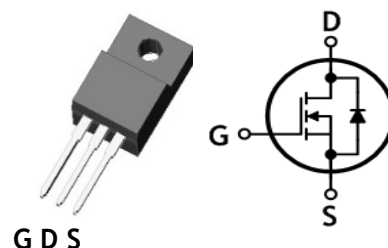


## N-Channel Super Junction MOSFET

### Features

- Drain-Source voltage:  $V_{DS}=650V$  (@ $T_J=150^{\circ}C$ )
- Low drain-source On resistance:  $R_{DS(on)}=0.6\Omega$  (Max.)
- Ultra low gate charge:  $Q_g=13.5nC$  (Typ.)
- RoHS compliant device
- 100% avalanche tested



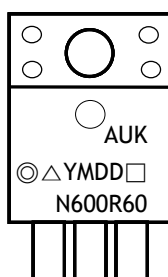
G D S

TO-220F-3L

### Ordering Information

| Part Number | Marking | Package    |
|-------------|---------|------------|
| SJMN600R60F | N600R60 | TO-220F-3L |

### Marking Information



Column 1 : Manufacture Logo  
Column 2 : Production Information

e.g) ◎△YMDD□

-. ◎ = Management Code

-. △ = Machine Code

-. YMDD = Date Code (year, week, daily)

-. □ = Factory Management Code

Column 3 : Device Code

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

| Characteristic                          | Symbol    | Rating             | Unit        |
|-----------------------------------------|-----------|--------------------|-------------|
| Drain-source voltage                    | $V_{DSS}$ | 600                | V           |
| Gate-source voltage                     | $V_{GSS}$ | $\pm 30$           | V           |
| Drain current (DC) (Note 1)             | $I_D$     | $T_C=25^{\circ}C$  | 7           |
|                                         |           | $T_C=100^{\circ}C$ | 4.4         |
| Drain current (Pulsed) (Note 1)         | $I_{DM}$  | 28                 | A           |
| Single pulsed avalanche energy (Note 2) | $E_{AS}$  | 158                | mJ          |
| Repetitive avalanche current (Note 1)   | $I_{AR}$  | 7                  | A           |
| Repetitive avalanche energy (Note 1)    | $E_{AR}$  | 3.2                | mJ          |
| Power dissipation                       | $P_D$     | 32                 | W           |
| Junction temperature                    | $T_J$     | 150                | $^{\circ}C$ |
| Storage temperature range               | $T_{stg}$ | -55~150            | $^{\circ}C$ |

\* Limited only maximum junction temperature

## Thermal Characteristics

| Characteristic                          | Symbol        | Rating    | Unit |
|-----------------------------------------|---------------|-----------|------|
| Thermal resistance, junction to case    | $R_{th(j-c)}$ | Max. 3.9  | °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 | $BV_{DSS}$   | $I_D=250\mu\text{A}$ , $V_{GS}=0$                               | 650  | -    | -         | V             |
| Gate threshold voltage         | $V_{GS(th)}$ | $I_D=250\mu\text{A}$ , $V_{DS}=V_{GS}$                          | 2    | 3    | 4         | V             |
| Drain-source cut-off current   | $I_{DSS}$    | $V_{DS}=600\text{V}$ , $V_{GS}=0\text{V}$                       | -    | -    | 1         | $\mu\text{A}$ |
|                                |              | $V_{DS}=600\text{V}$ , $T_J=125^\circ\text{C}$                  | -    | -    | 100       | $\mu\text{A}$ |
| Gate leakage current           | $I_{GSS}$    | $V_{DS}=0\text{V}$ , $V_{GS}=\pm 30\text{V}$                    | -    | -    | $\pm 100$ | nA            |
| Drain-source on-resistance     | $R_{DS(ON)}$ | $V_{GS}=10\text{V}$ , $I_D=3.5\text{A}$                         | -    | -    | 0.6       | $\Omega$      |
| Input capacitance              | $C_{iss}$    | $V_{DS}=25\text{V}$ , $V_{GS}=0\text{V}$ ,<br>$f=1\text{MHz}$   | -    | 557  | -         | pF            |
| Output capacitance             | $C_{oss}$    |                                                                 | -    | 294  | -         |               |
| Reverse transfer capacitance   | $C_{rss}$    |                                                                 | -    | 17   | -         |               |
| Turn-on delay time (Note 3)    | $t_{d(on)}$  | $V_{DS}=350\text{V}$ , $I_D=7\text{A}$ ,<br>$R_G=25\Omega$      | -    | 16   | -         | ns            |
| Rise time (Note 3)             | $t_r$        |                                                                 | -    | 13   | -         |               |
| Turn-off delay time (Note 3)   | $t_{d(off)}$ |                                                                 | -    | 35   | -         |               |
| Fall time (Note 3)             | $t_f$        |                                                                 | -    | 7    | -         |               |
| Total gate charge (Note 4)     | $Q_g$        | $V_{DS}=400\text{V}$ , $V_{GS}=10\text{V}$ ,<br>$I_D=7\text{A}$ | -    | 13.5 | -         | nC            |
| Gate-source charge (Note 4)    | $Q_{gs}$     |                                                                 | -    | 4.5  | -         |               |
| Gate-drain charge (Note 4)     | $Q_{gd}$     |                                                                 | -    | 3.5  | -         |               |

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                                     | -    | -    | 7    | A             |
| Source current (Pulsed)            | $I_{SM}$ |                                                                             | -    | -    | 28   | A             |
| Forward voltage                    | $V_{SD}$ | $V_{GS}=0\text{V}$ , $I_S=7\text{A}$                                        | -    | -    | 1.2  | V             |
| Reverse recovery time (Note 3,4)   | $t_{rr}$ | $I_S=7\text{A}$ , $V_{GS}=0\text{V}$ ,<br>$di_S/dt=100\text{A}/\mu\text{s}$ | -    | 278  | -    | ns            |
| Reverse recovery charge (Note 3,4) | $Q_{rr}$ |                                                                             | -    | 2    | -    | $\mu\text{C}$ |

Note:

1. Calculated continuous current based on maximum allowable junction temperature
2.  $L=7\text{mH}$ ,  $I_{AS}=7\text{A}$ ,  $V_{DD}=50\text{V}$ , Starting  $T_J=25^\circ\text{C}$
3. Guaranteed by design, not subject to production testing
4. Pulse test: Pulse width $\leq 300\mu\text{s}$ , Duty cycle $\leq 2\%$

## Typical Electrical Characteristics Curves

Fig. 1 Typical Output Characteristics

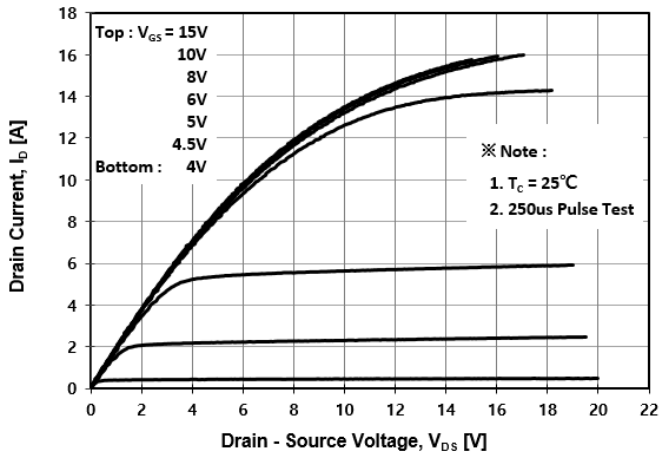


Fig. 2 Typical Transfer Characteristics

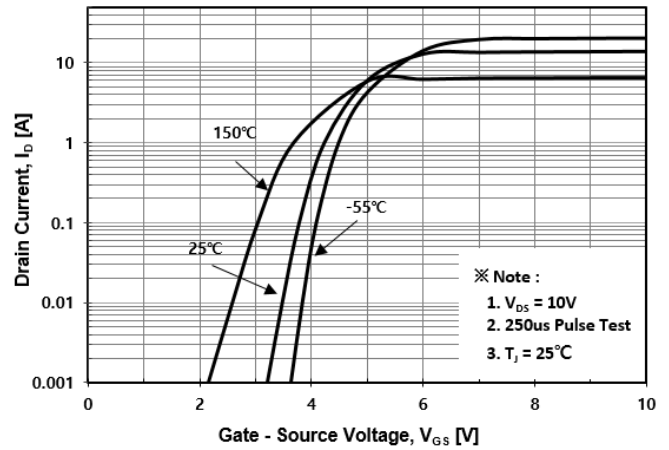


Fig.3 On-Resistance Variation with Drain Current and Gate Voltage

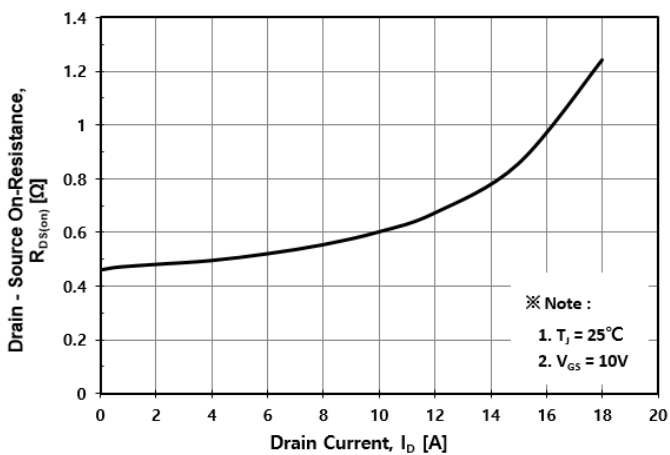


Fig. 4 Body Diode Forward Voltage Variation with Source Current

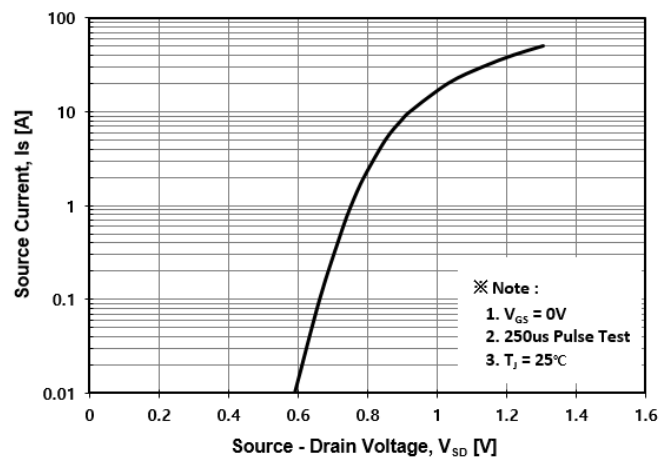


Fig. 5 Typical Capacitance Characteristics

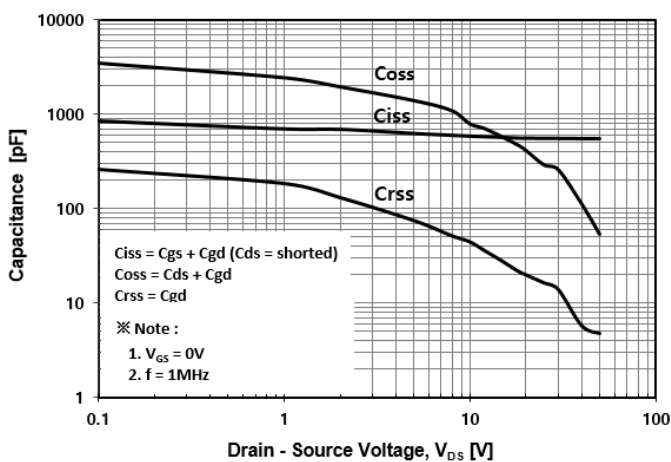
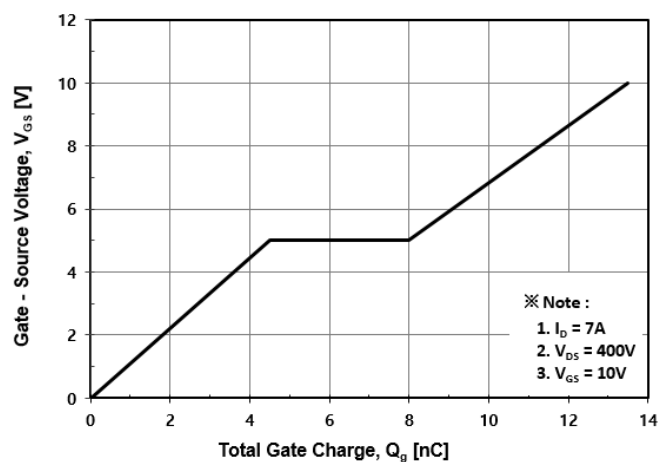


Fig. 6 Typical Total Gate Charge Characteristics



## Typical Electrical Characteristics Curves

Fig. 7 Breakdown Voltage Variation vs. Temperature

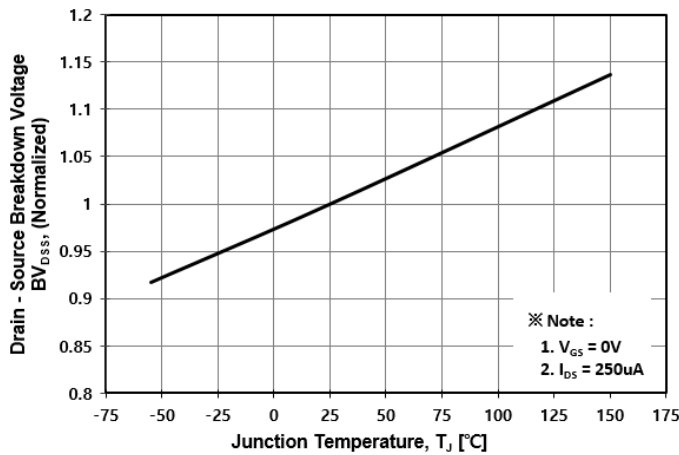


Fig. 8 On-Resistance Variation vs. Temperature

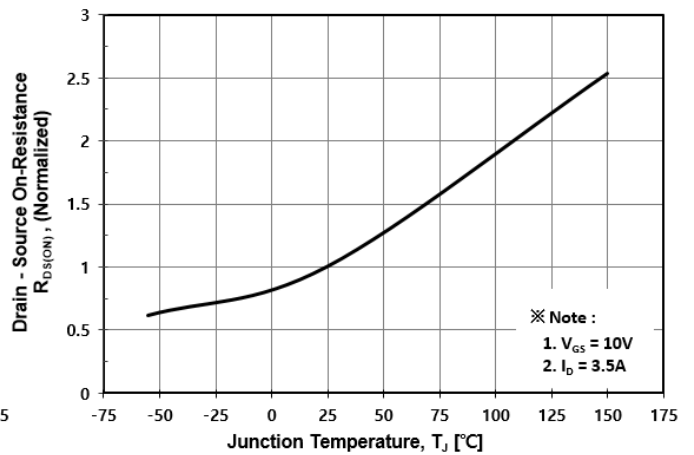


Fig. 9 Maximum Drain Current vs. Case Temperature

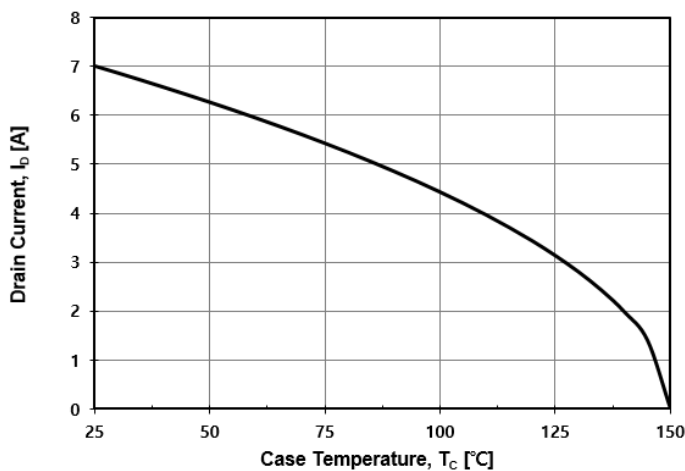


Fig. 10 Maximum Safe Operating Area

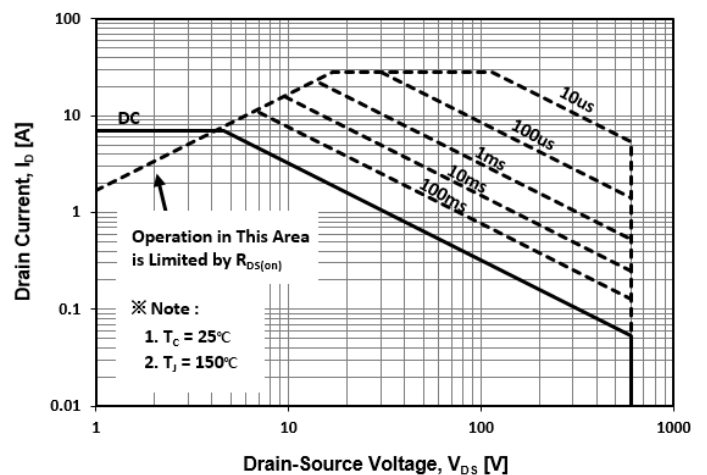
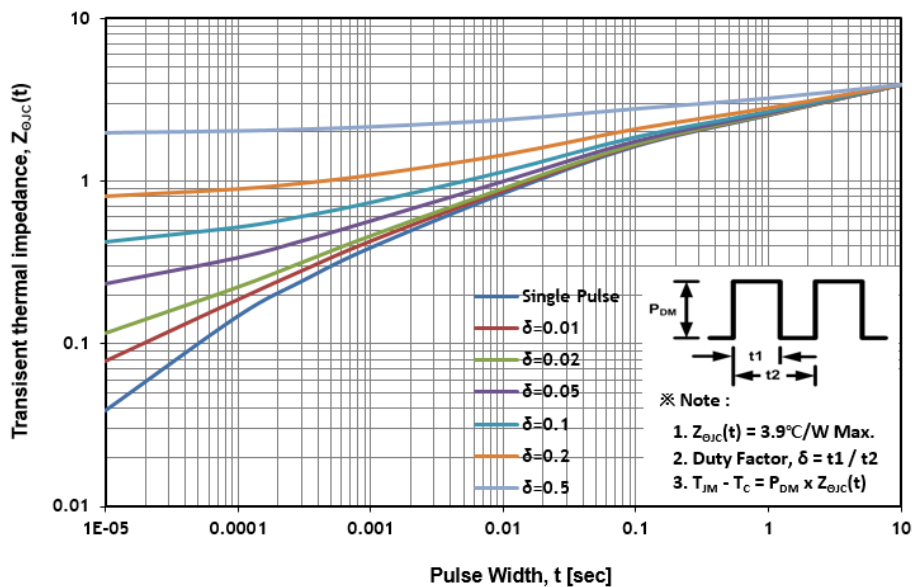
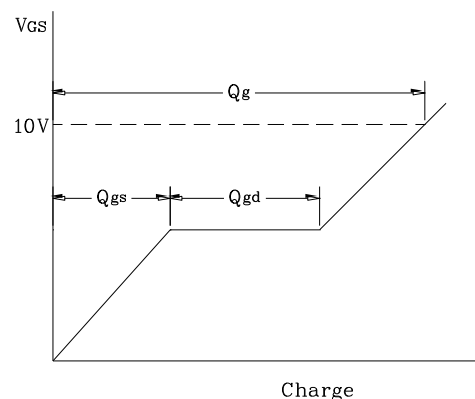
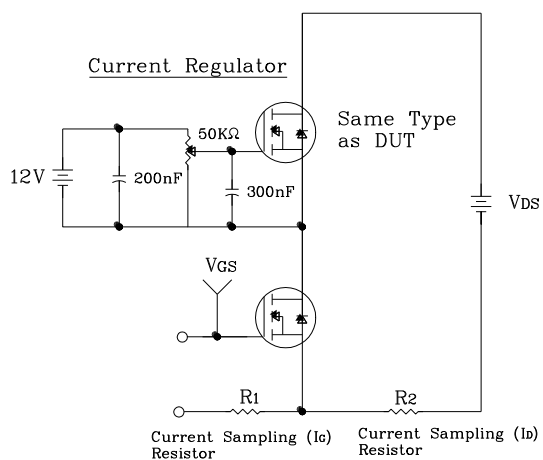


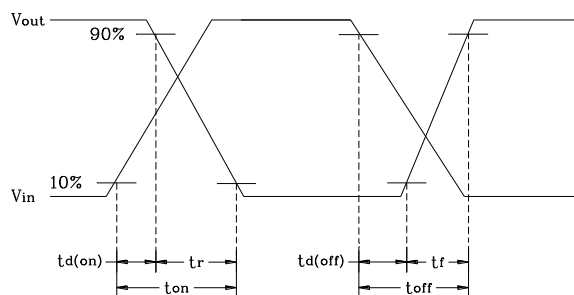
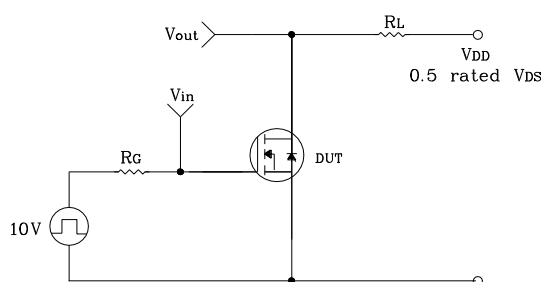
Fig. 11 Transient Thermal Impedance



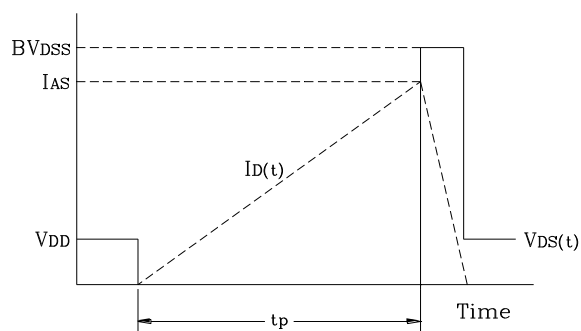
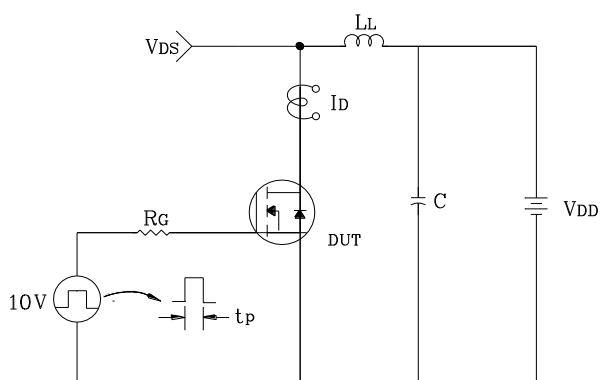
**Fig. 12 Gate Charge Test Circuit & Waveform**



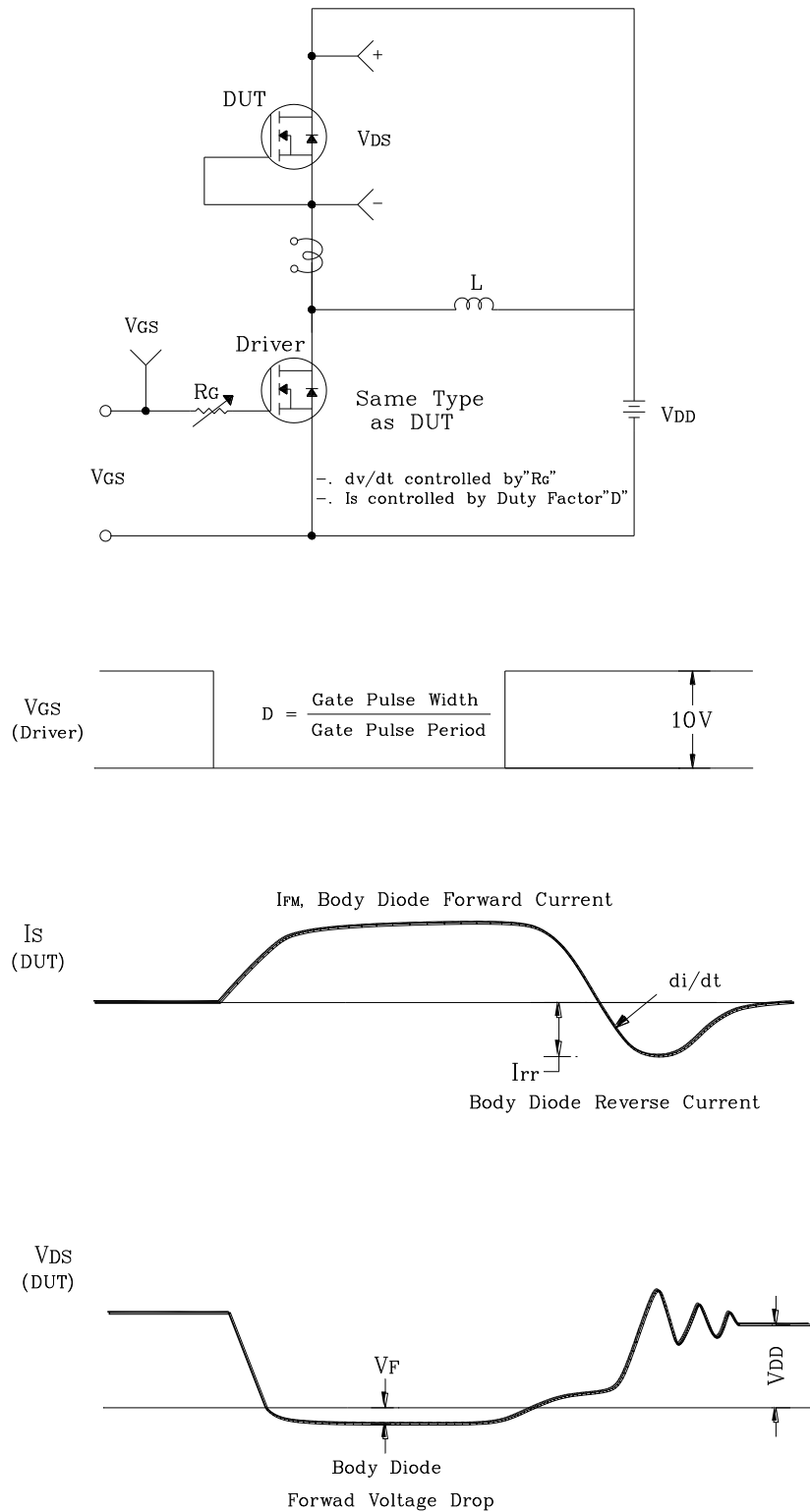
**Fig. 13 Resistive Switching Test Circuit & Waveform**



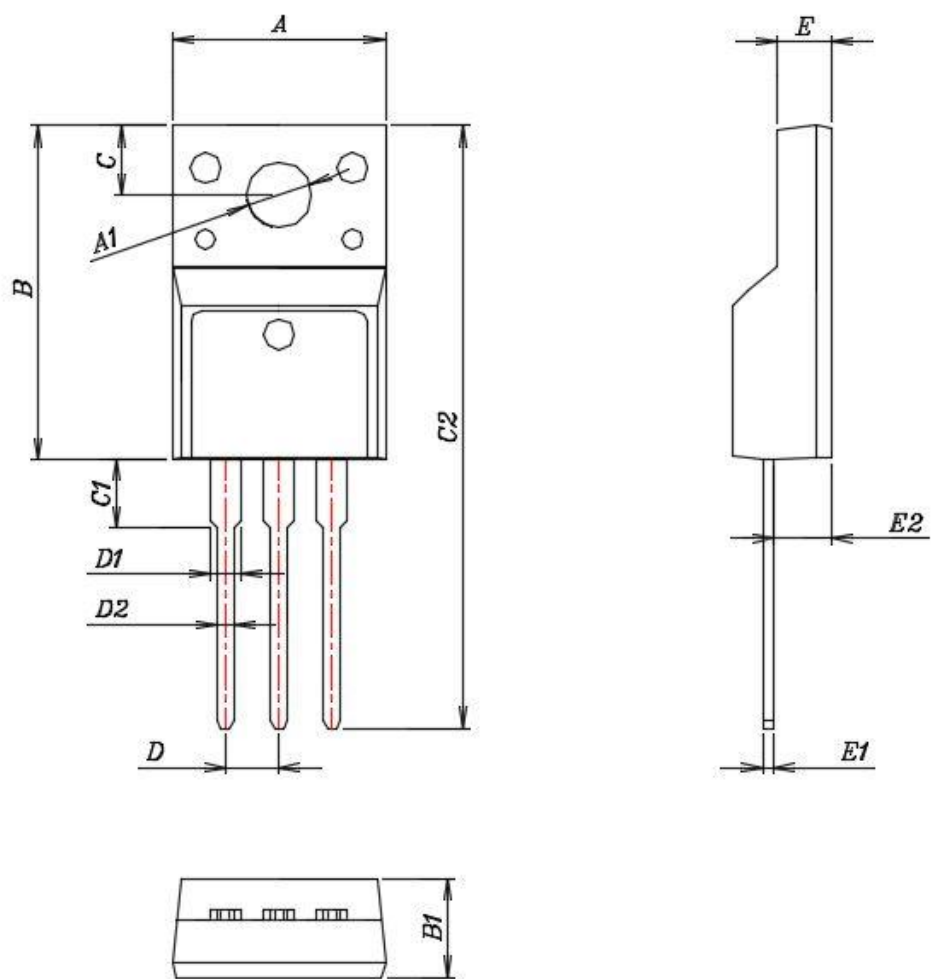
**Fig. 14 EAS Test Circuit & Waveform**



**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    |

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