

# NTJD4401N, NVJD4401N

## Small Signal MOSFET

20 V, Dual N-Channel, SC-88

### ESD Protection

#### Features

- Small Footprint (2 x 2 mm)
- Low Gate Charge N-Channel Device
- ESD Protected Gate
- Same Package as SC-70 (6 Leads)
- AEC-Q101 Qualified and PPAP Capable – NVJD4401N
- These Devices are Pb-Free and are RoHS Compliant

#### Applications

- Load Power Switching
- Li-Ion Battery Supplied Devices
- Cell Phones, Media Players, Digital Cameras, PDAs
- DC-DC Conversion

**MAXIMUM RATINGS** ( $T_J = 25^\circ\text{C}$  unless otherwise stated)

| Parameter                                                            |                         | Symbol         | Value                    | Unit             |
|----------------------------------------------------------------------|-------------------------|----------------|--------------------------|------------------|
| Drain-to-Source Voltage                                              |                         | $V_{DS}$       | 20                       | V                |
| Gate-to-Source Voltage                                               |                         | $V_{GS}$       | $\pm 12$                 | V                |
| Continuous Drain Current<br>(Based on $R_{\theta JA}$ )              | Steady State            | $I_D$          | $T_A = 25^\circ\text{C}$ | A                |
|                                                                      |                         |                | $T_A = 85^\circ\text{C}$ |                  |
| Power Dissipation<br>(Based on $R_{\theta JA}$ )                     | Steady State            | $P_D$          | $T_A = 25^\circ\text{C}$ | W                |
|                                                                      |                         |                | $T_A = 85^\circ\text{C}$ |                  |
| Continuous Drain Current<br>(Based on $R_{\theta JL}$ )              | Steady State            | $I_D$          | $T_A = 25^\circ\text{C}$ | A                |
|                                                                      |                         |                | $T_A = 85^\circ\text{C}$ |                  |
| Power Dissipation<br>(Based on $R_{\theta JL}$ )                     | Steady State            | $P_D$          | $T_A = 25^\circ\text{C}$ | W                |
|                                                                      |                         |                | $T_A = 85^\circ\text{C}$ |                  |
| Pulsed Drain Current                                                 | $t \leq 10 \mu\text{s}$ | $I_{DM}$       | $\pm 1.2$                | A                |
| Operating Junction and Storage Temperature                           |                         | $T_J, T_{STG}$ | -55 to 150               | $^\circ\text{C}$ |
| Continuous Source Current (Body Diode)                               |                         | $I_S$          | 0.63                     | A                |
| Lead Temperature for Soldering Purposes<br>(1/8" from case for 10 s) |                         | $T_L$          | 260                      | $^\circ\text{C}$ |

#### THERMAL RESISTANCE RATINGS (Note 1)

| Parameter                               | Symbol          | Typ | Max | Units              |
|-----------------------------------------|-----------------|-----|-----|--------------------|
| Junction-to-Ambient – Steady State      | $R_{\theta JA}$ | 400 | 458 | $^\circ\text{C/W}$ |
| Junction-to-Lead (Drain) – Steady State | $R_{\theta JL}$ | 194 | 252 |                    |

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 oz Cu area = 0.9523 in sq.

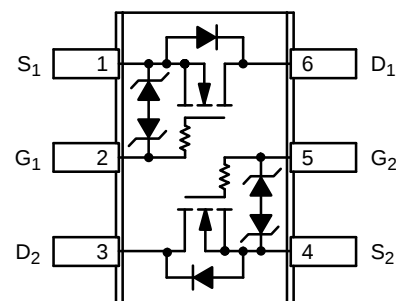


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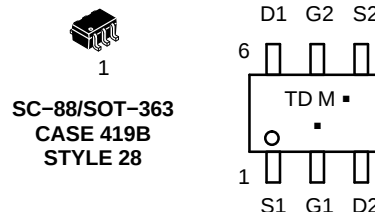
| $V_{(BR)DS}$ | $R_{DS(on)}$ Typ      | $I_D$ Max |
|--------------|-----------------------|-----------|
| 20 V         | 0.29 $\Omega$ @ 4.5 V | 0.63 A    |
|              | 0.36 $\Omega$ @ 2.5 V |           |

#### SC-88 (SOT-363)



Top View

#### MARKING DIAGRAM & PIN ASSIGNMENT



TD = Device Code  
M = Date Code  
▪ = Pb-Free Package

(Note: Microdot may be in either location)

#### ORDERING INFORMATION

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

# NTJD4401N, NVJD4401N

## ELECTRICAL CHARACTERISTICS (T<sub>J</sub> = 25°C unless otherwise stated)

| Parameter | Symbol | Test Condition | Min | Typ | Max | Unit |
|-----------|--------|----------------|-----|-----|-----|------|
|-----------|--------|----------------|-----|-----|-----|------|

### OFF CHARACTERISTICS

|                                                           |                                      |                                                |    |    |     |        |
|-----------------------------------------------------------|--------------------------------------|------------------------------------------------|----|----|-----|--------|
| Drain-to-Source Breakdown Voltage                         | V <sub>(BR)DSS</sub>                 | V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA | 20 | 27 |     | V      |
| Drain-to-Source Breakdown Voltage Temperature Coefficient | V <sub>(BR)DSS</sub> /T <sub>J</sub> |                                                |    | 22 |     | mV/ °C |
| Zero Gate Voltage Drain Current                           | I <sub>DSS</sub>                     | V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 16 V  |    |    | 1.0 | μA     |
| Gate-to-Source Leakage Current                            | I <sub>GSS</sub>                     | V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ±12 V |    |    | 10  | μA     |

### ON CHARACTERISTICS (Note 2)

|                                        |                                     |                                                             |     |      |       |        |
|----------------------------------------|-------------------------------------|-------------------------------------------------------------|-----|------|-------|--------|
| Gate Threshold Voltage                 | V <sub>GS(TH)</sub>                 | V <sub>GS</sub> = V <sub>DS</sub> , I <sub>D</sub> = 250 μA | 0.6 | 0.92 | 1.5   | V      |
| Gate Threshold Temperature Coefficient | V <sub>GS(TH)</sub> /T <sub>J</sub> |                                                             |     | -2.1 |       | mV/ °C |
| Drain-to-Source On Resistance          | R <sub>DS(on)</sub>                 | V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 0.63 A            |     | 0.29 | 0.375 | Ω      |
|                                        |                                     | V <sub>GS</sub> = 2.5 V, I <sub>D</sub> = 0.40 A            |     | 0.36 | 0.445 |        |
| Forward Transconductance               | g <sub>FS</sub>                     | V <sub>DS</sub> = 4.0 V, I <sub>D</sub> = 0.63 A            |     | 2.0  |       | S      |

### CHARGES AND CAPACITANCES

|                              |                     |                                                                             |  |     |     |    |
|------------------------------|---------------------|-----------------------------------------------------------------------------|--|-----|-----|----|
| Input Capacitance            | C <sub>ISS</sub>    | V <sub>GS</sub> = 0 V, f = 1.0 MHz,<br>V <sub>DS</sub> = 20 V               |  | 33  | 46  | pF |
| Output Capacitance           | C <sub>OSS</sub>    |                                                                             |  | 13  | 22  |    |
| Reverse Transfer Capacitance | C <sub>RSS</sub>    |                                                                             |  | 2.8 | 5.0 |    |
| Total Gate Charge            | Q <sub>G(TOT)</sub> | V <sub>GS</sub> = 4.5 V, V <sub>DS</sub> = 10 V,<br>I <sub>D</sub> = 0.63 A |  | 1.3 | 3.0 | nC |
| Threshold Gate Charge        | Q <sub>G(TH)</sub>  |                                                                             |  | 0.1 |     |    |
| Gate-to-Source Charge        | Q <sub>GS</sub>     |                                                                             |  | 0.2 |     |    |
| Gate-to-Drain Charge         | Q <sub>GD</sub>     |                                                                             |  | 0.4 |     |    |

### SWITCHING CHARACTERISTICS (Note 3)

|                     |                     |                                                                                                   |  |       |  |    |
|---------------------|---------------------|---------------------------------------------------------------------------------------------------|--|-------|--|----|
| Turn-On Delay Time  | t <sub>d(ON)</sub>  | V <sub>GS</sub> = 4.5 V, V <sub>DD</sub> = 10 V,<br>I <sub>D</sub> = 0.5 A, R <sub>G</sub> = 20 Ω |  | 0.083 |  | μs |
| Rise Time           | t <sub>r</sub>      |                                                                                                   |  | 0.227 |  |    |
| Turn-Off Delay Time | t <sub>d(OFF)</sub> |                                                                                                   |  | 0.786 |  |    |
| Fall Time           | t <sub>f</sub>      |                                                                                                   |  | 0.506 |  |    |

### DRAIN-SOURCE DIODE CHARACTERISTICS

|                       |                 |                                                                                   |                        |  |       |     |    |
|-----------------------|-----------------|-----------------------------------------------------------------------------------|------------------------|--|-------|-----|----|
| Forward Diode Voltage | V <sub>SD</sub> | V <sub>GS</sub> = 0 V,<br>I <sub>S</sub> = 0.23 A                                 | T <sub>J</sub> = 25°C  |  | 0.76  | 1.1 | V  |
|                       |                 |                                                                                   | T <sub>J</sub> = 125°C |  | 0.63  |     |    |
| Reverse Recovery Time | t <sub>RR</sub> | V <sub>GS</sub> = 0 V, dI <sub>S</sub> /dt = 100 A/μs,<br>I <sub>S</sub> = 0.63 A |                        |  | 0.410 |     | μs |

2. Pulse Test: pulse width ≤ 300 μs, duty cycle ≤ 2%.

3. Switching characteristics are independent of operating junction temperatures.

TYPICAL PERFORMANCE CURVES ( $T_J = 25^\circ\text{C}$  unless otherwise noted)

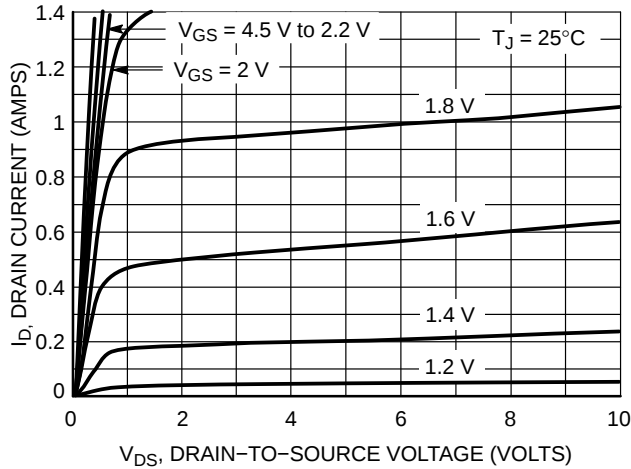


Figure 1. On-Region Characteristics

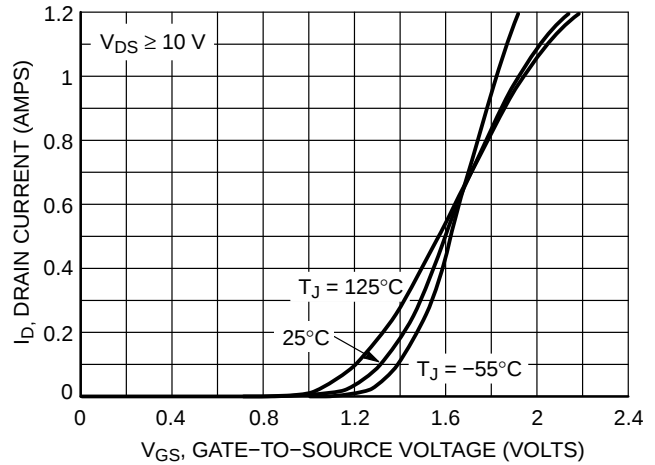


Figure 2. Transfer Characteristics

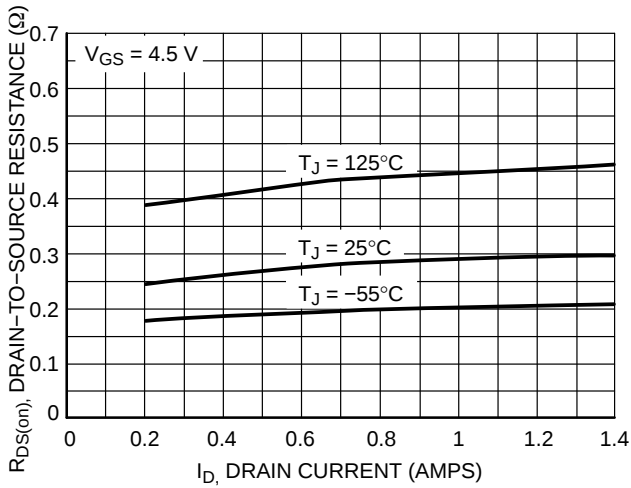


Figure 3. On-Resistance vs. Drain Current and Temperature

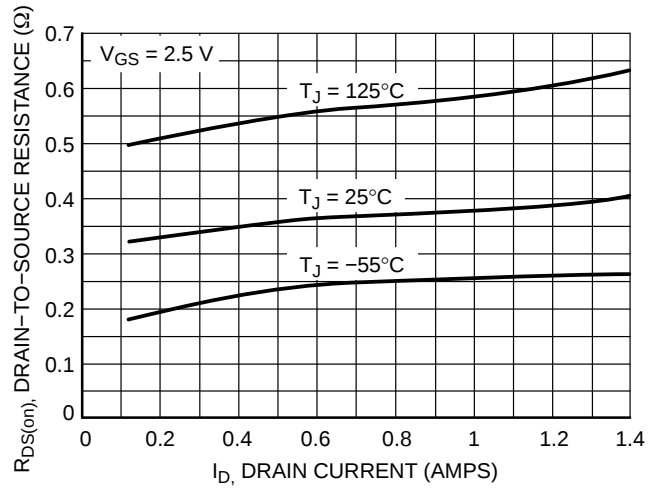


Figure 4. On-Resistance vs. Drain Current and Temperature

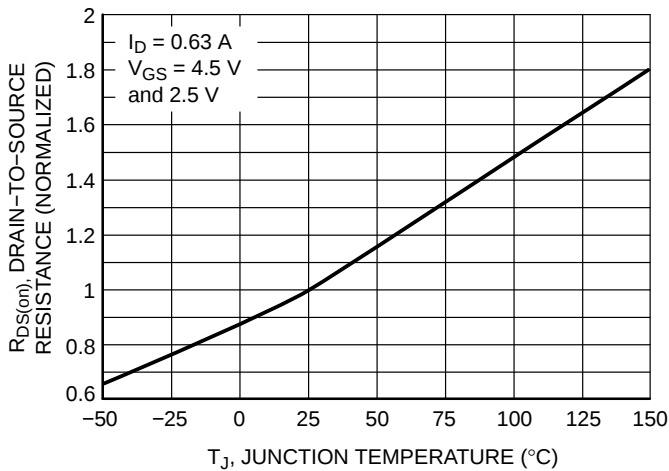


Figure 5. On-Resistance Variation with Temperature

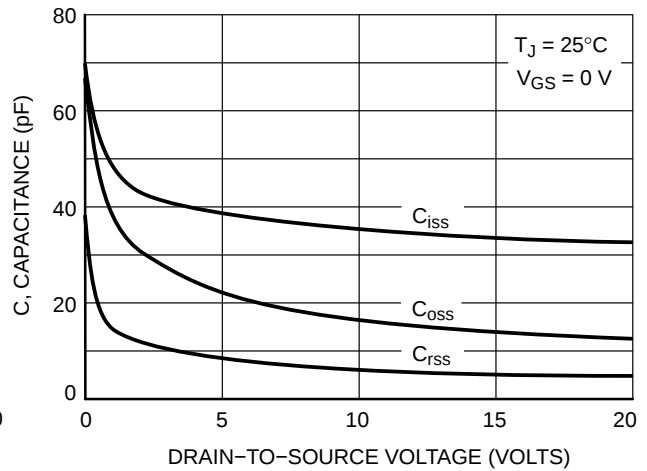
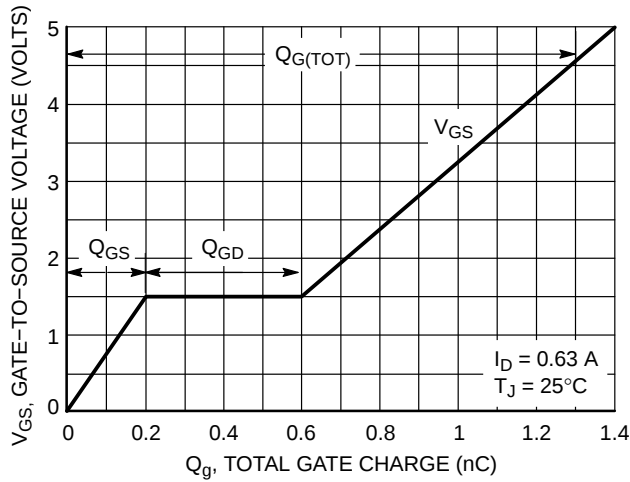


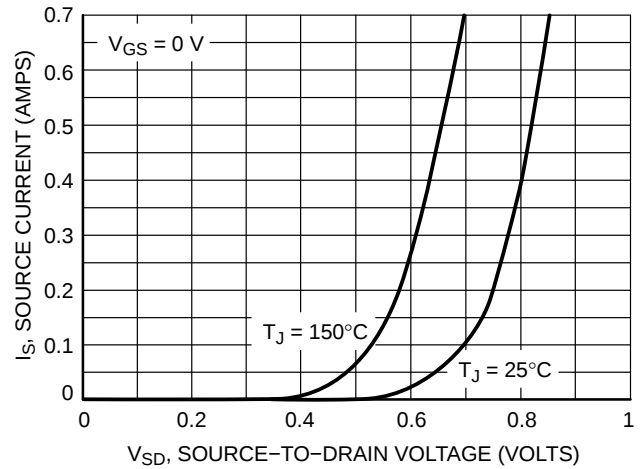
Figure 6. Capacitance Variation

# NTJD4401N, NVJD4401N

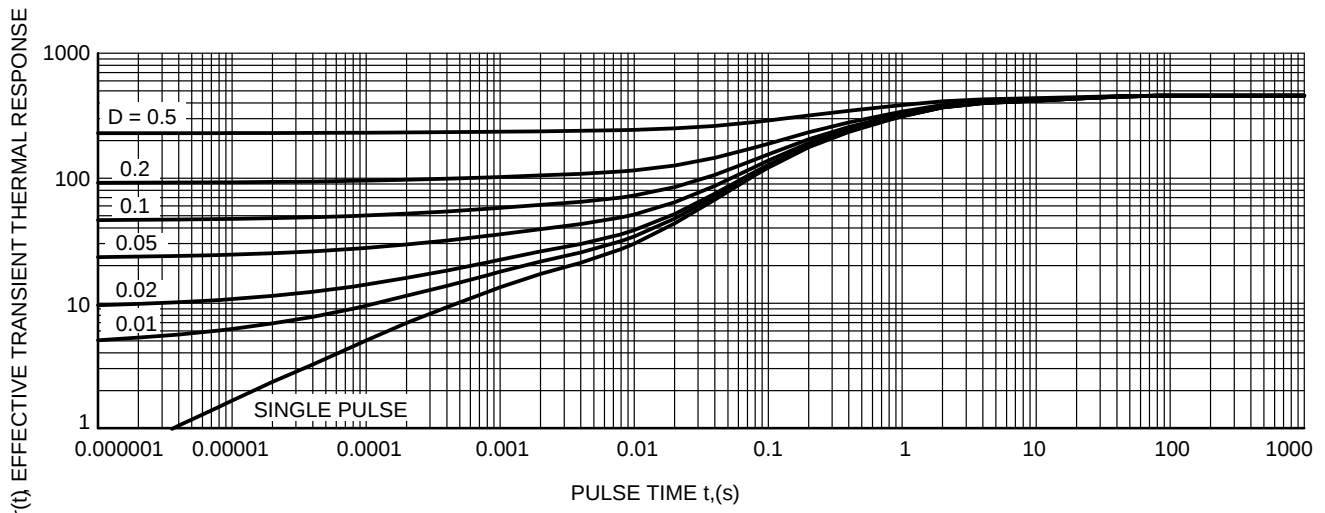
## TYPICAL PERFORMANCE CURVES ( $T_J = 25^\circ\text{C}$ unless otherwise noted)



**Figure 7. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge**



**Figure 8. Diode Forward Voltage vs. Current**



**Figure 9. Thermal Response**

### ORDERING INFORMATION

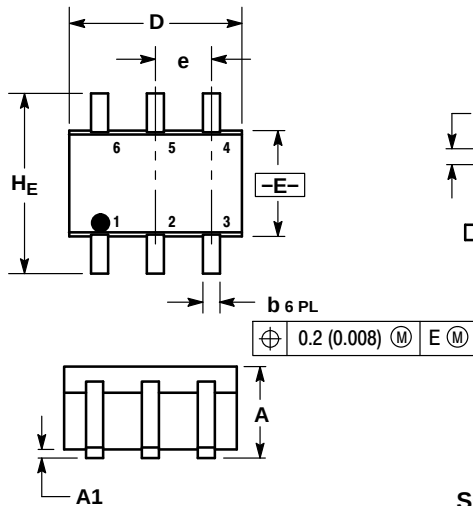
| Device       | Package            | Shipping <sup>†</sup> |
|--------------|--------------------|-----------------------|
| NTJD4401NT1G | SC-88<br>(Pb-Free) | 3000 / Tape & Reel    |
| NVJD4401NT1G | SC-88<br>(Pb-Free) | 3000 / Tape & Reel    |

<sup>†</sup>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.

# NTJD4401N, NVJD4401N

## PACKAGE DIMENSIONS

### SC-88/SC70-6/SOT-363 CASE 419B-02 ISSUE W



#### NOTES:

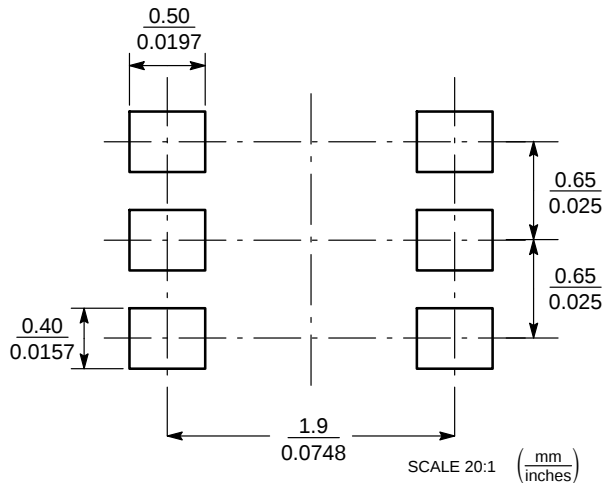
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. 419B-01 OBSOLETE, NEW STANDARD 419B-02.

| DIM | MILLIMETERS |      |      | INCHES    |       |       |
|-----|-------------|------|------|-----------|-------|-------|
|     | MIN         | NOM  | MAX  | MIN       | NOM   | MAX   |
| A   | 0.80        | 0.95 | 1.10 | 0.031     | 0.037 | 0.043 |
| A1  | 0.00        | 0.05 | 0.10 | 0.000     | 0.002 | 0.004 |
| A3  | 0.20 REF    |      |      | 0.008 REF |       |       |
| b   | 0.10        | 0.21 | 0.30 | 0.004     | 0.008 | 0.012 |
| C   | 0.10        | 0.14 | 0.25 | 0.004     | 0.005 | 0.010 |
| D   | 1.80        | 2.00 | 2.20 | 0.070     | 0.078 | 0.086 |
| E   | 1.15        | 1.25 | 1.35 | 0.045     | 0.049 | 0.053 |
| e   | 0.65 BSC    |      |      | 0.026 BSC |       |       |
| L   | 0.10        | 0.20 | 0.30 | 0.004     | 0.008 | 0.012 |
| HE  | 2.00        | 2.10 | 2.20 | 0.078     | 0.082 | 0.086 |

#### STYLE 26:

- PIN 1. SOURCE 1  
2. GATE 1  
3. DRAIN 2  
4. SOURCE 2  
5. GATE 2  
6. DRAIN 1

### SOLDERING FOOTPRINT\*



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

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