

# Silicon Transistor 2SC5336

# NPN EPITAXIAL SILICON TRANSISTOR HIGH FREQUENCY LOW DISTORTION AMPLIFIER

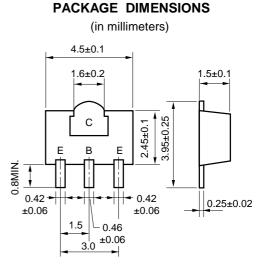
## FEATURES

• High gain

- $|S_{21}|^2 = 12 \text{ dB TYP}$ , @f = 1 GHz, V<sub>CE</sub> = 10 V, Ic = 20 mA
- New power mini-mold package version of a 4-pin type gain-improved on the 2SC3357

#### ABSOLUTE MAXIMUM RATINGS ( $T_A = 25 \text{ °C}$ )

Parameter	Symbol	Rating	Unit
Collector to Base Voltage	V <sub>CBO</sub>	20	V
Collector to Emitter Voltage	V <sub>CEO</sub>	12	V
Emitter to Base Voltage	V <sub>EBO</sub>	3.0	V
Collector Current	Ic	100	mA
Total Power Dissipation	$P_{T}^{Note1}$	1.2	W
Junction Temperature	Tj	150	°C
Storage Temperature	T <sub>stg</sub>	-65 to +150	°C



**PIN CONNECTIONS** 

E: Emitter

C: Collector B: Base

**Note 1**.  $0.7 \text{ mm} \times 16 \text{ cm}^2$  double sided ceramic substrate (Copper plating)

# ELECTRICAL CHARACTERISTICS ( $T_A = 25 \text{ °C}$ )

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Collector Cutoff Current	I <sub>CB0</sub>	$V_{CB} = 10 \text{ V}, I_E = 0$			1.0	μA
Emitter Cutoff Current	I <sub>EB0</sub>	$V_{EB} = 1 V, I_{C} = 0$			1.0	μA
DC Current Gain	h <sub>FE</sub>	$V_{CE} = 10 \text{ V}, I_{C} = 20 \text{ mA}^{Note2}$	50	120	250	
Gain Bandwidth Product	f⊤	V <sub>CE</sub> = 10 V, I <sub>C</sub> = 20 mA		6.5		GHz
Feed-back Capacitance	Cre	$V_{CB} = 10 \text{ V}, I_E = 0, f = 1.0 \text{ MHz}^{Note3}$		0.5	0.8	pF
Insertion Power Gain	S <sub>21e</sub>   <sup>2</sup>	V <sub>CE</sub> = 10 V, I <sub>C</sub> = 20 mA, f = 1.0 GHz		12.0		dB
Noise Figure	NF	V <sub>CE</sub> = 10 V, I <sub>C</sub> = 7 mA, f = 1.0 GHz		1.1		dB
Noise Figure	NF	$V_{CE}$ = 10 V, I <sub>C</sub> = 40 mA, f = 1.0 GHz		1.8	3.0	dB

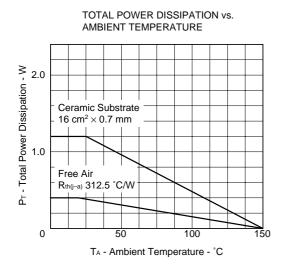
**Notes 2**. Pulse measurement : PW  $\leq$  350  $\mu$ S, Duty Cycle  $\leq$  2 %

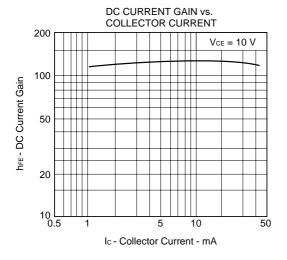
3. Mesured by a 3-terminal bridge. Emitter and Case should be connected to the guard terminal.

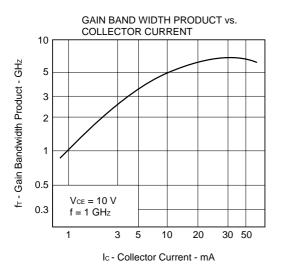
#### h<sub>FE</sub> Classification

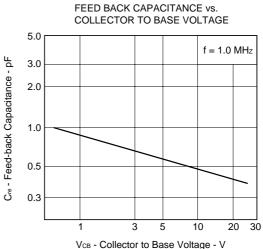
Rank	RH	RF	RE
Marking	RH	RF	RE
h <sub>FE</sub>	50 to 100	80 to 160	125 to 250

### TYPICAL CHARACTERISTICS ( $T_A = 25 \text{ °C}$ )



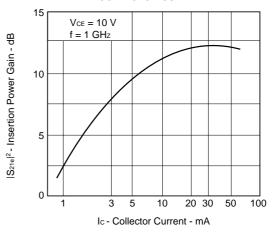


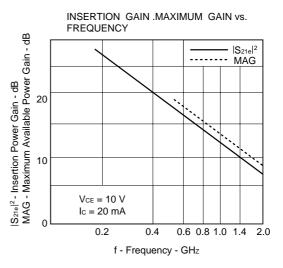


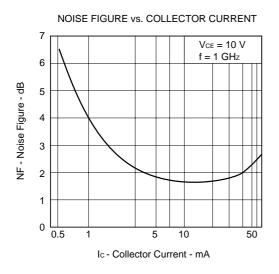


cb - Collector to Dase Voltage - (

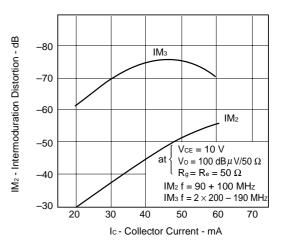
INSERTION GAIN vs. COLLECTOR CURRENT







INTERMODULATION DISTORTION vs. COLLECTOR CURRENT



## S-PARAMETER

 $V_{CE}=10~V,~I_C=20~mA$ 

f (MHz)MAGANGMAGANGMAGANGANGANGANG100.519-74.530.931131.9.01760.6.752-30.2200.413-112.918.965111.5.03161.9.570-39.7300.413-133.413.324101.9.03865.1.465-39.8400.345-145.710.16495.9.04569.8.428-40.1500.331-153.88.17791.8.05571.8.436-41.1600.320-159.66.83489.1.06470.9.438-43.5700.302-166.85.83286.7.07473.9.434-47.5800.296-169.25.10784.3.07774.4.429-47.8900.283-173.24.60083.1.08871.2.436-46.51000.285-179.84.20082.3.09774.5.455-47.81100.265175.23.93080.8.10076.3.467-46.81200.260174.13.97978.5.10975.9.529-47.41300.263166.03.74168.6.11476.8.551-55.81600.252160.12.84465.7.13382.0.510-58.51600.253154.02.59564.1.14081.0		S <sub>11</sub>			S <sub>21</sub>		<b>S</b> <sub>12</sub>		S <sub>22</sub>	
200.413-112.918.965111.5.03161.9.570-39.7300.413-133.413.324101.9.03865.1.465-39.8400.345-145.710.16495.9.04569.8.428-40.1500.331-153.88.17791.8.05571.8.436-41.1600.320-159.66.83489.1.06470.9.438-43.5700.302-166.85.83286.7.07473.9.434-47.5800.296-169.25.10784.3.07774.4.429-47.8900.283-173.24.60083.1.08871.2.436-46.51000.285-179.84.20082.3.09774.5.455-47.81100.265175.23.93080.8.10076.3.467-46.81200.260174.13.97978.5.10975.9.529-47.41300.263166.03.74168.6.11476.8.551-55.81400.242163.03.11566.6.11978.3.509-55.81500.252160.12.84465.7.13382.0.510-58.51600.253154.02.59564.1.14081.0.496-55.21700.253149.92.42063.7.15880.9	f (MHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG	
300.413-133.413.324101.9.03866.1.465-39.8400.345-145.710.16495.9.04569.8.428-40.1500.331-153.88.17791.8.05571.8.436-41.1600.320-159.66.83489.1.06470.9.438-43.5700.302-166.85.83286.7.07473.9.434-47.5800.296-169.25.10784.3.07774.4.429-47.8900.283-173.24.60083.1.08871.2.436-46.51000.285-179.84.20082.3.09774.5.455-47.81100.265175.23.93080.8.10076.3.467-46.81200.260174.13.97978.5.10975.9.529-47.41300.263166.03.74168.6.11476.8.551-55.81600.252160.12.84465.7.13382.0.510-58.51600.253154.02.59564.1.14081.0.496-55.21700.253149.92.42063.7.15880.9.515-54.81800.257147.22.30563.0.16582.2.518-56.51900.262143.02.17162.6.17280.5 <t< td=""><td>100</td><td>.519</td><td>- 74.5</td><td>30.931</td><td>131.9</td><td>.017</td><td>60.6</td><td>.752</td><td>- 30.2</td></t<>	100	.519	- 74.5	30.931	131.9	.017	60.6	.752	- 30.2	
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	200	.413	- 112.9	18.965	111.5	.031	61.9	.570	- 39.7	
500.331-153.88.17791.8.05571.8.436-41.1600.320-159.66.83489.1.06470.9.438-43.5700.302-166.85.83286.7.07473.9.434-47.5800.296-169.25.10784.3.07774.4.429-47.8900.283-173.24.60083.1.08871.2.436-46.51000.285-179.84.20082.3.09774.5.455-47.81100.265175.23.93080.8.10076.3.467-46.81200.260174.13.97978.5.10975.9.529-47.41300.263166.03.74168.6.11476.8.551-55.81400.242163.03.11566.6.11978.3.509-55.81500.252160.12.84465.7.13382.0.510-58.51600.253154.02.59564.1.14081.0.496-55.21700.253149.92.42063.7.15880.9.515-54.81800.257147.22.30563.0.16582.2.518-56.51900.262143.02.17162.6.17280.5.536-58.6	300	.413	- 133.4	13.324	101.9	.038	65.1	.465	- 39.8	
600.320- 159.66.83489.1.06470.9.438- 43.5700.302- 166.85.83286.7.07473.9.434- 47.5800.296- 169.25.10784.3.07774.4.429- 47.8900.283- 173.24.60083.1.08871.2.436- 46.51000.285- 179.84.20082.3.09774.5.455- 47.81100.265175.23.93080.8.10076.3.467- 46.81200.260174.13.97978.5.10975.9.529- 47.41300.263166.03.74168.6.11476.8.551- 55.81400.242163.03.11566.6.11978.3.509- 55.81500.252160.12.84465.7.13382.0.510- 58.51600.253154.02.59564.1.14081.0.496- 55.21700.253149.92.42063.7.15880.9.515- 54.81800.257147.22.30563.0.16582.2.518- 56.51900.262143.02.17162.6.17280.5.536- 58.6	400	.345	- 145.7	10.164	95.9	.045	69.8	.428	- 40.1	
700.302- 166.85.83286.7.07473.9.434- 47.5800.296- 169.25.10784.3.07774.4.429- 47.8900.283- 173.24.60083.1.08871.2.436- 46.51000.285- 179.84.20082.3.09774.5.455- 47.81100.265175.23.93080.8.10076.3.467- 46.81200.260174.13.97978.5.10975.9.529- 47.41300.263166.03.74168.6.11476.8.551- 55.81400.242163.03.11566.6.11978.3.509- 55.81500.252160.12.84465.7.13382.0.510- 58.51600.253154.02.59564.1.14081.0.496- 55.21700.253149.92.42063.7.15880.9.515- 54.81800.257147.22.30563.0.16582.2.518- 56.51900.262143.02.17162.6.17280.5.536- 58.6	500	.331	- 153.8	8.177	91.8	.055	71.8	.436	- 41.1	
800.296- 169.25.10784.3.07774.4.429- 47.8900.283- 173.24.60083.1.08871.2.436- 46.51000.285- 179.84.20082.3.09774.5.455- 47.81100.265175.23.93080.8.10076.3.467- 46.81200.260174.13.97978.5.10975.9.529- 47.41300.263166.03.74168.6.11476.8.551- 55.81400.242163.03.11566.6.11978.3.509- 55.81500.252160.12.84465.7.13382.0.510- 58.51600.253154.02.59564.1.14081.0.496- 55.21700.253149.92.42063.7.15880.9.515- 54.81800.267147.22.30563.0.16582.2.518- 56.51900.262143.02.17162.6.17280.5.536- 58.6	600	.320	- 159.6	6.834	89.1	.064	70.9	.438	- 43.5	
900.283-173.24.60083.1.08871.2.436-46.51000.285-179.84.20082.3.09774.5.455-47.81100.265175.23.93080.8.10076.3.467-46.81200.260174.13.97978.5.10975.9.529-47.41300.263166.03.74168.6.11476.8.551-55.81400.242163.03.11566.6.11978.3.509-55.81500.252160.12.84465.7.13382.0.510-58.51600.253154.02.59564.1.14081.0.496-55.21700.253149.92.42063.7.15880.9.515-54.81800.257147.22.30563.0.16582.2.518-56.51900.262143.02.17162.6.17280.5.536-58.6	700	.302	- 166.8	5.832	86.7	.074	73.9	.434	- 47.5	
1000.285- 179.84.20082.3.09774.5.455- 47.81100.265175.23.93080.8.10076.3.467- 46.81200.260174.13.97978.5.10975.9.529- 47.41300.263166.03.74168.6.11476.8.551- 55.81400.242163.03.11566.6.11978.3.509- 55.81500.252160.12.84465.7.13382.0.510- 58.51600.253154.02.59564.1.14081.0.496- 55.21700.253149.92.42063.7.15880.9.515- 54.81800.257147.22.30563.0.16582.2.518- 56.51900.262143.02.17162.6.17280.5.536- 58.6	800	.296	- 169.2	5.107	84.3	.077	74.4	.429	- 47.8	
1100.265175.23.93080.8.10076.3.467-46.81200.260174.13.97978.5.10975.9.529-47.41300.263166.03.74168.6.11476.8.551-55.81400.242163.03.11566.6.11978.3.509-55.81500.252160.12.84465.7.13382.0.510-58.51600.253154.02.59564.1.14081.0.496-55.21700.253149.92.42063.7.15880.9.515-54.81800.257147.22.30563.0.16582.2.518-56.51900.262143.02.17162.6.17280.5.536-58.6	900	.283	- 173.2	4.600	83.1	.088	71.2	.436	- 46.5	
1200.260174.13.97978.5.10975.9.529-47.41300.263166.03.74168.6.11476.8.551-55.81400.242163.03.11566.6.11978.3.509-55.81500.252160.12.84465.7.13382.0.510-58.51600.253154.02.59564.1.14081.0.496-55.21700.253149.92.42063.7.15880.9.515-54.81800.257147.22.30563.0.16582.2.518-56.51900.262143.02.17162.6.17280.5.536-58.6	1000	.285	- 179.8	4.200	82.3	.097	74.5	.455	- 47.8	
1300.263166.03.74168.6.11476.8.551-55.81400.242163.03.11566.6.11978.3.509-55.81500.252160.12.84465.7.13382.0.510-58.51600.253154.02.59564.1.14081.0.496-55.21700.253149.92.42063.7.15880.9.515-54.81800.257147.22.30563.0.16582.2.518-56.51900.262143.02.17162.6.17280.5.536-58.6	1100	.265	175.2	3.930	80.8	.100	76.3	.467	- 46.8	
1400.242163.03.11566.6.11978.3.509-55.81500.252160.12.84465.7.13382.0.510-58.51600.253154.02.59564.1.14081.0.496-55.21700.253149.92.42063.7.15880.9.515-54.81800.257147.22.30563.0.16582.2.518-56.51900.262143.02.17162.6.17280.5.536-58.6	1200	.260	174.1	3.979	78.5	.109	75.9	.529	- 47.4	
1500.252160.12.84465.7.13382.0.510-58.51600.253154.02.59564.1.14081.0.496-55.21700.253149.92.42063.7.15880.9.515-54.81800.257147.22.30563.0.16582.2.518-56.51900.262143.02.17162.6.17280.5.536-58.6	1300	.263	166.0	3.741	68.6	.114	76.8	.551	- 55.8	
1600.253154.02.59564.1.14081.0.496-55.21700.253149.92.42063.7.15880.9.515-54.81800.257147.22.30563.0.16582.2.518-56.51900.262143.02.17162.6.17280.5.536-58.6	1400	.242	163.0	3.115	66.6	.119	78.3	.509	- 55.8	
1700.253149.92.42063.7.15880.9.515- 54.81800.257147.22.30563.0.16582.2.518- 56.51900.262143.02.17162.6.17280.5.536- 58.6	1500	.252	160.1	2.844	65.7	.133	82.0	.510	- 58.5	
1800.257147.22.30563.0.16582.2.518- 56.51900.262143.02.17162.6.17280.5.536- 58.6	1600	.253	154.0	2.595	64.1	.140	81.0	.496	- 55.2	
1900 .262 143.0 2.171 62.6 .172 80.5 .536 -58.6	1700	.253	149.9	2.420	63.7	.158	80.9	.515	- 54.8	
	1800	.257	147.2	2.305	63.0	.165	82.2	.518	- 56.5	
2000 .273 141.5 2.049 61.2 .177 78.3 .524 -61.5	1900	.262	143.0	2.171	62.6	.172	80.5	.536	- 58.6	
	2000	.273	141.5	2.049	61.2	.177	78.3	.524	- 61.5	

## S-PARAMETER

 $V_{CE}=10\ V,\ I_C=40\ mA$ 

	S <sub>11</sub>			S <sub>21</sub>		S <sub>12</sub>		<b>S</b> <sub>22</sub>	
f (MHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG	
100	.378	- 97.1	32.908	123.3	.017	71.1	.665	- 34.7	
200	.317	- 131.8	18.819	106.0	.027	71.2	.487	- 38.7	
300	.308	- 150.1	12.955	97.5	.035	71.8	.398	- 38.5	
400	.299	- 158.7	9.775	93.1	.042	78.1	.393	- 36.9	
500	.297	- 165.5	7.899	89.8	.052	78.5	.399	- 37.6	
600	.288	- 169.2	6.586	87.6	.061	79.1	.407	- 39.9	
700	.274	- 173.7	5.607	85.2	.071	77.4	.400	- 44.6	
800	.261	- 177.3	4.879	83.5	.081	76.4	.415	- 47.4	
900	.255	178.9	4.435	82.2	.092	76.5	.399	- 46.2	
1000	.260	173.0	4.024	81.4	.095	77.6	.440	- 44.3	
1100	.243	169.4	3.801	80.6	.098	77.1	.441	- 45.2	
1200	.239	169.3	3.827	78.2	.109	78.3	.494	- 46.2	
1300	.245	160.3	3.587	68.4	.117	78.0	.517	- 55.4	
1400	.216	157.8	2.980	66.0	.125	80.3	.486	- 54.5	
1500	.235	155.3	2.726	66.1	.137	86.5	.500	- 59.0	
1600	.243	148.8	2.537	64.0	.143	80.6	.474	- 53.7	
1700	.233	146.0	2.348	64.2	.159	81.2	.496	- 56.8	
1800	.242	144.6	2.200	63.5	.163	80.4	.491	- 53.6	
1900	.249	141.9	2.073	63.3	.171	81.7	.534	- 58.0	
2000	.260	140.4	1.986	61.7	.184	77.5	.535	- 61.3	

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- 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: Aircrafts, aerospace equipment, submersible repeaters, nuclear reactor control systems, life support systems or medical equipment for life support, etc.

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Anti-radioactive design is not implemented in this product.

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