

Description

The VST04N020 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

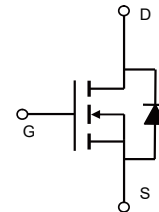
- DC/DC Converter
- Ideal for high-frequency switching and synchronous rectification

General Features

- $V_{DS}=40V, I_D=65A$
 $R_{DS(ON)}=2.2m\Omega$ (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



DFN3x3



Schematic

Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
VST04N020	VST04N020-D33	DFN3x3	-	-	-

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

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	V_{DS}	40	V
Gate-Source Voltage	V_{GS}	± 20	V
Drain Current-Continuous ($T_C=25^\circ\text{C}$)	$I_D(T_C=25^\circ\text{C})$	65	A
Drain Current-Continuous($T_C=100^\circ\text{C}$)	$I_D(T_C=100^\circ\text{C})$	45.5	A
Drain Current-Continuous ($T_A=25^\circ\text{C}$)	$I_D(T_A=25^\circ\text{C})$	21.5	A
Pulsed Drain Current (Note 1)	I_{DM}	260	A
Maximum Power Dissipation($T_C=25^\circ\text{C}$)	$P_D(T_C=25^\circ\text{C})$	55	W
Maximum Power Dissipation($T_A=25^\circ\text{C}$)	$P_D(T_A=25^\circ\text{C})$	2.1	W
Derating factor		0.44	W/°C
Single pulse avalanche energy (Note 5)	E_{AS}	500	mJ
Operating Junction and Storage Temperature Range	T_J, T_{STG}	-55 To 150	°C

Thermal Characteristic

Thermal Resistance, Junction-to-Case (Note 2)	$R_{\theta JC}$	2.3	°C/W
Thermal Resistance, Junction-to-Ambient (Note 2)	$R_{\theta JA}$	60	°C/W

Electrical Characteristics (T_c=25°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	2.0	V
Drain-Source On-State Resistance	R _{DS(ON)}	V _{GS} =10V, I _D =20A	-	2.2	2.8	mΩ
		V _{GS} =4.5V, I _D =20A	-	3.3	4.2	mΩ
Gate resistance	R _G	F=1.0MHz	-	4.0	-	Ω
Forward Transconductance	g _{FS}	V _{DS} =5V, I _D =20A	-	60	-	S
Dynamic Characteristics (Note4)						
Input Capacitance	C _{iss}	V _{DS} =20V, V _{GS} =0V, F=1.0MHz	1400	2100	2800	pF
Output Capacitance	C _{oss}		-	773	-	pF
Reverse Transfer Capacitance	C _{rss}		-	15.5	-	pF
Switching Characteristics (Note 4)						
Turn-on Delay Time	t _{d(on)}	V _{DD} =20V, I _D =20A V _{GS} =10V, R _G =1.6Ω	-	7.5	-	nS
Turn-on Rise Time	t _r		-	4.0	-	nS
Turn-Off Delay Time	t _{d(off)}		-	37	-	nS
Turn-Off Fall Time	t _f		-	7.5	-	nS
Total Gate Charge	Q _g	V _{DS} =20V, I _D =20A, V _{GS} =10V	-	34.8	-	nC
Gate-Source Charge	Q _{gs}		-	6.2	-	nC
Gate-Drain Charge	Q _{gd}		-	5.1	-	nC
Drain-Source Diode Characteristics						
Diode Forward Voltage (Note 3)	V _{SD}	V _{GS} =0V, I _S =20A	-	-	1.2	V
Diode Forward Current (Note 2)	I _S		-	-	65	A
Reverse Recovery Time	t _{rr}	T _J = 25°C, I _F = I _S	-	14	-	nS
Reverse Recovery Charge	Q _{rr}	di/dt = 100A/μs (Note3)	-	21	-	nC

Notes:

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

Typical Electrical and Thermal Characteristics

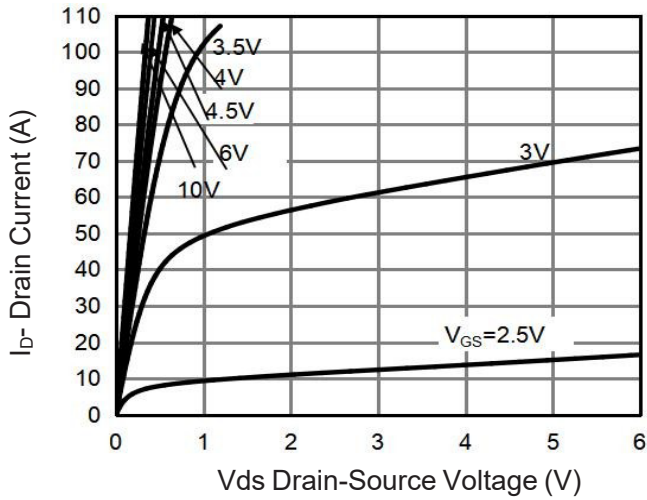


Figure 1 Output Characteristics

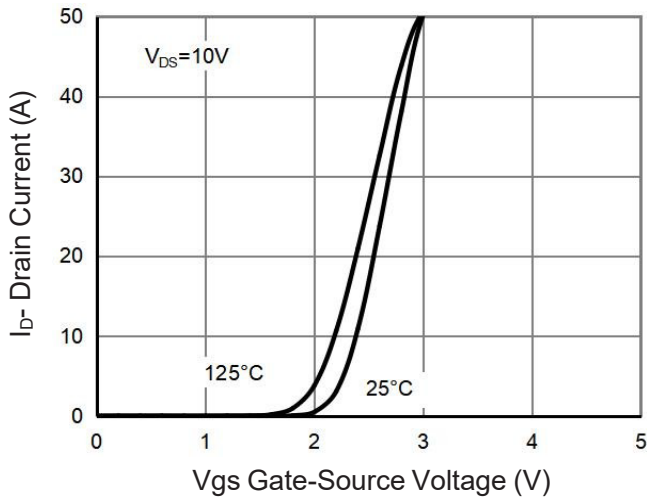


Figure 2 Transfer Characteristics

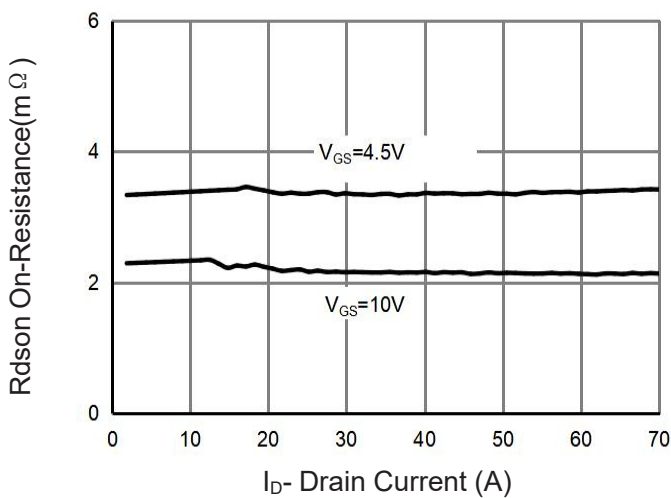


Figure 3 $R_{DS(on)}$ - Drain Current

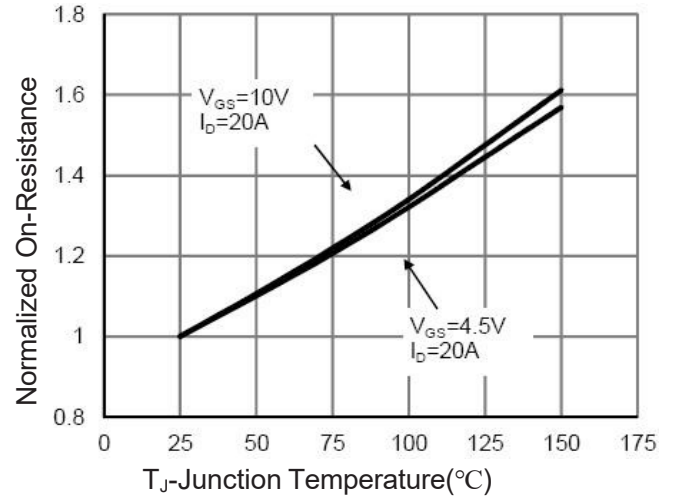


Figure 4 $R_{DS(on)}$ -Junction Temperature

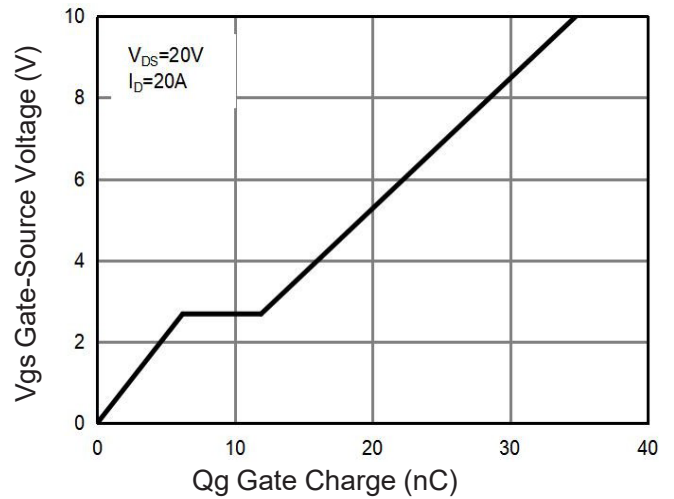


Figure 5 Gate Charge

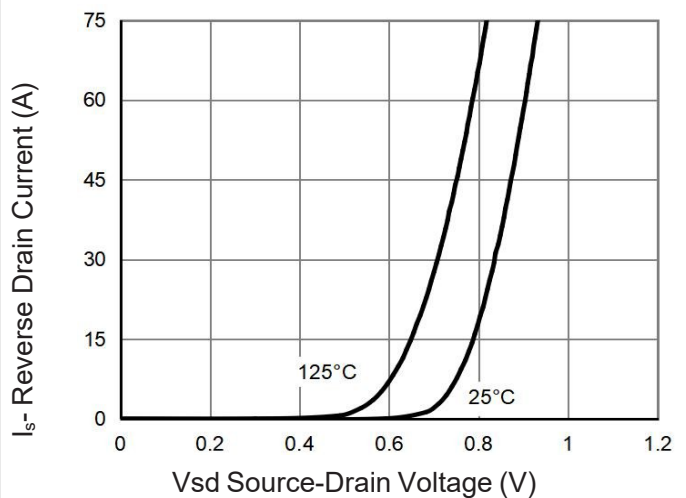
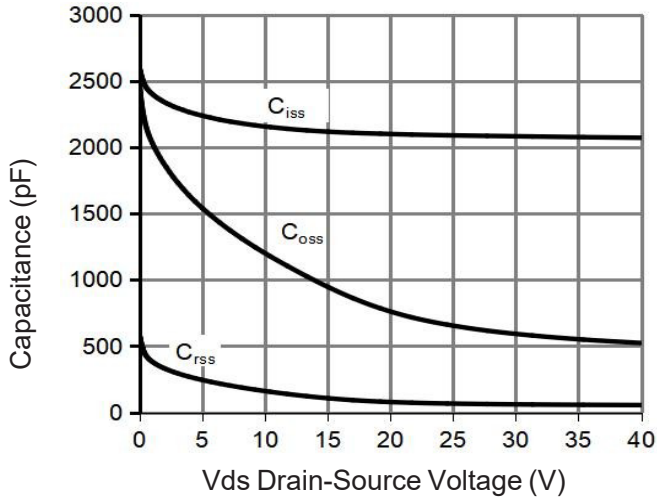
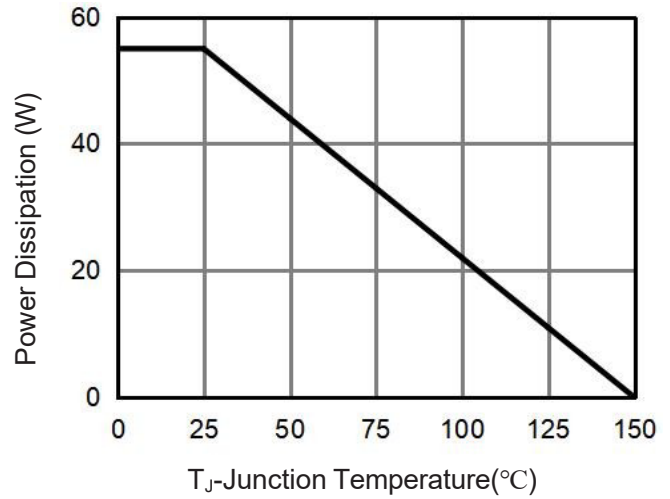
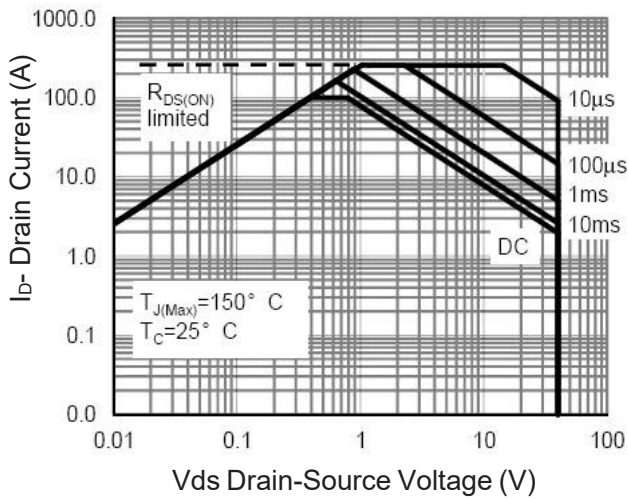
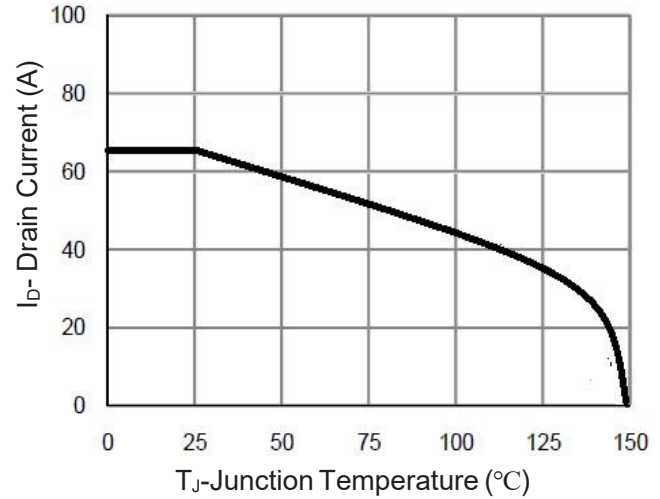
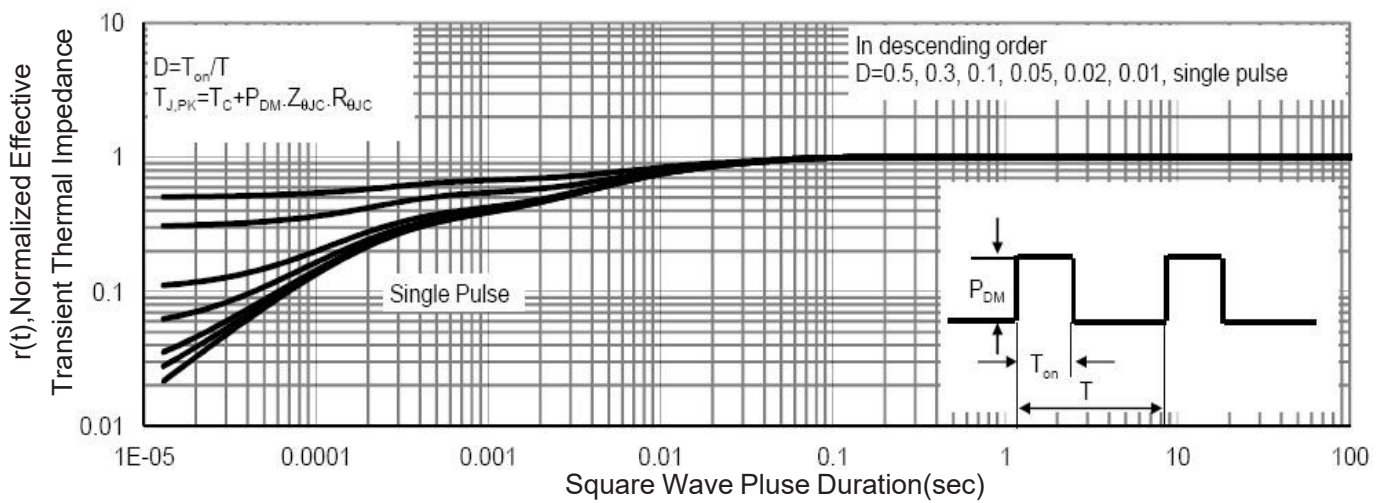


Figure 6 Source- Drain Diode Forward


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