

## SWITCHING REGULATOR APPLICATIONS

### Features

- High Voltage :  $BV_{DSS}=700V$ (Min.)
- Low  $C_{rss}$  :  $C_{rss}=13.7pF$ (Typ.)
- Low gate charge :  $Q_g=32nC$ (Typ.)
- Low  $R_{DS(on)}$  :  $R_{DS(on)}=0.9\Omega$ (Max.)

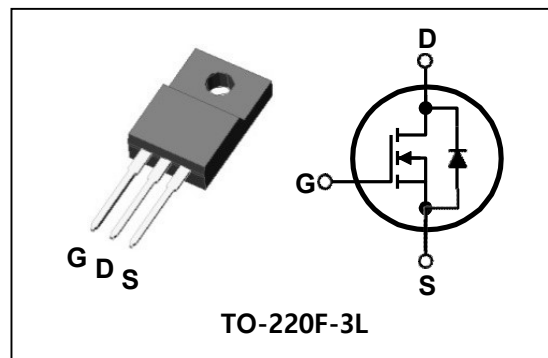
### Ordering Information

| Type No.      | Marking | Package Code |
|---------------|---------|--------------|
| KMK0870F      | KMK0870 | TO-220F-3L   |
| KMK0870F (HF) | KMK0870 | TO-220F-3L   |

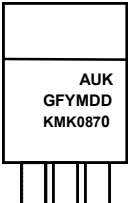
\* KMK0870F : Pb Free Product

\* KMK0870F (HF) : Halogen Free Product

### PIN Connection



### Marking Diagram

|                                                                                    |                                                   |
|------------------------------------------------------------------------------------|---------------------------------------------------|
|  | Column 1 : Manufacturer                           |
|                                                                                    | Column 2 : Production Information<br>e.g.) GFYRDD |
|                                                                                    | - . G : Option Code (H : Halogen Free)            |
|                                                                                    | - . F : Factory Management Code                   |
|                                                                                    | - . YRDD : Date Code (Year, Month, Date)          |
|                                                                                    | Column 3 : Device Code                            |

### Absolute maximum ratings ( $T_C=25^\circ C$ unless otherwise noted)

| Characteristic                   | Symbol    | Rating            | Unit       |
|----------------------------------|-----------|-------------------|------------|
| Drain-source voltage             | $V_{DSS}$ | 700               | V          |
| Gate-source voltage              | $V_{GSS}$ | $\pm 30$          | V          |
| Drain current (DC) *             | $I_D$     | $T_C=25^\circ C$  | 8          |
|                                  |           | $T_C=100^\circ C$ | 4.8        |
| Drain current (Pulsed) *         | $I_{DM}$  | 32                | A          |
| Power dissipation                | $P_D$     | 40                | W          |
| Avalanche current (Single) ②     | $I_{AS}$  | 8                 | A          |
| Single pulsed avalanche energy ② | $E_{AS}$  | 266               | mJ         |
| Avalanche current (Repetitive) ① | $I_{AR}$  | 8                 | A          |
| Repetitive avalanche energy ①    | $E_{AR}$  | 11.6              | mJ         |
| Junction temperature             | $T_J$     | 150               | $^\circ C$ |
| Storage temperature range        | $T_{stg}$ | -55~150           |            |

\* Limited by maximum junction temperature

| Characteristic     | Symbol           | Typ.          | Max. | Unit |
|--------------------|------------------|---------------|------|------|
| Thermal resistance | Junction-case    | $R_{th(J-C)}$ | -    | 3.1  |
|                    | Junction-ambient | $R_{th(J-A)}$ | -    | 62.5 |

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

| Characteristic                 | Symbol              | Test Condition                                                       | Min. | Typ. | Max. | Unit |
|--------------------------------|---------------------|----------------------------------------------------------------------|------|------|------|------|
| Drain-source breakdown voltage | BV <sub>DSS</sub>   | I <sub>D</sub> =250uA, V <sub>GS</sub> =0V                           | 700  | -    | -    | V    |
| Gate threshold voltage         | V <sub>GS(th)</sub> | I <sub>D</sub> =250uA, V <sub>DS</sub> =V <sub>GS</sub>              | 2.0  | -    | 4.0  | V    |
| Drain-source cut-off current   | I <sub>DSS</sub>    | V <sub>DS</sub> =700V, V <sub>GS</sub> =0V                           | -    | -    | 1    | uA   |
| Gate leakage current           | I <sub>GSS</sub>    | V <sub>DS</sub> =0V, V <sub>GS</sub> =±30V                           | -    | -    | ±100 | nA   |
| Drain-source on-resistance ④   | R <sub>DS(on)</sub> | V <sub>GS</sub> =10V, I <sub>D</sub> =4.0A                           | -    | 0.77 | 0.90 | Ω    |
| Forward transfer conductance ④ | g <sub>fs</sub>     | V <sub>DS</sub> =10V, I <sub>D</sub> =4.0A                           | -    | 11   | -    | S    |
| Input capacitance              | C <sub>iss</sub>    | V <sub>GS</sub> =0V, V <sub>DS</sub> =25V<br>f=1 MHz                 | -    | 2006 | 2507 | pF   |
| Output capacitance             | C <sub>oss</sub>    |                                                                      | -    | 148  | 185  |      |
| Reverse transfer capacitance   | C <sub>rss</sub>    |                                                                      | -    | 13.7 | 17.1 |      |
| Turn-on delay time             | t <sub>d(on)</sub>  | V <sub>DD</sub> =300V, I <sub>D</sub> =8A<br>R <sub>G</sub> =25Ω ③④  | -    | 23   | -    | ns   |
| Rise time                      | t <sub>r</sub>      |                                                                      | -    | 69   | -    |      |
| Turn-off delay time            | t <sub>d(off)</sub> |                                                                      | -    | 144  | -    |      |
| Fall time                      | t <sub>f</sub>      |                                                                      | -    | 77   | -    |      |
| Total gate charge              | Q <sub>g</sub>      | V <sub>DS</sub> =560V, V <sub>GS</sub> =10V<br>I <sub>D</sub> =8A ③④ | -    | 32   | 40   | nC   |
| Gate-source charge             | Q <sub>gs</sub>     |                                                                      | -    | 9    | -    |      |
| Gate-drain charge              | Q <sub>gd</sub>     |                                                                      | -    | 8    | -    |      |

## Source-Drain Diode Ratings and Characteristics (T<sub>C</sub>=25°C unless otherwise noted)

| Characteristic            | Symbol          | Test Condition                                                         | Min. | Typ. | Max. | Unit |
|---------------------------|-----------------|------------------------------------------------------------------------|------|------|------|------|
| Source current (DC)       | I <sub>S</sub>  | Integral reverse diode<br>in the MOSFET                                | -    | -    | 8    | A    |
| Source current (Pulsed) ① | I <sub>SM</sub> |                                                                        | -    | -    | 32   |      |
| Forward voltage ④         | V <sub>SD</sub> | V <sub>GS</sub> =0V, I <sub>S</sub> =8A                                | -    | -    | 1.4  | V    |
| Reverse recovery time     | t <sub>rr</sub> | I <sub>S</sub> =8A, V <sub>GS</sub> =0V<br>dI <sub>F</sub> /dt=100A/us | -    | 420  | -    | ns   |
| Reverse recovery charge   | Q <sub>rr</sub> |                                                                        | -    | 4.2  | -    | uC   |

Note ;

- ① Repetitive rating : Pulse width limited by maximum junction temperature
- ② L=7.74mH, I<sub>AS</sub>=8A, V<sub>DD</sub>=50V, R<sub>G</sub>=25Ω, Starting T<sub>J</sub>=25°C
- ③ Pulse Test : Pulse width≤300us, Duty cycle≤2%
- ④ Essentially independent of operating temperature

## Electrical Characteristic Curves

Fig. 1  $I_D - V_{DS}$

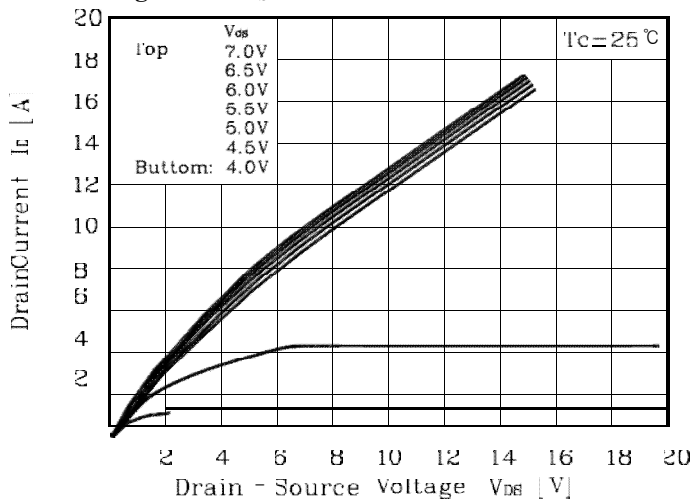


Fig. 2  $I_D - V_{GS}$

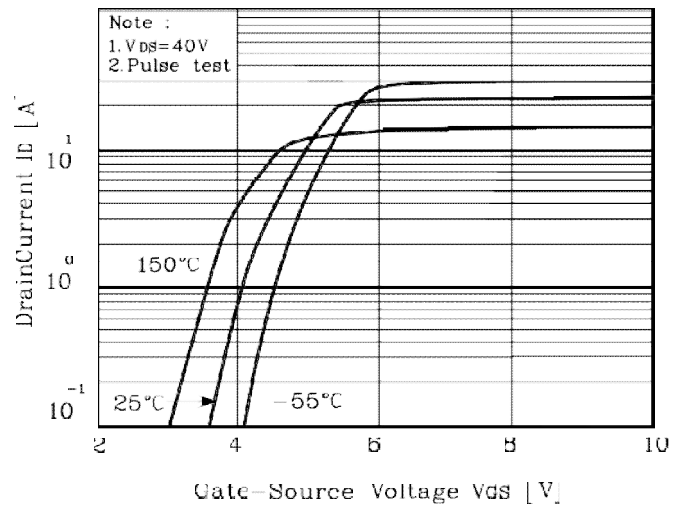


Fig. 3  $R_{DS(on)} - I_D$

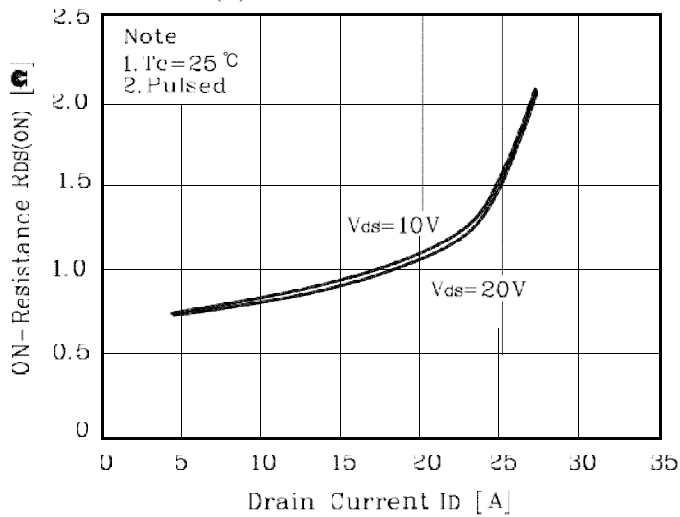


Fig. 4  $I_S - V_{SD}$

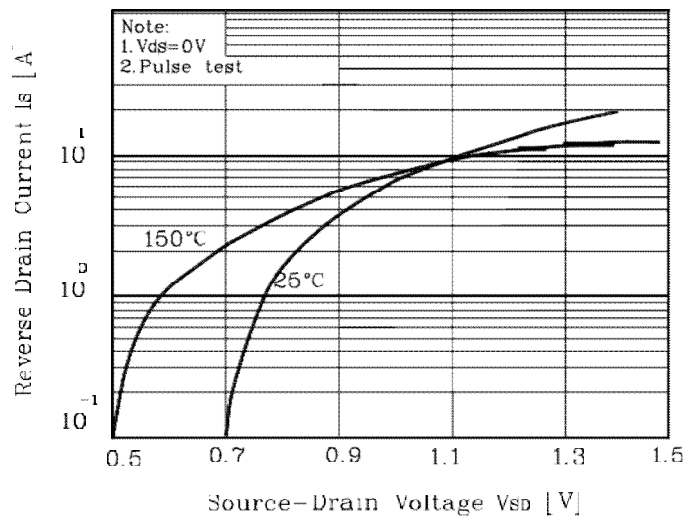


Fig. 5 Capacitance -  $V_{DS}$

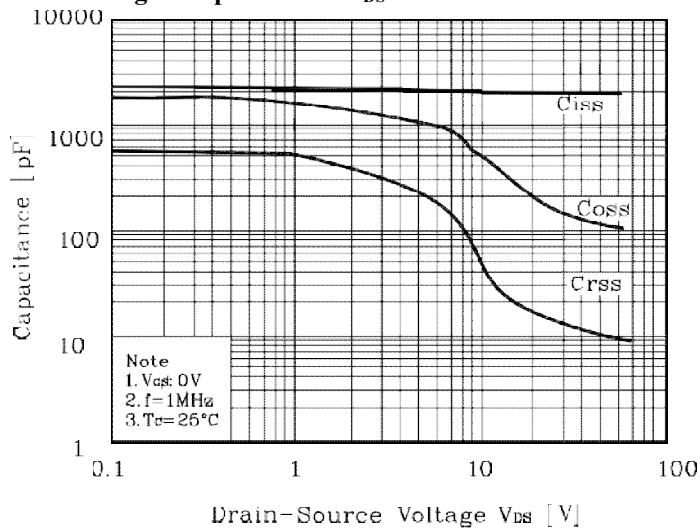
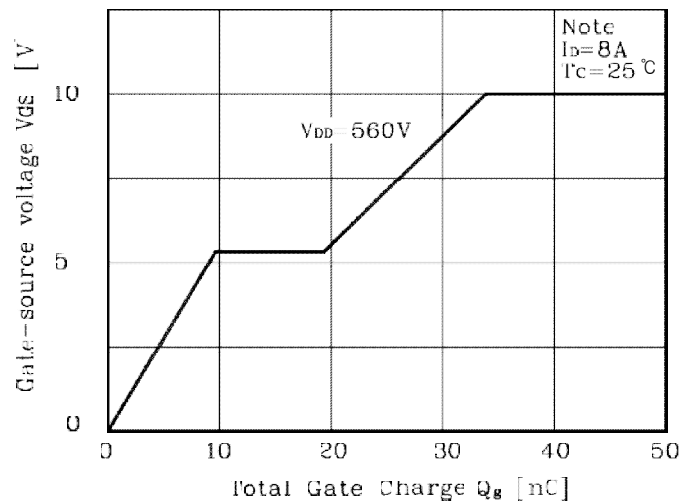
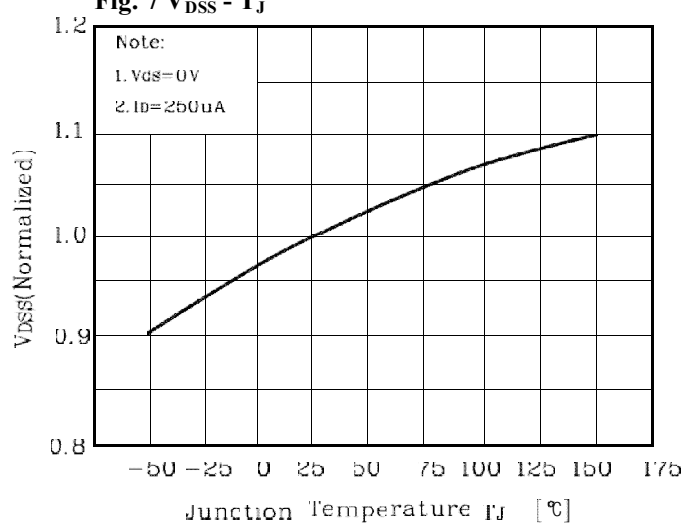


Fig. 6  $V_{GS} - Q_G$

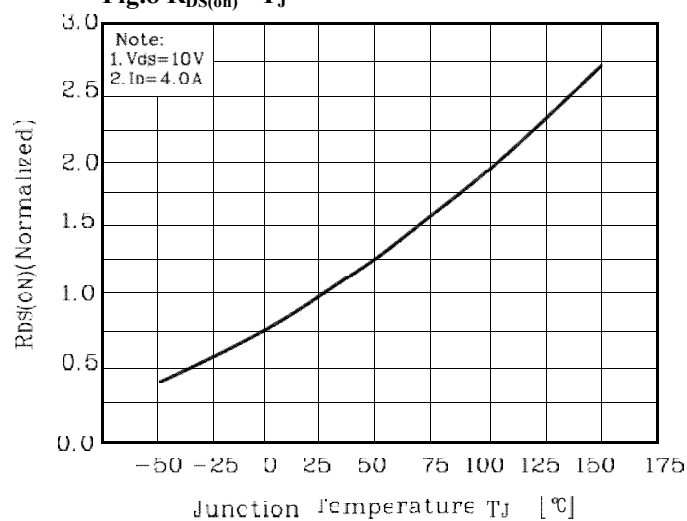


## Electrical Characteristic Curves

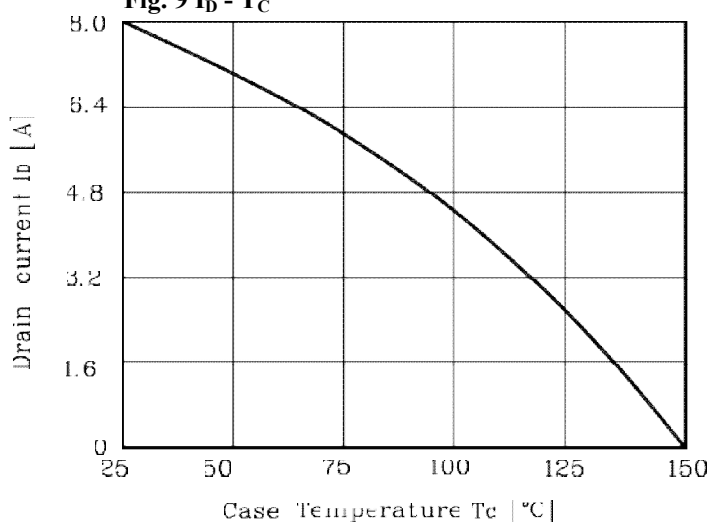
**Fig. 7  $V_{DS} - T_J$**



**Fig.8  $R_{DS(on)} - T_J$**



**Fig. 9  $I_D - T_C$**



**Fig. 10 Safe Operating Area**

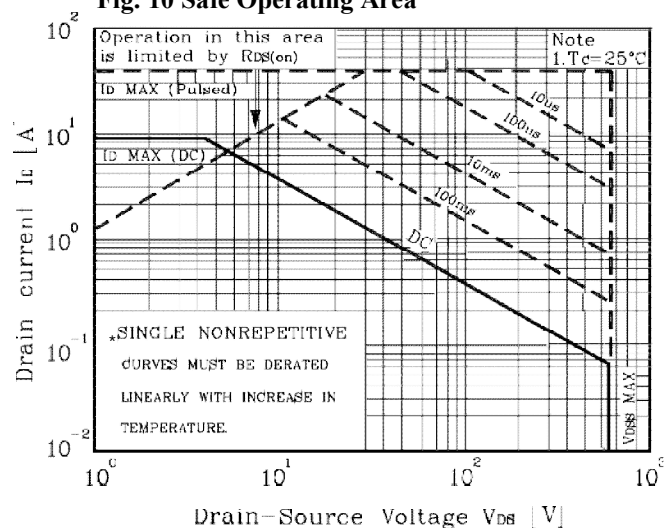


Fig. 11 Gate Charge Test Circuit & Waveform

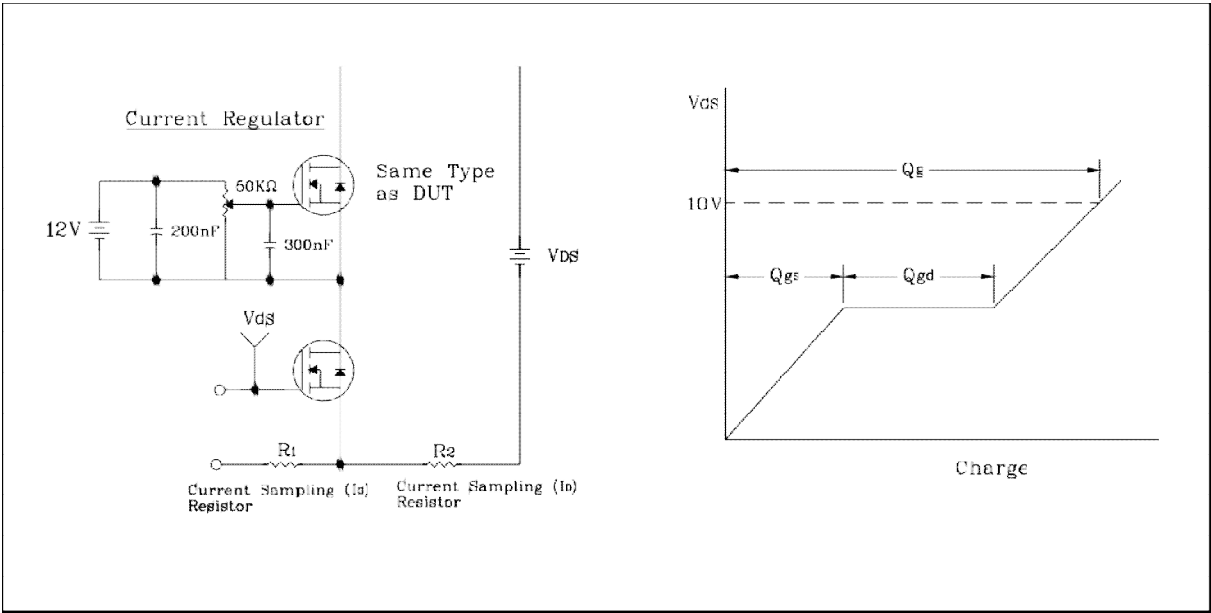


Fig. 12 Resistive Switching Test Circuit & Waveform

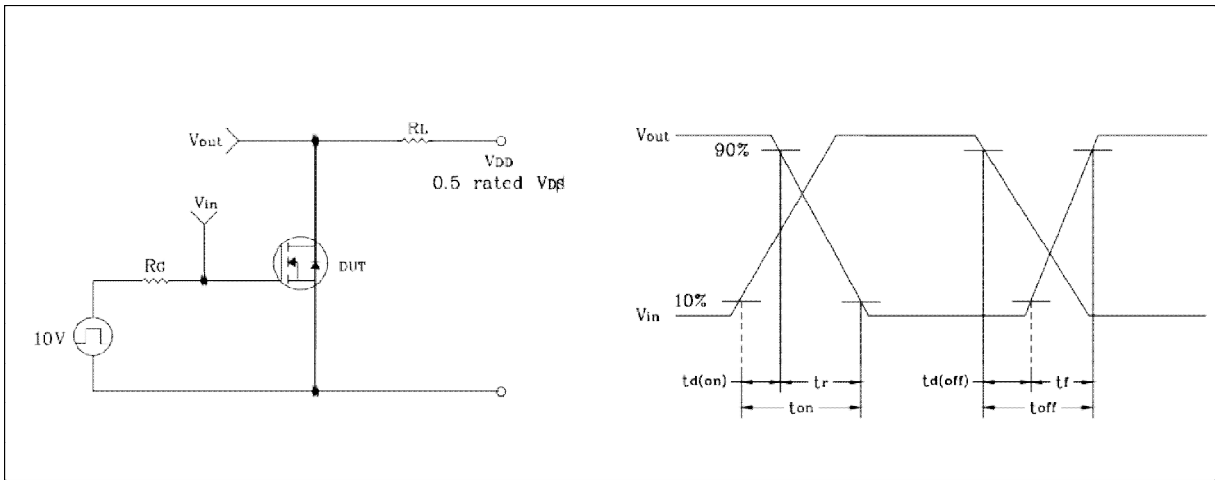


Fig. 13  $E_{AS}$  Test Circuit & Waveform

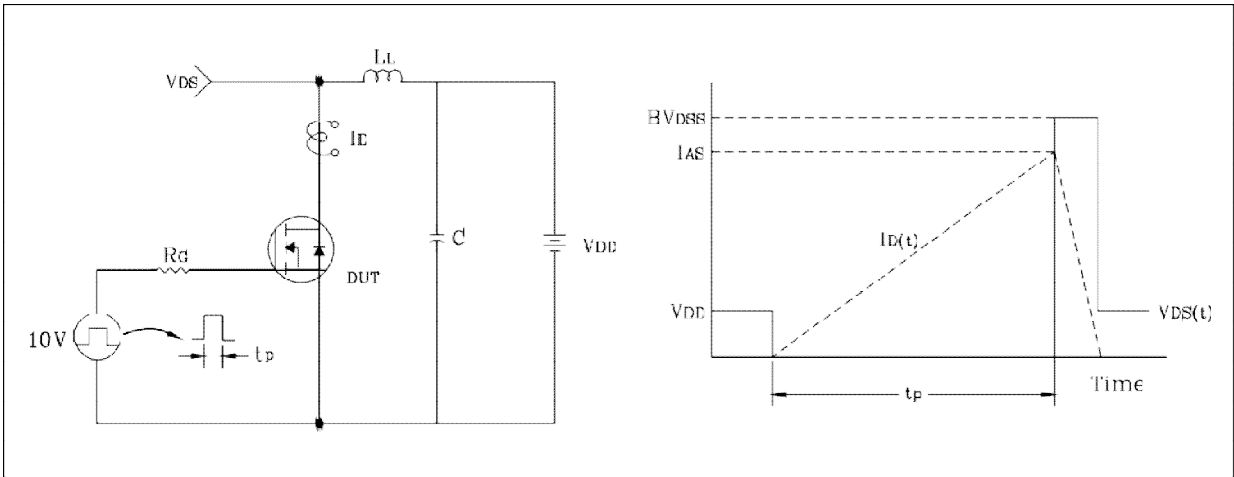
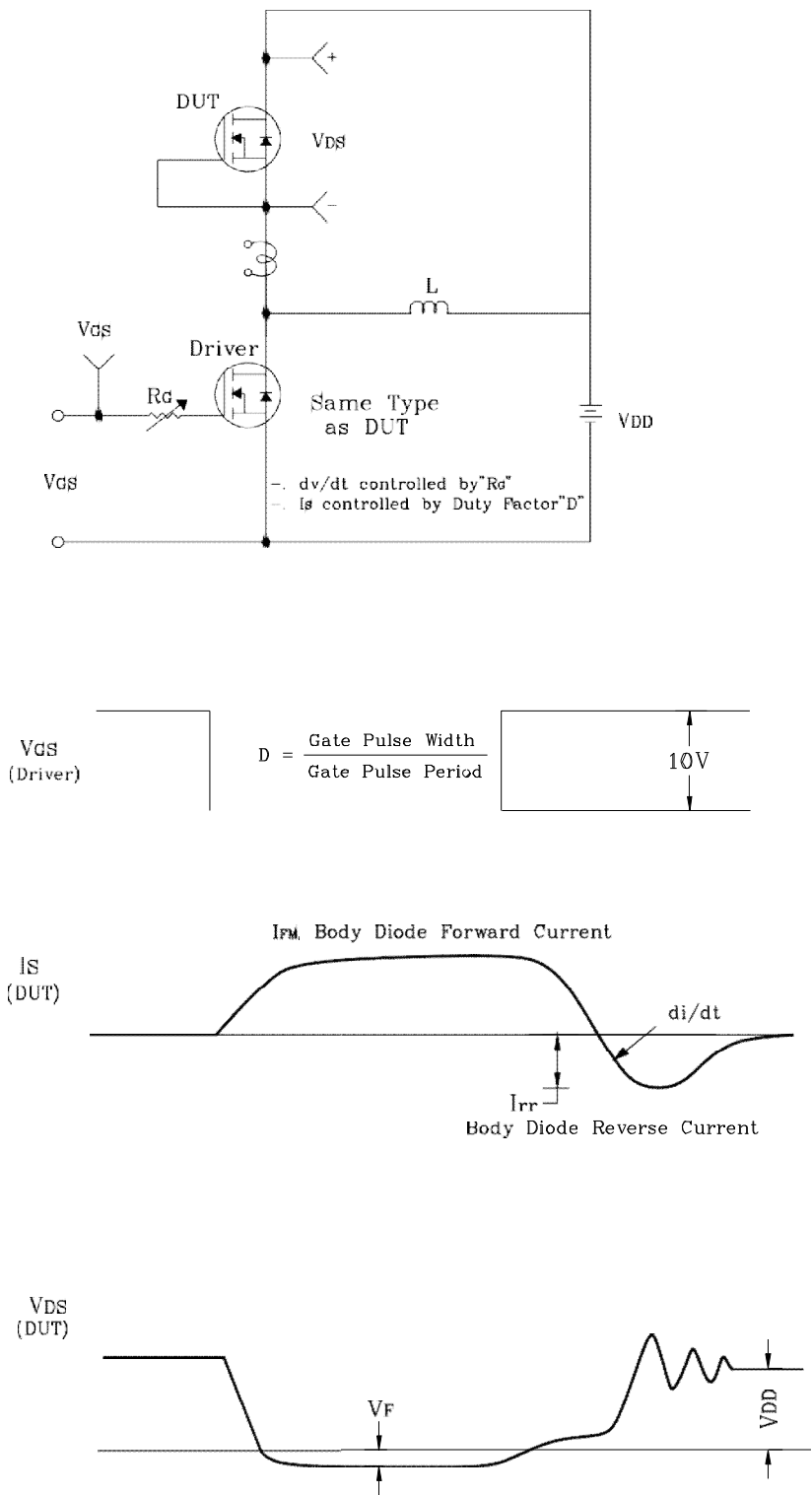
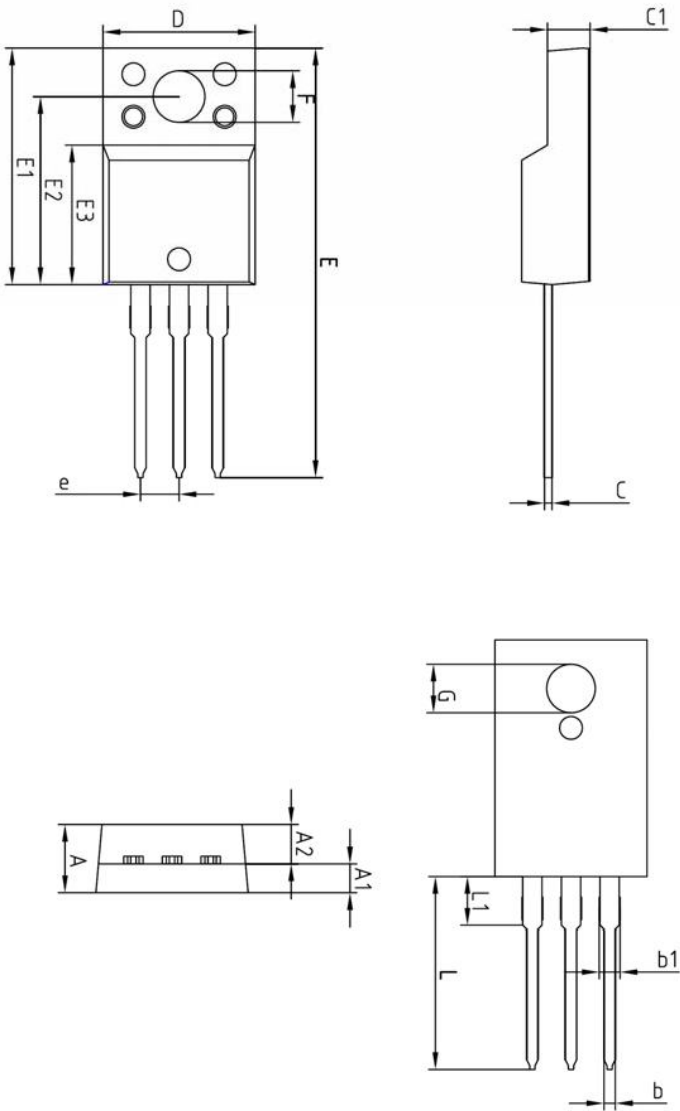


Fig. 14 Diode Reverse Recovery Time Test Circuit & Waveform



Outline Dimension

unit: mm



| SYMBOL | MILLIMETERS |         |         | NOTE |
|--------|-------------|---------|---------|------|
|        | MINIMUM     | NOMINAL | MAXIMUM |      |
| A      | —           | —       | 4.60    |      |
| A1     | 2.45        | 2.50    | 2.55    |      |
| A2     | 1.95        | 2.00    | 2.05    |      |
| b      | 0.65        | 0.75    | 0.85    |      |
| b1     | 1.07        | 1.27    | 1.47    |      |
| C      | 0.40        | 0.50    | 0.60    |      |
| C1     | 2.70        | 2.80    | 2.90    |      |
| D      | 9.90        | 10.00   | 10.10   |      |
| E      | 28.00       | —       | 28.60   |      |
| E1     | 15.50       | 15.60   | 15.70   |      |
| E2     | 12.30       | 12.40   | 12.50   |      |
| E3     | 9.15        | 9.20    | 9.25    |      |
| F      | 3.30        | 3.40    | 3.50    |      |
| G      | 3.10        | 3.20    | 3.30    |      |
| e      | 2.54 BSC    |         |         |      |
| L      | 12.40       | —       | 13.00   |      |
| L1     | 3.46 BSC    |         |         |      |

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