




# Power MOSFETS


## DATASHEET


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**LM40012NAK8A**

N-Channel  
Enhancement Mode MOSFET

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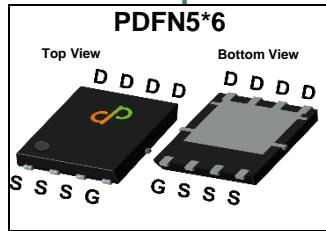


Quality Management Systems

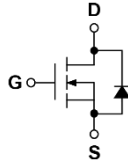
ISO 9001:2015 Certificate

## N-Channel Enhancement Mode MOSFET

### Pin Description



### Symbol



### Product Summary

Symbol	N-Channel	Unit
$V_{DSS}$	40	V
$R_{DS(ON)-Max}$	1	m $\Omega$
ID	290	A

### Feature

- Fast switching speed
- Reliable and Rugged
- ROHS Compliant & Halogen-Free
- 100% UIS and Rg Tested
- Moisture Sensitivity Level MSL1

### Applications

- DC-to-DC converters
- Switch Mode Power Supply
- Brushless DC motor control

### Ordering Information

Orderable Part Number	Package Type	Form	Shipping	Marking
LM40012NAK8A	PDFN5*6	Tape & Reel	5000 / Tape & Reel	40012 □□□□□□

Note : □□□□□□ = Lot Code

### Absolute Maximum Ratings (T<sub>J</sub>=25°C Unless Otherwise Noted)

Symbol	Parameter	N-Channel	Unit
$V_{DSS}$	Drain-Source Voltage	40	V
$V_{GSS}$	Gate-Source Voltage	±20	
$T_J$	Maximum Junction Temperature	175	°C
$T_{STG}$	Storage Temperature Range	-55 to 175	°C
$I_S$	Diode Continuous Forward Current	$T_C=25^\circ\text{C}$ 100	A
$I_{DM}$	Pulse Drain Current Tested	$T_C=25^\circ\text{C}$ 800 <sup>①</sup>	A
$I_D$	Continuous Drain Current	$T_C=25^\circ\text{C}$ 290	A
		$T_C=100^\circ\text{C}$ 205	
$P_D$	Maximum Power Dissipation	$T_C=25^\circ\text{C}$ 115	W
		$T_C=100^\circ\text{C}$ 58	
$I_D$	Continuous Drain Current	$T_A=25^\circ\text{C}$ 43	A
		$T_A=70^\circ\text{C}$ 36	
$P_D$	Maximum Power Dissipation	$T_A=25^\circ\text{C}$ 2.5	W
		$T_A=70^\circ\text{C}$ 1.8	
$I_{AS}^{②}$	Avalanche Current, Single pulse	L=0.1mH 64	A
		L=0.5mH 34	
$E_{AS}^{②}$	Avalanche Energy, Single pulse	L=0.1mH 204	mJ
		L=0.5mH 290	

### Thermal Characteristics

Symbol	Parameter	Rating	Unit
$R_{\theta JC}$	Thermal Resistance-Junction to Case	Steady State	1.3 °C/W
$R_{\theta JA}^{③}$	Thermal Resistance-Junction to Ambient	Steady State	60 °C/W

Note ① : Max. current is limited by bonding

Note ② : UIS tested and pulse width are limited by maximum junction temperature 150°C

Note ③ : Surface Mounted on 1in<sup>2</sup> 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	40	-	-	V
<b>I<sub>DSS</sub></b>	Zero Gate Voltage Drain Current	V <sub>DS</sub> =32V, 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	1	1.7	2.3	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> =20A	-	0.8	1.0	mΩ
		V <sub>GS</sub> =4.5V, I <sub>DS</sub> =10A	-	1.25	1.6	
<b>gfs</b>	Forward Transconductance	V <sub>DS</sub> =5V, I <sub>DS</sub> =10A	-	45	-	S
<b>Dynamic Characteristics</b> <sup>⑥</sup>						
<b>R<sub>G</sub></b>	Gate Resistance	V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, Freq.=1MHz	-	1.2	-	Ω
<b>C<sub>iss</sub></b>	Input Capacitance	V <sub>GS</sub> =0V, V <sub>DS</sub> =20V, Freq.=1MHz	-	4928	-	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> =20V, I <sub>D</sub> =20A, R <sub>GEN</sub> =3Ω	-	10.7	-	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> =10V, V <sub>DS</sub> =20V, I <sub>D</sub> =20A	-	69	-	nC
<b>Q<sub>gs</sub></b>	Gate-Source Charge					
<b>Q<sub>gd</sub></b>	Gate-Drain Charge					
<b>Source-Drain Characteristics</b>						
<b>V<sub>SD</sub></b> <sup>④</sup>	Diode Forward Voltage	I <sub>SD</sub> =10A, V <sub>GS</sub> =0V	-	0.72	1.1	V
<b>t<sub>rr</sub></b>	Reverse Recovery Time	I <sub>F</sub> =20A, V <sub>R</sub> =20V	-	48.6	-	nS
<b>Q<sub>rr</sub></b>	Reverse Recovery Charge	diF/dt=100A/μs	-	35.5	-	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

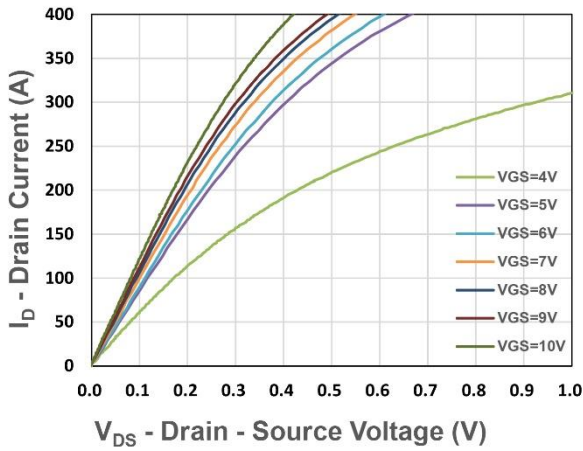


Figure 1. Output Characteristics

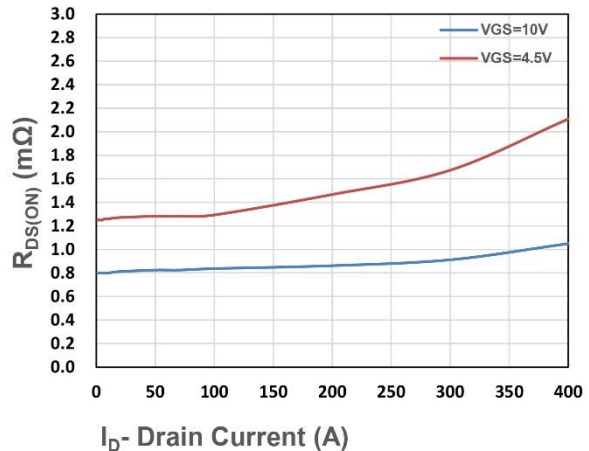


Figure 2. On-Resistance vs. ID

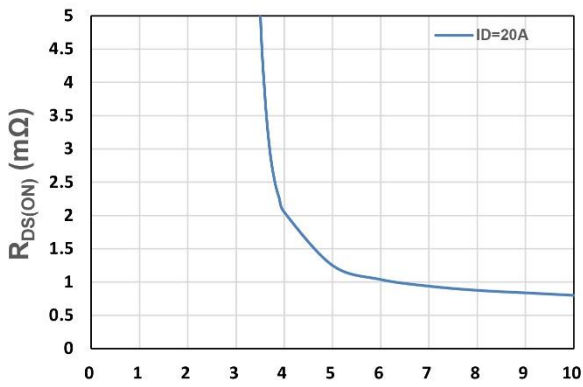


Figure 3. On-Resistance vs. VGS

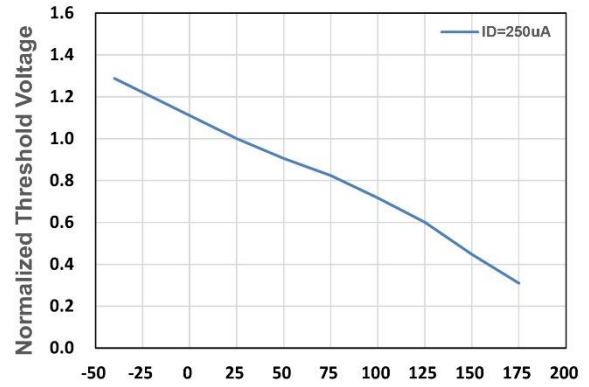


Figure 4. Gate Threshold Voltage

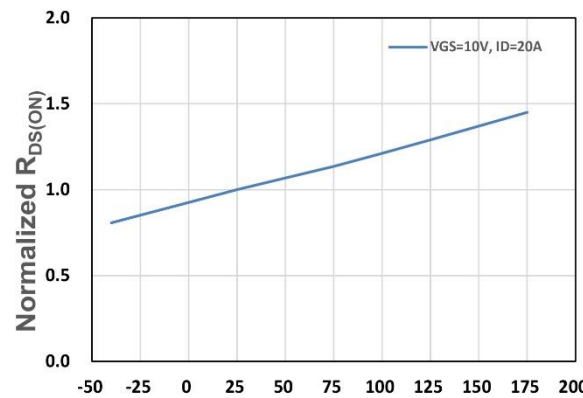


Figure 5. Drain-Source On Resistance

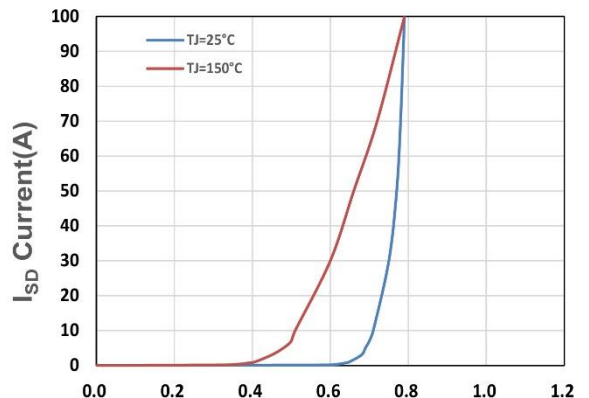
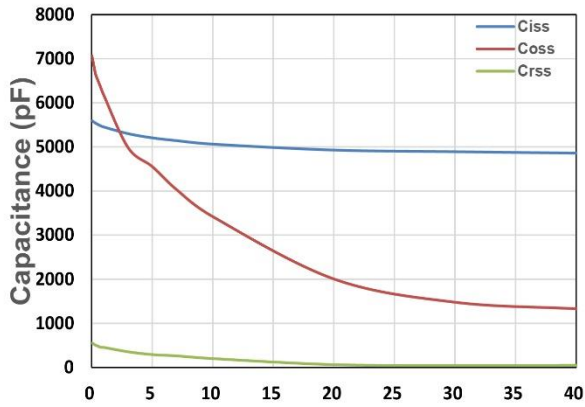
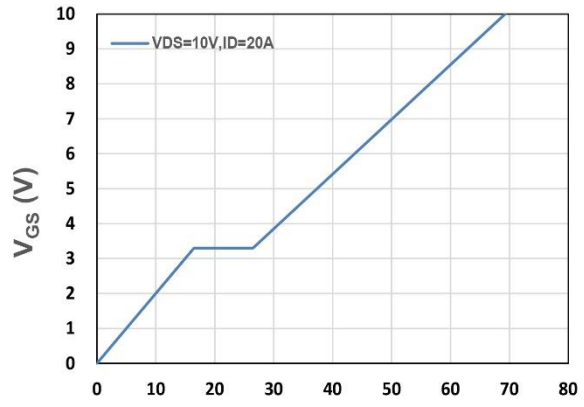


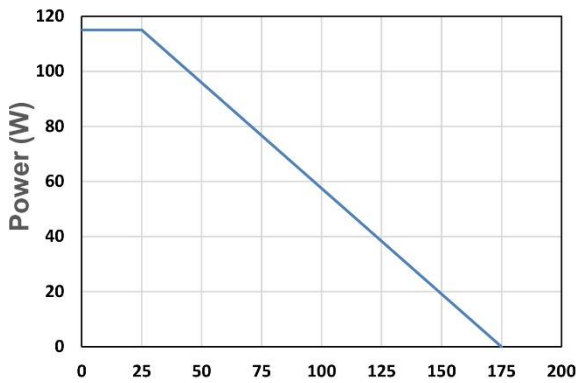
Figure 6. Source-Drain Diode Forward



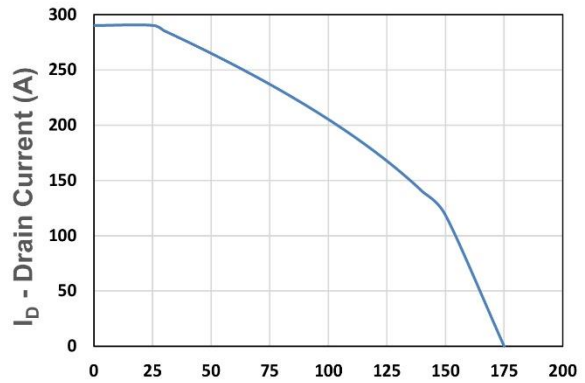
V<sub>DS</sub> - Drain - Source Voltage (V)  
Figure 7. Capacitance



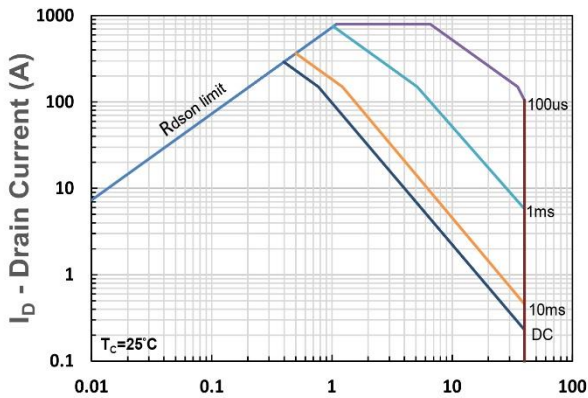
Q<sub>g</sub>, Total Gate Charge (nC)  
Figure 8. Gate Charge Characteristics



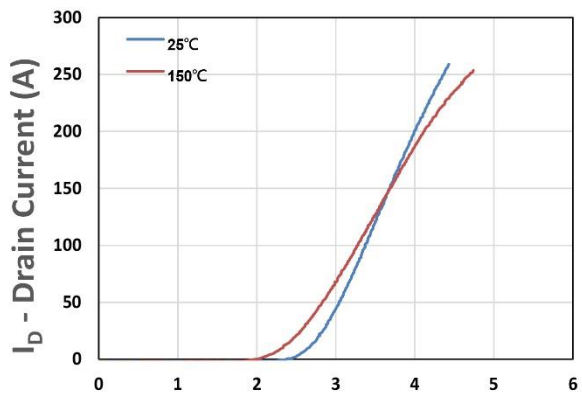
T<sub>c</sub> - Case Temperature (°C)  
Figure 9. Power Dissipation



T<sub>c</sub> - Case Temperature (°C)  
Figure 10. Drain Current



V<sub>DS</sub> - Drain-Source Voltage (V)  
Figure 11. Safe Operating Area



V<sub>GS</sub> - Gate - Source Voltage (V)  
Figure 12. Transfer Characteristics

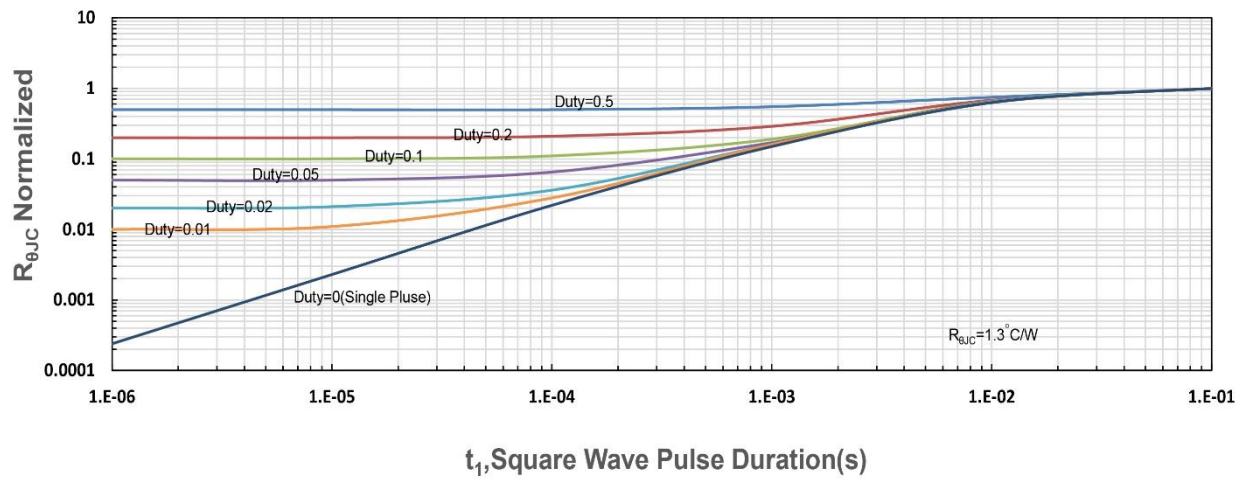


Figure 13.  $R_{\theta JC}$  Transient Thermal Impedance