

## Description

The VST10N070 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

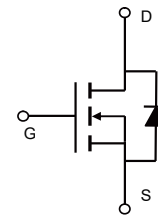
- $V_{DS}=100V, I_D=78A$   
 $R_{DS(ON)} < 8.5m\Omega @ V_{GS}=10V$
- Excellent gate charge x  $R_{DS(on)}$  product(FOM)
- Very low on-resistance  $R_{DS(on)}$
- 175 °C operating temperature
- Pb-free lead plating
- 100% UIS tested

## Application

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



TO-263



Schematic

## Package Marking and Ordering Information

| Device Marking | Device       | Device Package | Reel Size | Tape width | Quantity |
|----------------|--------------|----------------|-----------|------------|----------|
| VST10N070      | VST10N070-T3 | TO-263         | -         | -          | -        |

## 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                         | $I_D$               | 78         | A              |
| Drain Current-Continuous( $T_C=100^{\circ}C$ )   | $I_D(100^{\circ}C)$ | 60         | A              |
| Pulsed Drain Current                             | $I_{DM}$            | 320        | A              |
| Maximum Power Dissipation                        | $P_D$               | 125        | W              |
| Derating factor                                  |                     | 0.83       | W/ $^{\circ}C$ |
| Single pulse avalanche energy (Note 5)           | $E_{AS}$            | 210        | mJ             |
| Operating Junction and Storage Temperature Range | $T_J, T_{STG}$      | -55 To 175 | $^{\circ}C$    |

## Thermal Characteristic

|                                                          |                 |     |                      |
|----------------------------------------------------------|-----------------|-----|----------------------|
| Thermal Resistance, Junction-to-Case <sup>(Note 2)</sup> | $R_{\theta JC}$ | 1.2 | $^{\circ}\text{C/W}$ |
|----------------------------------------------------------|-----------------|-----|----------------------|

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

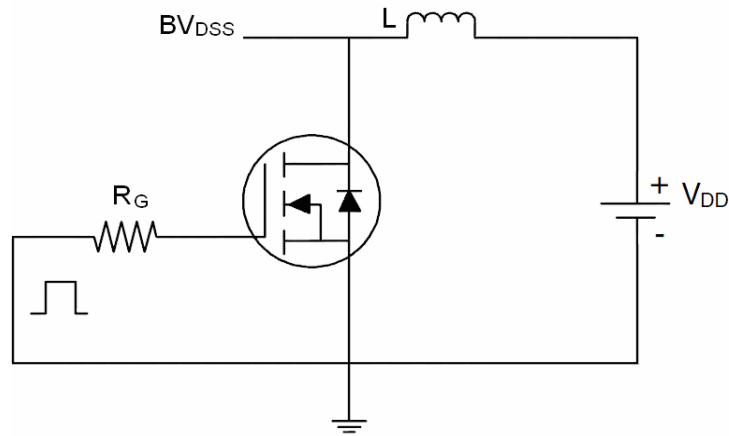
| Parameter                          | Symbol              | Condition                                                                                    | Min | Typ  | Max  | Unit |
|------------------------------------|---------------------|----------------------------------------------------------------------------------------------|-----|------|------|------|
| 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                                     | 2.5 | 3.5  | 4.5  | V    |
| Drain-Source On-State Resistance   | R <sub>DS(ON)</sub> | V <sub>GS</sub> =10V, I <sub>D</sub> =39A                                                    | -   | 7.2  | 8.5  | mΩ   |
| Forward Transconductance           | g <sub>FS</sub>     | V <sub>DS</sub> =10V, I <sub>D</sub> =39A                                                    | 40  | -    | -    | S    |
| Dynamic Characteristics (Note4)    |                     |                                                                                              |     |      |      |      |
| Input Capacitance                  | C <sub>iss</sub>    | V <sub>DS</sub> =50V, V <sub>GS</sub> =0V,<br>F=1.0MHz                                       | -   | 3500 | -    | PF   |
| Output Capacitance                 | C <sub>oss</sub>    |                                                                                              | -   | 600  | -    | PF   |
| Reverse Transfer Capacitance       | C <sub>rss</sub>    |                                                                                              | -   | 29   | -    | PF   |
| Switching Characteristics (Note 4) |                     |                                                                                              |     |      |      |      |
| Turn-on Delay Time                 | t <sub>d(on)</sub>  | V <sub>DD</sub> =50V, I <sub>D</sub> =39A<br>V <sub>GS</sub> =10V, R <sub>G</sub> =4.7Ω      | -   | 12   | -    | nS   |
| Turn-on Rise Time                  | t <sub>r</sub>      |                                                                                              | -   | 45   | -    | nS   |
| Turn-Off Delay Time                | t <sub>d(off)</sub> |                                                                                              | -   | 31   | -    | nS   |
| Turn-Off Fall Time                 | t <sub>f</sub>      |                                                                                              | -   | 10   | -    | nS   |
| Total Gate Charge                  | Q <sub>g</sub>      | V <sub>DS</sub> =50V, I <sub>D</sub> =39A,<br>V <sub>GS</sub> =10V                           | -   | 48   |      | nC   |
| Gate-Source Charge                 | Q <sub>gs</sub>     |                                                                                              | -   | 15   |      | nC   |
| Gate-Drain Charge                  | Q <sub>gd</sub>     |                                                                                              | -   | 8    |      | nC   |
| Drain-Source Diode Characteristics |                     |                                                                                              |     |      |      |      |
| Diode Forward Voltage (Note 3)     | V <sub>SD</sub>     | V <sub>GS</sub> =0V, I <sub>S</sub> =78A                                                     | -   |      | 1.2  | V    |
| Diode Forward Current (Note 2)     | I <sub>S</sub>      |                                                                                              | -   | -    | 78   | A    |
| Reverse Recovery Time              | t <sub>rr</sub>     | T <sub>J</sub> = 25°C, I <sub>F</sub> = I <sub>S</sub><br>di/dt = 100A/μs <sup>(Note3)</sup> | -   | 95   |      | nS   |
| Reverse Recovery Charge            | Q <sub>rr</sub>     |                                                                                              | -   | 110  |      | nC   |

## Notes:

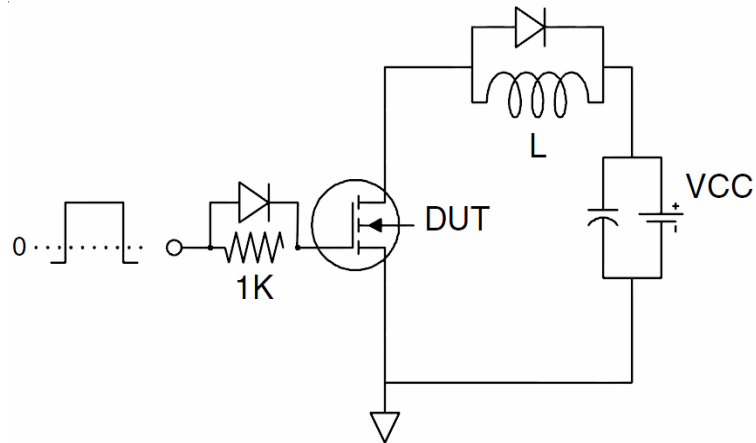
1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board,  $t \leq 10$  sec.
3. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ .
4. Guaranteed by design, not subject to production
5. EAS condition :  $T_J=25^{\circ}\text{C}, V_{DD}=50V, V_G=10V, L=0.5\text{mH}, R_g=25\Omega$

## Test Circuit

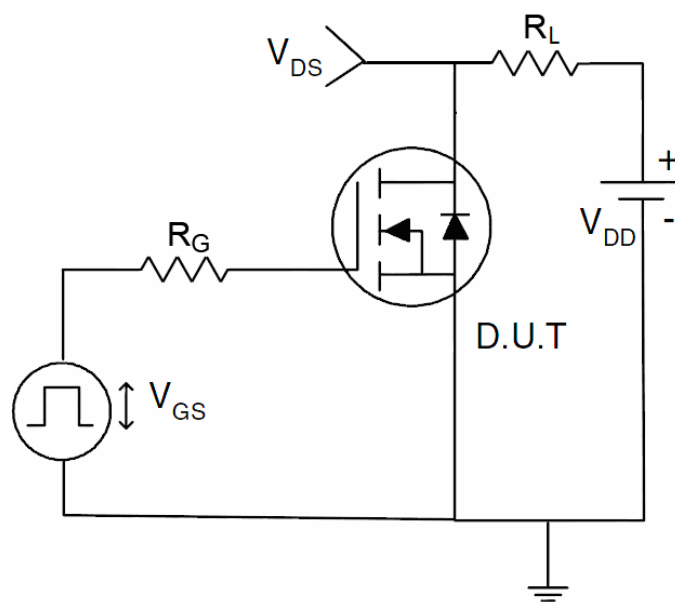
### 1) $E_{AS}$ test Circuit



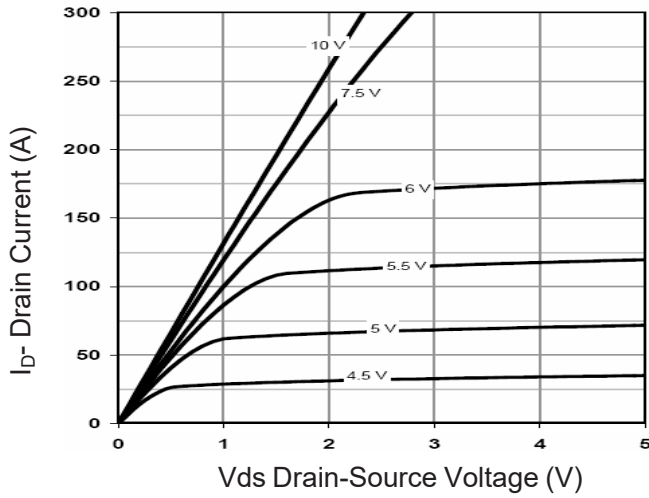
### 2) Gate charge test Circuit



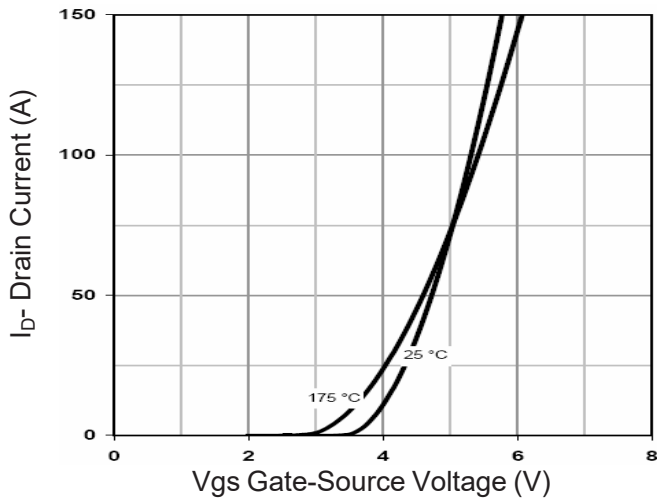
### 3) Switch Time Test Circuit



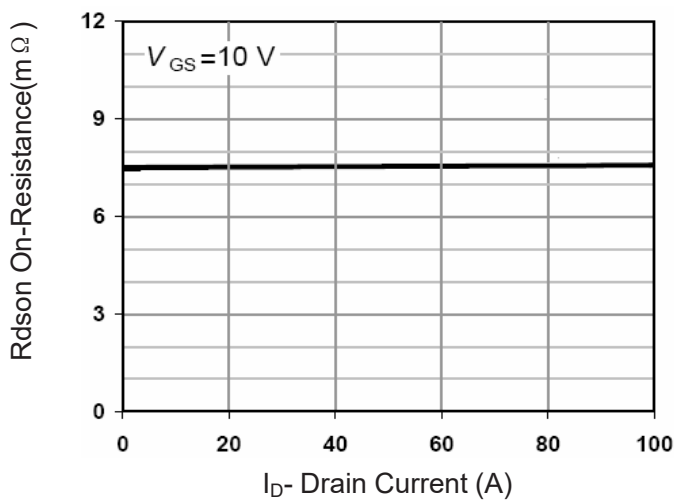
## Typical Electrical and Thermal Characteristics



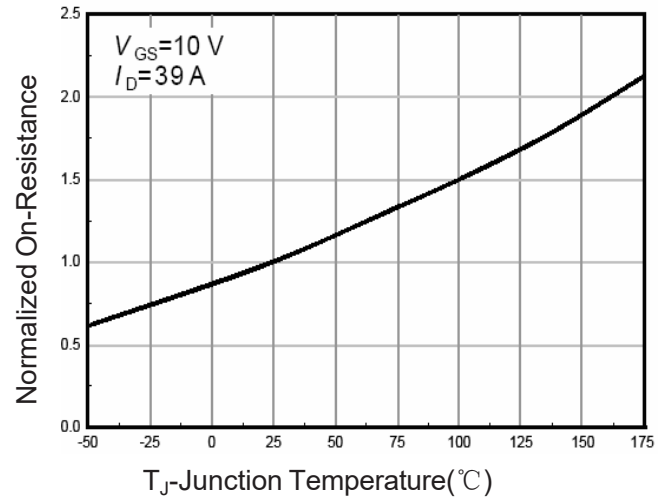
**Figure 1 Output Characteristics**



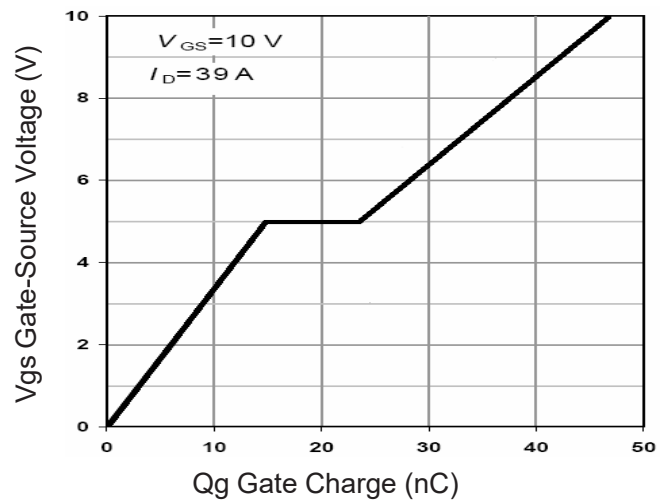
**Figure 2 Transfer Characteristics**



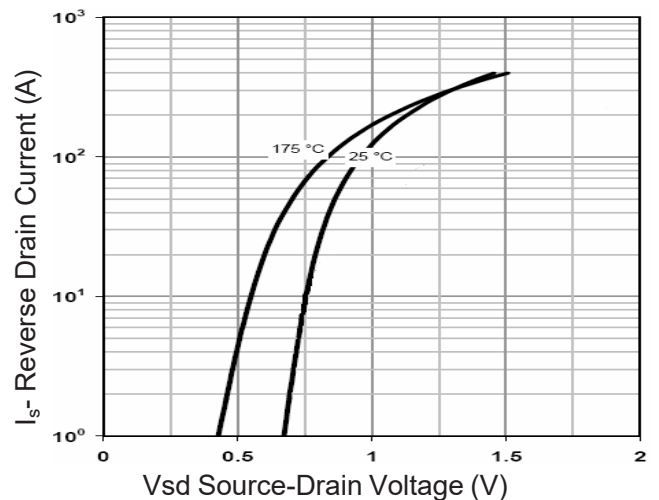
**Figure 3 Rdson- Drain Current**



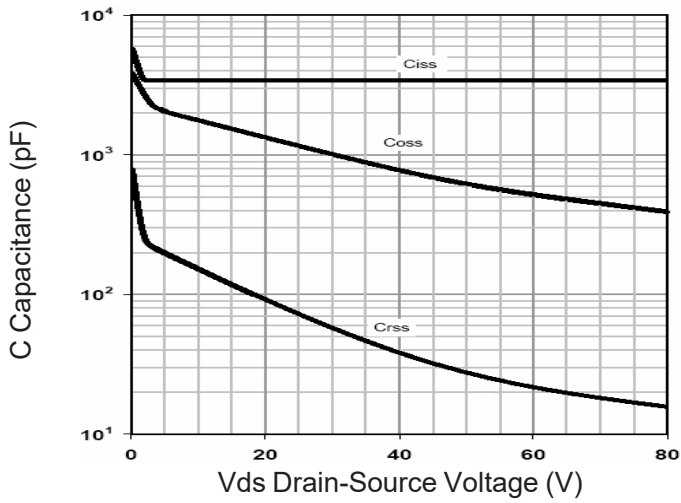
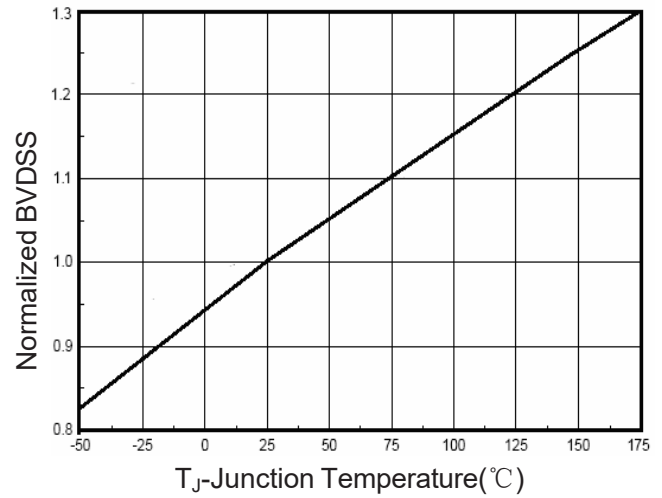
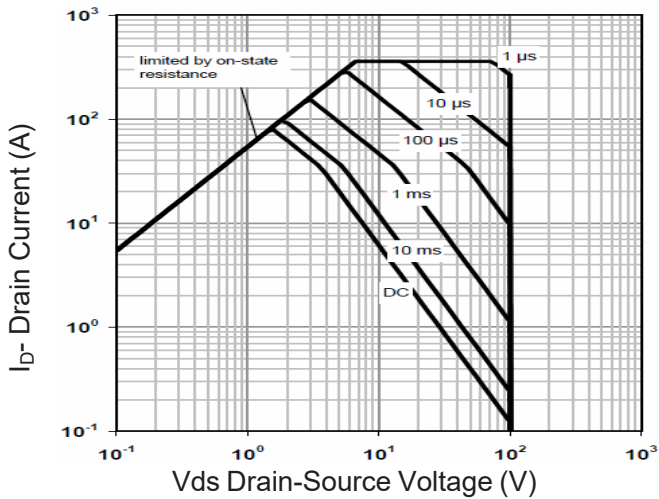
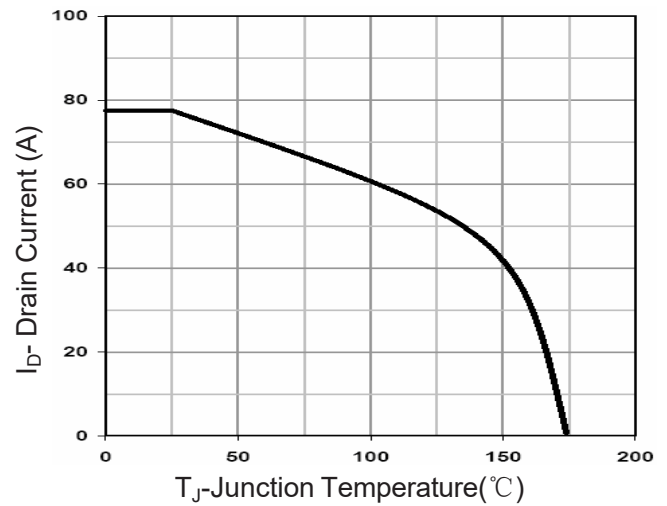
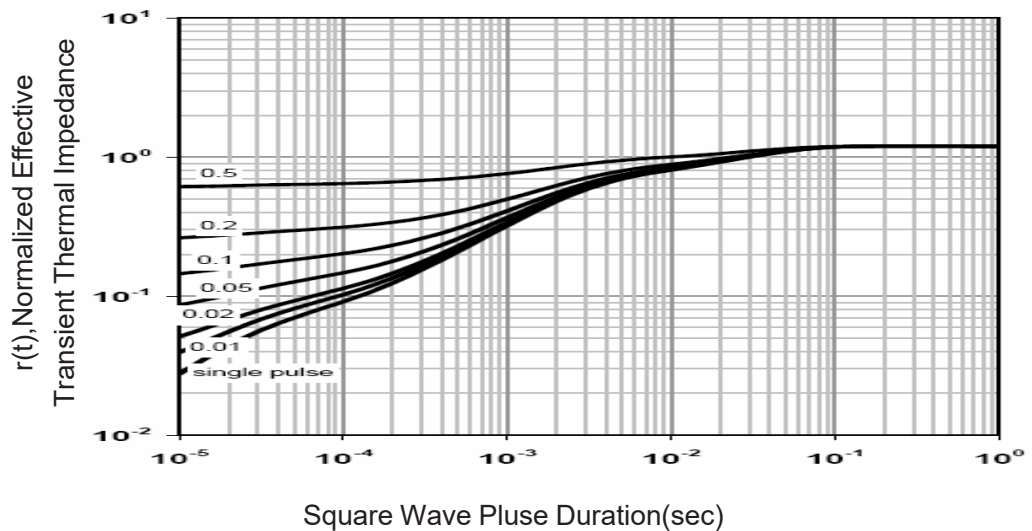
**Figure 4 Rdson-Junction Temperature**



**Figure 5 Gate Charge**



**Figure 6 Source- Drain Diode Forward**


**Figure 7 Capacitance vs Vds**

**Figure 9  $BV_{DSS}$  vs Junction Temperature**

**Figure 8 Safe Operation Area**

**Figure 10 Current De-rating**

**Figure 11 Normalized Maximum Transient Thermal Impedance**