# 40V 175°C DUAL N-CHANNEL ENHANCEMENT MODE MOSFET

## Product Summary

| $BV_{DSS}$ | $R_{DS(ON)}$ max | $I_D$ max $T_C$ = +25°C |
|---|---|---|
| 40V | 15mΩ @ $V_{GS}$ = 10V | 43.6A |
| | 25mΩ @ $V_{GS}$ = 4.5V | 33A |

## Features and Benefits

- Rated to +175°C – Ideal for High Ambient Temperature Environments
- 100% Unclamped Inductive Switching – Ensures More Reliable and Robust End Application
- High Conversion Efficiency
- Low $R_{DS(ON)}$ – Minimizes On State Losses
- Low Input Capacitance
- Fast Switching Speed
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **The DMTH4014LPDQ is suitable for automotive applications requiring specific change control and is AEC-Q101 qualified, is PPAP capable, and is manufactured in IATF16949:2016 certified facilities.**

## Description and Applications

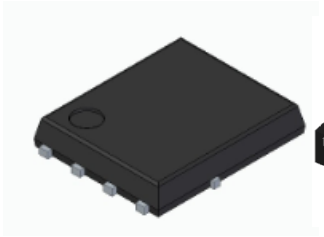
This MOSFET is designed to meet the stringent requirements of automotive applications. It is qualified to AEC-Q101, supported by a PPAP and is ideal for use in:

- Backlighting
- Power Management Functions
- DC-DC Converters

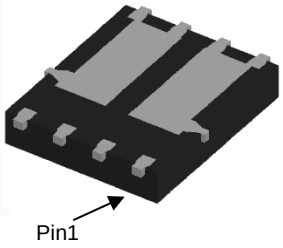
## Mechanical Data

- Case: PowerDI®5060-8
- Case Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish — Matte Tin Annealed over Copper Leadframe. Solderable per MIL-STD-202, Method 208 e3
- Weight: 0.097 grams (Approximate)

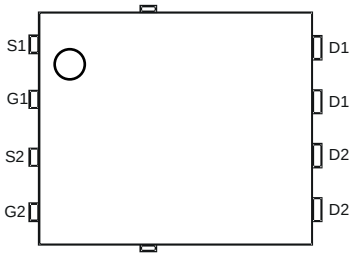
PowerDI5060-8 (Type C)



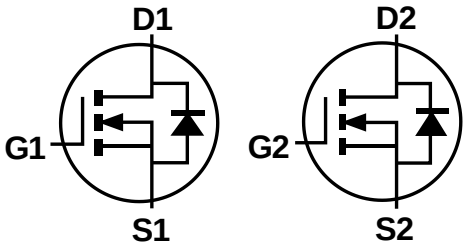
Top View




Bottom View




Pin Out
Top View



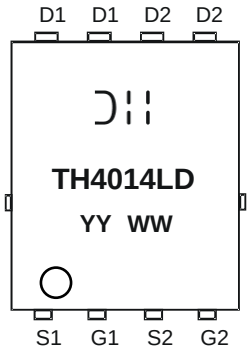

Equivalent Circuit

## Ordering Information (Note 4)

| Part Number | Case | Packaging |
|---|---|---|
| DMTH4014LPDQ-13 | PowerDI5060-8 (Type C) | 2,500/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/.

## Marking Information




YWW = Manufacturer's Marking
TH4014LD = Product Type Marking Code
YYWW = Date Code Marking
YY = Year (ex: 19 = 2019)
WW = Week (01 to 53)

*PowerDI is a registered trademark of Diodes Incorporated.*

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

| Characteristic | | Symbol | Value | Unit |
|---|---|---|---|---|
| Drain-Source Voltage | | $V_{DSS}$ | 40 | V |
| Gate-Source Voltage | | $V_{GSS}$ | ±20 | V |
| Continuous Drain Current (Note 6) | $T_C$ = +25°C<br>$T_C$ = +100°C | $I_D$ | 43.6<br>30.8 | A |
| Continuous Drain Current (Note 5) | $T_A$ = +25°C<br>$T_A$ = +85°C<br>$T_A$ = +100°C | $I_D$ | 10.6<br>7.8<br>7.5 | A |
| Pulsed Drain Current (10µs Pulse, Duty Cycle = 1%) (Note 6) | | $I_{DM}$ | 174 | A |
| Maximum Continuous Body Diode Forward Current (Note 6) | | $I_S$ | 36 | A |
| Avalanche Current, L = 0.3mH | | $I_{AS}$ | 11.7 | A |
| Avalanche Energy, L = 0.3mH | | $E_{AS}$ | 20.5 | mJ |

## Thermal Characteristics

| Characteristic | | Symbol | Value | Unit |
|---|---|---|---|---|
| Total Power Dissipation (Note 5) | $T_A$ = +25°C | $P_D$ | 2.41 | W |
| Thermal Resistance, Junction to Ambient (Note 5) | | $R_{\theta JA}$ | 62.6 | °C/W |
| Thermal Resistance, Junction to Ambient (Note 5) | $T_A$ = +85°C | $R_{\theta JA}$ | 65 | °C/W |
| Total Power Dissipation (Note 6) | $T_C$ = +25°C | $P_D$ | 42.8 | W |
| Thermal Resistance, Junction to Case (Note 6) | | $R_{\theta JC}$ | 3.5 | °C/W |
| Operating and Storage Temperature Range | | $T_J$, $T_{STG}$ | -55 to +175 | °C |

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

| Characteristic | Symbol | Min | Typ | Max | Unit | Test Condition |
|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS (Note 7)** | | | | | | |
| Drain-Source Breakdown Voltage | $BV_{DSS}$ | 40 | — | — | V | $V_{GS}$ = 0V, $I_D$ = 1mA |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | — | — | 1 | µA | $V_{DS}$ = 32V, $V_{GS}$ = 0V |
| Gate-Source Leakage | $I_{GSS}$ | — | — | ±100 | nA | $V_{GS}$ = ±20V, $V_{DS}$ = 0V |
| **ON CHARACTERISTICS (Note 7)** | | | | | | |
| Gate Threshold Voltage | $V_{GS(TH)}$ | 1 | 1.3 | 3 | V | $V_{DS}$ = $V_{GS}$, $I_D$ = 250µA |
| Static Drain-Source On-Resistance | $R_{DS(ON)}$ | — | 11.8 | 15 | mΩ | $V_{GS}$ = 10V, $I_D$ = 20A |
| | | — | 17.9 | 25 | | $V_{GS}$ = 4.5V, $I_D$ = 15A |
| Diode Forward Voltage | $V_{SD}$ | — | 0.9 | 1.2 | V | $V_{GS}$ = 0V, $I_S$ = 20A |
| **DYNAMIC CHARACTERISTICS (Note 8)** | | | | | | |
| Input Capacitance | $C_{iss}$ | — | 733 | — | pF | $V_{DS}$ = 20V, $V_{GS}$ = 0V, f = 1MHz |
| Output Capacitance | $C_{oss}$ | — | 235 | — | pF | |
| Reverse Transfer Capacitance | $C_{rss}$ | — | 24 | — | pF | |
| Gate Resistance | $R_g$ | — | 1.3 | — | Ω | $V_{DS}$ = 0V, $V_{GS}$ = 0V, f = 1MHz |
| Total Gate Charge ($V_{GS}$ = 4.5V) | $Q_g$ | — | 5.2 | — | nC | $V_{DS}$ = 20V, $I_D$ = 20A |
| Total Gate Charge ($V_{GS}$ = 10V) | $Q_g$ | — | 10.2 | — | nC | |
| Gate-Source Charge | $Q_{gs}$ | — | 1.5 | — | nC | |
| Gate-Drain Charge | $Q_{gd}$ | — | 3.1 | — | nC | |
| Turn-On Delay Time | $t_{D(ON)}$ | — | 3.5 | — | ns | $V_{DD}$ = 20V, $V_{GS}$ = 10V, $R_G$ = 1.6Ω, $I_D$ = 20A |
| Turn-On Rise Time | $t_R$ | — | 5.7 | — | ns | |
| Turn-Off Delay Time | $t_{D(OFF)}$ | — | 8.7 | — | ns | |
| Turn-Off Fall Time | $t_F$ | — | 1.8 | — | ns | |
| Body Diode Reverse Recovery Time | $t_{RR}$ | — | 11.9 | — | ns | $I_F$ = 15A, di/dt = 400A/µs |
| Body Diode Reverse Recovery Charge | $Q_{RR}$ | — | 9.28 | — | nC | |

Notes: 5. Device mounted on FR-4 substrate PC board, 2oz. copper, with thermal bias to bottom layer 1inch square copper plate.
6. Thermal resistance from junction to soldering point (on the exposed drain pad).
7. Short duration pulse test used to minimize self-heating effect.
8. Guaranteed by design. Not subject to product testing.

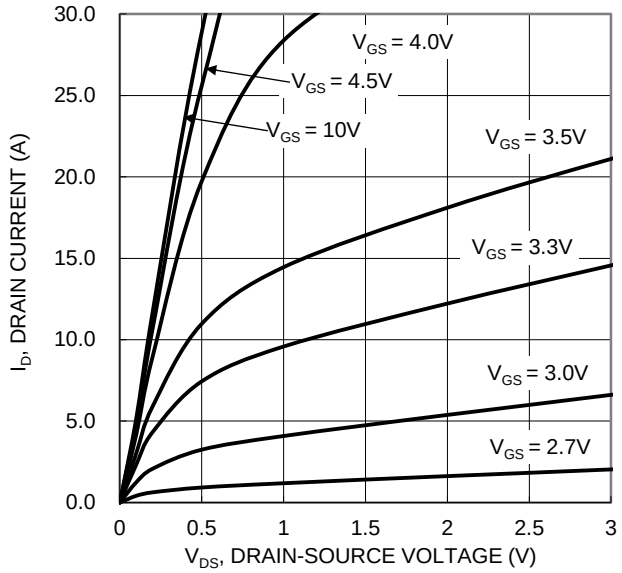



Figure 1. Typical Output Characteristic

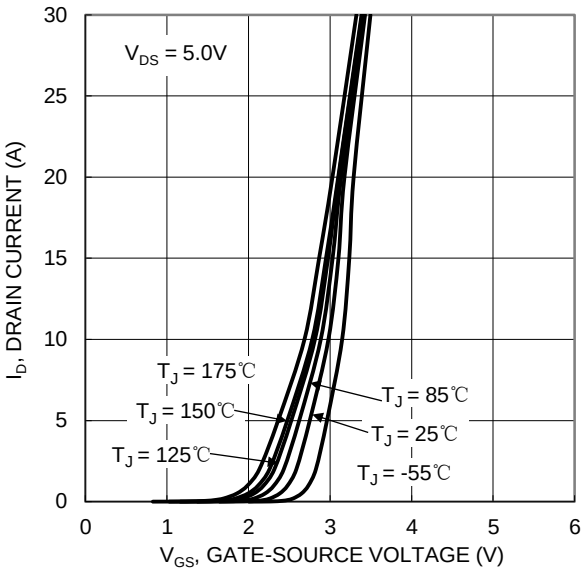



Figure 2. Typical Transfer Characteristic

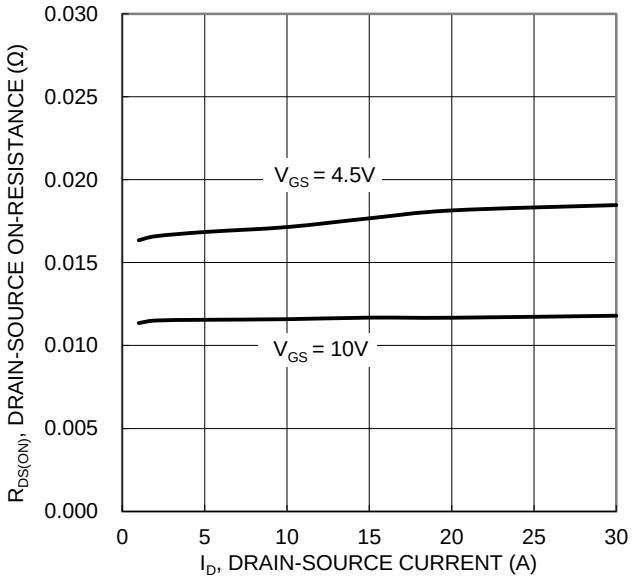



Figure 3. Typical On-Resistance vs. Drain Current and Gate Voltage

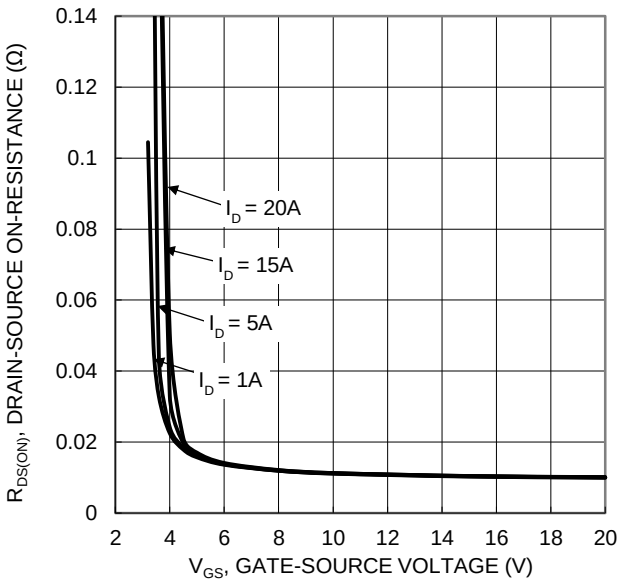



Figure 4. Typical Transfer Characteristic

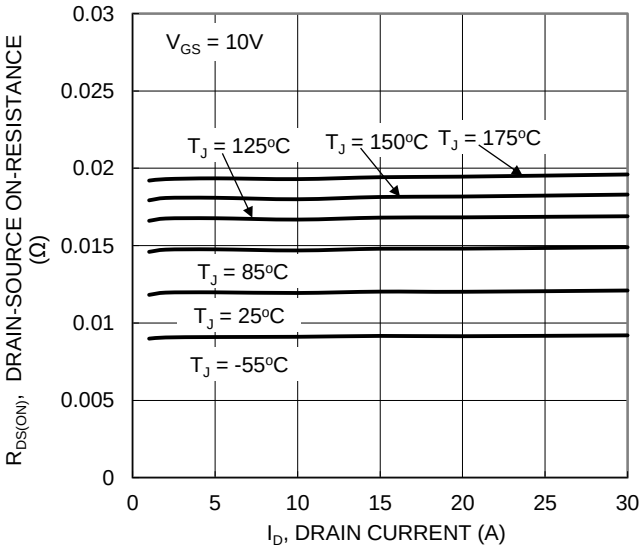



Figure 5. Typical On-Resistance vs. Drain Current and Temperature

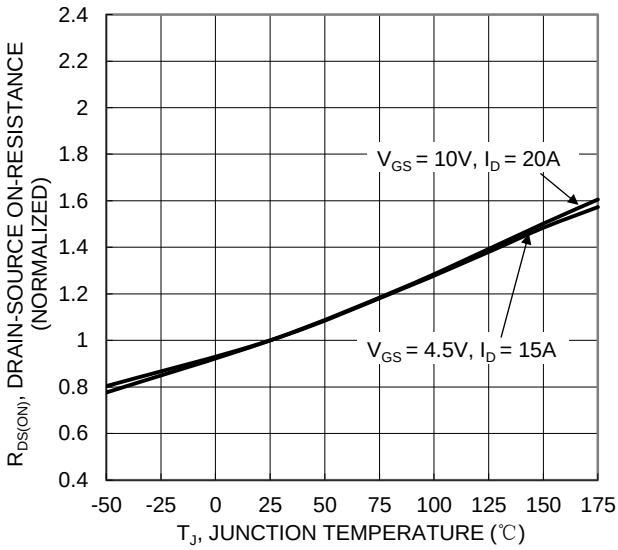



Figure 6. On-Resistance Variation with Temperature

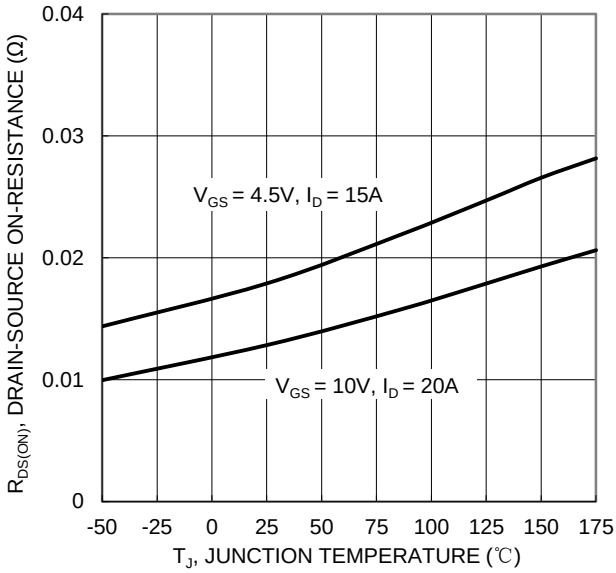



Figure 7. On-Resistance Variation with Temperature

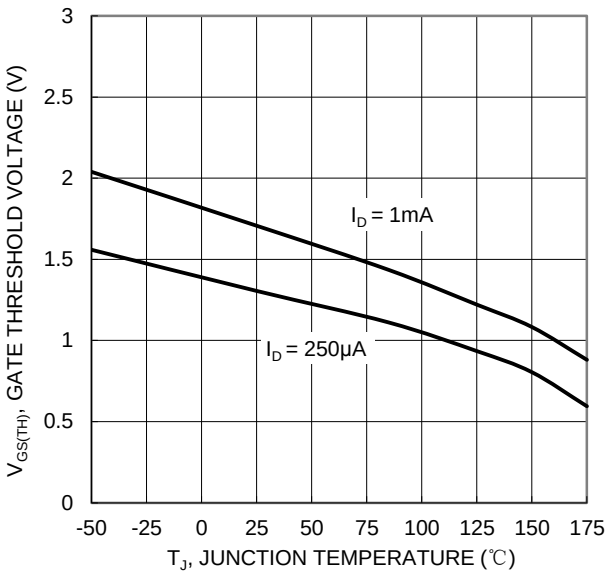



Figure 8. Gate Threshold Variation vs. Junction Temperature

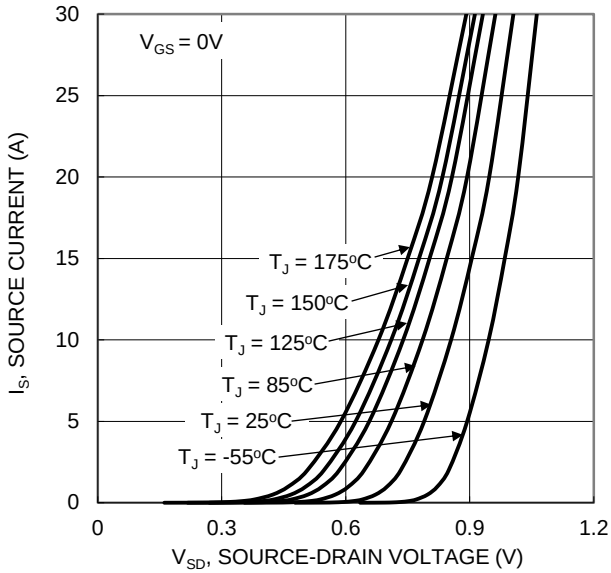



Figure 9. Diode Forward Voltage vs. Current

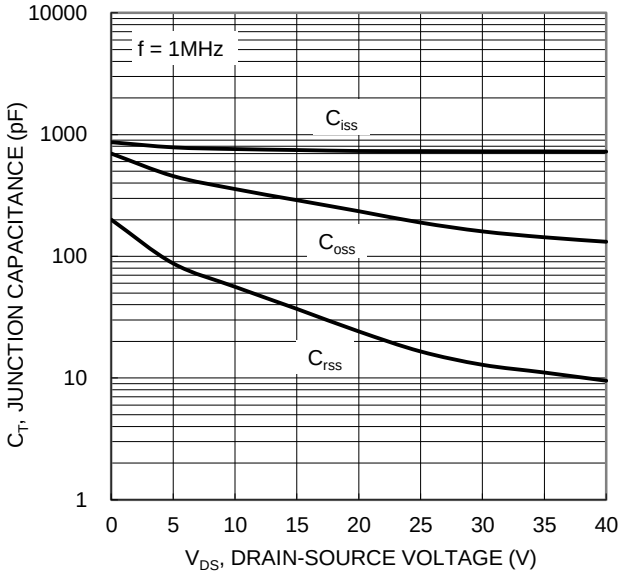



Figure 10. Typical Junction Capacitance

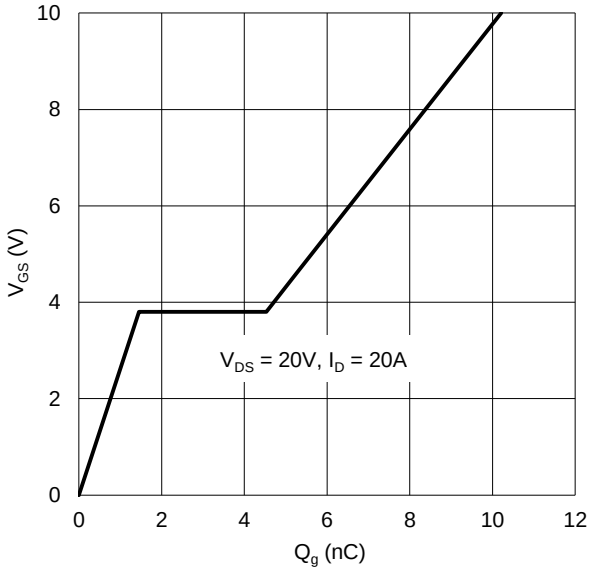



Figure 11. Gate Charge

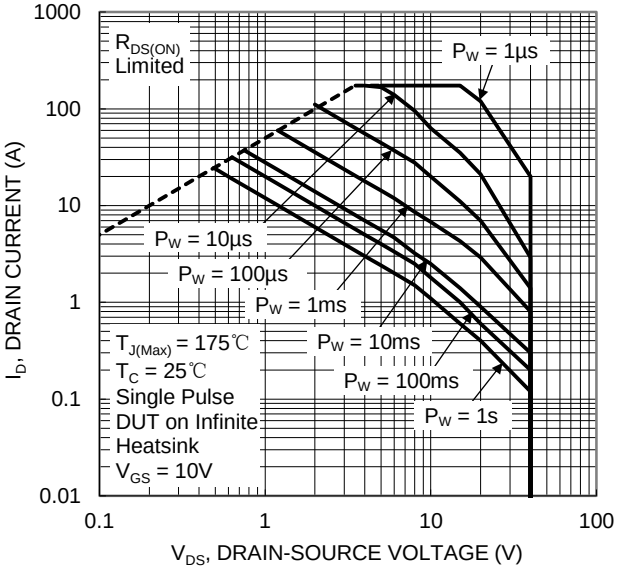



Figure 12. SOA, Safe Operation Area

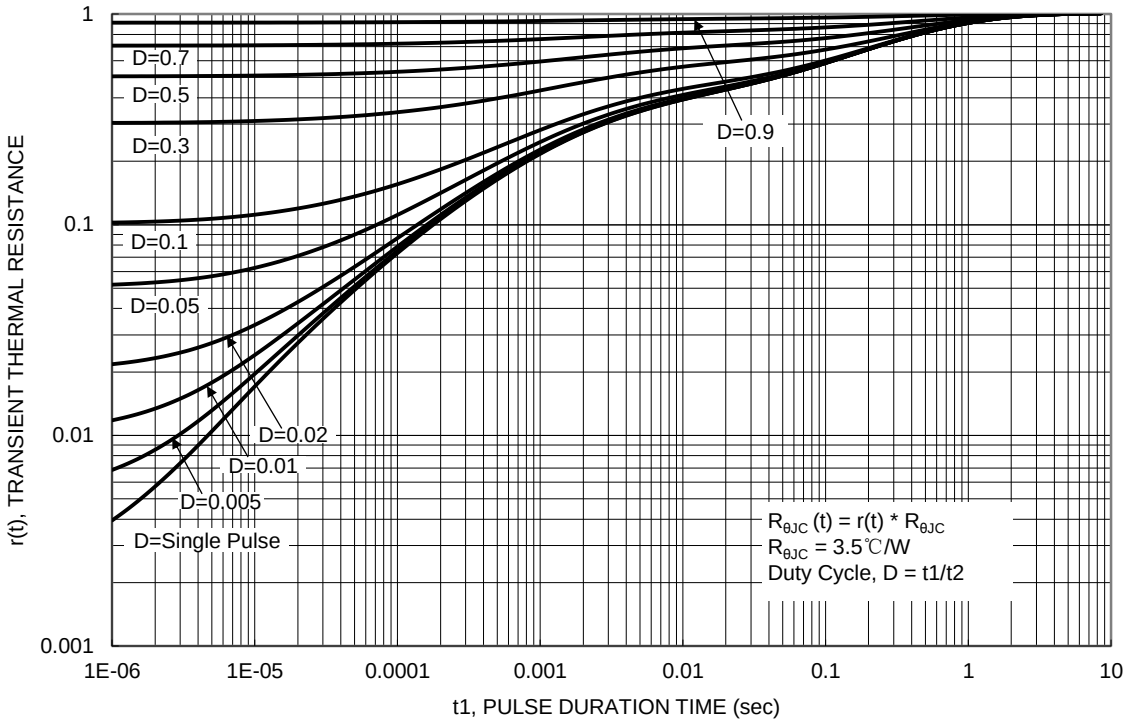
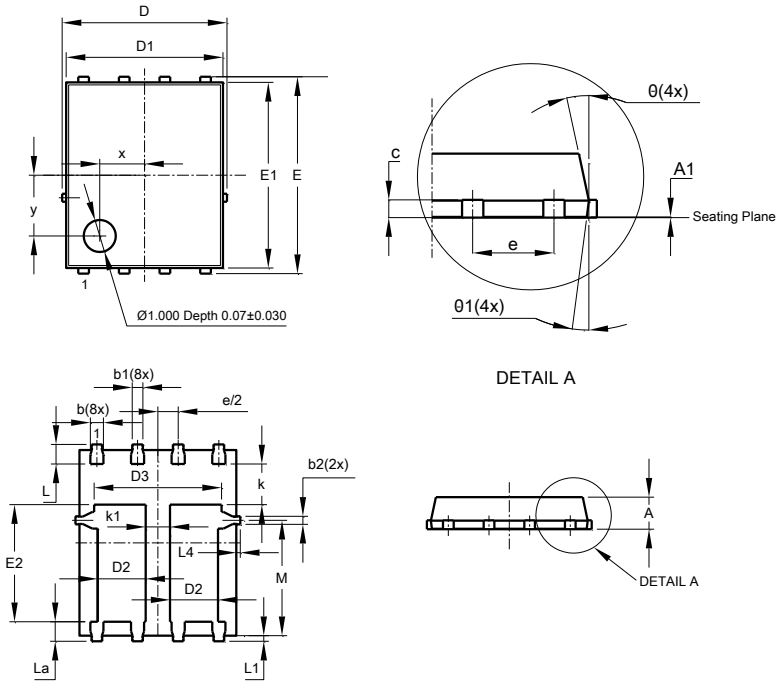



Figure 13. Transient Thermal Resistance

## Package Outline Dimensions

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

**PowerDI5060-8 (Type C)**

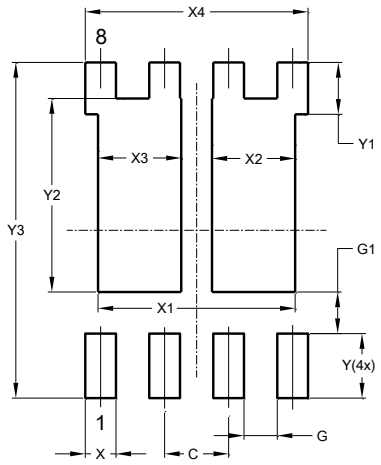



| PowerDI5060-8 (Type C) | | | |
|---|---|---|---|
| **Dim** | **Min** | **Max** | **Typ** |
| **A** | 0.90 | 1.10 | 1.00 |
| **A1** | 0 | 0.05 | 0.02 |
| **b** | 0.33 | 0.51 | 0.41 |
| **b1** | 0.300 | 0.366 | 0.333 |
| **b2** | 0.20 | 0.35 | 0.25 |
| **c** | 0.23 | 0.33 | 0.277 |
| **D** | 5.15 BSC | | |
| **D1** | 4.85 | 4.95 | 4.90 |
| **D2** | 1.40 | 1.60 | 1.50 |
| **D3** | - | - | 3.98 |
| **E** | 6.15 BSC | | |
| **E1** | 5.75 | 5.85 | 5.80 |
| **E2** | 3.56 | 3.76 | 3.66 |
| **e** | 1.27BSC | | |
| **k** | - | - | 1.27 |
| **k1** | 0.56 | - | - |
| **L** | 0.51 | 0.71 | 0.61 |
| **La** | 0.51 | 0.71 | 0.61 |
| **L1** | 0.05 | 0.20 | 0.175 |
| **L4** | - | - | 0.125 |
| **M** | 3.50 | 3.71 | 3.605 |
| **x** | - | - | 1.400 |
| **y** | - | - | 1.900 |
| **θ** | 10° | 12° | 11° |
| **θ1** | 6° | 8° | 7° |
| **All Dimensions in mm** | | | |

## Suggested Pad Layout

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

**PowerDI5060-8 (Type C)**




| Dimensions | Value (in mm) |
|---|---|
| **C** | 1.270 |
| **G** | 0.660 |
| **G1** | 0.820 |
| **X** | 0.610 |
| **X1** | 3.910 |
| **X2** | 1.650 |
| **X3** | 1.650 |
| **X4** | 4.420 |
| **Y** | 1.270 |
| **Y1** | 1.020 |
| **Y2** | 3.810 |
| **Y3** | 6.610 |

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