NEC

# NPN SILICON RF TRANSISTOR
# 2SC5667

## NPN SILICON RF TRANSISTOR FOR LOW NOISE · HIGH-GAIN AMPLIFICATION 3-PIN ULTRA SUPER MINIMOLD

### FEATURES

- Ideal for low noise · high-gain amplification and oscillation at 3 GHz or over
  NF = 1.1 dB TYP., $G_a$ = 11 dB @ f = 2 GHz, $V_{CE}$ = 2 V, $I_C$ = 5 mA
- Maximum available power gain: MAG. = 12.5 dB TYP. @ f = 2 GHz, $V_{CE}$ = 2 V, $I_C$ = 20 mA
- High $f_T$: $f_T$ = 21 GHz TYP. @ f = 2 GHz, $V_{CE}$ = 2 V, $I_C$ = 20 mA
- $f_T$ = 25 GHz "UHS0" (Ultra High Speed Process) technology adopted
- 3-pin ultra super minimold (t = 0.75 mm)

### ORDERING INFORMATION

| Part Number | Quantity | Supplying Form |
|---|---|---|
| 2SC5667 | 50 pcs (Non reel) | • 8 mm wide embossed taping |
| 2SC5667-T1 | 3 kpcs/reel | • Pin 3 (collector) face the perforation side of the tape |

**Remark** To order evaluation samples, consult your NEC sales representative (Unit sample quantity is 50 pcs).

### ABSOLUTE MAXIMUM RATINGS ($T_A$ = +25 °C)

| Parameter | Symbol | Ratings | Unit |
|---|---|---|---|
| Collector to Base Voltage | $V_{CBO}$ | 15 | V |
| Collector to Emitter Voltage | $V_{CEO}$ | 3.3 | V |
| Emitter to Base Voltage | $V_{EBO}$ | 1.5 | V |
| Collector Current | $I_C$ | 35 | mA |
| Total Power Dissipation | $P_{tot}$ Note | 115 | mW |
| Junction Temperature | $T_j$ | 150 | °C |
| Storage Temperature | $T_{stg}$ | −65 to +150 | °C |

**Note** Mounted on 1.08 $cm^2 \times$ 1.0 mm (t) glass epoxy substrate

**Because this product uses high-frequency technology, avoid excessive static electricity, etc.**



Document No. P14853EJ1V0DS00 (1st edition)
Date Published June 2000 NS CP(K)
Printed in Japan

## ELECTRICAL CHARACTERISTICS ($T_A$ = +25 °C)

| Parameter | Symbol | Test Conditions | MIN. | TYP. | MAX. | Unit |
|---|---|---|---|---|---|---|
| DC Characteristics | | | | | | |
| Collector Cut-off Current | $I_{CBO}$ | $V_{CB}$ = 5 V, $I_E$ = 0 mA | – | – | 100 | nA |
| Emitter Cut-off Current | $I_{EBO}$ | $V_{EB}$ = 1 V, $I_C$ = 0 mA | – | – | 100 | nA |
| DC Current Gain | $h_{FE}$ Note 1 | $V_{CE}$ = 2 V, $I_C$ = 5 mA | 50 | 70 | 100 | – |
| RF Characteristics | | | | | | |
| Gain Bandwidth Product | $f_T$ | $V_{CE}$ = 2 V, $I_C$ = 20 mA, f = 2 GHz | 18 | 21 | – | GHz |
| Insertion Power Gain (1) | $\lvert S_{21e} \rvert^2$ | $V_{CE}$ = 1 V, $I_C$ = 10 mA, f = 2 GHz | 9.0 | 11.0 | – | dB |
| Insertion Power Gain (2) | $\lvert S_{21e} \rvert^2$ | $V_{CE}$ = 2 V, $I_C$ = 20 mA, f = 2 GHz | 9.5 | 11.5 | – | dB |
| Noise Figure | NF | $V_{CE}$ = 2 V, $I_C$ = 5 mA, f = 2 GHz, $Z_S = Z_{opt}$ | – | 1.1 | 1.5 | dB |
| Reverse Transfer Capacitance | $C_{re}$ Note 2 | $V_{CB}$ = 2 V, $I_E$ = 0 mA, f = 1 MHz | – | 0.24 | 0.30 | pF |
| Maximum Available Power Gain | MAG. Note 3 | $V_{CE}$ = 2 V, $I_C$ = 20 mA, f = 2 GHz | – | 12.5 | – | dB |
| Maximum Stable Power Gain | MSG. Note 4 | $V_{CE}$ = 2 V, $I_C$ = 20 mA, f = 2 GHz | – | 13.5 | – | dB |

**Note 1.** Pulse measurement: PW ≤ 350 $\mu$s, Duty Cycle ≤ 2 %

**2.** Collector to base capacitance measured using capacitance meter (self-balancing bridge method) when the emitter is connected to the guard pin

**3.** MAG. $= \left| \frac{S_{21}}{S_{12}} \right| (k - \sqrt{(k^2 - 1)})$

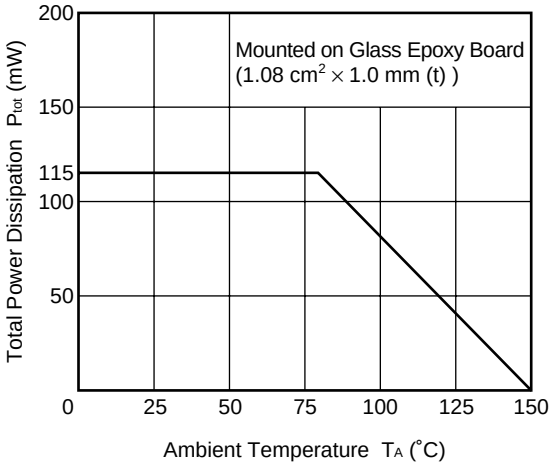
**4.** MSG. $= \left| \frac{S_{21}}{S_{12}} \right|$

## $h_{FE}$ CLASSIFICATION

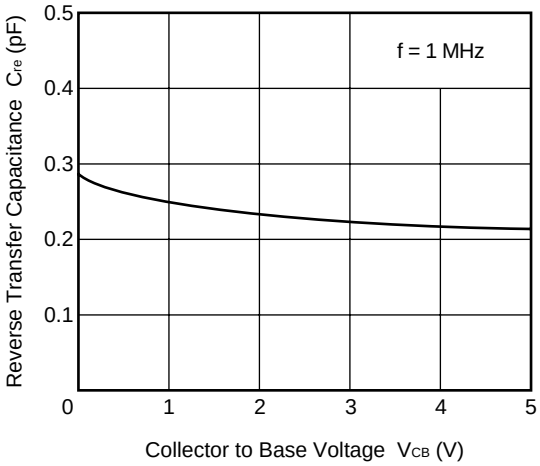
| Rank | FB |
|---|---|
| Marking | UB |
| $h_{FE}$ Value | 50 to 100 |

**TYPICAL CHARACTERISTICS (Unless otherwise specified, $T_A$ = +25 °C)**

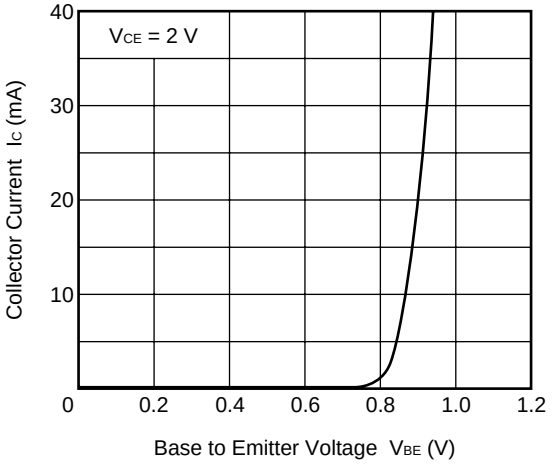
TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE



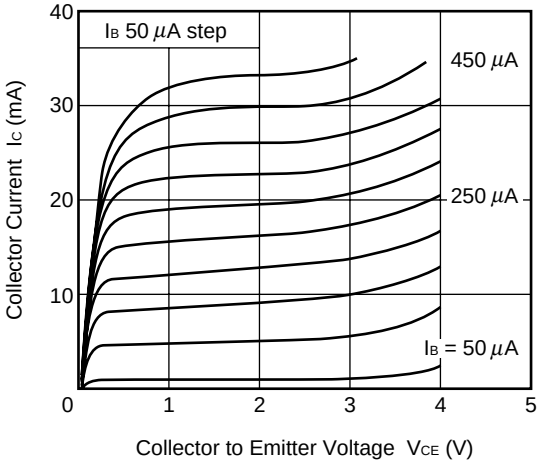

REVERSE TRANSFER CAPACITANCE vs. COLLECTOR TO BASE VOLTAGE



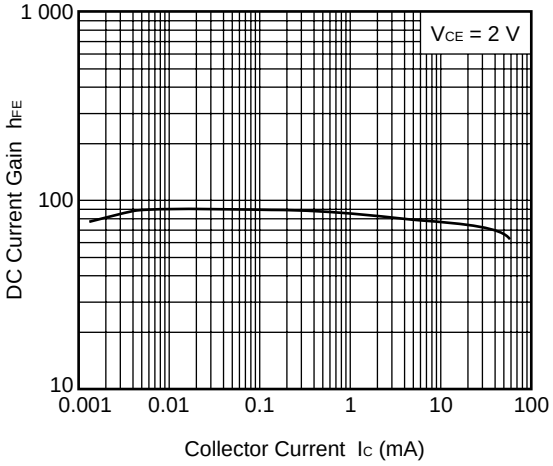

COLLECTOR CURRENT vs. BASE TO EMITTER VOLTAGE



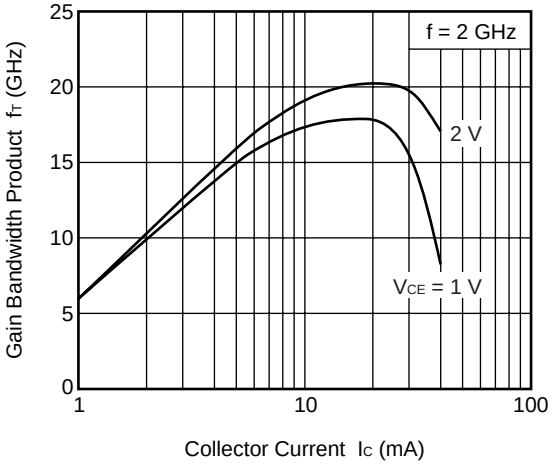

COLLECTOR CURRENT vs. COLLECTOR TO EMITTER VOLTAGE



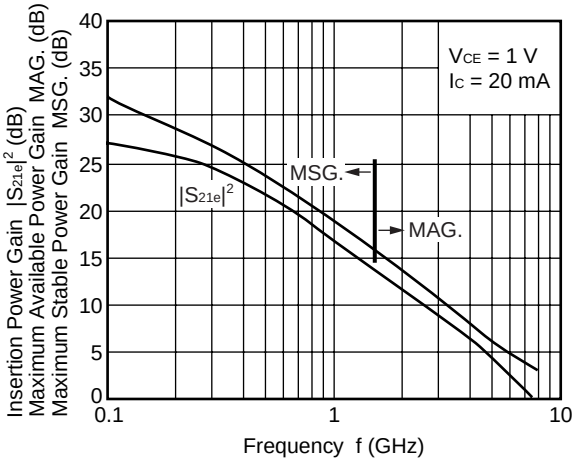

DC CURRENT GAIN vs. COLLECTOR CURRENT



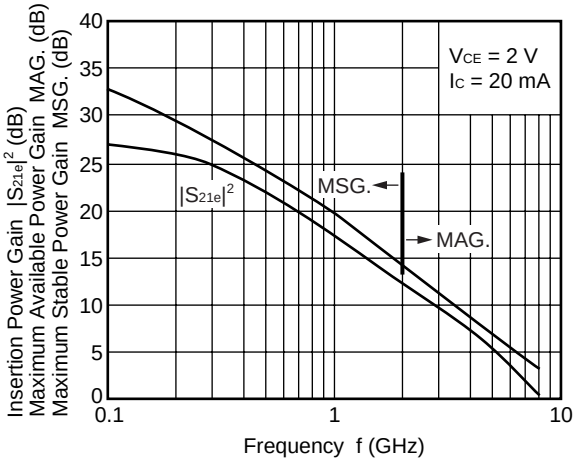

GAIN BANDWIDTH PRODUCT vs. COLLECTOR CURRENT



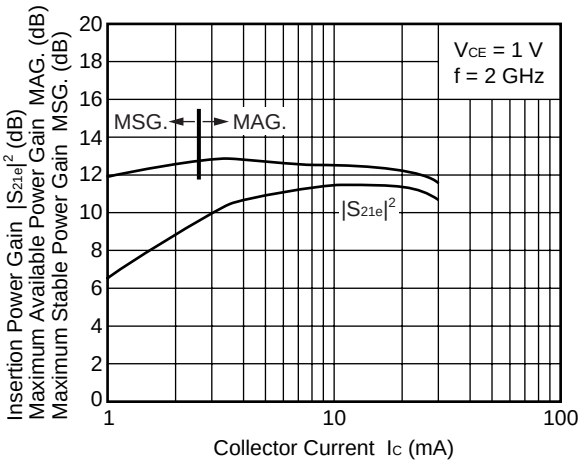
INSERTION POWER GAIN, MAXIMUM AVAILABLE POWER GAIN, MAXIMUM STABLE POWER GAIN vs. FREQUENCY



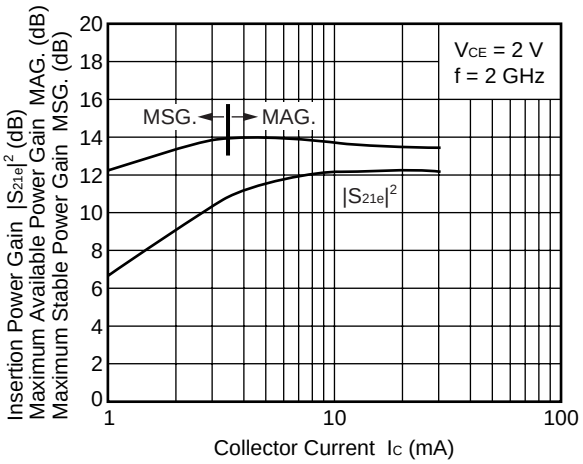

INSERTION POWER GAIN, MAXIMUM AVAILABLE POWER GAIN, MAXIMUM STABLE POWER GAIN vs. FREQUENCY



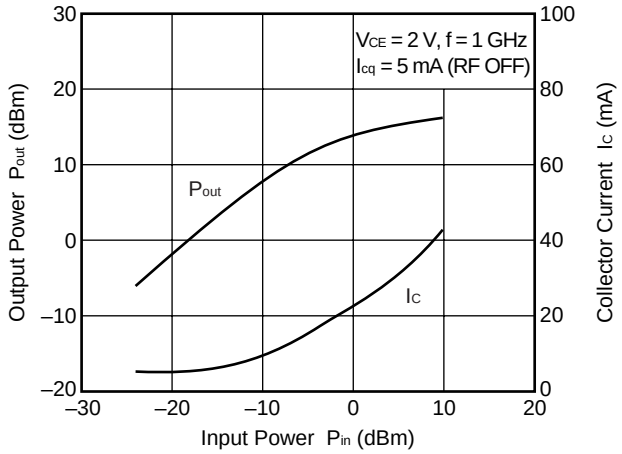

INSERTION POWER GAIN, MAXIMUM AVAILABLE POWER GAIN, MAXIMUM STABLE POWER GAIN vs. COLLECTOR CURRENT



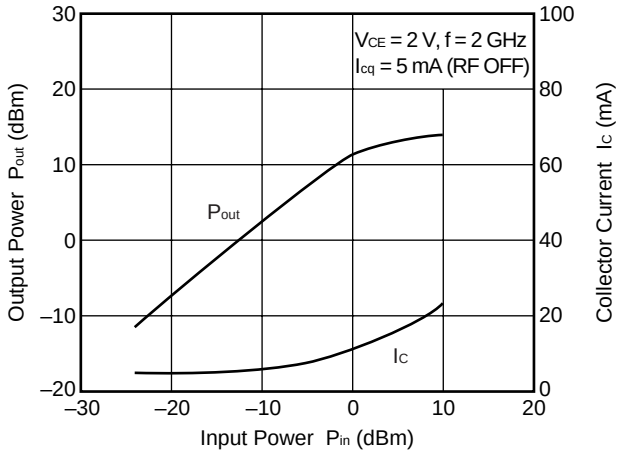

INSERTION POWER GAIN, MAXIMUM AVAILABLE POWER GAIN, MAXIMUM STABLE POWER GAIN vs. COLLECTOR CURRENT



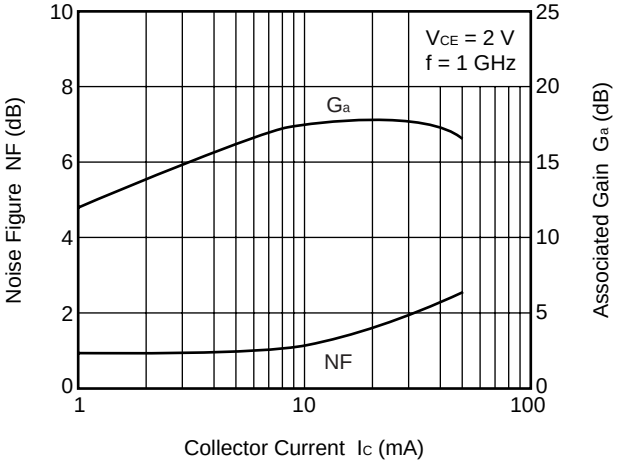

OUTPUT POWER, COLLECTOR CURRENT vs. INPUT POWER



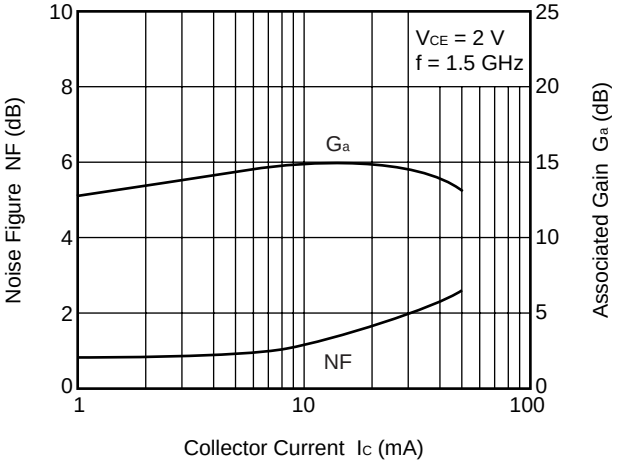

OUTPUT POWER, COLLECTOR CURRENT vs. INPUT POWER



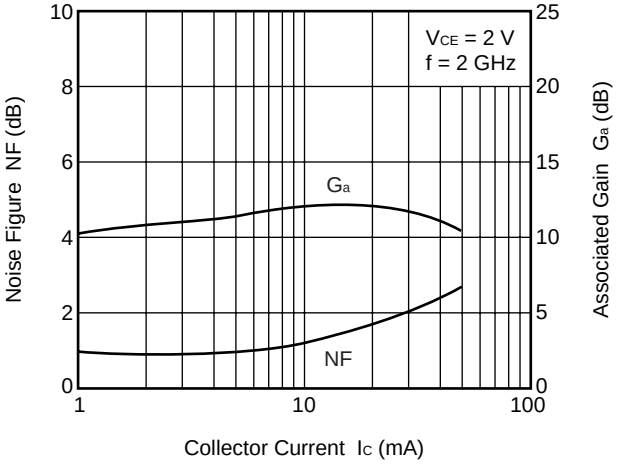
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



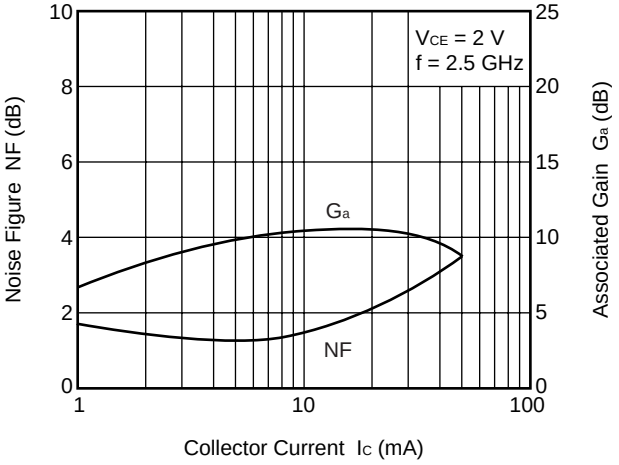

NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT




NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT




NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT




**Remark** The graphs indicate nominal characteristics.

## S-PARAMETERS

$V_{CE}$ = 1 V, $I_C$ = 3 mA, $Z_O$ = 50 Ω

| Frequency | $S_{11}$ | | $S_{21}$ | | $S_{12}$ | | $S_{22}$ | |
|---|---|---|---|---|---|---|---|---|
| GHz | MAG. | ANG. | MAG. | ANG. | MAG. | ANG. | MAG. | ANG. |
| 0.1 | 0.890 | –9.7 | 8.544 | 170.0 | 0.016 | 84.9 | 0.985 | –7.0 |
| 0.2 | 0.865 | –17.0 | 8.322 | 160.8 | 0.031 | 78.8 | 0.963 | –14.1 |
| 0.3 | 0.833 | –26.3 | 7.936 | 152.4 | 0.045 | 73.4 | 0.928 | –20.8 |
| 0.4 | 0.788 | –33.7 | 7.602 | 143.8 | 0.058 | 68.2 | 0.886 | –27.2 |
| 0.5 | 0.741 | –41.4 | 7.133 | 135.9 | 0.068 | 64.3 | 0.839 | –32.8 |
| 0.6 | 0.680 | –47.9 | 6.645 | 128.8 | 0.077 | 60.7 | 0.787 | –37.9 |
| 0.7 | 0.632 | –54.0 | 6.243 | 122.8 | 0.085 | 58.1 | 0.740 | –42.4 |
| 0.8 | 0.580 | –59.3 | 5.819 | 117.2 | 0.091 | 56.0 | 0.695 | –46.5 |
| 0.9 | 0.536 | –64.5 | 5.470 | 111.7 | 0.097 | 54.3 | 0.654 | –50.0 |
| 1.0 | 0.495 | –69.2 | 5.174 | 106.7 | 0.101 | 53.3 | 0.616 | –53.4 |
| 1.1 | 0.458 | –74.2 | 4.878 | 102.5 | 0.106 | 52.4 | 0.582 | –56.4 |
| 1.2 | 0.425 | –78.8 | 4.619 | 97.8 | 0.110 | 51.8 | 0.553 | –59.1 |
| 1.3 | 0.395 | –83.2 | 4.384 | 93.9 | 0.114 | 51.5 | 0.525 | –61.9 |
| 1.4 | 0.368 | –88.3 | 4.161 | 90.2 | 0.118 | 51.3 | 0.499 | –64.5 |
| 1.5 | 0.341 | –92.7 | 3.950 | 86.3 | 0.122 | 51.3 | 0.478 | –67.1 |
| 1.6 | 0.320 | –97.4 | 3.777 | 82.7 | 0.127 | 51.3 | 0.457 | –69.6 |
| 1.7 | 0.295 | –101.8 | 3.600 | 79.5 | 0.131 | 51.7 | 0.439 | –72.0 |
| 1.8 | 0.276 | –107.3 | 3.448 | 76.1 | 0.135 | 52.0 | 0.423 | –74.4 |
| 1.9 | 0.263 | –112.8 | 3.303 | 73.0 | 0.140 | 52.1 | 0.408 | –77.1 |
| 2.0 | 0.253 | –119.0 | 3.182 | 69.9 | 0.146 | 52.6 | 0.395 | –79.7 |
| 2.1 | 0.238 | –124.7 | 3.087 | 67.0 | 0.151 | 53.2 | 0.381 | –82.3 |
| 2.2 | 0.230 | –130.5 | 2.968 | 64.3 | 0.156 | 53.5 | 0.372 | –85.3 |
| 2.3 | 0.226 | –135.7 | 2.870 | 61.3 | 0.162 | 53.8 | 0.362 | –88.2 |
| 2.4 | 0.222 | –142.6 | 2.789 | 58.5 | 0.168 | 54.0 | 0.352 | –91.4 |
| 2.5 | 0.220 | –147.1 | 2.697 | 56.0 | 0.175 | 54.3 | 0.342 | –94.8 |
| 2.6 | 0.222 | –153.0 | 2.623 | 53.2 | 0.181 | 54.4 | 0.336 | –98.5 |
| 2.7 | 0.223 | –157.6 | 2.550 | 51.0 | 0.188 | 54.5 | 0.330 | –102.4 |
| 2.8 | 0.223 | –162.9 | 2.479 | 48.4 | 0.195 | 54.5 | 0.325 | –105.9 |
| 2.9 | 0.222 | –167.8 | 2.413 | 46.1 | 0.203 | 54.1 | 0.320 | –109.3 |
| 3.0 | 0.222 | –174.9 | 2.346 | 43.7 | 0.212 | 53.9 | 0.312 | –113.6 |
| 4.0 | 0.368 | 145.6 | 1.857 | 19.1 | 0.313 | 46.2 | 0.360 | –163.4 |
| 5.0 | 0.555 | 120.0 | 1.397 | –4.2 | 0.400 | 32.4 | 0.508 | 156.2 |
| 6.0 | 0.650 | 104.4 | 1.108 | –17.0 | 0.450 | 18.5 | 0.634 | 130.5 |
| 7.0 | 0.727 | 90.2 | 0.867 | –31.9 | 0.482 | 5.8 | 0.730 | 111.4 |
| 8.0 | 0.783 | 84.9 | 0.725 | –32.4 | 0.499 | –2.4 | 0.778 | 98.3 |

$V_{CE}$ = 1 V, $I_C$ = 5 mA, $Z_O$ = 50 Ω

| Frequency | $S_{11}$ | | $S_{21}$ | | $S_{12}$ | | $S_{22}$ | |
|---|---|---|---|---|---|---|---|---|
| GHz | MAG. | ANG. | MAG. | ANG. | MAG. | ANG. | MAG. | ANG. |
| 0.1 | 0.822 | –12.2 | 12.268 | 167.4 | 0.016 | 83.6 | 0.970 | –8.8 |
| 0.2 | 0.793 | –21.9 | 11.711 | 156.4 | 0.030 | 76.8 | 0.933 | –17.5 |
| 0.3 | 0.738 | –31.8 | 10.871 | 146.2 | 0.043 | 71.4 | 0.878 | –25.2 |
| 0.4 | 0.678 | –39.8 | 10.101 | 136.6 | 0.054 | 67.3 | 0.816 | –32.0 |
| 0.5 | 0.614 | –48.4 | 9.228 | 128.3 | 0.062 | 64.0 | 0.753 | –37.6 |
| 0.6 | 0.553 | –54.5 | 8.389 | 121.1 | 0.070 | 61.5 | 0.692 | –42.4 |
| 0.7 | 0.501 | –60.3 | 7.694 | 115.3 | 0.077 | 59.8 | 0.637 | –46.3 |
| 0.8 | 0.449 | –65.5 | 7.051 | 110.0 | 0.083 | 58.9 | 0.592 | –49.7 |
| 0.9 | 0.409 | –70.1 | 6.534 | 104.8 | 0.089 | 58.1 | 0.552 | –52.7 |
| 1.0 | 0.369 | –75.3 | 6.062 | 100.4 | 0.094 | 57.9 | 0.516 | –55.3 |
| 1.1 | 0.340 | –79.2 | 5.677 | 96.3 | 0.100 | 57.6 | 0.486 | –57.8 |
| 1.2 | 0.312 | –83.2 | 5.310 | 92.4 | 0.105 | 57.5 | 0.460 | –60.0 |
| 1.3 | 0.285 | –88.5 | 4.979 | 88.7 | 0.110 | 57.4 | 0.435 | –62.1 |
| 1.4 | 0.261 | –92.3 | 4.694 | 85.3 | 0.116 | 57.4 | 0.413 | –64.5 |
| 1.5 | 0.241 | –97.8 | 4.421 | 82.2 | 0.122 | 57.4 | 0.396 | –66.6 |
| 1.6 | 0.223 | –101.6 | 4.224 | 79.1 | 0.128 | 57.5 | 0.379 | –68.8 |
| 1.7 | 0.210 | –107.6 | 4.011 | 76.1 | 0.134 | 57.6 | 0.364 | –70.9 |
| 1.8 | 0.187 | –113.6 | 3.825 | 73.3 | 0.140 | 57.6 | 0.350 | –73.1 |
| 1.9 | 0.180 | –119.9 | 3.653 | 70.4 | 0.147 | 57.2 | 0.337 | –75.5 |
| 2.0 | 0.170 | –127.5 | 3.513 | 67.5 | 0.154 | 57.3 | 0.326 | –78.1 |
| 2.1 | 0.167 | –134.5 | 3.392 | 65.1 | 0.160 | 57.4 | 0.315 | –80.6 |
| 2.2 | 0.162 | –140.7 | 3.255 | 62.8 | 0.167 | 57.1 | 0.306 | –83.5 |
| 2.3 | 0.160 | –146.2 | 3.142 | 59.9 | 0.174 | 57.0 | 0.298 | –86.4 |
| 2.4 | 0.163 | –154.2 | 3.041 | 57.4 | 0.182 | 56.7 | 0.289 | –89.7 |
| 2.5 | 0.165 | –158.4 | 2.938 | 55.2 | 0.189 | 56.2 | 0.280 | –93.3 |
| 2.6 | 0.167 | –163.3 | 2.853 | 52.7 | 0.197 | 55.8 | 0.275 | –97.1 |
| 2.7 | 0.174 | –169.0 | 2.774 | 50.6 | 0.204 | 55.4 | 0.269 | –101.3 |
| 2.8 | 0.175 | –173.8 | 2.687 | 48.2 | 0.212 | 54.8 | 0.265 | –105.0 |
| 2.9 | 0.178 | –179.0 | 2.616 | 46.0 | 0.220 | 54.1 | 0.259 | –108.6 |
| 3.0 | 0.182 | 173.3 | 2.548 | 43.9 | 0.229 | 53.6 | 0.253 | –113.3 |
| 4.0 | 0.339 | 139.7 | 2.015 | 21.3 | 0.321 | 43.7 | 0.301 | –166.8 |
| 5.0 | 0.530 | 117.8 | 1.546 | –0.8 | 0.398 | 30.5 | 0.451 | 154.0 |
| 6.0 | 0.623 | 103.9 | 1.261 | –14.3 | 0.443 | 17.7 | 0.585 | 130.4 |
| 7.0 | 0.713 | 90.6 | 0.996 | –30.5 | 0.476 | 5.6 | 0.693 | 112.1 |
| 8.0 | 0.772 | 85.2 | 0.828 | –33.0 | 0.495 | –2.3 | 0.752 | 99.3 |

$V_{CE}$ = 1 V, $I_C$ = 10 mA, $Z_O$ = 50 Ω

| Frequency | $S_{11}$ | | $S_{21}$ | | $S_{12}$ | | $S_{22}$ | |
|---|---|---|---|---|---|---|---|---|
| GHz | MAG. | ANG. | MAG. | ANG. | MAG. | ANG. | MAG. | ANG. |
| 0.1 | 0.713 | –15.2 | 17.973 | 163.5 | 0.015 | 79.6 | 0.941 | –11.7 |
| 0.2 | 0.665 | –27.6 | 16.464 | 149.4 | 0.028 | 75.9 | 0.874 | –22.5 |
| 0.3 | 0.590 | –39.3 | 14.609 | 137.6 | 0.039 | 70.4 | 0.790 | –31.0 |
| 0.4 | 0.516 | –48.3 | 12.962 | 127.4 | 0.048 | 67.6 | 0.707 | –37.7 |
| 0.5 | 0.450 | –56.4 | 11.391 | 119.2 | 0.056 | 65.8 | 0.634 | –42.5 |
| 0.6 | 0.396 | –62.4 | 10.059 | 112.5 | 0.063 | 64.6 | 0.570 | –46.3 |
| 0.7 | 0.344 | –67.3 | 9.028 | 107.0 | 0.070 | 63.9 | 0.518 | –49.3 |
| 0.8 | 0.305 | –72.4 | 8.118 | 102.4 | 0.076 | 64.0 | 0.477 | –51.6 |
| 0.9 | 0.274 | –75.5 | 7.409 | 98.0 | 0.083 | 63.8 | 0.443 | –53.7 |
| 1.0 | 0.240 | –80.3 | 6.827 | 93.8 | 0.090 | 63.7 | 0.415 | –55.6 |
| 1.1 | 0.217 | –85.0 | 6.284 | 90.5 | 0.097 | 63.7 | 0.390 | –57.4 |
| 1.2 | 0.196 | –89.3 | 5.825 | 87.0 | 0.103 | 63.6 | 0.370 | –59.3 |
| 1.3 | 0.178 | –94.2 | 5.460 | 84.1 | 0.111 | 63.4 | 0.352 | –61.0 |
| 1.4 | 0.161 | –99.1 | 5.126 | 81.1 | 0.118 | 63.2 | 0.334 | –62.9 |
| 1.5 | 0.142 | –103.8 | 4.814 | 78.4 | 0.125 | 62.9 | 0.320 | –64.9 |
| 1.6 | 0.133 | –111.6 | 4.564 | 75.5 | 0.132 | 62.5 | 0.307 | –66.7 |
| 1.7 | 0.126 | –117.2 | 4.309 | 72.9 | 0.140 | 62.2 | 0.294 | –68.7 |
| 1.8 | 0.116 | –125.8 | 4.113 | 70.3 | 0.147 | 61.8 | 0.283 | –70.9 |
| 1.9 | 0.108 | –133.8 | 3.910 | 67.7 | 0.155 | 61.1 | 0.273 | –73.3 |
| 2.0 | 0.109 | –146.4 | 3.753 | 65.2 | 0.164 | 60.7 | 0.264 | –75.9 |
| 2.1 | 0.113 | –153.9 | 3.622 | 63.0 | 0.171 | 60.2 | 0.255 | –78.5 |
| 2.2 | 0.116 | –159.5 | 3.470 | 61.0 | 0.179 | 59.6 | 0.247 | –81.6 |
| 2.3 | 0.119 | –165.8 | 3.340 | 58.5 | 0.187 | 58.9 | 0.240 | –84.7 |
| 2.4 | 0.125 | –174.4 | 3.235 | 56.2 | 0.195 | 58.2 | 0.233 | –88.4 |
| 2.5 | 0.130 | –178.7 | 3.121 | 54.1 | 0.203 | 57.4 | 0.224 | –92.3 |
| 2.6 | 0.130 | 178.9 | 3.021 | 51.7 | 0.211 | 56.5 | 0.220 | –96.6 |
| 2.7 | 0.143 | 173.4 | 2.937 | 49.9 | 0.219 | 55.8 | 0.214 | –101.2 |
| 2.8 | 0.147 | 168.0 | 2.838 | 47.7 | 0.227 | 54.9 | 0.210 | –105.4 |
| 2.9 | 0.155 | 163.6 | 2.765 | 45.7 | 0.236 | 53.9 | 0.206 | –109.7 |
| 3.0 | 0.167 | 157.7 | 2.692 | 43.6 | 0.244 | 53.1 | 0.199 | –114.8 |
| 4.0 | 0.326 | 133.2 | 2.119 | 22.8 | 0.331 | 41.4 | 0.258 | –173.7 |
| 5.0 | 0.517 | 114.3 | 1.644 | 2.6 | 0.399 | 28.5 | 0.409 | 149.4 |
| 6.0 | 0.604 | 101.6 | 1.370 | –11.2 | 0.439 | 16.5 | 0.542 | 128.4 |
| 7.0 | 0.693 | 90.0 | 1.111 | –27.6 | 0.470 | 5.0 | 0.656 | 111.8 |
| 8.0 | 0.761 | 84.9 | 0.933 | –31.4 | 0.490 | –2.6 | 0.720 | 99.6 |

$V_{CE}$ = 1 V, $I_C$ = 20 mA, $Z_O$ = 50 Ω

| Frequency | $S_{11}$ | | $S_{21}$ | | $S_{12}$ | | $S_{22}$ | |
|---|---|---|---|---|---|---|---|---|
| GHz | MAG. | ANG. | MAG. | ANG. | MAG. | ANG. | MAG. | ANG. |
| 0.1 | 0.590 | –20.1 | 22.646 | 159.4 | 0.014 | 78.6 | 0.896 | –14.5 |
| 0.2 | 0.520 | –36.7 | 19.825 | 142.8 | 0.027 | 73.1 | 0.800 | –26.9 |
| 0.3 | 0.449 | –48.4 | 16.765 | 130.2 | 0.036 | 70.2 | 0.695 | –35.6 |
| 0.4 | 0.368 | –57.6 | 14.343 | 120.0 | 0.045 | 69.1 | 0.604 | –41.6 |
| 0.5 | 0.315 | –66.1 | 12.288 | 112.3 | 0.053 | 68.0 | 0.532 | –45.5 |
| 0.6 | 0.266 | –72.7 | 10.655 | 106.2 | 0.060 | 67.7 | 0.474 | –48.2 |
| 0.7 | 0.227 | –77.9 | 9.401 | 101.3 | 0.068 | 67.7 | 0.429 | –50.3 |
| 0.8 | 0.200 | –83.4 | 8.399 | 97.0 | 0.075 | 67.6 | 0.395 | –52.1 |
| 0.9 | 0.176 | –88.5 | 7.589 | 93.0 | 0.083 | 67.4 | 0.368 | –53.6 |
| 1.0 | 0.151 | –95.5 | 6.951 | 89.2 | 0.090 | 67.6 | 0.345 | –55.1 |
| 1.1 | 0.137 | –100.2 | 6.387 | 86.3 | 0.098 | 67.3 | 0.326 | –56.7 |
| 1.2 | 0.125 | –106.8 | 5.910 | 83.0 | 0.105 | 66.9 | 0.309 | –58.3 |
| 1.3 | 0.111 | –114.9 | 5.511 | 80.3 | 0.113 | 66.5 | 0.295 | –60.0 |
| 1.4 | 0.103 | –122.8 | 5.153 | 77.7 | 0.121 | 66.1 | 0.281 | –61.9 |
| 1.5 | 0.096 | –132.1 | 4.837 | 75.1 | 0.130 | 65.4 | 0.269 | –63.9 |
| 1.6 | 0.091 | –140.1 | 4.572 | 72.5 | 0.138 | 64.8 | 0.259 | –65.9 |
| 1.7 | 0.090 | –149.9 | 4.325 | 69.9 | 0.146 | 64.3 | 0.249 | –68.0 |
| 1.8 | 0.093 | –159.3 | 4.111 | 67.7 | 0.154 | 63.5 | 0.238 | –70.3 |
| 1.9 | 0.100 | –170.5 | 3.914 | 65.3 | 0.163 | 62.5 | 0.230 | –73.1 |
| 2.0 | 0.103 | –178.2 | 3.752 | 62.8 | 0.172 | 62.0 | 0.223 | –76.0 |
| 2.1 | 0.116 | 175.8 | 3.605 | 60.8 | 0.180 | 61.3 | 0.215 | –78.9 |
| 2.2 | 0.124 | 170.2 | 3.452 | 58.8 | 0.188 | 60.4 | 0.208 | –82.4 |
| 2.3 | 0.128 | 168.6 | 3.317 | 56.3 | 0.197 | 59.5 | 0.202 | –85.9 |
| 2.4 | 0.142 | 163.0 | 3.207 | 54.1 | 0.205 | 58.6 | 0.195 | –90.0 |
| 2.5 | 0.149 | 160.5 | 3.097 | 52.2 | 0.213 | 57.6 | 0.188 | –94.7 |
| 2.6 | 0.154 | 158.1 | 3.000 | 49.9 | 0.222 | 56.5 | 0.184 | –99.6 |
| 2.7 | 0.167 | 153.3 | 2.907 | 48.0 | 0.230 | 55.7 | 0.180 | –105.1 |
| 2.8 | 0.173 | 150.1 | 2.811 | 46.0 | 0.239 | 54.6 | 0.176 | –109.9 |
| 2.9 | 0.181 | 148.7 | 2.739 | 44.0 | 0.247 | 53.4 | 0.174 | –115.1 |
| 3.0 | 0.195 | 143.4 | 2.663 | 42.2 | 0.256 | 52.4 | 0.169 | –121.0 |
| 4.0 | 0.358 | 126.6 | 2.084 | 22.2 | 0.341 | 39.7 | 0.246 | 178.0 |
| 5.0 | 0.535 | 109.9 | 1.617 | 2.5 | 0.403 | 26.8 | 0.402 | 144.3 |
| 6.0 | 0.619 | 98.8 | 1.361 | –10.5 | 0.439 | 15.0 | 0.531 | 125.1 |
| 7.0 | 0.701 | 87.9 | 1.109 | –26.4 | 0.468 | 3.9 | 0.642 | 109.8 |
| 8.0 | 0.766 | 83.5 | 0.947 | –30.7 | 0.487 | –3.4 | 0.705 | 98.5 |

$V_{CE}$ = 2 V, $I_C$ = 3 mA, $Z_O$ = 50 Ω

| Frequency | $S_{11}$ | | $S_{21}$ | | $S_{12}$ | | $S_{22}$ | |
|---|---|---|---|---|---|---|---|---|
| GHz | MAG. | ANG. | MAG. | ANG. | MAG. | ANG. | MAG. | ANG. |
| 0.1 | 0.886 | –6.4 | 8.436 | 170.4 | 0.014 | 87.5 | 0.990 | –6.2 |
| 0.2 | 0.883 | –15.8 | 8.211 | 162.2 | 0.028 | 79.9 | 0.971 | –12.6 |
| 0.3 | 0.845 | –23.2 | 7.874 | 153.9 | 0.041 | 74.7 | 0.941 | –18.7 |
| 0.4 | 0.813 | –30.4 | 7.565 | 145.7 | 0.052 | 69.8 | 0.904 | –24.5 |
| 0.5 | 0.764 | –37.7 | 7.158 | 138.1 | 0.062 | 66.4 | 0.862 | –29.7 |
| 0.6 | 0.710 | –43.6 | 6.717 | 131.1 | 0.071 | 62.8 | 0.815 | –34.5 |
| 0.7 | 0.661 | –48.9 | 6.316 | 125.2 | 0.078 | 60.4 | 0.770 | –38.8 |
| 0.8 | 0.612 | –54.2 | 5.947 | 119.8 | 0.084 | 58.4 | 0.728 | –42.5 |
| 0.9 | 0.569 | –58.6 | 5.608 | 114.3 | 0.089 | 56.8 | 0.690 | –45.9 |
| 1.0 | 0.525 | –63.2 | 5.317 | 109.5 | 0.094 | 55.8 | 0.653 | –49.0 |
| 1.1 | 0.493 | –67.4 | 5.051 | 105.0 | 0.098 | 55.1 | 0.620 | –51.9 |
| 1.2 | 0.459 | –71.7 | 4.783 | 100.7 | 0.102 | 54.4 | 0.591 | –54.4 |
| 1.3 | 0.426 | –75.7 | 4.548 | 96.7 | 0.106 | 54.1 | 0.564 | –57.0 |
| 1.4 | 0.397 | –80.0 | 4.320 | 93.0 | 0.110 | 53.9 | 0.539 | –59.5 |
| 1.5 | 0.371 | –83.3 | 4.121 | 89.1 | 0.114 | 54.0 | 0.517 | –61.8 |
| 1.6 | 0.346 | –87.6 | 3.942 | 85.6 | 0.118 | 54.3 | 0.497 | –64.1 |
| 1.7 | 0.322 | –91.8 | 3.768 | 82.1 | 0.123 | 54.6 | 0.479 | –66.3 |
| 1.8 | 0.298 | –96.1 | 3.613 | 78.8 | 0.127 | 55.0 | 0.462 | –68.4 |
| 1.9 | 0.284 | –100.7 | 3.464 | 75.7 | 0.132 | 55.2 | 0.448 | –70.8 |
| 2.0 | 0.269 | –105.5 | 3.346 | 72.7 | 0.137 | 55.7 | 0.434 | –73.2 |
| 2.1 | 0.253 | –111.4 | 3.249 | 69.8 | 0.142 | 56.5 | 0.421 | –75.5 |
| 2.2 | 0.238 | –116.0 | 3.125 | 67.1 | 0.147 | 57.0 | 0.411 | –78.2 |
| 2.3 | 0.235 | –120.6 | 3.025 | 64.2 | 0.153 | 57.5 | 0.401 | –80.8 |
| 2.4 | 0.228 | –126.8 | 2.945 | 61.3 | 0.160 | 57.7 | 0.391 | –83.6 |
| 2.5 | 0.223 | –131.9 | 2.848 | 59.0 | 0.166 | 57.9 | 0.381 | –86.6 |
| 2.6 | 0.219 | –136.6 | 2.779 | 56.2 | 0.173 | 58.3 | 0.373 | –90.0 |
| 2.7 | 0.215 | –142.1 | 2.705 | 53.8 | 0.180 | 58.4 | 0.366 | –93.4 |
| 2.8 | 0.213 | –146.7 | 2.617 | 51.3 | 0.187 | 58.4 | 0.361 | –96.5 |
| 2.9 | 0.204 | –152.4 | 2.551 | 49.1 | 0.195 | 58.1 | 0.353 | –99.5 |
| 3.0 | 0.206 | –159.8 | 2.479 | 46.6 | 0.204 | 58.0 | 0.345 | –103.5 |
| 4.0 | 0.336 | 154.4 | 1.989 | 21.4 | 0.311 | 50.3 | 0.373 | –152.1 |
| 5.0 | 0.537 | 125.2 | 1.515 | –2.8 | 0.407 | 35.7 | 0.511 | 164.0 |
| 6.0 | 0.635 | 107.6 | 1.195 | –16.8 | 0.462 | 20.7 | 0.641 | 135.3 |
| 7.0 | 0.726 | 92.4 | 0.924 | –32.2 | 0.494 | 7.2 | 0.736 | 114.4 |
| 8.0 | 0.783 | 86.4 | 0.759 | –33.1 | 0.509 | –1.6 | 0.783 | 100.3 |

$V_{CE}$ = 2 V, $I_C$ = 5 mA, $Z_O$ = 50 Ω

| Frequency | $S_{11}$ | | $S_{21}$ | | $S_{12}$ | | $S_{22}$ | |
|---|---|---|---|---|---|---|---|---|
| GHz | MAG. | ANG. | MAG. | ANG. | MAG. | ANG. | MAG. | ANG. |
| 0.1 | 0.845 | –9.9 | 11.956 | 168.4 | 0.014 | 86.8 | 0.978 | –7.7 |
| 0.2 | 0.821 | –19.3 | 11.451 | 158.1 | 0.027 | 79.0 | 0.947 | –15.3 |
| 0.3 | 0.769 | –27.8 | 10.734 | 148.4 | 0.039 | 73.5 | 0.901 | –22.3 |
| 0.4 | 0.712 | –35.8 | 10.039 | 139.3 | 0.049 | 69.2 | 0.846 | –28.4 |
| 0.5 | 0.654 | –43.2 | 9.282 | 131.4 | 0.057 | 66.3 | 0.789 | –33.6 |
| 0.6 | 0.596 | –48.8 | 8.499 | 124.2 | 0.065 | 63.6 | 0.734 | –38.0 |
| 0.7 | 0.539 | –53.8 | 7.844 | 118.2 | 0.071 | 62.1 | 0.682 | –41.8 |
| 0.8 | 0.492 | –58.6 | 7.217 | 113.2 | 0.077 | 60.9 | 0.637 | –45.0 |
| 0.9 | 0.450 | –62.4 | 6.715 | 107.9 | 0.083 | 60.4 | 0.600 | –47.6 |
| 1.0 | 0.409 | –66.4 | 6.309 | 103.5 | 0.088 | 59.9 | 0.564 | –50.1 |
| 1.1 | 0.378 | –70.4 | 5.886 | 99.4 | 0.093 | 59.7 | 0.533 | –52.4 |
| 1.2 | 0.347 | –73.8 | 5.532 | 95.4 | 0.098 | 59.5 | 0.507 | –54.5 |
| 1.3 | 0.322 | –77.2 | 5.212 | 91.8 | 0.103 | 59.5 | 0.484 | –56.6 |
| 1.4 | 0.295 | –80.9 | 4.914 | 88.4 | 0.109 | 59.5 | 0.461 | –58.6 |
| 1.5 | 0.272 | –84.3 | 4.645 | 85.0 | 0.114 | 59.6 | 0.443 | –60.5 |
| 1.6 | 0.254 | –87.4 | 4.437 | 81.8 | 0.120 | 59.7 | 0.426 | –62.3 |
| 1.7 | 0.233 | –91.3 | 4.220 | 79.0 | 0.126 | 59.9 | 0.411 | –64.2 |
| 1.8 | 0.212 | –96.3 | 4.028 | 76.0 | 0.131 | 60.0 | 0.397 | –66.2 |
| 1.9 | 0.200 | –100.3 | 3.851 | 73.2 | 0.138 | 59.9 | 0.384 | –68.2 |
| 2.0 | 0.183 | –106.4 | 3.710 | 70.5 | 0.145 | 60.0 | 0.373 | –70.4 |
| 2.1 | 0.177 | –113.6 | 3.579 | 67.9 | 0.151 | 60.2 | 0.361 | –72.5 |
| 2.2 | 0.168 | –118.9 | 3.441 | 65.6 | 0.158 | 60.1 | 0.352 | –75.2 |
| 2.3 | 0.163 | –121.6 | 3.319 | 62.9 | 0.165 | 59.9 | 0.344 | –77.6 |
| 2.4 | 0.160 | –130.8 | 3.222 | 60.4 | 0.172 | 59.7 | 0.335 | –80.3 |
| 2.5 | 0.156 | –137.4 | 3.120 | 58.1 | 0.179 | 59.4 | 0.324 | –83.4 |
| 2.6 | 0.157 | –140.2 | 3.031 | 55.8 | 0.187 | 59.2 | 0.319 | –86.8 |
| 2.7 | 0.158 | –146.1 | 2.945 | 53.5 | 0.194 | 58.7 | 0.312 | –90.3 |
| 2.8 | 0.154 | –153.9 | 2.861 | 51.3 | 0.202 | 58.3 | 0.306 | –93.3 |
| 2.9 | 0.151 | –158.8 | 2.781 | 49.1 | 0.210 | 57.6 | 0.299 | –96.5 |
| 3.0 | 0.156 | –167.1 | 2.705 | 46.8 | 0.219 | 57.1 | 0.290 | –100.5 |
| 4.0 | 0.297 | 149.1 | 2.171 | 24.0 | 0.316 | 47.7 | 0.312 | –152.1 |
| 5.0 | 0.504 | 123.2 | 1.700 | 1.0 | 0.401 | 34.0 | 0.448 | 163.8 |
| 6.0 | 0.605 | 107.5 | 1.371 | –13.7 | 0.453 | 20.3 | 0.587 | 136.6 |
| 7.0 | 0.704 | 93.5 | 1.082 | –30.8 | 0.488 | 7.3 | 0.701 | 116.1 |
| 8.0 | 0.767 | 87.3 | 0.877 | –33.9 | 0.506 | –1.2 | 0.760 | 102.0 |

$V_{CE}$ = 2 V, $I_C$ = 10 mA, $Z_O$ = 50 Ω

| Frequency | $S_{11}$ | | $S_{21}$ | | $S_{12}$ | | $S_{22}$ | |
|---|---|---|---|---|---|---|---|---|
| GHz | MAG. | ANG. | MAG. | ANG. | MAG. | ANG. | MAG. | ANG. |
| 0.1 | 0.762 | –11.8 | 17.382 | 164.7 | 0.013 | 83.6 | 0.957 | –9.8 |
| 0.2 | 0.699 | –23.5 | 16.175 | 151.8 | 0.025 | 77.0 | 0.901 | –19.2 |
| 0.3 | 0.642 | –33.8 | 14.561 | 140.7 | 0.036 | 72.8 | 0.829 | –26.9 |
| 0.4 | 0.568 | –41.1 | 13.085 | 130.8 | 0.045 | 70.0 | 0.755 | –33.0 |
| 0.5 | 0.506 | –48.7 | 11.657 | 122.8 | 0.052 | 67.7 | 0.686 | –37.5 |
| 0.6 | 0.443 | –54.0 | 10.377 | 115.9 | 0.059 | 66.4 | 0.626 | –41.0 |
| 0.7 | 0.395 | –57.7 | 9.349 | 110.3 | 0.065 | 65.9 | 0.575 | –43.8 |
| 0.8 | 0.353 | –61.5 | 8.473 | 105.6 | 0.071 | 65.6 | 0.534 | –46.0 |
| 0.9 | 0.318 | –64.4 | 7.777 | 101.0 | 0.078 | 65.3 | 0.500 | –47.9 |
| 1.0 | 0.281 | –67.8 | 7.175 | 97.0 | 0.084 | 65.4 | 0.472 | –49.5 |
| 1.1 | 0.260 | –70.2 | 6.642 | 93.5 | 0.090 | 65.4 | 0.446 | –51.2 |
| 1.2 | 0.238 | –72.8 | 6.188 | 90.0 | 0.096 | 65.2 | 0.425 | –52.7 |
| 1.3 | 0.216 | –76.0 | 5.782 | 87.1 | 0.103 | 65.2 | 0.406 | –54.2 |
| 1.4 | 0.198 | –79.4 | 5.435 | 84.0 | 0.110 | 65.0 | 0.389 | –55.8 |
| 1.5 | 0.185 | –82.1 | 5.108 | 81.0 | 0.117 | 64.8 | 0.375 | –57.4 |
| 1.6 | 0.162 | –86.0 | 4.833 | 78.4 | 0.124 | 64.6 | 0.362 | –59.0 |
| 1.7 | 0.151 | –89.0 | 4.602 | 76.0 | 0.131 | 64.4 | 0.349 | –60.7 |
| 1.8 | 0.134 | –94.9 | 4.366 | 73.3 | 0.138 | 64.1 | 0.337 | –62.4 |
| 1.9 | 0.125 | –99.8 | 4.178 | 70.7 | 0.145 | 63.5 | 0.328 | –64.5 |
| 2.0 | 0.113 | –107.9 | 4.019 | 68.2 | 0.153 | 63.2 | 0.318 | –66.5 |
| 2.1 | 0.107 | –115.6 | 3.867 | 66.0 | 0.160 | 62.9 | 0.308 | –68.5 |
| 2.2 | 0.102 | –124.5 | 3.703 | 63.9 | 0.168 | 62.3 | 0.301 | –71.1 |
| 2.3 | 0.096 | –127.9 | 3.580 | 61.5 | 0.176 | 61.7 | 0.293 | –73.6 |
| 2.4 | 0.098 | –140.3 | 3.460 | 59.2 | 0.184 | 61.1 | 0.285 | –76.4 |
| 2.5 | 0.101 | –146.5 | 3.354 | 57.1 | 0.191 | 60.5 | 0.275 | –79.6 |
| 2.6 | 0.103 | –150.5 | 3.249 | 54.8 | 0.199 | 59.7 | 0.270 | –83.0 |
| 2.7 | 0.104 | –157.8 | 3.153 | 53.1 | 0.207 | 59.0 | 0.263 | –86.7 |
| 2.8 | 0.108 | –163.4 | 3.057 | 51.0 | 0.215 | 58.1 | 0.257 | –90.0 |
| 2.9 | 0.105 | –170.7 | 2.971 | 48.9 | 0.223 | 57.2 | 0.250 | –93.0 |
| 3.0 | 0.114 | 178.3 | 2.892 | 47.0 | 0.232 | 56.5 | 0.241 | –97.4 |
| 4.0 | 0.274 | 142.9 | 2.318 | 26.0 | 0.323 | 45.6 | 0.259 | –154.0 |
| 5.0 | 0.476 | 120.6 | 1.831 | 4.8 | 0.399 | 32.4 | 0.393 | 161.6 |
| 6.0 | 0.578 | 106.2 | 1.513 | –10.0 | 0.446 | 19.4 | 0.535 | 136.1 |
| 7.0 | 0.682 | 93.7 | 1.225 | –27.4 | 0.481 | 7.1 | 0.658 | 116.8 |
| 8.0 | 0.752 | 87.4 | 1.012 | –32.6 | 0.501 | –1.1 | 0.726 | 103.2 |

$V_{CE}$ = 2 V, $I_C$ = 20 mA, $Z_O$ = 50 Ω

| Frequency | $S_{11}$ | | $S_{21}$ | | $S_{12}$ | | $S_{22}$ | |
|---|---|---|---|---|---|---|---|---|
| GHz | MAG. | ANG. | MAG. | ANG. | MAG. | ANG. | MAG. | ANG. |
| 0.1 | 0.660 | –16.7 | 21.907 | 161.6 | 0.012 | 80.0 | 0.931 | –11.7 |
| 0.2 | 0.585 | –28.5 | 19.701 | 146.5 | 0.024 | 76.1 | 0.852 | –22.2 |
| 0.3 | 0.505 | –39.1 | 17.100 | 134.4 | 0.033 | 73.2 | 0.761 | –30.0 |
| 0.4 | 0.444 | –46.6 | 14.863 | 124.2 | 0.041 | 70.8 | 0.678 | –35.3 |
| 0.5 | 0.381 | –53.2 | 12.907 | 116.5 | 0.048 | 70.0 | 0.607 | –38.9 |
| 0.6 | 0.328 | –57.1 | 11.320 | 110.0 | 0.055 | 69.3 | 0.551 | –41.6 |
| 0.7 | 0.287 | –60.5 | 10.052 | 105.0 | 0.062 | 69.3 | 0.505 | –43.4 |
| 0.8 | 0.255 | –63.8 | 9.004 | 100.7 | 0.069 | 69.3 | 0.470 | –44.9 |
| 0.9 | 0.228 | –66.4 | 8.170 | 96.5 | 0.076 | 69.2 | 0.442 | –46.2 |
| 1.0 | 0.202 | –69.7 | 7.508 | 93.0 | 0.083 | 69.1 | 0.419 | –47.4 |
| 1.1 | 0.181 | –72.3 | 6.927 | 89.8 | 0.090 | 69.0 | 0.399 | –48.7 |
| 1.2 | 0.161 | –74.2 | 6.421 | 86.5 | 0.097 | 68.8 | 0.382 | –50.0 |
| 1.3 | 0.148 | –77.6 | 5.974 | 83.8 | 0.104 | 68.4 | 0.367 | –51.3 |
| 1.4 | 0.135 | –82.0 | 5.611 | 81.0 | 0.111 | 68.0 | 0.352 | –52.8 |
| 1.5 | 0.117 | –83.8 | 5.262 | 78.5 | 0.119 | 67.6 | 0.341 | –54.4 |
| 1.6 | 0.106 | –87.9 | 4.994 | 75.9 | 0.126 | 67.2 | 0.330 | –55.9 |
| 1.7 | 0.098 | –94.4 | 4.720 | 73.7 | 0.134 | 66.7 | 0.320 | –57.4 |
| 1.8 | 0.085 | –101.7 | 4.482 | 71.2 | 0.142 | 66.2 | 0.309 | –59.2 |
| 1.9 | 0.074 | –108.3 | 4.274 | 68.8 | 0.150 | 65.4 | 0.301 | –61.2 |
| 2.0 | 0.070 | –118.5 | 4.102 | 66.4 | 0.158 | 64.9 | 0.293 | –63.4 |
| 2.1 | 0.071 | –131.9 | 3.958 | 64.3 | 0.166 | 64.3 | 0.284 | –65.5 |
| 2.2 | 0.066 | –145.1 | 3.794 | 62.5 | 0.174 | 63.6 | 0.277 | –68.1 |
| 2.3 | 0.071 | –147.6 | 3.648 | 60.1 | 0.182 | 62.9 | 0.271 | –70.7 |
| 2.4 | 0.079 | –160.0 | 3.531 | 58.0 | 0.190 | 62.0 | 0.263 | –73.6 |
| 2.5 | 0.079 | –168.3 | 3.406 | 56.0 | 0.198 | 61.1 | 0.253 | –76.9 |
| 2.6 | 0.087 | –169.9 | 3.301 | 53.8 | 0.207 | 60.2 | 0.248 | –80.5 |
| 2.7 | 0.094 | –176.2 | 3.212 | 52.2 | 0.215 | 59.4 | 0.241 | –84.3 |
| 2.8 | 0.098 | 176.4 | 3.110 | 50.1 | 0.223 | 58.4 | 0.235 | –87.7 |
| 2.9 | 0.102 | 170.7 | 3.024 | 48.1 | 0.231 | 57.4 | 0.228 | –91.3 |
| 3.0 | 0.111 | 161.5 | 2.945 | 46.0 | 0.240 | 56.5 | 0.219 | –95.6 |
| 4.0 | 0.279 | 137.1 | 2.345 | 26.1 | 0.329 | 44.7 | 0.238 | –155.9 |
| 5.0 | 0.484 | 117.4 | 1.854 | 5.5 | 0.402 | 31.3 | 0.375 | 159.4 |
| 6.0 | 0.577 | 104.4 | 1.555 | –8.8 | 0.446 | 18.6 | 0.515 | 135.1 |
| 7.0 | 0.684 | 92.6 | 1.265 | –26.0 | 0.480 | 6.6 | 0.641 | 116.5 |
| 8.0 | 0.757 | 86.6 | 1.058 | –31.5 | 0.499 | –1.5 | 0.709 | 103.3 |

## NOISE PARAMETERS

$V_{CE}$ = 2 V, $I_C$ = 3 mA

| Frequency | $NF_{min.}$ | $G_a$ | Γopt | | Rn/50 |
|---|---|---|---|---|---|
| (GHz) | (dB) | (dB) | MAG. | ANG. (deg.) | |
| 0.8 | 0.83 | 18.1 | 0.37 | 22.9 | 0.22 |
| 1.0 | 0.86 | 16.3 | 0.36 | 29.3 | 0.21 |
| 1.5 | 0.93 | 13.2 | 0.31 | 46.7 | 0.19 |
| 1.8 | 0.97 | 11.9 | 0.26 | 60.0 | 0.16 |
| 2.0 | 1.00 | 11.1 | 0.23 | 70.8 | 0.15 |
| 2.5 | 1.07 | 9.6 | 0.16 | 107.0 | 0.12 |

$V_{CE}$ = 2 V, $I_C$ = 5 mA

| Frequency | $NF_{min.}$ | $G_a$ | Γopt | | Rn/50 |
|---|---|---|---|---|---|
| (GHz) | (dB) | (dB) | MAG. | ANG. (deg.) | |
| 0.8 | 0.88 | 18.5 | 0.24 | 19.6 | 0.19 |
| 1.0 | 0.91 | 16.7 | 0.23 | 26.6 | 0.18 |
| 1.5 | 0.96 | 13.5 | 0.18 | 41.2 | 0.17 |
| 1.8 | 1.00 | 12.2 | 0.14 | 54.6 | 0.15 |
| 2.0 | 1.02 | 11.4 | 0.11 | 68.2 | 0.14 |
| 2.5 | 1.08 | 9.8 | 0.06 | 128.5 | 0.12 |

$V_{CE}$ = 2 V, $I_C$ = 7 mA

| Frequency | $NF_{min.}$ | $G_a$ | Γopt | | Rn/50 |
|---|---|---|---|---|---|
| (GHz) | (dB) | (dB) | MAG. | ANG. (deg.) | |
| 0.8 | 1.07 | 19.1 | 0.13 | 35.5 | 0.17 |
| 1.0 | 1.09 | 17.0 | 0.12 | 11.3 | 0.17 |
| 1.5 | 1.13 | 13.8 | 0.06 | 27.3 | 0.16 |
| 1.8 | 1.16 | 12.5 | 0.03 | 75.9 | 0.14 |
| 2.0 | 1.17 | 11.7 | 0.02 | 119.0 | 0.14 |
| 2.5 | 1.22 | 9.9 | 0.07 | –115.5 | 0.14 |

$V_{CE}$ = 2 V, $I_C$ = 10 mA

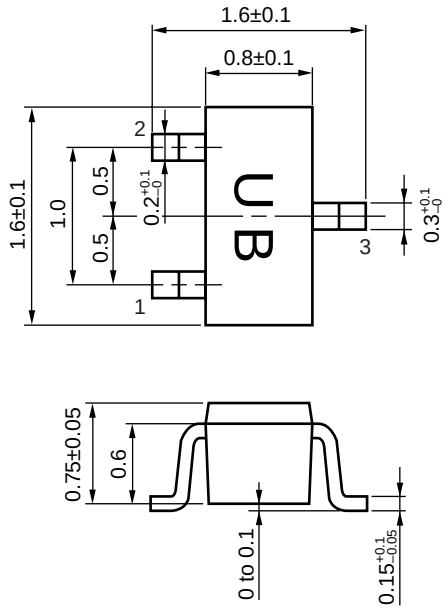
| Frequency (GHz) | $NF_{min.}$ (dB) | $G_a$ (dB) | Γopt | | Rn/50 |
|---|---|---|---|---|---|
| | | | MAG. | ANG. (deg.) | |
| 0.8 | 1.25 | 19.1 | 0.04 | –59.8 | 0.16 |
| 1.0 | 1.27 | 17.4 | 0.03 | 117.5 | 0.15 |
| 1.5 | 1.31 | 13.9 | 0.04 | –75.8 | 0.16 |
| 1.8 | 1.34 | 12.5 | 0.07 | –88.8 | 0.16 |
| 2.0 | 1.35 | 11.7 | 0.09 | –112.4 | 0.15 |
| 2.5 | 1.40 | 10.1 | 0.16 | –112.0 | 0.15 |

$V_{CE}$ = 2 V, $I_C$ = 20 mA

| Frequency (GHz) | $NF_{min.}$ (dB) | $G_a$ (dB) | Γopt | | Rn/50 |
|---|---|---|---|---|---|
| | | | MAG. | ANG. (deg.) | |
| 0.8 | 1.69 | 19.2 | 0.15 | –146.7 | 0.16 |
| 1.0 | 1.70 | 17.3 | 0.18 | –138.6 | 0.16 |
| 1.5 | 1.74 | 14.0 | 0.22 | –126.0 | 0.18 |
| 1.8 | 1.77 | 12.6 | 0.24 | –121.9 | 0.19 |
| 2.0 | 1.78 | 11.8 | 0.24 | –119.9 | 0.20 |
| 2.5 | 1.83 | 10.2 | 0.27 | –115.1 | 0.22 |

**PACKAGE DIMENSIONS**

**3 PIN ULTRA SUPER MINIMOLD (UNIT: mm)**




**PIN CONNECTIONS**

1. Emitter
2. Base
3. Collector

**[MEMO]**

**[MEMO]**

**[MEMO]**

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M8E 00.4