

Product Summary

| BV _{DSS} | R _{DS(ON)} Max | I _D T _c = +25°C |
|-------------------|--------------------------------|--|
| -40V | 10mΩ @ V _{GS} = -10V | -90.7A |
| | 14mΩ @ V _{GS} = -4.5V | -79.8A |

Features and Benefits

- Rated to +175°C – Ideal for High Ambient Temperature Environments
- 100% Unclamped Inductive Switch (UIS) Test in Production
- Low On-Resistance
- Fast Switching Speed
- Wettable Flank for Improved Optical Inspections
- **Lead-Free Finish; RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. “Green” Device (Note 3)**
- **For automotive applications requiring specific change control (i.e. parts qualified to AEC-Q100/101/104/200, PPAP capable, and manufactured in IATF 16949 certified facilities), please [contact us](mailto:contact@diodes.com) or your local Diodes representative. <https://www.diodes.com/quality/product-definitions/>**

Description and Applications

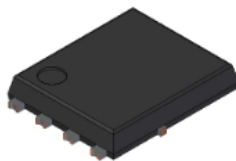
This new generation MOSFET has been designed to minimize the on-state resistance (R_{DS(ON)}) yet maintain superior switching performance, making it ideal for high-efficiency power-management applications.

- DC-DC converters
- Power-management functions
- Analog switches

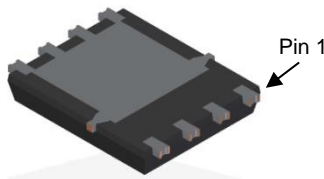
Mechanical Data

- Package: PowerDI[®]5060-8
- Package 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)

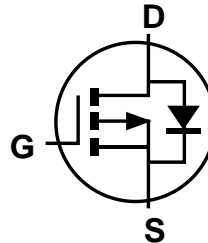
PowerDI5060-8/SWP (Type UX)



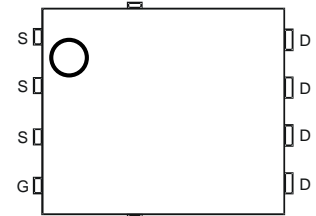
Top View



Bottom View



Internal Schematic



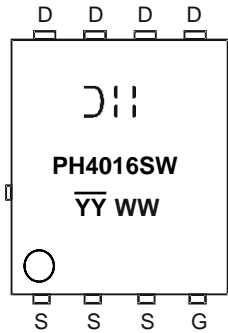
Top View
Pin Configuration

Ordering Information (Note 4)

| Part Number | Package | Packing | |
|-----------------|-----------------------------|---------|-------------|
| | | Qty. | Carrier |
| DMPH4016SPSW-13 | PowerDI5060-8/SWP (Type UX) | 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



☺|| = Manufacturer's Marking
 PH4016SW = Product Type Marking Code
 YYWW = Date Code Marking
 YY = Year (ex: 23 = 2023)
 WW = Week (01 to 53)

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 5) V _{GS} = -10V | Steady State | T _C = +25°C T _C = +100°C | I _D | -90.7 -64.3 | A |
| Pulsed Drain Current (10µs Pulse, Duty Cycle = 1%) | | | I _{DM} | -363 | A |
| Maximum Body Diode Continuous Current (Note 5) | | | I _S | -90.7 | A |
| Pulsed Source Current (10µs Pulse, Duty Cycle = 1%) | | | I _{SM} | -363 | A |
| Avalanche Current L = 1mH | | | I _{AS} | -28.9 | A |
| Avalanche Energy L = 1mH | | | E _{AS} | 418.6 | mJ |

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

| Characteristic | | Symbol | Value | Unit |
|--|------------------------|-----------------------------------|-------------|------|
| Total Power Dissipation (Note 6) | T _A = +25°C | P _D | 4.6 | W |
| Thermal Resistance, Junction to Ambient (Note 6) | Steady State | R _{θJA} | 32 | °C/W |
| Total Power Dissipation (Note 5) | T _C = +25°C | P _D | 143 | W |
| Thermal Resistance, Junction to Case (Note 5) | | R _{θJC} | 1.05 | °C/W |
| Operating and Storage Temperature Range | | T _J , T _{STG} | -55 to +175 | °C |

Notes: 5. Thermal resistance from junction to soldering point (on the exposed drain pad).
 6. Device mounted on FR-4 substrate PC board, 2oz copper, with thermal bias to bottom layer 1inch square copper plate.

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 = -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} = ±20V, V _{DS} = 0V |
| ON CHARACTERISTICS (Note 7) | | | | | | |
| Gate Threshold Voltage | V _{GS(TH)} | -1.5 | — | -2.5 | V | V _{DS} = V _{GS} , I _D = -250μA |
| Static Drain-Source On-Resistance | R _{DS(ON)} | — | 5.4 | 10 | mΩ | V _{GS} = -10V, I _D = -9.8A |
| | | — | 8.0 | 14 | | V _{GS} = -4.5V, I _D = -9.8A |
| Diode Forward Voltage | V _{SD} | — | -0.67 | -1 | V | V _{GS} = 0V, I _S = -1A |
| DYNAMIC CHARACTERISTICS (Note 8) | | | | | | |
| Input Capacitance | C _{iss} | — | 5697 | — | pF | V _{DS} = -20V, V _{GS} = 0V f = 1MHz |
| Output Capacitance | C _{oss} | — | 534 | — | | |
| Reverse Transfer Capacitance | C _{rss} | — | 408 | — | | |
| Gate Resistance | R _g | — | 7 | — | Ω | V _{DS} = 0V, V _{GS} = 0V, f = 1MHz |
| Total Gate Charge (V _{GS} = -4.5V) | Q _g | — | 53 | — | nC | V _{DS} = -20V, I _D = -9.8A |
| Total Gate Charge (V _{GS} = -10V) | Q _g | — | 112 | — | | |
| Gate-Source Charge | Q _{gs} | — | 20 | — | | |
| Gate-Drain Charge | Q _{gd} | — | 18 | — | | |
| Turn-On Delay Time | t _{D(ON)} | — | 11.5 | — | ns | V _{GS} = -10V, V _{DD} = -20V R _g = 2Ω, I _D = -9.8A |
| Turn-On Rise Time | t _R | — | 41 | — | | |
| Turn-Off Delay Time | t _{D(OFF)} | — | 146 | — | | |
| Turn-Off Fall Time | t _F | — | 165 | — | | |
| Reverse Recovery Time | t _{RR} | — | 27 | — | ns | I _F = -9.8A, dI/dt = -100A/μs |
| Reverse Recovery Charge | Q _{RR} | — | 22 | — | nC | I _F = -9.8A, dI/dt = -100A/μs |

Notes: 7. Short duration pulse test used to minimize self-heating effect.
8. Guaranteed by design. Not subject to product testing.

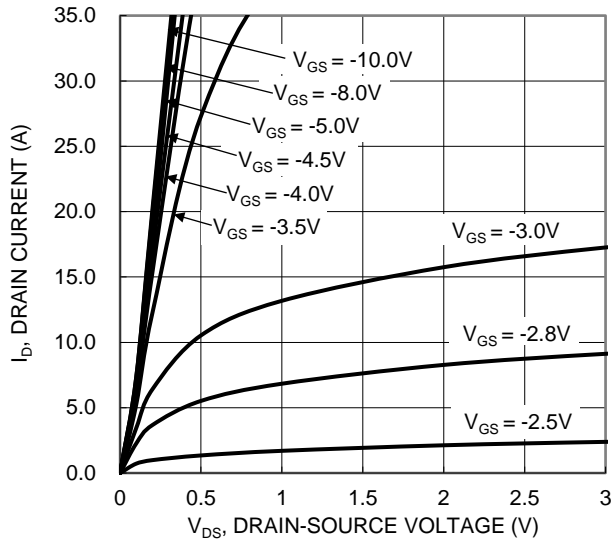


Figure 1. Typical Output Characteristic

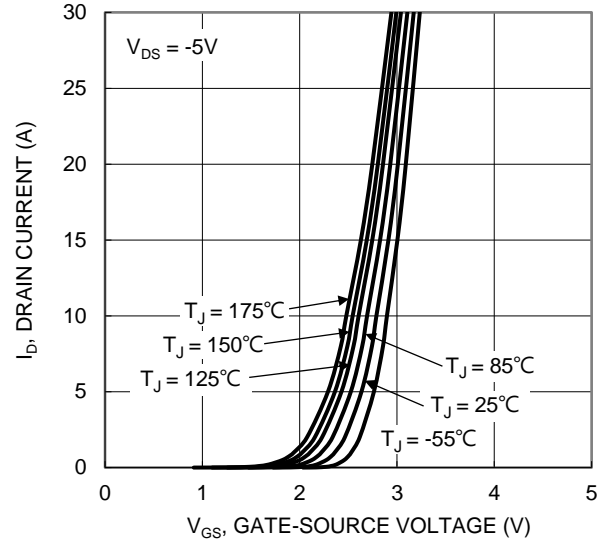


Figure 2. Typical Transfer Characteristic

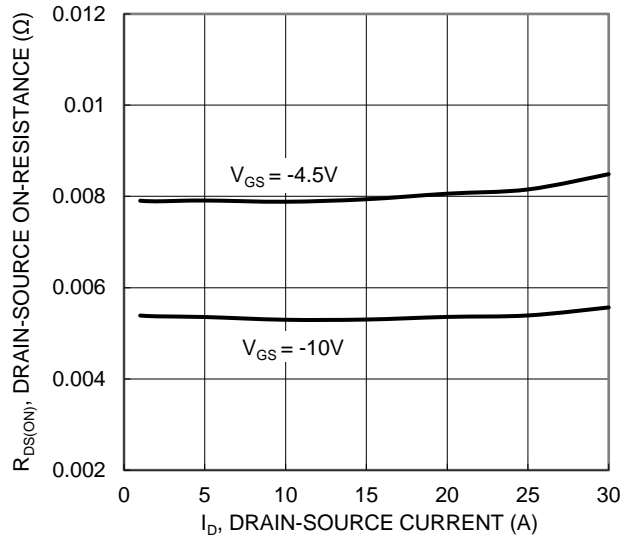


Figure 3. Typical On-Resistance vs. Drain Current and Gate Voltage

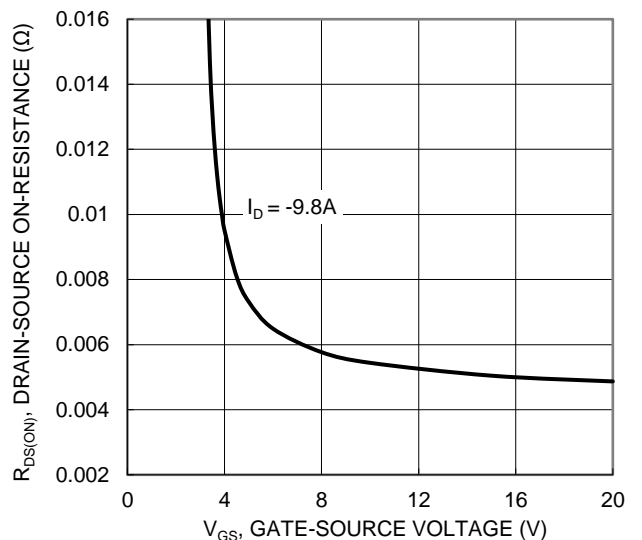


Figure 4. Typical Transfer Characteristic

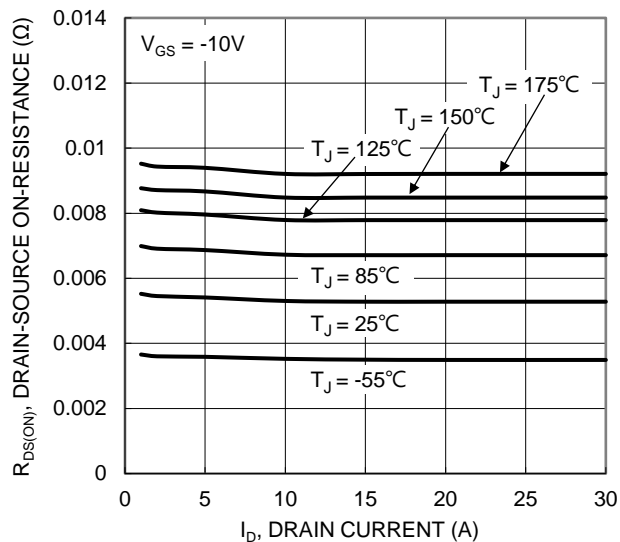


Figure 5. Typical On-Resistance vs. Drain Current and Junction Temperature

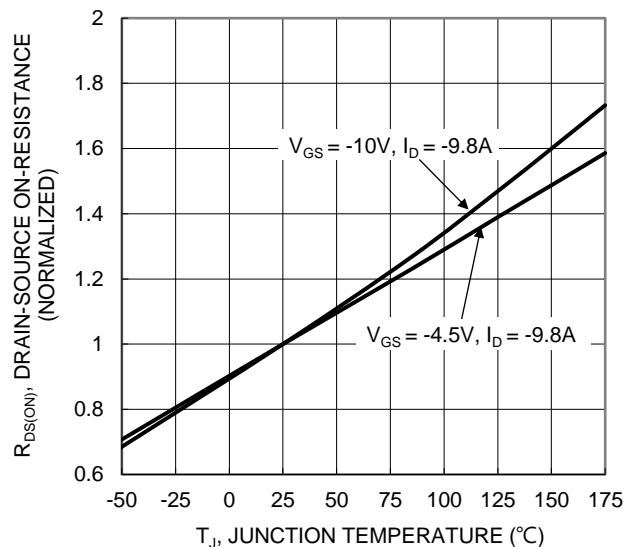


Figure 6. On-Resistance Variation with Junction Temperature

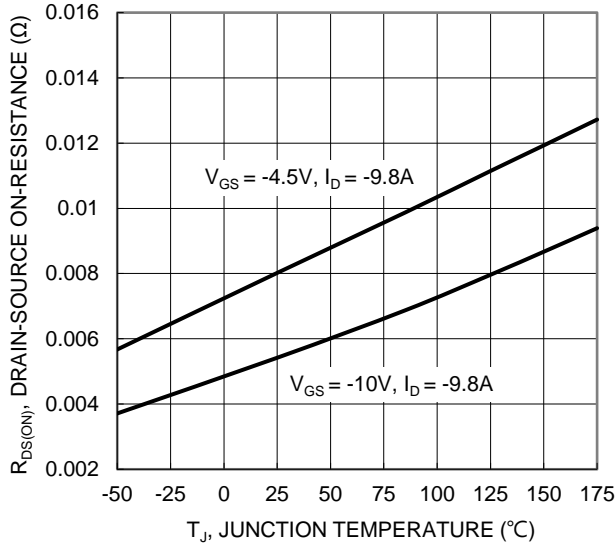


Figure 7. On-Resistance Variation with Junction Temperature

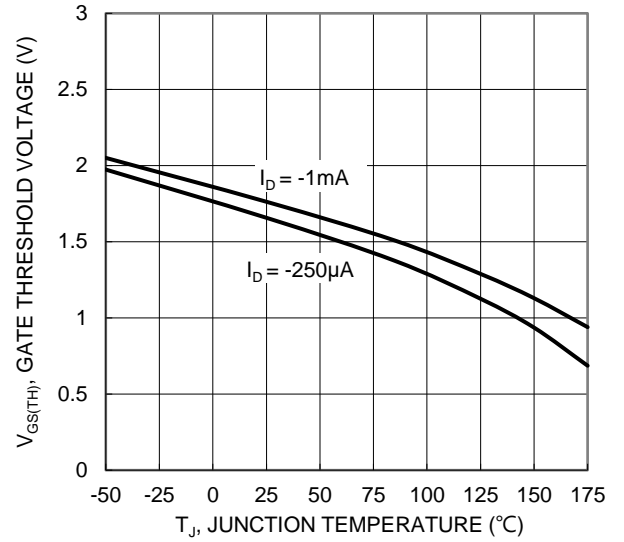


Figure 8. Gate Threshold Variation vs. Junction Temperature

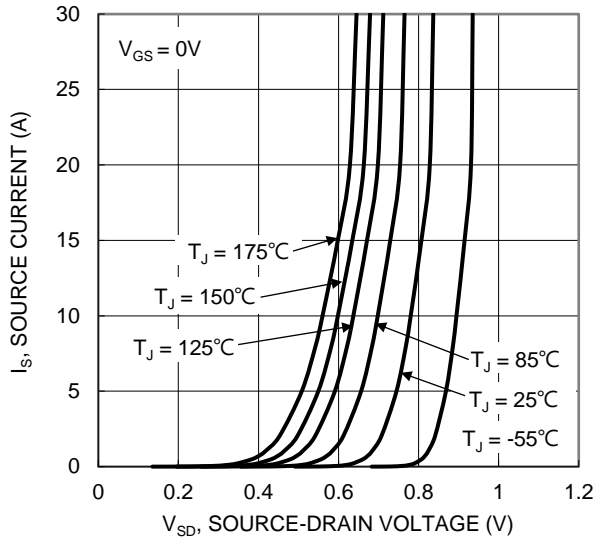


Figure 9. Diode Forward Voltage vs. Current

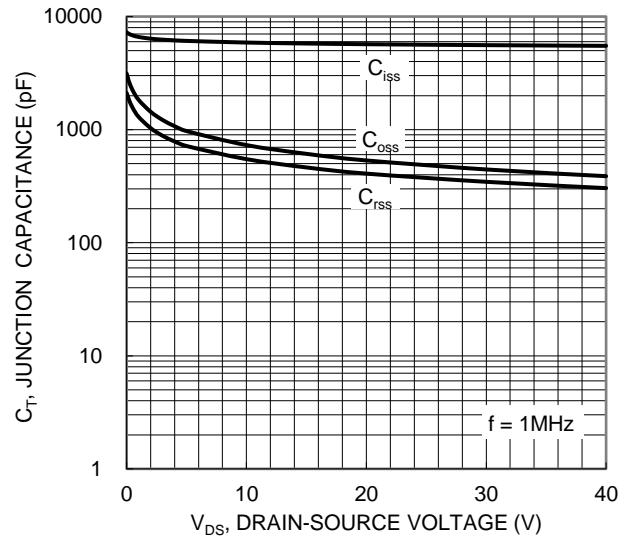


Figure 10. Typical Junction Capacitance

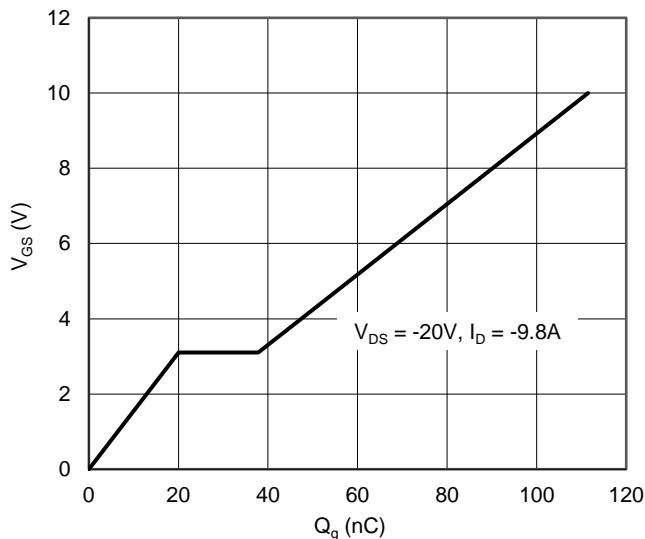


Figure 11. Gate Charge

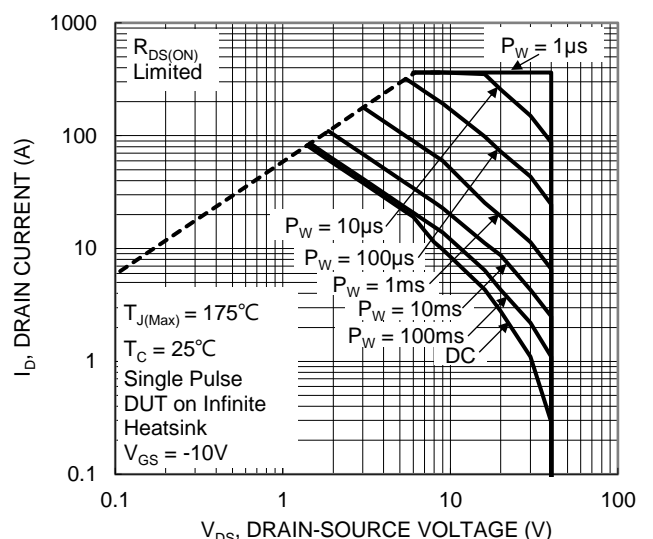


Figure 12. SOA, Safe Operation Area

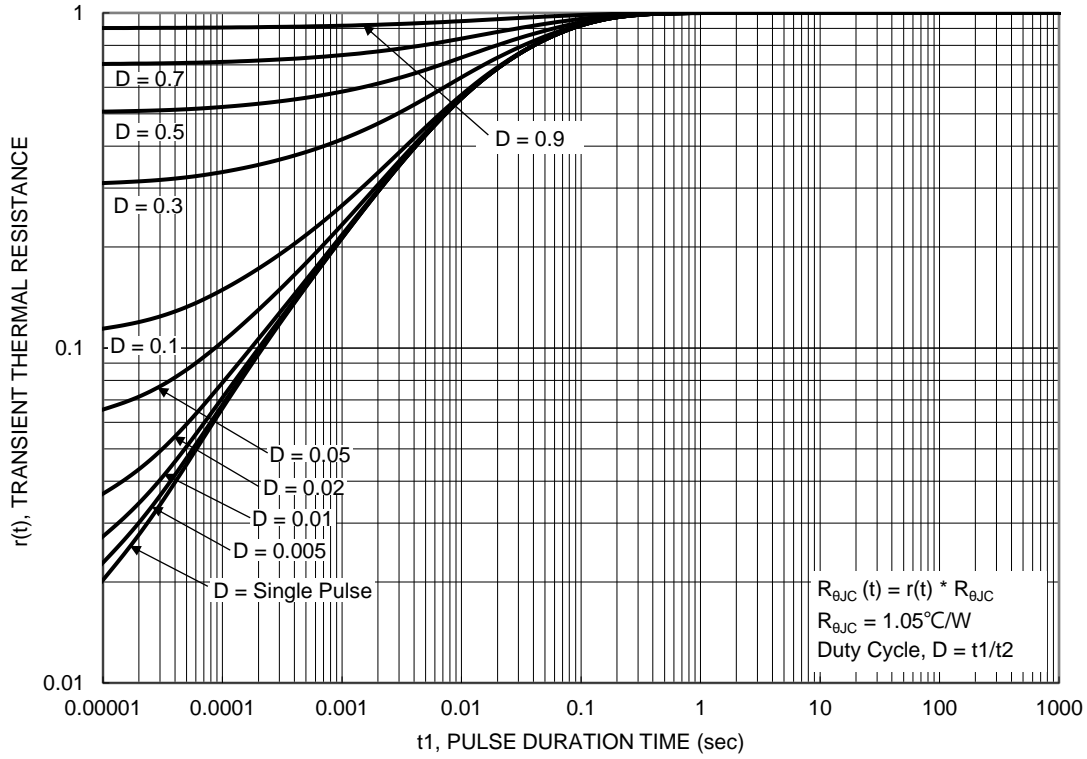
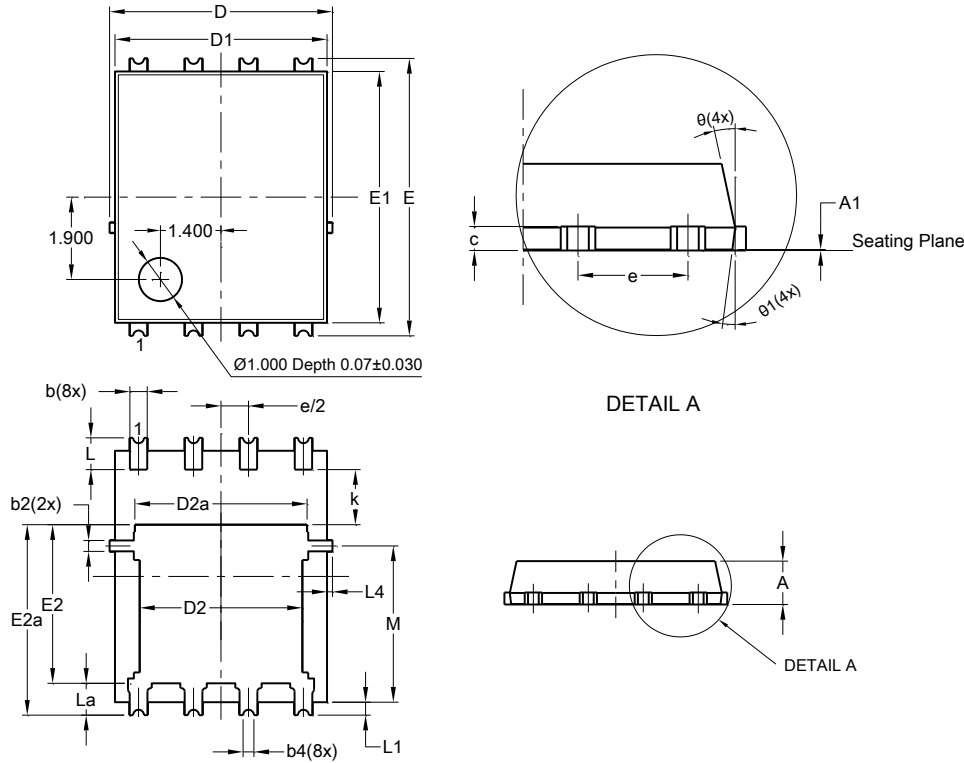


Figure 13. Transient Thermal Resistance

Package Outline Dimensions

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

PowerDI5060-8/SWP (Type UX)

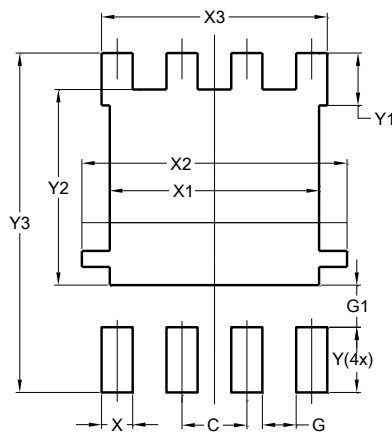


| PowerDI5060-8/SWP (Type UX) | | | |
|--------------------------------|----------|-------|-------|
| Dim | Min | Max | Typ |
| A | 0.90 | 1.10 | 1.00 |
| A1 | 0 | 0.05 | -- |
| b | 0.30 | 0.50 | 0.41 |
| b2 | 0.20 | 0.35 | 0.25 |
| b4 | 0.25REF | | |
| c | 0.230 | 0.330 | 0.277 |
| D | 5.15 BSC | | |
| D1 | 4.70 | 5.10 | 4.90 |
| D2 | 3.56 | 3.96 | 3.76 |
| D2a | 3.78 | 4.18 | 3.98 |
| E | 6.40 BSC | | |
| E1 | 5.60 | 6.00 | 5.80 |
| E2 | 3.46 | 3.86 | 3.66 |
| E2a | 4.195 | 4.595 | 4.395 |
| e | 1.27BSC | | |
| k | 1.05 | -- | -- |
| L | 0.635 | 0.835 | 0.735 |
| La | 0.635 | 0.835 | 0.735 |
| L1 | 0.200 | 0.400 | 0.300 |
| L1a | 0.050REF | | |
| L4 | 0.025 | 0.225 | 0.125 |
| M | 3.205 | 4.005 | 3.605 |
| 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/SWP (Type UX)



| Dimensions | Value (in mm) |
|------------|------------------|
| C | 1.270 |
| G | 0.660 |
| G1 | 0.820 |
| X | 0.610 |
| X1 | 4.100 |
| X2 | 5.190 |
| X3 | 4.420 |
| Y | 1.270 |
| Y1 | 1.020 |
| Y2 | 3.810 |
| Y3 | 6.610 |

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