




# Power MOSFETS


## DATASHEET

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**LM45012NAK8A**

N-Channel  
Enhancement Mode MOSFET

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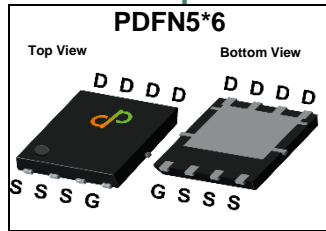


Quality Management Systems

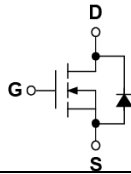
ISO 9001:2015 Certificate

## N-Channel Enhancement Mode MOSFET

### Pin Description



### Symbol



### Product Summary

Symbol	N-Channel	Unit
$V_{DSS}$	45	V
$R_{DS(ON)-Max}$	1.2	m $\Omega$
ID	224	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
LM45012NAK8A	PDFN5*6	Tape & Reel	5000 / Tape & Reel	45012 □□□□□□

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	45	V
$V_{GSS}$	Gate-Source Voltage	±20	V
$T_J$	Maximum Junction Temperature	150	°C
$T_{STG}$	Storage Temperature Range	-55 to 150	°C
$I_S$	Diode Continuous Forward Current	$T_C=25^\circ C$ 98	A
$I_{SP}$	Diode Pulse Current	$T_C=25^\circ C$ 400 <sup>①</sup>	A
$I_{DM}$	Pulse Drain Current Tested	$T_C=25^\circ C$ 800 <sup>①</sup>	A
$I_D$	Continuous Drain Current	$T_C=25^\circ C$ 224 $T_C=100^\circ C$ 141	A
$P_D$	Maximum Power Dissipation	$T_C=25^\circ C$ 96 $T_C=100^\circ C$ 39	W
$I_D$	Continuous Drain Current	$T_A=25^\circ C$ 33 $T_A=70^\circ C$ 26	A
$P_D$	Maximum Power Dissipation	$T_A=25^\circ C$ 2.1 $T_A=70^\circ C$ 1.3	W
$I_{AS}^{②}$	Avalanche Current, Single pulse	L=0.1mH 64 L=0.5mH 34	A
$E_{AS}^{②}$	Avalanche Energy, Single pulse	L=0.1mH 204 L=0.5mH 290	mJ

### 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 junction temperature.

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	45	-	-	V
<b>I<sub>DSS</sub></b>	Zero Gate Voltage Drain Current	V <sub>DS</sub> =36V, 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	1.2	2	2.5	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	-	0.95	1.2	mΩ
		V <sub>GS</sub> =4.5V, I <sub>DS</sub> =10A	-	1.6	2.1	
<b>gfs</b>	Forward Transconductance	V <sub>DS</sub> =5V, I <sub>DS</sub> =10A	-	48	-	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	-	0.95	-	Ω
<b>C<sub>iss</sub></b>	Input Capacitance	V <sub>GS</sub> =0V, V <sub>DS</sub> =20V, Freq.=1MHz	-	5828	-	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> =22.5V, I <sub>D</sub> =1A, R <sub>GEN</sub> =1Ω	-	15.3	-	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> =22.5V, I <sub>D</sub> =20A	-	87.2	-	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	-	0.7	1.1	V
<b>t<sub>rr</sub></b>	Reverse Recovery Time	I <sub>F</sub> =10A, V <sub>R</sub> =22.5V	-	45.1	-	nS
<b>Q<sub>rr</sub></b>	Reverse Recovery Charge	diF/dt=100A/μs	-	39	-	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

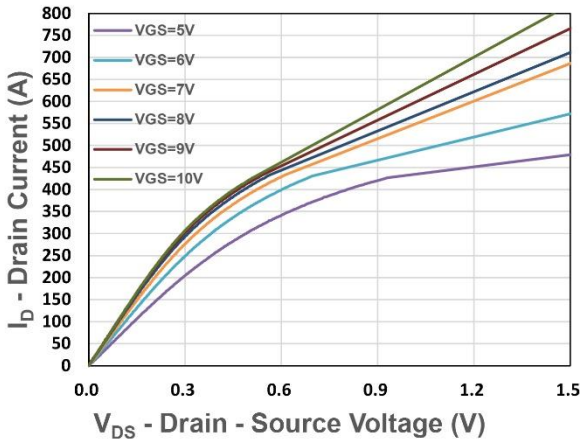


Figure 1. Output Characteristics

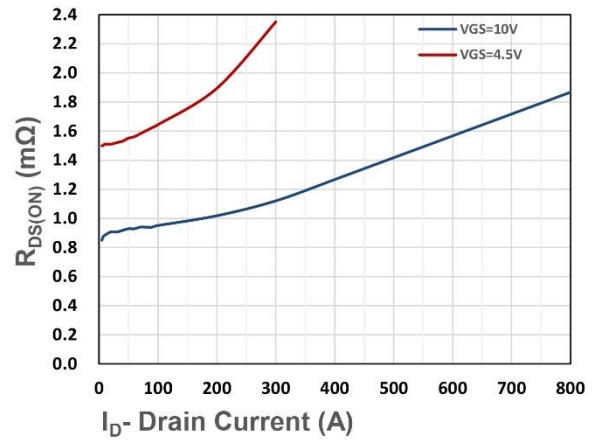


Figure 2. On-Resistance vs. ID

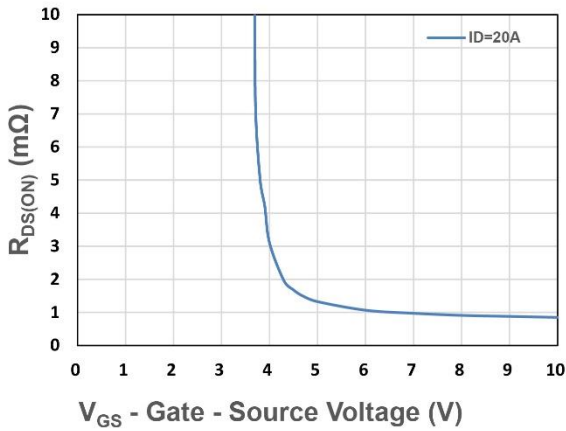


Figure 3. On-Resistance vs. VGS

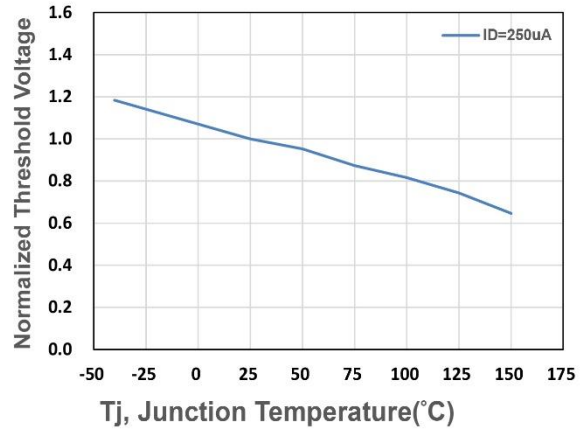


Figure 4. Gate Threshold Voltage

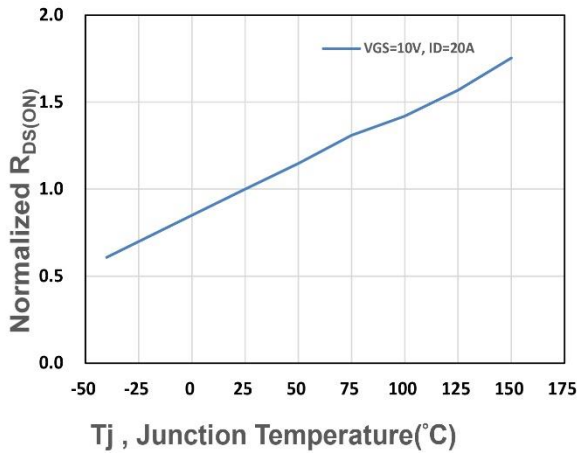


Figure 5. Drain-Source On Resistance

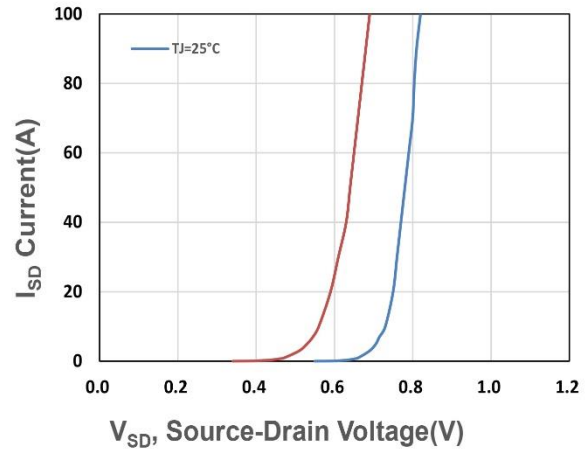
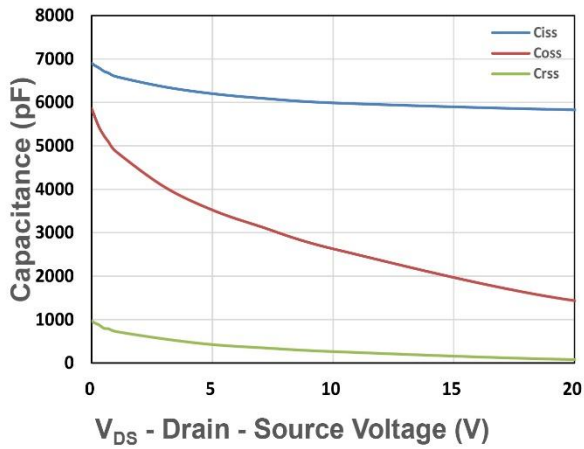
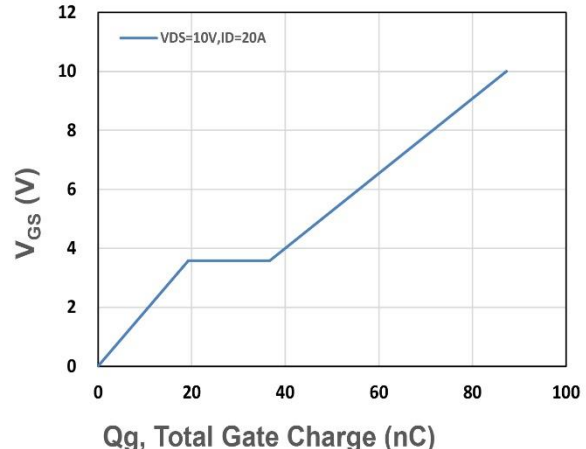


Figure 6. Source-Drain Diode Forward



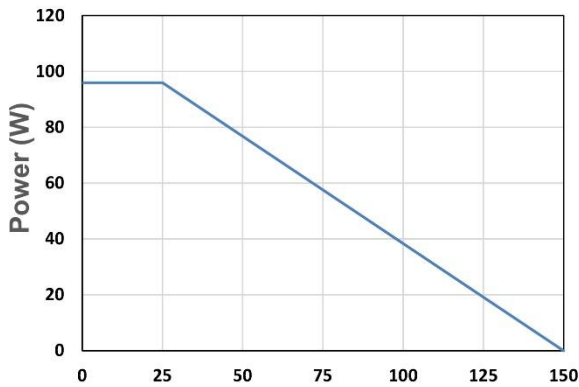
V<sub>DS</sub> - Drain - Source Voltage (V)

Figure 7. Capacitance



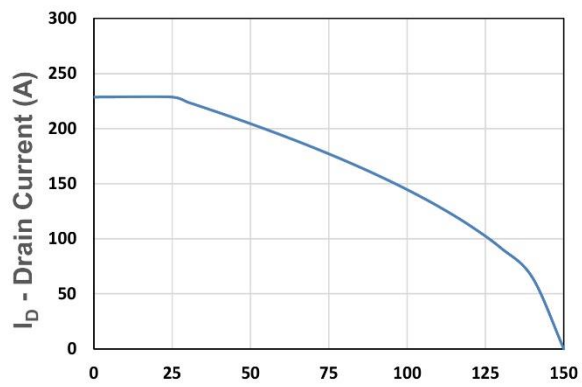
Q<sub>g</sub>, Total Gate Charge (nC)

Figure 8. Gate Charge Characteristics



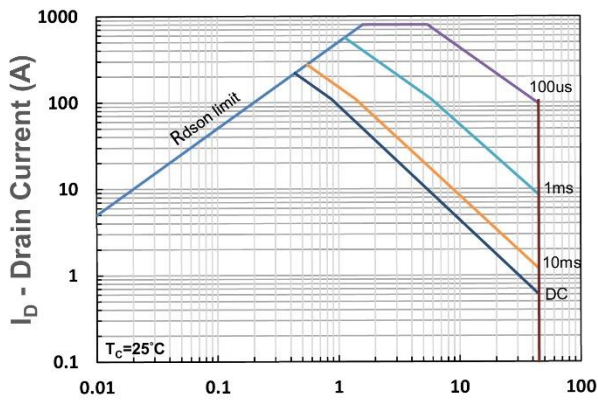
T<sub>c</sub> - Case Temperature (°C)

Figure 9. Power Dissipation



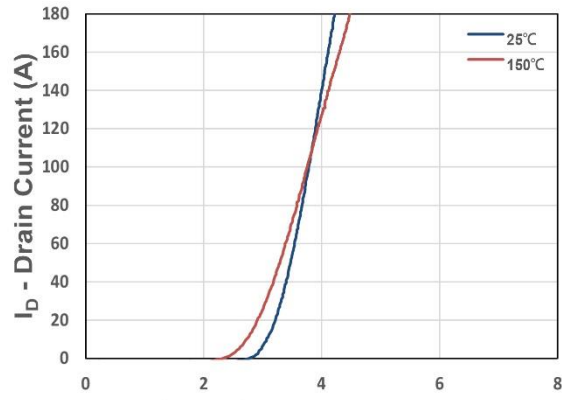
T<sub>c</sub> - Case Temperature (°C)

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

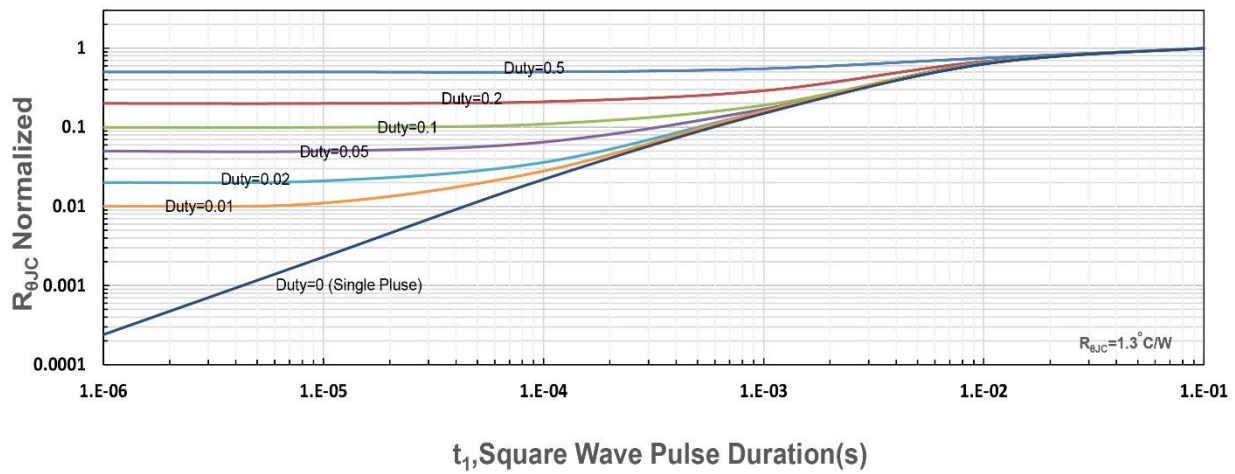


Figure 13.  $R_{\theta JC}$  Transient Thermal Impedance