

## Product Summary

<b>BV<sub>DSS</sub></b>	<b>R<sub>DS(ON)</sub> max</b>	<b>I<sub>D</sub> max</b> <b>T<sub>C</sub> = +25°C</b>
40V	15mΩ @ V <sub>GS</sub> = 10V	42A

## 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:

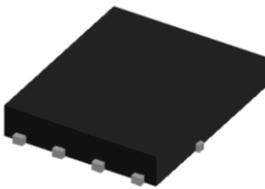
- Backlighting
- Power Management Functions
- DC-DC Converters

## Features and Benefits

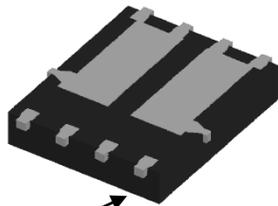
- Rated to +175°C – Ideal for High Ambient Temperature Environments
- 100% Unclamped Inductive Switching – Ensures More Reliable and Robust End Application
- High Conversion Efficiency
- Low R<sub>DS(ON)</sub> – Minimizes On State Losses
- Low Input Capacitance
- Fast Switching Speed
- **Totally Lead-Free & 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)**

## Mechanical Data

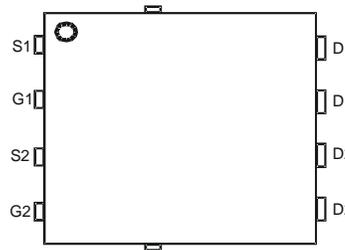
- Case: PowerDI<sup>®</sup> 5060-8 (Type C)
- Case Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish — Matte Tin Annealed over Copper Leadframe. Solderable per MIL-STD-202, Method 208 ③
- Weight: 0.097 grams (Approximate)



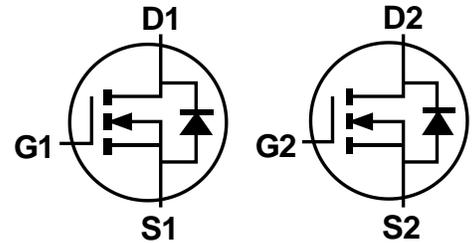
Top View



Bottom View



Pin Out Top View



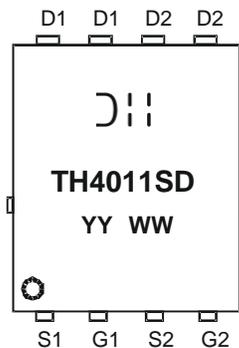
Equivalent Circuit

## Ordering Information (Note 5)

Part Number	Case	Packaging
DMTH4011SPDQ-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) & 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.
  4. Automotive products are AEC-Q101 qualified and are PPAP capable. Refer to <https://www.diodes.com/quality/>.
  5. For packaging details, go to our website at <https://www.diodes.com/design/support/packaging/diodes-packaging/>.

## Marking Information



- ⌋⌋⌋ = Manufacturer's Marking
- TH4011SD = Product Type Marking Code
- YYWW = Date Code Marking
- YY = Year (ex: 18 = 2018)
- WW = Week (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>	40	V
Gate-Source Voltage	V <sub>GSS</sub>	±20	V
Continuous Drain Current (Note 7)	I <sub>D</sub>	T <sub>C</sub> = +25°C	42
		T <sub>C</sub> = +100°C	29.7
Continuous Drain Current (Note 6)	I <sub>D</sub>	T <sub>A</sub> = +25°C	11.1
		T <sub>A</sub> = +100°C	7.8
Pulsed Drain Current (10µs Pulse, Duty Cycle = 1%)	I <sub>DM</sub>	60	A
Maximum Continuous Body Diode Forward Current (Note 7)	I <sub>S</sub>	3.3	A
Pulsed Body Diode Forward Current (10µs Pulse, Duty Cycle = 1%)	I <sub>SM</sub>	60	A
Avalanche Current, L = 0.3mH	I <sub>AS</sub>	11.9	A
Avalanche Energy, L = 0.3mH	E <sub>AS</sub>	21.4	mJ

**Thermal Characteristics**

Characteristic	Symbol	Value	Unit
Total Power Dissipation (Note 6)	P <sub>D</sub>	2.6	W
Thermal Resistance, Junction to Ambient (Note 6)	R <sub>θJA</sub>	57	°C/W
Total Power Dissipation (Note 7)	P <sub>D</sub>	37.5	W
Thermal Resistance, Junction to Case (Note 7)	R <sub>θJC</sub>	4	°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 (Note 8)</b>						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	40	—	—	V	V <sub>GS</sub> = 0V, I <sub>D</sub> = 1mA
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	—	—	1	µA	V <sub>DS</sub> = 32V, 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 (Note 8)</b>						
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>	—	11.6	15	mΩ	V <sub>GS</sub> = 10V, I <sub>D</sub> = 20A
Diode Forward Voltage	V <sub>SD</sub>	—	—	1.2	V	V <sub>GS</sub> = 0V, I <sub>S</sub> = 20A
<b>DYNAMIC CHARACTERISTICS (Note 9)</b>						
Input Capacitance	C <sub>iss</sub>	—	805	—	pF	V <sub>DS</sub> = 20V, V <sub>GS</sub> = 0V, f = 1MHz
Output Capacitance	C <sub>oss</sub>	—	208	—	pF	
Reverse Transfer Capacitance	C <sub>rss</sub>	—	15	—	pF	
Gate Resistance	R <sub>g</sub>	—	2.76	—	Ω	V <sub>DS</sub> = 0V, V <sub>GS</sub> = 0V, f = 1MHz
Total Gate Charge	Q <sub>g</sub>	—	10.6	—	nC	V <sub>DS</sub> = 20V, I <sub>D</sub> = 20A, V <sub>GS</sub> = 10V
Gate-Source Charge	Q <sub>gs</sub>	—	2.2	—	nC	
Gate-Drain Charge	Q <sub>gd</sub>	—	2.7	—	nC	
Turn-On Delay Time	t <sub>D(ON)</sub>	—	4.1	—	ns	V <sub>DD</sub> = 20V, V <sub>GS</sub> = 10V, R <sub>G</sub> = 1.6Ω, I <sub>D</sub> = 20A
Turn-On Rise Time	t <sub>R</sub>	—	3.8	—	ns	
Turn-Off Delay Time	t <sub>D(OFF)</sub>	—	8.6	—	ns	
Turn-Off Fall Time	t <sub>F</sub>	—	1.9	—	ns	
Body Diode Reverse Recovery Time	t <sub>RR</sub>	—	10.2	—	ns	I <sub>F</sub> = 15A, di/dt = 400A/µs
Body Diode Reverse Recovery Charge	Q <sub>RR</sub>	—	9.6	—	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 product testing.

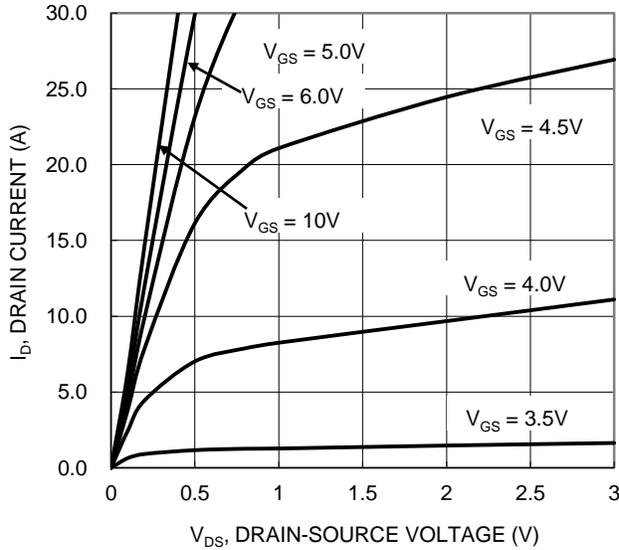


Figure 1. Typical Output Characteristic

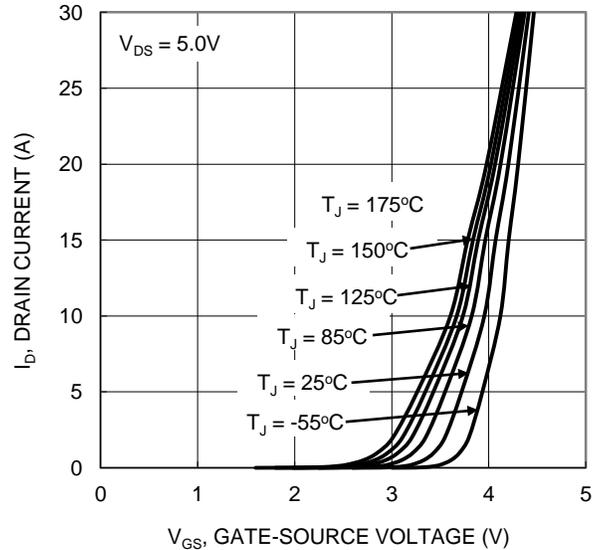


Figure 2. Typical Transfer Characteristic

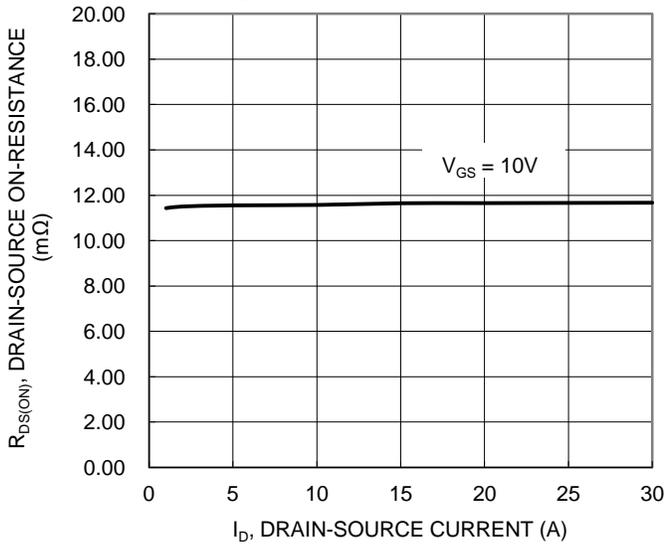


Figure 3. Typical On-Resistance vs. Drain Current and Gate Voltage

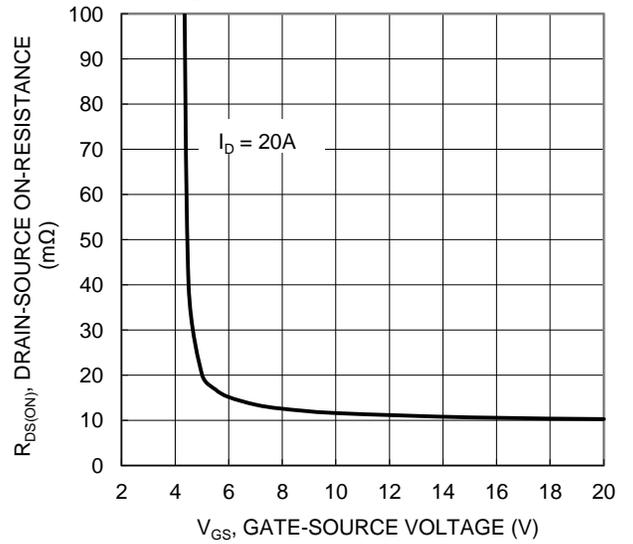


Figure 4. Typical Transfer Characteristic

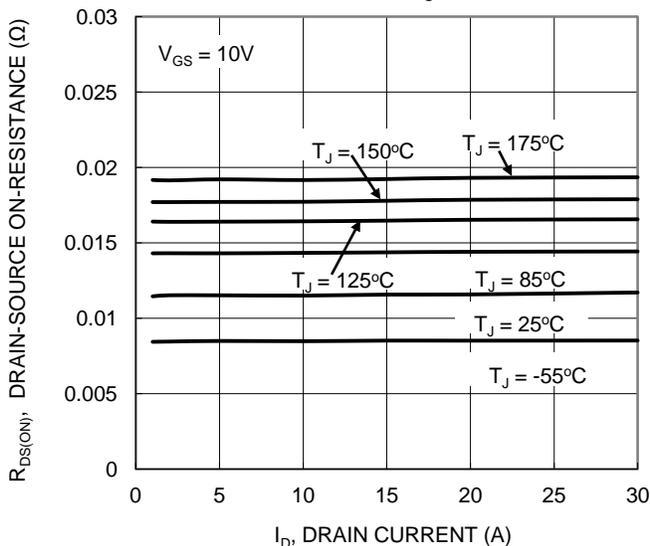


Figure 5. Typical On-Resistance vs. Drain Current and Temperature

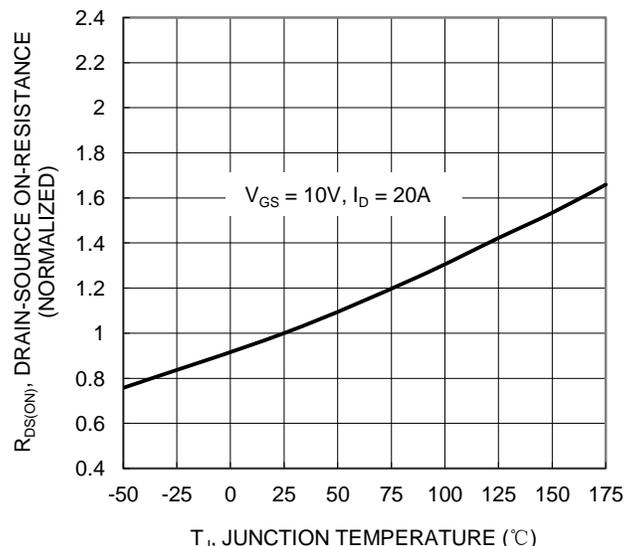


Figure 6. On-Resistance Variation with Temperature

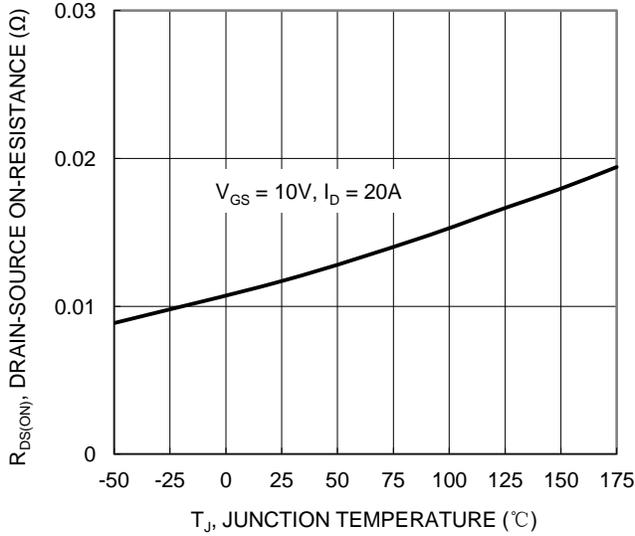


Figure 7. On-Resistance Variation with Temperature

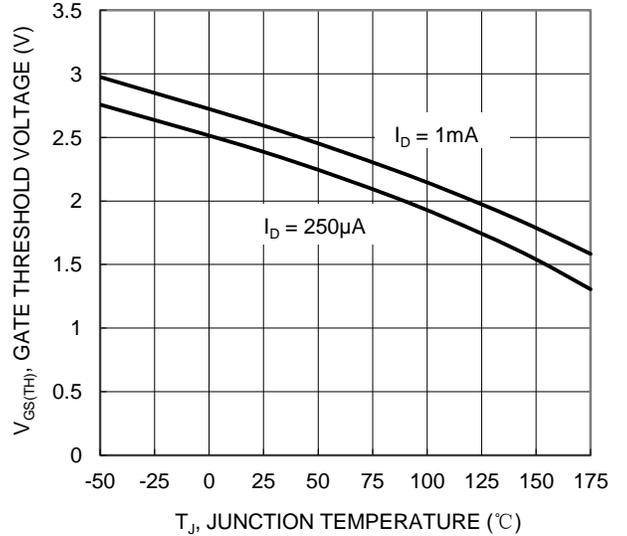


Figure 8. Gate Threshold Variation vs. Temperature

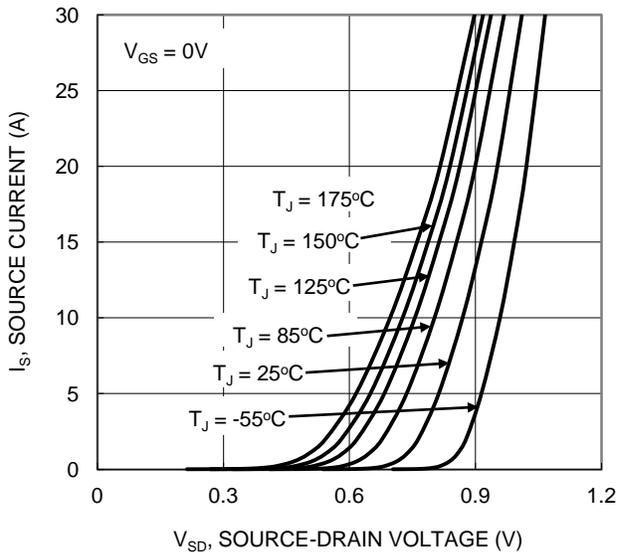


Figure 9. Diode Forward Voltage vs. Current

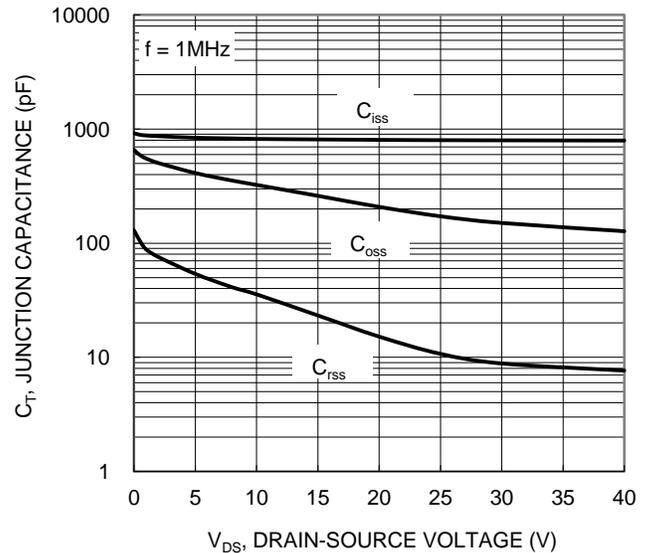


Figure 10. Typical Junction Capacitance

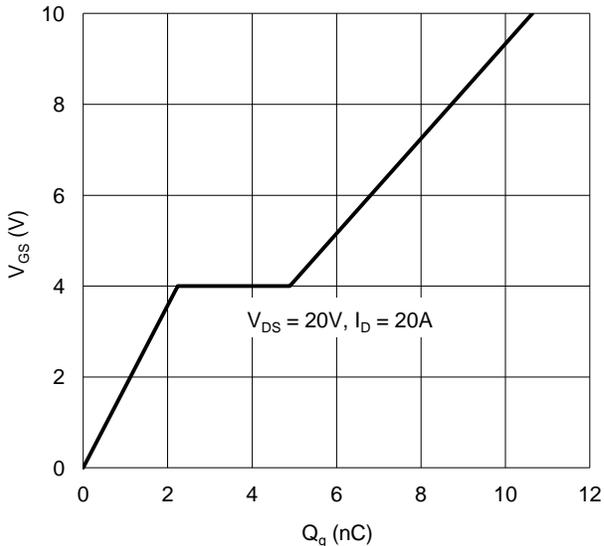


Figure 11. Gate Charge

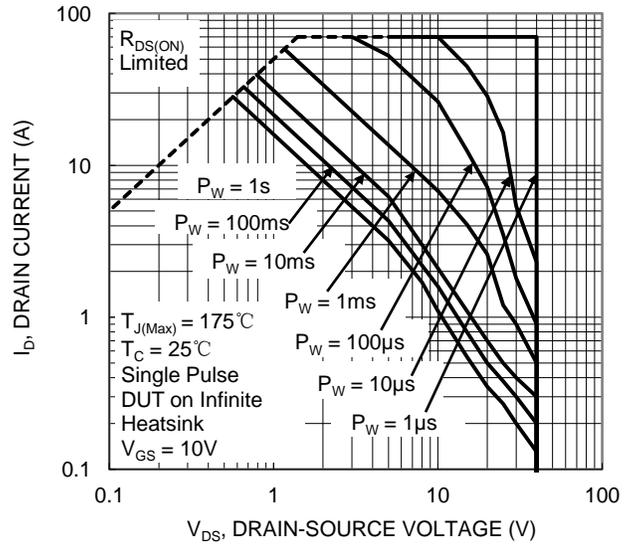


Figure 12. SOA, Safe Operation Area

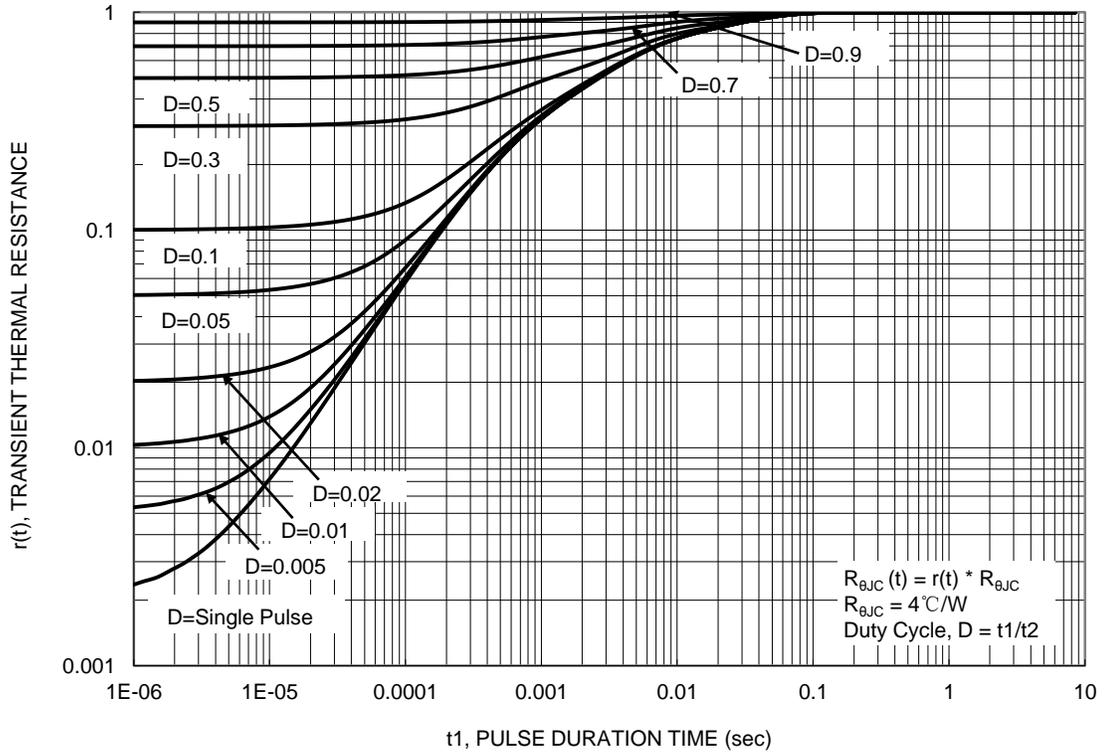
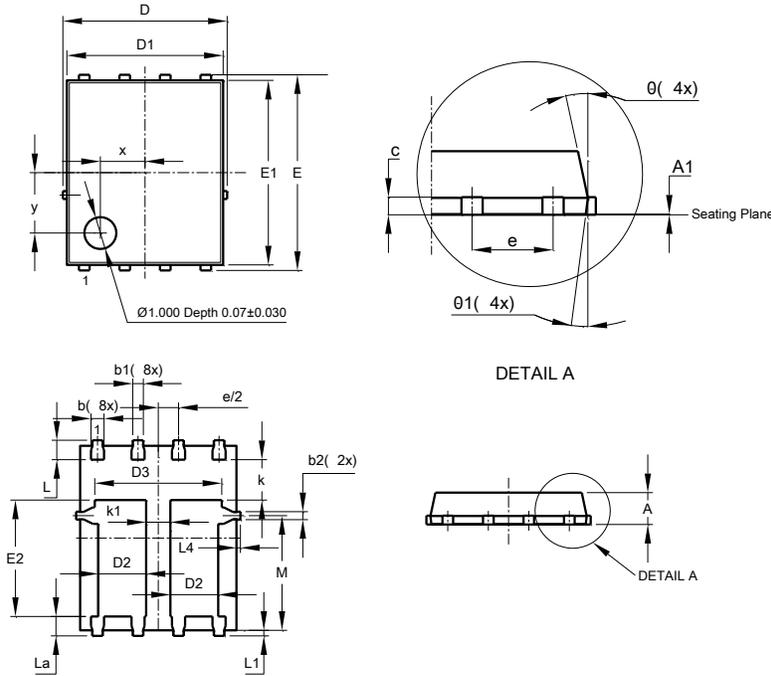


Figure 13. Transient Thermal Resistance

**Package Outline Dimensions**

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

**PowerDI5060-8 (Type C)**

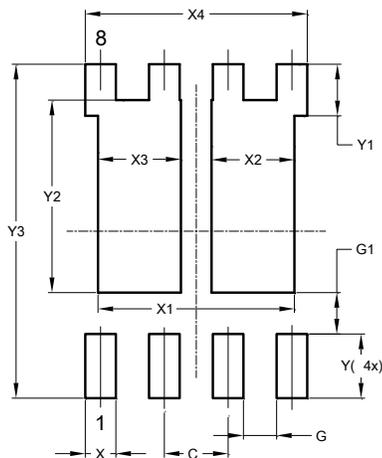


PowerDI5060-8 (Type C)			
Dim	Min	Max	Typ
A	0.90	1.10	1.00
A1	0	0.05	0.02
b	0.33	0.51	0.41
b1	0.300	0.366	0.333
b2	0.20	0.35	0.25
c	0.23	0.33	0.277
D	5.15 BSC		
D1	4.85	4.95	4.90
D2	1.40	1.60	1.50
D3	-	-	3.98
E	6.15 BSC		
E1	5.75	5.85	5.80
E2	3.56	3.76	3.66
e	1.27BSC		
k	-	-	1.27
k1	0.56	-	-
L	0.51	0.71	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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