

## Product Summary

| $BV_{DSS}$ | $R_{DS(ON)}$ max              | $I_D$ max<br>$T_C = +25^\circ C$ |
|------------|-------------------------------|----------------------------------|
| 40V        | 15m $\Omega$ @ $V_{GS} = 10V$ | 42A                              |

## 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.

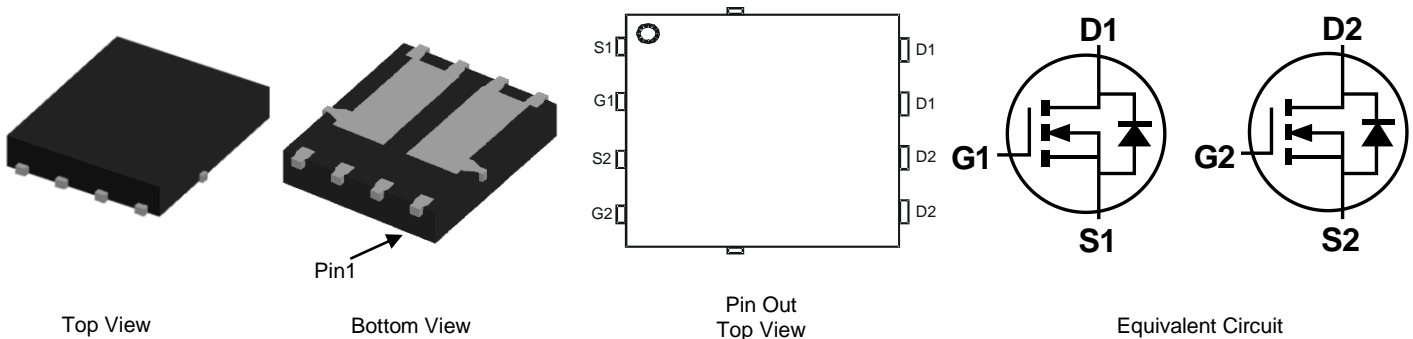
- Backlighting
- Power Management Functions
- DC-DC Converters

## 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)**
- **Qualified to AEC-Q101 Standards for High Reliability**
- **An Automotive-Compliant Part is Available Under Separate Datasheet ([DMTH4011SPDQ](#))**

## Mechanical Data

- Case: PowerDI<sup>®</sup> 5060-8 (Type C)
- 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 @3
- Weight: 0.097 grams (Approximate)

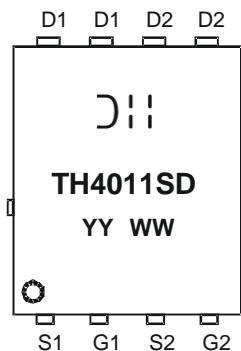


## Ordering Information (Note 4)

| Part Number    | Case                   | Packaging         |
|----------------|------------------------|-------------------|
| DMTH4011SPD-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) compliant.
  2. See [http://www.diodes.com/quality/lead\\_free.html](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 <https://www.diodes.com/design/support/packaging/diodes-packaging/>.

## Marking Information



DII = Manufacturer's Marking  
 TH4011SD = Product Type Marking Code  
 YYWW = Date Code Marking  
 YY = Year (ex: 17 = 2017)  
 WW = Week (01 to 53)

**Maximum Ratings** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

| Characteristic  | Symbol           | Value                   | Unit |
|---|------------------|-------------------------|------|
| Drain-Source Voltage  | V <sub>DSS</sub> | 40                      | V    |
| Gate-Source Voltage   | V <sub>GSS</sub> | ±20                     | V    |
| Continuous Drain Current (Note 6)                               | I <sub>D</sub>   | T <sub>C</sub> = +25°C  | 42   |
|   |                  | T <sub>C</sub> = +100°C | 29.7 |
| Continuous Drain Current (Note 5)                               | I <sub>D</sub>   | T <sub>A</sub> = +25°C  | 11.1 |
|   |                  | T <sub>A</sub> = +100°C | 7.8  |
| Pulsed Drain Current (10µs Pulse, Duty Cycle = 1%)              | I <sub>DM</sub>  | 60                      | A    |
| Maximum Continuous Body Diode Forward Current (Note 6)          | I <sub>S</sub>   | 3.3                     | A    |
| Pulsed Body Diode Forward Current (10µs Pulse, Duty Cycle = 1%) | I <sub>SM</sub>  | 60                      | A    |
| Avalanche Current, L = 0.3mH                                    | I <sub>AS</sub>  | 11.9                    | A    |
| Avalanche Energy, L = 0.3mH                                     | E <sub>AS</sub>  | 21.4                    | mJ   |

**Thermal Characteristics**

| Characteristic                                   | Symbol                            | Value       | Unit |
|--|-----------------------------------|-------------|------|
| Total Power Dissipation (Note 5)                 | P <sub>D</sub>                    | 2.6         | W    |
| Thermal Resistance, Junction to Ambient (Note 5) | R <sub>θJA</sub>                  | 57          | °C/W |
| Total Power Dissipation (Note 6)                 | P <sub>D</sub>                    | 37.5        | W    |
| Thermal Resistance, Junction to Case (Note 6)    | R <sub>θJC</sub>                  | 4           | °C/W |
| Operating and Storage Temperature Range          | T <sub>J</sub> , T <sub>STG</sub> | -55 to +175 | °C   |

**Electrical Characteristics** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

| Characteristic                          | Symbol              | Min | Typ  | Max  | Unit | Test Condition   |
|---|---------------------|-----|------|------|------|--|
| <b>OFF CHARACTERISTICS (Note 7)</b>     |                     |     |      |      |      |  |
| Drain-Source Breakdown Voltage          | BV <sub>DSS</sub>   | 40  | —    | —    | V    | V <sub>GS</sub> = 0V, I <sub>D</sub> = 1mA   |
| Zero Gate Voltage Drain Current         | I <sub>DSS</sub>    | —   | —    | 1    | µA   | V <sub>DS</sub> = 32V, V <sub>GS</sub> = 0V  |
| Gate-Source Leakage                     | I <sub>GSS</sub>    | —   | —    | ±100 | nA   | V <sub>GS</sub> = ±20V, V <sub>DS</sub> = 0V   |
| <b>ON CHARACTERISTICS (Note 7)</b>      |                     |     |      |      |      |  |
| Gate Threshold Voltage                  | V <sub>GS(TH)</sub> | 2   | —    | 4    | V    | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250µA                                   |
| Static Drain-Source On-Resistance       | R <sub>DS(ON)</sub> | —   | 11.6 | 15   | mΩ   | V <sub>GS</sub> = 10V, I <sub>D</sub> = 20A  |
| Diode Forward Voltage                   | V <sub>SD</sub>     | —   | —    | 1.2  | V    | V <sub>GS</sub> = 0V, I <sub>S</sub> = 20A   |
| <b>DYNAMIC CHARACTERISTICS (Note 8)</b> |                     |     |      |      |      |  |
| Input Capacitance                       | C <sub>iss</sub>    | —   | 805  | —    | pF   | V <sub>DS</sub> = 20V, V <sub>GS</sub> = 0V,<br>f = 1MHz                                     |
| Output Capacitance                      | C <sub>oss</sub>    | —   | 208  | —    | pF   |  |
| Reverse Transfer Capacitance            | C <sub>rss</sub>    | —   | 15   | —    | pF   |  |
| Gate Resistance                         | R <sub>g</sub>      | —   | 2.76 | —    | Ω    | V <sub>DS</sub> = 0V, V <sub>GS</sub> = 0V, f = 1MHz   |
| Total Gate Charge                       | Q <sub>g</sub>      | —   | 10.6 | —    | nC   | V <sub>DS</sub> = 20V, I <sub>D</sub> = 20A,<br>V <sub>GS</sub> = 10V                        |
| Gate-Source Charge                      | Q <sub>gs</sub>     | —   | 2.2  | —    | nC   |  |
| Gate-Drain Charge                       | Q <sub>gd</sub>     | —   | 2.7  | —    | nC   |  |
| Turn-On Delay Time                      | t <sub>D(ON)</sub>  | —   | 4.1  | —    | ns   | V <sub>DD</sub> = 20V, V <sub>GS</sub> = 10V,<br>R <sub>G</sub> = 1.6Ω, I <sub>D</sub> = 20A |
| Turn-On Rise Time                       | t <sub>r</sub>      | —   | 3.8  | —    | ns   |  |
| Turn-Off Delay Time                     | t <sub>D(OFF)</sub> | —   | 8.6  | —    | ns   |  |
| Turn-Off Fall Time                      | t <sub>f</sub>      | —   | 1.9  | —    | ns   |  |
| Body Diode Reverse Recovery Time        | t <sub>RR</sub>     | —   | 10.2 | —    | ns   | I <sub>F</sub> = 15A, di/dt = 400A/µs  |
| Body Diode Reverse Recovery Charge      | Q <sub>RR</sub>     | —   | 9.6  | —    | nC   |  |

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

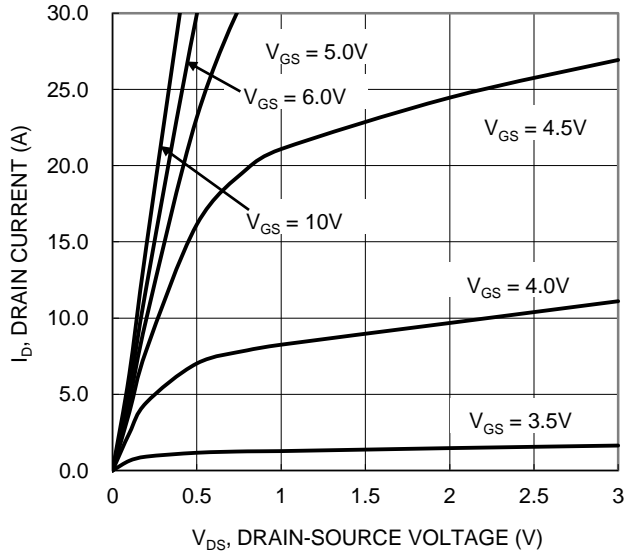


Figure 1. Typical Output Characteristic

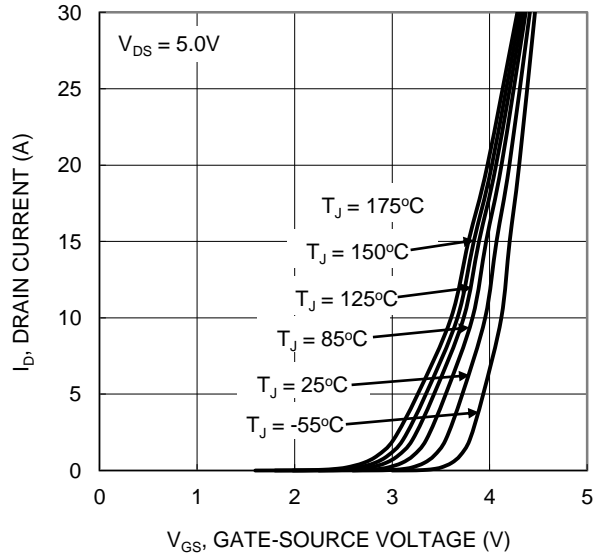


Figure 2. Typical Transfer Characteristic

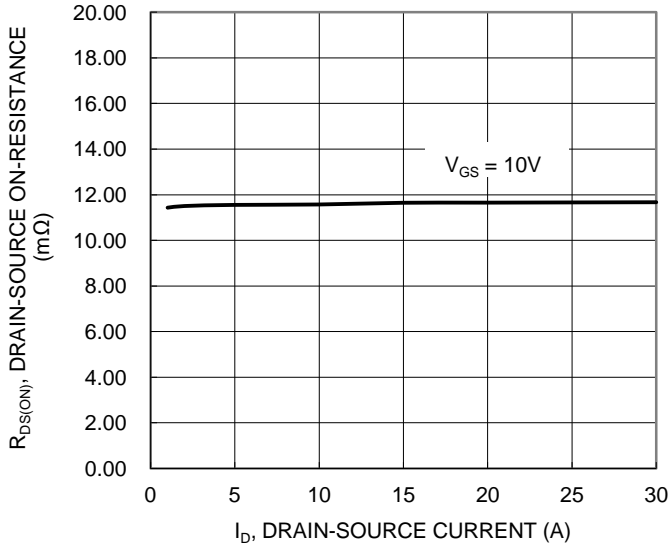


Figure 3. Typical On-Resistance vs. Drain Current and Gate Voltage

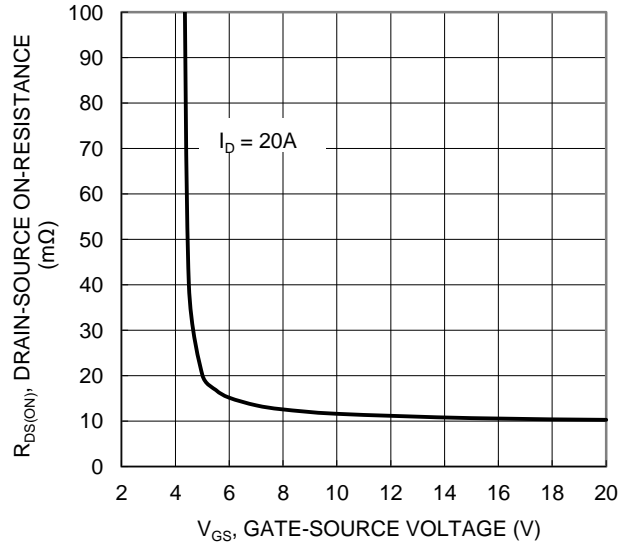


Figure 4. Typical Transfer Characteristic

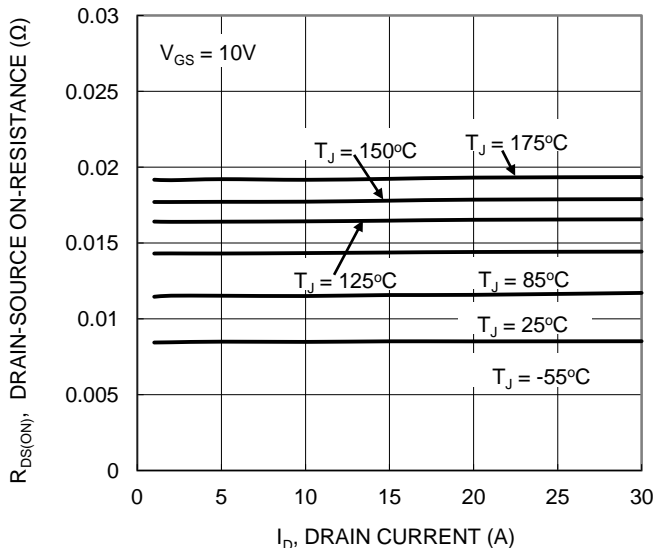


Figure 5. Typical On-Resistance vs. Drain Current and Temperature

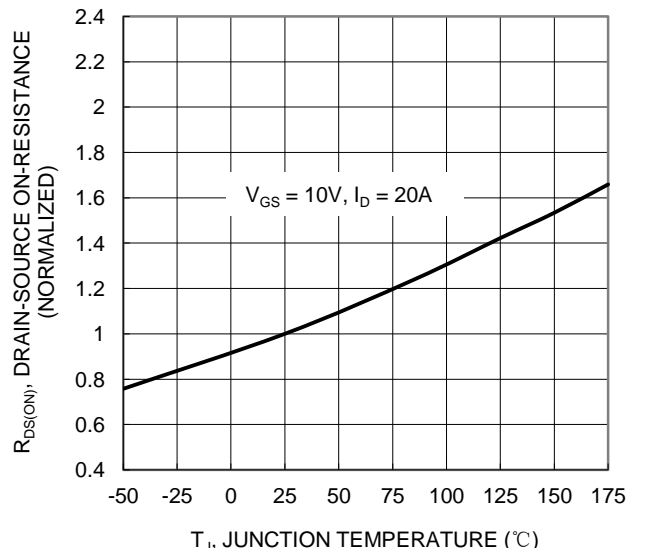


Figure 6. On-Resistance Variation with Temperature

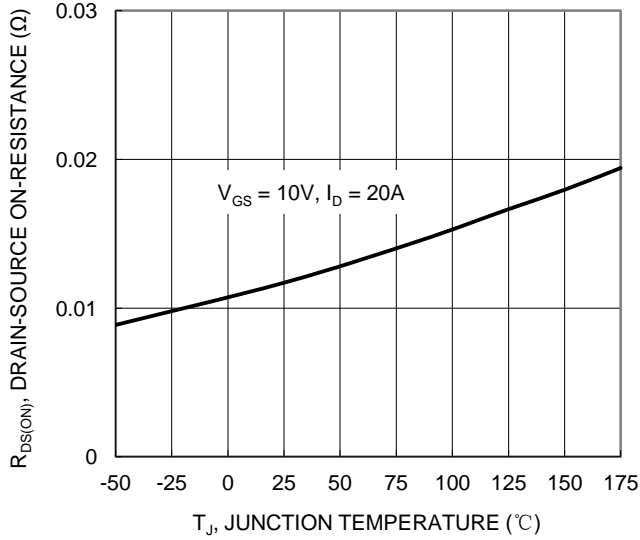


Figure 7. On-Resistance Variation with Temperature

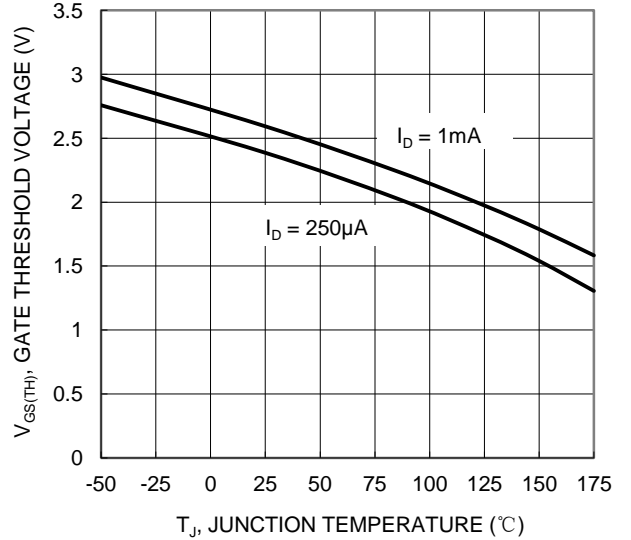


Figure 8. Gate Threshold Variation vs. Temperature

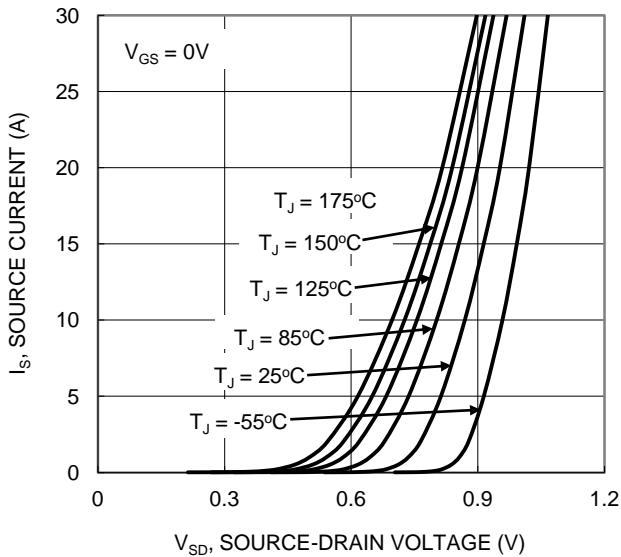


Figure 9. Diode Forward Voltage vs. Current

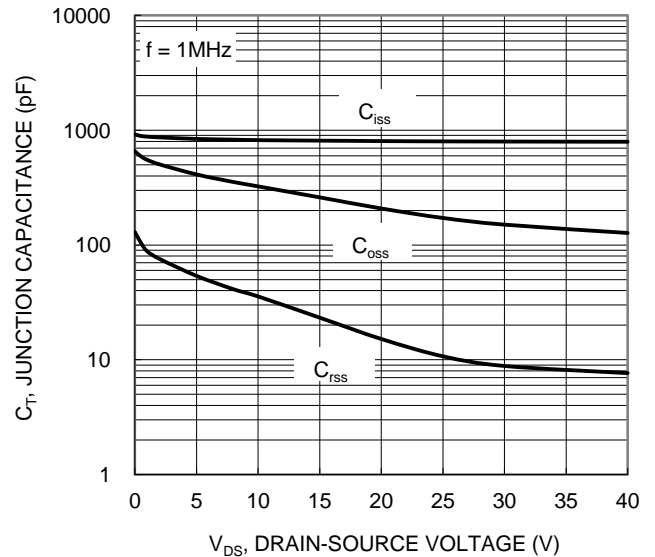


Figure 10. Typical Junction Capacitance

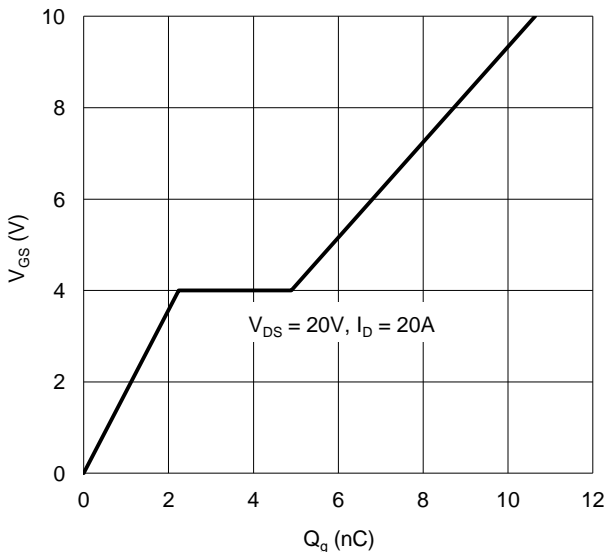


Figure 11. Gate Charge

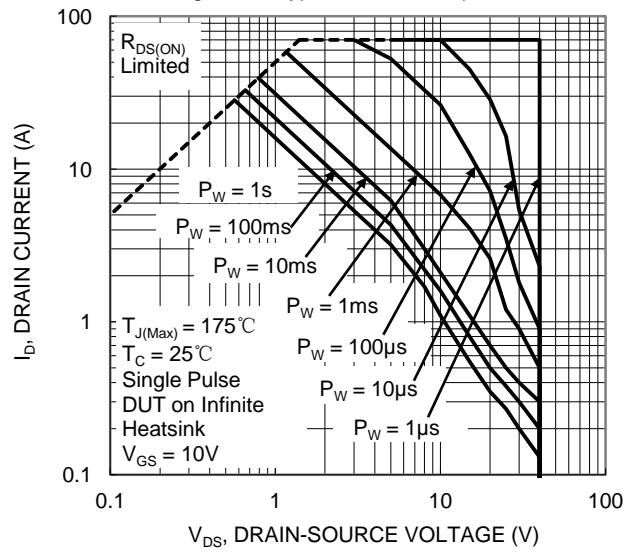


Figure 12. SOA, Safe Operation Area

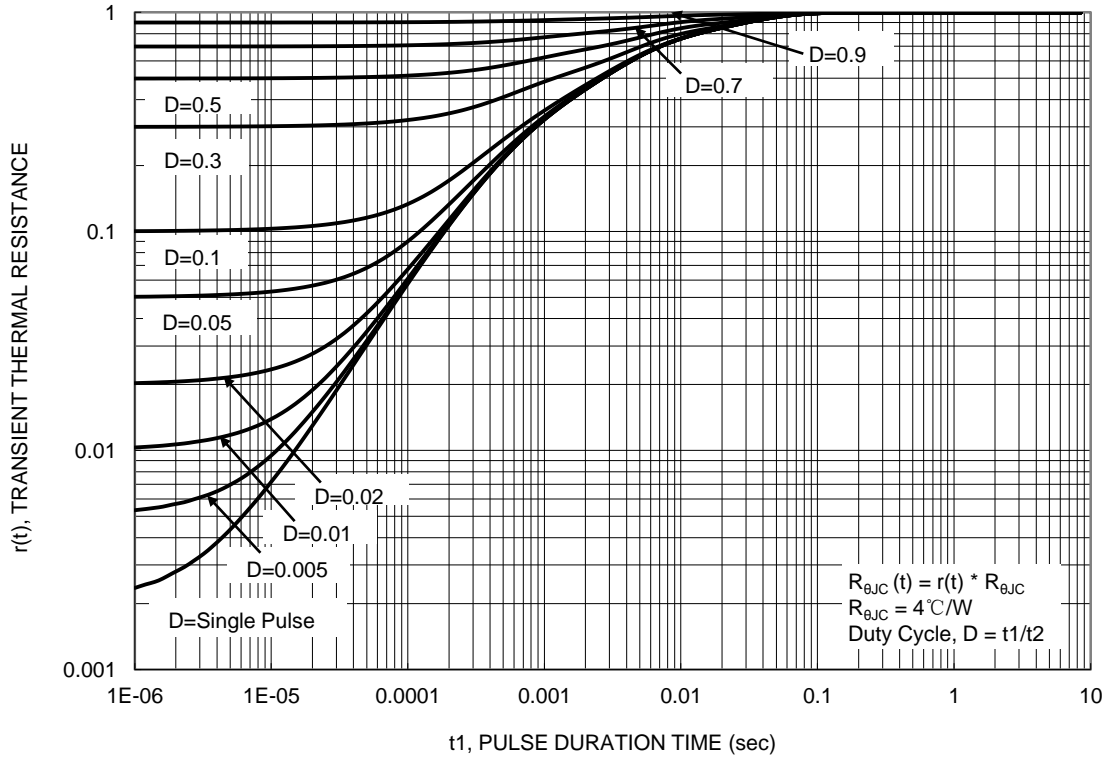
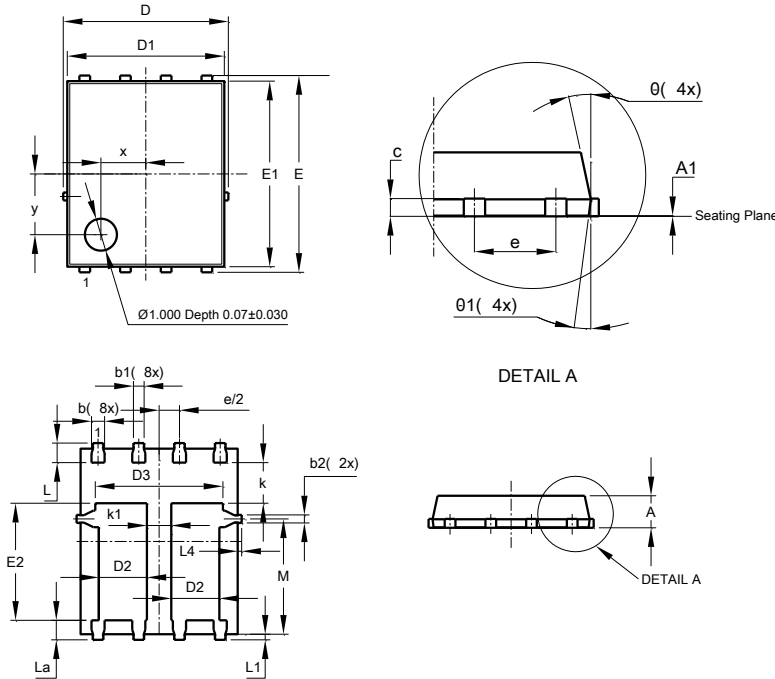


Figure 13. Transient Thermal Resistance

**Package Outline Dimensions**

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

**PowerDI5060-8 (Type C)**

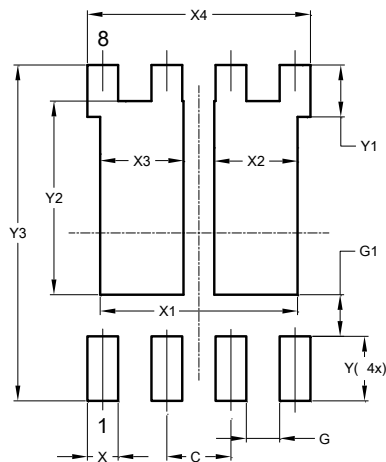


| PowerDI5060-8 (Type C) |          |       |       |
|------------------------|----------|-------|-------|
| Dim                    | Min      | Max   | Typ   |
| A                      | 0.90     | 1.10  | 1.00  |
| A1                     | 0        | 0.05  | 0.02  |
| b                      | 0.33     | 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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