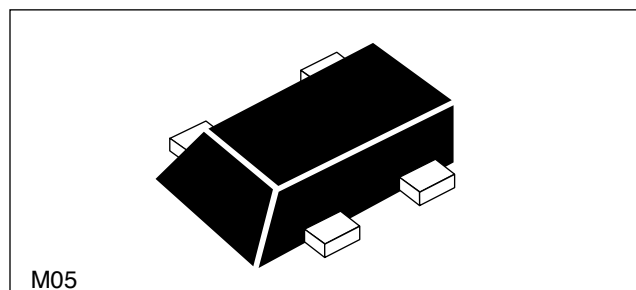


NEC's NPN SiGe HIGH FREQUENCY TRANSISTOR

FEATURES

- **HIGH BREAKDOWN VOLTAGE SiGe TECHNOLOGY**
V_{CEO} = 5 V (Absolute Maximum)
- **LOW NOISE FIGURE:**
NF = 0.8 dBm at 2 GHz
NF = 1.3 dBm at 5.2 GHz
- **HIGH MAXIMUM STABLE GAIN:**
MSG = 21.5 dB at 2 GHz
- **LOW PROFILE M05 PACKAGE:**
SOT-343 footprint, with a height of only 0.59 mm
Flat lead style for better RF performance
- **Pb Free Available (-A)**



DESCRIPTION

NEC's NESG2031M05 is fabricated using NEC's high voltage Silicon Germanium process (UHS2-HV), and is designed for a wide range of applications including low noise amplifiers, medium power amplifiers, and oscillators.

NEC's low profile, flat lead style M05 Package provides high frequency performance for compact wireless designs.

ELECTRICAL CHARACTERISTICS (T_A = 25°C)

| PART NUMBER PACKAGE OUTLINE | | NESG2031M05 M05 | | | | |
|--------------------------------|------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|-----|------|------|-----|
| SYMBOLS | PARAMETERS AND CONDITIONS | UNITS | MIN | TYP | MAX | |
| RF | NF | Noise Figure at V _{CE} = 2 V, I _C = 5 mA, f = 5.2 GHz, Z _S = Z _{SOPT} , Z _L = Z _{LOPT} | dB | | 1.3 | |
| | G _a | Associated Gain at V _{CE} = 2 V, I _C = 5 mA, f = 5.2 GHz, Z _S = Z _{SOPT} , Z _L = Z _{LOPT} | dB | | 10.0 | |
| | NF | Noise Figure at V _{CE} = 2 V, I _C = 5 mA, f = 2 GHz, Z _S = Z _{SOPT} , Z _L = Z _{LOPT} | dB | | 0.8 | 1.1 |
| | G _a | Associated Gain at V _{CE} = 2 V, I _C = 5 mA, f = 2 GHz, Z _S = Z _{SOPT} , Z _L = Z _{LOPT} | dB | 15.0 | 17.0 | |
| | MSG | Maximum Stable Gain ¹ at V _{CE} = 3 V, I _C = 20 mA, f = 2 GHz | dB | 19.0 | 21.5 | |
| | IS _{21E} I ² | Insertion Power Gain at V _{CE} = 3 V, I _C = 20 mA, f = 2 GHz | dB | 16.0 | 18.0 | |
| | P _{1dB} | Output Power at 1dB Compression Point at V _{CE} = 3 V, I _C = 20 mA, f = 2 GHz | dBm | | 13 | |
| | OIP ₃ | Output 3rd Order Intercept Point at V _{CE} = 3 V, I _C = 20 mA, f = 2 GHz | dBm | | 23 | |
| | f _T | Gain Bandwidth Product at V _{CE} = 3 V, I _C = 20 mA, f = 2 GHz | GHz | 20 | 25 | |
| C _{re} | Reverse Transfer Capacitance ² at V _{CB} = 2 V, I _C = 0 mA, f = 1 GHz | pF | | 0.15 | 0.25 | |
| DC | I _{CBO} | Collector Cutoff Current at V _{CB} = 5V, I _E = 0 | nA | | | 100 |
| | I _{EBO} | Emitter Cutoff Current at V _{EB} = 1 V, I _C = 0 | nA | | | 100 |
| | h _{FE} | DC Current Gain ³ at V _{CE} = 2 V, I _C = 5 mA | | 130 | 190 | 260 |

Notes:

$$1. \text{MSG} = \left| \frac{S_{21}}{S_{12}} \right|$$

2. Collector to base capacitance is measured by capacitance meter (automatic balance bridge method) when emitter pin is connected to the guard pin.

3. Pulsed measurement, pulse width ≤ 350 μs, duty cycle ≤ 2 %.

The information in this document is subject to change without notice. Before using this document, please confirm that this is the latest version.

ABSOLUTE MAXIMUM RATINGS¹ (T_A = 25°C)

| SYMBOLS | PARAMETERS | UNITS | RATINGS |
|-----------------------------|------------------------------|-------|-------------|
| V _{CB0} | Collector to Base Voltage | V | 13.0 |
| V _{CEO} | Collector to Emitter Voltage | V | 5.0 |
| V _{EBO} | Emitter to Base Voltage | V | 1.5 |
| I _C | Collector Current | mA | 35 |
| P _T ² | Total Power Dissipation | mW | 175 |
| T _J | Junction Temperature | °C | 150 |
| T _{STG} | Storage Temperature | °C | -65 to +150 |

Note:

1. Operation in excess of any one of these parameters may result in permanent damage.
2. Mounted on 1.08 cm² x 1.0 mm (t) glass epoxy PCB.

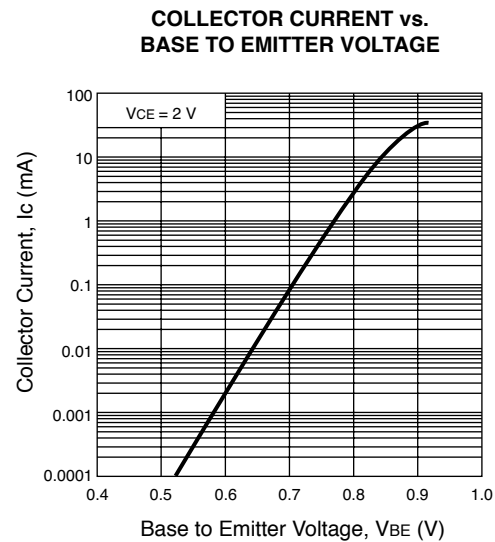
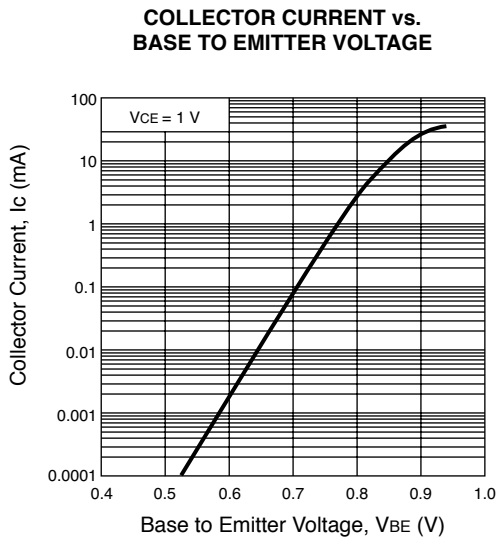
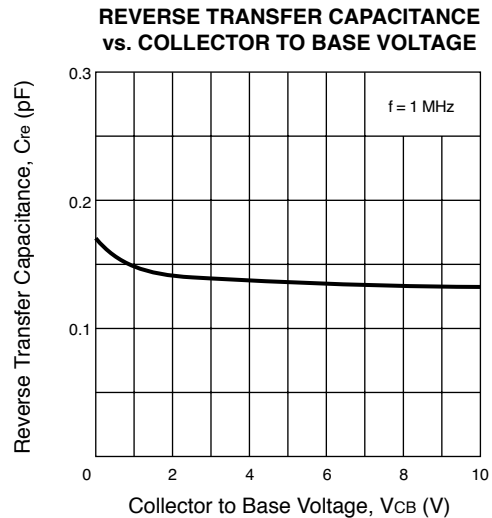
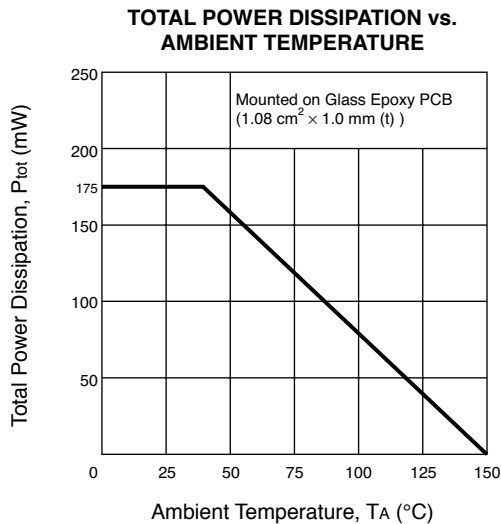
THERMAL RESISTANCE

| SYMBOLS | PARAMETERS | UNITS | RATINGS |
|---------------------|-----------------------------|-------|---------|
| R _{th j-c} | Junction to Case Resistance | °C/W | TBD |

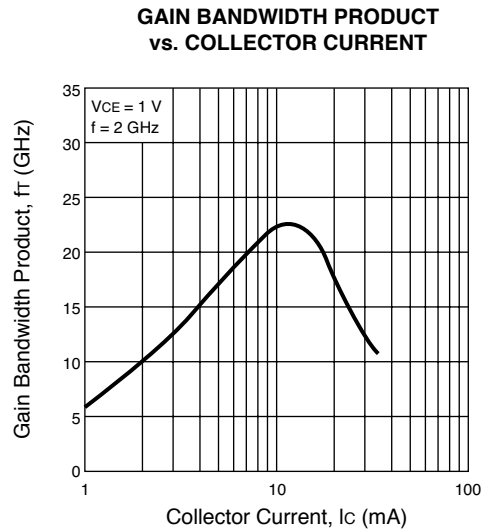
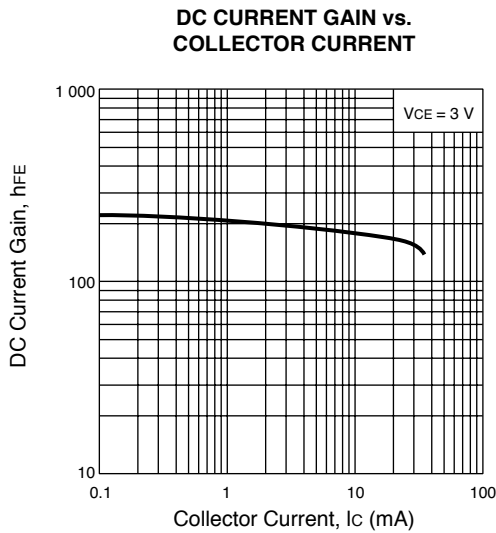
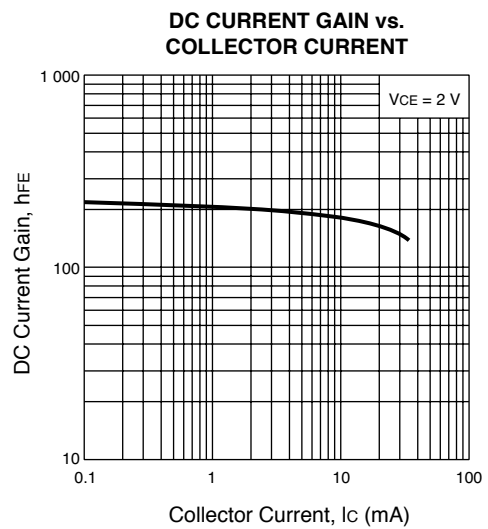
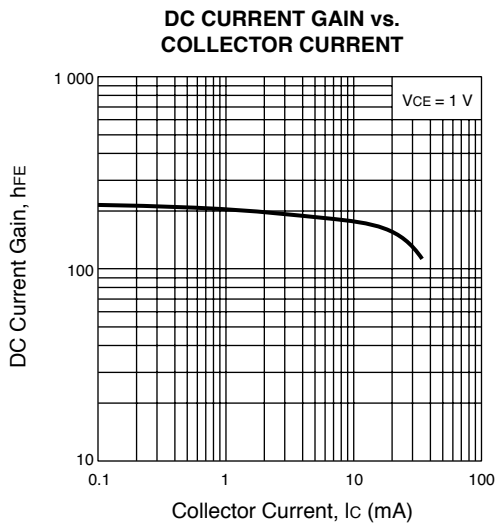
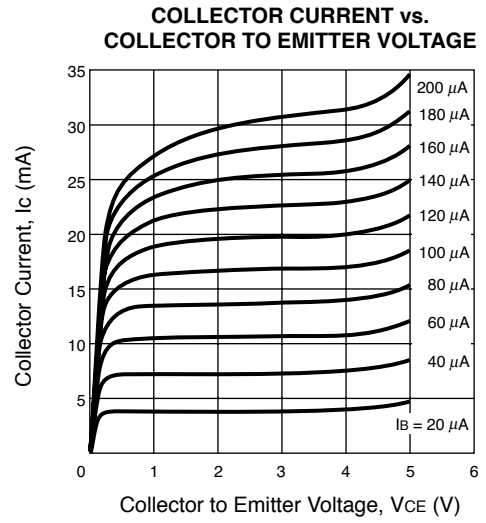
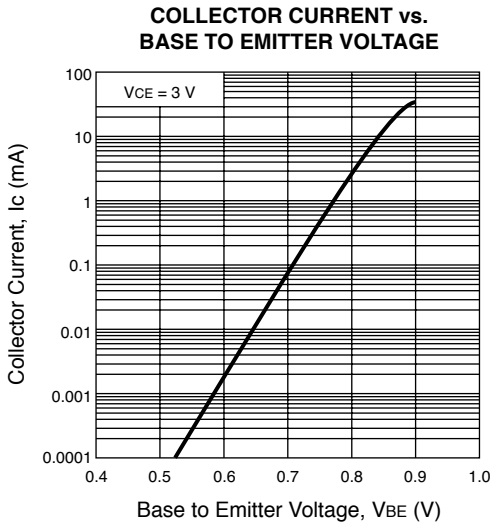
ORDERING INFORMATION

| PART NUMBER | QUANTITY | SUPPLY FORM |
|------------------|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| NESG2031M05-T1 | 3 kpcs/reel | <ul style="list-style-type: none"> • Pin 3 (Collector), Pin 4 (Emitter) face the perforation • 8 mm wide embossed taping |
| NESG2031M05-T1-A | 3 kpcs/reel | <ul style="list-style-type: none"> • Pb Free • Pin 3 (Collector), Pin 4 (Emitter) face the perforation • 8 mm wide embossed taping |

TYPICAL PERFORMANCE CURVES (T_A = 25°C)

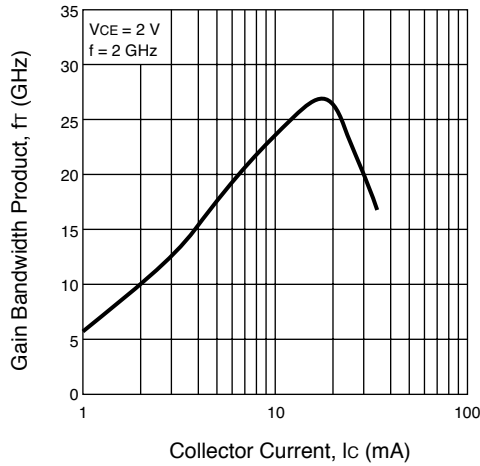


TYPICAL PERFORMANCE CURVES (T_A= 25°C)

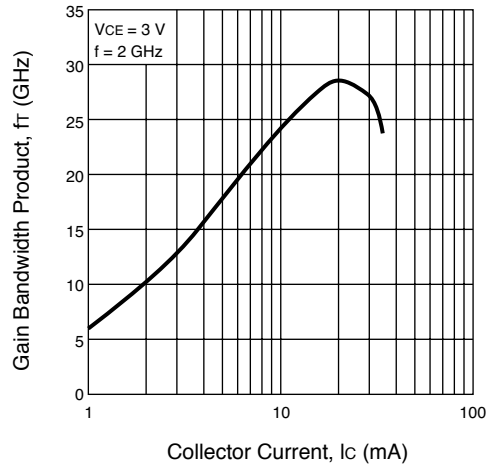


TYPICAL PERFORMANCE CURVES (T_A= 25°C)

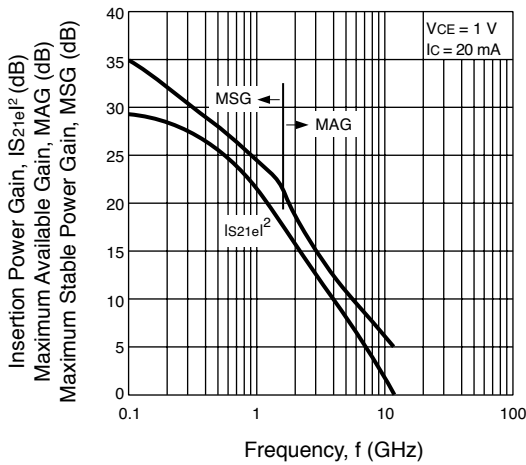
GAIN BANDWIDTH PRODUCT vs. COLLECTOR CURRENT



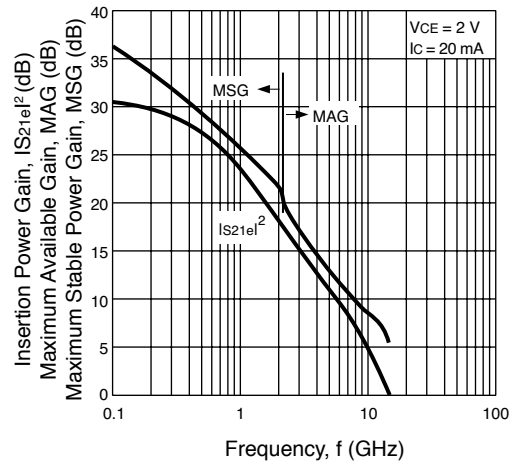
GAIN BANDWIDTH PRODUCT vs. COLLECTOR CURRENT



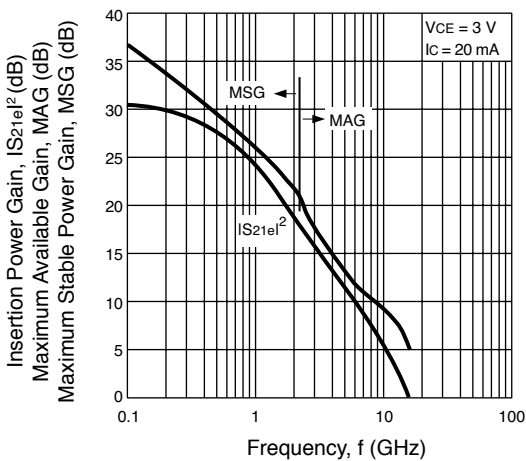
INSERTION POWER GAIN, MAG, MSG vs. FREQUENCY



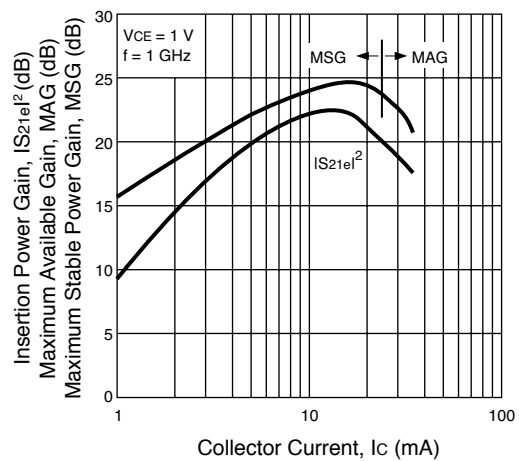
INSERTION POWER GAIN, MAG, MSG vs. FREQUENCY



INSERTION POWER GAIN, MAG, MSG vs. FREQUENCY

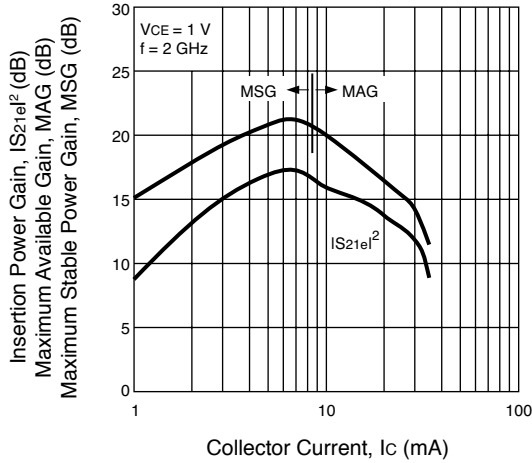


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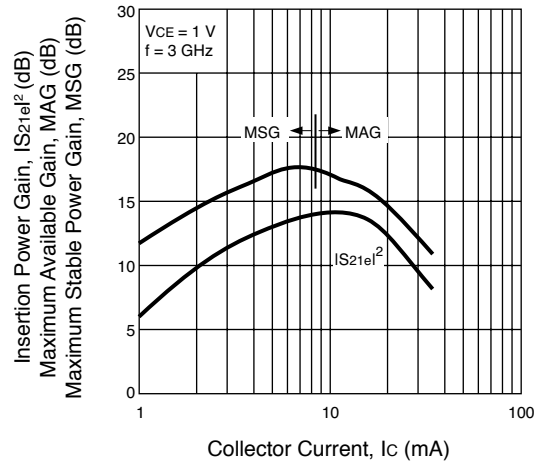


TYPICAL PERFORMANCE CURVES (T_A= 25°C)

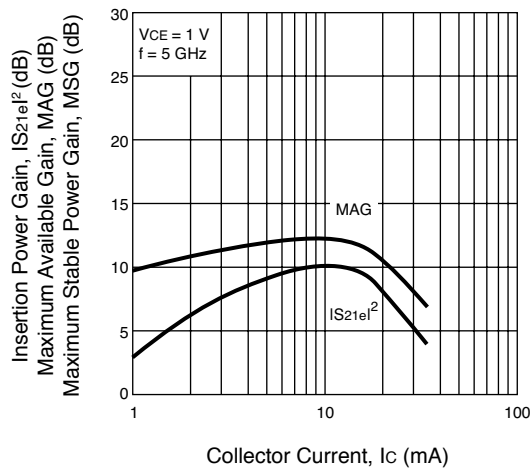
INSERTION POWER GAIN, MAG, MSG
vs. COLLECTOR CURRENT



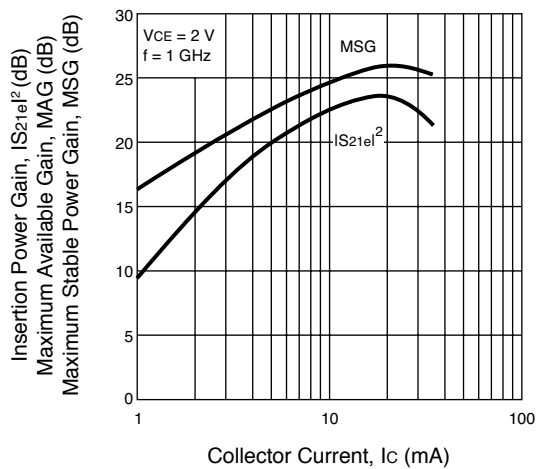
INSERTION POWER GAIN, MAG, MSG
vs. COLLECTOR CURRENT



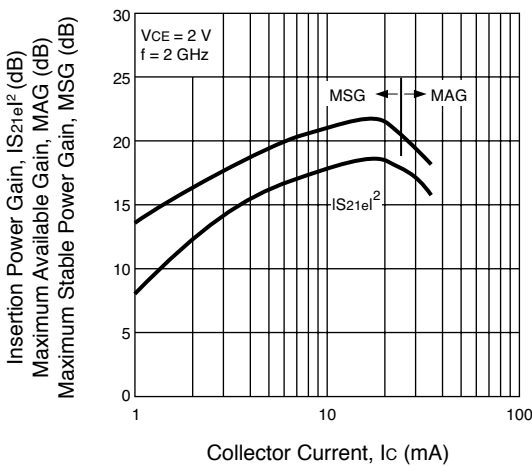
INSERTION POWER GAIN, MAG, MSG
vs. COLLECTOR CURRENT



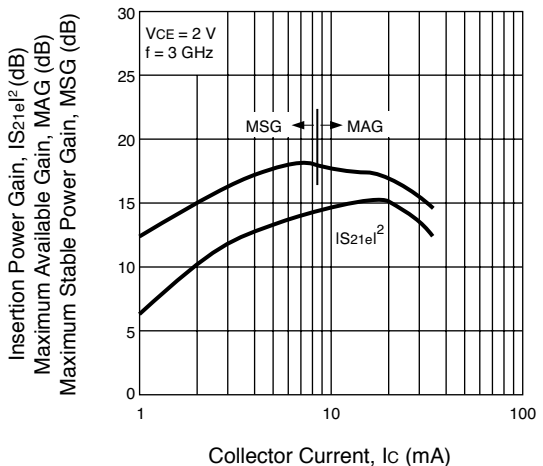
INSERTION POWER GAIN, MAG, MSG
vs. COLLECTOR CURRENT



INSERTION POWER GAIN, MAG, MSG
vs. COLLECTOR CURRENT

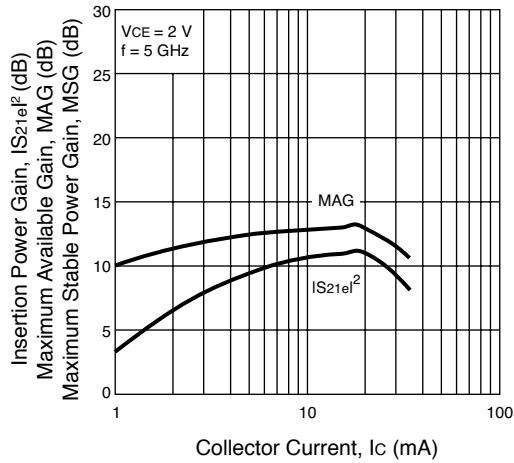


INSERTION POWER GAIN, MAG, MSG
vs. COLLECTOR CURRENT

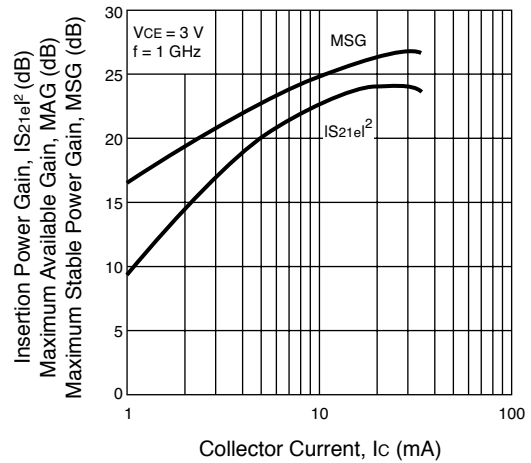


TYPICAL PERFORMANCE CURVES (T_A= 25°C)

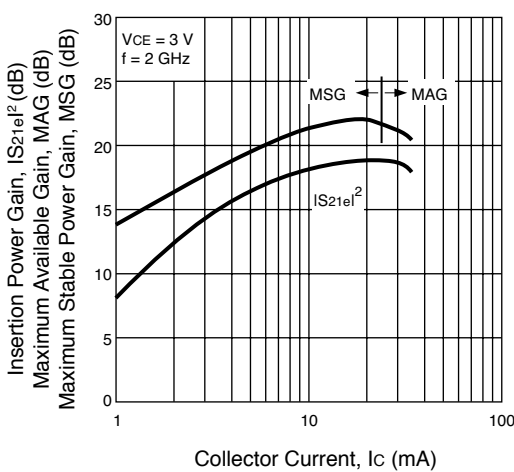
INSERTION POWER GAIN, MAG, MSG vs. COLLECTOR CURRENT



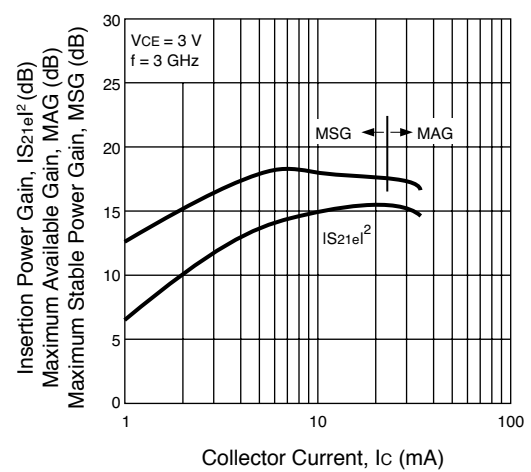
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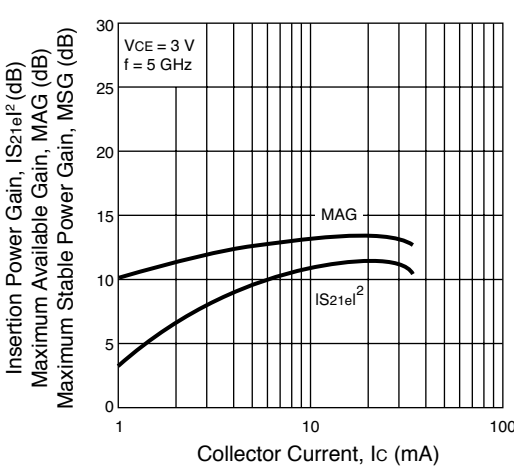
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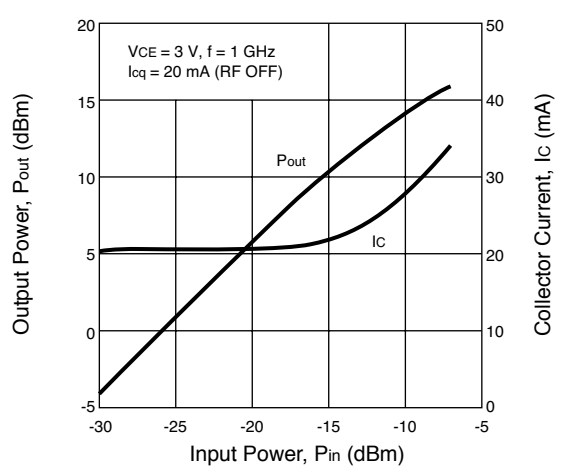
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INSERTION POWER GAIN, MAG, MSG vs. COLLECTOR CURRENT

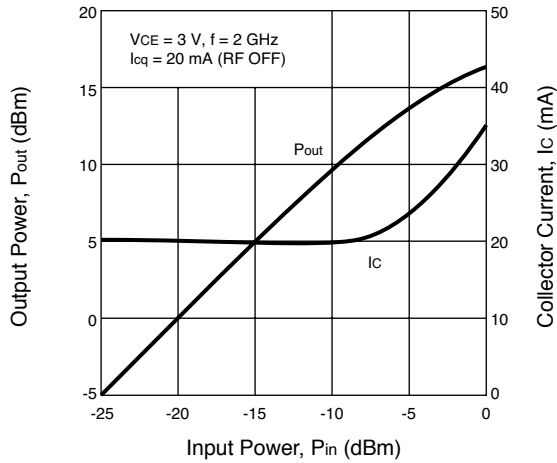


OUTPUT POWER, COLLECTOR CURRENT vs. INPUT POWER

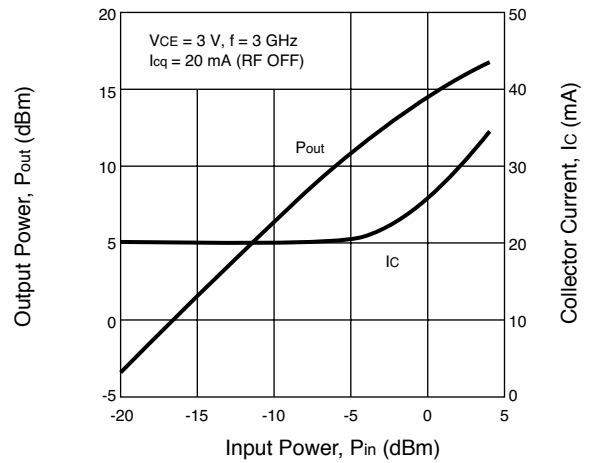


TYPICAL PERFORMANCE CURVES (TA= 25°C)

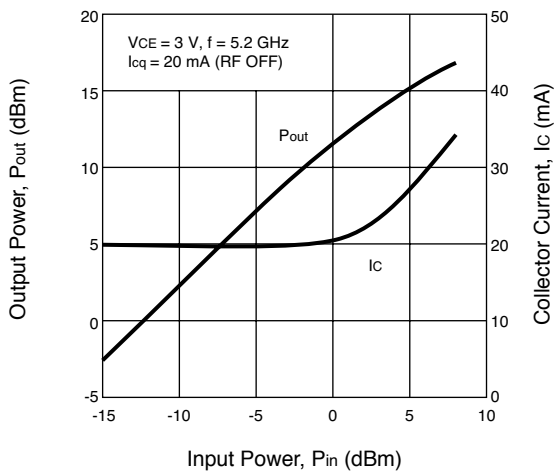
OUTPUT POWER, COLLECTOR CURRENT vs. INPUT POWER



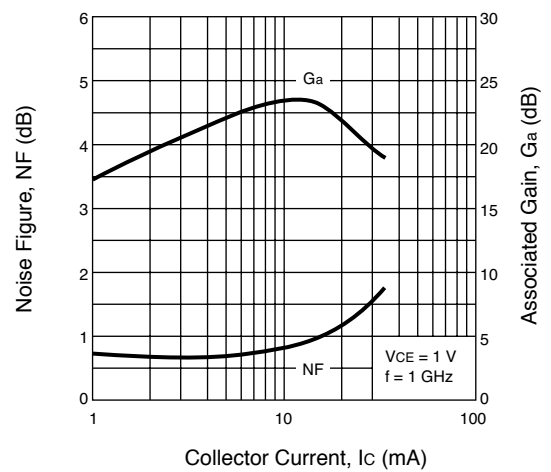
OUTPUT POWER, COLLECTOR CURRENT vs. INPUT POWER



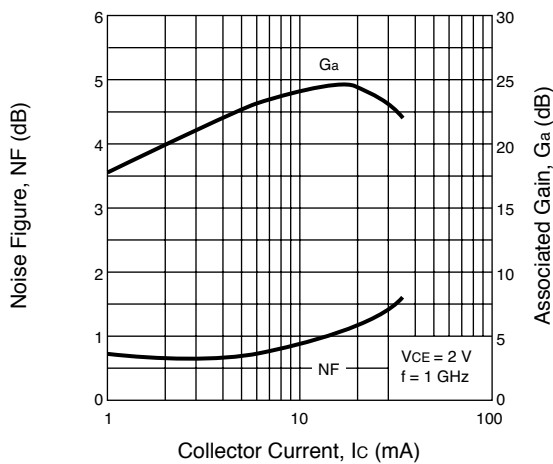
OUTPUT POWER, COLLECTOR CURRENT vs. INPUT POWER



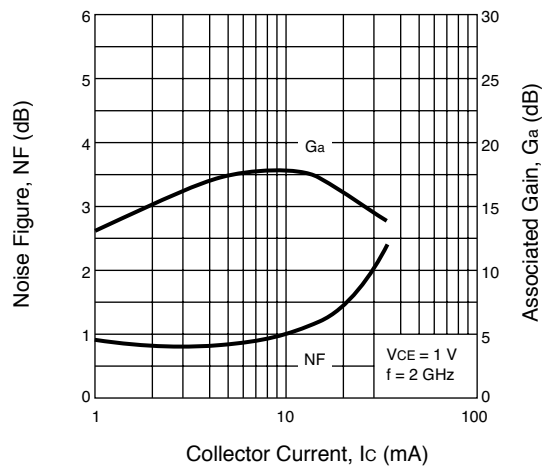
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT

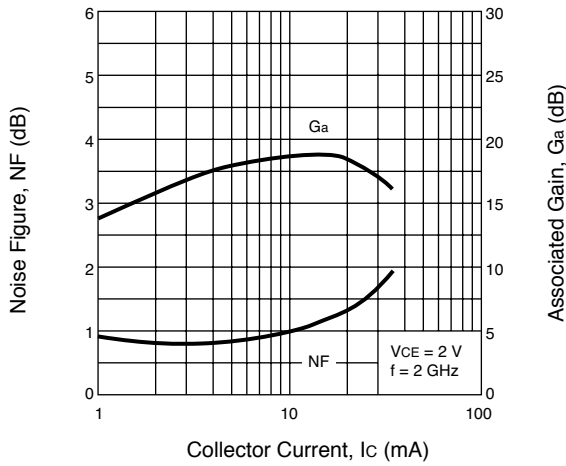


NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT

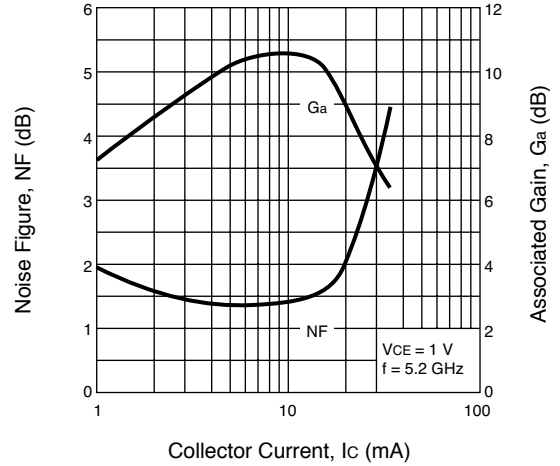


TYPICAL PERFORMANCE CURVES (T_A= 25°C)

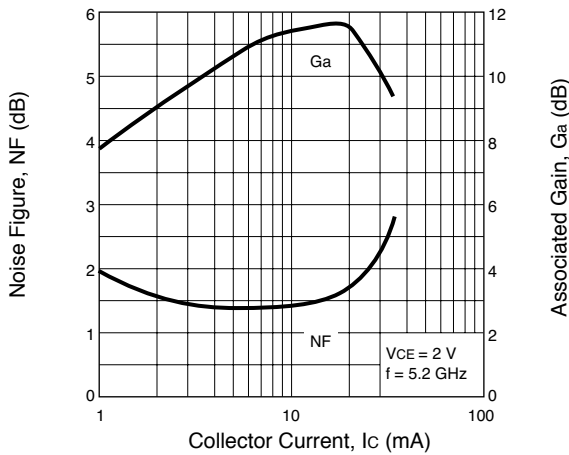
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



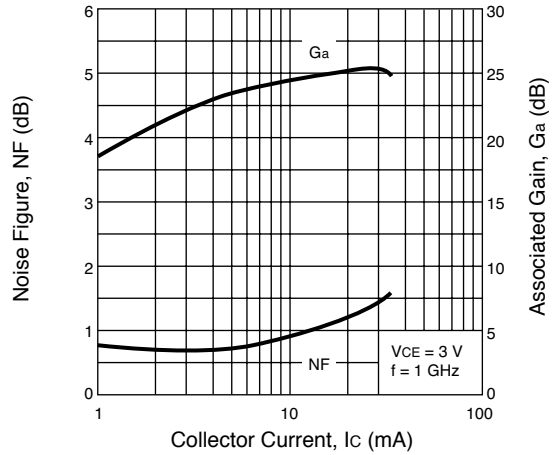
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



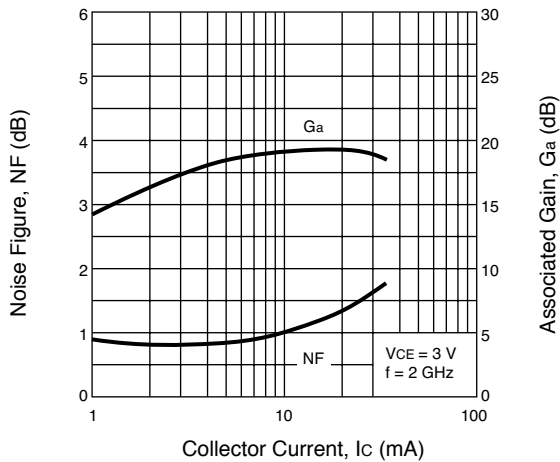
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



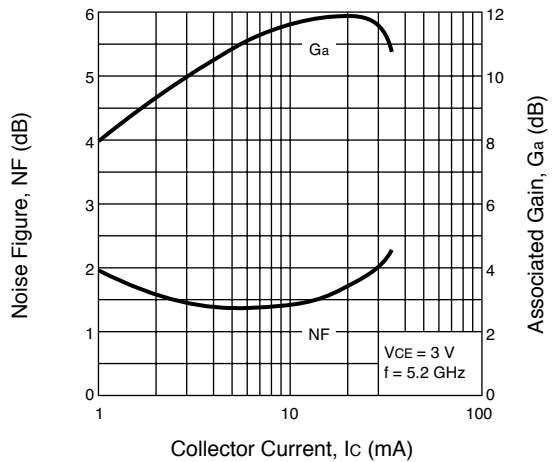
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



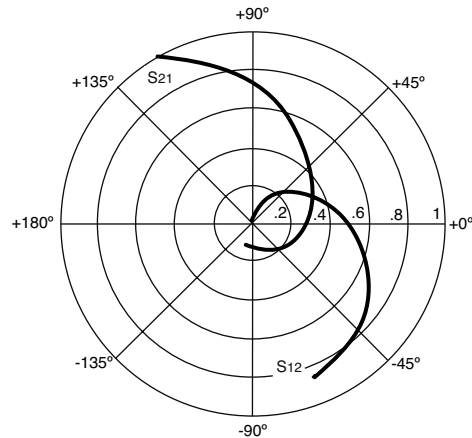
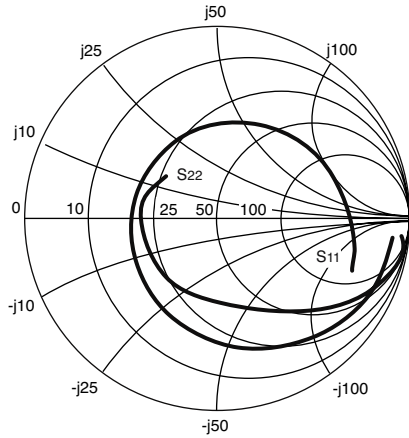
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



TYPICAL SCATTERING PARAMETERS (TA = 25°C)



NESG2031M05
Vc = 2 V, Ic = 5 mA

| FREQUENCY GHz | S11 | | S21 | | S12 | | S22 | | K | MAG ¹ (dB) |
|------------------|-------|---------|--------|---------|-------|--------|-------|---------|-------|--------------------------|
| | MAG | ANG | MAG | ANG | MAG | ANG | MAG | ANG | | |
| 0.200 | 0.905 | -17.55 | 13.476 | 166.44 | 0.015 | 75.48 | 0.961 | -12.14 | 0.109 | 29.62 |
| 0.400 | 0.883 | -35.30 | 12.930 | 153.01 | 0.027 | 67.20 | 0.917 | -22.40 | 0.114 | 26.77 |
| 0.600 | 0.800 | -50.74 | 11.773 | 139.58 | 0.036 | 57.16 | 0.838 | -29.39 | 0.260 | 25.09 |
| 0.800 | 0.747 | -65.74 | 10.912 | 128.86 | 0.044 | 50.21 | 0.774 | -36.45 | 0.312 | 23.91 |
| 1.000 | 0.700 | -79.13 | 10.032 | 119.48 | 0.050 | 44.20 | 0.717 | -42.55 | 0.364 | 22.98 |
| 1.200 | 0.651 | -91.64 | 9.211 | 110.79 | 0.055 | 39.35 | 0.668 | -47.96 | 0.421 | 22.20 |
| 1.400 | 0.605 | -103.05 | 8.432 | 102.94 | 0.059 | 34.88 | 0.624 | -52.70 | 0.487 | 21.55 |
| 1.600 | 0.569 | -114.06 | 7.754 | 95.75 | 0.062 | 31.30 | 0.586 | -57.00 | 0.544 | 20.94 |
| 1.800 | 0.544 | -123.33 | 7.158 | 89.32 | 0.065 | 28.57 | 0.557 | -60.70 | 0.597 | 20.44 |
| 1.900 | 0.525 | -128.19 | 6.874 | 86.26 | 0.066 | 27.02 | 0.542 | -62.68 | 0.632 | 20.20 |
| 2.000 | 0.515 | -132.91 | 6.638 | 83.05 | 0.067 | 25.54 | 0.529 | -64.60 | 0.657 | 19.96 |
| 2.100 | 0.504 | -137.65 | 6.391 | 80.23 | 0.068 | 24.56 | 0.517 | -66.48 | 0.683 | 19.73 |
| 2.200 | 0.499 | -141.94 | 6.159 | 77.36 | 0.069 | 23.62 | 0.508 | -68.03 | 0.701 | 19.49 |
| 2.300 | 0.487 | -145.95 | 5.948 | 74.61 | 0.070 | 22.54 | 0.496 | -69.64 | 0.737 | 19.31 |
| 2.400 | 0.476 | -150.04 | 5.744 | 71.95 | 0.071 | 21.41 | 0.488 | -71.29 | 0.765 | 19.10 |
| 2.500 | 0.470 | -154.38 | 5.553 | 69.39 | 0.072 | 20.20 | 0.481 | -73.07 | 0.787 | 18.90 |
| 2.600 | 0.465 | -158.84 | 5.379 | 66.64 | 0.073 | 19.38 | 0.474 | -74.39 | 0.805 | 18.69 |
| 2.700 | 0.459 | -162.43 | 5.214 | 64.24 | 0.073 | 18.80 | 0.468 | -76.05 | 0.828 | 18.51 |
| 2.800 | 0.454 | -166.08 | 5.060 | 61.68 | 0.074 | 18.02 | 0.462 | -77.35 | 0.851 | 18.34 |
| 2.900 | 0.447 | -170.06 | 4.915 | 59.28 | 0.075 | 17.16 | 0.456 | -79.07 | 0.878 | 18.18 |
| 3.000 | 0.444 | -173.81 | 4.761 | 57.03 | 0.076 | 15.82 | 0.453 | -80.50 | 0.895 | 17.98 |
| 3.200 | 0.438 | 178.47 | 4.501 | 52.30 | 0.078 | 14.90 | 0.444 | -83.07 | 0.932 | 17.64 |
| 3.400 | 0.428 | 171.27 | 4.273 | 47.78 | 0.079 | 13.32 | 0.440 | -85.90 | 0.974 | 17.33 |
| 3.600 | 0.427 | 163.98 | 4.057 | 43.37 | 0.081 | 11.88 | 0.434 | -88.27 | 1.003 | 16.66 |
| 3.800 | 0.423 | 157.49 | 3.872 | 39.01 | 0.082 | 11.04 | 0.430 | -90.93 | 1.033 | 15.60 |
| 4.000 | 0.422 | 149.92 | 3.698 | 34.77 | 0.085 | 9.18 | 0.428 | -93.39 | 1.055 | 14.98 |
| 4.200 | 0.426 | 143.92 | 3.541 | 30.51 | 0.087 | 8.09 | 0.426 | -96.22 | 1.066 | 14.54 |
| 4.400 | 0.420 | 137.30 | 3.394 | 26.35 | 0.088 | 6.73 | 0.427 | -98.70 | 1.096 | 13.97 |
| 4.600 | 0.428 | 130.50 | 3.262 | 22.21 | 0.091 | 4.94 | 0.422 | -101.17 | 1.103 | 13.61 |
| 4.800 | 0.430 | 125.03 | 3.136 | 18.13 | 0.093 | 4.19 | 0.423 | -103.93 | 1.115 | 13.23 |
| 5.000 | 0.434 | 118.39 | 3.023 | 14.16 | 0.094 | 2.32 | 0.423 | -106.12 | 1.131 | 12.86 |
| 5.200 | 0.445 | 112.90 | 2.915 | 10.11 | 0.097 | 0.88 | 0.422 | -108.86 | 1.117 | 12.68 |
| 5.400 | 0.445 | 107.35 | 2.823 | 6.11 | 0.099 | -0.22 | 0.423 | -111.50 | 1.133 | 12.34 |
| 5.600 | 0.456 | 101.71 | 2.727 | 2.18 | 0.102 | -2.52 | 0.423 | -114.31 | 1.123 | 12.15 |
| 5.800 | 0.461 | 96.57 | 2.643 | -1.88 | 0.104 | -3.64 | 0.421 | -117.30 | 1.129 | 11.87 |
| 6.000 | 0.467 | 90.38 | 2.564 | -5.81 | 0.106 | -5.93 | 0.419 | -119.34 | 1.136 | 11.60 |
| 7.000 | 0.515 | 69.13 | 2.189 | -24.90 | 0.118 | -14.29 | 0.414 | -135.23 | 1.120 | 10.59 |
| 8.000 | 0.557 | 48.59 | 1.912 | -43.02 | 0.129 | -23.38 | 0.403 | -148.98 | 1.113 | 9.68 |
| 9.000 | 0.603 | 28.65 | 1.706 | -61.61 | 0.143 | -33.62 | 0.392 | -164.98 | 1.048 | 9.43 |
| 10.000 | 0.658 | 9.89 | 1.525 | -80.10 | 0.154 | -44.64 | 0.382 | -177.36 | 0.981 | 9.96 |
| 11.000 | 0.711 | -6.46 | 1.363 | -98.43 | 0.163 | -56.19 | 0.363 | 158.46 | 0.926 | 9.23 |
| 12.000 | 0.755 | -21.02 | 1.228 | -116.23 | 0.172 | -68.02 | 0.339 | 141.23 | 0.863 | 8.54 |

Note:

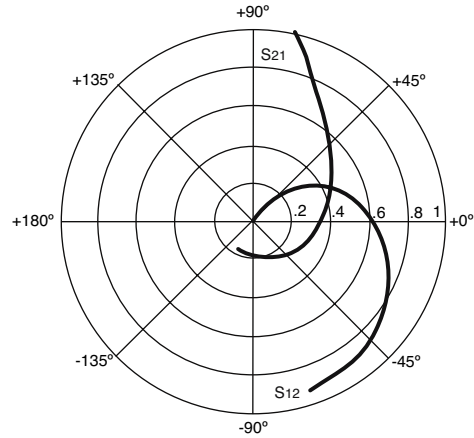
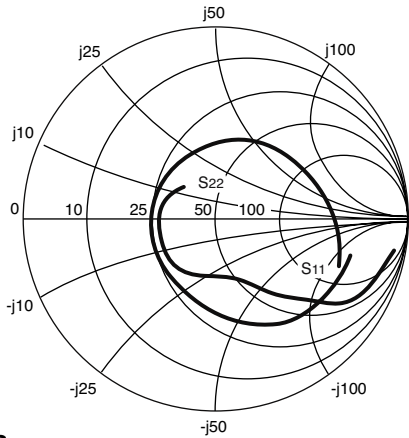
1. Gain Calculations:

$$MAG = \frac{|S_{21}|}{|S_{12}|} \left(K \sqrt{K^2 - 1} \right). \text{ When } K \leq 1, \text{ MAG is undefined and MSG values are used. } MSG = \frac{|S_{21}|}{|S_{12}|}, K = \frac{1 + |\Delta|^2 - |S_{11}|^2 - |S_{22}|^2}{2 |S_{12} S_{21}|}, \Delta = S_{11} S_{22} - S_{21} S_{12}$$

MAG = Maximum Available Gain

MSG = Maximum Stable Gain

TYPICAL SCATTERING PARAMETERS (TA = 25°C)



NESG2031M05
Vc = 3 V, Ic = 20 mA

| FREQUENCY | S11 | | S21 | | S12 | | S22 | | K | MAG ¹ |
|-----------|-------|---------|--------|---------|-------|--------|-------|---------|-------|------------------|
| GHz | MAG | ANG | MAG | ANG | MAG | ANG | MAG | ANG | | (dB) |
| 0.200 | 0.708 | -33.56 | 31.847 | 155.43 | 0.012 | 69.94 | 0.900 | -20.46 | 0.213 | 34.12 |
| 0.400 | 0.637 | -61.48 | 27.290 | 136.26 | 0.021 | 59.98 | 0.780 | -34.95 | 0.298 | 31.15 |
| 0.600 | 0.518 | -82.49 | 22.132 | 121.08 | 0.026 | 52.67 | 0.640 | -41.45 | 0.509 | 29.31 |
| 0.800 | 0.461 | -100.68 | 18.546 | 110.17 | 0.030 | 49.46 | 0.553 | -47.16 | 0.613 | 27.88 |
| 1.000 | 0.420 | -115.61 | 15.806 | 101.52 | 0.034 | 47.24 | 0.492 | -51.33 | 0.703 | 26.70 |
| 1.200 | 0.392 | -128.84 | 13.698 | 94.16 | 0.037 | 45.92 | 0.447 | -54.73 | 0.777 | 25.65 |
| 1.400 | 0.368 | -140.59 | 12.043 | 87.72 | 0.040 | 44.81 | 0.413 | -57.58 | 0.849 | 24.74 |
| 1.600 | 0.355 | -151.34 | 10.718 | 81.98 | 0.044 | 43.65 | 0.387 | -60.38 | 0.897 | 23.87 |
| 1.800 | 0.346 | -159.30 | 9.668 | 76.77 | 0.047 | 43.13 | 0.369 | -62.78 | 0.940 | 23.11 |
| 1.900 | 0.338 | -164.24 | 9.203 | 74.27 | 0.049 | 42.43 | 0.359 | -64.30 | 0.965 | 22.75 |
| 2.000 | 0.336 | -168.72 | 8.784 | 71.82 | 0.051 | 41.66 | 0.353 | -65.82 | 0.979 | 22.39 |
| 2.100 | 0.336 | -172.82 | 8.392 | 69.48 | 0.053 | 41.25 | 0.347 | -67.17 | 0.991 | 22.03 |
| 2.200 | 0.339 | -176.22 | 8.044 | 67.14 | 0.054 | 40.82 | 0.342 | -68.42 | 0.996 | 21.69 |
| 2.300 | 0.333 | -179.74 | 7.721 | 64.88 | 0.056 | 40.34 | 0.335 | -69.73 | 1.018 | 20.57 |
| 2.400 | 0.328 | 176.30 | 7.423 | 62.68 | 0.058 | 39.52 | 0.332 | -71.16 | 1.032 | 20.00 |
| 2.500 | 0.330 | 172.28 | 7.145 | 60.59 | 0.060 | 38.73 | 0.328 | -72.87 | 1.039 | 19.58 |
| 2.600 | 0.333 | 168.38 | 6.883 | 58.42 | 0.061 | 38.00 | 0.326 | -73.90 | 1.043 | 19.23 |
| 2.700 | 0.331 | 165.77 | 6.647 | 56.32 | 0.063 | 37.44 | 0.324 | -75.39 | 1.049 | 18.85 |
| 2.800 | 0.330 | 162.65 | 6.427 | 54.22 | 0.065 | 36.74 | 0.321 | -76.62 | 1.058 | 18.47 |
| 2.900 | 0.329 | 159.11 | 6.217 | 52.17 | 0.067 | 35.95 | 0.319 | -78.23 | 1.069 | 18.09 |
| 3.000 | 0.329 | 155.33 | 6.021 | 50.20 | 0.068 | 34.78 | 0.319 | -79.69 | 1.076 | 17.77 |
| 3.200 | 0.334 | 149.17 | 5.659 | 46.20 | 0.072 | 33.45 | 0.316 | -82.02 | 1.078 | 17.23 |
| 3.400 | 0.331 | 142.72 | 5.350 | 42.30 | 0.076 | 31.50 | 0.316 | -84.98 | 1.092 | 16.64 |
| 3.600 | 0.336 | 136.40 | 5.067 | 38.48 | 0.080 | 29.62 | 0.315 | -87.26 | 1.092 | 16.19 |
| 3.800 | 0.337 | 131.32 | 4.820 | 34.66 | 0.083 | 28.04 | 0.315 | -90.01 | 1.097 | 15.73 |
| 4.000 | 0.341 | 124.22 | 4.594 | 30.92 | 0.087 | 25.60 | 0.317 | -92.54 | 1.096 | 15.34 |
| 4.200 | 0.349 | 119.76 | 4.390 | 27.12 | 0.091 | 23.76 | 0.318 | -95.60 | 1.090 | 15.01 |
| 4.400 | 0.346 | 113.85 | 4.203 | 23.39 | 0.094 | 21.66 | 0.322 | -98.23 | 1.101 | 14.57 |
| 4.600 | 0.358 | 108.10 | 4.030 | 19.68 | 0.098 | 19.29 | 0.320 | -100.73 | 1.094 | 14.29 |
| 4.800 | 0.362 | 103.90 | 3.872 | 16.02 | 0.101 | 17.49 | 0.323 | -103.62 | 1.092 | 13.98 |
| 5.000 | 0.368 | 97.89 | 3.730 | 12.41 | 0.104 | 15.10 | 0.324 | -105.88 | 1.092 | 13.68 |
| 5.200 | 0.382 | 93.59 | 3.594 | 8.74 | 0.108 | 12.73 | 0.326 | -108.77 | 1.076 | 13.53 |
| 5.400 | 0.382 | 89.01 | 3.478 | 5.09 | 0.111 | 10.83 | 0.328 | -111.53 | 1.080 | 13.22 |
| 5.600 | 0.395 | 84.15 | 3.358 | 1.42 | 0.115 | 8.04 | 0.329 | -114.59 | 1.069 | 13.05 |
| 5.800 | 0.400 | 80.23 | 3.252 | -2.29 | 0.118 | 5.95 | 0.328 | -117.73 | 1.068 | 12.80 |
| 6.000 | 0.407 | 74.50 | 3.159 | -5.94 | 0.121 | 3.25 | 0.325 | -119.95 | 1.068 | 12.56 |
| 7.000 | 0.455 | 57.61 | 2.710 | -23.72 | 0.136 | -8.42 | 0.319 | -136.55 | 1.049 | 11.63 |
| 8.000 | 0.497 | 39.73 | 2.384 | -40.91 | 0.149 | -20.28 | 0.305 | -149.86 | 1.039 | 10.83 |
| 9.000 | 0.543 | 22.18 | 2.143 | -58.86 | 0.163 | -32.76 | 0.293 | -166.22 | 0.999 | 11.19 |
| 10.000 | 0.599 | 5.55 | 1.932 | -76.86 | 0.172 | -45.34 | 0.280 | 175.13 | 0.964 | 10.50 |
| 11.000 | 0.655 | -8.97 | 1.741 | -95.01 | 0.179 | -58.02 | 0.255 | 154.83 | 0.931 | 9.87 |
| 12.000 | 0.702 | -22.22 | 1.589 | -112.88 | 0.185 | -70.97 | 0.220 | 138.01 | 0.889 | 9.33 |

Note:

1. Gain Calculations:

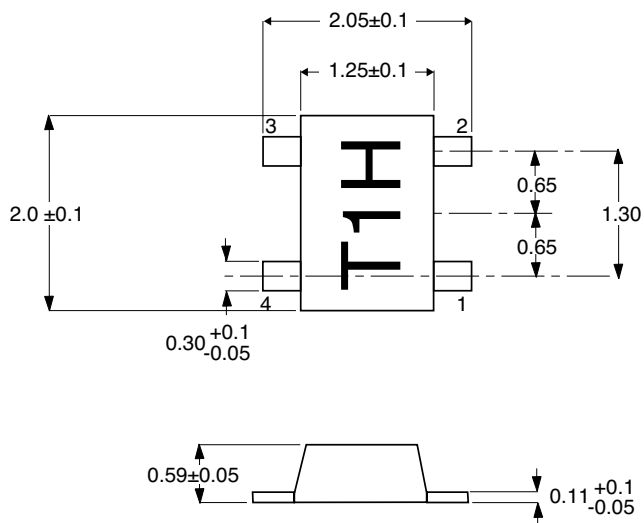
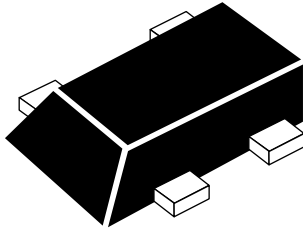
$$MAG = \frac{|S_{21}|}{|S_{12}|} (K \sqrt{K^2 - 1}). \text{ When } K \leq 1, \text{ MAG is undefined and MSG values are used. } MSG = \frac{|S_{21}|}{|S_{12}|}, K = \frac{1 + |\Delta|^2 - |S_{11}|^2 - |S_{22}|^2}{2 |S_{12}| |S_{21}|}, \Delta = S_{11} S_{22} - S_{21} S_{12}$$

MAG = Maximum Available Gain

MSG = Maximum Stable Gain

OUTLINE DIMENSIONS (Units in mm)

**PACKAGE OUTLINE M05
FLAT LEAD 4-PIN THIN TYPE SUPER MINIMOLD**

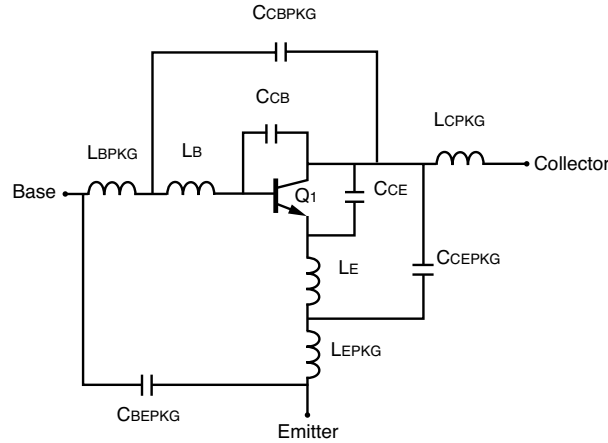


PIN CONNECTIONS

1. Base
2. Emitter
3. Collector
4. Emitter

NONLINEAR MODEL

SCHEMATIC



BJT NONLINEAR MODEL PARAMETERS⁽¹⁾

| Parameters | Q1 | Parameters | Q1 |
|------------|-----------|------------|-------|
| IS | 1.593e-15 | MJC | 0.125 |
| BF | 305.3 | XCJC | 1 |
| NF | 1.099 | CJS | 0 |
| VAF | 35.92 | VJS | 0.75 |
| IKF | 94.86e-3 | MJS | 0 |
| ISE | 27.45e-15 | FC | 0.8 |
| NE | 2.035 | TF | 4e-12 |
| BR | 21.10 | XTF | 10 |
| NR | 1.066 | VTF | 5 |
| VAR | 2.782 | ITF | 0.5 |
| IKR | 20.46e-3 | PTF | 20 |
| ISC | 11.77e-18 | TR | 0 |
| NC | 2.0 | EG | 1.11 |
| RE | 1.6 | XTB | 1.3 |
| RB | 1.0 | XTI | 5.2 |
| RBM | 50e-3 | KF | 0 |
| IRB | 1e-4 | AF | 1 |
| RC | 7.2 | | |
| CJE | 642e-15 | | |
| VJE | 751e-3 | | |
| MJE | 93.06e-3 | | |
| CJC | 163.4e-15 | | |
| VJC | 0.56 | | |

(1) Gummel-Poon Model

Life Support Applications

These NEC products are not intended for use in life support devices, appliances, or systems where the malfunction of these products can reasonably be expected to result in personal injury. The customers of CEL using or selling these products for use in such applications do so at their own risk and agree to fully indemnify CEL for all damages resulting from such improper use or sale.

ADDITIONAL PARAMETERS

| Parameters | NESG2031M05 |
|------------|-------------|
| CCB | 0.01 pF |
| CCE | 0.07 pF |
| LB | 0.25 nH |
| LE | 0.15 nH |
| CCBPKG | 0.13 pF |
| CCEPKG | 0.01 pF |
| CBEPKG | 0.03 pF |
| LBPKG | 0.9 nH |
| LCPKG | 1.0 nH |
| LEPKG | 0.19 nH |

MODEL TEST CONDITIONS

Frequency: 0.1 to 6 GHz
 Bias: V_{CE} = 2 V, I_C = 1 mA to 20 mA
 Date: 09/2003

Subject: Compliance with EU Directives

CEL certifies, to its knowledge, that semiconductor and laser products detailed below are compliant with the requirements of European Union (EU) Directive 2002/95/EC Restriction on Use of Hazardous Substances in electrical and electronic equipment (RoHS) and the requirements of EU Directive 2003/11/EC Restriction on Penta and Octa BDE.

CEL Pb-free products have the same base part number with a suffix added. The suffix –A indicates that the device is Pb-free. The –AZ suffix is used to designate devices containing Pb which are exempted from the requirement of RoHS directive (*). In all cases the devices have Pb-free terminals. All devices with these suffixes meet the requirements of the RoHS directive.

This status is based on CEL’s understanding of the EU Directives and knowledge of the materials that go into its products as of the date of disclosure of this information.

| Restricted Substance per RoHS | Concentration Limit per RoHS (values are not yet fixed) | Concentration contained in CEL devices | |
|-------------------------------|---------------------------------------------------------|----------------------------------------|-----|
| | | -A | -AZ |
| Lead (Pb) | < 1000 PPM | Not Detected | (*) |
| Mercury | < 1000 PPM | Not Detected | |
| Cadmium | < 100 PPM | Not Detected | |
| Hexavalent Chromium | < 1000 PPM | Not Detected | |
| PBB | < 1000 PPM | Not Detected | |
| PBDE | < 1000 PPM | Not Detected | |

If you should have any additional questions regarding our devices and compliance to environmental standards, please do not hesitate to contact your local representative.

Important Information and Disclaimer: Information provided by CEL on its website or in other communications concerning the substance content of its products represents knowledge and belief as of the date that it is provided. CEL bases its knowledge and belief on information provided by third parties and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. CEL has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. CEL and CEL suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

In no event shall CEL’s liability arising out of such information exceed the total purchase price of the CEL part(s) at issue sold by CEL to customer on an annual basis.

See CEL Terms and Conditions for additional clarification of warranties and liability.