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# 2SC4994

Silicon NPN Epitaxial

# HITACHI

ADE-208-012

1st. Edition

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## Application

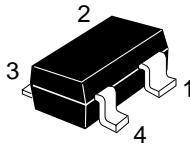
VHF / UHF wide band amplifier

## Features

- High gain bandwidth product  
 $f_T = 10.5 \text{ GHz Typ}$
- High gain, low noise figure  
 $PG = 17.0 \text{ dB Typ}$ ,  $NF = 1.2 \text{ dB Typ}$  at  $f = 900 \text{ MHz}$

## Outline

CMPAK-4



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

Absolute Maximum Ratings (Ta = 25°C)

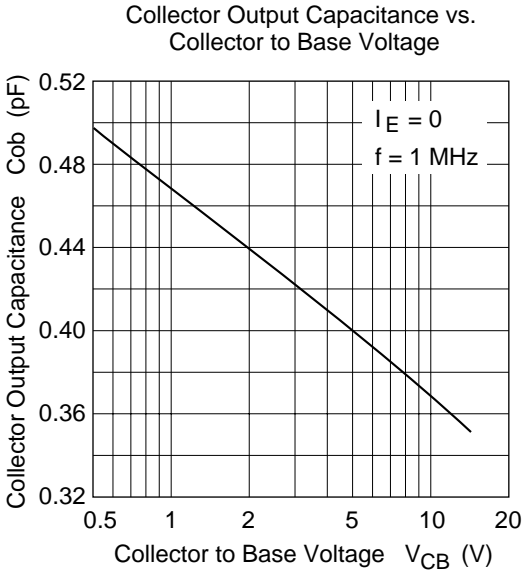
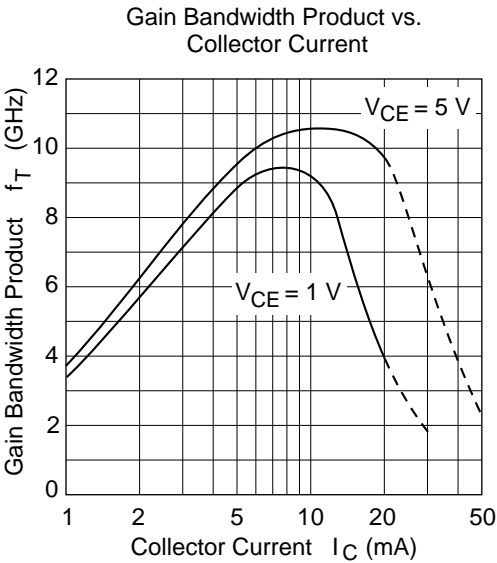
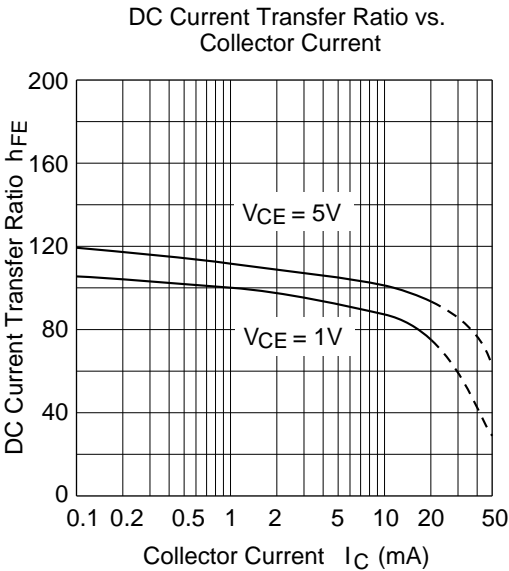
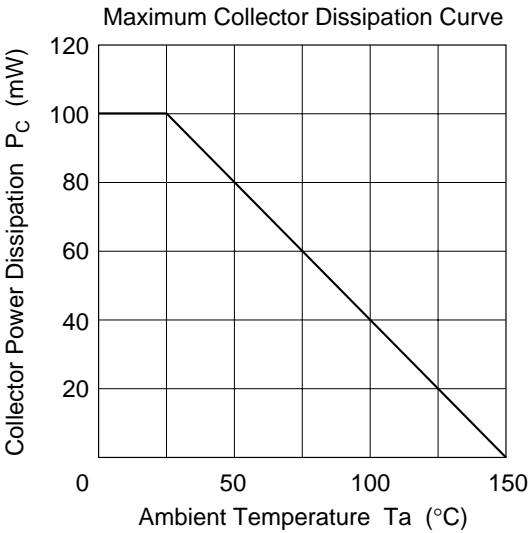
Item	Symbol	Ratings	Unit
Collector to base voltage	$V_{CBO}$	15	V
Collector to emitter voltage	$V_{CEO}$	8	V
Emitter to base voltage	$V_{EBO}$	1.5	V
Collector current	$I_C$	20	mA
Collector power dissipation	$P_C$	100	mW
Junction temperature	$T_j$	150	°C
Storage temperature	$T_{stg}$	-55 to +150	°C

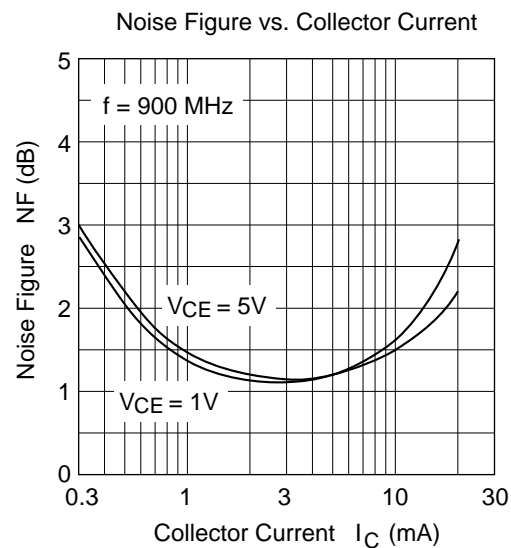
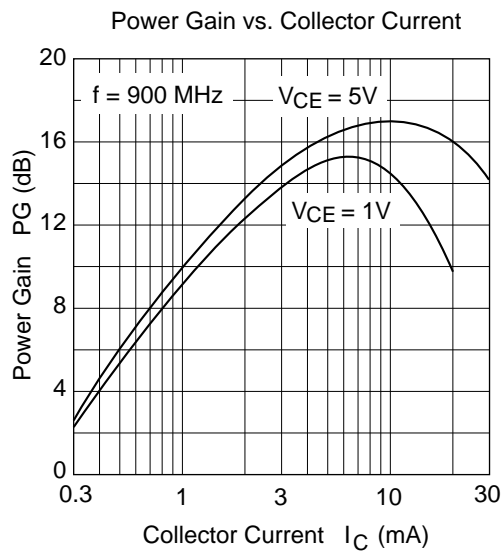
Electrical Characteristics (Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test conditions
Collector cutoff current	$I_{CBO}$	—	—	10	μA	$V_{CB} = 15\text{ V}, I_E = 0$
	$I_{CEO}$	—	—	1	mA	$V_{CE} = 8\text{ V}, R_{BE} = \infty$
Emitter cutoff current	$I_{EBO}$	—	—	10	μA	$V_{EB} = 1.5\text{ V}, I_C = 0$
DC current transfer ratio	$h_{FE}$	50	120	250		$V_{CE} = 5\text{ V}, I_C = 10\text{ mA}$
Collector output capacitance	$C_{ob}$	—	0.4	0.75	pF	$V_{CB} = 5\text{ V}, I_E = 0, f = 1\text{ MHz}$
Gain bandwidth product	$f_T$	7.5	10.5	—	GHz	$V_{CE} = 5\text{ V}, I_C = 10\text{ mA}$
Power gain	PG	14.0	17.0	—	dB	$V_{CE} = 5\text{ V}, I_C = 10\text{ mA}, f = 900\text{ MHz}$
Noise figure	NF	—	1.2	2.5	dB	$V_{CE} = 5\text{ V}, I_C = 5\text{ mA}, f = 900\text{ MHz}$

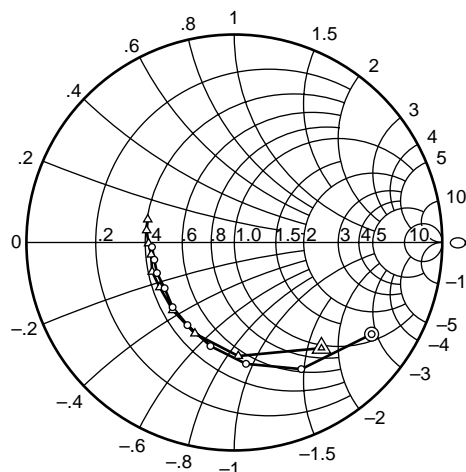
Note: Marking is “YS—”.

Attention: This device is very sensitive to electro static discharge.  
It is recommended to adopt appropriate cautions when handling this transistor.



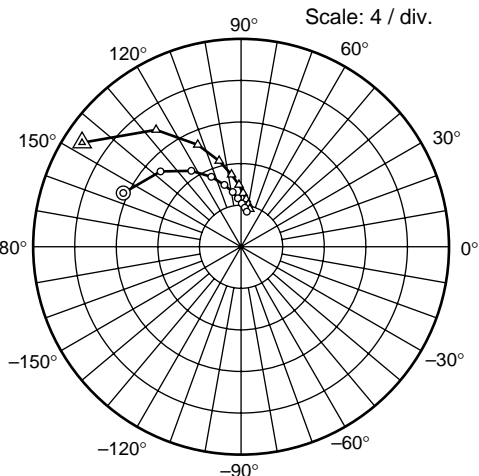


S11 Parameter vs. Frequency



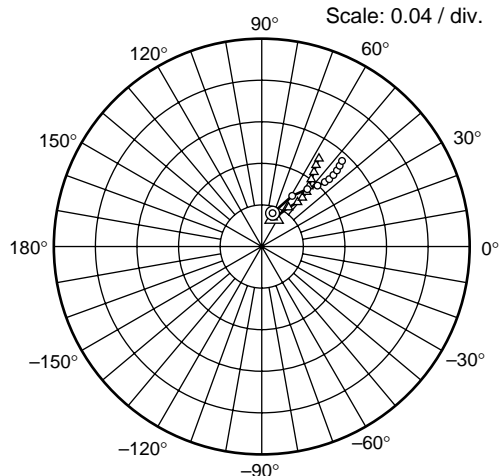
Condition:  $V_{CE} = 5\text{ V}$ ,  $Z_o = 50\ \Omega$   
200 to 2000 MHz (200 MHz step)  
○ (  $I_C = 5\text{ mA}$  )  
△ (  $I_C = 10\text{ mA}$  )

S21 Parameter vs. Frequency



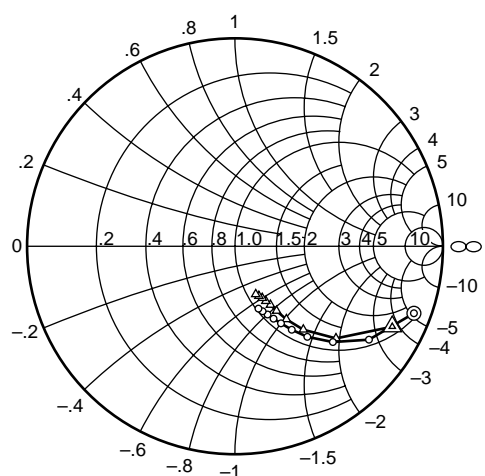
Condition:  $V_{CE} = 5\text{ V}$ ,  $Z_o = 50\ \Omega$   
200 to 2000 MHz (200 MHz step)  
○ (  $I_C = 5\text{ mA}$  )  
△ (  $I_C = 10\text{ mA}$  )

S12 Parameter vs. Frequency



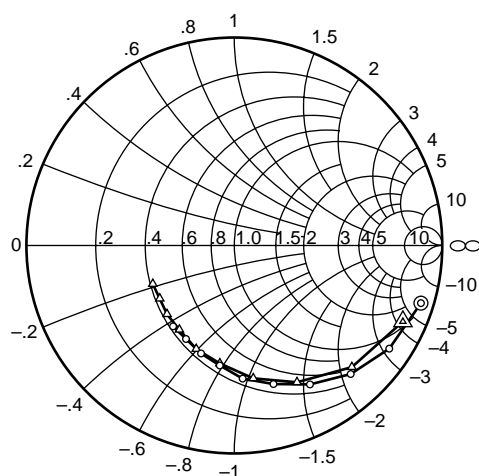
Condition:  $V_{CE} = 5\text{ V}$ ,  $Z_o = 50\ \Omega$   
200 to 2000 MHz (200 MHz step)  
○ (  $I_C = 5\text{ mA}$  )  
△ (  $I_C = 10\text{ mA}$  )

S22 Parameter vs. Frequency



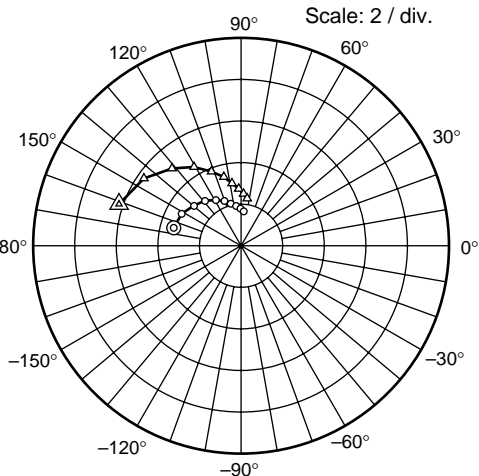
Condition:  $V_{CE} = 5\text{ V}$ ,  $Z_o = 50\ \Omega$   
200 to 2000 MHz (200 MHz step)  
○ (  $I_C = 5\text{ mA}$  )  
△ (  $I_C = 10\text{ mA}$  )

S11 Parameter vs. Frequency



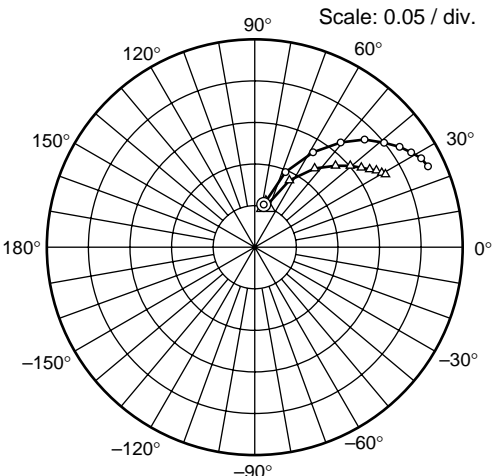
Condition:  $V_{CE} = 1\text{ V}$ ,  $Z_o = 50\ \Omega$   
200 to 2000 MHz (200 MHz step)  
○ — (I<sub>C</sub> = 1 mA)  
△ — (I<sub>C</sub> = 2 mA)

S21 Parameter vs. Frequency



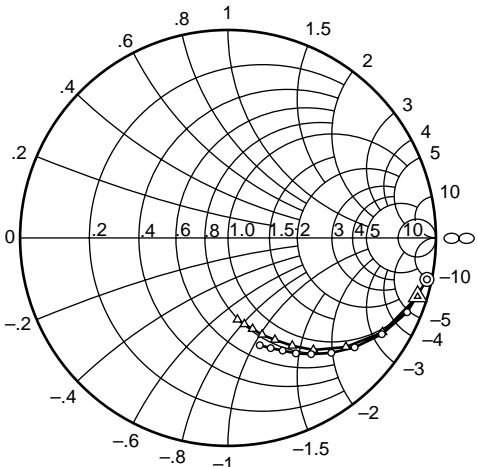
Condition:  $V_{CE} = 1\text{ V}$ ,  $Z_o = 50\ \Omega$   
200 to 2000 MHz (200 MHz step)  
○ — (I<sub>C</sub> = 1 mA)  
△ — (I<sub>C</sub> = 2 mA)

S12 Parameter vs. Frequency



Condition:  $V_{CE} = 1\text{ V}$ ,  $Z_o = 50\ \Omega$   
200 to 2000 MHz (200 MHz step)  
○ — (I<sub>C</sub> = 1 mA)  
△ — (I<sub>C</sub> = 2 mA)

S22 Parameter vs. Frequency



Condition:  $V_{CE} = 1\text{ V}$ ,  $Z_o = 50\ \Omega$   
200 to 2000 MHz (200 MHz step)  
○ — (I<sub>C</sub> = 1 mA)  
△ — (I<sub>C</sub> = 2 mA)

**S Parameters** ( $V_{CE} = 5\text{ V}$ ,  $I_C = 5\text{ mA}$ ,  $Z_O = 50\ \Omega$ )

Freq. (MHz)	S11		S21		S12		S22	
	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
200	0.794	−33.7	12.47	155.5	0.0338	71.9	0.919	−20.5
400	0.689	−62.1	10.61	136.9	0.0569	58.9	0.786	−34.9
600	0.586	−84.6	8.73	123.2	0.0706	51.5	0.659	−44.4
800	0.511	−103.0	7.31	113.0	0.0795	47.5	0.558	−51.4
1000	0.457	−119.6	6.16	105.0	0.0867	45.6	0.486	−55.8
1200	0.430	−133.7	5.33	98.6	0.0918	44.9	0.432	−59.2
1400	0.401	−146.8	4.67	93.7	0.0975	44.9	0.395	−62.0
1600	0.400	−158.5	4.16	88.9	0.103	45.3	0.364	−64.5
1800	0.394	−167.9	3.77	84.4	0.108	46.0	0.340	−67.0
2000	0.397	−176.9	3.42	80.6	0.113	46.8	0.321	−69.4

**S Parameters** ( $V_{CE} = 5\text{ V}$ ,  $I_C = 10\text{ mA}$ ,  $Z_O = 50\ \Omega$ )

Freq. (MHz)	S11		S21		S12		S22	
	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
200	0.659	−50.5	18.28	146.8	0.0297	66.3	0.850	−27.1
400	0.547	−88.0	13.90	126.0	0.0456	55.4	0.658	−42.4
600	0.478	−113.4	10.66	113.0	0.0549	51.0	0.519	−50.7
800	0.441	−132.4	8.53	104.3	0.0611	50.2	0.430	−54.9
1000	0.419	−148.9	7.00	97.5	0.0680	50.5	0.370	−57.3
1200	0.420	−160.3	5.96	91.9	0.0735	51.9	0.330	−58.9
1400	0.404	−171.6	5.17	87.8	0.0804	53.6	0.303	−60.7
1600	0.413	−179.3	4.59	83.3	0.0875	54.9	0.282	−62.3
1800	0.426	172.2	4.13	80.1	0.0942	56.3	0.266	−64.4
2000	0.431	165.2	3.73	76.8	0.101	56.9	0.252	−66.7

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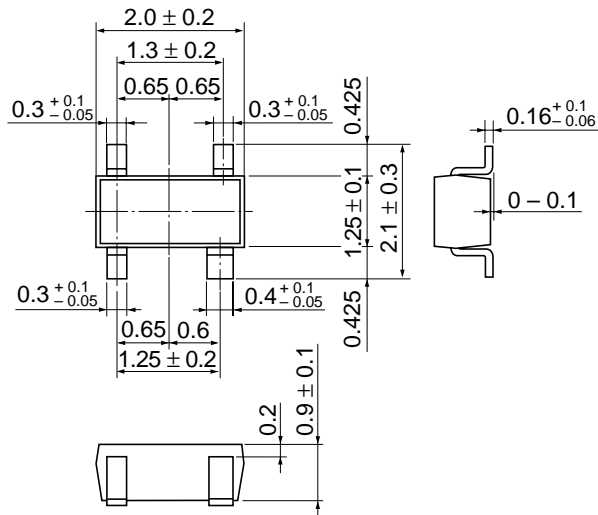
S Parameters (V<sub>CE</sub> = 1 V, I<sub>C</sub> = 1 mA, Z<sub>O</sub> = 50 Ω)

Freq. (MHz)	S11		S21		S12		S22	
	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
200	0.939	−17.2	3.35	165.1	0.0525	78.0	0.978	−11.8
400	0.895	−33.7	3.25	151.8	0.0977	67.7	0.933	−22.5
600	0.834	−47.9	2.79	139.8	134	58.4	0.873	−32.0
800	0.761	−61.5	2.77	128.9	0.163	50.6	0.805	−40.8
1000	0.693	−74.3	2.51	119.0	0.185	44.4	0.743	−48.0
1200	0.642	−86.5	2.30	110.5	0.200	38.9	0.687	−54.4
1400	0.582	−97.0	2.08	103.9	0.212	34.7	0.644	−59.5
1600	0.544	−107.2	1.93	97.2	0.220	31.2	0.602	−64.1
1800	0.507	−117.4	1.79	91.0	0.227	28.1	0.568	−68.8
2000	0.489	−127.2	1.66	85.7	0.230	25.0	0.538	−73.5

S Parameters (V<sub>CE</sub> = 1 V, I<sub>C</sub> = 2 mA, Z<sub>O</sub> = 50 Ω)

Freq. (MHz)	S11		S21		S12		S22	
	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
200	0.889	−24.3	6.20	161.2	0.0508	74.6	0.955	−17.2
400	0.814	−46.0	5.69	145.2	0.0906	62.5	0.871	−31.4
600	0.724	−65.4	4.99	131.7	0.119	52.7	0.773	−42.8
800	0.646	−81.9	4.42	120.8	0.138	45.2	0.678	−52.7
1000	0.572	−97.0	3.85	111.7	0.151	40.4	0.604	−59.2
1200	0.531	−110.2	3.42	104.0	0.160	36.7	0.540	−65.3
1400	0.484	−123.1	3.04	98.2	0.167	34.1	0.494	−70.6
1600	0.463	−134.4	2.75	92.3	0.173	32.2	0.454	−74.9
1800	0.441	−144.5	2.51	87.2	0.177	30.3	0.423	−79.3
2000	0.434	−154.7	2.30	82.6	0.180	29.1	0.396	−83.4





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

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## Hitachi, Ltd.

Semiconductor & Integrated Circuits.  
Nippon Bldg., 2-6-2, Ohte-machi, Chiyoda-ku, Tokyo 100-0004, Japan  
Tel: Tokyo (03) 3270-2111 Fax: (03) 3270-5109

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## For further information write to:

Hitachi Semiconductor (America) Inc. 179 East Tasman Drive, San Jose, CA 95134 Tel: <1> (408) 433-1990 Fax: <1> (408) 433-0223	Hitachi Europe GmbH Electronic components Group Dornacher Straße 3 D-85622 Feldkirchen, Munich Germany Tel: <49> (89) 9 9180-0 Fax: <49> (89) 9 29 30 00  Hitachi Europe Ltd. Electronic Components Group. Whitebrook Park Lower Cookham Road Maidenhead Berkshire SL6 8YA, United Kingdom Tel: <44> (1628) 585000 Fax: <44> (1628) 778322
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Hitachi Asia Pte. Ltd.  
16 Collyer Quay #20-00  
Hitachi Tower  
Singapore 049318  
Tel: 535-2100  
Fax: 535-1533

Hitachi Asia Ltd.  
Taipei Branch Office  
3F, Hung Kuo Building, No.167,  
Tun-Hwa North Road, Taipei (105)  
Tel: <886> (2) 2718-3666  
Fax: <886> (2) 2718-8180

Hitachi Asia (Hong Kong) Ltd.  
Group III (Electronic Components)  
7/F., North Tower, World Finance Centre,  
Harbour City, Canton Road, Tsim Sha Tsui,  
Kowloon, Hong Kong  
Tel: <852> (2) 735 9218  
Fax: <852> (2) 730 0281  
Telex: 40815 HITEC HX

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