

## Product Summary

$BV_{DSS}$	$R_{DS(ON)} \text{ max}$	$I_D \text{ max}$ $T_A = +25^\circ\text{C}$
60V	13m $\Omega$ @ $V_{GS} = 10\text{V}$	10.3A
	18m $\Omega$ @ $V_{GS} = 4.5\text{V}$	8.8A

## Description and Applications

This MOSFET is designed to meet the stringent requirements of Automotive applications. It is qualified to AEC-Q101, supported by a PPAP and is ideal for use in:

- Motor Control
- DC to DC Converters
- Reverse Polarity Protection

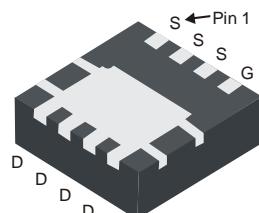
## Features and Benefits

- Low  $R_{DS(ON)}$  – ensures on state losses are minimized
- Small form factor thermally efficient package enables higher density end products
- Occupies just 33% of the board area occupied by SO-8 enabling smaller end product
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **Qualified to AEC-Q101 Standards for High Reliability**
- **PPAP Capable (Note 4)**

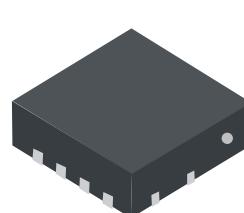
## Mechanical Data

- 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 (E3)
- Weight: 0.072 grams (Approximate)

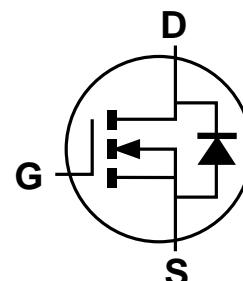
PowerDI3333-8



Bottom View



Top View



Equivalent Circuit

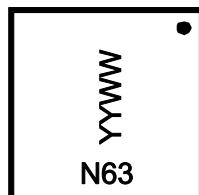
## Ordering Information (Note 5)

Part Number	Case	Packaging
DMN6013LFGQ-7	PowerDI3333-8	2,000/Tape & Reel
DMN6013LFGQ-13	PowerDI3333-8	3,000/Tape & Reel

Notes:

1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.
2. See [http://www.diodes.com/quality/lead\\_free.html](http://www.diodes.com/quality/lead_free.html) for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.
4. Automotive products are AEC-Q101 qualified and are PPAP capable. Refer to [http://www.diodes.com/product\\_compliance\\_definitions.html](http://www.diodes.com/product_compliance_definitions.html).
5. For packaging details, go to our website at <http://www.diodes.com/products/packages.html>.

## Marking Information



N63 = Product Type Marking Code  
 YYWW = Date Code Marking  
 YY = Last Two Digits of Year (ex: 16 = 2016)  
 WW = Week Code (01 to 53)

**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	$V_{GSS}$	$\pm 20$	V
Continuous Drain Current (Note 7) $V_{GS} = 10\text{V}$	$T_A = +25^\circ\text{C}$	$I_D$	10.3
	$T_A = +70^\circ\text{C}$		8.3
Pulsed Drain Current (10 $\mu\text{s}$ pulse, duty cycle = 1%)	$T_C = +25^\circ\text{C}$	$I_D$	45
	$T_C = +100^\circ\text{C}$		28
Maximum Continuous Body Diode Forward Current (Note 7)	$I_S$	3	A
Avalanche Current, $L = 0.1\text{mH}$	$I_{AS}$	33.3	A
Avalanche Energy, $L = 0.1\text{mH}$	$E_{AS}$	56.8	mJ

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

Characteristic	Symbol	Value	Units
Total Power Dissipation (Note 6)	$P_D$	1	W
Thermal Resistance, Junction to Ambient (Note 6)	Steady state	123	°C/W
	$t < 10\text{s}$	69	
Total Power Dissipation (Note 7)	$P_D$	2.1	W
Thermal Resistance, Junction to Ambient (Note 7)	Steady state	60	°C/W
	$t < 10\text{s}$	34	
Total Power Dissipation (Note 7)	$P_D$	40	W
Thermal Resistance, Junction to Case (Note 7)	$R_{\theta JC}$	6.7	°C/W
Operating and Storage Temperature Range	$T_J, T_{STG}$	-55 to +150	°C

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

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
<b>OFF CHARACTERISTICS (Note 8)</b>						
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	$\mu\text{A}$	$V_{DS} = 60\text{V}, V_{GS} = 0\text{V}$
Gate-Source Leakage	$I_{GSS}$	—	—	$\pm 100$	nA	$V_{GS} = \pm 20\text{V}, V_{DS} = 0\text{V}$
<b>ON CHARACTERISTICS (Note 8)</b>						
Gate Threshold Voltage	$V_{GS(\text{TH})}$	1	1.8	3	V	$V_{DS} = V_{GS}, I_D = 250\mu\text{A}$
Static Drain-Source On-Resistance	$R_{DS(\text{ON})}$	—	9.3	13	$\text{m}\Omega$	$V_{GS} = 10\text{V}, I_D = 10\text{A}$
		—	12.3	18		$V_{GS} = 4.5\text{V}, I_D = 8\text{A}$
Diode Forward Voltage	$V_{SD}$	—	0.7	1.2	V	$V_{GS} = 0\text{V}, I_S = 1.7\text{A}$
<b>DYNAMIC CHARACTERISTICS (Note 9)</b>						
Input Capacitance	$C_{iss}$	—	2577	—	pF	$V_{DS} = 30\text{V}, V_{GS} = 0\text{V}, f = 1\text{MHz}$
Output Capacitance	$C_{oss}$	—	162	—	pF	
Reverse Transfer Capacitance	$C_{rss}$	—	132	—	pF	
Gate Resistance	$R_g$	—	0.9	—	$\Omega$	$V_{DS} = 0\text{V}, V_{GS} = 0\text{V}, f = 1\text{MHz}$
Total Gate Charge ( $V_{GS} = 4.5\text{V}$ )	$Q_g$	—	26.6	—	nC	$V_{DS} = 30\text{V}, I_D = 10\text{A}$
Total Gate Charge ( $V_{GS} = 10\text{V}$ )	$Q_g$	—	55.4	—	nC	
Gate-Source Charge	$Q_{gs}$	—	9.3	—	nC	
Gate-Drain Charge	$Q_{gd}$	—	12.6	—	nC	
Turn-On Delay Time	$t_{D(\text{ON})}$	—	6.2	—	ns	$V_{GS} = 10\text{V}, V_{DS} = 30\text{V}, R_G = 3\Omega, I_D = 10\text{A}$
Turn-On Rise Time	$t_R$	—	9.9	—	ns	
Turn-Off Delay Time	$t_{D(\text{OFF})}$	—	27.6	—	ns	
Turn-Off Fall Time	$t_F$	—	11.7	—	ns	
Body Diode Reverse Recovery Time	$t_{RR}$	—	9.4	—	ns	$I_F = 10\text{A}, di/dt = 100\text{A}/\mu\text{s}$
Body Diode Reverse Recovery Charge	$Q_{RR}$	—	18.6	—	nC	

Notes: 6. Device mounted on FR-4 PC board, with minimum recommended pad layout, single sided.

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

8. Short duration pulse test used to minimize self-heating effect.

9. Guaranteed by design. Not subject to product testing.

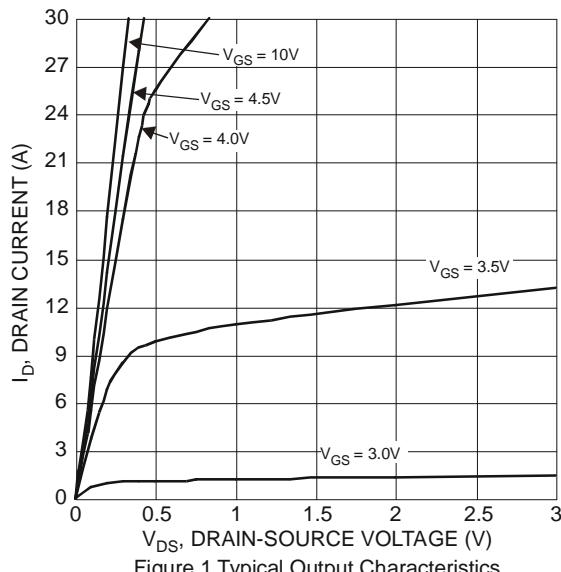


Figure 1 Typical Output Characteristics

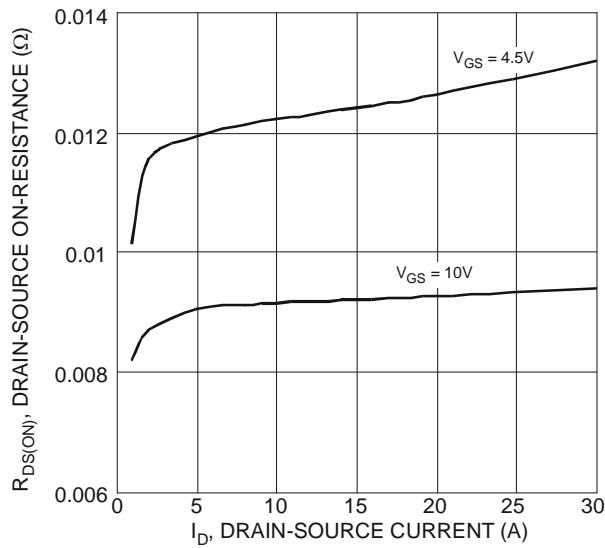


Figure 3 Typical On-Resistance vs.  
Drain Current and Gate Voltage

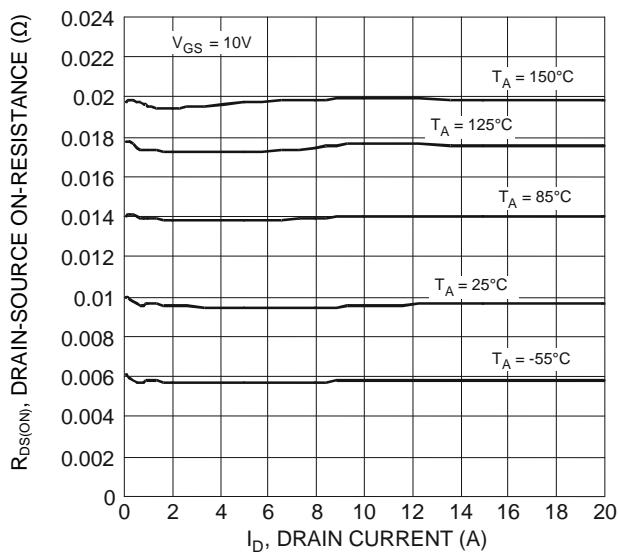


Figure 5 Typical On-Resistance vs.  
Drain Current and Temperature

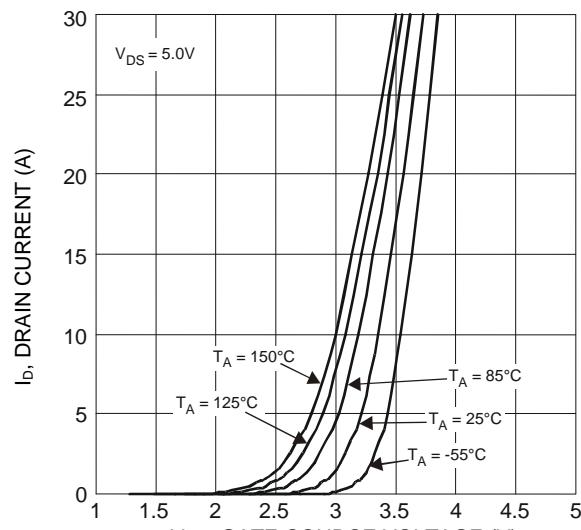


Figure 2 Typical Transfer Characteristics

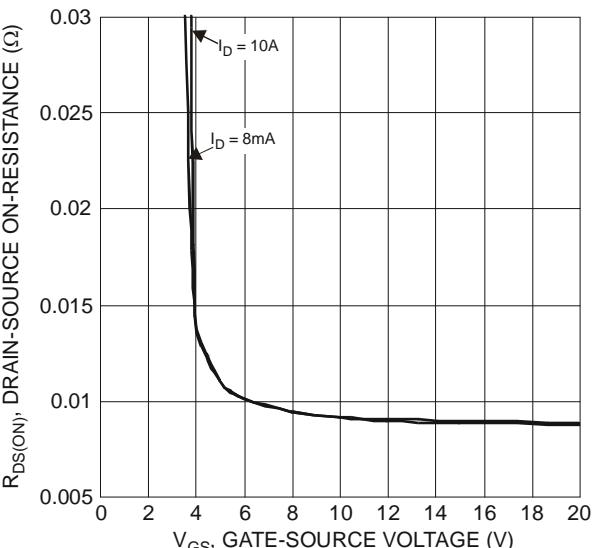


Figure 4 Typical Drain-Source On-Resistance  
vs. Gate-Source Voltage

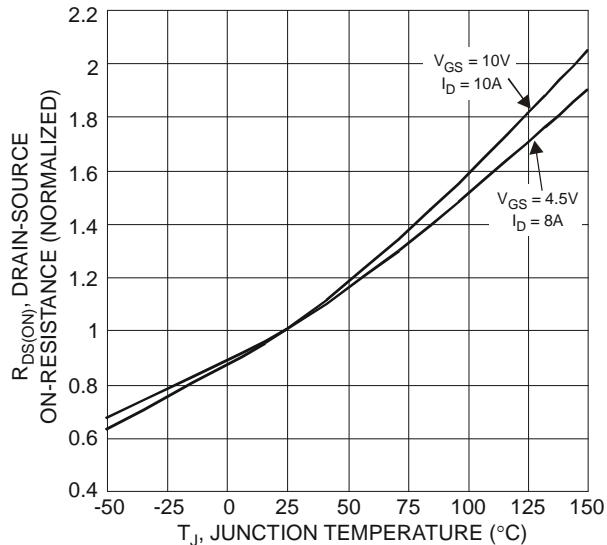
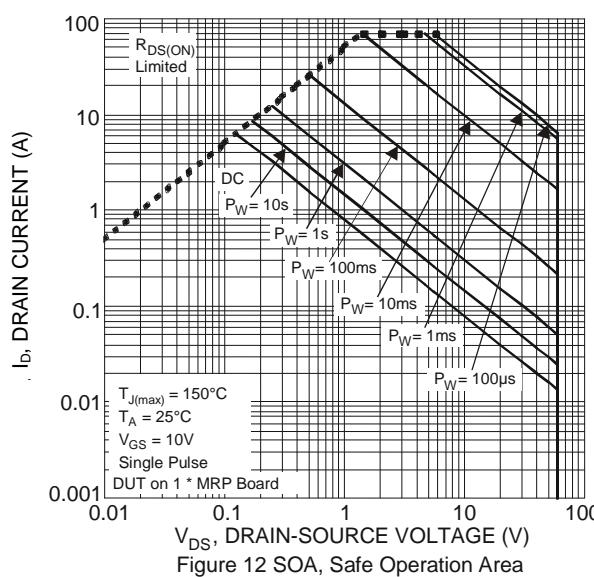
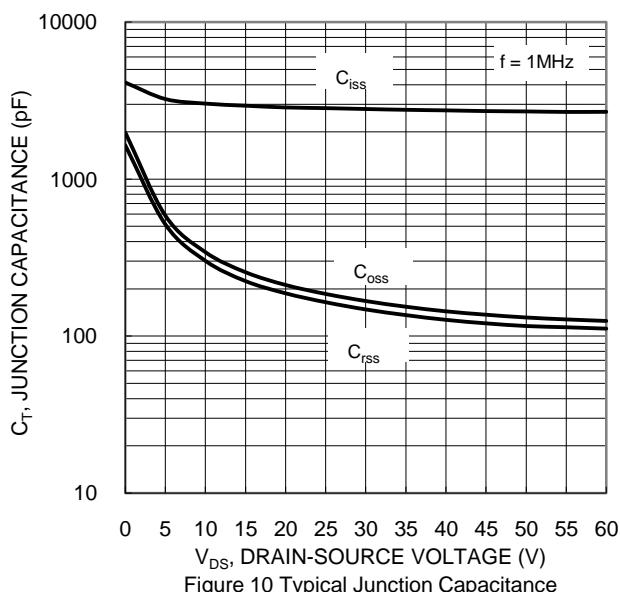
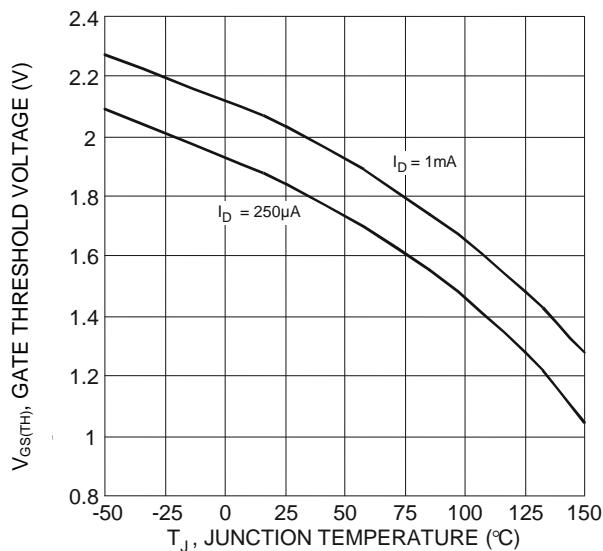
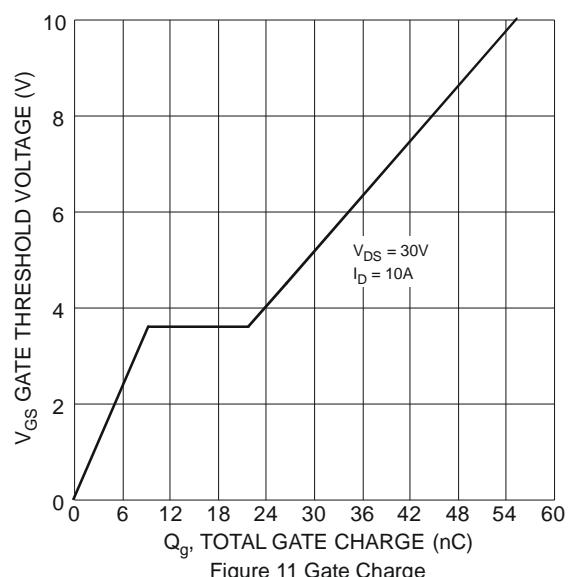
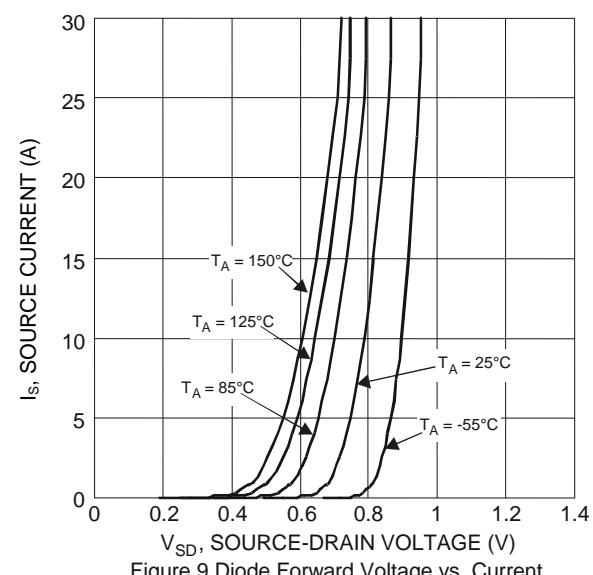
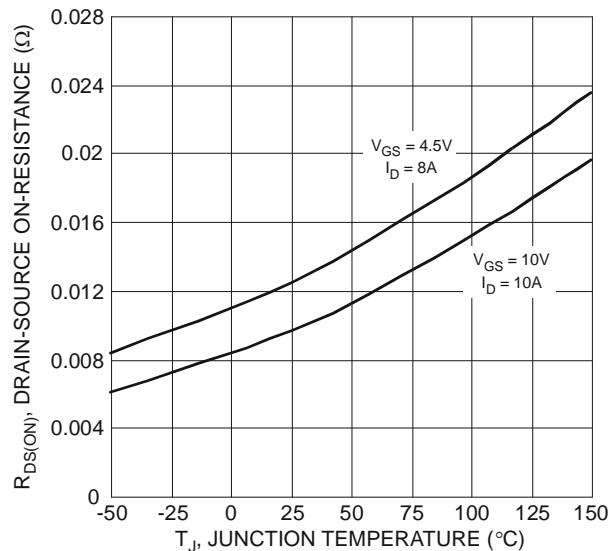


Figure 6 On-Resistance Variation with Temperature



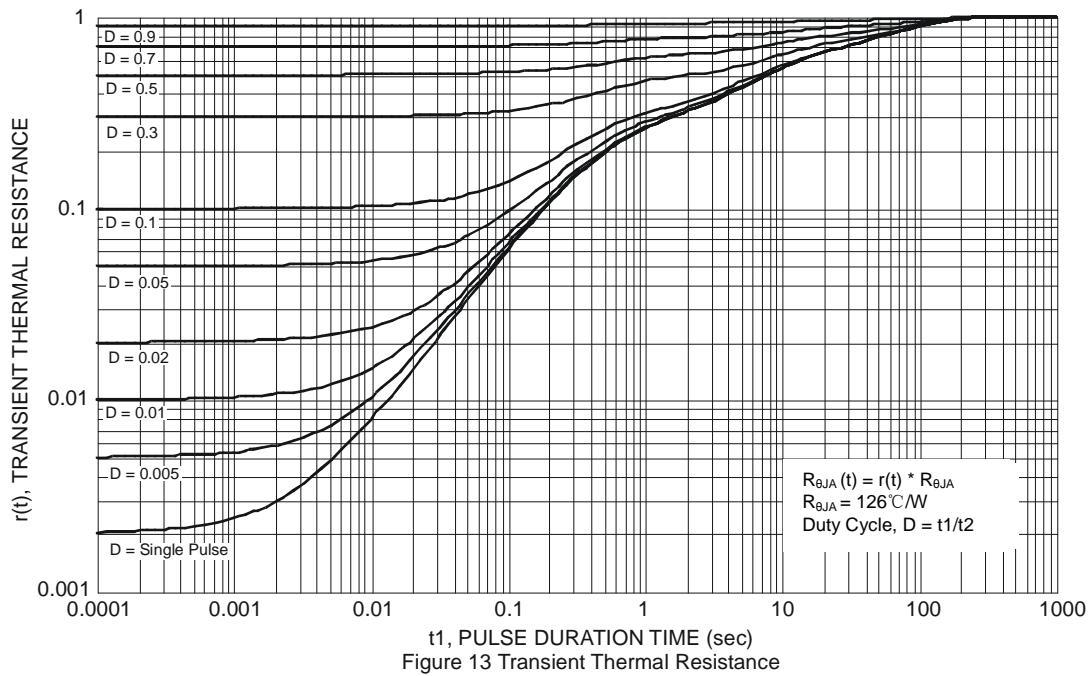
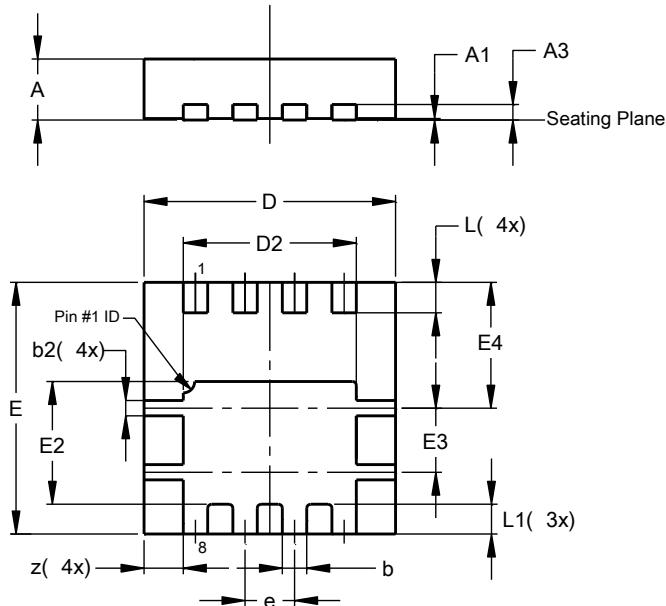


Figure 13 Transient Thermal Resistance

## Package Outline Dimensions

Please see <http://www.diodes.com/package-outlines.html> for the latest version.

PowerDI3333-8



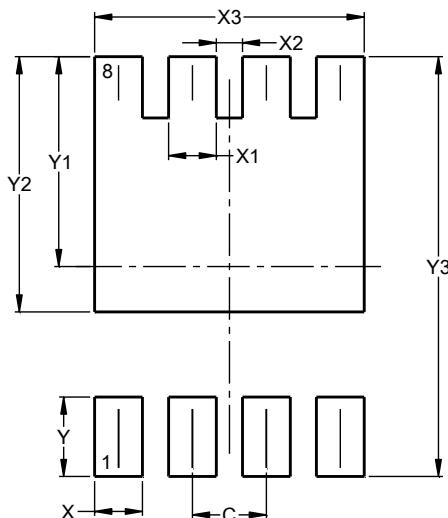
PowerDI3333-8			
Dim	Min	Max	Typ
<b>A</b>	0.75	0.85	0.80
<b>A1</b>	0.00	0.05	0.02
<b>A3</b>	—	—	0.203
<b>b</b>	0.27	0.37	0.32
<b>b2</b>	0.15	0.25	0.20
<b>D</b>	3.25	3.35	3.30
<b>D2</b>	2.22	2.32	2.27
<b>E</b>	3.25	3.35	3.30
<b>E2</b>	1.56	1.66	1.61
<b>E3</b>	0.79	0.89	0.84
<b>E4</b>	1.60	1.70	1.65
<b>e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

All Dimensions in mm

## Suggested Pad Layout

Please see <http://www.diodes.com/package-outlines.html> for the latest version.

PowerDI3333-8



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

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