

## General Description

The series of devices use advanced trench gate super junction technology and design to provide ultra-low  $R_{DS(ON)}$  and low gate charge and With a rapid recovery body diode. This super junction MOSFET fits the industry's AC-DC SMPS requirements for PFC, AC/DC power conversion, industrial power applications, Fast charger, new energy vehicle charging pile, on-board OBC etc.

## Features

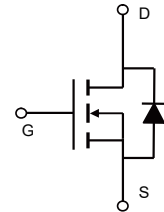
- New technology for high voltage device
- Ultra low on-resistance and ultra low conduction losses
- Ultra Low Gate Charge cause lower driving requirements
- Diode reverse recovery speed is super fast
- 100% Avalanche Tested and 100%  $T_{rr}$  Tested
- High reliability
- ROHS compliant

## Application

- Power factor correction (PFC)
- Switched mode power supplies(SMPS)
- Uninterruptible Power Supply (UPS)
- On-board charger(OBC)



SOT-223



Schematic

| Parameter                                                            | Symbol           | Value    | Unit          |
|----------------------------------------------------------------------|------------------|----------|---------------|
| Drain-Source Voltage ( $V_{GS}=0V$ )                                 | $V_{DS}$         | 600      | V             |
| Gate-Source Voltage ( $V_{DS}=0V$ ), AC ( $f>1$ Hz)                  | $V_{GS}$         | $\pm 30$ | V             |
| Gate-Source Voltage ( $V_{DS}=0V$ ), DC                              | $V_{GS}$         | $\pm 20$ | V             |
| Continuous Drain Current at $T_c=25^\circ C$                         | $I_{D(DC)}$      | 1.8      | A             |
| Continuous Drain Current at $T_c=100^\circ C$                        | $I_{D(DC)}$      | 1.26     | A             |
| Pulsed drain current (Note 1)                                        | $I_{DM}$ (pluse) | 5.4      | A             |
| Maximum Power Dissipation ( $T_c=25^\circ C$ )                       | $P_D$            | 4.7      | W             |
| Derate above $25^\circ C$                                            |                  | 0.03     | W/ $^\circ C$ |
| Single pulse avalanche energy (Note 2)                               | EAS              | 1.25     | mJ            |
| Single pulse avalanche current (Note 2)                              | $I_{AS}$         | 0.5      | A             |
| Repetitive Avalanche energy, $t_{AR}$ limited by $T_{Jmax}$ (Note 1) | $E_{AR}$         | 0.02     | mJ            |

|                                                       |                |            |      |
|-------------------------------------------------------|----------------|------------|------|
| Reverse diode dv/dt, $V_{DS} \leq 480V, I_{SD} < I_D$ | dv/dt          | 15         | V/ns |
| Drain Source voltage slope, $V_{DS} \leq 480V$        | dv/dt          | 50         | V/ns |
| Operating Junction and Storage Temperature Range      | $T_J, T_{STG}$ | -55...+175 | °C   |

**Table 2. Thermal Characteristic**

| Parameter                                         | Symbol     | Value | Unit  |
|---------------------------------------------------|------------|-------|-------|
| Thermal Resistance, Junction-to-Case (Maximum)    | $R_{thJC}$ | 31.9  | °C /W |
| Thermal Resistance, Junction-to-Ambient (Maximum) | $R_{thJA}$ | 62    | °C /W |

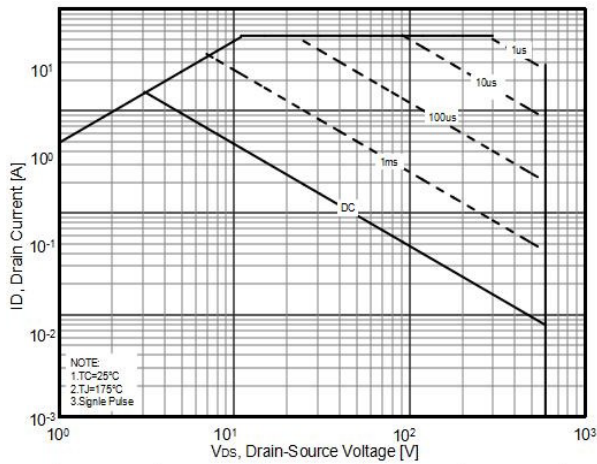
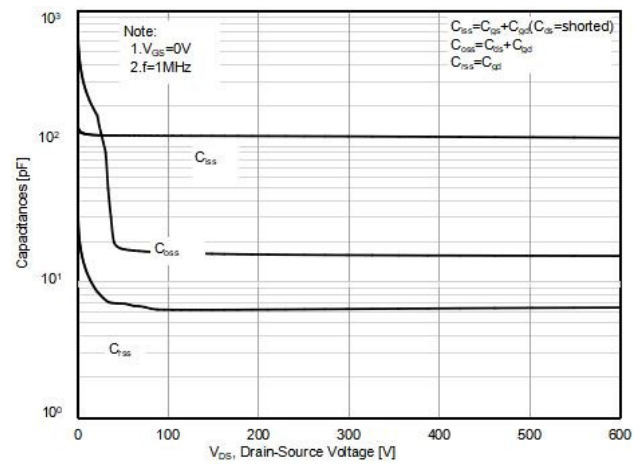
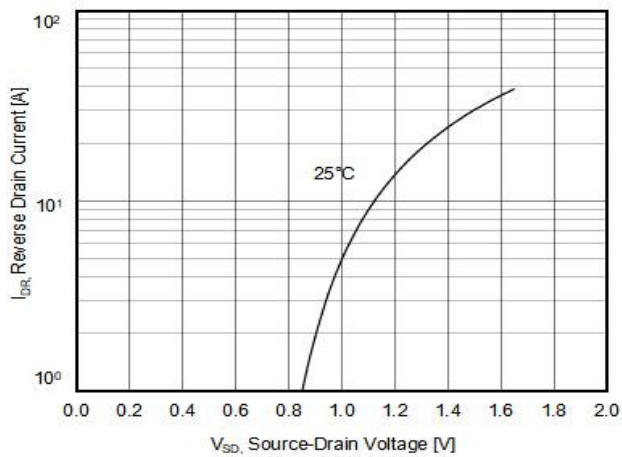
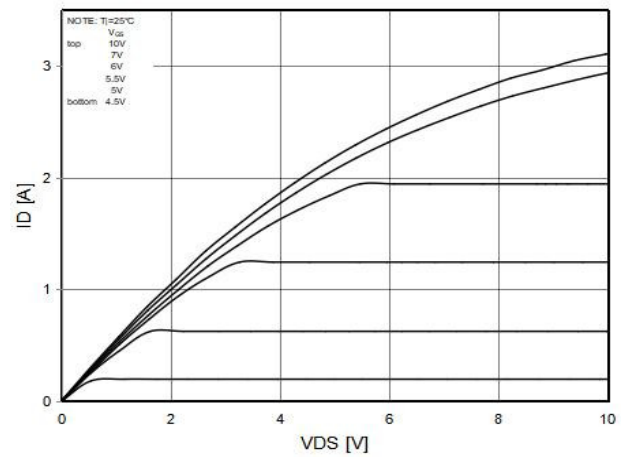
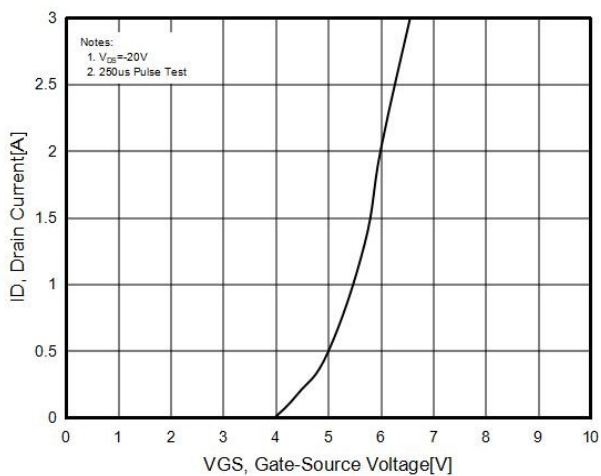
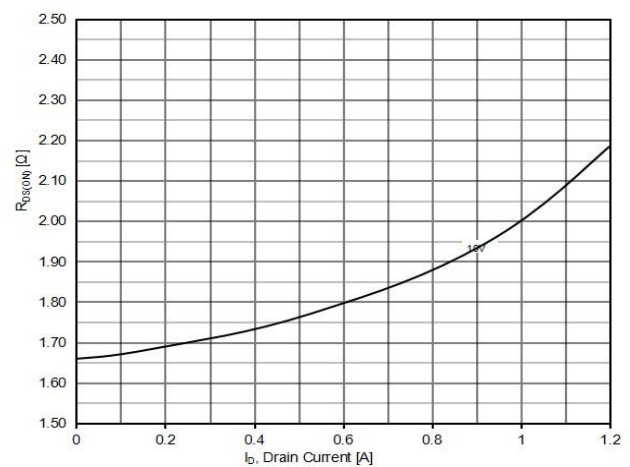
**Table 3. Electrical Characteristics (TA=25°C unless otherwise noted)**

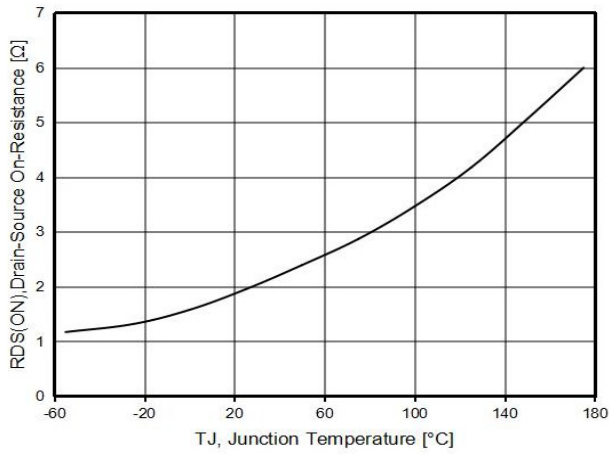
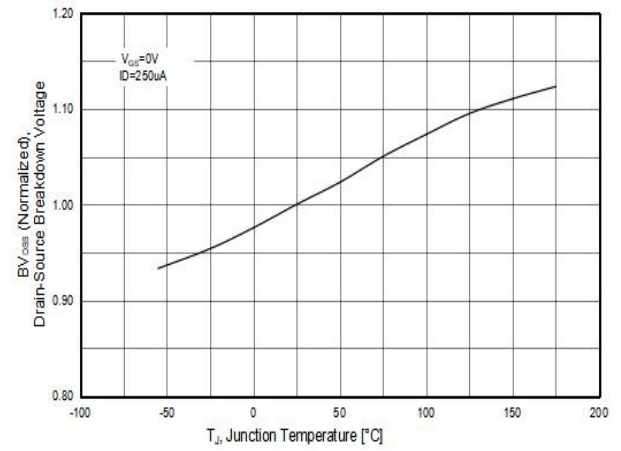
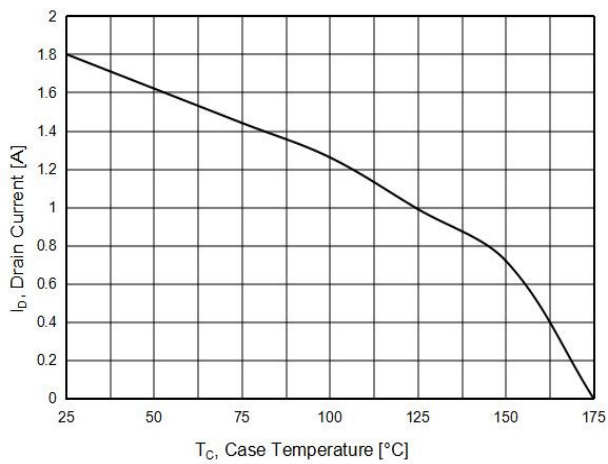
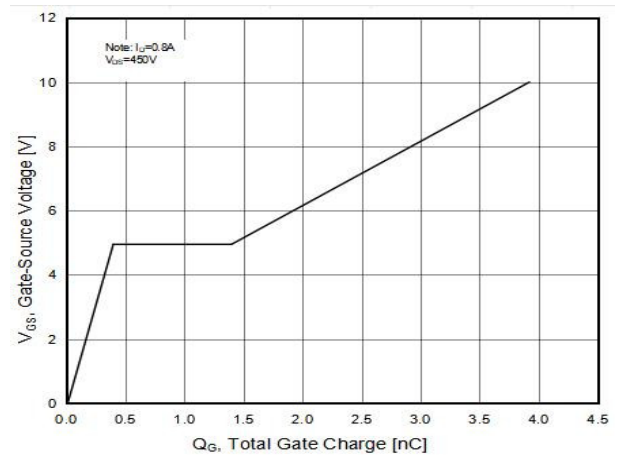
| Parameter                                | Symbol              | Condition                                                                                | Min | Typ  | Max  | Unit |
|------------------------------------------|---------------------|------------------------------------------------------------------------------------------|-----|------|------|------|
| On/off states                            |                     |                                                                                          |     |      |      |      |
| Drain-Source Breakdown Voltage           | BV <sub>DSS</sub>   | V <sub>GS</sub> =0V I <sub>D</sub> =250uA                                                | 600 |      |      | V    |
| Zero Gate Voltage Drain Current(Tc=25℃)  | I <sub>DSS</sub>    | V <sub>DS</sub> =600V, V <sub>GS</sub> =0V                                               |     |      | 1    | μA   |
| Zero Gate Voltage Drain Current(Tc=125℃) | I <sub>DSS</sub>    | V <sub>DS</sub> =600V, V <sub>GS</sub> =0V                                               |     |      | 100  | μA   |
| Gate-Body Leakage Current                | I <sub>GSS</sub>    | V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V                                               |     |      | ±200 | nA   |
| Gate Threshold Voltage                   | V <sub>GS(th)</sub> | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250uA                                 | 2.5 | 3.2  | 4.0  | V    |
| Drain-Source On-State Resistance         | R <sub>DS(ON)</sub> | V <sub>GS</sub> =10V, I <sub>D</sub> =0.9A                                               |     | 1950 | 2100 | mΩ   |
| Dynamic Characteristics                  |                     |                                                                                          |     |      |      |      |
| Gate Resistance                          | R <sub>g</sub>      | F=1MHZ, D-S short                                                                        |     | 17   |      | Ω    |
| Input Capacitance                        | C <sub>iss</sub>    | V <sub>DS</sub> =50V, V <sub>GS</sub> =0V,<br>F=1MHz                                     |     | 119  |      | pF   |
| Output Capacitance                       | C <sub>oss</sub>    |                                                                                          |     | 17.3 |      | pF   |
| Reverse Transfer Capacitance             | C <sub>rss</sub>    |                                                                                          |     | 6.8  |      | pF   |
| Total Gate Charge                        | Q <sub>g</sub>      | V <sub>DS</sub> =450V, I <sub>D</sub> =0.8A,<br>V <sub>GS</sub> =10V                     |     | 3.9  |      | nC   |
| Gate-Source Charge                       | Q <sub>gs</sub>     |                                                                                          |     | 0.4  |      | nC   |
| Gate-Drain Charge                        | Q <sub>gd</sub>     |                                                                                          |     | 1    |      | nC   |
| Gate plateau voltage                     | V <sub>gp</sub>     |                                                                                          |     | 4.9  |      | V    |
| Switching times                          |                     |                                                                                          |     |      |      |      |
| Turn-on Delay Time                       | t <sub>d(on)</sub>  | V <sub>DD</sub> =380V, I <sub>D</sub> =0.9A,<br>R <sub>G</sub> =3Ω, V <sub>GS</sub> =10V |     | 6    |      | nS   |
| Turn-on Rise Time                        | t <sub>r</sub>      |                                                                                          |     | 6    |      | nS   |
| Turn-Off Delay Time                      | t <sub>d(off)</sub> |                                                                                          |     | 29   |      | nS   |
| Turn-Off Fall Time                       | t <sub>f</sub>      |                                                                                          |     | 48   |      | nS   |
| Source- Drain Diode Characteristics      |                     |                                                                                          |     |      |      |      |
| Source-drain current(Body Diode)         | I <sub>SD</sub>     | T <sub>C</sub> =25℃                                                                      |     |      | 1.8  | A    |
| Pulsed-Source-drain current(Body Diode)  | I <sub>SDM</sub>    |                                                                                          |     |      | 5.4  | A    |
| Forward on voltage                       | V <sub>SD</sub>     | T <sub>J</sub> =25℃, I <sub>SD</sub> =1.8A, V <sub>GS</sub> =0V                          |     | 0.9  | 1.2  | V    |
| Reverse Recovery Time                    | t <sub>rr</sub>     | T <sub>J</sub> =25℃, I <sub>F</sub> =0.9 A,<br>di/dt=100A/μs                             |     | 130  |      | nS   |
| Reverse Recovery Charge                  | Q <sub>rr</sub>     |                                                                                          |     | 0.52 |      | uC   |
| Peak reverse recovery current            | I <sub>rm</sub>     |                                                                                          |     | 8    |      | A    |

Notes: 1. Repetitive Rating: Pulse width limited by maximum junction temperature

2.  $T_J=25^\circ C, V_{DD}=50V, V_G=10V, R_G=25\Omega$

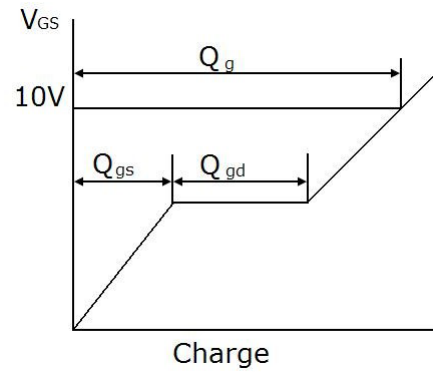
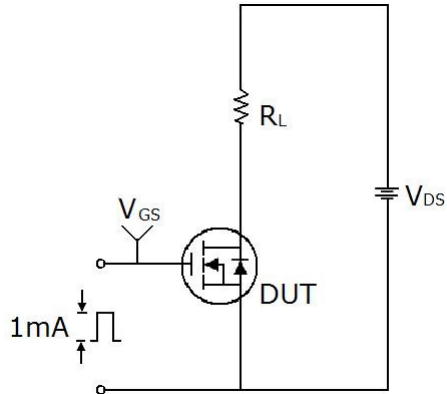
## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS (curves)

**Figure1. Safe operating area**

**Figure2. Capacitance**

**Figure3. Source-Drain Diode Forward Voltage**

**Figure4. Output characteristics**

**Figure5. Transfer characteristics**

**Figure6. Static drain-source on resistance**


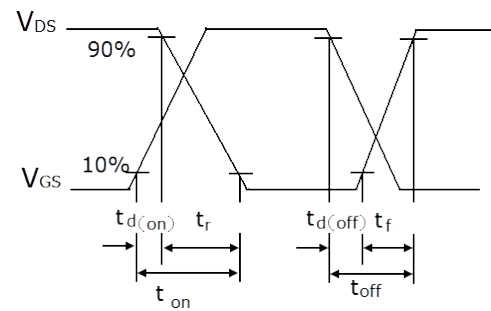
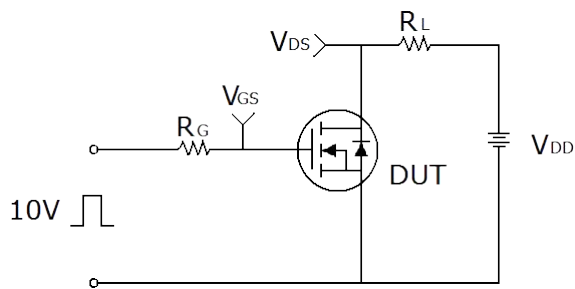
**Figure7.  $R_{DS(ON)}$  vs Junction Temperature**

**Figure8.  $BV_{DSS}$  vs Junction Temperature**

**Figure9. Maximum  $I_D$  vs Junction Temperature**

**Figure10. Gate charge waveforms**


## Test circuit

### 1) Gate charge test circuit & Waveform



### 2) Switch Time Test Circuit:



### 3) Unclamped Inductive Switching Test Circuit & Waveforms

