

# FDB1D7N10CL7

## N-Channel Shielded Gate POWERTRENCH<sup>®</sup> MOSFET

100 V, 268 A, 1.7 mΩ

### Description

This N-Channel MOSFET is produced using ON Semiconductor's advanced POWERTRENCH process that incorporates Shielded Gate technology. This process has been optimized to minimize on-state resistance and yet maintain superior switching performance with best in class soft body diode.

### Features

- Max  $R_{DS(on)}$  = 1.75 mΩ at  $V_{GS} = 10$  V,  $I_D = 100$  A
- Max  $R_{DS(on)}$  = 1.7 mΩ at  $V_{GS} = 12$  V,  $I_D = 100$  A
- Max  $R_{DS(on)}$  = 1.65 mΩ at  $V_{GS} = 15$  V,  $I_D = 100$  A
- Max  $R_{DS(on)}$  = 4.4 mΩ at  $V_{GS} = 6$  V,  $I_D = 63$  A
- 50% Lower  $Q_{rr}$  than Other MOSFET Suppliers
- Lowers Switching Noise/EMI
- MSL1 Robust Package Design
- 100% UIL Tested

### Applications

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

### MAXIMUM RATINGS ( $T_C = 25^\circ\text{C}$ , Unless otherwise specified)

| Symbol         | Parameter   | Ratings     | Unit             |
|----------------|---|-------------|------------------|
| $V_{DS}$       | Drain to Source Voltage   | 100         | V                |
| $V_{GS}$       | Gate to Source Voltage  | $\pm 20$    | V                |
| $I_D$          | Drain Current<br>Continuous ( $T_C = 25^\circ\text{C}$ ) (Note 5)<br>Continuous ( $T_C = 100^\circ\text{C}$ ) (Note 5)<br>Pulsed (Note 4) | 268         | A                |
|                |   | 190         |                  |
|                |   | 1390        |                  |
| $E_{AS}$       | Single Pulsed Avalanche Energy (Note 3)   | 595         | mJ               |
| $P_D$          | Power Dissipation<br>$T_C = 25^\circ\text{C}$<br>$T_A = 25^\circ\text{C}$ (Note 1a)   | 250         | W                |
|                |   | 3.8         |                  |
| $T_J, T_{STG}$ | Operating and Storage Temperature Range   | -55 to +175 | $^\circ\text{C}$ |

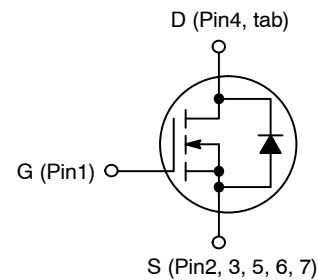
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.



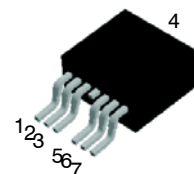
ON Semiconductor<sup>®</sup>

[www.onsemi.com](http://www.onsemi.com)

| $V_{DS}$ | $I_D$ MAX | $r_{DS(on)}$ MAX |
|----------|-----------|------------------|
| 100 V    | 268 A     | 1.7 mΩ           |



N-Channel MOSFET



1. Gate
2. Source
3. Source
4. Drain
5. Source
6. Source
7. Source

D2PAK7 (TO-263 7 LD)  
CASE 418AY

### MARKING DIAGRAM



- \$Y = ON Semiconductor Logo
- &Z = Assembly Plant Code
- &3 = Numeric Date Code
- &K = Lot Code
- FDB1D7N10CL7 = Specific Device Code

### ORDERING INFORMATION

See detailed ordering and shipping information on page 3 of this data sheet.

# FDB1D7N10CL7

## THERMAL CHARACTERISTICS

| Symbol          | Parameter   | Ratings | Unit |
|-----------------|---|---------|------|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case (Note 1)     | 0.6     | °C/W |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient (Note 1a) | 40      |      |

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

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

### OFF CHARACTERISTICS

|                              |   |  |     |    |           |               |
|------------------------------|---|--|-----|----|-----------|---------------|
| $BV_{DSS}$                   | Drain to Source Breakdown Voltage                               | $I_D = 250 \mu\text{A}$ , $V_{GS} = 0 \text{ V}$           | 100 | –  | –         | V             |
| $\Delta BV_{DSS}/\Delta T_J$ | Breakdown Voltage Temperature Coefficient                       | $I_D = 250 \mu\text{A}$ , referenced to $25^\circ\text{C}$ | –   | 57 | –         | mV/°C         |
| $I_{DSS}$                    | Zero Gate Voltage Drain Current Zero Gate Voltage Drain Current | $V_{DS} = 80 \text{ V}$ , $V_{GS} = 0 \text{ V}$           | –   | –  | 1         | $\mu\text{A}$ |
| $I_{GSS}$                    | Gate to Source Leakage Current                                  | $V_{GS} = \pm 20 \text{ V}$ , $V_{DS} = 0 \text{ V}$       | –   | –  | $\pm 100$ | nA            |

### ON CHARACTERISTICS

|                         |  |   |     |      |      |            |
|-------------------------|--|---|-----|------|------|------------|
| $V_{GS(th)}$            | Gate to Source Threshold Voltage                         | $V_{GS} = V_{DS}$ , $I_D = 700 \mu\text{A}$                                 | 2.0 | 3.1  | 4.0  | V          |
| $V_{GS(th)}/\Delta T_J$ | Gate to Source Threshold Voltage Temperature Coefficient | $I_D = 700 \mu\text{A}$ , referenced to $25^\circ\text{C}$                  | –   | –9   | –    | mV/°C      |
| $R_{DS(on)}$            | Static Drain to Source On Resistance                     | $V_{GS} = 10 \text{ V}$ , $I_D = 100 \text{ A}$                             | –   | 1.5  | 1.75 | m $\Omega$ |
|                         |  | $V_{GS} = 12 \text{ V}$ , $I_D = 100 \text{ A}$                             | –   | 1.4  | 1.7  |            |
|                         |  | $V_{GS} = 15 \text{ V}$ , $I_D = 100 \text{ A}$                             | –   | 1.33 | 1.65 |            |
|                         |  | $V_{GS} = 6 \text{ V}$ , $I_D = 63 \text{ A}$                               | –   | 2.2  | 4.4  |            |
|                         |  | $V_{GS} = 10 \text{ V}$ , $I_D = 100 \text{ A}$ , $T_J = 150^\circ\text{C}$ | –   | 2.65 | 3.1  |            |
| $g_{FS}$                | Forward Transconductance                                 | $V_{DS} = 5 \text{ V}$ , $I_D = 100 \text{ A}$                              | –   | 237  | –    | S          |

### DYNAMIC CHARACTERISTICS

|           |                              |  |     |      |       |          |
|-----------|------------------------------|--|-----|------|-------|----------|
| $C_{iss}$ | Input Capacitance            | $V_{DS} = 50 \text{ V}$ , $V_{GS} = 0 \text{ V}$ , $f = 1 \text{ MHz}$ | –   | 8285 | 11600 | pF       |
| $C_{oss}$ | Output Capacitance           |  | –   | 5025 | 7035  | pF       |
| $C_{rss}$ | Reverse Transfer Capacitance |  | –   | 50   | 80    | pF       |
| $R_g$     | Gate Resistance              |  | 0.1 | 0.8  | 1.6   | $\Omega$ |

### SWITCHING CHARACTERISTICS

|              |                               |   |  |    |     |     |    |
|--------------|-------------------------------|---|--|----|-----|-----|----|
| $t_{d(on)}$  | Turn-On Delay Time            | $V_{DD} = 50 \text{ V}$ , $I_D = 100 \text{ A}$ ,<br>$V_{GS} = 10 \text{ V}$ , $R_{GEN} = 6 \Omega$ | –  | 39 | 63  | ns  |    |
| $t_r$        | Rise Time                     |   | –  | 33 | 53  | ns  |    |
| $t_{d(off)}$ | Turn-Off Delay Time           |   | –  | 85 | 136 | ns  |    |
| $t_f$        | Fall Time                     |   | –  | 36 | 58  | ns  |    |
| $Q_g$        | Total Gate Charge             | $V_{GS} = 0 \text{ V to } 10 \text{ V}$   | $V_{DD} = 50 \text{ V}$ ,<br>$I_D = 100 \text{ A}$ | –  | 116 | 163 | nC |
| $Q_g$        | Total Gate Charge             | $V_{GS} = 0 \text{ V to } 6 \text{ V}$  |  | –  | 74  | 104 | nC |
| $Q_{gs}$     | Gate to Source Gate Charge    |   |  | –  | 37  | –   | nC |
| $Q_{gd}$     | Gate to Drain "Miller" Charge |   |  | –  | 24  | –   | nC |
| $Q_{oss}$    | Output Charge                 | $V_{DD} = 50 \text{ V}$ , $V_{GS} = 0 \text{ V}$  |  | –  | 333 | –   | nC |

### SOURCE-DRAIN DIODE CHARACTERISTICS

|          |  |   |   |      |     |   |
|----------|--|---|---|------|-----|---|
| $I_S$    | Continuous Drain to Source Diode Forward Current | –   | – | 268  | A   |   |
| $I_{SM}$ | Pulsed Drain to Source Diode Forward Current     | –   | – | 1390 | A   |   |
| $V_{SD}$ | Source to Drain Diode Forward Voltage            | $V_{GS} = 0 \text{ V}$ , $I_S = 100 \text{ A}$ (Note 2) | – | 0.9  | 1.2 | V |

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

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

### SOURCE-DRAIN DIODE CHARACTERISTICS

|          |                         |   |   |     |      |    |
|----------|-------------------------|---|---|-----|------|----|
| $t_{rr}$ | Reverse Recovery Time   | $I_F = 50\text{ A}$ , $di/dt = 300\text{ A}/\mu\text{s}$  | – | 63  | 101  | ns |
| $Q_{rr}$ | Reverse Recovery Charge |   | – | 186 | 298  | nC |
| $t_{rr}$ | Reverse Recovery Time   | $I_F = 50\text{ A}$ , $di/dt = 1000\text{ A}/\mu\text{s}$ | – | 82  | 132  | ns |
| $Q_{rr}$ | Reverse Recovery Charge |   | – | 869 | 1390 | 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.

- $R_{\theta JA}$  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  $R_{\theta CA}$  is determined by the user's board design.
  - $40^\circ\text{C}/\text{W}$  when mounted on a 1 in<sup>2</sup> pad of 2 oz copper.
  - $62.5^\circ\text{C}/\text{W}$  when mounted on a minimum pad of 2 oz copper.
- Pulse Test: Pulse Width < 300  $\mu\text{s}$ , Duty cycle < 2.0 %.
- $E_{AS}$  of 595 mJ is based on starting  $T_J = 25^\circ\text{C}$ ,  $L = 0.3\text{ mH}$ ,  $I_{AS} = 63\text{ A}$ ,  $V_{DD} = 90\text{ V}$ ,  $V_{GS} = 10\text{ V}$ . 100% test at  $L = 0.1\text{ mH}$ ,  $I_{AS} = 91\text{ A}$ .
- Pulsed Id please refer to Figure "Forward Bias Safe Operating Area" for more details.
- Computed continuous current limited to Max Junction Temperature only, actual continuous current will be limited by thermal & electro-mechanical application board design.

### PACKAGE MARKING AND ORDERING INFORMATION

| Device Marking | Device       | Package   | Reel Size | Tape Width | Quantity  |
|----------------|--------------|-----------|-----------|------------|-----------|
| FDB1D7N10CL7   | FDB1D7N10CL7 | D2-PAK-7L | 330 mm    | 24 mm      | 800 Units |

# FDB1D7N10CL7

## TYPICAL CHARACTERISTICS

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

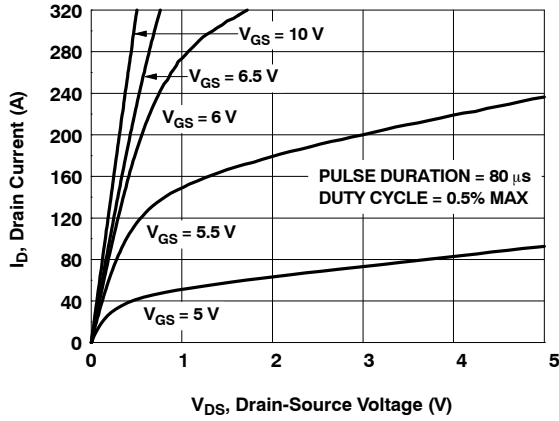


Figure 1. On-Region Characteristics

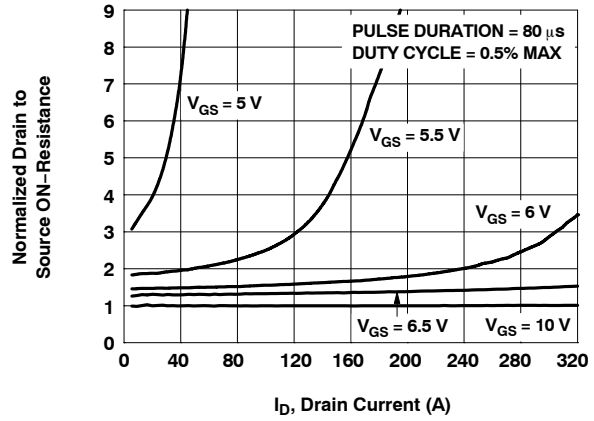


Figure 2. Normalized On-Resistance vs. Drain Current and Gate Voltage

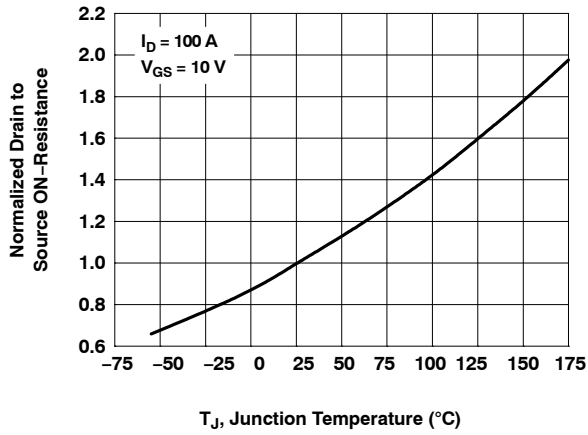


Figure 3. Normalized On-Resistance vs. Junction Temperature

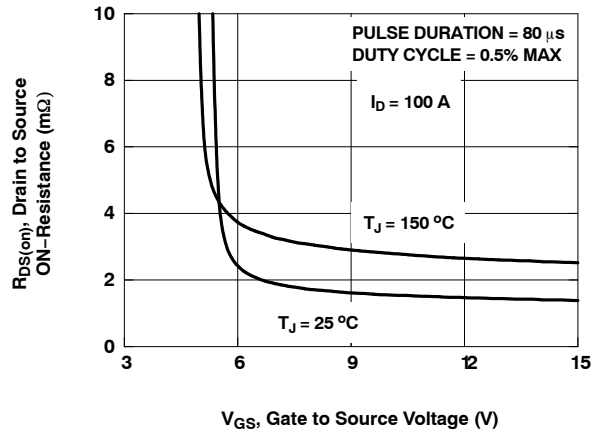


Figure 4. On-Resistance vs. Gate to Source Voltage

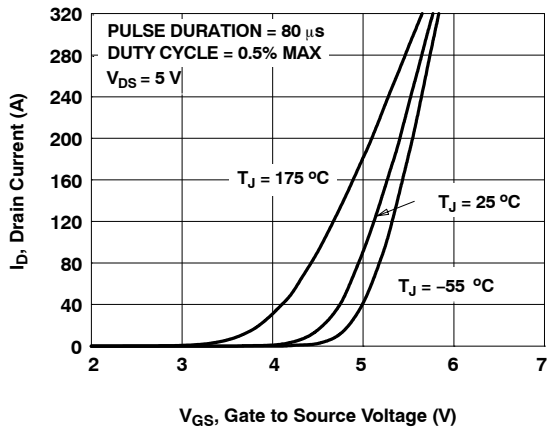


Figure 5. Transfer Characteristics

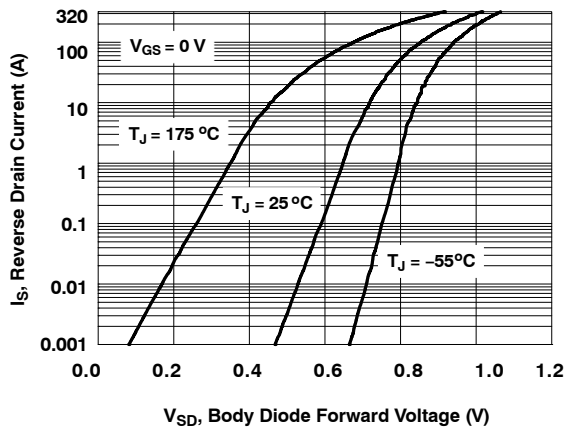


Figure 6. Source to Drain Diode Forward Voltage vs. Source Current

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## TYPICAL CHARACTERISTICS (Continued)

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

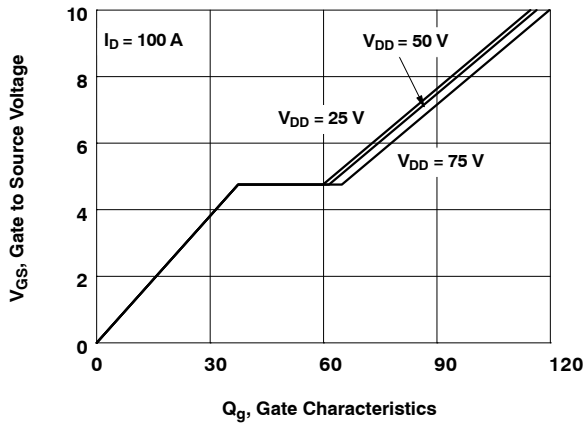


Figure 7. Gate Charge Characteristics

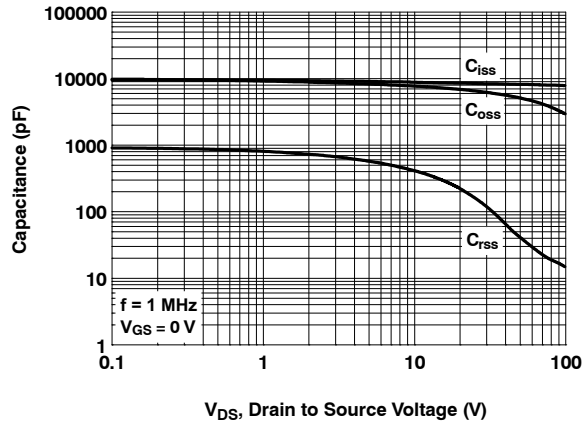


Figure 8. Capacitance vs. Drain to Source Voltage

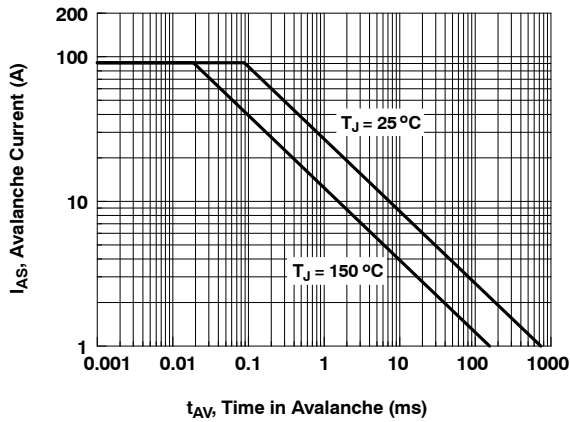


Figure 9. Unclamped Inductive Switching Capability

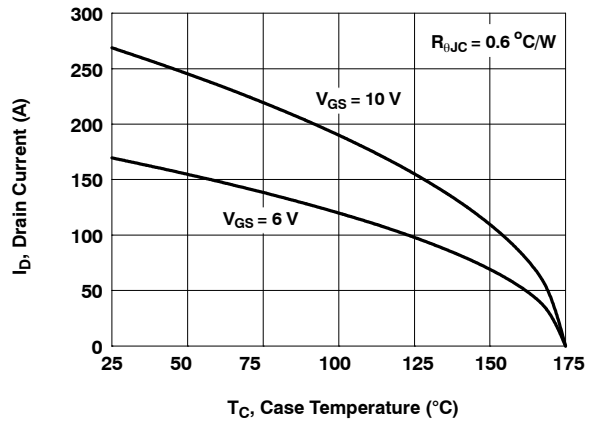


Figure 10. Maximum Continuous Drain Current vs. Case Temperature

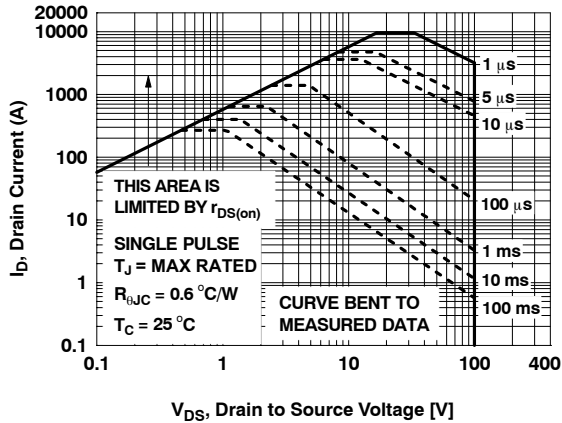


Figure 11. Forward Bias Safe Operating Area

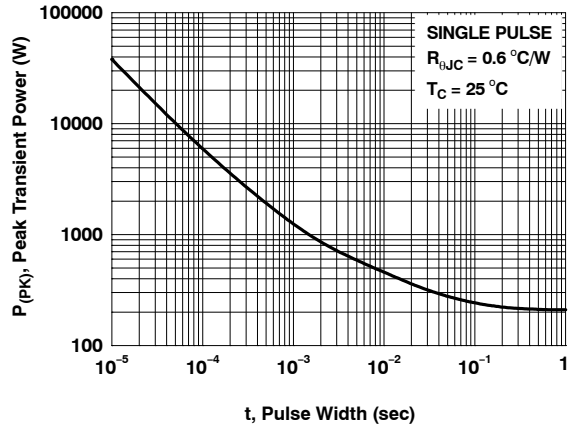


Figure 12. Single Pulse Maximum Power Dissipation

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## TYPICAL CHARACTERISTICS (Continued)

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

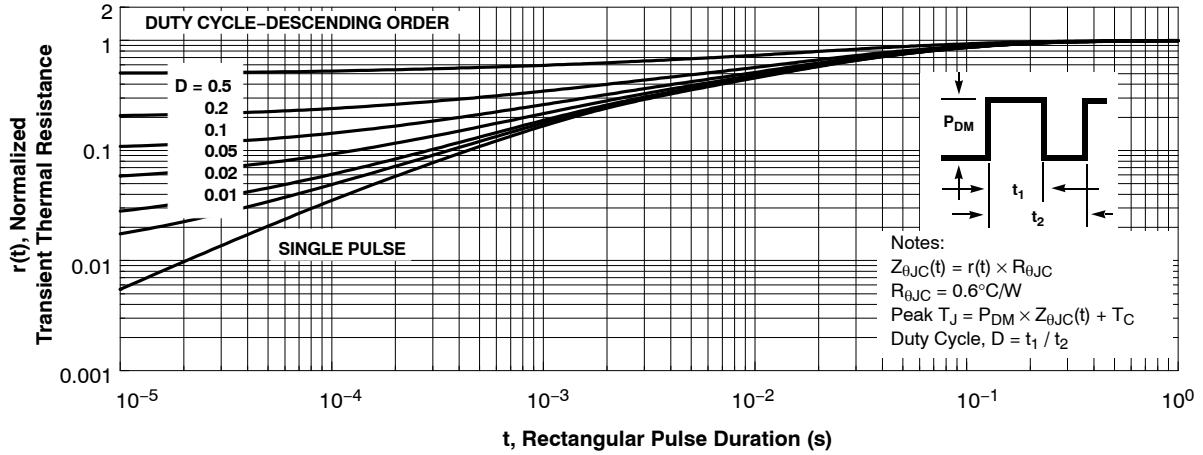


Figure 13. Normalized Max Junction to Case Transient Thermal Response Curve

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# MECHANICAL CASE OUTLINE

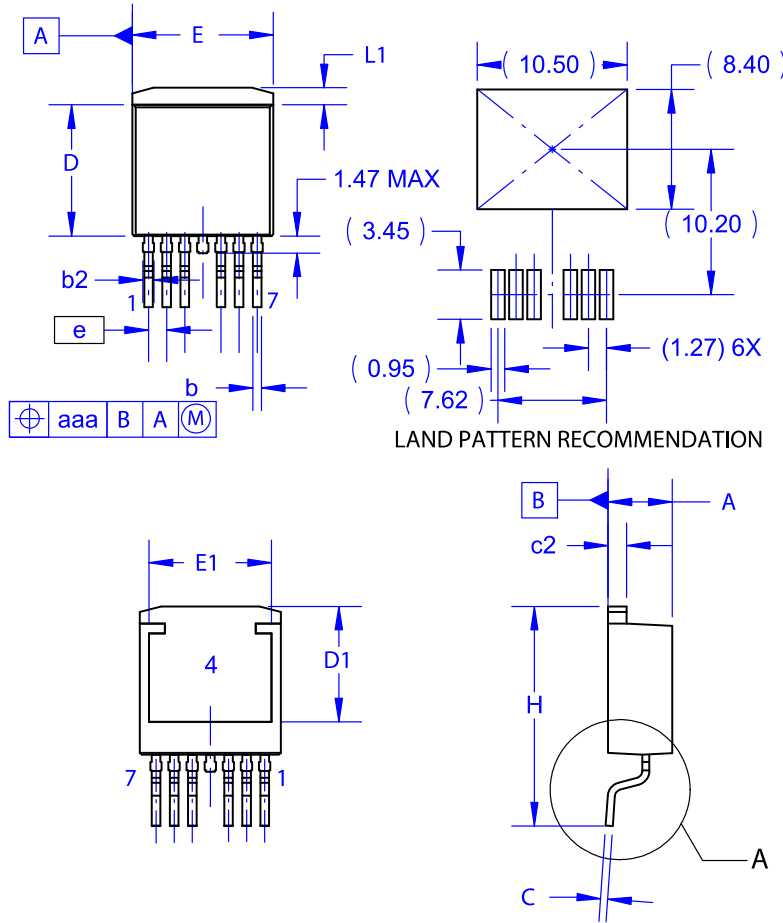
## PACKAGE DIMENSIONS

ON Semiconductor®



### D2PAK7 (TO-263 7 LD) CASE 418AY ISSUE C

DATE 15 JUL 2019

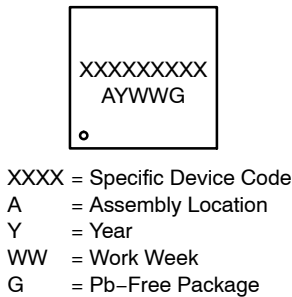


**NOTES:**

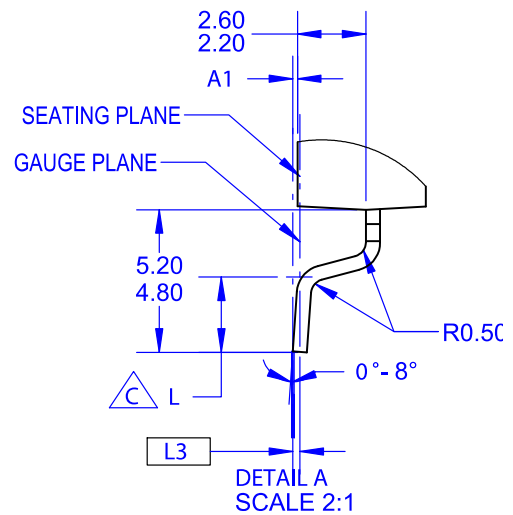
- A. PACKAGE CONFORMS TO JEDEC TO-263 VARIATION CB EXCEPT WHERE NOTED.
- B. ALL DIMENSIONS ARE IN MILLIMETERS.
- C. OUT OF JEDEC STANDARD VALUE.
- D. DIMENSION AND TOLERANCE AS PER ASME Y14.5-1994.
- E. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH AND TIE BAR PROTRUSIONS.
- F. LAND PATTERN RECOMMENDATION PER IPC-TO127P1524X465-8N.

| DIM | MILLIMETERS |       |       |
|-----|-------------|-------|-------|
|     | MIN         | NOM   | MAX   |
| A   | 4.30        | 4.50  | 4.70  |
| A1  | 0.00        | 0.10  | 0.20  |
| b2  | 0.70        | 0.80  | 0.90  |
| b   | 0.50        | 0.60  | 0.70  |
| c   | 0.40        | 0.50  | 0.60  |
| c2  | 1.20        | 1.30  | 1.40  |
| D   | 9.00        | 9.20  | 9.40  |
| D1  | 7.70        | ~     | ~     |
| E   | 9.70        | 9.90  | 10.20 |
| E1  | 8.38        | 8.58  | 8.78  |
| e   | ~           | 1.27  | ~     |
| H   | 15.10       | 15.40 | 15.70 |
| L   | 2.44        | 2.64  | 2.84  |
| L1  | 1.00        | 1.20  | 1.40  |
| L3  | ~           | 0.25  | ~     |
| aaa | ~           | ~     | 0.25  |

**GENERIC MARKING DIAGRAM\***



\*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>D2PAK7 (TO-263 7 LD)</b> | <b>PAGE 1 OF 1</b>   |

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