# 30V 175°C N-CHANNEL ENHANCEMENT MODE MOSFET
## PowerDI

## Product Summary

| $BV_{DSS}$ | $R_{DS(ON)}$ Max | $I_D$ Max $T_C$ = +25°C |
|---|---|---|
| 30V | 3.8mΩ @ $V_{GS}$ = 10V | 145A |
| | 6mΩ @ $V_{GS}$ = 4.5V | 115A |

## Features and Benefits

- Low $R_{DS(ON)}$ – Minimizes On-State Losses
- Excellent $Q_{gd}$ x $R_{DS(ON)}$ Product (FOM)
- Small Form Factor Thermally Efficient Package Enables Higher Density End Products
- 100% Unclamped Inductive Switching – Ensures More Reliability
- Rated to +175°C – Ideal for High Ambient Temperature Environments
- **Lead-Free Finish; RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **Qualified to AEC-Q101 Standards for High Reliability**
- **PPAP Capable (Note 4)**

## 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:

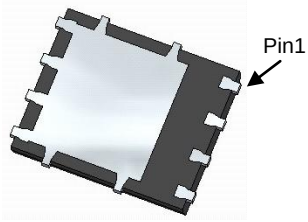
- Backlighting
- Power Management Functions
- DC-DC Converters

## Mechanical Data

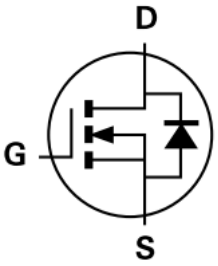
- Case: POWERDI®5060-8
- Case Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminal Connections Indicator: See Diagram
- Terminals: Finish — Matte Tin Annealed over Copper Leadframe. Solderable per MIL-STD-202,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

POWERDI®5060-8

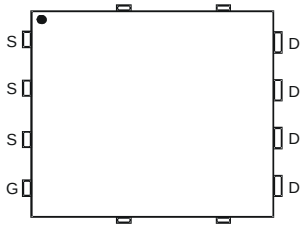
Top View




Bottom View




Internal Schematic




Top View
Pin Configuration

## Ordering Information (Note 5)

| Part Number | Case | Packaging |
|---|---|---|
| DMTH3004LPSQ-13 | POWERDI®5060-8 | 2,500/Tape & Reel |

Notes:
1. EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant. All applicable RoHS exemptions applied.
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. Automotive products are AEC-Q101 qualified and are PPAP capable. Refer to http://www.diodes.com/product_compliance_definitions.html.
5. For packaging details, go to our website at http://www.diodes.com/products/packages.html.

## Marking Information


= Manufacturer's Marking
H3004LS = Product Type Marking Code
YYWW = Date Code Marking
YY = Year (ex: 15 = 2015)
WW = Week (01 to 53)

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

| Characteristic | | Symbol | Value | Unit |
|---|---|---|---|---|
| Drain-Source Voltage | | $V_{DSS}$ | 30 | V |
| Gate-Source Voltage | | $V_{GSS}$ | +20<br>-16 | V |
| Continuous Drain Current (Note 6) | $T_A$ = +25°C<br>$T_A$ = +100°C | $I_D$ | 22<br>16 | A |
| Continuous Drain Current (Note 7) | $T_C$ = +25°C<br>$T_C$ = +100°C | $I_D$ | 145<br>103 | A |
| Maximum Continuous Body Diode Forward Current | | $I_S$ | 100 | A |
| Pulsed Drain Current (10µs Pulse, Duty Cycle = 1%) | | $I_{DM}$ | 180 | A |
| Avalanche Current, L=0.3mH | | $I_{AS}$ | 27 | A |
| Avalanche Energy, L=0.3mH | | $E_{AS}$ | 110 | mJ |

## Thermal Characteristics

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Total Power Dissipation | $P_D$ | 136 | W |
| Thermal Resistance, Junction to Ambient (Note 6) | $R_{\theta JA}$ | 47 | °C/W |
| Thermal Resistance, Junction to Case (Note 7) | $R_{\theta JC}$ | 1.1 | |
| 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 8) | | | | | | |
| Drain-Source Breakdown Voltage | $BV_{DSS}$ | 30 | — | — | V | $V_{GS}$ = 0V, $I_D$ = 250µA |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | — | — | 1 | µA | $V_{DS}$ = 24V, $V_{GS}$ = 0V |
| Zero Gate Voltage Drain Current (Note 9) | $I_{DSS}$ | — | — | 10 | µA | $V_{DS}$ = 24V, $V_{GS}$ = 0V<br>$T_J$ = +125°C |
| Gate-Source Leakage | $I_{GSS}$ | — | — | ±100 | nA | $V_{GS}$ = +20V, $V_{DS}$ = 0V<br>$V_{GS}$ = -16V, $V_{DS}$ = 0V |
| **ON CHARACTERISTICS** (Note 8) | | | | | | |
| Gate Threshold Voltage | $V_{GS(TH)}$ | 1 | 1.6 | 3 | V | $V_{DS}$ = $V_{GS}$, $I_D$ = 250µA |
| Static Drain-Source On-Resistance | $R_{DS(ON)}$ | — | 3.3 | 3.8 | mΩ | $V_{GS}$ = 10V, $I_D$ = 20A |
| | | — | 5 | 6 | | $V_{GS}$ = 4.5V, $I_D$ = 7A |
| Diode Forward Voltage | $V_{SD}$ | — | 0.70 | 1 | V | $V_{GS}$ = 0V, $I_S$ = 1A |
| **DYNAMIC CHARACTERISTICS** | | | | | | |
| Input Capacitance (Note 9) | $C_{iss}$ | — | 2370 | — | pF | $V_{DS}$ = 15V, $V_{GS}$ = 0V,<br>f = 1MHz |
| Output Capacitance (Note 9) | $C_{oss}$ | — | 1360 | — | | |
| Reverse Transfer Capacitance (Note 9) | $C_{rss}$ | — | 240 | — | | |
| Gate Resistance | $R_g$ | 0.14 | 0.7 | 1.75 | Ω | $V_{DS}$ = 0V, $V_{GS}$ = 0V, f = 1MHz |
| **SWITCHING CHARACTERISTICS** (Note 9) | | | | | | |
| Total Gate Charge ($V_{GS}$ = 10V) | $Q_g$ | — | 43.7 | — | nC | $V_{DS}$ = 15V, $I_D$ = 20A |
| Gate-Source Charge | $Q_{gs}$ | — | 6.9 | — | | |
| Gate-Drain Charge | $Q_{gd}$ | — | 8 | — | | |
| Turn-On Delay Time | $t_{D(ON)}$ | — | 6.2 | — | ns | $V_{DD}$ = 15V, $V_{GS}$ = 10V,<br>$R_G$ = 3Ω, $R_L$ = 0.75Ω |
| Turn-On Rise Time | $t_R$ | — | 4.2 | — | | |
| Turn-Off Delay Time | $t_{D(OFF)}$ | — | 21 | — | | |
| Turn-Off Fall Time | $t_F$ | — | 8 | — | | |
| Body Diode Reverse Recovery Time | $t_{RR}$ | — | 25 | — | ns | $I_F$ = 15A, dI/dt = 500A/µs |
| Body Diode Reverse Recovery Charge | $Q_{RR}$ | — | 37 | — | nC | |

Notes:
6. Device mounted with exposed drain pad on 25mm by 25mm 2oz copper on a single- sided 1.6mm FR-4 PCB; device is measured under still air conditions whilst operating in a steady state.
7. Thermal resistance from junction to soldering point (on the exposed drain pad).
8. Short duration pulse test used to minimize self-heating effect.
9. Guaranteed by design. Not subject to production testing.

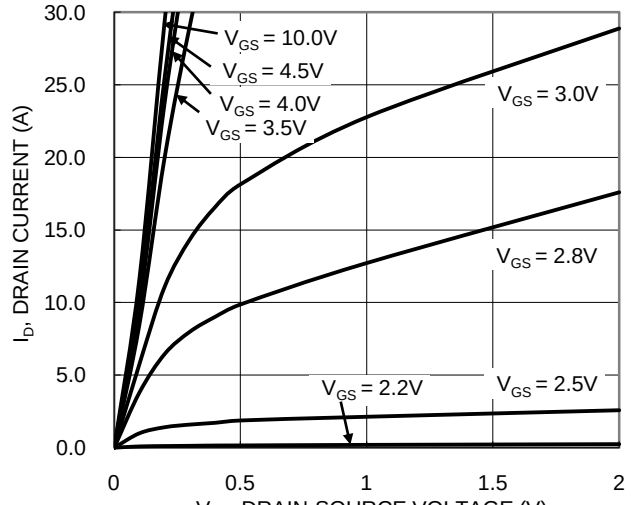



Figure 1. Typical Output Characteristic

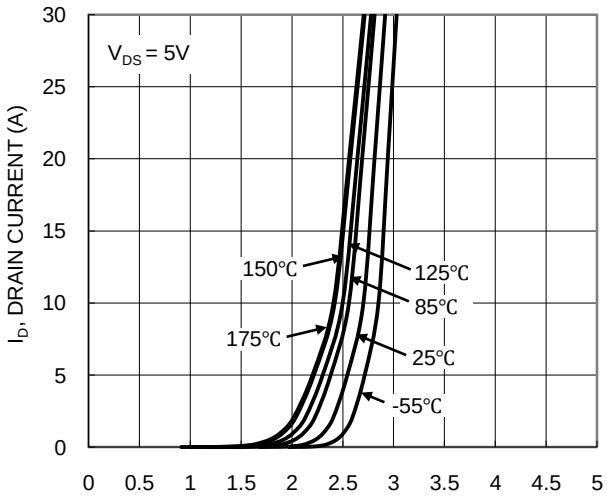



Figure 2. Typical Transfer Characteristic

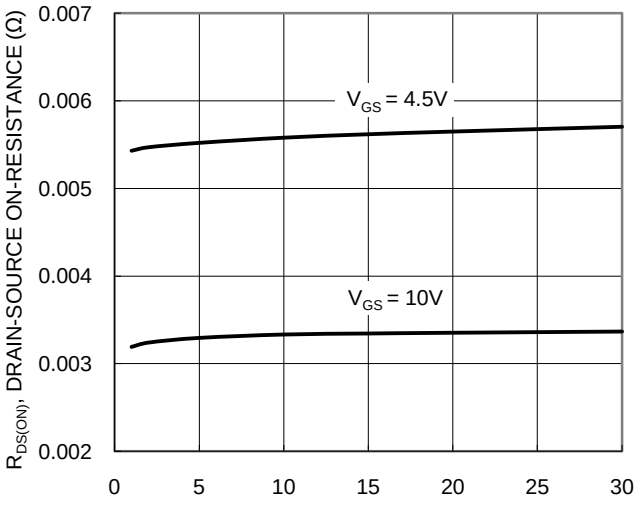



Figure 3. Typical On-Resistance vs. Drain Current and Gate Voltage

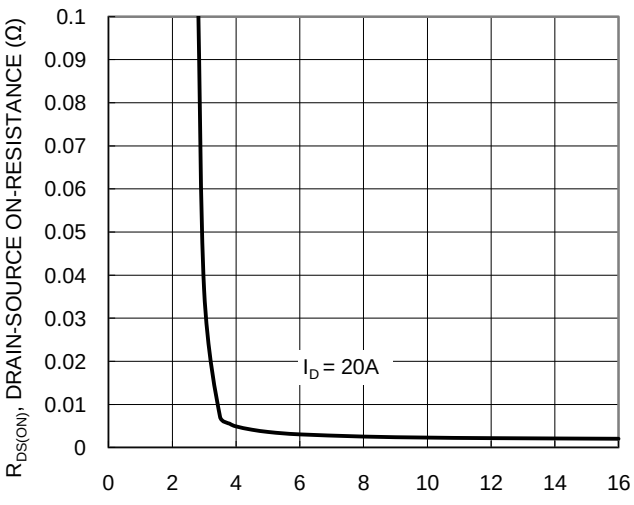



Figure 4. Typical Transfer Characteristic

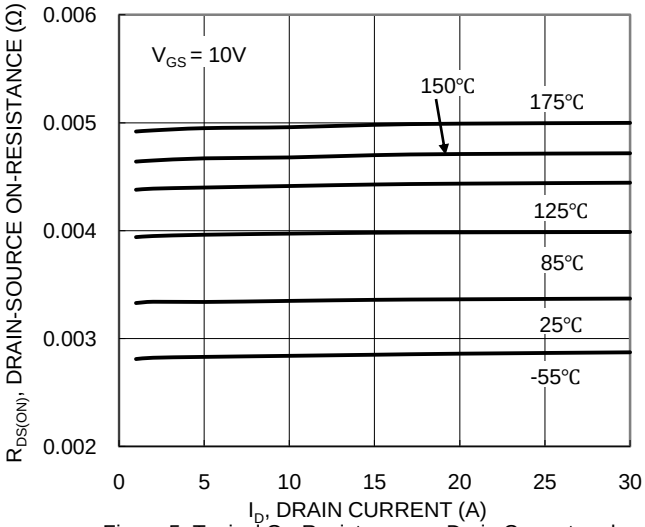



Figure 5. Typical On-Resistance vs. Drain Current and Junction Temperature

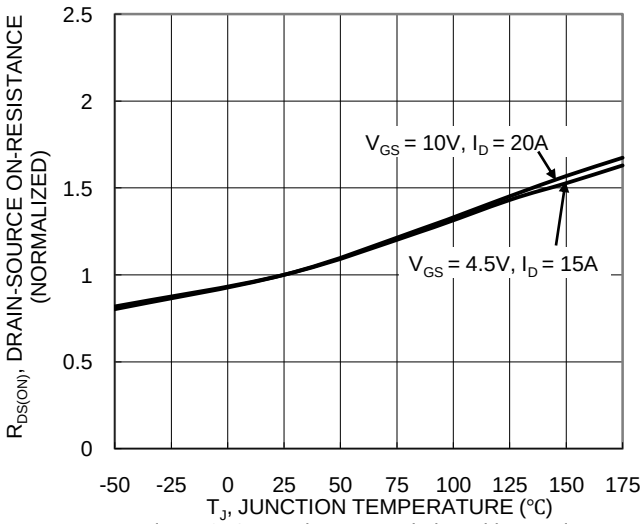



Figure 6. On-Resistance Variation with Junction Temperature

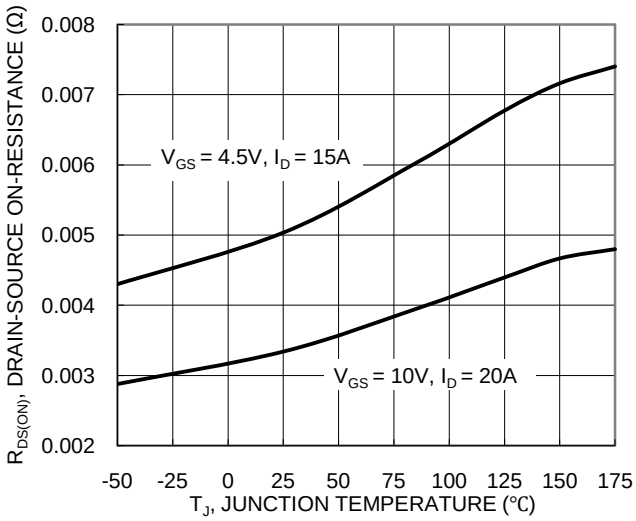



Figure 7. On-Resistance Variation with Junction Temperature

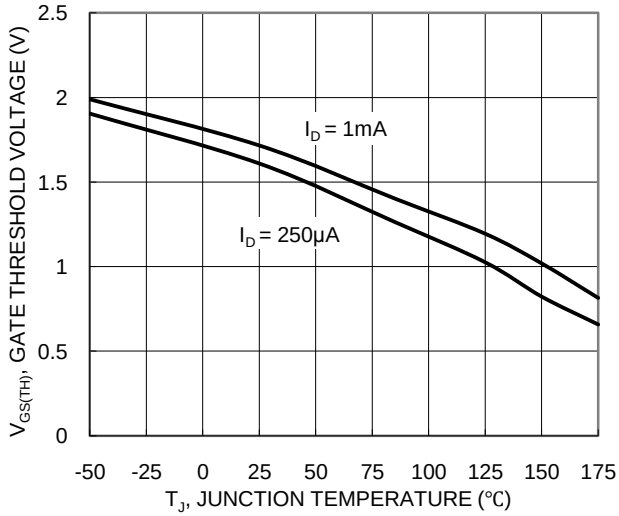



Figure 8. Gate Threshold Variation vs. Junction Temperature

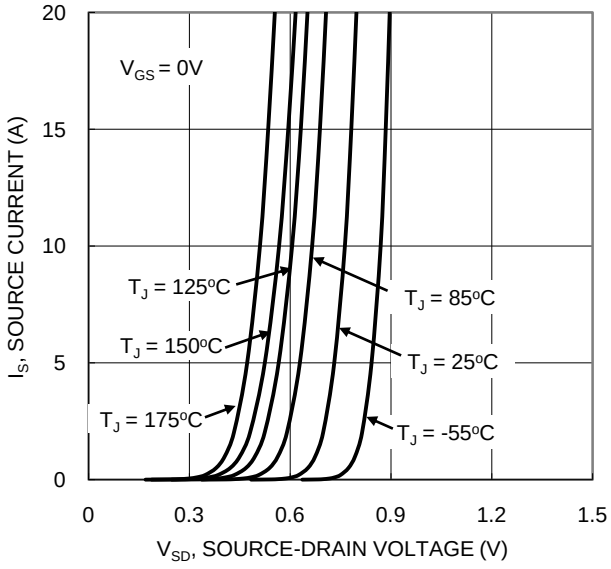



Figure 9. Diode Forward Voltage vs. Current

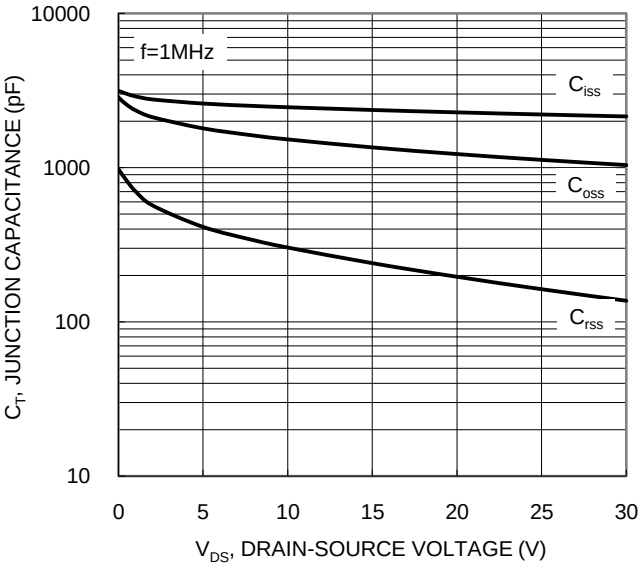



Figure 10. Typical Junction Capacitance

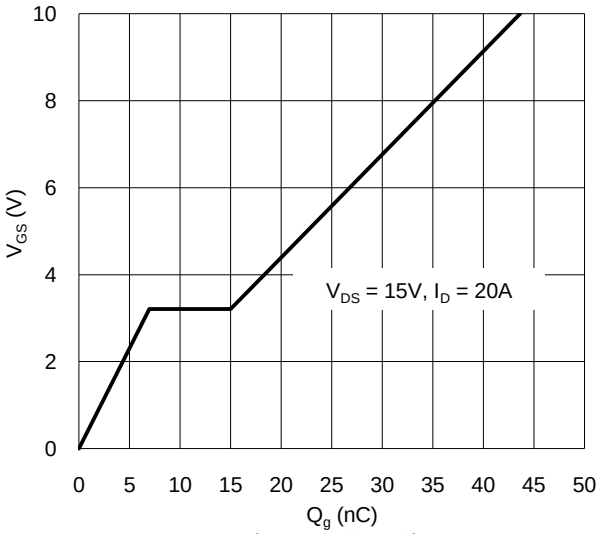



Figure 11. Gate Charge

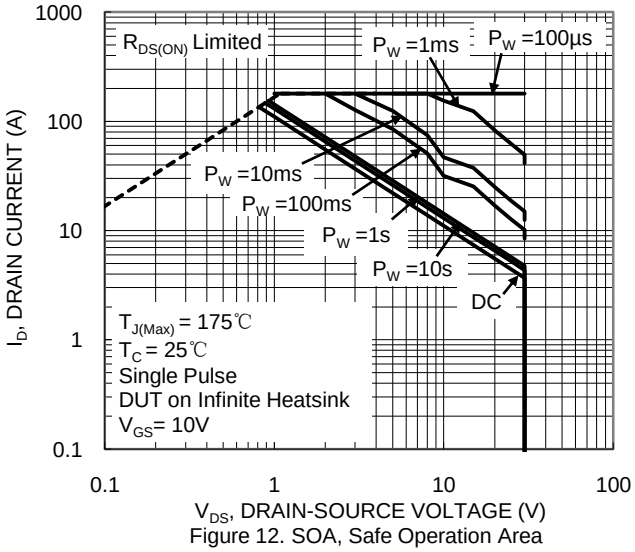



Figure 12. SOA, Safe Operation Area

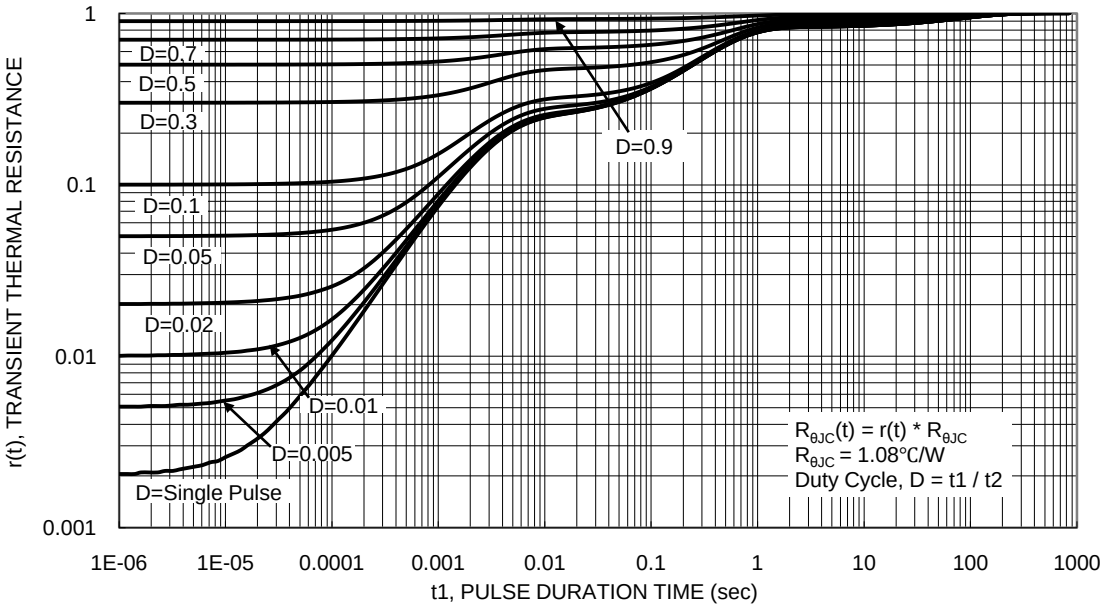
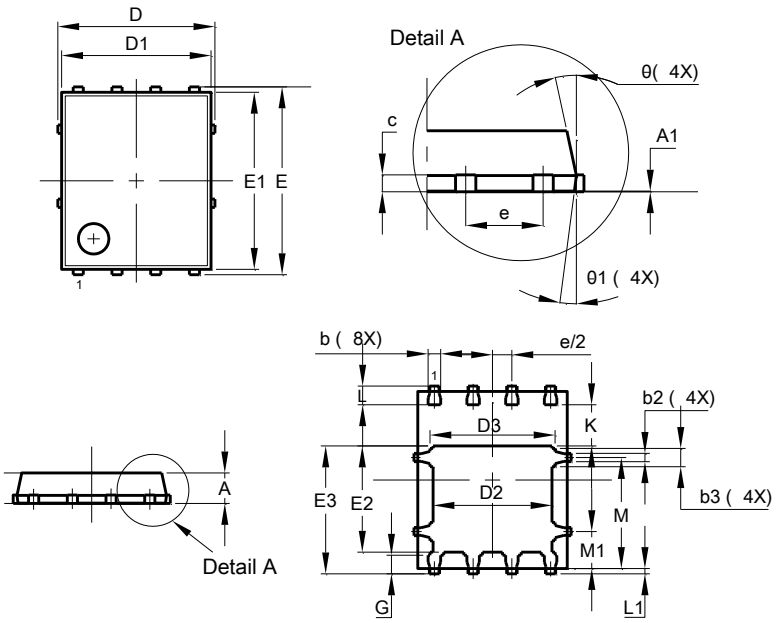



Figure 13. Transient Thermal Resistance

## Package Outline Dimensions

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

**POWERDI®5060-8**

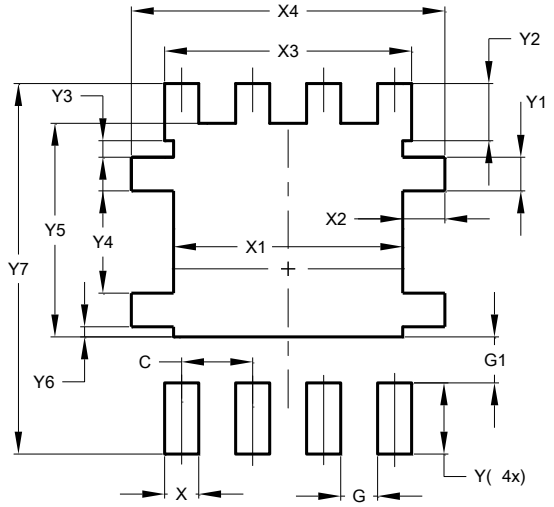



| POWERDI®5060-8 | | | |
|---|---|---|---|
| **Dim** | **Min** | **Max** | **Typ** |
| **A** | 0.90 | 1.10 | 1.00 |
| **A1** | 0.00 | 0.05 | – |
| **b** | 0.33 | 0.51 | 0.41 |
| **b2** | 0.200 | 0.350 | 0.273 |
| **b3** | 0.40 | 0.80 | 0.60 |
| **c** | 0.230 | 0.330 | 0.277 |
| **D** | 5.15 BSC | | |
| **D1** | 4.70 | 5.10 | 4.90 |
| **D2** | 3.70 | 4.10 | 3.90 |
| **D3** | 3.90 | 4.30 | 4.10 |
| **E** | 6.15 BSC | | |
| **E1** | 5.60 | 6.00 | 5.80 |
| **E2** | 3.28 | 3.68 | 3.48 |
| **E3** | 3.99 | 4.39 | 4.19 |
| **e** | 1.27 BSC | | |
| **G** | 0.51 | 0.71 | 0.61 |
| **K** | 0.51 | – | – |
| **L** | 0.51 | 0.71 | 0.61 |
| **L1** | 0.100 | 0.200 | 0.175 |
| **M** | 3.235 | 4.035 | 3.635 |
| **M1** | 1.00 | 1.40 | 1.21 |
| **Θ** | 10º | 12º | 11º |
| **Θ1** | 6º | 8º | 7º |
| **All Dimensions in mm** | | | |

## Suggested Pad Layout

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

**POWERDI®5060-8**




| Dimensions | Value (in mm) |
|---|---|
| **C** | 1.270 |
| **G** | 0.660 |
| **G1** | 0.820 |
| **X** | 0.610 |
| **X1** | 4.100 |
| **X2** | 0.755 |
| **X3** | 4.420 |
| **X4** | 5.610 |
| **Y** | 1.270 |
| **Y1** | 0.600 |
| **Y2** | 1.020 |
| **Y3** | 0.295 |
| **Y4** | 1.825 |
| **Y5** | 3.810 |
| **Y6** | 0.180 |
| **Y7** | 6.610 |

**IMPORTANT NOTICE**

DIODES INCORPORATED MAKES NO WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, WITH REGARDS TO THIS DOCUMENT, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE (AND THEIR EQUIVALENTS UNDER THE LAWS OF ANY JURISDICTION).

Diodes Incorporated and its subsidiaries reserve the right to make modifications, enhancements, improvements, corrections or other changes without further notice to this document and any product described herein. Diodes Incorporated does not assume any liability arising out of the application or use of this document or any product described herein; neither does Diodes Incorporated convey any license under its patent or trademark rights, nor the rights of others. Any Customer or user of this document or products described herein in such applications shall assume all risks of such use and will agree to hold Diodes Incorporated and all the companies whose products are represented on Diodes Incorporated website, harmless against all damages.

Diodes Incorporated does not warrant or accept any liability whatsoever in respect of any products purchased through unauthorized sales channel. Should Customers purchase or use Diodes Incorporated products for any unintended or unauthorized application, Customers shall indemnify and hold Diodes Incorporated and its representatives harmless against all claims, damages, expenses, and attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized application.

Products described herein may be covered by one or more United States, international or foreign patents pending. Product names and markings noted herein may also be covered by one or more United States, international or foreign trademarks.

This document is written in English but may be translated into multiple languages for reference. Only the English version of this document is the final and determinative format released by Diodes Incorporated.

**LIFE SUPPORT**

Diodes Incorporated products are specifically not authorized for use as critical components in life support devices or systems without the express written approval of the Chief Executive Officer of Diodes Incorporated. As used herein:

A. Life support devices or systems are devices or systems which:

1. are intended to implant into the body, or
2. support or sustain life and whose failure to perform when properly used in accordance with instructions for use provided in the labeling can be reasonably expected to result in significant injury to the user.

B. A critical component is any component in a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or to affect its safety or effectiveness.

Customers represent that they have all necessary expertise in the safety and regulatory ramifications of their life support devices or systems, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of Diodes Incorporated products in such safety-critical, life support devices or systems, notwithstanding any devices- or systems-related information or support that may be provided by Diodes Incorporated. Further, Customers must fully indemnify Diodes Incorporated and its representatives against any damages arising out of the use of Diodes Incorporated products in such safety-critical, life support devices or systems.



**www.diodes.com**