

### Description

These N-Channel enhancement mode power field effect transistors are using split gate trench DMOS technology. This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and with stand high energy pulse in the avalanche and commutation mode. These devices are well suited for high efficiency fast switching applications.

### Features

- ◆ 60V,104A,  $R_{DS(on),max} = 4.6m\Omega @ V_{GS} = 10V$
- ◆ Improved dv/dt capability
- ◆ Fast switching
- ◆ 100% EAS Guaranteed
- ◆ Green device available

### Applications

- ◆ Motor Drives
- ◆ UPS
- ◆ DC-DC Converter

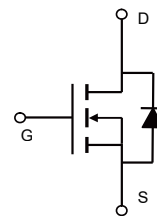
### Product Summary

$V_{DSS}$	60V
$R_{DS(on),max} @ V_{GS}=10V$	4.6m $\Omega$
$I_D$	104A

### Pin Configuration



TO-263



Schematic

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

Parameter	Symbol	Value	Unit
Drain-Source Voltage	$V_{DSS}$	60	V
Continuous drain current ( $T_C = 25^\circ C$ )	$I_D$	104	A
( $T_C = 100^\circ C$ )		65	A
Pulsed drain current <sup>1)</sup>	$I_{DM}$	312	A
Gate-Source voltage	$V_{GSS}$	$\pm 20$	V
Avalanche energy <sup>2)</sup>	$E_{AS}$	28	mJ
Power Dissipation	$P_D$	89	W
Storage Temperature Range	$T_{STG}$	-55 to +150	$^\circ C$
Operating Junction Temperature Range	$T_J$	-55 to +150	$^\circ C$

### Thermal Characteristics

Parameter	Symbol	Value	Unit
Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	1.4	$^\circ C/W$
Thermal Resistance Junction-to-Ambient	$R_{\theta JA}$	55	$^\circ C/W$

## Package Marking and Ordering Information

Device	Device Package	Marking	Units/Reel
VST06N046-T3	TO-263	VST06N046-T3	800

## Electrical Characteristics

 $T_J = 25^{\circ}\text{C}$  unless otherwise noted

Parameter	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Static characteristics						
Drain-source breakdown voltage	BV <sub>DSS</sub>	V <sub>GS</sub> =0 V, I <sub>D</sub> =250uA	60	---	---	V
Gate threshold voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250uA	2.0	3.0	4.0	V
Drain-source leakage current	I <sub>DSS</sub>	V <sub>DS</sub> =60 V, V <sub>GS</sub> =0V	---	---	1	μA
Gate leakage current, Forward	I <sub>GSSF</sub>	V <sub>GS</sub> =20 V, V <sub>DS</sub> =0 V	---	---	100	nA
Gate leakage current, Reverse	I <sub>GSSR</sub>	V <sub>GS</sub> =-20 V, V <sub>DS</sub> =0 V	---	---	-100	nA
Drain-source on-state resistance	R <sub>DS(on)</sub>	V <sub>GS</sub> =10 V, I <sub>D</sub> =20 A	---	3.6	4.6	mΩ
Forward transconductance	g <sub>fs</sub>	V <sub>DS</sub> =5V , I <sub>D</sub> =20A	---	66	---	S
Dynamic characteristics						
Input capacitance	C <sub>iss</sub>	V <sub>DS</sub> = 30 V, V <sub>GS</sub> = 0 V, F = 1MHz	---	3511	---	pF
Output capacitance	C <sub>oss</sub>		---	1176	---	
Reverse transfer capacitance	C <sub>rss</sub>		---	67	---	
Turn-on delay time	t <sub>d(on)</sub>	V <sub>DD</sub> = 30V,V <sub>GS</sub> =10V, I <sub>D</sub> = 20A R <sub>G</sub> =3Ω	---	20.3	---	ns
Rise time	t <sub>r</sub>		---	9.6	---	
Turn-off delay time	t <sub>d(off)</sub>		---	61	---	
Fall time	t <sub>f</sub>		---	15.2	---	
Gate resistance	R <sub>g</sub>	V <sub>GS</sub> =0 V,V <sub>DS</sub> =0 V, F=1MHz	---	1.1	---	Ω
Gate charge characteristics						
Gate to source charge	Q <sub>gs</sub>	V <sub>DS</sub> =30V, I <sub>D</sub> =20A, V <sub>GS</sub> = 10 V	---	15.5	---	nC
Gate to drain charge	Q <sub>gd</sub>		---	9.5	---	
Gate charge total	Q <sub>g</sub>		---	48	---	
Drain-Source diode characteristics and Maximum Ratings						
Continuous Source Current	I <sub>s</sub>		---	---	74	A
Pulsed Source Current <sup>3)</sup>	I <sub>SM</sub>		---	---	222	A
Diode Forward Voltage	V <sub>SD</sub>	V <sub>GS</sub> =0V, I <sub>S</sub> =20A, T <sub>J</sub> =25℃	---	---	1.2	V
Reverse recovery time	t <sub>rr</sub>	I <sub>F</sub> =20A,dI <sub>F</sub> /dt=100 A/μs	---	24	---	ns
Reverse recovery charge	Q <sub>rr</sub>		---	85	---	nC

Notes:

1: Repetitive Rating: Pulse width limited by maximum junction temperature.

2:  $V_{DD}=50\text{ V}$ ,  $V_{GS}=10\text{ V}$ ,  $L=0.1\text{ mH}$ ,  $I_{AS}=24\text{ A}$ , Starting  $T_J=25^{\circ}\text{C}$ .

3: Pulse Test: Pulse Width  $\leq 300\text{ }\mu\text{s}$ , Duty Cycle  $\leq 2\%$ .

## Electrical Characteristics Diagrams

Figure 1. Typ. Output Characteristics

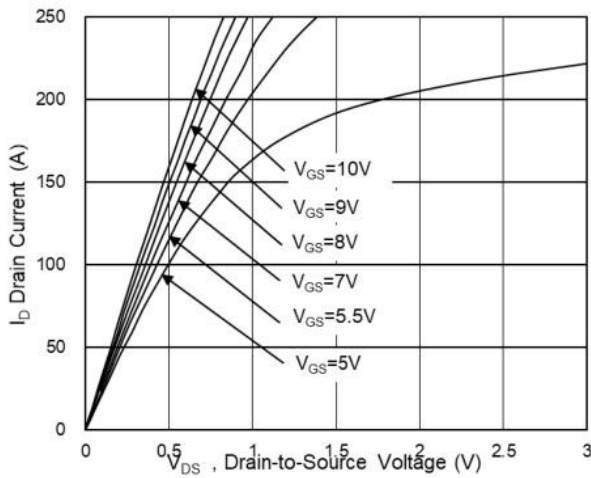


Figure 2. Transfer Characteristics

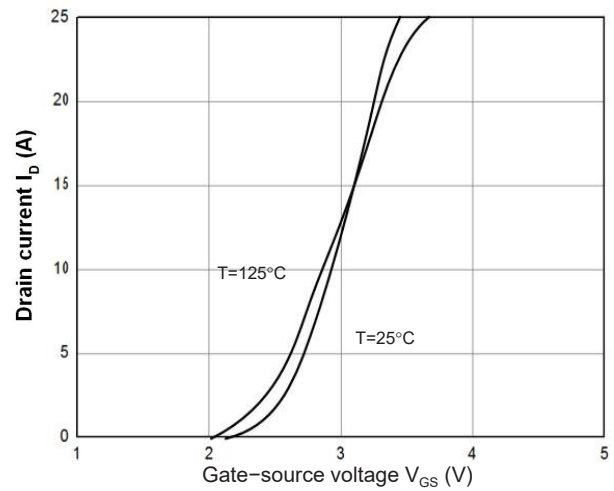


Figure 3. Capacitance Characteristics

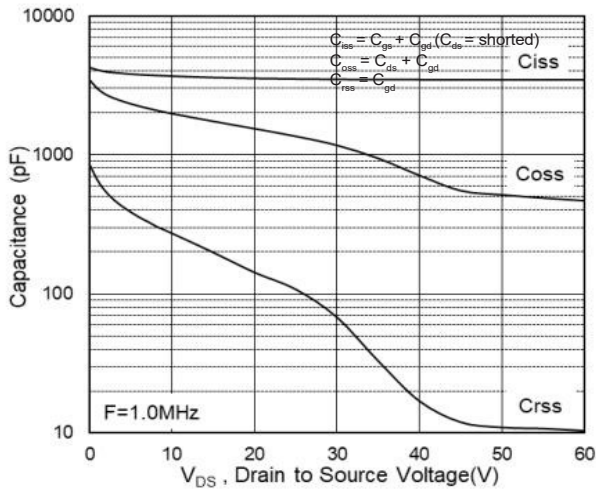


Figure 4. Gate Charge Waveform

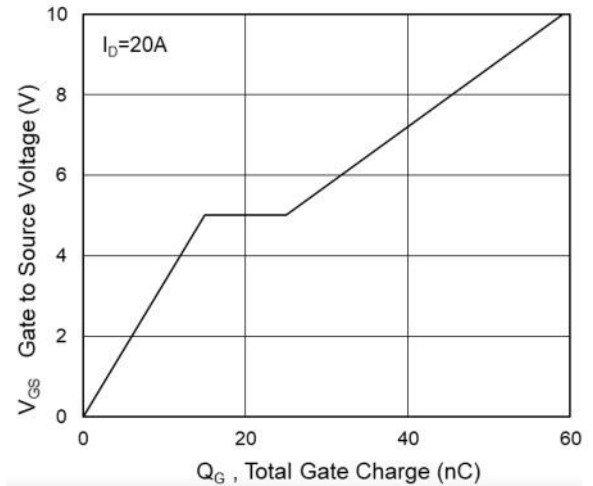


Figure 5. Body-Diode Characteristics

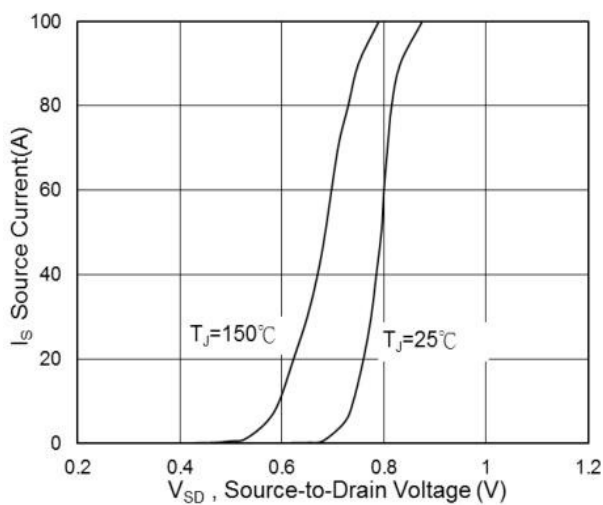


Figure 6. Rdson-Drain Current

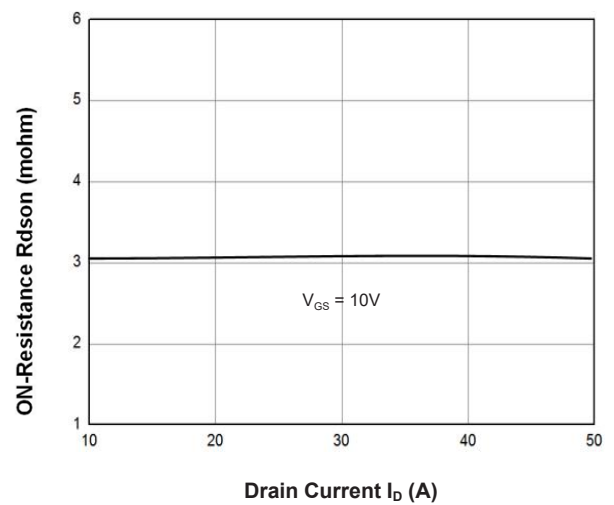


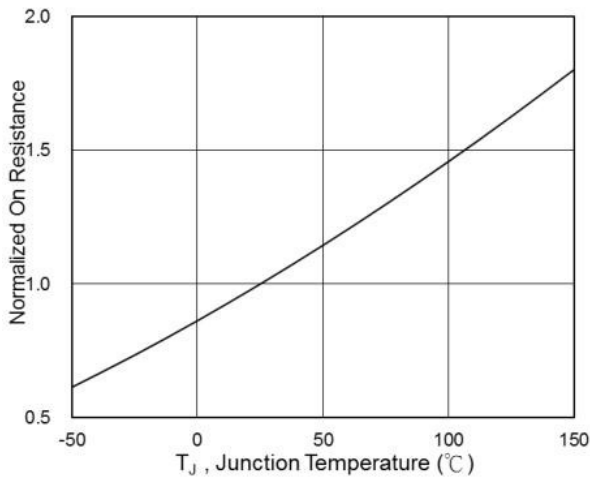
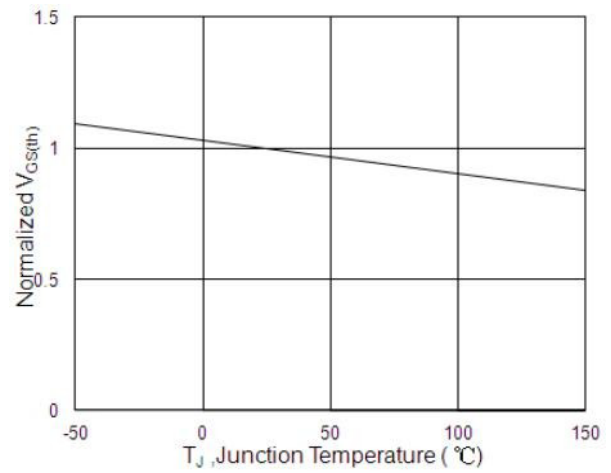
Figure 7.  $R_{DS(on)}$ -Junction Temperature

Figure 8.  $V_{GS(th)}$ -Junction Temperature


Figure 9. On-Resistance vs. Gate-to-Source voltage

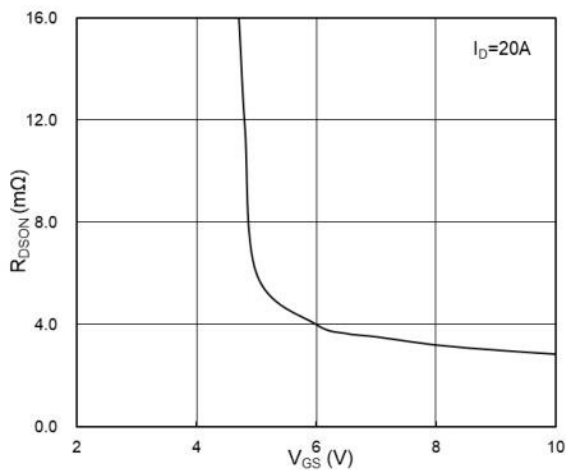
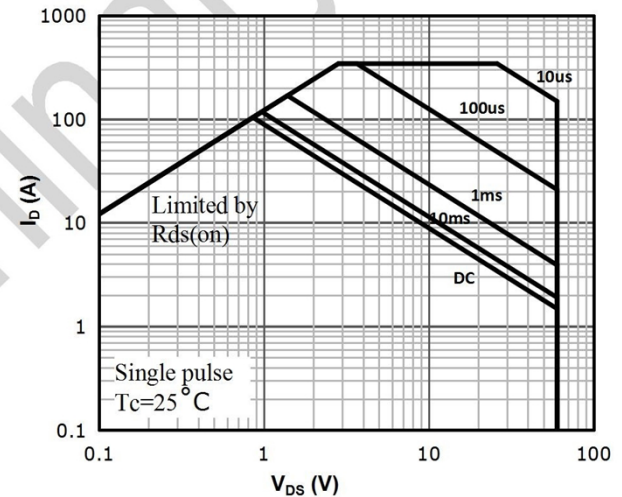
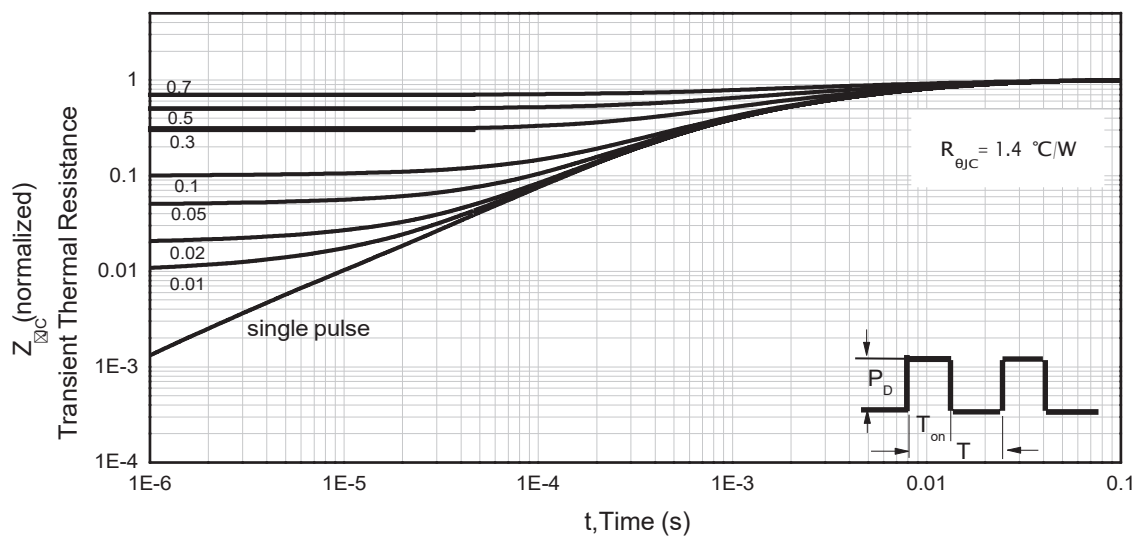
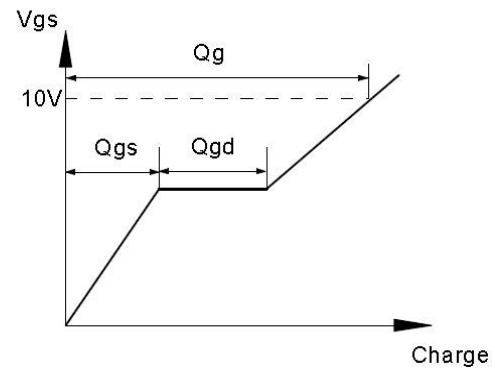
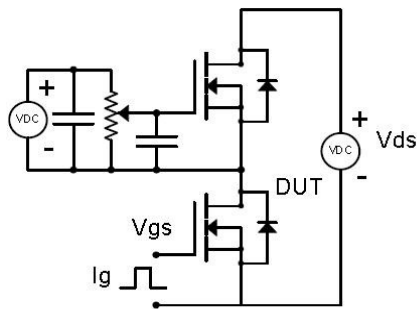


Figure 10: Safe Operating Area

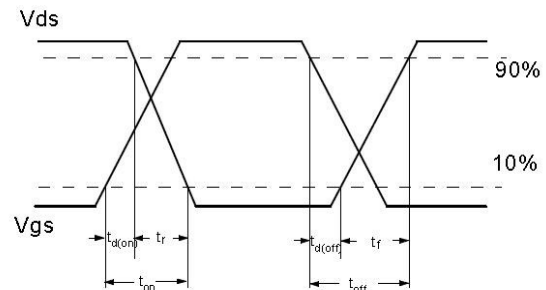
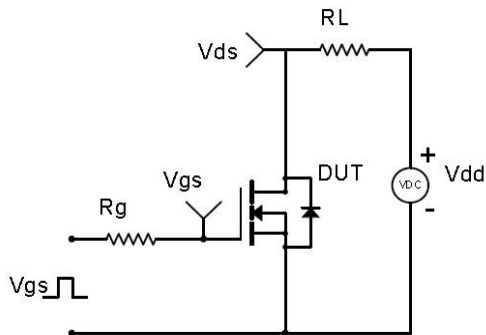

Figure 11. Normalized Maximum Transient Thermal Impedance ( $R_{thJC}$ )


## Test Circuit & Waveform

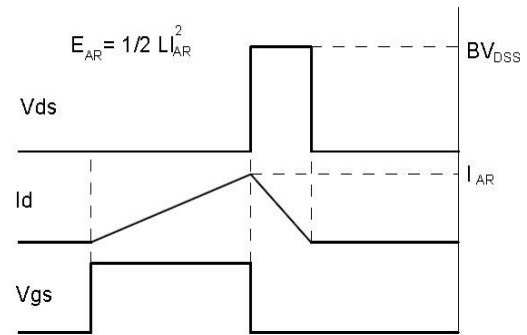
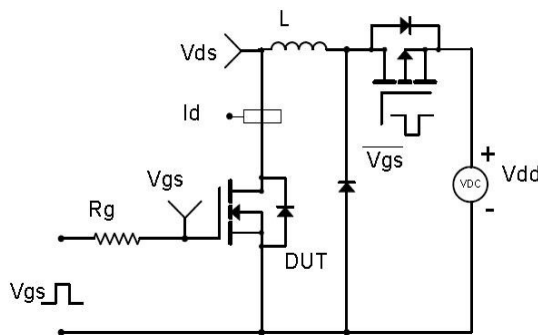
Gate Charge Test Circuit &amp; Waveform



Resistive Switching Test Circuit &amp; Waveforms



Unclamped Inductive Switching (UIS) Test Circuit &amp; Waveforms



Diode Recovery Test Circuit &amp; Waveforms

