

# NPN SILICON RF TRANSISTOR 2SC5337

# NPN SILICON RF TRANSISTOR FOR HIGH-FREQUENCY LOW DISTORTION AMPLIFIER 4-PIN POWER MINIMOLD

#### **FEATURES**

- Low distortion:  $IM_2 = 59.0 \text{ dB TYP.}$ ,  $IM_3 = 82.0 \text{ dB TYP.}$  @ VCE = 10 V, IC = 50 mA
- · Low noise

NF = 1.5 dB TYP. @  $V_{CE} = 10 \text{ V}$ ,  $I_{C} = 50 \text{ mA}$ , f = 500 MHzNF = 2.0 dB TYP. @  $V_{CE} = 10 \text{ V}$ ,  $I_{C} = 50 \text{ mA}$ , f = 1 GHz

• 4-pin power minimold package with improved gain from the 2SC4536

### **★ ORDERING INFORMATION**

Part Number	Quantity	Supplying Form
2SC5337	25 pcs (Non reel)	Magazine case
2SC5337-T1	1 kpcs/reel	• 12 mm wide embossed taping • Collector face the perforation side of the tape

**Remark** To order evaluation samples, consult your NEC sales representative. Unit sample quantity is 25 pcs.

# ABSOLUTE MAXIMUM RATINGS (TA = +25°C)

Parameter	Symbol	Ratings	Unit
Collector to Base Voltage	Vсво	30	V
Collector to Emitter Voltage	Vceo	15	V
Emitter to Base Voltage	V <sub>ЕВО</sub>	3.0	V
Collector Current	Ic	250	mA
Total Power Dissipation	Ptot Note	2.0	W
Junction Temperature	Tj	150	°C
Storage Temperature	T <sub>stg</sub>	-65 to +150	°C

**Note** Mounted on 16 cm<sup>2</sup> × 0.7 mm (t) ceramic substrate (Copper plating)

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 representative for availability and additional information.

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# **ELECTRICAL CHARACTERISTICS (TA = +25°C)**

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
DC Characteristics						
Collector Cut-off Current	Ісво	VcB = 20 V, IE = 0 mA	-	0.01	5.0	μΑ
Emitter Cut-off Current	Ієво	V <sub>BE</sub> = 2 V, I <sub>C</sub> = 0 mA	-	0.03	5.0	μΑ
DC Current Gain	hfE Note 1	Vce = 10 V, Ic = 50 mA	40	120	200	1
RF Characteristics						
Insertion Power Gain	S <sub>21e</sub>   ²	Vce = 10 V, Ic = 50 mA, f = 1 GHz	7.0	8.3	-	dB
Noise Figure (1)	NF Note 2	Vce = 10 V, Ic = 50 mA, f = 500 MHz	-	1.5	3.5	dB
Noise Figure (2)	NF Note 2	Vce = 10 V, Ic = 50 mA, f = 1 GHz	-	2.0	3.5	dB
2nd Order Intermoduration Distortion	IM <sub>2</sub>	$\begin{split} &\text{Vce} = 10 \text{ V, Ic} = 50 \text{ mA, Rs} = \text{RL} = 75 \Omega, \\ &\text{V}_{\text{in}} = 105 \text{ dB}\mu\text{V}/75 \Omega, f_{1} = 190 \text{ MHz}, \\ &\text{f}_{2} = 90 \text{ MHz, }f = f_{1} - f_{2} \end{split}$	-	59.0	-	dB
3rd Order Intermoduration Distortion	IM <sub>3</sub>	$\begin{split} &\text{VcE} = 10 \text{ V, Ic} = 50 \text{ mA, Rs} = \text{RL} = 75 \Omega, \\ &\text{V}_{\text{in}} = 105 \text{ dB}\mu\text{V}/75 \Omega, f_{1} = 190 \text{ MHz}, \\ &\text{f}_{2} = 200 \text{ MHz}, f = 2 \times \text{f}_{1} - \text{f}_{2} \end{split}$	-	82.0	-	dB

**Notes 1.** Pulse measurement: PW  $\leq$  350  $\mu$ s, Duty Cycle  $\leq$  2%

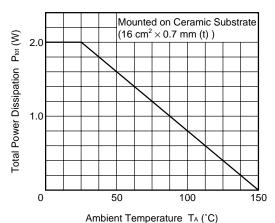
**2.** Rs = RL =  $50 \Omega$ , tuned

### **hfe CLASSIFICATION**

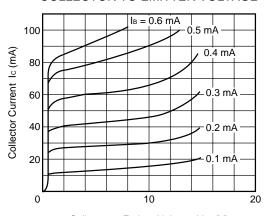
Rank	QQ	QR	QS
Marking	QQ	QR	QS
h <sub>FE</sub> Value	40 to 80	60 to 120	100 to 200

### ★ TYPICAL CHARACTERISTICS (Unless otherwise specified, T<sub>A</sub> = +25°C)

# TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE

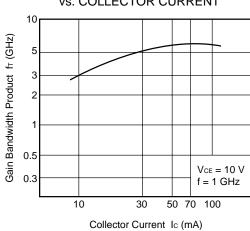


COLLECTOR CURRENT vs.
COLLECTOR TO EMITTER VOLTAGE

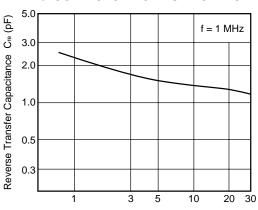


Collector to Emitter Voltage VcE (V)

GAIN BANDWIDTH PRODUCT vs. COLLECTOR CURRENT

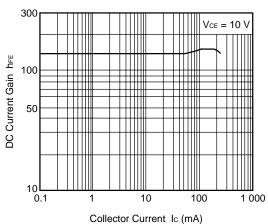


# REVERSE TRANSFER CAPACITANCE vs. COLLECTOR TO BASE VOLTAGE

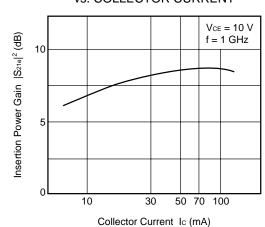


Collector to Base Voltage VcB (V)

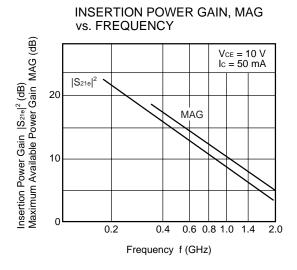
DC CURRENT GAIN vs. COLLECTOR CURRENT

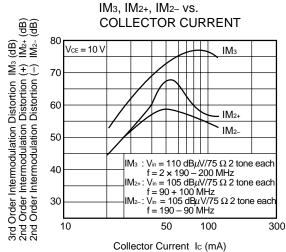


INSERTION POWER GAIN vs. COLLECTOR CURRENT

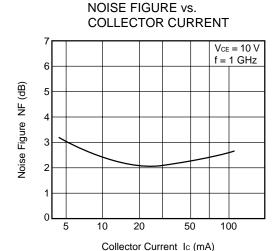


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Remark The graphs indicate nominal characteristics.



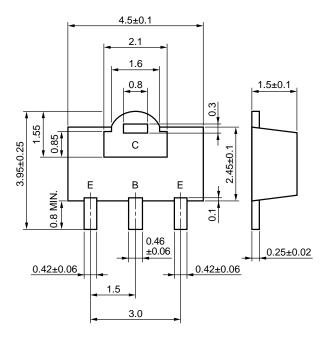
### **S-PARAMETERS**

VCE = TUV. TC = 50  m	10 V, Ic = 50	Ic = 50  m	V.	0	= 1	VCE
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Frequency	y S	S <sub>11</sub>	S	21	S	12	S	S22
(GHz)	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
(- /	_	(deg.)		(deg.)		(deg.)		(deg.)
		( 0 /		( 0,		( 0 /		( 0 /
0.1	0.592	-136.6	24.447	108.4	0.030	50.5	0.465	-95.2
0.2	0.577	-160.0	12.746	96.5	0.042	57.4	0.335	-123.0
0.3	0.566	-168.5	8.591	91.2	0.055	67.3	0.276	-130.1
0.4	0.558	-174.0	6.438	87.2	0.066	70.8	0.269	-132.7
0.5	0.554	-177.5	5.160	84.1	0.083	68.6	0.262	-134.5
0.6	0.542	-179.4	4.312	82.3	0.095	70.6	0.262	-139.1
0.7	0.527	177.9	3.729	80.9	0.112	71.2	0.251	-133.4
0.8	0.519	175.8	3.292	78.7	0.123	74.6	0.252	-132.9
0.9	0.509	174.4	2.983	77.7	0.136	75.0	0.252	-124.6
1.0	0.514	171.0	2.759	76.6	0.151	75.3	0.257	-125.3
1.1	0.498	166.8	2.648	75.4	0.166	75.8	0.278	-118.4
1.2	0.494	167.3	2.665	71.3	0.180	74.7	0.306	-120.2
1.3	0.487	161.7	2.478	63.0	0.194	75.9	0.314	-124.2
1.4	0.467	160.4	2.177	60.1	0.216	74.7	0.273	-124.0
1.5	0.477	157.4	1.973	57.9	0.230	74.9	0.281	-123.2
1.6	0.471	154.5	1.815	57.2	0.240	73.2	0.291	-120.2
1.7	0.467	152.5	1.754	55.3	0.260	72.9	0.316	-118.7
1.8	0.469	151.3	1.639	54.4	0.273	70.5	0.312	-123.1
1.9	0.465	149.1	1.568	53.4	0.285	69.9	0.316	-125.5
2.0	0.468	147.0	1.475	52.6	0.289	69.3	0.323	-126.3
Vce = 10 V	', Ic = 100 mA							
VCE = 10 V Frequency		S <sub>11</sub>	S	21	S	12	S	22
		S11 ANG.	S MAG.	21 ANG.	S MAG.	ANG.	S MAG.	S <sub>22</sub> ANG.
Frequency	y							
Frequency	y	ANG.		ANG.		ANG.		ANG.
Frequency	y	ANG.		ANG.		ANG.		ANG.
Frequency (GHz)	y S	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
Frequency (GHz) 0.1	MAG.	ANG. (deg.)	MAG. 24.857	ANG. (deg.) 105.3	MAG. 0.019	ANG. (deg.) 50.2	MAG. 0.284	ANG. (deg.) -116.1
Frequency (GHz) 0.1 0.2	MAG. 0.564 0.586	ANG. (deg.) -146.0 -165.8	MAG. 24.857 12.845	ANG. (deg.) 105.3 94.5	MAG. 0.019 0.026	ANG. (deg.) 50.2 59.6	MAG. 0.284 0.204	ANG. (deg.) -116.1 -129.9
(GHz)  0.1 0.2 0.3	MAG.  0.564 0.586 0.576	ANG. (deg.) -146.0 -165.8 -171.9	MAG. 24.857 12.845 8.681	ANG. (deg.) 105.3 94.5 89.7	0.019 0.026 0.041	ANG. (deg.) 50.2 59.6 73.2	MAG. 0.284 0.204 0.199	ANG. (deg.) -116.1 -129.9 -138.7
0.1 0.2 0.3 0.4	0.564 0.586 0.576 0.561	ANG. (deg.) -146.0 -165.8 -171.9 -176.3	MAG.  24.857 12.845 8.681 6.541	ANG. (deg.) 105.3 94.5 89.7 86.3	0.019 0.026 0.041 0.048	ANG. (deg.) 50.2 59.6 73.2 77.8	0.284 0.204 0.199 0.200	ANG. (deg.) -116.1 -129.9 -138.7 -140.1
0.1 0.2 0.3 0.4 0.5	0.564 0.586 0.576 0.561 0.550	ANG. (deg.) -146.0 -165.8 -171.9 -176.3 179.9	MAG.  24.857 12.845 8.681 6.541 5.209	ANG. (deg.)  105.3 94.5 89.7 86.3 83.5	0.019 0.026 0.041 0.048 0.060	ANG. (deg.) 50.2 59.6 73.2 77.8 81.4	0.284 0.204 0.199 0.200 0.196	ANG. (deg.) -116.1 -129.9 -138.7 -140.1 -137.0
0.1 0.2 0.3 0.4 0.5 0.6	0.564 0.586 0.576 0.561 0.550 0.540	ANG. (deg.)  -146.0 -165.8 -171.9 -176.3 179.9 178.2	MAG.  24.857 12.845 8.681 6.541 5.209 4.358	ANG. (deg.)  105.3  94.5  89.7  86.3  83.5  82.2	0.019 0.026 0.041 0.048 0.060 0.069	ANG. (deg.) 50.2 59.6 73.2 77.8 81.4 82.0	0.284 0.204 0.199 0.200 0.196 0.182	ANG. (deg.) -116.1 -129.9 -138.7 -140.1 -137.0 -137.6
0.1 0.2 0.3 0.4 0.5 0.6	0.564 0.586 0.576 0.561 0.550 0.540 0.538	ANG. (deg.) -146.0 -165.8 -171.9 -176.3 179.9 178.2 175.7	MAG.  24.857 12.845 8.681 6.541 5.209 4.358 3.772	ANG. (deg.)  105.3 94.5 89.7 86.3 83.5 82.2 80.6	0.019 0.026 0.041 0.048 0.060 0.069 0.086	ANG. (deg.) 50.2 59.6 73.2 77.8 81.4 82.0 84.2	0.284 0.204 0.199 0.200 0.196 0.182 0.216	ANG. (deg.) -116.1 -129.9 -138.7 -140.1 -137.0 -137.6 -131.0
0.1 0.2 0.3 0.4 0.5 0.6 0.7	0.564 0.586 0.576 0.561 0.550 0.540 0.538 0.521	ANG. (deg.) -146.0 -165.8 -171.9 -176.3 179.9 178.2 175.7 174.6	MAG.  24.857 12.845 8.681 6.541 5.209 4.358 3.772 3.332	ANG. (deg.)  105.3 94.5 89.7 86.3 83.5 82.2 80.6 78.4	0.019 0.026 0.041 0.048 0.060 0.069 0.086 0.099	ANG. (deg.) 50.2 59.6 73.2 77.8 81.4 82.0 84.2 85.1	0.284 0.204 0.199 0.200 0.196 0.182 0.216 0.210	ANG. (deg.) -116.1 -129.9 -138.7 -140.1 -137.0 -137.6 -131.0 -130.5
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8	0.564 0.586 0.576 0.561 0.550 0.540 0.538 0.521 0.510	ANG. (deg.)  -146.0 -165.8 -171.9 -176.3 179.9 178.2 175.7 174.6 173.2	MAG.  24.857 12.845 8.681 6.541 5.209 4.358 3.772 3.332 3.037	ANG. (deg.)  105.3 94.5 89.7 86.3 83.5 82.2 80.6 78.4 77.0	0.019 0.026 0.041 0.048 0.060 0.069 0.086 0.099 0.113	ANG. (deg.) 50.2 59.6 73.2 77.8 81.4 82.0 84.2 85.1 85.4	0.284 0.204 0.199 0.200 0.196 0.182 0.216 0.210	ANG. (deg.)  -116.1 -129.9 -138.7 -140.1 -137.0 -137.6 -131.0 -130.5 -122.2
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9	0.564 0.586 0.576 0.561 0.550 0.540 0.538 0.521 0.510 0.524	ANG. (deg.)  -146.0 -165.8 -171.9 -176.3 179.9 178.2 175.7 174.6 173.2 168.5	MAG.  24.857 12.845 8.681 6.541 5.209 4.358 3.772 3.332 3.037 2.780	ANG. (deg.)  105.3 94.5 89.7 86.3 83.5 82.2 80.6 78.4 77.0 76.9	0.019 0.026 0.041 0.048 0.060 0.069 0.086 0.099 0.113 0.119	ANG. (deg.) 50.2 59.6 73.2 77.8 81.4 82.0 84.2 85.1 85.4 83.5	0.284 0.204 0.199 0.200 0.196 0.182 0.216 0.210 0.222 0.198	ANG. (deg.)  -116.1 -129.9 -138.7 -140.1 -137.0 -137.6 -131.0 -130.5 -122.2 -120.1
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0	MAG.  0.564 0.586 0.576 0.561 0.550 0.540 0.538 0.521 0.510 0.524 0.502	ANG. (deg.)  -146.0 -165.8 -171.9 -176.3 179.9 178.2 175.7 174.6 173.2 168.5 165.2	MAG.  24.857 12.845 8.681 6.541 5.209 4.358 3.772 3.332 3.037 2.780 2.680	ANG. (deg.)  105.3 94.5 89.7 86.3 83.5 82.2 80.6 78.4 77.0 76.9 75.3	0.019 0.026 0.041 0.048 0.060 0.069 0.086 0.099 0.113 0.119	ANG. (deg.) 50.2 59.6 73.2 77.8 81.4 82.0 84.2 85.1 85.4 83.5 86.8	0.284 0.204 0.199 0.200 0.196 0.182 0.216 0.210 0.222 0.198 0.213	ANG. (deg.)  -116.1 -129.9 -138.7 -140.1 -137.0 -137.6 -131.0 -130.5 -122.2 -120.1 -114.9
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1	0.564 0.586 0.576 0.561 0.550 0.540 0.538 0.521 0.510 0.524 0.502	ANG. (deg.)  -146.0 -165.8 -171.9 -176.3 179.9 178.2 175.7 174.6 173.2 168.5 165.2	MAG.  24.857 12.845 8.681 6.541 5.209 4.358 3.772 3.332 3.037 2.780 2.680 2.718	ANG. (deg.)  105.3 94.5 89.7 86.3 83.5 82.2 80.6 78.4 77.0 76.9 75.3 72.3	0.019 0.026 0.041 0.048 0.060 0.069 0.086 0.099 0.113 0.119 0.136	ANG. (deg.) 50.2 59.6 73.2 77.8 81.4 82.0 84.2 85.1 85.4 83.5 86.8 83.5	0.284 0.204 0.199 0.200 0.196 0.182 0.216 0.210 0.222 0.198 0.213 0.246	ANG. (deg.)  -116.1 -129.9 -138.7 -140.1 -137.0 -137.6 -131.0 -130.5 -122.2 -120.1 -114.9 -114.9
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2	MAG.  0.564 0.586 0.576 0.561 0.550 0.540 0.538 0.521 0.510 0.524 0.502 0.489 0.488	ANG. (deg.)  -146.0 -165.8 -171.9 -176.3 179.9 178.2 175.7 174.6 173.2 168.5 165.2 165.9 161.1	MAG.  24.857 12.845 8.681 6.541 5.209 4.358 3.772 3.332 3.037 2.780 2.680 2.718 2.578	ANG. (deg.)  105.3 94.5 89.7 86.3 83.5 82.2 80.6 78.4 77.0 76.9 75.3 72.3 63.0	0.019 0.026 0.041 0.048 0.060 0.069 0.086 0.099 0.113 0.119 0.136 0.156 0.177	ANG. (deg.) 50.2 59.6 73.2 77.8 81.4 82.0 84.2 85.1 85.4 83.5 86.8 83.5 85.5	0.284 0.204 0.199 0.200 0.196 0.182 0.216 0.210 0.222 0.198 0.213 0.246 0.251	ANG. (deg.)  -116.1 -129.9 -138.7 -140.1 -137.0 -137.6 -131.0 -130.5 -122.2 -120.1 -114.9 -114.9 -122.8
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2 1.3	0.564 0.586 0.576 0.561 0.550 0.540 0.538 0.521 0.510 0.524 0.502 0.489 0.488 0.472 0.480 0.470	ANG. (deg.)  -146.0 -165.8 -171.9 -176.3 179.9 178.2 175.7 174.6 173.2 168.5 165.2 165.9 161.1 157.9 155.3	MAG.  24.857 12.845 8.681 6.541 5.209 4.358 3.772 3.332 3.037 2.780 2.680 2.718 2.578 2.213 2.012 1.846	ANG. (deg.)  105.3 94.5 89.7 86.3 83.5 82.2 80.6 78.4 77.0 76.9 75.3 72.3 63.0 58.7 57.8	0.019 0.026 0.041 0.048 0.060 0.069 0.086 0.099 0.113 0.119 0.136 0.156 0.177 0.184 0.194 0.219	ANG. (deg.) 50.2 59.6 73.2 77.8 81.4 82.0 84.2 85.1 85.4 83.5 86.8 83.5 85.5 81.8 85.3	0.284 0.204 0.199 0.200 0.196 0.182 0.216 0.210 0.222 0.198 0.213 0.246 0.251 0.209 0.252	ANG. (deg.)  -116.1 -129.9 -138.7 -140.1 -137.0 -137.6 -131.0 -130.5 -122.2 -120.1 -114.9 -112.8 -127.2 -114.1 -117.6
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2 1.3 1.4	MAG.  0.564 0.586 0.576 0.561 0.550 0.540 0.538 0.521 0.510 0.524 0.502 0.489 0.488 0.472 0.480	ANG. (deg.)  -146.0 -165.8 -171.9 -176.3 179.9 178.2 175.7 174.6 173.2 168.5 165.2 165.9 161.1 157.9 155.3	MAG.  24.857 12.845 8.681 6.541 5.209 4.358 3.772 3.332 3.037 2.780 2.680 2.718 2.578 2.213 2.012	ANG. (deg.)  105.3 94.5 89.7 86.3 83.5 82.2 80.6 78.4 77.0 76.9 75.3 72.3 63.0 58.7 57.8	0.019 0.026 0.041 0.048 0.060 0.069 0.086 0.099 0.113 0.119 0.136 0.156 0.177 0.184 0.194	ANG. (deg.) 50.2 59.6 73.2 77.8 81.4 82.0 84.2 85.1 85.4 83.5 86.8 83.5 85.5 81.8	0.284 0.204 0.199 0.200 0.196 0.182 0.216 0.210 0.222 0.198 0.213 0.246 0.251 0.209	ANG. (deg.)  -116.1 -129.9 -138.7 -140.1 -137.0 -137.6 -131.0 -130.5 -122.2 -120.1 -114.9 -114.9 -122.8 -127.2 -114.1 -117.6 -112.9
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7	0.564 0.586 0.576 0.561 0.550 0.540 0.538 0.521 0.510 0.524 0.502 0.489 0.488 0.472 0.480 0.470	ANG. (deg.)  -146.0 -165.8 -171.9 -176.3 179.9 178.2 175.7 174.6 173.2 168.5 165.2 165.9 161.1 157.9 155.3	MAG.  24.857 12.845 8.681 6.541 5.209 4.358 3.772 3.332 3.037 2.780 2.680 2.718 2.578 2.213 2.012 1.846	ANG. (deg.)  105.3 94.5 89.7 86.3 83.5 82.2 80.6 78.4 77.0 76.9 75.3 72.3 63.0 58.7 57.8	0.019 0.026 0.041 0.048 0.060 0.069 0.086 0.099 0.113 0.119 0.136 0.156 0.177 0.184 0.194 0.219	ANG. (deg.) 50.2 59.6 73.2 77.8 81.4 82.0 84.2 85.1 85.4 83.5 86.8 83.5 85.5 81.8 85.3	0.284 0.204 0.199 0.200 0.196 0.182 0.216 0.210 0.222 0.198 0.213 0.246 0.251 0.209 0.252	ANG. (deg.)  -116.1 -129.9 -138.7 -140.1 -137.0 -137.6 -131.0 -130.5 -122.2 -120.1 -114.9 -114.9 -122.8 -127.2 -114.1 -117.6 -112.9 -121.9
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2 1.3 1.4 1.5 1.6	0.564 0.586 0.576 0.561 0.550 0.540 0.538 0.521 0.510 0.524 0.502 0.489 0.488 0.472 0.480 0.470 0.465	ANG. (deg.)  -146.0 -165.8 -171.9 -176.3 179.9 178.2 175.7 174.6 173.2 168.5 165.2 165.9 161.1 157.9 155.3 153.4 151.1	MAG.  24.857 12.845 8.681 6.541 5.209 4.358 3.772 3.332 3.037 2.780 2.680 2.718 2.578 2.213 2.012 1.846 1.745	ANG. (deg.)  105.3 94.5 89.7 86.3 83.5 82.2 80.6 78.4 77.0 76.9 75.3 72.3 63.0 58.7 57.8 57.2 56.5	0.019 0.026 0.041 0.048 0.060 0.069 0.086 0.099 0.113 0.119 0.136 0.156 0.177 0.184 0.194 0.219 0.235	ANG. (deg.) 50.2 59.6 73.2 77.8 81.4 82.0 84.2 85.1 85.4 83.5 86.8 83.5 85.5 81.8 85.3 82.2 82.4	0.284 0.204 0.199 0.200 0.196 0.182 0.216 0.210 0.222 0.198 0.213 0.246 0.251 0.209 0.252 0.242	ANG. (deg.)  -116.1 -129.9 -138.7 -140.1 -137.0 -137.6 -131.0 -130.5 -122.2 -120.1 -114.9 -114.9 -122.8 -127.2 -114.1 -117.6 -112.9

### **★ PACKAGE DIMENSIONS**

# 4-PIN POWER MINIMOLD (UNIT: mm)



### **PIN CONNECTIONS**

E: Emitter C: Collector B: Base **NEC** 2SC5337

[MEMO]

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