

# NTD5802N

## Power MOSFET

40 V, Single N-Channel, 101 A DPAK

### Features

- Low  $R_{DS(on)}$  to Minimize Conduction Losses
- Low Capacitance to Minimize Driver Losses
- Optimized Gate Charge to Minimize Switching Losses
- MSL 1/260°C
- AEC Q101 Qualified
- 100% Avalanche Tested
- These are Pb-Free Devices

### Applications

- CPU Power Delivery
- DC-DC Converters
- Motor Driver

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

| Parameter  |                      |                       | Symbol                            | Value       | Unit |
|--|----------------------|-----------------------|-----------------------------------|-------------|------|
| Drain-to-Source Voltage  |                      |                       | V <sub>DSS</sub>                  | 40          | V    |
| Gate-to-Source Voltage   |                      |                       | V <sub>GS</sub>                   | ± 20        | V    |
| Continuous Drain Current (R <sub>θJC</sub> ) (Note 1)  | Steady State         | T <sub>C</sub> = 25°C | I <sub>D</sub>                    | 101         | A    |
|  |                      | T <sub>C</sub> = 85°C |                                   | 78          |      |
| Power Dissipation (R <sub>θJC</sub> ) (Note 1)   |                      | T <sub>C</sub> = 25°C | P <sub>D</sub>                    | 93.75       | W    |
| Continuous Drain Current (R <sub>θJA</sub> ) (Note 1)  |                      | T <sub>A</sub> = 25°C | I <sub>D</sub>                    | 16.4        | A    |
|  |                      | T <sub>A</sub> = 85°C |                                   | 12.7        |      |
| Power Dissipation (R <sub>θJA</sub> ) (Note 1)   |                      | T <sub>A</sub> = 25°C | P <sub>D</sub>                    | 2.5         | W    |
| Pulsed Drain Current   | t <sub>p</sub> =10μs | T <sub>A</sub> = 25°C | I <sub>DM</sub>                   | 300         | A    |
| Current Limited by Package   |                      | T <sub>A</sub> = 25°C | I <sub>DmaxPkg</sub>              | 45          | A    |
| Operating Junction and Storage Temperature   |                      |                       | T <sub>J</sub> , T <sub>stg</sub> | – 55 to 175 | °C   |
| Source Current (Body Diode)  |                      |                       | I <sub>S</sub>                    | 50          | A    |
| Drain to Source dV/dt  |                      |                       | dV/dt                             | 6.0         | V/ns |
| Single Pulse Drain-to-Source Avalanche Energy (V <sub>DD</sub> = 32 V, V <sub>GS</sub> = 10 V, L = 0.3 mH, I <sub>L(pk)</sub> = 40 A, R <sub>G</sub> = 25 Ω) |                      |                       | E <sub>AS</sub>                   | 240         | mJ   |
| Lead Temperature for Soldering Purposes (1/8" from case for 10 s)  |                      |                       | T <sub>L</sub>                    | 260         | °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.

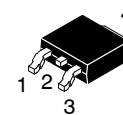
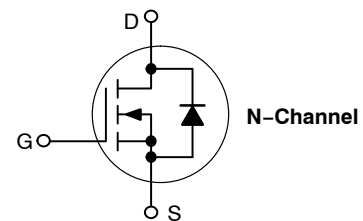


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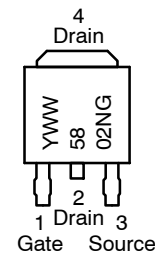
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| $V_{(BR)DS}$ | $R_{DS(on)}$           | $I_D$ |
|--------------|------------------------|-------|
| 40 V         | 4.4 m $\Omega$ @ 10 V  | 101 A |
|              | 7.8 m $\Omega$ @ 5.0 V | 50 A  |



CASE 369C  
DPAK  
(Bent Lead)  
STYLE 2

### MARKING DIAGRAMS & PIN ASSIGNMENT



Y = Year  
WW = Work Week  
5802N = Device Code  
G = Pb-Free Package

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 5 of this data sheet.

**THERMAL RESISTANCE MAXIMUM RATINGS**

| Parameter                                   | Symbol          | Value | Unit                 |
|---|-----------------|-------|----------------------|
| Junction-to-Case (Drain)                    | $R_{\theta JC}$ | 1.6   | $^{\circ}\text{C/W}$ |
| Junction-to-Ambient - Steady State (Note 1) | $R_{\theta JA}$ | 60    |                      |
| Junction-to-Ambient - Steady State (Note 2) | $R_{\theta JA}$ | 105   |                      |

1. Surface-mounted on FR4 board using 1 in sq pad size, 1 oz Cu.
2. Surface-mounted on FR4 board using the minimum recommended pad size.

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**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                         | $V_{(BR)DSS}$     | $V_{GS} = 0\text{ V}, I_D = 10\text{ }\mu\text{A}$ | 40                          |    |           | V                            |
| Drain-to-Source Breakdown Voltage Temperature Coefficient | $V_{(BR)DSS}/T_J$ |  |                             | 40 |           | $\text{mV}/^{\circ}\text{C}$ |
| Zero Gate Voltage Drain Current                           | $I_{DSS}$         | $V_{GS} = 0\text{ V},$<br>$V_{DS} = 40\text{ V}$   | $T_J = 25^{\circ}\text{C}$  |    | 1.0       | $\mu\text{A}$                |
|   |                   |  | $T_J = 150^{\circ}\text{C}$ |    | 50        |                              |
| Gate-to-Source Leakage Current                            | $I_{GSS}$         | $V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$    |                             |    | $\pm 100$ | nA                           |

**ON CHARACTERISTICS** (Note 3)

|  |                  |   |     |      |     |                              |
|--|------------------|---|-----|------|-----|------------------------------|
| Gate Threshold Voltage                     | $V_{GS(TH)}$     | $V_{GS} = V_{DS}, I_D = 250\text{ }\mu\text{A}$ | 1.5 |      | 3.5 | V                            |
| Negative Threshold Temperature Coefficient | $V_{GS(TH)}/T_J$ |   |     | -7.4 |     | $\text{mV}/^{\circ}\text{C}$ |
| Drain-to-Source On Resistance              | $R_{DS(on)}$     | $V_{GS} = 10\text{ V}, I_D = 50\text{ A}$       |     | 3.6  | 4.4 | $\text{m}\Omega$             |
|  |                  | $V_{GS} = 5.0\text{ V}, I_D = 50\text{ A}$      |     | 6.5  | 7.8 |                              |
| Forward Transconductance                   | $g_{FS}$         | $V_{DS} = 15\text{ V}, I_D = 15\text{ A}$       |     | 16.8 |     | S                            |

**CHARGES AND CAPACITANCES**

|                              |              |  |  |      |     |    |
|------------------------------|--------------|--|--|------|-----|----|
| Input Capacitance            | $C_{iss}$    | $V_{GS} = 0\text{ V}, f = 1.0\text{ MHz},$<br>$V_{DS} = 12\text{ V}$ |  | 5300 |     | pF |
| Output Capacitance           | $C_{oss}$    |  |  | 850  |     |    |
| Reverse Transfer Capacitance | $C_{rss}$    |  |  | 550  |     |    |
| Input Capacitance            | $C_{iss}$    | $V_{GS} = 0\text{ V}, f = 1.0\text{ MHz},$<br>$V_{DS} = 25\text{ V}$ |  | 5025 |     | pF |
| Output Capacitance           | $C_{oss}$    |  |  | 580  |     |    |
| Reverse Transfer Capacitance | $C_{rss}$    |  |  | 400  |     |    |
| Total Gate Charge            | $Q_{G(TOT)}$ | $V_{GS} = 10\text{ V}, V_{DS} = 15\text{ V},$<br>$I_D = 50\text{ A}$ |  | 75   | 100 | nC |
| Threshold Gate Charge        | $Q_{G(TH)}$  |  |  | 6.0  |     |    |
| Gate-to-Source Charge        | $Q_{GS}$     |  |  | 18   |     |    |
| Gate-to-Drain Charge         | $Q_{GD}$     |  |  | 15   |     |    |

**SWITCHING CHARACTERISTICS** (Note 4)

|                     |              |   |  |     |  |    |
|---------------------|--------------|---|--|-----|--|----|
| Turn-On Delay Time  | $t_{d(on)}$  | $V_{GS} = 10\text{ V}, V_{DS} = 20\text{ V},$<br>$I_D = 50\text{ A}, R_G = 2.0\text{ }\Omega$ |  | 14  |  | ns |
| Rise Time           | $t_r$        |   |  | 52  |  |    |
| Turn-Off Delay Time | $t_{d(off)}$ |   |  | 39  |  |    |
| Fall Time           | $t_f$        |   |  | 8.5 |  |    |

3. Pulse Test: Pulse Width  $\leq 300\text{ }\mu\text{s}$ , Duty Cycle  $\leq 2\%$ .
4. Switching characteristics are independent of operating junction temperatures.

# NTD5802N

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

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

### DRAIN-SOURCE DIODE CHARACTERISTICS

|                         |                 |   |                       |  |     |     |    |
|-------------------------|-----------------|---|-----------------------|--|-----|-----|----|
| Forward Diode Voltage   | V <sub>SD</sub> | V <sub>GS</sub> = 0 V,<br>I <sub>S</sub> = 50 A                                 | T <sub>J</sub> = 25°C |  | 0.9 | 1.2 | V  |
|                         |                 | V <sub>GS</sub> = 0 V,<br>I <sub>S</sub> = 20 A                                 | T <sub>J</sub> = 25°C |  | 0.8 | 1.0 |    |
| 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> = 50 A |                       |  | 25  |     | ns |
| Charge Time             | t <sub>a</sub>  |   |                       |  | 15  |     |    |
| Discharge Time          | t <sub>b</sub>  |   |                       |  | 10  |     |    |
| Reverse Recovery Charge | Q <sub>RR</sub> |   |                       |  | 15  |     | nC |

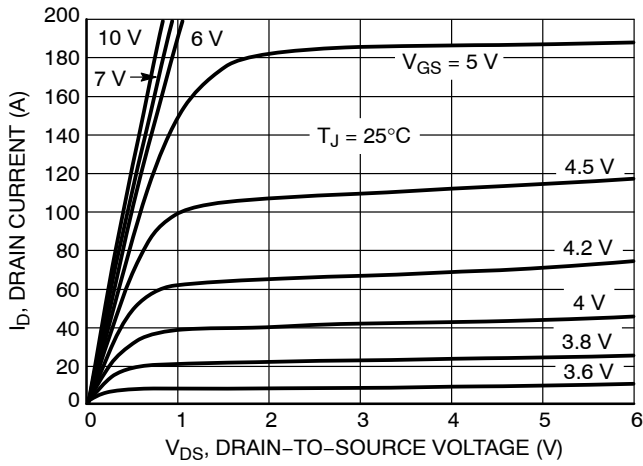


Figure 1. On-Region Characteristics

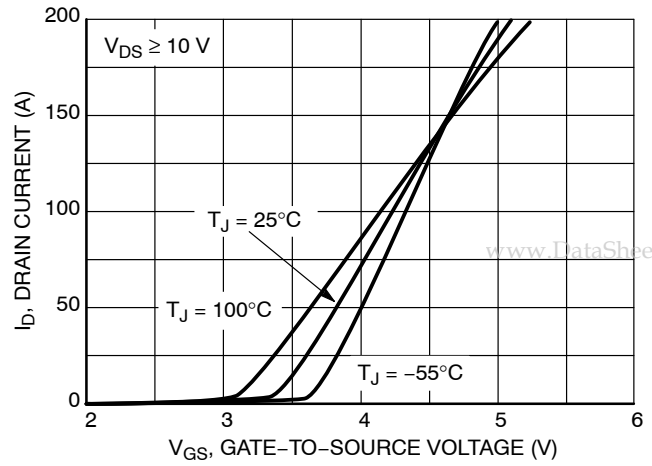


Figure 2. Transfer Characteristics

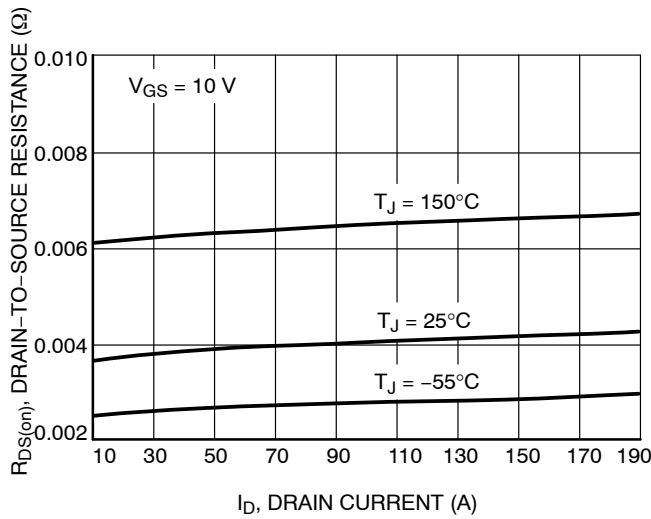


Figure 3. On-Resistance vs. Drain Current

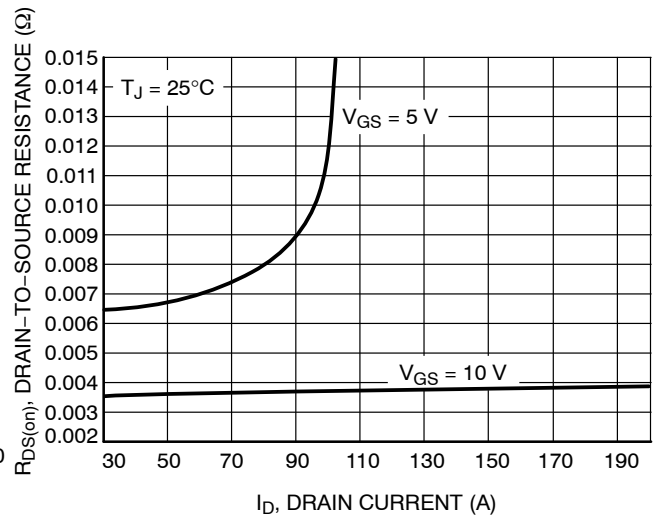


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

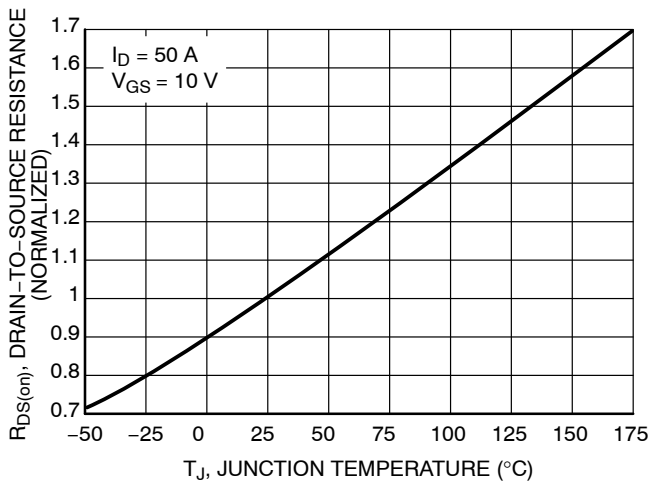


Figure 5. On-Resistance Variation with Temperature

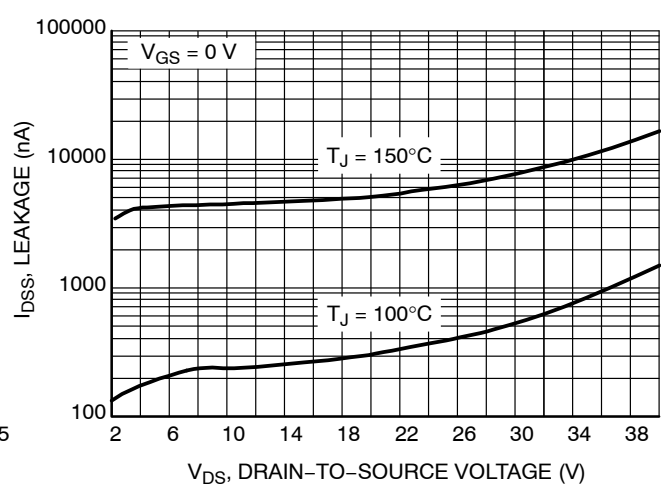


Figure 6. Drain-to-Source Leakage Current vs. Voltage

# NTD5802N

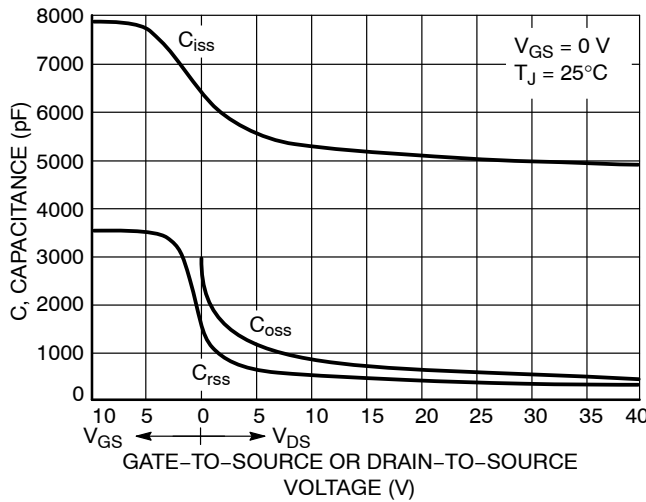


Figure 7. Capacitance Variation

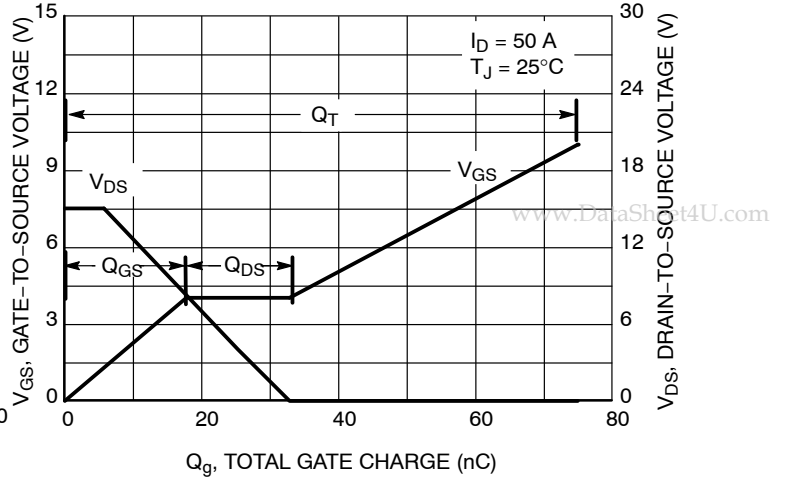


Figure 8. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

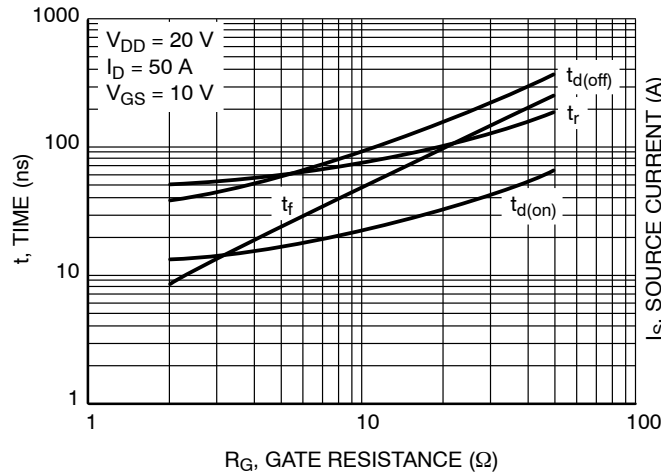


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

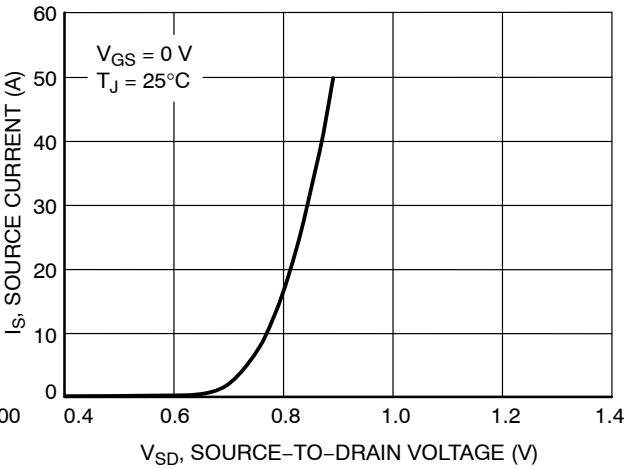


Figure 10. Diode Forward Voltage vs. Current

## ORDERING INFORMATION

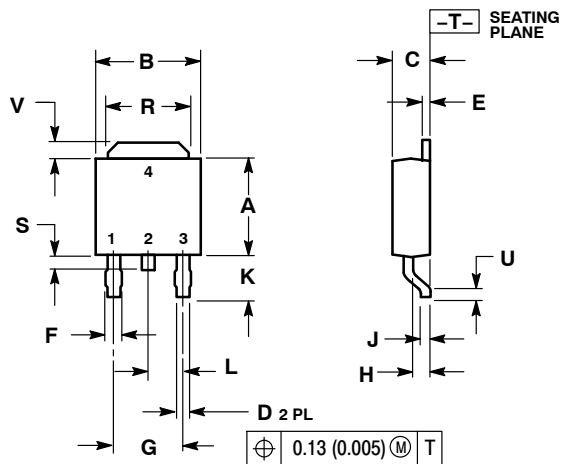
| Order Number | Package           | Shipping <sup>†</sup> |
|--------------|-------------------|-----------------------|
| NTD5802NT4G  | DPAK<br>(Pb-Free) | 2500/Tape & Reel      |

<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.

# NTD5802N

## PACKAGE DIMENSIONS

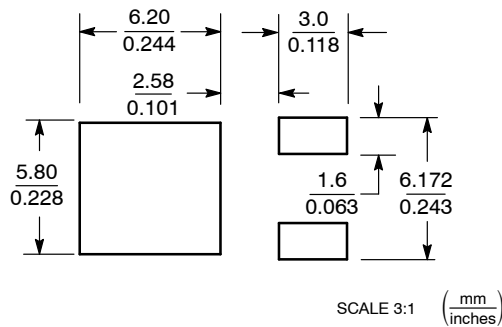
DPAK  
CASE 369C-01  
ISSUE O



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

| DIM | INCHES    |       | MILLIMETERS |      |
|-----|-----------|-------|-------------|------|
|     | MIN       | MAX   | MIN         | MAX  |
| A   | 0.235     | 0.245 | 5.97        | 6.22 |
| B   | 0.250     | 0.265 | 6.35        | 6.73 |
| C   | 0.086     | 0.094 | 2.19        | 2.38 |
| D   | 0.027     | 0.035 | 0.69        | 0.88 |
| E   | 0.018     | 0.023 | 0.46        | 0.58 |
| F   | 0.037     | 0.045 | 0.94        | 1.14 |
| G   | 0.180 BSC |       | 4.58 BSC    |      |
| H   | 0.034     | 0.040 | 0.87        | 1.01 |
| J   | 0.018     | 0.023 | 0.46        | 0.58 |
| K   | 0.102     | 0.114 | 2.60        | 2.89 |
| L   | 0.090 BSC |       | 2.29 BSC    |      |
| R   | 0.180     | 0.215 | 4.57        | 5.45 |
| S   | 0.025     | 0.040 | 0.63        | 1.01 |
| U   | 0.020     | ---   | 0.51        | ---  |
| V   | 0.035     | 0.050 | 0.89        | 1.27 |
| Z   | 0.155     | ---   | 3.93        | ---  |

## 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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