

Description

The series of devices 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

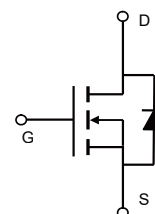
- DC/DC Converter
- Ideal for high-frequency switching and synchronous rectification

General Features

- $V_{DS} = 150V, I_D = 170A$
 $R_{DS(ON)} = 5.0m\Omega$, typical@ $V_{GS} = 10V$
- Excellent gate charge x $R_{DS(on)}$ product(FOM)
- Very low on-resistance $R_{DS(on)}$
- 175 °C operating temperature
- Pb-free lead plating



TOLL



Schematic

Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
VST15N050	VST15N050-OL	TOLL	-	-	-

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

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	V_{DS}	150	V
Gate-Source Voltage	V_{GS}	± 20	V
Drain Current-Continuous ($T_C = 25^\circ C$)	$I_D (T_C = 25^\circ C)$	170	A
Drain Current-Continuous ($T_C = 100^\circ C$)	$I_D (T_C = 100^\circ C)$	120	A
Drain Current-Continuous ($T_A = 25^\circ C$)	$I_D (T_A = 25^\circ C)$	16	A
Pulsed Drain Current (Note 1)	I_{DM}	680	A
Maximum Power Dissipation ($T_C = 25^\circ C$)	$P_D (T_C = 25^\circ C)$	380	W
Maximum Power Dissipation ($T_A = 25^\circ C$)	$P_D (T_A = 25^\circ C)$	3.75	W
Derating factor		2.5	W/ $^\circ C$
Single pulse avalanche energy (Note 5)	E_{AS}	1300	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)	$R_{\theta JC}$	0.4	$^\circ C/W$
Thermal Resistance, Junction-to-Ambient (Note 2)	$R_{\theta JA}$	40	$^\circ C/W$

Electrical Characteristics ($T_C=25^{\circ}\text{C}$ unless otherwise noted)

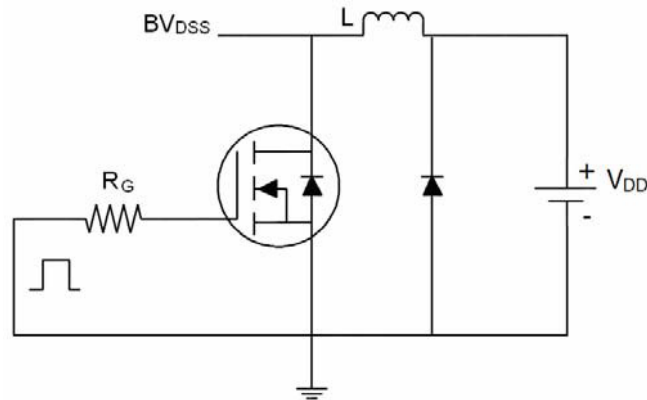
Parameter	Symbol	Condition	Min	Typ	Max	Unit
Off Characteristics						
Drain-Source Breakdown Voltage	BV_{DSS}	$V_{GS}=0V, I_D=250\mu A$	150		-	V
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS}=150V, V_{GS}=0V$	-	-	1	μA
Gate-Body Leakage Current	I_{GSS}	$V_{GS}=\pm 20V, V_{DS}=0V$	-	-	± 100	nA
On Characteristics (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	$R_{DS(ON)}$	$V_{GS}=10V, I_D=85A$	-	5	5.8	m Ω
Gate resistance	R_G	F=1.0MHz	-	5.0	-	Ω
Forward Transconductance	g_{FS}	$V_{DS}=10V, I_D=85A$	70	-	-	S
Dynamic Characteristics (Note4)						
Input Capacitance	C_{iss}	$V_{DS}=75V, V_{GS}=0V,$ F=1.0MHz	-	5500	7150	PF
Output Capacitance	C_{oss}		-	690	890	PF
Reverse Transfer Capacitance	C_{rss}		-	24	31	PF
Switching Characteristics (Note 4)						
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=75V, I_D=85A$ $V_{GS}=10V, R_G=4.7\Omega$	-	26	-	nS
Turn-on Rise Time	t_r		-	36	-	nS
Turn-Off Delay Time	$t_{d(off)}$		-	47	-	nS
Turn-Off Fall Time	t_f		-	15	-	nS
Total Gate Charge	Q_g	$V_{DS}=75V, I_D=85A,$ $V_{GS}=10V$	-	80	104	nC
Gate-Source Charge	Q_{gs}		-	32	41	nC
Gate-Drain Charge	Q_{gd}		-	22	28	nC
Drain-Source Diode Characteristics						
Diode Forward Voltage (Note 3)	V_{SD}	$V_{GS}=0V, I_F=85$	-		1.2	V
Diode Forward Current (Note 2)	I_S		-	-	170	A
Reverse Recovery Time	t_{rr}	$T_J = 25^{\circ}C, I_F = I_S$ $di/dt = 100A/\mu s$ (Note3)	-	146		nS
Reverse Recovery Charge	Q_{rr}		-	485		nC

Notes:

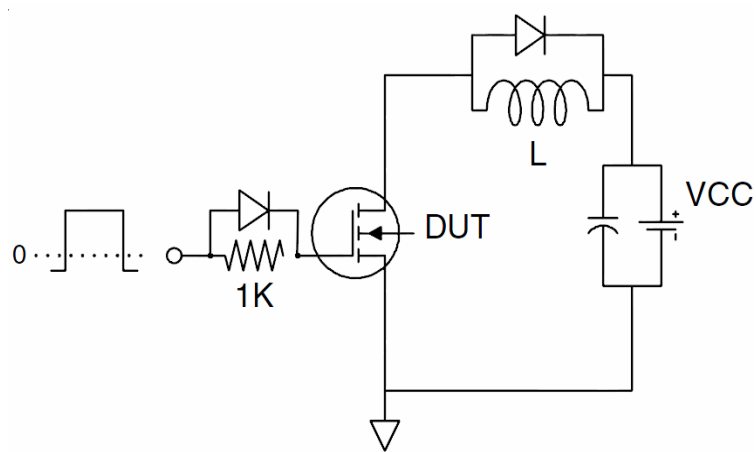
1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. The value of $R_{\theta JA}$ is measured with the device mounted on 1in2 FR-4 board with 2oz. Copper, in a still air environment with $T_A = 25^{\circ}\text{C}$. The value in any given application depends on the user's specific board design, and the maximum temperature of 175°C may be used if the PCB allows it.
3. Pulse Test: Pulse Width $\leq 300\mu s$, Duty Cycle $\leq 2\%$.
4. Guaranteed by design, not subject to production
5. EAS condition : $T_J=25^{\circ}\text{C}, V_{DD}=50V, V_G=10V, L=0.5mH, R_G=25\Omega$

Test Circuit

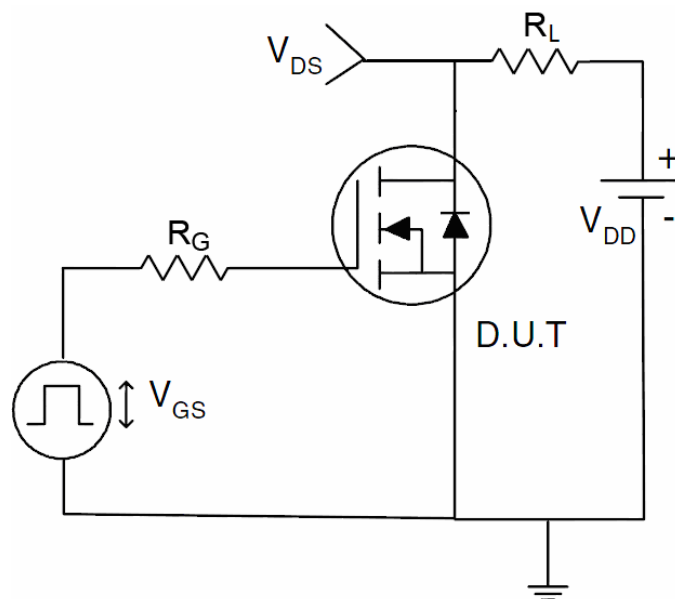
1) E_{AS} test Circuit



2) Gate charge test Circuit



3) Switch Time Test Circuit



Typical Electrical and Thermal Characteristics

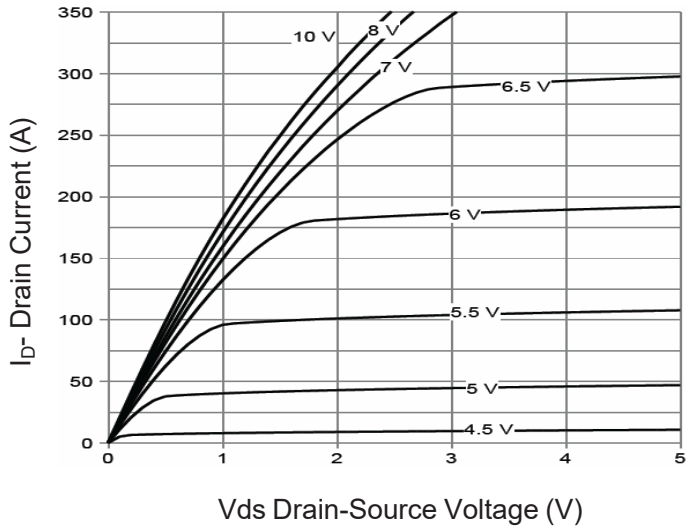


Figure 1 Output Characteristics

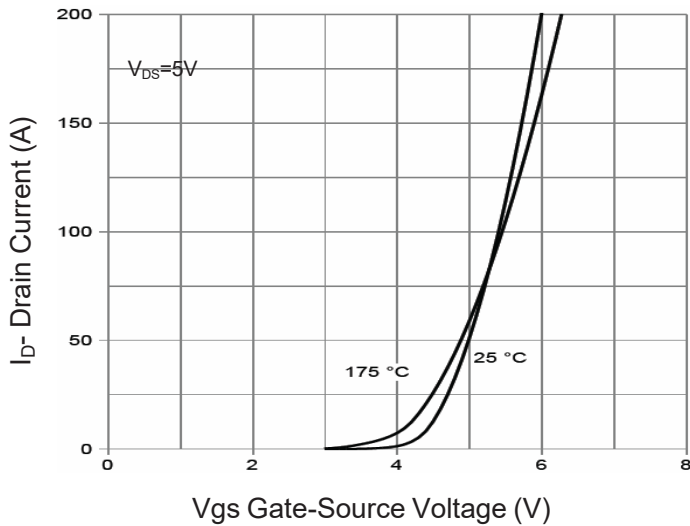


Figure 2 Transfer Characteristics

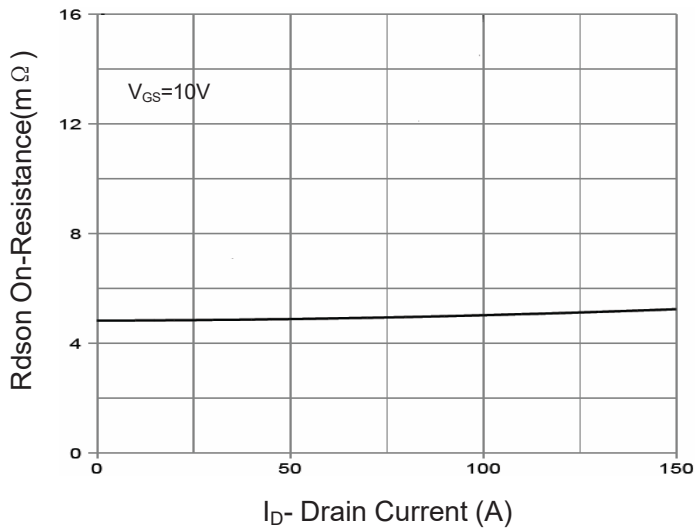


Figure 3 $R_{DS(on)}$ - Drain Current

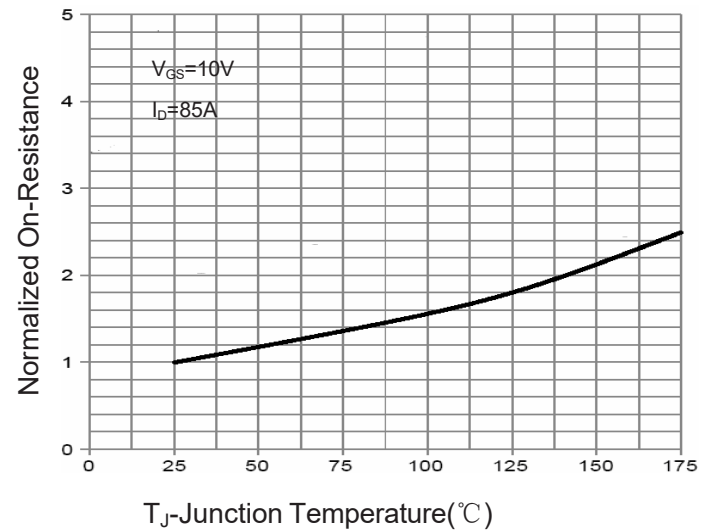


Figure 4 $R_{DS(on)}$ -Junction Temperature

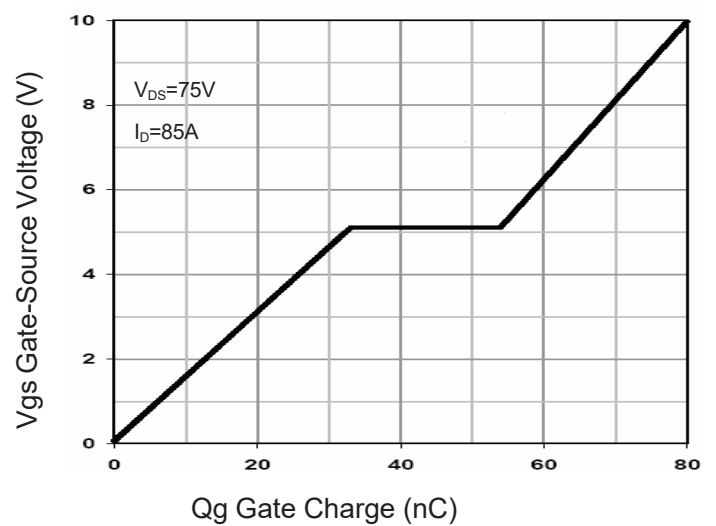


Figure 5 Gate Charge

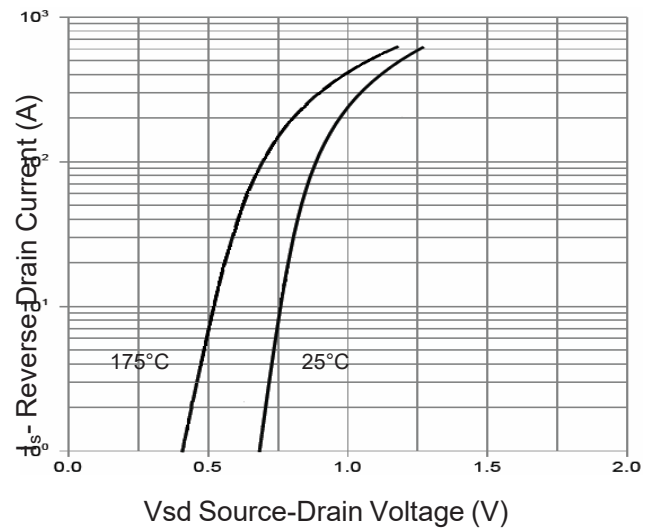
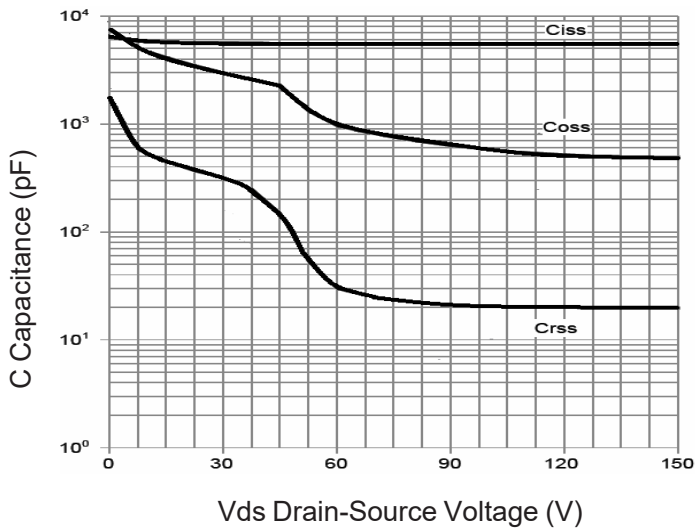
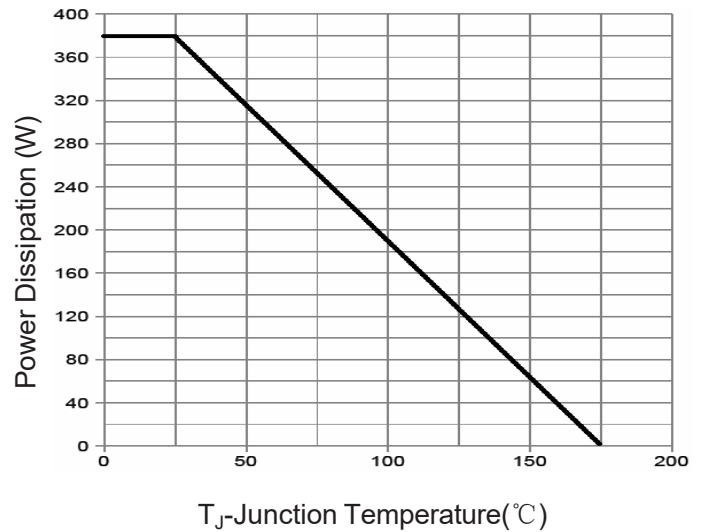


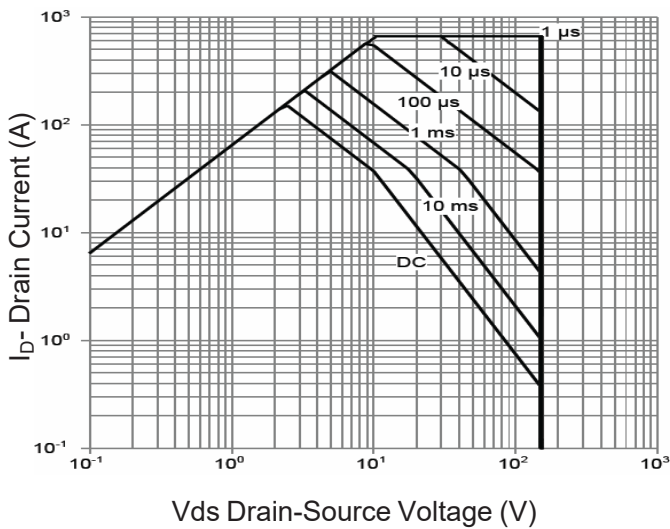
Figure 6 Source- Drain Diode Forward



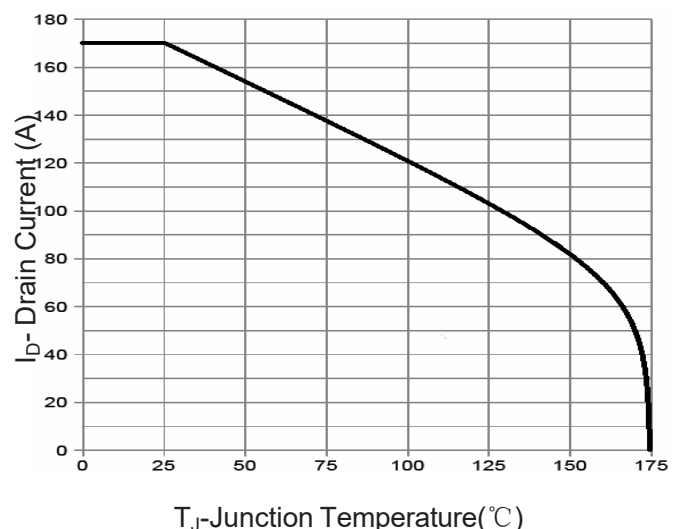
V_{ds} Drain-Source Voltage (V)
Figure 7 Capacitance vs V_{ds}



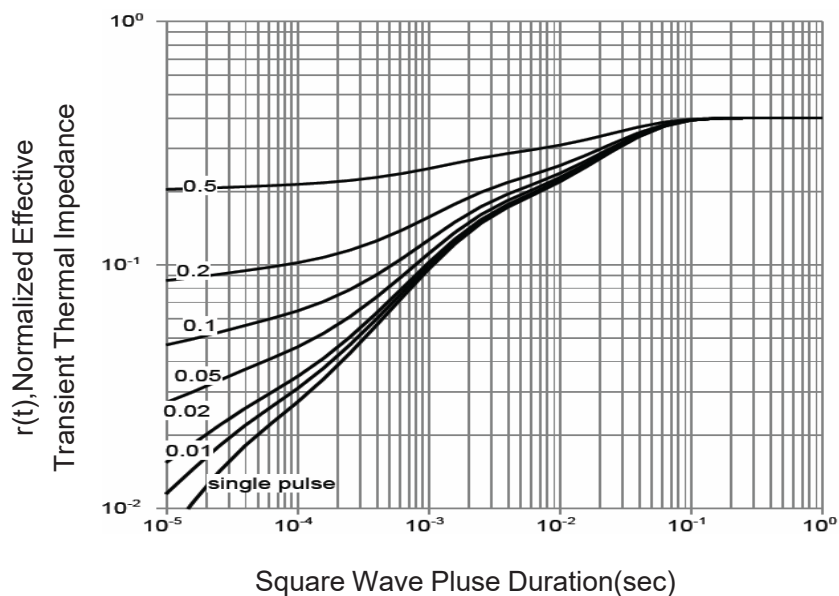
T_J-Junction Temperature($^{\circ}\text{C}$)
Figure 9 Power De-rating



V_{ds} Drain-Source Voltage (V)
Figure 8 Safe Operation Area



T_J-Junction Temperature($^{\circ}\text{C}$)
Figure 10 Current De-rating



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