

## Product Summary

$BV_{DSS}$	$R_{DS(ON)}$ Max	$I_D$ Max $T_C = +25^\circ C$
60V	11m $\Omega$ @ $V_{GS} = 10V$	50A

## 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  $R_{DS(ON)}$  – Minimizes Power Losses
- Low  $Q_G$  – Minimizes Switching Losses
- <1.1mm Package Profile – Ideal for Thin Applications
- 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)**

## Description and Applications

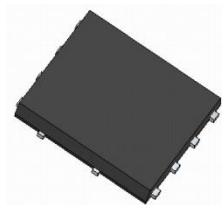
This MOSFET is designed to meet the stringent requirements of Automotive applications. It is qualified to AEC-Q101, supported by a PPAP and is ideal for use in:

- DC Motor Control
- Solenoid Driving
- Power Management Functions

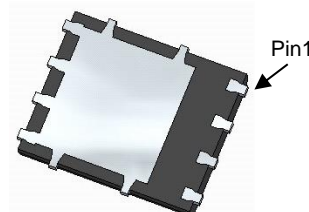
## Mechanical Data

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

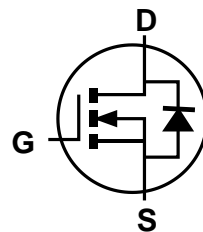
PowerDI5060-8



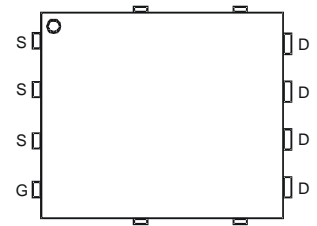
Top View



Bottom View



Internal Schematic

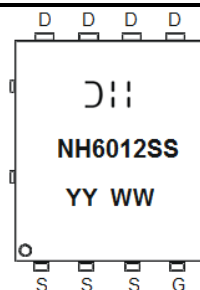

 Top View  
 Pin Configuration

## Ordering Information (Note 5)

Part Number	Case	Packaging
DMNH6012SPSQ-13	PowerDI5060-8	2,500/Tape & Reel

- Notes:
- EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant. All applicable RoHS exemptions applied.
  - See [http://www.diodes.com/quality/lead\\_free.html](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.
  - Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.
  - Automotive products are AEC-Q101 qualified and are PPAP capable. Refer to [http://www.diodes.com/quality/product\\_compliance\\_definitions/](http://www.diodes.com/quality/product_compliance_definitions/).
  - For packaging details, go to our website at <http://www.diodes.com/products/packages.html>.

## Marking Information



**D** = Manufacturer's Marking  
**NH6012SS** = Product Type Marking Code  
**YYWW** = Date Code Marking  
**YY** = Last Two Digits of Year (ex: 16 = 2016)  
**WW** = Week Code (01 to 53)

**Maximum Ratings** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

Characteristic	Symbol	Value	Unit
Drain-Source Voltage	V <sub>DSS</sub>	60	V
Gate-Source Voltage	V <sub>GSS</sub>	±20	V
Continuous Drain Current (Note 7) V <sub>GS</sub> = 10V	I <sub>D</sub>	T <sub>C</sub> = +25°C	50
		T <sub>C</sub> = +100°C	30
Pulsed Drain Current (380µs Pulse, Duty Cycle = 1%)	I <sub>DM</sub>	120	A
Maximum Continuous Body Diode Forward Current (Note 7)	I <sub>S</sub>	2.6	A
Avalanche Current, L = 0.1mH (Note 8)	I <sub>AS</sub>	45	A
Avalanche Energy, L = 0.1mH (Note 8)	E <sub>AS</sub>	100	mJ

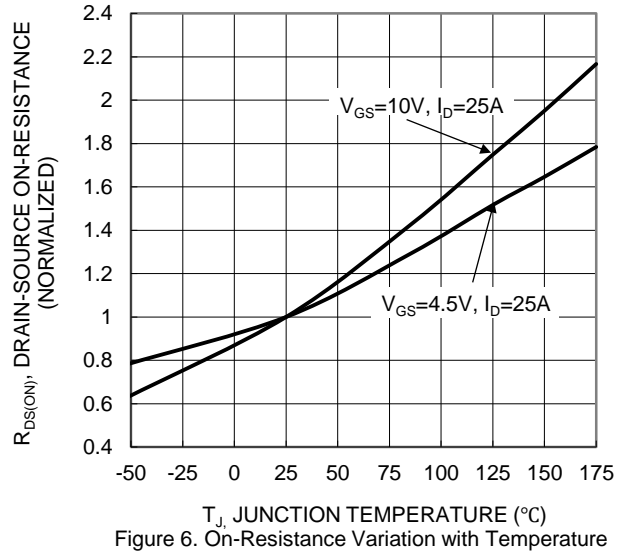
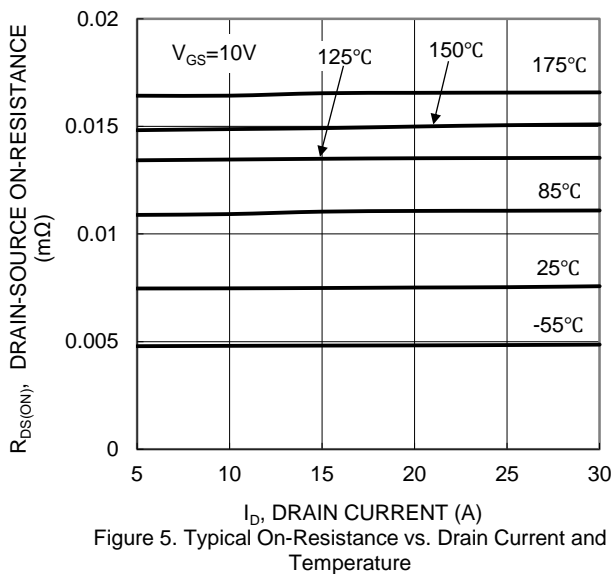
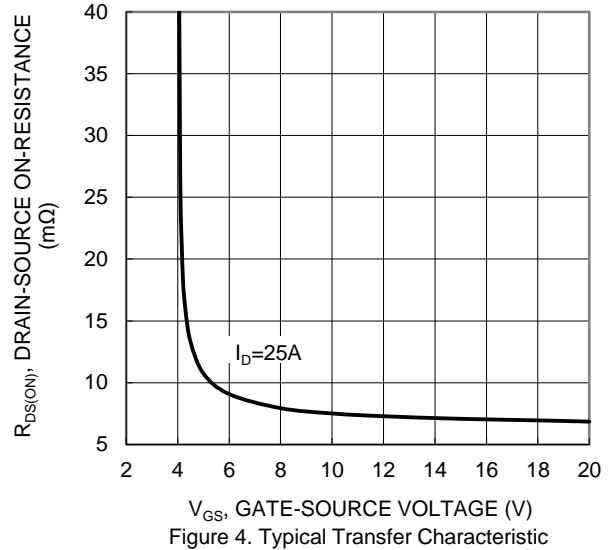
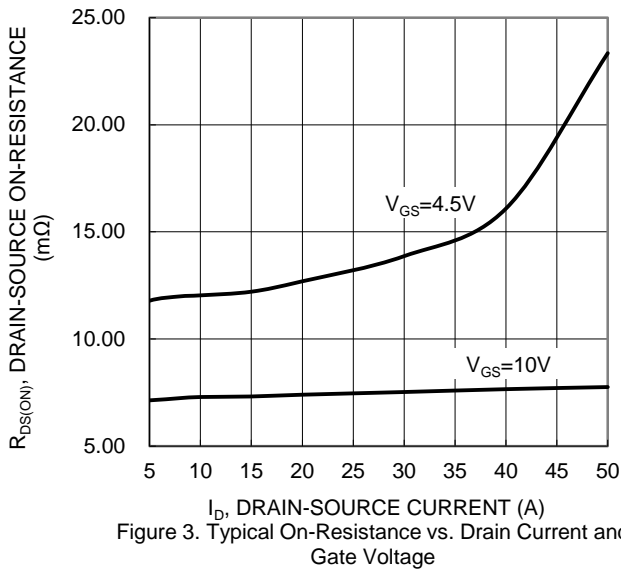
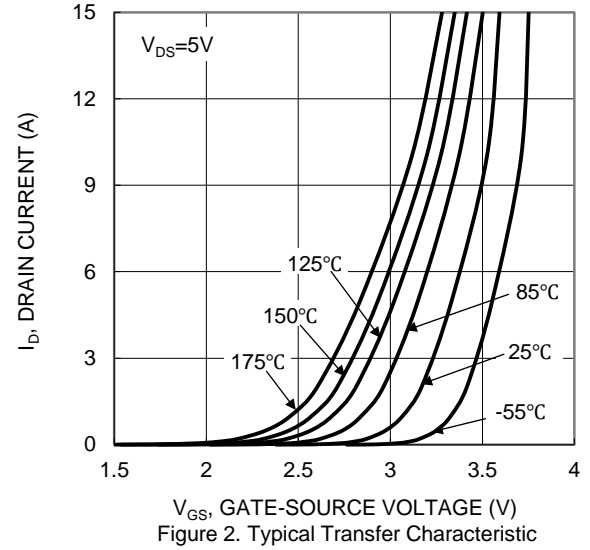
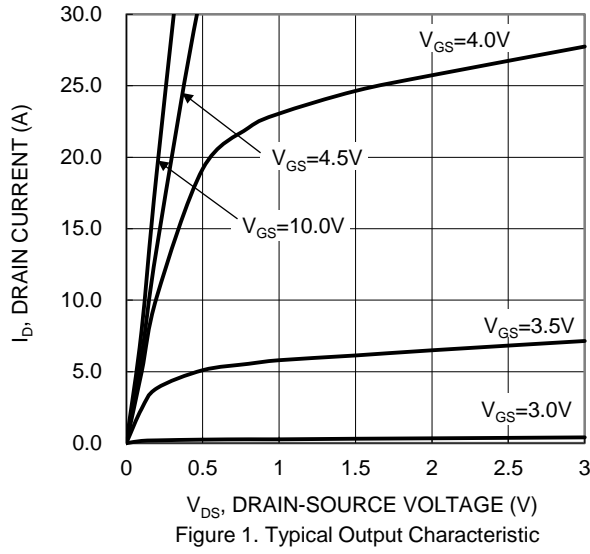
**Thermal Characteristics**

Characteristic	Symbol	Value	Unit
Total Power Dissipation (Note 6)	P <sub>D</sub>	1.6	W
Thermal Resistance, Junction to Ambient (Note 6)	R <sub>θJA</sub>	Steady State	93
		t < 10s	51
Total Power Dissipation (Note 7)	P <sub>D</sub>	3.1	W
Thermal Resistance, Junction to Ambient (Note 7)	R <sub>θJA</sub>	Steady State	49
		t < 10s	26
Thermal Resistance, Junction to Case	R <sub>θJC</sub>	3.8	°C/W
Operating and Storage Temperature Range	T <sub>J</sub> , T <sub>STG</sub>	-55 to +175	°C

**Electrical Characteristics** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
<b>OFF CHARACTERISTICS</b> (Note 9)						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	60	—	—	V	V <sub>GS</sub> = 0V, I <sub>D</sub> = 250µA
Zero Gate Voltage Drain Current, T <sub>J</sub> = +25°C	I <sub>DSS</sub>	—	—	1	µA	V <sub>DS</sub> = 60V, 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 9)						
Gate Threshold Voltage	V <sub>GS(TH)</sub>	2	—	4	V	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250µA
Static Drain-Source On-Resistance	R <sub>DS(ON)</sub>	—	8	11	mΩ	V <sub>GS</sub> = 10V, I <sub>D</sub> = 50A
Diode Forward Voltage	V <sub>SD</sub>	—	0.7	1.2	V	V <sub>GS</sub> = 0V, I <sub>S</sub> = 1.7A
<b>DYNAMIC CHARACTERISTICS</b> (Note 10)						
Input Capacitance	C <sub>ISS</sub>	—	1,926	—	pF	V <sub>DS</sub> = 30V, V <sub>GS</sub> = 0V, f = 1MHz
Output Capacitance	C <sub>OSS</sub>	—	330	—	pF	
Reverse Transfer Capacitance	C <sub>RSS</sub>	—	112	—	pF	
Gate Resistance	R <sub>G</sub>	—	2.0	—	Ω	V <sub>DS</sub> = 0V, V <sub>GS</sub> = 0V, f = 1MHz
Total Gate Charge (V <sub>GS</sub> = 4.5V)	Q <sub>G</sub>	—	16.3	—	nC	V <sub>DS</sub> = 30V, I <sub>D</sub> = 25A
Total Gate Charge (V <sub>GS</sub> = 10V)	Q <sub>G</sub>	—	35.2	—	nC	
Gate-Source Charge	Q <sub>GS</sub>	—	7.6	—	nC	
Gate-Drain Charge	Q <sub>GD</sub>	—	6.9	—	nC	
Turn-On Delay Time	t <sub>D(ON)</sub>	—	6.4	—	ns	V <sub>GS</sub> = 10V, V <sub>DS</sub> = 30V, R <sub>G</sub> = 3Ω, I <sub>D</sub> = 25A
Turn-On Rise Time	t <sub>R</sub>	—	11.9	—	ns	
Turn-Off Delay Time	t <sub>D(OFF)</sub>	—	16.5	—	ns	
Turn-Off Fall Time	t <sub>F</sub>	—	5	—	ns	
Body Diode Reverse Recovery Time	t <sub>RR</sub>	—	28	—	ns	I <sub>F</sub> = 25A, di/dt = 100A/µs
Body Diode Reverse Recovery Charge	Q <sub>RR</sub>	—	23	—	nC	

- 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.
  - I<sub>AS</sub> and E<sub>AS</sub> ratings are based on low frequency and duty cycles to keep T<sub>J</sub> = +25°C.
  - Short duration pulse test used to minimize self-heating effect.
  - Guaranteed by design. Not subject to product testing.



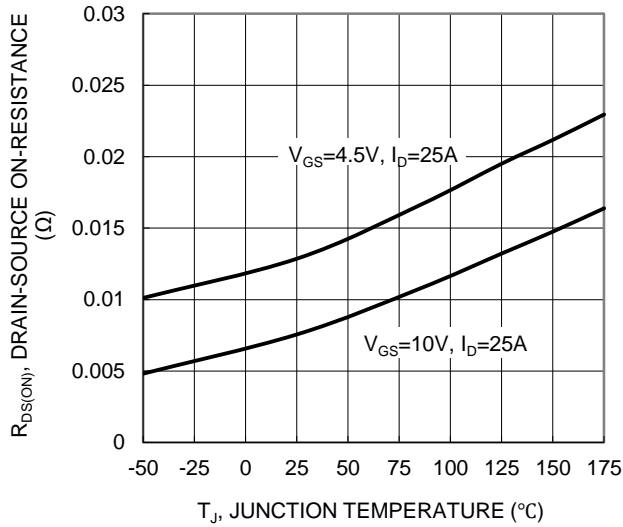


Figure 7. On-Resistance Variation with Temperature

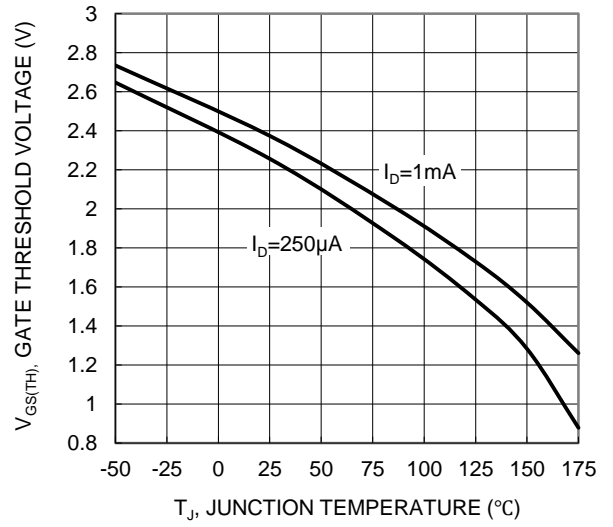


Figure 8. Gate Threshold Variation vs. Junction Temperature

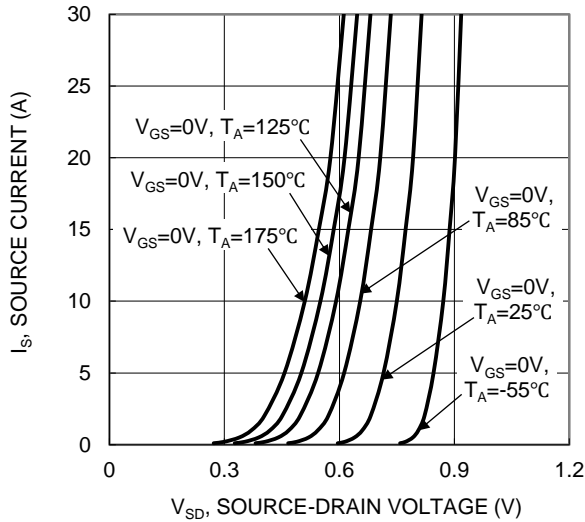


Figure 9. Diode Forward Voltage vs. Current

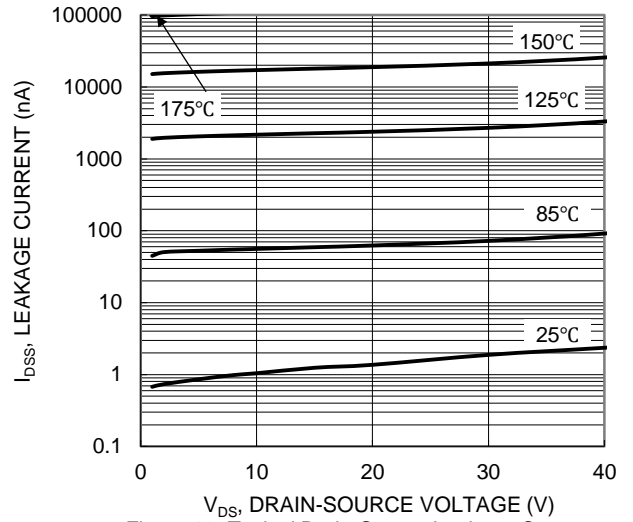


Figure 10. Typical Drain-Source Leakage Current vs. Voltage

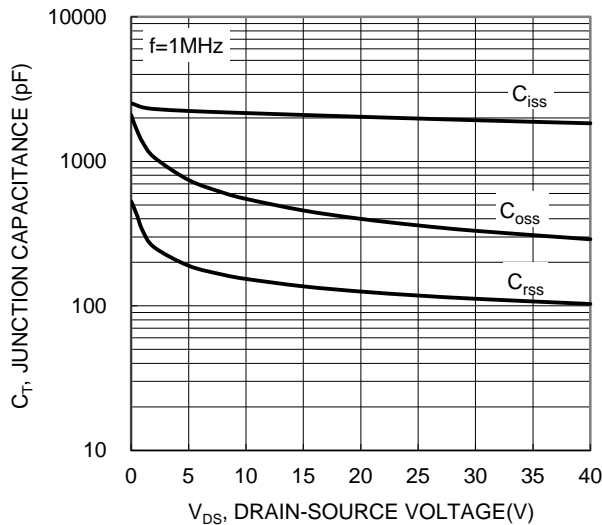


Figure 11. Typical Junction Capacitance

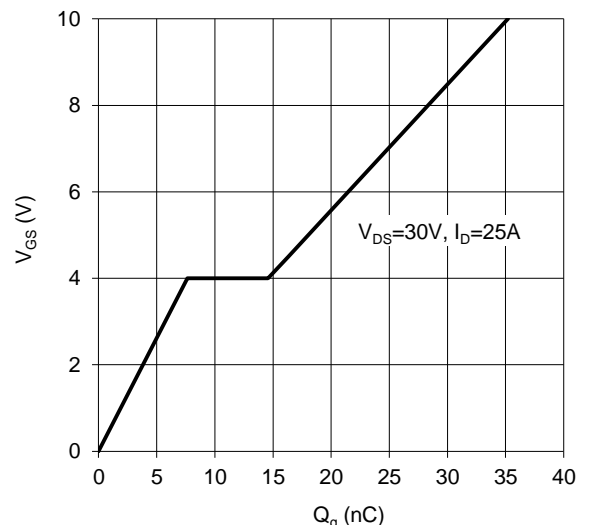
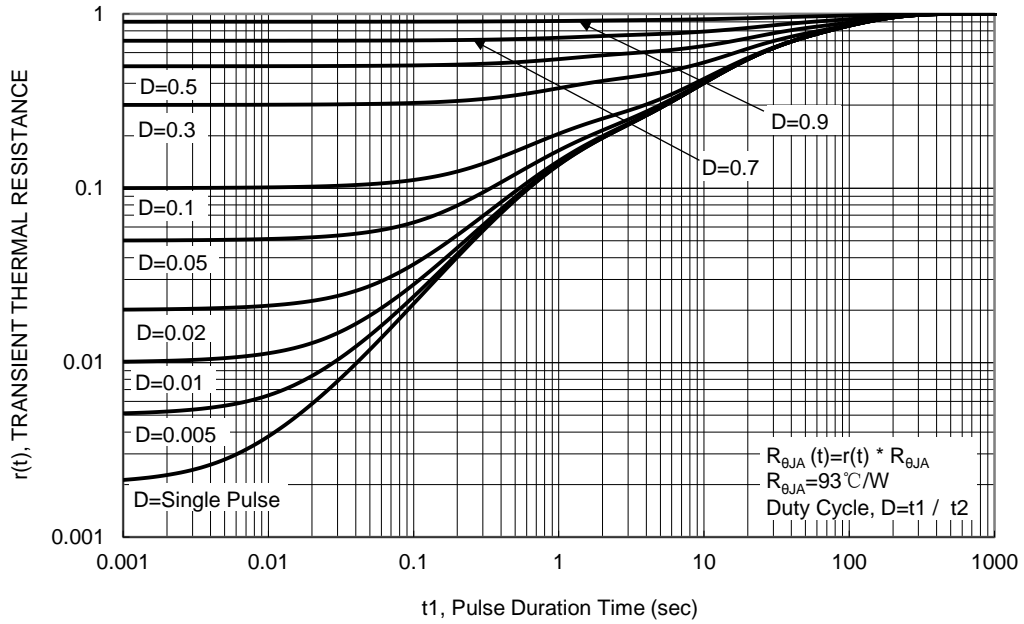
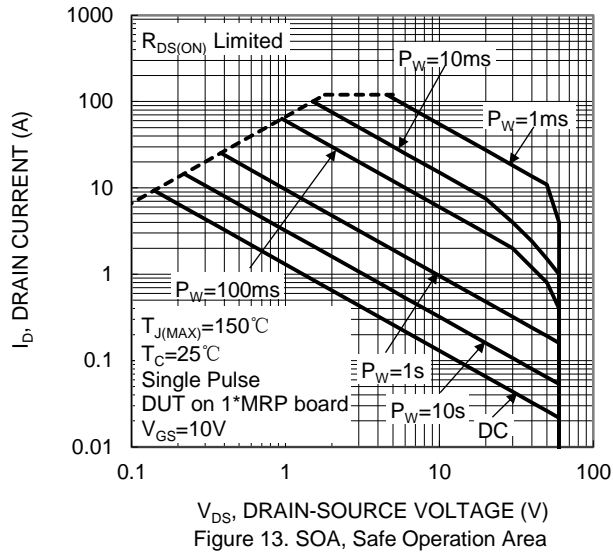


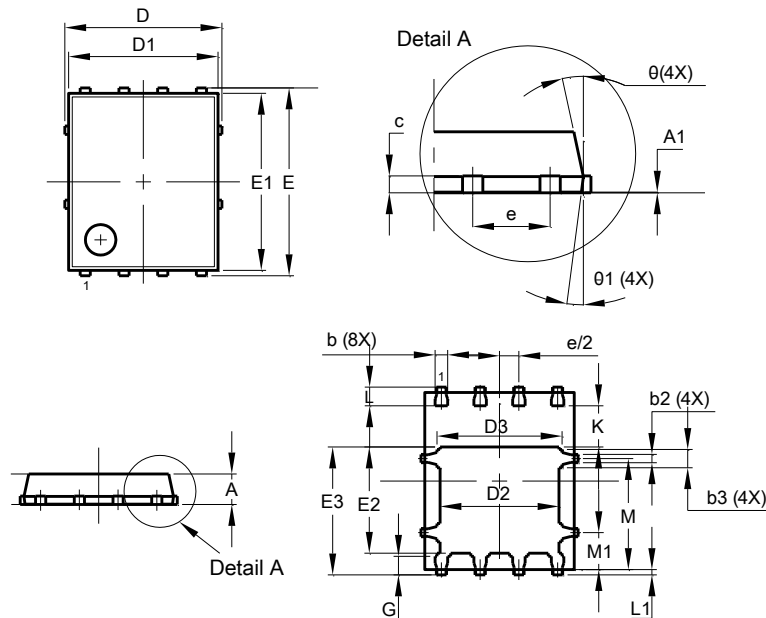
Figure 12. Gate Charge



**Package Outline Dimensions**

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

**PowerDI5060-8**

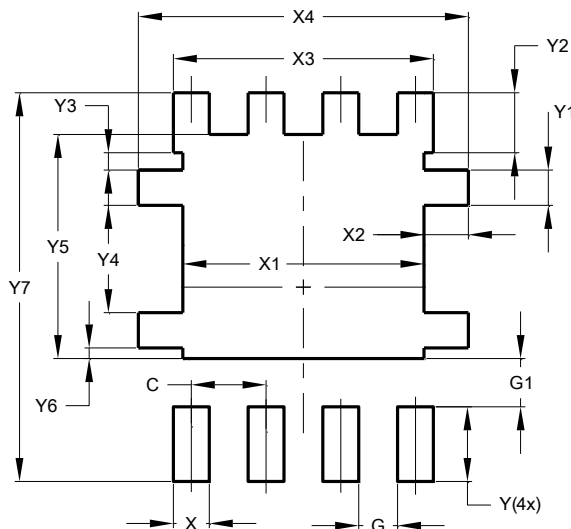


PowerDI5060-8			
Dim	Min	Max	Typ
A	0.90	1.10	1.00
A1	0.00	0.05	-
b	0.33	0.51	0.41
b2	0.200	0.350	0.273
b3	0.40	0.80	0.60
c	0.230	0.330	0.277
D	5.15 BSC		
D1	4.70	5.10	4.90
D2	3.70	4.10	3.90
D3	3.90	4.30	4.10
E	6.15 BSC		
E1	5.60	6.00	5.80
E2	3.28	3.68	3.48
E3	3.99	4.39	4.19
e	1.27 BSC		
G	0.51	0.71	0.61
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	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**



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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