

DATA SHEET

NEC

NPN SILICON RF TRANSISTOR

2SC5435

NPN EPITAXIAL SILICON TRANSISTOR FOR HIGH-FREQUENCY LOW-NOISE AMPLIFICATION FLAT-LEAD 3-PIN THIN-TYPE ULTRA SUPER MINIMOLD

FEATURES

- Contains same chip as 2SC5010
- Flat-lead 3-pin thin-type ultra super minimold package

★ ORDERING INFORMATION

Part Number	Quantity	Supplying Form
2SC5435	50 pcs (Non reel)	• 8 mm wide embossed taping
2SC5435-T1	3 kpcs/reel	• Pin 3 (collector) face the perforation side of the tape

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

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	30	mA
Total Power Dissipation	P _{tot} ^{Note}	125	mW
Junction Temperature	T _j	150	°C
Storage Temperature	T _{stg}	-65 to +150	°C

Note Free air

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

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 Compound Semiconductor Devices representative for availability and additional information.

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} = 3 V, I _C = 10 mA	75	–	140	–
Gain Bandwidth Product	f _T	V _{CE} = 3 V, I _C = 10 mA, f = 2 GHz	–	12.0	–	GHz
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
Reverse Transfer Capacitance	C _{re} ^{Note 2}	V _{CB} = 3 V, I _E = 0 mA, f = 1 MHz	–	0.4	0.7	pF

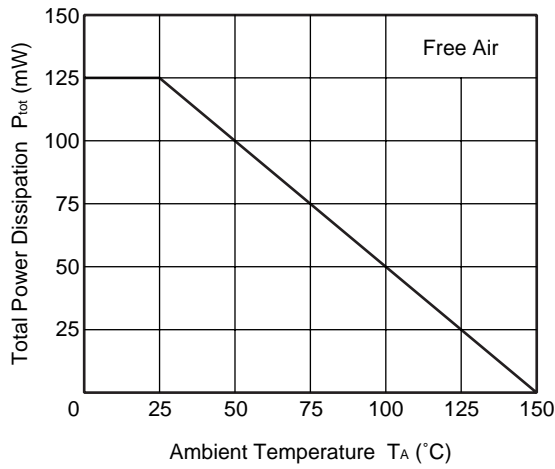
- Notes** 1. Pulse measurement: PW ≤ 350 μs, Duty Cycle ≤ 2%
 2. Collector to base capacitance when the emitter grounded

h_{FE} CLASSIFICATION

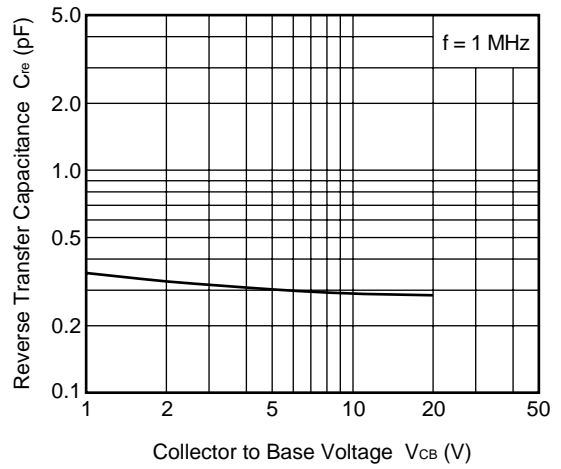
Rank	EB	FB
Marking	TK	TL
h _{FE} Value	75 to 110	95 to 140

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

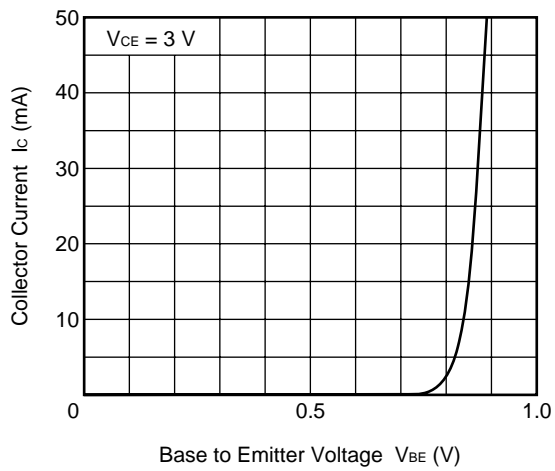
TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE



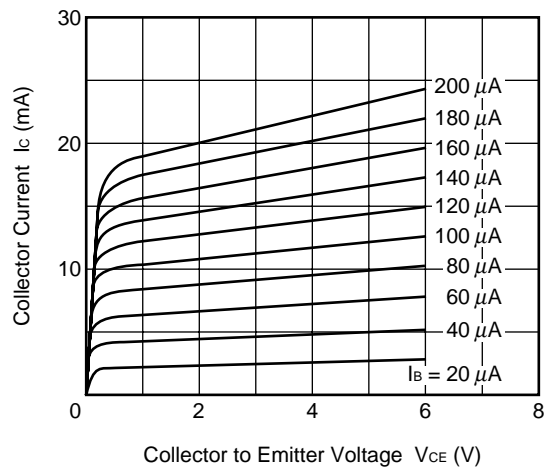
REVERSE TRANSFER CAPACITANCE vs. COLLECTOR TO BASE VOLTAGE



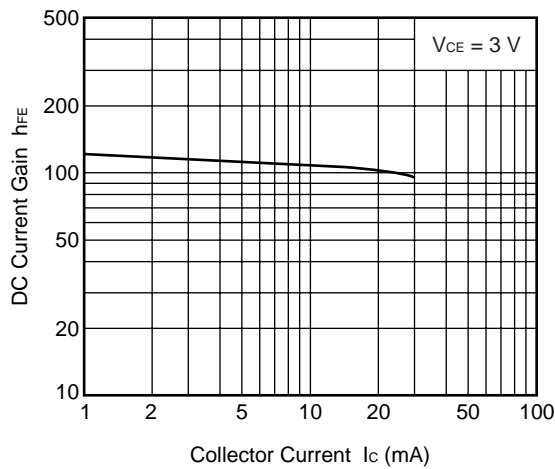
COLLECTOR CURRENT vs. BASE TO EMITTER VOLTAGE



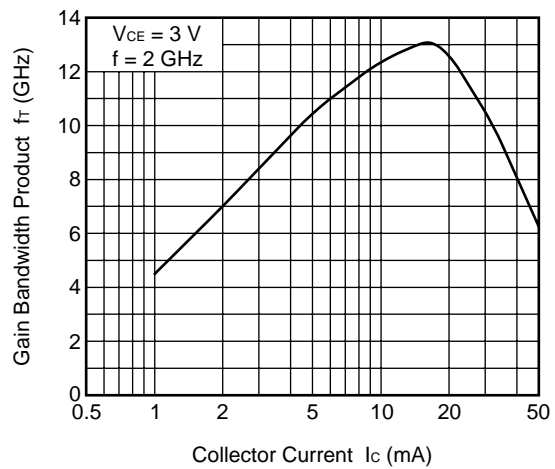
COLLECTOR CURRENT vs. COLLECTOR TO EMITTER VOLTAGE



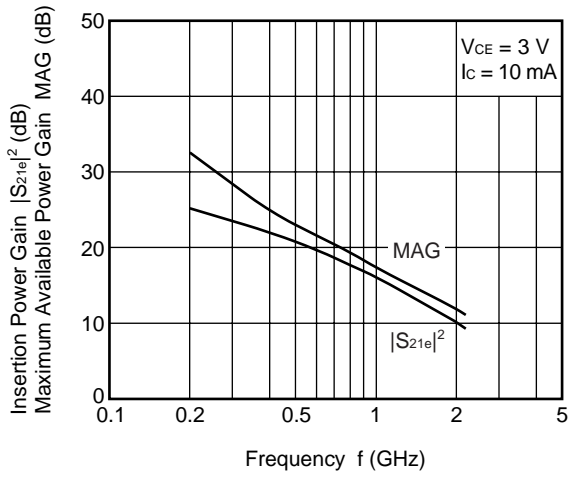
DC CURRENT GAIN vs. COLLECTOR CURRENT



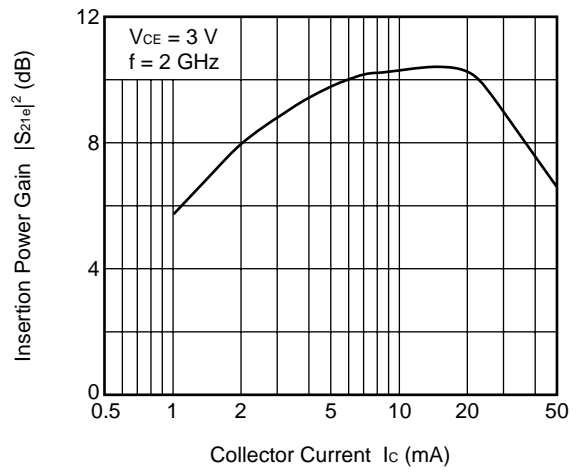
GAIN BANDWIDTH PRODUCT vs. COLLECTOR CURRENT



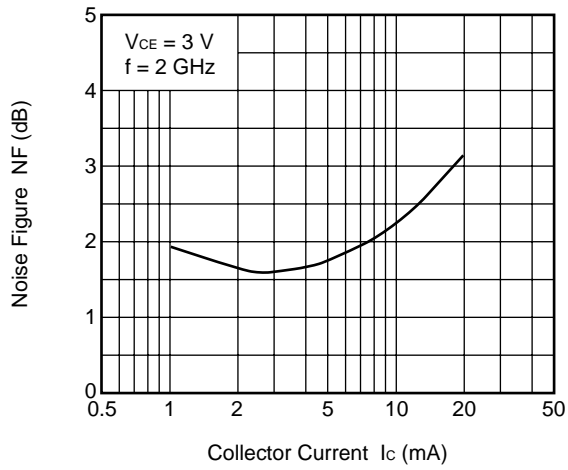
INSERTION POWER GAIN, MAG vs. FREQUENCY



INSERTION POWER GAIN vs. COLLECTOR CURRENT



NOISE FIGURE vs. COLLECTOR CURRENT



Remark The graphs indicate nominal characteristics.

S-PARAMETERS

V_{CE} = 1 V, I_c = 1 mA, Z₀ = 50 Ω

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.2	0.950	-15.4	3.449	164.3	0.050	80.0	0.985	-9.0
0.4	0.874	-30.3	3.205	149.9	0.094	68.3	0.921	-17.6
0.6	0.804	-47.6	2.937	136.1	0.132	59.3	0.840	-28.0
0.8	0.764	-62.1	2.773	123.9	0.160	51.8	0.796	-37.4
1.0	0.700	-74.5	2.666	114.7	0.181	44.6	0.758	-43.0
1.2	0.628	-86.3	2.427	106.6	0.200	38.8	0.697	-46.8
1.4	0.574	-98.6	2.200	96.9	0.216	35.6	0.630	-51.1
1.6	0.529	-110.5	2.080	88.4	0.220	33.5	0.570	-55.7
1.8	0.487	-121.4	1.938	81.7	0.220	31.1	0.530	-60.5
2.0	0.447	-134.5	1.779	75.6	0.218	27.3	0.493	-64.9
2.2	0.438	-147.4	1.660	68.2	0.222	25.2	0.453	-69.4
2.4	0.446	-157.1	1.581	61.7	0.224	24.4	0.424	-75.7
2.6	0.445	-164.9	1.523	57.4	0.225	24.1	0.412	-81.8
2.8	0.440	-172.6	1.425	53.3	0.220	24.1	0.406	-86.3
3.0	0.444	179.8	1.332	48.0	0.216	23.5	0.387	-90.2

V_{CE} = 1 V, I_c = 3 mA, Z₀ = 50 Ω

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.2	0.845	-27.5	8.623	154.9	0.048	72.9	0.936	-17.5
0.4	0.692	-52.2	7.239	135.2	0.080	60.6	0.777	-31.9
0.6	0.596	-75.4	6.076	119.0	0.103	53.2	0.643	-44.6
0.8	0.516	-92.2	5.213	107.7	0.116	48.5	0.561	-53.0
1.0	0.447	-107.1	4.559	99.7	0.129	45.3	0.492	-57.2
1.2	0.398	-121.7	4.018	92.7	0.141	43.5	0.429	-59.9
1.4	0.375	-134.1	3.526	84.8	0.154	43.6	0.373	-63.5
1.6	0.355	-145.5	3.117	78.8	0.163	44.7	0.328	-67.9
1.8	0.336	-157.2	2.779	73.8	0.169	45.0	0.295	-72.2
2.0	0.336	-169.7	2.520	69.4	0.175	44.1	0.266	-76.7
2.2	0.354	-179.1	2.330	63.9	0.185	43.1	0.235	-83.0
2.4	0.370	174.4	2.187	58.8	0.196	42.6	0.217	-91.3
2.6	0.380	168.5	2.083	55.6	0.209	43.0	0.210	-99.1
2.8	0.391	162.7	1.931	52.8	0.214	43.5	0.203	-105.2
3.0	0.406	158.0	1.785	48.3	0.218	42.8	0.194	-111.2

V_{CE} = 1 V, I_c = 5 mA, Z₀ = 50 Ω

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.2	0.750	-36.8	12.139	148.1	0.043	69.6	0.883	-23.4
0.4	0.570	-67.3	9.418	126.2	0.070	58.2	0.669	-39.8
0.6	0.476	-92.0	7.424	110.4	0.087	53.3	0.526	-51.9
0.8	0.404	-109.5	6.104	100.4	0.098	51.4	0.444	-58.7
1.0	0.354	-125.4	5.191	93.7	0.111	50.3	0.380	-61.7
1.2	0.330	-140.0	4.491	87.3	0.124	49.8	0.326	-63.7
1.4	0.323	-151.1	3.905	80.4	0.139	50.3	0.281	-67.3
1.6	0.312	-161.5	3.422	75.5	0.151	51.5	0.245	-71.8
1.8	0.308	-172.4	3.031	71.2	0.161	52.3	0.219	-76.5
2.0	0.320	177.0	2.732	67.1	0.170	51.2	0.194	-82.0
2.2	0.342	169.8	2.517	61.9	0.183	49.8	0.169	-90.3
2.4	0.360	164.6	2.361	57.6	0.197	48.9	0.157	-100.8
2.6	0.373	159.6	2.243	54.8	0.212	48.9	0.154	-110.5
2.8	0.389	154.8	2.075	52.4	0.220	49.0	0.150	-118.5
3.0	0.405	151.2	1.914	48.2	0.226	47.8	0.147	-126.7

V_{CE} = 3 V, I_c = 1 mA, Z_o = 50 Ω

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.2	0.954	-13.7	3.491	165.5	0.040	79.6	0.989	-7.4
0.4	0.886	-27.2	3.221	152.2	0.078	71.1	0.935	-14.5
0.6	0.817	-43.2	2.976	139.2	0.110	62.2	0.864	-23.4
0.8	0.782	-57.0	2.826	127.6	0.134	55.5	0.828	-31.9
1.0	0.725	-68.5	2.750	118.6	0.154	48.9	0.803	-36.9
1.2	0.654	-79.3	2.528	111.1	0.171	43.2	0.751	-40.0
1.4	0.594	-90.9	2.298	101.8	0.186	39.7	0.690	-43.5
1.6	0.545	-102.6	2.186	93.2	0.191	38.2	0.632	-47.4
1.8	0.502	-112.9	2.053	86.4	0.193	36.2	0.592	-51.8
2.0	0.452	-125.6	1.892	80.3	0.191	32.5	0.558	-55.7
2.2	0.434	-138.7	1.770	73.0	0.196	30.6	0.523	-59.2
2.4	0.440	-149.2	1.689	66.6	0.199	29.6	0.491	-64.5
2.6	0.436	-157.2	1.632	61.9	0.202	29.8	0.477	-69.9
2.8	0.427	-165.3	1.536	57.9	0.197	30.6	0.472	-74.1
3.0	0.427	-173.5	1.438	52.9	0.193	30.3	0.453	-77.3

V_{CE} = 3 V, I_c = 3 mA, Z_o = 50 Ω

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.2	0.858	-24.0	8.684	157.0	0.038	74.9	0.951	-14.1
0.4	0.716	-45.8	7.442	138.3	0.067	63.9	0.818	-25.7
0.6	0.617	-67.2	6.355	122.7	0.088	56.7	0.693	-36.4
0.8	0.538	-82.8	5.529	111.3	0.101	52.6	0.621	-43.8
1.0	0.460	-96.4	4.885	103.3	0.112	49.4	0.564	-47.0
1.2	0.399	-109.7	4.332	96.5	0.124	47.3	0.504	-48.4
1.4	0.365	-122.4	3.819	88.6	0.136	47.6	0.449	-50.6
1.6	0.338	-133.9	3.390	82.5	0.145	48.7	0.403	-53.5
1.8	0.314	-145.6	3.039	77.6	0.151	49.4	0.370	-56.9
2.0	0.304	-159.0	2.758	73.0	0.157	48.2	0.341	-60.0
2.2	0.316	-170.1	2.549	67.1	0.167	47.7	0.314	-63.5
2.4	0.331	-177.4	2.402	62.6	0.178	47.3	0.289	-69.1
2.6	0.340	175.8	2.289	59.2	0.191	47.6	0.275	-74.9
2.8	0.349	169.4	2.133	56.4	0.197	48.6	0.268	-79.6
3.0	0.364	163.8	1.977	52.1	0.201	47.9	0.252	-83.3

V_{CE} = 3 V, I_c = 5 mA, Z_o = 50 Ω

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.2	0.773	-31.6	12.320	150.7	0.036	72.7	0.910	-18.8
0.4	0.595	-58.3	9.846	129.7	0.060	62.0	0.725	-31.8
0.6	0.491	-81.2	7.923	114.1	0.075	56.6	0.587	-41.7
0.8	0.412	-97.4	6.600	103.8	0.087	55.2	0.512	-47.3
1.0	0.350	-111.8	5.638	96.9	0.098	54.0	0.457	-49.1
1.2	0.310	-126.2	4.908	90.8	0.110	53.7	0.406	-49.4
1.4	0.293	-138.4	4.286	83.9	0.124	53.8	0.362	-51.0
1.6	0.278	-149.6	3.766	78.8	0.136	55.2	0.323	-53.6
1.8	0.267	-161.4	3.388	74.5	0.145	56.1	0.296	-56.8
2.0	0.274	-173.7	3.018	70.5	0.154	55.1	0.272	-60.1
2.2	0.293	177.6	2.786	65.3	0.165	54.0	0.247	-63.9
2.4	0.310	171.5	2.600	60.9	0.179	53.0	0.225	-69.8
2.6	0.323	165.9	2.492	58.1	0.194	53.1	0.212	-76.5
2.8	0.337	160.4	2.314	55.6	0.203	53.5	0.204	-82.2
3.0	0.354	156.2	2.138	51.7	0.208	52.4	0.191	-86.9

$V_{CE} = 3\text{ V}$, $I_C = 7\text{ mA}$, $Z_o = 50\ \Omega$

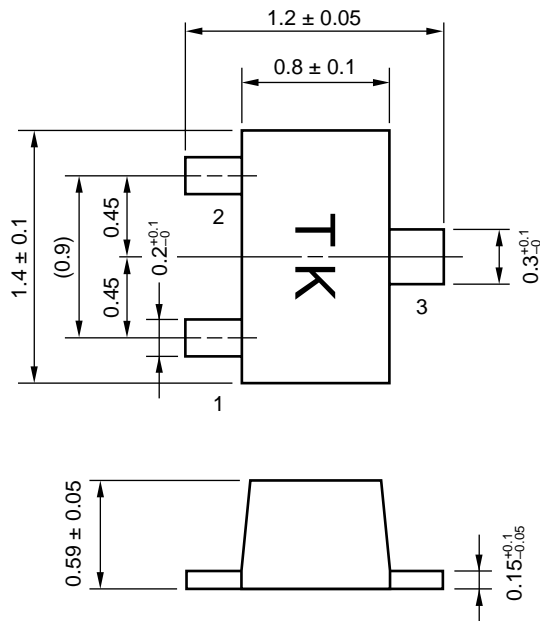
Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.2	0.688	-38.7	15.412	145.5	0.034	70.5	0.863	-22.7
0.4	0.498	-69.0	11.461	123.2	0.053	61.6	0.645	-36.0
0.6	0.400	-92.5	8.826	108.0	0.067	58.4	0.509	-44.4
0.8	0.332	-109.1	7.158	99.1	0.079	58.4	0.439	-48.5
1.0	0.286	-124.4	6.055	93.0	0.091	58.1	0.391	-49.2
1.2	0.263	-139.1	5.221	87.3	0.104	57.9	0.349	-48.9
1.4	0.257	-150.4	4.513	81.1	0.118	58.4	0.311	-50.2
1.6	0.249	-161.0	3.957	76.6	0.133	59.0	0.277	-52.6
1.8	0.248	-172.1	3.495	72.8	0.143	60.3	0.253	-55.9
2.0	0.262	177.1	3.158	69.1	0.153	59.1	0.232	-59.2
2.2	0.283	169.9	2.903	64.2	0.166	57.6	0.209	-63.3
2.4	0.302	164.9	2.712	59.9	0.180	56.4	0.189	-70.0
2.6	0.317	159.9	2.547	57.5	0.197	55.8	0.177	-77.7
2.8	0.333	155.3	2.408	55.3	0.206	56.2	0.169	-83.9
3.0	0.350	151.9	2.221	51.5	0.213	55.2	0.158	-89.8

$V_{CE} = 3\text{ V}$, $I_C = 10\text{ mA}$, $Z_o = 50\ \Omega$

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
0.2	0.598	-41.6	18.159	140.3	0.031	70.0	0.812	-26.3
0.4	0.414	-79.4	12.683	117.6	0.048	62.5	0.575	-38.7
0.6	0.330	-103.3	9.464	103.5	0.062	61.7	0.447	-45.3
0.8	0.278	-120.6	7.552	95.5	0.074	62.2	0.385	-48.1
1.0	0.246	-136.4	6.295	90.1	0.087	61.8	0.345	-48.2
1.2	0.237	-150.5	5.402	84.8	0.101	62.0	0.310	-47.3
1.4	0.239	-160.6	4.670	79.1	0.116	62.0	0.277	-48.3
1.6	0.235	-170.5	4.065	74.9	0.131	62.4	0.247	-50.7
1.8	0.239	179.4	3.597	71.5	0.143	63.2	0.225	-54.1
2.0	0.257	170.1	3.246	68.0	0.154	61.8	0.206	-57.7
2.2	0.280	164.1	2.987	63.2	0.167	60.3	0.184	-62.1
2.4	0.299	160.0	2.780	59.2	0.181	58.6	0.165	-69.6
2.6	0.315	155.6	2.609	57.0	0.199	57.9	0.153	-77.7
2.8	0.334	151.5	2.465	54.8	0.210	58.1	0.146	-85.0
3.0	0.350	148.7	2.272	51.0	0.217	56.6	0.136	-92.0

★ PACKAGE DIMENSIONS

FLAT-LEAD 3-PIN THIN-TYPE ULTRA SUPER MINIMOLD (UNIT: mm)



PIN CONNECTIONS

- 1. Emitter
- 2. Base
- 3. Collector

- **The information in this document is current as of February, 2002. The information is subject to change without notice. For actual design-in, refer to the latest publications of NEC's data sheets or data books, etc., for the most up-to-date specifications of NEC semiconductor products. Not all products and/or types are available in every country. Please check with an NEC sales representative for availability and additional information.**
 - No part of this document may be copied or reproduced in any form or by any means without prior written consent of NEC. NEC assumes no responsibility for any errors that may appear in this document.
 - NEC does not assume any liability for infringement of patents, copyrights or other intellectual property rights of third parties by or arising from the use of NEC semiconductor products listed in this document or any other liability arising from the use of such products. No license, express, implied or otherwise, is granted under any patents, copyrights or other intellectual property rights of NEC 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 customer's equipment shall be done under the full responsibility of customer. NEC assumes no responsibility for any losses incurred by customers or third parties arising from the use of these circuits, software and information.
 - While NEC endeavours to enhance the quality, reliability and safety of NEC semiconductor products, customers agree and acknowledge that the possibility of defects thereof cannot be eliminated entirely. To minimize risks of damage to property or injury (including death) to persons arising from defects in NEC semiconductor products, customers must incorporate sufficient safety measures in their design, such as redundancy, fire-containment, and anti-failure features.
 - NEC semiconductor products are classified into the following three quality grades:
 "Standard", "Special" and "Specific". The "Specific" quality grade applies only to semiconductor products developed based on a customer-designated "quality assurance program" for a specific application. The recommended applications of a semiconductor product depend on its quality grade, as indicated below. Customers must check the quality grade of each semiconductor product 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 and medical equipment for life support, etc.
- The quality grade of NEC semiconductor products is "Standard" unless otherwise expressly specified in NEC's data sheets or data books, etc. If customers wish to use NEC semiconductor products in applications not intended by NEC, they must contact an NEC sales representative in advance to determine NEC's willingness to support a given application.
- (Note)
- (1) "NEC" as used in this statement means NEC Corporation, NEC Compound Semiconductor Devices, Ltd. and also includes its majority-owned subsidiaries.
 - (2) "NEC semiconductor products" means any semiconductor product developed or manufactured by or for NEC (as defined above).

M8E 00.4-0110

► **Business issue**

NEC Compound Semiconductor Devices, Ltd.

5th Sales Group, Sales Division TEL: +81-3-3798-6372 FAX: +81-3-3798-6783 E-mail: salesinfo@csd-nec.com

NEC Compound Semiconductor Devices Hong Kong Limited

Hong Kong Head Office TEL: +852-3107-7303 FAX: +852-3107-7309

Taipei Branch Office TEL: +886-2-8712-0478 FAX: +886-2-2545-3859

Korea Branch Office TEL: +82-2-528-0301 FAX: +82-2-528-0302

NEC Electron Devices European Operations <http://www.nec.de/>

TEL: +49-211-6503-101 FAX: +49-211-6503-487

California Eastern Laboratories, Inc. <http://www.cel.com/>

TEL: +1-408-988-3500 FAX: +1-408-988-0279

► **Technical issue**

NEC Compound Semiconductor Devices, Ltd. <http://www.csd-nec.com/>

Sales Engineering Group, Sales Division

E-mail: techinfo@csd-nec.com FAX: +81-44-435-1918