

## N-Ch Super Junction MOSFET

# KP580N60FWM3

This Super Junction MOSFET has better characteristics, such as fast switching time, low on resistance, low gate charge, low EMI characteristics and excellent avalanche characteristics. It is mainly suitable for power factor correction and switching mode power supplies.

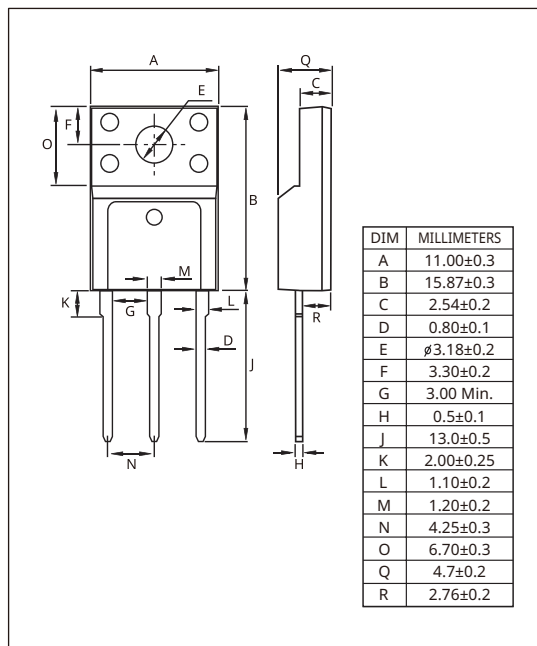
### FEATURES

- $V_{DS}=600V$ ,  $I_D=8A$
- Drain-Source ON Resistance:  
 $R_{DS(ON)}(MAX)=580m\Omega$  @  $V_{GS}=10V$
- $Q_g(typ.)=12nC$  @  $V_{GS}=10V$

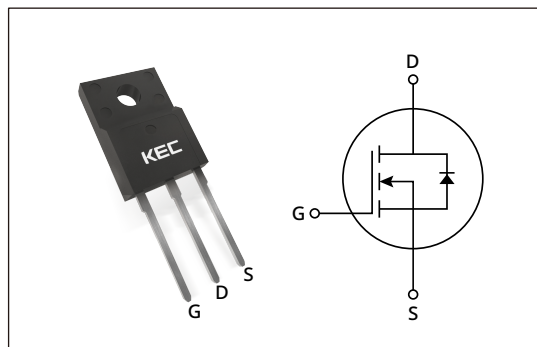
### APPLICATION

- PFC Stages
- Resonant switching stages
- Fly Back converters
- Power of PC, TV, Lighting, Adapter, Server and Telecom

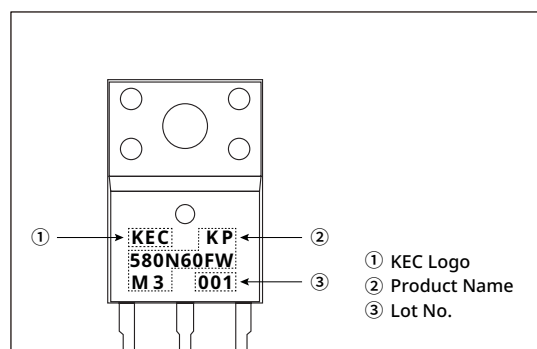
### PACKAGE DIMENSION(TO-220ISW)



### PIN CONFIGURATION



### MARKING CODE



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N-Ch Super Junction MOSFET - KP580N60FWM3

MAXIMUM RATING (T<sub>J</sub>=25°C)

| CHARACTERISTIC                          |                        | SYMBOL                              | RATING    | UNIT |
|-----------------------------------------|------------------------|-------------------------------------|-----------|------|
| Drain-Source Voltage                    |                        | V <sub>DSS</sub>                    | 600       | V    |
| Gate-Source Voltage                     |                        | V <sub>GSS</sub>                    | ±30       | V    |
| Drain Current                           | @T <sub>C</sub> =25°C  | I <sub>D</sub>                      | 8*        | A    |
|                                         | @T <sub>C</sub> =100°C |                                     | 5*        |      |
|                                         | Pulsed (Note 1)        | I <sub>DP</sub>                     | 24*       |      |
| Single Pulsed Avalanche Energy (Note 2) |                        | E <sub>AS</sub>                     | 110       | mJ   |
| Repetitive Avalanche Energy (Note 1)    |                        | E <sub>AR</sub>                     | 3.5       | mJ   |
| Peak MOSFET dv/dt                       |                        | dv/dt                               | 50        | V/ns |
| Peak Diode Recovery dv/dt (Note 3)      |                        | dv/dt                               | 15        | V/ns |
| Drain Power Dissipation                 | T <sub>C</sub> =25°C   | P <sub>D</sub>                      | 39.1      | W    |
|                                         | T <sub>A</sub> =25°C   |                                     | 2         | W    |
| Maximum Junction Temperature            |                        | T <sub>J</sub>                      | 150       | °C   |
| Operation and Storage Temperature Range |                        | T <sub>opr</sub> , T <sub>stg</sub> | -55 ~ 150 | °C   |
| Thermal Characteristics                 |                        |                                     |           |      |
| Thermal Resistance, Junction-to-Case    |                        | R <sub>thJC</sub>                   | 3.2       | °C/W |
| Thermal Resistance, Junction-to-Ambient |                        | R <sub>thJA</sub>                   | 62.5      | °C/W |

\* : Drain current limited by maximum junction temperature

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## N-Ch Super Junction MOSFET - KP580N60FWM3

### ELECTRICAL CHARACTERISTICS (T<sub>J</sub>=25°C)

| CHARACTERISTIC                               | SYMBOL                              | TEST CONDITION                                                                                   | MIN. | TYP. | MAX. | UNIT |
|----------------------------------------------|-------------------------------------|--------------------------------------------------------------------------------------------------|------|------|------|------|
| <b>Static</b>                                |                                     |                                                                                                  |      |      |      |      |
| Drain-Source Breakdown Voltage               | BV <sub>DSS</sub>                   | I <sub>D</sub> =250μA, V <sub>GS</sub> =0V                                                       | 600  | -    | -    | V    |
| Breakdown Voltage Temperature Coefficient    | ΔBV <sub>DSS</sub> /ΔT <sub>J</sub> | I <sub>D</sub> =1mA, Referenced to 25°C                                                          | -    | 0.7  | -    | V/°C |
| Drain Cut-off Current                        | I <sub>DSS</sub>                    | V <sub>DS</sub> =600V, V <sub>GS</sub> =0V                                                       | -    | -    | 10   | μA   |
| Gate Threshold Voltage                       | V <sub>th</sub>                     | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA                                         | 2    | 3    | 4    | V    |
| Gate Leakage Current                         | I <sub>GSS</sub>                    | V <sub>GS</sub> =±30V, V <sub>DS</sub> =0V                                                       | -    | -    | ±100 | nA   |
| Drain-Source ON Resistance                   | R <sub>DS(ON)</sub>                 | V <sub>GS</sub> =10V, I <sub>D</sub> =4A                                                         | -    | 510  | 580  | mΩ   |
| <b>Dynamic</b>                               |                                     |                                                                                                  |      |      |      |      |
| Total Gate Charge                            | Q <sub>g</sub>                      | V <sub>DD</sub> =400V, I <sub>D</sub> =4A,<br>V <sub>GS</sub> =10V (Note 4)                      | -    | 12   | -    | nC   |
| Gate-Source Charge                           | Q <sub>gs</sub>                     |                                                                                                  | -    | 2    | -    |      |
| Gate-Drain Charge                            | Q <sub>gd</sub>                     |                                                                                                  | -    | 5    | -    |      |
| Turn-on Delay time                           | t <sub>d(on)</sub>                  | V <sub>DD</sub> =400V, I <sub>D</sub> =4A,<br>V <sub>GS</sub> =10V, R <sub>G</sub> =25Ω (Note 4) | -    | 24   | -    | ns   |
| Turn-on Rise time                            | t <sub>r</sub>                      |                                                                                                  | -    | 19   | -    |      |
| Turn-off Delay time                          | t <sub>d(off)</sub>                 |                                                                                                  | -    | 81   | -    |      |
| Turn-off Fall time                           | t <sub>f</sub>                      |                                                                                                  | -    | 17   | -    |      |
| Input Capacitance                            | C <sub>iss</sub>                    | V <sub>DS</sub> =400V, V <sub>GS</sub> =0V, f=1.0MHz                                             | -    | 430  | -    | pF   |
| Output Capacitance                           | C <sub>oss</sub>                    |                                                                                                  | -    | 12   | -    |      |
| Reverse Transfer Capacitance                 | C <sub>rss</sub>                    | V <sub>DS</sub> =400V, V <sub>GS</sub> =0V, f=250kHz                                             | -    | 1    | -    |      |
| Effective output capacitance, energy related | C <sub>o(er)</sub>                  | V <sub>GS</sub> =0V, V <sub>DS</sub> =0...400V (Note 5)                                          | -    | 22   | -    |      |
| Effective output capacitance, time related   | C <sub>o(tr)</sub>                  | V <sub>GS</sub> =0V, V <sub>DS</sub> =0...400V (Note 6)                                          | -    | 112  | -    |      |
| Gate Resistance                              | R <sub>G</sub>                      | V <sub>GS</sub> =0V, f=1MHz                                                                      | -    | 19   | -    | Ω    |
| <b>Source-Drain Diode Ratings</b>            |                                     |                                                                                                  |      |      |      |      |
| Continuous Source Current                    | I <sub>S</sub>                      | V <sub>GS</sub> < V <sub>th</sub> , T <sub>C</sub> =25°C                                         | -    | -    | 8    | A    |
| Pulsed Source Current                        | I <sub>SP</sub>                     |                                                                                                  | -    | -    | 24   |      |
| Diode Forward Voltage                        | V <sub>SD</sub>                     | I <sub>S</sub> =4A, V <sub>GS</sub> =0V                                                          | -    | -    | 1.4  | V    |
| Reverse Recovery Time                        | t <sub>rr</sub>                     | I <sub>S</sub> =4A, V <sub>GS</sub> =0V, V <sub>DD</sub> =400V<br>dI <sub>S</sub> /dt=100A/μs    | -    | 210  | -    | ns   |
| Reverse Recovery Charge                      | Q <sub>rr</sub>                     |                                                                                                  | -    | 1.7  | -    | μC   |

Note 1) Repetivity rating: Pulse width limited by junction temperature.

Note 2) L=52.4mH, I<sub>D</sub>=2A, V<sub>DD</sub>=50V, R<sub>G</sub>=25Ω, Starting T<sub>J</sub>=25°C.

Note 3) I<sub>S</sub> ≤ I<sub>D</sub>, di/dt ≤ 100A/μs, V<sub>DD</sub> ≤ BV<sub>DSS</sub>, Starting T<sub>J</sub>=25°C.

Note 4) Essentially independent of operating temperature.

Note 5) C<sub>o(er)</sub> is a fixed capacitance that gives the same stored energy as C<sub>oss</sub> while V<sub>DS</sub> is rising from 0 to 400V.

Note 6) C<sub>o(tr)</sub> is a fixed capacitance that gives the same charging time as C<sub>oss</sub> while V<sub>DS</sub> is rising from 0 to 400V.

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Fig1.  $I_D - V_{DS}$  - 1

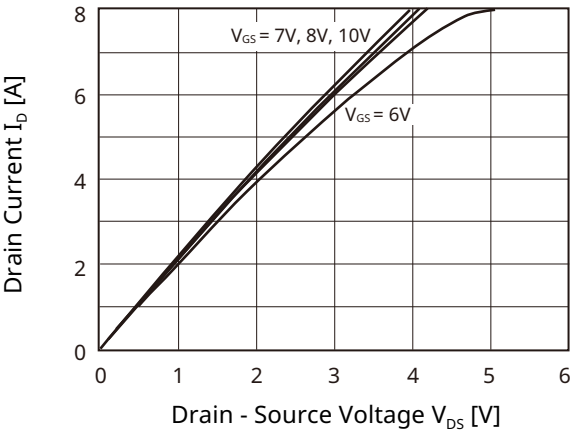


Fig1.  $I_D - V_{DS}$  - 2

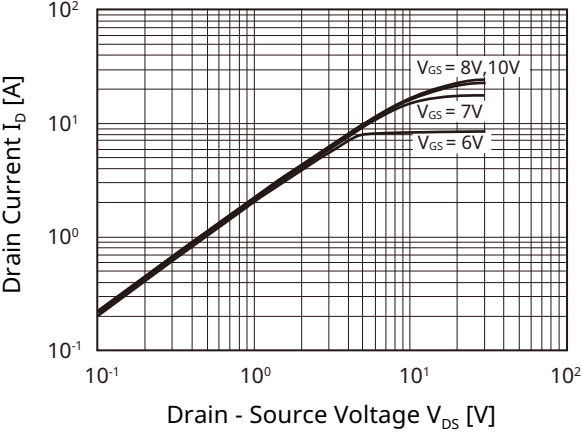


Fig3.  $I_D - V_{GS}$

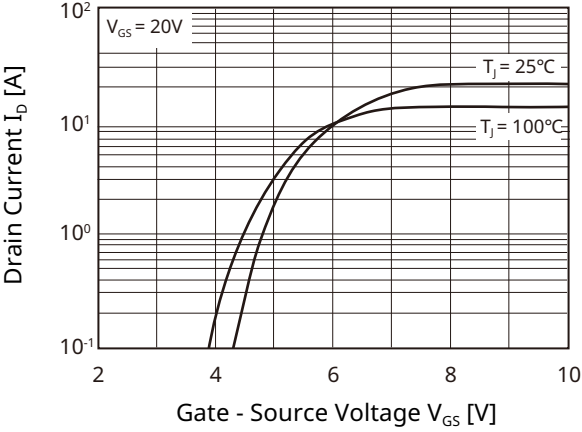


Fig4.  $R_{DS(ON)} - I_D$

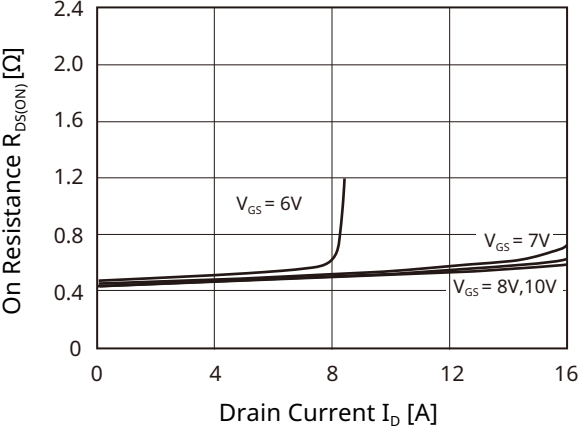


Fig5.  $R_{DS(ON)} - V_{GS}$

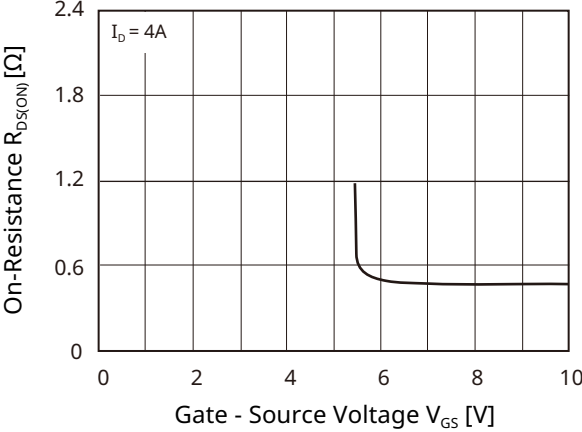
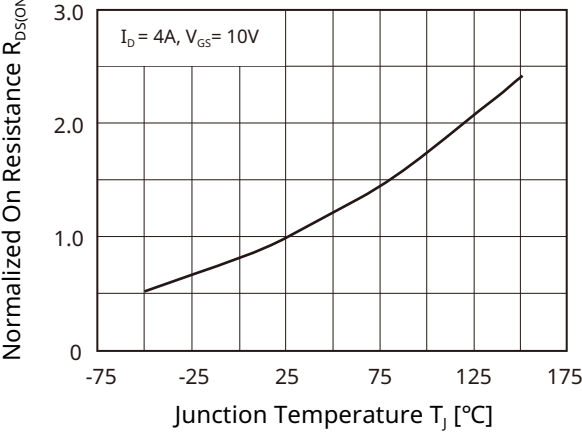


Fig6.  $R_{DS(ON)} - T_J$



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Fig7.  $BV_{DSS} - T_J$

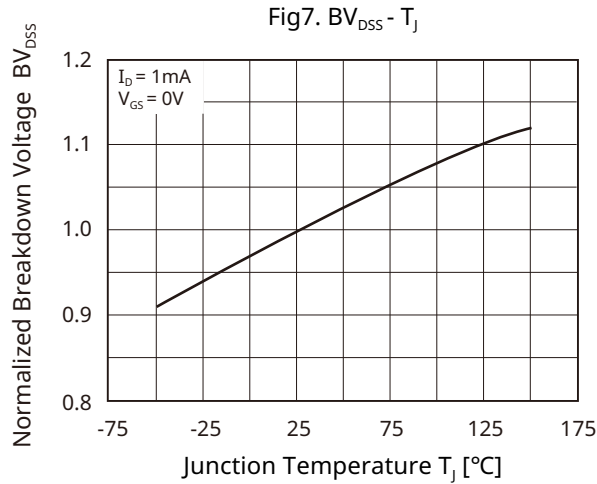


Fig8.  $V_{th} - T_J$

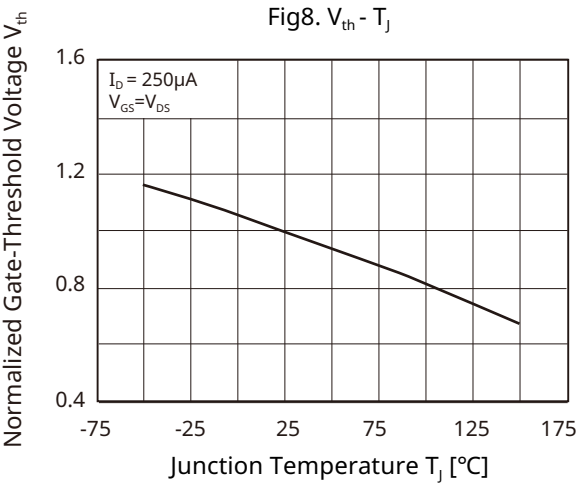


Fig9.  $I_S - V_{SD}$

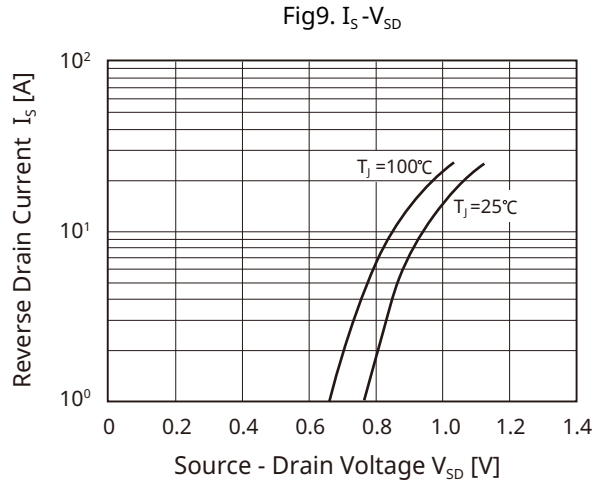


Fig10. Capacitance  $V_{DS}$

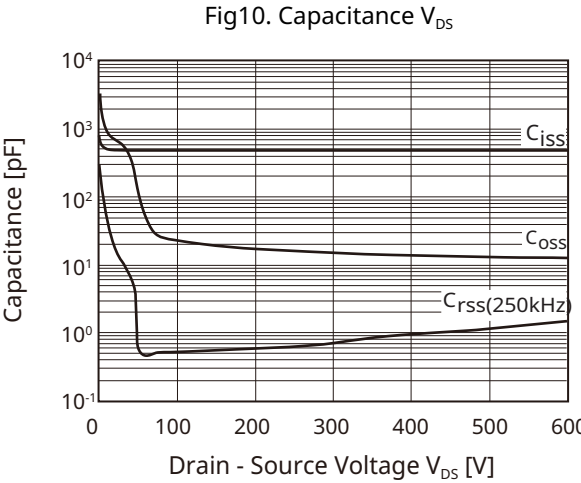


Fig11.  $E_{oss} - V_{DS}$

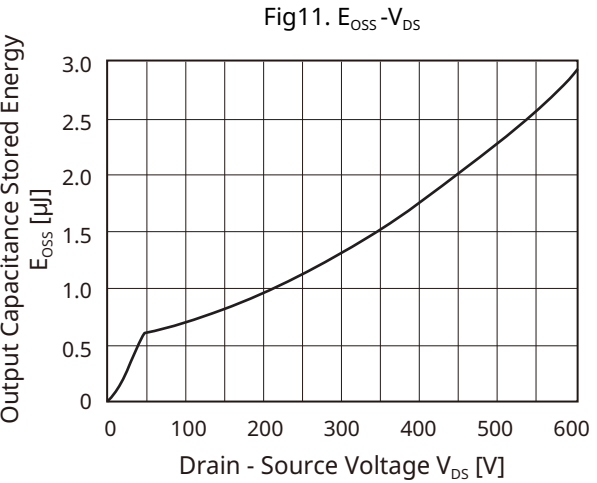
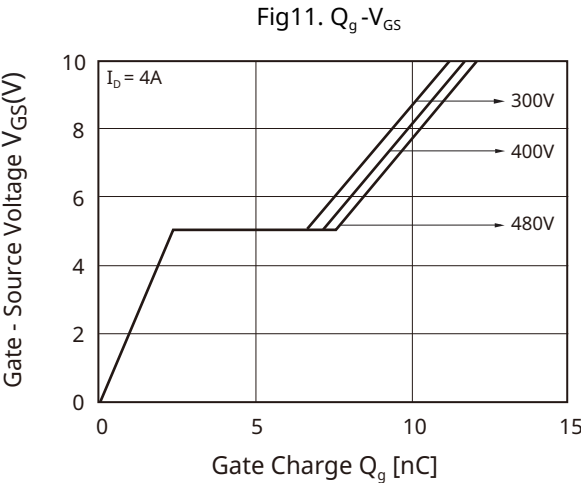


Fig11.  $Q_g - V_{GS}$



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Fig13. Ptot - T<sub>c</sub>

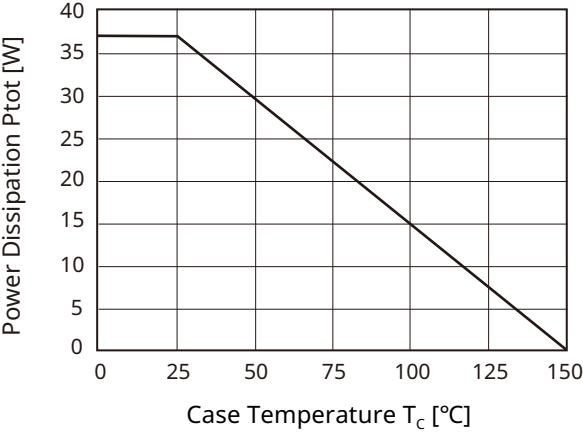


Fig14. Switching Time - I<sub>D</sub>

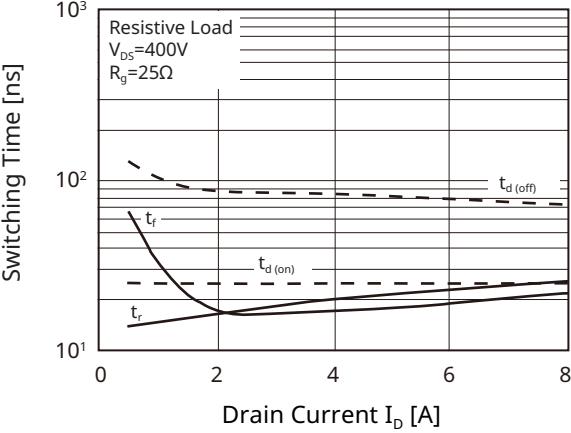


Fig15. Switching Loss - I<sub>D</sub>

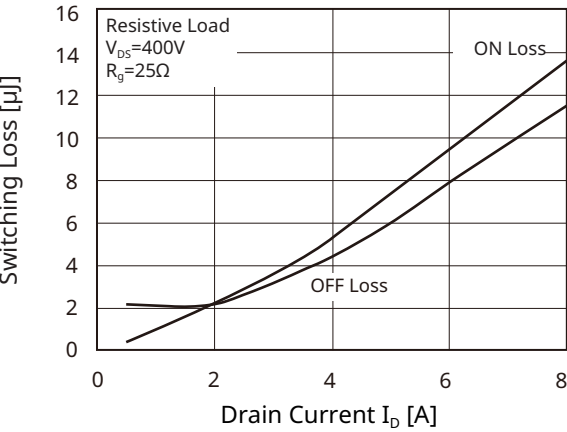


Fig16. Switching Time - R<sub>g</sub>

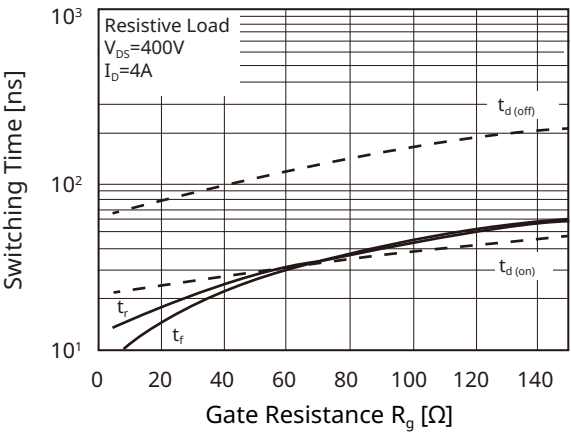


Fig17. Switching Loss - R<sub>g</sub>

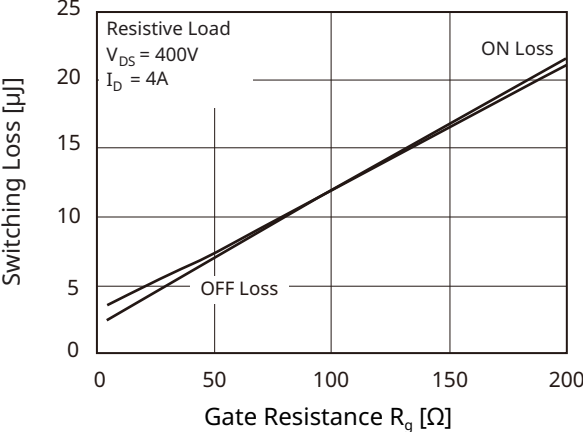
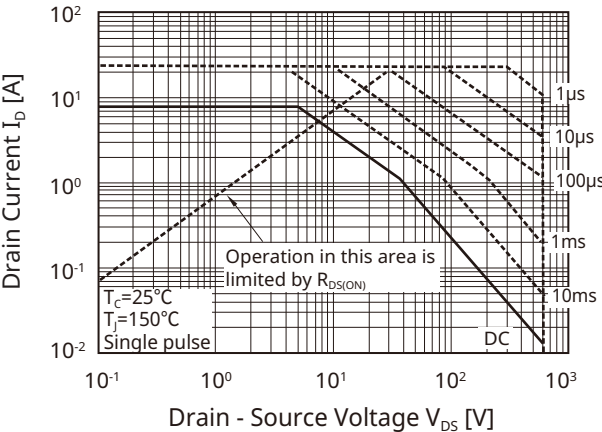


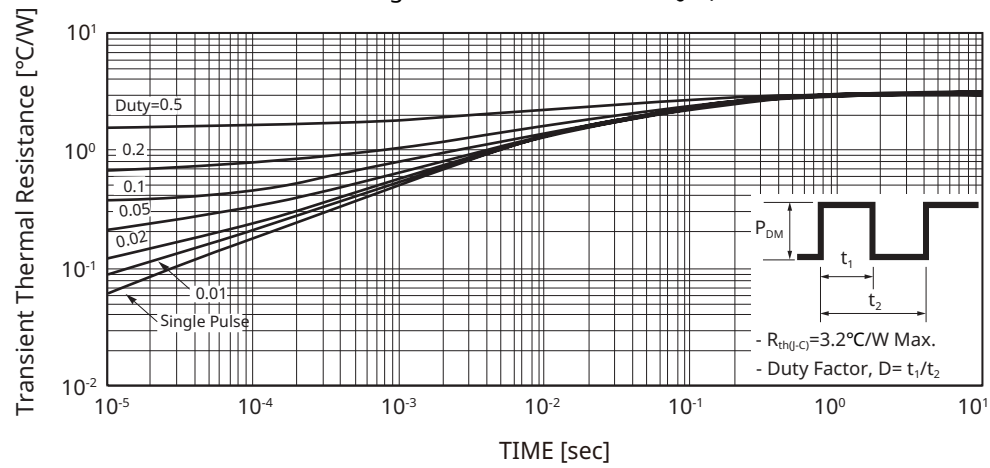
Fig18. Safe Operation Area



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Fig19. Transient Rth Curve (J-C)



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Fig20. Gate Charge

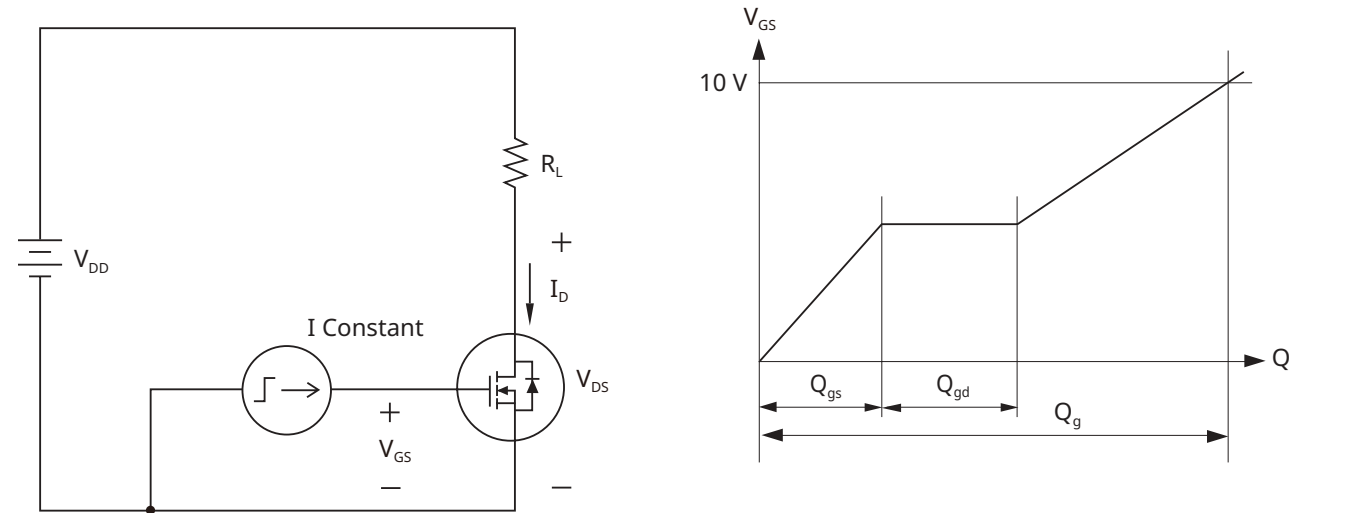


Fig21. Single Pulsed Avalanche Energy

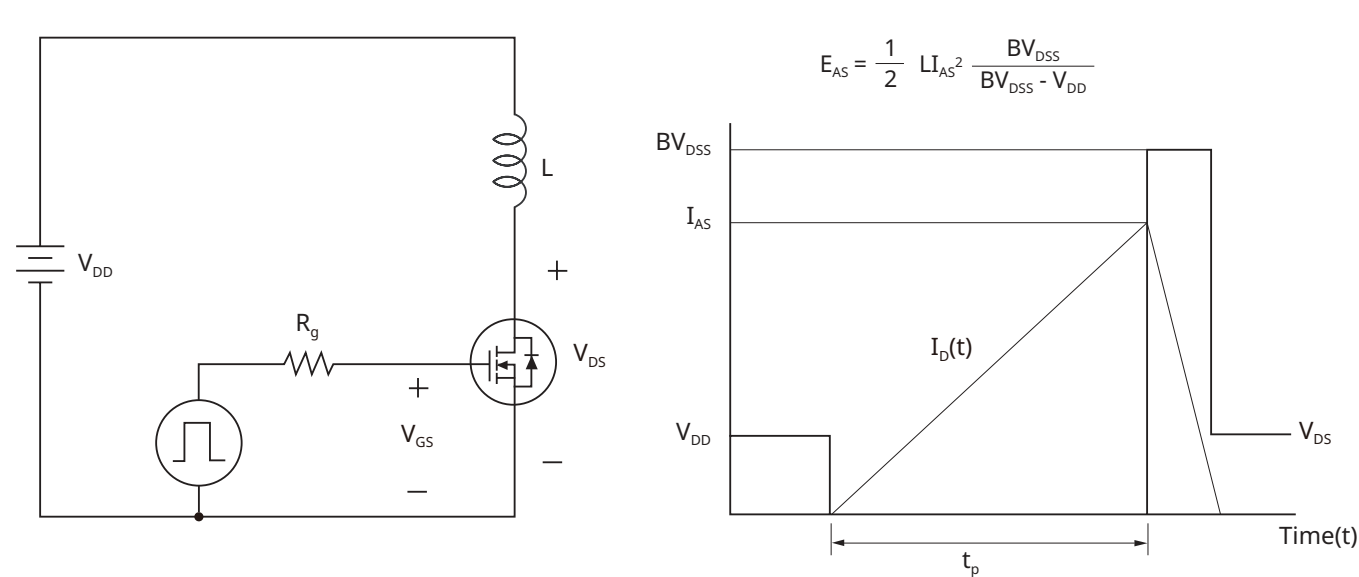
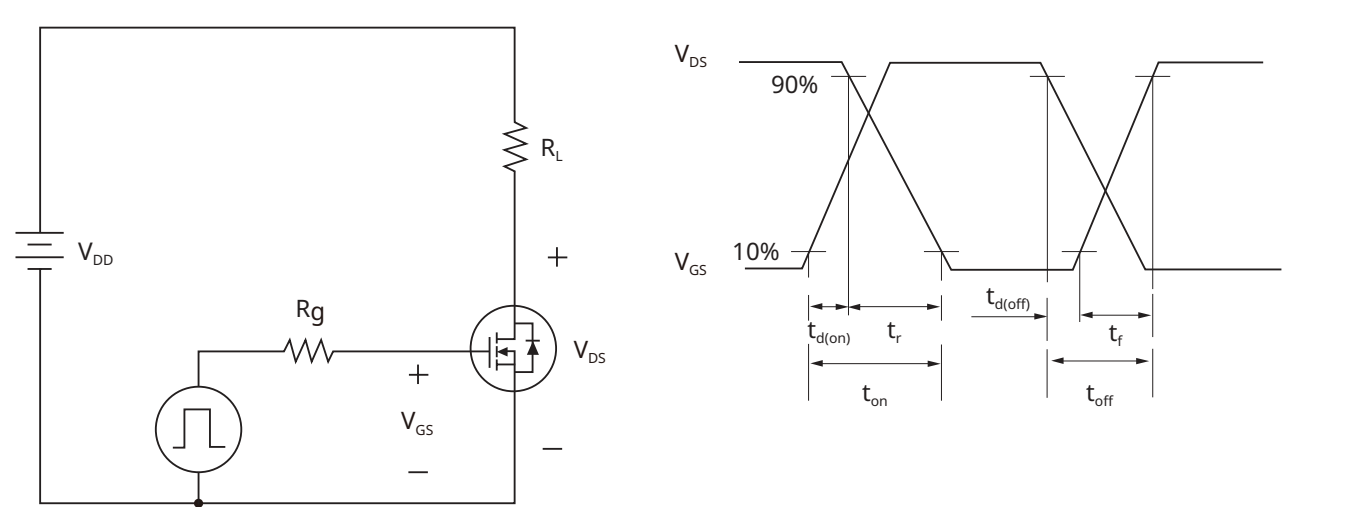


Fig22. Resistive Load Switching

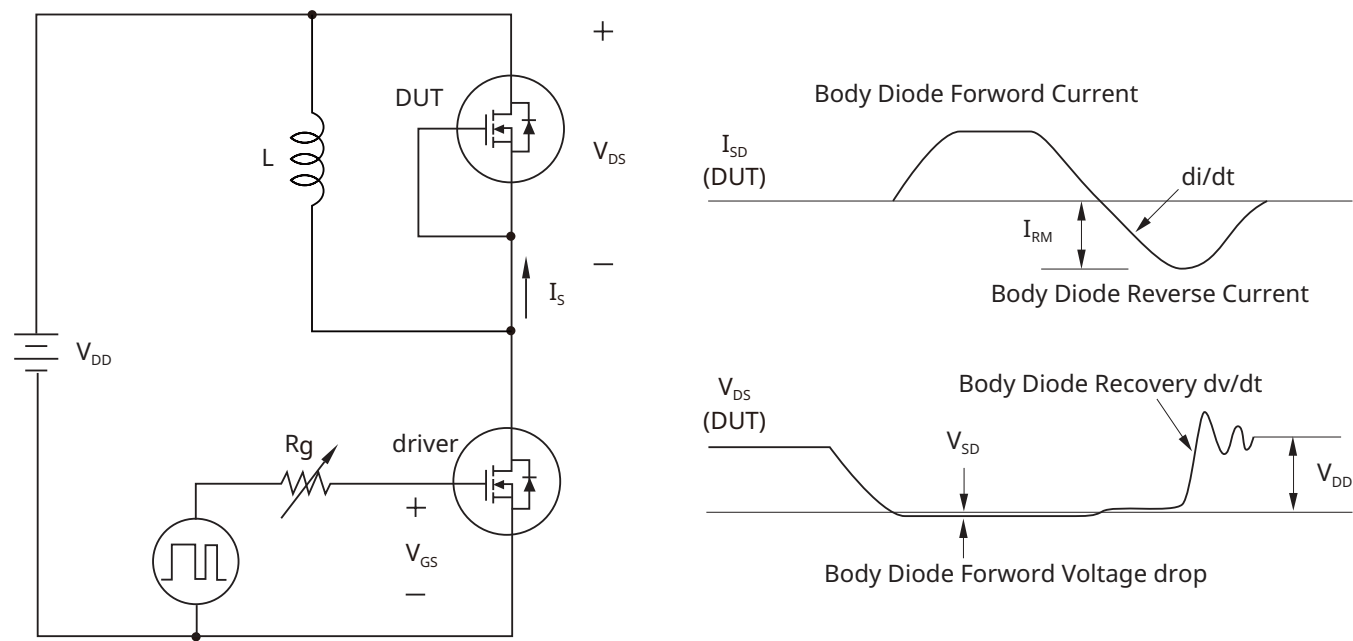




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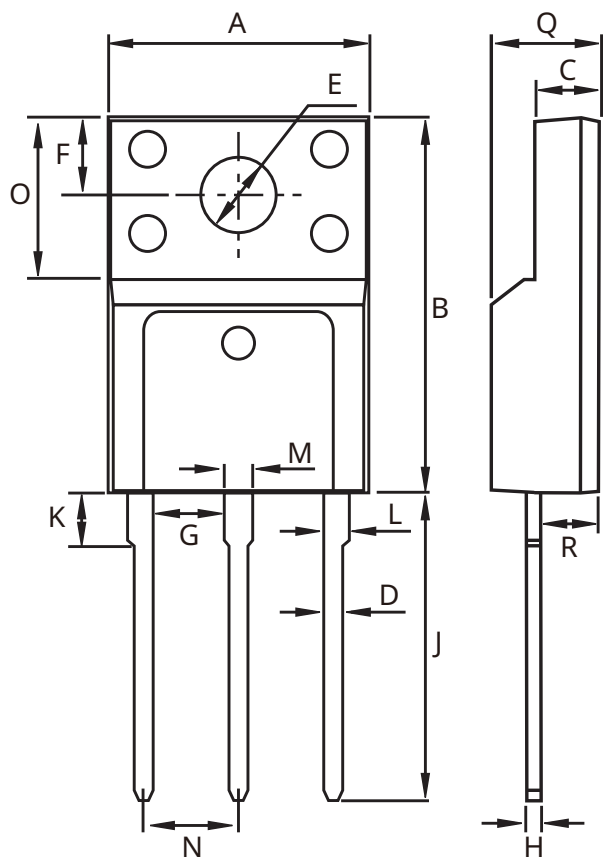
Fig23. Source - Drain Diode Reverse Recovery and  $dv/dt$



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PACKAGE INFORMATION(TO-220ISW)



| DIM | MILLIMETERS |
|-----|-------------|
| A   | 11.00±0.3   |
| B   | 15.87±0.3   |
| C   | 2.54±0.2    |
| D   | 0.80±0.1    |
| E   | ø3.18±0.2   |
| F   | 3.30±0.2    |
| G   | 3.00 Min.   |
| H   | 0.5±0.1     |
| J   | 13.0±0.5    |
| K   | 2.00±0.25   |
| L   | 1.10±0.2    |
| M   | 1.20±0.2    |
| N   | 4.25±0.3    |
| O   | 6.70±0.3    |
| Q   | 4.7±0.2     |
| R   | 2.76±0.2    |

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ORDERING INFORMATION

| Part Number      | Status | Compliance |              | Packing Type | Reel Size | Quantity |
|------------------|--------|------------|--------------|--------------|-----------|----------|
|                  |        | AEC-Q      | Halogen Free |              |           |          |
| KP580N60FWM3-U/H | Active | -          | -            | Tube         | -         | 45       |

# PRECAUTION ON USING KEC PRODUCTS

1. The products described in this data are intended to be used in general-purpose electronic equipment.  
(Office equipment, telecommunication equipment, measuring equipment, home appliances)
2. When you intend to use these products with equipment or device which require an extremely high of reliability and special applications (such as automobile, air travel aerospace, transportation equipment, life support, system and safety devices) in which special quality and reliability and the failure or malfunction of products may directly jeopardize or harm the human body or damage to property and any application other than the standard application intended, please be sure to consult with our sales representative in advance.
3. On designing your application, please use product within the ranges guaranteed by KEC for maximum rating, operating supply voltage range, heat radiation characteristics and other characteristics. User shall be responsible for failure or damage when used beyond the guaranteed ranges.
4. The technical information described in this data is limited to showing representative characteristics and applied circuit examples of the products and it does not constitute the warranting of industrial property, the granting of relative rights, or the granting of any license.
5. What are described in the data may be changed without any prior notice to reflect new technical development. Please confirm that you have received the latest product standards or specification before final design, purchase or use.
6. Although KEC is continuously working to improve product reliability and quality, semiconductors can break down and malfunction due to various factors. Therefore, in order to prevent personal injury or fire arising from failure, please take safety measures such as complying with the derating characteristics, implementing redundant and fire prevention designs, and utilizing backups and fail-safe procedures. KEC shall have no responsibility for any damages arising out of the use of our Products beyond the rating specified by KEC.

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