# P-CHANNEL ENHANCEMENT MODE MOSFET
# POWERDI®

## Product Summary

| $V_{(BR)DSS}$ | $R_{DS(ON)}$ max | $I_D$ max<br>$T_A$ = +25°C |
|---|---|---|
| -30V | 13mΩ @ $V_{GS}$ = -10V | -9.8A |
| | 25mΩ @ $V_{GS}$ = -4.5V | -7.0A |

## Description

This MOSFET has been 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.

## Applications

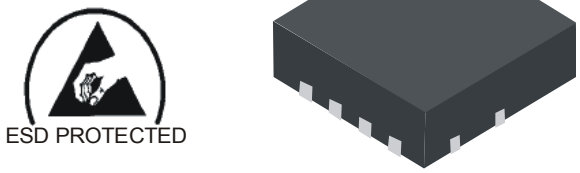
- Backlighting
- Power Management Functions
- DC-DC Converters

## 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 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**

## Mechanical Data

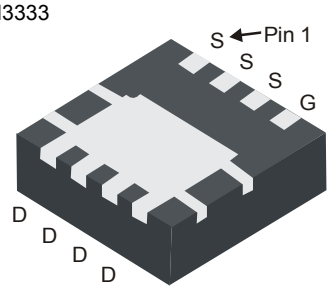
- Case: POWERDI3333
- Case Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminal Connections Indicator: See diagram
- Terminals: Finish — Matte Tin annealed over Copper leadframe. Solderable per MIL-STD-202, Method 208 e3
- Weight: 0.0174 grams (approximate)



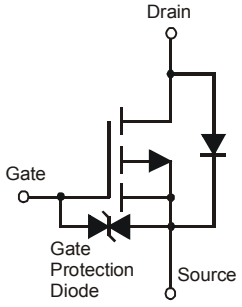


Top View

POWERDI3333



Bottom View



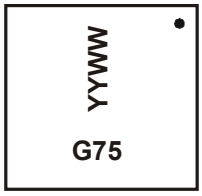
Equivalent Circuit

## Ordering Information (Note 4)

| Part Number | Case | Packaging |
|---|---|---|
| DMG7401SFG-7 | POWERDI3333 | 2000/Tape & Reel |
| DMG7401SFG-13 | POWERDI3333 | 3000/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




G75 = Product marking code
YYWW = Date code marking
YY = Last digit of year (ex: 10 for 2010)
WW = Week code (01 – 53)


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

| Characteristic | | | Symbol | Value | Units |
|---|---|---|---|---|---|
| Drain-Source Voltage | | | $V_{DSS}$ | -30 | V |
| Gate-Source Voltage | | | $V_{GSS}$ | ±25 | V |
| Continuous Drain Current (Note 6) $V_{GS}$ = -10V | Steady State | $T_A$ = +25°C<br>$T_A$ = +70°C | $I_D$ | -9.8<br>-7.7 | A |
| | t<10s | $T_A$ = +25°C<br>$T_A$ = +70°C | $I_D$ | -13.5<br>-10.8 | A |
| Maximum Continuous Body Diode Forward Current (Note 5) | | | $I_S$ | -3.0 | A |
| Pulsed Drain Current (10µs pulse, duty cycle = 1%) | | | $I_{DM}$ | -80 | A |
| Avalanche Current (Notes 7 & 8) | | | $I_{AR}$ | 14 | A |
| Repetitive Avalanche Energy (Notes 7 & 8) L = 1mH | | | $E_{AR}$ | 104 | mJ |

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

| Characteristic | | Symbol | Value | Units |
|---|---|---|---|---|
| Total Power Dissipation (Note 5) | $T_A$ = +25°C | $P_D$ | 0.94 | W |
| | $T_A$ = +70°C | | 0.6 | |
| Thermal Resistance, Junction to Ambient (Note 5) | Steady State | $R_{\theta JA}$ | 137 | °C/W |
| | t<10s | | 82 | °C/W |
| Total Power Dissipation (Note 6) | $T_A$ = +25°C | $P_D$ | 2.2 | W |
| | $T_A$ = +70°C | | 1.3 | |
| Thermal Resistance, Junction to Ambient (Note 6) | Steady State | $R_{\theta JA}$ | 60 | °C/W |
| | t<10s | | 36 | °C/W |
| Thermal Resistance, Junction to Case (Note 6) | | $R_{\theta JC}$ | 3.0 | °C/W |
| 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 | $BV_{DSS}$ | -30 | — | — | V | $V_{GS}$ = 0V, $I_D$ = -250µA |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | — | — | -1 | µA | $V_{DS}$ = -30V, $V_{GS}$ = 0V |
| Gate-Source Leakage | $I_{GSS}$ | — | — | ±10 | µA | $V_{GS}$ = ±20V, $V_{DS}$ = 0V |
| **ON CHARACTERISTICS (Note 8)** | | | | | | |
| Gate Threshold Voltage | $V_{GS(th)}$ | -1.7 | — | -3.0 | V | $V_{DS}$ = $V_{GS}$, $I_D$ = -250µA |
| Static Drain-Source On-Resistance | $R_{DS\ (ON)}$ | — | 9 | 11 | mΩ | $V_{GS}$ = -20V, $I_D$ = -12A |
| | | — | 10 | 13 | | $V_{GS}$ = -10V, $I_D$ = -9A |
| | | — | 17 | 25 | | $V_{GS}$ = -4.5V, $I_D$ = -5A |
| Forward Transfer Admittance | $\|Y_{fs}\|$ | — | 21 | — | S | $V_{DS}$ = -5V, $I_D$ = -10A |
| **DYNAMIC CHARACTERISTICS (Note 9)** | | | | | | |
| Input Capacitance | $C_{iss}$ | — | 2246 | 2987 | pF | $V_{DS}$ = -15V, $V_{GS}$ = 0V, f = 1.0MHz |
| Output Capacitance | $C_{oss}$ | — | 352 | 468 | pF | |
| Reverse Transfer Capacitance | $C_{rss}$ | — | 294 | 391 | pF | |
| Gate resistance | $R_g$ | — | 5.1 | 10 | Ω | $V_{DS}$ = 0V, $V_{GS}$ = 0V, f = 1.0MHz |
| Total Gate Charge ($V_{GS}$ = 4.5V) | $Q_g$ | — | 20.5 | 30 | nC | $V_{DS}$ = -15V, $I_D$ = -12A |
| Total Gate Charge ($V_{GS}$ = 10V) | $Q_g$ | — | 41 | 58 | nC | |
| Gate-Source Charge | $Q_{gs}$ | — | 7.6 | - | nC | |
| Gate-Drain Charge | $Q_{gd}$ | — | 8.0 | - | nC | |
| Turn-On Delay Time | $t_{D(on)}$ | — | 11.3 | 23 | ns | $V_{DD}$ = -15V, $V_{GS}$ = -10V, $R_L$ = 1.25Ω, $R_G$ = 3Ω, |
| Turn-On Rise Time | $t_r$ | — | 15.4 | 31 | ns | |
| Turn-Off Delay Time | $t_{D(off)}$ | — | 38.0 | 61 | ns | |
| Turn-Off Fall Time | $t_f$ | — | 22.0 | 38 | ns | |
| **BODY DIODE CHARACTERISTICS** | | | | | | |
| Diode Forward Voltage | $V_{SD}$ | — | -0.7 | -1.0 | V | $V_{GS}$ = 0V, $I_S$ = -1A |
| Reverse Recovery Time (Note 9) | $t_{rr}$ | — | 20 | 31 | ns | $I_S$ = -9.5A, dI/dt = 100A/µs |
| Reverse Recovery Charge (Note 9) | $Q_{rr}$ | — | 9.5 | 18 | 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. $I_{AR}$ and $E_{AR}$ rating 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


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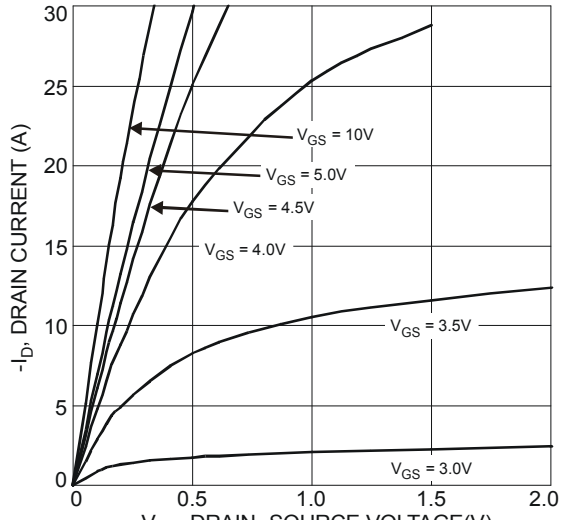



Fig. 1 Typical Output Characteristics

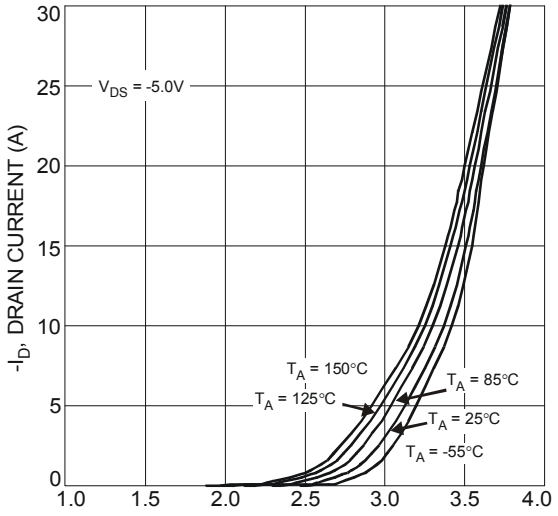



Fig. 2 Typical Transfer Characteristics

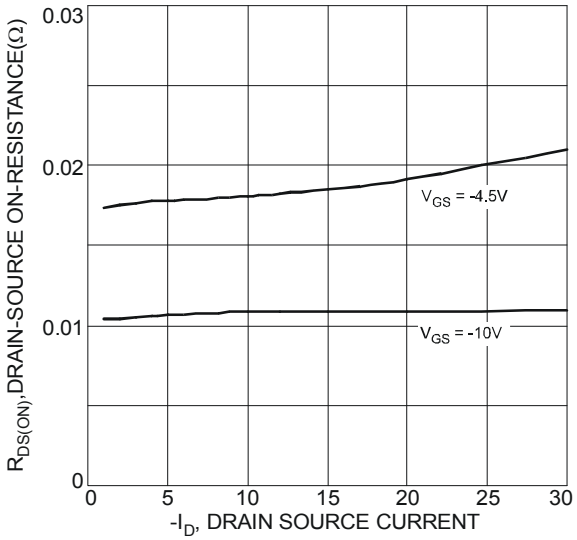



Fig. 3 Typical On-Resistance vs. Drain Current and Gate Voltage

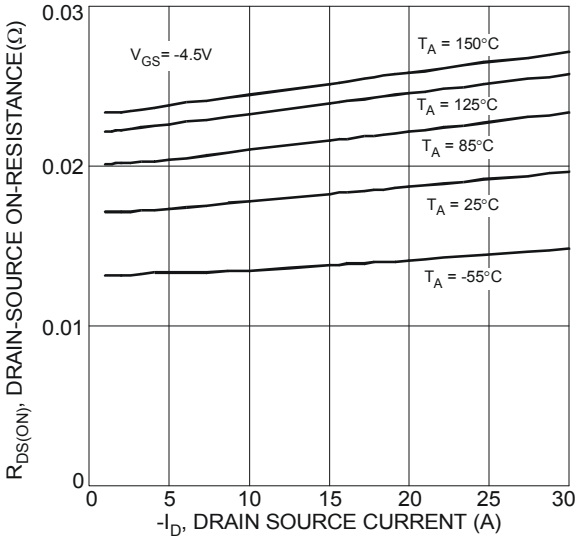



Fig. 4 Typical On-Resistance vs. Drain Current and Temperature

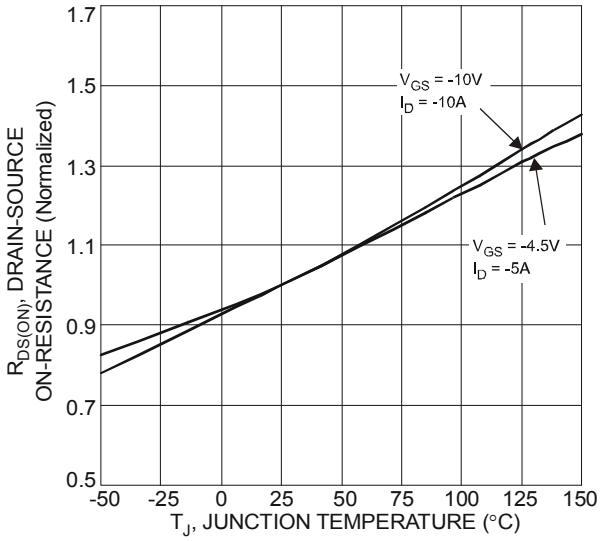



Fig. 5 On-Resistance Variation with Temperature

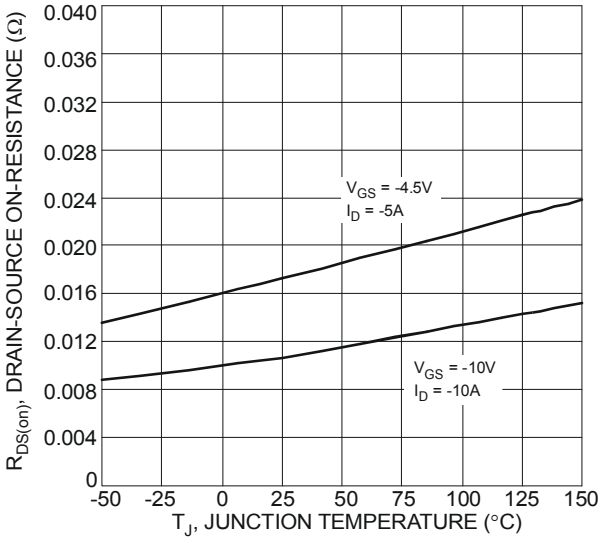



Fig. 6 On-Resistance Variation with Temperature


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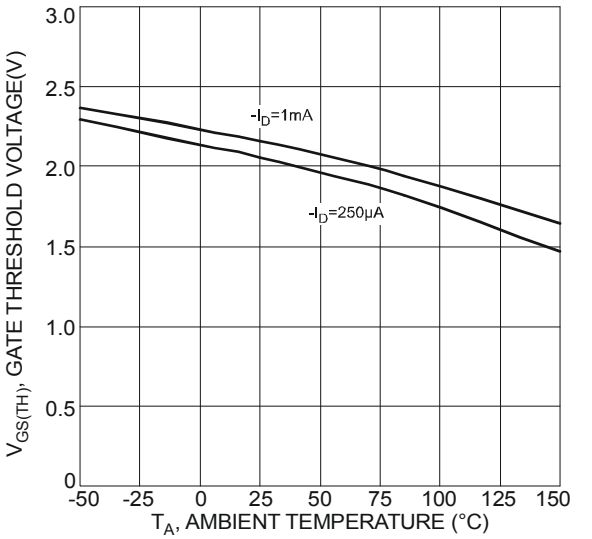



Fig. 7 Gate Threshold Variation vs. Ambient Temperature

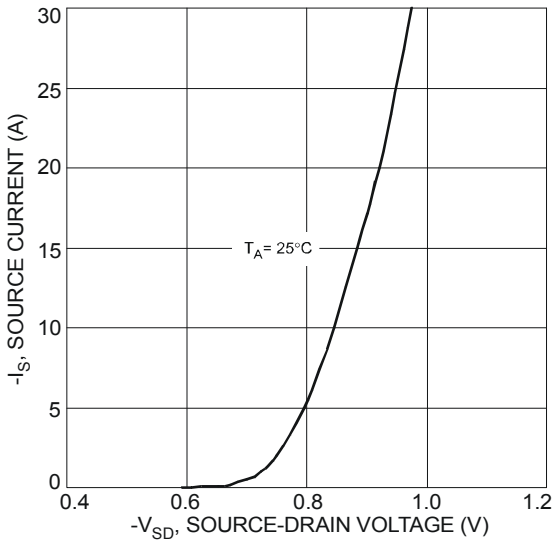



Fig. 8 Diode Forward Voltage vs. Current

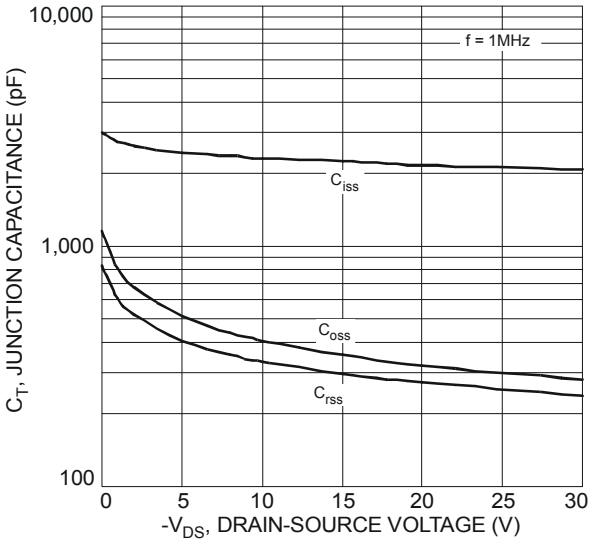



Fig. 9 Typical Junction Capacitance

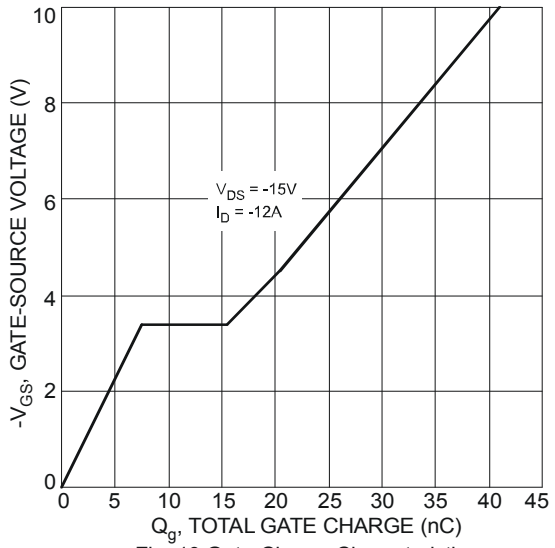



Fig. 10 Gate-Charge Characteristics

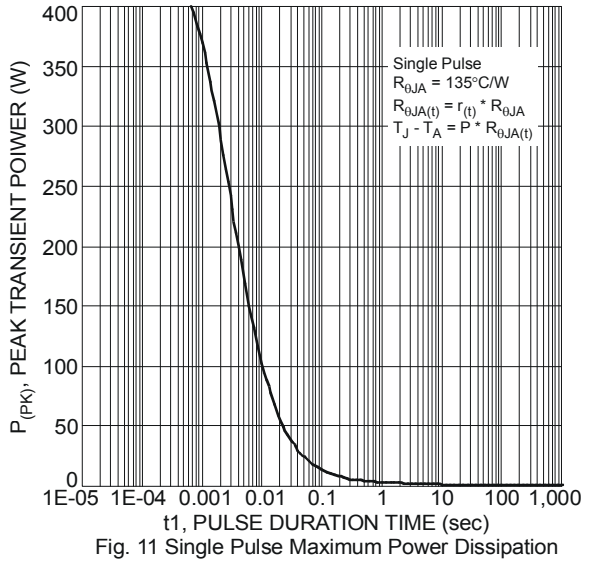



Fig. 11 Single Pulse Maximum Power Dissipation

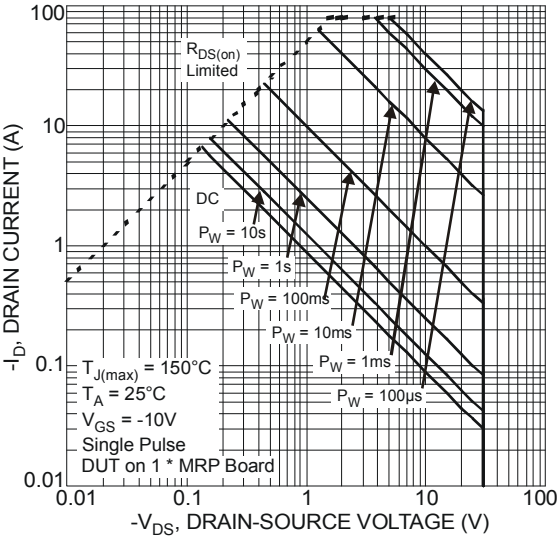



Fig. 12 SOA, Safe Operation Area


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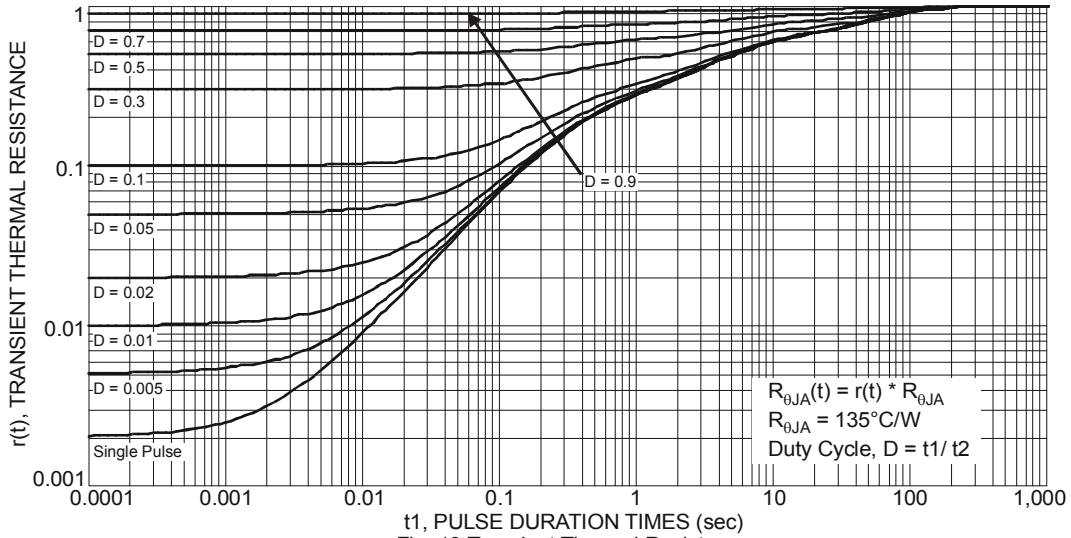
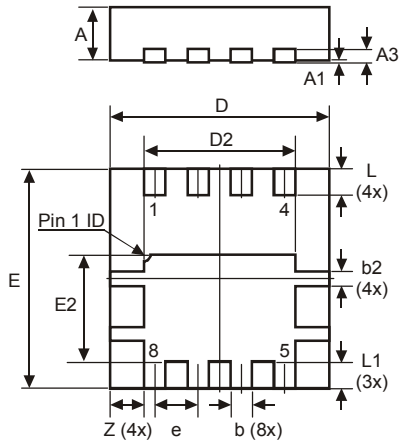



Fig. 13 Transient Thermal Resistance

## Package Outline Dimensions

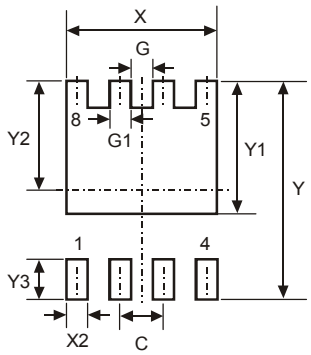
Please see AP02002 at http://www.diodes.com/datasheets/ap02002.pdf for latest version.




| POWERDI3333-8 | | | |
|---|---|---|---|
| **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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