

# NMLU1210

## Full Bridge Rectifier

Dual 20 V N-Channel with dual 3.2 A Schottky Barrier Diode, 4.0 x 4.0 mm  $\mu$ Cool™ Package

### Features

- Full-Bridge Rectifier Block
- Up to 3.2 A operation
- Low  $R_{DS(on)}$  MOSFET to minimize conduction loss
- Low gate charge MOSFET
- Low VF Schottky diode
- Ultra Low Inductance Package
- This Device uses Halogen-Free Molding Compound
- These are Pb-Free Devices

### Applications

- Wireless Charging
- AC-DC Rectification
- Optimized for Power Management Applications for Portable Products, such as Cell Phones, PMP, DSC, GPS, and others

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

| Parameter                                                         | Symbol         | Value                             | Unit             |
|-------------------------------------------------------------------|----------------|-----------------------------------|------------------|
| Input voltage between two MOSFET drain                            | $V_{LL}$       | 20                                | V                |
| Bridge Operating Junction and Storage Temperature                 | $T_J, T_{STG}$ | -55 to 125                        | $^\circ\text{C}$ |
| Lead Temperature for Soldering Purposes (1/8" from case for 10 s) | $T_L$          | 260                               | $^\circ\text{C}$ |
| Continuous Drain Current<br>$R_{JA}$ (Note 1)                     | $I_O$          | $T_A = 25^\circ\text{C}$<br>2.2   | A                |
|                                                                   |                | $T_A = 85^\circ\text{C}$<br>1.16  |                  |
| Power Dissipation<br>$R_{JA}$ (Note 1)                            | $P_D$          | $T_A = 25^\circ\text{C}$<br>1.2   | W                |
|                                                                   |                | $T_A = 85^\circ\text{C}$<br>0.47  |                  |
| Continuous Drain Current<br>$R_{JA} t < 5$ s (Note 1)             | $I_O$          | $T_A = 25^\circ\text{C}$<br>3.2   | A                |
|                                                                   |                | $T_A = 85^\circ\text{C}$<br>1.88  |                  |
| Power Dissipation<br>$R_{JA} t < 5$ s (Note 1)                    | $P_D$          | $T_A = 25^\circ\text{C}$<br>2.34  | W                |
|                                                                   |                | $T_A = 85^\circ\text{C}$<br>0.94  |                  |
| Continuous Drain Current<br>$R_{JA}$ (Note 2)                     | $I_O$          | $T_A = 25^\circ\text{C}$<br>1.16  | A                |
|                                                                   |                | $T_A = 85^\circ\text{C}$<br>0.6   |                  |
| Power Dissipation<br>$R_{JA}$ (Note 2)                            | $P_D$          | $T_A = 25^\circ\text{C}$<br>0.47  | W                |
|                                                                   |                | $T_A = 85^\circ\text{C}$<br>0.185 |                  |

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 of 30 mm<sup>2</sup>, 2 oz. Cu.



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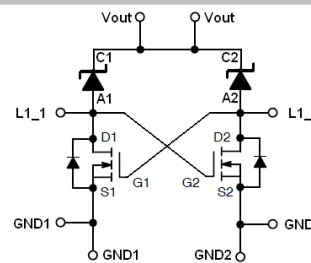
<http://onsemi.com>

### MOSFET

| $V_{(BR)DSS}$ | $R_{DS(on)}$ TYP      | $I_D$ MAX |
|---------------|-----------------------|-----------|
| 20 V          | 23 m $\Omega$ @ 4.5 V | 3.2 A     |
|               | 17 m $\Omega$ @ 10 V  |           |

### SCHOTTKY DIODE

| $V_R$ MAX | $V_F$ TYP | $I_F$ MAX |
|-----------|-----------|-----------|
| 20 V      | 0.45 V    | 3.2 A     |



### RECTIFIER

4.0 4.0 mm  $\mu$ Cool Pin Connections  
(Top View)

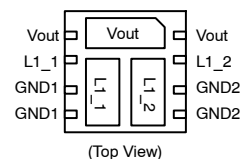
### MARKING DIAGRAM



1210 = Specific Device Code  
A = Assembly Location  
Y = Year  
WW = Work Week  
▪ = Pb-Free Package

(\*Note: Microdot may be in either location)

### PIN CONNECTIONS



### ORDERING INFORMATION

| Device      | Package        | Shipping†          |
|-------------|----------------|--------------------|
| NMLU1210TWG | UDFN (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.

## THERMAL RESISTANCE RATINGS

| Parameter                                           | Symbol          | Max  | Unit |
|-----------------------------------------------------|-----------------|------|------|
| Junction-to-Ambient – Steady State (Note 3)         | $R_{\theta JA}$ | 82.5 | °C/W |
| Junction-to-Ambient – $t \leq 5$ s (Note 3)         | $R_{\theta JA}$ | 42.5 |      |
| Junction-to-Ambient – Steady State min Pad (Note 4) | $R_{\theta JA}$ | 209  |      |

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 of 30 mm<sup>2</sup>, 2 oz. Cu.

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

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

## ON CHARACTERISTICS

|                                     |             |                                                                                         |  |      |      |    |
|-------------------------------------|-------------|-----------------------------------------------------------------------------------------|--|------|------|----|
| Rectifying Forward Voltage (Note 5) | $V_{fd2}$   | Input voltage $V_{LL} = \pm 5$ V;<br>The output current of Rectifier $I_{out} = 2$ A    |  | 0.45 | .56  | V  |
| Rectifier leakage current           | $I_{leak}$  | Input voltage $V_{LL} = 16$ V;<br>No Load on the Rectifier output                       |  | 31   | 1000 | uA |
| Rectifier Reverse leakage current   | $I_{rleak}$ | Input voltage $V_{LL} = 0$ V;<br>The output voltage of the Rectifier<br>$V_{out} = 5$ V |  | 21   | 1000 | uA |

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

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

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

## ON CHARACTERISTICS

|                                            |                    |                                               |     |     |     |            |
|--------------------------------------------|--------------------|-----------------------------------------------|-----|-----|-----|------------|
| Gate Threshold Voltage                     | $V_{GS(TH)}$       | $V_{GS} = V_{DS}$ , $I_D = 250$ $\mu\text{A}$ | 1.2 |     | 2.2 | V          |
| Negative Threshold Temperature Coefficient | $V_{GS(TH)} / T_J$ |                                               |     | 4   |     | mV/°C      |
| Drain-to-Source On Resistance (Note 6)     | $R_{DS(on)}$       | $V_{GS} = 10$ V, $I_D = 3.2$ A                |     | 17  | 26  | m $\Omega$ |
|                                            |                    | $V_{GS} = 4.5$ V, $I_D = 3.2$ A               |     | 23  | 32  |            |
| Forward Transconductance                   | $g_{FS}$           | $V_{DS} = 10$ V, $I_D = 2.0$ A                |     | 3.5 |     | S          |

## DRAIN-SOURCE DIODE CHARACTERISTICS

|                                |          |                               |                           |  |      |   |
|--------------------------------|----------|-------------------------------|---------------------------|--|------|---|
| Forward Diode Voltage (Note 6) | $V_{SD}$ | $V_{GS} = 0$ V, $I_S = 2.0$ A | $T_J = 25^\circ\text{C}$  |  | 0.79 | V |
|                                |          |                               | $T_J = 125^\circ\text{C}$ |  | 0.65 |   |

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

SCHOTTKY DIODE ELECTRICAL CHARACTERISTICS ( $T_J = 25^\circ\text{C}$  unless otherwise specified)

| Parameter                                      | Symbol | Test Condition | Min | Typ  | Max | Unit |
|------------------------------------------------|--------|----------------|-----|------|-----|------|
| Maximum Instantaneous Forward Voltage (Note 7) | $V_F$  | $I_F = 1.0$ A  |     | 0.36 |     | V    |
|                                                |        | $I_F = 2.0$ A  |     | 0.41 |     |      |
| Maximum Instantaneous Reverse Current          | $I_R$  | $V_R = 20$ V   |     | 0.04 |     | mA   |

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

SCHOTTKY DIODE ELECTRICAL CHARACTERISTICS ( $T_J = 100^\circ\text{C}$  unless otherwise specified)

| Parameter                                      | Symbol | Test Condition | Min | Typ  | Max | Unit |
|------------------------------------------------|--------|----------------|-----|------|-----|------|
| Maximum Instantaneous Forward Voltage (Note 8) | $V_F$  | $I_F = 1.0$ A  |     | 0.29 |     | V    |
|                                                |        | $I_F = 2.0$ A  |     | 0.36 |     |      |
| Maximum Instantaneous Reverse Current          | $I_R$  | $V_R = 20$ V   |     | 4    |     | mA   |

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

9. For detailed MOSFET and Diode parameters, please refer to the ON Semiconductor datasheets of NTTFS4930N and MBR230LSFT1G. The test on each individual die is limited to the system package.

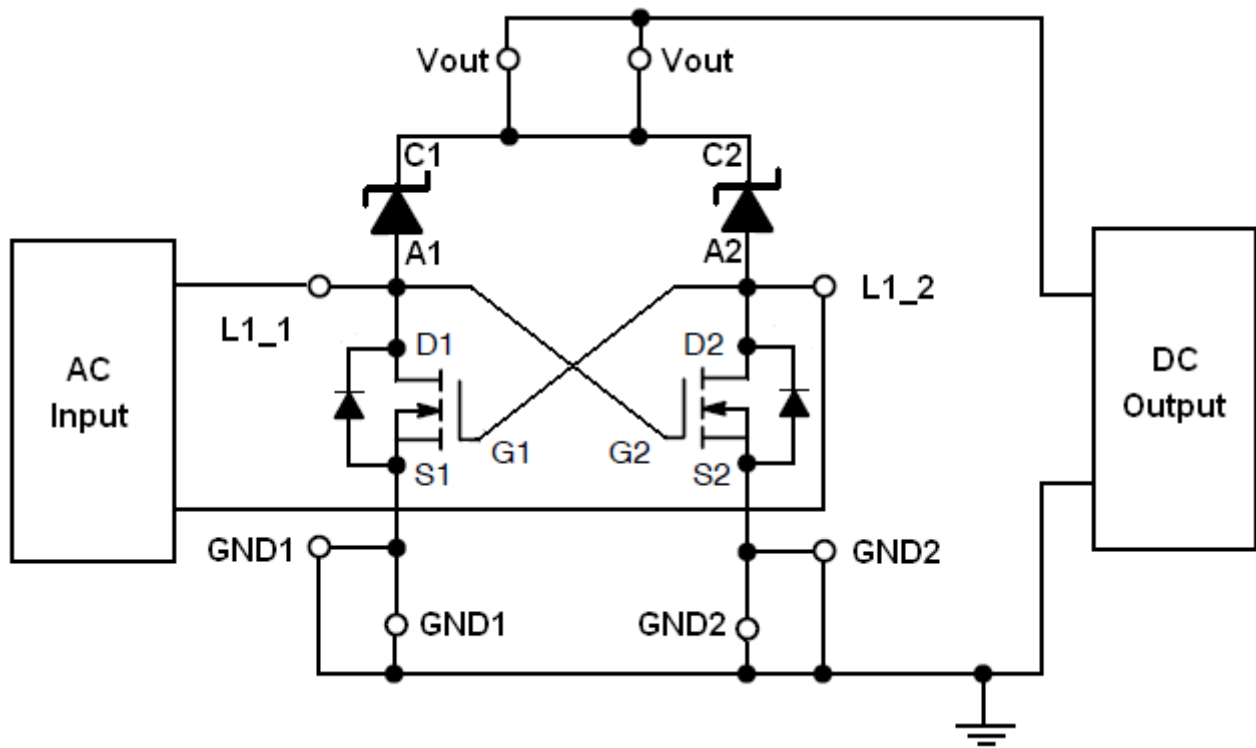
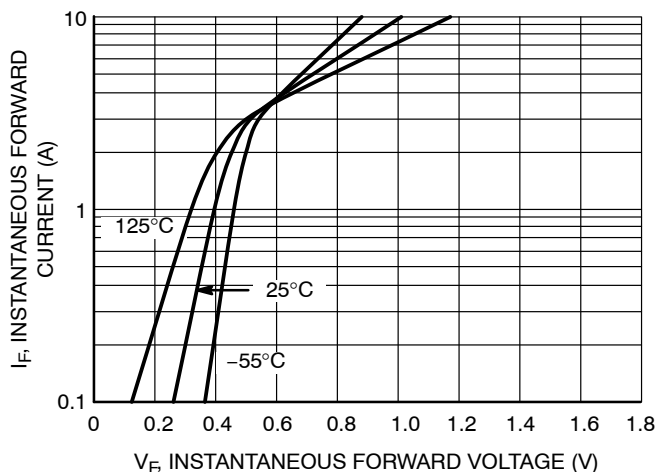


Figure 1. Typical Application Circuit

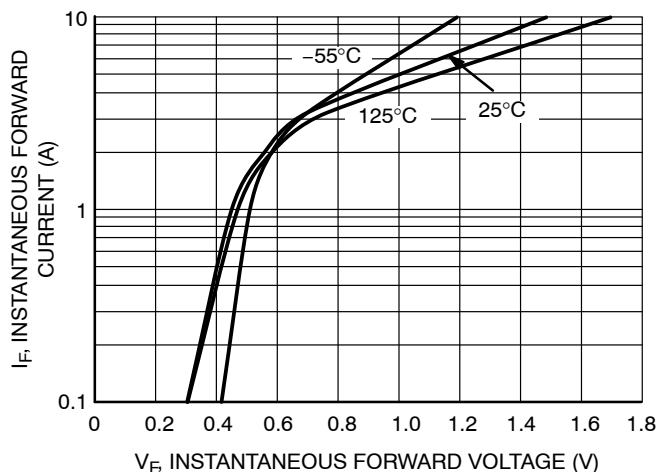
GND1 and GND2 are not internally connected. The user should make the connection in the PCB design.

# TYPICAL PERFORMANCE CURVES

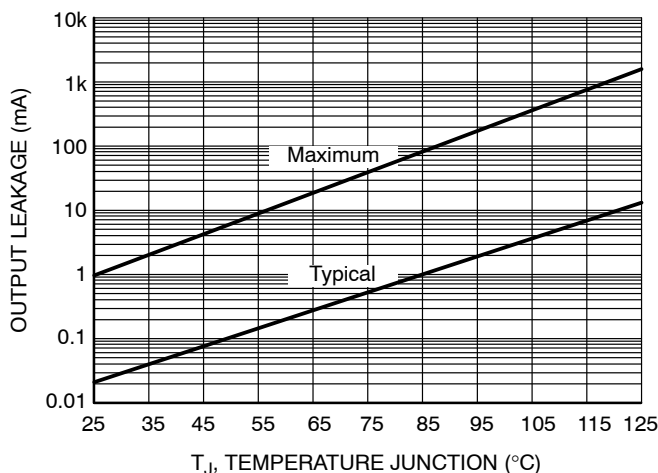
( $T_J = 25^\circ\text{C}$  unless otherwise specified)



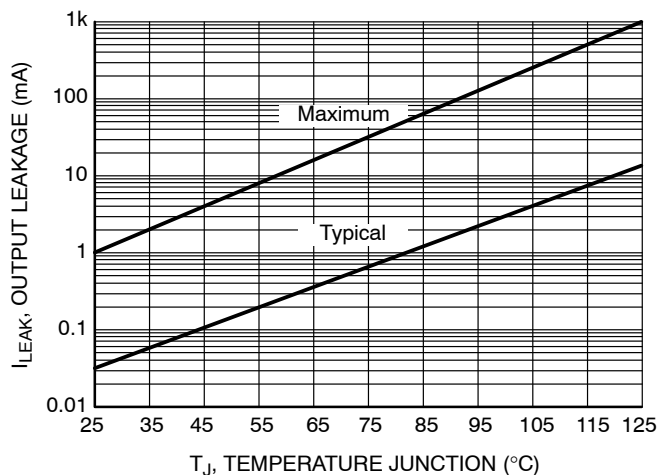
**Figure 2. Bridge Typical Forward Voltage Drop at  $V_{in} \geq 5\text{ V}$**



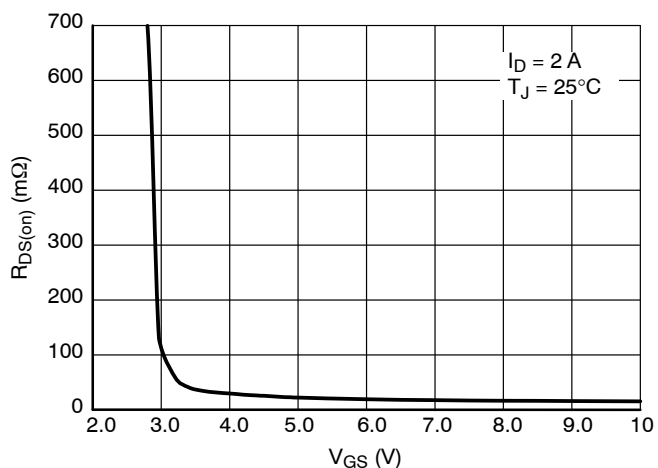
**Figure 3. Bridge Maximum Forward Voltage Drop at  $V_{in} \geq 5\text{ V}$**



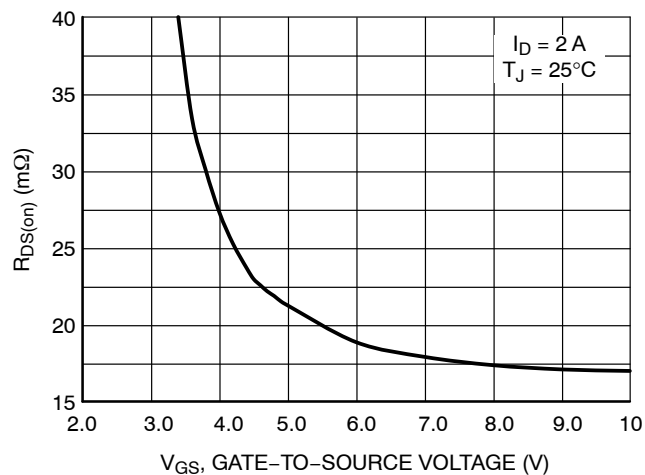
**Figure 4. Output Leakage at 5 V Bias vs. Junction Temperature**



**Figure 5. Input Leakage at 16 V vs. Junction Temperature**



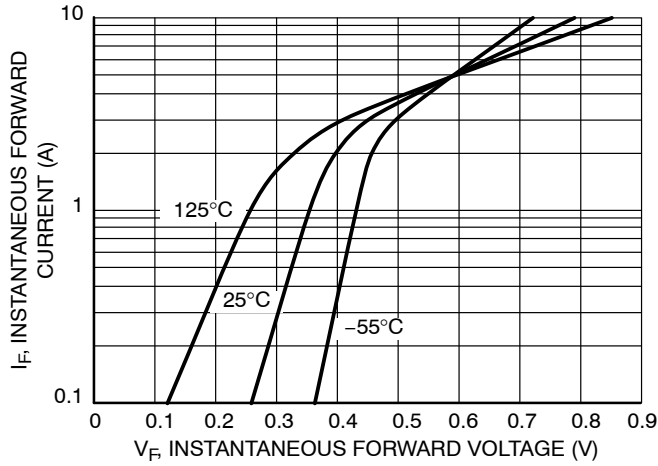
**Figure 6. FET Typical On-Resistance vs. Gate-to-Source Voltage (from 3 V to 10 V)**



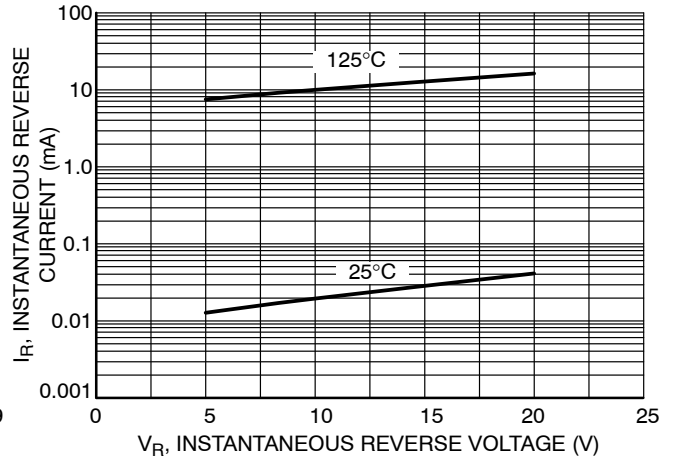
**Figure 7. FET Typical On-Resistance vs. Gate-to-Source Voltage**

**TYPICAL PERFORMANCE CURVES**

( $T_J = 25^\circ\text{C}$  unless otherwise specified)



**Figure 8. Schottky Typical Forward Current vs. Forward Voltage**

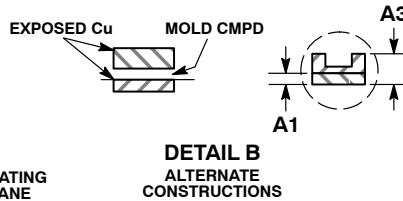
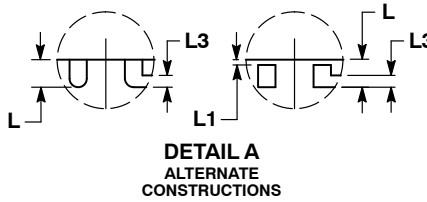
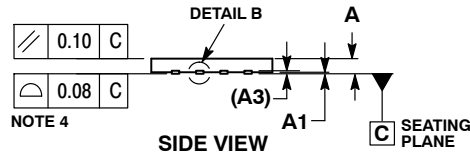
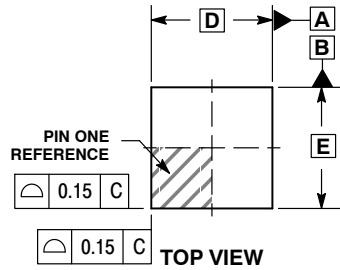


**Figure 9. Schottky Typical Reverse Current vs. Reverse Voltage**

# NMLU1210

## PACKAGE DIMENSIONS

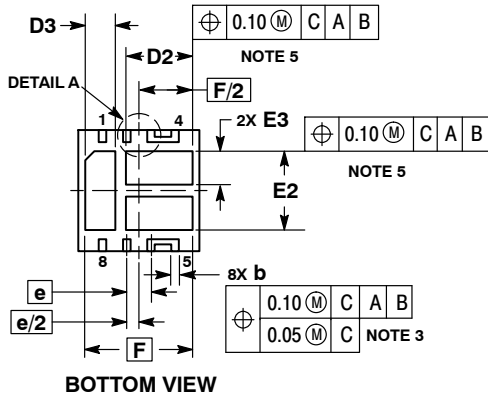
### UDFN8 4x4, 0.8P CASE 517BS ISSUE A



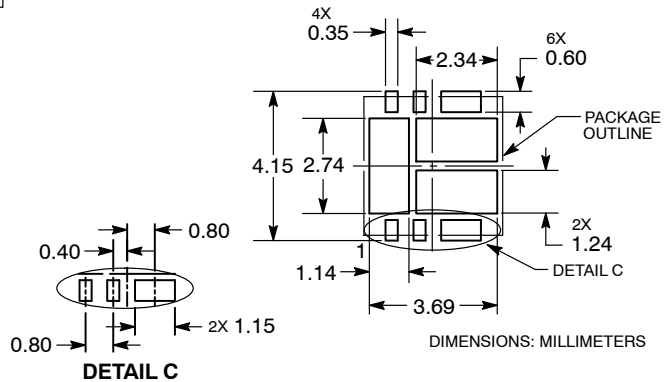
#### NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.25MM FROM TERMINAL TIP.
4. COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.
5. POSITIONAL TOLERANCE APPLIES TO ALL OF THE EXPOSED PADS.

| MILLIMETERS |      |      |
|-------------|------|------|
| DIM         | MIN  | MAX  |
| A           | 0.45 | 0.55 |
| A1          | 0.00 | 0.05 |
| A3          | 0.13 | REF  |
| b           | 0.20 | 0.30 |
| D           | 4.00 | BSC  |
| D2          | 2.10 | 2.30 |
| D3          | 0.90 | 1.10 |
| E           | 4.00 | BSC  |
| E2          | 2.50 | 2.70 |
| E3          | 1.00 | 1.20 |
| e           | 0.80 | BSC  |
| F           | 3.55 | BSC  |
| L           | 0.30 | 0.50 |
| L1          | 0.00 | 0.15 |
| L3          | 0.13 | 0.23 |



### RECOMMENDED 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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