

## Product Summary

$BV_{DSS}$	$R_{DS(ON)}$ Max	$I_D$ Max $T_A = +25^\circ\text{C}$
20V	$8\text{m}\Omega @ V_{GS} = 10\text{V}$	12.8A
	$9\text{m}\Omega @ V_{GS} = 4.5\text{V}$	12.1A
	$12\text{m}\Omega @ V_{GS} = 2.5\text{V}$	10.5A

## Description and Applications


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

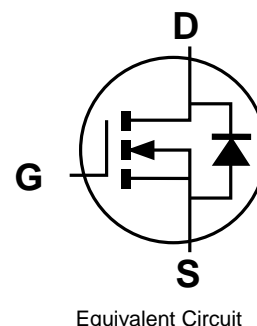
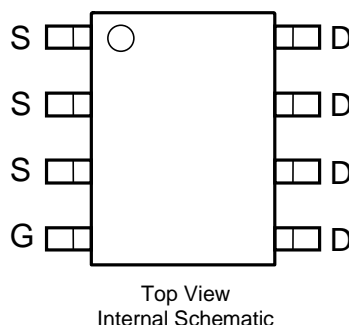
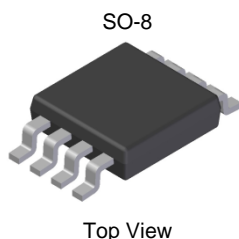
- Backlighting
- Power Management Functions
- DC-DC Converters

## Features

- Low On-Resistance
- Low Gate Threshold Voltage
- Low Input Capacitance
- Fast Switching Speed
- Low Input/Output Leakage
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**

## Mechanical Data

- Case: SO-8
- Case Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 3 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: 0.074 grams (Approximate)

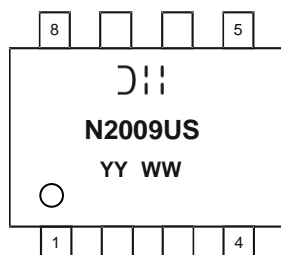


## Ordering Information (Note 4)

Part Number	Case	Packaging
DMN2009USS-13	SO-8	2500/Tape & Reel

- Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
  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



JII = Manufacturer's Marking  
N2009US = Product Type Marking Code  
YYWW = Date Code Marking  
YY or YY = Year (ex: 18 = 2018)  
WW = Week (01 to 53)

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

Characteristic			Symbol	Value	Unit
Drain-Source Voltage			V <sub>DSS</sub>	20	V
Gate-Source Voltage			V <sub>GSS</sub>	±12	V
Drain Current (Note 6) V <sub>GS</sub> = 4.5V	Steady State	T <sub>A</sub> = +25°C T <sub>A</sub> = +70°C	I <sub>D</sub>	12.1 9.7	A
Maximum Continuous Body Diode Forward Current (Note 6)			I <sub>S</sub>	3	A
Pulsed Drain Current (10μs Pulse, Duty Cycle = 1%)			I <sub>DM</sub>	100	A

**Thermal Characteristics**

Characteristic	Symbol	Value	Unit
Total Power Dissipation (Note 5)	P <sub>D</sub>	1.4	W
Thermal Resistance, Junction to Ambient @T <sub>A</sub> = +25°C (Note 5)	R <sub>θJA</sub>	90	°C/W
Total Power Dissipation (Note 6)	P <sub>D</sub>	2.0	W
Thermal Resistance, Junction to Ambient @T <sub>A</sub> = +25°C (Note 6)	R <sub>θJA</sub>	63	°C/W
Operating and Storage Temperature Range	T <sub>J</sub> , T <sub>STG</sub>	-55 to +150	°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>	20	—	—	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> = ±12V, V <sub>DS</sub> = 0V
<b>ON CHARACTERISTICS (Note 7)</b>						
Gate Threshold Voltage	V <sub>GS(TH)</sub>	0.5	0.7	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>	—	6.3	8	mΩ	V <sub>GS</sub> = 10V, I <sub>D</sub> = 12A
		—	6.7	9		V <sub>GS</sub> = 4.5V, I <sub>D</sub> = 10A
		—	8.7	12		V <sub>GS</sub> = 2.5V, I <sub>D</sub> = 8A
Diode Forward Voltage	V <sub>SD</sub>	0.5	0.63	1.2	V	V <sub>GS</sub> = 0V, I <sub>S</sub> = 3A
<b>DYNAMIC CHARACTERISTICS (Note 8)</b>						
Input Capacitance	C <sub>iss</sub>	—	1706	—	pF	V <sub>DS</sub> = 10V, V <sub>GS</sub> = 0V, f = 1MHz
Output Capacitance	C <sub>oss</sub>	—	383	—	pF	
Reverse Transfer Capacitance	C <sub>rss</sub>	—	176	—	pF	
Gate Resistance	R <sub>g</sub>	—	3.0	—	Ω	V <sub>GS</sub> = 0V V <sub>DS</sub> = 0V, f = 1MHz
Total Gate Charge (V <sub>GS</sub> = 4.5V)	Q <sub>g</sub>	—	16	—	nC	V <sub>DS</sub> = 10V, I <sub>D</sub> = 8.5A
Total Gate Charge (V <sub>GS</sub> = 10V)	Q <sub>g</sub>	—	34	—		
Gate-Source Charge	Q <sub>gs</sub>	—	1.9	—		
Gate-Drain Charge	Q <sub>gd</sub>	—	4.5	—		
Turn-On Delay Time	t <sub>D(ON)</sub>	—	4.2	—	ns	V <sub>DS</sub> = 10V, I <sub>D</sub> = 8.5A V <sub>GS</sub> = 4.5V, R <sub>g</sub> = 1.8Ω
Turn-On Rise Time	t <sub>r</sub>	—	6.2	—	ns	
Turn-Off Delay Time	t <sub>D(OFF)</sub>	—	25	—	ns	
Turn-Off Fall Time	t <sub>f</sub>	—	11	—	ns	
Body Diode Reverse Recovery Time	t <sub>RR</sub>	—	12	—	ns	I <sub>F</sub> = 8.5A, di/dt = 210A/μs
Body Diode Reverse Recovery Charge	Q <sub>RR</sub>	—	4.7	—	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.
  - Short duration pulse test used to minimize self-heating effect.
  - Guaranteed by design. Not subject to product testing.

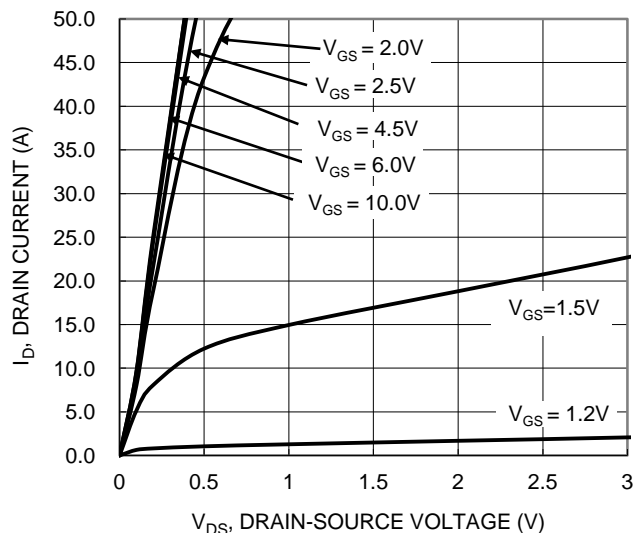


Figure 1. Typical Output Characteristic

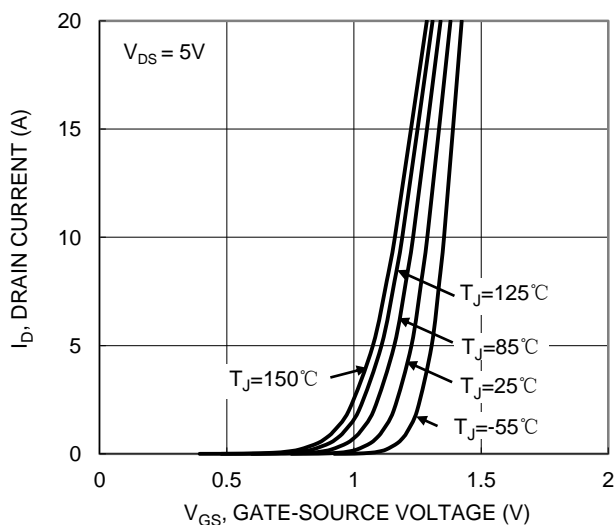


Figure 2. Typical Transfer Characteristic

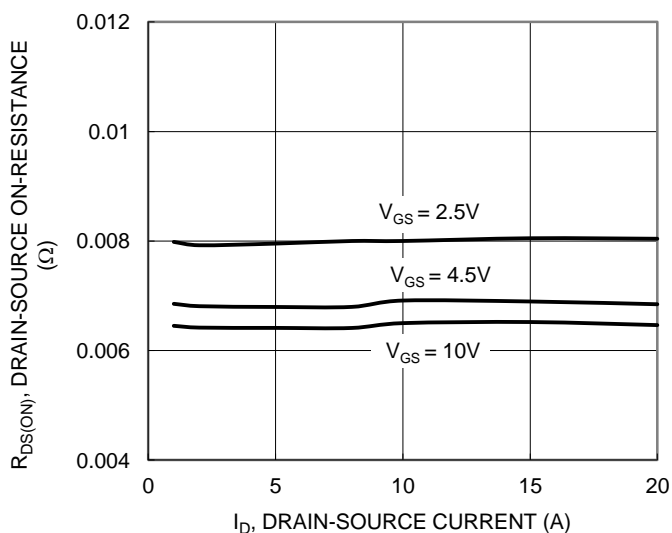


Figure 3. Typical On-Resistance vs. Drain Current and Gate Voltage

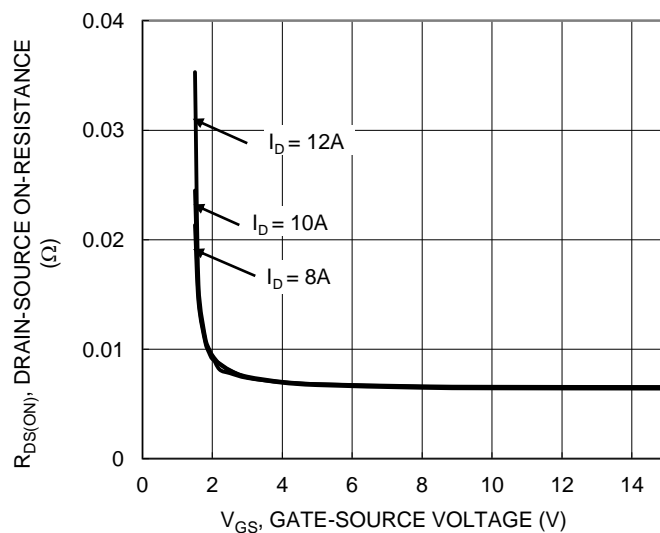


Figure 4. Typical Transfer Characteristic

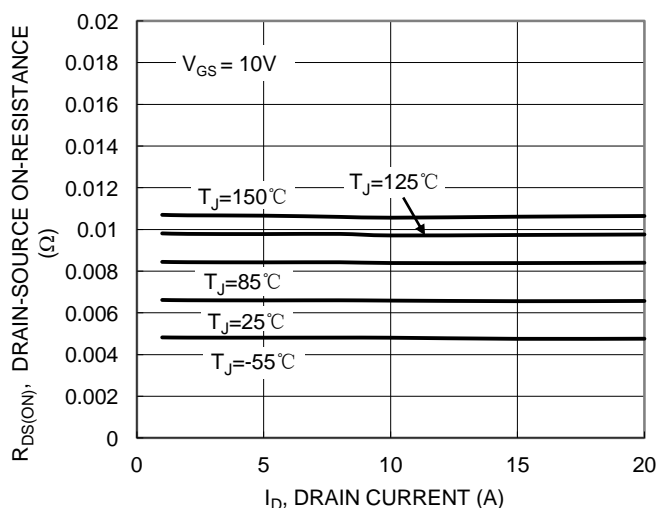


Figure 5. Typical On-Resistance vs. Drain Current and Junction Temperature

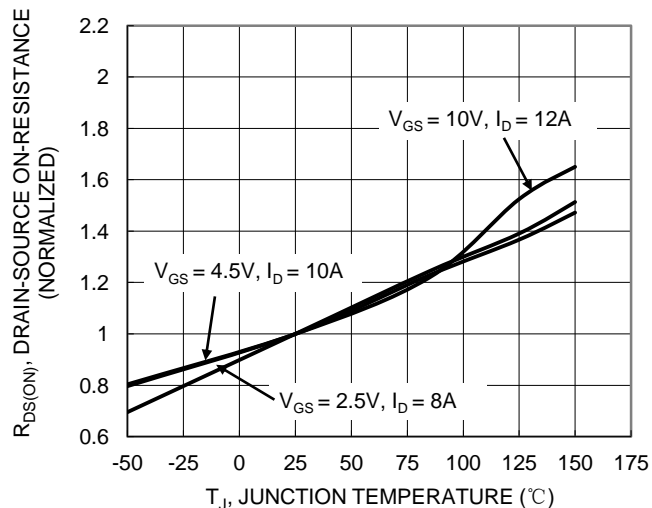


Figure 6. On-Resistance Variation with Junction Temperature

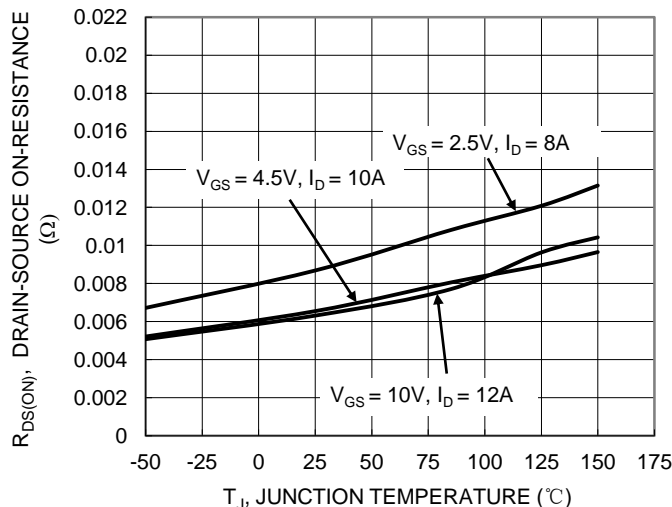


Figure 7. On-Resistance Variation with Junction Temperature

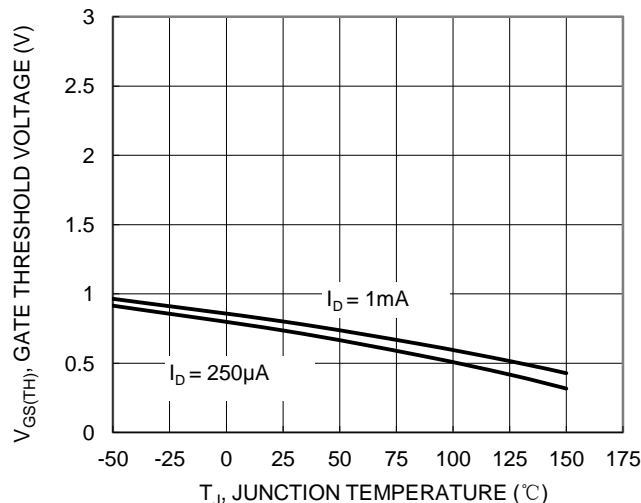


Figure 8. Gate Threshold Variation vs. Junction Temperature

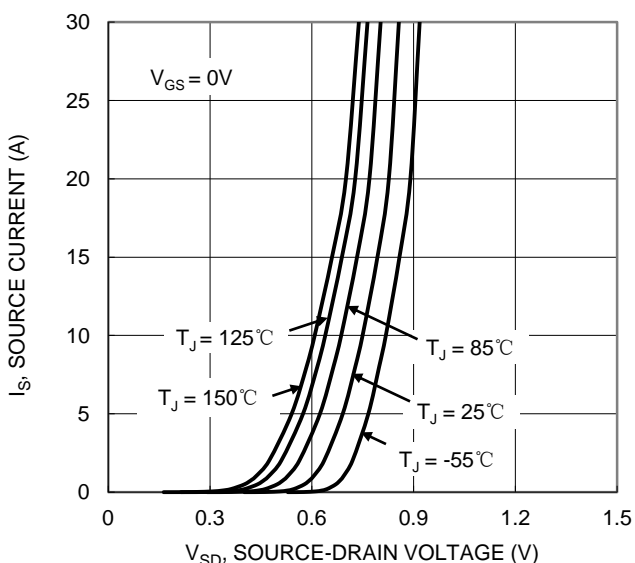


Figure 9. Diode Forward Voltage vs. Current

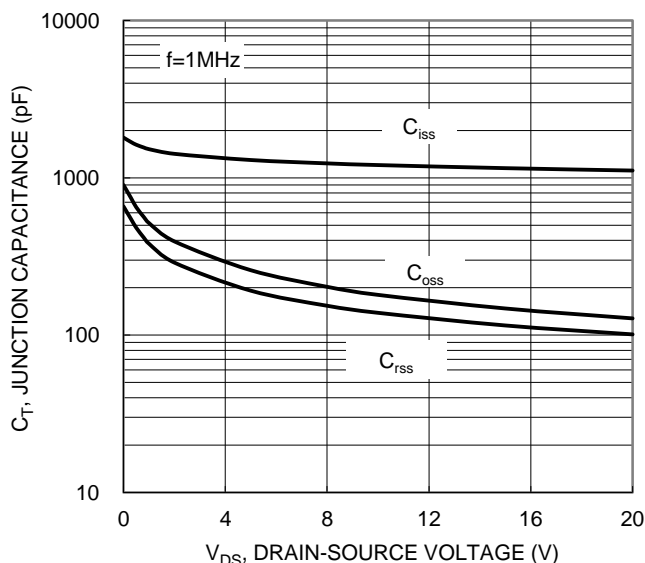


Figure 10. Typical Junction Capacitance

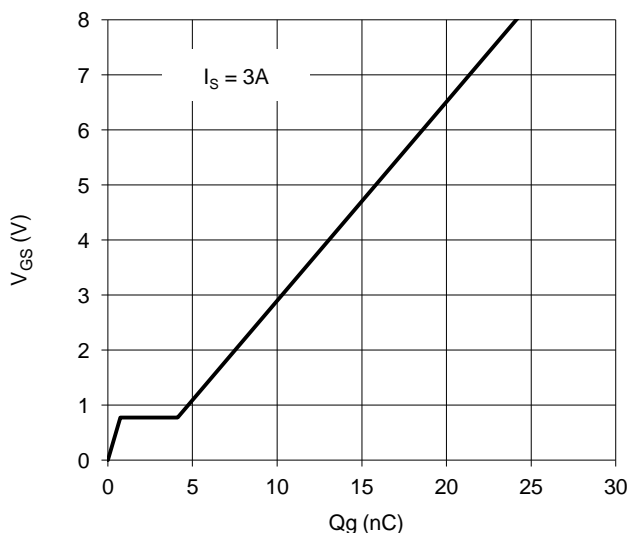


Figure 11. Gate Charge

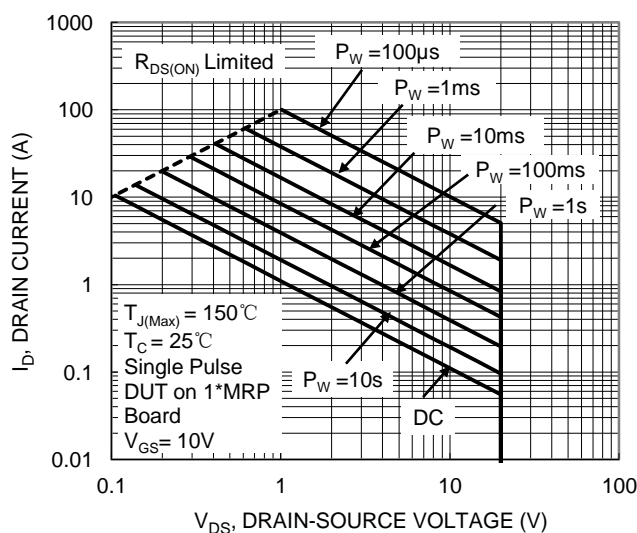


Figure 12. SOA, Safe Operation Area

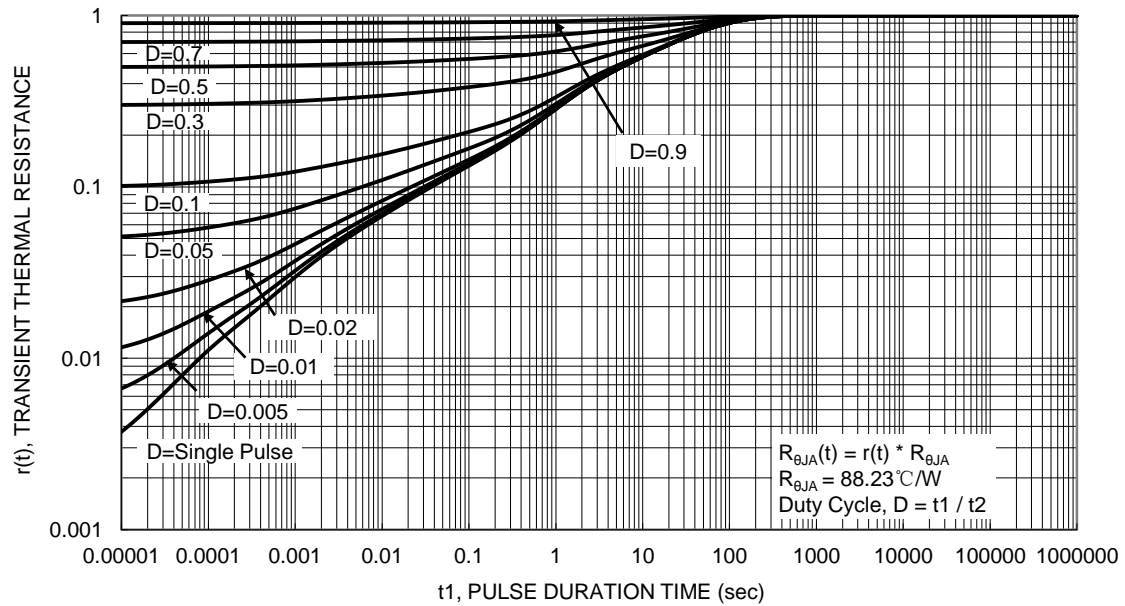
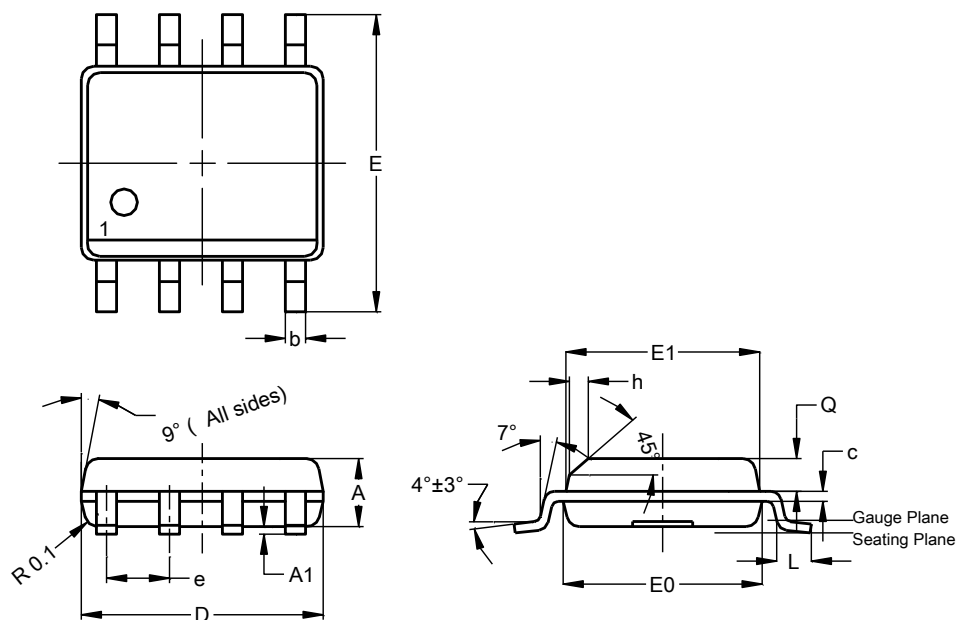


Figure 13. Transient Thermal Resistance

## Package Outline Dimensions

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

SO-8

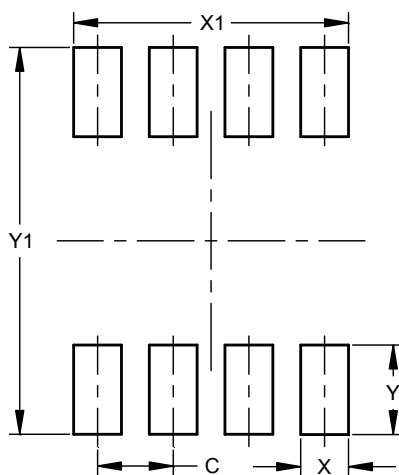


SO-8			
Dim	Min	Max	Typ
A	1.40	1.50	1.45
A1	0.10	0.20	0.15
b	0.30	0.50	0.40
c	0.15	0.25	0.20
D	4.85	4.95	4.90
E	5.90	6.10	6.00
E1	3.80	3.90	3.85
E0	3.85	3.95	3.90
e	--	--	1.27
h	--	--	0.35
L	0.62	0.82	0.72
Q	0.60	0.70	0.65
All Dimensions in mm			

## Suggested Pad Layout

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

SO-8



Dimensions	Value (in mm)
C	1.27
X	0.802
X1	4.612
Y	1.505
Y1	6.50

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