

To all our customers

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

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# 2SC5890

Silicon NPN Epitaxial  
UHF / VHF wide band amplifier

**RENESAS**

ADE-208-1533 (Z)

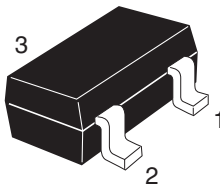
1st. Edition  
Aug.2002

## Features

- High gain bandwidth product:  
 $f_T = 7.8$  GHz typ.
- High power gain and low noise figure;  
PG = 12 dB typ., NF = 1.0 dB typ. at  $f = 900$  MHz
- High collector power dissipation:  
 $P_c = 700$  mW when using alumina ceramic board (25 x 60 x 0.7 mm)
- High withstanding to ESD of collector to emitter:  
Withstand up to 700 V (only real value) at  $C = 200$  pF,  $R_s = 0$  condition.

## Outline

MPAK



1. Emitter
2. Base
3. Collector

Note: Marking is "FS-".

## Absolute Maximum Ratings

(Ta = 25°C)

| Item                         | Symbol    | Ratings     | Unit |
|------------------------------|-----------|-------------|------|
| Collector to base voltage    | $V_{CBO}$ | 20          | V    |
| Collector to emitter voltage | $V_{CEO}$ | 12          | V    |
| Emitter to base voltage      | $V_{EBO}$ | 1.5         | V    |
| Collector current            | $I_C$     | 75          | mA   |
| Collector power dissipation  | Pc        | 700*        | mW   |
| Junction temperature         | Tj        | 150         | °C   |
| Storage temperature          | Tstg      | -55 to +150 | °C   |

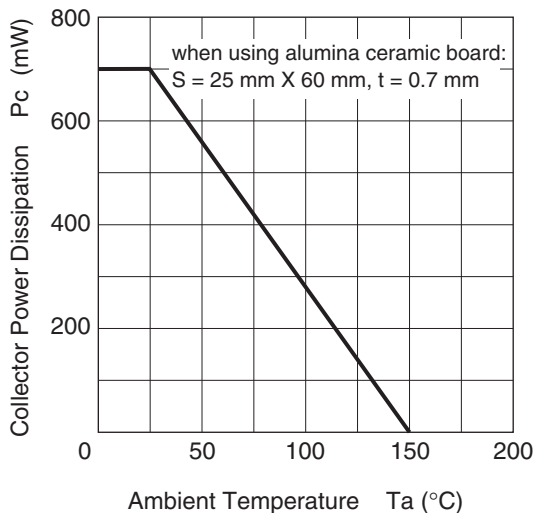
\*When using alumina ceramic board (25 x 60 x 0.7 mm)

## Electrical Characteristics

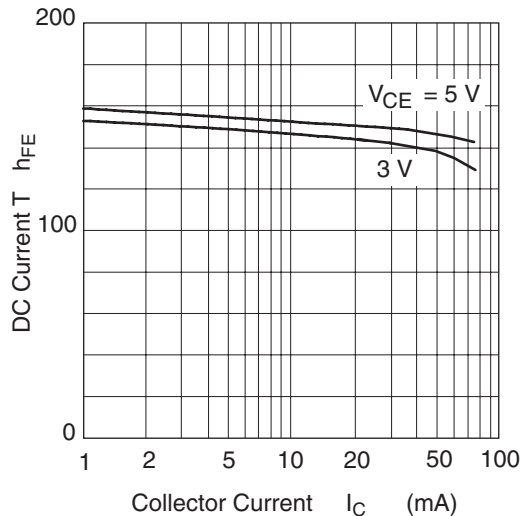
(Ta = 25°C)

| Item                                | Symbol        | Min | Typ  | Max | Unit          | Test Conditions   |
|-------------------------------------|---------------|-----|------|-----|---------------|---|
| Collector to base breakdown voltage | $V_{(BR)CBO}$ | 20  | —    | —   | V             | $I_C = 10\mu\text{A}$ , $I_E = 0$                                   |
| Collector cutoff current            | $I_{CBO}$     | —   | —    | 1   | $\mu\text{A}$ | $V_{CB} = 12\text{V}$ , $I_E = 0$                                   |
| Collector cutoff current            | $I_{CEO}$     | —   | —    | 1   | mA            | $V_{CE} = 9\text{V}$ , $R_{BE} = \infty$                            |
| Emitter cutoff current              | $I_{EBO}$     | —   | —    | 10  | $\mu\text{A}$ | $V_{EB} = 1.5\text{V}$ , $I_C = 0$                                  |
| DC current transfer ratio           | $h_{FE}$      | 100 | 150  | 200 | V             | $V_{CE} = 5\text{V}$ , $I_C = 20\text{mA}$                          |
| Collector output capacitance        | Cob           | —   | 0.9  | 1.5 | pF            | $V_{CB} = 5\text{V}$ , $I_E = 0$ , $f = 1\text{MHz}$                |
| Reverse transfer capacitance        | Cre           | —   | 0.85 | —   | pF            | $V_{CB} = 5\text{V}$ , $I_E = 0$ , $f = 1\text{MHz}$                |
| Gain bandwidth product              | $f_T$         | 5.5 | 7.8  | —   | GHz           | $V_{CE} = 5\text{V}$ , $I_C = 30\text{mA}$ ,<br>$f = 1\text{GHz}$   |
| Forward transfer coefficient        | $ S_{21} ^2$  | —   | 11   | —   | dB            | $V_{CE} = 5\text{V}$ , $I_C = 30\text{mA}$ ,<br>$f = 1\text{GHz}$   |
| Power gain                          | PG            | 9.5 | 12   | —   | dB            | $V_{CE} = 5\text{V}$ , $I_C = 30\text{mA}$ ,<br>$f = 900\text{MHz}$ |
| Noise figure                        | NF            | —   | 1.0  | 1.9 | dB            | $V_{CE} = 5\text{V}$ , $I_C = 5\text{mA}$ ,<br>$f = 900\text{MHz}$  |

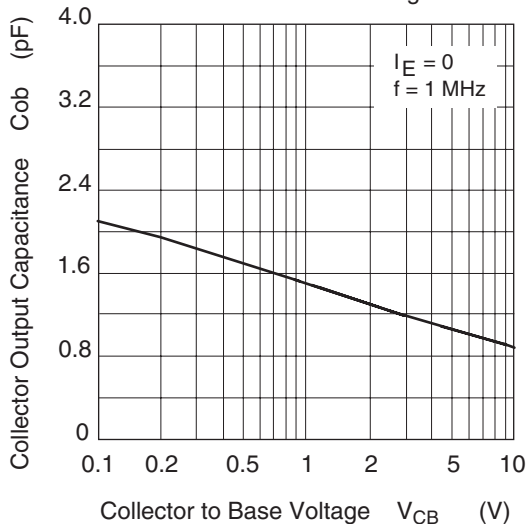
Collector Power Dissipation Curve



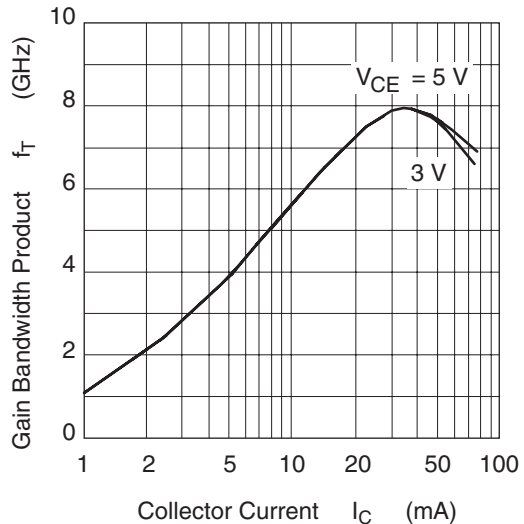
DC Current Transfer Ratio vs. Collector Current

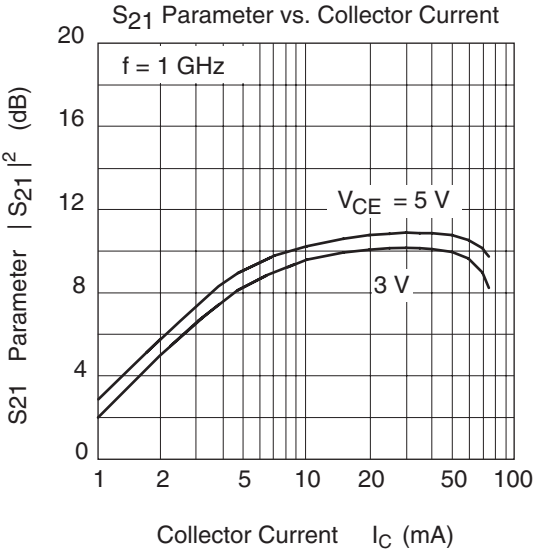
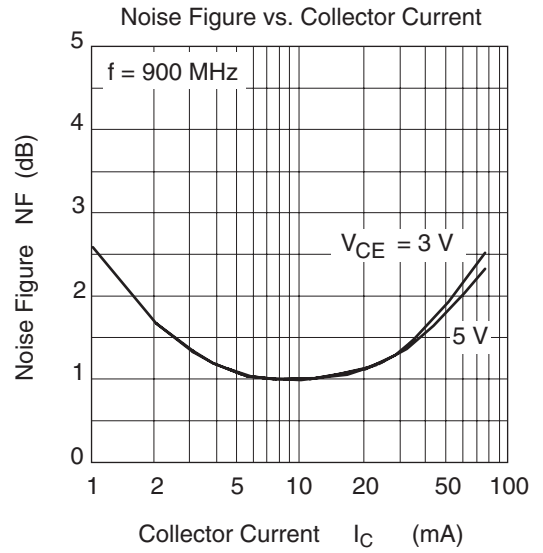
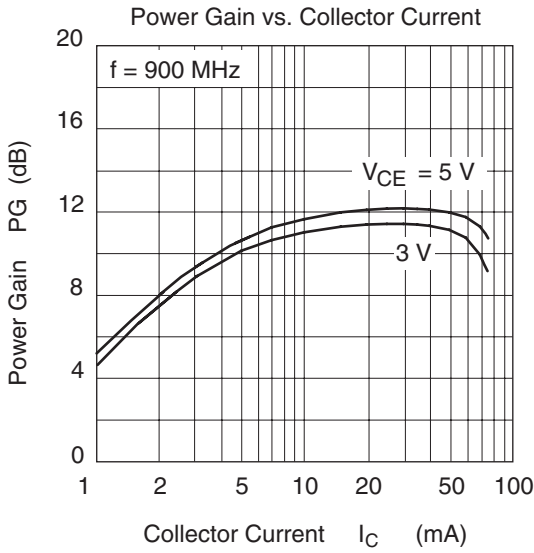


Collector Output Capacitance vs. Collector to Base Voltage

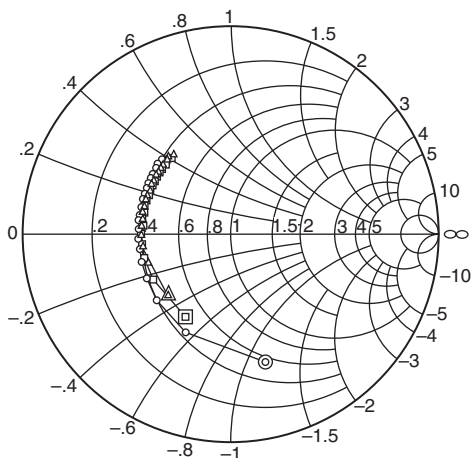


Gain Bandwidth Product vs. Collector Current





S11 Parameter vs. Frequency



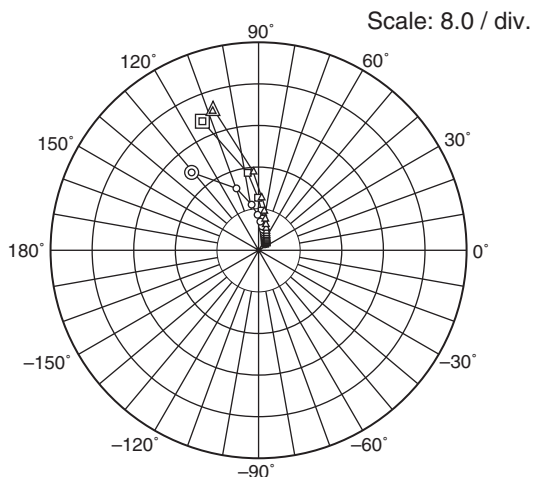
Condition:  $V_{CE} = 3\text{ V}$ ,  $Z_O = 50\ \Omega$   
 100 to 2000 MHz (100 MHz Step)

○—○ (IC = 10 mA)

□—□ (IC = 30 mA)

△—△ (IC = 50 mA)

S21 Parameter vs. Frequency



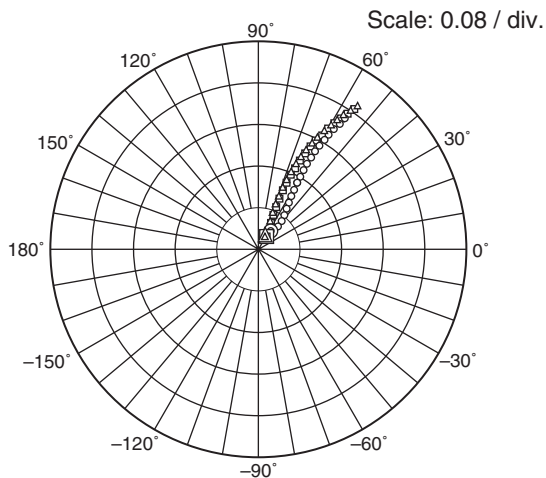
Condition:  $V_{CE} = 3\text{ V}$ ,  $Z_O = 50\ \Omega$   
 100 to 2000 MHz (100 MHz Step)

○—○ (IC = 10 mA)

□—□ (IC = 30 mA)

△—△ (IC = 50 mA)

S12 Parameter vs. Frequency



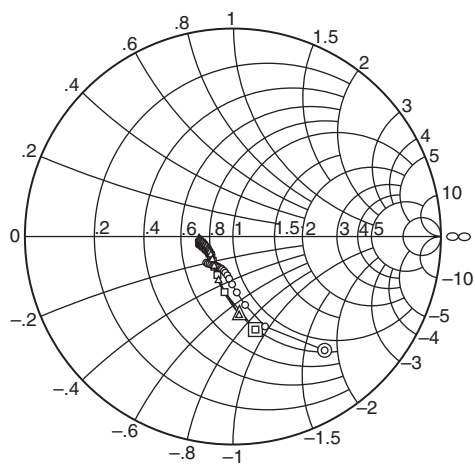
Condition:  $V_{CE} = 3\text{ V}$ ,  $Z_O = 50\ \Omega$   
 100 to 2000 MHz (100 MHz Step)

○—○ (IC = 10 mA)

□—□ (IC = 30 mA)

△—△ (IC = 50 mA)

S22 Parameter vs. Frequency



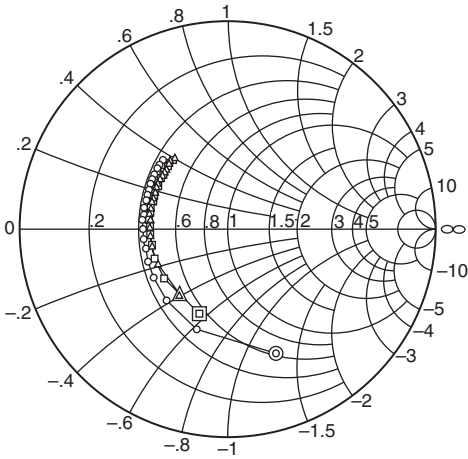
Condition:  $V_{CE} = 3\text{ V}$ ,  $Z_O = 50\ \Omega$   
 100 to 2000 MHz (100 MHz Step)

○—○ (IC = 10 mA)

□—□ (IC = 30 mA)

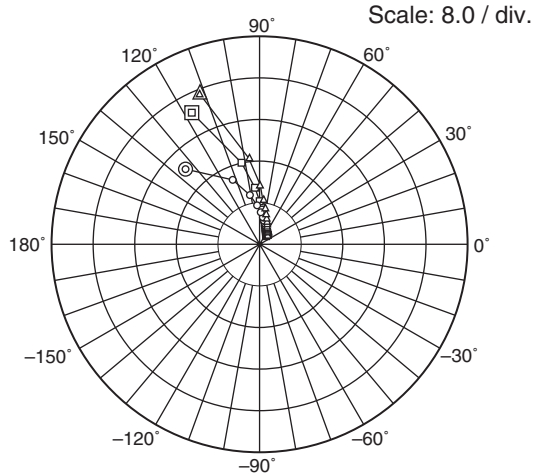
△—△ (IC = 50 mA)

S11 Parameter vs. Frequency



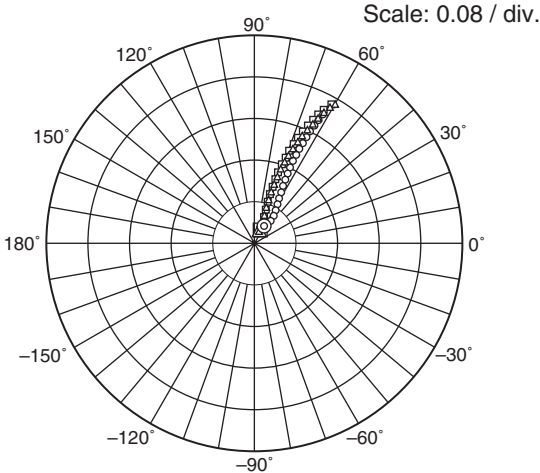
Condition:  $V_{CE} = 5\text{ V}$ ,  $Z_O = 50\ \Omega$   
 100 to 2000 MHz (100 MHz Step)  
 ○—○ ( $I_C = 10\text{ mA}$ )  
 □—□ ( $I_C = 30\text{ mA}$ )  
 ▲—▲ ( $I_C = 50\text{ mA}$ )

S21 Parameter vs. Frequency



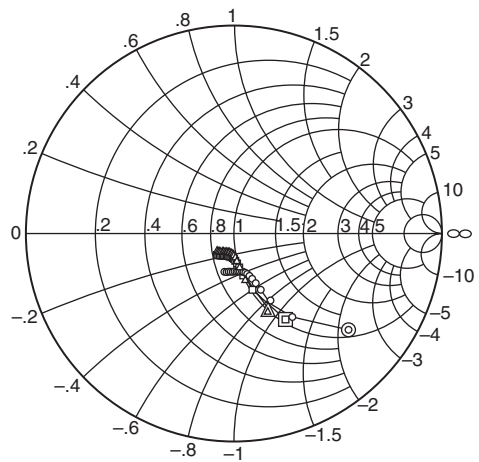
Condition:  $V_{CE} = 5\text{ V}$ ,  $Z_O = 50\ \Omega$   
 100 to 2000 MHz (100 MHz Step)  
 ○—○ ( $I_C = 10\text{ mA}$ )  
 □—□ ( $I_C = 30\text{ mA}$ )  
 ▲—▲ ( $I_C = 50\text{ mA}$ )

S12 Parameter vs. Frequency



Condition:  $V_{CE} = 5\text{ V}$ ,  $Z_O = 50\ \Omega$   
 100 to 2000 MHz (100 MHz Step)  
 ○—○ ( $I_C = 10\text{ mA}$ )  
 □—□ ( $I_C = 30\text{ mA}$ )  
 ▲—▲ ( $I_C = 50\text{ mA}$ )

S22 Parameter vs. Frequency



Condition:  $V_{CE} = 5\text{ V}$ ,  $Z_O = 50\ \Omega$   
 100 to 2000 MHz (100 MHz Step)  
 ○—○ ( $I_C = 10\text{ mA}$ )  
 □—□ ( $I_C = 30\text{ mA}$ )  
 ▲—▲ ( $I_C = 50\text{ mA}$ )

**S parameter**(VCE = 3V, I<sub>c</sub> = 10 mA, Z<sub>o</sub> = 50 Ω)

| f (MHz) | S11   |        | S21   |       | S12   |      | S22   |        |
|---------|-------|--------|-------|-------|-------|------|-------|--------|
|         | MAG   | ANG    | MAG   | ANG   | MAG   | ANG  | MAG   | ANG    |
| 100     | 0.635 | -75.2  | 19.73 | 130.5 | 0.042 | 55.9 | 0.698 | -51.2  |
| 200     | 0.524 | -115.1 | 12.64 | 109.7 | 0.058 | 49.5 | 0.455 | -70.6  |
| 300     | 0.483 | -138.4 | 8.86  | 98.7  | 0.071 | 50.6 | 0.330 | -80.4  |
| 400     | 0.462 | -152.3 | 6.82  | 91.6  | 0.083 | 52.8 | 0.266 | -86.8  |
| 500     | 0.454 | -162.6 | 5.51  | 86.4  | 0.096 | 55.2 | 0.226 | -91.9  |
| 600     | 0.448 | -170.5 | 4.63  | 81.9  | 0.108 | 56.8 | 0.201 | -96.3  |
| 700     | 0.451 | -176.9 | 4.01  | 78.0  | 0.121 | 58.2 | 0.185 | -99.5  |
| 800     | 0.448 | 177.1  | 3.54  | 74.2  | 0.134 | 59.0 | 0.175 | -103.3 |
| 900     | 0.453 | 171.7  | 3.17  | 71.5  | 0.149 | 59.8 | 0.169 | -106.3 |
| 1000    | 0.452 | 168.6  | 2.87  | 68.2  | 0.162 | 60.0 | 0.163 | -109.9 |
| 1100    | 0.453 | 163.6  | 2.63  | 65.1  | 0.176 | 60.3 | 0.161 | -112.3 |
| 1200    | 0.459 | 158.8  | 2.43  | 62.5  | 0.190 | 60.4 | 0.162 | -116.0 |
| 1300    | 0.460 | 155.4  | 2.27  | 59.8  | 0.204 | 60.1 | 0.160 | -118.1 |
| 1400    | 0.464 | 151.8  | 2.13  | 57.4  | 0.218 | 60.0 | 0.162 | -121.1 |
| 1500    | 0.469 | 148.8  | 2.00  | 54.8  | 0.232 | 59.5 | 0.162 | -124.7 |
| 1600    | 0.474 | 145.5  | 1.89  | 52.2  | 0.246 | 58.8 | 0.167 | -126.3 |
| 1700    | 0.477 | 143.0  | 1.80  | 49.9  | 0.260 | 58.6 | 0.169 | -129.4 |
| 1800    | 0.482 | 139.0  | 1.72  | 47.9  | 0.274 | 57.9 | 0.172 | -132.4 |
| 1900    | 0.491 | 136.7  | 1.65  | 45.6  | 0.288 | 57.1 | 0.177 | -134.6 |
| 2000    | 0.490 | 133.2  | 1.59  | 43.5  | 0.302 | 56.6 | 0.179 | -137.2 |

## 2SC5890

( $V_{CE} = 3V$ ,  $I_C = 30\text{ mA}$ ,  $Z_o = 50\ \Omega$ )

| f (MHz) | S11   |        | S21   |       | S12   |      | S22   |        |
|---------|-------|--------|-------|-------|-------|------|-------|--------|
|         | MAG   | ANG    | MAG   | ANG   | MAG   | ANG  | MAG   | ANG    |
| 100     | 0.449 | -118.4 | 27.19 | 113.3 | 0.029 | 57.1 | 0.459 | -76.8  |
| 200     | 0.431 | -150.0 | 15.04 | 98.0  | 0.043 | 61.4 | 0.270 | -98.5  |
| 300     | 0.429 | -165.1 | 10.09 | 90.5  | 0.060 | 65.3 | 0.199 | -112.0 |
| 400     | 0.428 | -174.1 | 7.63  | 85.6  | 0.076 | 67.0 | 0.170 | -121.5 |
| 500     | 0.430 | 179.3  | 6.12  | 81.7  | 0.093 | 67.6 | 0.152 | -129.4 |
| 600     | 0.421 | 174.0  | 5.12  | 78.2  | 0.110 | 67.9 | 0.144 | -135.4 |
| 700     | 0.431 | 169.6  | 4.42  | 75.3  | 0.126 | 67.8 | 0.139 | -139.6 |
| 800     | 0.428 | 165.6  | 3.89  | 72.2  | 0.143 | 67.4 | 0.138 | -144.1 |
| 900     | 0.438 | 161.3  | 3.48  | 69.8  | 0.160 | 66.9 | 0.137 | -146.7 |
| 1000    | 0.436 | 157.8  | 3.15  | 66.9  | 0.176 | 65.9 | 0.138 | -150.7 |
| 1100    | 0.436 | 154.0  | 2.88  | 64.2  | 0.193 | 65.3 | 0.138 | -152.5 |
| 1200    | 0.445 | 150.5  | 2.66  | 62.3  | 0.209 | 64.3 | 0.142 | -155.5 |
| 1300    | 0.446 | 147.5  | 2.49  | 59.7  | 0.225 | 63.4 | 0.141 | -157.2 |
| 1400    | 0.446 | 144.6  | 2.33  | 57.5  | 0.240 | 62.5 | 0.146 | -159.1 |
| 1500    | 0.451 | 141.6  | 2.19  | 55.0  | 0.256 | 61.2 | 0.148 | -162.0 |
| 1600    | 0.454 | 138.6  | 2.07  | 53.0  | 0.272 | 60.2 | 0.151 | -162.2 |
| 1700    | 0.457 | 136.2  | 1.98  | 50.6  | 0.287 | 59.3 | 0.155 | -164.6 |
| 1800    | 0.459 | 132.6  | 1.88  | 49.0  | 0.301 | 58.2 | 0.158 | -166.8 |
| 1900    | 0.473 | 130.7  | 1.80  | 46.6  | 0.317 | 57.0 | 0.163 | -167.7 |
| 2000    | 0.465 | 127.4  | 1.73  | 44.9  | 0.331 | 55.9 | 0.165 | -169.7 |

( $V_{CE} = 3V$ ,  $I_C = 50 \text{ mA}$ ,  $Z_o = 50 \Omega$ )

| f (MHz) | S11   |        | S21   |       | S12   |      | S22   |        |
|---------|-------|--------|-------|-------|-------|------|-------|--------|
|         | MAG   | ANG    | MAG   | ANG   | MAG   | ANG  | MAG   | ANG    |
| 100     | 0.424 | -136.3 | 28.25 | 108.0 | 0.025 | 60.4 | 0.382 | -86.3  |
| 200     | 0.426 | -160.8 | 15.12 | 94.5  | 0.041 | 65.8 | 0.225 | -108.8 |
| 300     | 0.433 | -171.8 | 10.08 | 88.0  | 0.058 | 69.0 | 0.172 | -122.9 |
| 400     | 0.437 | -179.2 | 7.59  | 83.5  | 0.076 | 70.1 | 0.152 | -132.5 |
| 500     | 0.440 | 175.1  | 6.09  | 80.1  | 0.093 | 70.2 | 0.141 | -140.5 |
| 600     | 0.435 | 170.8  | 5.08  | 76.8  | 0.110 | 69.9 | 0.138 | -146.0 |
| 700     | 0.443 | 166.5  | 4.39  | 73.9  | 0.128 | 69.4 | 0.134 | -149.8 |
| 800     | 0.441 | 162.8  | 3.86  | 70.9  | 0.145 | 68.6 | 0.135 | -153.3 |
| 900     | 0.446 | 158.4  | 3.44  | 68.4  | 0.163 | 67.8 | 0.136 | -155.4 |
| 1000    | 0.447 | 155.7  | 3.11  | 65.9  | 0.179 | 66.8 | 0.138 | -159.5 |
| 1100    | 0.444 | 152.5  | 2.86  | 63.3  | 0.196 | 65.9 | 0.138 | -160.9 |
| 1200    | 0.455 | 148.4  | 2.64  | 61.0  | 0.212 | 64.8 | 0.143 | -163.1 |
| 1300    | 0.455 | 145.9  | 2.47  | 58.5  | 0.229 | 63.6 | 0.142 | -164.6 |
| 1400    | 0.463 | 142.3  | 2.31  | 56.5  | 0.244 | 62.7 | 0.147 | -166.3 |
| 1500    | 0.462 | 140.1  | 2.17  | 54.0  | 0.261 | 61.3 | 0.151 | -169.0 |
| 1600    | 0.466 | 137.4  | 2.05  | 51.9  | 0.276 | 60.3 | 0.153 | -169.0 |
| 1700    | 0.469 | 135.1  | 1.97  | 50.0  | 0.291 | 59.1 | 0.157 | -171.3 |
| 1800    | 0.474 | 131.2  | 1.87  | 48.3  | 0.306 | 58.0 | 0.161 | -173.0 |
| 1900    | 0.481 | 129.6  | 1.79  | 46.0  | 0.321 | 56.7 | 0.165 | -173.5 |
| 2000    | 0.476 | 126.4  | 1.72  | 44.0  | 0.336 | 55.6 | 0.166 | -176.0 |

## 2SC5890

( $V_{CE} = 5V$ ,  $I_C = 10\text{ mA}$ ,  $Z_o = 50\ \Omega$ )

| f (MHz) | S11   |        | S21   |       | S12   |      | S22   |        |
|---------|-------|--------|-------|-------|-------|------|-------|--------|
|         | MAG   | ANG    | MAG   | ANG   | MAG   | ANG  | MAG   | ANG    |
| 100     | 0.643 | -69.1  | 20.28 | 134.6 | 0.038 | 60.7 | 0.719 | -40.0  |
| 200     | 0.512 | -107.8 | 13.36 | 113.9 | 0.053 | 54.0 | 0.485 | -55.1  |
| 300     | 0.460 | -130.9 | 9.51  | 102.7 | 0.064 | 54.8 | 0.362 | -61.6  |
| 400     | 0.433 | -146.9 | 7.33  | 95.6  | 0.075 | 57.2 | 0.295 | -64.8  |
| 500     | 0.421 | -157.7 | 5.96  | 90.2  | 0.087 | 59.4 | 0.256 | -66.7  |
| 600     | 0.411 | -166.4 | 5.01  | 85.6  | 0.098 | 61.2 | 0.230 | -68.5  |
| 700     | 0.414 | -173.0 | 4.34  | 81.7  | 0.111 | 62.2 | 0.212 | -70.4  |
| 800     | 0.414 | -179.6 | 3.83  | 78.0  | 0.123 | 63.5 | 0.200 | -72.5  |
| 900     | 0.419 | 174.3  | 3.43  | 75.0  | 0.136 | 64.1 | 0.192 | -74.5  |
| 1000    | 0.414 | 170.8  | 3.10  | 71.8  | 0.149 | 64.5 | 0.186 | -76.9  |
| 1100    | 0.421 | 166.3  | 2.84  | 68.8  | 0.161 | 64.8 | 0.182 | -78.9  |
| 1200    | 0.420 | 161.3  | 2.63  | 66.0  | 0.175 | 64.9 | 0.180 | -81.9  |
| 1300    | 0.424 | 157.6  | 2.45  | 63.3  | 0.188 | 64.7 | 0.178 | -84.6  |
| 1400    | 0.428 | 154.2  | 2.29  | 61.2  | 0.201 | 64.6 | 0.179 | -87.2  |
| 1500    | 0.435 | 150.5  | 2.16  | 58.4  | 0.214 | 64.2 | 0.178 | -90.2  |
| 1600    | 0.439 | 147.4  | 2.03  | 56.0  | 0.227 | 63.9 | 0.180 | -93.1  |
| 1700    | 0.444 | 144.2  | 1.94  | 53.8  | 0.240 | 63.6 | 0.181 | -96.2  |
| 1800    | 0.450 | 140.1  | 1.85  | 51.5  | 0.254 | 63.0 | 0.182 | -99.2  |
| 1900    | 0.454 | 137.5  | 1.77  | 49.4  | 0.267 | 62.5 | 0.185 | -102.2 |
| 2000    | 0.458 | 134.0  | 1.69  | 47.3  | 0.281 | 62.0 | 0.187 | -105.3 |

( $V_{CE} = 5V$ ,  $I_C = 30 \text{ mA}$ ,  $Z_o = 50 \Omega$ )

| f (MHz) | S11   |        | S21   |       | S12   |      | S22   |        |
|---------|-------|--------|-------|-------|-------|------|-------|--------|
|         | MAG   | ANG    | MAG   | ANG   | MAG   | ANG  | MAG   | ANG    |
| 100     | 0.430 | -108.9 | 28.25 | 118.1 | 0.026 | 61.8 | 0.482 | -59.0  |
| 200     | 0.387 | -142.7 | 16.05 | 102.5 | 0.040 | 65.5 | 0.283 | -72.0  |
| 300     | 0.380 | -158.5 | 10.90 | 94.7  | 0.055 | 69.2 | 0.205 | -77.8  |
| 400     | 0.374 | -168.7 | 8.27  | 89.8  | 0.070 | 70.7 | 0.165 | -81.7  |
| 500     | 0.375 | -176.5 | 6.67  | 85.8  | 0.085 | 71.8 | 0.143 | -84.6  |
| 600     | 0.376 | 177.6  | 5.59  | 82.3  | 0.101 | 72.1 | 0.130 | -87.9  |
| 700     | 0.384 | 172.9  | 4.82  | 79.4  | 0.116 | 71.7 | 0.121 | -90.6  |
| 800     | 0.383 | 167.8  | 4.24  | 76.5  | 0.131 | 71.6 | 0.116 | -93.5  |
| 900     | 0.388 | 164.0  | 3.78  | 73.8  | 0.147 | 71.3 | 0.112 | -96.9  |
| 1000    | 0.385 | 159.5  | 3.43  | 70.9  | 0.162 | 70.6 | 0.111 | -99.9  |
| 1100    | 0.390 | 155.7  | 3.13  | 68.4  | 0.177 | 69.7 | 0.111 | -102.7 |
| 1200    | 0.398 | 152.4  | 2.90  | 66.2  | 0.192 | 69.2 | 0.111 | -106.2 |
| 1300    | 0.396 | 148.1  | 2.70  | 63.8  | 0.207 | 68.2 | 0.112 | -108.8 |
| 1400    | 0.406 | 146.2  | 2.53  | 61.7  | 0.221 | 67.4 | 0.114 | -111.8 |
| 1500    | 0.407 | 142.5  | 2.37  | 59.2  | 0.236 | 66.4 | 0.115 | -115.0 |
| 1600    | 0.408 | 139.8  | 2.25  | 57.1  | 0.250 | 65.4 | 0.118 | -117.5 |
| 1700    | 0.414 | 137.8  | 2.13  | 54.9  | 0.265 | 64.4 | 0.122 | -120.7 |
| 1800    | 0.420 | 133.6  | 2.04  | 53.1  | 0.278 | 63.5 | 0.124 | -123.7 |
| 1900    | 0.428 | 131.5  | 1.94  | 50.9  | 0.292 | 62.5 | 0.128 | -126.6 |
| 2000    | 0.427 | 128.4  | 1.86  | 49.2  | 0.306 | 61.3 | 0.131 | -129.1 |

## 2SC5890

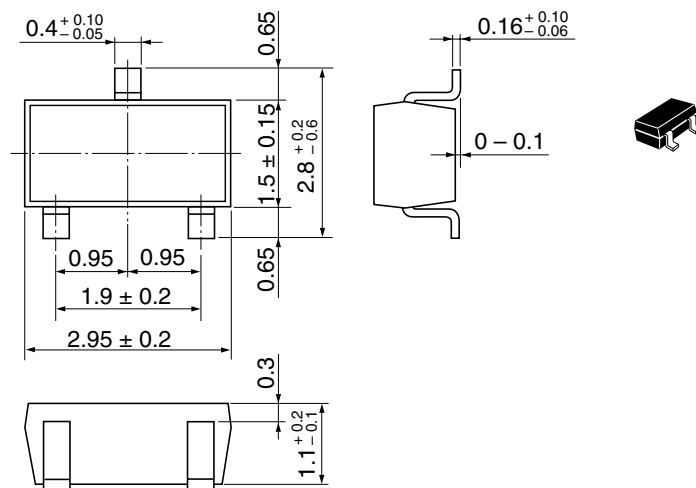
( $V_{CE} = 5V$ ,  $I_C = 50\text{ mA}$ ,  $Z_o = 50\ \Omega$ )

| f (MHz) | S11   |        | S21   |       | S12   |      | S22   |        |
|---------|-------|--------|-------|-------|-------|------|-------|--------|
|         | MAG   | ANG    | MAG   | ANG   | MAG   | ANG  | MAG   | ANG    |
| 100     | 0.392 | -125.2 | 30.12 | 111.6 | 0.023 | 62.6 | 0.411 | -67.0  |
| 200     | 0.380 | -153.9 | 16.44 | 97.6  | 0.037 | 67.6 | 0.235 | -78.0  |
| 300     | 0.379 | -167.5 | 11.03 | 90.8  | 0.053 | 70.8 | 0.170 | -82.6  |
| 400     | 0.380 | -175.1 | 8.33  | 86.2  | 0.069 | 72.1 | 0.139 | -86.5  |
| 500     | 0.381 | 178.8  | 6.68  | 82.5  | 0.085 | 72.2 | 0.121 | -89.3  |
| 600     | 0.381 | 173.2  | 5.59  | 79.4  | 0.100 | 72.3 | 0.111 | -93.0  |
| 700     | 0.390 | 168.9  | 4.82  | 76.5  | 0.116 | 71.7 | 0.105 | -95.3  |
| 800     | 0.389 | 165.1  | 4.25  | 73.5  | 0.132 | 71.1 | 0.102 | -98.9  |
| 900     | 0.394 | 160.4  | 3.79  | 71.2  | 0.148 | 70.7 | 0.101 | -101.5 |
| 1000    | 0.393 | 157.7  | 3.43  | 68.6  | 0.163 | 69.7 | 0.100 | -105.7 |
| 1100    | 0.396 | 153.6  | 3.13  | 66.0  | 0.178 | 69.0 | 0.100 | -107.8 |
| 1200    | 0.403 | 150.0  | 2.89  | 63.8  | 0.193 | 67.9 | 0.103 | -111.8 |
| 1300    | 0.407 | 147.4  | 2.70  | 61.4  | 0.209 | 67.0 | 0.103 | -113.8 |
| 1400    | 0.410 | 144.0  | 2.52  | 59.2  | 0.223 | 66.1 | 0.106 | -117.1 |
| 1500    | 0.411 | 141.2  | 2.36  | 57.0  | 0.238 | 65.0 | 0.108 | -120.5 |
| 1600    | 0.414 | 138.5  | 2.25  | 54.9  | 0.253 | 64.0 | 0.113 | -122.6 |
| 1700    | 0.416 | 136.4  | 2.13  | 52.6  | 0.267 | 63.0 | 0.115 | -125.9 |
| 1800    | 0.428 | 132.5  | 2.03  | 50.6  | 0.281 | 62.0 | 0.118 | -128.8 |
| 1900    | 0.436 | 130.7  | 1.94  | 48.6  | 0.295 | 60.9 | 0.123 | -131.2 |
| 2000    | 0.431 | 127.3  | 1.87  | 46.8  | 0.309 | 59.8 | 0.124 | -134.1 |

## Package Dimensions

As of January, 2002

Unit: mm



|                        |          |
|------------------------|----------|
| Hitachi Code           | MPAK(T)  |
| JEDEC                  | —        |
| JEITA                  | Conforms |
| Mass (reference value) | 0.011 g  |

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