# 20V P-CHANNEL ENHANCEMENT MODE MOSFET
## PowerDI3333-8

## Product Summary

| $BV_{DSS}$ | $R_{DS(ON)}$ Max | $I_D$ Max<br>$T_C$ = +25°C |
|---|---|---|
| -20V | 9.5mΩ @ $V_{GS}$ = -4.5V | -40A |
| | 12.5mΩ @ $V_{GS}$ = -2.5V | |

## Description

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

## Applications

- Load switches
- Power management functions

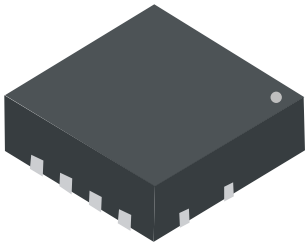
## Features

- 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 The 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)**
- **For automotive applications requiring specific change control (i.e. parts qualified to AEC-Q100/101/104/200, PPAP capable, and manufactured in IATF 16949 certified facilities), please contact us or your local Diodes representative. https://www.diodes.com/quality/product-definitions/**

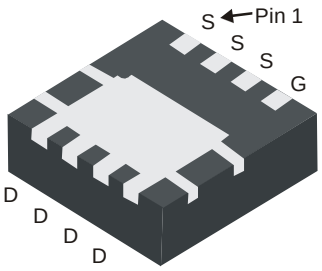
## Mechanical Data

- Package: PowerDI®3333-8
- Package 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 e3
- Weight: 0.008 grams (Approximate)

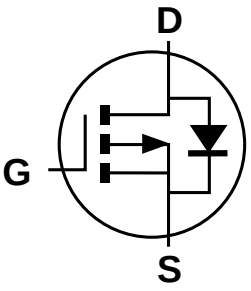
PowerDI3333-8



Top View




Bottom View




Equivalent Circuit

## Ordering Information (Note 4)

| Part Number | Package | Packing | |
|---|---|---|---|
| | | Qty. | Carrier |
| DMP2010UFG-7 | PowerDI3333-8 | 2000 | Tape & Reel |
| DMP2010UFG-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 https://www.diodes.com/design/support/packaging/diodes-packaging/.

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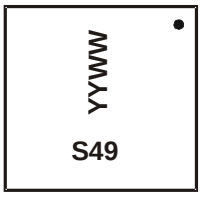
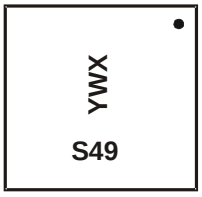
## Marking Information

Site1




S49 = Product Type Marking Code
YYWW = Date Code Marking
YY = Last Two Digits of Year (ex: 22 = 2022)
WW = Week Code (01 to 53)

Site2




S49 = Product Type Marking Code
Y = Year (ex: 2 = 2022)
W = Week (ex: a = Week 27; z Represents Week 52 and 53)
X = Internal Code (ex: U = Monday)

Date Code Key

| Year | 2015 | … | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Code | 5 | … | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 |

| Week | 1-26 | 27-52 | 53 |
|---|---|---|---|
| Code | A-Z | a-z | z |

| Internal Code | Sun | Mon | Tue | Wed | Thu | Fri | Sat |
|---|---|---|---|---|---|---|---|
| Code | T | U | V | W | X | Y | Z |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## Maximum Ratings (@$T_A$ = +25°C, unless otherwise specified.)

| Characteristic | | Symbol | Value | Unit |
|---|---|---|---|---|
| Drain-Source Voltage | | $V_{DSS}$ | -20 | V |
| Gate-Source Voltage | | $V_{GSS}$ | ±10 | V |
| Continuous Drain Current, $V_{GS}$ = -4.5V (Note 6) | $T_A$ = +25°C<br>$T_C$ = +25°C<br>(Note 10) | $I_D$ | -12.7<br>-40 | A |
| Maximum Continuous Body Diode Forward Current (Note 6) | | $I_S$ | -3 | A |
| Pulsed Drain Current (380µs Pulse, Duty Cycle = 1%) | | $I_{DM}$ | -80 | A |
| Avalanche Current, L= 0.1mH (Note 7) | | $I_{AS}$ | -35 | A |
| Avalanche Energy, L= 0.1mH (Note 7) | | $E_{AS}$ | 64 | mJ |

## Thermal Characteristics (@$T_A$ = +25°C, unless otherwise specified.)

| Characteristic | | Symbol | Value | Unit |
|---|---|---|---|---|
| Total Power Dissipation (Note 5) | | $P_D$ | 0.9 | W |
| Thermal Resistance, Junction to Ambient (Note 5) | Steady State | $R_{\theta JA}$ | 136 | °C/W |
| Total Power Dissipation (Note 6) | | $P_D$ | 2.3 | W |
| Thermal Resistance, Junction to Ambient (Note 6) | Steady State | $R_{\theta JA}$ | 54 | °C/W |
| Thermal Resistance, Junction to Case (Note 6) | | $R_{\theta JC}$ | 4 | |
| Operating and Storage Temperature Range | | $T_J$, $T_{STG}$ | -55 to +150 | °C |

## Electrical Characteristics (@$T_A$ = +25°C, unless otherwise specified.)

| Characteristic | Symbol | Min | Typ | Max | Unit | Test Condition |
|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS (Note 8)** | | | | | | |
| Drain-Source Breakdown Voltage | $BV_{DSS}$ | -20 | — | — | V | $V_{GS}$ = 0V, $I_D$ = -1mA |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | — | — | -1 | µA | $V_{DS}$ = -16V, $V_{GS}$ = 0V |
| Gate-Source Leakage | $I_{GSS}$ | — | — | ±100 | nA | $V_{GS}$ = ±8V, $V_{DS}$ = 0V |
| **ON CHARACTERISTICS (Note 8)** | | | | | | |
| Gate Threshold Voltage | $V_{GS(TH)}$ | -0.4 | — | -1.2 | V | $V_{DS}$ = $V_{GS}$, $I_D$ = -250µA |
| Static Drain-Source On-Resistance | $R_{DS(ON)}$ | — | — | 9.5 | mΩ | $V_{GS}$ = -4.5V, $I_D$ = -3.6A |
| | | — | — | 12.5 | | $V_{GS}$ = -2.5V, $I_D$ = -3.6A |
| Diode Forward Voltage | $V_{SD}$ | — | -0.7 | -1.2 | V | $V_{GS}$ = 0V, $I_S$ = -10A |
| **DYNAMIC CHARACTERISTICS (Note 9)** | | | | | | |
| Input Capacitance | $C_{iss}$ | — | 3350 | — | pF | $V_{DS}$ = -10V, $V_{GS}$ = 0V<br>f = 1.0MHz |
| Output Capacitance | $C_{oss}$ | — | 527 | — | | |
| Reverse Transfer Capacitance | $C_{rss}$ | — | 460 | — | | |
| Gate Resistance | $R_G$ | — | 10.7 | — | Ω | $V_{DS}$ = 0V, $V_{GS}$ = 0V, f = 1.0MHz |
| Total Gate Charge ($V_{GS}$ = -4.5V) | $Q_g$ | — | 50 | — | nC | $V_{DS}$ = -10V, $I_D$ = -3.6A |
| Total Gate Charge ($V_{GS}$ = -10V) | $Q_g$ | — | 103 | — | | |
| Gate-Source Charge | $Q_{gs}$ | — | 6.0 | — | | |
| Gate-Drain Charge | $Q_{gd}$ | — | 14.4 | — | | |
| Turn-On Delay Time | $t_{D(ON)}$ | — | 9.7 | — | ns | $V_{DD}$ = -10V, $V_{GS}$ = -4.5V,<br>$R_{GEN}$ = 4.7Ω, $I_D$ = -3.6A |
| Turn-On Rise Time | $t_R$ | — | 30 | — | | |
| Turn-Off Delay Time | $t_{D(OFF)}$ | — | 235 | — | | |
| Turn-Off Fall Time | $t_F$ | — | 110 | — | | |
| Reverse Recovery Time | $t_{RR}$ | — | 64 | — | ns | $I_F$ = -3.6A, di/dt = 100A/µs |
| Reverse Recovery Charge | $Q_{RR}$ | — | 60 | — | nC | |

Notes:
5. Device mounted on FR-4 substrate PC board, 2oz copper, with minimum recommended pad layout.
6. Device mounted on FR-4 substrate PC board, 2oz copper, with 1inch square copper plate.
7. $I_{AS}$ and $E_{AS}$ ratings are based on low frequency and duty cycles to keep $T_J$ = +25°C.
8. Short duration pulse test used to minimize self-heating effect.
9. Guaranteed by design. Not subject to product testing.
10. Package limited.


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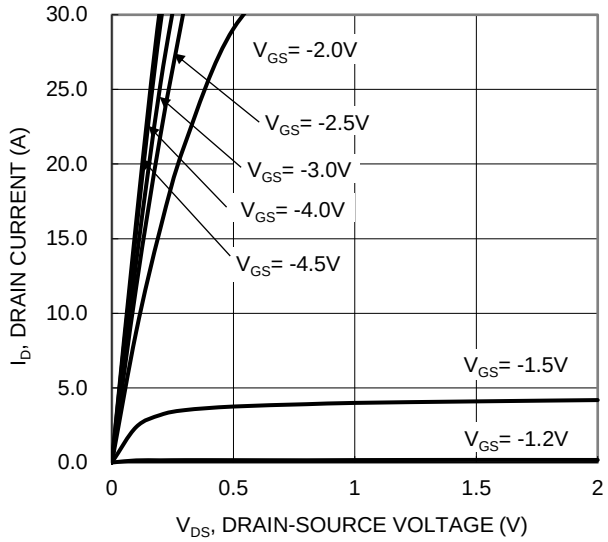


Figure 1. Typical Output Characteristic

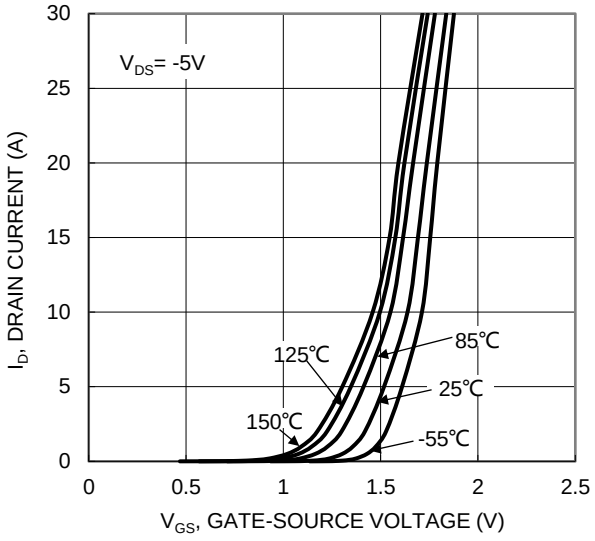


Figure 2. Typical Transfer Characteristic

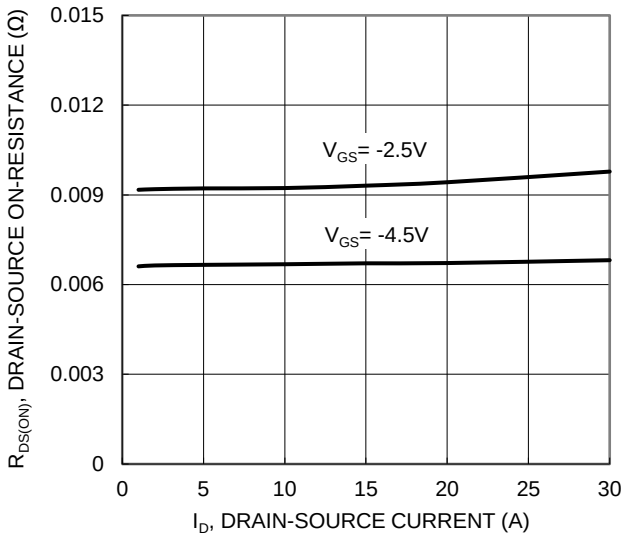


Figure 3. Typical On-Resistance vs. Drain Current and Gate Voltage

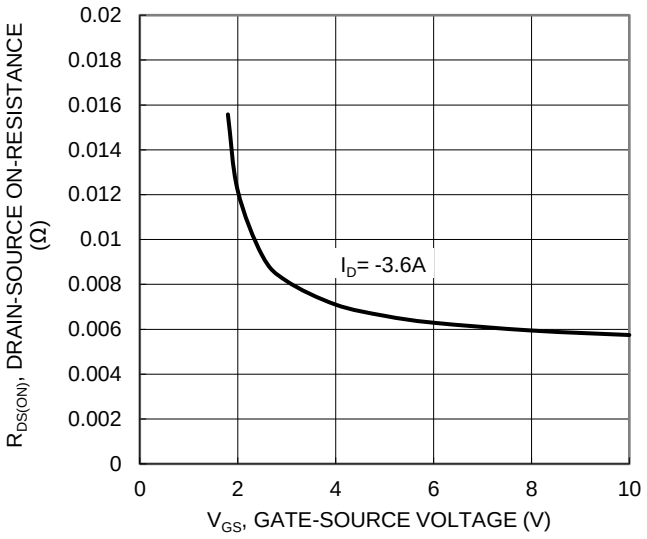


Figure 4. Typical Transfer Characteristic

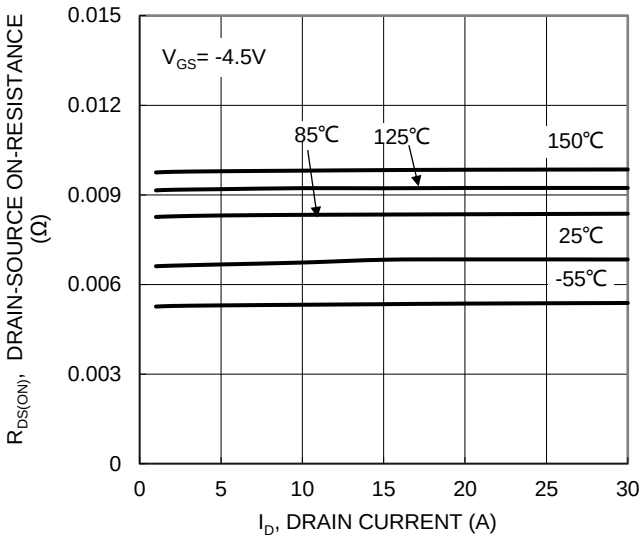


Figure 5. Typical On-Resistance vs. Drain Current and Junction Temperature

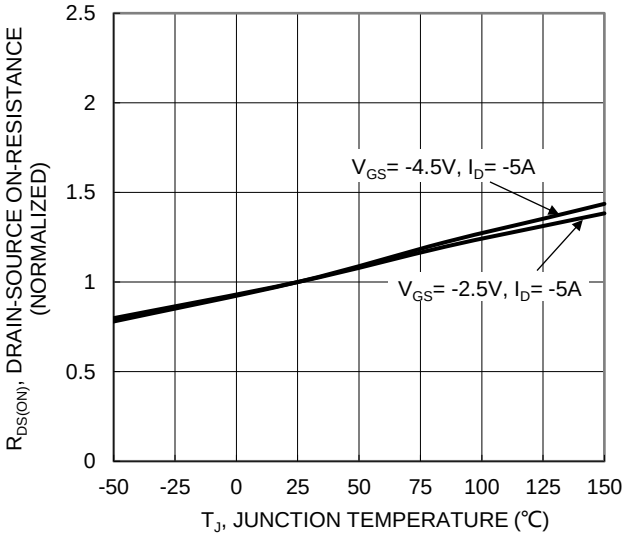


Figure 6. On-Resistance Variation with Junction Temperature


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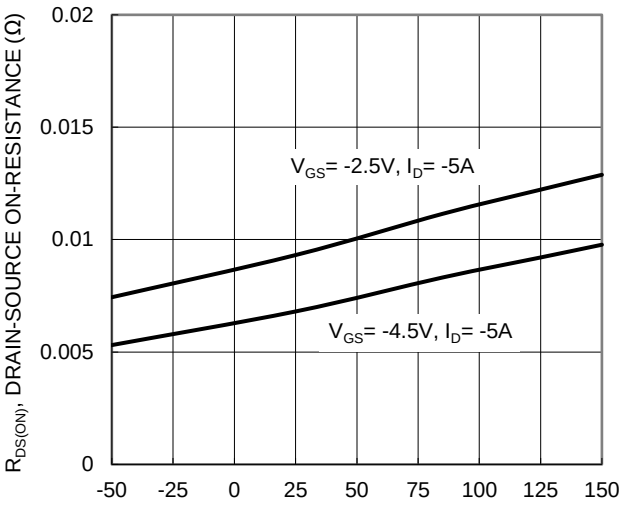


Figure 7. On-Resistance Variation with Junction Temperature

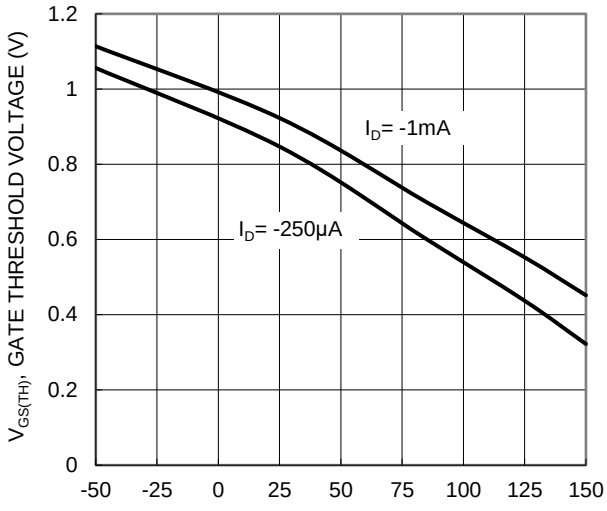


Figure 8. Gate Threshold Variation vs. Junction Temperature

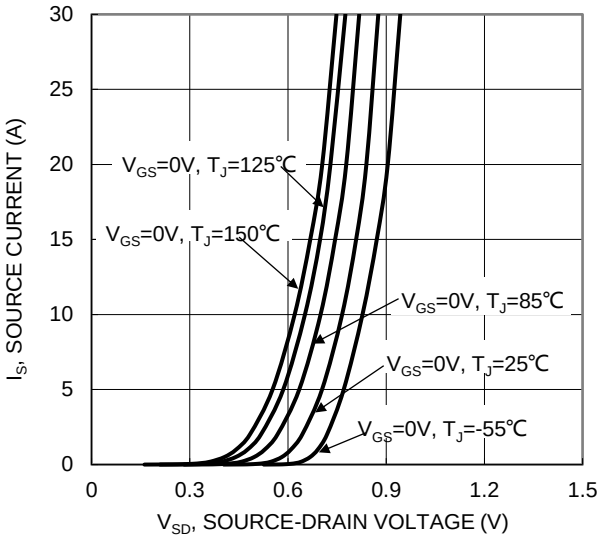


Figure 9. Diode Forward Voltage vs. Current

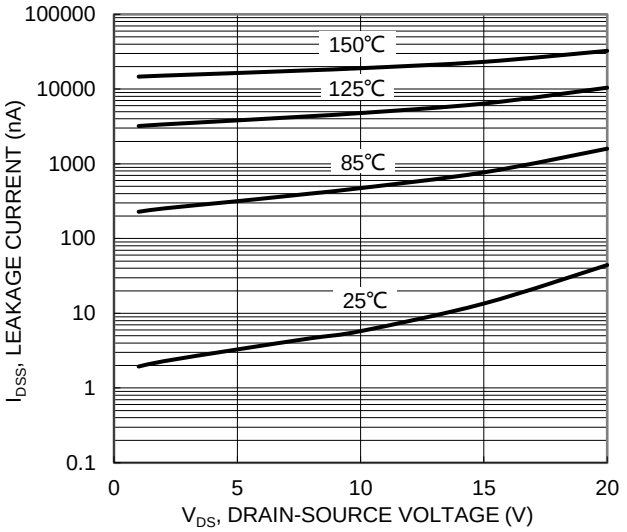


Figure 10. Typical Drain-Source Leakage Current vs. Voltage

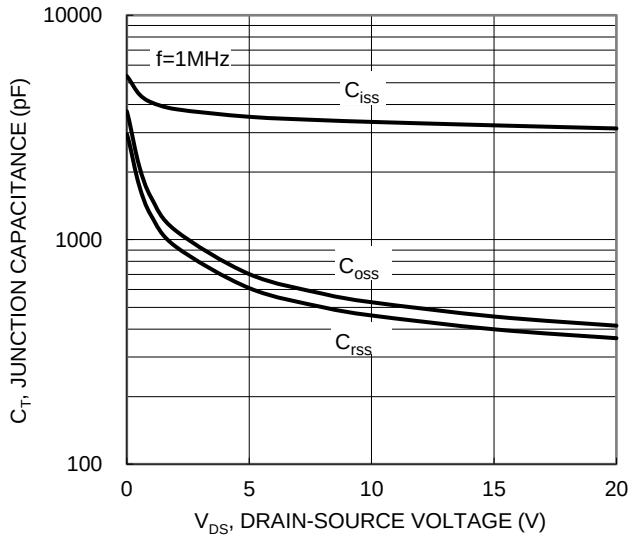


Figure 11. Typical Junction Capacitance

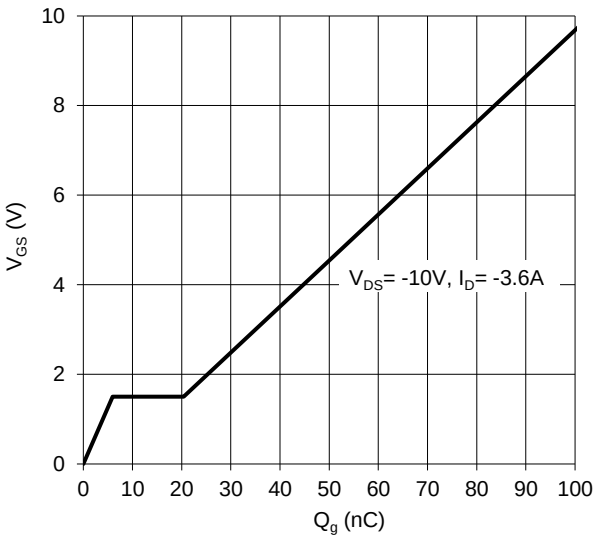


Figure 12. Gate Charge


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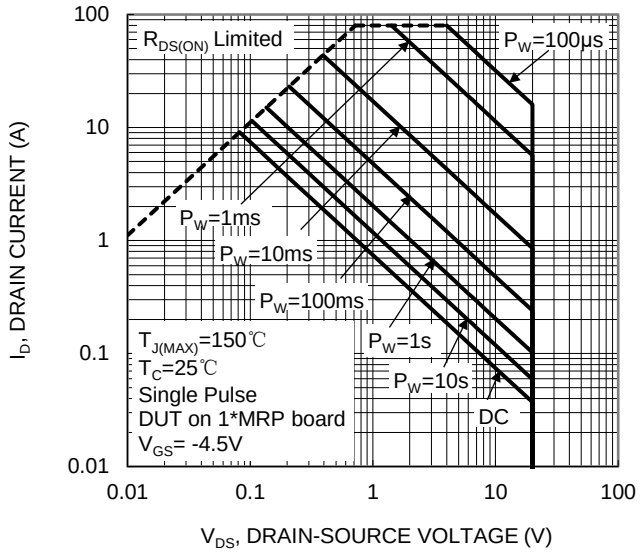


Figure 13. SOA, Safe Operation Area

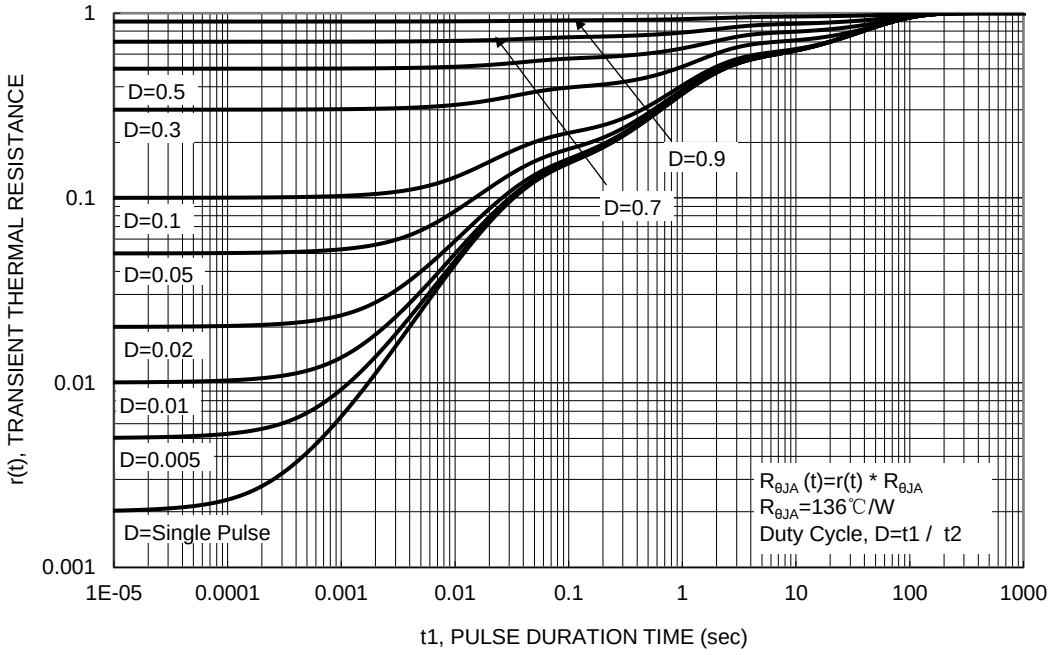


Figure 14. Transient Thermal Resistance


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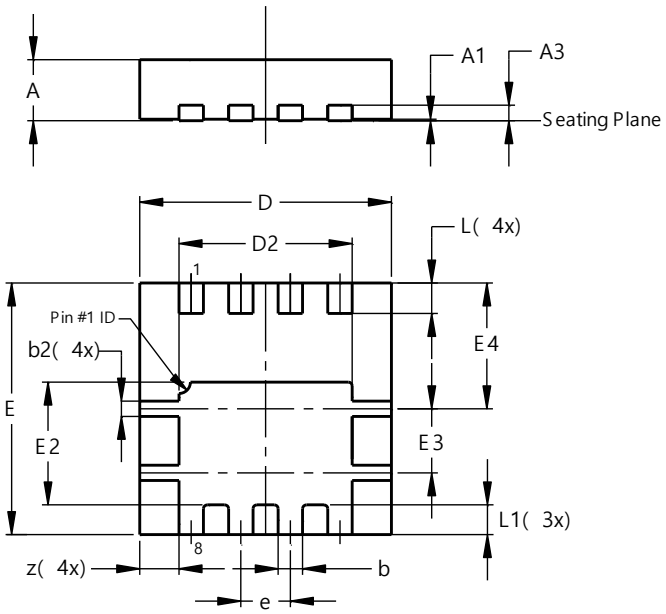
## Package Outline Dimensions

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

**PowerDI3333-8**

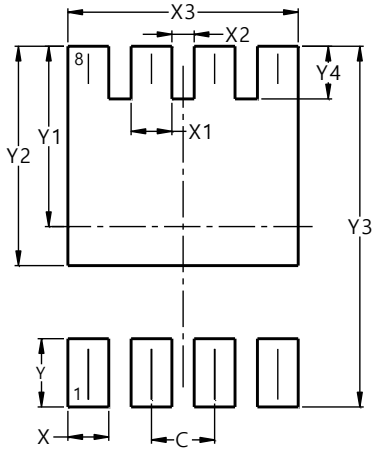



| PowerDI3333-8 | | | |
|---|---|---|---|
| **Dim** | **Min** | **Max** | **Typ** |
| **A** | 0.75 | 0.85 | 0.80 |
| **A1** | 0.00 | 0.05 | 0.02 |
| **A3** | – | – | 0.203 |
| **b** | 0.27 | 0.37 | 0.32 |
| **b2** | 0.15 | 0.25 | 0.20 |
| **D** | 3.25 | 3.35 | 3.30 |
| **D2** | 2.22 | 2.32 | 2.27 |
| **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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