DATA SHEET

NEC

NPN SILICON RF TWIN TRANSISTOR

μPA829TC

NPN SILICON RF TRANSISTOR (WITH 2 ELEMENTS) IN A FLAT-LEAD 6-PIN THIN-TYPE ULTRA SUPER MINIMOLD

FEATURES

- Low voltage operation, 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
- Built-in 2 transistors (2 × 2SC5437)
- Flat-lead 6-pin thin-type ultra super minimold package

BUILT-IN TRANSISTORS

	Q1, Q2
3-pin thin-type ultra super minimold part No.	2SC5437

ORDERING INFORMATION

Part Number	Quantity	Supplying Form
μPA829TC	50 pcs (Non reel)	• 8 mm wide embossed taping • Pin 6 (Q1 Base), Pin 5 (Q2 Emitter), Pin 4 (Q2 Base) face the perforation side of the tape
μPA829TC-T1	3 kpcs/reel	

Remark To order evaluation samples, contact your nearby sales office.
The unit sample quantity is 50 pcs.

Because this product uses high-frequency technology, avoid excessive static electricity, etc.

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ABSOLUTE MAXIMUM RATINGS (T_A = +25°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_{tot} Note	200 in 1 element	mW
		230 in 2 elements	
Junction Temperature	T_j	150	°C
Storage Temperature	T_{stg}	−65 to +150	°C

Note Mounted on 1.08 $cm^2 \times 1.0$ mm (t) glass epoxy PCB

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 mA	–	–	100	nA
Emitter Cut-off Current	I_{EBO}	V_{EB} = 1 V, I_C = 0 mA	–	–	100	nA
DC Current Gain	h_{FE} Note 1	V_{CE} = 1 V, I_C = 3 mA	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
Insertion Power Gain (1)	$\lvert S_{21e} \rvert^2$	V_{CE} = 1 V, I_C = 3 mA, f = 2 GHz	2.5	3.5	–	dB
Insertion Power Gain (2)	$\lvert S_{21e} \rvert^2$	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, $Z_S = Z_{opt}$	–	1.7	2.5	dB
Noise Figure (2)	NF	V_{CE} = 3 V, I_C = 7 mA, f = 2 GHz, $Z_S = Z_{opt}$	–	1.5	–	dB
Reverse Transfer Capacitance	C_{re} Note 2	V_{CB} = 1 V, I_E = 0 mA, f = 1 MHz	–	0.75	0.85	pF

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

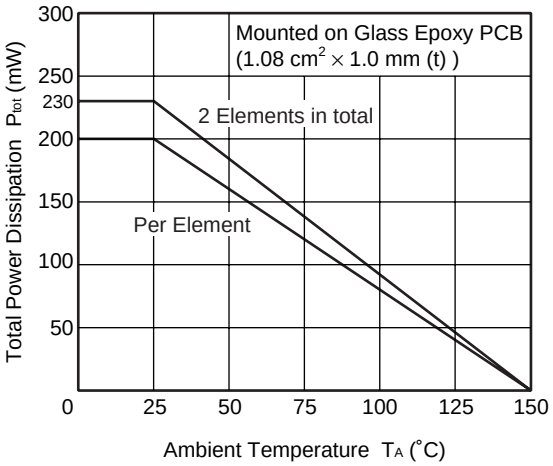
2. Collector to base capacitance when the emitter grounded

h_{FE} CLASSIFICATION

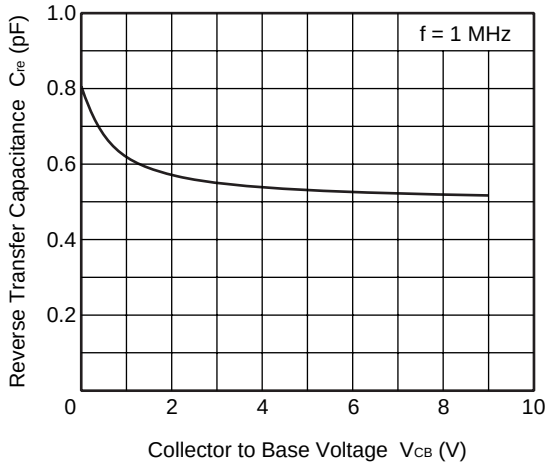
Rank	FB
Marking	4A
h_{FE} Value	80 to 160

TYPICAL CHARACTERISTICS (Unless otherwise specified, T_A = +25°C)

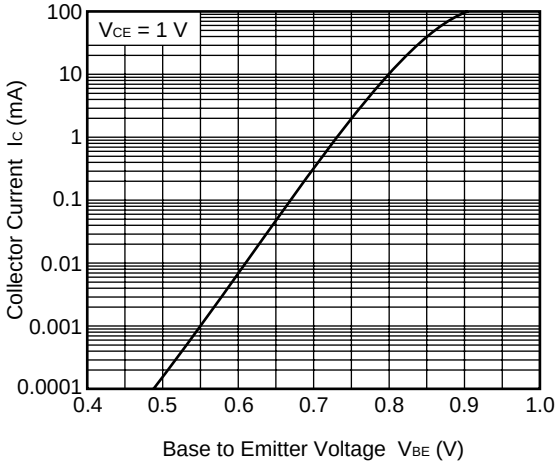
TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE



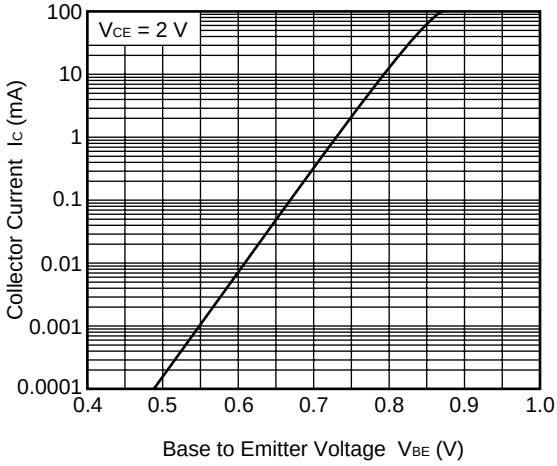
REVERSE TRANSFER CAPACITANCE vs. COLLECTOR TO BASE VOLTAGE



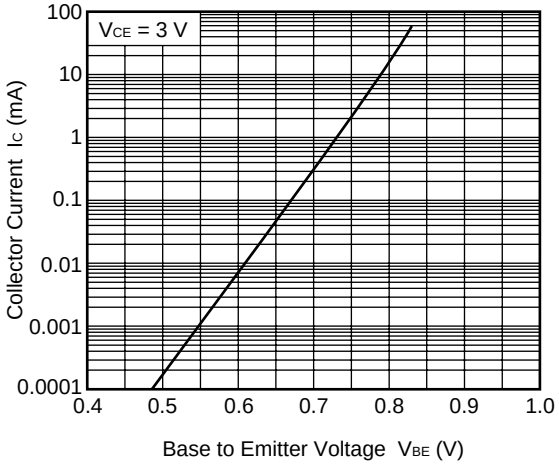
COLLECTOR CURRENT vs. BASE TO EMITTER VOLTAGE



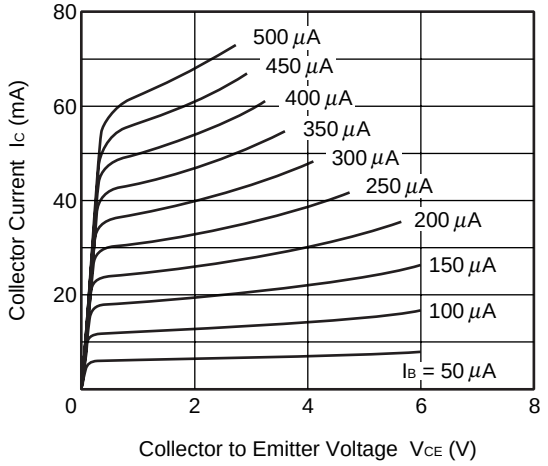
COLLECTOR CURRENT vs. BASE TO EMITTER VOLTAGE



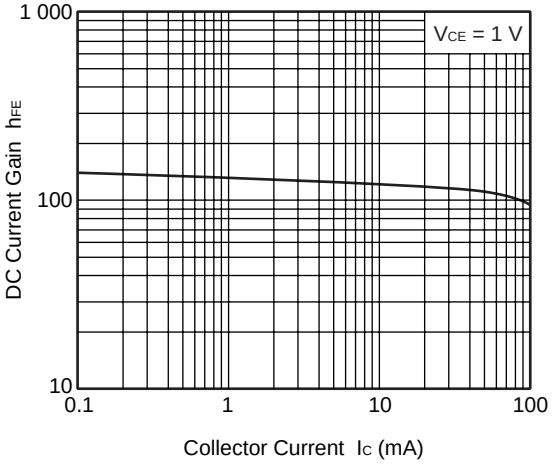
COLLECTOR CURRENT vs. BASE TO EMITTER VOLTAGE



COLLECTOR CURRENT vs. COLLECTOR TO EMITTER VOLTAGE



DC CURRENT GAIN vs.
COLLECTOR CURRENT



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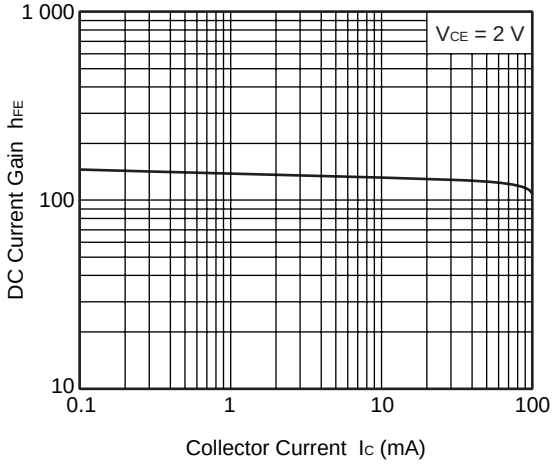

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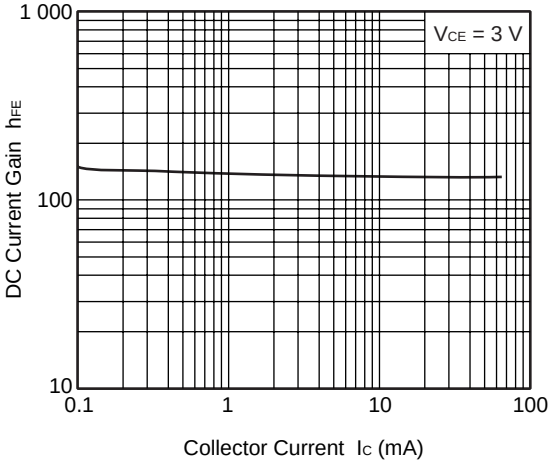
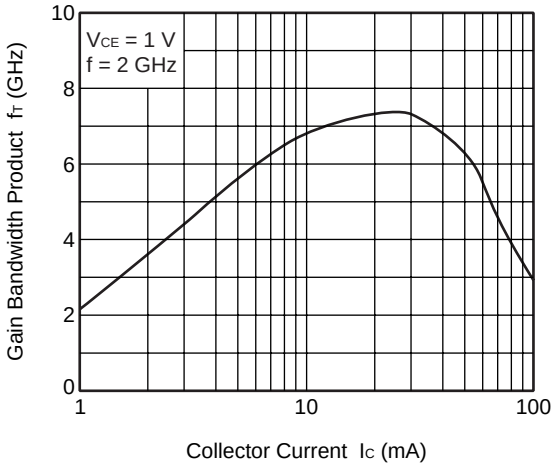


GAIN BANDWIDTH PRODUCT
vs. COLLECTOR CURRENT



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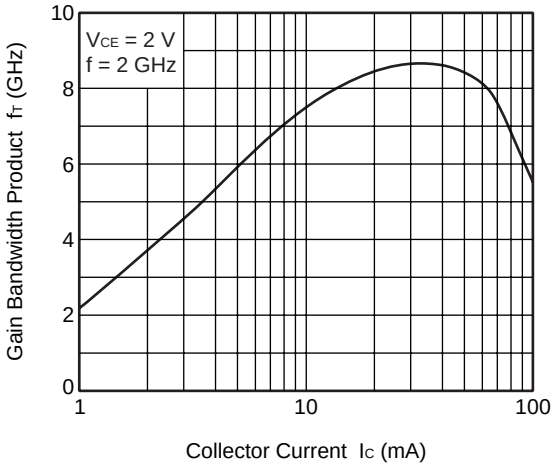

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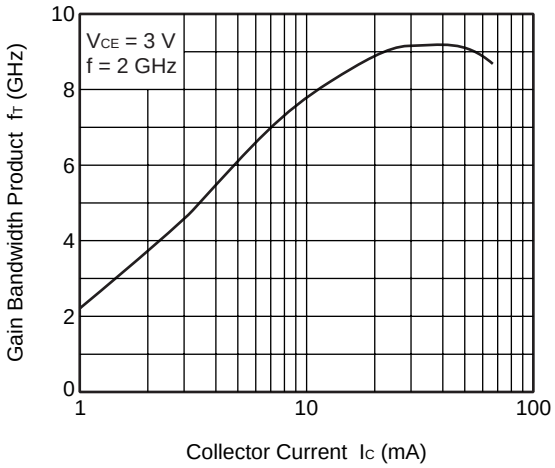
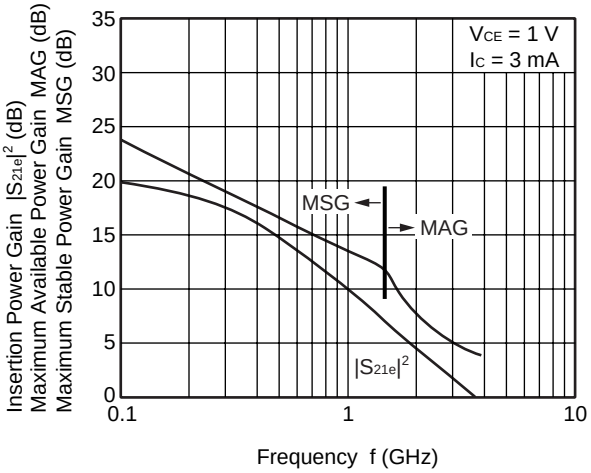


INSERTION POWER GAIN, MAG, MSG vs. FREQUENCY



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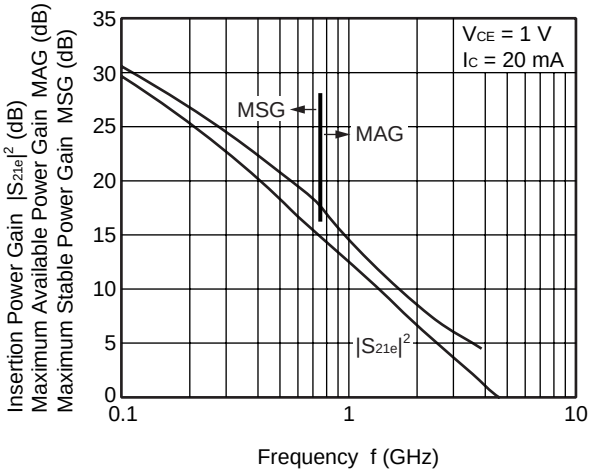

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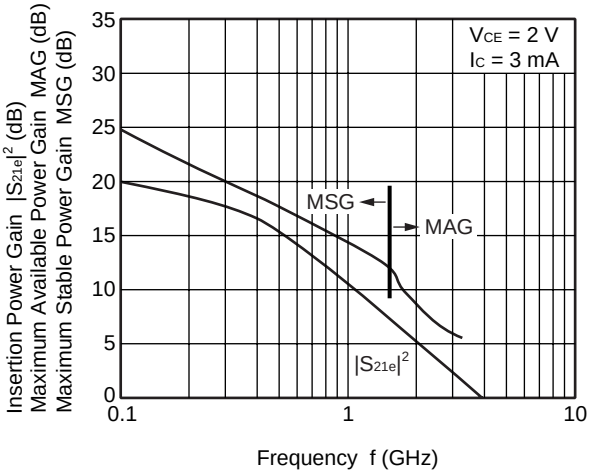

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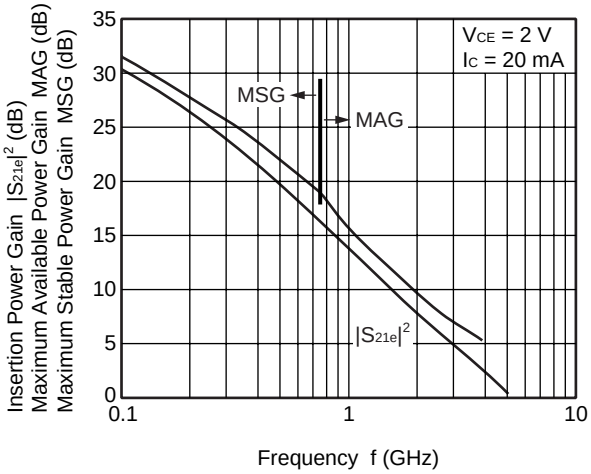

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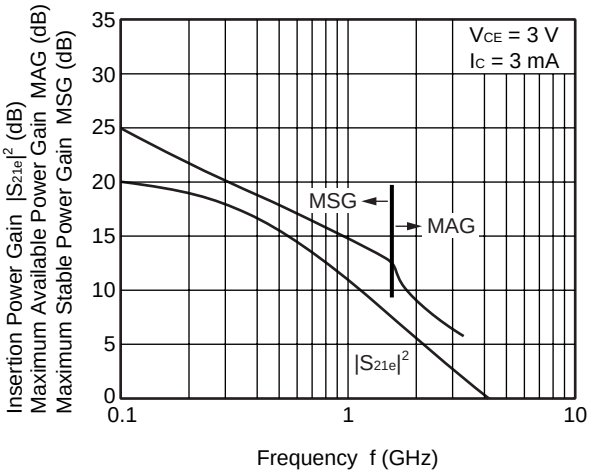

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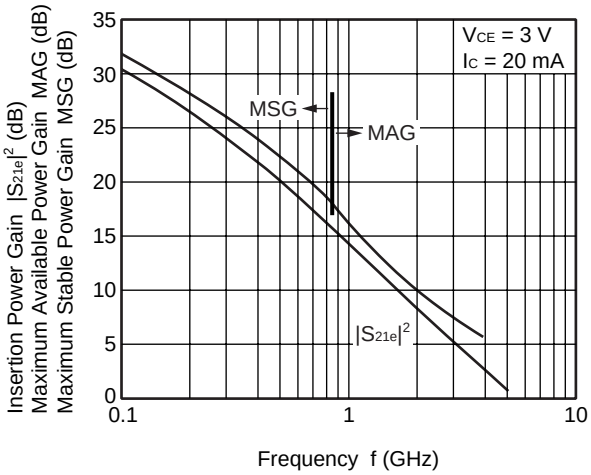
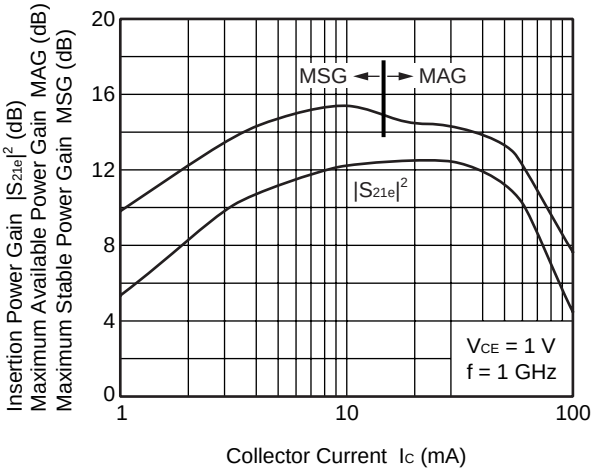


INSERTION POWER GAIN, MAG, MSG vs. COLLECTOR CURRENT



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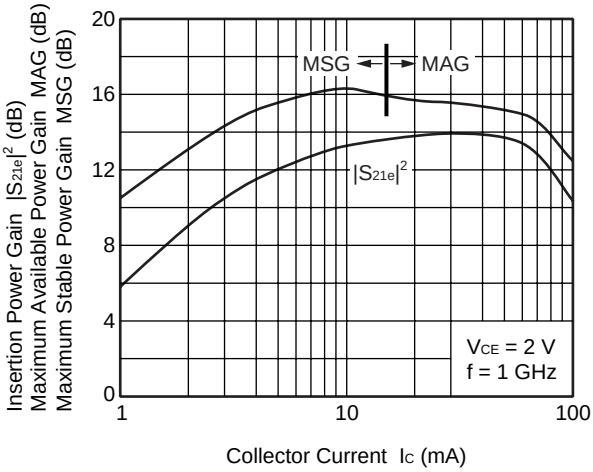

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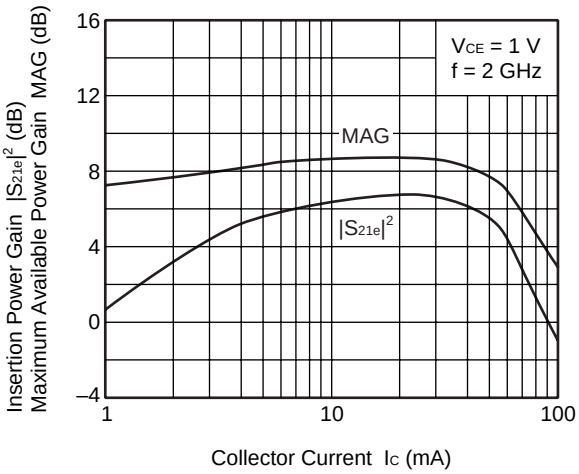

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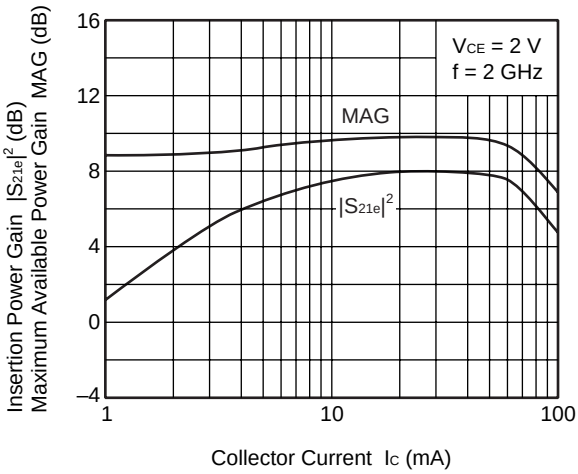

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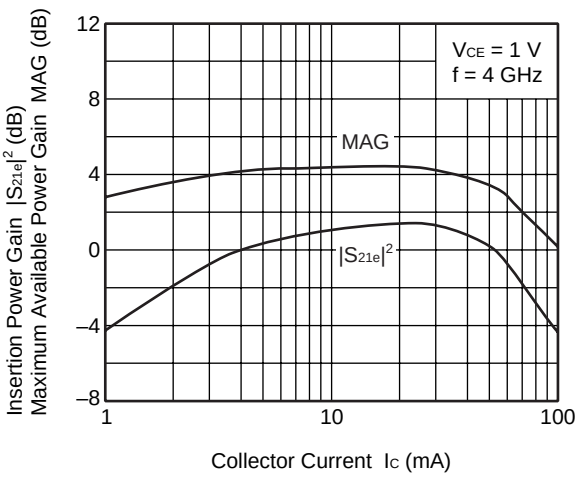

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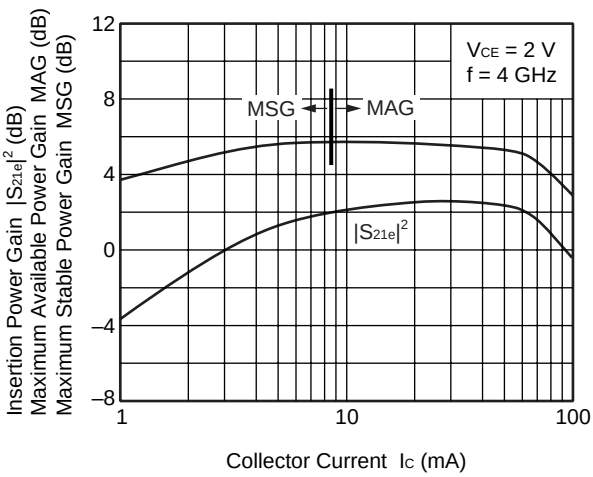

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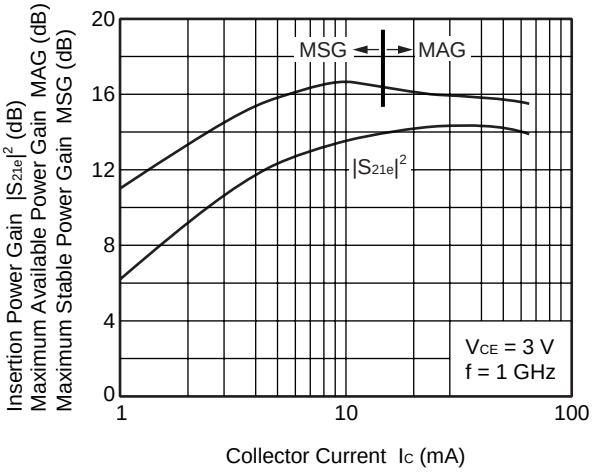

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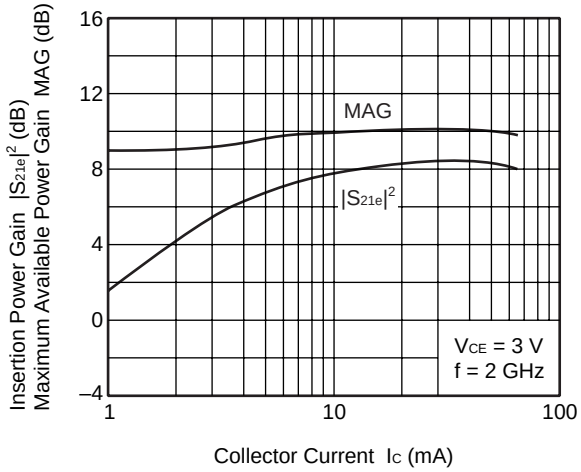

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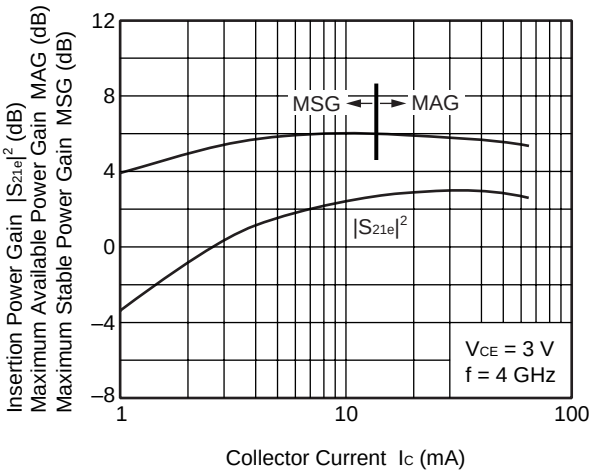
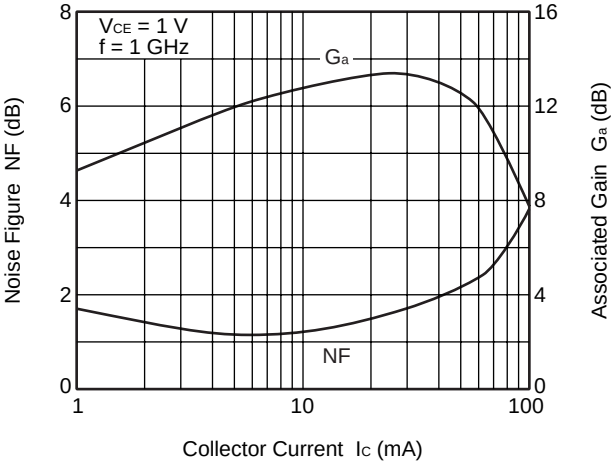


NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



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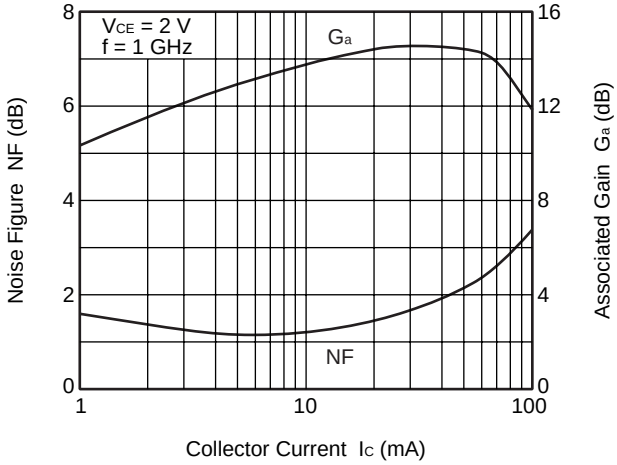

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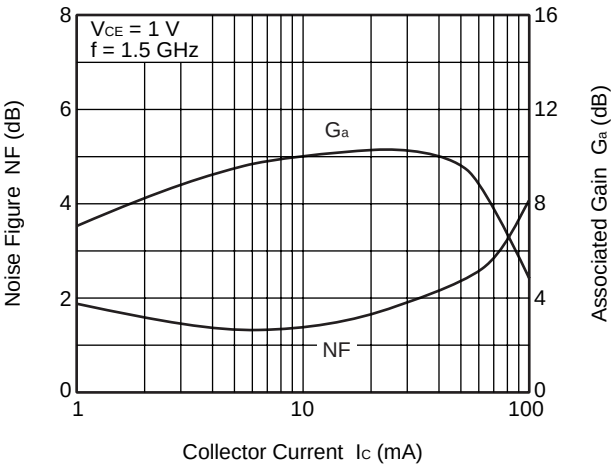

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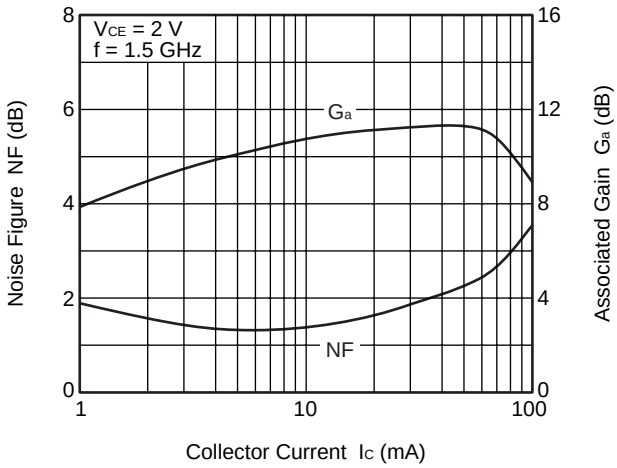

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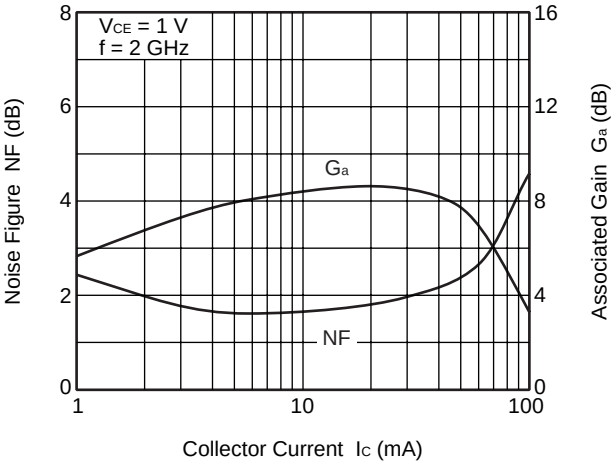

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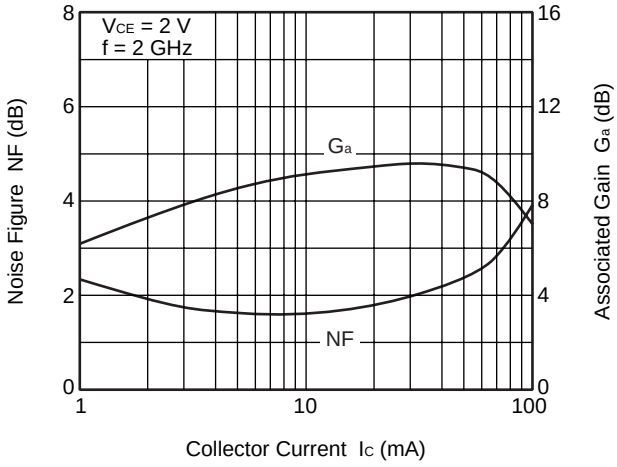

NOISE FIGURE, ASSOCIATED GAIN
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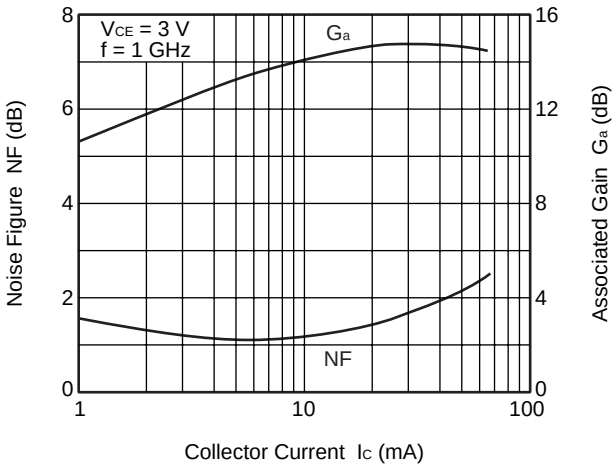

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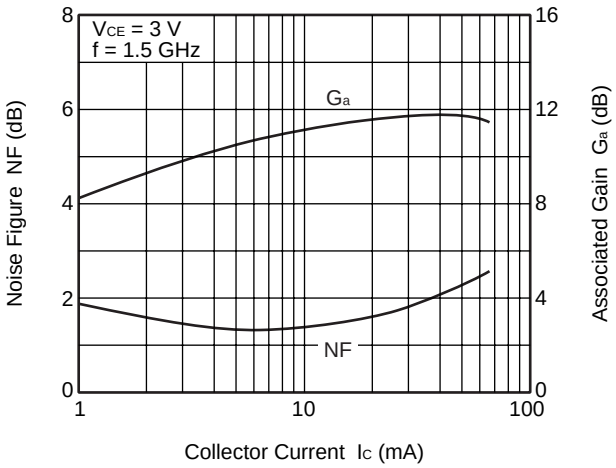

NOISE FIGURE, ASSOCIATED GAIN
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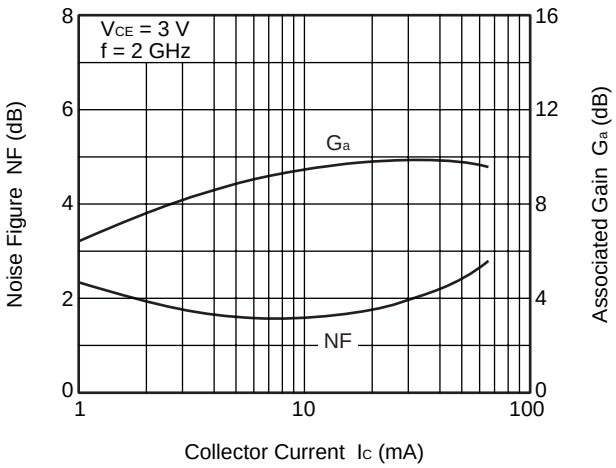


Remark The graphs indicate nominal characteristics.

S-PARAMETERS

V_{CE} = 1 V, I_C = 1 mA, Z_O = 50 Ω

Frequency	S_{11}		S_{21}		S_{12}		S_{22}	
(GHz)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.966	–19.4	3.744	166.8	0.044	80.2	0.985	–8.2
0.2	0.922	–37.0	3.444	153.0	0.083	68.4	0.950	–15.9
0.3	0.891	–53.4	3.247	141.8	0.116	58.5	0.899	–22.7
0.4	0.849	–68.8	2.992	130.9	0.143	50.5	0.845	–28.4
0.5	0.811	–82.6	2.751	121.6	0.161	43.3	0.792	–33.2
0.6	0.772	–94.9	2.528	112.9	0.175	37.2	0.743	–37.2
0.7	0.747	–106.0	2.334	105.6	0.185	32.2	0.701	–40.6
0.8	0.724	–115.8	2.154	99.0	0.191	27.8	0.664	–43.7
0.9	0.710	–125.1	1.996	92.8	0.194	24.1	0.631	–46.5
1.0	0.694	–133.7	1.865	86.8	0.196	21.0	0.602	–49.1
1.1	0.684	–141.4	1.738	81.6	0.196	18.2	0.577	–51.6
1.2	0.682	–148.2	1.646	76.7	0.195	15.8	0.555	–54.2
1.3	0.673	–154.9	1.539	71.9	0.192	13.7	0.536	–56.9
1.4	0.671	–160.8	1.455	67.5	0.189	12.1	0.520	–59.7
1.5	0.671	–166.2	1.382	63.3	0.185	10.8	0.505	–62.5
1.6	0.672	–171.4	1.314	59.4	0.181	10.0	0.493	–65.7
1.7	0.673	–176.0	1.247	55.5	0.177	9.5	0.482	–68.9
1.8	0.672	179.3	1.187	51.4	0.172	9.3	0.472	–72.3
1.9	0.676	175.2	1.139	48.6	0.167	9.7	0.463	–75.7
2.0	0.683	171.2	1.091	44.9	0.163	10.7	0.456	–79.6
2.1	0.687	167.6	1.049	41.6	0.159	12.2	0.449	–83.6
2.2	0.685	164.4	1.009	38.3	0.156	14.3	0.442	–87.9
2.3	0.689	161.0	0.972	35.4	0.152	16.3	0.433	–92.1
2.4	0.691	157.8	0.933	33.0	0.150	19.0	0.423	–95.6
2.5	0.696	154.8	0.901	30.6	0.149	21.8	0.427	–98.8
2.6	0.701	152.2	0.874	28.3	0.151	24.8	0.435	–103.7
2.7	0.706	149.3	0.848	25.7	0.154	27.8	0.437	–108.8
2.8	0.710	146.9	0.826	23.9	0.157	30.8	0.441	–113.4
2.9	0.717	144.7	0.800	21.3	0.163	32.9	0.443	–118.0
3.0	0.716	141.9	0.781	19.5	0.170	35.1	0.441	–122.9
4.0	0.767	119.8	0.615	4.9	0.285	37.3	0.499	–173.1
5.0	0.790	105.9	0.510	–2.5	0.386	23.1	0.586	145.4

V_{CE} = 1 V, I_C = 3 mA, Z_O = 50 Ω

Frequency	S_{11}		S_{21}		S_{12}		S_{22}	
(GHz)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.867	–31.5	9.973	159.4	0.041	74.1	0.948	–16.7
0.2	0.801	–57.3	8.535	141.6	0.074	60.3	0.841	–30.6
0.3	0.736	–78.9	7.394	128.3	0.094	50.4	0.726	–40.7
0.4	0.679	–97.3	6.307	117.3	0.108	44.0	0.626	–48.0
0.5	0.639	–111.6	5.435	108.7	0.117	39.6	0.545	–53.2
0.6	0.611	–124.1	4.747	101.3	0.123	36.5	0.480	–57.2
0.7	0.595	–134.4	4.221	95.5	0.128	34.5	0.430	–60.4
0.8	0.581	–142.9	3.781	90.3	0.132	33.2	0.390	–63.0
0.9	0.576	–150.7	3.422	85.6	0.135	32.6	0.356	–65.8
1.0	0.569	–157.6	3.131	81.0	0.138	32.3	0.329	–68.2
1.1	0.568	–163.9	2.871	76.9	0.141	32.0	0.305	–70.8
1.2	0.572	–169.1	2.674	73.1	0.144	32.1	0.284	–73.3
1.3	0.570	–174.4	2.474	69.3	0.147	32.3	0.266	–76.3
1.4	0.571	–178.9	2.317	65.9	0.150	32.6	0.251	–79.4
1.5	0.576	176.9	2.178	62.6	0.154	32.9	0.237	–82.8
1.6	0.580	172.9	2.055	59.4	0.157	33.3	0.225	–86.6
1.7	0.583	169.3	1.941	56.2	0.161	33.9	0.215	–90.8
1.8	0.588	165.8	1.838	53.1	0.165	34.3	0.206	–95.1
1.9	0.596	162.5	1.756	50.7	0.169	34.8	0.199	–99.7
2.0	0.603	159.9	1.674	47.7	0.175	35.3	0.193	–105.0
2.1	0.606	157.2	1.607	44.8	0.179	35.8	0.189	–110.4
2.2	0.608	154.6	1.536	42.2	0.184	36.4	0.185	–116.1
2.3	0.611	151.7	1.473	39.6	0.189	36.6	0.181	–121.8
2.4	0.615	149.2	1.418	37.3	0.194	37.1	0.176	–126.4
2.5	0.622	146.8	1.367	35.2	0.200	37.5	0.179	–129.8
2.6	0.627	144.5	1.328	32.7	0.207	37.6	0.187	–134.8
2.7	0.634	142.5	1.287	30.5	0.213	37.9	0.194	–140.7
2.8	0.640	140.6	1.246	28.6	0.220	38.1	0.199	–145.8
2.9	0.644	139.0	1.210	25.8	0.227	37.7	0.206	–150.6
3.0	0.647	136.5	1.184	23.8	0.235	37.5	0.211	–155.7
4.0	0.708	118.2	0.926	5.7	0.316	29.9	0.316	161.7
5.0	0.760	106.4	0.722	–7.0	0.386	18.7	0.445	132.2

V_{CE} = 1 V, I_C = 5 mA, Z_O = 50 Ω

Frequency	S_{11}		S_{21}		S_{12}		S_{22}	
(GHz)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.796	–41.6	14.919	153.3	0.038	71.2	0.905	–23.7
0.2	0.702	–73.0	11.916	133.1	0.065	56.5	0.743	–41.5
0.3	0.631	–96.8	9.710	119.6	0.079	48.5	0.598	–52.9
0.4	0.590	–115.2	7.903	109.5	0.088	44.1	0.491	–60.7
0.5	0.561	–128.7	6.624	102.0	0.095	42.0	0.412	–66.2
0.6	0.543	–139.9	5.679	95.6	0.101	41.0	0.353	–70.5
0.7	0.536	–149.3	4.984	90.5	0.107	41.0	0.308	–74.2
0.8	0.529	–156.4	4.424	86.1	0.112	41.0	0.273	–77.4
0.9	0.529	–162.7	3.978	81.9	0.118	41.4	0.245	–80.8
1.0	0.528	–169.1	3.616	78.0	0.124	41.8	0.222	–84.1
1.1	0.531	–173.9	3.299	74.5	0.129	42.1	0.202	–88.0
1.2	0.536	–178.5	3.064	71.1	0.135	42.4	0.185	–92.0
1.3	0.537	177.0	2.829	67.8	0.141	42.6	0.171	–96.5
1.4	0.539	173.3	2.644	64.6	0.148	42.9	0.160	–101.5
1.5	0.546	169.7	2.481	61.7	0.154	43.0	0.150	–107.1
1.6	0.550	166.5	2.336	58.9	0.160	43.0	0.142	–113.2
1.7	0.557	163.4	2.200	56.0	0.167	43.1	0.137	–119.7
1.8	0.561	160.1	2.082	53.2	0.173	42.9	0.133	–126.5
1.9	0.571	157.5	1.986	50.9	0.180	42.7	0.132	–133.2
2.0	0.581	155.2	1.894	48.1	0.187	42.4	0.132	–140.1
2.1	0.583	152.8	1.812	45.7	0.194	42.3	0.134	–146.9
2.2	0.584	150.3	1.734	43.1	0.201	42.1	0.137	–153.5
2.3	0.588	147.9	1.655	40.7	0.207	41.6	0.139	–160.2
2.4	0.595	145.6	1.594	38.6	0.214	41.5	0.139	–165.4
2.5	0.600	143.7	1.536	36.6	0.220	41.3	0.145	–168.2
2.6	0.605	141.6	1.490	34.3	0.229	40.8	0.155	–171.4
2.7	0.612	139.6	1.443	32.1	0.237	40.4	0.165	–176.1
2.8	0.619	137.7	1.397	30.3	0.244	39.9	0.173	179.9
2.9	0.625	136.4	1.357	27.6	0.251	39.1	0.184	176.7
3.0	0.626	134.5	1.331	25.7	0.258	38.4	0.191	173.0
4.0	0.688	117.1	1.039	7.8	0.331	28.0	0.304	143.2
5.0	0.746	106.3	0.817	–5.4	0.390	16.8	0.423	121.8

V_{CE} = 1 V, I_C = 7 mA, Z_O = 50 Ω

Frequency	S_{11}		S_{21}		S_{12}		S_{22}	
(GHz)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.723	–50.4	18.865	148.4	0.036	67.9	0.864	–29.8
0.2	0.627	–86.1	14.169	127.2	0.057	54.2	0.664	–49.8
0.3	0.572	–109.7	11.030	114.2	0.069	48.1	0.511	–61.9
0.4	0.542	–127.3	8.797	104.8	0.077	46.1	0.408	–70.1
0.5	0.522	–139.7	7.248	98.1	0.084	45.6	0.336	–76.2
0.6	0.511	–149.6	6.168	92.5	0.090	45.7	0.284	–81.3
0.7	0.508	–158.0	5.392	87.7	0.097	46.5	0.245	–85.8
0.8	0.506	–164.0	4.760	83.8	0.104	47.0	0.215	–90.1
0.9	0.509	–170.0	4.253	79.9	0.111	47.6	0.191	–94.8
1.0	0.510	–175.3	3.862	76.3	0.119	48.0	0.172	–99.5
1.1	0.514	–179.9	3.524	73.1	0.126	48.2	0.157	–105.0
1.2	0.519	176.4	3.267	69.9	0.133	48.3	0.144	–110.8
1.3	0.521	172.3	3.010	66.8	0.141	48.4	0.135	–117.4
1.4	0.526	168.9	2.812	63.9	0.149	48.3	0.128	–124.4
1.5	0.532	166.1	2.633	61.2	0.156	48.0	0.124	–131.8
1.6	0.538	162.7	2.481	58.5	0.165	47.7	0.122	–139.6
1.7	0.543	160.1	2.333	55.8	0.172	47.4	0.122	–147.0
1.8	0.550	157.0	2.206	53.1	0.180	46.8	0.124	–154.2
1.9	0.557	154.8	2.102	51.1	0.187	46.2	0.128	–160.7
2.0	0.567	152.4	2.005	48.6	0.196	45.6	0.133	–166.8
2.1	0.573	150.2	1.911	46.0	0.203	45.2	0.140	–172.5
2.2	0.573	148.0	1.832	43.6	0.211	44.6	0.146	–177.9
2.3	0.580	145.8	1.750	41.3	0.218	43.8	0.152	176.4
2.4	0.582	143.7	1.682	39.3	0.224	43.3	0.154	172.0
2.5	0.588	141.7	1.621	37.3	0.232	42.8	0.161	170.1
2.6	0.595	139.8	1.571	35.2	0.241	42.2	0.171	168.1
2.7	0.602	138.0	1.522	33.0	0.248	41.5	0.182	164.9
2.8	0.606	136.2	1.471	31.2	0.256	40.9	0.192	161.9
2.9	0.616	134.8	1.429	28.6	0.263	39.8	0.202	159.8
3.0	0.618	132.8	1.400	26.7	0.271	38.9	0.209	156.9
4.0	0.680	116.5	1.094	9.3	0.340	27.1	0.319	133.5
5.0	0.738	105.8	0.863	–4.5	0.393	15.8	0.427	115.5

V_{CE} = 1 V, I_C = 10 mA, Z_O = 50 Ω

Frequency	S_{11}		S_{21}		S_{12}		S_{22}	
(GHz)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.648	–63.1	23.217	142.6	0.033	66.7	0.806	–36.9
0.2	0.559	–100.4	16.239	121.1	0.050	53.2	0.576	–59.0
0.3	0.520	–123.8	12.188	108.9	0.059	50.2	0.428	–71.9
0.4	0.506	–139.2	9.515	100.6	0.067	50.1	0.335	–80.9
0.5	0.491	–150.2	7.780	94.6	0.075	50.7	0.273	–87.9
0.6	0.487	–159.1	6.560	89.6	0.083	51.5	0.229	–94.4
0.7	0.491	–166.0	5.692	85.2	0.091	52.4	0.198	–100.6
0.8	0.488	–171.4	5.017	81.8	0.099	53.0	0.174	–106.5
0.9	0.495	–176.1	4.489	78.3	0.108	53.5	0.156	–113.0
1.0	0.495	178.9	4.058	74.9	0.117	53.6	0.143	–119.6
1.1	0.500	175.1	3.694	71.9	0.125	53.7	0.134	–127.0
1.2	0.510	171.9	3.424	69.0	0.134	53.4	0.127	–134.5
1.3	0.512	168.4	3.160	66.1	0.143	53.0	0.124	–142.3
1.4	0.515	165.2	2.947	63.3	0.152	52.7	0.123	–149.9
1.5	0.523	162.5	2.757	60.7	0.160	52.0	0.125	–157.4
1.6	0.529	159.8	2.594	58.2	0.169	51.3	0.129	–164.3
1.7	0.536	157.2	2.439	55.6	0.177	50.8	0.134	–170.7
1.8	0.542	154.5	2.303	53.0	0.186	49.8	0.140	–176.5
1.9	0.552	152.3	2.195	50.9	0.194	49.1	0.147	178.8
2.0	0.559	150.0	2.089	48.5	0.203	48.2	0.155	173.9
2.1	0.570	148.0	1.994	46.1	0.211	47.3	0.164	170.0
2.2	0.567	146.2	1.909	43.8	0.219	46.5	0.172	165.7
2.3	0.575	144.2	1.825	41.6	0.226	45.5	0.180	161.7
2.4	0.576	142.0	1.751	39.7	0.233	44.8	0.184	158.0
2.5	0.583	140.1	1.689	37.8	0.242	44.1	0.190	156.5
2.6	0.587	138.5	1.635	35.8	0.251	43.1	0.200	154.8
2.7	0.594	136.6	1.582	33.8	0.259	42.3	0.211	152.5
2.8	0.602	134.9	1.529	32.0	0.266	41.5	0.221	149.9
2.9	0.609	133.7	1.488	29.5	0.274	40.3	0.231	148.6
3.0	0.611	132.0	1.457	27.6	0.281	39.2	0.238	146.0
4.0	0.674	116.0	1.135	10.5	0.348	26.4	0.342	126.4
5.0	0.732	105.9	0.898	–2.7	0.397	15.2	0.440	110.7

V_{CE} = 1 V, I_C = 20 mA, Z_O = 50 Ω

Frequency	S_{11}		S_{21}		S_{12}		S_{22}	
(GHz)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.495	–91.9	30.431	131.0	0.027	63.2	0.669	–52.2
0.2	0.473	–130.8	18.860	111.0	0.038	56.5	0.426	–77.3
0.3	0.463	–148.2	13.424	101.1	0.047	57.6	0.306	–92.4
0.4	0.469	–158.9	10.241	94.6	0.057	59.6	0.241	–103.9
0.5	0.469	–166.4	8.266	89.7	0.066	61.0	0.201	–113.7
0.6	0.469	–173.1	6.934	85.4	0.077	61.8	0.175	–123.4
0.7	0.477	–178.0	5.990	81.9	0.086	62.1	0.159	–132.4
0.8	0.480	178.1	5.269	78.8	0.097	62.1	0.149	–140.4
0.9	0.486	174.7	4.702	75.8	0.107	61.9	0.143	–148.4
1.0	0.490	170.7	4.253	72.8	0.118	61.3	0.140	–155.7
1.1	0.496	167.6	3.871	70.1	0.128	60.7	0.142	–162.8
1.2	0.503	165.5	3.571	67.5	0.138	59.8	0.144	–169.0
1.3	0.509	162.4	3.288	64.8	0.148	58.9	0.149	–174.9
1.4	0.513	159.9	3.069	62.2	0.158	58.0	0.154	179.8
1.5	0.520	157.7	2.866	59.9	0.167	56.9	0.162	174.9
1.6	0.527	155.2	2.695	57.5	0.177	55.6	0.170	170.6
1.7	0.532	153.1	2.531	55.1	0.186	54.7	0.179	166.6
1.8	0.538	150.5	2.389	52.7	0.196	53.4	0.188	162.9
1.9	0.548	148.7	2.273	50.9	0.205	52.3	0.197	160.1
2.0	0.558	146.7	2.163	48.5	0.214	50.9	0.207	157.0
2.1	0.564	145.2	2.062	46.4	0.222	49.8	0.216	154.4
2.2	0.566	143.3	1.972	44.1	0.231	48.7	0.225	151.3
2.3	0.571	141.3	1.882	42.1	0.239	47.4	0.234	148.4
2.4	0.575	139.3	1.810	40.2	0.246	46.5	0.239	145.6
2.5	0.581	137.8	1.743	38.4	0.255	45.5	0.245	144.3
2.6	0.588	136.2	1.685	36.4	0.264	44.2	0.254	143.0
2.7	0.592	134.5	1.630	34.4	0.273	43.3	0.265	141.2
2.8	0.601	133.1	1.576	32.8	0.280	42.2	0.275	139.1
2.9	0.607	131.8	1.534	30.2	0.288	40.9	0.284	138.1
3.0	0.610	130.0	1.502	28.3	0.295	39.7	0.290	136.0
4.0	0.673	114.9	1.170	11.9	0.359	25.6	0.386	119.0
5.0	0.731	105.0	0.926	–1.1	0.403	14.1	0.469	104.8

V_{CE} = 2 V, I_C = 1 mA, Z_O = 50 Ω

Frequency	S_{11}		S_{21}		S_{12}		S_{22}	
(GHz)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.976	–17.6	3.667	168.1	0.035	81.3	0.989	–6.8
0.2	0.930	–34.0	3.400	155.2	0.069	69.8	0.962	–13.2
0.3	0.899	–49.3	3.239	144.7	0.097	61.1	0.920	–18.8
0.4	0.858	–64.0	3.014	134.4	0.120	53.5	0.876	–23.8
0.5	0.824	–77.3	2.795	125.4	0.138	46.6	0.831	–28.0
0.6	0.789	–89.4	2.589	116.9	0.150	40.6	0.788	–31.5
0.7	0.763	–100.6	2.408	109.8	0.160	35.5	0.749	–34.6
0.8	0.736	–110.6	2.232	103.2	0.165	31.1	0.717	–37.3
0.9	0.720	–119.9	2.079	97.1	0.170	27.5	0.686	–39.9
1.0	0.702	–128.5	1.949	91.1	0.172	24.4	0.659	–42.1
1.1	0.691	–136.7	1.820	85.9	0.172	21.6	0.636	–44.4
1.2	0.686	–143.7	1.720	81.1	0.171	19.3	0.616	–46.6
1.3	0.677	–150.7	1.615	76.3	0.169	17.3	0.597	–48.8
1.4	0.672	–156.7	1.527	71.8	0.166	15.8	0.581	–51.2
1.5	0.669	–162.2	1.452	67.9	0.163	14.7	0.568	–53.6
1.6	0.670	–167.8	1.380	63.8	0.160	13.9	0.555	–56.3
1.7	0.668	–172.9	1.314	59.7	0.155	13.7	0.544	–59.1
1.8	0.671	–177.9	1.253	55.9	0.151	13.8	0.533	–61.9
1.9	0.674	177.9	1.202	53.0	0.147	14.5	0.525	–65.0
2.0	0.681	173.9	1.153	49.5	0.144	15.7	0.516	–68.3
2.1	0.680	170.2	1.108	46.0	0.140	17.6	0.508	–71.8
2.2	0.679	166.6	1.066	42.9	0.138	20.0	0.500	–75.5
2.3	0.683	163.2	1.026	39.8	0.135	22.3	0.490	–79.2
2.4	0.686	159.8	0.989	37.5	0.134	25.4	0.479	–82.1
2.5	0.690	156.8	0.952	35.1	0.134	28.5	0.481	–85.1
2.6	0.694	154.0	0.927	32.9	0.136	32.0	0.484	–89.5
2.7	0.695	150.9	0.900	30.3	0.139	35.3	0.485	–94.2
2.8	0.703	148.3	0.875	28.3	0.144	38.3	0.486	–98.2
2.9	0.710	145.9	0.850	25.7	0.150	40.6	0.484	–102.4
3.0	0.708	143.2	0.829	23.8	0.159	42.7	0.477	–107.1
4.0	0.756	120.7	0.655	8.3	0.281	44.1	0.501	–157.0
5.0	0.782	106.6	0.535	–0.6	0.392	28.1	0.569	157.2

V_{CE} = 2 V, I_C = 3 mA, Z_O = 50 Ω

Frequency	S_{11}		S_{21}		S_{12}		S_{22}	
(GHz)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.884	–27.7	10.031	161.3	0.033	76.7	0.958	–13.7
0.2	0.816	–51.5	8.757	144.4	0.061	63.1	0.870	–25.3
0.3	0.746	–72.1	7.720	131.6	0.080	54.1	0.769	–33.8
0.4	0.683	–89.7	6.684	120.7	0.093	47.6	0.678	–39.9
0.5	0.643	–104.4	5.803	112.1	0.101	43.1	0.601	–44.3
0.6	0.609	–116.8	5.117	104.8	0.108	39.8	0.541	–47.3
0.7	0.584	–127.6	4.572	98.8	0.113	37.8	0.491	–49.6
0.8	0.568	–136.5	4.110	93.5	0.116	36.5	0.452	–51.5
0.9	0.561	–144.6	3.728	88.7	0.120	35.7	0.420	–53.4
1.0	0.551	–151.8	3.419	84.2	0.123	35.5	0.392	–54.9
1.1	0.547	–158.8	3.141	80.1	0.126	35.4	0.369	–56.6
1.2	0.550	–164.3	2.929	76.4	0.128	35.3	0.348	–58.3
1.3	0.546	–169.7	2.713	72.7	0.131	35.7	0.330	–60.3
1.4	0.547	–174.6	2.543	69.1	0.135	36.1	0.314	–62.3
1.5	0.551	–179.1	2.392	66.0	0.138	36.6	0.300	–64.5
1.6	0.555	176.7	2.257	62.8	0.141	37.1	0.286	–67.0
1.7	0.559	173.0	2.130	59.6	0.145	37.8	0.274	–69.8
1.8	0.559	168.9	2.020	56.5	0.149	38.4	0.263	–72.7
1.9	0.569	165.8	1.925	54.0	0.153	39.0	0.253	–75.9
2.0	0.578	162.6	1.842	51.1	0.159	39.6	0.244	–79.7
2.1	0.583	159.8	1.766	48.2	0.163	40.4	0.235	–83.6
2.2	0.582	157.3	1.694	45.5	0.168	41.0	0.227	–87.7
2.3	0.586	154.3	1.619	43.0	0.173	41.3	0.218	–91.9
2.4	0.589	151.4	1.557	40.6	0.178	41.8	0.209	–95.0
2.5	0.597	149.3	1.501	38.5	0.184	42.4	0.209	–98.3
2.6	0.602	147.0	1.459	36.3	0.190	42.6	0.212	–103.2
2.7	0.608	144.7	1.415	33.8	0.198	43.0	0.212	–109.0
2.8	0.616	142.6	1.368	32.0	0.204	43.2	0.211	–113.7
2.9	0.623	141.1	1.328	29.3	0.211	42.8	0.212	–119.0
3.0	0.623	138.7	1.299	27.2	0.219	42.6	0.211	–124.3
4.0	0.689	119.9	1.015	8.4	0.305	35.5	0.274	–177.1
5.0	0.746	107.7	0.789	–5.8	0.384	23.5	0.397	144.8

V_{CE} = 2 V, I_C = 5 mA, Z_O = 50 Ω

Frequency	S_{11}		S_{21}		S_{12}		S_{22}	
(GHz)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.805	–37.0	15.169	155.8	0.032	73.1	0.926	–19.4
0.2	0.713	–65.0	12.420	136.5	0.055	59.5	0.784	–34.1
0.3	0.635	–87.7	10.329	123.2	0.068	51.4	0.651	–43.5
0.4	0.585	–106.6	8.571	112.9	0.077	47.2	0.548	–49.6
0.5	0.547	–120.4	7.228	105.2	0.084	45.3	0.470	–53.5
0.6	0.523	–132.0	6.231	98.9	0.090	44.1	0.410	–56.1
0.7	0.510	–141.5	5.483	93.4	0.095	43.7	0.365	–58.2
0.8	0.500	–149.7	4.882	89.1	0.100	43.7	0.331	–59.8
0.9	0.501	–156.6	4.393	84.8	0.105	44.2	0.302	–61.4
1.0	0.495	–163.4	3.999	80.9	0.111	44.7	0.278	–62.9
1.1	0.497	–169.0	3.663	77.3	0.116	45.1	0.256	–64.7
1.2	0.500	–173.5	3.404	74.0	0.122	45.4	0.238	–66.5
1.3	0.503	–178.4	3.139	70.6	0.127	45.7	0.222	–68.8
1.4	0.504	177.4	2.935	67.6	0.133	46.1	0.207	–71.3
1.5	0.508	173.6	2.753	64.7	0.139	46.2	0.194	–74.0
1.6	0.516	170.0	2.596	61.8	0.146	46.3	0.182	–77.4
1.7	0.521	166.8	2.446	58.9	0.152	46.4	0.171	–81.0
1.8	0.525	163.4	2.316	56.2	0.158	46.4	0.162	–85.1
1.9	0.536	160.7	2.208	54.0	0.165	46.3	0.153	–89.7
2.0	0.543	158.0	2.104	51.3	0.172	46.1	0.146	–94.8
2.1	0.545	155.4	2.013	48.7	0.179	46.1	0.139	–100.5
2.2	0.550	152.9	1.928	46.2	0.185	46.1	0.134	–106.3
2.3	0.554	150.6	1.841	43.7	0.191	45.6	0.127	–113.0
2.4	0.557	148.3	1.769	41.6	0.197	45.5	0.120	–117.4
2.5	0.565	146.2	1.710	39.7	0.204	45.3	0.122	–121.9
2.6	0.570	144.0	1.657	37.4	0.212	44.9	0.126	–127.6
2.7	0.579	141.9	1.605	35.3	0.220	44.6	0.130	–135.0
2.8	0.583	140.0	1.553	33.3	0.227	44.3	0.132	–141.0
2.9	0.591	138.7	1.510	30.8	0.234	43.4	0.138	–146.8
3.0	0.595	136.6	1.477	28.7	0.242	42.7	0.140	–152.9
4.0	0.663	119.3	1.151	10.5	0.319	32.8	0.235	160.6
5.0	0.728	108.2	0.900	–4.1	0.385	21.3	0.361	132.6

V_{CE} = 2 V, I_C = 7 mA, Z_O = 50 Ω

Frequency	S_{11}		S_{21}		S_{12}		S_{22}	
(GHz)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.729	–43.6	19.311	151.3	0.030	71.6	0.889	–24.2
0.2	0.636	–76.2	15.000	130.9	0.050	58.2	0.712	–40.7
0.3	0.563	–100.0	11.950	117.7	0.060	51.5	0.566	–50.3
0.4	0.522	–117.7	9.637	108.0	0.068	49.3	0.462	–56.2
0.5	0.495	–131.1	8.022	101.2	0.075	48.7	0.389	–59.9
0.6	0.479	–141.7	6.837	95.3	0.081	48.5	0.334	–62.4
0.7	0.472	–150.9	5.989	90.4	0.087	49.0	0.294	–64.4
0.8	0.468	–157.7	5.295	86.4	0.094	49.4	0.262	–66.0
0.9	0.470	–164.1	4.754	82.7	0.101	50.2	0.236	–67.8
1.0	0.468	–170.1	4.322	79.0	0.107	50.6	0.215	–69.5
1.1	0.470	–175.0	3.934	75.9	0.114	50.9	0.196	–71.7
1.2	0.477	–179.0	3.654	72.8	0.121	51.2	0.180	–73.9
1.3	0.479	176.8	3.373	69.7	0.128	51.3	0.165	–76.9
1.4	0.481	173.0	3.149	66.8	0.135	51.3	0.153	–80.3
1.5	0.489	169.6	2.952	64.2	0.142	51.0	0.141	–84.3
1.6	0.495	166.3	2.776	61.5	0.150	50.8	0.130	–88.9
1.7	0.500	163.4	2.612	58.8	0.157	50.6	0.121	–94.2
1.8	0.505	160.2	2.472	56.1	0.165	50.2	0.113	–100.2
1.9	0.514	157.9	2.358	53.9	0.172	49.7	0.108	–106.8
2.0	0.525	155.3	2.246	51.4	0.180	49.1	0.103	–114.4
2.1	0.530	152.9	2.149	48.8	0.187	48.8	0.100	–122.3
2.2	0.533	150.8	2.052	46.5	0.194	48.4	0.098	–130.2
2.3	0.540	148.6	1.963	44.1	0.201	47.6	0.096	–139.0
2.4	0.543	146.3	1.885	42.2	0.208	47.1	0.093	–145.9
2.5	0.550	144.2	1.815	40.3	0.215	46.8	0.097	–150.2
2.6	0.556	142.5	1.759	38.3	0.224	46.1	0.104	–155.2
2.7	0.563	140.5	1.704	36.0	0.231	45.5	0.112	–161.9
2.8	0.569	138.7	1.647	34.3	0.239	44.9	0.118	–167.6
2.9	0.577	137.5	1.601	31.7	0.246	43.8	0.127	–172.2
3.0	0.579	135.6	1.568	29.8	0.254	43.0	0.132	–177.2
4.0	0.650	119.0	1.222	11.9	0.327	31.8	0.238	147.0
5.0	0.718	108.0	0.958	–2.9	0.387	20.2	0.359	124.6

V_{CE} = 2 V, I_C = 10 mA, Z_O = 50 Ω

Frequency	S_{11}		S_{21}		S_{12}		S_{22}	
(GHz)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.638	–53.6	24.095	146.0	0.028	67.6	0.841	–29.8
0.2	0.550	–88.8	17.479	124.8	0.044	56.9	0.628	–48.0
0.3	0.493	–113.5	13.408	112.3	0.053	53.4	0.479	–57.5
0.4	0.469	–130.1	10.580	103.7	0.060	52.7	0.381	–63.1
0.5	0.452	–142.3	8.681	97.4	0.067	53.2	0.315	–66.7
0.6	0.441	–151.7	7.357	92.2	0.075	53.9	0.267	–69.4
0.7	0.443	–159.4	6.392	87.8	0.082	54.8	0.231	–71.6
0.8	0.442	–165.5	5.648	84.2	0.090	55.4	0.203	–73.7
0.9	0.445	–170.9	5.054	80.8	0.098	55.8	0.181	–75.9
1.0	0.445	–176.3	4.582	77.4	0.106	56.2	0.162	–78.3
1.1	0.451	179.3	4.174	74.5	0.114	56.1	0.146	–81.5
1.2	0.459	176.2	3.865	71.6	0.122	56.0	0.133	–85.1
1.3	0.460	172.0	3.564	68.7	0.130	55.7	0.121	–89.7
1.4	0.465	168.9	3.323	65.9	0.138	55.4	0.110	–94.9
1.5	0.472	165.7	3.116	63.4	0.146	54.9	0.101	–101.2
1.6	0.480	162.8	2.931	60.9	0.155	54.3	0.093	–108.6
1.7	0.484	160.2	2.754	58.3	0.163	53.7	0.088	–116.8
1.8	0.491	157.4	2.605	55.8	0.171	53.0	0.085	–125.9
1.9	0.503	155.2	2.477	53.9	0.179	52.4	0.084	–134.7
2.0	0.510	153.2	2.362	51.4	0.187	51.5	0.085	–144.3
2.1	0.515	150.8	2.254	49.1	0.195	50.8	0.089	–152.8
2.2	0.519	148.8	2.158	46.8	0.203	50.1	0.092	–161.3
2.3	0.525	146.6	2.060	44.6	0.210	49.0	0.096	–169.5
2.4	0.532	144.5	1.979	42.7	0.217	48.4	0.098	–176.4
2.5	0.538	142.6	1.905	40.8	0.225	47.8	0.103	–179.2
2.6	0.544	141.1	1.848	38.8	0.234	46.7	0.111	177.5
2.7	0.550	139.0	1.787	36.7	0.242	45.9	0.122	172.9
2.8	0.558	137.5	1.728	35.0	0.249	45.2	0.129	168.6
2.9	0.566	136.2	1.679	32.5	0.257	44.1	0.140	166.1
3.0	0.567	134.3	1.644	30.6	0.264	43.1	0.147	161.9
4.0	0.640	118.6	1.277	13.1	0.334	30.5	0.256	136.2
5.0	0.709	107.9	1.003	–1.1	0.390	19.0	0.367	117.9

V_{CE} = 2 V, I_C = 20 mA, Z_O = 50 Ω

Frequency	S_{11}		S_{21}		S_{12}		S_{22}	
(GHz)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.486	–81.5	32.771	135.4	0.023	66.0	0.723	–41.7
0.2	0.429	–117.5	21.075	114.6	0.034	59.2	0.475	–61.1
0.3	0.414	–138.2	15.252	104.1	0.043	60.0	0.340	–70.5
0.4	0.407	–151.0	11.705	97.2	0.051	61.5	0.262	–76.4
0.5	0.407	–159.7	9.491	92.1	0.060	63.2	0.211	–80.7
0.6	0.404	–166.7	7.958	87.9	0.069	63.5	0.174	–84.7
0.7	0.412	–173.1	6.891	84.3	0.078	64.0	0.148	–88.8
0.8	0.415	–177.5	6.070	81.2	0.088	64.1	0.128	–92.7
0.9	0.421	178.9	5.412	78.2	0.097	63.9	0.113	–97.5
1.0	0.424	174.7	4.897	75.2	0.107	63.5	0.100	–102.9
1.1	0.430	171.3	4.454	72.5	0.116	62.9	0.091	–110.0
1.2	0.438	169.0	4.118	70.0	0.126	62.2	0.083	–117.8
1.3	0.442	165.5	3.792	67.4	0.135	61.3	0.079	–127.3
1.4	0.448	162.8	3.533	64.9	0.144	60.5	0.077	–137.2
1.5	0.455	160.4	3.305	62.6	0.153	59.5	0.077	–147.2
1.6	0.464	158.3	3.105	60.3	0.163	58.3	0.080	–156.9
1.7	0.470	156.0	2.921	57.8	0.171	57.4	0.084	–165.7
1.8	0.478	153.5	2.756	55.5	0.180	56.3	0.091	–173.5
1.9	0.485	151.6	2.626	53.7	0.189	55.2	0.098	–179.5
2.0	0.496	149.7	2.500	51.5	0.198	54.0	0.107	174.9
2.1	0.504	147.8	2.385	49.2	0.206	53.0	0.115	169.9
2.2	0.507	145.8	2.276	47.1	0.215	51.9	0.124	165.1
2.3	0.514	144.0	2.176	45.0	0.222	50.6	0.132	160.1
2.4	0.519	142.0	2.090	43.1	0.229	49.7	0.137	155.9
2.5	0.525	140.1	2.012	41.4	0.238	48.9	0.144	154.4
2.6	0.531	138.7	1.944	39.5	0.247	47.6	0.152	153.0
2.7	0.539	136.9	1.881	37.6	0.255	46.7	0.164	150.6
2.8	0.546	135.4	1.818	35.8	0.263	45.7	0.174	148.0
2.9	0.553	134.4	1.766	33.3	0.270	44.4	0.184	146.8
3.0	0.556	132.7	1.731	31.5	0.277	43.3	0.191	144.1
4.0	0.631	117.5	1.340	14.6	0.345	29.6	0.296	125.5
5.0	0.701	107.4	1.054	0.4	0.395	17.7	0.395	110.2

V_{CE} = 3 V, I_C = 1 mA, Z_O = 50 Ω

Frequency	S_{11}		S_{21}		S_{12}		S_{22}	
(GHz)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.963	–17.1	3.821	168.2	0.034	80.1	0.989	–6.6
0.2	0.933	–33.7	3.531	155.5	0.065	70.7	0.963	–12.8
0.3	0.900	–48.9	3.363	145.3	0.091	61.5	0.924	–18.2
0.4	0.859	–63.3	3.134	135.0	0.113	54.0	0.878	–23.0
0.5	0.823	–76.4	2.908	126.1	0.129	47.4	0.836	–27.1
0.6	0.789	–88.6	2.695	117.8	0.142	41.4	0.794	–30.4
0.7	0.760	–99.8	2.505	110.7	0.150	36.4	0.757	–33.4
0.8	0.734	–109.6	2.325	104.2	0.156	32.2	0.723	–35.9
0.9	0.717	–118.8	2.165	98.3	0.160	28.7	0.694	–38.3
1.0	0.698	–127.6	2.031	92.3	0.162	25.7	0.668	–40.5
1.1	0.684	–135.7	1.899	87.2	0.162	23.0	0.645	–42.6
1.2	0.680	–142.8	1.794	82.5	0.161	20.8	0.625	–44.7
1.3	0.671	–149.9	1.683	77.6	0.160	18.9	0.607	–46.9
1.4	0.665	–156.0	1.593	73.3	0.157	17.6	0.592	–49.2
1.5	0.664	–161.7	1.514	69.2	0.155	16.5	0.577	–51.4
1.6	0.662	–167.2	1.439	65.3	0.152	16.0	0.565	–54.0
1.7	0.663	–172.3	1.367	61.4	0.147	15.8	0.553	–56.6
1.8	0.662	–177.2	1.305	57.4	0.144	16.2	0.544	–59.4
1.9	0.668	178.5	1.249	54.7	0.141	17.0	0.534	–62.3
2.0	0.674	174.4	1.199	51.2	0.138	18.4	0.525	–65.4
2.1	0.672	170.7	1.153	47.8	0.135	20.5	0.516	–68.6
2.2	0.672	167.3	1.109	44.6	0.133	23.0	0.509	–72.2
2.3	0.675	163.6	1.068	41.6	0.131	25.2	0.498	–75.7
2.4	0.677	160.2	1.026	39.2	0.130	28.3	0.487	–78.5
2.5	0.680	157.0	0.994	36.9	0.131	31.5	0.489	–81.3
2.6	0.687	154.2	0.967	34.4	0.133	34.8	0.493	–85.5
2.7	0.689	151.2	0.937	32.1	0.137	38.0	0.492	–89.9
2.8	0.697	148.8	0.913	30.0	0.142	41.0	0.492	–93.9
2.9	0.699	146.4	0.884	27.3	0.149	43.1	0.489	–97.9
3.0	0.700	143.6	0.863	25.4	0.157	45.1	0.482	–102.5
4.0	0.749	121.1	0.682	9.1	0.279	45.9	0.495	–151.6
5.0	0.781	106.8	0.553	–0.2	0.389	29.8	0.559	161.8

V_{CE} = 3 V, I_C = 3 mA, Z_O = 50 Ω

Frequency	S_{11}		S_{21}		S_{12}		S_{22}	
(GHz)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.880	–26.3	10.060	161.9	0.032	78.5	0.962	–12.9
0.2	0.818	–50.0	8.802	145.4	0.058	63.9	0.879	–23.8
0.3	0.750	–69.5	7.806	132.7	0.076	55.2	0.782	–31.8
0.4	0.689	–87.1	6.799	121.9	0.089	48.6	0.694	–37.7
0.5	0.646	–101.6	5.934	113.4	0.097	44.1	0.620	–41.8
0.6	0.608	–114.2	5.225	105.9	0.104	40.7	0.558	–44.7
0.7	0.582	–125.1	4.681	99.8	0.108	38.9	0.512	–46.8
0.8	0.565	–134.2	4.220	94.6	0.112	37.5	0.473	–48.6
0.9	0.556	–142.4	3.830	89.9	0.116	36.9	0.441	–50.3
1.0	0.545	–150.0	3.513	85.3	0.119	36.5	0.414	–51.6
1.1	0.540	–156.8	3.229	81.2	0.121	36.4	0.391	–53.2
1.2	0.543	–162.4	3.011	77.5	0.124	36.5	0.370	–54.7
1.3	0.538	–168.1	2.788	73.8	0.127	36.6	0.352	–56.4
1.4	0.538	–173.0	2.616	70.3	0.130	37.2	0.336	–58.2
1.5	0.541	–177.7	2.461	67.1	0.133	37.7	0.321	–60.2
1.6	0.544	178.1	2.323	64.0	0.137	38.3	0.308	–62.5
1.7	0.547	174.2	2.192	60.7	0.140	39.0	0.296	–64.9
1.8	0.551	170.3	2.082	57.6	0.145	39.5	0.284	–67.6
1.9	0.561	166.8	1.986	55.1	0.148	40.3	0.274	–70.4
2.0	0.566	163.8	1.896	52.2	0.154	40.9	0.264	–73.7
2.1	0.571	160.7	1.821	49.4	0.158	41.6	0.255	–77.2
2.2	0.571	158.0	1.742	46.6	0.163	42.4	0.246	–81.0
2.3	0.578	155.4	1.670	44.1	0.168	42.7	0.236	–84.7
2.4	0.582	152.4	1.606	41.8	0.173	43.2	0.226	–87.4
2.5	0.589	150.0	1.549	39.6	0.179	43.8	0.226	–90.4
2.6	0.590	147.9	1.501	37.5	0.185	44.2	0.227	–95.0
2.7	0.599	145.5	1.456	35.1	0.192	44.5	0.226	–100.4
2.8	0.607	143.2	1.409	33.0	0.199	44.7	0.224	–105.1
2.9	0.611	141.8	1.371	30.5	0.206	44.4	0.224	–109.8
3.0	0.614	139.5	1.340	28.5	0.214	44.2	0.220	–115.0
4.0	0.681	120.5	1.046	9.5	0.300	37.3	0.265	–169.0
5.0	0.742	108.3	0.812	–5.2	0.380	25.3	0.384	150.2

V_{CE} = 3 V, I_C = 5 mA, Z_O = 50 Ω

Frequency	S_{11}		S_{21}		S_{12}		S_{22}	
(GHz)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.815	–34.8	15.209	156.6	0.030	73.4	0.929	–18.1
0.2	0.715	–62.6	12.563	137.7	0.052	60.0	0.797	–32.0
0.3	0.635	–84.7	10.525	124.5	0.065	53.0	0.668	–41.0
0.4	0.586	–103.1	8.768	114.1	0.075	48.3	0.567	–46.6
0.5	0.543	–117.1	7.426	106.2	0.081	46.2	0.490	–50.2
0.6	0.519	–129.0	6.411	99.7	0.087	45.0	0.431	–52.5
0.7	0.503	–139.2	5.649	94.6	0.092	44.7	0.386	–54.3
0.8	0.492	–147.1	5.039	90.1	0.097	44.7	0.351	–55.6
0.9	0.488	–154.3	4.540	85.8	0.102	45.1	0.323	–56.9
1.0	0.485	–161.2	4.132	81.9	0.108	45.5	0.299	–58.1
1.1	0.485	–167.2	3.782	78.4	0.113	45.9	0.278	–59.5
1.2	0.490	–171.6	3.516	75.0	0.118	46.3	0.260	–61.0
1.3	0.488	–176.7	3.245	71.8	0.123	46.6	0.244	–62.8
1.4	0.490	179.2	3.037	68.6	0.129	47.0	0.229	–64.9
1.5	0.494	175.2	2.848	65.8	0.135	47.2	0.215	–67.2
1.6	0.503	171.6	2.685	63.0	0.141	47.3	0.203	–69.8
1.7	0.505	168.2	2.533	60.1	0.147	47.5	0.191	–72.8
1.8	0.511	164.7	2.394	57.3	0.154	47.5	0.181	–76.2
1.9	0.521	161.8	2.281	55.0	0.160	47.4	0.171	–79.9
2.0	0.529	159.1	2.175	52.3	0.167	47.3	0.162	–84.2
2.1	0.534	156.6	2.085	49.7	0.174	47.4	0.154	–89.0
2.2	0.536	154.0	1.994	47.2	0.180	47.2	0.146	–94.0
2.3	0.543	151.7	1.910	44.8	0.186	46.8	0.138	–99.3
2.4	0.546	149.1	1.833	42.9	0.192	46.7	0.130	–103.1
2.5	0.552	147.0	1.766	40.8	0.199	46.6	0.130	–107.1
2.6	0.559	145.2	1.715	38.7	0.207	46.2	0.132	–112.9
2.7	0.566	142.9	1.660	36.4	0.214	45.8	0.133	–120.2
2.8	0.572	141.1	1.605	34.7	0.222	45.5	0.132	–126.1
2.9	0.579	139.5	1.559	32.1	0.229	44.7	0.136	–132.4
3.0	0.581	137.5	1.526	30.0	0.237	44.0	0.136	–138.9
4.0	0.655	120.4	1.192	11.6	0.314	34.3	0.215	168.1
5.0	0.722	108.7	0.927	–3.2	0.380	22.9	0.341	137.3

V_{CE} = 3 V, I_C = 7 mA, Z_O = 50 Ω

Frequency	S_{11}		S_{21}		S_{12}		S_{22}	
(GHz)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.749	–42.5	19.394	152.3	0.028	72.1	0.898	–22.7
0.2	0.636	–73.2	15.233	132.1	0.047	58.8	0.728	–38.2
0.3	0.566	–96.1	12.222	118.9	0.058	52.7	0.586	–47.3
0.4	0.518	–114.6	9.908	109.2	0.066	50.3	0.482	–52.7
0.5	0.489	–127.8	8.275	102.2	0.072	49.4	0.409	–55.8
0.6	0.468	–138.9	7.062	96.3	0.078	49.3	0.354	–57.9
0.7	0.461	–148.3	6.181	91.5	0.085	49.9	0.314	–59.4
0.8	0.455	–155.3	5.493	87.3	0.091	50.2	0.282	–60.5
0.9	0.456	–161.7	4.920	83.6	0.097	50.9	0.257	–61.9
1.0	0.453	–167.9	4.468	80.0	0.104	51.4	0.235	–63.0
1.1	0.455	–173.2	4.075	76.8	0.111	51.8	0.216	–64.8
1.2	0.460	–177.2	3.787	73.7	0.117	51.9	0.200	–66.4
1.3	0.462	178.3	3.489	70.6	0.124	52.0	0.185	–68.8
1.4	0.467	174.3	3.259	67.7	0.131	52.1	0.172	–71.1
1.5	0.472	171.1	3.057	65.0	0.138	51.9	0.159	–74.1
1.6	0.480	167.8	2.878	62.4	0.146	51.7	0.147	–77.6
1.7	0.486	164.7	2.709	59.7	0.153	51.5	0.137	–81.9
1.8	0.492	161.6	2.562	57.0	0.160	51.0	0.127	–86.4
1.9	0.501	158.9	2.441	55.0	0.167	50.6	0.120	–91.6
2.0	0.508	156.3	2.328	52.4	0.175	50.2	0.113	–97.9
2.1	0.515	153.8	2.224	49.9	0.182	49.8	0.107	–104.6
2.2	0.517	151.9	2.128	47.5	0.190	49.4	0.102	–111.6
2.3	0.525	149.5	2.035	45.3	0.196	48.6	0.096	–119.8
2.4	0.528	147.3	1.956	43.3	0.203	48.2	0.090	–125.8
2.5	0.535	145.1	1.884	41.3	0.210	47.8	0.092	–130.7
2.6	0.541	143.4	1.825	39.3	0.218	47.1	0.096	–137.1
2.7	0.549	141.3	1.770	37.1	0.226	46.6	0.101	–145.3
2.8	0.556	139.6	1.709	35.4	0.233	45.9	0.105	–152.0
2.9	0.563	138.2	1.662	32.7	0.241	45.0	0.112	–157.8
3.0	0.567	136.2	1.627	30.8	0.249	44.2	0.115	–164.0
4.0	0.638	119.6	1.266	12.8	0.322	33.1	0.214	152.9
5.0	0.711	108.7	0.993	–2.0	0.382	21.8	0.338	128.9

V_{CE} = 3 V, I_C = 10 mA, Z_O = 50 Ω

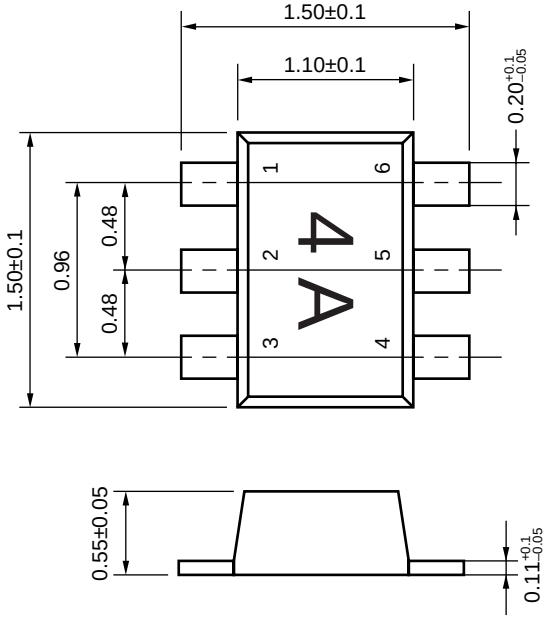
Frequency	S_{11}		S_{21}		S_{12}		S_{22}	
(GHz)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.657	–50.7	24.244	147.2	0.026	69.0	0.854	–27.9
0.2	0.557	–85.1	17.843	126.1	0.042	57.7	0.647	–44.9
0.3	0.491	–109.3	13.773	113.5	0.051	53.9	0.499	–53.8
0.4	0.460	–126.1	10.903	104.7	0.058	53.5	0.401	–58.8
0.5	0.443	–138.5	8.976	98.3	0.065	54.0	0.334	–61.7
0.6	0.431	–148.4	7.610	93.1	0.073	54.3	0.285	–63.6
0.7	0.428	–157.2	6.619	88.8	0.080	55.4	0.249	–65.1
0.8	0.425	–162.9	5.862	85.1	0.087	55.9	0.222	–66.3
0.9	0.429	–168.6	5.238	81.6	0.095	56.4	0.199	–67.8
1.0	0.429	–174.1	4.754	78.4	0.103	56.7	0.181	–69.3
1.1	0.433	–178.9	4.330	75.4	0.111	56.8	0.164	–71.6
1.2	0.441	177.8	4.013	72.5	0.118	56.6	0.149	–73.8
1.3	0.443	173.7	3.698	69.6	0.126	56.4	0.136	–76.9
1.4	0.447	170.4	3.449	66.9	0.134	56.2	0.124	–80.6
1.5	0.455	167.1	3.232	64.4	0.142	55.6	0.113	–85.1
1.6	0.460	164.3	3.040	62.0	0.150	55.1	0.104	–90.6
1.7	0.469	161.5	2.861	59.3	0.158	54.5	0.095	–97.2
1.8	0.474	158.6	2.706	56.8	0.166	53.9	0.088	–104.5
1.9	0.486	156.1	2.574	54.7	0.174	53.0	0.084	–112.5
2.0	0.493	154.0	2.456	52.3	0.183	52.3	0.081	–121.8
2.1	0.500	151.8	2.344	49.9	0.190	51.6	0.079	–131.7
2.2	0.503	149.8	2.242	47.6	0.198	50.9	0.079	–140.9
2.3	0.510	147.6	2.144	45.6	0.205	49.9	0.080	–151.6
2.4	0.514	145.4	2.057	43.6	0.212	49.3	0.078	–159.5
2.5	0.521	143.6	1.982	41.7	0.220	48.7	0.083	–163.9
2.6	0.526	141.9	1.920	39.9	0.228	47.9	0.090	–168.4
2.7	0.536	140.0	1.859	37.8	0.236	47.2	0.099	–174.7
2.8	0.543	138.5	1.798	36.0	0.243	46.3	0.107	–179.9
2.9	0.549	136.9	1.746	33.5	0.251	45.1	0.116	176.3
3.0	0.552	135.2	1.706	31.7	0.259	44.3	0.122	171.6
4.0	0.629	119.3	1.323	14.1	0.329	32.1	0.229	140.7
5.0	0.703	108.5	1.041	–0.7	0.385	20.6	0.345	121.5

V_{CE} = 3 V, I_C = 20 mA, Z_O = 50 Ω

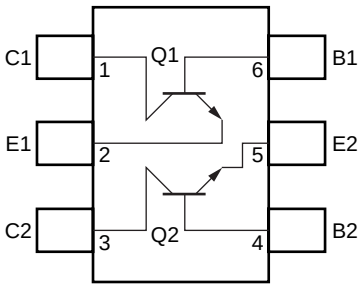
Frequency	S_{11}		S_{21}		S_{12}		S_{22}	
(GHz)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.1	0.479	–76.3	33.397	136.8	0.022	69.0	0.739	–39.0
0.2	0.428	–111.3	21.739	116.0	0.033	60.5	0.494	–57.0
0.3	0.402	–134.1	15.826	105.3	0.041	60.8	0.358	–65.2
0.4	0.390	–147.5	12.185	98.1	0.050	62.1	0.278	–69.8
0.5	0.384	–157.0	9.888	93.0	0.058	63.3	0.226	–72.8
0.6	0.386	–164.5	8.302	88.7	0.067	63.8	0.188	–75.2
0.7	0.392	–170.8	7.198	85.0	0.076	64.4	0.160	–77.5
0.8	0.392	–175.3	6.325	81.9	0.085	64.4	0.140	–79.7
0.9	0.399	–179.3	5.644	78.9	0.095	64.5	0.123	–82.7
1.0	0.401	176.2	5.114	76.1	0.104	64.0	0.108	–85.9
1.1	0.409	173.1	4.645	73.4	0.113	63.5	0.096	–90.9
1.2	0.416	170.0	4.301	70.8	0.122	62.7	0.086	–96.6
1.3	0.421	166.8	3.956	68.1	0.131	62.0	0.078	–104.1
1.4	0.426	164.1	3.690	65.6	0.140	61.1	0.071	–112.8
1.5	0.434	161.8	3.452	63.5	0.149	60.1	0.067	–123.1
1.6	0.440	159.1	3.244	61.1	0.158	59.0	0.066	–134.5
1.7	0.446	156.7	3.051	58.7	0.167	58.2	0.066	–145.9
1.8	0.455	154.4	2.883	56.4	0.176	57.1	0.069	–156.6
1.9	0.466	152.7	2.743	54.7	0.184	56.0	0.075	–165.4
2.0	0.475	150.8	2.611	52.5	0.193	54.7	0.081	–173.5
2.1	0.481	148.8	2.492	50.3	0.201	53.8	0.089	179.5
2.2	0.485	147.1	2.382	48.0	0.209	52.7	0.096	173.1
2.3	0.492	145.0	2.270	46.0	0.217	51.5	0.105	166.7
2.4	0.498	143.0	2.183	44.1	0.224	50.6	0.109	161.3
2.5	0.505	141.2	2.101	42.4	0.232	49.7	0.116	159.6
2.6	0.511	139.8	2.035	40.5	0.242	48.6	0.124	158.0
2.7	0.519	137.9	1.966	38.6	0.250	47.6	0.135	155.2
2.8	0.525	136.6	1.900	36.9	0.257	46.6	0.145	152.1
2.9	0.535	135.3	1.851	34.5	0.265	45.4	0.155	150.7
3.0	0.536	133.5	1.804	32.5	0.272	44.2	0.162	147.8
4.0	0.613	118.5	1.399	15.6	0.340	30.8	0.269	127.9
5.0	0.690	108.2	1.099	1.5	0.389	19.2	0.374	112.8

PACKAGE DIMENSIONS

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



(Top View)



PIN CONNECTIONS

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

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