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**N-CHANNEL ENHANCEMENT MODE FIELD MOSFET**
**Product Summary**

|          |                               |                                    |
|----------|-------------------------------|------------------------------------|
| $V_{SS}$ | $R_{SS(ON)} \text{ Max}$      | $I_S$<br>$T_A = +25^\circ\text{C}$ |
| 24V      | 36mΩ @ $V_{GS} = 4.5\text{V}$ | 5A                                 |

**Features and Benefits**

- Built-in G-S Protection Diode against ESD 2kV HBM
- Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- Halogen and Antimony Free. "Green" Device (Note 3)**

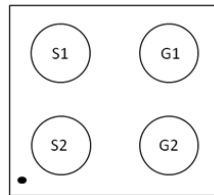
**Description and Applications**

This new generation MOSFET is designed to minimize the on-state resistance ( $R_{SS(ON)}$ ) and making it ideal for high efficiency power management.

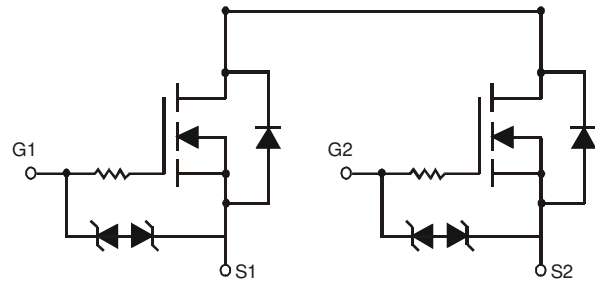
- Battery Management
- Load Switch
- Battery Protection

**Mechanical Data**

- Case: X2-WLB1616-4
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminal Connections: See Diagram
- Terminal Material: SnAgCu Ball
- Weight: 0.0023 grams (Approximate)



Top View



N-Channel

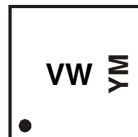
N-Channel

Equivalent Circuit

**Ordering Information** (Note 4)

| Part Number   | Case         | Packaging        |
|---------------|--------------|------------------|
| DMN2036UCB4-7 | X2-WLB1616-4 | 3000/Tape & Reel |

- Notes:
- No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
  - See <https://www.diodes.com/quality/lead-free/> for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
  - Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.
  - For packaging details, go to our website at <https://www.diodes.com/design/support/packaging/diodes-packaging/>.

**Marking Information**


VW/VW = Product Type Marking Code  
 YM = Date Code Marking  
 Y = Year (ex: F = 2018)  
 M = Month (ex: 9 = September)

## Date Code Key

| Year | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 |
|------|------|------|------|------|------|------|------|
| Code | C    | D    | E    | F    | G    | H    | I    |

| Month | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Code  | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | O   | N   | D   |

## Maximum Ratings

| Characteristic  |                 |                           | Symbol    | Value    | Unit |
|---|-----------------|---------------------------|-----------|----------|------|
| Source-Source Voltage   |                 |                           | $V_{SSS}$ | 24       | V    |
| Gate-Source Voltage   |                 |                           | $V_{GSS}$ | $\pm 12$ | V    |
| Continuous Source Current<br>@ $T_A = +25^\circ\text{C}$ (Note 5) | Steady<br>State | $T_A = +25^\circ\text{C}$ | $I_S$     | 5.0      | A    |
|   |                 | $T_A = +70^\circ\text{C}$ |           | 4.0      |      |
| Pulsed Source Current @ $T_A = +25^\circ\text{C}$ (Notes 5 & 6)   |                 |                           | $I_{SM}$  | 30       | A    |

## Thermal Characteristics

| Characteristic   |  |  | Symbol          | Value       | Unit               |
|--|--|--|-----------------|-------------|--------------------|
| Power Dissipation, @ $T_A = +25^\circ\text{C}$ (Note 5)                      |  |  | $P_D$           | 1.45        | W                  |
| Thermal Resistance, Junction to Ambient @ $T_A = +25^\circ\text{C}$ (Note 5) |  |  | $R_{\theta JA}$ | 86.68       | $^\circ\text{C/W}$ |
| Operating and Storage Temperature Range                                      |  |  | $T_J, T_{STG}$  | -55 to +150 | $^\circ\text{C}$   |

## Electrical Characteristics (@ $T_A = +25^\circ\text{C}$ , unless otherwise specified.)

| Characteristic   | Symbol       | Min  | Typ  | Max      | Unit          | Test Condition  |
|--|--------------|------|------|----------|---------------|---|
| <b>OFF CHARACTERISTICS (Note 7)</b>                          |              |      |      |          |               |   |
| Source to Source Breakdown Voltage $T_J = +25^\circ\text{C}$ | $V_{(BR)SS}$ | 24   | —    | —        | V             | $I_S = 1\text{mA}, V_{GS} = 0\text{V}$                          |
| Zero Gate Voltage Source Current $T_J = +25^\circ\text{C}$   | $I_{SSS}$    | —    | —    | 1.0      | $\mu\text{A}$ | $V_{SS} = 20\text{V}, V_{GS} = 0\text{V}$                       |
| Gate-Body Leakage  | $I_{GSS}$    | —    | —    | $\pm 10$ | $\mu\text{A}$ | $V_{GS} = \pm 8\text{V}, V_{SS} = 0\text{V}$                    |
| <b>ON CHARACTERISTICS (Note 7)</b>                           |              |      |      |          |               |   |
| Gate Threshold Voltage                                       | $V_{GS(TH)}$ | 0.5  | —    | 1.3      | V             | $V_{SS} = 10\text{V}, I_S = 1.0\text{mA}$                       |
| Static Source-Source On-Resistance                           | $R_{SS(ON)}$ | 20   | 29   | 36       | m $\Omega$    | $V_{GS} = 4.5\text{V}, I_S = 3.0\text{A}$                       |
|  |              | 20.5 | 30   | 37       |               | $V_{GS} = 4.0\text{V}, I_S = 3.0\text{A}$                       |
|  |              | 21   | 31   | 39       |               | $V_{GS} = 3.7\text{V}, I_S = 3.0\text{A}$                       |
|  |              | 22   | 33   | 44       |               | $V_{GS} = 3.1\text{V}, I_S = 3.0\text{A}$                       |
|  |              | 23   | 36   | 52       |               | $V_{GS} = 2.5\text{V}, I_S = 3.0\text{A}$                       |
| Forward Transfer Admittance                                  | $ Y_{fs} $   | —    | 9.4  | —        | S             | $V_{SS} = 10\text{V}, I_S = 3.0\text{A}$                        |
| Body Diode Forward Voltage                                   | $V_{F(S-S)}$ | —    | 0.8  | 1.2      | V             | $I_F = 3.0\text{A}, V_{GS} = 0\text{V}$                         |
| <b>DYNAMIC CHARACTERISTICS (Note 8)</b>                      |              |      |      |          |               |   |
| Total Gate Charge  | $Q_g$        | —    | 12.6 | —        | nC            | $V_{GS} = 4.5\text{V}, V_{SS} = 10\text{V}, I_S = 6\text{A}$    |
| Turn-On Delay Time   | $t_{D(ON)}$  | —    | 183  | —        | ns            | $V_{DD} = 10\text{V},$<br>$R_L = 3.33\Omega, I_S = 3.0\text{A}$ |
| Turn-On Rise Time  | $t_R$        | —    | 278  | —        | ns            |   |
| Turn-Off Delay Time  | $t_{D(OFF)}$ | —    | 738  | —        | ns            |   |
| Turn-Off Fall Time   | $t_F$        | —    | 572  | —        | ns            |   |

- Notes:
- Device mounted on FR-4 material with 1-inch<sup>2</sup> (6.45-cm<sup>2</sup>), 2-oz. (0.071-mm thick) Cu.
  - Repetitive rating, pulse width limited by junction temperature.
  - Short duration pulse test used to minimize self-heating effect.
  - Guaranteed by design. Not subject to production testing.



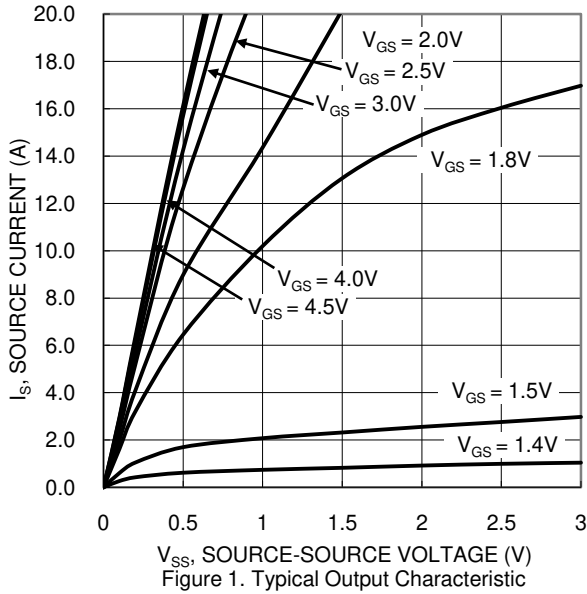


Figure 1. Typical Output Characteristic

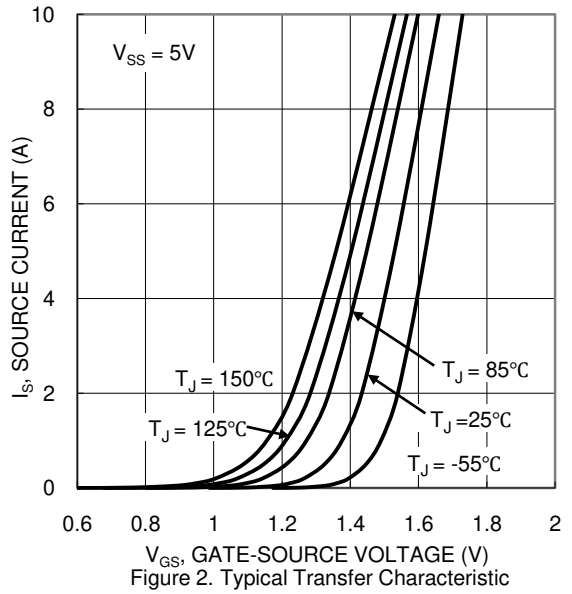


Figure 2. Typical Transfer Characteristic

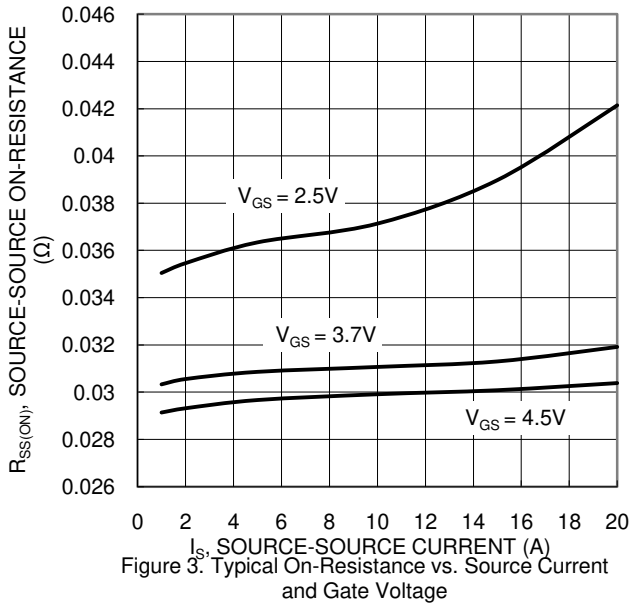


Figure 3. Typical On-Resistance vs. Source Current and Gate Voltage

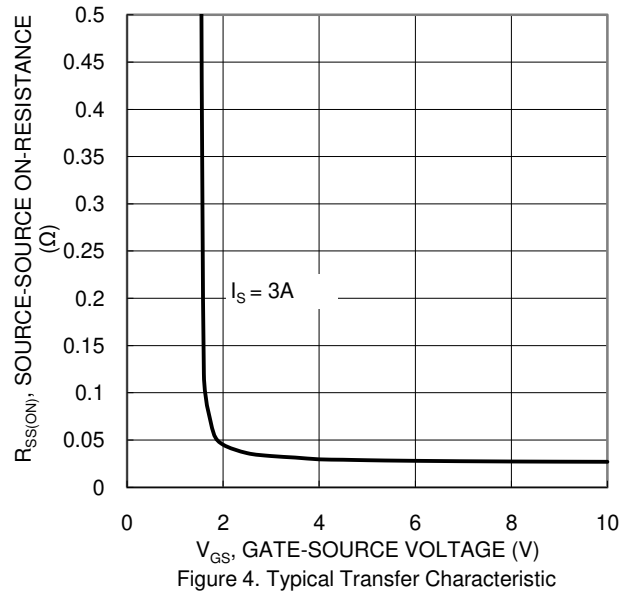


Figure 4. Typical Transfer Characteristic

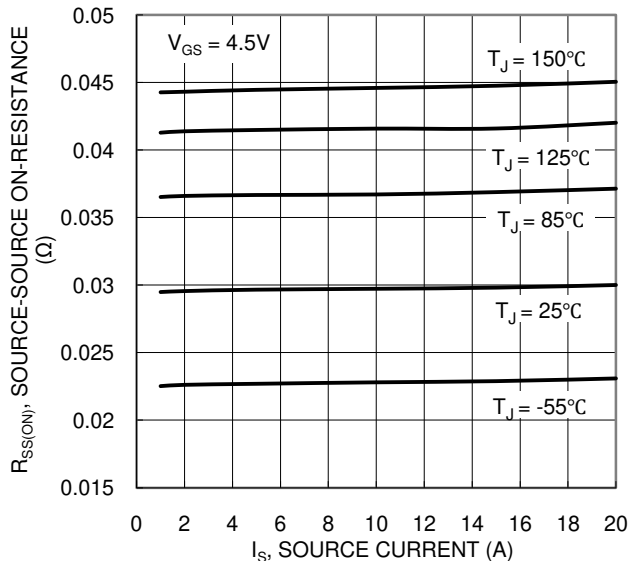


Figure 5. Typical On-Resistance vs. Source Current and Junction Temperature

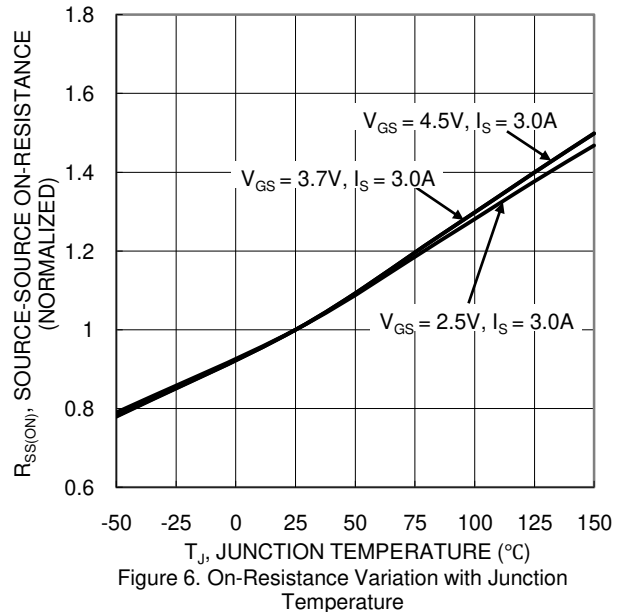


Figure 6. On-Resistance Variation with Junction Temperature

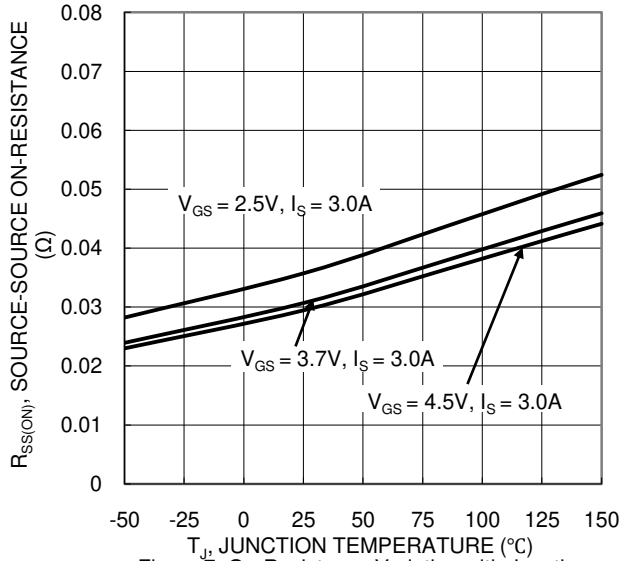


Figure 7. On-Resistance Variation with Junction Temperature

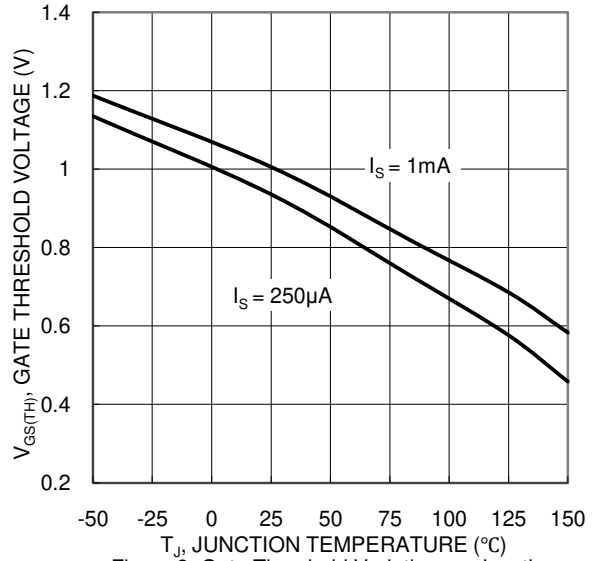


Figure 8. Gate Threshold Variation vs. Junction Temperature

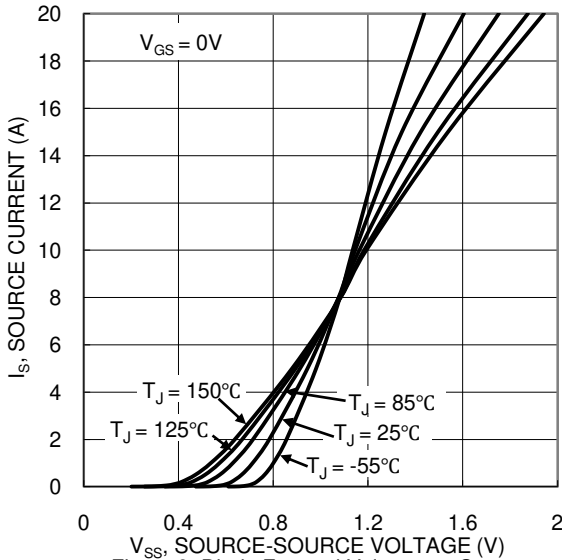


Figure 9. Diode Forward Voltage vs. Current

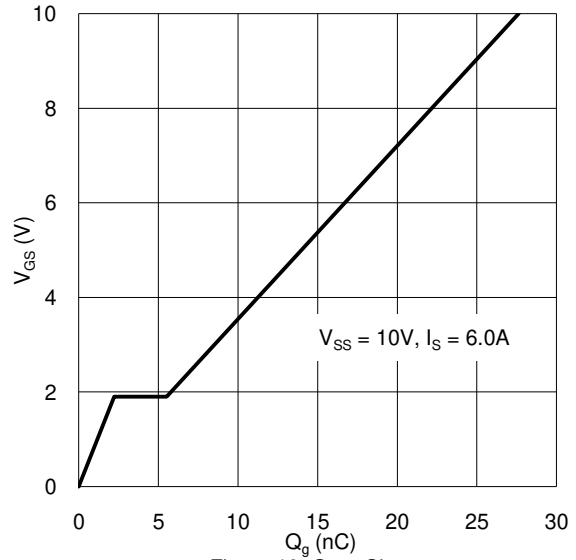


Figure 10. Gate Charge

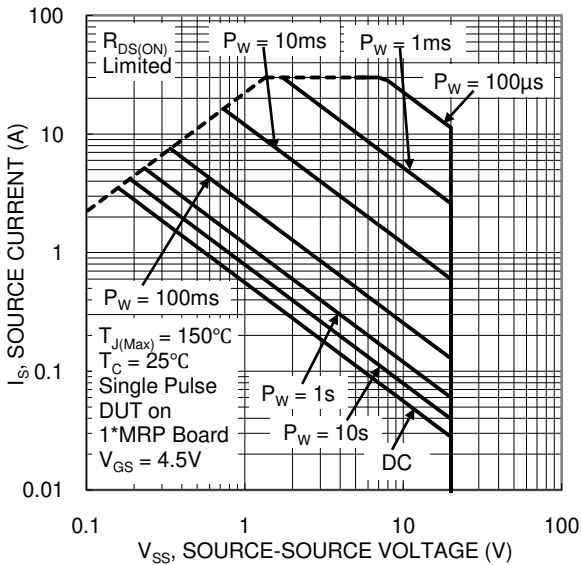


Figure 11. SOA, Safe Operation Area

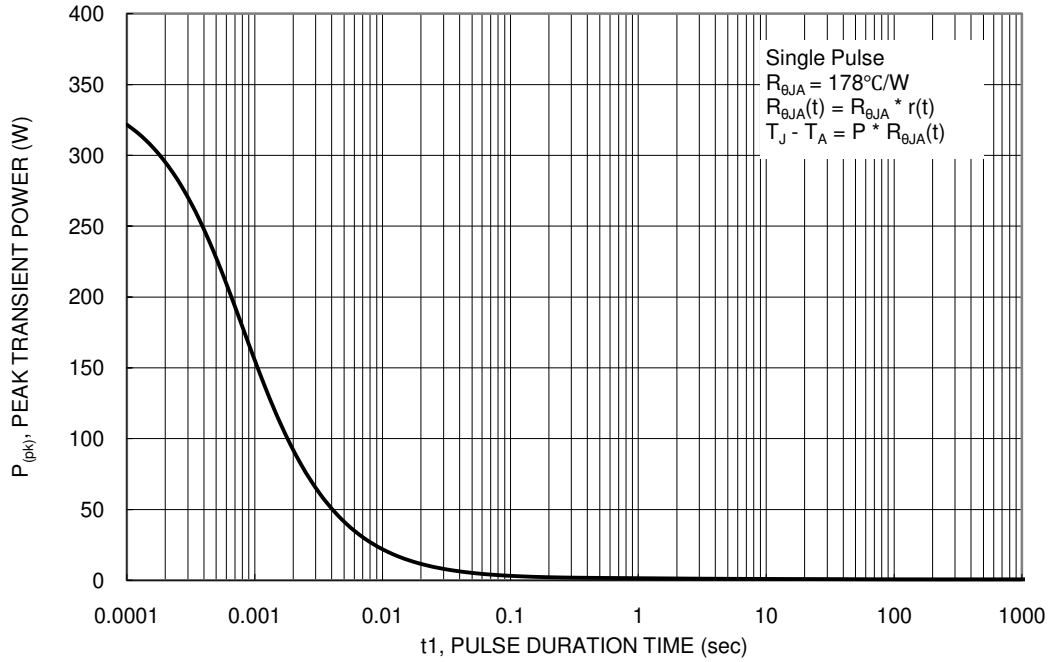


Figure 12. Single Pulse Maximum Power Dissipation

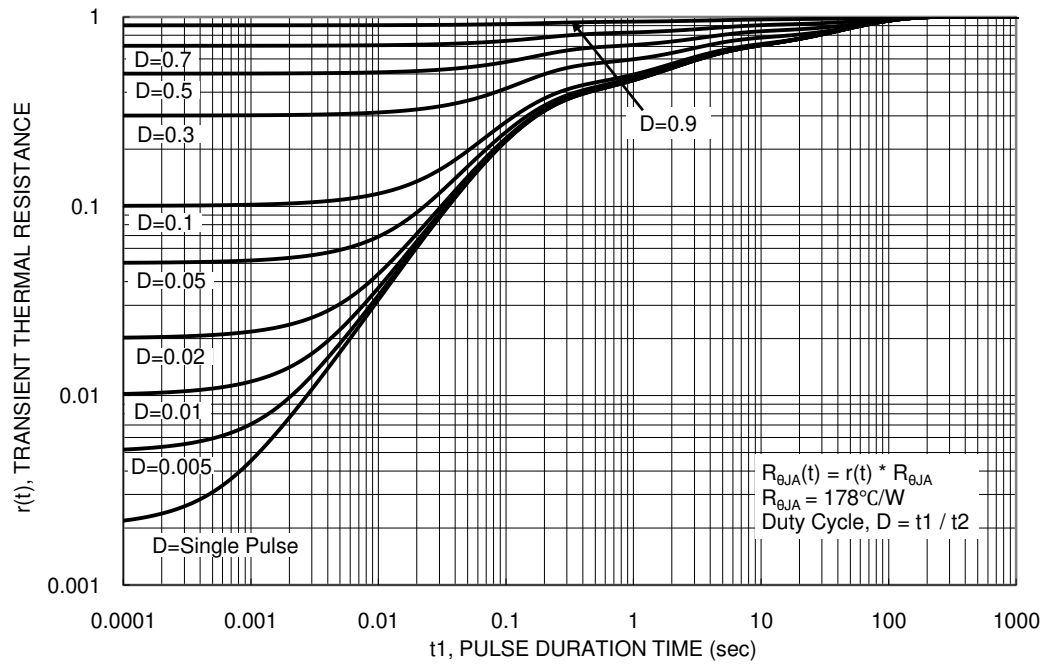
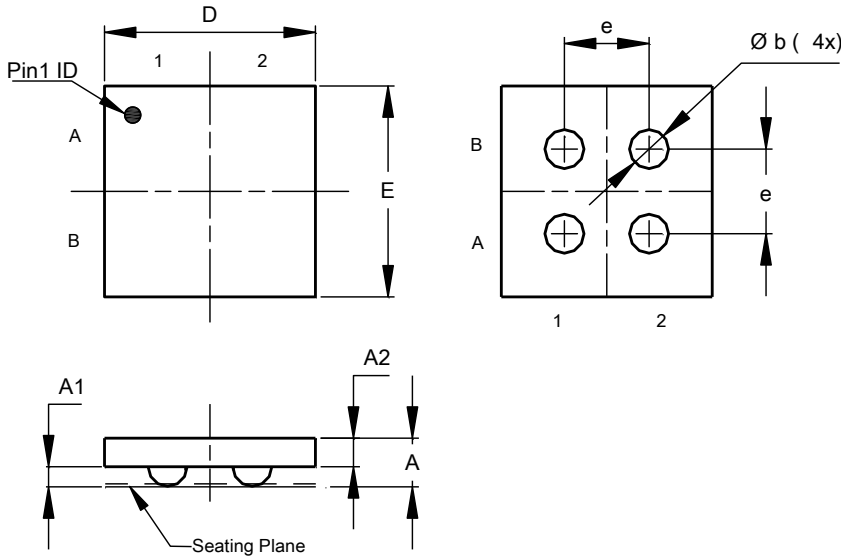


Figure 13. Transient Thermal Resistance

**Package Outline Dimensions**

Please see <http://www.diodes.com/package-outlines.html> for the latest version.

**X2-WLB1616-4**

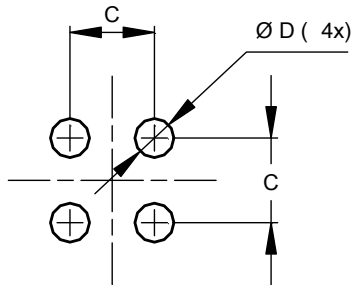


| X2-WLB1616-4         |      |      |      |
|----------------------|------|------|------|
| Dim                  | Min  | Max  | Typ  |
| A                    | --   | 0.40 | 0.37 |
| A1                   | --   | --   | 0.15 |
| A2                   | --   | --   | 0.22 |
| b                    | 0.25 | 0.35 | 0.30 |
| D                    | 1.58 | 1.66 | 1.62 |
| E                    | 1.58 | 1.66 | 1.62 |
| e                    | -    | -    | 0.65 |
| All Dimensions in mm |      |      |      |

**Suggested Pad Layout**

Please see <http://www.diodes.com/package-outlines.html> for the latest version.

**X2-WLB1616-4**



| Dimensions | Value (in mm) |
|------------|---------------|
| C          | 0.65          |
| D          | 0.30          |

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