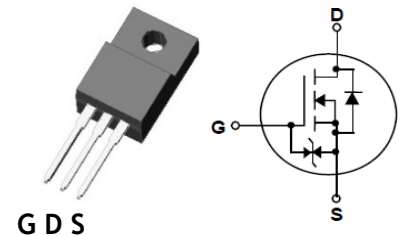


## 650V N-Channel Super Junction MOSFET

### Features

- Very Low FOM ( $R_{DS(on)} \times Q_g$ )
- Extremely low switching loss
- Built-in ESD Diode
- 100% avalanche tested
- Halogen free and RoHS compliant device

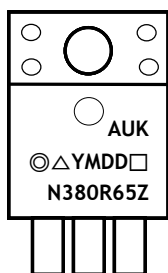


### Ordering Information

| Part Number  | Marking  | Package    |
|--------------|----------|------------|
| SJMN380R65ZF | N380R65Z | TO-220F-3L |

TO-220F-3L

### Marking Information



Column 1: Manufacturer Logo  
Column 2: Production Information

- ◎: Management Code
- △: Machine Code
- YMDD: Date Code Marking (Year, Monthly, Daily)
- □: Factory Management Code

Column 3: Device Code

### Absolute maximum ratings ( $T_c=25^\circ\text{C}$ unless otherwise noted)

| Characteristic                                        | Symbol         |                         | Rating   | Unit             |
|-------------------------------------------------------|----------------|-------------------------|----------|------------------|
| Drain-source voltage                                  | $V_{DS}$       |                         | 650      | V                |
| Gate-source voltage                                   | $V_{GS}$       |                         | $\pm 20$ | V                |
| Drain current (DC)                                    | $I_D$          | $T_c=25^\circ\text{C}$  | 10.4 *   | A                |
|                                                       |                | $T_c=100^\circ\text{C}$ | 6.6 *    | A                |
| Drain current (Pulsed) <sup>1)</sup>                  | $I_{DM}$       |                         | 31.0 *   | A                |
| Single pulsed avalanche energy <sup>2)</sup>          | $E_{AS}$       |                         | 142      | mJ               |
| Repetitive avalanche current                          | $I_{AR}$       |                         | 1.75     | A                |
| Power dissipation                                     | $P_D$          |                         | 30       | W                |
| Diode dv/dt ruggedness, $V_{DS}=0\ldots 400\text{V}$  | dv/dt          |                         | 15       | V/ns             |
| MOSFET dv/dt ruggedness, $V_{DS}=0\ldots 400\text{V}$ | dv/dt          |                         | 50       | V/ns             |
| Gate source ESD (Human Body Model)                    | $V_{ESD(G-S)}$ |                         | 2000     | V                |
| Storage temperature range                             | $T_{stg}$      |                         | -55~150  | $^\circ\text{C}$ |

\* Drain current limited by maximum junction temperature

## Thermal Characteristics

| Characteristic                          | Symbol        | Rating    | Unit |
|-----------------------------------------|---------------|-----------|------|
| Thermal resistance, junction to case    | $R_{th(j-c)}$ | Max. 4.17 | °C/W |
| Thermal resistance, junction to ambient | $R_{th(j-a)}$ | Max. 62.5 |      |

Electrical Characteristics ( $T_C=25^{\circ}\text{C}$  unless otherwise noted)

| Characteristic                 | Symbol       | Test Condition                                                    | Min. | Typ. | Max.    | Unit          |
|--------------------------------|--------------|-------------------------------------------------------------------|------|------|---------|---------------|
| Drain-source breakdown voltage | $BV_{DSS}$   | $I_D=1\text{mA}$ , $V_{GS}=0$                                     | 650  | -    | -       | V             |
| Gate threshold voltage         | $V_{GS(th)}$ | $I_D=370\mu\text{A}$ , $V_{DS}=V_{GS}$                            | 2.0  | -    | 4.0     | V             |
| Drain-source cut-off current   | $I_{DSS}$    | $V_{DS}=650\text{V}$ , $V_{GS}=0\text{V}$                         | -    | -    | 1       | $\mu\text{A}$ |
|                                |              | $V_{DS}=650\text{V}$ , $T_J=150^{\circ}\text{C}$                  | -    | -    | 100     | $\mu\text{A}$ |
| Gate leakage current           | $I_{GSS}$    | $V_{DS}=0\text{V}$ , $V_{GS}=\pm 20\text{V}$                      | -    | -    | $\pm 1$ | $\mu\text{A}$ |
| Drain-source on-resistance     | $R_{DS(ON)}$ | $V_{GS}=10\text{V}$ , $I_D=3.4\text{A}$                           | -    | 0.34 | 0.38    | $\Omega$      |
|                                | $R_g$        | $f=1\text{MHz}$ , Open drain                                      | -    | 4.7  | -       | $\Omega$      |
| Input capacitance              | $C_{iss}$    | $V_{DS}=200\text{V}$ , $V_{GS}=0\text{V}$ ,<br>$f=1\text{MHz}$    | -    | 1030 | -       | pF            |
| Output capacitance             | $C_{oss}$    |                                                                   | -    | 27   | -       |               |
| Reverse transfer capacitance   | $C_{rss}$    |                                                                   | -    | 0.7  | -       |               |
| Turn-on delay time (Note 3,4)  | $t_{d(on)}$  | $V_{DD}=325\text{V}$ , $I_D=4.8\text{A}$ ,<br>$R_G=25\Omega$      | -    | 41   | -       | ns            |
| Rise time (Note 3,4)           | $t_r$        |                                                                   | -    | 34   | -       |               |
| Turn-off delay time (Note 3,4) | $t_{d(off)}$ |                                                                   | -    | 96   | -       |               |
| Fall time (Note 3,4)           | $t_f$        |                                                                   | -    | 37   | -       |               |
| Total gate charge (Note 3,4)   | $Q_g$        | $V_{DS}=520\text{V}$ , $V_{GS}=10\text{V}$ ,<br>$I_D=4.8\text{A}$ | -    | 30   | -       | nC            |
| Gate-source charge (Note 3,4)  | $Q_{gs}$     |                                                                   | -    | 8    | -       |               |
| Gate-drain charge (Note 3,4)   | $Q_{gd}$     |                                                                   | -    | 10   | -       |               |

Source-Drain Diode Ratings and Characteristics ( $T_C=25^{\circ}\text{C}$  unless otherwise noted)

| Characteristic          | Symbol   | Test Condition                                                               | Min. | Typ. | Max. | Unit          |
|-------------------------|----------|------------------------------------------------------------------------------|------|------|------|---------------|
| Source current (DC)     | $I_S$    | Integral reverse diode<br>in the MOSFET                                      | -    | -    | 10.4 | A             |
| Source current (Pulsed) | $I_{SM}$ |                                                                              | -    | -    | 31   | A             |
| Forward voltage         | $V_{SD}$ | $V_{GS}=0\text{V}$ , $I_S=4.8\text{A}$                                       | -    | -    | 1.3  | V             |
| Reverse recovery time   | $t_{rr}$ | $I_S=4.8\text{A}$ , $V_{GS}=0\text{V}$<br>$dI_F/dt=-100\text{A}/\mu\text{s}$ | -    | 285  | -    | ns            |
| Reverse recovery charge | $Q_{rr}$ |                                                                              | -    | 2.7  | -    | $\mu\text{C}$ |

Note:

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2.  $I_{AS}=1.75\text{A}$ ,  $V_{DD}=50\text{V}$ ,  $R_G=25\Omega$ , Starting  $T_J=25^{\circ}\text{C}$
3. Pulse Test : Pulse width  $\leq 300\mu\text{s}$ , Duty Cycle  $\leq 2\%$
4. Essentially Independent of Operating Temperature

## Typical Characteristics Curve

Fig. 1  $I_D - V_{DS}$

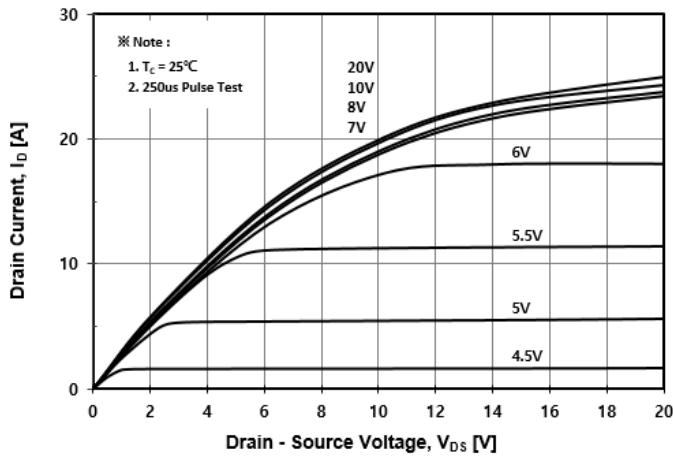


Fig. 2  $I_D - V_{GS}$

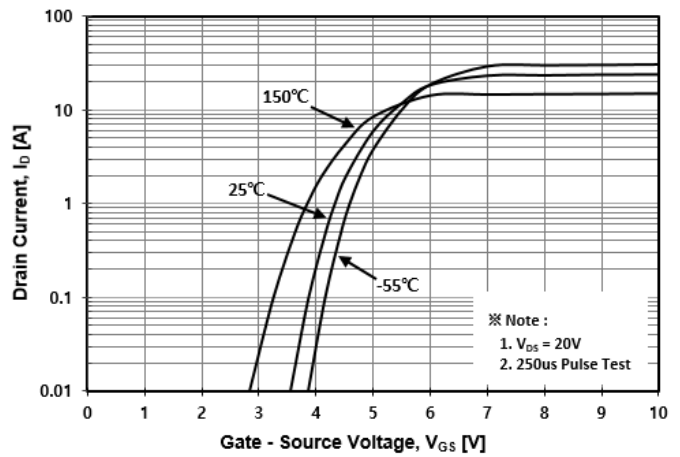


Fig. 3  $R_{DS(ON)} - I_D$

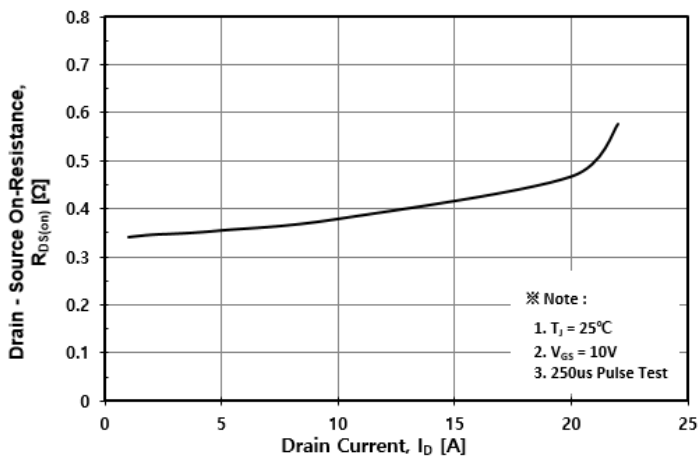


Fig. 4  $I_S - V_{SD}$

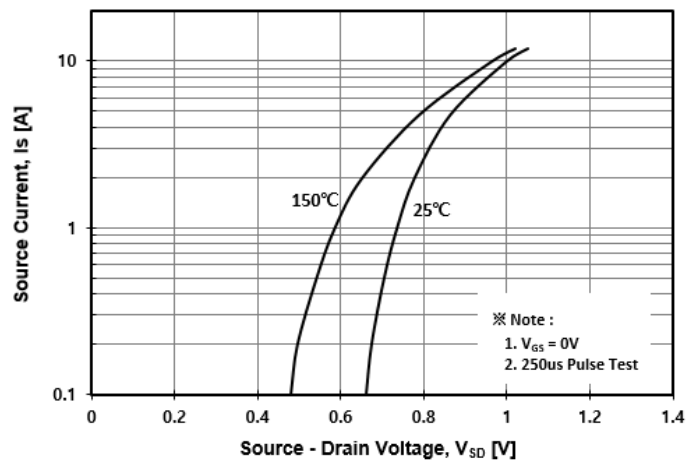


Fig. 5 Capacitance -  $V_{DS}$

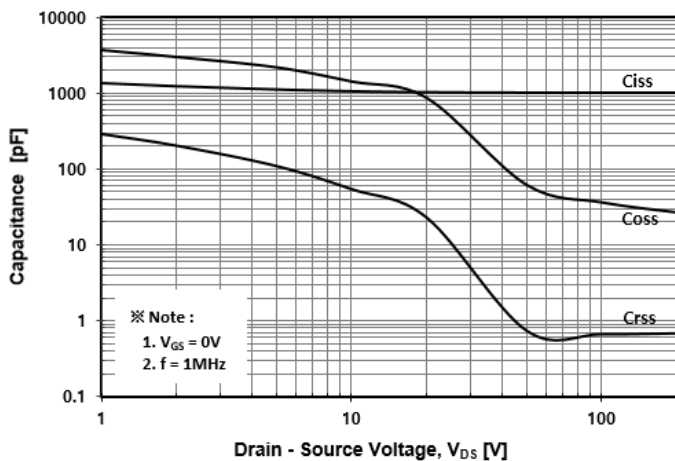
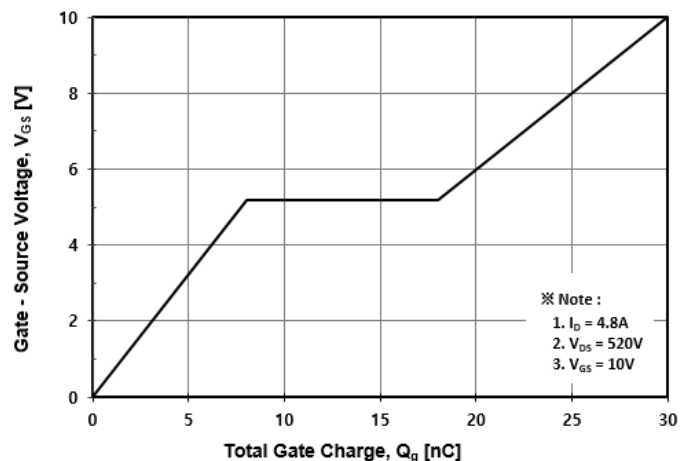


Fig. 6  $V_{GS} - Q_g$



## Typical Characteristics Curve (Continue)

Fig. 7  $BV_{DSS} - T_J$

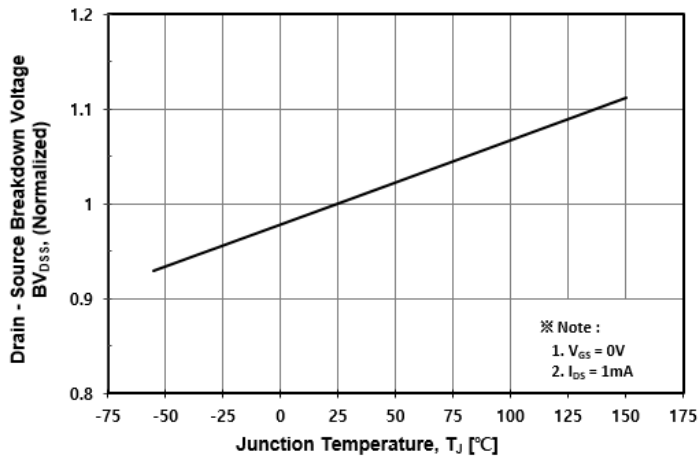


Fig. 8  $R_{DS(ON)} - T_J$

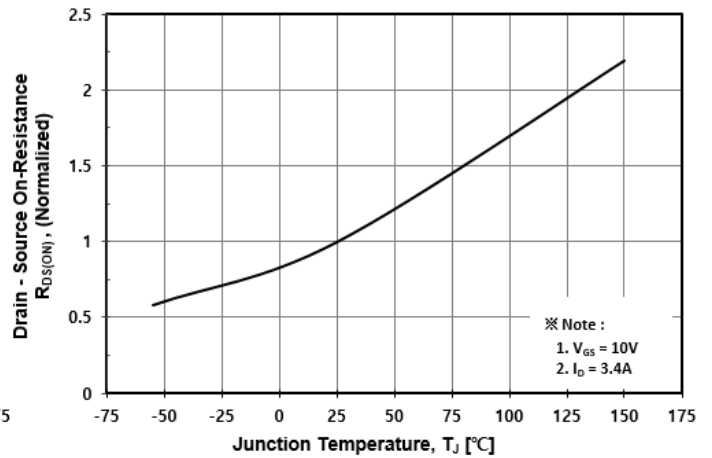


Fig. 9  $I_D - T_C$

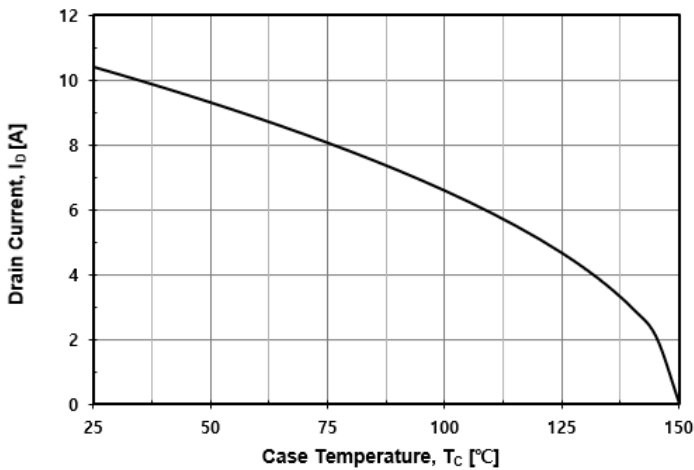


Fig. 10 Safe Operating Area

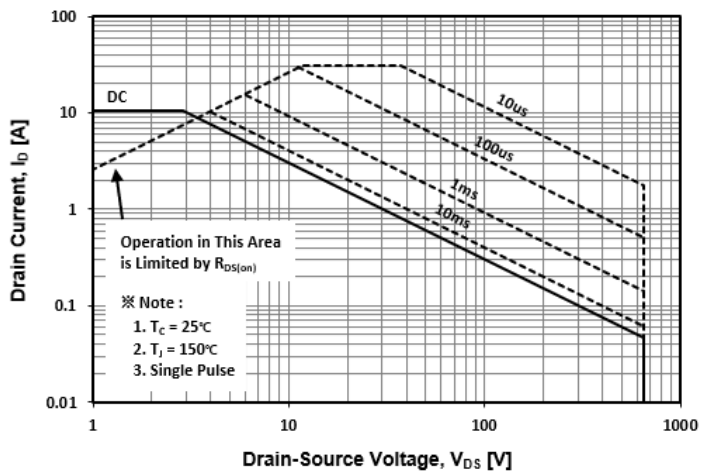
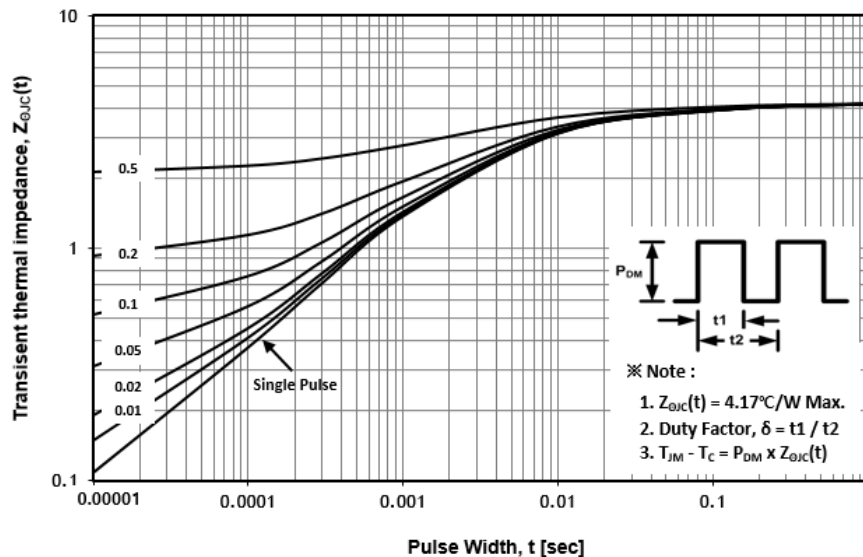
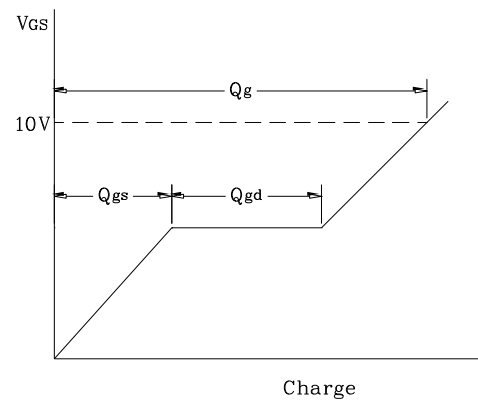
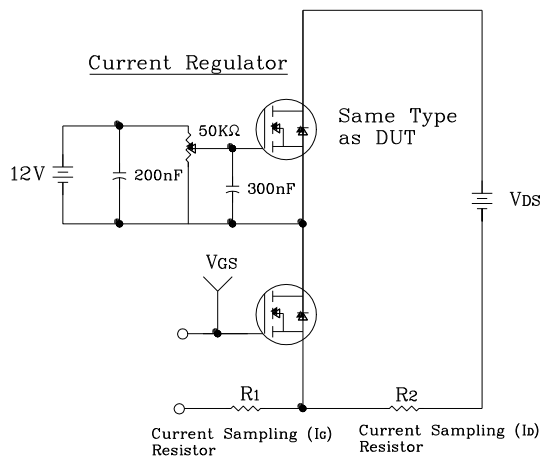


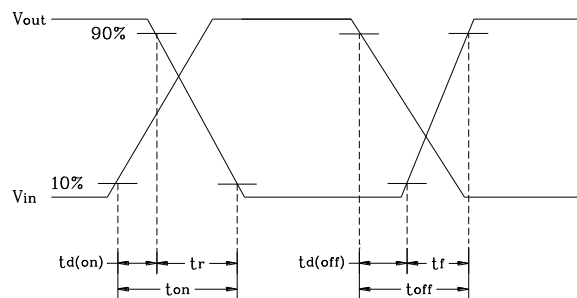
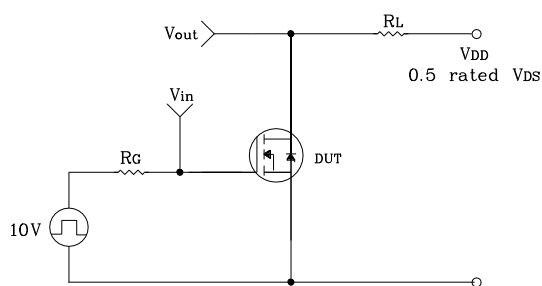
Fig. 11 Transient Thermal Impedance



**Fig. 12 Gate Charge Test Circuit & Waveform**



**Fig. 13 Resistive Switching Test Circuit & Waveform**



**Fig. 14 EAS Test Circuit & Waveform**

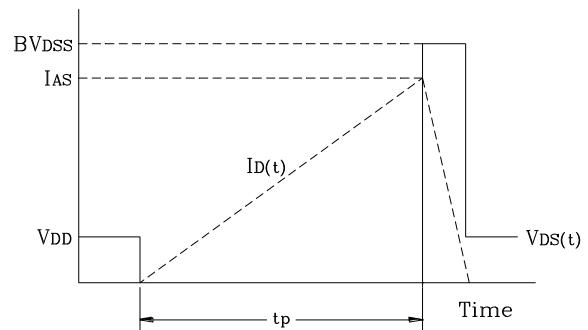
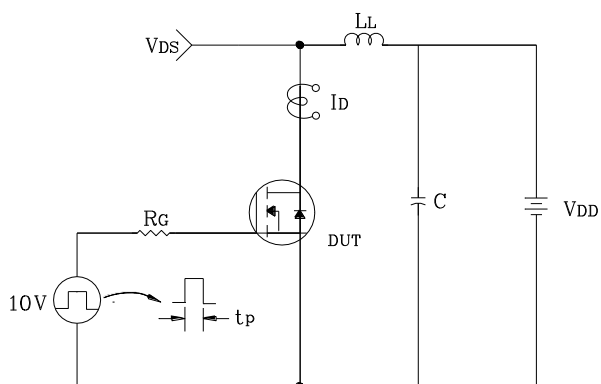
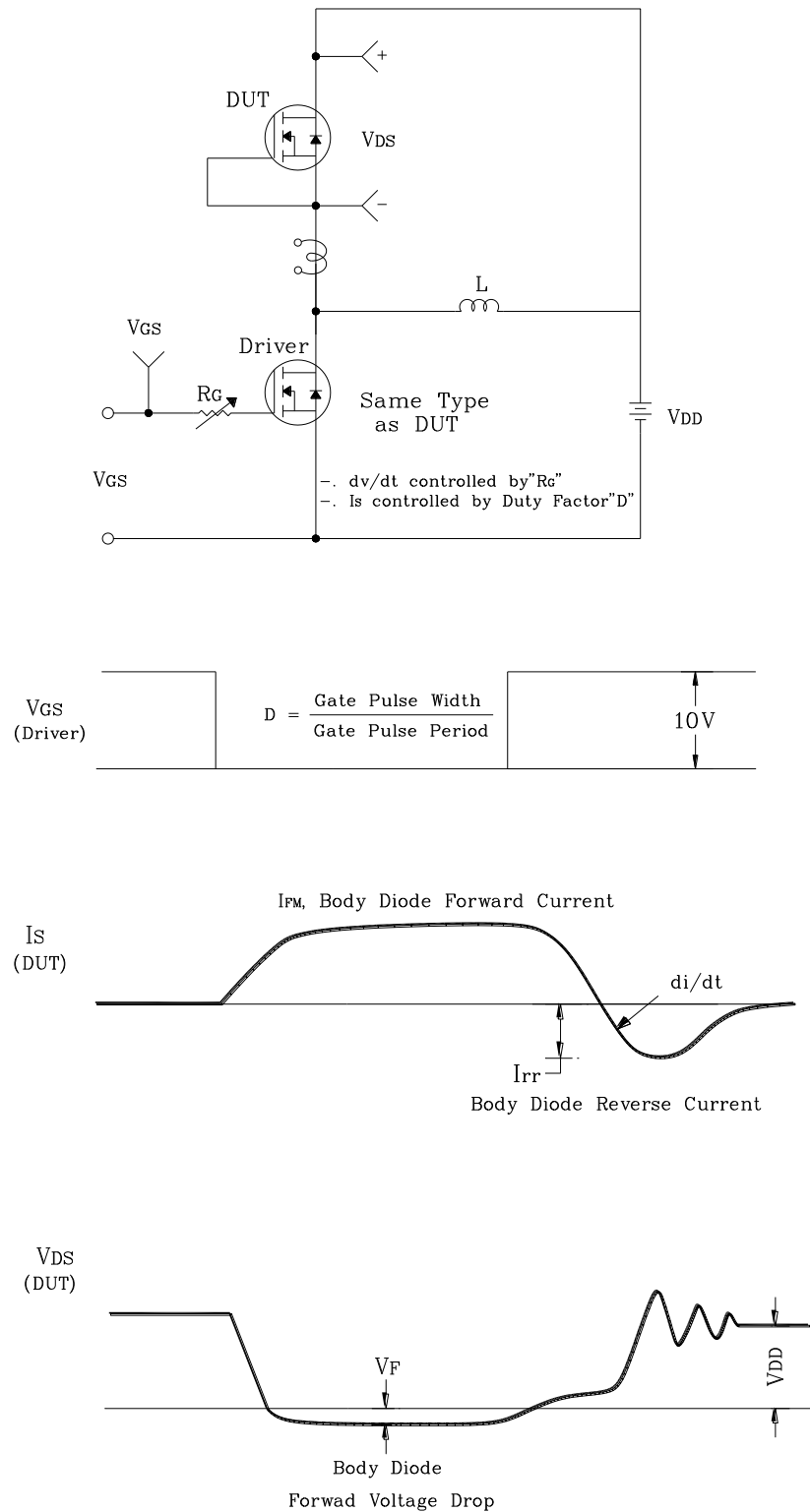
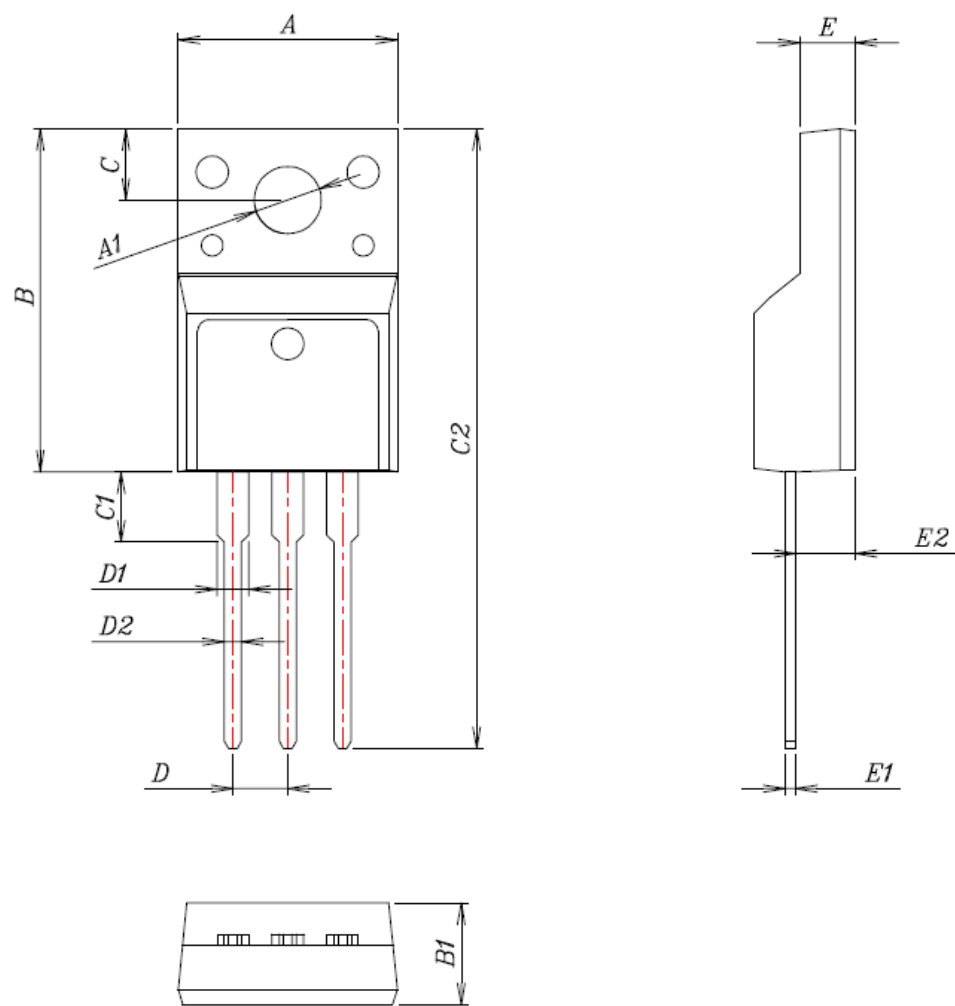


Fig. 15 Diode Reverse Recovery Time Test Circuit & Waveform



Package Outline Dimensions



| SYMBOL | MILLIMETERS  |
|--------|--------------|
| A      | 10.16±0.30   |
| A1     | 3.12±0.20    |
| B      | 15.90±0.50   |
| B1     | 4.70±0.30    |
| C      | 3.30±0.25    |
| C1     | 3.25±0.30    |
| C2     | 28.70±0.50   |
| D      | Typical 2.54 |
| D1     | 1.47(MAX)    |
| D2     | 0.80±0.20    |
| E      | 2.55±0.25    |
| E1     | 0.50±0.20    |
| E2     | 2.75±0.30    |

The AUK Corp. products are intended for the use as components in general electronic equipment (Office and communication equipment, measuring equipment, home appliance, etc.).

Please make sure that you consult with us before you use these AUK Corp. products in equipments which require high quality and / or reliability, and in equipments which could have major impact to the welfare of human life(atomic energy control, airplane, spaceship, transportation, combustion control, all types of safety device, etc.). AUK Corp. cannot accept liability to any damage which may occur in case these AUK Corp. products were used in the mentioned equipments without prior consultation with AUK Corp..

Specifications mentioned in this publication are subject to change without notice.