Description

The VST04N014 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 =170A

   $R_{DS(ON)}$=1.4mΩ (typical) @ 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-220C
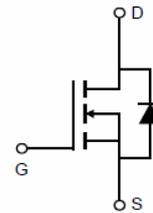
Schematic Diagram

Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
VST04N014-TC	VST04N014	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	I_D	170	A
Drain Current-Continuous(T$_C$=100℃)	I_D (100℃)	120	A
Pulsed Drain Current	I_{DM}	680	A
Maximum Power Dissipation	P_D	250	W
Derating factor		1.66	W/℃
Single pulse avalanche energy [Note 5]	E_{AS}	1200	mJ
Operating Junction and Storage Temperature Range	T_J,T_{STG}	-55 To 175	℃

Thermal Characteristic

| Thermal Resistance,Junction-to-Case[Note 2]	$R_{\theta JC}$	0.6	℃/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	2.0	3.0	4.0	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	V_{GS}=10V, I_D=85A	-	1.4	1.7	mΩ
Forward Transconductance	g_{FS}	V_{DS}=5V,I_D=85A	-	80	-	S
Dynamic Characteristics [Note4]						
Input Capacitance	C_{Iss}	V_{DS}=20V,V_{GS}=0V, F=1.0MHz	-	5670	-	PF
Output Capacitance	C_{oss}		-	1930	-	PF
Reverse Transfer Capacitance	C_{rss}		-	62	-	PF
Switching Characteristics [Note 4]						
Turn-on Delay Time	$t_{d(on)}$	V_{DD}=20V,I_D=85A V_{GS}=10V,R_G=1.6Ω	-	13.5	-	nS
Turn-on Rise Time	t_r		-	7.2	-	nS
Turn-Off Delay Time	$t_{d(off)}$		-	55	-	nS
Turn-Off Fall Time	t_f		-	8.6	-	nS
Total Gate Charge	Q_g	V_{DS}=20V,I_D=85A, V_{GS}=10V	-	88.6	-	nC
Gate-Source Charge	Q_{gs}		-	16		nC
Gate-Drain Charge	Q_{gd}		-	13		nC
Drain-Source Diode Characteristics						
Diode Forward Voltage [Note 3]	V_{SD}	V_{GS}=0V,I_S=85A	-		1.2	V
Diode Forward Current [Note 2]	I_S		-	-	170	A
Reverse Recovery Time	t_{rr}	T_J = 25°C, I_F = I_S di/dt = 100A/µs[Note3]	-		33	nS
Reverse Recovery Charge	Qrr		-		119	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
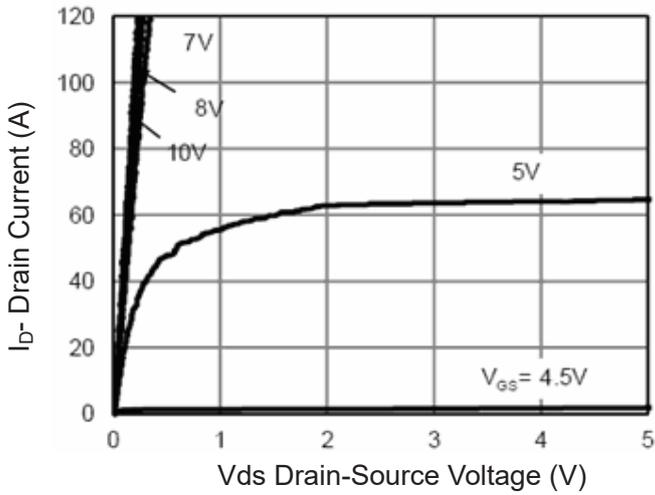
Figure 1 Output Characteristics
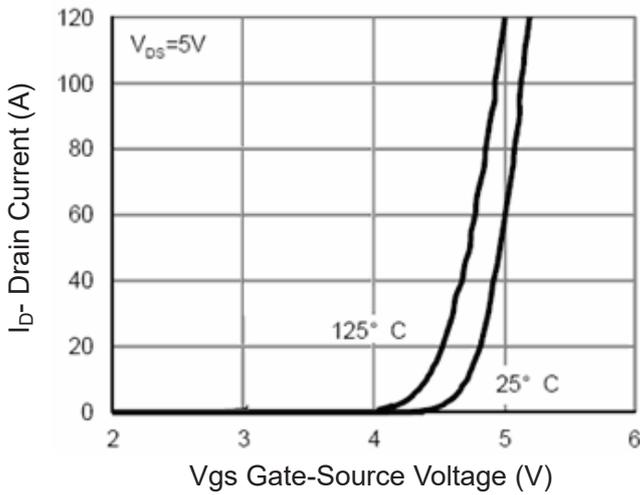
Figure 2 Transfer Characteristics
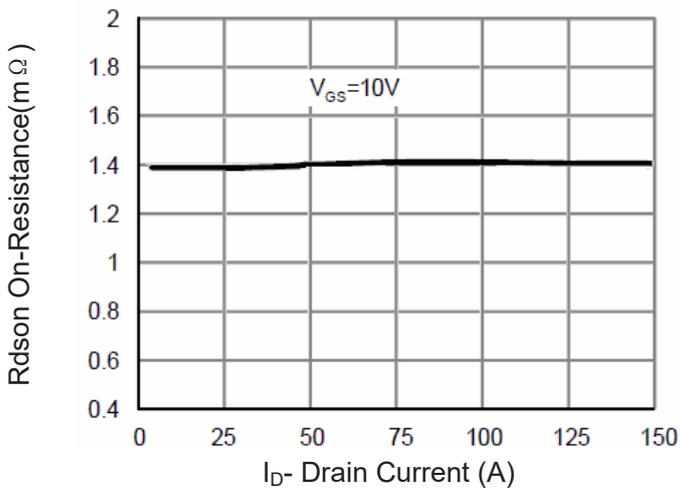
Figure 3 Rdson- Drain Current
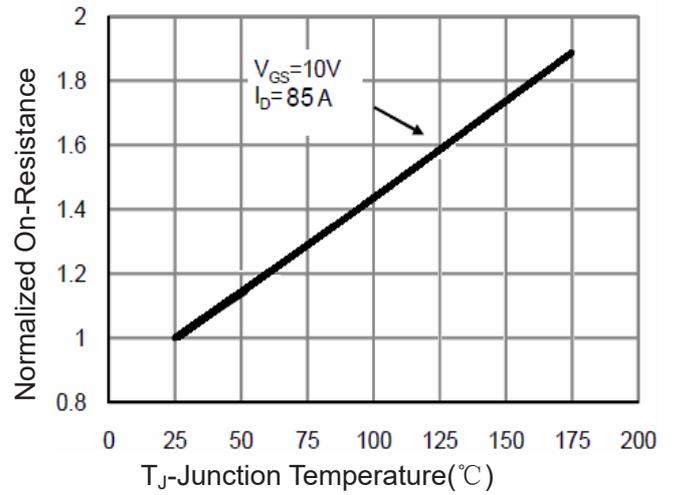
Figure 4 Rdson-Junction Temperature
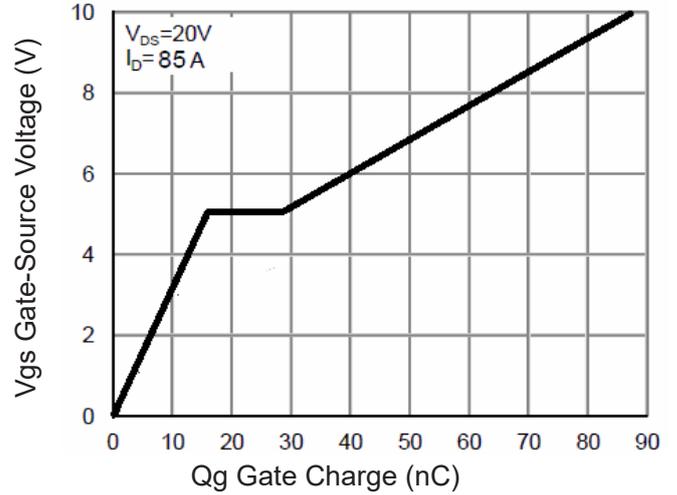
Figure 5 Gate Charge
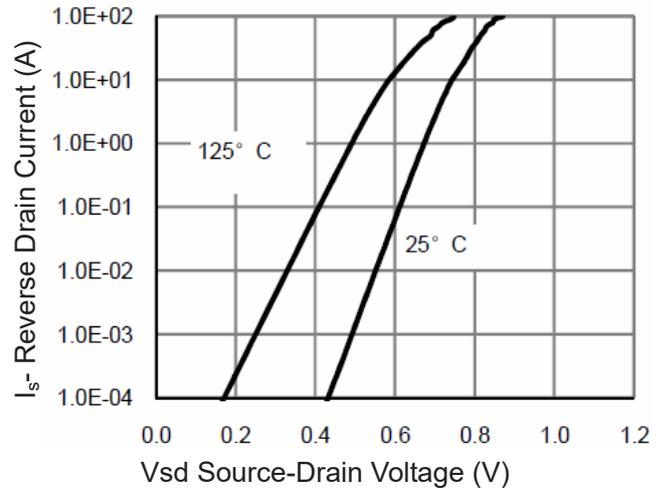
Figure 6 Source- Drain Diode Forward
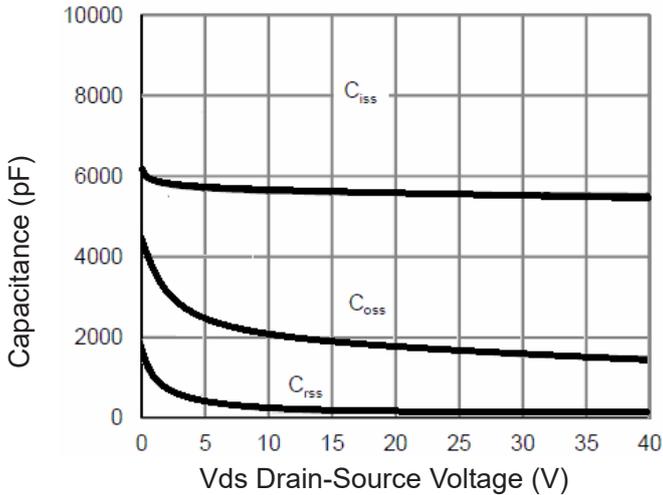
Figure 7 Capacitance vs Vds
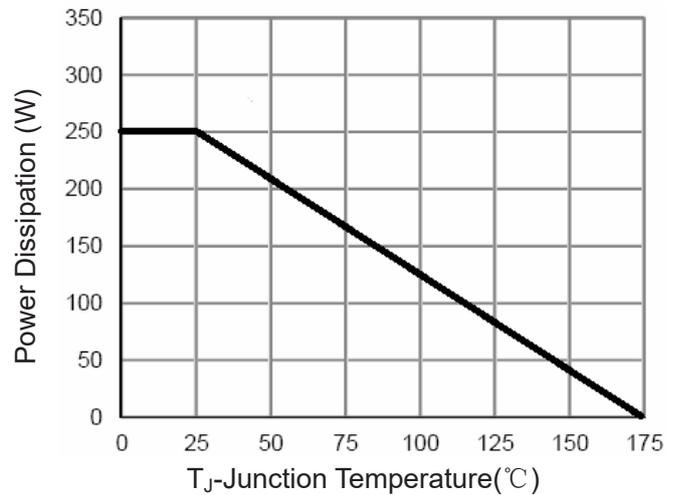
Figure 9 Power De-rating
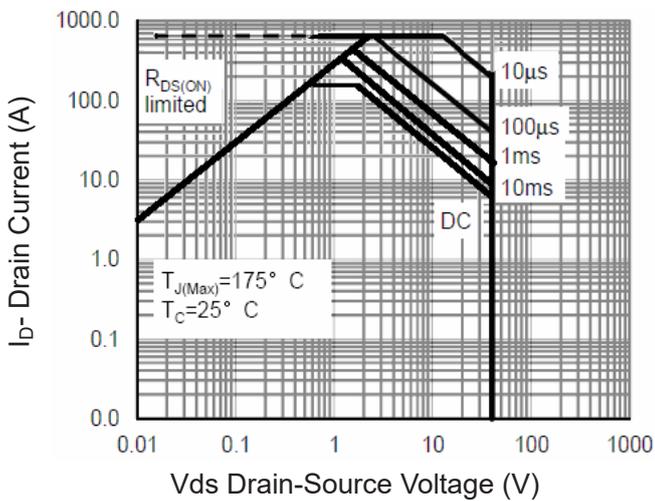
Figure 8 Safe Operation Area
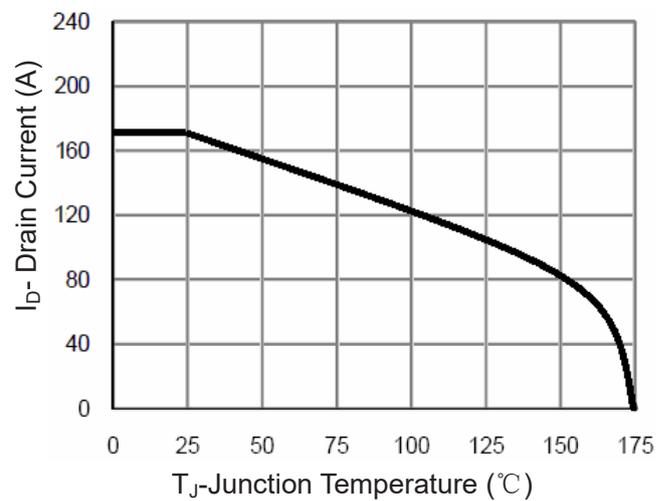
Figure 10 Current De-rating

$D=T_{on}/T$

$T_{J,PK}=T_C+P_{DM}\cdot Z_{\theta JC}\cdot R_{\theta JC}$

In descending order
D=0.5, 0.3, 0.1, 0.05, 0.02, 0.01, single pulse

Single Pulse

Square Wave Pluse Duration(sec)
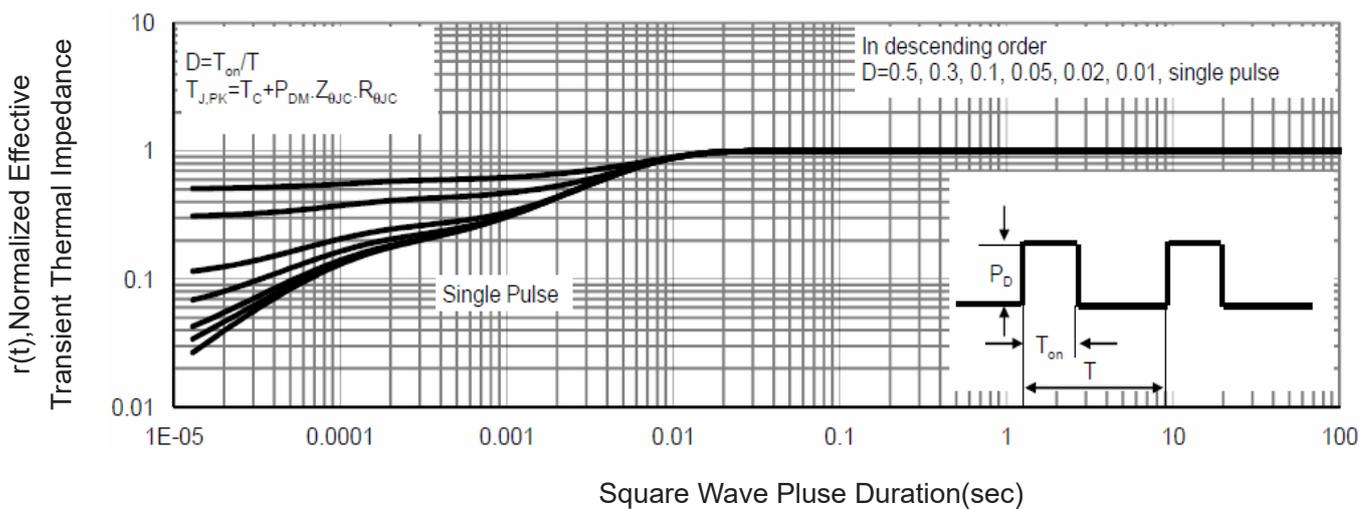
Figure 11 Normalized Maximum Transient Thermal Impedance