

Description

The VST04P020 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.

Application

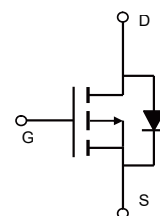
- DC/DC Converter
- Ideal for high-frequency switching and synchronous rectification

General Features

- $V_{DS} = -40V, I_D = -150A$
 $R_{DS(ON)} = 2.8m\Omega$ (typical) @ $V_{GS} = -10V$
 $R_{DS(ON)} = 3.8m\Omega$ (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



DFN5x6



Schematic

Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
VST04P020	VST04P020-D56	DFN5x6	-	-	-

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}	± 20	V
Drain Current-Continuous ($T_C = 25^\circ C$)	$I_D (T_C = 25^\circ C)$	-150	A
Drain Current-Continuous ($T_C = 100^\circ C$)	$I_D (T_C = 100^\circ C)$	-106	A
Drain Current-Continuous ($T_A = 25^\circ C$)	$I_D (T_A = 25^\circ C)$	-20.5	A
Pulsed Drain Current (Note 1)	I_{DM}	-600	A
Maximum Power Dissipation ($T_C = 25^\circ C$)	$P_D (T_C = 25^\circ C)$	150	W
Maximum Power Dissipation ($T_A = 25^\circ C$)	$P_D (T_A = 25^\circ C)$	2.5	W
Derating factor		1.2	W/ $^\circ C$
Single pulse avalanche energy (Note 5)	E_{AS}	1076	mJ
Operating Junction and Storage Temperature Range	T_J, T_{STG}	-55 To 150	$^\circ C$

Thermal Characteristic

Thermal Resistance, Junction-to-Case (Note 2)	$R_{\theta JC}$	0.83	$^\circ C/W$
Thermal Resistance, Junction-to-Ambient (Note 2)	$R_{\theta JA}$	50	$^\circ C/W$

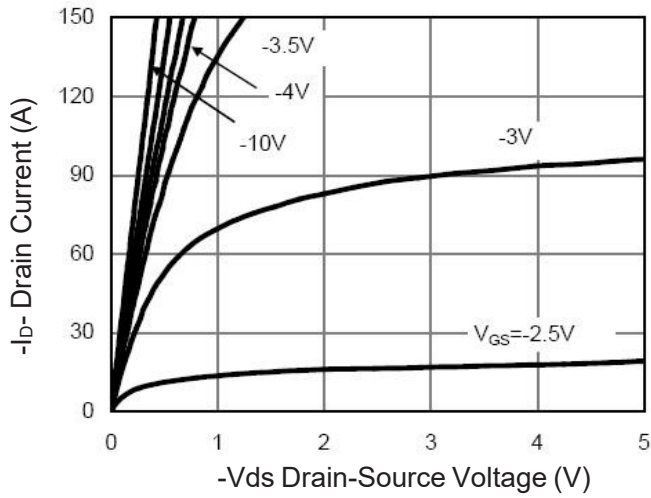
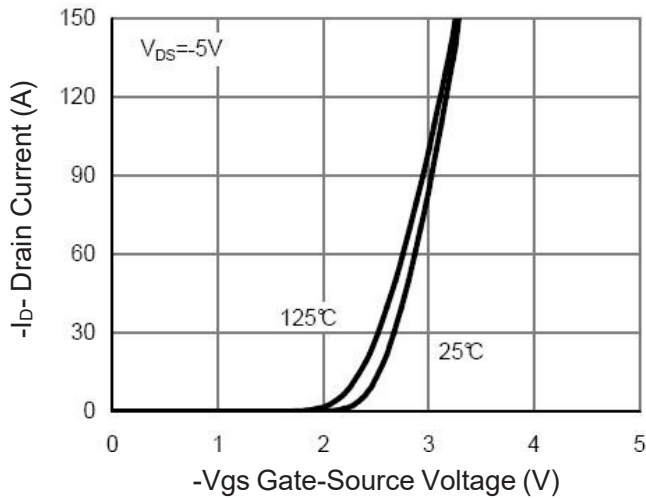
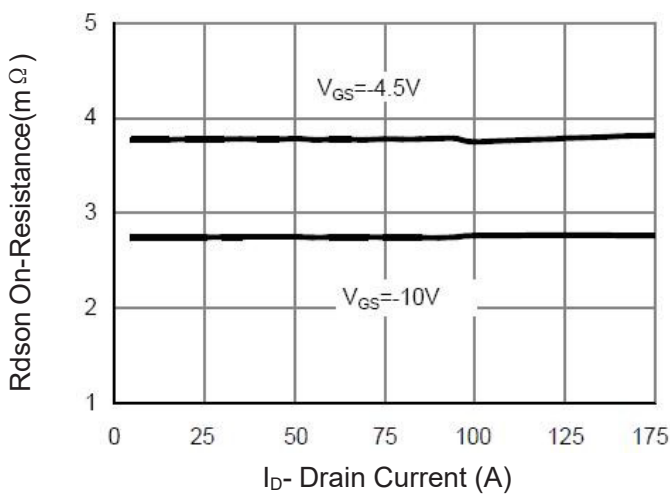
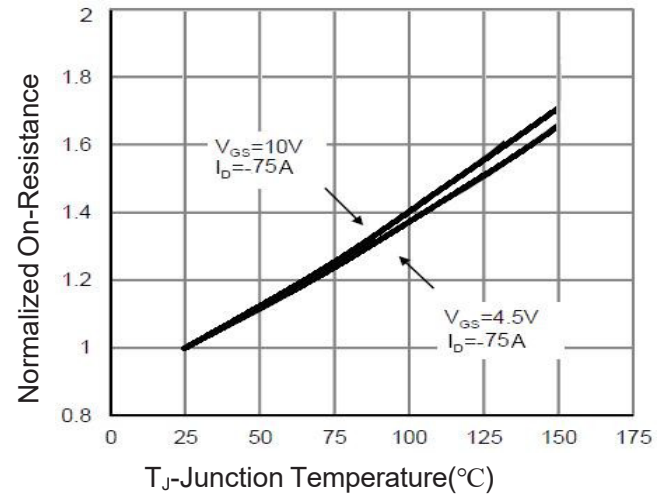
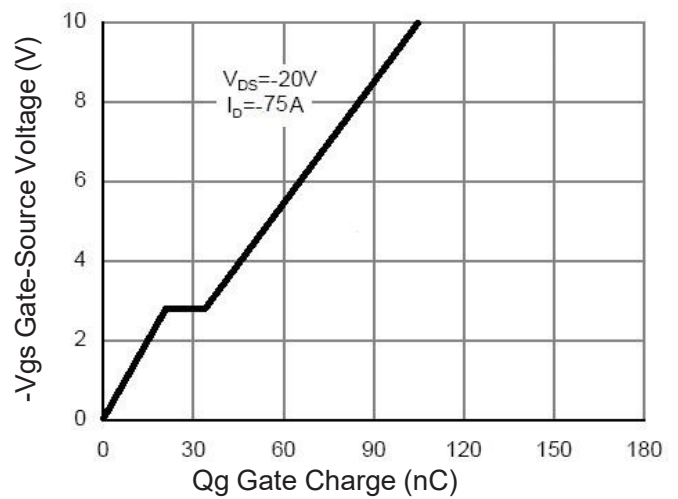
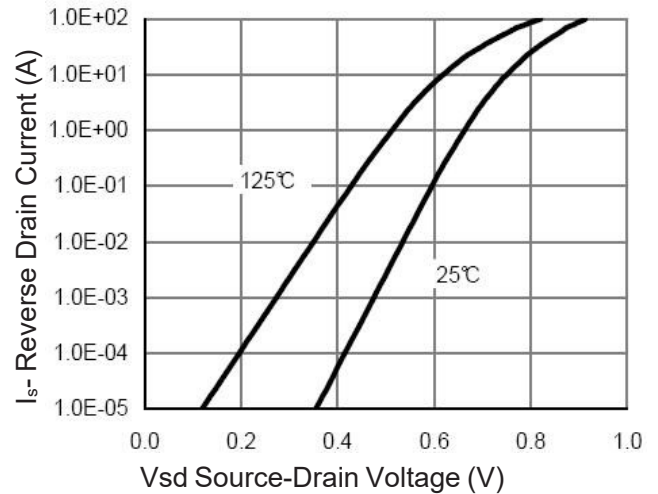
Electrical Characteristics ($T_c=25^{\circ}\text{C}$ unless otherwise noted)

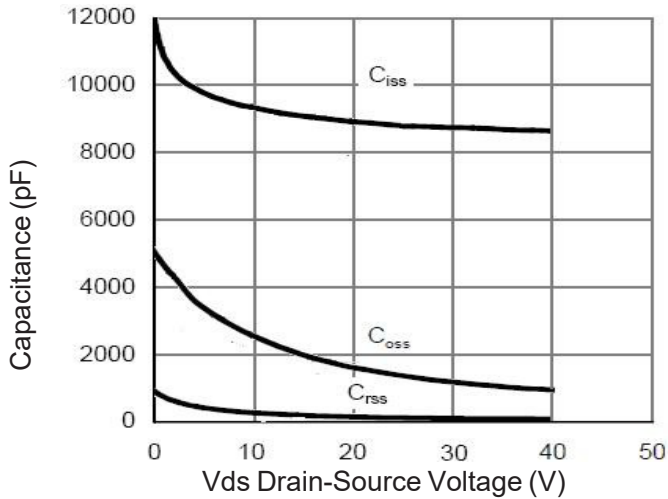
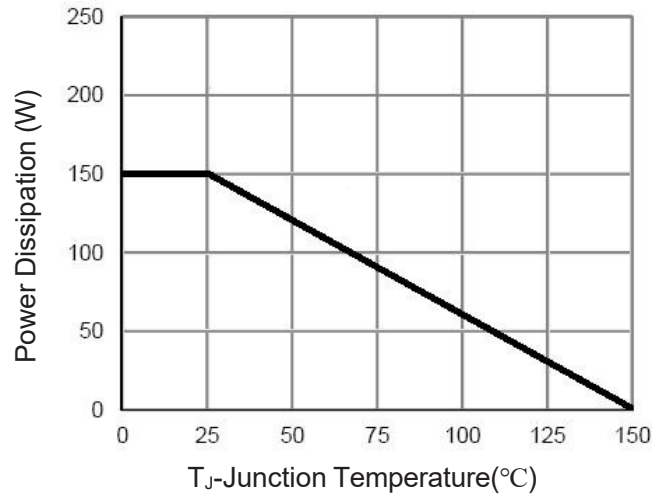
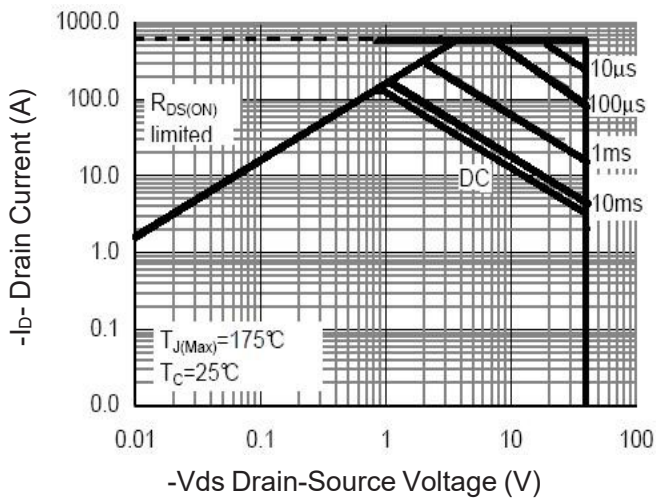
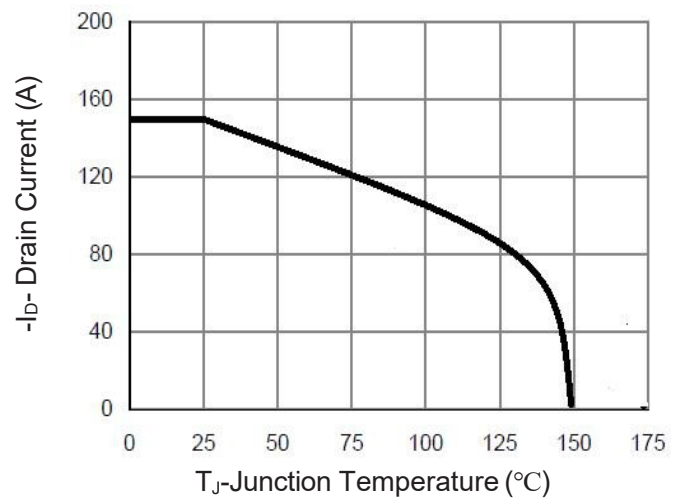
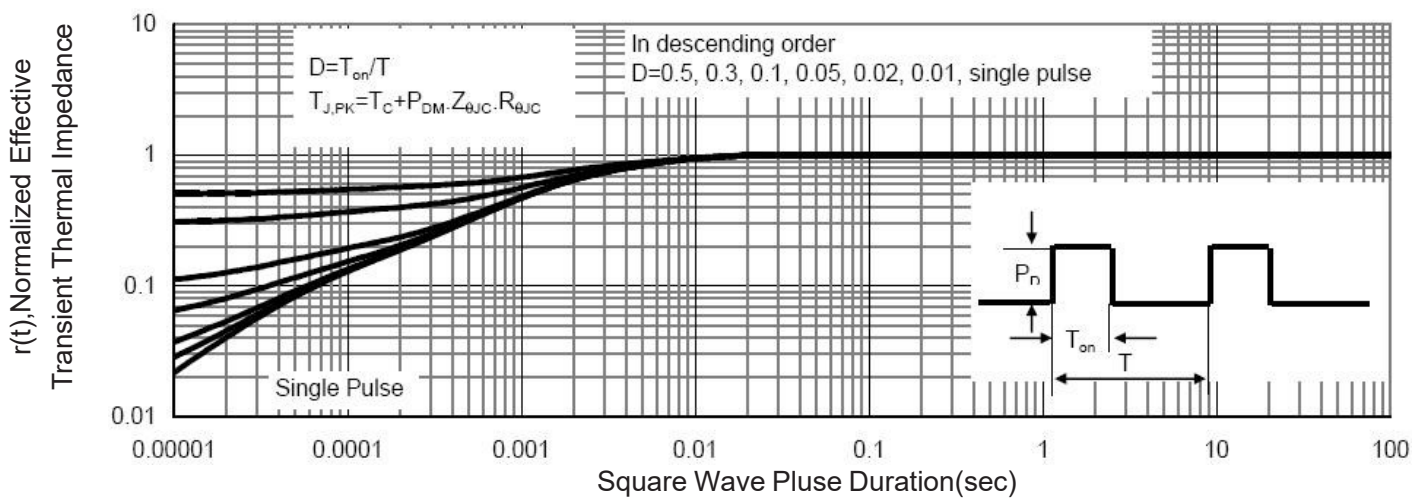
Parameter	Symbol	Condition	Min	Typ	Max	Unit
Off Characteristics						
Drain-Source Breakdown Voltage	BV _{DSS}	V _{GS} =0V I _D =-250μA	-40		-	V
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} =-40V, V _{GS} =0V	-	-	1	μA
Gate-Body Leakage Current	I _{GSS}	V _{GS} =±20V, V _{DS} =0V	-	-	±100	nA
On Characteristics (Note 3)						
Gate Threshold Voltage	V _{GS(th)}	V _{DS} =V _{GS} , I _D =-250μA	-1.0	-1.5	-2.2	V
Drain-Source On-State Resistance	R _{DS(ON)}	V _{GS} =-10V, I _D =-75A	-	2.8	3.5	mΩ
		V _{GS} =-4.5V, I _D =-75A	-	3.9	6.0	mΩ
Gate resistance	R _G	F=1.0MHz	-	5.5	-	Ω
Forward Transconductance	g _{FS}	V _{DS} =-5V, I _D =-75A	-	30	-	S
Dynamic Characteristics (Note4)						
Input Capacitance	C _{iss}	V _{DS} =-20V, V _{GS} =0V, F=1.0MHz	-	8940	-	PF
Output Capacitance	C _{oss}		-	1900	-	PF
Reverse Transfer Capacitance	C _{rss}		-	45	-	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	-	18	-	nS
Turn-on Rise Time	t _r		-	13	-	nS
Turn-Off Delay Time	t _{d(off)}		-	90	-	nS
Turn-Off Fall Time	t _f		-	15	-	nS
Total Gate Charge	Q _g	V _{DS} =-20V, I _D =-75A, V _{GS} =-10V	-	104.4	-	nC
Gate-Source Charge	Q _{gs}		-	20.8		nC
Gate-Drain Charge	Q _{gd}		-	13.5		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 =-75A di/dt = 100A/μs (Note3)	-		35	nS
Reverse Recovery Charge	Q _{rr}		-		85	nC

Notes:

1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. The value of $R_{\theta JA}$ is measured with the device mounted on 1in² FR-4 board with 2oz. Copper, in a still air environment with $T_A=25^{\circ}\text{C}$. The value in any given application depends on the user's specific board design.
3. Pulse Test: Pulse Width $\leq 300\mu s$, Duty Cycle $\leq 2\%$.
4. Guaranteed by design, not subject to production
5. EAS condition : $T_J=25^{\circ}\text{C}, V_{DD}=-20V, V_G=-10V, L=0.5mH, R_G=25\Omega$

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