

## General Description

The series of devices use advanced trench gate super junction technology and design to provide excellent  $R_{DS(ON)}$  with low gate charge. This super junction MOSFET fits the industry's AC-DC SMPS requirements for PFC, AC/DC power conversion, and industrial power applications.

## Features

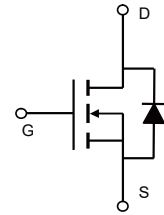
- Optimized body diode reverse recovery performance
- Low on-resistance and low conduction losses
- Small package
- Ultra Low Gate Charge cause lower driving requirements
- 100% Avalanche Tested
- ROHS compliant

## Application

- Power factor correction (PFC)
- Switched mode power supplies(SMPS)
- Uninterruptible Power Supply (UPS)



TO-252



Schematic

| Parameter                                                   | Symbol          | Value      | Unit          |
|-------------------------------------------------------------|-----------------|------------|---------------|
| Drain-Source Voltage ( $V_{GS}=0V$ )                        | $V_{DS}$        | 650        | 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 $T_c=25^\circ C$                | $I_{D(DC)}$     | 8.0        | A             |
| Continuous Drain Current at $T_c=100^\circ C$               | $I_{D(DC)}$     | 5.6        | A             |
| Pulsed drain current (Note 1)                               | $I_{DM(pluse)}$ | 20         | A             |
| Maximum Power Dissipation( $T_c=25^\circ C$ )               | $P_D$           | 90         | W             |
| Derate above $25^\circ C$                                   |                 | 0.6        | W/ $^\circ C$ |
| Avalanche current (Note 2)                                  | $I_{AS}$        | 2.0        | A             |
| Drain Source voltage slope, $V_{DS} \leq 480$ V,            | $dv/dt$         | 50         | V/ns          |
| Reverse diode $dv/dt$ , $V_{DS} \leq 480$ V, $I_{SD} < I_D$ | $dv/dt$         | 15         | V/ns          |
| Operating Junction and Storage Temperature Range            | $T_J, T_{STG}$  | -55...+175 | $^\circ C$    |

**Table 2. Thermal Characteristic**

| Parameter                                         | Symbol     | Value | Unit                        |
|---------------------------------------------------|------------|-------|-----------------------------|
| Thermal Resistance, Junction-to-Case (Maximum)    | $R_{thJC}$ | 1.67  | $^{\circ}\text{C}/\text{W}$ |
| Thermal Resistance, Junction-to-Ambient (Maximum) | $R_{thJA}$ | 62    | $^{\circ}\text{C}/\text{W}$ |

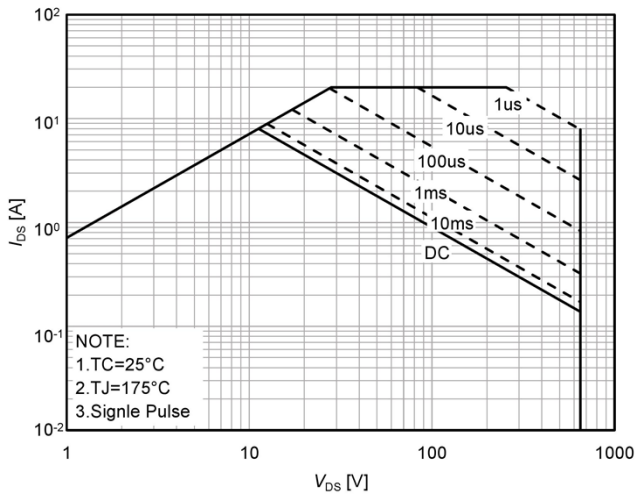
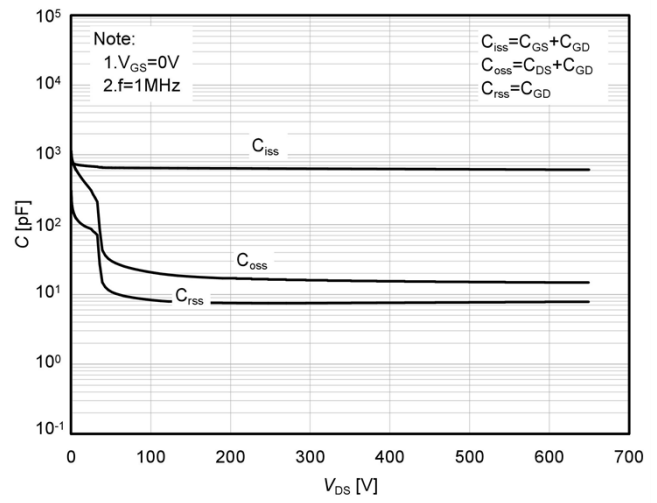
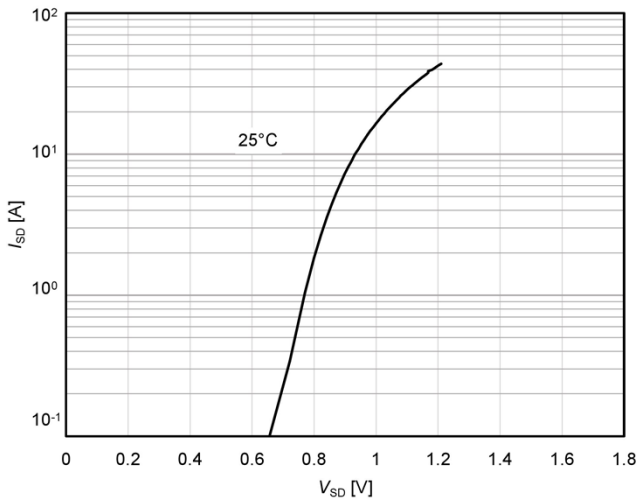
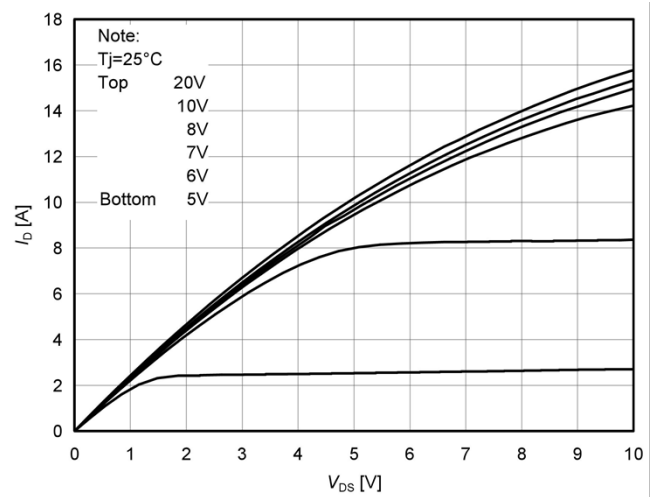
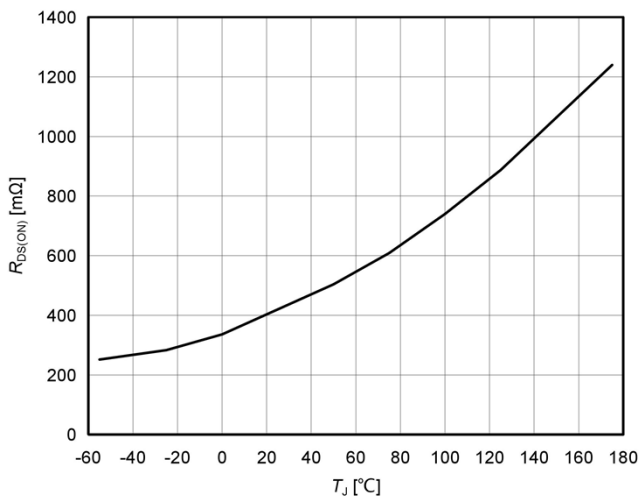
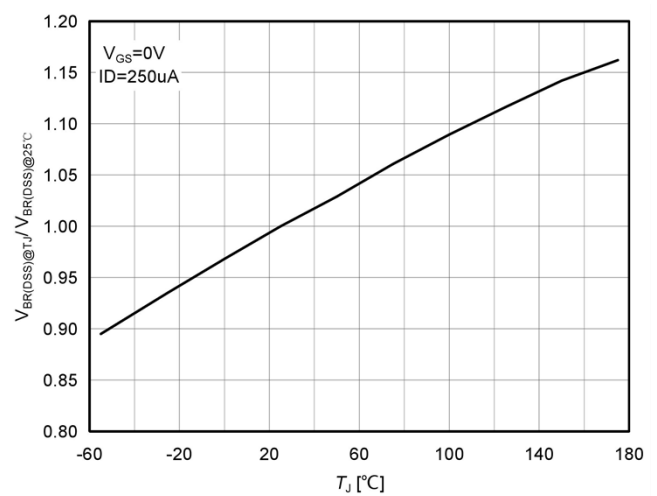
**Table 3. Electrical Characteristics ( $T_J=25^{\circ}\text{C}$  unless otherwise noted)**

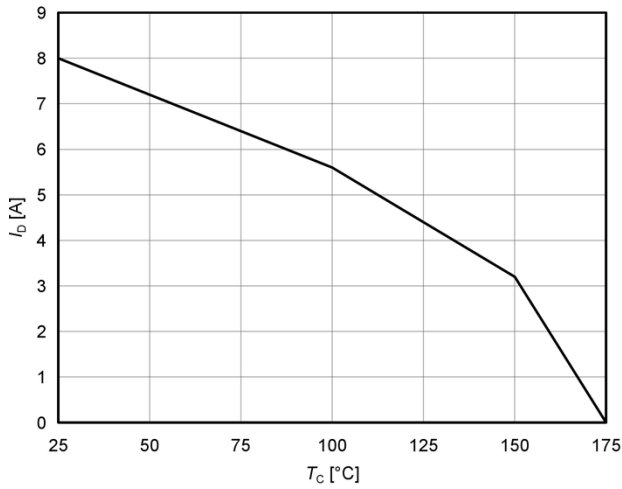
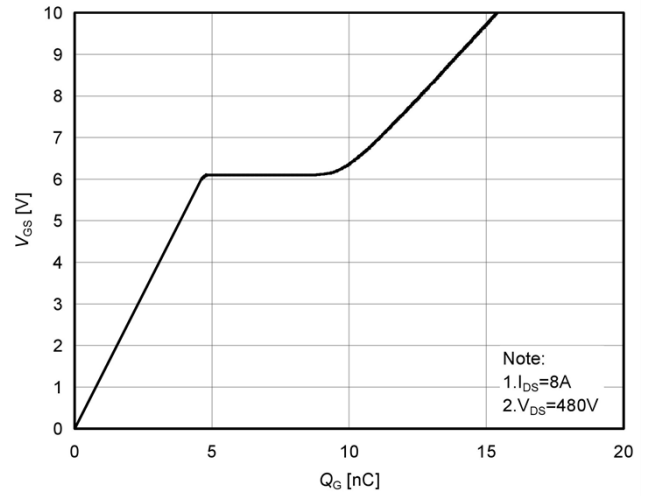
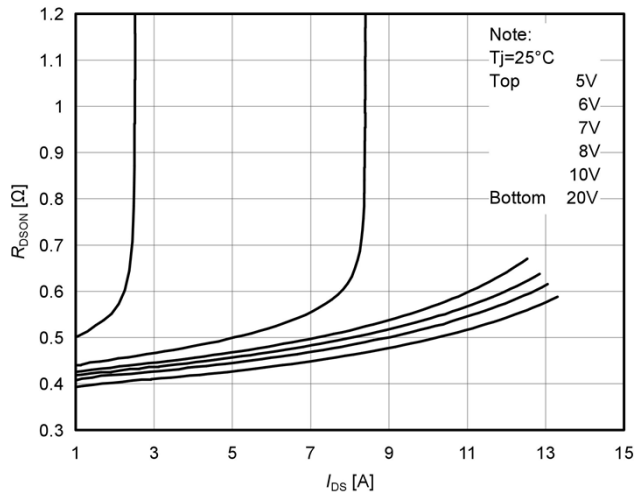
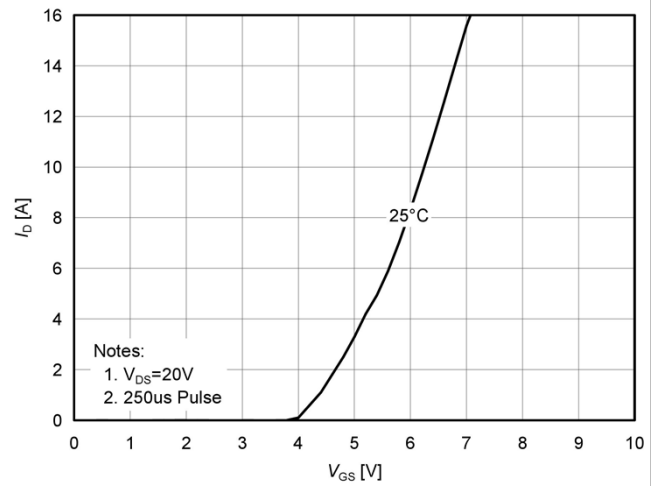
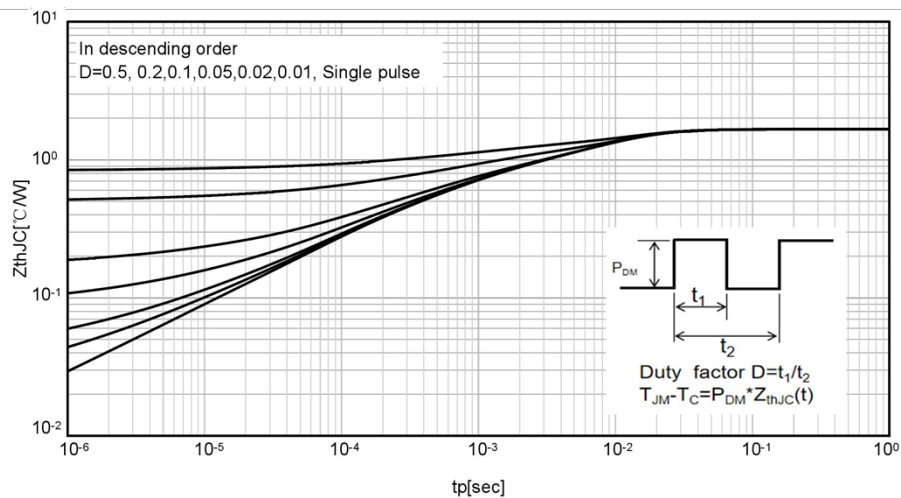
| Parameter                                             | Symbol              | Condition                                                                                 | Min | Typ | Max  | Unit |
|-------------------------------------------------------|---------------------|-------------------------------------------------------------------------------------------|-----|-----|------|------|
| On/off states                                         |                     |                                                                                           |     |     |      |      |
| Drain-Source Breakdown Voltage                        | BV <sub>DSS</sub>   | V <sub>GS</sub> =0V I <sub>D</sub> =250μA                                                 | 650 |     |      | V    |
| Zero Gate Voltage Drain Current(T <sub>J</sub> =25℃)  | I <sub>DSS</sub>    | V <sub>DS</sub> =650V, V <sub>GS</sub> =0V                                                |     |     | 1    | μA   |
| Zero Gate Voltage Drain Current(T <sub>J</sub> =125℃) | I <sub>DSS</sub>    | V <sub>DS</sub> =650V, 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                                                |     |     | ±100 | nA   |
| Gate Threshold Voltage                                | V <sub>GS(th)</sub> | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA                                  | 3.0 | 3.5 | 4.0  | V    |
| Drain-Source On-State Resistance                      | R <sub>DS(ON)</sub> | V <sub>GS</sub> =10V, I <sub>D</sub> =4A                                                  |     | 420 | 540  | mΩ   |
| Dynamic Characteristics                               |                     |                                                                                           |     |     |      |      |
| Input Capacitance                                     | C <sub>iss</sub>    | V <sub>DS</sub> =50V, V <sub>GS</sub> =0V,<br>F=1.0MHz                                    |     | 652 |      | pF   |
| Output Capacitance                                    | C <sub>oss</sub>    |                                                                                           |     | 30  |      | pF   |
| Reverse Transfer Capacitance                          | C <sub>rss</sub>    |                                                                                           |     | 11  |      | pF   |
| Total Gate Charge                                     | Q <sub>g</sub>      | V <sub>DS</sub> =480V, I <sub>D</sub> =8A,<br>V <sub>GS</sub> =10V                        |     | 16  |      | nC   |
| Gate-Source Charge                                    | Q <sub>gs</sub>     |                                                                                           |     | 4   |      | nC   |
| Gate-Drain Charge                                     | Q <sub>gd</sub>     |                                                                                           |     | 6   |      | nC   |
| Gate plateau voltage                                  | V <sub>gp</sub>     |                                                                                           |     | 6.1 |      | V    |
| Intrinsic gate resistance                             | R <sub>G</sub>      | f = 1 MHz D-S short                                                                       |     | 5.0 |      | Ω    |
| Switching times                                       |                     |                                                                                           |     |     |      |      |
| Turn-on Delay Time                                    | t <sub>d(on)</sub>  | V <sub>DD</sub> =480V, I <sub>D</sub> =4.0A,<br>R <sub>G</sub> =20Ω, V <sub>GS</sub> =10V |     | 9   |      | nS   |
| Turn-on Rise Time                                     | t <sub>r</sub>      |                                                                                           |     | 15  |      | nS   |
| Turn-Off Delay Time                                   | t <sub>d(off)</sub> |                                                                                           |     | 68  |      | nS   |
| Turn-Off Fall Time                                    | t <sub>f</sub>      |                                                                                           |     | 20  |      | nS   |
| Source- Drain Diode Characteristics                   |                     |                                                                                           |     |     |      |      |
| Source-drain current(Body Diode)                      | I <sub>SD</sub>     | T <sub>c</sub> =25℃                                                                       |     |     | 8    | A    |
| Pulsed Source-drain current(Body Diode)               | I <sub>SDM</sub>    |                                                                                           |     |     | 20   | A    |
| Forward On Voltage                                    | V <sub>SD</sub>     | T <sub>J</sub> =25℃, I <sub>SD</sub> =8A, V <sub>GS</sub> =0V                             |     | 0.8 | 1.2  | V    |
| Reverse Recovery Time                                 | t <sub>rr</sub>     | T <sub>J</sub> =25℃, I <sub>F</sub> =4.0A,<br>di/dt=100A/μs                               |     | 165 |      | nS   |
| Reverse Recovery Charge                               | Q <sub>rr</sub>     |                                                                                           |     | 1.4 |      | uC   |
| Peak Reverse Recovery Current                         | I <sub>rrm</sub>    |                                                                                           |     | 15  |      | A    |

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

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

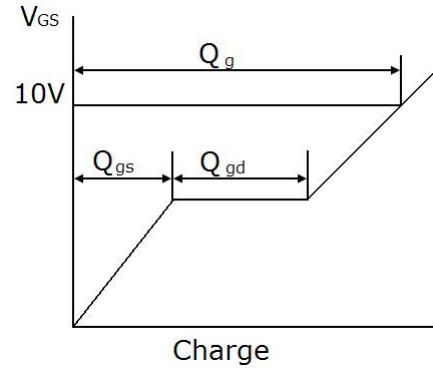
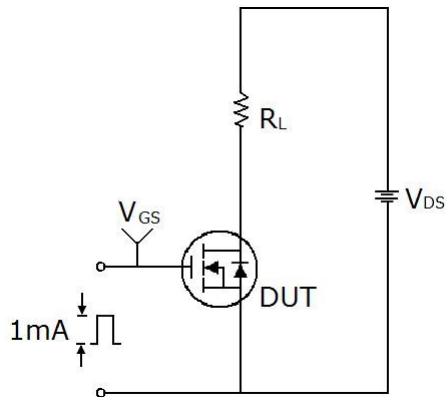
## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS (curves)

**Figure1. Safe operating area**

**Figure2. Capacitance**

**Figure3. Body Diode Forward Voltage**

**Figure4. Output characteristics**

**Figure5.  $R_{DS(ON)}$  vs Junction Temperature**

**Figure6.  $V_{BR(DSS)}$  vs Junction Temperature**


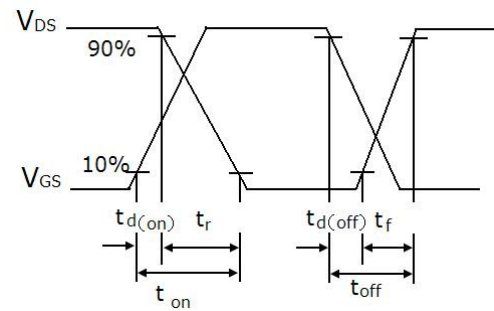
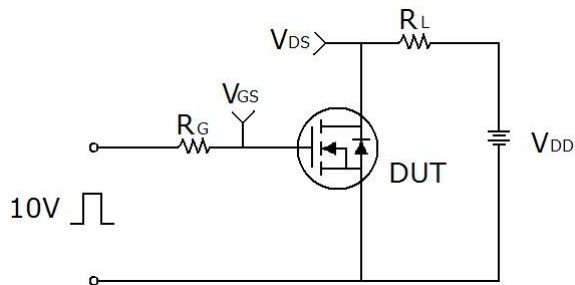
**Figure7. Maximum  $I_D$  vs Junction Temperature**

**Figure8. Gate charge waveforms**

**Figure9. Static drain-source on resistance**

**Figure10. Transfer characteristics**

**Figure11. Transient thermal impedance**


## Test circuit

### 1) Gate charge test circuit & Waveform



### 2) Switch Time Test Circuit:



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

