

## Description

The VSM3N06 uses advanced trench technology to provide excellent  $R_{DS(ON)}$ , low gate charge and operation with gate voltages as low as 2.5V. This device is suitable for use as a Battery protection or in other switching application.

## General Feature

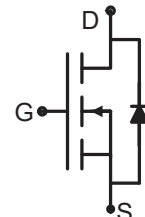
- $V_{DS} = 60V, I_D = 3.0A$   
 $R_{DS(ON)} < 100m\Omega @ V_{GS} = 10V$   
 $R_{DS(ON)} < 120m\Omega @ V_{GS} = 4.5V$
- High Power and current handling capability
- Lead free product is acquired
- Surface mount package

## Application

- Battery switch
- DC/DC converter



SOT-89



Schematic Diagram

## Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
VSM3N06-S9	VSM3N06	SOT-89	Ø180mm	12mm	1000units

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

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	60	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	V
Drain Current-Continuous	$I_D$	3	A
Drain Current-Pulsed (Note 1)	$I_{DM}$	10	A
Maximum Power Dissipation	$P_D$	1.7	W
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 To 150	$^\circ C$

## Thermal Characteristic

Thermal Resistance, Junction-to-Ambient (Note 2)	$R_{\theta JA}$	73.5	$^\circ C/W$
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## Electrical Characteristics ( $T_A = 25^\circ C$ unless otherwise noted)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
<b>Off Characteristics</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS} = 0V, I_D = 250\mu A$	60	65	-	V
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 60V, V_{GS} = 0V$	-	-	1	$\mu A$

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Gate-Body Leakage Current	I <sub>GSS</sub>	V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V	-	-	±100	nA
On Characteristics (Note 3)						
Gate Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA	1.0	1.3	2.0	V
Drain-Source On-State Resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> =10V, I <sub>D</sub> =3A	-	73	100	mΩ
		V <sub>GS</sub> =4.5V, I <sub>D</sub> =3A	-	90	120	mΩ
Forward Transconductance	g <sub>FS</sub>	V <sub>DS</sub> =15V, I <sub>D</sub> =2A	2	-	-	S
Dynamic Characteristics (Note4)						
Input Capacitance	C <sub>ISS</sub>	V <sub>DS</sub> =30V, V <sub>GS</sub> =0V, F=1.0MHz	-	247	-	PF
Output Capacitance	C <sub>OSS</sub>		-	34	-	PF
Reverse Transfer Capacitance	C <sub>rSS</sub>		-	19.5	-	PF
Switching Characteristics (Note 4)						
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> =30V, I <sub>D</sub> =1.5A V <sub>GS</sub> =10V, R <sub>GEN</sub> =1Ω	-	6	-	nS
Turn-on Rise Time	t <sub>r</sub>		-	15	-	nS
Turn-Off Delay Time	t <sub>d(off)</sub>		-	15	-	nS
Turn-Off Fall Time	t <sub>f</sub>		-	10	-	nS
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> =30V, I <sub>D</sub> =3A, V <sub>GS</sub> =4.5V	-	6	-	nC
Gate-Source Charge	Q <sub>gs</sub>		-	1	-	nC
Gate-Drain Charge	Q <sub>gd</sub>		-	1.3	-	nC
Drain-Source Diode Characteristics						
Diode Forward Voltage (Note 3)	V <sub>SD</sub>	V <sub>GS</sub> =0V, I <sub>S</sub> =3A	-	-	1.2	V
Diode Forward Current (Note 2)	I <sub>S</sub>		-	-	3	A

## 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

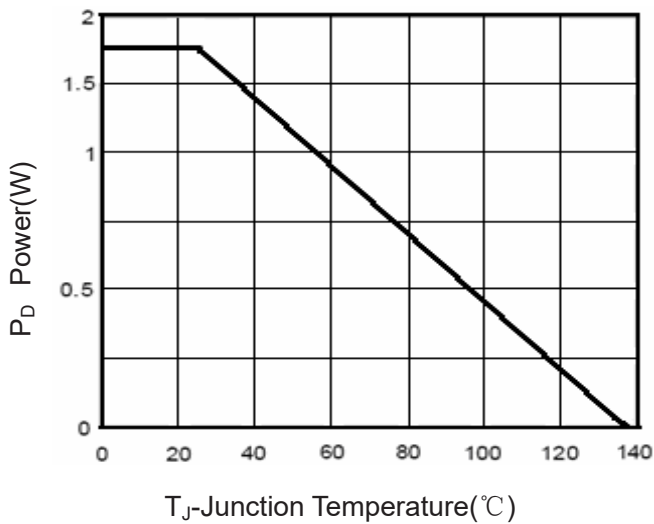
## Typical Electrical and Thermal Characteristics



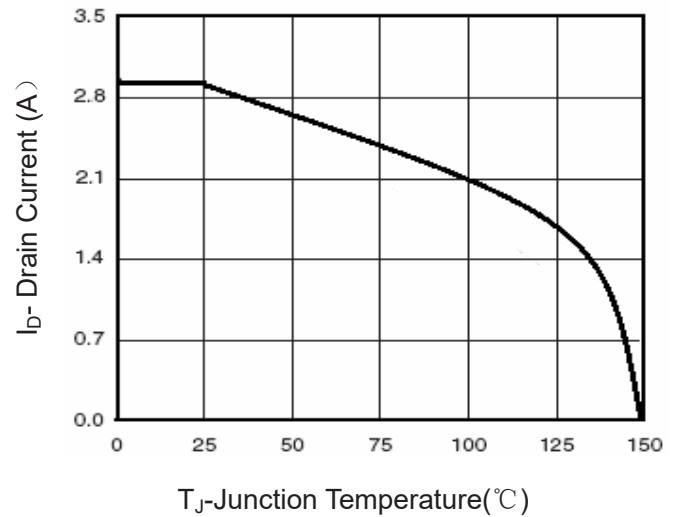
**Figure 1 Switching Test Circuit**



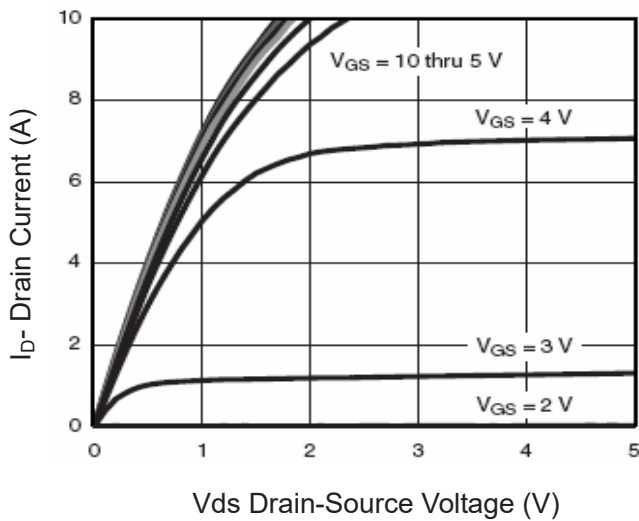
**Figure 2 Switching Waveforms**



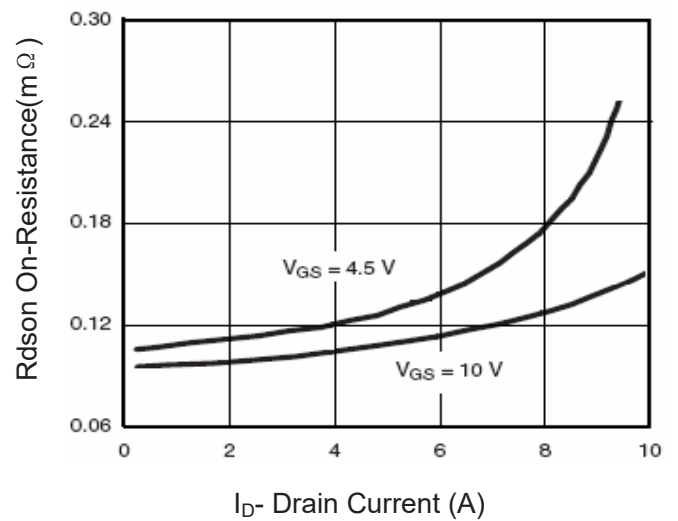
**Figure 3 Power Dissipation**



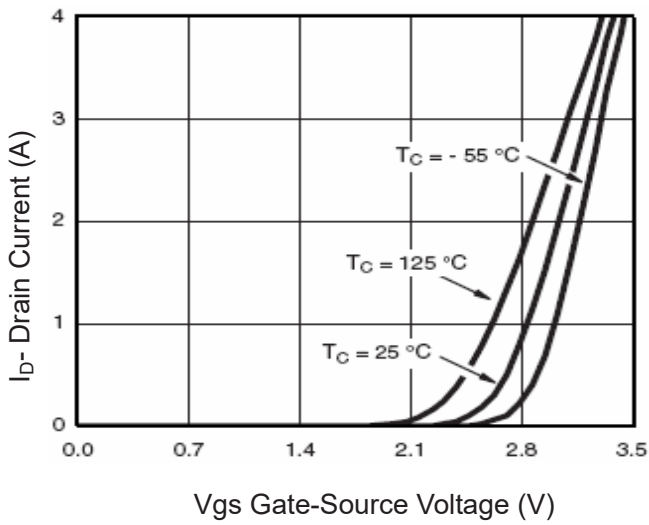
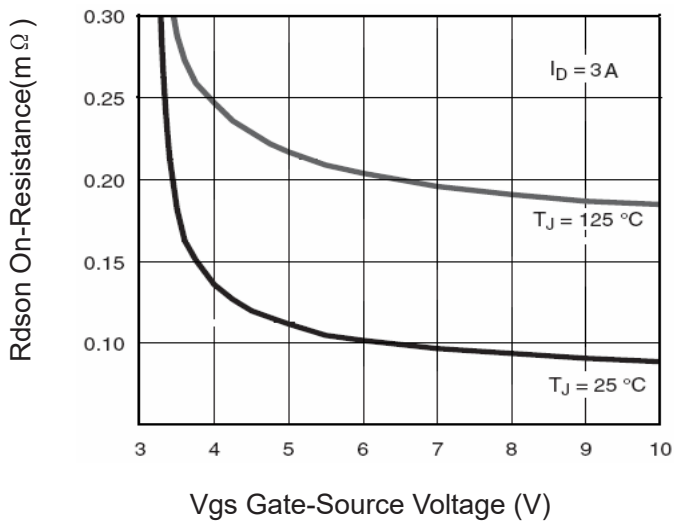
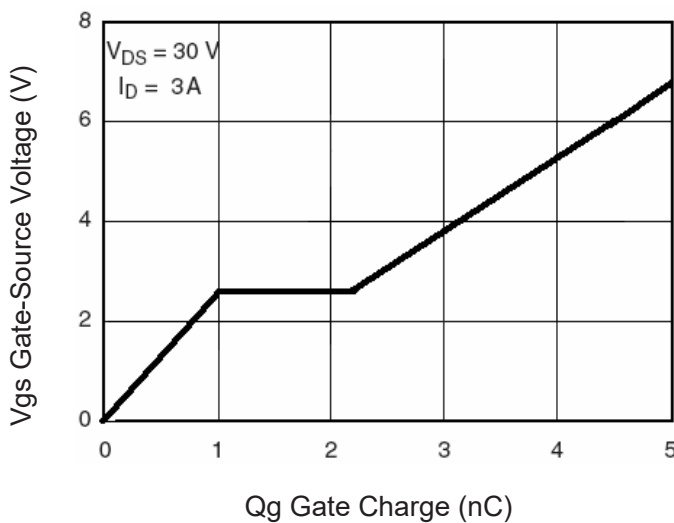
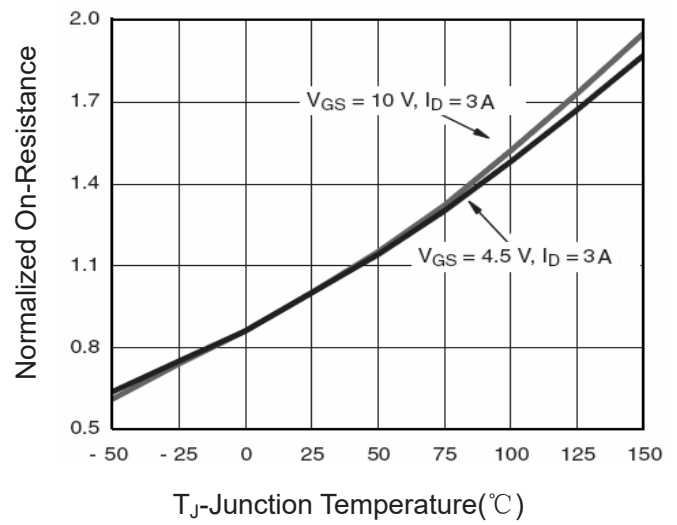
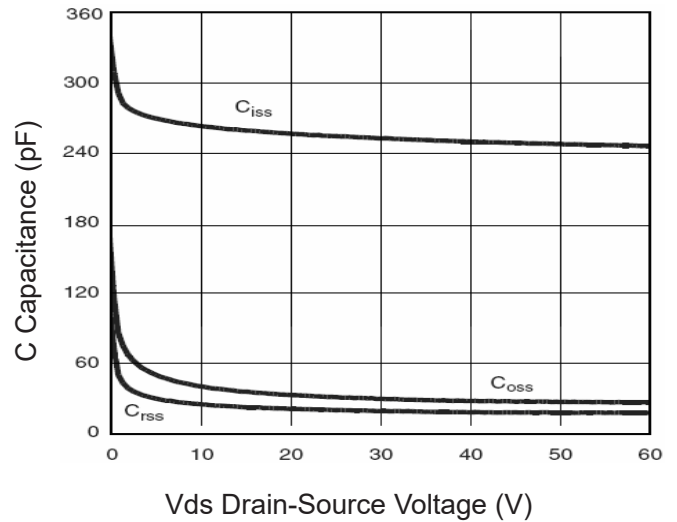
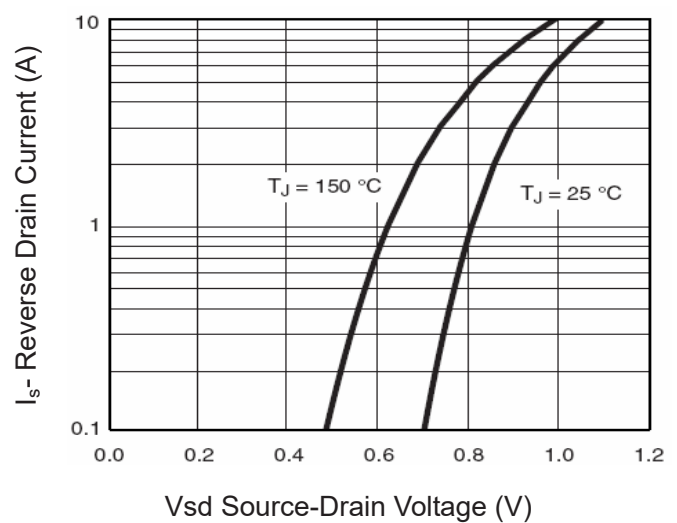
**Figure 4 Drain Current**

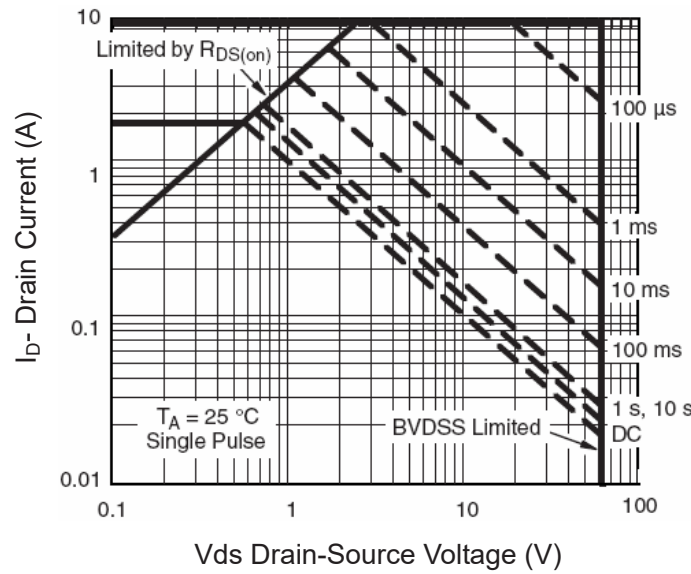


**Figure 5 Output Characteristics**

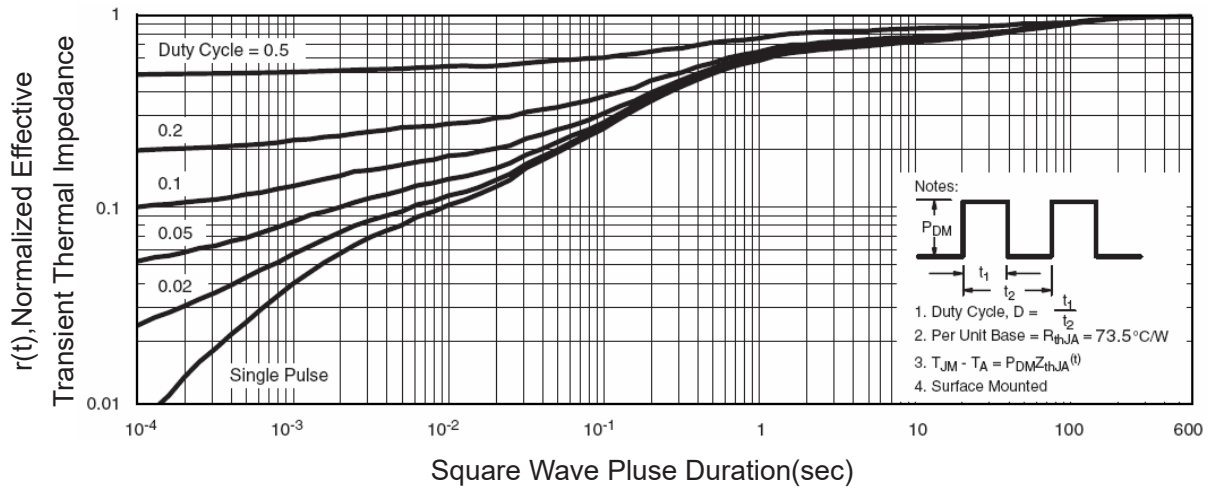


**Figure 6 Drain-Source On-Resistance**


**Figure 7 Transfer Characteristics**

**Figure 9  $R_{DS(on)}$  vs  $V_{GS}$** 

**Figure 11 Gate Charge**

**Figure 8 Drain-Source On-Resistance**

**Figure 10 Capacitance vs  $V_{DS}$** 

**Figure 12 Source- Drain Diode Forward**



**Figure 13 Safe Operation Area**



**Figure 14 Normalized Maximum Transient Thermal Impedance**