

## Product Summary

BV <sub>DSS</sub>	R <sub>DS(ON)</sub> Max	I <sub>D</sub> T <sub>C</sub> = +25°C
60V	10mΩ @ V <sub>GS</sub> = 10V	89.5A
	13.5mΩ @ V <sub>GS</sub> = 4.5V	77A

## Description

This MOSFET is designed to minimize the on-state resistance (R<sub>DS(ON)</sub>) yet maintain superior switching performance, making it ideal for high-efficiency power-management applications.

## Applications

- High frequency switching
- Sync. rectifications
- DCDC converters

## Features

- Rated to +175°C – Ideal for High Ambient Temperature Environments
- 100% Unclamped Inductive Switching – Ensures More Reliable and Robust End Application
- Low R<sub>DS(ON)</sub> – Minimizes Power Losses
- Low Q<sub>G</sub> – Minimizes Switching Losses
- **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/>**

## Mechanical Data

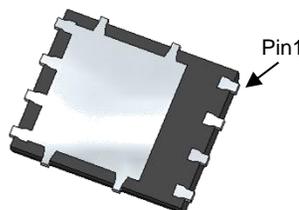
- Package: PowerDI<sup>®</sup>5060-8
- Package Material: Molded Plastic, “Green” Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminal Finish – Matte Tin Annealed over Copper Leadframe. Solderable per MIL-STD-202, Method 208 **Ⓔ**
- Weight: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

Site 1:

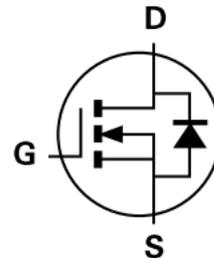
PowerDI5060-8



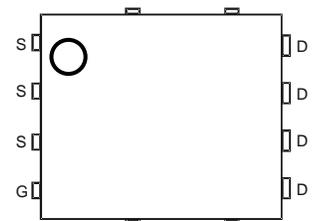
Top View



Bottom View



Internal Schematic



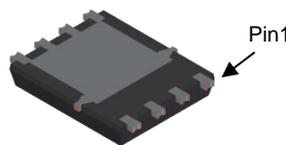
Top View  
Pin Configuration

Site 2:

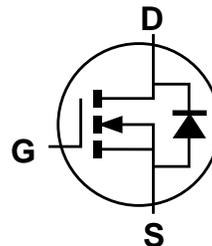
PowerDI5060-8/SWP (Type UX)



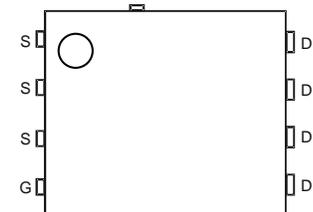
Top View



Bottom View



Internal Schematic



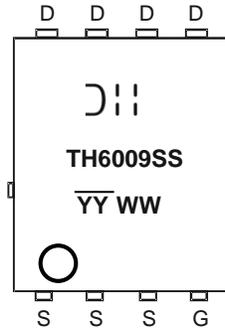
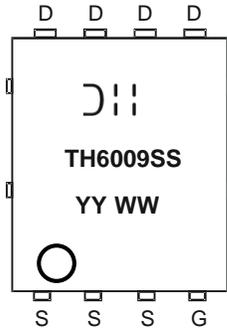
Top View  
Pin Configuration

- 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.

**Ordering Information** (Note 4)

Part Number	Package	Packing	
		Qty.	Carrier
DMTH6009SPS-13	PowerDI5060-8	2,500	Tape & Reel
DMTH6009SPS-13	PowerDI5060-8/SWP (Type UX)	2,500	Tape & Reel

Note: 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 Code Marking  
 TH6009SS = Product Type Marking Code  
 YYWW = Date Code Marking  
 YY or YY = Year (ex: 23 = 2023)  
 WW = Week (01 to 53)

**Maximum Ratings** (@ $T_A = +25^\circ\text{C}$ , unless otherwise specified.)

Characteristic	Symbol	Value	Unit
Drain-Source Voltage	$V_{DS}$	60	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	V
Continuous Drain Current (Note 5)	$I_D$	$T_A = +25^\circ\text{C}$	12.9
		$T_A = +100^\circ\text{C}$	9.1
Continuous Drain Current (Note 6)	$I_D$	$T_C = +25^\circ\text{C}$	89.5
		$T_C = +100^\circ\text{C}$	63.3
Maximum Continuous Body Diode Forward Current (Note 6)	$I_S$	80	A
Pulsed Drain Current (10 $\mu\text{s}$ Pulse, Duty Cycle = 1%)	$I_{DM}$	350	A
Pulsed Body Diode Forward Current (10 $\mu\text{s}$ Pulse, Duty Cycle = 1%)	$I_{SM}$	350	A
Avalanche Current, $L = 0.1\text{mH}$	$I_{AS}$	20.3	A
Avalanche Energy, $L = 0.1\text{mH}$	$E_{AS}$	20.6	mJ

**Thermal Characteristics**

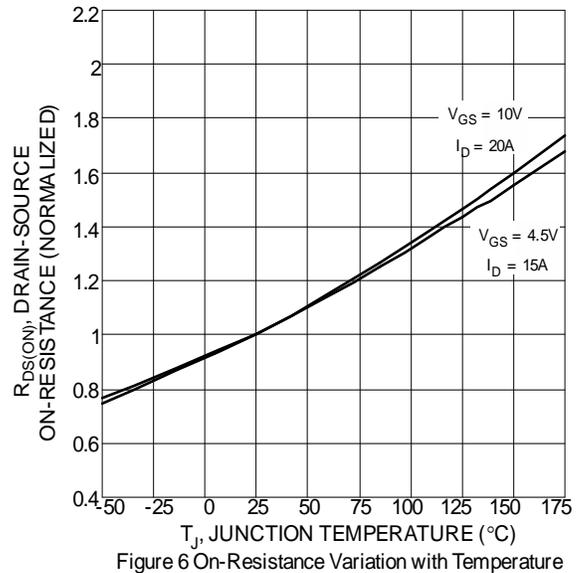
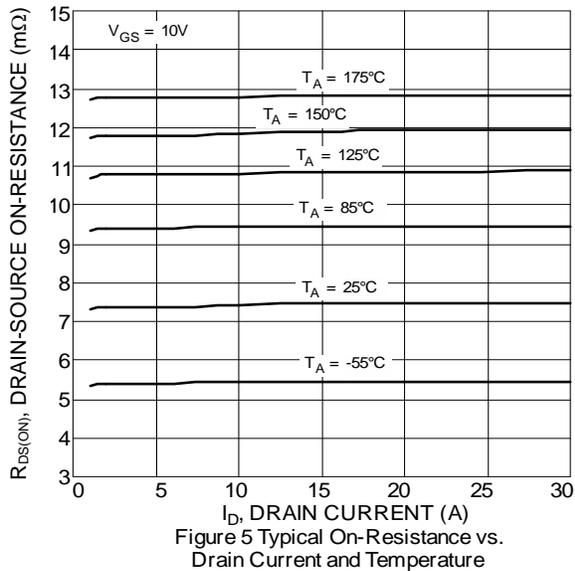
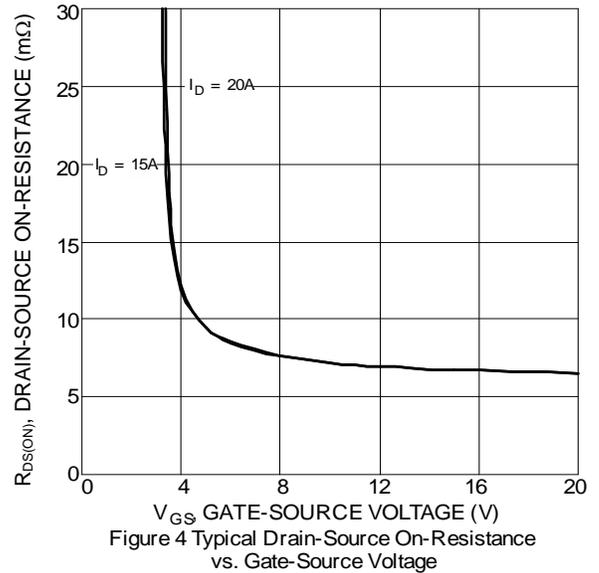
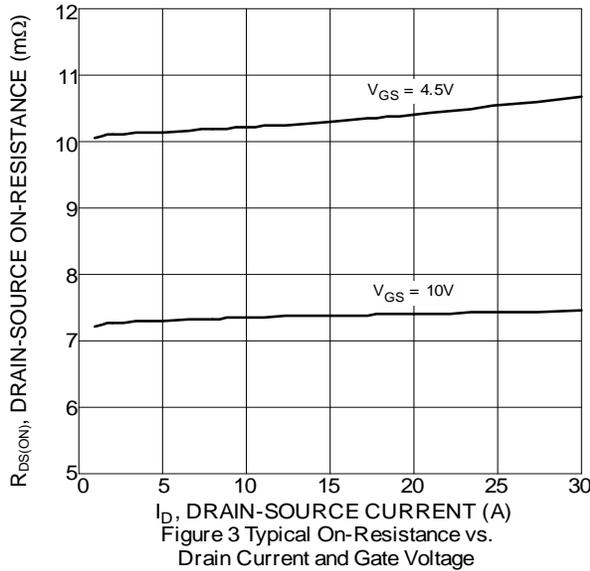
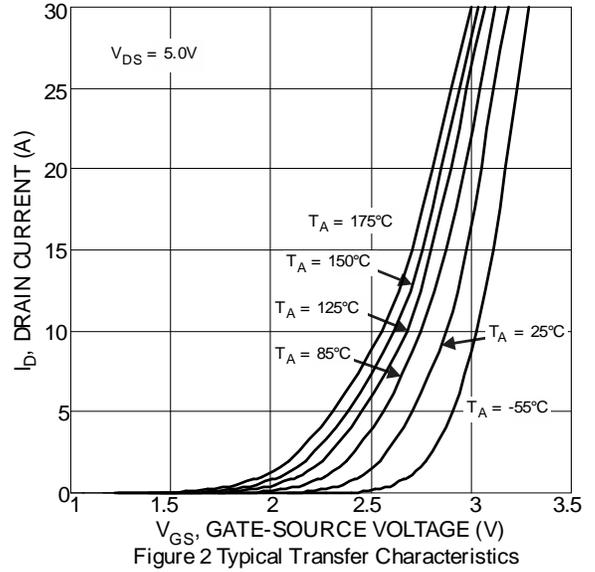
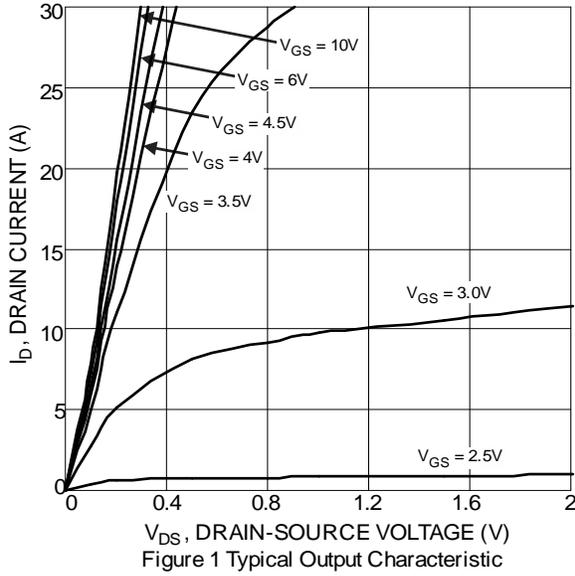
Characteristic	Symbol	Value	Unit
Total Power Dissipation (Note 5)	$P_D$	2.8	W
Thermal Resistance, Junction to Ambient (Note 5)	$R_{\theta JA}$	53	$^\circ\text{C}/\text{W}$
Total Power Dissipation (Note 6)	$P_D$	136	W
Thermal Resistance, Junction to Case (Note 6)	$R_{\theta JC}$	1.1	$^\circ\text{C}/\text{W}$
Operating and Storage Temperature Range	$T_J, T_{STG}$	-55 to +175	$^\circ\text{C}$

Notes: 5. Device mounted on FR-4 substrate PC board, 2oz copper, with thermal bias to bottom layer 1-inch square copper plate.  
 6. 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</b> (Note 7)						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	60	—	—	V	V <sub>GS</sub> = 0V, I <sub>D</sub> = 1mA
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	—	—	1	μA	V <sub>DS</sub> = 48V, 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</b> (Note 7)						
Gate Threshold Voltage	V <sub>GS(TH)</sub>	1.2	—	2.8	V	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA
Static Drain-Source On-Resistance	R <sub>DS(ON)</sub>	—	7.6	10	mΩ	V <sub>GS</sub> = 10V, I <sub>D</sub> = 20A
		—	10.7	13.5		V <sub>GS</sub> = 4.5V, I <sub>D</sub> = 15A
Diode Forward Voltage	V <sub>SD</sub>	—	0.9	1.2	V	V <sub>GS</sub> = 0V, I <sub>S</sub> = 20A
<b>DYNAMIC CHARACTERISTICS</b> (Note 8)						
Input Capacitance	C <sub>iss</sub>	—	1572	—	pF	V <sub>DS</sub> = 30V, V <sub>GS</sub> = 0V, f = 1MHz
Output Capacitance	C <sub>oss</sub>	—	490	—		
Reverse Transfer Capacitance	C <sub>rss</sub>	—	50	—		
Gate Resistance	R <sub>g</sub>	—	1.6	—	Ω	V <sub>DS</sub> = 0V, V <sub>GS</sub> = 0V, f = 1MHz
Total Gate Charge (V <sub>GS</sub> = 10V)	Q <sub>g</sub>	—	29.3	—	nC	V <sub>DS</sub> = 30V, I <sub>D</sub> = 13.5A
Total Gate Charge (V <sub>GS</sub> = 4.5V)	Q <sub>g</sub>	—	13.9	—		
Gate-Source Charge	Q <sub>gs</sub>	—	4.3	—		
Gate-Drain Charge	Q <sub>gd</sub>	—	5.9	—		
Turn-On Delay Time	t <sub>D(ON)</sub>	—	5.4	—	ns	V <sub>DD</sub> = 30V, V <sub>GS</sub> = 10V, R <sub>G</sub> = 6Ω, I <sub>D</sub> = 13.5A
Turn-On Rise Time	t <sub>r</sub>	—	9.8	—		
Turn-Off Delay Time	t <sub>D(OFF)</sub>	—	28.1	—		
Turn-Off Fall Time	t <sub>f</sub>	—	16.3	—		
Body Diode Reverse Recovery Time	t <sub>RR</sub>	—	17.2	—	ns	I <sub>F</sub> = 13.5A, di/dt = 400A/μs
Body Diode Reverse Recovery Charge	Q <sub>RR</sub>	—	25.1	—	nC	

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



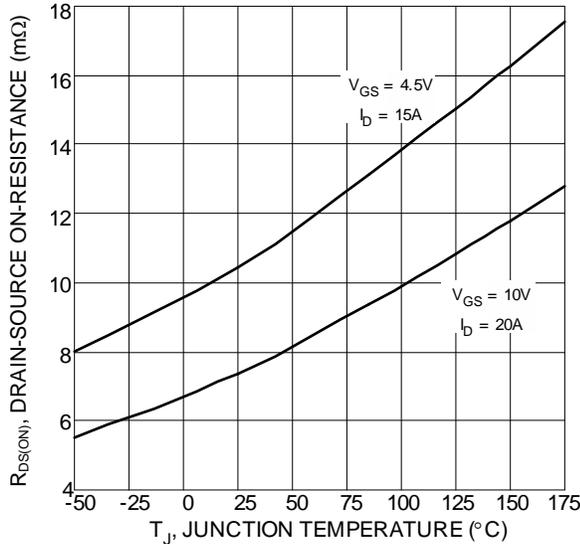


Figure 7 On-Resistance Variation with Temperature

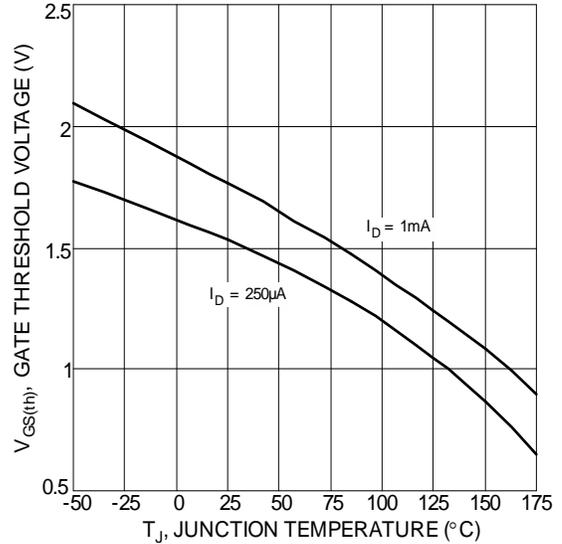


Figure 8 Threshold Variation vs. Temperature

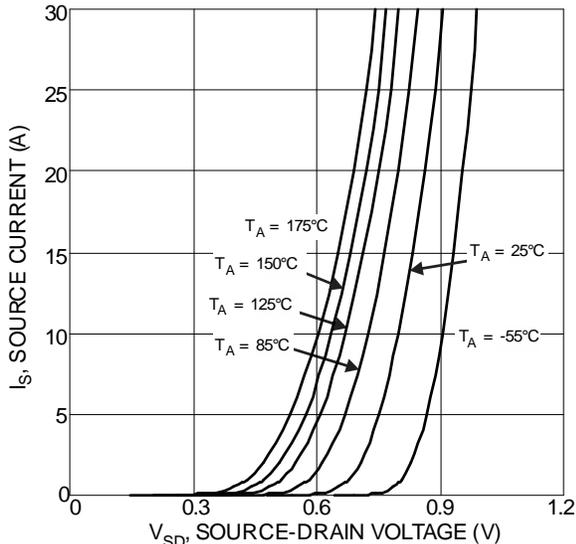


Figure 9 Diode Forward Voltage vs. Current

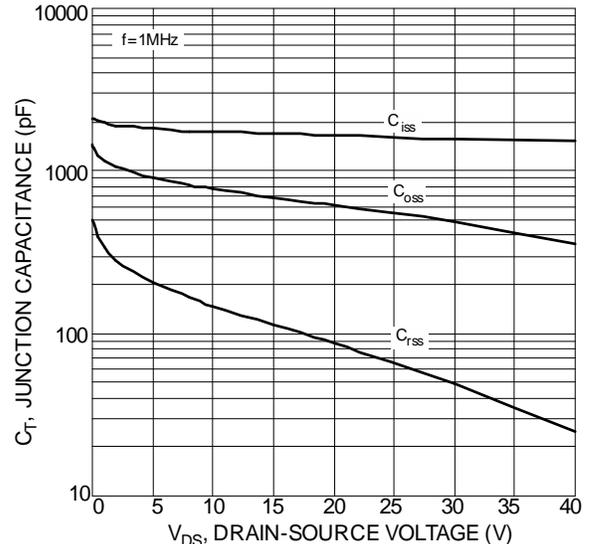


Figure 10 Typical Junction Capacitance

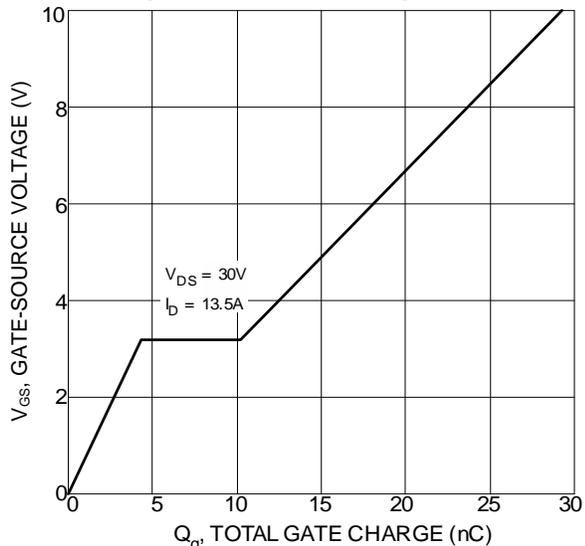


Figure 11 Gate Charge

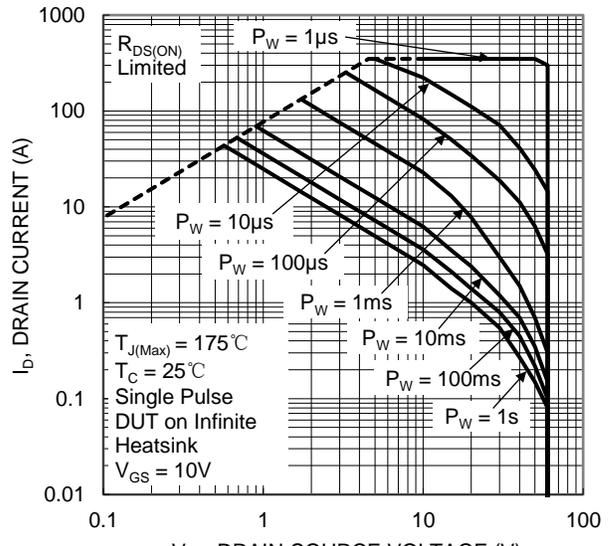


Figure 12. SOA, Safe Operation Area

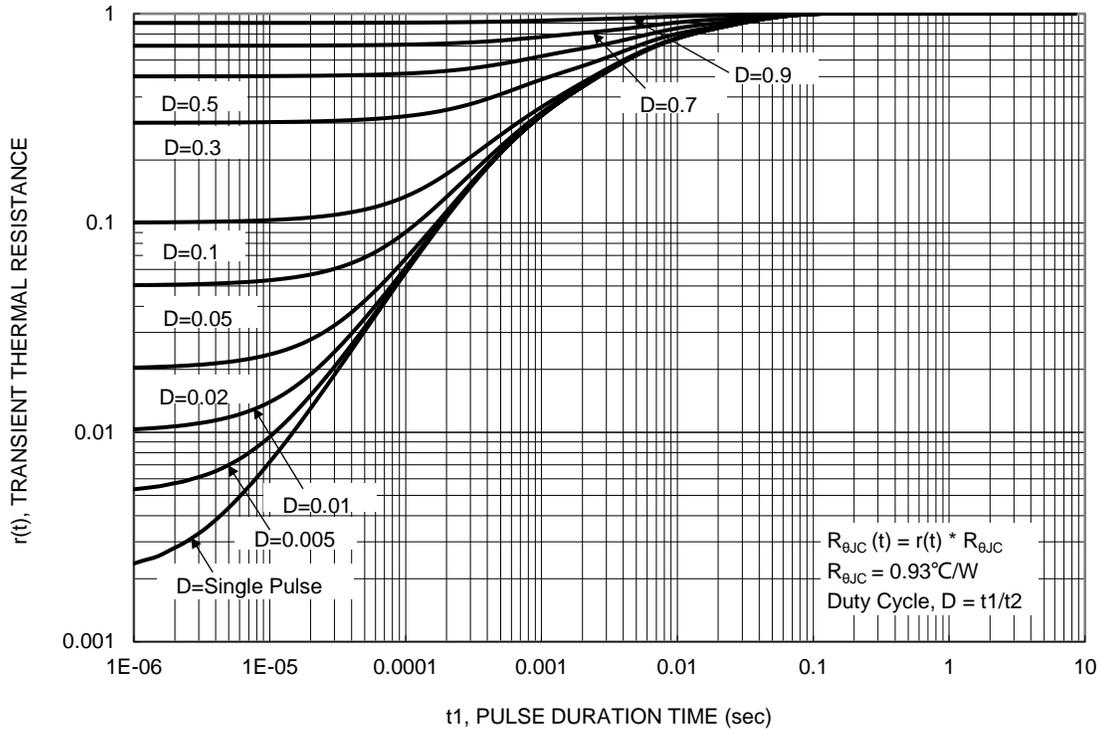


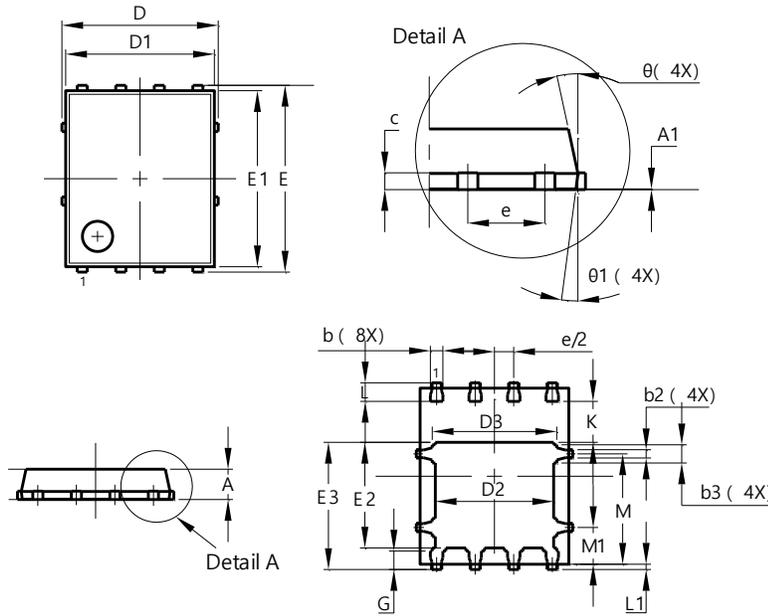
Figure 13. Transient Thermal Resistance

**Package Outline Dimensions**

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

Site 1:

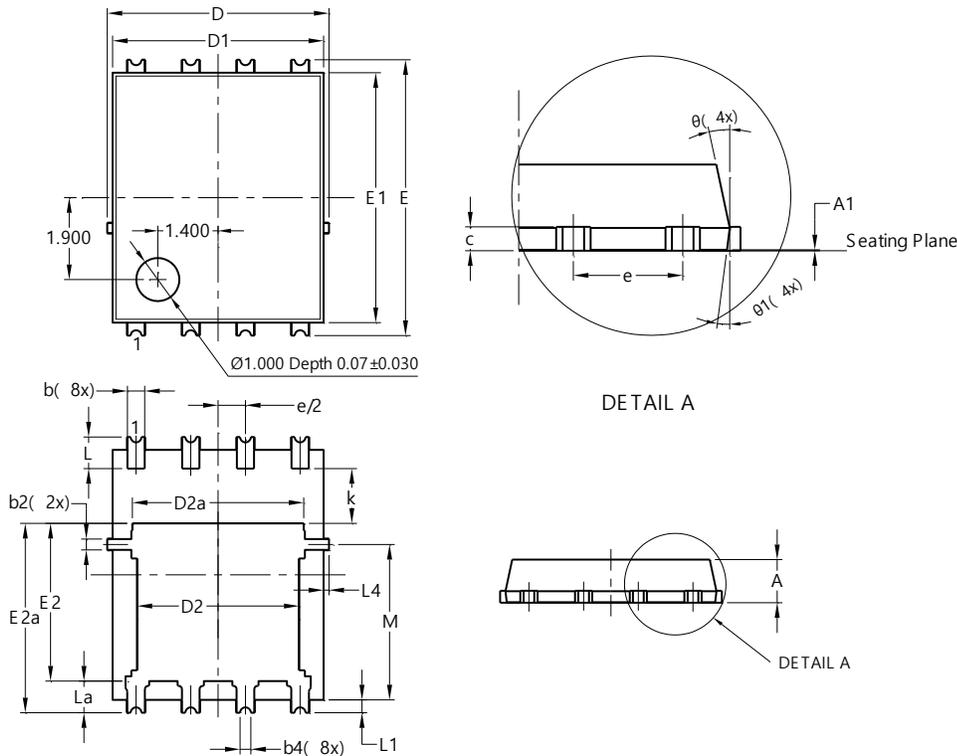
**PowerDI5060-8**



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
θ	10°	12°	11°
θ1	6°	8°	7°
All Dimensions in mm			

Site 2:

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



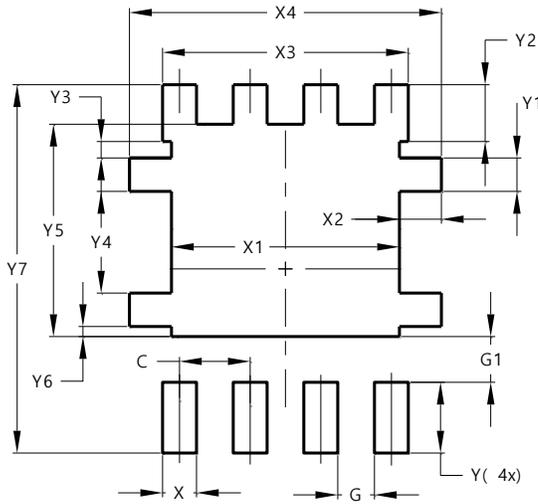
PowerDI5060-8/SWP (Type UX)			
Dim	Min	Max	Typ
A	0.90	1.10	1.00
A1	0	0.05	--
b	0.30	0.50	0.41
b2	0.20	0.35	0.25
b4	0.25REF		
c	0.230	0.330	0.277
D	5.15 BSC		
D1	4.70	5.10	4.90
D2	3.56	3.96	3.76
D2a	3.78	4.18	3.98
E	6.40 BSC		
E1	5.60	6.00	5.80
E2	3.46	3.86	3.66
E2a	4.195	4.595	4.395
e	1.27BSC		
k	1.05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

Site 1:

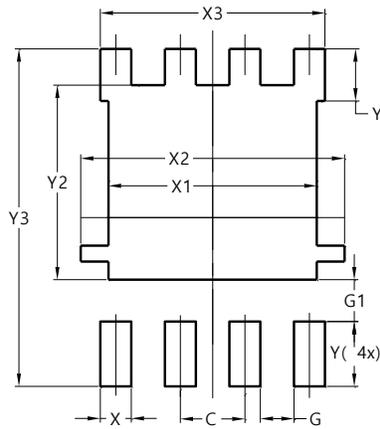
**PowerDI5060-8**



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

Site 2:

**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>	5.190
<b>X3</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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