

2SC4993

Silicon NPN Bipolar Transistor

Application

VHF & UHF wide band amplifier

Features

- High gain bandwidth product
 $f_T = 10.5$ GHz typ
- High gain, low noise figure
 $PG = 16.5$ dB typ,
 $NF = 1.2$ dB typ at $f = 900$ MHz

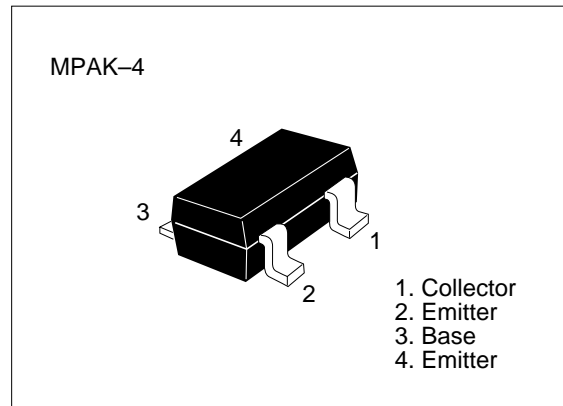


Table 1 Absolute Maximum Ratings ($T_a = 25^\circ\text{C}$)

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	$^\circ\text{C}$
Storage temperature	T_{stg}	-55 to +150	$^\circ\text{C}$

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Table 2 Electrical Characteristics (Ta = 25°C)

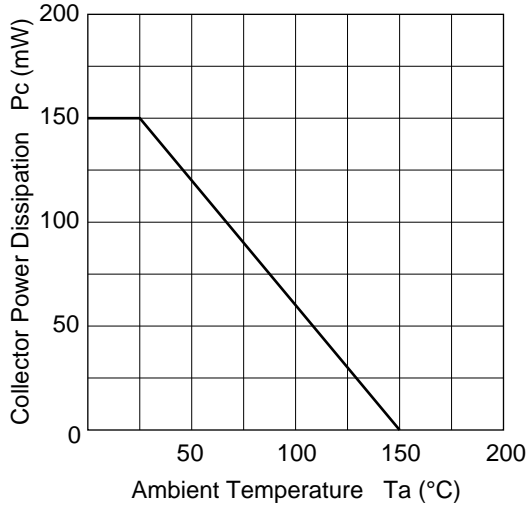
Item	Symbol	Min	Typ	Max	Unit	Test conditions
Collector cutoff current	I_{CBO}	—	—	10	μA	$V_{CB} = 15\text{ V}$, $I_E = 0$
	I_{CEO}	—	—	1	mA	$V_{CE} = 8\text{ V}$, $R_{BE} = \infty$
Emitter cutoff current	I_{EBO}	—	—	10	μA	$V_{EB} = 1.5\text{ V}$, $I_C = 0$
DC current transfer ratio	h_{FE}	50	120	250	—	$V_{CE} = 5\text{ V}$, $I_C = 10\text{ mA}$
Output capacitance	C_{ob}	—	0.45	0.8	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	13.5	16.5	—	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 of 2SC4993 is "YS-".

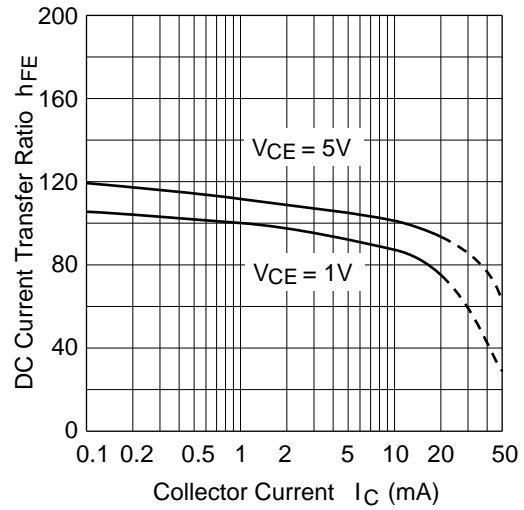
Attention: This device is very sensitive to electro static discharge.

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

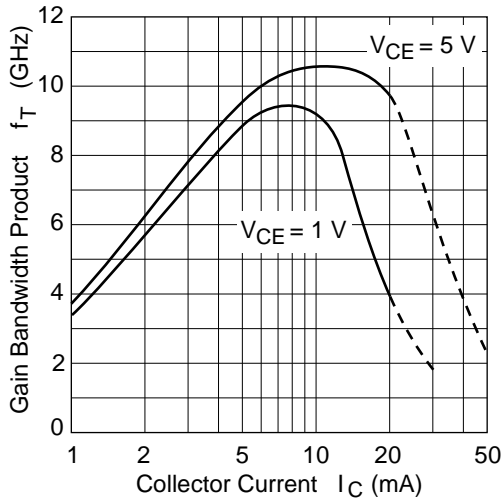
Collector power dissipation curve



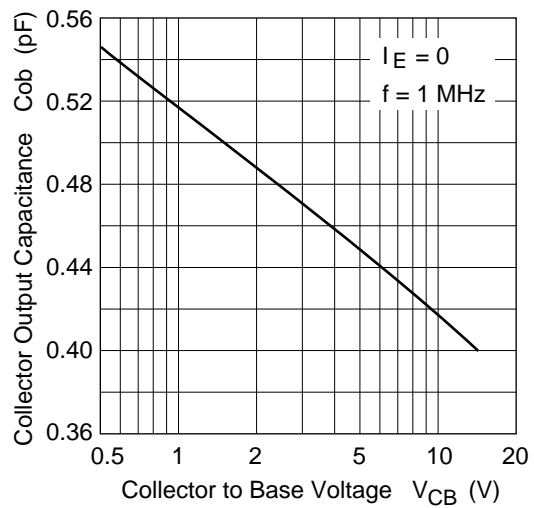
DC current transfer ratio vs. collector current



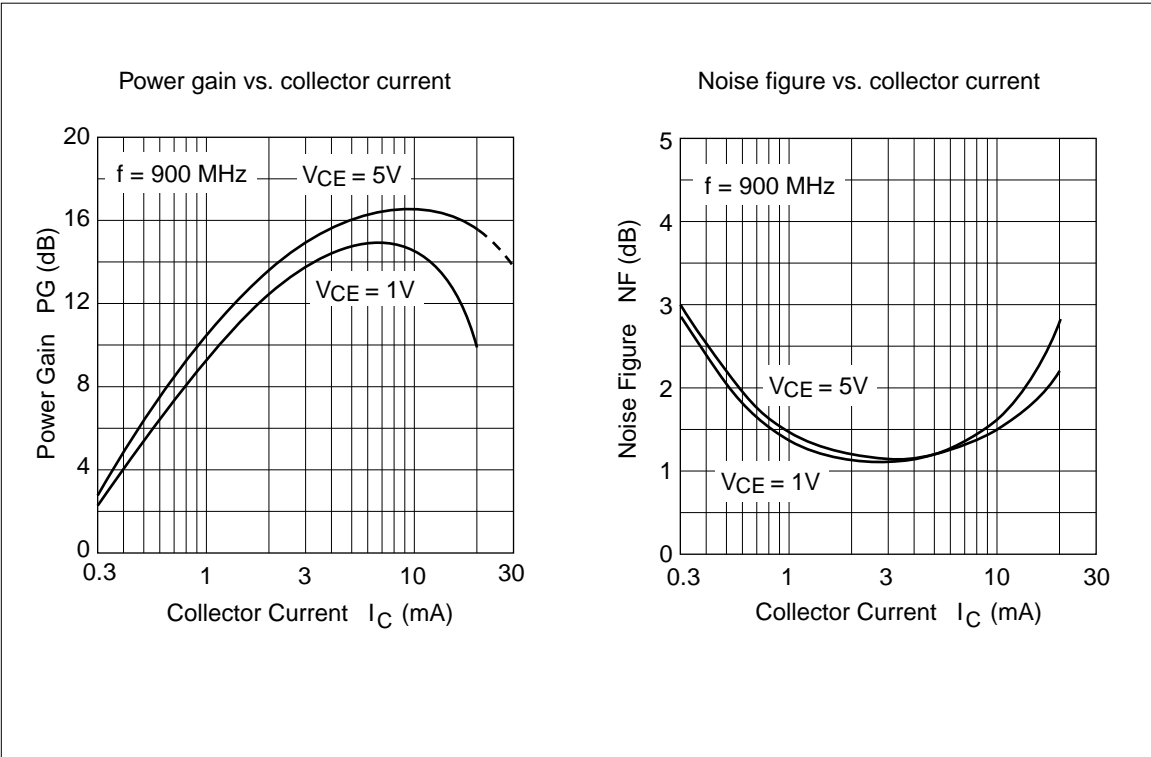
Gain bandwidth product vs. collector current



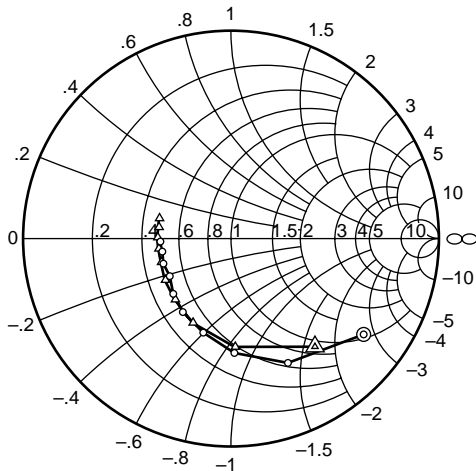
Collector output capacitance vs. collector to base voltage



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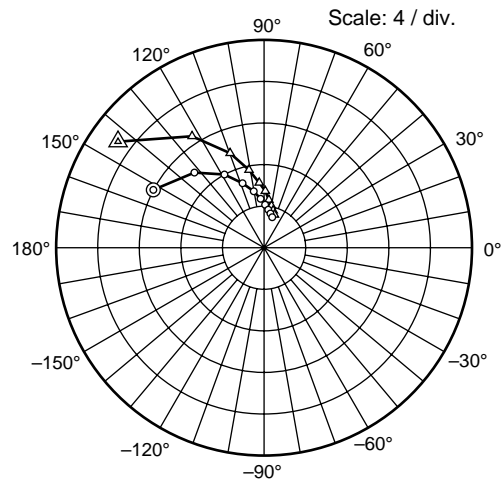
S11 parameter vs. frequency



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

○ — ○ (Ic = 5 mA)
△ — △ (Ic = 10 mA)

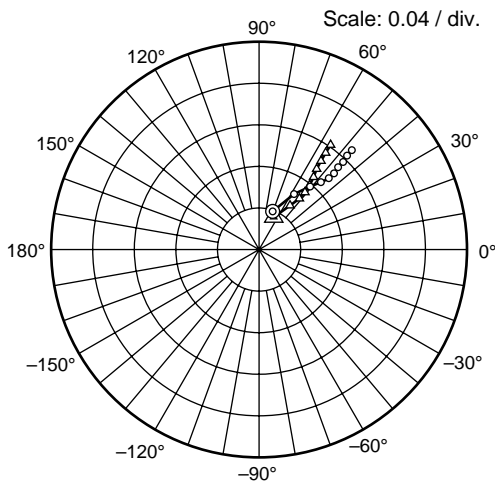
S21 parameter vs. frequency



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

○ — ○ (Ic = 5 mA)
△ — △ (Ic = 10 mA)

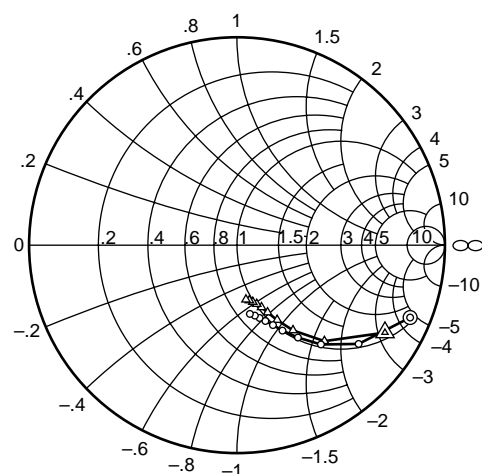
S12 parameter vs. frequency



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

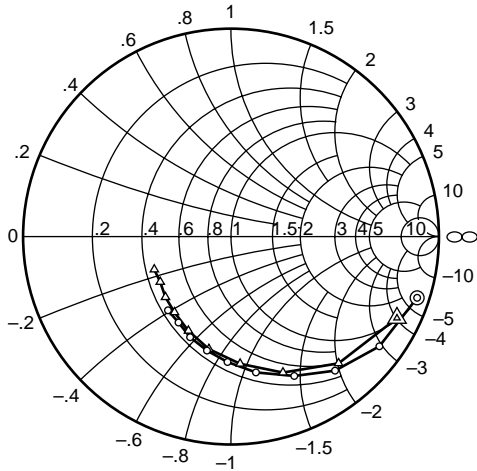


Condition: $V_{CE} = 5\text{ V}$, $Z_o = 50\ \Omega$
200 to 2000 MHz (200 MHz step)

○ — ○ (Ic = 5 mA)
△ — △ (Ic = 10 mA)

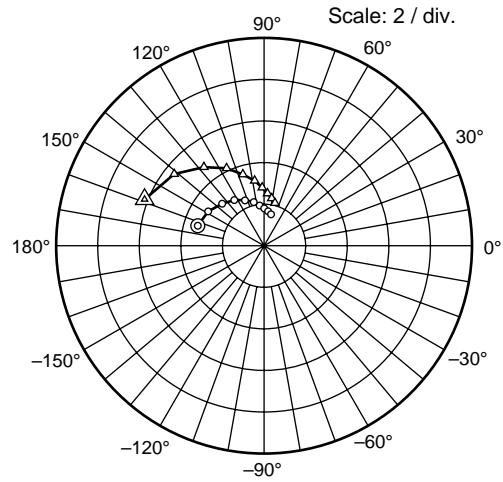
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S11 parameter vs. frequency



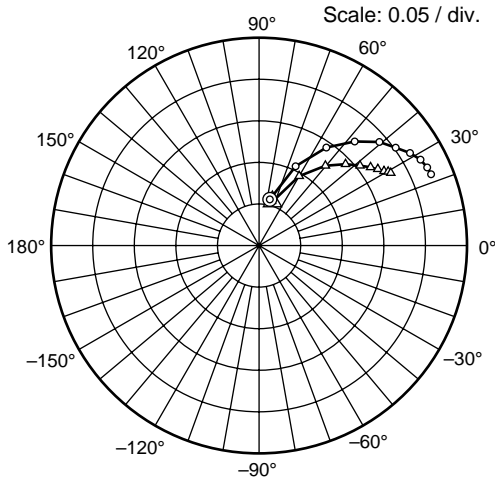
Condition: $V_{CE} = 1\text{ V}$, $Z_o = 50\ \Omega$
 200 to 2000 MHz (200 MHz step)
 ○ — ○ (Ic = 1 mA)
 △ — △ (Ic = 2 mA)

S21 parameter vs. frequency



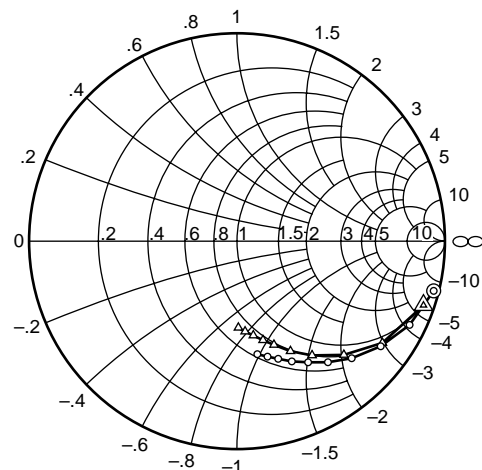
Scale: 2 / div.
 Condition: $V_{CE} = 1\text{ V}$, $Z_o = 50\ \Omega$
 200 to 2000 MHz (200 MHz step)
 ○ — ○ (Ic = 1 mA)
 △ — △ (Ic = 2 mA)

S12 parameter vs. frequency



Scale: 0.05 / div.
 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)

Table 3 S Parameter ($V_{CE} = 5\text{ V}$, $I_C = 5\text{ mA}$, $Z_O = 50\ \Omega$)

f (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

Table 4 S Parameter ($V_{CE} = 5\text{ V}$, $I_C = 10\text{ mA}$, $Z_O = 50\ \Omega$)

f (MHz)	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
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

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Table 5 S Parameter ($V_{CE} = 1\text{ V}$, $I_C = 1\text{ mA}$, $Z_O = 50\ \Omega$)

f (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

Table 6 S Parameter ($V_{CE} = 1\text{ V}$, $I_C = 2\text{ mA}$, $Z_O = 50\ \Omega$)

f (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	95.2	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