

To all our customers

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Renesas Technology Corp.
Customer Support Dept.
April 1, 2003

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Keep safety first in your circuit designs!

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Remember to give due consideration to safety when making your circuit designs, with appropriate measures such as (i) placement of substitutive, auxiliary circuits, (ii) use of nonflammable material or (iii) prevention against any malfunction or mishap.

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2SC4899

Silicon NPN Epitaxial

RENESAS

ADE-208-1126A (Z)
2nd. Edition
Mar. 2001

Application

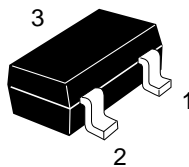
VHF / UHF wide band amplifier

Features

- High gain bandwidth product
 $f_T = 9 \text{ GHz Typ}$
- High gain, low noise figure
 $PG = 14.0 \text{ dB Typ}$, $NF = 1.2 \text{ dB Typ}$ at $f = 900 \text{ MHz}$

Outline

CMPAK



1. Emitter
2. Base
3. Collector

Note: Marking is "YH-".

Attention: This is electrostatic sensitive device.

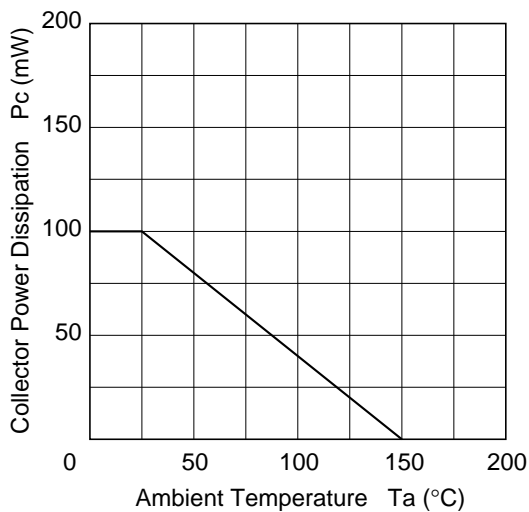
Absolute Maximum Ratings (Ta = 25°C)

| 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 | 20 | mA |
| Collector power dissipation | P_C | 100 | mW |
| Junction temperature | T_j | 150 | °C |
| Storage temperature | T_{stg} | -55 to +150 | °C |

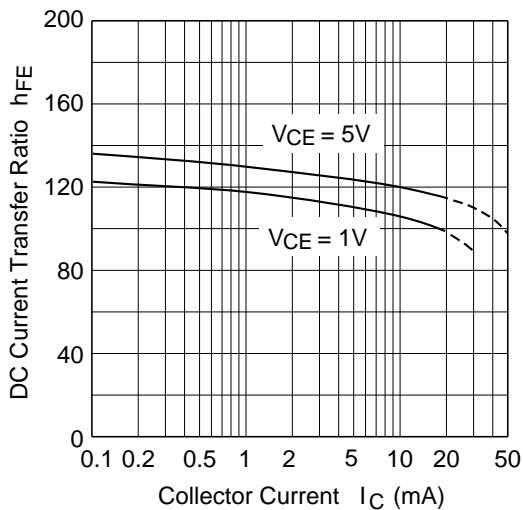
Electrical Characteristics (Ta = 25°C)

| Item | Symbol | Min | Typ | Max | Unit | Test conditions |
|------------------------------|-----------|------|------|------|------|--|
| Collector cutoff current | I_{CBO} | — | — | 10 | μA | $V_{CB} = 15\text{ V}, I_E = 0$ |
| | I_{CEO} | — | — | 1 | mA | $V_{CE} = 9\text{ V}, R_{BE} =$ |
| 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} | — | 0.5 | 0.85 | pF | $V_{CB} = 5\text{ V}, I_E = 0, f = 1\text{ MHz}$ |
| Gain bandwidth product | f_T | 6.0 | 9.0 | — | GHz | $V_{CE} = 5\text{ V}, I_C = 10\text{ mA}$ |
| Power gain | PG | 11.0 | 14.0 | — | dB | $V_{CE} = 5\text{ V}, I_C = 10\text{ mA},$ $f = 900\text{ MHz}$ |
| Noise figure | NF | — | 1.2 | 2.5 | dB | $V_{CE} = 5\text{ V}, I_C = 5\text{ mA},$ $f = 900\text{ MHz}$ |

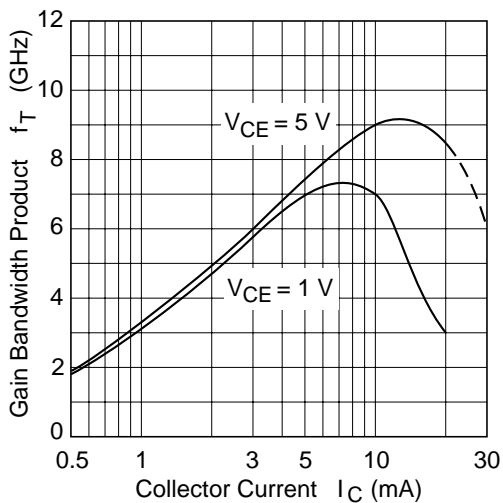
Maximum Collector Dissipation Curve



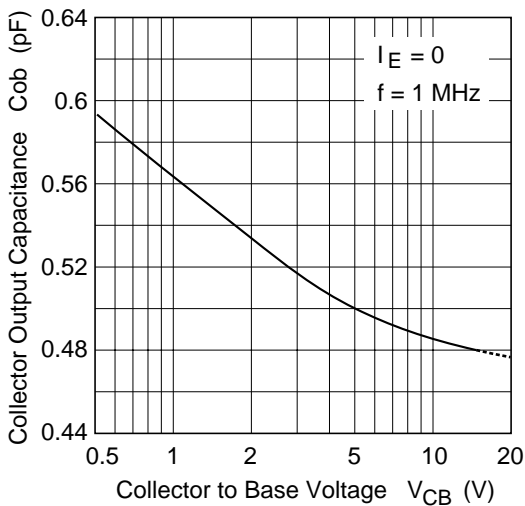
DC Current Transfer Ratio vs. Collector Current



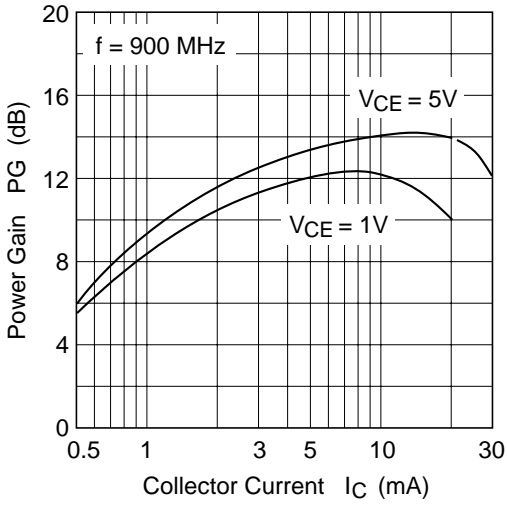
Gain Bandwidth Product vs. Collector Current



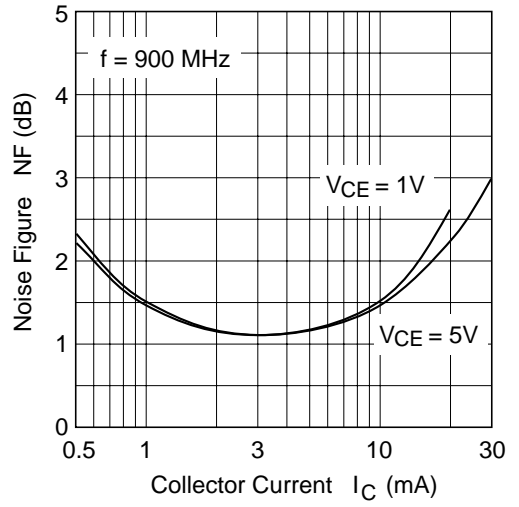
Collector Output Capacitance vs. Collector to Base Voltage



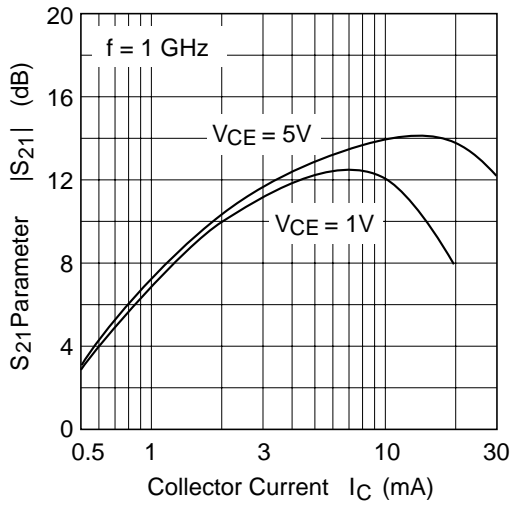
Power Gain vs. Collector Current



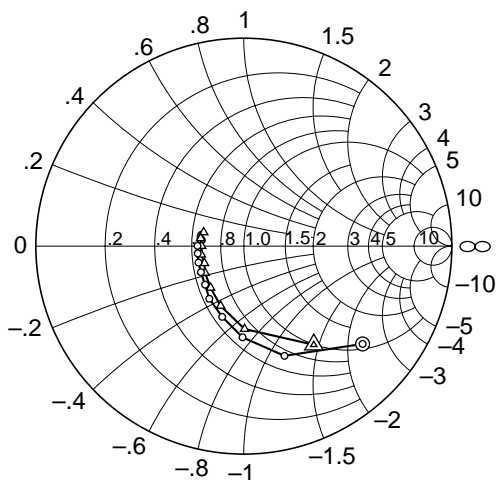
Noise Figure vs. Collector Current



S21 Parameter vs. Collector Current



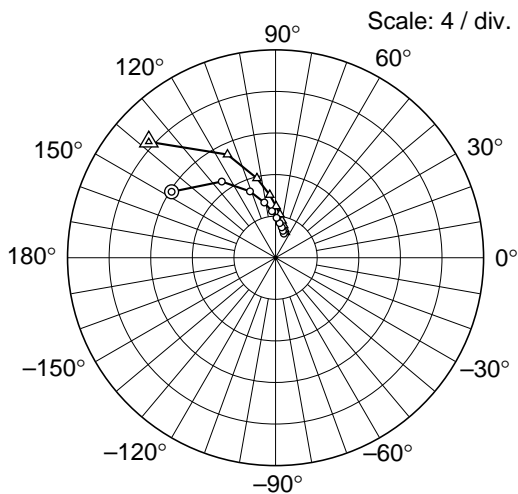
S11 Parameter vs. Frequency



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

○ — ○ ($I_C = 5\text{ mA}$)
△ — △ ($I_C = 10\text{ mA}$)

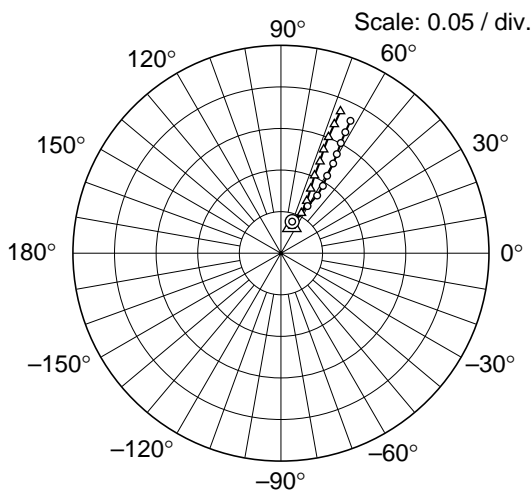
S21 Parameter vs. Frequency



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

○ — ○ ($I_C = 5\text{ mA}$)
△ — △ ($I_C = 10\text{ mA}$)

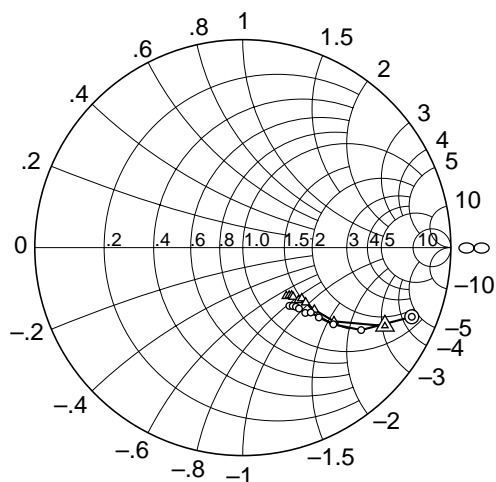
S12 Parameter vs. Frequency



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

○ — ○ ($I_C = 5\text{ mA}$)
△ — △ ($I_C = 10\text{ mA}$)

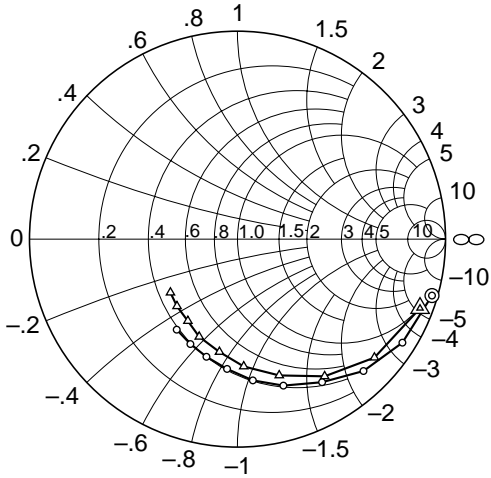
S22 Parameter vs. Frequency



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

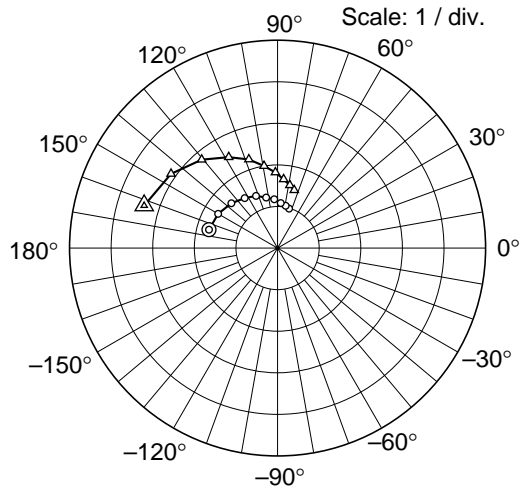
○ — ○ ($I_C = 5\text{ mA}$)
△ — △ ($I_C = 10\text{ mA}$)

S11 Parameter vs. Frequency



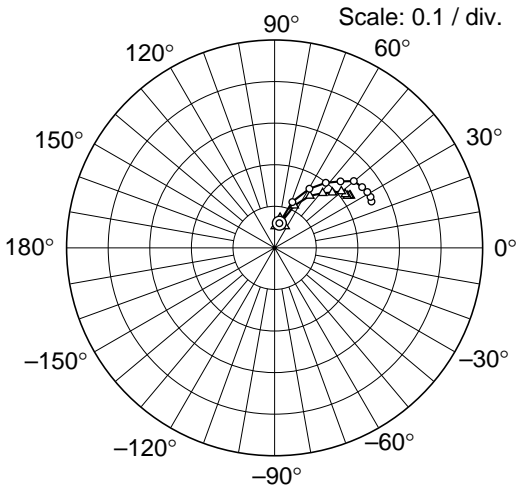
Condition: $V_{CE} = 1\text{ V}$, $Z_o = 50\ \Omega$
 200 to 2000 MHz (200 MHz step)
 ○ (I_C = 0.5 mA)
 △ (I_C = 1 mA)

S21 Parameter vs. Frequency



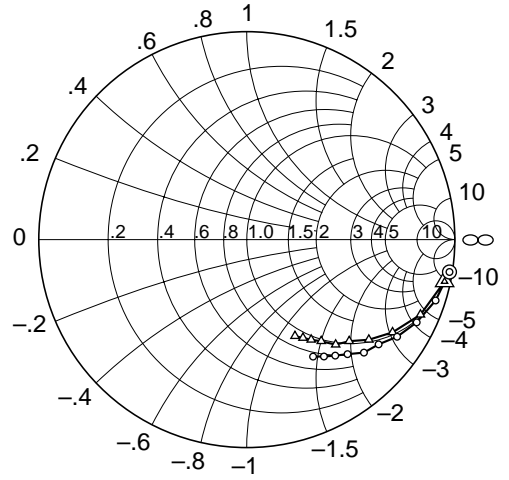
Condition: $V_{CE} = 1\text{ V}$, $Z_o = 50\ \Omega$
 200 to 2000 MHz (200 MHz step)
 ○ (I_C = 0.5 mA)
 △ (I_C = 1 mA)

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 mA)
 △ (I_C = 1 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 mA)
 △ (I_C = 1 mA)

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

| Freq. (MHz) | S11 | | S21 | | S12 | | S22 | |
|----------------|-------|--------|-------|-------|--------|------|-------|-------|
| | MAG. | ANG. | MAG. | ANG. | MAG. | ANG. | MAG. | ANG. |
| 100 | 0.814 | -20.5 | 13.23 | 163.0 | 0.0214 | 79.4 | 0.961 | -11.8 |
| 200 | 0.740 | -39.5 | 11.84 | 147.6 | 0.0403 | 70.6 | 0.878 | -22.3 |
| 300 | 0.648 | -56.3 | 10.34 | 134.9 | 0.0550 | 64.1 | 0.780 | -29.7 |
| 400 | 0.563 | -69.7 | 8.99 | 125.2 | 0.0653 | 60.6 | 0.694 | -34.9 |
| 500 | 0.499 | -80.8 | 7.81 | 117.6 | 0.0744 | 58.4 | 0.626 | -38.1 |
| 600 | 0.439 | -90.8 | 6.81 | 111.1 | 0.0821 | 57.9 | 0.571 | -40.3 |
| 700 | 0.393 | -99.1 | 6.11 | 106.0 | 0.0888 | 57.8 | 0.528 | -41.8 |
| 800 | 0.356 | -107.0 | 5.44 | 101.6 | 0.0956 | 58.1 | 0.497 | -42.6 |
| 900 | 0.322 | -115.5 | 4.93 | 97.7 | 0.102 | 58.3 | 0.469 | -43.0 |
| 1000 | 0.303 | -123.2 | 4.51 | 94.6 | 0.109 | 59.2 | 0.452 | -43.7 |
| 1100 | 0.275 | -129.7 | 4.17 | 91.6 | 0.116 | 60.3 | 0.442 | -43.8 |
| 1200 | 0.263 | -135.1 | 3.86 | 88.7 | 0.125 | 59.8 | 0.435 | -46.3 |
| 1300 | 0.253 | -141.7 | 3.61 | 85.9 | 0.130 | 60.2 | 0.414 | -47.3 |
| 1400 | 0.242 | -148.6 | 3.37 | 83.5 | 0.137 | 60.6 | 0.399 | -47.4 |
| 1500 | 0.237 | -154.2 | 3.17 | 81.1 | 0.144 | 61.2 | 0.360 | -47.8 |
| 1600 | 0.232 | -160.0 | 3.00 | 78.7 | 0.151 | 61.5 | 0.383 | -48.1 |
| 1700 | 0.224 | -166.4 | 2.83 | 77.0 | 0.158 | 61.8 | 0.376 | -48.8 |
| 1800 | 0.225 | -171.0 | 2.70 | 74.9 | 0.165 | 62.0 | 0.370 | -49.5 |
| 1900 | 0.228 | -176.5 | 2.59 | 73.0 | 0.172 | 62.2 | 0.363 | -50.2 |
| 2000 | 0.223 | 179.7 | 2.47 | 71.3 | 0.180 | 62.3 | 0.359 | -51.4 |

2SC4899

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

| Freq. (MHz) | S11 | | S21 | | S12 | | S22 | |
|----------------|-------|--------|-------|-------|--------|------|-------|-------|
| | MAG. | ANG. | MAG. | ANG. | MAG. | ANG. | MAG. | ANG. |
| 100 | 0.688 | -29.6 | 20.06 | 156.3 | 0.0201 | 76.3 | 0.921 | -16.8 |
| 200 | 0.582 | -54.7 | 16.54 | 137.5 | 0.0349 | 67.8 | 0.780 | -28.9 |
| 300 | 0.479 | -74.0 | 13.31 | 124.0 | 0.0459 | 64.0 | 0.653 | -35.6 |
| 400 | 0.399 | -89.5 | 10.97 | 114.9 | 0.0544 | 63.0 | 0.564 | -39.0 |
| 500 | 0.345 | -101.3 | 9.20 | 108.4 | 0.0624 | 62.6 | 0.501 | -40.4 |
| 600 | 0.309 | -111.2 | 7.87 | 103.1 | 0.0702 | 63.7 | 0.456 | -41.0 |
| 700 | 0.280 | -120.4 | 6.90 | 98.7 | 0.0782 | 64.3 | 0.424 | -41.1 |
| 800 | 0.257 | -128.5 | 6.09 | 95.2 | 0.0857 | 65.2 | 0.402 | -41.2 |
| 900 | 0.243 | -137.6 | 5.45 | 92.0 | 0.0936 | 66.0 | 0.384 | -41.0 |
| 1000 | 0.227 | -145.3 | 4.97 | 89.3 | 0.102 | 66.6 | 0.375 | -40.8 |
| 1100 | 0.216 | -153.0 | 4.56 | 86.8 | 0.111 | 67.3 | 0.373 | -40.8 |
| 1200 | 0.207 | -156.5 | 4.22 | 84.2 | 0.120 | 66.9 | 0.369 | -43.5 |
| 1300 | 0.206 | -163.1 | 3.93 | 82.2 | 0.126 | 67.1 | 0.350 | -44.4 |
| 1400 | 0.209 | -168.6 | 3.65 | 80.0 | 0.135 | 67.6 | 0.339 | -44.5 |
| 1500 | 0.204 | -176.8 | 3.43 | 77.9 | 0.143 | 67.5 | 0.334 | -44.4 |
| 1600 | 0.203 | 180.0 | 3.24 | 75.9 | 0.151 | 67.7 | 0.330 | -44.6 |
| 1700 | 0.207 | 173.7 | 3.06 | 74.2 | 0.160 | 67.6 | 0.325 | -45.5 |
| 1800 | 0.211 | 169.8 | 2.91 | 72.5 | 0.168 | 67.5 | 0.322 | -46.1 |
| 1900 | 0.215 | 164.6 | 2.78 | 71.1 | 0.177 | 67.4 | 0.317 | -47.2 |
| 2000 | 0.204 | 161.2 | 2.66 | 69.2 | 0.185 | 67.2 | 0.314 | -48.2 |

S Parameter ($V_{CE} = 1 \text{ V}$, $I_C = 0.5 \text{ mA}$, $Z_O = 50 \Omega$, Emitter Common)

| Freq. (MHz) | S11 | | S21 | | S12 | | S22 | |
|----------------|-------|--------|-------|-------|--------|------|-------|-------|
| | MAG. | ANG. | MAG. | ANG. | MAG. | ANG. | MAG. | ANG. |
| 100 | 0.983 | -7.8 | 1.76 | 172.6 | 0.0295 | 85.3 | 0.996 | -4.5 |
| 200 | 0.974 | -16.2 | 1.71 | 165.0 | 0.0604 | 79.3 | 0.987 | -9.1 |
| 300 | 0.958 | -24.3 | 1.69 | 157.1 | 0.0910 | 73.8 | 0.972 | -13.7 |
| 400 | 0.936 | -32.1 | 1.65 | 149.9 | 0.118 | 68.9 | 0.954 | -17.9 |
| 500 | 0.904 | -39.4 | 1.59 | 142.8 | 0.143 | 64.1 | 0.933 | -22.0 |
| 600 | 0.877 | -46.3 | 1.55 | 135.7 | 0.165 | 59.6 | 0.909 | -26.0 |
| 700 | 0.845 | -53.1 | 1.48 | 129.3 | 0.184 | 55.5 | 0.886 | -29.3 |
| 800 | 0.799 | -59.4 | 1.44 | 123.2 | 0.199 | 51.9 | 0.861 | -32.9 |
| 900 | 0.781 | -66.6 | 1.39 | 117.4 | 0.214 | 48.3 | 0.835 | -35.9 |
| 1000 | 0.738 | -72.6 | 1.36 | 112.3 | 0.225 | 45.3 | 0.810 | -38.5 |
| 1100 | 0.714 | -78.0 | 1.32 | 107.2 | 0.235 | 43.5 | 0.791 | -40.9 |
| 1200 | 0.683 | -83.8 | 1.25 | 102.6 | 0.249 | 40.2 | 0.783 | -44.0 |
| 1300 | 0.657 | -89.0 | 1.21 | 98.3 | 0.253 | 37.0 | 0.758 | -46.7 |
| 1400 | 0.626 | -94.6 | 1.18 | 93.8 | 0.256 | 34.8 | 0.734 | -48.7 |
| 1500 | 0.603 | -99.6 | 1.14 | 89.8 | 0.259 | 32.9 | 0.717 | -50.9 |
| 1600 | 0.585 | -104.8 | 1.09 | 85.9 | 0.260 | 31.1 | 0.702 | -52.7 |
| 1700 | 0.567 | -109.5 | 1.06 | 82.5 | 0.261 | 29.6 | 0.687 | -54.7 |
| 1800 | 0.553 | -114.2 | 1.04 | 79.1 | 0.261 | 28.0 | 0.674 | -56.6 |
| 1900 | 0.538 | -119.8 | 1.02 | 76.5 | 0.260 | 27.1 | 0.659 | -58.7 |
| 2000 | 0.524 | -123.9 | 0.994 | 73.7 | 0.258 | 25.6 | 0.647 | -60.5 |

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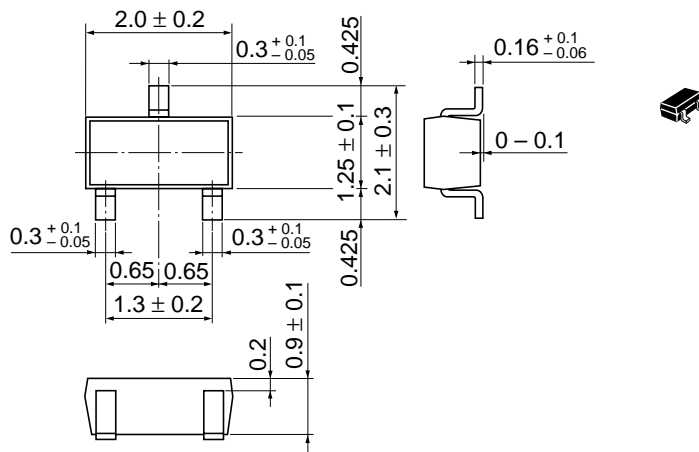
S Parameter ($V_{CE} = 1\text{ V}$, $I_C = 1\text{ mA}$, $Z_O = 50\ \Omega$, Emitter Common)

| Freq. (MHz) | S11 | | S21 | | S12 | | S22 | |
|----------------|-------|--------|------|-------|--------|------|-------|-------|
| | MAG. | ANG. | MAG. | ANG. | MAG. | ANG. | MAG. | ANG. |
| 100 | 0.956 | -10.5 | 3.49 | 171.1 | 0.0298 | 83.7 | 0.991 | -6.1 |
| 200 | 0.938 | -20.8 | 3.37 | 162.3 | 0.0596 | 77.0 | 0.972 | -12.0 |
| 300 | 0.912 | -31.1 | 3.26 | 153.2 | 0.0874 | 70.7 | 0.945 | -18.1 |
| 400 | 0.871 | -40.9 | 3.12 | 145.1 | 0.112 | 65.1 | 0.910 | -23.4 |
| 500 | 0.830 | -50.1 | 2.94 | 137.9 | 0.133 | 60.0 | 0.871 | -28.1 |
| 600 | 0.782 | -57.6 | 2.80 | 130.6 | 0.151 | 56.0 | 0.831 | -32.5 |
| 700 | 0.740 | -65.8 | 2.63 | 124.0 | 0.164 | 51.9 | 0.795 | -36.1 |
| 800 | 0.686 | -73.0 | 2.48 | 118.2 | 0.175 | 48.8 | 0.759 | -39.4 |
| 900 | 0.656 | -80.7 | 2.35 | 112.5 | 0.185 | 45.9 | 0.725 | -42.4 |
| 1000 | 0.613 | -87.2 | 2.24 | 107.9 | 0.192 | 43.8 | 0.694 | -44.8 |
| 1100 | 0.582 | -93.3 | 2.13 | 103.8 | 0.200 | 42.8 | 0.672 | -47.0 |
| 1200 | 0.551 | -99.1 | 2.00 | 99.3 | 0.210 | 40.3 | 0.662 | -49.8 |
| 1300 | 0.532 | -104.7 | 1.91 | 95.3 | 0.210 | 38.1 | 0.631 | -52.4 |
| 1400 | 0.505 | -111.4 | 1.82 | 91.6 | 0.213 | 37.2 | 0.606 | -53.8 |
| 1500 | 0.483 | -116.3 | 1.74 | 88.1 | 0.215 | 36.3 | 0.587 | -55.6 |
| 1600 | 0.461 | -121.2 | 1.66 | 84.9 | 0.216 | 35.6 | 0.573 | -57.3 |
| 1700 | 0.445 | -127.2 | 1.59 | 81.9 | 0.217 | 34.9 | 0.558 | -58.6 |
| 1800 | 0.435 | -132.0 | 1.54 | 78.9 | 0.219 | 35.0 | 0.545 | -60.3 |
| 1900 | 0.425 | -137.6 | 1.49 | 76.7 | 0.221 | 34.7 | 0.531 | -61.8 |
| 2000 | 0.413 | -141.4 | 1.45 | 73.9 | 0.221 | 34.6 | 0.519 | -63.5 |

Package Dimensions

As of January, 2001

Unit: mm



| | |
|------------------------|----------|
| Hitachi Code | CMPAK |
| JEDEC | — |
| EIAJ | Conforms |
| Mass (reference value) | 0.006 g |

Cautions

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