

NPN SILICON RF TWIN TRANSISTOR μ PA840TC

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

DESCRIPTION

The μ PA840TC has built-in two different transistors (Q1 and Q2) for low noise amplification in the VHF band to UHF band.

FEATURES

- Low noise
Q1 : NF = 1.5 dB TYP. @ f = 2 GHz, $V_{CE} = 3$ V, $I_c = 3$ mA
Q2 : NF = 1.4 dB TYP. @ f = 1 GHz, $V_{CE} = 3$ V, $I_c = 7$ mA
- High gain
Q1 : $|S_{21e}|^2 = 8.5$ dB TYP. @ f = 2 GHz, $V_{CE} = 3$ V, $I_c = 10$ mA
Q2 : $|S_{21e}|^2 = 12.0$ dB TYP. @ f = 1 GHz, $V_{CE} = 3$ V, $I_c = 7$ mA
- Flat-lead 6-pin thin-type ultra super minimold package
- Built-in 2 different transistors (2SC5010, 2SC5007)

BUILT-IN TRANSISTORS

	Q1	Q2
3-pin ultra super minimold part No.	2SC5010	2SC5007

ORDERING INFORMATION

Part Number	Package	Quantity	Supplying Form
μ PA840TC	Flat-lead 6-pin thin-type ultra super minimold	Loose products (50 pcs)	8 mm wide embossed tape. Pin 6 (Q1 Base), pin 5 (Q2 Emitter), pin 4 (Q2 Base) face to perforation side of the tape.
μ PA840TC-T1		Taping products (3 kp/reel)	

Remark To order evaluation samples, please contact your local NEC sales office. (Part number for sample order: μ PA840TC.)

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.

ABSOLUTE MAXIMUM RATINGS (T_A = +25°C)

Parameter	Symbol	Ratings		Unit
		Q1	Q2	
Collector to Base Voltage	V _{CB0}	9	20	V
Collector to Emitter Voltage	V _{CEO}	6	10	V
Emitter to Base Voltage	V _{EBO}	2	1.5	V
Collector Current	I _c	30	65	mA
Total Power Dissipation	P _T ^{Note}	180 in 1 element	200 in 1 element	mW
		230 in 2 elements		
Junction Temperature	T _j	150	150	°C
Storage Temperature	T _{stg}	-65 to +150		°C

Note Mounted on 1.08 cm² × 1.0 mm glass epoxy substrate.

ELECTRICAL CHARACTERISTICS (T_A = +25°C)

(1) Q1

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 _{EBO}	V _{EB} = 1 V, I _C = 0	–	–	0.1	μA
DC Current Gain	h _{FE}	V _{CE} = 3 V, I _C = 10 mA ^{Note 1}	75	–	150	
Gain Bandwidth Product	f _T	V _{CE} = 3 V, I _C = 10 mA, f = 2 GHz	10.0	12.0	–	GHz
Feedback Capacitance	C _{re}	V _{CB} = 3 V, I _E = 0, f = 1 MHz ^{Note 2}	–	0.4	0.7	pF
Insertion Power Gain	S _{21e} ²	V _{CE} = 3 V, I _C = 10 mA, f = 2 GHz	7.0	8.5	–	dB
Noise Figure	NF	V _{CE} = 3 V, I _C = 3 mA, f = 2 GHz	–	1.5	2.5	dB

- Notes**
1. Pulse Measurement: PW ≤ 350 μs, Duty Cycle ≤ 2%
 2. Collector to base capacitance when measured with capacitance meter (automatic balanced bridge method), with emitter connected to guard pin of capacitance meter.

(2) Q2

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Collector Cutoff Current	I_{CBO}	$V_{CB} = 10\text{ V}, I_E = 0$	–	–	0.8	μA
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 1\text{ V}, I_C = 0$	–	–	0.8	μA
DC Current Gain	h_{FE}	$V_{CE} = 3\text{ V}, I_C = 7\text{ mA}$ ^{Note 1}	70	–	150	
Gain Bandwidth Product	f_T	$V_{CE} = 3\text{ V}, I_C = 7\text{ mA}, f = 1\text{ GHz}$	4.5	7.0	–	GHz
Feedback Capacitance	C_{re}	$V_{CB} = 3\text{ V}, I_E = 0, f = 1\text{ MHz}$ ^{Note 2}	–	–	0.9	pF
Insertion Power Gain	$ S_{21e} ^2$	$V_{CE} = 3\text{ V}, I_C = 7\text{ mA}, f = 1\text{ GHz}$	10.0	12.0	–	dB
Noise Figure	NF	$V_{CE} = 3\text{ V}, I_C = 7\text{ mA}, f = 1\text{ GHz}$	–	1.4	2.7	dB

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

2. Collector to base capacitance when measured with capacitance meter (automatic balanced bridge method), with emitter connected to guard pin of capacitance meter.

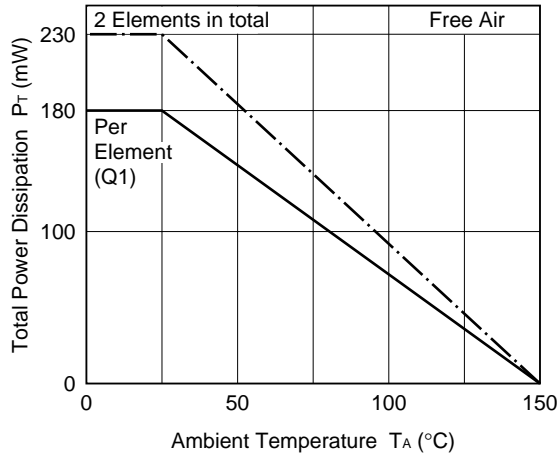
h_{FE} CLASSIFICATION

Rank	FB
Marking	89
h_{FE} Value of Q1	75 to 150
h_{FE} Value of Q2	70 to 150

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

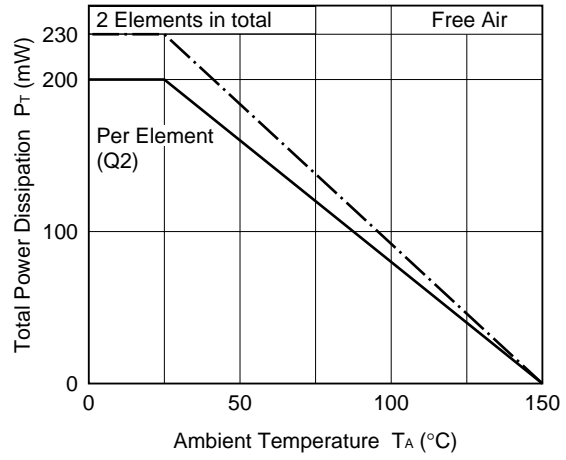
Q1

TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE

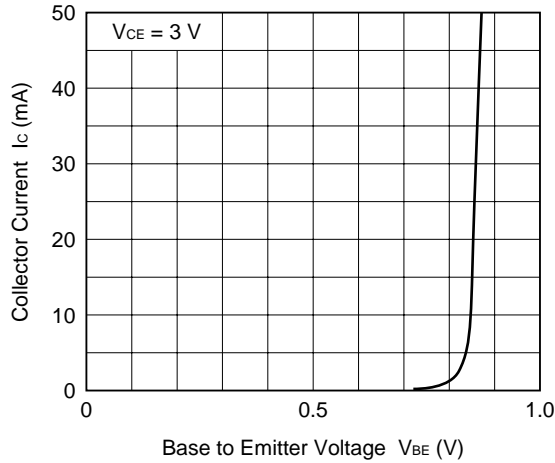


Q2

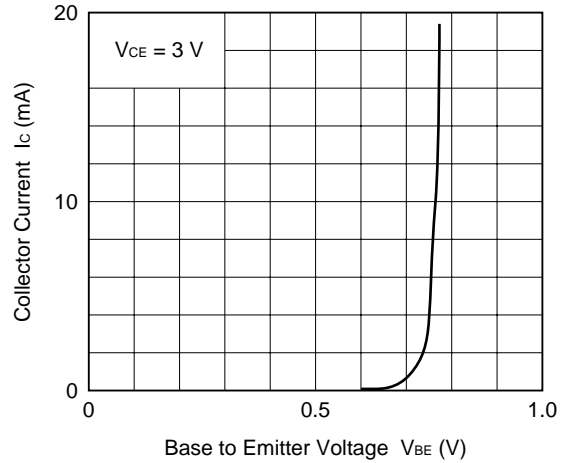
TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE



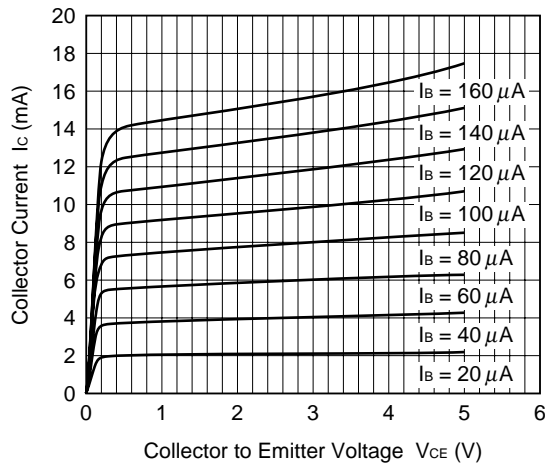
COLLECTOR CURRENT vs. BASE TO EMITTER VOLTAGE



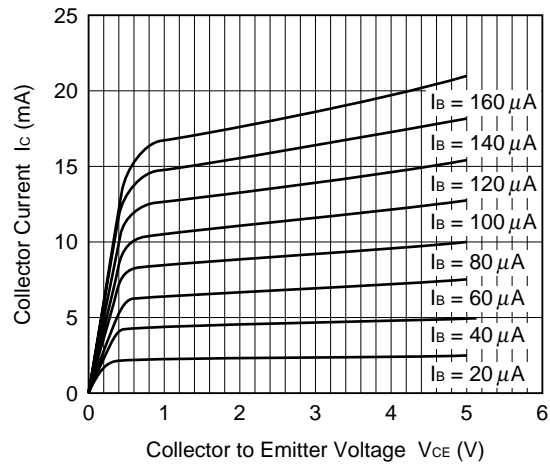
COLLECTOR CURRENT vs. BASE TO EMITTER VOLTAGE



COLLECTOR CURRENT vs. COLLECTOR TO EMITTER VOLTAGE

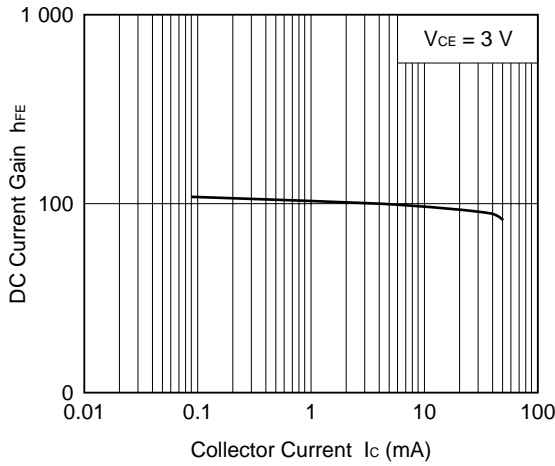


COLLECTOR CURRENT vs. COLLECTOR TO EMITTER VOLTAGE



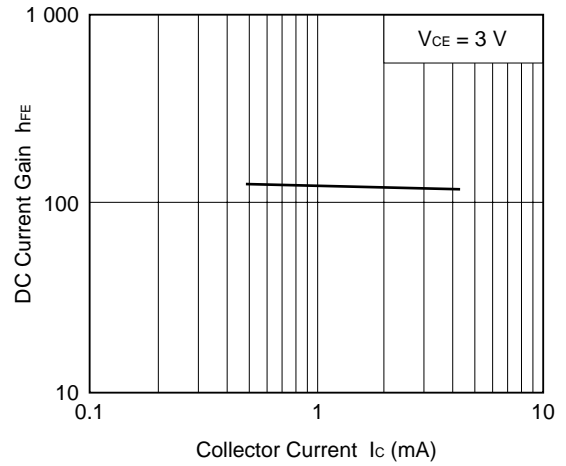
Q1

DC CURRENT GAIN vs. COLLECTOR CURRENT

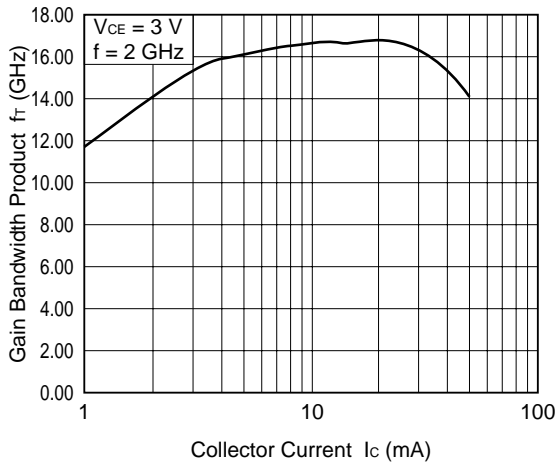


Q2

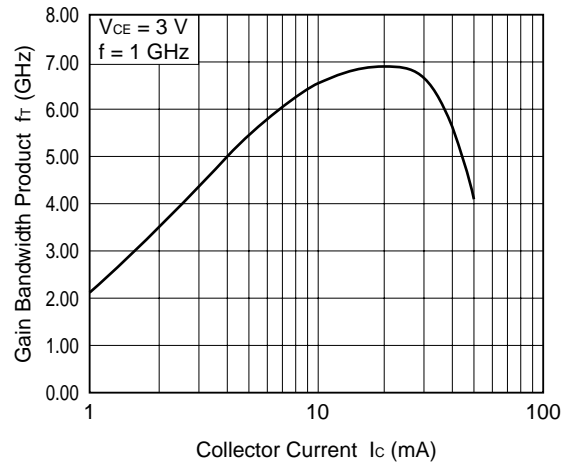
DC CURRENT GAIN vs. COLLECTOR CURRENT



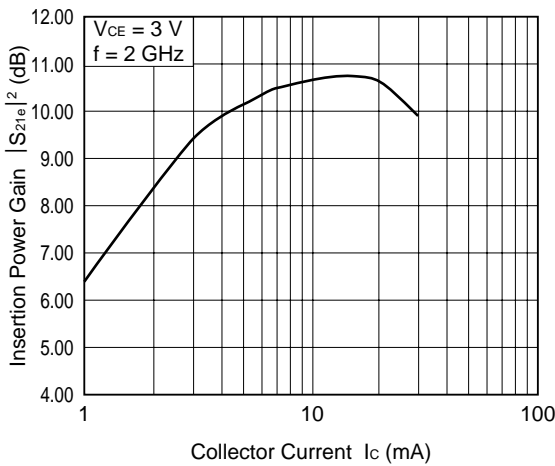
GAIN BANDWIDTH PRODUCT vs. COLLECTOR CURRENT



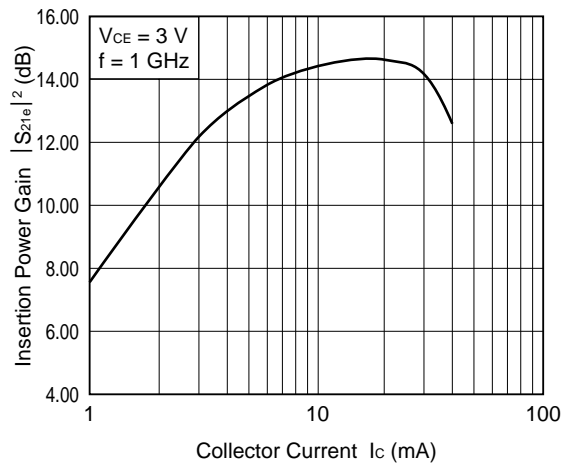
GAIN BANDWIDTH PRODUCT vs. COLLECTOR CURRENT



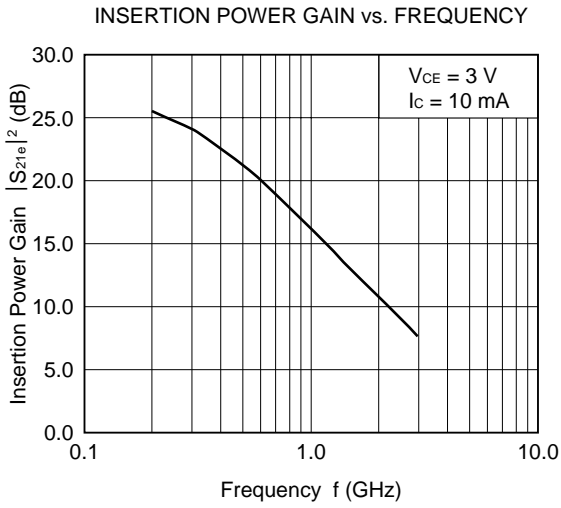
INSERTION POWER GAIN vs. COLLECTOR CURRENT



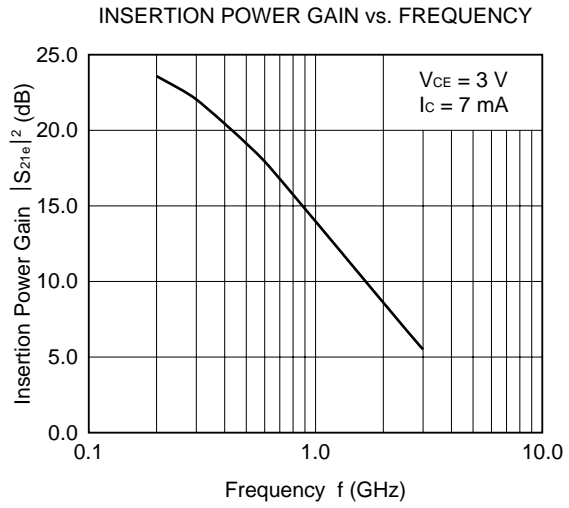
INSERTION POWER GAIN vs. COLLECTOR CURRENT



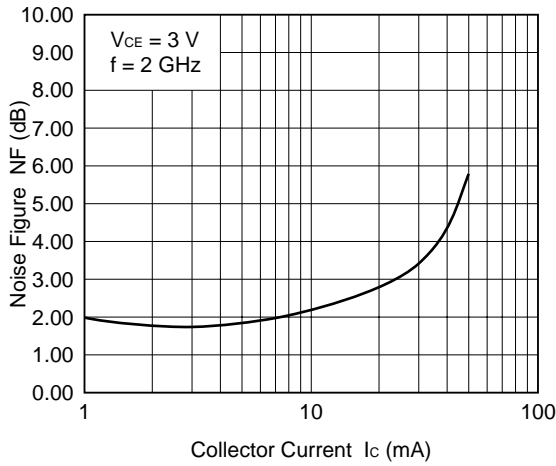
Q1



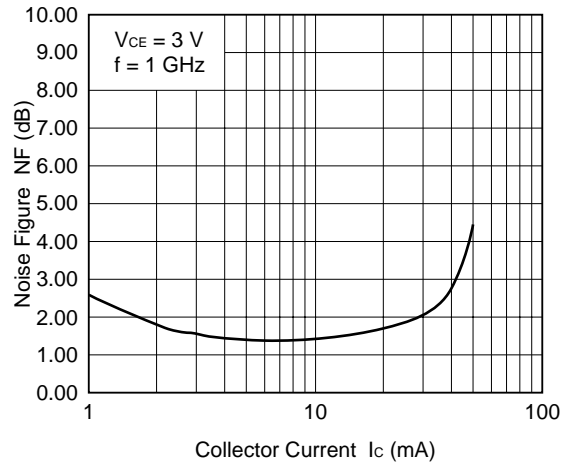
Q2



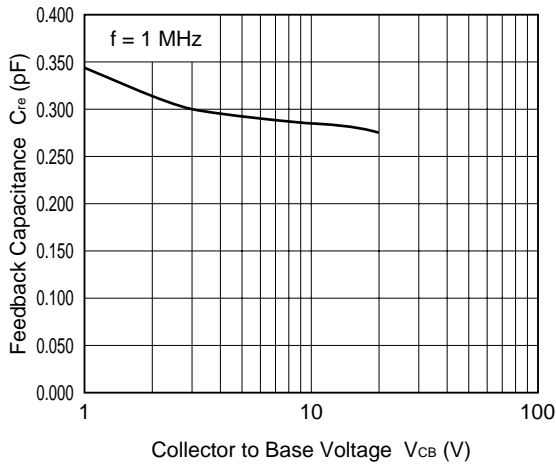
NOISE FIGURE vs. COLLECTOR CURRENT



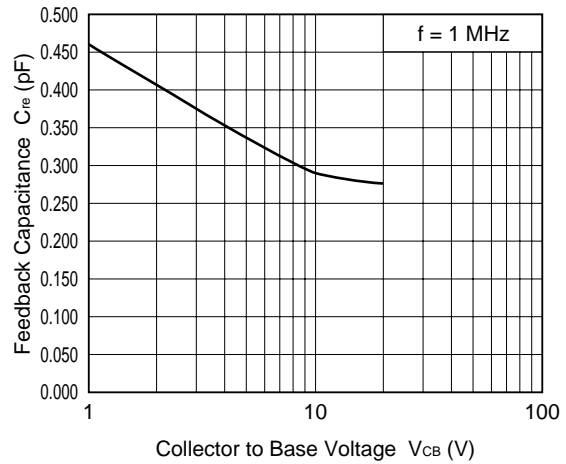
NOISE FIGURE vs. COLLECTOR CURRENT



FEEDBACK CAPACITANCE vs. COLLECTOR TO BASE VOLTAGE



FEEDBACK CAPACITANCE vs. COLLECTOR TO BASE VOLTAGE



S-PARAMETERS Q1

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	0.952	-14.6	3.781	166.9	0.012	19.7	0.997	-9.8
0.2	0.948	-25.2	3.629	154.2	0.037	67.2	0.995	-18.9
0.3	0.931	-38.1	3.537	142.6	0.055	60.4	0.976	-28.6
0.4	0.909	-51.0	3.429	130.3	0.068	49.7	0.967	-37.7
0.5	0.884	-63.4	3.380	118.8	0.086	39.5	0.945	-47.0
0.6	0.847	-75.8	3.247	106.6	0.100	31.1	0.918	-55.4
0.7	0.814	-87.5	3.167	95.3	0.113	20.5	0.892	-64.0
0.8	0.782	-99.6	3.055	84.4	0.125	10.4	0.869	-72.3
0.9	0.746	-111.4	2.968	73.3	0.137	3.3	0.844	-81.3
1.0	0.706	-123.7	2.866	62.4	0.147	-5.6	0.816	-89.7
1.1	0.668	-135.6	2.760	52.2	0.157	-15.1	0.789	-97.6
1.2	0.630	-147.0	2.683	41.6	0.162	-22.9	0.762	-105.6
1.3	0.603	-159.3	2.591	31.3	0.171	-31.3	0.740	-113.7
1.4	0.567	-171.2	2.512	21.6	0.171	-38.4	0.715	-121.1
1.5	0.539	176.5	2.424	11.6	0.176	-46.8	0.692	-128.9
1.6	0.513	164.3	2.349	1.6	0.185	-54.2	0.667	-136.4
1.7	0.488	152.2	2.277	-8.2	0.188	-60.9	0.647	-144.2
1.8	0.466	139.4	2.212	-17.7	0.191	-68.6	0.627	-151.5
1.9	0.447	126.7	2.150	-27.1	0.192	-76.1	0.606	-159.5
2.0	0.428	114.6	2.078	-36.7	0.197	-81.6	0.594	-166.1
2.1	0.414	101.1	2.013	-46.0	0.196	-89.0	0.573	-173.8
2.2	0.405	89.4	1.951	-55.2	0.202	-95.2	0.552	-178.6
2.3	0.397	76.3	1.893	-64.1	0.204	-103.4	0.537	-170.9
2.4	0.392	63.6	1.840	-73.2	0.204	-110.3	0.524	-163.2
2.5	0.385	50.6	1.785	-82.0	0.205	-116.7	0.506	-155.5
2.6	0.383	38.5	1.732	-91.0	0.206	-122.6	0.493	-147.9
2.7	0.388	27.0	1.683	-99.5	0.206	-128.7	0.479	-139.9
2.8	0.388	15.5	1.631	-108.0	0.205	-134.8	0.471	-132.3
2.9	0.393	4.4	1.586	-116.6	0.203	-141.2	0.455	-124.2
3.0	0.400	-6.4	1.551	-125.1	0.206	-147.2	0.447	-116.1

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	0.890	-18.5	9.709	161.7	0.021	36.0	0.992	-12.6
0.2	0.848	-35.4	9.062	146.2	0.036	69.5	0.958	-25.4
0.3	0.809	-50.5	8.523	131.7	0.053	51.6	0.924	-37.3
0.4	0.744	-67.1	7.960	117.0	0.065	43.6	0.867	-47.8
0.5	0.688	-82.1	7.476	103.5	0.070	35.4	0.804	-57.8
0.6	0.627	-96.1	6.870	90.8	0.082	24.7	0.756	-67.0
0.7	0.571	-110.0	6.369	78.7	0.090	15.1	0.704	-75.8
0.8	0.518	-123.4	5.908	67.5	0.098	6.9	0.661	-84.2
0.9	0.472	-136.5	5.498	56.5	0.104	1.5	0.623	-92.2
1.0	0.430	-149.6	5.135	46.4	0.107	-6.5	0.588	-99.3
1.1	0.392	-162.2	4.796	36.3	0.115	-14.0	0.556	-107.1
1.2	0.364	-175.2	4.511	26.5	0.121	-17.9	0.527	-114.1
1.3	0.337	171.4	4.240	17.0	0.125	-26.8	0.506	-121.4
1.4	0.313	157.9	4.011	7.8	0.131	-32.3	0.483	-128.1
1.5	0.298	144.6	3.796	-1.0	0.134	-38.4	0.462	-135.5
1.6	0.284	131.2	3.620	-10.5	0.142	-44.0	0.447	-142.5
1.7	0.274	117.6	3.425	-18.9	0.147	-50.3	0.427	-150.0
1.8	0.266	104.3	3.274	-27.9	0.150	-56.5	0.410	-156.8
1.9	0.263	90.9	3.140	-36.1	0.155	-63.4	0.392	-164.1
2.0	0.260	77.4	2.995	-44.9	0.163	-69.3	0.383	-171.3
2.1	0.266	63.7	2.883	-53.2	0.167	-75.3	0.365	-178.6
2.2	0.270	52.3	2.768	-61.7	0.171	-81.3	0.352	-174.0
2.3	0.276	40.2	2.660	-69.9	0.175	-87.2	0.334	-166.1
2.4	0.281	28.8	2.565	-78.1	0.178	-93.2	0.323	-158.6
2.5	0.290	17.0	2.467	-86.2	0.184	-99.9	0.310	-150.6
2.6	0.304	7.0	2.386	-94.4	0.190	-105.7	0.297	-142.3
2.7	0.312	-3.6	2.303	-102.5	0.196	-112.3	0.285	-134.0
2.8	0.321	-13.5	2.227	-110.5	0.199	-119.4	0.277	-126.2
2.9	0.335	-22.7	2.153	-118.3	0.203	-124.5	0.261	-118.1
3.0	0.347	-32.0	2.083	-125.8	0.208	-131.1	0.252	-108.9

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	0.815	-22.5	14.288	158.1	0.013	75.2	0.971	-16.2
0.2	0.767	-42.6	12.989	140.3	0.038	56.3	0.917	-29.7
0.3	0.696	-60.5	11.812	123.8	0.046	49.6	0.845	-42.9
0.4	0.614	-78.3	10.605	108.1	0.054	40.7	0.768	-53.5
0.5	0.545	-94.5	9.627	94.4	0.063	30.1	0.699	-63.4
0.6	0.477	-108.7	8.581	81.4	0.074	26.6	0.645	-71.7
0.7	0.427	-123.2	7.793	70.1	0.077	15.8	0.590	-79.9
0.8	0.375	-137.4	7.051	59.3	0.085	9.4	0.549	-87.2
0.9	0.339	-150.8	6.470	49.0	0.092	2.9	0.511	-94.3
1.0	0.302	-164.6	5.947	39.2	0.093	-0.7	0.482	-101.1
1.1	0.276	-178.0	5.487	29.6	0.100	-8.5	0.454	-108.4
1.2	0.255	168.3	5.121	20.5	0.111	-13.0	0.434	-114.6
1.3	0.241	154.3	4.788	11.5	0.114	-20.5	0.414	-122.1
1.4	0.227	139.2	4.488	2.8	0.121	-26.2	0.393	-128.7
1.5	0.219	126.0	4.223	-5.8	0.126	-31.2	0.381	-135.7
1.6	0.214	111.6	3.993	-14.5	0.133	-37.8	0.362	-142.6
1.7	0.214	98.2	3.797	-22.6	0.140	-43.6	0.351	-149.9
1.8	0.216	84.9	3.597	-31.2	0.144	-49.8	0.334	-157.1
1.9	0.221	71.5	3.455	-39.2	0.150	-56.9	0.321	-164.2
2.0	0.225	59.5	3.283	-47.8	0.156	-61.9	0.311	-171.4
2.1	0.236	47.3	3.148	-55.7	0.164	-69.1	0.295	-178.4
2.2	0.243	36.2	3.009	-64.0	0.169	-74.8	0.282	-173.6
2.3	0.253	24.9	2.894	-71.7	0.174	-81.4	0.270	-165.2
2.4	0.265	15.2	2.787	-79.9	0.181	-87.9	0.258	-158.0
2.5	0.275	4.9	2.676	-87.7	0.186	-94.0	0.246	-149.0
2.6	0.291	-4.7	2.585	-95.6	0.195	-100.7	0.233	-140.9
2.7	0.302	-14.1	2.501	-103.5	0.199	-106.9	0.224	-132.6
2.8	0.315	-23.3	2.402	-111.3	0.204	-113.8	0.215	-123.0
2.9	0.325	-32.0	2.328	-118.9	0.209	-119.9	0.199	-114.6
3.0	0.340	-40.4	2.246	-126.4	0.213	-126.8	0.195	-105.7

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	0.713	-26.5	21.445	152.2	0.032	52.8	0.962	-19.8
0.2	0.603	-53.2	18.474	130.7	0.029	63.2	0.833	-36.4
0.3	0.522	-74.1	15.783	112.6	0.041	43.3	0.734	-49.4
0.4	0.425	-92.8	13.307	96.9	0.049	41.9	0.633	-59.1
0.5	0.369	-110.2	11.614	83.5	0.054	33.2	0.570	-67.3
0.6	0.308	-124.2	10.014	71.9	0.061	32.8	0.512	-74.1
0.7	0.267	-140.0	8.853	60.9	0.065	21.8	0.467	-80.6
0.8	0.232	-154.8	7.913	51.0	0.072	16.8	0.437	-87.3
0.9	0.208	-169.3	7.113	41.4	0.081	13.3	0.411	-92.5
1.0	0.188	175.0	6.506	32.3	0.086	5.7	0.387	-99.4
1.1	0.176	159.2	5.958	23.3	0.096	-0.9	0.369	-105.6
1.2	0.167	143.5	5.524	14.8	0.101	-6.8	0.351	-112.8
1.3	0.164	129.9	5.134	6.3	0.110	-13.7	0.336	-119.0
1.4	0.161	115.5	4.809	-1.7	0.113	-17.7	0.327	-125.3
1.5	0.165	101.5	4.506	-10.1	0.122	-24.0	0.312	-132.8
1.6	0.171	87.4	4.242	-18.4	0.129	-31.4	0.299	-139.6
1.7	0.178	75.5	4.004	-26.4	0.135	-36.9	0.289	-146.6
1.8	0.186	63.3	3.816	-34.5	0.143	-43.4	0.276	-153.7
1.9	0.196	52.0	3.634	-42.1	0.151	-50.0	0.267	-161.6
2.0	0.204	41.5	3.461	-50.2	0.158	-56.6	0.257	-168.5
2.1	0.218	31.0	3.312	-58.1	0.162	-63.0	0.242	-175.3
2.2	0.230	21.5	3.169	-66.1	0.171	-70.2	0.232	-176.1
2.3	0.243	12.4	3.046	-73.7	0.178	-76.1	0.221	-167.1
2.4	0.254	3.9	2.930	-81.4	0.185	-83.6	0.209	-159.0
2.5	0.266	-5.8	2.823	-89.2	0.193	-89.7	0.196	-150.5
2.6	0.284	-14.1	2.719	-97.1	0.197	-96.9	0.187	-141.2
2.7	0.297	-22.9	2.627	-104.5	0.206	-102.6	0.175	-132.1
2.8	0.305	-30.7	2.527	-112.3	0.211	-109.6	0.166	-121.2
2.9	0.319	-38.5	2.452	-119.8	0.216	-116.6	0.154	-112.8
3.0	0.331	-46.4	2.372	-127.4	0.220	-123.5	0.149	-102.6

S-PARAMETERS Q2

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	0.966	-19.4	4.009	163.3	0.026	37.6	1.002	-11.1
0.2	0.934	-37.8	3.771	148.1	0.050	63.4	0.978	-20.8
0.3	0.915	-55.2	3.587	134.0	0.070	46.6	0.957	-30.8
0.4	0.881	-73.2	3.401	119.4	0.087	40.4	0.930	-40.5
0.5	0.851	-90.0	3.240	106.0	0.096	27.3	0.895	-49.3
0.6	0.812	-106.1	3.030	92.8	0.110	16.3	0.854	-57.9
0.7	0.780	-122.2	2.861	79.9	0.123	4.5	0.819	-66.2
0.8	0.753	-137.2	2.700	68.3	0.130	-4.3	0.791	-73.7
0.9	0.723	-151.6	2.535	56.9	0.138	-12.5	0.763	-81.9
1.0	0.700	-165.7	2.403	45.8	0.139	-21.4	0.737	-89.2
1.1	0.678	-179.4	2.270	34.8	0.142	-30.9	0.712	-96.5
1.2	0.661	167.1	2.157	24.3	0.147	-39.5	0.691	-103.9
1.3	0.647	154.4	2.046	14.2	0.147	-46.2	0.675	-111.1
1.4	0.640	141.9	1.953	4.2	0.146	-53.1	0.657	-118.2
1.5	0.631	129.4	1.853	-5.6	0.147	-61.0	0.639	-125.4
1.6	0.630	117.7	1.783	-15.6	0.146	-67.0	0.625	-132.6
1.7	0.624	106.2	1.703	-24.8	0.145	-72.8	0.612	-140.3
1.8	0.620	94.8	1.630	-34.4	0.141	-79.5	0.603	-147.2
1.9	0.621	84.0	1.576	-43.5	0.140	-84.7	0.592	-154.7
2.0	0.616	73.0	1.508	-53.0	0.138	-89.6	0.582	-162.3
2.1	0.618	62.6	1.449	-61.7	0.136	-96.3	0.568	-169.5
2.2	0.619	52.2	1.395	-70.6	0.133	-100.1	0.558	-177.1
2.3	0.622	42.5	1.347	-79.1	0.131	-104.9	0.551	-175.3
2.4	0.627	32.8	1.305	-87.7	0.132	-109.2	0.549	-166.9
2.5	0.631	23.2	1.261	-96.3	0.131	-112.7	0.539	-158.7
2.6	0.633	13.5	1.223	-104.8	0.131	-117.0	0.535	-150.5
2.7	0.635	4.8	1.181	-113.1	0.133	-120.3	0.524	-141.9
2.8	0.638	-4.1	1.146	-121.3	0.134	-123.8	0.520	-133.6
2.9	0.646	-12.6	1.118	-129.3	0.134	-127.2	0.510	-124.8
3.0	0.650	-21.1	1.081	-137.2	0.141	-130.2	0.505	-115.8

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	0.866	-27.8	10.288	157.1	0.017	62.1	0.980	-15.5
0.2	0.831	-52.0	9.222	138.4	0.048	59.3	0.919	-28.3
0.3	0.779	-74.1	8.316	121.7	0.063	40.3	0.852	-40.8
0.4	0.713	-95.3	7.433	105.5	0.070	32.4	0.772	-51.5
0.5	0.666	-114.1	6.706	91.5	0.079	23.2	0.709	-60.3
0.6	0.614	-131.7	5.981	78.5	0.086	13.6	0.653	-68.0
0.7	0.574	-148.5	5.383	66.7	0.084	4.1	0.608	-75.0
0.8	0.551	-163.7	4.885	55.6	0.095	-2.8	0.567	-82.1
0.9	0.527	-177.8	4.460	44.9	0.100	-8.2	0.539	-89.0
1.0	0.510	168.6	4.101	34.7	0.101	-14.2	0.510	-95.3
1.1	0.500	155.3	3.805	25.0	0.106	-21.0	0.487	-101.9
1.2	0.491	143.2	3.550	15.5	0.111	-25.5	0.468	-108.6
1.3	0.487	131.7	3.320	6.4	0.111	-32.5	0.454	-114.9
1.4	0.486	119.7	3.118	-2.7	0.116	-37.2	0.436	-121.6
1.5	0.488	108.9	2.940	-11.5	0.118	-42.6	0.420	-128.1
1.6	0.486	98.0	2.785	-20.7	0.122	-48.6	0.406	-134.9
1.7	0.488	87.9	2.640	-29.4	0.126	-53.3	0.397	-141.5
1.8	0.492	77.6	2.521	-37.9	0.128	-58.3	0.389	-148.3
1.9	0.496	67.9	2.407	-46.2	0.132	-64.2	0.373	-155.5
2.0	0.497	58.0	2.290	-54.7	0.138	-69.8	0.363	-162.7
2.1	0.507	48.6	2.195	-62.9	0.139	-74.9	0.353	-169.7
2.2	0.508	39.4	2.110	-71.6	0.144	-79.7	0.341	-177.2
2.3	0.516	30.8	2.028	-79.6	0.147	-84.1	0.331	-175.3
2.4	0.521	22.0	1.954	-87.8	0.154	-89.8	0.323	-167.5
2.5	0.525	13.2	1.883	-95.7	0.158	-95.2	0.311	-159.5
2.6	0.535	4.7	1.821	-104.0	0.162	-101.1	0.303	-151.6
2.7	0.540	-3.4	1.762	-111.7	0.169	-105.5	0.294	-143.3
2.8	0.546	-11.6	1.701	-119.8	0.173	-112.1	0.288	-134.6
2.9	0.553	-19.6	1.653	-127.6	0.178	-117.0	0.276	-126.3
3.0	0.560	-27.4	1.600	-135.3	0.185	-123.2	0.274	-117.5

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	0.820	-33.4	14.905	152.8	0.020	47.4	0.956	-18.6
0.2	0.751	-62.2	12.868	131.8	0.047	54.3	0.856	-34.1
0.3	0.675	-87.3	11.094	113.7	0.054	35.5	0.762	-47.0
0.4	0.605	-109.5	9.504	97.5	0.062	31.4	0.673	-56.4
0.5	0.547	-129.0	8.289	83.8	0.063	22.7	0.595	-64.5
0.6	0.513	-146.5	7.248	71.5	0.072	17.2	0.540	-71.6
0.7	0.480	-162.9	6.399	60.2	0.073	9.0	0.499	-77.9
0.8	0.462	-177.7	5.744	49.7	0.079	1.3	0.467	-84.2
0.9	0.448	168.9	5.201	39.6	0.086	-1.1	0.441	-90.2
1.0	0.441	155.7	4.748	30.2	0.092	-7.0	0.419	-96.1
1.1	0.433	143.1	4.364	20.9	0.095	-15.1	0.397	-102.4
1.2	0.429	131.5	4.051	11.9	0.099	-17.8	0.382	-107.6
1.3	0.432	120.5	3.771	3.1	0.106	-24.6	0.368	-114.2
1.4	0.430	109.4	3.528	-5.5	0.107	-28.8	0.353	-121.2
1.5	0.436	99.0	3.322	-14.2	0.116	-34.3	0.342	-127.5
1.6	0.437	89.2	3.132	-22.8	0.120	-40.1	0.328	-133.9
1.7	0.444	79.8	2.960	-31.1	0.126	-44.9	0.318	-141.0
1.8	0.448	70.4	2.826	-39.5	0.129	-50.8	0.308	-147.1
1.9	0.455	61.0	2.687	-47.5	0.136	-57.1	0.298	-154.5
2.0	0.458	51.9	2.563	-55.8	0.140	-61.6	0.288	-161.0
2.1	0.468	42.9	2.453	-64.0	0.146	-68.6	0.274	-167.7
2.2	0.474	33.7	2.351	-72.3	0.152	-74.1	0.266	-175.4
2.3	0.482	25.8	2.262	-80.1	0.157	-78.8	0.255	-176.3
2.4	0.483	17.0	2.171	-88.0	0.165	-86.1	0.247	-169.8
2.5	0.494	8.8	2.092	-96.0	0.170	-90.9	0.235	-161.2
2.6	0.502	0.8	2.025	-104.0	0.176	-96.8	0.225	-153.3
2.7	0.509	-7.2	1.956	-111.5	0.182	-103.4	0.216	-144.3
2.8	0.516	-15.1	1.883	-119.4	0.189	-109.8	0.209	-136.1
2.9	0.525	-22.6	1.831	-127.2	0.194	-115.3	0.196	-127.0
3.0	0.533	-30.4	1.772	-134.7	0.202	-121.0	0.192	-117.7

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

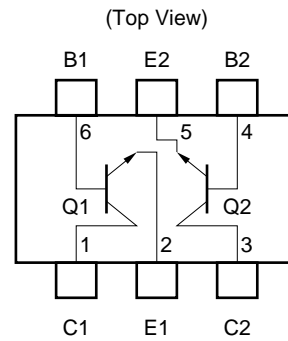
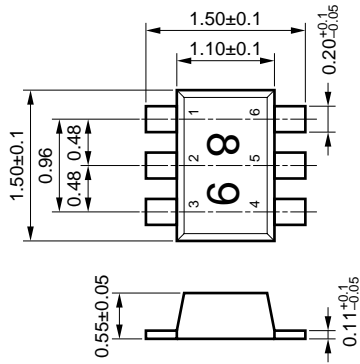
FREQUENCY GHz	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
0.1	0.802	-36.6	17.259	151.1	0.030	29.4	0.952	-20.5
0.2	0.708	-66.3	14.639	128.6	0.043	58.3	0.819	-36.6
0.3	0.621	-93.5	12.355	110.2	0.048	35.5	0.715	-49.7
0.4	0.550	-115.4	10.389	94.3	0.056	28.9	0.618	-58.9
0.5	0.508	-135.0	8.980	80.8	0.061	25.6	0.551	-66.0
0.6	0.469	-152.7	7.774	68.8	0.072	19.3	0.500	-72.6
0.7	0.445	-168.1	6.830	57.8	0.074	10.7	0.453	-78.9
0.8	0.428	176.9	6.100	47.6	0.078	7.0	0.424	-84.8
0.9	0.416	163.6	5.492	38.0	0.083	2.1	0.401	-90.5
1.0	0.413	150.8	5.013	28.6	0.091	-3.7	0.380	-96.3
1.1	0.406	138.6	4.594	19.5	0.096	-9.5	0.360	-102.3
1.2	0.405	127.8	4.260	10.6	0.096	-15.2	0.349	-108.0
1.3	0.410	117.2	3.958	2.1	0.106	-21.4	0.332	-114.2
1.4	0.411	106.1	3.699	-6.6	0.112	-26.3	0.319	-120.4
1.5	0.414	96.2	3.479	-14.9	0.116	-31.3	0.308	-126.8
1.6	0.418	86.6	3.275	-23.5	0.122	-37.1	0.298	-133.2
1.7	0.422	77.5	3.095	-31.8	0.129	-42.0	0.287	-140.4
1.8	0.429	68.2	2.948	-39.9	0.134	-48.2	0.277	-146.6
1.9	0.435	58.9	2.815	-47.9	0.142	-54.6	0.268	-154.3
2.0	0.441	50.1	2.675	-55.9	0.148	-60.6	0.258	-160.6
2.1	0.450	41.2	2.559	-64.0	0.153	-66.0	0.243	-167.4
2.2	0.457	32.6	2.454	-72.3	0.159	-72.2	0.233	-174.7
2.3	0.464	24.4	2.362	-80.0	0.164	-77.9	0.223	-177.6
2.4	0.471	16.1	2.270	-88.1	0.170	-84.3	0.217	-169.8
2.5	0.477	7.7	2.188	-95.8	0.179	-90.1	0.202	-161.6
2.6	0.487	0.0	2.113	-103.7	0.183	-96.2	0.194	-153.6
2.7	0.494	-7.7	2.044	-111.2	0.190	-102.5	0.184	-144.6
2.8	0.501	-15.3	1.975	-119.2	0.196	-109.0	0.175	-136.4
2.9	0.511	-23.3	1.920	-127.0	0.203	-114.6	0.165	-128.1
3.0	0.517	-30.7	1.854	-134.2	0.209	-121.0	0.157	-117.3

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	0.709	-45.9	23.344	145.0	0.036	35.3	0.925	-25.6
0.2	0.582	-81.2	18.347	120.2	0.037	58.3	0.724	-41.5
0.3	0.506	-109.5	14.613	101.7	0.041	39.1	0.603	-53.3
0.4	0.449	-132.8	11.837	86.5	0.048	39.5	0.519	-60.5
0.5	0.418	-151.9	9.941	74.2	0.054	30.6	0.453	-66.3
0.6	0.395	-168.9	8.491	62.9	0.058	26.0	0.412	-71.5
0.7	0.385	176.3	7.391	52.6	0.060	14.6	0.381	-77.0
0.8	0.375	162.0	6.530	43.3	0.072	12.6	0.356	-82.5
0.9	0.371	150.2	5.887	33.9	0.080	9.7	0.340	-88.2
1.0	0.369	138.3	5.324	25.0	0.084	3.3	0.325	-93.0
1.1	0.372	126.8	4.866	16.3	0.092	-3.1	0.310	-99.2
1.2	0.372	116.6	4.502	7.8	0.097	-8.1	0.298	-105.1
1.3	0.380	107.1	4.181	-0.5	0.102	-13.3	0.286	-110.7
1.4	0.384	97.0	3.897	-8.7	0.109	-19.5	0.277	-116.9
1.5	0.390	88.1	3.665	-17.0	0.117	-24.5	0.267	-123.9
1.6	0.394	78.3	3.436	-25.1	0.121	-30.9	0.256	-130.2
1.7	0.402	70.3	3.249	-33.2	0.133	-36.8	0.245	-137.5
1.8	0.407	61.1	3.086	-41.4	0.137	-43.8	0.238	-143.6
1.9	0.416	52.4	2.939	-49.3	0.144	-49.8	0.227	-150.4
2.0	0.421	43.9	2.809	-57.4	0.152	-56.1	0.219	-157.4
2.1	0.433	35.3	2.681	-65.1	0.156	-61.8	0.208	-163.6
2.2	0.440	27.6	2.567	-73.2	0.164	-68.7	0.200	-171.3
2.3	0.448	19.3	2.467	-80.8	0.169	-74.2	0.185	-179.0
2.4	0.455	11.7	2.372	-88.7	0.176	-81.5	0.181	173.5
2.5	0.463	3.8	2.284	-96.3	0.185	-87.7	0.167	165.7
2.6	0.472	-3.8	2.203	-104.2	0.192	-93.8	0.158	156.2
2.7	0.477	-11.4	2.132	-111.5	0.198	-99.2	0.147	147.8
2.8	0.488	-19.2	2.058	-119.5	0.205	-106.5	0.137	138.7
2.9	0.495	-26.5	1.996	-126.8	0.212	-112.9	0.127	130.9
3.0	0.504	-33.9	1.939	-134.6	0.219	-120.0	0.123	121.4

PACKAGE DIMENSIONS

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



PIN CONNECTIONS

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

[MEMO]

[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.