

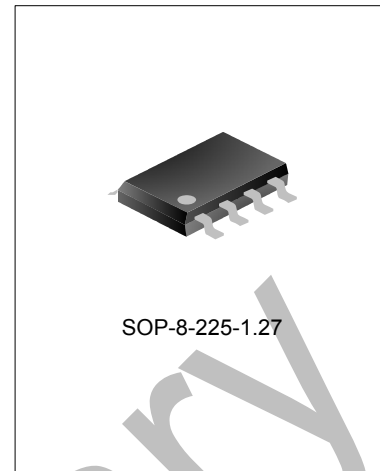
CURRENT MODE PWM+PFM CONTROLLER

DESCRIPTION

SDH6871X is current mode PWM+PFM controller for SMPS. With the advanced technology of built-in high voltage MOSFET, the high voltage pin can be connected directly to the high voltage wire, which simplified the periphery design and reduced the standby power dissipation.

The built-in cycle skipping makes the controller enter the burst mode when the output power is lower than the predetermined value. Because the burst mode occurs during low peak current, the audible noise can be reduced to minimum. The frequency is internally limited to prevent the controller from operating above the 150 kHz CISPR-22 EMI starting limit. The cycle skipping adjustment allows the customer to select the frequency when the burst mode is recovered.

SDH6871X uses current mode control with simple loop stability design. It has high efficiency up to more than 90%, and has excellent constant current characteristic when the input/output voltage changed, with the excellent current accuracy within $\pm 3\%$.



APPLICATIONS

- * AC-DC adapter for notebook
- * Consumer electronics such as DVD player , set-top box, etc.

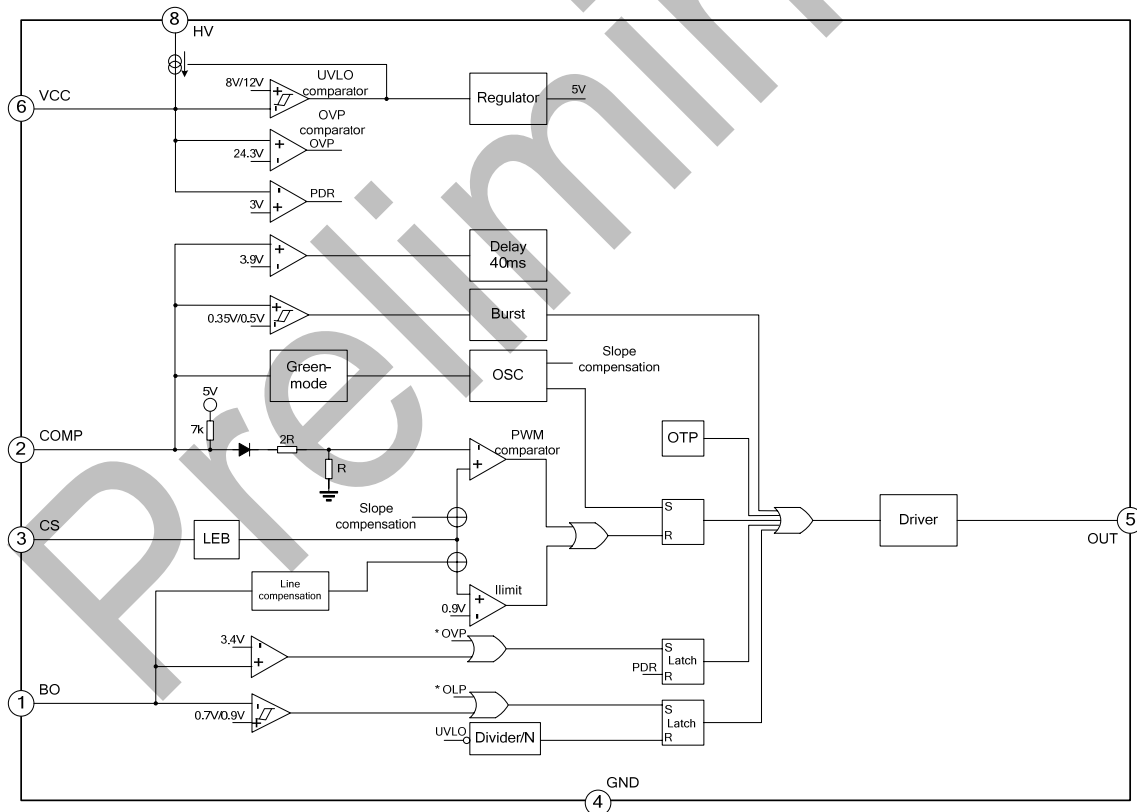
FEATURES

- * High-voltage start;
- * Switch frequency 66kHz/132kHz selectable with frequency jitter for low EMI;
- * Reduced frequency control for improving the efficiency under light load/no load;
- * External power MOSFET for cycle-by-cycle overcurrent protection;
- * VCC undervoltage protection;
- * VCC overvoltage protection (auto restart or lockout selectable);
- * Overload protection (auto restart or lockout selectable);
- * Linear output power compensation;
- * Overvoltage protection for input voltage(lockout);
- * Undervoltage protection for input voltage (restart);
- * Built-in 2s counter to reduce the restart power dissipation;
- * Available in SOP8 package;

ORDERING INFORMATION

Part No.	Package	Marking	Material	Packing
SDH68711	SOP-8-225-1.27	SDH68711	Pb free	Tube
SDH68712	SOP-8-225-1.27	SDH68712	Pb free	Tube
SDH68713	SOP-8-225-1.27	SDH68713	Pb free	Tube
SDH68714	SOP-8-225-1.27	SDH68714	Pb free	Tube
SDH68715	SOP-8-225-1.27	SDH68715	Pb free	Tube
SDH68716	SOP-8-225-1.27	SDH68716	Pb free	Tube
SDH68711TR	SOP-8-225-1.27	SDH68711	Pb free	Tape&Reel
SDH68712TR	SOP-8-225-1.27	SDH68712	Pb free	Tape&Reel
SDH68713TR	SOP-8-225-1.27	SDH68713	Pb free	Tape&Reel
SDH68714TR	SOP-8-225-1.27	SDH68714	Pb free	Tape&Reel
SDH68715TR	SOP-8-225-1.27	SDH68715	Pb free	Tape&Reel
SDH68716TR	SOP-8-225-1.27	SDH68716	Pb free	Tape&Reel

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATING

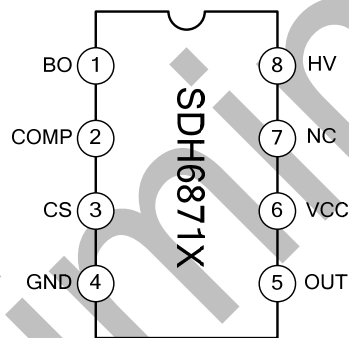
Characteristics	Symbol	Ratings	Unit
Voltage on pin BO	V _{BO}	-0.3~12	V
Voltage on pin COMP	V _{COMP}	-0.3~12	V
Voltage on pin CS	V _{CS}	-0.3~12	V
Voltage on pin OUT	V _{OUT}	-0.3~50	V
Voltage on pin VCC	V _{VCC}	-0.3~50	V
Voltage on pin HV	V _{HV}	-0.3~600	V
Junction temperature	T _j	-20~150	°C
Lead temperature	T _L	260	°C
Operating temperature range	T _A	-20~85	°C
Storage temperature range	T _{stg}	-55~160	°C

ELECTRICAL CHARACTERISTICS (Unless otherwise specified, V_{CC}=16V, T_{amb}=25°C)

Characteristics	Symbol	Test conditions	Min.	Typ.	Max.	Unit
HV						
Charge current for high-voltage power supply	I _c	60V on pin HV, 0V on pin VCC	--	600	--	μA
Leakage current	I _L		--	1	20	μA
VCC						
VCC level for circuit starting (UVLO on)	V _{CCON}	VCC is increasing	--	11.5	--	V
VCC level for circuit shutdown (UVLO off)	V _{CCOFF}	VCC is decreasing	--	7.5	--	V
VCC level for overvoltage protection	V _{CCOVP}		--	24.5	--	V
I _{VCC} (V _{comp} =3V)	I _{VCC}		--	1.5	--	mA
BO						
Shutdown voltage	V _{BOOFF}		--	0.7	--	V
Start voltage	V _{BOST}		--	0.9	--	V
Input overvoltage detecting point (lockout)	V _{BOOVP}		--	3.4	--	V
COMP						
Maximum pull-up current	I _{FBMAX}	Connect FB directly to GND to test the current	--	0.9	--	mA
Overvoltage protection	V _{FBOVP}		--	3.9	--	V
Overvoltage detecting delay	T _{FBDELAY}		--	40	--	ms
Input voltage of Burst mode	V _{INB}		--	0.35	--	V
Output voltage of Burst mode	V _{OUTB}		--	0.5	--	V
Oscillator						
Frequency	SDH68711/2/3	f _{OSC}	--	66	--	kHz
	SDH68714/5/6	f _{OSC}	--	132	--	kHz

Characteristics		Symbol	Test conditions	Min.	Typ.	Max.	Unit
Operating frequency of Cycle skipping mode	SDH68711/2/3	f_{OSCG}		--	22	--	kHz
	SDH68714/5/6	f_{OSCG}		--	44	--	kHz
Frequency jitter		f_{DV}		--	--	--	--
Maximum duty cycle		D_{MAX}		72	77	82	%
CS							
Maximum voltage		V_{CSMAX}	BO=0.9V	--	0.9	--	V
LEB time		T_{LEB}		--	450	--	ns
OUT							
Rising time (Load capacitance=1nF)		T_R		--	200	--	ns
Falling time(Load capacitance=1nF)		T_F		--	100	--	ns
Output maximum voltage		V_{OUTMAX}		--	17	--	V

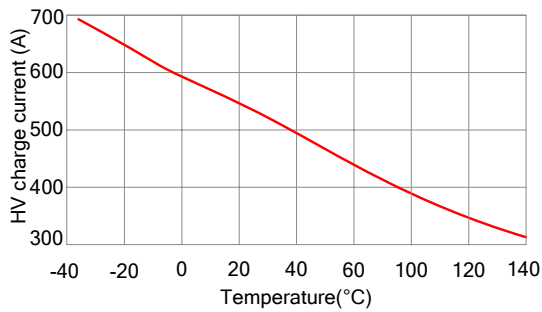
PIN CONFIGURATION



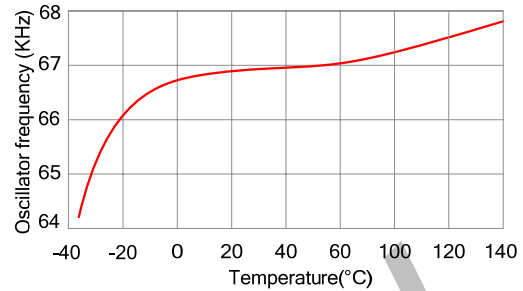
PIN DESCRIPTION

Pin No.	Pin Name	I/O	Function description
1	BO	I	Input voltage detecting pin
2	COMP	I/O	Feedback pin for peak current setpoint adjustment. The output is feedback via the optical coupling. The peak current setpoint changes following the output power.
3	CS	I/O	Current sense pin to sense the primary current and routes it to the internal comparator via an LEB. Control the standard level of cycle skipping by connecting a resistor in series.
4	GND	G	Ground
5	OUT	I/O	Driving output pin for external power MOSFET.
6	VCC	I/O	Power supply pin
7	NC	G	No connection
8	HV	I	High voltage pin

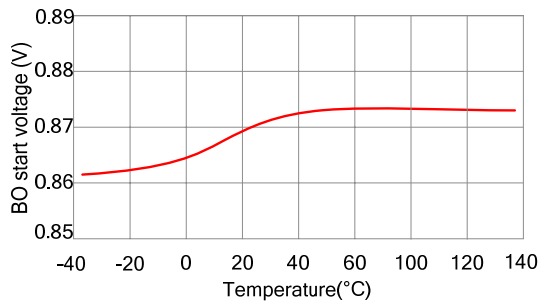
TYPICAL CHARACTERISTICS CURVE



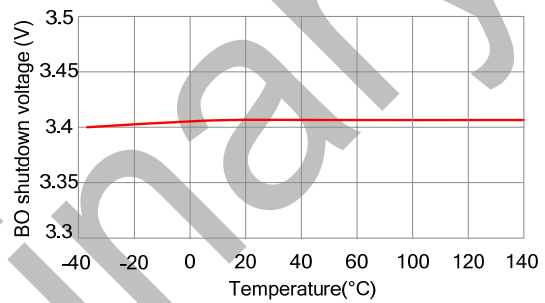
HV charge current vs. temperature curve



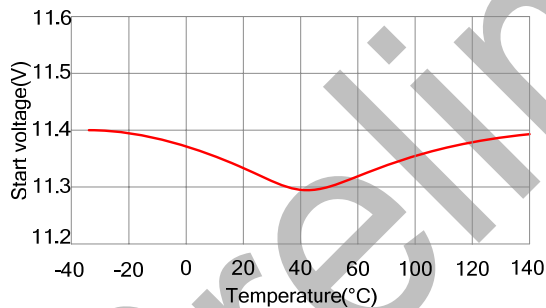
Oscillator frequency vs. temperature curve



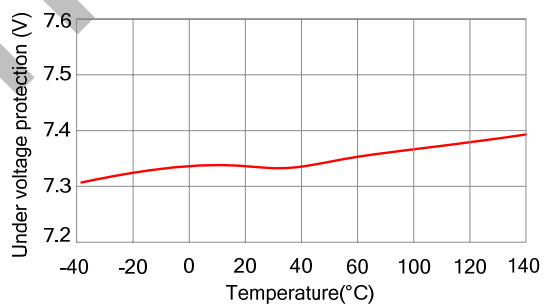
BO start voltage vs. temperature curve



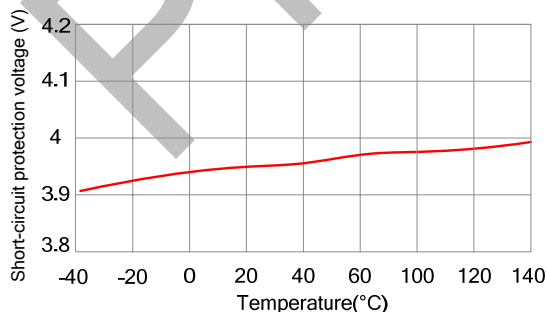
BO shutdown voltage vs. temperature curve



Start voltage vs. temperature curve



Shutdown voltage vs. temperature curve



Short-circuit protection voltage vs. temperature curve

FUNCTION DESCRIPTION

SDH6871X is current mode PWM_PFM controller for SMPS with built-in 650V power MOSFET. It features frequency jitter with switch frequency changed following the load, output power limit adjustment, peak current compensation, undervoltage lockout, overvoltage, overload protections, leading edge blanking, primary side overcurrent protection and temperature protection.

High-voltage start

Based on the advanced high-voltage process of Silan-IC, the high-voltage pin can be connected directly to the high-voltage DC wire and achieved a small charging current without connecting an external big resistor. The working principle of high-voltage starting is shown in fig. 1; it uses a controllable high-voltage current source to power the circuit by charging the capacitor connected to VCC.

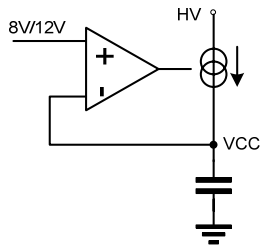


Fig. 1 Working principle of high-voltage starting

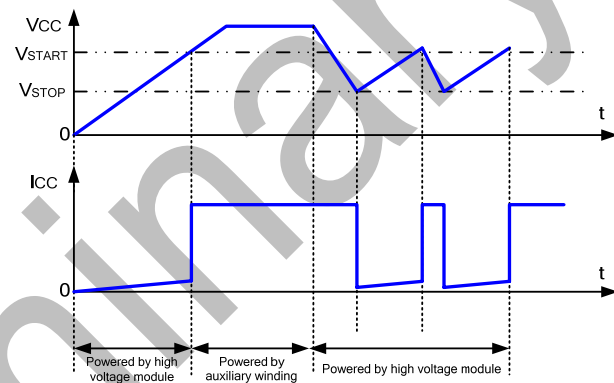


Fig. 2 Schematic diagram of charge/discharge

At the beginning of power-on, $VCC < VCC_{OFF}$ and the current source is connected, the VCC is charged by the high-voltage and the internal current limit resistor can prevent the charge current more than 2mA; when VCC is decreasing, and $VCC > VCC_{ON}$, the current source is off and the circuit quits the undervoltage mode to work normally, and the VCC is charged by auxiliary winding; If abnormality occurs and $VCC < VCC_{OFF}$, the current source is connected, the VCC is recharged by the high-voltage; the typical values of VCC_{OFF} and VCC_{ON} are 12V and 8V. Refer to fig.2 for detailed waveform.

The circuit is powered by auxiliary winding and the HV current source is off for low power dissipation during normal working.

Function of pin BO

Pin BO has two functions:

Enable control: when the voltage on pin BO is more than 0.9V, the circuit starts to work; when the voltage on pin BO is less than 0.7V, the driver signal is shut down; when the voltage on pin BO is more than 3.4V, the circuit is locked with most modules off until the VCC is less than 4V, the locking will released and the circuit restarts to work.

Input compensation: in general, the overcurrent point is fixed, so a greater change is in input power even the input current is the same under different voltages. Thus the input compensation makes the input power be constant in the whole input voltage range by changing the maximum input current via detecting the input voltage.

Mode control

In normal working condition, the peak current setpoint of corresponding load is sensed by the pin COMP. If the load decreases, the feedback current of output circuit increases and the optical coupling is enhanced, which makes the current delivered from pin FB to the ground increase and the voltage on pin FB is reduced, thus the peak current setpoint decreases, as shown in fig. 3. Frequency conversion is integrated for lower power dissipation. Refer to fig.4 for detailed parameters.

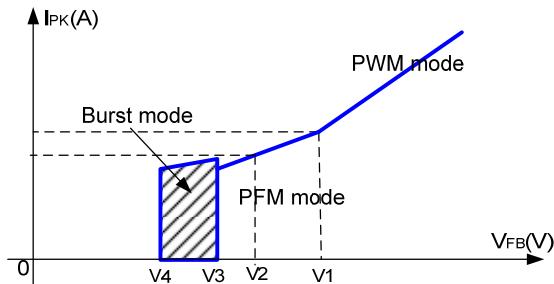


Fig. 3 Relation between peak current and V_{FB}

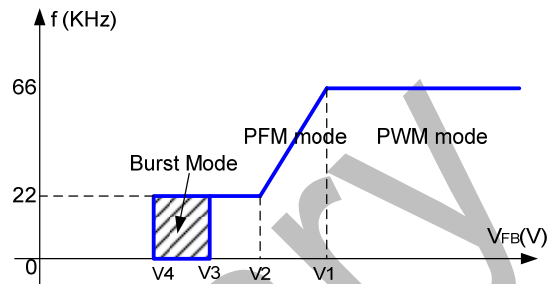


Fig. 4 Relation between frequency and V_{FB}

Burst mode

Working in this mode can reduce power dissipation significantly. It works normally when FB is 0.5V above, and during $0.35V < FB < 0.5V$, there are two different conditions: when FB voltage changes from low to high, there is no action for switch and it is the same with condition of FB voltage lower than 0.35V; the other is that FB voltage changes from high to low, comparison value is increased for increasing turning on time to decrease switch loss. In this mode, switching frequency is down to 22KHz.

In this mode, the FB voltage is about 0.5V below during light load. When FB changes from high to low, the output voltage increases (increasing speed is decided by load) because of the high comparison value to decrease FB until it is 0.35V below; when $FB < 0.35V$, there is no action for switch and output voltage decreases (decreasing speed is also decided by load) to increase FB voltage. This is repeated to decrease actions of switch for lower power dissipation.

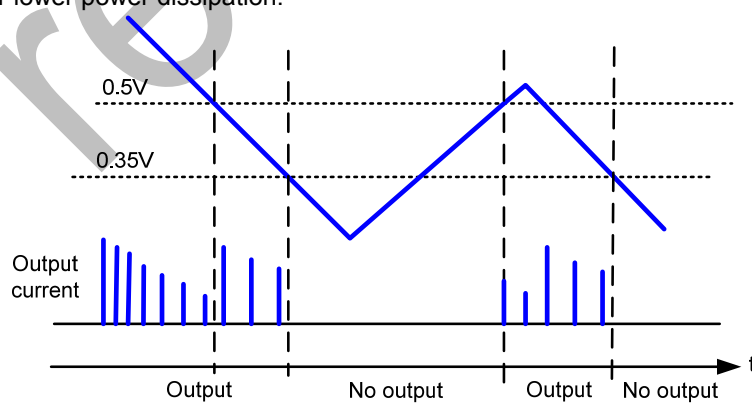


Fig. 5 Burst mode

VCC Overvoltage protection

The voltage on VCC is detected, when it is more than 24.5V, the SDH6871X is locked and all the switch

actions stop, and this state keeps until the locking is released when the voltage on VCC decreased to 8V below, at the same, the high voltage start module starts to power the VCC and the circuit starts normally. The protection voltage is decided by the ratio between auxiliary winding and output winding. Given that, the ratio is N2, and the VCC protection voltage is 24.5V, then the output protection voltage is $24.5/N2$ V.

Overcurrent protection

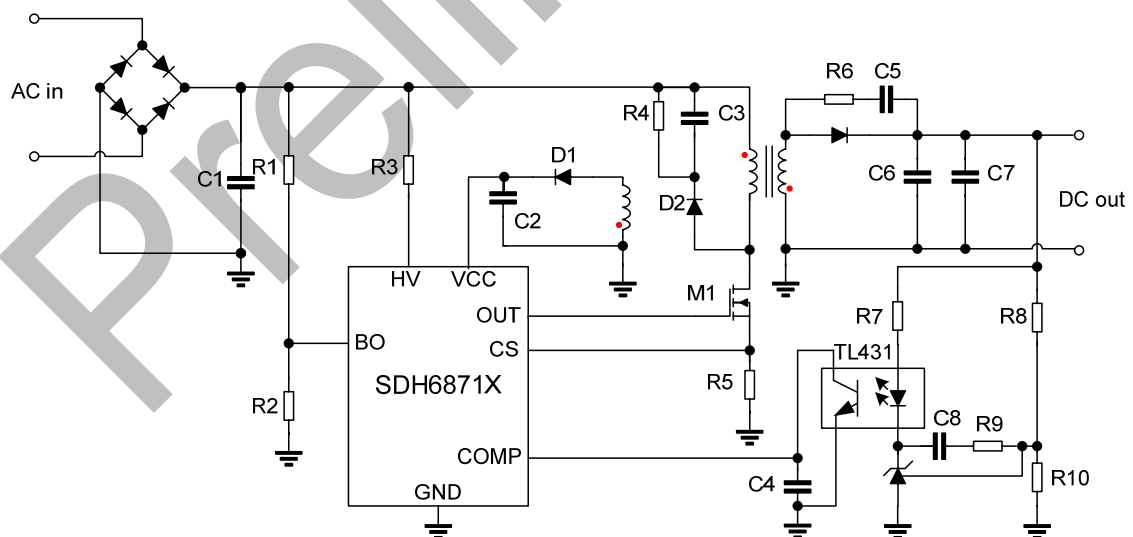
The overcurrent protection is designed for the condition that the output current cannot be well controlled, which is equivalent to the short-circuit protection in a sense. When the output voltage decreases caused by a sudden increasing on the output current, the current source controlled by the optical coupling of FB feedback circuit is off and then the voltage on pin FB is pulled up to 4.2V by the internal circuit with the maximum peak current setpoint, which will result in very high power if there is no protection. Consider this condition, the voltage on pin FB is detected, when it is more than 3.9V and lasts for more than 20ms, the circuit is turned off for abnormal output.

At this time, the output is shutdown and the high voltage module is still working to charge or discharge VCC, which is monitored by the circuit and if it quits the undervoltage protection, start the circuit. If the overcurrent protection is still active, then the circuit restarts again. The restarting time is controlled by the capacitor connected to VCC.

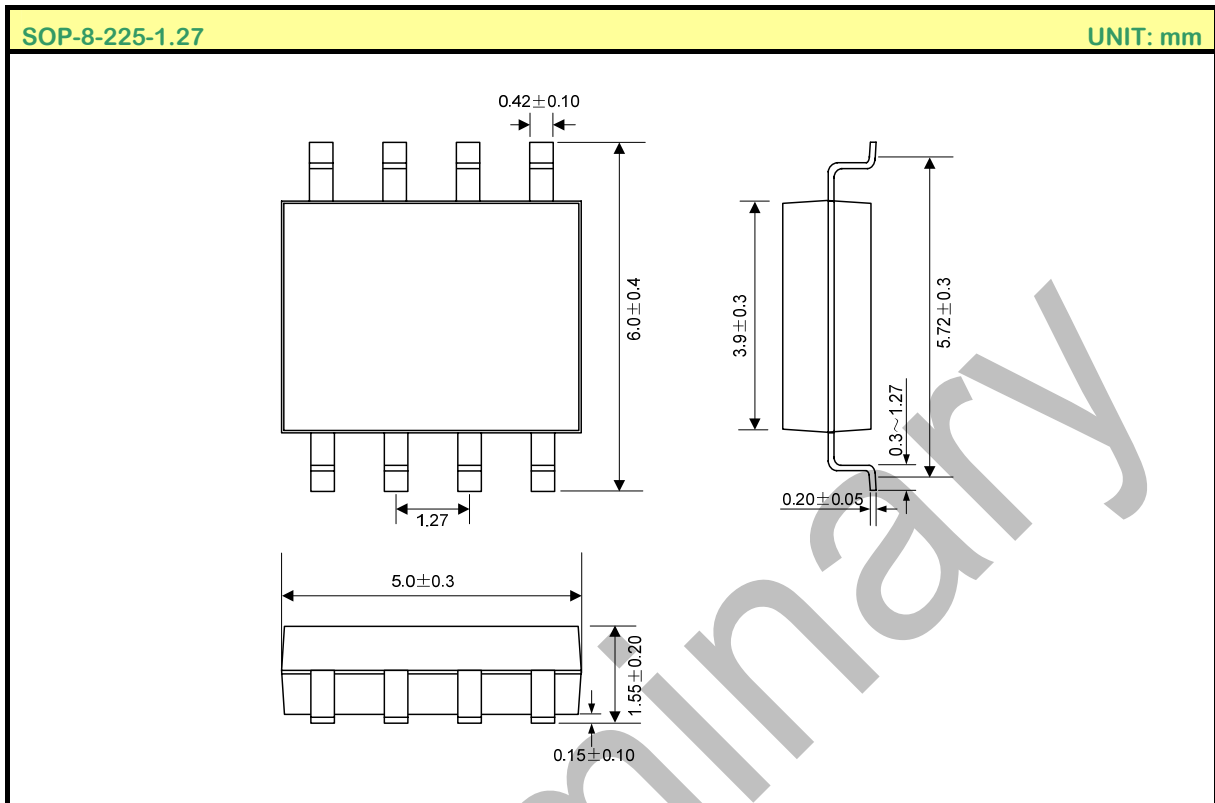
Over temperature protection

The over temperature protection can shut down the circuit (charge section and regulator for SMPS) when the IC temperature is more than 150 °C, while the circuit resumes working until the IC temperature decreases to about 20°C.

TYPICAL APPLICATION CIRCUIT



PACKAGE OUTLINE



MOS DEVICES OPERATE NOTES:

Electrostatic charges may exist in many things. Please take following preventive measures to prevent effectively the MOS electric circuit as a result of the damage which is caused by discharge:

- The operator must put on wrist strap which should be earthed to against electrostatic.
- Equipment cases should be earthed.
- All tools used during assembly, including soldering tools and solder baths, must be earthed.
- MOS devices should be packed in antistatic/conductive containers for transportation.

Disclaimer :

- Silan reserves the right to make changes to the information herein for the improvement of the design and performance without further notice! Customers should obtain the latest relevant information before placing orders and should verify that such information is complete and current.
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