

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

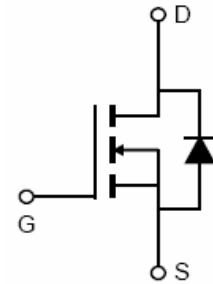
- $V_{DS} = 120V, I_D = 130A$
 $R_{DS(ON)} = 4.5m\Omega$, typical (TO-220) @ $V_{GS} = 10V$
 $R_{DS(ON)} = 4.3m\Omega$, typical (TO-263) @ $V_{GS} = 10V$
- Excellent gate charge x $R_{DS(on)}$ product(FOM)
- Very low on-resistance $R_{DS(on)}$
- 175 °C operating temperature
- Pb-free lead plating



TO-220C



TO-263



Schematic Diagram

Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
VST12N043-TC	VST12N043	TO-220C	-	-	-
VST12N043-T3	VST12N043	TO-263	-	-	-

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

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	V_{DS}	120	V
Gate-Source Voltage	V_{GS}	± 20	V
Drain Current-Continuous	I_D	130	A
Drain Current-Continuous($T_C = 100^\circ C$)	$I_D(100^\circ C)$	93	A
Pulsed Drain Current	I_{DM}	520	A
Maximum Power Dissipation	P_D	220	W
Derating factor		1.47	W/ $^\circ C$
Single pulse avalanche energy ^(Note 5)	E_{AS}	1050	mJ
Operating Junction and Storage Temperature Range	T_J, T_{STG}	-55 To 175	$^\circ C$

Thermal Characteristic

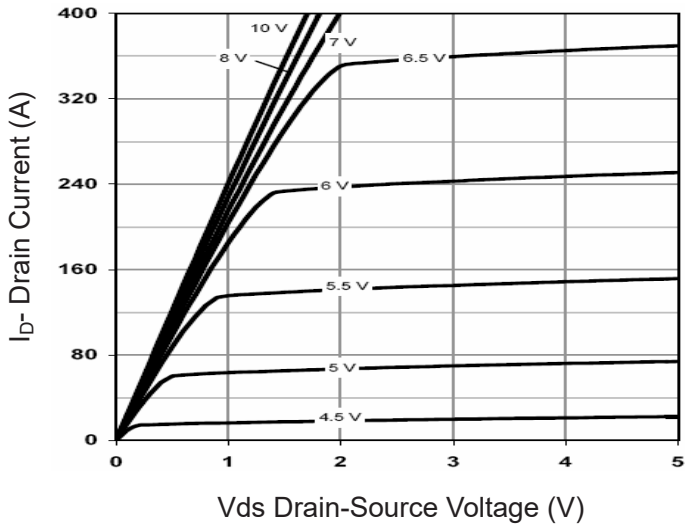
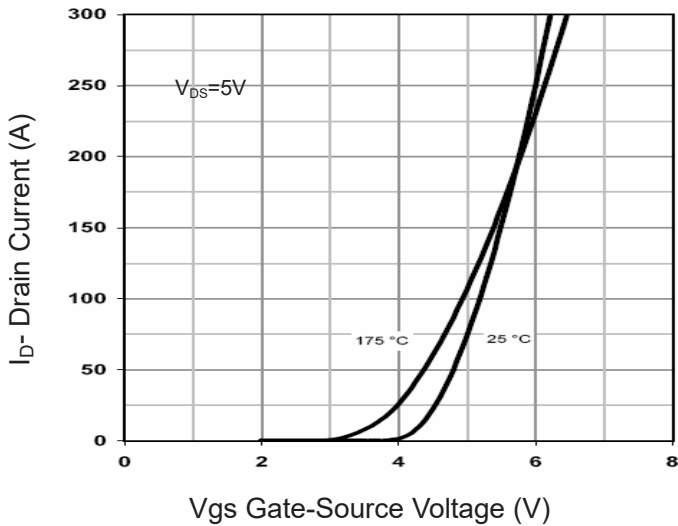
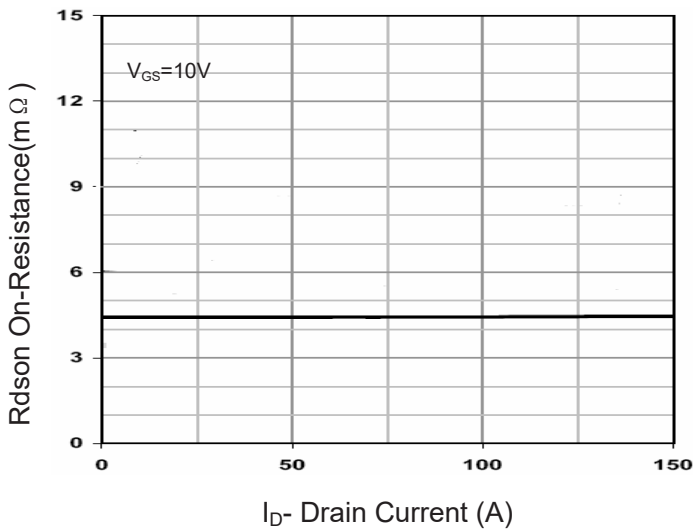
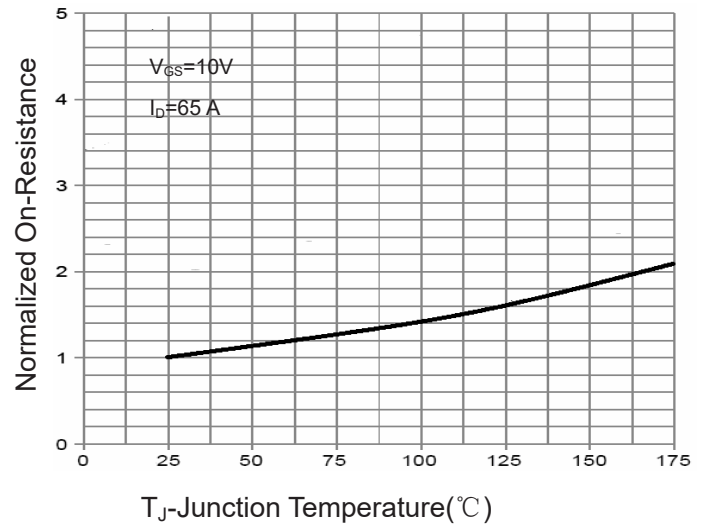
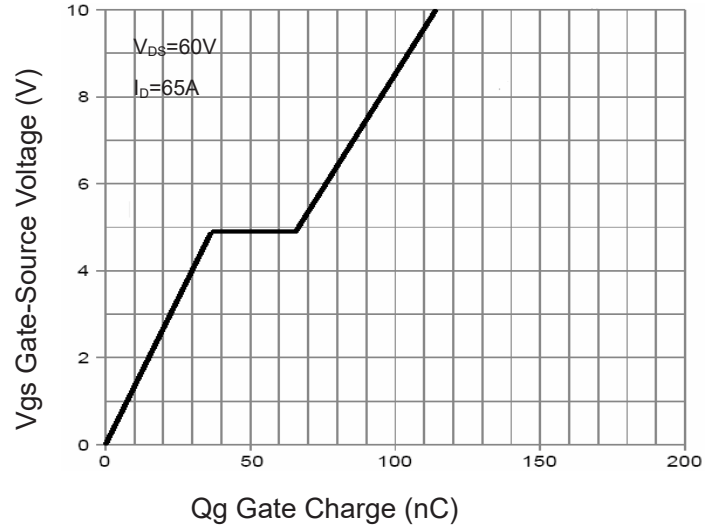
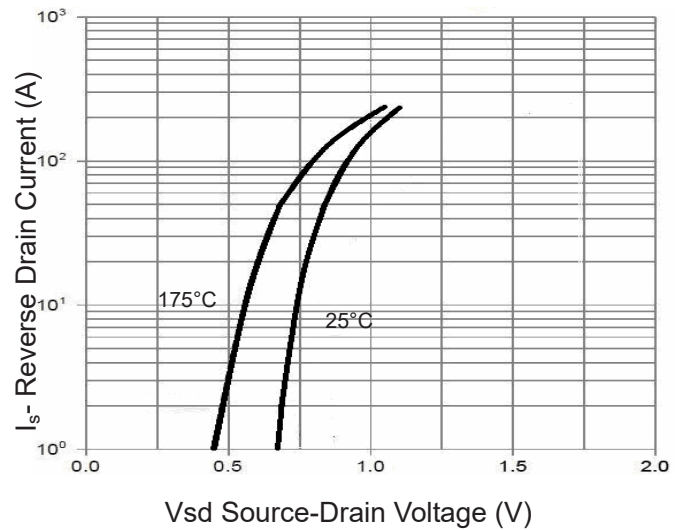
Thermal Resistance, Junction-to-Case ^(Note 2)	$R_{\theta JC}$	0.68	$^{\circ}\text{C/W}$
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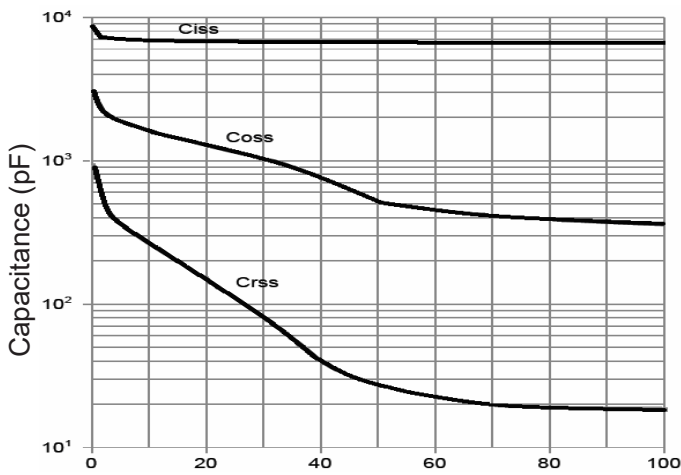
Electrical Characteristics ($T_C=25^{\circ}\text{C}$ unless otherwise noted)

Parameter	Symbol	Condition	Min	Typ	Max	Unit	
Off Characteristics							
Drain-Source Breakdown Voltage	BV_{DSS}	$V_{GS}=0V, I_D=250\mu A$	120		-	V	
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS}=120V, V_{GS}=0V$	-	-	1	μA	
Gate-Body Leakage Current	I_{GSS}	$V_{GS}=\pm 20V, V_{DS}=0V$	-	-	± 100	nA	
On Characteristics ^(Note 3)							
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	2.0	3.0	4.0	V	
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS}=10V, I_D=65A$	TO-220	-	4.5	5.0	m Ω
			TO-263		4.3	5.0	m Ω
Forward Transconductance	g_{FS}	$V_{DS}=5V, I_D=65A$	85	-	-	S	
Dynamic Characteristics ^(Note 4)							
Input Capacitance	C_{iss}	$V_{DS}=60V, V_{GS}=0V,$ $F=1.0\text{MHz}$	-	6880	-	PF	
Output Capacitance	C_{oss}		-	450	-	PF	
Reverse Transfer Capacitance	C_{rss}		-	22	-	PF	
Switching Characteristics ^(Note 4)							
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=60V, I_D=65A$ $V_{GS}=10V, R_G=1.6\Omega$	-	20	-	nS	
Turn-on Rise Time	t_r		-	11.5	-	nS	
Turn-Off Delay Time	$t_{d(off)}$		-	48	-	nS	
Turn-Off Fall Time	t_f		-	10	-	nS	
Total Gate Charge	Q_g	$V_{DS}=60V, I_D=65A,$ $V_{GS}=10V$	-	112	-	nC	
Gate-Source Charge	Q_{gs}		-	36		nC	
Gate-Drain Charge	Q_{gd}		-	27		nC	
Drain-Source Diode Characteristics							
Diode Forward Voltage ^(Note 3)	V_{SD}	$V_{GS}=0V, I_S=65A$	-		1.2	V	
Diode Forward Current ^(Note 2)	I_S		-	-	130	A	
Reverse Recovery Time	t_{rr}	$T_J = 25^{\circ}\text{C}, I_F = I_S$ $di/dt = 100A/\mu s$ ^(Note 3)	-	76	-	nS	
Reverse Recovery Charge	Q_{rr}		-	150	-	nC	

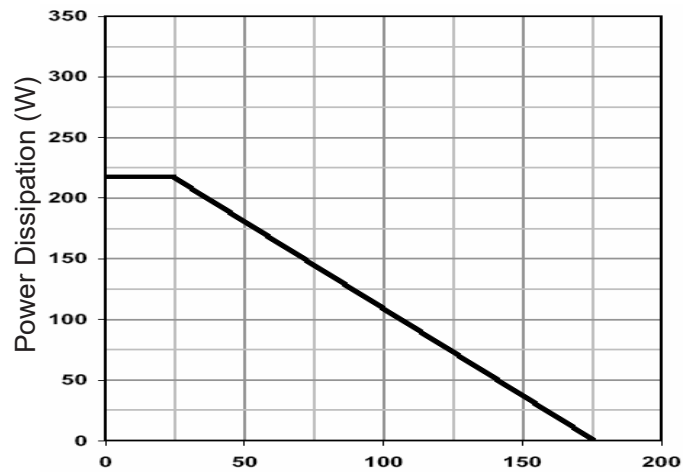
Notes:

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 : $T_J=25^{\circ}\text{C}, V_{DD}=50V, V_G=10V, L=0.5\text{mH}, R_G=25\Omega$

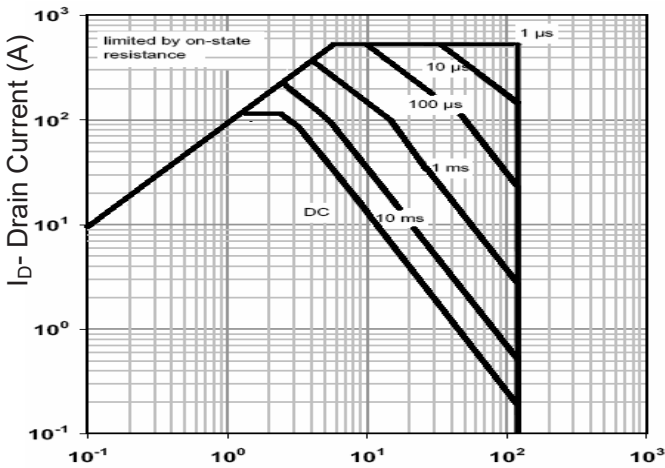
Typical Electrical and Thermal Characteristics

Figure 1 Output Characteristics

Figure 2 Transfer Characteristics

Figure 3 Rdson- Drain Current

Figure 4 Rdson-Junction Temperature

Figure 5 Gate Charge

Figure 6 Source- Drain Diode Forward



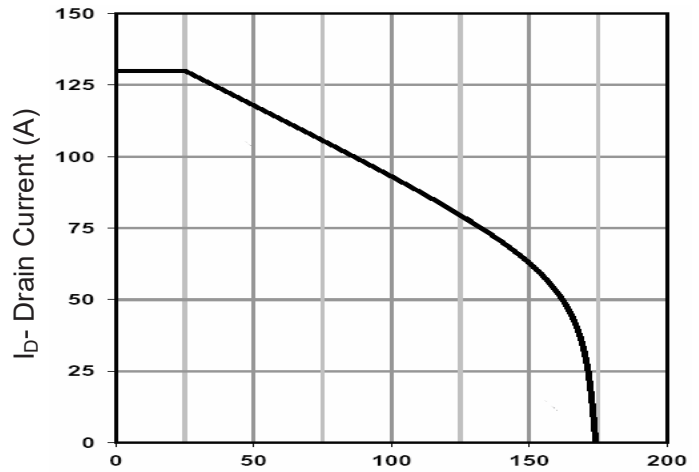
Vds Drain-Source Voltage (V)
Figure 7 Capacitance vs Vds



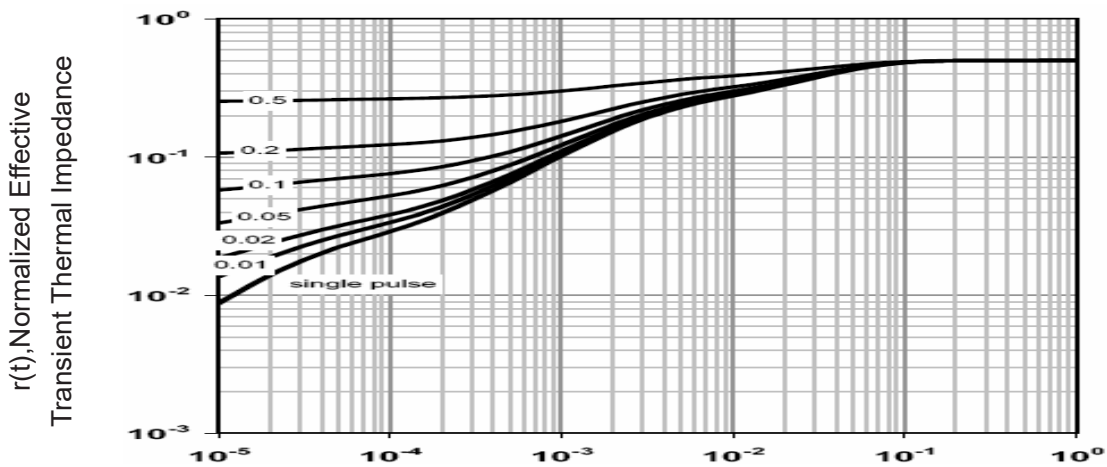
T_J-Junction Temperature(°C)
Figure 9 Power De-rating



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