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# 2SC4995

Silicon NPN Epitaxial

# HITACHI

ADE-208-013  
1st. Edition

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## Application

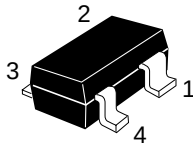
VHF / UHF wide band amplifier

## Features

- High gain bandwidth product  
 $f_T = 11 \text{ GHz Typ}$
- High gain, low noise figure  
 $PG = 16.5 \text{ dB Typ}$ ,  $NF = 1.1 \text{ dB Typ}$  at  $f = 900 \text{ MHz}$

## Outline

CMPAK-4



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

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            | $I_C$     | 50          | mA   |
| Collector power dissipation  | $P_C$     | 100         | mW   |
| Junction temperature         | $T_j$     | 150         | °C   |
| Storage temperature          | $T_{stg}$ | -55 to +150 | °C   |

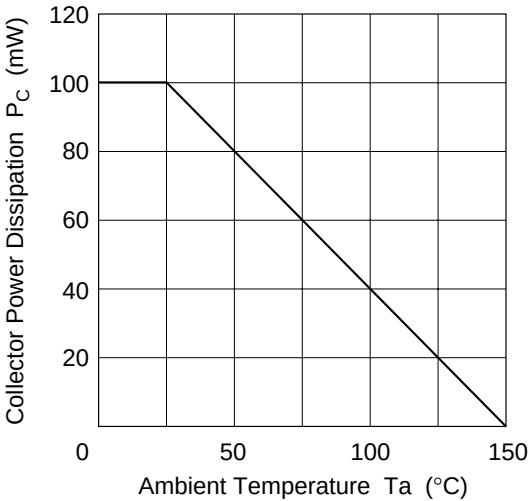
Electrical Characteristics (Ta = 25°C)

| Item                                | Symbol        | Min  | Typ  | Max  | Unit          | Test conditions                                                         |
|-------------------------------------|---------------|------|------|------|---------------|-------------------------------------------------------------------------|
| Collector to base breakdown voltage | $V_{(BR)CBO}$ | 15   | —    | —    | V             | $I_C = 10\text{ }\mu\text{A}$ , $I_E = 0$                               |
| Collector cutoff current            | $I_{CBO}$     | —    | —    | 10   | $\mu\text{A}$ | $V_{CB} = 12\text{ V}$ , $I_E = 0$                                      |
|                                     | $I_{CEO}$     | —    | —    | 1    | mA            | $V_{CE} = 8\text{ V}$ , $R_{BE} = \infty$                               |
| Emitter cutoff current              | $I_{EBO}$     | —    | —    | 10   | $\mu\text{A}$ | $V_{EB} = 1.5\text{ V}$ , $I_C = 0$                                     |
| DC current transfer ratio           | $h_{FE}$      | 50   | 120  | 250  |               | $V_{CE} = 5\text{ V}$ , $I_C = 20\text{ mA}$                            |
| Collector output capacitance        | $C_{ob}$      | —    | 0.55 | 1.05 | pF            | $V_{CB} = 5\text{ V}$ , $I_E = 0$ , $f = 1\text{ MHz}$                  |
| Gain bandwidth product              | $f_T$         | 8.0  | 11.0 | —    | GHz           | $V_{CE} = 5\text{ V}$ , $I_C = 20\text{ mA}$                            |
| S21 Parameter                       | $ S_{21} $    | —    | 16   | —    | dB            | $V_{CE} = 5\text{ V}$ , $I_C = 20\text{ mA}$ ,<br>$f = 1000\text{ MHz}$ |
| Power gain                          | PG            | 13.5 | 16.5 | —    | dB            | $V_{CE} = 5\text{ V}$ , $I_C = 20\text{ mA}$ ,<br>$f = 900\text{ MHz}$  |
| Noise figure                        | NF            | —    | 1.1  | 2.0  | dB            | $V_{CE} = 5\text{ V}$ , $I_C = 5\text{ mA}$ ,<br>$f = 900\text{ MHz}$   |

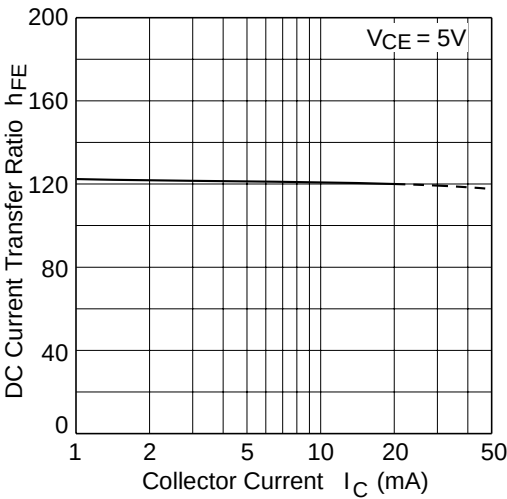
Note: Marking is “YD—”.

Attention: This device is very sensitive to electro static discharge.  
It is recommended to adopt appropriate cautions when handling this transistor.

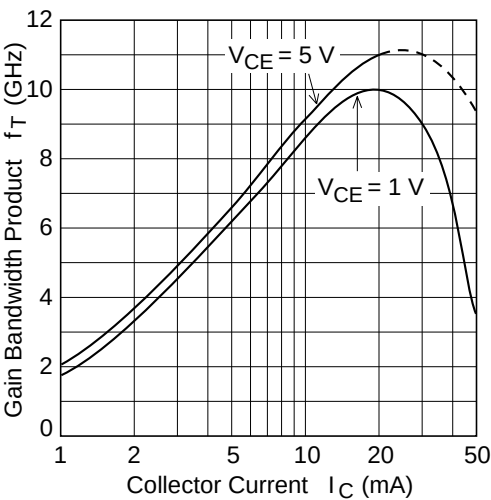
Maximum Collector Dissipation Curve



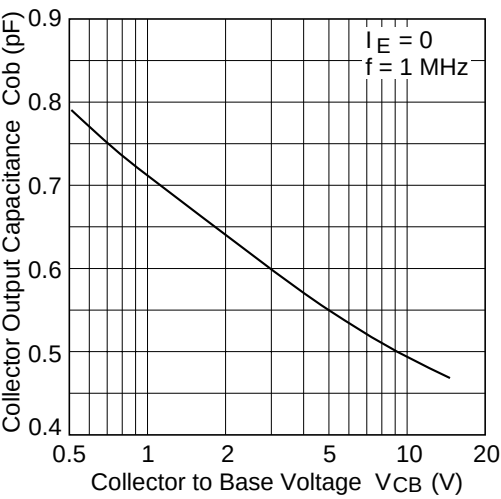
DC Current Transfer Ratio vs. Collector Current



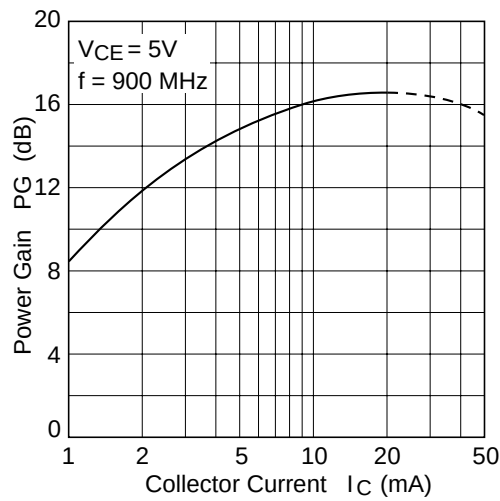
Gain Bandwidth Product vs. Collector Current



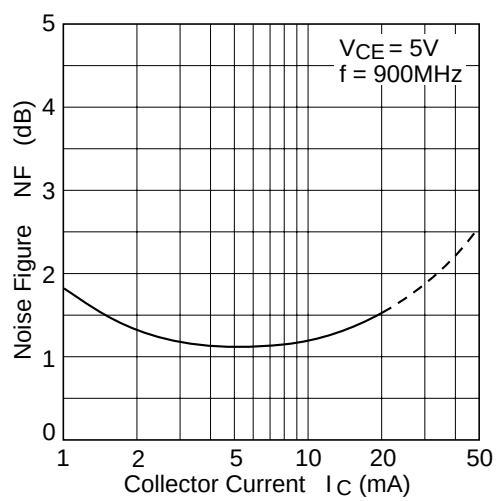
Collector Output Capacitance vs. Collector to Base Voltage



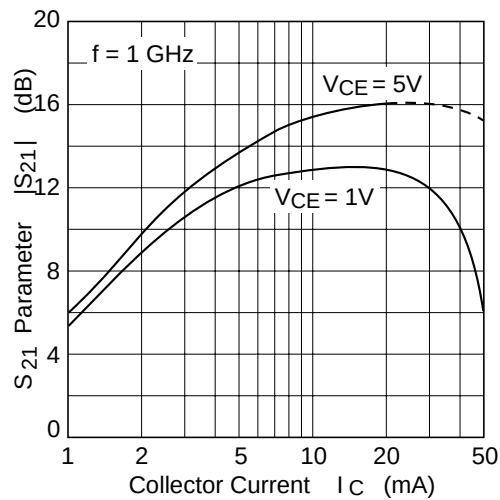
Power Gain vs. Collector Current



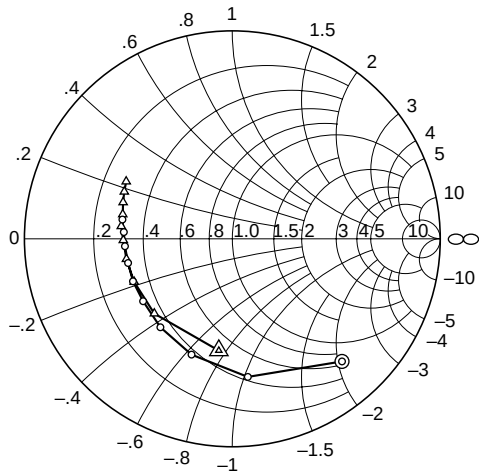
Noise Figure vs. Collector Current



S21 Parameter vs. Collector Current

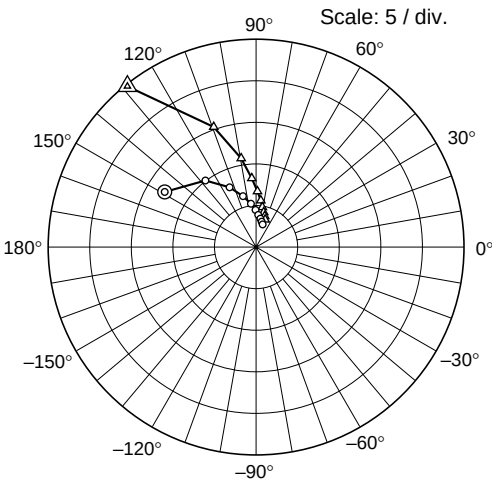


S11 Parameter vs. Frequency



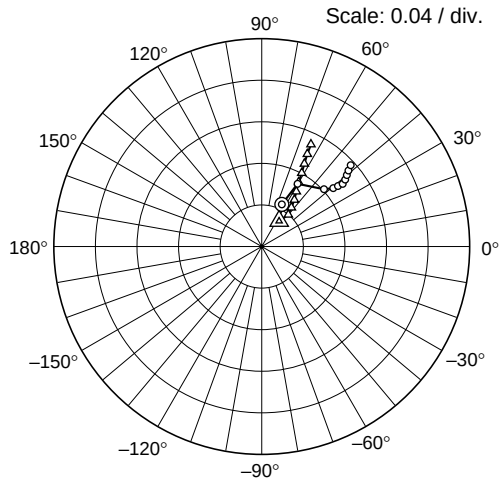
Condition:  $V_{CE} = 5\text{ V}$ ,  $Z_o = 50\ \Omega$   
200 to 2000 MHz (200 MHz step)  
○ — ○ ( $I_C = 5\text{ mA}$ )  
△ — △ ( $I_C = 20\text{ mA}$ )

S21 Parameter vs. Frequency



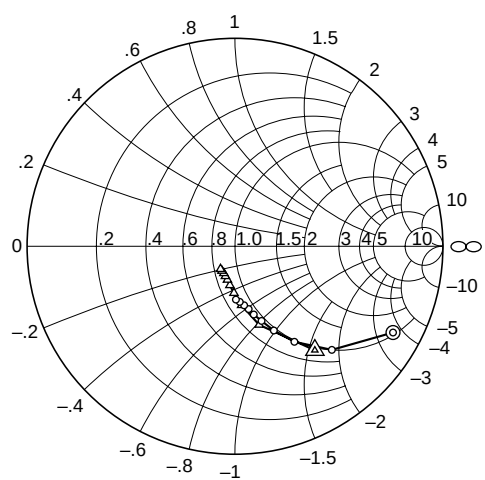
Condition:  $V_{CE} = 5\text{ V}$ ,  $Z_o = 50\ \Omega$   
200 to 2000 MHz (200 MHz step)  
○ — ○ ( $I_C = 5\text{ mA}$ )  
△ — △ ( $I_C = 20\text{ mA}$ )

S12 Parameter vs. Frequency



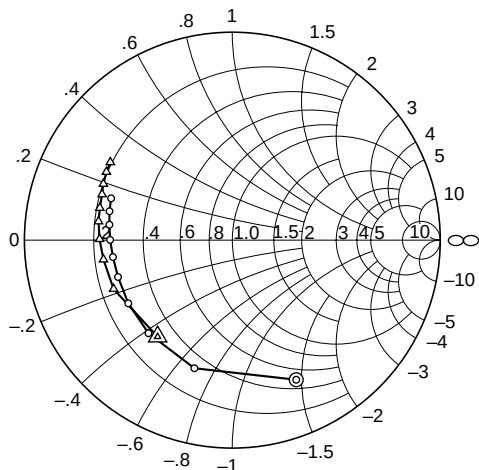
Condition:  $V_{CE} = 5\text{ V}$ ,  $Z_o = 50\ \Omega$   
200 to 2000 MHz (200 MHz step)  
○ — ○ ( $I_C = 5\text{ mA}$ )  
△ — △ ( $I_C = 20\text{ mA}$ )

S22 Parameter vs. Frequency



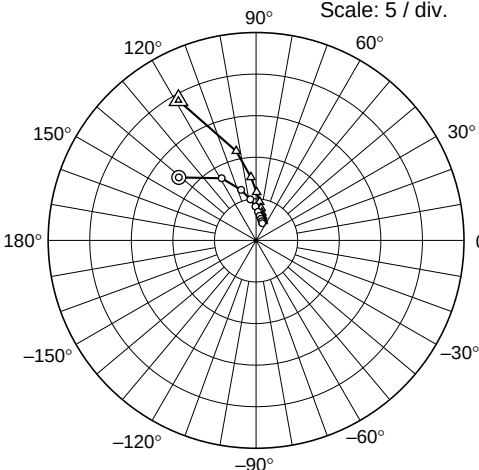
Condition:  $V_{CE} = 5\text{ V}$ ,  $Z_o = 50\ \Omega$   
200 to 2000 MHz (200 MHz step)  
○ — ○ ( $I_C = 5\text{ mA}$ )  
△ — △ ( $I_C = 20\text{ mA}$ )

S11 Parameter vs. Frequency



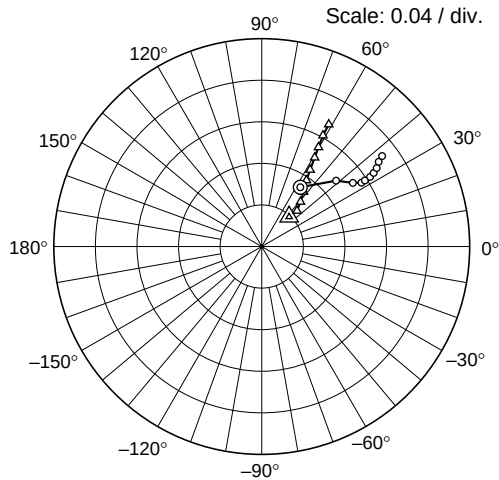
Condition:  $V_{CE} = 1\text{ V}$ ,  $Z_o = 50\ \Omega$   
200 to 2000 MHz (200 MHz step)  
○ — ○ ( $I_C = 5\text{ mA}$ )  
△ — △ ( $I_C = 20\text{ mA}$ )

S21 Parameter vs. Frequency



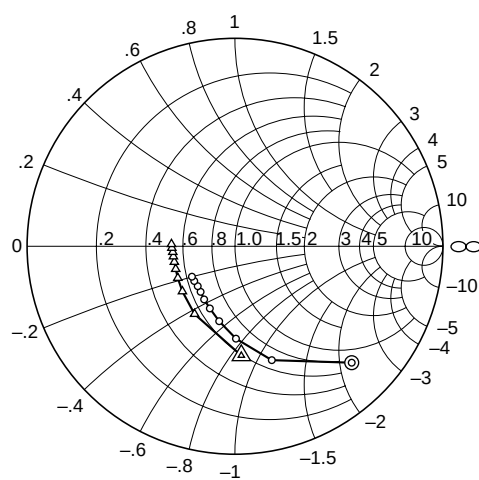
Condition:  $V_{CE} = 1\text{ V}$ ,  $Z_o = 50\ \Omega$   
200 to 2000 MHz (200 MHz step)  
○ — ○ ( $I_C = 5\text{ mA}$ )  
△ — △ ( $I_C = 20\text{ mA}$ )

S12 Parameter vs. Frequency



Condition:  $V_{CE} = 1\text{ V}$ ,  $Z_o = 50\ \Omega$   
200 to 2000 MHz (200 MHz step)  
○ — ○ ( $I_C = 5\text{ mA}$ )  
△ — △ ( $I_C = 20\text{ mA}$ )

S22 Parameter vs. Frequency



Condition:  $V_{CE} = 1\text{ V}$ ,  $Z_o = 50\ \Omega$   
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            | 0.781 | -48.2  | 12.84 | 148.8 | 0.0449 | 64.6 | 0.866 | -28.6 |
| 400            | 0.669 | -83.6  | 10.04 | 127.3 | 0.0695 | 50.3 | 0.682 | -46.9 |
| 600            | 0.591 | -109.4 | 7.84  | 113.9 | 0.0815 | 42.6 | 0.541 | -58.1 |
| 800            | 0.549 | -129.1 | 6.30  | 104.4 | 0.0889 | 39.2 | 0.446 | -65.2 |
| 1000           | 0.524 | -145.0 | 5.23  | 96.7  | 0.0937 | 38.4 | 0.381 | -70.4 |
| 1200           | 0.520 | -156.8 | 4.45  | 90.7  | 0.0986 | 37.7 | 0.340 | -74.6 |
| 1400           | 0.515 | -166.9 | 3.86  | 86.0  | 0.103  | 38.7 | 0.309 | -77.7 |
| 1600           | 0.518 | -176.0 | 3.44  | 81.1  | 0.107  | 40.0 | 0.287 | -81.2 |
| 1800           | 0.523 | 176.5  | 3.11  | 77.3  | 0.111  | 41.2 | 0.268 | -85.1 |
| 2000           | 0.537 | 170.1  | 2.82  | 73.5  | 0.116  | 42.4 | 0.256 | -89.0 |

**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            | 0.542 | -69.9  | 24.74 | 128.7 | 0.0296 | 55.5 | 0.631 | -52.5  |
| 400            | 0.520 | -136.2 | 15.31 | 109.4 | 0.0398 | 50.2 | 0.395 | -72.9  |
| 600            | 0.516 | -156.3 | 10.81 | 99.5  | 0.0470 | 52.8 | 0.285 | -83.6  |
| 800            | 0.519 | -169.1 | 8.29  | 93.5  | 0.0547 | 55.1 | 0.225 | -91.3  |
| 1000           | 0.525 | -179.2 | 6.70  | 88.5  | 0.0624 | 57.9 | 0.189 | -97.5  |
| 1200           | 0.538 | 173.6  | 5.63  | 84.1  | 0.0712 | 60.2 | 0.166 | -102.8 |
| 1400           | 0.540 | 167.5  | 4.85  | 80.9  | 0.0805 | 61.5 | 0.151 | -107.9 |
| 1600           | 0.554 | 161.6  | 4.29  | 77.5  | 0.0895 | 62.8 | 0.140 | -112.6 |
| 1800           | 0.567 | 159.5  | 3.86  | 74.3  | 0.0991 | 63.8 | 0.134 | -118.1 |
| 2000           | 0.580 | 151.7  | 3.48  | 71.6  | 0.109  | 64.3 | 0.129 | -122.5 |

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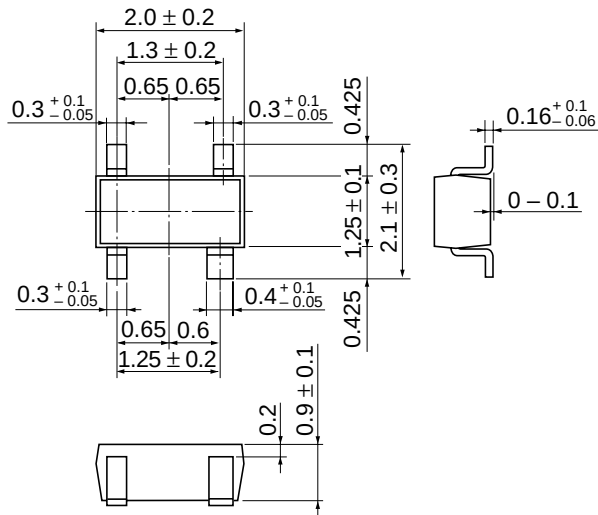
S Parameter (V<sub>CE</sub> = 1 V, I<sub>C</sub> = 5 mA, Z<sub>O</sub> = 50 Ω)

| Freq.<br>(MHz) | S11   |        | S21   |       | S12    |      | S22   |        |
|----------------|-------|--------|-------|-------|--------|------|-------|--------|
|                | MAG.  | ANG.   | MAG.  | ANG.  | MAG.   | ANG. | MAG.  | ANG.   |
| 200            | 0.739 | −65.4  | 11.99 | 140.8 | 0.0681 | 56.9 | 0.793 | −44.9  |
| 400            | 0.643 | −106.5 | 8.54  | 118.9 | 0.0957 | 41.5 | 0.576 | −72.1  |
| 600            | 0.603 | −132.0 | 6.34  | 106.4 | 0.107  | 34.9 | 0.446 | −89.4  |
| 800            | 0.586 | −148.7 | 4.99  | 97.9  | 0.114  | 32.6 | 0.369 | −101.9 |
| 1000           | 0.578 | −162.1 | 4.08  | 90.9  | 0.118  | 32.6 | 0.323 | −112.0 |
| 1200           | 0.580 | −171.9 | 3.45  | 86.0  | 0.124  | 32.7 | 0.396 | −120.1 |
| 1400           | 0.588 | 179.9  | 2.99  | 81.7  | 0.129  | 33.3 | 0.275 | −127.0 |
| 1600           | 0.596 | 172.9  | 2.67  | 77.2  | 0.134  | 34.3 | 0.263 | −133.0 |
| 1800           | 0.607 | 166.8  | 2.41  | 73.4  | 0.139  | 35.9 | 0.256 | −139.5 |
| 2000           | 0.617 | 161.0  | 2.20  | 70.0  | 0.145  | 36.9 | 0.254 | −144.7 |

S Parameter (V<sub>CE</sub> = 1 V, I<sub>C</sub> = 20 mA, Z<sub>O</sub> = 50 Ω)

| Freq.<br>(MHz) | S11   |        | S21   |       | S12    |      | S22   |        |
|----------------|-------|--------|-------|-------|--------|------|-------|--------|
|                | MAG.  | ANG.   | MAG.  | ANG.  | MAG.   | ANG. | MAG.  | ANG.   |
| 200            | 0.588 | −127.7 | 19.25 | 119.0 | 0.0389 | 47.2 | 0.527 | −86.7  |
| 400            | 0.618 | −157.6 | 11.00 | 102.5 | 0.0483 | 45.3 | 0.380 | −120.8 |
| 600            | 0.627 | −171.4 | 7.62  | 94.6  | 0.0570 | 49.0 | 0.334 | −139.3 |
| 800            | 0.639 | 179.6  | 5.80  | 89.2  | 0.0662 | 52.6 | 0.315 | −150.9 |
| 1000           | 0.650 | 172.1  | 4.66  | 84.5  | 0.0768 | 55.9 | 0.306 | −158.9 |
| 1200           | 0.656 | −166.4 | 3.94  | 81.1  | 0.873  | 57.7 | 0.302 | −165.4 |
| 1400           | 0.664 | 160.7  | 3.40  | 78.2  | 0.0996 | 59.2 | 0.301 | −170.5 |
| 1600           | 0.677 | 156.5  | 3.03  | 75.2  | 0.110  | 60.2 | 0.301 | −174.6 |
| 1800           | 0.689 | 151.6  | 2.71  | 71.9  | 0.122  | 61.1 | 0.304 | −178.4 |
| 2000           | 0.696 | 147.5  | 2.47  | 69.2  | 0.134  | 61.2 | 0.306 | 178.2  |





|                          |            |
|--------------------------|------------|
| Hitachi Code             | CMPAK-4(T) |
| JEDEC                    | —          |
| EIAJ                     | Conforms   |
| Weight (reference value) | 0.006 g    |

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## Hitachi, Ltd.

Semiconductor & Integrated Circuits.  
Nippon Bldg., 2-6-2, Ohte-machi, Chiyoda-ku, Tokyo 100-0004, Japan  
Tel: Tokyo (03) 3270-2111 Fax: (03) 3270-5109

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Hitachi Asia Pte. Ltd.  
16 Collyer Quay #20-00  
Hitachi Tower  
Singapore 049318  
Tel: 535-2100  
Fax: 535-1533

Hitachi Asia Ltd.  
Taipei Branch Office  
3F, Hung Kuo Building, No.167,  
Tun-Hwa North Road, Taipei (105)  
Tel: <886> (2) 2718-3666  
Fax: <886> (2) 2718-8180

Hitachi Asia (Hong Kong) Ltd.  
Group III (Electronic Components)  
7/F., North Tower, World Finance Centre,  
Harbour City, Canton Road, Tsim Sha Tsui,  
Kowloon, Hong Kong  
Tel: <852> (2) 735 9218  
Fax: <852> (2) 730 0281  
Telex: 40815 HITEC HX

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