

## Description

The VSM150N03 uses advanced trench technology and design to provide excellent  $R_{DS(ON)}$  with low gate charge. It can be used in a wide variety of applications.

## General Features

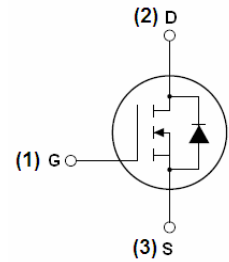
- $V_{DS} = 30V, I_D = 150A$   
 $R_{DS(ON)} < 3.0 \text{ m}\Omega @ V_{GS} = 10V$   
 $R_{DS(ON)} < 4.0 \text{ m}\Omega @ V_{GS} = 4.5V$
- High density cell design for ultra low  $R_{dson}$
- Fully characterized avalanche voltage and current
- Good stability and uniformity with high  $E_{AS}$
- Excellent package for good heat dissipation
- Special process technology for high ESD capability

## Application

- Power switching application
- Hard switched and high frequency circuits
- Uninterruptible power supply



TO-220C



Schematic Diagram

## Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
VSM150N03-TC	VSM150N03	TO-220C	-	-	-

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

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	30	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	V
Drain Current-Continuous	$I_D$	150	A
Drain Current-Continuous( $T_C = 100^\circ\text{C}$ )	$I_D(100^\circ\text{C})$	105	A
Pulsed Drain Current	$I_{DM}$	600	A
Maximum Power Dissipation	$P_D$	130	W
Derating factor		0.87	W/ $^\circ\text{C}$
Single pulse avalanche energy (Note 5)	$E_{AS}$	1700	mJ
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 To 175	$^\circ\text{C}$

**Thermal Characteristic**

Thermal Resistance, Junction-to-Case <sup>(Note 2)</sup>	$R_{\theta JC}$	1.15	$^{\circ}\text{C/W}$
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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 <sub>DSS</sub>	V <sub>GS</sub> =0V I <sub>D</sub> =250μA	30	35	-	V
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> =30V, V <sub>GS</sub> =0V	-	-	1	μA
Gate-Body Leakage Current	I <sub>GSS</sub>	V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V	-	-	±100	nA
On Characteristics <sup>(Note 3)</sup>						
Gate Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA	1.2	1.7	2.5	V
Drain-Source On-State Resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> =10V, I <sub>D</sub> =20A	-	2.3	3.0	mΩ
		V <sub>GS</sub> =4.5V, I <sub>D</sub> =10A		3.2	4.0	
Forward Transconductance	g <sub>FS</sub>	V <sub>DS</sub> =10V, I <sub>D</sub> =20A	32	-	-	S
Dynamic Characteristics <sup>(Note4)</sup>						
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> =15V, V <sub>GS</sub> =0V, F=1.0MHz	-	5000	-	PF
Output Capacitance	C <sub>oss</sub>		-	1135	-	PF
Reverse Transfer Capacitance	C <sub>rss</sub>		-	563	-	PF
Switching Characteristics <sup>(Note 4)</sup>						
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> =15V, I <sub>D</sub> =2A, R <sub>L</sub> =15Ω V <sub>GS</sub> =10V, R <sub>G</sub> =2.5Ω	-	26	-	nS
Turn-on Rise Time	t <sub>r</sub>		-	24	-	nS
Turn-Off Delay Time	t <sub>d(off)</sub>		-	91	-	nS
Turn-Off Fall Time	t <sub>f</sub>		-	39	-	nS
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> =15V, I <sub>D</sub> =30A, V <sub>GS</sub> =10V	-	38		nC
Gate-Source Charge	Q <sub>gs</sub>		-	9		nC
Gate-Drain Charge	Q <sub>gd</sub>		-	13		nC
Drain-Source Diode Characteristics						
Diode Forward Voltage <sup>(Note 3)</sup>	V <sub>SD</sub>	V <sub>GS</sub> =0V, I <sub>S</sub> =150A	-		1.2	V
Diode Forward Current <sup>(Note 2)</sup>	I <sub>S</sub>		-	-	150	A
Reverse Recovery Time	t <sub>rr</sub>	T <sub>J</sub> = 25°C, I <sub>F</sub> = 20A di/dt = 100A/μs <sup>(Note3)</sup>	-	42	-	nS
Reverse Recovery Charge	Q <sub>rr</sub>		-	39	-	nC
Forward Turn-On Time	t <sub>on</sub>	Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD)				

**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  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ .
4. Guaranteed by design, not subject to production
5.  $E_{AS}$  condition :  $T_J=25^{\circ}\text{C}, V_{DD}=20V, V_G=10V, L=1\text{mH}, R_G=25\Omega, I_{AS}=58.5A$

## Test circuit

### 1) $E_{AS}$ Test Circuit



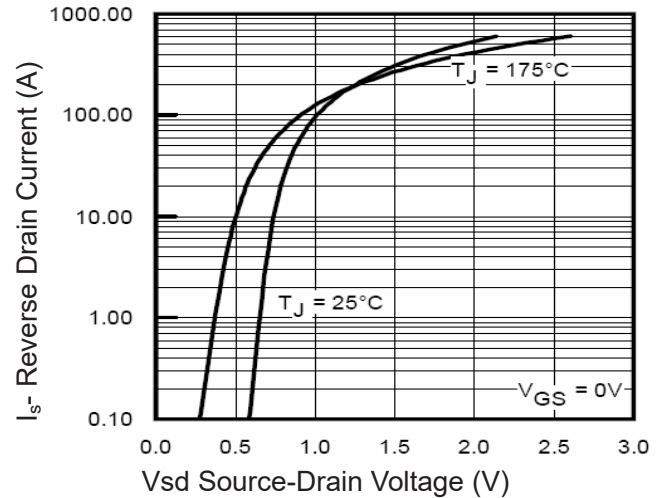
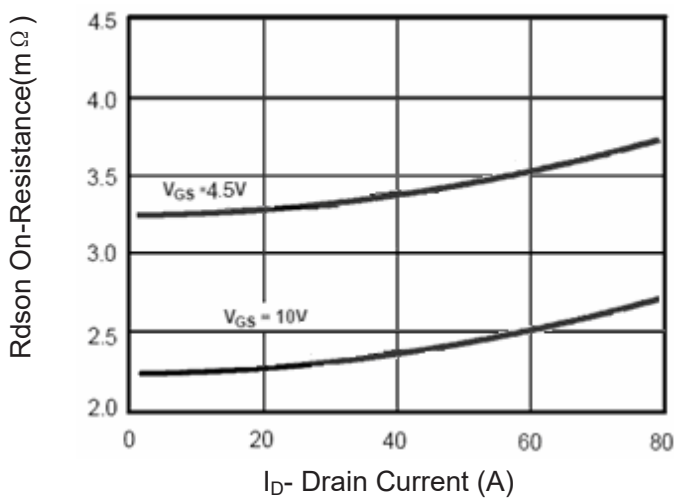
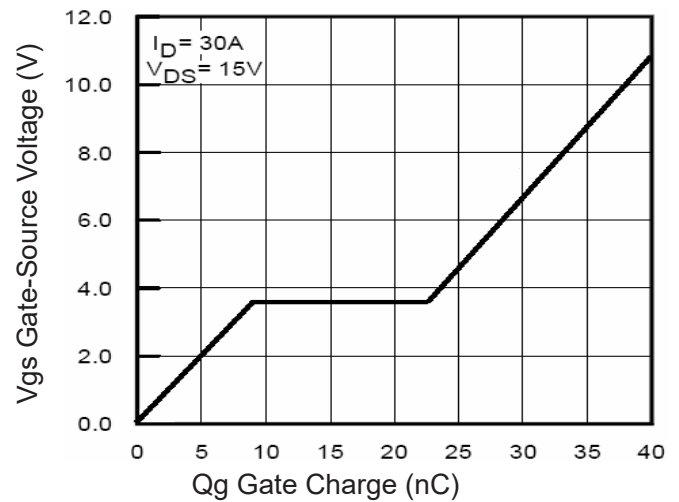
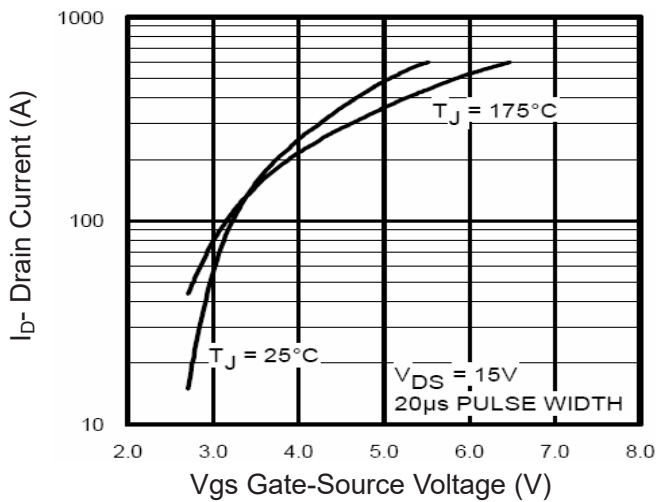
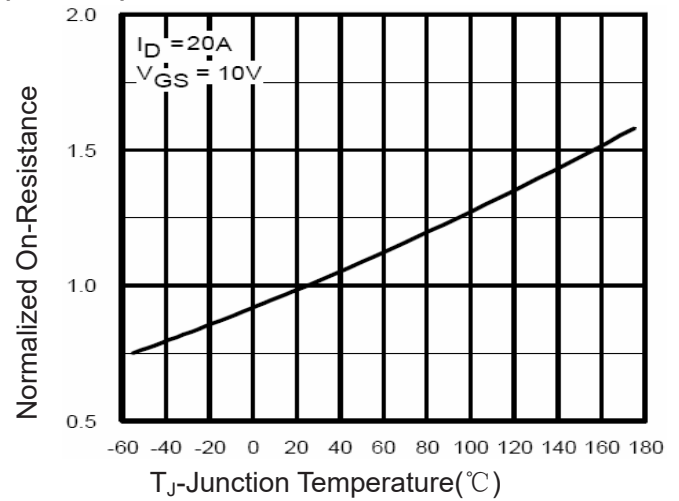
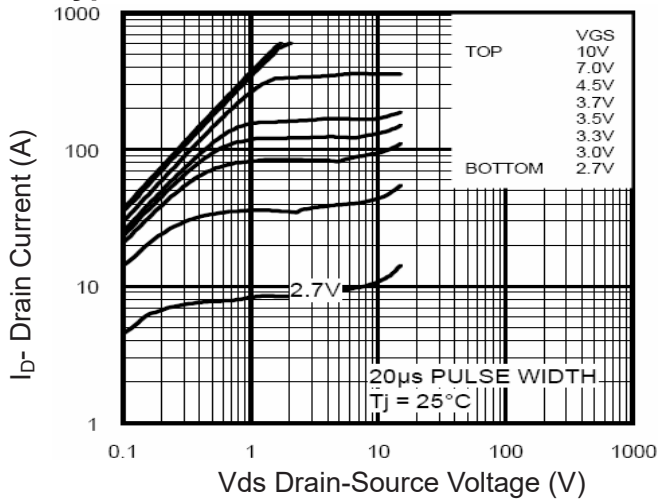
### 2) Gate Charge Test Circuit

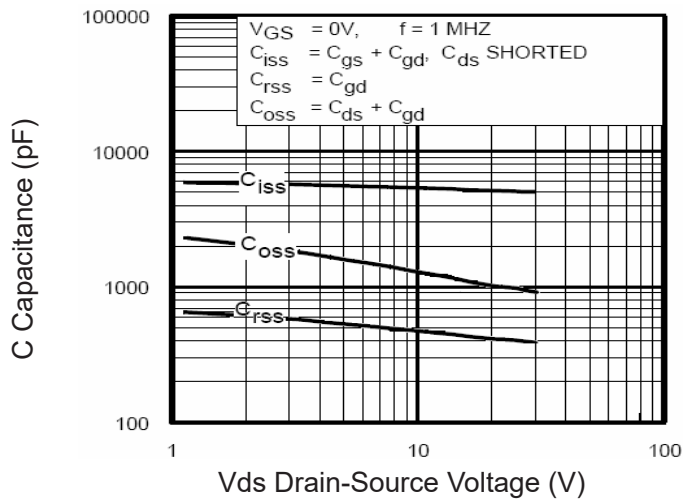
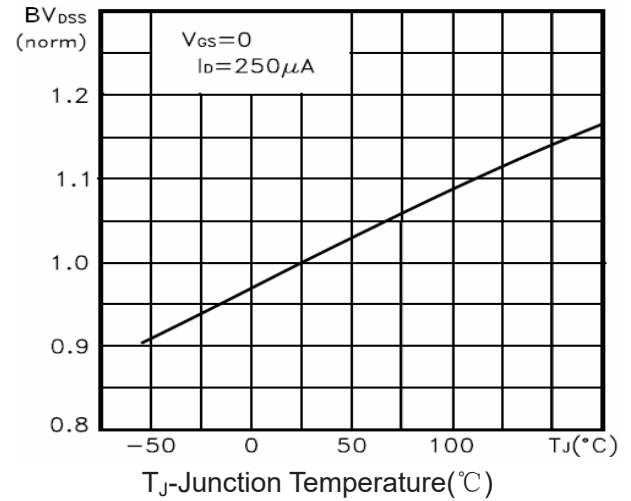
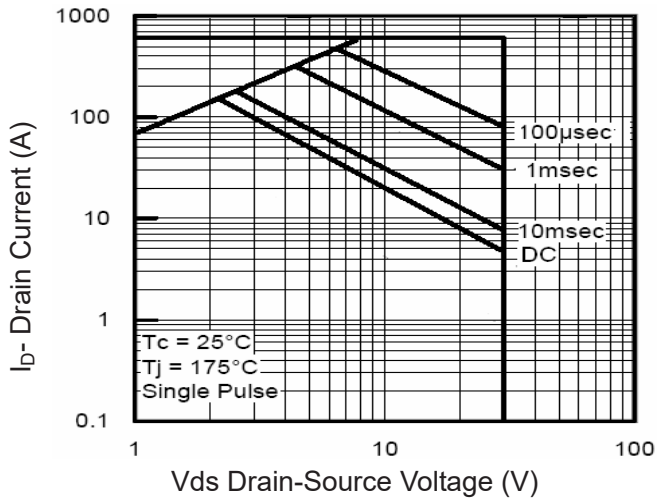
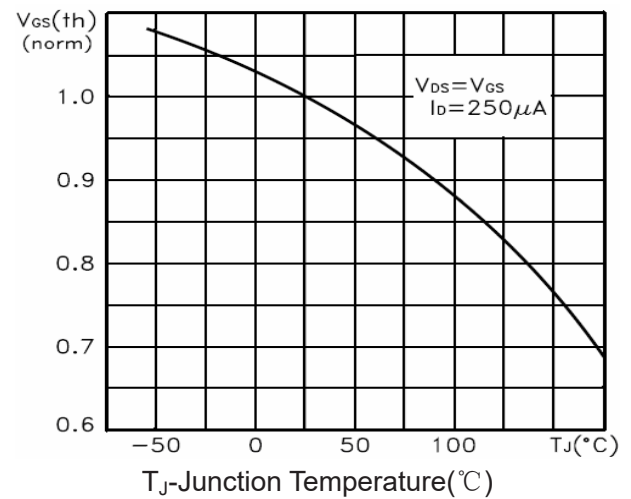
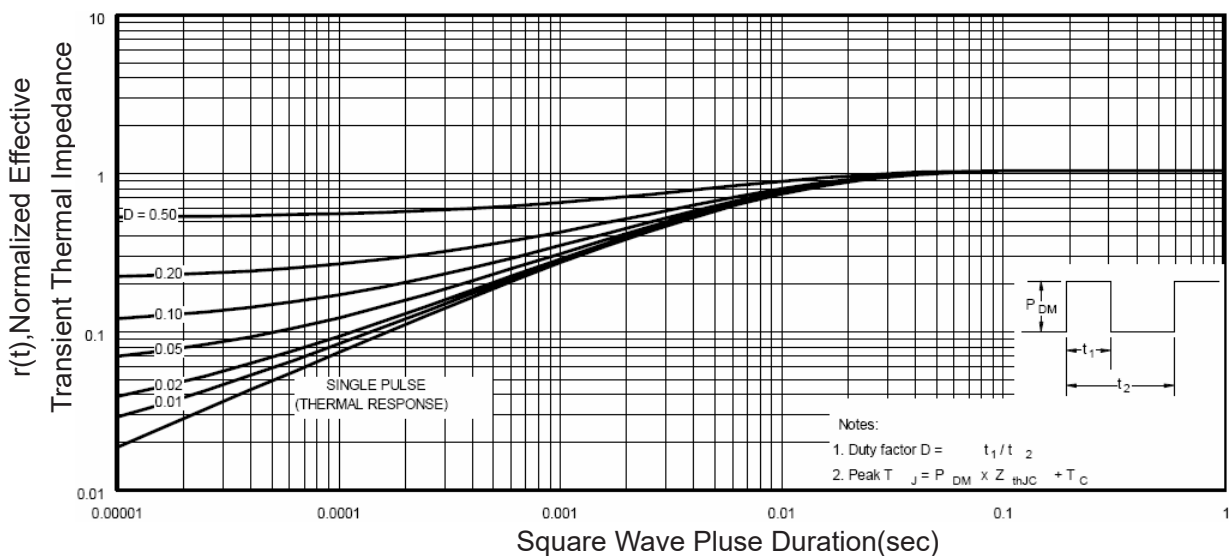


### 3) Switch Time Test Circuit



## Typical Electrical and Thermal Characteristics (Curves)




**Figure 7 Capacitance vs Vds**

**Figure 9 BV<sub>DSS</sub> vs Junction Temperature**

**Figure 8 Safe Operation Area**

**Figure 10 V<sub>GS(th)</sub> vs Junction Temperature**

**Figure 11 Normalized Maximum Transient Thermal Impedance**