VDIC
Hi-Rel Latch-Up Current Limiter

VDPM0168xS20xx2V01
USER MANUAL

Version: A0

Contents

1 Description

Advanced high performance semiconductor devices can be sensitive to Single Event Latch-Up (SEL) effect when exposed under radiation in the space environment. Even if SEL is a very rare event, it can lead to device destruction. A safe design for a mission critical application shall include a protection device called the Latch-Up current Limiter (LCL).

The VDPM0168xS20xx2v01 monitors the power supply line of the radiation sensitive device and switches it off instantaneously in case of "radiation induced SEL". Featuring specific radiation effect mitigation techniques and utilizing space design derating rules, the Rad Hard by Design VDPM0168xS20xx2v01 is an ITAR Free product and features a SEL/SET LETth of 80 Mev.cm^2/mg and aTID of 50krad (Si). The VDPM0168xS20xx2v01 is manufactured with Orbita Space Qualified stacking technology designed for high reliability applications, and is available in a compact size and low weight 20-pins SOP package 1.27mm.
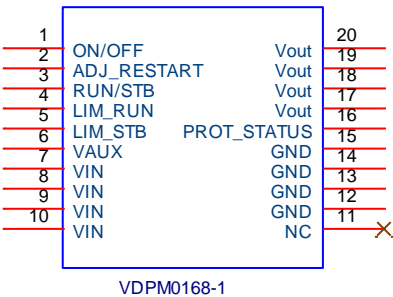
2 Features

- Protection device to power sensitive load with automatic disconnection in case of over-current
- Large input voltage range : 0.8V to 5.5V
- Output current up to 2A
- Low voltage drop (95mV @ 1A)
- Fast Switch OFF time (10µs max) in case of over-current
- 2 adjustable current threshold (Run & Standby) by external resistors.
- Active threshold selection through external digital command
- External ON/OFF command
- Manual or Automatic reconnection (after a delay adjustable by the user through external capacitor)
- Digital status for system monitoring
- Aux. Supply (3.2V to 5.5V and up to 15V with serial R) to power the device for Vin < 3.3V
- Space Qualified Technology
- Radiation Hardened design
- Temperature Range -40°C / +105°C
- Compact Size and Low Weight
- 20-pins SOP package 1.27mm
- ITAR Free Product
- Size: 15 x 15 x 9.4 mm
- Mass: 5.4 g

3 BLOCK DIAGRAM
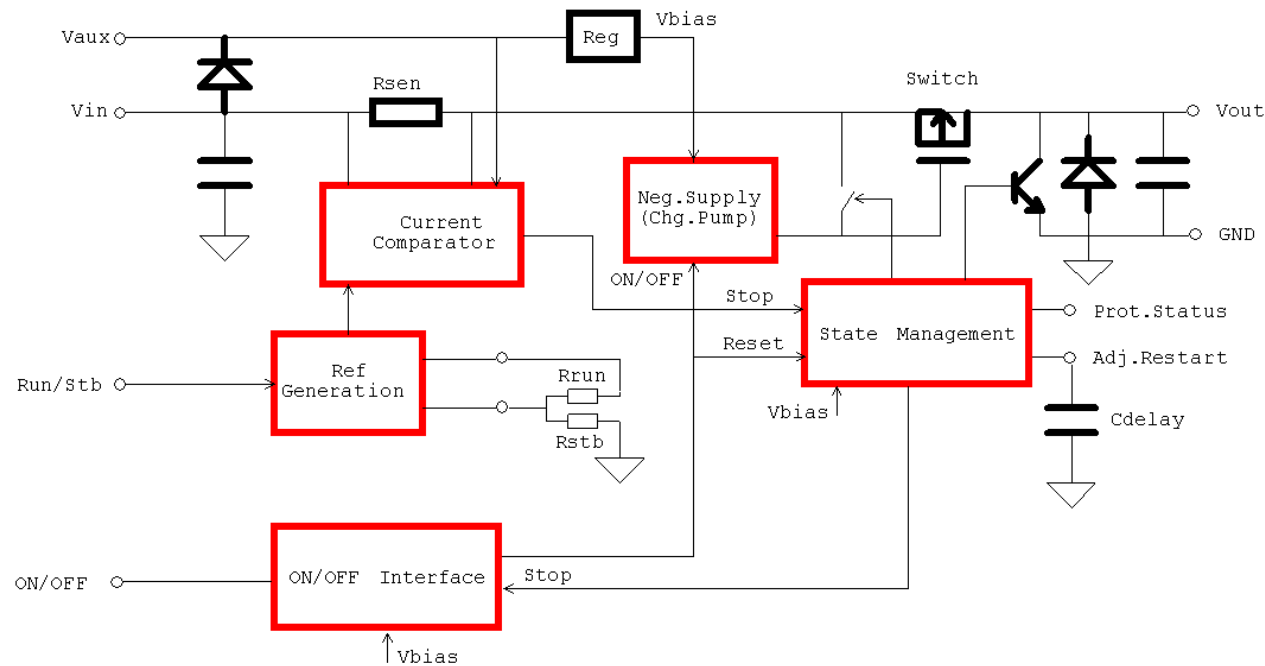
4 PIN ASSIGNMENTAND DESCRIPTIONS

Pin Id	Pin #		Pin Id
ON/OFF	1	20	Vout
ADJ_RESTART	2	19	Vout
RUN/STB	3	18	Vout
LIM_RUN	4	17	Vout
LIM_STB	5	16	PROT_STATUS
VAUX	6	15	GND
VIN	7	14	GND
VIN	8	13	GND
VIN	9	12	GND
VIN	10	11	NC

Pin Name	Function
ON/OFF	ON/OFF command pin. When left unconnected or connected to GND, LCL is in OFF state and load is disconnected from the Vin supply .When connected to high level, LCL is started and load is connected to the Vin supply .This is an input pin.
ADJ_RESTART	Pin used to select the automatic restart function provided by the LCL and to adjust the delay .When connected directly to GND, automatic restart function is inhibited. When connected to a capacitor, automatic restart is selected. Capacitor value set the delay for automatic reconnection (see

	automatic restart setting section).This is an input pin.
RUN/STB	Pin used to select the active current protection threshold. When this pin is connected to a low level voltage, low level current threshold corresponding to standby mode is selected (Ith_stb).When this pin is connected to a high level voltage, high level current threshold corresponding to run mode is selected (Ith_run).This is an input pin.
LIM_RUN	Pin used to set the high level current threshold (Ith_run). Ith_run value is set by a resistor (see current limitation setting section) connected between this pin and the LIM_STB pin. This is an input pin
LIM_STB	Pin used to set the low level current threshold (Ith_stb). Ith_stb value is set by a resistor (see current limitation setting section) connected between this pin and GND.This is an input pin.
VAUX	Auxiliary supply pin used to power the internal control circuits of the LCL. Internal control circuit needs at least 3.2V to run correctly. When input voltage (Vin) is greater than 3.2V, this pin can be connected to Vin pins. When input voltage is lower than 3.2V an auxiliary supply needs to be connected to this pin. Auxiliary supply voltage shall be between 3.2V and 5.5V. If higher voltage is used, a serial resistor shall beadded to limit the auxiliary supply current and to reduce internal LCL power dissipation. This is an input pin
VIN	Input voltage pins. Connect the load supply voltage to these pins.These are input pins
NC	Not used pin
GND	Reference grounds for the LCL module (load current is not going through this pin)
PROT_STATUS	Protection Status pin. The signal at this pin is used to survey the LCL state. Signal is pulled to GND when LCLis not tripped. Signal is pulled to high level when LCL is tripped (load disconnected after overcurrent).This is an output pin
Vout	Output voltage pins. This is the protected supply to power the LCL load.These are output pins.

5   ELECTRICAL SPECIFICATIONS

5.1   ABSOLUTE MAXIMUM RATINGS

Parameter	Conditions	Min	Typ	Max	Unit
Input Voltage (Vin)	Continuous	-0.3		Vaux+0.2	V

Auxiliary Voltage (Vaux)	Continuous	-0.5		5.5	V
Output Current	Continuous			2	A
ON/OFF Command	Continuous	-0.3		7	V
Run/Stb Command	Continuous	-0.3		7	V
Storage Temperature	-	-55		+150	°C

5.2 RECOMMENDED OPERATING RANGES

Parameter	Conditions	Min	Typ	Max	Unit
Input Voltage (Vin)	Continuous	0.8		5.5	V
Auxiliary Voltage (Vaux)	Continuous	3.2		5.5	V
Output Current	Continuous	0		1	A
ON/OFF Command	Continuous	0		Vaux	V
Run/Stb Command	Continuous	0		Vaux	V
Junction Temperature	-	-40		+105	°C

5.3 DC Characteristics

5.3.1 Input & Output Specifications

Parameter	Conditions	Min	Typ	Max	Unit
Supply Characteristics					
Auxiliary Supply Current	Vaux = 5.5V	10	15	21	mA
Output Characteristics					
Output Current		0		2000	mA
Capacitive Load		0		10	µF
Voltage Drop	Iload = 1A	35	54	65	mV
Free wheeling diode Vdrop	Iout = 1A @ 25°C			1.3	V
Internal decoupling capacitor	Ceramic capacitor implemented at module output		0.22		µF

5.3.2 commands and Status Specifications

Parameter	Conditions	Min	Typ	Max	Unit
ON/OFF Commands Characteristics (LCL input)					
ON Voltage threshold see	Vaux = 3,3V	2.32			V
	Vaux = 5V	3.32			V
OFF Voltage threshold	Vaux = 3,3V			1.05	V
	Vaux = 5V			1.7	V
Input impedance	LCL not in protection mode		50		kΩ
	LCL in protection mode		50		kΩ

RUN/STB Commands Characteristics (LCL input)					
RUN Voltage level		2.0			V
STB Voltage level				0.35	V
PROT_STATUS Characteristics (LCL output)					
LCL not tripped		0		0.2	V
LCL tripped	High level is always lower than Vaux	2.9		3.1	V
Output impedance		40		100	Ω

5.3.3 protections

Parameter	Conditions	Min	Typ	Max	Unit
Current Protection					
Standby threshold Current	Ith_stb, adjustable by Rstb	100		Ith_run	mA
Run threshold Current	Ith_run, adjustable by Rrun	Ith_stb		2000	mA
Current threshold accuracy see note (5)	Ith = 100mA	-20		20	%
	Ith = 1A	-8		8	%
Automatic reconnection Delay	Adjustable by Cdelay	0.5		300	ms
Delay accuracy		-25		25	%
Performances					
Switch OFF time (current protection activated)	Cload < 7µFsee Figure 1			10	µs
dV/dt at switch ON	Output slope controlled at ON command	3		16	mV/µs

6 TYPICAL APPLICATION

Case 1:Vin voltage is lower than 3.3V (1.5V in this case).Internal circuits need to be powered by an auxiliary supply (Vaux) of 3.3V minimum. Ith_stb is set to 0.2A.Ith_run is set to 1.25A.Delay is set to 85ms.ON/OFF state and RUN/STB mode are selected by dedicated commands.
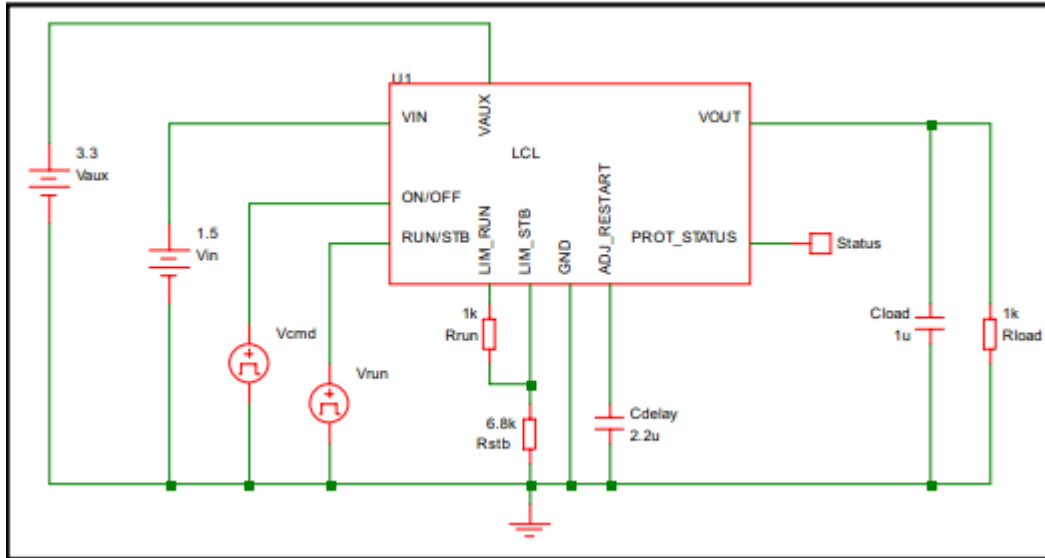
Case 2:Vin voltage is equal to 3.3V. Internal circuits are alsopowered from Vin.Ith_stb is set to 0.2A.Ith_run is set to 1.2A.Delay is set to 85ms.ON/OFF state and RUN/STB mode are selected bydedicated commands.
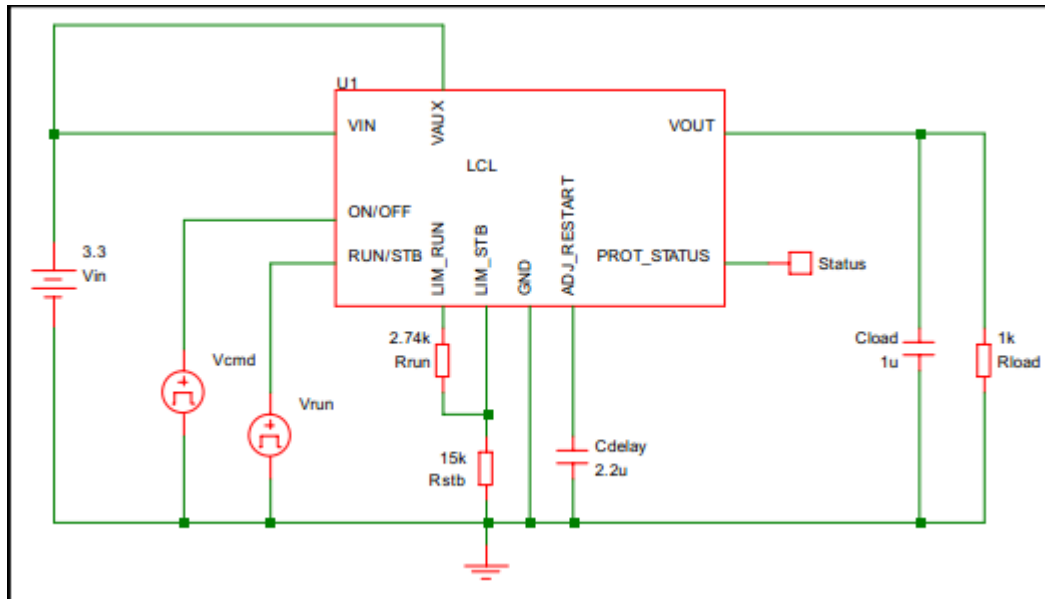
7 ORDERING INFORMATION

1	2	3	4	5	6	7	8	9	10	11
<u>VD</u>	<u>PM</u>	<u>0168</u>	<u>V</u>	<u>S</u>	<u>20</u>	<u>E</u>	<u>E</u>	<u>2</u>	<u>V</u>	<u>01</u>

VDIC

PM=Power Module

Product Code

R= Radiation Data Tested;
V= Generic Radiation Data Available

Package: S=SOP

20=20 Pin

Temperature:E=0～70℃;I=-40～85℃; S=Specific

Quality: E= Sample；B= Industry; S= Space

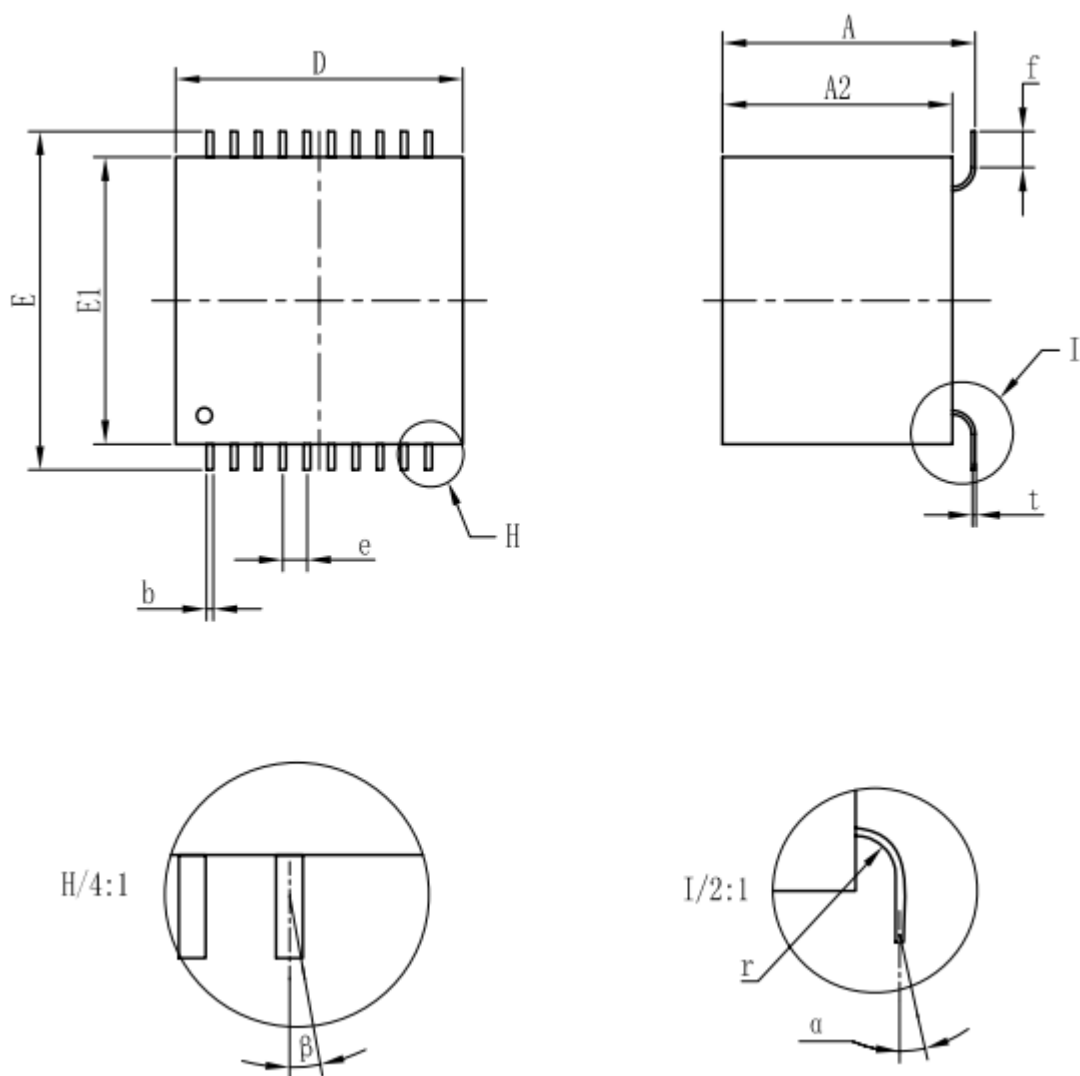Stacking Layer:2=2layer

Power Supply :V=3.3V

01=First Version

Bank Number	Access time(us)	Radiation			Packaging	Temperature (℃)
		TID[1]	SEL[2]	SEU[3]		
VDPM0168VS20EE2V01	10	--	--	--	SOP20	0～＋70
VDPM0168VS20IB2V01	10	--	--	--	SOP20	-40～＋85
VDPM0168RS20SS2V01	10	＞50	＞80	1	SOP20	-40～＋105

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[1] TID: Total Dose（Krads(Si)）
[2] SEL: LET Threshold （Mev.cm2/mg）
[3] SEU:SEU Threshold （Mev.cm2/mg）

8 PACKAGE DIMENSIONS

	Min	Max
A	10.30	11.00
A2	9.10	9.70
D	14.80	15.20
E	17.40	17.80
E1	14.80	15.20
f	2.00	
b	0.35	
e	1.27	
r	1.00	

t	0.20
α	≤3°
β	≤3°
NOTE : 1. Unit : mm 2. A1= A - A2	

9 REVISION HISTORY

Revision	Date	Description of Change
A0	Aug 27,2018	First Created