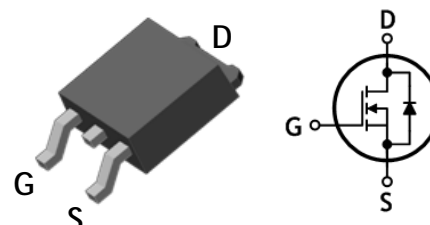


**DC-DC CONVERTER APPLICATION**
**HIGH VOLTAGE SWITCHING APPLICATIONS**

## Features

- High Voltage :  $BV_{DSS}=200V(\text{Min.})$
- Low  $C_{RSS}$  :  $C_{RSS}=24pF(\text{Typ.})$
- Low gate charge :  $Qg=12nC(\text{Typ.})$
- Low  $R_{DS(on)}$  :  $R_{DS(on)}=0.4\Omega(\text{Max.})$

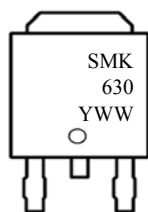


## Ordering Information

| Type No. | Marking | Package Code |
|----------|---------|--------------|
| SMK630D  | SMK630  | TO-252       |

**TO-252**

## Marking Diagram



Column 1,2 : Device Code  
 Column 3 : Production Information  
 e.g.) YWW  
 -. YWW : Date Code (year, week)

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

| Characteristic                   | Symbol    | Rating                      | Unit             |   |
|----------------------------------|-----------|-----------------------------|------------------|---|
| Drain-source voltage             | $V_{DSS}$ | 200                         | V                |   |
| Gate-source voltage              | $V_{GSS}$ | $\pm 30$                    | V                |   |
| Drain current (DC) *             | $I_D$     | ( $T_C=25^\circ\text{C}$ )  | 9                | A |
|                                  |           | ( $T_C=100^\circ\text{C}$ ) | 5.7              | A |
| Drain current (Pulsed) *         | $I_{DM}$  | 36                          | A                |   |
| Power dissipation                | $P_D$     | 45                          | W                |   |
| Avalanche current (Single) ②     | $I_{AS}$  | 9                           | A                |   |
| Single pulsed avalanche energy ② | $E_{AS}$  | 232                         | mJ               |   |
| Avalanche current (Repetitive) ① | $I_{AR}$  | 9                           | A                |   |
| Repetitive avalanche energy ①    | $E_{AR}$  | 9.5                         | 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       | -    | 2.77 | $^\circ\text{C}/\text{W}$ |
|                    | Junction-ambient ** | -    | 50   |                           |

\*\* When mounted on the minimum pad size recommended (PCB Mount)

## Electrical Characteristics (T<sub>C</sub>=25°C unless otherwise noted)

| Characteristic                 | Symbol              | Test Condition                                                    | Min. | Typ. | Max. | Unit |   |
|--------------------------------|---------------------|-------------------------------------------------------------------|------|------|------|------|---|
| Drain-source breakdown voltage | BV <sub>DSS</sub>   | I <sub>D</sub> =250μA, V <sub>GS</sub> =0                         | 200  | -    | -    | V    |   |
| Gate threshold voltage         | V <sub>GS(th)</sub> | I <sub>D</sub> =250μA, V <sub>DS</sub> =V <sub>GS</sub>           | 2.0  | -    | 4.0  | V    |   |
| Drain-source cut-off current   | I <sub>DSS</sub>    | V <sub>DS</sub> =200V, V <sub>GS</sub> =0V                        | -    | -    | 1    | μA   |   |
| Gate leakage current           | I <sub>GSS</sub>    | V <sub>DS</sub> =0V, V <sub>GS</sub> =±30V                        | -    | -    | ±100 | nA   |   |
| Drain-source on-resistance ④   | R <sub>DS(ON)</sub> | V <sub>GS</sub> =10V, I <sub>D</sub> =4.5A                        | -    | 0.34 | 0.40 | Ω    |   |
| Forward transfer conductance ④ | g <sub>fs</sub>     | V <sub>DS</sub> =10V, I <sub>D</sub> =4.5A                        | -    | 5.5  | -    | S    |   |
| Input capacitance              | C <sub>iss</sub>    | V <sub>GS</sub> =0V, V <sub>DS</sub> =25V,<br>f=1MHz              | -    | 420  | 525  | pF   |   |
| Output capacitance             | C <sub>oss</sub>    |                                                                   | -    | 99   | 128  |      |   |
| Reverse transfer capacitance   | C <sub>rss</sub>    |                                                                   | -    | 24   | 28   |      |   |
| Turn-on delay time             | t <sub>d(on)</sub>  | V <sub>DD</sub> =100V, I <sub>D</sub> =9A<br>R <sub>G</sub> =25Ω  | -    | 11   | -    | ns   |   |
| Rise time                      | t <sub>r</sub>      |                                                                   | -    | 92   | -    |      |   |
| Turn-off delay time            | t <sub>d(off)</sub> |                                                                   | ③④   | -    | 70   |      | - |
| Fall time                      | t <sub>f</sub>      |                                                                   | -    | 72   | -    |      |   |
| Total gate charge              | Q <sub>g</sub>      | V <sub>DS</sub> =160V, V <sub>GS</sub> =10V<br>I <sub>D</sub> =9A | -    | 12   | 17   | nC   |   |
| Gate-source charge             | Q <sub>gs</sub>     |                                                                   | -    | 2.4  | -    |      |   |
| Gate-drain charge              | Q <sub>gd</sub>     |                                                                   | ③④   | -    | 3.5  |      | - |

## Source-Drain Diode Ratings and Characteristics (T<sub>C</sub>=25°C unless otherwise noted)

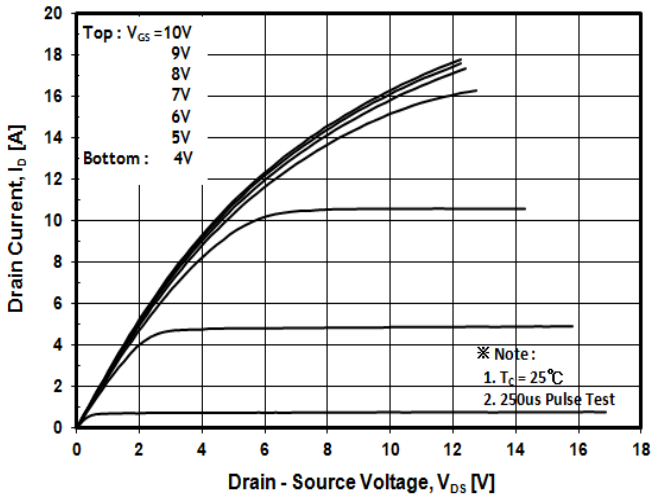
| Characteristic            | Symbol          | Test Condition                                                         | Min. | Typ. | Max. | Unit |
|---------------------------|-----------------|------------------------------------------------------------------------|------|------|------|------|
| Source current (DC)       | I <sub>S</sub>  | Integral reverse diode<br>in the MOSFET                                | -    | -    | 9    | A    |
| Source current (Pulsed) ① | I <sub>SM</sub> |                                                                        | -    | -    | 36   |      |
| Forward voltage ④         | V <sub>SD</sub> | V <sub>GS</sub> =0V, I <sub>S</sub> =9A                                | -    | -    | 1.4  | V    |
| Reverse recovery time     | t <sub>rr</sub> | I <sub>S</sub> =9A, V <sub>GS</sub> =0V<br>dI <sub>F</sub> /dt=100A/μs | -    | 158  | -    | ns   |
| Reverse recovery charge   | Q <sub>rr</sub> |                                                                        | -    | 0.97 | -    | μC   |

Note ;

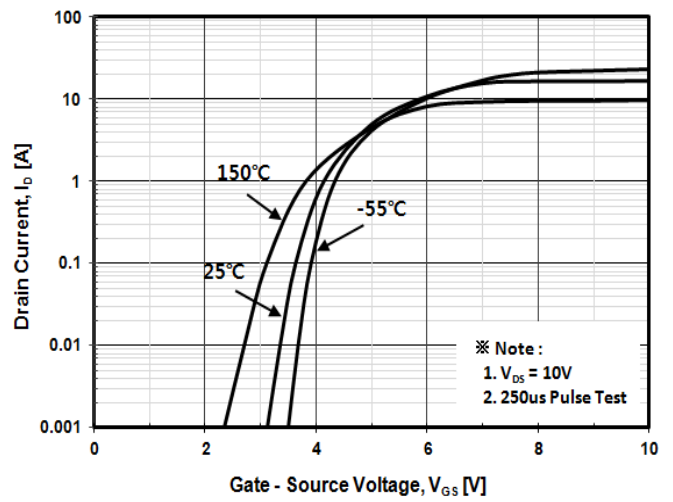
- ① Repetitive rating : Pulse width limited by maximum junction temperature
- ② L=4.3mH, I<sub>AS</sub>=9A, V<sub>DD</sub>=50V, R<sub>G</sub>=25Ω, Starting T<sub>J</sub>=25°C
- ③ Pulse Test : Pulse width≤300μs, Duty cycle≤2%
- ④ Essentially independent of operating temperature

## Typical Characteristic Curves

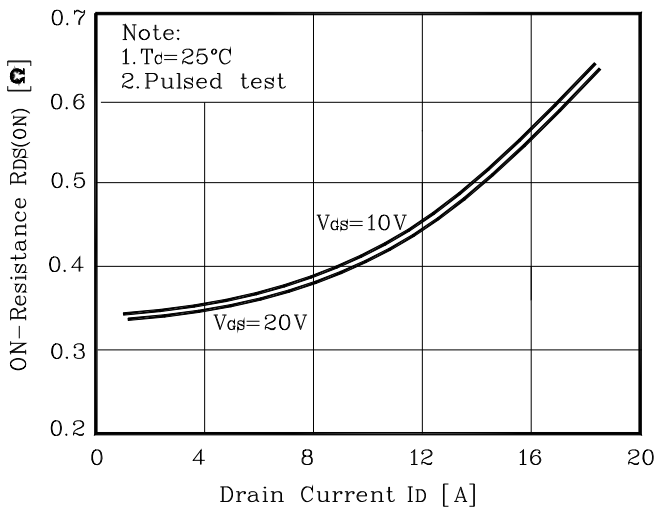
**Fig. 1  $I_D - V_{DS}$**



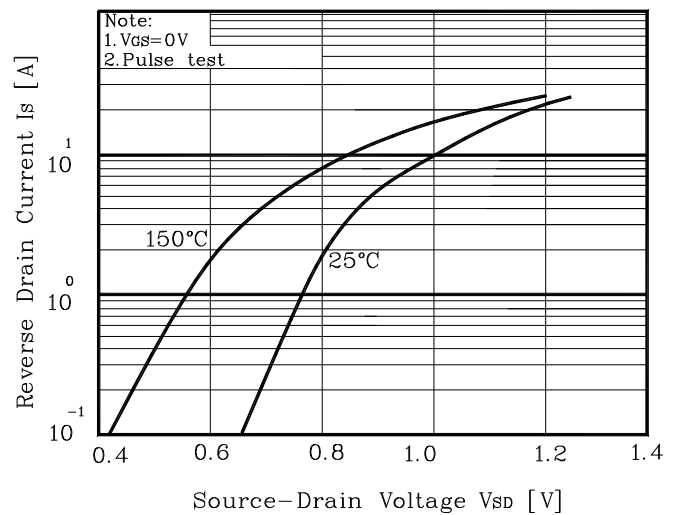
**Fig. 2  $I_D - V_{GS}$**



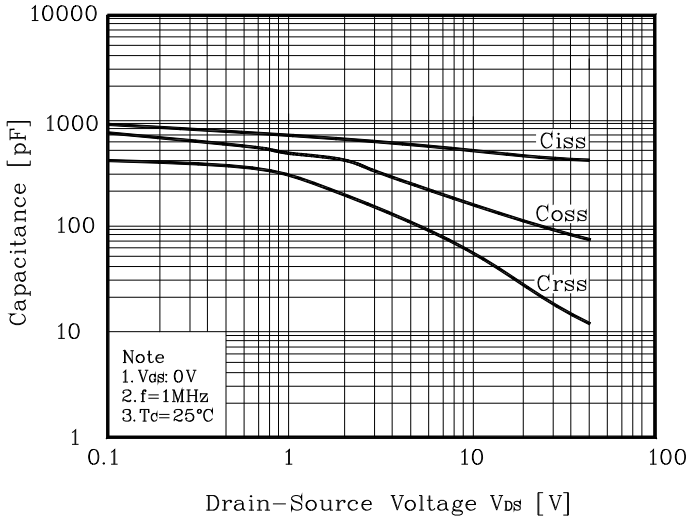
**Fig. 3  $R_{DS(on)} - I_D$**



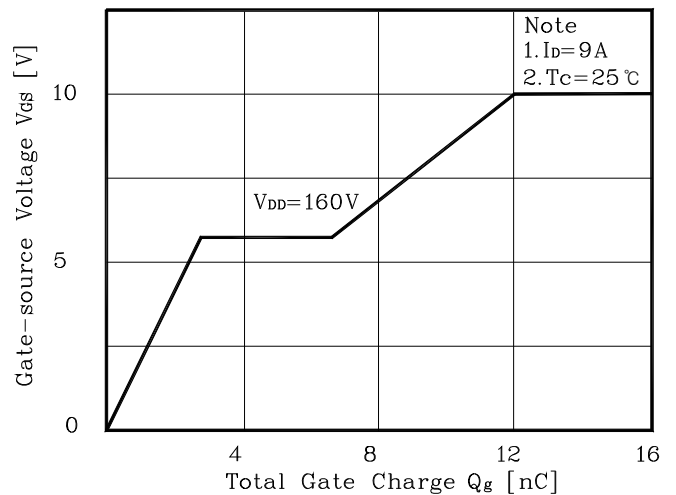
**Fig. 4  $I_S - V_{SD}$**



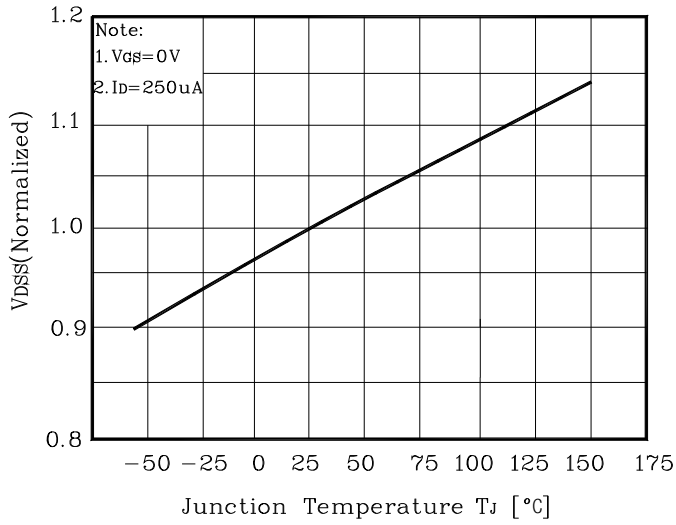
**Fig. 5 Capacitance -  $V_{DS}$**



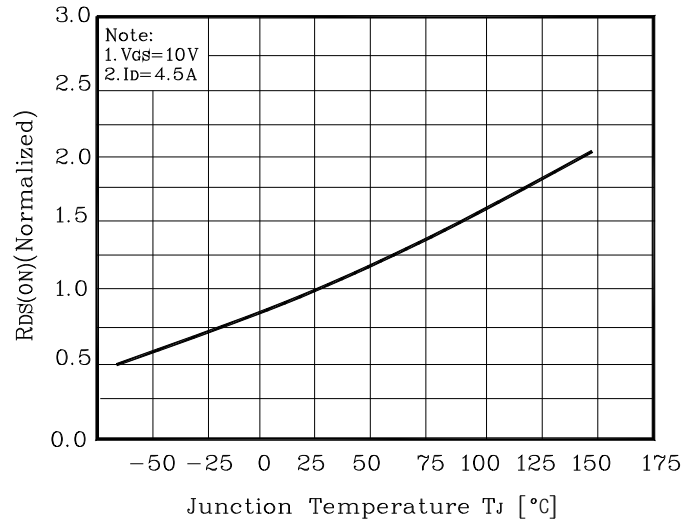
**Fig. 6  $V_{GS} - Q_g$**



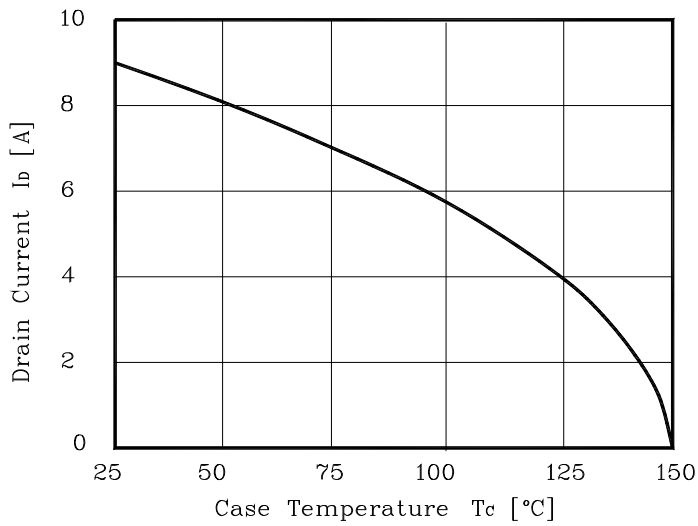
**Fig. 7  $V_{DSS} - T_J$**



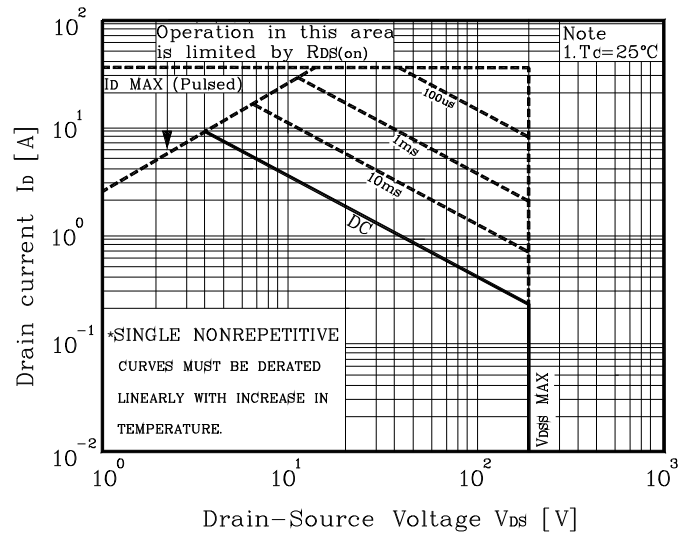
**Fig. 8  $R_{DS(on)} - T_J$**



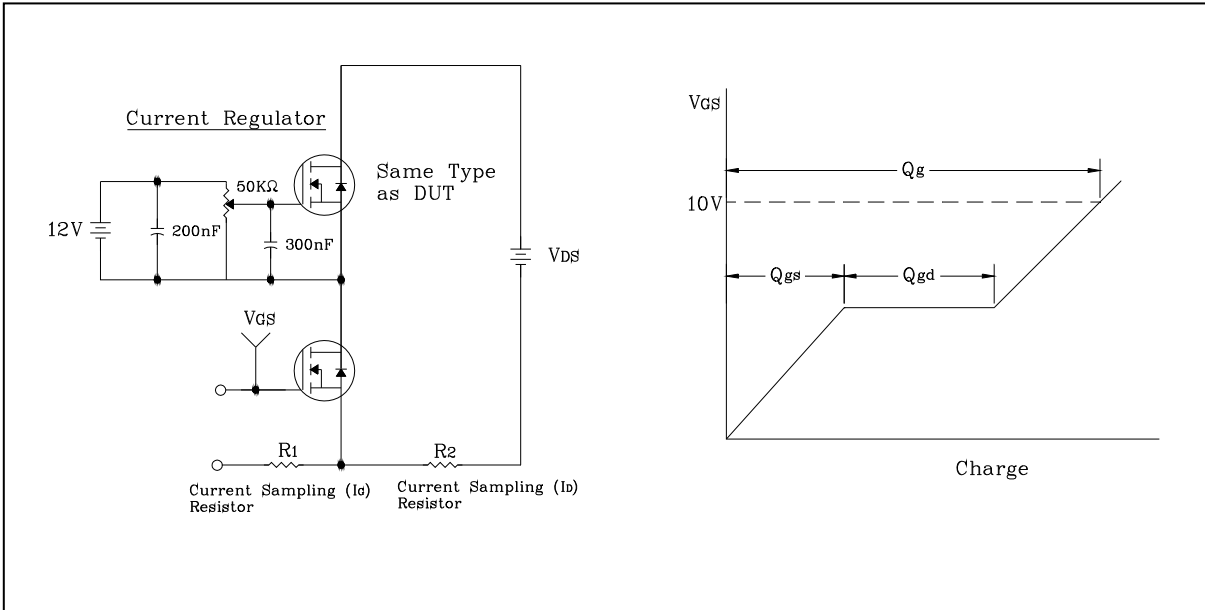
**Fig. 9  $I_D - T_C$**



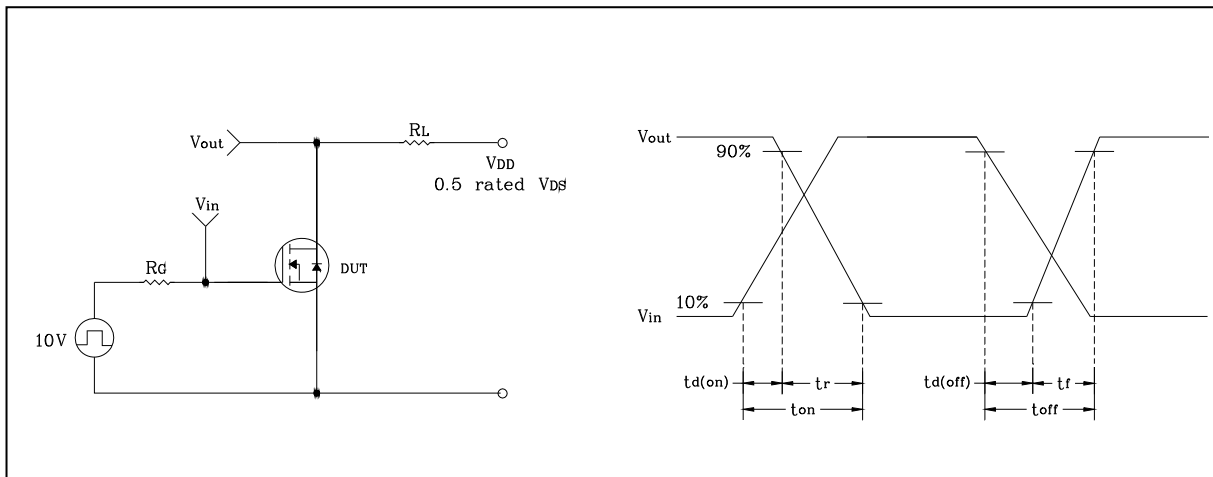
**Fig. 10 Safe Operating Area**



**Fig. 11 Gate Charge Test Circuit & Waveform**



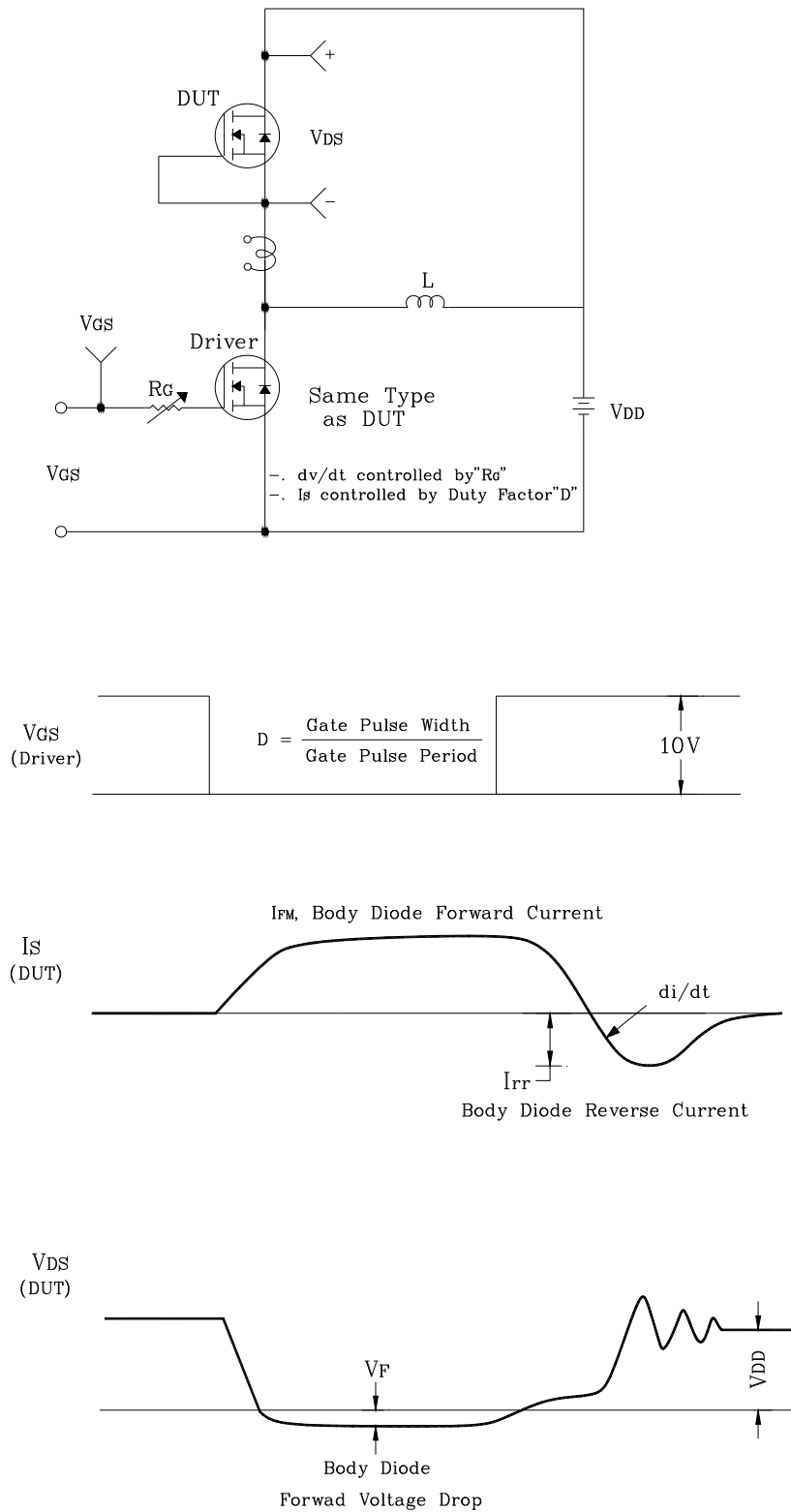
**Fig. 12 Resistive Switching Test Circuit & Waveform**



**Fig. 13 E<sub>AS</sub> Test Circuit & Waveform**

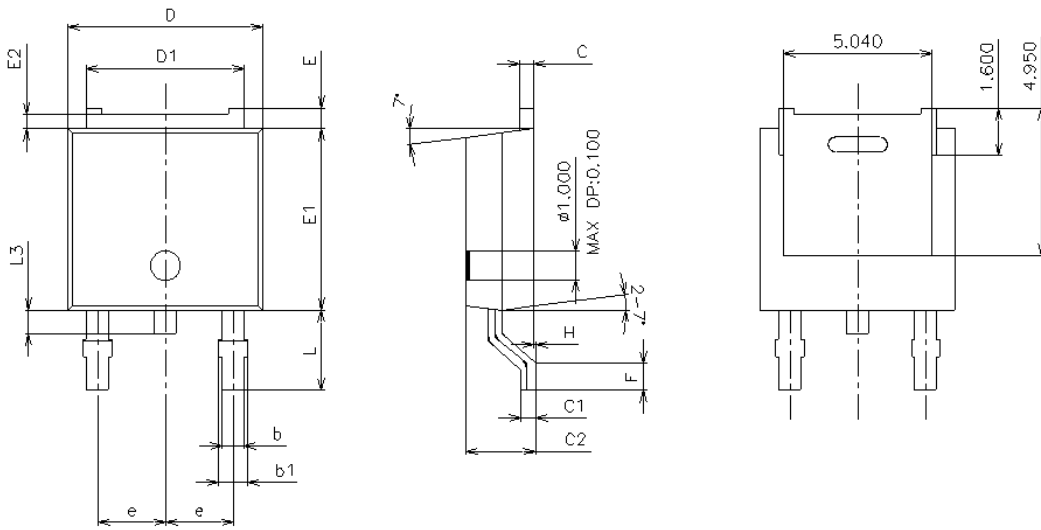


Fig. 14 Diode Reverse Recovery Time Test Circuit & Waveform

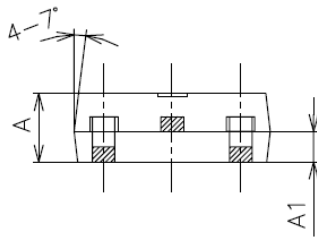


## Outline Dimension

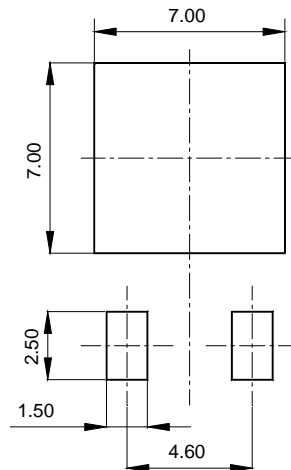
unit: mm



| SYMBOL | MILLIMETERS |         |         | NOTE |
|--------|-------------|---------|---------|------|
|        | MINIMUM     | NOMINAL | MAXIMUM |      |
| D      | 6.40        | 6.60    | 6.80    |      |
| D1     | 5.14        | 5.34    | 5.54    |      |
| E      | 0.50        | 0.70    | 0.90    |      |
| E1     | 5.90        | 6.10    | 6.30    |      |
| E2     | 0.50 TYP    |         |         |      |
| A      | 2.20        | 2.30    | 2.40    |      |
| A1     | 0.87        | 1.07    | 1.27    |      |
| C      | 0.40        | 0.50    | 0.60    |      |
| C1     | 0.40        | 0.50    | 0.60    |      |
| C2     | 2.10        | 2.30    | 2.50    |      |
| L      | 2.50        | 2.70    | 2.90    |      |
| L3     | 0.60        | 0.80    | 1.00    |      |
| b      | 0.66        | 0.76    | 0.86    |      |
| b1     | 0.96 MAX    |         |         |      |
| e      | 2.10        | 2.30    | 2.50    |      |
| F      | 0.80 MIN    |         |         |      |
| H      | 0.00        | -       | 0.10    |      |



## Recommended Land Pattern [unit: mm]



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