

Description

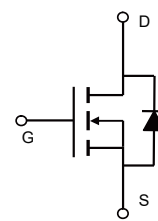
The series of devices uses **Super Trench II** technology that is uniquely optimized to provide the most efficient high frequency switching performance. Both conduction and switching power losses are minimized due to an extremely low combination of $R_{DS(ON)}$ and Q_g . This device is ideal for high-frequency 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



Schematic

Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
VST12N040	VST12N040-TC	TO-220	-	-	-

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 1)	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	$R_{\theta JC}$	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 =250μA	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} =±20V, V _{DS} =0V	-	-	±100	nA	
On Characteristics							
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 =65A	TO-220	-	4.5	5.0	mΩ
			TO-263		4.3	5.0	mΩ
Forward Transconductance	g _{FS}	V _{DS} =5V, I _D =65A	85	-	-	S	
Dynamic Characteristics							
Input Capacitance	C _{iss}	V _{DS} =60V, V _{GS} =0V, F=1.0MHz	-	6880	-	PF	
Output Capacitance	C _{oss}		-	450	-	PF	
Reverse Transfer Capacitance	C _{rss}		-	22	-	PF	
Switching Characteristics (Note 2)							
Turn-on Delay Time	t _{d(on)}	V _{DD} =60V, I _D =65A V _{GS} =10V, R _G =1.6Ω	-	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	V _{SD}	V _{GS} =0V, I _S =65A	-		1.2	V	
Diode Forward Current	I _S		-	-	130	A	
Reverse Recovery Time	t _{rr}	T _J = 25°C, I _F = I _S di/dt = 100A/μs	-	76	-	nS	
Reverse Recovery Charge	Q _{rr}		-	150	-	nC	

Notes:

1. EAS condition : $T_J=25^{\circ}\text{C}, V_{DD}=50V, V_G=10V, L=0.5\text{mH}, R_G=25\Omega$
2. Guaranteed by design, not subject to production
3. These curves are based on the junction-to-case thermal impedance which is measured with the device mounted to a large heatsink, assuming a maximum junction temperature of $T_J(\text{MAX})=175^{\circ}\text{C}$. The SOA curve provides a single pulse rating.

Typical Electrical and Thermal Characteristics

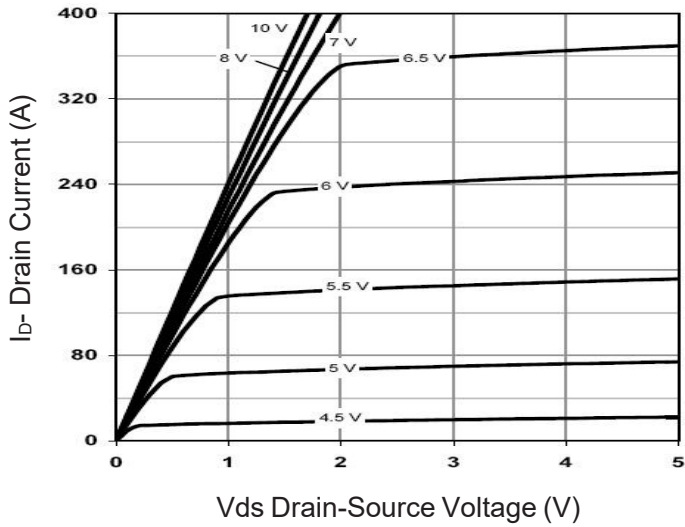


Figure 1 Output Characteristics

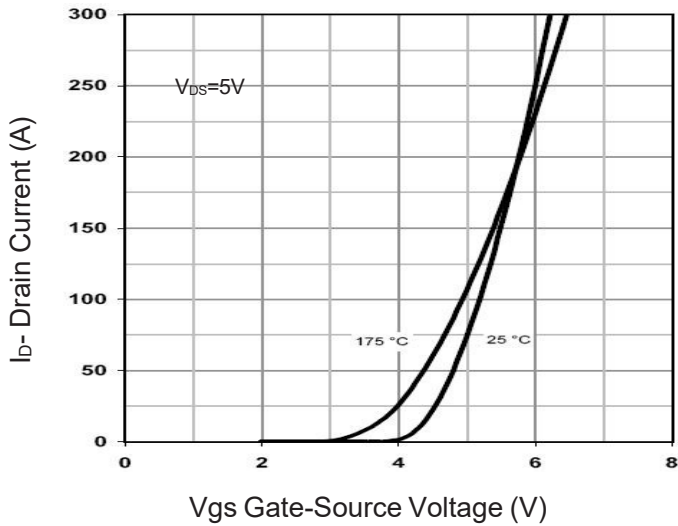


Figure 2 Transfer Characteristics

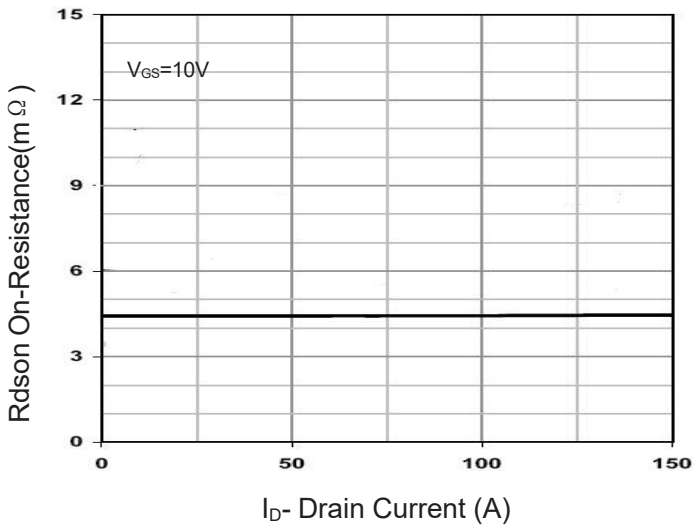


Figure 3 $R_{DS(on)}$ - Drain Current

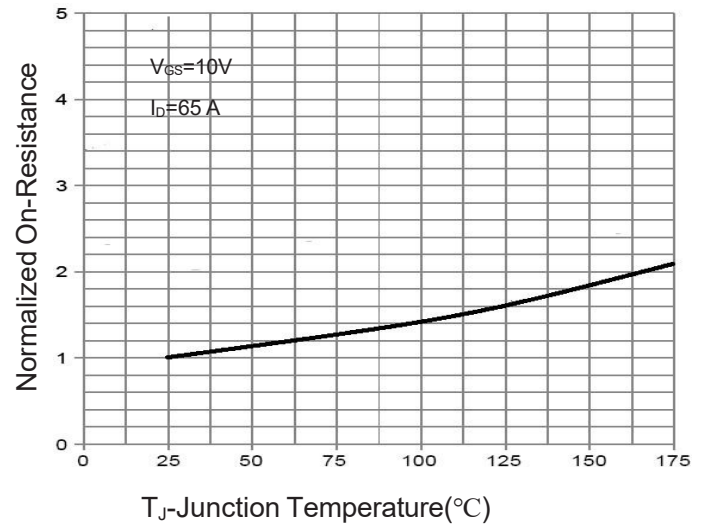


Figure 4 $R_{DS(on)}$ -Junction Temperature

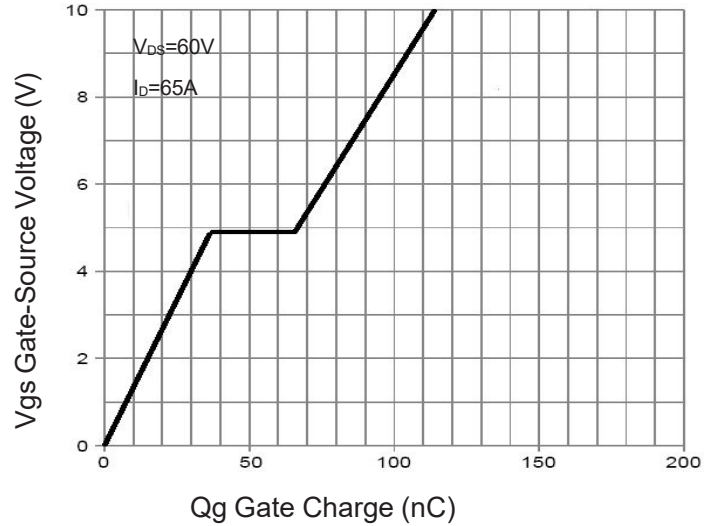


Figure 5 Gate Charge

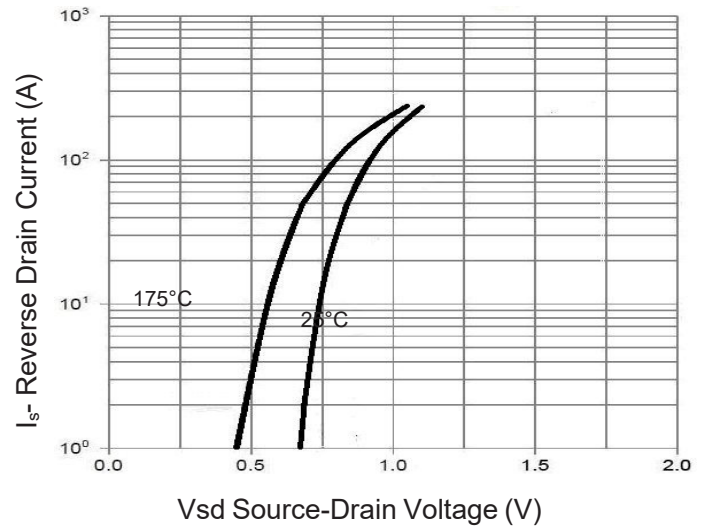
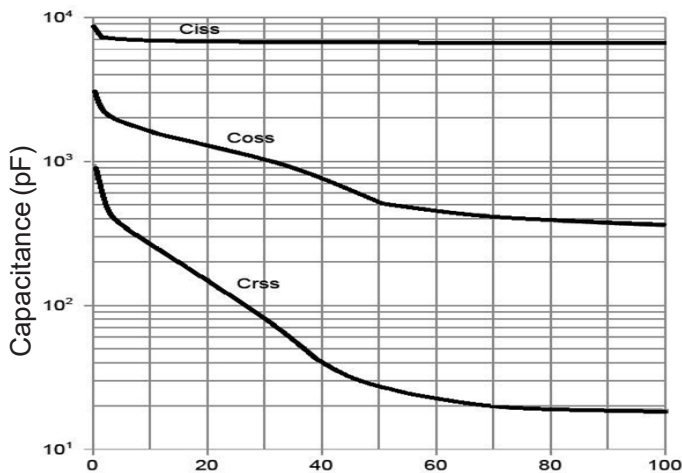
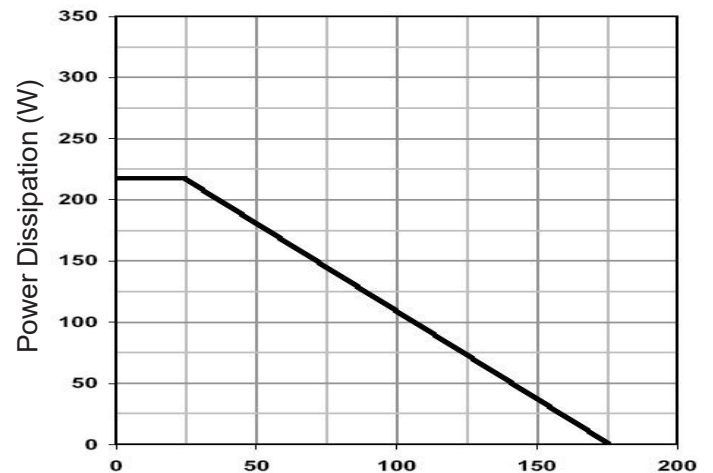


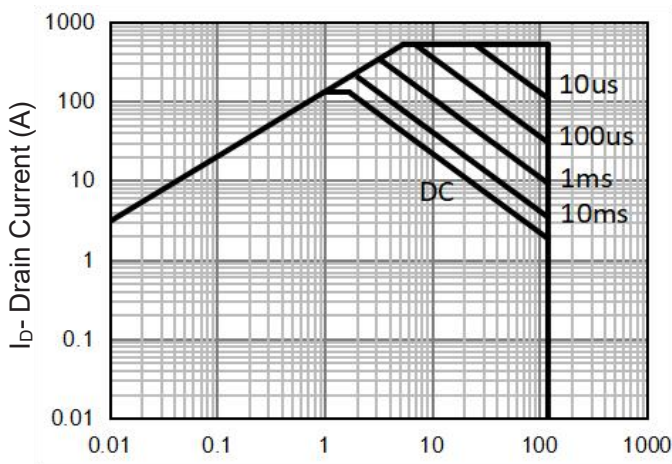
Figure 6 Source- Drain Diode Forward



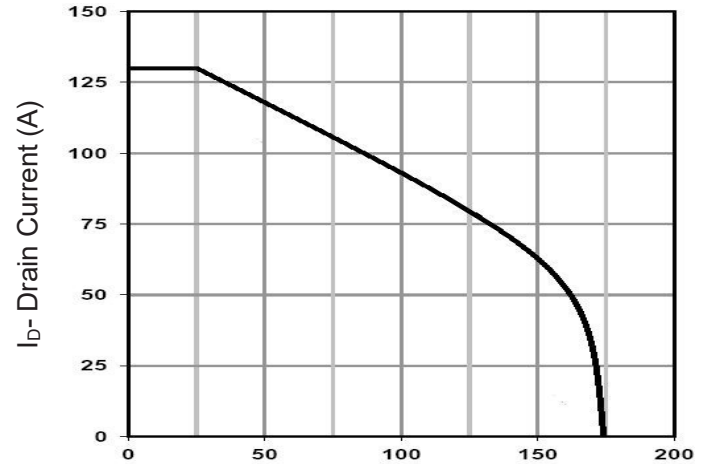
Vds Drain-Source Voltage (V)
Figure 7 Capacitance vs Vds



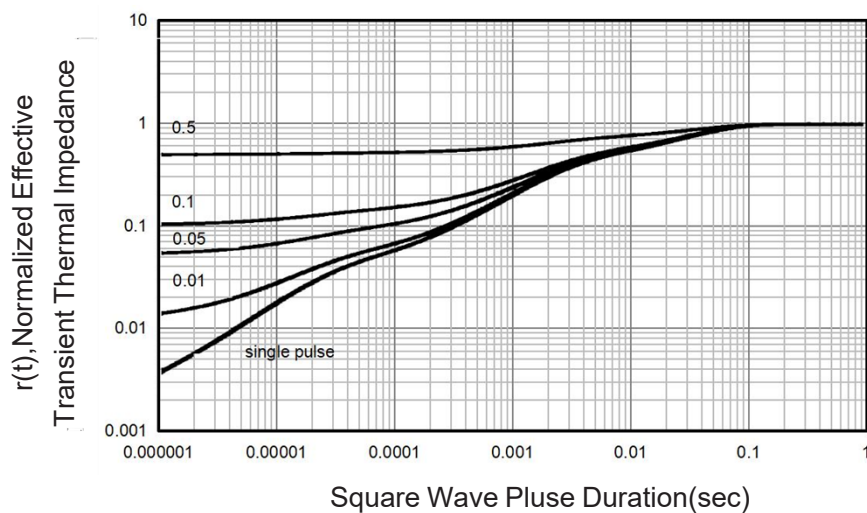
TA-Case Temperature(°C)
Figure 9 Power De-rating



Vds Drain-Source Voltage (V)
Figure 8 Safe Operation Area (Note 3)



TA-Case Temperature (°C)
Figure 10 Current De-rating



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