



NANJING INTERNATIONAL GROUP CO.,LTD.

SOT-23 Plastic-Encapsulate MOSFETS

NJ2309DS P-Channel MOSFET

PRODUCT SUMMARY

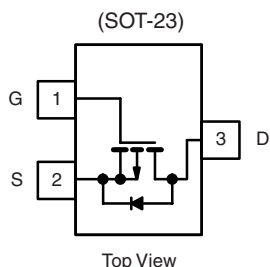
V_{DS} (V)	$R_{DS(on)}$ (Ω)	I_D (A) ^d	Q_g (Typ.)
- 60	0.345 at $V_{GS} = - 10$ V	- 1.6	2.7 nC
	0.450 at $V_{GS} = - 4.5$ V	- 1.4	

FEATURES

- Halogen-free Option Available
- TrenchFET[®] Power MOSFET

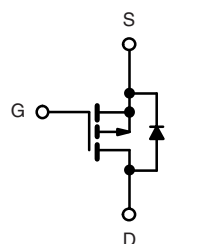
APPLICATIONS

- Load Switch



Marking

Marking	A9*
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P-Channel MOSFET

ABSOLUTE MAXIMUM RATINGS $T_A = 25$ °C, unless otherwise noted

Parameter		Symbol	Limit	Unit
Drain-Source Voltage		V_{DS}	- 60	V
Gate-Source Voltage		V_{GS}	± 20	
Continuous Drain Current ($T_J = 150$ °C) ^{a, b}	$T_C = 25$ °C	I_D	- 1.6	A
	$T_C = 70$ °C		- 1.3	
	$T_A = 25$ °C		- 1.2 ^{a, b}	
	$T_A = 70$ °C		- 1.0 ^{a, b}	
Pulsed Drain Current (10 μ s Pulse Width)		I_{DM}	- 8	
Single Pulse Avalanche Current		$L = 0.1$ mH I_{AS}	- 5	
Continuous Source-Drain Diode Current	$T_C = 25$ °C	I_S	- 1.4	W
	$T_A = 25$ °C		- 0.9 ^{a, b}	
Maximum Power Dissipation	$T_C = 25$ °C	P_D	1.7	
	$T_C = 70$ °C		1.1	
	$T_A = 25$ °C		1.0 ^{a, b}	
	$T_A = 70$ °C		0.67 ^{a, b}	
Operating Junction and Storage Temperature Range		T_J, T_{stg}	- 55 to 150	°C
Soldering Recommendations (Peak Temperature) ^c			260	

THERMAL RESISTANCE RATINGS

Parameter		Symbol	Typical	Maximum	Unit
Maximum Junction-to-Ambient ^{a, c}	$t \leq 5$ s	R_{thJA}	92	120	°C/W
Maximum Junction-to-Foot (Drain)	Steady State	R_{thJF}	58	73	

Notes:

a. Surface Mounted on 1" x 1" FR4 board.

b. $t = 5$ s.

c. Maximum under Steady State conditions is 166 °C/W.

d. When $T_C = 25$ °C.

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SPECIFICATIONS $T_J = 25\text{ }^{\circ}\text{C}$, unless otherwise noted						
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Static						
Drain-Source Breakdown Voltage	V_{DS}	$V_{GS} = 0\text{ V}$, $I_D = -250\text{ }\mu\text{A}$	- 60			V
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	$I_D = -250\text{ }\mu\text{A}$		- 65		mV/ $^{\circ}\text{C}$
$V_{GS(th)}$ Temperature Coefficient	$\Delta V_{GS(th)}/T_J$			4.5		
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}$, $I_D = -250\text{ }\mu\text{A}$	- 1		- 3	V
Gate-Source Leakage	I_{GSS}	$V_{DS} = 0\text{ V}$, $V_{GS} = \pm 20\text{ V}$			- 100	nA
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = -60\text{ V}$, $V_{GS} = 0\text{ V}$			- 1	μA
		$V_{DS} = -60\text{ V}$, $V_{GS} = 0\text{ V}$, $T_J = 55\text{ }^{\circ}\text{C}$			- 10	
On-State Drain Current ^a	$I_{D(on)}$	$V_{DS} \leq 5\text{ V}$, $V_{GS} = -10\text{ V}$	- 6			A
Drain-Source On-State Resistance ^a	$R_{DS(on)}$	$V_{GS} = -10\text{ V}$, $I_D = -1.25\text{ A}$		0.285	0.345	Ω
		$V_{GS} = -4.5\text{ V}$, $I_D = -1.0\text{ A}$		0.360	0.450	
Forward Transconductance ^a	g_{fs}	$V_{DS} = -10\text{ V}$, $I_D = -1.0\text{ A}$		2.8		S
Dynamic ^b						
Input Capacitance	C_{iss}	$V_{DS} = -30\text{ V}$, $V_{GS} = 0\text{ V}$, $f = 1\text{ MHz}$		100		pF
Output Capacitance	C_{oss}			22		
Reverse Transfer Capacitance	C_{rss}			18		
Total Gate Charge	Q_g	$V_{DS} = -30\text{ V}$, $V_{GS} = -4.5\text{ V}$, $I_D = -1.25\text{ A}$		2.7	4.1	nC
Gate-Source Charge	Q_{gs}			0.8		
Gate-Drain Charge	Q_{gd}			1.2		
Gate Resistance	R_g	$f = 1\text{ MHz}$		7		Ω
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = -30\text{ V}$, $R_L = 30\text{ }\Omega$ $I_D \cong -1\text{ A}$, $V_{GEN} = -4.5\text{ V}$, $R_g = 1\text{ }\Omega$		40	60	ns
Rise Time	t_r			35	55	
Turn-Off Delay Time	$t_{d(off)}$			15	25	
Fall Time	t_f			10	20	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = -30\text{ V}$, $R_L = 30\text{ }\Omega$ $I_D \cong -1\text{ A}$, $V_{GEN} = -10\text{ V}$, $R_g = 1\text{ }\Omega$		5	10	
Rise Time	t_r			10	20	
Turn-Off Delay Time	$t_{d(off)}$			15	25	
Fall Time	t_f			10	20	
Drain-Source Body Diode Characteristics						
Continuous Source-Drain Diode Current	I_S	$T_C = 25\text{ }^{\circ}\text{C}$			- 1.4	A
Pulse Diode Forward Current	I_{SM}				- 8	
Body Diode Voltage	V_{SD}	$I_S = -0.75\text{ A}$, $V_{GS} = 0\text{ V}$		- 0.8	- 1.2	V
Body Diode Reverse Recovery Time	t_{rr}	$I_F = -1.25\text{ A}$, $dI/dt = 100\text{ A}/\mu\text{s}$, $T_J = 25\text{ }^{\circ}\text{C}$		30	60	ns
Body Diode Reverse Recovery Charge	Q_{rr}			33	60	nC
Reverse Recovery Fall Time	t_a			18		ns
Reverse Recovery Rise Time	t_b			12		

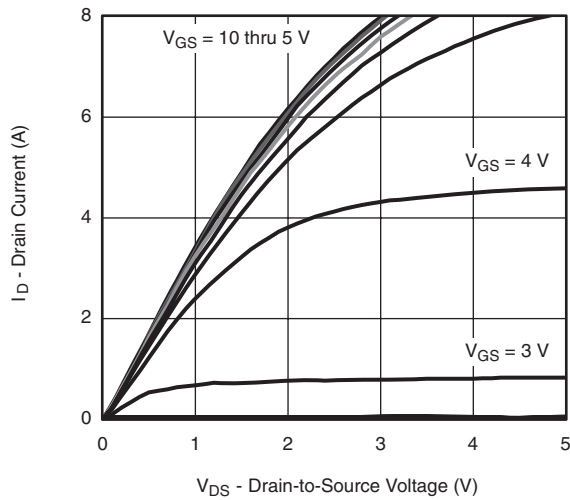
Notes:

a. Pulse test; pulse width $\leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$.

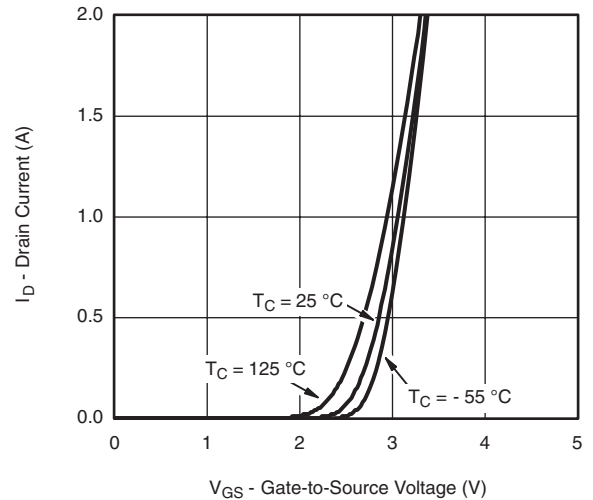
b. Guaranteed by design, not subject to production testing.

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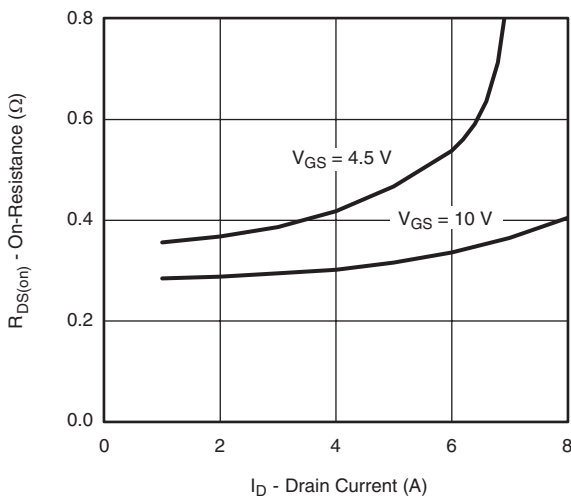
TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



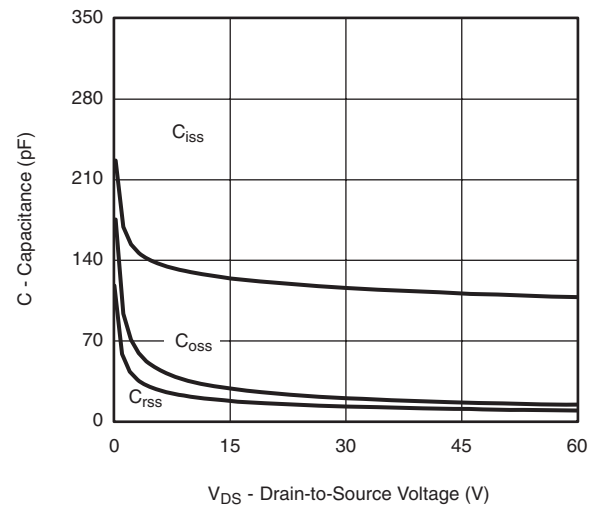
Output Characteristics



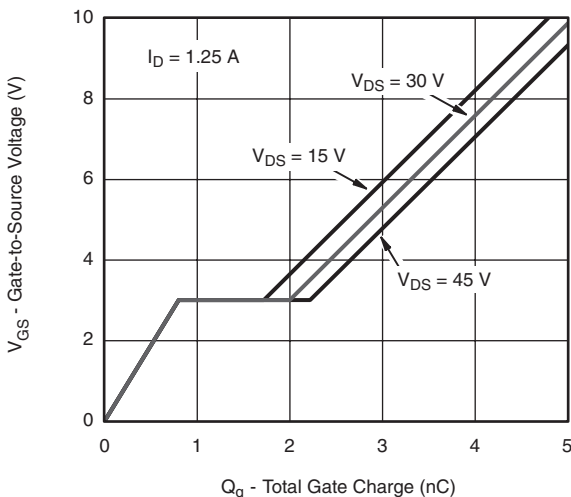
Transfer Characteristics



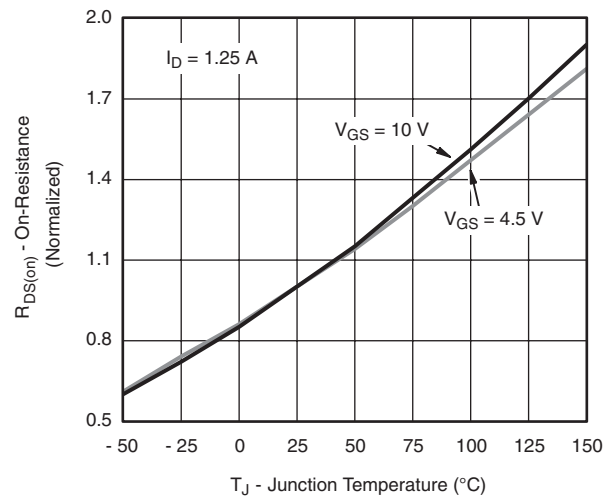
On-Resistance vs. Drain Current and Gate Voltage



Capacitance



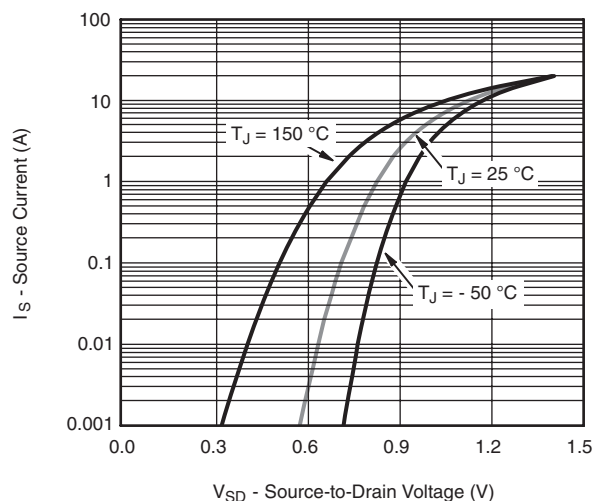
Gate Charge



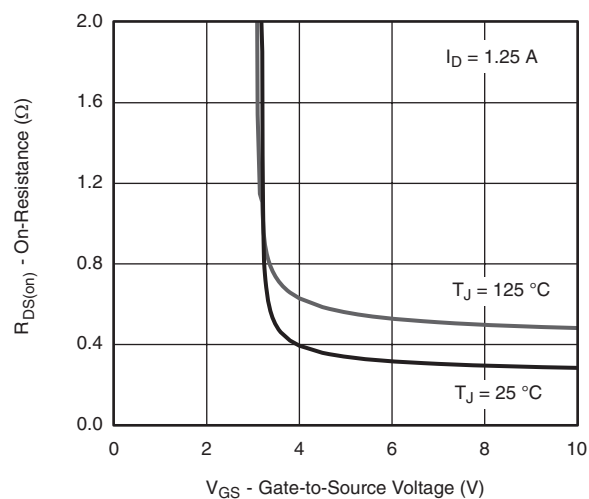
On-Resistance vs. Junction Temperature

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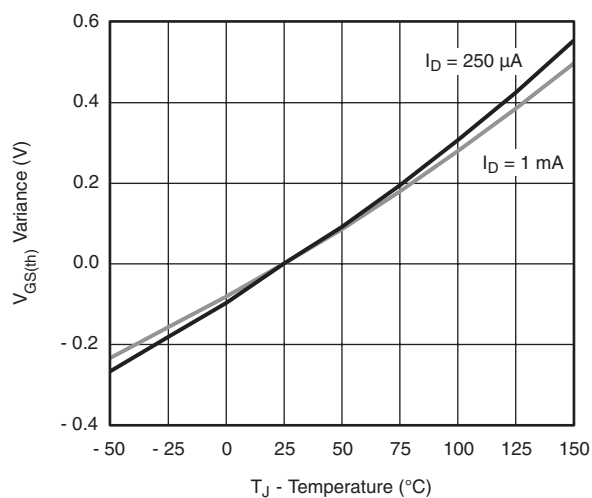
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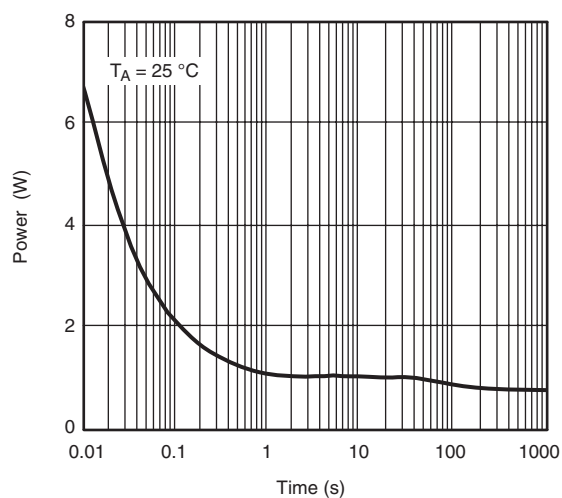
Source-Drain Diode Forward Voltage



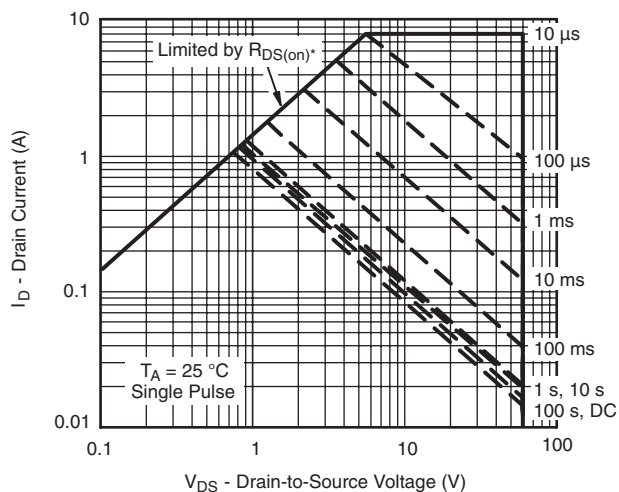
On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage



Single Pulse Power, Junction-to-Ambient



* $V_{GS} >$ minimum V_{GS} at which $R_{DS(on)}$ is specified

Safe Operating Area, Junction-to-Ambient

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