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# 2SC4988

Silicon NPN Epitaxial

# HITACHI

ADE-208-004  
1st. Edition

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## Application

VHF / UHF wide band amplifier

## 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  $f = 900 \text{ MHz}$

## Outline

UPAK



1. Base
2. Collector
3. Emitter
4. Collector (Flange)

## 2SC4988

### Absolute Maximum Ratings (Ta = 25°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* <sup>1</sup> | mW   |
| Junction temperature         | $T_j$     | 150               | °C   |
| Storage temperature          | $T_{stg}$ | -55 to +150       | °C   |

Note: 1. This value is allowed when using the alumina ceramics board (12.5 x 20 x 0.7 mm)

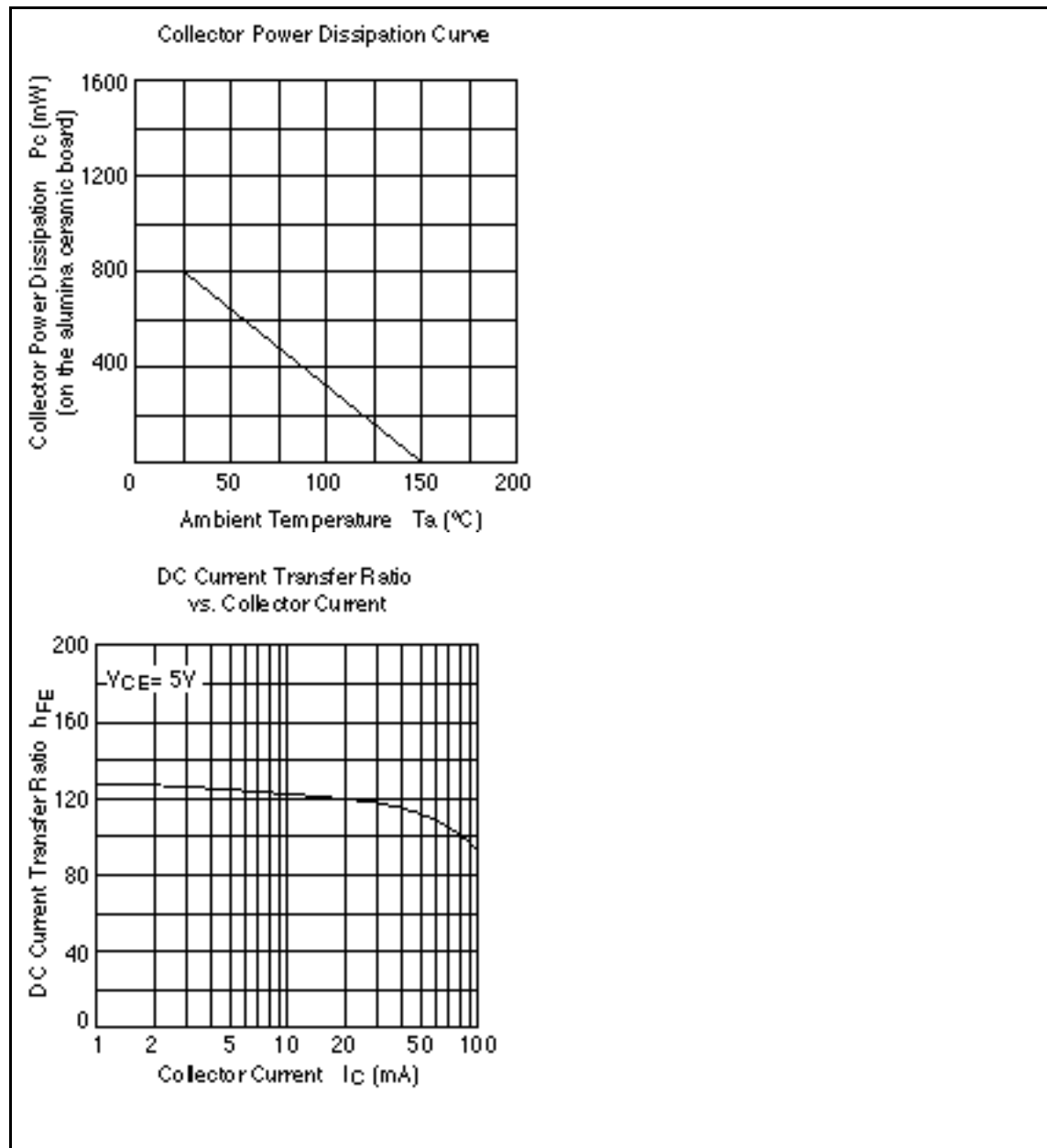
### Electrical Characteristics (Ta = 25°C)

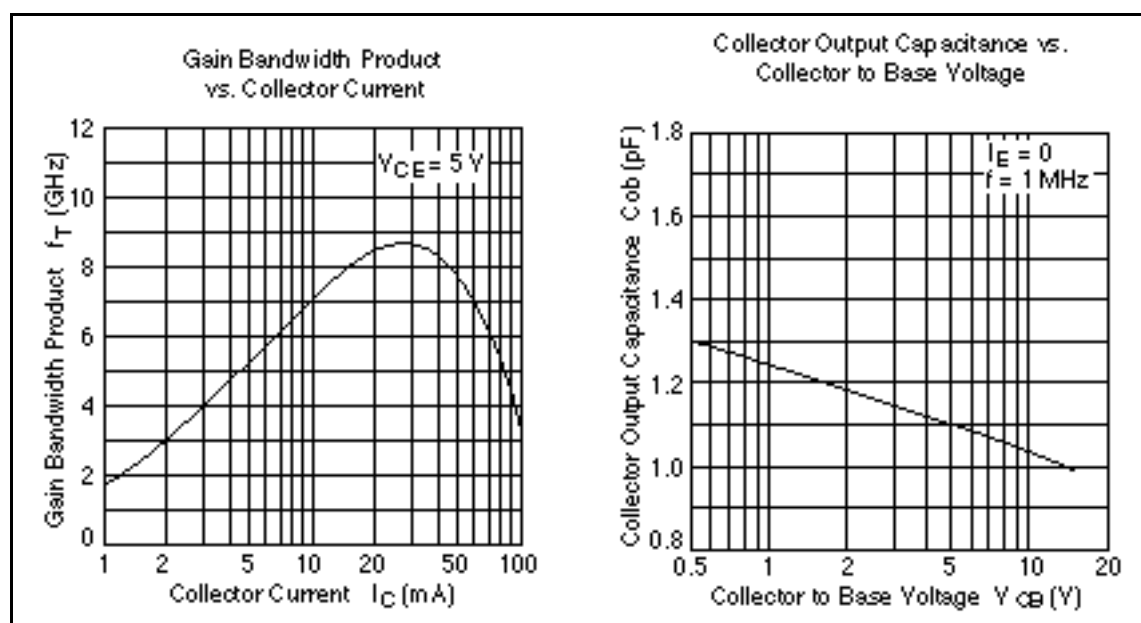
| Item                                | Symbol        | Min | Typ  | Max | Unit    | Test conditions                               |
|-------------------------------------|---------------|-----|------|-----|---------|---|
| Collector to base breakdown voltage | $V_{(BR)CBO}$ | 15  | —    | —   | V       | $I_C = 10 \mu A, I_E = 0$                     |
| Collector cutoff current            | $I_{CBO}$     | —   | —    | 1   | $\mu A$ | $V_{CB} = 12 V, I_E = 0$                      |
|                                     | $I_{CEO}$     | —   | —    | 1   | mA      | $V_{CE} = 9 V, R_{BE} =$                      |
| 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 |         | $V_{CE} = 5 V, I_C = 20 mA$                   |
| Collector 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      | $V_{CE} = 5 V, I_C = 20 mA,$<br>$f = 900 MHz$ |
| Noise figure                        | NF            | —   | 1.3  | 2.5 | dB      | $V_{CE} = 5 V, I_C = 5 mA,$<br>$f = 900 MHz$  |

Note: Marking is "FR".

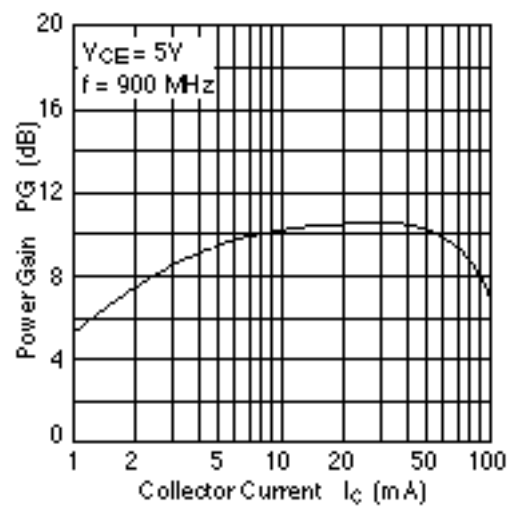
Attention: This device is very sensitive to electro static discharge.

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

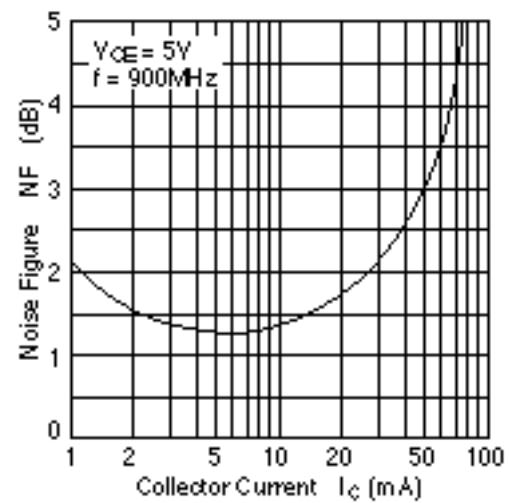




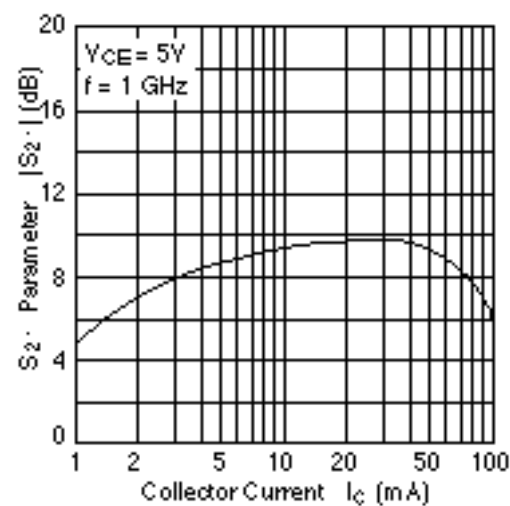
Power Gain vs. Collector Current



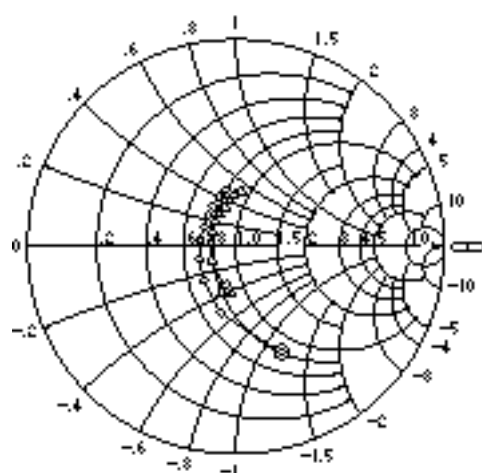
Noise Figure vs. Collector Current



S21 Parameter vs. Collector Current

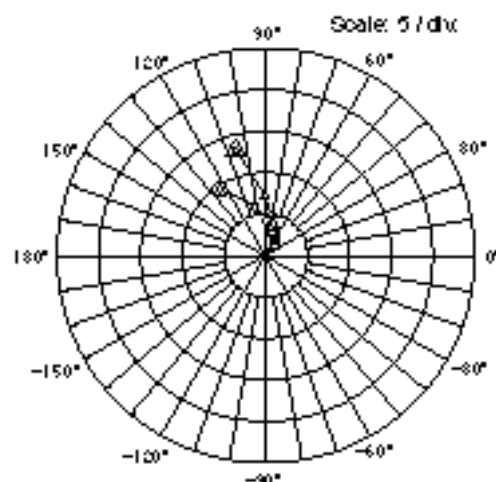


S11 Parameter vs. Frequency



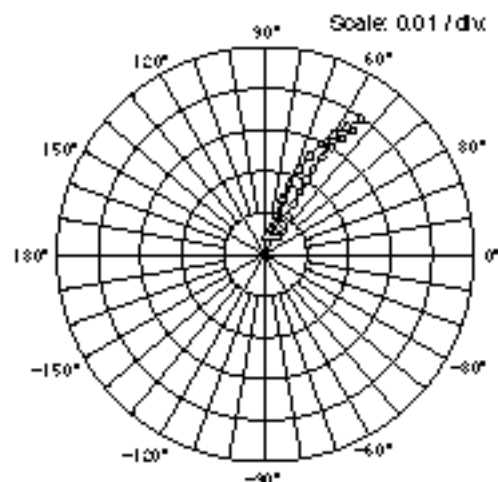
Condition:  $V_{CE} = 5 \text{ V}$ ,  $Z_0 = 50 \Omega$   
 200 to 2000 MHz (200 MHz step)  
 (○)  $I_C = 5 \text{ mA}$   
 (△)  $I_C = 20 \text{ mA}$

S21 Parameter vs. Frequency



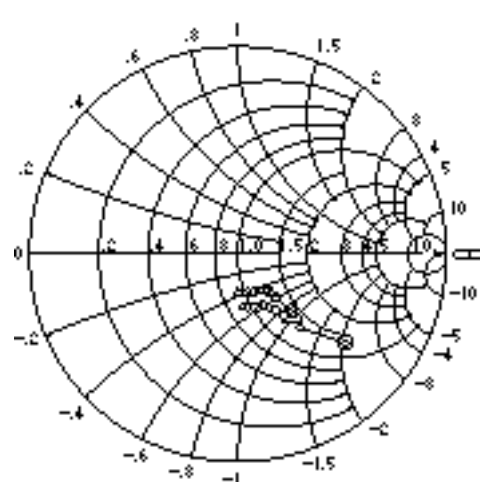
Condition:  $V_{CE} = 5 \text{ V}$ ,  $Z_0 = 50 \Omega$   
 200 to 2000 MHz (200 MHz step)  
 (○)  $I_C = 5 \text{ mA}$   
 (△)  $I_C = 20 \text{ mA}$

S12 Parameter vs. Frequency



Condition:  $V_{CE} = 5 \text{ V}$ ,  $Z_0 = 50 \Omega$   
 200 to 2000 MHz (200 MHz step)  
 (○)  $I_C = 5 \text{ mA}$   
 (△)  $I_C = 20 \text{ mA}$

S22 Parameter vs. Frequency



Condition:  $V_{CE} = 5 \text{ V}$ ,  $Z_0 = 50 \Omega$   
 200 to 2000 MHz (200 MHz step)  
 (○)  $I_C = 5 \text{ mA}$   
 (△)  $I_C = 20 \text{ mA}$

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

| Freq.<br>(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 |

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

| Freq.<br>(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 |

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