

## Product Summary

| BV <sub>DSS</sub> | R <sub>DS(ON)</sub> Max        | I <sub>D</sub><br>T <sub>A</sub> = +25°C |
|-------------------|--------------------------------|--|
| -40V              | 11mΩ @ V <sub>GS</sub> = -10V  | -11A                                     |
|                   | 15mΩ @ V <sub>GS</sub> = -4.5V | -10A                                     |

## 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:

- DC-DC Converters
- Power Management Functions
- Analog Switch

## Features and Benefits

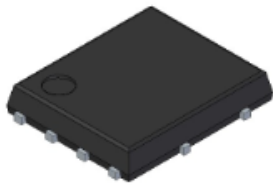
- 100% Unclamped Inductive Switch (UIS) Test in Production
- Low On-Resistance
- Fast Switching Speed
- **Lead-Free Finish; RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **The DMP4015SPSQ is suitable for automotive applications requiring specific change control; this part is AEC-Q101 qualified, PPAP capable, and manufactured in IATF 16949 certified facilities.**

<https://www.diodes.com/quality/product-definitions/>

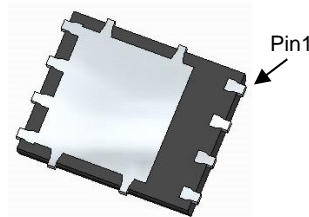
## Mechanical Data

- Case: PowerDI<sup>®</sup>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—100% Matte Tin Annealed over Copper Leadframe. Solderable per MIL-STD-202, Method 208 (E3)
- Weight: 0.097 grams (Approximate)

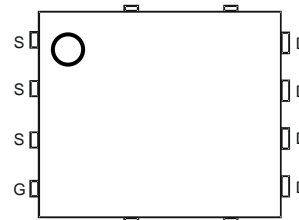
PowerDI5060-8



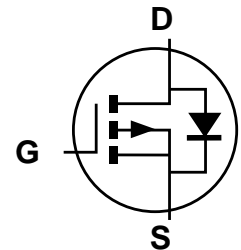
Top View



Bottom View



Top View  
Pin Configuration



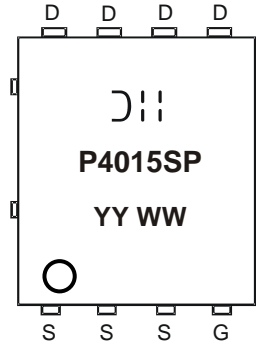
Internal Schematic

## Ordering Information (Note 4)

| Part Number    | Case          | Packaging         |
|----------------|---------------|-------------------|
| DMP4015SPSQ-13 | PowerDI5060-8 | 2,500/Tape & Reel |

- Notes:
1. EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant. All applicable RoHS exemptions applied.
  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**



D|| = Manufacturer's Marking  
 P4015SP = Product Type Marking Code  
 YYWW = Date Code Marking  
 YY or YY = Year (ex: 21 = 2021)  
 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> | ±25            | V    |
| Continuous Drain Current (Note 5) V <sub>GS</sub> = -10V | Steady State | I <sub>D</sub>   | -8.5<br>-6.8   | A    |
|  | t < 10s      | I <sub>D</sub>   | -13.0<br>-10.5 | A    |
| Continuous Drain Current (Note 6) V <sub>GS</sub> = -10V | Steady State | I <sub>D</sub>   | -11.0<br>-8.7  | A    |
|  | t < 10s      | I <sub>D</sub>   | -17.0<br>-13.5 | A    |
| Pulsed Drain Current (10µs Pulse, Duty Cycle = 1%)       |              | I <sub>DM</sub>  | -100           | A    |
| Maximum Body Diode Continuous Current (Note 6)           |              | I <sub>S</sub>   | -11            | A    |
| Avalanche Current (Note 8)                               |              | I <sub>AS</sub>  | -22            | A    |
| Avalanche Energy (Note 8)                                |              | E <sub>AS</sub>  | 242            | mJ   |

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

| Characteristic                                   |                        | Symbol                            | Value       | Unit |
|--|------------------------|-----------------------------------|-------------|------|
| Total Power Dissipation (Note 5)                 | T <sub>A</sub> = +25°C | P <sub>D</sub>                    | 1.3         | W    |
|  | T <sub>A</sub> = +70°C |                                   | 0.8         |      |
| Thermal Resistance, Junction to Ambient (Note 5) | Steady State           | R <sub>θJA</sub>                  | 96.4        | °C/W |
|  | t < 10s                |                                   | 40.6        | °C/W |
| Total Power Dissipation (Note 6)                 | T <sub>A</sub> = +25°C | P <sub>D</sub>                    | 2.1         | W    |
|  | T <sub>A</sub> = +70°C |                                   | 1.4         |      |
| Thermal Resistance, Junction to Ambient (Note 6) | Steady State           | R <sub>θJA</sub>                  | 55.0        | °C/W |
|  | t < 10s                |                                   | 24.0        | °C/W |
| Thermal Resistance, Junction to Case (Note 7)    |                        | R <sub>θJC</sub>                  | 4.15        | °C/W |
| Operating and Storage Temperature Range          |                        | T <sub>J</sub> , T <sub>STG</sub> | -55 to +150 | °C   |

- Notes:
- Device mounted on FR-4 PCB, with minimum recommended pad layout, single sided.
  - Device mounted on FR-4 substrate PCB, 2oz copper, with thermal bias to bottom layer 1inch square copper plate.
  - Thermal resistance from junction to soldering point (on the exposed drain pad).
  - UIS in production with L = 0.1mH, T<sub>J</sub> = +25°C.

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

| Characteristic                           | Symbol              | Min  | Typ   | Max  | Unit | Test Condition   |
|--|---------------------|------|-------|------|------|--|
| <b>OFF CHARACTERISTICS</b> (Note 9)      |                     |      |       |      |      |  |
| Drain-Source Breakdown Voltage           | BV <sub>DSS</sub>   | -40  | —     | —    | V    | V <sub>GS</sub> = 0V, I <sub>D</sub> = -250μA  |
| Zero Gate Voltage Drain Current          | I <sub>DSS</sub>    | —    | —     | -1   | μA   | V <sub>DS</sub> = -40V, V <sub>GS</sub> = 0V   |
| Gate-Source Leakage                      | I <sub>GSS</sub>    | —    | —     | ±100 | nA   | V <sub>GS</sub> = ±25V, V <sub>DS</sub> = 0V   |
| <b>ON CHARACTERISTICS</b> (Note 9)       |                     |      |       |      |      |  |
| Gate Threshold Voltage                   | V <sub>GS(TH)</sub> | -1.5 | -2    | -2.5 | V    | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = -250μA  |
| Static Drain-Source On-Resistance        | R <sub>DS(ON)</sub> | —    | 7     | 11   | mΩ   | V <sub>GS</sub> = -10V, I <sub>D</sub> = -9.8A   |
|  |                     | —    | 9     | 15   |      | V <sub>GS</sub> = -4.5V, I <sub>D</sub> = -9.8A  |
| Forward Transfer Admittance              | Y <sub>fs</sub>     | —    | 26    | —    | S    | V <sub>DS</sub> = -20V, I <sub>D</sub> = -9.8A   |
| Diode Forward Voltage                    | V <sub>SD</sub>     | —    | -0.7  | -1   | V    | V <sub>GS</sub> = 0V, I <sub>S</sub> = -1A   |
| <b>DYNAMIC CHARACTERISTICS</b> (Note 10) |                     |      |       |      |      |  |
| Input Capacitance                        | C <sub>iss</sub>    | —    | 4,234 | —    | pF   | V <sub>DS</sub> = -20V, V <sub>GS</sub> = 0V<br>f = 1MHz   |
| Output Capacitance                       | C <sub>oss</sub>    | —    | 1,036 | —    |      |  |
| Reverse Transfer Capacitance             | C <sub>rss</sub>    | —    | 526   | —    |      |  |
| Gate Resistance                          | R <sub>G</sub>      | —    | 7.77  | —    | Ω    | V <sub>DS</sub> = 0V, V <sub>GS</sub> = 0V, f = 1MHz   |
| Total Gate Charge                        | Q <sub>g</sub>      | —    | 47.5  | —    | nC   | V <sub>DS</sub> = -20V, V <sub>GS</sub> = -5V<br>I <sub>D</sub> = -9.8A  |
| Gate-Source Charge                       | Q <sub>gs</sub>     | —    | 14.2  | —    |      |  |
| Gate-Drain Charge                        | Q <sub>gd</sub>     | —    | 13.5  | —    |      |  |
| Turn-On Delay Time                       | t <sub>D(ON)</sub>  | —    | 13.2  | —    | ns   | V <sub>GS</sub> = -10V, V <sub>DD</sub> = -20V, R <sub>G</sub> = 6Ω,<br>I <sub>D</sub> = -1A, R <sub>L</sub> = 20Ω |
| Turn-On Rise Time                        | t <sub>R</sub>      | —    | 10    | —    |      |  |
| Turn-Off Delay Time                      | t <sub>D(OFF)</sub> | —    | 302.7 | —    |      |  |
| Turn-Off Fall Time                       | t <sub>F</sub>      | —    | 137.9 | —    |      |  |

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

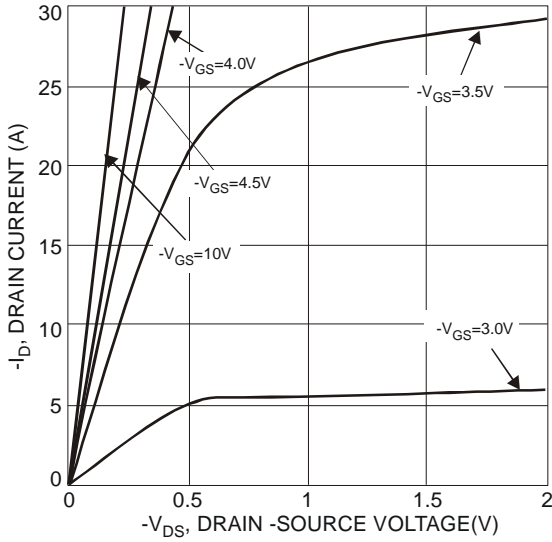


Fig. 1 Typical Output Characteristics

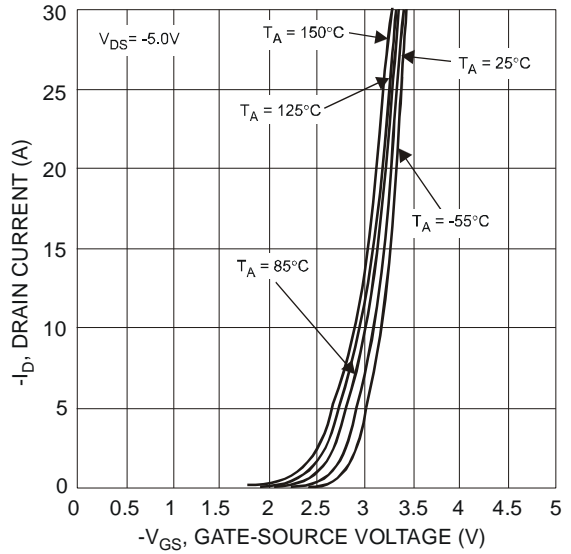


Fig. 2 Typical Transfer Characteristics

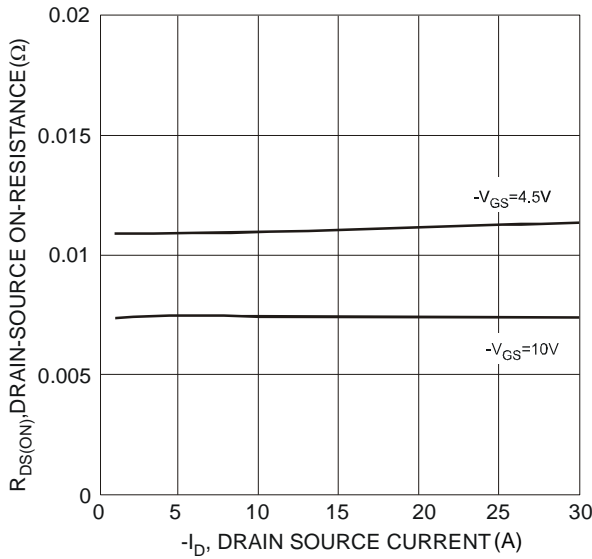


Fig. 3 Typical On-Resistance vs. Drain Current and Gate Voltage

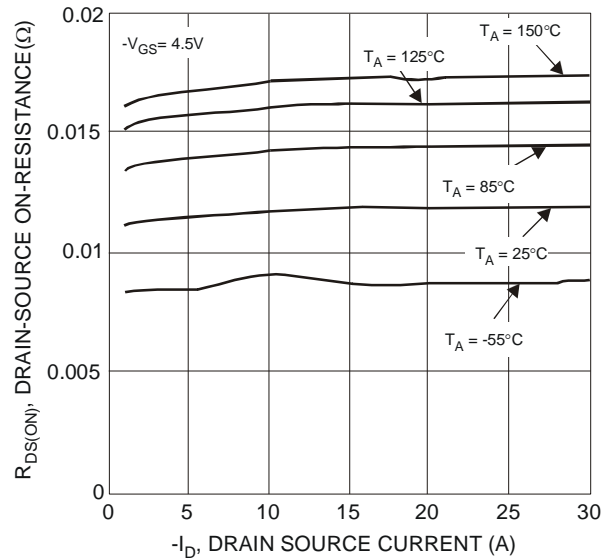


Fig. 4 Typical On-Resistance vs. Drain Current and Temperature

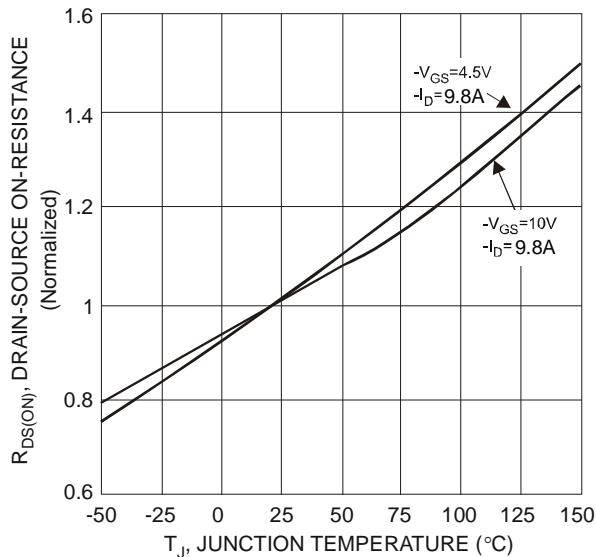


Fig. 5 On-Resistance Variation with Temperature

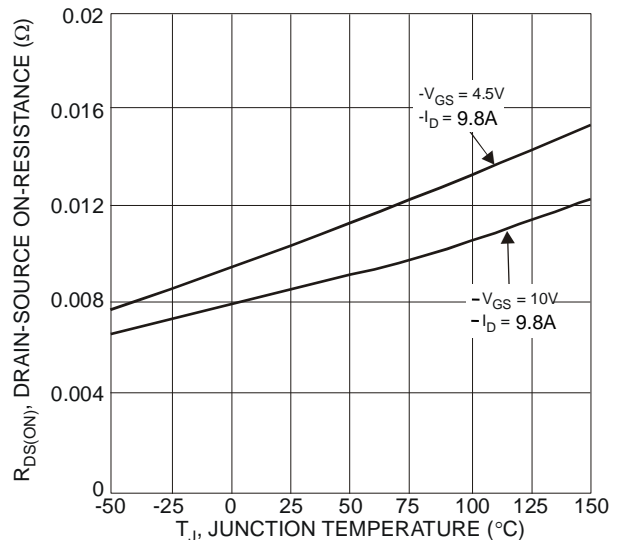


Fig. 6 On-Resistance Variation with Temperature

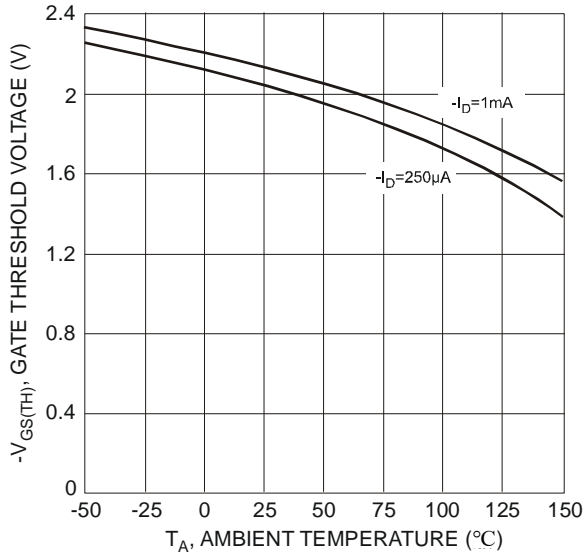


Fig. 7 Gate Threshold Variation vs. Ambient Temperature

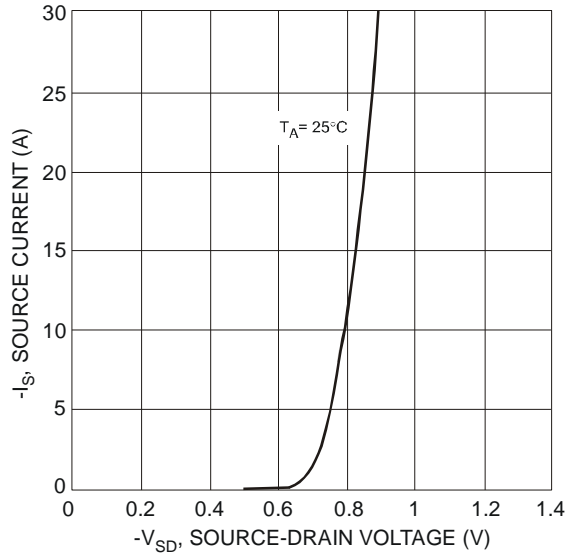


Fig. 8 Diode Forward Voltage vs. Current

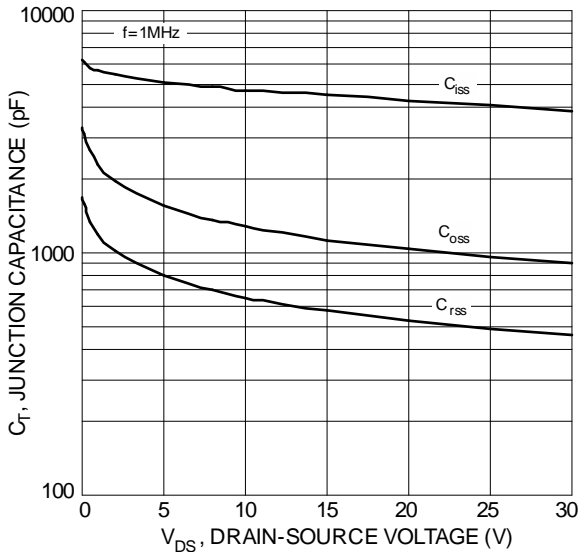


Fig. 9 Typical Junction Capacitance

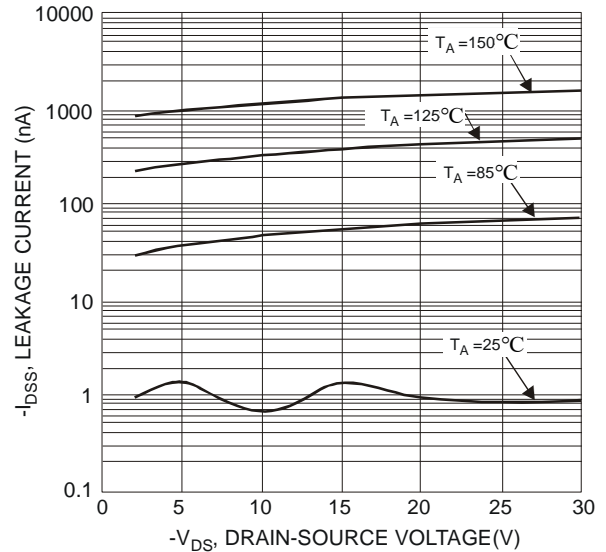


Fig. 10 Typical Drain-Source Leakage Current vs. Voltage

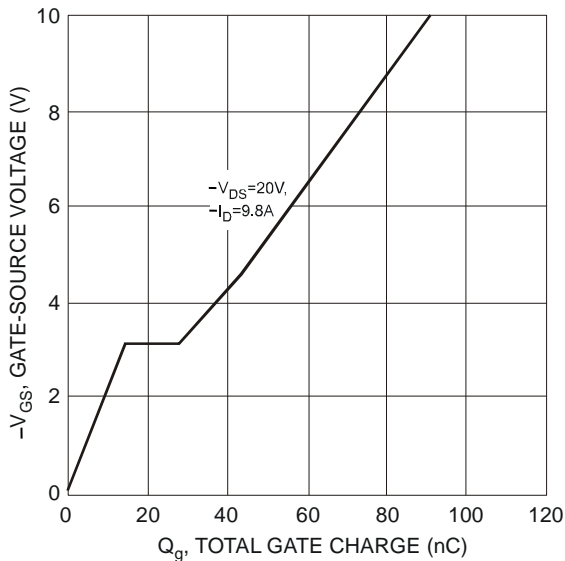


Fig. 11 Gate-Charge Characteristics

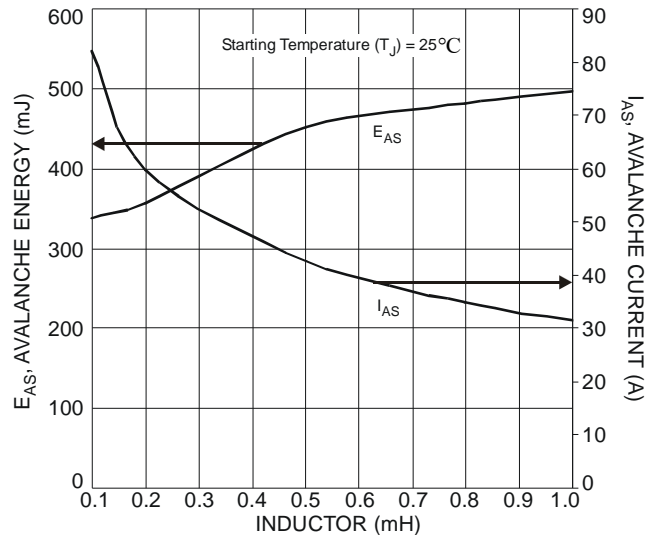


Fig. 12 Single-Pulse Avalanche Tested

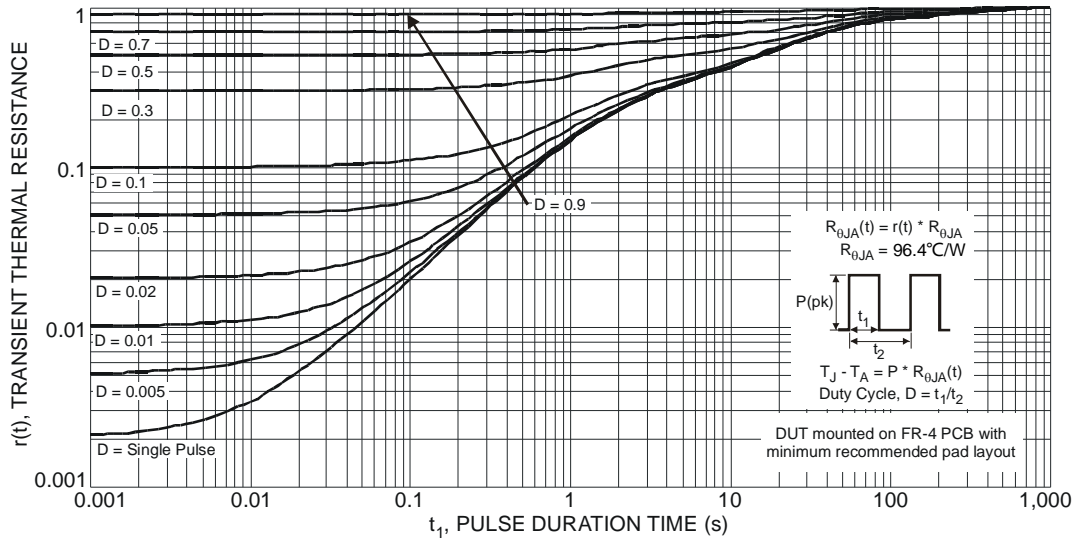
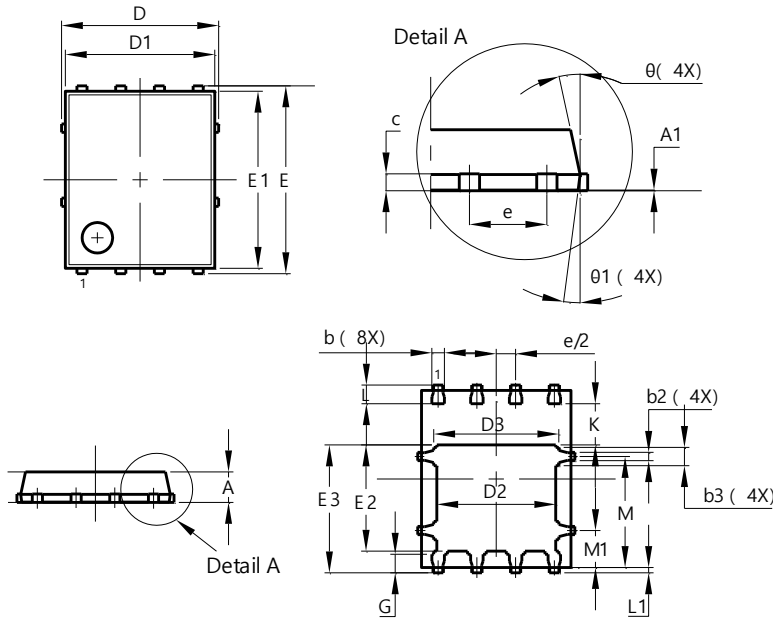


Fig. 13 Transient Thermal Response

**Package Outline Dimensions**

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

**PowerDI5060-8**

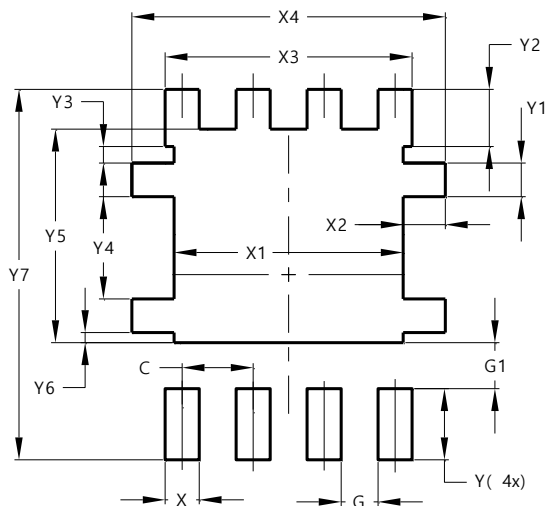


| PowerDI5060-8        |          |       |       |
|----------------------|----------|-------|-------|
| Dim                  | Min      | Max   | Typ   |
| A                    | 0.90     | 1.10  | 1.00  |
| A1                   | 0.00     | 0.05  | —     |
| b                    | 0.33     | 0.51  | 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                    | 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**



| 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         |

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