



YOUSHANG SEMICONDUCTOR

**设计研发新型功率器件**

**各类小信号开关**

**中低压及高压大电流等场效应管**

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## Product Summary

$BV_{DSS}$	$R_{DS(ON)}$	$I_D$ $T_C = +25^\circ C$
60V	12m $\Omega$ @ $V_{GS} = 10V$	31.5A
	17m $\Omega$ @ $V_{GS} = 4.5V$	26.5A

## Features

- 100% Unclamped Inductive Switching (UIS) Test in Production — Ensures More Reliable and Robust End Application
- High Conversion Efficiency
- Low  $R_{DS(ON)}$  — Minimizes On State Losses
- Low Input Capacitance
- Fast Switching Speed
- ESD Protected Gate
- Wettable Flank for Improved Optical Inspection

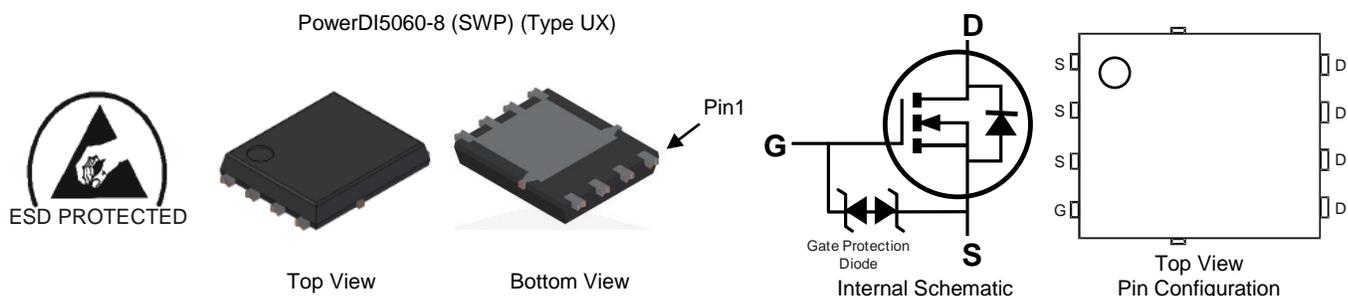
## Description and Applications

This MOSFET is designed to minimize the on-state resistance ( $R_{DS(ON)}$ ), yet maintain superior switching performance, making it ideal for high efficiency power management applications.

- Synchronous Rectifier
- DC-DC Converters
- Power Management

## 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 Finish — Matte Tin Annealed over Copper Leadframe; Solderable per MIL-STD-202, Method 208 (E3)
- Weight: 0.097 grams (Approximate)



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

Characteristic	Symbol	Value	Unit	
Drain-Source Voltage	$V_{DS}$	60	V	
Gate-Source Voltage	$V_{GS}$	$\pm 20$	V	
Continuous Drain Current (Note 5) $V_{GS} = 10\text{V}$	$I_D$	$T_A = +25^\circ\text{C}$ $T_A = +70^\circ\text{C}$	13.1 10.5	A
Continuous Drain Current (Note 6) $V_{GS} = 10\text{V}$		$T_C = +25^\circ\text{C}$ $T_C = +70^\circ\text{C}$	31.5 25.2	A
Pulsed Drain Current (10 $\mu\text{s}$ Pulse, Duty Cycle = 1%)	$I_{DM}$	120	A	
Maximum Continuous Body Diode Forward Current (Note 6)	$I_S$	30	A	
Pulsed Body Diode Forward Current (10 $\mu\text{s}$ Pulse, Duty Cycle = 1%)	$I_{SM}$	120	A	
Avalanche Current, $L = 0.3\text{mH}$	$I_{AS}$	16.3	A	
Avalanche Energy, $L = 0.3\text{mH}$	$E_{AS}$	39.5	mJ	

**Thermal Characteristics**

Characteristic	Symbol	Value	Unit	
Total Power Dissipation (Note 5)	$P_D$	$T_A = +25^\circ\text{C}$	3.1	W
Thermal Resistance, Junction to Ambient (Note 5)		$R_{\theta JA}$	40.3	$^\circ\text{C/W}$
Total Power Dissipation (Note 6)	$P_D$	$T_C = +25^\circ\text{C}$	17.9	W
Thermal Resistance, Junction to Case (Note 6)		$R_{\theta JC}$	7.0	$^\circ\text{C/W}$
Operating and Storage Temperature Range	$T_J, T_{STG}$	-55 to +150	$^\circ\text{C}$	

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

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
<b>OFF CHARACTERISTICS (Note 7)</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	60	—	—	V	$V_{GS} = 0\text{V}, I_D = 1\text{mA}$
Zero Gate Voltage Drain Current	$I_{DSS}$	—	—	1	$\mu\text{A}$	$V_{DS} = 48\text{V}, V_{GS} = 0\text{V}$
Gate-Source Leakage	$I_{GSS}$	—	—	$\pm 10$	$\mu\text{A}$	$V_{GS} = \pm 20\text{V}, V_{DS} = 0\text{V}$
<b>ON CHARACTERISTICS (Note 7)</b>						
Gate Threshold Voltage	$V_{GS(TH)}$	1	—	2.5	V	$V_{DS} = V_{GS}, I_D = 250\mu\text{A}$
Static Drain-Source On-Resistance	$R_{DS(ON)}$	—	9.1	12	m $\Omega$	$V_{GS} = 10\text{V}, I_D = 20\text{A}$
		—	12.9	17		$V_{GS} = 4.5\text{V}, I_D = 12.5\text{A}$
Diode Forward Voltage	$V_{SD}$	—	0.8	1.2	V	$V_{GS} = 0\text{V}, I_S = 20\text{A}$
<b>DYNAMIC CHARACTERISTICS (Note 8)</b>						
Input Capacitance	$C_{iss}$	—	1522	—	pF	$V_{DS} = 30\text{V}, V_{GS} = 0\text{V}, f = 1\text{MHz}$
Output Capacitance	$C_{oss}$	—	352	—		
Reverse Transfer Capacitance	$C_{rss}$	—	27.5	—		
Gate Resistance	$R_G$	—	1.4	—	$\Omega$	$V_{DS} = 0\text{V}, V_{GS} = 0\text{V}, f = 1\text{MHz}$
Total Gate Charge ( $V_{GS} = 4.5\text{V}$ )	$Q_g$	—	10.7	—	nC	$V_{DS} = 30\text{V}, I_D = 10\text{A}$
Total Gate Charge ( $V_{GS} = 10\text{V}$ )	$Q_g$	—	22.2	—		
Gate-Source Charge	$Q_{gs}$	—	3.3	—		
Gate-Drain Charge	$Q_{gd}$	—	4.2	—		
Turn-On Delay Time	$t_{D(ON)}$	—	4.4	—	ns	$V_{DS} = 30\text{V}, V_{GS} = 10\text{V}, I_D = 10\text{A}, R_G = 6\Omega$
Turn-On Rise Time	$t_R$	—	6.7	—		
Turn-Off Delay Time	$t_{D(OFF)}$	—	25.5	—		
Turn-Off Fall Time	$t_F$	—	12.5	—		
Reverse Recovery Time	$t_{RR}$	—	25.8	—	ns	$I_F = 10\text{A}, di/dt = 100\text{A}/\mu\text{s}$
Reverse Recovery Charge	$Q_{RR}$	—	15.1	—	nC	

- Notes:
- Device mounted on FR-4 substrate PC board, 2oz copper, with 1inch square copper plate.
  - Thermal resistance from junction to soldering point (on the exposed drain pad).
  - Short duration pulse test used to minimize self-heating effect.
  - Guaranteed by design. Not subject to product testing.

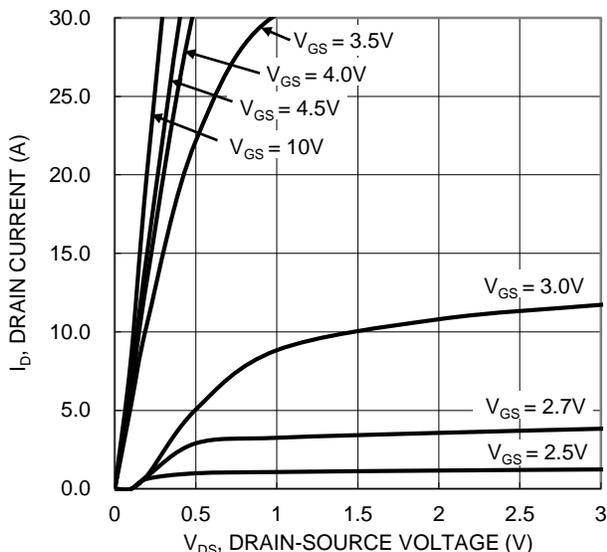


Figure 1. Typical Output Characteristic

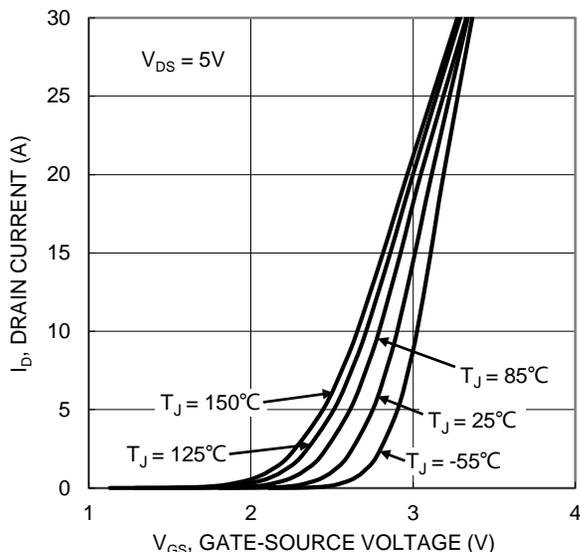


Figure 2. Typical Transfer Characteristic

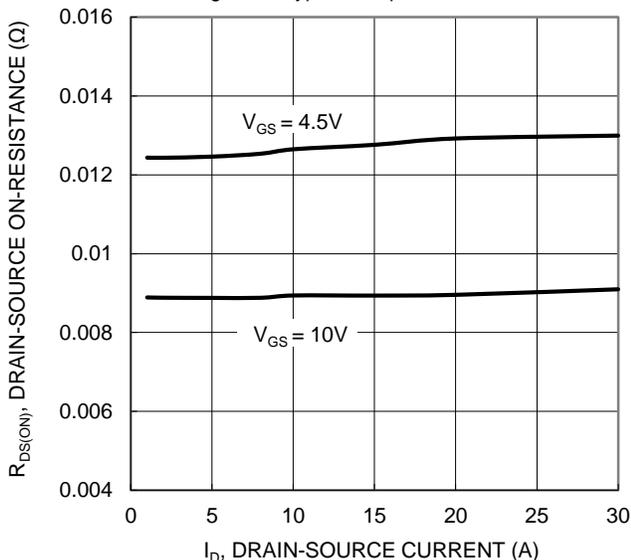


Figure 3. Typical On-Resistance vs. Drain Current and Gate Voltage

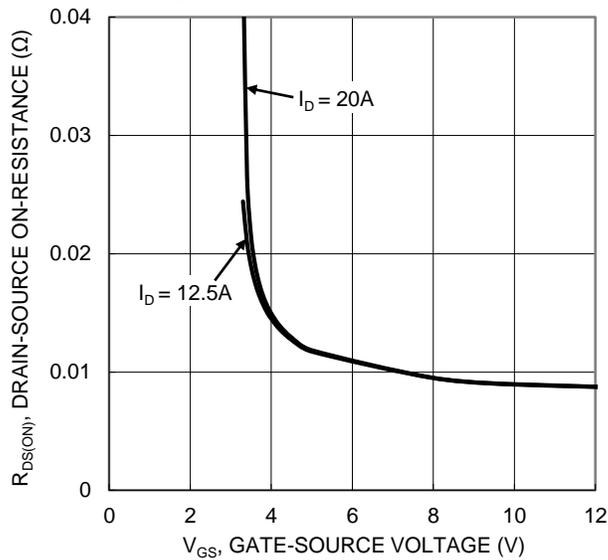


Figure 4. Typical Transfer Characteristic

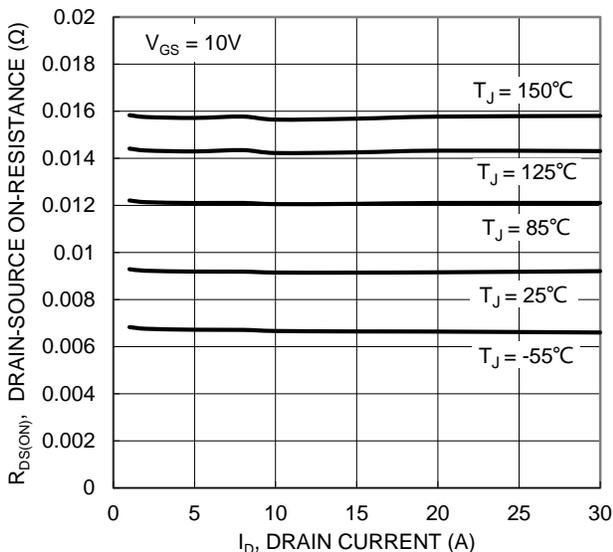


Figure 5. Typical On-Resistance vs. Drain Current and Junction Temperature

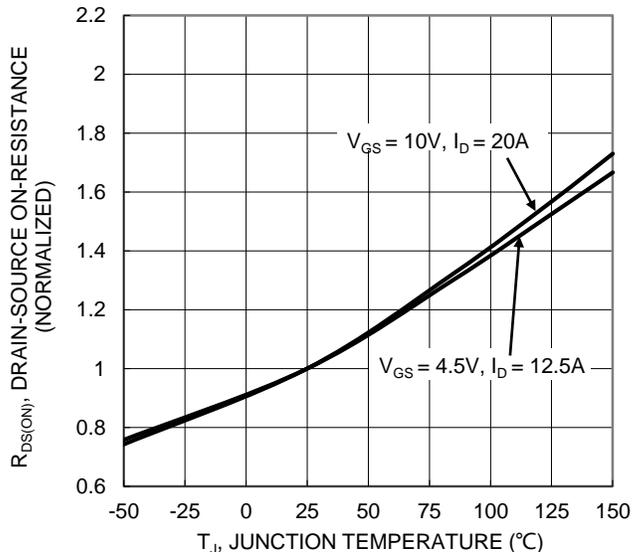


Figure 6. On-Resistance Variation with Junction Temperature

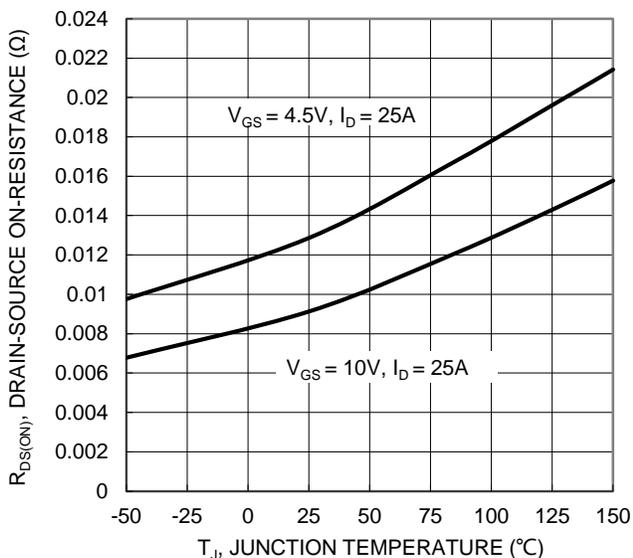


Figure 7. On-Resistance Variation with Junction Temperature

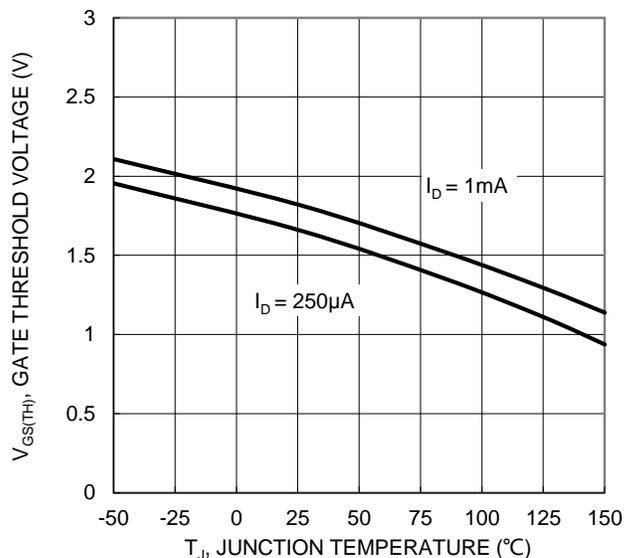


Figure 8. Gate Threshold Variation vs. Junction Temperature

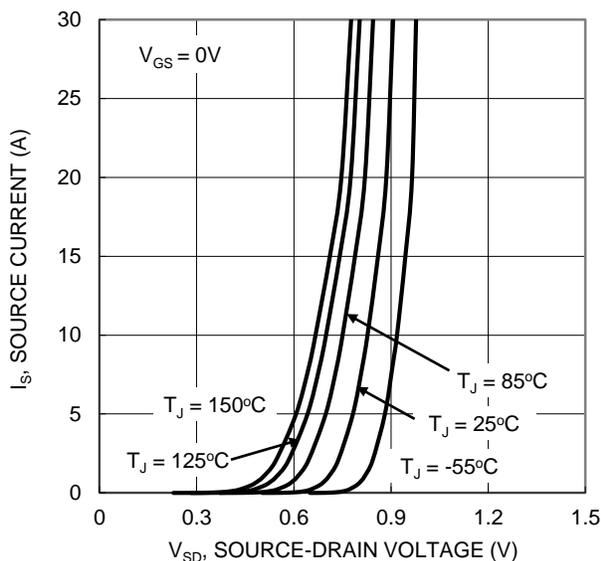


Figure 9. Diode Forward Voltage vs. Current

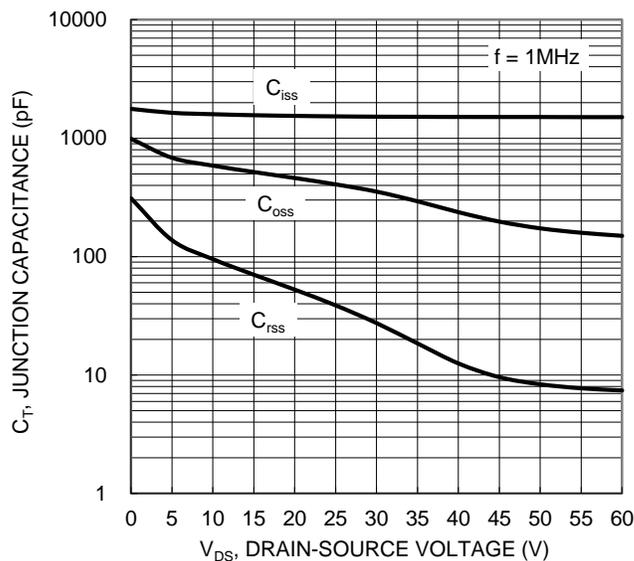


Figure 10. Typical Junction Capacitance

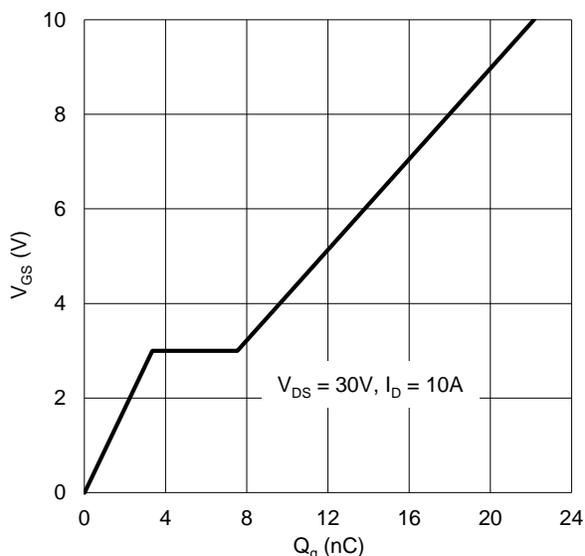


Figure 11. Gate Charge

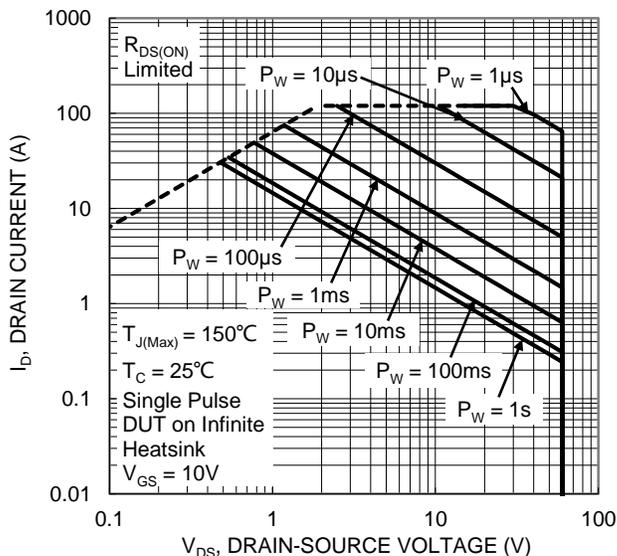


Figure 12. SOA, Safe Operation Area

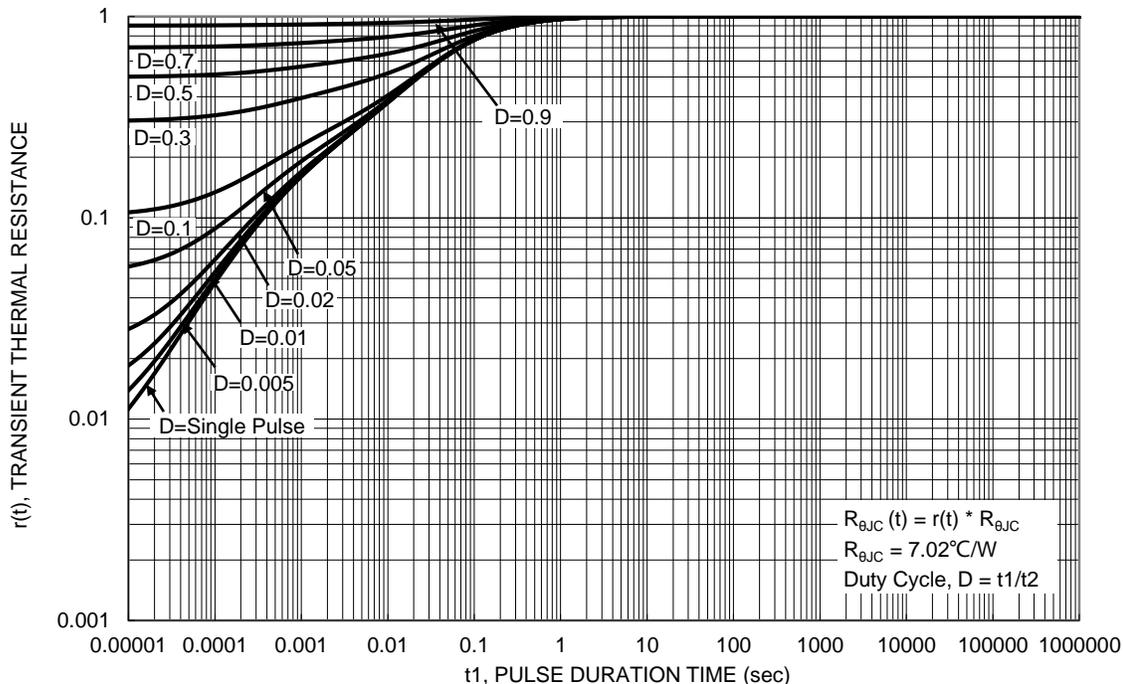
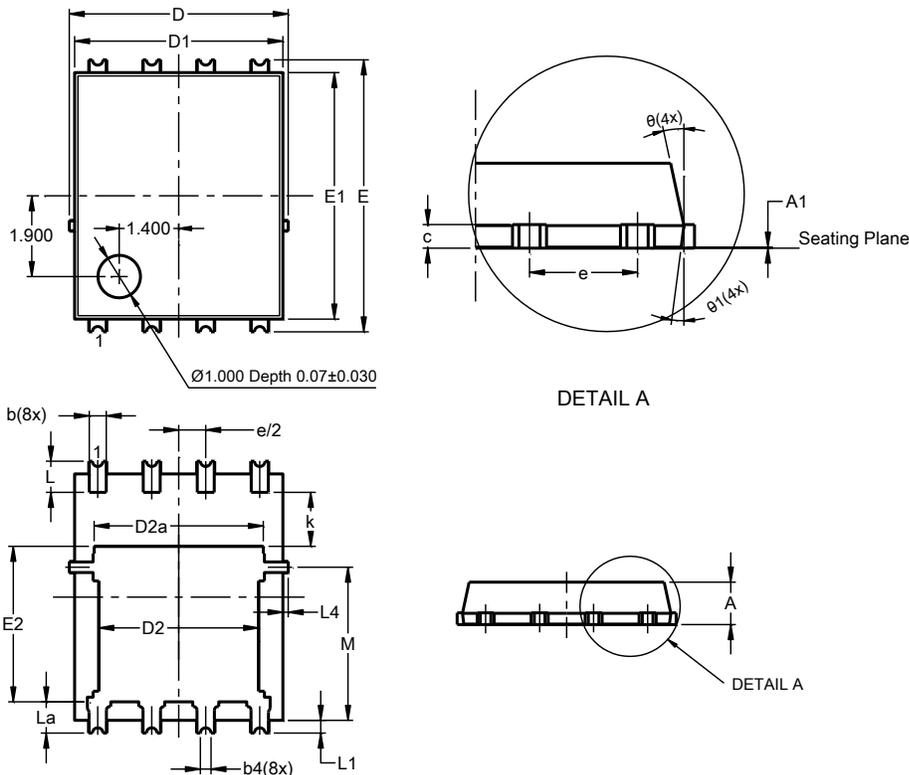


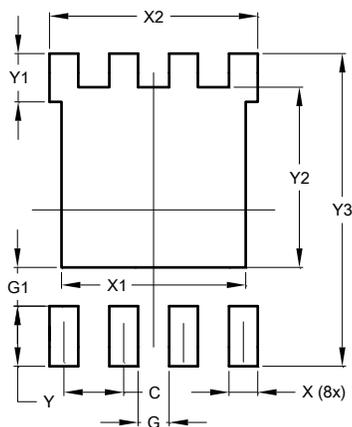
Figure 13. Transient Thermal Resistance

## Package Outline Dimensions

**PowerDI5060-8 (SWP) (Type UX)**


PowerDI5060-8 (SWP) (Type UX)			
Dim	Min	Max	Typ
A	0.90	1.10	1.00
A1	0	0.05	--
b	0.30	0.50	0.41
b2	0.20	0.35	0.25
b4	0.25REF		
c	0.230	0.330	0.277
D	5.15 BSC		
D1	4.70	5.10	4.90
D2	3.56	3.96	3.76
D2a	3.78	4.18	3.98
E	6.40 BSC		
E1	5.60	6.00	5.80
E2	3.46	3.86	3.66
E2a	4.195	4.595	4.395
e	1.27BSC		
k	1.05	--	--
L	0.635	0.835	0.735
La	0.635	0.835	0.735
L1	0.200	0.400	0.300
L1a	0.050REF		
L4	0.025	0.225	0.125
M	3.205	4.005	3.605
θ	10°	12°	11°
θ1	6°	8°	7°
<b>All Dimensions in mm</b>			

## Suggested Pad Layout

**PowerDI5060-8 (SWP) (Type UX)**


Dimensions	Value (in mm)
C	1.270
G	0.660
G1	0.820
X	0.610
X1	4.100
X2	4.420
Y	1.270
Y1	1.020
Y2	3.810
Y3	6.610