

## 2SC4988

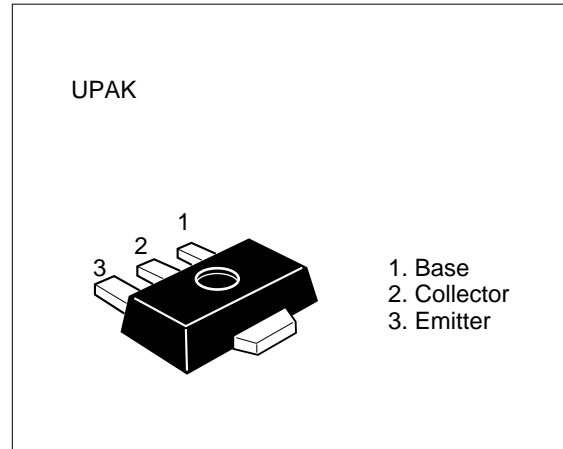
Silicon NPN Bipolar Transistor

### Application

VHF & UHF wide band amplifire

### Features

- High gain bandwidth product  
 $f_T = 8.5 \text{ GHz typ}$
- High gain, low noise figure  
 $PG = 10.5 \text{ dB typ,}$   
 $NF = 1.3 \text{ dB typ at } f = 900 \text{ MHz}$



**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	$V_{CEO}$	9	V
Emitter to base voltage	$V_{EBO}$	1.5	V
Collector current	$I_C$	100	mA
Collector power dissipation	$P_C$	800*	mW
Junction temperature	$T_j$	150	$^\circ\text{C}$
Storage temperature	$T_{stg}$	-55 to +150	$^\circ\text{C}$

Note: This value is allowed when using the alumina ceramics board (12.5 x 2.0 x 0.7 mm)

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**Table 2 Electrical Characteristics** (Ta = 25°C)

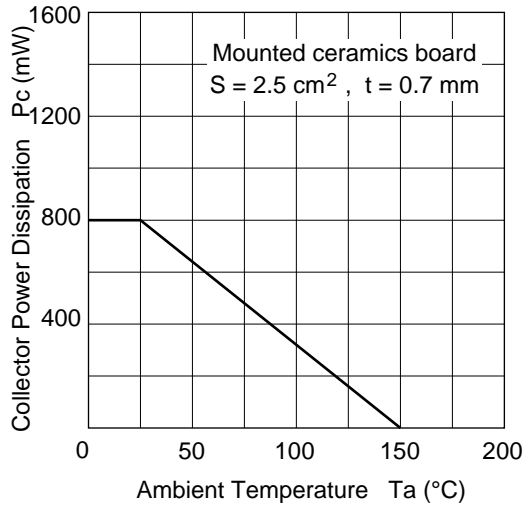
Item	Symbol	Min	Typ	Max	Unit	Test conditions
Collector to base breakdown voltage	$V_{(BR)CBO}$	15	—	—	V	$I_C = 10 \mu A, I_E = 0$
Collector cutoff current	$I_{CBO}$	—	—	1	$\mu A$	$V_{CB} = 12 V, I_E = 0$
	$I_{CEO}$	—	—	1	mA	$V_{CE} = 9 V, R_{BE} = \infty$
Emitter cutoff current	$I_{EBO}$	—	—	10	$\mu A$	$V_{EB} = 1.5 V, I_C = 0$
DC current transfer ratio	$h_{FE}$	50	120	250		$V_{CE} = 5 V, I_C = 20 mA$
Output capacitance	$C_{ob}$	—	1.1	1.6	pF	$V_{CB} = 5 V, I_E = 0, f = 1 MHz$
Gain bandwidth product	$f_T$	5.5	8.5	—	GHz	$V_{CE} = 5 V, I_C = 20 mA$
Power gain	PG	7.5	10.5	—	dB	$V_{CE} = 5 V, I_C = 20 mA, f = 900 MHz$
Noise figure	NF	—	1.3	2.5	dB	$V_{CE} = 5 V, I_C = 5 mA, f = 900 MHz$

Note: Marking of 2SC4988 is "FR".

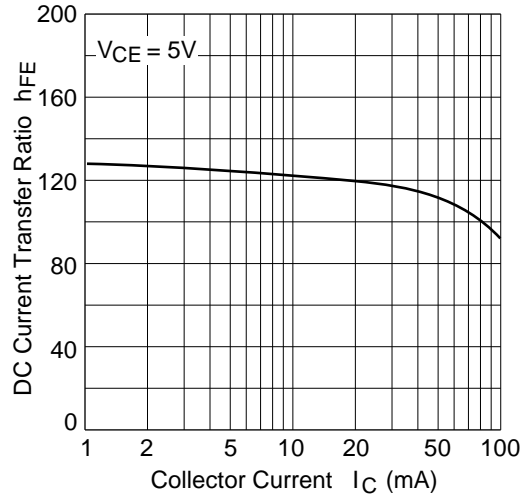
Attention: This device is very sensitive to electro static discharge.

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

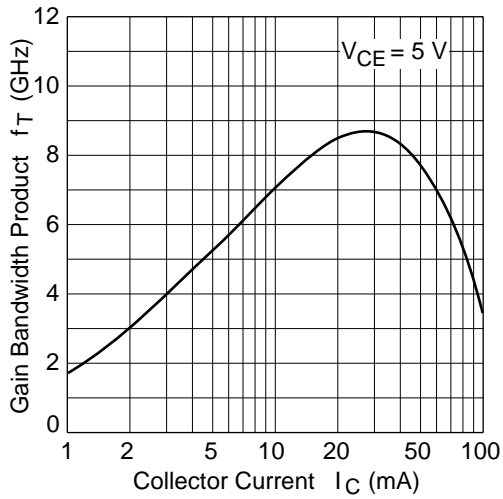
Collector power dissipation curve



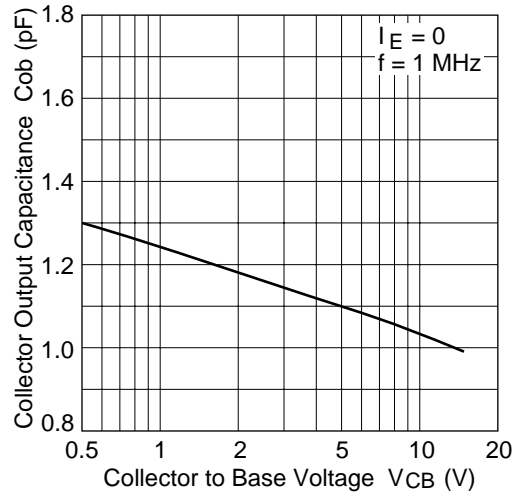
DC current transfer ratio vs. collector current



Gain bandwidth product vs. collector current

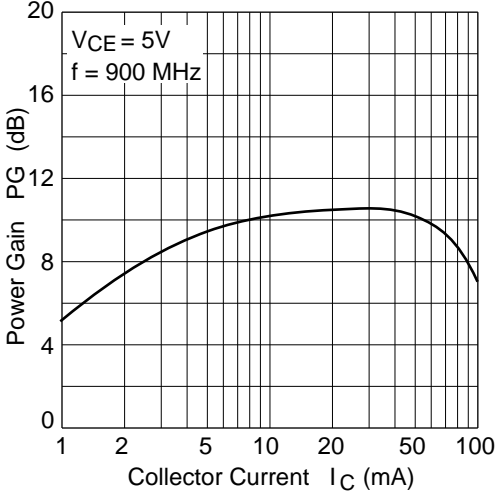


Collector output capacitance vs. collector to base voltage

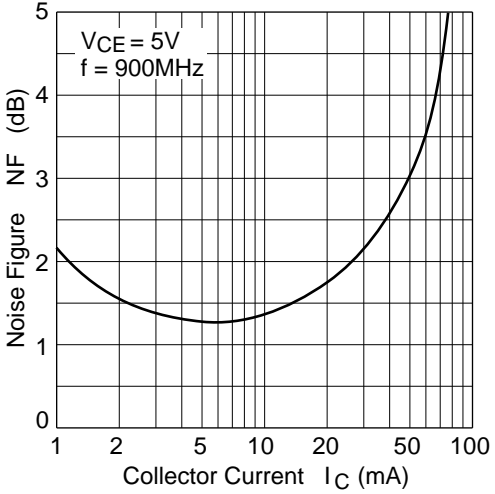


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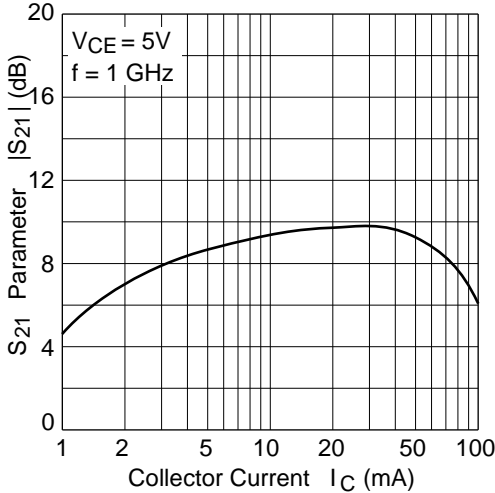
Power gain vs. collector current



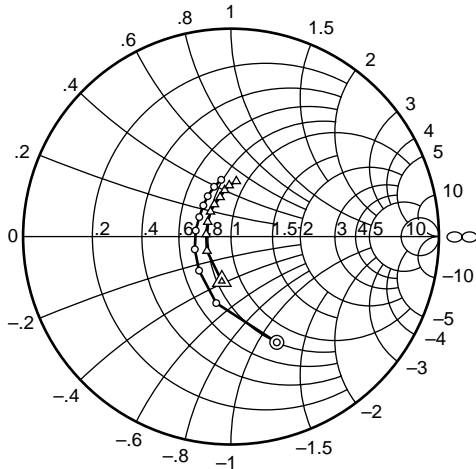
Noise figure vs. collector current



S21 parameter vs. collector current



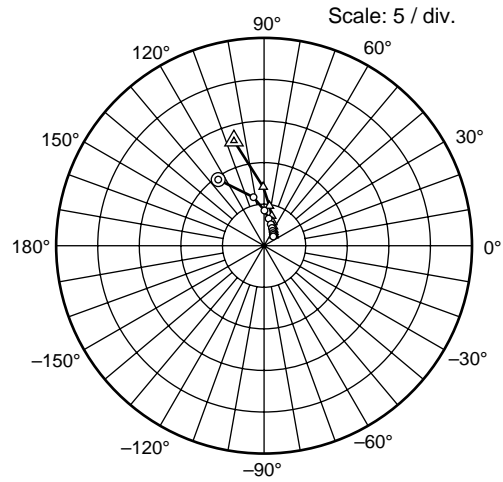
S11 parameter vs. frequency



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

○ — ○ (Ic = 5 mA)  
△ — △ (Ic = 20 mA)

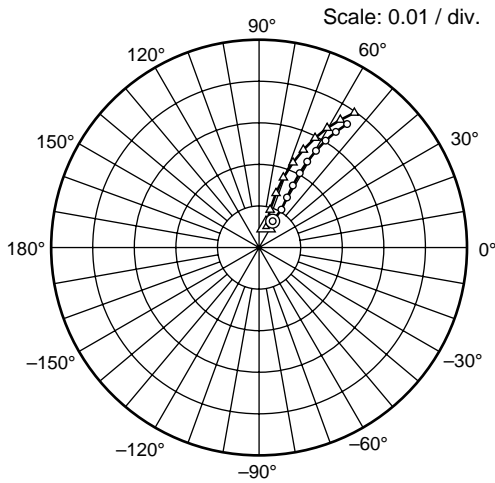
S21 parameter vs. frequency



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

○ — ○ (Ic = 5 mA)  
△ — △ (Ic = 20 mA)

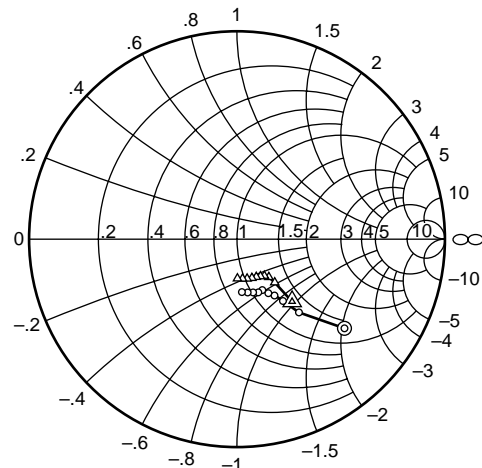
S12 parameter vs. frequency



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

○ — ○ (Ic = 5 mA)  
△ — △ (Ic = 20 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 = 20 mA)

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**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	0.555	-66.6	9.68	124.7	0.0717	62.3	0.672	-39.7
400	0.328	-102.5	5.98	102.2	0.106	59.4	0.462	-49.8
600	0.225	-133.1	4.24	89.3	0.138	60.8	0.371	-53.4
800	0.185	-160.5	3.31	80.3	0.170	61.4	0.326	-56.4
1000	0.172	170.5	2.71	72.4	0.204	61.3	0.301	-59.9
1200	0.179	148.5	2.34	65.8	0.237	60.7	0.285	-63.6
1400	0.200	131.7	2.06	59.9	0.270	59.5	0.276	-68.2
1600	0.224	120.0	1.86	54.4	0.303	58.1	0.268	-73.2
1800	0.253	108.7	1.71	49.6	0.334	56.4	0.262	-78.7
2000	0.277	99.8	1.58	44.9	0.365	54.5	0.256	-84.7

**Table 4 S Parameter** ( $V_{CE} = 5\text{ V}$ ,  $I_C = 20\text{ mA}$ ,  $Z_O = 50\ \Omega$ )

f (MHz)	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
200	0.220	-101.8	13.13	106.0	0.0532	71.5	0.401	-48.6
400	0.135	-149.0	7.08	90.8	0.0946	73.6	0.277	-49.0
600	0.120	175.1	4.83	82.2	0.137	72.6	0.239	-50.1
800	0.132	148.0	3.70	75.5	0.178	70.8	0.221	-53.4
1000	0.155	129.6	3.02	69.5	0.220	68.2	0.212	-57.9
1200	0.174	117.3	2.58	63.9	0.258	65.6	0.205	-63.1
1400	0.196	105.5	2.26	58.8	0.296	62.9	0.201	-69.1
1600	0.225	97.8	2.04	54.1	0.331	60.3	0.197	-75.7
1800	0.246	92.0	1.86	50.0	0.364	57.5	0.193	-82.1
2000	0.267	84.5	1.72	45.7	0.397	54.7	0.190	-89.4