

## 600V 12A N-Channel Enhancement Mode Power MOSFET

### Description

The AKQP12N60 is an N-Channel enhancement mode power MOSFET which using proprietary planar stripe and DMOS technology.

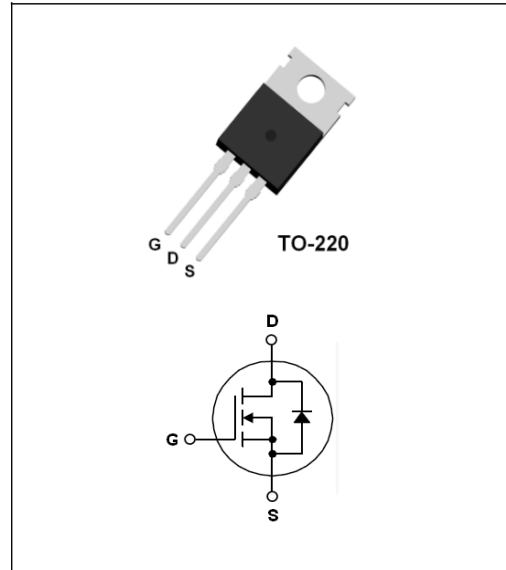
This MOSFET has low static on-resistance and high avalanche energy strength. This device provide excellent switching performance for UPS,DC-DC converters and AC-DC power supply.

### Features

- Low on-Resistance:  $R_{DS(on)}=0.50\Omega(\text{typ.})$
- Special Process Technology for high ESD Capability
- 100% Avalanche Test
- Good Stability and Uniformity with High  $E_{AS}$

### Applications

- UPS Applications
- DC-DC Converters and AC-DC Power Supply



### Absolute Maximum Ratings @ $T_C=25^\circ\text{C}$ unless otherwise noted

| Symbol    | Parameter                               | Ratings                 | Unit             |
|-----------|---|-------------------------|------------------|
| $V_{DSS}$ | Drain to Source Voltage                 | 600                     | V                |
| $V_{GSS}$ | Gate to Source Voltage                  | $\pm 30$                | V                |
| $I_D$     | Drain Current                           | $T_C=25^\circ\text{C}$  | 12               |
|           |   | $T_C=100^\circ\text{C}$ | 7.5              |
| $I_{DM}$  | Pulsed Drain Current (Note1)            | 48                      | A                |
| $P_D$     | Maximum Power Dissipation               | $T_C=25^\circ\text{C}$  | 225              |
|           | Derate above $25^\circ\text{C}$         |                         | 1.78             |
| $E_{AS}$  | Single Pulsed Avalanche Energy (Note 2) | 210                     | mJ               |
| $T_J$     | Operating Junction Temperature Range    | -55~+150                | $^\circ\text{C}$ |
| $T_{STG}$ | Storage Temperature Range               | -55~+150                | $^\circ\text{C}$ |

### Thermal Characteristics

| Symbol        | Parameter                               | Ratings | Unit                      |
|---------------|---|---------|---------------------------|
| $R_{th(J-C)}$ | Thermal Resistance, Junction to case    | 0.56    | $^\circ\text{C}/\text{W}$ |
| $R_{th(J-A)}$ | Thermal Resistance, Junction to Ambient | 62.5    | $^\circ\text{C}/\text{W}$ |

## Electrical Characteristics @T<sub>C</sub>=25 °C unless otherwise noted

| Symbol              | Parameter                         | Conditions   | Min. | Typ. | Max. | Unit |
|---------------------|-----------------------------------|--|------|------|------|------|
| BV <sub>DSS</sub>   | Drain to Source Breakdown Voltage | V <sub>GS</sub> =0V, I <sub>D</sub> =250uA               | 600  | -    | -    | V    |
| V <sub>GS(th)</sub> | Gate Threshold Voltage            | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250uA | 2.0  | -    | 4.0  | V    |
| R <sub>DS(on)</sub> | Static Drain-Source On-Resistance | V <sub>GS</sub> =10V, I <sub>D</sub> =6A                 | -    | 0.5  | 0.8  | Ω    |
| I <sub>DSS</sub>    | Zero Gate Voltage Drain Current   | V <sub>DS</sub> =600V, V <sub>GS</sub> =0V               | -    | -    | 1    | uA   |
| I <sub>GSS</sub>    | Gate to Source Leakage Current    | V <sub>GS</sub> =±30V, V <sub>DS</sub> =0V               | -    | -    | ±200 | nA   |

## D-S Diode Characteristics and Maximum Rating @T<sub>C</sub>=25 °C unless otherwise noted

| Symbol          | Parameter                                     | Conditions                                | Min. | Typ. | Max. | Unit |
|-----------------|---|---|------|------|------|------|
| I <sub>S</sub>  | Maximum Drain to Source Diode Forward Current |   | -    | -    | 12   | A    |
| V <sub>SD</sub> | Drain-Source Diode Forward Voltage            | V <sub>GS</sub> =0V, I <sub>S</sub> =12A  | -    | 0.83 | 1.2  | V    |
| t <sub>rr</sub> | Reverse Recovery Time                         | V <sub>GS</sub> =0V, I <sub>S</sub> =12A, | -    | 430  | -    | ns   |
| Q <sub>rr</sub> | Reverse Recovery Charge                       | di/dt=-100A/us                            | -    | 5.1  | -    | uC   |

## Switching Characteristics @T<sub>C</sub>=25 °C unless otherwise noted

| Symbol              | Parameter                    | Conditions   | Min. | Typ. | Max. | Unit |
|---------------------|------------------------------|--|------|------|------|------|
| t <sub>d(on)</sub>  | Turn-on Delay Time           | I <sub>D</sub> =12A,<br>V <sub>DD</sub> =300V,<br>R <sub>G</sub> =25Ω (Note 3) | -    | 30   | -    | ns   |
| t <sub>r</sub>      | Rising Time                  |  | -    | 82   | -    | ns   |
| t <sub>d(off)</sub> | Turn-off Delay Time          |  | -    | 135  | -    | ns   |
| t <sub>f</sub>      | Falling Time                 |  | -    | 85   | -    | ns   |
| C <sub>iss</sub>    | Input Capacitance            | V <sub>GS</sub> =0V, V <sub>DS</sub> =25V,<br>f=1.0MHz                         | -    | 1490 | -    | pF   |
| C <sub>oss</sub>    | Output Capacitance           |  | -    | 193  | -    | pF   |
| C <sub>rss</sub>    | Reverse Transfer Capacitance |  | -    | 22   | -    | pF   |
| Q <sub>g</sub>      | Total Gate Charge            | I <sub>D</sub> =12A,<br>V <sub>DS</sub> =480V<br>V <sub>GS</sub> =10V (Note 3) | -    | 43   | -    | nC   |
| Q <sub>gs</sub>     | Gate to Source Charge        |  | -    | 8.6  | -    | nC   |
| Q <sub>gd</sub>     | Gate to Drain Charge         |  | -    | 20.5 | -    | nC   |

### Note:

1. Repetitive rating: pulse-width limited by maximum junction temperature
2. L=2mH, V<sub>DD</sub>=100V, V<sub>G</sub>=10V, @T<sub>C</sub>=25 °C
3. Essentially independent of operating temperature typical characteristics

**Typical Performance Characteristics**

Fig. 1. Typical on-Region Characteristics

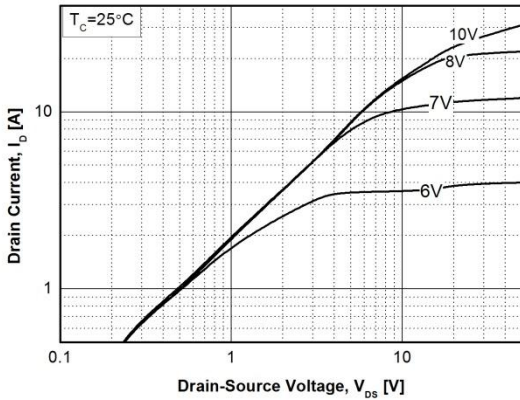


Fig. 2. Typical Transfer Characteristics

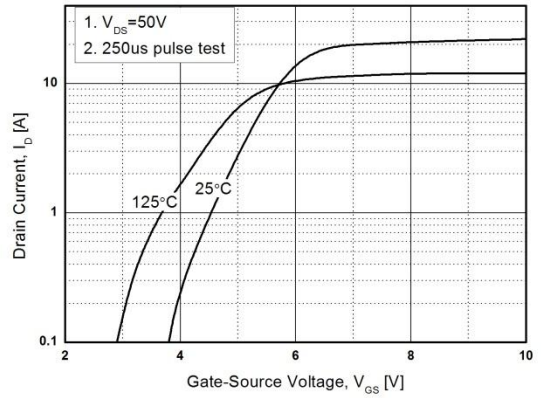


Fig. 3. Static on-Resistance vs.  $I_D$

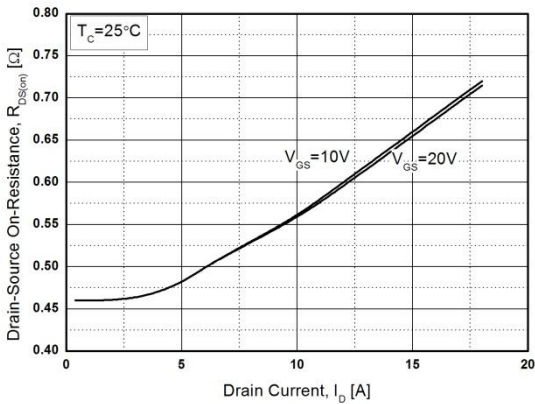


Fig. 4. Body Diode Forward Voltage vs.  $I_{DR}$

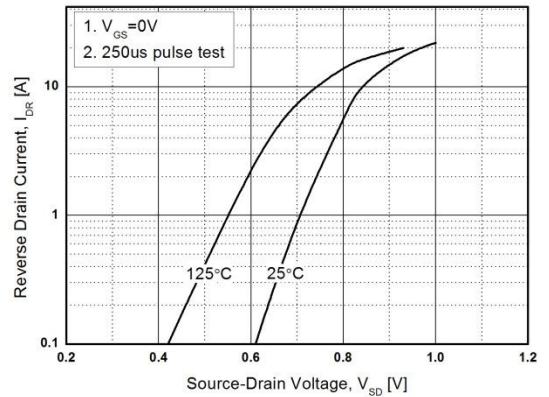


Fig. 5. Capacitance Characteristics

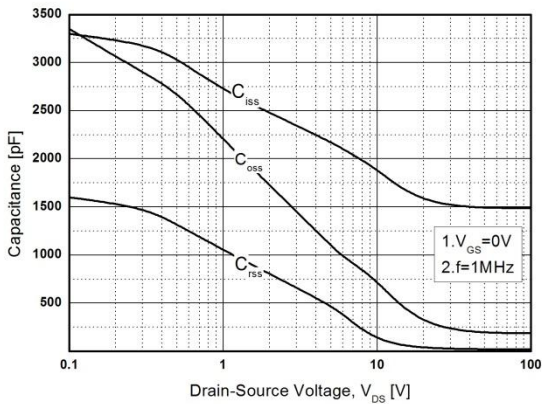
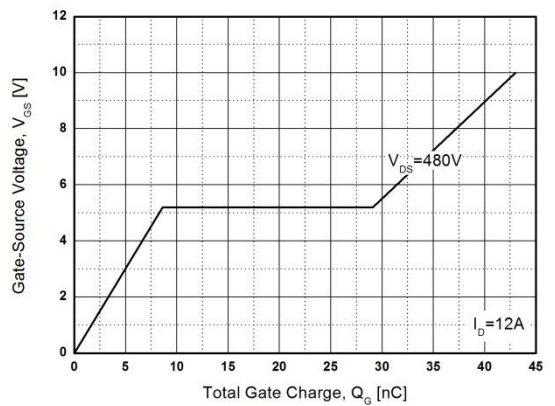


Fig. 6. Gate Charge Characteristics



**Typical Performance Characteristics**

Fig. 7. Breakdown Voltage vs. Temperature

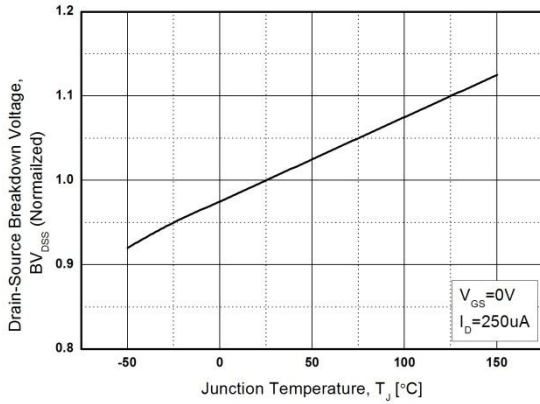


Fig. 8. Static on-Resistance vs. Temperature

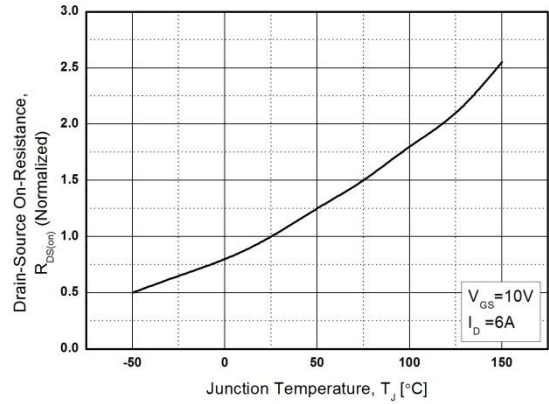


Fig. 9. Maximum Safe Operating Area

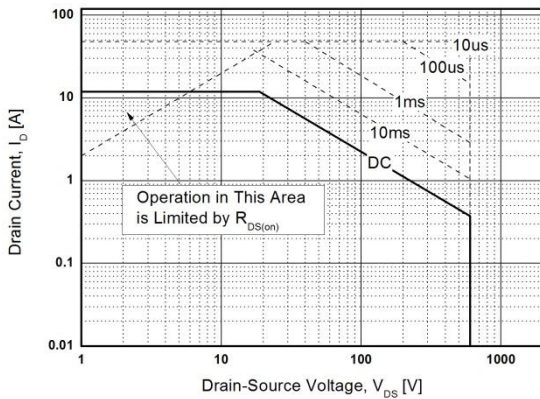


Fig. 10. Maximum Drain Current vs. Temperature

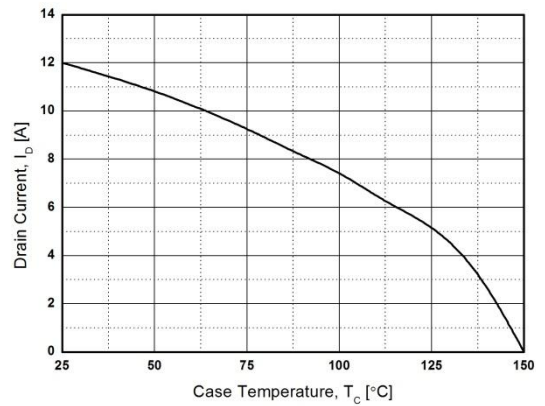
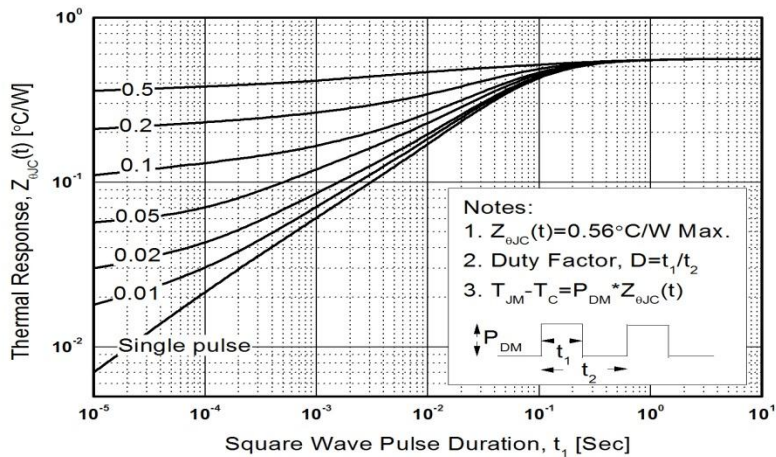


Fig. 11. Transient Thermal Response Curve



**Package Dimensions**

**TO-220**

(Dimensions in Millimeters)

