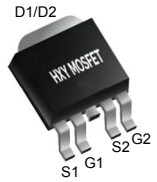
# HXY3012GD

Dual N+P-Channel Enhancement Mode MOSFET

## Description

The HXY3012GD uses advanced trench technology to provide excellent $R_{DS(ON)}$, low gate charge and operation with gate voltages as low as 4.5V. This device is suitable for use as a Battery protection or in other Switching application.




TO252-4L

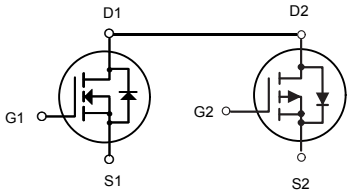
## General Features

$V_{DS}$ = 30V $I_D$ =20A

$R_{DS(ON)}$ < 24mΩ @ $V_{GS}$=10V

$V_{DS}$ = -30V $I_D$ =-20A

$R_{DS(ON)}$ < 40mΩ @ $V_{GS}$=-10V




N-Channel MOSFET P-Channel MOSFET

## Application

Wireless charging

Boost driver

Brushless motor

## Package Marking and Ordering Information

| Product ID | Pack | Marking | Qty(PCS) |
|---|---|---|---|
| HXY3012GD | TO252-4L | 3012 XXXX | 2500 |

## Absolute Maximum Ratings ($T_C$=25℃unless otherwise noted)

| Symbol | Parameter | Rating | | Units |
|---|---|---|---|---|
| | | N-Channel | P-Channel | |
| VDS | Drain-Source Voltage | 30 | -30 | V |
| VGS | Gate-Source Voltage | ±20 | ±20 | V |
| $I_D$@$T_A$=25℃ | Continuous Drain Current, $V_{GS}$ @ 10V[1] | 20 | -20 | A |
| $I_D$@$T_A$=70℃ | Continuous Drain Current, $V_{GS}$ @ 10V[1] | 15 | -14 | A |
| IDM | Pulsed Drain Current[2] | 50 | -50 | A |
| EAS | Single Pulse Avalanche Energy[3] | 26.6 | 110 | mJ |
| IAS | Avalanche Current | 12.7 | -30 | A |
| $P_D$@$T_A$=25℃ | Total Power Dissipation[4] | 20.8 | 20.8 | W |
| TSTG | Storage Temperature Range | -55 to 150 | -55 to 150 | ℃ |
| $T_J$ | Operating Junction Temperature Range | -55 to 150 | -55 to 150 | ℃ |
| $R_{\theta}JA$ | Thermal Resistance Junction-Ambient [1] | 62 | | ℃/W |
| $R_{\theta}JC$ | Thermal Resistance Junction-Case[1] | 6 | | ℃/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 | 30 | --- | --- | V |
| $\triangle BV_{DSS}/\triangle T_J$ | BVDSS Temperature Coefficient | Reference to 25℃ , $I_D$=1mA | --- | 0.023 | --- | V/℃ |
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance[2] | $V_{GS}$=10V , $I_D$=10A | --- | 16 | 24 | mΩ |
| | | $V_{GS}$=4.5V , $I_D$=6A | --- | 25 | 30 | |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{GS}$=$V_{DS}$ , $I_D$ =250uA | 1.0 | --- | 2.5 | V |
| $\triangle V_{GS(th)}$ | $V_{GS(th)}$ Temperature Coefficient | | --- | -4.2 | --- | mV/℃ |
| $I_{DSS}$ | Drain-Source Leakage Current | $V_{DS}$=24V , $V_{GS}$=0V , $T_J$=25℃ | --- | --- | 1 | uA |
| | | $V_{DS}$=24V , $V_{GS}$=0V , $T_J$=55℃ | --- | --- | 5 | |
| $I_{GSS}$ | Gate-Source Leakage Current | $V_{GS}$=±20V , $V_{DS}$=0V | --- | --- | ±100 | nA |
| gfs | Forward Transconductance | $V_{DS}$=5V , $I_D$=10A | --- | 14 | --- | S |
| $R_g$ | Gate Resistance | $V_{DS}$=0V , $V_{GS}$=0V , f=1MHz | --- | 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 , $R_G$=3.3Ω $I_D$=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=1MHz | --- | 416 | --- | pF |
| $C_{oss}$ | Output Capacitance | | --- | 62 | --- | |
| $C_{rss}$ | 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℃ | --- | --- | 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=0.1mH,$I_{AS}$=12.7A
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 ˚C, unless otherwise noted)

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $BV_{DSS}$ | Drain-Source Breakdown Voltage | $V_{GS}$=0V , $I_D$=-250uA | -30 | --- | --- | V |
| $\triangle BV_{DSS}/\triangle T_J$ | $BV_{DSS}$ Temperature Coefficient | Reference to 25˚C , $I_D$=-1mA | --- | -0.021 | --- | V/˚C |
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance[2] | $V_{GS}$=-10V , $I_D$=-8A | --- | 37 | 40 | mΩ |
| | | $V_{GS}$=-4.5V , $I_D$=-6A | --- | 45 | 53 | |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{GS}$=$V_{DS}$ , $I_D$ =-250uA | -1.0 | --- | -2.5 | V |
| $\triangle V_{GS(th)}$ | $V_{GS(th)}$ Temperature Coefficient | | --- | -4.2 | --- | mV/˚C |
| $I_{DSS}$ | Drain-Source Leakage Current | $V_{DS}$=-24V , $V_{GS}$=0V , $T_J$=25˚C | --- | --- | 1 | uA |
| | | $V_{DS}$=-24V , $V_{GS}$=0V , $T_J$=55˚C | --- | --- | 5 | |
| $I_{GSS}$ | Gate-Source Leakage Current | $V_{GS}$=±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=1MHz | | 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 , $R_G$=3.3Ω, $I_D$=-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=1MHz | --- | 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˚C | --- | --- | -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=0.1mH,$I_{AS}$=-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

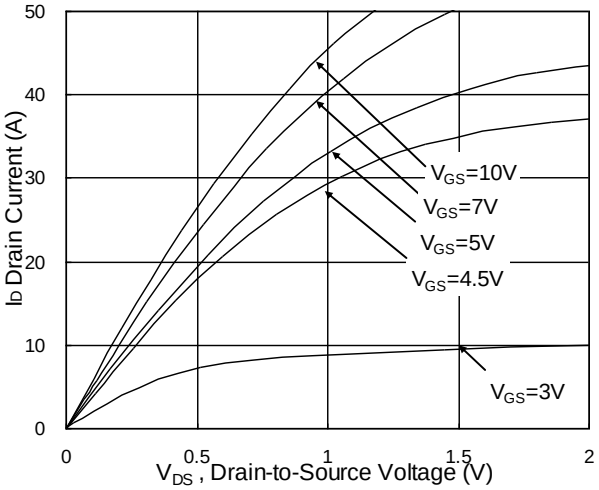



Fig.1 Typical Output Characteristics

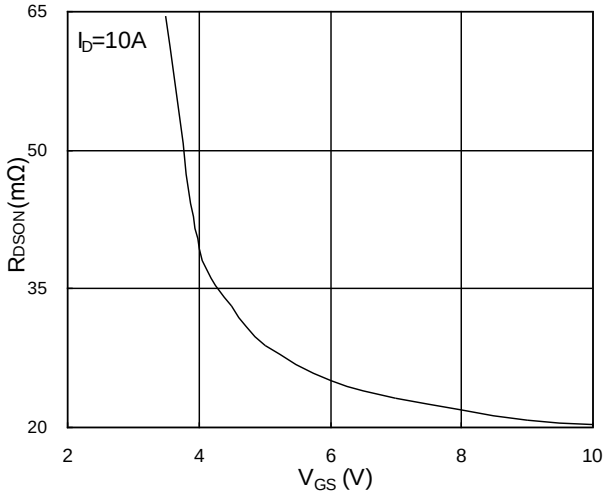



Fig.2 On-Resistance vs. Gate-Source

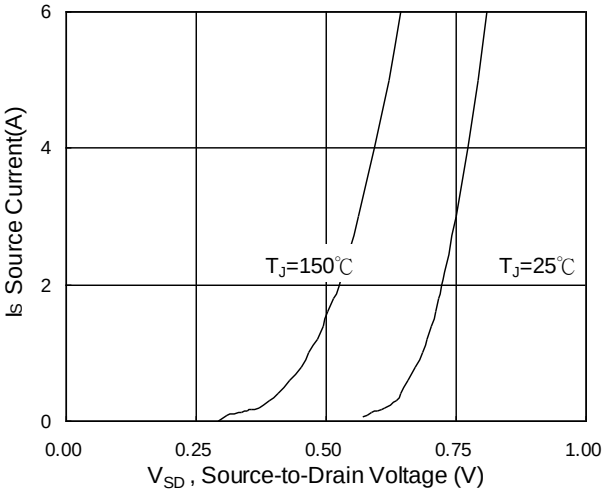



Fig.3 Forward Characteristics Of Reverse

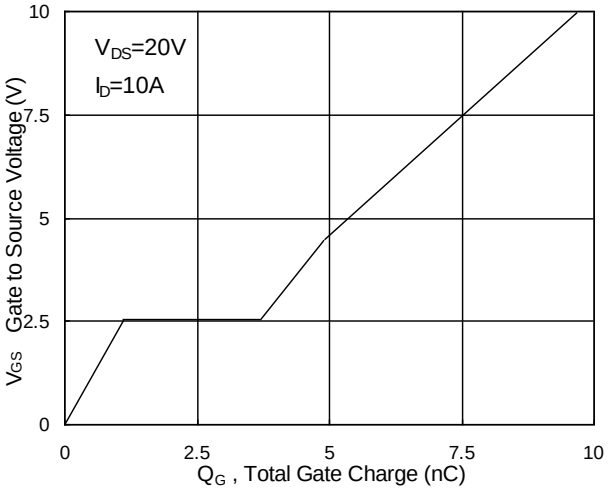



Fig.4 Gate-Charge Characteristics

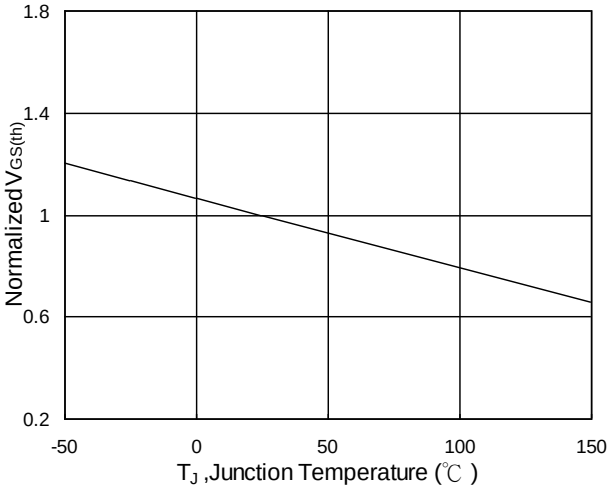



Fig.5 Normalized $V_{GS(th)}$ vs. $T_J$

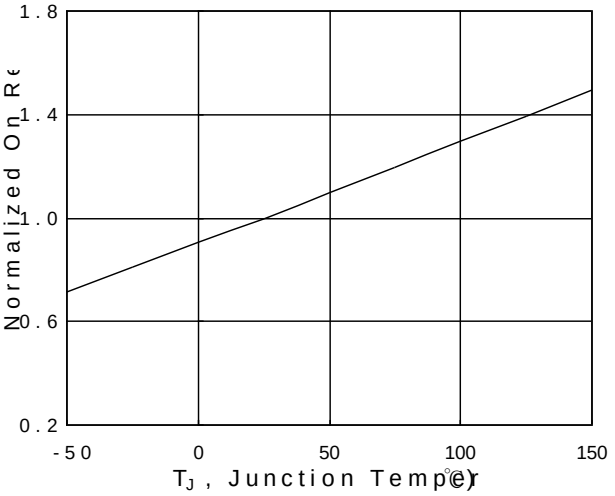



Fig.6 Normalized $R_{DSON}$ vs. $T_J$

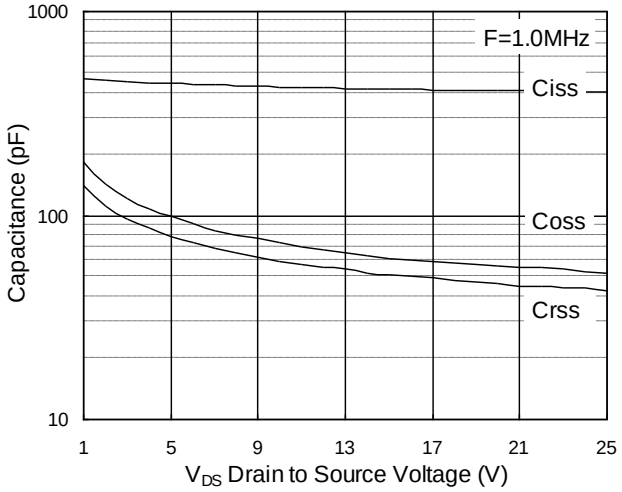



**Fig.7 Capacitance**

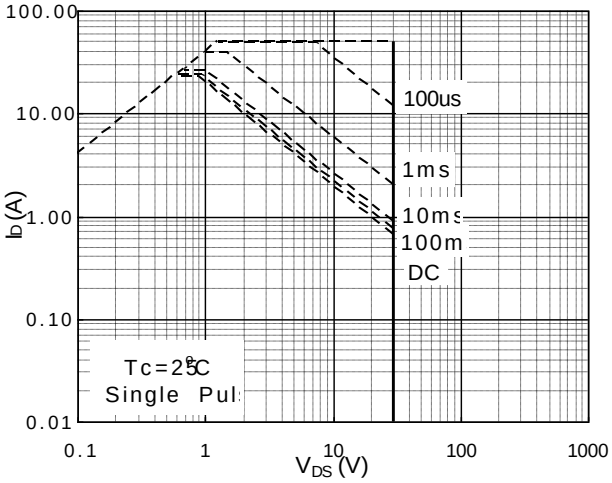



**Fig.8 Safe Operating Area**

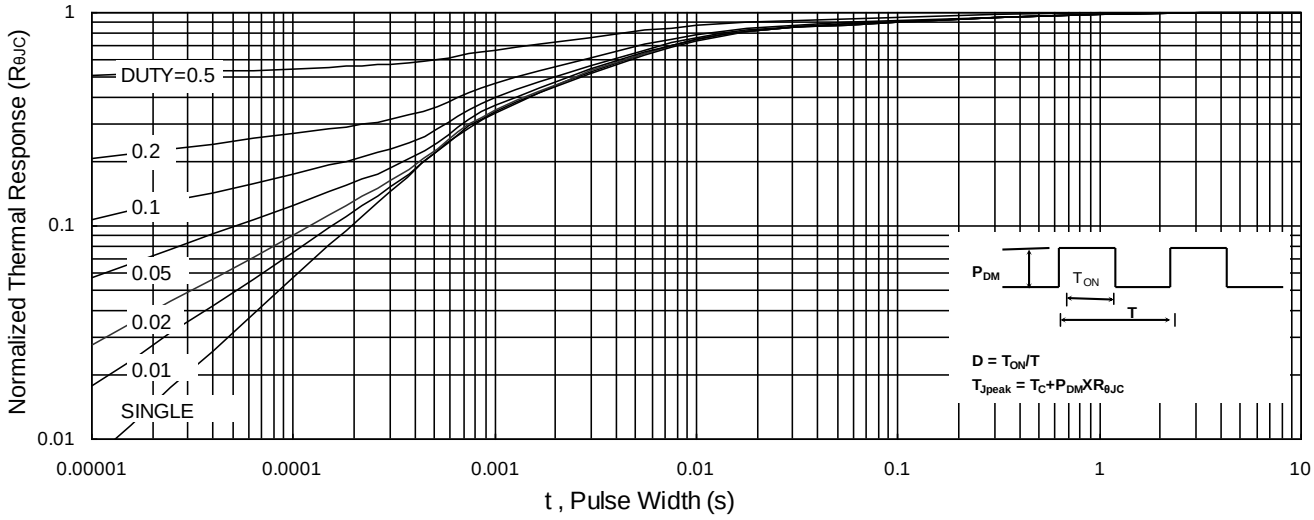



**Fig.9 Normalized Maximum Transient Thermal Impedance**

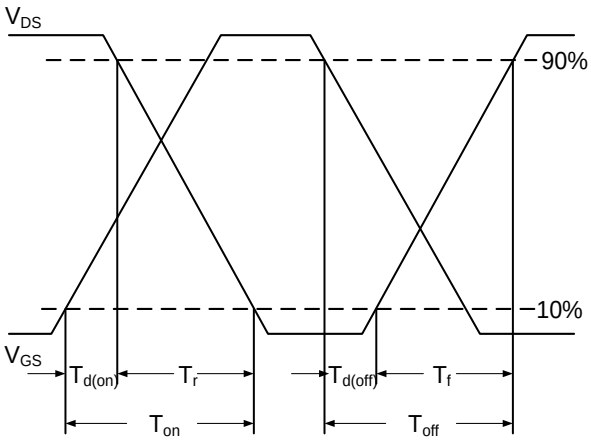



**Fig.10 Switching Time Waveform**

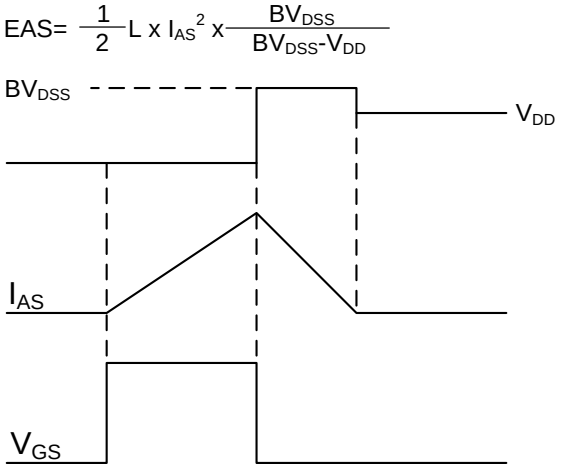



**Fig.11 Unclamped Inductive Switching Waveform**

## P-Channel Typical Characteristics

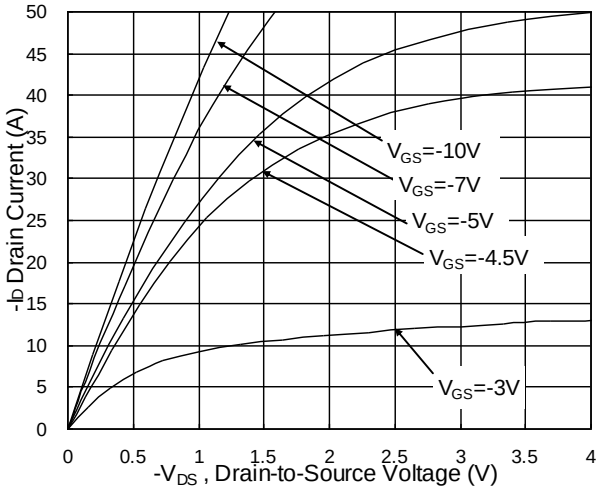



**Fig.1 Typical Output Characteristics**

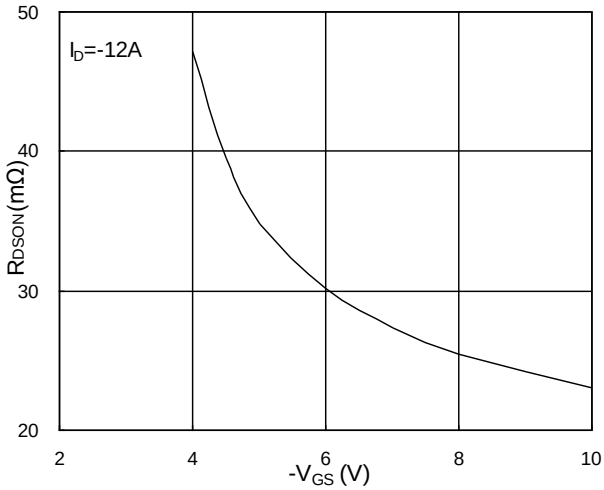



**Fig.2 On-Resistance v.s Gate-Source**

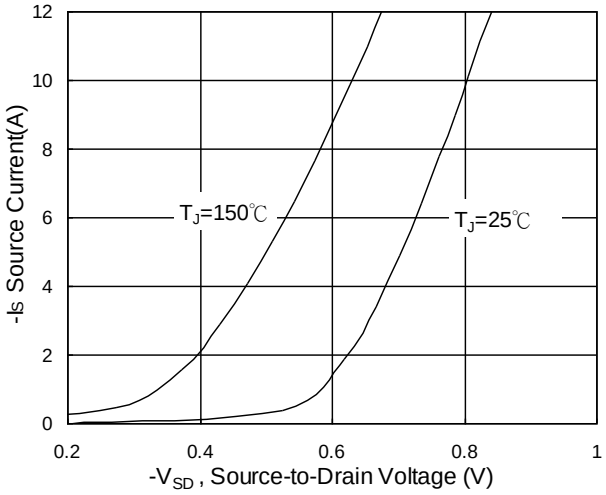



**Fig.3 Forward Characteristics Of Reverse**

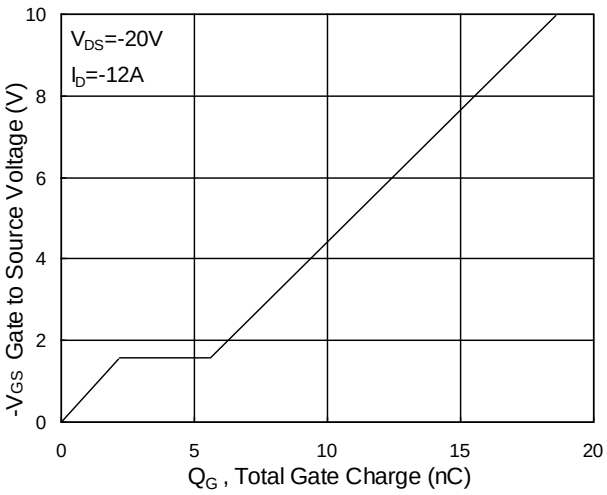



**Fig.4 Gate-Charge Characteristics**

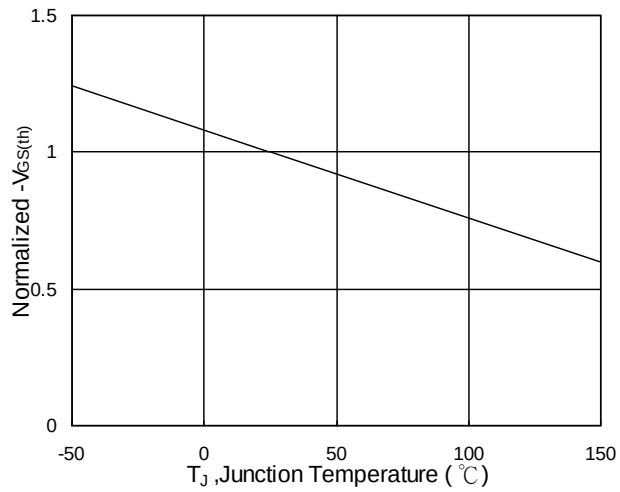



**Fig.5 Normalized $V_{GS(th)}$ v.s $T_J$**

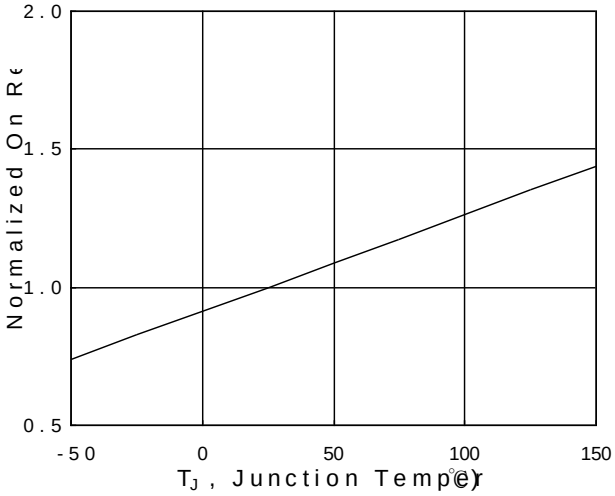



**Fig.6 Normalized $R_{DSON}$ v.s $T_J$**

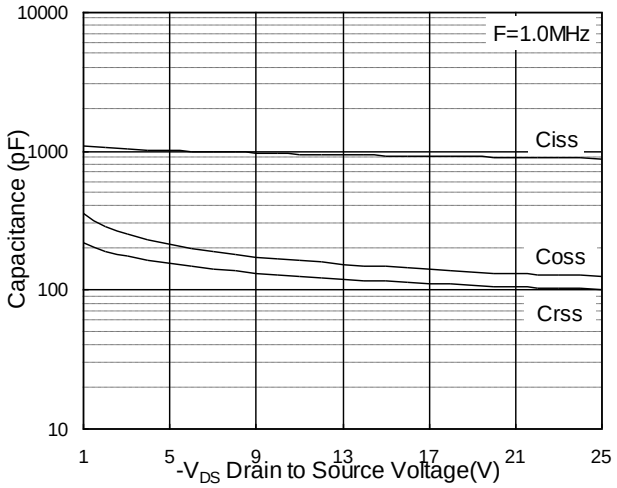



**Fig.7 Capacitance**

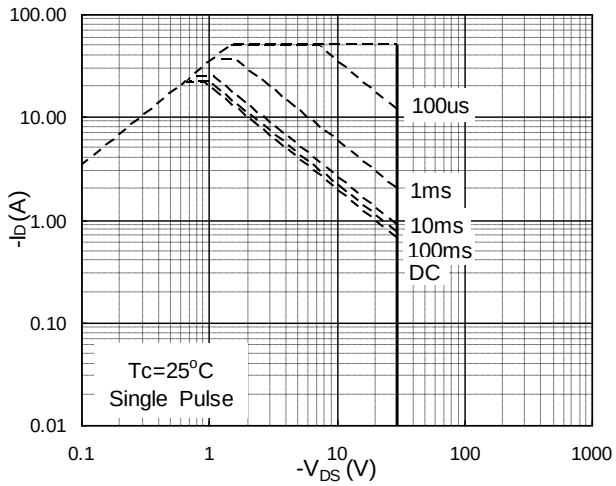



**Fig.8 Safe Operating Area**

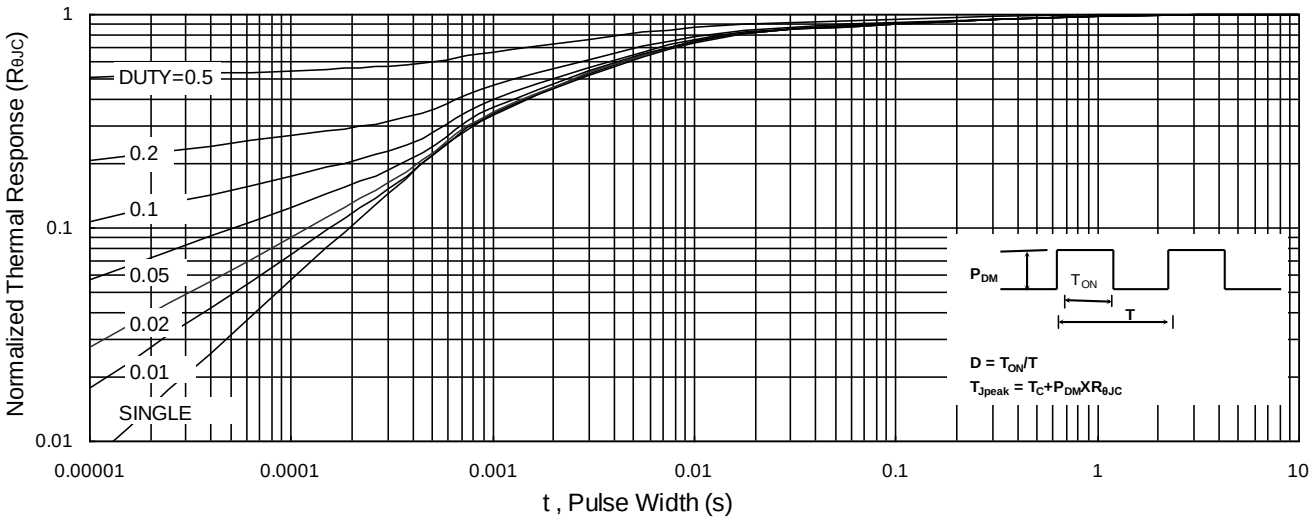



**Fig.9 Normalized Maximum Transient Thermal Impedance**

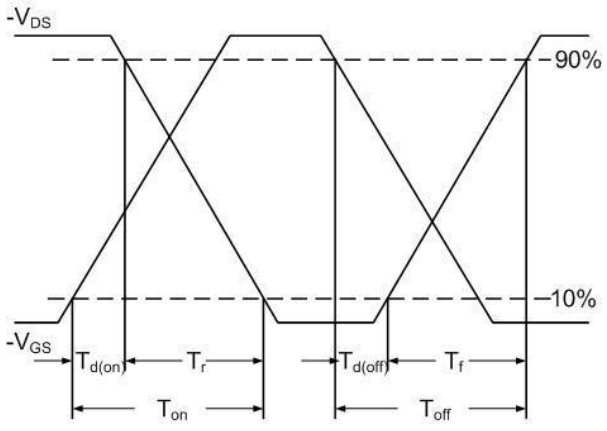



**Fig.10 Switching Time Waveform**

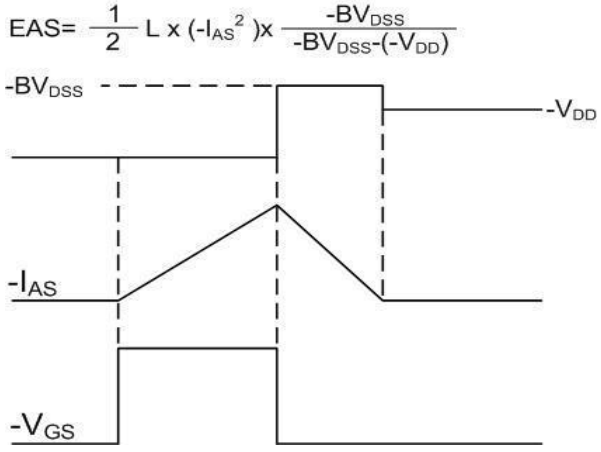
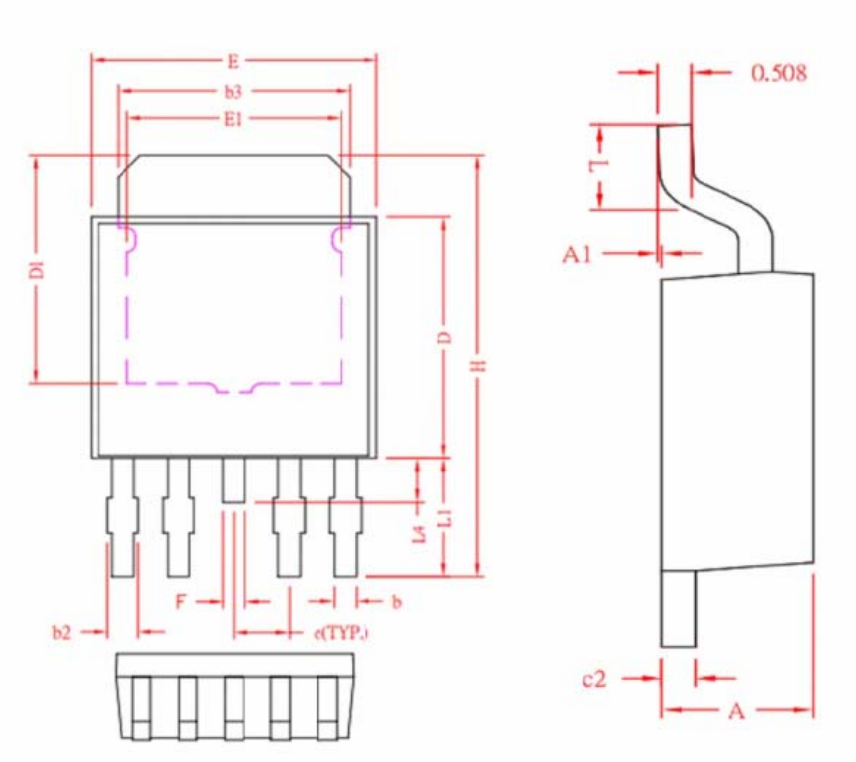



**Fig.11 Unclamped Inductive Switching Waveform**

## TO252-4L Package Information




COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

| SYMBOL | MIN | NOM | MAX |
|---|---|---|---|
| A | 2.20 | 2.30 | 2.40 |
| A1 | 0 | 0.08 | 0.15 |
| b | 0.45 | 0.53 | 0.60 |
| b2 | 0.50 | 0.65 | 0.80 |
| b3 | 5.20 | 5.35 | 5.50 |
| c2 | 0.45 | 0.50 | 0.55 |
| D | 5.40 | 5.60 | 5.80 |
| D1 | 4.57 | - | - |
| E | 6.40 | 6.60 | 6.80 |
| E1 | 3.81 | - | - |
| e | 1.27 REF. | | |
| F | 0.40 | 0.50 | 0.60 |
| H | 9.40 | 9.80 | 10.20 |
| L | 1.40 | 1.59 | 1.77 |
| L1 | 2.40 | 2.70 | 3.00 |
| L4 | 0.80 | 1.00 | 1.20 |

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