
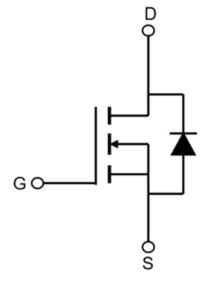


## Description

<b>Features</b> <ul style="list-style-type: none"> <li>● 20V, 50A  <math>R_{DS(ON)} &lt; 8m\Omega @ V_{GS} = 4.5V</math>  <math>R_{DS(ON)} &lt; 13m\Omega @ V_{GS} = 2.5V</math></li> <li>● Advanced Trench Technology</li> <li>● Excellent <math>R_{DS(ON)}</math> and Low Gate Charge</li> <li>● Lead free product is acquired</li> </ul>	<b>Application</b> <ul style="list-style-type: none"> <li>● Load Switch</li> <li>● PWM Application</li> <li>● Power management</li> </ul> <p>100% UIS 100% <math>\Delta V_{ds}</math></p>
 <p>TO-252</p>	 <p>Schematic Diagram</p>

## Package Marking and Ordering Information

Device Marking	Device	OUTLINE	Device Package	Reel Size	Reel (PCS)	Per Carton (PCS)
VSM50N02-T2	VSM50N02	TAPING	TO-252	13inch	2500	25000

## Absolute Maximum Ratings (T<sub>C</sub>=25°C unless otherwise specified)

Symbol	Parameter		Max.	Units
V <sub>DSS</sub>	Drain-Source Voltage		20	V
V <sub>GSS</sub>	Gate-Source Voltage		±12	V
I <sub>D</sub>	Continuous Drain Current	T <sub>C</sub> = 25°C	50	A
		T <sub>C</sub> = 100°C	33	A
I <sub>DM</sub>	Pulsed Drain Current <sup>note1</sup>		200	A
E <sub>AS</sub>	Single Pulsed Avalanche Energy <sup>note2</sup>		36	mJ
P <sub>D</sub>	Power Dissipation	T <sub>C</sub> = 25°C	31	W
R <sub>θJC</sub>	Thermal Resistance, Junction to Case		4.84	°C/W
T <sub>J</sub> , T <sub>STG</sub>	Operating and Storage Temperature Range		-55 to +175	°C

**Electrical Characteristics** ( $T_J=25^{\circ}\text{C}$  unless otherwise specified)

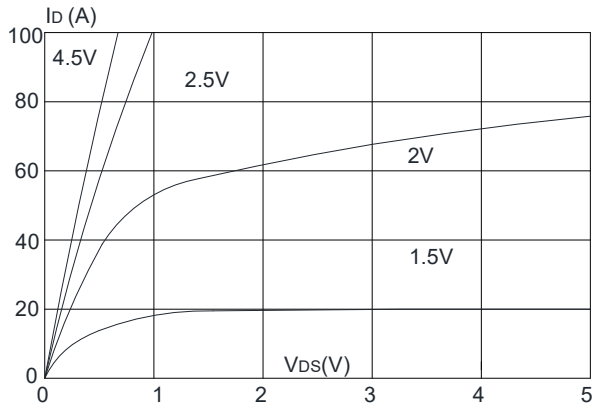
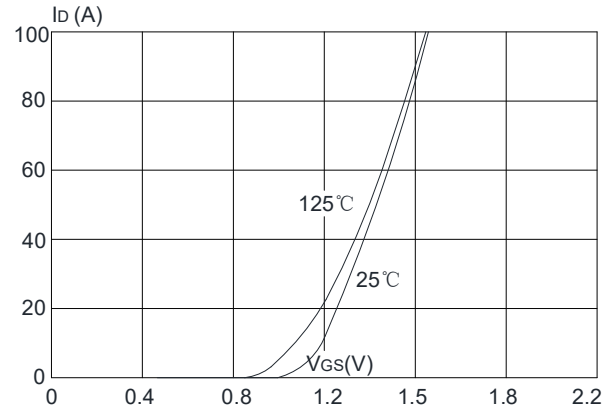
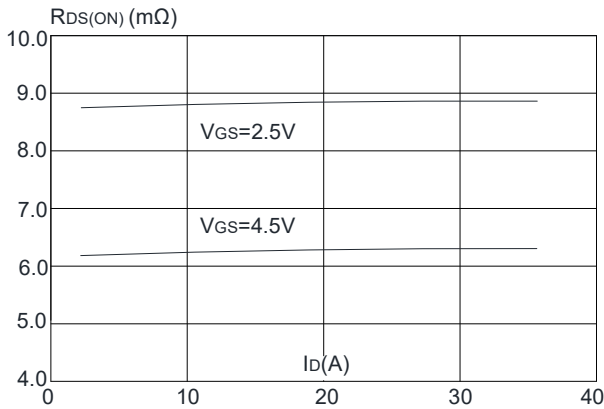
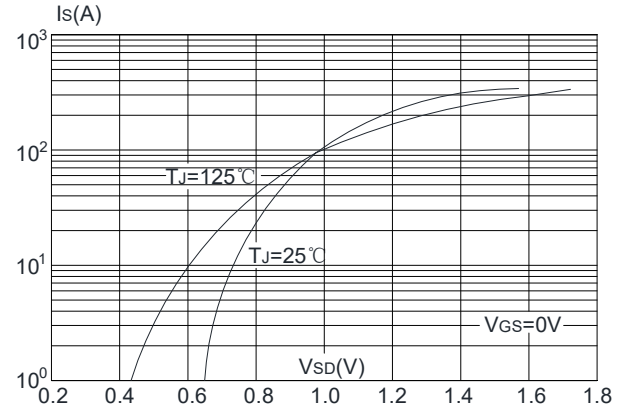
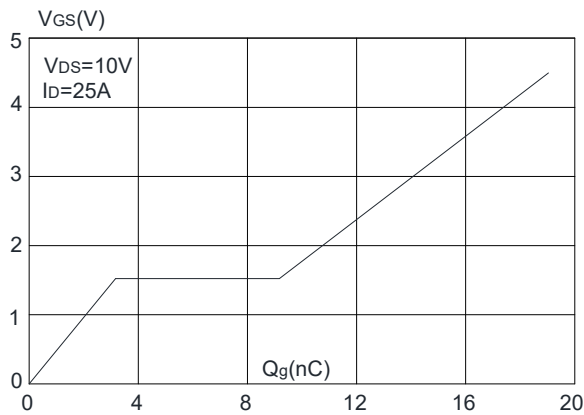
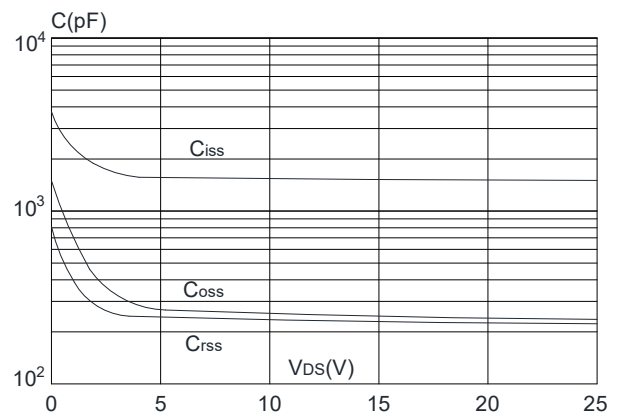
Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Units
Off Characteristic						
V <sub>(BR)DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> =0V, I <sub>D</sub> =250μA	20	-	-	V
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> =20V, V <sub>GS</sub> =0V,	-	-	1.0	μA
I <sub>GSS</sub>	Gate to Body Leakage Current	V <sub>DS</sub> =0V, V <sub>GS</sub> =±12V	-	-	±100	nA
On Characteristics						
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA	0.4	0.7	1.1	V
R <sub>DS(on)</sub>	Static Drain-Source on-Resistance <small>note3</small>	V <sub>GS</sub> =4.5V, I <sub>D</sub> =25A	-	6.3	8.0	mΩ
		V <sub>GS</sub> =2.5V, I <sub>D</sub> =10A	-	8.8	13	
Dynamic Characteristics						
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> =10V, V <sub>GS</sub> =0V, f=1.0MHz	-	1458	-	pF
C <sub>oss</sub>	Output Capacitance		-	238	-	pF
C <sub>rss</sub>	Reverse Transfer Capacitance		-	212	-	pF
Q <sub>g</sub>	Total Gate Charge	V <sub>DS</sub> =10V, I <sub>D</sub> =25A, V <sub>GS</sub> =4.5V	-	19	-	nC
Q <sub>gs</sub>	Gate-Source Charge		-	3	-	nC
Q <sub>gd</sub>	Gate-Drain(“Miller”) Charge		-	6.4	-	nC
Switching Characteristics						
t <sub>d(on)</sub>	Turn-on Delay Time	V <sub>DS</sub> =10V, I <sub>D</sub> =10A, R <sub>GEN</sub> =3Ω, V <sub>GS</sub> =4.5V	-	10	-	ns
t <sub>r</sub>	Turn-on Rise Time		-	21	-	ns
t <sub>d(off)</sub>	Turn-off Delay Time		-	39	-	ns
t <sub>f</sub>	Turn-off Fall Time		-	19	-	ns
Drain-Source Diode Characteristics and Maximum Ratings						
I <sub>S</sub>	Maximum Continuous Drain to Source Diode Forward Current		-	-	50	A
I <sub>SM</sub>	Maximum Pulsed Drain to Source Diode Forward Current		-	-	200	A
V <sub>SD</sub>	Drain to Source Diode Forward Voltage	V <sub>GS</sub> =0V, I <sub>S</sub> =30A	-	-	1.2	V
t <sub>rr</sub>	Body Diode Reverse Recovery Time	IF=20A,dI/dt=100A/μs	-	25	-	ns
Q <sub>rr</sub>	Body Diode Reverse Recovery Charge		-	20	-	nC

Notes:1. Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature

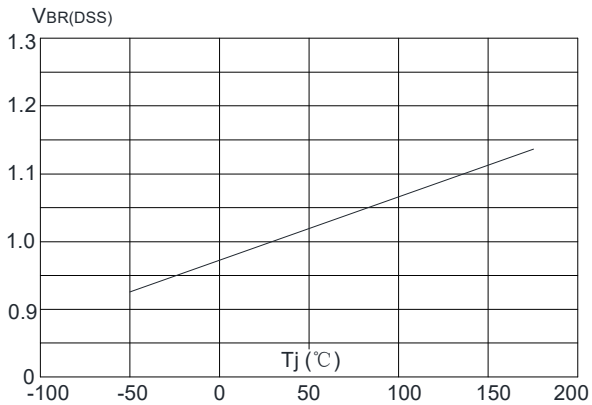
2. EAS condition:  $T_J=25^{\circ}\text{C}$ ,  $V_{DD}=10V$ ,  $V_G=4.5V$ ,  $L=0.5mH$ ,  $R_G=25\Omega$ ,  $I_{AS}=12A$ 

3. Pulse Test: Pulse Width $\leq 300\mu s$ , Duty Cycle $\leq 0.5\%$

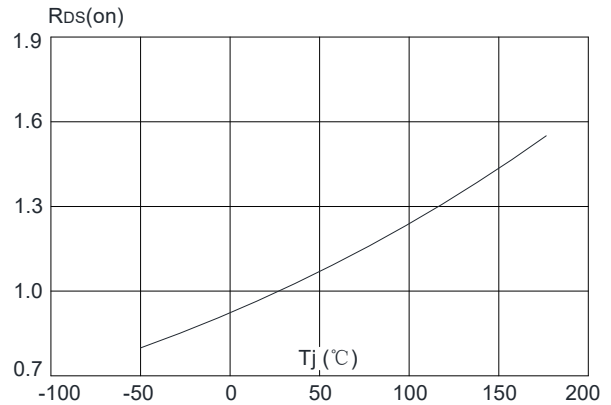
## Typical Performance Characteristics

**Figure1: Output Characteristics**

**Figure 2: Typical Transfer Characteristics**

**Figure 3: On-resistance vs. Drain Current**

**Figure 4: Body Diode Characteristics**

**Figure 5: Gate Charge Characteristics**

**Figure 6: Capacitance Characteristics**


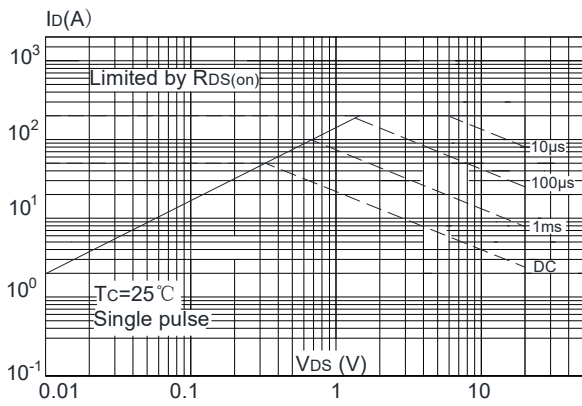
**Figure 7:** Normalized Breakdown Voltage vs. Junction Temperature



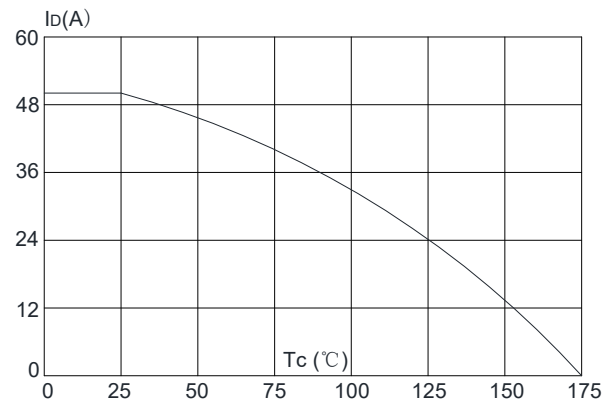
**Figure 8:** Normalized on Resistance vs. Junction Temperature



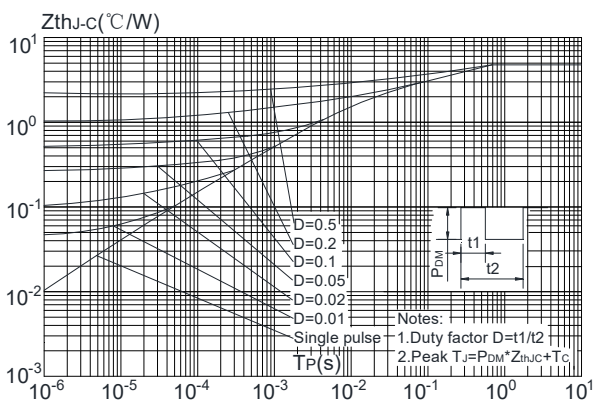
**Figure 9:** Maximum Safe Operating Area



**Figure 10:** Maximum Continuous Drain Current vs. Case Temperature



**Figure.11:** Maximum Effective Transient Thermal Impedance, Junction-to-Case



## Test Circuit

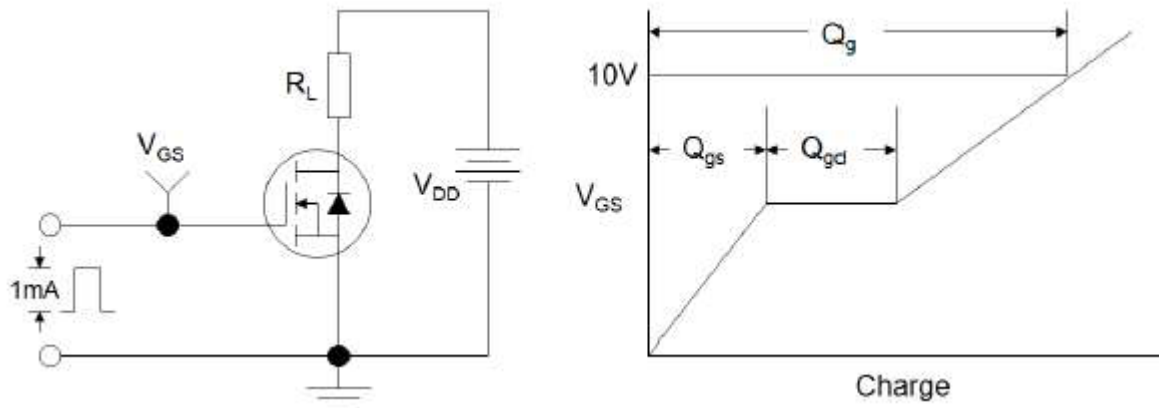


Figure1:Gate Charge Test Circuit & Waveform

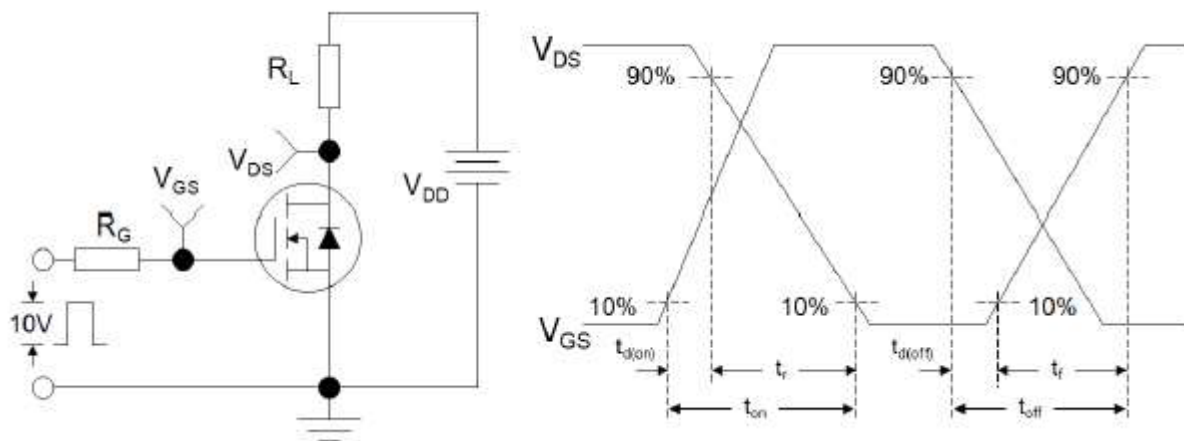


Figure 2: Resistive Switching Test Circuit & Waveforms

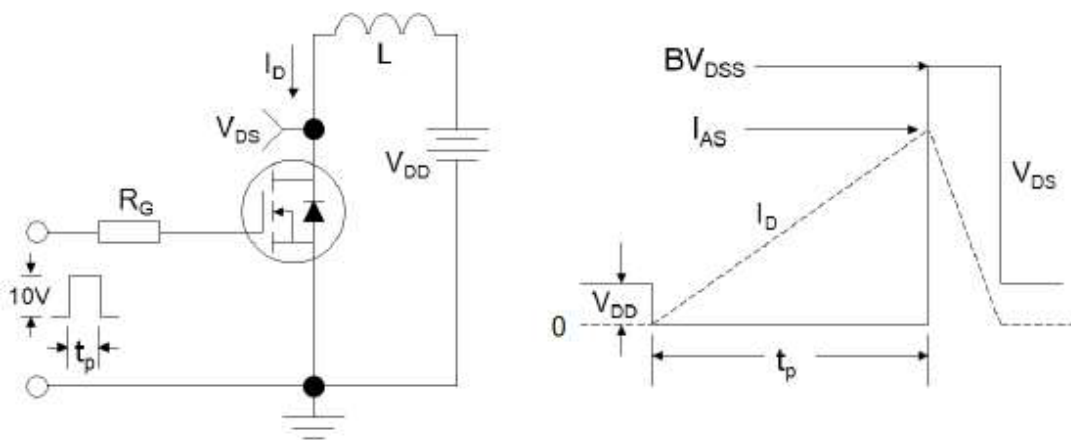


Figure 3:Unclamped Inductive Switching Test Circuit & Waveforms