



# Power MOSFETS

## DATASHEET

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**LM60068NAK8A**

N-Channel  
Enhancement Mode MOSFET



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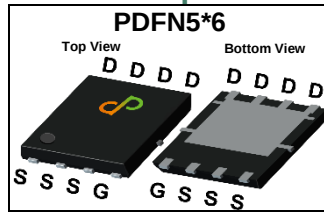


Quality Management Systems

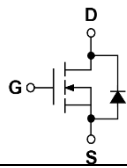
ISO 9001:2015 Certificate

## N-Channel Enhancement Mode MOSFET

### Pin Description



### Symbol



### Product Summary

| Symbol           | N-Channel | Unit |
|------------------|-----------|------|
| $V_{DSS}$        | 60        | V    |
| $R_{DS(ON)-Max}$ | 6.6       | mΩ   |
| $I_D$            | 72        | A    |

### Feature

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

### Applications

- DC/DC converter

### Ordering Information

| Orderable Part Number | Package Type | Form        | Shipping           | Marking         |
|-----------------------|--------------|-------------|--------------------|-----------------|
| LM60068NAK8A          | PDFN5*6      | Tape & Reel | 5000 / Tape & Reel | 60068<br>□□□□□□ |

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              | $\pm 20$                                                       | V                |
| $T_J$          | Maximum Junction Temperature     | 150                                                            | $^\circ\text{C}$ |
| $T_{STG}$      | Storage Temperature Range        | -55 to 150                                                     | $^\circ\text{C}$ |
| $I_{DM}$       | Pulse Drain Current Tested       | $T_C=25^\circ\text{C}$<br>180                                  | A                |
| $I_S$          | Diode Continuous Forward Current | $T_C=25^\circ\text{C}$<br>17                                   | A                |
| $I_D^{(1)}$    | Continuous Drain Current         | $T_C=25^\circ\text{C}$<br>72<br>$T_C=100^\circ\text{C}$<br>46  | A                |
| $P_D$          | Maximum Power Dissipation        | $T_C=25^\circ\text{C}$<br>50<br>$T_C=100^\circ\text{C}$<br>20  | W                |
| $I_D^{(2)}$    | Continuous Drain Current         | $T_A=25^\circ\text{C}$<br>16<br>$T_A=70^\circ\text{C}$<br>13   | A                |
| $P_D^{(2)}$    | Maximum Power Dissipation        | $T_A=25^\circ\text{C}$<br>2.5<br>$T_A=70^\circ\text{C}$<br>1.6 | W                |
| $I_{AS}^{(3)}$ | Avalanche Current, Single pulse  | $L=0.1\text{mH}$<br>30<br>$L=0.5\text{mH}$<br>18               | A                |
| $E_{AS}^{(3)}$ | Avalanche Energy, Single pulse   | $L=0.1\text{mH}$<br>45<br>$L=0.5\text{mH}$<br>81               | mJ               |

### Thermal Characteristics

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

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

Note ② : Surface Mounted on 1in<sup>2</sup> FR-4 board with 1oz.

Note ③ : UIS tested and pulse width are limited by maximum junction temperature 150 $^\circ\text{C}$

**N-Channel Electrical Characteristics** ( $T_J=25^{\circ}\text{C}$  Unless Otherwise Noted)

| Symbol                            | Parameter                        | Test Conditions                                                                       | Min. | Typ. | Max. | Unit |
|-----------------------------------|----------------------------------|---------------------------------------------------------------------------------------|------|------|------|------|
| Static Electrical Characteristics |                                  |                                                                                       |      |      |      |      |
| BV <sub>DSS</sub>                 | Drain-Source Breakdown Voltage   | V <sub>GS</sub> =0V, I <sub>DS</sub> =250uA                                           | 60   | -    | -    | V    |
| I <sub>DSS</sub>                  | Zero Gate Voltage Drain Current  | V <sub>DS</sub> =48V, V <sub>GS</sub> =0V                                             | -    | -    | 1    | uA   |
| V <sub>GS(th)</sub>               | Gate Threshold Voltage           | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>DS</sub> =250uA                             | 1    | 1.7  | 2.5  | V    |
| I <sub>GSS</sub>                  | Gate Leakage Current             | V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V                                            | -    | -    | ±100 | nA   |
| R <sub>DS(ON)</sub> ④             | Drain-Source On-state Resistance | V <sub>GS</sub> =10V, I <sub>DS</sub> =20A                                            | -    | 5.4  | 6.6  | mΩ   |
|                                   |                                  | V <sub>GS</sub> =4.5V, I <sub>DS</sub> =10A                                           | -    | 8.2  | 10.5 |      |
| gfs                               | Forward Transconductance         | V <sub>DS</sub> =5V, I <sub>DS</sub> =10A                                             | -    | 21   | -    | S    |
| Dynamic Characteristics ⑥         |                                  |                                                                                       |      |      |      |      |
| R <sub>G</sub>                    | Gate Resistance                  | V <sub>GS</sub> =0V,V <sub>DS</sub> =0V,<br>Freq.=1MHz                                | -    | 1.2  | 3    | Ω    |
| C <sub>iss</sub>                  | Input Capacitance                | V <sub>GS</sub> =0V,<br>V <sub>DS</sub> =30V,<br>Freq.=1MHz                           | -    | 1609 | -    | pF   |
| C <sub>oss</sub>                  | Output Capacitance               |                                                                                       | -    | 484  | -    |      |
| C <sub>rss</sub>                  | Reverse Transfer Capacitance     |                                                                                       | -    | 77   | -    |      |
| td(ON)                            | Turn-on Delay Time               | V <sub>GS</sub> =10V,V <sub>DS</sub> =30V,<br>I <sub>D</sub> =1A,R <sub>GEN</sub> =1Ω | -    | 10.9 | -    | nS   |
| t <sub>r</sub>                    | Turn-on Rise Time                |                                                                                       | -    | 6.9  | -    |      |
| t <sub>d(OFF)</sub>               | Turn-off Delay Time              |                                                                                       | -    | 24.9 | -    |      |
| t <sub>f</sub>                    | Turn-off Fall Time               |                                                                                       | -    | 37.4 | -    |      |
| Q <sub>g</sub>                    | Total Gate Charge                | V <sub>GS</sub> =4.5V,V <sub>DS</sub> =30V<br>I <sub>D</sub> =20A                     | -    | 18.8 | -    | nC   |
| Q <sub>g</sub>                    | Total Gate Charge                | V <sub>GS</sub> =10V,V <sub>DS</sub> =30V,<br>I <sub>D</sub> =20A                     | -    | 37   | -    |      |
| Q <sub>gs</sub>                   | Gate-Source Charge               |                                                                                       | -    | 7.25 | -    |      |
| Q <sub>gd</sub>                   | Gate-Drain Charge                |                                                                                       | -    | 8.49 | -    |      |
| Source-Drain Characteristics      |                                  |                                                                                       |      |      |      |      |
| V <sub>SD</sub> ④                 | Diode Forward Voltage            | I <sub>SD</sub> =10A, V <sub>GS</sub> =0V                                             | -    | 0.78 | 1.1  | V    |
| t <sub>rr</sub>                   | Reverse Recovery Time            | I <sub>F</sub> =10A, V <sub>R</sub> =30V                                              | -    | 21.9 | -    | nS   |
| Q <sub>rr</sub>                   | Reverse Recovery Charge          | dI <sub>F</sub> /dt=100A/μs                                                           | -    | 9.4  | -    | nC   |

Note ④ : Pulse test (pulse width $\leq 300\mu s$ , duty cycle $\leq 2\%$ ).

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

## N-Channel Typical Characteristics

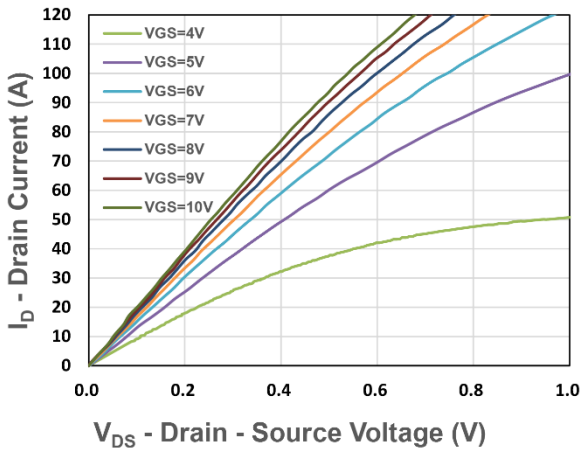


Figure 1. Output Characteristics

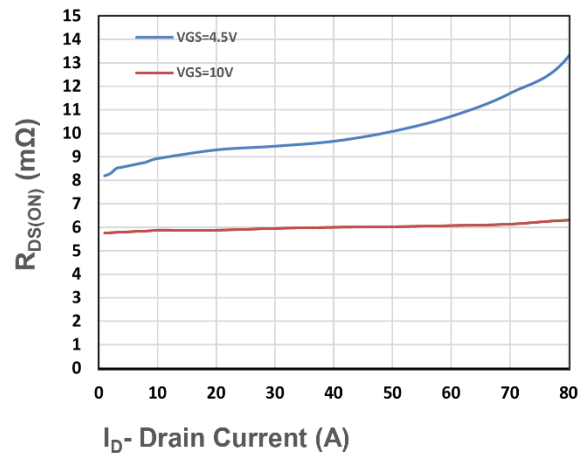


Figure 2. On-Resistance vs.  $I_D$

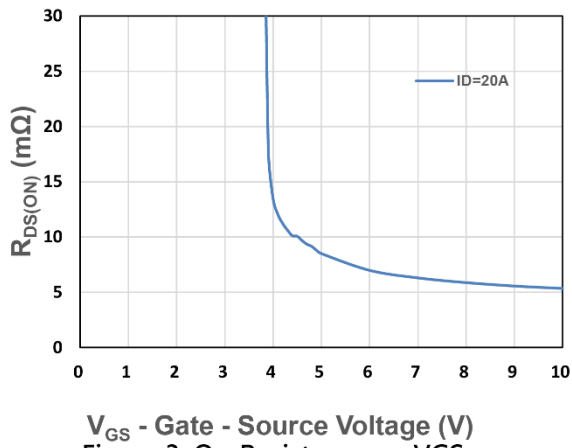


Figure 3. On-Resistance vs.  $V_{GS}$

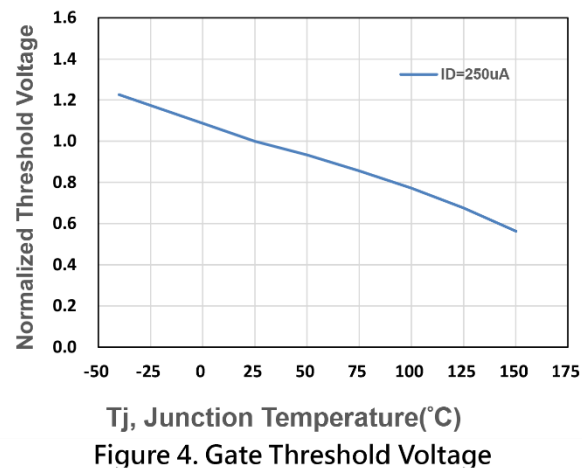


Figure 4. Gate Threshold Voltage

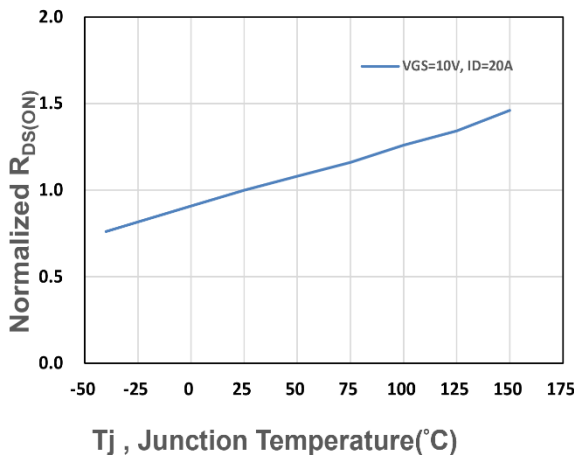


Figure 5. Drain-Source On Resistance

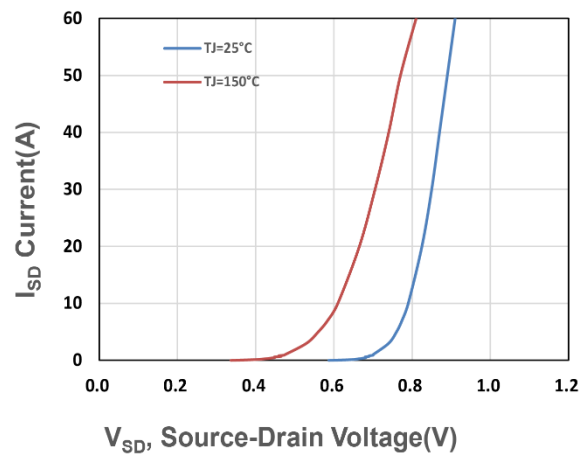


Figure 6. Source-Drain Diode Forward

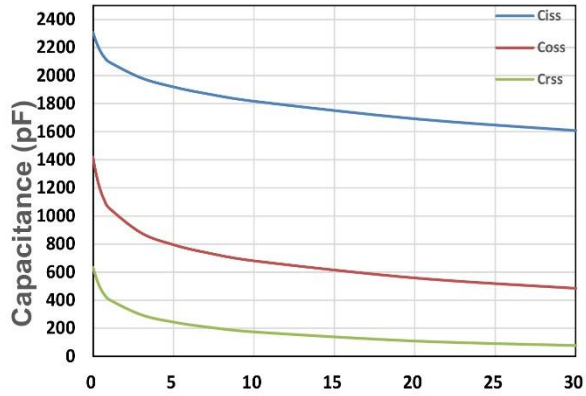


Figure 7. Capacitance

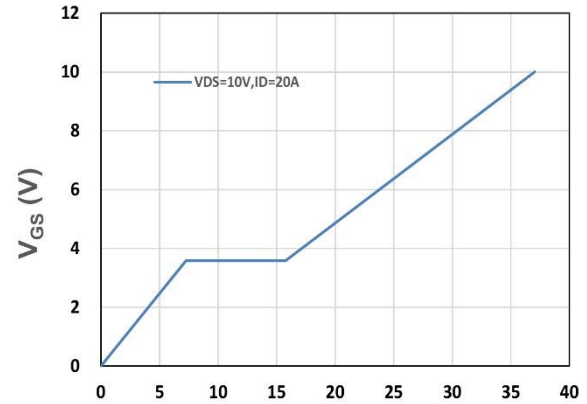


Figure 8. Gate Charge Characteristics

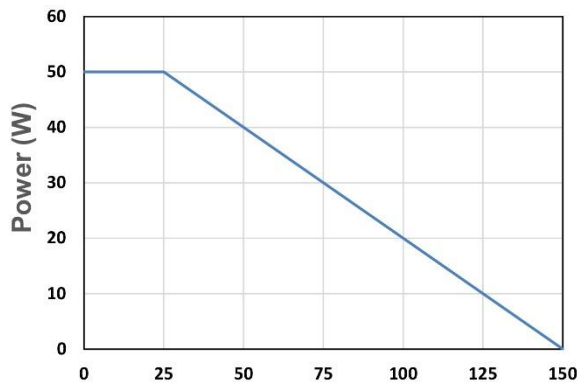


Figure 9. Power Dissipation

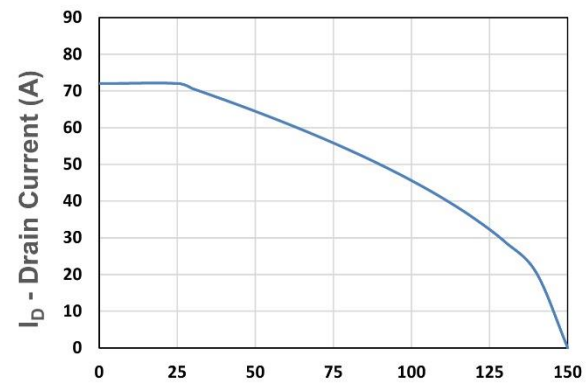


Figure 10. Drain Current

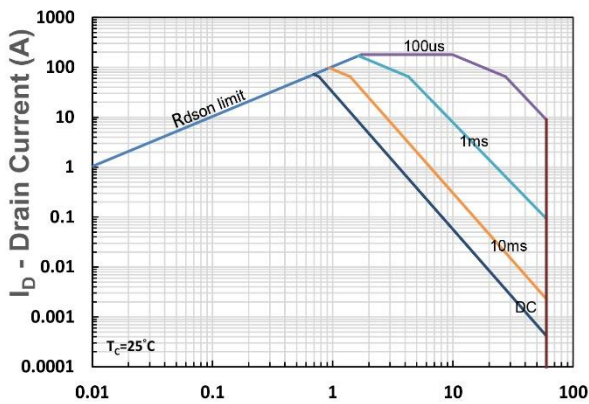


Figure 11. Safe Operating Area

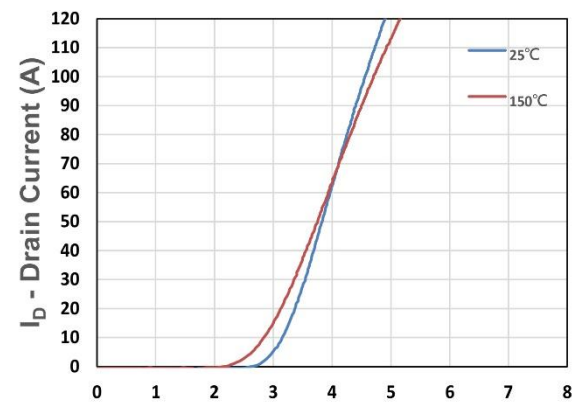


Figure 12. Transfer Characteristics

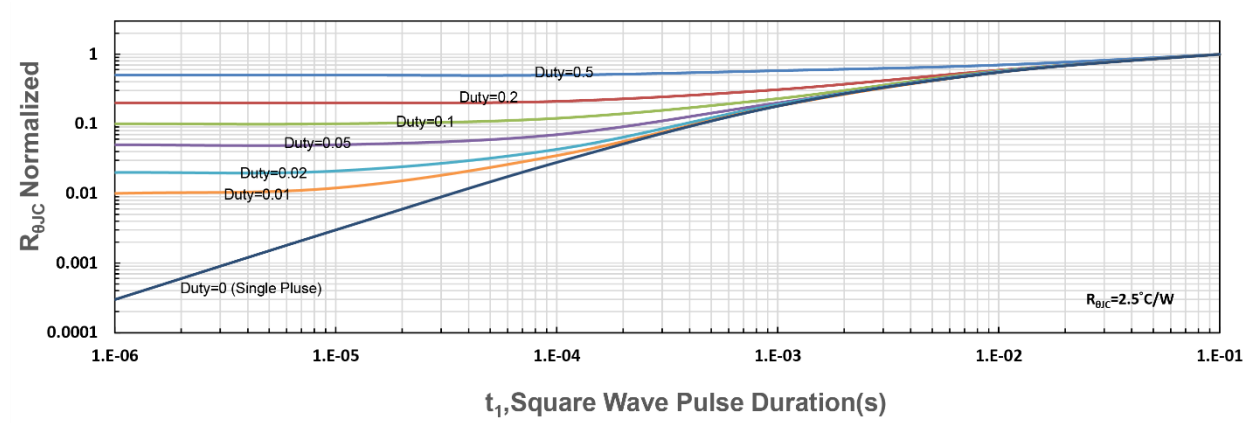


Figure 13.  $R_{\theta JC}$  Transient Thermal Impedance