

## Description

The VSM2312A 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 Features

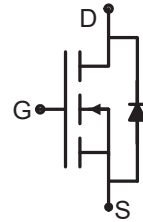
- $V_{DS} = 20V, I_D = 5A$   
 $R_{DS(ON)} < 35m\Omega @ V_{GS}=2.5V$   
 $R_{DS(ON)} < 28m\Omega @ V_{GS}=4.5V$
- High power and current handling capability
- Lead free product is acquired
- Surface mount package

## Application

- Battery protection
- Load switch
- Power management



SOT-23-3



Schematic Diagram

## Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
VSM2312A-S2	VSM2312A	SOT-23-3	Ø180mm	8 mm	3000 units

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

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	20	V
Gate-Source Voltage	$V_{GS}$	$\pm 10$	V
Drain Current-Continuous	$I_D$	5	A
Drain Current-Pulsed (Note 1)	$I_{DM}$	15	A
Maximum Power Dissipation	$P_D$	1.25	W
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 To 150	$^\circ\text{C}$

## Thermal Characteristic

Thermal Resistance, Junction-to-Ambient (Note 2)	$R_{\theta JA}$	100	$^\circ\text{C/W}$
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## Electrical Characteristics ( $T_A=25^\circ\text{C}$ unless otherwise noted)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
<b>Off Characteristics</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS}=0V, I_D=250\mu A$	20	22	-	V
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS}=20V, V_{GS}=0V$	-	-	1	$\mu A$

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Gate-Body Leakage Current	I <sub>GSS</sub>	V <sub>GS</sub> =±10V,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	0.5	0.65	1.0	V
Drain-Source On-State Resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> =2.5V, I <sub>D</sub> =4.5 A	-	20	35	mΩ
		V <sub>GS</sub> =4.5V, I <sub>D</sub> =5A	-	17	28	mΩ
Forward Transconductance	g <sub>FS</sub>	V <sub>DS</sub> =15V,I <sub>D</sub> =5A	25	-	-	S
Dynamic Characteristics (Note4)						
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> =10V,V <sub>GS</sub> =0V, F=1.0MHz	-	780	-	PF
Output Capacitance	C <sub>Oss</sub>		-	140	-	PF
Reverse Transfer Capacitance	C <sub>rss</sub>		-	80	-	PF
Switching Characteristics (Note 4)						
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> =10V,I <sub>D</sub> =1A V <sub>GS</sub> =4.5V,R <sub>GEN</sub> =6Ω	-	9	-	nS
Turn-on Rise Time	t <sub>r</sub>		-	30	-	nS
Turn-Off Delay Time	t <sub>d(off)</sub>		-	35	-	nS
Turn-Off Fall Time	t <sub>f</sub>		-	10	-	nS
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> =10V,I <sub>D</sub> =5A,V <sub>GS</sub> =4.5V	-	11	-	nC
Gate-Source Charge	Q <sub>gs</sub>		-	2.3	-	nC
Gate-Drain Charge	Q <sub>gd</sub>		-	2.9	-	nC
Drain-Source Diode Characteristics						
Diode Forward Voltage (Note 3)	V <sub>SD</sub>	V <sub>GS</sub> =0V,I <sub>S</sub> =1A	-	-	1.2	V
Diode Forward Current (Note 2)	I <sub>S</sub>		-	-	5	A

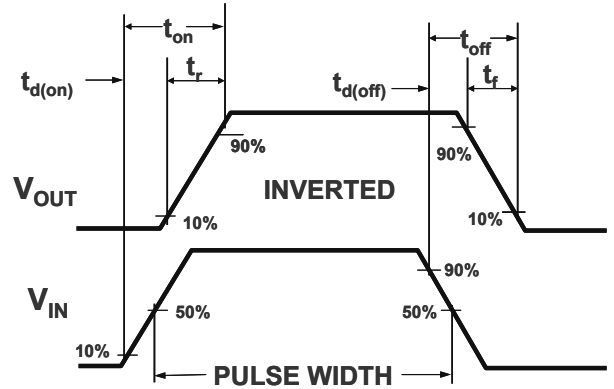
## Notes:

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

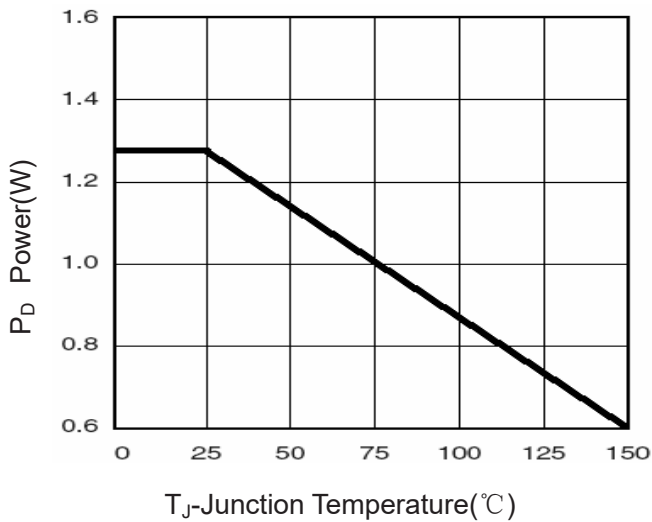
## Typical Electrical and Thermal Characteristics



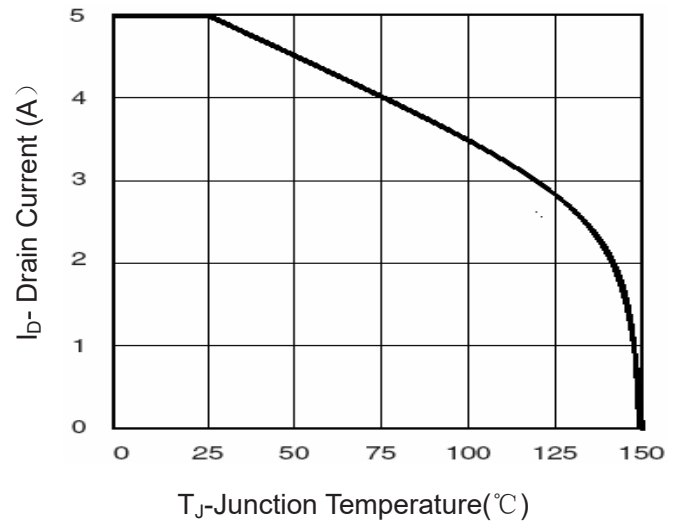
**Figure 1: Switching Test Circuit**



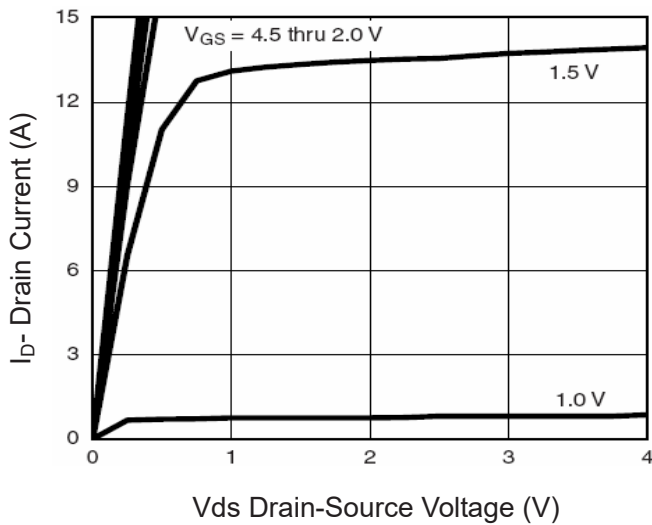
**Figure 2: Switching Waveforms**



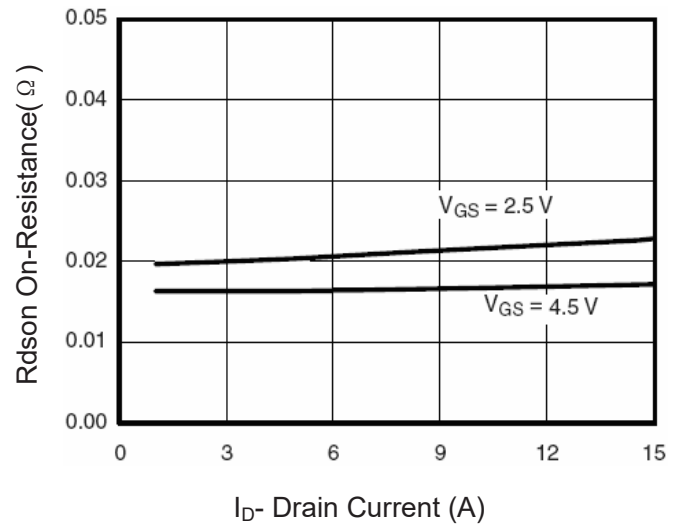
**Figure 3 Power Dissipation**



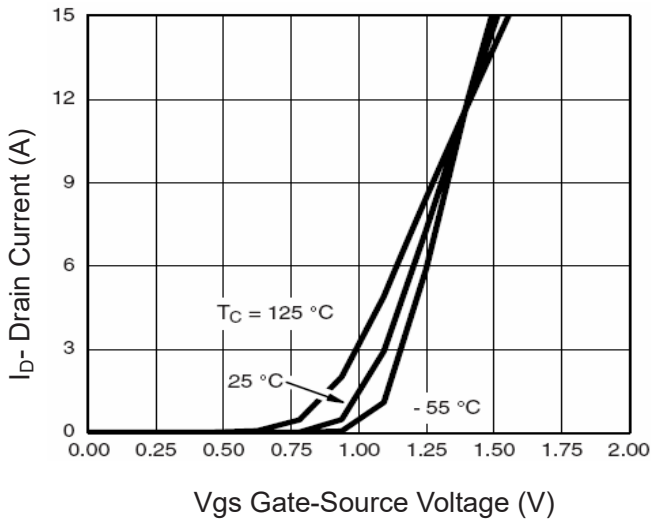
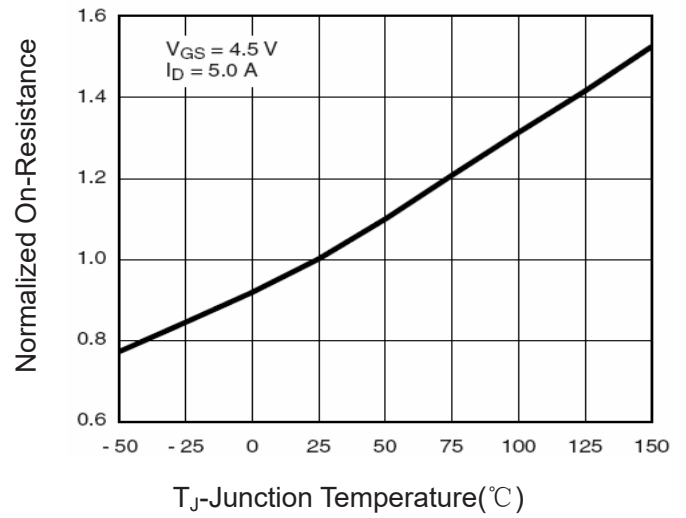
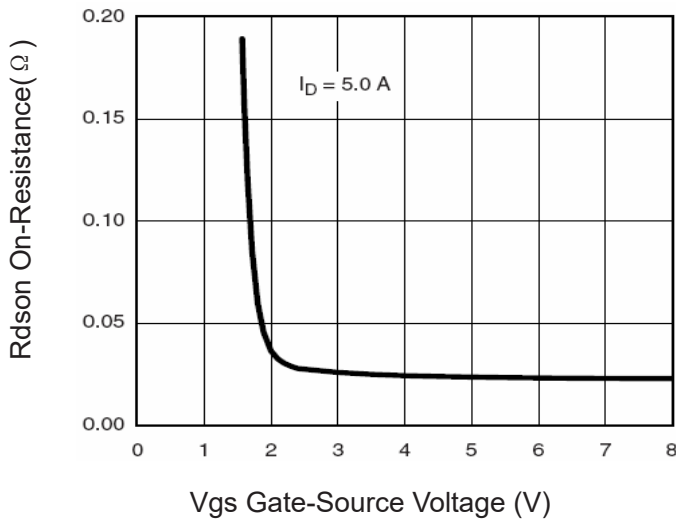
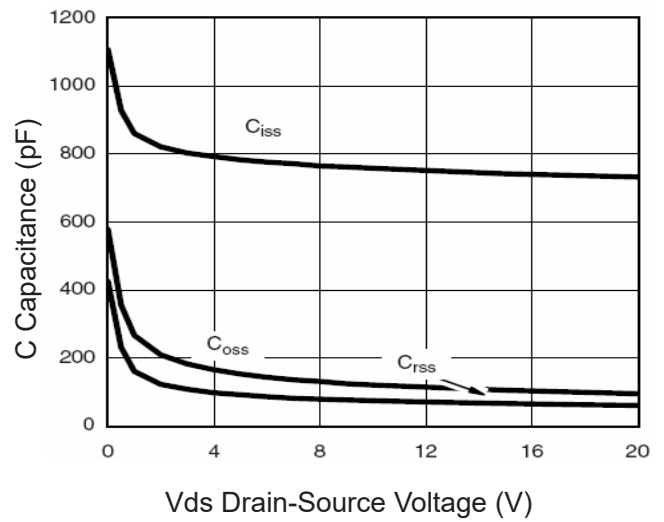
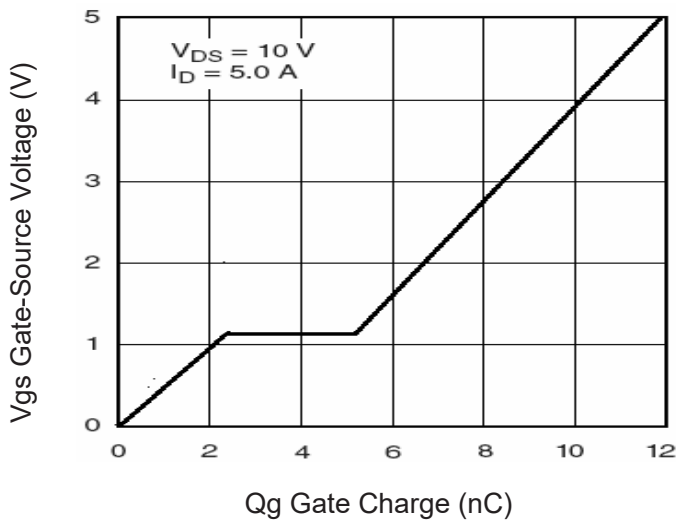
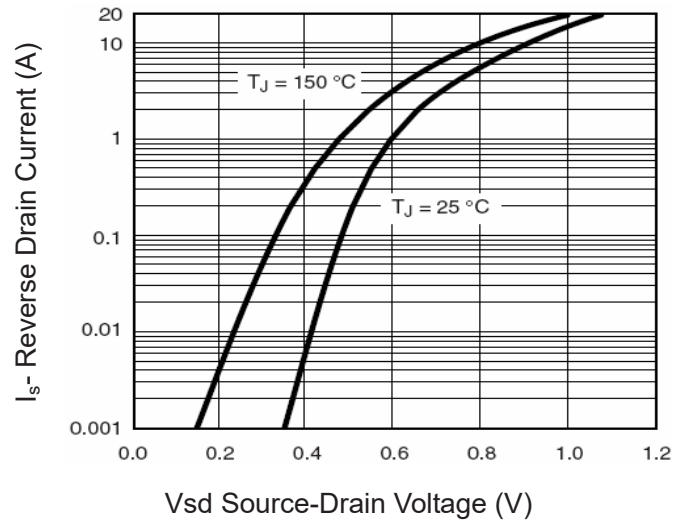
**Figure 4 Drain Current**

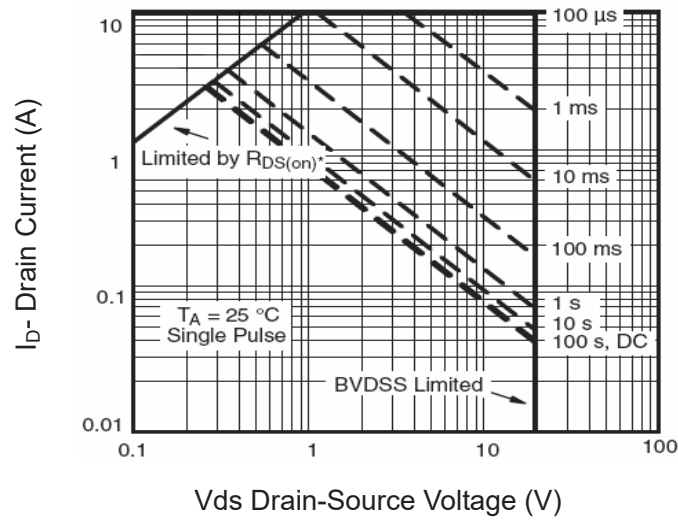


**Figure 5 Output Characteristics**

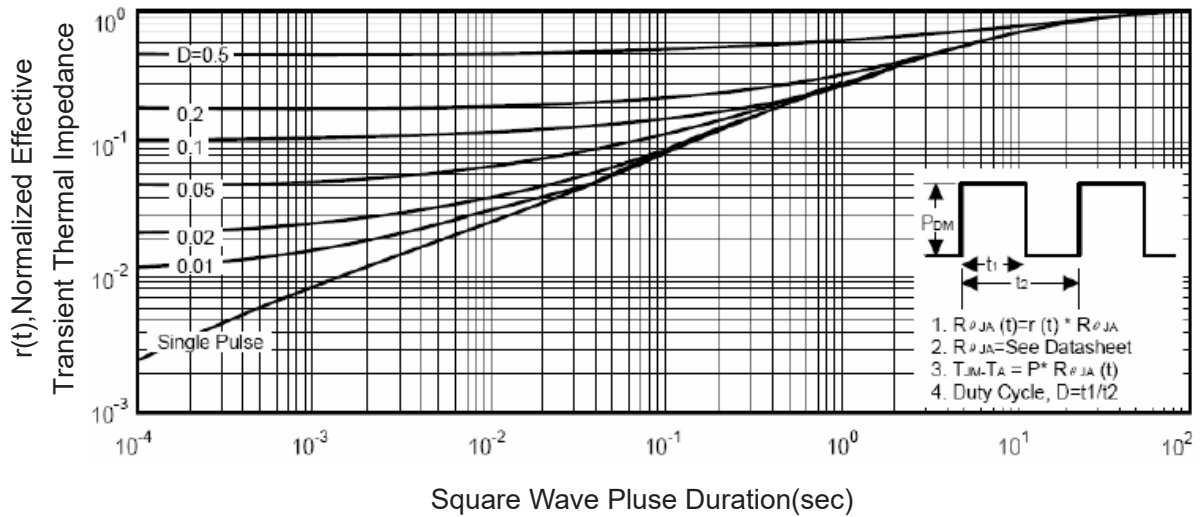


**Figure 6 Drain-Source On-Resistance**


**Figure 7 Transfer Characteristics**

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

**Figure 9 Rdson vs Vgs**

**Figure 10 Capacitance vs Vds**

**Figure 11 Gate Charge**

**Figure 12 Source- Drain Diode Forward**



**Figure 13 Safe Operation Area**



**Figure 14 Normalized Maximum Transient Thermal Impedance**