

DATA SHEET

NEC

NPN SILICON RF TRANSISTOR 2SC5603

NPN SILICON RF TRANSISTOR FLAT-LEAD 3-PIN THIN-TYPE ULTRA SUPER MINIMOLD

FEATURES

- High-gain transistor for buffer amplifier : $|S_{21e}|^2 = 10.0$ dB TYP. @ $V_{CE} = 1$ V, $I_c = 5$ mA, $f = 2$ GHz
- $f_T = 25$ GHz "UHS0" (Ultra High Speed Process) technology adopted
- Flat-lead 3-pin thin-type ultra super minimold package

ORDERING INFORMATION

| Part Number | Quantity | Supplying Form |
|-------------|-------------------|---|
| 2SC5603 | 50 pcs (Non reel) | • 8 mm wide embossed taping |
| 2SC5603-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} | 6 | V |
| Emitter to Base Voltage | V _{EBO} | 2 | V |
| Collector Current | I _c | 35 | mA |
| Total Power Dissipation | P _{tot} ^{Note} | 200 | mW |
| Junction Temperature | T _j | 150 | °C |
| Storage Temperature | T _{stg} | -65 to +150 | °C |

Note Mounted on 1.08 cm² × 1.0 mm (t) glass epoxy substrate

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

The information in this document is subject to change without notice. Before using this document, please confirm that this is the latest version.
Not all devices/types available in every country. Please check with local NEC representative for availability and additional information.

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 | – | – | 200 | nA |
| Emitter Cut-off Current | I _{EBO} | V _{BE} = 1 V, I _C = 0 mA | – | – | 200 | nA |
| DC Current Gain | h _{FE} ^{Note 1} | V _{CE} = 1 V, I _C = 5 mA | 60 | – | 120 | – |
| RF Characteristics | | | | | | |
| Gain Bandwidth Product | f _T | V _{CE} = 1 V, I _C = 5 mA, f = 2 GHz | 12.0 | 13.5 | – | GHz |
| Insertion Power Gain | S _{21e} ² | V _{CE} = 1 V, I _C = 5 mA, f = 2 GHz | 8.5 | 10.0 | – | dB |
| Noise Figure | NF | V _{CE} = 1 V, I _C = 5 mA, f = 2 GHz, Z _S = Z _{opt} | – | 1.3 | 2.5 | dB |
| Reverse Transfer Capacitance | C _{re} ^{Note 2} | V _{CB} = 1 V, I _E = 0 mA, f = 1 MHz | – | 0.25 | 0.5 | pF |

Notes 1. Pulse measurement: PW ≤ 350 μs, Duty Cycle ≤ 2%

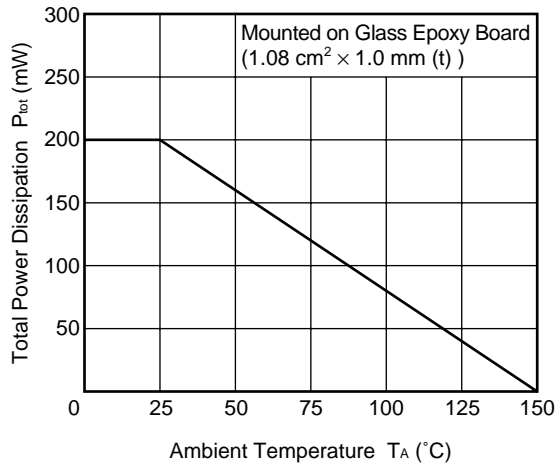
2. Collector to base capacitance measured using capacitance meter (self-balancing bridge method) when the emitter is connected to the guard pin

h_{FE} CLASSIFICATION

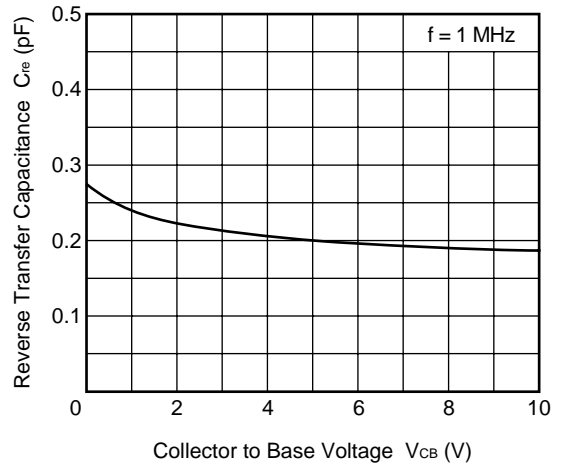
| | |
|-----------------------|-----------|
| Rank | FB |
| Marking | TW |
| h _{FE} Value | 60 to 120 |

TYPICAL CHARACTERISTICS (Unless otherwise specified, $T_A = +25^\circ\text{C}$)

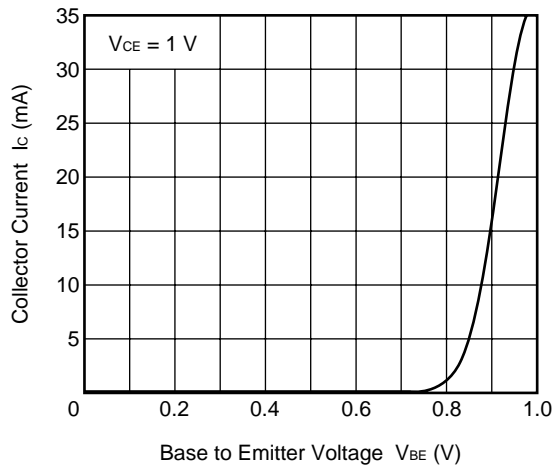
TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE



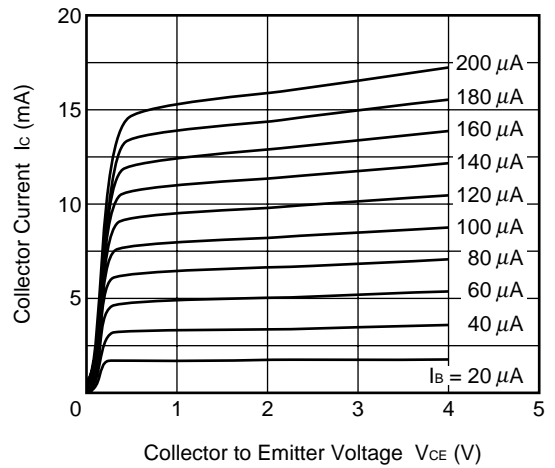
REVERSE TRANSFER CAPACITANCE vs. COLLECTOR TO BASE VOLTAGE



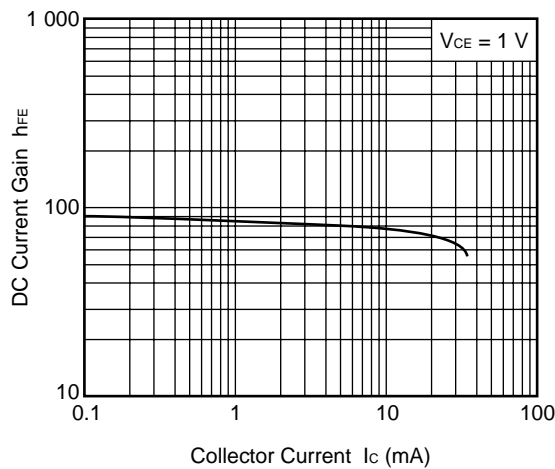
COLLECTOR CURRENT vs. BASE TO EMITTER VOLTAGE



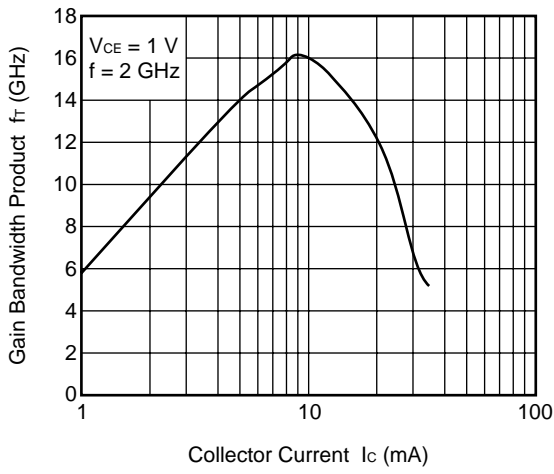
COLLECTOR CURRENT vs. COLLECTOR TO EMITTER VOLTAGE



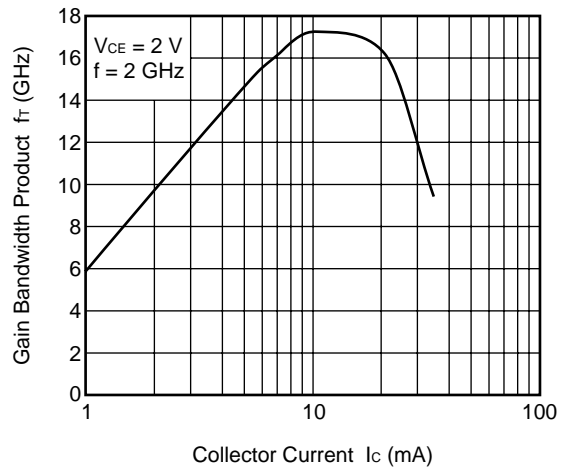
DC CURRENT GAIN vs. COLLECTOR CURRENT



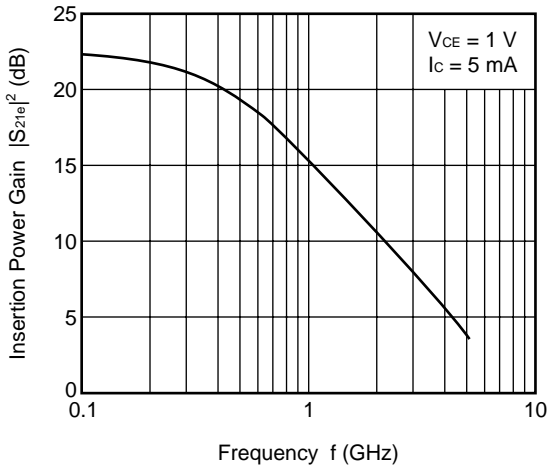
GAIN BANDWIDTH PRODUCT vs. COLLECTOR CURRENT



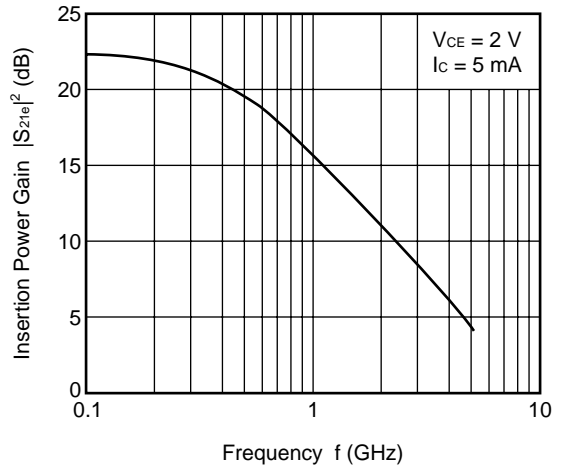
GAIN BANDWIDTH PRODUCT vs. COLLECTOR CURRENT



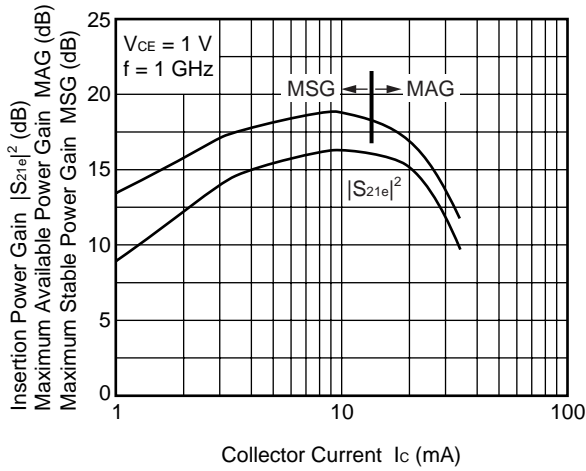
INSERTION POWER GAIN vs. FREQUENCY



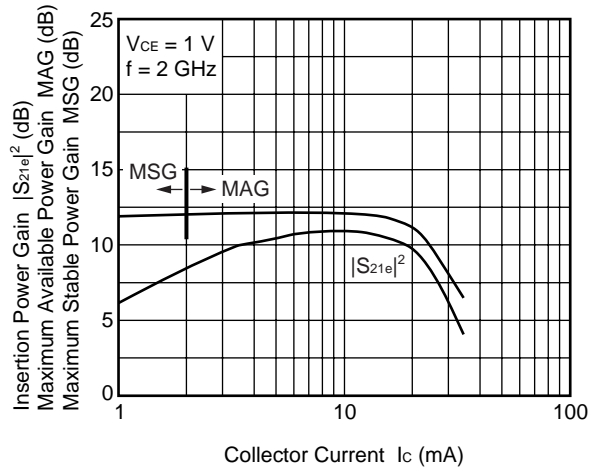
INSERTION POWER GAIN vs. FREQUENCY



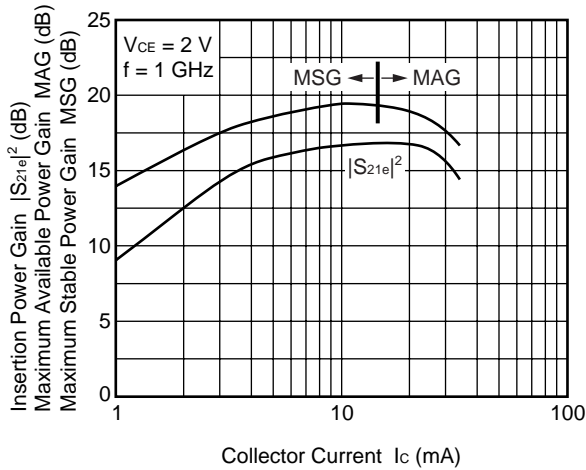
INSERTION POWER GAIN, MAG, MSG vs. COLLECTOR CURRENT



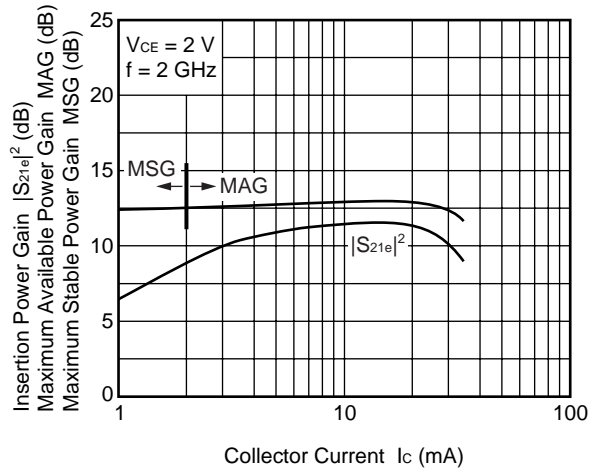
INSERTION POWER GAIN, MAG, MSG vs. COLLECTOR CURRENT



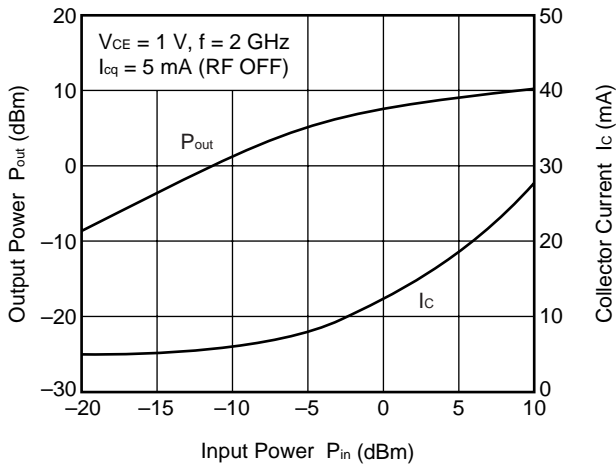
INSERTION POWER GAIN, MAG, MSG vs. COLLECTOR CURRENT



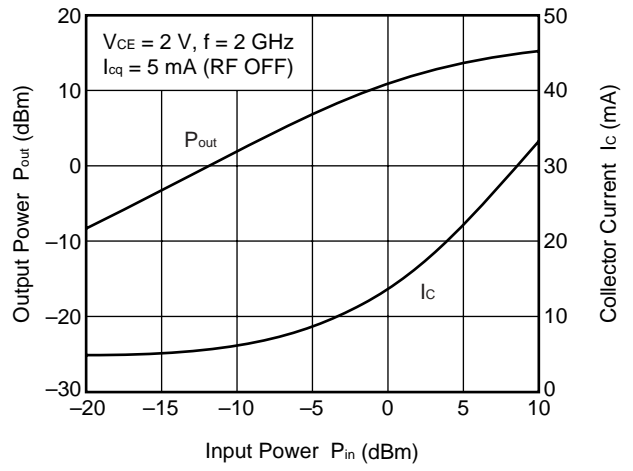
INSERTION POWER GAIN, MAG, MSG vs. COLLECTOR CURRENT



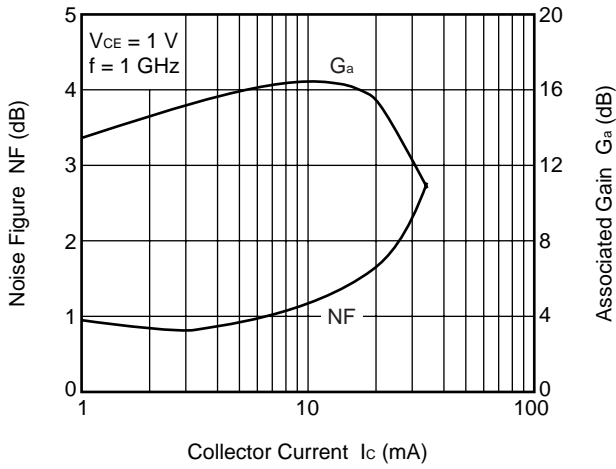
OUTPUT POWER, COLLECTOR CURRENT vs. INPUT POWER



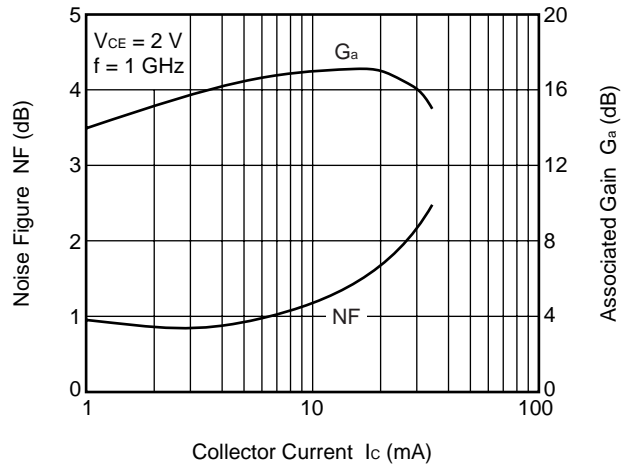
OUTPUT POWER, COLLECTOR CURRENT vs. INPUT POWER



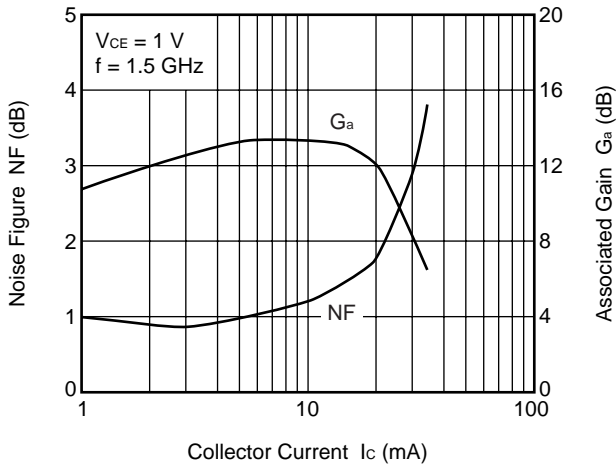
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



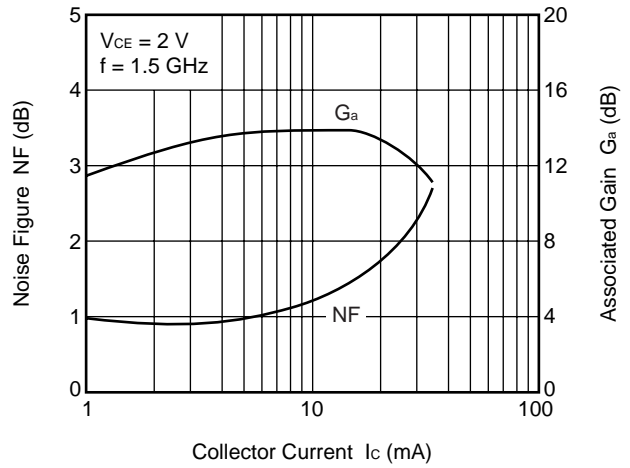
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



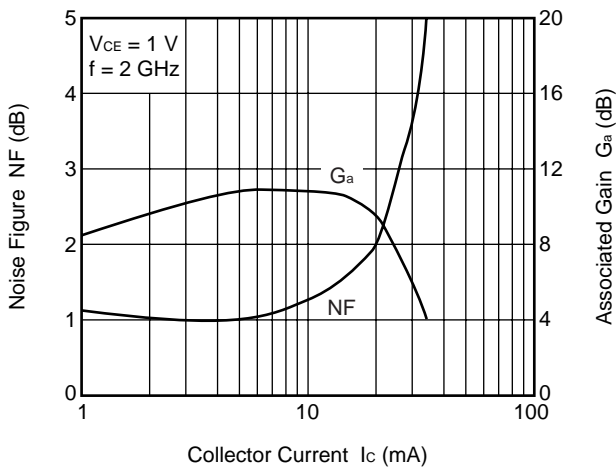
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



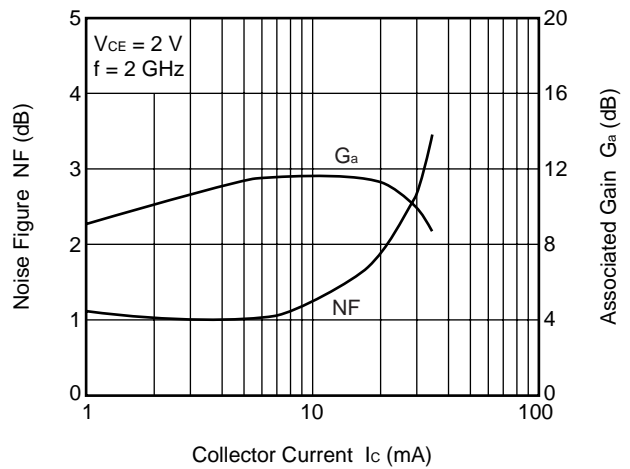
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



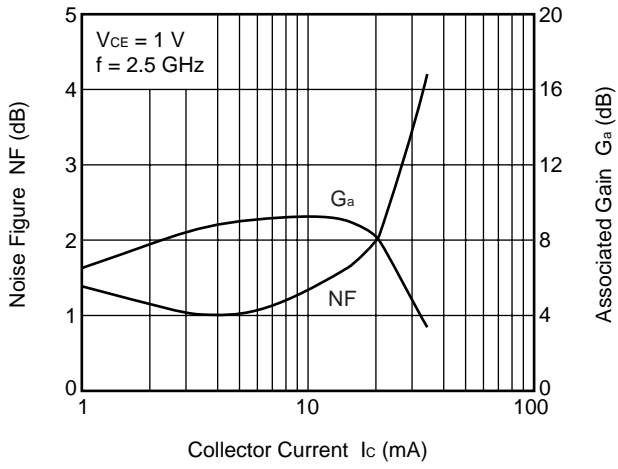
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



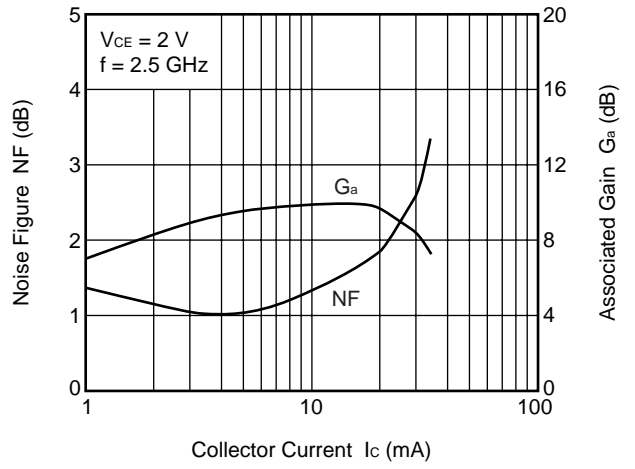
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



Remark The graphs indicate nominal characteristics.

S-PARAMETERS

Note When $K \geq 1$, the MAG (Maximum Available Gain) is used. $MAG = \left| \frac{S_{21}}{S_{12}} \right| (K - \sqrt{K^2 - 1})$

When $K < 1$, the MSG (Maximum Stable Gain) is used. $MSG = \left| \frac{S_{21}}{S_{12}} \right|$

$V_{CE} = 1 \text{ V}$, $I_c = 1 \text{ mA}$, $Z_o = 50 \Omega$

| Frequency (GHz) | S ₁₁ | | S ₂₁ | | S ₁₂ | | S ₂₂ | | K | MAG/MSG ^{Note} (dB) |
|--------------------|-----------------|----------------|-----------------|----------------|-----------------|----------------|-----------------|----------------|-------|---------------------------------|
| | MAG. | ANG. (deg.) | MAG. | ANG. (deg.) | MAG. | ANG. (deg.) | MAG. | ANG. (deg.) | | |
| 0.1 | 0.947 | -5.9 | 3.474 | 173.2 | 0.018 | 84.9 | 0.994 | -5.0 | 0.057 | 22.85 |
| 0.2 | 0.944 | -12.8 | 3.464 | 166.9 | 0.035 | 80.6 | 0.989 | -10.0 | 0.065 | 20.01 |
| 0.3 | 0.933 | -18.7 | 3.415 | 160.6 | 0.051 | 76.2 | 0.971 | -14.4 | 0.110 | 18.24 |
| 0.4 | 0.909 | -24.2 | 3.333 | 154.4 | 0.067 | 71.3 | 0.952 | -19.4 | 0.159 | 16.99 |
| 0.5 | 0.890 | -30.7 | 3.278 | 147.8 | 0.081 | 67.2 | 0.931 | -23.9 | 0.191 | 16.09 |
| 0.6 | 0.859 | -36.4 | 3.193 | 141.7 | 0.093 | 63.0 | 0.902 | -28.5 | 0.235 | 15.36 |
| 0.7 | 0.831 | -42.0 | 3.105 | 136.4 | 0.104 | 59.2 | 0.875 | -32.8 | 0.268 | 14.75 |
| 0.8 | 0.795 | -47.4 | 3.012 | 130.8 | 0.113 | 55.5 | 0.844 | -37.0 | 0.318 | 14.26 |
| 0.9 | 0.766 | -53.2 | 2.916 | 125.3 | 0.121 | 52.1 | 0.818 | -41.1 | 0.352 | 13.83 |
| 1.0 | 0.733 | -58.6 | 2.833 | 120.1 | 0.127 | 49.4 | 0.788 | -45.1 | 0.393 | 13.49 |
| 1.1 | 0.707 | -63.9 | 2.752 | 115.3 | 0.132 | 46.8 | 0.763 | -48.7 | 0.426 | 13.20 |
| 1.2 | 0.678 | -68.9 | 2.652 | 110.8 | 0.135 | 44.6 | 0.737 | -52.2 | 0.466 | 12.93 |
| 1.3 | 0.651 | -74.2 | 2.582 | 106.2 | 0.138 | 42.7 | 0.714 | -55.7 | 0.504 | 12.73 |
| 1.4 | 0.627 | -79.0 | 2.488 | 101.8 | 0.139 | 41.0 | 0.689 | -59.3 | 0.551 | 12.53 |
| 1.5 | 0.601 | -83.8 | 2.415 | 97.3 | 0.139 | 39.7 | 0.669 | -62.6 | 0.599 | 12.38 |
| 1.6 | 0.578 | -88.6 | 2.347 | 93.1 | 0.139 | 38.8 | 0.644 | -65.9 | 0.657 | 12.29 |
| 1.7 | 0.553 | -93.2 | 2.263 | 89.2 | 0.138 | 38.3 | 0.625 | -69.2 | 0.716 | 12.16 |
| 1.8 | 0.533 | -97.6 | 2.185 | 85.1 | 0.137 | 38.2 | 0.604 | -72.4 | 0.782 | 12.04 |
| 1.9 | 0.523 | -102.2 | 2.122 | 81.9 | 0.134 | 38.5 | 0.589 | -75.7 | 0.828 | 11.98 |
| 2.0 | 0.501 | -107.0 | 2.061 | 78.2 | 0.132 | 39.4 | 0.568 | -79.1 | 0.909 | 11.92 |
| 2.1 | 0.497 | -111.5 | 2.015 | 74.5 | 0.130 | 40.9 | 0.558 | -82.9 | 0.943 | 11.90 |
| 2.2 | 0.480 | -116.8 | 1.958 | 71.1 | 0.128 | 42.7 | 0.543 | -86.6 | 1.014 | 11.11 |
| 2.3 | 0.479 | -120.7 | 1.923 | 67.9 | 0.128 | 45.0 | 0.543 | -89.9 | 1.020 | 10.91 |
| 2.4 | 0.473 | -125.9 | 1.883 | 64.7 | 0.128 | 47.9 | 0.531 | -93.7 | 1.052 | 10.27 |
| 2.5 | 0.467 | -129.8 | 1.823 | 61.8 | 0.129 | 51.0 | 0.528 | -96.8 | 1.084 | 9.73 |
| 2.6 | 0.472 | -134.7 | 1.779 | 58.9 | 0.131 | 54.5 | 0.524 | -101.2 | 1.084 | 9.56 |
| 2.7 | 0.464 | -138.6 | 1.736 | 55.9 | 0.135 | 57.7 | 0.521 | -104.3 | 1.097 | 9.19 |
| 2.8 | 0.473 | -142.4 | 1.697 | 53.4 | 0.140 | 61.0 | 0.525 | -107.9 | 1.052 | 9.43 |
| 2.9 | 0.465 | -145.9 | 1.659 | 51.3 | 0.147 | 63.8 | 0.516 | -110.7 | 1.063 | 8.98 |
| 3.0 | 0.465 | -149.7 | 1.599 | 49.3 | 0.155 | 66.9 | 0.510 | -114.2 | 1.071 | 8.51 |
| 4.0 | 0.531 | 178.4 | 1.234 | 26.7 | 0.297 | 70.5 | 0.557 | -153.8 | 0.772 | 6.19 |
| 5.0 | 0.604 | 151.0 | 0.917 | 11.0 | 0.435 | 55.8 | 0.637 | 173.4 | 0.755 | 3.24 |

$V_{CE} = 1\text{ V}$, $I_C = 3\text{ mA}$, $Z_o = 50\ \Omega$

| Frequency (GHz) | S ₁₁ | | S ₂₁ | | S ₁₂ | | S ₂₂ | | K | MAG/MSG (dB) |
|--------------------|-----------------|----------------|-----------------|----------------|-----------------|----------------|-----------------|----------------|-------|-----------------|
| | MAG. | ANG. (deg.) | MAG. | ANG. (deg.) | MAG. | ANG. (deg.) | MAG. | ANG. (deg.) | | |
| 0.1 | 0.859 | -10.1 | 8.996 | 169.5 | 0.017 | 83.5 | 0.982 | -8.0 | 0.090 | 27.31 |
| 0.2 | 0.840 | -20.4 | 8.728 | 159.3 | 0.032 | 76.4 | 0.955 | -15.6 | 0.165 | 24.29 |
| 0.3 | 0.800 | -29.7 | 8.296 | 150.3 | 0.046 | 72.2 | 0.906 | -22.1 | 0.222 | 22.52 |
| 0.4 | 0.746 | -37.8 | 7.774 | 141.8 | 0.059 | 67.4 | 0.855 | -28.4 | 0.300 | 21.22 |
| 0.5 | 0.690 | -46.2 | 7.278 | 133.8 | 0.068 | 63.5 | 0.801 | -33.7 | 0.368 | 20.27 |
| 0.6 | 0.636 | -53.3 | 6.762 | 126.7 | 0.077 | 60.4 | 0.743 | -38.5 | 0.443 | 19.46 |
| 0.7 | 0.587 | -59.9 | 6.299 | 121.1 | 0.084 | 58.1 | 0.693 | -42.5 | 0.505 | 18.77 |
| 0.8 | 0.539 | -66.0 | 5.839 | 115.2 | 0.089 | 56.5 | 0.645 | -46.1 | 0.576 | 18.17 |
| 0.9 | 0.500 | -71.8 | 5.436 | 110.2 | 0.094 | 55.3 | 0.607 | -49.4 | 0.632 | 17.62 |
| 1.0 | 0.463 | -77.5 | 5.099 | 105.4 | 0.098 | 54.7 | 0.568 | -52.4 | 0.691 | 17.15 |
| 1.1 | 0.433 | -82.9 | 4.791 | 101.3 | 0.102 | 54.5 | 0.539 | -55.0 | 0.739 | 16.70 |
| 1.2 | 0.408 | -88.0 | 4.492 | 97.5 | 0.106 | 54.8 | 0.509 | -57.4 | 0.788 | 16.25 |
| 1.3 | 0.382 | -93.4 | 4.244 | 93.7 | 0.110 | 54.9 | 0.487 | -59.8 | 0.831 | 15.85 |
| 1.4 | 0.362 | -97.6 | 4.024 | 90.1 | 0.114 | 55.4 | 0.463 | -62.5 | 0.874 | 15.47 |
| 1.5 | 0.343 | -102.6 | 3.826 | 86.6 | 0.118 | 56.0 | 0.445 | -64.8 | 0.909 | 15.10 |
| 1.6 | 0.325 | -107.4 | 3.644 | 83.4 | 0.122 | 56.6 | 0.426 | -67.2 | 0.947 | 14.74 |
| 1.7 | 0.310 | -112.3 | 3.468 | 80.4 | 0.127 | 57.6 | 0.411 | -69.7 | 0.977 | 14.37 |
| 1.8 | 0.296 | -116.4 | 3.313 | 77.4 | 0.131 | 58.2 | 0.394 | -72.1 | 1.009 | 13.44 |
| 1.9 | 0.290 | -121.0 | 3.165 | 75.0 | 0.136 | 58.9 | 0.383 | -75.0 | 1.027 | 12.66 |
| 2.0 | 0.279 | -126.8 | 3.047 | 72.2 | 0.141 | 59.8 | 0.366 | -77.7 | 1.049 | 11.99 |
| 2.1 | 0.282 | -131.1 | 2.942 | 69.4 | 0.146 | 60.7 | 0.361 | -81.2 | 1.049 | 11.69 |
| 2.2 | 0.275 | -137.4 | 2.836 | 66.9 | 0.152 | 61.4 | 0.350 | -84.4 | 1.063 | 11.19 |
| 2.3 | 0.281 | -140.6 | 2.753 | 64.3 | 0.158 | 62.0 | 0.350 | -87.2 | 1.047 | 11.08 |
| 2.4 | 0.283 | -145.9 | 2.675 | 61.8 | 0.165 | 62.7 | 0.341 | -90.8 | 1.045 | 10.81 |
| 2.5 | 0.285 | -149.5 | 2.583 | 59.5 | 0.172 | 63.3 | 0.338 | -93.4 | 1.044 | 10.49 |
| 2.6 | 0.295 | -153.7 | 2.510 | 57.5 | 0.179 | 63.9 | 0.334 | -97.8 | 1.031 | 10.39 |
| 2.7 | 0.293 | -157.3 | 2.438 | 55.2 | 0.186 | 64.3 | 0.332 | -100.6 | 1.030 | 10.11 |
| 2.8 | 0.306 | -160.4 | 2.378 | 53.0 | 0.194 | 64.7 | 0.336 | -104.3 | 1.006 | 10.40 |
| 2.9 | 0.303 | -163.4 | 2.315 | 51.1 | 0.203 | 64.9 | 0.329 | -106.5 | 1.007 | 10.07 |
| 3.0 | 0.306 | -165.8 | 2.245 | 49.6 | 0.210 | 65.3 | 0.324 | -109.8 | 1.010 | 9.68 |
| 4.0 | 0.401 | 169.9 | 1.783 | 30.0 | 0.315 | 61.4 | 0.377 | -148.8 | 0.871 | 7.53 |
| 5.0 | 0.502 | 148.1 | 1.385 | 12.4 | 0.419 | 51.1 | 0.488 | 179.8 | 0.805 | 5.19 |

$V_{CE} = 1\text{ V}$, $I_C = 5\text{ mA}$, $Z_o = 50\ \Omega$

| Frequency (GHz) | S ₁₁ | | S ₂₁ | | S ₁₂ | | S ₂₂ | | K | MAG/MSG (dB) |
|--------------------|-----------------|----------------|-----------------|----------------|-----------------|----------------|-----------------|----------------|-------|-----------------|
| | MAG. | ANG. (deg.) | MAG. | ANG. (deg.) | MAG. | ANG. (deg.) | MAG. | ANG. (deg.) | | |
| 0.1 | 0.806 | -13.4 | 13.052 | 166.5 | 0.017 | 82.2 | 0.968 | -10.1 | 0.130 | 28.96 |
| 0.2 | 0.751 | -26.6 | 12.356 | 153.8 | 0.031 | 75.5 | 0.919 | -19.4 | 0.214 | 26.02 |
| 0.3 | 0.687 | -37.6 | 11.390 | 143.2 | 0.043 | 70.2 | 0.848 | -26.8 | 0.316 | 24.27 |
| 0.4 | 0.621 | -46.6 | 10.289 | 133.8 | 0.053 | 66.1 | 0.775 | -33.3 | 0.416 | 22.89 |
| 0.5 | 0.556 | -55.7 | 9.299 | 125.5 | 0.061 | 63.4 | 0.706 | -38.2 | 0.501 | 21.82 |
| 0.6 | 0.496 | -63.0 | 8.416 | 118.6 | 0.068 | 61.5 | 0.642 | -42.4 | 0.589 | 20.93 |
| 0.7 | 0.449 | -69.3 | 7.662 | 113.2 | 0.074 | 60.8 | 0.589 | -45.6 | 0.657 | 20.14 |
| 0.8 | 0.404 | -75.6 | 6.963 | 107.9 | 0.080 | 60.4 | 0.540 | -48.4 | 0.728 | 19.41 |
| 0.9 | 0.369 | -81.5 | 6.382 | 103.2 | 0.085 | 60.1 | 0.505 | -50.7 | 0.784 | 18.76 |
| 1.0 | 0.337 | -87.0 | 5.908 | 99.1 | 0.090 | 60.4 | 0.471 | -53.1 | 0.835 | 18.16 |
| 1.1 | 0.317 | -92.4 | 5.488 | 95.3 | 0.095 | 60.9 | 0.445 | -55.1 | 0.873 | 17.60 |
| 1.2 | 0.297 | -97.5 | 5.102 | 92.3 | 0.101 | 61.7 | 0.420 | -56.8 | 0.909 | 17.04 |
| 1.3 | 0.281 | -103.2 | 4.791 | 88.9 | 0.107 | 62.1 | 0.402 | -58.7 | 0.935 | 16.53 |
| 1.4 | 0.266 | -107.6 | 4.507 | 85.8 | 0.112 | 62.7 | 0.384 | -60.9 | 0.962 | 16.04 |
| 1.5 | 0.250 | -113.1 | 4.266 | 82.8 | 0.118 | 63.2 | 0.369 | -62.8 | 0.983 | 15.58 |
| 1.6 | 0.240 | -118.2 | 4.043 | 79.9 | 0.124 | 63.8 | 0.353 | -64.9 | 1.002 | 14.85 |
| 1.7 | 0.230 | -123.5 | 3.834 | 77.3 | 0.130 | 64.2 | 0.340 | -67.2 | 1.018 | 13.86 |
| 1.8 | 0.221 | -128.4 | 3.654 | 74.6 | 0.137 | 64.5 | 0.325 | -69.4 | 1.034 | 13.14 |
| 1.9 | 0.220 | -132.4 | 3.483 | 72.5 | 0.144 | 64.8 | 0.317 | -72.4 | 1.039 | 12.63 |
| 2.0 | 0.215 | -139.4 | 3.346 | 69.9 | 0.150 | 65.0 | 0.302 | -75.0 | 1.050 | 12.11 |
| 2.1 | 0.220 | -142.8 | 3.220 | 67.5 | 0.157 | 65.4 | 0.299 | -78.6 | 1.045 | 11.83 |
| 2.2 | 0.219 | -150.1 | 3.095 | 65.2 | 0.164 | 65.5 | 0.290 | -81.8 | 1.050 | 11.39 |
| 2.3 | 0.227 | -152.6 | 2.999 | 62.9 | 0.172 | 65.5 | 0.291 | -84.6 | 1.035 | 11.28 |
| 2.4 | 0.236 | -157.9 | 2.907 | 60.6 | 0.179 | 65.6 | 0.283 | -88.3 | 1.029 | 11.06 |
| 2.5 | 0.239 | -160.8 | 2.809 | 58.7 | 0.187 | 65.6 | 0.280 | -90.8 | 1.026 | 10.79 |
| 2.6 | 0.252 | -164.8 | 2.725 | 56.8 | 0.195 | 65.7 | 0.276 | -95.6 | 1.016 | 10.69 |
| 2.7 | 0.251 | -168.5 | 2.641 | 54.6 | 0.203 | 65.5 | 0.275 | -98.4 | 1.014 | 10.41 |
| 2.8 | 0.265 | -170.5 | 2.571 | 52.7 | 0.211 | 65.4 | 0.278 | -102.5 | 0.999 | 10.86 |
| 2.9 | 0.265 | -173.5 | 2.502 | 50.7 | 0.220 | 65.1 | 0.273 | -104.4 | 0.997 | 10.56 |
| 3.0 | 0.269 | -175.5 | 2.431 | 49.4 | 0.228 | 65.1 | 0.267 | -107.7 | 0.997 | 10.28 |
| 4.0 | 0.371 | 164.5 | 1.939 | 31.3 | 0.326 | 59.1 | 0.317 | -148.5 | 0.899 | 7.75 |
| 5.0 | 0.472 | 145.2 | 1.535 | 14.5 | 0.419 | 49.1 | 0.433 | -179.4 | 0.840 | 5.64 |

$V_{CE} = 1\text{ V}$, $I_C = 7\text{ mA}$, $Z_o = 50\ \Omega$

| Frequency (GHz) | S ₁₁ | | S ₂₁ | | S ₁₂ | | S ₂₂ | | K | MAG/MSG (dB) |
|--------------------|-----------------|----------------|-----------------|----------------|-----------------|----------------|-----------------|----------------|-------|-----------------|
| | MAG. | ANG. (deg.) | MAG. | ANG. (deg.) | MAG. | ANG. (deg.) | MAG. | ANG. (deg.) | | |
| 0.1 | 0.732 | -16.4 | 16.182 | 164.1 | 0.015 | 83.6 | 0.954 | -11.8 | 0.135 | 30.24 |
| 0.2 | 0.677 | -31.1 | 14.961 | 149.7 | 0.029 | 73.7 | 0.888 | -22.2 | 0.280 | 27.09 |
| 0.3 | 0.604 | -43.1 | 13.358 | 138.1 | 0.040 | 69.6 | 0.800 | -29.9 | 0.392 | 25.22 |
| 0.4 | 0.530 | -52.7 | 11.776 | 128.5 | 0.049 | 66.2 | 0.716 | -36.1 | 0.504 | 23.78 |
| 0.5 | 0.466 | -61.8 | 10.411 | 120.2 | 0.057 | 64.6 | 0.642 | -40.5 | 0.597 | 22.64 |
| 0.6 | 0.409 | -69.5 | 9.262 | 113.7 | 0.063 | 63.7 | 0.577 | -44.0 | 0.683 | 21.66 |
| 0.7 | 0.366 | -76.1 | 8.316 | 108.5 | 0.070 | 63.4 | 0.526 | -46.4 | 0.752 | 20.78 |
| 0.8 | 0.325 | -82.4 | 7.489 | 103.6 | 0.075 | 63.7 | 0.483 | -48.6 | 0.816 | 19.98 |
| 0.9 | 0.297 | -88.4 | 6.817 | 99.4 | 0.081 | 63.9 | 0.450 | -50.4 | 0.863 | 19.24 |
| 1.0 | 0.271 | -94.3 | 6.270 | 95.5 | 0.087 | 64.5 | 0.419 | -52.4 | 0.904 | 18.56 |
| 1.1 | 0.255 | -99.7 | 5.806 | 92.1 | 0.093 | 65.0 | 0.397 | -53.8 | 0.932 | 17.94 |
| 1.2 | 0.240 | -105.2 | 5.377 | 89.3 | 0.100 | 65.6 | 0.375 | -55.4 | 0.959 | 17.32 |
| 1.3 | 0.228 | -111.0 | 5.027 | 86.2 | 0.106 | 66.1 | 0.360 | -57.1 | 0.976 | 16.75 |
| 1.4 | 0.217 | -115.9 | 4.716 | 83.4 | 0.113 | 66.4 | 0.345 | -59.0 | 0.995 | 16.22 |
| 1.5 | 0.206 | -121.2 | 4.444 | 80.5 | 0.119 | 66.8 | 0.332 | -60.8 | 1.009 | 15.13 |
| 1.6 | 0.199 | -126.6 | 4.214 | 78.0 | 0.126 | 67.0 | 0.318 | -62.8 | 1.020 | 14.37 |
| 1.7 | 0.193 | -132.5 | 3.988 | 75.6 | 0.134 | 67.2 | 0.307 | -65.0 | 1.028 | 13.72 |
| 1.8 | 0.188 | -137.8 | 3.800 | 73.0 | 0.141 | 67.3 | 0.294 | -67.2 | 1.037 | 13.13 |
| 1.9 | 0.189 | -141.4 | 3.617 | 71.0 | 0.148 | 67.3 | 0.286 | -70.3 | 1.041 | 12.64 |
| 2.0 | 0.187 | -149.3 | 3.468 | 68.7 | 0.156 | 67.4 | 0.273 | -72.8 | 1.047 | 12.16 |
| 2.1 | 0.194 | -151.8 | 3.333 | 66.4 | 0.163 | 67.4 | 0.271 | -76.6 | 1.041 | 11.87 |
| 2.2 | 0.199 | -159.5 | 3.205 | 64.3 | 0.170 | 67.3 | 0.262 | -79.8 | 1.042 | 11.50 |
| 2.3 | 0.209 | -161.1 | 3.102 | 62.1 | 0.179 | 67.0 | 0.264 | -82.7 | 1.026 | 11.41 |
| 2.4 | 0.221 | -165.9 | 3.005 | 59.9 | 0.187 | 66.9 | 0.256 | -86.6 | 1.019 | 11.21 |
| 2.5 | 0.222 | -168.9 | 2.900 | 58.0 | 0.195 | 66.6 | 0.253 | -89.1 | 1.019 | 10.90 |
| 2.6 | 0.237 | -172.3 | 2.810 | 56.3 | 0.203 | 66.4 | 0.249 | -94.3 | 1.011 | 10.79 |
| 2.7 | 0.241 | -175.5 | 2.722 | 54.2 | 0.211 | 66.1 | 0.248 | -97.2 | 1.006 | 10.63 |
| 2.8 | 0.255 | -177.0 | 2.652 | 52.3 | 0.219 | 65.7 | 0.251 | -101.4 | 0.993 | 10.82 |
| 2.9 | 0.254 | -179.5 | 2.585 | 50.5 | 0.229 | 65.2 | 0.246 | -103.5 | 0.990 | 10.53 |
| 3.0 | 0.257 | 178.3 | 2.509 | 49.1 | 0.237 | 65.0 | 0.241 | -106.8 | 0.993 | 10.26 |
| 4.0 | 0.361 | 161.0 | 2.003 | 31.9 | 0.332 | 58.1 | 0.291 | -148.8 | 0.909 | 7.80 |
| 5.0 | 0.465 | 143.1 | 1.595 | 15.3 | 0.421 | 48.1 | 0.407 | -179.7 | 0.855 | 5.79 |

$V_{CE} = 1\text{ V}$, $I_C = 10\text{ mA}$, $Z_0 = 50\ \Omega$

| Frequency (GHz) | S ₁₁ | | S ₂₁ | | S ₁₂ | | S ₂₂ | | K | MAG/MSG (dB) |
|--------------------|-----------------|----------------|-----------------|----------------|-----------------|----------------|-----------------|----------------|-------|-----------------|
| | MAG. | ANG. (deg.) | MAG. | ANG. (deg.) | MAG. | ANG. (deg.) | MAG. | ANG. (deg.) | | |
| 0.1 | 0.645 | -20.6 | 19.601 | 161.4 | 0.015 | 80.0 | 0.937 | -13.7 | 0.208 | 31.04 |
| 0.2 | 0.592 | -36.7 | 17.495 | 145.0 | 0.028 | 73.0 | 0.848 | -25.1 | 0.345 | 28.02 |
| 0.3 | 0.508 | -50.3 | 15.128 | 132.8 | 0.037 | 69.8 | 0.744 | -32.7 | 0.475 | 26.06 |
| 0.4 | 0.434 | -60.4 | 12.979 | 123.1 | 0.046 | 67.2 | 0.651 | -38.3 | 0.598 | 24.53 |
| 0.5 | 0.373 | -70.3 | 11.229 | 115.3 | 0.053 | 66.4 | 0.579 | -41.8 | 0.691 | 23.26 |
| 0.6 | 0.324 | -77.6 | 9.861 | 109.1 | 0.059 | 66.4 | 0.517 | -44.4 | 0.776 | 22.21 |
| 0.7 | 0.289 | -84.9 | 8.741 | 104.3 | 0.066 | 66.4 | 0.471 | -46.1 | 0.835 | 21.22 |
| 0.8 | 0.256 | -91.6 | 7.824 | 99.6 | 0.072 | 67.2 | 0.432 | -47.7 | 0.889 | 20.34 |
| 0.9 | 0.233 | -97.7 | 7.087 | 95.9 | 0.079 | 67.6 | 0.404 | -49.0 | 0.927 | 19.54 |
| 1.0 | 0.216 | -104.6 | 6.482 | 92.3 | 0.085 | 68.2 | 0.377 | -50.5 | 0.957 | 18.80 |
| 1.1 | 0.205 | -110.3 | 5.980 | 89.3 | 0.092 | 68.5 | 0.359 | -51.7 | 0.976 | 18.12 |
| 1.2 | 0.196 | -116.0 | 5.524 | 86.6 | 0.099 | 69.1 | 0.340 | -53.1 | 0.994 | 17.45 |
| 1.3 | 0.188 | -122.6 | 5.154 | 83.9 | 0.107 | 69.4 | 0.328 | -54.6 | 1.005 | 16.42 |
| 1.4 | 0.182 | -127.2 | 4.827 | 81.1 | 0.114 | 69.6 | 0.314 | -56.5 | 1.016 | 15.50 |
| 1.5 | 0.176 | -133.6 | 4.555 | 78.5 | 0.121 | 69.8 | 0.304 | -58.2 | 1.022 | 14.84 |
| 1.6 | 0.174 | -139.1 | 4.302 | 76.0 | 0.129 | 69.8 | 0.292 | -60.2 | 1.029 | 14.20 |
| 1.7 | 0.173 | -145.1 | 4.071 | 73.7 | 0.136 | 69.8 | 0.282 | -62.4 | 1.033 | 13.63 |
| 1.8 | 0.169 | -150.4 | 3.869 | 71.4 | 0.144 | 69.5 | 0.270 | -64.7 | 1.040 | 13.06 |
| 1.9 | 0.174 | -154.1 | 3.681 | 69.5 | 0.152 | 69.4 | 0.264 | -67.8 | 1.041 | 12.61 |
| 2.0 | 0.176 | -161.2 | 3.533 | 67.3 | 0.160 | 69.3 | 0.251 | -70.4 | 1.042 | 12.19 |
| 2.1 | 0.185 | -163.1 | 3.391 | 65.1 | 0.168 | 69.1 | 0.250 | -74.4 | 1.035 | 11.91 |
| 2.2 | 0.195 | -169.5 | 3.255 | 62.9 | 0.175 | 68.7 | 0.242 | -77.7 | 1.034 | 11.55 |
| 2.3 | 0.203 | -170.8 | 3.151 | 61.0 | 0.184 | 68.3 | 0.245 | -80.8 | 1.020 | 11.46 |
| 2.4 | 0.215 | -174.8 | 3.048 | 58.8 | 0.193 | 68.0 | 0.237 | -84.8 | 1.014 | 11.26 |
| 2.5 | 0.222 | -176.8 | 2.941 | 57.0 | 0.201 | 67.6 | 0.235 | -87.5 | 1.010 | 11.05 |
| 2.6 | 0.238 | -179.5 | 2.852 | 55.4 | 0.210 | 67.2 | 0.230 | -92.9 | 1.001 | 11.14 |
| 2.7 | 0.240 | 177.1 | 2.761 | 53.4 | 0.218 | 66.7 | 0.229 | -95.9 | 0.999 | 11.02 |
| 2.8 | 0.255 | 176.1 | 2.688 | 51.6 | 0.227 | 66.2 | 0.233 | -100.5 | 0.986 | 10.74 |
| 2.9 | 0.255 | 173.7 | 2.616 | 49.7 | 0.236 | 65.5 | 0.229 | -102.5 | 0.984 | 10.45 |
| 3.0 | 0.260 | 172.2 | 2.541 | 48.5 | 0.244 | 65.3 | 0.223 | -105.9 | 0.985 | 10.17 |
| 4.0 | 0.366 | 156.9 | 2.036 | 31.7 | 0.340 | 57.5 | 0.275 | -149.5 | 0.911 | 7.78 |
| 5.0 | 0.470 | 140.6 | 1.622 | 15.7 | 0.425 | 47.3 | 0.392 | 179.7 | 0.864 | 5.82 |

$V_{CE} = 1\text{ V}$, $I_C = 20\text{ mA}$, $Z_O = 50\ \Omega$

| Frequency (GHz) | S ₁₁ | | S ₂₁ | | S ₁₂ | | S ₂₂ | | K | MAG/MSG (dB) |
|--------------------|-----------------|----------------|-----------------|----------------|-----------------|----------------|-----------------|----------------|-------|-----------------|
| | MAG. | ANG. (deg.) | MAG. | ANG. (deg.) | MAG. | ANG. (deg.) | MAG. | ANG. (deg.) | | |
| 0.1 | 0.485 | -34.7 | 23.640 | 154.0 | 0.015 | 77.4 | 0.857 | -18.3 | 0.357 | 31.85 |
| 0.2 | 0.409 | -61.8 | 19.383 | 134.2 | 0.027 | 70.2 | 0.722 | -30.6 | 0.510 | 28.60 |
| 0.3 | 0.340 | -81.4 | 15.540 | 121.4 | 0.034 | 67.2 | 0.602 | -36.8 | 0.672 | 26.54 |
| 0.4 | 0.292 | -96.3 | 12.708 | 112.1 | 0.042 | 68.0 | 0.515 | -40.2 | 0.785 | 24.78 |
| 0.5 | 0.263 | -109.8 | 10.633 | 105.2 | 0.049 | 68.5 | 0.456 | -41.7 | 0.871 | 23.37 |
| 0.6 | 0.242 | -121.1 | 9.132 | 99.8 | 0.056 | 69.6 | 0.410 | -42.7 | 0.934 | 22.13 |
| 0.7 | 0.230 | -130.1 | 8.006 | 95.8 | 0.063 | 70.3 | 0.378 | -43.2 | 0.974 | 21.03 |
| 0.8 | 0.223 | -139.3 | 7.081 | 91.6 | 0.070 | 71.3 | 0.352 | -44.0 | 1.010 | 19.43 |
| 0.9 | 0.222 | -145.5 | 6.369 | 88.3 | 0.078 | 71.9 | 0.334 | -44.9 | 1.029 | 18.10 |
| 1.0 | 0.220 | -152.2 | 5.795 | 85.2 | 0.085 | 72.3 | 0.316 | -46.3 | 1.045 | 17.03 |
| 1.1 | 0.224 | -157.2 | 5.327 | 82.3 | 0.093 | 72.9 | 0.305 | -47.4 | 1.050 | 16.22 |
| 1.2 | 0.227 | -161.2 | 4.897 | 79.9 | 0.101 | 73.1 | 0.292 | -48.9 | 1.059 | 15.38 |
| 1.3 | 0.231 | -165.9 | 4.567 | 77.1 | 0.109 | 73.4 | 0.285 | -50.8 | 1.059 | 14.75 |
| 1.4 | 0.234 | -169.5 | 4.270 | 74.7 | 0.117 | 73.3 | 0.276 | -53.0 | 1.059 | 14.13 |
| 1.5 | 0.238 | -173.5 | 4.012 | 72.1 | 0.125 | 73.3 | 0.270 | -55.2 | 1.058 | 13.58 |
| 1.6 | 0.243 | -177.1 | 3.788 | 69.7 | 0.134 | 73.2 | 0.261 | -57.6 | 1.058 | 13.05 |
| 1.7 | 0.248 | 179.8 | 3.573 | 67.5 | 0.142 | 72.9 | 0.255 | -60.3 | 1.058 | 12.53 |
| 1.8 | 0.253 | 176.2 | 3.397 | 65.3 | 0.151 | 72.6 | 0.245 | -63.0 | 1.058 | 12.05 |
| 1.9 | 0.261 | 174.8 | 3.224 | 63.5 | 0.159 | 72.2 | 0.241 | -66.9 | 1.055 | 11.62 |
| 2.0 | 0.270 | 170.8 | 3.085 | 61.3 | 0.168 | 71.8 | 0.231 | -70.0 | 1.051 | 11.24 |
| 2.1 | 0.279 | 170.3 | 2.959 | 59.1 | 0.177 | 71.5 | 0.232 | -74.8 | 1.040 | 10.99 |
| 2.2 | 0.294 | 166.2 | 2.840 | 56.8 | 0.186 | 70.9 | 0.225 | -78.8 | 1.035 | 10.70 |
| 2.3 | 0.302 | 165.9 | 2.747 | 54.8 | 0.196 | 70.3 | 0.230 | -82.6 | 1.018 | 10.66 |
| 2.4 | 0.319 | 164.2 | 2.655 | 52.5 | 0.205 | 69.7 | 0.225 | -87.4 | 1.006 | 10.66 |
| 2.5 | 0.325 | 162.6 | 2.563 | 50.8 | 0.215 | 69.2 | 0.224 | -90.6 | 0.999 | 10.77 |
| 2.6 | 0.341 | 161.1 | 2.480 | 49.0 | 0.224 | 68.6 | 0.222 | -96.7 | 0.990 | 10.45 |
| 2.7 | 0.345 | 159.1 | 2.400 | 46.9 | 0.233 | 68.0 | 0.223 | -100.4 | 0.985 | 10.12 |
| 2.8 | 0.362 | 158.5 | 2.332 | 45.0 | 0.243 | 67.2 | 0.229 | -105.5 | 0.968 | 9.83 |
| 2.9 | 0.363 | 156.7 | 2.277 | 42.9 | 0.253 | 66.4 | 0.228 | -108.3 | 0.962 | 9.54 |
| 3.0 | 0.367 | 155.5 | 2.215 | 41.9 | 0.262 | 66.0 | 0.225 | -112.0 | 0.962 | 9.27 |
| 4.0 | 0.474 | 143.7 | 1.756 | 25.4 | 0.364 | 56.4 | 0.299 | -156.6 | 0.883 | 6.83 |
| 5.0 | 0.564 | 129.7 | 1.366 | 9.9 | 0.450 | 44.8 | 0.426 | 173.3 | 0.850 | 4.82 |

$V_{CE} = 2\text{ V}$, $I_C = 1\text{ mA}$, $Z_0 = 50\ \Omega$

| Frequency (GHz) | S ₁₁ | | S ₂₁ | | S ₁₂ | | S ₂₂ | | K | MAG/MSG (dB) |
|--------------------|-----------------|----------------|-----------------|----------------|-----------------|----------------|-----------------|----------------|-------|-----------------|
| | MAG. | ANG. (deg.) | MAG. | ANG. (deg.) | MAG. | ANG. (deg.) | MAG. | ANG. (deg.) | | |
| 0.1 | 0.966 | -6.1 | 3.457 | 173.3 | 0.015 | 83.5 | 0.995 | -4.7 | 0.072 | 23.62 |
| 0.2 | 0.949 | -11.9 | 3.449 | 167.4 | 0.031 | 81.4 | 0.991 | -9.4 | 0.060 | 20.47 |
| 0.3 | 0.935 | -17.6 | 3.406 | 161.4 | 0.046 | 76.8 | 0.973 | -13.6 | 0.108 | 18.72 |
| 0.4 | 0.916 | -23.0 | 3.336 | 155.3 | 0.060 | 72.1 | 0.957 | -18.2 | 0.156 | 17.46 |
| 0.5 | 0.897 | -29.1 | 3.282 | 148.9 | 0.073 | 68.3 | 0.938 | -22.5 | 0.186 | 16.54 |
| 0.6 | 0.868 | -34.6 | 3.208 | 143.0 | 0.084 | 64.2 | 0.911 | -27.0 | 0.229 | 15.82 |
| 0.7 | 0.839 | -39.9 | 3.123 | 137.8 | 0.094 | 60.5 | 0.885 | -30.9 | 0.268 | 15.20 |
| 0.8 | 0.810 | -45.3 | 3.033 | 132.3 | 0.102 | 57.1 | 0.856 | -35.0 | 0.307 | 14.72 |
| 0.9 | 0.778 | -50.8 | 2.944 | 127.0 | 0.110 | 54.0 | 0.832 | -38.8 | 0.343 | 14.29 |
| 1.0 | 0.746 | -55.8 | 2.866 | 121.8 | 0.115 | 51.1 | 0.803 | -42.7 | 0.388 | 13.97 |
| 1.1 | 0.719 | -61.0 | 2.787 | 117.1 | 0.119 | 48.7 | 0.781 | -46.1 | 0.420 | 13.68 |
| 1.2 | 0.691 | -66.1 | 2.693 | 112.7 | 0.123 | 46.7 | 0.754 | -49.6 | 0.461 | 13.41 |
| 1.3 | 0.663 | -70.9 | 2.626 | 108.2 | 0.125 | 44.8 | 0.733 | -52.8 | 0.502 | 13.23 |
| 1.4 | 0.640 | -75.5 | 2.536 | 103.9 | 0.126 | 43.3 | 0.708 | -56.2 | 0.551 | 13.04 |
| 1.5 | 0.616 | -80.3 | 2.467 | 99.2 | 0.126 | 42.2 | 0.688 | -59.5 | 0.598 | 12.91 |
| 1.6 | 0.589 | -85.0 | 2.399 | 95.1 | 0.125 | 41.6 | 0.665 | -62.6 | 0.658 | 12.82 |
| 1.7 | 0.566 | -89.3 | 2.320 | 91.3 | 0.125 | 41.5 | 0.646 | -65.7 | 0.718 | 12.70 |
| 1.8 | 0.544 | -93.6 | 2.243 | 87.2 | 0.123 | 41.6 | 0.626 | -68.9 | 0.789 | 12.60 |
| 1.9 | 0.534 | -98.0 | 2.177 | 83.9 | 0.121 | 42.3 | 0.610 | -72.1 | 0.838 | 12.54 |
| 2.0 | 0.509 | -102.9 | 2.122 | 80.2 | 0.120 | 43.6 | 0.589 | -75.2 | 0.921 | 12.49 |
| 2.1 | 0.505 | -107.1 | 2.076 | 76.6 | 0.118 | 45.5 | 0.580 | -79.0 | 0.953 | 12.47 |
| 2.2 | 0.488 | -112.6 | 2.017 | 73.1 | 0.116 | 47.9 | 0.565 | -82.4 | 1.023 | 11.46 |
| 2.3 | 0.486 | -116.3 | 1.985 | 70.0 | 0.117 | 50.7 | 0.565 | -85.7 | 1.020 | 11.43 |
| 2.4 | 0.478 | -121.5 | 1.943 | 66.9 | 0.118 | 54.3 | 0.553 | -89.1 | 1.053 | 10.76 |
| 2.5 | 0.472 | -125.4 | 1.883 | 63.9 | 0.120 | 57.7 | 0.549 | -92.3 | 1.075 | 10.29 |
| 2.6 | 0.474 | -130.2 | 1.839 | 60.8 | 0.123 | 61.6 | 0.546 | -96.5 | 1.062 | 10.22 |
| 2.7 | 0.466 | -134.0 | 1.794 | 57.9 | 0.128 | 64.9 | 0.541 | -99.6 | 1.066 | 9.89 |
| 2.8 | 0.474 | -137.9 | 1.757 | 55.3 | 0.135 | 68.3 | 0.546 | -103.1 | 1.010 | 10.53 |
| 2.9 | 0.465 | -141.6 | 1.713 | 53.1 | 0.143 | 71.1 | 0.535 | -105.8 | 1.020 | 9.90 |
| 3.0 | 0.465 | -145.3 | 1.652 | 51.0 | 0.152 | 73.9 | 0.528 | -109.4 | 1.019 | 9.50 |
| 4.0 | 0.526 | -178.3 | 1.282 | 28.0 | 0.304 | 74.7 | 0.571 | -149.4 | 0.719 | 6.25 |
| 5.0 | 0.603 | 153.3 | 0.955 | 11.5 | 0.449 | 58.3 | 0.646 | 176.9 | 0.713 | 3.28 |

$V_{CE} = 2\text{ V}$, $I_C = 3\text{ mA}$, $Z_o = 50\ \Omega$

| Frequency (GHz) | S ₁₁ | | S ₂₁ | | S ₁₂ | | S ₂₂ | | K | MAG/MSG (dB) |
|--------------------|-----------------|----------------|-----------------|----------------|-----------------|----------------|-----------------|----------------|-------|-----------------|
| | MAG. | ANG. (deg.) | MAG. | ANG. (deg.) | MAG. | ANG. (deg.) | MAG. | ANG. (deg.) | | |
| 0.1 | 0.862 | -9.9 | 8.988 | 170.0 | 0.015 | 84.3 | 0.984 | -7.3 | 0.076 | 27.73 |
| 0.2 | 0.845 | -19.4 | 8.745 | 160.1 | 0.029 | 78.1 | 0.961 | -14.3 | 0.144 | 24.77 |
| 0.3 | 0.807 | -27.7 | 8.341 | 151.4 | 0.041 | 73.0 | 0.916 | -20.3 | 0.224 | 23.04 |
| 0.4 | 0.758 | -35.4 | 7.844 | 143.2 | 0.053 | 68.7 | 0.868 | -26.2 | 0.294 | 21.69 |
| 0.5 | 0.707 | -43.3 | 7.354 | 135.4 | 0.062 | 64.8 | 0.818 | -31.0 | 0.364 | 20.73 |
| 0.6 | 0.652 | -49.8 | 6.887 | 128.5 | 0.070 | 62.1 | 0.764 | -35.5 | 0.438 | 19.95 |
| 0.7 | 0.604 | -56.0 | 6.422 | 122.6 | 0.076 | 59.8 | 0.717 | -39.3 | 0.502 | 19.26 |
| 0.8 | 0.555 | -61.9 | 5.978 | 117.0 | 0.081 | 58.3 | 0.671 | -42.7 | 0.570 | 18.66 |
| 0.9 | 0.516 | -67.3 | 5.577 | 111.9 | 0.086 | 57.2 | 0.633 | -45.6 | 0.630 | 18.11 |
| 1.0 | 0.476 | -72.5 | 5.243 | 107.2 | 0.090 | 56.8 | 0.596 | -48.5 | 0.690 | 17.64 |
| 1.1 | 0.447 | -77.4 | 4.937 | 103.0 | 0.094 | 56.6 | 0.568 | -50.8 | 0.738 | 17.21 |
| 1.2 | 0.421 | -82.0 | 4.634 | 99.3 | 0.098 | 57.0 | 0.539 | -53.2 | 0.787 | 16.75 |
| 1.3 | 0.394 | -87.0 | 4.401 | 95.5 | 0.101 | 57.4 | 0.517 | -55.4 | 0.828 | 16.37 |
| 1.4 | 0.374 | -91.1 | 4.152 | 92.1 | 0.105 | 57.9 | 0.494 | -57.7 | 0.873 | 15.96 |
| 1.5 | 0.354 | -95.6 | 3.965 | 88.5 | 0.109 | 58.7 | 0.477 | -59.8 | 0.907 | 15.61 |
| 1.6 | 0.333 | -99.9 | 3.781 | 85.2 | 0.113 | 59.6 | 0.458 | -62.0 | 0.945 | 15.25 |
| 1.7 | 0.316 | -104.4 | 3.600 | 82.2 | 0.117 | 60.6 | 0.442 | -64.3 | 0.976 | 14.87 |
| 1.8 | 0.299 | -108.8 | 3.443 | 79.2 | 0.122 | 61.5 | 0.426 | -66.5 | 1.006 | 14.04 |
| 1.9 | 0.292 | -112.9 | 3.294 | 76.7 | 0.126 | 62.4 | 0.414 | -69.1 | 1.025 | 13.20 |
| 2.0 | 0.279 | -118.3 | 3.172 | 73.8 | 0.131 | 63.4 | 0.397 | -71.5 | 1.046 | 12.51 |
| 2.1 | 0.279 | -122.4 | 3.065 | 71.1 | 0.136 | 64.5 | 0.393 | -74.8 | 1.044 | 12.23 |
| 2.2 | 0.270 | -128.7 | 2.958 | 68.6 | 0.142 | 65.4 | 0.381 | -77.6 | 1.055 | 11.74 |
| 2.3 | 0.275 | -131.9 | 2.877 | 66.0 | 0.149 | 66.1 | 0.382 | -80.2 | 1.035 | 11.72 |
| 2.4 | 0.276 | -137.5 | 2.795 | 63.6 | 0.156 | 66.9 | 0.372 | -83.5 | 1.030 | 11.48 |
| 2.5 | 0.274 | -140.9 | 2.704 | 61.3 | 0.163 | 67.7 | 0.369 | -85.9 | 1.027 | 11.20 |
| 2.6 | 0.284 | -145.6 | 2.626 | 59.3 | 0.170 | 68.4 | 0.364 | -90.0 | 1.014 | 11.17 |
| 2.7 | 0.279 | -149.2 | 2.553 | 56.9 | 0.178 | 68.8 | 0.362 | -92.5 | 1.009 | 11.00 |
| 2.8 | 0.293 | -152.5 | 2.489 | 54.8 | 0.186 | 69.2 | 0.365 | -96.0 | 0.983 | 11.27 |
| 2.9 | 0.288 | -155.4 | 2.422 | 52.9 | 0.195 | 69.4 | 0.358 | -98.0 | 0.985 | 10.95 |
| 3.0 | 0.291 | -158.4 | 2.349 | 51.2 | 0.203 | 70.0 | 0.351 | -101.2 | 0.986 | 10.64 |
| 4.0 | 0.385 | 175.5 | 1.873 | 31.3 | 0.313 | 65.7 | 0.395 | -140.4 | 0.834 | 7.76 |
| 5.0 | 0.491 | 152.2 | 1.459 | 12.8 | 0.426 | 54.3 | 0.502 | -174.0 | 0.763 | 5.35 |

$V_{CE} = 2\text{ V}$, $I_C = 5\text{ mA}$, $Z_o = 50\ \Omega$

| Frequency (GHz) | S ₁₁ | | S ₂₁ | | S ₁₂ | | S ₂₂ | | K | MAG/MSG (dB) |
|--------------------|-----------------|----------------|-----------------|----------------|-----------------|----------------|-----------------|----------------|-------|-----------------|
| | MAG. | ANG. (deg.) | MAG. | ANG. (deg.) | MAG. | ANG. (deg.) | MAG. | ANG. (deg.) | | |
| 0.1 | 0.800 | -11.4 | 13.112 | 166.9 | 0.014 | 82.9 | 0.974 | -9.3 | 0.138 | 29.72 |
| 0.2 | 0.761 | -24.4 | 12.461 | 154.8 | 0.027 | 76.1 | 0.930 | -17.7 | 0.217 | 26.58 |
| 0.3 | 0.703 | -34.5 | 11.503 | 144.7 | 0.039 | 71.1 | 0.864 | -24.5 | 0.316 | 24.72 |
| 0.4 | 0.638 | -43.0 | 10.459 | 135.4 | 0.048 | 67.7 | 0.796 | -30.4 | 0.410 | 23.37 |
| 0.5 | 0.574 | -51.2 | 9.514 | 127.2 | 0.056 | 65.1 | 0.731 | -34.9 | 0.498 | 22.33 |
| 0.6 | 0.514 | -57.9 | 8.646 | 120.3 | 0.062 | 63.5 | 0.670 | -38.8 | 0.584 | 21.44 |
| 0.7 | 0.465 | -64.0 | 7.888 | 114.8 | 0.068 | 62.6 | 0.620 | -41.6 | 0.653 | 20.64 |
| 0.8 | 0.420 | -69.2 | 7.191 | 109.5 | 0.073 | 62.2 | 0.573 | -44.2 | 0.726 | 19.92 |
| 0.9 | 0.384 | -74.8 | 6.607 | 104.9 | 0.078 | 62.1 | 0.538 | -46.4 | 0.779 | 19.27 |
| 1.0 | 0.351 | -79.7 | 6.131 | 100.7 | 0.083 | 62.6 | 0.505 | -48.4 | 0.832 | 18.68 |
| 1.1 | 0.328 | -84.8 | 5.705 | 97.0 | 0.088 | 63.2 | 0.480 | -50.1 | 0.870 | 18.12 |
| 1.2 | 0.306 | -89.3 | 5.307 | 93.9 | 0.093 | 63.9 | 0.455 | -51.8 | 0.907 | 17.55 |
| 1.3 | 0.286 | -94.0 | 4.994 | 90.6 | 0.098 | 64.5 | 0.437 | -53.4 | 0.935 | 17.06 |
| 1.4 | 0.268 | -97.9 | 4.700 | 87.6 | 0.104 | 65.2 | 0.419 | -55.2 | 0.962 | 16.56 |
| 1.5 | 0.253 | -102.1 | 4.447 | 84.4 | 0.110 | 65.8 | 0.406 | -56.9 | 0.981 | 16.08 |
| 1.6 | 0.240 | -107.3 | 4.223 | 81.6 | 0.115 | 66.4 | 0.390 | -58.8 | 0.999 | 15.64 |
| 1.7 | 0.228 | -112.3 | 4.004 | 79.0 | 0.121 | 67.1 | 0.378 | -60.8 | 1.014 | 14.46 |
| 1.8 | 0.215 | -117.0 | 3.821 | 76.3 | 0.128 | 67.5 | 0.363 | -62.8 | 1.030 | 13.70 |
| 1.9 | 0.214 | -120.4 | 3.643 | 74.3 | 0.134 | 68.0 | 0.354 | -65.4 | 1.035 | 13.19 |
| 2.0 | 0.203 | -127.8 | 3.500 | 71.6 | 0.141 | 68.3 | 0.339 | -67.5 | 1.045 | 12.66 |
| 2.1 | 0.208 | -130.9 | 3.377 | 69.3 | 0.147 | 68.7 | 0.336 | -70.8 | 1.036 | 12.44 |
| 2.2 | 0.206 | -138.8 | 3.249 | 67.0 | 0.154 | 69.0 | 0.326 | -73.5 | 1.040 | 12.02 |
| 2.3 | 0.211 | -141.8 | 3.151 | 64.8 | 0.162 | 69.0 | 0.328 | -76.2 | 1.023 | 11.96 |
| 2.4 | 0.216 | -147.3 | 3.054 | 62.5 | 0.170 | 69.2 | 0.319 | -79.4 | 1.017 | 11.76 |
| 2.5 | 0.219 | -150.1 | 2.953 | 60.5 | 0.177 | 69.4 | 0.316 | -81.7 | 1.012 | 11.55 |
| 2.6 | 0.232 | -155.0 | 2.866 | 58.6 | 0.185 | 69.5 | 0.311 | -86.0 | 1.000 | 11.89 |
| 2.7 | 0.230 | -158.6 | 2.781 | 56.4 | 0.194 | 69.4 | 0.308 | -88.6 | 0.996 | 11.57 |
| 2.8 | 0.244 | -161.1 | 2.710 | 54.5 | 0.202 | 69.3 | 0.310 | -92.3 | 0.979 | 11.28 |
| 2.9 | 0.242 | -164.5 | 2.634 | 52.6 | 0.210 | 69.0 | 0.304 | -94.1 | 0.979 | 10.98 |
| 3.0 | 0.247 | -166.5 | 2.556 | 51.1 | 0.219 | 69.0 | 0.297 | -97.3 | 0.978 | 10.68 |
| 4.0 | 0.347 | 170.9 | 2.055 | 32.7 | 0.321 | 63.1 | 0.336 | -137.6 | 0.867 | 8.06 |
| 5.0 | 0.458 | 150.0 | 1.632 | 15.1 | 0.422 | 52.7 | 0.446 | -171.2 | 0.800 | 5.87 |

$V_{CE} = 2\text{ V}$, $I_C = 7\text{ mA}$, $Z_0 = 50\ \Omega$

| Frequency (GHz) | S ₁₁ | | S ₂₁ | | S ₁₂ | | S ₂₂ | | K | MAG/MSG (dB) |
|--------------------|-----------------|----------------|-----------------|----------------|-----------------|----------------|-----------------|----------------|-------|-----------------|
| | MAG. | ANG. (deg.) | MAG. | ANG. (deg.) | MAG. | ANG. (deg.) | MAG. | ANG. (deg.) | | |
| 0.1 | 0.734 | -14.1 | 16.263 | 164.7 | 0.013 | 82.2 | 0.963 | -10.7 | 0.165 | 30.81 |
| 0.2 | 0.691 | -28.5 | 15.110 | 151.0 | 0.026 | 74.7 | 0.903 | -20.1 | 0.274 | 27.62 |
| 0.3 | 0.620 | -39.2 | 13.572 | 139.7 | 0.036 | 71.1 | 0.822 | -27.0 | 0.387 | 25.75 |
| 0.4 | 0.548 | -48.0 | 12.059 | 130.2 | 0.045 | 68.2 | 0.743 | -32.8 | 0.496 | 24.29 |
| 0.5 | 0.482 | -56.6 | 10.729 | 122.0 | 0.052 | 66.4 | 0.673 | -36.7 | 0.590 | 23.18 |
| 0.6 | 0.426 | -62.9 | 9.574 | 115.4 | 0.058 | 65.4 | 0.611 | -39.9 | 0.678 | 22.17 |
| 0.7 | 0.381 | -68.9 | 8.615 | 110.2 | 0.064 | 65.3 | 0.562 | -42.0 | 0.747 | 21.31 |
| 0.8 | 0.338 | -74.2 | 7.795 | 105.2 | 0.069 | 65.5 | 0.518 | -44.0 | 0.813 | 20.51 |
| 0.9 | 0.310 | -79.4 | 7.106 | 101.0 | 0.075 | 65.6 | 0.487 | -45.6 | 0.859 | 19.78 |
| 1.0 | 0.280 | -84.4 | 6.538 | 97.1 | 0.080 | 66.4 | 0.458 | -47.1 | 0.901 | 19.10 |
| 1.1 | 0.260 | -89.2 | 6.059 | 93.8 | 0.086 | 67.2 | 0.436 | -48.4 | 0.930 | 18.48 |
| 1.2 | 0.245 | -93.7 | 5.614 | 90.9 | 0.092 | 67.9 | 0.414 | -49.7 | 0.958 | 17.85 |
| 1.3 | 0.230 | -98.8 | 5.272 | 87.8 | 0.098 | 68.4 | 0.400 | -51.2 | 0.972 | 17.30 |
| 1.4 | 0.215 | -102.9 | 4.940 | 85.0 | 0.105 | 68.9 | 0.385 | -52.8 | 0.992 | 16.74 |
| 1.5 | 0.203 | -108.1 | 4.670 | 82.1 | 0.111 | 69.4 | 0.373 | -54.4 | 1.002 | 15.94 |
| 1.6 | 0.193 | -113.2 | 4.426 | 79.5 | 0.118 | 69.8 | 0.359 | -56.1 | 1.014 | 15.04 |
| 1.7 | 0.185 | -118.3 | 4.186 | 77.1 | 0.124 | 70.1 | 0.349 | -58.0 | 1.023 | 14.34 |
| 1.8 | 0.176 | -123.7 | 3.993 | 74.7 | 0.131 | 70.2 | 0.335 | -59.9 | 1.032 | 13.73 |
| 1.9 | 0.175 | -127.4 | 3.805 | 72.8 | 0.138 | 70.4 | 0.327 | -62.5 | 1.034 | 13.26 |
| 2.0 | 0.170 | -134.7 | 3.652 | 70.5 | 0.146 | 70.4 | 0.314 | -64.6 | 1.038 | 12.79 |
| 2.1 | 0.176 | -138.0 | 3.514 | 68.2 | 0.152 | 70.7 | 0.312 | -68.0 | 1.031 | 12.54 |
| 2.2 | 0.177 | -146.4 | 3.378 | 66.1 | 0.160 | 70.6 | 0.302 | -70.7 | 1.032 | 12.16 |
| 2.3 | 0.186 | -148.8 | 3.279 | 63.9 | 0.168 | 70.4 | 0.304 | -73.4 | 1.013 | 12.19 |
| 2.4 | 0.193 | -154.3 | 3.173 | 61.8 | 0.177 | 70.3 | 0.296 | -76.6 | 1.007 | 12.04 |
| 2.5 | 0.197 | -157.0 | 3.066 | 59.9 | 0.185 | 70.3 | 0.293 | -79.0 | 1.002 | 11.94 |
| 2.6 | 0.210 | -161.5 | 2.973 | 58.2 | 0.193 | 70.1 | 0.287 | -83.4 | 0.993 | 11.88 |
| 2.7 | 0.211 | -165.4 | 2.883 | 56.1 | 0.201 | 69.7 | 0.285 | -86.0 | 0.990 | 11.56 |
| 2.8 | 0.226 | -167.0 | 2.809 | 54.3 | 0.209 | 69.5 | 0.287 | -89.9 | 0.974 | 11.28 |
| 2.9 | 0.222 | -170.0 | 2.731 | 52.5 | 0.218 | 69.0 | 0.281 | -91.6 | 0.975 | 10.98 |
| 3.0 | 0.227 | -172.1 | 2.651 | 51.1 | 0.227 | 68.8 | 0.274 | -94.8 | 0.975 | 10.68 |
| 4.0 | 0.333 | 167.9 | 2.133 | 33.5 | 0.326 | 62.1 | 0.309 | -136.2 | 0.880 | 8.15 |
| 5.0 | 0.445 | 148.5 | 1.707 | 16.3 | 0.422 | 51.8 | 0.418 | -170.4 | 0.819 | 6.06 |

$V_{CE} = 2\text{ V}$, $I_C = 10\text{ mA}$, $Z_O = 50\ \Omega$

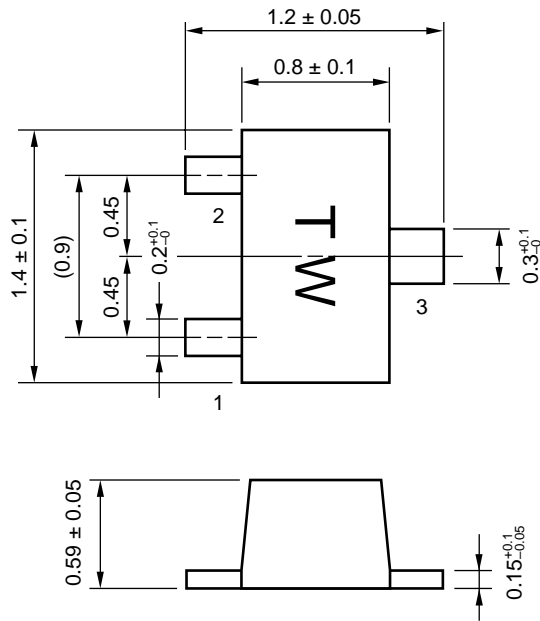
| Frequency (GHz) | S ₁₁ | | S ₂₁ | | S ₁₂ | | S ₂₂ | | K | MAG/MSG (dB) |
|--------------------|-----------------|----------------|-----------------|----------------|-----------------|----------------|-----------------|----------------|-------|-----------------|
| | MAG. | ANG. (deg.) | MAG. | ANG. (deg.) | MAG. | ANG. (deg.) | MAG. | ANG. (deg.) | | |
| 0.1 | 0.663 | -18.0 | 19.742 | 162.2 | 0.013 | 80.7 | 0.949 | -12.2 | 0.203 | 31.69 |
| 0.2 | 0.608 | -33.1 | 17.798 | 146.6 | 0.025 | 74.7 | 0.869 | -22.4 | 0.333 | 28.59 |
| 0.3 | 0.529 | -44.5 | 15.556 | 134.7 | 0.034 | 71.2 | 0.773 | -29.3 | 0.470 | 26.61 |
| 0.4 | 0.456 | -53.3 | 13.439 | 125.0 | 0.042 | 68.8 | 0.687 | -34.4 | 0.590 | 25.08 |
| 0.5 | 0.393 | -61.7 | 11.696 | 117.2 | 0.048 | 68.2 | 0.615 | -37.5 | 0.686 | 23.82 |
| 0.6 | 0.342 | -68.6 | 10.304 | 110.9 | 0.054 | 68.1 | 0.557 | -39.9 | 0.767 | 22.79 |
| 0.7 | 0.303 | -74.2 | 9.195 | 106.1 | 0.061 | 68.6 | 0.512 | -41.3 | 0.826 | 21.82 |
| 0.8 | 0.267 | -79.5 | 8.229 | 101.6 | 0.066 | 69.2 | 0.474 | -42.7 | 0.883 | 20.93 |
| 0.9 | 0.243 | -84.9 | 7.456 | 97.6 | 0.072 | 69.5 | 0.446 | -43.8 | 0.921 | 20.13 |
| 1.0 | 0.218 | -89.8 | 6.833 | 94.2 | 0.079 | 70.1 | 0.421 | -45.0 | 0.953 | 19.39 |
| 1.1 | 0.206 | -94.9 | 6.310 | 91.0 | 0.085 | 70.8 | 0.403 | -45.9 | 0.971 | 18.70 |
| 1.2 | 0.195 | -99.0 | 5.837 | 88.5 | 0.092 | 71.3 | 0.385 | -47.1 | 0.989 | 18.04 |
| 1.3 | 0.183 | -105.0 | 5.459 | 85.6 | 0.099 | 71.8 | 0.374 | -48.4 | 0.997 | 17.43 |
| 1.4 | 0.174 | -109.5 | 5.108 | 83.0 | 0.106 | 72.0 | 0.360 | -50.0 | 1.008 | 16.30 |
| 1.5 | 0.165 | -115.1 | 4.812 | 80.4 | 0.113 | 72.3 | 0.351 | -51.4 | 1.015 | 15.57 |
| 1.6 | 0.157 | -120.7 | 4.560 | 77.9 | 0.120 | 72.4 | 0.339 | -53.1 | 1.021 | 14.93 |
| 1.7 | 0.152 | -126.4 | 4.309 | 75.6 | 0.127 | 72.4 | 0.330 | -55.0 | 1.026 | 14.32 |
| 1.8 | 0.145 | -132.0 | 4.113 | 73.4 | 0.135 | 72.4 | 0.317 | -56.8 | 1.031 | 13.78 |
| 1.9 | 0.149 | -136.4 | 3.912 | 71.5 | 0.142 | 72.5 | 0.310 | -59.5 | 1.031 | 13.34 |
| 2.0 | 0.145 | -144.2 | 3.756 | 69.3 | 0.150 | 72.3 | 0.298 | -61.5 | 1.032 | 12.90 |
| 2.1 | 0.155 | -147.6 | 3.609 | 67.1 | 0.157 | 72.1 | 0.296 | -65.1 | 1.023 | 12.67 |
| 2.2 | 0.158 | -155.6 | 3.467 | 65.1 | 0.165 | 72.0 | 0.287 | -67.8 | 1.023 | 12.30 |
| 2.3 | 0.170 | -157.3 | 3.360 | 63.1 | 0.173 | 71.6 | 0.289 | -70.5 | 1.006 | 12.41 |
| 2.4 | 0.181 | -161.9 | 3.252 | 61.0 | 0.182 | 71.3 | 0.281 | -73.9 | 0.999 | 12.53 |
| 2.5 | 0.183 | -164.7 | 3.142 | 59.2 | 0.190 | 71.1 | 0.279 | -76.2 | 0.995 | 12.18 |
| 2.6 | 0.200 | -168.8 | 3.047 | 57.6 | 0.199 | 70.8 | 0.272 | -80.7 | 0.985 | 11.86 |
| 2.7 | 0.201 | -171.6 | 2.953 | 55.7 | 0.207 | 70.4 | 0.271 | -83.3 | 0.981 | 11.53 |
| 2.8 | 0.217 | -173.2 | 2.876 | 53.9 | 0.216 | 69.9 | 0.272 | -87.3 | 0.967 | 11.25 |
| 2.9 | 0.215 | -175.8 | 2.794 | 52.0 | 0.225 | 69.3 | 0.268 | -89.0 | 0.968 | 10.95 |
| 3.0 | 0.219 | -177.7 | 2.716 | 50.9 | 0.233 | 69.1 | 0.260 | -92.1 | 0.968 | 10.66 |
| 4.0 | 0.329 | 164.5 | 2.188 | 33.8 | 0.331 | 61.6 | 0.292 | -134.9 | 0.886 | 8.20 |
| 5.0 | 0.441 | 146.3 | 1.760 | 16.8 | 0.425 | 51.1 | 0.401 | -169.6 | 0.829 | 6.17 |

$V_{CE} = 2\text{ V}$, $I_C = 20\text{ mA}$, $Z_O = 50\ \Omega$

| Frequency (GHz) | S ₁₁ | | S ₂₁ | | S ₁₂ | | S ₂₂ | | K | MAG/MSG (dB) |
|--------------------|-----------------|----------------|-----------------|----------------|-----------------|----------------|-----------------|----------------|-------|-----------------|
| | MAG. | ANG. (deg.) | MAG. | ANG. (deg.) | MAG. | ANG. (deg.) | MAG. | ANG. (deg.) | | |
| 0.1 | 0.523 | -22.4 | 25.341 | 156.8 | 0.011 | 77.8 | 0.913 | -14.9 | 0.340 | 33.61 |
| 0.2 | 0.433 | -44.6 | 21.510 | 138.5 | 0.022 | 73.5 | 0.797 | -25.7 | 0.478 | 29.97 |
| 0.3 | 0.356 | -58.7 | 17.679 | 125.8 | 0.030 | 72.2 | 0.684 | -31.3 | 0.631 | 27.76 |
| 0.4 | 0.298 | -69.1 | 14.672 | 116.6 | 0.037 | 71.8 | 0.598 | -34.6 | 0.745 | 26.02 |
| 0.5 | 0.250 | -78.9 | 12.399 | 109.4 | 0.043 | 72.3 | 0.538 | -36.0 | 0.831 | 24.59 |
| 0.6 | 0.215 | -86.4 | 10.718 | 103.9 | 0.049 | 73.1 | 0.489 | -36.9 | 0.897 | 23.36 |
| 0.7 | 0.192 | -93.6 | 9.430 | 99.6 | 0.056 | 73.8 | 0.456 | -37.3 | 0.935 | 22.24 |
| 0.8 | 0.169 | -101.9 | 8.363 | 95.5 | 0.063 | 74.5 | 0.427 | -37.9 | 0.972 | 21.24 |
| 0.9 | 0.157 | -109.0 | 7.535 | 92.2 | 0.069 | 74.9 | 0.409 | -38.6 | 0.993 | 20.35 |
| 1.0 | 0.147 | -115.7 | 6.872 | 89.1 | 0.076 | 75.6 | 0.390 | -39.5 | 1.010 | 18.94 |
| 1.1 | 0.143 | -121.9 | 6.321 | 86.3 | 0.084 | 76.1 | 0.379 | -40.4 | 1.015 | 18.05 |
| 1.2 | 0.143 | -127.5 | 5.823 | 84.1 | 0.091 | 76.4 | 0.365 | -41.3 | 1.023 | 17.15 |
| 1.3 | 0.141 | -133.8 | 5.439 | 81.6 | 0.098 | 76.6 | 0.358 | -42.7 | 1.023 | 16.51 |
| 1.4 | 0.137 | -138.8 | 5.078 | 79.2 | 0.106 | 76.6 | 0.348 | -44.3 | 1.027 | 15.81 |
| 1.5 | 0.138 | -144.4 | 4.784 | 76.6 | 0.113 | 76.7 | 0.341 | -45.9 | 1.024 | 15.29 |
| 1.6 | 0.139 | -150.1 | 4.519 | 74.5 | 0.121 | 76.6 | 0.332 | -47.8 | 1.025 | 14.75 |
| 1.7 | 0.141 | -155.0 | 4.266 | 72.4 | 0.129 | 76.4 | 0.325 | -49.8 | 1.024 | 14.23 |
| 1.8 | 0.143 | -161.0 | 4.065 | 70.2 | 0.137 | 76.2 | 0.315 | -51.8 | 1.024 | 13.76 |
| 1.9 | 0.148 | -162.6 | 3.867 | 68.5 | 0.145 | 75.9 | 0.309 | -54.7 | 1.022 | 13.34 |
| 2.0 | 0.154 | -169.3 | 3.707 | 66.3 | 0.154 | 75.6 | 0.298 | -56.8 | 1.019 | 12.96 |
| 2.1 | 0.164 | -170.4 | 3.561 | 64.3 | 0.162 | 75.4 | 0.297 | -60.6 | 1.010 | 12.81 |
| 2.2 | 0.175 | -176.5 | 3.421 | 62.3 | 0.170 | 75.0 | 0.290 | -63.3 | 1.005 | 12.58 |
| 2.3 | 0.186 | -176.4 | 3.313 | 60.4 | 0.179 | 74.4 | 0.293 | -66.4 | 0.989 | 12.67 |
| 2.4 | 0.202 | -179.9 | 3.208 | 58.3 | 0.188 | 74.0 | 0.285 | -69.8 | 0.978 | 12.31 |
| 2.5 | 0.207 | 178.3 | 3.098 | 56.6 | 0.197 | 73.5 | 0.283 | -72.4 | 0.973 | 11.97 |
| 2.6 | 0.225 | 176.6 | 3.004 | 54.8 | 0.206 | 73.1 | 0.277 | -77.0 | 0.962 | 11.63 |
| 2.7 | 0.228 | 173.7 | 2.909 | 52.9 | 0.216 | 72.5 | 0.277 | -79.7 | 0.958 | 11.30 |
| 2.8 | 0.242 | 173.1 | 2.827 | 51.2 | 0.224 | 71.9 | 0.279 | -84.0 | 0.945 | 11.00 |
| 2.9 | 0.246 | 171.2 | 2.754 | 49.4 | 0.234 | 71.2 | 0.275 | -85.7 | 0.941 | 10.71 |
| 3.0 | 0.249 | 169.4 | 2.676 | 48.1 | 0.243 | 70.8 | 0.268 | -88.9 | 0.942 | 10.42 |
| 4.0 | 0.365 | 156.9 | 2.155 | 31.3 | 0.346 | 62.0 | 0.302 | -133.4 | 0.863 | 7.94 |
| 5.0 | 0.481 | 141.1 | 1.716 | 14.6 | 0.441 | 50.5 | 0.414 | -169.3 | 0.811 | 5.90 |

PACKAGE DIMENSIONS

FLAT-LEAD 3-PIN THIN-TYPE ULTRA SUPER MINIMOLD (UNIT: mm)



PIN CONNECTIONS

- 1. Emitter
- 2. Base
- 3. Collector

[MEMO]

[MEMO]

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