

## Description

The VST06N090 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.

## Application

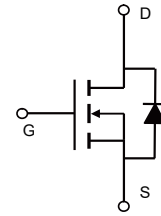
- DC/DC Converter
- Ideal for high-frequency switching and synchronous rectification

## General Features

- $V_{DS}=60V, I_D=35A$   
 $R_{DS(ON)}=9.8m\Omega$  (typical) @  $V_{GS}=10V$   
 $R_{DS(ON)}=12.5m\Omega$  (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



DFN5x6



Schematic

## Package Marking and Ordering Information

| Device Marking | Device        | Device Package | Reel Size | Tape width | Quantity |
|----------------|---------------|----------------|-----------|------------|----------|
| VST06N090      | VST06N090-D56 | DFN5x6         | -         | -          | -        |

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

| Parameter                                        | Symbol              | Limit      | Unit           |
|--------------------------------------------------|---------------------|------------|----------------|
| Drain-Source Voltage                             | $V_{DS}$            | 60         | V              |
| Gate-Source Voltage                              | $V_{GS}$            | $\pm 20$   | V              |
| Drain Current-Continuous                         | $I_D$               | 35         | A              |
| Drain Current-Continuous( $T_C=100^{\circ}C$ )   | $I_D(100^{\circ}C)$ | 27         | A              |
| Pulsed Drain Current                             | $I_{DM}$            | 160        | A              |
| Maximum Power Dissipation                        | $P_D$               | 43         | W              |
| Derating factor                                  |                     | 0.34       | W/ $^{\circ}C$ |
| Single pulse avalanche energy (Note 5)           | $E_{AS}$            | 96         | mJ             |
| Operating Junction and Storage Temperature Range | $T_J, T_{STG}$      | -55 To 150 | $^{\circ}C$    |

## Thermal Characteristic

|                                               |                 |     |               |
|-----------------------------------------------|-----------------|-----|---------------|
| Thermal Resistance, Junction-to-Case (Note 2) | $R_{\theta JC}$ | 2.9 | $^{\circ}C/W$ |
|-----------------------------------------------|-----------------|-----|---------------|

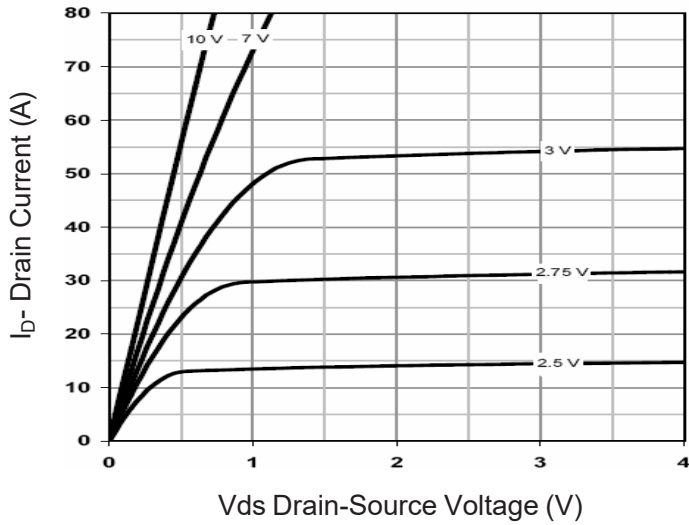
**Electrical Characteristics ( $T_C=25^{\circ}\text{C}$  unless otherwise noted)**

| 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                                               | 60  |      | -    | V    |
| Zero Gate Voltage Drain Current    | I <sub>DSS</sub>    | V <sub>DS</sub> =60V, 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                                | 1.2 | 1.7  | 2.4  | V    |
| Drain-Source On-State Resistance   | R <sub>DS(ON)</sub> | V <sub>GS</sub> =10V, I <sub>D</sub> =20A                                               | -   | 9.8  | 11   | mΩ   |
|                                    |                     | V <sub>GS</sub> =4.5V, I <sub>D</sub> =20A                                              | -   | 12.5 | 14.5 |      |
| 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> =30V, V <sub>GS</sub> =0V,<br>F=1.0MHz                                  | -   | 1040 | -    | PF   |
| Output Capacitance                 | C <sub>oss</sub>    |                                                                                         | -   | 156  | -    | PF   |
| Reverse Transfer Capacitance       | C <sub>rss</sub>    |                                                                                         | -   | 14   | -    | PF   |
| Switching Characteristics (Note 4) |                     |                                                                                         |     |      |      |      |
| Turn-on Delay Time                 | t <sub>d(on)</sub>  | V <sub>DD</sub> =30V, I <sub>D</sub> =20A<br>V <sub>GS</sub> =10V, R <sub>G</sub> =1.6Ω | -   | 4.3  | -    | nS   |
| Turn-on Rise Time                  | t <sub>r</sub>      |                                                                                         | -   | 2.7  | -    | nS   |
| Turn-Off Delay Time                | t <sub>d(off)</sub> |                                                                                         | -   | 13.8 | -    | nS   |
| Turn-Off Fall Time                 | t <sub>f</sub>      |                                                                                         | -   | 2.7  | -    | nS   |
| Total Gate Charge                  | Q <sub>g</sub>      | V <sub>DS</sub> =30V, I <sub>D</sub> =20A,<br>V <sub>GS</sub> =10V                      | -   | 22.6 | -    | nC   |
| Gate-Source Charge                 | Q <sub>gs</sub>     |                                                                                         | -   | 4.7  |      | nC   |
| Gate-Drain Charge                  | Q <sub>gd</sub>     |                                                                                         | -   | 3.7  |      | nC   |
| Drain-Source Diode Characteristics |                     |                                                                                         |     |      |      |      |
| Diode Forward Voltage (Note 3)     | V <sub>SD</sub>     | V <sub>GS</sub> =0V, I <sub>S</sub> =20A                                                | -   |      | 1.2  | V    |
| Diode Forward Current (Note 2)     | I <sub>S</sub>      |                                                                                         | -   | -    | 35   | A    |
| Reverse Recovery Time              | t <sub>rr</sub>     | T <sub>J</sub> = 25°C, I <sub>F</sub> =20A<br>di/dt = 100A/μs(Note3)                    | -   | 18   | -    | nS   |
| Reverse Recovery Charge            | Q <sub>rr</sub>     |                                                                                         | -   | 12   | -    | nC   |

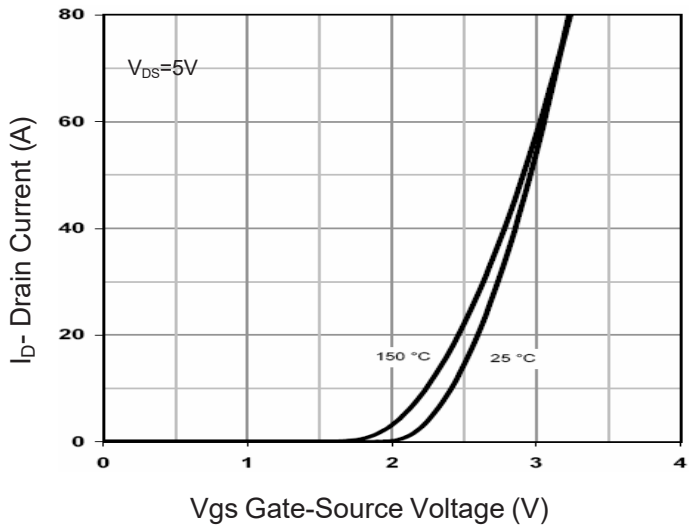
**Notes:**

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 :  $T_J=25^{\circ}\text{C}, V_{DD}=30V, V_G=10V, L=0.5mH, R_g=25\Omega$
6. The spike duty cycle 5% max, limited by junction temperature  $T_J(\text{MAX})=125^{\circ}\text{C}$ .

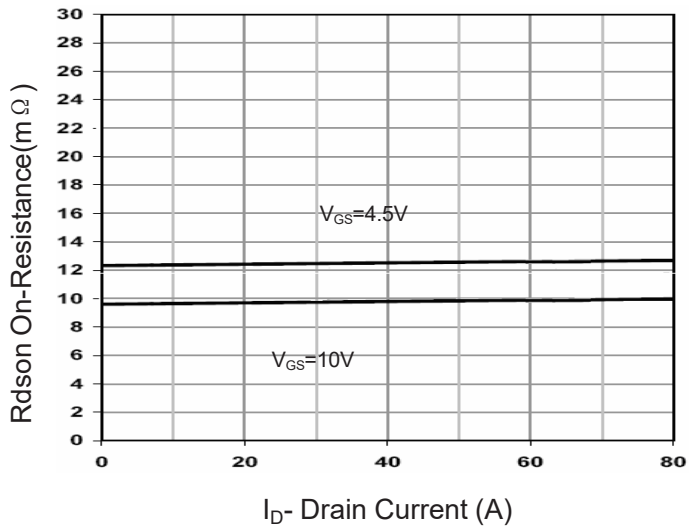
## Typical Electrical and Thermal Characteristics



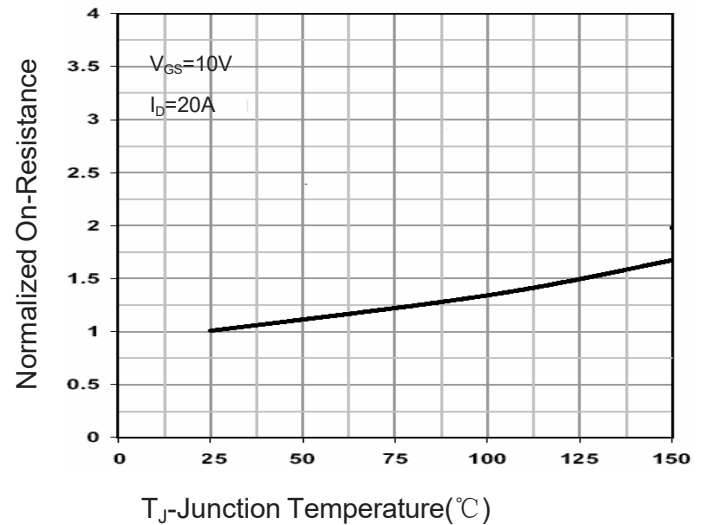
**Figure 1 Output Characteristics**



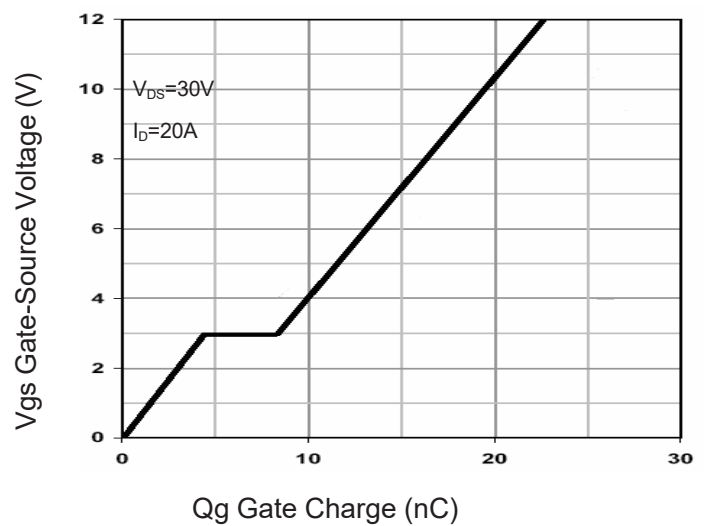
**Figure 2 Transfer Characteristics**



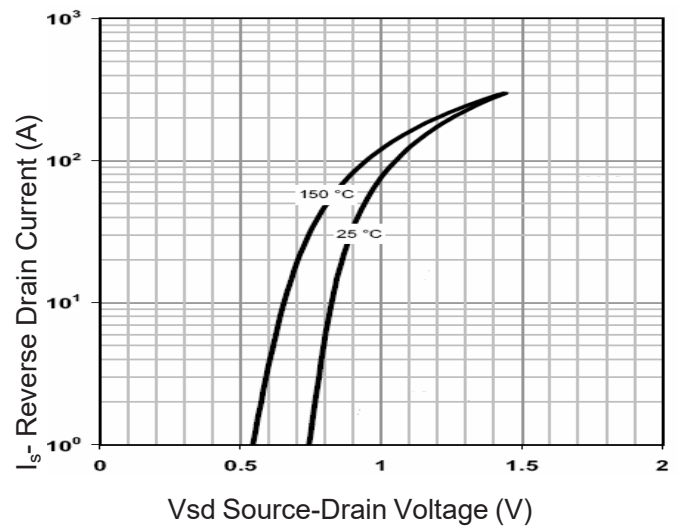
**Figure 3 Rdson- Drain Current**



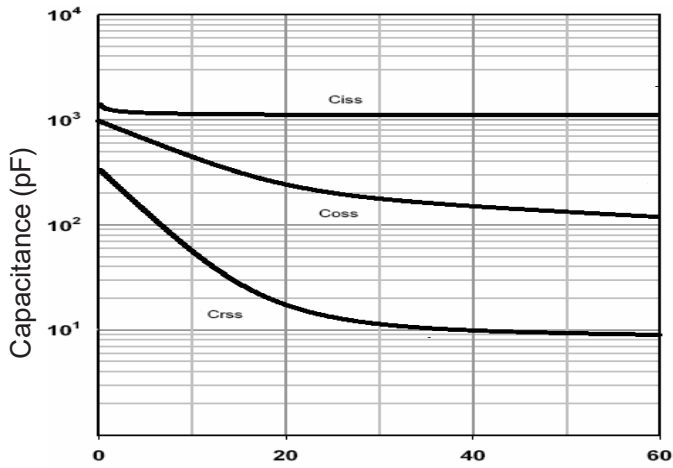
**Figure 4 Rdson-Junction Temperature**



**Figure 5 Gate Charge**

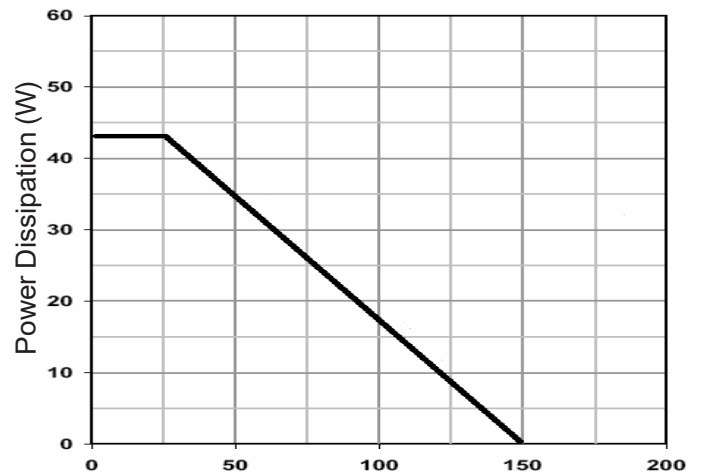


**Figure 6 Source- Drain Diode Forward**



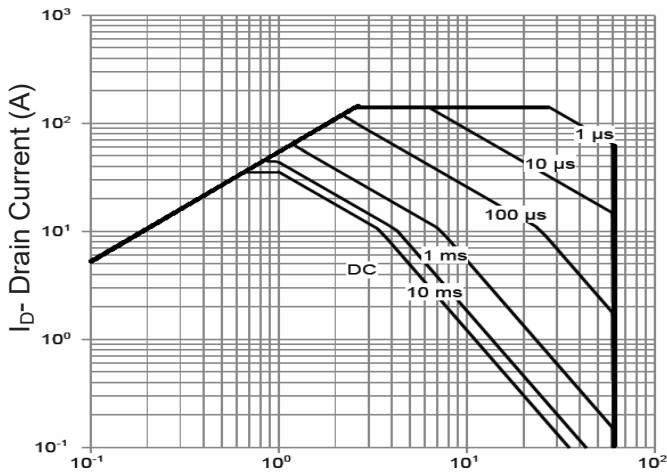
Vds Drain-Source Voltage (V)

**Figure 7 Capacitance vs Vds**



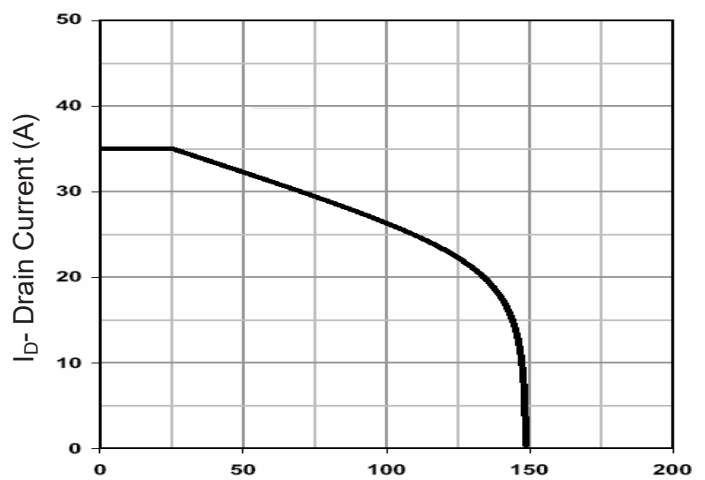
T<sub>J</sub>-Junction Temperature(°C)

**Figure 9 Power De-rating**



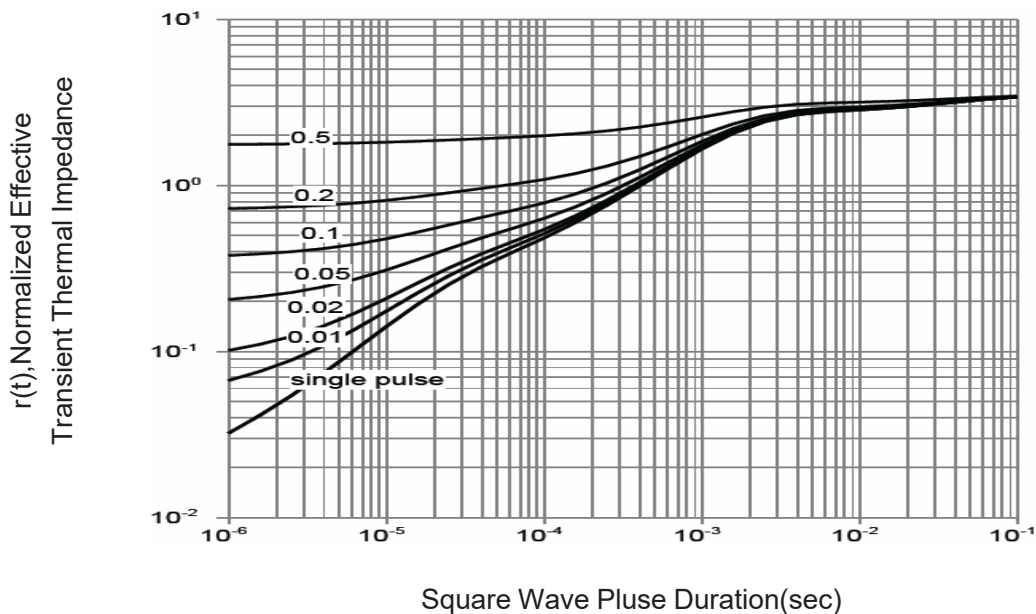
Vds Drain-Source Voltage (V)

**Figure 8 Safe Operation Area**



T<sub>J</sub>-Junction Temperature (°C)

**Figure 10 Current De-ratin**



Square Wave Pluse Duration(sec)

**Figure 11 Normalized Maximum Transient Thermal Impedance**