

---

# 2SC4791

Silicon NPN Epitaxial

# HITACHI

---

## Application

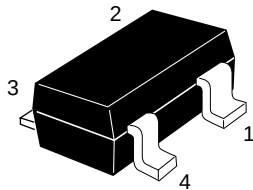
VHF / UHF wide band amplifier

## Features

- High gain bandwidth product  
 $f_T = 10 \text{ GHz Typ.}$
- High gain, low noise figure  
 $PG = 15.5 \text{ dB Typ, NF} = 1.2 \text{ dB Typ at } f = 900 \text{ MHz}$

## Outline

MPAK-4



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

Absolute Maximum Ratings (Ta = 25°C)

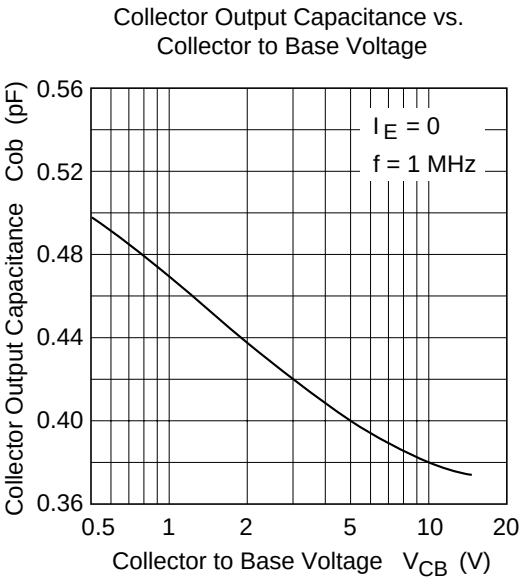
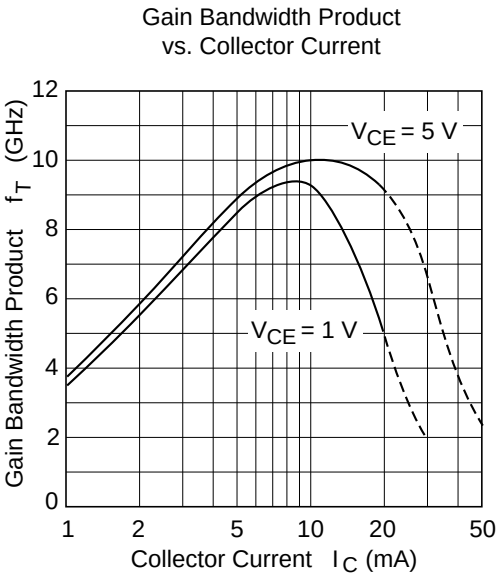
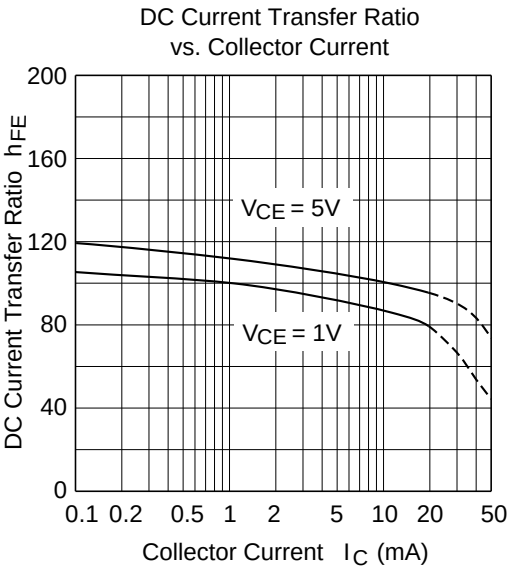
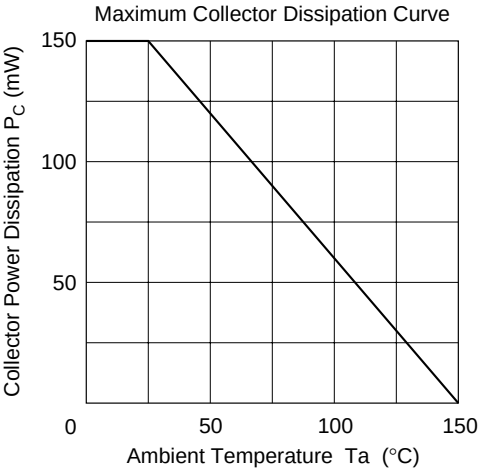
| Item                         | Symbol    | Ratings     | Unit |
|------------------------------|-----------|-------------|------|
| Collector to base voltage    | $V_{CBO}$ | 15          | V    |
| Collector to emitter voltage | $V_{CEO}$ | 8           | V    |
| Emitter to base voltage      | $V_{EBO}$ | 1.5         | V    |
| Collector current            | $I_C$     | 20          | mA   |
| Collector power dissipation  | $P_C$     | 150         | mW   |
| Junction temperature         | $T_j$     | 150         | °C   |
| Storage temperature          | $T_{stg}$ | -55 to +150 | °C   |

Electrical Characteristics (Ta = 25°C)

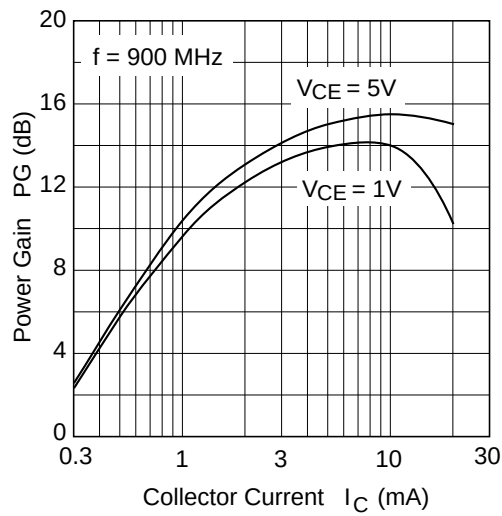
| Item                         | Symbol    | Min  | Typ  | Max  | Unit | Test conditions                                               |
|------------------------------|-----------|------|------|------|------|---------------------------------------------------------------|
| Collector cutoff current     | $I_{CBO}$ | —    | —    | 10   | μA   | $V_{CB} = 15\text{ V}, I_E = 0$                               |
|                              | $I_{CEO}$ | —    | —    | 1    | mA   | $V_{CE} = 8\text{ V}, R_{BE} = \infty$                        |
| 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  |      | $V_{CE} = 5\text{ V}, I_C = 10\text{ mA}$                     |
| 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       | $f_T$     | 7.0  | 10.0 | —    | GHz  | $V_{CE} = 5\text{ V}, I_C = 10\text{ mA}$                     |
| Power gain                   | PG        | 12.5 | 15.5 | —    | 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 is “YA—”.

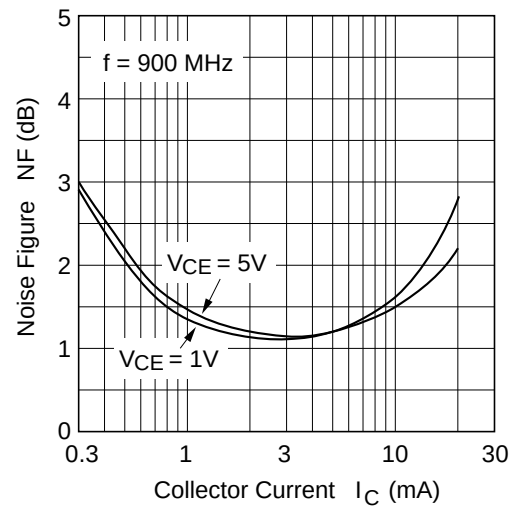
Attention: This is electrostatic sensitive device.



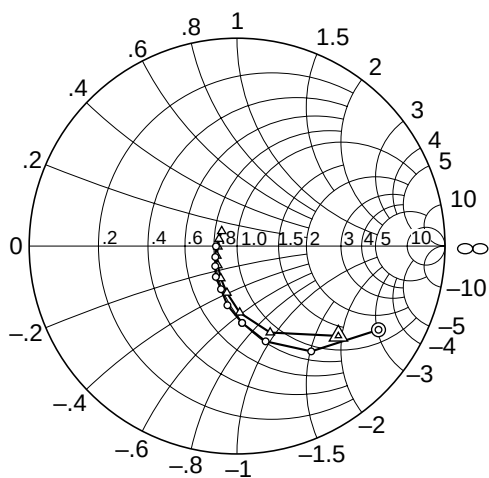
Power Gain vs. Collector Current



Noise Figure vs. Collector Current

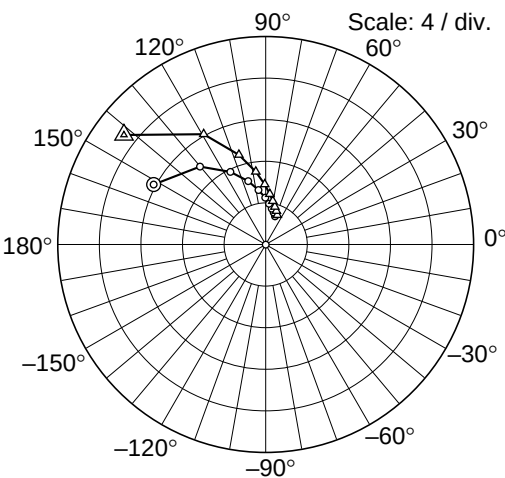


S11 Parameter vs. Frequency



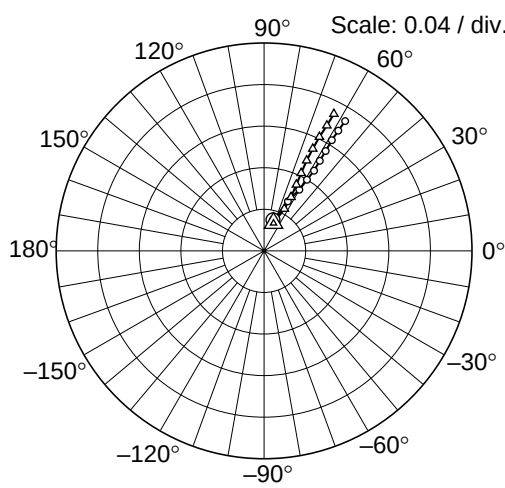
Condition:  $V_{CE} = 5\text{ V}$ ,  $Z_o = 50\ \Omega$   
200 to 2000 MHz (200 MHz step)  
○ (  $I_C = 5\text{ mA}$  )  
△ (  $I_C = 10\text{ mA}$  )

S21 Parameter vs. Frequency



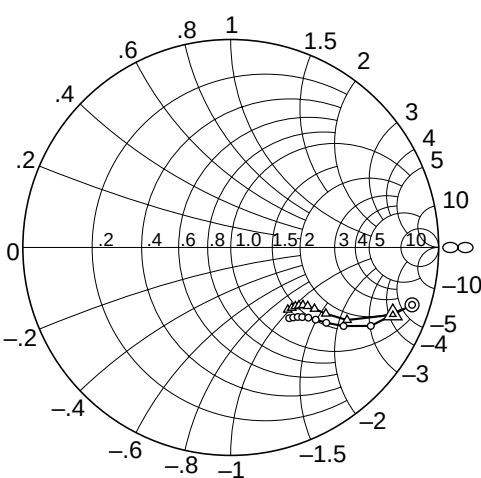
Condition:  $V_{CE} = 5\text{ V}$ ,  $Z_o = 50\ \Omega$   
200 to 2000 MHz (200 MHz step)  
○ (  $I_C = 5\text{ mA}$  )  
△ (  $I_C = 10\text{ mA}$  )

S12 Parameter vs. Frequency



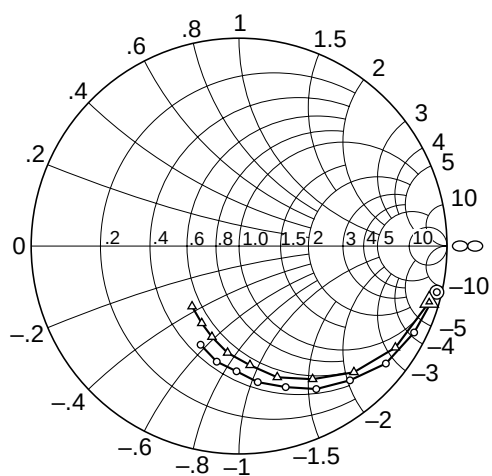
Condition:  $V_{CE} = 5\text{ V}$ ,  $Z_o = 50\ \Omega$   
200 to 2000 MHz (200 MHz step)  
○ (  $I_C = 5\text{ mA}$  )  
△ (  $I_C = 10\text{ mA}$  )

S22 Parameter vs. Frequency



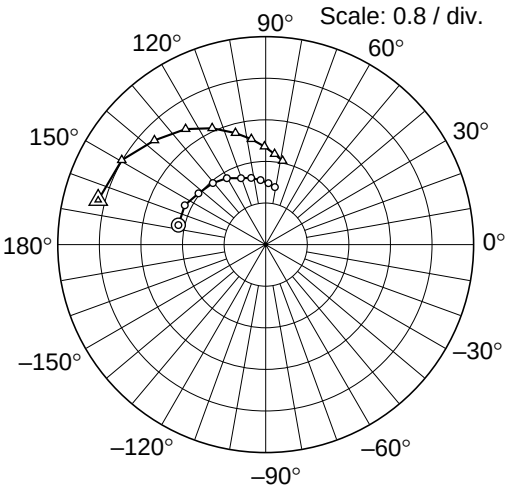
Condition:  $V_{CE} = 5\text{ V}$ ,  $Z_o = 50\ \Omega$   
200 to 2000 MHz (200 MHz step)  
○ (  $I_C = 5\text{ mA}$  )  
△ (  $I_C = 10\text{ mA}$  )

S11 Parameter vs. Frequency



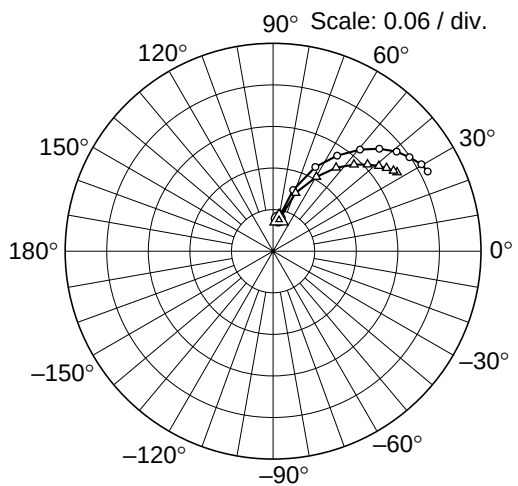
Condition:  $V_{CE} = 1\text{ V}$ ,  $Z_o = 50\ \Omega$   
200 to 2000 MHz (200 MHz step)  
○ — ○ ( $I_C = 0.5\text{ mA}$ )  
△ — △ ( $I_C = 1\text{ mA}$ )

S21 Parameter vs. Frequency



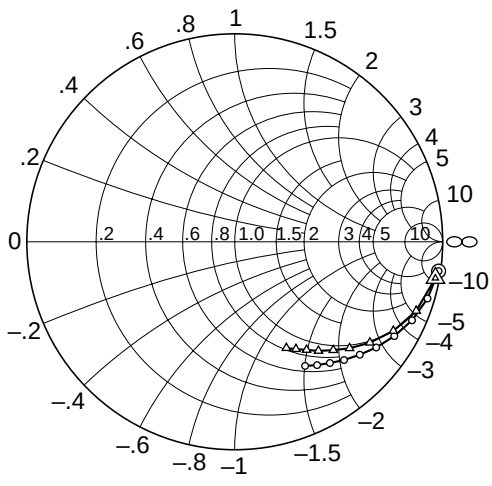
Condition:  $V_{CE} = 1\text{ V}$ ,  $Z_o = 50\ \Omega$   
200 to 2000 MHz (200 MHz step)  
○ — ○ ( $I_C = 0.5\text{ mA}$ )  
△ — △ ( $I_C = 1\text{ mA}$ )

S12 Parameter vs. Frequency



Condition:  $V_{CE} = 1\text{ V}$ ,  $Z_o = 50\ \Omega$   
200 to 2000 MHz (200 MHz step)  
○ — ○ ( $I_C = 0.5\text{ mA}$ )  
△ — △ ( $I_C = 1\text{ mA}$ )

S22 Parameter vs. Frequency



Condition:  $V_{CE} = 1\text{ V}$ ,  $Z_o = 50\ \Omega$   
200 to 2000 MHz (200 MHz step)  
○ — ○ ( $I_C = 0.5\text{ mA}$ )  
△ — △ ( $I_C = 1\text{ mA}$ )

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

| Freq.<br>(MHz) | S11   |        | S21    |       | S12   |      | S22   |       |
|----------------|-------|--------|--------|-------|-------|------|-------|-------|
|                | MAG.  | ANG.   | MAG.   | ANG.  | MAG.  | ANG. | MAG.  | ANG.  |
| 100            | 0.859 | −15.9  | 13.192 | 165.5 | 0.016 | 82.3 | 0.974 | −9.3  |
| 200            | 0.790 | −30.6  | 12.225 | 151.9 | 0.031 | 73.9 | 0.914 | −17.5 |
| 300            | 0.700 | −44.0  | 10.967 | 139.9 | 0.043 | 68.2 | 0.841 | −24.2 |
| 400            | 0.618 | −54.8  | 9.802  | 130.2 | 0.053 | 64.0 | 0.771 | −29.2 |
| 500            | 0.543 | −64.7  | 8.686  | 122.4 | 0.061 | 61.4 | 0.710 | −32.5 |
| 600            | 0.477 | −73.3  | 7.761  | 116.0 | 0.068 | 59.8 | 0.660 | −34.8 |
| 700            | 0.421 | −80.1  | 6.955  | 110.2 | 0.074 | 58.9 | 0.619 | −36.7 |
| 800            | 0.369 | −86.3  | 6.316  | 105.5 | 0.080 | 58.7 | 0.584 | −38.2 |
| 900            | 0.331 | −92.8  | 5.748  | 101.0 | 0.086 | 58.1 | 0.557 | −39.3 |
| 1000           | 0.287 | −99.4  | 5.275  | 97.6  | 0.091 | 57.9 | 0.535 | −40.3 |
| 1100           | 0.226 | −104.8 | 4.869  | 94.1  | 0.097 | 57.9 | 0.517 | −41.2 |
| 1200           | 0.220 | −110.7 | 4.498  | 90.6  | 0.102 | 58.1 | 0.502 | −42.1 |
| 1300           | 0.200 | −110.7 | 4.169  | 88.2  | 0.107 | 58.4 | 0.492 | −43.1 |
| 1400           | 0.179 | −125.0 | 3.926  | 85.4  | 0.113 | 58.2 | 0.479 | −44.2 |
| 1500           | 0.159 | −131.7 | 3.698  | 83.0  | 0.119 | 58.2 | 0.471 | −44.9 |
| 1600           | 0.142 | −138.0 | 3.493  | 80.5  | 0.125 | 58.4 | 0.463 | −46.0 |
| 1700           | 0.126 | −147.6 | 3.311  | 78.1  | 0.130 | 58.5 | 0.456 | −47.2 |
| 1800           | 0.117 | −154.1 | 3.143  | 76.1  | 0.136 | 58.2 | 0.450 | −48.2 |
| 1900           | 0.109 | −166.9 | 3.008  | 74.0  | 0.142 | 58.0 | 0.445 | −49.3 |
| 2000           | 0.102 | 179.8  | 2.864  | 71.9  | 0.147 | 57.9 | 0.440 | −50.4 |

2SC4791

S Parameter (V<sub>CE</sub> = 5 V, I<sub>C</sub> = 10 mA, Z<sub>O</sub> = 50 Ω, Emitter Common)

| Freq.<br>(MHz) | S11   |        | S21    |       | S12   |      | S22   |       |
|----------------|-------|--------|--------|-------|-------|------|-------|-------|
|                | MAG.  | ANG.   | MAG.   | ANG.  | MAG.  | ANG. | MAG.  | ANG.  |
| 100            | 0.758 | −22.4  | 19.871 | 159.8 | 0.015 | 78.6 | 0.942 | −12.6 |
| 200            | 0.650 | −41.5  | 17.252 | 142.4 | 0.028 | 71.0 | 0.842 | −22.5 |
| 300            | 0.538 | −57.1  | 14.423 | 129.0 | 0.037 | 66.8 | 0.739 | −28.5 |
| 400            | 0.445 | −69.1  | 12.168 | 119.4 | 0.045 | 64.3 | 0.659 | −32.0 |
| 500            | 0.383 | −79.6  | 10.376 | 112.2 | 0.052 | 63.3 | 0.600 | −33.7 |
| 600            | 0.320 | −87.8  | 8.995  | 106.7 | 0.058 | 63.4 | 0.577 | −34.9 |
| 700            | 0.274 | −95.4  | 7.914  | 101.8 | 0.065 | 63.7 | 0.524 | −35.4 |
| 800            | 0.230 | −102.4 | 7.057  | 97.8  | 0.071 | 64.0 | 0.499 | −36.3 |
| 900            | 0.205 | −109.8 | 6.332  | 93.9  | 0.076 | 64.4 | 0.480 | −36.7 |
| 1000           | 0.174 | −116.9 | 5.778  | 91.0  | 0.083 | 64.5 | 0.466 | −37.4 |
| 1100           | 0.154 | −125.9 | 5.291  | 88.1  | 0.089 | 64.6 | 0.454 | −38.0 |
| 1200           | 0.131 | −135.1 | 4.862  | 85.4  | 0.096 | 64.7 | 0.444 | −38.7 |
| 1300           | 0.118 | −142.7 | 4.508  | 82.9  | 0.102 | 64.6 | 0.438 | −39.4 |
| 1400           | 0.108 | −154.7 | 4.226  | 80.8  | 0.109 | 64.5 | 0.431 | −40.4 |
| 1500           | 0.104 | −165.2 | 3.961  | 78.7  | 0.116 | 64.3 | 0.426 | −41.4 |
| 1600           | 0.093 | −178.6 | 3.718  | 76.4  | 0.122 | 64.1 | 0.420 | −42.4 |
| 1700           | 0.095 | 169.4  | 3.532  | 74.3  | 0.129 | 64.0 | 0.417 | −43.6 |
| 1800           | 0.094 | 158.4  | 3.347  | 72.4  | 0.135 | 63.4 | 0.413 | −44.8 |
| 1900           | 0.094 | 148.2  | 3.190  | 70.5  | 0.142 | 63.2 | 0.409 | −46.0 |
| 2000           | 0.101 | 136.0  | 3.036  | 68.6  | 0.148 | 63.0 | 0.406 | −47.3 |



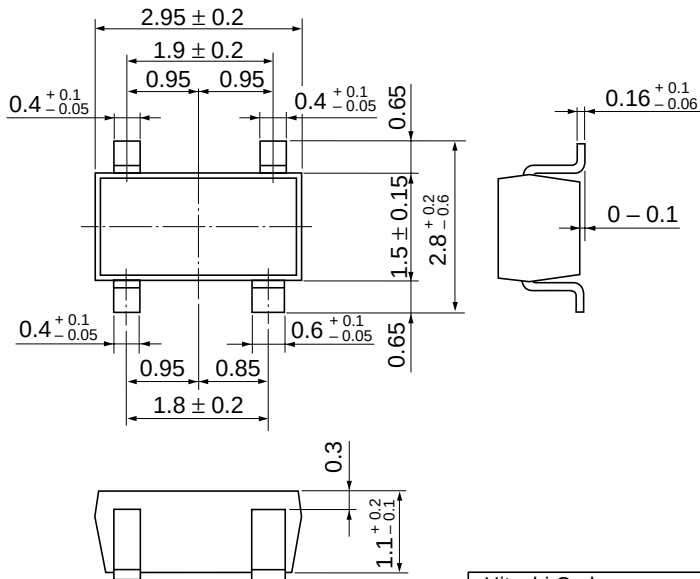
S Parameter (V<sub>CE</sub> = 1 V, I<sub>C</sub> = 0.5 mA, Z<sub>O</sub> = 50 Ω, Emitter Common)

| Freq.<br>(MHz) | S11   |        | S21   |       | S12   |      | S22   |       |
|----------------|-------|--------|-------|-------|-------|------|-------|-------|
|                | MAG.  | ANG.   | MAG.  | ANG.  | MAG.  | ANG. | MAG.  | ANG.  |
| 100            | 0.983 | −6.6   | 1.757 | 174.0 | 0.023 | 85.8 | 0.995 | −4.1  |
| 200            | 0.976 | −13.1  | 1.723 | 167.3 | 0.047 | 80.7 | 0.990 | −8.2  |
| 300            | 0.961 | −19.6  | 1.741 | 160.2 | 0.071 | 76.4 | 0.980 | −12.3 |
| 400            | 0.938 | −26.2  | 1.734 | 154.0 | 0.093 | 71.9 | 0.966 | −16.4 |
| 500            | 0.920 | −32.5  | 1.666 | 147.6 | 0.093 | 67.6 | 0.950 | −20.1 |
| 600            | 0.903 | −38.6  | 1.629 | 142.6 | 0.133 | 63.4 | 0.932 | −23.9 |
| 700            | 0.868 | −44.6  | 1.584 | 136.2 | 0.151 | 59.9 | 0.913 | −27.3 |
| 800            | 0.836 | −50.4  | 1.564 | 130.6 | 0.166 | 56.2 | 0.891 | −30.6 |
| 900            | 0.819 | −56.1  | 1.520 | 125.3 | 0.180 | 52.8 | 0.869 | −33.8 |
| 1000           | 0.780 | −61.6  | 1.484 | 120.3 | 0.193 | 49.5 | 0.849 | −36.8 |
| 1100           | 0.749 | −66.9  | 1.434 | 115.3 | 0.204 | 46.7 | 0.828 | −39.6 |
| 1200           | 0.713 | −71.7  | 1.369 | 110.4 | 0.213 | 44.0 | 0.810 | −42.1 |
| 1300           | 0.687 | −77.0  | 1.322 | 107.2 | 0.221 | 41.4 | 0.794 | −44.8 |
| 1400           | 0.659 | −82.2  | 1.317 | 102.3 | 0.229 | 38.9 | 0.774 | −47.3 |
| 1500           | 0.629 | −86.9  | 1.282 | 98.5  | 0.234 | 36.7 | 0.757 | −49.7 |
| 1600           | 0.601 | −91.2  | 1.248 | 94.6  | 0.239 | 34.6 | 0.741 | −51.9 |
| 1700           | 0.578 | −96.7  | 1.215 | 91.0  | 0.243 | 32.4 | 0.726 | −54.2 |
| 1800           | 0.656 | −101.0 | 1.187 | 87.5  | 0.248 | 30.4 | 0.713 | −56.3 |
| 1900           | 0.532 | −106.3 | 1.155 | 84.4  | 0.249 | 28.9 | 0.699 | −58.4 |
| 2000           | 0.508 | −111.4 | 1.124 | 81.0  | 0.251 | 27.3 | 0.686 | −60.5 |

2SC4791

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

| Freq.<br>(MHz) | S11   |        | S21   |       | S12   |      | S22   |       |
|----------------|-------|--------|-------|-------|-------|------|-------|-------|
|                | MAG.  | ANG.   | MAG.  | ANG.  | MAG.  | ANG. | MAG.  | ANG.  |
| 100            | 0.969 | −8.3   | 3.406 | 172.8 | 0.023 | 84.7 | 0.992 | −5.3  |
| 200            | 0.953 | −16.4  | 3.337 | 165.1 | 0.046 | 79.1 | 0.980 | −10.3 |
| 300            | 0.927 | −25.1  | 3.270 | 157.0 | 0.070 | 73.7 | 0.960 | −15.8 |
| 400            | 0.896 | −33.0  | 3.218 | 149.3 | 0.090 | 68.8 | 0.933 | −20.8 |
| 500            | 0.860 | −40.5  | 3.068 | 143.0 | 0.108 | 64.2 | 0.905 | −25.1 |
| 600            | 0.820 | −47.7  | 2.950 | 136.9 | 0.124 | 59.7 | 0.874 | −29.3 |
| 700            | 0.778 | −54.5  | 2.816 | 130.7 | 0.139 | 56.3 | 0.844 | −33.2 |
| 800            | 0.731 | −61.1  | 2.711 | 124.8 | 0.151 | 52.9 | 0.810 | −36.7 |
| 900            | 0.703 | −67.5  | 2.580 | 119.7 | 0.162 | 49.8 | 0.780 | −39.9 |
| 1000           | 0.657 | −73.8  | 2.470 | 114.8 | 0.171 | 46.9 | 0.752 | −42.8 |
| 1100           | 0.617 | −79.8  | 2.363 | 110.2 | 0.178 | 44.7 | 0.725 | −45.5 |
| 1200           | 0.575 | −84.8  | 2.229 | 105.3 | 0.185 | 42.5 | 0.703 | −47.7 |
| 1300           | 0.549 | −89.8  | 2.104 | 102.4 | 0.191 | 40.8 | 0.686 | −50.1 |
| 1400           | 0.516 | −96.2  | 2.053 | 97.9  | 0.196 | 38.8 | 0.660 | −52.5 |
| 1500           | 0.485 | −101.5 | 1.975 | 94.3  | 0.199 | 37.6 | 0.641 | −54.5 |
| 1600           | 0.456 | −106.7 | 1.891 | 90.9  | 0.203 | 36.2 | 0.623 | −56.4 |
| 1700           | 0.429 | −111.9 | 1.827 | 87.8  | 0.206 | 34.9 | 0.607 | −58.3 |
| 1800           | 0.412 | −115.9 | 1.751 | 84.6  | 0.209 | 33.7 | 0.593 | −60.3 |
| 1900           | 0.389 | −122.6 | 1.700 | 81.7  | 0.211 | 33.2 | 0.580 | −62.1 |
| 2000           | 0.368 | −128.0 | 1.645 | 78.8  | 0.212 | 32.4 | 0.567 | −64.1 |



|                          |          |
|--------------------------|----------|
| Hitachi Code             | MPAK-4   |
| JEDEC                    | —        |
| EIAJ                     | Conforms |
| Weight (reference value) | 0.013 g  |

## Cautions

1. Hitachi neither warrants nor grants licenses of any rights of Hitachi's or any third party's patent, copyright, trademark, or other intellectual property rights for information contained in this document. Hitachi bears no responsibility for problems that may arise with third party's rights, including intellectual property rights, in connection with use of the information contained in this document.
2. Products and product specifications may be subject to change without notice. Confirm that you have received the latest product standards or specifications before final design, purchase or use.
3. Hitachi makes every attempt to ensure that its products are of high quality and reliability. However, contact Hitachi's sales office before using the product in an application that demands especially high quality and reliability or where its failure or malfunction may directly threaten human life or cause risk of bodily injury, such as aerospace, aeronautics, nuclear power, combustion control, transportation, traffic, safety equipment or medical equipment for life support.
4. Design your application so that the product is used within the ranges guaranteed by Hitachi particularly for maximum rating, operating supply voltage range, heat radiation characteristics, installation conditions and other characteristics. Hitachi bears no responsibility for failure or damage when used beyond the guaranteed ranges. Even within the guaranteed ranges, consider normally foreseeable failure rates or failure modes in semiconductor devices and employ systemic measures such as fail-safes, so that the equipment incorporating Hitachi product does not cause bodily injury, fire or other consequential damage due to operation of the Hitachi product.
5. This product is not designed to be radiation resistant.
6. No one is permitted to reproduce or duplicate, in any form, the whole or part of this document without written approval from Hitachi.
7. Contact Hitachi's sales office for any questions regarding this document or Hitachi semiconductor products.

# HITACHI

## 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

|     |                  |                                                                                                                       |
|-----|------------------|-----------------------------------------------------------------------------------------------------------------------|
| URL | NorthAmerica     | : <a href="http://semiconductor.hitachi.com/">http://semiconductor.hitachi.com/</a>                                   |
|     | Europe           | : <a href="http://www.hitachi-eu.com/hel/ecg">http://www.hitachi-eu.com/hel/ecg</a>                                   |
|     | Asia (Singapore) | : <a href="http://www.has.hitachi.com.sg/grp3/sicd/index.htm">http://www.has.hitachi.com.sg/grp3/sicd/index.htm</a>   |
|     | Asia (Taiwan)    | : <a href="http://www.hitachi.com.tw/E/Product/SICD_Frame.htm">http://www.hitachi.com.tw/E/Product/SICD_Frame.htm</a> |
|     | Asia (HongKong)  | : <a href="http://www.hitachi.com.hk/eng/bo/grp3/index.htm">http://www.hitachi.com.hk/eng/bo/grp3/index.htm</a>       |
|     | Japan            | : <a href="http://www.hitachi.co.jp/Sicd/indx.htm">http://www.hitachi.co.jp/Sicd/indx.htm</a>                         |

## For further information write to:

|                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                         |
|--------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Hitachi Semiconductor (America) Inc.<br>179 East Tasman Drive,<br>San Jose, CA 95134<br>Tel: <1> (408) 433-1990<br>Fax: <1> (408) 433-0223 | Hitachi Europe GmbH<br>Electronic components Group<br>Dornacher Straße 3<br>D-85622 Feldkirchen, Munich<br>Germany<br>Tel: <49> (89) 9 9180-0<br>Fax: <49> (89) 9 29 30 00<br><br>Hitachi Europe Ltd.<br>Electronic Components Group.<br>Whitebrook Park<br>Lower Cookham Road<br>Maidenhead<br>Berkshire SL6 8YA, United Kingdom<br>Tel: <44> (1628) 585000<br>Fax: <44> (1628) 778322 |
|--------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                                                                                                                                                                                                                                                                                                        |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Hitachi Asia Pte. Ltd.<br>16 Collyer Quay #20-00<br>Hitachi Tower<br>Singapore 049318<br>Tel: 535-2100<br>Fax: 535-1533<br><br>Hitachi Asia Ltd.<br>Taipei Branch Office<br>3F, Hung Kuo Building. No.167,<br>Tun-Hwa North Road, Taipei (105)<br>Tel: <886> (2) 2718-3666<br>Fax: <886> (2) 2718-8180 |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

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

Copyright ' Hitachi, Ltd., 1999. All rights reserved. Printed in Japan.