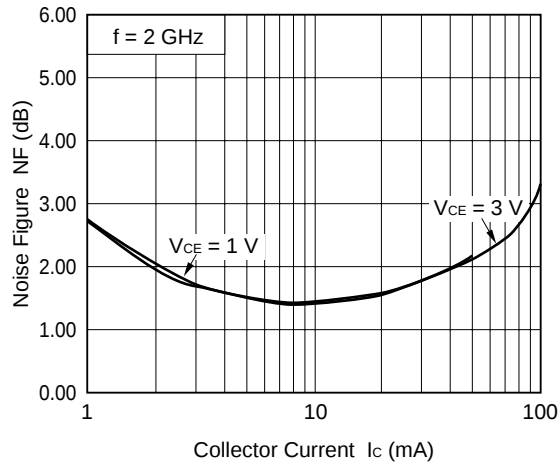
h_{FE} CLASSIFICATION

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

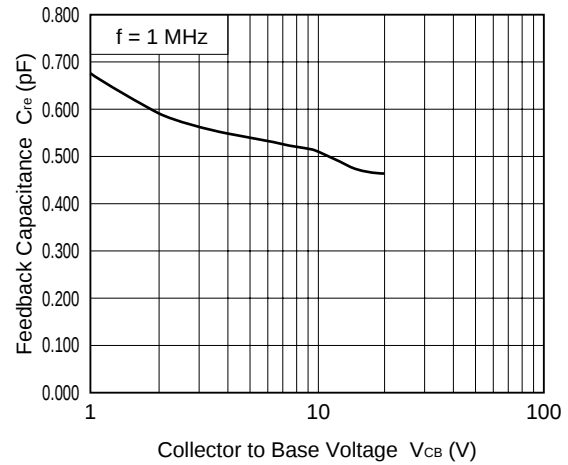
TYPICAL CHARACTERISTICS ($T_A = +25\text{ }^{\circ}\text{C}$)



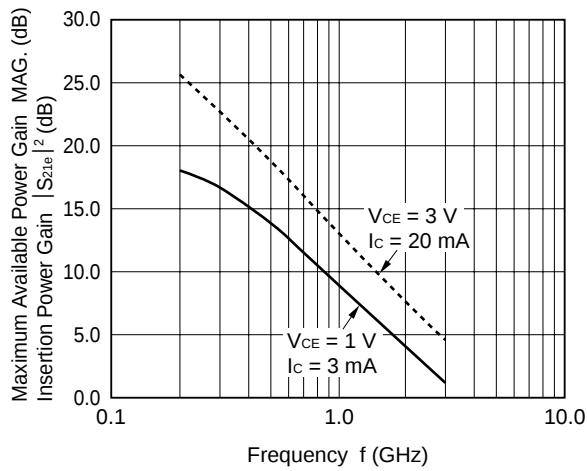
NOISE FIGURE vs. COLLECTOR CURRENT



FEEDBACK CAPACITANCE vs. COLLECTOR TO BASE VOLTAGE



INSERTION POWER GAIN/MAXIMUM AVAILABLE GAIN vs. FREQUENCY



S-PARAMETERS Q1

 $V_{CE} = 1\text{ V}$, $I_C = 1\text{ mA}$

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

 $V_{CE} = 1\text{ V}$, $I_C = 3\text{ mA}$

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

$V_{CE} = 1 \text{ V}$, $I_C = 5 \text{ mA}$

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

 $V_{CE} = 1 \text{ V}$, $I_C = 7 \text{ mA}$

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

$V_{CE} = 1\text{ V}$, $I_C = 10\text{ mA}$

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	

$V_{CE} = 3\text{ V}$, $I_C = 1\text{ mA}$

FREQUENCY		S ₁₁		S ₂₁		S ₁₂		S ₂₂	
GHz	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	

 $V_{CE} = 3\text{ V}$, $I_C = 3\text{ mA}$

FREQUENCY		S ₁₁		S ₂₁		S ₁₂		S ₂₂	
GHz	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	

$V_{CE} = 3\text{ V}$, $I_C = 5\text{ mA}$

FREQUENCY		S ₁₁		S ₂₁		S ₁₂		S ₂₂	
GHz	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	

 $V_{CE} = 3\text{ V}$, $I_C = 7\text{ mA}$

FREQUENCY		S ₁₁		S ₂₁		S ₁₂		S ₂₂	
GHz	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	

$V_{CE} = 3 \text{ V}$, $I_C = 10 \text{ mA}$

FREQUENCY		S ₁₁		S ₂₁		S ₁₂		S ₂₂	
GHz	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	

 $V_{CE} = 3 \text{ V}$, $I_C = 20 \text{ mA}$

FREQUENCY		S ₁₁		S ₂₁		S ₁₂		S ₂₂	
GHz	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

 $V_{CE} = 1\text{ V}$, $I_C = 1\text{ mA}$

FREQUENCY GHz	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	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

 $V_{CE} = 1\text{ V}$, $I_C = 3\text{ mA}$

FREQUENCY GHz	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	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

$V_{CE} = 1\text{ V}$, $I_C = 5\text{ mA}$

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

 $V_{CE} = 1\text{ V}$, $I_C = 7\text{ mA}$

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

$V_{CE} = 1\text{ V}$, $I_C = 10\text{ mA}$

FREQUENCY		S ₁₁		S ₂₁		S ₁₂		S ₂₂	
GHz	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	

$V_{CE} = 3\text{ V}$, $I_C = 1\text{ mA}$

FREQUENCY		S ₁₁		S ₂₁		S ₁₂		S ₂₂	
GHz	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	

 $V_{CE} = 3\text{ V}$, $I_C = 3\text{ mA}$

FREQUENCY		S ₁₁		S ₂₁		S ₁₂		S ₂₂	
GHz	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	

$V_{CE} = 3\text{ V}$, $I_C = 5\text{ mA}$

FREQUENCY	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	GHz	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.
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

 $V_{CE} = 3\text{ V}$, $I_C = 7\text{ mA}$

FREQUENCY	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	GHz	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.
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

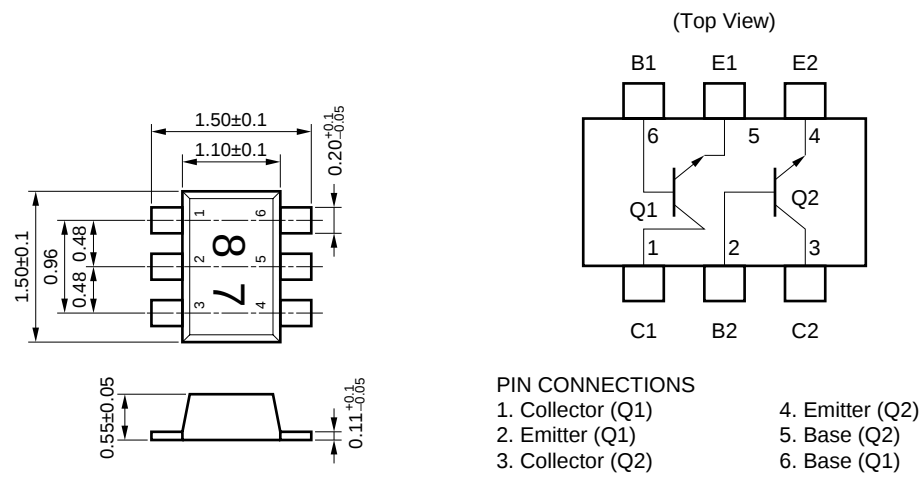
FREQUENCY	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	GHz	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.
0.1	0.675	−57.8	20.393	137.1	0.028	51.2	0.827	−39.8
0.2	0.540	−94.0	14.596	110.5	0.061	49.7	0.595	−61.8
0.3	0.445	−122.1	11.009	92.3	0.067	38.2	0.456	−77.1
0.4	0.389	−144.5	8.636	78.1	0.083	32.5	0.360	−89.4
0.5	0.354	−162.6	7.143	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		S ₁₁		S ₂₁		S ₁₂		S ₂₂	
GHz	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)



[MEMO]

[MEMO]

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