

To all our customers

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Renesas Technology Corp.  
Customer Support Dept.  
April 1, 2003

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Remember to give due consideration to safety when making your circuit designs, with appropriate measures such as (i) placement of substitutive, auxiliary circuits, (ii) use of nonflammable material or (iii) prevention against any malfunction or mishap.

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# 2SC5593

## Silicon NPN Epitaxial High Frequency Low Noise Amplifier

# RENESAS

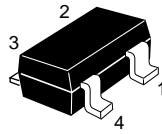
ADE-208-797 (Z)  
1st. Edition  
Nov. 2000

### Features

- High gain bandwidth product  
 $f_T = 23$  GHz typ.
- High power gain and low noise figure ;  
PG = 18 dB typ. , NF = 1.8 dB typ. at  $f = 1.8$  GHz

### Outline

CMPAK-4



1. Emitter
2. Collector
3. Emitter
4. Base

Note: Marking is "XH-".

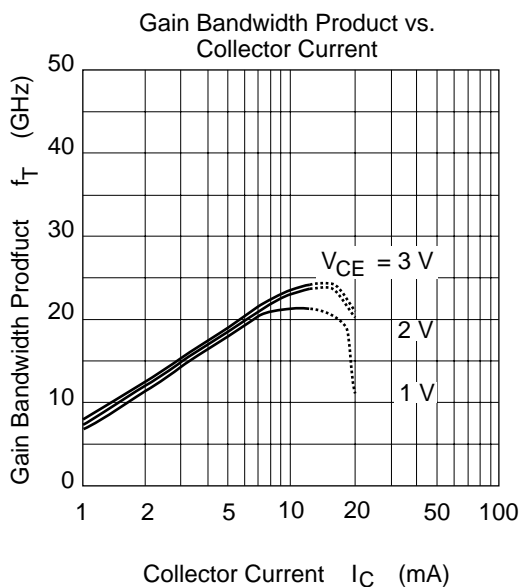
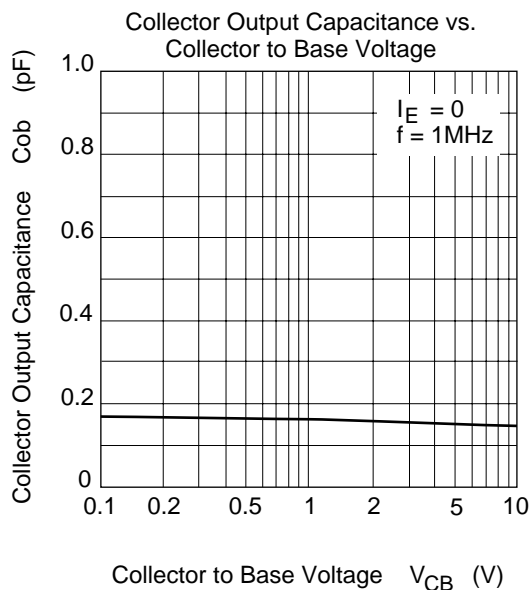
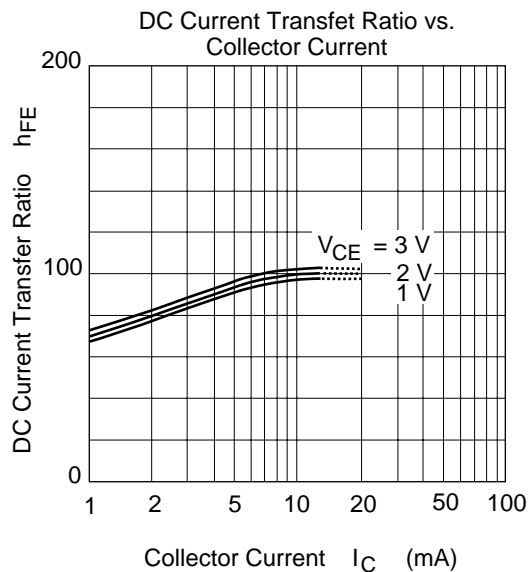
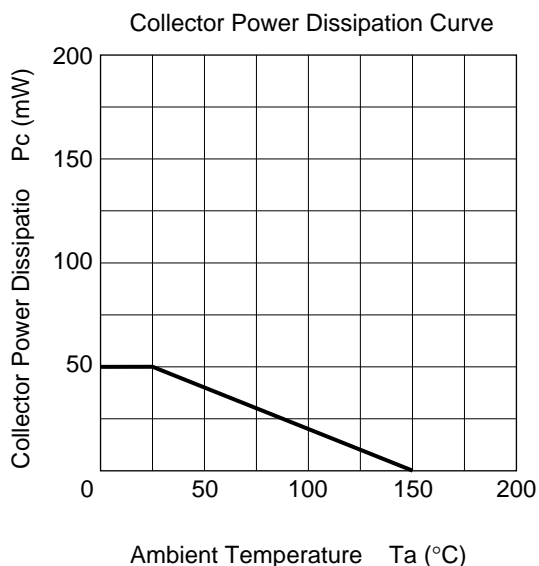
## Absolute Maximum Ratings (Ta = 25°C)

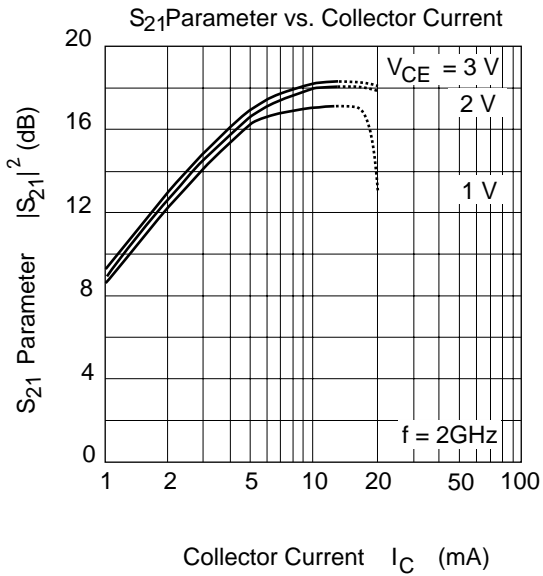
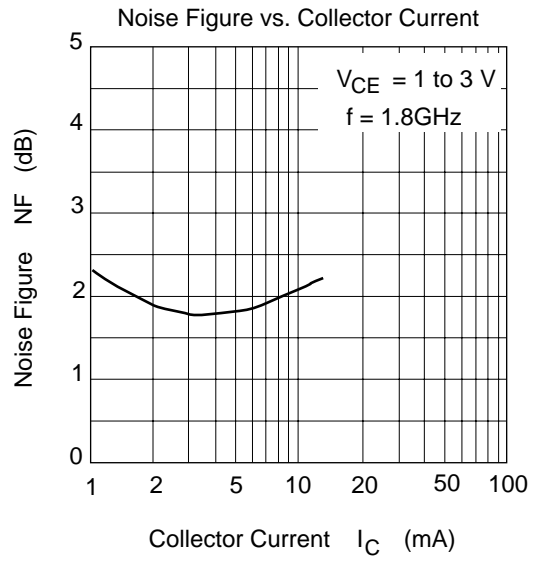
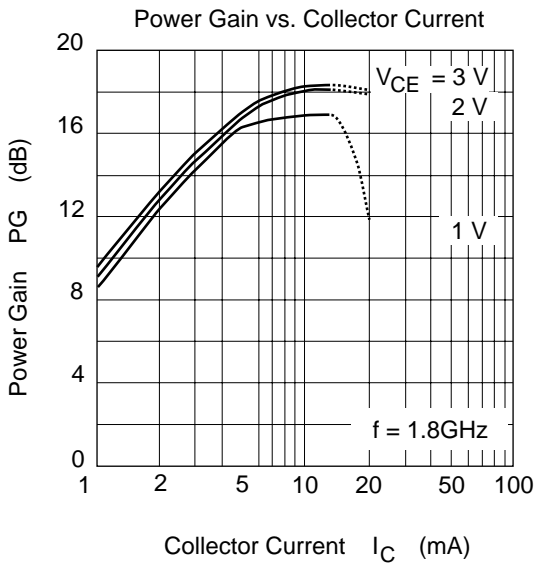
Item	Symbol	Ratings	Unit
Collector to base voltage	$V_{CBO}$	12	V
Collector to emitter voltage	$V_{CEO}$	4.5	V
Emitter to base voltage	$V_{EBO}$	1	V
Collector current	$I_C$	12	mA
Collector power dissipation	Pc	50	mW
Junction temperature	Tj	150	°C
Storage temperature	Tstg	-55 to +150	°C

## Electrical Characteristics (Ta = 25°C)

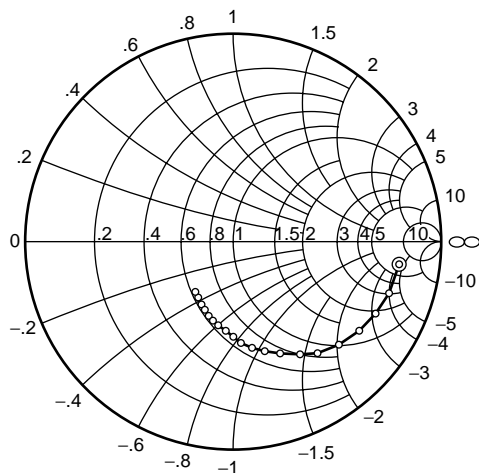
Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Collector to base breakdown voltage	$V_{(BR)CBO}$	12	—	—	V	$I_C = 10 \mu A, I_E = 0$
Collector cutoff current	$I_{CBO}$	—	—	1	$\mu A$	$V_{CB} = 10 V, I_E = 0$
Collector cutoff current	$I_{CEO}$	—	—	1	$\mu A$	$V_{CE} = 4 V, R_{BE} = \infty$
Emitter cutoff current	$I_{EBO}$	—	—	12	$\mu A$	$V_{EB} = 1 V, I_C = 0$
DC current transfer ratio	$h_{FE}$	60	100	140	V	$V_{CE} = 2 V, I_C = 10 mA$
Collector output capacitance	Cob	—	0.16	0.4	pF	$V_{CB} = 2 V, I_E = 0$ $f = 1 MHz$
Gain bandwidth product	$f_T$	20	23	—	GHz	$V_{CE} = 2 V, I_C = 10 mA$ $f = 2 GHz$
Power gain	PG	14	18	—	dB	$V_{CE} = 2 V, I_C = 10 mA$ $f = 1.8 GHz$
Noise figure	NF	—	1.8	2.3	dB	$V_{CE} = 2 V, I_C = 3 mA$ $f = 1.8 GHz$

## Main Characteristics





S11 Parameter vs. Frequency

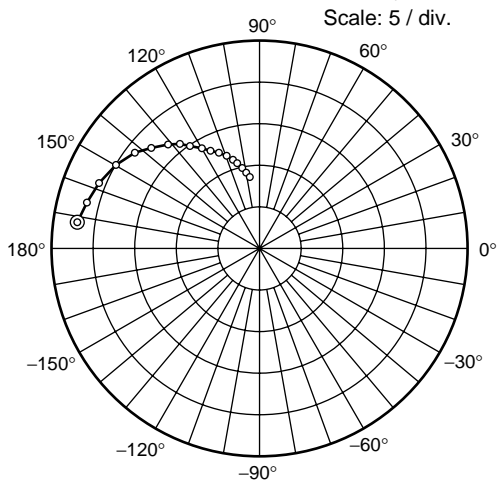


Condition :  $V_{CE} = 2\text{ V}$  ,  $I_C = 10\text{ mA}$

100 to 2000 MHz (100 MHz step)

⊙—○

S21 Paramter vs. Frequency

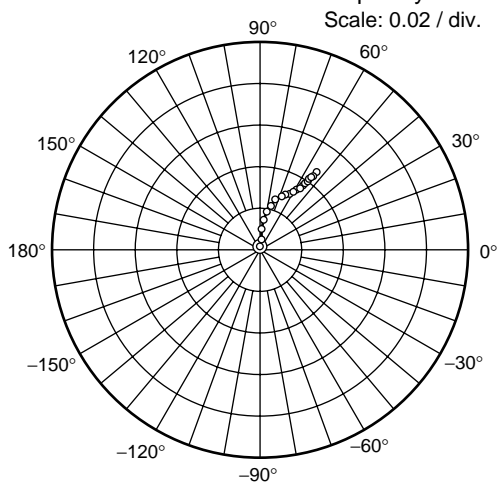


Condition :  $V_{CE} = 2\text{ V}$  ,  $I_C = 10\text{ mA}$

100 to 2000 MHz (100 MHz step)

⊙—○

S12 Parameter vs. Frequency

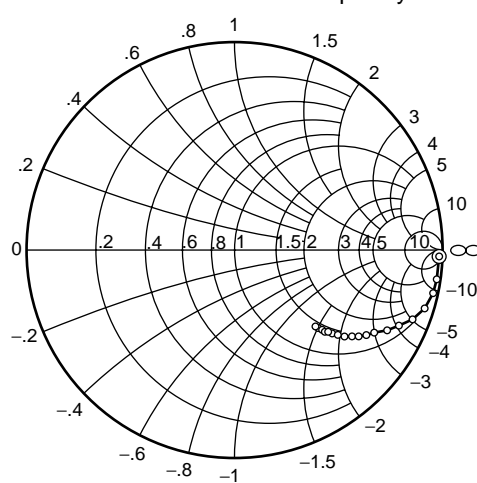


Condition :  $V_{CE} = 2\text{ V}$  ,  $I_C = 10\text{ mA}$

100 to 2000 MHz (100 MHz step)

⊙—○

S22 Parameter vs. Frequency



Condition :  $V_{CE} = 2\text{ V}$  ,  $I_C = 10\text{ mA}$

100 to 2000 MHz (100 MHz step)

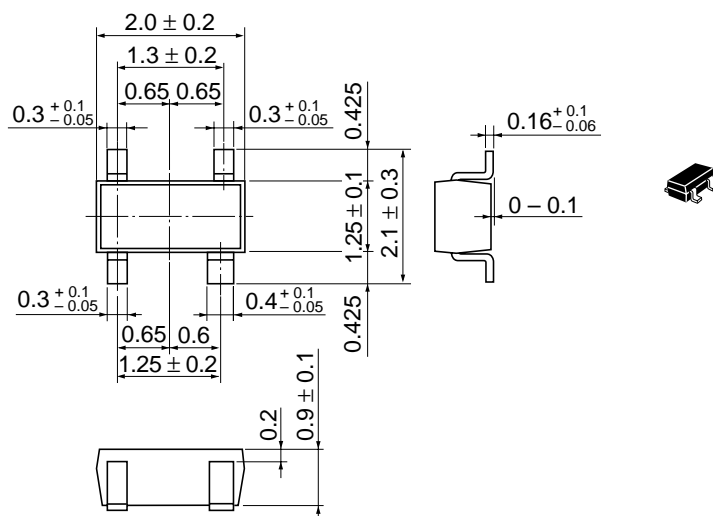
⊙—○

## S-parameter ( $V_{CE} = 2\text{ V}$ , $I_C = 10\text{ mA}$ , $Z_o = 50\ \Omega$ )

f (MHz)	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100	0.804	-8.2	22.02	172.5	0.00305	94.6	0.993	-3.4
200	0.795	-17.8	21.55	165.0	0.0067	86.8	0.986	-8.1
300	0.776	-27.4	20.88	157.5	0.0107	85.4	0.972	-12.7
400	0.746	-35.8	20.05	150.2	0.0146	82.5	0.947	-17.2
500	0.714	-44.5	18.93	143.7	0.0182	78.4	0.917	-21.2
600	0.673	-53.2	17.84	137.9	0.0215	74.8	0.881	-25.1
700	0.632	-59.9	16.60	132.5	0.0249	71.8	0.842	-28.3
800	0.595	-67.1	15.69	127.9	0.0274	67.9	0.808	-31.2
900	0.557	-74.6	14.64	123.5	0.0296	65.1	0.763	-33.7
1000	0.519	-79.1	13.68	119.5	0.0319	63.6	0.729	-35.6
1100	0.488	-86.0	12.88	116.0	0.0337	61.6	0.696	-37.2
1200	0.454	-91.1	12.03	112.8	0.0350	60.4	0.666	-38.6
1300	0.430	-95.9	11.26	110.6	0.0366	58.8	0.644	-39.5
1400	0.403	-101.8	10.69	107.8	0.0382	57.4	0.619	-40.6
1500	0.377	-106.3	10.16	105.4	0.0401	56.6	0.598	-41.2
1600	0.364	-111.0	9.66	103.6	0.0410	56.3	0.581	-42.0
1700	0.346	-116.6	9.19	101.4	0.0422	55.6	0.564	-42.6
1800	0.327	-120.0	8.79	99.3	0.0435	55.2	0.550	-43.2
1900	0.313	-124.9	8.40	97.5	0.0447	55.2	0.537	-43.9
2000	0.296	-130.8	7.99	95.5	0.0457	54.8	0.525	-44.0

## Package Dimensions

Unit: mm



Hitachi Code	CMPAK-4(T)
JEDEC	—
EIAJ	Conforms
Mass (reference value)	0.006 g

## Cautions

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