

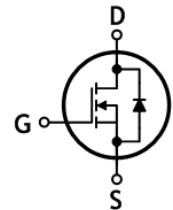
SWITCHING REGULATOR APPLICATION

Features

- Drain-Source breakdown voltage: $BV_{DSS}=700V$ (Min.)
- Low gate charge: $Q_g=13nC$ (Typ.)
- Low drain-source On resistance: $R_{DS(on)}=2.36\Omega$ (Max.)
- 100% avalanche tested
- RoHS compliant device

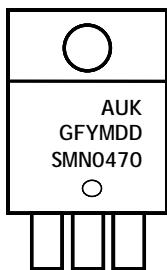
Ordering Information

| Part Number | Marking | Package |
|-------------|---------|------------|
| SMN0470F | SMN0470 | TO-220F-3L |



TO-220F-3L

Marking Information



Column 1: Manufacturer
 Column 2: Production Information
 e.g.) GFYMDD
 -. G: Option Code (H: Halogen Free)
 -. F: Factory Management Code
 -. YMDD: 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} | ± 30 | V | |
| Drain current (DC) * | I_D | $T_C=25^\circ C$ | 4 | A |
| | | $T_C=100^\circ C$ | 2.53 | A |
| Drain current (Pulsed) * | I_{DM} | 16 | A | |
| Single avalanche current ^(Note 2) | I_{AS} | 4 | A | |
| Single pulsed avalanche energy ^(Note 2) | E_{AS} | 344 | mJ | |
| Repetitive avalanche current ^(Note 1) | I_{AR} | 4 | A | |
| Repetitive avalanche energy ^(Note 1) | E_{AR} | 2.9 | mJ | |
| Power dissipation | P_D | 29 | 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. 4.27 | °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} | $I_D=250\mu\text{A}$, $V_{GS}=0$ | 700 | - | - | V |
| Gate threshold voltage | $V_{GS(th)}$ | $I_D=250\mu\text{A}$, $V_{DS}=V_{GS}$ | 3 | 4 | 5 | V |
| Drain-source cut-off current | I_{DSS} | $V_{DS}=700\text{V}$, $V_{GS}=0\text{V}$ | - | - | 1 | μA |
| Gate leakage current | I_{GSS} | $V_{DS}=0\text{V}$, $V_{GS}=\pm 30\text{V}$ | - | - | ± 100 | nA |
| Drain-source on-resistance | $R_{DS(on)}$ | $V_{GS}=10\text{V}$, $I_D=2\text{A}$ | - | 2 | 2.36 | Ω |
| Forward transfer conductance (Note 3) | g_{fs} | $V_{DS}=10\text{V}$, $I_D=2\text{A}$ | - | 4 | - | S |
| Input capacitance | C_{iss} | $V_{DS}=25\text{V}$, $V_{GS}=0\text{V}$, $f=1.0\text{MHz}$ | - | 736 | 1046 | pF |
| Output capacitance | C_{oss} | | - | 65 | 92 | |
| Reverse transfer capacitance | C_{rss} | | - | 8.2 | 12 | |
| Turn-on delay time (Note 3,4) | $t_{d(on)}$ | $V_{DD}=350\text{V}$, $I_D=4\text{A}$, $R_G=25\Omega$ | - | 60 | 139 | ns |
| Rise time (Note 3,4) | t_r | | - | 73 | 161 | |
| Turn-off delay time (Note 3,4) | $t_{d(off)}$ | | - | 98 | 216 | |
| Fall time (Note 3,4) | t_f | | - | 32 | 73 | |
| Total gate charge (Note 3,4) | Q_g | $V_{DS}=560\text{V}$, $V_{GS}=10\text{V}$, $I_D=4\text{A}$ | - | 13 | 18 | nC |
| Gate-source charge (Note 3,4) | Q_{gs} | | - | 5 | - | |
| Gate-drain charge (Note 3,4) | Q_{gd} | | - | 3 | - | |

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 in the MOSFET | - | - | 4 | A |
| Source current (Pulsed) | I_{SM} | | - | - | 16 | A |
| Forward voltage | V_{SD} | $V_{GS}=0\text{V}$, $I_S=4\text{A}$ | - | - | 1.4 | V |
| Reverse recovery time (Note 3,4) | t_{rr} | $I_S=4\text{A}$, $V_{GS}=0\text{V}$ $di_F/dt=100\text{A}/\mu\text{s}$ | - | 481 | - | ns |
| Reverse recovery charge (Note 3,4) | Q_{rr} | | - | 2.1 | - | μC |

Note:

1. Repeated rating: Pulse width limited by safe operating area
2. $L=40\text{mH}$, $I_{AS}=4\text{A}$, $V_{DD}=50\text{V}$, $R_G=25\Omega$, 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

Electrical Characteristics Curves

Fig. 1 $I_D - V_{DS}$

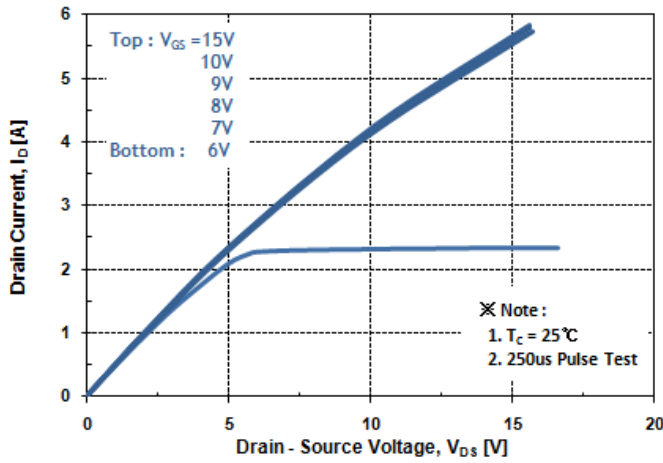


Fig. 2 $I_D - V_{GS}$

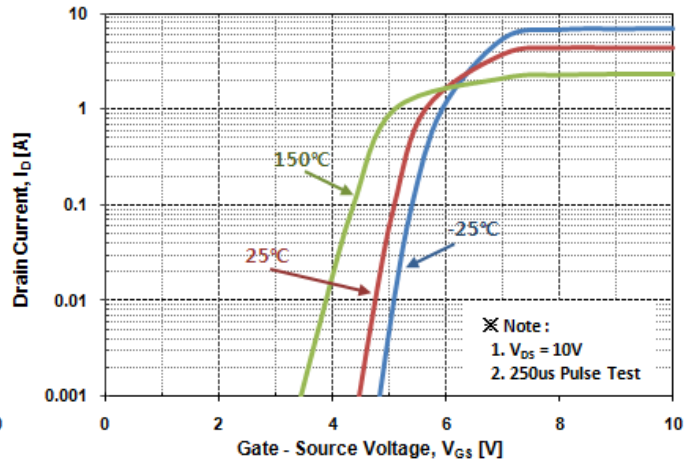


Fig. 3 $R_{DS(ON)} - I_D$

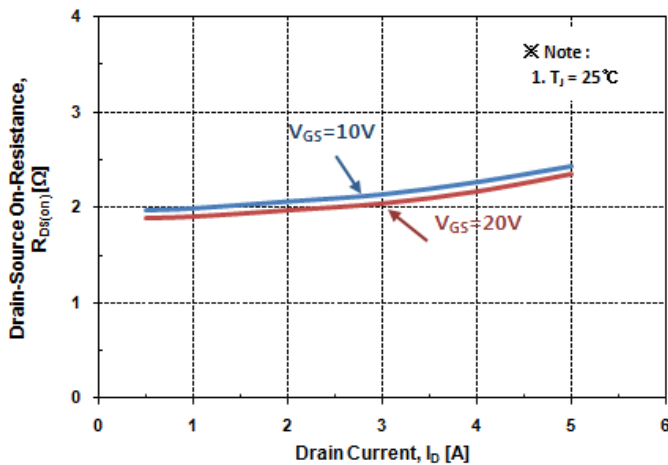


Fig. 4 $I_S - V_{SD}$

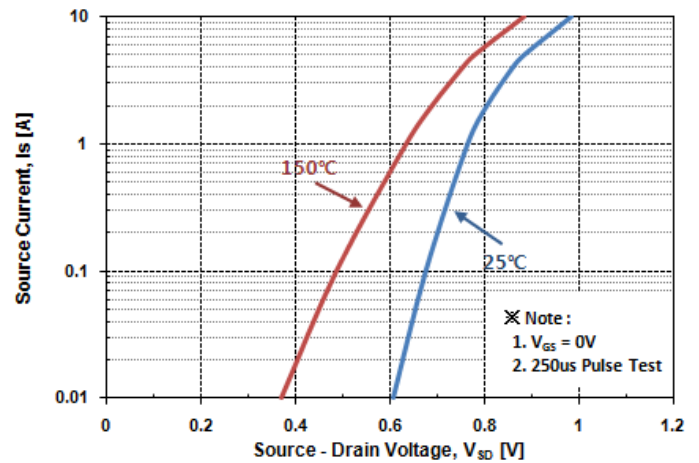


Fig. 5 Capacitance - V_{DS}

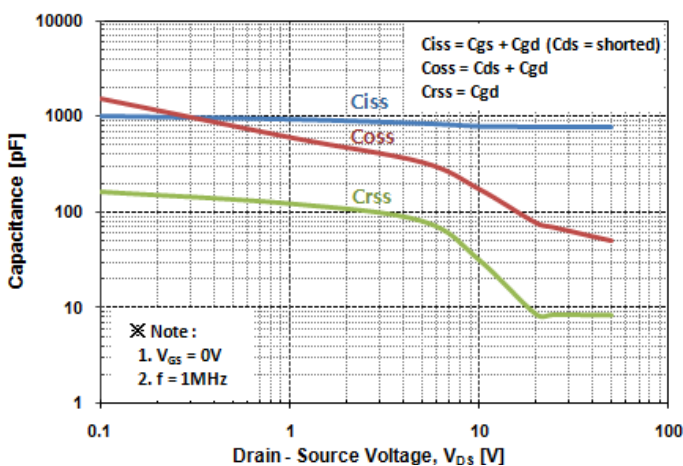


Fig. 6 $V_{GS} - Q_G$

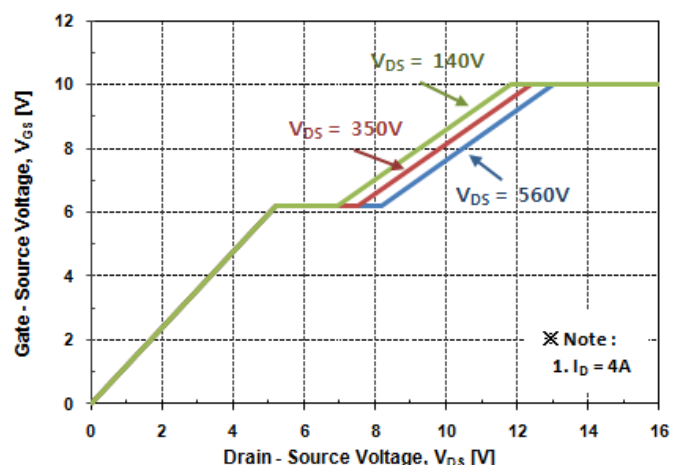


Fig. 7 $V_{DSS} - T_J$

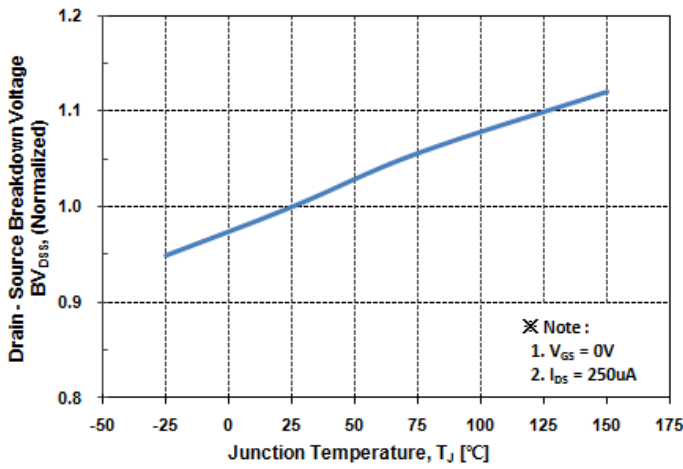


Fig. 8 $R_{DS(on)} - T_J$

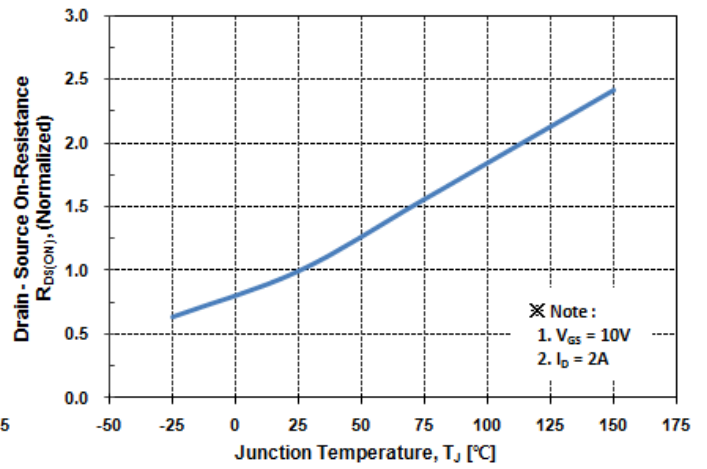


Fig. 9 $I_D - T_C$

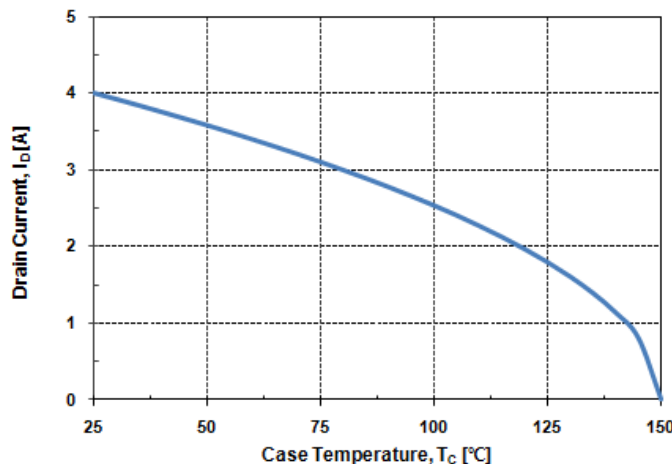


Fig. 10 Safe Operating Area

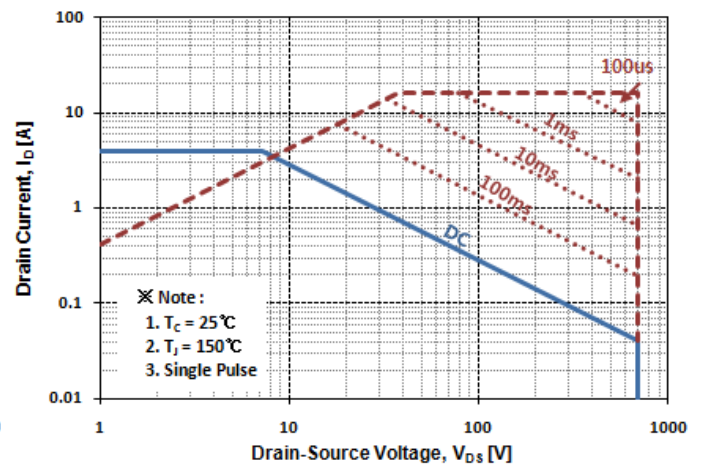


Fig. 11 Transient Thermal Impedance

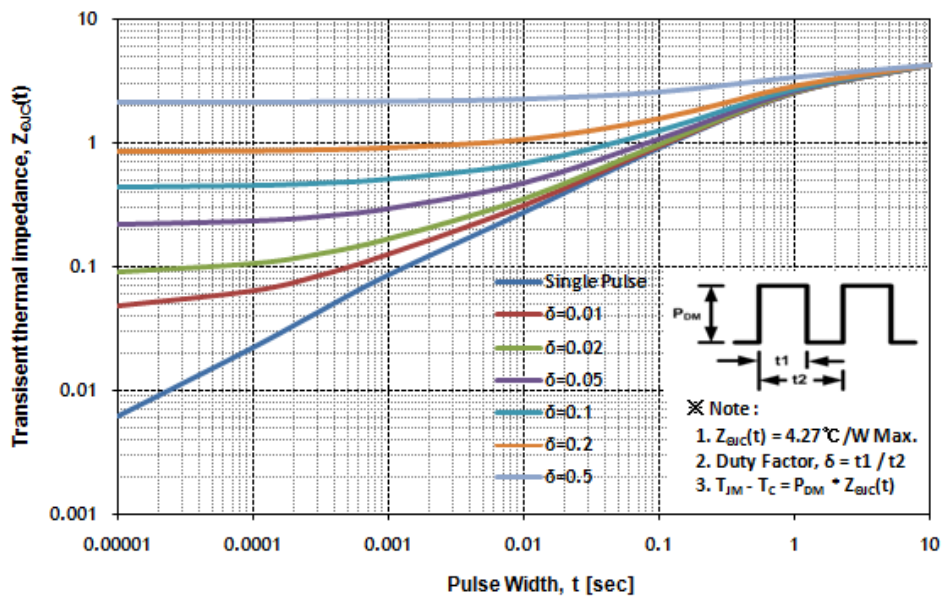


Fig. 12 Gate Charge Test Circuit & Waveform

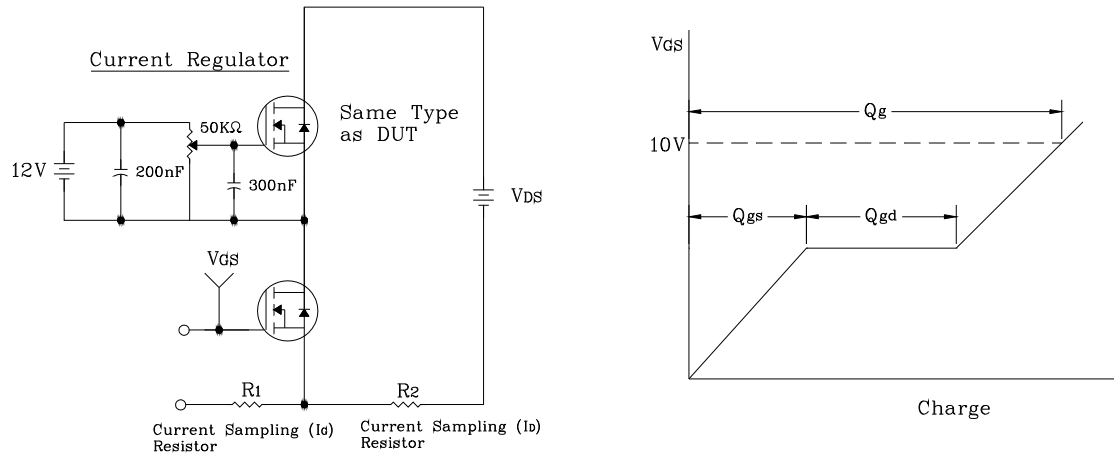


Fig. 13 Resistive Switching Test Circuit & Waveform

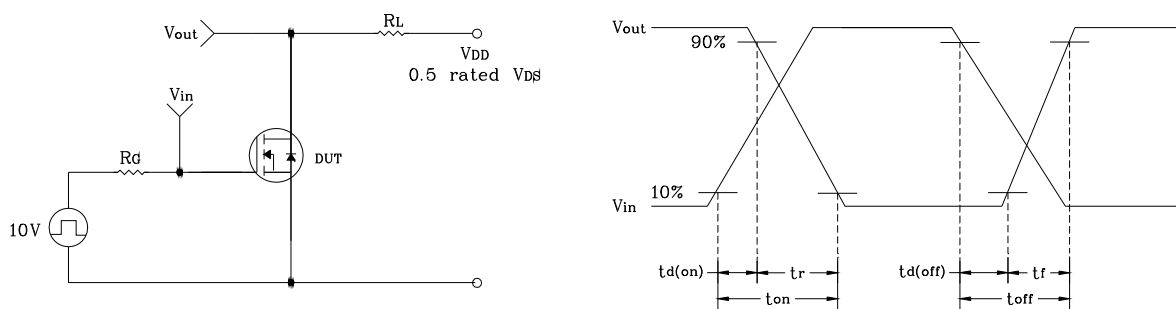


Fig. 14 E_{AS} Test Circuit & Waveform

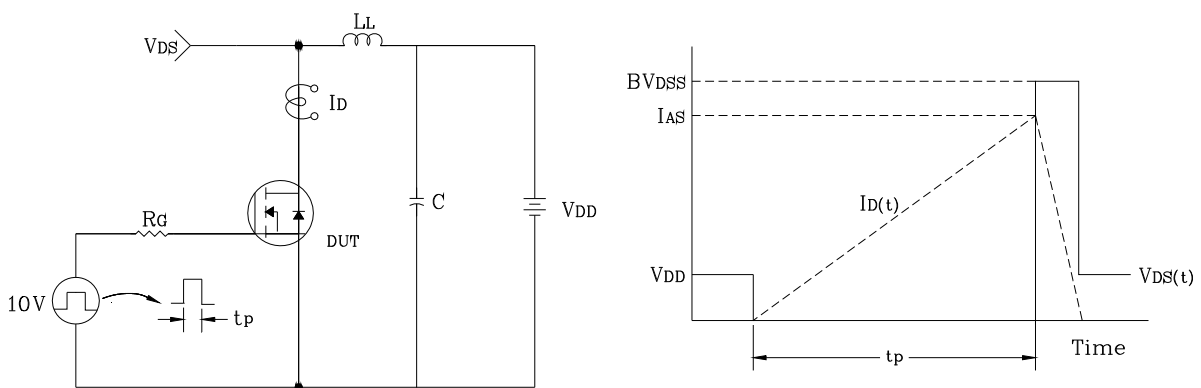
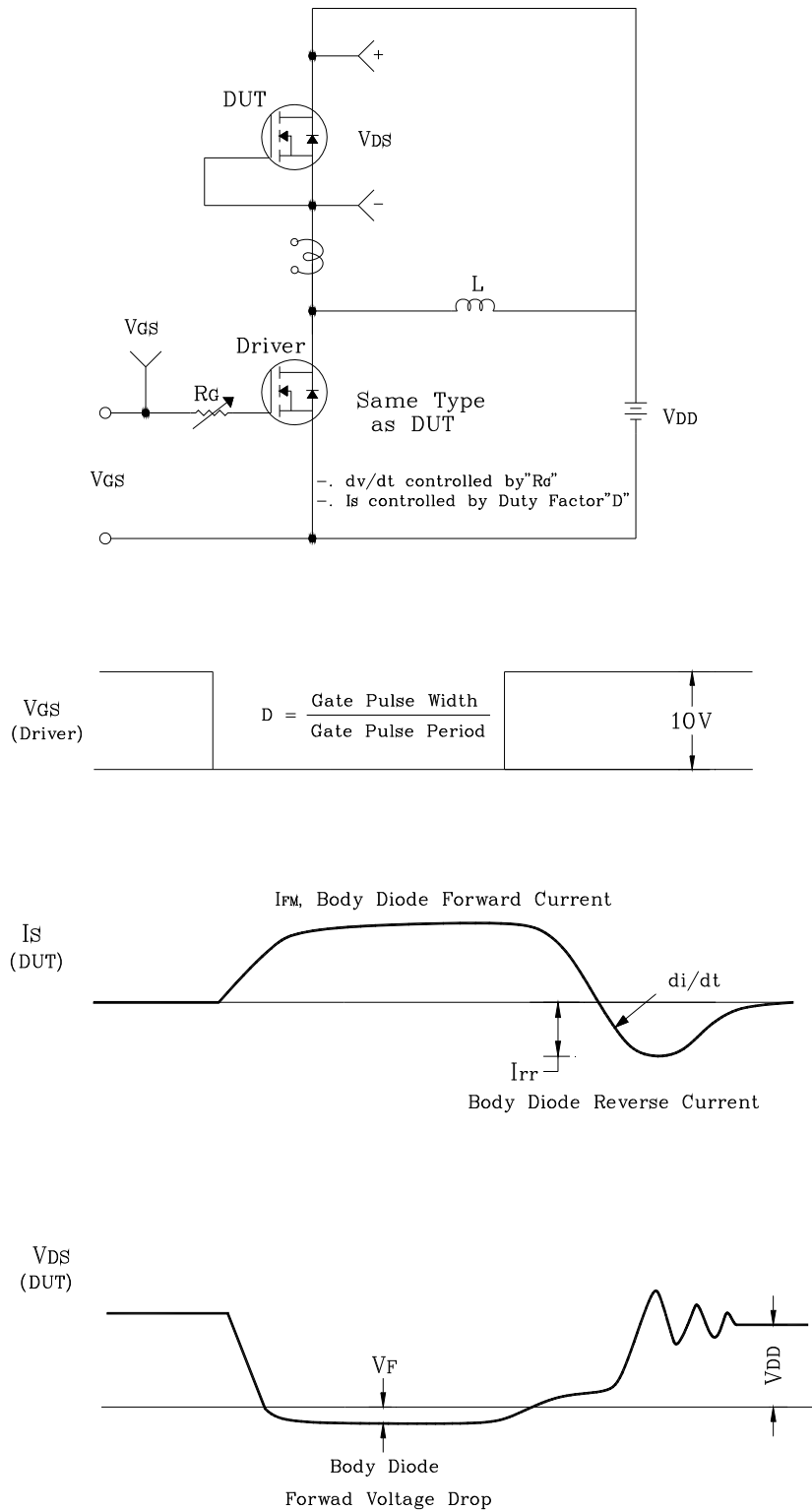
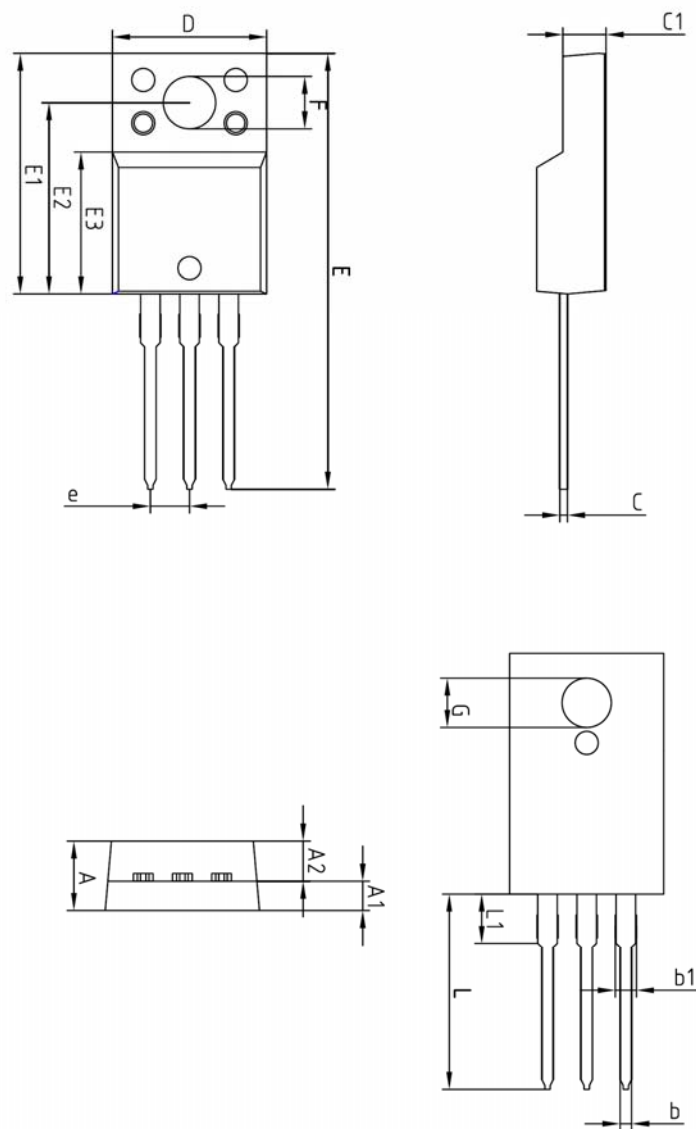


Fig. 15 Diode Reverse Recovery Time Test Circuit & Waveform



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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