

## N-Ch 60V Fast Switching MOSFETs

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

## Product Summary

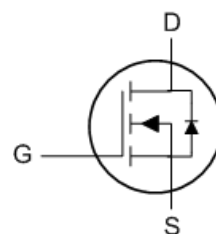
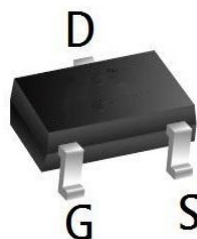


| BVDSS | RDSON | ID |
|-------|-------|----|
| 60V   | 75 mΩ | 3A |

## Description

The XR2310 is the high cell density trenched N-ch MOSFETs, which provides excellent RDSON and efficiency for most of the small power switching and load switch applications. The XR2310 meet the RoHS and Green Product requirement with full function reliability approved.

## SOT23 Pin Configuration

Absolute Maximum Ratings ( $T_A=25^\circ\text{C}$  unless otherwise specified)

| Symbol          | Parameter                               |                           | Max.        | Units              |
|-----------------|-----------------------------------------|---------------------------|-------------|--------------------|
| $V_{DSS}$       | Drain-Source Voltage                    |                           | 60          | V                  |
| $V_{GSS}$       | Gate-Source Voltage                     |                           | $\pm 20$    | V                  |
| $I_D$           | Continuous Drain Current                | $T_A = 25^\circ\text{C}$  | 3           | A                  |
|                 |                                         | $T_A = 100^\circ\text{C}$ | 2           | A                  |
| $I_{DM}$        | Pulsed Drain Current <sup>note1</sup>   |                           | 12          | A                  |
| $P_D$           | Power Dissipation                       | $T_A = 25^\circ\text{C}$  | 1.5         | W                  |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient |                           | 83          | $^\circ\text{C/W}$ |
| $T_J, T_{STG}$  | Operating and Storage Temperature Range |                           | -55 to +150 | $^\circ\text{C}$   |

**Electrical Characteristics** ( $T_J=25^{\circ}\text{C}$  unless otherwise specified)

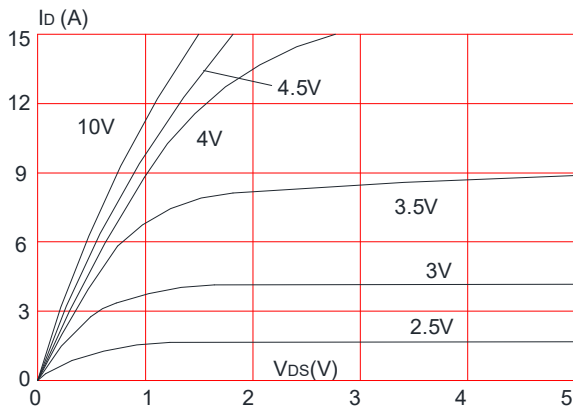
| Symbol                                                 | Parameter                                                 | Test Condition                                                                         | Min. | Typ. | Max. | Units |
|--------------------------------------------------------|-----------------------------------------------------------|----------------------------------------------------------------------------------------|------|------|------|-------|
| Off Characteristic                                     |                                                           |                                                                                        |      |      |      |       |
| V <sub>(BR)DSS</sub>                                   | Drain-Source Breakdown Voltage                            | V <sub>GS</sub> =0V, I <sub>D</sub> =250μA                                             | 60   | -    | -    | V     |
| I <sub>DSS</sub>                                       | Zero Gate Voltage Drain Current                           | V <sub>DS</sub> =60V, V <sub>GS</sub> =0V,                                             | -    | -    | 1.0  | μA    |
| I <sub>GSS</sub>                                       | Gate to Body Leakage Current                              | V <sub>DS</sub> =0V, V <sub>GS</sub> =±20V                                             | -    | -    | ±100 | nA    |
| On Characteristics                                     |                                                           |                                                                                        |      |      |      |       |
| V <sub>GS(th)</sub>                                    | Gate Threshold Voltage                                    | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA                               | 1.0  | 1.4  | 2.0  | V     |
| R <sub>DS(on)</sub>                                    | Static Drain-Source on-Resistance<br><small>note2</small> | V <sub>GS</sub> =10V, I <sub>D</sub> =3A                                               | -    | 75   | 100  | mΩ    |
|                                                        |                                                           | V <sub>GS</sub> =4.5V, I <sub>D</sub> =2A                                              | -    | 85   | 120  |       |
| Dynamic Characteristics                                |                                                           |                                                                                        |      |      |      |       |
| C <sub>iss</sub>                                       | Input Capacitance                                         | V <sub>DS</sub> =25V, V <sub>GS</sub> =0V,<br>f=1.0MHz                                 | -    | 350  | -    | pF    |
| C <sub>oss</sub>                                       | Output Capacitance                                        |                                                                                        | -    | 29   | -    | pF    |
| C <sub>rss</sub>                                       | Reverse Transfer Capacitance                              |                                                                                        | -    | 23   | -    | pF    |
| Q <sub>g</sub>                                         | Total Gate Charge                                         | V <sub>DS</sub> =30V, I <sub>D</sub> =3A,<br>V <sub>GS</sub> =10V                      | -    | 9    | -    | nC    |
| Q <sub>gs</sub>                                        | Gate-Source Charge                                        |                                                                                        | -    | 1.5  | -    | nC    |
| Q <sub>gd</sub>                                        | Gate-Drain(“Miller”) Charge                               |                                                                                        | -    | 2    | -    | nC    |
| Switching Characteristics                              |                                                           |                                                                                        |      |      |      |       |
| t <sub>d(on)</sub>                                     | Turn-on Delay Time                                        | V <sub>DD</sub> =30V,I <sub>D</sub> =2A,<br>R <sub>GEN</sub> =3Ω, V <sub>GS</sub> =10V | -    | 5    | -    | ns    |
| t <sub>r</sub>                                         | Turn-on Rise Time                                         |                                                                                        | -    | 7    | -    | ns    |
| t <sub>d(off)</sub>                                    | Turn-off Delay Time                                       |                                                                                        | -    | 37   | -    | ns    |
| t <sub>f</sub>                                         | Turn-off Fall Time                                        |                                                                                        | -    | 22   | -    | ns    |
| Drain-Source Diode Characteristics and Maximum Ratings |                                                           |                                                                                        |      |      |      |       |
| I <sub>S</sub>                                         | Maximum Continuous Drain to Source Diode Forward Current  |                                                                                        | -    | -    | 3    | A     |
| I <sub>SM</sub>                                        | Maximum Pulsed Drain to Source Diode Forward Current      |                                                                                        | -    | -    | 12   | A     |
| V <sub>SD</sub>                                        | Drain to Source Diode Forward Voltage                     | V <sub>GS</sub> = 0V, I <sub>S</sub> =3A                                               | -    | -    | 1.2  | V     |

Notes: 1. Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature

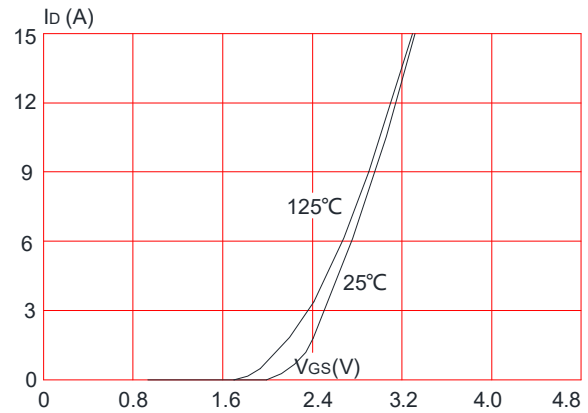
2. Pulse Test: Pulse Width $\leq 300\mu s$ , Duty Cycle $\leq 0.5\%$

### Typical Performance Characteristics

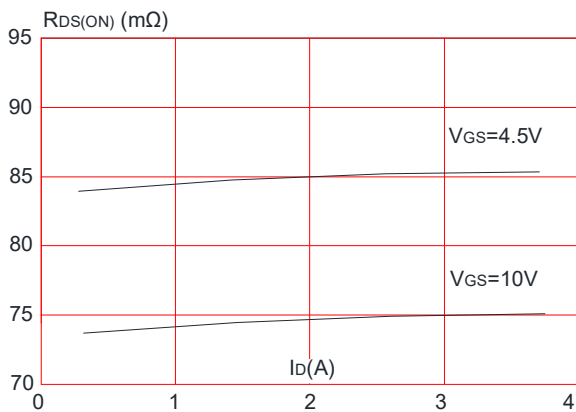
**Figure 1: Output Characteristics**



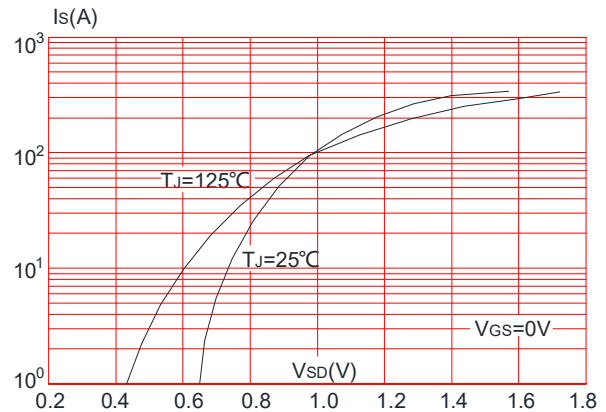
**Figure 2: Typical Transfer Characteristics**



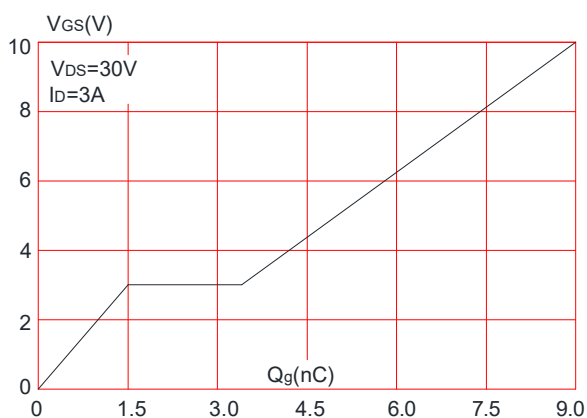
**Figure 3: On-resistance vs. Drain Current**



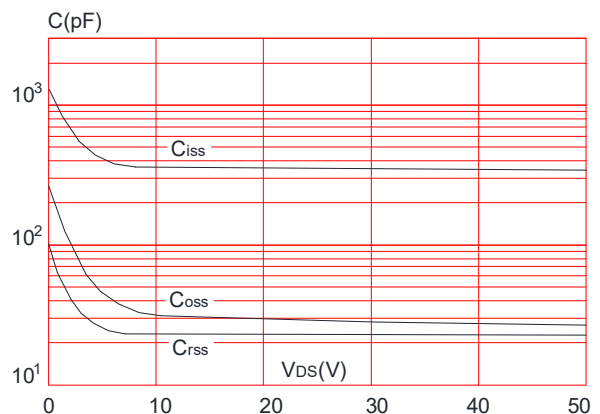
**Figure 4: Body Diode Characteristics**



**Figure 5: Gate Charge Characteristics**

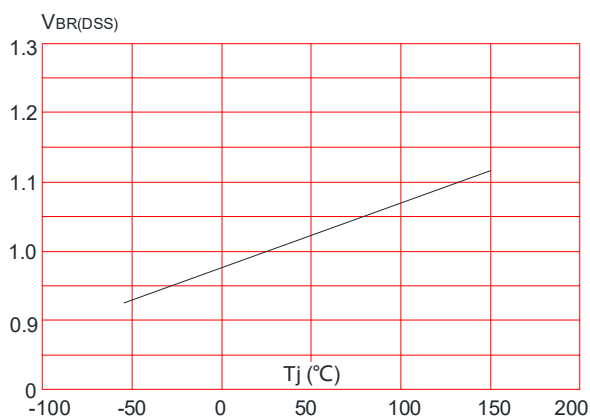


**Figure 6: Capacitance Characteristics**

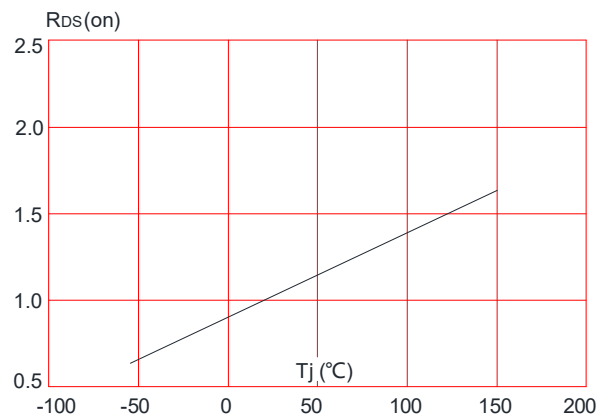


### N-Ch 60V Fast Switching MOSFETs

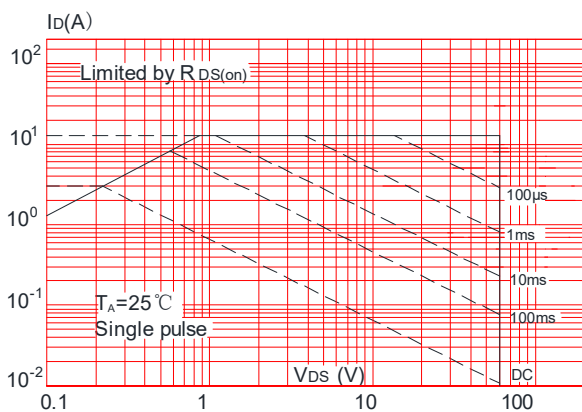
**Figure 7:** Normalized Breakdown Voltage vs. Junction Temperature



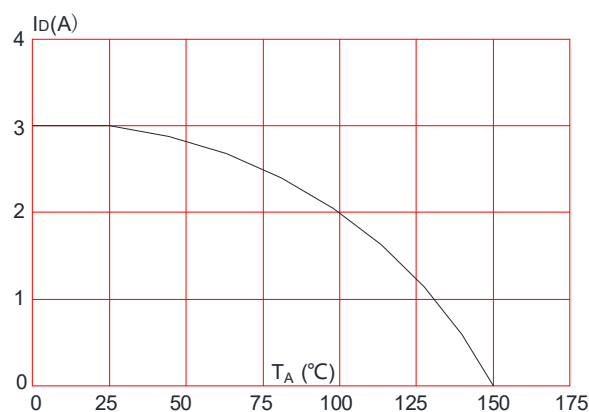
**Figure 8:** Normalized on Resistance vs. Junction Temperature



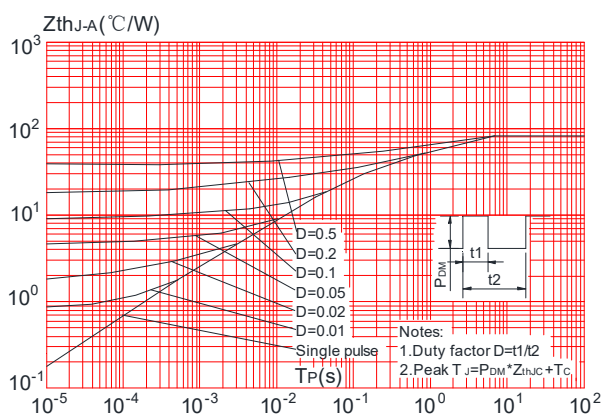
**Figure 9:** Maximum Safe Operating Area



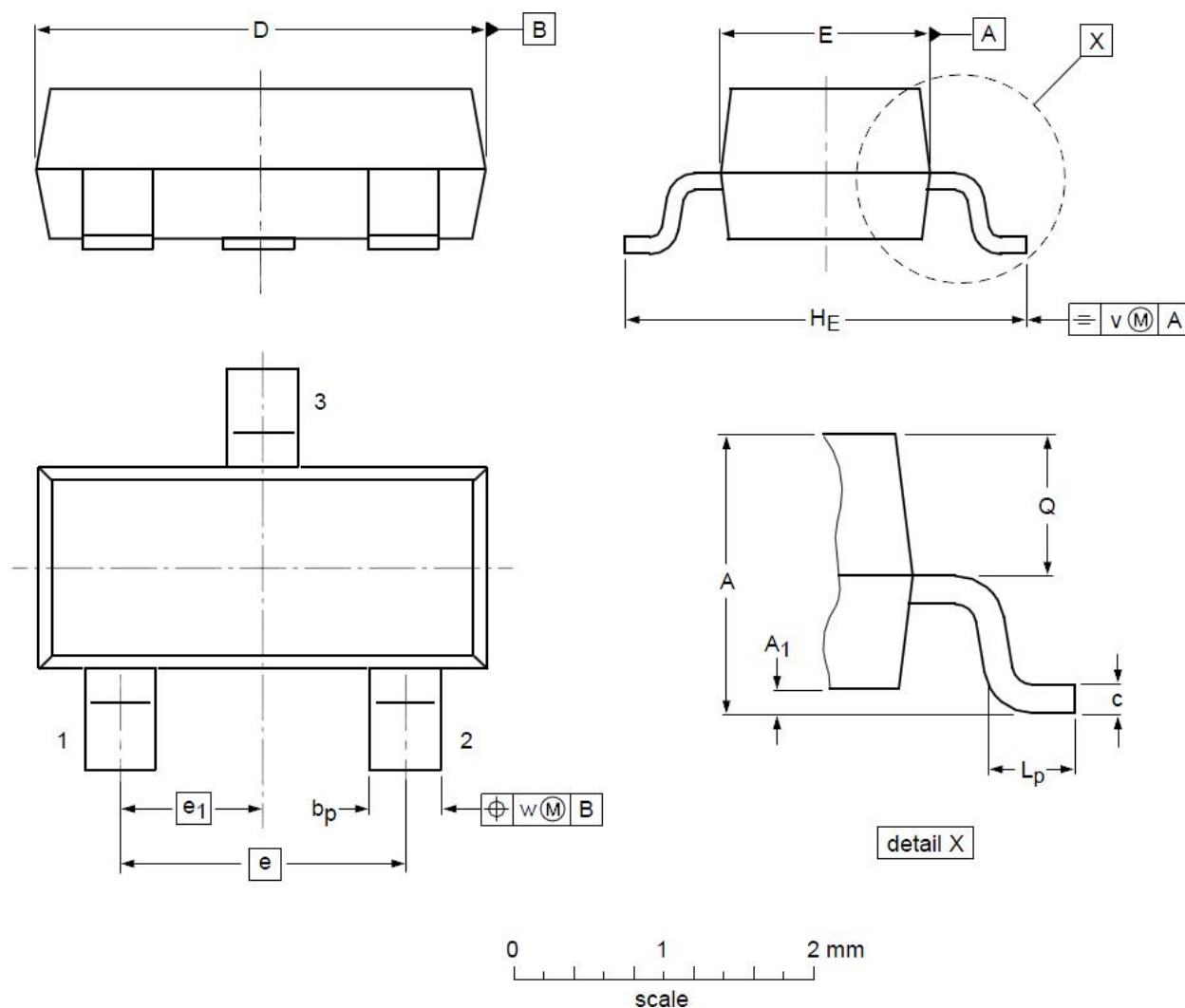
**Figure 10:** Maximum Continuous Drain Current vs. Ambient Temperature



**Figure.11:** Maximum Effective Transient Thermal Impedance, Junction-to-Ambient



### Package Mechanical Data-SOT-23



#### DIMENSIONS ( unit : mm )

| Symbol               | Min  | Typ  | Max  | Symbol               | Min  | Typ  | Max  |
|----------------------|------|------|------|----------------------|------|------|------|
| <b>A</b>             | 0.90 | 1.01 | 1.15 | <b>A<sub>1</sub></b> | 0.01 | 0.05 | 0.10 |
| <b>b<sub>p</sub></b> | 0.30 | 0.42 | 0.50 | <b>c</b>             | 0.08 | 0.13 | 0.15 |
| <b>D</b>             | 2.80 | 2.92 | 3.00 | <b>E</b>             | 1.20 | 1.33 | 1.40 |
| <b>e</b>             | --   | 1.90 | --   | <b>e<sub>1</sub></b> | --   | 0.95 | --   |
| <b>H<sub>E</sub></b> | 2.25 | 2.40 | 2.55 | <b>L<sub>p</sub></b> | 0.30 | 0.42 | 0.50 |
| <b>Q</b>             | 0.45 | 0.49 | 0.55 | <b>v</b>             | --   | 0.20 | --   |
| <b>w</b>             | --   | 0.10 | --   |                      |      |      |      |