

# NSF2250WT1

## NPN Silicon Oscillator and Mixer Transistor

The NSF2250WT1 NPN silicon epitaxial bipolar transistor is intended for use in general purpose UHF oscillator and mixer applications. It is suitable for automotive keyless entry and TV tuner designs.

The device features stable oscillation and small frequency drift during changes in the supply voltage and over the ambient temperature range.

### Features

- High Gain Bandwidth Product:  $f_T = 2000$  MHz Minimum
- Tightly Controlled  $h_{FE}$  Range:  $h_{FE} = 120$  to 250
- Low Feedback Capacitance:  $C_{RE} = 0.45$  pF Typical
- Pb-Free Package is Available

### MAXIMUM RATINGS

| Rating                       | Symbol    | Value                          | Units |
|------------------------------|-----------|--------------------------------|-------|
| Collector to Base Voltage    | $V_{CBO}$ | 30                             | V     |
| Collector to Emitter Voltage | $V_{CEO}$ | 15                             | V     |
| Emitter to Base Voltage      | $V_{EBO}$ | 3.0                            | V     |
| Collector Current            | $I_C$     | 50                             | mA    |
| Electrostatic Discharge      | ESD       | HBM – Class 1C<br>MM – Class A |       |

### THERMAL CHARACTERISTICS

| Characteristic                                                                          | Symbol          | Max                                                          | Unit                       |
|-----------------------------------------------------------------------------------------|-----------------|--------------------------------------------------------------|----------------------------|
| Total Device Dissipation<br>$T_A = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | $P_D$           | 202 (Note 1)<br>310 (Note 2)<br>1.6 (Note 1)<br>2.5 (Note 2) | mW<br>mW/ $^\circ\text{C}$ |
| Thermal Resistance, Junction-to-Ambient                                                 | $R_{\theta JA}$ | 618 (Note 1)<br>403 (Note 2)                                 | $^\circ\text{C/W}$         |
| Thermal Resistance, Junction-to-Lead                                                    | $R_{\theta JL}$ | 280 (Note 1)<br>332 (Note 2)                                 | $^\circ\text{C/W}$         |
| Junction and Storage Temperature Range                                                  | $T_J, T_{stg}$  | -55 to +150                                                  | $^\circ\text{C}$           |

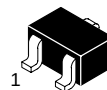
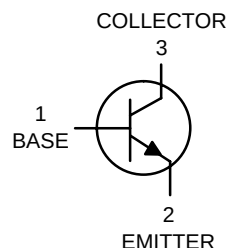
Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

1. FR-4 @ Minimum Pad
2. FR-4 @ 1.0 x 1.0 inch Pad



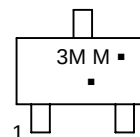
ON Semiconductor®

<http://onsemi.com>



SOT-323/SC-70  
CASE 419  
STYLE 3

### MARKING DIAGRAM



3M = Specific Device Code  
M = Date Code\*  
■ = Pb-Free Package

(Note: Microdot may be in either location)

\*Date Code orientation may vary depending upon manufacturing location.

### ORDERING INFORMATION

| Device      | Package              | Shipping†        |
|-------------|----------------------|------------------|
| NSF2250WT1  | SOT-323              | 3000/Tape & Reel |
| NSF2250WT1G | SOT-323<br>(Pb-Free) | 3000/Tape & Reel |

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

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

| Characteristic                                                                                      | Symbol              | Min | Typ  | Max | Unit          |
|-----------------------------------------------------------------------------------------------------|---------------------|-----|------|-----|---------------|
| Collector Cutoff Current<br>$V_{CB} = 12\text{ V}, I_E = 0$                                         | $I_{CBO}$           | –   | –    | 0.1 | $\mu\text{A}$ |
| DC Current Gain<br>$V_{CE} = 10\text{ V}, I_C = 5.0\text{ mA}$                                      | $h_{FE}$            | 120 | –    | 250 | –             |
| Collector Saturation Voltage<br>$I_C = 10\text{ mA}, I_B = 1.0\text{ mA}$                           | $V_{CE(sat)}$       | –   | –    | 0.5 | V             |
| Gain Bandwidth Product<br>$V_{CE} = 3\text{ V}, I_E = -5.0\text{ mA}$                               | $f_T$               | 2.0 | 2.3  | –   | GHz           |
| Output Capacitance<br>$V_{CB} = 3\text{ V}, I_E = 0\text{ mA}, f = 1.0\text{ MHz}$                  | $C_{OB}$            | –   | 0.7  | 1.2 | pF            |
| Collector to Base Time Constant<br>$V_{CE} = 3\text{ V}, I_E = -5.0\text{ mA}, f = 31.9\text{ MHz}$ | $C_C \cdot r_{b'b}$ | –   | 3.5  | 8.0 | ps            |
| Feedback Capacitance<br>$V_{CB} = 10\text{ V}, I_E = 0\text{ mA}, f = 1.0\text{ MHz}$               | $C_{RE}$            | –   | 0.45 | –   | pF            |

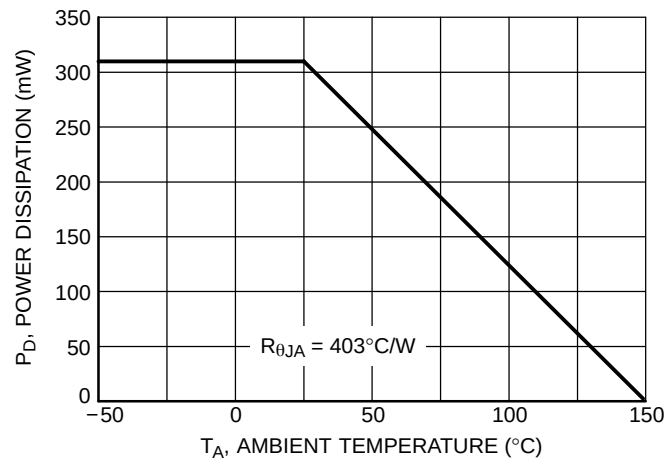


Figure 1. Derating Curve

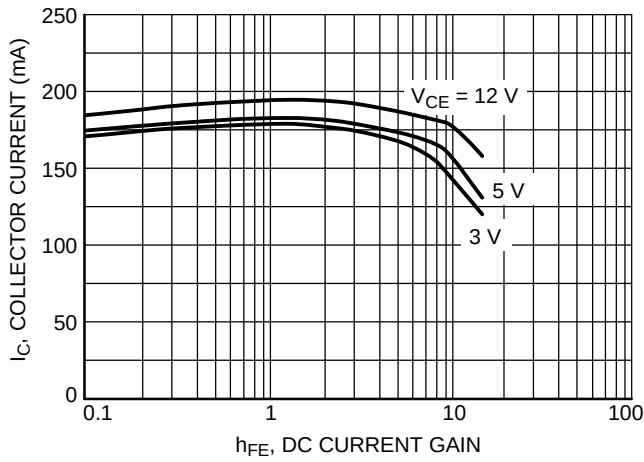


Figure 2. DC Current Gain versus Collector Current

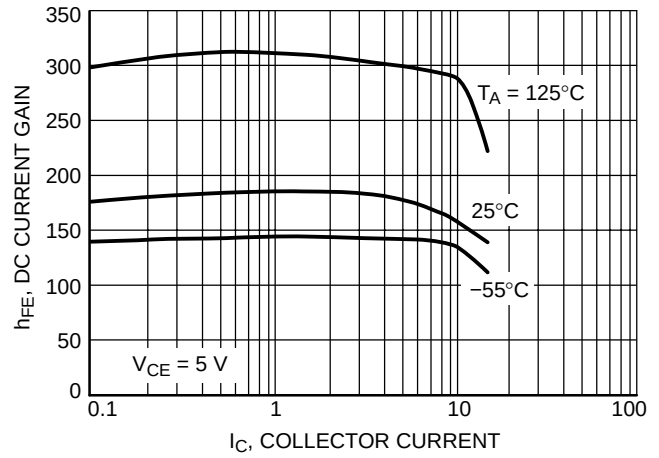


Figure 3. DC Current Gain versus Collector Current

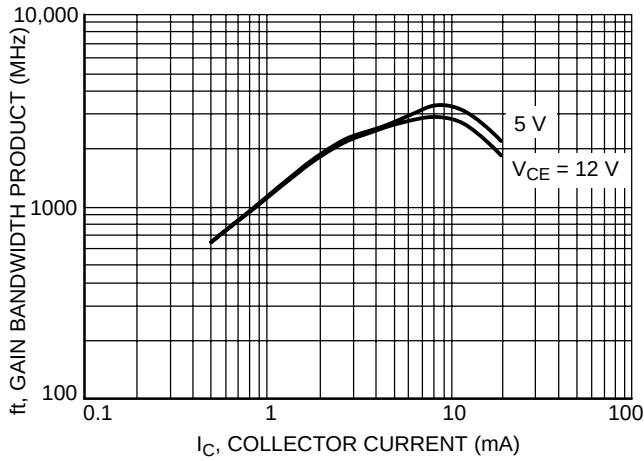


Figure 4. Gain Bandwidth Product versus Collector Current

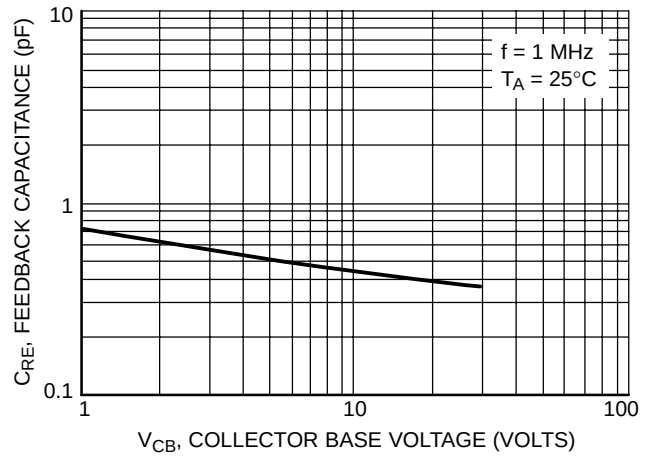


Figure 5. Device Capacitance versus Collector Base Voltage

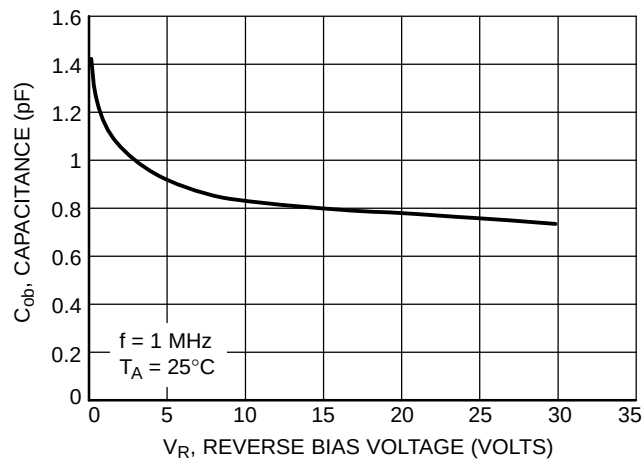


Figure 6. Output Capacitance

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## TYPICAL COMMON EMITTER SCATTERING PARAMETER ( $T_A = 25^\circ\text{C}$ )

| Freq | S11 |     | S21 |     | S12 |     | S22 |     |
|------|-----|-----|-----|-----|-----|-----|-----|-----|
| MHz  | Mag | Ang | Mag | Ang | Mag | Ang | Mag | Ang |

$V_{CE} = 2.5 \text{ V}$ ,  $I_C = 2.5 \text{ mA}$

|      |       |          |       |         |       |        |       |         |
|------|-------|----------|-------|---------|-------|--------|-------|---------|
| 50   | 0.926 | -14.124  | 6.803 | 162.639 | 0.018 | 82.792 | 0.973 | -7.062  |
| 100  | 0.855 | -26.794  | 6.224 | 148.649 | 0.034 | 73.296 | 0.921 | -12.818 |
| 200  | 0.667 | -47.287  | 5.033 | 126.317 | 0.058 | 62.292 | 0.807 | -19.210 |
| 300  | 0.513 | -60.931  | 4.072 | 110.981 | 0.074 | 58.641 | 0.736 | -21.979 |
| 400  | 0.411 | -70.342  | 3.326 | 100.524 | 0.090 | 57.333 | 0.694 | -23.695 |
| 500  | 0.342 | -77.461  | 2.831 | 92.771  | 0.104 | 56.067 | 0.670 | -25.311 |
| 600  | 0.297 | -84.335  | 2.445 | 86.222  | 0.117 | 55.166 | 0.651 | -27.095 |
| 700  | 0.261 | -90.986  | 2.154 | 80.493  | 0.131 | 53.800 | 0.637 | -29.095 |
| 800  | 0.236 | -97.798  | 1.935 | 75.382  | 0.144 | 52.087 | 0.627 | -31.026 |
| 900  | 0.218 | -104.905 | 1.755 | 70.672  | 0.155 | 50.745 | 0.617 | -33.167 |
| 1000 | 0.205 | -112.449 | 1.617 | 66.258  | 0.168 | 49.386 | 0.608 | -35.352 |
| 1500 | 0.190 | -147.224 | 1.200 | 48.079  | 0.219 | 42.418 | 0.575 | -46.016 |
| 2000 | 0.215 | -171.677 | 1.011 | 33.299  | 0.258 | 35.910 | 0.544 | -58.267 |
| 2500 | 0.230 | -172.291 | 0.889 | 20.271  | 0.294 | 31.024 | 0.510 | -68.713 |
| 3000 | 0.236 | -155.125 | 0.866 | 10.984  | 0.340 | 28.868 | 0.450 | -81.517 |

## TYPICAL COMMON EMITTER SCATTERING PARAMETER ( $T_A = 25^\circ\text{C}$ )

| Freq | S11 |     | S21 |     | S12 |     | S22 |     |
|------|-----|-----|-----|-----|-----|-----|-----|-----|
| MHz  | Mag | Ang | Mag | Ang | Mag | Ang | Mag | Ang |

$V_{CE} = 3 \text{ V}$ ,  $I_C = 5 \text{ mA}$

|      |       |          |        |         |       |        |       |         |
|------|-------|----------|--------|---------|-------|--------|-------|---------|
| 50   | 0.858 | -20.126  | 12.065 | 156.269 | 0.017 | 78.802 | 0.945 | -10.278 |
| 100  | 0.733 | -36.552  | 10.452 | 139.116 | 0.029 | 69.100 | 0.850 | -16.656 |
| 200  | 0.493 | -58.358  | 7.472  | 115.678 | 0.047 | 62.893 | 0.712 | -20.497 |
| 300  | 0.362 | -69.976  | 5.544  | 103.053 | 0.062 | 62.188 | 0.653 | -21.545 |
| 400  | 0.288 | -78.272  | 4.337  | 94.866  | 0.075 | 61.876 | 0.621 | -22.551 |
| 500  | 0.242 | -85.666  | 3.582  | 88.592  | 0.090 | 61.259 | 0.603 | -23.975 |
| 600  | 0.212 | -93.237  | 3.048  | 83.504  | 0.103 | 59.861 | 0.590 | -25.526 |
| 700  | 0.190 | -101.308 | 2.656  | 78.785  | 0.116 | 58.802 | 0.580 | -27.405 |
| 800  | 0.177 | -109.656 | 2.375  | 74.561  | 0.128 | 57.017 | 0.573 | -29.334 |
| 900  | 0.167 | -118.336 | 2.145  | 70.348  | 0.141 | 55.629 | 0.563 | -31.402 |
| 1000 | 0.163 | -127.188 | 1.968  | 66.700  | 0.153 | 53.851 | 0.555 | -33.301 |
| 1500 | 0.176 | -164.287 | 1.435  | 50.083  | 0.203 | 47.574 | 0.528 | -43.164 |
| 2000 | 0.210 | -174.155 | 1.187  | 35.998  | 0.246 | 41.767 | 0.501 | -54.213 |
| 2500 | 0.226 | -159.754 | 1.034  | 23.227  | 0.288 | 36.614 | 0.469 | -63.689 |
| 3000 | 0.239 | -144.224 | 0.995  | 14.088  | 0.340 | 34.458 | 0.413 | -74.387 |

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## TYPICAL COMMON EMITTER SCATTERING PARAMETER ( $T_A = 25^\circ\text{C}$ )

| Freq                                      | S11   |          | S21    |         | S12   |        | S22   |         |
|-------------------------------------------|-------|----------|--------|---------|-------|--------|-------|---------|
| MHz                                       | Mag   | Ang      | Mag    | Ang     | Mag   | Ang    | Mag   | Ang     |
| $V_{CE} = 3\text{ V}, I_C = 10\text{ mA}$ |       |          |        |         |       |        |       |         |
| 50                                        | 0.643 | -35.313  | 15.384 | 140.063 | 0.015 | 69.823 | 0.864 | -14.048 |
| 100                                       | 0.459 | -53.013  | 11.650 | 121.580 | 0.024 | 63.636 | 0.738 | -17.013 |
| 200                                       | 0.289 | -70.035  | 7.214  | 104.714 | 0.040 | 65.531 | 0.647 | -17.265 |
| 300                                       | 0.225 | -80.644  | 5.260  | 96.934  | 0.053 | 66.205 | 0.618 | -18.444 |
| 400                                       | 0.192 | -91.607  | 4.122  | 91.266  | 0.068 | 66.344 | 0.598 | -20.216 |
| 500                                       | 0.172 | -102.488 | 3.419  | 86.447  | 0.082 | 64.574 | 0.584 | -22.273 |
| 600                                       | 0.161 | -113.748 | 2.929  | 82.212  | 0.096 | 63.206 | 0.572 | -24.418 |
| 700                                       | 0.156 | -125.151 | 2.575  | 78.231  | 0.107 | 61.822 | 0.561 | -26.828 |
| 800                                       | 0.155 | -135.549 | 2.313  | 74.282  | 0.119 | 60.606 | 0.553 | -28.821 |
| 900                                       | 0.156 | -145.469 | 2.099  | 70.461  | 0.131 | 59.154 | 0.543 | -31.132 |
| 1000                                      | 0.163 | -153.718 | 1.925  | 67.004  | 0.141 | 57.409 | 0.536 | -33.247 |
| 1500                                      | 0.201 | -175.526 | 1.415  | 50.535  | 0.193 | 52.024 | 0.505 | -43.365 |
| 2000                                      | 0.237 | -159.398 | 1.173  | 36.726  | 0.240 | 46.396 | 0.477 | -54.652 |
| 2500                                      | 0.247 | -147.097 | 1.021  | 24.113  | 0.289 | 41.529 | 0.444 | -64.094 |
| 3000                                      | 0.259 | -133.925 | 0.982  | 15.023  | 0.346 | 38.491 | 0.382 | -75.243 |

## TYPICAL COMMON EMITTER SCATTERING PARAMETER ( $T_A = 25^\circ\text{C}$ )

| Freq                                      | S11   |          | S21    |         | S12   |        | S22   |         |
|-------------------------------------------|-------|----------|--------|---------|-------|--------|-------|---------|
| MHz                                       | Mag   | Ang      | Mag    | Ang     | Mag   | Ang    | Mag   | Ang     |
| $V_{CE} = 10\text{ V}, I_C = 5\text{ mA}$ |       |          |        |         |       |        |       |         |
| 50                                        | 0.877 | -17.278  | 11.972 | 157.707 | 0.012 | 81.580 | 0.972 | -7.268  |
| 100                                       | 0.765 | -31.274  | 10.386 | 140.944 | 0.022 | 72.099 | 0.900 | -12.126 |
| 200                                       | 0.539 | -49.213  | 7.575  | 118.277 | 0.037 | 66.849 | 0.803 | -14.944 |
| 300                                       | 0.406 | -57.758  | 5.678  | 105.478 | 0.049 | 66.104 | 0.757 | -16.182 |
| 400                                       | 0.334 | -63.347  | 4.464  | 97.467  | 0.062 | 65.473 | 0.729 | -17.508 |
| 500                                       | 0.286 | -68.461  | 3.698  | 91.347  | 0.073 | 64.460 | 0.717 | -19.007 |
| 600                                       | 0.252 | -73.828  | 3.159  | 86.264  | 0.085 | 63.014 | 0.706 | -20.874 |
| 700                                       | 0.227 | -79.612  | 2.766  | 81.745  | 0.095 | 62.100 | 0.697 | -22.551 |
| 800                                       | 0.208 | -86.135  | 2.474  | 77.803  | 0.106 | 60.785 | 0.690 | -24.442 |
| 900                                       | 0.190 | -93.121  | 2.237  | 73.571  | 0.116 | 59.532 | 0.682 | -26.405 |
| 1000                                      | 0.179 | -100.507 | 2.047  | 70.150  | 0.125 | 57.905 | 0.674 | -28.385 |
| 1500                                      | 0.162 | -139.494 | 1.495  | 53.949  | 0.169 | 52.604 | 0.652 | -37.411 |
| 2000                                      | 0.185 | -167.453 | 1.242  | 40.156  | 0.207 | 47.697 | 0.631 | -47.834 |
| 2500                                      | 0.200 | -175.534 | 1.082  | 27.306  | 0.247 | 44.045 | 0.609 | -55.962 |
| 3000                                      | 0.208 | -159.130 | 1.050  | 18.234  | 0.296 | 42.716 | 0.557 | -65.696 |

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$V_{CE} = 2.5 \text{ V}$ ,  $I_C = 2.5 \text{ mA}$

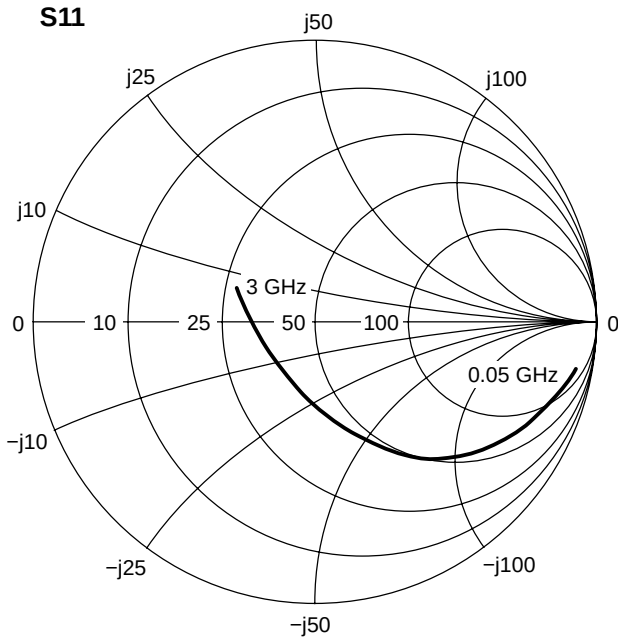


Figure 7. Input Reflection Coefficient

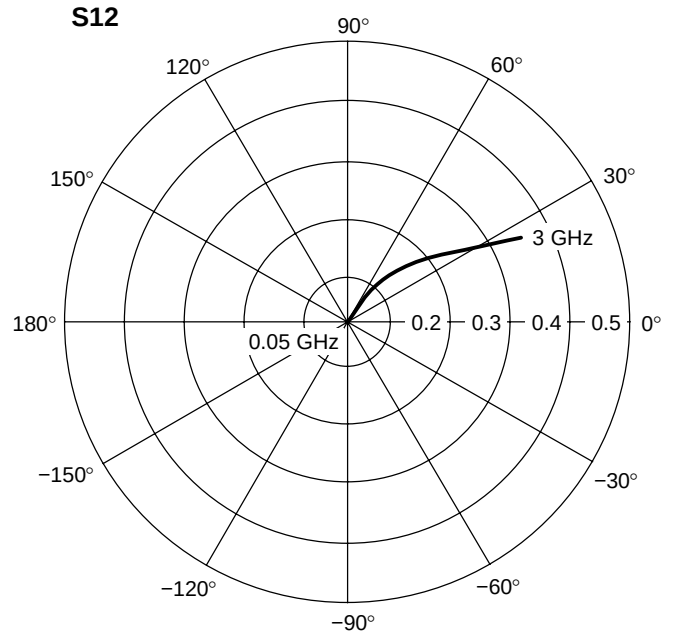


Figure 8. Reverse Transmission Coefficient

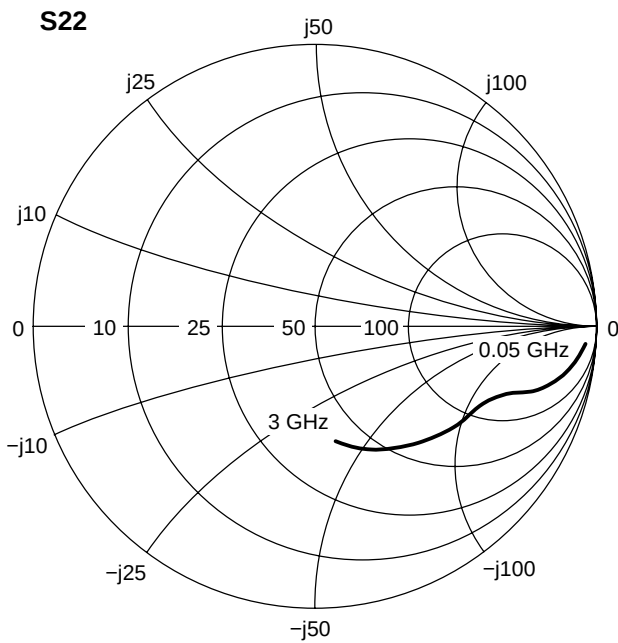


Figure 9. Output Reflection Coefficient

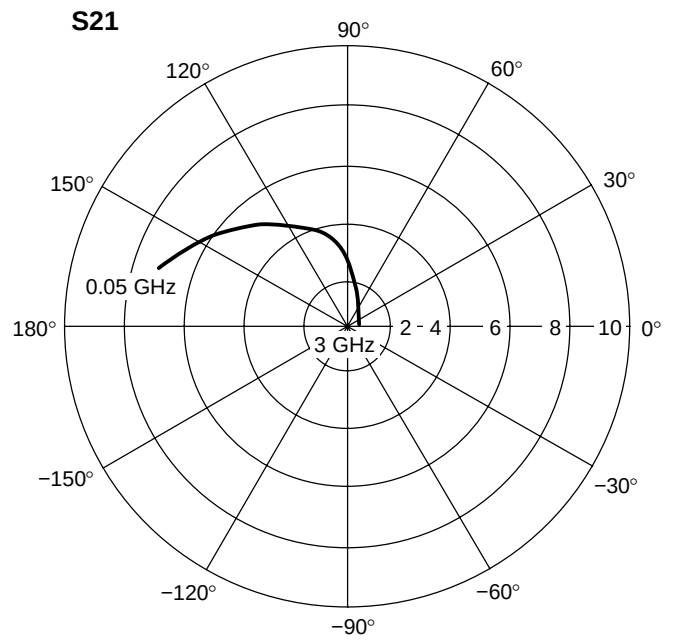


Figure 10. Forward Transmission Coefficient

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$V_{CE} = 3.0 \text{ V}$ ,  $I_C = 10 \text{ mA}$

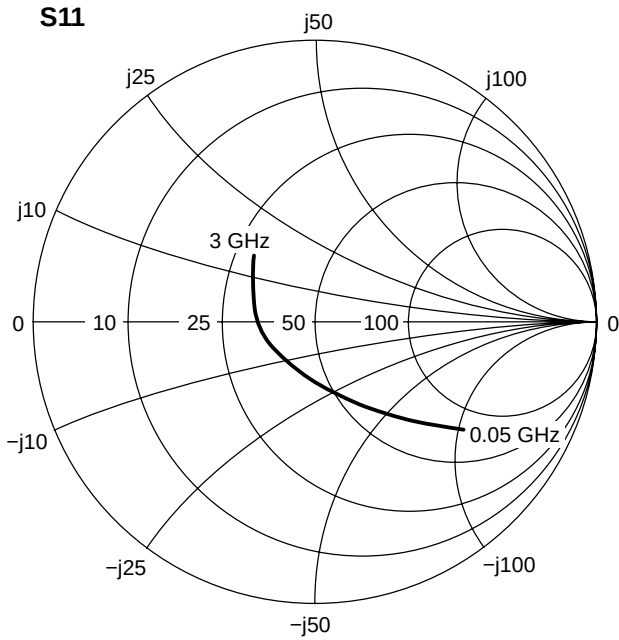


Figure 11. Input Reflection Coefficient

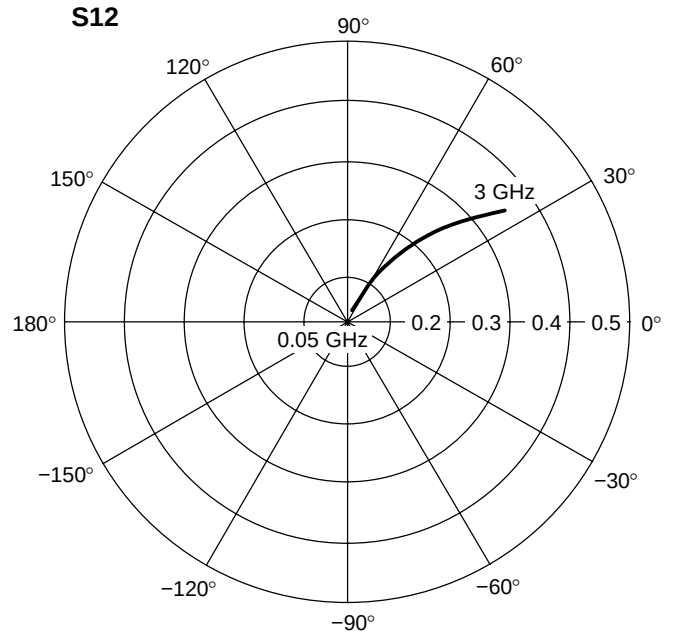


Figure 12. Reverse Transmission Coefficient

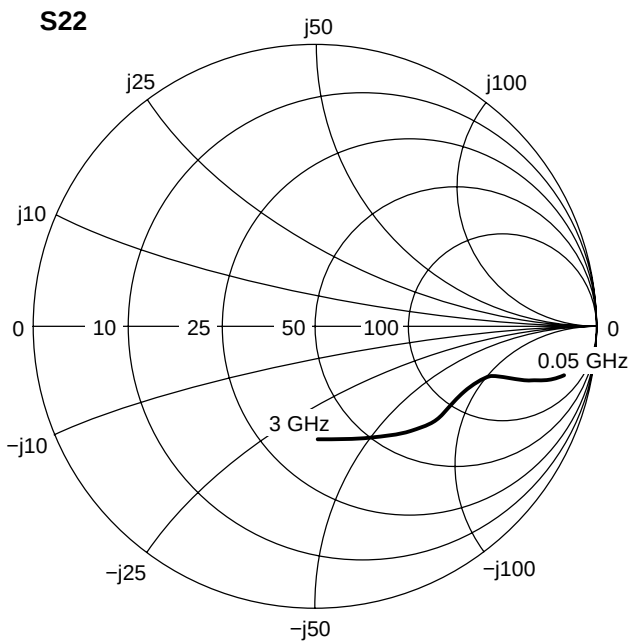


Figure 13. Output Reflection Coefficient

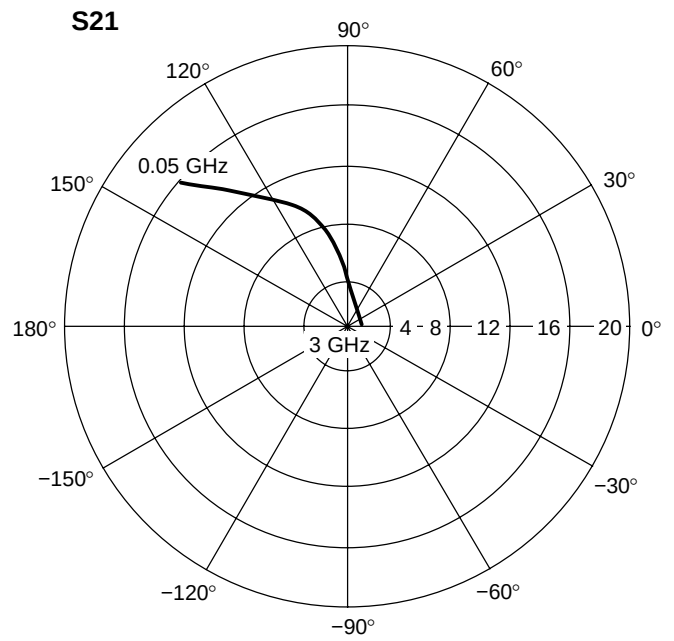


Figure 14. Forward Transmission Coefficient

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## TYPICAL COMMON BASE SCATTERING PARAMETER ( $T_A = 25^\circ\text{C}$ )

| Freq | S11 |     | S21 |     | S12 |     | S22 |     |
|------|-----|-----|-----|-----|-----|-----|-----|-----|
| MHz  | Mag | Ang | Mag | Ang | Mag | Ang | Mag | Ang |

$V_{CE} = 2.5\text{ V}$ ,  $I_C = 2.5\text{ mA}$

|      |       |         |        |         |       |        |       |         |
|------|-------|---------|--------|---------|-------|--------|-------|---------|
| 50   | 0.627 | 176.455 | 1.6218 | -3.3808 | 0.003 | 81.692 | 1.006 | -1.7455 |
| 100  | 0.626 | 172.821 | 1.6153 | -6.8404 | 0.008 | 87.954 | 1.002 | -3.5734 |
| 200  | 0.622 | 165.583 | 1.6042 | -13.205 | 0.014 | 92.620 | 1.005 | -6.7806 |
| 400  | 0.608 | 151.867 | 1.5630 | -26.289 | 0.031 | 96.834 | 1.006 | -13.779 |
| 600  | 0.589 | 138.455 | 1.5099 | -39.579 | 0.052 | 96.285 | 1.016 | -21.141 |
| 800  | 0.566 | 126.103 | 1.4461 | -52.382 | 0.076 | 94.675 | 1.022 | -28.553 |
| 1000 | 0.541 | 114.811 | 1.3613 | -65.315 | 0.102 | 90.577 | 1.026 | -36.519 |
| 1500 | 0.476 | 89.445  | 1.1404 | -98.892 | 0.170 | 78.774 | 1.014 | -57.448 |
| 2000 | 0.397 | 68.206  | 0.8928 | -133.58 | 0.233 | 68.003 | 0.922 | -77.708 |

## TYPICAL COMMON BASE SCATTERING PARAMETER ( $T_A = 25^\circ\text{C}$ )

| Freq | S11 |     | S21 |     | S12 |     | S22 |     |
|------|-----|-----|-----|-----|-----|-----|-----|-----|
| MHz  | Mag | Ang | Mag | Ang | Mag | Ang | Mag | Ang |

$V_{CE} = 3\text{ V}$ ,  $I_C = 5\text{ mA}$

|      |       |         |        |         |       |        |       |         |
|------|-------|---------|--------|---------|-------|--------|-------|---------|
| 50   | 0.781 | 176.95  | 1.7732 | -3.0425 | 0.004 | 85.472 | 1.006 | -1.6658 |
| 100  | 0.780 | 174.093 | 1.7625 | -5.9870 | 0.006 | 88.871 | 1.002 | -3.5604 |
| 200  | 0.776 | 168.012 | 1.7622 | -11.733 | 0.013 | 94.408 | 1.004 | -6.7723 |
| 400  | 0.759 | 156.688 | 1.7285 | -23.541 | 0.029 | 100.70 | 1.006 | -13.627 |
| 600  | 0.743 | 145.893 | 1.6911 | -35.161 | 0.047 | 100.93 | 1.015 | -20.799 |
| 800  | 0.725 | 135.660 | 1.6441 | -46.886 | 0.071 | 98.938 | 1.024 | -28.057 |
| 1000 | 0.709 | 126.241 | 1.5817 | -58.697 | 0.095 | 95.803 | 1.031 | -35.921 |
| 1500 | 0.674 | 103.465 | 1.4275 | -90.316 | 0.172 | 85.633 | 1.037 | -56.915 |
| 2000 | 0.620 | 81.3686 | 1.1968 | -123.89 | 0.249 | 73.589 | 0.957 | -77.953 |

## TYPICAL COMMON BASE SCATTERING PARAMETER ( $T_A = 25^\circ\text{C}$ )

| Freq | S11 |     | S21 |     | S12 |     | S22 |     |
|------|-----|-----|-----|-----|-----|-----|-----|-----|
| MHz  | Mag | Ang | Mag | Ang | Mag | Ang | Mag | Ang |

$V_{CE} = 3\text{ V}$ ,  $I_C = 10\text{ mA}$

|      |       |         |        |         |       |        |       |         |
|------|-------|---------|--------|---------|-------|--------|-------|---------|
| 50   | 0.867 | 176.898 | 1.8601 | -3.2938 | 0.004 | 88.195 | 1.006 | -1.7132 |
| 100  | 0.863 | 173.941 | 1.8432 | -6.3479 | 0.007 | 90.044 | 1.001 | -3.6916 |
| 200  | 0.851 | 167.942 | 1.8370 | -12.359 | 0.014 | 91.598 | 1.003 | -6.9503 |
| 400  | 0.821 | 157.527 | 1.7814 | -23.95  | 0.029 | 96.128 | 1.003 | -13.909 |
| 600  | 0.795 | 148.933 | 1.7303 | -34.993 | 0.045 | 97.955 | 1.011 | -21.082 |
| 800  | 0.782 | 139.487 | 1.6831 | -46.443 | 0.067 | 98.521 | 1.018 | -28.456 |
| 1000 | 0.773 | 131.501 | 1.6327 | -57.916 | 0.091 | 96.532 | 1.024 | -36.296 |
| 1500 | 0.765 | 110.253 | 1.4975 | -89.11  | 0.169 | 88.005 | 1.031 | -57.462 |
| 2000 | 0.730 | 87.937  | 1.2711 | -123.21 | 0.253 | 76.070 | 0.950 | -78.777 |

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$V_{CE} = 2.5 \text{ V}$ ,  $I_C = 2.5 \text{ mA}$

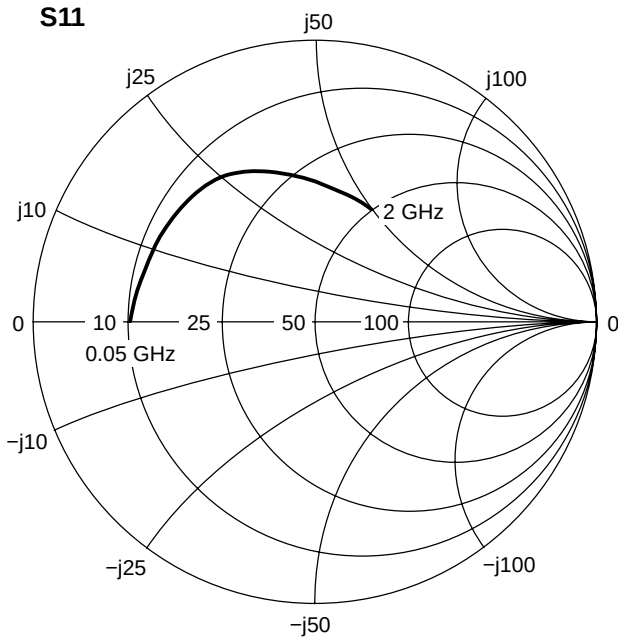


Figure 15. Input Reflection Coefficient

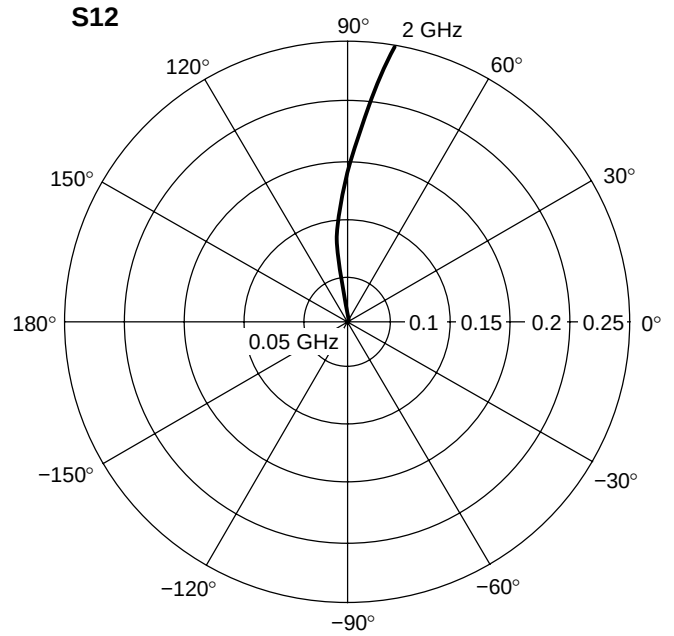


Figure 16. Reverse Transmission Coefficient

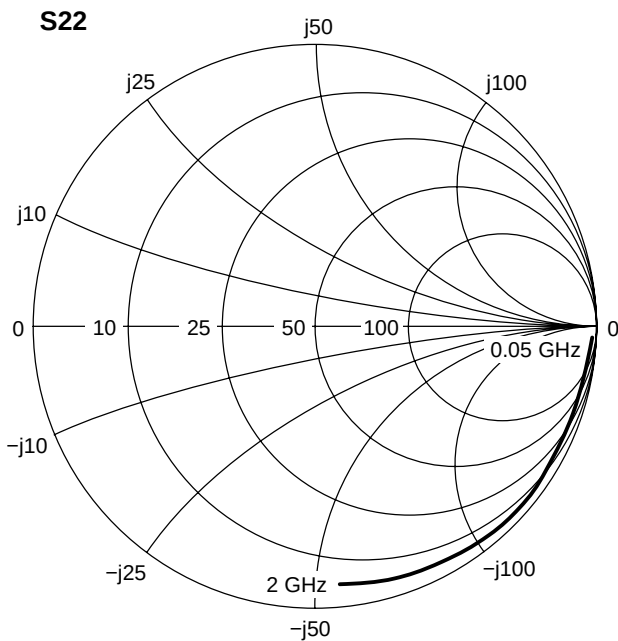


Figure 17. Output Reflection Coefficient

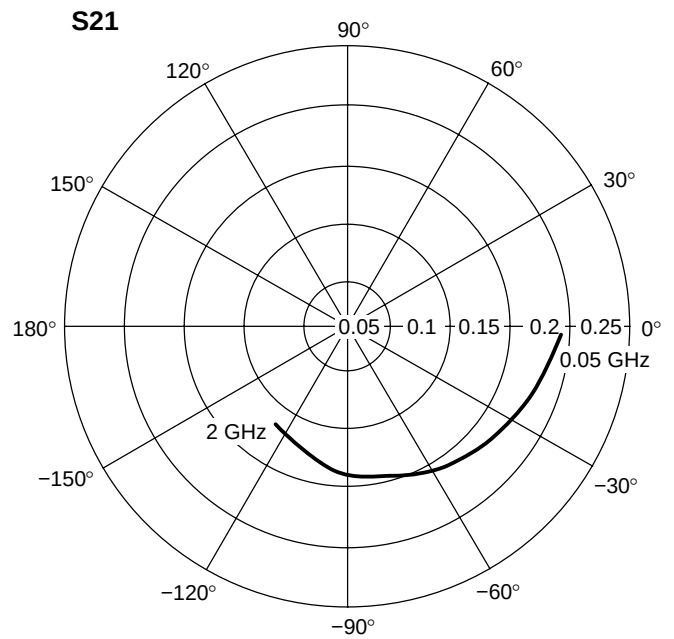
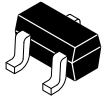


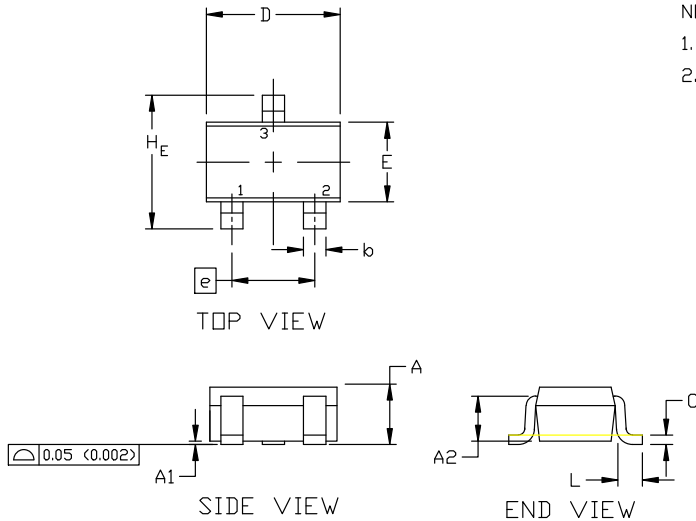
Figure 18. Forward Transmission Coefficient



SCALE 4:1

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ISSUE R

DATE 11 OCT 2022

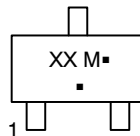


NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH

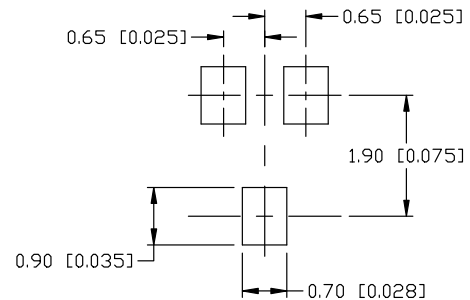
| DIM | MILLIMETERS |      |      | INCHES    |       |       |
|-----|-------------|------|------|-----------|-------|-------|
|     | MIN.        | NOM. | MAX. | MIN.      | NOM.  | MAX.  |
| A   | 0.80        | 0.90 | 1.00 | 0.032     | 0.035 | 0.040 |
| A1  | 0.00        | 0.05 | 0.10 | 0.000     | 0.002 | 0.004 |
| A2  | 0.70 REF    |      |      | 0.028 BSC |       |       |
| b   | 0.30        | 0.35 | 0.40 | 0.012     | 0.014 | 0.016 |
| c   | 0.10        | 0.18 | 0.25 | 0.004     | 0.007 | 0.010 |
| D   | 1.80        | 2.00 | 2.20 | 0.071     | 0.080 | 0.087 |
| E   | 1.15        | 1.24 | 1.35 | 0.045     | 0.049 | 0.053 |
| e   | 1.20        | 1.30 | 1.40 | 0.047     | 0.051 | 0.055 |
| e1  | 0.65 BSC    |      |      | 0.026 BSC |       |       |
| L   | 0.20        | 0.38 | 0.56 | 0.008     | 0.015 | 0.022 |
| H_E | 2.00        | 2.10 | 2.40 | 0.079     | 0.083 | 0.095 |

GENERIC  
MARKING DIAGRAM



XX = Specific Device Code  
M = Date Code  
▪ = Pb-Free Package

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present. Some products may not follow the Generic Marking.



\* For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

SOLDERING FOOTPRINT

STYLE 1:  
CANCELLED

STYLE 2:  
PIN 1. ANODE  
2. N.C.  
3. CATHODE

STYLE 3:  
PIN 1. BASE  
2. EMITTER  
3. COLLECTOR

STYLE 4:  
PIN 1. CATHODE  
2. CATHODE  
3. ANODE

STYLE 5:  
PIN 1. ANODE  
2. ANODE  
3. CATHODE

STYLE 6:  
PIN 1. EMITTER  
2. BASE  
3. COLLECTOR

STYLE 7:  
PIN 1. BASE  
2. EMITTER  
3. COLLECTOR

STYLE 8:  
PIN 1. GATE  
2. SOURCE  
3. DRAIN

STYLE 9:  
PIN 1. ANODE  
2. CATHODE  
3. CATHODE-ANODE

STYLE 10:  
PIN 1. CATHODE  
2. ANODE  
3. ANODE-CATHODE

STYLE 11:  
PIN 1. CATHODE  
2. CATHODE  
3. CATHODE

|                  |                 |                                                                                                                                                                                  |
|------------------|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
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