

Product Summary

BV _{DSS}	R _{DS(ON)} Max	I _D T _C = +25°C
-60V	48mΩ @ V _{GS} = -10V	-26A
	60mΩ @ V _{GS} = -4.5V	-23A

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:

- Engine management systems
- Body control electronics
- DC-DC converters

Features and Benefits

- Rated to +175°C – ideal for high ambient temperature environments
- 100% Unclamped Inductive Switching – ensures more reliable and robust end application
- Low R_{DS(ON)} – minimises power losses
- Low Q_g – minimises switching losses
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. “Green” Device (Note 3)**
- **The DMPH6050SPDQ is suitable for automotive applications requiring specific change control; this part is AEC-Q101 qualified, PPAP capable, and manufactured in IATF 16949 certified facilities.**

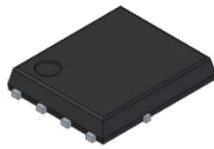
<https://www.diodes.com/quality/product-definitions/>

Mechanical Data

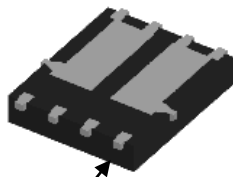
- Package: PowerDI[®]5060-8
- Package Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminal Connections Indicator: See Diagram
- Terminals: Finish — Matte Tin Annealed over Copper Leadframe. Solderable per MIL-STD-202, Method 208 (E3)
- Weight: 0.097 grams (Approximate)

Site 1:

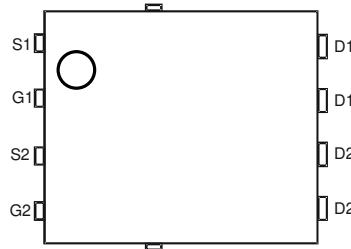
PowerDI5060-8 (Type C)



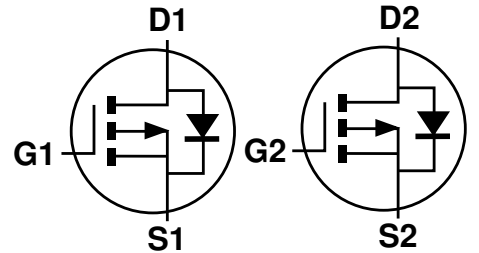
Top View



Bottom View



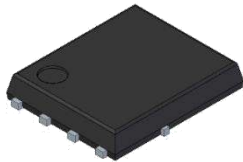
Top View
Pin Configuration



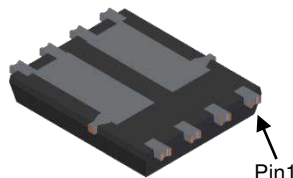
Equivalent Circuit

Site 2:

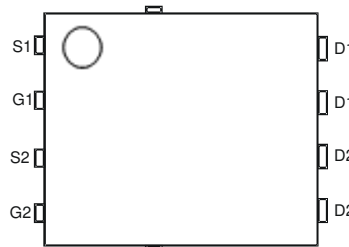
PowerDI5060-8/SWP (Type UXD)



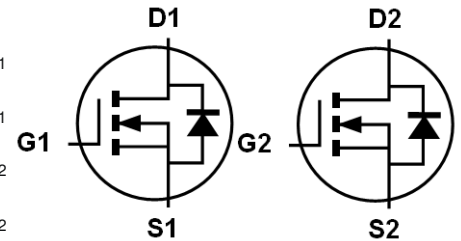
Top View



Bottom View



Top View
Pin Configuration



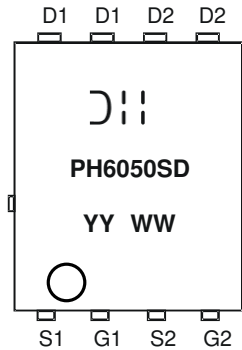
Equivalent Circuit

- 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 <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
DMPH6050SPDQ-13	PowerDI5060-8 (Type C)	2500	Tape & Reel
DMPH6050SPDQ-13	PowerDI5060-8/SWP (Type UXD)	2500	Tape & Reel

Note: 4. For packaging details, go to our website at <https://www.diodes.com/design/support/packaging/diodes-packaging/>.

Marking Information


= Manufacturer's Marking
 PH6050SD = 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_{DSS}	-60	V
Gate-Source Voltage	V_{GSS}	± 20	V
Continuous Drain Current (Note 6) $V_{GS} = -10\text{V}$	I_D	Steady State $T_A = +25^\circ\text{C}$	-6.3
		$T_A = +100^\circ\text{C}$	-4.4
Continuous Drain Current (Note 7) $V_{GS} = -10\text{V}$	I_D	Steady State $T_C = +25^\circ\text{C}$	-26
		$T_C = +100^\circ\text{C}$	-18
Pulsed Drain Current (10 μs Pulse, Duty Cycle = 1%)	I_{DM}	-40	A
Maximum Continuous Body Diode Forward Current (Note 6)	I_S	-2.0	A
Avalanche Current (Note 8) $L = 0.1\text{mH}$	I_{AS}	-21	A
Avalanche Energy (Note 8) $L = 0.1\text{mH}$	E_{AS}	30	mJ

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

Characteristic	Symbol	Value	Unit
Total Power Dissipation (Note 5)	P_D	1.5	W
Thermal Resistance, Junction to Ambient (Note 5)	$R_{\theta JA}$	Steady State	100
		$t < 10\text{s}$	53
Total Power Dissipation (Note 6)	P_D	2.8	W
Thermal Resistance, Junction to Ambient (Note 6)	$R_{\theta JA}$	Steady State	52
		$t < 10\text{s}$	27
Thermal Resistance, Junction to Case (Note 7)	$R_{\theta JC}$	2.9	$^\circ\text{C/W}$
Operating and Storage Temperature Range	T_J, T_{STG}	-55 to +175	$^\circ\text{C}$

- 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 $T_J = +25^\circ\text{C}$.

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

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
OFF CHARACTERISTICS (Note 9)						
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 9)						
Gate Threshold Voltage	V _{GS(TH)}	-1.0	—	-3.0	V	V _{DS} = V _{GS} , I _D = -250μA
Static Drain-Source On-Resistance	R _{DS(ON)}	—	36	48	mΩ	V _{GS} = -10V, I _D = -5A
			44	60		V _{GS} = -4.5V, I _D = -4A
Diode Forward Voltage	V _{SD}	—	-0.7	-1.2	V	V _{GS} = 0V, I _S = -1A
DYNAMIC CHARACTERISTICS (Note 10)						
Input Capacitance	C _{iss}	—	1525	—	pF	V _{DS} = -30V, V _{GS} = 0V, f = 1.0MHz
Output Capacitance	C _{oss}	—	90	—	pF	
Reverse Transfer Capacitance	C _{rss}	—	70	—	pF	
Gate Resistance	R _g	—	16	—	Ω	V _{DS} = 0V, V _{GS} = 0V, f = 1MHz
Total Gate Charge (V _{GS} = -4.5V)	Q _g	—	14.5	—	nC	V _{DS} = -30V, I _D = -5A
Total Gate Charge (V _{GS} = -10V)	Q _g	—	30.6	—	nC	
Gate-Source Charge	Q _{gs}	—	4.9	—	nC	
Gate-Drain Charge	Q _{gd}	—	5.2	—	nC	
Turn-On Delay Time	t _{D(ON)}	—	5.3	—	ns	V _{GS} = -10V, V _{DS} = -30V, R _G = 3Ω, I _D = -5A
Turn-On Rise Time	t _r	—	15.4	—	ns	
Turn-Off Delay Time	t _{D(OFF)}	—	79.2	—	ns	
Turn-Off Fall Time	t _f	—	45.3	—	ns	
Body Diode Reverse Recovery Time	t _{RR}	—	15.2	—	ns	I _F = -5A, di/dt = -100A/μs
Body Diode Reverse Recovery Charge	Q _{RR}	—	9.3	—	nC	I _F = -5A, di/dt = -100A/μs

Notes: 9. Short duration pulse test used to minimize self-heating effect.
10. Guaranteed by design. Not subject to product testing.

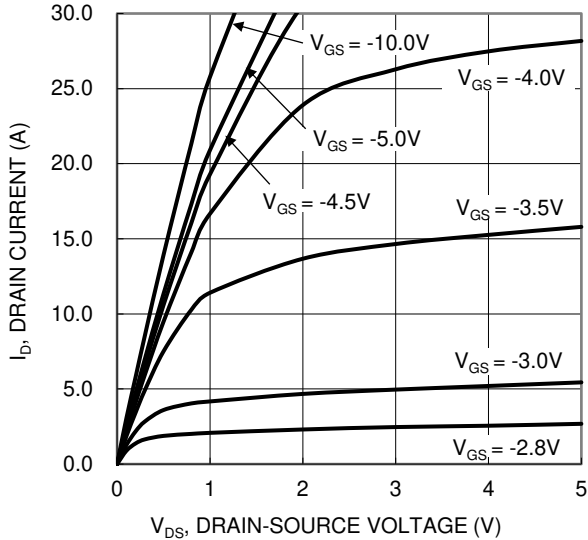


Figure 1. Typical Output Characteristic

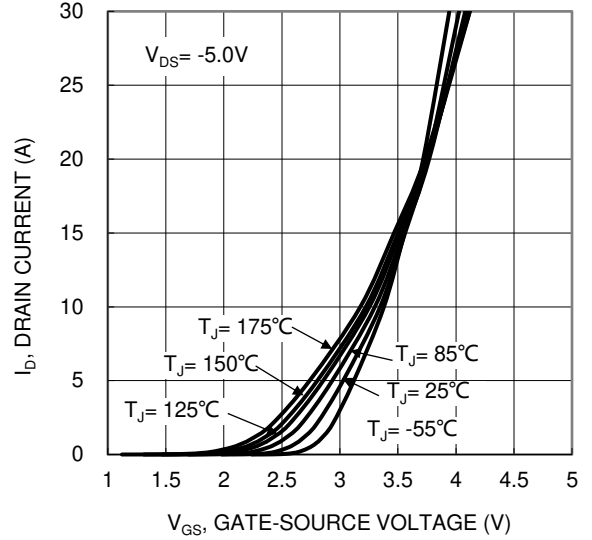


Figure 2. Typical Transfer Characteristic

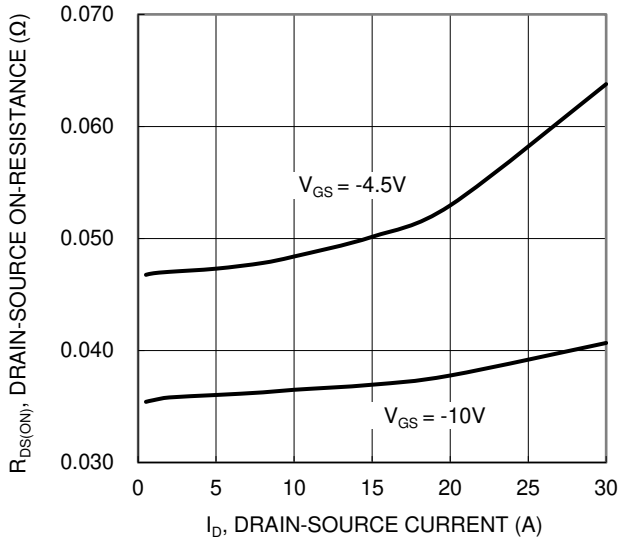


Figure 3. Typical On-Resistance vs. Drain Current and Gate Voltage

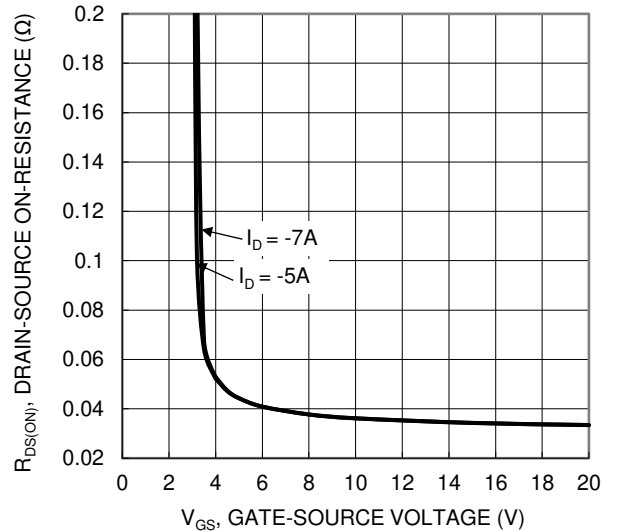


Figure 4. Typical Transfer Characteristic

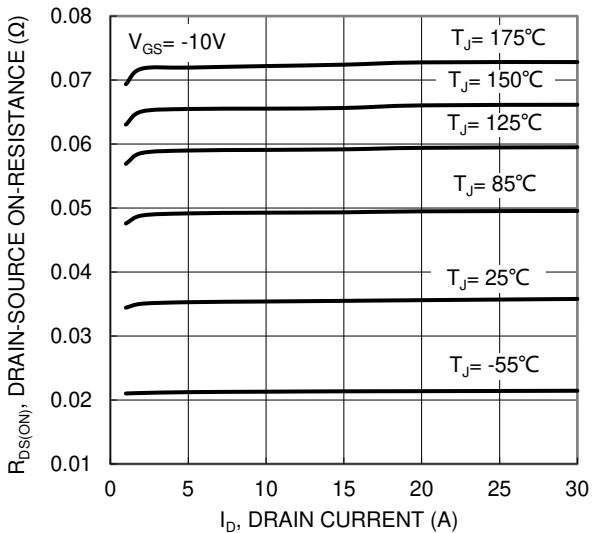


Figure 5. Typical On-Resistance vs. Drain Current and Temperature

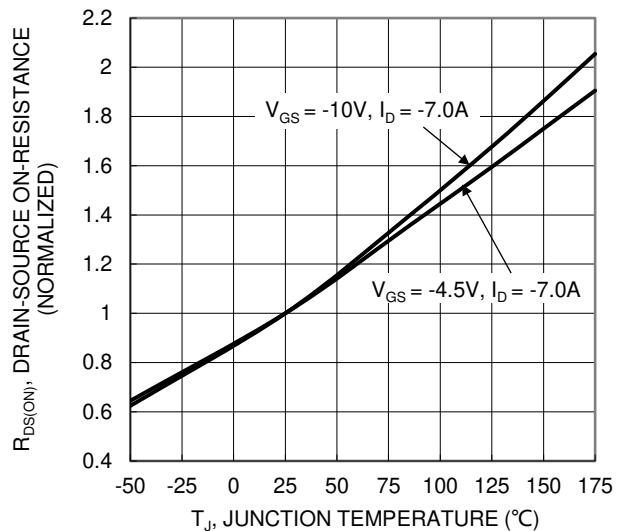


Figure 6. On-Resistance Variation with Temperature

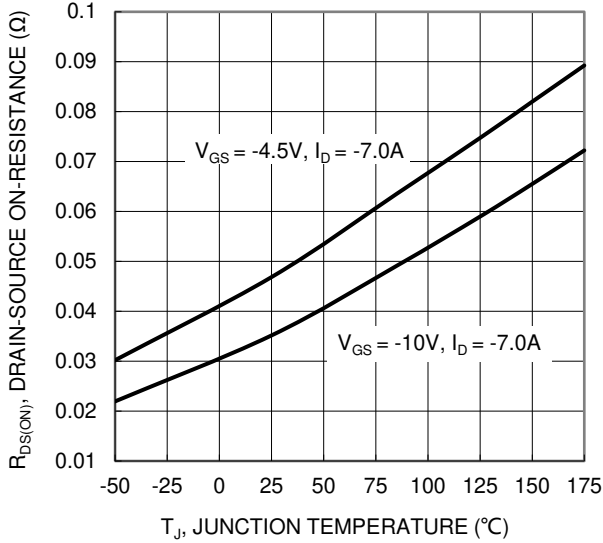


Figure 7. On-Resistance Variation with Temperature

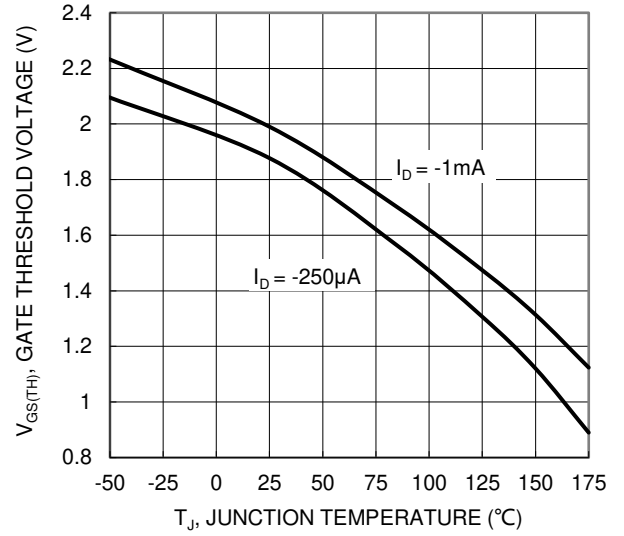


Figure 8. Gate Threshold Variation vs Temperature

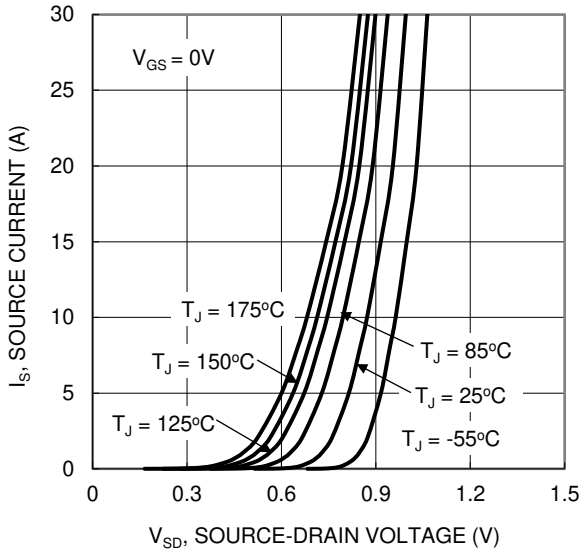


Figure 9. Diode Forward Voltage vs. Current

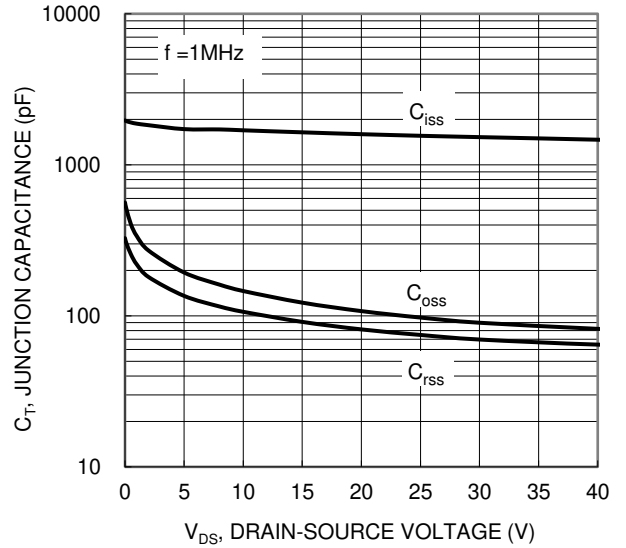


Figure 10. Typical Junction Capacitance

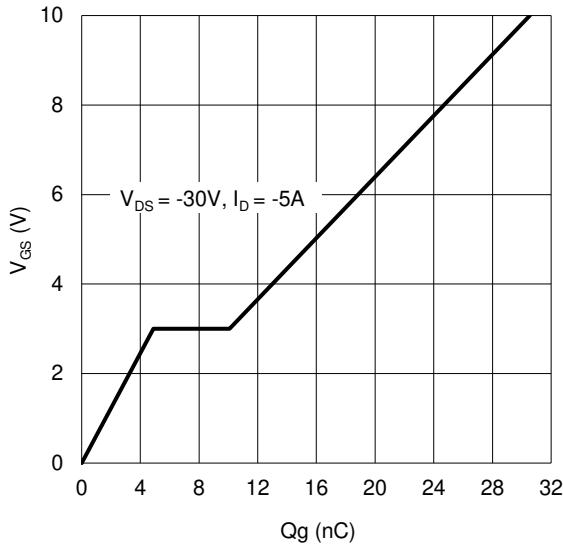


Figure 11. Gate Charge

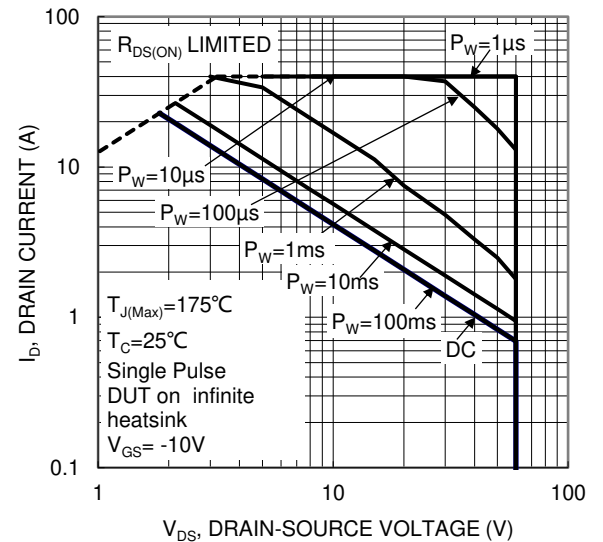


Figure 12. SOA, Safe Operation Area

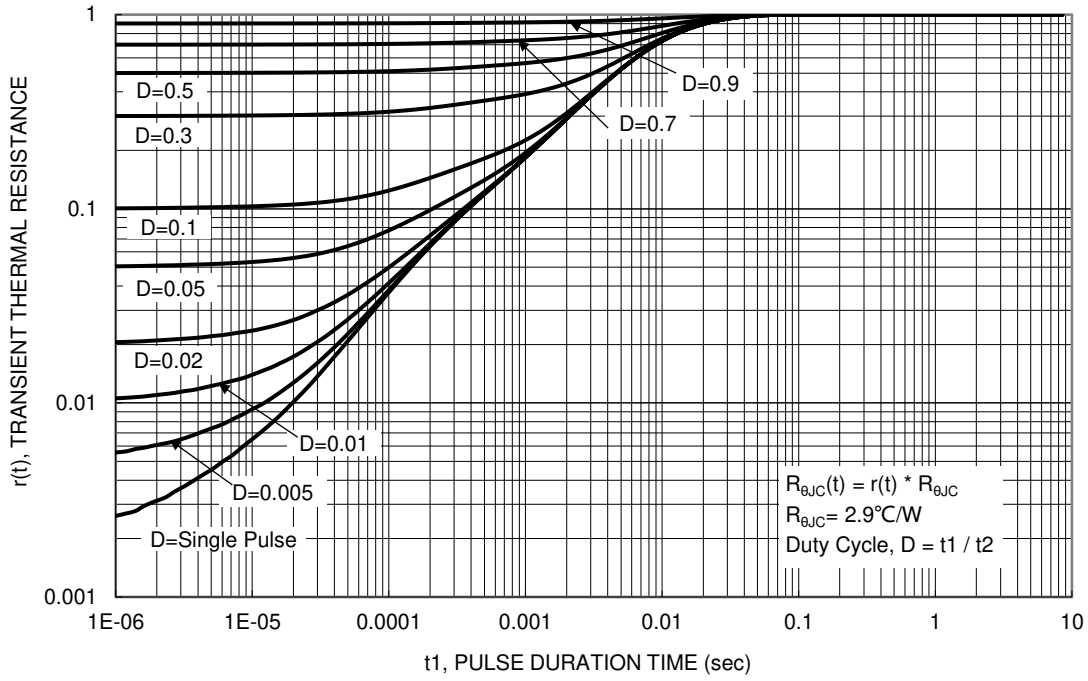


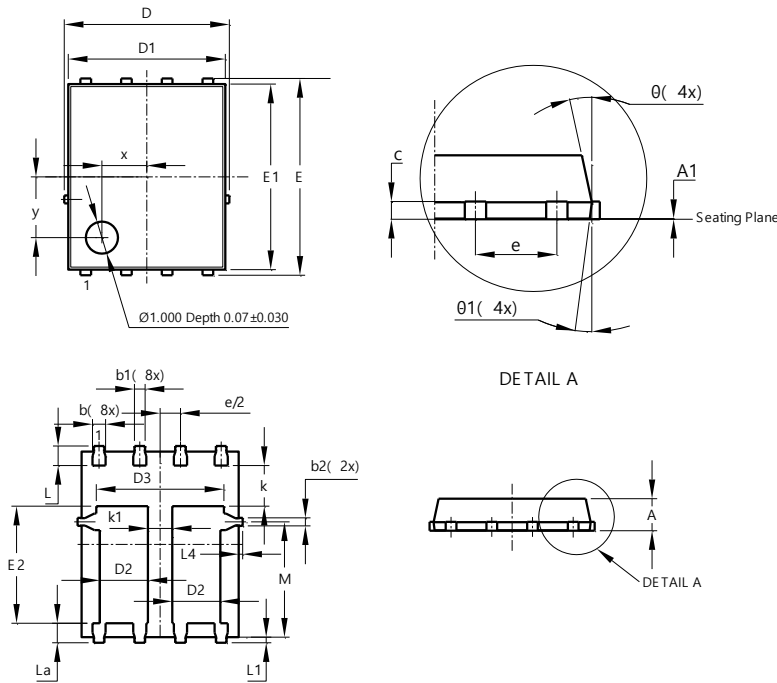
Figure 13. Transient Thermal Resistance

Package Outline Dimensions

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

Site1:

PowerDI5060-8 (Type C)



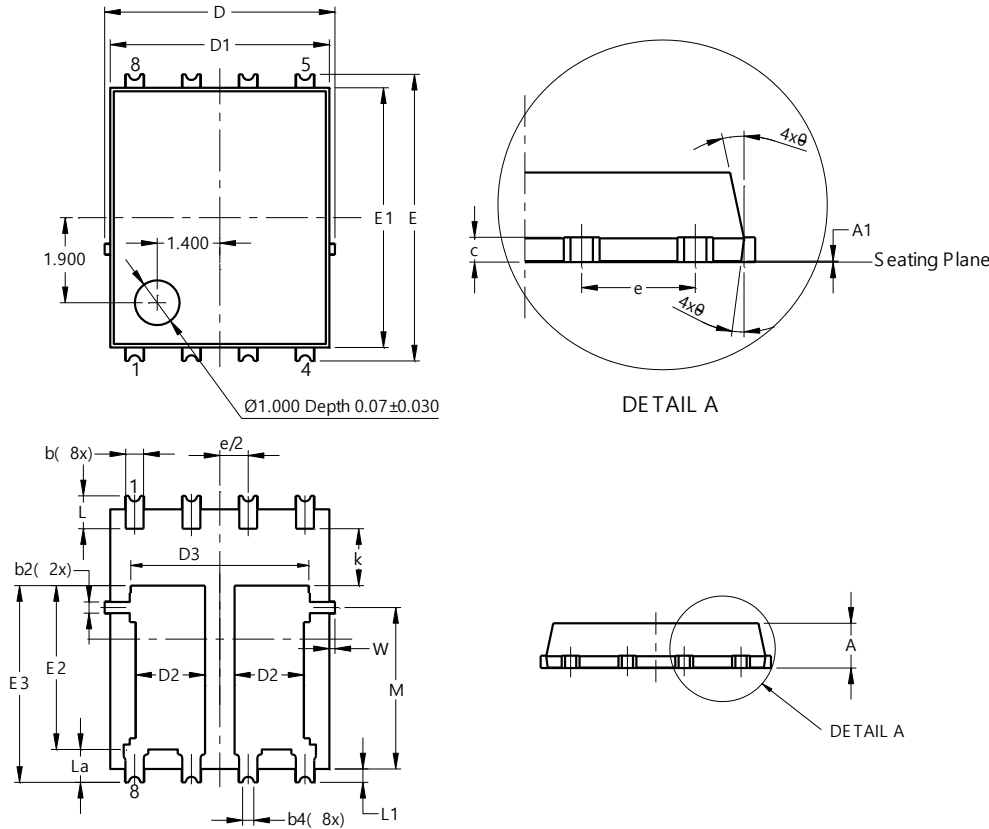
PowerDI5060-8 (Type C)			
Dim	Min	Max	Typ
A	0.90	1.10	1.00
A1	0	0.05	0.02
b	0.33	0.51	0.41
b1	0.300	0.366	0.333
b2	0.20	0.35	0.25
c	0.23	0.33	0.277
D	5.15 BSC		
D1	4.85	4.95	4.90
D2	1.40	1.60	1.50
D3	-	-	3.98
E	6.15 BSC		
E1	5.75	5.85	5.80
E2	3.56	3.76	3.66
e	1.27BSC		
k	-	-	1.27
k1	0.56	-	-
L	0.51	0.71	0.61
La	0.51	0.71	0.61
L1	0.05	0.20	0.175
L4	-	-	0.125
M	3.50	3.71	3.605
x	-	-	1.400
y	-	-	1.900
θ	10°	12°	11°
θ1	6°	8°	7°
All Dimensions in mm			

Package Outline Dimensions (continued)

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

Site2:

PowerDI5060-8/SWP (Type UXD)



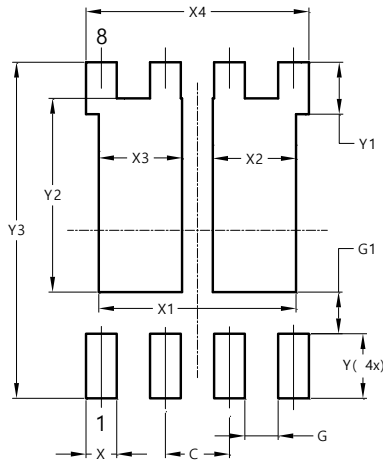
PowerDI5060-8/SWP (Type UXD)			
Dim	Min	Max	Typ
A	0.90	1.10	1.00
A1	0.00	0.05	--
b	0.30	0.50	0.41
b2	0.20	0.35	0.25
b4	0.25REF		
c	0.230	0.330	0.277
D	5.15 BSC		
D1	4.70	5.10	4.90
D2	1.46	1.66	1.55
D3	3.78	4.18	3.98
E	6.40 BSC		
E1	5.60	6.00	5.80
E2	3.46	3.86	3.66
E2a	4.195	4.595	4.395
e	1.27BSC		
k	1.05	--	--
L	0.635	0.835	0.735
La	0.635	0.835	0.735
L1	0.200	0.400	0.300
M	3.205	4.005	3.605
W	0.025	0.225	0.125
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.

Site1:

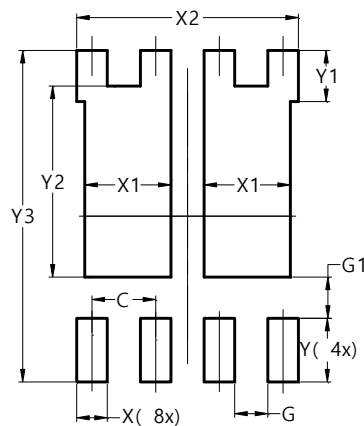
PowerDI5060-8 (Type C)



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

Site2:

PowerDI5060-8/SWP (Type UXD)



Dimensions	Value (in mm)
C	1.270
G	0.660
G1	0.820
X	0.610
X1	1.720
X2	4.420
Y	1.270
Y1	1.020
Y2	3.810
Y3	6.610

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