## Description

The VST04N016 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.

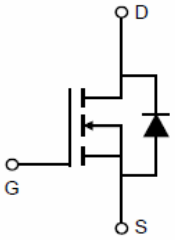
## General Features

- $V_{DS}$ =40V,$I_D$ =150A
  $R_{DS(ON)}$=1.6mΩ (typical) @ $V_{GS}$=10V
  $R_{DS(ON)}$=1.9mΩ (typical) @ $V_{GS}$=4.5V
- 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-220C




Schematic Diagram

## Package Marking and Ordering Information

| Device Marking | Device | Device Package | Reel Size | Tape width | Quantity |
|---|---|---|---|---|---|
| VST04N016-TC | VST04N016 | TO-220C | - | - | - |

## Absolute Maximum Ratings ($T_C$=25℃unless otherwise noted)

| Parameter | Symbol | Limit | Unit |
|---|---|---|---|
| Drain-Source Voltage | $V_{DS}$ | 40 | V |
| Gate-Source Voltage | $V_{GS}$ | ±20 | V |
| Drain Current-Continuous **(Silicon Limited)** | $I_D$ | 150 | A |
| Drain Current-Continuous($T_C$=100℃) | $I_D$ (100℃) | 106 | A |
| Pulsed Drain Current **(Package Limited)** | $I_{DM}$ | 400 | A |
| Maximum Power Dissipation | $P_D$ | 210 | W |
| Derating factor | | 1.4 | W/℃ |
| Single pulse avalanche energy (Note 5) | $E_{AS}$ | 720 | mJ |
| Operating Junction and Storage Temperature Range | $T_J$,$T_{STG}$ | -55 To 175 | ℃ |

## Thermal Characteristic

| | | | |
|---|---|---|---|
| Thermal Resistance,Junction-to-Case (Note 2) | $R_{\theta JC}$ | 0.71 | ℃/W |

## Electrical Characteristics ($T_C$=25℃unless otherwise noted)

| Parameter | Symbol | Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **Off Characteristics** | | | | | | |
| Drain-Source Breakdown Voltage | $BV_{DSS}$ | $V_{GS}$=0V $I_D$=250μA | 40 | | - | V |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$=40V,$V_{GS}$=0V | - | - | 1 | μA |
| Gate-Body Leakage Current | $I_{GSS}$ | $V_{GS}$=±20V,$V_{DS}$=0V | - | - | ±100 | nA |
| **On Characteristics** (Note 3) | | | | | | |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{DS}$=$V_{GS}$,$I_D$=250μA | 1.2 | 1.5 | 2.2 | V |
| Drain-Source On-State Resistance | $R_{DS(ON)}$ | $V_{GS}$=10V, $I_D$=75A | - | 1.6 | 1.8 | mΩ |
| | | $V_{GS}$=4.5V, $I_D$=75A | - | 1.9 | 2.3 | mΩ |
| Forward Transconductance | $g_{FS}$ | $V_{DS}$=5V,$I_D$=75A | | 80 | - | S |
| **Dynamic Characteristics** (Note4) | | | | | | |
| Input Capacitance | $C_{lss}$ | $V_{DS}$=20V,$V_{GS}$=0V, F=1.0MHz | - | 6000 | 7150 | PF |
| Output Capacitance | $C_{oss}$ | | - | 1450 | 1700 | PF |
| Reverse Transfer Capacitance | $C_{rss}$ | | - | 100 | 145 | PF |
| **Switching Characteristics** (Note 4) | | | | | | |
| Turn-on Delay Time | $t_{d(on)}$ | $V_{DD}$=20V,$I_D$=75A $V_{GS}$=10V,$R_G$=1.6Ω | - | 12.5 | - | nS |
| Turn-on Rise Time | $t_r$ | | - | 7.0 | - | nS |
| Turn-Off Delay Time | $t_{d(off)}$ | | - | 50 | - | nS |
| Turn-Off Fall Time | $t_f$ | | - | 8.5 | - | nS |
| Total Gate Charge | $Q_g$ | $V_{DS}$=20V,$I_D$=75A, $V_{GS}$=10V | - | 95 | 115 | nC |
| Gate-Source Charge | $Q_{gs}$ | | - | 15 | | nC |
| Gate-Drain Charge | $Q_{gd}$ | | - | 11 | | nC |
| **Drain-Source Diode Characteristics** | | | | | | |
| Diode Forward Voltage (Note 3) | $V_{SD}$ | $V_{GS}$=0V,$I_S$=75A | - | | 1.2 | V |
| Diode Forward Current (Note 2) | $I_S$ | | - | - | 150 | A |
| Reverse Recovery Time | $t_{rr}$ | $T_J$ = 25°C, $I_F$ = $I_S$ di/dt = 100A/μs (Note3) | - | | 31 | nS |
| Reverse Recovery Charge | Qrr | | - | | 110 | nC |

## Notes:

1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board, t ≤ 10 sec.
3. Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 2%.
4. Guaranteed by design, not subject to production
5. EAS condition : Tj=25℃,$V_{DD}$=20V,$V_G$=10V,L=0.5mH,Rg=25Ω

## Typical Electrical and Thermal Characteristics

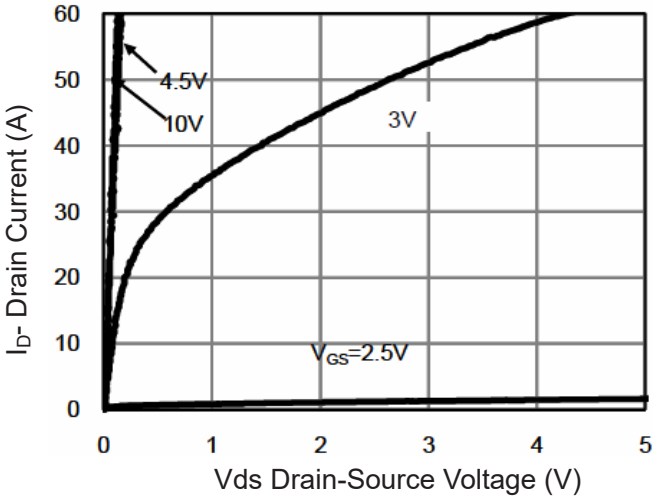



**Figure 1 Output Characteristics**

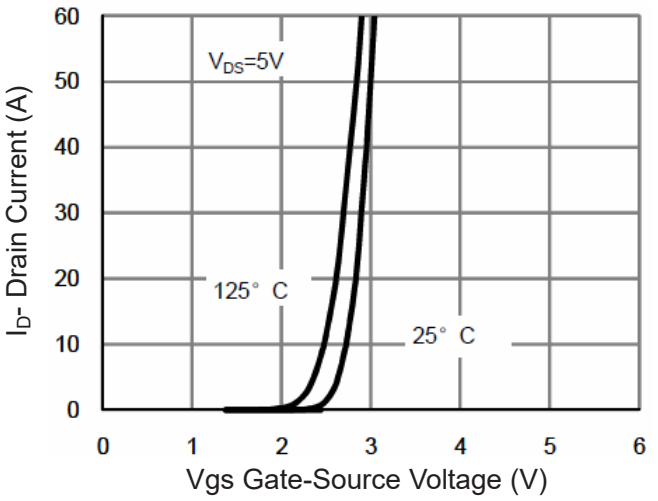



**Figure 2 Transfer Characteristics**

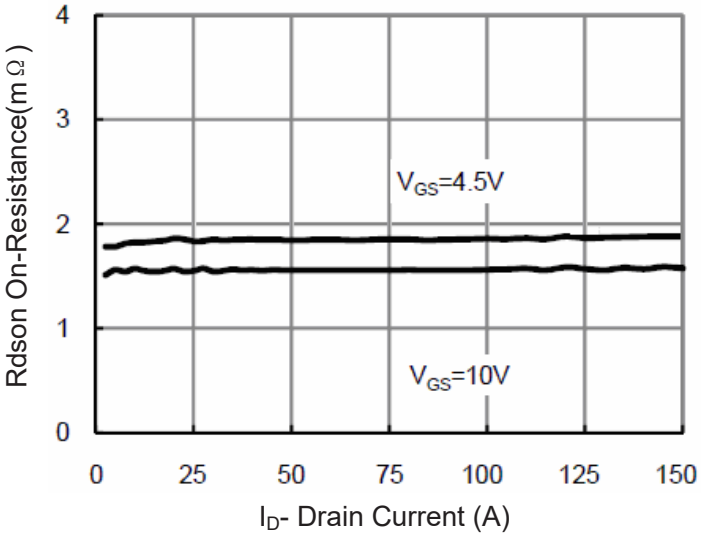



**Figure 3 Rdson- Drain Current**

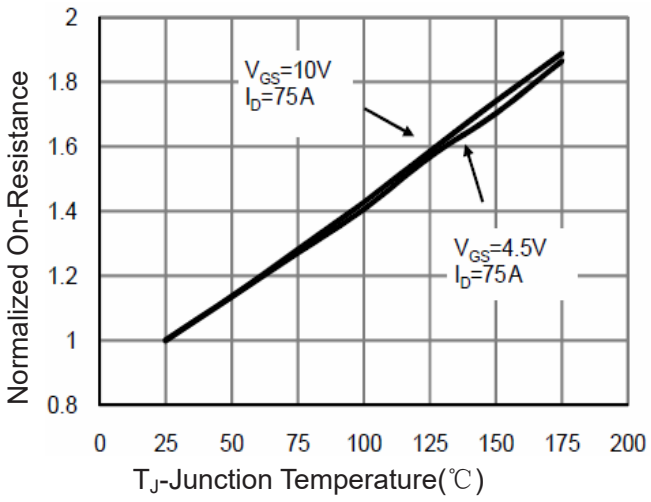



**Figure 4 Rdson-JunctionTemperature**

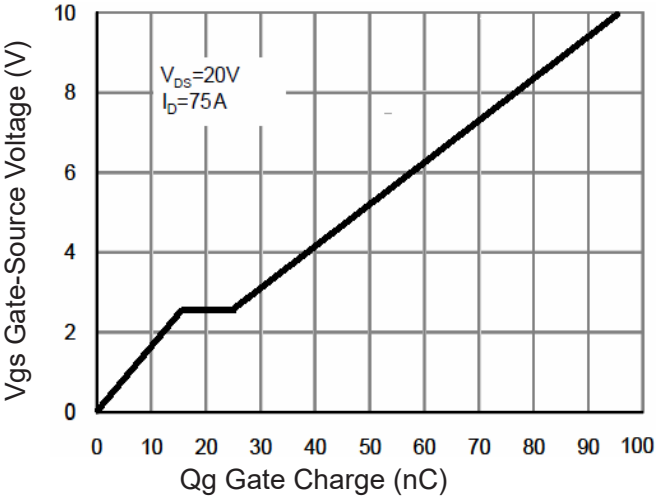



**Figure 5 Gate Charge**

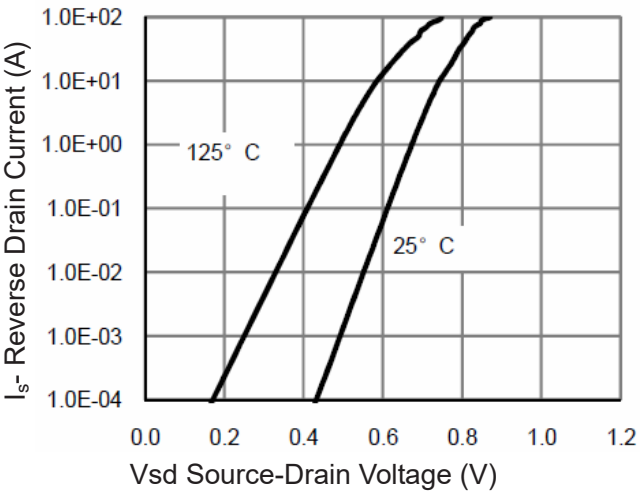



**Figure 6 Source- Drain Diode Forward**

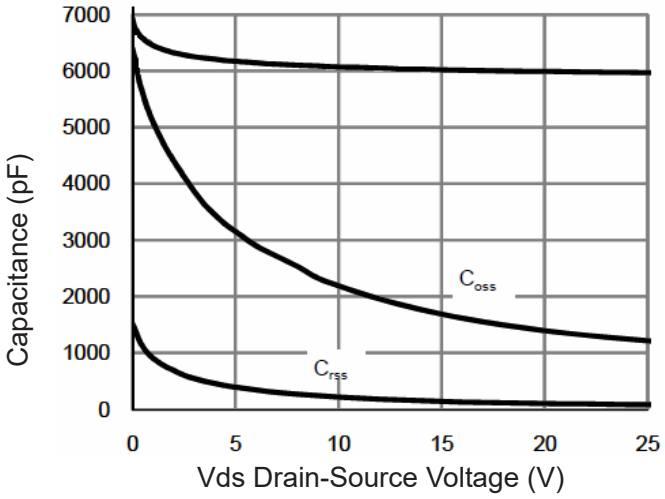



**Figure 7 Capacitance vs Vds**

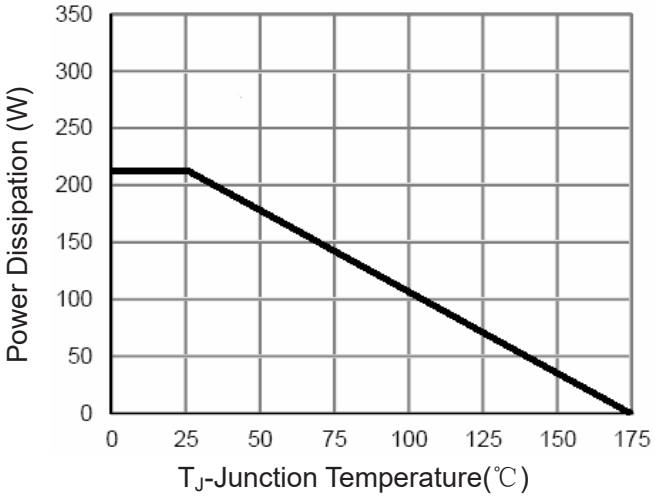



**Figure 9 Power De-rating**

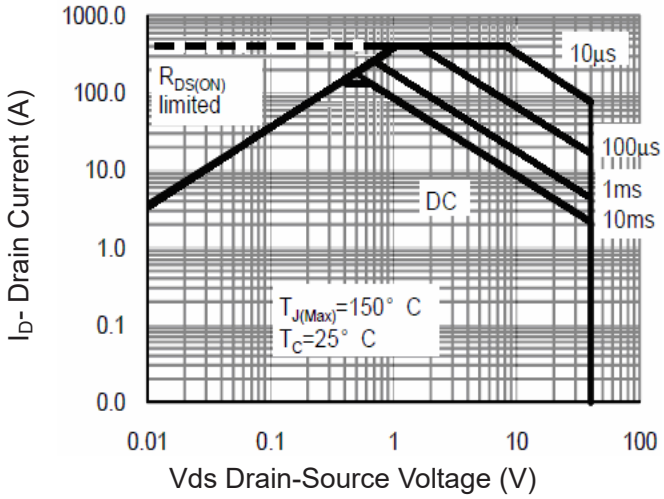



**Figure 8 Safe Operation Area**

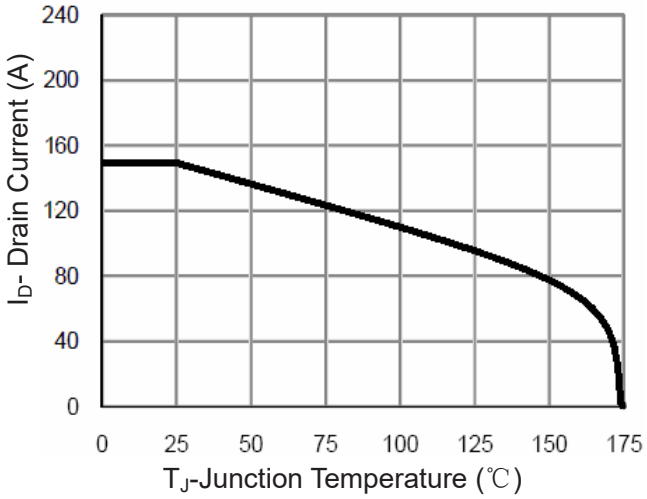



**Figure 10 Current De-rating**

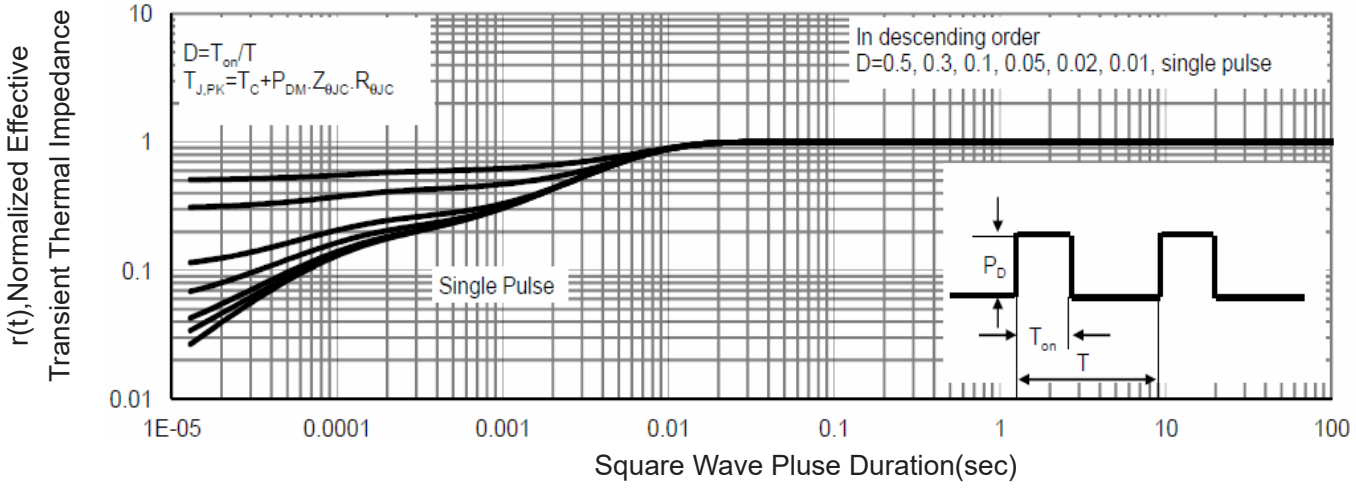



**Figure 11 Normalized Maximum Transient Thermal Impedance**