



# NEC's NPN SILICON EPITAXIAL TRANSISTOR 3 PINS ULTRA SUPER MINI MOLD

## NE58219

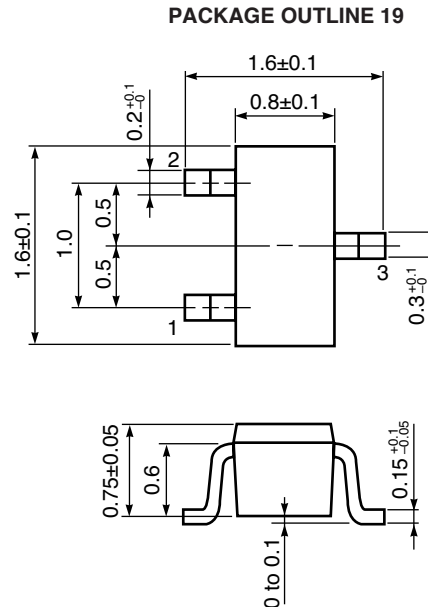
### FEATURES

- **HIGH  $f_T$ :** 5 GHz TYP at  $V_{CE} = 5$  V,  $I_C = 5$  mA,  $f = 1$  GHz
- **LOW  $C_{re}$ :** 0.9 pF TYP at  $V_{CB} = 5$  V,  $I_E = 0$ ,  $f = 1$  MHz
- **ULTRA SUPER MINI MOLD PACKAGE:** 1.6 x 0.8 mm

### DESCRIPTION

NEC's NE58219 is a low supply voltage transistor designed for UHF Mixer and oscillator applications. The 3 pin ultra super mini mold package makes this device ideally suited for high density surface mount assembly.

### OUTLINE DIMENSIONS (Units in mm)



PIN CONNECTIONS  
1. Emitter  
2. Base  
3. Collector

### ELECTRICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ )

| PART NUMBER<br>EIAJ <sup>1</sup> REGISTERED NUMBER<br>PACKAGE OUTLINE |                                                                              | NE58219<br>2SC5004<br>19 |     |     |     |
|-----------------------------------------------------------------------|------------------------------------------------------------------------------|--------------------------|-----|-----|-----|
| SYMBOLS                                                               | PARAMETERS AND CONDITIONS                                                    | UNITS                    | MIN | TYP | MAX |
| $I_{CBO}$                                                             | Collector Cutoff Current at $V_{CB} = 15$ V, $I_E = 0$                       | $\mu\text{A}$            |     |     | 0.1 |
| $I_{EBO}$                                                             | Emitter Cutoff Current at $V_{EB} = 1$ V, $I_C = 0$                          | $\mu\text{A}$            |     |     | 0.1 |
| $V_{CE(sat)}$                                                         | Collector Saturation Voltage at $h_{FE} = 10$ , $I_C = 5$ mA                 | V                        |     |     | 0.5 |
| $h_{FE}$                                                              | DC Current Gain at $V_{CE} = 5$ V, $I_C = 5$ mA <sup>2</sup>                 |                          | 60  |     | 120 |
| $f_T$                                                                 | Gain Bandwidth at $V_{CE} = 5$ V, $I_C = 5$ mA                               | GHz                      | 3.0 | 5.0 |     |
| $C_{RE}$                                                              | Feedback Capacitance at $V_{CB} = 5$ V, $I_E = 0$ , $f = 1$ MHz <sup>3</sup> | pF                       |     | 0.9 | 1.2 |
| $IS_{21EI}^2$                                                         | Insertion Power Gain at $V_{CE} = 5$ V, $I_C = 5$ mA, $f = 1$ GHz            | dB                       | 5.0 |     |     |

Notes:

1. Electronic Industrial Association of Japan
2. Pulsed measurement, pulse width  $\leq 350$   $\mu\text{s}$ , Duty Cycle  $\leq 2$  %.
3. The emitter terminal and the case shall be connected to the guard terminal of the three-terminal capacitance bridge.

**ABSOLUTE MAXIMUM RATINGS<sup>1</sup>** ( $T_A = 25^\circ\text{C}$ )

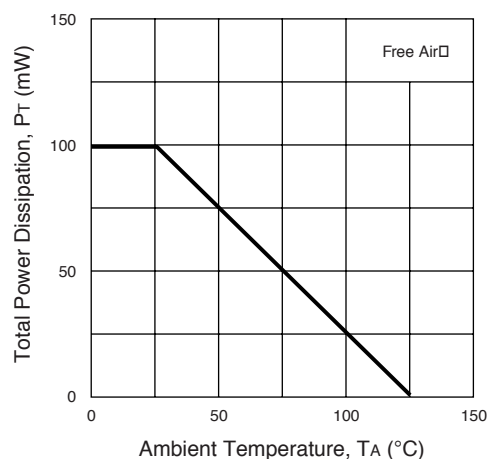
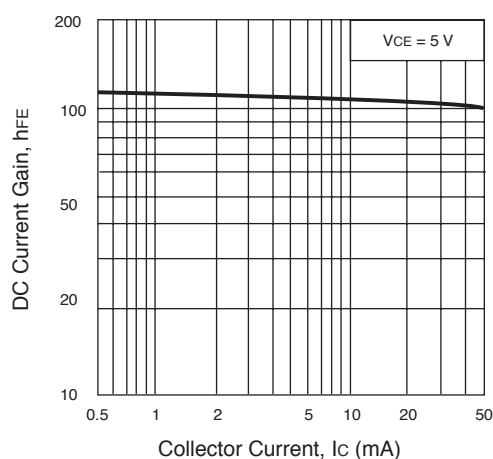
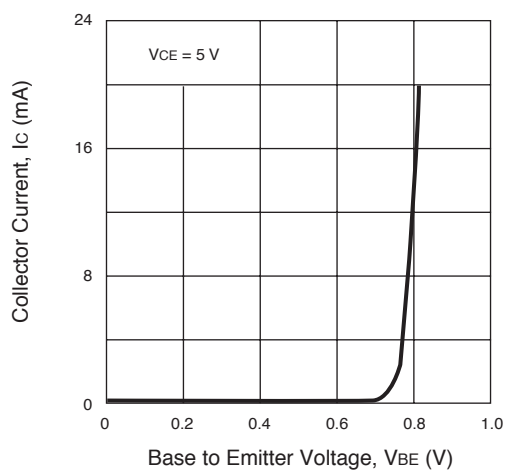
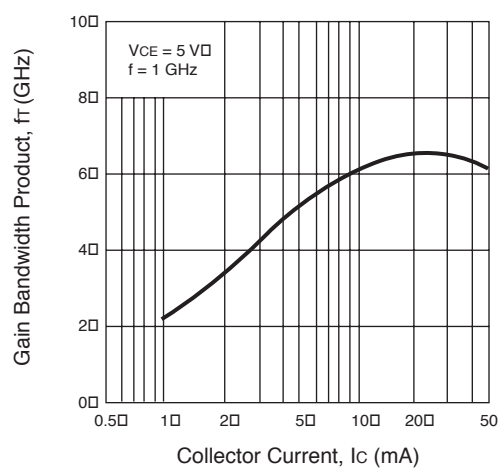
| SYMBOLS   | PARAMETERS                   | UNITS            | RATINGS     |
|-----------|------------------------------|------------------|-------------|
| $V_{CBO}$ | Collector to Base Voltage    | V                | 20          |
| $V_{CEO}$ | Collector to Emitter Voltage | V                | 12          |
| $V_{EBO}$ | Emitter to Base Voltage      | V                | 3           |
| $I_C$     | Collector Current            | mA               | 60          |
| $P_T$     | Total Power Dissipation      | mW               | 100         |
| $T_J$     | Junction Temperature         | $^\circ\text{C}$ | 125         |
| $T_{STG}$ | Storage Temperature          | $^\circ\text{C}$ | -55 to +125 |

Notes:

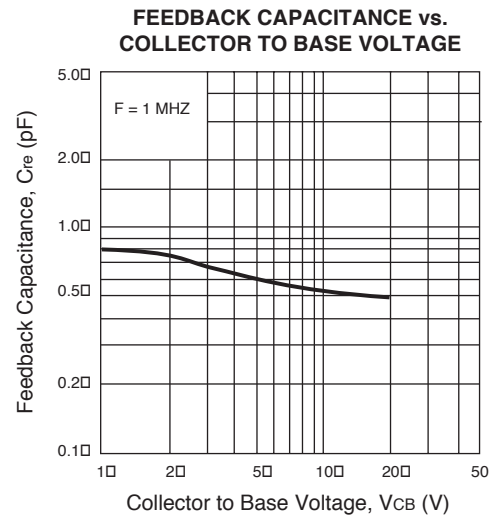
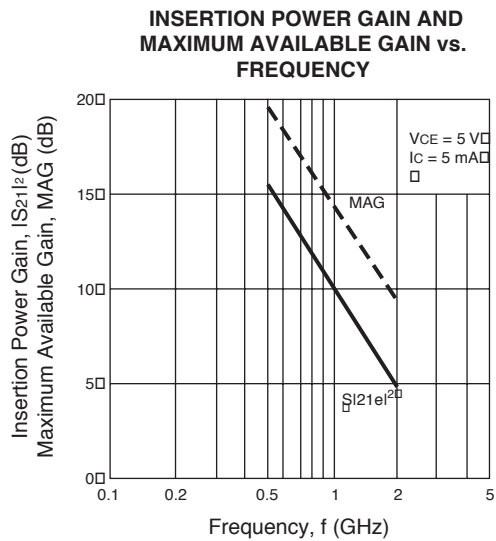
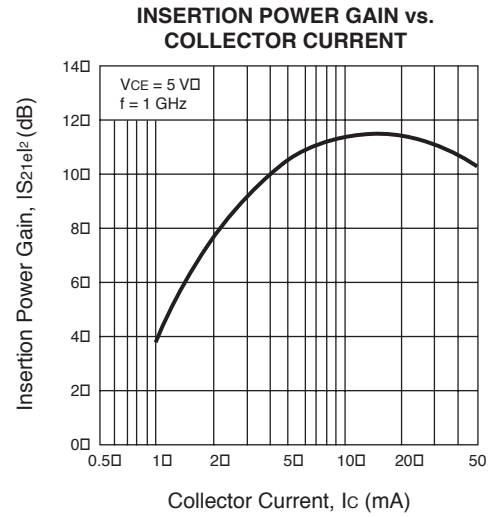
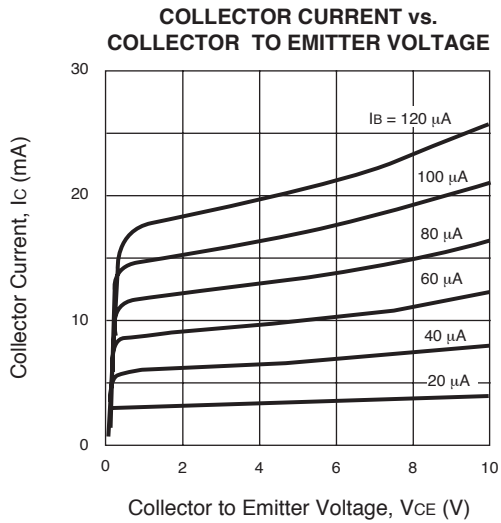
1. Operation in excess of any one of these parameters may result in permanent damage.

**ORDERING INFORMATION**

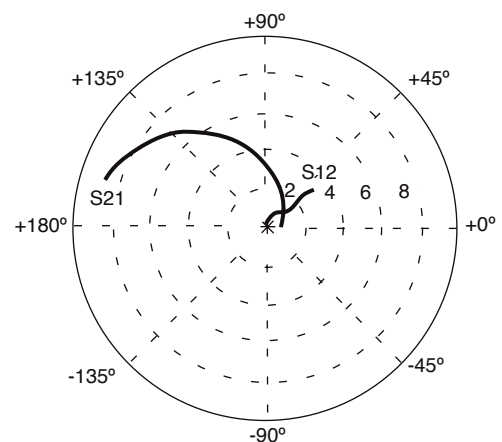
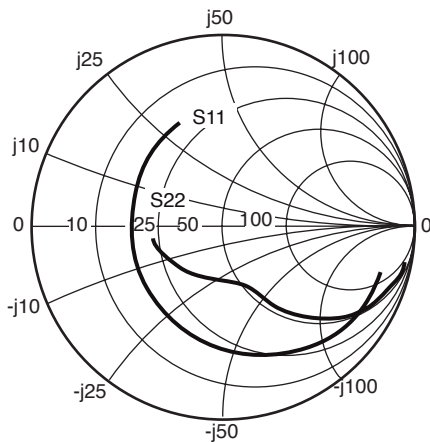
| PART NUMBER  | QUANTITY       | PACKAGING                                                                      |
|--------------|----------------|--------------------------------------------------------------------------------|
| NE58219-T1-A | 3000 pcs./reel | Embossed tape 8mm wide.<br>Pin 3 (collector) face to perforation side of tape. |

**TYPICAL PERFORMANCE CURVES** ( $T_A = 25^\circ\text{C}$ )**TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE****DC CURRENT GAIN vs. COLLECTOR CURRENT****COLLECTOR CURRENT vs. BASE TO EMITTER VOLTAGE****GAIN BANDWIDTH PRODUCT vs. COLLECTOR CURRENT**

# TYPICAL PERFORMANCE CURVES (TA = 25°C)



# SCATTERING PARAMETERS (T<sub>A</sub> = 25°C)

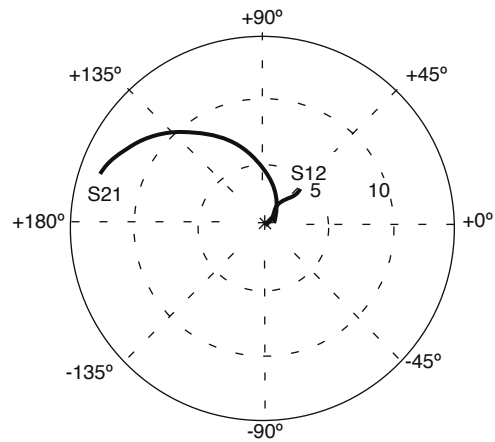
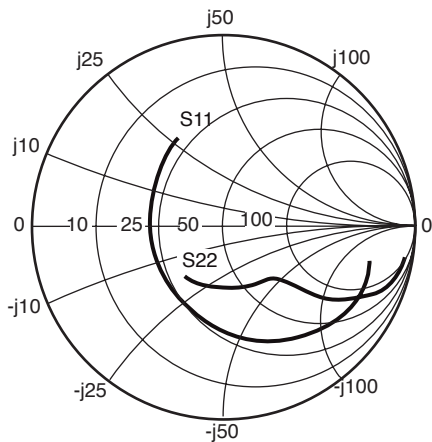


## NE58219

V<sub>c</sub> = 1 V, I<sub>c</sub> = 3 mA

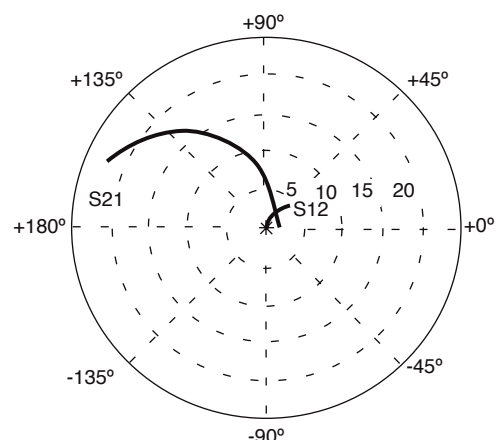
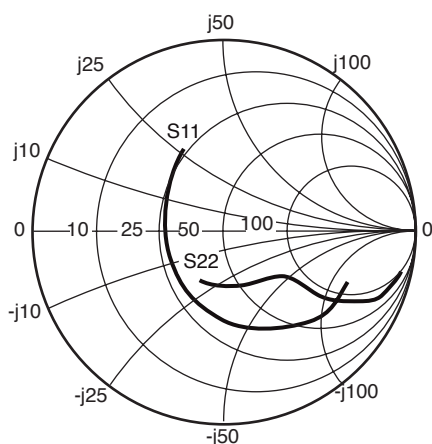
| FREQUENCY<br>(GHz) | S <sub>11</sub> |         | S <sub>21</sub> |        | S <sub>22</sub> |         | S <sub>12</sub> |       | K<br>(unitless) | MAG<br>(dB) |
|--------------------|-----------------|---------|-----------------|--------|-----------------|---------|-----------------|-------|-----------------|-------------|
|                    | MAG             | ANG     | MAG             | ANG    | MAG             | ANG     | MAG             | ANG   |                 |             |
| 0.050              | 0.84            | -16.28  | 8.69            | 162.16 | 0.95            | -11.12  | 0.03            | 71.19 | 0.31            | 25.05       |
| 0.100              | 0.84            | -33.14  | 8.22            | 155.75 | 0.93            | -20.33  | 0.05            | 70.75 | 0.12            | 22.03       |
| 0.200              | 0.74            | -61.59  | 7.05            | 136.55 | 0.79            | -34.69  | 0.09            | 57.41 | 0.24            | 19.10       |
| 0.300              | 0.65            | -84.29  | 5.92            | 122.15 | 0.66            | -44.45  | 0.11            | 48.65 | 0.36            | 17.38       |
| 0.400              | 0.59            | -102.61 | 5.00            | 111.38 | 0.57            | -51.15  | 0.12            | 43.53 | 0.45            | 16.14       |
| 0.500              | 0.55            | -117.08 | 4.28            | 102.97 | 0.50            | -55.78  | 0.13            | 40.52 | 0.55            | 15.15       |
| 0.600              | 0.53            | -129.02 | 3.72            | 96.03  | 0.44            | -59.22  | 0.14            | 38.95 | 0.64            | 14.29       |
| 0.700              | 0.51            | -138.97 | 3.29            | 90.09  | 0.40            | -62.35  | 0.14            | 38.03 | 0.72            | 13.57       |
| 0.800              | 0.49            | -147.58 | 2.94            | 84.92  | 0.37            | -64.76  | 0.15            | 37.73 | 0.79            | 12.91       |
| 0.900              | 0.49            | -155.03 | 2.66            | 80.24  | 0.35            | -67.47  | 0.16            | 37.81 | 0.85            | 12.33       |
| 1.000              | 0.48            | -161.81 | 2.44            | 75.92  | 0.33            | -70.19  | 0.16            | 37.99 | 0.91            | 11.78       |
| 1.100              | 0.48            | -167.71 | 2.25            | 71.90  | 0.32            | -72.91  | 0.17            | 38.27 | 0.96            | 11.28       |
| 1.200              | 0.48            | -173.05 | 2.09            | 68.18  | 0.31            | -75.58  | 0.17            | 38.83 | 1.00            | 10.69       |
| 1.300              | 0.48            | -177.95 | 1.95            | 64.62  | 0.30            | -78.51  | 0.18            | 39.27 | 1.04            | 9.20        |
| 1.400              | 0.48            | 177.41  | 1.83            | 61.29  | 0.29            | -81.48  | 0.19            | 39.74 | 1.07            | 8.34        |
| 1.500              | 0.48            | 173.15  | 1.73            | 58.09  | 0.28            | -84.48  | 0.19            | 40.16 | 1.10            | 7.66        |
| 1.600              | 0.48            | 168.99  | 1.64            | 55.02  | 0.28            | -87.73  | 0.20            | 40.55 | 1.12            | 7.10        |
| 1.700              | 0.49            | 165.21  | 1.56            | 52.11  | 0.28            | -91.11  | 0.21            | 40.82 | 1.13            | 6.60        |
| 1.800              | 0.49            | 161.56  | 1.49            | 49.31  | 0.27            | -94.65  | 0.21            | 41.19 | 1.14            | 6.16        |
| 1.900              | 0.49            | 158.14  | 1.43            | 46.56  | 0.27            | -98.18  | 0.22            | 41.44 | 1.15            | 5.77        |
| 2.000              | 0.50            | 154.96  | 1.37            | 43.96  | 0.27            | -101.84 | 0.23            | 41.49 | 1.16            | 5.41        |
| 2.100              | 0.50            | 152.01  | 1.32            | 41.45  | 0.27            | -105.68 | 0.24            | 41.65 | 1.16            | 5.10        |
| 2.200              | 0.51            | 149.18  | 1.27            | 38.97  | 0.28            | -109.36 | 0.24            | 41.72 | 1.15            | 4.81        |
| 2.300              | 0.51            | 146.47  | 1.23            | 36.71  | 0.28            | -113.26 | 0.25            | 41.69 | 1.15            | 4.56        |
| 2.400              | 0.52            | 143.90  | 1.19            | 34.45  | 0.28            | -117.01 | 0.26            | 41.63 | 1.15            | 4.30        |
| 2.500              | 0.52            | 141.49  | 1.16            | 32.27  | 0.29            | -120.76 | 0.27            | 41.48 | 1.14            | 4.06        |
| 2.600              | 0.53            | 139.05  | 1.12            | 30.21  | 0.29            | -124.41 | 0.28            | 41.14 | 1.14            | 3.83        |
| 2.700              | 0.53            | 136.85  | 1.09            | 28.21  | 0.29            | -128.09 | 0.29            | 40.97 | 1.13            | 3.64        |
| 2.800              | 0.54            | 134.56  | 1.06            | 26.30  | 0.30            | -131.59 | 0.29            | 40.70 | 1.12            | 3.47        |
| 2.900              | 0.54            | 132.43  | 1.03            | 24.45  | 0.31            | -135.17 | 0.30            | 40.33 | 1.11            | 3.28        |
| 3.000              | 0.55            | 130.33  | 1.01            | 22.68  | 0.31            | -138.54 | 0.31            | 39.92 | 1.11            | 3.11        |
| 3.100              | 0.55            | 128.52  | 0.98            | 20.96  | 0.32            | -141.89 | 0.32            | 39.46 | 1.10            | 2.98        |
| 3.200              | 0.56            | 126.66  | 0.96            | 19.34  | 0.32            | -145.28 | 0.33            | 38.97 | 1.09            | 2.84        |
| 3.300              | 0.56            | 124.92  | 0.94            | 17.77  | 0.33            | -148.51 | 0.34            | 38.44 | 1.08            | 2.72        |
| 3.400              | 0.57            | 123.18  | 0.92            | 16.22  | 0.34            | -151.84 | 0.35            | 37.80 | 1.07            | 2.59        |
| 3.500              | 0.57            | 121.66  | 0.90            | 14.75  | 0.34            | -154.93 | 0.36            | 37.19 | 1.06            | 2.52        |
| 3.600              | 0.58            | 120.12  | 0.88            | 13.34  | 0.35            | -158.22 | 0.37            | 36.50 | 1.05            | 2.39        |
| 3.700              | 0.58            | 118.56  | 0.87            | 12.03  | 0.36            | -161.09 | 0.38            | 35.74 | 1.05            | 2.30        |
| 3.800              | 0.58            | 117.13  | 0.85            | 10.73  | 0.36            | -164.14 | 0.39            | 35.00 | 1.04            | 2.19        |
| 3.900              | 0.59            | 115.69  | 0.84            | 9.51   | 0.37            | -166.91 | 0.40            | 34.23 | 1.03            | 2.11        |
| 4.000              | 0.59            | 114.19  | 0.83            | 8.33   | 0.38            | -169.73 | 0.41            | 33.42 | 1.03            | 2.03        |

SCATTERING PARAMETERS (TA = 25°C)



NE58219  
Vc = 5 V, Ic = 5 mA

| FREQUENCY<br>(GHz) | S11  |         | S21   |        | S22  |         | S12  |       | K<br>(unitless) | MAG<br>(dB) |
|--------------------|------|---------|-------|--------|------|---------|------|-------|-----------------|-------------|
|                    | MAG  | ANG     | MAG   | ANG    | MAG  | ANG     | MAG  | ANG   |                 |             |
| 0.050              | 0.78 | -15.97  | 13.43 | 162.03 | 0.95 | -9.31   | 0.01 | 80.11 | 0.23            | 29.98       |
| 0.100              | 0.78 | -32.63  | 12.68 | 155.23 | 0.93 | -16.92  | 0.03 | 71.25 | 0.18            | 26.35       |
| 0.200              | 0.67 | -60.08  | 10.68 | 136.09 | 0.79 | -27.63  | 0.05 | 61.51 | 0.32            | 23.37       |
| 0.300              | 0.57 | -81.72  | 8.83  | 122.20 | 0.68 | -33.64  | 0.06 | 55.73 | 0.45            | 21.52       |
| 0.400              | 0.51 | -99.23  | 7.37  | 112.16 | 0.59 | -36.97  | 0.07 | 52.31 | 0.57            | 20.14       |
| 0.500              | 0.46 | -113.17 | 6.27  | 104.46 | 0.53 | -38.75  | 0.08 | 51.51 | 0.67            | 19.02       |
| 0.600              | 0.43 | -125.01 | 5.42  | 98.23  | 0.49 | -39.79  | 0.09 | 51.49 | 0.75            | 18.03       |
| 0.700              | 0.41 | -134.99 | 4.76  | 92.93  | 0.46 | -40.85  | 0.09 | 51.76 | 0.83            | 17.15       |
| 0.800              | 0.39 | -143.77 | 4.24  | 88.36  | 0.44 | -41.52  | 0.10 | 52.53 | 0.89            | 16.35       |
| 0.900              | 0.38 | -151.46 | 3.83  | 84.26  | 0.42 | -42.56  | 0.11 | 53.26 | 0.93            | 15.61       |
| 1.000              | 0.38 | -158.46 | 3.49  | 80.48  | 0.40 | -43.81  | 0.11 | 53.98 | 0.97            | 14.94       |
| 1.100              | 0.38 | -164.56 | 3.21  | 76.95  | 0.39 | -45.13  | 0.12 | 54.45 | 1.00            | 13.91       |
| 1.200              | 0.37 | -170.14 | 2.97  | 73.66  | 0.38 | -46.52  | 0.13 | 55.14 | 1.03            | 12.72       |
| 1.300              | 0.37 | -175.24 | 2.77  | 70.53  | 0.37 | -48.11  | 0.13 | 55.52 | 1.05            | 11.85       |
| 1.400              | 0.37 | -180.00 | 2.60  | 67.57  | 0.37 | -49.82  | 0.14 | 55.92 | 1.06            | 11.14       |
| 1.500              | 0.38 | 175.58  | 2.44  | 64.71  | 0.36 | -51.66  | 0.15 | 56.20 | 1.07            | 10.50       |
| 1.600              | 0.38 | 171.25  | 2.31  | 61.94  | 0.35 | -53.64  | 0.16 | 56.38 | 1.08            | 9.95        |
| 1.700              | 0.38 | 167.32  | 2.19  | 59.30  | 0.35 | -55.69  | 0.17 | 56.44 | 1.08            | 9.46        |
| 1.800              | 0.39 | 163.57  | 2.09  | 56.73  | 0.34 | -58.05  | 0.17 | 56.48 | 1.09            | 9.03        |
| 1.900              | 0.39 | 160.04  | 2.00  | 54.20  | 0.34 | -60.48  | 0.18 | 56.51 | 1.09            | 8.62        |
| 2.000              | 0.40 | 156.80  | 1.91  | 51.76  | 0.33 | -63.18  | 0.19 | 56.29 | 1.08            | 8.27        |
| 2.100              | 0.40 | 153.84  | 1.84  | 49.40  | 0.33 | -65.85  | 0.20 | 56.10 | 1.08            | 7.96        |
| 2.200              | 0.41 | 151.04  | 1.77  | 47.03  | 0.33 | -68.79  | 0.21 | 55.83 | 1.08            | 7.64        |
| 2.300              | 0.42 | 148.44  | 1.71  | 44.86  | 0.32 | -71.69  | 0.22 | 55.65 | 1.07            | 7.41        |
| 2.400              | 0.42 | 145.82  | 1.65  | 42.67  | 0.32 | -74.76  | 0.22 | 55.31 | 1.06            | 7.15        |
| 2.500              | 0.43 | 143.48  | 1.59  | 40.50  | 0.32 | -77.76  | 0.23 | 54.82 | 1.05            | 6.96        |
| 2.600              | 0.43 | 141.09  | 1.54  | 38.43  | 0.32 | -80.98  | 0.24 | 54.43 | 1.05            | 6.74        |
| 2.700              | 0.44 | 138.92  | 1.50  | 36.38  | 0.32 | -84.11  | 0.25 | 54.02 | 1.04            | 6.56        |
| 2.800              | 0.45 | 136.72  | 1.46  | 34.42  | 0.32 | -87.35  | 0.26 | 53.50 | 1.03            | 6.42        |
| 2.900              | 0.45 | 134.69  | 1.42  | 32.47  | 0.31 | -90.64  | 0.27 | 52.95 | 1.02            | 6.31        |
| 3.000              | 0.46 | 132.66  | 1.38  | 30.58  | 0.31 | -93.92  | 0.28 | 52.41 | 1.01            | 6.24        |
| 3.100              | 0.47 | 130.89  | 1.35  | 28.73  | 0.31 | -97.19  | 0.29 | 51.85 | 1.00            | 6.35        |
| 3.200              | 0.47 | 129.12  | 1.31  | 26.92  | 0.32 | -100.72 | 0.30 | 51.17 | 0.99            | 6.45        |
| 3.300              | 0.48 | 127.48  | 1.28  | 25.16  | 0.32 | -103.97 | 0.31 | 50.59 | 0.98            | 6.21        |
| 3.400              | 0.48 | 125.87  | 1.25  | 23.43  | 0.32 | -107.52 | 0.32 | 49.80 | 0.98            | 5.98        |
| 3.500              | 0.49 | 124.41  | 1.23  | 21.73  | 0.32 | -110.78 | 0.33 | 49.17 | 0.96            | 5.75        |
| 3.600              | 0.50 | 122.98  | 1.20  | 20.08  | 0.32 | -114.26 | 0.34 | 48.41 | 0.96            | 5.53        |
| 3.700              | 0.50 | 121.52  | 1.18  | 18.49  | 0.32 | -117.44 | 0.35 | 47.56 | 0.95            | 5.31        |
| 3.800              | 0.51 | 120.14  | 1.15  | 16.93  | 0.33 | -120.69 | 0.36 | 46.79 | 0.94            | 5.11        |
| 3.900              | 0.51 | 118.81  | 1.13  | 15.44  | 0.33 | -123.76 | 0.37 | 46.00 | 0.93            | 4.90        |
| 4.000              | 0.52 | 117.39  | 1.11  | 13.94  | 0.33 | -126.88 | 0.38 | 45.16 | 0.93            | 4.70        |

SCATTERING PARAMETERS (T<sub>A</sub> = 25°C)

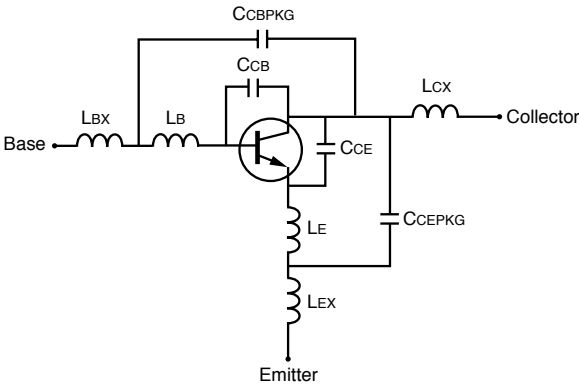
NE58219

V<sub>c</sub> = 8 V, I<sub>c</sub> = 10 mA

| FREQUENCY<br>(GHz) | S <sub>11</sub> |         | S <sub>21</sub> |        | S <sub>22</sub> |         | S <sub>12</sub> |       | K<br>(unitless) | MAG<br>(dB) |
|--------------------|-----------------|---------|-----------------|--------|-----------------|---------|-----------------|-------|-----------------|-------------|
|                    | MAG             | ANG     | MAG             | ANG    | MAG             | ANG     | MAG             | ANG   |                 |             |
| 0.050              | 0.67            | -21.79  | 22.12           | 157.69 | 0.91            | -12.56  | 0.01            | 73.96 | 0.35            | 32.88       |
| 0.100              | 0.66            | -44.79  | 20.12           | 147.32 | 0.87            | -21.76  | 0.02            | 70.10 | 0.26            | 29.06       |
| 0.200              | 0.51            | -77.37  | 15.18           | 126.02 | 0.69            | -31.47  | 0.04            | 60.88 | 0.47            | 26.10       |
| 0.300              | 0.42            | -100.22 | 11.62           | 113.06 | 0.56            | -34.70  | 0.05            | 58.80 | 0.65            | 24.07       |
| 0.400              | 0.38            | -117.42 | 9.27            | 104.45 | 0.50            | -35.60  | 0.05            | 59.12 | 0.76            | 22.36       |
| 0.500              | 0.35            | -130.39 | 7.68            | 98.13  | 0.45            | -35.57  | 0.06            | 60.14 | 0.85            | 20.95       |
| 0.600              | 0.33            | -141.10 | 6.54            | 93.02  | 0.42            | -35.42  | 0.07            | 61.41 | 0.91            | 19.73       |
| 0.700              | 0.32            | -149.97 | 5.69            | 88.66  | 0.40            | -35.64  | 0.08            | 62.39 | 0.95            | 18.64       |
| 0.800              | 0.32            | -157.65 | 5.03            | 84.86  | 0.38            | -35.80  | 0.09            | 63.19 | 0.99            | 17.68       |
| 0.900              | 0.31            | -164.24 | 4.52            | 81.42  | 0.37            | -36.49  | 0.09            | 63.82 | 1.01            | 16.11       |
| 1.000              | 0.31            | -170.13 | 4.10            | 78.23  | 0.36            | -37.57  | 0.10            | 64.03 | 1.03            | 15.00       |
| 1.100              | 0.31            | -175.32 | 3.76            | 75.21  | 0.35            | -38.79  | 0.11            | 64.23 | 1.04            | 14.04       |
| 1.200              | 0.32            | -179.93 | 3.47            | 72.37  | 0.35            | -40.04  | 0.12            | 64.39 | 1.05            | 13.28       |
| 1.300              | 0.32            | -175.70 | 3.23            | 69.64  | 0.34            | -41.54  | 0.13            | 64.33 | 1.05            | 12.60       |
| 1.400              | 0.32            | -171.61 | 3.02            | 67.04  | 0.34            | -43.13  | 0.14            | 64.13 | 1.06            | 11.95       |
| 1.500              | 0.33            | -167.86 | 2.84            | 64.50  | 0.33            | -44.89  | 0.15            | 63.73 | 1.06            | 11.37       |
| 1.600              | 0.33            | -164.10 | 2.68            | 62.04  | 0.32            | -46.84  | 0.16            | 63.50 | 1.06            | 10.86       |
| 1.700              | 0.34            | -160.72 | 2.54            | 59.66  | 0.32            | -48.78  | 0.16            | 63.15 | 1.06            | 10.41       |
| 1.800              | 0.34            | -157.44 | 2.42            | 57.31  | 0.31            | -51.02  | 0.17            | 62.67 | 1.06            | 10.00       |
| 1.900              | 0.35            | -154.45 | 2.31            | 55.02  | 0.31            | -53.26  | 0.18            | 62.20 | 1.05            | 9.61        |
| 2.000              | 0.35            | -151.60 | 2.21            | 52.78  | 0.31            | -55.77  | 0.19            | 61.72 | 1.05            | 9.27        |
| 2.100              | 0.36            | -149.09 | 2.12            | 50.62  | 0.30            | -58.30  | 0.20            | 61.09 | 1.04            | 8.96        |
| 2.200              | 0.37            | -146.67 | 2.03            | 48.40  | 0.30            | -61.15  | 0.21            | 60.51 | 1.04            | 8.67        |
| 2.300              | 0.37            | -144.44 | 1.96            | 46.40  | 0.30            | -63.92  | 0.22            | 59.93 | 1.03            | 8.45        |
| 2.400              | 0.38            | -142.19 | 1.90            | 44.33  | 0.29            | -66.93  | 0.23            | 59.21 | 1.03            | 8.23        |
| 2.500              | 0.39            | -140.17 | 1.83            | 42.27  | 0.29            | -69.77  | 0.24            | 58.48 | 1.02            | 8.03        |
| 2.600              | 0.39            | -138.05 | 1.78            | 40.31  | 0.29            | -72.71  | 0.24            | 57.78 | 1.02            | 7.83        |
| 2.700              | 0.40            | -136.26 | 1.72            | 38.37  | 0.28            | -75.76  | 0.25            | 57.18 | 1.01            | 7.77        |
| 2.800              | 0.41            | -134.26 | 1.67            | 36.47  | 0.28            | -78.87  | 0.26            | 56.42 | 1.00            | 7.79        |
| 2.900              | 0.41            | -132.45 | 1.63            | 34.60  | 0.28            | -82.00  | 0.27            | 55.66 | 1.00            | 7.78        |
| 3.000              | 0.42            | -130.63 | 1.59            | 32.76  | 0.28            | -85.10  | 0.28            | 54.91 | 0.99            | 7.52        |
| 3.100              | 0.43            | -129.18 | 1.55            | 30.95  | 0.28            | -88.23  | 0.29            | 54.16 | 0.98            | 7.27        |
| 3.200              | 0.43            | -127.63 | 1.51            | 29.18  | 0.28            | -91.56  | 0.30            | 53.38 | 0.97            | 7.03        |
| 3.300              | 0.44            | -126.18 | 1.47            | 27.44  | 0.28            | -94.82  | 0.31            | 52.59 | 0.96            | 6.80        |
| 3.400              | 0.45            | -124.79 | 1.44            | 25.71  | 0.28            | -98.34  | 0.32            | 51.79 | 0.96            | 6.57        |
| 3.500              | 0.45            | -123.57 | 1.41            | 24.03  | 0.28            | -101.39 | 0.33            | 50.96 | 0.95            | 6.34        |
| 3.600              | 0.46            | -122.30 | 1.38            | 22.35  | 0.28            | -104.84 | 0.34            | 50.13 | 0.94            | 6.14        |
| 3.700              | 0.47            | -121.00 | 1.35            | 20.74  | 0.28            | -107.86 | 0.35            | 49.29 | 0.93            | 5.93        |
| 3.800              | 0.47            | -119.87 | 1.33            | 19.15  | 0.28            | -111.10 | 0.35            | 48.43 | 0.93            | 5.73        |
| 3.900              | 0.48            | -118.69 | 1.30            | 17.61  | 0.28            | -113.87 | 0.36            | 47.61 | 0.92            | 5.54        |
| 4.000              | 0.48            | -117.43 | 1.28            | 16.07  | 0.29            | -117.00 | 0.37            | 46.74 | 0.91            | 5.35        |

NONLINEAR MODEL

SCHEMATIC



BJT NONLINEAR MODEL PARAMETERS (1)

| Parameters | Q1       | Parameters | Q1     |
|------------|----------|------------|--------|
| IS         | 2.3e-16  | MJC        | 0.28   |
| BF         | 100.3    | XCJC       | 0.2    |
| NF         | 0.9917   | CJS        | 0      |
| VAF        | 31.6     | VJS        | 0.75   |
| IKF        | 2.2      | MJS        | 0      |
| ISE        | 3.5e-11  | FC         | 0.7    |
| NE         | 30       | TF         | 12e-12 |
| BR         | 13.5     | XTF        | 4      |
| NR         | 0.9899   | VTF        | 4      |
| VAR        | 3.9      | ITF        | 0.01   |
| IKR        | 0.05     | PTF        | 50     |
| ISC        | 15.4e-12 | TR         | 1.0e-9 |
| NC         | 30       | EG         | 1.11   |
| RE         | 1.4      | XTB        | 0      |
| RB         | 14       | XTI        | 3      |
| RBM        | 9        | KF         | 0      |
| IRB        | 0.003    | AF         | 1      |
| RC         | 1.6      |            |        |
| CJE        | 1.3e-12  |            |        |
| VJE        | 0.87     |            |        |
| MJE        | 0.36     |            |        |
| CJC        | 0.6e-12  |            |        |
| VJC        | 0.59     |            |        |

(1) Gummel-Poon Model

ADDITIONAL PARAMETERS

| Parameters | NE58219  |
|------------|----------|
| CCB        | 0.03e-12 |
| CCE        | 0.2e-12  |
| LB         | 0.75e-9  |
| LE         | 0.65e-9  |
| CCBPKG     | 0.17e-12 |
| CCEPKG     | 0.15e-12 |
| LBX        | 0.19e-9  |
| LCX        | 0.7e-9   |
| LEX        | 0.19e-9  |

MODEL RANGE

Frequency: 0.05 to 4 GHz  
Bias:  $V_{CE} = 1\text{ V to }8\text{ V}$ ,  $I_c = 3\text{ mA to }10\text{ mA}$   
Date: 2/2002

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.

**CEL** California Eastern Laboratories, Your source for NEC RF, Microwave, Optoelectronic, and Fiber Optic Semiconductor Devices.  
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DATA SUBJECT TO CHANGE WITHOUT NOTICE

03/03/03

Subject: Compliance with EU Directives

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

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

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

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

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

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

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

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