

## Portable Equipment Application.

## Notebook Application.

## Features

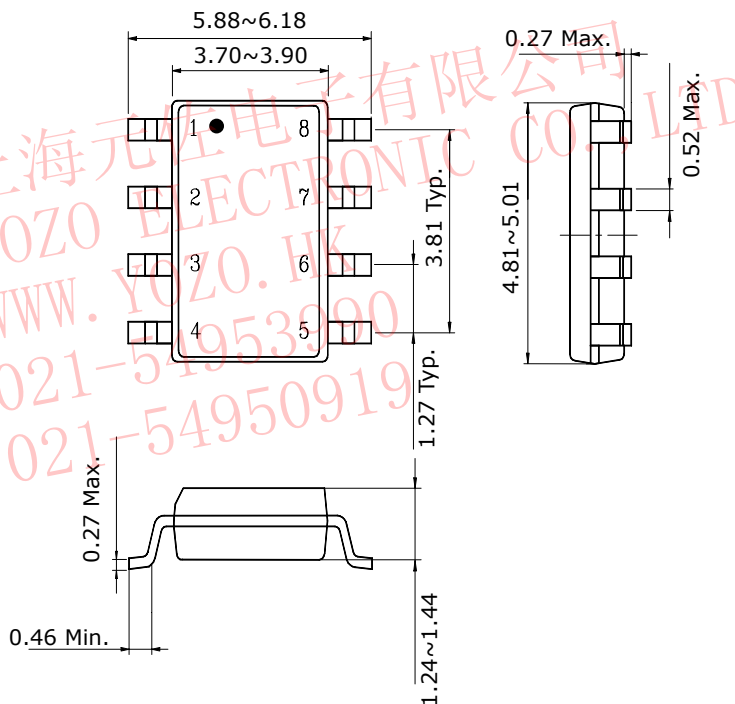
- Low  $V_{GS(th)}$  :  $V_{GS(th)}=1.0\sim3.0V$
- Small footprint due to small package
- Low  $R_{DS(ON)}$  : Low  $R_{DS(ON)}=N\text{-ch}:24m\Omega$  ,  $P\text{-ch}:66m\Omega$

## Ordering Information

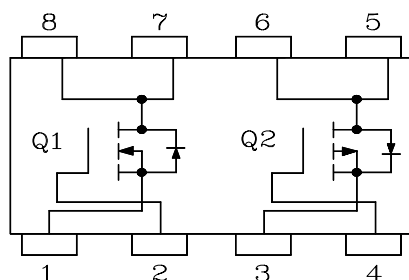
| Type NO. | Marking | Package Code |
|----------|---------|--------------|
| SUF2001  | SUF2001 | SOP-8        |

## Outline Dimensions

unit : mm



## Block Diagram



## PIN Connections

1. Source 1
2. Gate 1
3. Source 2
4. Gate 2
5. Drain 2
6. Drain 2
7. Drain 1
8. Drain 1

## Absolute maximum ratings

(Ta=25°C)

| Characteristic                   | Symbol           | Rating  |       | Unit |
|----------------------------------|------------------|---------|-------|------|
|                                  |                  | N-Ch    | P-Ch  |      |
| Drain-source voltage             | V <sub>DSS</sub> | 30      | -30   | V    |
| Gate-source voltage              | V <sub>GSS</sub> | ±20     |       | V    |
| Drain current (DC)               | I <sub>D</sub>   | 5.8     | -5.3  | A    |
| Drain current (Pulsed) *         | I <sub>DP</sub>  | 23.2    | -21.2 | A    |
| Total Power dissipation **       | P <sub>D</sub>   | 2.0     |       | W    |
| Avalanche current (Single)       | I <sub>AS</sub>  | ②5.8    | ⑥-5.3 | A    |
| Single pulsed avalanche energy   | E <sub>AS</sub>  | ②72     | ⑥33   | mJ   |
| Avalanche current (Repetitive) ① | I <sub>AR</sub>  | 5.8     | -5.3  | A    |
| Repetitive avalanche energy ①    | E <sub>AR</sub>  | 3.4     | 1.6   | mJ   |
| Junction temperature             | T <sub>J</sub>   | 150     |       | °C   |
| Storage temperature range        | T <sub>stg</sub> | -55~150 |       |      |

\* Limited by maximum junction temperature

\*\* Device mounted on a glass-epoxy board

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

## N-CH Electrical Characteristics

(Ta=25°C)

| Characteristic                 | Symbol       | Test Condition                                    | Min. | Typ. | Max.      | Unit      |
|--------------------------------|--------------|---------------------------------------------------|------|------|-----------|-----------|
| Drain-source breakdown voltage | $BV_{DSS}$   | $I_D=250\mu A$ , $V_{GS}=0$                       | 30   | -    | -         | V         |
| Gate threshold voltage         | $V_{GS(th)}$ | $I_D=250\mu A$ , $V_{DS}=V_{GS}$                  | 1.0  | -    | 3.0       | V         |
| Drain-source cut-off current   | $I_{DSS}$    | $V_{DS}=30V$ , $V_{GS}=0V$                        | -    | -    | 1         | $\mu A$   |
| Gate leakage current           | $I_{GSS}$    | $V_{DS}=0V$ , $V_{GS}=\pm 20V$                    | -    | -    | $\pm 100$ | nA        |
| Drain-source on-resistance     | $R_{DS(on)}$ | $V_{GS}=10V$ , $I_D=2.9A$                         | -    | 24   | 30        | $m\Omega$ |
|                                |              | $V_{GS}=5.0V$ , $I_D=2.9A$                        | -    | 28   | 34        | $m\Omega$ |
| Forward transfer conductance ④ | $g_{fs}$     | $V_{DS}=5V$ , $I_D=5.8A$                          | -    | 12   | -         | S         |
| Input capacitance              | $C_{iss}$    | $V_{GS}=0V$ , $V_{DD}=10V$ ,<br>$f=1MHz$          | -    | 370  | 560       | pF        |
| Output capacitance             | $C_{oss}$    |                                                   | -    | 60   | 90        |           |
| Reverse transfer capacitance   | $C_{rss}$    |                                                   | -    | 36   | 54        |           |
| Turn-on delay time             | $t_{d(on)}$  | $V_{DD}=15V$ , $I_D=5.8A$<br>$R_G=10\Omega$<br>③④ | -    | 1.2  | -         | ns        |
| Rise time                      | $t_r$        |                                                   | -    | 1.1  | -         |           |
| Turn-off delay time            | $t_{d(off)}$ |                                                   | -    | 2.5  | -         |           |
| Fall time                      | $t_f$        |                                                   | -    | 1.1  | -         |           |
| Total gate charge              | $Q_g$        | $V_{DD}=15V$ , $V_{GS}=5V$ ,<br>$I_D=5.8A$<br>③④  | -    | 4.2  | 6.3       | nC        |
| Gate-source charge             | $Q_{gs}$     |                                                   | -    | 0.9  | 1.4       |           |
| Gate-drain charge              | $Q_{gd}$     |                                                   | -    | 1.4  | 2.1       |           |

## Source-Drain Diode Ratings and Characteristics

(Ta=25°C)

| Characteristic           | Symbol   | Test Condition                          | Min | Typ | Max | Unit    |
|--------------------------|----------|-----------------------------------------|-----|-----|-----|---------|
| Source current           | $I_S$    | Integral reverse diode<br>in the MOSFET | -   | -   | 1.5 | A       |
| Source current(Plused) ① | $I_{SM}$ |                                         | -   | -   | 6.0 |         |
| Forward voltage ④        | $V_{SD}$ | $V_{GS}=0V$ , $I_S=1.5A$                | -   | -   | 1.2 | V       |
| Reverse recovery time    | $t_{rr}$ | $I_S=1.5A$<br>$di_S/dt=100A/us$         | -   | 90  | -   | ns      |
| Reverse recovery charge  | $Q_{rr}$ |                                         | -   | 0.5 | -   | $\mu C$ |

Note ;

- ① Repetitive Rating : Pulse width limited by maximum junction temperature  
 ②  $L=3.4mH$ ,  $I_{AS}=5.8A$ ,  $V_{DD}=15V$ ,  $R_G=25\Omega$   
 ③ Pulse Test : Pulse Width < 300us, Duty cycle ≤ 2%  
 ④ Essentially independent of operating temperature

## P-CH Electrical Characteristics

(Ta=25°C)

| Characteristic                 | Symbol       | Test Condition                               | Min. | Typ. | Max.      | Unit      |
|--------------------------------|--------------|----------------------------------------------|------|------|-----------|-----------|
| Drain-source breakdown voltage | $BV_{DSS}$   | $I_D=250\mu A, V_{GS}=0$                     | -30  | -    | -         | V         |
| Gate threshold voltage         | $V_{GS(th)}$ | $I_D=250\mu A, V_{DS}=V_{GS}$                | -1.0 | -    | -3.0      | V         |
| Drain-source cut-off current   | $I_{DSS}$    | $V_{DS}=-30V, V_{GS}=0V$                     | -    | -    | 1         | $\mu A$   |
| Gate leakage current           | $I_{GSS}$    | $V_{DS}=0V, V_{GS}=\pm 20V$                  | -    | -    | $\pm 100$ | nA        |
| Drain-source on-resistance     | $R_{DS(on)}$ | $V_{GS}=-10V, I_D=-2.7A$                     | -    | 66   | 72        | $m\Omega$ |
|                                |              | $V_{GS}=-5.0V, I_D=-2.7A$                    | -    | 77   | 83        | $m\Omega$ |
| Forward transfer conductance ⑧ | $g_{fs}$     | $V_{DS}=-5V, I_D=-5.3A$                      | -    | 11   | -         | S         |
| Input capacitance              | $C_{iss}$    | $V_{GS}=0V, V_{DD}=-10V, f=1MHz$             | -    | 390  | 590       | pF        |
| Output capacitance             | $C_{oss}$    |                                              | -    | 97   | 150       |           |
| Reverse transfer capacitance   | $C_{rss}$    |                                              | -    | 37   | 60        |           |
| Turn-on delay time             | $t_{d(on)}$  | $V_{DD}=-15V, I_D=-5.3A, R_G=10\Omega$<br>⑦⑧ | -    | 1.2  | -         | ns        |
| Rise time                      | $t_r$        |                                              | -    | 1.1  | -         |           |
| Turn-off delay time            | $t_{d(off)}$ |                                              | -    | 2.5  | -         |           |
| Fall time                      | $t_f$        |                                              | -    | 1.1  | -         |           |
| Total gate charge              | $Q_g$        | $V_{DD}=-15V, V_{GS}=-5V, I_D=-5.3A$<br>⑦⑧   | -    | 4.7  | 7.0       | nC        |
| Gate-source charge             | $Q_{gs}$     |                                              | -    | 1.4  | 2.1       |           |
| Gate-drain charge              | $Q_{gd}$     |                                              | -    | 1.7  | 2.5       |           |

## Source-Drain Diode Ratings and Characteristics

(Ta=25°C)

| Characteristic           | Symbol   | Test Condition                       | Min | Typ | Max  | Unit    |
|--------------------------|----------|--------------------------------------|-----|-----|------|---------|
| Source current           | $I_S$    | Integral reverse diode in the MOSFET | -   | -   | -1.5 | A       |
| Source current(Plused) ⑤ | $I_{SM}$ |                                      | -   | -   | -6.0 |         |
| Forward voltage ⑧        | $V_{SD}$ | $V_{GS}=0V, I_S=-1.5A$               | -   | -   | -1.2 | V       |
| Reverse recovery time    | $t_{rr}$ | $I_S=-1.5A, di_S/dt=100A/us$         | -   | 90  | -    | ns      |
| Reverse recovery charge  | $Q_{rr}$ |                                      | -   | 0.5 | -    | $\mu C$ |

Note ;

- ⑤ Repetitive Rating : Pulse Width Limited by Maximum Junction Temperature
- ⑥  $L=2.0mH, I_{AS}=-5.0A, V_{DD}=-15V, R_G=25\Omega$
- ⑦ Pulse Test : Pulse Width < 300us, Duty cycle  $\leq 2\%$
- ⑧ Essentially independent of operating temperature

## N-CH Electrical Characteristic Curves

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Fig. 1  $I_D - V_{DS}$

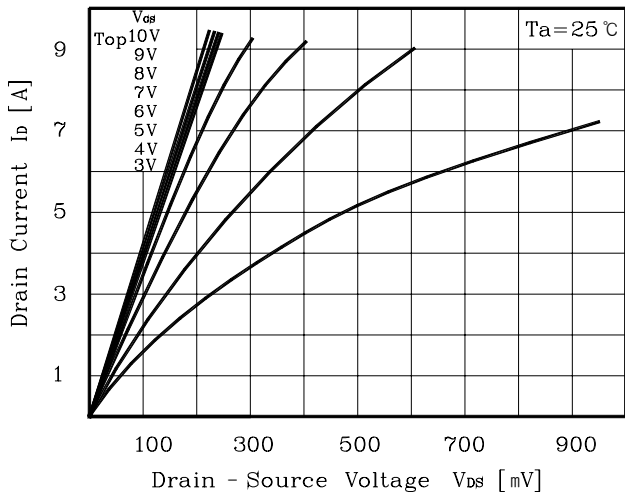


Fig. 2  $I_D - V_{GS}$

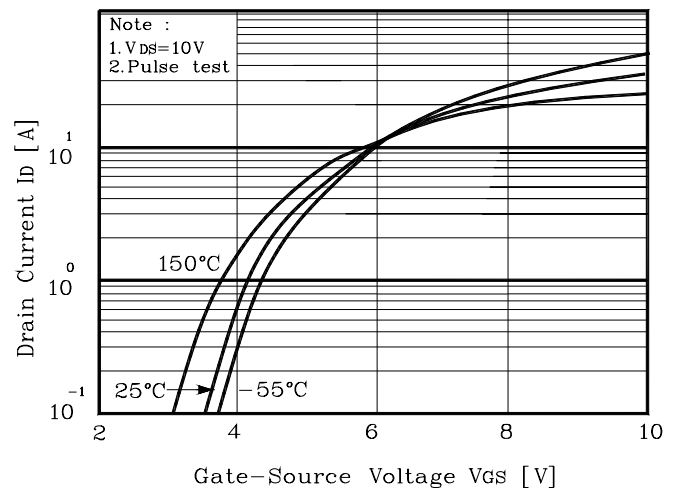


Fig. 3  $R_{DS(on)} - I_D$

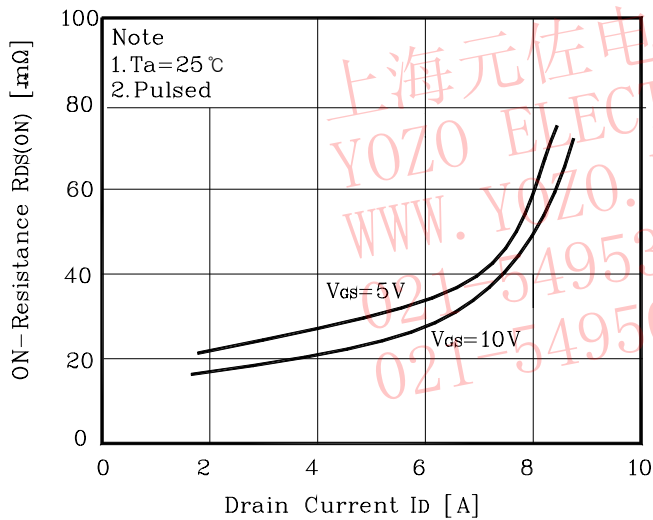


Fig. 4  $I_S - V_{SD}$

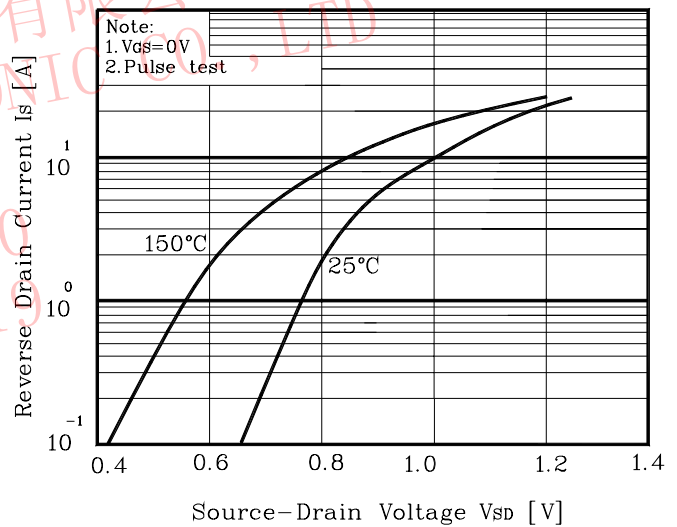


Fig. 5 Capacitance -  $V_{DS}$

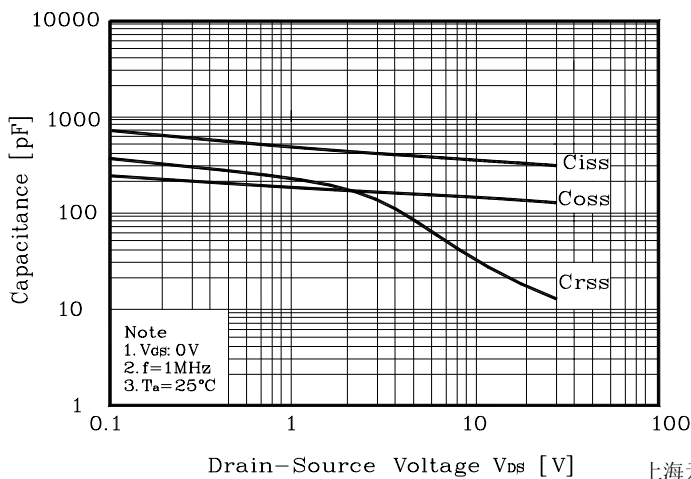


Fig. 6  $V_{GS} - Q_G$

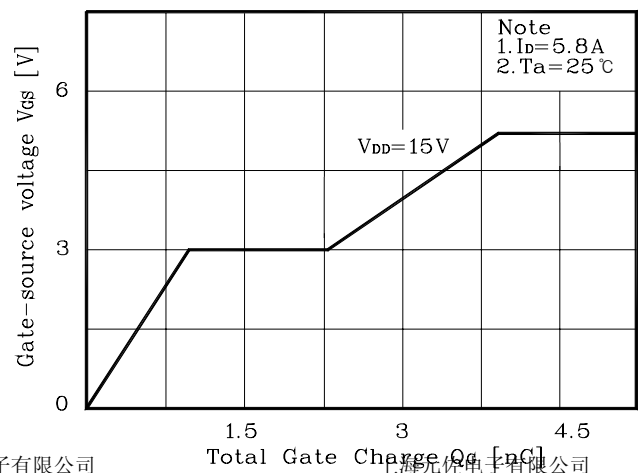


Fig. 7  $V_{DS} - T_J$

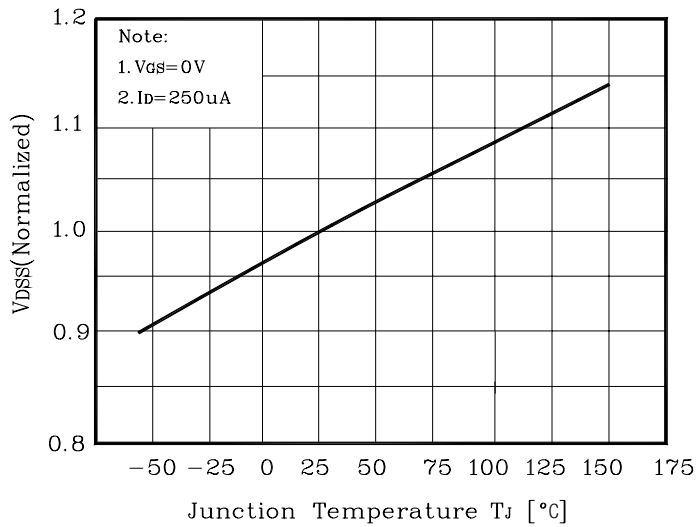


Fig. 8  $R_{DS(on)} - T_J$

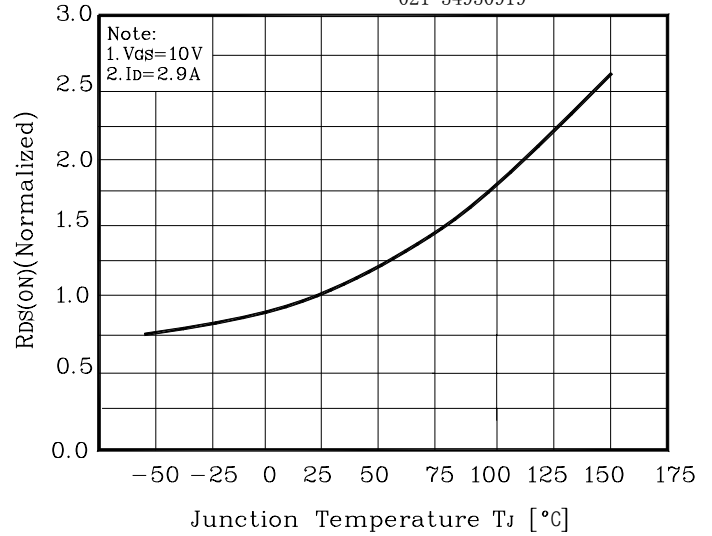


Fig. 9  $I_D - T_a$

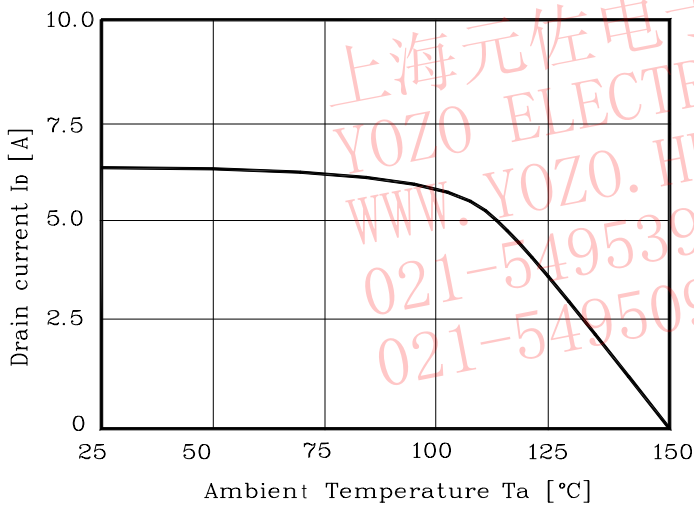


Fig. 10 Safe Operating Area

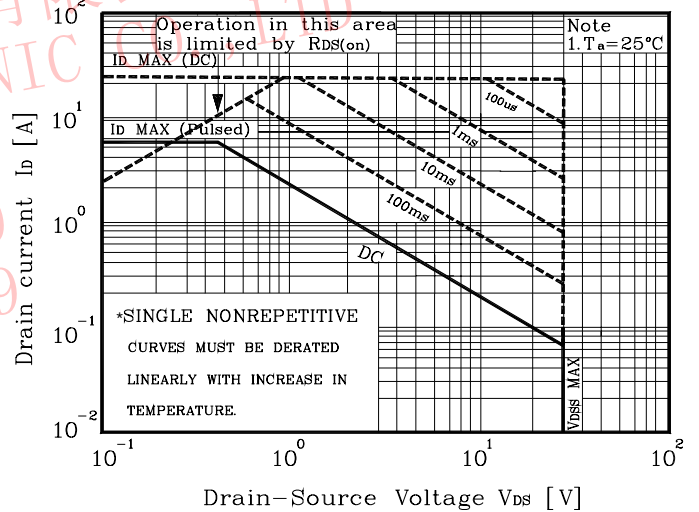


Fig. 11 Gate Charge Test Circuit & Waveform

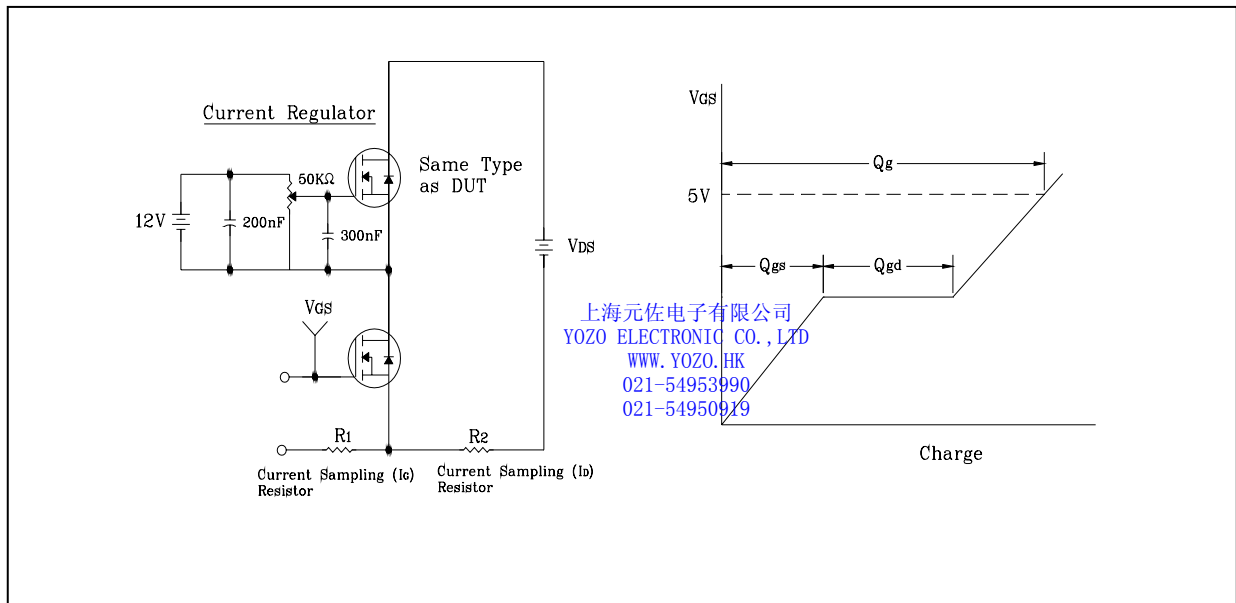


Fig. 12 Resistive Switching Test Circuit & Waveform

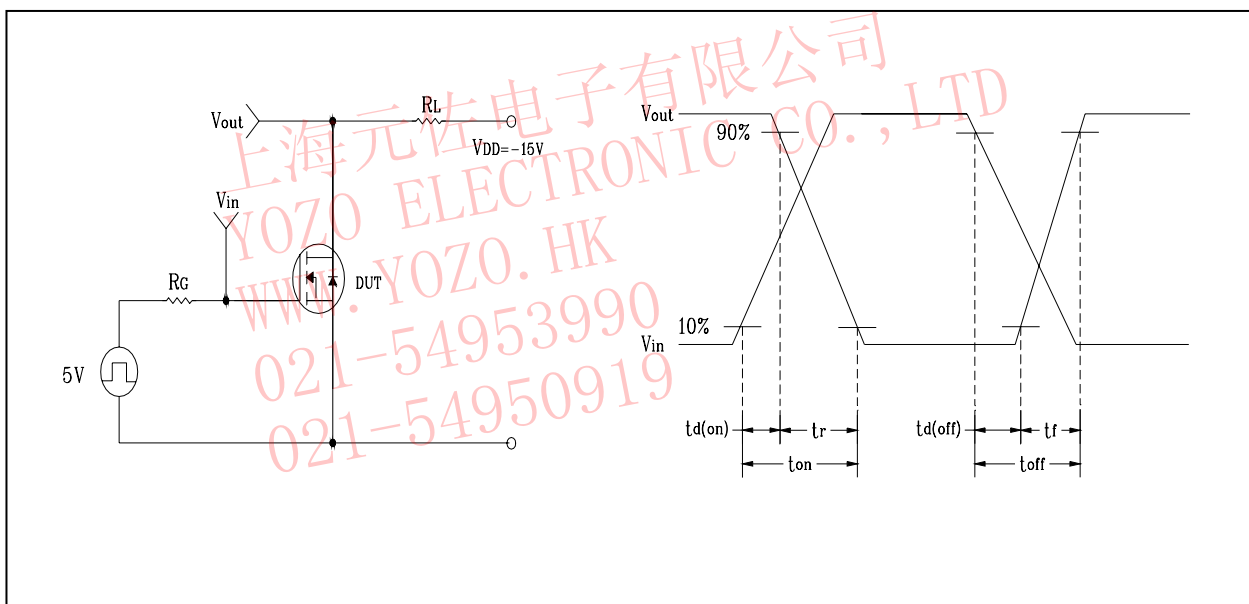


Fig. 13 EAS Test Circuit & Waveform

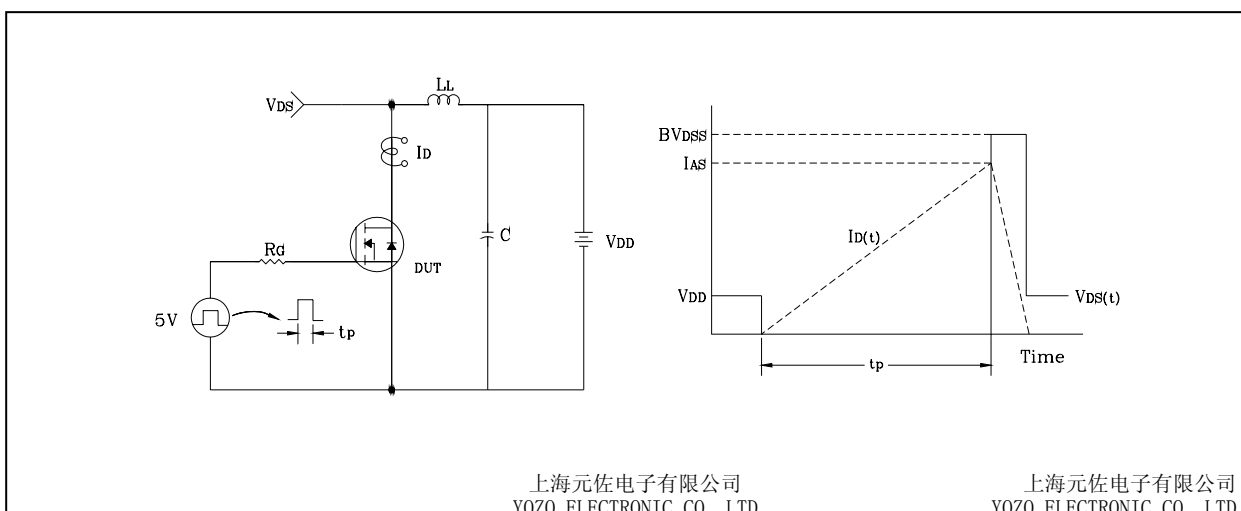
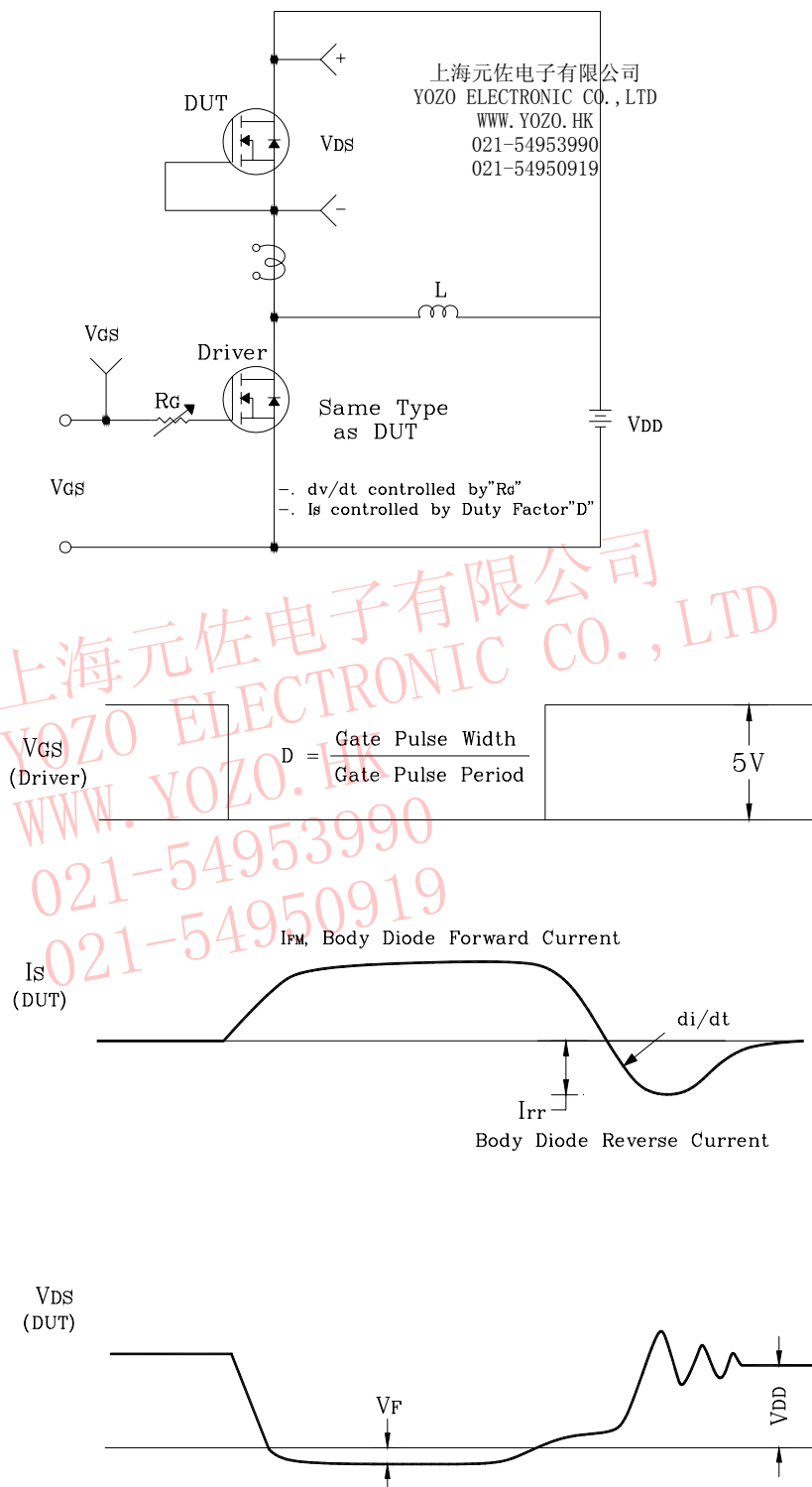


Fig. 14 Diode Reverse Recovery Time Test Circuit &amp; Waveform



## P-CH Electrical Characteristic Curves

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Fig. 1  $I_D - V_{DS}$

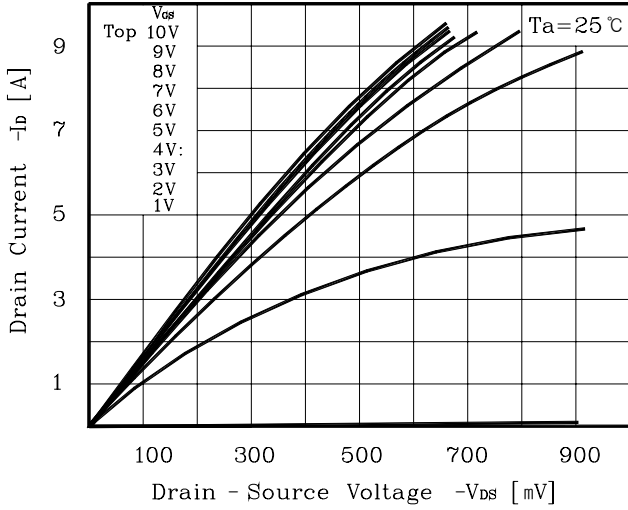


Fig. 2  $I_D - V_{GS}$

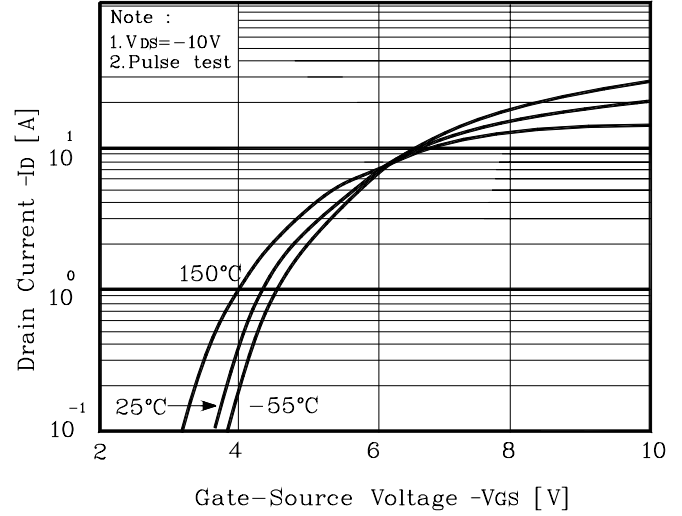


Fig. 3  $R_{DS(on)} - I_D$

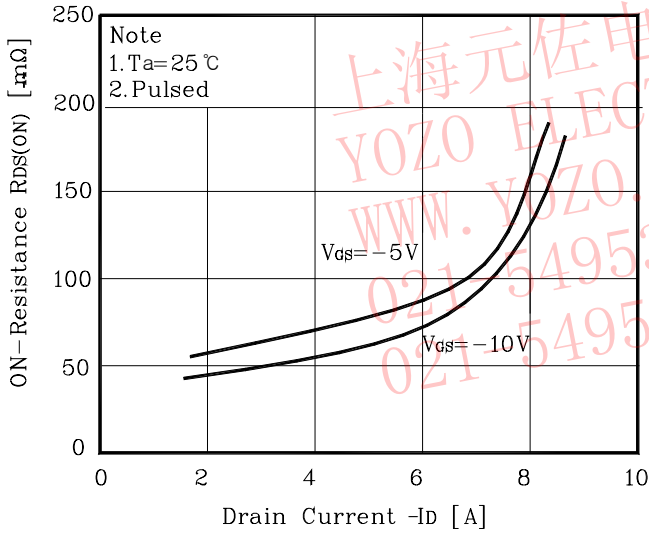


Fig. 4  $I_S - V_{SD}$

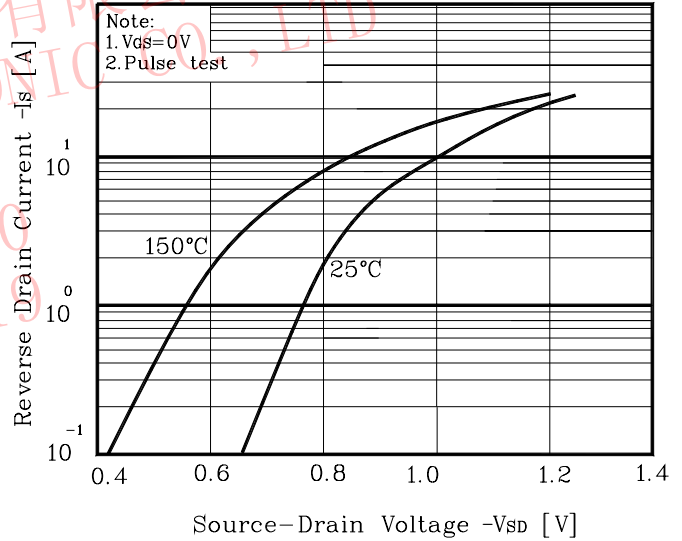


Fig. 5 Capacitance -  $V_{DS}$

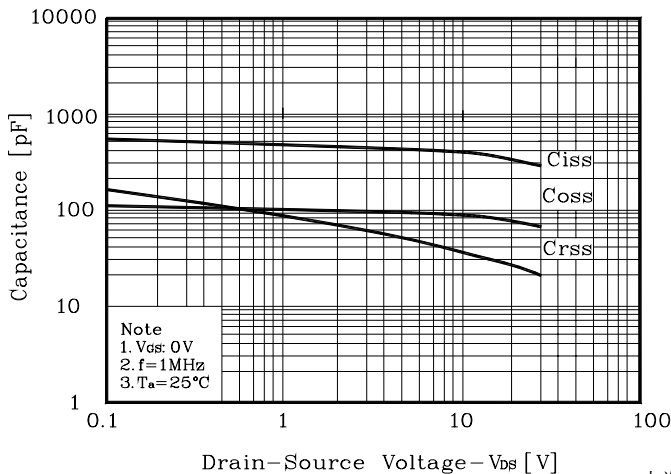
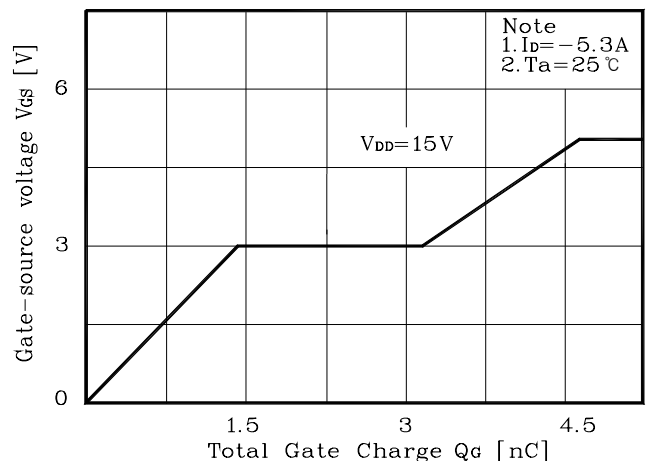
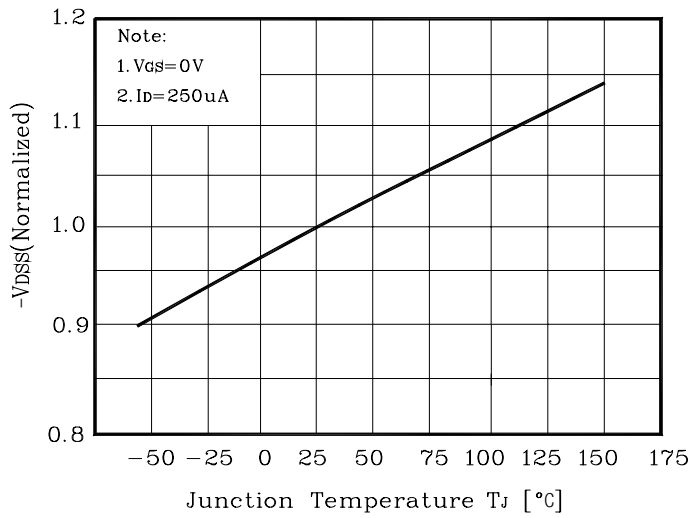


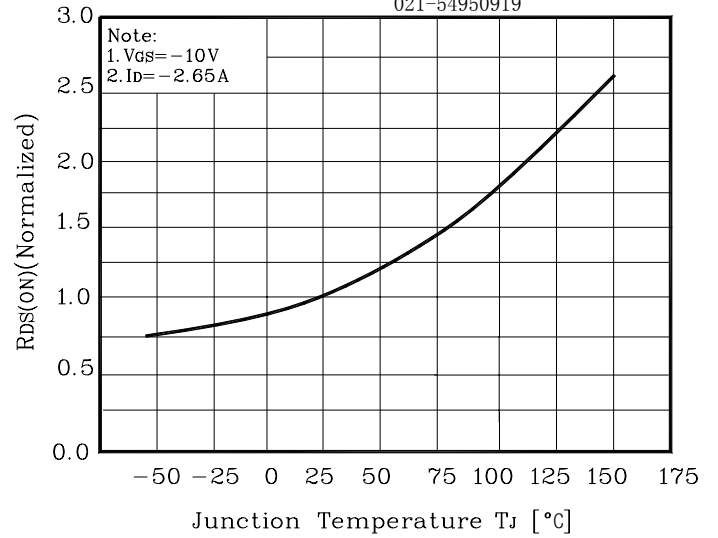
Fig. 6  $V_{GS} - Q_G$



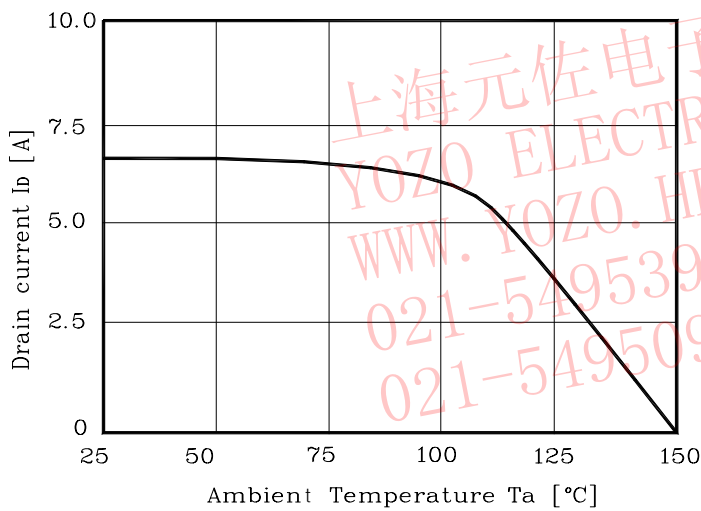
**Fig. 7  $V_{DS} - T_J$**



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



**Fig. 9  $I_D - T_a$**



**Fig. 10 Safe Operating Area**

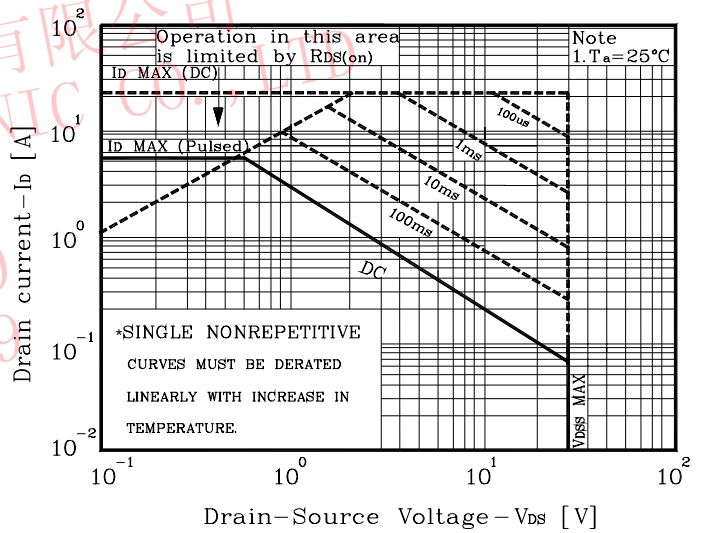


Fig. 11 Gate Charge Test Circuit & Waveform

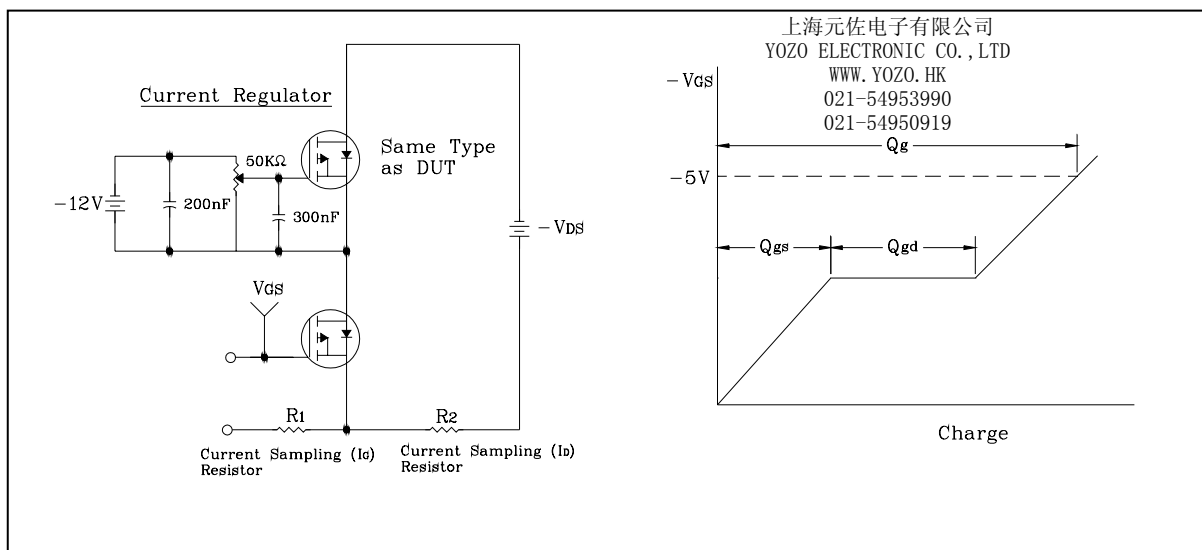


Fig. 12 Resistive Switching Test Circuit & Waveform

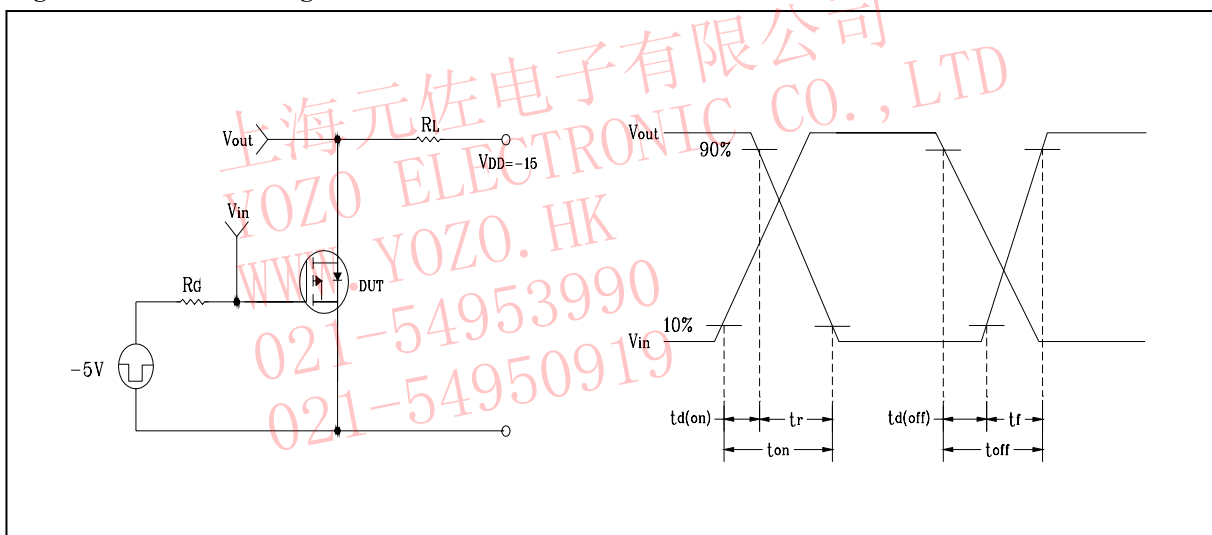
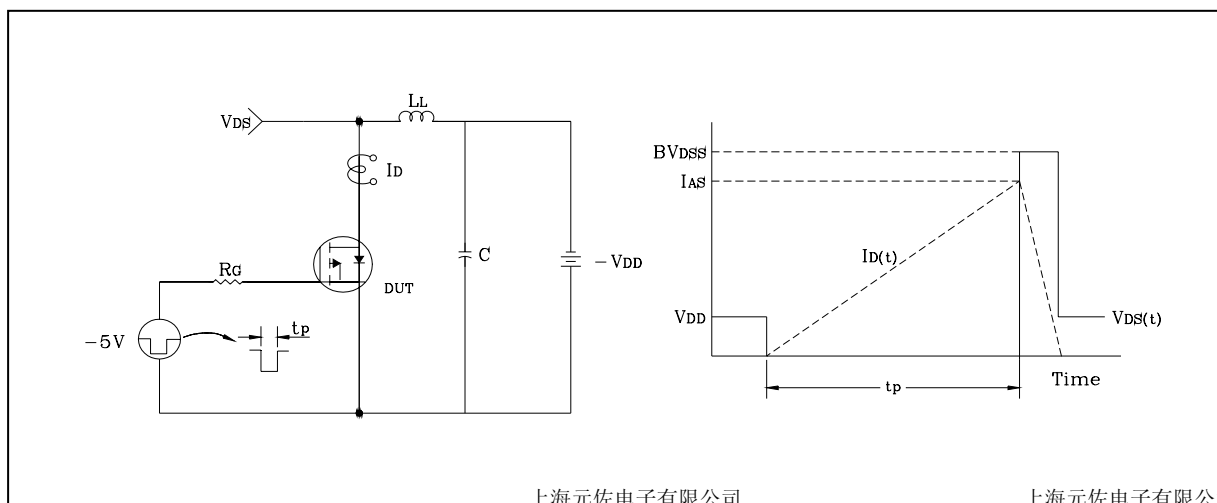


Fig. 13 E<sub>AS</sub> Test Circuit & Waveform



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DUT

$V_{DS}$

Driver

$V_{GS}$

$-V_{GS}$

$R_g$

$L$

Same Type as DUT

- $dv/dt$  controlled by " $R_g$ "
- $I_s$  controlled by Duty Factor " $D$ "

