

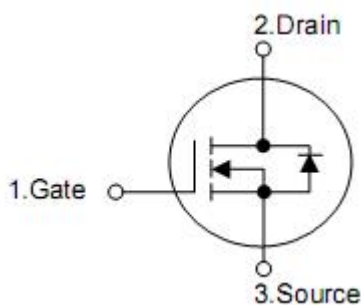
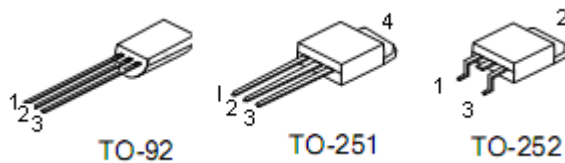
## 1. Description

The KIA1N60H N-Channel enhancement mode silicon gate power MOSFET is designed for high voltage, high speed power switching applications such as switching regulators, switching converters, solenoid, motor drivers, relay drivers.

## 2. Features

- n 1A, 600V,  $R_{DS(on)} = 9.3\Omega$  @  $V_{GS} = 10V$
- n Low gate charge ( typical 5.0nC)
- n High ruggedness
- n Fast switching capability
- n Avalanche energy specified
- n Improved dv/dt capability

## 3. Pin configuration



| Pin | Function |
|-----|----------|
| 1   | Gate     |
| 2   | Drain    |
| 3   | Source   |
| 4   | Drain    |

#### 4. Absolute maximum ratings

| (T <sub>C</sub> = 25 °C , unless otherwise noted) |                        |                  |          |       |       |       |
|---------------------------------------------------|------------------------|------------------|----------|-------|-------|-------|
| Parameter                                         |                        | Symbol           | Rating   |       |       | Unit  |
|                                                   |                        |                  | TO251    | TO252 | TO92  |       |
| Drain-source voltage                              |                        | V <sub>DSS</sub> | 600      |       |       | V     |
| Gate-source voltage                               |                        | V <sub>GSS</sub> | ±30      |       |       | V     |
| Drain current continuous                          | T <sub>C</sub> =25 °C  | I <sub>D</sub>   | 1.0      |       | 0.3*  | A     |
|                                                   | T <sub>C</sub> =100 °C |                  | 0.6      |       | 0.18* | A     |
| Drain current pulsed (note 1)                     |                        | I <sub>DP</sub>  | 4.0      |       | 1.0*  | A     |
| Repetitive avalanche energy (note 1)              |                        | E <sub>AR</sub>  | 2.8      |       | 0.3   | mJ    |
| Single pulsed avalanche energy (note 2)           |                        | E <sub>AS</sub>  | 33       |       | 33    | mJ    |
| Peak diode recovery dv/dt (note 3)                |                        | dv/dt            | 4.5      |       |       | V/ns  |
| Total Power dissipation                           | T <sub>C</sub> =25 °C  | P <sub>D</sub>   | 28       |       | 1.0   | W     |
|                                                   | derate above 25 °C     | P <sub>D</sub>   | 0.22     |       | 0.02  | W/ °C |
| Junction temperature                              |                        | T <sub>J</sub>   | +150     |       |       | °C    |
| Stroage temperature                               |                        | T <sub>STG</sub> | -55~+150 |       |       | °C    |

\*Drain current limited by maximum junction temperature

#### 5. Thermal characteristics

| Parameter                             | Symbol            | Ratings   |       |      | Unit |
|---------------------------------------|-------------------|-----------|-------|------|------|
|                                       |                   | TO251     | TO252 | TO92 |      |
| Thermal resistance, junction -ambient | R <sub>thJA</sub> | 50* (110) |       | 140  | °C/W |
| Thermal resistance, case-to-sink typ  | R <sub>thCS</sub> | -         |       | -    |      |
| Thermal resistance, junction -case    | R <sub>thJC</sub> | 4.53      |       | 50   |      |

## 6. Electrical characteristics

(T<sub>C</sub>=25°C, unless otherwise noted)

| Parameter                                              | Symbol                              | Test conditions                                                                         |             | Min | Typ  | Max  | Unit |
|--------------------------------------------------------|-------------------------------------|-----------------------------------------------------------------------------------------|-------------|-----|------|------|------|
| Off characteristics                                    |                                     |                                                                                         |             |     |      |      |      |
| Drain-source breakdown voltage                         | BV <sub>DSS</sub>                   | V <sub>GS</sub> =0V, I <sub>D</sub> =250μA                                              |             | 600 | -    | -    | V    |
| Breakdown voltage temperature coefficient              | ΔBV <sub>DSS</sub> /ΔT <sub>J</sub> | I <sub>D</sub> =250μA                                                                   |             | -   | 0.6  | -    | V/°C |
| Zero gate voltage drain current                        | I <sub>DSS</sub>                    | V <sub>GS</sub> =0V, V <sub>DS</sub> =600V                                              | TO251,TO252 | -   | -    | 1    | μA   |
|                                                        |                                     |                                                                                         | TO92        | -   | -    | 50   |      |
|                                                        |                                     | T <sub>C</sub> =125°C, V <sub>DS</sub> =480V                                            | TO251,TO252 | -   | -    | 10   | μA   |
|                                                        |                                     |                                                                                         | TO92        | -   | -    | 250  |      |
| Gate body leakage current, forward                     | I <sub>GSS</sub>                    | V <sub>GS</sub> =30V, V <sub>DS</sub> =0V                                               |             | -   | -    | 100  | nA   |
| Gate body leakage current, reverse                     | I <sub>GSS</sub>                    | V <sub>GS</sub> =-30V, V <sub>DS</sub> =0V                                              |             | -   | -    | -100 | nA   |
| On characteristics                                     |                                     |                                                                                         |             |     |      |      |      |
| Gate threshold voltage                                 | V <sub>GS(th)</sub>                 | V <sub>DS</sub> = V <sub>GS</sub> I <sub>D</sub> =250μA                                 |             | 2.0 | -    | 4.0  | V    |
| Static drain-source on-resistance                      | R <sub>DS(on)</sub>                 | V <sub>DS</sub> =10V, I <sub>D</sub> =0.5A(TO251.TO252)<br>I <sub>D</sub> =0.15A(TO92)  |             | -   | 9.3  | 11.5 | Ω    |
| Dynamic characteristics                                |                                     |                                                                                         |             |     |      |      |      |
| Input capacitance                                      | C <sub>iss</sub>                    | V <sub>DS</sub> =25V, V <sub>GS</sub> =0V, f=1.0MHz                                     |             | -   | 120  | 150  | pF   |
| Output capacitance                                     | C <sub>oss</sub>                    |                                                                                         |             | -   | 20   | 60   | pF   |
| Reverse transfer capacitance                           | C <sub>rss</sub>                    |                                                                                         |             | -   | 3    | 4    | pF   |
| Switching characteristics                              |                                     |                                                                                         |             |     |      |      |      |
| Turn-on delay time                                     | t <sub>d(on)</sub>                  | V <sub>DD</sub> =300V, I <sub>D</sub> =1.2A, R <sub>G</sub> =25Ω (note4,5)              |             | -   | 7    | 24   | ns   |
| Turn-on rise time                                      | t <sub>r</sub>                      |                                                                                         |             | -   | 21   | 52   | ns   |
| Turn-off delay time                                    | t <sub>d(off)</sub>                 |                                                                                         |             | -   | 13   | 36   | ns   |
| Turn-off fall time                                     | t <sub>f</sub>                      |                                                                                         |             | -   | 27   | 64   | ns   |
| Total gate charge                                      | Q <sub>G</sub>                      | V <sub>DS</sub> =480V, I <sub>D</sub> =1.1A<br>V <sub>GS</sub> =10V                     |             | -   | 4.8  | 6.2  | nC   |
| Gate-source charge                                     | Q <sub>GS</sub>                     |                                                                                         |             | -   | 0.7  | -    | nC   |
| Gate-drain charge                                      | Q <sub>GD</sub>                     |                                                                                         |             | -   | 2.7  | -    | nC   |
| Drain source diode characteristics and maximum ratings |                                     |                                                                                         |             |     |      |      |      |
| Continuous drain-source current                        | I <sub>SD</sub>                     | TO251.TO252                                                                             |             | -   | -    | 1.0  | A    |
|                                                        |                                     | TO92                                                                                    |             | -   | -    | 0.3  |      |
| Pulsed drain-source current                            | I <sub>SM</sub>                     | TO251.TO252                                                                             |             | -   | -    | 4.0  | A    |
|                                                        |                                     | TO92                                                                                    |             | -   | -    | 1.2  |      |
| Drain-source diode forward voltage                     | V <sub>SD</sub>                     | V <sub>GS</sub> =0V, I <sub>SD</sub> =1.0A(TO251.TO252).<br>I <sub>SD</sub> =0.3A(TO92) |             | -   | -    | 1.4  | V    |
| Reverse recovery time                                  | t <sub>RR</sub>                     | I <sub>SD</sub> =1.2A, dI <sub>SD</sub> /dt=100A/μs<br>(note4)                          |             | --  | 190  | --   | ns   |
| Reverse recovery charge                                | Q <sub>RR</sub>                     |                                                                                         |             | --  | 0.53 | --   | μC   |

Note: 1. repetitive rating: pulse width limited by maximum junction temperature;  
2. V<sub>DD</sub>=50V, R<sub>G</sub>=25Ω, starting T<sub>J</sub>=25°C, L=50mH, I<sub>AS</sub>=1.1A;  
3. I<sub>SD</sub>≤1.1A(TO251, TO252), I<sub>SD</sub>≤0.3A(TO92), di/dt≤200A/μs, V<sub>DD</sub>≤BV<sub>DSS</sub>, starting T<sub>J</sub>=25°C  
4. Pulse test: pulse width≤300μs, duty cycle≤2%  
5. Essentially independent of operating temperature