

## Description

The VST04N023 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

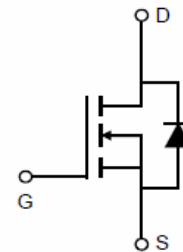
- $V_{DS} = 40V, I_D = 110A$   
 $R_{DS(ON)} = 2.3m\Omega$  (typical) @  $V_{GS} = 10V$   
 $R_{DS(ON)} = 3.3m\Omega$  (typical) @  $V_{GS} = 4.5V$
- Excellent gate charge x  $R_{DS(on)}$  product(FOM)
- Very low on-resistance  $R_{DS(on)}$
- 150 °C operating temperature
- Pb-free lead plating
- 100% UIS tested

## Application

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



TO-220C



Schematic Diagram

## Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
VST04N023-TC	VST04N023	TO-220C	-	-	-

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

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	40	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	V
Drain Current-Continuous	$I_D$	110	A
Drain Current-Continuous( $T_C = 100^\circ C$ )	$I_D(100^\circ C)$	85	A
Pulsed Drain Current	$I_{DM}$	380	A
Maximum Power Dissipation	$P_D$	150	W
Derating factor		1	W/°C
Single pulse avalanche energy <sup>(Note 5)</sup>	$E_{AS}$	500	mJ
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 To 175	°C

**Thermal Characteristic**

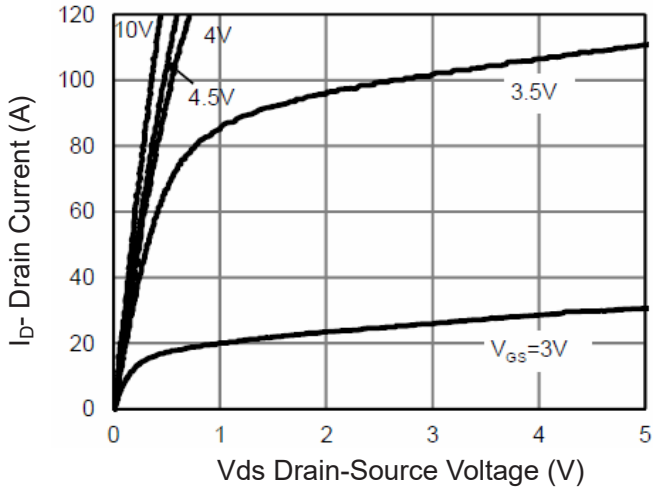
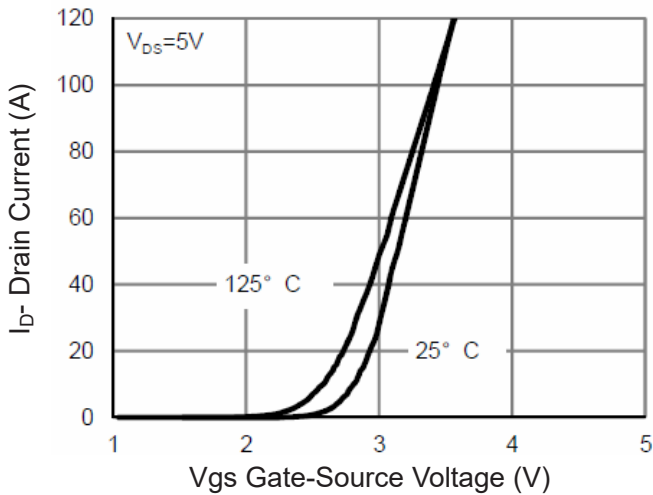
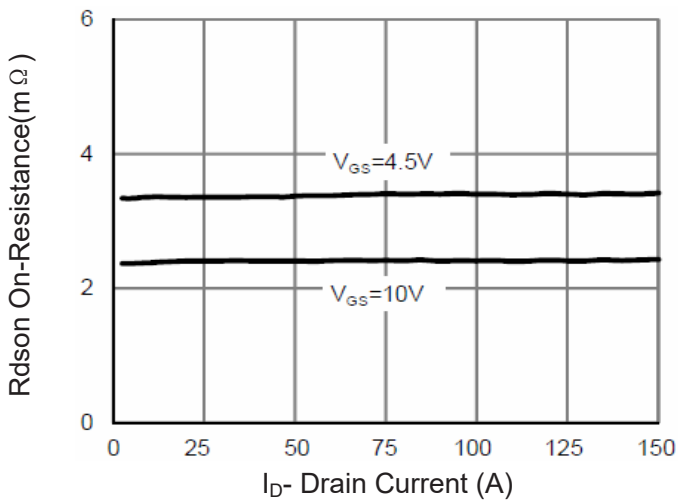
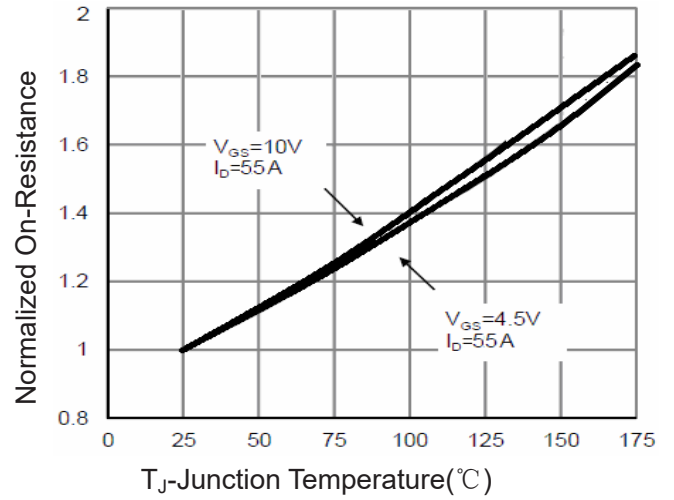
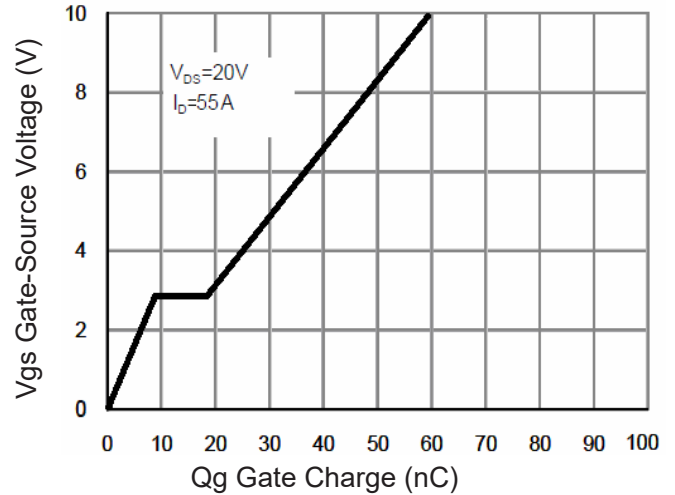
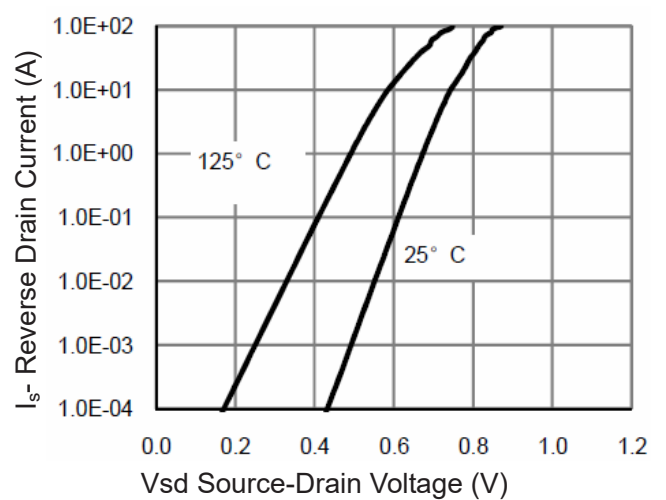
Thermal Resistance, Junction-to-Case <sup>(Note 2)</sup>	$R_{\theta JC}$	1.0	$^{\circ}\text{C}/\text{W}$
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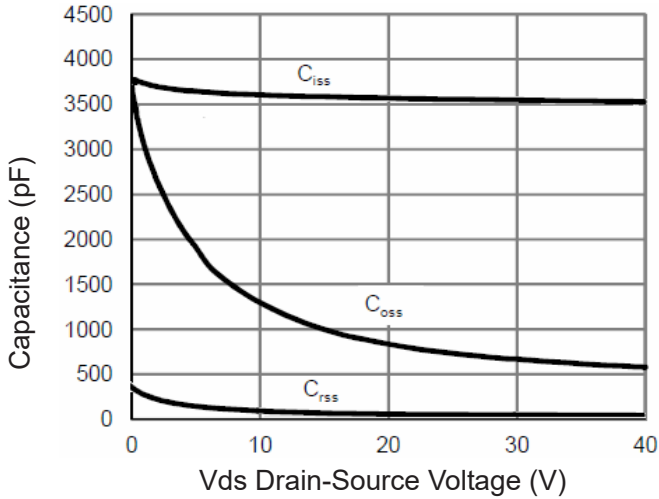
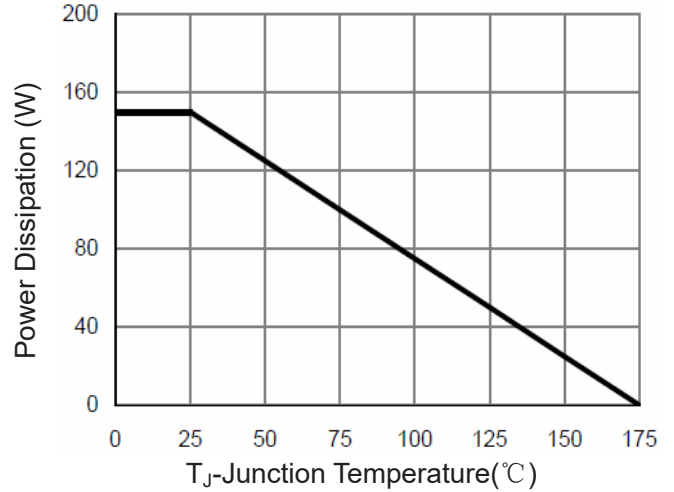
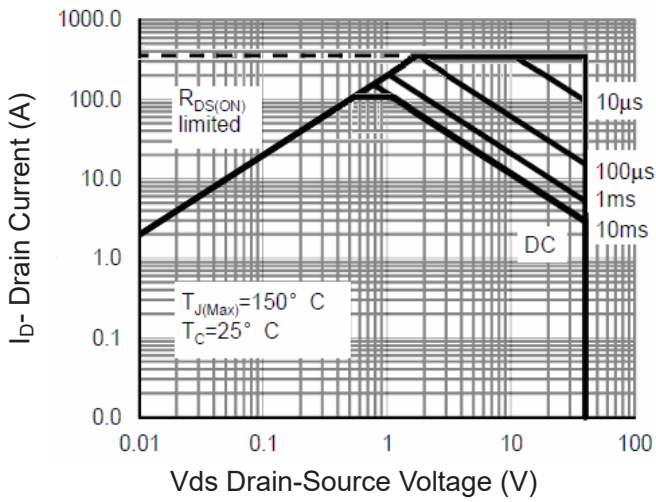
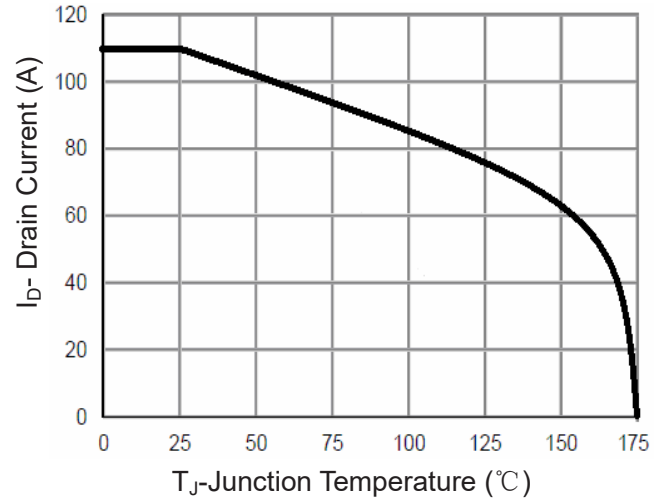
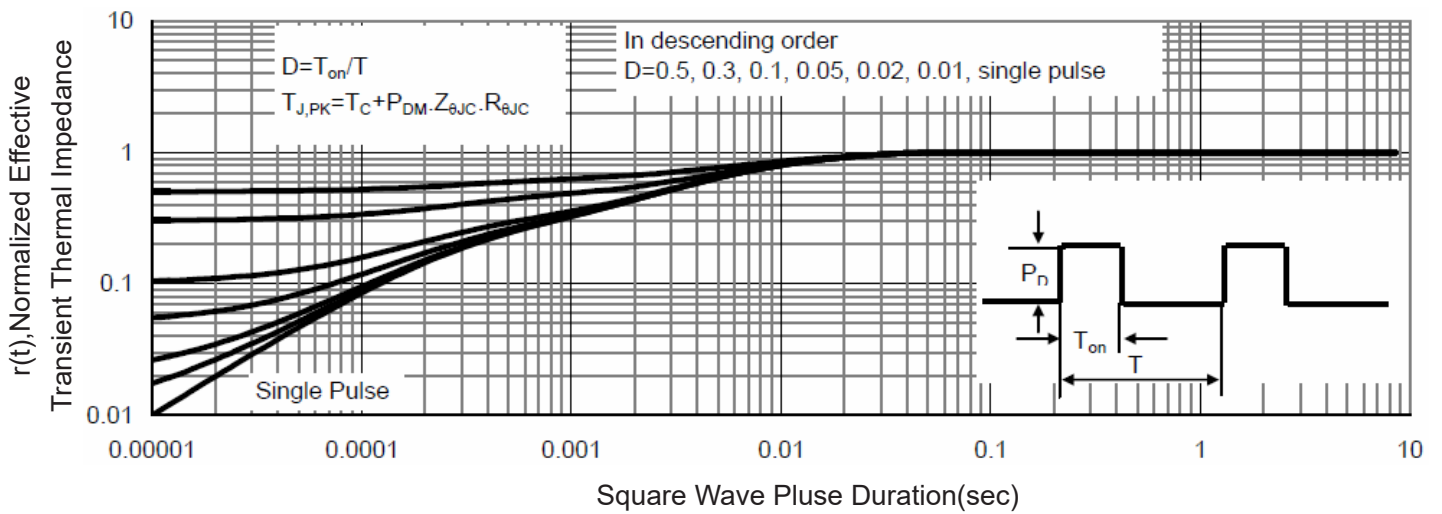
**Electrical Characteristics ( $T_C=25^{\circ}\text{C}$  unless otherwise noted)**

Parameter	Symbol	Condition	Min	Typ	Max	Unit
<b>Off Characteristics</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS}=0V, I_D=250\mu A$	40		-	V
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS}=40V, V_{GS}=0V$	-	-	1	$\mu A$
Gate-Body Leakage Current	$I_{GSS}$	$V_{GS}=\pm 20V, V_{DS}=0V$	-	-	$\pm 100$	nA
<b>On Characteristics</b> <sup>(Note 3)</sup>						
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	1.2	1.7	2.2	V
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS}=10V, I_D=55A$	-	2.3	2.7	m $\Omega$
		$V_{GS}=4.5V, I_D=55A$	-	3.3	3.9	m $\Omega$
Forward Transconductance	$g_{FS}$	$V_{DS}=5V, I_D=55A$	-	60	-	S
<b>Dynamic Characteristics</b> <sup>(Note 4)</sup>						
Input Capacitance	$C_{iss}$	$V_{DS}=20V, V_{GS}=0V,$ $F=1.0\text{MHz}$	-	3510	4200	PF
Output Capacitance	$C_{oss}$		-	860	1000	PF
Reverse Transfer Capacitance	$C_{rss}$		-	60	78	PF
<b>Switching Characteristics</b> <sup>(Note 4)</sup>						
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=20V, I_D=55A$ $V_{GS}=10V, R_G=1.6\Omega$	-	10.5	-	nS
Turn-on Rise Time	$t_r$		-	4	-	nS
Turn-Off Delay Time	$t_{d(off)}$		-	35	-	nS
Turn-Off Fall Time	$t_f$		-	5	-	nS
Total Gate Charge	$Q_g$	$V_{DS}=20V, I_D=55A,$ $V_{GS}=10V$	-	60	72	nC
Gate-Source Charge	$Q_{gs}$		-	9.9		nC
Gate-Drain Charge	$Q_{gd}$		-	9.5		nC
<b>Drain-Source Diode Characteristics</b>						
Diode Forward Voltage <sup>(Note 3)</sup>	$V_{SD}$	$V_{GS}=0V, I_S=55A$	-		1.2	V
Diode Forward Current <sup>(Note 2)</sup>	$I_S$		-	-	110	A
Reverse Recovery Time	$t_{rr}$	$T_J = 25^{\circ}\text{C}, I_F = I_S$ $di/dt = 100A/\mu s$ <sup>(Note 3)</sup>	-		24	nS
Reverse Recovery Charge	$Q_{rr}$		-		68	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**