

**NPN EPITAXIAL SILICON TRANSISTOR  
HIGH FREQUENCY LOW DISTORTION AMPLIFIER**

**DESCRIPTION**

The 2SC5338 is designed for a low distortion and low noise RF amplifier with an operation on the low supply voltage ( $V_{CE} = 5\text{ V}$ ). This low distortion characteristics is suitable for the CATV, tele-communication, and such.

**FEATURES**

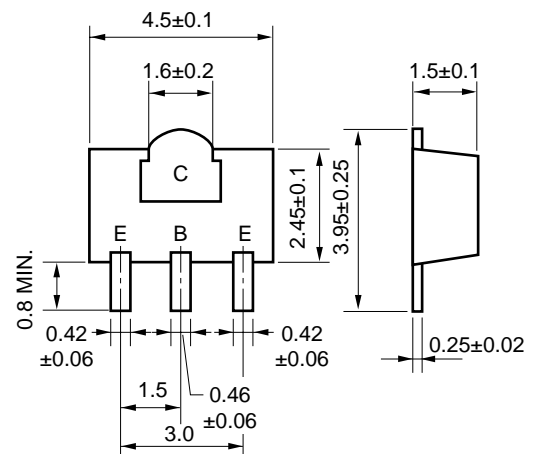
- High gain  
 $|S_{21}|^2 = 10\text{ dB TYP.}$ , @ $V_{CE} = 5\text{ V}$ ,  $I_C = 50\text{ mA}$ ,  $f = 1\text{ GHz}$
- Low distortion and low voltage  
 $IM_2 = -55\text{ dB TYP.}$ ,  $IM_3 = -76\text{ dB TYP.}$   
@ $V_{CE} = 5\text{ V}$ ,  $I_C = 50\text{ mA}$ ,  $V_{in} = 105\text{ dB } \mu\text{V}/75\ \Omega$
- New power mini-mold package version of a 4-pin type gain-improved on the 2SC4703

**ABSOLUTE MAXIMUM RATINGS ( $T_A = 25\text{ }^\circ\text{C}$ )**

Parameter	Symbol	Rating	Unit
Collector to Base Voltage	$V_{CBO}$	25	V
Collector to Emitter Voltage	$V_{CEO}$	12	V
Emitter to Base Voltage	$V_{EBO}$	2.5	V
Collector Current	$I_C$	150	mA
Total Power Dissipation	$P_T$ <sup>Note1</sup>	1.8	W
Junction Temperature	$T_j$	150	$^\circ\text{C}$
Storage Temperature	$T_{stg}$	-65 to +150	$^\circ\text{C}$

**PACKAGE DIMENSIONS**

(in millimeters)



**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<sub>A</sub> = 25 °C)**

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Collector Cutoff Current	I <sub>CBO</sub>	V <sub>CB</sub> = 20 V, I <sub>E</sub> = 0			1.5	μA
Emitter Cutoff Current	I <sub>EBO</sub>	V <sub>EB</sub> = 2 V, I <sub>C</sub> = 0			1.5	μA
DC Current Gain	h <sub>FE</sub>	V <sub>CE</sub> = 5 V, I <sub>C</sub> = 50 mA <sup>Note2</sup>	50		250	
Gain Bandwidth Product	f <sub>T</sub>	V <sub>CE</sub> = 5 V, I <sub>C</sub> = 50 mA		6.0		GHz
Feed-back Capacitance	C <sub>re</sub>	V <sub>CB</sub> = 5 V, I <sub>E</sub> = 0, f = 1 MHz <sup>Note3</sup>		1.0	2.0	pF
Insertion Power Gain	S <sub>21e</sub>   <sup>2</sup>	V <sub>CE</sub> = 5 V, I <sub>C</sub> = 50 mA, f = 1 GHz	8.5	10		dB
Nose Figure	NF	V <sub>CE</sub> = 5 V, I <sub>C</sub> = 50 mA, f = 1 GHz			3.5	dB
2nd Order Intermodulation Distortion	IM <sub>2</sub>	I <sub>C</sub> = 50 mA V <sub>in</sub> = 105 dB μV/75 Ω f = 190 MHz – 90 MHz	V <sub>CE</sub> = 5 V	-55		dB
			V <sub>CE</sub> = 10 V	-63		
3rd Order Intermodulation Distortion	IM <sub>3</sub>	I <sub>C</sub> = 50 mA V <sub>in</sub> = 105 dB μV/75 Ω f = 2 × 190 MHz – 200 MHz	V <sub>CE</sub> = 5 V	-76		dB
			V <sub>CE</sub> = 10 V	-83		

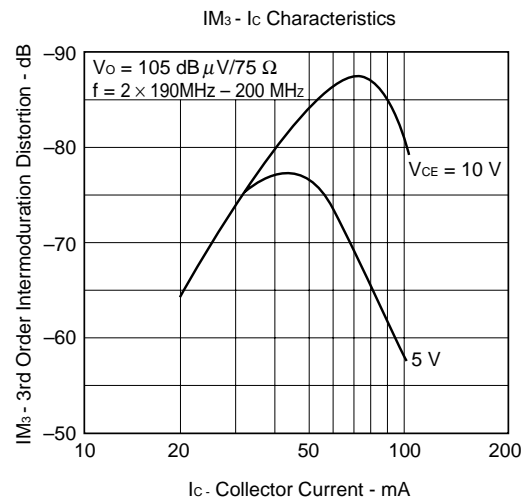
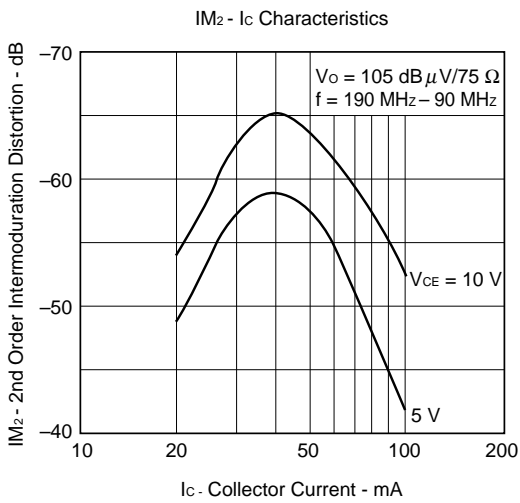
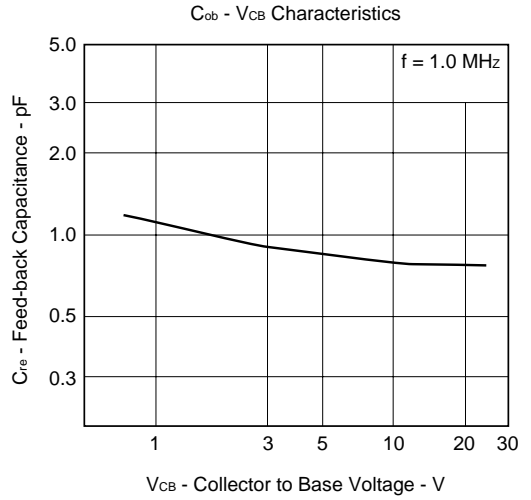
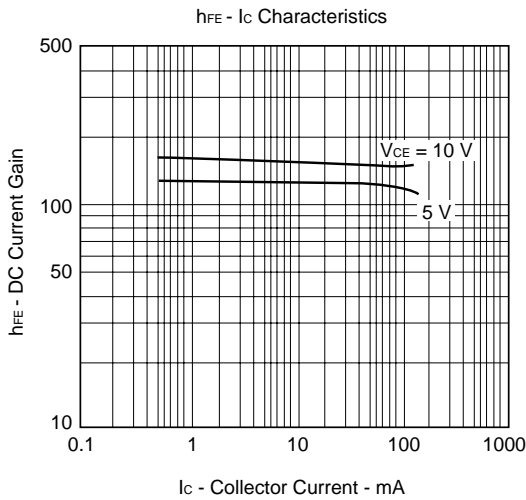
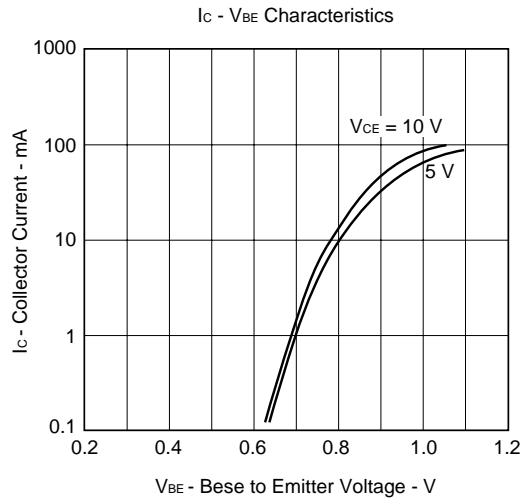
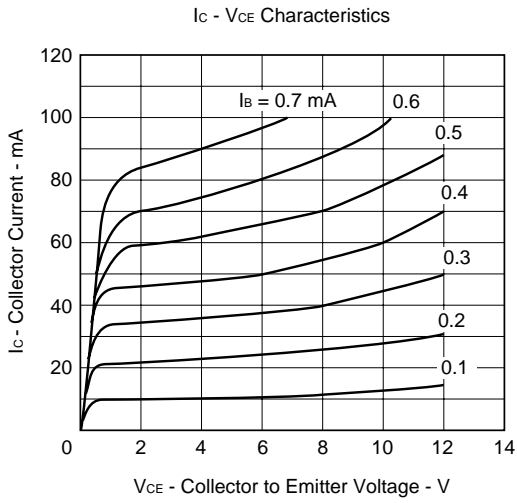
**Notes 2.** Pulse measurement: PW ≤ 350 μS, Duty Cycle ≤ 2 %

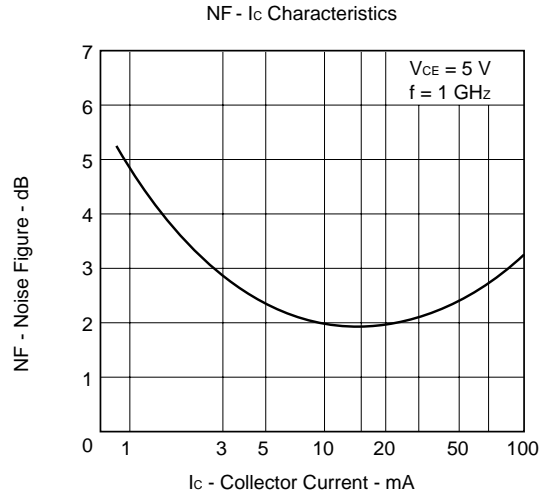
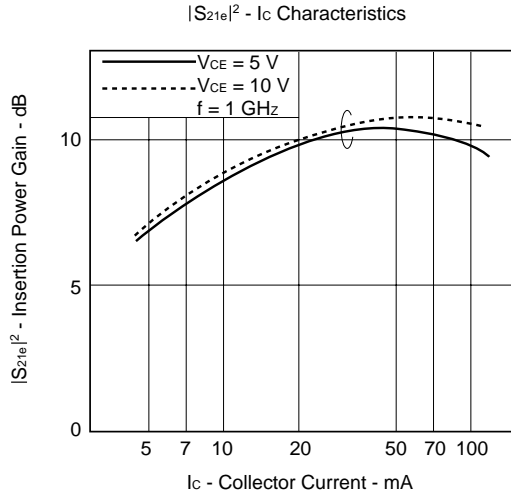
**3.** Measured by a 3-terminal bridge. Emitter and Case should be connected to the guard terminal.

**h<sub>FE</sub> Classification**

Rank	SH	SF	SE
Marking	SH	SF	SE
h <sub>FE</sub>	50 to 100	80 to 160	125 to 250

TYPICAL CHARACTERISTICS (T<sub>A</sub> = 25 °C)





**S-PARAMETER**

V<sub>CE</sub> = 5 V, I<sub>C</sub> = 50 mA

f (MHz)	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100	.642	- 61.5	19.689	138.5	.026	64.9	.603	- 39.7
200	.521	- 103.0	13.393	116.8	.045	53.1	.461	- 62.1
300	.464	- 123.8	9.708	106.3	.053	57.8	.359	- 72.8
400	.428	- 137.2	7.480	99.5	.059	62.1	.304	- 75.7
500	.408	- 147.7	6.078	94.5	.072	63.7	.289	- 79.4
600	.390	- 154.3	5.104	91.3	.080	65.9	.275	- 83.2
700	.374	- 161.1	4.394	88.6	.088	66.2	.277	- 82.8
800	.360	- 163.9	3.880	86.2	.097	68.9	.261	- 85.0
900	.348	- 168.0	3.527	84.5	.110	72.1	.271	- 81.6
1000	.351	- 175.1	3.224	83.3	.119	72.0	.268	- 79.9
1100	.329	179.8	3.078	81.8	.125	76.4	.276	- 75.5
1200	.328	- 179.9	3.111	78.9	.144	73.7	.321	- 75.3
1300	.319	171.9	2.914	69.6	.157	77.8	.320	- 82.4
1400	.297	168.9	2.501	66.2	.166	75.7	.291	- 83.6
1500	.307	165.2	2.285	65.3	.182	77.7	.325	- 83.4
1600	.308	159.6	2.115	63.9	.192	77.7	.305	- 82.7
1700	.303	156.6	1.993	62.9	.201	77.4	.313	- 81.7
1800	.309	154.1	1.880	62.0	.219	75.5	.327	- 83.5
1900	.312	150.3	1.786	60.8	.222	74.9	.321	- 86.3
2000	.315	148.4	1.704	59.9	.242	75.9	.341	- 91.2

**S-PARAMETER**

$V_{CE} = 5\text{ V}$ ,  $I_C = 100\text{ mA}$

f (MHz)	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100	.647	- 73.2	21.091	134.7	.039	58.3	.793	- 45.3
200	.529	- 112.8	13.280	113.6	.060	53.9	.561	- 71.0
300	.480	- 133.5	9.390	103.3	.072	54.2	.409	- 82.3
400	.459	- 146.3	7.213	96.7	.079	55.6	.360	- 86.1
500	.443	- 155.4	5.826	92.0	.090	58.6	.333	- 90.2
600	.424	- 160.9	4.890	89.2	.102	57.6	.315	- 95.6
700	.406	- 166.8	4.206	86.9	.111	61.4	.297	- 96.0
800	.401	- 169.8	3.711	84.3	.120	64.2	.292	- 95.6
900	.396	- 173.9	3.372	82.7	.135	66.9	.288	- 93.9
1000	.391	- 178.9	3.093	81.8	.143	67.0	.294	- 91.3
1100	.361	176.3	2.950	80.4	.157	67.4	.298	- 86.5
1200	.366	175.3	2.984	77.2	.166	67.9	.338	- 86.4
1300	.363	167.7	2.788	67.5	.178	68.5	.359	- 94.6
1400	.337	165.3	2.413	64.6	.192	71.3	.320	- 95.5
1500	.352	160.9	2.194	63.4	.210	70.8	.322	- 96.3
1600	.349	157.0	2.017	61.7	.220	68.8	.314	- 92.3
1700	.352	154.7	1.900	60.9	.236	69.4	.329	- 91.1
1800	.353	152.0	1.810	60.3	.248	69.1	.339	- 93.7
1900	.354	147.9	1.730	58.8	.252	68.8	.336	- 98.1
2000	.354	146.6	1.633	57.8	.261	66.2	.342	- 98.2

**S-PARAMETER**

V<sub>CE</sub> = 10 V, I<sub>C</sub> = 50 mA

f (MHz)	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100	.699	- 59.3	21.061	140.1	.037	68.2	.860	- 37.6
200	.540	- 97.0	14.088	118.4	.057	57.8	.629	- 62.0
300	.461	- 119.1	10.216	107.1	.066	55.0	.464	- 72.1
400	.423	- 133.2	7.898	99.9	.076	56.4	.409	- 77.1
500	.403	- 144.4	6.431	95.0	.087	56.6	.375	- 80.6
600	.383	- 150.8	5.407	91.8	.099	58.7	.363	- 86.2
700	.355	- 158.1	4.640	89.3	.110	59.6	.327	- 87.7
800	.338	- 161.3	4.093	86.7	.118	61.4	.323	- 87.8
900	.333	- 165.1	3.723	84.9	.129	63.9	.310	- 86.0
1000	.322	- 172.7	3.406	84.0	.137	66.0	.324	- 83.2
1100	.303	- 177.8	3.245	82.6	.150	65.6	.333	- 79.9
1200	.306	- 178.3	3.278	79.5	.159	66.2	.371	- 80.5
1300	.295	171.3	3.074	69.9	.168	67.6	.377	- 86.5
1400	.276	171.0	2.644	67.0	.180	69.7	.347	- 86.7
1500	.283	164.5	2.397	66.2	.198	70.5	.363	- 88.4
1600	.282	159.5	2.208	64.7	.208	69.1	.342	- 85.6
1700	.283	157.3	2.088	64.1	.220	70.0	.344	- 86.0
1800	.287	154.8	1.986	62.6	.232	70.0	.366	- 87.8
1900	.290	150.4	1.886	61.7	.247	69.4	.371	- 89.3
2000	.300	148.7	1.787	60.7	.254	68.4	.361	- 92.9

**S-PARAMETER**

V<sub>CE</sub> = 10 V, I<sub>C</sub> = 100 mA

f (MHz)	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100	.651	- 64.8	21.694	136.2	.029	62.4	.588	- 43.4
200	.520	- 106.4	14.288	114.6	.042	53.0	.435	- 62.7
300	.460	- 126.5	10.214	104.5	.051	56.6	.330	- 73.0
400	.420	- 140.1	7.822	98.1	.061	58.4	.284	- 77.1
500	.395	- 150.0	6.355	93.2	.070	65.6	.270	- 78.8
600	.384	- 156.3	5.314	90.3	.077	67.0	.257	- 82.2
700	.367	- 162.9	4.569	87.8	.089	70.9	.258	- 82.1
800	.350	- 165.5	4.037	85.6	.095	71.6	.241	- 82.9
900	.343	- 169.3	3.649	83.8	.106	72.5	.257	- 79.5
1000	.339	- 177.1	3.353	82.8	.117	73.9	.258	- 79.3
1100	.316	177.9	3.193	81.0	.125	75.0	.261	- 73.6
1200	.315	179.4	3.217	78.4	.142	75.5	.311	- 72.3
1300	.309	170.1	3.026	69.1	.152	78.1	.324	- 80.4
1400	.287	165.6	2.592	65.9	.164	75.6	.280	- 81.0
1500	.303	161.9	2.374	65.2	.173	80.5	.308	- 82.6
1600	.293	157.9	2.179	63.5	.187	78.1	.295	- 81.4
1700	.301	153.7	2.054	62.4	.200	78.2	.307	- 78.7
1800	.303	150.7	1.945	61.4	.214	75.9	.313	- 82.1
1900	.306	148.8	1.840	60.5	.225	75.4	.321	- 82.8
2000	.311	147.2	1.753	59.7	.240	75.0	.332	- 86.9



[MEMO]

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.

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

The quality grade of NEC devices in “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 NEC Sales Representative in advance.

Anti-radioactive design is not implemented in this product.