

N-Ch and P-Ch Fast Switching MOSFETs

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

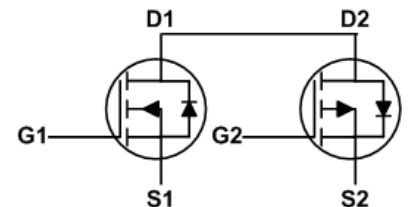
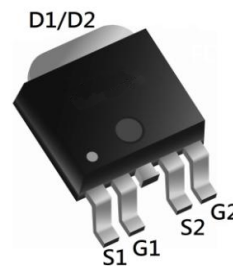
Product Summary

| BVDSS | RDSON | ID |
|-------|-------|------|
| 30V | 21mΩ | 20A |
| -30V | 28mΩ | -20A |

Description

The 3012 is the high performance complementary N-ch and P-ch MOSFETs with high cell density, which provide excellent RDSON and gate charge for most of the synchronous buck converter applications . The 3012 meet the RoHS and Green Product requirement 100% EAS guaranteed with full function reliability approved.

TO252 Pin Configuration



Absolute Maximum Ratings

| Symbol | Parameter | Rating | | Units |
|-----------------------|--|------------|------------|------------|
| | | N-Ch | P-Ch | |
| V_{DS} | Drain-Source Voltage | 30 | -30 | V |
| V_{GS} | Gate-Source Voltage | ± 20 | ± 20 | V |
| $I_D@T_C=25^\circ C$ | Continuous Drain Current, $V_{GS} @ 10V^1$ | 20 | -20 | A |
| $I_D@T_C=100^\circ C$ | Continuous Drain Current, $V_{GS} @ 10V^1$ | 15 | -14 | A |
| $I_D@T_A=25^\circ C$ | Continuous Drain Current, $V_{GS} @ 10V^1$ | 7.3 | -6.8 | A |
| $I_D@T_A=70^\circ C$ | Continuous Drain Current, $V_{GS} @ 10V^1$ | 5.8 | -5.5 | A |
| I_{DM} | Pulsed Drain Current ² | 50 | -50 | A |
| EAS | Single Pulse Avalanche Energy ³ | 26.6 | 110 | mJ |
| I_{AS} | Avalanche Current | 12.7 | -30 | A |
| $P_D@T_C=25^\circ C$ | Total Power Dissipation ⁴ | 20.8 | 20.8 | W |
| $P_D@T_A=25^\circ C$ | Total Power Dissipation ⁴ | 2 | 2 | W |
| T_{STG} | Storage Temperature Range | -55 to 150 | -55 to 150 | $^\circ C$ |
| T_J | Operating Junction Temperature Range | -55 to 150 | -55 to 150 | $^\circ C$ |

Thermal Data

| Symbol | Parameter | Typ. | Max. | Unit |
|-----------------|--|------|------|--------------|
| $R_{\theta JA}$ | Thermal Resistance Junction-Ambient ¹ | --- | 62 | $^\circ C/W$ |
| $R_{\theta JC}$ | Thermal Resistance Junction-Case ¹ | --- | 6 | $^\circ C/W$ |

N-Channel Electrical Characteristics ($T_J=25\text{ }^\circ\text{C}$, unless otherwise noted)

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|------------------------------|--|---|------|-------|-----------|----------------------------|
| BV_{DSS} | Drain-Source Breakdown Voltage | $V_{GS}=0V, I_D=250\mu A$ | 30 | --- | --- | V |
| $\Delta BV_{DSS}/\Delta T_J$ | BVDSS Temperature Coefficient | Reference to 25°C , $I_D=1\text{mA}$ | --- | 0.023 | --- | $V/^\circ\text{C}$ |
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance ² | $V_{GS}=10V, I_D=10A$ | --- | 21 | 30 | m Ω |
| | | $V_{GS}=4.5V, I_D=6A$ | --- | 33 | 40 | |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{GS}=V_{DS}, I_D=250\mu A$ | 1.0 | --- | 2.5 | V |
| $\Delta V_{GS(th)}$ | $V_{GS(th)}$ Temperature Coefficient | | --- | -4.2 | --- | $\text{mV}/^\circ\text{C}$ |
| I_{DSS} | Drain-Source Leakage Current | $V_{DS}=24V, V_{GS}=0V, T_J=25^\circ\text{C}$ | --- | --- | 1 | μA |
| | | $V_{DS}=24V, V_{GS}=0V, T_J=55^\circ\text{C}$ | --- | --- | 5 | |
| I_{GSS} | Gate-Source Leakage Current | $V_{GS}=\pm 20V, V_{DS}=0V$ | --- | --- | ± 100 | nA |
| g_{fs} | Forward Transconductance | $V_{DS}=5V, I_D=10A$ | --- | 14 | --- | S |
| R_g | Gate Resistance | $V_{DS}=0V, V_{GS}=0V, f=1\text{MHz}$ | --- | 2.3 | --- | Ω |
| Q_g | Total Gate Charge (4.5V) | $V_{DS}=20V, V_{GS}=4.5V, I_D=10A$ | --- | 5 | --- | nC |
| Q_{gs} | Gate-Source Charge | | --- | 1.11 | --- | |
| Q_{gd} | Gate-Drain Charge | | --- | 2.61 | --- | |
| $T_{d(on)}$ | Turn-On Delay Time | $V_{DD}=12V, V_{GS}=10V, R_G=3.3\Omega$ $I_D=6A$ | --- | 7.7 | --- | ns |
| T_r | Rise Time | | --- | 46 | --- | |
| $T_{d(off)}$ | Turn-Off Delay Time | | --- | 11 | --- | |
| T_f | Fall Time | | --- | 3.6 | --- | |
| C_{iss} | Input Capacitance | $V_{DS}=15V, V_{GS}=0V, f=1\text{MHz}$ | --- | 416 | --- | pF |
| C_{oss} | Output Capacitance | | --- | 62 | --- | |
| C_{riss} | Reverse Transfer Capacitance | | --- | 51 | --- | |

Diode Characteristics

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|----------|--|---|------|------|------|------|
| I_S | Continuous Source Current ^{1,5} | $V_G=V_D=0V$, Force Current | --- | --- | 24 | A |
| I_{SM} | Pulsed Source Current ^{2,5} | | --- | --- | 50 | A |
| V_{SD} | Diode Forward Voltage ² | $V_{GS}=0V, I_S=1A, T_J=25^\circ\text{C}$ | --- | --- | 1.2 | V |

Note :

- 1.The data tested by surface mounted on a 1 inch² FR-4 board with 20Z copper.
- 2.The data tested by pulsed , pulse width $\leq 300\mu\text{s}$, duty cycle $\leq 2\%$
- 3.The EAS data shows Max. rating . The test condition is $V_{DD}=25V, V_{GS}=10V, L=0.1\text{mH}, I_{AS}=12.7A$
- 4.The power dissipation is limited by 150°C 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 ($T_J=25\text{ }^\circ\text{C}$, unless otherwise noted)

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|------------------------------|--|---|------|--------|-----------|----------------------------|
| BV_{DSS} | Drain-Source Breakdown Voltage | $V_{GS}=0V, I_D=-250\mu A$ | -30 | --- | --- | V |
| $\Delta BV_{DSS}/\Delta T_J$ | BV_{DSS} Temperature Coefficient | Reference to 25°C , $I_D=-1\text{mA}$ | --- | -0.021 | --- | $V/^\circ\text{C}$ |
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance ² | $V_{GS}=-10V, I_D=-8A$ | --- | 28 | 35 | m Ω |
| | | $V_{GS}=-4.5V, I_D=-6A$ | --- | 40 | 60 | |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{GS}=V_{DS}, I_D=-250\mu A$ | -1.0 | --- | -2.5 | V |
| $\Delta V_{GS(th)}$ | $V_{GS(th)}$ Temperature Coefficient | | --- | -4.2 | --- | $\text{mV}/^\circ\text{C}$ |
| I_{DSS} | Drain-Source Leakage Current | $V_{DS}=-24V, V_{GS}=0V, T_J=25^\circ\text{C}$ | --- | --- | 1 | μA |
| | | $V_{DS}=-24V, V_{GS}=0V, T_J=55^\circ\text{C}$ | --- | --- | 5 | |
| I_{GSS} | Gate-Source Leakage Current | $V_{GS}=\pm 20V, V_{DS}=0V$ | --- | --- | ± 100 | nA |
| gfs | Forward Transconductance | $V_{DS}=-5V, I_D=-8A$ | --- | 12.6 | --- | S |
| R_g | Gate Resistance | $V_{DS}=0V, V_{GS}=0V, f=1\text{MHz}$ | --- | 15 | --- | Ω |
| Q_g | Total Gate Charge (-4.5V) | $V_{DS}=-20V, V_{GS}=-4.5V, I_D=-6A$ | --- | 9.8 | --- | nC |
| Q_{gs} | Gate-Source Charge | | --- | 2.2 | --- | |
| Q_{gd} | Gate-Drain Charge | | --- | 3.4 | --- | |
| $T_{d(on)}$ | Turn-On Delay Time | $V_{DD}=-24V, V_{GS}=-10V, R_G=3.3\Omega, I_D=-1A$ | --- | 16.4 | --- | ns |
| T_r | Rise Time | | --- | 20.2 | --- | |
| $T_{d(off)}$ | Turn-Off Delay Time | | --- | 55 | --- | |
| T_f | Fall Time | | --- | 10 | --- | |
| C_{iss} | Input Capacitance | $V_{DS}=-15V, V_{GS}=0V, f=1\text{MHz}$ | --- | 930 | --- | pF |
| C_{oss} | Output Capacitance | | --- | 148 | --- | |
| C_{rss} | Reverse Transfer Capacitance | | --- | 115 | --- | |

Diode Characteristics

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|----------|--|--|------|------|------|------|
| I_S | Continuous Source Current ^{1,5} | $V_G=V_D=0V$, Force Current | --- | --- | -22 | A |
| I_{SM} | Pulsed Source Current ^{2,5} | | --- | --- | -50 | A |
| V_{SD} | Diode Forward Voltage ² | $V_{GS}=0V, I_S=-1A, T_J=25^\circ\text{C}$ | --- | --- | -1.2 | V |

Note :

- 1.The data tested by surface mounted on a 1 inch²FR-4 board with 2OZ copper.
- 2.The data tested by pulsed , pulse width $\leq 300\mu\text{s}$, duty cycle $\leq 2\%$
- 3.The EAS data shows Max. rating . The test condition is $V_{DD}=-25V, V_{GS}=-10V, L=0.1\text{mH}, I_{AS}=-30A$
- 4.The power dissipation is limited by 150°C 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

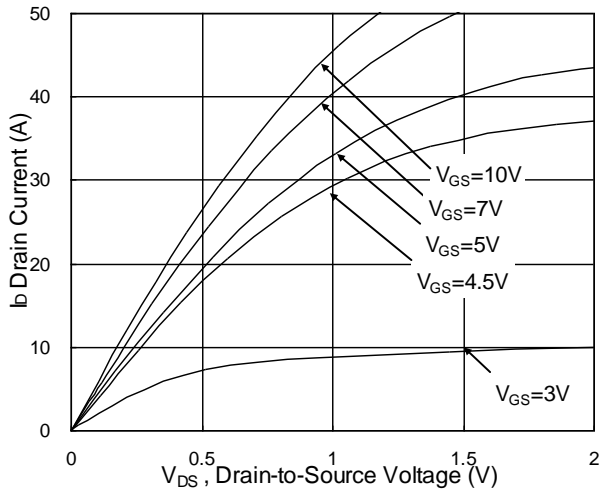


Fig.1 Typical Output Characteristics

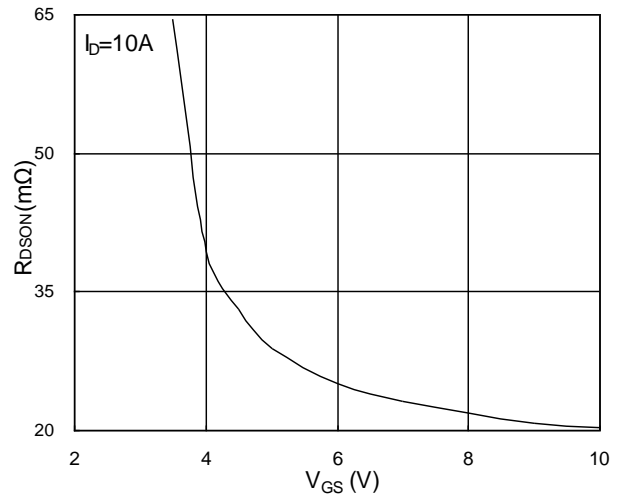


Fig.2 On-Resistance vs. Gate-Source

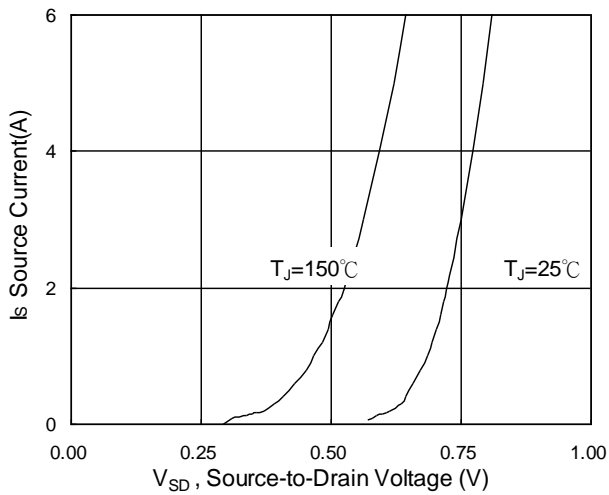


Fig.3 Forward Characteristics Of Reverse

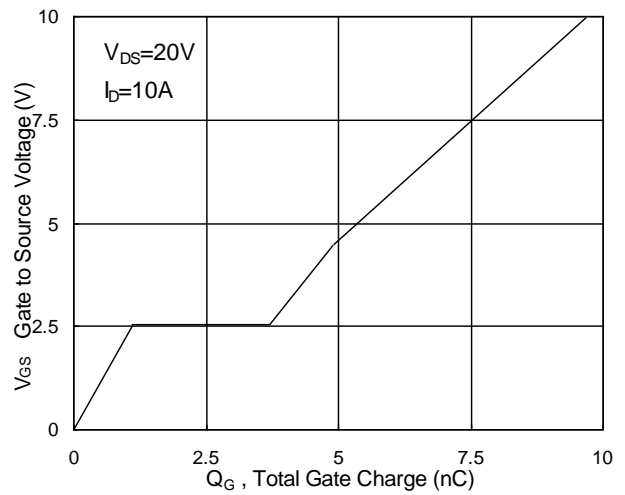


Fig.4 Gate-Charge Characteristics

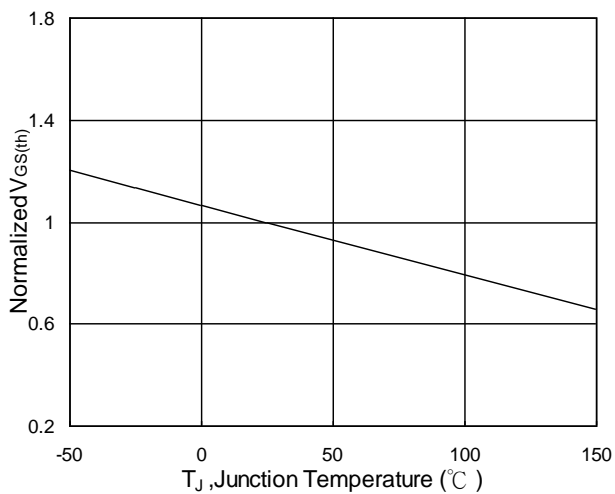


Fig.5 Normalized $V_{GS(th)}$ vs. T_J

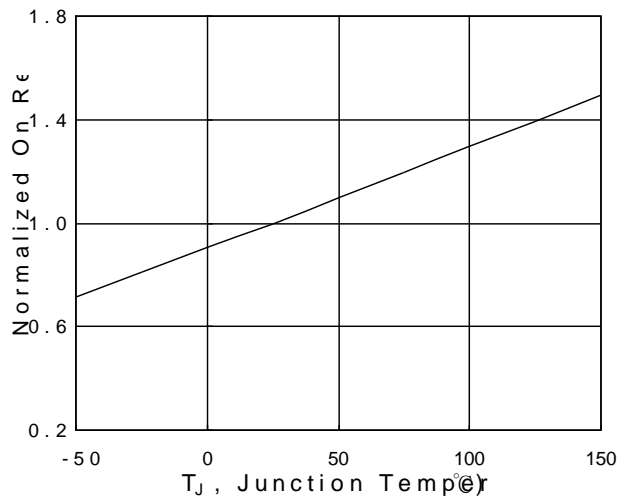


Fig.6 Normalized $R_{DS(on)}$ vs. T_J

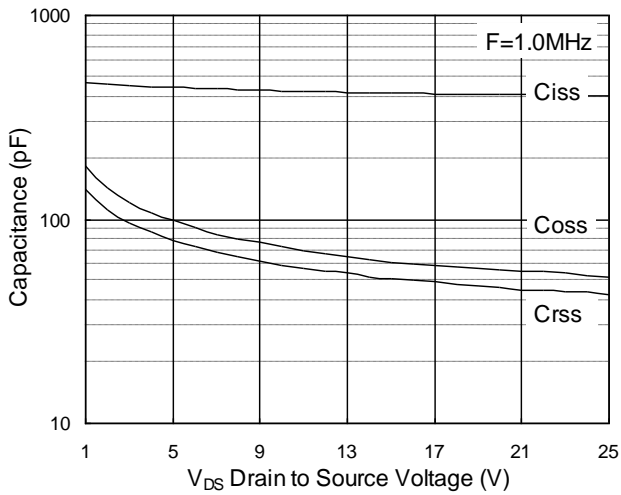


Fig.7 Capacitance

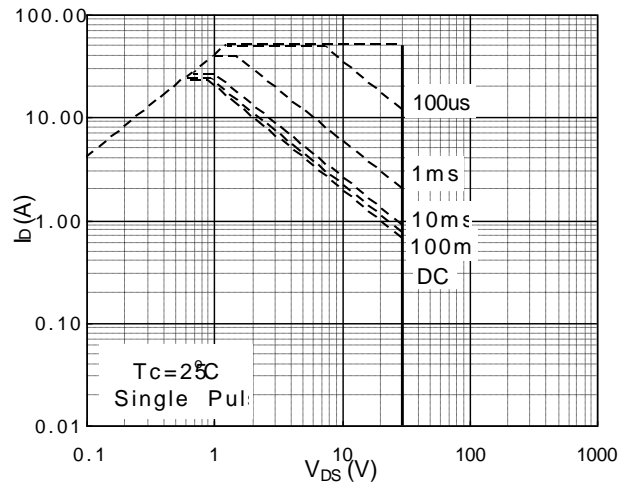


Fig.8 Safe Operating Area

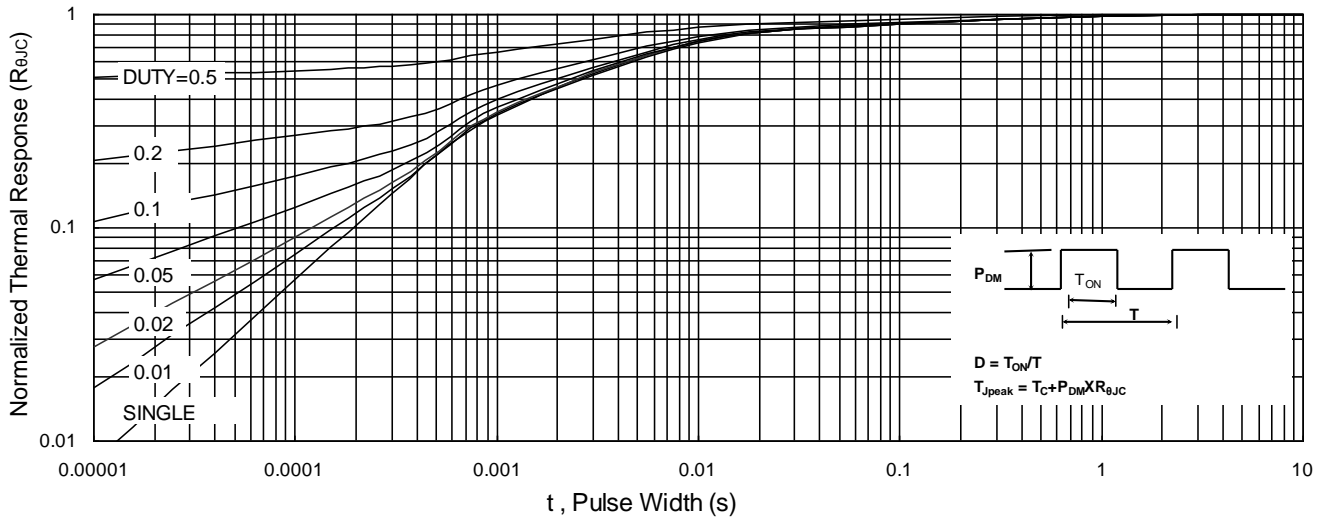


Fig.9 Normalized Maximum Transient Thermal Impedance

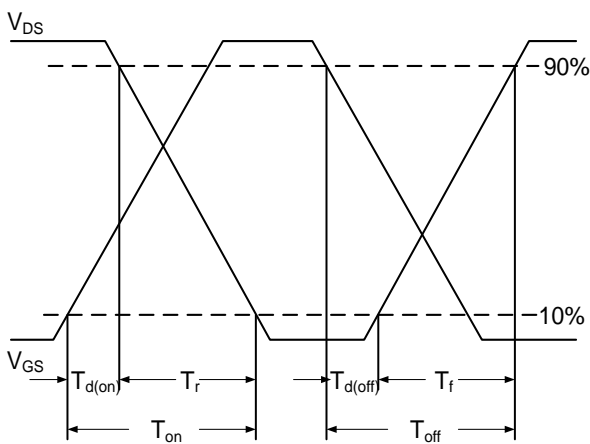


Fig.10 Switching Time Waveform

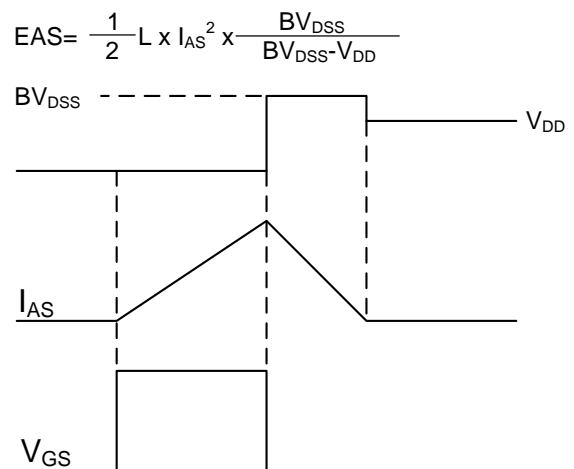


Fig.11 Unclamped Inductive Switching Waveform

P-Channel Typical Characteristics

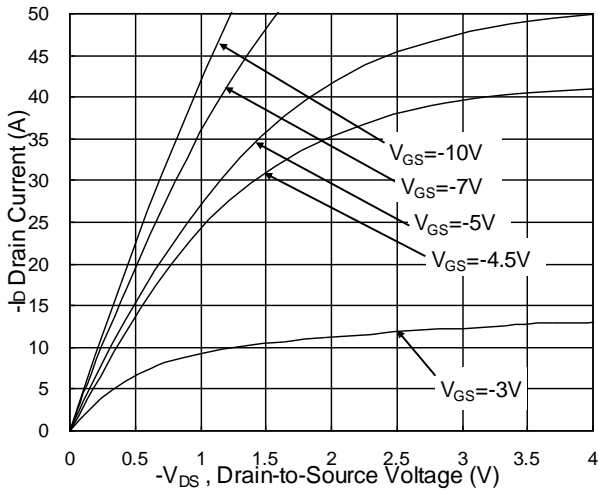


Fig.1 Typical Output Characteristics

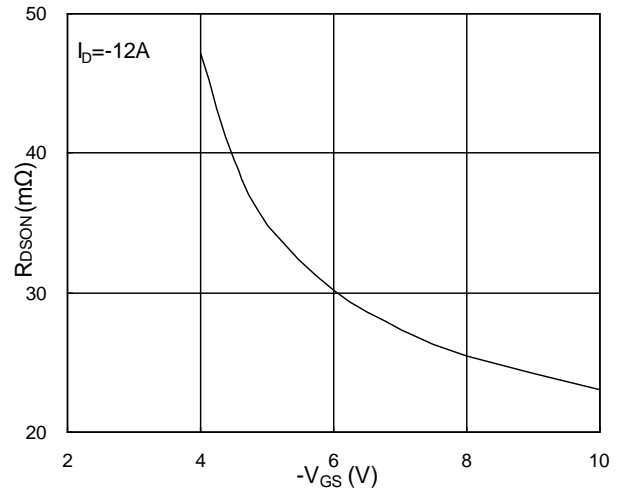


Fig.2 On-Resistance v.s Gate-Source

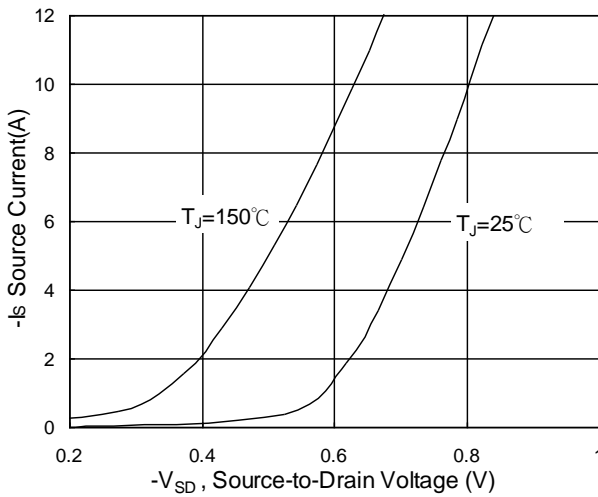


Fig.3 Forward Characteristics Of Reverse

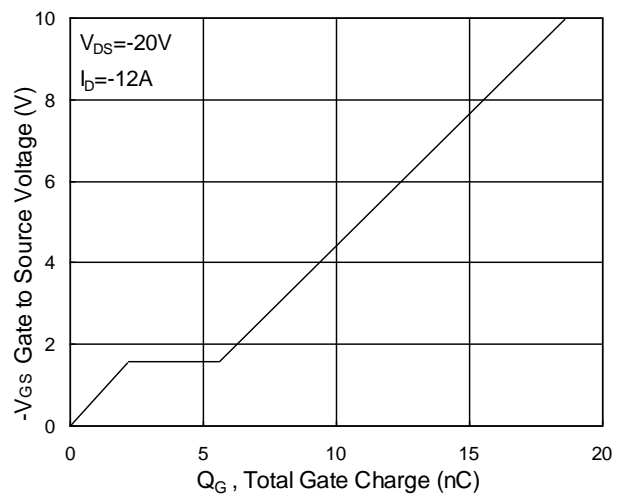


Fig.4 Gate-Charge Characteristics

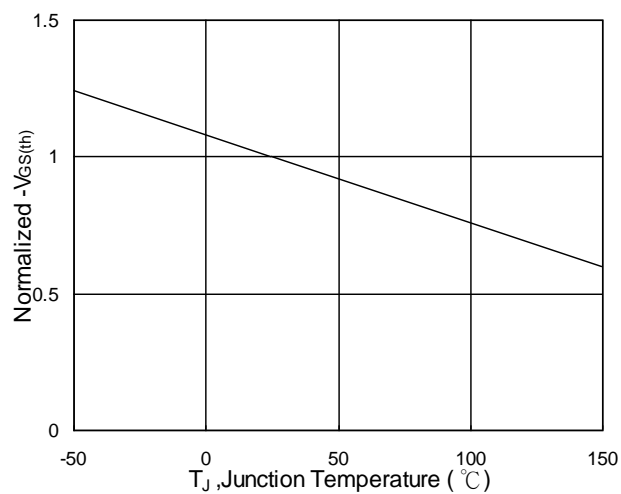


Fig.5 Normalized V_{GS(th)} v.s T_J

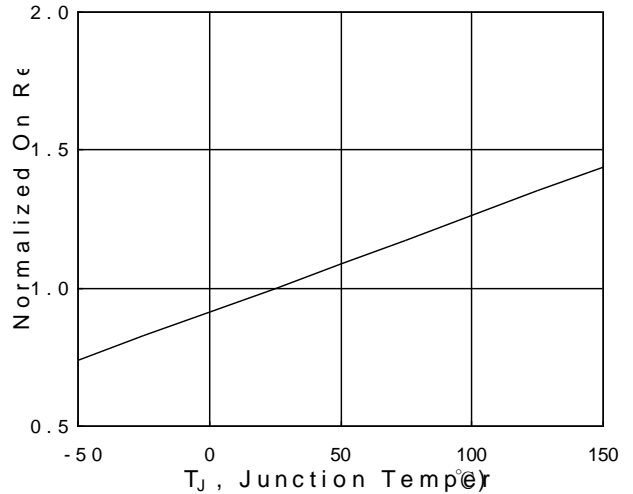


Fig.6 Normalized R_{DS(on)} v.s T_J

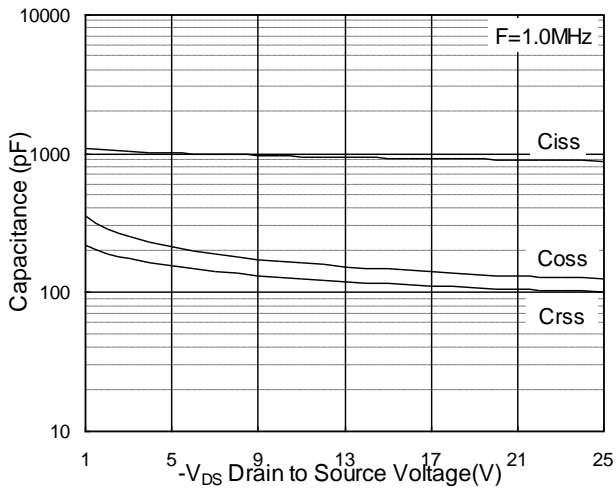


Fig.7 Capacitance

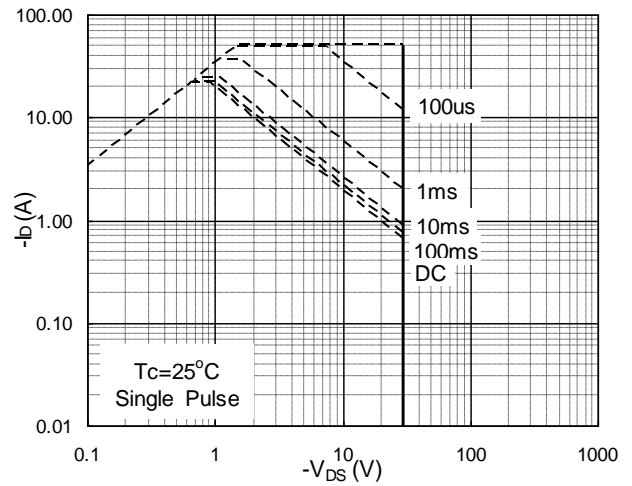


Fig.8 Safe Operating Area

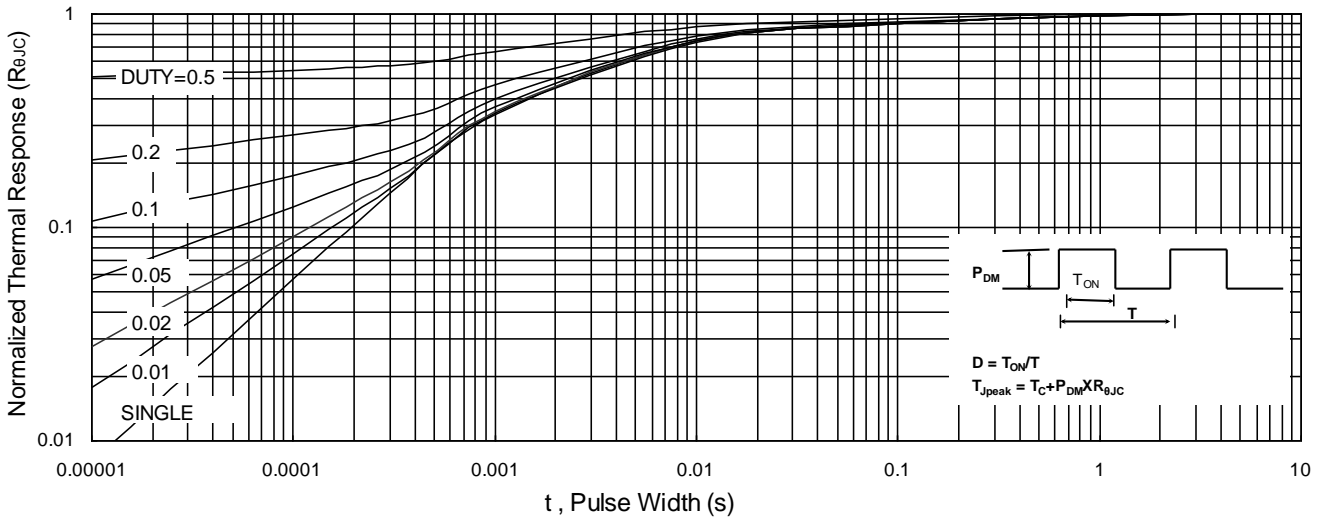


Fig.9 Normalized Maximum Transient Thermal Impedance

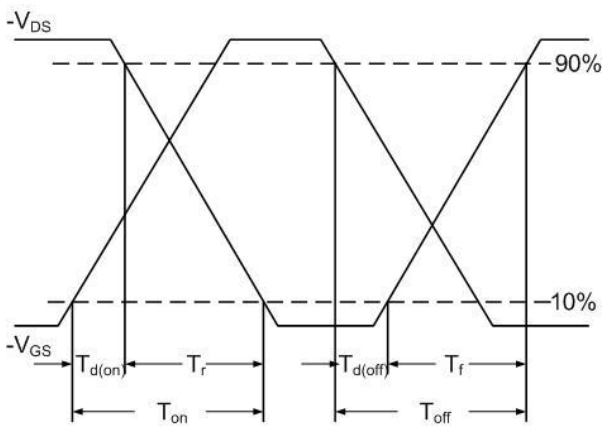


Fig.10 Switching Time Waveform

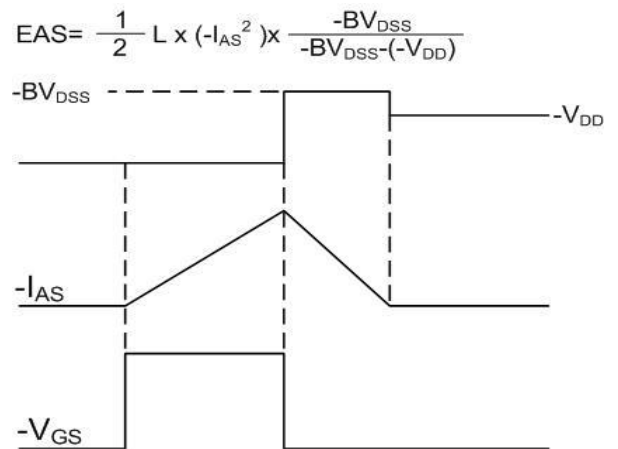


Fig.11 Unclamped Inductive Switching Waveform

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