

Product Summary

| BV _{DSS} | R _{DS(ON)} Max | I _D Max T _C = +25°C |
|-------------------|-------------------------------|--|
| 60V | 25mΩ @ V _{GS} = 10V | 32A |
| | 40mΩ @ V _{GS} = 4.5V | 25A |

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
- Wettable Flank for Improved Optical Inspection
- **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**
- **PPAP Capable (Note 4)**

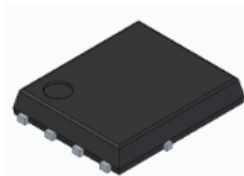
Description and Applications

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:

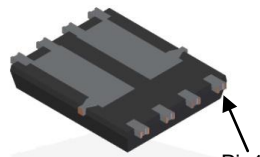
- Backlighting
- Power Management Functions
- DC-DC Converters

Mechanical Data

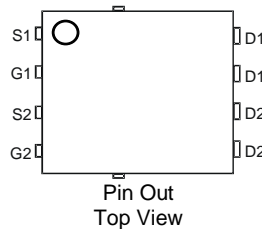
- Case: PowerDI[®] 5060-8
- Case Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 3 per J-STD-020
- Terminal Connections Indicator: See Diagram
- Terminals: Finish—Matte Tin Annealed over Copper Leadframe. Solderable per MIL-STD-202, Method 208 ③
- Weight: 0.097 grams (Approximate)



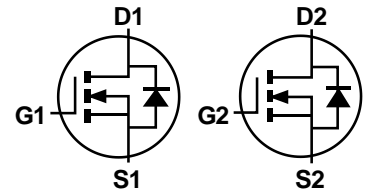
Top View



Bottom View



Pin Out
Top View



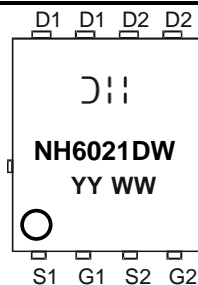
Equivalent Circuit

Ordering Information (Note 5)

| Part Number | Case | Packaging |
|------------------|------------------------------|------------------|
| DMNH6021SPDWQ-13 | PowerDI5060-8 (SWP) (Type R) | 2500/Tape & Reel |

- Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
 2. See http://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 <https://www.diodes.com/design/support/packaging/diodes-packaging/>.

Marking Information



⌋|| = Manufacturer's Marking
 NH6021DW = Product Type Marking Code
 YYWW = Date Code Marking
 YY = Year (ex: 19 = 2019)
 WW = Week (01 to 53)

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

| Characteristic | Symbol | Value | Unit |
|---|------------------|-------------------------|------|
| Drain-Source Voltage | V _{DSS} | 60 | V |
| Gate-Source Voltage | V _{GSS} | ±20 | V |
| Continuous Drain Current (Note 7) V _{GS} = 10V | I _D | T _A = +25°C | 8.2 |
| | | T _A = +70°C | 6.5 |
| Continuous Drain Current (Note 8) V _{GS} = 10V | I _D | T _C = +25°C | 32 |
| | | T _C = +100°C | 22 |
| Pulsed Drain Current (380µs Pulse, Duty Cycle = 1%) | I _{DM} | 80 | A |
| Maximum Continuous Body Diode Forward Current (Note 7) | I _S | 32 | A |
| Avalanche Current, L = 0.1mH (Note 9) | I _{AS} | 35 | A |
| Avalanche Energy, L = 0.1mH (Note 9) | E _{AS} | 64 | mJ |

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

| Characteristic | Symbol | Value | Unit |
|--|-----------------------------------|--------------|------|
| Total Power Dissipation (Note 6) | P _D | 1.5 | W |
| Thermal Resistance, Junction to Ambient (Note 6) | R _{θJA} | Steady State | 99 |
| | | t < 10s | 53 |
| Total Power Dissipation (Note 7) | P _D | 2.8 | W |
| Thermal Resistance, Junction to Ambient (Note 7) | R _{θJA} | Steady State | 54 |
| | | t < 10s | 27 |
| Thermal Resistance, Junction to Case (Note 8) | R _{θJC} | 2.2 | °C/W |
| 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 10) | | | | | | |
| Drain-Source Breakdown Voltage | BV _{DSS} | 60 | — | — | V | V _{GS} = 0V, I _D = 250µA |
| Zero Gate Voltage Drain Current T _J = +25°C | I _{DSS} | — | — | 1 | µA | V _{DS} = 60V, V _{GS} = 0V |
| Gate-Source Leakage | I _{GSS} | — | — | ±100 | nA | V _{GS} = ±20V, V _{DS} = 0V |
| ON CHARACTERISTICS (Note 10) | | | | | | |
| Gate Threshold Voltage | V _{GS(TH)} | 1 | — | 3 | V | V _{DS} = V _{GS} , I _D = 250µA |
| Static Drain-Source On-Resistance | R _{DS(ON)} | — | 15 | 25 | mΩ | V _{GS} = 10V, I _D = 15A |
| | | — | 21 | 40 | | V _{GS} = 4.5V, I _D = 12A |
| Diode Forward Voltage | V _{SD} | — | 0.75 | 1.2 | V | V _{GS} = 0V, I _S = 2.6A |
| DYNAMIC CHARACTERISTICS (Note 11) | | | | | | |
| Input Capacitance | C _{iss} | — | 1,143 | — | pF | V _{DS} = 25V, V _{GS} = 0V, f = 1MHz |
| Output Capacitance | C _{oss} | — | 168 | — | pF | |
| Reverse Transfer Capacitance | C _{riss} | — | 69 | — | pF | |
| Gate Resistance | R _g | — | 2.5 | — | Ω | V _{DS} = 0V, V _{GS} = 0V, f = 1MHz |
| Total Gate Charge (V _{GS} = 10V) | Q _g | — | 20.1 | — | nC | V _{DS} = 30V, I _D = 20A, |
| Total Gate Charge (V _{GS} = 6V) | Q _g | — | 12 | — | nC | |
| Gate-Source Charge | Q _{gs} | — | 4.3 | — | nC | |
| Gate-Drain Charge | Q _{gd} | — | 5.5 | — | nC | |
| Turn-On Delay Time | t _{D(ON)} | — | 4.4 | — | ns | V _{DD} = 30V, V _{GS} = 10V, R _g = 4.7Ω, I _D = 20A |
| Turn-On Rise Time | t _r | — | 6.0 | — | ns | |
| Turn-Off Delay Time | t _{D(OFF)} | — | 14.2 | — | ns | |
| Turn-Off Fall Time | t _f | — | 5.4 | — | ns | |
| Body Diode Reverse Recovery Time | t _{RR} | — | 21.2 | — | ns | I _f = 20A, di/dt = 100A/µs |
| Body Diode Reverse Recovery Charge | Q _{RR} | — | 15.2 | — | nC | |

- Notes:
- Device mounted on FR-4 PC board, with minimum recommended pad layout, single sided.
 - 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).
 - I_{AS} and E_{AS} ratings are based on low frequency and duty cycles to keep T_J = +25°C.
 - Short duration pulse test used to minimize self-heating effect.
 - Guaranteed by design. Not subject to product testing.

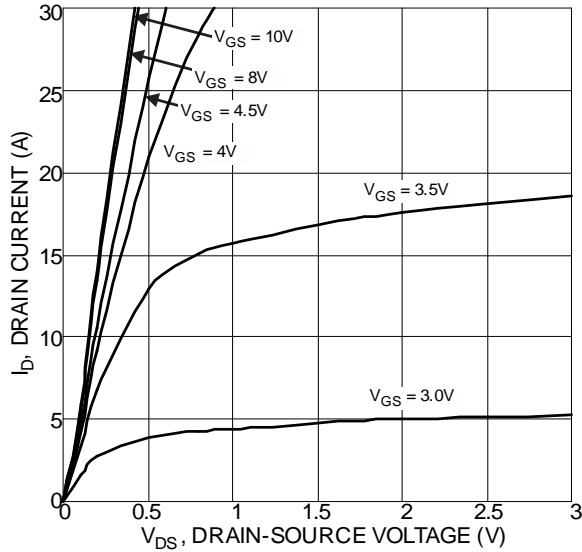


Figure 1 Typical Output Characteristic

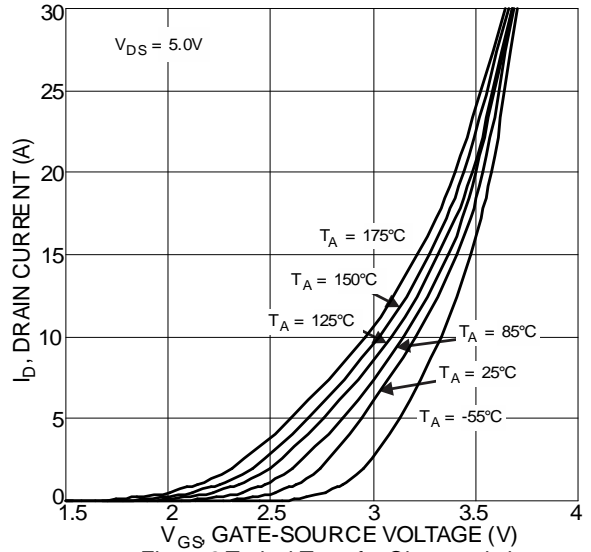


Figure 2 Typical Transfer Characteristics

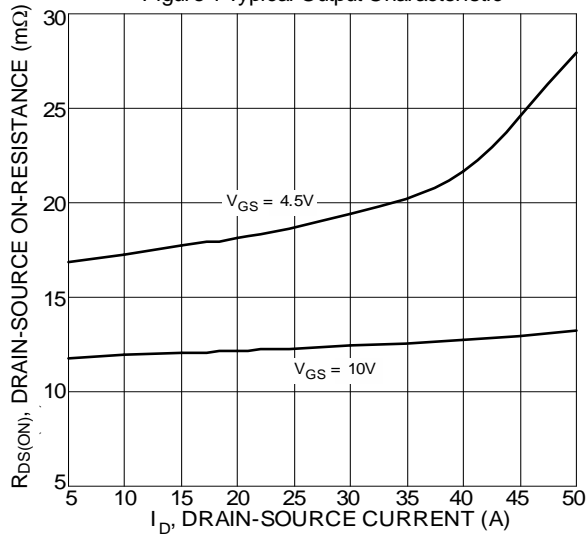


Figure 3 Typical On-Resistance vs. Drain Current and Gate Voltage

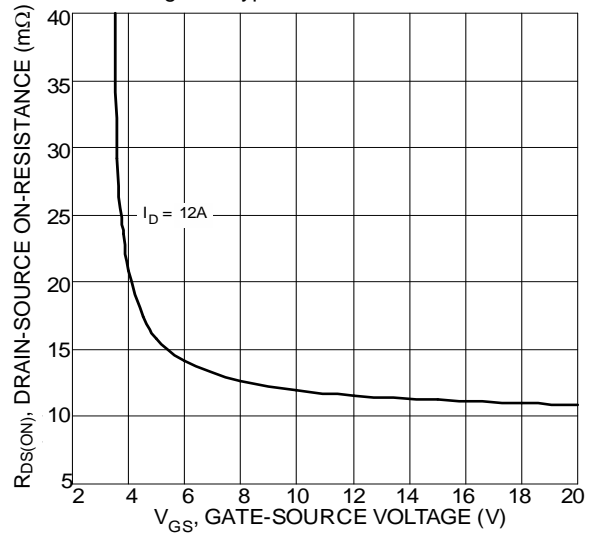


Figure 4 Typical Drain-Source On-Resistance vs. Gate-Source Voltage

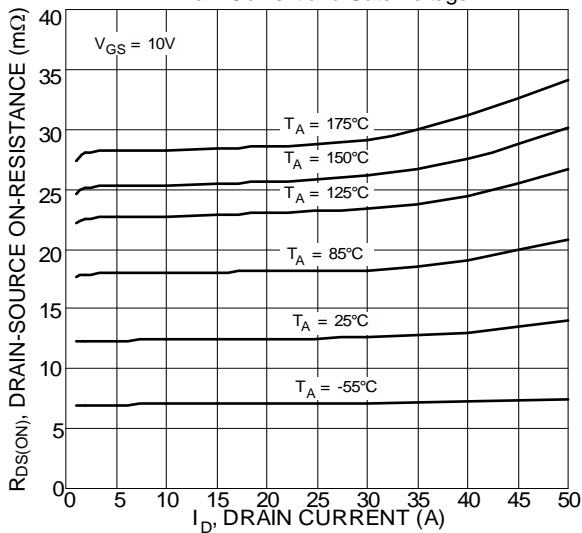


Figure 5 Typical On-Resistance vs. Drain Current and Temperature

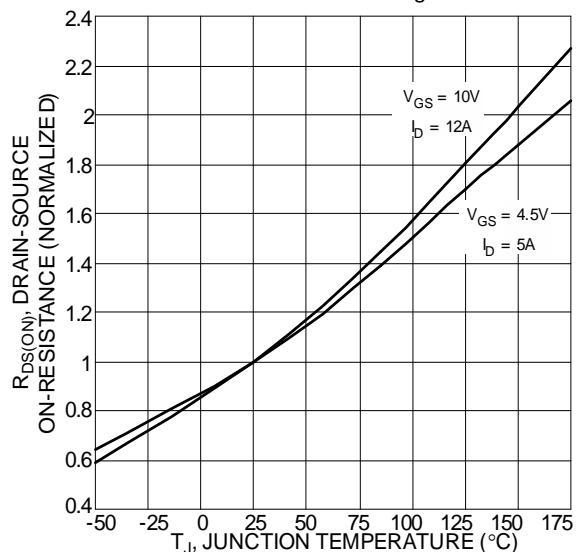


Figure 6 On-Resistance Variation with Temperature

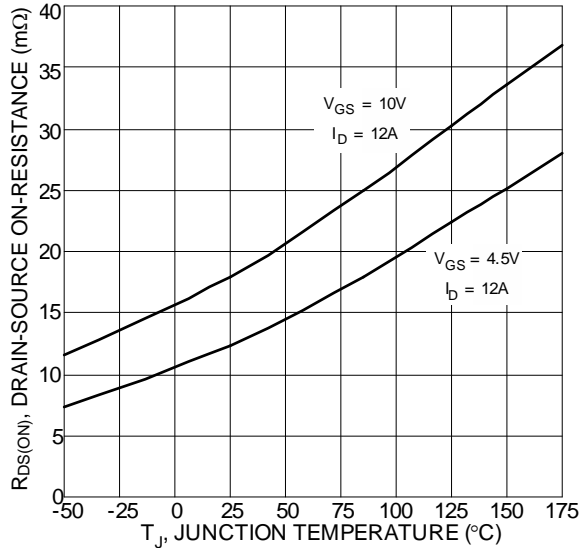


Figure 7 On-Resistance Variation with Temperature

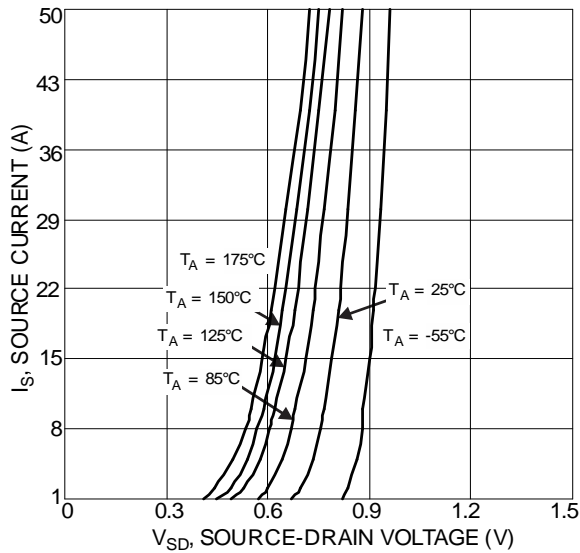


Figure 9 Diode Forward Voltage vs. Current

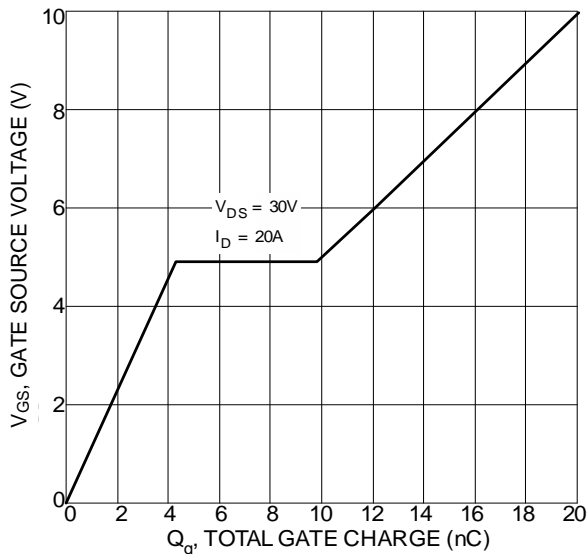


Figure 11 Gate Charge

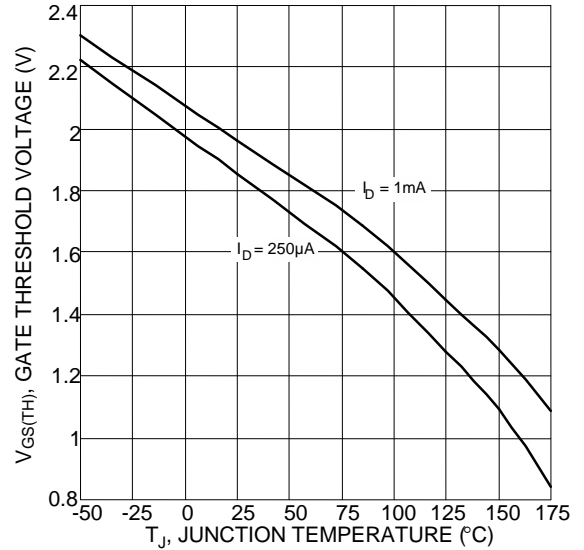


Figure 8 Gate Threshold Variation vs. Junction Temperature

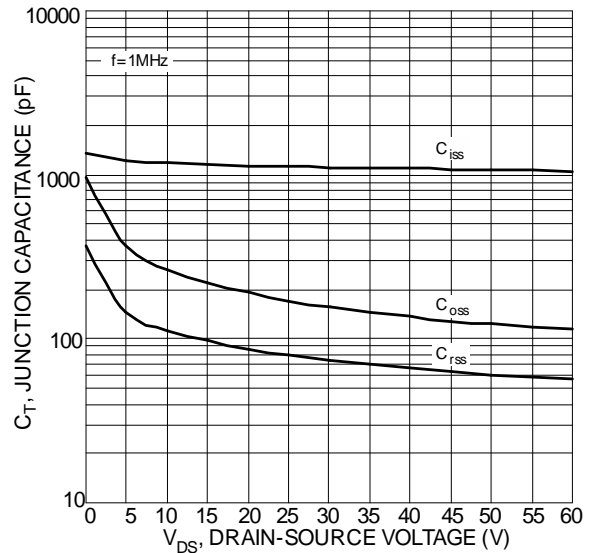


Figure 10 Typical Junction Capacitance

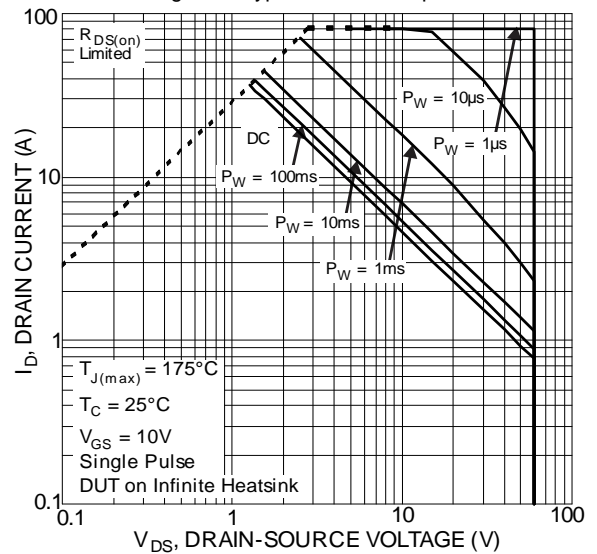
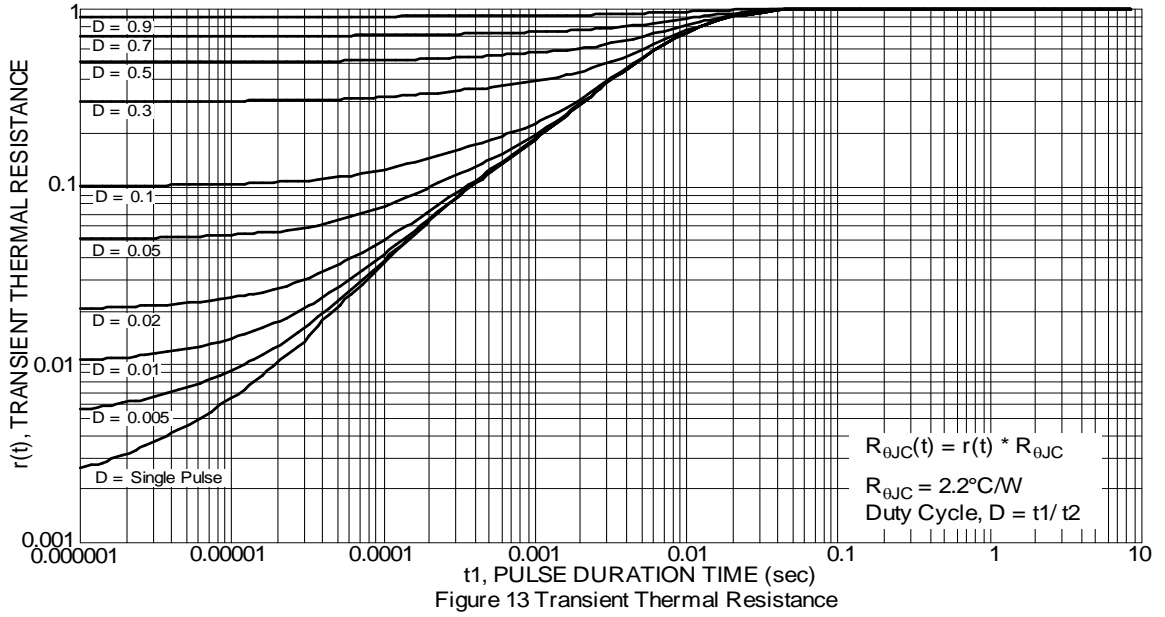


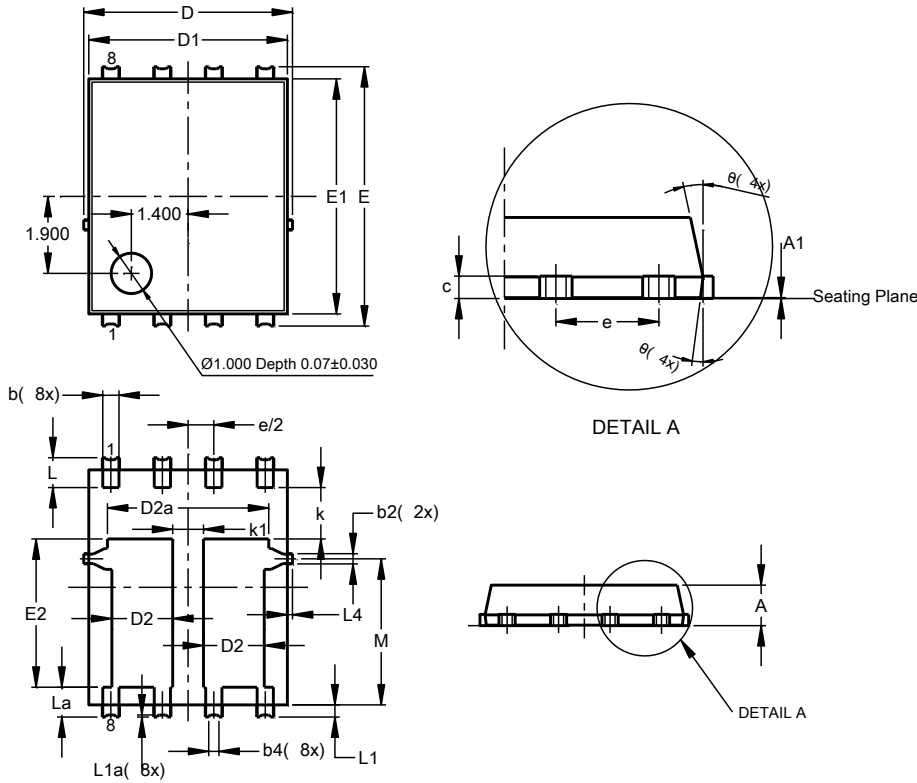
Figure 12 SOA, Safe Operation Area



Package Outline Dimensions

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

PowerDI5060-8 (SWP) (Type R)

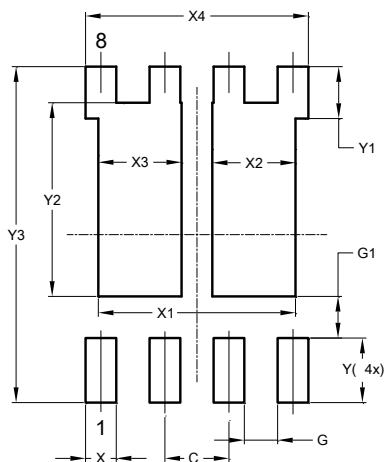


| PowerDI5060-8 (SWP) (Type R) | | | |
|---------------------------------|----------|-------|-------|
| Dim | Min | Max | Typ |
| A | 0.90 | 1.10 | 1.00 |
| A1 | 0 | 0.05 | -- |
| b | 0.30 | 0.50 | 0.41 |
| b2 | 0.20 | 0.35 | 0.25 |
| b4 | 0.25REF | | |
| c | 0.230 | 0.330 | 0.277 |
| D | 5.15 BSC | | |
| D1 | 4.70 | 5.10 | 4.90 |
| D2 | 1.40 | 1.60 | 1.50 |
| 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 |
| e | 1.27BSC | | |
| k | 1.05 | -- | -- |
| k1 | 0.56 | -- | -- |
| 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 R)



| 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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