

## Product Summary

$BV_{DSS}$	$R_{DS(ON)}$ Max	$I_D$ Max $T_C = +25^\circ\text{C}$
30V	1.7m $\Omega$ @ $V_{GS} = 10\text{V}$	100A
	2.4m $\Omega$ @ $V_{GS} = 4.5\text{V}$	80A

## Features and Benefits

- Rated to +175°C—Ideal for High Ambient Temperature Environments
- Low  $R_{DS(ON)}$  – Minimizes On-State Losses
- Excellent  $Q_{gd} \times R_{DS(ON)}$  Product (FOM)
- Advanced Technology for DC-DC Converters
- Small Form Factor Thermally Efficient Package Enables Higher Density End Products
- 100% Unclamped Inductive Switching – Ensures More Reliability
- Lead-Free Finish; RoHS Compliant (Notes 1 & 2)**
- Halogen- and Antimony-Free. "Green" Device (Note 3)**
- The DMTH31M7LPSQ is suitable for automotive applications requiring specific change control; is AEC-Q101 qualified, PPAP capable, and manufactured in IATF16949:2016 certified facilities.**

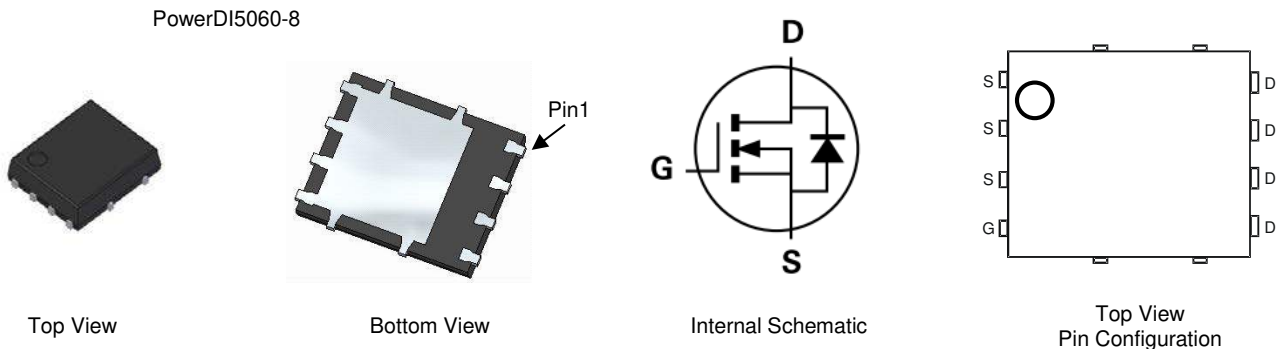
## Description and Applications

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

- Backlighting
- Power Management Functions
- DC-DC Converters

## 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
- Terminal Connections Indicator: See Diagram
- Terminals: Finish — Matte Tin Annealed over Copper Lead-frame. Solderable per MIL-STD-202, Method 208
- Weight: 0.097 grams (Approximate)

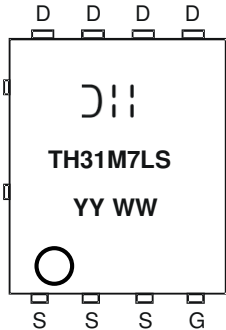



## Ordering Information (Note 4)

Part Number	Case	Packaging
DMTH31M7LPSQ-13	PowerDI5060-8	2,500/Tape & Reel

- Notes:
- EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant. All applicable RoHS exemptions applied.
  - 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.
  - Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.
  - For packaging details, go to our website at <https://www.diodes.com/design/support/packaging/diodes-packaging/>.

## Marking Information



 = Manufacturer's Marking  
 TH31M7LS = Product Type Marking Code  
 YYWW = Date Code Marking  
 YY = Year (ex: 19 = 2019)  
 WW = Week (01 to 53)

## Maximum Ratings (@ $T_A = +25^\circ\text{C}$ , unless otherwise specified.)

Characteristic	Symbol	Value	Unit
Drain-Source Voltage	$V_{DSS}$	30	V
Gate-Source Voltage	$V_{GSS}$	$\pm 16$	V
Continuous Drain Current, $V_{GS} = 10\text{V}$ (Note 6)	$I_D$	$T_A = +25^\circ\text{C}$	30
		$T_A = +100^\circ\text{C}$	23
Continuous Drain Current, $V_{GS} = 10\text{V}$ (Note 7)	$I_D$	$T_C = +25^\circ\text{C}$	100
		$T_C = +100^\circ\text{C}$	80
Maximum Continuous Body Diode Forward Current (Note 6)	$I_S$	2.8	A
Pulsed Drain Current (380 $\mu\text{s}$ Pulse, Duty Cycle = 1%)	$I_{DM}$	400	A
Pulsed Body Diode Forward Current (380 $\mu\text{s}$ Pulse, Duty Cycle = 1%)	$I_{SM}$	400	A
Avalanche Current, $L=0.1\text{mH}$ (Note 8)	$I_{AS}$	65	A
Avalanche Energy, $L=0.1\text{mH}$ (Note 8)	$E_{AS}$	215	mJ

## Thermal Characteristics

Characteristic	Symbol	Value	Unit
Total Power Dissipation (Note 5)	$P_D$	1.3	W
Thermal Resistance, Junction to Ambient (Note 5)	Steady State $R_{\theta JA}$	94	$^\circ\text{C/W}$
Total Power Dissipation (Note 6)	$P_D$	2.4	W
Thermal Resistance, Junction to Ambient (Note 6)	Steady State $R_{\theta JA}$	52	$^\circ\text{C/W}$
Total Power Dissipation (Note 7)	$P_D$	113	W
Thermal Resistance, Junction to Case (Note 7)	$R_{\theta JC}$	1.1	$^\circ\text{C/W}$
Operating and Storage Temperature Range	$T_J, T_{STG}$	-55 to +175	$^\circ\text{C}$

**Electrical Characteristics** (@  $T_A = +25^\circ\text{C}$ , unless otherwise specified.)

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
<b>OFF CHARACTERISTICS (Note 9)</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	30	—	—	V	$V_{GS} = 0V, I_D = 250\mu A$
Zero Gate Voltage Drain Current	$I_{DSS}$	—	—	1	$\mu A$	$V_{DS} = 24V, V_{GS} = 0V$
Gate-Source Leakage	$I_{GSS}$	—	—	$\pm 100$	nA	$V_{GS} = \pm 16V, V_{DS} = 0V$
<b>ON CHARACTERISTICS (Note 9)</b>						
Gate Threshold Voltage	$V_{GS(TH)}$	1.0	—	3.0	V	$V_{DS} = V_{GS}, I_D = 250\mu A$
Static Drain-Source On-Resistance	$R_{DS(ON)}$	—	1.3	1.7	m $\Omega$	$V_{GS} = 10V, I_D = 20A$
		—	1.9	2.4		$V_{GS} = 4.5V, I_D = 20A$
Diode Forward Voltage	$V_{SD}$	—	0.7	1.0	V	$V_{GS} = 0V, I_S = 2A$
<b>DYNAMIC CHARACTERISTICS (Note 10)</b>						
Input Capacitance	$C_{iss}$	—	5741	—	pF	$V_{DS} = 15V, V_{GS} = 0V,$ $f = 1.0MHz$
Output Capacitance	$C_{oss}$	—	2119	—		
Reverse Transfer Capacitance	$C_{rss}$	—	424	—		
Gate Resistance	$R_g$	—	1.5	—	$\Omega$	$V_{DS} = 0V, V_{GS} = 0V, f = 1.0MHz$
Total Gate Charge ( $V_{GS} = 10V$ )	$Q_g$	—	90	—	nC	$V_{DD} = 15V, I_D = 20A$
Total Gate Charge ( $V_{GS} = 4.5V$ )	$Q_g$	—	45	—		
Gate-Source Charge	$Q_{gs}$	—	11.6	—		
Gate-Drain Charge	$Q_{gd}$	—	21.6	—		
Turn-On Delay Time	$t_{D(ON)}$	—	6.9	—	ns	$V_{DD} = 15V, V_{GS} = 10V,$ $R_g = 3\Omega, I_D = 20A$
Turn-On Rise Time	$t_R$	—	16.5	—		
Turn-Off Delay Time	$t_{D(OFF)}$	—	49.6	—		
Turn-Off Fall Time	$t_F$	—	34.5	—		
Reverse Recovery Time	$t_{RR}$	—	32.5	—	ns	$I_F = 15A, di/dt = 500A/\mu s$
Reverse Recovery Charge	$Q_{RR}$	—	55	—	nC	$I_F = 15A, di/dt = 500A/\mu s$

- 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.
  - Thermal resistance from junction to soldering point (on the exposed drain pad).
  - $I_{AS}$  and  $E_{AS}$  ratings are based on low frequency and duty cycles to keep  $T_J = +25^\circ\text{C}$ .
  - Short duration pulse test used to minimize self-heating effect.
  - Guaranteed by design. Not subject to product testing.

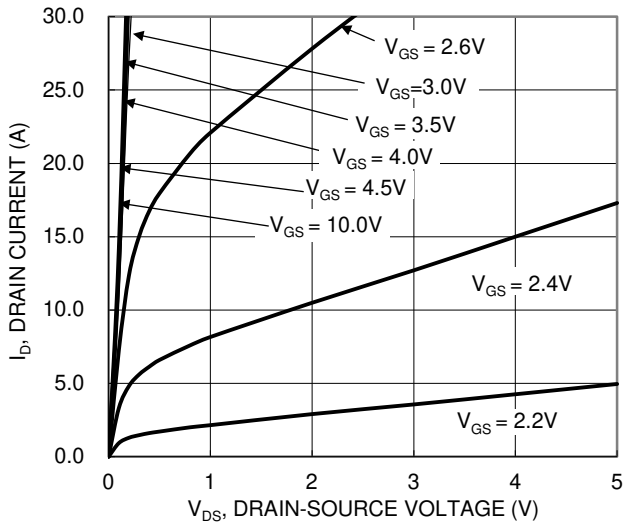


Figure 1. Typical Output Characteristic

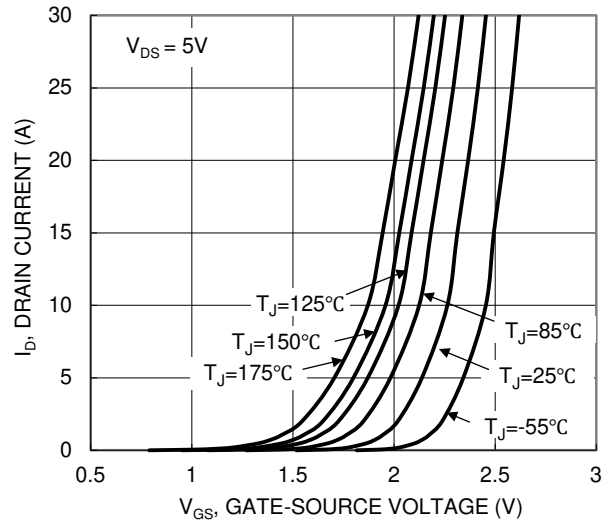


Figure 2. Typical Transfer Characteristic

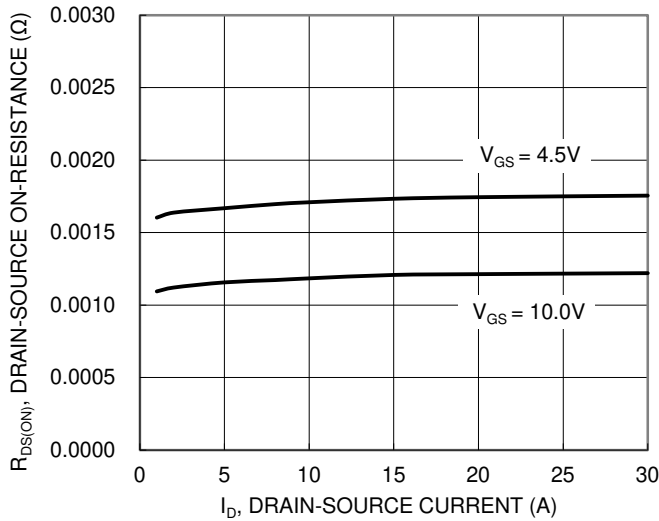


Figure 3. Typical On-Resistance vs. Drain Current and Gate Voltage

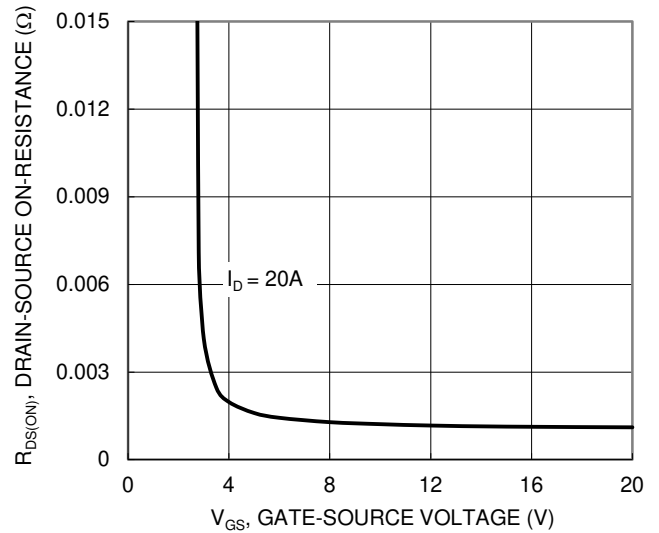


Figure 4. Typical Transfer Characteristic

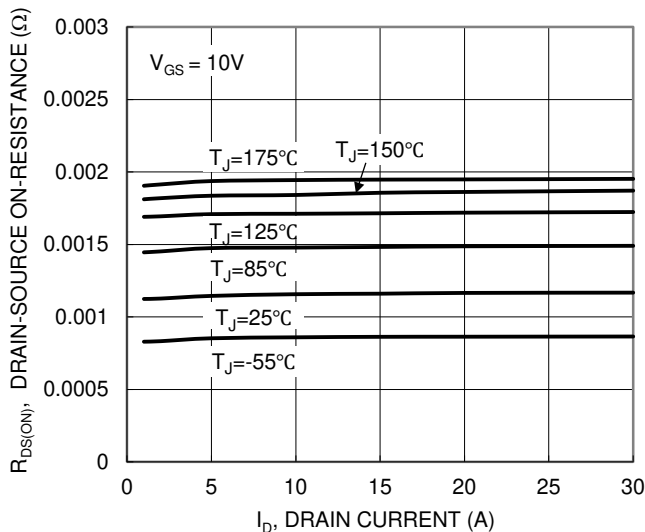


Figure 5. Typical On-Resistance vs. Drain Current and Temperature

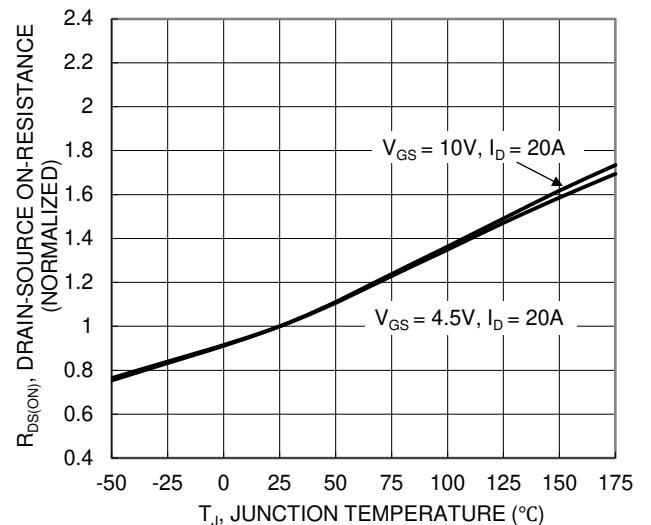


Figure 6. On-Resistance Variation with Temperature

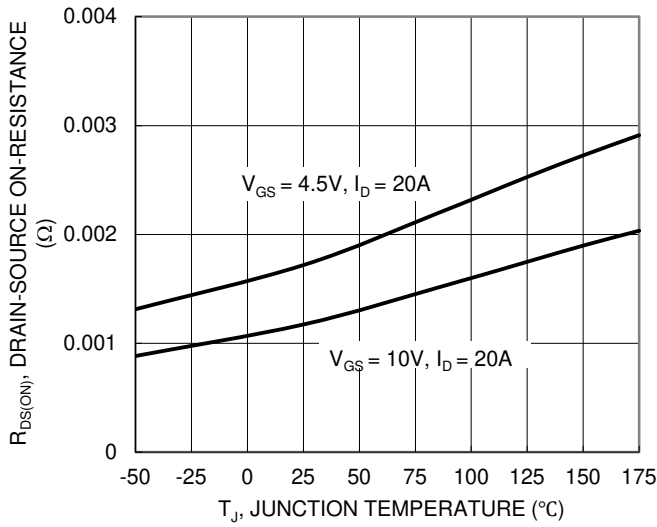


Figure 7. On-Resistance Variation with Temperature

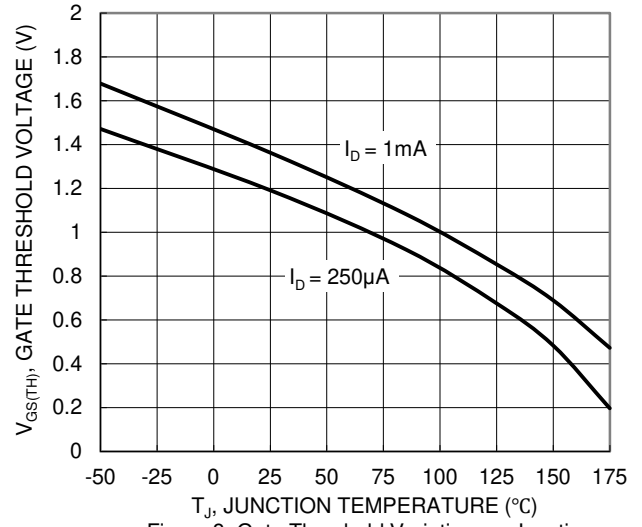


Figure 8. Gate Threshold Variation vs. Junction Temperature

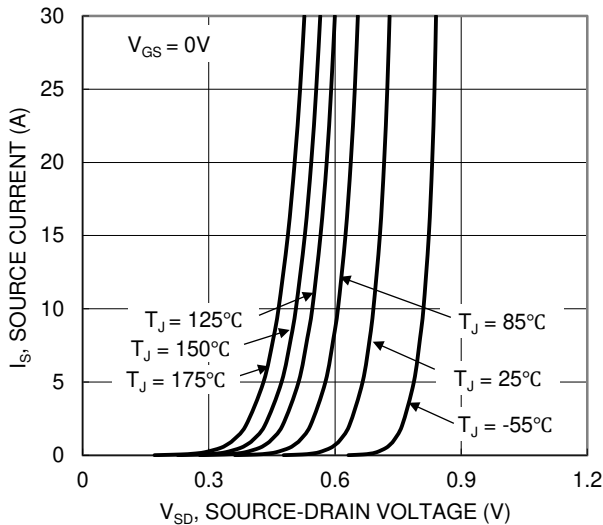


Figure 9. Diode Forward Voltage vs. Current

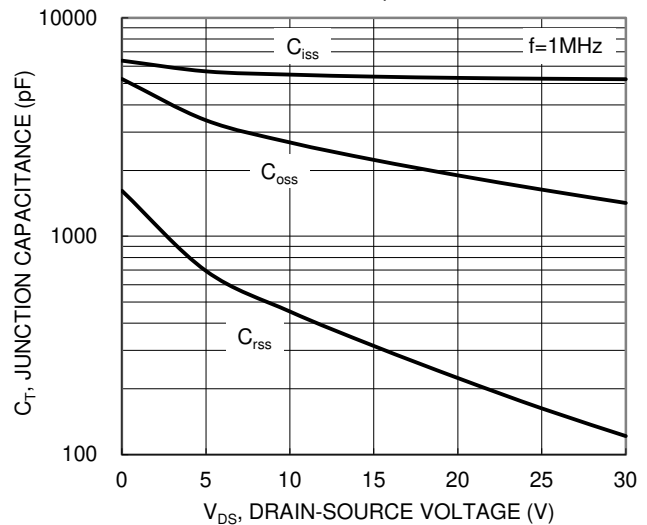


Figure 10. Typical Junction Capacitance

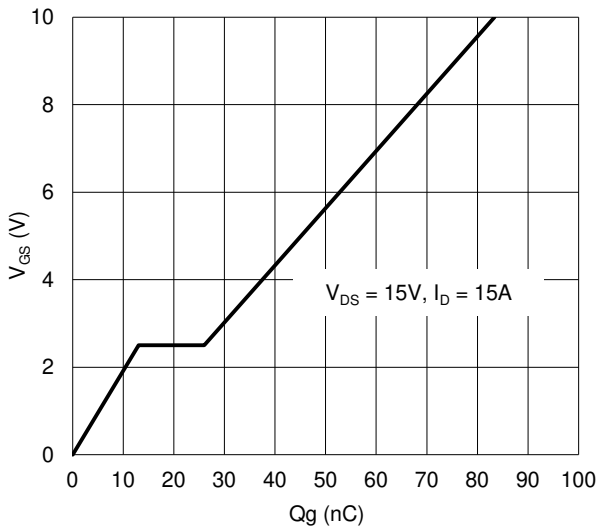


Figure 11. Gate Charge

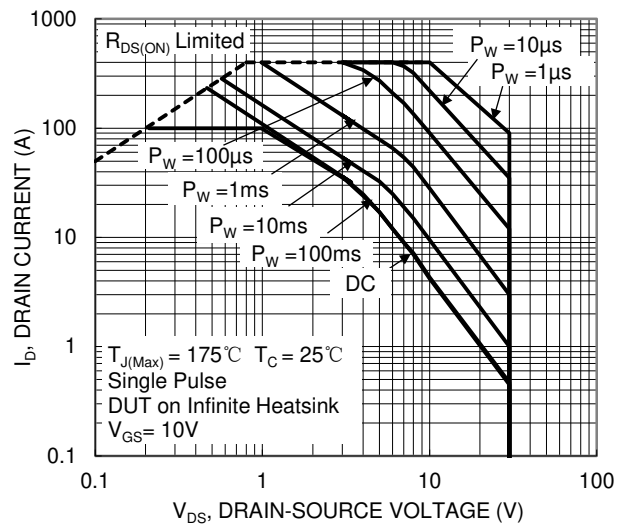


Figure 12. SOA, Safe Operation Area

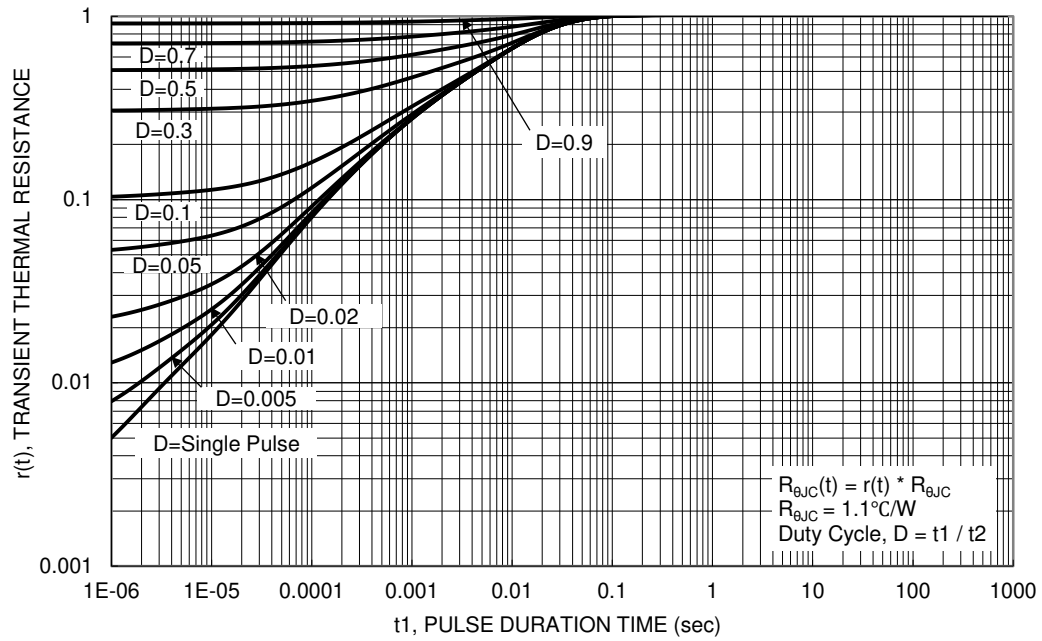
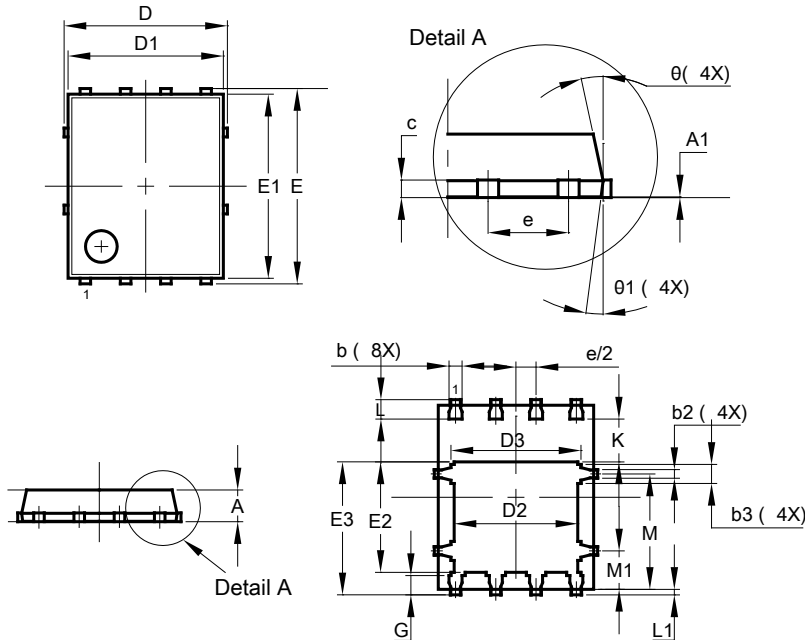


Figure 13. Transient Thermal Resistance

## Package Outline Dimensions

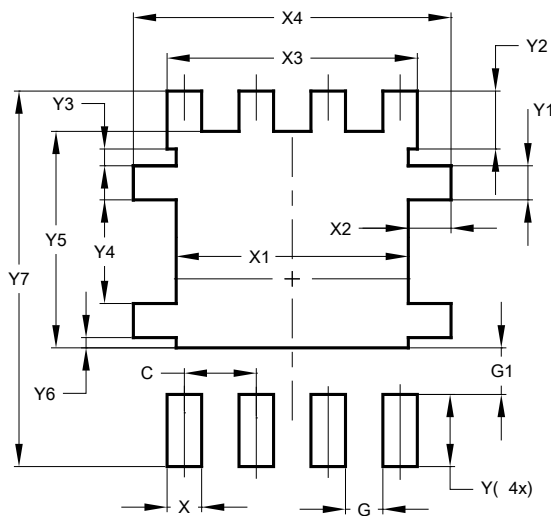
Please see <http://www.diodes.com/package-outlines.html> for the latest version.



PowerDI5060-8			
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
$\theta$	10°	12°	11°
$\theta_1$	6°	8°	7°
All Dimensions in mm			

## Suggested Pad Layout

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



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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