

NPN SILICON RF TRANSISTOR 2SC5336

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

FEATURES

- High gain: $|S_{21e}|^2 = 12 \text{ dB TYP}$. @ VcE = 10 V, Ic = 20 mA, f = 1 GHz
- 4-pin power minimold package with improved gain from the 2SC3357

★ ORDERING INFORMATION

Part Number	Quantity	Supplying Form
2SC5336	25 pcs (Non reel)	Magazine case
2SC5336-T1	1 kpcs/reel	12 mm wide embossed tapingCollector 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	20	V
Collector to Emitter Voltage	Vceo	12	V
Emitter to Base Voltage	VEBO	3.0	V
Collector Current	lc	100	mA
Total Power Dissipation	Ptot Note	1.2	W
Junction Temperature	Tj	150	°C
Storage Temperature	T _{stg}	-65 to +150	°C

Note Mounted on 16 cm $^2 \times 0.7$ 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.



ELECTRICAL CHARACTERISTICS (TA = +25°C)

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
DC Characteristics						
Collector Cut-off Current	Ісво	VcB = 10 V, IE = 0 mA	-	-	1.0	μΑ
Emitter Cut-off Current	Ієво	V _{BE} = 1 V, I _C = 0 mA	-	_	1.0	μΑ
DC Current Gain	hfe Note 1	VcE = 10 V, Ic = 20 mA	50	120	250	-
RF Characteristics						
Gain Bandwidth Product	f⊤	Vce = 10 V, Ic = 20 mA	_	6.5	_	GHz
Insertion Power Gain	S _{21e} ²	Vce = 10 V, Ic = 20 mA, f = 1 GHz	-	12	_	dB
Noise Figure (1)	NF	Vce = 10 V, Ic = 7 mA, f = 1 GHz	-	1.1	_	dB
Noise Figure (2)	NF	Vce = 10 V, Ic = 40 mA, f = 1 GHz	_	1.8	3.0	dB
Reverse Transfer Capacitance	Cre Note 2	VcB = 10 V, IE = 0 mA, f = 1 MHz	_	0.5	0.8	pF

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

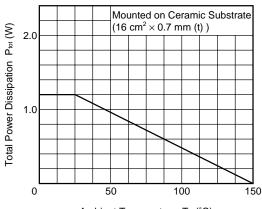
2. Collector to base capacitance when the emitter grounded

hfe CLASSIFICATION

Rank	RH	RF	RE
Marking	RH	RF	RE
h _{FE} Value	50 to 100	80 to 160	125 to 250

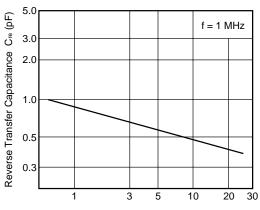
★ TYPICAL CHARACTERISTICS (Unless otherwise specified, T_A = +25°C)

TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE



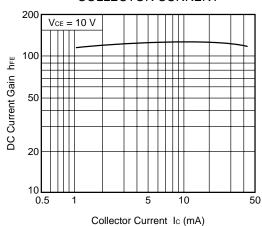
Ambient Temperature TA (°C)

REVERSE TRANSFER CAPACITANCE vs. COLLECTOR TO BASE VOLTAGE

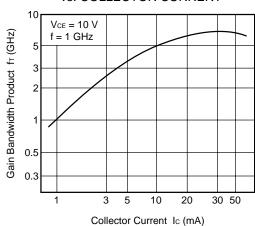


Collector to Base Voltage VcB (V)

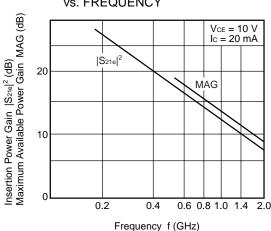
DC CURRENT GAIN vs. COLLECTOR CURRENT



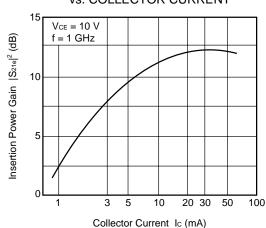
GAIN BANDWIDTH PRODUCT vs. COLLECTOR CURRENT



INSERTION POWER GAIN, MAG vs. FREQUENCY

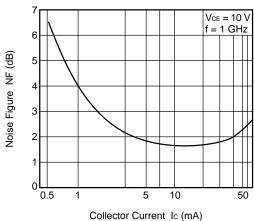


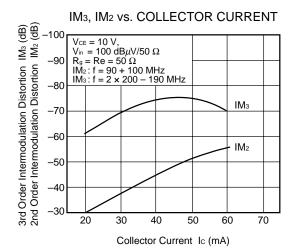
INSERTION POWER GAIN vs. COLLECTOR CURRENT



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NOISE FIGURE vs. COLLECTOR CURRENT





Remark The graphs indicate nominal characteristics.

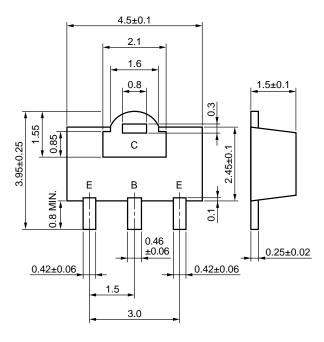
S-PARAMETERS

Vce =	10 V.	Ic = 20	mΑ

Frequency	5	S ₁₁	S	21	S	12	S	22
(GHz)	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
,		(deg.)		(deg.)		(deg.)		(deg.)
						, ,,		
0.1	0.519	-74.5	30.931	131.9	0.017	60.6	0.752	-30.2
0.2	0.413	-112.9	18.965	111.5	0.031	61.9	0.570	-39.7
0.3	0.413	-133.4	13.324	101.9	0.038	65.1	0.465	-39.8
0.4	0.345	-145.7	10.164	95.9	0.045	69.8	0.428	-40.1
0.5	0.331	-153.8	8.177	91.8	0.055	71.8	0.436	-41.1
0.6	0.320	-159.6	6.834	89.1	0.064	70.9	0.438	-43.5
0.7	0.302	-166.8	5.832	86.7	0.074	73.9	0.434	-47.5
0.8	0.296	-169.2	5.107	84.3	0.077	74.4	0.429	-47.8
0.9	0.283	-173.2	4.600	83.1	0.088	71.2	0.436	-46.5
1.0	0.285	-179.8	4.200	82.3	0.097	74.5	0.455	-47.8
1.1	0.265	175.2	3.930	80.8	0.100	76.3	0.467	-46.8
1.2	0.260	174.1	3.979	78.5	0.109	75.9	0.529	-47.4
1.3	0.263	166.0	3.741	68.6	0.114	76.8	0.551	-55.8
1.4	0.242	163.0	3.115	66.6	0.119	78.3	0.509	-55.8
1.5	0.252	160.1	2.844	65.7	0.133	82.0	0.510	-58.5
1.6	0.253	154.0	2.595	64.1	0.140	81.0	0.496	-55.2
1.7	0.253	149.9	2.420	63.7	0.158	80.9	0.515	-54.8
1.8	0.257	147.2	2.305	63.0	0.165	82.2	0.518	-56.5
1.9	0.262	143.0	2.171	62.6	0.172	80.5	0.536	-58.6
2.0	0.273	141.5	2.049	61.2	0.177	78.3	0.524	-61.5
Vce = 10 V, Ic	= 40 mA							
	- 10 11111							
Frequency		3 11	S	21	S	12	S	22
	5	S ₁₁ ANG.		21 ANG.	S MAG.	ANG.	S MAG.	22 ANG.
Frequency		ANG.	S MAG.	ANG.		ANG.		ANG.
Frequency	5							
Frequency	5	ANG.		ANG.		ANG.		ANG.
Frequency (GHz)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)
Frequency (GHz) 0.1	MAG. 0.378	ANG. (deg.) -97.1	MAG. 32.908	ANG. (deg.) 123.3	MAG. 0.017	ANG. (deg.) 71.1	MAG. 0.665	ANG. (deg.) -34.7
Frequency (GHz) 0.1 0.2	MAG. 0.378 0.317	ANG. (deg.) -97.1 -131.8	MAG. 32.908 18.819	ANG. (deg.) 123.3 106.0	MAG. 0.017 0.027	ANG. (deg.) 71.1 71.2	MAG. 0.665 0.487	ANG. (deg.) -34.7 -38.7
(GHz) 0.1 0.2 0.3	0.378 0.317 0.308	ANG. (deg.) -97.1 -131.8 -150.1	MAG. 32.908 18.819 12.955	ANG. (deg.) 123.3 106.0 97.5	0.017 0.027 0.035	ANG. (deg.) 71.1 71.2 71.8	0.665 0.487 0.398	ANG. (deg.) -34.7 -38.7 -38.5
(GHz) 0.1 0.2 0.3 0.4	0.378 0.317 0.308 0.299	ANG. (deg.) -97.1 -131.8 -150.1 -158.7	MAG. 32.908 18.819 12.955 9.775	ANG. (deg.) 123.3 106.0 97.5 93.1	0.017 0.027 0.035 0.042	ANG. (deg.) 71.1 71.2 71.8 78.1	MAG. 0.665 0.487 0.398 0.393	ANG. (deg.) -34.7 -38.7 -38.5 -36.9
0.1 0.2 0.3 0.4 0.5	0.378 0.317 0.308 0.299 0.297	ANG. (deg.) -97.1 -131.8 -150.1 -158.7 -165.5	MAG. 32.908 18.819 12.955 9.775 7.899	ANG. (deg.) 123.3 106.0 97.5 93.1 89.8	MAG. 0.017 0.027 0.035 0.042 0.052	ANG. (deg.) 71.1 71.2 71.8 78.1 78.5	0.665 0.487 0.398 0.393 0.399	ANG. (deg.) -34.7 -38.7 -38.5 -36.9 -37.6
(GHz) 0.1 0.2 0.3 0.4 0.5 0.6	0.378 0.317 0.308 0.299 0.297 0.288	ANG. (deg.) -97.1 -131.8 -150.1 -158.7 -165.5 -169.2	MAG. 32.908 18.819 12.955 9.775 7.899 6.586	ANG. (deg.) 123.3 106.0 97.5 93.1 89.8 87.6	0.017 0.027 0.035 0.042 0.052 0.061	ANG. (deg.) 71.1 71.2 71.8 78.1 78.5 79.1	0.665 0.487 0.398 0.393 0.399 0.407	ANG. (deg.) -34.7 -38.7 -38.5 -36.9 -37.6 -39.9
0.1 0.2 0.3 0.4 0.5 0.6	0.378 0.317 0.308 0.299 0.297 0.288 0.274	ANG. (deg.) -97.1 -131.8 -150.1 -158.7 -165.5 -169.2 -173.7	MAG. 32.908 18.819 12.955 9.775 7.899 6.586 5.607	ANG. (deg.) 123.3 106.0 97.5 93.1 89.8 87.6 85.2	0.017 0.027 0.035 0.042 0.052 0.061 0.071	ANG. (deg.) 71.1 71.2 71.8 78.1 78.5 79.1 77.4	0.665 0.487 0.398 0.393 0.399 0.407 0.400	ANG. (deg.) -34.7 -38.7 -38.5 -36.9 -37.6 -39.9 -44.6
0.1 0.2 0.3 0.4 0.5 0.6 0.7	0.378 0.317 0.308 0.299 0.297 0.288 0.274 0.261	ANG. (deg.) -97.1 -131.8 -150.1 -158.7 -165.5 -169.2 -173.7 -177.3	MAG. 32.908 18.819 12.955 9.775 7.899 6.586 5.607 4.879	ANG. (deg.) 123.3 106.0 97.5 93.1 89.8 87.6 85.2 83.5	0.017 0.027 0.035 0.042 0.052 0.061 0.071 0.081	ANG. (deg.) 71.1 71.2 71.8 78.1 78.5 79.1 77.4 76.4	0.665 0.487 0.398 0.393 0.399 0.407 0.400 0.415	ANG. (deg.) -34.7 -38.7 -38.5 -36.9 -37.6 -39.9 -44.6 -47.4
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8	0.378 0.317 0.308 0.299 0.297 0.288 0.274 0.261 0.255	ANG. (deg.) -97.1 -131.8 -150.1 -158.7 -165.5 -169.2 -173.7 -177.3 178.9	32.908 18.819 12.955 9.775 7.899 6.586 5.607 4.879 4.435	ANG. (deg.) 123.3 106.0 97.5 93.1 89.8 87.6 85.2 83.5 82.2	0.017 0.027 0.035 0.042 0.052 0.061 0.071 0.081 0.092	ANG. (deg.) 71.1 71.2 71.8 78.1 78.5 79.1 77.4 76.4 76.5	0.665 0.487 0.398 0.393 0.399 0.407 0.400 0.415 0.399	ANG. (deg.) -34.7 -38.7 -38.5 -36.9 -37.6 -39.9 -44.6 -47.4 -46.2
Frequency (GHz) 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0	0.378 0.317 0.308 0.299 0.297 0.288 0.274 0.261 0.255 0.260	ANG. (deg.) -97.1 -131.8 -150.1 -158.7 -165.5 -169.2 -173.7 -177.3 178.9 173.0	32.908 18.819 12.955 9.775 7.899 6.586 5.607 4.879 4.435 4.024	ANG. (deg.) 123.3 106.0 97.5 93.1 89.8 87.6 85.2 83.5 82.2 81.4	0.017 0.027 0.035 0.042 0.052 0.061 0.071 0.081 0.092 0.095	ANG. (deg.) 71.1 71.2 71.8 78.1 78.5 79.1 77.4 76.4 76.5 77.6	0.665 0.487 0.398 0.393 0.399 0.407 0.400 0.415 0.399 0.440	ANG. (deg.) -34.7 -38.7 -38.5 -36.9 -37.6 -39.9 -44.6 -47.4 -46.2 -44.3
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0	0.378 0.317 0.308 0.299 0.297 0.288 0.274 0.261 0.255 0.260 0.243	ANG. (deg.) -97.1 -131.8 -150.1 -158.7 -165.5 -169.2 -173.7 -177.3 178.9 173.0 169.4	32.908 18.819 12.955 9.775 7.899 6.586 5.607 4.879 4.435 4.024 3.801	ANG. (deg.) 123.3 106.0 97.5 93.1 89.8 87.6 85.2 83.5 82.2 81.4 80.6	0.017 0.027 0.035 0.042 0.052 0.061 0.071 0.081 0.092 0.095 0.098	ANG. (deg.) 71.1 71.2 71.8 78.1 78.5 79.1 77.4 76.4 76.5 77.6 77.1	0.665 0.487 0.398 0.393 0.399 0.407 0.400 0.415 0.399 0.440 0.441	ANG. (deg.) -34.7 -38.7 -38.5 -36.9 -37.6 -39.9 -44.6 -47.4 -46.2 -44.3 -45.2
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1	0.378 0.317 0.308 0.299 0.297 0.288 0.274 0.261 0.255 0.260 0.243 0.239	ANG. (deg.) -97.1 -131.8 -150.1 -158.7 -165.5 -169.2 -173.7 -177.3 178.9 173.0 169.4 169.3	32.908 18.819 12.955 9.775 7.899 6.586 5.607 4.879 4.435 4.024 3.801 3.827	ANG. (deg.) 123.3 106.0 97.5 93.1 89.8 87.6 85.2 83.5 82.2 81.4 80.6 78.2	0.017 0.027 0.035 0.042 0.052 0.061 0.071 0.081 0.092 0.095 0.098 0.109	ANG. (deg.) 71.1 71.2 71.8 78.1 78.5 79.1 77.4 76.4 76.5 77.6 77.1 78.3	0.665 0.487 0.398 0.393 0.399 0.407 0.400 0.415 0.399 0.440 0.441	ANG. (deg.) -34.7 -38.7 -38.5 -36.9 -37.6 -39.9 -44.6 -47.4 -46.2 -44.3 -45.2 -46.2
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2	0.378 0.317 0.308 0.299 0.297 0.288 0.274 0.261 0.255 0.260 0.243 0.239 0.245	ANG. (deg.) -97.1 -131.8 -150.1 -158.7 -165.5 -169.2 -173.7 -177.3 178.9 173.0 169.4 169.3 160.3	MAG. 32.908 18.819 12.955 9.775 7.899 6.586 5.607 4.879 4.435 4.024 3.801 3.827 3.587	ANG. (deg.) 123.3 106.0 97.5 93.1 89.8 87.6 85.2 83.5 82.2 81.4 80.6 78.2 68.4	MAG. 0.017 0.027 0.035 0.042 0.052 0.061 0.071 0.081 0.092 0.095 0.098 0.109 0.117	ANG. (deg.) 71.1 71.2 71.8 78.1 78.5 79.1 77.4 76.4 76.5 77.6 77.1 78.3 78.0	0.665 0.487 0.398 0.393 0.399 0.407 0.400 0.415 0.399 0.440 0.441 0.494	ANG. (deg.) -34.7 -38.7 -38.5 -36.9 -37.6 -39.9 -44.6 -47.4 -46.2 -44.3 -45.2 -46.2 -55.4
Frequency (GHz) 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	0.378 0.317 0.308 0.299 0.297 0.288 0.274 0.261 0.255 0.260 0.243 0.239 0.245 0.216	ANG. (deg.) -97.1 -131.8 -150.1 -158.7 -165.5 -169.2 -173.7 -177.3 178.9 173.0 169.4 169.3 160.3 157.8	MAG. 32.908 18.819 12.955 9.775 7.899 6.586 5.607 4.879 4.435 4.024 3.801 3.827 3.587 2.980	ANG. (deg.) 123.3 106.0 97.5 93.1 89.8 87.6 85.2 83.5 82.2 81.4 80.6 78.2 68.4 66.0	MAG. 0.017 0.027 0.035 0.042 0.052 0.061 0.071 0.081 0.092 0.095 0.098 0.109 0.117 0.125	ANG. (deg.) 71.1 71.2 71.8 78.1 78.5 79.1 77.4 76.4 76.5 77.6 77.1 78.3 78.0 80.3	0.665 0.487 0.398 0.393 0.399 0.407 0.400 0.415 0.399 0.440 0.441 0.494 0.517	ANG. (deg.) -34.7 -38.7 -38.5 -36.9 -37.6 -39.9 -44.6 -47.4 -46.2 -44.3 -45.2 -46.2 -55.4 -54.5
Frequency (GHz) 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	0.378 0.317 0.308 0.299 0.297 0.288 0.274 0.261 0.255 0.260 0.243 0.239 0.245 0.216	ANG. (deg.) -97.1 -131.8 -150.1 -158.7 -165.5 -169.2 -173.7 -177.3 178.9 173.0 169.4 169.3 160.3 157.8 155.3	MAG. 32.908 18.819 12.955 9.775 7.899 6.586 5.607 4.879 4.435 4.024 3.801 3.827 3.587 2.980 2.726	ANG. (deg.) 123.3 106.0 97.5 93.1 89.8 87.6 85.2 83.5 82.2 81.4 80.6 78.2 68.4 66.0 66.1	MAG. 0.017 0.027 0.035 0.042 0.052 0.061 0.071 0.081 0.092 0.095 0.098 0.109 0.117 0.125 0.137	ANG. (deg.) 71.1 71.2 71.8 78.1 78.5 79.1 77.4 76.4 76.5 77.6 77.1 78.3 78.0 80.3 86.5	MAG. 0.665 0.487 0.398 0.393 0.399 0.407 0.400 0.415 0.399 0.440 0.441 0.494 0.517 0.486 0.500	ANG. (deg.) -34.7 -38.7 -38.5 -36.9 -37.6 -39.9 -44.6 -47.4 -46.2 -44.3 -45.2 -46.2 -55.4 -54.5
Frequency (GHz) 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	0.378 0.317 0.308 0.299 0.297 0.288 0.274 0.261 0.255 0.260 0.243 0.239 0.245 0.216 0.235 0.243	ANG. (deg.) -97.1 -131.8 -150.1 -158.7 -165.5 -169.2 -173.7 -177.3 178.9 173.0 169.4 169.3 160.3 157.8 155.3 148.8	32.908 18.819 12.955 9.775 7.899 6.586 5.607 4.879 4.435 4.024 3.801 3.827 3.587 2.980 2.726 2.537	ANG. (deg.) 123.3 106.0 97.5 93.1 89.8 87.6 85.2 83.5 82.2 81.4 80.6 78.2 68.4 66.0 66.1 64.0	MAG. 0.017 0.027 0.035 0.042 0.052 0.061 0.071 0.081 0.092 0.095 0.098 0.109 0.117 0.125 0.137 0.143	ANG. (deg.) 71.1 71.2 71.8 78.1 78.5 79.1 77.4 76.4 76.5 77.6 77.1 78.3 78.0 80.3 86.5 80.6	0.665 0.487 0.398 0.393 0.399 0.407 0.400 0.415 0.399 0.440 0.441 0.494 0.517 0.486 0.500 0.474	ANG. (deg.) -34.7 -38.7 -38.5 -36.9 -37.6 -39.9 -44.6 -47.4 -46.2 -44.3 -45.2 -46.2 -55.4 -54.5 -59.0 -53.7
Frequency (GHz) 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	0.378 0.317 0.308 0.299 0.297 0.288 0.274 0.261 0.255 0.260 0.243 0.239 0.245 0.216 0.235 0.243	ANG. (deg.) -97.1 -131.8 -150.1 -158.7 -165.5 -169.2 -173.7 -177.3 178.9 173.0 169.4 169.3 160.3 157.8 155.3 148.8 146.0	MAG. 32.908 18.819 12.955 9.775 7.899 6.586 5.607 4.879 4.435 4.024 3.801 3.827 3.587 2.980 2.726 2.537 2.348	ANG. (deg.) 123.3 106.0 97.5 93.1 89.8 87.6 85.2 83.5 82.2 81.4 80.6 78.2 68.4 66.0 66.1 64.0 64.2	MAG. 0.017 0.027 0.035 0.042 0.052 0.061 0.071 0.081 0.092 0.095 0.098 0.109 0.117 0.125 0.137 0.143 0.159	ANG. (deg.) 71.1 71.2 71.8 78.1 78.5 79.1 77.4 76.4 76.5 77.6 77.1 78.3 78.0 80.3 86.5 80.6 81.2	0.665 0.487 0.398 0.393 0.399 0.407 0.400 0.415 0.399 0.440 0.441 0.494 0.517 0.486 0.500 0.474	ANG. (deg.) -34.7 -38.7 -38.5 -36.9 -37.6 -39.9 -44.6 -47.4 -46.2 -44.3 -45.2 -46.2 -55.4 -54.5 -59.0 -53.7 -56.8
Frequency (GHz) 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 1.8	0.378 0.317 0.308 0.299 0.297 0.288 0.274 0.261 0.255 0.260 0.243 0.239 0.245 0.216 0.235 0.243 0.233	ANG. (deg.) -97.1 -131.8 -150.1 -158.7 -165.5 -169.2 -173.7 -177.3 178.9 173.0 169.4 169.3 160.3 157.8 155.3 148.8 146.0 144.6	MAG. 32.908 18.819 12.955 9.775 7.899 6.586 5.607 4.879 4.435 4.024 3.801 3.827 3.587 2.980 2.726 2.537 2.348 2.200	ANG. (deg.) 123.3 106.0 97.5 93.1 89.8 87.6 85.2 83.5 82.2 81.4 80.6 78.2 68.4 66.0 66.1 64.0 64.2 63.5	MAG. 0.017 0.027 0.035 0.042 0.052 0.061 0.071 0.081 0.092 0.095 0.098 0.109 0.117 0.125 0.137 0.143 0.159 0.163	ANG. (deg.) 71.1 71.2 71.8 78.1 78.5 79.1 77.4 76.4 76.5 77.6 77.1 78.3 78.0 80.3 86.5 80.6 81.2 80.4	MAG. 0.665 0.487 0.398 0.393 0.399 0.407 0.400 0.415 0.399 0.440 0.441 0.494 0.517 0.486 0.500 0.474 0.496 0.491	ANG. (deg.) -34.7 -38.7 -38.5 -36.9 -37.6 -39.9 -44.6 -47.4 -46.2 -44.3 -45.2 -46.2 -55.4 -54.5 -59.0 -53.7 -56.8 -53.6

★ PACKAGE DIMENSIONS

4-PIN POWER MINIMOLD (UNIT: mm)



PIN CONNECTIONS

E: Emitter C: Collector B: Base **NEC** 2SC5336

[MEMO]

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