

## Product Summary

| $V_{(BR)DSS}$ | $R_{DS(ON)}$ Max                      | $I_D$ Max<br>$T_A = +25^\circ\text{C}$ |
|---------------|---------------------------------------|----------------------------------------|
| 60V           | 13m $\Omega$ @ $V_{GS} = 10\text{V}$  | 10.3A                                  |
|               | 18m $\Omega$ @ $V_{GS} = 4.5\text{V}$ | 8.8A                                   |

## Description

This MOSFET has been designed to minimize the on-state resistance ( $R_{DS(ON)}$ ) yet maintain superior switching performance, which makes it ideal for high-efficiency power management applications.

## Applications

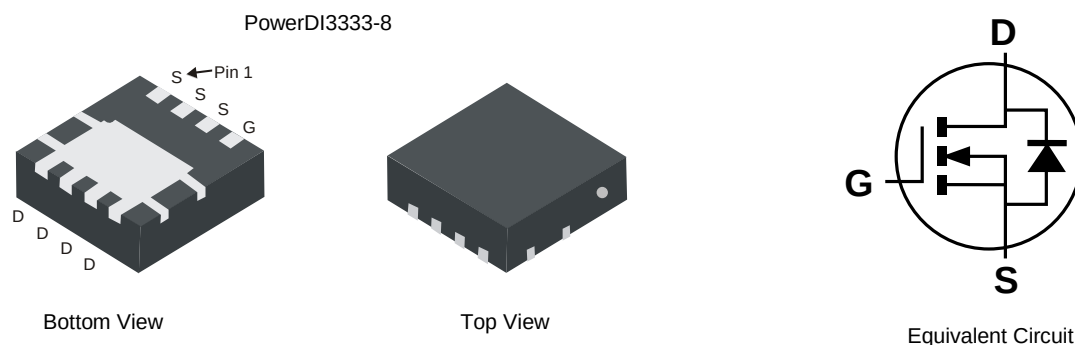
- Backlighting
- Power Management Functions
- DC-DC Converters

## Features and Benefits

- Low  $R_{DS(ON)}$ —Ensures On-state Losses are Minimized
- Small Form Factor Thermally Efficient Package Enables Higher Density End Products
- Occupies Just 33% of Board Area Occupied by SO-8 Enabling Smaller End Product
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **Qualified to AEC-Q101 Standards for High Reliability**

## Mechanical Data

- Case: PowerDI<sup>®</sup>3333-8
- Case Material: Molded Plastic, "Green" Molding Compound  
UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminal Connections Indicator: See diagram
- Terminals: Finish—Matte Tin Annealed over Copper Leadframe  
Solderable per MIL-STD-202, Method 208 <sup>(3)</sup>
- Weight: 0.072 grams (Approximate)

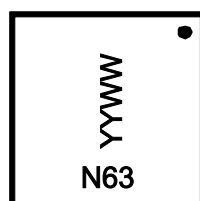


## Ordering Information (Note 4)

| Part Number   | Case          | Packaging        |
|---------------|---------------|------------------|
| DMN6013LFG-7  | PowerDI3333-8 | 2000/Tape & Reel |
| DMN6013LFG-13 | PowerDI3333-8 | 3000/Tape & Reel |

- Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
  2. 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.
  3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.
  4. For packaging details, go to our website at <http://www.diodes.com/products/packages.html>.

## Marking Information



N63= Product Type Marking Code  
 YYWW = Date Code Marking  
 YY = Last digit of year (ex: 18 = 2018)  
 WW = Week code (01 ~ 53)

**Maximum Ratings** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

| Characteristic                                          | Symbol           | Value | Units |
|---------------------------------------------------------|------------------|-------|-------|
| Drain-Source Voltage                                    | V <sub>DSS</sub> | 60    | V     |
| Gate-Source Voltage                                     | V <sub>GSS</sub> | ±20   | V     |
| Continuous Drain Current (Note 6) V <sub>GS</sub> = 10V | I <sub>D</sub>   | 10.3  | A     |
|                                                         |                  | 8.3   |       |
|                                                         | I <sub>D</sub>   | 45    | A     |
|                                                         |                  | 28    |       |
| Pulsed Drain Current (10μs Pulse, Duty Cycle = 1%)      | I <sub>DM</sub>  | 58.3  | A     |
| Maximum Continuous Body Diode Forward Current (Note 6)  | I <sub>S</sub>   | 3     | A     |
| Avalanche Current, L = 0.1mH                            | I <sub>AS</sub>  | 33.3  | A     |
| Avalanche Energy, L = 0.1mH                             | E <sub>AS</sub>  | 56.8  | mJ    |

**Thermal Characteristics** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

| Characteristic                                   | Symbol                            | Value       | Units |
|--------------------------------------------------|-----------------------------------|-------------|-------|
| Total Power Dissipation (Note 5)                 | P <sub>D</sub>                    | 1           | W     |
| Thermal Resistance, Junction to Ambient (Note 5) | R <sub>ΘJA</sub>                  | 123         | °C/W  |
|                                                  |                                   | 69          |       |
| Total Power Dissipation (Note 6)                 | P <sub>D</sub>                    | 2.1         | W     |
| Thermal Resistance, Junction to Ambient (Note 6) | R <sub>ΘJA</sub>                  | 60          | °C/W  |
|                                                  |                                   | 34          |       |
| Total Power Dissipation (Note 6)                 | P <sub>D</sub>                    | 40          | W     |
| Thermal Resistance, Junction to Case (Note 6)    | R <sub>ΘJC</sub>                  | 3.2         | °C/W  |
| Operating and Storage Temperature Range          | T <sub>J</sub> , T <sub>STG</sub> | -55 to +150 | °C    |

**Electrical Characteristics** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

| Characteristic                                          | Symbol              | Min | Typ  | Max  | Unit | Test Condition                                                                             |
|---------------------------------------------------------|---------------------|-----|------|------|------|--------------------------------------------------------------------------------------------|
| <b>OFF CHARACTERISTICS (Note 7)</b>                     |                     |     |      |      |      |                                                                                            |
| Drain-Source Breakdown Voltage                          | BV <sub>DSS</sub>   | 60  | —    | —    | V    | V <sub>GS</sub> = 0V, I <sub>D</sub> = 250μA                                               |
| Zero Gate Voltage Drain Current, T <sub>J</sub> = +25°C | I <sub>DSS</sub>    | —   | —    | 1    | μA   | V <sub>DS</sub> = 60V, V <sub>GS</sub> = 0V                                                |
| Gate-Source Leakage                                     | I <sub>GSS</sub>    | —   | —    | ±100 | nA   | V <sub>GS</sub> = ±20V, V <sub>DS</sub> = 0V                                               |
| <b>ON CHARACTERISTICS (Note 7)</b>                      |                     |     |      |      |      |                                                                                            |
| Gate Threshold Voltage                                  | V <sub>GS(th)</sub> | 1   | 1.8  | 3    | V    | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA                                 |
| Static Drain-Source On-Resistance                       | R <sub>DS(ON)</sub> | —   | 9.3  | 13   | mΩ   | V <sub>GS</sub> = 10V, I <sub>D</sub> = 10A                                                |
|                                                         |                     | —   | 12.3 | 18   |      | V <sub>GS</sub> = 4.5V, I <sub>D</sub> = 8A                                                |
| Diode Forward Voltage                                   | V <sub>SD</sub>     | —   | 0.7  | 1.2  | V    | V <sub>GS</sub> = 0V, I <sub>S</sub> = 1.7A                                                |
| <b>DYNAMIC CHARACTERISTICS (Note 8)</b>                 |                     |     |      |      |      |                                                                                            |
| Input Capacitance                                       | C <sub>iss</sub>    | —   | 2577 | —    | pF   | V <sub>DS</sub> = 30V, V <sub>GS</sub> = 0V,<br>f = 1MHz                                   |
| Output Capacitance                                      | C <sub>oss</sub>    | —   | 162  | —    | pF   |                                                                                            |
| Reverse Transfer Capacitance                            | C <sub>rss</sub>    | —   | 132  | —    | pF   |                                                                                            |
| Gate Resistance                                         | R <sub>g</sub>      | —   | 0.9  | —    | Ω    | V <sub>DS</sub> = 0V, V <sub>GS</sub> = 0V, f = 1MHz                                       |
| Total Gate Charge (V <sub>GS</sub> = 4.5V)              | Q <sub>g</sub>      | —   | 26.6 | —    | nC   | V <sub>DS</sub> = 30V, I <sub>D</sub> = 10A                                                |
| Total Gate Charge (V <sub>GS</sub> = 10V)               | Q <sub>g</sub>      | —   | 55.4 | —    | nC   |                                                                                            |
| Gate-Source Charge                                      | Q <sub>gs</sub>     | —   | 9.3  | —    | nC   |                                                                                            |
| Gate-Drain Charge                                       | Q <sub>gd</sub>     | —   | 12.6 | —    | nC   |                                                                                            |
| Turn-On Delay Time                                      | t <sub>D(on)</sub>  | —   | 6.2  | —    | ns   | V <sub>GS</sub> = 10V, V <sub>DS</sub> = 30V,<br>R <sub>G</sub> = 3Ω, I <sub>D</sub> = 10A |
| Turn-On Rise Time                                       | t <sub>r</sub>      | —   | 9.9  | —    | ns   |                                                                                            |
| Turn-Off Delay Time                                     | t <sub>D(off)</sub> | —   | 27.6 | —    | ns   |                                                                                            |
| Turn-Off Fall Time                                      | t <sub>f</sub>      | —   | 11.7 | —    | ns   |                                                                                            |
| Body Diode Reverse Recovery Time                        | t <sub>rr</sub>     | —   | 9.4  | —    | nS   | I <sub>F</sub> = 10A, di/dt = 100A/μs                                                      |
| Body Diode Reverse Recovery Charge                      | Q <sub>rr</sub>     | —   | 18.6 | —    | nC   |                                                                                            |

- Notes:
- Device mounted on FR-4 PCB, with minimum recommended pad layout, single sided.
  - Device mounted on FR-4 substrate PCB, 2oz copper, with thermal bias to bottom layer 1inch square copper plate
  - Short duration pulse test used to minimize self-heating effect.
  - Guaranteed by design. Not subject to product testing.

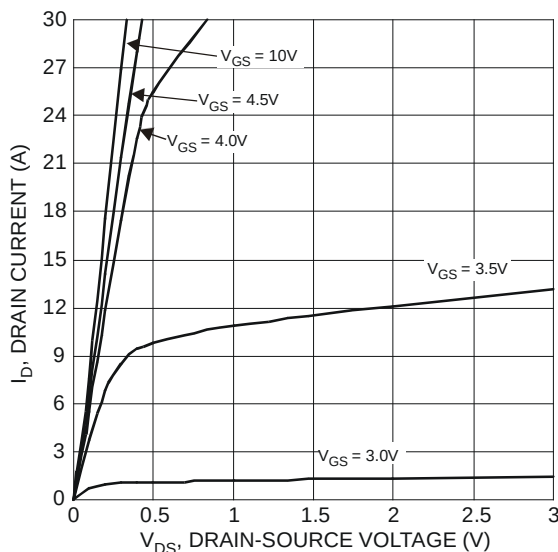


Figure 1 Typical Output Characteristics

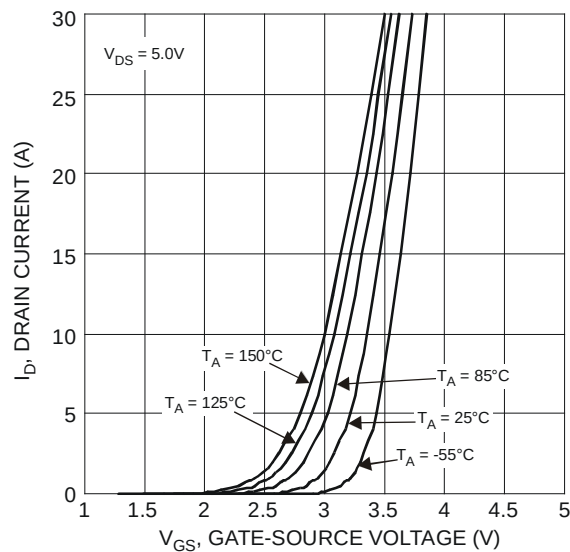


Figure 2 Typical Transfer Characteristics

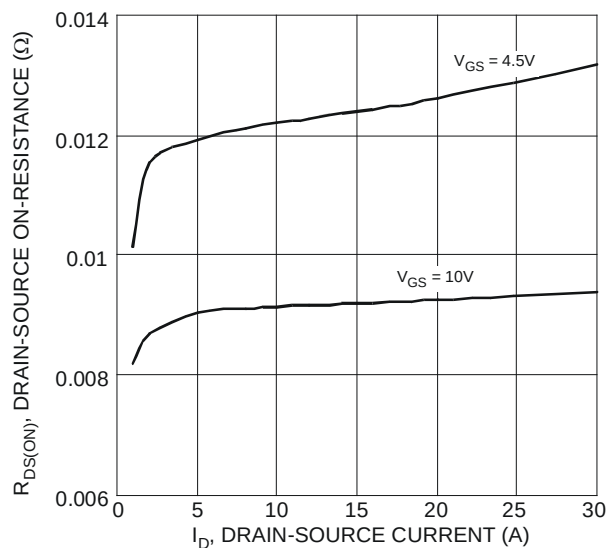


Figure 3 Typical On-Resistance vs. Drain Current and Gate Voltage

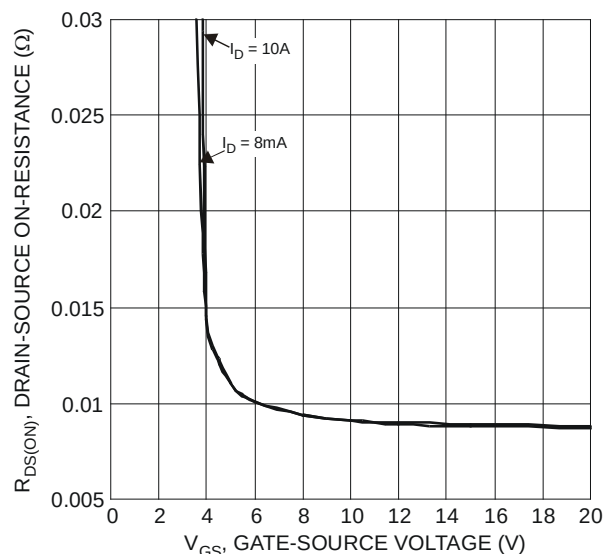


Figure 4 Typical Drain-Source On-Resistance vs. Gate-Source Voltage

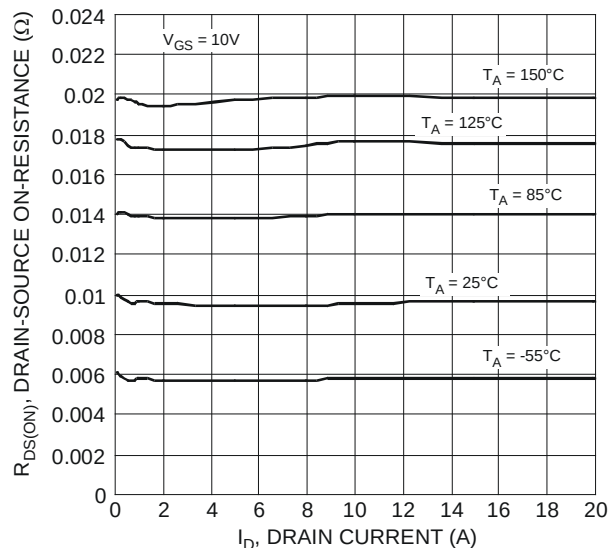


Figure 5 Typical On-Resistance vs. Drain Current and Temperature

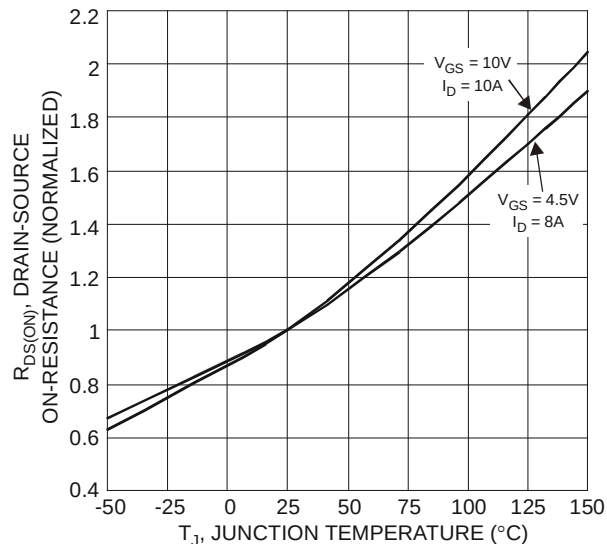
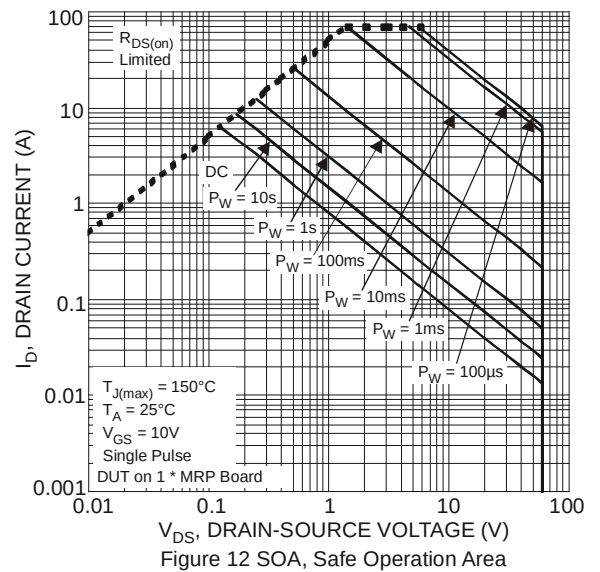
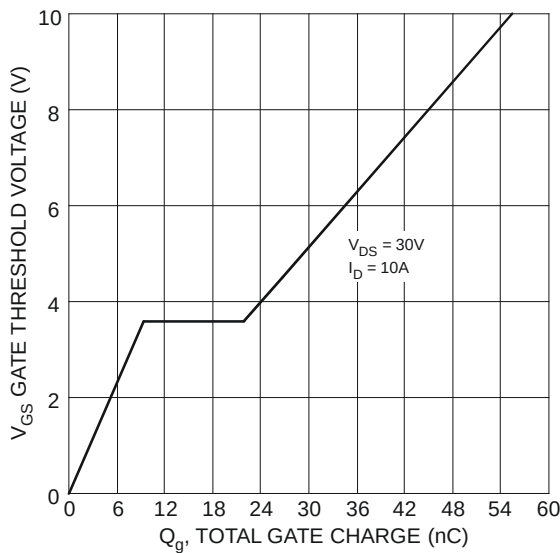
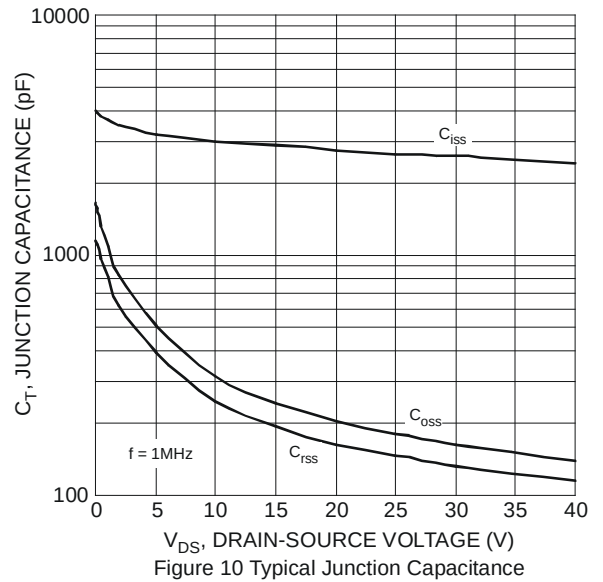
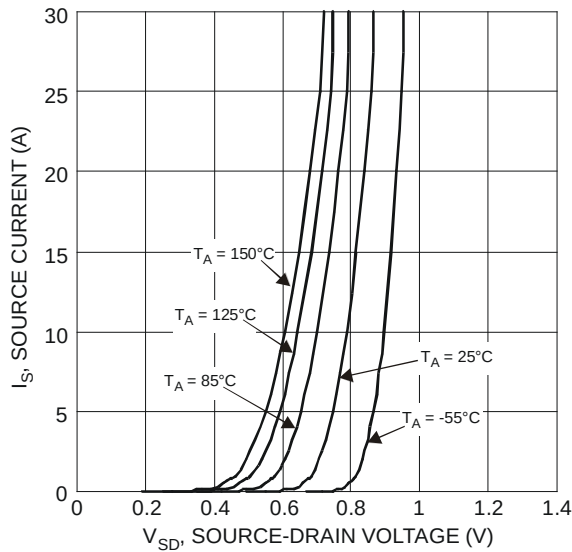
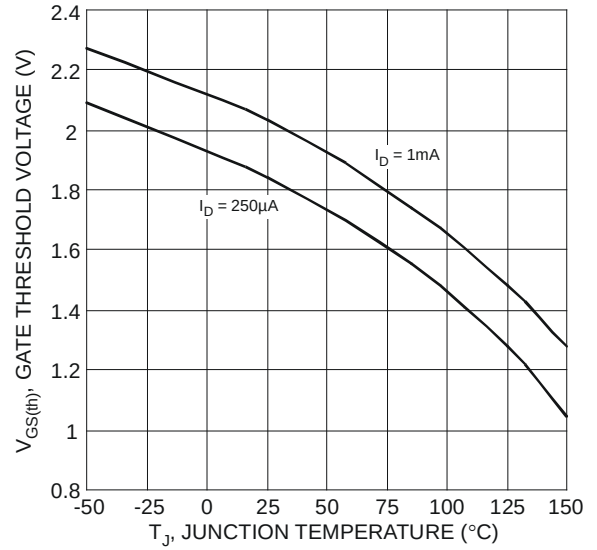
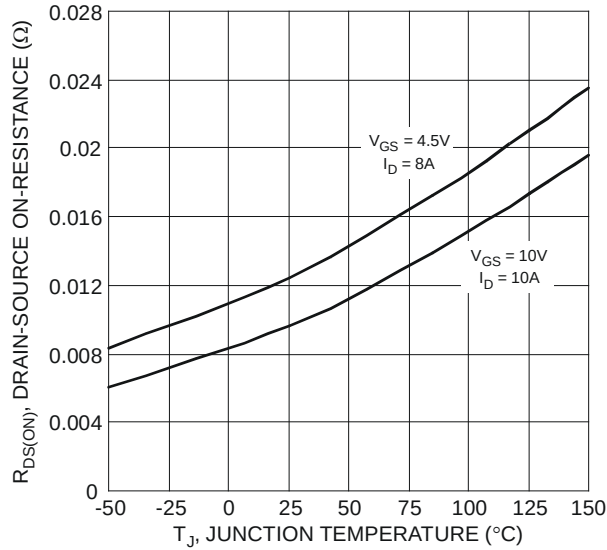
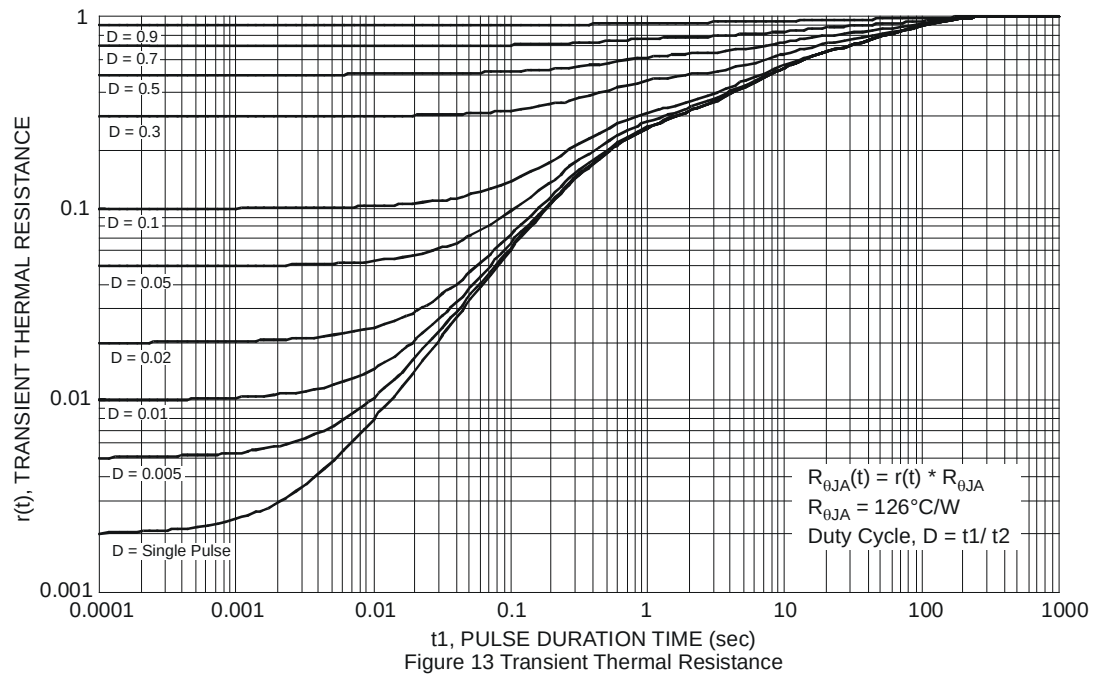


Figure 6 On-Resistance Variation with Temperature

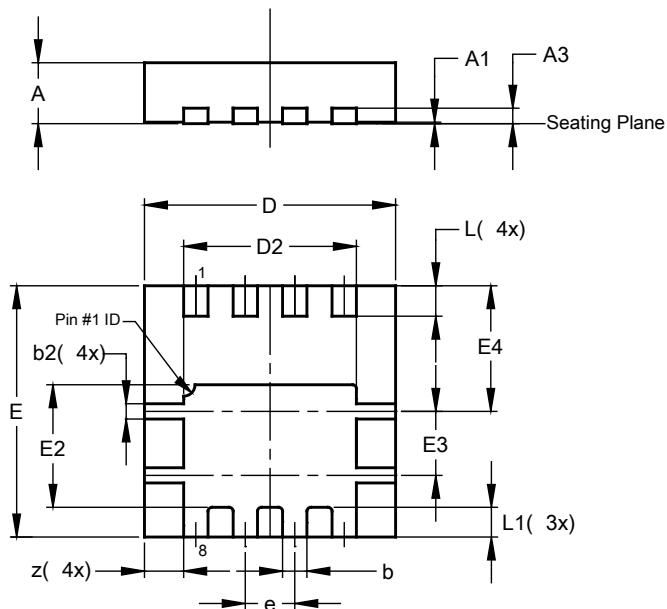




## Package Outline Dimensions

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

PowerDI3333-8

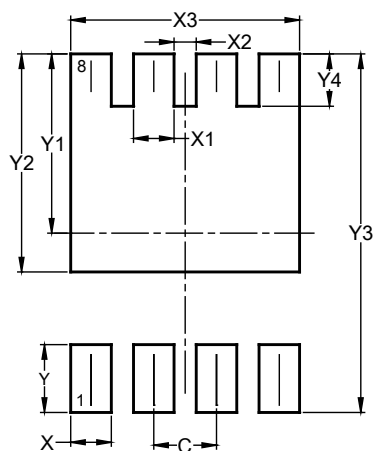


| PowerDI3333-8        |      |      |       |
|----------------------|------|------|-------|
| Dim                  | Min  | Max  | Typ   |
| A                    | 0.75 | 0.85 | 0.80  |
| A1                   | 0.00 | 0.05 | 0.02  |
| A3                   | —    | —    | 0.203 |
| b                    | 0.27 | 0.37 | 0.32  |
| b2                   | 0.15 | 0.25 | 0.20  |
| D                    | 3.25 | 3.35 | 3.30  |
| D2                   | 2.22 | 2.32 | 2.27  |
| E                    | 3.25 | 3.35 | 3.30  |
| E2                   | 1.56 | 1.66 | 1.61  |
| E3                   | 0.79 | 0.89 | 0.84  |
| E4                   | 1.60 | 1.70 | 1.65  |
| e                    | —    | —    | 0.65  |
| L                    | 0.35 | 0.45 | 0.40  |
| L1                   | —    | —    | 0.39  |
| z                    | —    | —    | 0.515 |
| All Dimensions in mm |      |      |       |

## Suggested Pad Layout

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

PowerDI3333-8



| Dimensions | Value (in mm) |
|------------|---------------|
| C          | 0.650         |
| X          | 0.420         |
| X1         | 0.420         |
| X2         | 0.230         |
| X3         | 2.370         |
| Y          | 0.700         |
| Y1         | 1.850         |
| Y2         | 2.250         |
| Y3         | 3.700         |
| Y4         | 0.540         |

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