

## Product Summary

$BV_{DSS}$	$R_{DS(ON)}$ Max	$I_D$ Max $T_A = +25^\circ C$
50V	40m $\Omega$ @ $V_{GS} = 10V$	5.2A
	60m $\Omega$ @ $V_{GS} = 4.5V$	4.3A

## Features and Benefits

- Low On-Resistance
- Low Input Capacitance
- Fast Switching Speed
- **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**

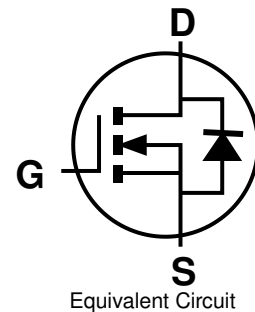
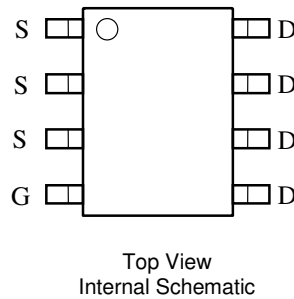
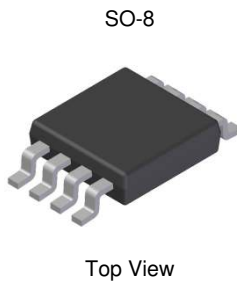
## Description and Applications

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.

- Motor Control
- Backlighting
- Power Management Functions
- DC-DC Converters

## Mechanical Data

- Case: SO-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 Below
- Terminals: Finish — Matte Tin Annealed Over Copper Lead Frame. Solderable per MIL-STD-202, Method 208  $\text{e3}$
- Weight: 0.074 grams (Approximate)

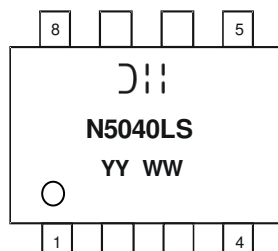


## Ordering Information (Note 4)

Part Number	Case	Packaging
DMN5040LSS-13	SO-8	2,500/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. For packaging details, go to our website at <http://www.diodes.com/products/packages.html>.

## Marking Information



$\text{D}||$  = Manufacturer's Marking  
 N5040LS = Product Type Marking Code  
 YYWW = Date Code Marking  
 YY or YY = Year (ex: 16 = 2016)  
 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>	50	V
Gate-Source Voltage			V <sub>GSS</sub>	±20	V
Continuous Drain Current (Note 6) V <sub>GS</sub> = 10V	Steady State	T <sub>A</sub> = +25°C	I <sub>D</sub>	5.2	A
		T <sub>A</sub> = +70°C		4.2	
Pulsed Drain Current (10µs Pulse, Duty Cycle = 1%)			I <sub>DM</sub>	25	A
Maximum Continuous Body Diode Forward Current (Note 6)			I <sub>S</sub>	1.8	A
Avalanche Current (Note 7) L = 0.1mH			I <sub>AS</sub>	13	A
Avalanche Energy (Note 7) L = 0.1mH			E <sub>AS</sub>	8	mJ

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

Characteristic		Symbol	Value	Unit
Total Power Dissipation (Note 5) (T <sub>A</sub> = +25°C)	Steady State	P <sub>D</sub>	1.3	W
Thermal Resistance, Junction to Ambient (Note 5)		R <sub>θJA</sub>	99	°C/W
Total Power Dissipation (Note 6) (T <sub>A</sub> = +25°C)	Steady State	P <sub>D</sub>	1.6	W
Thermal Resistance, Junction to Ambient (Note 6)		R <sub>θJA</sub>	77	°C/W
Thermal Resistance, Junction to Case (Note 6)		R <sub>θJC</sub>	13	°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 8)</b>						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	50	-	-	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> = 50V, 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 8)</b>						
Gate Threshold Voltage	V <sub>GS(TH)</sub>	1.0	-	3.0	V	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250µA
Static Drain-Source On-Resistance	R <sub>DS(ON)</sub>	-	29	40	mΩ	V <sub>GS</sub> = 10V, I <sub>D</sub> = 4.5A
		-	37	60		V <sub>GS</sub> = 4.5V, I <sub>D</sub> = 3.5A
Diode Forward Voltage	V <sub>SD</sub>	-	0.7	1.2	V	V <sub>GS</sub> = 0V, I <sub>S</sub> = 1A
<b>DYNAMIC CHARACTERISTICS (Note 9)</b>						
Input Capacitance	C <sub>ISS</sub>	-	836	-	pF	V <sub>DS</sub> = 30V, V <sub>GS</sub> = 0V, f = 1.0MHz
Output Capacitance	C <sub>OSS</sub>	-	42	-	pF	
Reverse Transfer Capacitance	C <sub>RSS</sub>	-	28	-	pF	
Gate Resistance	R <sub>g</sub>	-	2.2	-	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>	-	6.5	-	nC	
Total Gate Charge (V <sub>GS</sub> = 10V)	Q <sub>g</sub>	-	14.5	-	nC	
Gate-Source Charge	Q <sub>gs</sub>	-	2.0	-	nC	
Gate-Drain Charge	Q <sub>gd</sub>	-	2.3	-	nC	V <sub>DD</sub> = 30V, V <sub>GS</sub> = 10V, R <sub>L</sub> = 6Ω, R <sub>g</sub> = 6Ω, I <sub>D</sub> = 5A
Turn-On Delay Time	t <sub>D(ON)</sub>	-	3.1	-	ns	
Turn-On Rise Time	t <sub>r</sub>	-	5.0	-	ns	
Turn-Off Delay Time	t <sub>D(OFF)</sub>	-	13.4	-	ns	
Turn-Off Fall Time	t <sub>f</sub>	-	3.7	-	ns	
Reverse Recovery Time	t <sub>RR</sub>	-	9.4	-	ns	I <sub>F</sub> = 5A, di/dt = 100A/µs
Reverse Recovery Charge	Q <sub>RR</sub>	-	3.7	-	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.
  - 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.

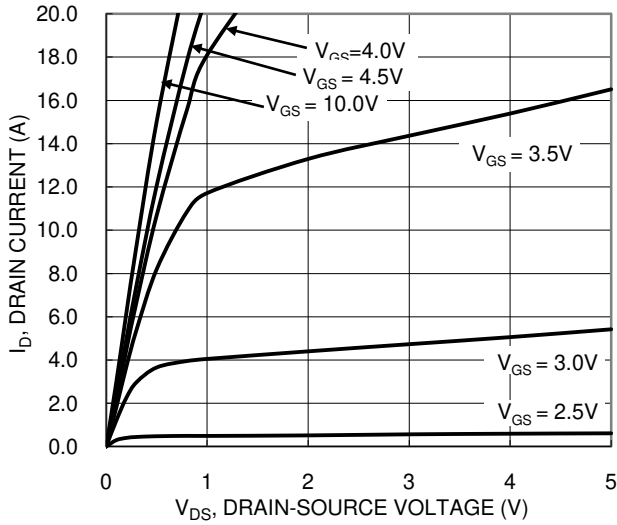


Figure 1. Typical Output Characteristic

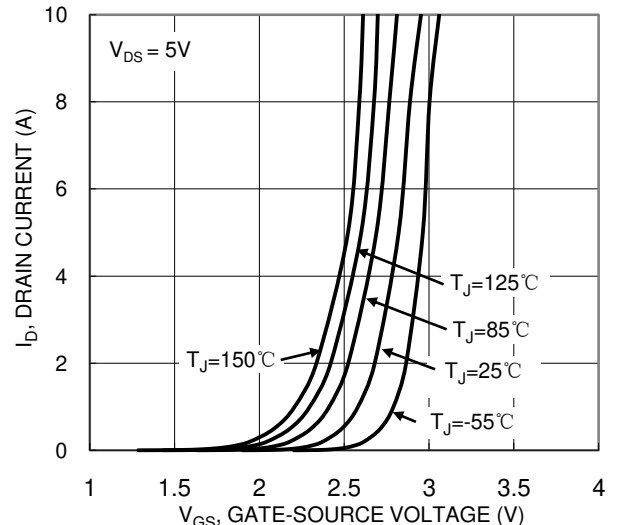


Figure 2. Typical Transfer Characteristic

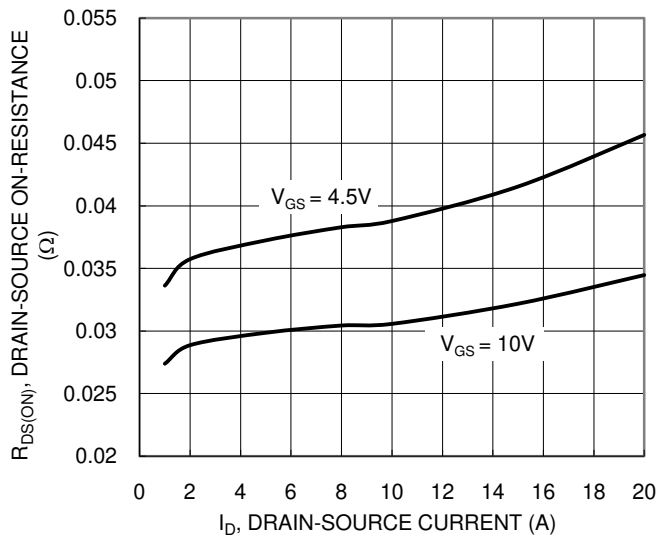


Figure 3. Typical On-Resistance vs. Drain Current and Gate Voltage

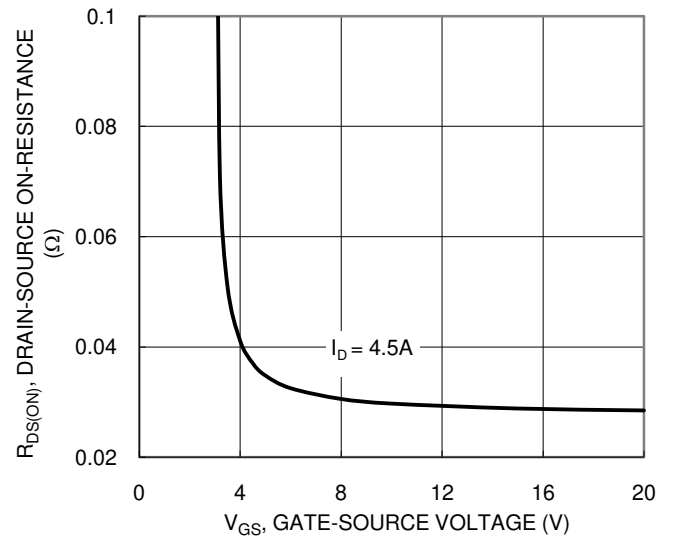


Figure 4. Typical Transfer Characteristic

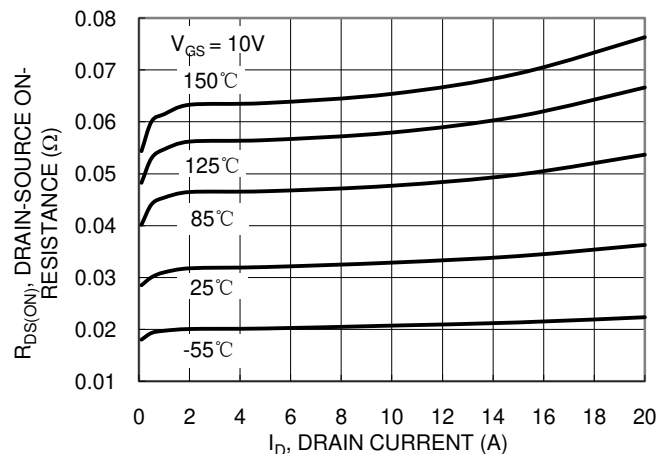


Figure 5. Typical On-Resistance vs. Drain Current and Junction Temperature

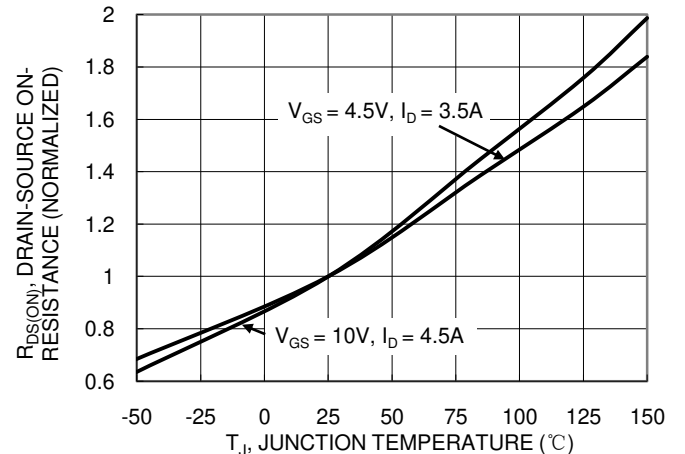


Figure 6. On-Resistance Variation with Junction Temperature

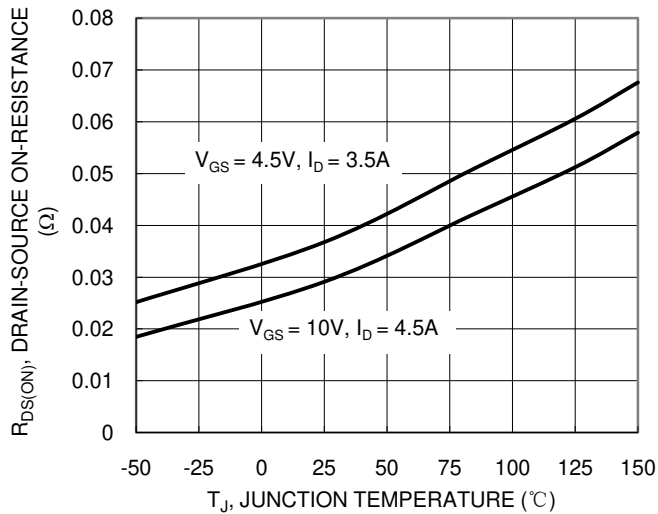


Figure 7. On-Resistance Variation with Junction Temperature

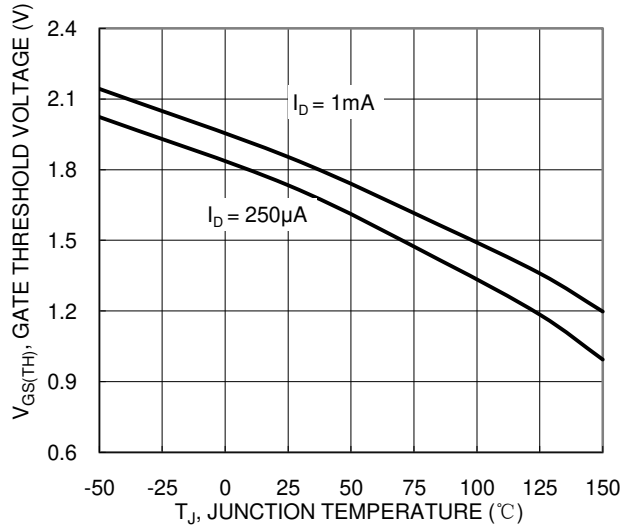


Figure 8. Gate Threshold Variation vs. Junction Temperature

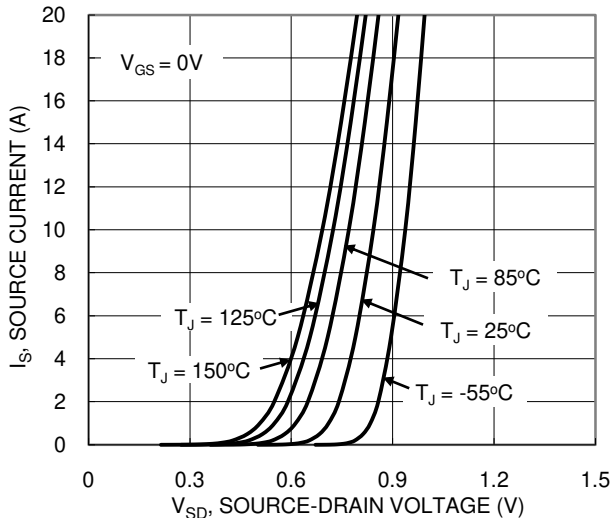


Figure 9. Diode Forward Voltage vs. Current

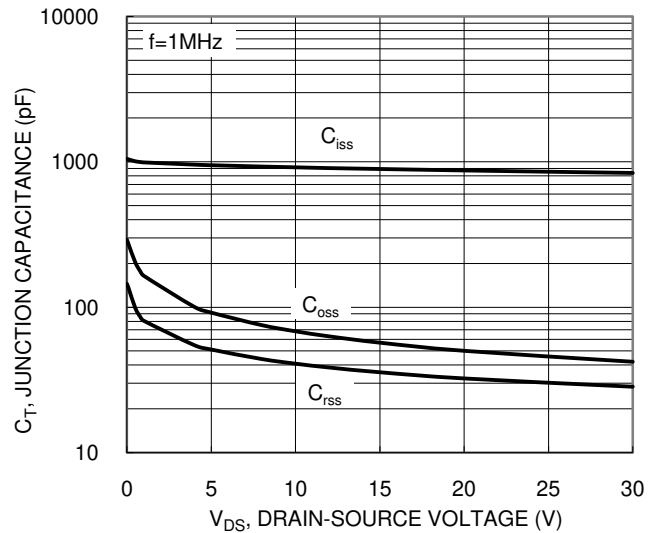


Figure 10. Typical Junction Capacitance

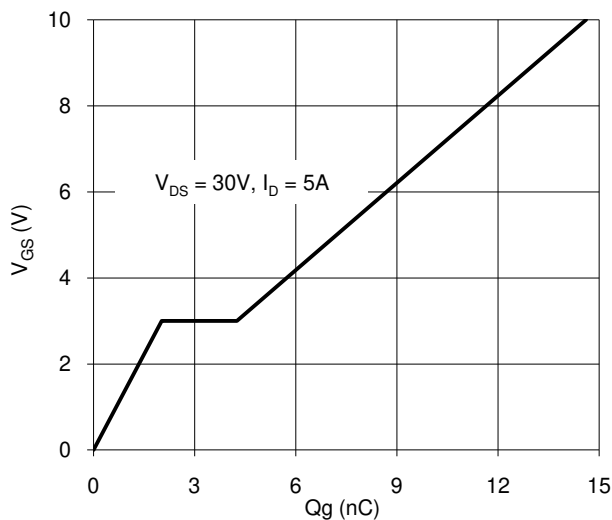


Figure 11. Gate Charge

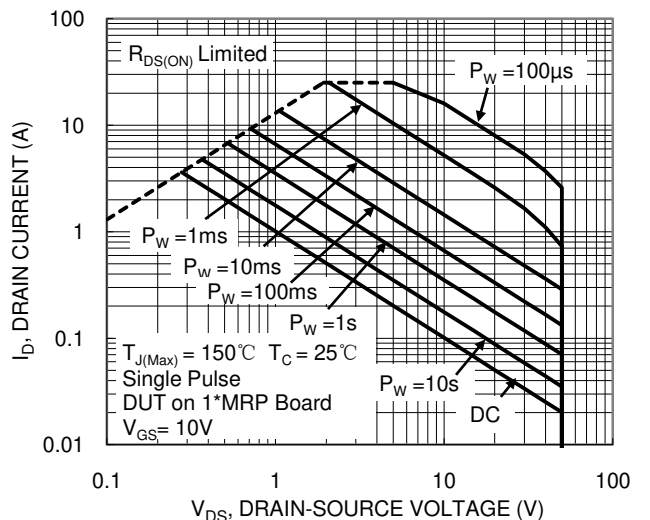


Figure 12. SOA, Safe Operation Area

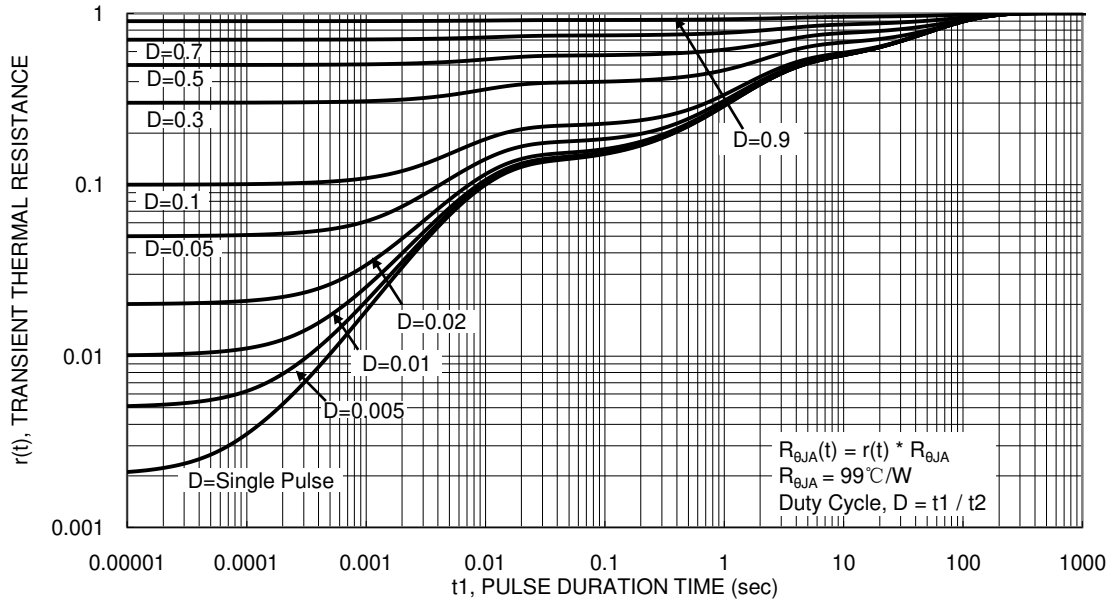
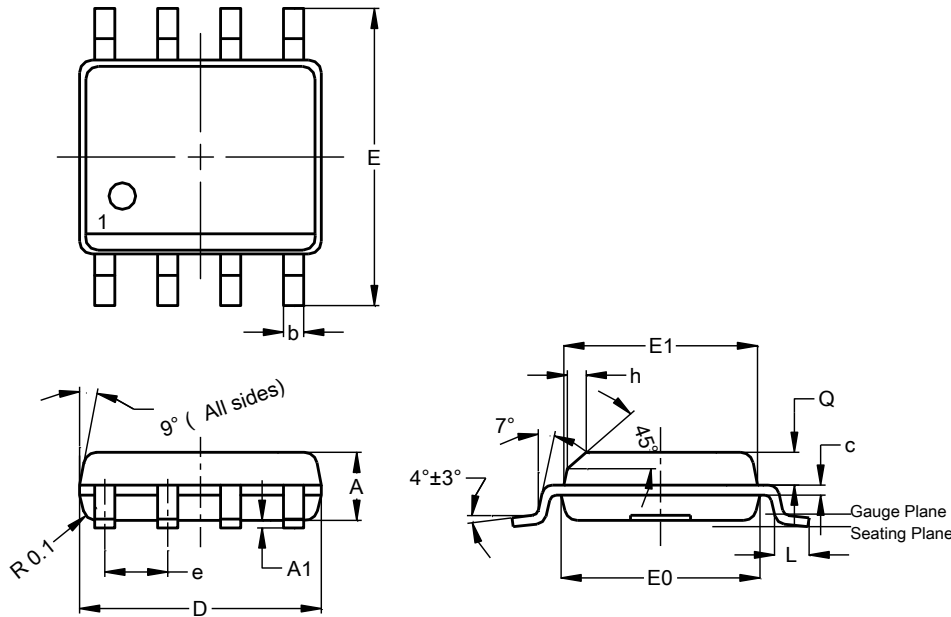


Figure 13. Transient Thermal Resistance

**Package Outline Dimensions**

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

SO-8



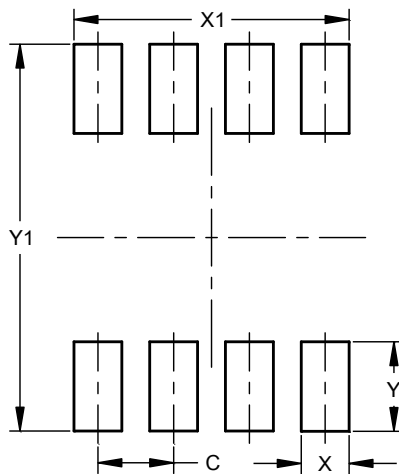
SO-8			
Dim	Min	Max	Typ
A	1.40	1.50	1.45
A1	0.10	0.20	0.15
b	0.30	0.50	0.40
c	0.15	0.25	0.20
D	4.85	4.95	4.90
E	5.90	6.10	6.00
E1	3.80	3.90	3.85
E0	3.85	3.95	3.90
e	--	--	1.27
h	-	--	0.35
L	0.62	0.82	0.72
Q	0.60	0.70	0.65

**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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