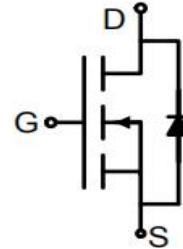




### N-Channel Enhancement Mode Power MOSFET

#### Description

The MX2300 uses advanced trench technology to provide excellent  $R_{DS(ON)}$ , low gate charge and operation with gate voltages as low as 2.5V. This device is suitable for use as a load switch or in PWM applications.



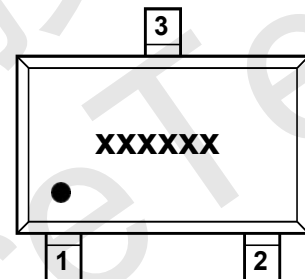
Schematic diagram

#### General Features

- ◆  $V_{DS} = 20V$ ,  $I_D = 4.5A$
- ◆  $R_{DS(ON)}(Typ.) 27m\Omega @ V_{GS}=4.5V$
- ◆  $R_{DS(ON)}(Typ.) 33m\Omega @ V_{GS}=2.5V$
- ◆ High power and current handling capability
- ◆ Lead free product is acquired
- ◆ Surface mount package

#### Application

- ◆ PWM applications
- ◆ Load switch
- ◆ Power management



Marking and pin assignment



SOT-23 top view

#### Absolute Maximum Ratings (TA=25°C unless otherwise noted)

| parameter  | symbol   | limit    | unit |
|--|----------|----------|------|
| Drain-source voltage   | $V_{DS}$ | 20       | V    |
| Gate-source voltage  | $V_{GS}$ | $\pm 10$ | V    |
| Drain current-continuous <sup>a</sup> @Tj=125°C<br>-pulse <sup>b</sup> | $I_D$    | 4.5      | A    |
|  | $I_{DM}$ | 13.5     | A    |
| Maximum power dissipation  | $P_D$    | 1.25     | W    |
| Operating junction Temperature range                                   | $T_j$    | -55—150  | °C   |



#### Electrical Characteristics (TA=25°C unless otherwise noted)

| Symbol                                    | Parameter                        | Conditions  | Min | Typ  | Max  | Unit |
|---|----------------------------------|---|-----|------|------|------|
| <b>On/Off States</b>                      |                                  |   |     |      |      |      |
| BV <sub>DSS</sub>                         | Drain-Source Breakdown Voltage   | V <sub>GS</sub> =0V, I <sub>D</sub> =250μA  | 20  | 22   |      | V    |
| I <sub>DSS</sub>                          | Zero Gate Voltage Drain Current  | V <sub>DS</sub> =20V, V <sub>GS</sub> =0V   | -   | -    | 1    | μA   |
| I <sub>GSS</sub>                          | Gate-Body Leakage Current        | V <sub>GS</sub> =±10V, V <sub>DS</sub> =0V  |     |      | ±100 | nA   |
| V <sub>GS(th)</sub>                       | Gate Threshold Voltage           | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA  | 0.5 | 0.65 | 1.2  | V    |
| g <sub>FS</sub>                           | Forward Transconductance         | V <sub>DS</sub> =10V, I <sub>D</sub> =4A  | -   | 10   | -    | S    |
| R <sub>DS(ON)</sub>                       | Drain-Source On-State Resistance | V <sub>GS</sub> =4.5V, I <sub>D</sub> =4.5A   | -   | 27   | 33   | mΩ   |
|   |                                  | V <sub>GS</sub> =2.5V, I <sub>D</sub> =4A   | -   | 33   | 40   | mΩ   |
| <b>Dynamic Characteristics</b>            |                                  |   |     |      |      |      |
| C <sub>iss</sub>                          | Input Capacitance                | V <sub>DS</sub> =8V, V <sub>GS</sub> =0V,<br>f=1.0MHz   | -   | 500  | -    | pF   |
| C <sub>oss</sub>                          | Output Capacitance               |   | -   | 300  | -    | pF   |
| C <sub>rss</sub>                          | Reverse Transfer Capacitance     |   | -   | 140  | -    | pF   |
| <b>Switching Times</b>                    |                                  |   |     |      |      |      |
| t <sub>d(on)</sub>                        | Turn-on Delay Time               | V <sub>DD</sub> =10V, I <sub>D</sub> =1A, I <sub>D</sub> =1A<br>V <sub>GS</sub> =4.5V, R <sub>G</sub> =6Ω | -   | 20   | 40   | nS   |
| t <sub>r</sub>                            | Turn-on Rise Time                |   | -   | 18   | 40   | nS   |
| t <sub>d(off)</sub>                       | Turn-Off Delay Time              |   | -   | 60   | 108  | nS   |
| t <sub>f</sub>                            | Turn-Off Fall Time               |   | -   | 28   | 56   | nS   |
| Q <sub>g</sub>                            | Total Gate Charge                | V <sub>DS</sub> =10V, I <sub>D</sub> =3A,<br>V <sub>GS</sub> =4.5V  | -   | 10   | 15   | nC   |
| Q <sub>gs</sub>                           | Gate-Source Charge               |   | -   | 2.3  | -    | nC   |
| Q <sub>gd</sub>                           | Gate-Drain Charge                |   | -   | 2.9  | -    | nC   |
| <b>Source-Drain Diode Characteristics</b> |                                  |   |     |      |      |      |
| I <sub>SD</sub>                           | Source-Drain Current(Body Diode) |   | -   | -    | 1    | A    |
| V <sub>SD</sub>                           | Forward on Voltag                | V <sub>GS</sub> =0V, I <sub>S</sub> =1A   | -   | -    | 1.2  | V    |

#### Notes:

- surface mounted on FR4 board, t<sub>s</sub>≤10sec
- pulse test: pulse width≤300μs, duty≤2%
- guaranteed by design, not subject to production testing



### Typical Performance Characteristics

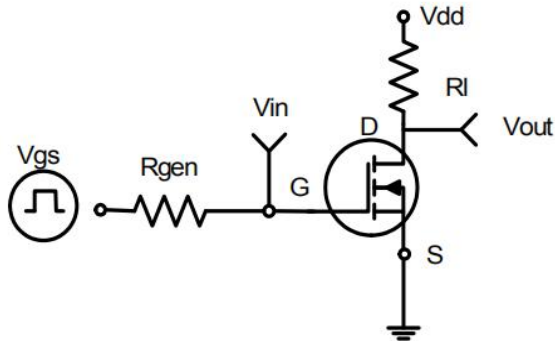


Figure 1: Switching Test Circuit

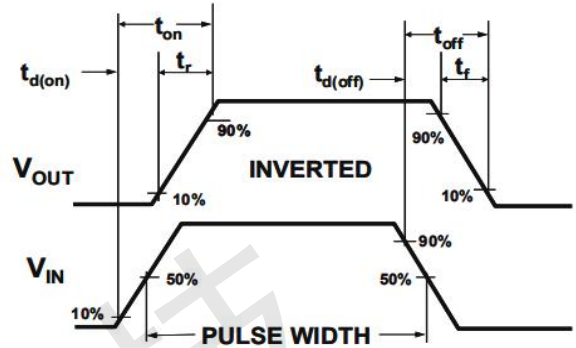


Figure 2: Switching Waveforms

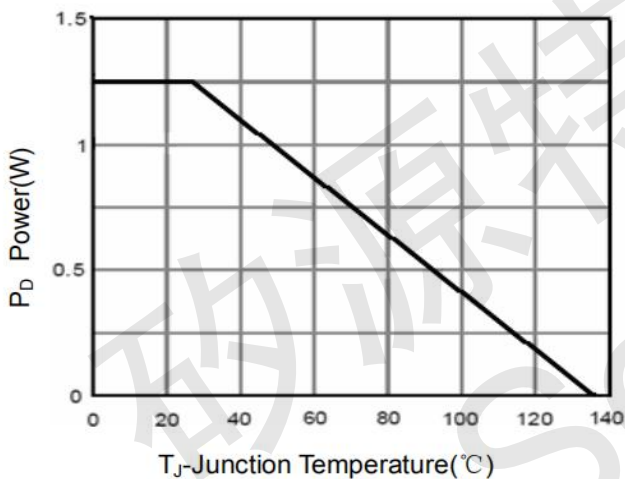


Figure 3 Power Dissipation

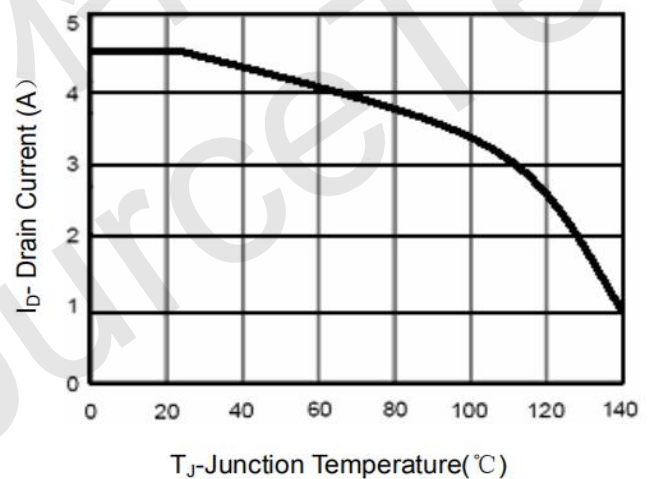


Figure 4 Drain Current

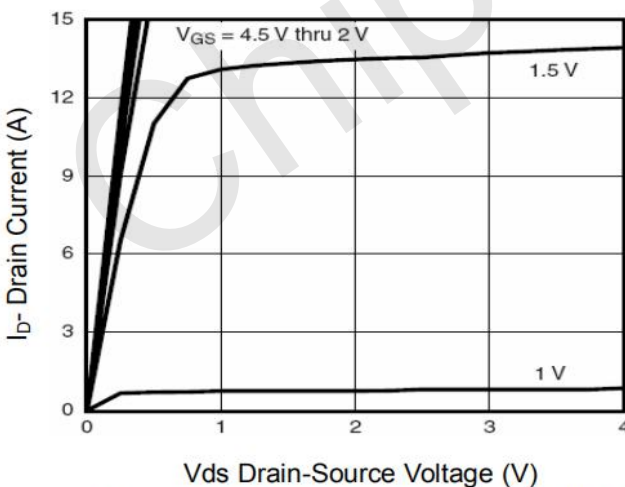


Figure 5 Output CHARACTERISTICS

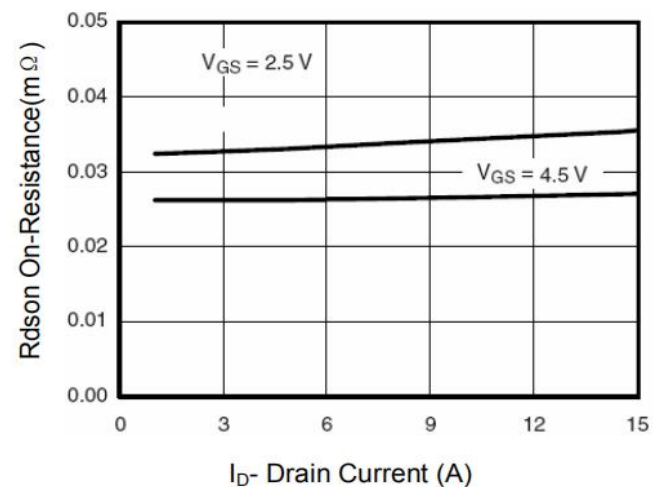


Figure 6 Drain-Source On-Resistance

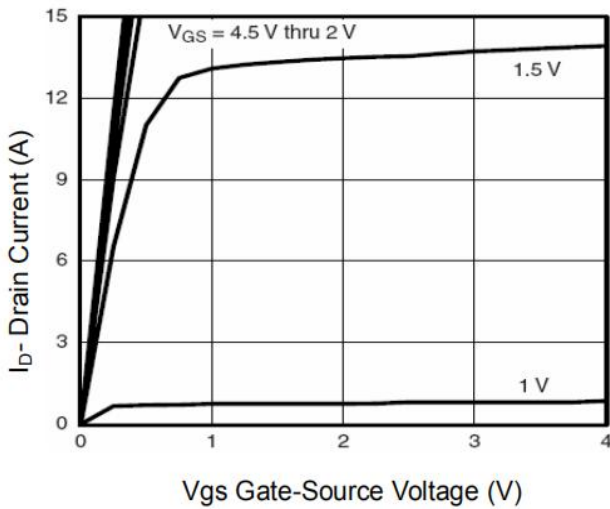


Figure 7 Transfer Characteristics

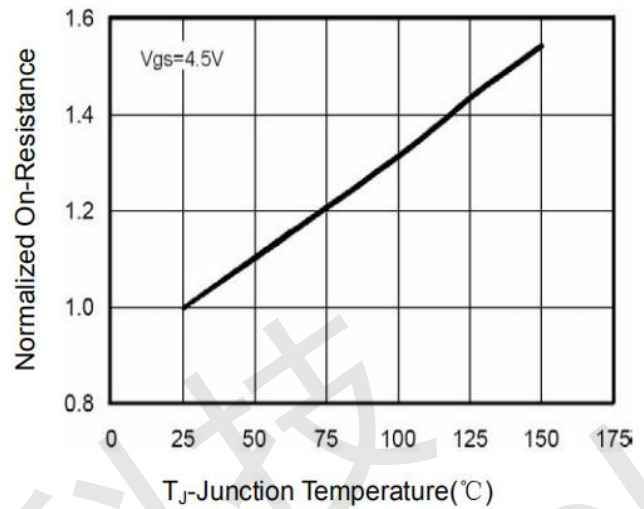


Figure 8 Drain-Source On-Resistance

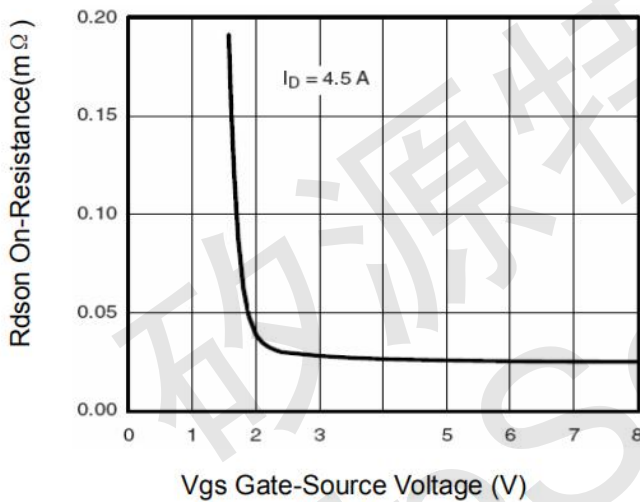


Figure 9 Rdson vs Vgs

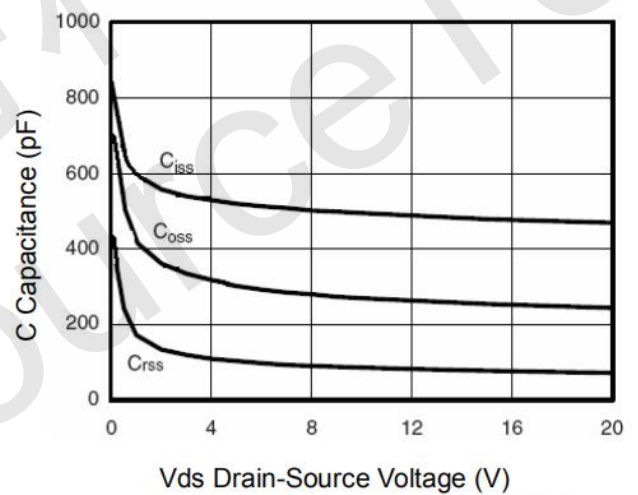


Figure 10 Capacitance vs Vds

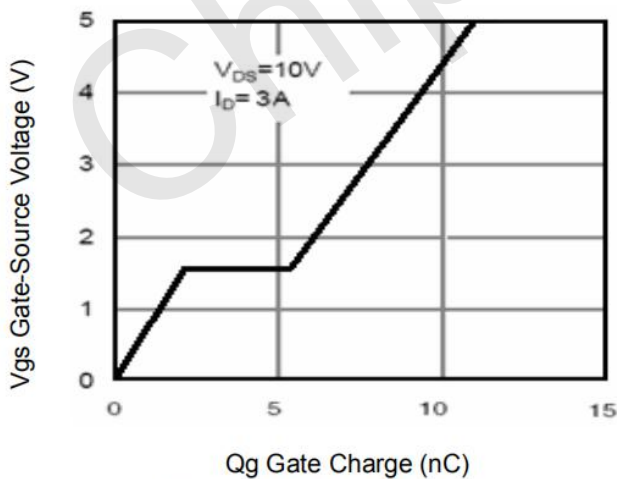


Figure 11 Gate Charge

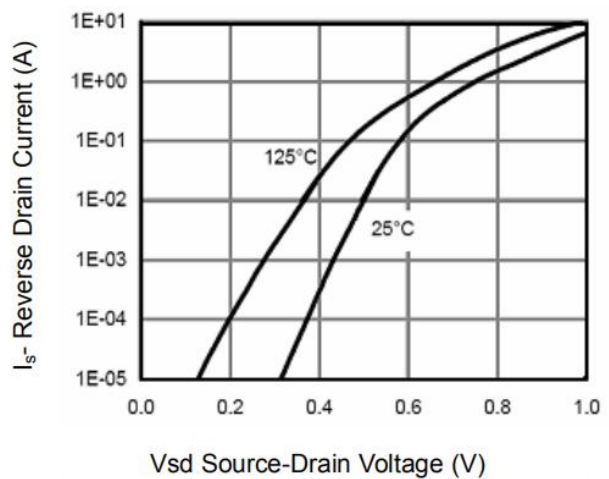


Figure 12 Source-Drain Diode Forward

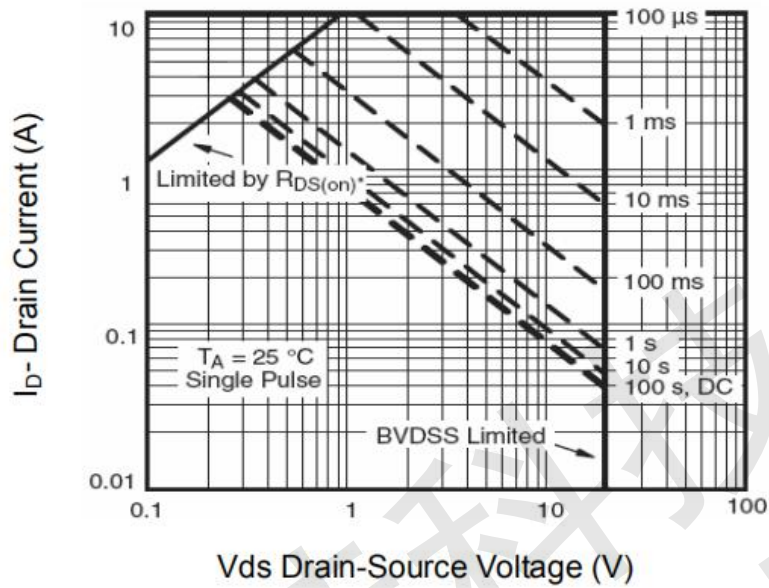


Figure 13 Safe Operation Area

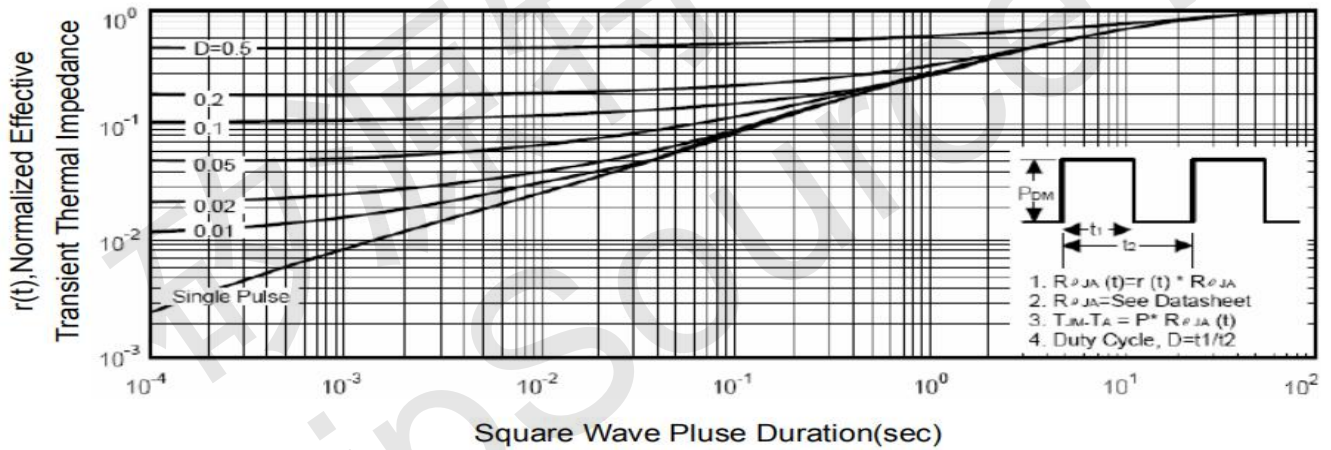
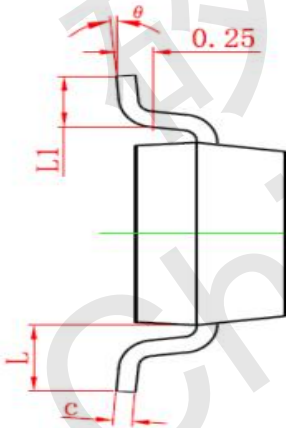
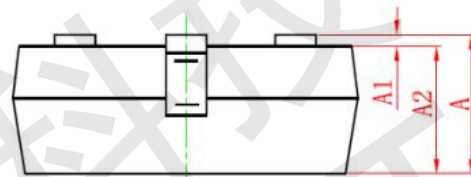
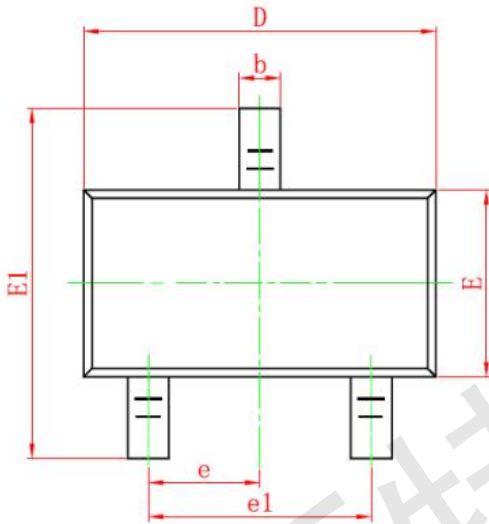


Figure 14 Normalized Maximum Transient Thermal Impedance



## SOT-23 PACKAGE INFORMATION

Dimensions in Millimeters (UNIT:mm)



| Symbol   | Dimensions in Millimeters |       |
|----------|---------------------------|-------|
|          | MIN.                      | MAX.  |
| A        | 0.900                     | 1.150 |
| A1       | 0.000                     | 0.100 |
| A2       | 0.900                     | 1.050 |
| b        | 0.300                     | 0.500 |
| c        | 0.080                     | 0.150 |
| D        | 2.800                     | 3.000 |
| E        | 1.200                     | 1.400 |
| E1       | 2.250                     | 2.550 |
| e        | 0.950TYP                  |       |
| e1       | 1.800                     | 2.000 |
| L        | 0.550REF                  |       |
| L1       | 0.300                     | 0.500 |
| $\theta$ | 0°                        | 8°    |

### NOTES

1. All dimensions are in millimeters.
2. Tolerance  $\pm 0.10\text{mm}$  (4 mil) unless otherwise specified
3. Package body sizes exclude mold flash and gate burrs. Mold flash at the non-lead sides should be less than 5 mils.
4. Dimension L is measured in gauge plane.
5. Controlling dimension is millimeter, converted inch dimensions are not necessarily exact.