

## Description

The VST10N090 uses **Super Trench** 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.

## General Features

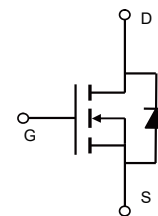
- $V_{DS}=100V, I_D=55A$   
 $R_{DS(ON)}=9.5m\Omega$  (typical) @  $V_{GS}=10V$   
 $R_{DS(ON)}=11.5m\Omega$  (typical) @  $V_{GS}=4.5V$
- Excellent gate charge x  $R_{DS(on)}$  product(FOM)
- Very low on-resistance  $R_{DS(on)}$
- 150 °C operating temperature
- Pb-free lead plating
- 100% UIS tested

## Application

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



DFN5x6



Schematic

## Package Marking and Ordering Information

| Device Marking | Device        | Device Package | Reel Size | Tape width | Quantity |
|----------------|---------------|----------------|-----------|------------|----------|
| VST10N090      | VST10N090-D56 | DFN5x6         | -         | -          | -        |

## 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 ( <b>Silicon Limited</b> ) | $I_D$               | 55         | A              |
| Drain Current-Continuous( $T_C=100^{\circ}C$ )      | $I_D(100^{\circ}C)$ | 38.9       | A              |
| Pulsed Drain Current ( <b>Package Limited</b> )     | $I_{DM}$            | 220        | A              |
| Maximum Power Dissipation                           | $P_D$               | 78         | W              |
| Derating factor                                     |                     | 0.62       | W/ $^{\circ}C$ |
| Single pulse avalanche energy <sup>(Note 5)</sup>   | $E_{AS}$            | 240        | mJ             |
| Operating Junction and Storage Temperature Range    | $T_J, T_{STG}$      | -55 To 150 | $^{\circ}C$    |

## Thermal Characteristic

|                                                          |                 |     |                      |
|----------------------------------------------------------|-----------------|-----|----------------------|
| Thermal Resistance, Junction-to-Case <sup>(Note 2)</sup> | $R_{\theta JC}$ | 1.6 | $^{\circ}\text{C/W}$ |
|----------------------------------------------------------|-----------------|-----|----------------------|

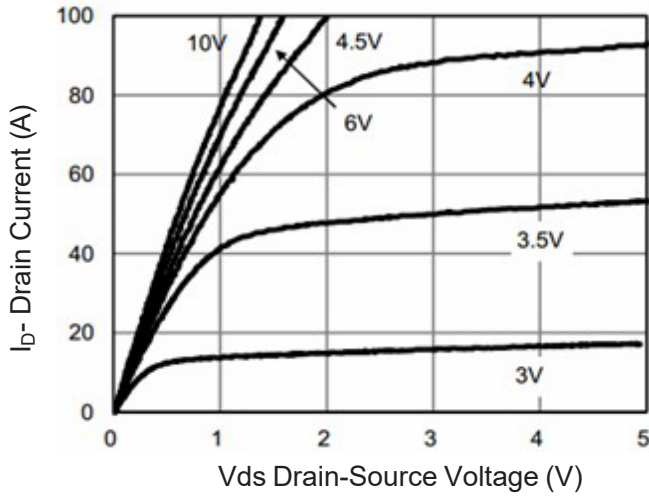
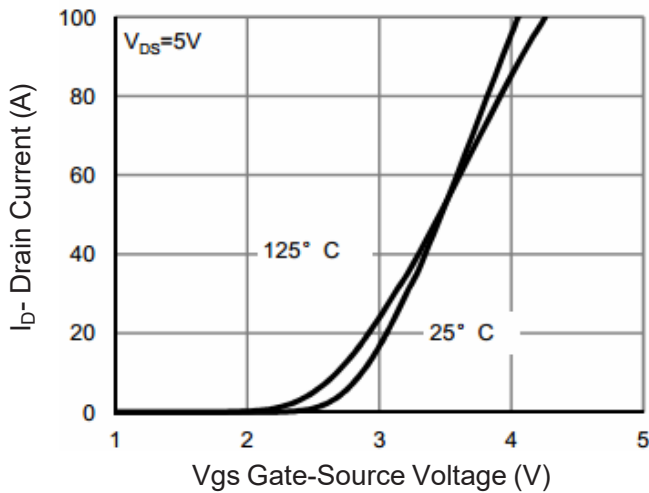
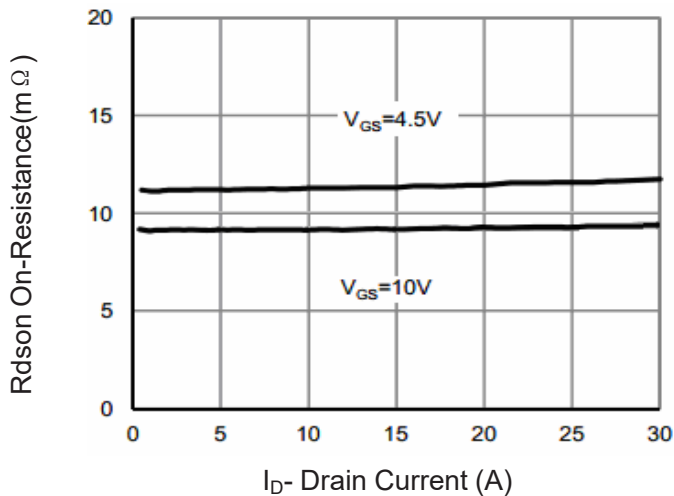
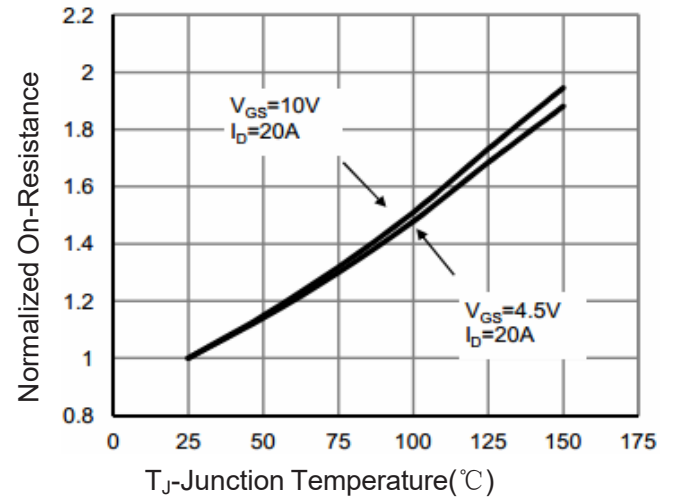
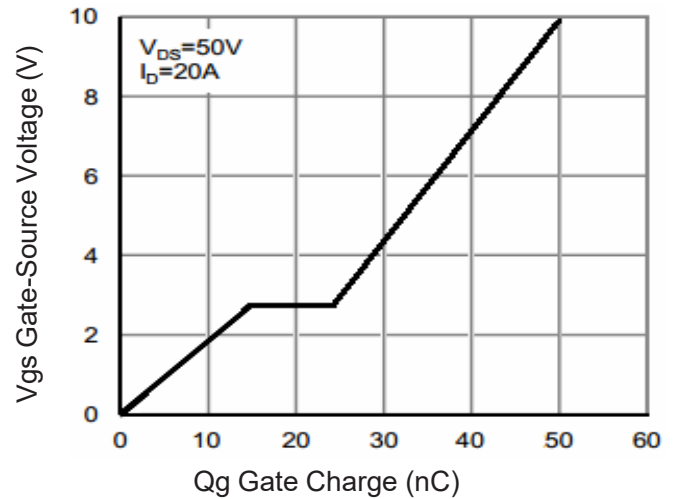
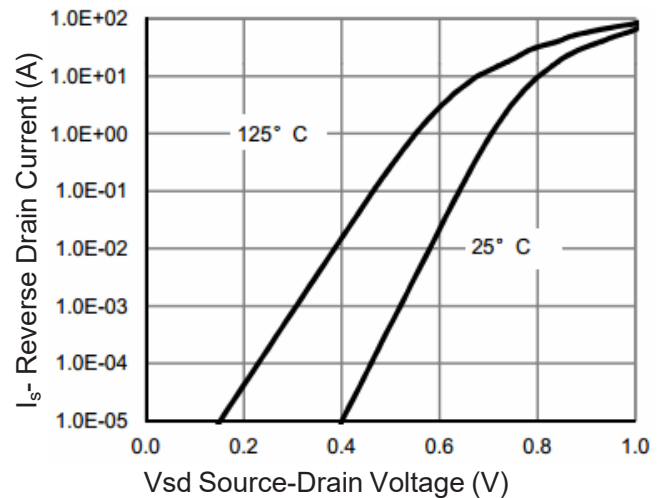
## Electrical Characteristics ( $T_C=25^{\circ}\text{C}$ unless otherwise noted)

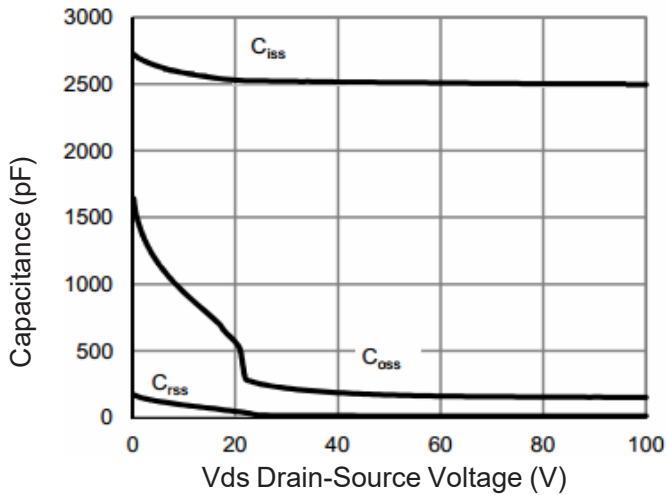
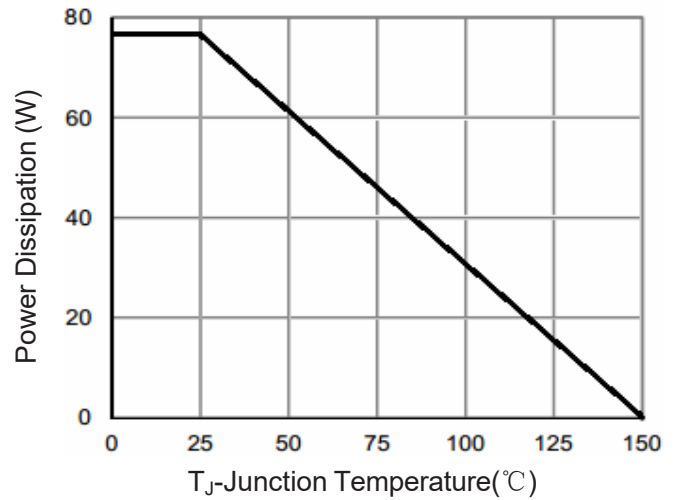
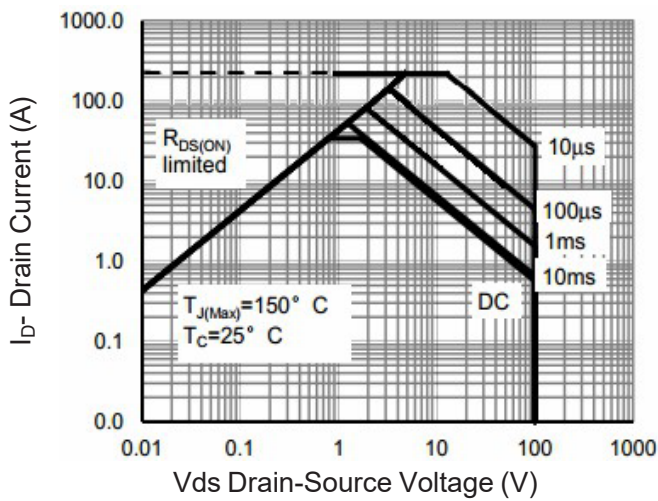
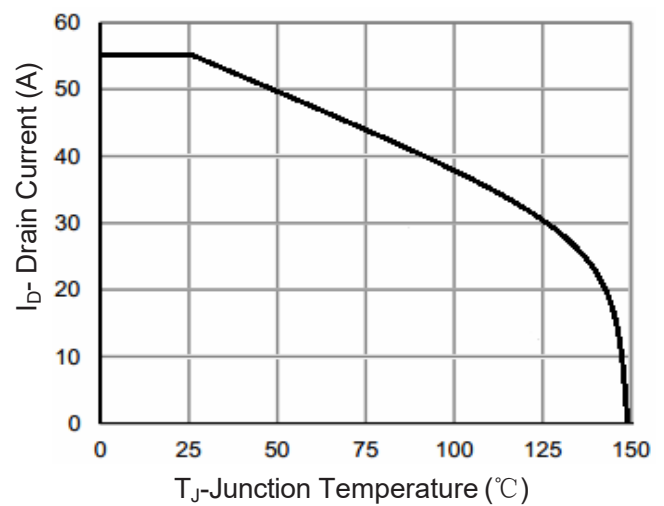
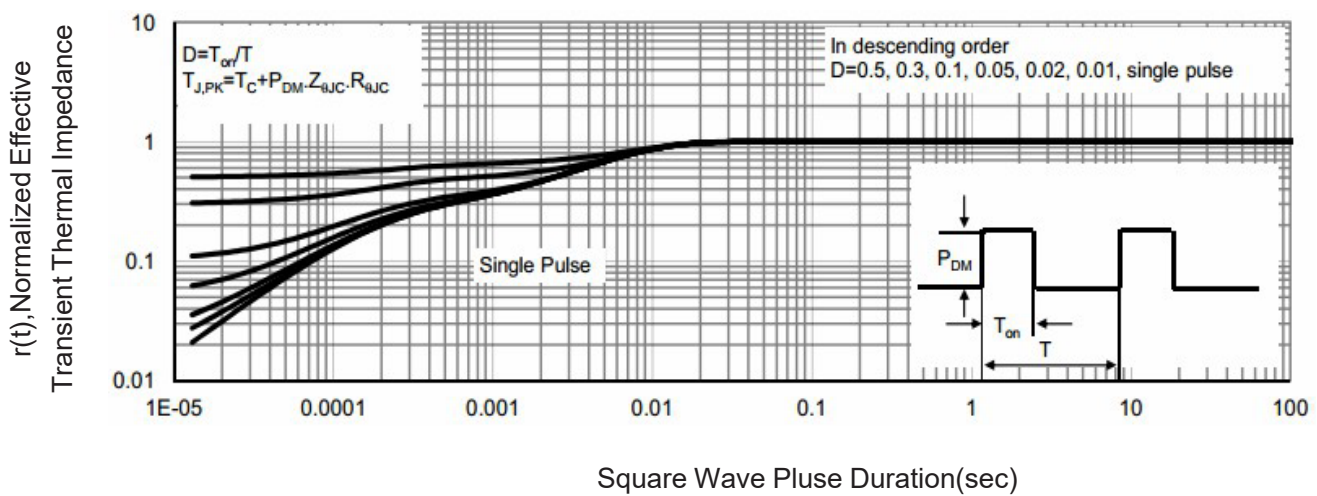
| Parameter                          | Symbol              | Condition                                                                             | Min | Typ  | Max  | Unit |
|------------------------------------|---------------------|---------------------------------------------------------------------------------------|-----|------|------|------|
| 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 (Note 3)        |                     |                                                                                       |     |      |      |      |
| Gate Threshold Voltage             | V <sub>GS(th)</sub> | V <sub>DS</sub> =V <sub>GS</sub> ,I <sub>D</sub> =250μA                               | 1.3 | 1.8  | 2.3  | V    |
| Drain-Source On-State Resistance   | R <sub>DS(ON)</sub> | V <sub>GS</sub> =10V, I <sub>D</sub> =20A                                             | -   | 9.5  | 12   | mΩ   |
|                                    |                     | V <sub>GS</sub> =4.5V, I <sub>D</sub> =20A                                            | -   | 11.5 | 15   | mΩ   |
| Forward Transconductance           | g <sub>FS</sub>     | V <sub>DS</sub> =5V,I <sub>D</sub> =20A                                               | -   | 60   | -    | S    |
| Dynamic Characteristics (Note4)    |                     |                                                                                       |     |      |      |      |
| Input Capacitance                  | C <sub>ISS</sub>    | V <sub>DS</sub> =50V,V <sub>GS</sub> =0V,<br>F=1.0MHz                                 | -   | 2500 | -    | PF   |
| Output Capacitance                 | C <sub>OSS</sub>    |                                                                                       | -   | 170  | -    | PF   |
| Reverse Transfer Capacitance       | C <sub>RSS</sub>    |                                                                                       | -   | 11   | -    | PF   |
| Switching Characteristics (Note 4) |                     |                                                                                       |     |      |      |      |
| Turn-on Delay Time                 | t <sub>d(on)</sub>  | V <sub>DD</sub> =50V,I <sub>D</sub> =20A<br>V <sub>GS</sub> =10V,R <sub>G</sub> =1.6Ω | -   | 8    | -    | nS   |
| Turn-on Rise Time                  | t <sub>r</sub>      |                                                                                       | -   | 3    | -    | nS   |
| Turn-Off Delay Time                | t <sub>d(off)</sub> |                                                                                       | -   | 25   | -    | nS   |
| Turn-Off Fall Time                 | t <sub>f</sub>      |                                                                                       | -   | 4    | -    | nS   |
| Total Gate Charge                  | Q <sub>g</sub>      | V <sub>DS</sub> =50V,I <sub>D</sub> =20A,<br>V <sub>GS</sub> =10V                     | -   | 50   | -    | nC   |
| Gate-Source Charge                 | Q <sub>gs</sub>     |                                                                                       | -   | 15   |      | nC   |
| Gate-Drain Charge                  | Q <sub>gd</sub>     |                                                                                       | -   | 8.9  |      | nC   |
| Drain-Source Diode Characteristics |                     |                                                                                       |     |      |      |      |
| Diode Forward Voltage (Note 3)     | V <sub>SD</sub>     | V <sub>GS</sub> =0V,I <sub>S</sub> =55A                                               | -   |      | 1.2  | V    |
| Diode Forward Current (Note 2)     | I <sub>S</sub>      |                                                                                       | -   | -    | 55   | A    |
| Reverse Recovery Time              | t <sub>rr</sub>     | T <sub>J</sub> = 25°C, I <sub>F</sub> = 20A                                           | -   |      | 28   | nS   |
| Reverse Recovery Charge            | Q <sub>rr</sub>     | di/dt = 500A/μs(Note3)                                                                | -   |      | 128  | nC   |

## Notes:

1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board,  $t \leq 10$  sec.
3. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ .
4. Guaranteed by design, not subject to production
5. EAS condition :  $T_J=25^{\circ}\text{C}, V_{DD}=20V, V_G=10V, L=0.5\text{mH}, R_g=25\Omega$

## 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**

**Figure 10 Current De-rating**

**Figure 11 Normalized Maximum Transient Thermal Impedance**