# GSMDB2116S

## 20V N+P Dual Channel MOSFETs

### Product Description

These N+P dual Channel enhancement mode power field effect transistors are using trench DMOS technology. This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode.

These devices are well suited for high efficiency fast switching applications.

### Features

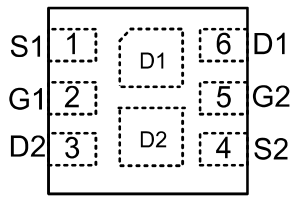
- N-Channel
  20V, 5A, $R_{DS(ON)}$=40mΩ@$V_{GS}$=4.5V
- P-Channel
  -20V, -4.7A, $R_{DS(ON)}$=95mΩ@$V_{GS}$=-4.5V
- Fast switching
- Suit for -1.8V/1.8V Gate Drive Applications
- Green Device Available
- DFN2X2-6L package design

### Applications

- Notebook
- Load Switch
- Networking
- Hand-held Instruments

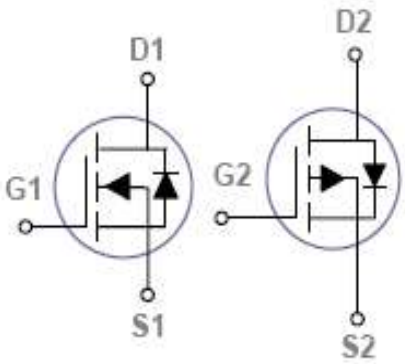
### Packages & Pin Assignments

**GSMDB2116SFF (DFN2X2-6L)**

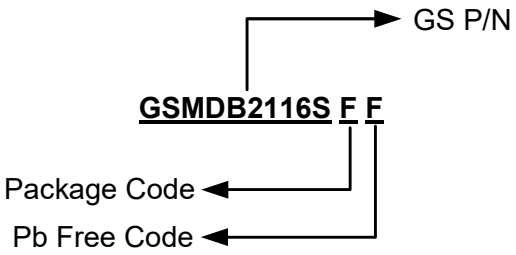



Top Views

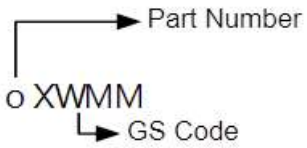
| Pin | Description |
|---|---|
| 1 | Source 1 |
| 2 | Gate 1 |
| 3 | Drain 2 |
| 4 | Source 2 |
| 5 | Gate 2 |
| 6 | Drain 1 |



## Ordering Information




## Marking Information




| Part Number | Package | Part Marking | Quantity |
|---|---|---|---|
| GSMDB2116SFF | DFN2X2-6L | oXWMM | 4000pcs |

## Absolute Maximum Ratings

$T_C$=25ºC Unless otherwise noted

| Symbol | Parameter | | Typical | | Unit |
|---|---|---|---|---|---|
| | | | N-Channel | P-Channel | |
| $V_{DS}$ | Drain-Source Voltage | | 20 | -20 | V |
| $V_{GS}$ | Gate-Source Voltage | | ±10 | ±10 | V |
| $I_D$ | Continuous Drain Current($T_J$=150℃) | $T_C$=25℃ | 5 | -4.7 | A |
| | | $T_C$=100℃ | 4.1 | -3.9 | |
| $I_{DM}$ | Pulsed Drain Current (Note 1) | | 15.2 | -10 | A |
| $P_D$ | Power Dissipation | $T_C$=25℃ | 1.56 | | W |
| | | Derate above 25℃ | 0.01 | | W/℃ |
| $T_J$ | Operating Junction Temperature Range | | -55 to +150 | | ℃ |
| $T_{STG}$ | Storage Temperature Range | | -55 to +150 | | ℃ |
| $R_{\theta JA}$ | Thermal Resistance-Junction to Ambient | | 80 | | ℃/W |
| $R_{\theta JC}$ | Thermal Resistance-Junction to Case | | 15 | | ℃/W |

Note 1: Repetitive Rating: Pulsed width limited by maximum junction temperature.

## Electrical Characteristics (N-Channel)

$T_J$=25℃ Unless otherwise noted

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **Static** | | | | | | |
| $V_{(BR)DSS}$ | Drain-Source Breakdown Voltage | $V_{GS}$=0V,$I_D$=250uA | 20 | | | V |
| $\triangle BV_{DSS}/\triangle T_J$ | $BV_{DSS}$ Temperature Coefficient | Reference to 25℃, $I_D$=1mA | | 0.02 | | V/℃ |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}$=$V_{GS}$,$I_D$=250uA | 0.3 | 0.6 | 1.0 | V |
| $\triangle V_{GS(th)}$ | $V_{GS(th)}$ Temperature Coefficient | | | -2 | | mV/℃ |
| $I_{GSS}$ | Gate Leakage Current | $V_{DS}$=0V,$V_{GS}$=±10V | | | ±100 | nA |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$=20V,$V_{GS}$=0V | | | 1 | uA |
| | | $V_{DS}$=16V,$V_{GS}$=0V, $T_J$=125℃ | | | 10 | |
| $I_S$ | Continuous Source Current | $V_G$=$V_D$=0V, Force Current | | | 5 | A |
| $I_{SM}$ | Pulsed Source Current | | | | 10 | |
| $R_{DS(on)}$ | Drain-Source On-Resistance | $V_{GS}$=4.5V,$I_D$=3A | | 30 | 40 | mΩ |
| | | $V_{GS}$=2.5V,$I_D$=2A | | 42 | 55 | |
| | | $V_{GS}$=1.8V,$I_D$=1.5A | | 55 | 70 | |
| $g_{FS}$ | Forward Transconductance | $V_{DS}$=10V,$I_D$=2A | | 4.4 | | S |
| $V_{SD}$ | Diode Forward Voltage | $V_{GS}$=0V,$I_S$=1A | | | 1 | V |
| **Dynamic** | | | | | | |
| $Q_g$ | Total Gate Charge | $V_{DS}$=10V,$V_{GS}$=4.5V, $I_D$=3A | | 5.8 | 10 | nC |
| $Q_{gs}$ | Gate-Source Charge | | | 0.6 | 1.5 | |
| $Q_{gd}$ | Gate-Drain Charge | | | 1.5 | 3 | |
| $C_{iss}$ | Input Capacitance | $V_{DS}$=15V,$V_{GS}$=0V, f=1MHz | | 315 | 600 | pF |
| $C_{oss}$ | Output Capacitance | | | 50 | 80 | |
| $C_{rss}$ | Reverse Transfer Capacitance | | | 40 | 60 | |
| $t_{d(on)}$ | Turn-On Time (Note 2,3) | $V_{DD}$=10V,$I_D$=1A, $V_{GS}$=4.5V,$R_G$=25Ω | | 2.9 | 6 | ns |
| $t_r$ | | | | 8.4 | 16 | |
| $t_{d(off)}$ | Turn-Off Time (Note 2,3) | | | 19.2 | 38 | |
| $t_f$ | | | | 5.6 | 12 | |

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

Note 3: Essentially independent of operating temperature.

## Electrical Characteristics (P-Channel)

$T_J$=25℃ Unless otherwise noted

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **Static** | | | | | | |
| $V_{(BR)DSS}$ | Drain-Source Breakdown Voltage | $V_{GS}$=0V,$I_D$=-250uA | -20 | | | V |
| $\triangle BV_{DSS}/\triangle T_J$ | $BV_{DSS}$ Temperature Coefficient | Reference to 25℃, $I_D$=-1mA | | -0.01 | | V/℃ |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}$=$V_{GS}$,$I_D$=-250uA | -0.3 | -0.6 | -1.0 | V |
| $\triangle V_{GS(th)}$ | $V_{GS(th)}$ Temperature Coefficient | | | 3 | | mV/℃ |
| $I_{GSS}$ | Gate Leakage Current | $V_{DS}$=0V,$V_{GS}$=±10V | | | ±100 | nA |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$=-20V,$V_{GS}$=0V | | | -1 | uA |
| | | $V_{DS}$=-16V,$V_{GS}$=0V, $T_J$=125℃ | | | -10 | |
| $I_S$ | Continuous Source Current | $V_G$=$V_D$=0V, Force Current | | | -4.7 | A |
| $I_{SM}$ | Pulsed Source Current | | | | -9.4 | |
| $R_{DS(on)}$ | Drain-Source On-Resistance | $V_{GS}$ =-4.5V,$I_D$=-3A | | 80 | 95 | mΩ |
| | | $V_{GS}$ =-2.5V,$I_D$=-2A | | 109 | 125 | |
| | | $V_{GS}$ =-1.8V,$I_D$=-1A | | 148 | 161 | |
| $g_{FS}$ | Forward Transconductance | $V_{DS}$=-10V,$I_D$=-1A | | 2.2 | | S |
| $V_{SD}$ | Diode Forward Voltage | $V_{GS}$=0V,$I_S$=-1A | | | -1 | V |
| **Dynamic** | | | | | | |
| $Q_g$ | Total Gate Charge | $V_{DS}$=-10V,$V_{GS}$=-4.5V, $I_D$=-2A | | 4.8 | 10 | nC |
| $Q_{gs}$ | Gate-Source Charge | | | 0.5 | 1 | |
| $Q_{gd}$ | Gate-Drain Charge | | | 1.9 | 4 | |
| $C_{iss}$ | Input Capacitance | $V_{DS}$=-15V,$V_{GS}$=0V, f=1MHz | | 350 | 510 | pF |
| $C_{oss}$ | Output Capacitance | | | 65 | 95 | |
| $C_{rss}$ | Reverse Transfer Capacitance | | | 50 | 75 | |
| $t_{d(on)}$ | Turn-On Time (Note 2,3) | $V_{DD}$=-10V,$I_D$=-1A, $V_{GS}$=-4.5V,$R_G$=25Ω | | 3.5 | 7 | ns |
| $t_r$ | | | | 12.6 | 24 | |
| $t_{d(off)}$ | Turn-Off Time (Note 2,3) | | | 32.6 | 62 | |
| $t_f$ | | | | 8.4 | 16 | |

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

Note 3: Essentially independent of operating temperature.

## Typical Performance Characteristics (N-Channel)

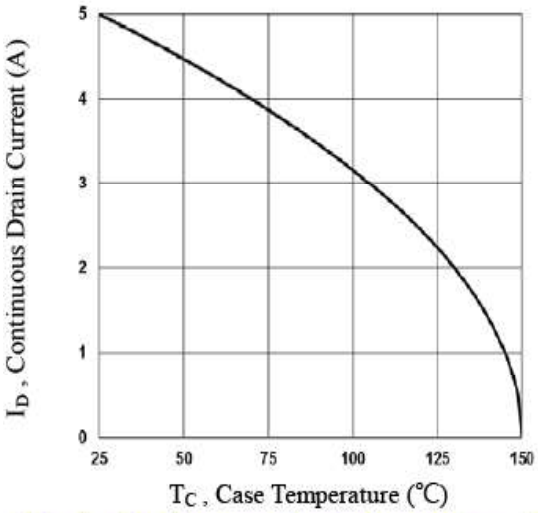



**Fig.1 Continuous Drain Current vs. $T_c$**

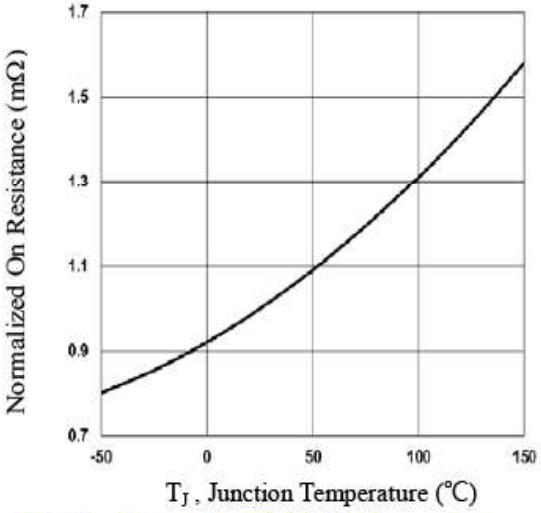



**Fig.2 Normalized RDSON vs. $T_J$**

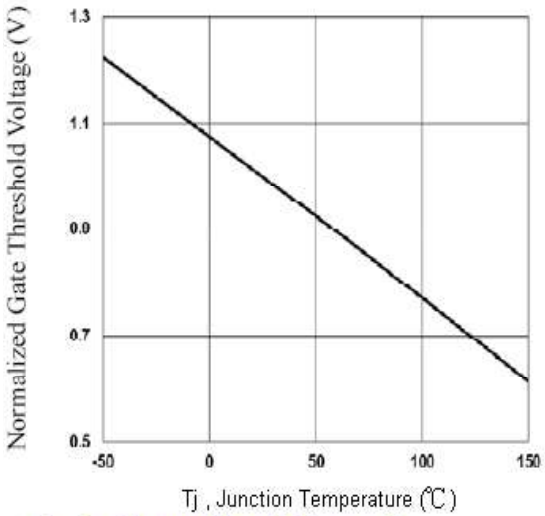



**Fig.3 Normalized $V_{th}$ vs. $T_J$**

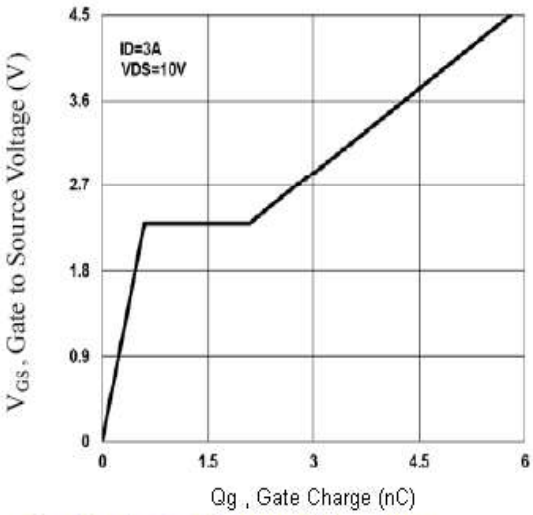



**Fig.4 Gate Charge Waveform**

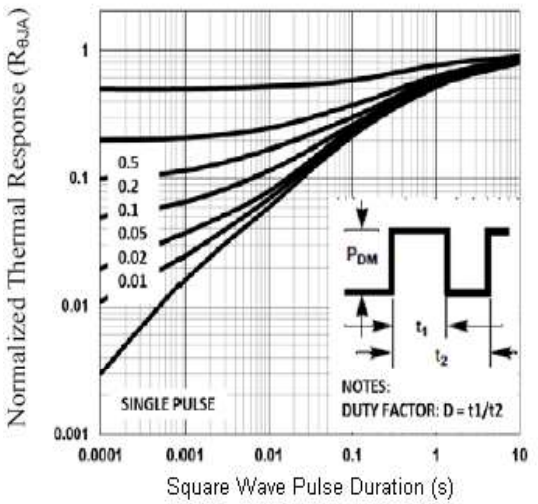



**Fig.5 Normalized Transient Impedance**

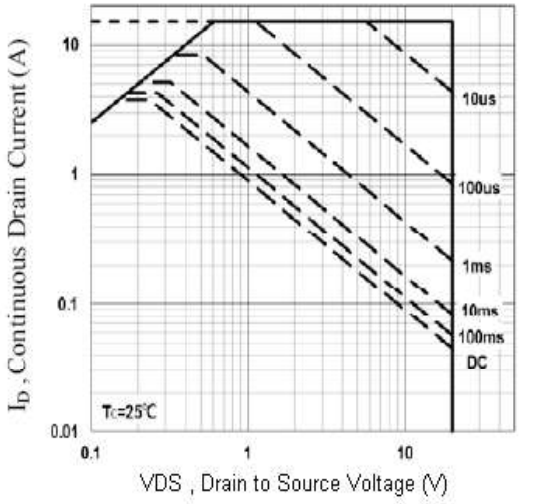
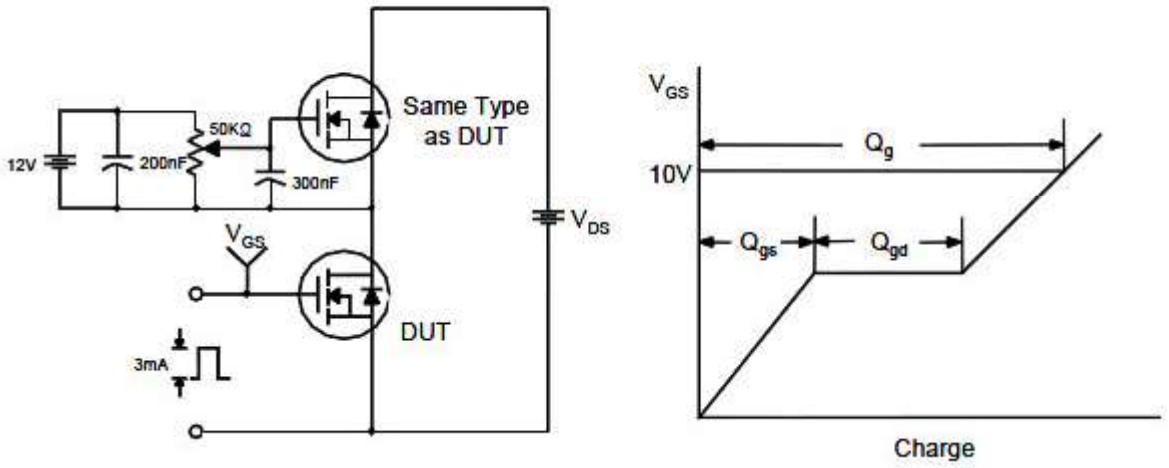


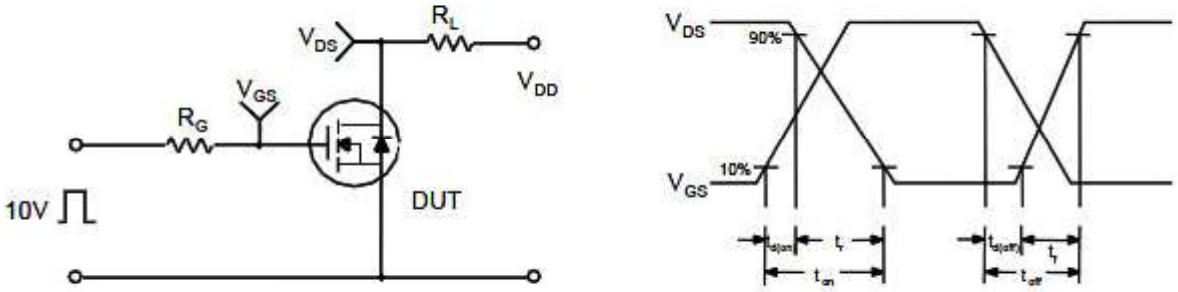

**Fig.6 Maximum Safe Operation Area**

## Typical Performance Characteristics (N-Channel)

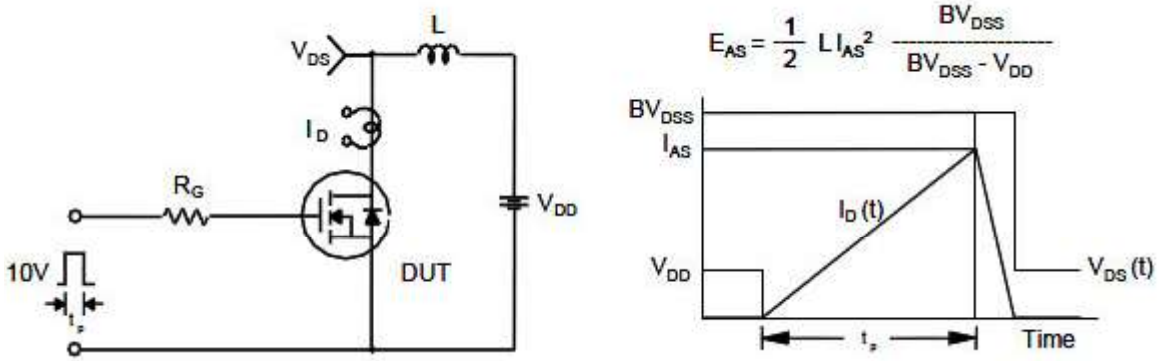
Gate Charge Test Circuit & Waveform




Resistive Switching Test Circuit & Waveforms




Unclamped Inductive Switching Test Circuit & Waveforms



## Typical Performance Characteristics (P-Channel)

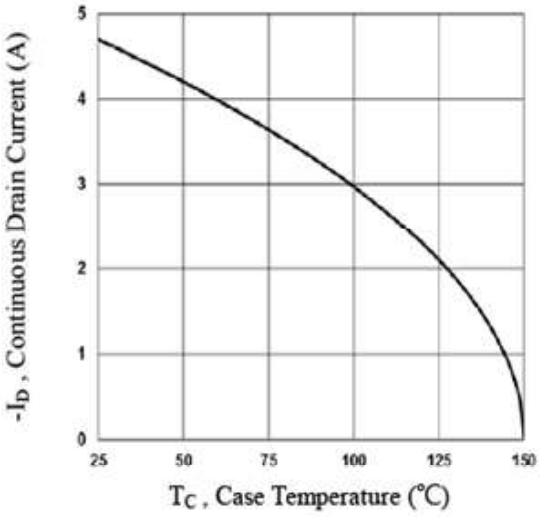



**Fig.7 Continuous Drain Current vs. $T_c$**

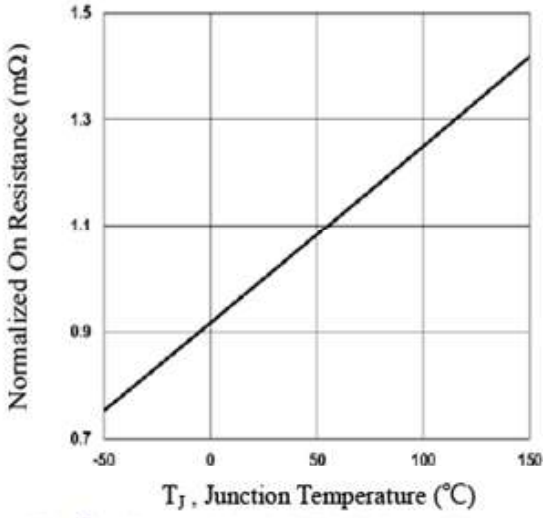



**Fig.8 Normalized RDSON vs. $T_J$**

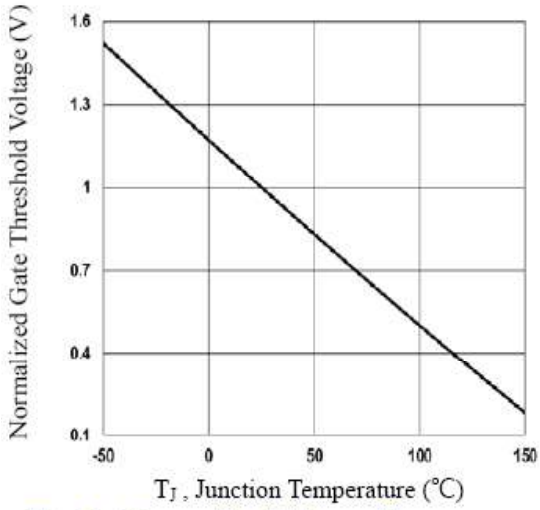



**Fig.9 Normalized $V_{th}$ vs. $T_J$**

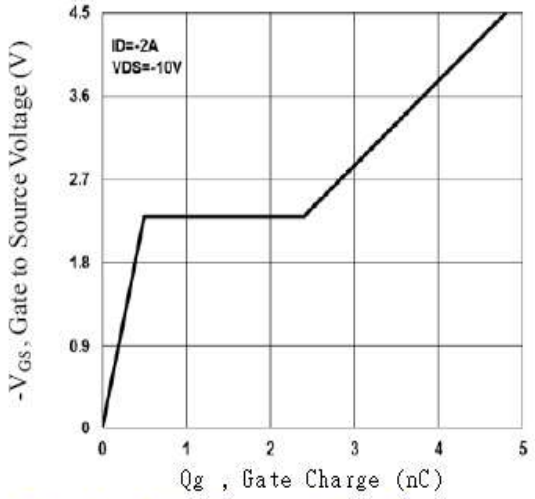



**Fig.10 Gate Charge Waveform**

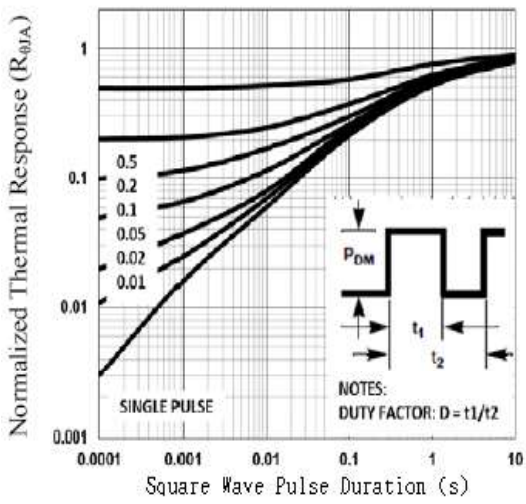



**Fig.11 Normalized Transient Impedance**

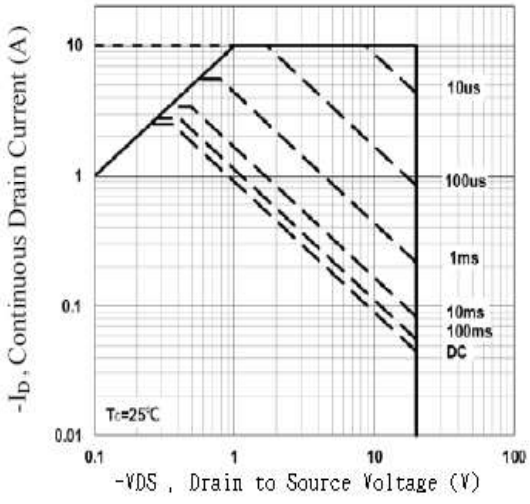
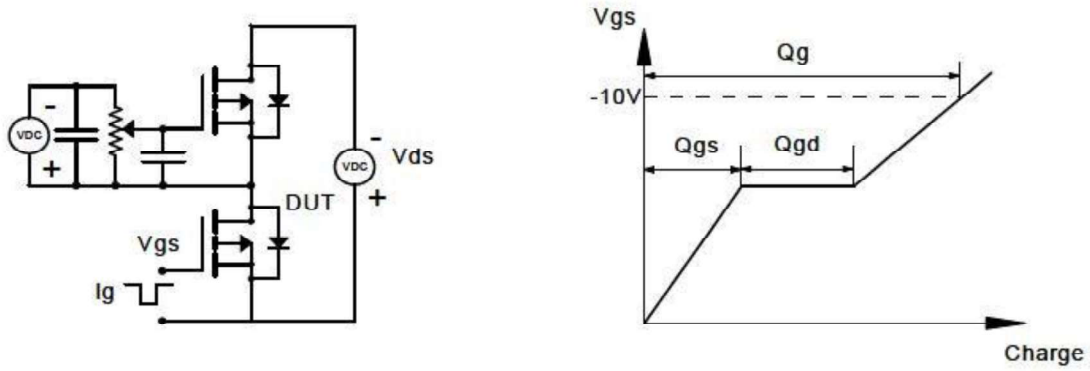


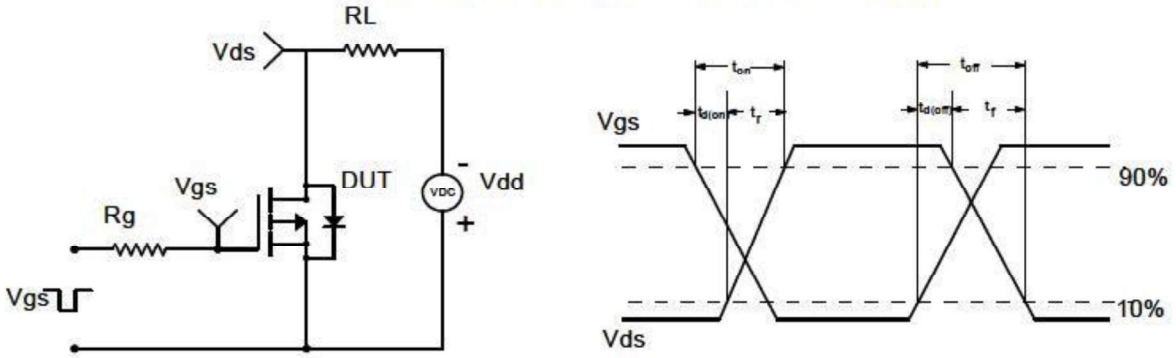

**Fig.12 Maximum Safe Operation Area**

## Typical Performance Characteristics (P-Channel)

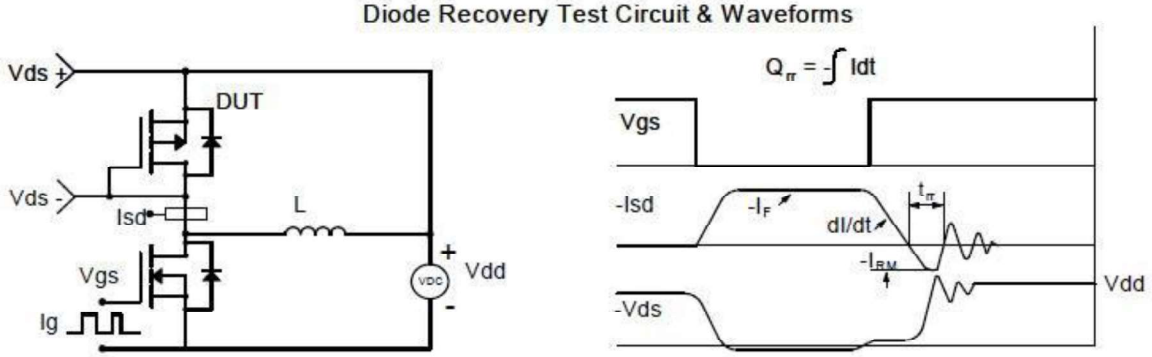
Gate Charge Test Circuit & Waveform




Resistive Switching Test Circuit & Waveforms

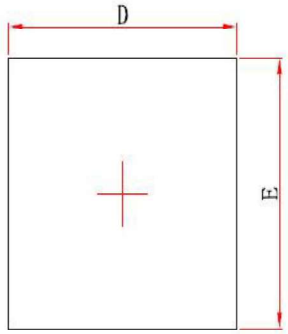



Diode Recovery Test Circuit & Waveforms

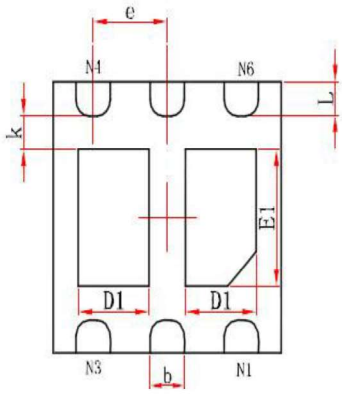


## Package Dimension

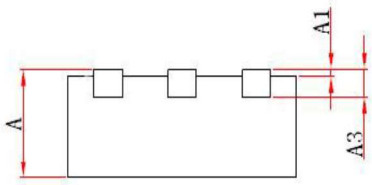
# DFN2X2-6L




Top View




Bottom View




Side View

| Dimensions | | | | |
|---|---|---|---|---|
| SYMBOL | Millimeters | | Inches | |
| | MIN | MAX | MIN | MAX |
| A | 0.700/0.800 | 0.800/0.900 | 0.028/0.031 | 0.031/0.035 |
| A1 | 0.000 | 0.050 | 0.000 | 0.002 |
| A3 | 0.203 (REF) | | 0.008 (REF) | |
| D | 1.924 | 2.076 | 0.076 | 0.082 |
| E | 1.924 | 2.076 | 0.076 | 0.082 |
| D1 | 0.520 | 0.720 | 0.020 | 0.028 |
| E1 | 0.900 | 1.100 | 0.035 | 0.043 |
| k | 0.200 (MIN) | | 0.008 (MIN) | |
| b | 0.250 | 0.350 | 0.010 | 0.014 |
| e | 0.650 (TYP) | | 0.026 (TYP) | |
| L | 0.174 | 0.326 | 0.007 | 0.013 |

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