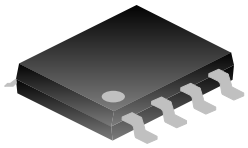
CURRENT MODE PWM CONTROLLER

DESCRIPTION

SDH8302S is a current mode PWM controller with built-in high-voltage MOSFET used for SMPS.

SDH8302S has a built-in high-voltage startup circuit. It enters burst mode at light load to reduce the system standby power dissipation; the frequency reduction function optimizes the conversion efficiency at light load; frequency jitter improves EMI characteristics; the soft startup function reduces the device stress to avoid transformer saturation; the VDD burst function not only prevents VDD restart at undervoltage condition, but also reduces standby power dissipation.

SDH8302S integrates various protections, including VDD undervoltage protection, VDD overvoltage protection, lead edge blanking, output short-circuit protection, over current protection, over temperature protection, etc. Meanwhile, the circuit will continue to restart automatically until the system restore.



SOP-8-225-1.27

FEATURES

- High-voltage startup
- Burst mode at light load
- Frequency reduction
- Frequency jitter
- Soft startup
- VDD burst
- VDD undervoltage protection
- VDD overvoltage protection
- Lead edge blanking
- Output short-circuit protection
- Over current protection
- Over temperature protection

APPLICATIONS

- Off-line SMPS
- Non-isolated buck-boost converter
- Small house-hold appliances

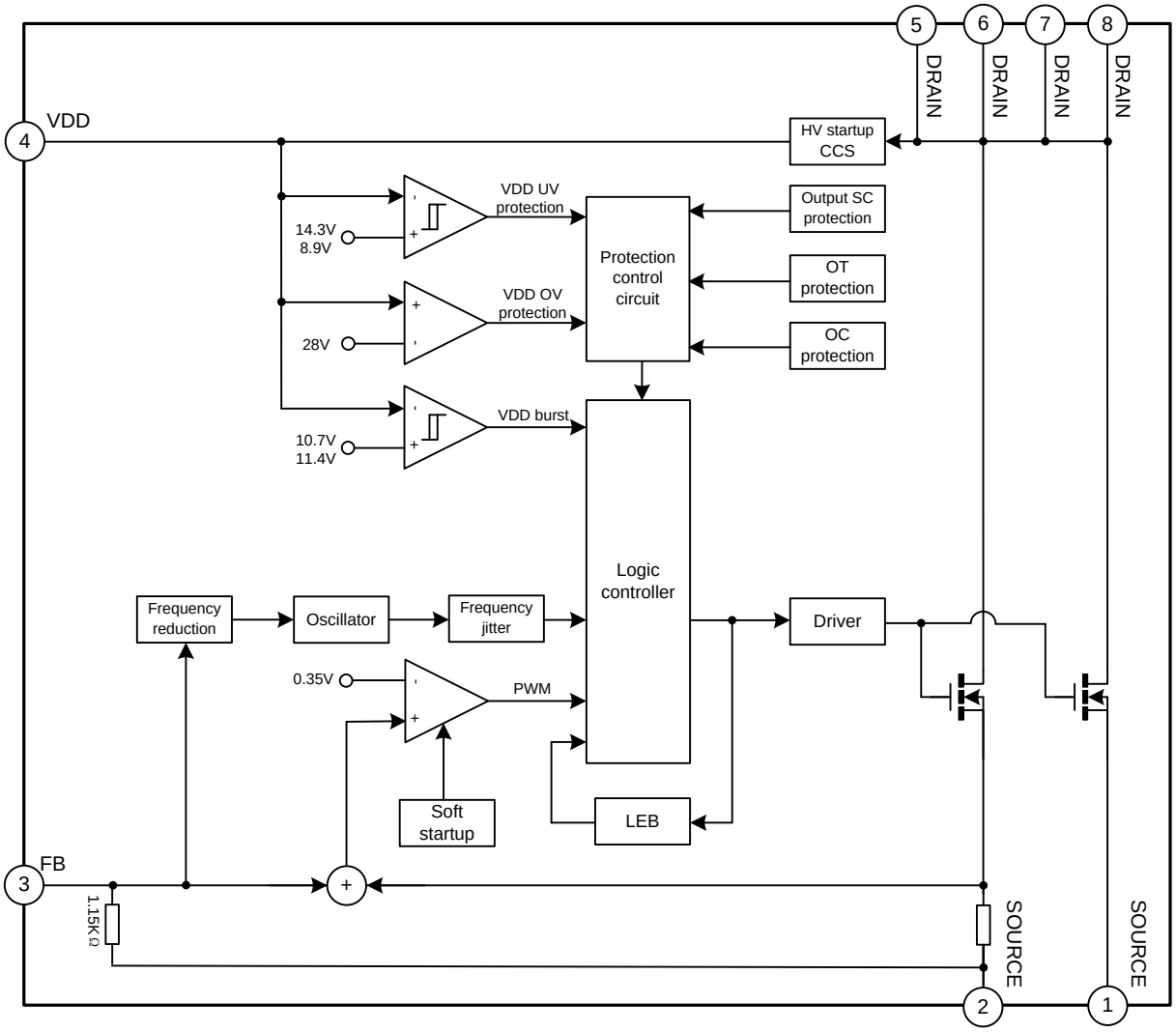
ORDERING INFORMATION

Part No.	Package	Marking	Hazardous Substance Control	Packing Type
SDH8302S	SOP-8-225-1.27	SDH8302S	Halogen free	Tube
SDH8302STR	SOP-8-225-1.27	SDH8302S	Halogen free	Tape&Reel

TYPICAL OUTPUT POWER CAPABILITY

Part No.	195~265V		85~265V	
	Adaptor	Open type	Adaptor	Open type
SDH8302S	10W	13W	5W	8W

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATING

Characteristics	Symbol	Ratings	Unit
Drain-gate voltage (R_{GS}=1MΩ)	V_{DGR}	650	V
Gate-source (ground) voltage	V_{GS}	±30	V
Drain current pulse note1	I_{DM}	2.8	A
Drain continuous current (T_{amb}=25°C)	I_D	0.8	A
Signal pulsed avalanche energy note2	EAS	30	mJ

Characteristics	Symbol	Ratings	Unit
High-voltage input	$V_{HV,MAX}$	650	V
Power voltage	$V_{DD,MAX}$	30	V
Feedback current	I_{FB}	3	mA
Power dissipation	P_D	0.65	W
Thermal resistance from chip surface to the ambient	$R_{th(j-a)}$	150	°C/W
Operating junction temperature	T_J	+150	°C
Storage temperature range	T_{STG}	-55~+150	°C

Note：

1. The pulse width is determined by maximum junction temperature.
2. L=51mH, T_J=25 °C (start)

MOSFET ELECTRICAL CHARACTERISTICS (UNLESS OTHERWISE SPECIFIED, T_{amb}=25°C)

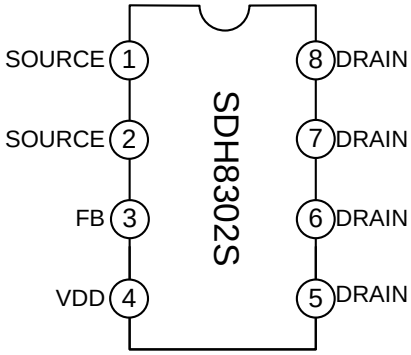
Characteristics	Symbol	Test conditions	Min.	Typ.	Max.	Unit
Drain-source break-down voltage	BV_{DSS}	V_{GS}=0V, I_D=50μA	650	--	--	V
Zero gate voltage drain current	I_{DSS}	V_{DS}=650V, V_{GS}=0V	--	--	50	μA
		V_{DS}=480V, V_{GS}=0V, T_{amb}=125°C	--	--	200	μA
Static drain-source on resistance	$R_{DS(ON)}$	V_{GS}=10V, I_D=0.5A	15	18	21	Ω
Input capacitance	C_{ISS}	V_{GS}=0V, V_{DS}=25V, f=1MHz	--	128	--	pF
Output capacitance	C_{OSS}	V_{GS}=0V, V_{DS}=25V, f=1MHz	--	16	--	pF
Reverse transfer capacitance	C_{RSS}	V_{GS}=0V, V_{DS}=25V, f=1MHz	--	0.6	--	pF
Turn-on delay time	$T_{D(ON)}$	V_{DD}=0.5BV_{DSS}, I_D=25mA	--	13.4	--	ns
Rise time	T_R	V_{DD}=0.5BV_{DSS}, I_D=25mA	--	26.4	--	ns
Turn-off delay time	$T_{D(OFF)}$	V_{DD}=0.5BV_{DSS}, I_D=25mA	--	23.8	--	ns
Fall time	T_F	V_{DD}=0.5BV_{DSS}, I_D=25mA	--	86.4	--	ns

ELECTRICAL CHARACTERISTICS (UNLESS OTHERWISE SPECIFIED, V_{DD}=18V, T_{amb}=25°C)

Characteristics	Symbol	Test conditions	Min.	Typ.	Max.	Unit
HV startup						
Charging current	I_{HVC}	V_{DD}=0V, V_{HV}=100V	--	1	--	mA
Shutdown drain current	I_{HVS}	V_{DD}=18V, V_{HV}=700V	--	3	--	μA
Operating voltage						
Operating voltage range	VDD	After startup	10	--	25	V
Operating current 0	IDD0	I_{FB}=1.2mA	--	0.7	--	mA
Operating current 1	IDD1	I_{FB}=0.55mA	--	0.9	--	mA
VDD on voltage	VDD_{ON}	I_{FB}=0.5mA	13.6	14.3	15.0	V

Characteristics	Symbol	Test conditions	Min.	Typ.	Max.	Unit
VDD under voltage protect voltage	VDD_{OFF}	I_{FB}=0.5mA	8.3	8.9	9.5	V
VDD threshold hysteresis	VDD_{HYS}	--	4.1	5.4	6.7	V
VDD over voltage protect voltage	VDD_{OVP}	I_{FB}=0.5mA	--	28	--	V
VDD clamp voltage	VDD_{CLAMP}	--	--	30	--	V
VDD burst threshold	VDD_{LOW}	I_{FB}=1.5mA	--	10.7	--	V
VDD burst threshold hysteresis	VDD_{LOWHYS}	I_{FB}=1.5mA	--	0.7	--	V
Operating frequency						
Normal switching frequency	f_{SW1}	I_{FB}=0.5mA	50	60	68	KHz
Frequency jitter range	f_{JIT}	I_{FB}=0.5mA	-2	--	2	KHz
Modulation frequency	f_{MOD}	I_{FB}=0.5mA	--	250	--	Hz
Max. duty ratio	D_{MAX}	I_{FB}=0.5mA	70	80	85	%
FB frequency reduction start threshold	IFB_{FD1}	--	--	830	--	μA
FB frequency reduction end threshold	IFB_{FD2}	--	--	930	--	μA
Switching frequency after frequency reduction	f_{SW2}	I_{FB}=0.99mA	--	20	--	KHz
Feedback input						
FB input impedance	RFB	--	--	1.15	--	kΩ
FB turn-off current	IFB_{SD}	--	0.8	1	1.3	mA
FB turn-off current hysteresis	IFB_{SDHYS}	--	--	70	--	μA
FB over load protect detecting current	IFB_{OLP}	--	--	500	--	μA
FB over load protect operating current	IDD_{FBOLP}	I_{FB}=0.35mA	--	3.2	--	mA
Peak current limit						
Peak limiting threshold	I_{PKLIM}	I_{FB}=0mA	400	470	540	mA
Current gain	G_{ID}	--	--	470	--	A/A
Current sensing turn-off delay	t_d	--	--	250	--	ns
LEB time	t_{LEB}	--	--	300	--	ns
Min. turn-on time	t_{ONMIN}	--	--	550	--	ns
Soft startup time	t_{SS}	I_{FB}=0.55mA	--	9	--	ms
Over temperature protection						
Over temperature detection	T_{SD}	--	--	145	--	°C
Over temperature hysteresis	T_{HYS}	--	--	25	--	°C

PIN CONFIGURATION



PIN DESCRIPTION

Pin No.	Pin Name	I/O	Function description
1, 2	SOURCE	I/O	Source of power MOSFET and reference ground of control circuit
3	FB	I	Feedback input
4	VDD	I/O	Power supply for control circuit
5, 6, 7, 8	DRAIN	I/O	Drain of power MOSFET

FUNCTION DESCRIPTION

SDH8302S is a current mode PWM controller with built-in high-voltage MOSFET used for SMPS. It features a built-in high-voltage startup circuit, burst mode at light load, functions of frequency reduction, frequency jitter, soft startup, VDD burst. Additionally, it offers complete protection coverage with VDD undervoltage protection, VDD overvoltage protection, leading edge blanking, output short-circuit protection, over current protection, over temperature protection, etc.

High-voltage startup

SDH8302S includes a high-voltage startup circuit. When the IC is powered, AC input voltage activates the built-in constant current source from DRAIN pin, and charges the VDD capacitor C1 with charging current of 1mA. When the VDD voltage reaches to on voltage 14.3V, the high-voltage start-up constant current source is cut off, VDD is no longer charged by DRAIN, but is powered by auxiliary winding L1 through diode D1; if VDD voltage falls to UVP voltage 8.9V, the high-voltage start-up constant current source is activated again, and charges VDD via DRAIN till VDD voltage reaches to on voltage 14.3V.

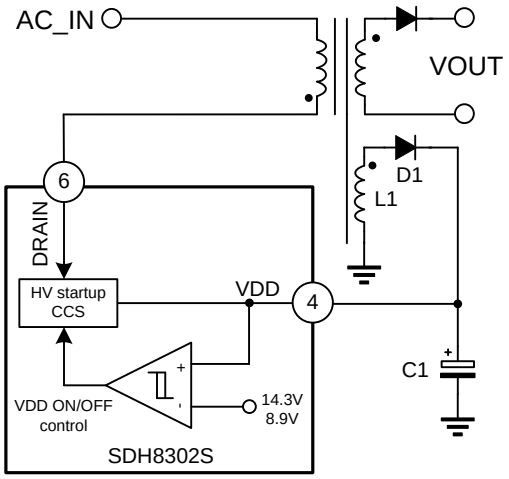


Figure 1: High-voltage startup circuit

Burst mode at light load

At light load, if the output VOUT is too high, the input current IFB fed to FB pin exceeds the shut-down current 1mA then SDH8302S turns off the switch to decrease VOUT; when VOUT drops till IFB decreases by 70μA, SDH8302S opens the switch again to increase VOUT; repeat the foregoing process to enter burst mode, so decreases switch times for low system standby power dissipation.

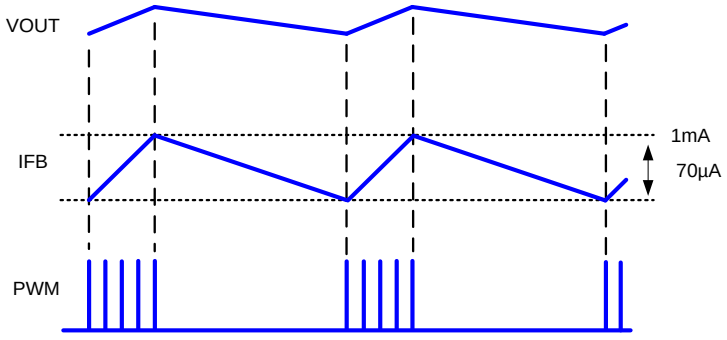


Figure 2: Waveforms at burst mode

Frequency reduction

In order to optimize the conversion efficiency at light load, SDH8302S adopts frequency reduction mode, i.e., adjusting the switching frequency through detecting the current IFB input to FB pin. When IFB is smaller than frequency reduction start threshold 830μA, the switching frequency is 60KHz; when IFB increases from 830μA to 900μA (frequency reduction end threshold), the switching frequency decreases linearly from to 60KHz to 20KHz; if IFB is larger than 930μA, the switching frequency is 20KHz.

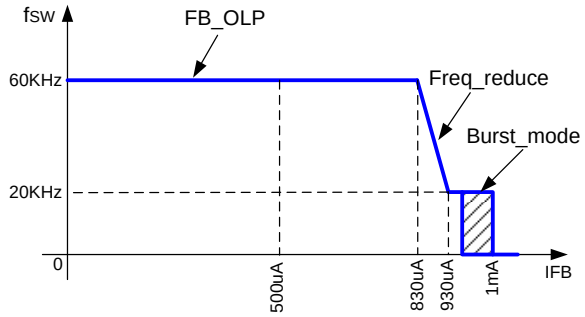


Figure 3: Frequency reduction curve

Frequency jitter

SDH8302S adopts frequency jitter technology to reduce EMI, namely, making the switching frequency constantly changing in jitter frequency range of ±2KHz at 250Hz modulation frequency to reduce the radiation at a certain single frequency.

Soft startup

SDH8302S enables the maximum peak current of DRAIN to increase restrictedly step by step within soft startup time, hence, it can reduce the stress of devices and prevent the transformer from turning into saturation.

VDD burst

SDH8302S at light load or the state switching between full load and no load, when the switch is turned off, enabling VDD voltage to drop to burst threshold (10.7V), the switch is turned on, making VDD voltage rising; when VDD voltage increases by 0.7V, the switch is off again, VDD drops; repeat the foregoing process to enter burst mode, VDD voltage will not decreases to UVP voltage (8.9V), which not only prevents VDD restart at undervoltage condition, but also reduces the standby power dissipation.

VDD undervoltage protection

The MOSFET is off if SDH8302S is at abnormal state, which causes VDD voltage to fall. When VDD reaches to the UVP voltage (8.9V), the buit-in high-voltage start-up constant current source is activated, then VDD is charged by the input AC voltage, once it increases to UVP stop voltage as on voltage (14.3V), the SDH8302S resumes normal operation, then the circuit is able to auto restart after fault is cleared.

VDD overvoltage protection

SDH8302S turns off the switch once the VDD voltage reaches to OVP voltage (28V), and is locked out till the VDD voltage decreases to UVP voltage (8.9V), and then the circuit restarts.

Leading edge blanking

At the instant of internal MOSFET on, a high current spike will appear since the existed parasitic capacitor at DRAIN. If this signal is sensed, the overcurrent protection will be activated. To avoid this false trigger, SDH8302S senses the

current of DRAIN pin for a LEB time of 300ns after the MOSFET is turned on.

Output short-circuit protection

Once the current input to FB pin is less than 500uA, the short-circuit protection is activated, decreasing VDD voltage to UVP voltage (8.9V), and then the circuit restarts.

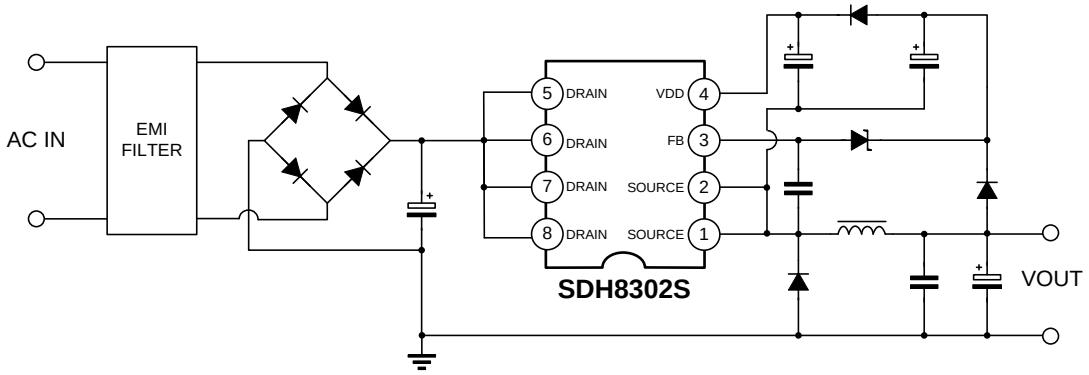
Over current protection

If an over current fault is sensed at DRAIN pin, the switching times are reduced and turned to normal until the fault is cleared.

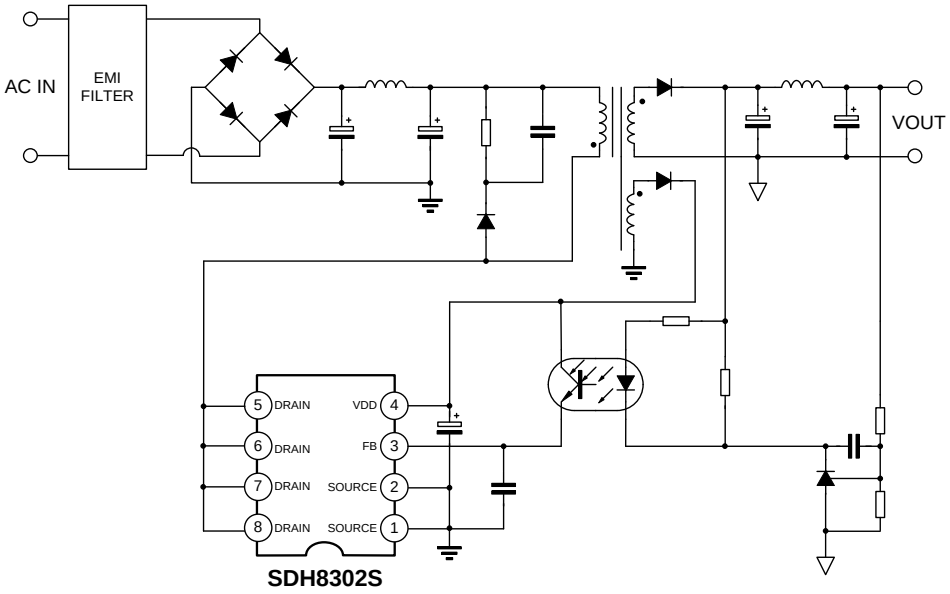
Over temperature protection

SDH8302S turns off the switch once the temperature reaches to OTP threshold 145°C, and turns on the switch if the temperature decreases by 25°C.

TYPICAL APPLICATION CIRCUIT



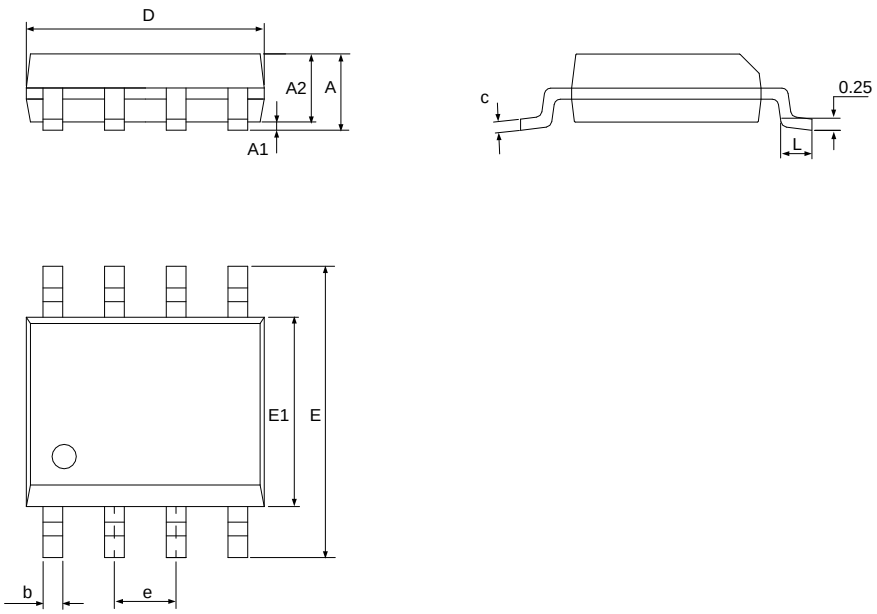
Non isolation（BUCK）



Isolation（FLYBACK）

PACKAGE OUTLINE

SOP-8-225-1.27 **UNIT: mm**



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	1.35	1.55	1.75
A1	0.05	0.15	0.25
A2	1.25	—	1.65
b	0.32	0.42	0.52
c	0.15	0.20	0.26
D	4.70	4.90	5.30
E	5.60	6.00	6.40
E1	3.60	3.90	4.20
e	1.27BSC		
L	0.30	—	1.27

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.

Important notice :

1. **The instructions are subject to change without notice!**
2. **Customers should obtain the latest relevant information before placing orders and should verify that such information is complete and current. Please read the instructions carefully before using our products, including the circuit operation precautions.**
3. **Our products are consumer electronic products or the other civil electronic products.**
4. **When using our products, please do not exceed the maximum rating of the products, otherwise the reliability of the whole machine will be affected. There is a certain possibility of failure or malfunction of any semiconductor product under specific conditions. The buyer is responsible for complying with safety standards and taking safety measures when using our products for system design, sample and whole machine manufacturing, so as to avoid potential failure risk that may cause personal injury or property loss.**
5. **It is strongly recommended to identify the trademark when buying our products. Please contact us if there is any question.**
6. **Product promotion is endless, our company will wholeheartedly provide customers with better products!**
7. **Website: http: //www.silan.com.cn**

Part No.:	SDH8302S	Document Type:	Datasheet
Copyright:	HANGZHOU SILAN MICROELECTRONICS CO.,LTD	Website:	http: //www.silan.com.cn

Rev.: 1.1

Revision History:

1. Modify the absolute maximum rating
2. Update package outline

Rev.: 1.0

Revision History:

1. First Release