

## Description

The series of devices uses **Super Trench II** technology that is uniquely optimized to provide the most efficient high frequency switching performance. Both conduction and switching power losses are minimized due to an extremely low combination of  $R_{DS(ON)}$  and  $Q_g$ . This device is ideal for high-frequency switching and synchronous rectification.

## Application

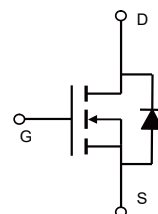
- DC/DC Converter
- Ideal for high-frequency switching and synchronous rectification

## General Features

- $V_{DS} = 100V, I_D = 230A$   
 $R_{DS(ON)} = 2.15m\Omega$ , typical@  $V_{GS} = 10V$
- Excellent gate charge x  $R_{DS(on)}$  product(FOM)
- Very low on-resistance  $R_{DS(on)}$
- 175 °C operating temperature
- Pb-free lead plating



TO-247



Schematic

## Package Marking and Ordering Information

| Device Marking | Device       | Device Package | Reel Size | Tape width | Quantity |
|----------------|--------------|----------------|-----------|------------|----------|
| VST10N020      | VST10N020-T7 | TO-247         | -         | -          | -        |

## Absolute Maximum Ratings ( $T_c = 25^\circ C$ unless otherwise noted)

| Parameter                                        | Symbol             | Limit      | Unit          |
|--------------------------------------------------|--------------------|------------|---------------|
| Drain-Source Voltage                             | $V_{DS}$           | 100        | V             |
| Gate-Source Voltage                              | $V_{GS}$           | $\pm 20$   | V             |
| Drain Current-Continuous                         | $I_D$              | 230        | A             |
| Drain Current-Continuous( $T_c = 100^\circ C$ )  | $I_D(100^\circ C)$ | 165        | A             |
| Pulsed Drain Current                             | $I_{DM}$           | 920        | A             |
| Maximum Power Dissipation                        | $P_D$              | 300        | W             |
| Derating factor                                  |                    | 2          | W/ $^\circ C$ |
| Single pulse avalanche energy (Note 1)           | $E_{AS}$           | 2300       | mJ            |
| Operating Junction and Storage Temperature Range | $T_J, T_{STG}$     | -55 To 175 | $^\circ C$    |

## Thermal Characteristic

|                                      |                 |     |              |
|--------------------------------------|-----------------|-----|--------------|
| Thermal Resistance, Junction-to-Case | $R_{\theta JC}$ | 0.5 | $^\circ C/W$ |
|--------------------------------------|-----------------|-----|--------------|

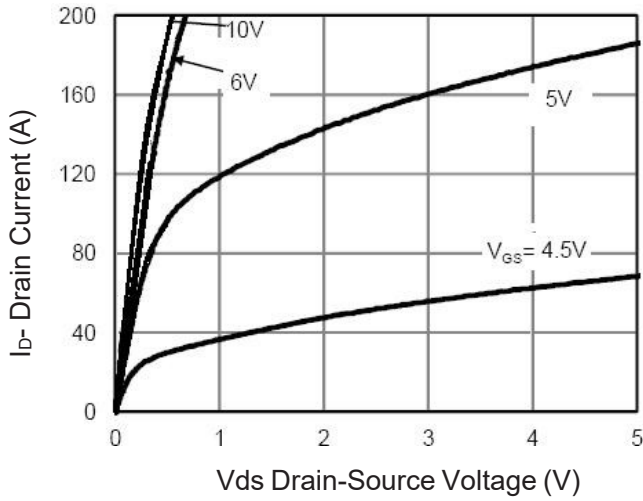
**Electrical Characteristics (T<sub>c</sub>=25°C unless otherwise noted)**

| Parameter                          | Symbol              | Condition                                                                                | Min | Typ   | Max  | Unit |
|------------------------------------|---------------------|------------------------------------------------------------------------------------------|-----|-------|------|------|
| Off Characteristics                |                     |                                                                                          |     |       |      |      |
| Drain-Source Breakdown Voltage     | BV <sub>DSS</sub>   | V <sub>GS</sub> =0V I <sub>D</sub> =250μA                                                | 100 |       | -    | V    |
| Zero Gate Voltage Drain Current    | I <sub>DSS</sub>    | V <sub>DS</sub> =100V, V <sub>GS</sub> =0V                                               | -   | -     | 1    | μA   |
| Gate-Body Leakage Current          | I <sub>GSS</sub>    | V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V                                               | -   | -     | ±100 | nA   |
| On Characteristics                 |                     |                                                                                          |     |       |      |      |
| Gate Threshold Voltage             | V <sub>GS(th)</sub> | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA                                 | 2.0 | 3.0   | 4.0  | V    |
| Drain-Source On-State Resistance   | R <sub>DS(ON)</sub> | V <sub>GS</sub> =10V, I <sub>D</sub> =115A                                               | -   | 2.15  | 2.6  | mΩ   |
| Forward Transconductance           | g <sub>FS</sub>     | V <sub>DS</sub> =5V, I <sub>D</sub> =115A                                                |     | 90    | -    | S    |
| Dynamic Characteristics            |                     |                                                                                          |     |       |      |      |
| Input Capacitance                  | C <sub>iss</sub>    | V <sub>DS</sub> =50V, V <sub>GS</sub> =0V,<br>F=1.0MHz                                   | -   | 17500 | -    | PF   |
| Output Capacitance                 | C <sub>oss</sub>    |                                                                                          | -   | 1100  | -    | PF   |
| Reverse Transfer Capacitance       | C <sub>rss</sub>    |                                                                                          | -   | 50    | -    | PF   |
| Switching Characteristics (Note 2) |                     |                                                                                          |     |       |      |      |
| Turn-on Delay Time                 | t <sub>d(on)</sub>  | V <sub>DD</sub> =50V, I <sub>D</sub> =115A<br>V <sub>GS</sub> =10V, R <sub>G</sub> =1.6Ω | -   | 34    | -    | nS   |
| Turn-on Rise Time                  | t <sub>r</sub>      |                                                                                          | -   | 27    | -    | nS   |
| Turn-Off Delay Time                | t <sub>d(off)</sub> |                                                                                          | -   | 78    | -    | nS   |
| Turn-Off Fall Time                 | t <sub>f</sub>      |                                                                                          | -   | 30    | -    | nS   |
| Total Gate Charge                  | Q <sub>g</sub>      | V <sub>DS</sub> =50V, I <sub>D</sub> =100A,<br>V <sub>GS</sub> =10V                      | -   | 240   | -    | nC   |
| Gate-Source Charge                 | Q <sub>gs</sub>     |                                                                                          | -   | 75    |      | nC   |
| Gate-Drain Charge                  | Q <sub>gd</sub>     |                                                                                          | -   | 60    |      | nC   |
| Drain-Source Diode Characteristics |                     |                                                                                          |     |       |      |      |
| Diode Forward Voltage              | V <sub>SD</sub>     | V <sub>GS</sub> =0V, I <sub>S</sub> =115A                                                | -   |       | 1.2  | V    |
| Diode Forward Current              | I <sub>S</sub>      |                                                                                          | -   | -     | 230  | A    |
| Reverse Recovery Time              | t <sub>rr</sub>     | T <sub>J</sub> = 25°C, I <sub>F</sub> = 115A                                             | -   | 101   | -    | nS   |
| Reverse Recovery Charge            | Q <sub>rr</sub>     | di/dt = 100A/μs                                                                          | -   | 280   | -    | nC   |

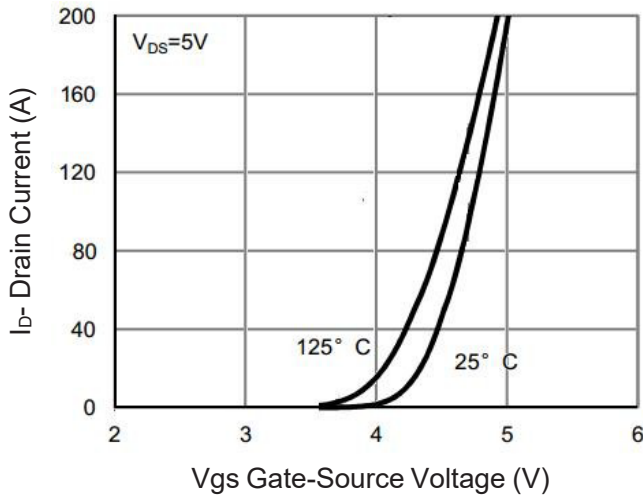
**Notes:**

1. EAS condition : T<sub>J</sub>=25°C, V<sub>DD</sub>=50V, V<sub>G</sub>=10V, L=0.5mH, R<sub>G</sub>=25Ω
2. Guaranteed by design, not subject to production
3. These curves are based on the junction-to-case thermal impedance which is measured with the device mounted to a large heatsink, assuming a maximum junction temperature of T<sub>J(MAX)</sub>=175° C. The SOA curve provides a single pulse rating.

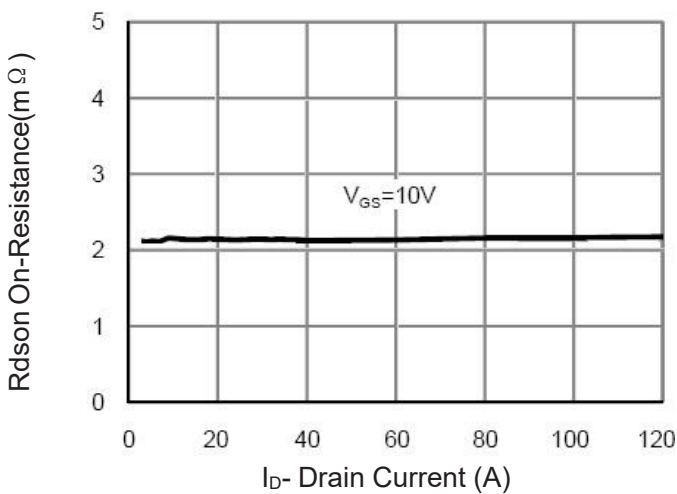
## Typical Electrical and Thermal Characteristics



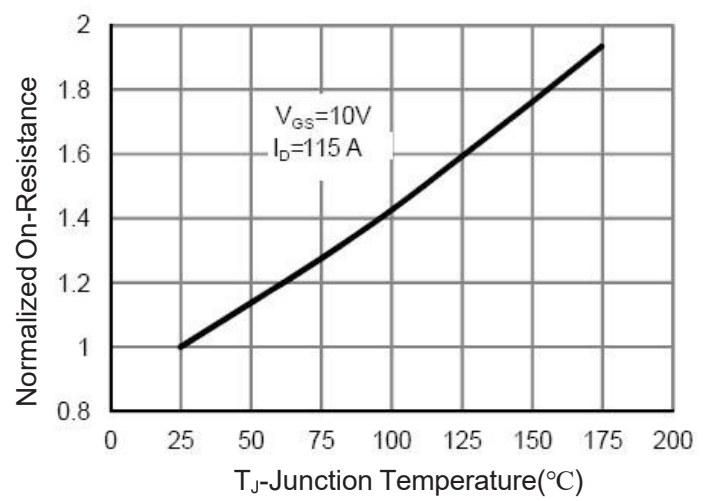
**Figure 1 Output Characteristics**



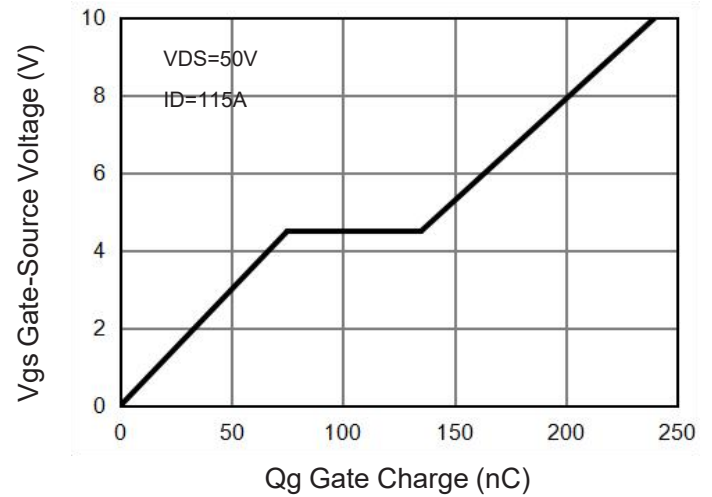
**Figure 2 Transfer Characteristics**



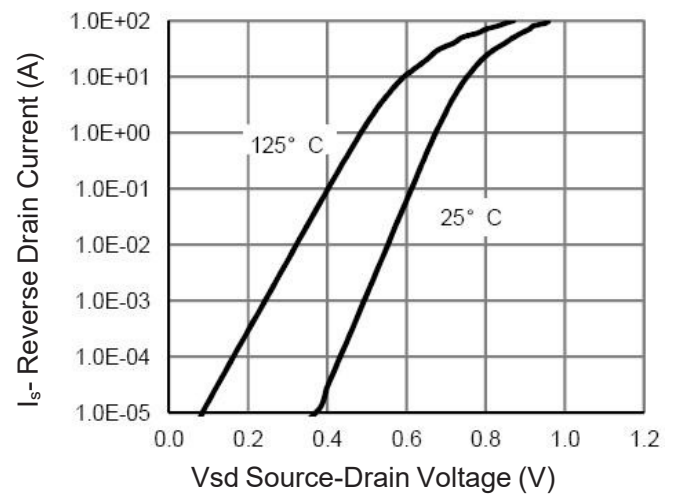
**Figure 3 Rdson- Drain Current**



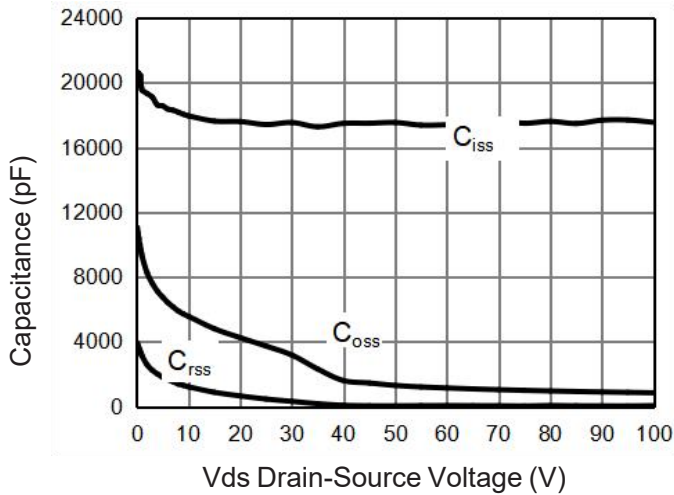
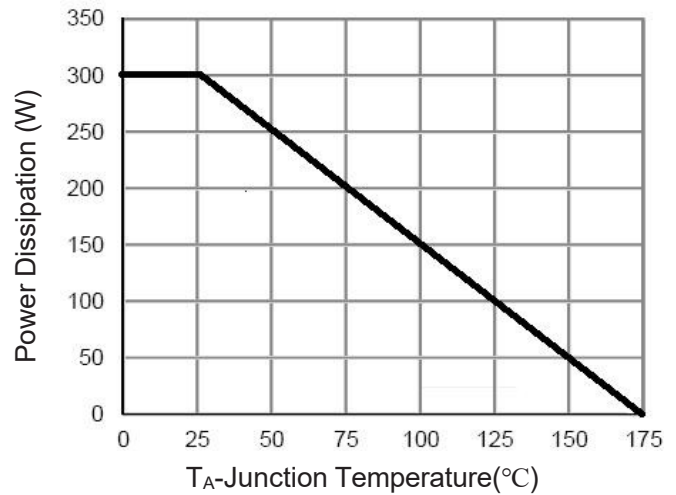
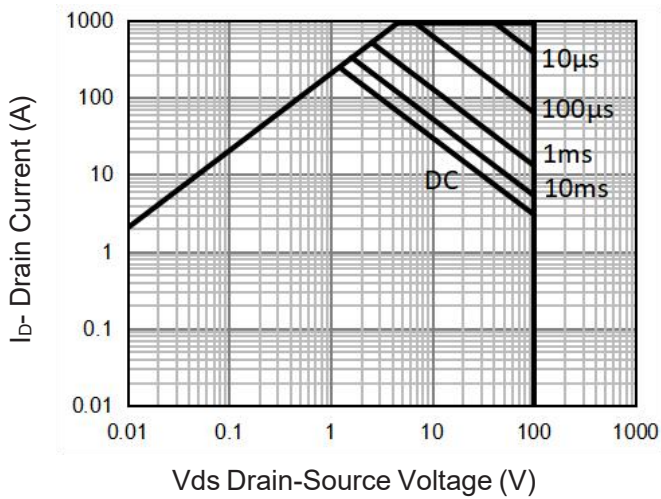
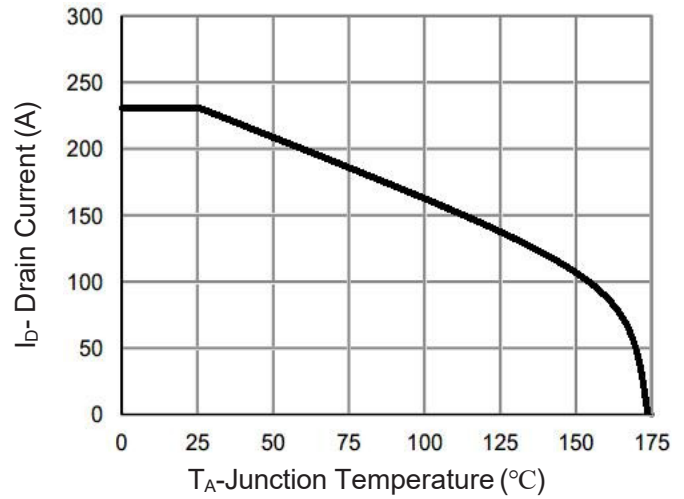
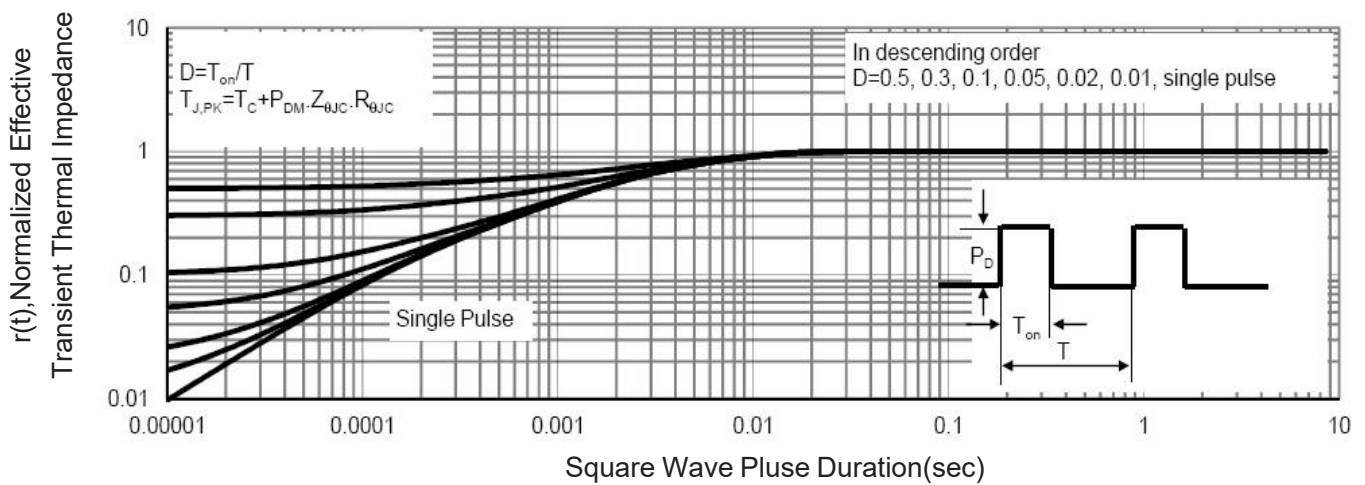
**Figure 4 Rdson-Junction Temperature**



**Figure 5 Gate Charge**



**Figure 6 Source- Drain Diode Forward**


**Figure 7 Capacitance vs Vds**

**Figure 9 Power De-rating**

**Figure 8 Safe Operation Area** (Note 3)

**Figure 10 Current De-rating**

**Figure 11 Normalized Maximum Transient Thermal Impedance**