

Product Summary

| $V_{(BR)DSS}$ | $R_{DS(ON)}$ Max | I_D $T_A = +25^\circ C$ |
|---------------|---------------------------------|------------------------------|
| -40V | 11m Ω @ $V_{GS} = -10V$ | -17.0A |
| | 15m Ω @ $V_{GS} = -4.5V$ | -14.5A |

Description

This new generation MOSFET is designed to minimize the on-state resistance ($R_{DS(ON)}$) yet maintain superior switching performance, making it ideal for high-efficiency power management applications.

Applications

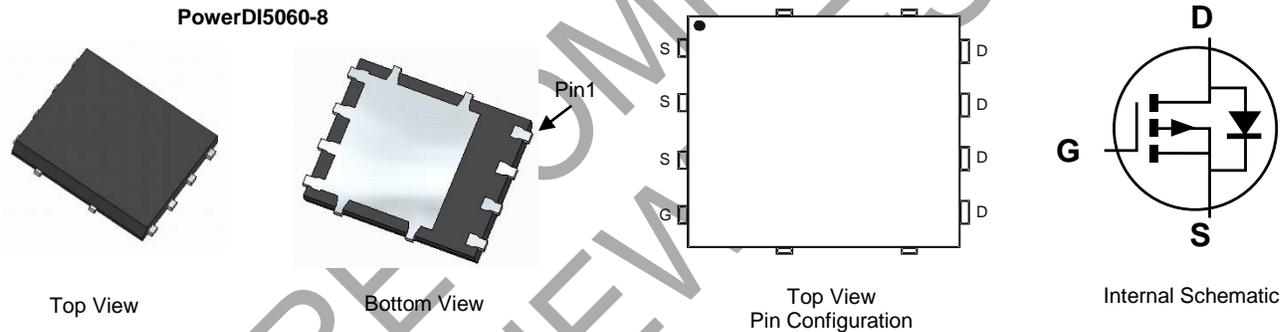
- DC-DC Converters
- Power Management Functions
- Analog Switch

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)**
- **Qualified to AEC-Q101 Standards for High Reliability**
- **PPAP Capable (Note 4)**

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—100% Matte Tin Annealed over Copper Leadframe. Solderable per MIL-STD-202, Method 208
- Weight: 0.097 grams (Approximate)

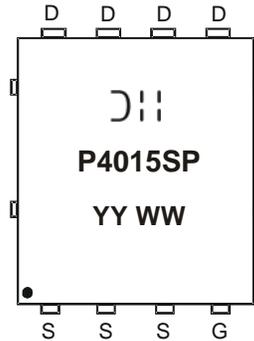


Ordering Information (Note 5)

| Part Number | Compliance | Case | Packaging |
|----------------|------------|---------------|-------------------|
| DMP4015SPSQ-13 | Automotive | 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. Automotive products are AEC-Q101 qualified and are PPAP capable. Refer to <https://www.diodes.com/quality/>.
 5. For packaging details, go to our website at <http://www.diodes.com/products/packages.html>.

Marking Information



⤵ = Manufacturer's Marking
 P4015SP = Product Type Marking Code
 YYWW = Date Code Marking
 YY = Year (ex: 18 = 2018)
 WW = Week (01 - 53)

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

| Characteristic | | | Symbol | Value | Units |
|--|--------------|--|------------------|----------------|-------|
| Drain-Source Voltage | | | V _{DSS} | -40 | V |
| Gate-Source Voltage | | | V _{GSS} | ±25 | V |
| Continuous Drain Current (Note 6) V _{GS} = -10V | Steady State | T _A = +25°C T _A = +70°C | I _D | -8.5 -6.8 | A |
| | t < 10s | T _A = +25°C T _A = +70°C | I _D | -13.0 -10.5 | A |
| Continuous Drain Current (Note 7) V _{GS} = -10V | Steady State | T _A = +25°C T _A = +70°C | I _D | -11.0 -8.7 | A |
| | t < 10s | T _A = +25°C T _A = +70°C | I _D | -17.0 -13.5 | A |
| Pulsed Drain Current (10µs Pulse, Duty Cycle = 1%) | | | I _{DM} | -100 | A |
| Maximum Body Diode Continuous Current (Note 7) | | | I _S | -3.5 | A |
| Avalanche Current (Note 8) | | | I _{AS} | -22 | A |
| Avalanche Energy (Note 8) | | | E _{AS} | 242 | mJ |

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

| Characteristic | | Symbol | Value | Units |
|--|------------------------|-----------------------------------|-------------|-------|
| Total Power Dissipation (Note 6) | T _A = +25°C | P _D | 1.3 | W |
| | T _A = +70°C | | 0.8 | |
| Thermal Resistance, Junction to Ambient (Note 6) | Steady State | R _{θJA} | 96.4 | °C/W |
| | t < 10s | | 40.6 | °C/W |
| Total Power Dissipation (Note 7) | T _A = +25°C | P _D | 2.1 | W |
| | T _A = +70°C | | 1.4 | |
| Thermal Resistance, Junction to Ambient (Note 7) | Steady State | R _{θJA} | 55.0 | °C/W |
| | t < 10s | | 24.0 | °C/W |
| Thermal Resistance, Junction to Case (Note 7) | | R _{θJC} | 4.15 | °C/W |
| Operating and Storage Temperature Range | | T _J , T _{STG} | -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.
 - UIS in production with L = 0.1mH, T_J = +25°C.

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

| Characteristic | Symbol | Min | Typ | Max | Unit | Test Condition |
|--|---------------------|------|-------|------|------|--|
| OFF CHARACTERISTICS (Note 9) | | | | | | |
| Drain-Source Breakdown Voltage | BV _{DSS} | -40 | — | — | V | V _{GS} = 0V, I _D = -250μA |
| Zero Gate Voltage Drain Current | I _{DSS} | — | — | -1 | μA | V _{DS} = -40V, V _{GS} = 0V |
| Gate-Source Leakage | I _{GSS} | — | — | ±100 | nA | V _{GS} = ±25V, V _{DS} = 0V |
| ON CHARACTERISTICS (Note 9) | | | | | | |
| Gate Threshold Voltage | V _{GS(th)} | -1.5 | -2 | -2.5 | V | V _{DS} = V _{GS} , I _D = -250μA |
| Static Drain-Source On-Resistance | R _{DS(ON)} | — | 7 | 11 | mΩ | V _{GS} = -10V, I _D = -9.8A |
| | | — | 9 | 15 | | V _{GS} = -4.5V, I _D = -9.8A |
| Forward Transfer Admittance | Y _{fs} | — | 26 | — | S | V _{DS} = -20V, I _D = -9.8A |
| Diode Forward Voltage | V _{SD} | — | -0.7 | -1 | V | V _{GS} = 0V, I _S = -1A |
| DYNAMIC CHARACTERISTICS (Note 10) | | | | | | |
| Input Capacitance | C _{ISS} | — | 4,234 | — | pF | V _{DS} = -20V, V _{GS} = 0V f = 1MHz |
| Output Capacitance | C _{OSS} | — | 1,036 | — | | |
| Reverse Transfer Capacitance | C _{RSS} | — | 526 | — | | |
| Gate Resistance | R _G | — | 7.77 | — | Ω | V _{DS} = 0V, V _{GS} = 0V, f = 1MHz |
| Total Gate Charge | Q _g | — | 47.5 | — | nC | V _{DS} = -20V, V _{GS} = -5V I _D = -9.8A |
| Gate-Source Charge | Q _{gs} | — | 14.2 | — | | |
| Gate-Drain Charge | Q _{gd} | — | 13.5 | — | | |
| Turn-On Delay Time | t _{D(on)} | — | 13.2 | — | ns | V _{GS} = -10V, V _{DD} = -20V, R _G = 6Ω, I _D = -1A, R _L = 20Ω |
| Turn-On Rise Time | t _r | — | 10 | — | | |
| Turn-Off Delay Time | t _{D(off)} | — | 302.7 | — | | |
| Turn-Off Fall Time | t _f | — | 137.9 | — | | |

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

NOT RECOMMENDED FOR NEW DESIGN

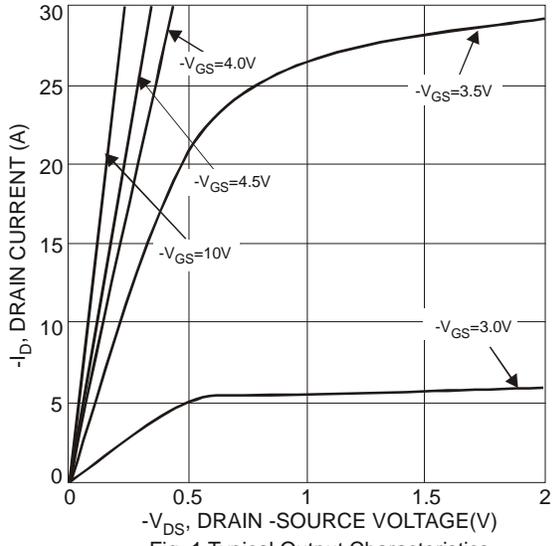


Fig. 1 Typical Output Characteristics

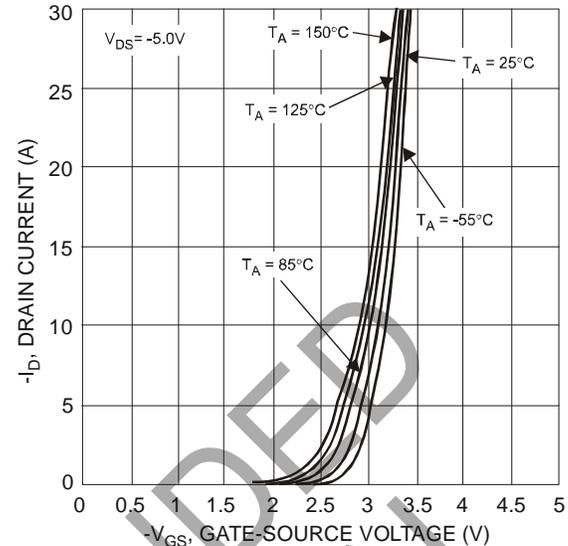


Fig. 2 Typical Transfer Characteristics

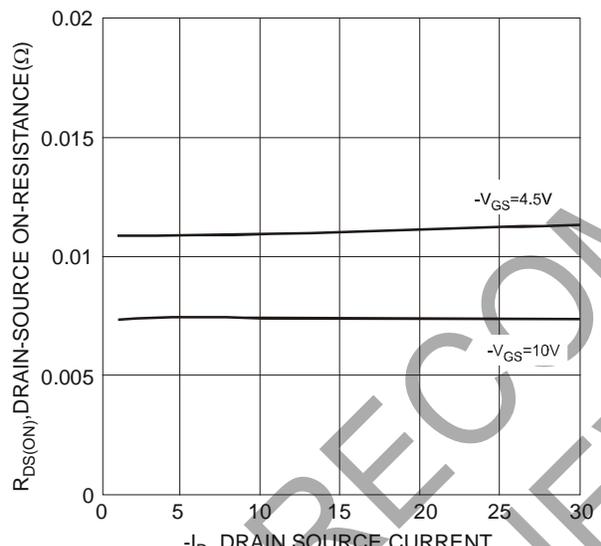


Fig. 3 Typical On-Resistance vs. Drain Current and Gate Voltage

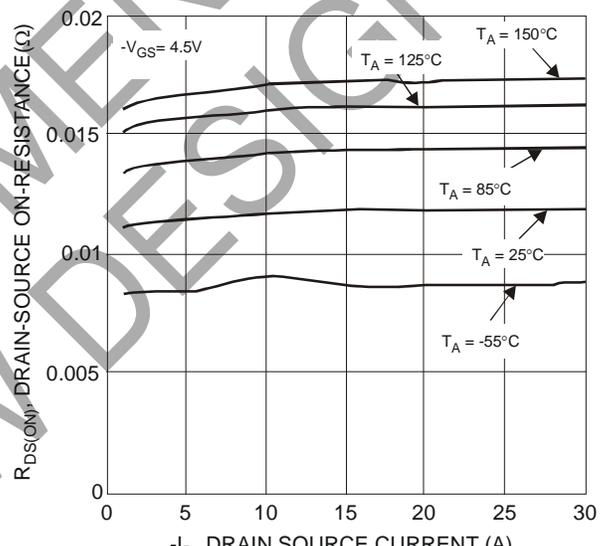


Fig. 4 Typical On-Resistance vs. Drain Current and Temperature

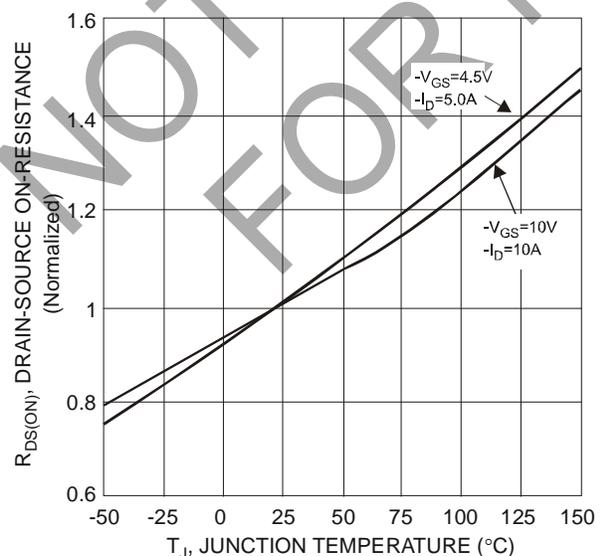


Fig. 5 On-Resistance Variation with Temperature

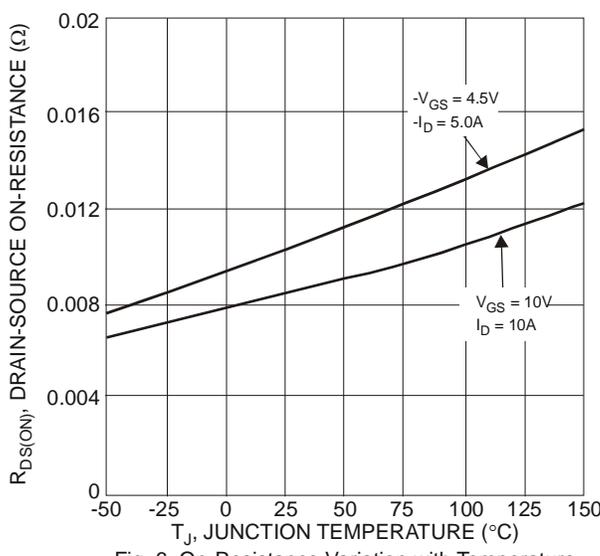


Fig. 6 On-Resistance Variation with Temperature

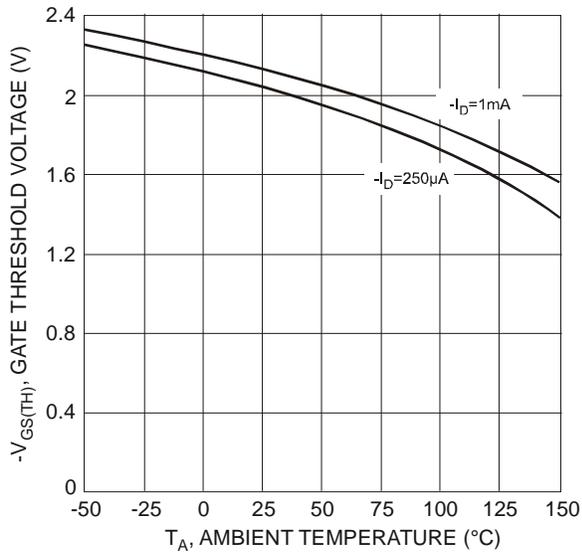


Fig. 7 Gate Threshold Variation vs. Ambient Temperature

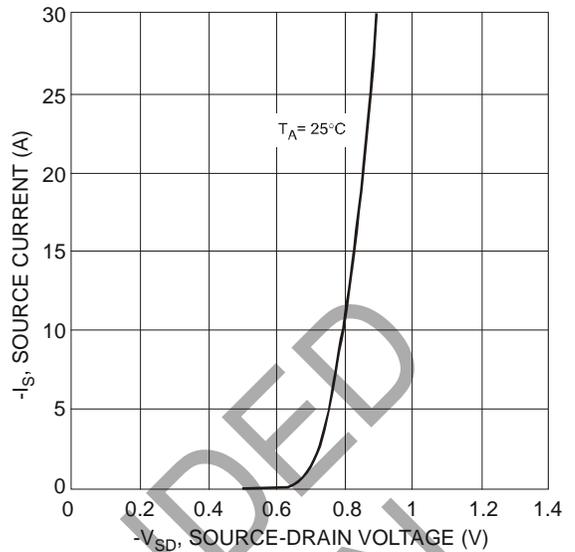


Fig. 8 Diode Forward Voltage vs. Current

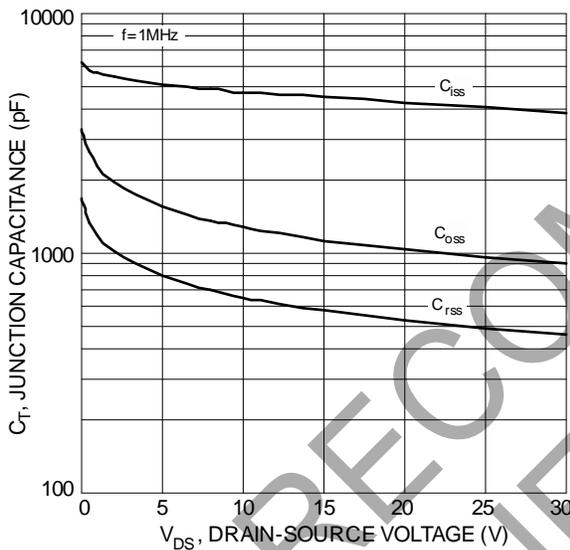


Fig. 9 Typical Junction Capacitance

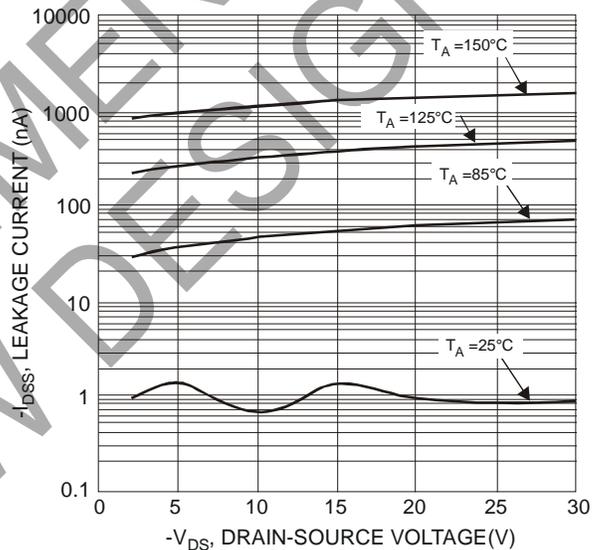


Fig. 10 Typical Drain-Source Leakage Current vs. Voltage

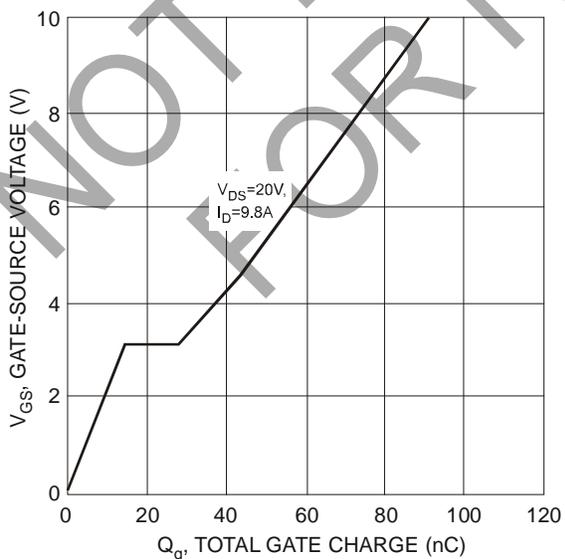


Fig. 11 Gate-Charge Characteristics

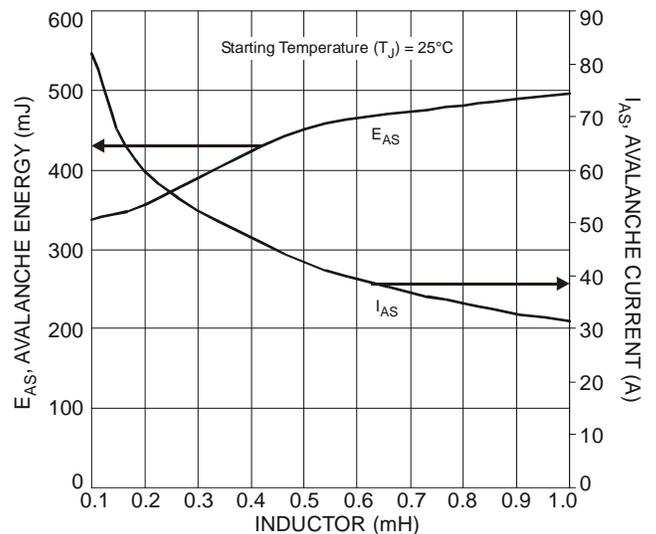


Fig. 12 Single-Pulse Avalanche Tested

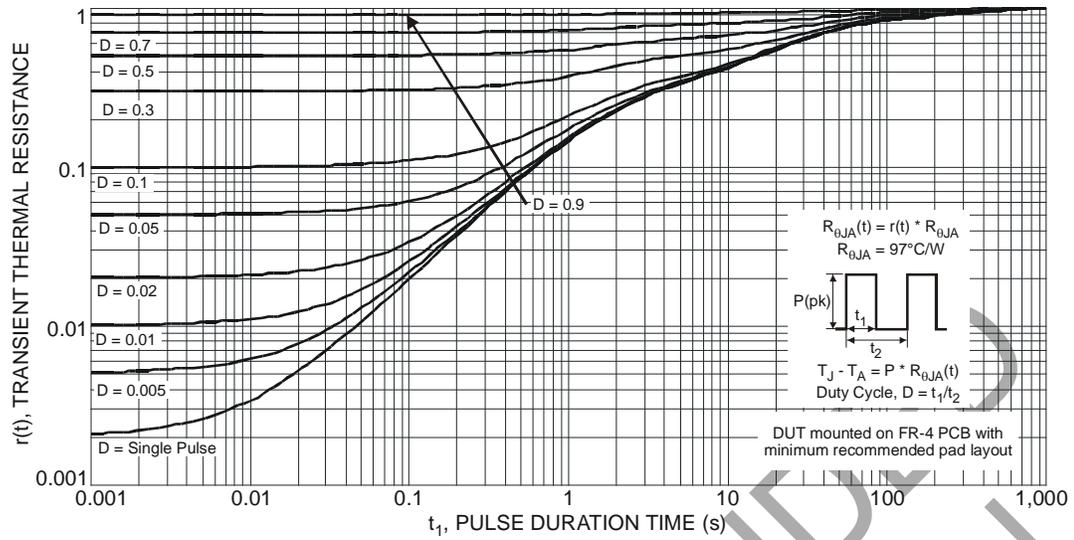


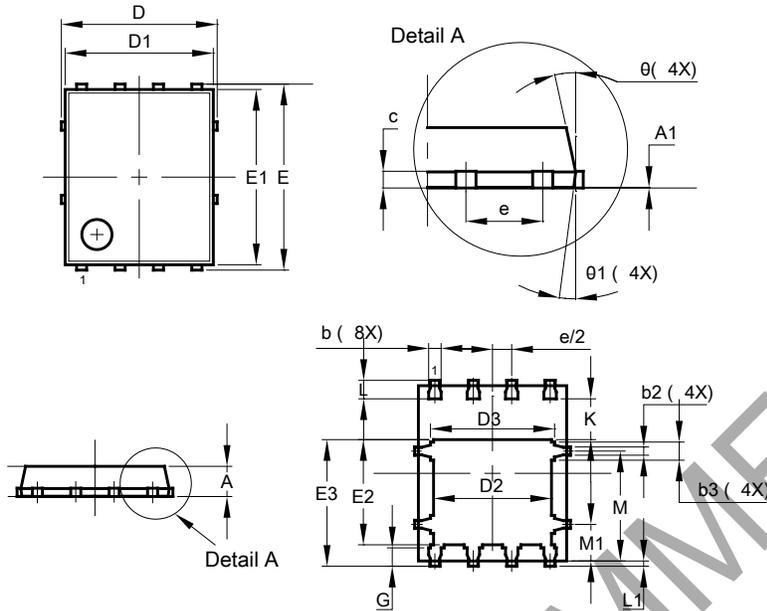
Fig. 13 Transient Thermal Response

NOT RECOMMENDED FOR NEW DESIGN

Package Outline Dimensions

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

PowerDI5060-8

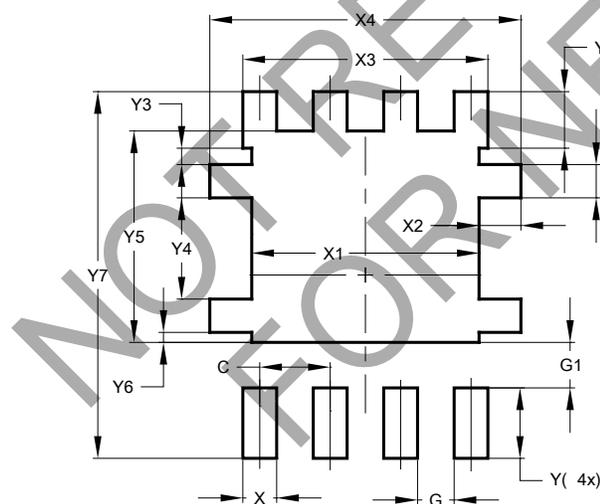


| PowerDI5060-8 | | | |
|----------------------|----------|-------|-------|
| Dim | Min | Max | Typ |
| A | 0.90 | 1.10 | 1.00 |
| A1 | 0.00 | 0.05 | — |
| b | 0.33 | 0.51 | 0.41 |
| b2 | 0.200 | 0.350 | 0.273 |
| b3 | 0.40 | 0.80 | 0.60 |
| c | 0.230 | 0.330 | 0.277 |
| D | 5.15 BSC | | |
| D1 | 4.70 | 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° |
| $\theta1$ | 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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