



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

$BV_{DSS}$	$R_{DS(ON)}$	$I_D$ $T_C = +25^\circ C$
-30V	2.6m $\Omega$ @ $V_{GS} = -10V$	-100A
	3.75m $\Omega$ @ $V_{GS} = -4.5V$	-70A

## Description

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

## Applications

- Switch

## Features

- 100% Unclamped Inductive Switch (UIS) Test in Production
- Thermally Efficient Package-Cooler Running Applications
- High Conversion Efficiency
- Low  $R_{DS(ON)}$  – Minimizes On State Losses
- <1.1mm Package Profile – Ideal for Thin Applications

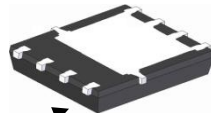
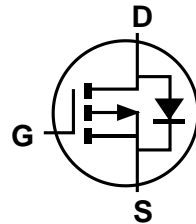
## Mechanical Data

- 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 <sup>Ⓔ</sup>
- Weight: 0.097 grams (Approximate)

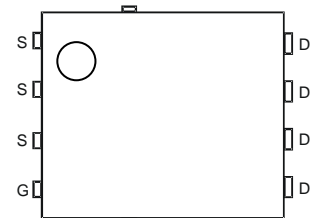
PowerDI5060-8 (Type K)



Top View


 Pin1  
 Bottom View


Internal Schematic


 Top View  
 Pin Configuration

**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			$V_{GSS}$	$\pm 20$	V
Continuous Drain Current, $V_{GS} = -10\text{V}$ (Note 7) (Package Limited)	Steady State	$T_C = +25^\circ\text{C}$ $T_C = +70^\circ\text{C}$	$I_D$	-100 -70	A
Continuous Drain Current, $V_{GS} = -10\text{V}$ (Note 6)	$t \leq 10\text{s}$	$T_A = +25^\circ\text{C}$ $T_A = +70^\circ\text{C}$	$I_D$	-37 -30	A
Pulsed Drain Current (380 $\mu\text{s}$ Pulse, Duty Cycle = 1%)			$I_{DM}$	-400	A
Maximum Continuous Body Diode Forward Current (Note 6)			$I_S$	-2.7	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)			$I_{AS}$	-80	A
Avalanche Energy, $L = 0.1\text{mH}$ (Note 8)			$E_{AS}$	250	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	$R_{\theta JA}$	98	$^\circ\text{C/W}$
	$t \leq 10\text{s}$		49	
Total Power Dissipation (Note 6)		$P_D$	2.3	W
Thermal Resistance, Junction to Ambient (Note 6)	Steady State	$R_{\theta JA}$	54	$^\circ\text{C/W}$
	$t \leq 10\text{s}$		27	
Thermal Resistance, Junction to Case (Note 7)		$R_{\theta JC}$	0.9	$^\circ\text{C/W}$
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 9)</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	-30	—	—	V	$V_{GS} = 0\text{V}, I_D = -250\mu\text{A}$
Zero Gate Voltage Drain Current	$I_{DSS}$	—	—	-1	$\mu\text{A}$	$V_{DS} = -24\text{V}, V_{GS} = 0\text{V}$
Gate-Source Leakage	$I_{GSS}$	—	—	$\pm 100$	nA	$V_{GS} = \pm 20\text{V}, V_{DS} = 0\text{V}$
<b>ON CHARACTERISTICS (Note 9)</b>						
Gate Threshold Voltage	$V_{GS(TH)}$	-1.0	—	-2.5	V	$V_{DS} = V_{GS}, I_D = -250\mu\text{A}$
Static Drain-Source On-Resistance	$R_{DS(ON)}$	—	1.8	2.6	m $\Omega$	$V_{GS} = -10\text{V}, I_D = -20\text{A}$
		—	2.4	3.75		$V_{GS} = -4.5\text{V}, I_D = -20\text{A}$
Diode Forward Voltage	$V_{SD}$	—	-0.6	-1.2	V	$V_{GS} = 0\text{V}, I_S = -1\text{A}$
<b>DYNAMIC CHARACTERISTICS (Note 10)</b>						
Input Capacitance	$C_{iss}$	—	8594	—	pF	$V_{DS} = -15\text{V}, V_{GS} = 0\text{V}$ $f = 1\text{MHz}$
Output Capacitance	$C_{oss}$	—	1491	—	pF	
Reverse Transfer Capacitance	$C_{rss}$	—	874	—	pF	
Gate Resistance	$R_g$	—	6.38	—	$\Omega$	$V_{DS} = 0\text{V}, V_{GS} = -15\text{mV}, f = 1\text{MHz}$
Total Gate Charge ( $V_{GS} = -4.5\text{V}$ )	$Q_g$	—	75	—	nC	$V_{DS} = -15\text{V}, I_D = -25\text{A}$
Total Gate Charge ( $V_{GS} = -10\text{V}$ )	$Q_g$	—	158	—	nC	
Gate-Source Charge	$Q_{gs}$	—	23.0	—	nC	
Gate-Drain Charge	$Q_{gd}$	—	25.5	—	nC	
Turn-On Delay Time	$t_{D(ON)}$	—	6.74	—	ns	
Turn-On Rise Time	$t_R$	—	5.46	—	ns	$V_{DS} = -15\text{V}, V_{GS} = -10\text{V},$ $R_G = 2.7\Omega, I_D = -1\text{A}$
Turn-Off Delay Time	$t_{D(OFF)}$	—	227	—	ns	
Turn-Off Fall Time	$t_F$	—	108	—	ns	$I_F = -25\text{A}, di/dt = 100\text{A}/\mu\text{s}$
Reverse Recovery Time	$t_{RR}$	—	37.4	—	ns	
Reverse Recovery Charge	$Q_{RR}$	—	36.8	—	nC	

- Notes:
- Device mounted on FR-4 substrate PC board, 2oz copper, with minimum recommended pad layout.
  - 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).
  - $I_{AS}$  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.

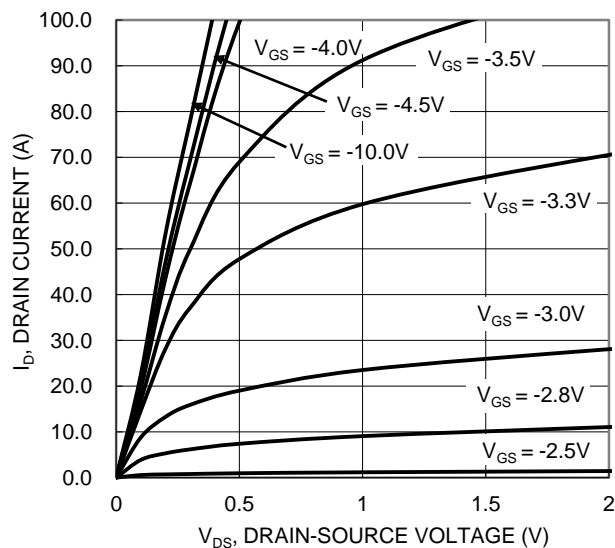


Figure 1. Typical Output Characteristic

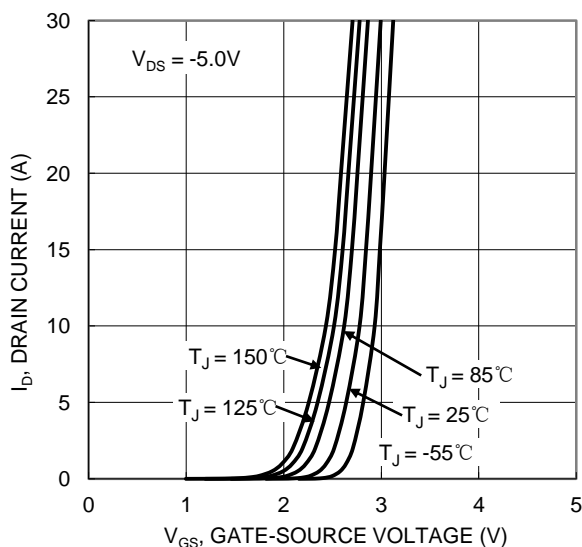


Figure 2. Typical Transfer Characteristic

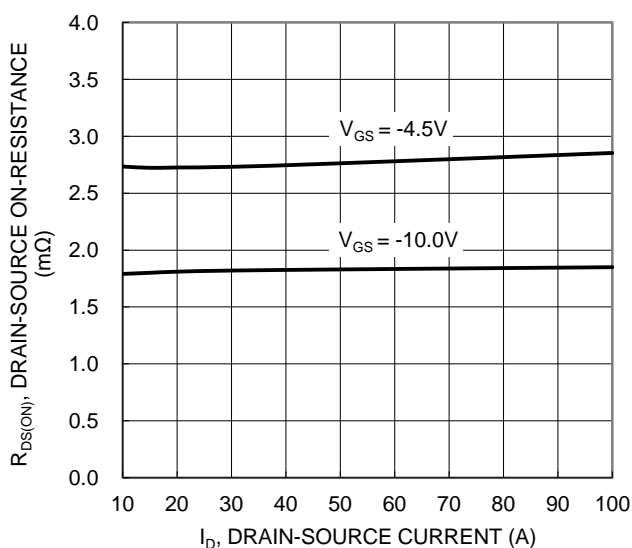


Figure 3. Typical On-Resistance vs. Drain Current and Gate Voltage

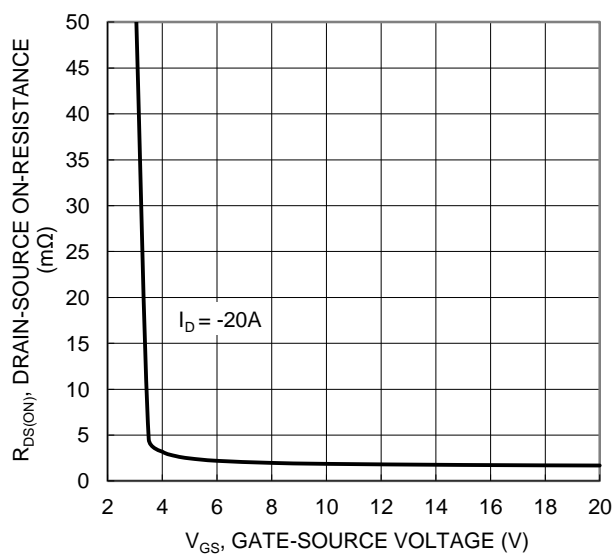


Figure 4. Typical Transfer Characteristic

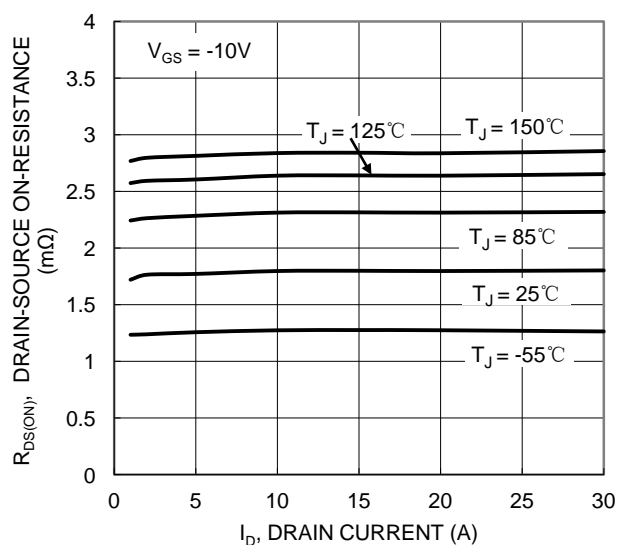


Figure 5. Typical On-Resistance vs. Drain Current and Junction Temperature

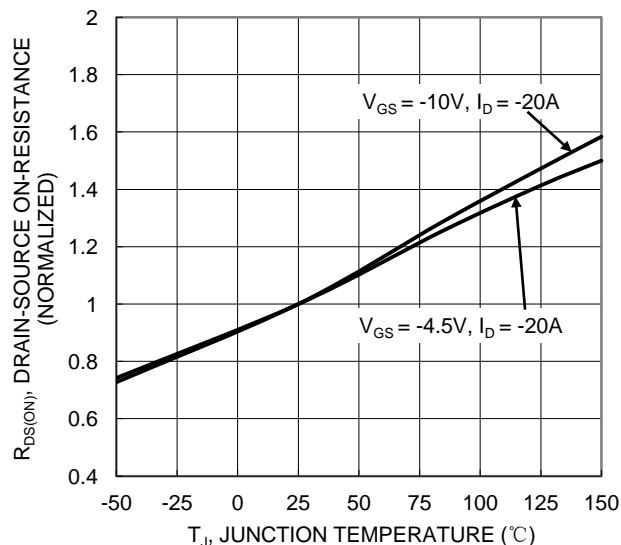
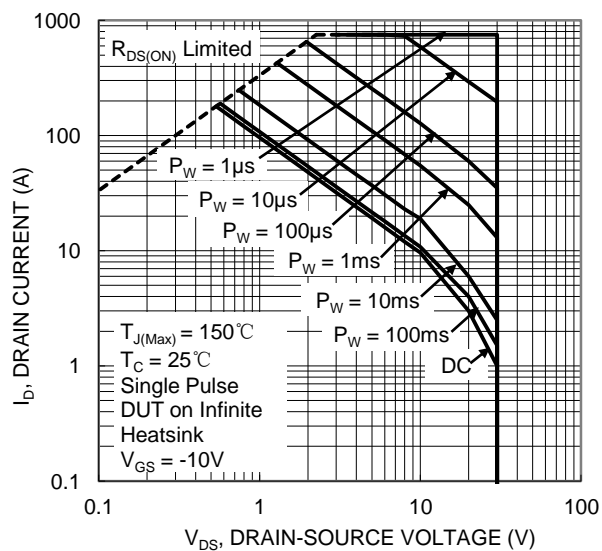
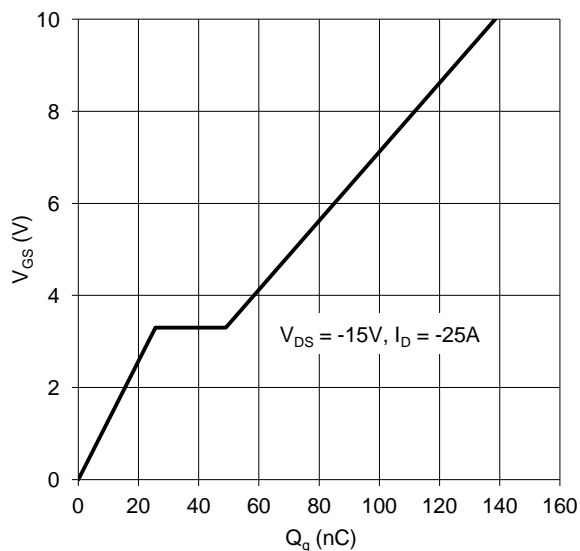
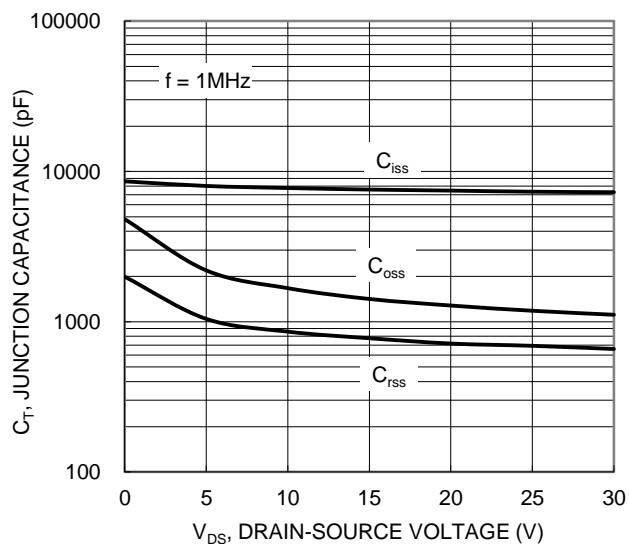
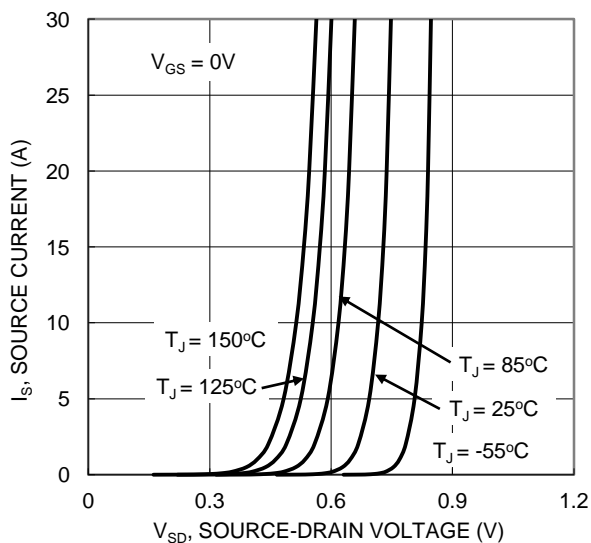
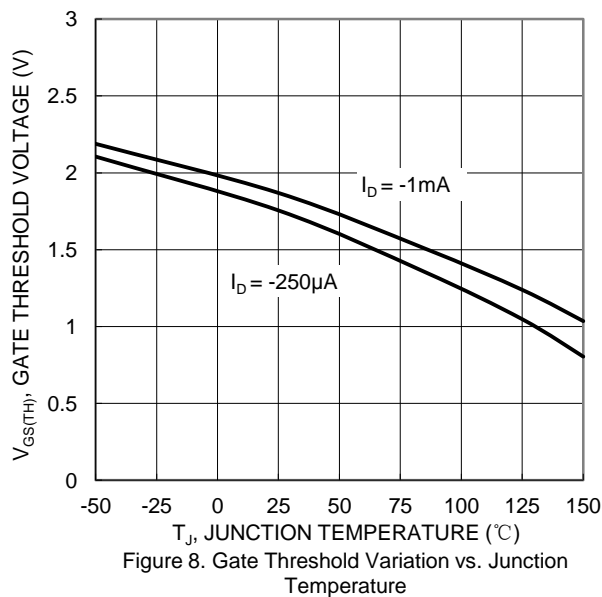
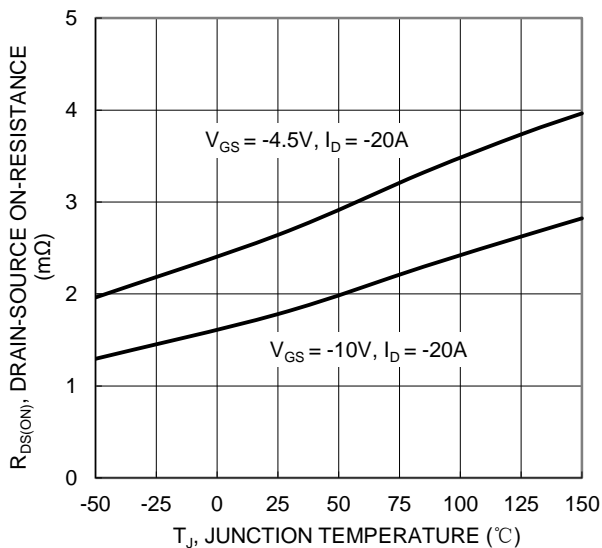


Figure 6. On-Resistance Variation with Junction Temperature



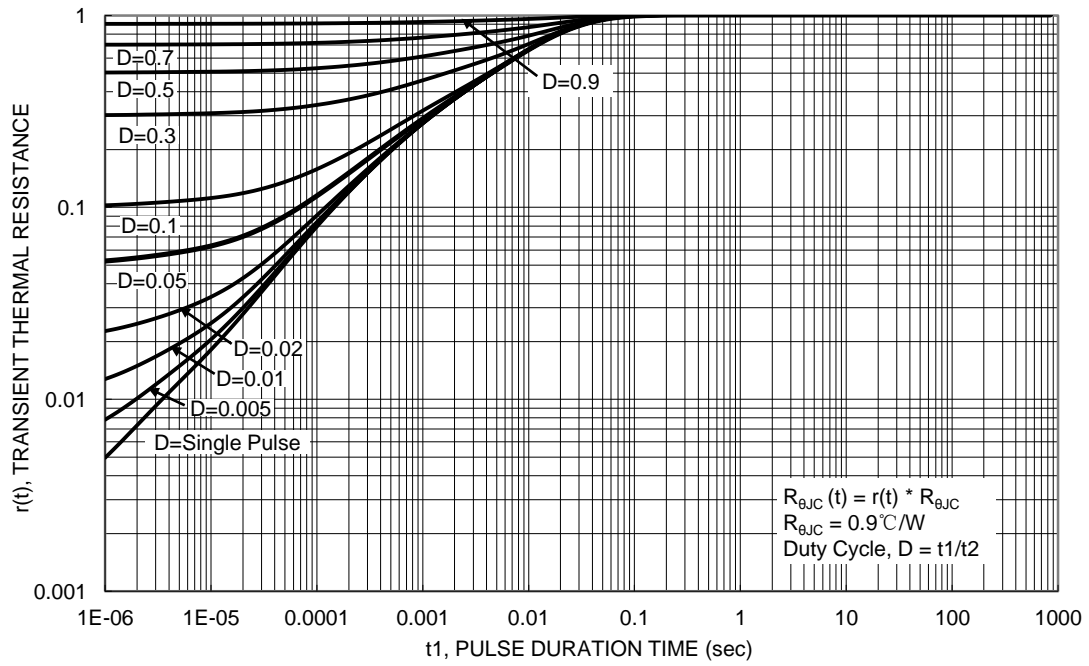
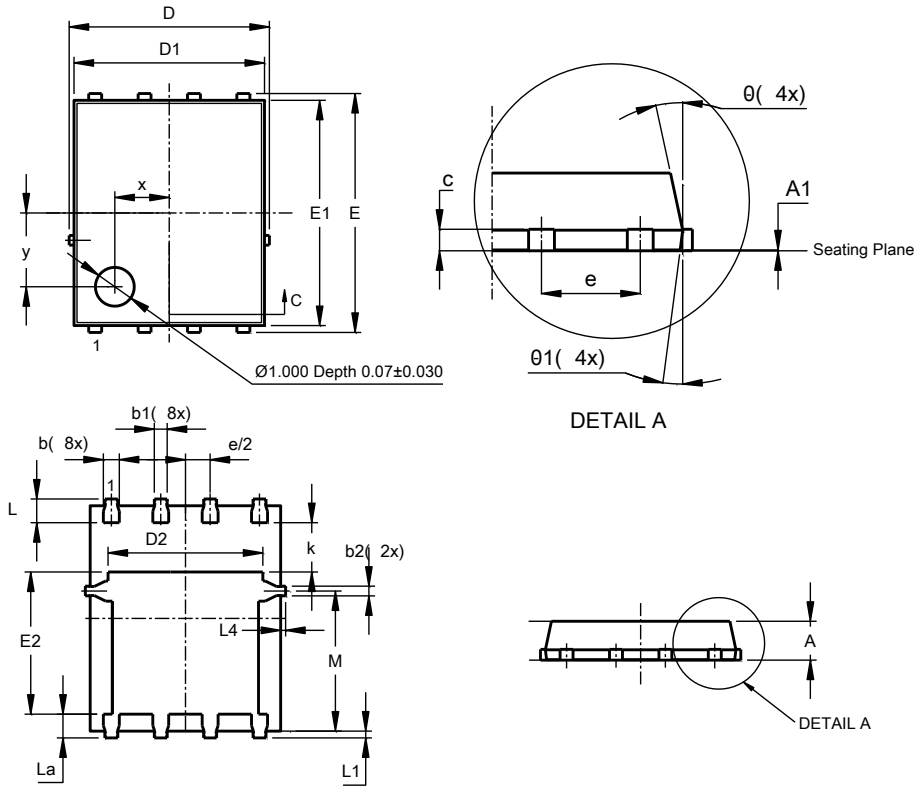


Figure 13. Transient Thermal Resistance

Package Outline Dimensions

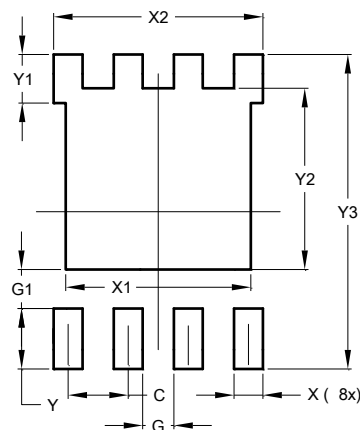
PowerDI5060-8 (Type K)



PowerDI5060-8 (Type K)			
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	-	-	3.98
E	6.15 BSC		
E1	5.75	5.85	5.80
E2	3.56	3.725	3.66
e	1.27BSC		
k	-	-	1.27
L	0.51	0.71	0.61
La	0.51	0.675	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
$\theta$	10°	12°	11°
$\theta 1$	6°	8°	7°
All Dimensions in mm			

Suggested Pad Layout

PowerDI5060-8 (Type K)



Dimensions	Value (in mm)
C	1.270
G	0.660
G1	0.820
X	0.610
X1	3.910
X2	4.420
Y	1.270
Y1	1.020
Y2	3.810
Y3	6.610