

## Product Summary

| BV <sub>DSS</sub> | R <sub>DS(ON)</sub> Max       | I <sub>D</sub> Max<br>T <sub>C</sub> = +25°C |
|-------------------|-------------------------------|--|
| 60V               | 23mΩ @ V <sub>GS</sub> = 10V  | 55A  |
|                   | 28mΩ @ V <sub>GS</sub> = 4.5V | 48A  |

## 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:

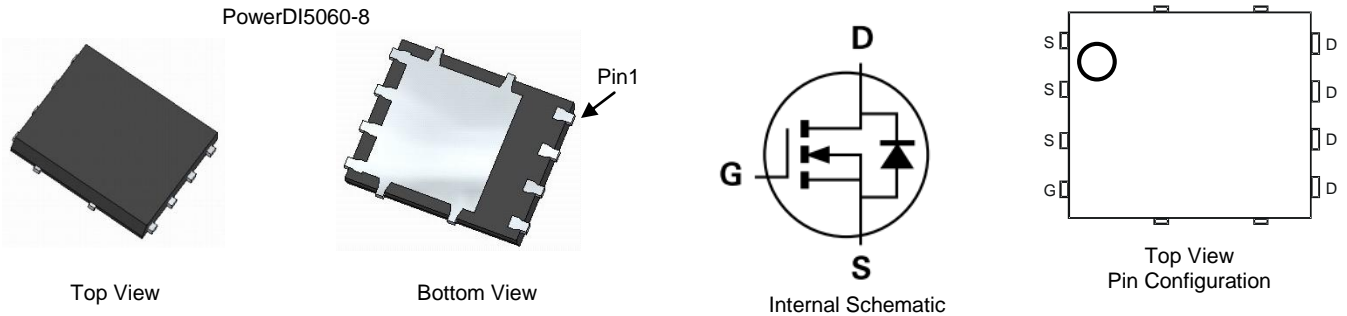
- Driving Solenoids
- Driving Relays
- Power Management Functions

## 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<sub>DS(ON)</sub> – Minimizes On-State Losses
- Low Input Capacitance
- 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: PowerDI5060-8
- Case Material: Molded Plastic, “Green” Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminal Finish - Matte Tin Annealed over Copper Leadframe. Solderable per MIL-STD-202, Method 208 (E3)
- Weight: 0.097 grams (Approximate)

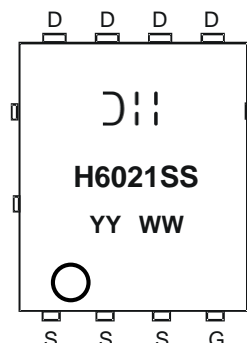


## Ordering Information (Note 5)

| Part Number     | Case          | Packaging           |
|-----------------|---------------|---------------------|
| DMNH6021SPSQ-13 | PowerDI5060-8 | 2,500 / Tape & Reel |

- Notes:
1. EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant. All applicable RoHS exemptions applied.
  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. Automotive products are AEC-Q101 qualified and are PPAP capable. Refer to [http://www.diodes.com/product\\_compliance\\_definitions.html](http://www.diodes.com/product_compliance_definitions.html).
  5. For packaging details, go to our website at <http://www.diodes.com/products/packages.html>.

## Marking Information



D = Manufacturer's Marking  
 H6021SS = Product Type Marking Code  
 YYWW = Date Code Marking  
 YY = Year (ex: 16 = 2016)  
 WW = Week (01 to 53)

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

| Characteristic   | Symbol           | Value                   | Unit |
|--|------------------|-------------------------|------|
| Drain-Source Voltage                                     | V <sub>DSS</sub> | 60                      | V    |
| Gate-Source Voltage                                      | V <sub>GSS</sub> | ±20                     | V    |
| Continuous Drain Current, V <sub>GS</sub> = 10V (Note 8) | I <sub>D</sub>   | T <sub>C</sub> = +25°C  | 55   |
|  |                  | T <sub>C</sub> = +100°C | 39   |
| Maximum Continuous Body Diode Forward Current (Note 8)   | I <sub>S</sub>   | 55                      | A    |
| Pulsed Drain Current (10µs Pulse, Duty Cycle = 1%)       | I <sub>DM</sub>  | 88                      | A    |
| Avalanche Current, L = 0.1mH (Note 9)                    | I <sub>AS</sub>  | 35                      | A    |
| Avalanche Energy, L = 0.1mH (Note 9)                     | E <sub>AS</sub>  | 64                      | mJ   |

**Thermal Characteristics**

| Characteristic                                   | Symbol                            | Value       | Unit |
|--|-----------------------------------|-------------|------|
| Total Power Dissipation (Note 6)                 | P <sub>D</sub>                    | 1.6         | W    |
| Thermal Resistance, Junction to Ambient (Note 6) | R <sub>θJA</sub>                  | 96          | °C/W |
| Total Power Dissipation (Note 7)                 | P <sub>D</sub>                    | 3.0         | W    |
| Thermal Resistance, Junction to Ambient (Note 7) | R <sub>θJA</sub>                  | 50          | °C/W |
| Total Power Dissipation (Note 8)                 | P <sub>D</sub>                    | 53          | W    |
| Thermal Resistance, Junction to Case (Note 8)    | R <sub>θJC</sub>                  | 1.5         | °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 10)</b>       |                     |     |       |      |      |   |
| Drain-Source Breakdown Voltage             | BV <sub>DSS</sub>   | 60  | -     | -    | 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> = 60V, 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 10)</b>        |                     |     |       |      |      |   |
| Gate Threshold Voltage                     | V <sub>GS(TH)</sub> | 1   | -     | 3    | V    | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250µA                                |
| Static Drain-Source On-Resistance          | R <sub>DS(ON)</sub> | -   | 12    | 23   | mΩ   | V <sub>GS</sub> = 10V, I <sub>D</sub> = 12A   |
|  |                     | -   | 18    | 28   |      | V <sub>GS</sub> = 4.5V, I <sub>D</sub> = 12A  |
| Diode Forward Voltage                      | V <sub>SD</sub>     | -   | 0.75  | 1.2  | V    | V <sub>GS</sub> = 0V, I <sub>S</sub> = 20A  |
| <b>DYNAMIC CHARACTERISTICS (Note 11)</b>   |                     |     |       |      |      |   |
| Input Capacitance                          | C <sub>iss</sub>    | -   | 1,016 | -    | pF   | V <sub>DS</sub> = 30V, V <sub>GS</sub> = 0V, f = 1MHz                                     |
| Output Capacitance                         | C <sub>oss</sub>    | -   | 153   | -    |      |   |
| Reverse Transfer Capacitance               | C <sub>rss</sub>    | -   | 76.8  | -    |      |   |
| Gate Resistance                            | R <sub>g</sub>      | -   | 2.5   | -    | Ω    | V <sub>DS</sub> = 0V, V <sub>GS</sub> = 0V, f = 1MHz                                      |
| Total Gate Charge (V <sub>GS</sub> = 4.5V) | Q <sub>g</sub>      | -   | 9.5   | -    | nC   | V <sub>DS</sub> = 30V, I <sub>D</sub> = 20A   |
| Total Gate Charge (V <sub>GS</sub> = 10V)  | Q <sub>g</sub>      | -   | 19.7  | -    |      |   |
| Gate-Source Charge                         | Q <sub>gs</sub>     | -   | 3.6   | -    |      |   |
| Gate-Drain Charge                          | Q <sub>gd</sub>     | -   | 4.8   | -    |      |   |
| Turn-On Delay Time                         | t <sub>D(ON)</sub>  | -   | 4.2   | -    | ns   | V <sub>DD</sub> = 30V, V <sub>GS</sub> = 10V, I <sub>D</sub> = 10A, R <sub>g</sub> = 4.7Ω |
| Turn-On Rise Time                          | t <sub>R</sub>      | -   | 13    | -    |      |   |
| Turn-Off Delay Time                        | t <sub>D(OFF)</sub> | -   | 27.5  | -    |      |   |
| Turn-Off Fall Time                         | t <sub>F</sub>      | -   | 15.3  | -    |      |   |
| Body Diode Reverse Recovery Time           | t <sub>RR</sub>     | -   | 20.8  | -    | ns   | I <sub>F</sub> = 20A, di/dt = 100A/µs   |
| Body Diode Reverse Recovery Charge         | Q <sub>RR</sub>     | -   | 13.9  | -    | 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<sub>AS</sub> and E<sub>AS</sub> ratings are based on low frequency and duty cycles to keep T<sub>J</sub> = +25°C.
  - Short duration pulse test used to minimize self-heating effect.
  - Guaranteed by design. Not subject to product testing.

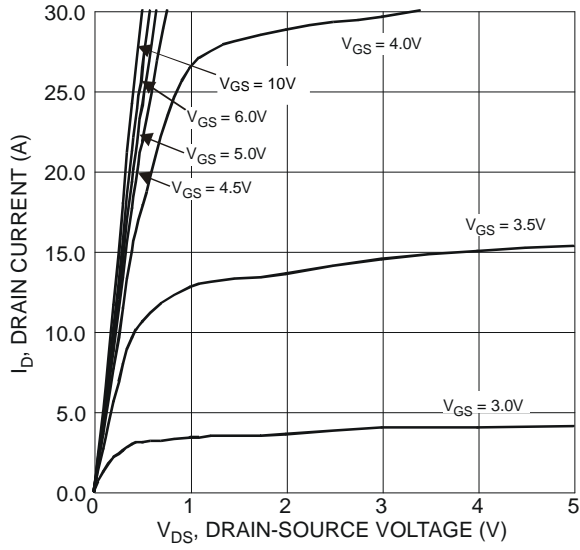


Figure 1 Typical Output Characteristics

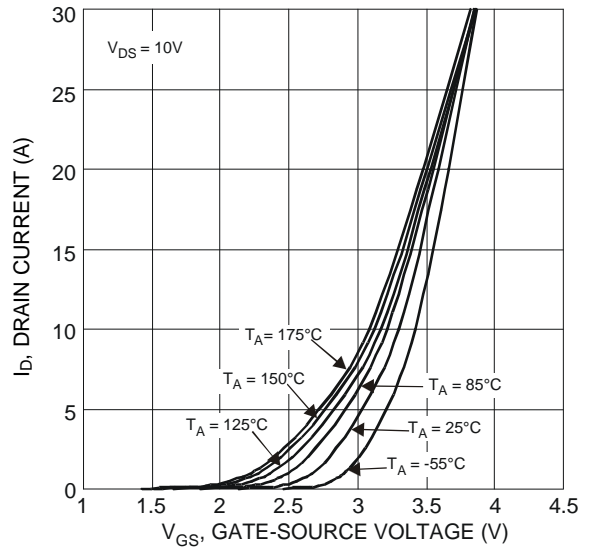


Figure 2 Typical Transfer Characteristics

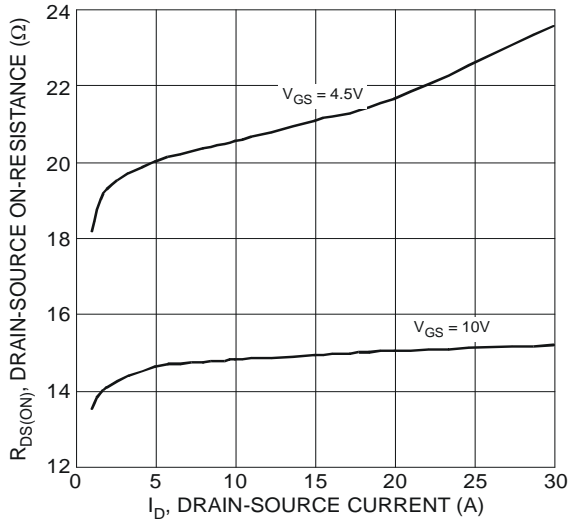


Figure 3 Typical On-Resistance vs. Drain Current and Gate Voltage

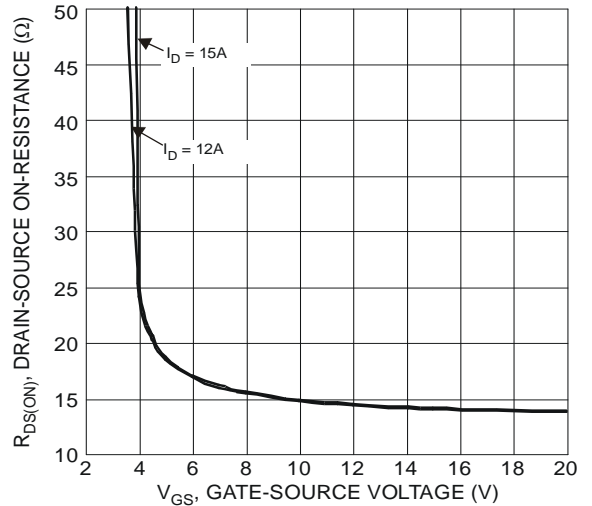


Figure 4 Typical Drain-Source On-Resistance vs. Gate-Source Voltage

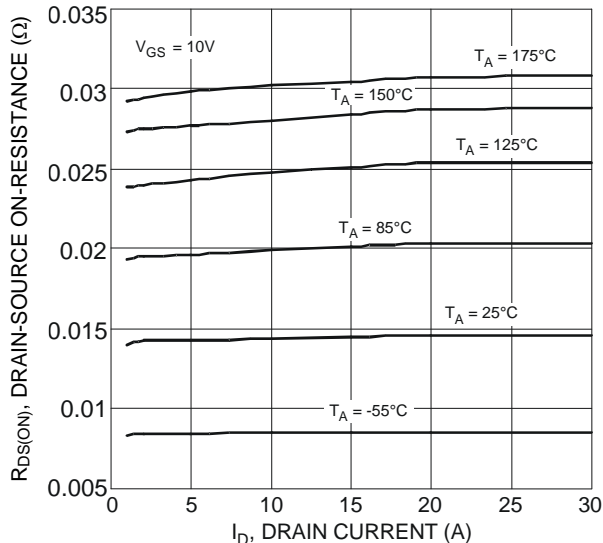


Figure 5 Typical On-Resistance vs. Drain Current and Temperature

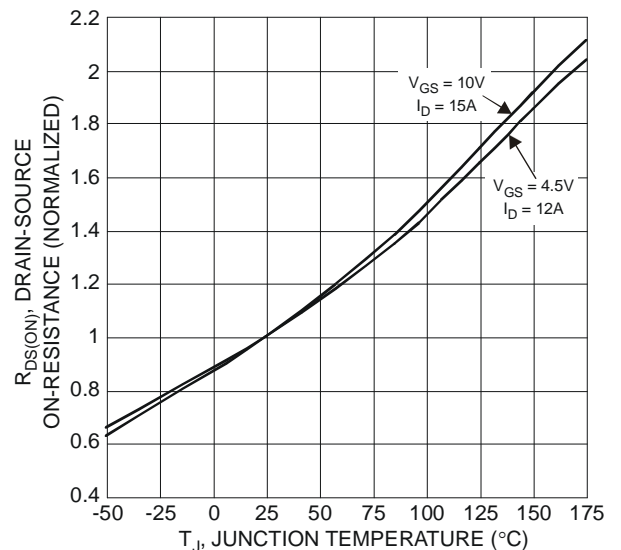


Figure 6 On-Resistance Variation with Temperature

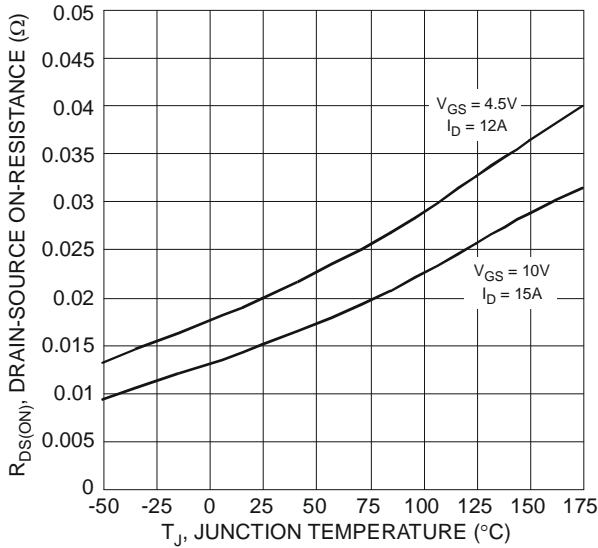


Figure 7 On-Resistance Variation with Temperature

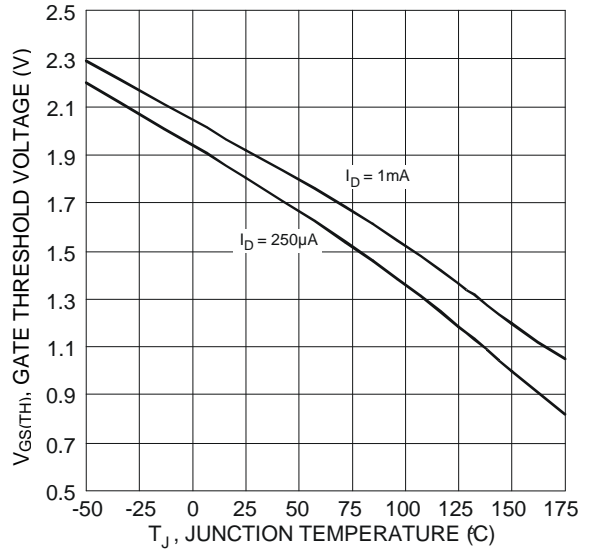


Figure 8 Gate Threshold Variation vs. Junction Temperature

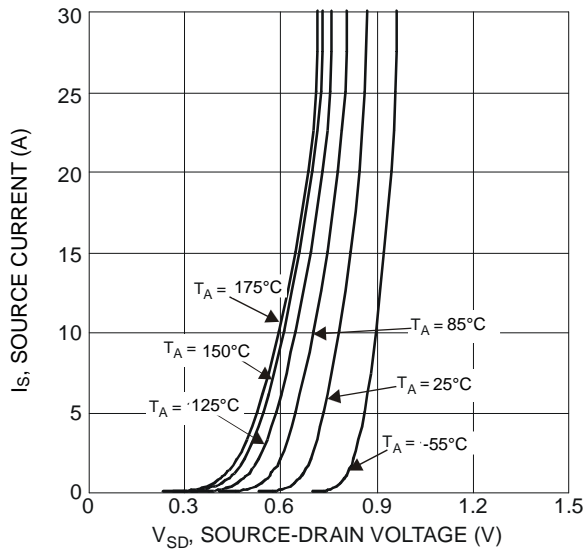


Figure 9 Diode Forward Voltage vs. Current

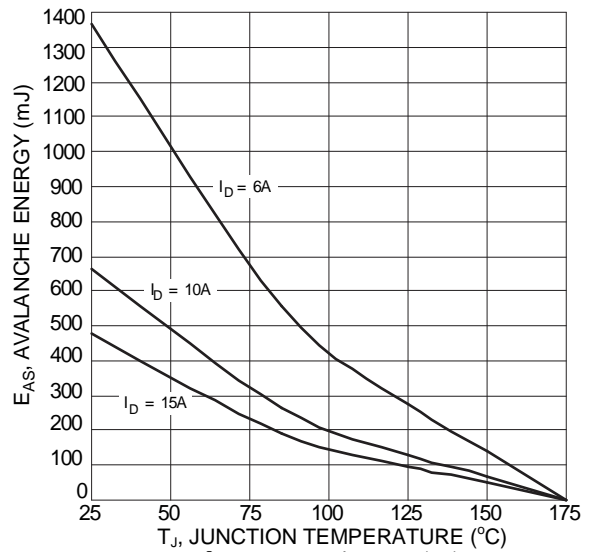


Figure 10 Avalanche Energy

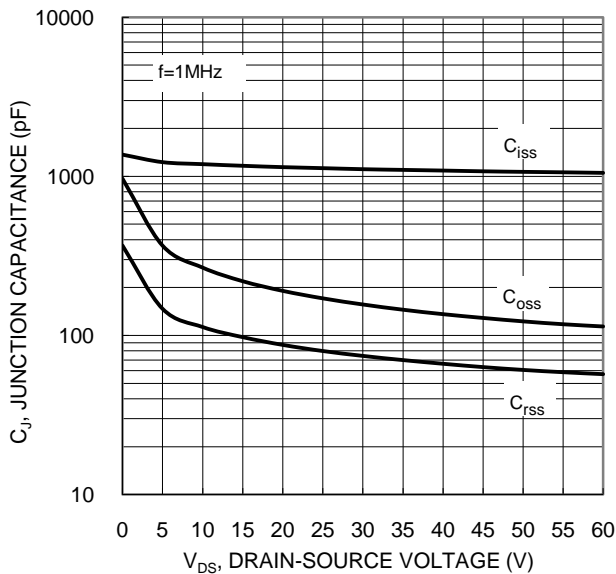


Figure 11 Typical Junction Capacitance

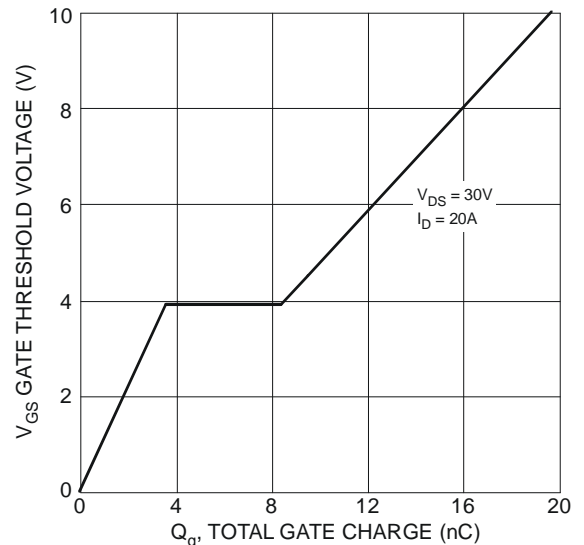


Figure 12 Gate Charge

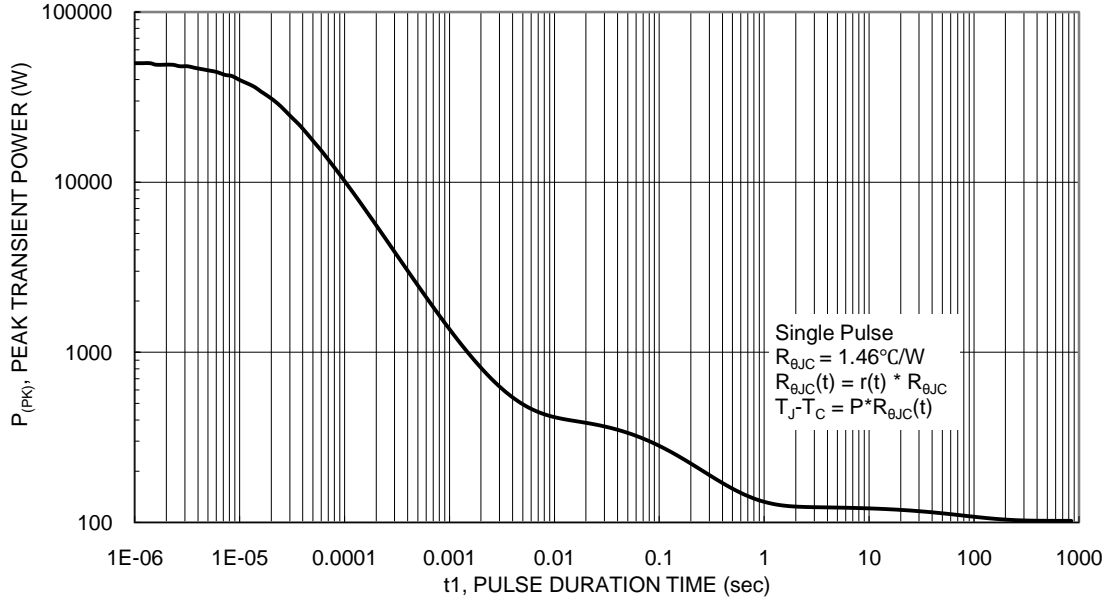


Figure 13 Single Pulse Maximum Power Dissipation

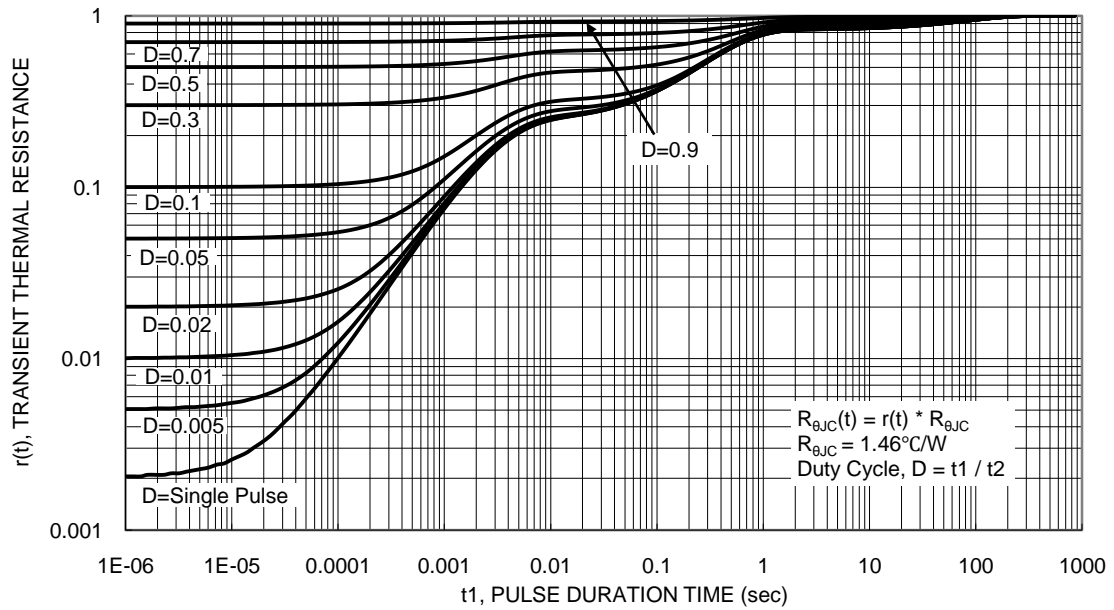
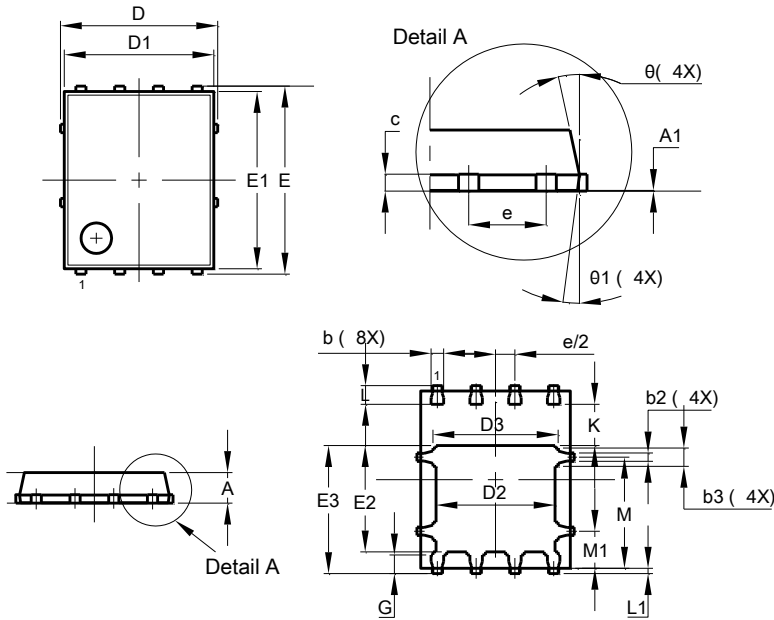


Figure 14 Transient Thermal Resistance

**Package Outline Dimensions**

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

**PowerDI5060-8**

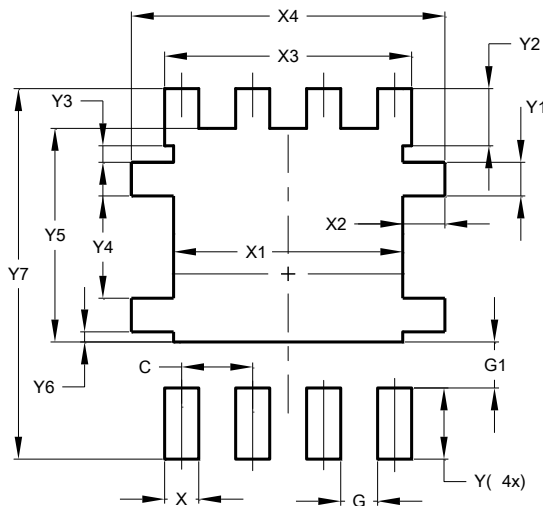


| PowerDI5060-8        |          |       |       |
|----------------------|----------|-------|-------|
| Dim                  | Min      | Max   | Typ   |
| A                    | 0.90     | 1.10  | 1.00  |
| A1                   | 0.00     | 0.05  | -     |
| b                    | 0.33     | 0.51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