

## Product Summary

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

## Description and Applications

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.

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

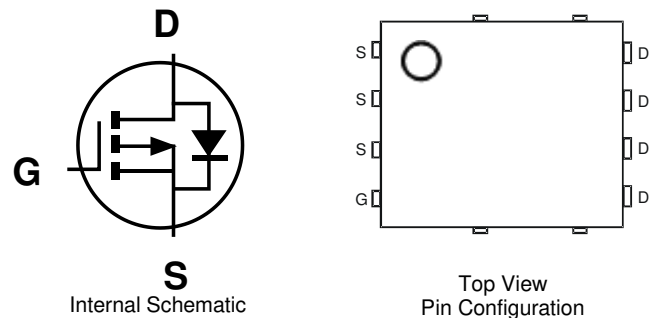
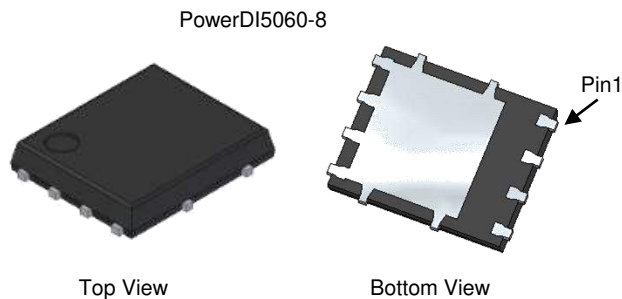
## Features and Benefits

- 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)**
- **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 refer to the related automotive grade (Q-suffix) part. A listing can be found at <https://www.diodes.com/products/automotive/automotive-products/>.**
- **This part is qualified to JEDEC standards (as references in AEC-Q) for High Reliability.** <https://www.diodes.com/quality/product-definitions/>
- **An Automotive-Compliant Part is Available Under Separate Datasheet ([DMP4015SPSQ](#))**

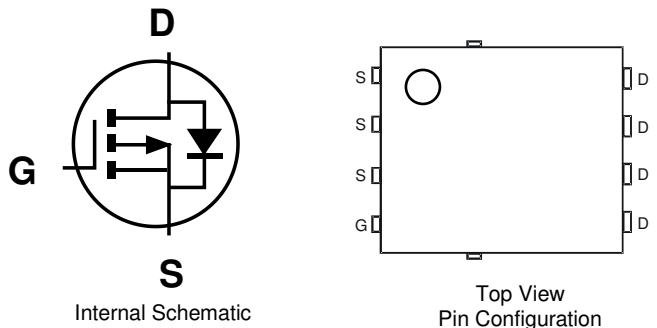
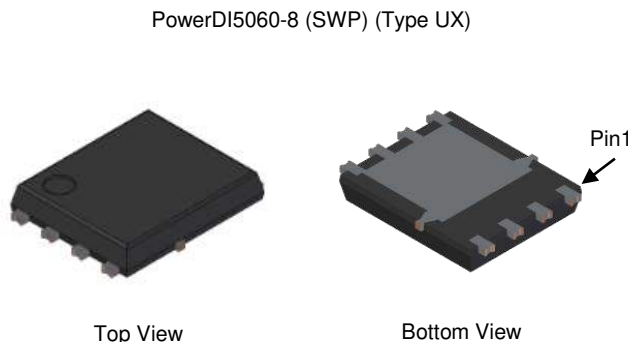
## Mechanical Data

- Package: PowerDI<sup>®</sup>5060-8
- Package Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminal Connections: See Diagram
- Terminals: Finish – 100% Matte Tin Annealed over Copper Leadframe. Solderable per MIL-STD-202, Method 208
- Weight: 0.097 grams (Approximate)

Site1:



Site2:



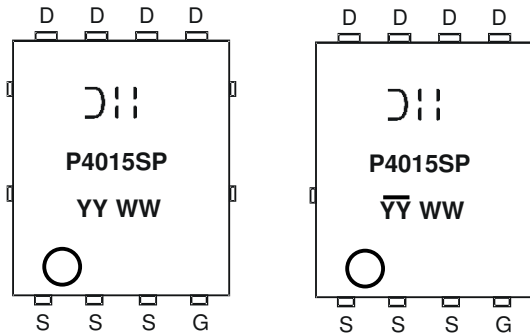
PowerDI is a registered trademark of Diodes Incorporated.

### Ordering Information (Note 4)

Part Number	Package	Packing	
		Qty.	Carrier
DMP4015SPS-13	PowerDI5060-8	2,500	Reel
DMP4015SPS-13	PowerDI5060-8 (SWP) (Type UX)	2,500	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 D D D = Manufacturer's Marking  
 P4015SP = Product Type Marking Code  
 YYWW or YYWW = Date Code Marking  
 YY or YY = Year (ex: 22 = 2022)  
 WW = Week (01 to 53)

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

Characteristic		Symbol	Value	Units
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 T <sub>A</sub> = +25°C T <sub>A</sub> = +70°C	I <sub>D</sub>	-8.5 -6.8	A
	t < 10s T <sub>A</sub> = +25°C T <sub>A</sub> = +70°C	I <sub>D</sub>	-13 -10.5	A
Continuous Drain Current (Note 6) V <sub>GS</sub> = -10V	Steady State T <sub>A</sub> = +25°C T <sub>A</sub> = +70°C	I <sub>D</sub>	-11 -8.7	A
	t < 10s T <sub>A</sub> = +25°C T <sub>A</sub> = +70°C	I <sub>D</sub>	-17 -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 L = 1mH		I <sub>AS</sub>	-22	A
Avalanche Energy L = 1mH		E <sub>AS</sub>	242	mJ

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

Characteristic		Symbol	Value	Units
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	
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>	49	°C/W
	t < 10s		24	
Thermal Resistance, Junction to Case (Note 7)		R <sub>θJC</sub>	1.6	°C/W
Operating and Storage Temperature Range		T <sub>J</sub> , T <sub>STG</sub>	-55 to +150	°C

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

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

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
<b>OFF CHARACTERISTICS (Note 8)</b>						
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 (Note 8)</b>						
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 (Note 9)</b>						
Input Capacitance	C <sub>iss</sub>	—	4,234	—	pF	V <sub>DS</sub> = -20V, V <sub>GS</sub> = 0V 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 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, 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: 8. Short duration pulse test used to minimize self-heating effect.  
9. Guaranteed by design. Not subject to production testing.

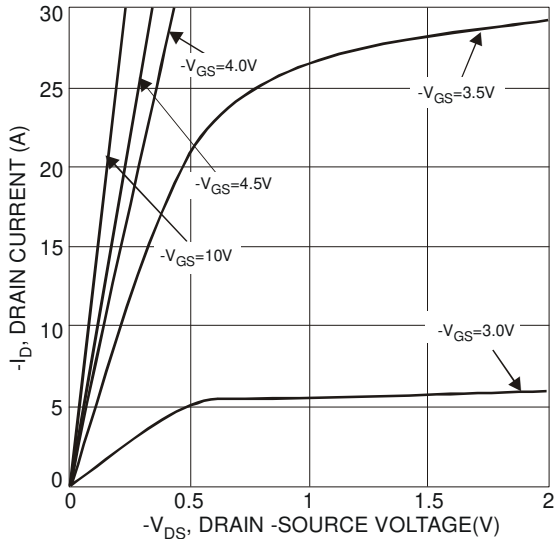


Fig. 1 Typical Output Characteristics

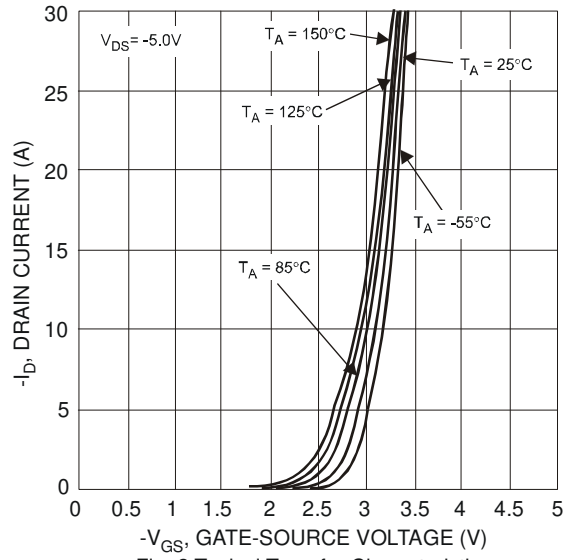


Fig. 2 Typical Transfer Characteristics

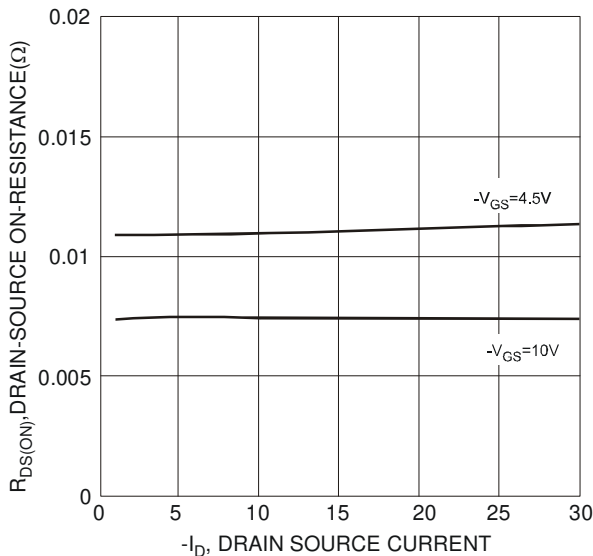


Fig. 3 Typical On-Resistance vs. Drain Current and Gate Voltage

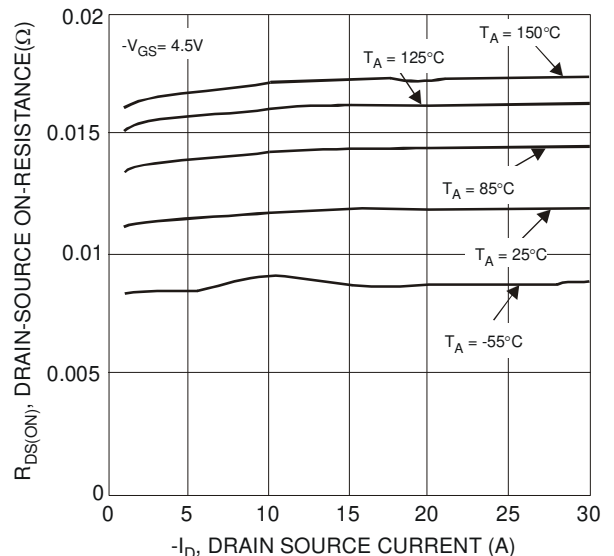


Fig. 4 Typical On-Resistance vs. Drain Current and Temperature

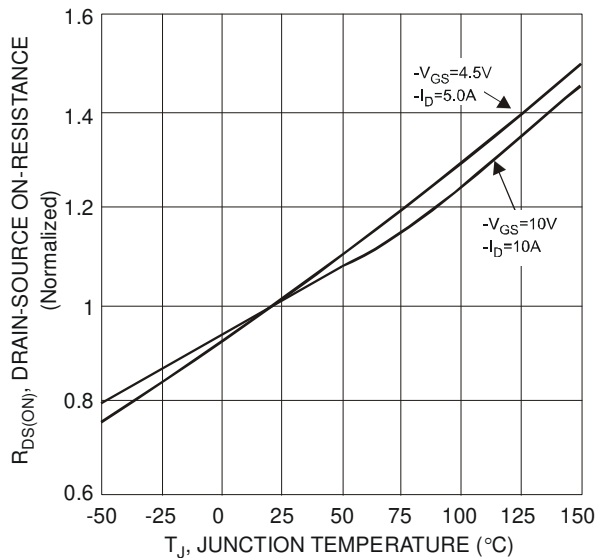


Fig. 5 On-Resistance Variation with Temperature

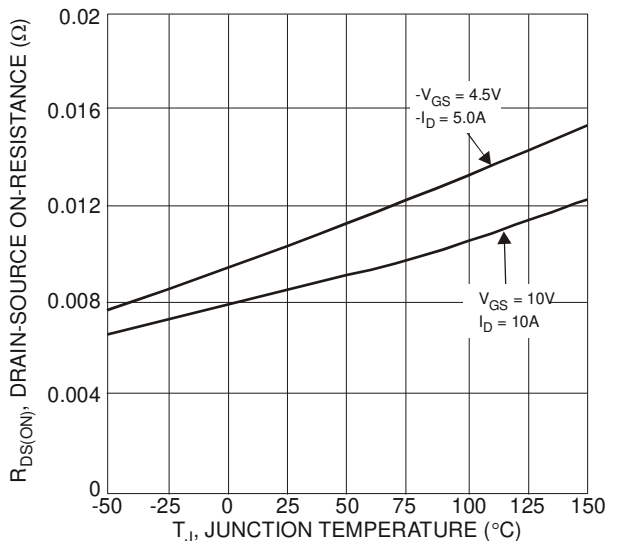


Fig. 6 On-Resistance Variation with Temperature

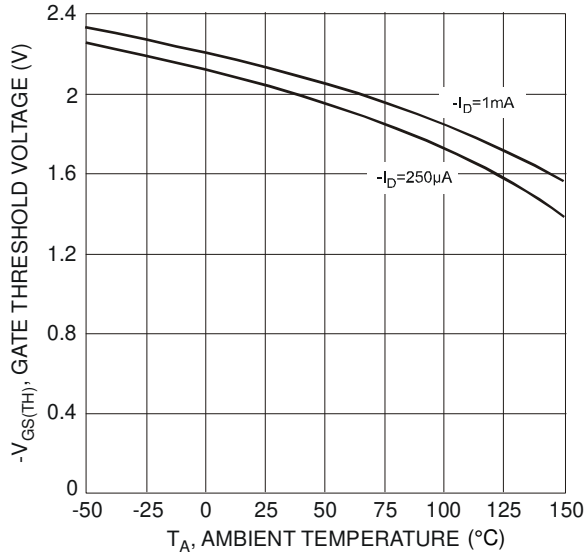


Fig. 7 Gate Threshold Variation vs. Ambient Temperature

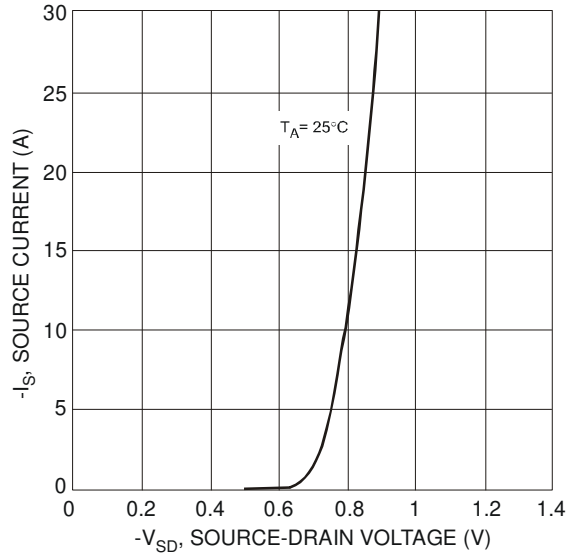


Fig. 8 Diode Forward Voltage vs. Current

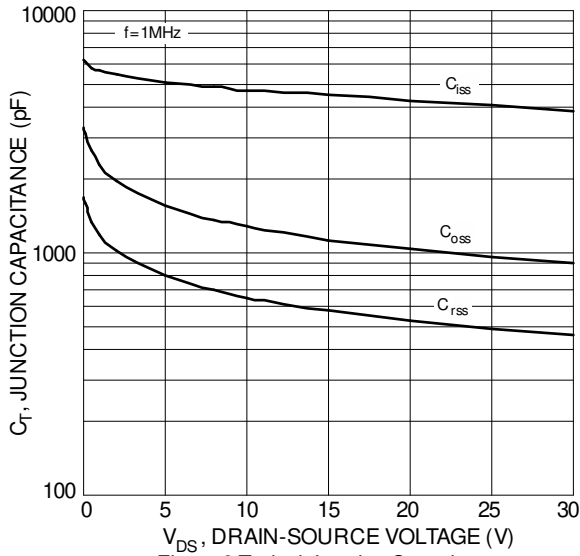


Figure 9 Typical Junction Capacitance

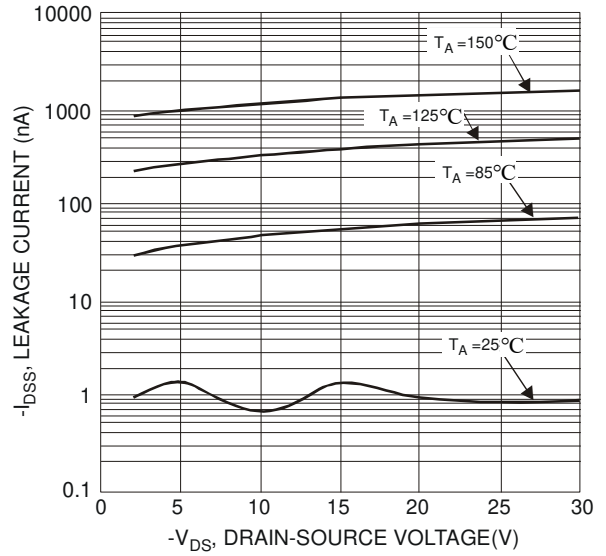


Fig. 10 Typical Drain-Source Leakage Current vs. Voltage

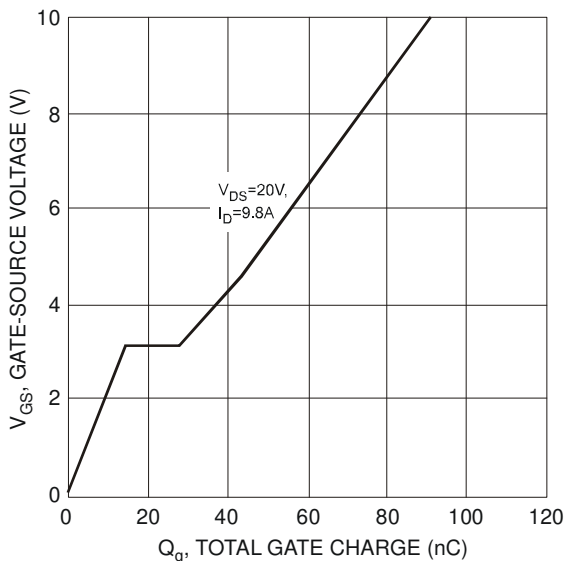


Fig. 11 Gate-Charge Characteristics

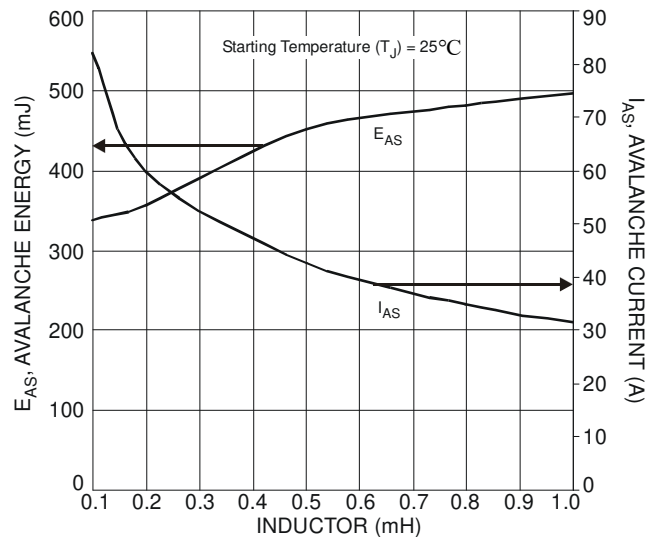


Fig. 12 Single-Pulse Avalanche Tested

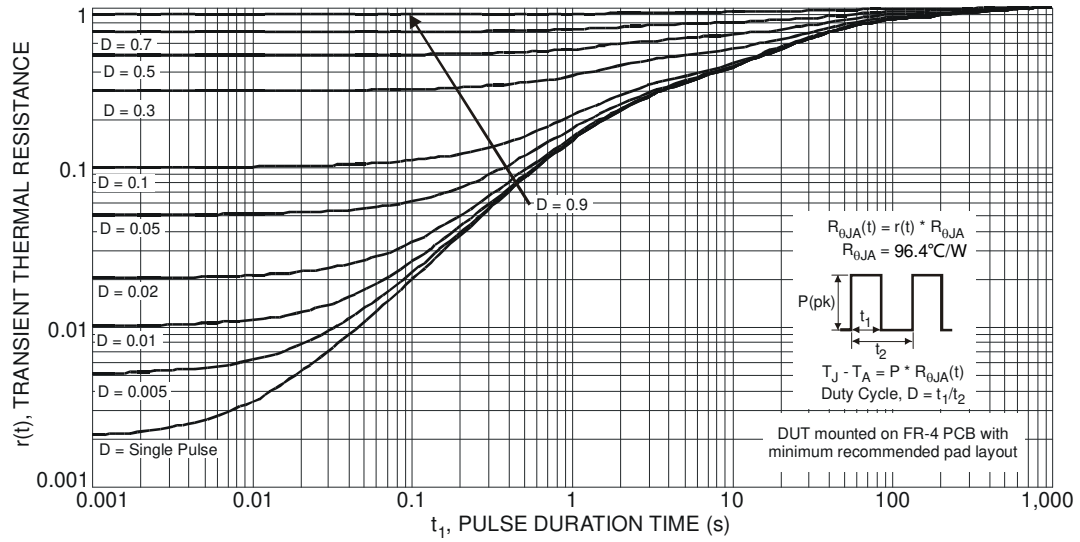
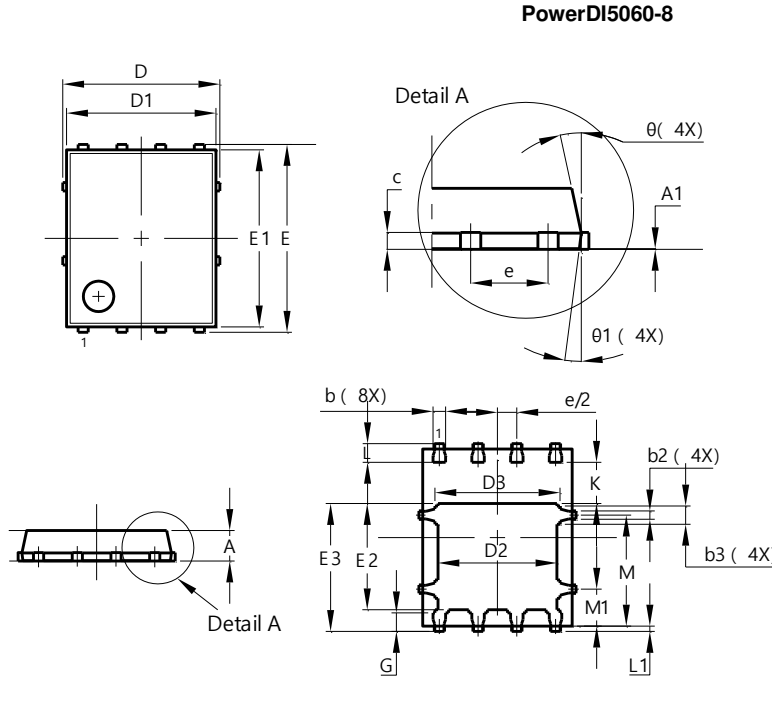


Fig. 13 Transient Thermal Response

**Package Outline Dimensions**

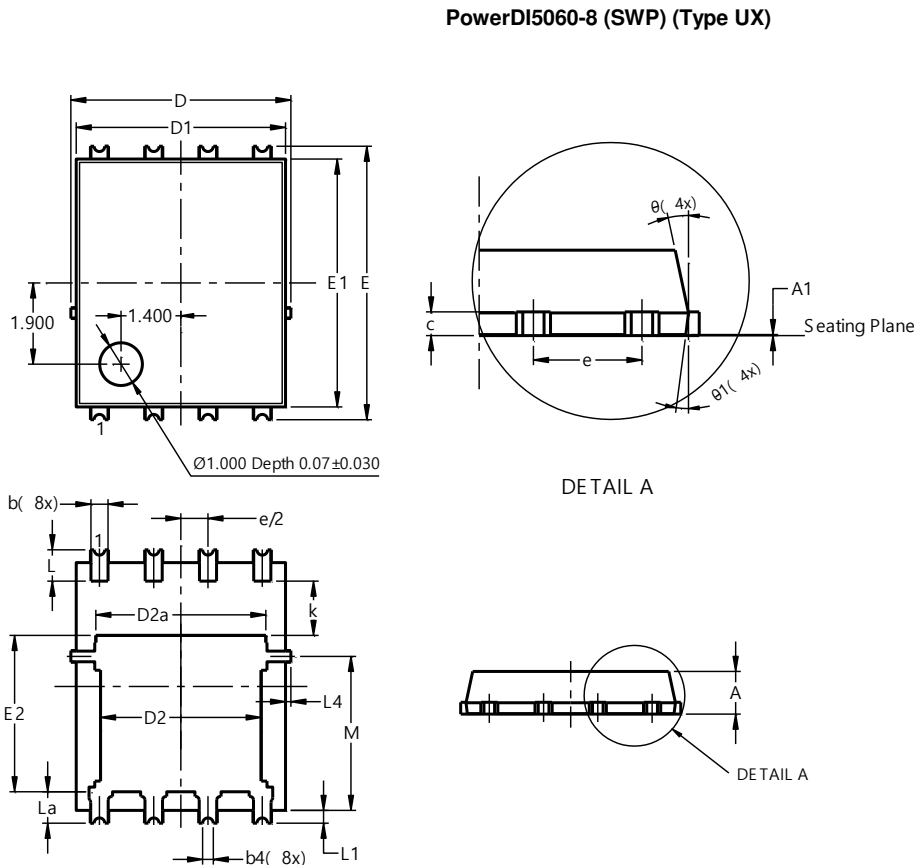
Please see <http://www.diodes.com/package-outlines.html> for the latest version.

Site1:



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			

Site2:



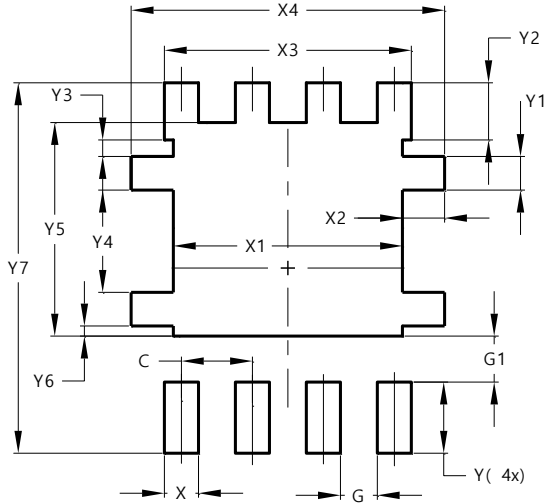
PowerDI5060-8 (SWP) (Type UX)			
Dim	Min	Max	Typ
A	0.90	1.10	1.00
A1	0	0.05	--
b	0.30	0.50	0.41
b2	0.20	0.35	0.25
b4	0.25REF		
c	0.230	0.330	0.277
D	5.15 BSC		
D1	4.70	5.10	4.90
D2	3.56	3.96	3.76
D2a	3.78	4.18	3.98
E	6.40 BSC		
E1	5.60	6.00	5.80
E2	3.46	3.86	3.66
E2a	4.195	4.595	4.395
e	1.27BSC		
k	1.05	--	--
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
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.

Site1:

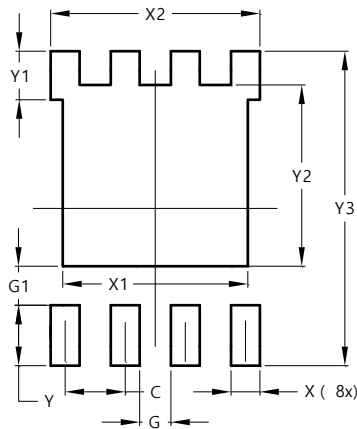
**PowerDI5060-8**



Dimensions	Value (in mm)
<b>C</b>	1.270
<b>G</b>	0.660
<b>G1</b>	0.820
<b>X</b>	0.610
<b>X1</b>	4.100
<b>X2</b>	0.755
<b>X3</b>	4.420
<b>X4</b>	5.610
<b>Y</b>	1.270
<b>Y1</b>	0.600
<b>Y2</b>	1.020
<b>Y3</b>	0.295
<b>Y4</b>	1.825
<b>Y5</b>	3.810
<b>Y6</b>	0.180
<b>Y7</b>	6.610

Site2:

**PowerDI5060-8 (SWP) (Type UX)**



Dimensions	Value (in mm)
<b>C</b>	1.270
<b>G</b>	0.660
<b>G1</b>	0.820
<b>X</b>	0.610
<b>X1</b>	4.100
<b>X2</b>	4.420
<b>Y</b>	1.270
<b>Y1</b>	1.020
<b>Y2</b>	3.810
<b>Y3</b>	6.610



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