

# N-Channel PowerTrench® MOSFET

60 V, 110 A, 2.7 mΩ

## NTBS2D7N06M7

### Features

- Typical  $R_{DS(on)}$  = 2.2 mΩ at  $V_{GS}$  = 10 V,  $I_D$  = 80 A
- Typical  $Q_{g(tot)}$  = 80 nC at  $V_{GS}$  = 10 V,  $I_D$  = 80 A
- UIS Capability
- These Devices are Pb-Free and are RoHS Compliant

### Applications

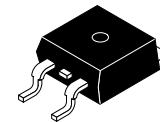
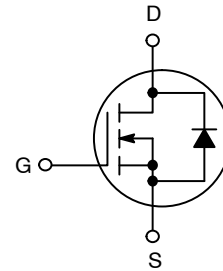
- Industrial Motor Drive
- Industrial Power Supply
- Industrial Automation
- Battery Operated Tools
- Battery Protection
- Solar Inverters
- UPS and Energy Inverters
- Energy Storage
- Load Switch

### ABSOLUTE MAXIMUM RATINGS ( $T_J$ = 25°C, Unless otherwise noted)

| Rating                                                                  | Symbol          | Value        | Unit |
|-------------------------------------------------------------------------|-----------------|--------------|------|
| Drain-to-Source Voltage                                                 | $V_{DSS}$       | 60           | V    |
| Gate-to-Source Voltage                                                  | $V_{GS}$        | ±20          | V    |
| Drain Current – Continuous ( $T_C$ = 25°C)<br>( $V_{GS}$ = 10) (Note 1) | $I_D$           | 110          | A    |
| Pulsed Drain Current ( $T_C$ = 25°C)                                    |                 | See Figure 4 |      |
| Single Pulse Avalanche Energy (Note 2)                                  | $E_{AS}$        | 193          | mJ   |
| Power Dissipation                                                       | $P_D$           | 176          | W    |
| Derate Above 25°C                                                       |                 | 1.2          |      |
| Operating and Storage Temperature Range                                 | $T_J, T_{STG}$  | -55 to +175  | °C   |
| Thermal Resistance, Junction to Case                                    | $R_{\theta JC}$ | 0.85         | °C/W |
| Maximum Thermal Resistance, Junction to Ambient (Note 3)                | $R_{\theta JA}$ | 43           | °C/W |

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. Current is limited by bondwire configuration.
2. Starting  $T_J$  = 25°C,  $L$  = 50 μH,  $I_{AS}$  = 88 A,  $V_{DD}$  = 60 V during inductor charging and  $V_{DD}$  = 0 V during time in avalanche.
3.  $R_{\theta JA}$  is the sum of the junction-to-case and case-to-ambient thermal resistance, where the case thermal reference is defined as the solder mounting surface of the drain pins.  $R_{\theta JC}$  is guaranteed by design, while  $R_{\theta JA}$  is determined by the board design. The maximum rating presented here is based on mounting on a 1 in<sup>2</sup> pad of 2oz copper.



D<sup>2</sup>PAK-3  
TO-263  
CASE 418AJ

### MARKING DIAGRAM



NTBS2D7N06M7 = Specific Device Code  
A = Assembly Location  
Y = Year  
WW = Work Week  
G = Pb-Free Package

### ORDERING INFORMATION

See detailed ordering and shipping information on page 2 of this data sheet.

# NTBS2D7N06M7

## PACKAGE MARKING AND ORDERING INFORMATION

| Device       | Device Marking | Package                     | Reel Size | Tape Width | Quantity  |
|--------------|----------------|-----------------------------|-----------|------------|-----------|
| NTBS2D7N06M7 | NTBS2D7N       | D <sup>2</sup> PAK (TO-263) | 330 mm    | 24 mm      | 800 Units |

†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](#).

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

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

### OFF CHARACTERISTICS

|                   |                                   |                                                                                |    |   |      |    |
|-------------------|-----------------------------------|--------------------------------------------------------------------------------|----|---|------|----|
| BV <sub>DSS</sub> | Drain-to-Source Breakdown Voltage | V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA                                 | 60 | – | –    | V  |
| I <sub>DSS</sub>  | Drain-to-Source Leakage Current   | V <sub>DS</sub> = 60 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 25°C           | –  | – | 1    | μA |
|                   |                                   | V <sub>DS</sub> = 60 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 175°C (Note 4) | –  | – | 1    | mA |
| I <sub>GSS</sub>  | Gate-to-Source Leakage Current    | V <sub>GS</sub> = ±20 V                                                        | –  | – | ±100 | nA |

### ON CHARACTERISTICS

|                     |                                  |                                                                                |     |     |     |    |
|---------------------|----------------------------------|--------------------------------------------------------------------------------|-----|-----|-----|----|
| V <sub>GS(th)</sub> | Gate-to-Source Threshold Voltage | V <sub>GS</sub> = V <sub>DS</sub> , I <sub>D</sub> = 250 μA                    | 2.0 | 3.2 | 4.0 | V  |
| R <sub>DS(on)</sub> | Drain-to-Source On Resistance    | V <sub>GS</sub> = 10 V, I <sub>D</sub> = 80 A, T <sub>J</sub> = 25°C           | –   | 2.2 | 2.7 | mΩ |
|                     |                                  | V <sub>GS</sub> = 10 V, I <sub>D</sub> = 80 A, T <sub>J</sub> = 175°C (Note 4) | –   | 4.1 | 5.0 | mΩ |

### DYNAMIC CHARACTERISTICS

|                     |                               |                                                                            |   |      |     |    |
|---------------------|-------------------------------|----------------------------------------------------------------------------|---|------|-----|----|
| C <sub>iss</sub>    | Input Capacitance             | V <sub>DS</sub> = 30 V, V <sub>GS</sub> = 0 V, f = 1 MHz                   | – | 6655 | –   | pF |
| C <sub>oss</sub>    | Output Capacitance            |                                                                            | – | 1745 | –   | pF |
| C <sub>rss</sub>    | Reverse Transfer Capacitance  |                                                                            | – | 57   | –   | pF |
| R <sub>g</sub>      | Gate Resistance               | f = 1 MHz                                                                  | – | 2.2  | –   | Ω  |
| Q <sub>g(tot)</sub> | Total Gate Charge at 10 V     | V <sub>DD</sub> = 30 V, I <sub>D</sub> = 80 A, V <sub>GS</sub> = 0 to 10 V | – | 80   | 110 | nC |
| Q <sub>g(th)</sub>  | Threshold Gate Charge         | V <sub>DD</sub> = 30 V, I <sub>D</sub> = 80 A, V <sub>GS</sub> = 0 to 2 V  | – | 12   | –   | nC |
| Q <sub>gs</sub>     | Gate-to-Source Gate Charge    | V <sub>DD</sub> = 30 V, I <sub>D</sub> = 80 A                              | – | 35   | –   | nC |
| Q <sub>gd</sub>     | Gate-to-Drain "Miller" Charge | V <sub>DD</sub> = 30 V, I <sub>D</sub> = 80 A                              | – | 10   | –   | nC |

### SWITCHING CHARACTERISTICS

|                     |                |                                                                                                  |   |    |     |    |
|---------------------|----------------|--------------------------------------------------------------------------------------------------|---|----|-----|----|
| t <sub>(on)</sub>   | Turn-On Time   | V <sub>DD</sub> = 30 V, I <sub>D</sub> = 80 A,<br>V <sub>GS</sub> = 10 V, R <sub>GEN</sub> = 6 Ω | – | –  | 115 | ns |
| t <sub>d(on)</sub>  | Turn-On Delay  |                                                                                                  | – | 36 | –   | ns |
| t <sub>r</sub>      | Rise Time      |                                                                                                  | – | 52 | –   | ns |
| t <sub>d(off)</sub> | Turn-Off Delay |                                                                                                  | – | 36 | –   | ns |
| t <sub>f</sub>      | Fall Time      |                                                                                                  | – | 13 | –   | ns |
| t <sub>off</sub>    | Turn-Off Time  |                                                                                                  | – | –  | 64  | ns |

### DRAIN-SOURCE DIODE CHARACTERISTICS

|                 |                               |                                                                                   |   |     |      |    |
|-----------------|-------------------------------|-----------------------------------------------------------------------------------|---|-----|------|----|
| V <sub>SD</sub> | Source-to-Drain Diode Voltage | V <sub>GS</sub> = 0 V, I <sub>SD</sub> = 80 A                                     | – | –   | 1.25 | V  |
|                 |                               | V <sub>GS</sub> = 0 V, I <sub>SD</sub> = 40 A                                     | – | –   | 1.2  | V  |
| t <sub>rr</sub> | Reverse-Recovery Time         | V <sub>DD</sub> = 48 V, I <sub>F</sub> = 80 A,<br>dI <sub>SD</sub> /dt = 100 A/μs | – | 78  | 102  | ns |
| Q <sub>rr</sub> | Reverse-Recovery Charge       |                                                                                   | – | 100 | 130  | nC |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

4. The maximum value is specified by design at T<sub>J</sub> = 175°C. Product is not tested to this condition in production.

TYPICAL PERFORMANCE CHARACTERISTICS

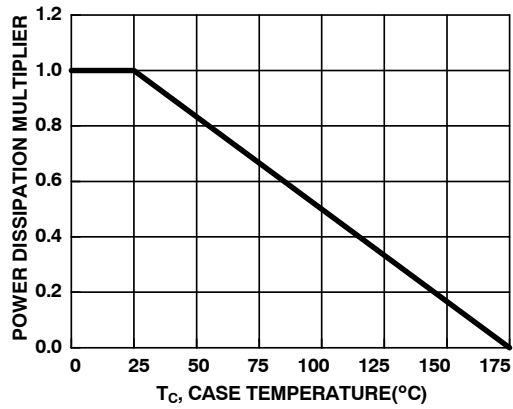


Figure 1. Normalized Power Dissipation vs. Case Temperature

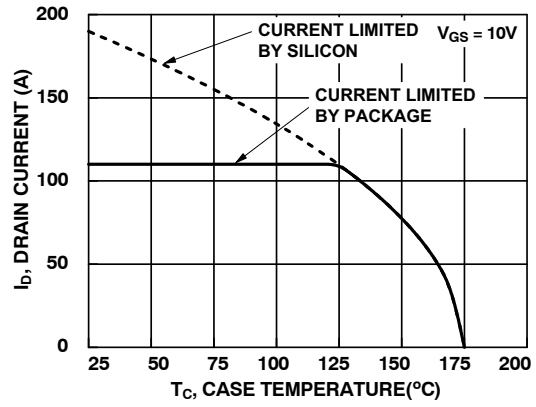


Figure 2. Maximum Continuous Drain Current vs. Case Temperature

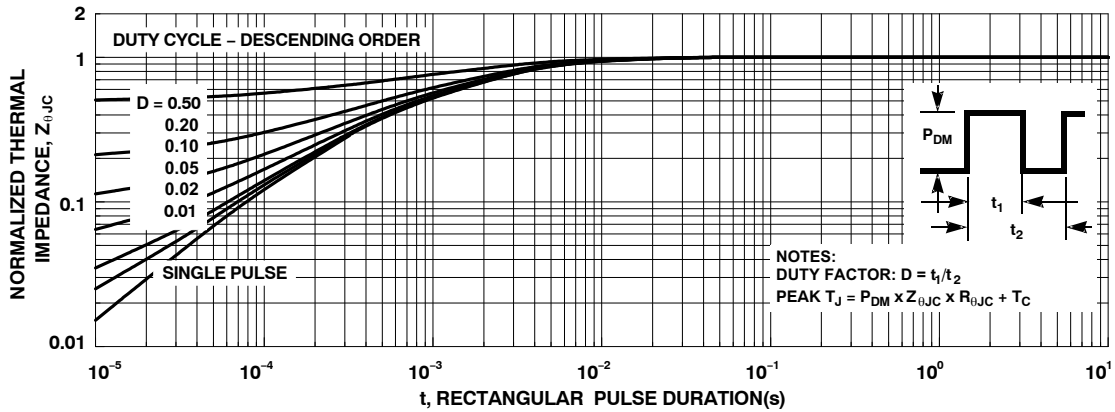


Figure 3. Normalized Maximum Transient Thermal Impedance

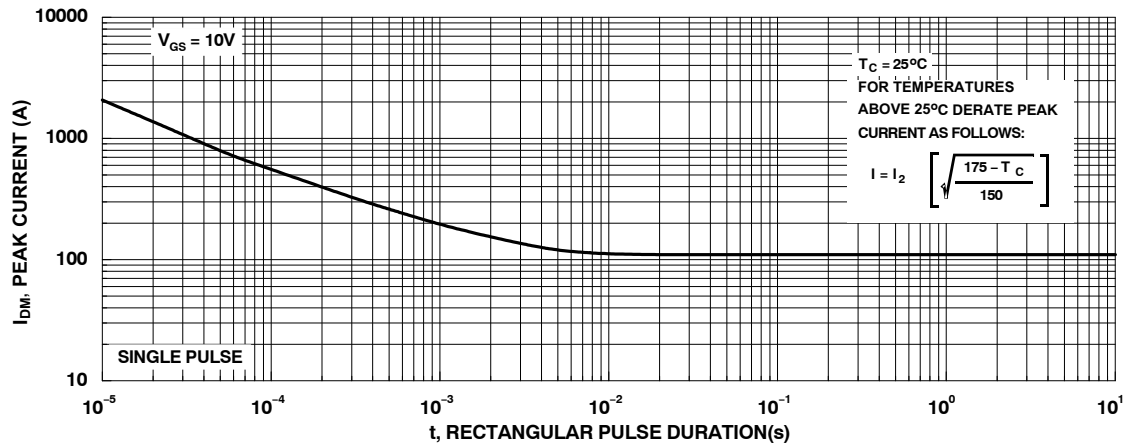


Figure 4. Peak Current Capability

TYPICAL PERFORMANCE CHARACTERISTICS

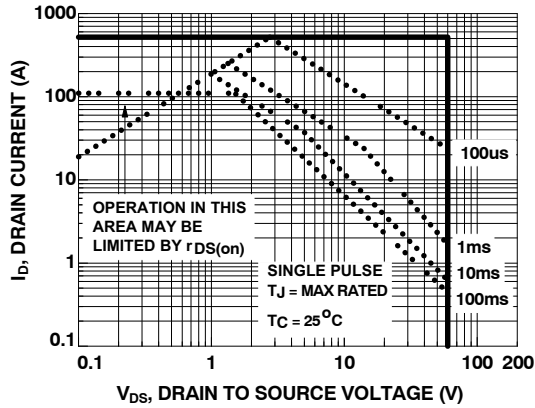
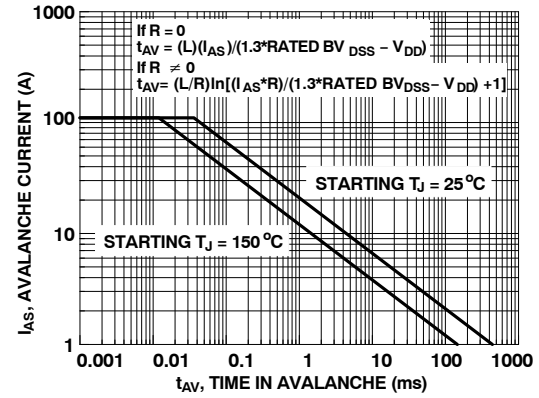


Figure 5. Forward Bias Safe Operating Area



NOTE: Refer to ON Semiconductor Application Notes AN7514 and AN7515

Figure 6. Unclamped Inductive Switching Capability

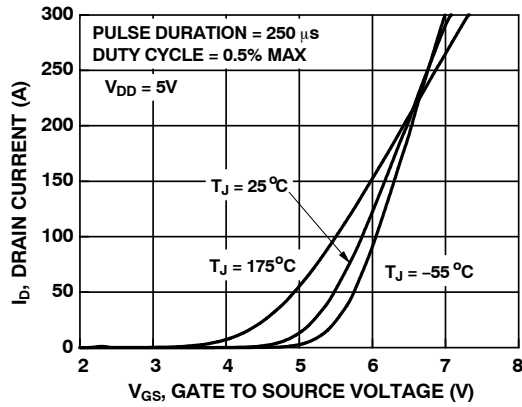


Figure 7. Transfer Characteristics

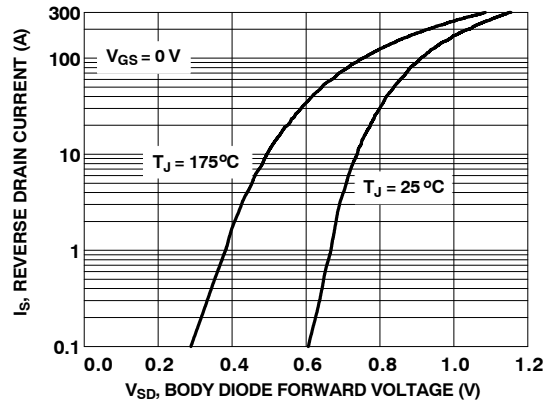


Figure 8. Forward Diode Characteristics

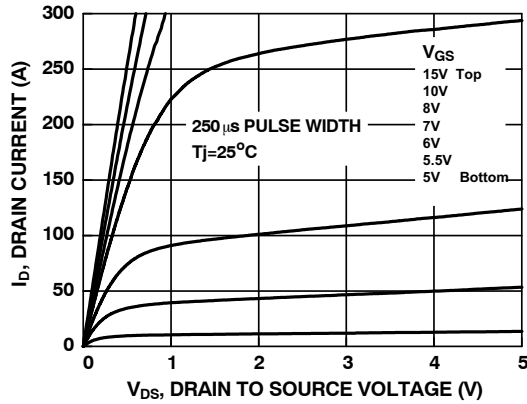


Figure 9. Saturation Characteristics

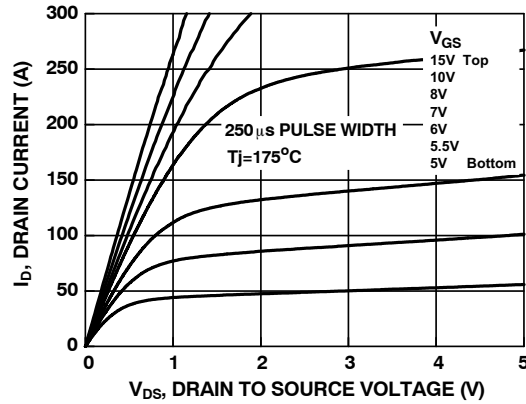


Figure 10. Saturation Characteristics

TYPICAL PERFORMANCE CHARACTERISTICS

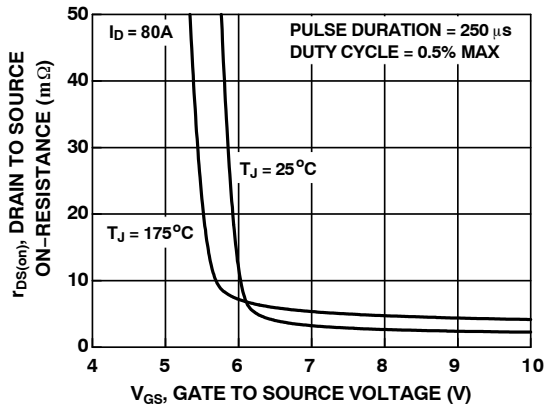


Figure 11.  $R_{DS(on)}$  vs. Gate Voltage

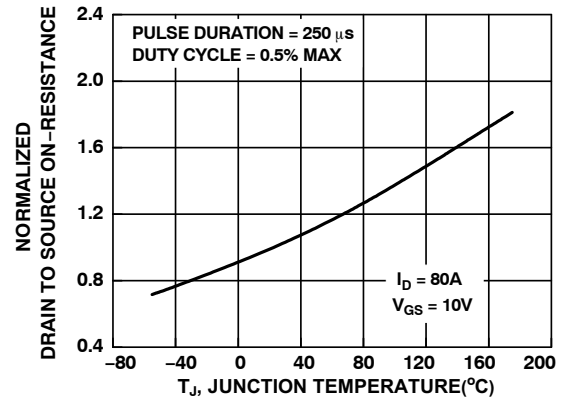


Figure 12. Normalized  $R_{DS(on)}$  vs. Junction Temperature

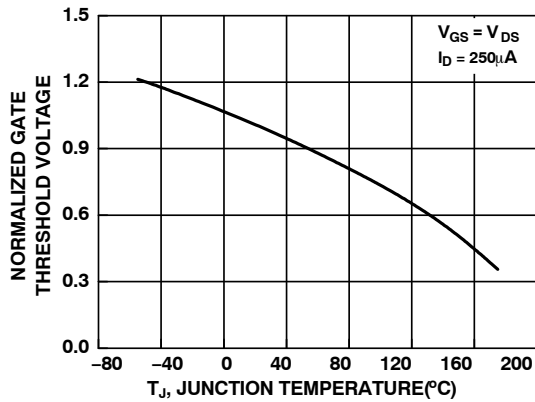


Figure 13. Normalized Gate Threshold Voltage vs. Temperature

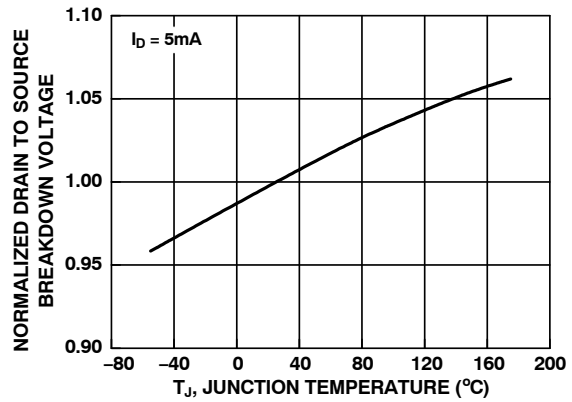


Figure 14. Normalized Drain-to-Source Breakdown Voltage vs. Junction Temperature

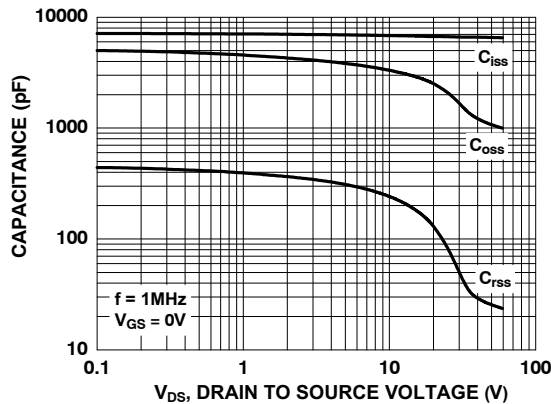


Figure 15. Capacitance vs. Drain-to-Source Voltage

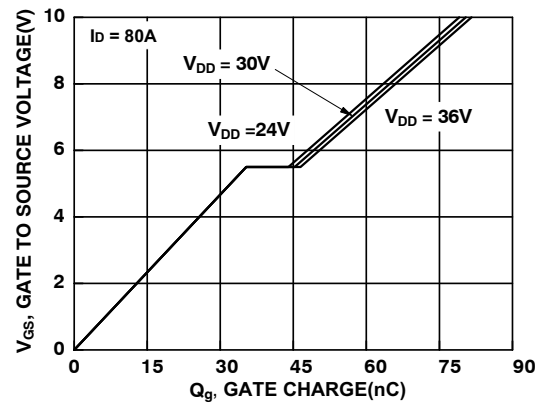
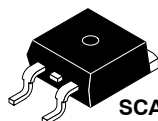


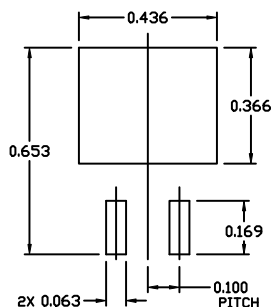
Figure 16. Gate Charge vs. Gate-to-Source Voltage



SCALE 1:1

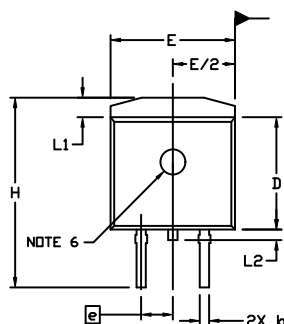
**D<sup>2</sup>PAK-3 (TO-263, 3-LEAD)**  
CASE 418AJ  
ISSUE F

DATE 11 MAR 2021



**RECOMMENDED  
MOUNTING 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.

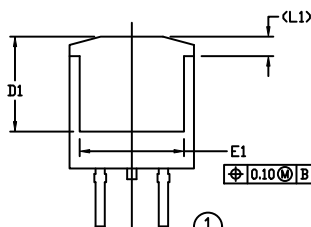
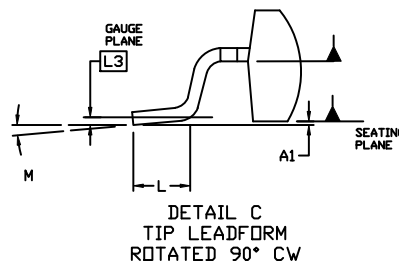
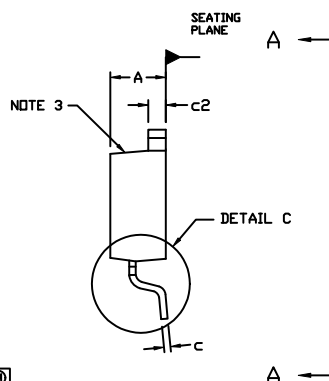


0.100 BSC 0.100 BSC

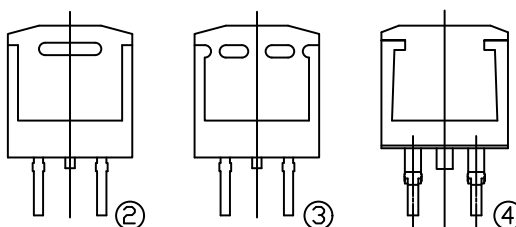
**NOTES:**

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: INCHES
3. CHAMFER OPTIONAL.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.005 PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY AT DATUM H.
5. THERMAL PAD CONTOUR IS OPTIONAL WITHIN DIMENSIONS E, L1, D1, AND E1.
6. OPTIONAL MOLD FEATURE.
7. ①, ② ... OPTIONAL CONSTRUCTION FEATURE CALL OUTS.

| DIM | INCHES    |       | MILLIMETERS |       |
|-----|-----------|-------|-------------|-------|
|     | MIN.      | MAX.  | MIN.        | MAX.  |
| A   | 0.160     | 0.190 | 4.06        | 4.83  |
| A1  | 0.000     | 0.010 | 0.00        | 0.25  |
| b   | 0.020     | 0.039 | 0.51        | 0.99  |
| c   | 0.012     | 0.029 | 0.30        | 0.74  |
| c2  | 0.045     | 0.065 | 1.14        | 1.65  |
| D   | 0.330     | 0.380 | 8.38        | 9.65  |
| D1  | 0.260     | ---   | 6.60        | ---   |
| E   | 0.380     | 0.420 | 9.65        | 10.67 |
| E1  | 0.245     | ---   | 6.22        | ---   |
| e   | 0.100 BSC | ---   | 2.54 BSC    | ---   |
| H   | 0.575     | 0.625 | 14.60       | 15.88 |
| L   | 0.070     | 0.110 | 1.78        | 2.79  |
| L1  | ---       | 0.066 | ---         | 1.68  |
| L2  | ---       | 0.070 | ---         | 1.78  |
| L3  | 0.010 BSC | ---   | 0.25 BSC    | ---   |
| M   | 0°        | 8°    | 0°          | 8°    |

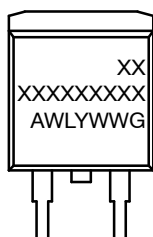


VIEW A-A

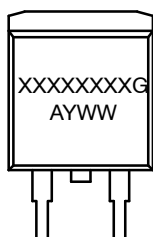


VIEW A-A  
OPTIONAL CONSTRUCTIONS

**GENERIC MARKING DIAGRAMS\***



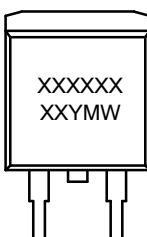
IC



Standard



Rectifier



SSG

XXXXXX = Specific Device Code  
A = Assembly Location  
WL = Wafer Lot  
Y = Year  
WW = Work Week  
W = Week Code (SSG)  
M = Month Code (SSG)  
G = Pb-Free Package  
AKA = Polarity Indicator

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-free indicator, "G" or microdot "•", may or may not be present. Some products may not follow the Generic Marking.

|                         |                                            |                                                                                                                                                                                  |
|-------------------------|--------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
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| <b>DESCRIPTION:</b>     | <b>D<sup>2</sup>PAK-3 (TO-263, 3-LEAD)</b> | <b>PAGE 1 OF 1</b>                                                                                                                                                               |

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