
2SC4784

Silicon NPN Epitaxial

HITACHI

Application

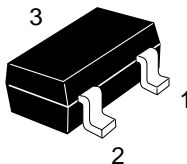
VHF / UHF wide band amplifier

Features

- High gain bandwidth product
 $f_T = 10 \text{ GHz Typ.}$
- High gain, low noise figure
 $PG = 15.0 \text{ dB Typ, NF} = 1.2 \text{ dB Typ at } f = 900 \text{ MHz}$

Outline

CMPAK



1. Emitter
2. Base
3. Collector

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Absolute Maximum Ratings (Ta = 25°C)

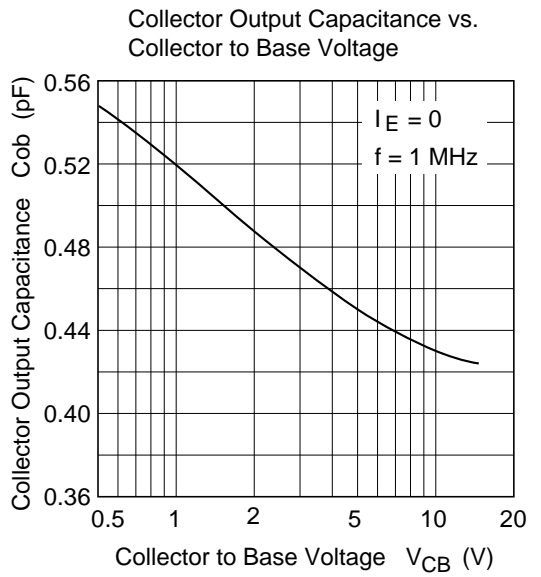
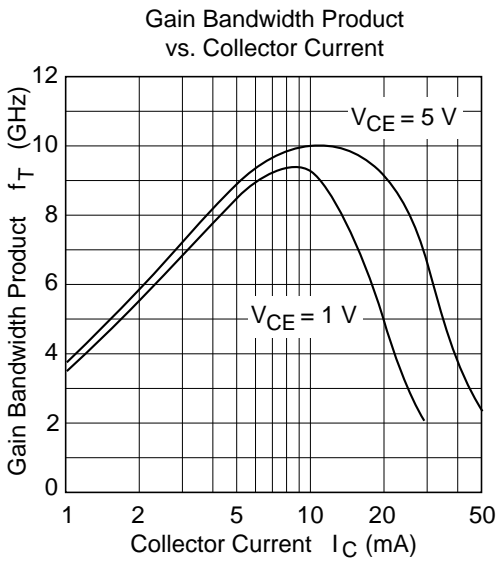
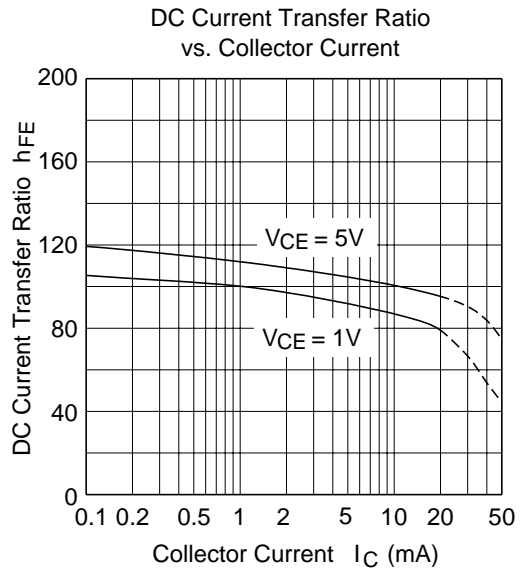
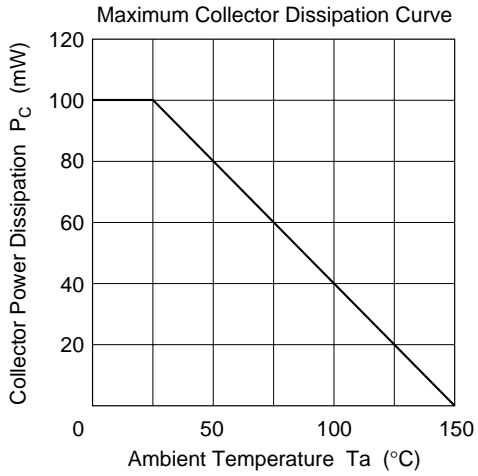
| Item | Symbol | Ratings | Unit |
|------------------------------|-----------|-------------|------|
| Collector to base voltage | V_{CBO} | 15 | V |
| Collector to emitter voltage | V_{CEO} | 8 | V |
| Emitter to base voltage | V_{EBO} | 1.5 | V |
| Collector current | I_C | 20 | mA |
| Collector power dissipation | P_C | 100 | mW |
| Junction temperature | T_j | 150 | °C |
| Storage temperature | T_{stg} | -55 to +150 | °C |

Electrical Characteristics (Ta = 25°C)

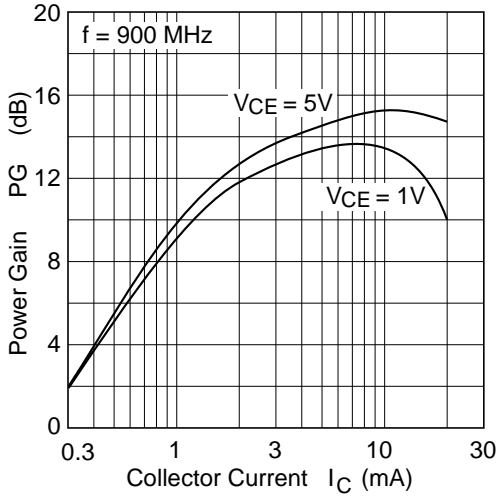
| Item | Symbol | Min | Typ | Max | Unit | Test conditions |
|------------------------------|-----------|------|------|-----|---------|--|
| Collector cutoff current | I_{CBO} | — | — | 10 | μ A | $V_{CB} = 15\text{ V}, I_E = 0$ |
| | I_{CEO} | — | — | 1 | mA | $V_{CE} = 8\text{ V}, R_{BE} = \infty$ |
| Emitter cutoff current | I_{EBO} | — | — | 10 | μ A | $V_{EB} = 1.5\text{ V}, I_C = 0$ |
| DC current transfer ratio | h_{FE} | 50 | 120 | 250 | | $V_{CE} = 5\text{ V}, I_C = 10\text{ mA}$ |
| Collector output capacitance | C_{ob} | — | 0.45 | 0.8 | 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 | 12.0 | 15.0 | — | dB | $V_{CE} = 5\text{ V}, I_C = 10\text{ mA},$ $f = 900\text{ MHz}$ |
| Noise figure | NF | — | 1.2 | 2.5 | dB | $V_{CE} = 5\text{ V}, I_C = 5\text{ mA},$ $f = 900\text{ MHz}$ |

Note: Marking is "YA-".

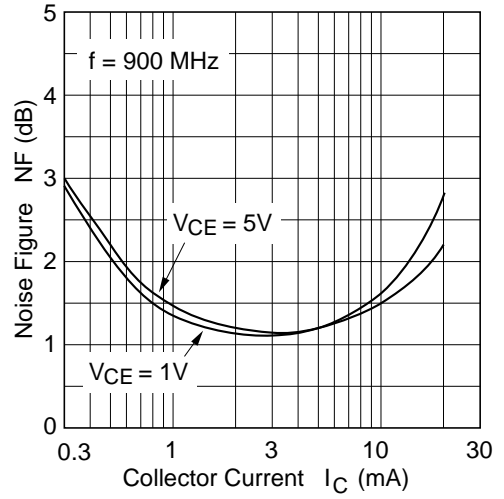
Attention: This is electrostatic sensitive device.



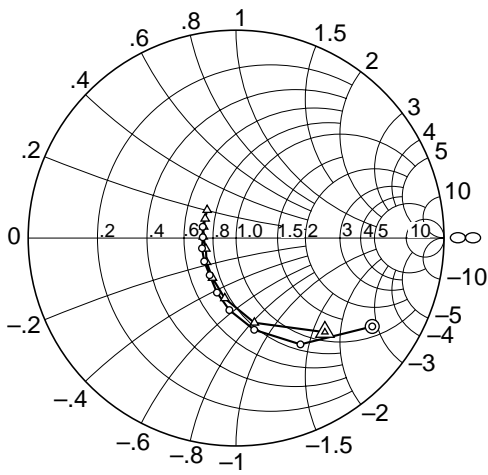
Power Gain vs. Collector Current



Noise Figure vs. Collector Current

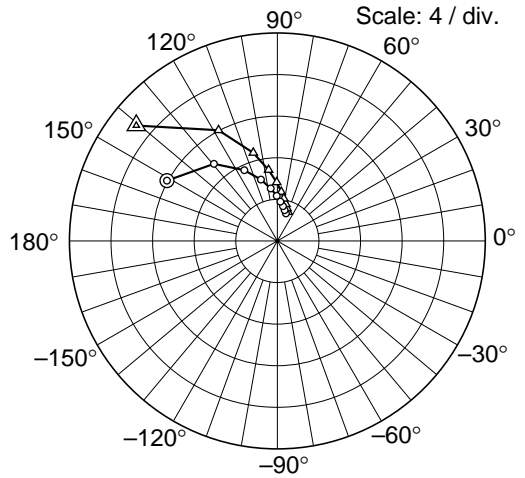


S11 Parameter vs. Frequency



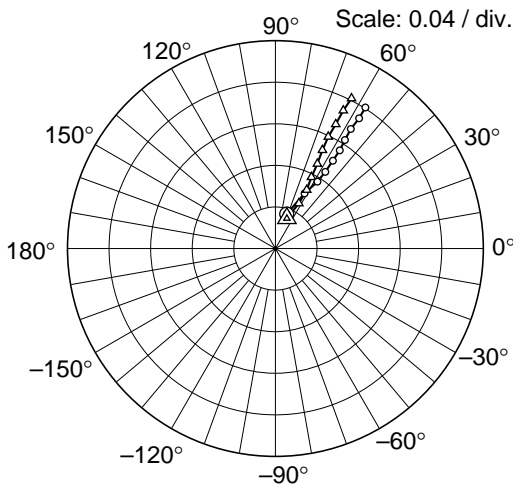
Condition: $V_{CE} = 5\text{ V}$, $Z_o = 50\ \Omega$
 200 to 2000 MHz (200 MHz step)
 ○ — ○ ($I_C = 5\text{ mA}$)
 △ — △ ($I_C = 10\text{ mA}$)

S21 Parameter vs. Frequency



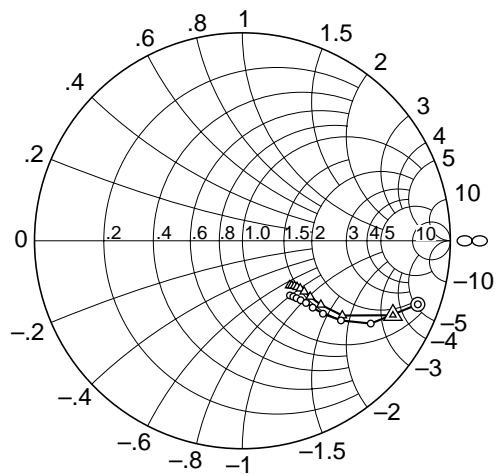
Condition: $V_{CE} = 5\text{ V}$, $Z_o = 50\ \Omega$
 200 to 2000 MHz (200 MHz step)
 ○ — ○ ($I_C = 5\text{ mA}$)
 △ — △ ($I_C = 10\text{ mA}$)

S12 Parameter vs. Frequency



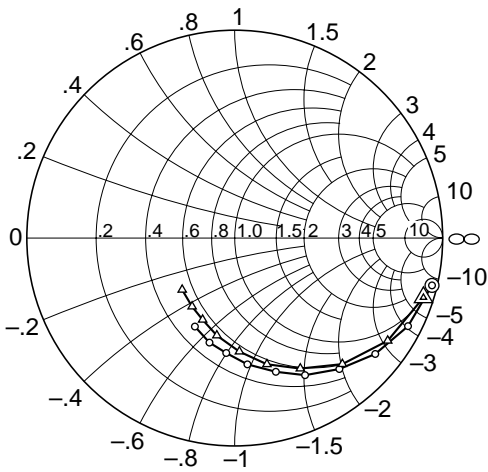
Condition: $V_{CE} = 5\text{ V}$, $Z_o = 50\ \Omega$
 200 to 2000 MHz (200 MHz step)
 ○ — ○ ($I_C = 5\text{ mA}$)
 △ — △ ($I_C = 10\text{ mA}$)

S22 Parameter vs. Frequency



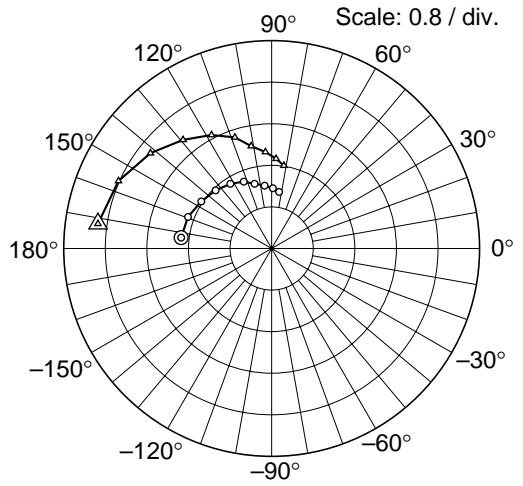
Condition: $V_{CE} = 5\text{ V}$, $Z_o = 50\ \Omega$
 200 to 2000 MHz (200 MHz step)
 ○ — ○ ($I_C = 5\text{ mA}$)
 △ — △ ($I_C = 10\text{ mA}$)

S11 Parameter vs. Frequency



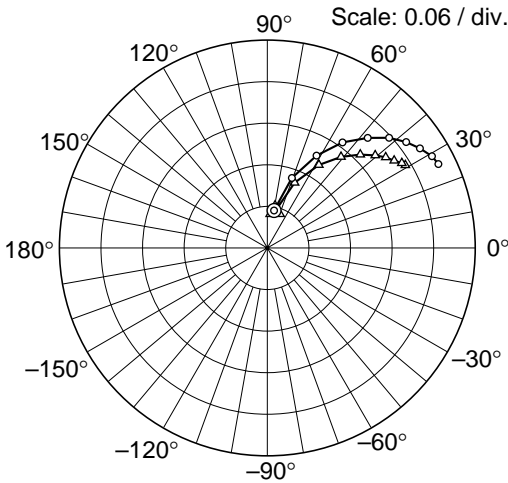
Condition: $V_{CE} = 1\text{ V}$, $Z_o = 50\ \Omega$
 200 to 2000 MHz (200 MHz step)
 ○ (I_C = 0.5 mA)
 △ (I_C = 1 mA)

S21 Parameter vs. Frequency



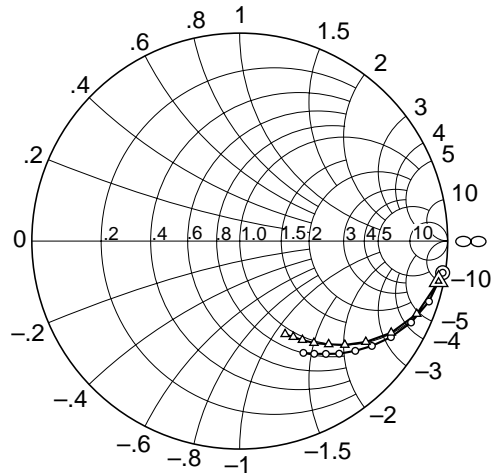
Condition: $V_{CE} = 1\text{ V}$, $Z_o = 50\ \Omega$
 200 to 2000 MHz (200 MHz step)
 ○ (I_C = 0.5 mA)
 △ (I_C = 1 mA)

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 | 0.850 | -17.1 | 13.203 | 164.8 | 0.018 | 80.4 | 0.965 | -10.5 |
| 200 | 0.781 | -33.0 | 12.116 | 151.3 | 0.035 | 72.0 | 0.898 | -19.9 |
| 300 | 0.689 | -47.5 | 10.894 | 139.0 | 0.049 | 65.9 | 0.815 | -27.5 |
| 400 | 0.598 | -58.8 | 9.620 | 129.5 | 0.060 | 62.2 | 0.735 | -32.8 |
| 500 | 0.523 | -69.4 | 8.489 | 121.6 | 0.069 | 59.5 | 0.667 | -36.4 |
| 600 | 0.450 | -78.8 | 7.534 | 115.1 | 0.076 | 57.9 | 0.610 | -38.9 |
| 700 | 0.394 | -87.1 | 6.760 | 109.9 | 0.083 | 57.1 | 0.563 | -40.6 |
| 800 | 0.348 | -95.3 | 6.129 | 105.1 | 0.088 | 57.0 | 0.523 | -42.1 |
| 900 | 0.306 | -102.7 | 5.550 | 100.7 | 0.095 | 56.6 | 0.493 | -42.7 |
| 1000 | 0.278 | -109.3 | 5.113 | 97.4 | 0.101 | 56.8 | 0.467 | -43.5 |
| 1100 | 0.243 | -117.8 | 4.716 | 94.0 | 0.107 | 57.0 | 0.445 | -44.2 |
| 1200 | 0.219 | -125.4 | 4.342 | 91.0 | 0.113 | 56.8 | 0.428 | -44.3 |
| 1300 | 0.203 | -132.4 | 4.057 | 88.5 | 0.118 | 57.1 | 0.416 | -45.1 |
| 1400 | 0.190 | -143.7 | 3.804 | 85.9 | 0.124 | 57.4 | 0.401 | -45.5 |
| 1500 | 0.167 | -153.7 | 3.580 | 83.8 | 0.130 | 57.5 | 0.390 | -45.9 |
| 1600 | 0.171 | -163.2 | 3.391 | 81.1 | 0.136 | 57.8 | 0.380 | -46.6 |
| 1700 | 0.161 | -172.5 | 3.207 | 79.2 | 0.143 | 57.7 | 0.371 | -47.0 |
| 1800 | 0.160 | 178.6 | 3.051 | 77.1 | 0.149 | 57.3 | 0.364 | -47.6 |
| 1900 | 0.167 | 169.4 | 2.921 | 75.0 | 0.155 | 57.6 | 0.356 | -48.3 |
| 2000 | 0.170 | 161.4 | 2.788 | 73.1 | 0.161 | 57.5 | 0.349 | -48.9 |

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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 | 0.730 | -25.1 | 20.636 | 158.3 | 0.017 | 77.3 | 0.929 | -15.0 |
| 200 | 0.622 | -46.7 | 17.551 | 140.7 | 0.031 | 69.3 | 0.808 | -26.3 |
| 300 | 0.508 | -64.4 | 14.512 | 127.1 | 0.041 | 64.0 | 0.689 | -33.0 |
| 400 | 0.417 | -77.8 | 12.064 | 118.0 | 0.049 | 62.8 | 0.600 | -36.8 |
| 500 | 0.349 | -89.5 | 10.223 | 111.0 | 0.057 | 62.1 | 0.534 | -38.7 |
| 600 | 0.295 | -100.6 | 8.803 | 105.3 | 0.064 | 62.1 | 0.487 | -39.2 |
| 700 | 0.256 | -110.7 | 7.735 | 101.0 | 0.070 | 62.9 | 0.451 | -39.3 |
| 800 | 0.223 | -120.6 | 6.899 | 97.1 | 0.077 | 63.4 | 0.423 | -39.6 |
| 900 | 0.195 | -129.7 | 6.178 | 93.5 | 0.084 | 63.6 | 0.403 | -39.4 |
| 1000 | 0.183 | -140.7 | 5.644 | 90.7 | 0.091 | 63.8 | 0.385 | -39.5 |
| 1100 | 0.173 | -151.8 | 5.167 | 88.0 | 0.098 | 64.3 | 0.372 | -39.6 |
| 1200 | 0.154 | -160.4 | 4.743 | 85.5 | 0.105 | 64.6 | 0.361 | -39.6 |
| 1300 | 0.158 | -171.4 | 4.423 | 83.5 | 0.112 | 64.5 | 0.353 | -40.0 |
| 1400 | 0.158 | 177.6 | 4.121 | 81.4 | 0.119 | 64.8 | 0.345 | -40.3 |
| 1500 | 0.157 | 165.9 | 3.866 | 79.1 | 0.126 | 64.7 | 0.338 | -40.6 |
| 1600 | 0.165 | 160.7 | 3.648 | 77.0 | 0.133 | 64.2 | 0.332 | -41.0 |
| 1700 | 0.172 | 154.4 | 3.460 | 75.1 | 0.141 | 64.1 | 0.327 | -41.8 |
| 1800 | 0.176 | 147.9 | 3.277 | 73.7 | 0.148 | 63.9 | 0.321 | -42.3 |
| 1900 | 0.187 | 140.9 | 3.129 | 71.6 | 0.155 | 63.7 | 0.317 | -42.8 |
| 2000 | 0.194 | 136.0 | 2.982 | 69.8 | 0.162 | 63.2 | 0.312 | -43.5 |

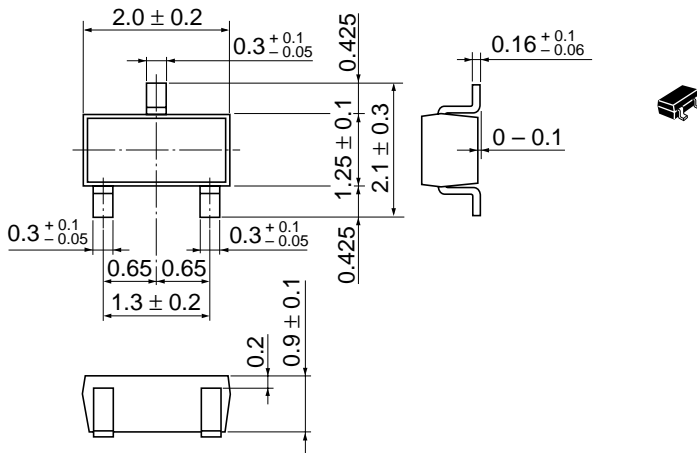
S Parameter ($V_{CE} = 1\text{ V}$, $I_C = 0.5\text{ mA}$, $Z_O = 50\ \Omega$, Emitter Common)

| Freq. (MHz) | S11 | | S21 | | S12 | | S22 | |
|----------------|-------|--------|-------|-------|-------|------|-------|-------|
| | MAG. | ANG. | MAG. | ANG. | MAG. | ANG. | MAG. | ANG. |
| 100 | 0.983 | -6.8 | 1.755 | 173.2 | 0.027 | 84.6 | 0.995 | -4.5 |
| 200 | 0.975 | -13.4 | 1.721 | 166.6 | 0.055 | 79.9 | 0.987 | -8.8 |
| 300 | 0.957 | -20.2 | 1.722 | 159.4 | 0.082 | 75.0 | 0.974 | -13.3 |
| 400 | 0.933 | -26.9 | 1.706 | 152.9 | 0.107 | 70.6 | 0.956 | -17.7 |
| 500 | 0.910 | -33.2 | 1.629 | 146.3 | 0.130 | 66.2 | 0.937 | -21.4 |
| 600 | 0.879 | -39.5 | 1.597 | 139.8 | 0.151 | 61.9 | 0.913 | -25.4 |
| 700 | 0.845 | -45.8 | 1.553 | 134.0 | 0.170 | 58.1 | 0.890 | -28.9 |
| 800 | 0.804 | -51.4 | 1.528 | 128.1 | 0.187 | 54.4 | 0.862 | -32.4 |
| 900 | 0.778 | -57.3 | 1.475 | 122.6 | 0.203 | 51.1 | 0.838 | -35.2 |
| 1000 | 0.739 | -62.9 | 1.432 | 117.8 | 0.215 | 47.6 | 0.813 | -38.4 |
| 1100 | 0.706 | -68.6 | 1.392 | 112.7 | 0.227 | 44.9 | 0.790 | -41.1 |
| 1200 | 0.671 | -73.0 | 1.317 | 107.8 | 0.237 | 42.1 | 0.767 | -43.5 |
| 1300 | 0.643 | -78.5 | 1.286 | 104.8 | 0.245 | 39.7 | 0.745 | -46.1 |
| 1400 | 0.609 | -84.4 | 1.261 | 100.0 | 0.252 | 37.3 | 0.723 | -48.5 |
| 1500 | 0.573 | -88.6 | 1.215 | 96.4 | 0.258 | 35.3 | 0.702 | -50.4 |
| 1600 | 0.553 | -94.4 | 1.186 | 92.6 | 0.263 | 33.1 | 0.683 | -52.6 |
| 1700 | 0.531 | -100.1 | 1.158 | 88.8 | 0.267 | 31.1 | 0.667 | -54.5 |
| 1800 | 0.516 | -103.8 | 1.128 | 85.7 | 0.272 | 29.1 | 0.650 | -56.5 |
| 1900 | 0.485 | -109.6 | 1.098 | 82.5 | 0.273 | 27.7 | 0.634 | -58.4 |
| 2000 | 0.466 | -114.5 | 1.070 | 78.9 | 0.275 | 26.1 | 0.619 | -60.3 |

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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 | 0.962 | -8.8 | 3.376 | 172.0 | 0.027 | 83.7 | 0.991 | -5.9 |
| 200 | 0.950 | -17.5 | 3.268 | 164.5 | 0.054 | 78.2 | 0.975 | -11.4 |
| 300 | 0.919 | -26.2 | 3.223 | 156.2 | 0.080 | 72.6 | 0.951 | -17.2 |
| 400 | 0.885 | -33.8 | 3.139 | 148.7 | 0.102 | 67.2 | 0.920 | -22.4 |
| 500 | 0.839 | -41.8 | 2.969 | 141.8 | 0.123 | 62.2 | 0.887 | -26.8 |
| 600 | 0.797 | -49.5 | 2.833 | 135.1 | 0.141 | 58.1 | 0.851 | -31.2 |
| 700 | 0.748 | -56.3 | 2.699 | 129.2 | 0.157 | 54.5 | 0.815 | -35.1 |
| 800 | 0.701 | -63.3 | 2.611 | 123.2 | 0.169 | 51.1 | 0.776 | -38.7 |
| 900 | 0.664 | -69.9 | 2.473 | 117.9 | 0.181 | 47.9 | 0.743 | -41.8 |
| 1000 | 0.625 | -75.7 | 2.363 | 113.1 | 0.190 | 45.2 | 0.710 | -44.7 |
| 1100 | 0.577 | -82.3 | 2.254 | 108.3 | 0.198 | 43.0 | 0.680 | -47.3 |
| 1200 | 0.545 | -87.7 | 2.109 | 104.2 | 0.205 | 40.7 | 0.655 | -49.3 |
| 1300 | 0.515 | -93.8 | 2.011 | 101.3 | 0.210 | 39.1 | 0.633 | -51.8 |
| 1400 | 0.475 | -100.5 | 1.946 | 97.0 | 0.215 | 37.5 | 0.606 | -54.0 |
| 1500 | 0.446 | -105.5 | 1.863 | 93.7 | 0.219 | 36.2 | 0.584 | -55.7 |
| 1600 | 0.421 | -111.6 | 1.800 | 90.1 | 0.222 | 34.6 | 0.563 | -57.7 |
| 1700 | 0.403 | -117.9 | 1.732 | 87.2 | 0.225 | 33.7 | 0.545 | -59.2 |
| 1800 | 0.387 | -122.1 | 1.663 | 84.4 | 0.229 | 32.2 | 0.528 | -60.9 |
| 1900 | 0.366 | -129.0 | 1.614 | 81.6 | 0.230 | 31.7 | 0.512 | -62.7 |
| 2000 | 0.354 | -135.7 | 1.554 | 78.6 | 0.232 | 31.0 | 0.498 | -64.1 |



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

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