

# 30V SYNCHRONOUS N-CHANNEL ENHANCEMENT MODE MOSFET PowerDI3333-8 (Type D)

## Product Summary

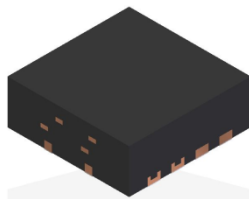
Device	BV <sub>DSS</sub>	R <sub>DS(ON)</sub> Max
Q1	30V	14.3mΩ @ V <sub>GS</sub> = 8V, I <sub>D</sub> = 4A
Q2	30V	14.3mΩ @ V <sub>GS</sub> = 8V, I <sub>D</sub> = 4A

## Description and Applications

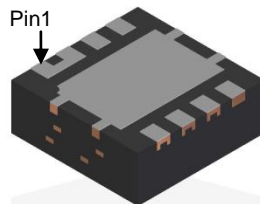
This new generation MOSFET is designed to minimize the on-state resistance (R<sub>DS(ON)</sub>) and yet maintain superior switching performance, making it ideal for high efficiency power management applications.

- DC-DC Converters
- Power Management Functions
- Analog Switch

PowerDI3333-8 (Type D)



Top View



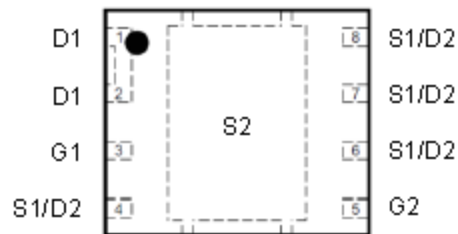
Bottom View

## Features and Benefits

- 100% Unclamped Inductive Switch (UIS) Test in Production
- Low On-Resistance
- Low Input Capacitance
- Fast Switching Speed
- **Lead-Free Finish; RoHS Compliant (Note 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**

## Mechanical Data

- Case: PowerDI<sup>®</sup> 3333-8 (Type D)
- 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
- Terminals: Finish – Matte Tin Annealed over Copper Leadframe.  
Solderable per MIL-STD-202, Method 208
- Weight: 0.044 grams (Approximate)



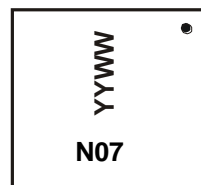
Top View  
Pin Configuration

## Ordering Information (Note 4)

Part Number	Case	Packaging
DMN3013LFG-7	PowerDI3333-8 (Type D)	1000 / Tape & Reel
DMN3013LFG-13	PowerDI3333-8 (Type D)	3000 / Tape & Reel

- Notes:
1. EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant. All applicable RoHS exemptions applied.
  2. See [http://www.diodes.com/quality/lead\\_free/](http://www.diodes.com/quality/lead_free/) 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. For packaging details, go to our website at <https://www.diodes.com/design/support/packaging/diodes-packaging/>.

## Marking Information



N07 = Product Type Marking Code  
YYWW = Date Code Marking  
YY = Last Two Digits of Year (ex: 18 = 2018)  
WW = Week Code (01 to 53)

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

Characteristic	Symbol	Q1	Q2	Unit
Drain-Source Voltage	V <sub>DSS</sub>	30		V
Gate-Source Voltage	V <sub>GSS</sub>	10		V
Continuous Drain Current @ V <sub>GS</sub> = 5V	I <sub>D</sub>	15		A
		12		
	I <sub>D</sub>	9.5		A
		7.6		
Continuous Source-Drain Diode Current (Note 5)	I <sub>S</sub>	2.7	2.7	A
Pulsed Drain Current (10μs Pulse, Duty Cycle = 1%)	I <sub>DM</sub>	80	80	A
Avalanche Current (Note 6) L = 0.1mH	I <sub>AS</sub>	24	24	A
Avalanche Energy (Note 6) L = 0.1mH	E <sub>AS</sub>	28	28	mJ

**Thermal Characteristics** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

Characteristic	Symbol	Value	Unit
Total Power Dissipation	P <sub>D</sub>	2.16	W
		1.25	
Thermal Resistance, Junction to Ambient (Note 5)	R <sub>θJA</sub>	58.8	°C/W
		34	
Thermal Resistance, Junction to Case	R <sub>θJC</sub>	6.9	
Operating and Storage Temperature Range	T <sub>J</sub> , T <sub>STG</sub>	-55 to +150	°C

**Electrical Characteristics Q1** (@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>	30	-	-	V	V <sub>GS</sub> = 0V, I <sub>D</sub> = 250μA
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	-	-	1	μA	V <sub>DS</sub> = 20V, V <sub>GS</sub> = 0V
Gate-Source Leakage	I <sub>GSS</sub>	-	-	100	nA	V <sub>GS</sub> = 10V, V <sub>DS</sub> = 0V
<b>ON CHARACTERISTICS (Note 7)</b>						
Gate Threshold Voltage	V <sub>GS(TH)</sub>	0.75	0.95	1.2	V	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA
Static Drain-Source On-Resistance	R <sub>DS(ON)</sub>	-	10.9	14.3	mΩ	V <sub>GS</sub> = 8V, I <sub>D</sub> = 4A
		-	13.3	16.1	mΩ	V <sub>GS</sub> = 4.5V, I <sub>D</sub> = 4A
		-	15.3	17.7	mΩ	V <sub>GS</sub> = 3.5V, I <sub>D</sub> = 4A
Forward Transfer Admittance	Y <sub>fs</sub>	-	13	-	S	V <sub>DS</sub> = 15V, I <sub>D</sub> = 4A
Diode Forward Voltage	V <sub>SD</sub>	-	0.8	1.0	V	V <sub>GS</sub> = 0V, I <sub>S</sub> = 4A
<b>DYNAMIC CHARACTERISTICS (Note 8)</b>						
Input Capacitance	C <sub>iss</sub>	-	387	600	pF	V <sub>DS</sub> = 15V, V <sub>GS</sub> = 0V, f = 1.0MHz
Output Capacitance	C <sub>oss</sub>	-	219	350		
Reverse Transfer Capacitance	C <sub>rss</sub>	-	10.4	16		
Gate Resistance	R <sub>g</sub>	-	3.3	6.8	Ω	V <sub>DS</sub> = 0V, V <sub>GS</sub> = 0V, f = 1.0MHz
Total Gate Charge (V <sub>GS</sub> = 4.5V)	Q <sub>g</sub>	-	3.3	5.7	nC	V <sub>DS</sub> = 15V, I <sub>D</sub> = 4A
Total Gate Charge at V <sub>TH</sub>	Q <sub>g(TH)</sub>	-	0.37	-		
Gate-Source Charge	Q <sub>gs</sub>	-	0.6	-		
Gate-Drain Charge	Q <sub>gd</sub>	-	0.6	-		
Turn-On Delay Time	t <sub>D(ON)</sub>	-	4.2	6.3	ns	V <sub>DD</sub> = 15V, V <sub>GS</sub> = 4.5V, I <sub>D</sub> = 4A, R <sub>g</sub> = 2Ω,
Turn-On Rise Time	t <sub>R</sub>	-	6.2	-		
Turn-Off Delay Time	t <sub>D(OFF)</sub>	-	9.7	15		
Turn-Off Fall Time	t <sub>F</sub>	-	2.0	-		
Reverse Recovery Time	t <sub>RR</sub>	-	11.7	-	ns	V <sub>DS</sub> = 15V, I <sub>F</sub> = 4A, di/dt = 300A/μs
Reverse Recovery Charge	Q <sub>RR</sub>	-	7.5	-	nC	

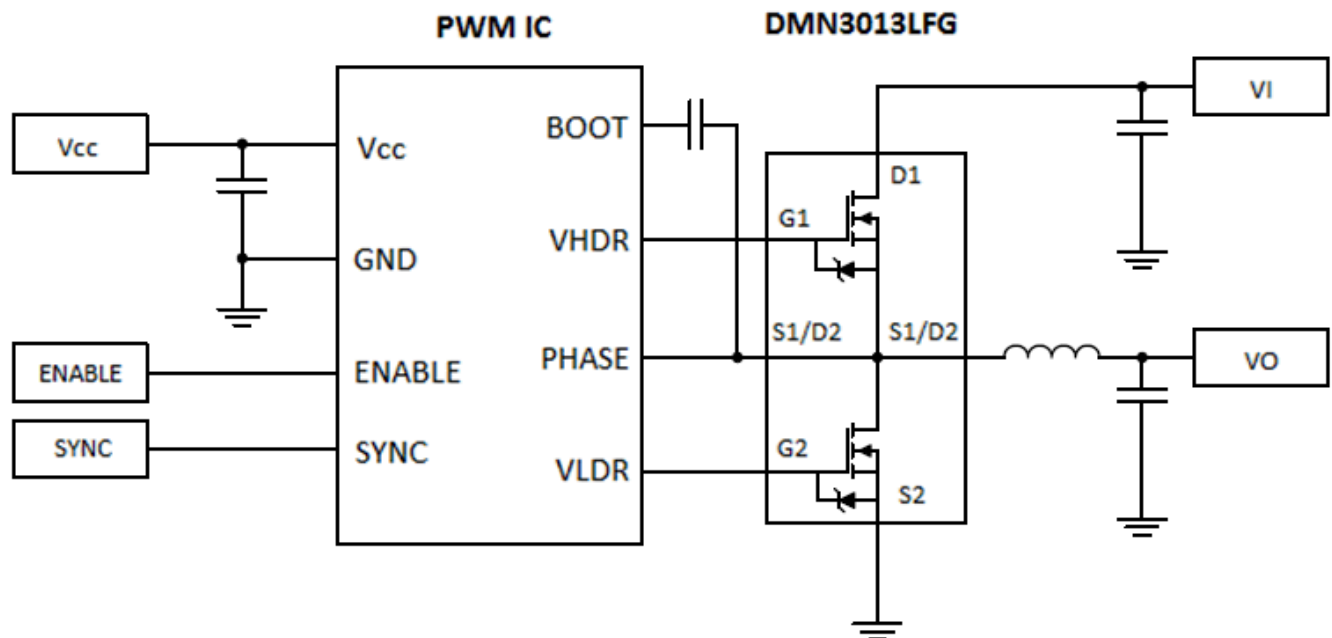
- Notes:
- Device mounted on FR-4 substrate PC board, 2oz copper, with 1inch square copper plate.
  - I<sub>AS</sub> and E<sub>AS</sub> ratings are based on low frequency and duty cycles to keep T<sub>J</sub> = +25°C.
  - Short duration pulse test used to minimize self-heating effect.
  - Guaranteed by design. Not subject to product testing.

## Electrical Characteristics Q2 (@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>	30	-	-	V	V <sub>GS</sub> = 0V, I <sub>D</sub> = 250μA
Zero Gate Voltage Drain Current T <sub>J</sub> = +25°C	I <sub>DSS</sub>	-	-	1.0	μA	V <sub>DS</sub> = 20V, V <sub>GS</sub> = 0V
Gate-Source Leakage	I <sub>GSS</sub>	-	-	100	nA	V <sub>GS</sub> = 10V, V <sub>DS</sub> = 0V
<b>ON CHARACTERISTICS (Note 7)</b>						
Gate Threshold Voltage	V <sub>GS(TH)</sub>	0.75	0.95	1.2	V	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA
Static Drain-Source On-Resistance	R <sub>DS(ON)</sub>	-	10.2	14.3	mΩ	V <sub>GS</sub> = 8V, I <sub>D</sub> = 4A
		-	12.7	16.1	mΩ	V <sub>GS</sub> = 4.5V, I <sub>D</sub> = 4A
		-	14.8	17.7	mΩ	V <sub>GS</sub> = 3.5V, I <sub>D</sub> = 4A
Forward Transfer Admittance	Y <sub>fs</sub>	-	13	-	s	V <sub>DS</sub> = 15V, I <sub>D</sub> = 4A
Diode Forward Voltage	V <sub>SD</sub>	-	0.8	1.0	V	V <sub>GS</sub> = 0V, I <sub>S</sub> = 4A
<b>DYNAMIC CHARACTERISTICS (Note 8)</b>						
Input Capacitance	C <sub>iss</sub>	-	397	600	pF	V <sub>DS</sub> = 15V, V <sub>GS</sub> = 0V, f = 1.0MHz
Output Capacitance	C <sub>oss</sub>	-	217	350	pF	
Reverse Transfer Capacitance	C <sub>rss</sub>	-	10.4	16	pF	
Gate Resistance	R <sub>g</sub>	-	3.3	6.8	Ω	V <sub>DS</sub> = 0V, V <sub>GS</sub> = 0V, f = 1MHz
Total Gate Charge (V <sub>GS</sub> = 4.5V)	Q <sub>g</sub>	-	3.4	5.7	nC	V <sub>DS</sub> = 15V, I <sub>D</sub> = 4A
Total Gate Charge at V <sub>TH</sub>	Q <sub>g(TH)</sub>	-	0.39	-	nC	
Gate-Source Charge	Q <sub>gs</sub>	-	0.6	-	nC	
Gate-Drain Charge	Q <sub>gd</sub>	-	0.6	-	nC	
Turn-On Delay Time	t <sub>D(ON)</sub>	-	4.4	6.3	ns	V <sub>DD</sub> = 15V, V <sub>GS</sub> = 4.5V, I <sub>D</sub> = 4A, R <sub>g</sub> = 2Ω
Turn-On Rise Time	t <sub>R</sub>	-	6.7	-	ns	
Turn-Off Delay Time	t <sub>D(OFF)</sub>	-	10.4	15	ns	
Turn-Off Fall Time	t <sub>F</sub>	-	2.2	-	ns	V <sub>DS</sub> = 15V, I <sub>F</sub> = 4A, di/dt = 300A/μs
Reverse Recovery Time	t <sub>RR</sub>	-	11.8	-	ns	
Reverse Recovery Charge	Q <sub>RR</sub>	-	7.8	-	nC	

Notes: 7. Short duration pulse test used to minimize self-heating effect.  
8. Guaranteed by design. Not subject to product testing.

## Typical Circuit



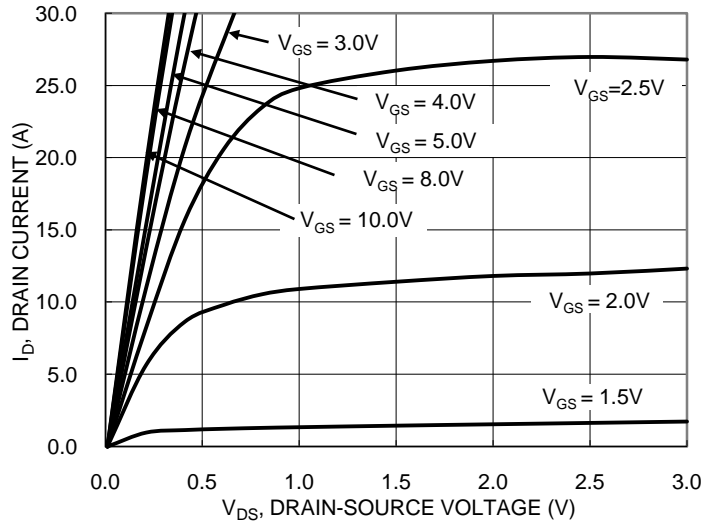


Figure 1. Typical Output Characteristic

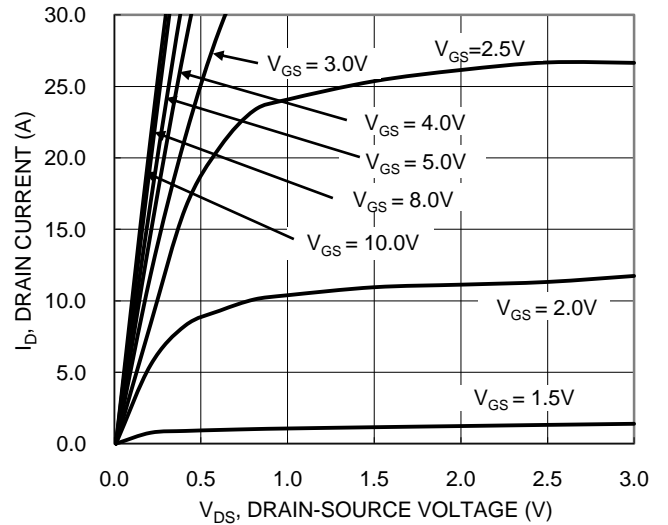


Figure 2. Typical Output Characteristic

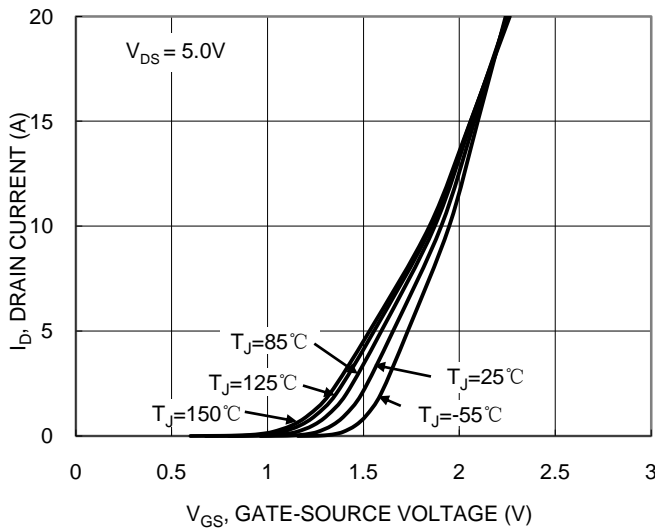


Figure 3. Typical Transfer Characteristic

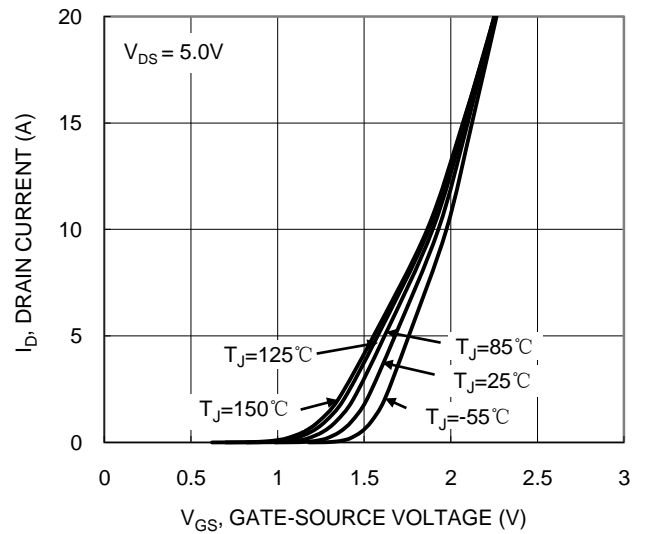


Figure 4. Typical Transfer Characteristic

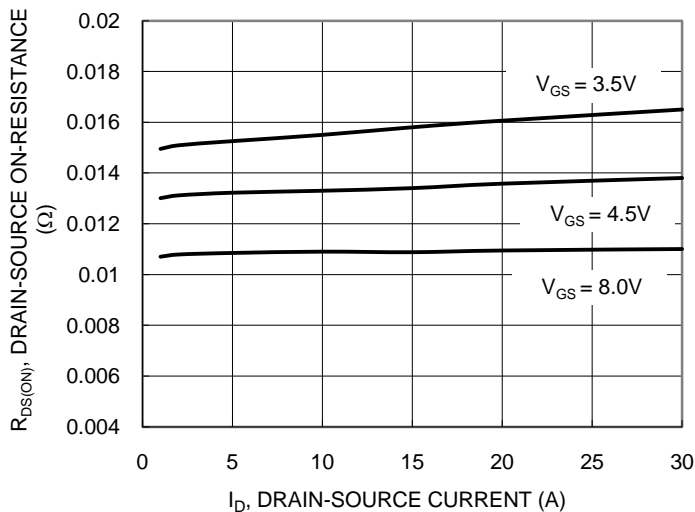


Figure 5. Typical On-Resistance vs. Drain Current and Gate Voltage

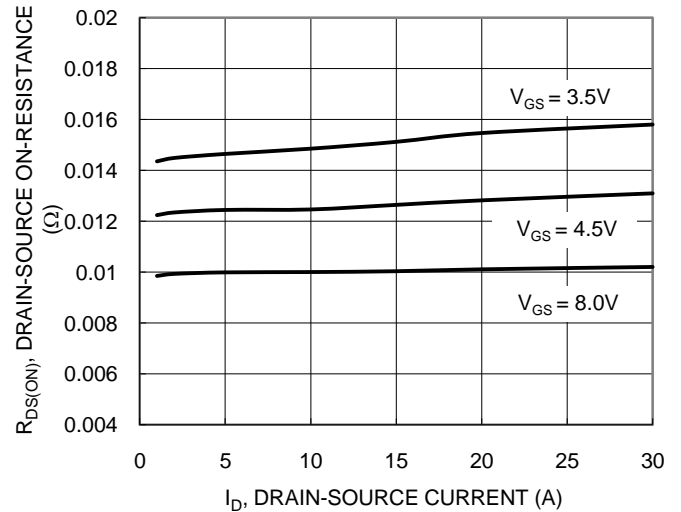


Figure 6. Typical On-Resistance vs. Drain Current and Gate Voltage

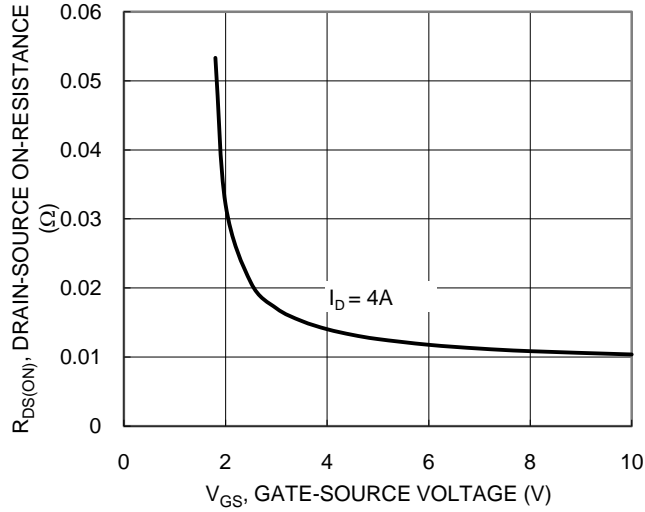


Figure 7. Typical Transfer Characteristic

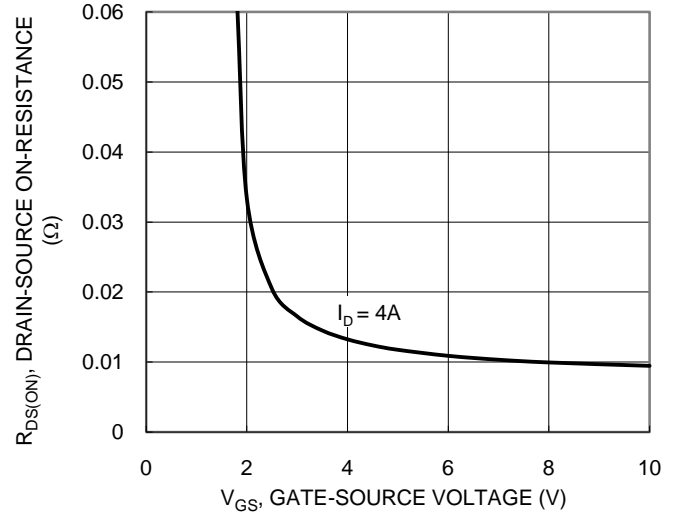


Figure 8. Typical Transfer Characteristic

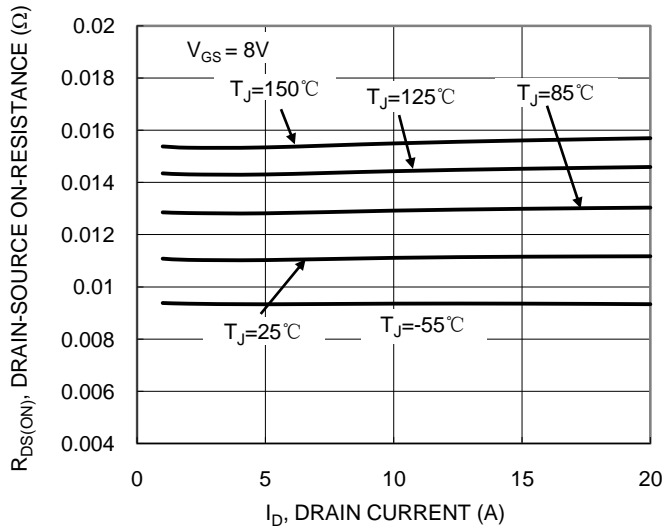


Figure 9. Typical On-Resistance vs. Drain Current and Junction Temperature

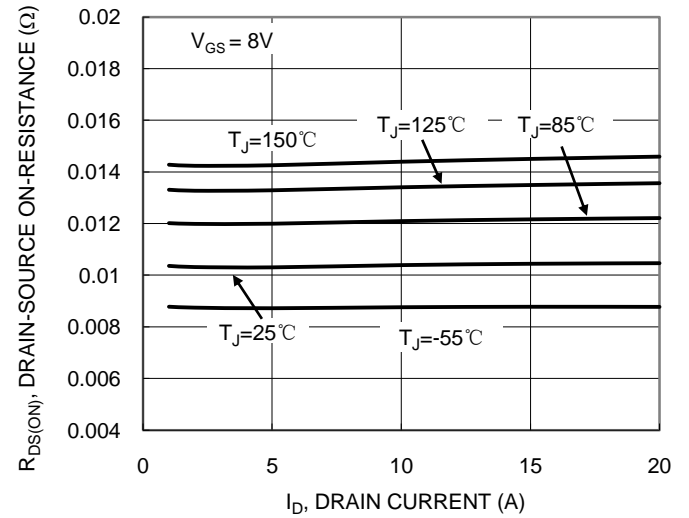


Figure 10. Typical On-Resistance vs. Drain Current and Junction Temperature

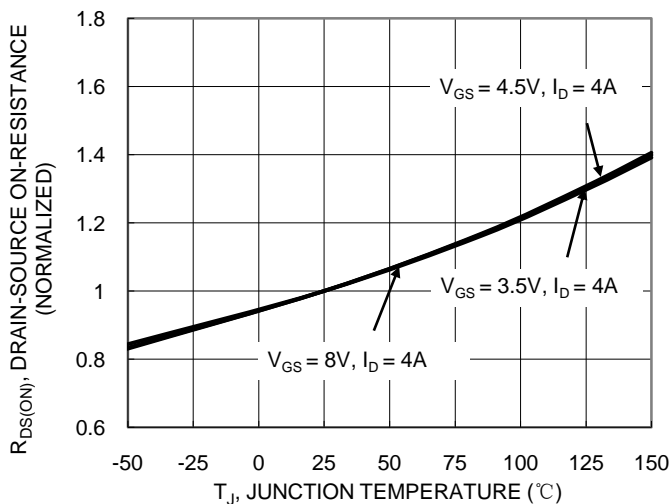


Figure 11. On-Resistance Variation with Junction Temperature

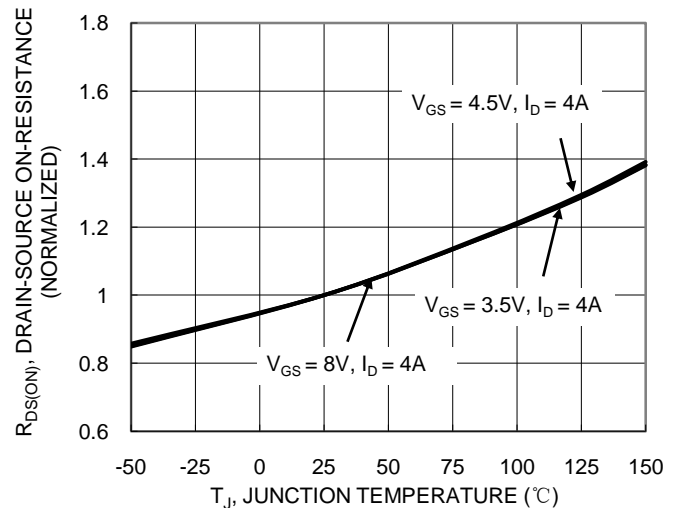


Figure 12. On-Resistance Variation with Junction Temperature

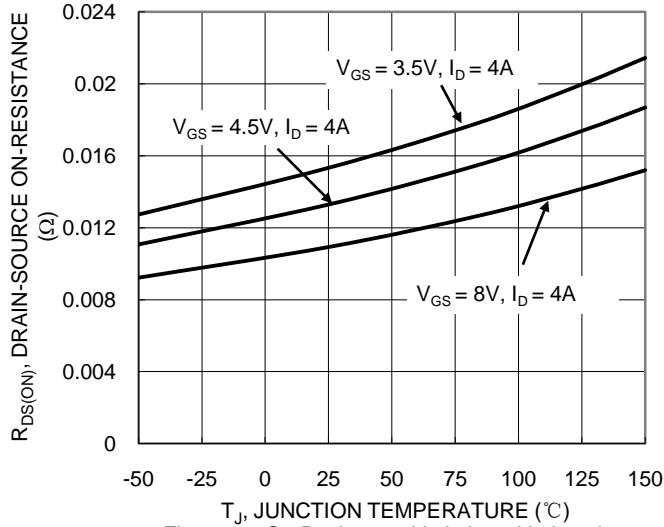


Figure 13. On-Resistance Variation with Junction Temperature

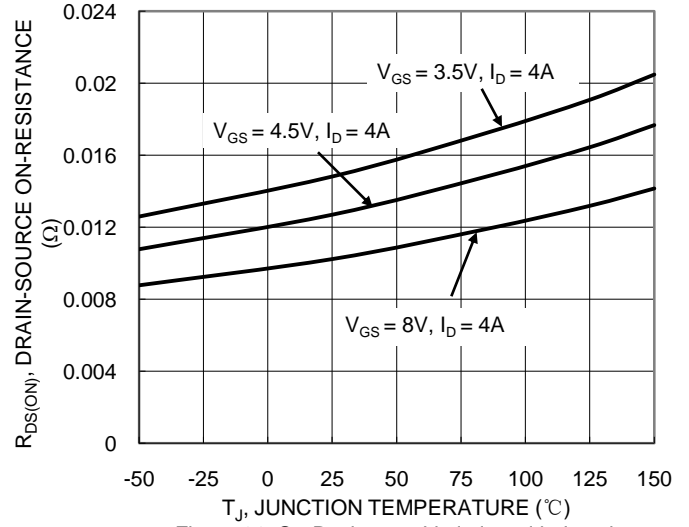


Figure 14. On-Resistance Variation with Junction Temperature

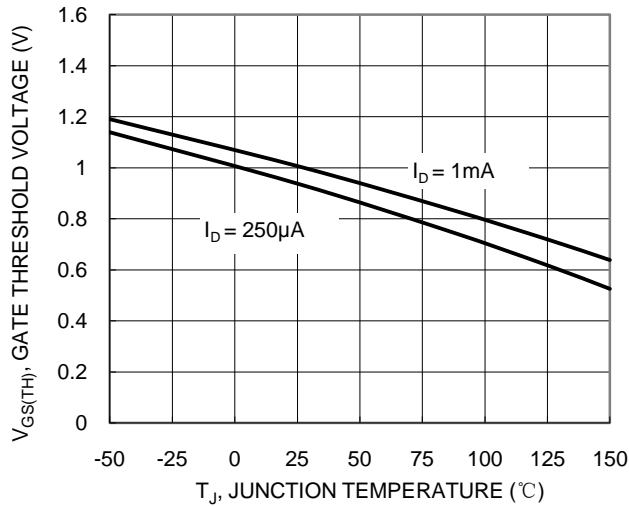


Figure 15. Gate Threshold Variation vs. Junction Temperature

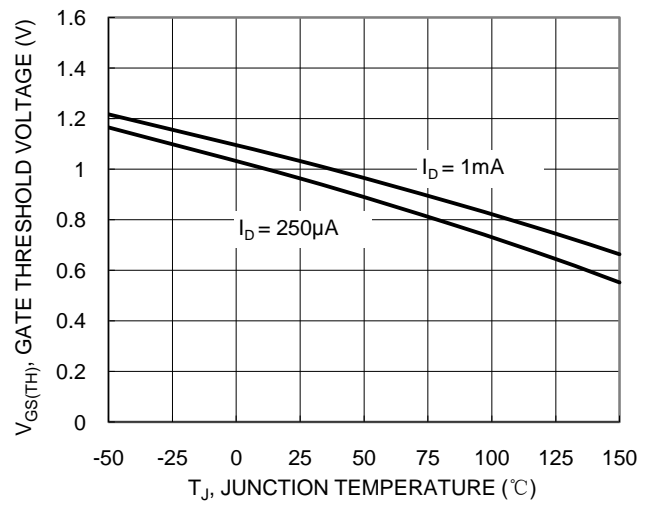


Figure 16. Gate Threshold Variation vs. Junction Temperature

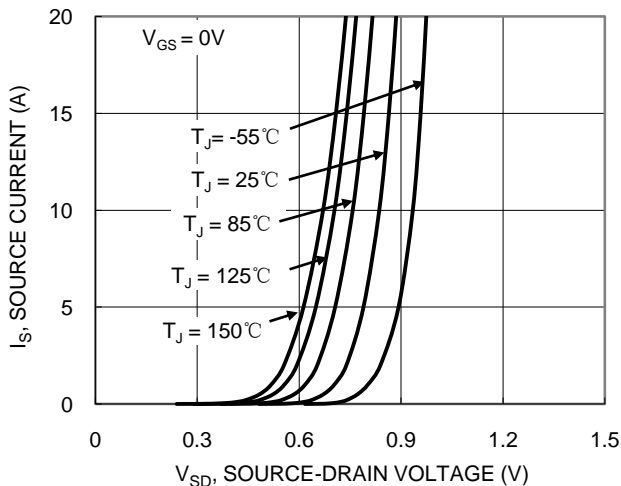


Figure 17. Diode Forward Voltage vs. Current

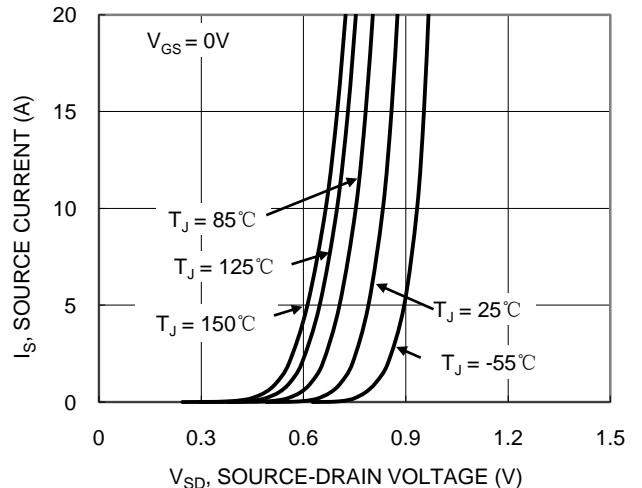


Figure 18. Diode Forward Voltage vs. Current

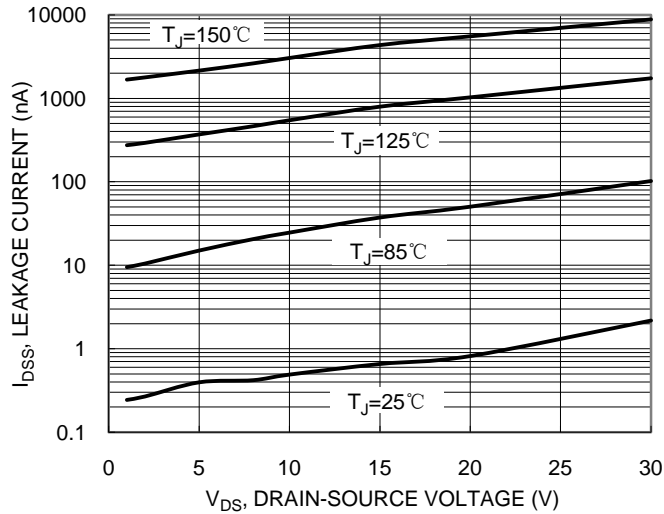


Figure 19. Typical Drain-Source Leakage Current vs. Voltage

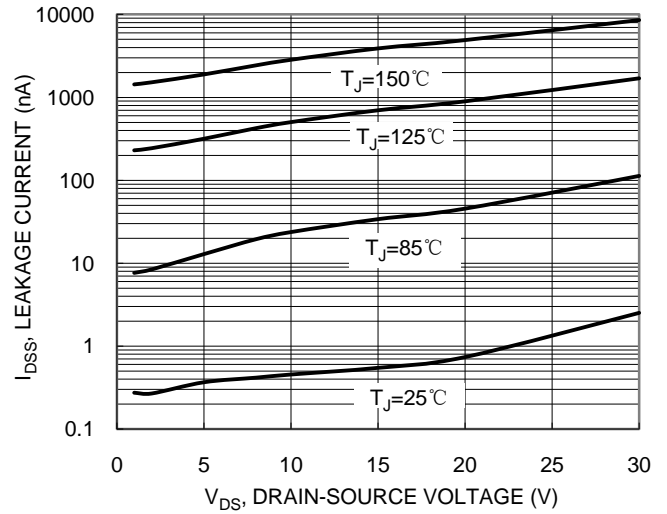


Figure 20. Typical Drain-Source Leakage Current vs. Voltage

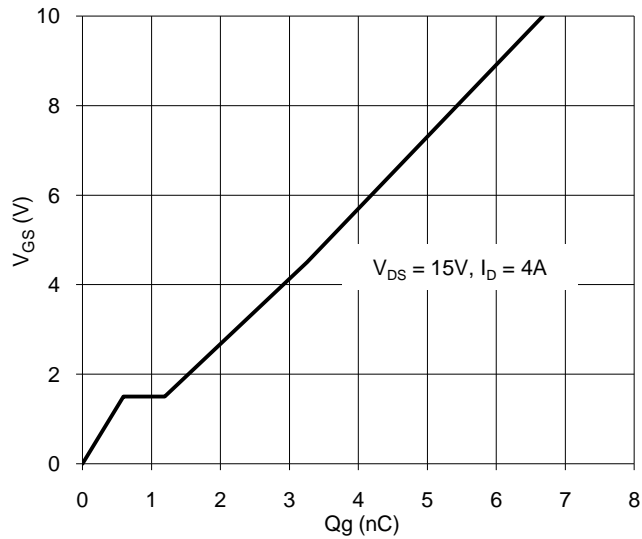


Figure 21. Gate Charge

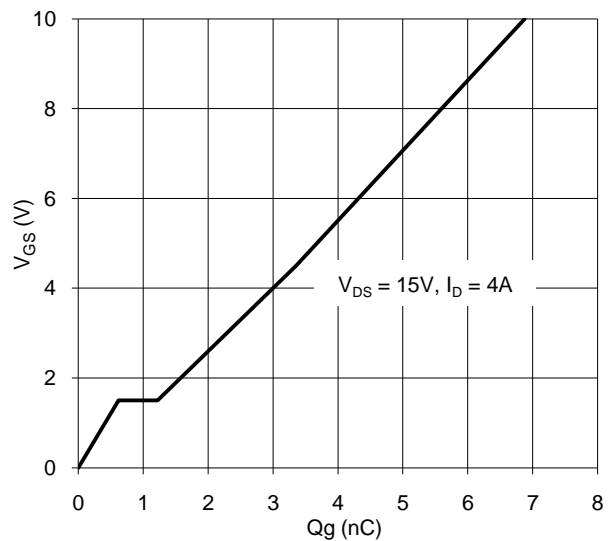


Figure 22. Gate Charge

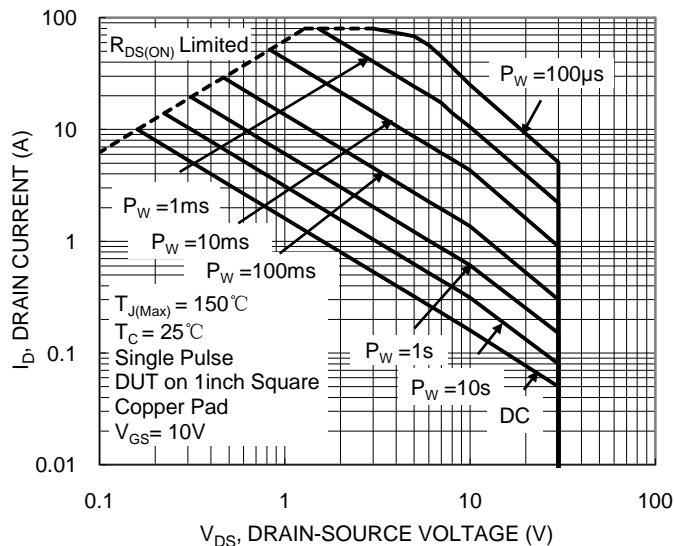


Figure 23. SOA, Safe Operation Area

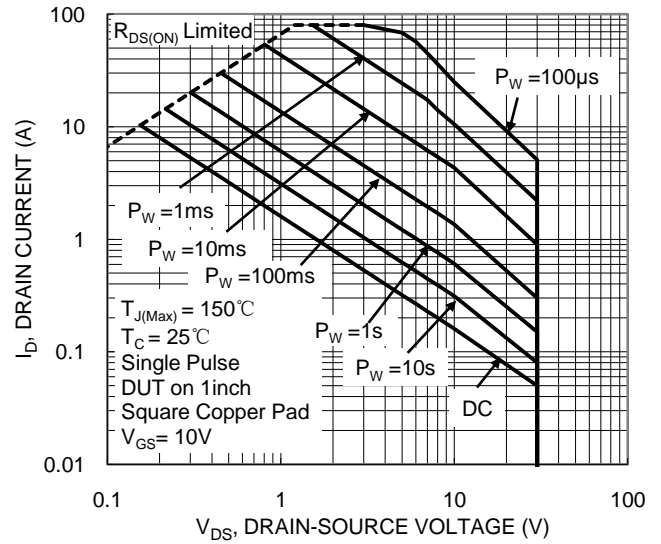


Figure 24. SOA, Safe Operation Area

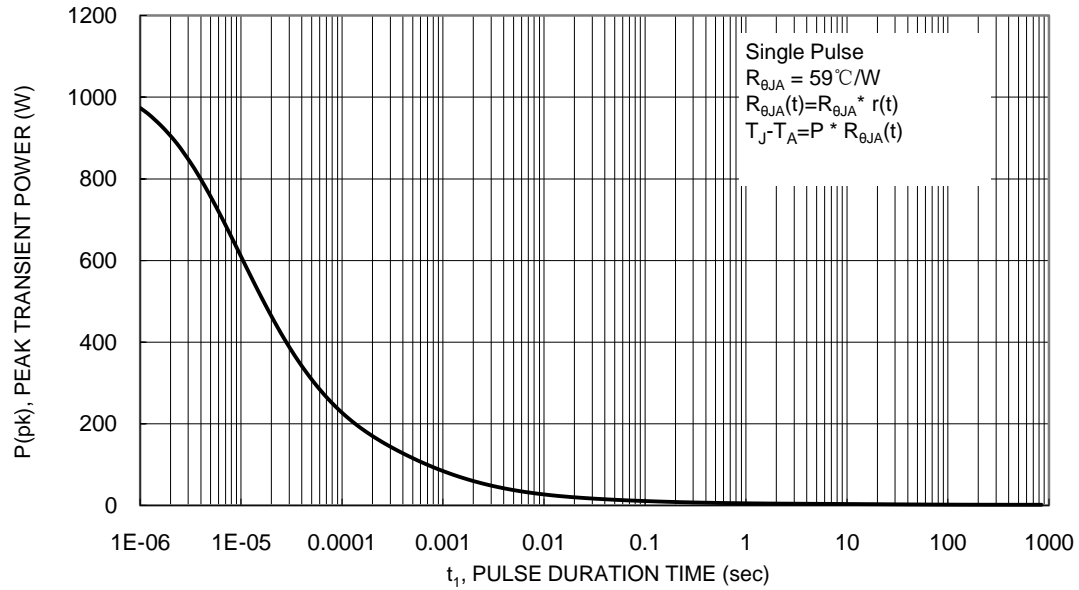


Figure 25. Single Pulse Maximum Power Dissipation

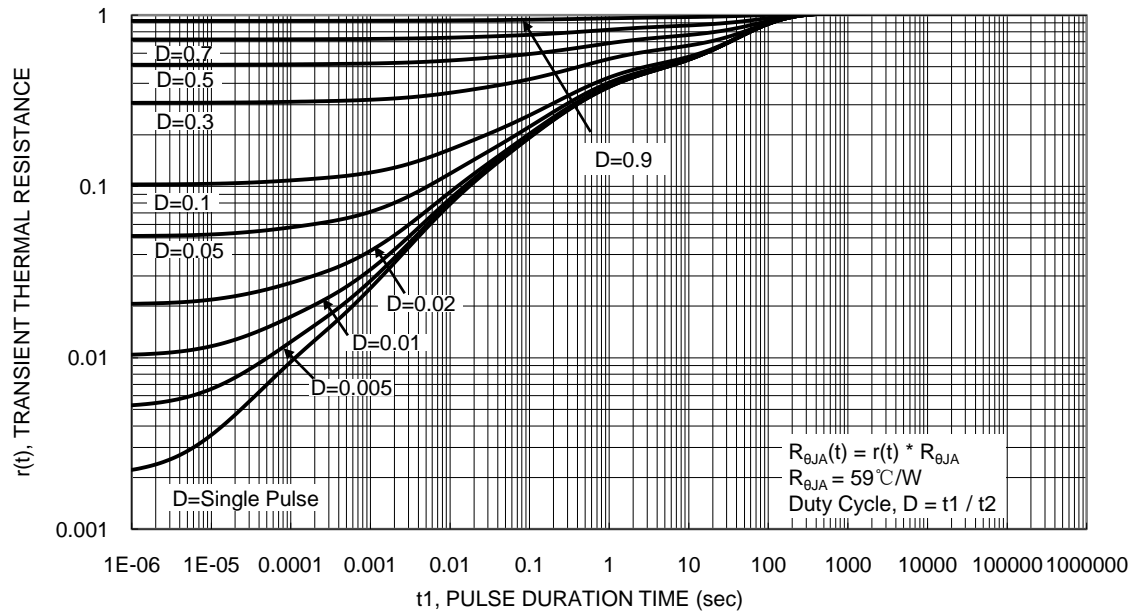


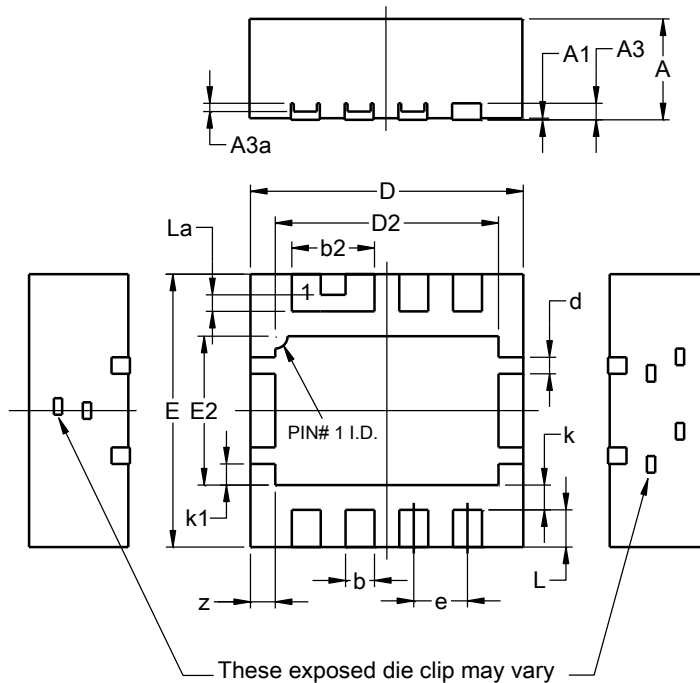
Figure 26. Transient Thermal Resistance



## Package Outline Dimensions

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

**PowerDI3333-8 (Type D)**

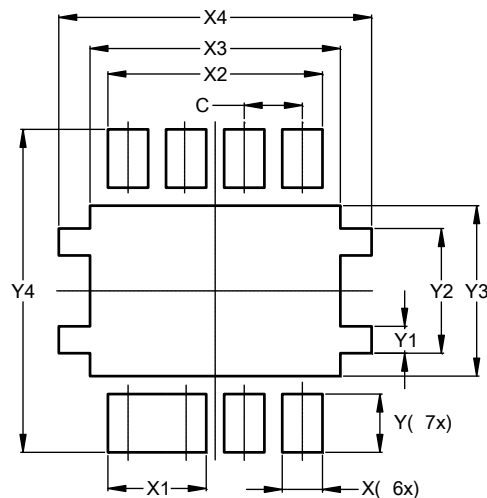


PowerDI3333-8 (Type D)			
Dim	Min	Max	Typ
A	1.17	1.23	1.20
A1	0.00	0.05	0.02
A3	0.15	0.25	0.20
A3a	0.05	0.15	0.10
b	0.30	0.40	0.35
b2	0.95	1.05	1.00
D	3.20	3.40	3.30
D2	2.65	2.75	2.70
E	3.20	3.40	3.30
E2	1.75	1.85	1.80
d	0.15	0.25	0.20
e	--	--	0.65
k	--	--	0.30
k1	0.21	0.31	0.26
L	0.40	0.50	0.45
La	0.15	0.25	0.20
z	0.25	0.35	0.30
All Dimensions in mm			

## Suggested Pad Layout

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

**PowerDI3333-8 (Type D)**



Dimensions	Value (in mm)
C	0.650
X	0.450
X1	1.100
X2	2.400
X3	2.800
X4	3.500
Y	0.650
Y1	0.300
Y2	1.390
Y3	1.900
Y4	3.600

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