40V 175°C N-CHANNEL ENHANCEMENT MODE MOSFET
PowerDI5060-8

Product Summary

BV_{DSS}	$R_{DS(ON)}$ max	I_D T_C = +25°C
40V	10mΩ @ V_{GS} = 10V	80A

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
- DC-DC Converters
- Body Control Electronics

Features and Benefits

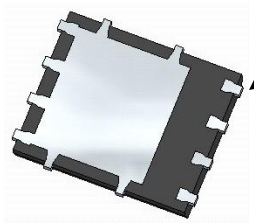
- Rated to +175°C – Ideal for High Ambient Temperature Environments
- 100% Unclamped Inductive Switching – Ensures More Reliable and Robust End Application
- Low Q_g – Minimizes Switching Loss
- Low $R_{DS(ON)}$ – Minimizes On State Loss
- **Lead-Free Finish; RoHS Compliant (Notes 1 & 2)**
- **Halogen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

Mechanical Data

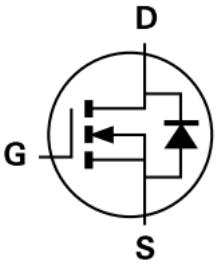
- Case: PowerDI®5060-8
- Case Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminal Connections: See Diagram Below
- Terminals: Finish — Matte Tin Annealed over Copper Leadframe, Solderable per MIL-STD-202,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

PowerDI5060-8

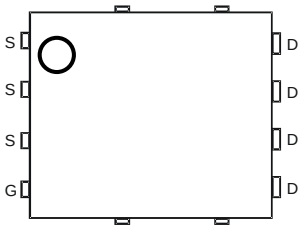
Top View



Bottom View



Internal Schematic



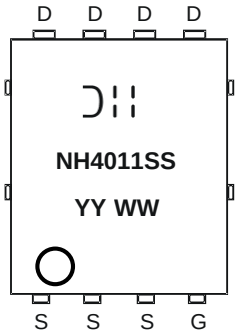
Top View
Pin Configuration

Ordering Information (Note 5)

Part Number	Case	Packaging
DMNH4011SPSQ-13	PowerDI5060-8	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 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. Refer to http://www.diodes.com/product_compliance_definitions.html.
5. For packaging details, go to our website at https://www.diodes.com/design/support/packaging/diodes-packaging/.

Marking Information



= Manufacturer's Marking
NH4011SS = Product Type Marking Code
YYWW = Date Code Marking
YY = Year (ex: 17 = 2017)
WW = Week (01 to 53)

PowerDI is a registered trademark of Diodes Incorporated.

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

Characteristic		Symbol	Value	Unit
Drain-Source Voltage		V_{DSS}	40	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	13 10.8	A
	T_C = +25°C T_C = +100°C (Note 8)	I_D	80 57	A
Pulsed Drain Current (10µs Pulse, Duty Cycle = 1%)		I_{DM}	90	A
Maximum Continuous Body Diode Forward Current (Note 6)		I_S	80	A
Pulsed Source Current (10µs Pulse, Duty Cycle = 1%)		I_{SM}	90	A
Avalanche Current, L = 1mH		I_{AS}	18	A
Avalanche Energy, L = 1mH		E_{AS}	170	mJ

Thermal Characteristics

Characteristic		Symbol	Value	Unit
Total Power Dissipation (Note 6)	T_A = +25°C	P_D	2.5	W
Thermal Resistance, Junction to Ambient (Note 6)		$R_{\theta JA}$	60	°C/W
Total Power Dissipation (Note 7)	T_C = +25°C	P_D	150	W
Thermal Resistance, Junction to Case (Note 7)		$R_{\theta JC}$	1	°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 8)						
Drain-Source Breakdown Voltage	BV_{DSS}	40	—	—	V	V_{GS} = 0V, I_D = 250µA
Zero Gate Voltage Drain Current	I_{DSS}	—	—	1	µA	V_{DS} = 40V, V_{GS} = 0V
Gate-Source Leakage	I_{GSS}	—	—	±100	nA	V_{GS} = ±20V, V_{DS} = 0V
ON CHARACTERISTICS (Note 8)						
Gate Threshold Voltage	$V_{GS(TH)}$	2	—	4	V	V_{DS} = V_{GS}, I_D = 250µA
Static Drain-Source On-Resistance	$R_{DS(ON)}$	—	8.5	10	mΩ	V_{GS} = 10V, I_D = 50A
Diode Forward Voltage	V_{SD}	—	0.9	1.2	V	V_{GS} = 0V, I_S = 50A
DYNAMIC CHARACTERISTICS (Note 9)						
Input Capacitance	C_{iss}	—	1405	—	pF	V_{DS} = 20V, V_{GS} = 0V, f = 1MHz
Output Capacitance	C_{oss}	—	247	—		
Reverse Transfer Capacitance	C_{rss}	—	108	—		
Gate Resistance	R_g	—	2.2	—	Ω	V_{DS} = 0V, V_{GS} = 0V, f = 1MHz
Total Gate Charge	Q_g	—	25.5	—	nC	V_{DS} = 20V, V_{GS} = 10V, I_D = 50A
Gate-Source Charge	Q_{gs}	—	4.6	—		
Gate-Drain Charge	Q_{gd}	—	6.9	—		
Turn-On Delay Time	$t_{D(ON)}$	—	4.6	—	ns	V_{DD} = 20V, V_{GS} = 10V, I_D = 50A, R_G = 3.5Ω
Turn-On Rise Time	t_R	—	3.7	—		
Turn-Off Delay Time	$t_{D(OFF)}$	—	16	—		
Turn-Off Fall Time	t_F	—	5.1	—		
Body Diode Reverse Recovery Time	t_{RR}	—	22.1	—	ns	I_F = 50A, di/dt = 100A/µs
Body Diode Reverse Recovery Charge	Q_{RR}	—	13.4	—	nC	

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

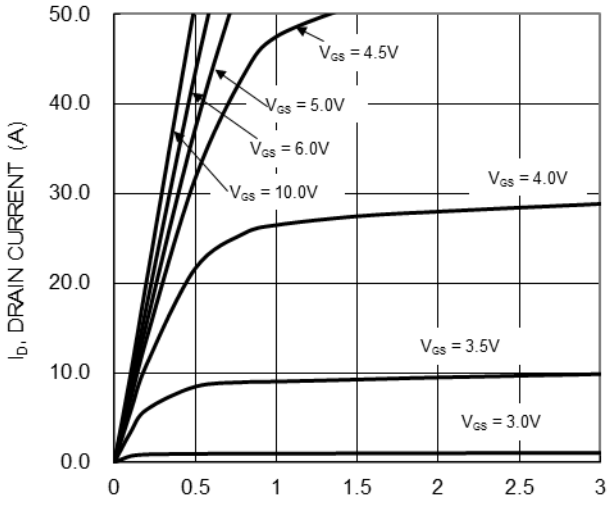


Figure 1 Typical Output Characteristic

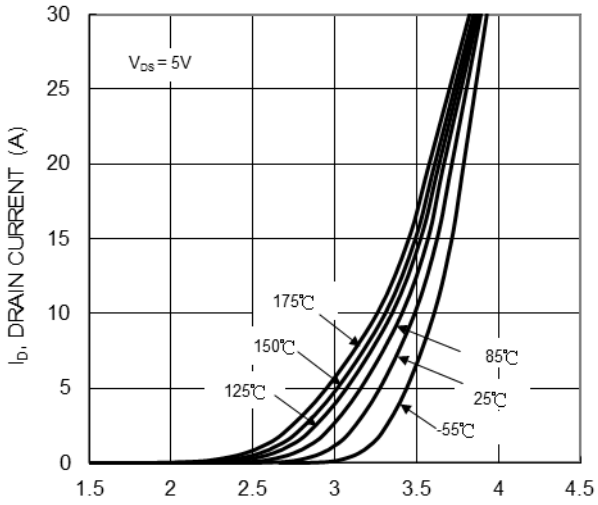


Figure 2 Typical Transfer Characteristic

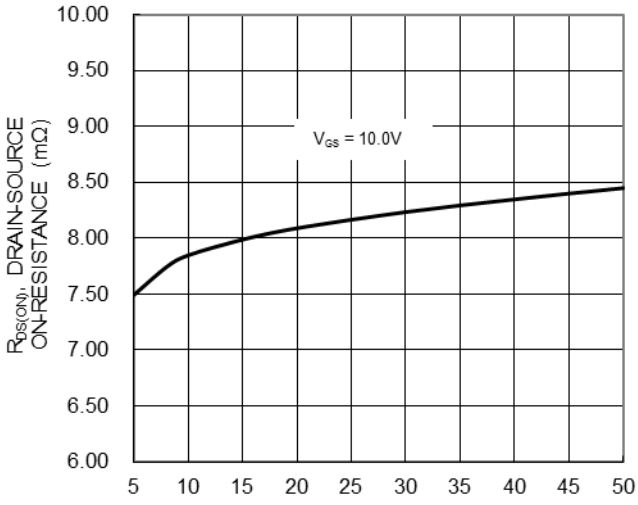


Figure 3 Typical On-Resistance vs Drain Current and Gate Voltage

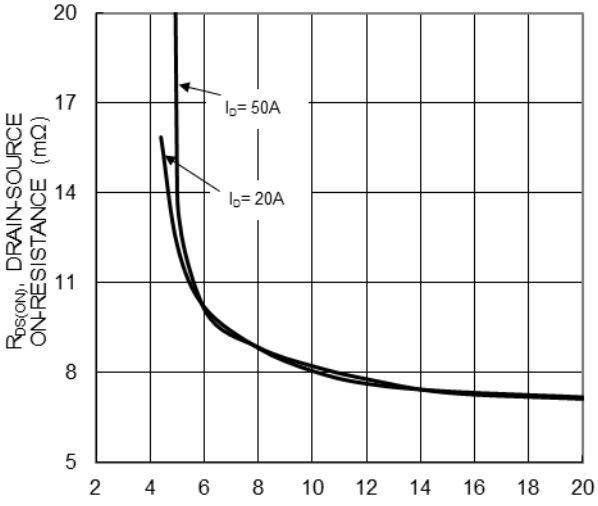


Figure 4 Typical Transfer Characteristic

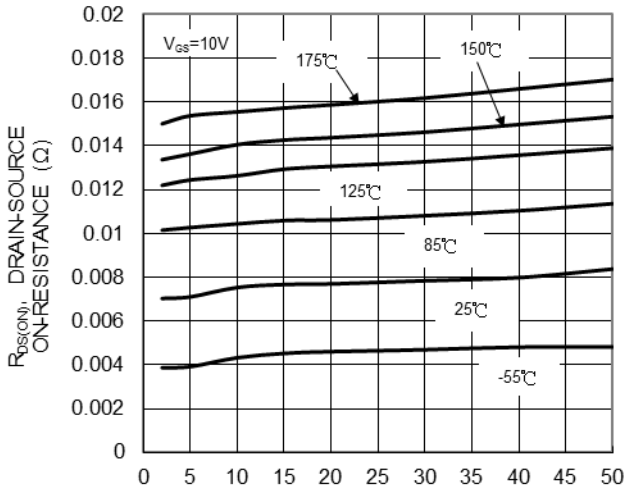


Figure 5 Typical On-Resistance vs Drain Current and Temperature

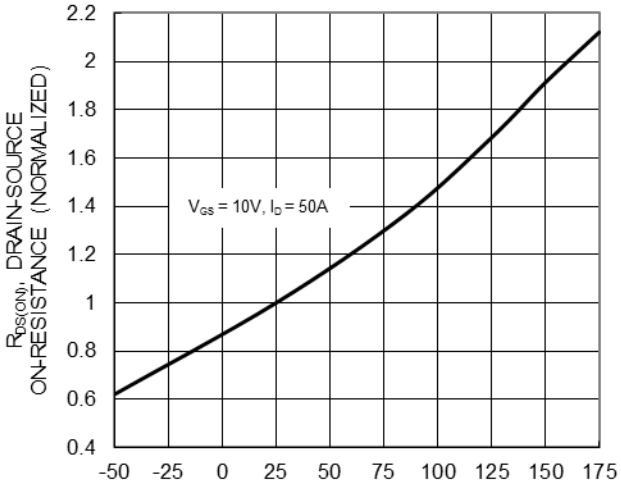


Figure 6 On-Resistance Variation with Temperature

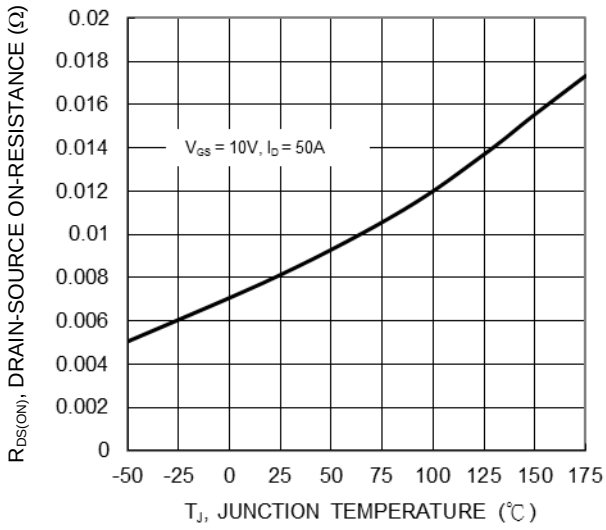


Figure 7 On-Resistance Variation with Temperature

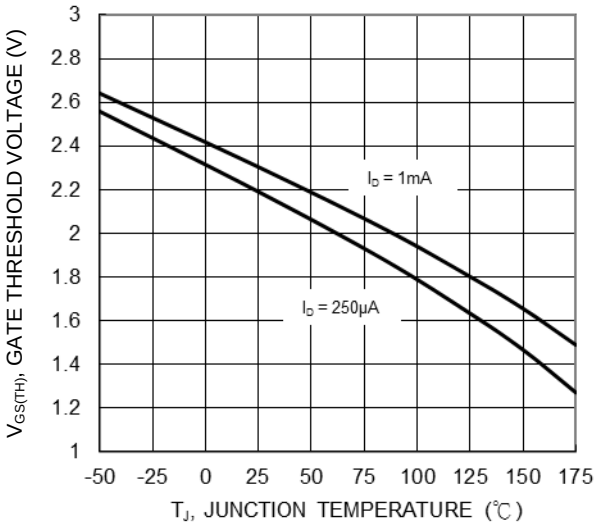


Figure 8 Gate Threshold Variation vs Temperature

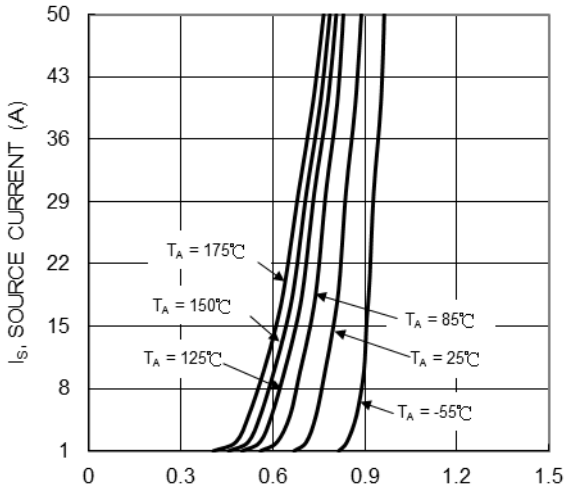


Figure 9 Diode Forward Voltage vs Current

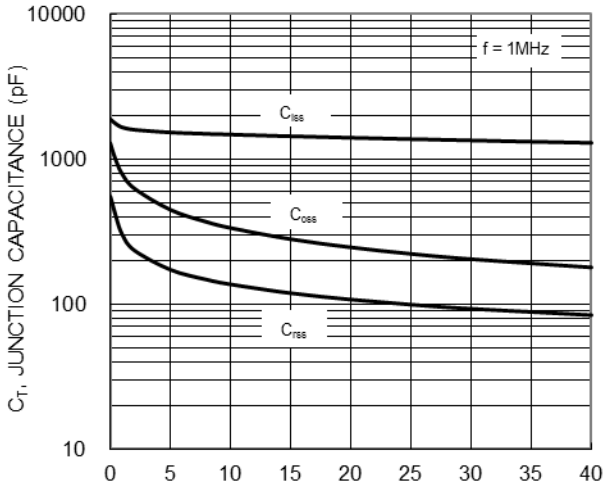


Figure 10 Typical Junction Capacitance

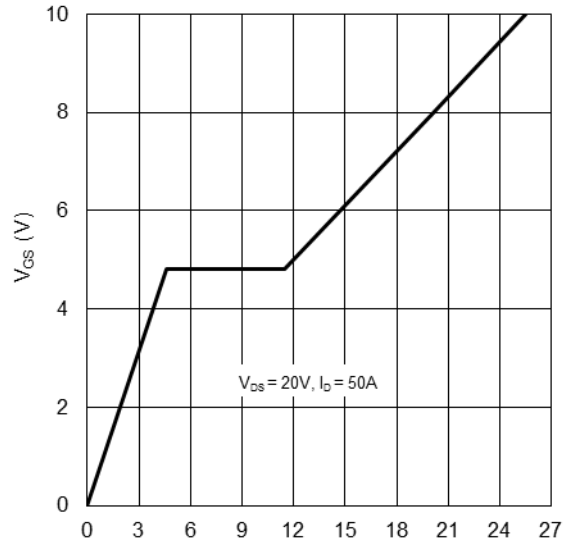


Figure 11 Gate Charge

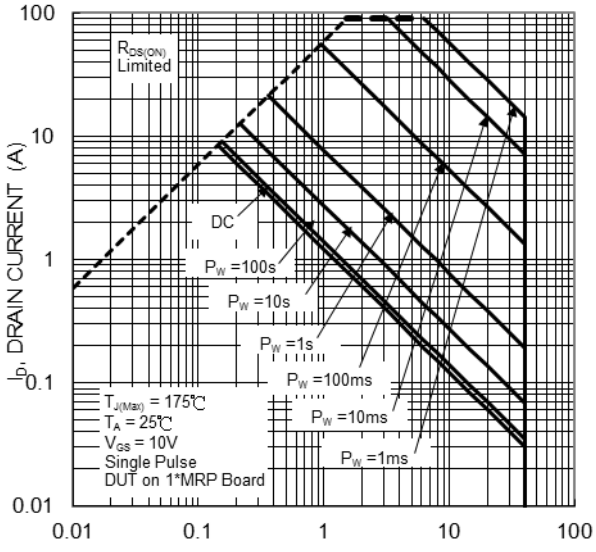


Figure 12 SOA, Safe Operation Area

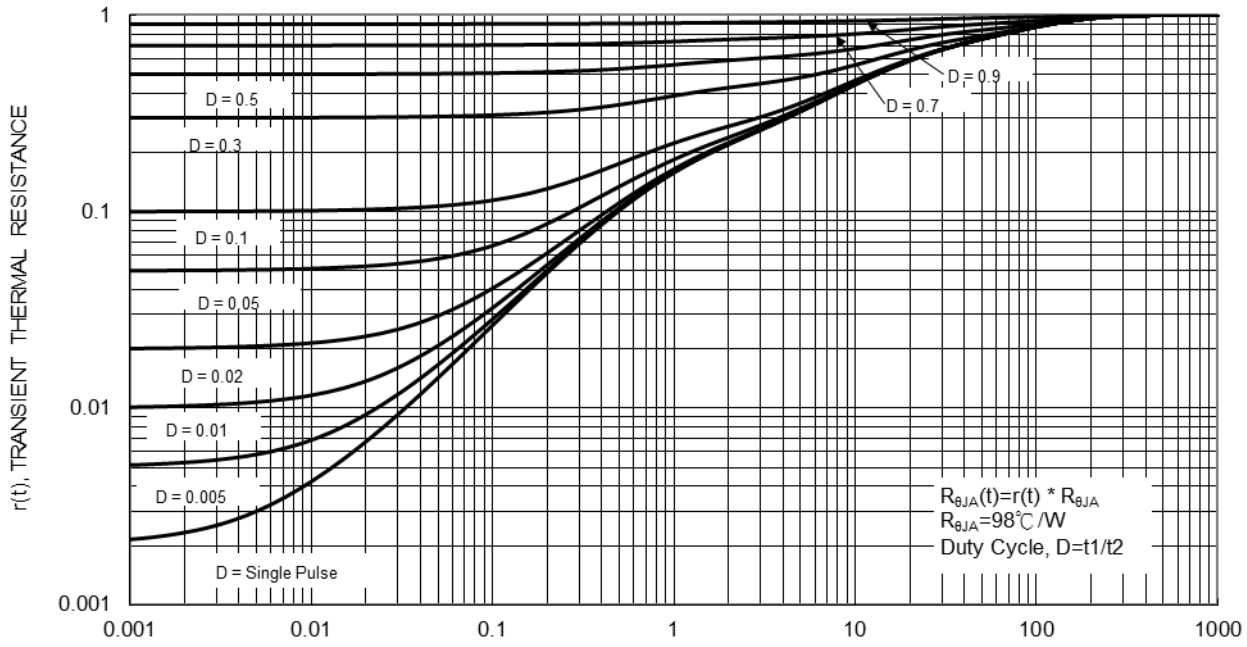
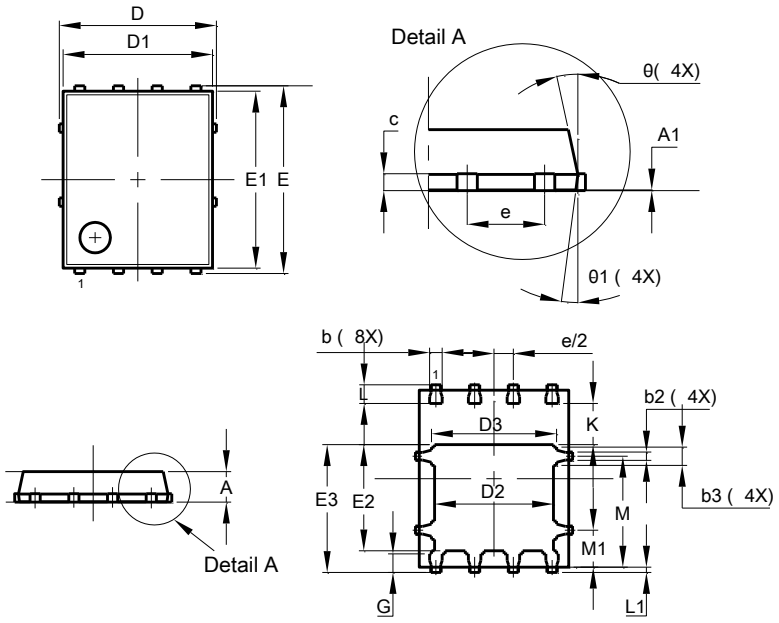


Figure 13 Transient Thermal Resistance

Package Outline Dimensions

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

PowerDI5060-8

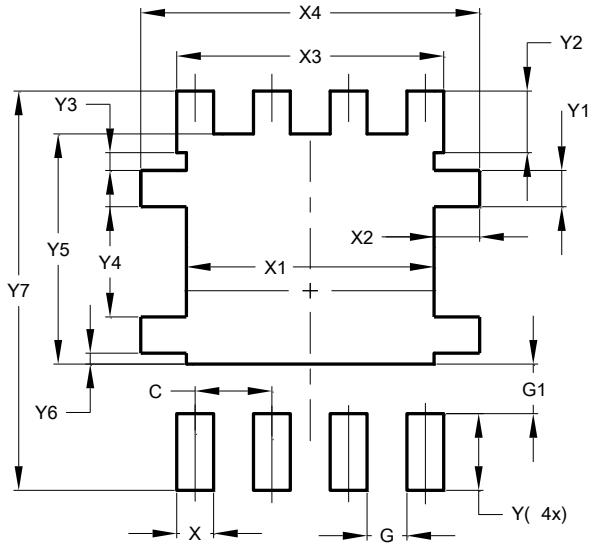


PowerDI5060-8			
Dim	**Min**	**Max**	**Typ**
A	0.90	1.10	1.00
A1	0.00	0.05	–
b	0.33	0.51	0.41
b2	0.200	0.350	0.273
b3	0.40	0.80	0.60
c	0.230	0.330	0.277
D	5.15 BSC		
D1	4.70	5.10	4.90
D2	3.70	4.10	3.90
D3	3.90	4.30	4.10
E	6.15 BSC		
E1	5.60	6.00	5.80
E2	3.28	3.68	3.48
E3	3.99	4.39	4.19
e	1.27 BSC		
G	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	10º	12º	11º
Θ1	6º	8º	7º
All Dimensions in mm			

Suggested Pad Layout

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

PowerDI5060-8



Dimensions	Value (in mm)
C	1.270
G	0.660
G1	0.820
X	0.610
X1	4.100
X2	0.755
X3	4.420
X4	5.610
Y	1.270
Y1	0.600
Y2	1.020
Y3	0.295
Y4	1.825
Y5	3.810
Y6	0.180
Y7	6.610

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