




# Power MOSFETS


## DATASHEET


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**LM60099NHK8A**

N-Channel  
Enhancement Mode MOSFET

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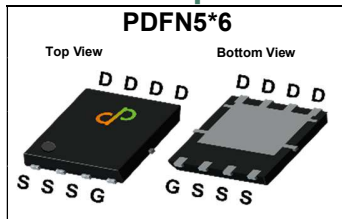


Quality Management Systems

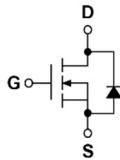
ISO 9001:2015 Certificate

## N-Channel Enhancement Mode MOSFET

### Pin Description



### Symbol



### Ordering Information

Symbol	N-Channel	Unit
$V_{DSS}$	60	V
$R_{DS(ON)-Max}$	9.9	m $\Omega$
$I_D$	49	A

### Feature

- Lower  $Q_g$  and  $Q_{gd}$  for high-speed switching
- Reliable and Rugged
- ROHS Compliant & Halogen-Free
- 100% UIS and  $R_g$  Tested

### Applications

- Secondary Side Synchronous Rectification
- DC-DC Converter
- Motor Control

### Ordering Information

Orderable Part Number	Package Type	Form	Shipping	Marking
LM60099NHK8A	PDFN5*6	Tape & Reel	5000 / Tape & Reel	60099 □□□□□□

Note : □□□□□□ = Lot Code

### Absolute Maximum Ratings ( $T_J=25^\circ\text{C}$ Unless Otherwise Noted)

Symbol	Parameter	N-Channel	Unit
$V_{DSS}$	Drain-Source Voltage	60	V
$V_{GSS}$	Gate-Source Voltage	$\pm 20$	
$T_J$	Maximum Junction Temperature	150	$^\circ\text{C}$
$T_{STG}$	Storage Temperature Range	-55 to 150	$^\circ\text{C}$
$I_{DM}^{(1)}$	Pulse Drain Current Tested	$T_c=25^\circ\text{C}$	122 A
$I_D$	Continuous Drain Current	$T_c=25^\circ\text{C}$	49 A
		$T_c=100^\circ\text{C}$	31
$P_D$	Maximum Power Dissipation	$T_c=25^\circ\text{C}$	50 W
		$T_c=100^\circ\text{C}$	20
$I_{AS}^{(2)}$	Avalanche Current, Single pulse	$L=0.1\text{mH}$	33 A
$E_{AS}^{(2)}$	Avalanche Energy, Single pulse	$L=0.1\text{mH}$	54 mJ

### Thermal Characteristics

Symbol	Parameter	Rating	Unit
$R_{\theta JC}$	Thermal Resistance-Junction to Case	Steady State	2.5 $^\circ\text{C}/\text{W}$
$R_{\theta JA}^{(3)}$	Thermal Resistance-Junction to Ambient	Steady State	50 $^\circ\text{C}/\text{W}$

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

Note ② : UIS tested and pulse width are limited by maximum junction temperature  $150^\circ\text{C}$

Note ③ : Surface Mounted on  $1\text{in}^2$  FR-4 board with 1oz.

## N-Channel Electrical Characteristics (T<sub>J</sub>=25°C Unless Otherwise Noted)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
<b>Static Electrical Characteristics</b>						
<b>BV<sub>DSS</sub></b>	Drain-Source Breakdown Voltage	V <sub>GS</sub> =0V, I <sub>DS</sub> =250uA	60	-	-	V
<b>I<sub>DSS</sub></b>	Zero Gate Voltage Drain Current	V <sub>DS</sub> =48V, V <sub>GS</sub> =0V	-	-	1	uA
<b>V<sub>GS(th)</sub></b>	Gate Threshold Voltage	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>DS</sub> =250uA	2	2.8	4	V
<b>I<sub>GSS</sub></b>	Gate Leakage Current	V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V	-	-	±100	nA
<b>R<sub>DS(ON)</sub></b> <sup>④</sup>	Drain-Source On-state Resistance	V <sub>GS</sub> =10V, I <sub>DS</sub> =15A	-	8.6	9.9	mΩ
		V <sub>GS</sub> =6V, I <sub>DS</sub> =8A	-	12	16	
<b>gfs</b>	Forward Transconductance	V <sub>DS</sub> =5V, I <sub>DS</sub> =15A	-	20	-	S
<b>Dynamic Characteristics</b> <sup>⑤</sup>						
<b>R<sub>G</sub></b>	Gate Resistance	V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, Freq.=1MHz	-	2.6	-	Ω
<b>C<sub>iss</sub></b>	Input Capacitance	V <sub>GS</sub> =0V, V <sub>DS</sub> =30V, Freq.=1MHz	-	2490	-	pF
<b>C<sub>oss</sub></b>	Output Capacitance					
<b>C<sub>rss</sub></b>	Reverse Transfer Capacitance					
<b>td(ON)</b>	Turn-on Delay Time	V <sub>GS</sub> =10V, V <sub>DS</sub> =30V, I <sub>D</sub> =1A, R <sub>GEN</sub> =6Ω	-	17	-	nS
<b>t<sub>r</sub></b>	Turn-on Rise Time					
<b>t<sub>d(OFF)</sub></b>	Turn-off Delay Time					
<b>t<sub>f</sub></b>	Turn-off Fall Time					
<b>Q<sub>g</sub></b>	Total Gate Charge	V <sub>GS</sub> =6V, V <sub>DS</sub> =30V, I <sub>D</sub> =15A	-	32	-	nC
<b>Q<sub>g</sub></b>	Total Gate Charge	V <sub>GS</sub> =10V, V <sub>DS</sub> =30V, I <sub>D</sub> =15A	-	52	-	
<b>Q<sub>gs</sub></b>	Gate-Source Charge		-	20	-	
<b>Q<sub>gd</sub></b>	Gate-Drain Charge		-	12	-	
<b>Source-Drain Characteristics</b>						
<b>V<sub>SD</sub></b> <sup>④</sup>	Diode Forward Voltage	I <sub>SD</sub> =1A, V <sub>GS</sub> =0V	-	0.8	1.1	V
<b>t<sub>rr</sub></b>	Reverse Recovery Time	I <sub>F</sub> =1A, V <sub>R</sub> =10	-	26	-	nS
<b>Q<sub>rr</sub></b>	Reverse Recovery Charge	dI <sub>F</sub> /dt=100A/μs	-	32	-	nC

Note ④ : Pulse test (pulse width≤300us, duty cycle≤2%).

Note ⑤ : Guaranteed by design, not subject to production testing.

## N-Channel Typical Characteristics

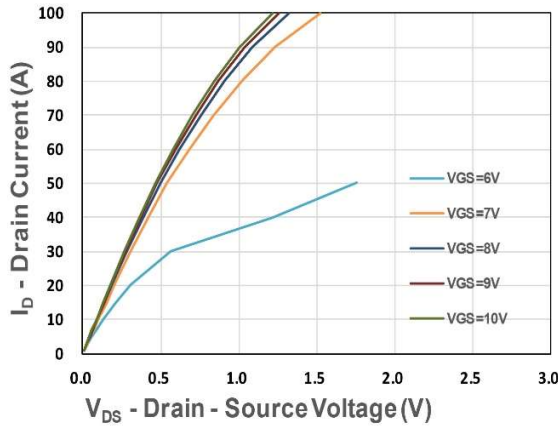


Figure 1. Output Characteristics

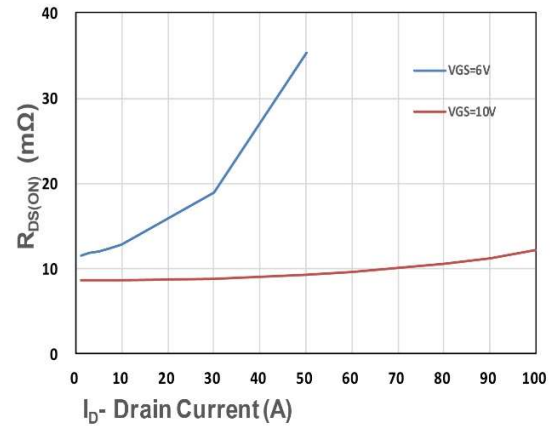


Figure 2. On-Resistance vs. ID

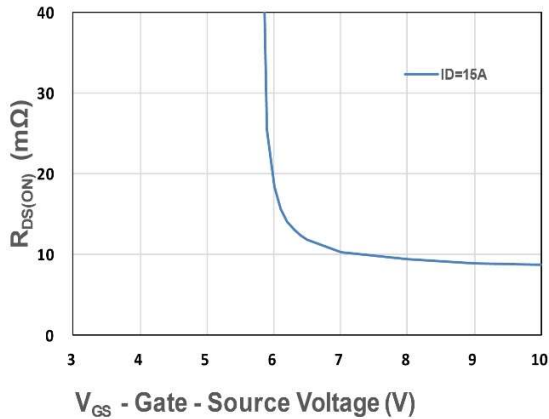


Figure 3. On-Resistance vs. VGS

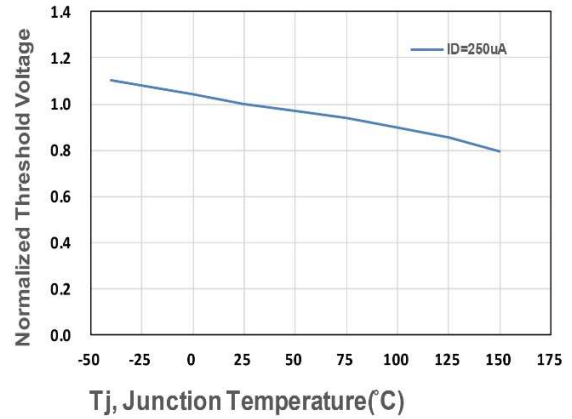


Figure 4. Gate Threshold Voltage

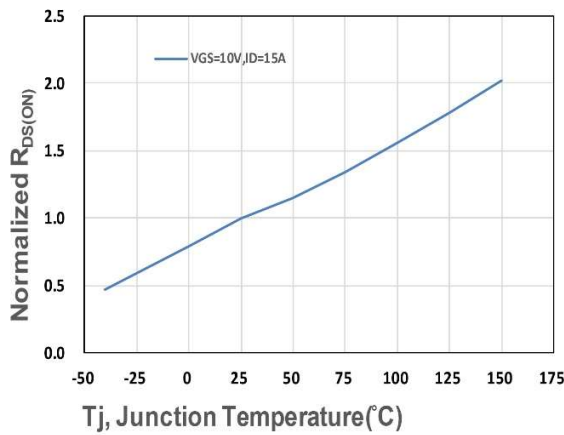


Figure 5. Drain-Source On Resistance

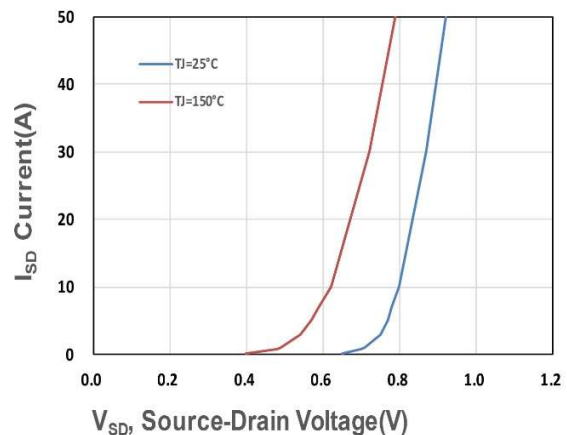


Figure 6. Source-Drain Diode Forward

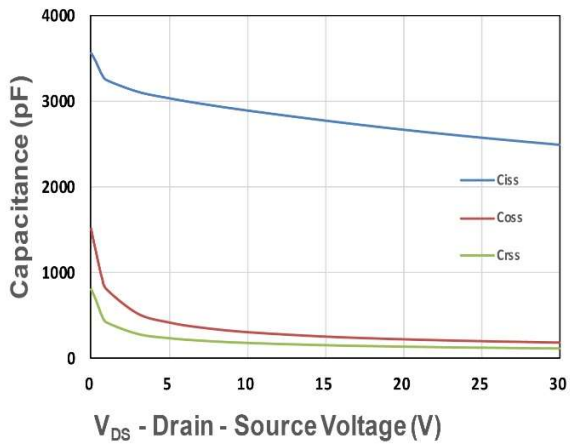


Figure 7. Capacitance

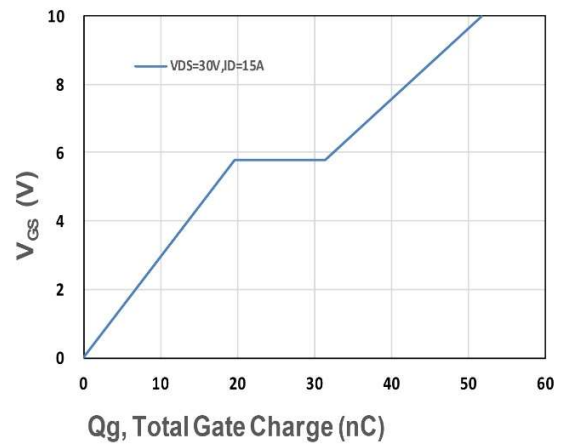


Figure 8. Gate Charge Characteristics

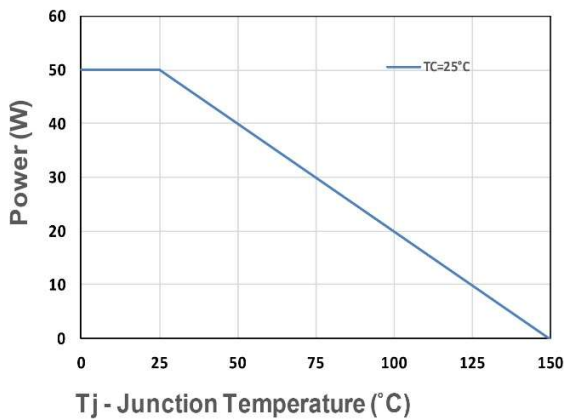


Figure 9. Power Dissipation

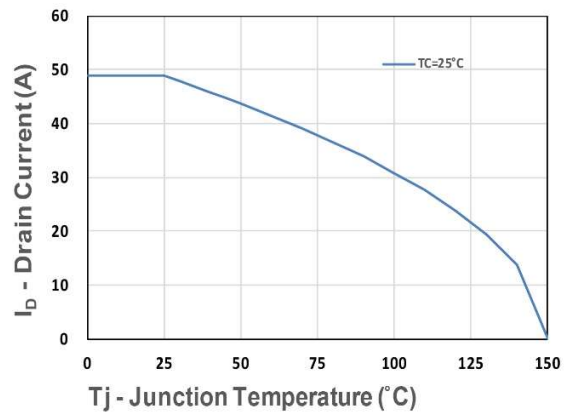


Figure 10. Drain Current

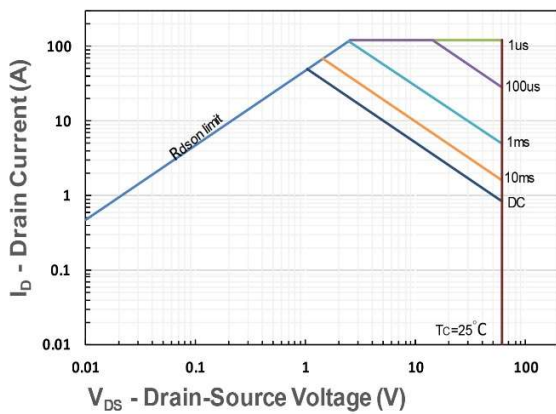


Figure 11. Safe Operating Area

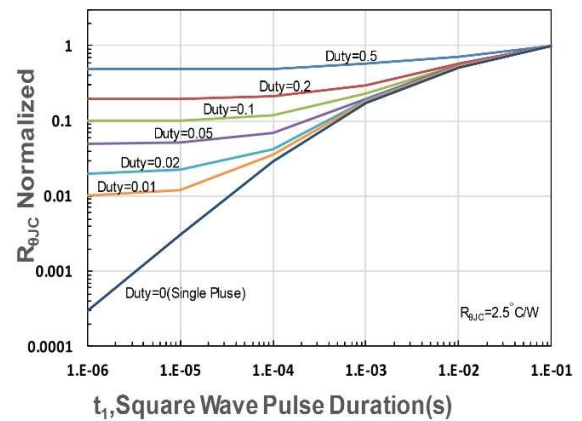


Figure 12.  $R_{\theta JC}$  Transient Thermal Impedance