

SWITCHING REGULATOR APPLICATIONS

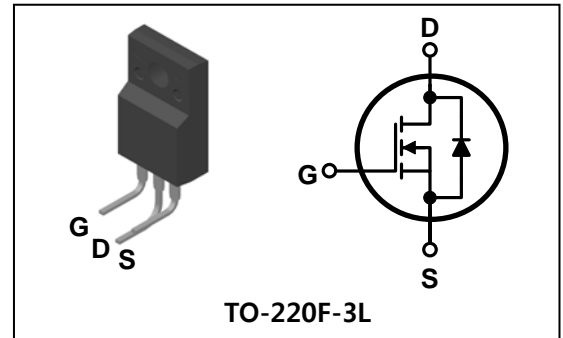
Features

- High Voltage : $BV_{DSS}=650V(\text{Min.})$
- Low C_{RSS} : $C_{RSS}=5.6pF(\text{Typ.})$
- Low gate charge : $Qg=11.2nC(\text{Typ.})$
- Low $R_{DS(on)}$: $R_{DS(on)}=3.0\Omega(\text{Max.})$

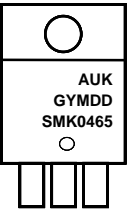
Ordering Information

| Type No. | Marking | Package Code |
|-----------|---------|---------------------------|
| SMK0465FJ | SMK0465 | TO-220F-3L (J Forming) |

PIN Connection



Marking Diagram

| | |
|--|---|
|  | Column 1 : Manufacturer |
| | Column 2 : Production Information e.g.) GYMDD |
| | - G : Factory management code - YMDD : Date Code (year, month, date) |
| | Column 3 : Device Code |

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

| Characteristic | Symbol | Rating | Unit | |
|----------------------------------|-----------|-------------------------|------------------|---|
| Drain-source voltage | V_{DSS} | 650 | V | |
| Gate-source voltage | V_{GSS} | ± 30 | V | |
| Drain current (DC) * | I_D | $T_C=25^\circ\text{C}$ | 4 | A |
| | | $T_C=100^\circ\text{C}$ | 2.0 | A |
| Drain current (Pulsed) * | I_{DM} | 16 | A | |
| Power dissipation | P_D | 30 | W | |
| Avalanche current (Single) ② | I_{AS} | 4 | A | |
| Single pulsed avalanche energy ② | E_{AS} | 81.5 | mJ | |
| Avalanche current (Repetitive) ① | I_{AR} | 4 | A | |
| Repetitive avalanche energy ① | E_{AR} | 3.4 | mJ | |
| Junction temperature | T_J | 150 | $^\circ\text{C}$ | |
| Storage temperature range | T_{stg} | -55~150 | | |

* Limited by maximum junction temperature

| Characteristic | Symbol | Typ. | Max. | Unit |
|--------------------|------------------|------|------|--------------------|
| Thermal resistance | Junction-case | - | 4.16 | $^\circ\text{C/W}$ |
| | Junction-ambient | - | 62.5 | |

Electrical Characteristics (T_C=25°C unless otherwise noted)

| Characteristic | Symbol | Test Condition | Min. | Typ. | Max. | Unit | |
|--------------------------------|---------------------|---|------|------|------|------|---|
| Drain-source breakdown voltage | BV _{DSS} | I _D =250μA, V _{GS} =0 | 650 | - | - | V | |
| Gate threshold voltage | V _{GS(th)} | I _D =250μA, V _{DS} =V _{GS} | 2.0 | - | 4.0 | V | |
| Drain-source cut-off current | I _{DSS} | V _{DS} =650V, V _{GS} =0V | - | - | 1 | μA | |
| Gate leakage current | I _{GSS} | V _{DS} =0V, V _{GS} =±30V | - | - | ±100 | nA | |
| Drain-source on-resistance ④ | R _{DS(ON)} | V _{GS} =10V, I _D =2.0A | - | 2.4 | 3.0 | Ω | |
| Forward transfer conductance ④ | g _{fs} | V _{DS} =10V, I _D =2.0A | - | 4.0 | - | S | |
| Input capacitance | C _{iss} | V _{GS} =0V, V _{DS} =25V, f=1MHz | - | 703 | 878 | pF | |
| Output capacitance | C _{oss} | | - | 54.6 | 68.2 | | |
| Reverse transfer capacitance | C _{rss} | | - | 5.6 | 7.0 | | |
| Turn-on delay time | t _{d(on)} | V _{DD} =300V, I _D =4.0A R _G =25Ω | - | 10 | - | ns | |
| Rise time | t _r | | - | 42 | - | | |
| Turn-off delay time | t _{d(off)} | | ③④ | - | 38 | | - |
| Fall time | t _f | | - | 46 | - | | |
| Total gate charge | Q _g | V _{DS} =520V, V _{GS} =10V I _D =4.0A | - | 11.2 | 14.0 | nC | |
| Gate-source charge | Q _{gs} | | - | 3.9 | - | | |
| Gate-drain charge | Q _{gd} | | ③④ | - | 2.5 | | - |

Source-Drain Diode Ratings and Characteristics (T_C=25°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) ① | I _{SM} | | - | - | 16 | |
| Forward voltage ④ | V _{SD} | V _{GS} =0V, I _S =4.0A | - | - | 1.4 | V |
| Reverse recovery time | t _{rr} | I _S =4.0A, V _{GS} =0V dI _F /dt=100A/μs | - | 300 | - | ns |
| Reverse recovery charge | Q _{rr} | | - | 2.2 | - | μC |

Note ;

- ① Repetitive rating : Pulse width limited by maximum junction temperature
- ② L=9.4mH, I_{AS}=4.0A, V_{DD}=50V, R_G=25Ω, Starting T_J=25°C
- ③ Pulse Test : Pulse width≤300μs, Duty cycle≤2%
- ④ Essentially independent of operating temperature

Electrical Characteristic Curves

Fig. 1 $I_D - V_{DS}$

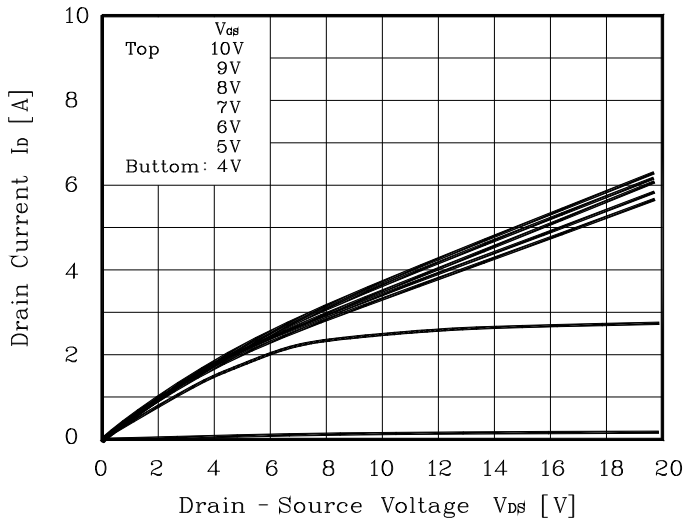


Fig. 2 $I_D - V_{GS}$

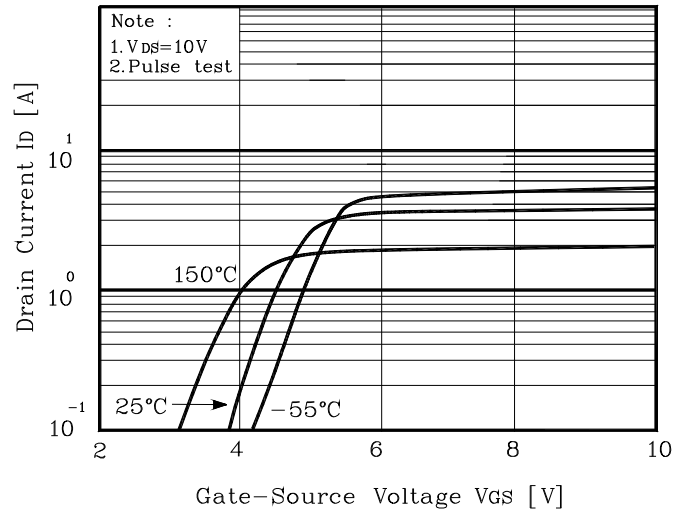


Fig. 3 $R_{DS(on)} - I_D$

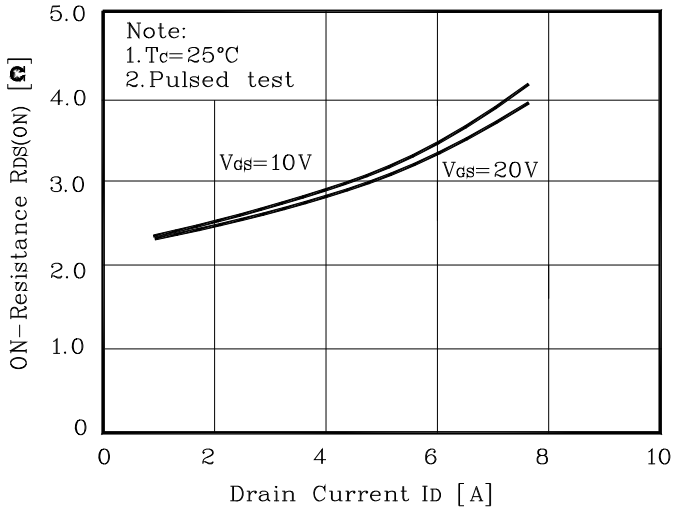


Fig. 4 $I_S - V_{SD}$

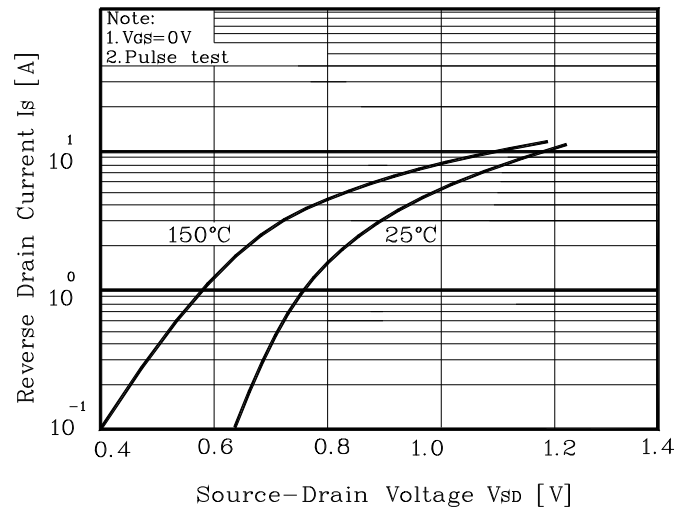


Fig. 5 Capacitance - V_{DS}

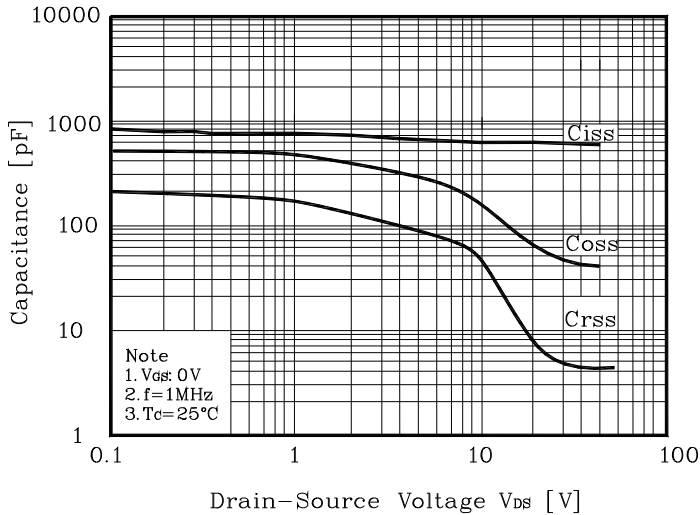
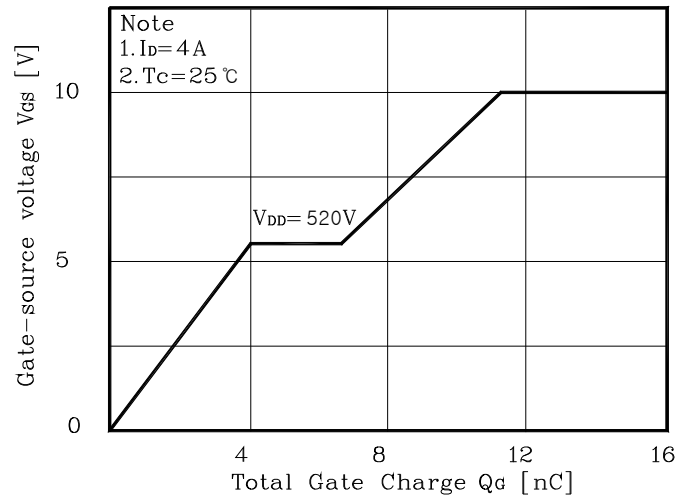


Fig. 6 $V_{GS} - Q_G$



Electrical Characteristic Curves

Fig. 7 $V_{DSS} - T_J$

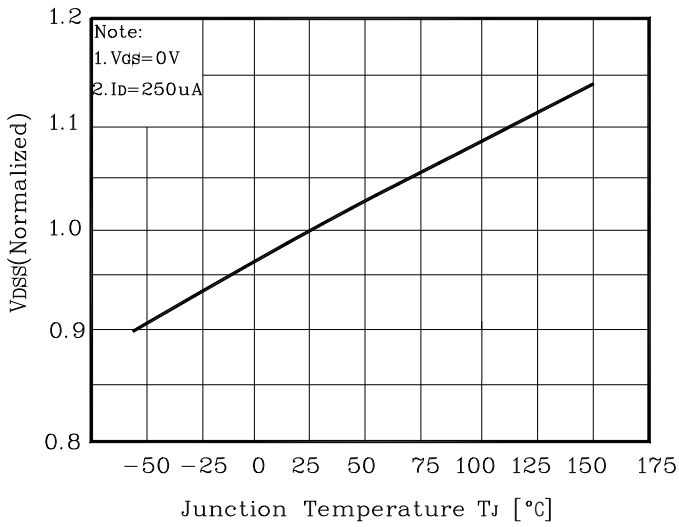


Fig. 8 $R_{DS(on)} - T_J$

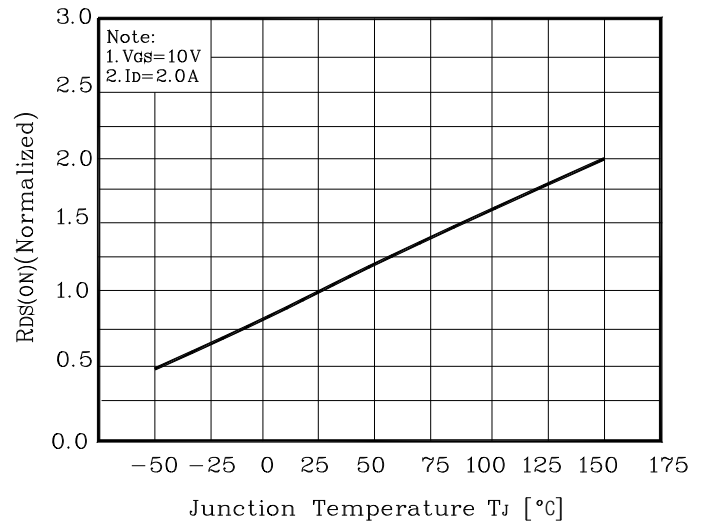


Fig. 9 $I_D - T_C$

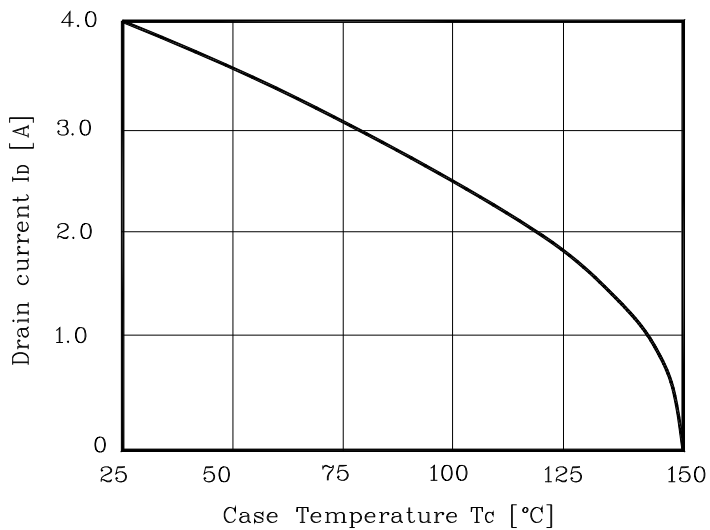


Fig. 10 Safe Operating Area

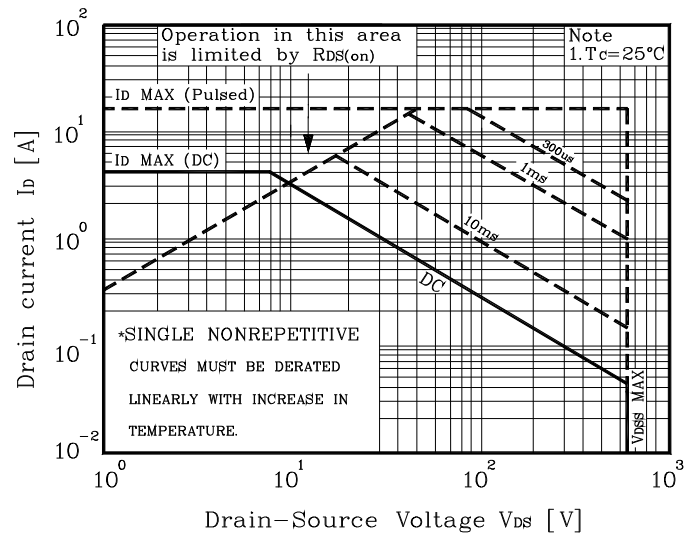


Fig. 11 Gate Charge Test Circuit & Waveform

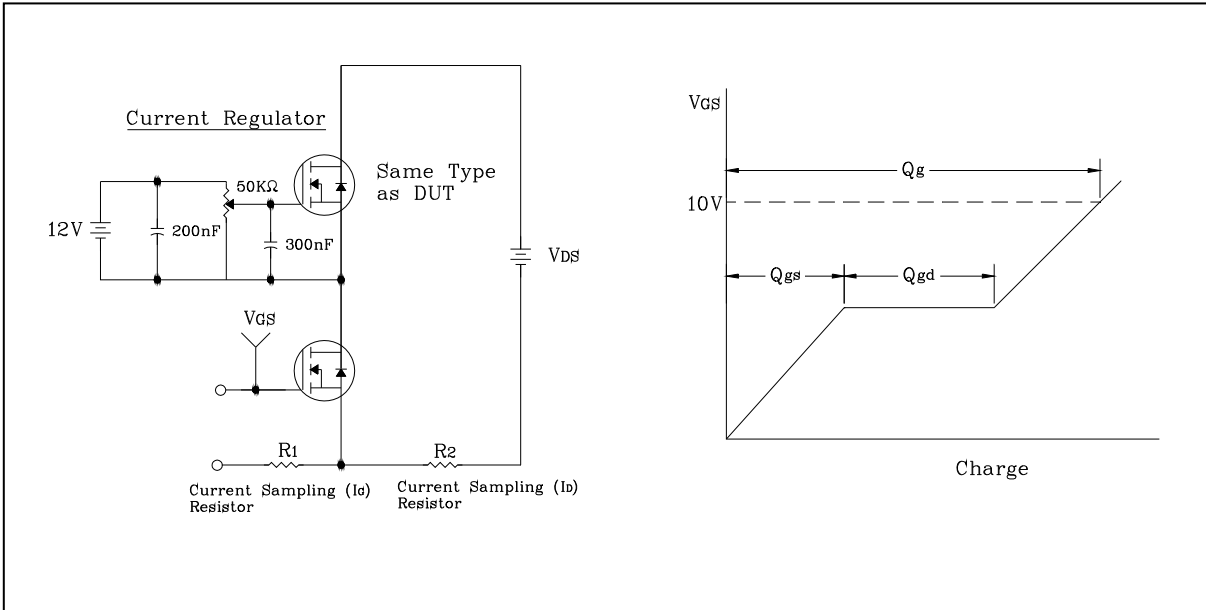


Fig. 12 Resistive Switching Test Circuit & Waveform

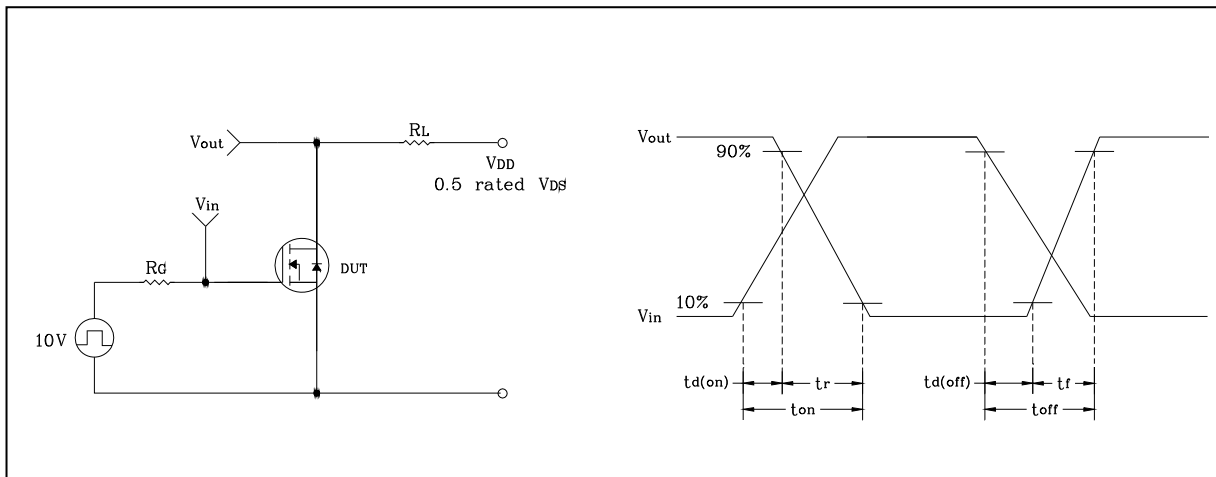


Fig. 13 EAS Test Circuit & Waveform

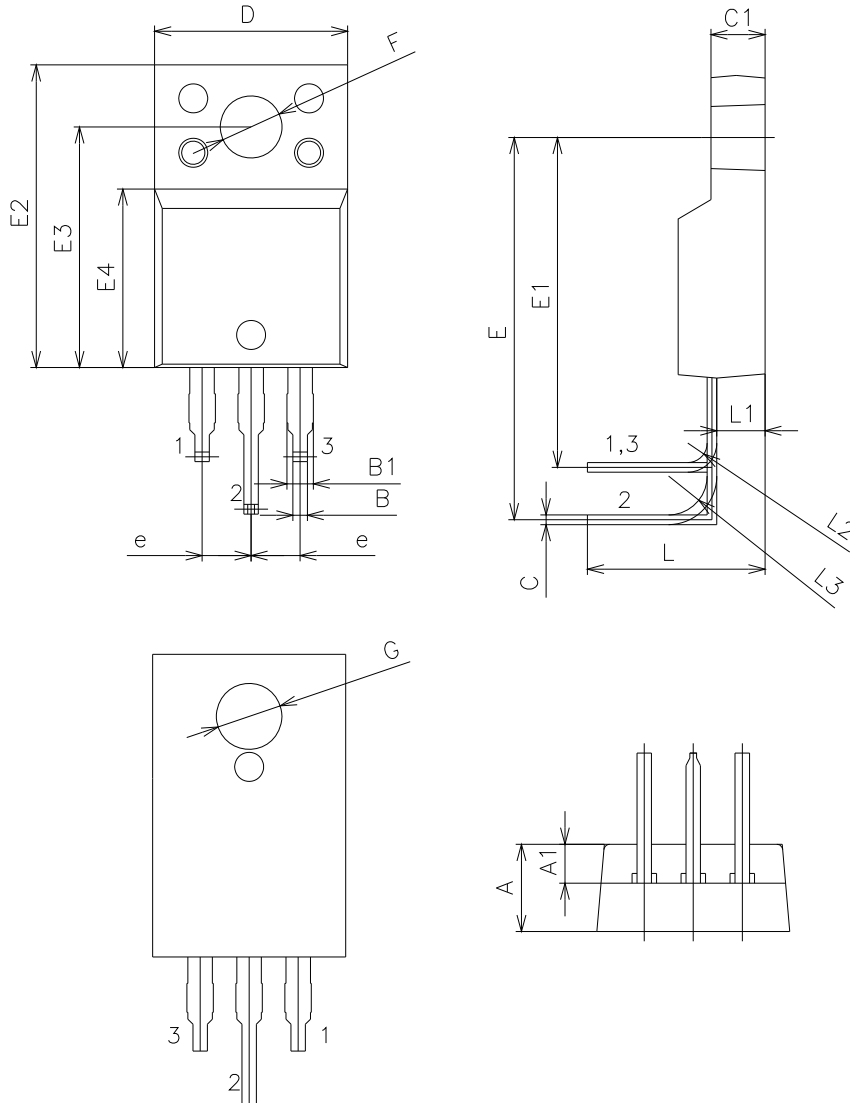


Fig. 14 Diode Reverse Recovery Time Test Circuit & Waveform



Outline Dimension

unit: mm



| SYMBOL | MILLIMETERS | | | NOTE |
|--------|-------------|---------|---------|------|
| | MINIMUM | NOMINAL | MAXIMUM | |
| A | 4.40 | 4.50 | 4.60 | |
| A1 | 1.90 | 2.00 | 2.10 | |
| 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 | 9.80 | 10.00 | 10.20 | |
| E | 19.20 | 19.70 | 20.20 | |
| E1 | 16.50 | 17.00 | 17.50 | |
| E2 | 15.40 | 15.60 | 15.80 | |
| E3 | 12.20 | 12.40 | 12.60 | |
| E4 | 9.00 | 9.20 | 9.40 | |
| F | 3.10 | 3.20 | 3.30 | |
| G | 3.30 | 3.40 | 3.50 | |
| e | 2.54 BSC | | | |
| L | 9.00 | 9.20 | 9.40 | |
| L1 | - | 2.50 | - | |
| L2 | - | 1.00 | - | |
| L3 | - | 2.00 | - | |

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