

SWITCHING REGULATOR APPLICATIONS

**Features**

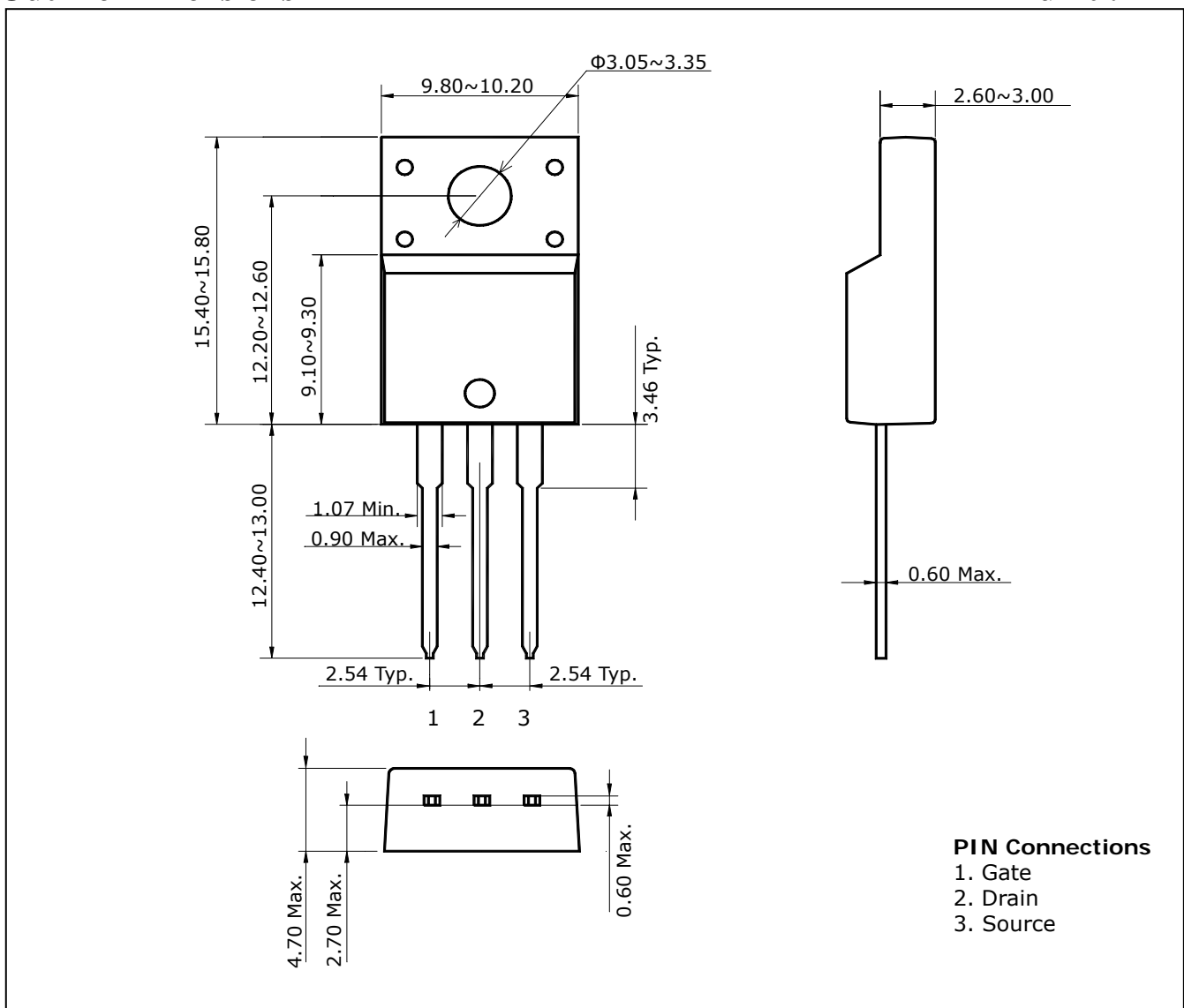
- High Voltage:  $BV_{DSS}=400V(\text{Min.})$
- Low  $C_{rSS}$  :  $C_{rSS}=8.4pF(\text{Typ.})$
- Low gate charge :  $Qg=16nC(\text{Typ.})$
- Low  $R_{DS(on)}$  :  $R_{DS(on)}=1.0\Omega(\text{Max.})$

**Ordering Information**

| Type NO. | Marking | Package Code |
|----------|---------|--------------|
| STK730F  | STK730  | TO-220F-3L   |

**Outline Dimensions**

unit : mm



## Absolute maximum ratings

(Tc=25°C)

| Characteristic                   | Symbol    | Rating   | Unit |   |
|----------------------------------|-----------|----------|------|---|
| Drain-source voltage             | $V_{DSS}$ | 400      | V    |   |
| Gate-source voltage              | $V_{GSS}$ | ±30      | V    |   |
| Drain current (DC)               | $I_D$     | Tc=25°C  | 5.5  | A |
|                                  |           | Tc=100°C | 3.5  | A |
| Drain current (Pulsed) *         | $I_{DP}$  | 22       | A    |   |
| Drain power dissipation          | $P_D$     | 25       | W    |   |
| Avalanche current (Single) ②     | $I_{AS}$  | 5.5      | A    |   |
| Single pulsed avalanche energy ② | $E_{AS}$  | 270      | mJ   |   |
| Avalanche current (Repetitive) ① | $I_{AR}$  | 5.5      | A    |   |
| Repetitive avalanche energy ①    | $E_{AR}$  | 7.3      | mJ   |   |
| Junction temperature             | $T_J$     | 150      | °C   |   |
| Storage temperature range        | $T_{stg}$ | -55~150  | °C   |   |

\* Limited by maximum junction temperature

| Characteristic     |                  | Symbol        | Typ. | Max  | Unit |
|--------------------|------------------|---------------|------|------|------|
| Thermal resistance | Junction-case    | $R_{th(J-C)}$ | -    | 5.0  | °C/W |
|                    | Junction-ambient | $R_{th(J-A)}$ | -    | 62.5 |      |

## Electrical Characteristics

(Tc=25°C)

| Characteristic                 | Symbol        | Test Condition                               | Min. | Typ. | Max.      | Unit     |     |
|--------------------------------|---------------|--|------|------|-----------|----------|-----|
| Drain-source breakdown voltage | $V_{(BR)DSS}$ | $I_D=250 \mu A, V_{GS}=0$                    | 400  | -    | -         | V        |     |
| Gate threshold voltage         | $V_{GS(th)}$  | $I_D=250 \mu A, V_{DS}=V_{GS}$               | 2.0  | -    | 4.0       | V        |     |
| Drain-source cut-off current   | $I_{DSS}$     | $V_{DS}=400V, V_{GS}=0$                      | -    | -    | 10        | $\mu A$  |     |
| Gate leakage current           | $I_{GSS}$     | $V_{DS}=0V, V_{GS}=\pm 30V$                  | -    | -    | $\pm 100$ | nA       |     |
| Drain-source on-resistance ④   | $R_{DS(on)}$  | $V_{GS}=10V, I_D=2.75A$                      | -    | 0.8  | 1         | $\Omega$ |     |
| Forward transfer conductance ④ | $g_{fs}$      | $V_{DS}=10V, I_D=2.75A$                      | -    | 3.6  | -         | S        |     |
| Input capacitance              | $C_{iss}$     | $V_{GS}=0V, V_{DS}=25V$<br>$f=1 \text{ MHz}$ | -    | 550  | 825       | pF       |     |
| Output capacitance             | $C_{oss}$     |  | -    | 46   | 70        |          |     |
| Reverse transfer capacitance   | $C_{rss}$     |  | -    | 8.4  | 13        |          |     |
| Turn-on delay time             | $t_{d(on)}$   | $V_{DD}=200V, I_D=5.5A$<br>$R_G=12\Omega$    | -    | 13   | -         | ns       |     |
| Rise time                      | $t_r$         |  | -    | 65   | -         |          |     |
| Turn-off delay time            | $t_{d(off)}$  |  | ③④   | -    | 21        |          | -   |
| Fall time                      | $t_f$         |  | -    | 38   | -         |          |     |
| Total gate charge              | $Q_g$         | $V_{DS}=200V, V_{GS}=10V$<br>$I_D=5.5A$      | -    | 16   | 24        | nC       |     |
| Gate-source charge             | $Q_{gs}$      |  | ③④   | -    | 2.5       |          | 3.8 |
| Gate-drain charge              | $Q_{gd}$      |  | -    | 6.6  | 10        |          |     |

## Source-Drain Diode Ratings and Characteristics

(Tc=25°C)

| Characteristic            | Symbol   | Test Condition                                | Min | Typ  | Max | Unit    |
|---------------------------|----------|---|-----|------|-----|---------|
| Source current (DC)       | $I_S$    | Integral reverse diode<br>in the MOSFET       | -   | -    | 5.5 | A       |
| Source current (Pulsed) ① | $I_{SP}$ |   | -   | -    | 22  |         |
| Forward voltage ④         | $V_{SD}$ | $V_{GS}=0V, I_S=5.5A$                         | -   | -    | 1.5 | V       |
| Reverse recovery time     | $t_{rr}$ | $I_S=5.5A, V_{GS}=0V$<br>$dI_S/dt=100A/\mu S$ | -   | 270  | -   | ns      |
| Reverse recovery charge   | $Q_{rr}$ |   | -   | 2.16 | -   | $\mu C$ |

Note ;

- ① Repetitive rating : Pulse width limited by maximum junction temperature
- ②  $L=13.7mH, I_{AS}=5.5A, V_{DD}=50V, R_G=27\Omega$
- ③ Pulse Test : Pulse Width  $\leq 400 \mu S$ , Duty cycle  $\leq 2\%$
- ④ Essentially independent of operating temperature

Electrical Characteristic Curves

Fig. 1  $I_D - V_{DS}$

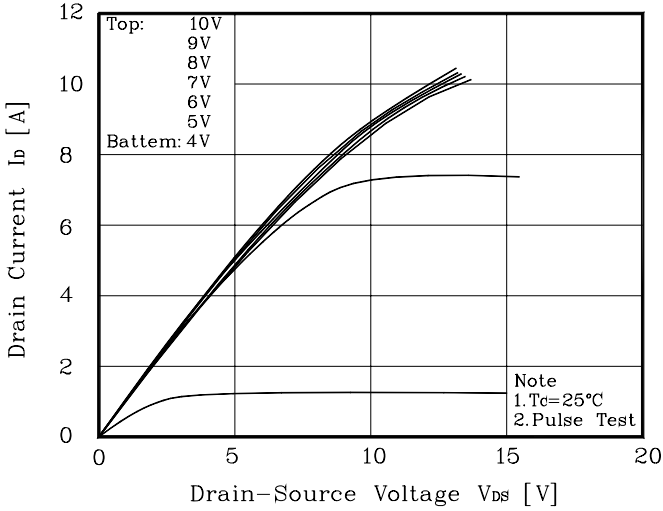


Fig. 2  $I_D - V_{GS}$

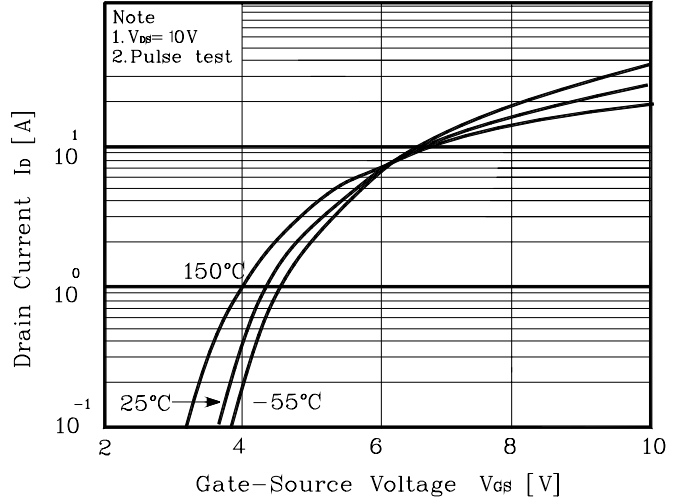


Fig. 3  $R_{DS(on)} - I_D$

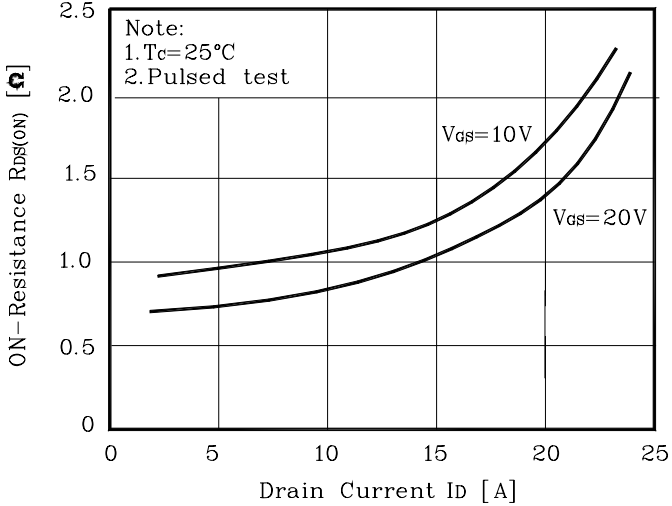


Fig. 4  $I_S - V_{SD}$

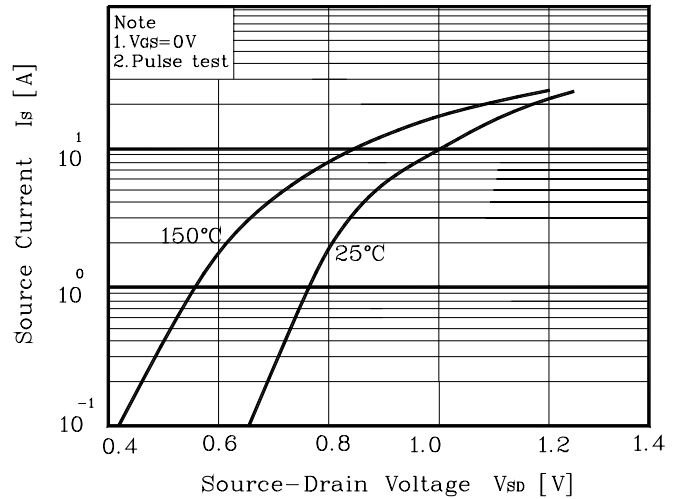


Fig. 5 Capacitance -  $V_{DS}$

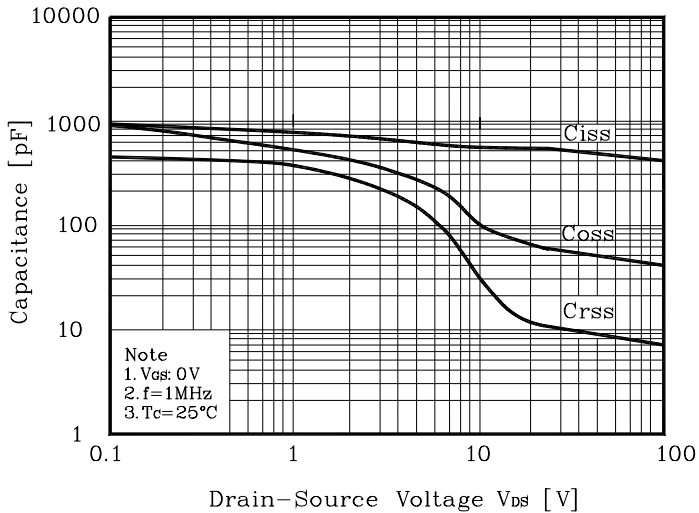
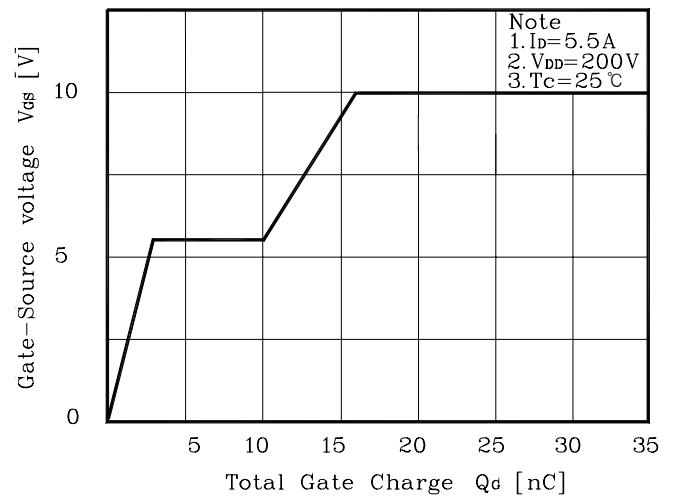
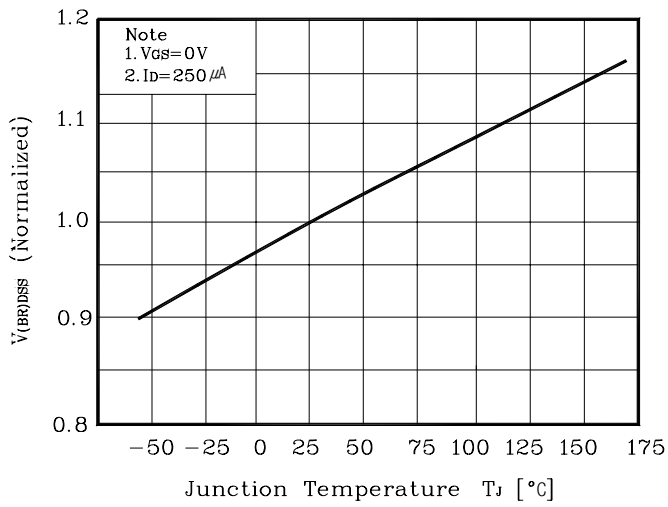


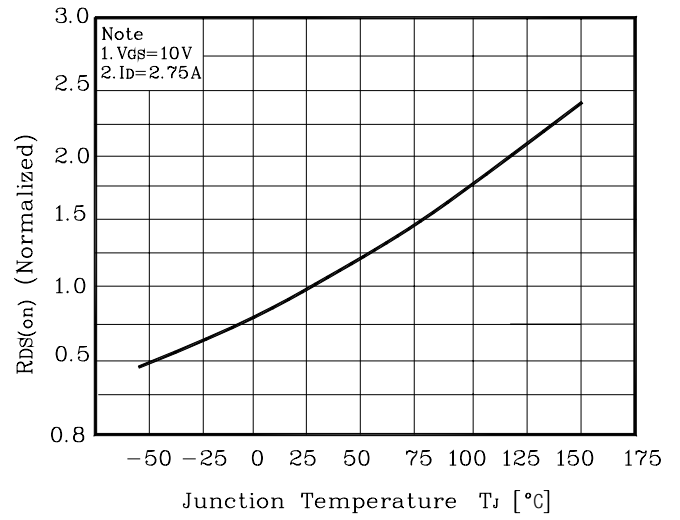
Fig. 6  $V_{GS} - Q_g$



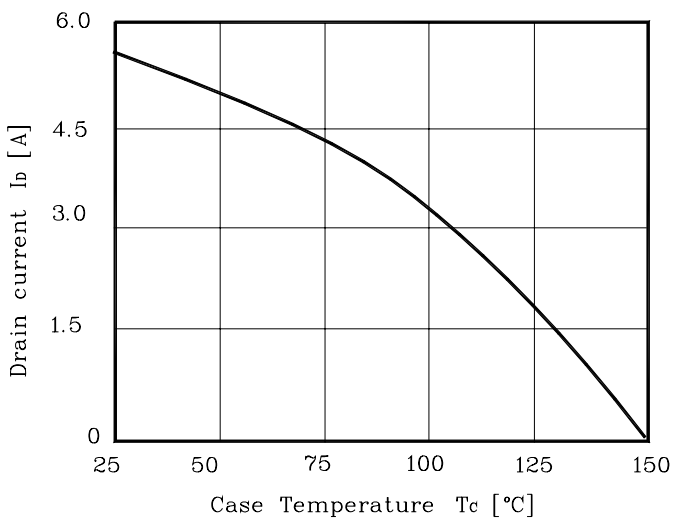
**Fig. 7  $V_{(BR)DSS} - T_J$**



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



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



**Fig. 10 Safe Operating Area**

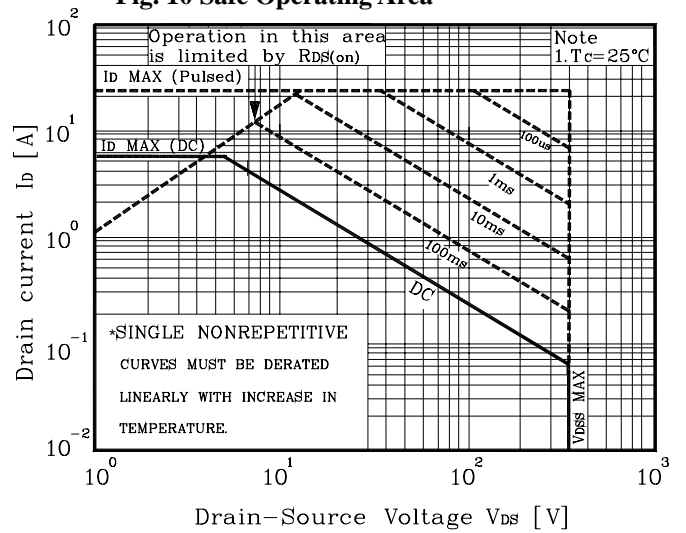


Fig. 11 Gate Charge Test Circuit & Waveform

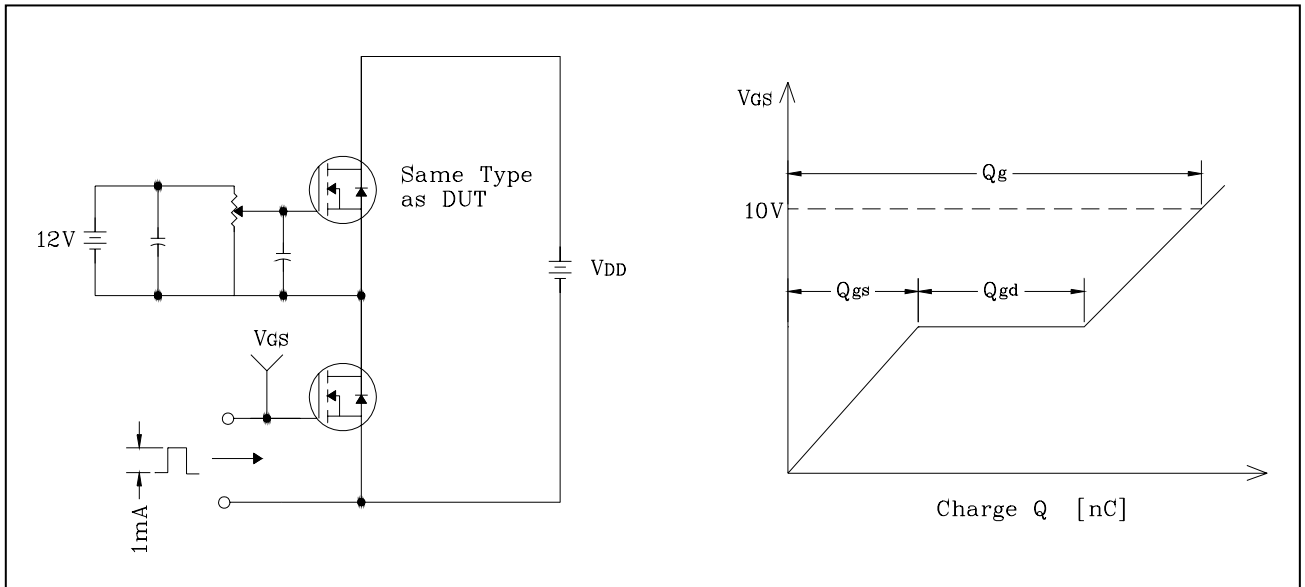


Fig. 12 Resistive Switching Test Circuit & Waveform

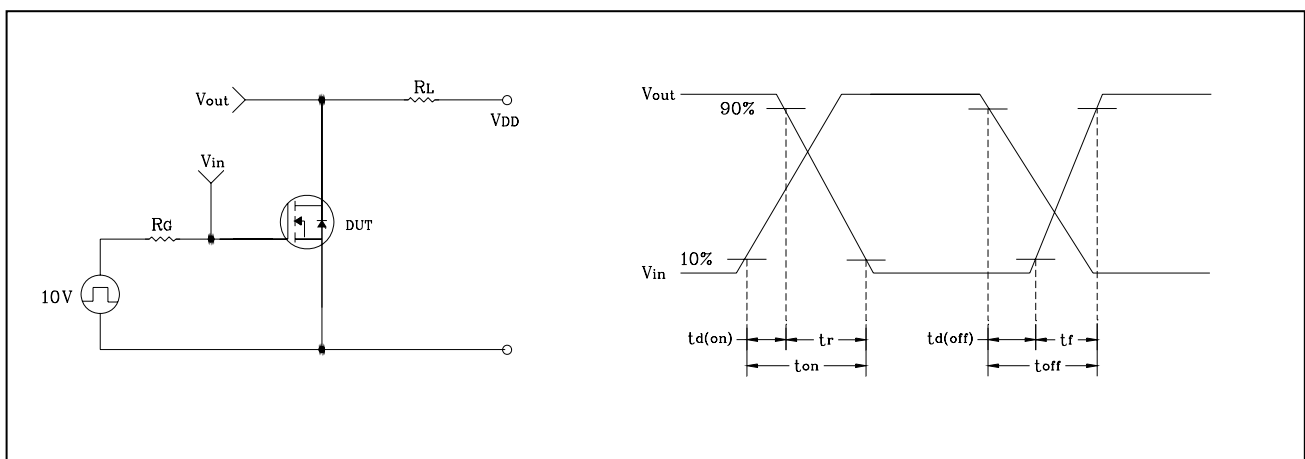


Fig. 13 E<sub>AS</sub> Test Circuit & Waveform

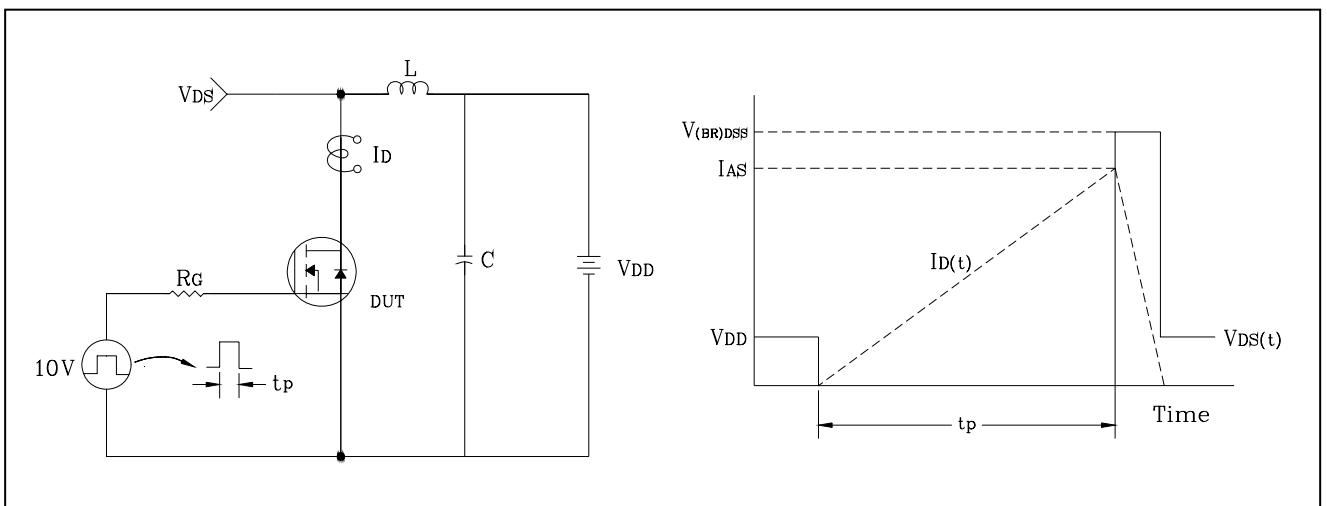
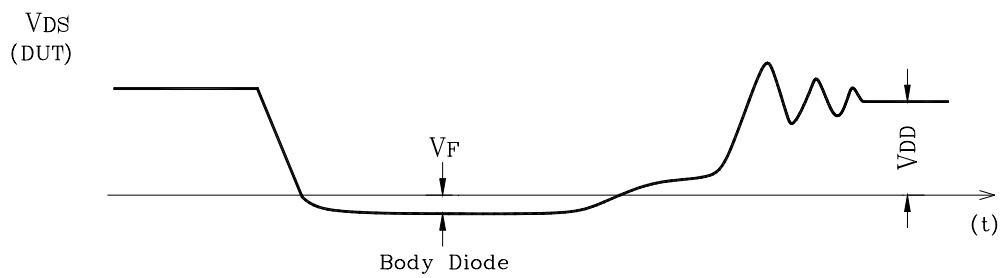
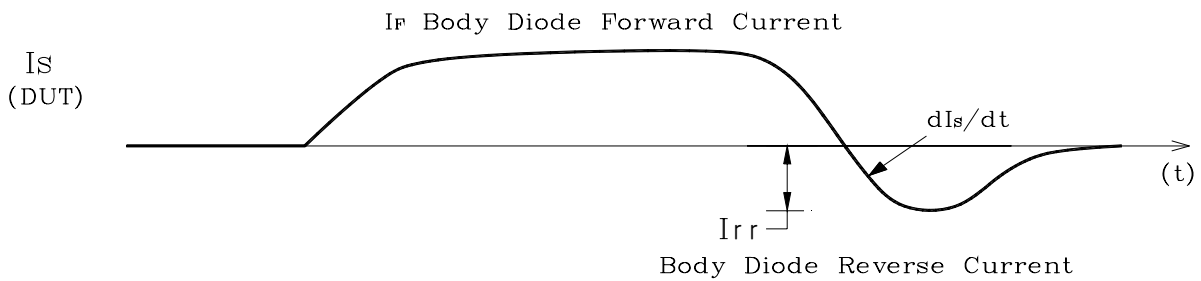
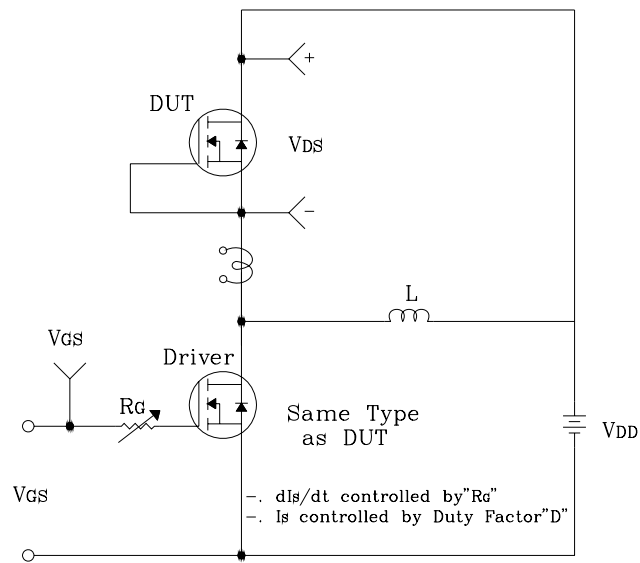


Fig. 14 Diode Reverse Recovery Time Test Circuit & Waveform



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