

FEATURES

- **LOW NOISE:** 1.3 dB AT 2.0 GHz
- **LOW VOLTAGE OPERATION**
- **EASY TO MATCH**
- **HIGH GAIN BANDWIDTH PRODUCT:** ft of 13 GHz
- **AVAILABLE IN SIX LOW COST PLASTIC SURFACE MOUNT PACKAGE STYLES**

DESCRIPTION

The NE687 series of NPN epitaxial silicon transistors are designed for low cost, low noise applications. Excellent performance at low voltage/low current makes this series an ideal choice for portable wireless applications at 1.6, 1.9 and 2.4 GHz. The NE687 die is available in six different low cost plastic surface mount package styles.

| | |
|--|---|
|  18 (SOT 343 STYLE) |  19 (3 PIN ULTRA SUPER MINI MOLD) |
|  30 (SOT 323 STYLE) |  33 (SOT 23 STYLE) |
|  39 (SOT 143 STYLE) |  39R (SOT 143R STYLE) |

ELECTRICAL CHARACTERISTICS (TA = 25°C)

| PART NUMBER ¹ EIAJ ² REGISTERED NUMBER PACKAGE OUTLINE | | | NE68718 2SC5185 18 | | | NE68719 2SC5186 19 | | | NE68730 2SC5184 30 | | | NE68733 2SC5182 33 | | | NE68739/39R 2SC5183/83R 39/39R | | |
|--|---|-------|--------------------------|-----|-----|--------------------------|-----|------|--------------------------|-----|-----|--------------------------|-----|-----|--------------------------------------|-----|-----|
| SYMBOLS | PARAMETERS AND CONDITIONS | UNITS | MIN | TYP | MAX | MIN | TYP | MAX | MIN | TYP | MAX | MIN | TYP | MAX | MIN | TYP | MAX |
| ft | Gain Bandwidth Product at VCE = 2 V, IC = 20 mA, f = 2.0 GHz | GHz | 10 | 13 | | 9 | 11 | | 9 | 11 | | 9 | 12 | | 7.5 | 10 | |
| ft | Gain Bandwidth Product at VCE = 1 V, IC = 10 mA, f = 2.0 GHz | GHz | 8 | 11 | | 7 | 9 | | 7 | 9 | | 7 | 10 | | 7 | 8.5 | |
| NFMIN | Minimum Noise Figure at VCE = 2 V, IC = 3 mA, f = 2.0 GHz | dB | | 1.3 | 2.0 | | 1.3 | 2.0 | | 1.3 | 2.0 | | 1.3 | 2.0 | | 1.3 | 2.0 |
| NFMIN | Minimum Noise Figure at VCE = 1 V, IC = 3 mA, f = 2.0 GHz | dB | | 1.3 | 2.0 | | 1.3 | 2.0 | | 1.3 | 2.0 | | 1.3 | 2.0 | | 1.3 | 2.0 |
| S21e ² | Insertion Power Gain at VCE = 2 V, IC = 20 mA, f = 2.0 GHz | dB | 8 | 11 | | 8.5 | 10 | | 7 | 8.5 | | 7 | 8.5 | | 7.5 | 10 | |
| S21e ² | Insertion Power Gain at VCE = 1 V, IC = 10 mA, f = 2.0 GHz | dB | 7.5 | 9 | | 6 | 7.5 | | 6 | 7.5 | | 6 | 7.5 | | 7 | 8.5 | |
| hFE | Forward Current Gain ³ at VCE = 2 V, IC = 20 mA | | 70 | | 140 | 70 | | 140 | 70 | | 140 | 70 | | 140 | 70 | | 140 |
| ICBO | Collector Cutoff Current at VCB = 5 V, IE = 0 mA | nA | | | 100 | | | 100 | | | 100 | | | 100 | | | 100 |
| IEBO | Emitter Cutoff Current at VEB = 1 V, IC = 0 mA | nA | | | 100 | | | 100 | | | 100 | | | 100 | | | 100 |
| CRE ⁴ | Feedback Capacitance at VCB = 2 V, IE = 0 mA, f = 1 MHz | pF | | 0.3 | 0.6 | | 0.4 | 0.8 | | 0.4 | 0.8 | | 0.4 | 0.8 | | 0.4 | 0.8 |
| PT | Total Power Dissipation | mW | | | 90 | | | 90 | | | 90 | | | 90 | | | 90 |
| RTH(J-A) | Thermal Resistance (Junction to Ambient) | °C/W | | | 833 | | | 1250 | | | 833 | | | 625 | | | 625 |
| RTH(J-C) | Thermal Resistance (Junction to Case) | °C/W | | | | | | | | | | | | | | | |

Notes:

1. Precaution: Devices are ESD sensitive. Use proper handling procedures.
2. Electronic Industrial Association of Japan.
3. Pulsed measurement, PW ≤ 350 μs, duty cycle ≤ 2%.
4. The emitter terminal should be connected to the ground terminal of the 3 terminal capacitance bridge.

NE687 SERIES

ABSOLUTE MAXIMUM RATINGS¹ (T_A = 25°C)

| SYMBOLS | PARAMETERS | UNITS | RATINGS |
|------------------|--------------------------------|-------|-------------|
| V _{CB0} | Collector to Base Voltage | V | 5 |
| V _{CE0} | Collector to Emitter Voltage | V | 3 |
| V _{EBO} | Emitter to Base Voltage | V | 2 |
| I _C | Collector Current | mA | 30 |
| T _J | Operating 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.

NE68718

TYPICAL NOISE PARAMETERS (T_A = 25°C)

| FREQ. (MHz) | NF _{OPT} (dB) | G _A (dB) | Γ _{OPT} | | R _{n/50} |
|--|------------------------|---------------------|------------------|------|-------------------|
| | | | MAG | ANG | |
| V _{CE} = 0.5 V, I _C = 0.5 mA | | | | | |
| 500 | 1.10 | 13.07 | 0.72 | 30 | 1.00 |
| 800 | 1.31 | 11.23 | 0.67 | 54 | 0.65 |
| 1000 | 1.41 | 9.36 | 0.65 | 67 | 0.55 |
| V _{CE} = 1.0 V, I _C = 1.0 mA | | | | | |
| 500 | 0.93 | 16.53 | 0.63 | 27 | 0.56 |
| 800 | 1.08 | 13.44 | 0.59 | 47 | 0.39 |
| 1000 | 1.20 | 12.21 | 0.55 | 62 | 0.36 |
| 1500 | 1.48 | 8.53 | 0.46 | 83 | 0.34 |
| 2000 | 1.72 | 6.50 | 0.37 | 107 | 0.28 |
| V _{CE} = 1.0 V, I _C = 3 mA | | | | | |
| 500 | 1.10 | 18.68 | 0.48 | 23 | 0.28 |
| 800 | 1.15 | 15.74 | 0.40 | 48 | 0.25 |
| 1000 | 1.20 | 13.90 | 0.36 | 58 | 0.24 |
| 1500 | 1.38 | 10.63 | 0.28 | 81 | 0.21 |
| 2000 | 1.60 | 8.43 | 0.21 | 104 | 0.20 |
| 2500 | 1.82 | 7.04 | 0.14 | 151 | 0.18 |
| 3000 | 2.00 | 5.84 | 0.16 | -167 | 0.13 |
| V _{CE} = 2 V, I _C = 3 mA | | | | | |
| 500 | 1.10 | 19.83 | 0.50 | 21 | 0.26 |
| 800 | 1.15 | 16.61 | 0.42 | 39 | 0.26 |
| 1000 | 1.20 | 14.85 | 0.38 | 48 | 0.25 |
| 1500 | 1.38 | 11.83 | 0.29 | 74 | 0.24 |
| 2000 | 1.60 | 9.49 | 0.23 | 91 | 0.22 |
| 2500 | 1.82 | 8.16 | 0.14 | 135 | 0.20 |
| 3000 | 2.00 | 6.93 | 0.13 | 177 | 0.12 |
| V _{CE} = 2 V, I _C = 10 mA | | | | | |
| 500 | 1.60 | 22.57 | 0.13 | 19 | 0.27 |
| 800 | 1.62 | 18.75 | 0.11 | 48 | 0.26 |
| 1000 | 1.65 | 16.91 | 0.09 | 67 | 0.25 |
| 1500 | 1.73 | 13.52 | 0.07 | 100 | 0.24 |
| 2000 | 1.80 | 11.17 | 0.06 | 143 | 0.22 |
| 2500 | 2.00 | 9.48 | 0.08 | -161 | 0.20 |
| 3000 | 2.19 | 8.18 | 0.13 | -133 | 0.16 |

NE68730

TYPICAL NOISE PARAMETERS (T_A = 25°C)

| FREQ. (MHz) | NF _{OPT} (dB) | G _A (dB) | Γ _{OPT} | | R _{n/50} |
|---|------------------------|---------------------|------------------|------|-------------------|
| | | | MAG | ANG | |
| V _{CE} = 1.0 V, I _C = 3.0 mA | | | | | |
| 500 | 1.10 | 17.66 | 0.47 | 15 | 0.28 |
| 800 | 1.19 | 14.48 | 0.39 | 33 | 1.20 |
| 1000 | 1.25 | 12.93 | 0.34 | 45 | 0.28 |
| 1500 | 1.36 | 9.61 | 0.29 | 57 | 0.27 |
| 2000 | 1.50 | 7.52 | 0.24 | 73 | 0.27 |
| V _{CE} = 2.0 V, I _C = 3.0 mA | | | | | |
| 500 | 1.10 | 18.60 | 0.40 | 12 | 0.30 |
| 800 | 1.19 | 15.10 | 0.35 | 24 | 0.22 |
| 1000 | 1.25 | 13.40 | 0.31 | 33 | 0.26 |
| 1500 | 1.36 | 10.30 | 0.26 | 44 | 0.28 |
| 2000 | 1.50 | 8.10 | 0.23 | 58 | 0.28 |
| V _{CE} = 2.0 V, I _C = 20.0 mA | | | | | |
| 500 | 2.00 | 20.30 | 0.02 | -170 | 0.23 |
| 800 | 2.06 | 16.70 | 0.06 | 171 | 0.15 |
| 1000 | 2.10 | 15.00 | 0.08 | 172 | 0.28 |
| 1500 | 2.20 | 11.90 | 0.12 | 178 | 0.24 |
| 2000 | 2.34 | 9.80 | 0.14 | -175 | 0.24 |
| 2500 | 2.46 | 6.70 | 0.18 | -160 | 0.23 |

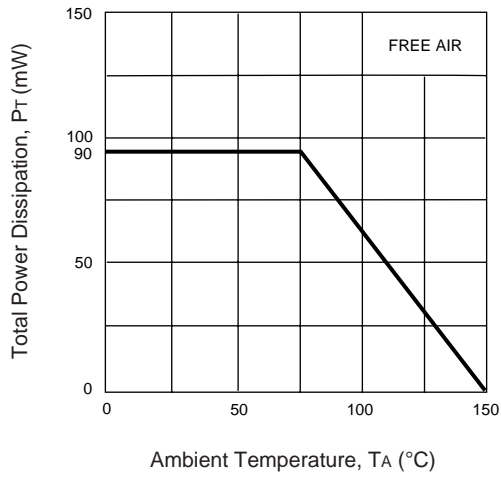
NE68739

TYPICAL NOISE PARAMETERS (T_A = 25°C)

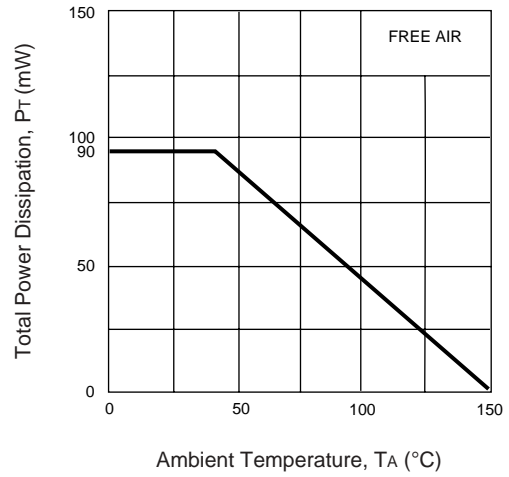
| FREQ. (MHz) | NF _{OPT} (dB) | G _A (dB) | Γ _{OPT} | | R _{n/50} |
|---|------------------------|---------------------|------------------|------|-------------------|
| | | | MAG | ANG | |
| V _{CE} = 0.5 V, I _C = 0.5 mA | | | | | |
| 500 | 1.23 | 15.7 | 0.77 | 36 | 0.61 |
| 800 | 1.37 | 10.9 | 0.71 | 46 | 0.61 |
| 1000 | 1.45 | 8.7 | 0.60 | 64 | 0.50 |
| V _{CE} = 1.0 V, I _C = 3.0 mA | | | | | |
| 500 | 1.07 | 18.0 | 0.48 | 30 | 0.31 |
| 800 | 1.13 | 14.8 | 0.39 | 49 | 0.28 |
| 1000 | 1.18 | 13.2 | 0.32 | 60 | 0.26 |
| 1500 | 1.30 | 10.5 | 0.23 | 76 | 0.24 |
| 2000 | 1.50 | 8.0 | 0.12 | 120 | 0.20 |
| 2500 | 1.66 | 7.0 | 0.16 | -172 | 0.15 |
| V _{CE} = 2.0 V, I _C = 3.0 mA | | | | | |
| 500 | 1.07 | 18.6 | 0.46 | 26 | 0.28 |
| 800 | 1.13 | 15.5 | 0.37 | 38 | 0.28 |
| 1000 | 1.18 | 14.0 | 0.32 | 46 | 0.26 |
| 1500 | 1.30 | 11.2 | 0.20 | 66 | 0.25 |
| 2000 | 1.50 | 9.3 | 0.12 | 113 | 0.19 |
| 2500 | 1.66 | 7.8 | 0.14 | 177 | 0.17 |
| 3000 | 1.86 | 6.6 | 0.23 | -157 | 0.10 |
| V _{CE} = 2.0 V, I _C = 20.0 mA | | | | | |
| 500 | 1.93 | 21.2 | 0.08 | -150 | 0.22 |
| 800 | 1.95 | 17.6 | 0.14 | -138 | 0.17 |
| 1000 | 2.00 | 16.0 | 0.16 | -134 | 0.17 |
| 1500 | 2.15 | 12.9 | 0.21 | -127 | 0.24 |
| 2000 | 2.30 | 10.6 | 0.26 | -123 | 0.25 |
| 2500 | 2.40 | 9.0 | 0.31 | -121 | 0.25 |
| 3000 | 2.52 | 7.7 | 0.46 | -114 | 0.24 |

TYPICAL PERFORMANCE CURVES (TA = 25°)

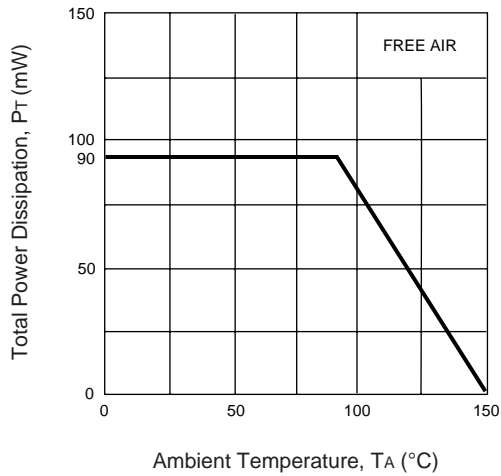
NE68718, NE68730
D.C. POWER DERATING CURVE



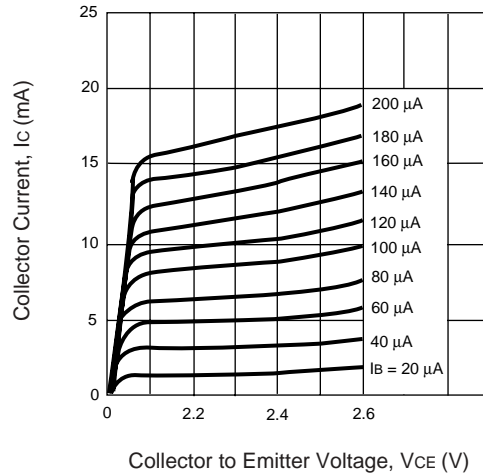
NE68719
D.C. POWER DERATING CURVE



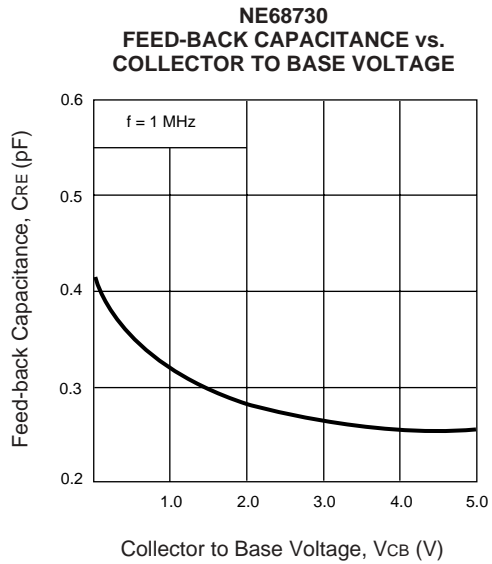
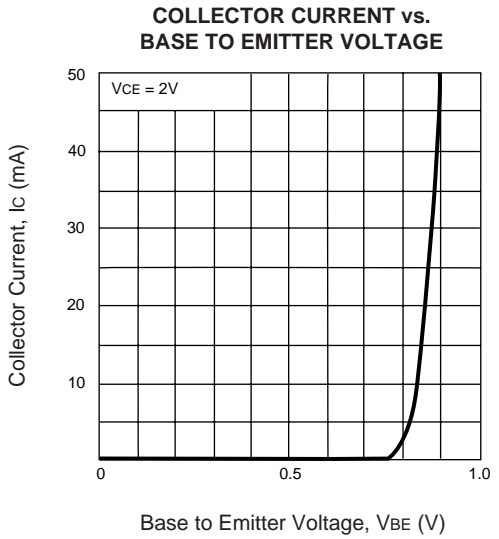
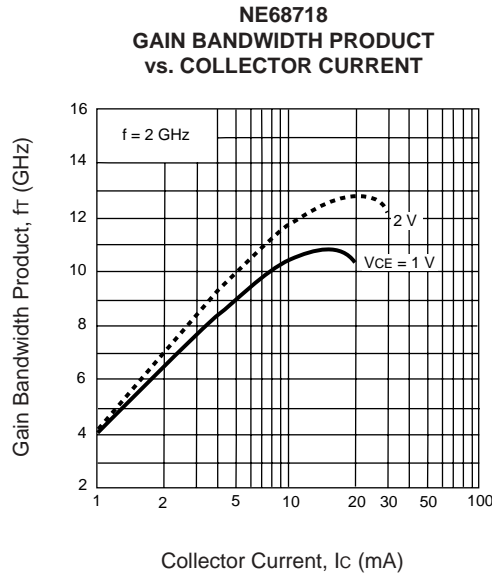
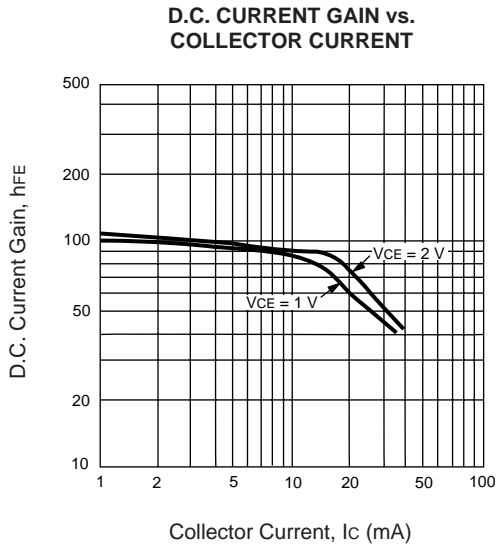
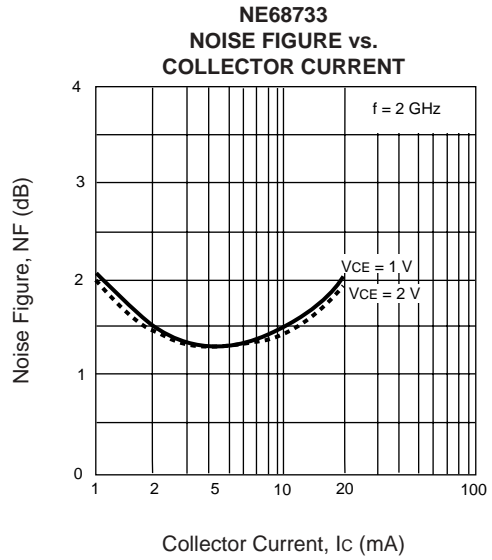
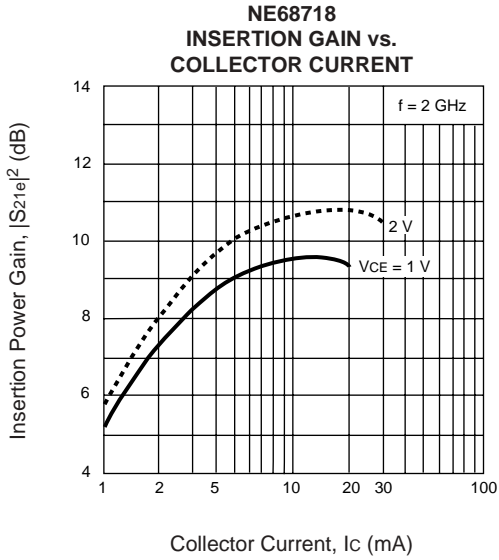
NE68733, NE68739
D.C. POWER DERATING CURVE



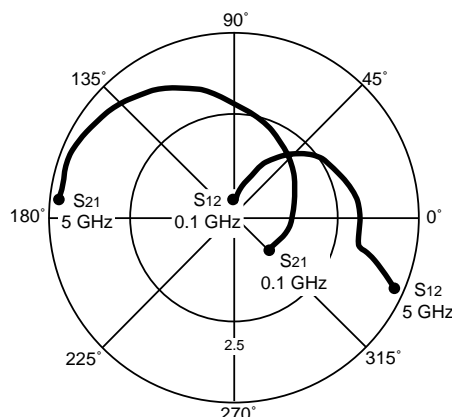
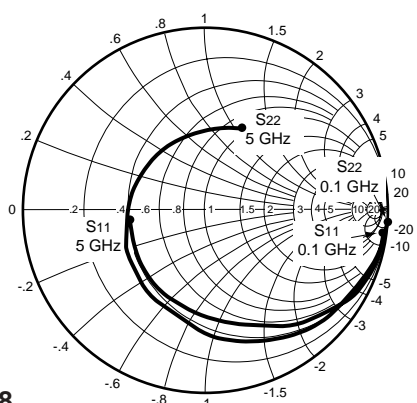
COLLECTOR CURRENT vs.
COLLECTOR TO EMITTER VOLTAGE



TYPICAL PERFORMANCE CURVES (TA = 25°C)



TYPICAL SCATTERING PARAMETERS (TA = 25°C)



Coordinates in Ohms
Frequency in GHz
(VCE = 1 V, IC = 1 mA)

NE68718

VCE = 1.0 V, IC = 1.0 mA

| FREQUENCY GHz | S11 | | S21 | | S12 | | S22 | | K | MAG ¹ (dB) |
|------------------|-------|----------|-------|---------|-------|---------|-------|----------|-------|--------------------------|
| | MAG | ANG | MAG | ANG | MAG | ANG | MAG | ANG | | |
| 0.1 | 0.962 | -8.100 | 3.385 | 168.800 | 0.023 | 81.800 | 0.993 | -6.700 | 0.122 | 21.678 |
| 0.4 | 0.893 | -38.800 | 3.278 | 144.800 | 0.091 | 62.800 | 0.944 | -25.400 | 0.160 | 15.566 |
| 0.8 | 0.755 | -73.500 | 2.809 | 114.700 | 0.152 | 40.300 | 0.831 | -45.900 | 0.321 | 12.667 |
| 1.0 | 0.689 | -89.000 | 2.566 | 101.800 | 0.170 | 31.300 | 0.776 | -54.200 | 0.399 | 11.788 |
| 1.5 | 0.559 | -124.000 | 2.063 | 74.800 | 0.192 | 13.700 | 0.666 | -71.100 | 0.593 | 10.312 |
| 2.0 | 0.481 | -154.200 | 1.704 | 52.700 | 0.197 | 2.300 | 0.599 | -84.300 | 0.787 | 9.370 |
| 2.5 | 0.440 | 178.000 | 1.461 | 33.400 | 0.195 | -5.200 | 0.560 | -96.200 | 0.968 | 8.746 |
| 3.0 | 0.417 | 152.500 | 1.288 | 16.800 | 0.195 | -9.700 | 0.531 | -107.700 | 1.131 | 5.997 |
| 4.0 | 0.434 | 103.700 | 1.083 | -13.500 | 0.215 | -14.400 | 0.473 | -133.500 | 1.264 | 3.931 |
| 5.0 | 0.512 | 63.400 | 0.929 | -42.700 | 0.270 | -23.500 | 0.410 | -174.700 | 1.201 | 2.658 |

VCE = 1.0 V, IC = 3.0 mA

| | | | | | | | | | | |
|-----|-------|----------|-------|---------|-------|---------|-------|----------|-------|--------|
| 0.1 | 0.872 | -14.000 | 8.998 | 165.400 | 0.023 | 80.600 | 0.971 | -11.300 | 0.117 | 25.924 |
| 0.4 | 0.710 | -60.600 | 7.542 | 130.500 | 0.079 | 55.100 | 0.807 | -39.500 | 0.288 | 19.799 |
| 0.8 | 0.501 | -104.700 | 5.258 | 99.100 | 0.114 | 37.200 | 0.595 | -61.600 | 0.543 | 16.639 |
| 1.0 | 0.438 | -122.100 | 4.463 | 87.700 | 0.124 | 32.100 | 0.527 | -68.900 | 0.653 | 15.562 |
| 1.5 | 0.354 | -159.700 | 3.211 | 65.100 | 0.144 | 24.100 | 0.425 | -82.000 | 0.875 | 13.483 |
| 2.0 | 0.321 | 170.800 | 2.502 | 46.800 | 0.164 | 18.400 | 0.377 | -92.400 | 1.025 | 10.866 |
| 2.5 | 0.312 | 145.400 | 2.064 | 30.300 | 0.186 | 12.900 | 0.352 | -101.800 | 1.112 | 8.414 |
| 3.0 | 0.311 | 123.000 | 1.777 | 15.400 | 0.210 | 6.800 | 0.334 | -111.500 | 1.160 | 6.851 |
| 4.0 | 0.361 | 83.600 | 1.438 | -12.600 | 0.263 | -7.700 | 0.280 | -136.000 | 1.163 | 4.930 |
| 5.0 | 0.461 | 51.700 | 1.206 | -40.100 | 0.315 | -25.300 | 0.211 | 177.500 | 1.140 | 3.560 |

VCE = 1.0 V, IC = 10.0 mA

| | | | | | | | | | | |
|-----|-------|----------|--------|---------|-------|---------|-------|----------|-------|--------|
| 0.1 | 0.645 | -29.400 | 21.295 | 155.400 | 0.019 | 74.200 | 0.892 | -21.300 | 0.247 | 30.495 |
| 0.4 | 0.392 | -95.800 | 12.537 | 110.900 | 0.055 | 55.600 | 0.541 | -57.100 | 0.618 | 23.578 |
| 0.8 | 0.270 | -144.400 | 7.101 | 85.100 | 0.085 | 50.500 | 0.347 | -73.800 | 0.884 | 19.219 |
| 1.0 | 0.252 | -161.700 | 5.792 | 76.200 | 0.100 | 48.600 | 0.303 | -79.000 | 0.948 | 17.628 |
| 1.5 | 0.234 | 164.600 | 3.980 | 58.000 | 0.136 | 42.200 | 0.249 | -89.300 | 1.037 | 13.489 |
| 2.0 | 0.234 | 140.600 | 3.042 | 42.500 | 0.174 | 34.400 | 0.226 | -98.900 | 1.069 | 10.825 |
| 2.5 | 0.235 | 121.100 | 2.489 | 27.900 | 0.212 | 25.600 | 0.215 | -107.400 | 1.079 | 8.983 |
| 3.0 | 0.242 | 103.100 | 2.127 | 14.200 | 0.249 | 16.000 | 0.207 | -117.800 | 1.080 | 7.590 |
| 4.0 | 0.300 | 73.800 | 1.705 | -12.200 | 0.318 | -4.300 | 0.161 | -151.100 | 1.065 | 5.736 |
| 5.0 | 0.414 | 47.400 | 1.421 | -38.700 | 0.374 | -25.800 | 0.141 | 133.500 | 1.054 | 4.375 |

VCE = 2.0 V, IC = 3.0 mA

| | | | | | | | | | | |
|-----|-------|----------|-------|---------|-------|---------|-------|----------|-------|--------|
| 0.1 | 0.881 | -12.200 | 9.094 | 166.600 | 0.017 | 79.500 | 0.977 | -9.600 | 0.142 | 27.283 |
| 0.4 | 0.736 | -52.900 | 7.869 | 134.300 | 0.066 | 58.400 | 0.844 | -34.300 | 0.280 | 20.764 |
| 0.8 | 0.527 | -92.900 | 5.706 | 103.400 | 0.099 | 40.800 | 0.653 | -54.800 | 0.521 | 17.607 |
| 1.0 | 0.454 | -109.000 | 4.901 | 91.900 | 0.109 | 35.700 | 0.586 | -61.700 | 0.629 | 16.529 |
| 1.5 | 0.344 | -144.400 | 3.575 | 69.100 | 0.128 | 27.300 | 0.485 | -74.400 | 0.847 | 14.461 |
| 2.0 | 0.294 | -174.000 | 2.789 | 50.900 | 0.146 | 21.700 | 0.434 | -84.700 | 1.002 | 12.525 |
| 2.5 | 0.274 | 159.700 | 2.308 | 34.500 | 0.166 | 16.500 | 0.410 | -94.000 | 1.087 | 9.632 |
| 3.0 | 0.264 | 136.200 | 1.980 | 19.800 | 0.189 | 11.100 | 0.393 | -103.600 | 1.134 | 7.975 |
| 4.0 | 0.306 | 94.100 | 1.605 | -7.800 | 0.241 | -2.400 | 0.343 | -126.700 | 1.130 | 6.042 |
| 5.0 | 0.407 | 59.500 | 1.356 | -35.700 | 0.296 | -19.700 | 0.264 | -167.400 | 1.102 | 4.663 |

Note:

1. Gain Calculations:

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

MAG = Maximum Available Gain

MSG = Maximum Stable Gain

NE687 SERIES

TYPICAL SCATTERING PARAMETERS (T_A = 25°C)

NE68718

VCE = 2.0 V, Ic = 7.0 mA

| FREQUENCY GHz | S ₁₁ | | S ₂₁ | | S ₁₂ | | S ₂₂ | | K | MAG ¹ (dB) |
|------------------|-----------------|----------|-----------------|---------|-----------------|---------|-----------------|----------|-------|--------------------------|
| | MAG | ANG | MAG | ANG | MAG | ANG | MAG | ANG | | |
| 0.1 | 0.745 | -19.300 | 17.318 | 160.600 | 0.017 | 74.400 | 0.942 | -14.900 | 0.242 | 30.080 |
| 0.4 | 0.501 | -72.400 | 12.131 | 119.600 | 0.053 | 57.300 | 0.677 | -44.600 | 0.500 | 23.596 |
| 0.8 | 0.306 | -114.500 | 7.399 | 91.300 | 0.080 | 48.800 | 0.471 | -60.500 | 0.790 | 19.661 |
| 1.0 | 0.257 | -131.700 | 6.113 | 81.600 | 0.092 | 46.600 | 0.419 | -65.300 | 0.877 | 18.225 |
| 1.5 | 0.202 | -168.800 | 4.245 | 62.300 | 0.123 | 40.700 | 0.354 | -74.800 | 0.995 | 15.380 |
| 2.0 | 0.181 | 160.000 | 3.252 | 46.200 | 0.155 | 34.000 | 0.326 | -84.000 | 1.051 | 11.842 |
| 2.5 | 0.177 | 134.700 | 2.655 | 31.300 | 0.187 | 26.200 | 0.315 | -92.700 | 1.073 | 9.870 |
| 3.0 | 0.182 | 113.100 | 2.269 | 17.600 | 0.219 | 17.800 | 0.305 | -102.300 | 1.080 | 8.424 |
| 4.0 | 0.236 | 78.300 | 1.820 | -8.500 | 0.284 | -0.500 | 0.257 | -127.400 | 1.065 | 6.508 |
| 5.0 | 0.356 | 50.600 | 1.530 | -35.200 | 0.343 | -21.000 | 0.175 | -178.000 | 1.049 | 5.142 |

VCE = 2.0 V, Ic = 20.0 mA

| | | | | | | | | | | |
|-----|-------|----------|--------|---------|-------|---------|-------|----------|-------|--------|
| 0.1 | 0.491 | -34.600 | 29.872 | 150.600 | 0.014 | 74.200 | 0.851 | -22.900 | 0.370 | 33.291 |
| 0.4 | 0.259 | -102.300 | 15.243 | 105.900 | 0.042 | 63.500 | 0.479 | -52.400 | 0.781 | 25.598 |
| 0.8 | 0.174 | -151.900 | 8.321 | 82.800 | 0.072 | 59.100 | 0.327 | -62.200 | 0.966 | 20.628 |
| 1.0 | 0.160 | -169.400 | 6.748 | 74.700 | 0.087 | 56.600 | 0.296 | -65.700 | 1.004 | 18.526 |
| 1.5 | 0.158 | 155.900 | 4.599 | 57.900 | 0.125 | 48.700 | 0.262 | -74.300 | 1.040 | 14.437 |
| 2.0 | 0.163 | 131.600 | 3.497 | 43.300 | 0.163 | 39.800 | 0.249 | -83.500 | 1.053 | 11.911 |
| 2.5 | 0.169 | 112.200 | 2.843 | 29.400 | 0.199 | 30.300 | 0.246 | -92.200 | 1.057 | 10.084 |
| 3.0 | 0.173 | 95.000 | 2.416 | 16.300 | 0.235 | 20.300 | 0.242 | -102.400 | 1.058 | 8.648 |
| 4.0 | 0.228 | 69.700 | 1.929 | -9.100 | 0.303 | 0.001 | 0.196 | -130.200 | 1.044 | 6.752 |
| 5.0 | 0.349 | 46.900 | 1.611 | -35.100 | 0.361 | -21.600 | 0.127 | 164.300 | 1.035 | 5.346 |

Note:

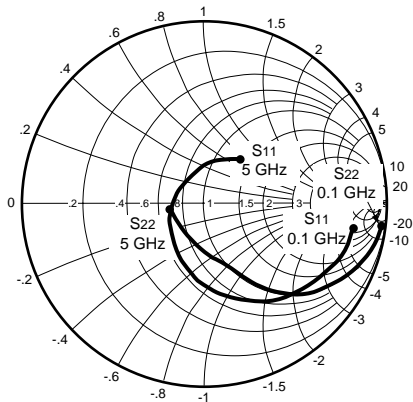
1. Gain Calculations:

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

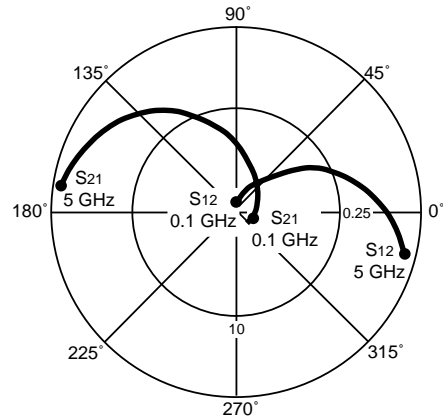
MAG = Maximum Available Gain

MSG = Maximum Stable Gain

TYPICAL SCATTERING PARAMETERS (TA = 25°C)



Coordinates in Ohms
Frequency in GHz
(VCE = 2 V, IC = 5 mA)



NE68719

VCE = 1.0 V, IC = 1.0 mA

| FREQUENCY | S11 | | S21 | | S12 | | S22 | | K | MAG ¹ |
|-----------|-------|----------|-------|---------|-------|---------|-------|----------|-------|------------------|
| GHz | MAG | ANG | MAG | ANG | MAG | ANG | MAG | ANG | | (dB) |
| 0.1 | 0.945 | -9.900 | 3.475 | 168.900 | 0.027 | 82.500 | 0.992 | -6.900 | 0.085 | 21.096 |
| 0.4 | 0.890 | -39.700 | 3.213 | 143.800 | 0.097 | 62.200 | 0.936 | -25.900 | 0.174 | 15.201 |
| 0.8 | 0.748 | -74.800 | 2.705 | 114.000 | 0.158 | 40.600 | 0.817 | -45.200 | 0.336 | 12.335 |
| 1.0 | 0.682 | -89.600 | 2.449 | 101.900 | 0.176 | 32.300 | 0.764 | -52.500 | 0.417 | 11.435 |
| 1.5 | 0.559 | -122.400 | 1.957 | 76.300 | 0.197 | 17.100 | 0.658 | -65.800 | 0.624 | 9.971 |
| 2.0 | 0.488 | -150.400 | 1.629 | 55.800 | 0.203 | 7.800 | 0.589 | -75.500 | 0.822 | 9.044 |
| 2.5 | 0.441 | -176.700 | 1.427 | 38.000 | 0.206 | 2.300 | 0.540 | -84.200 | 0.994 | 8.406 |
| 3.0 | 0.411 | -158.700 | 1.288 | 22.100 | 0.210 | -0.600 | 0.494 | -94.200 | 1.148 | 5.541 |
| 4.0 | 0.408 | 110.100 | 1.113 | -7.200 | 0.247 | -4.600 | 0.409 | -123.800 | 1.233 | 3.628 |
| 5.0 | 0.457 | 64.500 | 0.959 | -35.600 | 0.319 | -14.700 | 0.393 | -171.200 | 1.147 | 2.454 |

VCE = 1.0 V, IC = 3.0 mA

| | | | | | | | | | | |
|-----|-------|----------|-------|---------|-------|---------|-------|----------|-------|--------|
| 0.1 | 0.854 | -15.800 | 9.251 | 165.000 | 0.026 | 79.100 | 0.969 | -11.700 | 0.132 | 25.512 |
| 0.4 | 0.694 | -60.500 | 7.411 | 129.600 | 0.082 | 55.800 | 0.792 | -40.000 | 0.312 | 19.561 |
| 0.8 | 0.485 | -102.100 | 5.078 | 99.200 | 0.117 | 40.200 | 0.582 | -60.000 | 0.575 | 16.375 |
| 1.0 | 0.425 | -118.200 | 4.308 | 88.600 | 0.128 | 36.100 | 0.517 | -65.700 | 0.683 | 15.271 |
| 1.5 | 0.332 | -150.100 | 3.098 | 67.200 | 0.152 | 30.200 | 0.421 | -74.600 | 0.902 | 13.092 |
| 2.0 | 0.294 | -176.000 | 2.442 | 50.200 | 0.177 | 25.900 | 0.368 | -80.500 | 1.034 | 10.273 |
| 2.5 | 0.277 | 160.700 | 2.052 | 34.700 | 0.207 | 21.200 | 0.331 | -86.100 | 1.093 | 8.101 |
| 3.0 | 0.266 | 140.200 | 1.795 | 20.500 | 0.240 | 15.400 | 0.295 | -94.200 | 1.123 | 6.608 |
| 4.0 | 0.304 | 97.300 | 1.486 | -6.400 | 0.312 | 0.800 | 0.212 | -127.000 | 1.108 | 4.780 |
| 5.0 | 0.386 | 55.900 | 1.263 | -33.100 | 0.379 | -17.300 | 0.215 | -172.500 | 1.074 | 3.562 |

VCE = 1.0 V, IC = 10.0 mA

| | | | | | | | | | | |
|-----|-------|----------|--------|---------|-------|---------|-------|----------|-------|--------|
| 0.1 | 0.621 | -32.800 | 21.498 | 153.900 | 0.022 | 74.000 | 0.883 | -22.400 | 0.255 | 29.900 |
| 0.4 | 0.376 | -98.600 | 11.952 | 109.600 | 0.057 | 56.500 | 0.514 | -57.600 | 0.651 | 23.216 |
| 0.8 | 0.257 | -144.700 | 6.684 | 85.200 | 0.089 | 52.900 | 0.325 | -71.000 | 0.916 | 18.756 |
| 1.0 | 0.233 | -161.000 | 5.451 | 76.800 | 0.105 | 51.400 | 0.284 | -74.100 | 0.980 | 17.153 |
| 1.5 | 0.206 | 169.800 | 3.754 | 59.800 | 0.146 | 45.700 | 0.231 | -78.100 | 1.055 | 12.670 |
| 2.0 | 0.195 | 148.100 | 2.890 | 45.100 | 0.187 | 38.600 | 0.204 | -81.300 | 1.085 | 10.111 |
| 2.5 | 0.190 | 130.800 | 2.374 | 31.500 | 0.230 | 30.200 | 0.184 | -84.500 | 1.092 | 8.288 |
| 3.0 | 0.192 | 116.700 | 2.055 | 18.600 | 0.272 | 21.200 | 0.159 | -91.900 | 1.090 | 6.956 |
| 4.0 | 0.258 | 84.100 | 1.666 | -6.900 | 0.353 | 1.600 | 0.087 | -145.200 | 1.069 | 5.134 |
| 5.0 | 0.369 | 47.400 | 1.402 | -31.900 | 0.414 | -19.100 | 0.170 | -137.600 | 1.048 | 3.958 |

VCE = 2.0 V, IC = 3.0 mA

| | | | | | | | | | | |
|-----|-------|----------|-------|---------|-------|---------|-------|----------|-------|--------|
| 0.1 | 0.875 | -14.200 | 9.368 | 165.600 | 0.022 | 79.800 | 0.975 | -10.200 | 0.134 | 26.292 |
| 0.4 | 0.713 | -54.800 | 7.686 | 132.000 | 0.070 | 57.900 | 0.817 | -35.100 | 0.322 | 20.406 |
| 0.8 | 0.503 | -92.800 | 5.388 | 101.900 | 0.103 | 42.800 | 0.615 | -53.100 | 0.587 | 17.186 |
| 1.0 | 0.429 | -107.500 | 4.581 | 91.300 | 0.113 | 38.800 | 0.551 | -58.300 | 0.704 | 16.079 |
| 1.5 | 0.325 | -137.400 | 3.322 | 70.100 | 0.136 | 32.800 | 0.453 | -66.500 | 0.924 | 13.879 |
| 2.0 | 0.270 | -163.000 | 2.611 | 53.200 | 0.159 | 28.900 | 0.402 | -72.600 | 1.063 | 10.615 |
| 2.5 | 0.241 | 175.400 | 2.175 | 38.300 | 0.185 | 24.600 | 0.368 | -78.200 | 1.140 | 8.432 |
| 3.0 | 0.226 | 155.900 | 1.903 | 24.700 | 0.216 | 19.600 | 0.337 | -85.800 | 1.160 | 7.024 |
| 4.0 | 0.247 | 111.400 | 1.588 | -1.600 | 0.288 | 6.100 | 0.256 | -113.400 | 1.125 | 5.264 |
| 5.0 | 0.328 | 65.600 | 1.369 | -28.500 | 0.359 | -11.900 | 0.245 | -168.700 | 1.062 | 4.288 |

See note on previous page.

NE687 SERIES

TYPICAL SCATTERING PARAMETERS (T_A = 25°C)

NE68719

V_{CE} = 2.0 V, I_C = 5.0 mA

| FREQUENCY GHz | S ₁₁ | | S ₂₁ | | S ₁₂ | | S ₂₂ | | K | MAG ¹ (dB) |
|------------------|-----------------|----------|-----------------|---------|-----------------|---------|-----------------|----------|-------|--------------------------|
| | MAG | ANG | MAG | ANG | MAG | ANG | MAG | ANG | | |
| 0.1 | 0.795 | -18.000 | 13.956 | 162.300 | 0.020 | 76.300 | 0.954 | -13.300 | 0.200 | 28.437 |
| 0.4 | 0.577 | -66.300 | 10.170 | 123.500 | 0.062 | 56.800 | 0.721 | -41.500 | 0.440 | 22.149 |
| 0.8 | 0.364 | -106.100 | 6.431 | 94.800 | 0.090 | 46.900 | 0.508 | -57.100 | 0.740 | 18.540 |
| 1.0 | 0.303 | -120.700 | 5.350 | 85.100 | 0.102 | 44.900 | 0.452 | -61.000 | 0.844 | 17.198 |
| 1.5 | 0.224 | -151.800 | 3.763 | 65.800 | 0.132 | 40.100 | 0.377 | -66.900 | 1.000 | 14.550 |
| 2.0 | 0.187 | -178.500 | 2.912 | 49.900 | 0.163 | 35.300 | 0.340 | -71.600 | 1.079 | 10.809 |
| 2.5 | 0.171 | 159.500 | 2.403 | 35.700 | 0.197 | 29.100 | 0.316 | -76.100 | 1.108 | 8.858 |
| 3.0 | 0.165 | 139.500 | 2.086 | 22.700 | 0.233 | 22.100 | 0.291 | -83.000 | 1.112 | 7.483 |
| 4.0 | 0.212 | 96.600 | 1.712 | -2.900 | 0.309 | 5.600 | 0.207 | -110.900 | 1.087 | 5.641 |
| 5.0 | 0.319 | 53.600 | 1.460 | -29.000 | 0.378 | -14.000 | 0.192 | -174.900 | 1.047 | 4.538 |

V_{CE} = 2.0 V, I_C = 20.0 mA

| | | | | | | | | | | |
|-----|-------|----------|--------|---------|-------|---------|-------|----------|-------|--------|
| 0.1 | 0.469 | -38.900 | 29.942 | 148.800 | 0.016 | 71.900 | 0.835 | -24.600 | 0.390 | 32.722 |
| 0.4 | 0.247 | -106.600 | 14.412 | 104.600 | 0.045 | 64.000 | 0.448 | -53.100 | 0.809 | 25.055 |
| 0.8 | 0.166 | -153.400 | 7.775 | 82.800 | 0.077 | 61.100 | 0.303 | -59.500 | 0.987 | 20.042 |
| 1.0 | 0.148 | -169.000 | 6.300 | 75.200 | 0.094 | 58.900 | 0.276 | -60.900 | 1.018 | 17.433 |
| 1.5 | 0.129 | 161.600 | 4.295 | 59.400 | 0.135 | 51.600 | 0.246 | -63.500 | 1.056 | 13.584 |
| 2.0 | 0.122 | 139.700 | 3.279 | 45.600 | 0.176 | 43.500 | 0.232 | -66.900 | 1.069 | 11.099 |
| 2.5 | 0.115 | 124.900 | 2.678 | 32.900 | 0.217 | 34.400 | 0.223 | -70.400 | 1.072 | 9.271 |
| 3.0 | 0.116 | 114.300 | 2.304 | 20.600 | 0.258 | 25.300 | 0.205 | -77.100 | 1.069 | 7.908 |
| 4.0 | 0.187 | 85.100 | 1.857 | -3.600 | 0.337 | 5.700 | 0.120 | -110.500 | 1.053 | 6.005 |
| 5.0 | 0.307 | 47.800 | 1.572 | -28.300 | 0.403 | -15.200 | 0.137 | 160.100 | 1.032 | 4.822 |

Note:

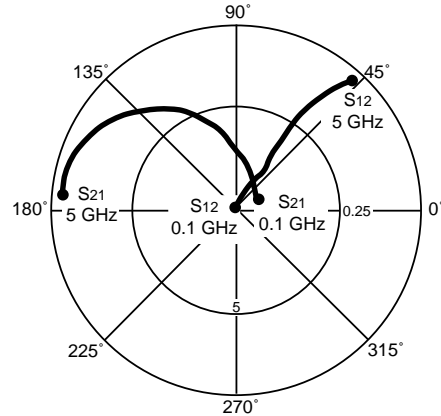
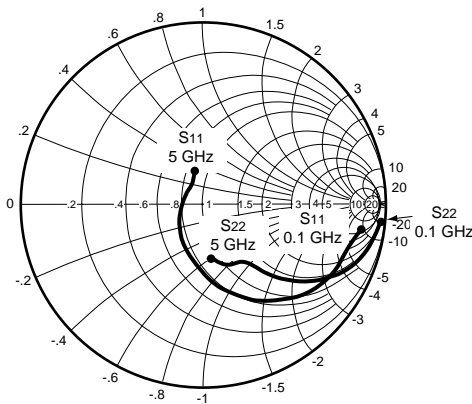
1. Gain Calculations:

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

MAG = Maximum Available Gain

MSG = Maximum Stable Gain

TYPICAL SCATTERING PARAMETERS (TA = 25°C)



Coordinates in Ohms
Frequency in GHz
(VCE = 2 V, IC = 3 mA)

NE68730

VCE = 1.0 V, IC = 1.0 mA

| FREQUENCY GHz | S11 | | S21 | | S12 | | S22 | | K | MAG ¹ (dB) |
|------------------|-------|----------|-------|---------|-------|--------|-------|---------|-------|--------------------------|
| | MAG | ANG | MAG | ANG | MAG | ANG | MAG | ANG | | |
| 0.1 | 0.942 | -7.800 | 3.487 | 169.100 | 0.028 | 84.900 | 0.991 | -5.800 | 0.098 | 20.953 |
| 0.4 | 0.870 | -35.400 | 3.178 | 146.800 | 0.103 | 67.200 | 0.924 | -21.300 | 0.208 | 14.893 |
| 0.8 | 0.714 | -65.000 | 2.676 | 120.900 | 0.167 | 51.600 | 0.791 | -36.200 | 0.392 | 12.048 |
| 1.0 | 0.639 | -77.100 | 2.433 | 110.800 | 0.185 | 46.500 | 0.732 | -41.300 | 0.484 | 11.190 |
| 1.5 | 0.493 | -103.600 | 1.944 | 90.400 | 0.207 | 39.200 | 0.621 | -50.400 | 0.707 | 9.727 |
| 2.0 | 0.400 | -125.900 | 1.621 | 75.500 | 0.216 | 38.200 | 0.557 | -56.400 | 0.905 | 8.753 |
| 2.5 | 0.334 | -147.500 | 1.412 | 63.200 | 0.224 | 41.400 | 0.520 | -61.600 | 1.063 | 6.464 |
| 3.0 | 0.298 | -169.000 | 1.269 | 53.200 | 0.242 | 46.600 | 0.495 | -66.800 | 1.139 | 4.930 |
| 4.0 | 0.268 | 145.900 | 1.085 | 38.200 | 0.325 | 53.700 | 0.455 | -77.900 | 1.108 | 3.231 |
| 5.0 | 0.328 | 110.600 | 0.990 | 26.400 | 0.449 | 51.000 | 0.389 | -96.200 | 1.016 | 2.652 |

VCE = 1.0 V, IC = 3.0 mA

| | | | | | | | | | | |
|-----|-------|----------|-------|---------|-------|--------|-------|---------|-------|--------|
| 0.1 | 0.853 | -14.800 | 9.270 | 164.300 | 0.026 | 81.700 | 0.963 | -11.100 | 0.134 | 25.521 |
| 0.4 | 0.653 | -55.800 | 7.088 | 131.200 | 0.087 | 61.800 | 0.758 | -35.400 | 0.385 | 19.110 |
| 0.8 | 0.430 | -89.900 | 4.754 | 105.400 | 0.126 | 54.000 | 0.541 | -49.200 | 0.670 | 15.767 |
| 1.0 | 0.361 | -102.200 | 4.019 | 97.100 | 0.141 | 53.300 | 0.477 | -52.300 | 0.778 | 14.549 |
| 1.5 | 0.260 | -128.600 | 2.893 | 81.600 | 0.177 | 54.200 | 0.388 | -56.600 | 0.951 | 12.134 |
| 2.0 | 0.207 | -150.800 | 2.283 | 70.200 | 0.215 | 55.000 | 0.348 | -59.300 | 1.037 | 9.084 |
| 2.5 | 0.173 | -173.200 | 1.916 | 60.600 | 0.255 | 55.100 | 0.330 | -62.000 | 1.073 | 7.114 |
| 3.0 | 0.159 | 165.900 | 1.681 | 52.200 | 0.298 | 54.300 | 0.322 | -65.400 | 1.072 | 5.880 |
| 4.0 | 0.166 | 126.100 | 1.394 | 38.600 | 0.387 | 50.200 | 0.302 | -74.700 | 1.049 | 4.212 |
| 5.0 | 0.239 | 103.800 | 1.242 | 26.600 | 0.476 | 43.700 | 0.235 | -92.200 | 1.020 | 3.302 |

VCE = 1.0 V, IC = 10.0 mA

| | | | | | | | | | | |
|-----|-------|----------|--------|---------|-------|--------|-------|---------|-------|--------|
| 0.1 | 0.590 | -30.900 | 20.999 | 151.700 | 0.022 | 75.800 | 0.864 | -21.900 | 0.319 | 29.798 |
| 0.4 | 0.314 | -84.600 | 10.808 | 111.200 | 0.064 | 66.400 | 0.479 | -48.700 | 0.749 | 22.276 |
| 0.8 | 0.184 | -120.500 | 5.986 | 92.200 | 0.107 | 68.000 | 0.312 | -53.100 | 0.950 | 17.478 |
| 1.0 | 0.155 | -133.700 | 4.891 | 86.500 | 0.129 | 68.100 | 0.279 | -53.400 | 0.988 | 15.788 |
| 1.5 | 0.119 | -163.200 | 3.377 | 75.100 | 0.184 | 66.800 | 0.239 | -53.900 | 1.030 | 11.572 |
| 2.0 | 0.100 | -170.800 | 2.615 | 66.300 | 0.239 | 63.900 | 0.225 | -55.300 | 1.043 | 9.127 |
| 2.5 | 0.098 | 146.300 | 2.171 | 58.300 | 0.292 | 60.600 | 0.223 | -57.600 | 1.040 | 7.483 |
| 3.0 | 0.099 | 129.000 | 1.884 | 50.900 | 0.342 | 56.800 | 0.224 | -61.100 | 1.035 | 6.265 |
| 4.0 | 0.121 | 99.700 | 1.545 | 38.800 | 0.435 | 48.800 | 0.211 | -72.200 | 1.024 | 4.560 |
| 5.0 | 0.193 | 95.100 | 1.366 | 27.400 | 0.516 | 40.200 | 0.140 | -95.100 | 1.012 | 3.565 |

Note:

1. Gain Calculations:

$$MAG = \frac{|S_{21}|}{|S_{12}|} (K \pm \sqrt{K^2 - 1})$$

When $K \leq 1$, 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

NE687 SERIES

TYPICAL SCATTERING PARAMETERS (T_A = 25°C)

NE68730

V_{CE} = 2.0 V, I_C = 3.0 mA

| FREQUENCY GHz | S ₁₁ | | S ₂₁ | | S ₁₂ | | S ₂₂ | | K | MAG ¹ (dB) |
|------------------|-----------------|----------|-----------------|---------|-----------------|--------|-----------------|---------|-------|--------------------------|
| | MAG | ANG | MAG | ANG | MAG | ANG | MAG | ANG | | |
| 0.1 | 0.850 | -12.800 | 9.307 | 165.200 | 0.023 | 81.500 | 0.970 | -9.600 | 0.158 | 26.071 |
| 0.4 | 0.678 | -49.700 | 7.314 | 133.800 | 0.076 | 64.100 | 0.792 | -30.800 | 0.381 | 19.833 |
| 0.8 | 0.450 | -80.500 | 5.036 | 108.200 | 0.114 | 56.500 | 0.587 | -43.100 | 0.659 | 16.452 |
| 1.0 | 0.375 | -91.900 | 4.279 | 99.900 | 0.128 | 55.900 | 0.526 | -45.800 | 0.763 | 15.241 |
| 1.5 | 0.256 | -114.600 | 3.094 | 84.300 | 0.162 | 56.700 | 0.439 | -49.300 | 0.939 | 12.810 |
| 2.0 | 0.187 | -135.300 | 2.436 | 73.000 | 0.197 | 57.600 | 0.402 | -51.700 | 1.027 | 9.908 |
| 2.5 | 0.141 | -156.700 | 2.040 | 63.500 | 0.236 | 58.000 | 0.385 | -54.100 | 1.060 | 7.874 |
| 3.0 | 0.115 | 179.500 | 1.782 | 55.100 | 0.276 | 57.500 | 0.379 | -57.300 | 1.062 | 6.578 |
| 4.0 | 0.110 | 127.300 | 1.466 | 41.900 | 0.362 | 54.300 | 0.365 | -65.400 | 1.039 | 4.866 |
| 5.0 | 0.184 | 103.000 | 1.305 | 30.400 | 0.453 | 48.700 | 0.305 | -78.400 | 1.004 | 4.201 |

V_{CE} = 2.0 V, I_C = 5.0 mA

| | | | | | | | | | | |
|-----|-------|----------|--------|---------|-------|--------|-------|---------|-------|--------|
| 0.1 | 0.781 | -17.800 | 13.806 | 161.000 | 0.021 | 80.300 | 0.945 | -12.700 | 0.194 | 28.178 |
| 0.4 | 0.531 | -58.400 | 9.434 | 124.700 | 0.067 | 64.700 | 0.683 | -36.000 | 0.533 | 21.486 |
| 0.8 | 0.313 | -86.300 | 5.827 | 101.200 | 0.103 | 62.400 | 0.482 | -44.100 | 0.816 | 17.526 |
| 1.0 | 0.250 | -96.500 | 4.846 | 94.100 | 0.120 | 62.900 | 0.433 | -45.200 | 0.894 | 16.062 |
| 1.5 | 0.160 | -117.000 | 3.408 | 80.700 | 0.163 | 63.600 | 0.371 | -46.600 | 0.998 | 13.203 |
| 2.0 | 0.104 | -136.200 | 2.651 | 70.800 | 0.208 | 62.900 | 0.348 | -48.200 | 1.037 | 9.874 |
| 2.5 | 0.067 | -163.800 | 2.205 | 62.300 | 0.253 | 61.400 | 0.340 | -50.400 | 1.047 | 8.077 |
| 3.0 | 0.053 | 164.400 | 1.913 | 54.600 | 0.298 | 59.300 | 0.339 | -53.700 | 1.041 | 6.833 |
| 4.0 | 0.069 | 98.700 | 1.562 | 42.300 | 0.386 | 53.800 | 0.328 | -62.200 | 1.027 | 5.072 |
| 5.0 | 0.143 | 93.700 | 1.390 | 31.200 | 0.474 | 47.100 | 0.265 | -75.500 | 1.002 | 4.419 |

V_{CE} = 2.0 V, I_C = 20.0 mA

| | | | | | | | | | | |
|-----|-------|----------|--------|---------|-------|--------|-------|---------|-------|--------|
| 0.1 | 0.447 | -35.800 | 28.663 | 146.000 | 0.017 | 76.400 | 0.808 | -24.200 | 0.451 | 32.269 |
| 0.4 | 0.200 | -84.600 | 12.701 | 106.600 | 0.052 | 72.800 | 0.422 | -43.500 | 0.876 | 23.878 |
| 0.8 | 0.103 | -117.300 | 6.817 | 90.300 | 0.096 | 74.000 | 0.301 | -42.600 | 0.989 | 18.513 |
| 1.0 | 0.081 | -131.600 | 5.544 | 85.300 | 0.117 | 73.500 | 0.280 | -42.000 | 1.010 | 16.144 |
| 1.5 | 0.054 | -168.200 | 3.795 | 75.300 | 0.171 | 70.900 | 0.258 | -42.600 | 1.028 | 12.443 |
| 2.0 | 0.046 | 154.600 | 2.921 | 67.300 | 0.224 | 67.400 | 0.253 | -44.500 | 1.030 | 10.086 |
| 2.5 | 0.049 | 118.800 | 2.407 | 59.900 | 0.274 | 63.700 | 0.256 | -47.300 | 1.029 | 8.397 |
| 3.0 | 0.057 | 99.400 | 2.076 | 53.200 | 0.322 | 59.900 | 0.261 | -51.500 | 1.023 | 7.169 |
| 4.0 | 0.086 | 75.300 | 1.681 | 41.800 | 0.410 | 52.100 | 0.255 | -61.800 | 1.014 | 5.396 |
| 5.0 | 0.140 | 86.000 | 1.478 | 31.200 | 0.490 | 44.000 | 0.187 | -77.200 | 1.005 | 4.368 |

Note:

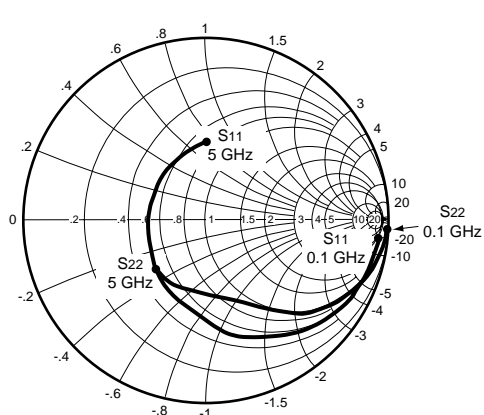
1. Gain Calculations:

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

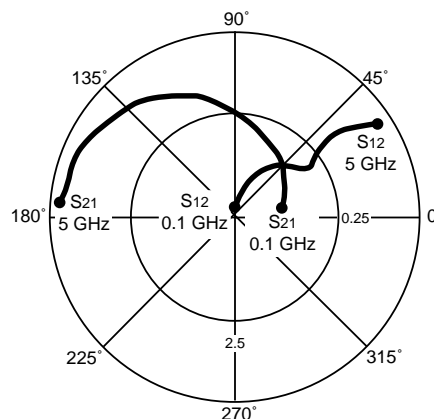
MAG = Maximum Available Gain

MSG = Maximum Stable Gain

TYPICAL SCATTERING PARAMETERS (TA = 25°C)



Coordinates in Ohms
Frequency in GHz
(VCE = 1 V, IC = 1 mA)



NE68733

VCE = 1.0 V, IC = 1.0 mA

| FREQUENCY | S11 | | S21 | | S12 | | S22 | | K | MAG ¹ |
|-----------|-------|----------|-------|---------|-------|--------|-------|----------|-------|------------------|
| GHz | MAG | ANG | MAG | ANG | MAG | ANG | MAG | ANG | | (dB) |
| 0.1 | 0.953 | -8.300 | 3.433 | 170.300 | 0.031 | 83.500 | 0.990 | -6.200 | 0.090 | 20.443 |
| 0.4 | 0.864 | -36.800 | 3.200 | 144.900 | 0.111 | 66.000 | 0.921 | -23.100 | 0.221 | 14.598 |
| 0.8 | 0.688 | -68.700 | 2.683 | 117.400 | 0.180 | 48.900 | 0.778 | -39.800 | 0.412 | 11.733 |
| 1.0 | 0.608 | -82.600 | 2.432 | 106.200 | 0.200 | 42.900 | 0.713 | -45.900 | 0.504 | 10.849 |
| 1.5 | 0.451 | -114.800 | 1.958 | 83.500 | 0.223 | 34.100 | 0.583 | -57.200 | 0.732 | 9.435 |
| 2.0 | 0.359 | -145.300 | 1.631 | 66.000 | 0.232 | 31.500 | 0.501 | -65.800 | 0.939 | 8.470 |
| 2.5 | 0.323 | -175.700 | 1.415 | 51.400 | 0.242 | 33.100 | 0.451 | -74.500 | 1.081 | 5.930 |
| 3.0 | 0.320 | -158.100 | 1.261 | 40.000 | 0.263 | 36.500 | 0.421 | -84.700 | 1.145 | 4.499 |
| 4.0 | 0.365 | 117.200 | 1.059 | 21.900 | 0.351 | 39.100 | 0.399 | -107.700 | 1.076 | 3.119 |
| 5.0 | 0.433 | 87.400 | 0.935 | 7.700 | 0.470 | 32.500 | 0.383 | -134.500 | 1.001 | 2.817 |

VCE = 1.0 V, IC = 3.0 mA

| | | | | | | | | | | |
|-----|-------|----------|-------|---------|-------|--------|-------|----------|-------|--------|
| 0.1 | 0.856 | -15.400 | 8.971 | 165.000 | 0.029 | 80.500 | 0.964 | -11.600 | 0.130 | 24.904 |
| 0.4 | 0.631 | -56.900 | 6.949 | 128.500 | 0.092 | 60.700 | 0.751 | -37.200 | 0.416 | 18.781 |
| 0.8 | 0.389 | -93.700 | 4.599 | 101.200 | 0.135 | 52.500 | 0.525 | -52.300 | 0.704 | 15.323 |
| 1.0 | 0.318 | -108.300 | 3.874 | 92.100 | 0.152 | 51.400 | 0.458 | -56.200 | 0.808 | 14.063 |
| 1.5 | 0.216 | -145.300 | 2.790 | 74.600 | 0.193 | 50.400 | 0.358 | -62.900 | 0.972 | 11.600 |
| 2.0 | 0.184 | -179.400 | 2.201 | 61.200 | 0.237 | 49.100 | 0.304 | -69.100 | 1.045 | 8.375 |
| 2.5 | 0.199 | 149.200 | 1.849 | 49.400 | 0.282 | 46.900 | 0.271 | -77.400 | 1.065 | 6.610 |
| 3.0 | 0.220 | 127.900 | 1.617 | 39.800 | 0.328 | 43.800 | 0.252 | -88.300 | 1.065 | 5.366 |
| 4.0 | 0.285 | 99.500 | 1.336 | 22.800 | 0.420 | 35.600 | 0.242 | -114.500 | 1.032 | 3.937 |
| 5.0 | 0.360 | 80.300 | 1.167 | 8.000 | 0.505 | 25.700 | 0.231 | -144.300 | 1.005 | 3.210 |

VCE = 1.0 V, IC = 10.0 mA

| | | | | | | | | | | |
|-----|-------|----------|--------|---------|-------|--------|-------|----------|-------|--------|
| 0.1 | 0.587 | -32.000 | 19.990 | 152.200 | 0.025 | 75.900 | 0.862 | -22.700 | 0.306 | 29.029 |
| 0.4 | 0.295 | -88.800 | 10.311 | 108.800 | 0.068 | 65.200 | 0.471 | -50.700 | 0.762 | 21.808 |
| 0.8 | 0.163 | -132.400 | 5.665 | 88.600 | 0.115 | 65.600 | 0.302 | -57.000 | 0.957 | 16.925 |
| 1.0 | 0.140 | -152.000 | 4.610 | 82.100 | 0.139 | 64.900 | 0.266 | -58.500 | 0.994 | 15.207 |
| 1.5 | 0.133 | 167.700 | 3.194 | 68.900 | 0.199 | 61.600 | 0.215 | -63.300 | 1.029 | 11.009 |
| 2.0 | 0.151 | 139.000 | 2.478 | 58.200 | 0.257 | 56.900 | 0.185 | -70.200 | 1.040 | 8.616 |
| 2.5 | 0.183 | 121.800 | 2.060 | 48.100 | 0.313 | 51.600 | 0.166 | -80.800 | 1.035 | 7.030 |
| 3.0 | 0.210 | 108.600 | 1.786 | 39.700 | 0.364 | 46.100 | 0.156 | -95.500 | 1.033 | 5.802 |
| 4.0 | 0.263 | 90.500 | 1.466 | 24.000 | 0.457 | 34.700 | 0.163 | -129.300 | 1.017 | 4.267 |
| 5.0 | 0.330 | 75.600 | 1.279 | 9.700 | 0.531 | 23.300 | 0.169 | -164.800 | 1.007 | 3.319 |

Note:

1. Gain Calculations:

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

MAG = Maximum Available Gain

MSG = Maximum Stable Gain

NE687 SERIES

TYPICAL SCATTERING PARAMETERS (T_A = 25°C)

NE68733

VCE = 2.0 V, Ic = 3.0 mA

| FREQUENCY GHz | S ₁₁ | | S ₂₁ | | S ₁₂ | | S ₂₂ | | K | MAG ¹ (dB) |
|------------------|-----------------|----------|-----------------|---------|-----------------|--------|-----------------|----------|-------|--------------------------|
| | MAG | ANG | MAG | ANG | MAG | ANG | MAG | ANG | | |
| 0.1 | 0.860 | -13.200 | 8.984 | 165.800 | 0.024 | 83.200 | 0.970 | -9.900 | 0.113 | 25.733 |
| 0.4 | 0.653 | -51.000 | 7.149 | 131.000 | 0.081 | 63.300 | 0.781 | -32.600 | 0.413 | 19.458 |
| 0.8 | 0.403 | -82.900 | 4.837 | 103.900 | 0.123 | 55.400 | 0.570 | -45.700 | 0.702 | 15.947 |
| 1.0 | 0.324 | -95.500 | 4.091 | 94.600 | 0.139 | 54.300 | 0.507 | -49.000 | 0.804 | 14.688 |
| 1.5 | 0.198 | -127.200 | 2.967 | 77.100 | 0.179 | 53.400 | 0.409 | -54.500 | 0.964 | 12.195 |
| 2.0 | 0.141 | -164.900 | 2.341 | 63.700 | 0.221 | 52.200 | 0.358 | -59.700 | 1.037 | 9.073 |
| 2.5 | 0.139 | 156.600 | 1.971 | 52.100 | 0.266 | 50.200 | 0.325 | -66.500 | 1.054 | 7.271 |
| 3.0 | 0.164 | 130.300 | 1.715 | 42.300 | 0.311 | 47.300 | 0.305 | -75.900 | 1.053 | 6.005 |
| 4.0 | 0.230 | 98.200 | 1.414 | 25.400 | 0.405 | 39.400 | 0.286 | -99.000 | 1.018 | 4.597 |
| 5.0 | 0.311 | 79.300 | 1.236 | 10.300 | 0.495 | 29.800 | 0.264 | -125.800 | 0.988 | 3.974 |

VCE = 2.0 V, Ic = 7.0 mA

| | | | | | | | | | | |
|-----|-------|----------|--------|---------|-------|--------|-------|----------|-------|--------|
| 0.1 | 0.704 | -21.900 | 16.558 | 158.400 | 0.023 | 77.300 | 0.922 | -16.100 | 0.248 | 28.573 |
| 0.4 | 0.410 | -66.900 | 10.214 | 116.700 | 0.066 | 65.000 | 0.600 | -41.100 | 0.649 | 21.897 |
| 0.8 | 0.209 | -97.700 | 5.923 | 94.000 | 0.107 | 63.900 | 0.409 | -47.800 | 0.898 | 17.432 |
| 1.0 | 0.157 | -110.500 | 4.860 | 86.800 | 0.128 | 63.700 | 0.365 | -49.200 | 0.954 | 15.794 |
| 1.5 | 0.092 | -152.600 | 3.391 | 72.900 | 0.180 | 61.700 | 0.305 | -52.500 | 1.016 | 11.986 |
| 2.0 | 0.086 | 157.500 | 2.635 | 61.900 | 0.233 | 58.100 | 0.271 | -57.400 | 1.034 | 9.404 |
| 2.5 | 0.113 | 127.700 | 2.193 | 51.700 | 0.284 | 53.800 | 0.248 | -64.800 | 1.035 | 7.738 |
| 3.0 | 0.143 | 110.900 | 1.896 | 43.100 | 0.333 | 49.000 | 0.233 | -75.300 | 1.031 | 6.477 |
| 4.0 | 0.203 | 89.100 | 1.551 | 27.500 | 0.425 | 39.000 | 0.220 | -101.500 | 1.013 | 4.921 |
| 5.0 | 0.270 | 76.200 | 1.353 | 13.100 | 0.506 | 28.400 | 0.202 | -130.800 | 0.998 | 4.271 |

VCE = 2.0 V, Ic = 20.0 mA

| | | | | | | | | | | |
|-----|-------|----------|--------|---------|-------|--------|-------|----------|-------|--------|
| 0.1 | 0.437 | -34.500 | 26.620 | 145.800 | 0.018 | 76.800 | 0.809 | -24.400 | 0.461 | 31.699 |
| 0.4 | 0.179 | -90.400 | 11.869 | 104.400 | 0.056 | 72.600 | 0.424 | -43.100 | 0.880 | 23.262 |
| 0.8 | 0.082 | -134.900 | 6.340 | 86.700 | 0.102 | 71.800 | 0.306 | -43.200 | 0.996 | 17.935 |
| 1.0 | 0.067 | -160.200 | 5.143 | 80.900 | 0.126 | 70.500 | 0.282 | -43.800 | 1.012 | 15.430 |
| 1.5 | 0.077 | 149.800 | 3.531 | 69.100 | 0.184 | 66.200 | 0.248 | -47.500 | 1.027 | 11.828 |
| 2.0 | 0.106 | 123.200 | 2.732 | 59.200 | 0.241 | 60.900 | 0.225 | -53.300 | 1.027 | 9.541 |
| 2.5 | 0.137 | 109.800 | 2.254 | 50.000 | 0.295 | 55.400 | 0.207 | -62.300 | 1.024 | 7.889 |
| 3.0 | 0.165 | 99.000 | 1.946 | 41.700 | 0.346 | 49.700 | 0.194 | -74.900 | 1.019 | 6.645 |
| 4.0 | 0.221 | 83.800 | 1.594 | 26.700 | 0.437 | 38.400 | 0.185 | -105.800 | 1.006 | 5.161 |
| 5.0 | 0.290 | 73.400 | 1.379 | 12.300 | 0.515 | 27.000 | 0.172 | -139.300 | 0.994 | 4.278 |

Note:

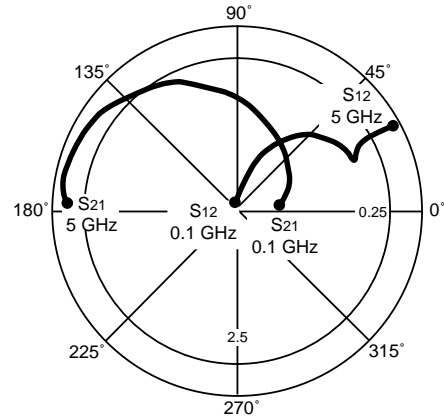
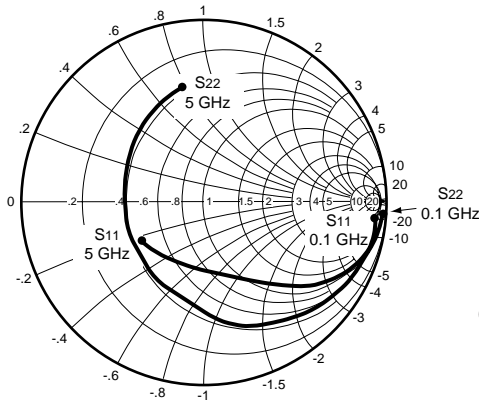
1. Gain Calculations:

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

MAG = Maximum Available Gain

MSG = Maximum Stable Gain

TYPICAL SCATTERING PARAMETERS (TA = 25°C)



Coordinates in Ohms
Frequency in GHz
(VCE = 1 V, IC = 1 mA)

NE68739

VCE = 1.0 V, IC = 1.0 mA

| FREQUENCY GHz | S11 | | S21 | | S12 | | S22 | | K | MAG ¹ (dB) |
|------------------|-------|----------|-------|---------|-------|--------|-------|----------|-------|--------------------------|
| | MAG | ANG | MAG | ANG | MAG | ANG | MAG | ANG | | |
| 0.1 | 0.960 | -7.500 | 3.509 | 172.000 | 0.024 | 85.500 | 0.993 | -4.600 | 0.055 | 21.650 |
| 0.4 | 0.888 | -34.300 | 3.358 | 149.700 | 0.091 | 68.900 | 0.941 | -17.900 | 0.181 | 15.670 |
| 0.8 | 0.734 | -67.000 | 2.974 | 123.500 | 0.157 | 51.100 | 0.815 | -32.000 | 0.362 | 12.774 |
| 1.0 | 0.651 | -82.900 | 2.738 | 112.400 | 0.178 | 44.300 | 0.751 | -37.600 | 0.440 | 11.870 |
| 1.5 | 0.496 | -122.300 | 2.250 | 88.500 | 0.205 | 31.600 | 0.602 | -49.100 | 0.642 | 10.404 |
| 2.0 | 0.436 | -159.300 | 1.842 | 69.200 | 0.210 | 24.400 | 0.500 | -58.700 | 0.834 | 9.431 |
| 2.5 | 0.441 | 169.800 | 1.566 | 53.700 | 0.207 | 22.000 | 0.428 | -69.200 | 1.006 | 8.323 |
| 3.0 | 0.473 | 147.900 | 1.339 | 40.900 | 0.208 | 23.300 | 0.384 | -81.700 | 1.146 | 5.769 |
| 4.0 | 0.565 | 119.100 | 1.047 | 20.800 | 0.233 | 28.500 | 0.358 | -113.400 | 1.192 | 3.876 |
| 5.0 | 0.651 | 99.800 | 0.852 | 5.200 | 0.287 | 28.500 | 0.399 | -147.500 | 1.074 | 3.064 |

VCE = 1.0 V, IC = 3.0 mA

| | | | | | | | | | | |
|-----|-------|----------|-------|---------|-------|--------|-------|----------|-------|--------|
| 0.1 | 0.869 | -14.000 | 9.245 | 166.800 | 0.023 | 81.300 | 0.971 | -9.100 | 0.122 | 26.042 |
| 0.4 | 0.690 | -53.600 | 7.614 | 134.500 | 0.078 | 62.400 | 0.800 | -31.100 | 0.345 | 19.895 |
| 0.8 | 0.453 | -94.600 | 5.373 | 106.500 | 0.116 | 50.400 | 0.572 | -46.200 | 0.620 | 16.658 |
| 1.0 | 0.376 | -113.100 | 4.571 | 96.900 | 0.129 | 47.900 | 0.493 | -50.700 | 0.730 | 15.494 |
| 1.5 | 0.295 | -157.100 | 3.303 | 78.500 | 0.158 | 45.000 | 0.359 | -59.700 | 0.923 | 13.203 |
| 2.0 | 0.312 | 168.300 | 2.556 | 64.100 | 0.185 | 43.300 | 0.277 | -70.300 | 1.032 | 10.301 |
| 2.5 | 0.359 | 145.700 | 2.105 | 52.000 | 0.213 | 41.400 | 0.223 | -85.000 | 1.080 | 8.224 |
| 3.0 | 0.409 | 130.200 | 1.785 | 41.700 | 0.240 | 39.200 | 0.193 | -104.300 | 1.105 | 6.745 |
| 4.0 | 0.510 | 109.500 | 1.385 | 24.100 | 0.294 | 33.400 | 0.202 | -147.000 | 1.084 | 4.963 |
| 5.0 | 0.599 | 94.300 | 1.134 | 8.900 | 0.341 | 26.000 | 0.276 | -178.000 | 1.038 | 4.019 |

VCE = 1.0 V, IC = 10.0 mA

| | | | | | | | | | | |
|-----|-------|----------|--------|---------|-------|--------|-------|----------|-------|--------|
| 0.1 | 0.629 | -29.300 | 21.353 | 155.300 | 0.021 | 76.600 | 0.887 | -19.700 | 0.262 | 30.072 |
| 0.4 | 0.370 | -90.900 | 12.179 | 114.000 | 0.058 | 61.700 | 0.521 | -50.300 | 0.658 | 23.222 |
| 0.8 | 0.247 | -141.800 | 6.904 | 92.100 | 0.092 | 60.500 | 0.313 | -61.900 | 0.907 | 18.753 |
| 1.0 | 0.237 | -162.500 | 5.624 | 85.300 | 0.109 | 60.200 | 0.261 | -66.100 | 0.964 | 17.126 |
| 1.5 | 0.268 | 163.600 | 3.862 | 71.900 | 0.151 | 57.800 | 0.182 | -80.300 | 1.027 | 13.064 |
| 2.0 | 0.323 | 143.700 | 2.930 | 60.700 | 0.191 | 54.000 | 0.143 | -103.800 | 1.052 | 10.469 |
| 2.5 | 0.380 | 130.100 | 2.384 | 50.800 | 0.229 | 49.500 | 0.137 | -132.500 | 1.053 | 8.763 |
| 3.0 | 0.428 | 120.400 | 2.000 | 42.200 | 0.262 | 45.000 | 0.158 | -157.100 | 1.060 | 7.334 |
| 4.0 | 0.526 | 105.100 | 1.537 | 27.100 | 0.320 | 35.700 | 0.231 | 173.700 | 1.040 | 5.586 |
| 5.0 | 0.609 | 92.600 | 1.256 | 13.600 | 0.362 | 26.600 | 0.314 | 157.000 | 1.018 | 4.590 |

Note:

1. Gain Calculations:

$$MAG = \frac{|S_{21}|}{|S_{12}|} (K \pm \sqrt{K^2 - 1})$$

When $K \leq 1$, 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

NE687 SERIES

TYPICAL SCATTERING PARAMETERS (T_A = 25°C)

NE68739

VCE = 2.0 V, Ic = 3.0 mA

| FREQUENCY GHz | S ₁₁ | | S ₂₁ | | S ₁₂ | | S ₂₂ | | K | MAG ¹ (dB) |
|------------------|-----------------|----------|-----------------|---------|-----------------|--------|-----------------|----------|-------|--------------------------|
| | MAG | ANG | MAG | ANG | MAG | ANG | MAG | ANG | | |
| 0.1 | 0.877 | -12.300 | 9.280 | 167.700 | 0.020 | 85.100 | 0.976 | -8.000 | 0.076 | 26.665 |
| 0.4 | 0.717 | -48.900 | 7.832 | 137.800 | 0.070 | 64.500 | 0.829 | -27.700 | 0.321 | 20.488 |
| 0.8 | 0.484 | -87.400 | 5.716 | 110.300 | 0.107 | 52.300 | 0.618 | -41.900 | 0.581 | 17.277 |
| 1.0 | 0.404 | -104.800 | 4.907 | 100.700 | 0.119 | 49.500 | 0.542 | -46.100 | 0.685 | 16.153 |
| 1.5 | 0.299 | -147.400 | 3.585 | 82.300 | 0.145 | 46.300 | 0.409 | -54.200 | 0.883 | 13.931 |
| 2.0 | 0.301 | 176.200 | 2.784 | 67.900 | 0.169 | 44.900 | 0.327 | -62.800 | 1.000 | 12.168 |
| 2.5 | 0.340 | 151.300 | 2.293 | 56.000 | 0.194 | 43.500 | 0.271 | -74.100 | 1.058 | 9.251 |
| 3.0 | 0.393 | 134.900 | 1.939 | 45.800 | 0.219 | 42.000 | 0.236 | -88.400 | 1.083 | 7.716 |
| 4.0 | 0.495 | 113.600 | 1.500 | 28.400 | 0.270 | 37.300 | 0.219 | -124.100 | 1.064 | 5.902 |
| 5.0 | 0.587 | 98.400 | 1.227 | 13.100 | 0.316 | 30.900 | 0.265 | -157.500 | 1.015 | 5.141 |

VCE = 2.0 V, Ic = 5.0 mA

| | | | | | | | | | | |
|-----|-------|----------|--------|---------|-------|--------|-------|----------|-------|--------|
| 0.1 | 0.804 | -15.700 | 13.813 | 163.800 | 0.018 | 81.700 | 0.956 | -10.300 | 0.165 | 28.850 |
| 0.4 | 0.570 | -55.800 | 10.275 | 128.600 | 0.058 | 65.000 | 0.736 | -31.100 | 0.481 | 22.484 |
| 0.8 | 0.326 | -91.000 | 6.655 | 102.800 | 0.090 | 59.200 | 0.522 | -40.500 | 0.774 | 18.689 |
| 1.0 | 0.252 | -108.300 | 5.559 | 94.500 | 0.104 | 58.500 | 0.458 | -42.800 | 0.864 | 17.280 |
| 1.5 | 0.179 | -155.100 | 3.937 | 78.900 | 0.138 | 57.200 | 0.355 | -48.000 | 0.991 | 14.553 |
| 2.0 | 0.201 | 165.000 | 3.040 | 66.500 | 0.173 | 55.100 | 0.287 | -56.000 | 1.044 | 11.167 |
| 2.5 | 0.257 | 142.400 | 2.504 | 55.800 | 0.208 | 52.100 | 0.234 | -67.800 | 1.058 | 9.338 |
| 3.0 | 0.311 | 127.700 | 2.124 | 46.400 | 0.242 | 48.600 | 0.196 | -84.500 | 1.064 | 7.885 |
| 4.0 | 0.423 | 109.600 | 1.657 | 29.800 | 0.304 | 40.600 | 0.177 | -129.000 | 1.041 | 6.124 |
| 5.0 | 0.524 | 96.000 | 1.366 | 14.900 | 0.356 | 31.800 | 0.234 | -167.600 | 1.006 | 5.353 |

VCE = 2.0 V, Ic = 20.0 mA

| | | | | | | | | | | |
|-----|-------|----------|--------|---------|-------|--------|-------|----------|-------|--------|
| 0.1 | 0.473 | -29.900 | 29.491 | 150.100 | 0.014 | 80.300 | 0.843 | -20.300 | 0.405 | 33.236 |
| 0.4 | 0.222 | -83.800 | 14.470 | 109.000 | 0.044 | 70.800 | 0.475 | -40.400 | 0.838 | 25.170 |
| 0.8 | 0.113 | -135.400 | 7.915 | 90.200 | 0.079 | 70.200 | 0.321 | -42.300 | 0.987 | 20.008 |
| 1.0 | 0.106 | -164.400 | 6.422 | 84.300 | 0.097 | 69.200 | 0.283 | -43.300 | 1.012 | 17.550 |
| 1.5 | 0.145 | 153.400 | 4.407 | 72.500 | 0.140 | 65.200 | 0.217 | -49.700 | 1.038 | 13.780 |
| 2.0 | 0.209 | 135.300 | 3.357 | 62.200 | 0.182 | 60.400 | 0.163 | -63.400 | 1.046 | 11.350 |
| 2.5 | 0.269 | 123.800 | 2.745 | 53.000 | 0.222 | 55.000 | 0.124 | -86.400 | 1.043 | 9.652 |
| 3.0 | 0.329 | 116.000 | 2.314 | 44.500 | 0.258 | 49.600 | 0.110 | -119.900 | 1.041 | 8.283 |
| 4.0 | 0.437 | 102.500 | 1.786 | 29.200 | 0.321 | 38.900 | 0.161 | -173.100 | 1.027 | 6.450 |
| 5.0 | 0.535 | 90.900 | 1.461 | 15.100 | 0.368 | 28.600 | 0.254 | 162.100 | 1.008 | 5.429 |

Note:

1. Gain Calculations:

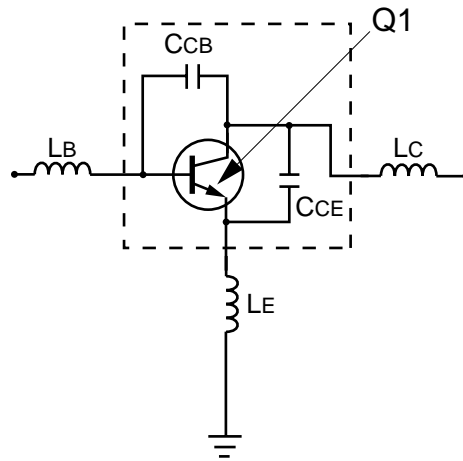
$$\text{MAG} = \frac{|S_{21}|}{|S_{12}|} (K \pm \sqrt{K^2 - 1}). \text{ When } K \leq 1, \text{ MAG is undefined and MSG values are used. } \text{MSG} = \frac{|S_{21}|}{|S_{12}|}, K = \frac{1 + |\Delta|^2 - |S_{11}|^2 - |S_{22}|^2}{2 |S_{12} S_{21}|}, \Delta = S_{11} S_{22} - S_{21} S_{12}$$

MAG = Maximum Available Gain

MSG = Maximum Stable Gain

NE68700 NONLINEAR MODEL

SCHEMATIC



BJT NONLINEAR MODEL PARAMETERS ⁽¹⁾

| Parameters | Q1 | Parameters | Q1 |
|------------|-----------|------------|---------|
| IS | 8.0e-17 | MJC | 0.53 |
| BF | 128 | XCJC | 0.27 |
| NF | 1.0 | CJS | 0 |
| VAF | 17 | VJS | 0.75 |
| IKF | 0.18 | MJS | 0 |
| ISE | 3.3e-15 | FC | 0.37 |
| NE | 1.48 | TF | 6.0e-12 |
| BR | 9.05 | XTF | 11.9 |
| NR | 1.05 | VTF | 9.55 |
| VAR | 4.3 | ITF | 1.78 |
| IKR | 0.009 | PTF | 69.1 |
| ISC | 4.0e-15 | TR | 1.0e-9 |
| NC | 1.5 | EG | 1.11 |
| RE | 0.8 | XTB | 0 |
| RB | 1.11 | XTI | 3 |
| RBM | 2.46 | KF | 0 |
| IRB | 0.017 | AF | 1 |
| RC | 7.5 | | |
| CJE | 0.415e-12 | | |
| VJE | 0.68 | | |
| MJE | 0.53 | | |
| CJC | 0.102e-12 | | |
| VJC | 0.29 | | |

(1) Gummel-Poon Model

UNITS

| Parameter | Units |
|-------------|---------|
| time | seconds |
| capacitance | farads |
| inductance | henries |
| resistance | ohms |
| voltage | volts |
| current | amps |

ADDITIONAL PARAMETERS

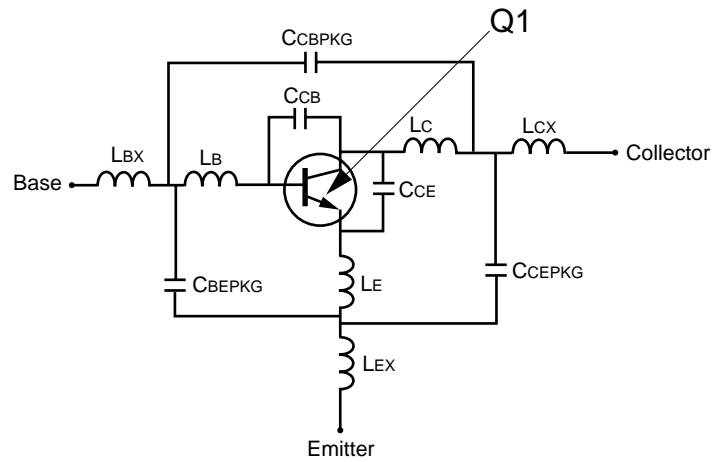
| Parameters | 68700 |
|------------|----------|
| CcB | 0.26e-12 |
| CcE | 0.19e-12 |
| Lb | 0.49e-9 |
| Lc | 0.70e-9 |
| LE | 0.26e-9 |

MODEL RANGE

Frequency: 0.1 to 6.0 GHz
 Bias: V_{CE} = 1 V to 3V, I_c = 1 mA to 10 mA
 P_{dB}: 3 V, 10 mA, 2 GHz

NE68718 NONLINEAR MODEL

SCHEMATIC



BJT NONLINEAR MODEL PARAMETERS (1)

| Parameters | Q1 | Parameters | Q1 |
|------------|-----------|------------|---------|
| IS | 8.0e-17 | MJC | 0.53 |
| BF | 128 | XCJC | 0.27 |
| NF | 1.0 | CJS | 0 |
| VAF | 17 | VJS | 0.75 |
| IKF | 0.18 | MJS | 0 |
| ISE | 3.3e-15 | FC | 0.37 |
| NE | 1.48 | TF | 6.0e-12 |
| BR | 9.05 | XTF | 11.9 |
| NR | 1.05 | VTF | 9.55 |
| VAR | 4.3 | ITF | 1.78 |
| IKR | 0.009 | PTF | 69.1 |
| ISC | 4.0e-15 | TR | 1.0e-9 |
| NC | 1.5 | EG | 1.11 |
| RE | 0.8 | XTB | 0 |
| RB | 11.1 | XTI | 3 |
| RBM | 2.46 | KF | 0 |
| IRB | 0.017 | AF | 1 |
| RC | 7.5 | | |
| CJE | 0.415e-12 | | |
| VJE | 0.68 | | |
| MJE | 0.53 | | |
| CJC | 0.102e-12 | | |
| VJC | 0.29 | | |

(1) Gummel-Poon Model

UNITS

| Parameter | Units |
|-------------|---------|
| time | seconds |
| capacitance | farads |
| inductance | henries |
| resistance | ohms |
| voltage | volts |
| current | amps |

ADDITIONAL PARAMETERS

| Parameters | 68718 |
|---------------------|-----------|
| C _{CB} | 0.26e-12 |
| C _{CCE} | 0.19e-12 |
| L _B | 1.51e-9 |
| L _C | 1.18e-9 |
| L _E | 0.71e-9 |
| C _{CBPKG} | 0.063e-12 |
| C _{CCEPKG} | 0.409e-12 |
| C _{BEPKG} | 0.361e-12 |
| L _{BX} | 0.18e-9 |
| L _{CX} | 0.18e-9 |
| L _{EX} | 0.09e-9 |

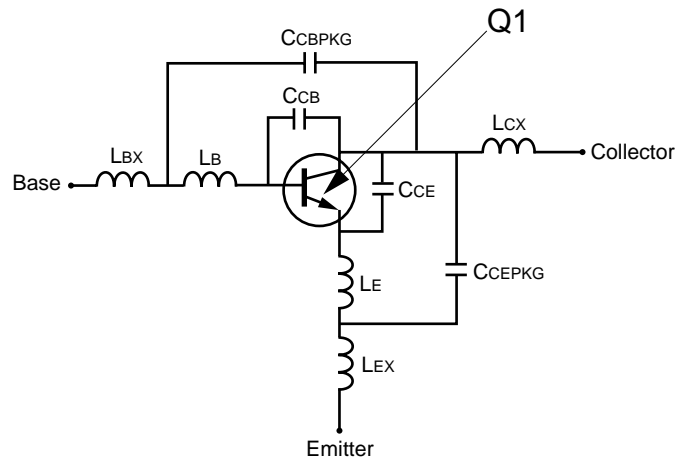
MODEL RANGE

Frequency: 0.05 to 5.0 GHz

Bias: V_{CE} = 1 V to 2 V, I_c = 1 mA to 10 mA

NE68719 NONLINEAR MODEL

SCHEMATIC



BJT NONLINEAR MODEL PARAMETERS(1)

| Parameters | Q1 | Parameters | Q1 |
|------------|-----------|------------|---------|
| IS | 8.0e-17 | MJC | 0.53 |
| BF | 128 | XCJC | 0.27 |
| NF | 1.0 | CJS | 0 |
| VAF | 17 | VJS | 0.75 |
| IKF | 0.18 | MJS | 0 |
| ISE | 3.3e-15 | FC | 0.37 |
| NE | 1.48 | TF | 6.0e-12 |
| BR | 9.05 | XTF | 11.9 |
| NR | 1.05 | VTF | 9.55 |
| VAR | 4.3 | ITF | 1.78 |
| IKR | 0.009 | PTF | 69.1 |
| ISC | 4.0e-15 | TR | 1.0e-9 |
| NC | 1.5 | EG | 1.11 |
| RE | 0.8 | XTB | 0 |
| RB | 11.1 | XTI | 3 |
| RBM | 2.46 | KF | 0 |
| IRB | 0.017 | AF | 1 |
| RC | 7.5 | | |
| CJE | 0.415e-12 | | |
| VJE | 0.68 | | |
| MJE | 0.53 | | |
| CJC | 0.102e-12 | | |
| VJC | 0.29 | | |

(1) Gummel-Poon Model

UNITS

| Parameter | Units |
|-------------|---------|
| time | seconds |
| capacitance | farads |
| inductance | henries |
| resistance | ohms |
| voltage | volts |
| current | amps |

ADDITIONAL PARAMETERS

| Parameters | 68719 |
|------------|----------|
| CCB | 0.26e-12 |
| CCE | 0.19e-12 |
| LB | 0.81e-9 |
| LE | 0.85e-9 |
| CCBPKG | 0.17e-12 |
| CCEPKG | 0.21e-12 |
| LBX | 0.19e-9 |
| LCX | 0.19e-9 |
| LEX | 0.19e-9 |

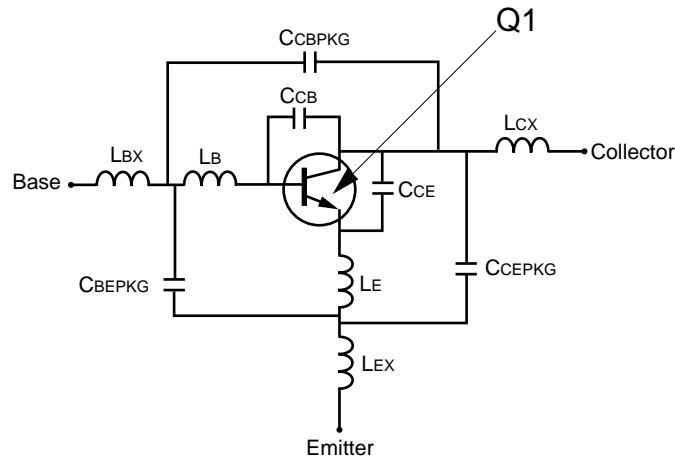
MODEL TEST CONDITIONS

Frequency: 0.05 to 3.0 GHz

Bias: VCE = 1 V to 2 V, IC = 1 mA to 10 mA

NE68730 NONLINEAR MODEL

SCHEMATIC



BJT NONLINEAR MODEL PARAMETERS (1)

| Parameters | Q1 | Parameters | Q1 |
|------------|-----------|------------|-------|
| IS | 8e-17 | MJC | 0.53 |
| BF | 128 | XCJC | 0.27 |
| NF | 1 | CJS | 0 |
| VAF | 17 | VJS | 0.75 |
| IKF | 0.18 | MJS | 0 |
| ISE | 3.3e-15 | FC | 0.37 |
| NE | 1.48 | TF | 6e-12 |
| BR | 9.05 | XTF | 11.9 |
| NR | 1.05 | VTF | 9.55 |
| VAR | 4.3 | ITF | 1.78 |
| IKR | 0.009 | PTF | 69.1 |
| ISC | 4e-15 | TR | 1e-9 |
| NC | 1.5 | EG | 1.11 |
| RE | 0.8 | XTB | 0 |
| RB | 11.1 | XTI | 3 |
| RBM | 2.46 | KF | 0 |
| IRB | 0.017 | AF | 1 |
| RC | 7.5 | | |
| CJE | 0.415e-12 | | |
| VJE | 0.68 | | |
| MJE | 0.53 | | |
| CJC | 0.102e-12 | | |
| VJC | 0.29 | | |

(1) Gummel-Poon Model

UNITS

| Parameter | Units |
|-------------|---------|
| time | seconds |
| capacitance | farads |
| inductance | henries |
| resistance | ohms |
| voltage | volts |
| current | amps |

ADDITIONAL PARAMETERS

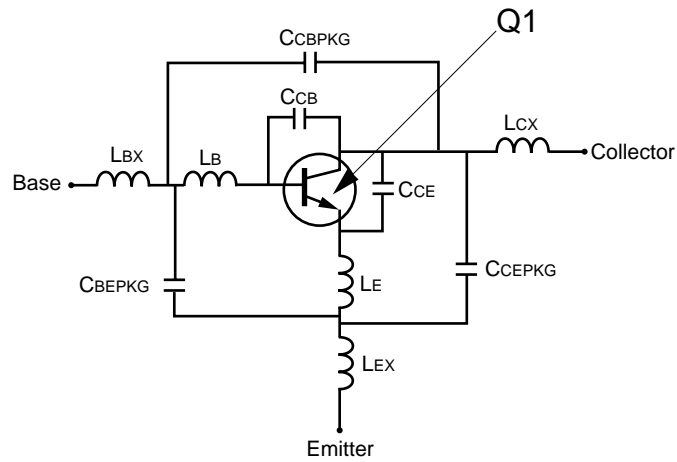
| Parameters | 68730 |
|------------|----------|
| CCB | 0.26e-12 |
| CCE | 0.19e-12 |
| LB | 0.5e-9 |
| LE | 1.07e-9 |
| CCBPKG | 0.08e-12 |
| CCEPKG | 0.04e-12 |
| CBEPKG | 0.04e-12 |
| LBX | 0.2e-9 |
| LCX | 0.1e-9 |
| LEX | 0.2e-9 |

MODEL RANGE

Frequency: 0.05 to 3.0 GHz
 Bias: VCE = 1 V to 2 V, IC = 1 mA to 10 mA
 Date: 10/25/96

NE68733 NONLINEAR MODEL

SCHEMATIC



BJT NONLINEAR MODEL PARAMETERS (1)

| Parameters | Q1 | Parameters | Q1 |
|------------|-----------|------------|-------|
| IS | 8e-17 | MJC | 0.53 |
| BF | 128 | XCJC | 0.27 |
| NF | 1 | CJS | 0 |
| VAF | 17 | VJS | 0.75 |
| IKF | 0.18 | MJS | 0 |
| ISE | 3.3e-15 | FC | 0.37 |
| NE | 1.48 | TF | 6e-12 |
| BR | 9.05 | XTF | 11.9 |
| NR | 1.05 | VTF | 9.55 |
| VAR | 4.3 | ITF | 1.78 |
| IKR | 0.009 | PTF | 69.1 |
| ISC | 4e-15 | TR | 1e-9 |
| NC | 1.5 | EG | 1.11 |
| RE | 0.8 | XTB | 0 |
| RB | 11.1 | XTI | 3 |
| RBM | 2.46 | KF | 0 |
| IRB | 0.017 | AF | 1 |
| RC | 7.5 | | |
| CJE | 0.415e-12 | | |
| VJE | 0.68 | | |
| MJE | 0.53 | | |
| CJC | 0.102e-12 | | |
| VJC | 0.29 | | |

(1) Gummel-Poon Model

UNITS

| Parameter | Units |
|-------------|---------|
| time | seconds |
| capacitance | farads |
| inductance | henries |
| resistance | ohms |
| voltage | volts |
| current | amps |

ADDITIONAL PARAMETERS

| Parameters | 68733 |
|------------|----------|
| CCB | 0.26e-12 |
| CCE | 0.19e-12 |
| LB | 0.96e-9 |
| LE | 1.05e-9 |
| CCBPKG | 0.15e-12 |
| CCEPKG | 0.09e-12 |
| CBEPKG | 0.09e-12 |
| LBX | 0.3e-9 |
| LCX | 0.3e-9 |
| LEX | 0.3e-9 |

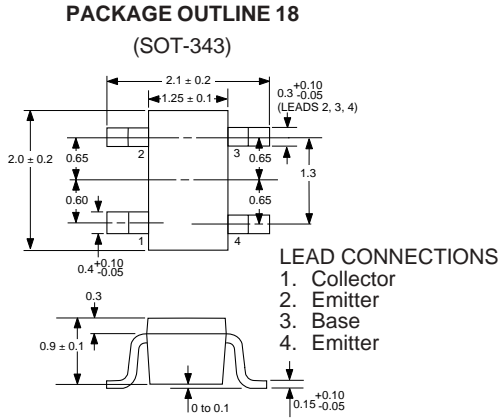
MODEL RANGE

Frequency: 0.05 to 5.0 GHz
 Bias: $V_{CE} = 1\text{ V to }2\text{ V}$, $I_C = 1\text{ mA to }10\text{ mA}$
 Date: 7/97

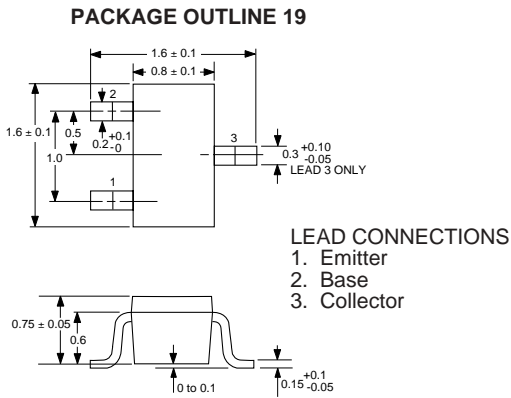
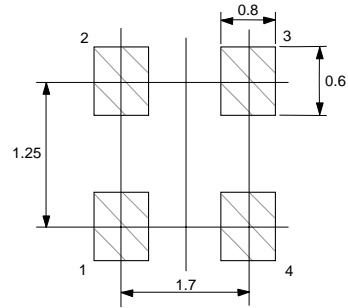
Note:

This nonlinear model utilized the latest data available. See our Design Parameter Library at www.cel.com for this data.

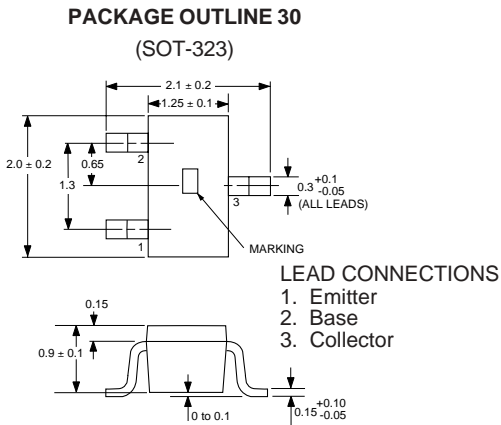
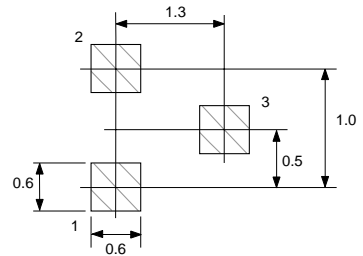
OUTLINE DIMENSIONS¹ (Units in mm)



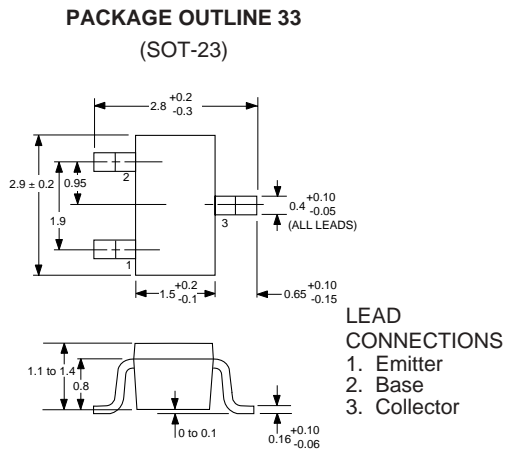
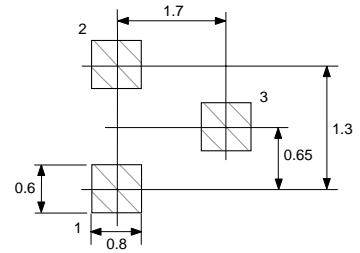
OUTLINE 18
RECOMMENDED P.C.B. LAYOUT



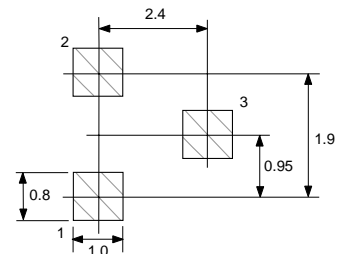
OUTLINE 19
RECOMMENDED P.C.B. LAYOUT



OUTLINE 30
RECOMMENDED P.C.B. LAYOUT

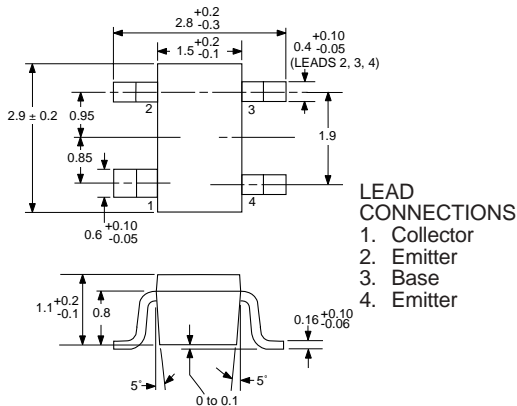


OUTLINE 33
RECOMMENDED P.C.B. LAYOUT

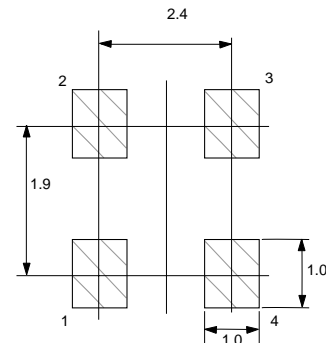


OUTLINE DIMENSIONS¹ (Units in mm)

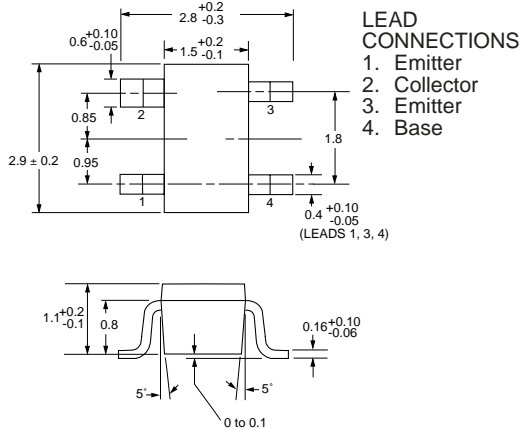
PACKAGE OUTLINE 39
(SOT-143)



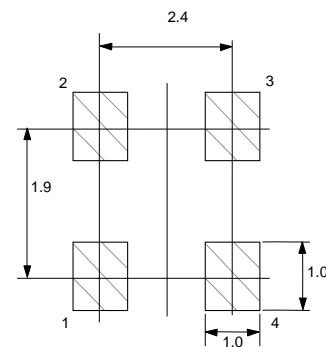
OUTLINE 39
RECOMMENDED P.C.B. LAYOUT



PACKAGE OUTLINE 39R
(SOT-143)



OUTLINE 39R
RECOMMENDED P.C.B. LAYOUT



ORDERING INFORMATION

| PART NUMBER | QUANTITY | PACKAGING |
|-------------|----------|-------------|
| NE68718-T1 | 3000 | Tape & Reel |
| NE68719-T1 | 3000 | Tape & Reel |
| NE68730-T1 | 3000 | Tape & Reel |
| NE68733-T1 | 3000 | Tape & Reel |
| NE68739-T1 | 3000 | Tape & Reel |
| NE68739R-T1 | 3000 | Tape & Reel |

Note:

- Lead material: Cu
Lead plating: PbSn

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.

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