Description

The VSM1013E uses advanced trench technology to provide excellent $R_{DS(ON)}$, low gate charge and operation with gate voltages as low as -1.8V. This device is suitable for use as a Battery protection or in other Switching application.

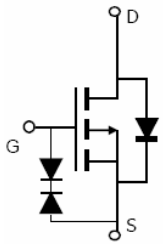
General Features

- V_{DS} = -20V,I_D =-0.66A
  $R_{DS(ON)}$ <520mΩ @ V_{GS}=-4.5V
  $R_{DS(ON)}$ <700mΩ @ V_{GS}=-2.5V
  $R_{DS(ON)}$ <1000mΩ @ V_{GS}=-1.8V
  ESD Rating : HBM 2000V
- High power and current handing capability
- Lead free product is acquired
- Gate-Source ESD protection

Application

- Battery operated systems
- Load/ power switching cell phones pagers
- Power supply converter circuits

SOT-23-3



Schematic Diagram

Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
VSM1013E-S2	VSM1013E	SOT-23-3	Ø180mm	8 mm	3000units

Absolute Maximum Ratings (T_A=25℃unless otherwise noted)

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	V_{DS}	-20	V
Gate-Source Voltage	V_{GS}	±12	V
Drain Current-Continuous	I_D	-0.66	A
Drain Current-Pulsed (Note 1)	I_{DM}	-3	A
Maximum Power Dissipation	P_D	0.3	W
Operating Junction and Storage Temperature Range	T_J,T_{STG}	-55 To 150	℃

Thermal Characteristic

Thermal Resistance,Junction-to-Ambient (Note 2)	$R_{\theta JA}$	417	℃/W

Electrical Characteristics (T_A=25℃unless otherwise noted)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Off Characteristics						
Drain-Source Breakdown Voltage	BV_{DSS}	V_{GS}=0V I_D=-250μA	-20	-	-	V

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS}=-20V,V_{GS}=0V	-	-	1	μA
Gate-Body Leakage Current	I_{GSS}	V_{GS}=±10V,V_{DS}=0V	-	-	±10	μA
On Characteristics (Note 3)						
Gate Threshold Voltage	$V_{GS(th)}$	V_{DS}=V_{GS},I_D=-250μA	-0.5	-0.6	-0.9	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	V_{GS}=-4.5V, I_D=-0.6A	-	362	520	mΩ
		V_{GS}=-2.5V, I_D=-0.5A	-	471	700	mΩ
		V_{GS}=-1.8V, I_D=-0.4A	-	837	1000	mΩ
Forward Transconductance	g_{FS}	V_{DS}=-5V,I_D=-0.6A	-	1	-	S
Dynamic Characteristics (Note4)						
Input Capacitance	C_{lss}	V_{DS} = -10 V ,V_{GS} = 0 V, F= 1.0 MHz,	-	114	-	pF
Output Capacitance	C_{oss}		-	17	-	pF
Reverse Transfer Capacitance	C_{rss}		-	14	-	pF
Switching Characteristics (Note 4)						
Turn-on Delay Time	$t_{d(on)}$	V_{DD}= -10 V, R_L = 47Ω V_G= -4.5 V, R_G = 10Ω	-	6.5	-	nS
Turn-on Rise Time	t_r		-	6.5	-	nS
Turn-Off Delay Time	$t_{d(off)}$		-	18.2	-	nS
Turn-Off Fall Time	t_f		-	5.5	-	nS
Total Gate Charge	Q_g	V_{DS} =- 10 V, V_{GS} = -4.5 V, I_D = -0.6A	-	1.44	-	nC
Gate-Source Charge	Q_{gs}		-	0.14	-	nC
Gate-Drain Charge	Q_{gd}		-	0.35	-	nC
Drain-Source Diode Characteristics						
Diode Forward Voltage (Note 3)	V_{SD}	V_{GS}=0V,I_S=-0.6A	-	-	-1.2	V
Diode Forward Current (Note 2)	I_S		-	-	-0.6	A

Notes:

1. Repetitive Rating: Pulse width limited by maximum junction temperature.

2. Surface Mounted on 1in 2 FR-4 board with 2oz. Copper, in a still air environment with T A =25°C.The value in any given application depends on the user's specific board design. The current rating is based on the t≤ 10s thermal resistance rating.

3. Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 2%.

4. Guaranteed by design, not subject to production

Typical Electrical and Thermal Characteristics

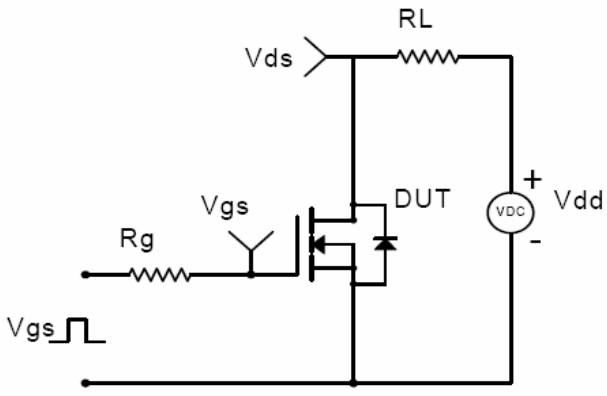


Figure 1:Switching Test Circuit

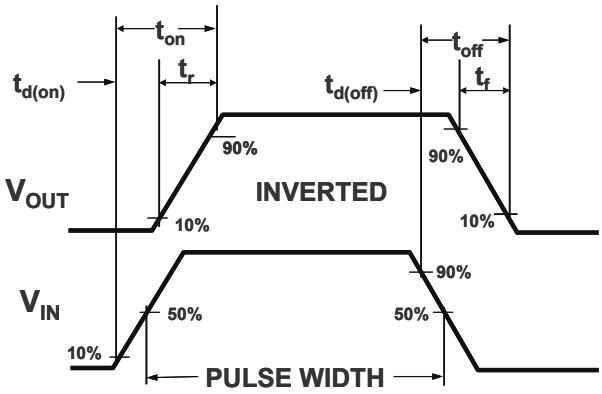


Figure 2:Switching Waveforms

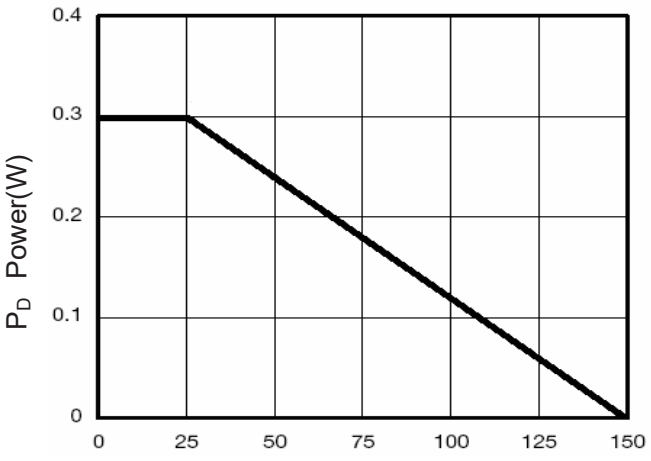


Figure 3 Power Dissipation

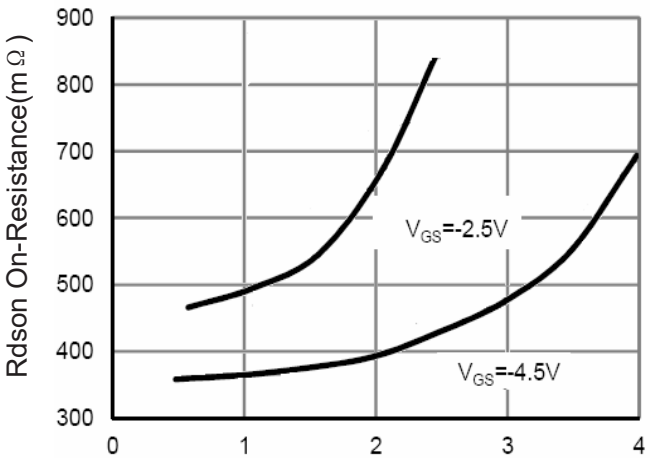


Figure 4 Drain-Source On-Resistance

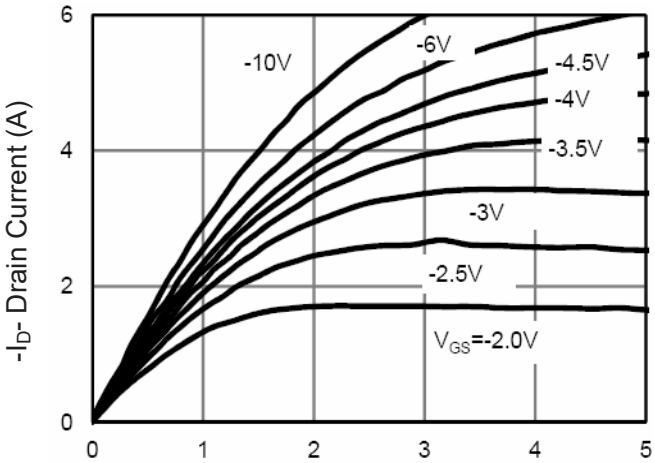


Figure 5 Output Characteristics

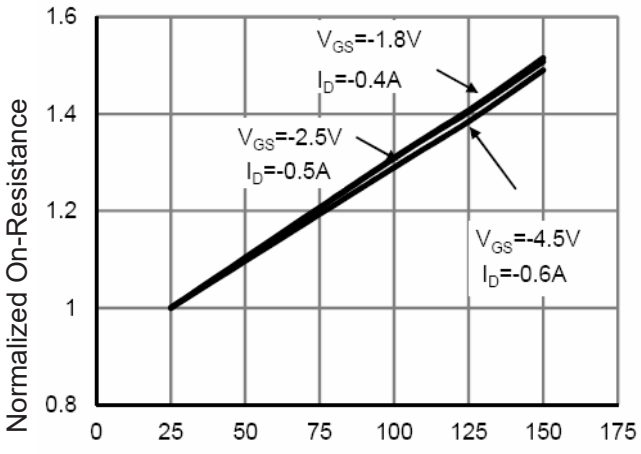


Figure 6 Drain-Source On-Resistance

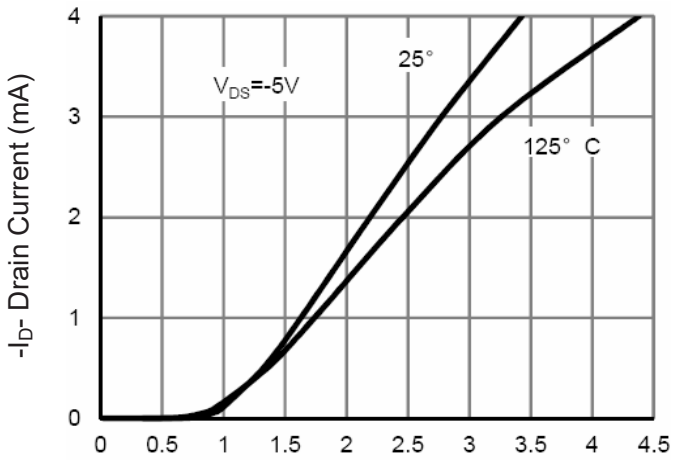


Figure 7 Transfer Characteristics

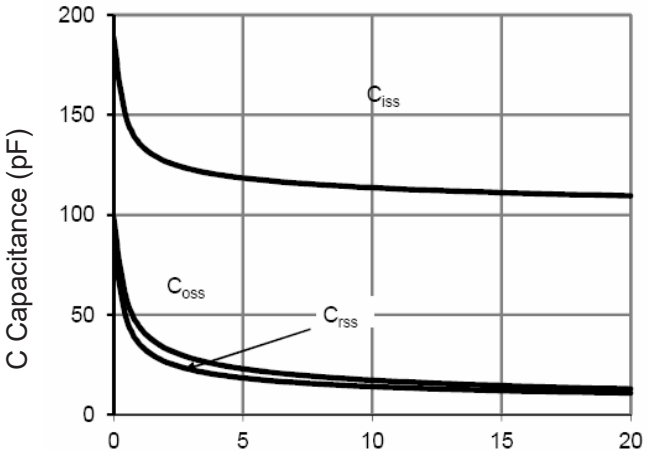


Figure 8 Capacitance vs Vds

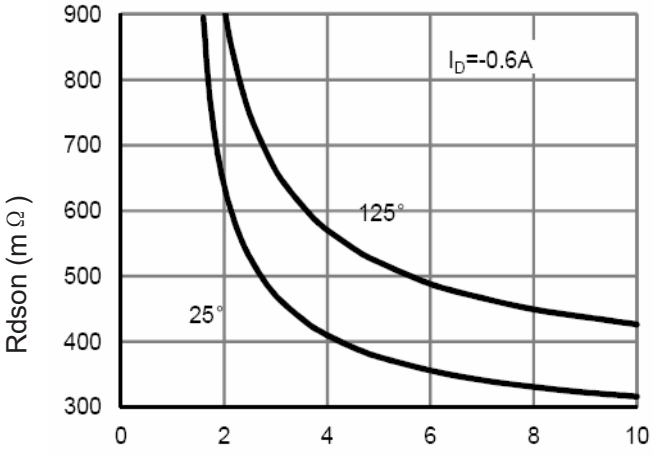


Figure 9 Rdson vs Vgs

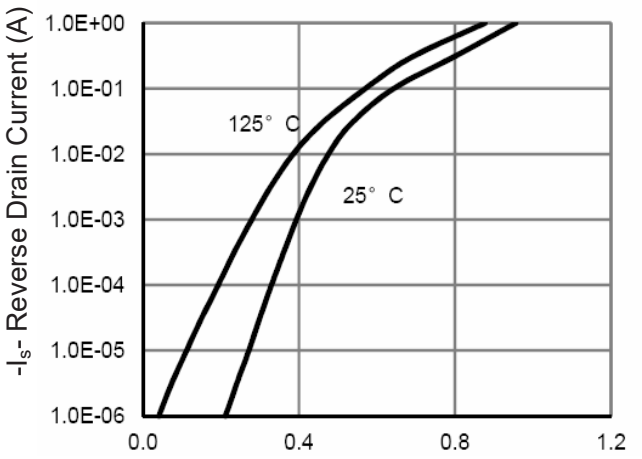


Figure 10 Source- Drain Diode Forward

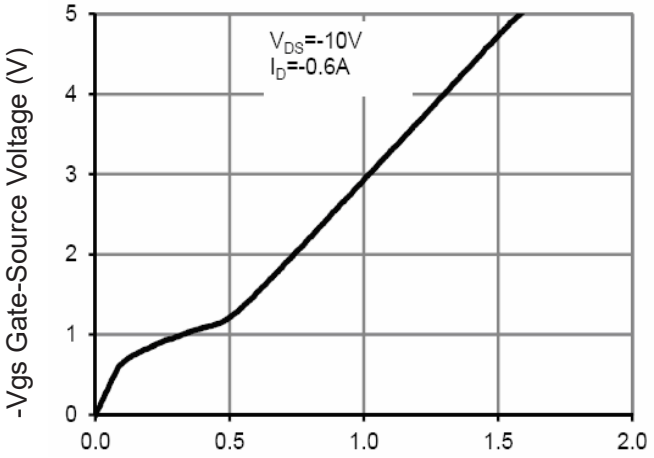


Figure 11 Gate Charge

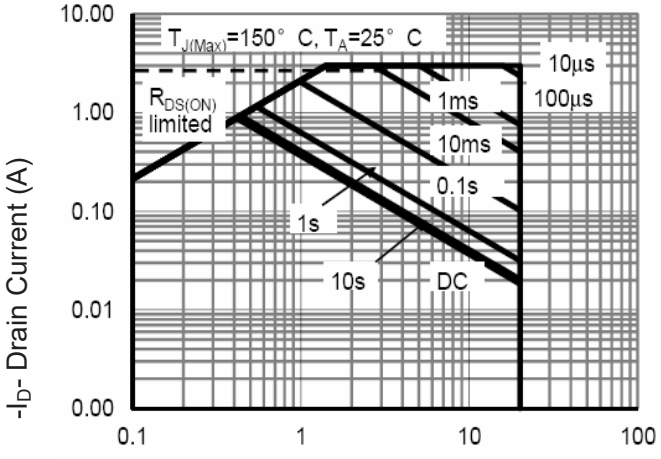


Figure 12 Safe Operation Area

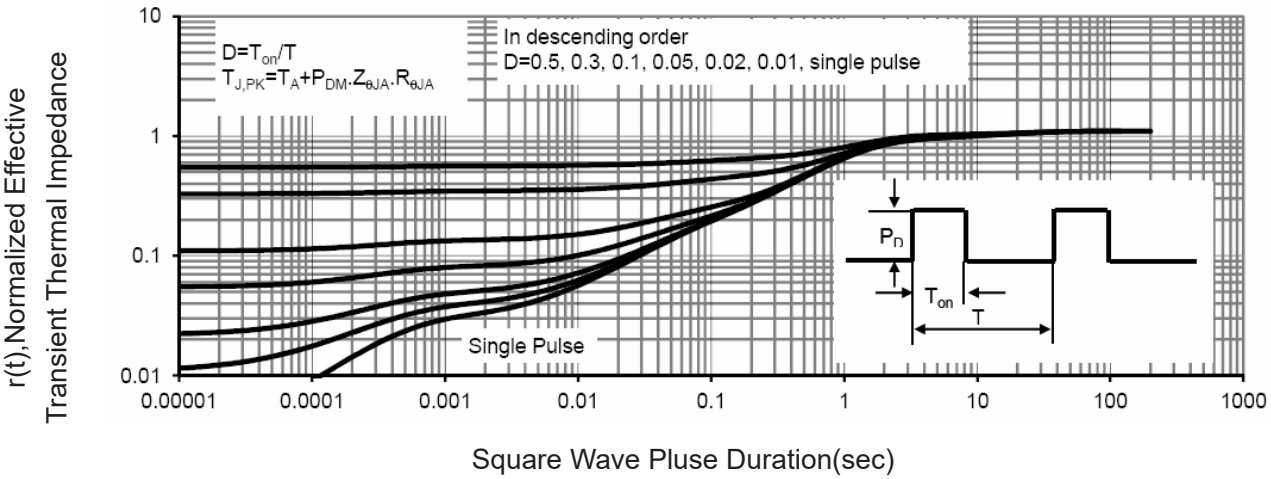


Figure 13 Normalized Maximum Transient Thermal Impedance