NEC

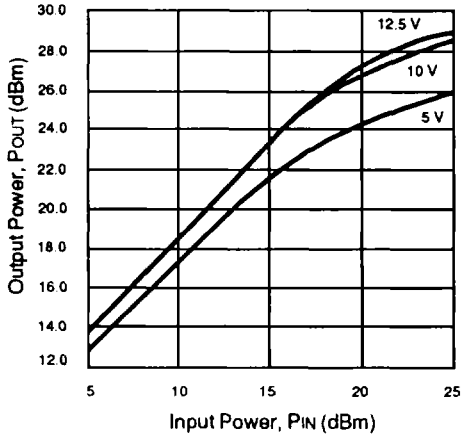
# NPN MEDIUM POWER MICROWAVE TRANSISTOR

# NE46100 NE46134

## FEATURES

- **HIGH DYNAMIC RANGE**
- **LOW IM DISTORTION:** -40 dBc
- **HIGH OUTPUT POWER** : 27.5 dBm at TYP
- **LOW NOISE:** 1.5 dB TYP at 500 MHz
- **LOW COST**
- **AVAILABLE IN TAPE & REEL OR BULK**

**NE46134**
**TYPICAL OUTPUT POWER**
**vs. INPUT POWER**
**f = 1.0 GHz, Ic = 100 mA**




## DESCRIPTION

The NE461 series of NPN silicon epitaxial bipolar transistors is designed for medium power applications requiring high dynamic range. This device exhibits an outstanding combination of high gain and low intermodulation distortion, as well as low noise figure. The NE461 series offers excellent performance and reliability at low cost through NEC's titanium, platinum, gold metallization system and direct nitride passivation of the surface of the chip. Devices are available in a low cost surface mount package (SOT-89) as well as in chip form.

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

| | PART NUMBER<br>PACKAGE CODE | | NE46100<br>00 (CHIP) | | | NE46134<br>34 | | |
|---|---|---|---|---|---|---|---|---|
| **SYMBOLS** | **PARAMETERS AND CONDITIONS** | **UNITS** | **MIN** | **TYP** | **MAX** | **MIN** | **TYP** | **MAX** |
| $f_T$ | Gain Bandwidth Product at $V_{CE}$ = 10 V, $I_C$ = 100 mA | GHz | | 5.5 | | | 5.5 | |
| NF | Minimum Noise Figure[2] at $V_{CE}$ = 10 V, $I_C$ = 50 mA, 500 MHz<br>$V_{CE}$ = 10 V, $I_C$ = 50 mA, 1 GHz | dB<br>dB | | 1.5<br>2.0 | | | 1.5<br>2.0 | |
| $G_L$ | Linear Gain, $V_{CE}$ = 12.5 V, $I_C$ = 100 mA, 2.0 GHz<br>$V_{CE}$ = 12.5 V, $I_C$ = 100 mA, 1.0 GHz | dB<br>dB | | 9.0 | | | <br>8.0 | |
| $\|S_{21E}\|^2$ | Insertion Power Gain at 10 V, 50 mA, f = 1.0 GHz | dB | | 10.0 | | 5.5 | 7.0 | |
| $h_{FE}$ | DC Current Gain[1] at $V_{CE}$ = 10 V, $I_C$ = 50 mA | | 40 | | 200 | 40 | | 200 |
| $I_{CBO}$ | Collector Cutoff Current at $V_{CB}$ = 20 V, $I_E$ = 0 mA | μA | | | 5.0 | | | 5.0 |
| $I_{EBO}$ | Emitter Cutoff Current at $V_{EB}$ = 2 V, $I_C$ = 0 mA | μA | | | 5.0 | | | 5.0 |
| $P_{1dB}$ | Output Power at 1 dB Compression, $V_{CE}$ = 12.5 V, $I_C$ = 100 mA, 2.0 GHz<br>$V_{CE}$ = 12.5 V, $I_C$ = 100 mA, 1.0 GHz | dBm<br>dBm | 27.0 | | | | <br>27.5 | |
| $IM_3$ | Intermodulation Distortion, 10 V, 100 mA, F1 = 1.0 GHz, F2 = 0.99 GHz,<br>Total $P_{OUT}$ = 20 dBm | dBc | -40.0 | | | -40.0 | | |
| $R_{TH(J-C)}$ | Thermal Resistance (Junction to Case) | °C/W | | | 30 | | | 32.5 |
| $R_{TH(J-A)}$ | Thermal Resistance (Junction to Ambient) | °C/W | | | | | 312.5 | |

Notes:
1. Pulsed: PW ≤ 350 ms, Duty Cycle ≤ 2%
2. RS = RL = 50 Ω untuned

## ABSOLUTE MAXIMUM RATINGS[1] ($T_A$ = 25°C)

| SYMBOLS | PARAMETERS | UNITS | RATINGS |
|---|---|---|---|
| $V_{CBO}$ | Collector to Base Voltage | V | 30 |
| $V_{CEO}$ | Collector to Emitter Voltage | V | 15 |
| $V_{EBO}$ | Emitter to Base Voltage | V | 3 |
| $I_C$ | Collector Current | mA | 250 |
| $P_T$ | Total Power Dissipation<br>NE46100[2]<br>NE46134[3] | <br>W<br>W | <br>3.75<br>2.0 |
| $T_J$ | Junction Temperature<br>NE46100<br>NE46134 | <br>°C<br>°C | <br>200<br>150 |
| $T_{STG}$ | Storage Temperature<br>NE46100<br>NE46134 | <br>°C<br>°C | <br>-65 to +200<br>-65 to +150 |

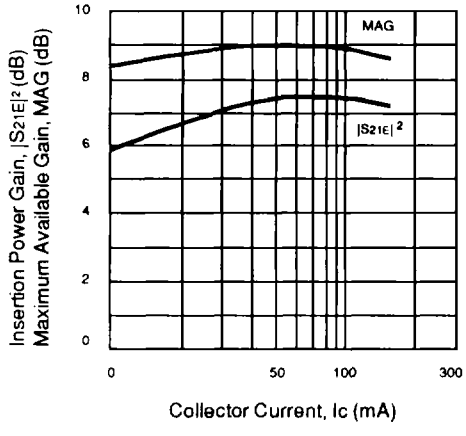
Notes:
1. Operation in excess of any one of these parameters may result in permanent damage.
2. Chip mounted on an infinite heat sink (see AN-1001 for handling instructions).
3. Packaged device mounted on 0.7 mm x 2.5 $cm^2$ double sided ceramic substrate (copper plating).

## NE46134
## TYPICAL NOISE PARAMETERS ($T_A$ = 25°C)

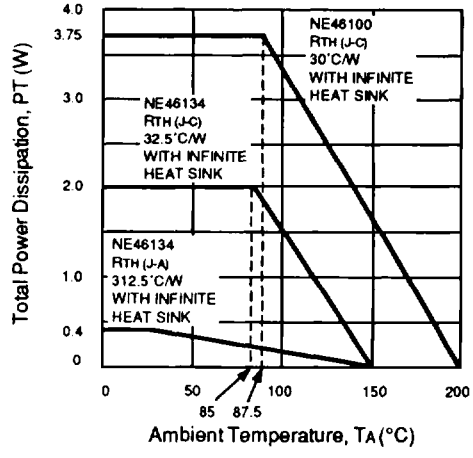
| FREQ. (GHz) | $NF_{OPT}$ (dB) | $G_A$ (dB) | $\Gamma_{OPT}$ MAG | $\Gamma_{OPT}$ ANG | RN/50 |
|---|---|---|---|---|---|
| $V_{CC}$ = 10 V, $I_C$ = 50 mA | | | | | |
| 0.5 | 1.5 | 13.5 | 0.34 | -176 | 0.09 |

## TYPICAL PERFORMANCE CURVES ($T_A$=25°C)

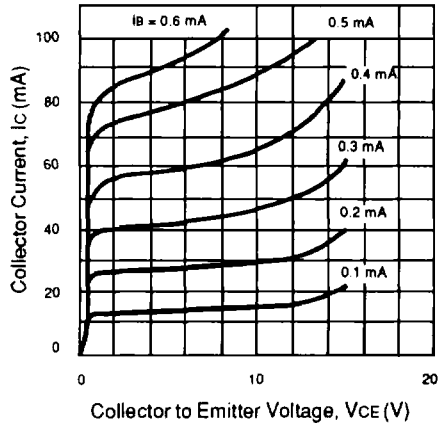
**NE46134**
**INSERTION POWER GAIN AND MAXIMUM AVAILABLE GAIN vs. COLLECTOR CURRENT**
**$V_{CE}$ = 10 V, f = 1 GHz**



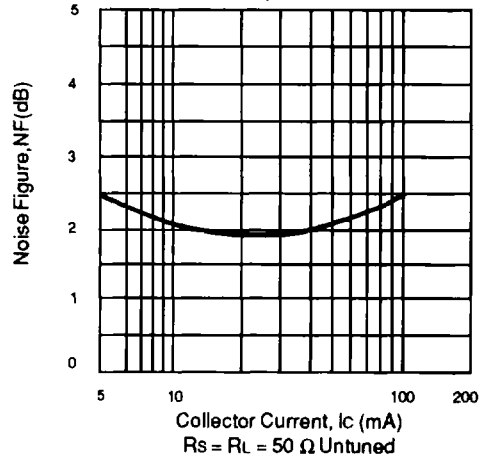

**NE46100, NE46134**
**TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE**




**NE46100, NE46134**
**COLLLECTOR CURRENT vs. COLLECTOR TO EMITTER VOLTAGE**

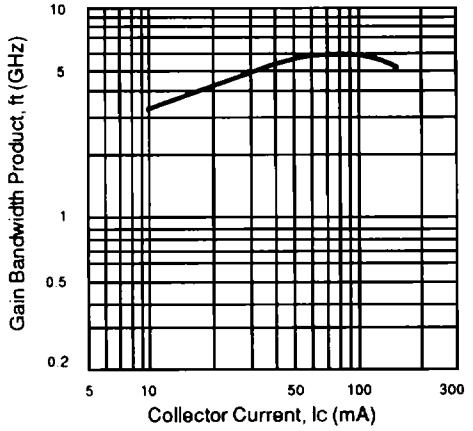



**NE46100, NE46134**
**NOISE FIGURE vs. COLLECTOR CURRENT**
**$V_{CE}$ = 10 V, f = 1 GHz**

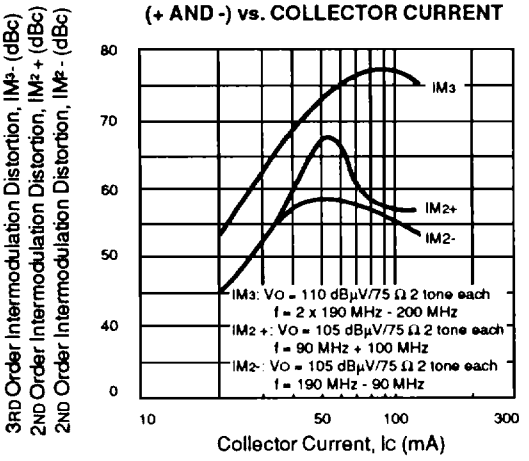


## TYPICAL PERFORMANCE CURVES ($T_A$ = 25°C)

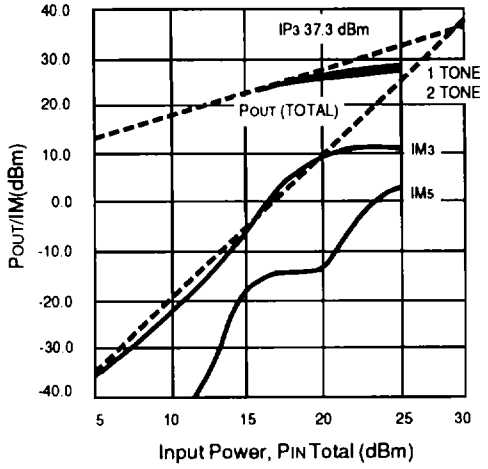
**NE46100, NE46134**
**GAIN BANDWIDTH PRODUCT vs. COLLECTOR CURRENT**
**$V_{CE}$ = 10 V**



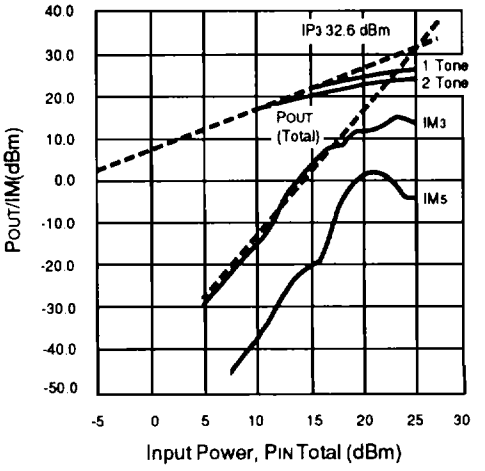

**NE46134**
**3RD ORDER INTERMODULATION DISTORTION, 2ND ORDER INTERMODULATION DISTORTION (+ AND -) vs. COLLECTOR CURRENT**



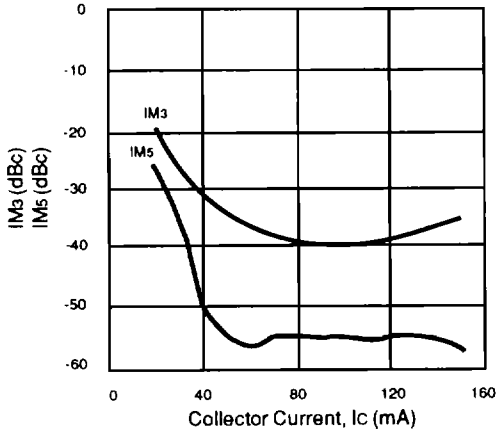

**NE46134**
**TYPICAL OUTPUT POWER/INTERMODULATION DISTORTION vs. INPUT POWER**
**f = 1.0 GHz, $V_{CE}$ = 10 V, Ic = 100 mA**
**2 Tone Test $F_1$ = 1.0 GHz, $F_2$ = 0.99 GHz**




**NE46134**
**TYPICAL OUTPUT POWER/INTERMODULATION DISTORTION vs. INPUT POWER**
**f = 1.0 GHz, $V_{CE}$ = 5 V, Ic = 100 mA**
**2 Tone Test $F_1$= 1.0 GHz, $F_2$ = 0.99 GHz**

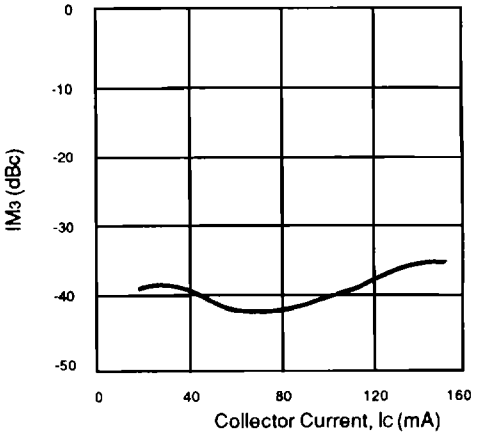



**NE46100, NE46134**
**INTERMODULATION DISTORTION vs. COLLECTOR CURRENT**
**f = 1.0 GHz, $V_{CE}$ = 10 V**



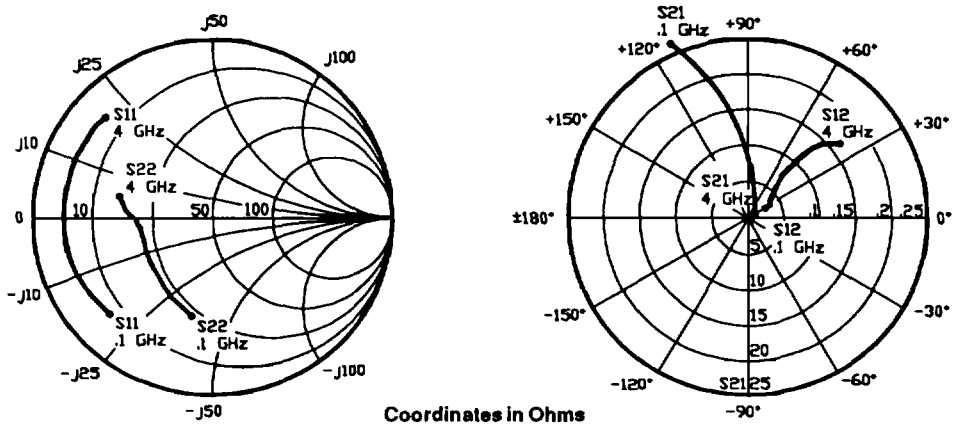

2 Tone Test
Total $P_{IN}$ = 12.1 dBm
$F_1$ = 1.0 GHz, $F_2$ = 0.99 GHz

**NE46100, NE46134**
**INTERMODULATION DISTORTION vs. COLLECTOR CURRENT**
**f = 1.0 GHz, $V_{CE}$ = 5 V**




Total $P_{IN}$ = 6.0 dBm
$F_1$ = 1.0 GHz, $F_2$ = 0.99 GHz
Note: $IM_5$ > than 58 dB down from carrier for measured currents greater than 40 mA.

## TYPICAL COMMON EMITTER SCATTERING PARAMETERS[1] ($T_A$ = 25°C)




**Coordinates in Ohms**
**Frequency in GHz**
**$V_{CE}$ = 5 V, $I_C$ = 50 mA**

### NE46100

#### $V_{CE}$ = 5 V, $I_C$ = 50 mA

| FREQUENCY | $S_{11}$ | | $S_{21}$ | | $S_{12}$ | | $S_{22}$ | | K | $MAG^2$ |
|---|---|---|---|---|---|---|---|---|---|---|
| (MHz) | MAG | ANG | MAG | ANG | MAG | ANG | MAG | ANG | | (dB) |
| 100 | 0.778 | -137 | 26.776 | 114 | 0.028 | 30 | 0.555 | -102 | 0.16 | 29.8 |
| 200 | 0.815 | -159 | 14.407 | 100 | 0.035 | 29 | 0.434 | -135 | 0.36 | 26.2 |
| 500 | 0.826 | -177 | 5.855 | 84 | 0.040 | 38 | 0.400 | -162 | 0.75 | 21.7 |
| 800 | 0.827 | 176 | 3.682 | 76 | 0.052 | 43 | 0.402 | -169 | 0.91 | 18.5 |
| 1000 | 0.826 | 173 | 2.963 | 71 | 0.058 | 47 | 0.405 | -172 | 1.02 | 16.3 |
| 1200 | 0.825 | 170 | 2.441 | 66 | 0.064 | 47 | 0.412 | -174 | 1.08 | 14.0 |
| 1400 | 0.820 | 167 | 2.111 | 61 | 0.069 | 47 | 0.413 | -176 | 1.17 | 12.4 |
| 1600 | 0.828 | 165 | 1.863 | 57 | 0.078 | 54 | 0.426 | -177 | 1.15 | 11.4 |
| 1800 | 0.827 | 162 | 1.671 | 53 | 0.087 | 50 | 0.432 | -178 | 1.14 | 10.6 |
| 2000 | 0.828 | 159 | 1.484 | 49 | 0.093 | 50 | 0.431 | -180 | 1.17 | 9.5 |
| 2500 | 0.822 | 153 | 1.218 | 39 | 0.11 | 48 | 0.462 | 177 | 1.18 | 7.8 |
| 3000 | 0.818 | 148 | 1.010 | 30 | 0.135 | 46 | 0.490 | 174 | 1.16 | 6.3 |
| 3500 | 0.824 | 142 | 0.876 | 21 | 0.147 | 44 | 0.507 | 170 | 1.16 | 5.3 |
| 4000 | 0.812 | 137 | 0.762 | 13 | 0.168 | 38 | 0.535 | 167 | 1.14 | 4.3 |

#### $V_{CE}$ = 5 V, $I_C$ = 100 mA

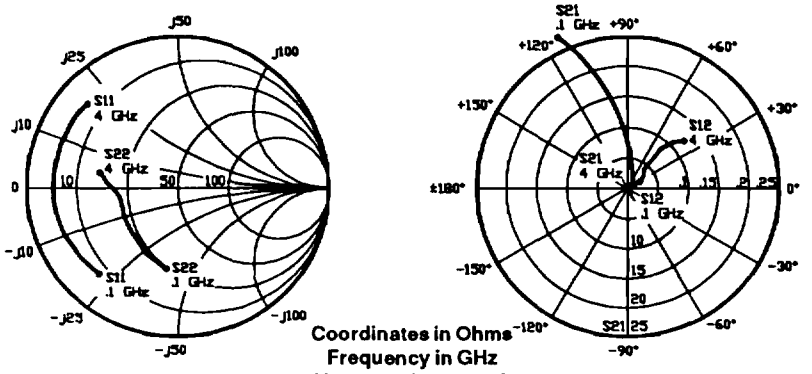
| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 100 | 0.778 | -144 | 27.669 | 111 | 0.027 | 35 | 0.523 | -114 | 0.27 | 30.2 |
| 200 | 0.820 | -164 | 14.559 | 97 | 0.029 | 29 | 0.445 | -144 | 0.42 | 27.0 |
| 500 | 0.832 | -179 | 5.885 | 84 | 0.035 | 38 | 0.435 | -166 | 0.81 | 22.2 |
| 800 | 0.833 | 175 | 3.691 | 76 | 0.048 | 45 | 0.435 | -173 | 0.95 | 18.8 |
| 1000 | 0.831 | 172 | 2.980 | 71 | 0.056 | 51 | 0.437 | -176 | 1.05 | 16.0 |
| 1200 | 0.836 | 169 | 2.464 | 67 | 0.061 | 52 | 0.432 | -178 | 1.11 | 14.0 |
| 1400 | 0.829 | 166 | 2.121 | 61 | 0.072 | 53 | 0.447 | -180 | 1.12 | 12.6 |
| 1600 | 0.831 | 164 | 1.867 | 58 | 0.080 | 54 | 0.445 | 179 | 1.14 | 11.4 |
| 1800 | 0.827 | 161 | 1.671 | 54 | 0.090 | 53 | 0.460 | 178 | 1.14 | 10.4 |
| 2000 | 0.830 | 159 | 1.499 | 49 | 0.096 | 52 | 0.456 | 176 | 1.15 | 9.6 |
| 2500 | 0.831 | 153 | 1.228 | 40 | 0.115 | 51 | 0.479 | 173 | 1.15 | 8.0 |
| 3000 | 0.821 | 147 | 1.018 | 31 | 0.134 | 48 | 0.504 | 170 | 1.18 | 6.3 |
| 3500 | 0.820 | 142 | 0.881 | 23 | 0.155 | 42 | 0.516 | 167 | 1.14 | 5.3 |
| 4000 | 0.812 | 136 | 0.779 | 14 | 0.170 | 41 | 0.543 | 164 | 1.16 | 4.2 |

Notes:
1. S-Parameters include Bond wires.
   Base: Total 1 wire, 1 per Bond Pad, 0.0259" (658 µm) long each wire.
   Collector: Total 1 wire, 1 per Bond Pad, 0.0182" (463 µm) long each wire.
   Emitter: Total 2 wires, 1 per side, 0.0224" (569 µm) long each wire.
   Wire: 0.0007" (17.8µm) dia., gold.
2. Gain Calculations:

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

## TYPICAL COMMON EMITTER SCATTERING PARAMETERS[1] ($T_A$ = 25°C)




Coordinates in Ohms
Frequency in GHz
$V_{CE}$ = 8 V, $I_C$ = 50 mA

### NE46100

#### $V_{CE}$ = 8 V, $I_C$ = 50 mA

| FREQUENCY | $S_{11}$ | | $S_{21}$ | | $S_{12}$ | | $S_{22}$ | | K | MAG[2] |
|---|---|---|---|---|---|---|---|---|---|---|
| (MHz) | MAG | ANG | MAG | ANG | MAG | ANG | MAG | ANG | | (dB) |
| 100 | 0.773 | -133 | 27.779 | 115 | 0.031 | 30 | 0.538 | -99 | 0.20 | 29.5 |
| 200 | 0.808 | -157 | 15.007 | 100 | 0.033 | 30 | 0.428 | -132 | 0.36 | 26.6 |
| 500 | 0.824 | -176 | 6.118 | 85 | 0.041 | 35 | 0.388 | -160 | 0.70 | 21.8 |
| 800 | 0.823 | 177 | 3.841 | 76 | 0.050 | 42 | 0.388 | -168 | 0.91 | 18.8 |
| 1000 | 0.822 | 173 | 3.095 | 71 | 0.060 | 50 | 0.388 | -171 | 0.99 | 17.2 |
| 1200 | 0.824 | 170 | 2.570 | 67 | 0.065 | 48 | 0.389 | -173 | 1.05 | 14.6 |
| 1400 | 0.820 | 167 | 2.201 | 61 | 0.075 | 46 | 0.395 | -175 | 1.06 | 13.2 |
| 1600 | 0.825 | 165 | 1.937 | 57 | 0.080 | 49 | 0.410 | -176 | 1.09 | 12.0 |
| 1800 | 0.822 | 162 | 1.747 | 53 | 0.084 | 48 | 0.416 | -177 | 1.15 | 10.9 |
| 2000 | 0.821 | 160 | 1.551 | 49 | 0.095 | 50 | 0.421 | -179 | 1.15 | 9.8 |
| 2500 | 0.816 | 154 | 1.267 | 39 | 0.116 | 50 | 0.449 | 177 | 1.16 | 8.0 |
| 3000 | 0.817 | 148 | 1.051 | 30 | 0.128 | 45 | 0.474 | 175 | 1.17 | 6.7 |
| 3500 | 0.817 | 143 | 0.910 | 22 | 0.154 | 45 | 0.496 | 171 | 1.12 | 5.6 |
| 4000 | 0.807 | 137 | 0.800 | 13 | 0.169 | 40 | 0.527 | 168 | 1.13 | 4.6 |

#### $V_{CE}$ = 8 V, $I_C$ = 100 mA

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 100 | 0.771 | -141 | 28.901 | 111 | 0.025 | 27 | 0.507 | -109 | 0.23 | 30.6 |
| 200 | 0.816 | -162 | 15.323 | 98 | 0.028 | 23 | 0.434 | -142 | 0.38 | 27.4 |
| 500 | 0.823 | -177 | 6.183 | 84 | 0.038 | 36 | 0.417 | -165 | 0.76 | 22.1 |
| 800 | 0.822 | 176 | 3.889 | 76 | 0.047 | 48 | 0.419 | -172 | 1.01 | 18.7 |
| 1000 | 0.824 | 172 | 3.124 | 71 | 0.057 | 49 | 0.418 | -175 | 1.02 | 16.5 |
| 1200 | 0.822 | 169 | 2.605 | 67 | 0.064 | 54 | 0.422 | -177 | 1.09 | 14.2 |
| 1400 | 0.816 | 166 | 2.223 | 62 | 0.073 | 56 | 0.426 | -178 | 1.15 | 12.5 |
| 1600 | 0.821 | 164 | 1.962 | 58 | 0.079 | 54 | 0.435 | 180 | 1.15 | 11.6 |
| 1800 | 0.823 | 161 | 1.751 | 54 | 0.088 | 54 | 0.443 | 179 | 1.14 | 10.7 |
| 2000 | 0.823 | 159 | 1.563 | 50 | 0.097 | 55 | 0.438 | 177 | 1.17 | 9.6 |
| 2500 | 0.816 | 153 | 1.292 | 40 | 0.117 | 51 | 0.462 | 174 | 1.16 | 8.0 |
| 3000 | 0.814 | 148 | 1.061 | 31 | 0.134 | 48 | 0.491 | 171 | 1.18 | 6.5 |
| 3500 | 0.820 | 142 | 0.927 | 23 | 0.154 | 45 | 0.501 | 168 | 1.12 | 5.7 |
| 4000 | 0.807 | 137 | 0.814 | 15 | 0.170 | 41 | 0.529 | 165 | 1.15 | 4.4 |

#### $V_{CE}$ = 10 V, $I_C$ = 50 mA

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 100 | 0.780 | -132 | 28.079 | 115 | 0.029 | 46 | 0.548 | -99 | 0.21 | 29.8 |
| 200 | 0.809 | -156 | 15.218 | 100 | 0.033 | 29 | 0.425 | -131 | 0.34 | 26.7 |
| 500 | 0.819 | -175 | 6.206 | 85 | 0.041 | 34 | 0.387 | -159 | 0.70 | 21.8 |
| 800 | 0.817 | 177 | 3.888 | 76 | 0.048 | 42 | 0.386 | -168 | 0.96 | 19.4 |
| 1000 | 0.821 | 174 | 3.136 | 71 | 0.060 | 48 | 0.385 | -170 | 0.97 | 17.2 |
| 1200 | 0.821 | 171 | 2.596 | 67 | 0.063 | 47 | 0.388 | -173 | 1.07 | 14.5 |
| 1400 | 0.814 | 168 | 2.236 | 62 | 0.068 | 53 | 0.394 | -174 | 1.19 | 12.6 |
| 1600 | 0.819 | 165 | 1.976 | 58 | 0.075 | 50 | 0.401 | -176 | 1.17 | 11.7 |
| 1800 | 0.816 | 162 | 1.769 | 53 | 0.084 | 51 | 0.413 | -178 | 1.17 | 10.7 |
| 2000 | 0.819 | 160 | 1.565 | 49 | 0.094 | 49 | 0.416 | -179 | 1.15 | 9.8 |
| 2500 | 0.815 | 154 | 1.290 | 39 | 0.116 | 51 | 0.439 | 178 | 1.14 | 8.2 |
| 3000 | 0.814 | 148 | 1.072 | 30 | 0.128 | 46 | 0.468 | 175 | 1.18 | 6.7 |
| 3500 | 0.819 | 143 | 0.920 | 22 | 0.150 | 44 | 0.488 | 173 | 1.12 | 5.8 |
| 4000 | 0.806 | 137 | 0.803 | 13 | 0.168 | 40 | 0.519 | 168 | 1.14 | 4.5 |

See notes on previous page.

## TYPICAL COMMON EMITTER SCATTERING PARAMETERS[1] ($T_A$ = 25°C)

### NE46100

**$V_{CE}$ = 10 V, $I_C$ = 100 mA**

| FREQUENCY | $S_{11}$ | | $S_{21}$ | | $S_{12}$ | | $S_{22}$ | | K | MAG[2] |
|---|---|---|---|---|---|---|---|---|---|---|
| (MHZ) | MAG | ANG | MAG | ANG | MAG | ANG | MAG | ANG | | (dB) |
| 100 | 0.791 | -139 | 29.278 | 112 | 0.027 | 30 | 0.508 | -109 | 0.22 | 30.4 |
| 200 | 0.809 | -161 | 15.503 | 98 | 0.027 | 32 | 0.433 | -140 | 0.43 | 27.5 |
| 500 | 0.822 | -177 | 6.280 | 84 | 0.037 | 43 | 0.414 | -165 | 0.81 | 22.3 |
| 800 | 0.815 | 176 | 3.939 | 76 | 0.046 | 48 | 0.408 | -171 | 1.02 | 18.5 |
| 1000 | 0.819 | 173 | 3.176 | 71 | 0.055 | 50 | 0.411 | -174 | 1.05 | 16.2 |
| 1200 | 0.818 | 170 | 2.621 | 67 | 0.064 | 54 | 0.412 | -176 | 1.11 | 14.1 |
| 1400 | 0.814 | 167 | 2.255 | 62 | 0.070 | 52 | 0.418 | -178 | 1.16 | 12.7 |
| 1600 | 0.821 | 164 | 1.990 | 58 | 0.078 | 52 | 0.430 | -180 | 1.14 | 11.8 |
| 1800 | 0.823 | 161 | 1.786 | 54 | 0.090 | 53 | 0.434 | 179 | 1.11 | 11.0 |
| 2000 | 0.819 | 159 | 1.585 | 50 | 0.097 | 52 | 0.429 | 177 | 1.15 | 9.8 |
| 2500 | 0.816 | 153 | 1.304 | 40 | 0.113 | 51 | 0.458 | 174 | 1.18 | 8.1 |
| 3000 | 0.812 | 148 | 1.085 | 31 | 0.139 | 47 | 0.484 | 171 | 1.13 | 6.7 |
| 3500 | 0.813 | 142 | 0.937 | 23 | 0.153 | 45 | 0.501 | 168 | 1.14 | 5.6 |
| 4000 | 0.802 | 137 | 0.824 | 15 | 0.168 | 42 | 0.520 | 165 | 1.18 | 4.3 |
| **$V_{CE}$ = 12.5 V, $I_C$ = 50 mA** | | | | | | | | | | |
| 100 | 0.759 | -129 | 28.230 | 116 | 0.032 | 30 | 0.543 | -96 | 0.21 | 29.5 |
| 200 | 0.806 | -155 | 15.378 | 101 | 0.035 | 31 | 0.420 | -130 | 0.35 | 26.4 |
| 500 | 0.815 | -175 | 6.261 | 85 | 0.041 | 34 | 0.380 | -159 | 0.71 | 21.9 |
| 800 | 0.813 | 178 | 3.926 | 76 | 0.052 | 44 | 0.379 | -167 | 0.91 | 18.8 |
| 1000 | 0.140 | 174 | 3.179 | 71 | 0.058 | 45 | 0.375 | -171 | 1.00 | 17.1 |
| 1200 | 0.816 | 171 | 2.629 | 67 | 0.067 | 47 | 0.382 | -172 | 1.03 | 14.8 |
| 1400 | 0.810 | 168 | 2.266 | 62 | 0.071 | 46 | 0.385 | -174 | 1.12 | 12.9 |
| 1600 | 0.817 | 165 | 1.993 | 58 | 0.079 | 47 | 0.400 | -175 | 1.11 | 12.0 |
| 1800 | 0.816 | 163 | 1.770 | 53 | 0.087 | 49 | 0.408 | -176 | 1.13 | 10.9 |
| 2000 | 0.817 | 160 | 1.592 | 49 | 0.090 | 51 | 0.408 | -178 | 1.20 | 9.8 |
| 2500 | 0.811 | 154 | 1.301 | 40 | 0.109 | 50 | 0.441 | 179 | 1.20 | 8.0 |
| 3000 | 0.809 | 149 | 1.084 | 30 | 0.131 | 46 | 0.459 | 176 | 1.17 | 6.7 |
| 3500 | 0.811 | 143 | 0.934 | 22 | 0.150 | 45 | 0.482 | 172 | 1.15 | 5.6 |
| 4000 | 0.803 | 137 | 0.816 | 13 | 0.166 | 42 | 0.514 | 169 | 1.17 | 4.4 |
| **$V_{CE}$ = 12.5 V, $I_C$ = 100 mA** | | | | | | | | | | |
| 100 | 0.785 | -138 | 29.375 | 112 | 0.027 | 25 | 0.510 | -109 | 0.21 | 30.4 |
| 200 | 0.804 | -160 | 15.593 | 98 | 0.030 | 32 | 0.421 | -140 | 0.43 | 27.1 |
| 500 | 0.814 | -177 | 6.318 | 84 | 0.040 | 42 | 0.401 | -164 | 0.78 | 22.0 |
| 800 | 0.809 | 176 | 3.951 | 76 | 0.048 | 48 | 0.398 | -171 | 1.02 | 18.3 |
| 1000 | 0.815 | 173 | 3.193 | 71 | 0.057 | 52 | 0.400 | -174 | 1.05 | 16.1 |
| 1200 | 0.813 | 170 | 2.656 | 67 | 0.060 | 53 | 0.403 | -177 | 1.17 | 14.0 |
| 1400 | 0.811 | 167 | 2.264 | 62 | 0.073 | 51 | 0.411 | -178 | 1.13 | 12.7 |
| 1600 | 0.818 | 164 | 1.997 | 58 | 0.076 | 55 | 0.416 | -180 | 1.19 | 11.6 |
| 1800 | 0.814 | 162 | 1.797 | 54 | 0.090 | 54 | 0.421 | 180 | 1.14 | 10.7 |
| 2000 | 0.813 | 160 | 1.613 | 49 | 0.094 | 50 | 0.424 | 178 | 1.18 | 9.8 |
| 2500 | 0.805 | 154 | 1.316 | 40 | 0.113 | 52 | 0.442 | 175 | 1.22 | 7.9 |
| 3000 | 0.813 | 148 | 1.091 | 31 | 0.133 | 46 | 0.470 | 172 | 1.15 | 6.7 |
| 3500 | 0.807 | 142 | 0.948 | 23 | 0.156 | 45 | 0.481 | 169 | 1.15 | 5.5 |
| 4000 | 0.802 | 137 | 0.826 | 14 | 0.164 | 40 | 0.510 | 166 | 1.19 | 4.4 |

Notes:

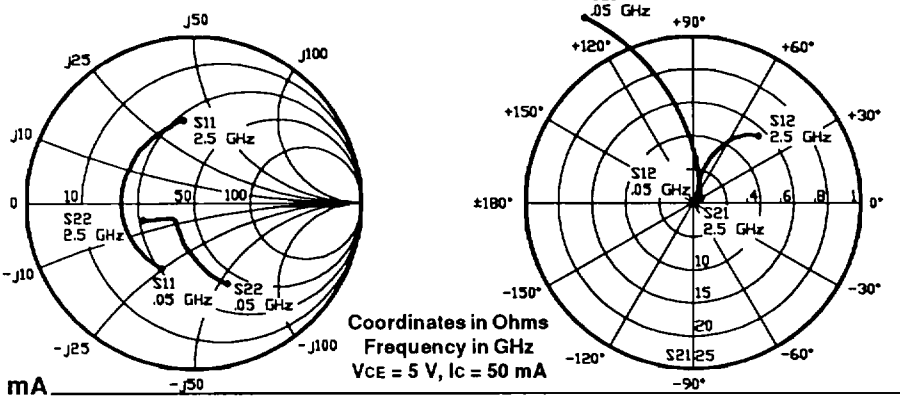
1. S-Parameters include Bond wires.
   - Base: Total 1 wire, 1 per Bond Pad, 0.0259" (658 µm) long each wire.
   - Collector: Total 1 wire, 1 per Bond Pad, 0.0182 " (463 µm) long each wire.
   - Emitter: Total 2 wires, 1 per side, 0.0224" (569 µm) long each wire.
   - Wire: 0.0007" (17.8 µm) dia., gold.
2. Gain Calculations:

$$MAG = \frac{|S_{21}|}{|S_{12}|}\left(K \pm \sqrt{K^2 - 1}\right)$$. When $K \le 1$, 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

## TYPICAL COMMON EMITTER SCATTERING PARAMETERS ($T_A$ = 25°C)




Coordinates in Ohms
Frequency in GHz
$V_{CE}$ = 5 V, $I_C$ = 50 mA

### NE46134

#### $V_{CE}$ = 5 V, $I_C$ = 50 mA

| FREQUENCY | $S_{11}$ | | $S_{21}$ | | $S_{12}$ | | $S_{22}$ | | K | $MAG^2$ |
|---|---|---|---|---|---|---|---|---|---|---|
| (MHz) | MAG | ANG | MAG | ANG | MAG | ANG | MAG | ANG | | (dB) |
| 50 | 0.436 | -117 | 32.710 | 120 | 0.026 | 60 | 0.520 | -68 | 0.55 | 31.0 |
| 100 | 0.429 | -148 | 18.264 | 104 | 0.037 | 65 | 0.310 | -91 | 0.79 | 26.9 |
| 200 | 0.433 | -169 | 9.472 | 92 | 0.059 | 70 | 0.197 | -115 | 0.97 | 22.1 |
| 400 | 0.435 | 175 | 4.861 | 81 | 0.116 | 73 | 0.155 | -133 | 1.01 | 15.7 |
| 600 | 0.436 | 165 | 3.318 | 74 | 0.170 | 74 | 0.153 | -141 | 1.02 | 12.0 |
| 800 | 0.439 | 158 | 2.575 | 67 | 0.226 | 72 | 0.161 | -146 | 1.01 | 10.0 |
| 1000 | 0.435 | 150 | 2.145 | 61 | 0.269 | 70 | 0.168 | -148 | 1.02 | 8.2 |
| 1200 | 0.441 | 143 | 1.851 | 55 | 0.319 | 67 | 0.185 | -151 | 1.01 | 7.1 |
| 1400 | 0.450 | 136 | 1.656 | 51 | 0.368 | 64 | 0.197 | -152 | 0.99 | 6.5 |
| 1600 | 0.451 | 129 | 1.517 | 46 | 0.408 | 61 | 0.215 | -155 | 0.99 | 5.7 |
| 1800 | 0.460 | 123 | 1.411 | 42 | 0.451 | 58 | 0.232 | -157 | 0.98 | 5.0 |
| 2000 | 0.467 | 115 | 1.324 | 37 | 0.485 | 55 | 0.254 | -157 | 0.97 | 4.4 |
| 2200 | 0.476 | 108 | 1.255 | 33 | 0.519 | 52 | 0.281 | -159 | 0.97 | 3.8 |
| 2400 | 0.498 | 101 | 1.194 | 29 | 0.546 | 48 | 0.310 | -161 | 0.96 | 3.4 |
| 2500 | 0.500 | 98 | 1.163 | 28 | 0.557 | 46 | 0.327 | -161 | 0.96 | 3.2 |
| **$V_{CE}$ = 5 V, $I_C$ = 100 mA** | | | | | | | | | | |
| 50 | 0.425 | -131 | 33.735 | 115 | 0.022 | 68 | 0.446 | -77 | 0.65 | 31.9 |
| 100 | 0.439 | -157 | 18.257 | 101 | 0.034 | 71 | 0.272 | -103 | 0.87 | 27.3 |
| 200 | 0.437 | -173 | 9.367 | 91 | 0.064 | 75 | 0.186 | -128 | 0.97 | 21.7 |
| 400 | 0.442 | 173 | 4.787 | 81 | 0.121 | 77 | 0.164 | -145 | 1.01 | 15.3 |
| 600 | 0.446 | 164 | 3.266 | 73 | 0.175 | 75 | 0.166 | -152 | 1.02 | 11.0 |
| 800 | 0.445 | 156 | 2.537 | 67 | 0.229 | 73 | 0.176 | -155 | 1.02 | 9.6 |
| 1000 | 0.451 | 148 | 2.108 | 61 | 0.276 | 69 | 0.184 | -159 | 1.02 | 8.1 |
| 1200 | 0.449 | 142 | 1.831 | 56 | 0.327 | 67 | 0.189 | -159 | 1.01 | 7.0 |
| 1400 | 0.454 | 135 | 1.650 | 50 | 0.372 | 63 | 0.208 | -160 | 1.00 | 6.5 |
| 1600 | 0.458 | 129 | 1.515 | 46 | 0.415 | 60 | 0.221 | -162 | 0.99 | 5.6 |
| 1800 | 0.465 | 122 | 1.397 | 41 | 0.456 | 57 | 0.238 | -163 | 0.98 | 4.9 |
| 2000 | 0.470 | 115 | 1.316 | 37 | 0.489 | 54 | 0.255 | -163 | 0.98 | 4.3 |
| 2200 | 0.483 | 108 | 1.249 | 33 | 0.523 | 50 | 0.284 | -164 | 0.97 | 3.8 |
| 2400 | 0.499 | 100 | 1.184 | 29 | 0.548 | 47 | 0.307 | -166 | 0.97 | 3.3 |
| 2500 | 0.503 | 97 | 1.166 | 27 | 0.562 | 45 | 0.325 | -167 | 0.97 | 3.2 |
| **$V_{CE}$ = 8 V, $I_C$ = 50 mA** | | | | | | | | | | |
| 50 | 0.447 | -110 | 33.339 | 121 | 0.024 | 60 | 0.534 | -64 | 0.52 | 31.4 |
| 100 | 0.426 | -143 | 18.770 | 104 | 0.039 | 69 | 0.317 | -86 | 0.77 | 26.9 |
| 200 | 0.415 | -166 | 9.754 | 93 | 0.060 | 72 | 0.189 | -106 | 0.95 | 22.1 |
| 400 | 0.417 | 177 | 5.004 | 82 | 0.113 | 74 | 0.141 | -124 | 1.01 | 15.8 |
| 600 | 0.417 | 167 | 3.423 | 74 | 0.167 | 74 | 0.138 | -132 | 1.02 | 12.3 |
| 800 | 0.420 | 158 | 2.649 | 68 | 0.216 | 73 | 0.145 | -138 | 1.02 | 10.0 |
| 1000 | 0.421 | 150 | 2.203 | 62 | 0.266 | 71 | 0.152 | -140 | 1.01 | 8.5 |
| 1200 | 0.430 | 144 | 1.900 | 56 | 0.316 | 68 | 0.166 | -142 | 1.00 | 7.8 |
| 1400 | 0.435 | 136 | 1.700 | 51 | 0.360 | 64 | 0.184 | -145 | 0.99 | 6.7 |
| 1600 | 0.438 | 131 | 1.547 | 47 | 0.400 | 62 | 0.202 | -147 | 0.99 | 5.9 |
| 1800 | 0.444 | 123 | 1.447 | 42 | 0.443 | 59 | 0.226 | -149 | 0.98 | 5.1 |
| 2000 | 0.453 | 116 | 1.354 | 37 | 0.480 | 56 | 0.241 | -151 | 0.97 | 4.5 |
| 2200 | 0.466 | 109 | 1.274 | 33 | 0.513 | 53 | 0.270 | -154 | 0.96 | 4.0 |
| 2400 | 0.479 | 102 | 1.226 | 29 | 0.539 | 49 | 0.304 | -156 | 0.96 | 3.6 |
| 2500 | 0.494 | 98 | 1.192 | 28 | 0.549 | 48 | 0.319 | -156 | 0.95 | 3.4 |

See notes on previous page.

3

## TYPICAL COMMON EMITTER SCATTERING PARAMETERS ($T_A$ = 25°C)

### NE46134

**$V_{CE}$ = 8 V, $I_C$ = 100 mA**

| FREQUENCY | $S_{11}$ | | $S_{21}$ | | $S_{12}$ | | $S_{22}$ | | K | $MAG^2$ |
|---|---|---|---|---|---|---|---|---|---|---|
| (MHz) | MAG | ANG | MAG | ANG | MAG | ANG | MAG | ANG | | (dB) |
| 50 | .467 | -110.1 | 33.112 | 120.2 | .025 | 56.9 | .518 | -70.1 | 0.52 | 31.2 |
| 100 | .437 | -143.8 | 18.512 | 103.6 | .037 | 62.7 | .310 | -94.2 | 0.78 | 27.0 |
| 200 | .427 | -166.4 | 9.583 | 92.1 | .063 | 69.8 | .198 | -118.6 | 0.95 | 21.8 |
| 400 | .427 | 176.0 | 4.926 | 81.3 | .117 | 73.5 | .163 | -139.0 | 1.01 | 15.6 |
| 600 | .430 | 165.3 | 3.353 | 73.5 | .169 | 72.8 | .161 | -147.1 | 1.03 | 12.0 |
| 800 | .432 | 156.6 | 2.599 | 66.7 | .222 | 70.7 | .167 | -151.2 | 1.02 | 9.8 |
| 1000 | .434 | 148.6 | 2.168 | 60.4 | .272 | 68.5 | .177 | -153.7 | 1.02 | 8.3 |
| 1200 | .439 | 141.5 | 1.873 | 55.0 | .318 | 65.5 | .190 | -156.0 | 1.01 | 7.1 |
| 1400 | .446 | 134.3 | 1.688 | 49.5 | .362 | 62.7 | .207 | -157.6 | 1.00 | 6.7 |
| 1600 | .456 | 127.3 | 1.538 | 45.4 | .403 | 59.6 | .221 | -158.8 | 0.99 | 5.8 |
| 1800 | .464 | 119.9 | 1.419 | 40.3 | .441 | 56.5 | .239 | -160.3 | 0.99 | 5.1 |
| 2000 | .473 | 112.7 | 1.338 | 36.3 | .475 | 53.0 | .263 | -162.3 | 0.98 | 4.5 |
| 2200 | .485 | 105.7 | 1.267 | 31.6 | .505 | 49.6 | .289 | -163.5 | 0.97 | 4.0 |
| 2400 | .505 | 98.7 | 1.196 | 27.4 | .531 | 46.1 | .321 | -165.6 | 0.97 | 3.5 |
| 2500 | .515 | 95.8 | 1.167 | 25.6 | .539 | 44.5 | .337 | -166.2 | 0.97 | 3.4 |

**$V_{CE}$ = 10 V, $I_C$ = 50 mA**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 50 | 0.453 | -107 | 33.713 | 121 | 0.029 | 69 | 0.531 | -64 | 0.54 | 30.7 |
| 100 | 0.420 | -142 | 18.960 | 104 | 0.034 | 63 | 0.317 | -84 | 0.79 | 27.5 |
| 200 | 0.410 | -165 | 9.847 | 93 | 0.061 | 74 | 0.187 | -105 | 0.95 | 22.0 |
| 400 | 0.410 | 177 | 5.053 | 82 | 0.112 | 73 | 0.139 | -123 | 1.01 | 15.8 |
| 600 | 0.412 | 167 | 3.452 | 74 | 0.168 | 73 | 0.133 | -130 | 1.01 | 12.4 |
| 800 | 0.414 | 158 | 2.676 | 68 | 0.213 | 72 | 0.139 | -136 | 1.02 | 10.0 |
| 1000 | 0.418 | 151 | 2.219 | 62 | 0.262 | 70 | 0.151 | -140 | 1.02 | 8.5 |
| 1200 | 0.420 | 143 | 1.920 | 56 | 0.314 | 68 | 0.161 | -141 | 1.00 | 7.6 |
| 1400 | 0.425 | 137 | 1.722 | 51 | 0.357 | 65 | 0.180 | -144 | 0.99 | 6.8 |
| 1600 | 0.432 | 131 | 1.570 | 46 | 0.401 | 62 | 0.196 | -146 | 0.98 | 5.9 |
| 1800 | 0.443 | 124 | 1.465 | 42 | 0.443 | 59 | 0.216 | -149 | 0.97 | 5.2 |
| 2000 | 0.448 | 117 | 1.372 | 38 | 0.477 | 56 | 0.241 | -151 | 0.97 | 4.6 |
| 2200 | 0.459 | 110 | 1.306 | 33 | 0.509 | 53 | 0.270 | -153 | 0.96 | 4.1 |
| 2400 | 0.481 | 103 | 1.227 | 28 | 0.536 | 49 | 0.299 | -154 | 0.95 | 3.6 |
| 2500 | 0.489 | 99 | 1.205 | 28 | 0.549 | 48 | 0.321 | -156 | 0.95 | 3.4 |

**$V_{CE}$ = 10 V, $I_C$ = 100 mA**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 50 | 0.440 | -117 | 34.984 | 117 | 0.025 | 64 | 0.463 | -71 | 0.60 | 31.5 |
| 100 | 0.418 | -149 | 19.063 | 102 | 0.034 | 67 | 0.271 | -93 | 0.84 | 27.5 |
| 200 | 0.413 | -169 | 9.811 | 91 | 0.061 | 73 | 0.166 | -115 | 0.97 | 22.1 |
| 400 | 0.415 | 176 | 5.003 | 81 | 0.115 | 76 | 0.132 | -133 | 1.02 | 15.6 |
| 600 | 0.414 | 166 | 3.420 | 74 | 0.170 | 75 | 0.136 | -140 | 1.02 | 12.1 |
| 800 | 0.415 | 158 | 2.656 | 67 | 0.222 | 73 | 0.143 | -144 | 1.02 | 10.0 |
| 1000 | 0.418 | 150 | 2.200 | 61 | 0.267 | 70 | 0.151 | -146 | 1.02 | 8.3 |
| 1200 | 0.425 | 143 | 1.899 | 56 | 0.317 | 67 | 0.162 | -148 | 1.01 | 7.3 |
| 1400 | 0.430 | 136 | 1.710 | 50 | 0.361 | 64 | 0.179 | -149 | 0.99 | 6.8 |
| 1600 | 0.440 | 130 | 1.554 | 45 | 0.403 | 61 | 0.196 | -151 | 0.99 | 5.9 |
| 1800 | 0.443 | 123 | 1.445 | 41 | 0.442 | 59 | 0.210 | -153 | 0.98 | 5.1 |
| 2000 | 0.452 | 116 | 1.360 | 37 | 0.479 | 55 | 0.238 | -154 | 0.97 | 4.5 |
| 2200 | 0.457 | 109 | 1.275 | 34 | 0.511 | 52 | 0.260 | -156 | 0.97 | 4.0 |
| 2400 | 0.478 | 102 | 1.234 | 30 | 0.536 | 48 | 0.292 | -158 | 0.96 | 3.6 |
| 2500 | 0.487 | 98 | 1.200 | 28 | 0.548 | 47 | 0.312 | -159 | 0.96 | 3.4 |

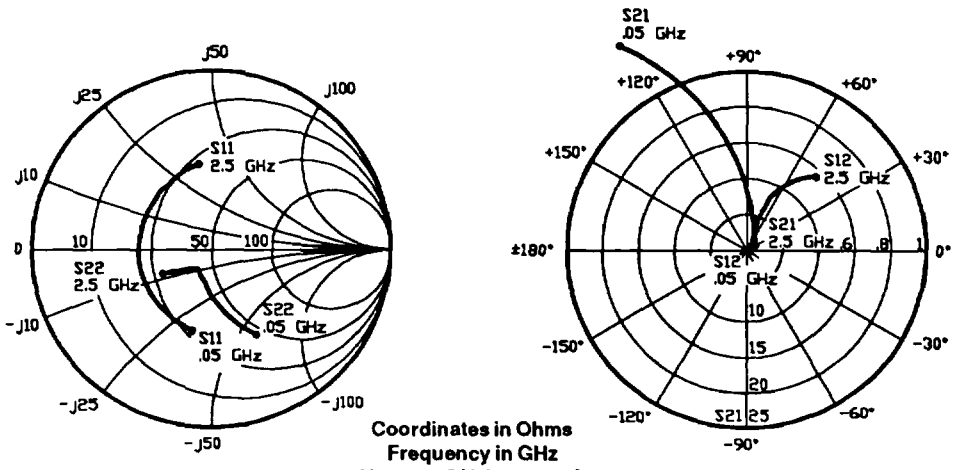
Notes:

1. The NE41634 was measured with the package mounted on a 0.030" thick RT Duroid 5880 substrate.
   To avoid exceeding Tj MAX when using poor thermal conducting substrates, use of a heat sink is recommended. For example:
   The Thermalloy 7100D series heat sink or thermal equivalent may be suitable. The above S parameters were measured without heat sink.
2. Gain Calculations:

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

## TYPICAL COMMON EMITTER SCATTERING PARAMETERS ($T_A$ = 25°C)




Coordinates in Ohms
Frequency in GHz
$V_{CE}$ = 12.5 V, $I_C$ = 50 mA

### NE46134

#### $V_{CE}$ = 12.5 V, $I_C$ = 50 mA

| FREQUENCY | $S_{11}$ | | $S_{21}$ | | $S_{12}$ | | $S_{22}$ | | K | $MAG^2$ |
|---|---|---|---|---|---|---|---|---|---|---|
| (MHz) | MAG | ANG | MAG | ANG | MAG | ANG | MAG | ANG | | (dB) |
| 50 | 0.464 | -104 | 33.701 | 122 | 0.027 | 60 | 0.533 | -63 | 0.52 | 31.0 |
| 100 | 0.419 | -140 | 19.054 | 105 | 0.040 | 64 | 0.319 | -82 | 0.75 | 26.8 |
| 200 | 0.409 | -164 | 9.913 | 93 | 0.062 | 71 | 0.185 | -102 | 0.93 | 22.0 |
| 400 | 0.407 | 177 | 5.085 | 82 | 0.115 | 73 | 0.139 | -121 | 1.00 | 16.4 |
| 600 | 0.405 | 167 | 3.483 | 74 | 0.165 | 74 | 0.131 | -128 | 1.02 | 12.4 |
| 800 | 0.409 | 159 | 2.688 | 68 | 0.215 | 72 | 0.137 | -132 | 1.02 | 10.2 |
| 1000 | 0.411 | 152 | 2.234 | 62 | 0.266 | 69 | 0.148 | -135 | 1.01 | 8.8 |
| 1200 | 0.414 | 144 | 1.941 | 56 | 0.316 | 68 | 0.161 | -140 | 1.00 | 7.9 |
| 1400 | 0.420 | 137 | 1.727 | 51 | 0.356 | 65 | 0.181 | -141 | 0.99 | 6.9 |
| 1600 | 0.432 | 131 | 1.579 | 46 | 0.400 | 62 | 0.194 | -144 | 0.98 | 6.0 |
| 1800 | 0.434 | 124 | 1.463 | 42 | 0.437 | 59 | 0.213 | -146 | 0.98 | 5.2 |
| 2000 | 0.448 | 117 | 1.387 | 38 | 0.476 | 56 | 0.239 | -150 | 0.96 | 4.6 |
| 2200 | 0.458 | 109 | 1.291 | 33 | 0.509 | 53 | 0.266 | -151 | 0.96 | 4.0 |
| 2400 | 0.476 | 102 | 1.222 | 29 | 0.538 | 50 | 0.293 | -154 | 0.96 | 3.6 |
| 2500 | 0.483 | 99 | 1.208 | 28 | 0.553 | 48 | 0.307 | -154 | 0.95 | 3.4 |

#### $V_{CE}$= 12.5 V, $I_C$ = 100 mA

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 50 | 0.451 | -114 | 34,804 | 117 | 0.025 | 55 | 0.461 | -69 | 0.59 | 31.4 |
| 100 | 0.421 | -146 | 19,038 | 102 | 0.034 | 62 | 0.270 | -89 | 0.82 | 27.5 |
| 200 | 0.408 | -167 | 9,781 | 91 | 0.064 | 72 | 0.163 | -110 | 0.95 | 21.9 |
| 400 | 0.412 | 176 | 5,009 | 81 | 0.115 | 76 | 0.129 | -131 | 1.02 | 15.6 |
| 600 | 0.411 | 166 | 3,424 | 74 | 0.167 | 75 | 0.125 | -136 | 1.03 | 12.1 |
| 800 | 0.413 | 158 | 2,647 | 67 | 0.216 | 72 | 0.133 | -140 | 1.03 | 9.9 |
| 1000 | 0.417 | 150 | 2,199 | 61 | 0.268 | 70 | 0.111 | -142 | 1.01 | 8.4 |
| 1200 | 0.420 | 143 | 1,905 | 56 | 0.311 | 68 | 0.151 | -146 | 1.01 | 7.2 |
| 1400 | 0.430 | 137 | 1,702 | 50 | 0.360 | 64 | 0.167 | -147 | 0.99 | 6.7 |
| 1600 | 0.431 | 130 | 1,565 | 46 | 0.401 | 62 | 0.190 | -149 | 0.99 | 5.9 |
| 1800 | 0.437 | 123 | 1,465 | 41 | 0.438 | 59 | 0.208 | -150 | 0.98 | 5.2 |
| 2000 | 0.448 | 116 | 1,357 | 37 | 0.476 | 56 | 0.230 | -153 | 0.97 | 4.6 |
| 2200 | 0.460 | 109 | 1,288 | 33 | 0.510 | 52 | 0.263 | -153 | 0.96 | 4.0 |
| 2400 | 0.479 | 102 | 1,228 | 28 | 0.536 | 49 | 0.287 | -156 | 0.96 | 3.6 |
| 2500 | 0.488 | 99 | 1,199 | 27 | 0.548 | 48 | 0.305 | -157 | 0.96 | 3.4 |

Notes:

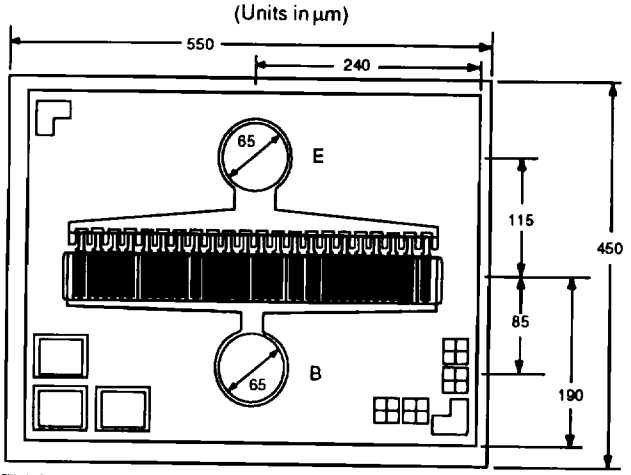
1. The NE41634 was measured with the package mounted on a 0.030" thick RT Duroid 5880 substrate.
   To avoid exceeding Tj MAX when using poor thermal conducting substrates, use of a heat sink is recommended. For example:
   The Thermalloy 7100D series heat sink or thermal equivalent may be suitable. The above S parameters were measured without heat sink.
2. Gain Calculations:

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

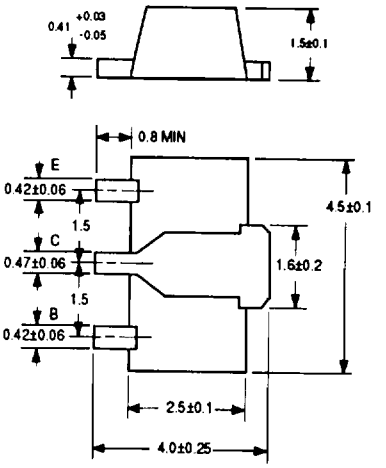
## OUTLINE DIMENSIONS (Units in mm)

**46100 (CHIP)**
(Units in μm)




Thickness: 160 μm

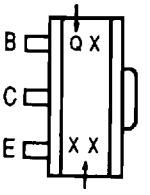
**PACKAGE OUTLINE 34**
(SOT-89)




**BOTTOM VIEW**

**TOP VIEW**

Part Number Identifier




Lot Number Identifier