

Description

The series of devices uses **Super Trench II** 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

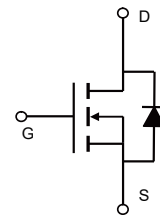
- DC/DC Converter
- Ideal for high-frequency switching and synchronous rectification

General Features

- $V_{DS} = 100V, I_D = 240A$
 $R_{DS(ON)} = 2.1m\Omega$, typical (TO-220) @ $V_{GS} = 10V$
 $R_{DS(ON)} = 1.9m\Omega$, typical (TO-263) @ $V_{GS} = 10V$
- Excellent gate charge x $R_{DS(on)}$ product(FOM)
- Very low on-resistance $R_{DS(on)}$
- 175 °C operating temperature
- Pb-free lead plating



TO-220



Schematic

Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
VST10N020	VST10N020-TC	TO-220	-	-	-

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}	± 20	V
Drain Current-Continuous	I_D	240	A
Drain Current-Continuous($T_c = 100^\circ\text{C}$)	$I_D(100^\circ\text{C})$	170	A
Pulsed Drain Current	I_{DM}	960	A
Maximum Power Dissipation	P_D	340	W
Derating factor		2.27	W/ $^\circ\text{C}$
Single pulse avalanche energy ^(Note 4)	E_{AS}	2332	mJ
Operating Junction and Storage Temperature Range	T_J, T_{STG}	-55 To 175	$^\circ\text{C}$

Thermal Characteristic

Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	0.44	$^{\circ}\text{C/W}$
Thermal Resistance, Junction-to-Ambient ^(Note 2)	$R_{\theta JA}$	60	$^{\circ}\text{C/W}$

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	100	-	-	V	
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} =100V, V _{GS} =0V	-	-	1	μA	
Gate-Body Leakage Current	I _{GSS}	V _{GS} =±20V, V _{DS} =0V	-	-	±100	nA	
On Characteristics (Note 2)							
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 =120A	TO-220	-	2.1	2.3	mΩ
			TO-263		1.9	2.3	mΩ
Gate resistance	R _G		-	2.9	-	Ω	
Forward Transconductance	g _{FS}	V _{DS} =5V, I _D =120A		200	-	S	
Dynamic Characteristics (Note3)							
Input Capacitance	C _{iss}	V _{DS} =50V, V _{GS} =0V, F=1.0MHz	-	17000	-	pF	
Output Capacitance	C _{oss}		-	1500	-	pF	
Reverse Transfer Capacitance	C _{rss}		-	77	-	pF	
Switching Characteristics (Note 3)							
Turn-on Delay Time	t _{d(on)}	V _{DD} =50V, I _D =120A V _{GS} =10V, R _G =1.6Ω	-	37	-	nS	
Turn-on Rise Time	t _r		-	29	-	nS	
Turn-Off Delay Time	t _{d(off)}		-	82	-	nS	
Turn-Off Fall Time	t _f		-	34	-	nS	
Total Gate Charge	Q _g	V _{DS} =50V, I _D =120A, V _{GS} =10V	-	252	-	nC	
Gate-Source Charge	Q _{gs}		-	72	-	nC	
Gate-Drain Charge	Q _{gd}		-	63	-	nC	
Drain-Source Diode Characteristics							
Diode Forward Voltage (Note 3)	V _{SD}	V _{GS} =0V, I _S =120A	-	-	1.2	V	
Diode Forward Current (Note 2)	I _S		-	-	240	A	
Reverse Recovery Time	t _{rr}	T _J = 25°C, I _F = 120A	-	105	-	nS	
Reverse Recovery Charge	Q _{rr}	di/dt = 100A/μs ^(Note2)	-	290	-	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 Power dissipation P_{DSM} is based on $R_{\theta JA}$ and the maximum allowed junction temperature of 150°C . The value in any given application depends on the user's specific board design, and the maximum temperature of 175°C may be used if the PCB allows it.
3. Guaranteed by design, not subject to production
4. EAS condition : $T_J=25^{\circ}\text{C}, V_{DD}=50V, V_G=10V, L=0.5\text{mH}, R_g=25\Omega$

Typical Electrical and Thermal Characteristics

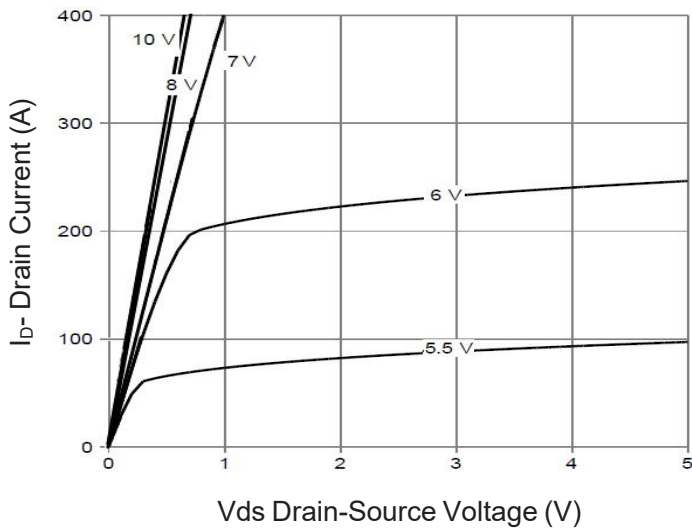


Figure 1 Output Characteristics

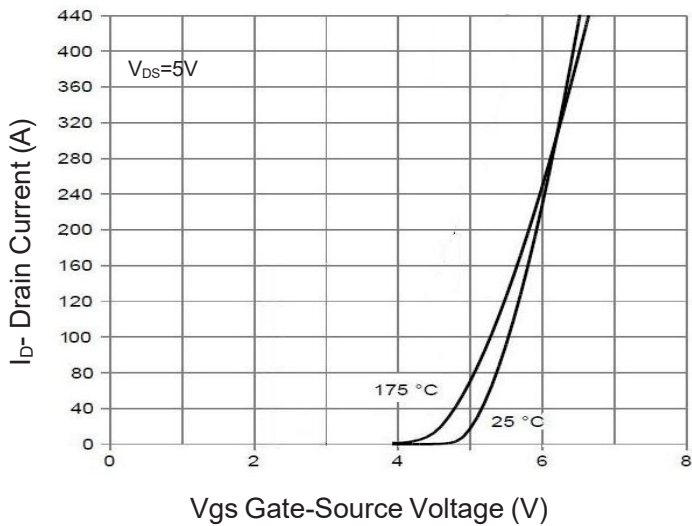


Figure 2 Transfer Characteristics

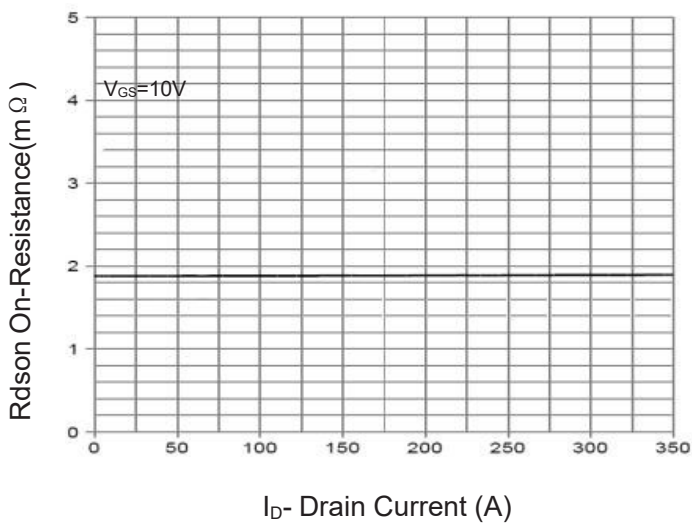


Figure 3 $R_{DS(on)}$ - Drain Current

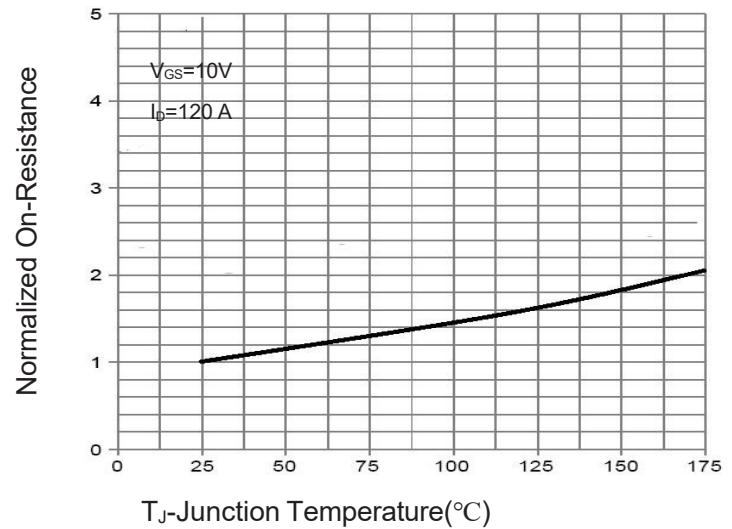


Figure 4 $R_{DS(on)}$ -Junction Temperature

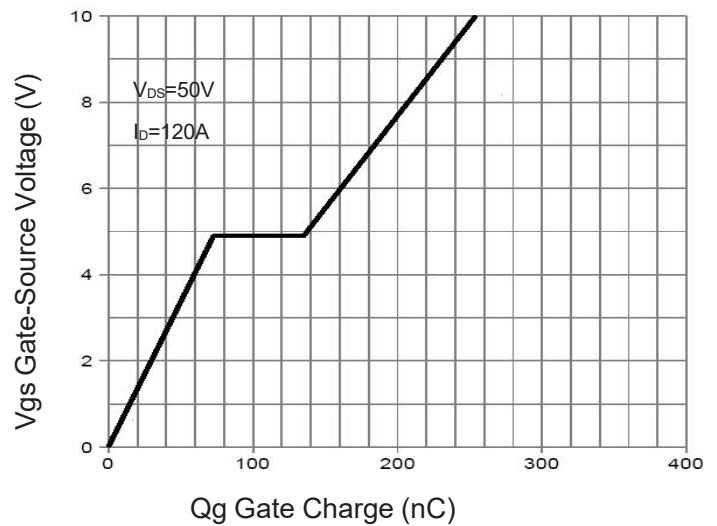


Figure 5 Gate Charge

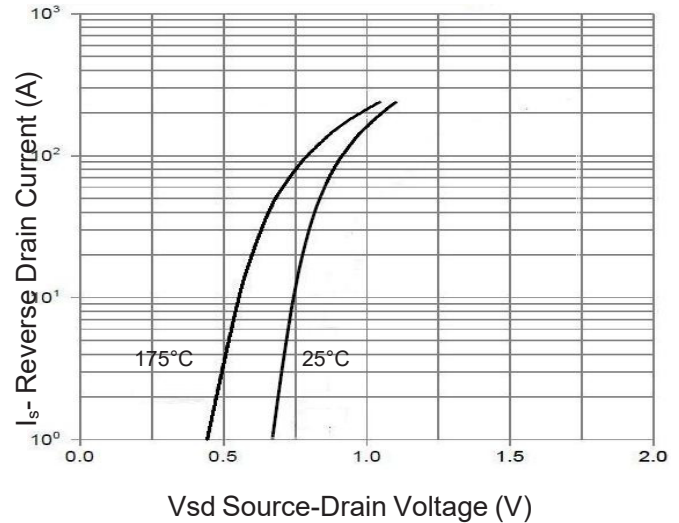
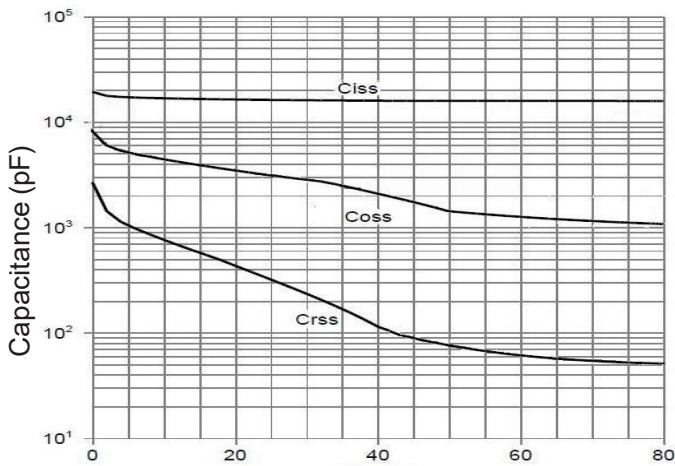
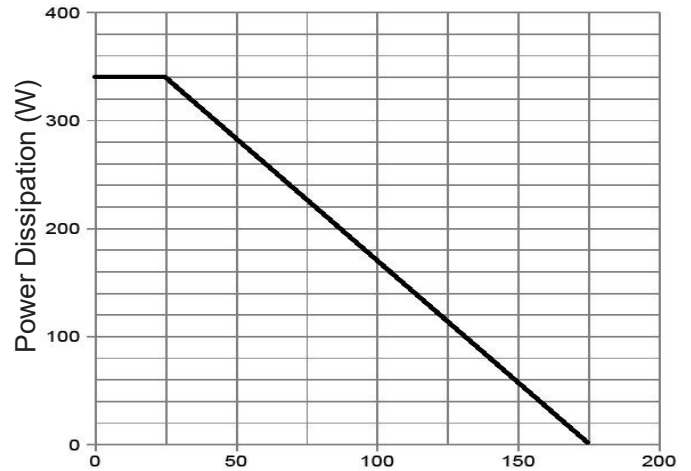


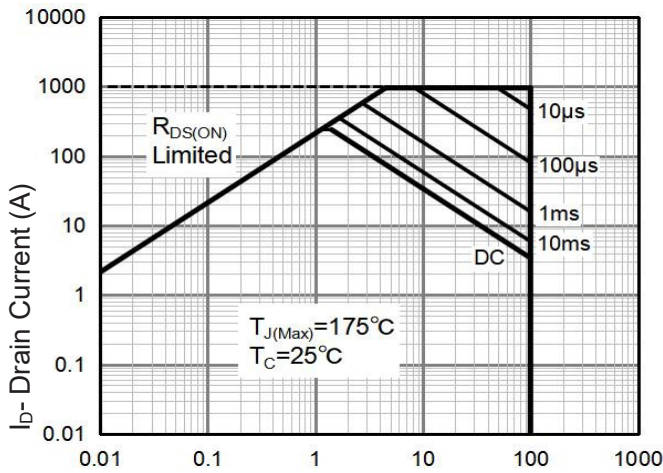
Figure 6 Source- Drain Diode Forward



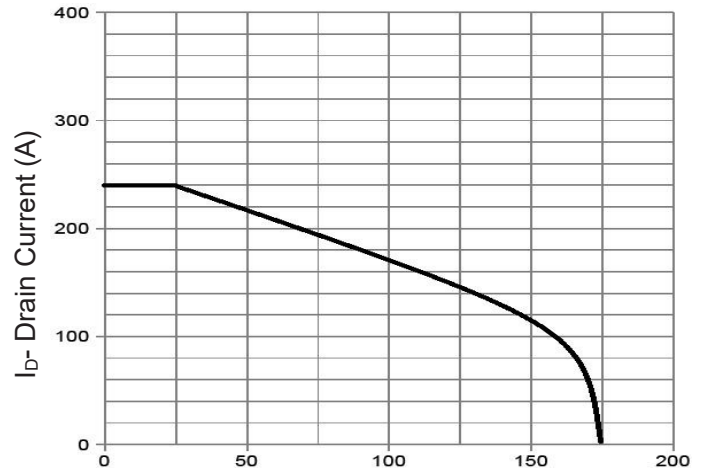
Vds Drain-Source Voltage (V)
Figure 7 Capacitance vs Vds



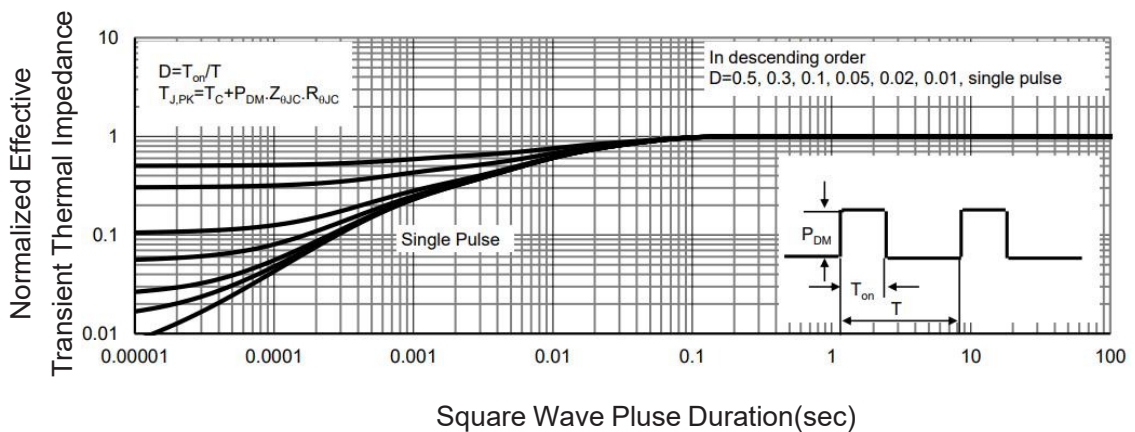
T_J-Junction Temperature(°C)
Figure 9 Power De-rating



Vds Drain-Source Voltage (V)
Figure 8 Safe Operation Area



T_J-Junction Temperature (°C)
Figure 10 Current De-rating



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