



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

$BV_{DSS}$	$R_{DS(on)}$	$I_D$ $T_C = +25^\circ C$
-20V	$6m\Omega @ V_{GS} = -4.5V$	-83A
	$8m\Omega @ V_{GS} = -2.5V$	-72A

## Features

- Thermally Efficient Package-Cooler Running Applications
- <1.1mm Package Profile – Ideal for Thin Applications
- High Conversion Efficiency
- Low  $R_{DS(on)}$  – Minimizes On State Losses
- Low Input Capacitance
- Fast Switching Speed

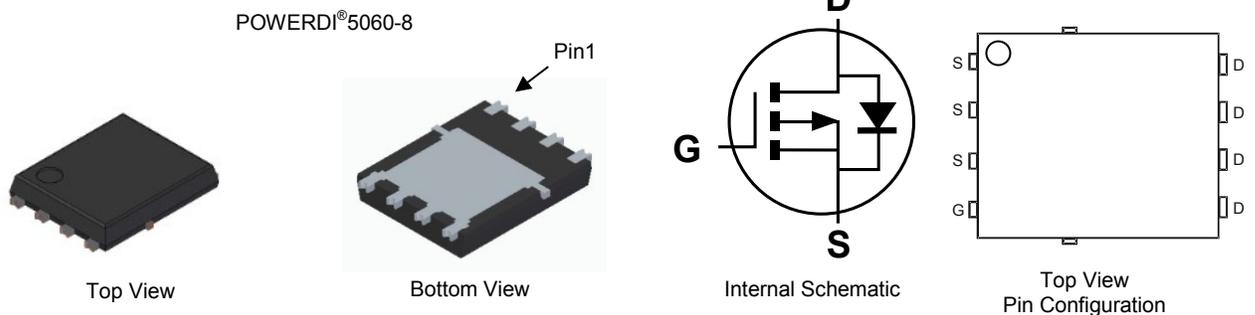
## Description and Applications

This new generation MOSFET is designed to minimize  $R_{DS(on)}$ , yet maintain superior switching performance. This device is ideal for use in power management and load switch.

- DC-DC Converters
- Load Switch

## Mechanical Data

- Case: POWERDI®5060-8 (Type UX)
- 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 Lead-Frame. Solderable per MIL-STD-202, Method 208 ③
- Weight: 0.097 grams (Approximate)



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

Characteristic			Symbol	Value	Unit
Drain-Source Voltage			$V_{DSS}$	-20	V
Gate-Source Voltage			$V_{GSS}$	$\pm 10$	V
Continuous Drain Current, $V_{GS} = 10\text{V}$ (Note 7)	Steady State	$T_C = +25^\circ\text{C}$ $T_C = +70^\circ\text{C}$	$I_D$	-83 -66	A
Maximum Continuous Body Diode Forward Current (Note 6)			$I_S$	-2.5	A
Pulsed Drain Current (10 $\mu\text{s}$ Pulse, Duty Cycle = 1%)			$I_{DM}$	-134	A
Pulsed Body Diode Forward Current (10 $\mu\text{s}$ Pulse, Duty Cycle = 1%)			$I_{SM}$	-134	A
Avalanche Current, $L=0.1\text{mH}$ (Note 8)			$I_{AS}$	-33	A
Avalanche Energy, $L=0.1\text{mH}$ (Note 8)			$E_{AS}$	57	mJ

### Thermal Characteristics (@ $T_C = +25^\circ\text{C}$ , unless otherwise specified.)

Characteristic		Symbol	Value	Units
Total Power Dissipation (Note 5)	$T_A = 25^\circ\text{C}$	$P_D$	1.9	W
Thermal Resistance, Junction to Ambient (Note 5)		$R_{\theta JA}$	67	$^\circ\text{C/W}$
Total Power Dissipation (Note 6)	$T_C = 25^\circ\text{C}$	$P_D$	2.6	W
Thermal Resistance, Junction to Case (Note 6)		$R_{\theta JA}$	47	$^\circ\text{C/W}$
Thermal Resistance, Junction to Case (Note 7)		$R_{\theta JC}$	2.0	$^\circ\text{C/W}$
Operating and Storage Temperature Range		$T_L, T_{STG}$	-55 to +150	$^\circ\text{C}$

- Notes:
5. Device mounted on FR-4 substrate PC board, 2oz copper, with minimum recommended pad layout.
  6. Device mounted on FR-4 substrate PC board, 2oz copper, with 1inch square copper plate.
  7. Thermal resistance from junction to soldering point (on the exposed drain pad).
  8.  $I_{AS}$  and  $E_{AS}$  ratings are based on low frequency and duty cycles to keep  $T_J = +25^\circ\text{C}$ .

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

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
<b>OFF CHARACTERISTICS (Note 9)</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	-20	—	—	V	$V_{GS} = 0V, I_D = -250\mu A$
Zero Gate Voltage Drain Current	$I_{DSS}$	—	—	-1	$\mu A$	$V_{DS} = -16V, V_{GS} = 0V$
Gate-Source Leakage	$I_{GSS}$	—	—	$\pm 100$	nA	$V_{GS} = \pm 8V, V_{DS} = 0V$
<b>ON CHARACTERISTICS (Note 9)</b>						
Gate Threshold Voltage	$V_{GS(th)}$	-0.4	—	-1.0	V	$V_{DS} = V_{GS}, I_D = -250\mu A$
Static Drain-Source On-Resistance	$R_{DS(on)}$	—	4.2	6	m $\Omega$	$V_{GS} = -4.5V, I_D = -15A$
		—	5.4	8		$V_{GS} = -2.5V, I_D = -10A$
Diode Forward Voltage	$V_{SD}$	—	-0.7	-1.1	V	$V_{GS} = 0V, I_S = -10A$
<b>DYNAMIC CHARACTERISTICS (Note 10)</b>						
Input Capacitance	$C_{iss}$	—	5392	—	pF	$V_{DS} = -10V, V_{GS} = 0V$ $f = 1.0MHz$
Output Capacitance	$C_{oss}$	—	608	—		
Reverse Transfer Capacitance	$C_{rss}$	—	564	—		
Gate Resistance	$R_G$	—	2.05	—	$\Omega$	$V_{DS} = 0V, V_{GS} = 0V, f = 1.0MHz$
Total Gate Charge ( $V_{GS} = -4.5V$ )	$Q_g$	—	75	—	nC	$V_{DD} = -10V, I_D = -20A$
Total Gate Charge ( $V_{GS} = -10V$ )	$Q_g$	—	164	—		
Gate-Source Charge	$Q_{gs}$	—	6.9	—		
Gate-Drain Charge	$Q_{gd}$	—	19.8	—		
Turn-On Delay Time	$t_{D(on)}$	—	9	—	ns	$V_{DD} = -10V, V_{GEN} = -4.5V,$ $R_{GEN} = 1\Omega, I_D = -10A$
Turn-On Rise Time	$t_R$	—	24	—		
Turn-Off Delay Time	$t_{D(off)}$	—	69	—		
Turn-Off Fall Time	$t_F$	—	107	—		
Reverse Recovery Time	$t_{RR}$	—	54	—	ns	$I_F = -10A, di/dt = 100A/\mu s$
Reverse Recovery Charge	$Q_{RR}$	—	55	—	nC	

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

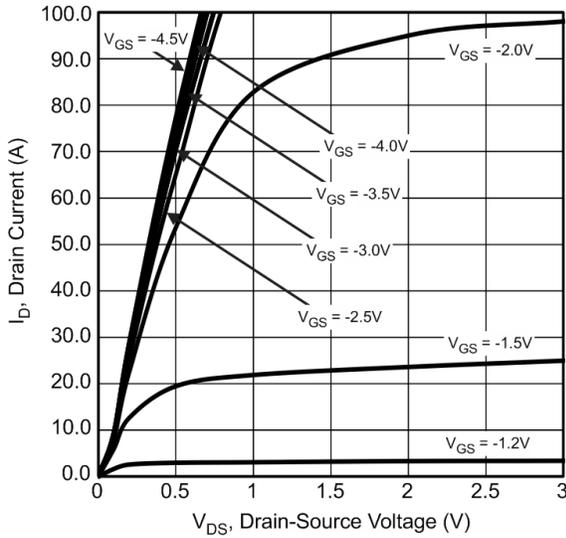


Fig. 1 Typical Output Characteristic

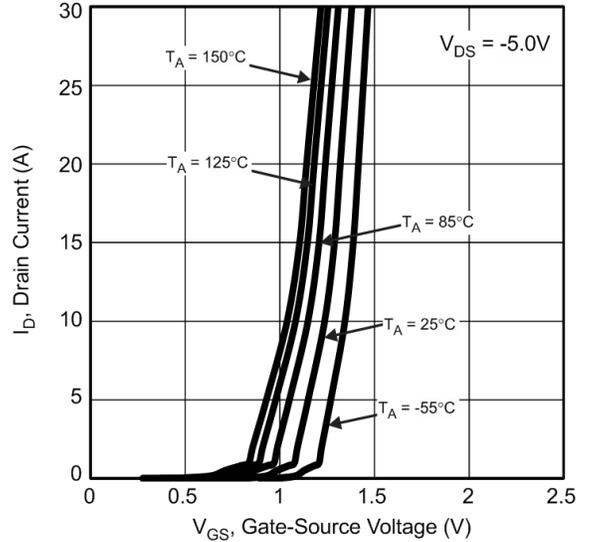


Fig. 2 Typical Transfer Characteristic

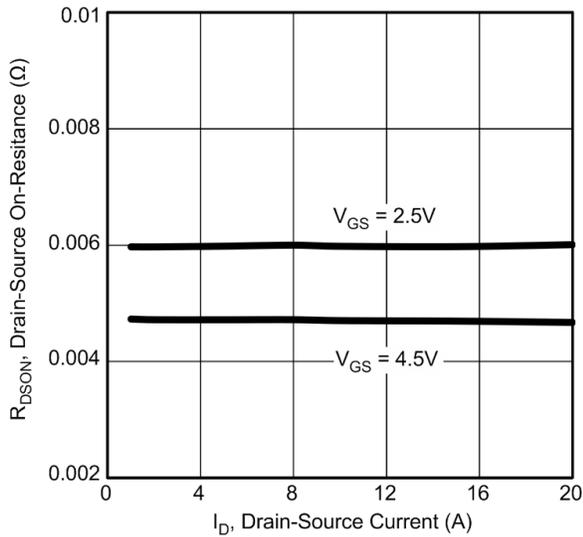


Fig. 3 Typical On-Resistance vs Drain Current and Gate Voltage

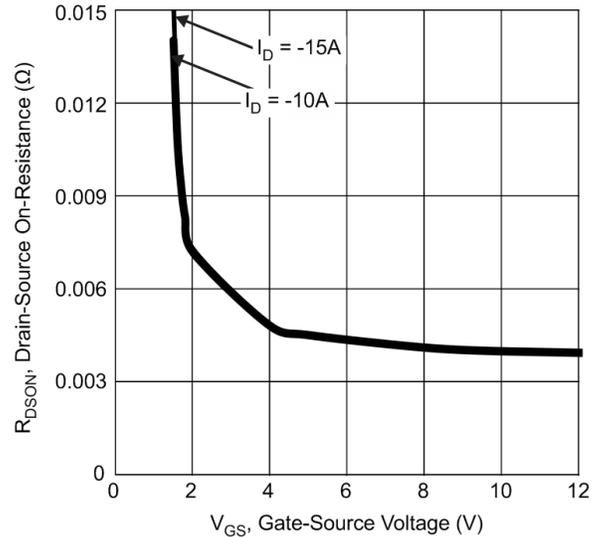


Fig. 4 Typical Transfer Characteristic

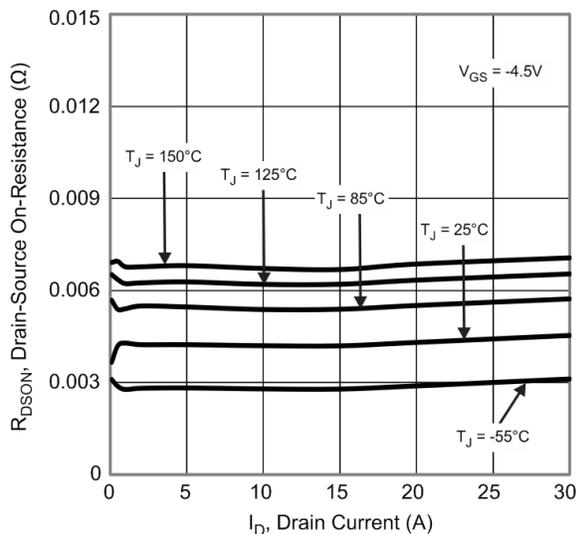


Fig. 5 Typical On-Resistance vs Drain Current and Junction Temperature

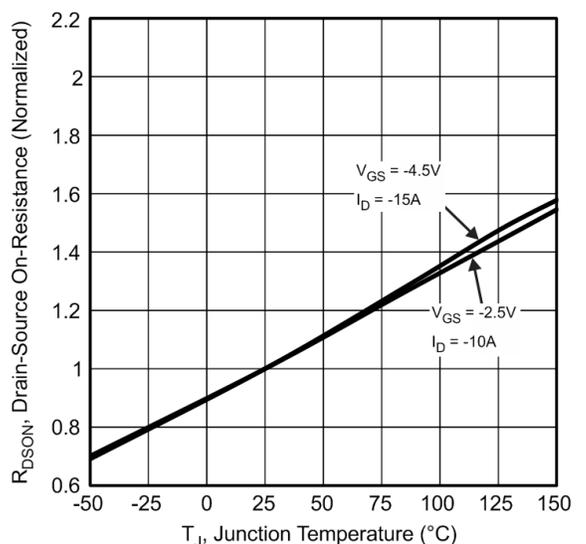


Fig. 6 On-Resistance Variation with Junction Temperature

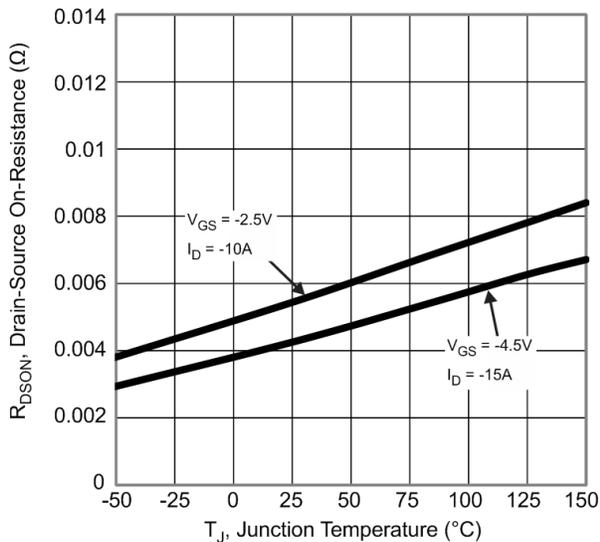


Fig. 7 On-Resistance Variation with Junction Temperature

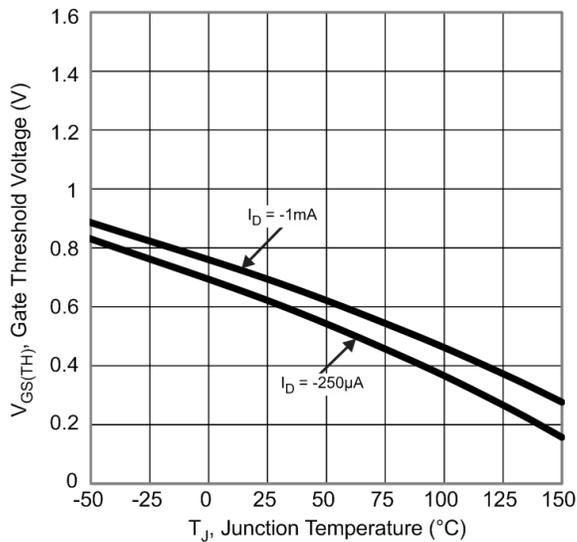


Fig. 8 Gate Threshold Variation vs Junction Temperature

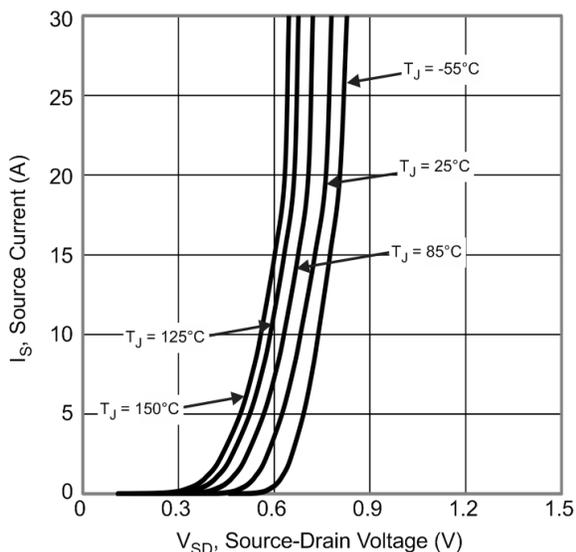


Fig. 9 Diode Forward Voltage vs Current

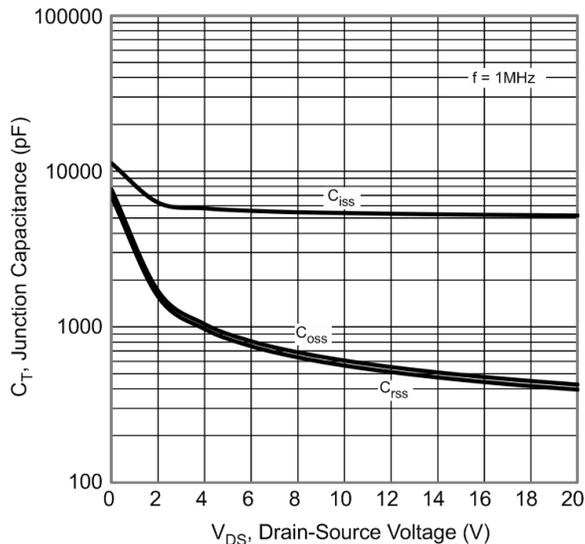


Fig. 10 Typical Junction Capacitance

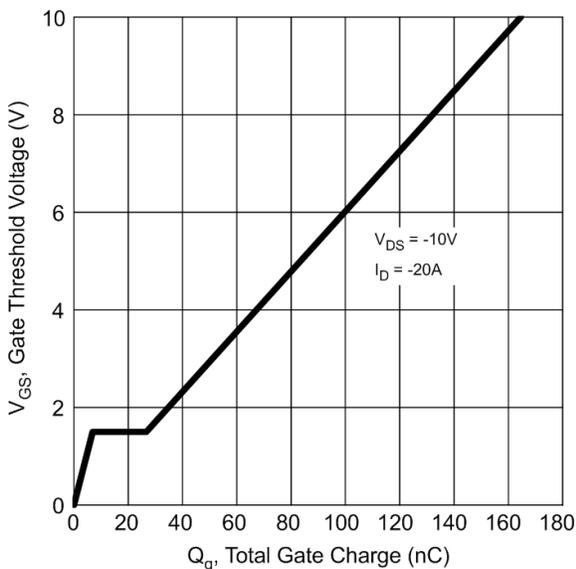


Fig. 11 Gate Charge

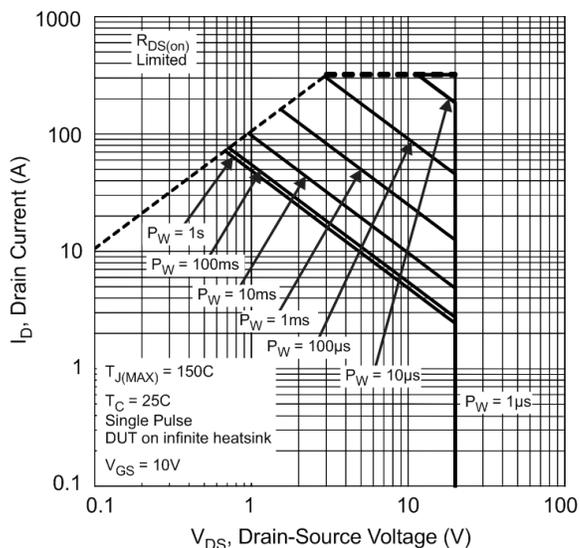


Fig. 12 SOA, Safe Operation Area

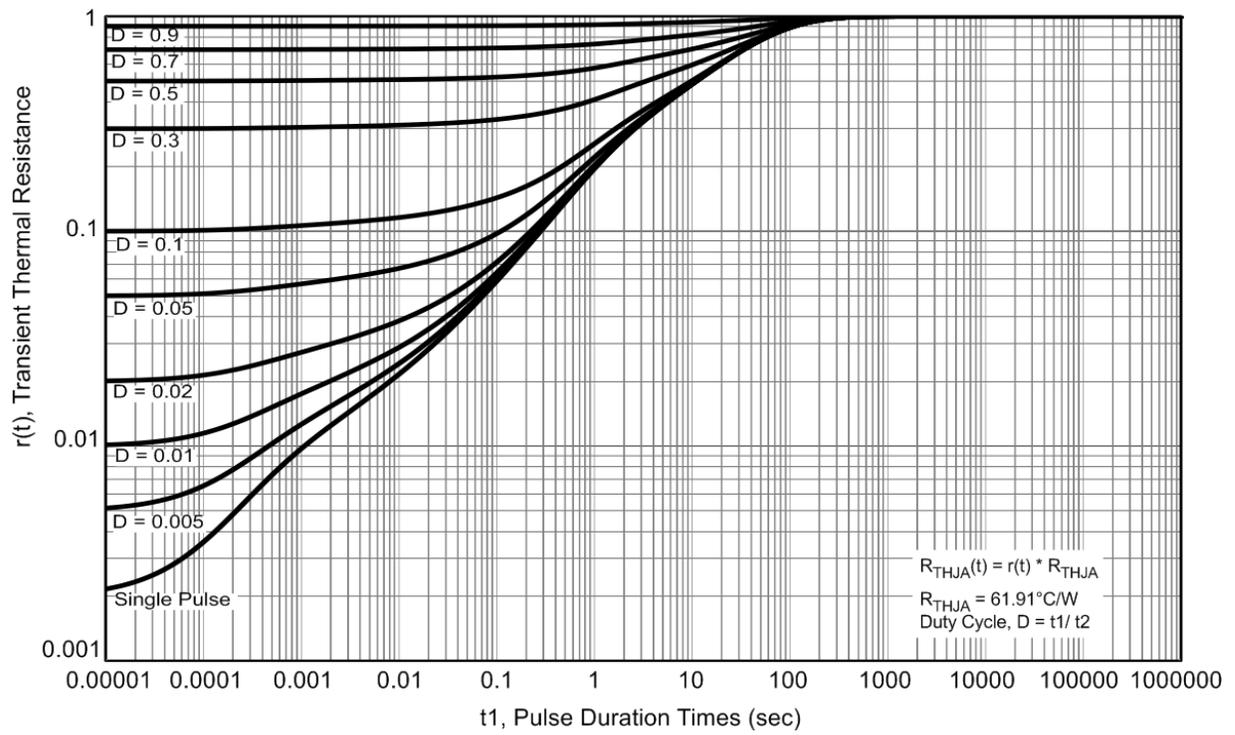
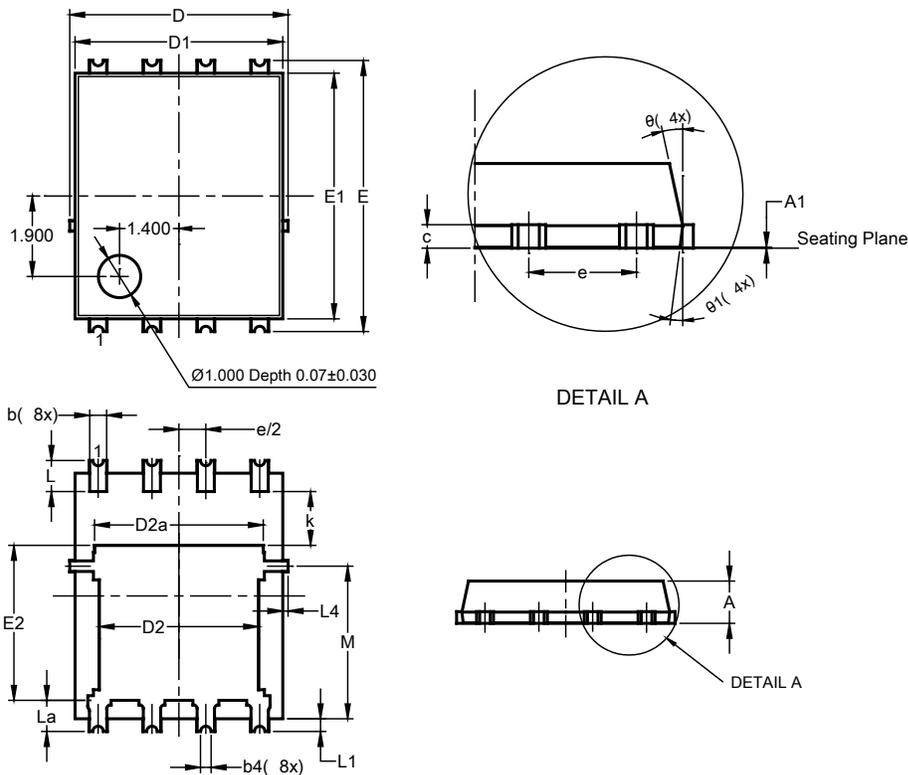


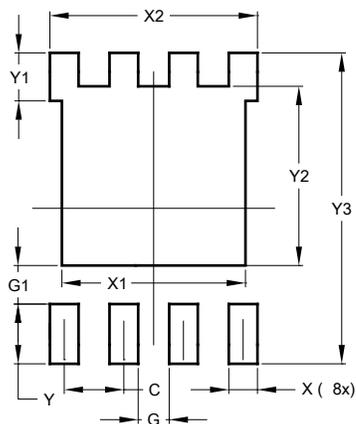
Fig. 13 Transient Thermal Resistance

## 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°
All Dimensions in mm			

## 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