

## Description

The VSM290N03 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

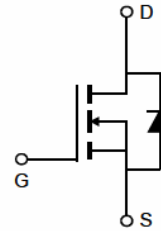
- $V_{DS} = 33V$ ,  $I_D = 290A$   
 $R_{DS(ON)} < 1.8m\Omega$  @  $V_{GS} = 10V$
- High density cell design for ultra low  $R_{DS(ON)}$
- Fully characterized avalanche voltage and current
- Good stability and uniformity with high  $E_{AS}$
- Excellent package for good heat dissipation
- Special process technology for high ESD capability

## Application

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



TO-263



Schematic Diagram

## Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
VSM290N03-T3	VSM290N03	TO-263	-	-	-

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

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	33	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	V
Drain Current-Continuous	$I_D$	290	A
Drain Current-Continuous( $T_C = 100^\circ C$ )	$I_D(100^\circ C)$	205	A
Pulsed Drain Current	$I_{DM}$	1160	A
Maximum Power Dissipation	$P_D$	270	W
Derating factor		1.8	W/ $^\circ C$
Single pulse avalanche energy <sup>(Note 5)</sup>	$E_{AS}$	1300	mJ
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 To 175	$^\circ C$

## Thermal Characteristic

Thermal Resistance, Junction-to-Case <sup>(Note 2)</sup>	$R_{\theta JC}$	0.56	$^\circ C/W$
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**Electrical Characteristics ( $T_A=25^{\circ}\text{C}$  unless otherwise noted)**

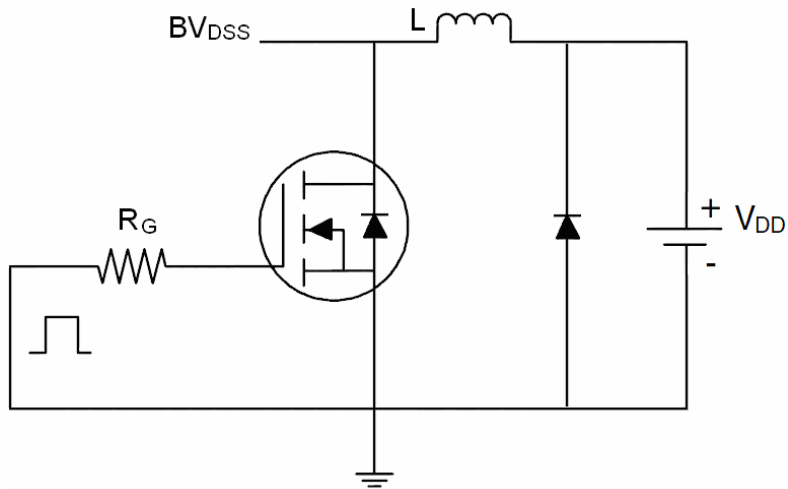
Parameter	Symbol	Condition	Min	Typ	Max	Unit
Off Characteristics						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	V <sub>GS</sub> =0V I <sub>D</sub> =250μA	33		-	V
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> =33V, V <sub>GS</sub> =0V	-	-	1	μA
Gate-Body Leakage Current	I <sub>GSS</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	2	3	4	V
Drain-Source On-State Resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> =10V, I <sub>D</sub> =160A	-	1.4	1.8	mΩ
Forward Transconductance	g <sub>FS</sub>	V <sub>DS</sub> =5V, I <sub>D</sub> =160A	50	-	-	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	-	7848	-	PF
Output Capacitance	C <sub>OSS</sub>		-	2046	-	PF
Reverse Transfer Capacitance	C <sub>RSS</sub>		-	1516	-	PF
Switching Characteristics <sup>(Note 4)</sup>						
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> =15V, R <sub>L</sub> =15Ω, R <sub>G</sub> =2.5Ω, V <sub>GS</sub> =10V	-	17	-	nS
Turn-on Rise Time	t <sub>r</sub>		-	160	-	nS
Turn-Off Delay Time	t <sub>d(off)</sub>		-	80	-	nS
Turn-Off Fall Time	t <sub>f</sub>		-	100	-	nS
Total Gate Charge	Q <sub>g</sub>	I <sub>D</sub> =160A, V <sub>DD</sub> =15V, V <sub>GS</sub> =10V	-	168	-	nC
Gate-Source Charge	Q <sub>gs</sub>		-	32.5	-	nC
Gate-Drain Charge	Q <sub>gd</sub>		-	72.9	-	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> =160A	-	0.85	1.2	V
Diode Forward Current <sup>(Note 2)</sup>	I <sub>S</sub>		-	-	290	A
Reverse Recovery Time	t <sub>rr</sub>	TJ = 25°C, I <sub>F</sub> = 160A	-	45		nS
Reverse Recovery Charge	Q <sub>rr</sub>	di/dt = 100A/μs <sup>(Note3)</sup>	-	160		nC
Forward Turn-On Time	t <sub>on</sub>	Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD)				

**Notes:**

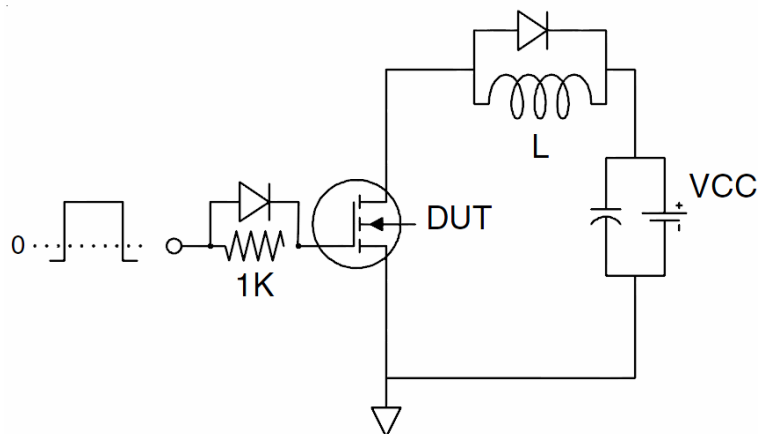
1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board,  $t \leq 10$  sec.
3. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ .
4. Guaranteed by design, not subject to production
5. EAS condition:  $T_J=25^{\circ}\text{C}, V_{DD}=15V, V_G=10V, L=0.5mH, R_g=25\Omega$

## Test circuit

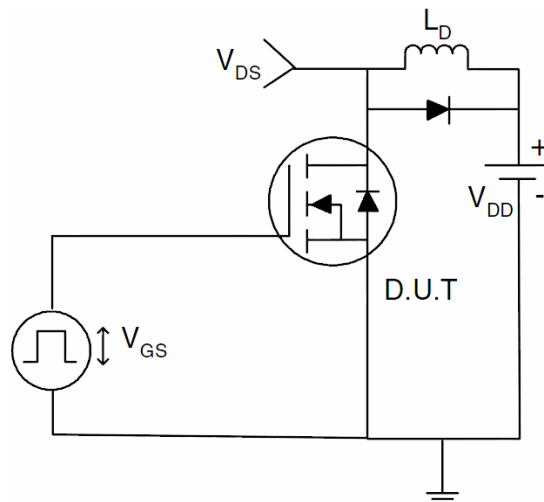
### 1) $E_{AS}$ test Circuits



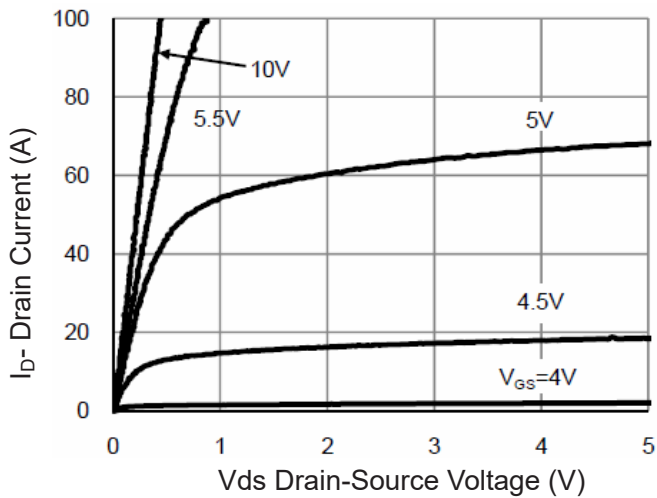
### 2) Gate charge test Circuit:



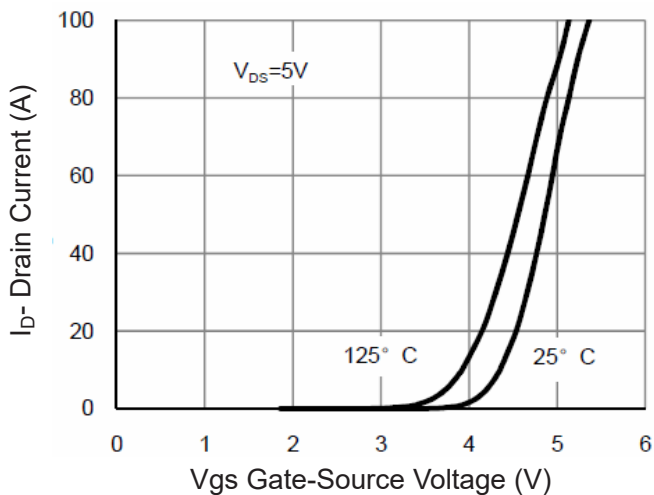
### 3) Switch Time Test Circuit:



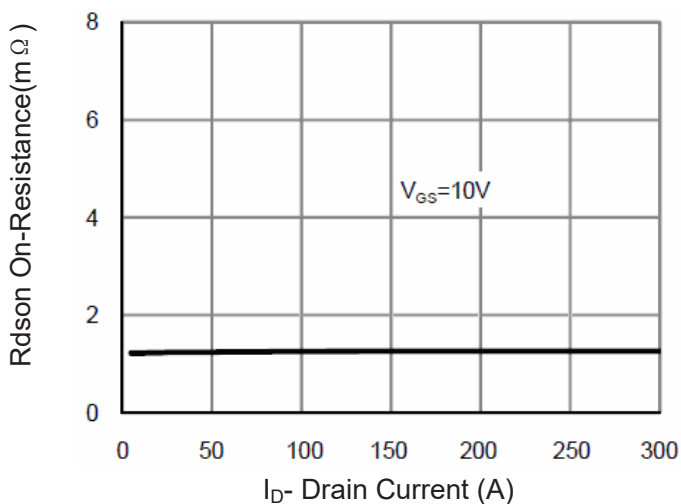
## Typical Electrical and Thermal Characteristics (Curves)



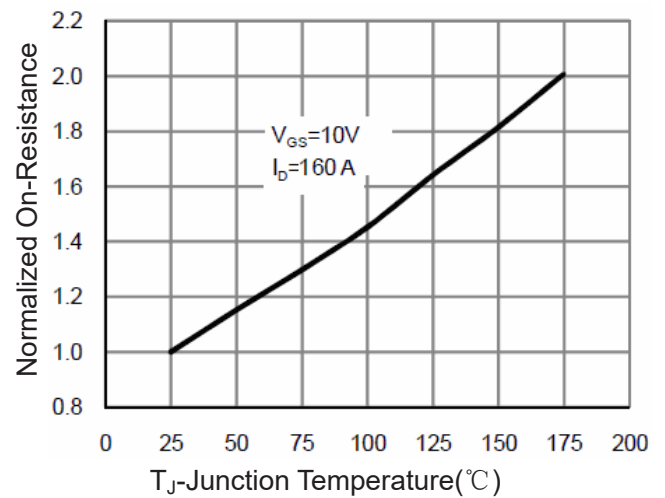
**Figure 1 Output Characteristics**



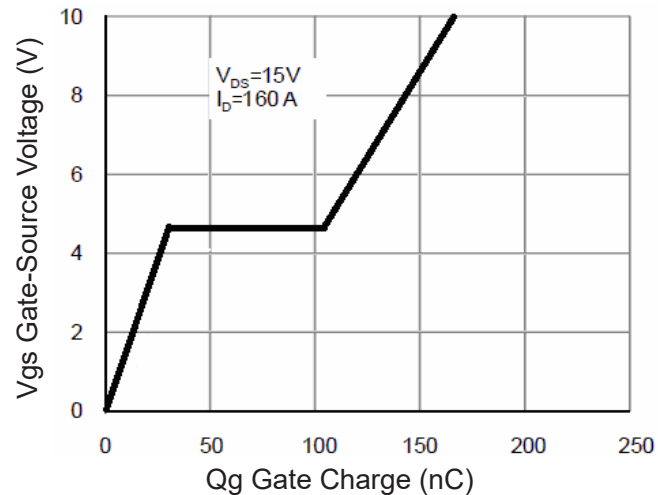
**Figure 2 Transfer Characteristics**



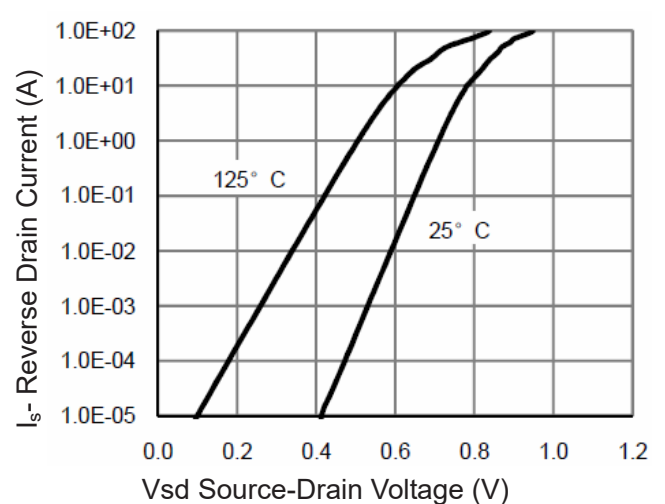
**Figure 3  $R_{DS(on)}$ - Drain Current**



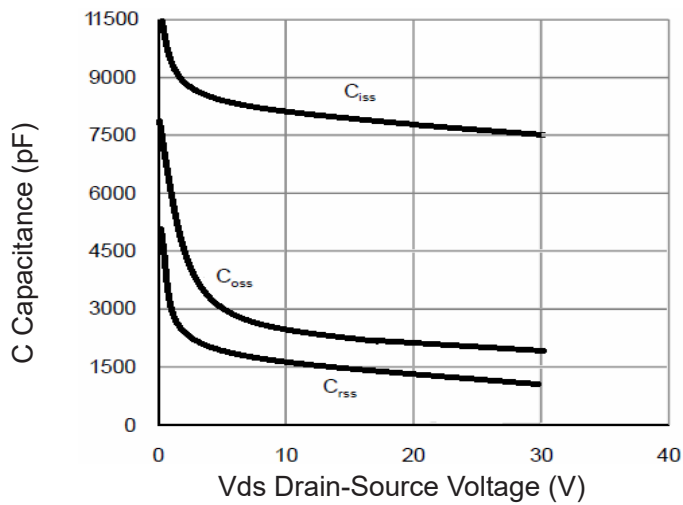
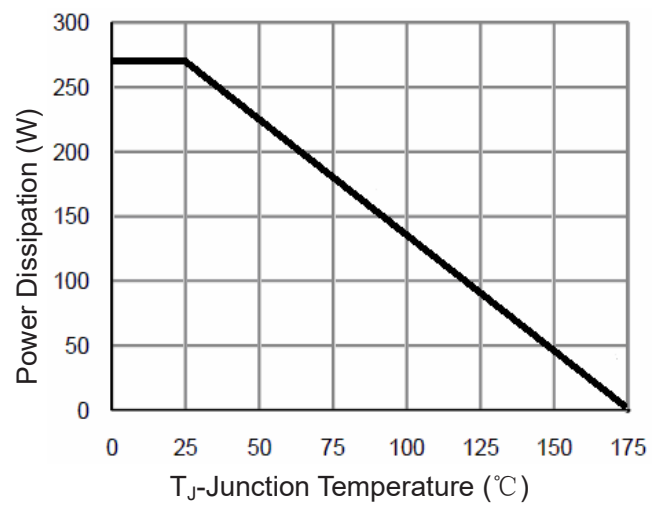
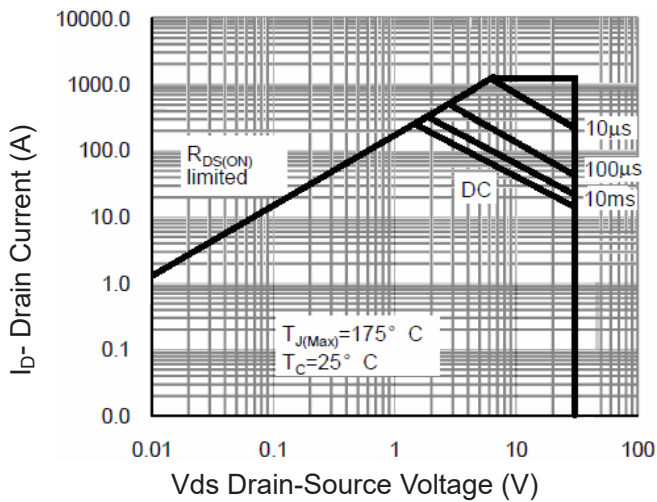
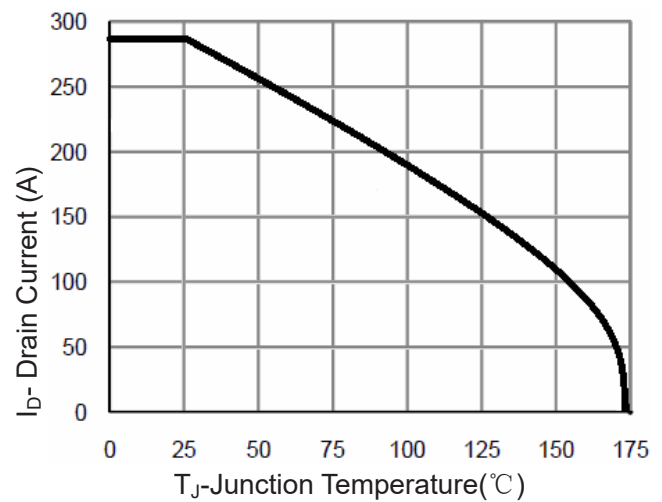
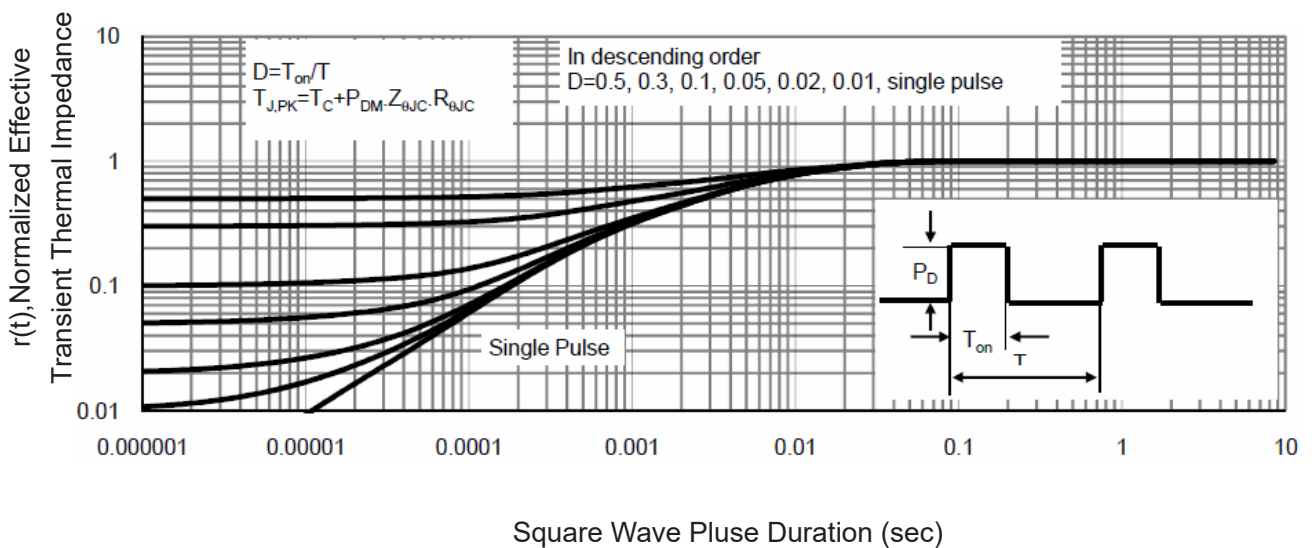
**Figure 4  $R_{DS(on)}$ -Junction Temperature**



**Figure 5 Gate Charge**



**Figure 6 Source- Drain Diode Forward**


**Figure 7 Capacitance vs Vds**

**Figure 9 Power De-rating**

**Figure 8 Safe Operation Area**

**Figure 10 Current vs Junction Temperature**

**Figure 11 Normalized Maximum Transient Thermal Impedance**