
2SC4994

Silicon NPN Epitaxial

HITACHI

ADE-208-012

1st. Edition

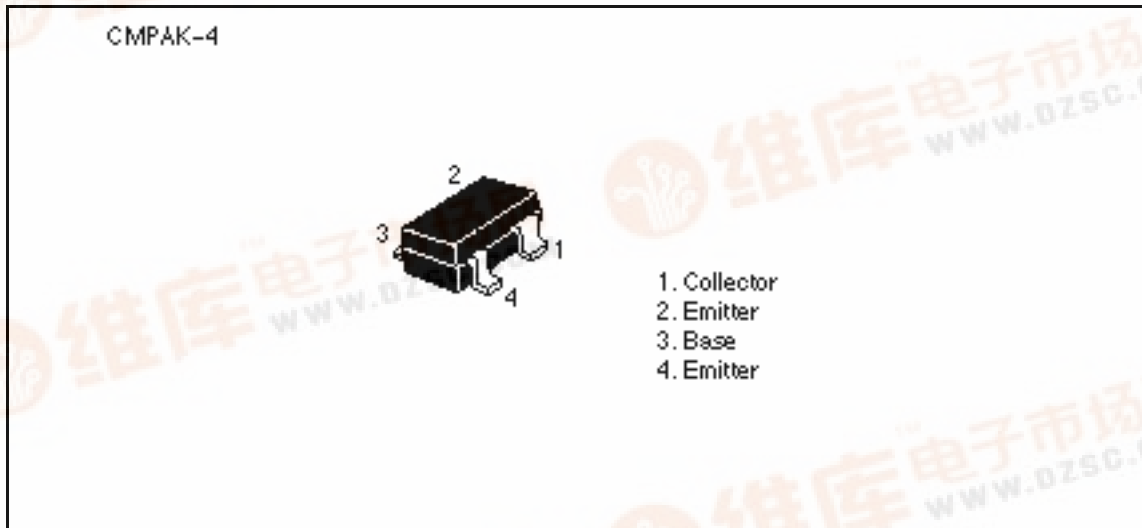
Application

VHF / UHF wide band amplifier

Features

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

Outline



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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

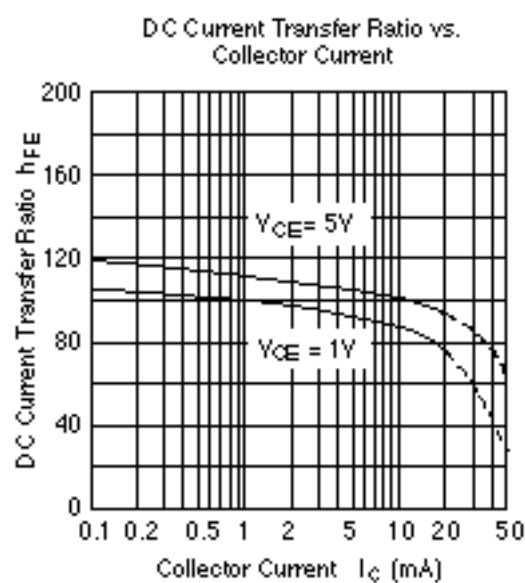
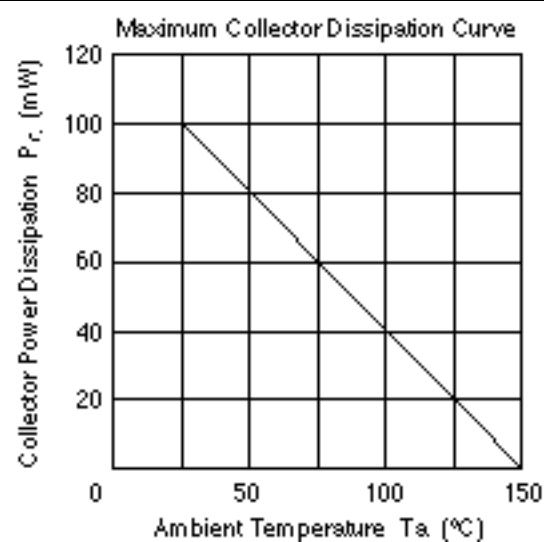
Electrical Characteristics (Ta = 25°C)

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	$V_{CE} = 8\text{ V}, R_{BE} = \bullet$
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	$V_{CE} = 5\text{ V}, I_C = 5\text{ mA},$ $f = 900\text{ MHz}$

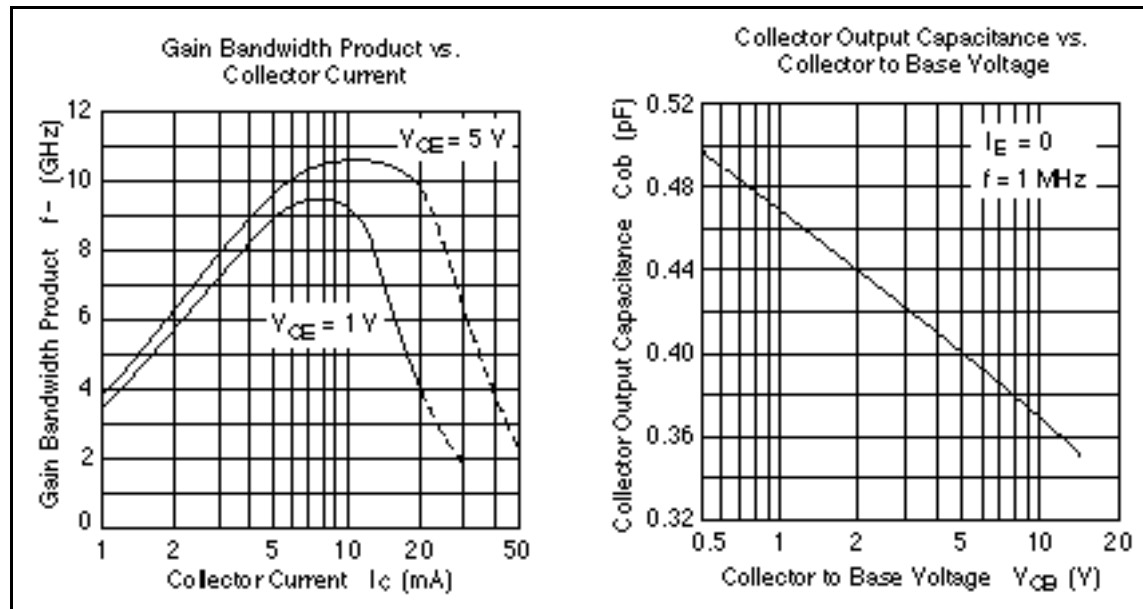
Note: Marking is “YS—”.

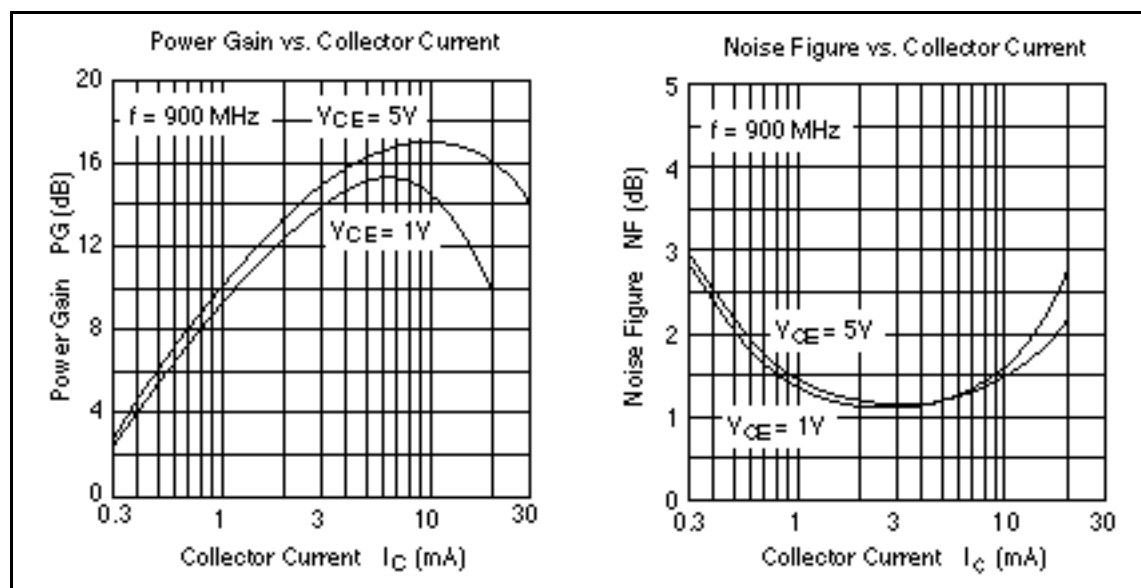
Attention: This device is very sensitive to electro static discharge.

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

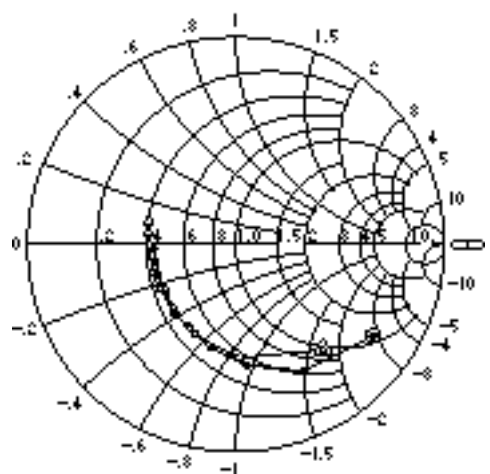


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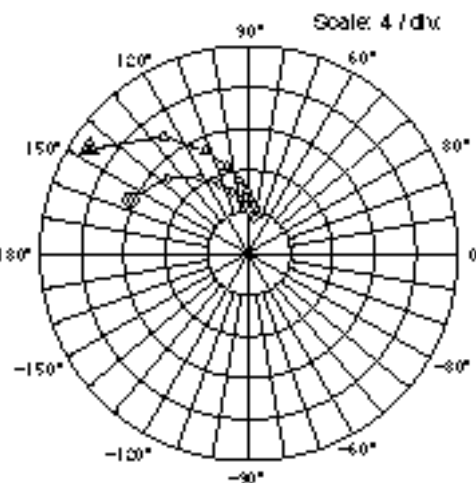


S11 Parameter vs. Frequency



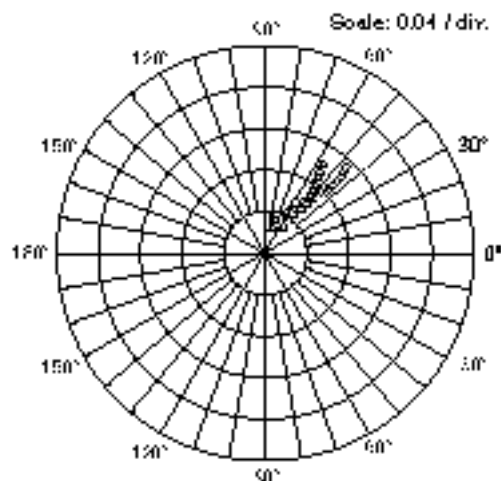
Condition: $V_{CE} = 5\text{ V}$, $Z_0 = 50\ \Omega$
 200 to 2000 MHz (200 MHz step)
 ○ — (IC = 5 mA)
 △ — (IC = 10 mA)

S21 Parameter vs. Frequency



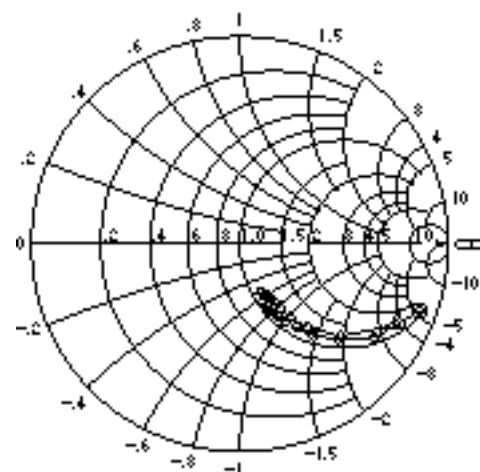
Condition: $V_{CE} = 5\text{ V}$, $Z_0 = 50\ \Omega$
 200 to 2000 MHz (200 MHz step)
 ○ — (IC = 5 mA)
 △ — (IC = 10 mA)

S12 Parameter vs. Frequency



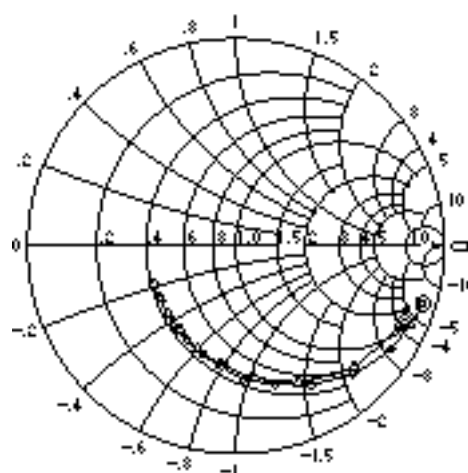
Condition: $V_{CE} = 5\text{ V}$, $Z_0 = 50\ \Omega$
 200 to 2000 MHz (200 MHz step)
 ○ — (IC = 5 mA)
 △ — (IC = 10 mA)

S22 Parameter vs. Frequency



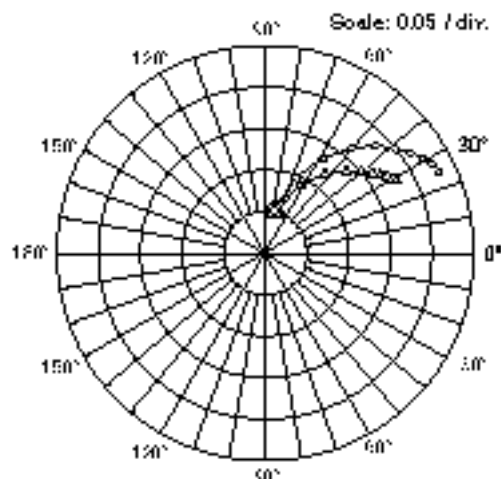
Condition: $V_{CE} = 5\text{ V}$, $Z_0 = 50\ \Omega$
 200 to 2000 MHz (200 MHz step)
 ○ — (IC = 5 mA)
 △ — (IC = 10 mA)

S11 Parameter vs. Frequency



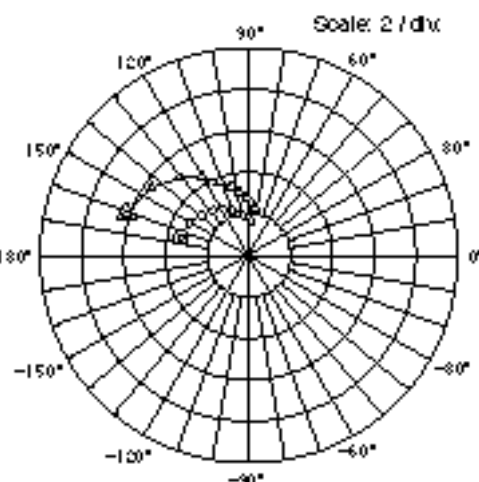
Condition: $V_{CE} = 1 \text{ V}$, $Z_0 = 50 \Omega$
 200 to 2000 MHz (200 MHz step)
 ○ ($I_C = 1 \text{ mA}$)
 △ ($I_C = 2 \text{ mA}$)

S12 Parameter vs. Frequency



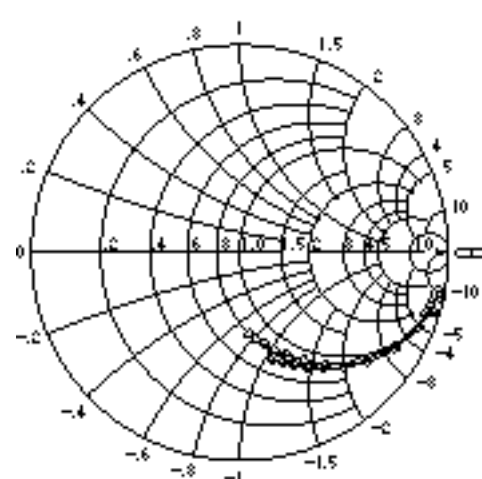
Condition: $V_{CE} = 1 \text{ V}$, $Z_0 = 50 \Omega$
 200 to 2000 MHz (200 MHz step)
 ○ ($I_C = 1 \text{ mA}$)
 △ ($I_C = 2 \text{ mA}$)

S21 Parameter vs. Frequency



Condition: $V_{CE} = 1 \text{ V}$, $Z_0 = 50 \Omega$
 200 to 2000 MHz (200 MHz step)
 ○ ($I_C = 1 \text{ mA}$)
 △ ($I_C = 2 \text{ mA}$)

S22 Parameter vs. Frequency



Condition: $V_{CE} = 1 \text{ V}$, $Z_0 = 50 \Omega$
 200 to 2000 MHz (200 MHz step)
 ○ ($I_C = 1 \text{ mA}$)
 △ ($I_C = 2 \text{ mA}$)

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

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

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

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

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

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