



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**

0755-83047638

ysbdt@szyoushang.cn

www.szyoushang.cn



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## Product Summary

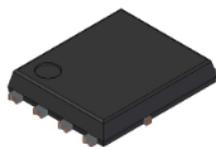
$BV_{DSS}$	$R_{DS(ON)}$ Max	$I_D$ Max $T_c = +25^\circ C$
60V	2.7m $\Omega$ @ $V_{GS} = 10V$	170A

## Description and Applications

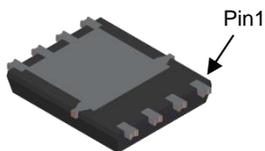
This MOSFET is designed to minimize the on-state resistance ( $R_{DS(ON)}$ ) yet maintain superior switching performance, making it ideal for high-efficiency power-management applications.

- Switching
- Synchronous rectifications
- DC-DC converters

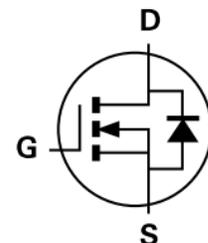
PowerDI5060-8/SWP (Type UX)



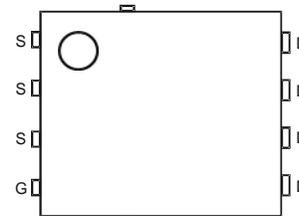
Top View



Bottom View



Internal Schematic



Top View  
Pin Configuration

## Features

- Rated to +175°C – Ideal for High Ambient Temperature Environment
- 100% Unclamped Inductive Switching (UIS) Test in Production – Ensures More Reliable and Robust End Application
- 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
- **Lead-Free Finish; RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. “Green” Device (Note 3)**

## Mechanical Data

- Package: PowerDI<sup>®</sup>5060-8
- Package 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 (E3)
- Weight: 0.097 grams (Approximate)

## Maximum Ratings (@T<sub>A</sub> = +25°C, unless otherwise specified.)

Characteristic	Symbol	Value	Unit	
Drain-Source Voltage	V <sub>DSS</sub>	60	V	
Gate-Source Voltage	V <sub>GSS</sub>	±20	V	
Continuous Drain Current, V <sub>GS</sub> = 10V (Note 6)	I <sub>D</sub>	T <sub>C</sub> = +25°C	170	A
		T <sub>C</sub> = +100°C	120	
Pulsed Drain Current (10μs Pulse, Duty Cycle = 1%)	I <sub>DM</sub>	680	A	
Maximum Continuous Body Diode Forward Current (Note 6)	I <sub>S</sub>	170	A	
Pulsed Body Diode Forward Current (10μs Pulse, Duty Cycle = 1%)	I <sub>SM</sub>	680	A	
Avalanche Current, L = 0.2mH	I <sub>AS</sub>	45	A	
Avalanche Energy, L = 0.2mH	E <sub>AS</sub>	202	mJ	

## Thermal Characteristics

Characteristic	Symbol	Value	Unit
Total Power Dissipation (Note 5)	P <sub>D</sub>	3	W
Thermal Resistance, Junction to Ambient (Note 5)	R <sub>θJA</sub>	50	°C/W
Total Power Dissipation (Note 6)	P <sub>D</sub>	150	W
Thermal Resistance, Junction to Case (Note 6)	R <sub>θJC</sub>	1	°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 7)</b>						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	60	—	—	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> = 48V, 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 7)</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>	—	2.1	2.7	mΩ	V <sub>GS</sub> = 10V, I <sub>D</sub> = 30A
Diode Forward Voltage	V <sub>SD</sub>	—	0.8	1.2	V	V <sub>GS</sub> = 0V, I <sub>S</sub> = 20A
<b>DYNAMIC CHARACTERISTICS (Note 8)</b>						
Input Capacitance	C <sub>iss</sub>	—	4973	—	pF	V <sub>DS</sub> = 30V, V <sub>GS</sub> = 0V, f = 1MHz
Output Capacitance	C <sub>oss</sub>	—	1613	—		
Reverse Transfer Capacitance	C <sub>rss</sub>	—	86	—		
Gate Resistance	R <sub>g</sub>	—	0.81	—	Ω	V <sub>DS</sub> = 0V, V <sub>GS</sub> = 0V, f = 1MHz
Total Gate Charge	Q <sub>g</sub>	—	68.7	—	nC	V <sub>DD</sub> = 30V, I <sub>D</sub> = 30A, V <sub>GS</sub> = 10V
Gate-Source Charge	Q <sub>gs</sub>	—	16.3	—		
Gate-Drain Charge	Q <sub>gd</sub>	—	14.1	—		
Turn-On Delay Time	t <sub>D(ON)</sub>	—	11.45	—	ns	V <sub>DD</sub> = 30V, V <sub>GS</sub> = 10V, I <sub>D</sub> = 30A, R <sub>g</sub> = 3.5Ω
Turn-On Rise Time	t <sub>r</sub>	—	10.68	—		
Turn-Off Delay Time	t <sub>D(OFF)</sub>	—	33.01	—		
Turn-Off Fall Time	t <sub>f</sub>	—	14.86	—		
Reverse Recovery Time	t <sub>RR</sub>	—	53.34	—	ns	I <sub>F</sub> = 30A, di/dt = 100A/μs
Reverse Recovery Charge	Q <sub>RR</sub>	—	90.49	—	nC	

- Notes:
- Device mounted on FR-4 substrate PC board, 2oz copper, with thermal bias to bottom layer 1 inch 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.

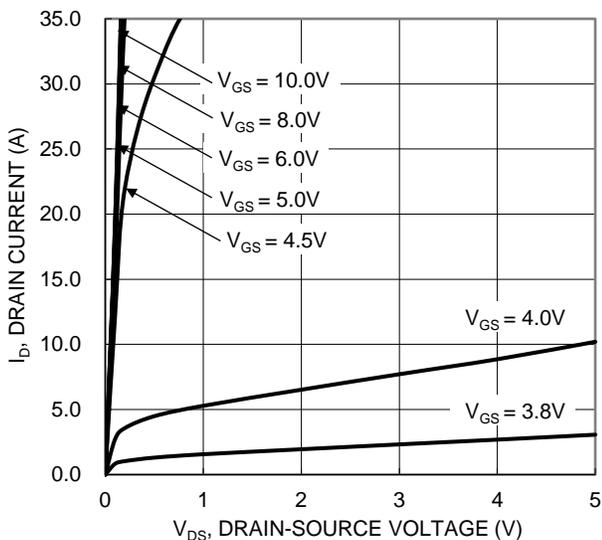


Figure 1. Typical Output Characteristic

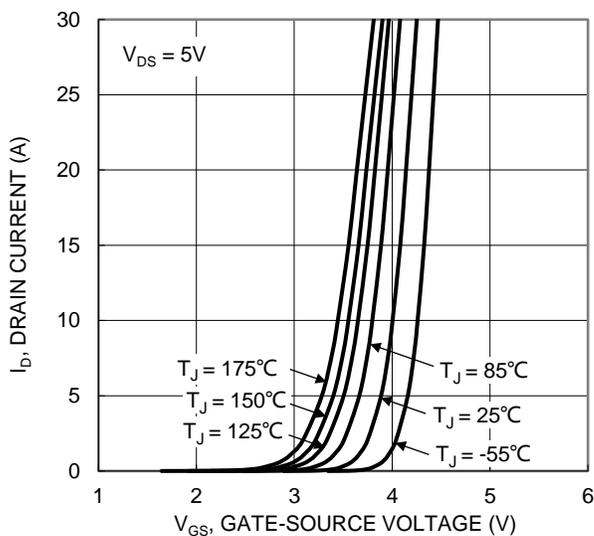


Figure 2. Typical Transfer Characteristic

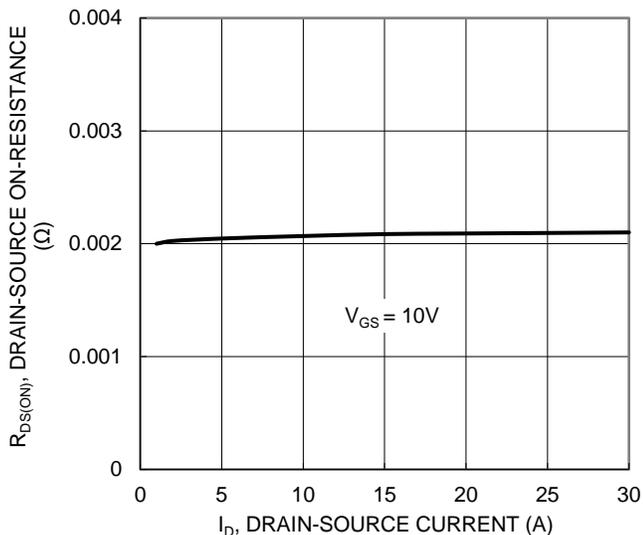


Figure 3. Typical On-Resistance vs. Drain Current and Gate Voltage

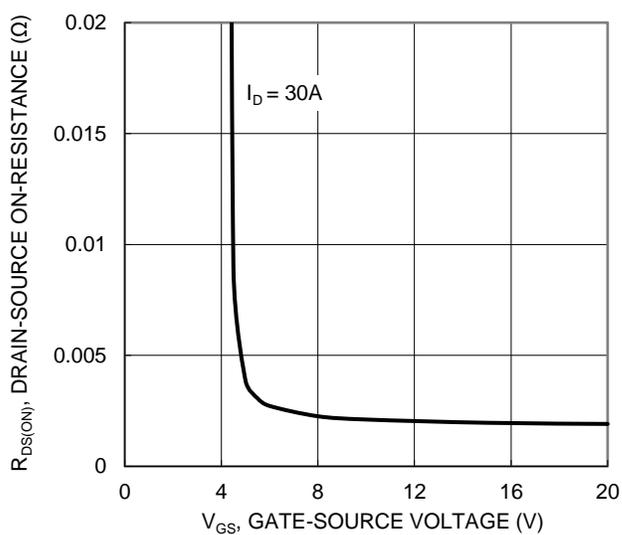


Figure 4. Typical Transfer Characteristic

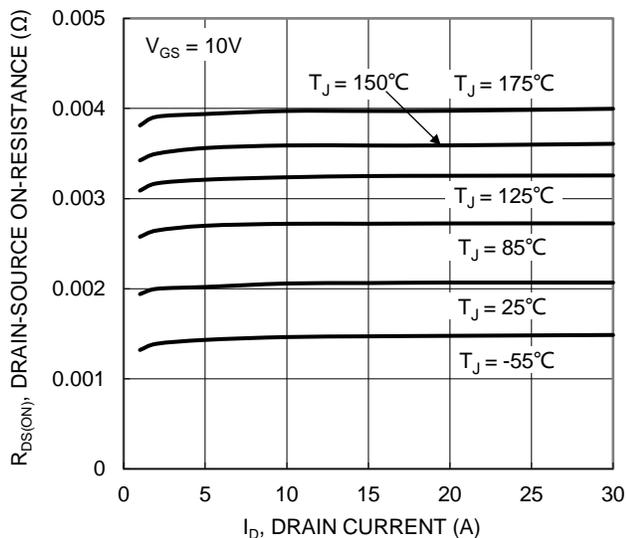


Figure 5. Typical On-Resistance vs. Drain Current and Temperature

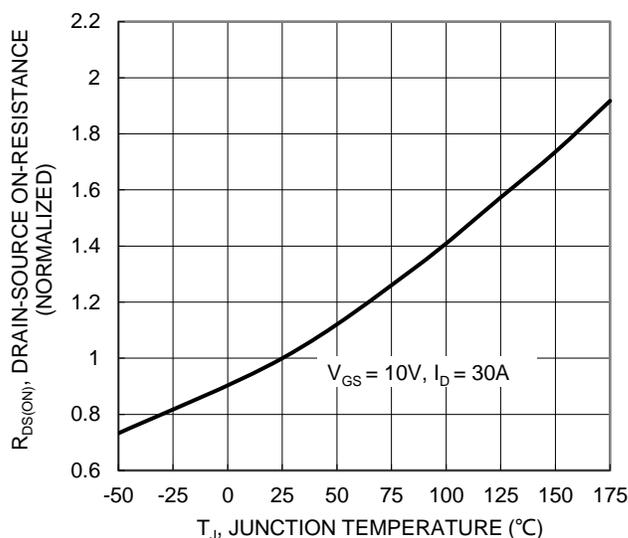


Figure 6. On-Resistance Variation with Junction Temperature

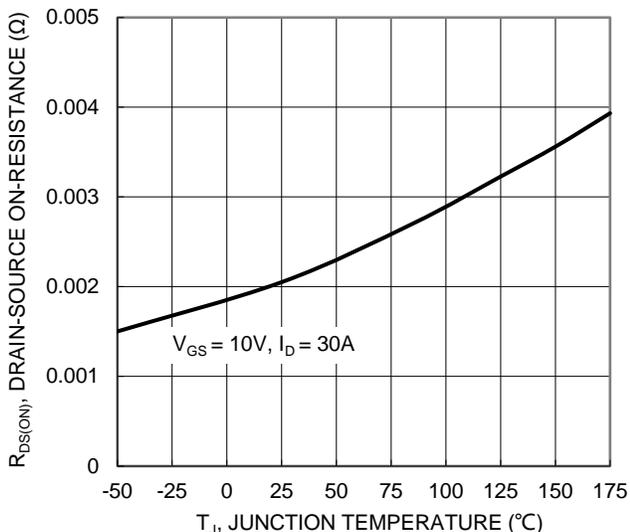


Figure 7. On-Resistance Variation with Temperature

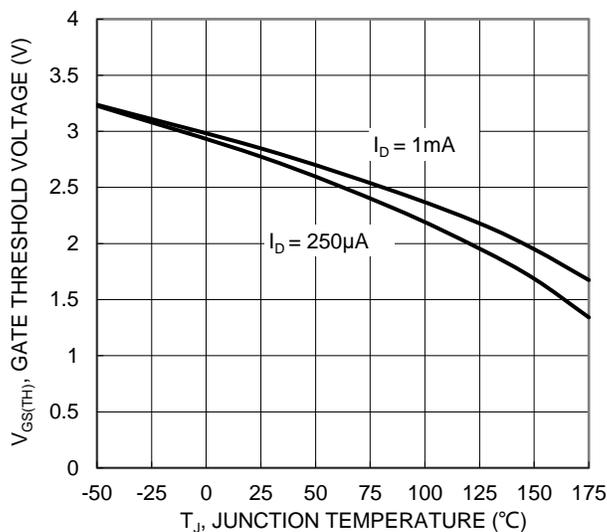


Figure 8. Gate Threshold Variation vs. Temperature

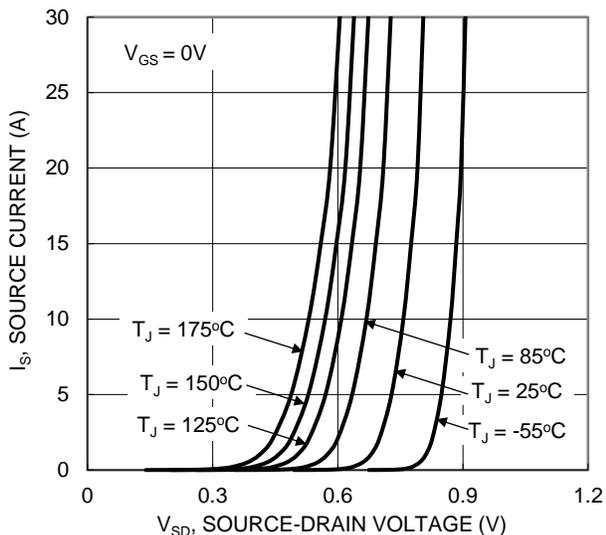


Figure 9. Diode Forward Voltage vs. Current

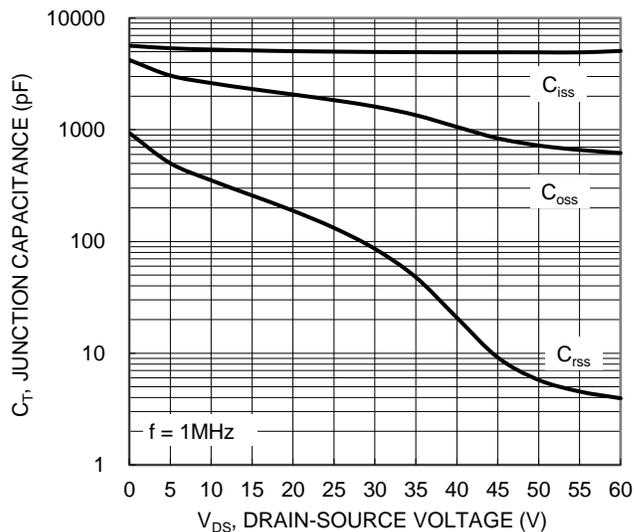


Figure 10. Typical Junction Capacitance

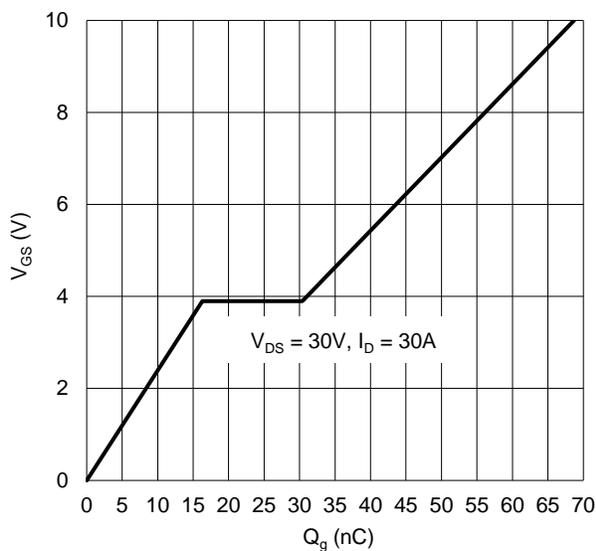


Figure 11. Gate Charge

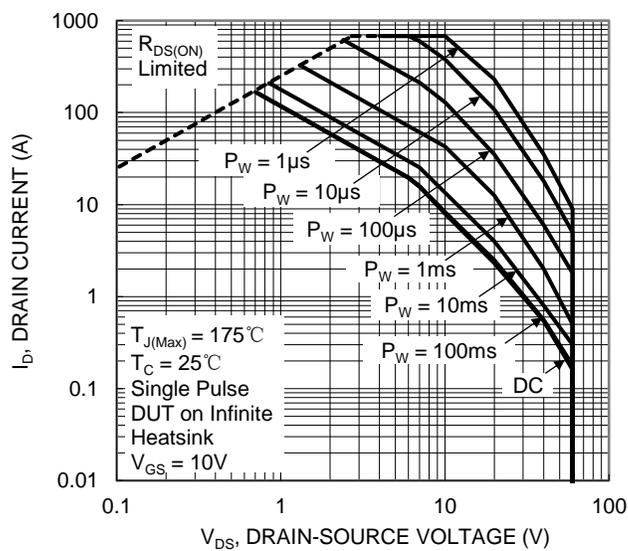


Figure 12. SOA, Safe Operation Area

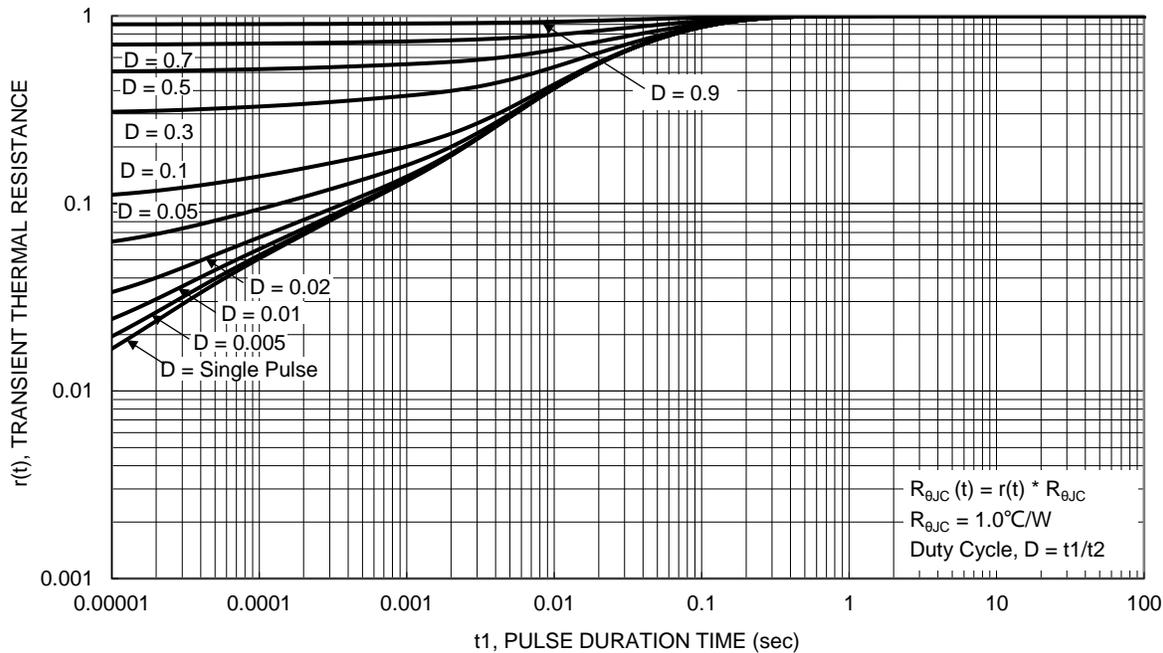
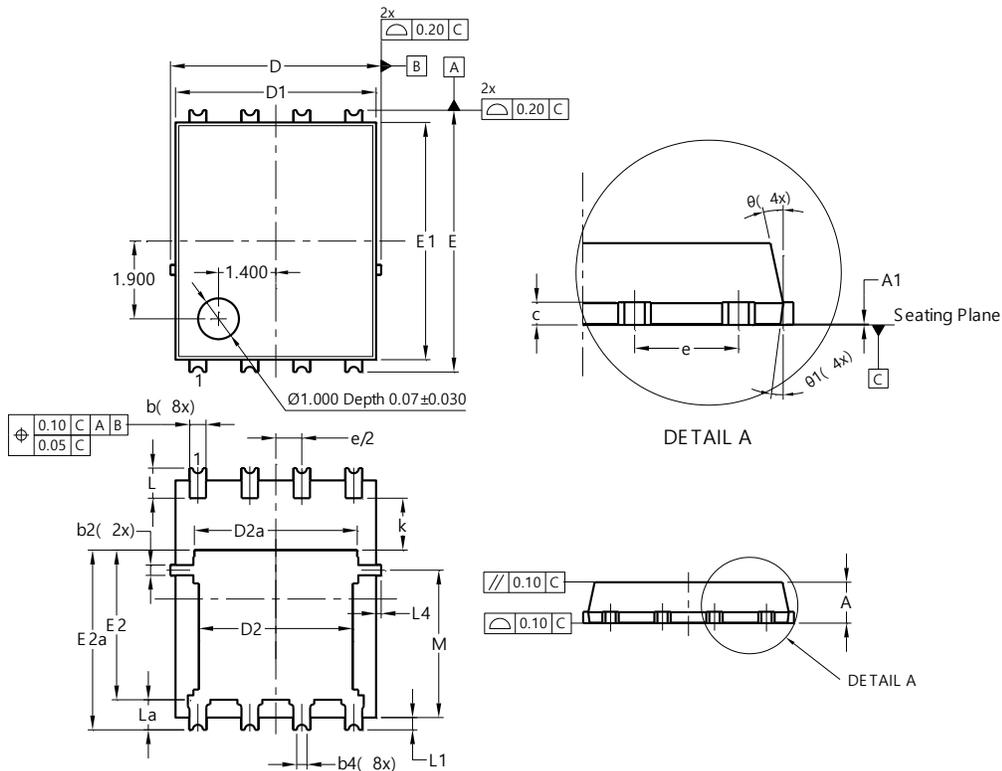


Figure 13. Transient Thermal Resistance

### Package Outline Dimensions

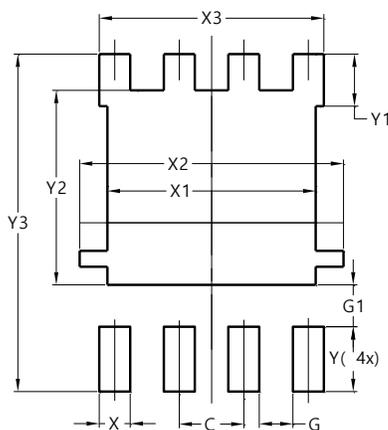
PowerDI5060-8/SWP (Type UX)



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
L4	0.025	0.225	0.125
M	3.205	4.005	3.605
$\theta$	10°	12°	11°
$\theta1$	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	5.190
X3	4.420
Y	1.270
Y1	1.020
Y2	3.810
Y3	6.610