# -200V P-Channel Enhancement Mode MOSFET

## Description

The SX9P20D uses advanced trench technology to provide excellent $R_{DS(ON)}$, low gate charge and operation with gate voltages as low as 10V. This device is suitable for use as a Battery protection or in other Switching application.

## General Features

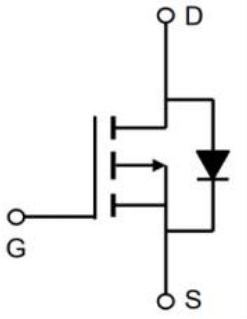
$V_{DS}$ = -200V $I_D$ =-9.0A

$R_{DS(ON)}$ < 750mΩ @ $V_{GS}$=-10V

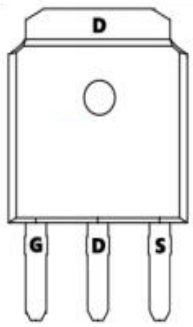
## Application

Lithium battery protection

Mobile phone fast charging




TO-252-3L


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

| Symbol | Parameter | Rating | Units |
|---|---|---|---|
| VDS | Drain-Source Voltage | - 200 | V |
| VGS | Gate-Source Voltage | ± 20 | V |
| $I_D$@$T_C$=25℃ | Continuous Drain Current, -$V_{GS}$ @ -10V[1] | -8.7 | A |
| $I_D$@$T_C$=100℃ | Continuous Drain Current, -$V_{GS}$ @ -10V[1] | -3.6 | A |
| IDM | Pulsed Drain Currenta | - 22.8 | A |
| EAS | Single Pulse Avalanche Energyb | 570 | mJ |
| IAR | Repetitive Avalanche Currenta | -8.7 | A |
| EAR | Repetitive Avalanche Energya | 5.5 | mJ |
| PD | Maximum Power Dissipation TC = 25 °C | 55 | W |
| dV/dt | Peak Diode Recovery dV/dtc | - 5.5 | V/ns |
| TJ, Tstg | Operating Junction and Storage Temperature Range | - 55 to + 150 | °C |
| RthJA | Maximum Junction-to-Ambient | 62.5 | °C/W |
| RthJC | Maximum Junction-to-Case (Drain) | 2.2 | °C/W |

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

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| BVDSS | Drain-Source Breakdown Voltage | $V_{GS}$=0V , $I_D$=-250uA | -200 | -230 | --- | V |
| △BVDSS/△TJ | $BV_{DSS}$ Temperature Coefficient | Reference to 25℃ , $I_D$=-1mA | --- | -0.035 | --- | V/℃ |
| RDS(ON) | Static Drain-Source On-Resistance[2] | $V_{GS}$=-10V , $I_D$=-20A | --- | 625 | 750 | mΩ |
| VGS(th) | Gate Threshold Voltage | $V_{GS}$=$V_{DS}$ , $I_D$ =-250uA | -2.0 | -3.0 | -4.0 | V |
| △$V_{GS(th)}$ | $V_{GS(th)}$ Temperature Coefficient | | --- | 4.28 | --- | mV/℃ |
| IDSS | Drain-Source Leakage Current | $V_{DS}$=-60V , $V_{GS}$=0V , $T_J$=25℃ | --- | --- | 1 | uA |
| | | $V_{DS}$=-60V , $V_{GS}$=0V , $T_J$=55℃ | --- | --- | 5 | |
| IGSS | Gate-Source Leakage Current | $V_{GS}$=±20V , $V_{DS}$=0V | --- | --- | ±100 | nA |
| gfs | Forward Transconductance | VDS=-50V, ID=- 2.2A | --- | 18 | --- | S |
| $Q_g$ | Total Gate Charge (-4.5V) | ID=-7.3A, VDS=-160V VGS=-10V | --- | 20 | --- | nC |
| $Q_{gs}$ | Gate-Source Charge | | --- | 3.3 | --- | |
| $Q_{gd}$ | Gate-Drain Charge | | --- | 11 | --- | |
| Td(on) | Turn-On Delay Time | VDD=-100V, ID=-7.3A, RG=18 Ω, RD=25Ω, | --- | 8.8 | --- | ns |
| $T_r$ | Rise Time | | --- | 27 | --- | |
| Td(off) | Turn-Off Delay Time | | --- | 7.3 | --- | |
| $T_f$ | Fall Time | | --- | 19 | --- | |
| $C_{iss}$ | Input Capacitance | VGS=0V, VDS=-25V, f=1.0MHz, | --- | 590 | --- | pF |
| Coss | Output Capacitance | | --- | 140 | --- | |
| Crss | Reverse Transfer Capacitance | | --- | 25 | --- | |
| Is | Continuous Source Current[1,5] | $V_G$=$V_D$=0V , Force Current | --- | --- | -9.0 | A |
| ISM | Pulsed Source Current[2,5] | | --- | --- | -27 | A |
| VSD | Diode Forward Voltage[2] | $V_{GS}$=0V , Is=-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 VDD =-48V,VGS =-10V,L=0.1mH,IAS =-82A

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.

## Typical Characteristics

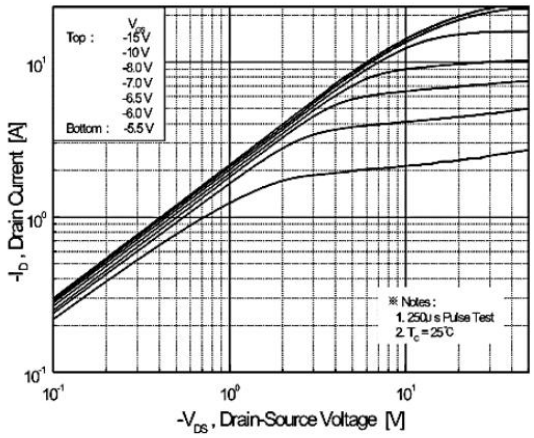



Figure 1. On-Region Characteristics

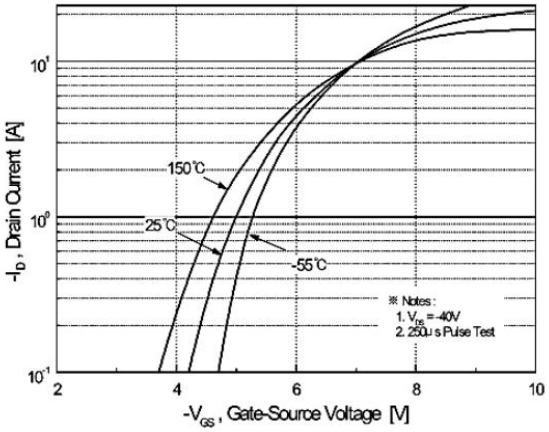



Figure 2. Transfer Characteristics

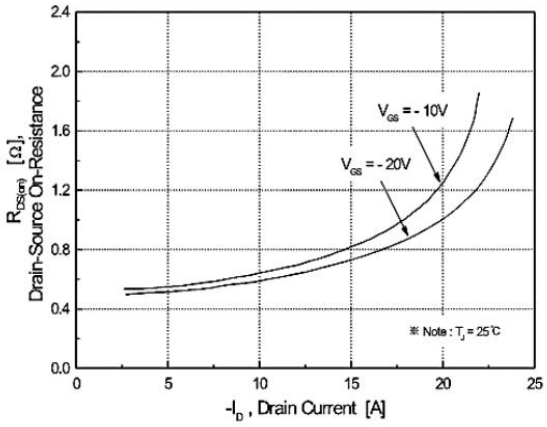



Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

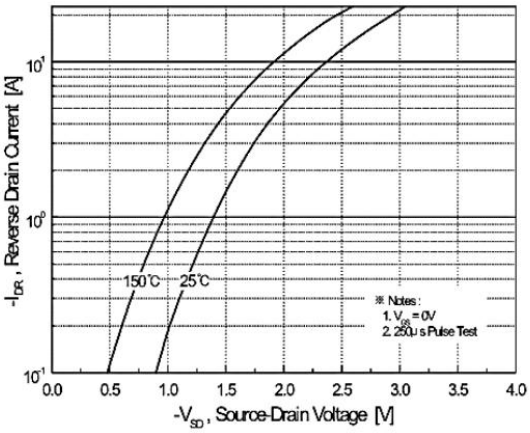



Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

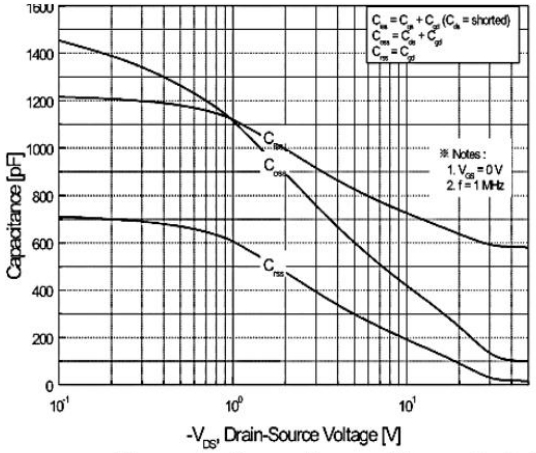



Figure 5. Capacitance Characteristics

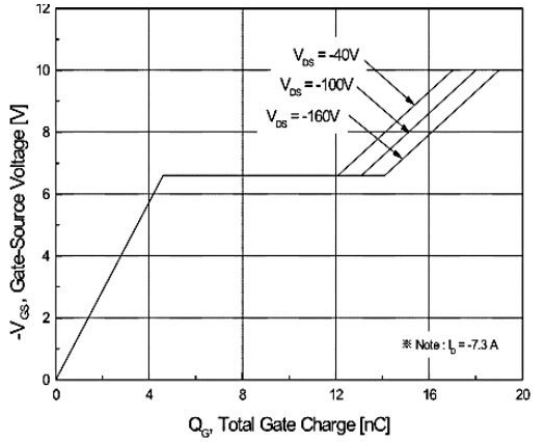



Figure 6. Gate Charge Characteristics

## Typical Characteristics

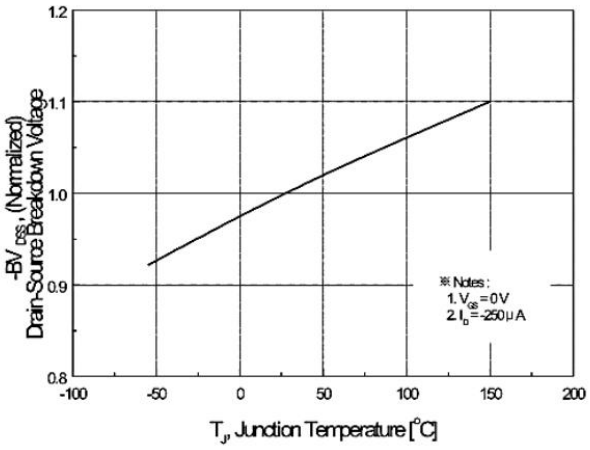



**Figure 7. Breakdown Voltage Variation vs. Temperature**

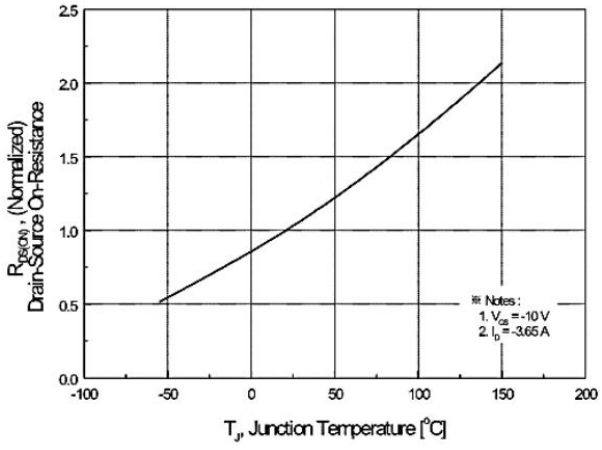



**Figure 8. On-Resistance Variation vs. Temperature**

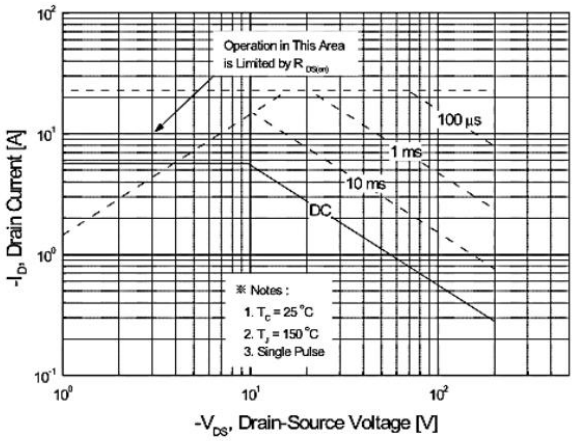



**Figure 9. Maximum Safe Operating Area**

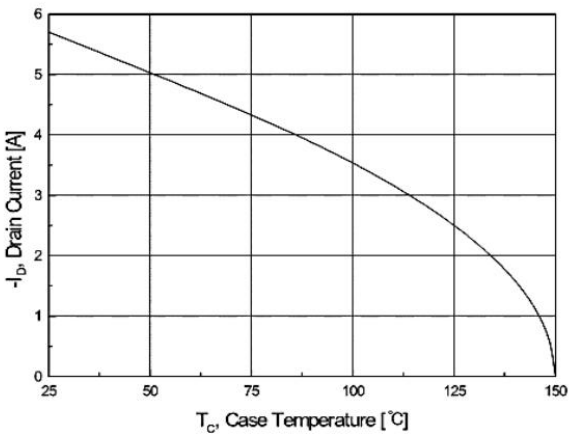



**Figure 10. Maximum Drain Current vs. Case Temperature**

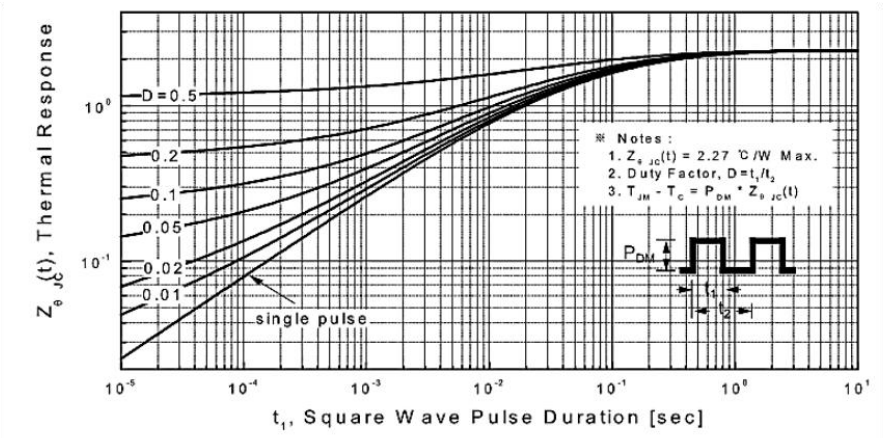
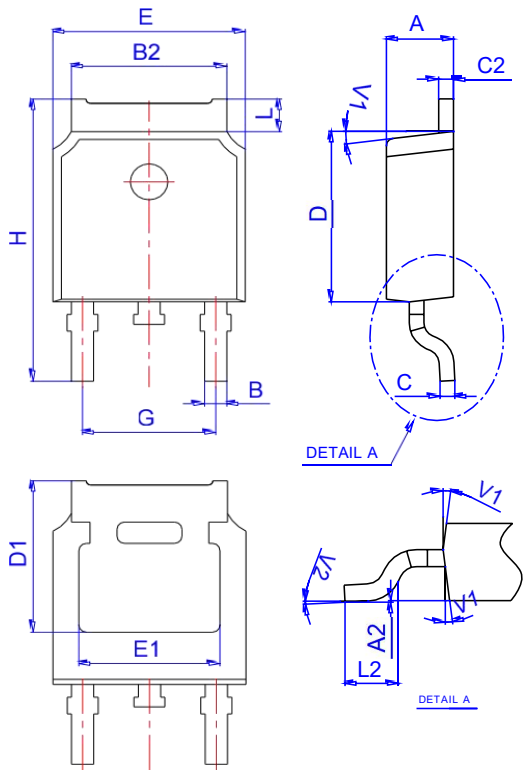



**Figure 11. Transient Thermal Response Curve**

## Package Mechanical Data：TO-252-3L




| Ref. | Dimensions | | | | | |
|---|---|---|---|---|---|---|
| | Millimeters | | | Inches | | |
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| A | 2.10 | | 2.50 | 0.083 | | 0.098 |
| A2 | 0 | | 0.10 | 0 | | 0.004 |
| B | 0.66 | | 0.86 | 0.026 | | 0.034 |
| B2 | 5.18 | | 5.48 | 0.202 | | 0.216 |
| C | 0.40 | | 0.60 | 0.016 | | 0.024 |
| C2 | 0.44 | | 0.58 | 0.017 | | 0.023 |
| D | 5.90 | | 6.30 | 0.232 | | 0.248 |
| D1 | 5.30REF | | | 0.209REF | | |
| E | 6.40 | | 6.80 | 0.252 | | 0.268 |
| E1 | 4.63 | | | 0.182 | | |
| G | 4.47 | | 4.67 | 0.176 | | 0.184 |
| H | 9.50 | | 10.70 | 0.374 | | 0.421 |
| L | 1.09 | | 1.21 | 0.043 | | 0.048 |
| L2 | 1.35 | | 1.65 | 0.053 | | 0.065 |
| V1 | | 7° | | | 7° | |
| V2 | 0° | | 6° | 0° | | 6° |

### Package Marking and Ordering Information

| Product ID | Pack | Marking | Qty(PCS) |
|---|---|---|---|
| TAPING | TO-252-3L | | 2500 |