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# 2SC4993

Silicon NPN Epitaxial

# HITACHI

ADE-208-011  
1st. Edition

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## Application

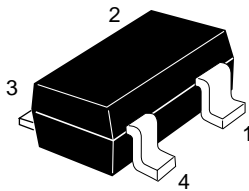
VHF / UHF wide band amplifier

## Features

- High gain bandwidth product  
 $f_T = 10.5 \text{ GHz Typ}$
- High gain, low noise figure  
 $PG = 16.5 \text{ dB Typ}$ ,  $NF = 1.2 \text{ dB Typ}$  at  $f = 900 \text{ MHz}$

## Outline

MPAK-4



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

## 2SC4993

### 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	$P_C$	150	mW
Junction temperature	$T_j$	150	°C
Storage temperature	$T_{stg}$	-55 to +150	°C

### Electrical Characteristics (Ta = 25°C)

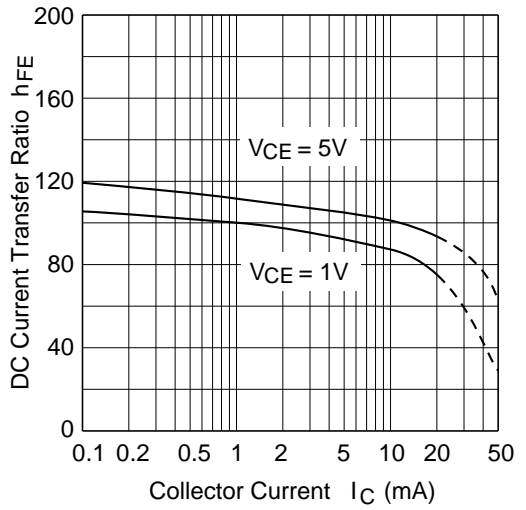
Item	Symbol	Min	Typ	Max	Unit	Test conditions
Collector cutoff current	$I_{CBO}$	—	—	10	$\mu$ A	$V_{CB} = 15$ V, $I_E = 0$
	$I_{CEO}$	—	—	1	mA	$V_{CE} = 8$ V, $R_{BE} = \infty$
Emitter cutoff current	$I_{EBO}$	—	—	10	$\mu$ A	$V_{EB} = 1.5$ V, $I_C = 0$
DC current transfer ratio	$h_{FE}$	50	120	250		$V_{CE} = 5$ V, $I_C = 10$ mA
Collector output capacitance	$C_{ob}$	—	0.45	0.8	pF	$V_{CB} = 5$ V, $I_E = 0$ , $f = 1$ MHz
Gain bandwidth product	$f_T$	7.5	10.5	—	GHz	$V_{CE} = 5$ V, $I_C = 10$ mA
Power gain	PG	13.5	16.5	—	dB	$V_{CE} = 5$ V, $I_C = 10$ mA, $f = 900$ MHz
Noise figure	NF	—	1.2	2.5	dB	$V_{CE} = 5$ V, $I_C = 5$ mA, $f = 900$ MHz

Note: Marking is "YS-".

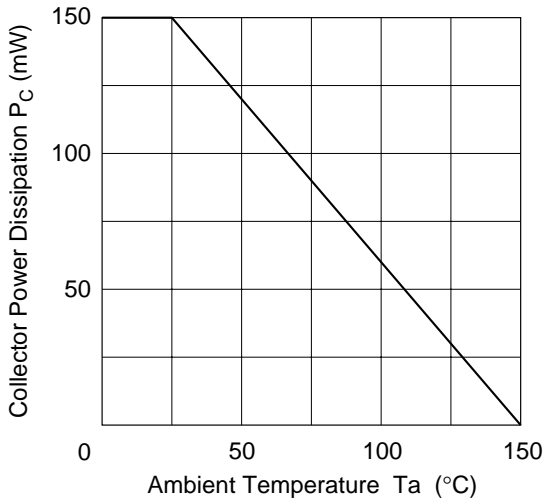
Attention: This device is very sensitive to electro static discharge.

It is recommended to adopt appropriate cautions when handling this transistor.

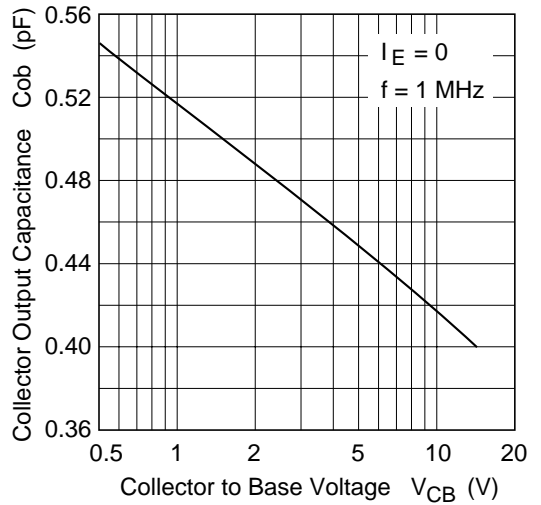
DC Current Transfer Ratio vs. Collector Current



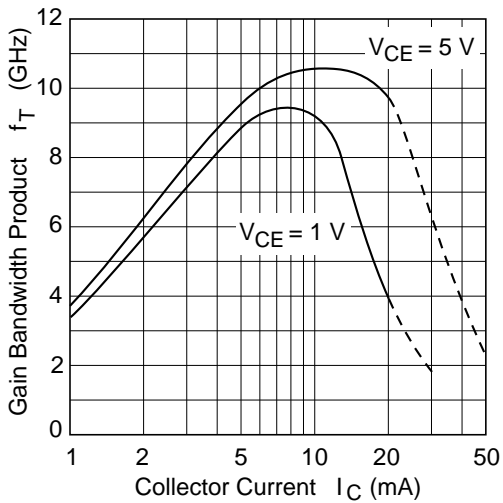
Maximum Collector Dissipation Curve



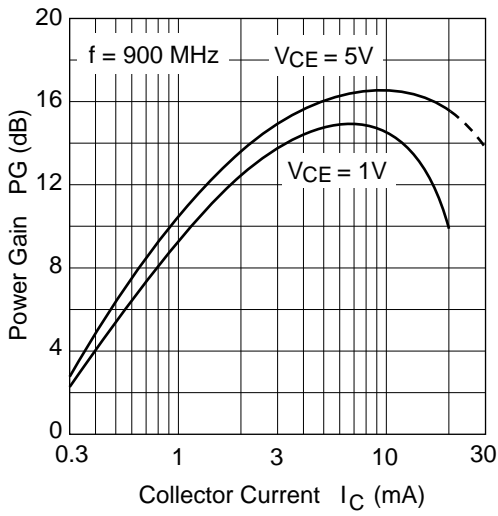
Collector Output Capacitance vs. Collector to Base Voltage



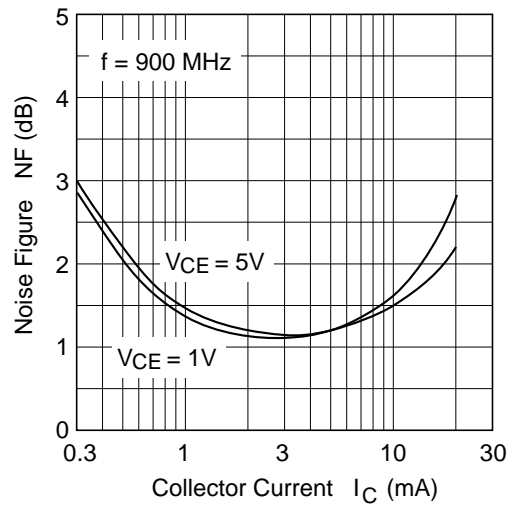
Gain Bandwidth Product vs. Collector Current



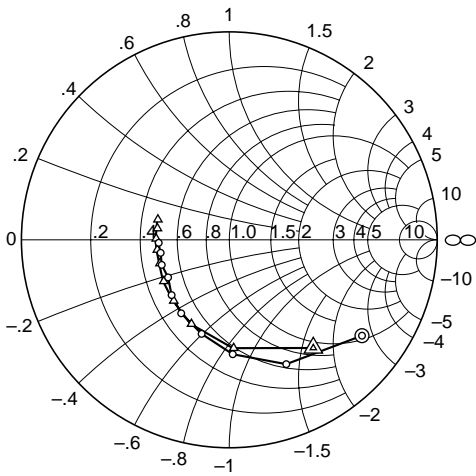
Power Gain vs. Collector Current



Noise Figure vs. Collector Current

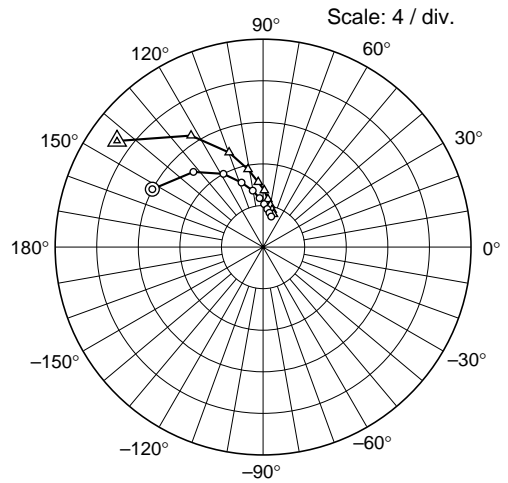


S11 Parameter vs. Frequency



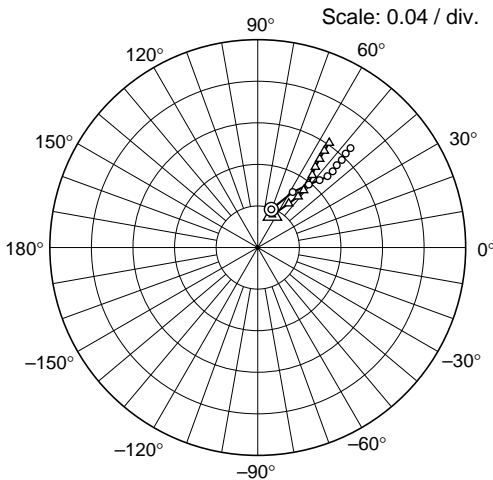
Condition:  $V_{CE} = 5\text{ V}$ ,  $Z_o = 50\ \Omega$   
 200 to 2000 MHz (200 MHz step)  
 ○ (IC = 5 mA)  
 △ (IC = 10 mA)

S21 Parameter vs. Frequency



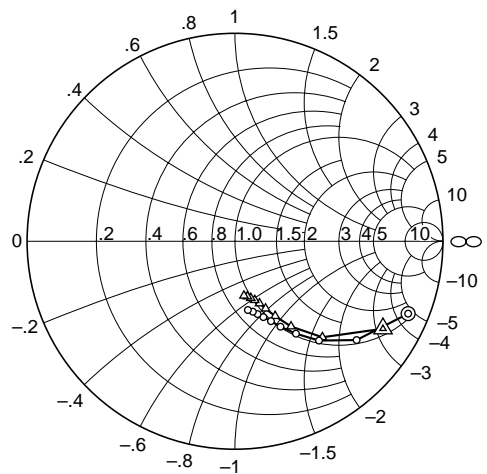
Condition:  $V_{CE} = 5\text{ V}$ ,  $Z_o = 50\ \Omega$   
 200 to 2000 MHz (200 MHz step)  
 ○ (IC = 5 mA)  
 △ (IC = 10 mA)

S12 Parameter vs. Frequency



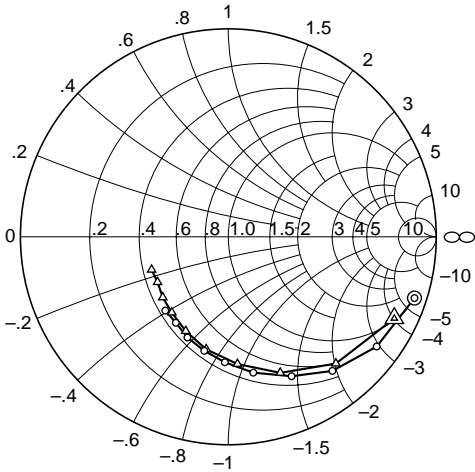
Condition:  $V_{CE} = 5\text{ V}$ ,  $Z_o = 50\ \Omega$   
 200 to 2000 MHz (200 MHz step)  
 ○ (IC = 5 mA)  
 △ (IC = 10 mA)

S22 Parameter vs. Frequency



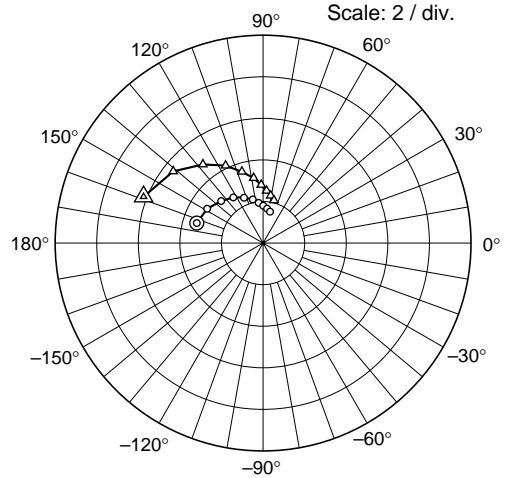
Condition:  $V_{CE} = 5\text{ V}$ ,  $Z_o = 50\ \Omega$   
 200 to 2000 MHz (200 MHz step)  
 ○ (IC = 5 mA)  
 △ (IC = 10 mA)

S11 Parameter vs. Frequency



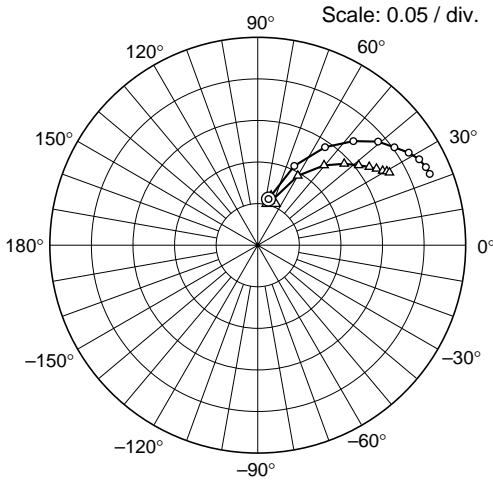
Condition:  $V_{CE} = 1\text{ V}$ ,  $Z_o = 50\ \Omega$   
 200 to 2000 MHz (200 MHz step)  
 ○ (IC = 1 mA)  
 △ (IC = 2 mA)

S21 Parameter vs. Frequency



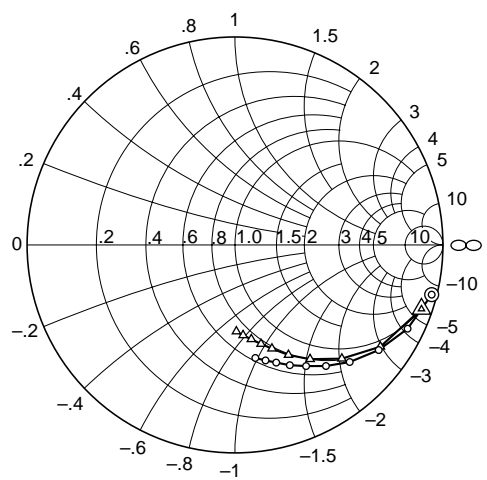
Condition:  $V_{CE} = 1\text{ V}$ ,  $Z_o = 50\ \Omega$   
 200 to 2000 MHz (200 MHz step)  
 ○ (IC = 1 mA)  
 △ (IC = 2 mA)

S12 Parameter vs. Frequency



Condition:  $V_{CE} = 1\text{ V}$ ,  $Z_o = 50\ \Omega$   
 200 to 2000 MHz (200 MHz step)  
 ○ (IC = 1 mA)  
 △ (IC = 2 mA)

S22 Parameter vs. Frequency



Condition:  $V_{CE} = 1\text{ V}$ ,  $Z_o = 50\ \Omega$   
 200 to 2000 MHz (200 MHz step)  
 ○ (IC = 1 mA)  
 △ (IC = 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	0.787	-35.9	12.02	152.4	0.0390	70.3	0.903	-22.7
400	0.655	-65.4	9.86	132.8	0.0633	51.0	0.754	-39.1
600	0.551	-88.3	8.01	118.4	0.0782	51.0	0.626	-49.8
800	0.472	-106.4	6.54	108.4	0.0882	47.5	0.533	-56.6
1000	0.423	-123.2	5.52	100.3	0.0962	45.7	0.466	-62.0
1200	0.385	-136.2	4.72	94.0	0.103	45.5	0.422	-65.8
1400	0.357	-148.4	4.14	88.5	0.110	46.2	0.390	-69.5
1600	0.347	-159.6	3.68	83.6	0.117	46.2	0.367	-72.8
1800	0.338	-169.2	3.35	79.3	0.124	46.9	0.350	-75.8
2000	0.340	-177.5	3.04	74.9	0.131	47.1	0.337	-79.4

**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	-52.2	17.36	144.0	0.0343	65.6	0.827	-30.6
400	0.522	-87.8	12.78	122.8	0.0518	54.8	0.625	-47.7
600	0.445	-114.3	9.68	109.7	0.0626	51.6	0.491	-56.7
800	0.398	-132.4	7.64	100.9	0.0706	51.2	0.409	-61.8
1000	0.374	-147.7	6.29	94.2	0.0789	51.8	0.356	-65.6
1200	0.354	-161.2	5.33	88.7	0.0872	53.0	0.322	-68.5
1400	0.351	-172.0	4.64	84.2	0.0953	54.4	0.299	-71.5
1600	0.353	179.2	4.10	79.9	0.104	55.0	0.284	-74.5
1800	0.351	171.1	3.70	76.3	0.113	55.4	0.273	-77.4
2000	0.358	164.3	3.34	72.5	0.122	55.6	0.266	-80.7

## 2SC4993

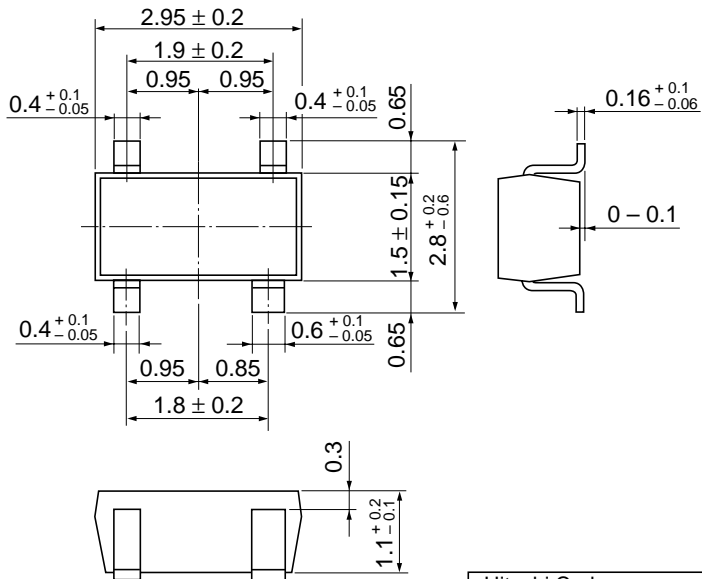
### S Parameters ( $V_{CE} = 1\text{ V}$ , $I_C = 1\text{ mA}$ , $Z_O = 50\ \Omega$ )

Freq. (MHz)	S11		S21		S12		S22	
	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
200	0.942	-18.2	3.33	163.2	0.0570	76.8	0.976	-14.2
400	0.888	-36.5	3.16	148.5	0.105	65.2	0.923	-25.9
600	0.817	-52.2	2.86	135.0	0.143	55.5	0.857	-36.2
800	0.737	-65.6	2.62	123.3	0.170	47.4	0.789	-45.6
1000	0.665	-79.6	2.36	113.0	0.191	40.7	0.729	-53.1
1200	0.604	-91.6	2.15	103.5	0.204	35.6	0.676	-59.6
1400	0.561	-101.9	1.94	96.4	0.213	31.5	0.636	-65.5
1600	0.523	-112.1	1.79	89.9	0.220	28.0	0.600	-70.7
1800	0.485	-121.4	1.66	83.4	0.223	24.9	0.575	-75.2
2000	0.467	-130.5	1.54	77.6	0.224	22.5	0.553	-79.8

### S Parameters ( $V_{CE} = 1\text{ V}$ , $I_C = 2\text{ mA}$ , $Z_O = 50\ \Omega$ )

Freq. (MHz)	S11		S21		S12		S22	
	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
200	0.890	-26.2	6.17	158.9	0.0552	73.0	0.949	-19.0
400	0.800	-49.7	5.53	141.4	0.0967	60.0	0.854	-35.0
600	0.701	-69.1	4.76	127.4	0.125	50.3	0.751	-46.8
800	0.614	-85.9	4.14	115.8	0.143	43.3	0.658	-56.7
1000	0.552	-101.1	3.58	106.5	0.155	38.4	0.589	-64.1
1200	0.498	-114.3	3.16	98.2	0.164	35.1	0.530	-70.4
1400	0.455	-126.7	2.80	91.8	0.170	32.8	0.493	-75.3
1600	0.430	-137.2	2.52	85.2	0.175	30.8	0.461	-80.2
1800	0.405	-147.3	2.31	80.8	0.179	29.8	0.437	-84.9
2000	0.402	-156.7	2.12	75.6	0.181	28.9	0.417	-89.1





Hitachi Code	MPAK-4
JEDEC	—
EIAJ	Conforms
Weight (reference value)	0.013 g

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