



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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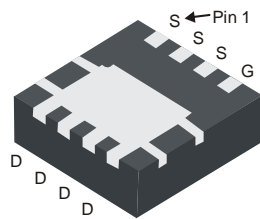
Product Summary

BV_{DSS}	$R_{DS(ON)}$ Max	I_D Max $T_C = +25^\circ C$
60V	50m Ω @ $V_{GS} = 10V$	18A
	63m Ω @ $V_{GS} = 4.5V$	16A

Description and Applications

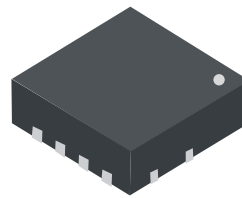
This MOSFET is designed to minimize the on-state resistance ($R_{DS(ON)}$), yet maintain superior switching performance, making it ideal for high efficiency power management applications.

- Backlighting
- Power Management Functions
- DC-DC Converters

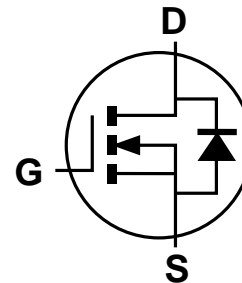


Bottom View

PowerDI3333-8



Top View



Equivalent Circuit

Features and Benefits

- Low $R_{DS(ON)}$ – Ensures On-State Losses are Minimized
- Small Form Factor Thermally Efficient Package Enables Higher Density End Products (PowerDI[®])
- Occupies Just 33% of the Board Area Occupied by SO-8 Enabling Smaller End Product

Mechanical Data

- Case: PowerDI3333-8
- 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 Leadframe. Solderable per MIL-STD-202, Method 208
- Weight: 0.03 grams (Approximate)



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

Characteristic	Symbol	Value	Units	
Drain-Source Voltage	V_{DSS}	60	V	
Gate-Source Voltage	V_{GSS}	± 20	V	
Continuous Drain Current (Note 6) $V_{GS} = 10\text{V}$	Steady State	$T_A = +25^\circ\text{C}$ $T_A = +70^\circ\text{C}$	5.6 4.5	A
	Steady State	$T_C = +25^\circ\text{C}$ $T_C = +70^\circ\text{C}$	18 14.5	A
Pulsed Drain Current (380 μs Pulse, Duty Cycle = 1%)	I_{DM}	25	A	
Maximum Continuous Body Diode Forward Current (Note 6)	I_S	2.5	A	
Avalanche Current (Note 7) $L = 0.1\text{mH}$	I_{AS}	12	A	
Avalanche Energy (Note 7) $L = 0.1\text{mH}$	E_{AS}	7.2	mJ	

Thermal Characteristics

Characteristic	Symbol	Value	Units	
Total Power Dissipation (Note 5)	P_D	0.93	W	
Thermal Resistance, Junction to Ambient (Note 5)	Steady State $t < 10\text{s}$	$R_{\theta JA}$	134	$^\circ\text{C/W}$
			82	
Total Power Dissipation (Note 6)	P_D	2.4	W	
Thermal Resistance, Junction to Ambient (Note 6)	Steady State $t < 10\text{s}$	$R_{\theta JA}$	53	$^\circ\text{C/W}$
			33	
Thermal Resistance, Junction to Case	$R_{\theta JC}$	5		
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
OFF CHARACTERISTICS (Note 8)						
Drain-Source Breakdown Voltage	BV_{DSS}	60	—	—	V	$V_{GS} = 0\text{V}, I_D = 250\mu\text{A}$
Zero Gate Voltage Drain Current $T_J = +25^\circ\text{C}$	I_{DSS}	—	—	1	μA	$V_{DS} = 60\text{V}, V_{GS} = 0\text{V}$
Zero Gate Voltage Drain Current $T_J = +150^\circ\text{C}$ (Note 9)	I_{DSS}	—	—	100	μA	$V_{DS} = 60\text{V}, V_{GS} = 0\text{V}$
Gate-Source Leakage	I_{GSS}	—	—	± 100	nA	$V_{GS} = \pm 20\text{V}, V_{DS} = 0\text{V}$
ON CHARACTERISTICS (Note 8)						
Gate Threshold Voltage	$V_{GS(TH)}$	1	—	3	V	$V_{DS} = V_{GS}, I_D = 250\mu\text{A}$
Static Drain-Source On-Resistance	$R_{DS(ON)}$	—	39	50	m Ω	$V_{GS} = 10\text{V}, I_D = 4.5\text{A}$
		—	47	63		$V_{GS} = 4.5\text{V}, I_D = 3\text{A}$
Diode Forward Voltage	V_{SD}	—	—	1.1	V	$V_{GS} = 0\text{V}, I_S = 2.5\text{A}$
On State Drain Current (Note 9)	$I_{D(ON)}$	20	—	—	A	$V_{DS} \geq 5\text{V}, V_{GS} = 10\text{V}$
DYNAMIC CHARACTERISTICS (Note 9)						
Input Capacitance	C_{ISS}	—	740	1,480	pF	$V_{DS} = 30\text{V}, V_{GS} = 0\text{V},$ $f = 1.0\text{MHz}$
Output Capacitance	C_{OSS}	—	40	80	pF	
Reverse Transfer Capacitance	C_{RSS}	—	28	55	pF	
Gate Resistance	R_G	—	2.2	4	Ω	$V_{DS} = 0\text{V}, V_{GS} = 0\text{V}, f = 1\text{MHz}$
Total Gate Charge ($V_{GS} = 4.5\text{V}$)	Q_G	—	6.4	12	nC	$V_{DS} = 30\text{V}, I_D = 12\text{A}$
Total Gate Charge ($V_{GS} = 10\text{V}$)	Q_G	—	14	25	nC	
Gate-Source Charge	Q_{GS}	—	2.8	5.5	nC	
Gate-Drain Charge	Q_{GD}	—	2.3	5	nC	
Turn-On Delay Time	$t_{D(ON)}$	—	3.6	10	ns	$V_{DS} = 30\text{V}, I_D = 12\text{A}$ $V_{GS} = 10\text{V}, R_G = 6.0\Omega$
Turn-On Rise Time	t_R	—	5.0	10	ns	
Turn-Off Delay Time	$t_{D(OFF)}$	—	12	24	ns	
Turn-Off Fall Time	t_F	—	3.3	10	ns	
Body Diode Reverse Recovery Time	t_{RR}	—	11	22	ns	$I_F = 4.5\text{A}, di/dt = 100\text{A}/\mu\text{s}$
Body Diode Reverse Recovery Charge	Q_{RR}	—	5.1	10	nC	

- 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 1-inch square copper plate.
 - 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.

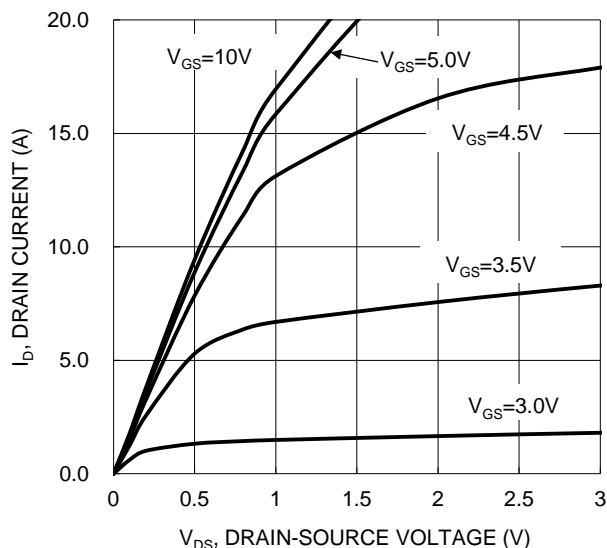


Figure 1. Typical Output Characteristic

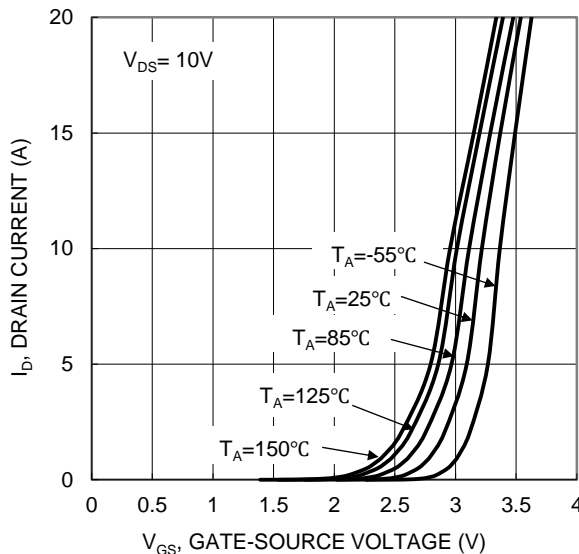


Figure 2. Typical Transfer Characteristic

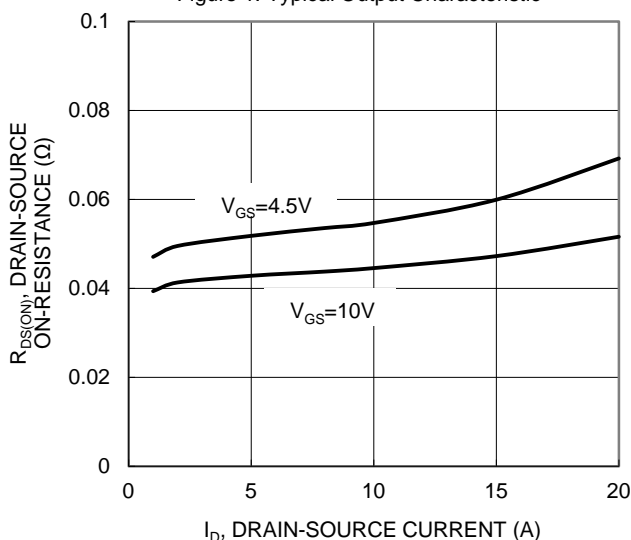


Figure 3. Typical On-Resistance vs. Drain Current and Gate Voltage

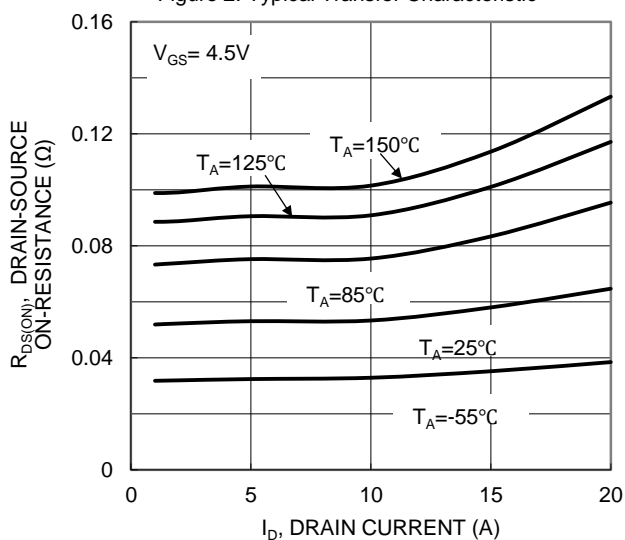


Figure 4. Typical On-Resistance vs. Drain Current and Temperature

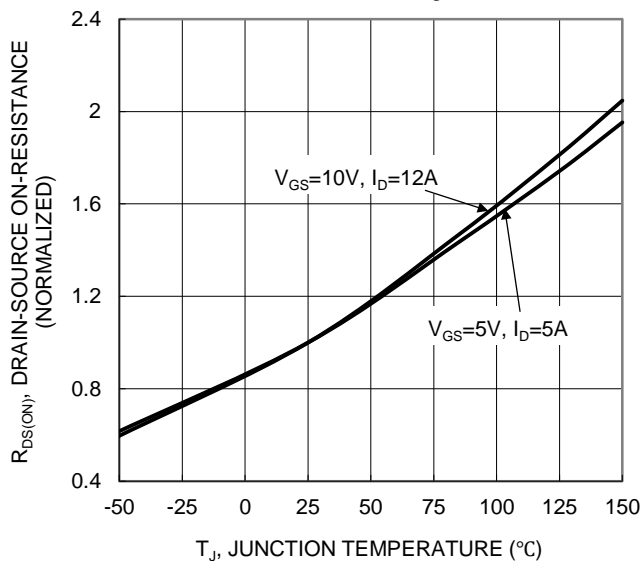


Figure 5. On-Resistance Variation with Temperature

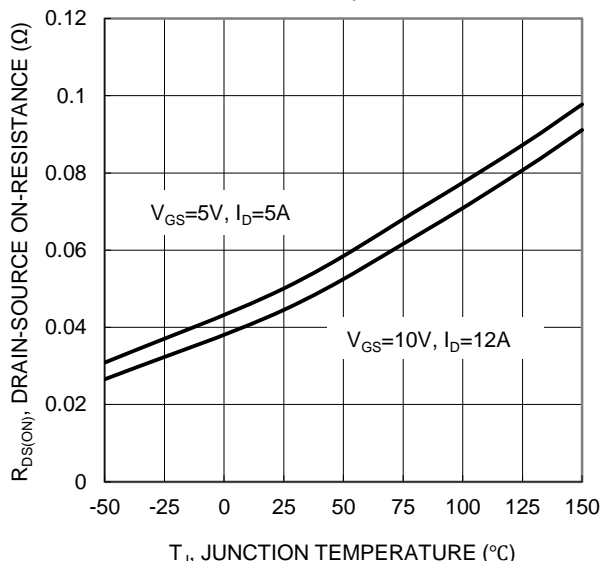
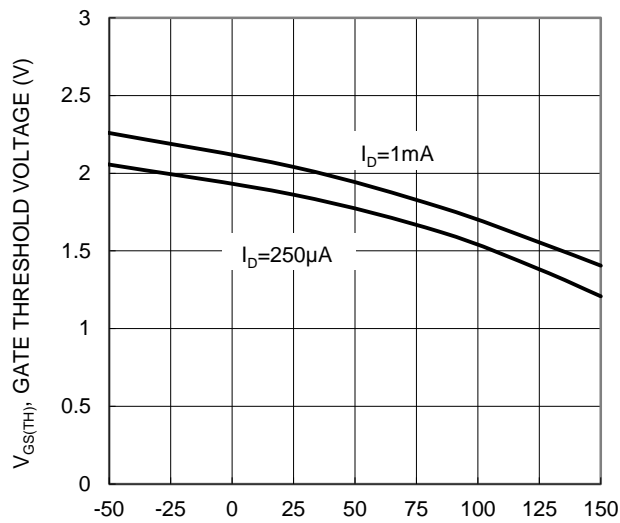
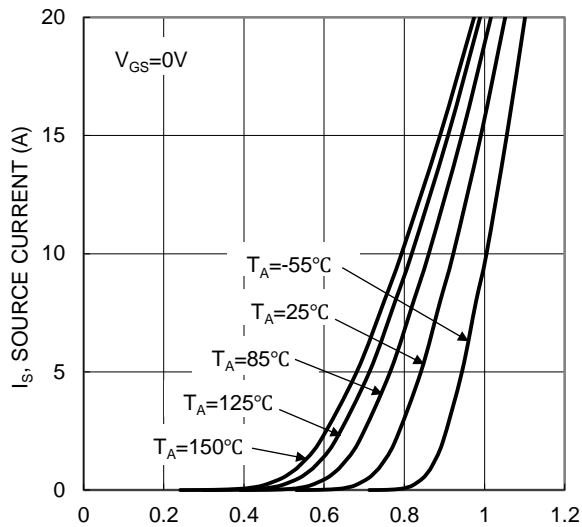


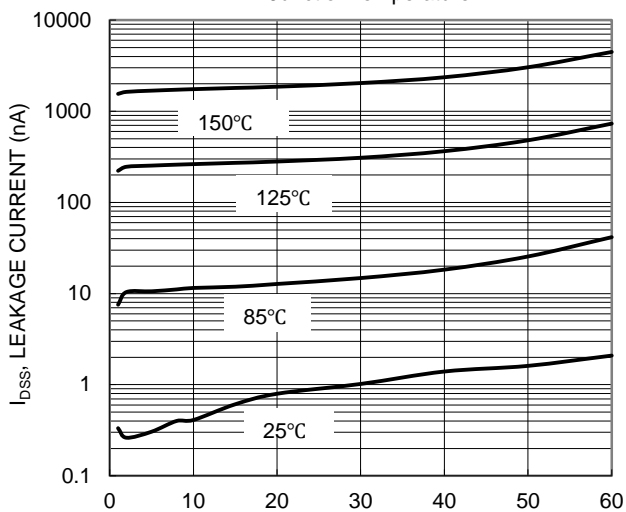
Figure 6. On-Resistance Variation with Temperature



T_J , JUNCTION TEMPERATURE (°C)
Figure 7. Gate Threshold Variation vs. Junction Temperature



V_{SD} , SOURCE-DRAIN VOLTAGE (V)
Figure 8. Diode Forward Voltage vs. Current



V_{DS} , DRAIN-SOURCE VOLTAGE (V)
Figure 9. Typical Drain-Source Leakage Current vs. Voltage

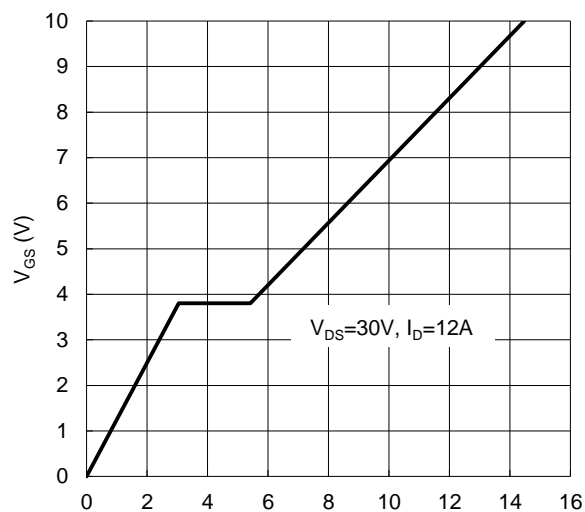
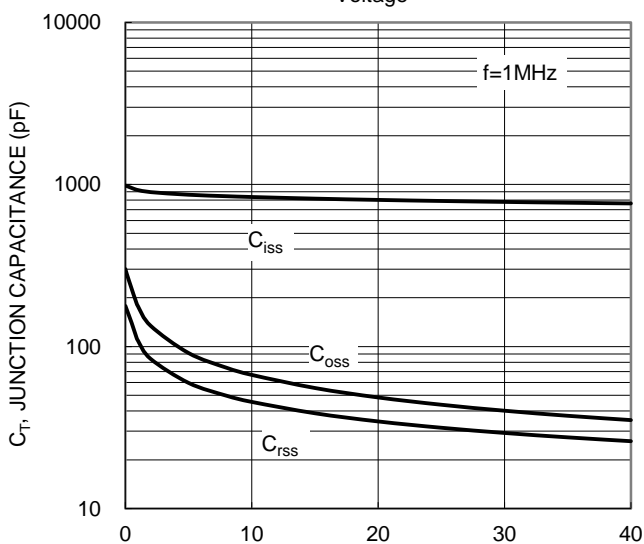
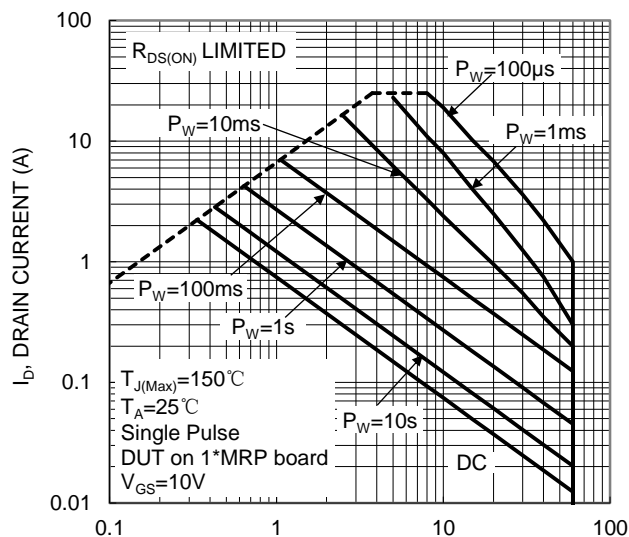


Figure 10. Gate Charge



V_{DS} , DRAIN-SOURCE VOLTAGE (V)
Figure 11. Typical Junction Capacitance



V_{DS} , DRAIN-SOURCE VOLTAGE (V)
Figure 12. SOA, Safe Operation Area

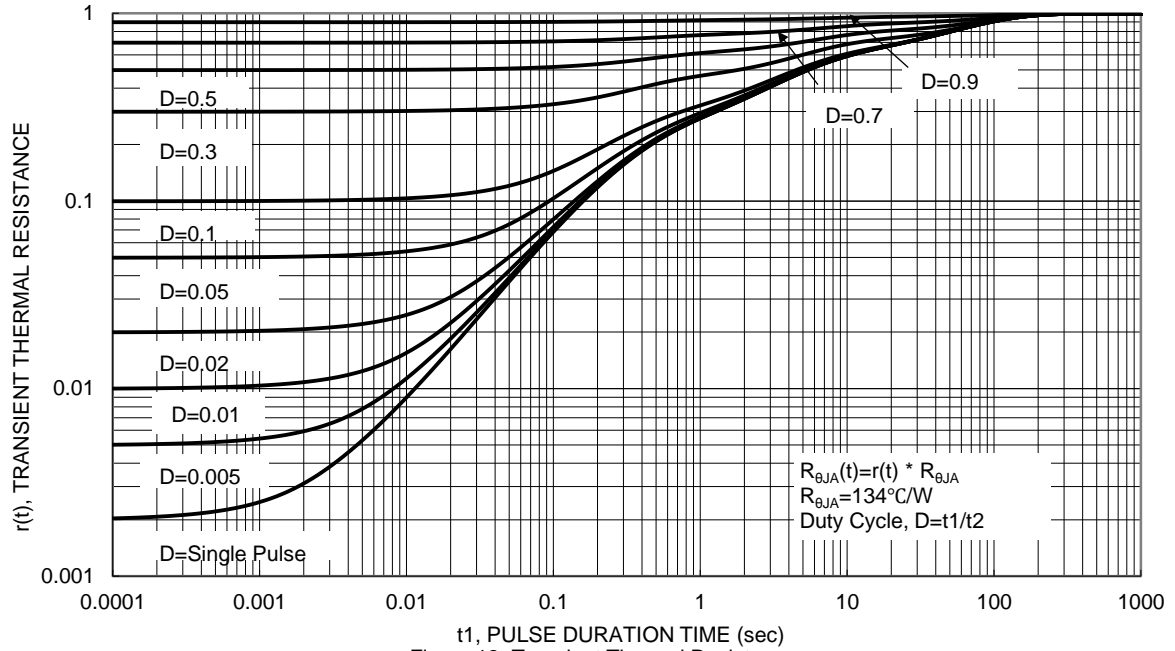
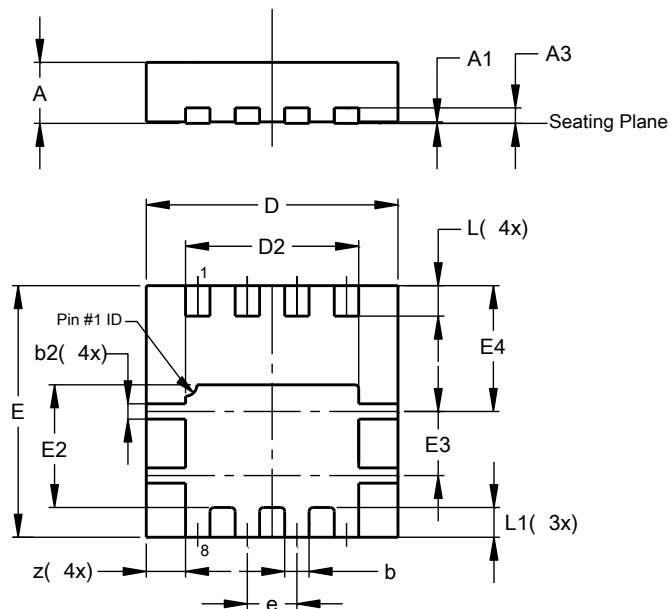


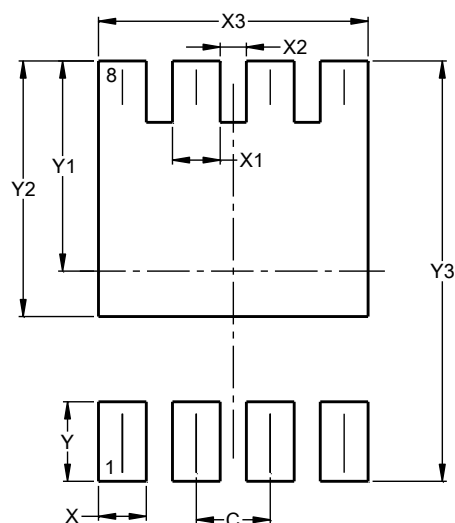
Figure 13. Transient Thermal Resistance

Package Outline Dimensions

PowerDI3333-8


PowerDI3333-8			
Dim	Min	Max	Typ
A	0.75	0.85	0.80
A1	0.00	0.05	0.02
A3	-	-	0.203
b	0.27	0.37	0.32
b2	0.15	0.25	0.20
D	3.25	3.35	3.30
D2	2.22	2.32	2.27
E	3.25	3.35	3.30
E2	1.56	1.66	1.61
E3	0.79	0.89	0.84
E4	1.60	1.70	1.65
e	-	-	0.65
L	0.35	0.45	0.40
L1	-	-	0.39
z	-	-	0.515
All Dimensions in mm			

Suggested Pad Layout

PowerDI3333-8


Dimensions	Value (in mm)
C	0.650
X	0.420
X1	0.420
X2	0.230
X3	2.370
Y	0.700
Y1	1.850
Y2	2.250
Y3	3.700