

# NTJS4160N

## Power MOSFET

30 V, 3.2 A, Single N-Channel, SC-88

### Features

- Offers an Low  $R_{DS(on)}$  Solution in the SC-88 Package
- Low Profile (< 1.1 mm) Allows it to fit Easily into Extremely Thin Environments such as Portable Electronics
- Operates at Standard Logic Level Gate Drive
- Low Gate Charge
- This is a Pb-Free Device

### Applications

- DC-DC Converters (Buck and Boost Circuit)
- Optimized for Battery Powered Portable Equipment such as, Cell Phones, PDAs, Media Players, etc.
- Load Management
- Battery Charging and OV IC Protection Circuits

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

| Parameter                                                         |                               | Symbol         | Value                    | Unit             |
|-------------------------------------------------------------------|-------------------------------|----------------|--------------------------|------------------|
| Drain-to-Source Voltage                                           |                               | $V_{DS}$       | 30                       | V                |
| Gate-to-Source Voltage                                            |                               | $V_{GS}$       | $\pm 20$                 | V                |
| Continuous Drain Current (Note 1)                                 | Steady State                  | $I_D$          | $T_A = 25^\circ\text{C}$ | A                |
|                                                                   |                               |                | $T_A = 85^\circ\text{C}$ |                  |
|                                                                   | $t \leq 1\text{ s}$           |                | $T_A = 25^\circ\text{C}$ |                  |
| Power Dissipation (Note 1)                                        | Steady State                  | $P_D$          | $T_A = 25^\circ\text{C}$ | W                |
|                                                                   | $t \leq 1\text{ s}$           |                |                          |                  |
| Continuous Drain Current (Note 2)                                 | Steady State                  | $I_D$          | $T_A = 25^\circ\text{C}$ | A                |
|                                                                   |                               |                | $T_A = 85^\circ\text{C}$ |                  |
| Power Dissipation (Note 2)                                        | Steady State                  | $P_D$          | $T_A = 25^\circ\text{C}$ | W                |
| Pulsed Drain Current                                              | $t_p = 10\text{ }\mu\text{s}$ | $I_{DM}$       | 10                       | A                |
| Operating Junction and Storage Temperature                        |                               | $T_J, T_{STG}$ | -55 to 150               | $^\circ\text{C}$ |
| Source Current (Body Diode)                                       |                               | $I_S$          | 1.3                      | A                |
| Lead Temperature for Soldering Purposes (1/8" from case for 10 s) |                               | $T_L$          | 260                      | $^\circ\text{C}$ |

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

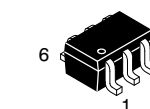


ON Semiconductor®

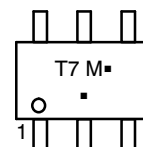
<http://onsemi.com>

| $V_{(BR)DS}$ | $R_{DS(on)}$ TYP      | $I_D$ Max |
|--------------|-----------------------|-----------|
| 30 V         | 45 m $\Omega$ @ 10 V  | 3.2 A     |
|              | 65 m $\Omega$ @ 4.5 V |           |

### MARKING DIAGRAM

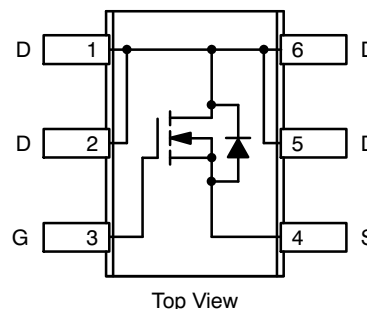


SC-88 (SOT 363)  
CASE 419B  
STYLE 28



T7 = Device Code  
M = Date Code  
▪ = Pb-Free Package  
(Note: Microdot may be in either location)

### SC-88 (SOT-363)



### ORDERING INFORMATION

| Device       | Package            | Shipping†       |
|--------------|--------------------|-----------------|
| NTJS4160NT1G | SC-88<br>(Pb-Free) | 3000 Units/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.

# NTJS4160N

## THERMAL RESISTANCE RATINGS

| Parameter                                   | Symbol          | Max | Unit |
|---------------------------------------------|-----------------|-----|------|
| Junction-to-Ambient – Steady State (Note 3) | $R_{\theta JA}$ | 200 | °C/W |
| Junction-to-Ambient – $t \leq 1$ s (Note 3) | $R_{\theta JA}$ | 132 |      |
| Junction-to-Ambient – Steady State (Note 4) | $R_{\theta JA}$ | 420 |      |

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

4. Surface mounted on FR4 board using the minimum recommended pad size.

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

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

### OFF CHARACTERISTICS

|                                                           |                   |                                                            |                           |    |      |               |
|-----------------------------------------------------------|-------------------|------------------------------------------------------------|---------------------------|----|------|---------------|
| Drain-to-Source Breakdown Voltage                         | $V_{(BR)DSS}$     | $V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$        | 30                        |    |      | V             |
| Drain-to-Source Breakdown Voltage Temperature Coefficient | $V_{(BR)DSS}/T_J$ | $I_D = 250\text{ }\mu\text{A}$ , ref to $25^\circ\text{C}$ |                           | 20 |      | mV/°C         |
| Zero Gate Voltage Drain Current                           | $I_{DSS}$         | $V_{GS} = 0\text{ V}, V_{DS} = 24\text{ V}$                | $T_J = 25^\circ\text{C}$  |    | 1.0  | $\mu\text{A}$ |
|                                                           |                   |                                                            | $T_J = 125^\circ\text{C}$ |    | 10   |               |
| Gate-to-Source Leakage Current                            | $I_{GSS}$         | $V_{DS} = 0\text{ V}, V_{GS} = +20\text{ V}$               |                           |    | 100  | nA            |
|                                                           |                   | $V_{DS} = 0\text{ V}, V_{GS} = -20\text{ V}$               |                           |    | -200 |               |

### ON CHARACTERISTICS (Note 5)

|                                        |                  |                                                 |     |      |     |            |
|----------------------------------------|------------------|-------------------------------------------------|-----|------|-----|------------|
| Gate Threshold Voltage                 | $V_{GS(TH)}$     | $V_{GS} = V_{DS}, I_D = 250\text{ }\mu\text{A}$ | 0.8 |      | 2.4 | V          |
| Gate Threshold Temperature Coefficient | $V_{GS(TH)}/T_J$ |                                                 |     | -5.0 |     | mV/°C      |
| Drain-to-Source On Resistance          | $R_{DS(on)}$     | $V_{GS} = 10\text{ V}, I_D = 2.6\text{ A}$      |     | 45   | 60  | m $\Omega$ |
|                                        |                  | $V_{GS} = 4.5\text{ V}, I_D = 2.2\text{ A}$     |     | 65   | 85  |            |
| Forward Transconductance               | $g_{FS}$         | $V_{GS} = 5.0\text{ V}, I_D = 3.0\text{ A}$     |     | 4.2  |     | S          |

### CHARGES AND CAPACITANCES

|                              |              |                                                                   |  |      |  |    |
|------------------------------|--------------|-------------------------------------------------------------------|--|------|--|----|
| Input Capacitance            | $C_{ISS}$    | $V_{GS} = 0\text{ V}, f = 1.0\text{ MHz}, V_{DS} = 10\text{ V}$   |  | 230  |  | pF |
| Output Capacitance           | $C_{OSS}$    |                                                                   |  | 62   |  |    |
| Reverse Transfer Capacitance | $C_{RSS}$    |                                                                   |  | 39   |  |    |
| Total Gate Charge            | $Q_{G(TOT)}$ | $V_{GS} = 4.5\text{ V}, V_{DS} = 15\text{ V}, I_D = 2.6\text{ A}$ |  | 2.75 |  | nC |
| Threshold Gate Charge        | $Q_{G(TH)}$  |                                                                   |  | 0.37 |  |    |
| Gate-to-Source Charge        | $Q_{GS}$     |                                                                   |  | 0.87 |  |    |
| Gate-to-Drain Charge         | $Q_{GD}$     |                                                                   |  | 1.1  |  |    |

### SWITCHING CHARACTERISTICS (Note 6)

|                     |              |                                                                                            |  |      |     |    |
|---------------------|--------------|--------------------------------------------------------------------------------------------|--|------|-----|----|
| Turn-On Delay Time  | $t_{d(ON)}$  | $V_{GS} = 4.5\text{ V}, V_{DD} = 15\text{ V}, I_D = 1.0\text{ A}, R_G = 6.0\text{ }\Omega$ |  | 8.7  | 15  | ns |
| Rise Time           | $t_r$        |                                                                                            |  | 7.2  | 13  |    |
| Turn-Off Delay Time | $t_{d(OFF)}$ |                                                                                            |  | 10.9 | 19  |    |
| Fall Time           | $t_f$        |                                                                                            |  | 1.9  | 4.0 |    |

### DRAIN-SOURCE DIODE CHARACTERISTICS

|                         |          |                                                                               |                           |  |      |     |    |
|-------------------------|----------|-------------------------------------------------------------------------------|---------------------------|--|------|-----|----|
| Forward Diode Voltage   | $V_{SD}$ | $V_{GS} = 0\text{ V}, I_S = 1.3\text{ A}$                                     | $T_J = 25^\circ\text{C}$  |  | 0.79 | 1.2 | V  |
|                         |          |                                                                               | $T_J = 125^\circ\text{C}$ |  | 0.67 |     |    |
| Reverse Recovery Time   | $t_{RR}$ | $V_{GS} = 0\text{ V}, dI_S/dt = 100\text{ A}/\mu\text{s}, I_S = 1.3\text{ A}$ |                           |  | 10.3 |     | ns |
| Charge Time             | $T_a$    |                                                                               |                           |  | 7.2  |     |    |
| Discharge Time          | $T_b$    |                                                                               |                           |  | 3.1  |     |    |
| Reverse Recovery Charge | $Q_{RR}$ |                                                                               |                           |  | 4.0  |     | nC |

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

6. Switching characteristics are independent of operating junction temperatures.

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

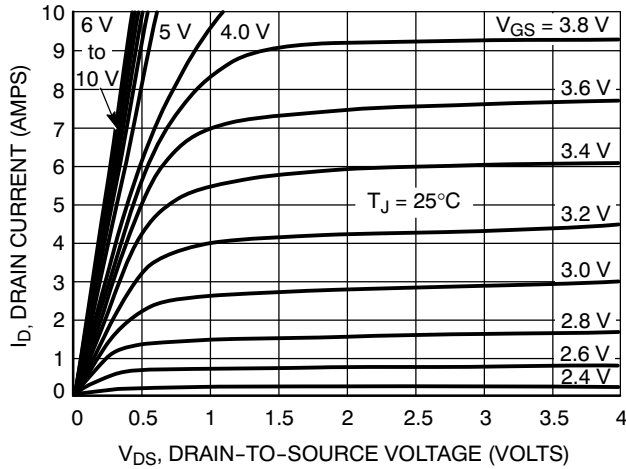


Figure 1. On-Region Characteristics

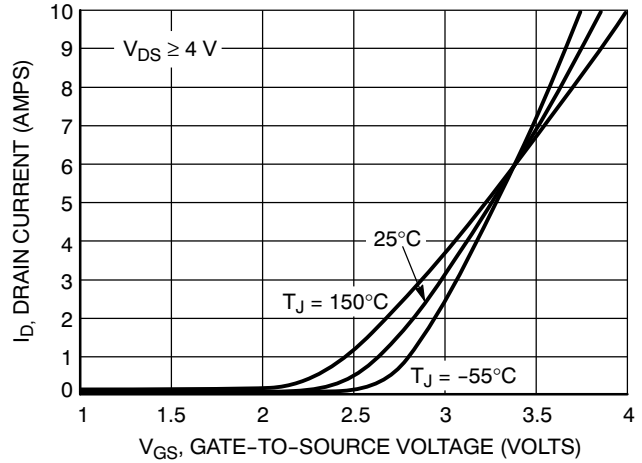


Figure 2. Transfer Characteristics

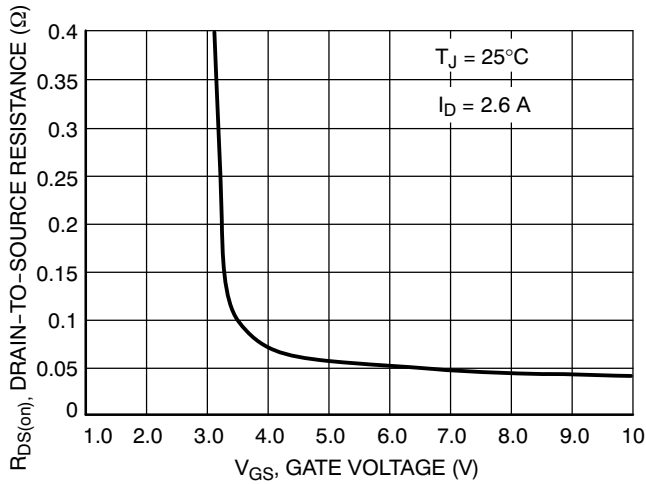


Figure 3. On-Resistance vs. Gate Voltage

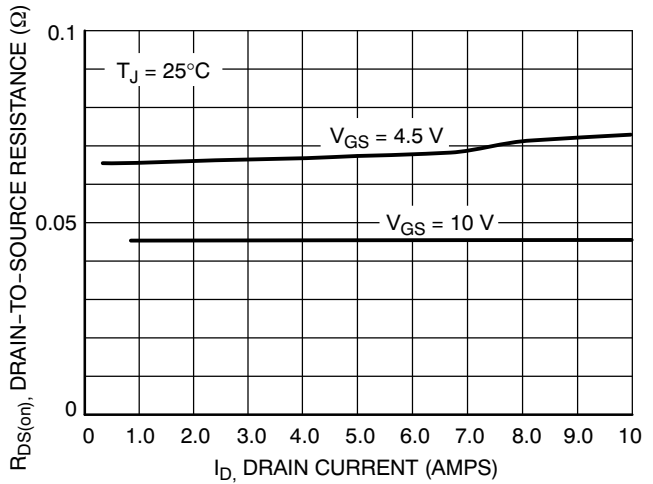


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

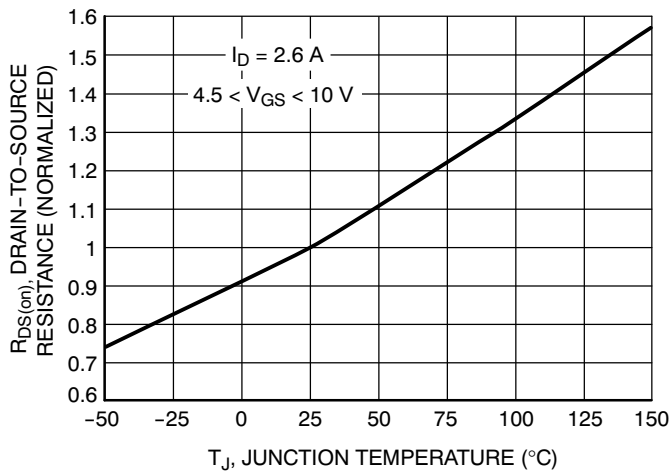


Figure 5. On-Resistance Variation with Temperature

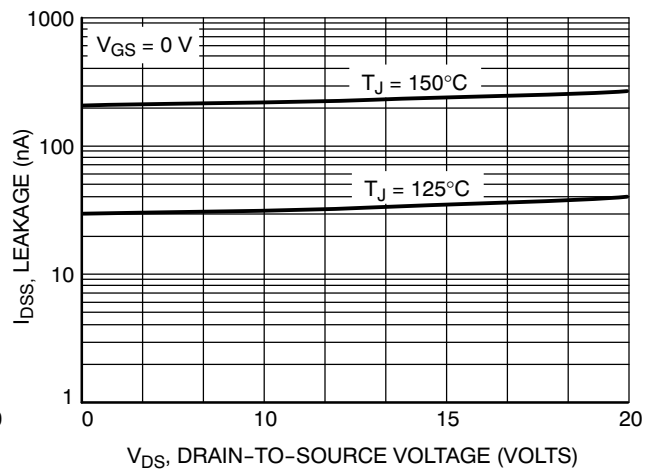


Figure 6. Drain-to-Source Leakage Current vs. Voltage

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

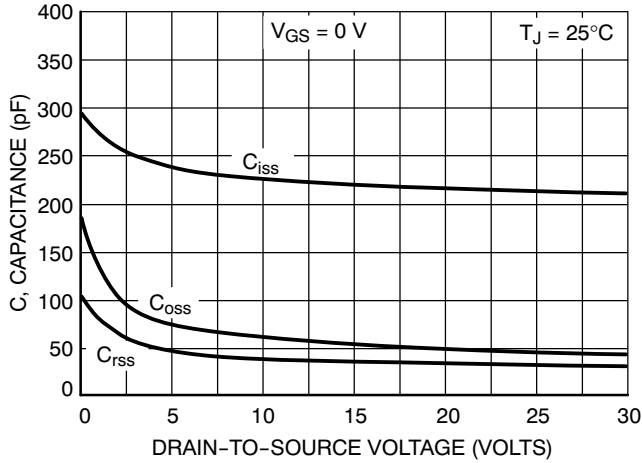


Figure 7. Capacitance Variation

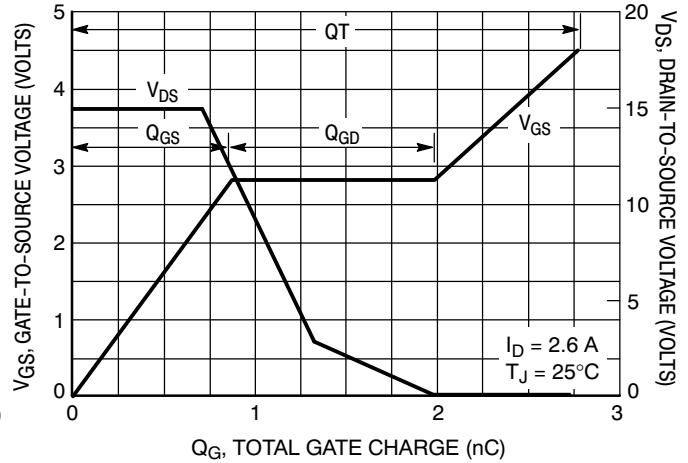


Figure 8. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

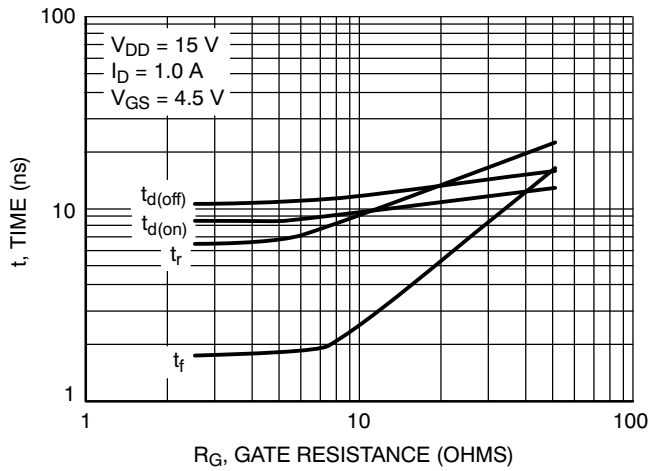


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

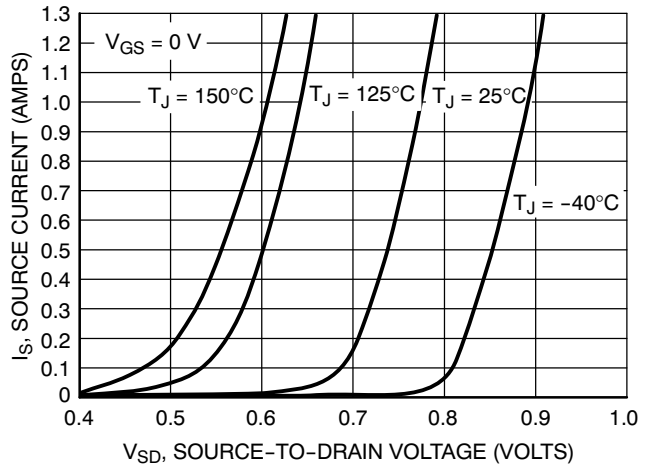
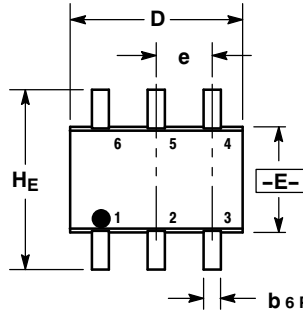


Figure 10. Diode Forward Voltage vs. Current

# NTJS4160N

## PACKAGE DIMENSIONS

SC-88 (SOT-363)  
CASE 419B-02  
ISSUE W



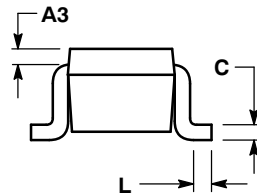
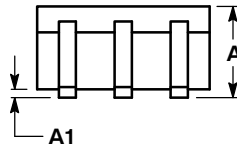
STYLE 28:  
PIN 1. DRAIN  
2. DRAIN  
3. GATE  
4. SOURCE  
5. DRAIN  
6. DRAIN

⊕ 0.2 (0.008) M E M

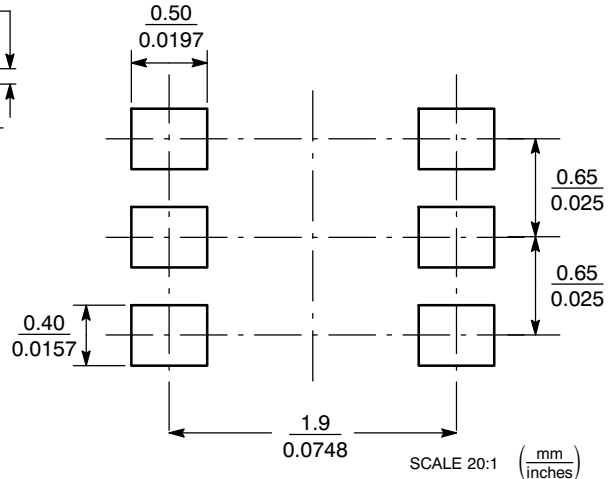
### NOTES:

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 |



### 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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