60V 175°C N-CHANNEL ENHANCEMENT MODE MOSFET
PowerDI5060-8

Product Summary

BV_{DSS}	$R_{DS(ON)}$ Max	I_D Max T_C = +25°C
60V	23mΩ @ V_{GS} = 10V	44A
	28mΩ @ V_{GS} = 4.5V	40A

Description and Applications

This 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.

- Backlighting
- Power Management Functions
- DC-DC Converters

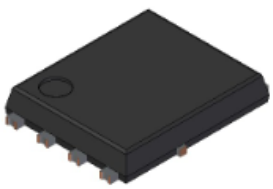
Features and Benefits

- Rated to +175°C – Ideal for High Ambient Temperature Environments
- 100% Unclamped Inductive Switch (UIS) Test in Production
- High Conversion Efficiency
- Low $R_{DS(ON)}$ – Minimizes On State Losses
- Low Input Capacitance
- Fast Switching Speed
- Wettable Flank for Improved Optical Inspection
- **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-Q100/101/200, 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/**

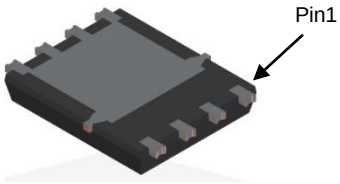
Mechanical Data

- 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
- Terminal Finish - Matte Tin Annealed over Copper Leadframe; Solderable per MIL-STD-202, Method 208 e3
- Weight: 0.097 grams (Approximate)

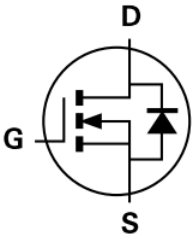
PowerDI5060-8 (SWP) (Type UX)



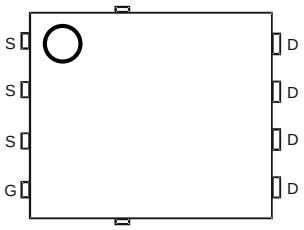
Top View



Bottom View



Internal Schematic



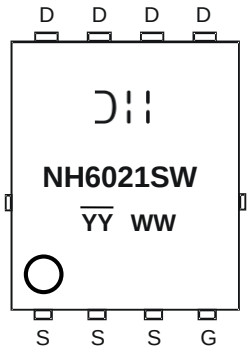
Top View
Pin Configuration

Ordering Information (Note 4)

Part Number	Case	Packaging
DMNH6021SPSW-13	PowerDI5060-8 (SWP) (Type UX)	2,500 / Tape & 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



= Manufacturer's Marking
NH6021SW = Product Type Marking Code
YYWW = Date Code Marking
YY = Year (ex: 20 = 2020)
WW = Week (01 to 53)

Maximum Ratings (@T_A = +25°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, V_{GS} = 10V (Note 7)	T_C = +25°C T_C = +100°C	I_D	44 31	A
Maximum Continuous Body Diode Forward Current (Note 6)		I_S	44	A
Pulsed Drain Current (10µs Pulse, Duty Cycle = 1%)		I_{DM}	176	A
Pulsed Source Current (10µs Pulse, Duty Cycle = 1%)		I_{SM}	176	A
Avalanche Current, L = 0.1mH		I_{AS}	35.7	A
Avalanche Energy, L = 0.1mH		E_{AS}	64	mJ

Thermal Characteristics

Characteristic		Symbol	Value	Unit
Total Power Dissipation (Note 5)		P_D	1.6	W
Thermal Resistance, Junction to Ambient (Note 5)	Steady State	$R_{\theta JA}$	96	°C/W
Total Power Dissipation (Note 6)		P_D	3.0	W
Thermal Resistance, Junction to Ambient (Note 6)	Steady State	$R_{\theta JA}$	50	°C/W
Total Power Dissipation (Note 7)		P_D	100	W
Thermal Resistance, Junction to Case (Note 7)	Steady State	$R_{\theta JC}$	1.5	°C/W
Operating and Storage Temperature Range		T_J, T_{STG}	-55 to +175	°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_A = +25°C, unless otherwise specified.)

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
OFF CHARACTERISTICS (Note 8)						
Drain-Source Breakdown Voltage	BV_{DSS}	60	—	—	V	V_{GS} = 0V, I_D = 250µA
Zero Gate Voltage Drain Current	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 8)						
Gate Threshold Voltage	$V_{GS(TH)}$	1	—	3	V	V_{DS} = V_{GS}, I_D = 250µA
Static Drain-Source On-Resistance	$R_{DS(ON)}$	—	12	23	mΩ	V_{GS} = 10V, I_D = 12A
		—	20	28		V_{GS} = 4.5V, I_D = 12A
Diode Forward Voltage	V_{SD}	—	0.75	1.2	V	V_{GS} = 0V, I_S = 20A
DYNAMIC CHARACTERISTICS (Note 9)						
Input Capacitance	C_{iss}	—	1,132	—	pF	V_{DS} = 30V, V_{GS} = 0V, f = 1MHz
Output Capacitance	C_{oss}	—	157	—		
Reverse Transfer Capacitance	C_{rss}	—	75	—		
Gate Resistance	R_g	—	2.5	—	Ω	V_{DS} = 0V, V_{GS} = 0V, f = 1MHz
Total Gate Charge (V_{GS} = 4.5V)	Q_g	—	9.7	—	nC	V_{DS} = 30V, I_D = 20A
Total Gate Charge (V_{GS} = 10V)	Q_g	—	20.1	—		
Gate-Source Charge	Q_{gs}	—	4.3	—		
Gate-Drain Charge	Q_{gd}	—	5.5	—		
Turn-On Delay Time	$t_{D(ON)}$	—	4.4	—	ns	V_{DD} = 30V, V_{GS} = 10V, I_D = 20A, R_G = 4.7Ω
Turn-On Rise Time	t_R	—	6.0	—		
Turn-Off Delay Time	$t_{D(OFF)}$	—	14.2	—		
Turn-Off Fall Time	t_F	—	5.4	—		
Body Diode Reverse Recovery Time	t_{RR}	—	21.2	—	ns	I_F = 20A, di/dt = 100A/µs
Body Diode Reverse Recovery Charge	Q_{RR}	—	15.2	—	nC	

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

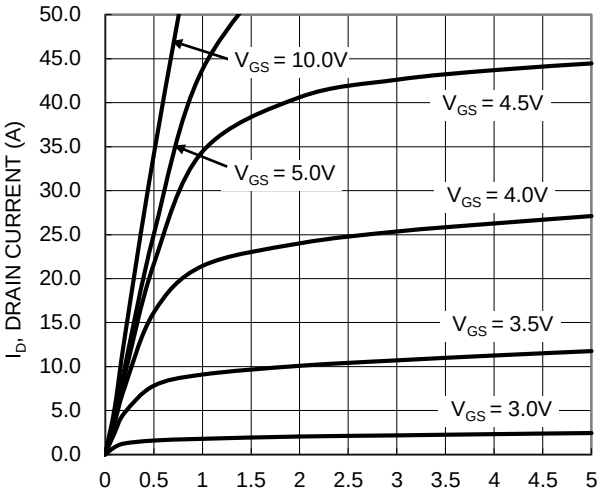


Figure 1.Typical Output Characteristic

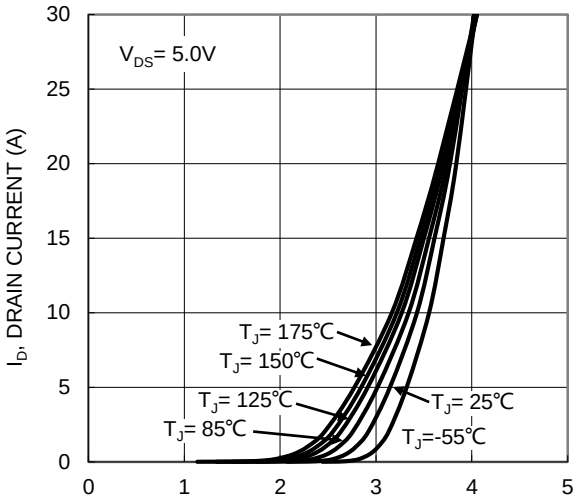


Figure 2. Typical Transfer Characteristic

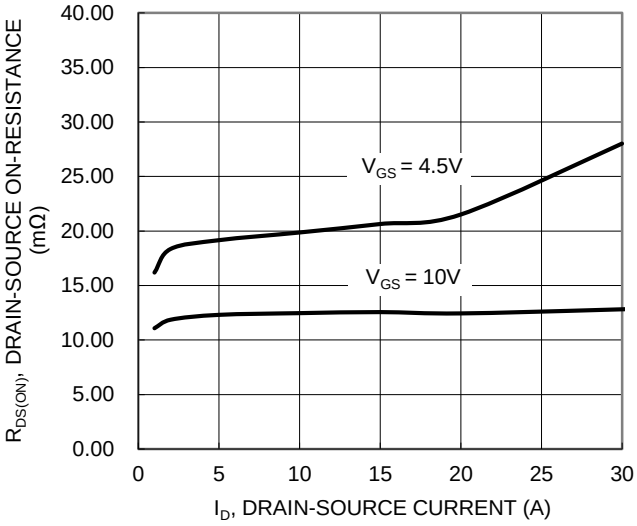


Figure 3. Typical On-Resistance vs. Drain Current and Gate Voltage

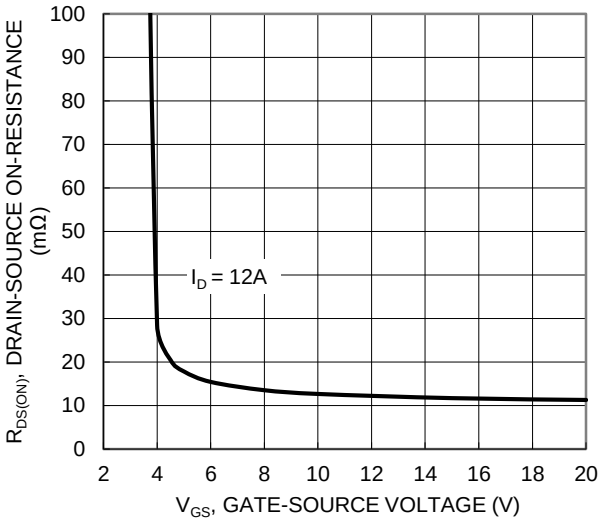


Figure 4. Typical Transfer Characteristic

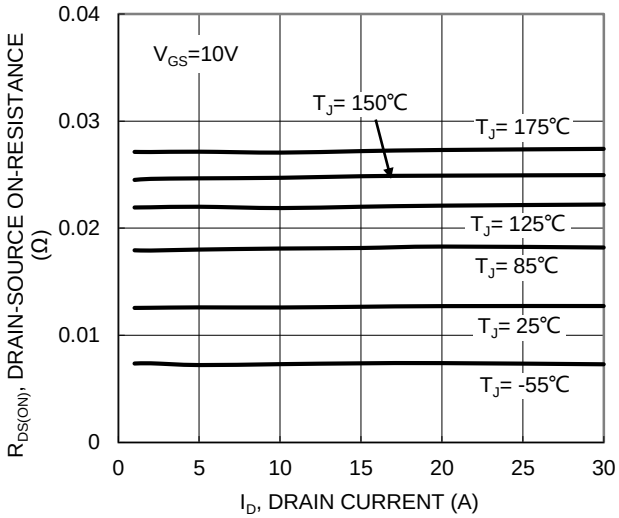


Figure 5. Typical On-Resistance vs. Drain Current and Temperature

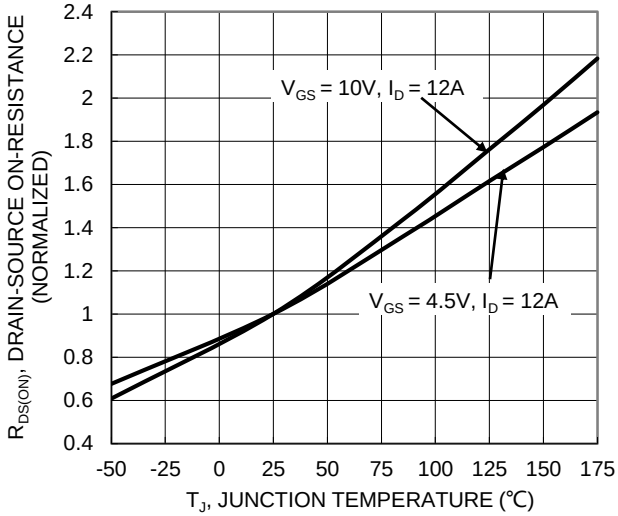


Figure 6. On-Resistance Variation with Temperature

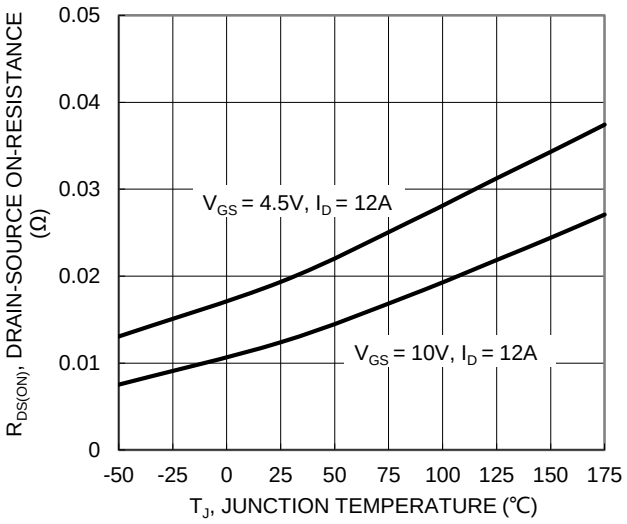


Figure 7. On-Resistance Variation with Temperature

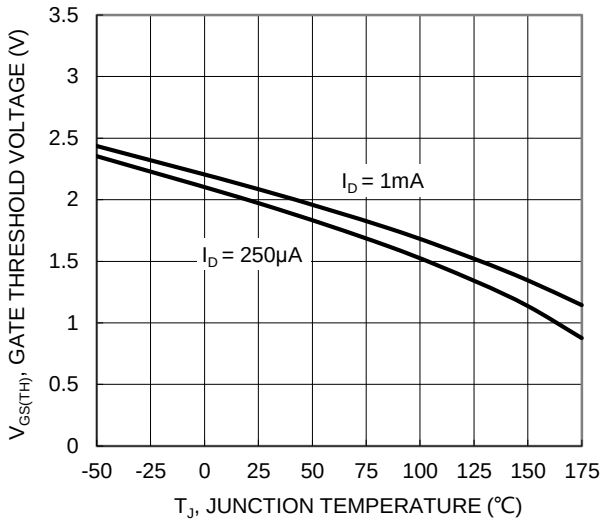


Figure 8. Gate Threshold Variation vs. JunctionTemperature

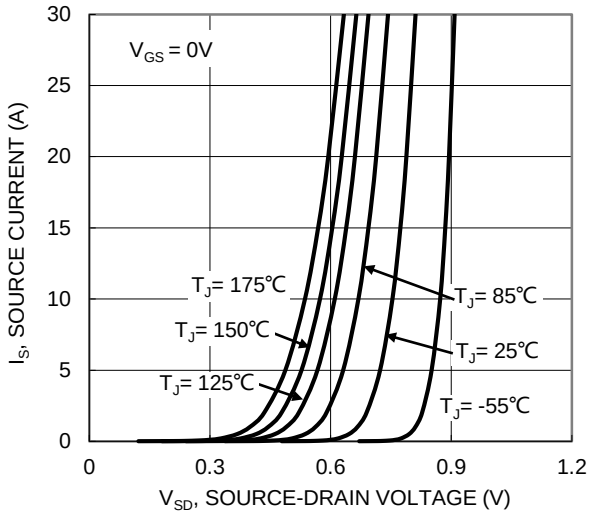


Figure 9. Diode Forward Voltage vs. Current

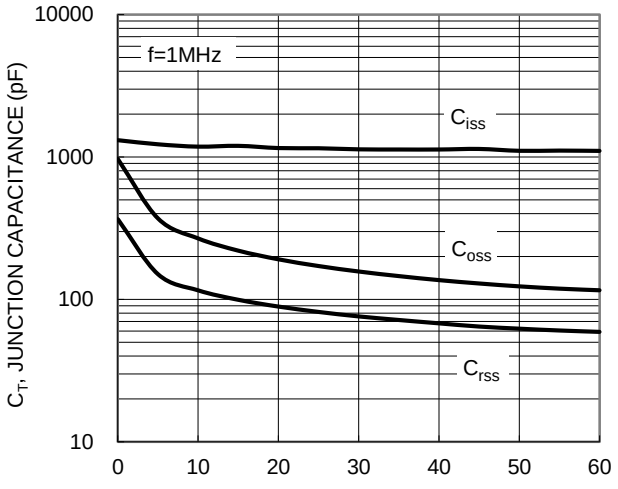


Figure 10. Typical Junction Capacitance

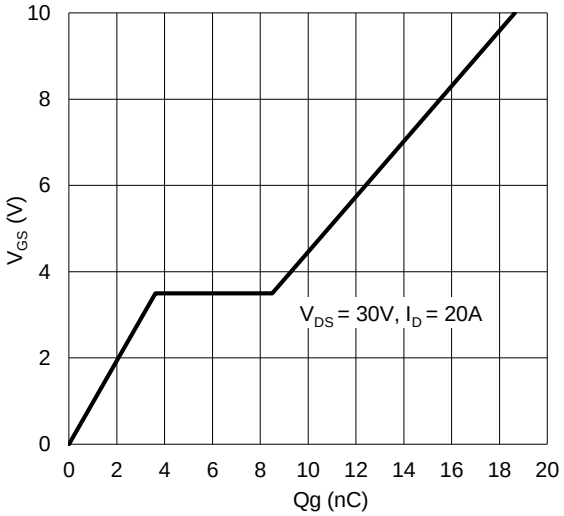


Figure 11. Gate Charge

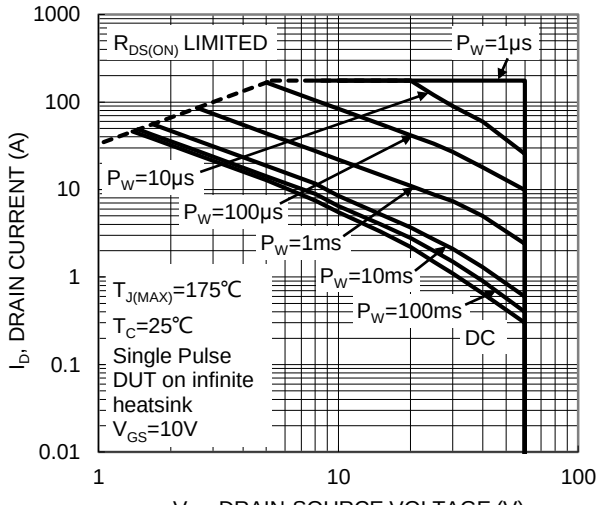


Figure 12. SOA, Safe Operation Area

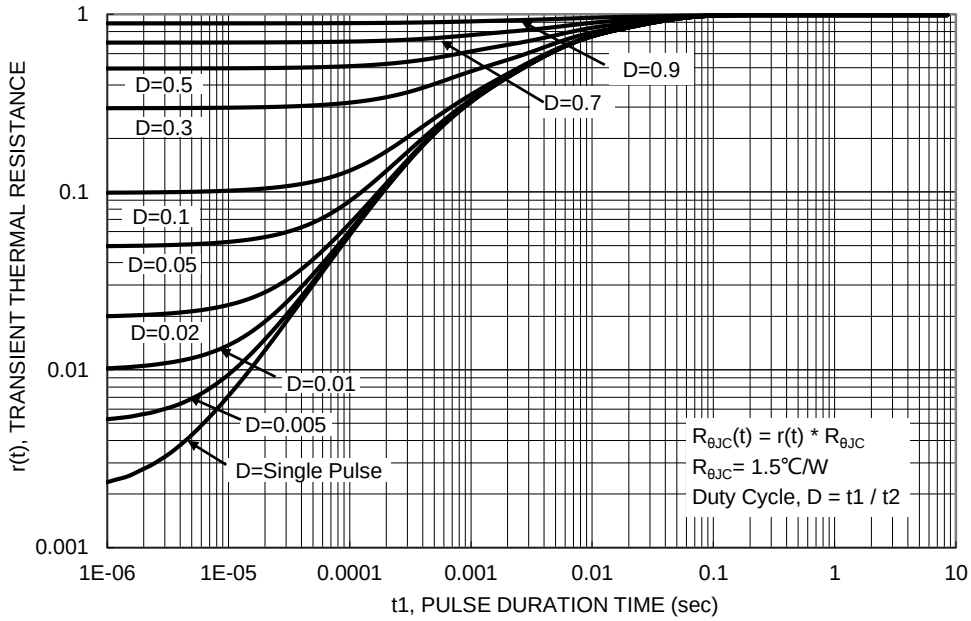
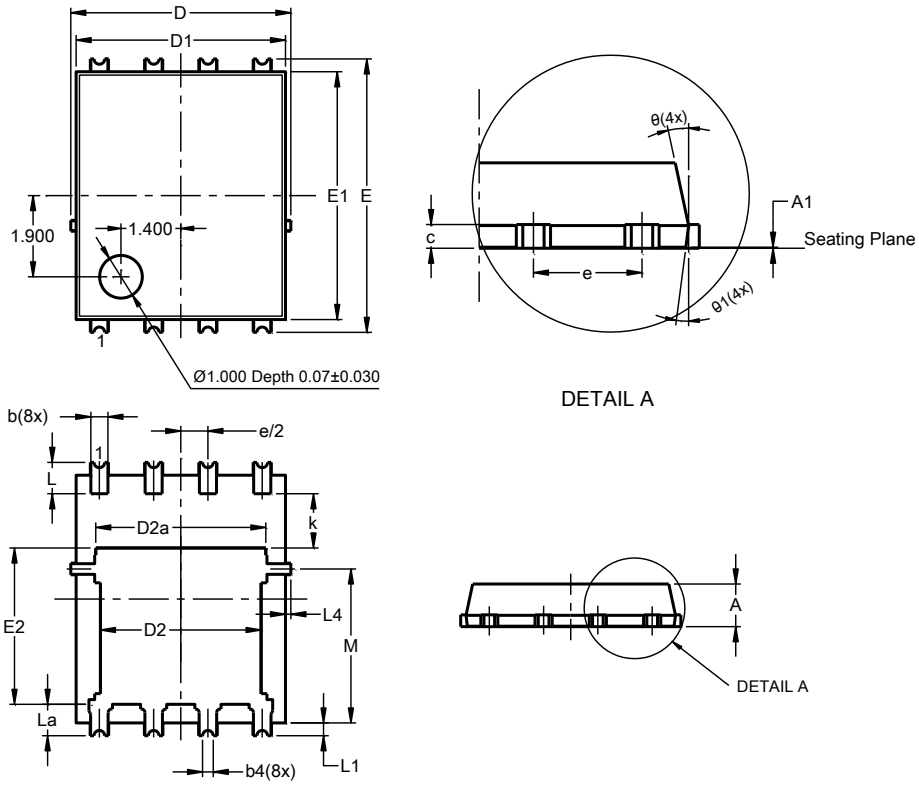


Figure 13. Transient Thermal Resistance

Package Outline Dimensions

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

PowerDI5060-8 (SWP) (Type UX)

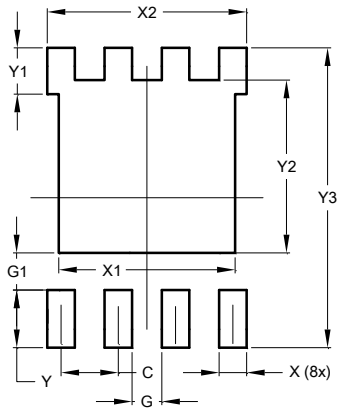


PowerDI5060-8 (SWP) (Type UX)			
Dim	**Min**	**Max**	**Typ**
A	0.90	1.10	1.00
A1	0	0.05	--
b	0.30	0.50	0.41
b2	0.20	0.35	0.25
b4	0.25REF		
c	0.230	0.330	0.277
D	5.15 BSC		
D1	4.70	5.10	4.90
D2	3.56	3.96	3.76
D2a	3.78	4.18	3.98
E	6.40 BSC		
E1	5.60	6.00	5.80
E2	3.46	3.86	3.66
E2a	4.195	4.595	4.395
e	1.27BSC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

PowerDI5060-8 (SWP) (Type UX)



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

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