

# NTZD5110N

## MOSFET – Dual, N-Channel with ESD Protection, Small Signal, SOT-563 60 V, 310 mA

### Features

- Low  $R_{DS(on)}$  Improving System Efficiency
- Low Threshold Voltage
- ESD Protected Gate
- Small Footprint 1.6 x 1.6 mm
- These are Pb-Free Devices

### Applications

- Load/Power Switches
- Driver Circuits: Relays, Lamps, Displays, Memories, etc.
- Battery Management/Battery Operated Systems
- Cell Phones, Digital Cameras, PDAs, Pagers, etc.

### MAXIMUM RATINGS ( $T_J = 25^\circ\text{C}$ unless otherwise noted.)

| Parameter   |                               | Symbol         | Value                           | Unit             |
|---|-------------------------------|----------------|---------------------------------|------------------|
| Drain-to-Source Voltage   |                               | $V_{DS}$       | 60                              | V                |
| Gate-to-Source Voltage  |                               | $V_{GS}$       | $\pm 20$                        | V                |
| Continuous Drain Current (Note 1)                                 | Steady State                  | $I_D$          | $T_A = 25^\circ\text{C}$<br>294 | mA               |
|   |                               |                | $T_A = 85^\circ\text{C}$<br>212 |                  |
| Power Dissipation (Note 1)  | Steady State                  | $P_D$          | 250                             | mW               |
| Continuous Drain Current (Note 1)                                 | $t \leq 5\text{ s}$           | $I_D$          | $T_A = 25^\circ\text{C}$<br>310 | mA               |
|   |                               |                | $T_A = 85^\circ\text{C}$<br>225 |                  |
| Power Dissipation (Note 1)  | $t \leq 5\text{ s}$           | $P_D$          | 280                             | mW               |
| Pulsed Drain Current  | $t_p = 10\text{ }\mu\text{s}$ | $I_{DM}$       | 590                             | mA               |
| Operating Junction and Storage Temperature                        |                               | $T_J, T_{STG}$ | -55 to 150                      | $^\circ\text{C}$ |
| Source Current (Body Diode)                                       |                               | $I_S$          | 350                             | mA               |
| Lead Temperature for Soldering Purposes (1/8" from case for 10 s) |                               | $T_L$          | 260                             | $^\circ\text{C}$ |
| Gate-Source ESD Rating (HBM, Method 3015)                         |                               | ESD            | 1800                            | V                |

### THERMAL RESISTANCE RATINGS

| Parameter  | Symbol          | Max | Unit               |
|--|-----------------|-----|--------------------|
| Junction-to-Ambient – Steady State (Note 1)        | $R_{\theta JA}$ | 500 | $^\circ\text{C/W}$ |
| Junction-to-Ambient – $t \leq 5\text{ s}$ (Note 1) |                 | 447 |                    |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

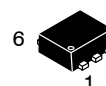
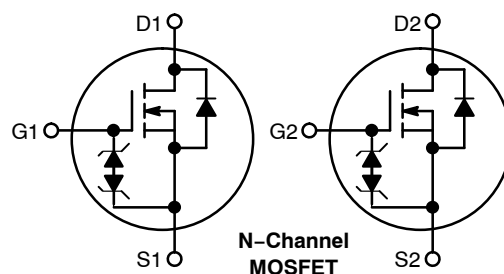
1. Surface mounted on FR4 board using 1 in sq pad size (Cu. area = 1.127 in sq [1 oz] including traces).



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| $V_{(BR)DS}$ | $R_{DS(on)}$ MAX     | $I_D$ Max |
|--------------|----------------------|-----------|
| 60           | 1.6 $\Omega$ @ 10 V  | 310 mA    |
|              | 2.5 $\Omega$ @ 4.5 V |           |



SOT-563  
CASE 463A

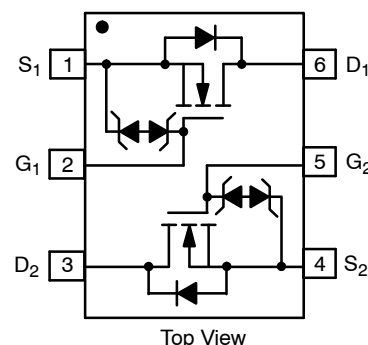
### MARKING DIAGRAM



S7 = Specific Device Code  
M = Date Code

(Note: Microdot may be in either location)

### PINOUT: SOT-563



### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 4 of this data sheet.

# NTZD5110N

## ELECTRICAL CHARACTERISTICS ( $T_J = 25^\circ\text{C}$ unless otherwise noted.)

| Parameter   | Symbol            | Test Condition                                      | Min                       | Typ | Max      | Unit          |               |
|---|-------------------|---|---------------------------|-----|----------|---------------|---------------|
| OFF CHARACTERISTICS                                       |                   |   |                           |     |          |               |               |
| Drain-to-Source Breakdown Voltage                         | $V_{(BR)DSS}$     | $V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$ | 60                        | –   | –        | V             |               |
| Drain-to-Source Breakdown Voltage Temperature Coefficient | $V_{(BR)DSS}/T_J$ | –   | –                         | 71  | –        | mV/°C         |               |
| Zero Gate Voltage Drain Current                           | $I_{DSS}$         | $V_{GS} = 0\text{ V}$<br>$V_{DS} = 60\text{ V}$     | $T_J = 25^\circ\text{C}$  | –   | –        | 1.0           | $\mu\text{A}$ |
|   |                   |   | $T_J = 125^\circ\text{C}$ | –   | –        | 500           |               |
|   |                   | $V_{GS} = 0\text{ V}$<br>$V_{DS} = 50\text{ V}$     | $T_J = 25^\circ\text{C}$  | –   | –        | 100           | nA            |
|   |                   |   | $T_J = 85^\circ\text{C}$  | –   | –        | 100           |               |
| Gate-to-Source Leakage Current                            | $I_{GSS}$         | $V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$     | –                         | –   | $\pm 10$ | $\mu\text{A}$ |               |
|   |                   | $V_{DS} = 0\text{ V}, V_{GS} = \pm 10\text{ V}$     | –                         | –   | 450      | nA            |               |
|   |                   | $V_{DS} = 0\text{ V}, V_{GS} = \pm 5.0\text{ V}$    | –                         | –   | 150      | nA            |               |

## ON CHARACTERISTICS (Note 3)

|  |                  |   |     |      |     |                      |
|--|------------------|---|-----|------|-----|----------------------|
| Gate Threshold Voltage                     | $V_{GS(TH)}$     | $V_{GS} = V_{DS}, I_D = 250\text{ }\mu\text{A}$ | 1.0 | –    | 2.5 | V                    |
| Negative Threshold Temperature Coefficient | $V_{GS(TH)}/T_J$ | –   | –   | 4.0  | –   | mV/ $^\circ\text{C}$ |
| Drain-to-Source On Resistance              | $R_{DS(on)}$     | $V_{GS} = 10\text{ V}, I_D = 500\text{ mA}$     | –   | 1.19 | 1.6 | $\Omega$             |
|  |                  | $V_{GS} = 4.5\text{ V}, I_D = 200\text{ mA}$    | –   | 1.33 | 2.5 |                      |
| Forward Transconductance                   | $g_{FS}$         | $V_{DS} = 5.0\text{ V}, I_D = 200\text{ mA}$    | –   | 80   | –   | S                    |

## CHARGES AND CAPACITANCES

|                              |              |   |   |      |   |    |
|------------------------------|--------------|---|---|------|---|----|
| Input Capacitance            | $C_{ISS}$    | $V_{GS} = 0\text{ V}, f = 1.0\text{ MHz},$<br>$V_{DS} = 20\text{ V}$    | – | 24.5 | – | pF |
| Output Capacitance           | $C_{OSS}$    |   | – | 4.2  | – |    |
| Reverse Transfer Capacitance | $C_{RSS}$    |   | – | 2.2  | – |    |
| Total Gate Charge            | $Q_{G(TOT)}$ | $V_{GS} = 4.5\text{ V}, V_{DS} = 10\text{ V};$<br>$I_D = 200\text{ mA}$ | – | 0.7  | – | nC |
| Threshold Gate Charge        | $Q_{G(TH)}$  |   | – | 0.1  | – |    |
| Gate-to-Source Charge        | $Q_{GS}$     |   | – | 0.3  | – |    |
| Gate-to-Drain Charge         | $Q_{GD}$     |   | – | 0.1  | – |    |

## SWITCHING CHARACTERISTICS (Note 4)

|                     |              |  |   |      |   |    |
|---------------------|--------------|--|---|------|---|----|
| Turn-On Delay Time  | $t_{d(ON)}$  | $V_{GS} = 10\text{ V}, V_{DD} = 30\text{ V},$<br>$I_D = 200\text{ mA}, R_G = 10\text{ }\Omega$ | – | 12   | – | ns |
| Rise Time           | $t_r$        |  | – | 7.3  | – |    |
| Turn-Off Delay Time | $t_{d(OFF)}$ |  | – | 63.7 | – |    |
| Fall Time           | $t_f$        |  | – | 30.6 | – |    |

## DRAIN-SOURCE DIODE CHARACTERISTICS

|                       |          |   |                          |   |     |     |   |
|-----------------------|----------|---|--------------------------|---|-----|-----|---|
| Forward Diode Voltage | $V_{SD}$ | $V_{GS} = 0\text{ V},$<br>$I_S = 200\text{ mA}$ | $T_J = 25^\circ\text{C}$ | – | 0.8 | 1.2 | V |
|                       |          |   | $T_J = 85^\circ\text{C}$ | – | 0.7 | –   |   |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

2. Surface-mounted on FR4 board using 1 in. sq. pad size (Cu. area = 1.127 in sq [1 oz] including traces).

3. Pulse Test: pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .

4. Switching characteristics are independent of operating junction temperatures.

TYPICAL CHARACTERISTICS

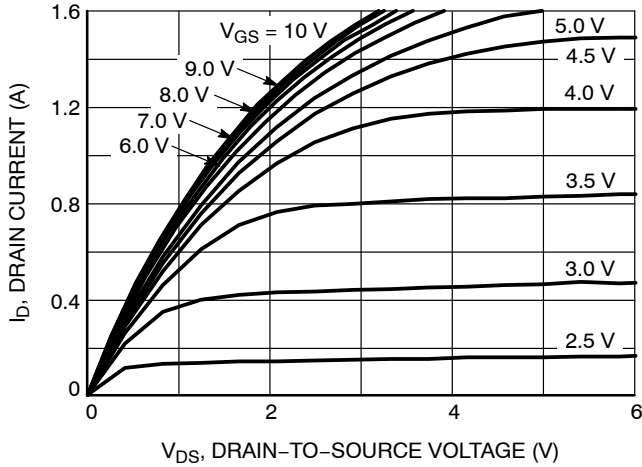


Figure 1. On-Region Characteristics

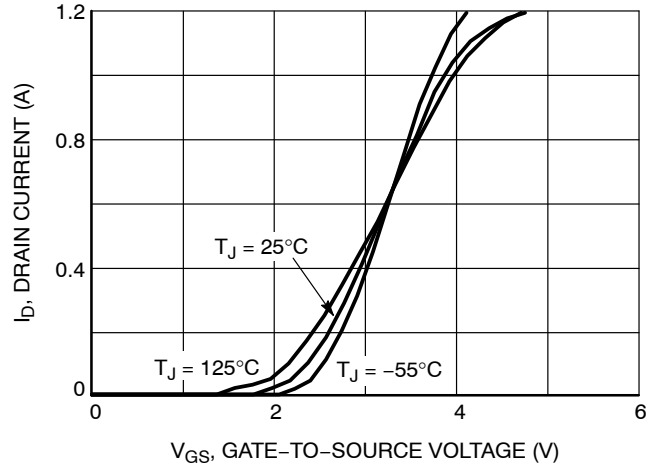


Figure 2. Transfer Characteristics

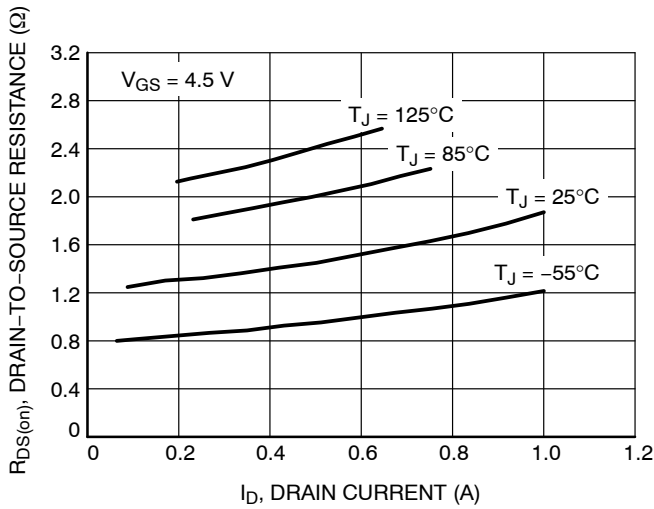


Figure 3. On-Resistance vs. Drain Current and Temperature

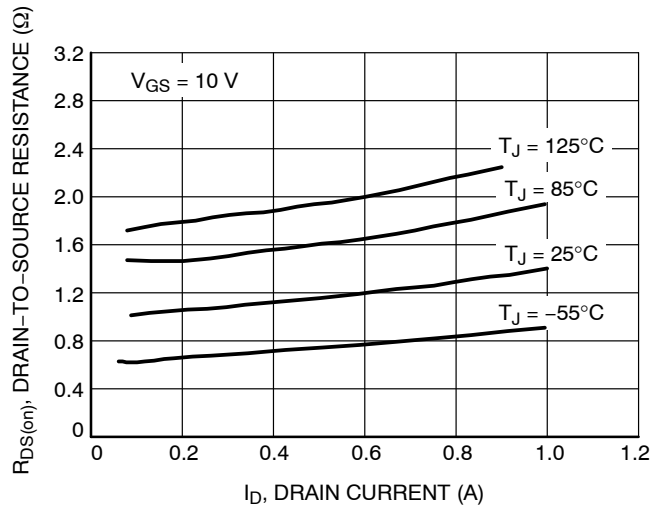


Figure 4. On-Resistance vs. Drain Current and Temperature

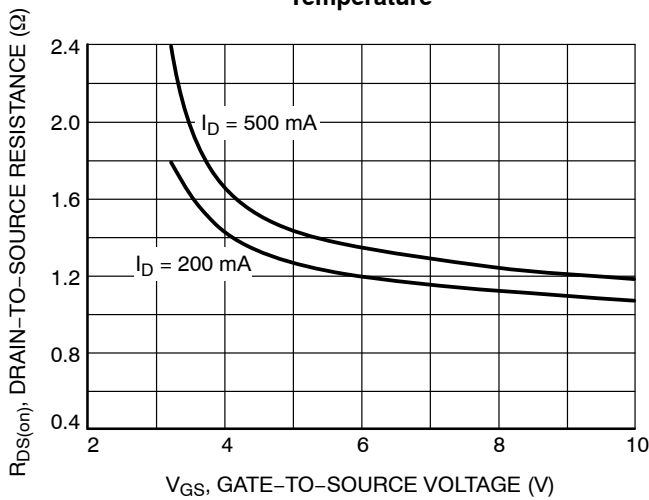


Figure 5. On-Resistance vs. Gate-to-Source Voltage

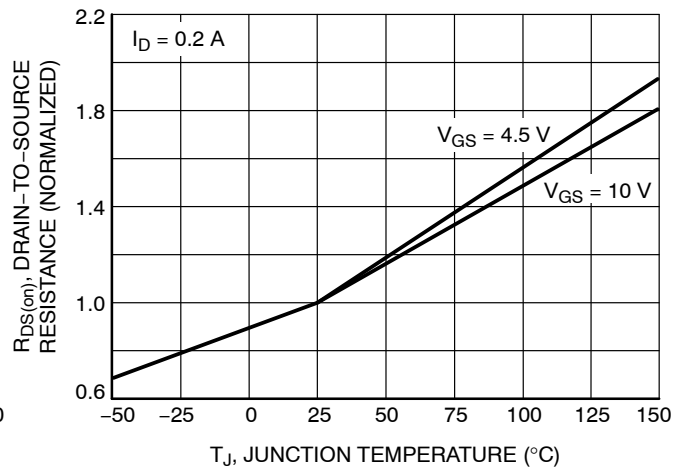


Figure 6. On-Resistance Variation with Temperature

TYPICAL CHARACTERISTICS

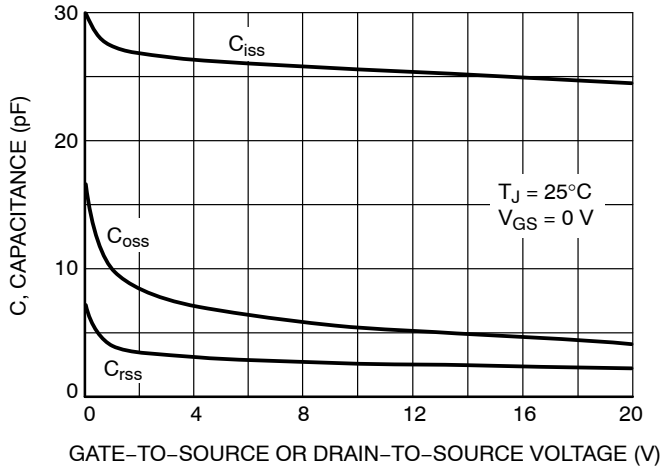


Figure 7. Capacitance Variation

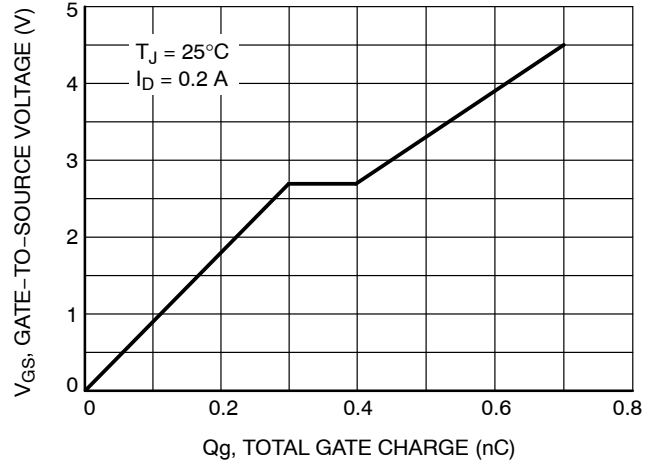


Figure 8. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

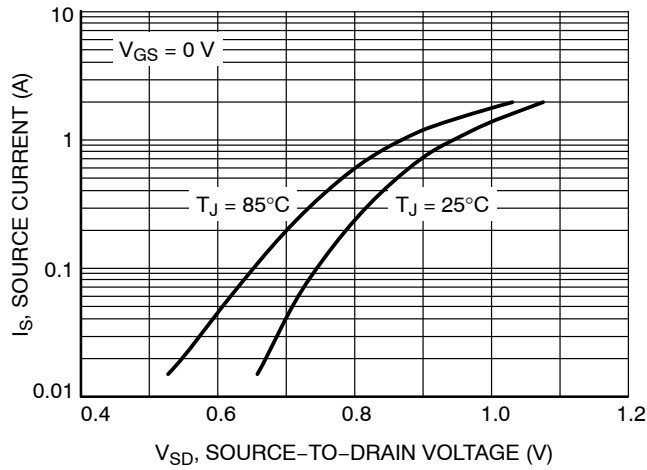


Figure 9. Diode Forward Voltage vs. Current

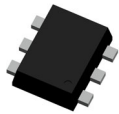
ORDERING INFORMATION

| Device       | Package              | Shipping           |
|--------------|----------------------|--------------------|
| NTZD5110NT1G | SOT-563<br>(Pb-Free) | 4000 / Tape & Reel |
| NTZD5110NT5G | SOT-563<br>(Pb-Free) | 8000 / 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.

# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS

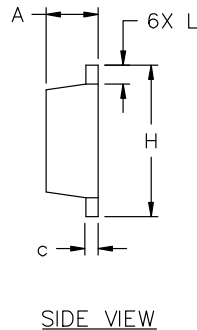
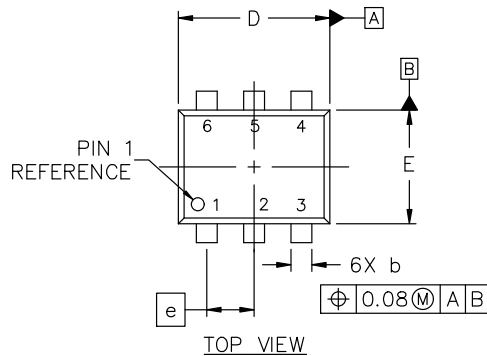


**SOT-563-6 1.60x1.20x0.55, 0.50P**  
**CASE 463A**  
**ISSUE J**

**DATE 15 FEB 2024**

### NOTES:

1. DIMENSIONING AND TOLERANCING CONFORM TO ASME Y14.5-2018.
2. ALL DIMENSION ARE IN MILLIMETERS.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.



| DIM | MILLIMETERS |      |      |
|-----|-------------|------|------|
|     | MIN.        | NOM. | MAX. |
| A   | 0.50        | 0.55 | 0.60 |
| b   | 0.17        | 0.22 | 0.27 |
| c   | 0.08        | 0.13 | 0.18 |
| D   | 1.50        | 1.60 | 1.70 |
| E   | 1.10        | 1.20 | 1.30 |
| e   | 0.50 BSC    |      |      |
| H   | 1.50        | 1.60 | 1.70 |
| L   | 0.10        | 0.20 | 0.30 |

**STYLE 1:**  
**PIN** 1. EMITTER 1  
 2. BASE 1  
 3. COLLECTOR 2  
 4. EMITTER 2  
 5. BASE 2  
 6. COLLECTOR 1

**STYLE 2:**  
**PIN** 1. EMITTER 1  
 2. EMITTER 2  
 3. BASE 2  
 4. COLLECTOR 2  
 5. BASE 1  
 6. COLLECTOR 1

**STYLE 3:**  
**PIN** 1. CATHODE 1  
 2. CATHODE 1  
 3. ANODE/ANODE 2  
 4. CATHODE 2  
 5. CATHODE 2  
 6. ANODE/ANODE 1

**STYLE 4:**  
**PIN** 1. COLLECTOR  
 2. COLLECTOR  
 3. BASE  
 4. EMITTER  
 5. COLLECTOR  
 6. COLLECTOR

**STYLE 5:**  
**PIN** 1. CATHODE  
 2. CATHODE  
 3. ANODE  
 4. ANODE  
 5. CATHODE  
 6. CATHODE

**STYLE 6:**  
**PIN** 1. CATHODE  
 2. ANODE  
 3. CATHODE  
 4. CATHODE  
 5. CATHODE  
 6. CATHODE

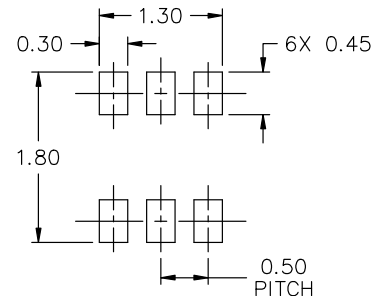
**STYLE 7:**  
**PIN** 1. CATHODE  
 2. ANODE  
 3. CATHODE  
 4. CATHODE  
 5. ANODE  
 6. CATHODE

**STYLE 8:**  
**PIN** 1. DRAIN  
 2. DRAIN  
 3. GATE  
 4. SOURCE  
 5. DRAIN  
 6. DRAIN

**STYLE 9:**  
**PIN** 1. SOURCE 1  
 2. GATE 1  
 3. DRAIN 2  
 4. SOURCE 2  
 5. GATE 2  
 6. DRAIN 1

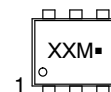
**STYLE 10:**  
**PIN** 1. CATHODE 1  
 2. N/C  
 3. CATHODE 2  
 4. ANODE 2  
 5. N/C  
 6. ANODE 1

**STYLE 11:**  
**PIN** 1. EMITTER 2  
 2. BASE 2  
 3. COLLECTOR 1  
 4. EMITTER 1  
 5. BASE 1  
 6. COLLECTOR 2



\* FOR ADDITIONAL INFORMATION ON OUR Pb-FREE STRATEGY AND SOLDERING DETAILS, PLEASE DOWNLOAD THE ON SEMICONDUCTOR SOLDERING AND MOUNTING TECHNIQUES REFERENCE MANUAL, SOLDERM/D.

### GENERIC MARKING DIAGRAM\*



XX = Specific Device Code  
 M = Month 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.

|                         |  |  |
|-------------------------|--|--|
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| <b>DESCRIPTION:</b>     | <b>SOT-563-6 1.60x1.20x0.55, 0.50P</b> | <b>PAGE 1 OF 1</b>   |

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