

## Product Summary

$V_{(BR)DSS}$	$R_{DS(on)}$	$I_D$ $T_A = 25^\circ C$
40V	8.5m $\Omega$ @ $V_{GS} = 10V$	27.6A
	14m $\Omega$ @ $V_{GS} = 4.5V$	21.5A

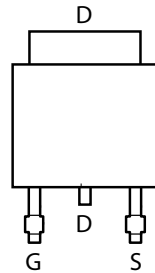
## Description and Applications

This new generation MOSFET has been 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.

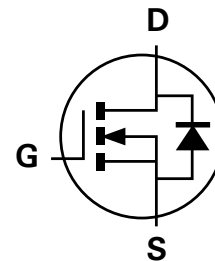
- Backlighting
- DC-DC Converters
- Power management functions



TOP VIEW



PIN OUT -TOP VIEW



Equivalent Circuit

## Features and Benefits

- Low on-resistance
- Fast switching speed
- "Green" component and RoHS compliant (Note 1)

## Mechanical Data

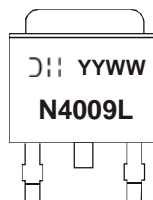
- Case: TO252-3L
- Case Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0 (Note 1)
- Moisture Sensitivity: Level 1 per J-STD-020D
- Terminals Connections: See Diagram
- Terminals: Matte Tin Finish annealed over Copper leadframe. Solderable per MIL-STD-202, Method 208
- Marking Information: See Below
- Ordering Information: See Below
- Weight: 0.33 grams (approximate)

## Ordering Information (Note 1)

Product	Marking	Reel size (inches)	Tape width (mm)	Quantity per reel
DMN4009LK3-13	N4009L	13	16	2,500

Note: 1. Diodes, Inc. defines "Green" products as those which are Eu RoHS compliant and contain no halogens or antimony compounds; further information about Diodes Inc.'s "Green" Policy can be found on our website. For packaging details, go to our website.

## Marking Information



⌋⌋ = Manufacturer's Marking  
 N4009L = Product Type Marking Code  
 YYWW = Date Code Marking  
 YY = Last two digits of year (ex: 09 = 2009)  
 WW = Week (01-52)

**Maximum Ratings** @T<sub>A</sub> = 25°C unless otherwise specified

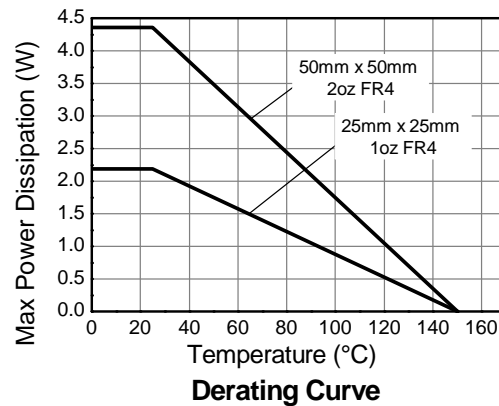
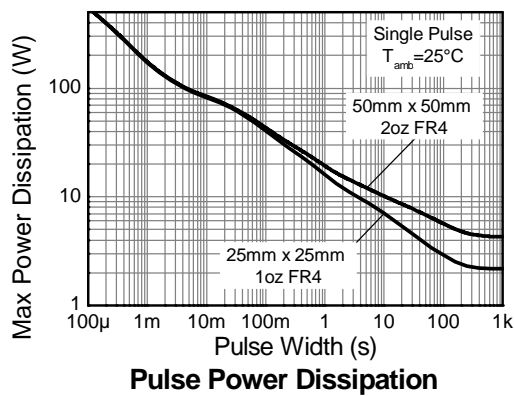
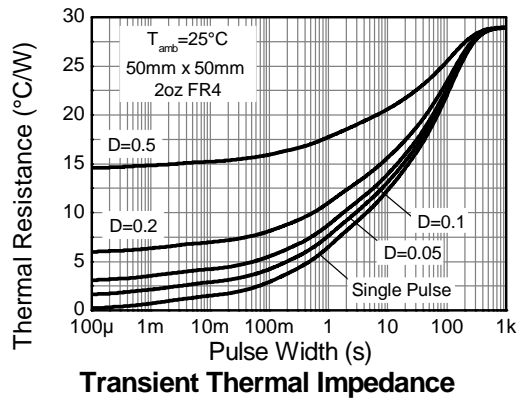
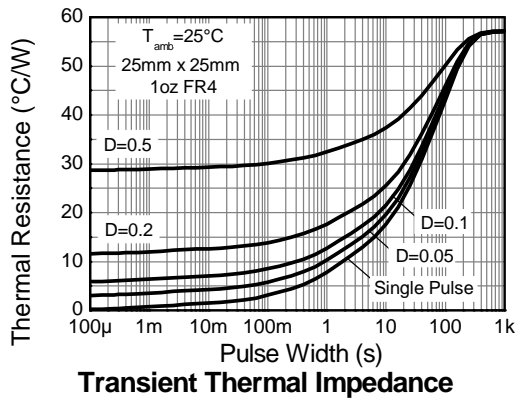
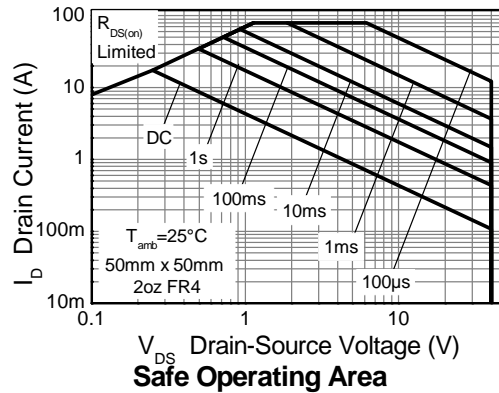
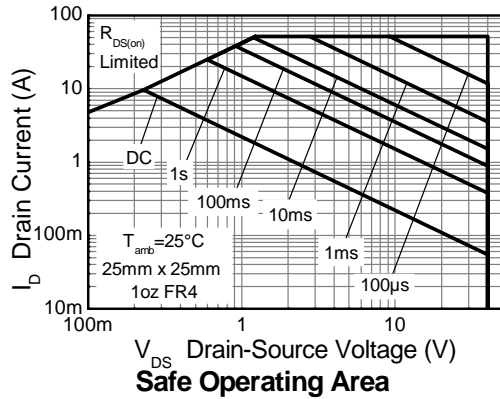
Characteristic			Symbol	Value	Unit	
Drain-Source voltage			V <sub>DSS</sub>	40	V	
Gate-Source voltage			V <sub>GS</sub>	±20	V	
Continuous Drain current	V <sub>GS</sub> = 10V	(Note 3)	I <sub>D</sub>	27.6	A	
		T <sub>A</sub> =70°C (Note 3)		22.1		
		(Note 2)		18.0		
Pulsed Drain current	V <sub>GS</sub> = 10V	(Note 4)	I <sub>DM</sub>	96.6	A	
Continuous Source current (Body diode)			(Note 3)	I <sub>S</sub>	13.2	A
Pulsed Source current (Body diode)			(Note 4)	I <sub>SM</sub>	96.6	A

**Thermal Characteristics** @T<sub>A</sub> = 25°C unless otherwise specified

Characteristic		Symbol	Value	Unit
Power dissipation Linear derating factor	(Note 2)	P <sub>D</sub>	4.36	W mW/°C
	(Note 3)		34.8	
	(Note 3)		10.3	
	(Note 5)		82.4	
Thermal Resistance, Junction to Ambient	(Note 2)	R <sub>θJA</sub>	2.19	°C/W
	(Note 3)		17.5	
	(Note 5)		28.6	
Thermal Resistance, Junction to Lead	(Note 3)	R <sub>θJL</sub>	12.1	°C/W
	(Note 5)		57.0	
Operating and storage temperature range		T <sub>J</sub> , T <sub>STG</sub>	-55 to 150	°C

- Notes:
2. For a device surface mounted on 50mm x 50mm x 1.6mm FR4 PCB with high coverage of single sided 2oz copper, in still air conditions; the device is measured when operating in a steady-state condition.
  3. Same as note 2, except the device is measured at t ≤ 10 sec.
  4. Same as note 2, except the device is pulsed with D = 0.02 and pulse width 300 μs. The pulse current is limited by the maximum junction temperature.
  5. For a device surface mounted on 25mm x 25mm x 1.6mm FR4 PCB with high coverage of single sided 1oz copper, in still air conditions; the device is measured when operating in a steady-state condition.
  6. Thermal resistance from junction to solder-point (at the end of the drain lead).

**Thermal Characteristics**

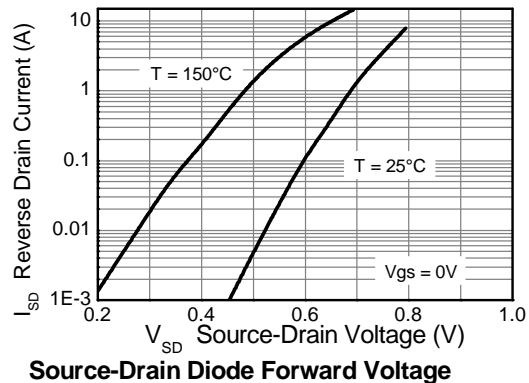
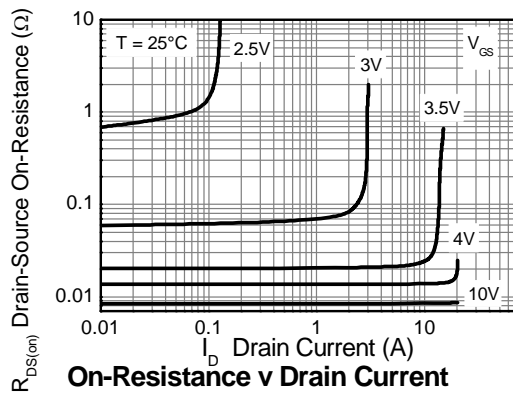
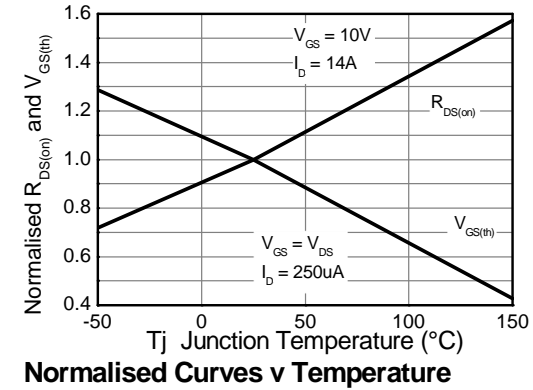
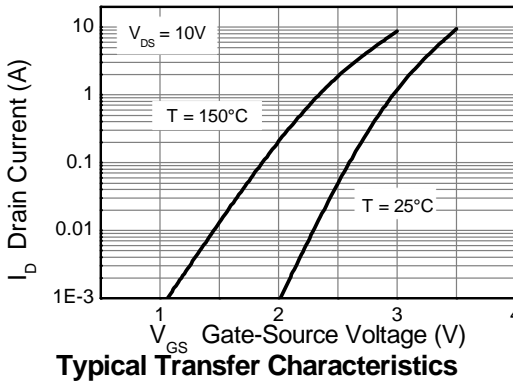
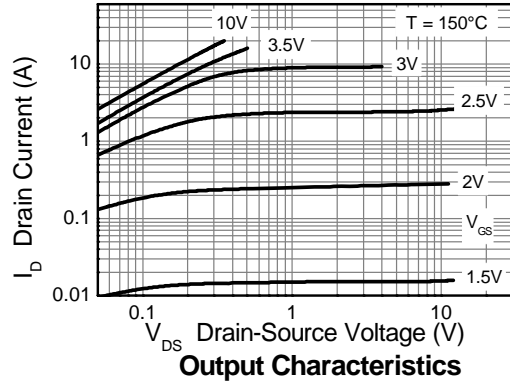
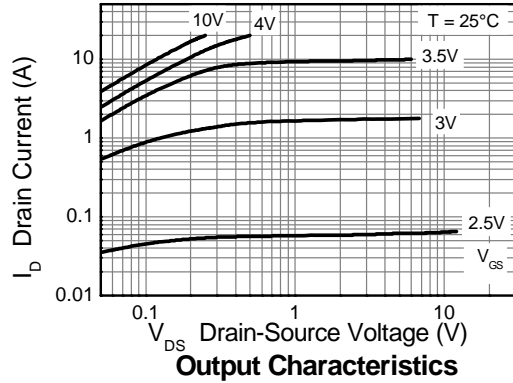


**Electrical Characteristics** @ $T_A = 25^\circ\text{C}$  unless otherwise specified

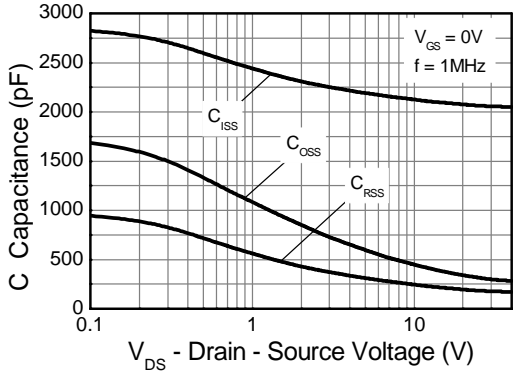
Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
<b>OFF CHARACTERISTICS</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	40	—	—	V	$I_D = 250\mu\text{A}$ , $V_{GS} = 0\text{V}$
Zero Gate Voltage Drain Current	$I_{DSS}$	—	—	0.5	$\mu\text{A}$	$V_{DS} = 40\text{V}$ , $V_{GS} = 0\text{V}$
Gate-Source Leakage	$I_{GSS}$	—	—	$\pm 100$	nA	$V_{GS} = \pm 20\text{V}$ , $V_{DS} = 0\text{V}$
<b>ON CHARACTERISTICS</b>						
Gate Threshold Voltage	$V_{GS(th)}$	1.0	—	3.0	V	$I_D = 250\mu\text{A}$ , $V_{DS} = V_{GS}$
Static Drain-Source On-Resistance (Note 7)	$R_{DS(on)}$	—	—	8.5	m $\Omega$	$V_{GS} = 10\text{V}$ , $I_D = 14\text{A}$
				14		$V_{GS} = 4.5\text{V}$ , $I_D = 11\text{A}$
Forward Transconductance (Notes 7 & 8)	$g_{fs}$	—	35.3	—	S	$V_{DS} = 15\text{V}$ , $I_D = 12\text{A}$
Diode Forward Voltage (Note 7)	$V_{SD}$	—	0.82	1.0	V	$I_S = 14\text{A}$ , $V_{GS} = 0\text{V}$
Reverse recovery time (Note 8)	$t_{rr}$	—	141	—	ns	$I_S = 14\text{A}$ , $di/dt = 100\text{A}/\mu\text{s}$
Reverse recovery charge (Note 8)	$Q_{rr}$	—	872	—	nC	
<b>DYNAMIC CHARACTERISTICS (Note 8)</b>						
Input Capacitance	$C_{iss}$	—	2072	—	pF	$V_{DS} = 20\text{V}$ , $V_{GS} = 0\text{V}$ $f = 1\text{MHz}$
Output Capacitance	$C_{oss}$	—	338	—	pF	
Reverse Transfer Capacitance	$C_{rss}$	—	193	—	pF	
Total Gate Charge	$Q_g$	—	21	—	nC	$V_{GS} = 4.5\text{V}$
Total Gate Charge	$Q_g$	—	42	—	nC	$V_{GS} = 10\text{V}$
Gate-Source Charge	$Q_{gs}$	—	7.3	—	nC	
Gate-Drain Charge	$Q_{gd}$	—	10.7	—	nC	
Turn-On Delay Time (Note 9)	$t_{D(on)}$	—	7.8	—	ns	$V_{DD} = 20\text{V}$ , $V_{GS} = 10\text{V}$ $I_D = 14\text{A}$ , $R_G \cong 6.0\Omega$
Turn-On Rise Time (Note 9)	$t_r$	—	18.5	—	ns	
Turn-Off Delay Time (Note 9)	$t_{D(off)}$	—	37.3	—	ns	
Turn-Off Fall Time (Note 9)	$t_f$	—	14.9	—	ns	

- Notes:
7. Measured under pulsed conditions. Pulse width  $\leq 300\mu\text{s}$ ; duty cycle  $\leq 2\%$
  8. For design aid only, not subject to production testing.
  9. Switching characteristics are independent of operating junction temperatures.

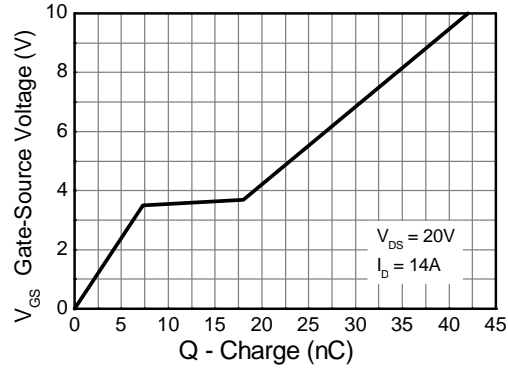
**Typical Characteristics**



**Typical Characteristics - continued**

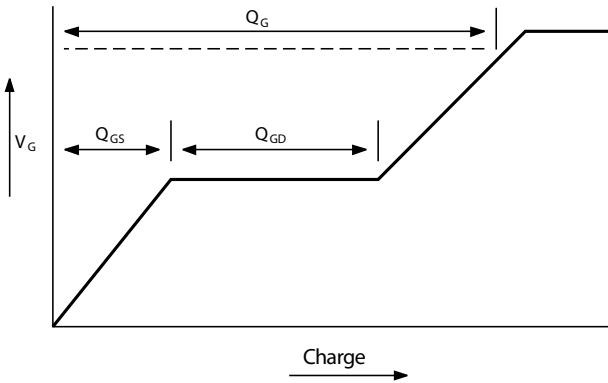


**Capacitance v Drain-Source Voltage**

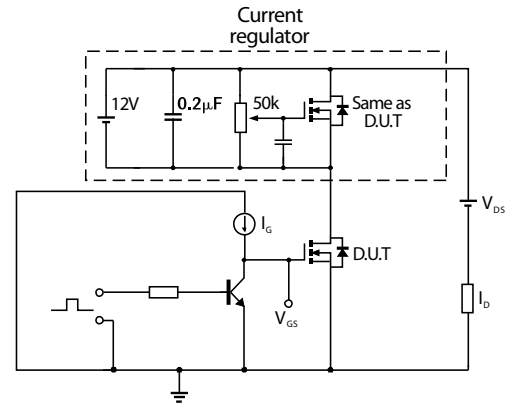


**Gate-Source Voltage v Gate Charge**

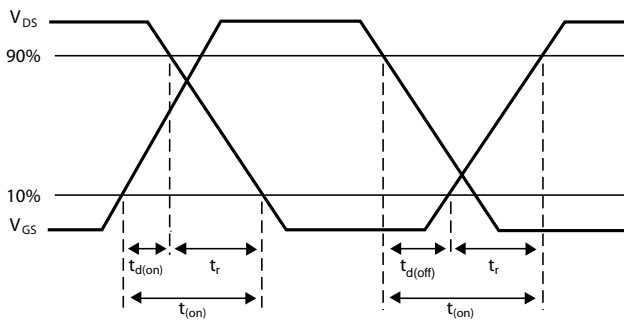
**Test Circuits**



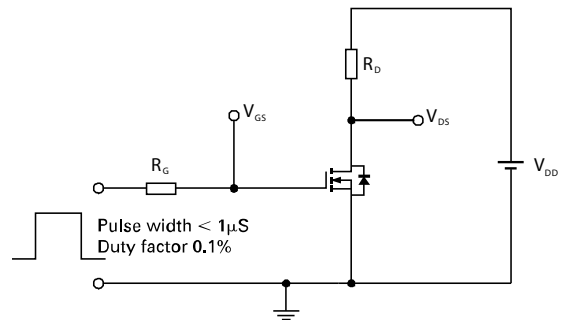
**Basic gate charge waveform**



**Gate charge test circuit**

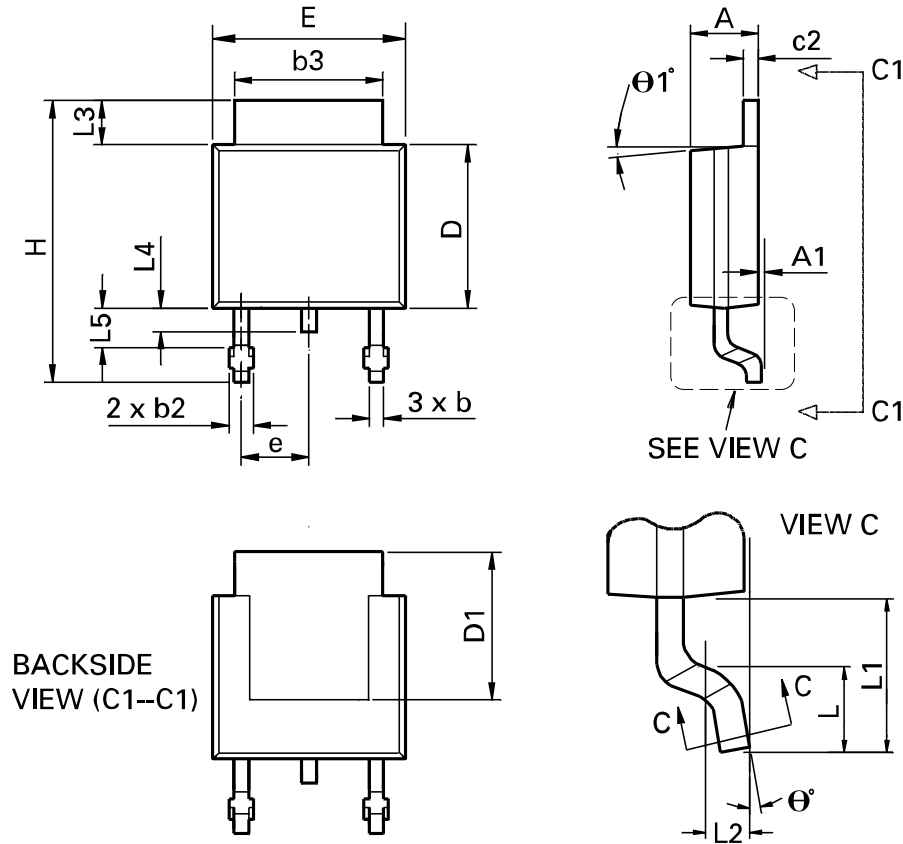


**Switching time waveforms**



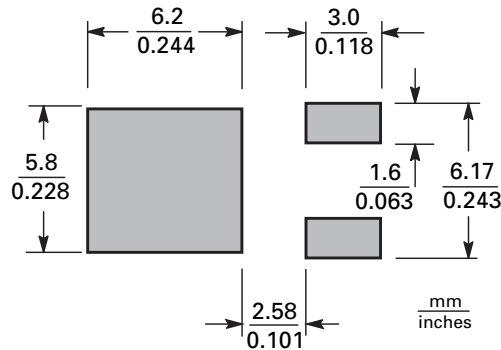
**Switching time test circuit**

**Package Outline Dimensions**



DIM	Inches		Millimeters		DIM	Inches		Millimeters	
	Min	Max	Min	Max		Min	Max	Min	Max
A	0.086	0.094	2.18	2.39	e	0.090 BSC		2.29 BSC	
A1	-	0.005	-	0.127	H	0.370	0.410	9.40	10.41
b	0.020	0.035	0.508	0.89	L	0.055	0.070	1.40	1.78
b2	0.030	0.045	0.762	1.14	L1	0.108 REF		2.74 REF	
b3	0.205	0.215	5.21	5.46	L2	0.020 BSC		0.508 BSC	
c	0.018	0.024	0.457	0.61	L3	0.035	0.065	0.89	1.65
c2	0.018	0.023	0.457	0.584	L4	0.025	0.040	0.635	1.016
D	0.213	0.245	5.41	6.22	L5	0.045	0.060	1.14	1.52
D1	0.205	-	5.21	-	$\theta_1^\circ$	0°	10°	0°	10°
E	0.250	0.265	6.35	6.73	$\theta^\circ$	0°	15°	0°	15°
E1	0.170	-	4.32	-	-	-	-	-	-

**Suggested Pad Layout**



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