

PRELIMINARY DATA SHEET

NEC

Silicon Transistor 2SC5338

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

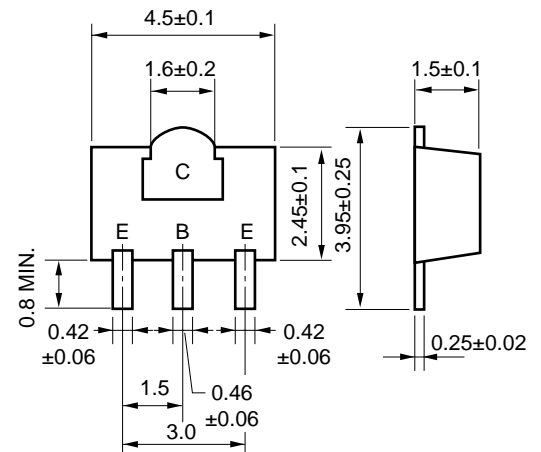
- High gain
 $|S_{21}|^2 = 10\text{ dB TYP.}$, @ $V_{CE} = 5\text{ V}$, $I_C = 50\text{ mA}$, $f = 1\text{ GHz}$
- Low distortion and low voltage
 $IM_2 = -55\text{ dB TYP.}$, $IM_3 = -76\text{ dB TYP.}$
 @ $V_{CE} = 5\text{ V}$, $I_C = 50\text{ mA}$, $V_{in} = 105\text{ dB } \mu\text{V}/75\ \Omega$
- 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 ^{Note1}	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_A = 25 °C)

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

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

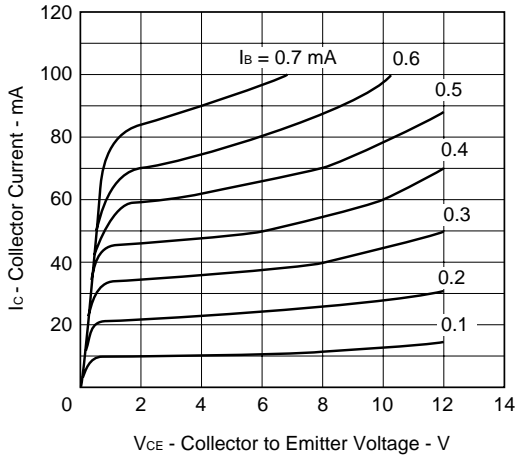
3. Measured by a 3-terminal bridge. Emitter and Case should be connected to the guard terminal.

h_{FE} Classification

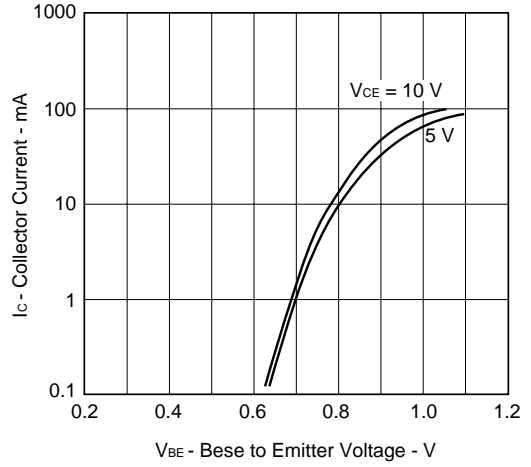
Rank	SH	SF	SE
Marking	SH	SF	SE
h _{FE}	50 to 100	80 to 160	125 to 250

TYPICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$)

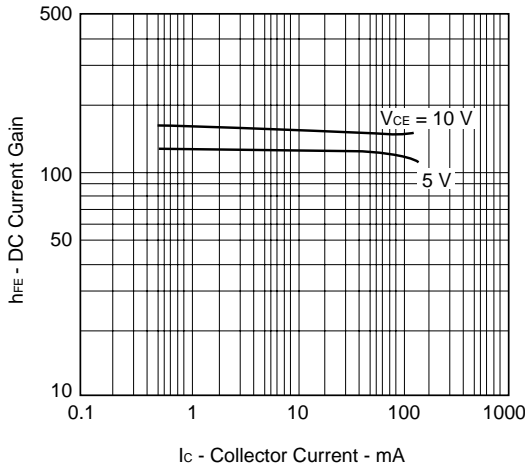
$I_c - V_{CE}$ Characteristics



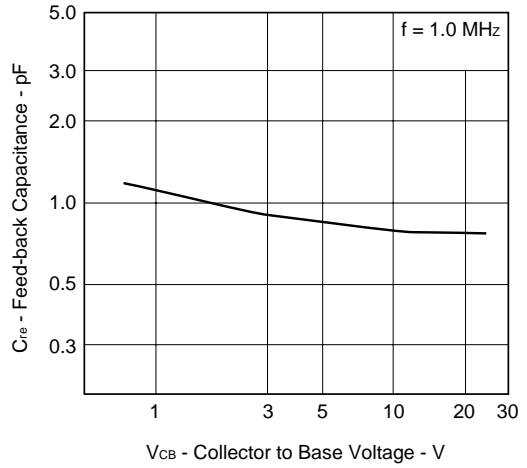
$I_c - V_{BE}$ Characteristics



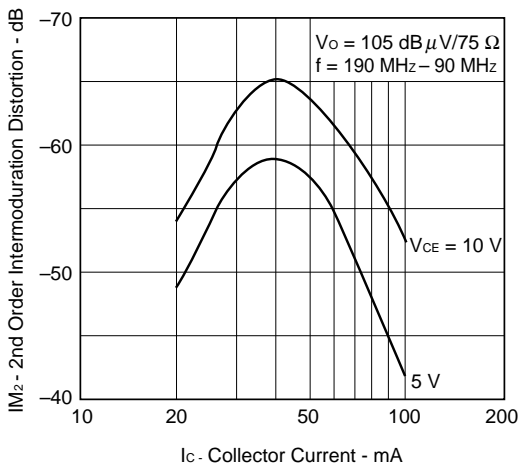
$h_{FE} - I_c$ Characteristics



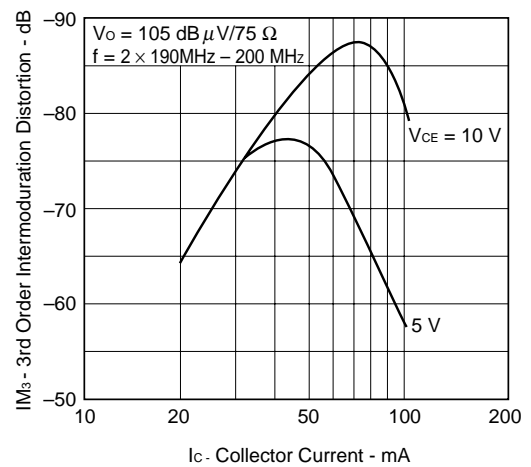
$C_{ob} - V_{CB}$ Characteristics



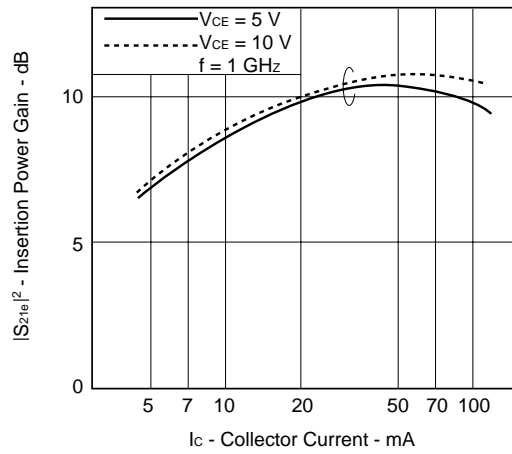
$IM_2 - I_c$ Characteristics



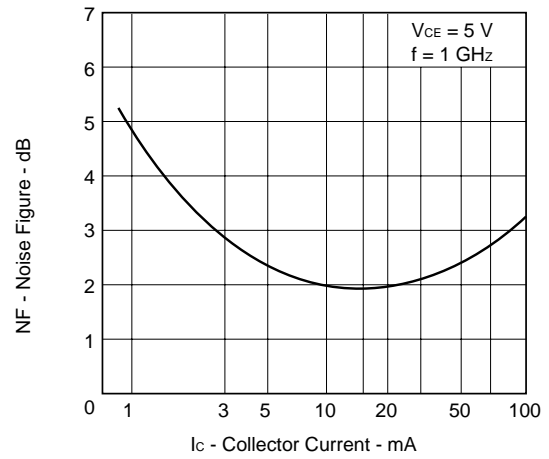
$IM_3 - I_c$ Characteristics



$|S_{21e}|^2$ - I_c Characteristics



NF - I_c Characteristics



S-PARAMETER

V_{CE} = 5 V, I_C = 50 mA

f (MHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	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 V, I_C = 100 mA

f (MHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	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_{CE} = 10 V, I_C = 50 mA

f (MHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	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_{CE} = 10 V, I_C = 100 mA

f (MHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂	
	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]

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