

## Description

The VST10N180 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

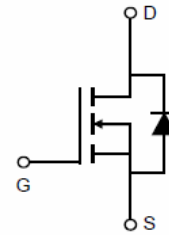
- $V_{DS} = 100V, I_D = 45A$   
 $R_{DS(ON)} = 18m\Omega$  (typical) @  $V_{GS} = 10V$   
 $R_{DS(ON)} = 22m\Omega$  (typical) @  $V_{GS} = 4.5V$
- Excellent gate charge x  $R_{DS(on)}$  product(FOM)
- Very low on-resistance  $R_{DS(on)}$
- 150 °C operating temperature
- Pb-free lead plating
- 100% UIS tested

## Application

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



TO-252



Schematic Diagram

## Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
VST10N180-T2	VST10N180	TO-252	-	-	-

## Absolute Maximum Ratings ( $T_C = 25^\circ\text{C}$ 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 (Silicon Limited)	$I_D$	45	A
Drain Current-Continuous( $T_C = 100^\circ\text{C}$ )	$I_D(100^\circ\text{C})$	31.8	A
Pulsed Drain Current (Package Limited)	$I_{DM}$	180	A
Maximum Power Dissipation	$P_D$	110	W
Derating factor		0.73	W/ $^\circ\text{C}$
Single pulse avalanche energy (Note 5)	$E_{AS}$	200	mJ
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 To 175	$^\circ\text{C}$

## Thermal Characteristic

Thermal Resistance, Junction-to-Case <sup>(Note 2)</sup>	$R_{\theta JC}$	1.36	$^{\circ}\text{C/W}$
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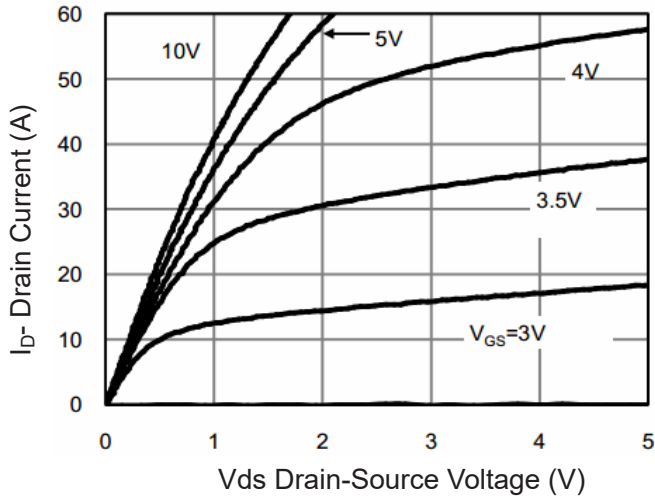
## Electrical Characteristics ( $T_C=25^{\circ}\text{C}$ unless otherwise noted)

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 <sup>(Note 3)</sup>						
Gate Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA	1.2	2.0	2.8	V
Drain-Source On-State Resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> =10V, I <sub>D</sub> =20A	-	18	23	mΩ
		V <sub>GS</sub> =4.5V, I <sub>D</sub> =20A	-	22	27	mΩ
Forward Transconductance	g <sub>FS</sub>	V <sub>DS</sub> =5V, I <sub>D</sub> =20A	-	35	-	S
Dynamic Characteristics <sup>(Note4)</sup>						
Input Capacitance	C <sub>ISS</sub>	V <sub>DS</sub> =50V, V <sub>GS</sub> =0V, F=1.0MHz	-	1600	-	PF
Output Capacitance	C <sub>OSS</sub>		-	139	-	PF
Reverse Transfer Capacitance	C <sub>RSS</sub>		-	11	-	PF
Switching Characteristics <sup>(Note 4)</sup>						
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> =50V, I <sub>D</sub> =20A V <sub>GS</sub> =10V, R <sub>G</sub> =1.6Ω	-	6	-	nS
Turn-on Rise Time	t <sub>r</sub>		-	2	-	nS
Turn-Off Delay Time	t <sub>d(off)</sub>		-	18	-	nS
Turn-Off Fall Time	t <sub>f</sub>		-	2	-	nS
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> =50V, I <sub>D</sub> =20A, V <sub>GS</sub> =10V	-	26	-	nC
Gate-Source Charge	Q <sub>gs</sub>		-	7.4		nC
Gate-Drain Charge	Q <sub>gd</sub>		-	3.8		nC
Drain-Source Diode Characteristics						
Diode Forward Voltage <sup>(Note 3)</sup>	V <sub>SD</sub>	V <sub>GS</sub> =0V, I <sub>S</sub> =45A	-		1.2	V
Diode Forward Current <sup>(Note 2)</sup>	I <sub>S</sub>		-	-	45	A
Reverse Recovery Time	t <sub>rr</sub>	T <sub>J</sub> = 25°C, I <sub>F</sub> = 20A	-		26	nS
Reverse Recovery Charge	Q <sub>rr</sub>	di/dt = 500A/μs <sup>(Note3)</sup>	-		98	nC

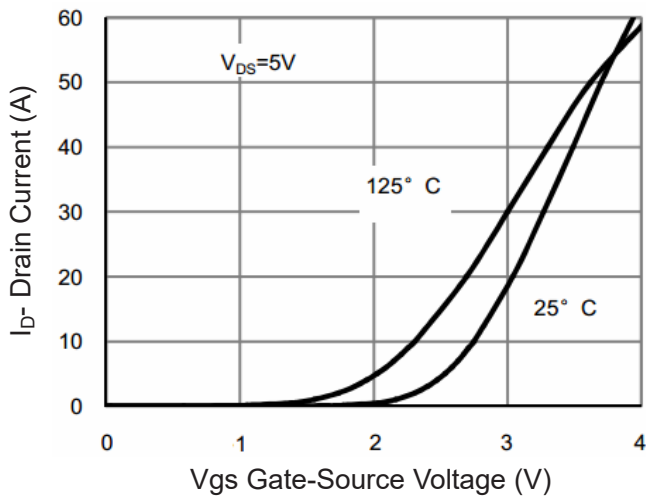
## Notes:

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 :  $T_J=25^{\circ}\text{C}, V_{DD}=20V, V_G=10V, L=0.5\text{mH}, R_g=25\Omega$

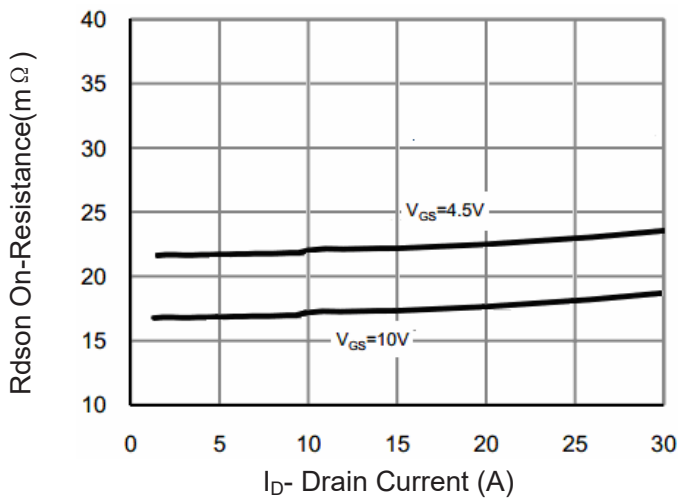
## Typical Electrical and Thermal Characteristics



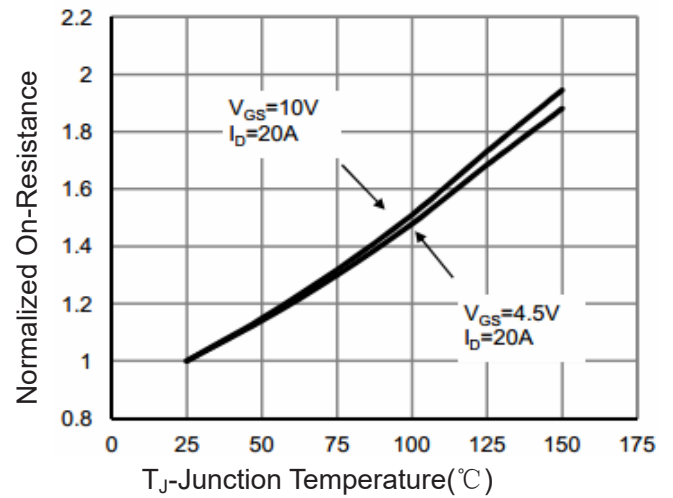
**Figure 1 Output Characteristics**



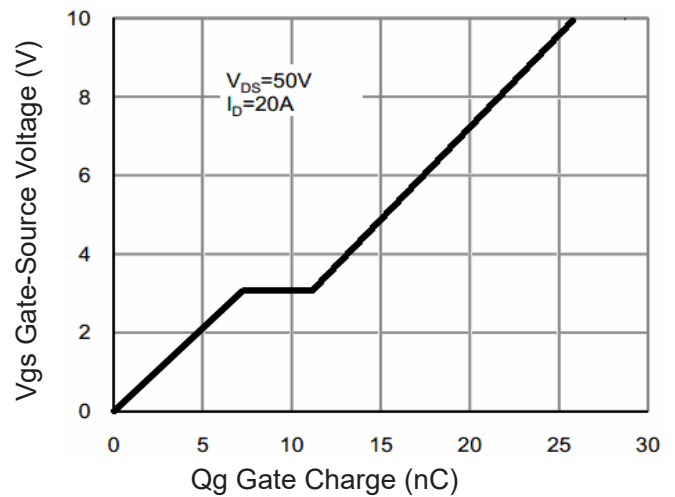
**Figure 2 Transfer Characteristics**



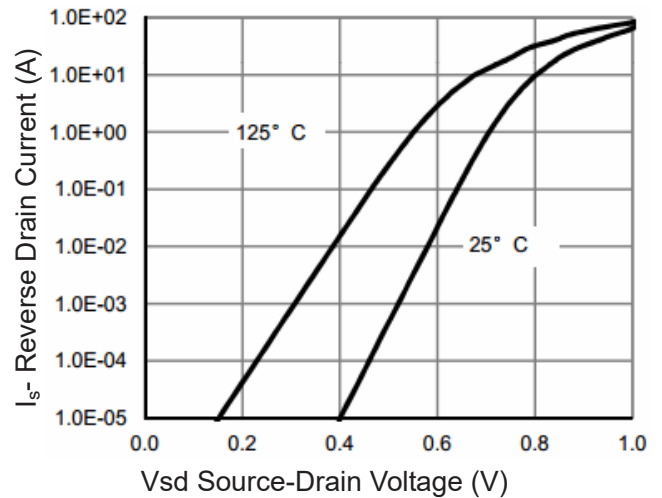
**Figure 3  $R_{DS(on)}$ - Drain Current**



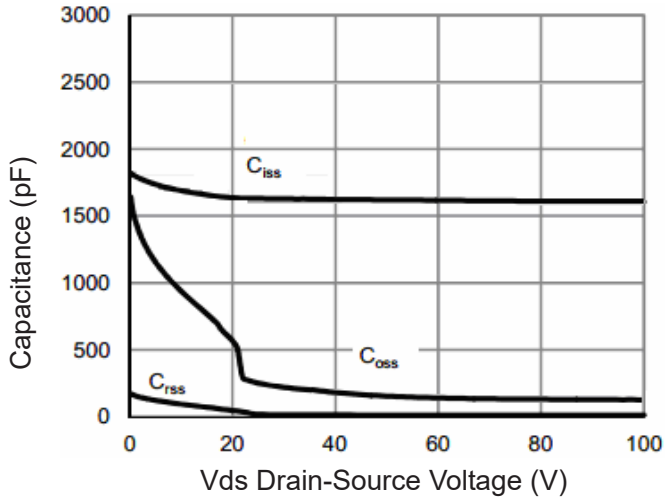
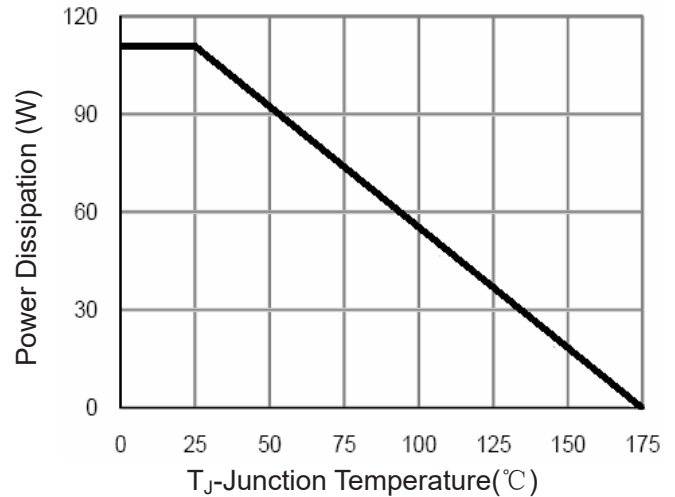
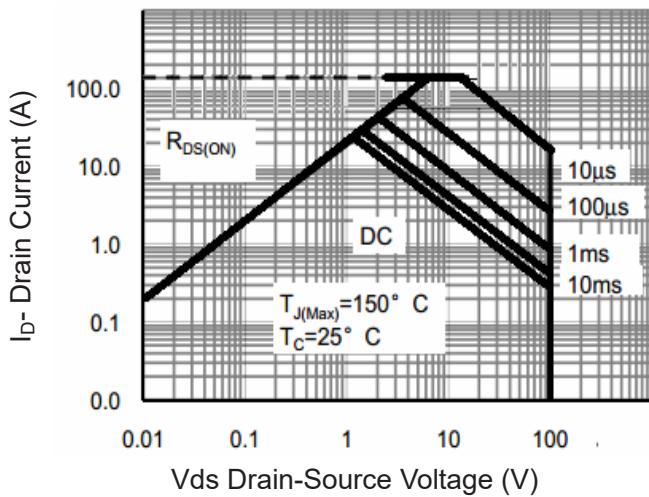
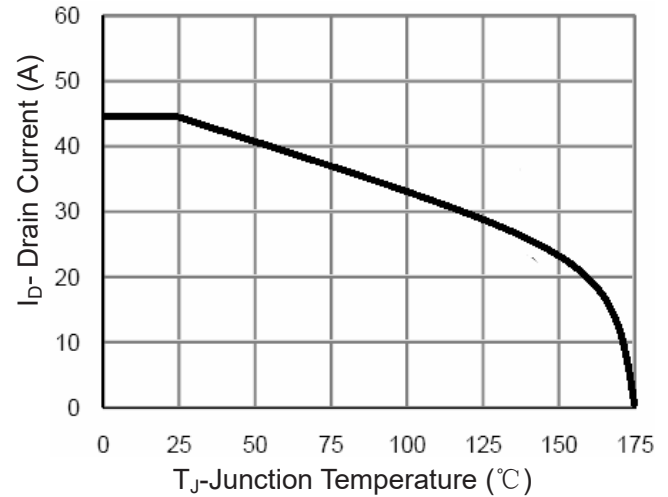
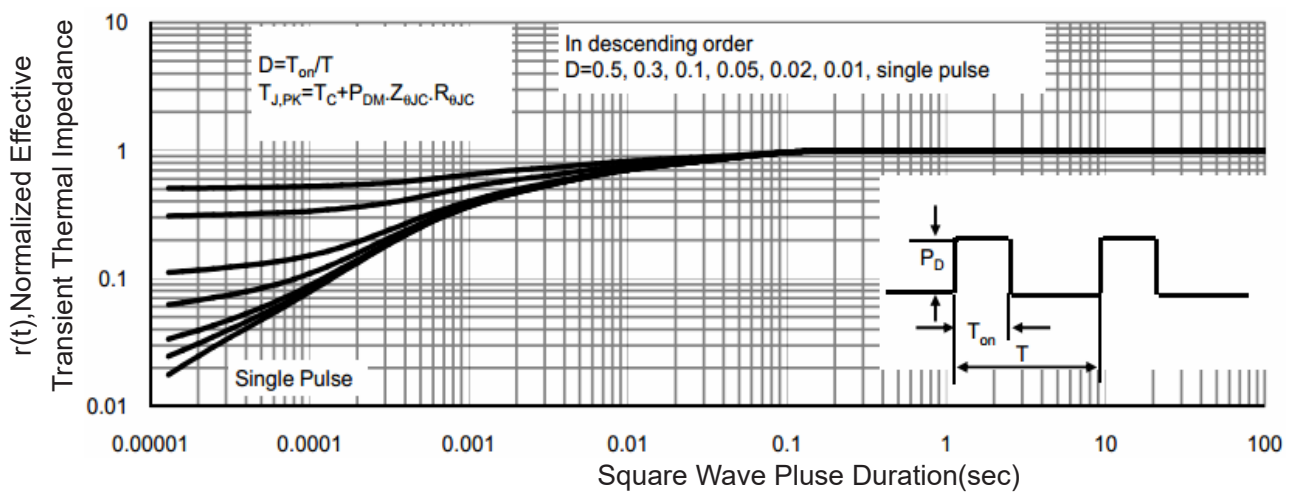
**Figure 4  $R_{DS(on)}$ -Junction Temperature**



**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**