60V 175°C DUAL N-CHANNEL ENHANCEMENT MODE MOSFET PowerDI

Product Summary

$V_{(BR)DSS}$	$R_{DS(ON)}$ Max	I_D Max T_C = +25°C
60V	25mΩ @ V_{GS} = 10V	32A
	40mΩ @ V_{GS} = 4.5V	25A

Features and Benefits

- Rated to +175°C – Ideal for High Ambient Temperature Environments
- 100% Unclamped Inductive Switching – Ensures More Reliable and Robust End Application
- High Conversion Efficiency
- Low $R_{DS(ON)}$ – Minimizes On-State Losses
- Low Input Capacitance
- Fast Switching Speed
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **Qualified to AEC-Q101 Standards for High Reliability**
- **PPAP Capable (Note 4)**

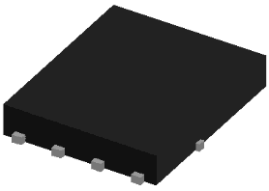
Description and Applications

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:

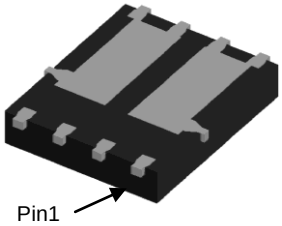
- Backlighting
- Power Management Functions
- DC-DC Converters

Mechanical Data

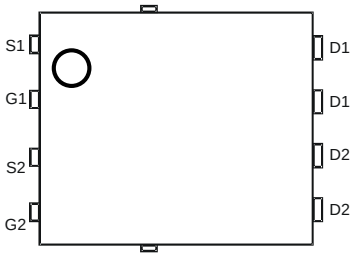
- Case: PowerDI®5060-8 (Type C)
- Case Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminal Connections Indicator: See diagram
- Terminals: Finish — Matte Tin Annealed over Copper Leadframe. Solderable per MIL-STD-202, Method 208 e3
- Weight: 0.097 grams (Approximate)



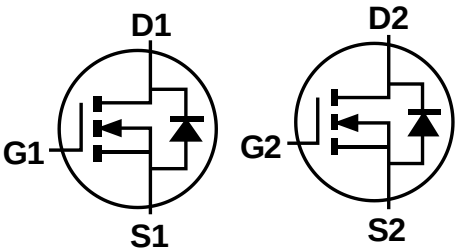
Top View



Bottom View



Pin Out
Top View



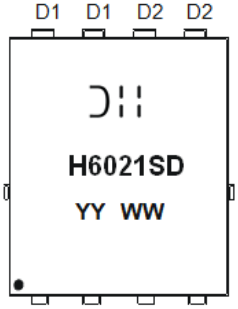
Equivalent Circuit

Ordering Information (Note 5)

Part Number	Case	Packaging
DMNH6021SPDQ-13	PowerDI5060-8 (Type C)	2,500/Tape & Reel

Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.
2. See 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. Please refer to http://www.diodes.com/quality/product_compliance_definitions/.
5. For packaging details, go to our website at http://www.diodes.com/products/packages.html.

Marking Information



= Manufacturer's Marking
H6021SD = Product Type Marking Code
YYWW = Date Code Marking
YY = Year (ex: 16 = 2016)
WW = Week (01 - 53)

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Maximum Ratings (@T_A = +25°C, unless otherwise specified.)

Characteristic		Symbol	Value	Units
Drain-Source Voltage		V_{DSS}	60	V
Gate-Source Voltage		V_{GSS}	±20	V
Continuous Drain Current (Note 7) V_{GS} = 10V	T_A = +25°C T_A = +70°C	I_D	8.2 6.5	A
Continuous Drain Current (Note 8) V_{GS} = 10V	T_C = +25°C T_C = +100°C	I_D	32 22	A
Pulsed Drain Current (380µs Pulse, Duty Cycle = 1%)		I_{DM}	80	A
Maximum Continuous Body Diode Forward Current (Note 8)		I_S	32	A
Avalanche Current, L = 0.1mH (Note 9)		I_{AS}	35	A
Avalanche Energy, L = 0.1mH (Note 9)		E_{AS}	64	mJ

Thermal Characteristics

Characteristic		Symbol	Value	Units
Total Power Dissipation (Note 6)		P_D	1.5	W
Thermal Resistance, Junction to Ambient (Note 6)	Steady State	$R_{\theta JA}$	99	°C/W
	t<10s		53	
Total Power Dissipation (Note 7)		P_D	2.8	W
Thermal Resistance, Junction to Ambient (Note 7)	Steady State	$R_{\theta JA}$	54	°C/W
	t<10s		27	
Thermal Resistance, Junction to Case (Note 8)		$R_{\theta JC}$	2.2	°C/W
Operating and Storage Temperature Range		T_J, T_{STG}	-55 to +175	°C

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

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
OFF CHARACTERISTICS (Note 10)						
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 10)						
Gate Threshold Voltage	$V_{GS(TH)}$	1	—	3	V	V_{DS} = V_{GS}, I_D = 250µA
Static Drain-Source On-Resistance	$R_{DS(ON)}$	—	15	25	mΩ	V_{GS} = 10V, I_D = 15A
		—	21	40		V_{GS} = 4.5V, I_D = 12A
Diode Forward Voltage	V_{SD}	—	0.75	1.2	V	V_{GS} = 0V, I_S = 2.6A
DYNAMIC CHARACTERISTICS (Note 11)						
Input Capacitance	C_{ISS}	—	1,143	—	pF	V_{DS} = 25V, V_{GS} = 0V, f = 1MHz
Output Capacitance	C_{OSS}	—	168	—	pF	
Reverse Transfer Capacitance	C_{RSS}	—	69	—	pF	
Gate Resistance	R_G	—	2.1	—	Ω	V_{DS} = 0V, V_{GS} = 0V, f = 1MHz
Total Gate Charge (V_{GS} = 10V)	Q_G	—	20.1	—	nC	V_{DS} = 30V, I_D = 20A,
Total Gate Charge (V_{GS} = 6V)	Q_G	—	12	—	nC	
Gate-Source Charge	Q_{GS}	—	4.3	—	nC	
Gate-Drain Charge	Q_{GD}	—	5.5	—	nC	
Turn-On Delay Time	$t_{D(ON)}$	—	4.4	—	ns	V_{DD} = 30V, V_{GS} = 10V, R_G = 4.7Ω, I_D = 20A
Turn-On Rise Time	t_R	—	6.0	—	ns	
Turn-Off Delay Time	$t_{D(OFF)}$	—	14.2	—	ns	
Turn-Off Fall Time	t_F	—	5.4	—	ns	
Body Diode Reverse Recovery Time	t_{RR}	—	21.2	—	ns	IF=20A, di/dt=100A/µs
Body Diode Reverse Recovery Charge	Q_{RR}	—	15.2	—	nC	

Notes:
6. Device mounted on FR-4 PC board, with minimum recommended pad layout, single sided.
7. Device mounted on FR-4 substrate PC board, 2oz copper, with thermal bias to bottom layer 1-inch square copper plate.
8. Thermal resistance from junction to soldering point (on the exposed drain pad).
9. I_{AS} and E_{AS} rating are based on low frequency and duty cycles to keep T_J = 25°C
10. Short duration pulse test used to minimize self-heating effect.
11. Guaranteed by design. Not subject to product testing.

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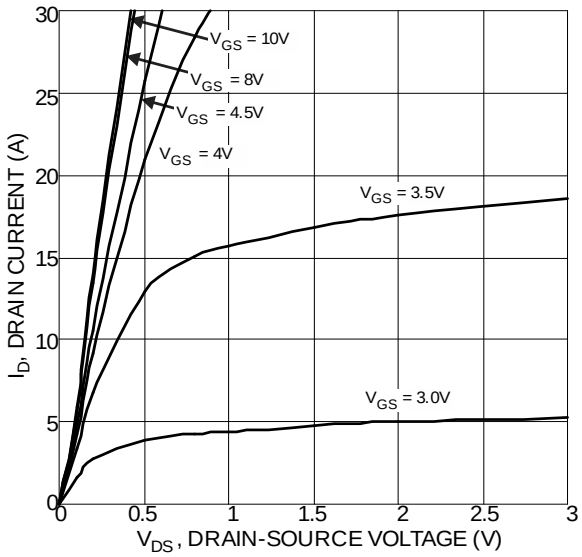

Figure 1 Typical Output Characteristic

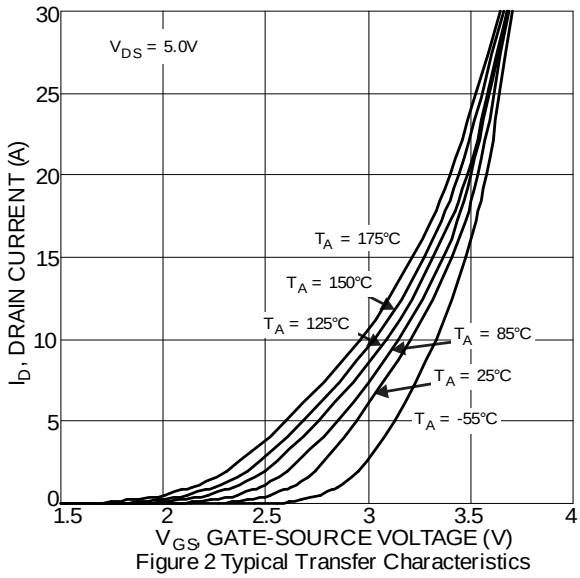

Figure 2 Typical Transfer Characteristics

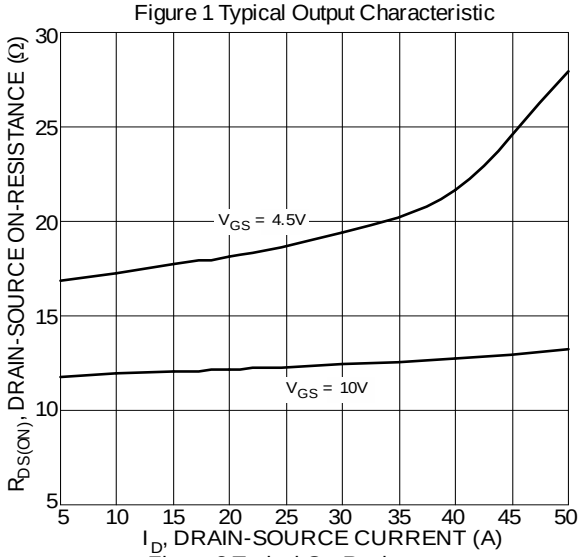

Figure 3 Typical On-Resistance vs. Drain Current and Gate Voltage

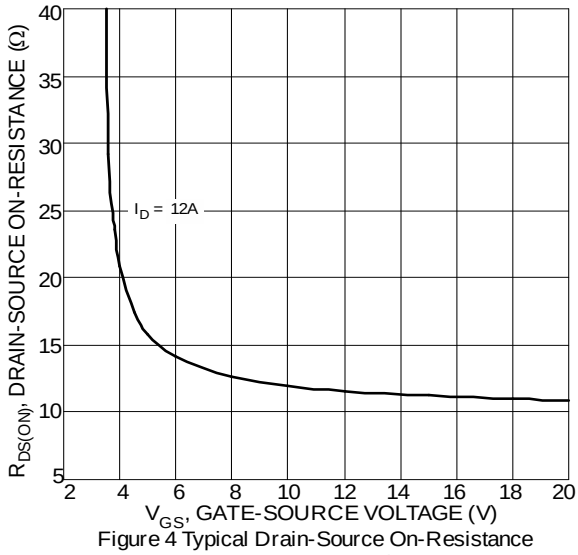

Figure 4 Typical Drain-Source On-Resistance vs. Gate-Source Voltage

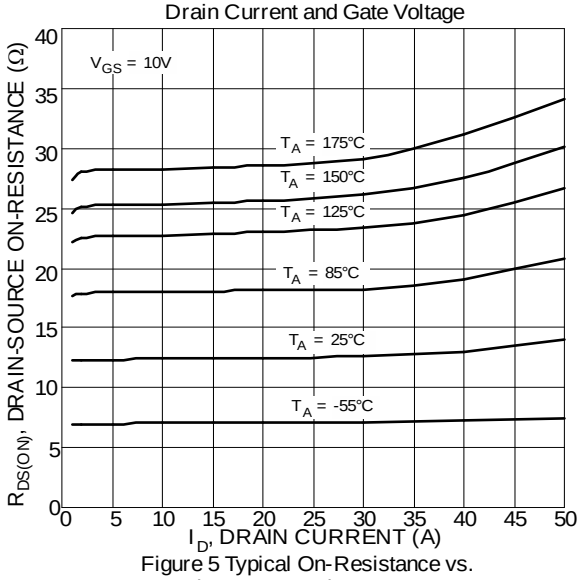

Figure 5 Typical On-Resistance vs. Drain Current and Temperature

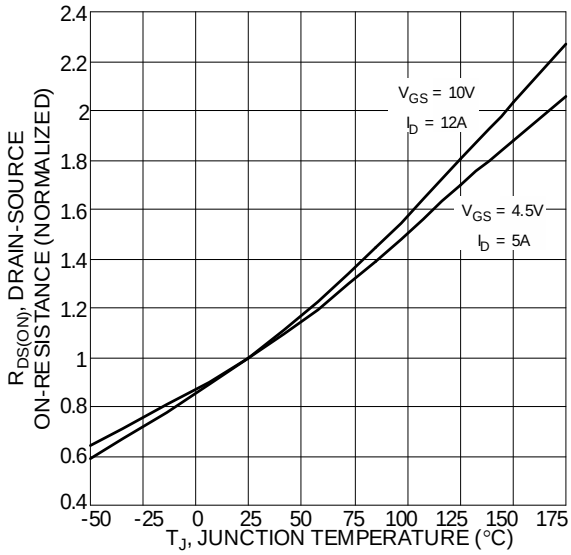

Figure 6 On-Resistance Variation with Temperature

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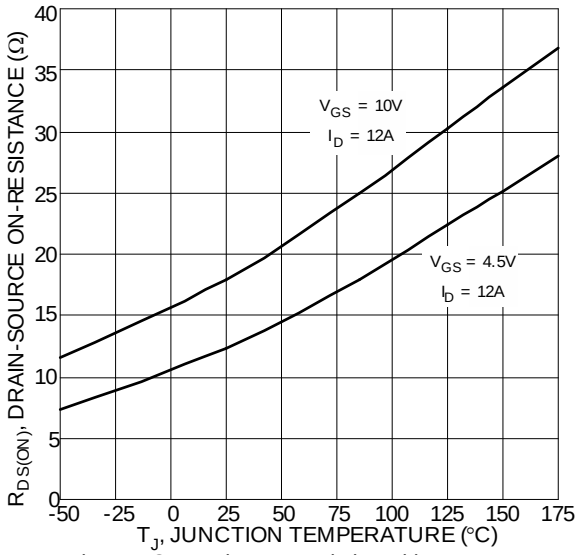

Figure 7 On-Resistance Variation with Temperature

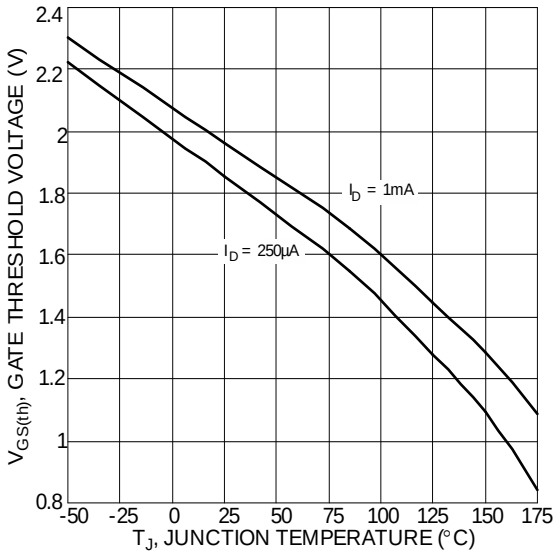

Figure 8 Gate Threshold Variation vs. Ambient Temperature

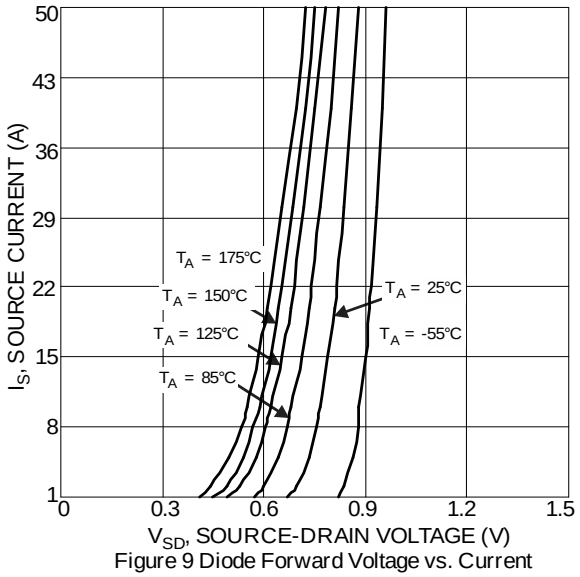

Figure 9 Diode Forward Voltage vs. Current

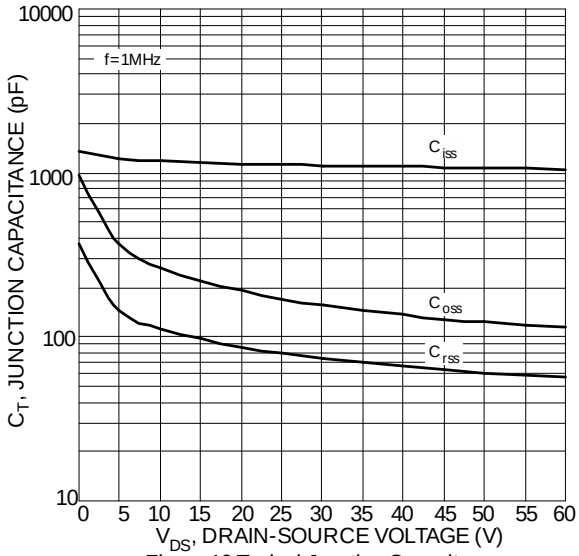

Figure 10 Typical Junction Capacitance

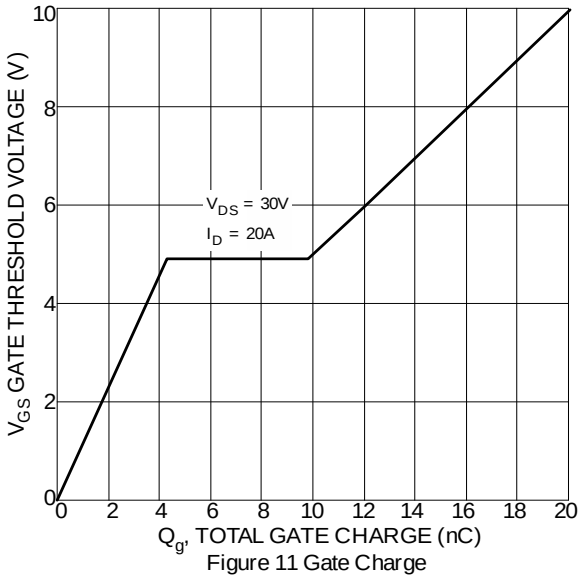

Figure 11 Gate Charge

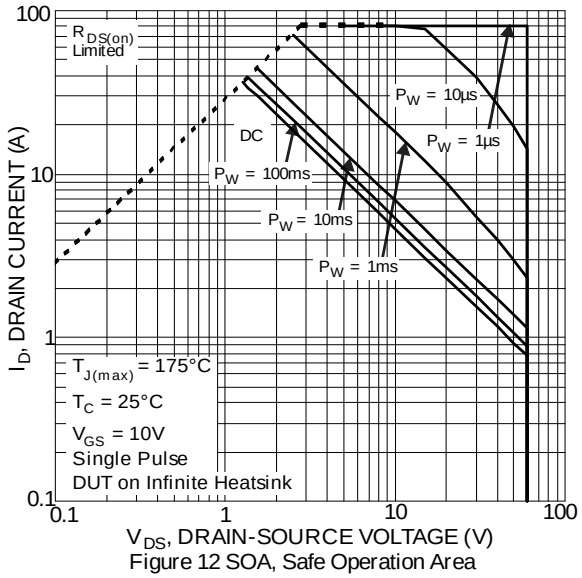

Figure 12 SOA, Safe Operation Area

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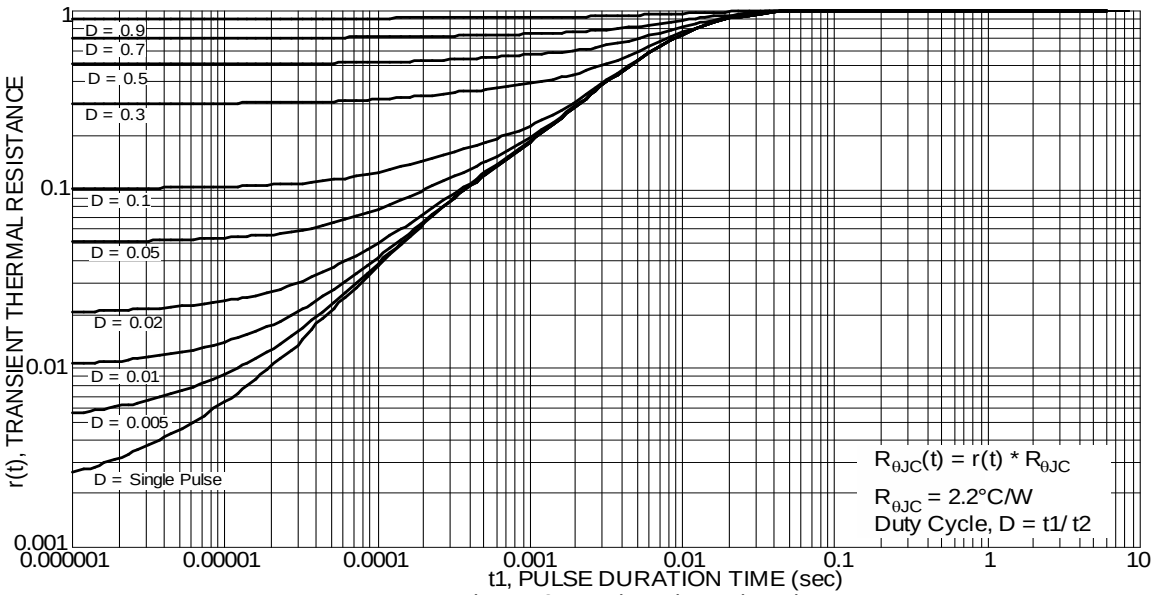

Figure 13 Transient Thermal Resistance

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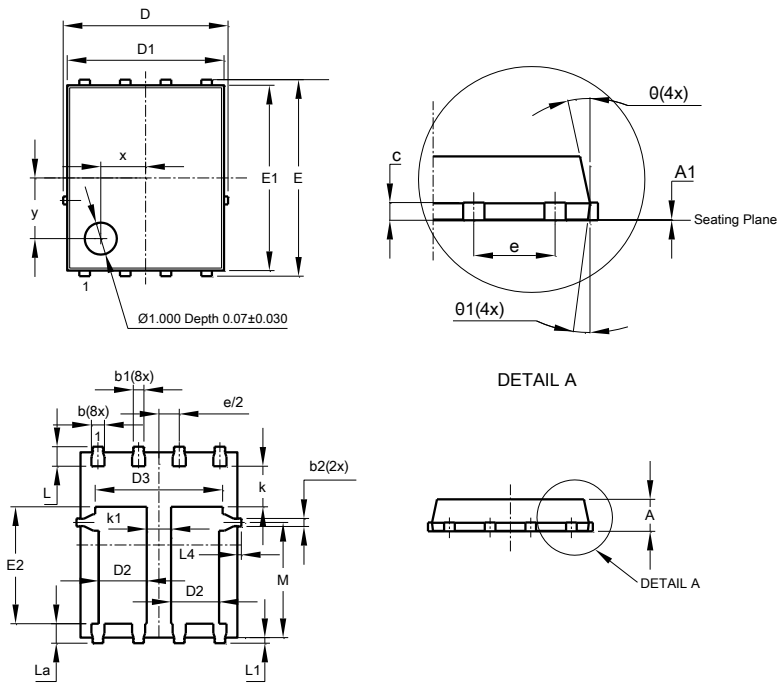
Package Outline Dimensions

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

PowerDI5060-8 (Type C)

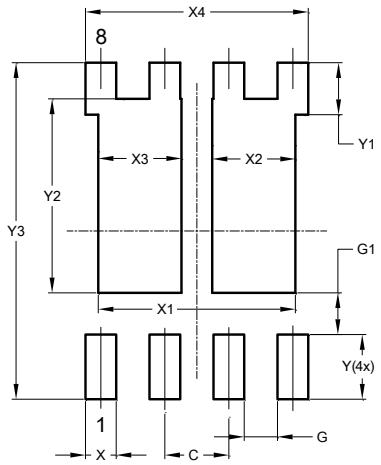


PowerDI5060-8 (Type C)			
Dim	**Min**	**Max**	**Typ**
A	0.90	1.10	1.00
A1	0	0.05	0.02
b	0.33	0.51	0.41
b1	0.300	0.366	0.333
b2	0.20	0.35	0.25
c	0.23	0.33	0.277
D	5.15 BSC		
D1	4.85	4.95	4.90
D2	1.40	1.60	1.50
D3	–	–	3.98
E	6.15 BSC		
E1	5.75	5.85	5.80
E2	3.56	3.76	3.66
e	1.27BSC		
k	–	–	1.27
k1	0.56	–	–
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			

Suggested Pad Layout

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

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

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