

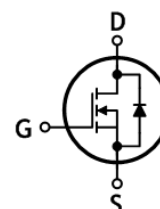
## N-Channel Super Junction MOSFET

### Features

- Drain-Source voltage:  $V_{DS}=650V$  (@ $T_J=150^{\circ}C$ )
- Low drain-source On resistance:  $R_{DS(on)}=0.34\Omega$  (Typ.)
- Ultra low gate charge:  $Q_g=20nC$  (Typ.)
- RoHS compliant device
- 100% avalanche tested

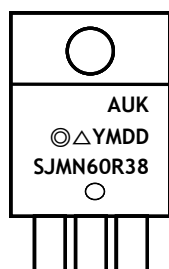
### Ordering Information

| Part Number | Marking   | Package    |
|-------------|-----------|------------|
| SJMN60R38F  | SJMN60R38 | TO-220F-3L |



TO-220F-3L

### Marking Information



Column 1: Manufacturer  
 Column 2: Production Information  
 e.g.) ◎△YMDD  
 -. ◎△: Factory Management Code  
 -. YMDD: Date Code (Year, Month, Daily)  
 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)             | $I_D$     | $T_C=25^{\circ}C$  | 11          |
|                                         |           | $T_C=100^{\circ}C$ | 7           |
| Drain current (Pulsed) (Note 1)         | $I_{DM}$  | 30                 | A           |
| Single pulsed avalanche energy (Note 2) | $E_{AS}$  | 346                | 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 | $BV_{DSS}$   | $I_D=250\mu\text{A}$ , $V_{GS}=0$                                | 600  | -    | -         | V             |
| Gate threshold voltage         | $V_{GS(th)}$ | $I_D=250\mu\text{A}$ , $V_{DS}=V_{GS}$                           | 2.5  | 3.5  | 4.5       | V             |
| Drain-source cut-off current   | $I_{DSS}$    | $V_{DS}=600\text{V}$ , $V_{GS}=0\text{V}$                        | -    | -    | 1         | $\mu\text{A}$ |
|                                |              | $V_{DS}=480\text{V}$ , $T_J=125^\circ\text{C}$                   | -    | -    | 10        | $\mu\text{A}$ |
| Gate leakage current           | $I_{GSS}$    | $V_{DS}=0\text{V}$ , $V_{GS}=\pm 30\text{V}$                     | -    | -    | $\pm 100$ | nA            |
| Drain-source on-resistance     | $R_{DS(ON)}$ | $V_{GS}=10\text{V}$ , $I_D=5.5\text{A}$                          | -    | 0.34 | 0.38      | $\Omega$      |
| Input capacitance              | $C_{iss}$    | $V_{DS}=25\text{V}$ , $V_{GS}=0\text{V}$ ,<br>$f=1\text{MHz}$    | -    | 1050 | -         | pF            |
| Output capacitance             | $C_{oss}$    |                                                                  | -    | 792  | -         |               |
| Reverse transfer capacitance   | $C_{rss}$    |                                                                  | -    | 5    | -         |               |
| Turn-on delay time (Note 3)    | $t_{d(on)}$  | $V_{DS}=400\text{V}$ , $I_D=11\text{A}$ ,<br>$R_G=25\Omega$      | -    | 16   | -         | ns            |
| Rise time (Note 3)             | $t_r$        |                                                                  | -    | 14   | -         |               |
| Turn-off delay time (Note 3)   | $t_{d(off)}$ |                                                                  | -    | 40   | -         |               |
| Fall time (Note 3)             | $t_f$        |                                                                  | -    | 5    | -         |               |
| Total gate charge (Note 4)     | $Q_g$        | $V_{DS}=480\text{V}$ , $V_{GS}=10\text{V}$ ,<br>$I_D=11\text{A}$ | -    | 20   | -         | nC            |
| Gate-source charge (Note 4)    | $Q_{gs}$     |                                                                  | -    | 6.5  | -         |               |
| Gate-drain charge (Note 4)     | $Q_{gd}$     |                                                                  | -    | 6.5  | -         |               |

## 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                                      | -    | -    | 11   | A             |
| Source current (Pulsed)            | $I_{SM}$ |                                                                              | -    | -    | 30   | A             |
| Forward voltage                    | $V_{SD}$ | $V_{GS}=0\text{V}$ , $I_S=11\text{A}$                                        | -    | -    | 1.3  | V             |
| Reverse recovery time (Note 3,4)   | $t_{rr}$ | $I_S=11\text{A}$ , $V_{GS}=0\text{V}$ ,<br>$dI_S/dt=100\text{A}/\mu\text{s}$ | -    | 360  | -    | ns            |
| Reverse recovery charge (Note 3,4) | $Q_{rr}$ |                                                                              | -    | 3.4  | -    | $\mu\text{C}$ |

Note:

1. Calculated continuous current based on maximum allowable junction temperature
2.  $L=10\text{mH}$ ,  $I_{AS}=8\text{A}$ ,  $V_{DD}=50\text{V}$ , 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

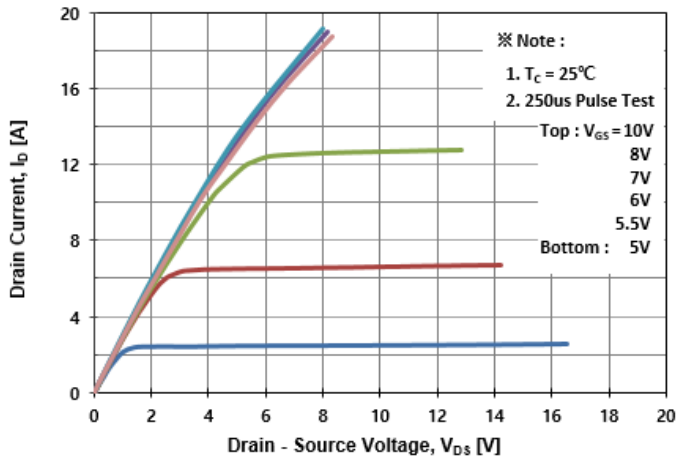


Fig. 2 Typical Transfer Characteristics

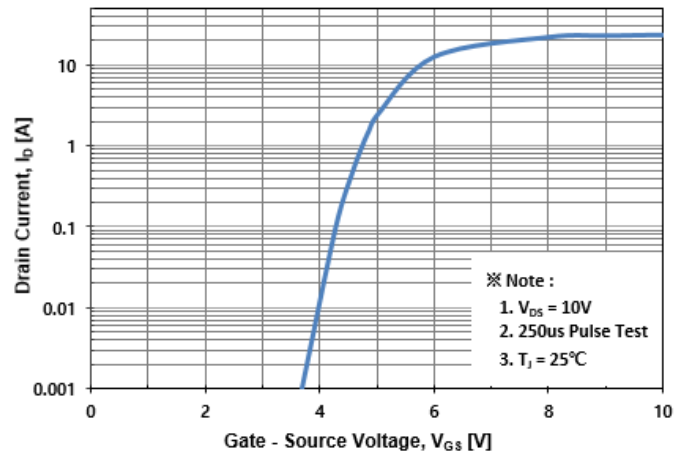


Fig.3 On-Resistance Variation with Drain Current and Gate Voltage

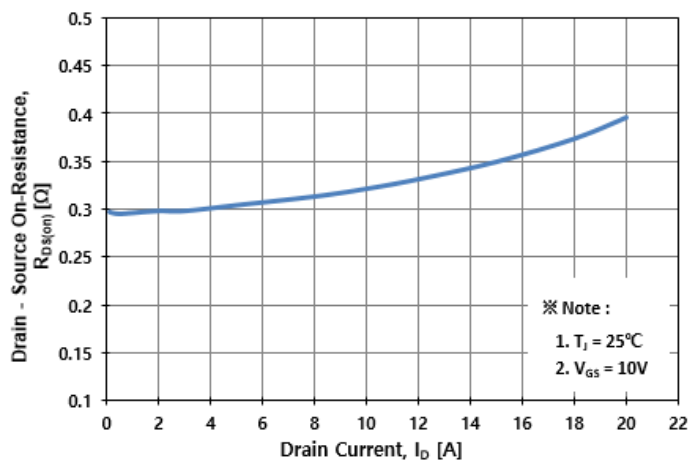


Fig. 4 Body Diode Forward Voltage Variation with Source Current

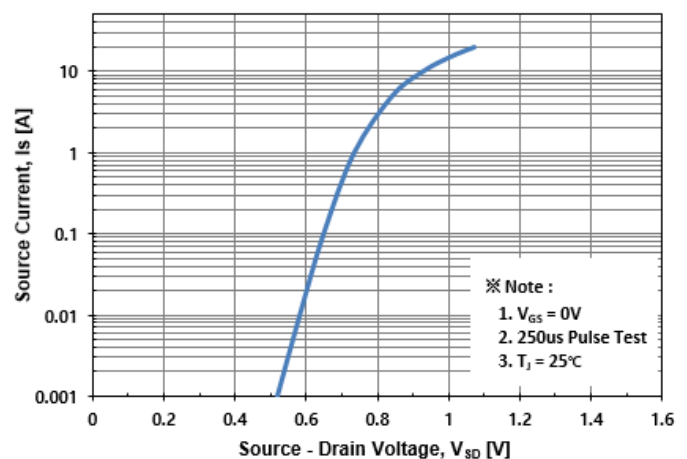


Fig. 5 Typical Capacitance Characteristics

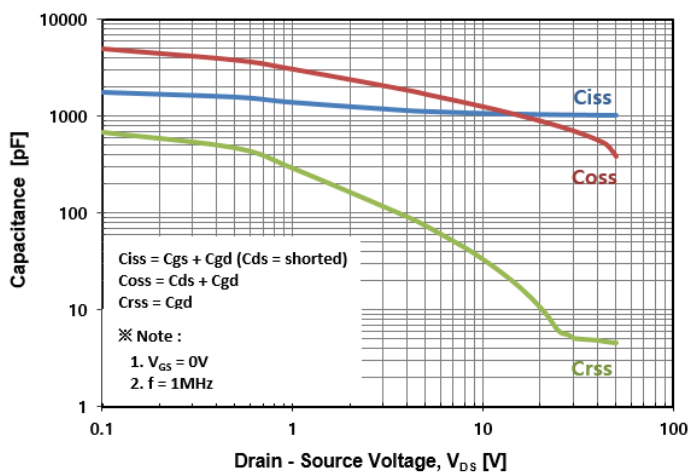


Fig. 6 Typical Total Gate Charge Characteristics

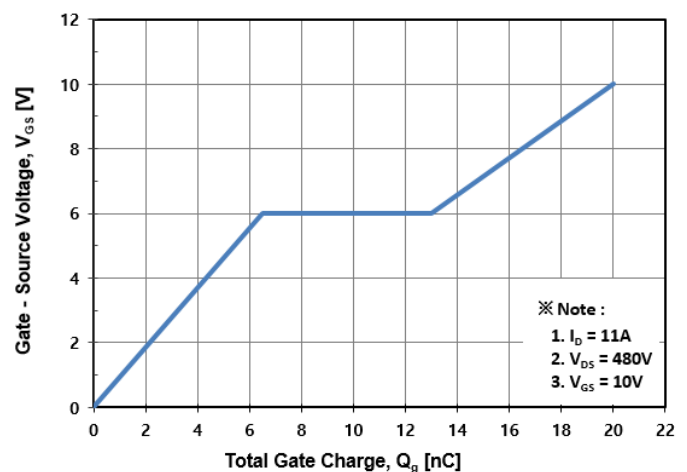


Fig. 7 Breakdown Voltage Variation vs. Temperature

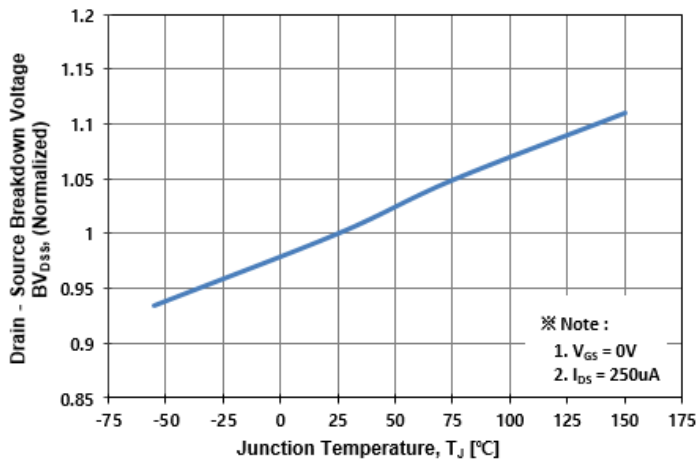


Fig. 8 On-Resistance Variation vs. Temperature

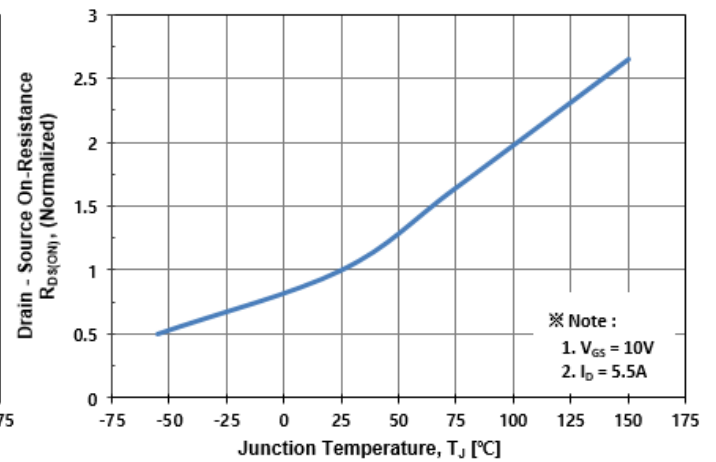


Fig. 9 Maximum Drain Current vs. Case Temperature

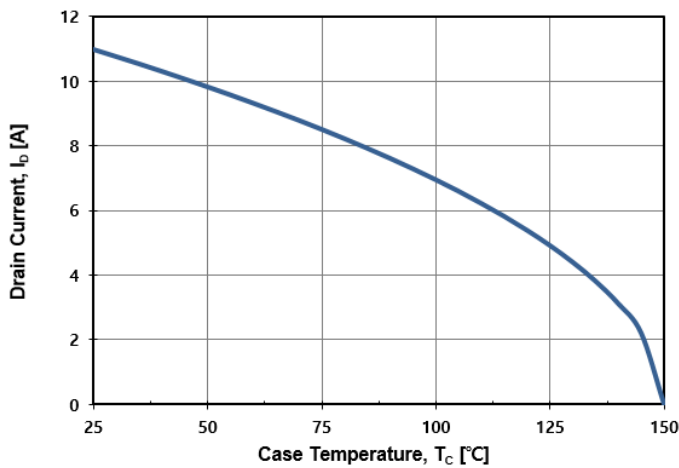


Fig. 10 Maximum Safe Operating Area

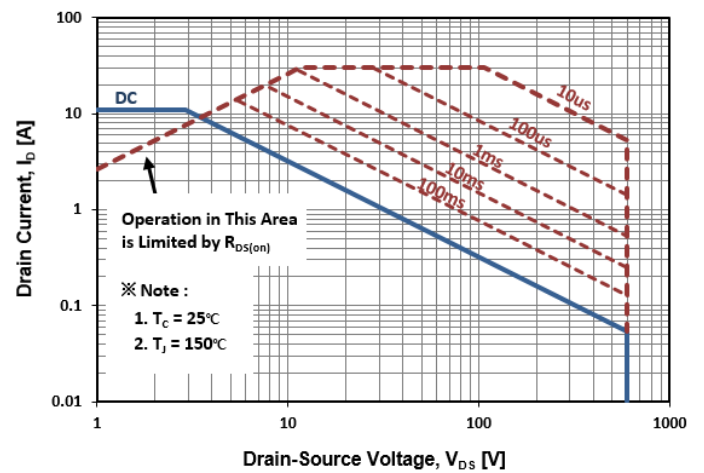


Fig. 11 Transient Thermal Impedance

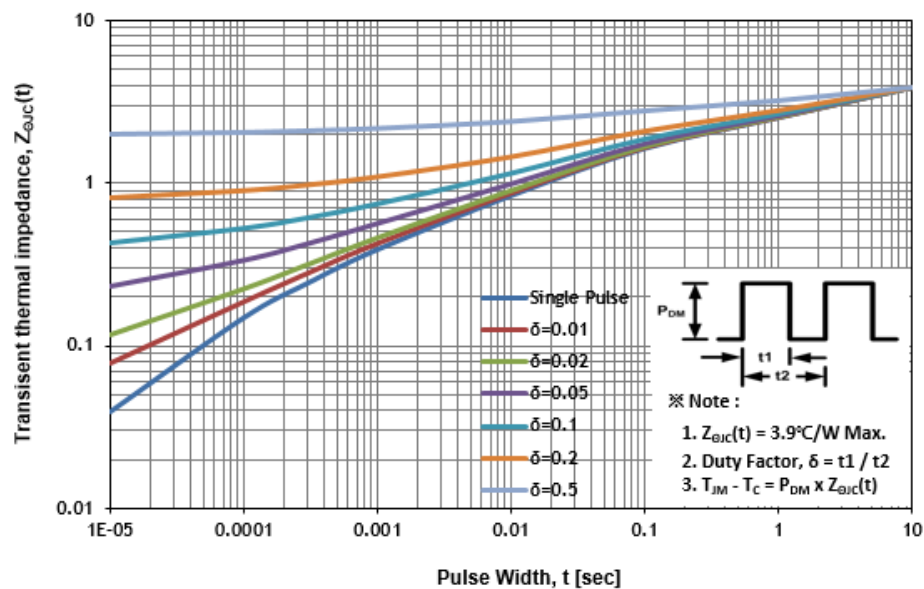


Fig. 12 Gate Charge Test Circuit & Waveform

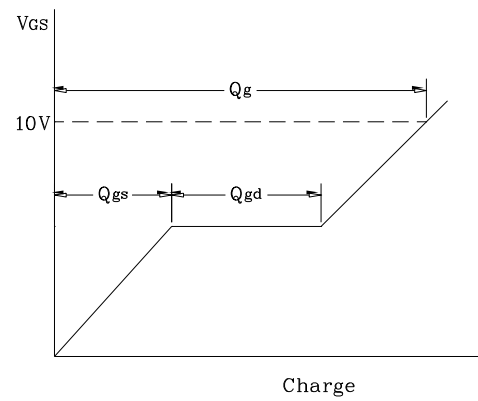
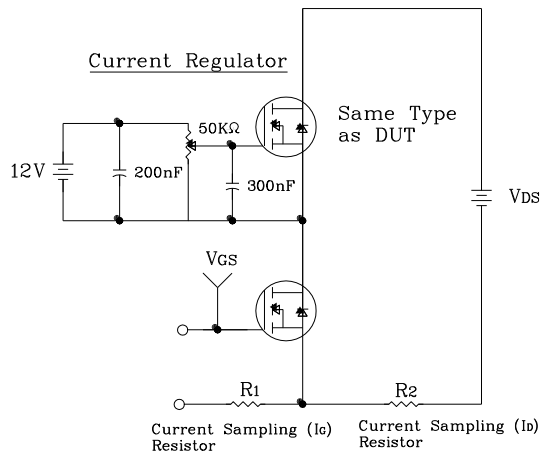


Fig. 13 Resistive Switching Test Circuit & Waveform

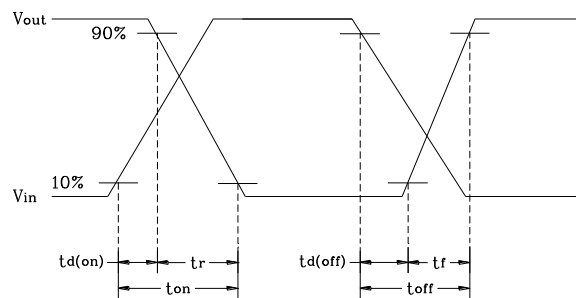
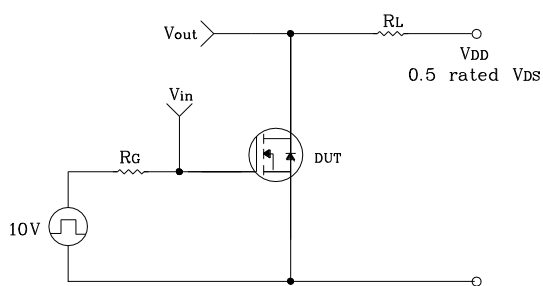
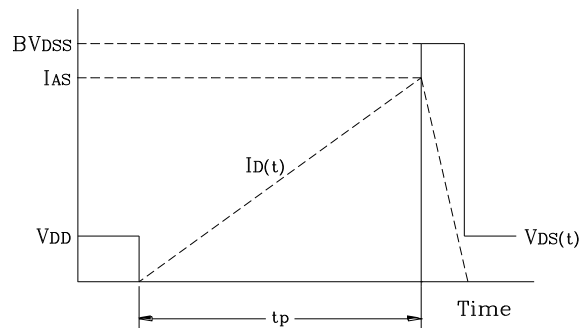
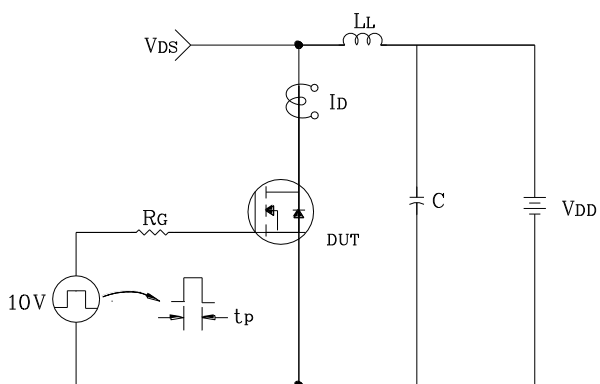
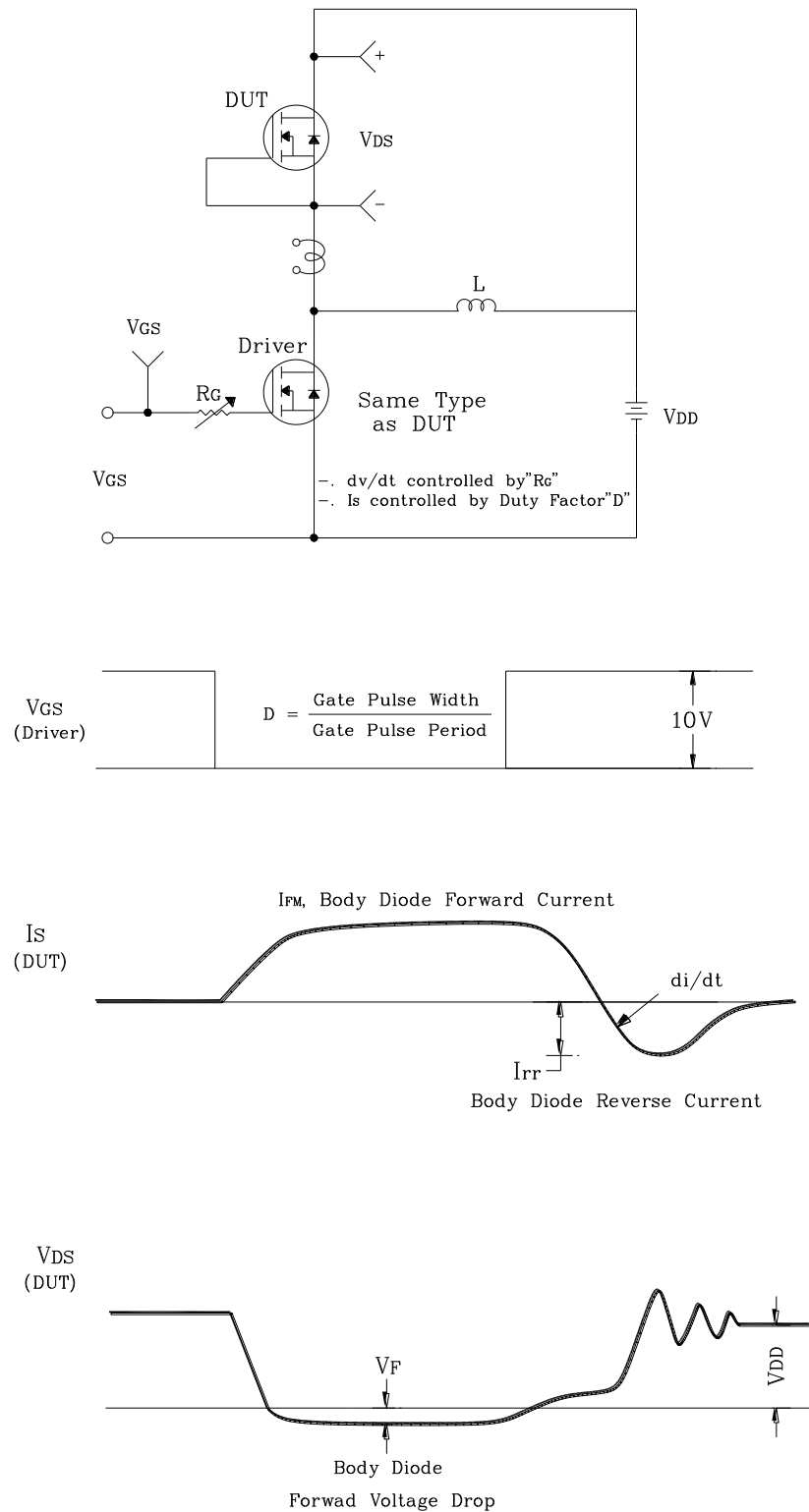


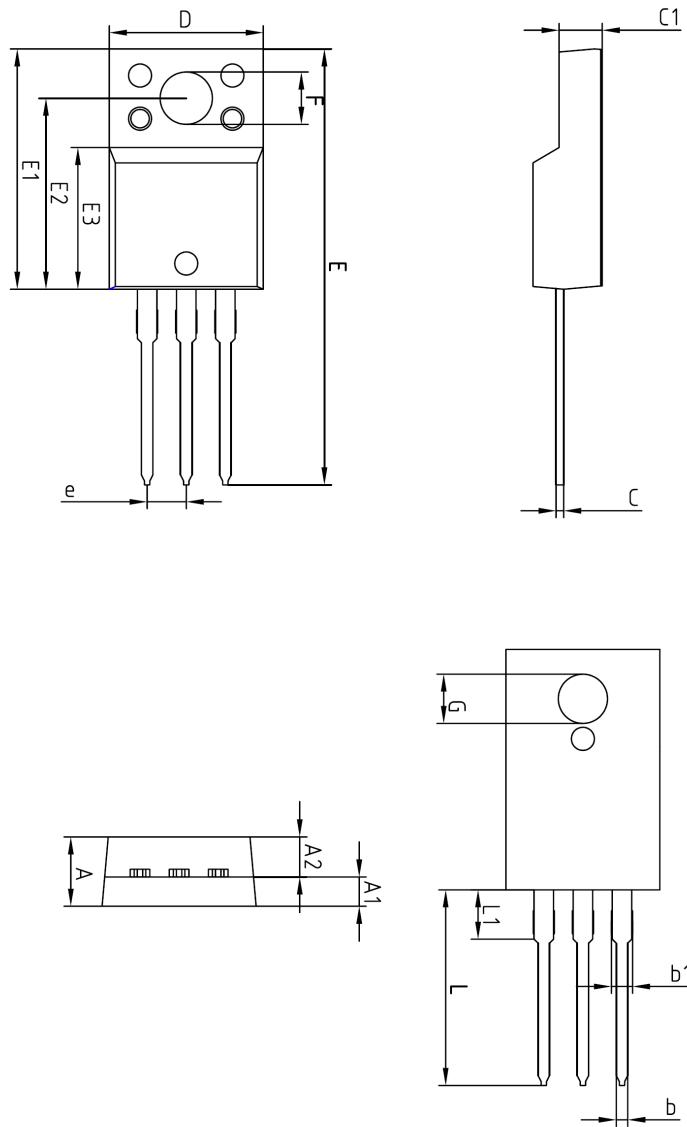
Fig. 14  $E_{AS}$  Test Circuit & Waveform



**Fig. 15 Diode Reverse Recovery Time Test Circuit & Waveform**



## Package Outline Dimensions



| 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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