




# Power MOSFETS


## DATASHEET


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**LM40013NAM8A**

N-Channel  
Enhancement Mode MOSFET

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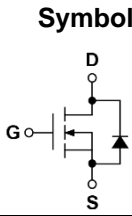
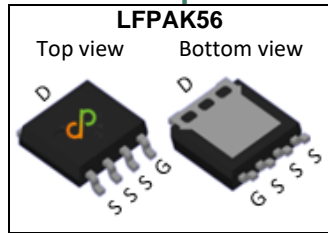


Quality Management Systems

ISO 9001:2015 Certificate

## N-Channel Enhancement Mode MOSFET

### Pin Description



### Product Summary

Symbol	N-Channel	Unit
$V_{DSS}$	40	V
$R_{DS(ON)-Max}$	1.2	m $\Omega$
ID	276	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
LM40013NAM8A	LFPK56	Tape & Reel	4000 / Tape & Reel	40013 □□□□□□

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	$T_C=25^\circ C$ 75	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	$T_C=25^\circ C$ 276	A
		$T_C=100^\circ C$ 195	
$P_D$	Maximum Power Dissipation	$T_C=25^\circ C$ 125	W
		$T_C=100^\circ C$ 62.5	
$I_D$	Continuous Drain Current	$T_A=25^\circ C$ 45	A
		$T_A=70^\circ C$ 38	
$P_D$	Maximum Power Dissipation	$T_A=25^\circ C$ 3.3	W
		$T_A=70^\circ C$ 2.3	
$I_{AS}^{②}$	Avalanche Current, Single pulse	L=0.1mH 48	A
		L=0.5mH 25	
$E_{AS}^{②}$	Avalanche Energy, Single pulse	L=0.1mH 115	mJ
		L=0.5mH 156	

### Thermal Characteristics

Symbol	Parameter	Rating	Unit
$R_{\theta JC}$	Thermal Resistance-Junction to Case	Steady State	1.2
$R_{\theta JA}^{③}$	Thermal Resistance-Junction to Ambient	Steady State	45

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

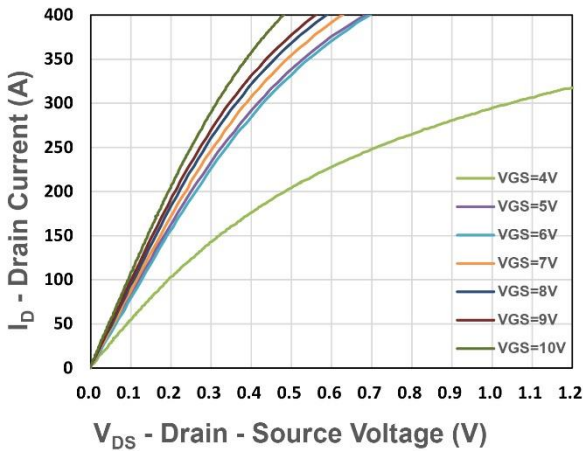
## N-Channel Electrical Characteristics (T<sub>J</sub>=25°C Unless Otherwise Noted)

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><sup>④</sup></b>	Drain-Source On-state Resistance	V <sub>GS</sub> =10V, I <sub>DS</sub> =20A	-	1.0	1.2	mΩ
		V <sub>GS</sub> =4.5V, I <sub>DS</sub> =10A	-	1.6	2	
<b>gfs</b>	Forward Transconductance	V <sub>DS</sub> =5V, I <sub>DS</sub> =10A	-	48	-	S
<b>Dynamic Characteristics<sup>®</sup></b>						
<b>R<sub>G</sub></b>	Gate Resistance	V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, Freq.=1MHz	-	1.3	-	Ω
<b>C<sub>iss</sub></b>	Input Capacitance	V <sub>GS</sub> =0V, V <sub>DS</sub> =20V, Freq.=1MHz	-	4930	-	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	-	10.5	-	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	-	70	-	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><sup>④</sup></b>	Diode Forward Voltage	I <sub>SD</sub> =10A, V <sub>GS</sub> =0V	-	0.75	1.1	V
<b>t<sub>rr</sub></b>	Reverse Recovery Time	I <sub>F</sub> =20A, V <sub>R</sub> =20V	-	48.8	-	nS
<b>Q<sub>rr</sub></b>	Reverse Recovery Charge	di <sub>F</sub> /dt=100A/μs	-	35.8	-	nC

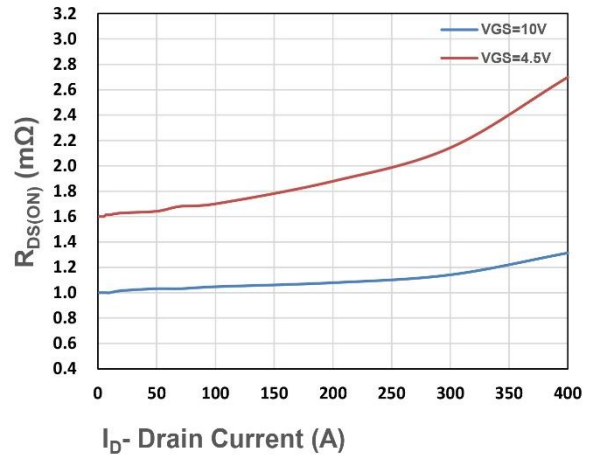
Note ④ : Pulse test (pulse width≤300us, duty cycle≤2%).

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

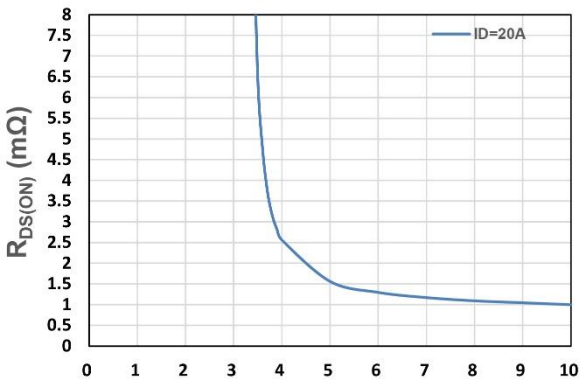
## N-Channel Typical Characteristics



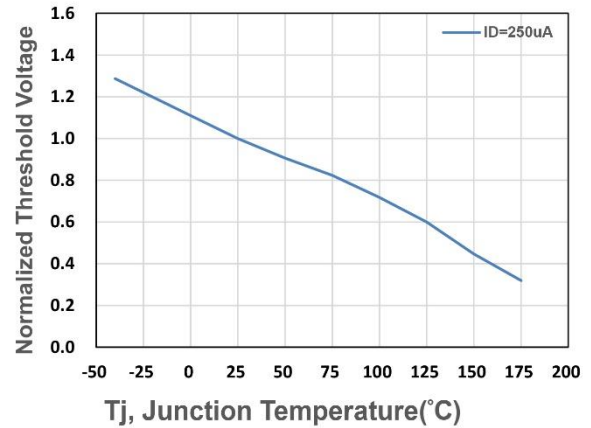
$V_{DS}$  - Drain - Source Voltage (V)  
Figure 1. Output Characteristics



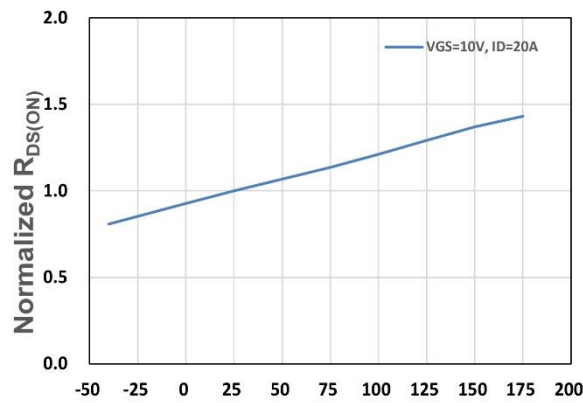
$I_D$ - Drain Current (A)  
Figure 2. On-Resistance vs. ID



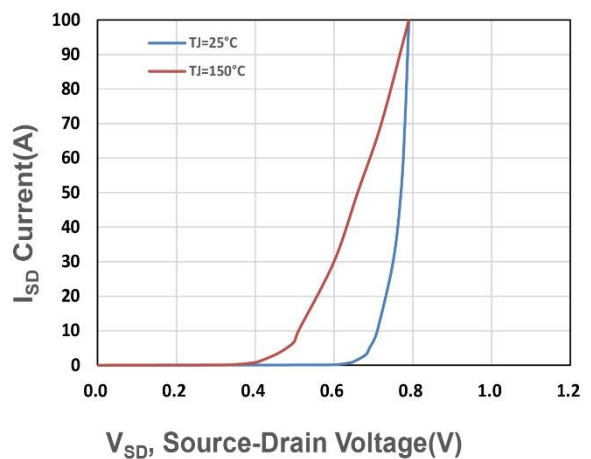
$V_{GS}$  - Gate - Source Voltage (V)  
Figure 3. On-Resistance vs. VGS



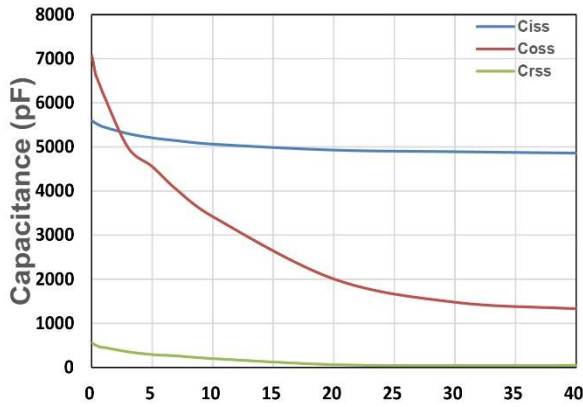
$T_j$ , Junction Temperature( $^{\circ}C$ )  
Figure 4. Gate Threshold Voltage



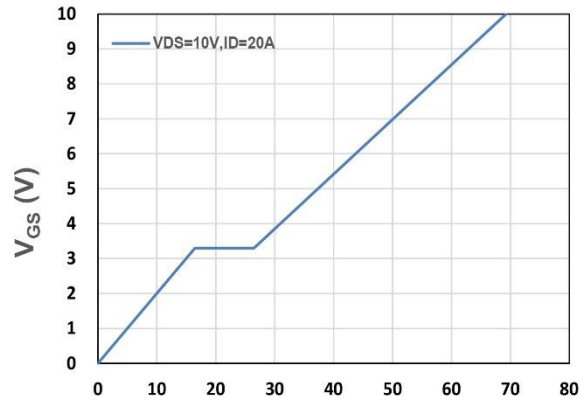
$T_j$ , Junction Temperature( $^{\circ}C$ )  
Figure 5. Drain-Source On Resistance



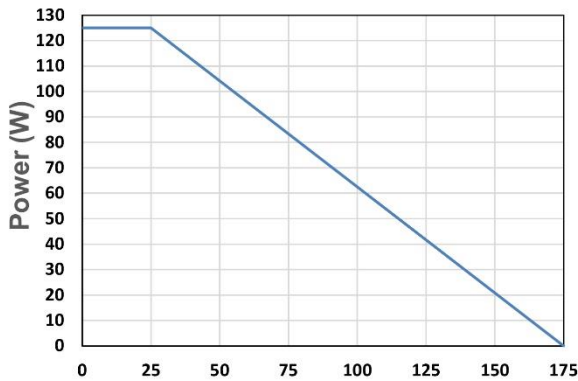
$V_{SD}$ , Source-Drain Voltage(V)  
Figure 6. Source-Drain Diode Forward



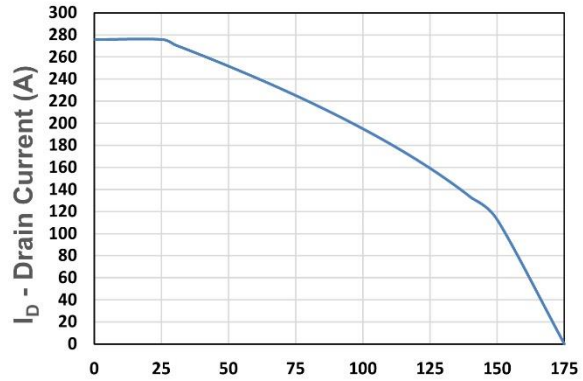
$V_{DS}$  - Drain - Source Voltage (V)  
Figure 7. Capacitance



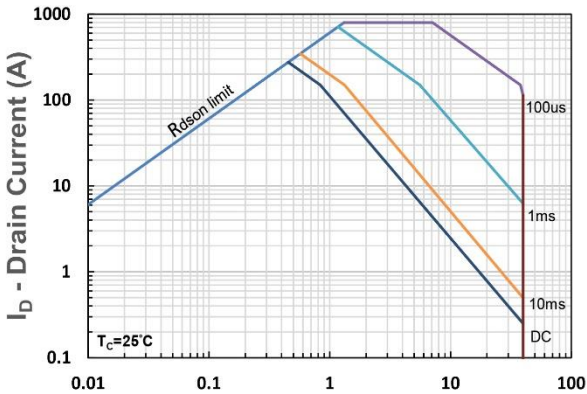
$Q_g$ , Total Gate Charge (nC)  
Figure 8. Gate Charge Characteristics



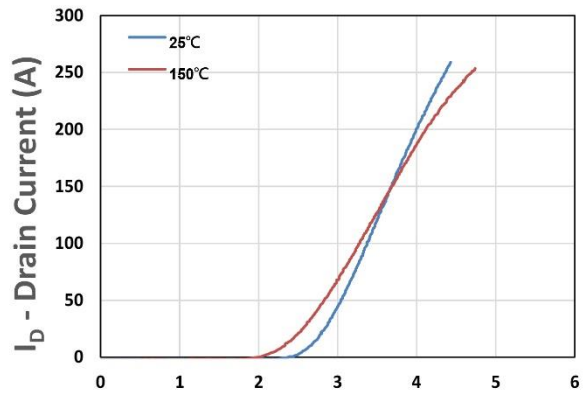
$T_c$  - Case Temperature ( $^{\circ}C$ )  
Figure 9. Power Dissipation



$T_c$  - Case Temperature ( $^{\circ}C$ )  
Figure 10. Drain Current



$V_{DS}$  - Drain-Source Voltage (V)  
Figure 11. Safe Operating Area



$V_{GS}$  - Gate - Source Voltage (V)  
Figure 12. Transfer Characteristics

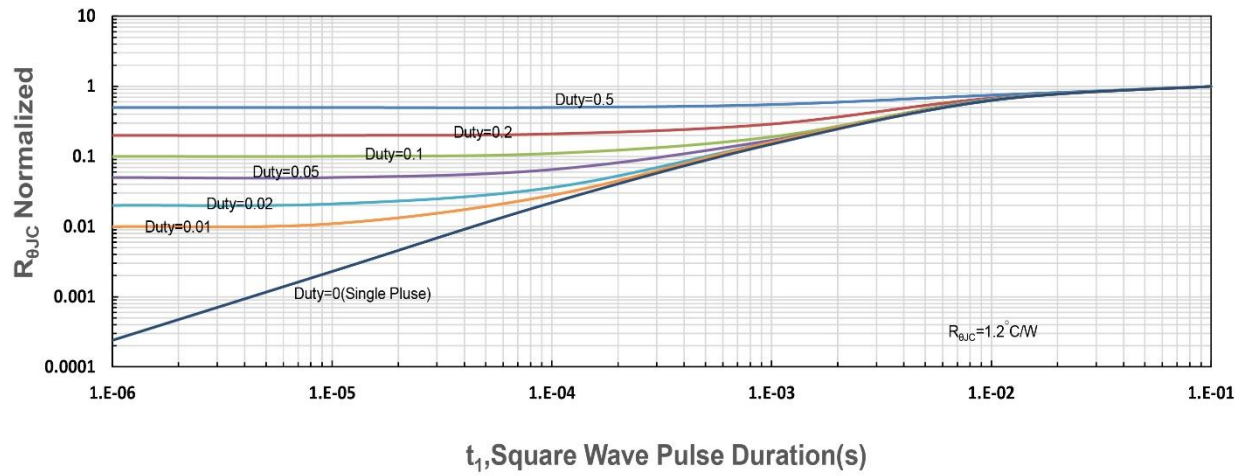


Figure 13.  $R_{\theta JC}$  Transient Thermal Impedance