

## Product Summary

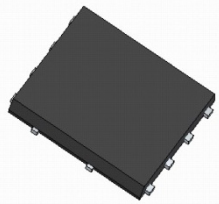
$V_{(BR)DSS}$	$R_{DS(on) \max}$	$I_D$ $T_A = +25^\circ\text{C}$
-40V	11m $\Omega$ @ $V_{GS} = -10\text{V}$	-17.0A
	15m $\Omega$ @ $V_{GS} = -4.5\text{V}$	-14.5A

## Description

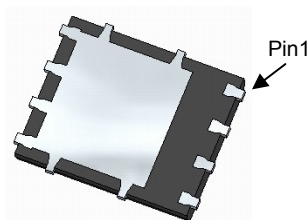
This new generation MOSFET has been designed to minimize the on-state resistance ( $R_{DS(on)}$ ) and yet maintain superior switching performance, making it ideal for high efficiency power management applications.

## Applications

- DC-DC Converters
- Power management functions
- Analog Switch



Top View



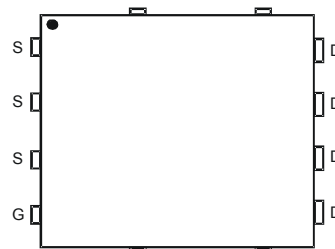
Bottom View

## Features and Benefits

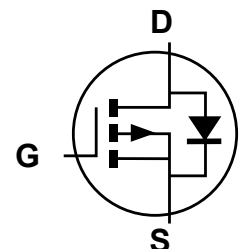
- 100% Unclamped Inductive Switch (UIS) Test In Production
- Low On-Resistance
- Fast Switching Speed
- **Lead-Free Finish; RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **Qualified to AEC-Q101 Standards for High Reliability**
- **PPAP Available**

## 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)



Top View  
Pin Configuration



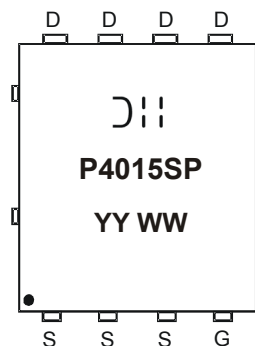
Internal Schematic

## Ordering Information (Note 4 & 5)

Part Number	Compliance	Case	Packaging
DMP4015SPSQ-13	Automotive	POWERDI®5060-8	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. Automotive, AEC-Q101 and standard products are electrically and thermally the same, except where specified. For more information, please refer to [http://www.diodes.com/quality/product\\_grade\\_definitions/](http://www.diodes.com/quality/product_grade_definitions/).
  5. For packaging details, go to our website at <http://www.diodes.com/products/packages.html>.

## Marking Information



$\text{D}||$  = Manufacturer's Marking  
 P4015SP = Product Type Marking Code  
 YYWW = Date Code Marking  
 YY = Year (ex: 13 = 2013)  
 WW = Week (01 - 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 6) 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>	-13.0 -10.5	A
Continuous Drain Current (Note 7) V <sub>GS</sub> = -10V	Steady State	T <sub>A</sub> = +25°C T <sub>A</sub> = +70°C	I <sub>D</sub>	-11.0 -8.7	A
	t < 10s	T <sub>A</sub> = +25°C T <sub>A</sub> = +70°C	I <sub>D</sub>	-17.0 -13.5	A
Pulsed Drain Current (10µs pulse, duty cycle = 1%)			I <sub>DM</sub>	-100	A
Maximum Body Diode Continuous Current (Note 7)			I <sub>S</sub>	-3.5	A
Avalanche Current (Note 8)			I <sub>AS</sub>	-22	A
Avalanche Energy (Note 8)			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 6)	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 6)	Steady state	R <sub>θJA</sub>	96.4	°C/W
	t < 10s		40.6	°C/W
Total Power Dissipation (Note 7)	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 7)	Steady state	R <sub>θJA</sub>	55.0	°C/W
	t < 10s		24.0	°C/W
Thermal Resistance, Junction to Case (Note 7)		R <sub>θJC</sub>	4.15	°C/W
Operating and Storage Temperature Range		T <sub>J</sub> , T <sub>STG</sub>	-55 to +150	°C

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

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
<b>OFF CHARACTERISTICS (Note 9)</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 9)</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 10)</b>						
Input Capacitance	C <sub>iss</sub>	—	4234	—	pF	V <sub>DS</sub> = -20V, V <sub>GS</sub> = 0V f = 1MHz
Output Capacitance	C <sub>oss</sub>	—	1036	—		
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:
- 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
  - UIS in production with L = 0.1mH, T<sub>J</sub> = +25°C
  - Short duration pulse test used to minimize self-heating effect.
  - Guaranteed by design. Not subject to production testing.

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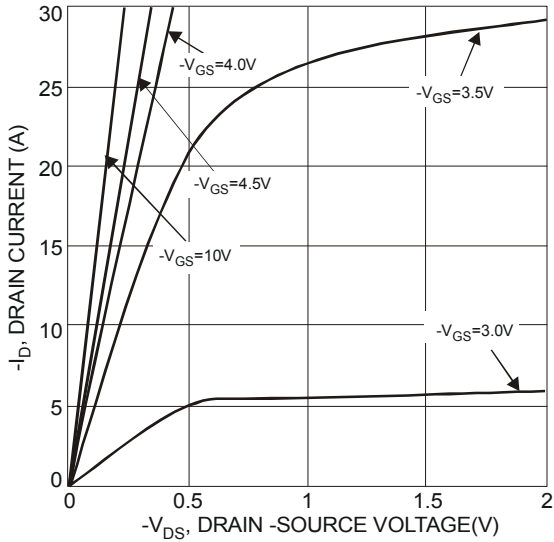


Fig. 1 Typical Output Characteristics

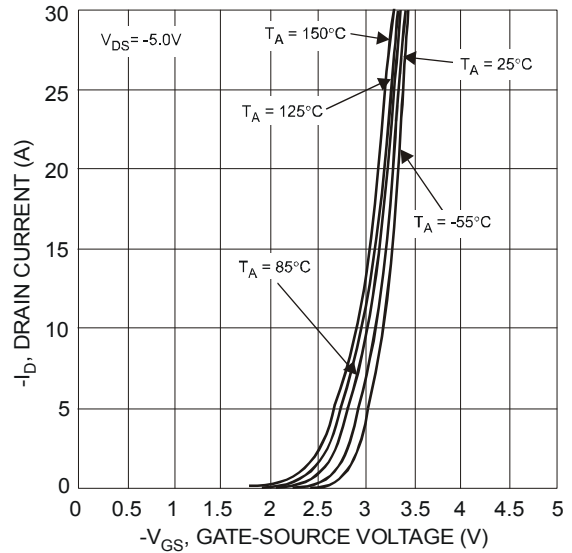


Fig. 2 Typical Transfer Characteristics

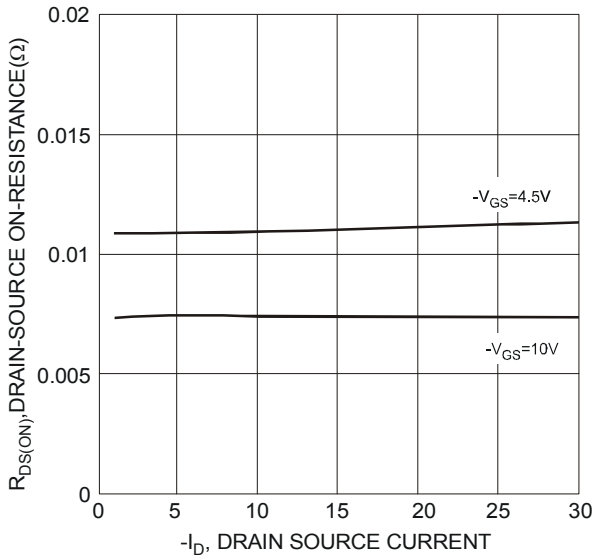


Fig. 3 Typical On-Resistance vs. Drain Current and Gate Voltage

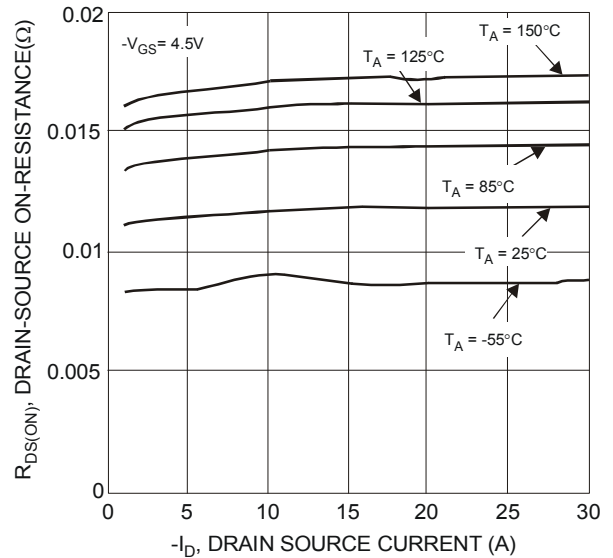


Fig. 4 Typical On-Resistance vs. Drain Current and Temperature

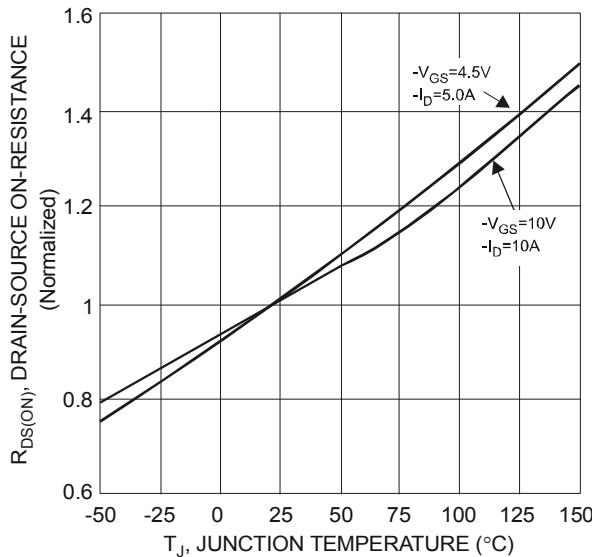


Fig. 5 On-Resistance Variation with Temperature

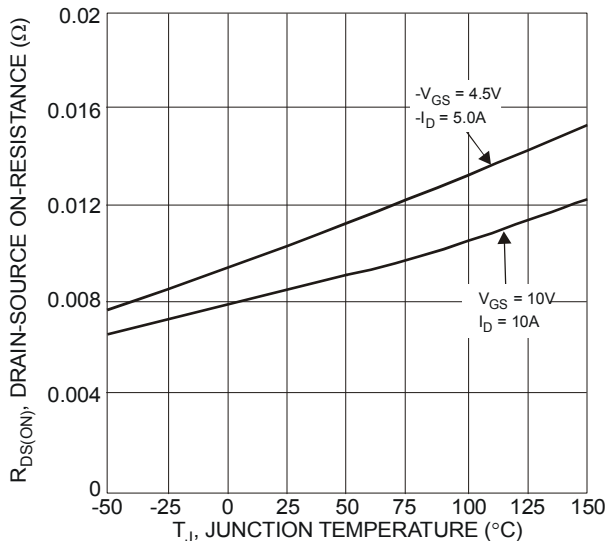


Fig. 6 On-Resistance Variation with Temperature

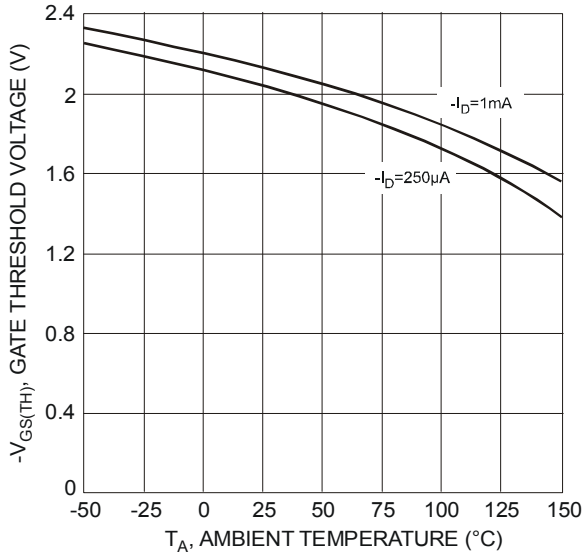


Fig. 7 Gate Threshold Variation vs. Ambient Temperature

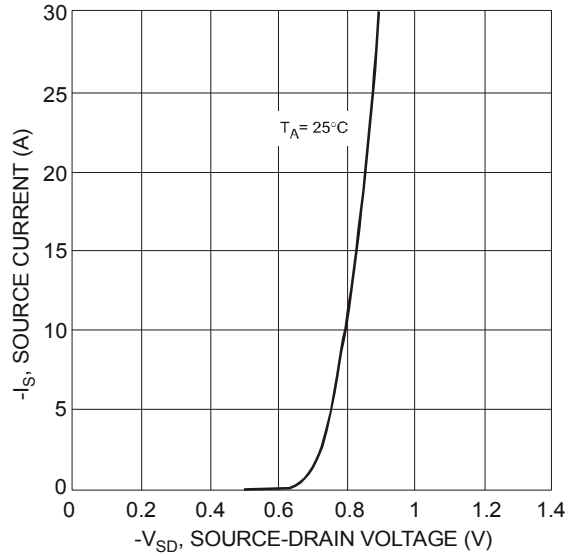


Fig. 8 Diode Forward Voltage vs. Current

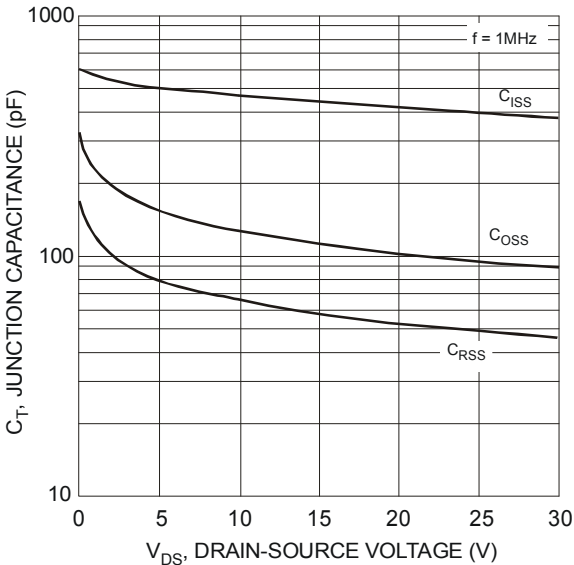


Fig. 9 Typical Junction Capacitance

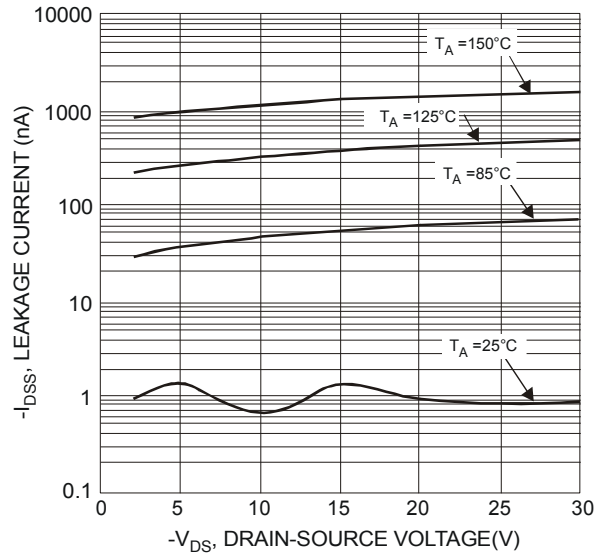


Fig. 10 Typical Drain-Source Leakage Current vs. Voltage

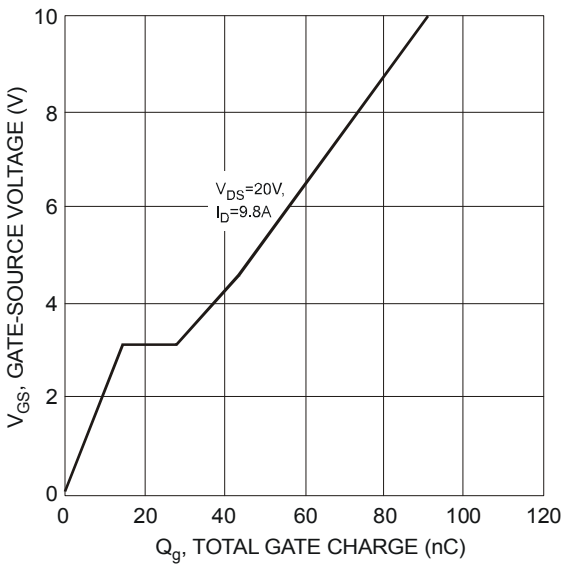


Fig. 11 Gate-Charge Characteristics

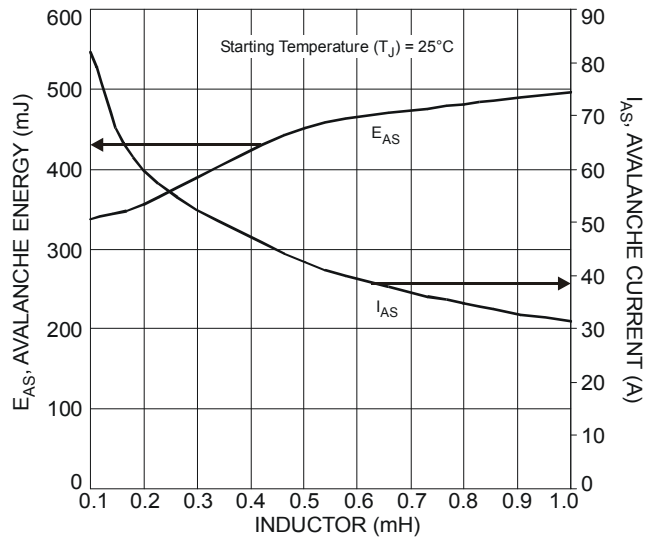
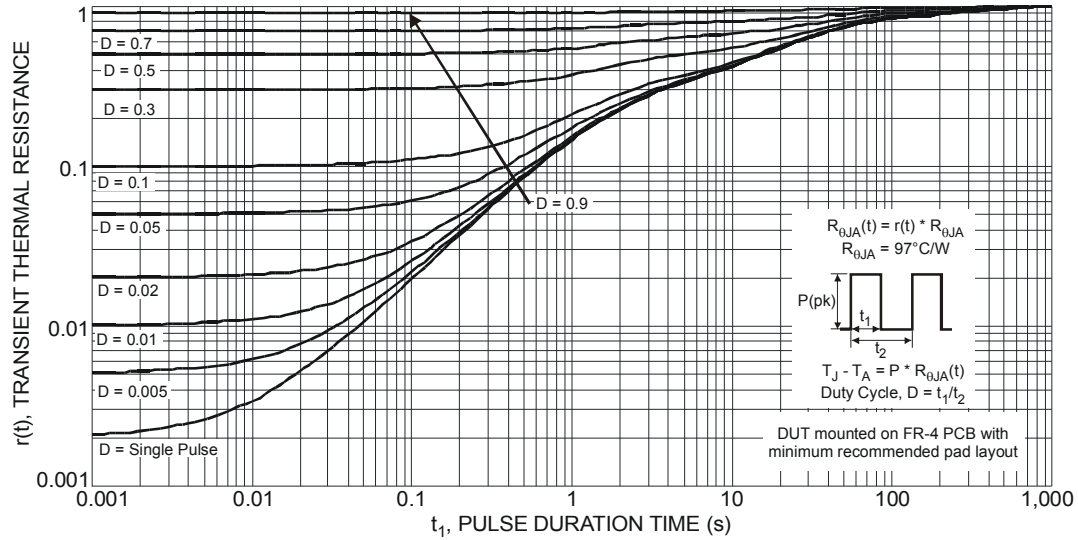
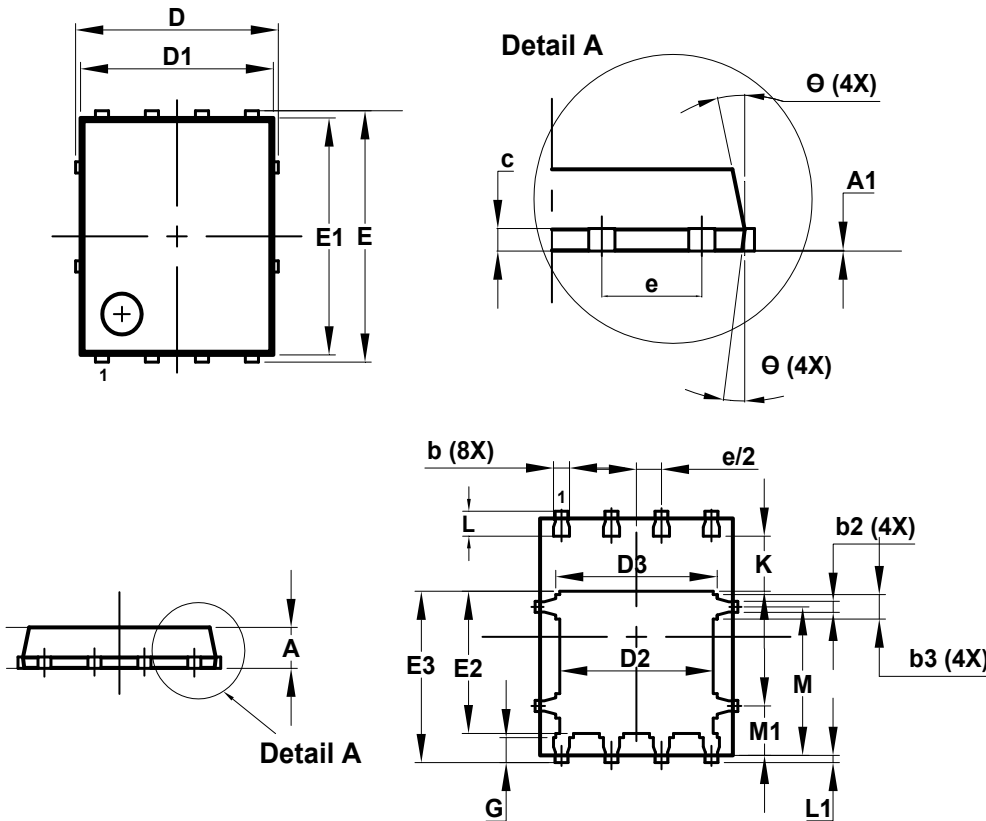


Fig. 12 Single-Pulse Avalanche Tested



**Package Outline Dimensions**

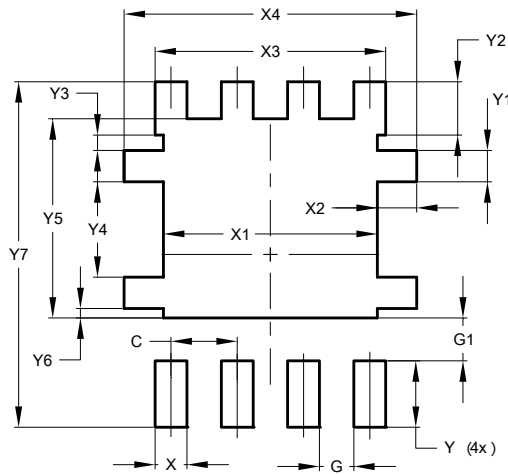
Please see AP02002 at <http://www.diodes.com/datasheets/ap02002.pdf> for latest version.



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	0.050	0.20	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 AP02001 at <http://www.diodes.com/datasheets/ap02001.pdf> for the latest version.



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

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