# 40V N-CHANNEL ENHANCEMENT MODE MOSFET
# POWERDI®

## Product Summary

| $V_{(BR)DSS}$ | $R_{DS(ON)}$ max | $I_D$ max<br>$T_A$ = +25°C |
|---|---|---|
| 40V | 12mΩ @ $V_{GS}$ = 10V | 11.5A |
| | 15mΩ @ $V_{GS}$ = 4.5V | 10.3A |

## 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 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)**
- **Qualified to AEC-Q101 Standards for High Reliability**

## Description and Applications

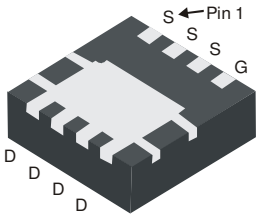
This MOSFET is designed to minimize the on-state resistance ($R_{DS(ON)}$) and yet maintain superior switching performance, making it ideal for high-efficiency power management applications such as:

- Backlighting
- Power Management Functions
- DC-DC Converters

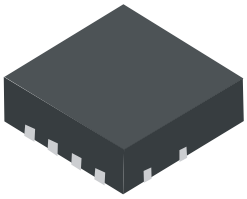
## Mechanical Data

- Case: POWERDI 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 e3
- Weight: 0.072 grams (Approximate)

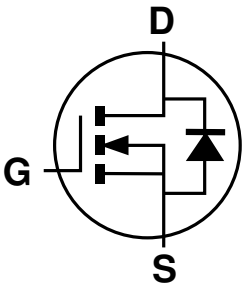
POWERDI 3333-8




Bottom View



Top View




Equivalent Circuit

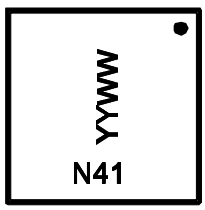
## Ordering Information (Note 4)

| Part Number | Case | Packaging |
|---|---|---|
| DMN4010LFG-7 | POWERDI 3333-8 | 2,000/Tape & Reel |
| DMN4010LFG-13 | POWERDI 3333-8 | 3,000/Tape & Reel |

Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.
2. See http://www.diodes.com/quality/lead_free.html 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

POWERDI 3333-8




N41= Product Type Marking Code
YYWW = Date Code Marking
YY = Last Digit of Year (ex: 13 = 2013)
WW = Week Code (01 ~ 53)

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

| Characteristic | | | Symbol | Value | Units |
|---|---|---|---|---|---|
| Drain-Source Voltage | | | $V_{DSS}$ | 40 | V |
| Gate-Source Voltage | | | $V_{GSS}$ | ±20 | V |
| Continuous Drain Current (Note 6) $V_{GS}$ = 10V | Steady State | $T_A$ = +25°C<br>$T_A$ = +70°C | $I_D$ | 11.5<br>9.2 | A |
| | t<10s | $T_A$ = +25°C<br>$T_A$ = +70°C | $I_D$ | 14.2<br>11.4 | A |
| Pulsed Drain Current (10µs pulse, duty cycle = 1%) | | | $I_{DM}$ | 80 | A |
| Maximum Continuous Body Diode Forward Current (Note 6) | | | $I_S$ | 2 | A |
| Avalanche Current (Note 7) L = 0.1mH | | | $I_{AS}$ | 27 | A |
| Avalanche Energy (Note 7) L = 0.1mH | | | $E_{AS}$ | 37 | mJ |

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

| Characteristic | | Symbol | Value | Units |
|---|---|---|---|---|
| Total Power Dissipation (Note 5) | | $P_D$ | 0.93 | W |
| Thermal Resistance, Junction to Ambient (Note 5) | Steady state | $R_{\theta JA}$ | 137 | °C/W |
| | t<10s | | 89 | |
| Total Power Dissipation (Note 6) | | $P_D$ | 2.45 | W |
| Thermal Resistance, Junction to Ambient (Note 6) | Steady state | $R_{\theta JA}$ | 52 | °C/W |
| | t<10s | | 34 | |
| Thermal Resistance, Junction to Case (Note 6) | | $R_{\theta JC}$ | 3 | |
| Operating and Storage Temperature Range | | $T_J$, $T_{STG}$ | -55 to +150 | °C |

Notes: 5. Device mounted on FR-4 PC board, with minimum recommended pad layout, single sided.
6. Device mounted on FR-4 substrate PC board, 2oz copper, with thermal bias to bottom layer 1inch square copper plate.
7. $I_{AS}$ and $E_{AS}$ rating are based on low frequency and duty cycles to keep $T_J$ = +25°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 | $BV_{DSS}$ | 40 | — | — | V | $V_{GS}$ = 0V, $I_D$ = 250μA |
| Zero Gate Voltage Drain Current $T_J$ = +25°C | $I_{DSS}$ | — | — | 1 | μA | $V_{DS}$ = 32V, $V_{GS}$ = 0V |
| Gate-Source Leakage | $I_{GSS}$ | — | — | ±100 | nA | $V_{GS}$ = ±20V, $V_{DS}$ = 0V |
| **ON CHARACTERISTICS (Note 8)** | | | | | | |
| Gate Threshold Voltage | $V_{GS(th)}$ | 1.0 | — | 3.0 | V | $V_{DS}$ = $V_{GS}$, $I_D$ = 250μA |
| Static Drain-Source On-Resistance | $R_{DS\ (ON)}$ | — | — | 12 | mΩ | $V_{GS}$ = 10V, $I_D$ = 14A |
| | | | — | 15 | | $V_{GS}$ = 4.5V, $I_D$ = 11A |
| Diode Forward Voltage | $V_{SD}$ | — | 0.72 | — | V | $V_{GS}$ = 0V, $I_S$ = 14A |
| **DYNAMIC CHARACTERISTICS (Note 9)** | | | | | | |
| Input Capacitance | $C_{iss}$ | — | 1,810 | — | pF | $V_{DS}$ = 20V, $V_{GS}$ = 0V, f = 1.0MHz |
| Output Capacitance | $C_{oss}$ | — | 135 | — | pF | |
| Reverse Transfer Capacitance | $C_{rss}$ | — | 112 | — | pF | |
| Gate Resistance | $R_g$ | — | 1.7 | — | Ω | $V_{DS}$ = 0V, $V_{GS}$ = 0V, f = 1MHz |
| Total Gate Charge ($V_{GS}$ = 4.5V) | $Q_g$ | — | 17 | — | nC | $V_{DS}$ = 20V, $I_D$ = 14A |
| Total Gate Charge ($V_{GS}$ = 10V) | $Q_g$ | — | 37 | — | nC | |
| Gate-Source Charge | $Q_{gs}$ | — | 5.6 | — | nC | |
| Gate-Drain Charge | $Q_{gd}$ | — | 7.1 | — | nC | |
| Turn-On Delay Time | $t_{D(on)}$ | — | 5.1 | — | ns | $V_{GS}$ = 10V, $V_{DS}$ = 20V, $R_G$ = 6Ω, $I_D$ = 14A |
| Turn-On Rise Time | $t_r$ | — | 13 | — | ns | |
| Turn-Off Delay Time | $t_{D(off)}$ | — | 36 | — | ns | |
| Turn-Off Fall Time | $t_f$ | — | 13 | — | ns | |
| Body Diode Reverse Recovery Time | $t_{rr}$ | — | 12.2 | — | nS | $I_F$ = 3A, di/dt = 100A/μs |
| Body Diode Reverse Recovery Charge | $Q_{rr}$ | — | 5.4 | — | nC | $I_F$ = 3A, di/dt = 100A/μs |

Notes: 8. Short duration pulse test used to minimize self-heating effect.
9. Guaranteed by design. Not subject to product testing.

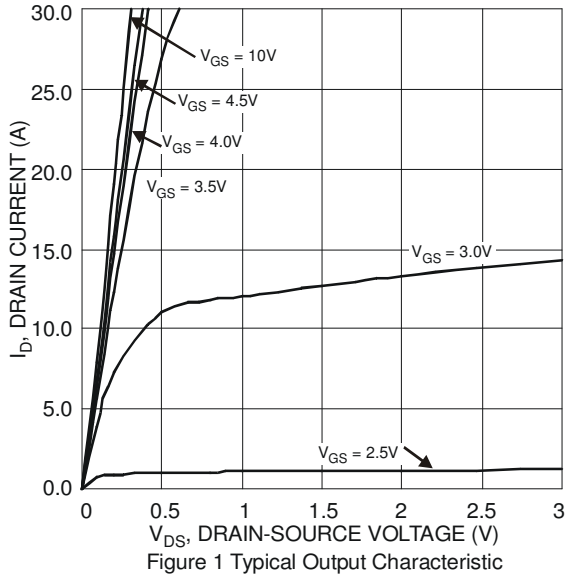


Figure 1 Typical Output Characteristic

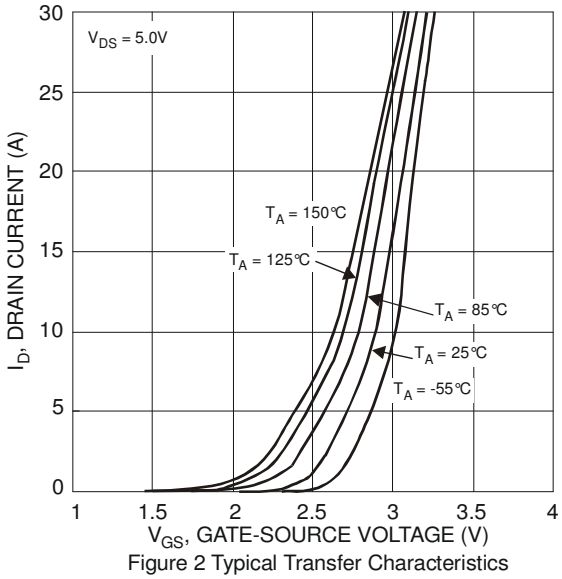


Figure 2 Typical Transfer Characteristics

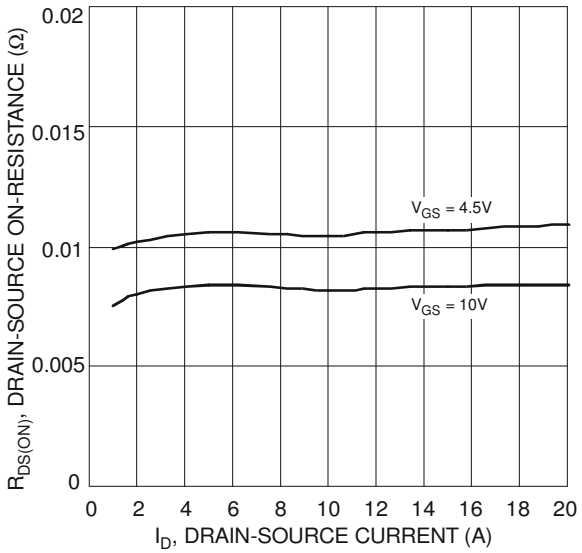



Figure 3 Typical On-Resistance vs. Drain Current and Gate Voltage

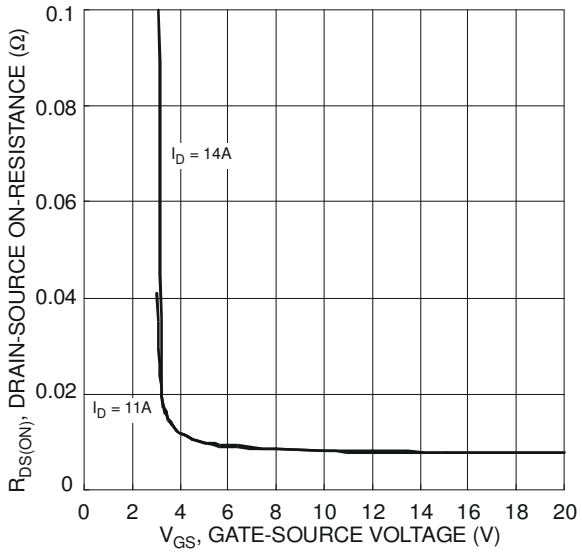



Figure 4 Typical Transfer Characteristic

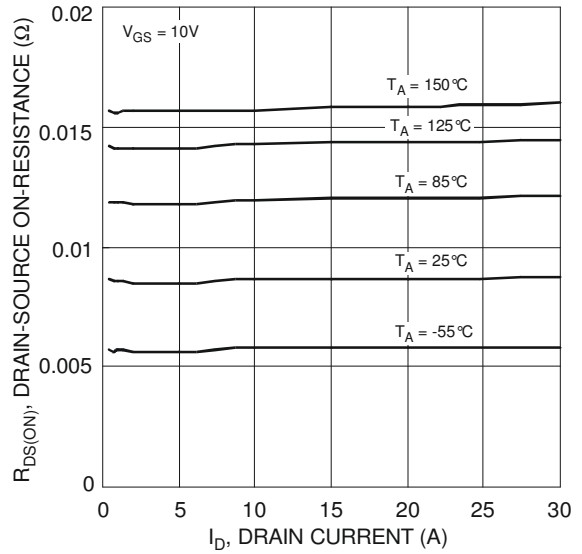



Figure 5 Typical On-Resistance vs. Drain Current and Temperature

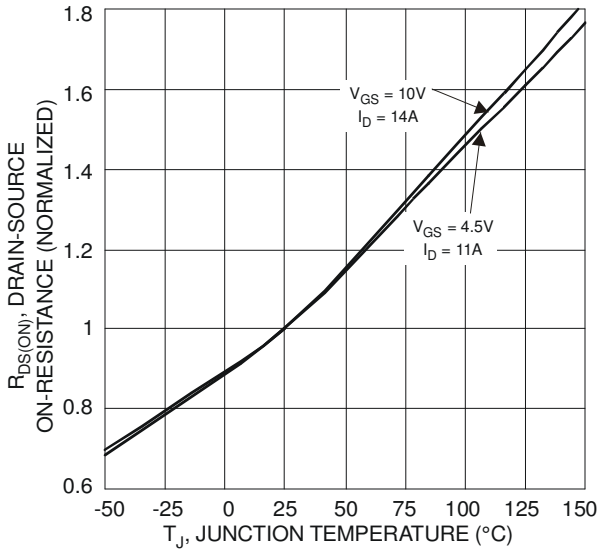



Figure 6 On-Resistance Variation with Temperature

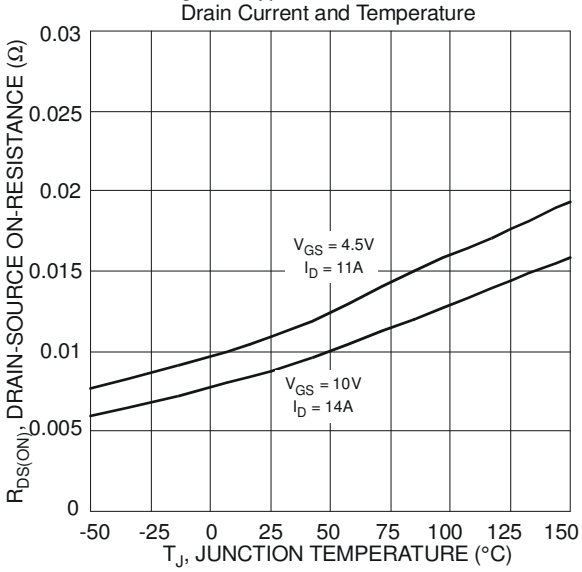



Figure 7 On-Resistance Variation with Temperature

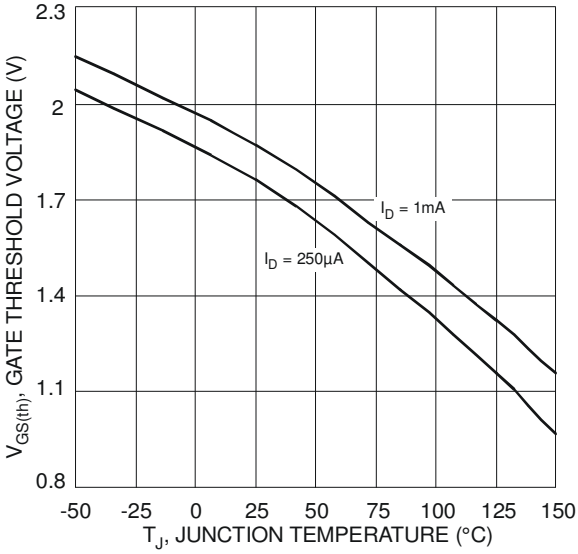



Figure 8 Gate Threshold Variation vs. Ambient Temperature

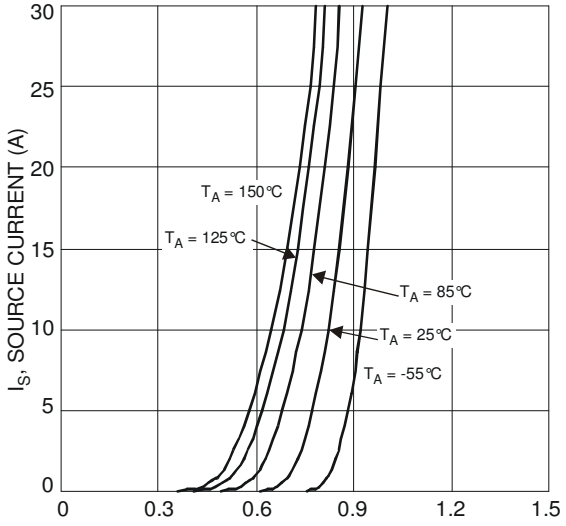



Figure 9 Diode Forward Voltage vs. Current

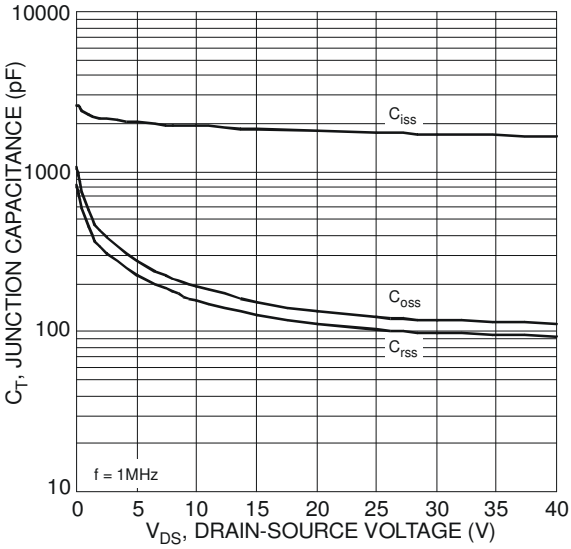



Figure 10 Typical Junction Capacitance

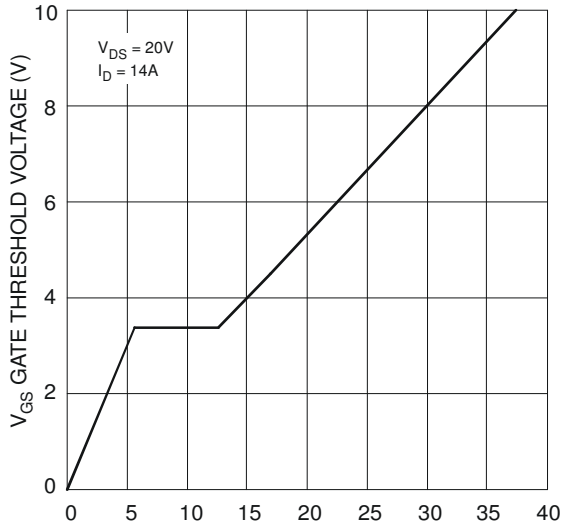



Figure 11 Gate Charge

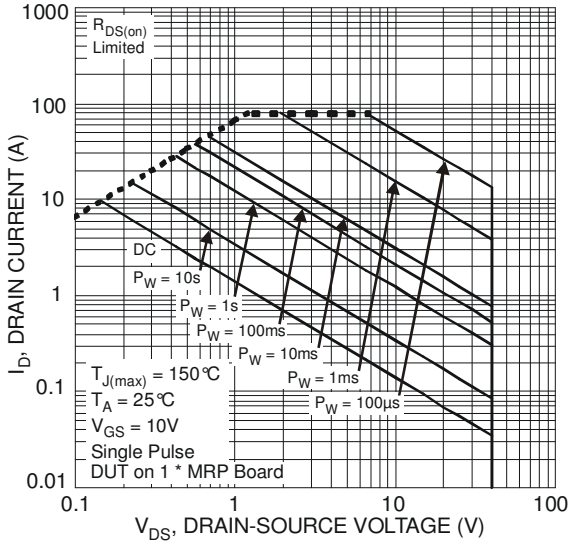



Figure 12 SOA, Safe Operation Area

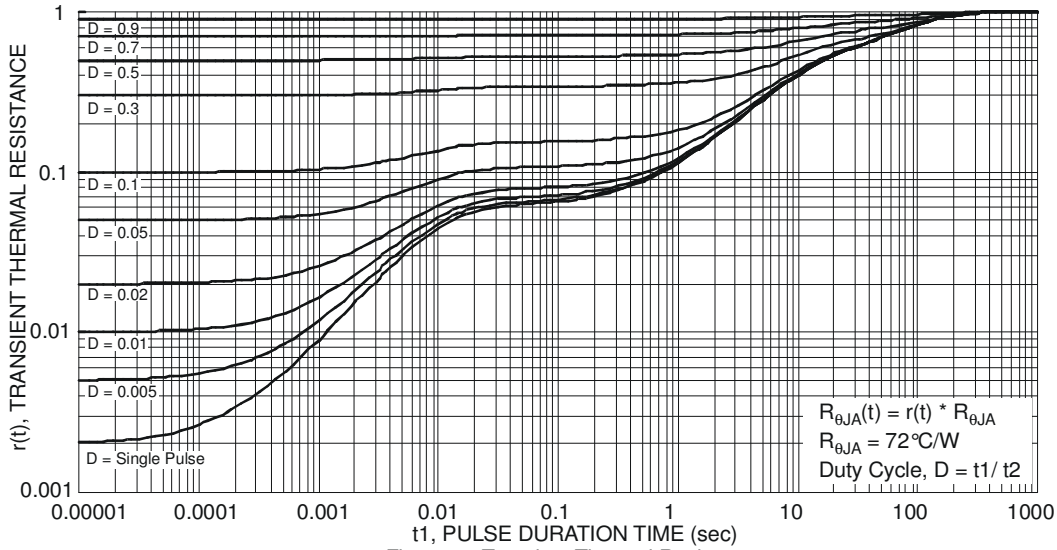
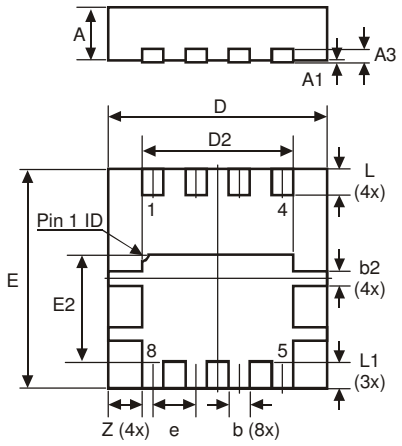



Figure 13 Transient Thermal Resistance

## Package Outline Dimensions

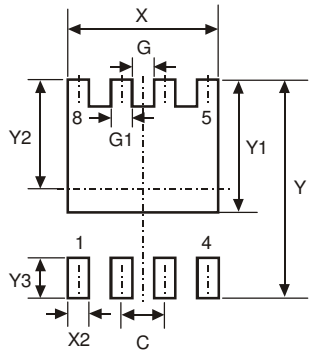
Please see AP02002 at http://www.diodes.com/datasheets/ap02002.pdf for the latest version.




| POWERDI®3333-8 | | | |
|---|---|---|---|
| **Dim** | **Min** | **Max** | **Typ** |
| **D** | 3.25 | 3.35 | 3.30 |
| **E** | 3.25 | 3.35 | 3.30 |
| **D2** | 2.22 | 2.32 | 2.27 |
| **E2** | 1.56 | 1.66 | 1.61 |
| **A** | 0.75 | 0.85 | 0.80 |
| **A1** | 0 | 0.05 | 0.02 |
| **A3** | – | – | 0.203 |
| **b** | 0.27 | 0.37 | 0.32 |
| **b2** | – | – | 0.20 |
| **L** | 0.35 | 0.45 | 0.40 |
| **L1** | – | – | 0.39 |
| **e** | – | – | 0.65 |
| **Z** | – | – | 0.515 |
| **All Dimensions in mm** | | | |

## Suggested Pad Layout

Please see AP02001 at http://www.diodes.com/datasheets/ap02001.pdf for the latest version.




| Dimensions | Value (in mm) |
|---|---|
| **C** | 0.650 |
| **G** | 0.230 |
| **G1** | 0.420 |
| **Y** | 3.700 |
| **Y1** | 2.250 |
| **Y2** | 1.850 |
| **Y3** | 0.700 |
| **X** | 2.370 |
| **X2** | 0.420 |

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