




Power MOSFETS


DATASHEET

LM138NEI3A

N-Channel
Enhancement Mode MOSFET

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Quality Management Systems

ISO 9001:2015 Certificate

N-Channel Enhancement Mode MOSFET

Pin Description

SOT-23 (TOP view) 	Symbol 	Symbol	N-Channel	Unit
		V_{DSS}	50	V
		$R_{DS(ON)-Max}$	1.9	Ω
		I_D	0.31	A

Ordering Information

Feature

- Low V_{th} low gate drive
- Reliable and Rugged
- ROHS Compliant & Halogen-Free
- ESD protection

Applications

- Small signal application
- Load switch

Ordering Information

Orderable Part Number	Package Type	Form	Shipping	Marking
LM138NEI3A	SOT-23	Tape & Reel	3000 / Tape & Reel	03□□

Note : □□ = Lot Code

Absolute Maximum Ratings (T_J=25°C Unless Otherwise Noted)

Symbol	Parameter	N-Channel	Unit	
V_{DSS}	Drain-Source Voltage	50	V	
V_{GSS}	Gate-Source Voltage	±20		
T_J	Maximum Junction Temperature	150	°C	
T_{STG}	Storage Temperature Range	-55 to 150	°C	
$I_{DM}^{①}$	Pulse Drain Current Tested	$T_A=25^\circ C$	0.77	A
I_D	Continuous Drain Current	$T_A=25^\circ C$	0.31	A
		$T_A=70^\circ C$	0.25	
P_D	Maximum Power Dissipation	$T_A=25^\circ C$	0.36	W
		$T_A=70^\circ C$	0.23	

Thermal Characteristics

Symbol	Parameter	Rating	Unit	
$R_{\theta JA}^{②}$	Thermal Resistance-Junction to Ambient	Steady State	350	°C/W

Note ① : Max. current is limited by junction temperature.

Note ② : Surface Mounted on 1in² FR-4 board with 1oz.

N-Channel Electrical Characteristics (T_J=25°C Unless Otherwise Noted)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
Static Electrical Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	V _{GS} =0V, I _{DS} =250uA	50	-	-	V
I_{DSS}	Zero Gate Voltage Drain Current	V _{DS} =40V, V _{GS} =0V	-	-	1	uA
V_{GS(th)}	Gate Threshold Voltage	V _{DS} =V _{GS} , I _{DS} =250uA	0.6	1.2	1.5	V
I_{GSS}	Gate Leakage Current	V _{GS} =±20V, V _{DS} =0V	-	-	±10	uA
R_{DS(ON)} ^③	Drain-Source On-state Resistance	V _{GS} =10V, I _{DS} =0.23A	-	1.6	1.9	Ω
		V _{GS} =4.5V, I _{DS} =0.19A	-	1.7	2.2	
		V _{GS} =2.5V, I _{DS} =0.05A	-	2	-	
gfs	Forward Transconductance	V _{DS} =2V, I _{DS} =0.18A	-	0.6	-	S
Dynamic Characteristics ^④						
C_{iss}	Input Capacitance	V _{GS} =0V, V _{DS} =30V, Freq.=1MHz	-	25.2	-	pF
C_{oss}	Output Capacitance		-	3.2	-	
C_{rss}	Reverse Transfer Capacitance		-	2.1	-	
t_{d(ON)}	Turn-on Delay Time	V _{GS} =10V, V _{DS} =50V, I _D =0.23A, R _{GEN} =10Ω	-	0.5	-	nS
t_r	Turn-on Rise Time		-	19.4	-	
t_{d(OFF)}	Turn-off Delay Time		-	26.2	-	
t_f	Turn-off Fall Time		-	22.4	-	
Q_g	Total Gate Charge	V _{GS} =4.5V, V _{DS} =50V I _D =1A	-	0.9	-	nC
Q_g	Total Gate Charge	V _{GS} =10V, V _{DS} =50V, I _D =1A	-	1.7	-	
Q_{gs}	Gate-Source Charge		-	0.3	-	
Q_{gd}	Gate-Drain Charge		-	0.3	-	
Source-Drain Characteristics						
V_{SD} ^③	Diode Forward Voltage	I _{SD} =0.23A, V _{GS} =0V	-	0.8	1.1	V
t_{rr}	Reverse Recovery Time	I _F =0.5A, V _{GS} =0	-	7.2	-	nS
Q_{rr}	Reverse Recovery Charge	di _F /dt=100A/μs	-	1.9	-	nC

Note ③ : Pulse test (pulse width≤300us, duty cycle≤2%).

Note ④ : Guaranteed by design, not subject to production testing.

N-Channel Typical Characteristics

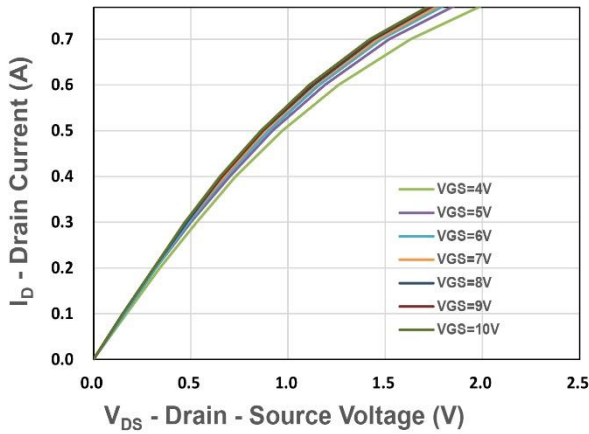


Figure 1. Output Characteristics

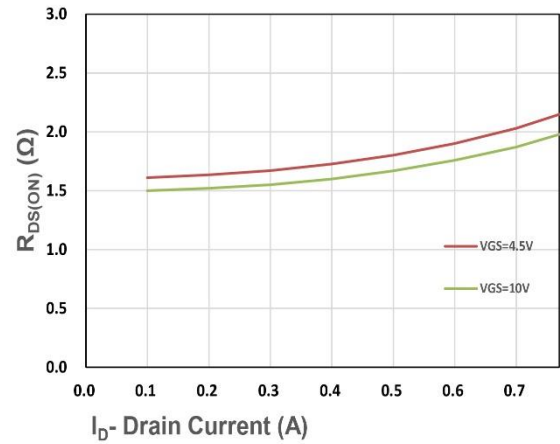


Figure 2. On-Resistance vs. ID

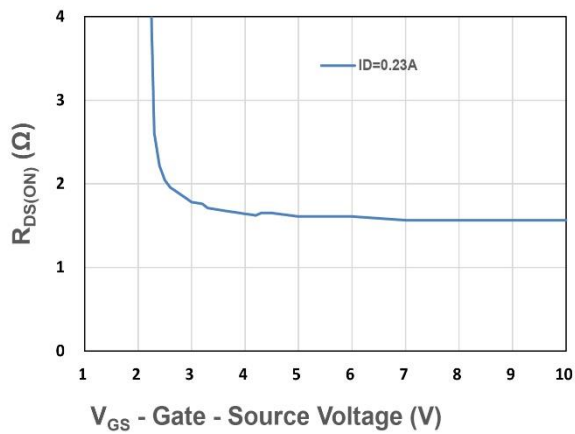


Figure 3. On-Resistance vs. VGS

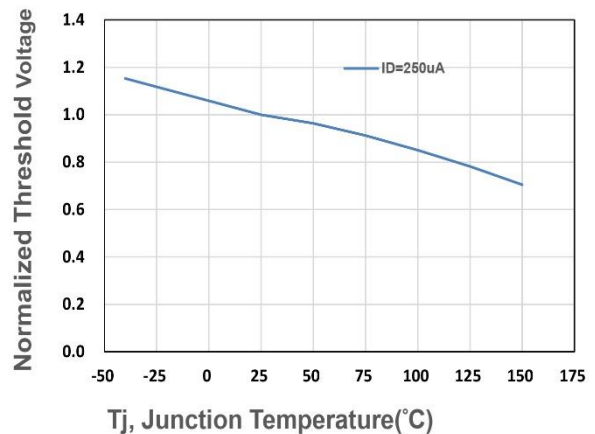


Figure 4. Gate Threshold Voltage

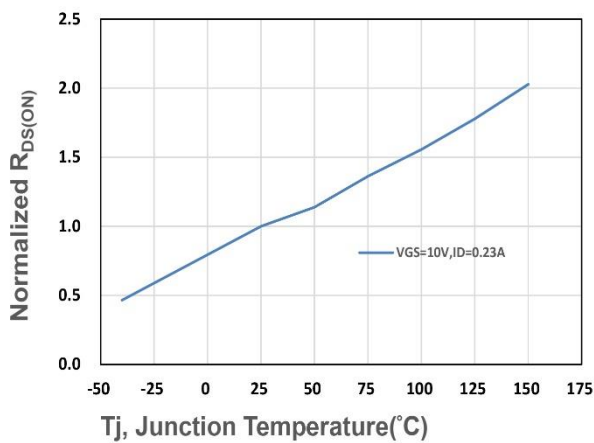


Figure 5. Drain-Source On Resistance

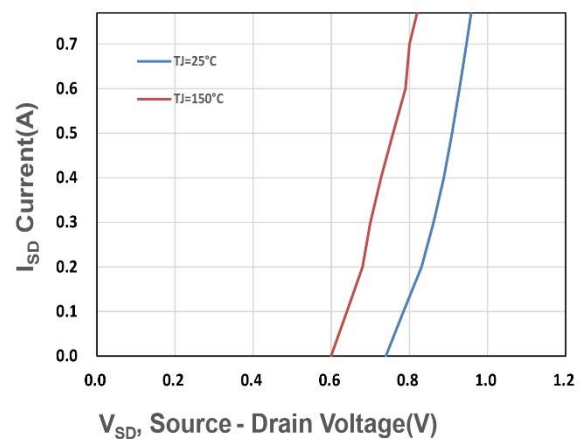


Figure 6. Source-Drain Diode Forward

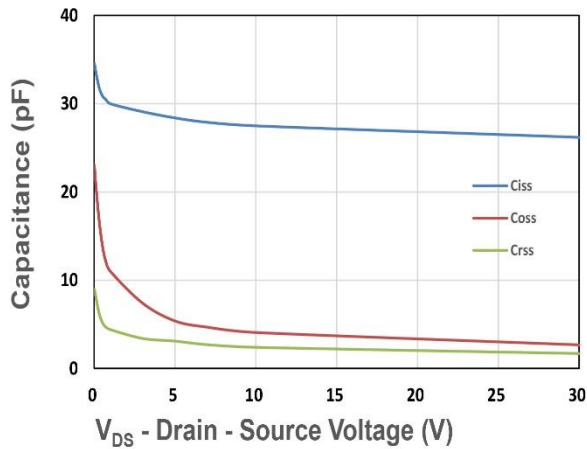


Figure 7. Capacitance

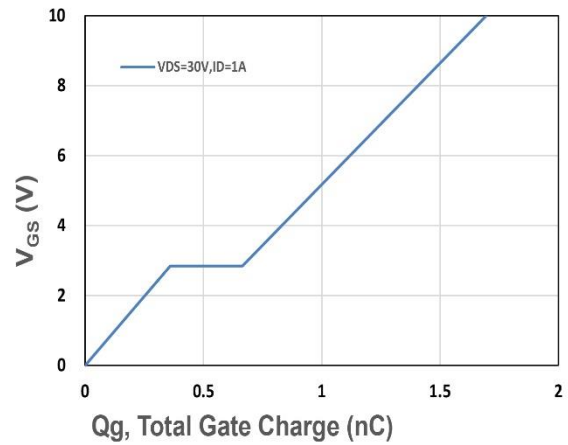


Figure 8. Gate Charge Characteristics

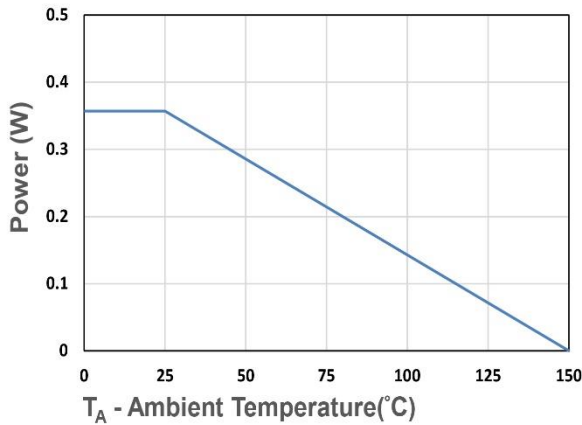


Figure 9. Power Dissipation

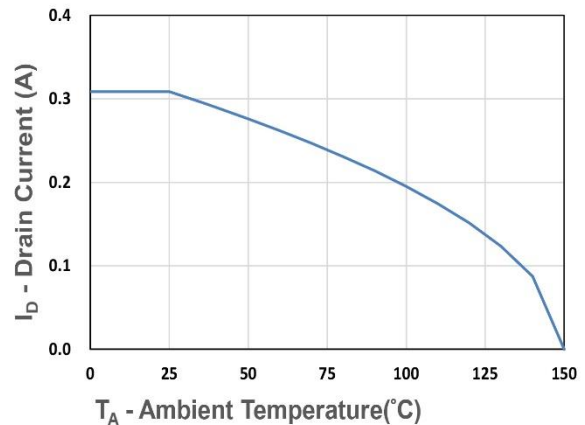


Figure 10. Drain Current

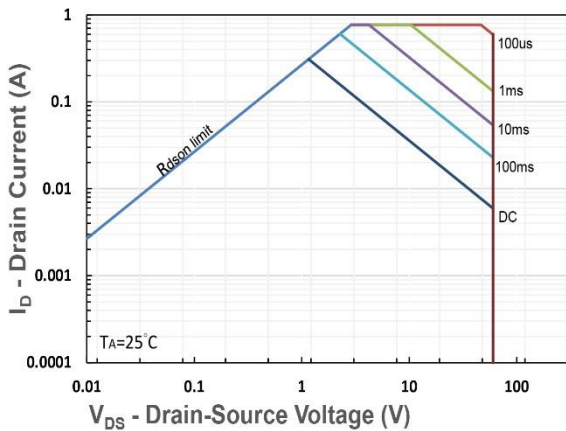


Figure 11. Safe Operating Area

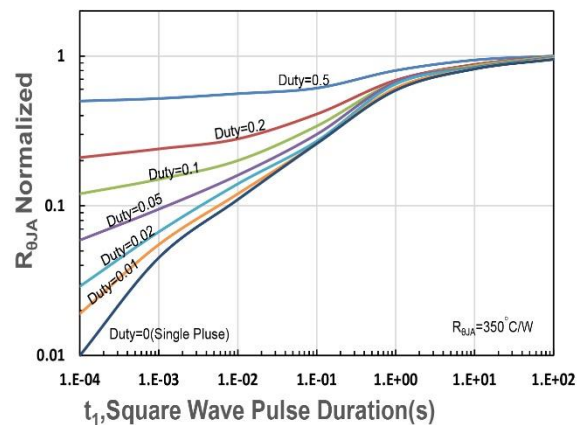


Figure 12. $R_{\theta JA}$ Transient Thermal Impedance