

Description

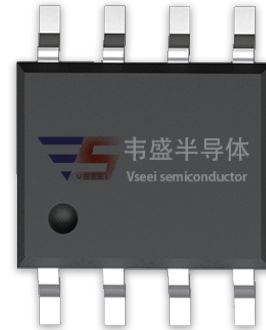
The VST12N109 uses **Super Trench** technology that is uniquely optimized to provide the most efficient high frequency switching performance. Both conduction and switching power losses are minimized due to an extremely low combination of $R_{DS(ON)}$ and Q_g . This device is ideal for high-frequency switching and synchronous rectification.

General Features

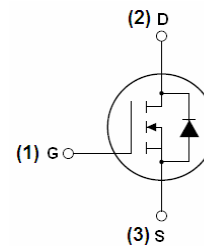
- $V_{DS} = 120V, I_D = 12A$
 $R_{DS(ON)} = 10.9m\Omega$ (typical) @ $V_{GS} = 10V$
 $R_{DS(ON)} = 12.7m\Omega$ (typical) @ $V_{GS} = 4.5V$
- Excellent gate charge x $R_{DS(on)}$ product(FOM)
- Very low on-resistance $R_{DS(on)}$
- 150 °C operating temperature
- Pb-free lead plating
- 100% UIS tested

Application

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



SOP-8



Schematic Diagram

Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
VST12N109-S8	VST12N109	SOP-8	Ø330mm	12mm	2500 units

Absolute Maximum Ratings ($T_A = 25^\circ C$ 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	12	A
Drain Current-Continuous($T_C = 100^\circ C$)	$I_D(100^\circ C)$	8	A
Pulsed Drain Current	I_{DM}	48	A
Maximum Power Dissipation	P_D	3.5	W
Derating factor		0.028	W/ $^\circ C$
Single pulse avalanche energy ^(Note 5)	E_{AS}	152	mJ
Operating Junction and Storage Temperature Range	T_J, T_{STG}	-55 To 150	$^\circ C$

Thermal Characteristic

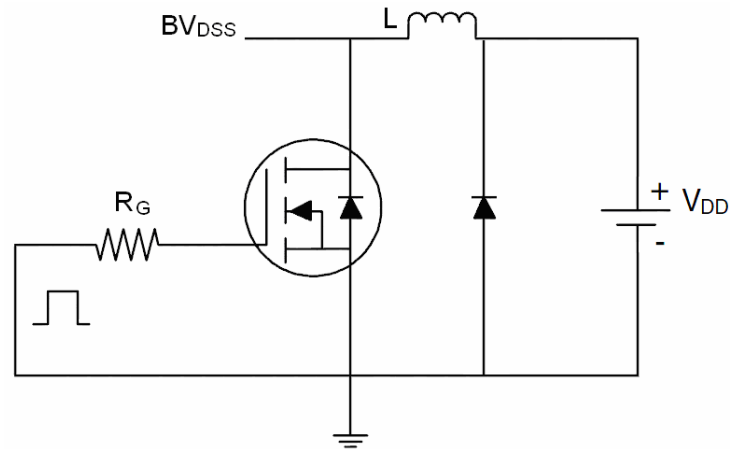
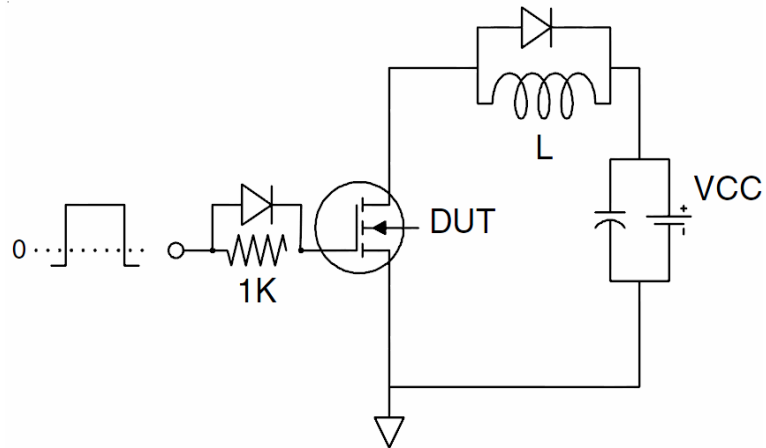
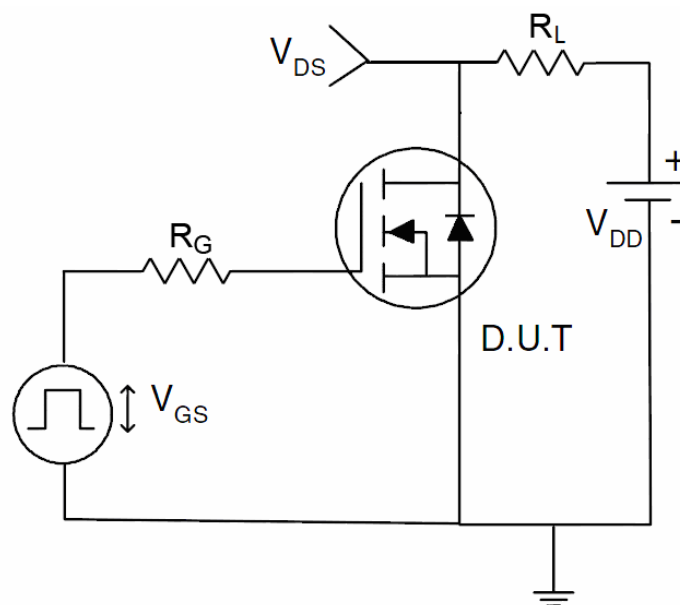
Thermal Resistance, Junction-to-Ambient ^(Note 2)	$R_{\theta JA}$	36	°C/W
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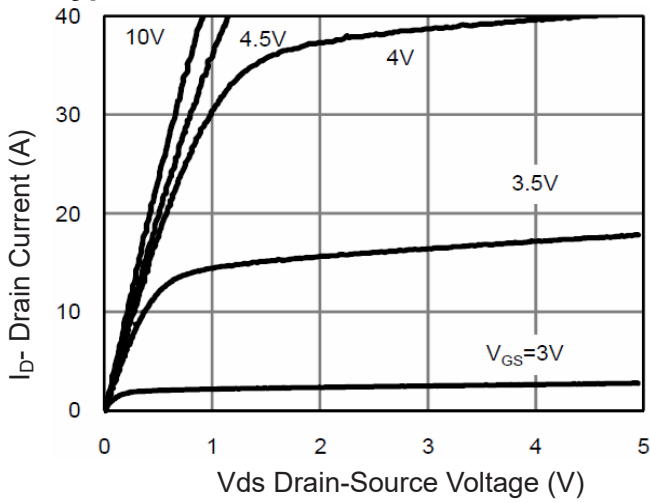
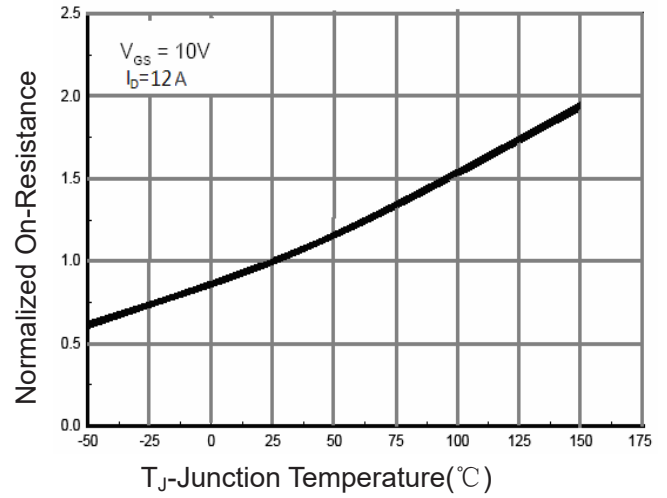
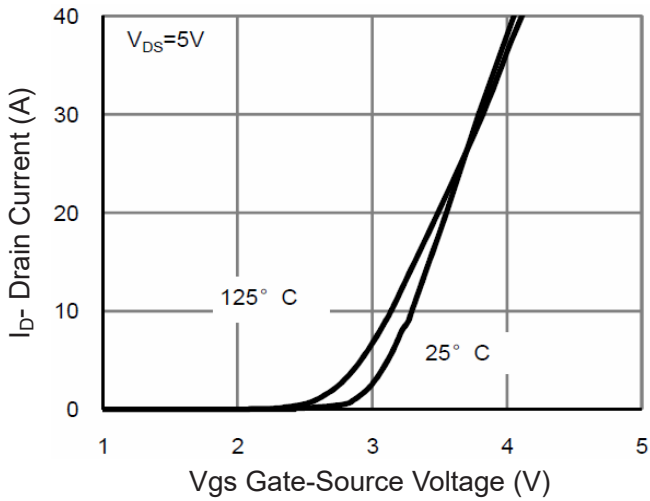
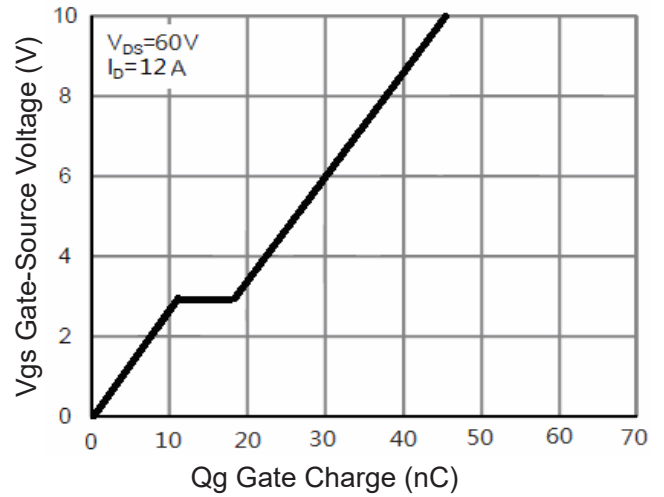
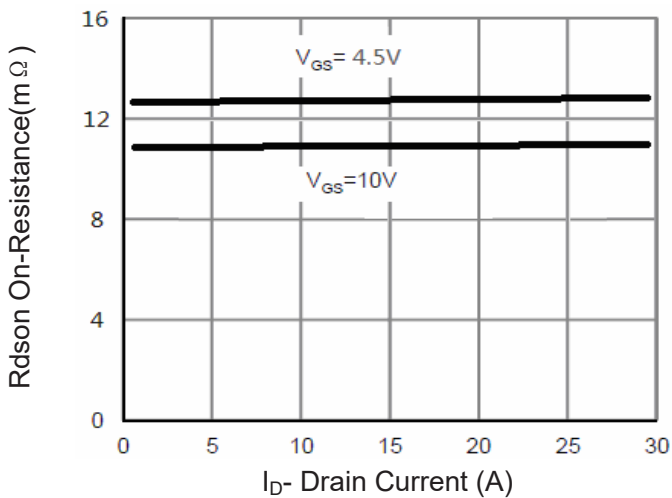
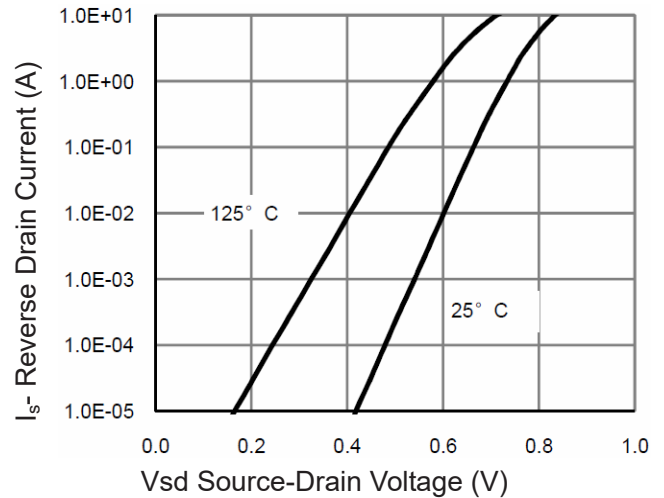
Electrical Characteristics ($T_A=25^\circ\text{C}$ unless otherwise noted)

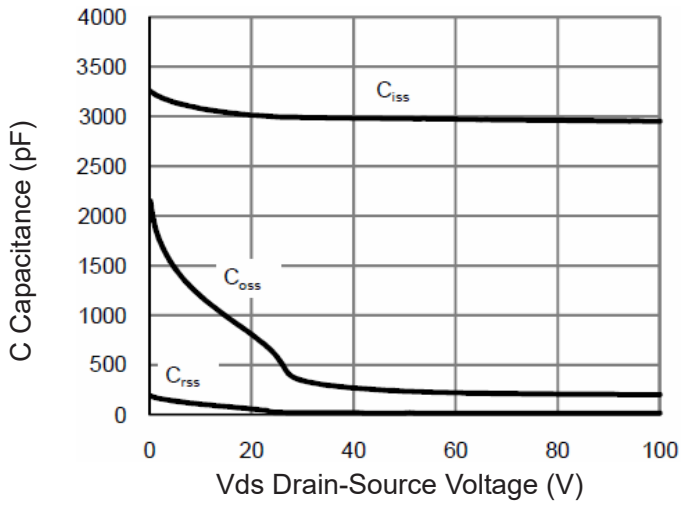
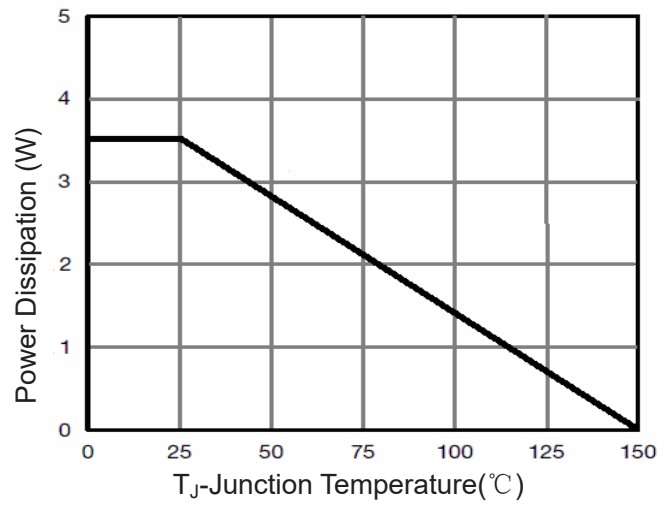
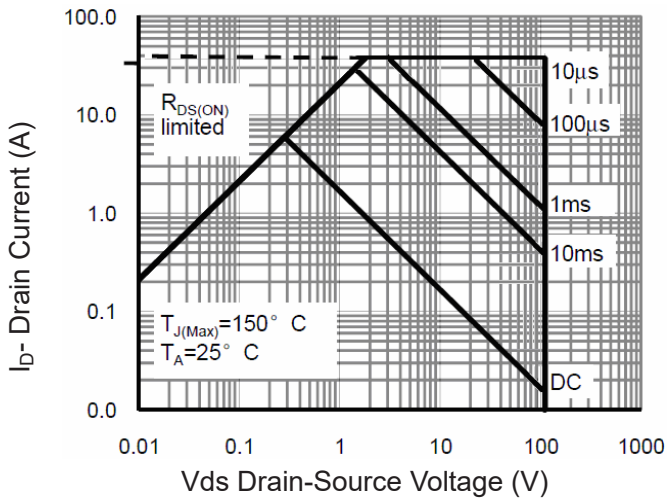
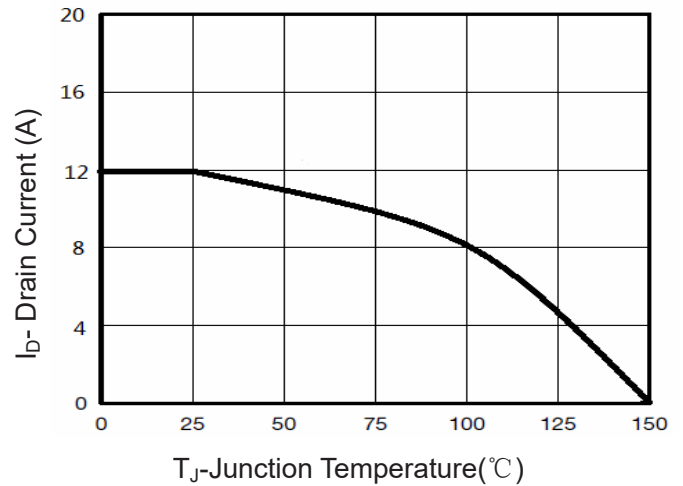
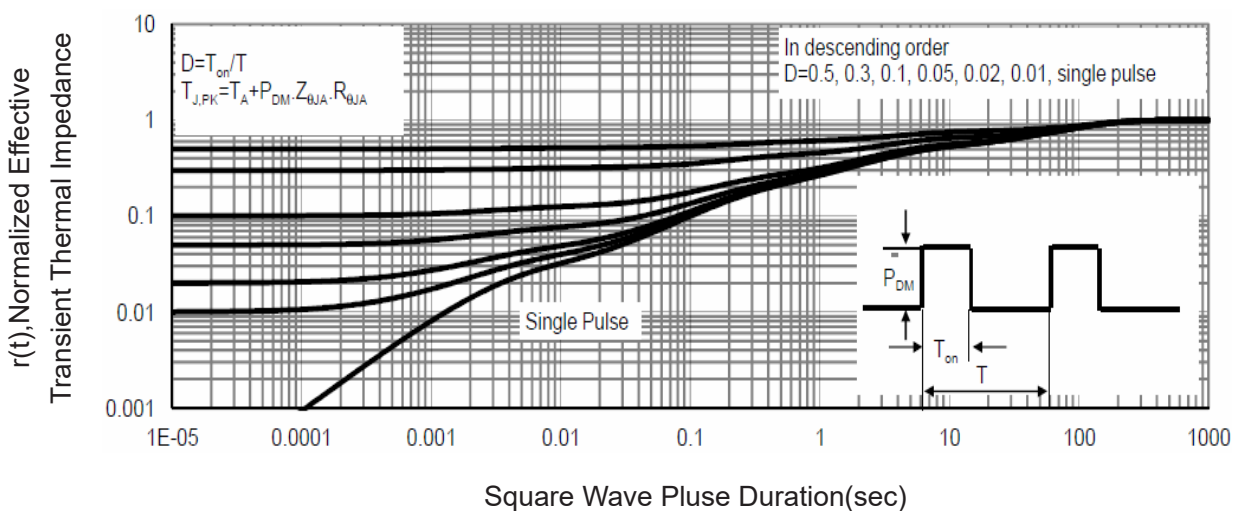
Parameter	Symbol	Condition	Min	Typ	Max	Unit
Off Characteristics						
Drain-Source Breakdown Voltage	BV_{DSS}	$V_{GS}=0V, I_D=250\mu A$	120	-	-	V
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS}=120V, V_{GS}=0V$	-	-	1	μA
Gate-Body Leakage Current	I_{GSS}	$V_{GS}=\pm 20V, V_{DS}=0V$	-	-	± 100	nA
On Characteristics ^(Note 3)						
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	1.0	1.7	2.2	V
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS}=10V, I_D=12A$	-	10.9	14	m Ω
		$V_{GS}=4.5V, I_D=12A$	-	12.7	16.5	m Ω
Forward Transconductance	g_{FS}	$V_{DS}=5V, I_D=12A$	-	30	-	S
Dynamic Characteristics ^(Note 4)						
Input Capacitance	C_{iss}	$V_{DS}=50V, V_{GS}=0V,$ $F=1.0\text{MHz}$	-	3050	-	PF
Output Capacitance	C_{oss}		-	274	-	PF
Reverse Transfer Capacitance	C_{rss}		-	17.8	-	PF
Switching Characteristics ^(Note 4)						
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=60V, I_D=12A$ $V_{GS}=10V, R_G=1.6\Omega$	-	11	-	nS
Turn-on Rise Time	t_r		-	7	-	nS
Turn-Off Delay Time	$t_{d(off)}$		-	30	-	nS
Turn-Off Fall Time	t_f		-	4	-	nS
Total Gate Charge	Q_g	$V_{DS}=60V, I_D=12A,$ $V_{GS}=10V$	-	45	-	nC
Gate-Source Charge	Q_{gs}		-	11.6	-	nC
Gate-Drain Charge	Q_{gd}		-	6	-	nC
Drain-Source Diode Characteristics						
Diode Forward Voltage ^(Note 3)	V_{SD}	$V_{GS}=0V, I_S=12A$	-	-	1.2	V
Diode Forward Current ^(Note 2)	I_S		-	-	12	A
Reverse Recovery Time	t_{rr}	$T_J = 25^\circ\text{C}, I_F = I_S$ $di/dt = 100A/\mu\text{s}$ ^(Note 3)	-	78	-	nS
Reverse Recovery Charge	Q_{rr}		-	149	-	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 $\leq 300\mu\text{s}$, Duty Cycle $\leq 2\%$.
4. Guaranteed by design, not subject to production
5. EAS condition : $T_J=25^\circ\text{C}, V_{DD}=50V, V_G=10V, L=0.5\text{mH}, R_g=25\Omega$

Test Circuit
1) E_{AS} test Circuit

2) Gate charge test Circuit

3) Switch Time Test Circuit


Typical Electrical and Thermal Characteristics

Figure 1 Output Characteristics

Figure 4 Rds(on)-Junction Temperature

Figure 2 Transfer Characteristics

Figure 5 Gate Charge

Figure 3 Rds(on)- Drain Current

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