HUASHUO SEMICONDUCTOR

# HSU0903

## N-Ch and P-Ch Fast Switching MOSFETs

### Application

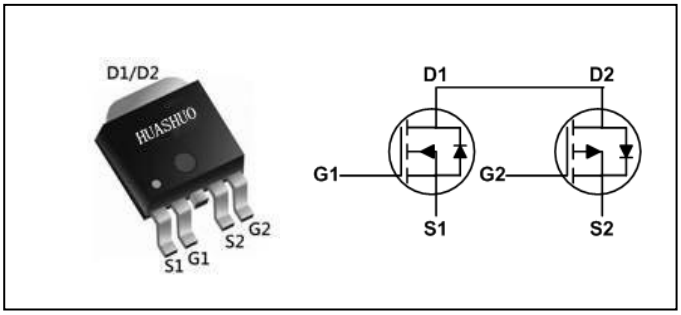
- Power Management.
- DC Motor Control.

### Product Summary

| BVDSS | RDSON | ID |
|---|---|---|
| 100V | 100mΩ | 8A |
| -100V | 220mΩ | -6.2A |

- Super Low Gate Charge
- 100% EAS Guaranteed
- Green Device Available
- Excellent CdV/dt effect decline
- Advanced high cell density Trench technology

### TO252-4L Pin Configuration




### Absolute Maximum Ratings

| Symbol | Parameter | Rating | | Units |
|---|---|---|---|---|
| | | N-Channel | P-Channel | |
| $V_{DS}$ | Drain-Source Voltage | 100 | -100 | V |
| $V_{GS}$ | Gate-Source Voltage | ±20 | ±20 | V |
| $I_D$@$T_A$=25℃ | Continuous Drain Current, $V_{GS}$ @ 10V[1] | 2.6 | -1.8 | A |
| $I_D$@$T_A$=100℃ | Continuous Drain Current, $V_{GS}$ @ 10V[1] | 1.6 | -1.1 | A |
| $I_D$@$T_C$=25℃ | Continuous Drain Current, $V_{GS}$ @ 10V[1] | 8 | -6.2 | A |
| $I_D$@$T_C$=100℃ | Continuous Drain Current, $V_{GS}$ @ 10V[1] | 4.4 | -3.9 | A |
| $I_{DM}$ | Pulsed Drain Current[2] | 25 | -25 | A |
| EAS | Single Pulse Avalanche Energy[3] | 25 | 49 | mJ |
| $I_{AS}$ | Avalanche Current | 10 | -14 | A |
| $P_D$@$T_A$=25℃ | Total Power Dissipation[4] | 1.5 | 1.5 | W |
| $T_{STG}$ | Storage Temperature Range | -55 to 150 | -55 to 150 | ℃ |
| $T_J$ | Operating Junction Temperature Range | -55 to 150 | -55 to 150 | ℃ |

### Thermal Data

| Symbol | Parameter | Typ. | Max. | Unit |
|---|---|---|---|---|
| $R_{\theta JA}$ | Thermal Resistance Junction-Ambient [1] | --- | 85 | ℃/W |
| $R_{\theta JC}$ | Thermal Resistance Junction-Case[1] | --- | 7 | ℃/W |

## N-Channel Electrical Characteristics ($T_J$=25 ℃, unless otherwise noted)

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $BV_{DSS}$ | Drain-Source Breakdown Voltage | $V_{GS}$=0V , $I_D$=250uA | 100 | --- | --- | V |
| $\triangle BV_{DSS}/\triangle T_J$ | $BV_{DSS}$ Temperature Coefficient | Reference to 25℃ , $I_D$=1mA | --- | 0.063 | --- | V/℃ |
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance[2] | $V_{GS}$=10V , $I_D$=2.5A | --- | 80 | 100 | mΩ |
| | | $V_{GS}$=4.5V , $I_D$=2A | --- | 90 | 125 | |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{GS}$=$V_{DS}$ , $I_D$ =250uA | 1.2 | --- | 2.5 | V |
| $\triangle V_{GS(th)}$ | $V_{GS(th)}$ Temperature Coefficient | | --- | -5.24 | --- | mV/℃ |
| $I_{DSS}$ | Drain-Source Leakage Current | $V_{DS}$=80V , $V_{GS}$=0V , $T_J$=25℃ | --- | --- | 1 | uA |
| | | $V_{DS}$=80V , $V_{GS}$=0V , $T_J$=55℃ | --- | --- | 30 | |
| $I_{GSS}$ | Gate-Source Leakage Current | $V_{GS}$=±20V , $V_{DS}$=0V | --- | --- | ±100 | nA |
| $R_g$ | Gate Resistance | $V_{DS}$=0V , $V_{GS}$=0V , f=1MHz | --- | 3.5 | --- | Ω |
| $Q_g$ | Total Gate Charge (4.5V) | $V_{DS}$=50V , $V_{GS}$=4.5V , $I_D$=2A | --- | 15 | --- | nC |
| $Q_{gs}$ | Gate-Source Charge | | --- | 3.2 | --- | |
| $Q_{gd}$ | Gate-Drain Charge | | --- | 2.3 | --- | |
| $T_{d(on)}$ | Turn-On Delay Time | $V_{DD}$=30V , $V_{GS}$=10V , $R_G$=3.3Ω, $I_D$=1A | --- | 8 | --- | ns |
| $T_r$ | Rise Time | | --- | 12 | --- | |
| $T_{d(off)}$ | Turn-Off Delay Time | | --- | 20 | --- | |
| $T_f$ | Fall Time | | --- | 6 | --- | |
| $C_{iss}$ | Input Capacitance | $V_{DS}$=30V , $V_{GS}$=0V , f=1MHz | --- | 990 | --- | pF |
| $C_{oss}$ | Output Capacitance | | --- | 36 | --- | |
| $C_{rss}$ | Reverse Transfer Capacitance | | --- | 24 | --- | |

## Diode Characteristics

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $I_S$ | Continuous Source Current[1,5] | $V_G$=$V_D$=0V , Force Current | --- | --- | 12 | A |
| $V_{SD}$ | Diode Forward Voltage[2] | $V_{GS}$=0V , $I_S$=1A , $T_J$=25℃ | --- | --- | 1.2 | V |

Note :

1.The data tested by surface mounted on a 1 inch$^2$ FR-4 board with 2OZ copper.

2.The data tested by pulsed , pulse width ≦ 300us , duty cycle ≦ 2%

3.The EAS data shows Max. rating . The test condition is $V_{DD}$=25V,$V_{GS}$=10V,L=0.5mH,$I_{AS}$=10A

4.The power dissipation is limited by 150℃ junction temperature

5.The data is theoretically the same as $I_D$ and $I_{DM}$ , in real applications , should be limited by total power dissipation.

## P-Channel Electrical Characteristics ($T_J$=25 ℃, unless otherwise noted)

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $BV_{DSS}$ | Drain-Source Breakdown Voltage | $V_{GS}$=0V , $I_D$=-250uA | -100 | --- | --- | V |
| $\triangle BV_{DSS}/\triangle T_J$ | $BV_{DSS}$ Temperature Coefficient | Reference to 25℃ , $I_D$=-1mA | --- | -0.03 | --- | V/℃ |
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance[2] | $V_{GS}$=-10V , $I_D$=-2A | --- | 180 | 220 | mΩ |
| | | $V_{GS}$=-4.5V , $I_D$=-1.6A | --- | 200 | 255 | |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{GS}$=$V_{DS}$ , $I_D$ =-250uA | -1.2 | --- | -2.5 | V |
| $\triangle V_{GS(th)}$ | $V_{GS(th)}$ Temperature Coefficient | | --- | 4.56 | --- | mV/℃ |
| $I_{DSS}$ | Drain-Source Leakage Current | $V_{DS}$=-80V , $V_{GS}$=0V , $T_J$=25℃ | --- | --- | 1 | uA |
| | | $V_{DS}$=-80V , $V_{GS}$=0V , $T_J$=55℃ | --- | --- | 30 | |
| $I_{GSS}$ | Gate-Source Leakage Current | $V_{GS}$=±20V , $V_{DS}$=0V | --- | --- | ±100 | nA |
| $R_g$ | Gate Resistance | $V_{DS}$=0V , $V_{GS}$=0V , f=1MHz | --- | 13 | --- | Ω |
| $Q_g$ | Total Gate Charge (-10V) | $V_{DS}$=-50V , $V_{GS}$=-10V , $I_D$=-2A | --- | 19 | --- | nC |
| $Q_{gs}$ | Gate-Source Charge | | --- | 3.1 | --- | |
| $Q_{gd}$ | Gate-Drain Charge | | --- | 2.95 | --- | |
| $T_{d(on)}$ | Turn-On Delay Time | $V_{DD}$=-30V , $V_{GS}$=-10V , $R_G$=3.3Ω, $I_D$=-1A | --- | 9 | --- | ns |
| $T_r$ | Rise Time | | --- | 6 | --- | |
| $T_{d(off)}$ | Turn-Off Delay Time | | --- | 38 | --- | |
| $T_f$ | Fall Time | | --- | 33 | --- | |
| $C_{iss}$ | Input Capacitance | $V_{DS}$=-30V , $V_{GS}$=0V , f=1MHz | --- | 1229 | --- | pF |
| $C_{oss}$ | Output Capacitance | | --- | 41 | --- | |
| $C_{rss}$ | Reverse Transfer Capacitance | | --- | 29 | --- | |

## Diode Characteristics

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $I_S$ | Continuous Source Current[1,5] | $V_G$=$V_D$=0V , Force Current | --- | --- | -10 | A |
| $V_{SD}$ | Diode Forward Voltage[2] | $V_{GS}$=0V , $I_S$=-1A , $T_J$=25℃ | --- | --- | -1.2 | V |

Note :

1.The data tested by surface mounted on a 1 inch$^2$ FR-4 board with 2OZ copper.

2.The data tested by pulsed , pulse width ≦ 300us , duty cycle ≦ 2%

3.The EAS data shows Max. rating . The test condition is $V_{DD}$=-25V,$V_{GS}$=-10V,L=0.5mH,$I_{AS}$=-14A

4.The power dissipation is limited by 150℃ junction temperature

5.The data is theoretically the same as $I_D$ and $I_{DM}$ , in real applications , should be limited by total power dissipation.

## N-Channel Typical Characteristics

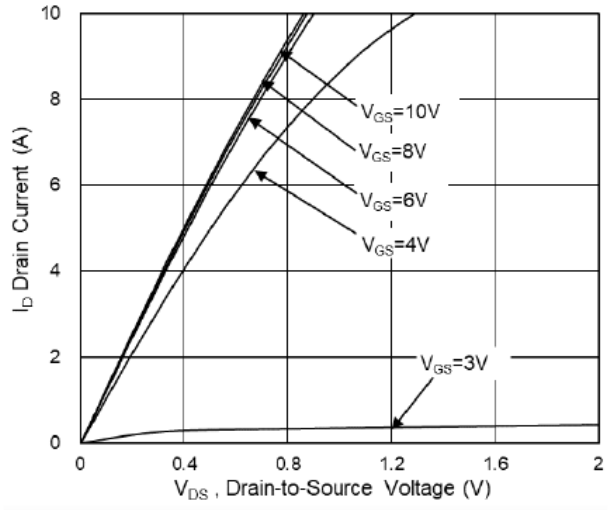



Fig.1 Typical Output Characteristics

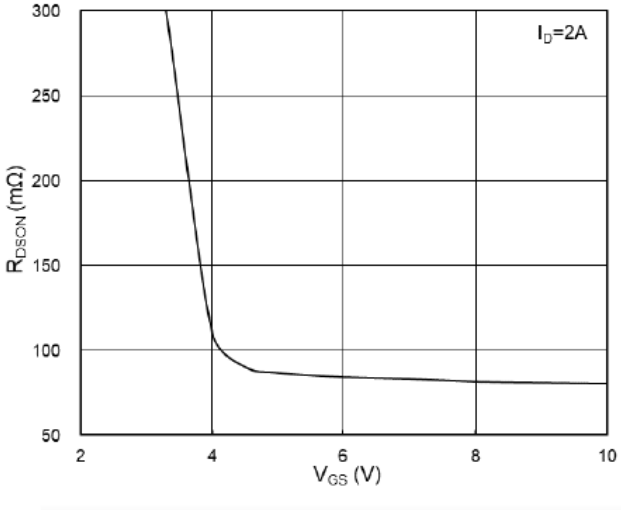



Fig.2 On-Resistance v.s Gate-Source

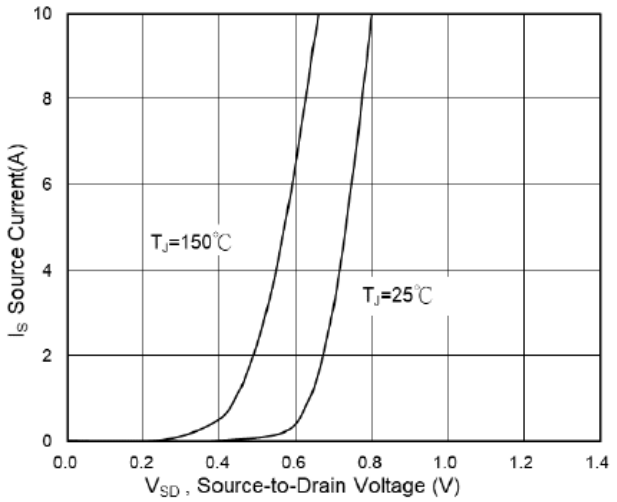



Fig.3 Forward Characteristics of Reverse

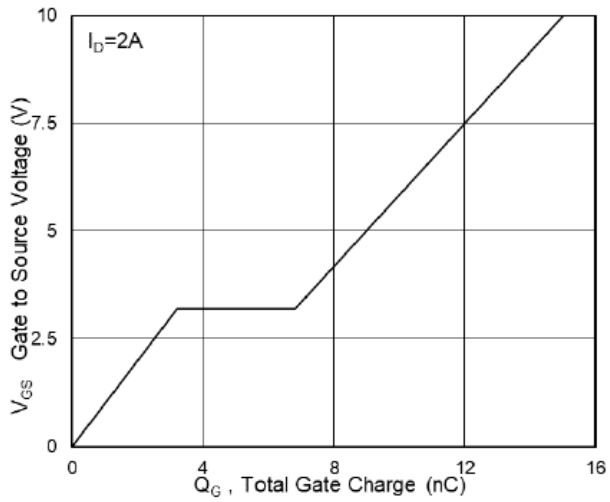



Fig.4 Gate-Charge Characteristics

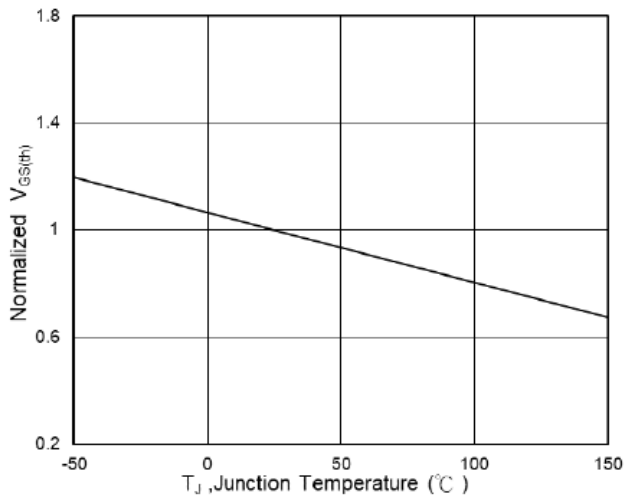



Fig.5 Normalized $V_{GS(th)}$ v.s $T_J$

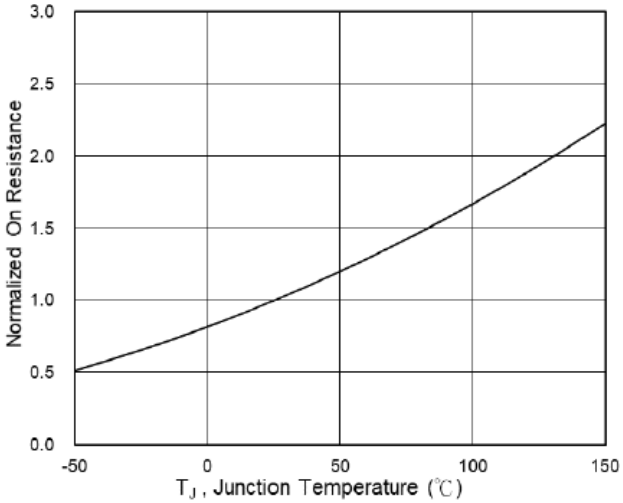



Fig.6 Normalized $R_{DSON}$ v.s $T_J$

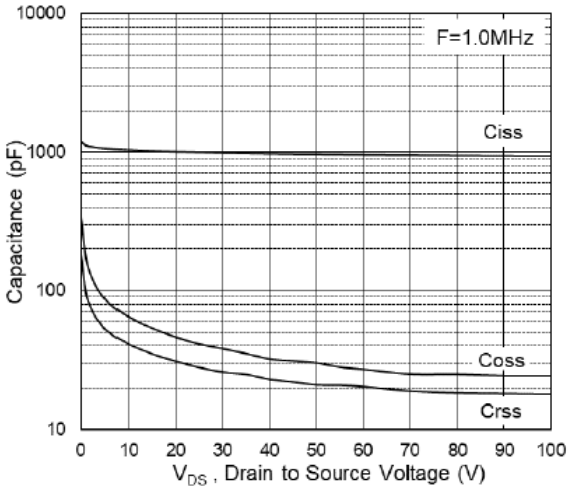



Fig.7 Capacitance

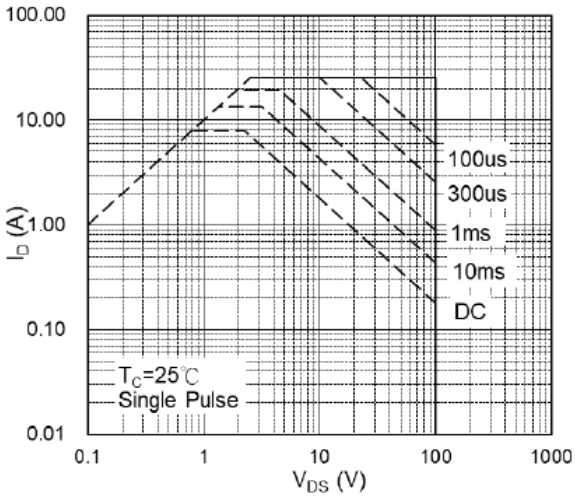



Fig.8 Safe Operating Area

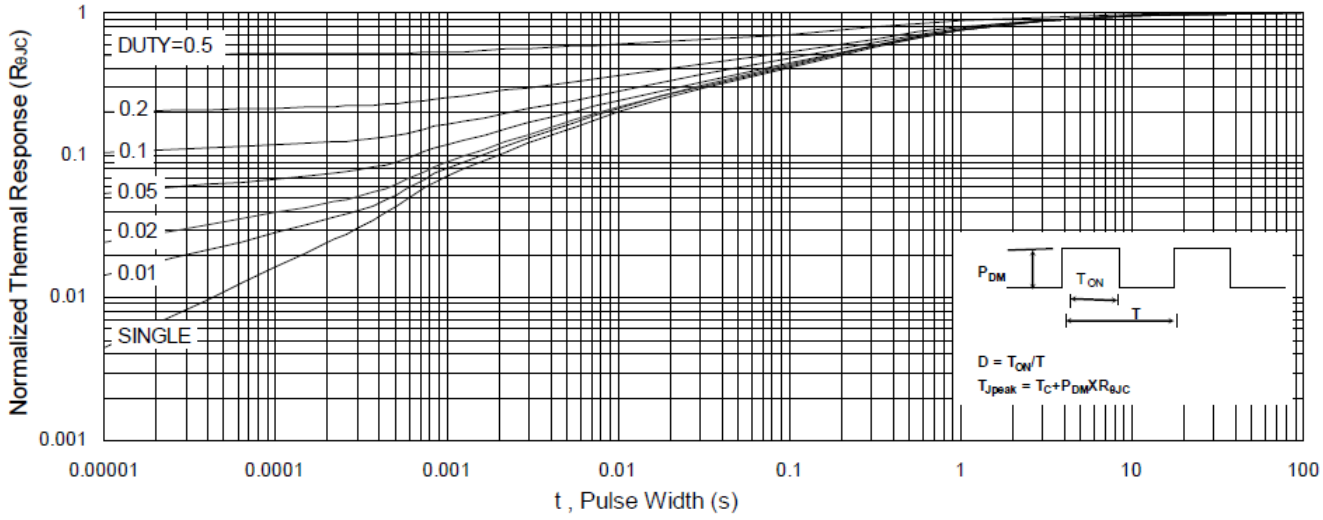



Fig.9 Normalized Maximum Transient Thermal Impedance

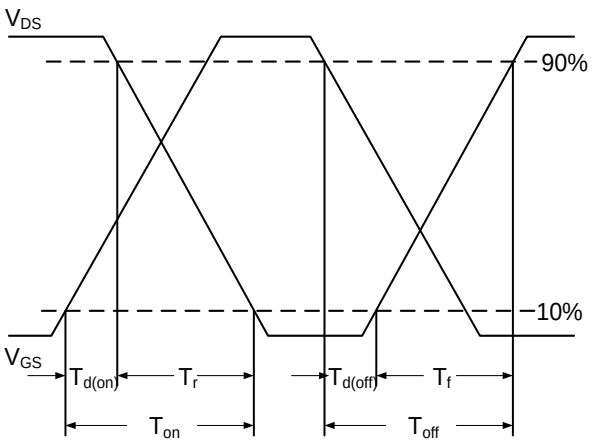



Fig.10 Switching Time Waveform

$$EAS = \frac{1}{2} L \times I_{AS}^2 \times \frac{BV_{DSS}}{BV_{DSS}-V_{DD}}$$

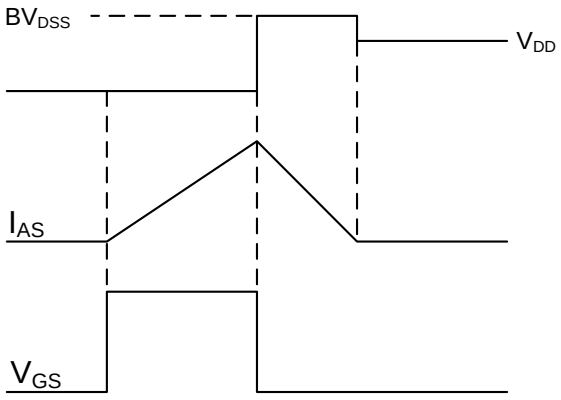



Fig.11 Unclamped Inductive Waveform

## P-Channel Typical Characteristics

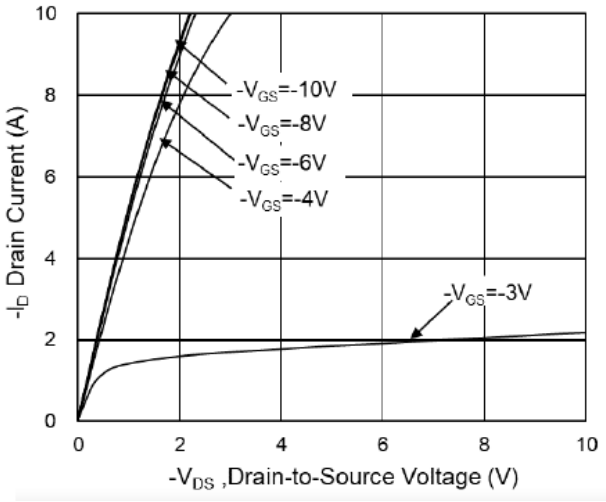



Fig.1 Typical Output Characteristics

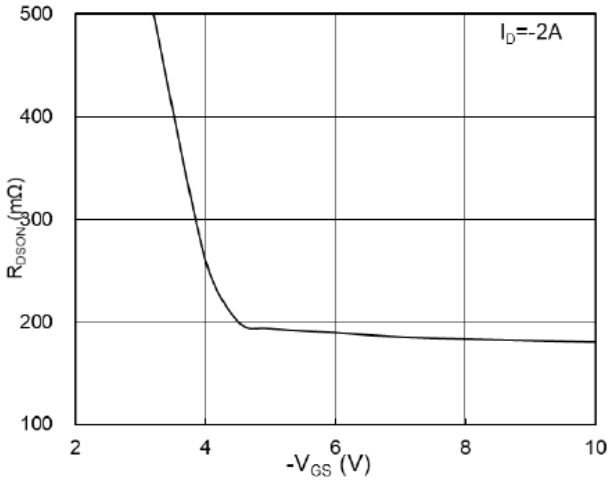



Fig.2 On-Resistance v.s Gate-Source

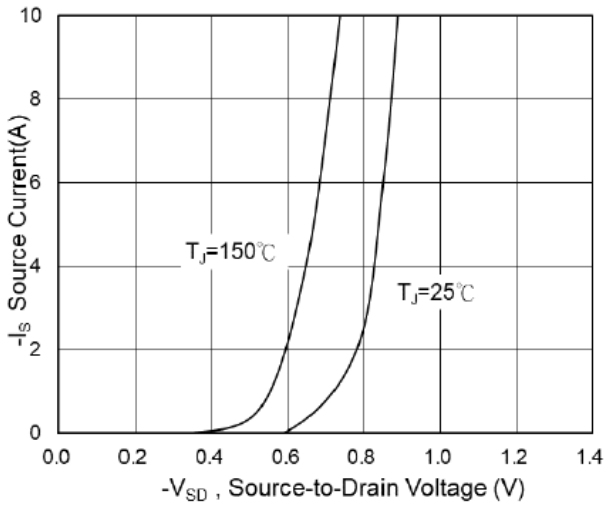



Fig.3 Forward Characteristics of Reverse

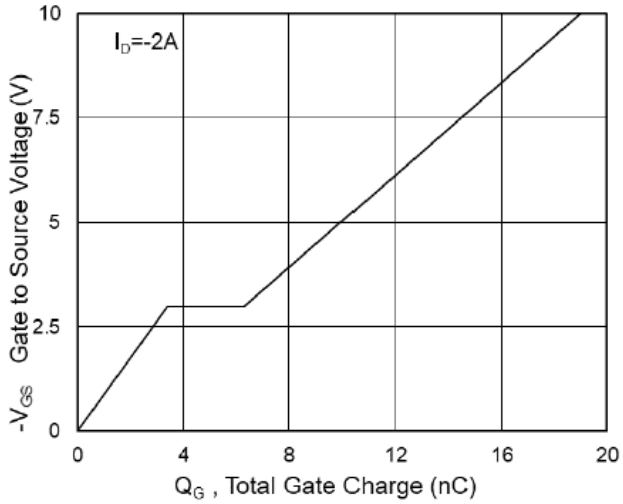



Fig.4 Gate-Charge Characteristics

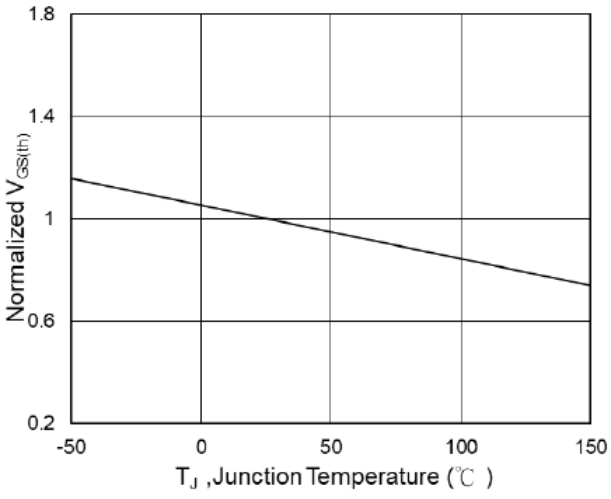



Fig.5 Normalized $V_{GS(th)}$ v.s $T_J$

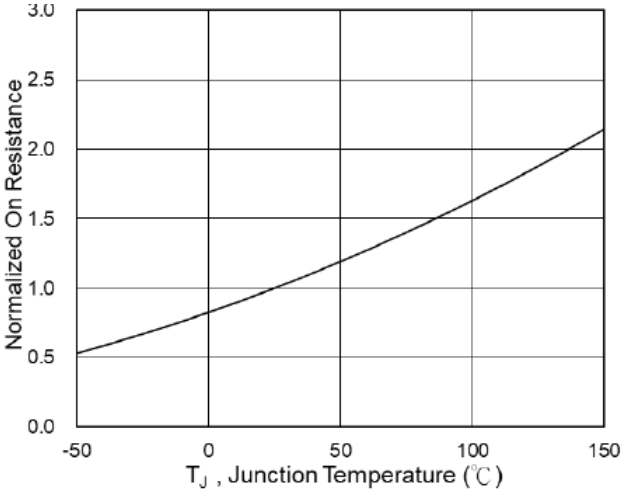



Fig.6 Normalized $R_{DSON}$ v.s $T_J$

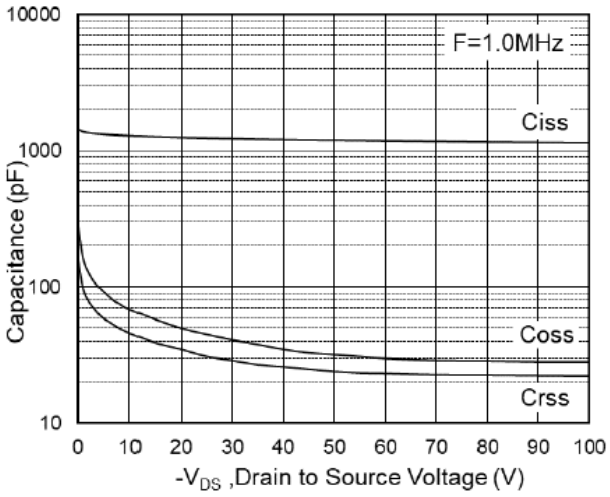



Fig.7 Capacitance

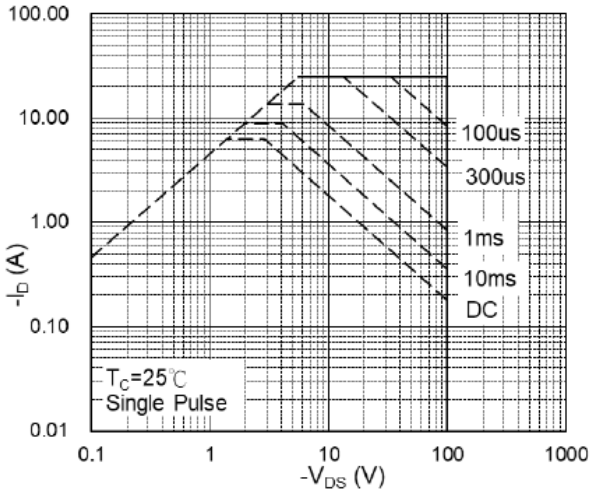



Fig.8 Safe Operating Area

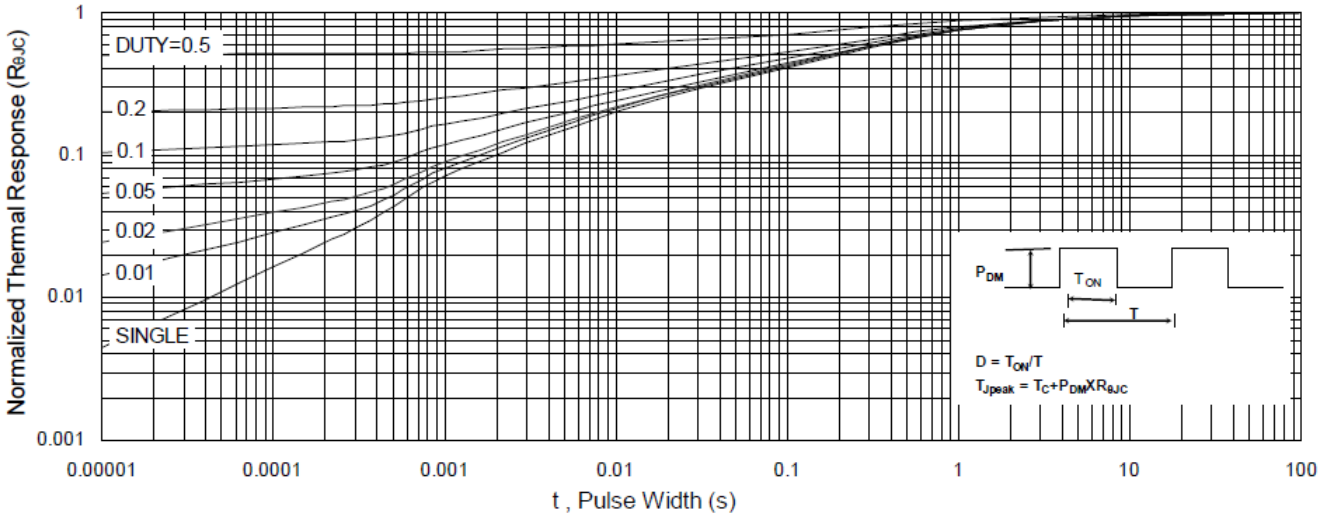



Fig.9 Normalized Maximum Transient Thermal Impedance

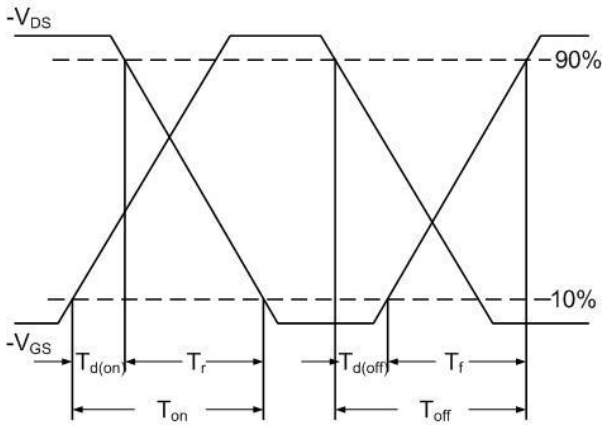



Fig.10 Switching Time Waveform

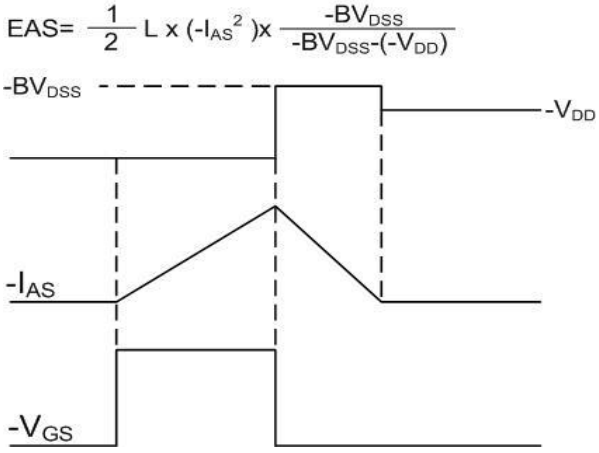



Fig.11 Unclamped Inductive Waveform