# NTA4153N, NTE4153N

# Small Signal MOSFET

## 20 V, 915 mA, Single N−Channel with ESD Protection, SC−75 and SC−89

### Features

- Low $R_{DS(on)}$ Improving System Efficiency
- Low Threshold Voltage, 1.5 V Rated
- ESD Protected Gate
- Pb−Free Packages are Available

### Applications

- Load/Power Switches
- Power Supply Converter Circuits
- Battery Management
- Portables like Cell Phones, PDAs, Digital Cameras, Pagers, etc.

**MAXIMUM RATINGS** ($T_J$ = 25°C unless otherwise stated)

| Parameter | | | Symbol | Value | Units |
|---|---|---|---|---|---|
| Drain−to−Source Voltage | | | $V_{DSS}$ | 20 | V |
| Gate−to−Source Voltage | | | $V_{GS}$ | ±6.0 | V |
| Continuous Drain Current (Note 1) | Steady State | $T_A$ = 25°C | $I_D$ | 915 | mA |
| | | $T_A$ = 85°C | | 660 | |
| Power Dissipation (Note 1) | Steady State | | $P_D$ | 300 | mW |
| Pulsed Drain Current | $t_p$ =10 μs | | $I_{DM}$ | 1.3 | A |
| Operating Junction and Storage Temperature | | | $T_J$, $T_{STG}$ | −55 to 150 | °C |
| Continuous Source Current (Body Diode) | | | $I_S$ | 280 | mA |
| Lead Temperature for Soldering Purposes (1/8" from case for 10 s) | | | $T_L$ | 260 | °C |

**THERMAL RESISTANCE RATINGS**

| Parameter | Symbol | Value | Units |
|---|---|---|---|
| Junction−to−Ambient − Steady State (Note 1) | $R_{\theta JA}$ | | °C/W |
| SC−75 / SOT−416 | | 416 | |
| SC−89 | | 400 | |

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 [1 oz] including traces).

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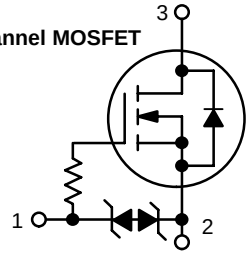
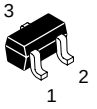
| $V_{(BR)DSS}$ | $R_{DS(on)}$ TYP | $I_D$ MAX |
|---|---|---|
| 20 V | 0.127 Ω @ 4.5 V | 915 mA |
| | 0.170 Ω @ 2.5 V | |
| | 0.242 Ω @ 1.8 V | |
| | 0.500 Ω @ 1.5 V | |

**N−Channel MOSFET**

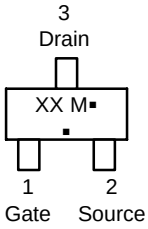



**MARKING DIAGRAM & PIN ASSIGNMENT**




**SC−75 / SOT−416**
**CASE 463**
**STYLE 5**

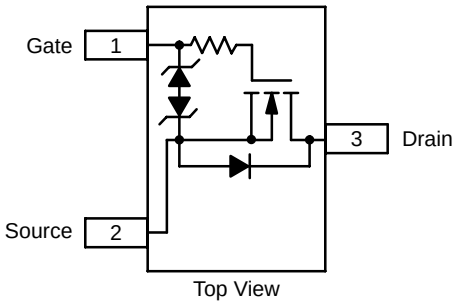

**SC−89**
**CASE 463C**




XX = Device Code
M = Date Code*
▪ = Pb−Free Package
(Note: Microdot may be in either location)

*Date Code orientation may vary depending upon manufacturing location.

**SC−75, SC−89**




**ORDERING INFORMATION**

See detailed ordering and shipping information in the package dimensions section on page 2 of this data sheet.

**ELECTRICAL CHARACTERISTICS** ($T_J$ = 25°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 V, $I_D$ = 250 μA | | 20 | 26 | | V |
| Drain−to−Source Breakdown Voltage Temperature Coefficient | $V_{(BR)DSS}/T_J$ | | | | 18.4 | | mV/°C |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{GS}$ = 0 V, $V_{DS}$ = 16 V | | | | 100 | nA |
| Gate−to−Source Leakage Current | $I_{GSS}$ | $V_{DS}$ = 0 V, $V_{GS}$ = ±4.5 V | | | | ±1.0 | μA |
| **ON CHARACTERISTICS** (Note 2) | | | | | | | |
| Gate Threshold Voltage | $V_{GS(TH)}$ | $V_{GS}$ = $V_{DS}$, $I_D$ = 250 μA | | 0.45 | 0.76 | 1.1 | V |
| Negative Threshold Temperature Coefficient | $V_{GS(TH)}/T_J$ | | | | −2.15 | | mV/°C |
| Drain−to−Source On Resistance | $R_{DS(on)}$ | $V_{GS}$ = 4.5 V, $I_D$ = 600 mA | | | 127 | 230 | mΩ |
| | | $V_{GS}$ = 2.5 V, $I_D$ = 500 mA | | | 170 | 275 | |
| | | $V_{GS}$ = 1.8 V, $I_D$ = 350 mA | | | 242 | 700 | |
| | | $V_{GS}$ = 1.5 V, $I_D$ = 40 mA | | | 500 | 9500 | |
| Forward Transconductance | $g_{FS}$ | $V_{DS}$ = 10 V, $I_D$ = 400 mA | | | 1.4 | | S |
| **CHARGES AND CAPACITANCES** | | | | | | | |
| Input Capacitance | $C_{ISS}$ | $V_{GS}$ = 0 V, f = 1.0 MHz, $V_{DS}$ = 16 V | | | 110 | | pF |
| Output Capacitance | $C_{OSS}$ | | | | 16 | | |
| Reverse Transfer Capacitance | $C_{RSS}$ | | | | 12 | | |
| Total Gate Charge | $Q_{G(TOT)}$ | $V_{GS}$ = 4.5 V, $V_{DS}$ = 10 V, $I_D$ = 0.2 A | | | 1.82 | | nC |
| Threshold Gate Charge | $Q_{G(TH)}$ | | | | 0.2 | | |
| Gate−to−Source Charge | $Q_{GS}$ | | | | 0.3 | | |
| Gate−to−Drain Charge | $Q_{GD}$ | | | | 0.42 | | |
| **SWITCHING CHARACTERISTICS** (Note 3) | | | | | | | |
| Turn−On Delay Time | $t_{d(ON)}$ | $V_{GS}$ = 4.5 V, $V_{DD}$ = 10 V, $I_D$ = 0.2 A, $R_G$ = 10 Ω | | | 3.7 | | ns |
| Rise Time | $t_r$ | | | | 4.4 | | |
| Turn−Off Delay Time | $t_{d(OFF)}$ | | | | 25 | | |
| Fall Time | $t_f$ | | | | 7.6 | | |
| **DRAIN−SOURCE DIODE CHARACTERISTICS** | | | | | | | |
| Forward Diode Voltage | $V_{SD}$ | $V_{GS}$ = 0 V, $I_S$ = 200 mA | $T_J$ = 25°C | | 0.67 | 1.1 | V |
| | | | $T_J$ = 125°C | | 0.54 | | |

2. Pulse Test: pulse width ≤ 300μs, duty cycle ≤ 2%.
3. Switching characteristics are independent of operating junction temperatures.

**ORDERING INFORMATION**

| Device | Marking (XX) | Package | Shipping† |
|---|---|---|---|
| NTA4153NT1 | TR | SC−75 / SOT−416 | 3000/Tape & Reel |
| NTA4153NT1G | TR | SC−75 / SOT−416 (Pb−Free) | 3000/Tape & Reel |
| NTE4153NT1G | TP | SC−89 (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.

## TYPICAL ELECTRICAL CHARACTERISTICS

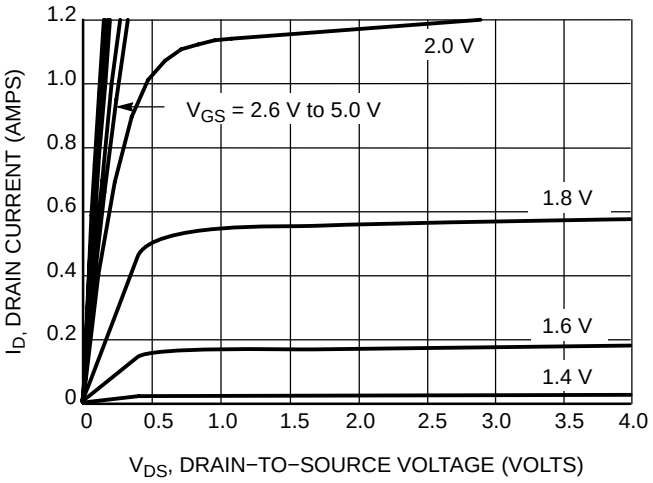



**Figure 1. On−Region Characteristics**

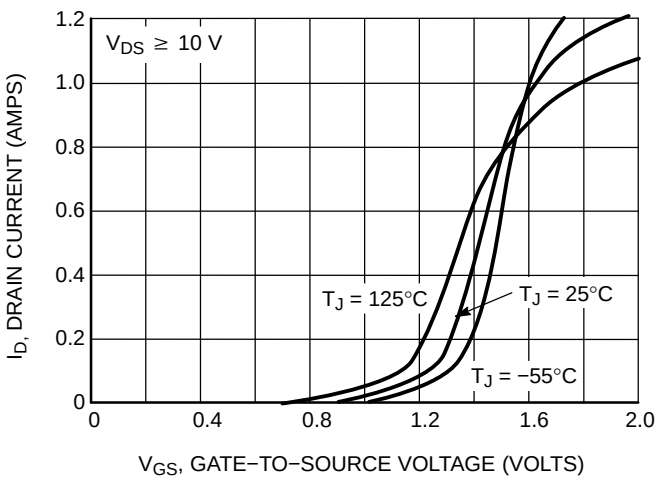



**Figure 2. Transfer Characteristics**

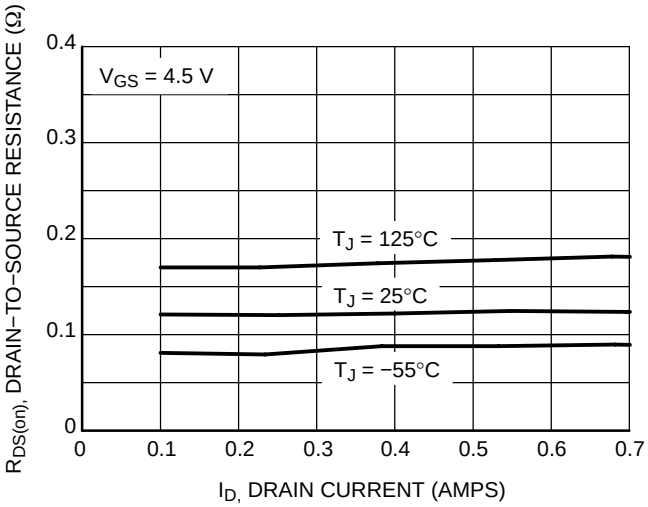



**Figure 3. On−Resistance vs. Drain Current and Temperature**

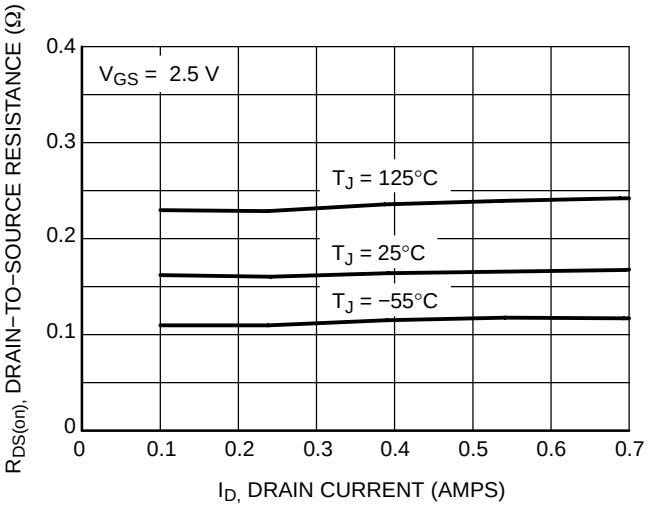



**Figure 4. On−Resistance vs. Drain Current and Temperature**

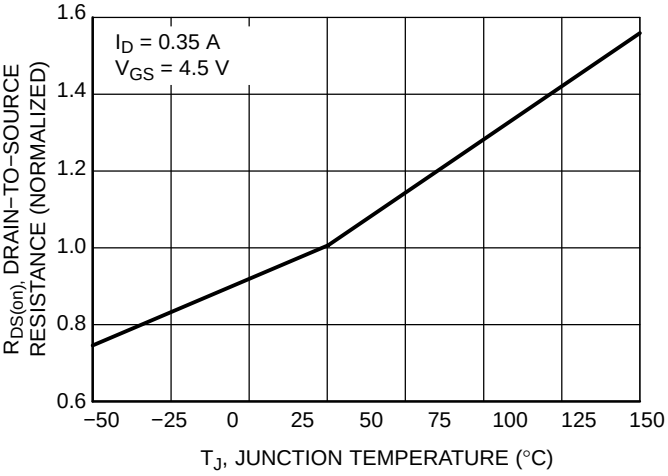



**Figure 5. On−Resistance Variation with Temperature**

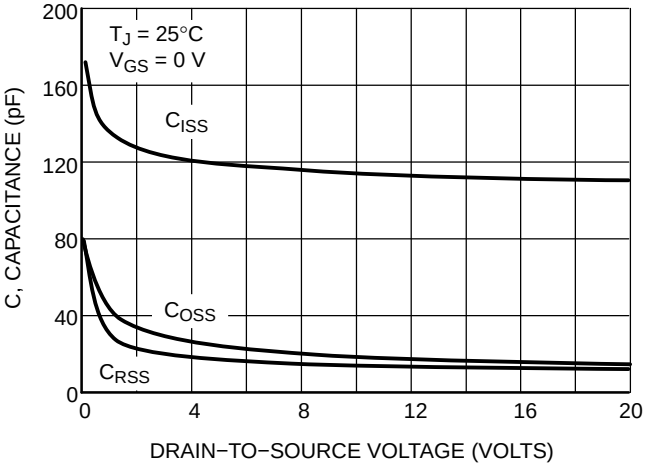



**Figure 6. Capacitance Variation**

## TYPICAL ELECTRICAL CHARACTERISTICS

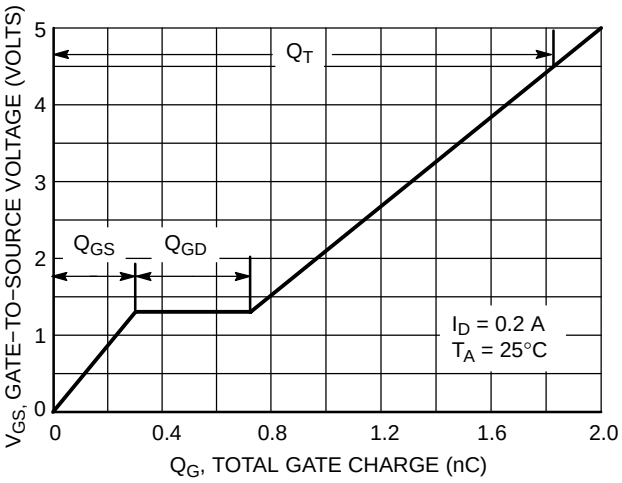



**Figure 7. Gate−to−Source Voltage vs. Total Gate Charge**

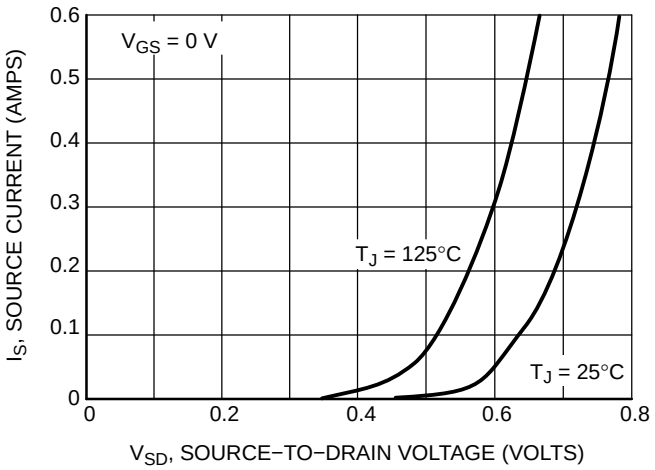



**Figure 8. Diode Forward Voltage vs. Current**

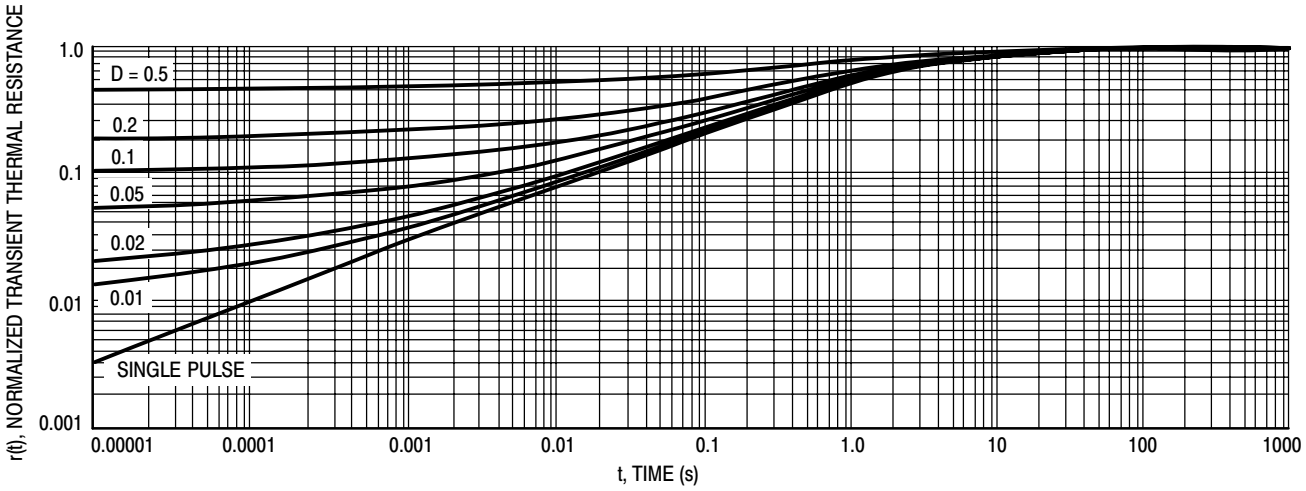
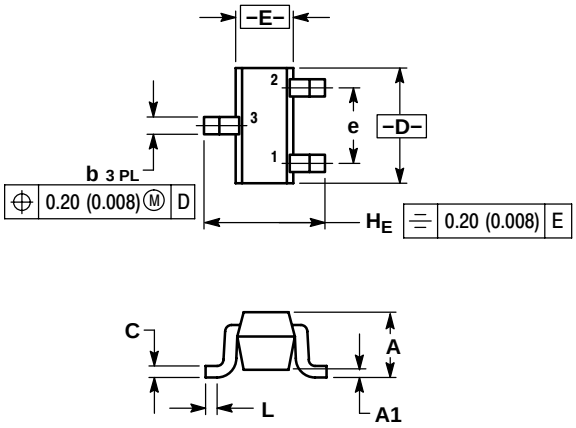



**Figure 9. Normalized Thermal Response**

## PACKAGE DIMENSIONS

**SC−75/SOT−416**
CASE 463−01
ISSUE F

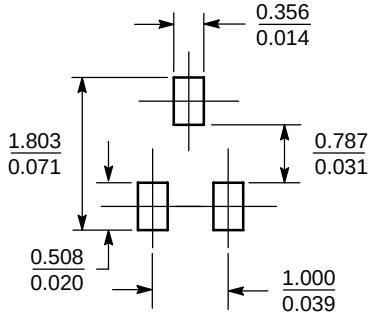



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.

| | MILLIMETERS | | | INCHES | | |
|---|---|---|---|---|---|---|
| DIM | MIN | NOM | MAX | MIN | NOM | MAX |
| A | 0.70 | 0.80 | 0.90 | 0.027 | 0.031 | 0.035 |
| A1 | 0.00 | 0.05 | 0.10 | 0.000 | 0.002 | 0.004 |
| b | 0.15 | 0.20 | 0.30 | 0.006 | 0.008 | 0.012 |
| C | 0.10 | 0.15 | 0.25 | 0.004 | 0.006 | 0.010 |
| D | 1.55 | 1.60 | 1.65 | 0.059 | 0.063 | 0.067 |
| E | 0.70 | 0.80 | 0.90 | 0.027 | 0.031 | 0.035 |
| e | 1.00 BSC | | | 0.04 BSC | | |
| L | 0.10 | 0.15 | 0.20 | 0.004 | 0.006 | 0.008 |
| $H_E$ | 1.50 | 1.60 | 1.70 | 0.061 | 0.063 | 0.065 |

STYLE 5:
PIN 1. GATE
2. SOURCE
3. DRAIN

### SOLDERING FOOTPRINT*

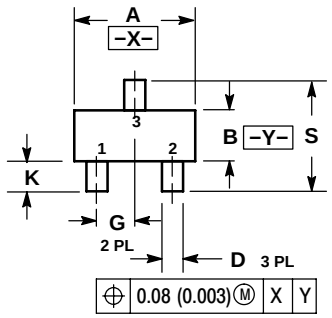


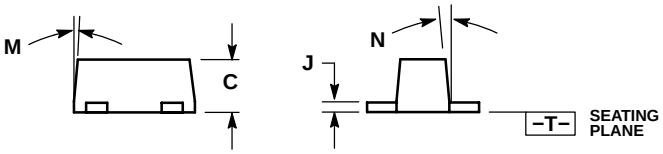

SCALE 10:1 $\left(\frac{\text{mm}}{\text{inches}}\right)$

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

## PACKAGE DIMENSIONS

**SC−89**
CASE 463C−03
ISSUE C

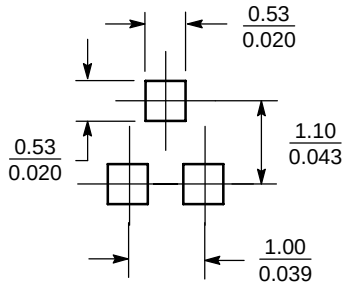



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETERS
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. 463C−01 OBSOLETE, NEW STANDARD 463C−02.

| | MILLIMETERS | | | INCHES | | |
|---|---|---|---|---|---|---|
| DIM | MIN | NOM | MAX | MIN | NOM | MAX |
| A | 1.50 | 1.60 | 1.70 | 0.059 | 0.063 | 0.067 |
| B | 0.75 | 0.85 | 0.95 | 0.030 | 0.034 | 0.040 |
| C | 0.60 | 0.70 | 0.80 | 0.024 | 0.028 | 0.031 |
| D | 0.23 | 0.28 | 0.33 | 0.009 | 0.011 | 0.013 |
| G | | 0.50 BSC | | | 0.020 BSC | |
| H | | 0.53 REF | | | 0.021 REF | |
| J | 0.10 | 0.15 | 0.20 | 0.004 | 0.006 | 0.008 |
| K | 0.30 | 0.40 | 0.50 | 0.012 | 0.016 | 0.020 |
| L | | 1.10 REF | | | 0.043 REF | |
| M | −−− | −−− | 10 ° | −−− | −−− | 10 ° |
| N | −−− | −−− | 10 ° | −−− | −−− | 10 ° |
| S | 1.50 | 1.60 | 1.70 | 0.059 | 0.063 | 0.067 |

### SOLDERING FOOTPRINT*




SCALE 10:1 $\left(\frac{\text{mm}}{\text{inches}}\right)$

*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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