

ISL9N304AP3/ISL9N304AS3ST

N-Channel Logic Level UltraFET[®] Trench MOSFETs 30V, 75A, 4.5mΩ

General Description

This device employs a new advanced trench MOSFET technology and features low gate charge while maintaining low on-resistance.

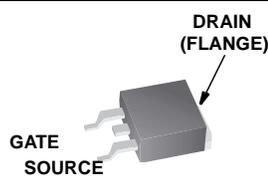
Optimized for switching applications, this device improves the overall efficiency of DC/DC converters and allows operation to higher switching frequencies.

Applications

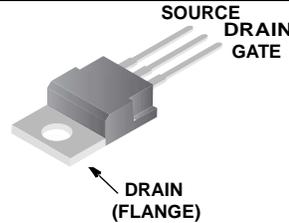
- DC/DC converters

Features

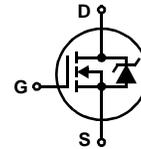
- Fast switching
- $r_{DS(ON)} = 0.0036\Omega$ (Typ), $V_{GS} = 10V$
- $r_{DS(ON)} = 0.0060\Omega$ (Typ), $V_{GS} = 4.5V$
- Q_g (Typ) = 38nC, $V_{GS} = 5V$
- Q_{gd} (Typ) = 13nC
- C_{ISS} (Typ) = 4075pF



TO-263



TO-220



MOSFET Maximum Ratings $T_A = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Ratings	Units
V_{DSS}	Drain to Source Voltage	30	V
V_{GS}	Gate to Source Voltage	± 20	V
I_D	Drain Current		
	Continuous ($T_C = 25^\circ\text{C}$, $V_{GS} = 10V$)	75	A
	Continuous ($T_C = 100^\circ\text{C}$, $V_{GS} = 4.5V$)	74	A
	Continuous ($T_C = 25^\circ\text{C}$, $V_{GS} = 10V$, $R_{\theta JA} = 43^\circ\text{C/W}$)	20	A
	Pulsed	Figure 4	A
P_D	Power dissipation	145	W
	Derate above 25°C	0.97	W/ $^\circ\text{C}$
T_J, T_{STG}	Operating and Storage Temperature	-55 to 175	$^\circ\text{C}$

Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance Junction to Case TO-220, TO-263	1.03	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance Junction to Ambient TO-220, TO-263	62	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance Junction to Ambient TO-263, 1in ² copper pad area	43	$^\circ\text{C/W}$

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
N304AS	ISL9N304AS3ST	TO-263AB	330mm	24mm	800 units
N304AP	ISL9N304AP3	TO-220AB	Tube	N/A	50

Electrical Characteristics $T_A = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
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Off Characteristics

B_{VDSS}	Drain to Source Breakdown Voltage	$I_D = 250\mu\text{A}$, $V_{GS} = 0\text{V}$	30	-	-	V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 25\text{V}$ $V_{GS} = 0\text{V}$ $T_C = 150^\circ$	-	-	1	μA
I_{GSS}	Gate to Source Leakage Current	$V_{GS} = \pm 20\text{V}$	-	-	± 100	nA

On Characteristics

$V_{GS(TH)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}$, $I_D = 250\mu\text{A}$	1	-	3	V
$r_{DS(ON)}$	Drain to Source On Resistance	$I_D = 75\text{A}$, $V_{GS} = 10\text{V}$ $I_D = 74\text{A}$, $V_{GS} = 4.5\text{V}$	-	0.0036 0.0060	0.0045 0.0075	Ω

Dynamic Characteristics

C_{ISS}	Input Capacitance	$V_{DS} = 15\text{V}$, $V_{GS} = 0\text{V}$, $f = 1\text{MHz}$	-	4075	-	pF	
C_{OSS}	Output Capacitance		-	830	-	pF	
C_{RSS}	Reverse Transfer Capacitance		-	380	-	pF	
$Q_{g(TOT)}$	Total Gate Charge at 10V	$V_{GS} = 0\text{V}$ to 10V	$V_{DD} = 15\text{V}$ $I_D = 74\text{A}$ $I_g = 1.0\text{mA}$	70	105	nC	
$Q_{g(5)}$	Total Gate Charge at 5V	$V_{GS} = 0\text{V}$ to 5V		-	38	57	nC
$Q_{g(TH)}$	Threshold Gate Charge	$V_{GS} = 0\text{V}$ to 1V		-	3.9	5.8	nC
Q_{gs}	Gate to Source Gate Charge			-	11	-	nC
Q_{gd}	Gate to Drain "Miller" Charge			-	13	-	nC

Switching Characteristics ($V_{GS} = 4.5\text{V}$)

t_{ON}	Turn-On Time	$V_{DD} = 15\text{V}$, $I_D = 20\text{A}$ $V_{GS} = 4.5\text{V}$, $R_{GS} = 2.4\Omega$	-	-	137	ns
$t_{d(ON)}$	Turn-On Delay Time		-	14	-	ns
t_r	Rise Time		-	77	-	ns
$t_{d(OFF)}$	Turn-Off Delay Time		-	33	-	ns
t_f	Fall Time		-	20	-	ns
t_{OFF}	Turn-Off Time		-	-	79	ns

Switching Characteristics ($V_{GS} = 10\text{V}$)

t_{ON}	Turn-On Time	$V_{DD} = 15\text{V}$, $I_D = 20\text{A}$ $V_{GS} = 10\text{V}$, $R_{GS} = 2.4\Omega$	-	-	113	ns
$t_{d(ON)}$	Turn-On Delay Time		-	9	-	ns
t_r	Rise Time		-	67	-	ns
$t_{d(OFF)}$	Turn-Off Delay Time		-	51	-	ns
t_f	Fall Time		-	19	-	ns
t_{OFF}	Turn-Off Time		-	-	104	ns

Unclamped Inductive Switching

t_{AV}	Avalanche Time	$I_D = 3.8\text{A}$, $L = 3.0\text{mH}$	255	-	-	μs
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Drain-Source Diode Characteristics

V_{SD}	Source to Drain Diode Voltage	$I_{SD} = 74\text{A}$	-	-	1.25	V
		$I_{SD} = 35\text{A}$	-	-	1.0	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 74\text{A}$, $dI_{SD}/dt = 100\text{A}/\mu\text{s}$	-	-	27	ns
Q_{RR}	Reverse Recovered Charge	$I_{SD} = 74\text{A}$, $dI_{SD}/dt = 100\text{A}/\mu\text{s}$	-	-	16	nC

Typical Characteristic

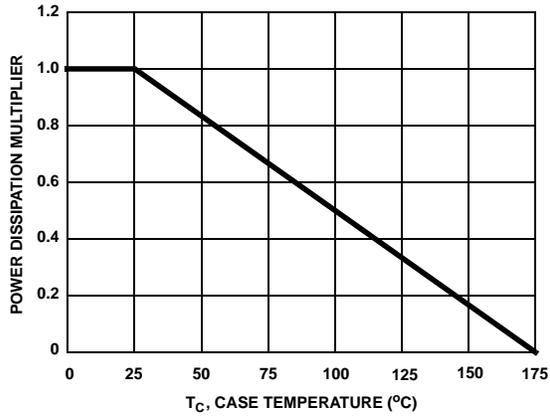


Figure 1. Normalized Power Dissipation vs Ambient Temperature

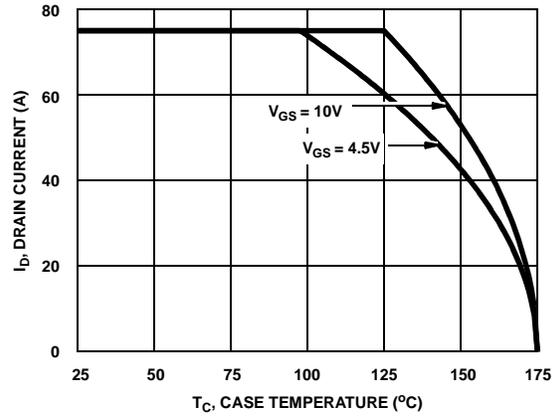


Figure 2. Maximum Continuous Drain Current vs Case Temperature

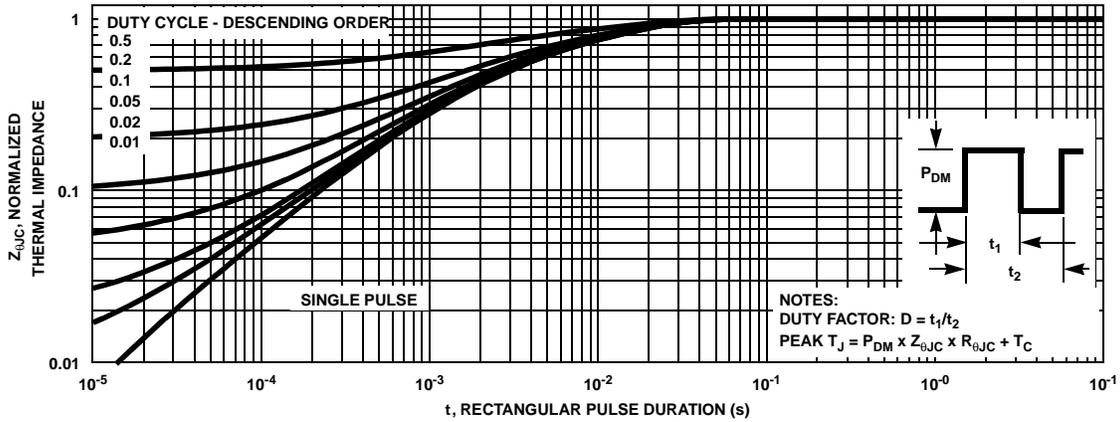


Figure 3. Normalized Maximum Transient Thermal Impedance

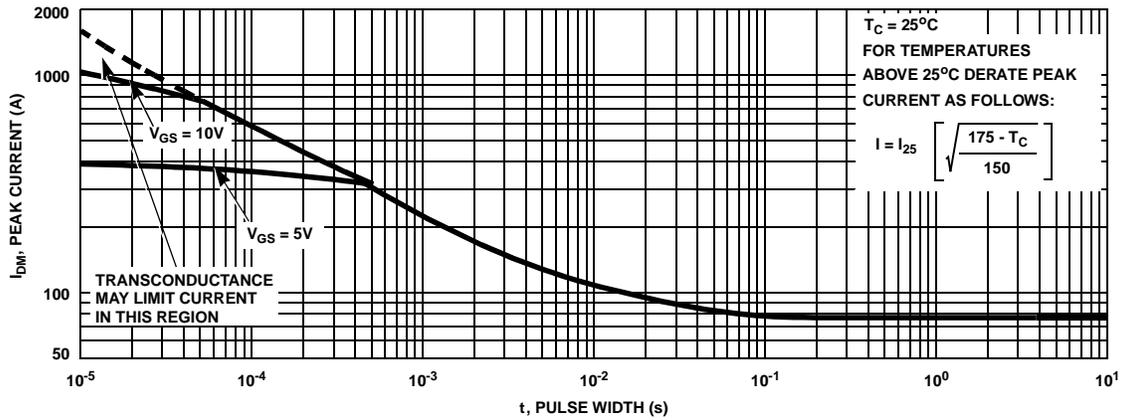


Figure 4. Peak Current Capability