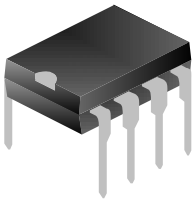
NON-ISOLATED BUCK LED CONSTANT CURRENT DRIVER IC

DESCRIPTION

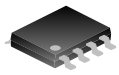
The SDH771XN is a high accuracy LED constant current driver IC, it is applicable to non-isolated buck LED constant current power system with full AC input voltage range of 85VAC~265VAC.

The SDH771XN integrates high-voltage power supply circuit, it is able to supply power to itself without any startup resistor and auxiliary winding, and at the same time, a conventional external power supply capacitor is omitted, which greatly shortens the startup time as well as saves the system cost. The SDH771XN works in inductor current boundary conduction mode, it uses a unique high-accuracy current sense technology, combined with internal compensation, can achieve high constant current accuracy and excellent line/load regulation.

The SDH771XN provides various protections, such as output short/open circuit protection, cycle-by-cycle over current protection, over temperature regulation, and open circuit protection for sensing resistor, which greatly improves the system safety and reliability. The open-circuit protection voltage can be set externally through the ROVP pin.



DIP-8A-300-2.54



SOP-7-225-1.27

FEATURES

- Available 500V high voltage power MOSFET in one package with stable performance
- Integrated high-voltage power supply, without the need of startup resistor and VCC capacitor
- Accurate constant current threshold (<±3%)
- Output short/open circuit protection
- Open circuit protection threshold value external adjusted
- Over temperature regulation
- Cycle-by-cycle over current protection
- No auxiliary winding

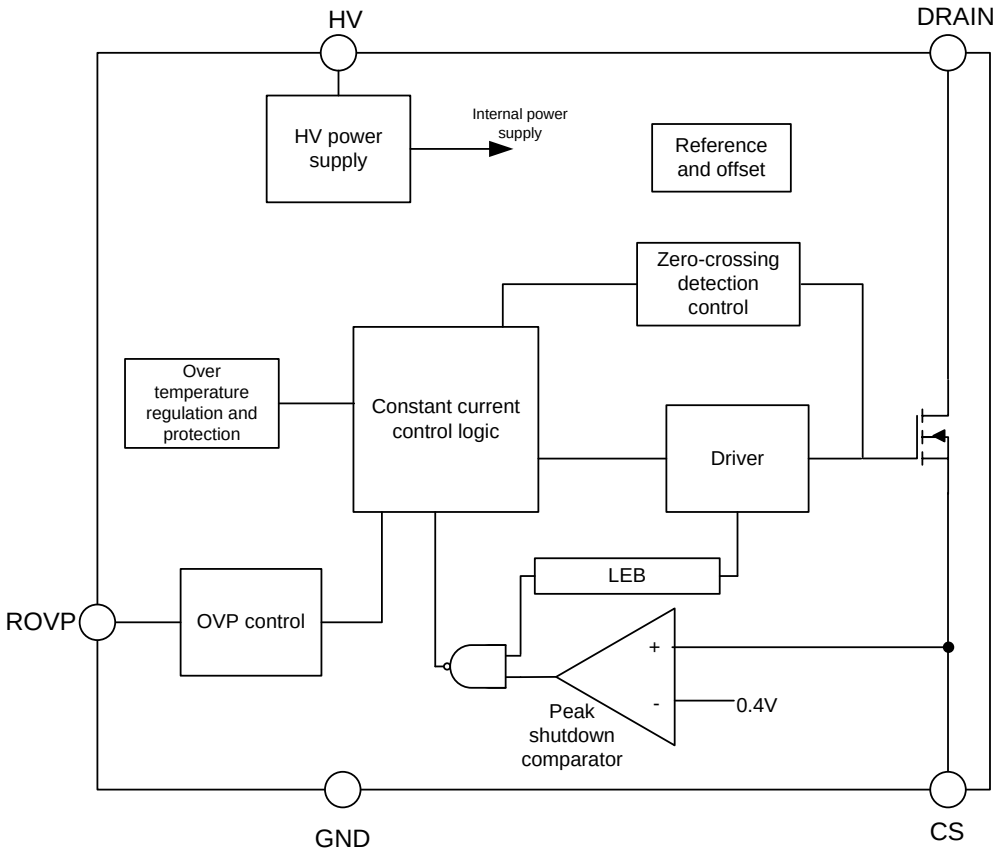
APPLICATION

- Bulb Lamp
- Down light
- Various LED Lighting

ORDERING INFORMATION

Part No.	Package	Hazardous Substance Control	Packing Type
SDH7711SN	SOP-7-225-1.27	Halogen free	Tube
SDH7711SNTR	SOP-7-225-1.27	Halogen free	Tape&Reel
SDH7712ASN	SOP-7-225-1.27	Halogen free	Tube
SDH7712ASNTR	SOP-7-225-1.27	Halogen free	Tape&Reel
SDH7712SN	SOP-7-225-1.27	Halogen free	Tube
SDH7712SNTR	SOP-7-225-1.27	Halogen free	Tape&Reel
SDH7712DN	DIP-8A-300-2.54	Halogen free	Tube
SDH7713SN	SOP-7-225-1.27	Halogen free	Tube
SDH7713SNTR	SOP-7-225-1.27	Halogen free	Tape&Reel
SDH7713DN	DIP-8A-300-2.54	Halogen free	Tube
SDH7714SN	SOP-7-225-1.27	Halogen free	Tube
SDH7714SNTR	SOP-7-225-1.27	Halogen free	Tape&Reel
SDH7714DN	DIP-8A-300-2.54	Halogen free	Tube

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Characteristics	Symbol	Rating	Unit
CS Voltage	Vcs	-0.3~7	V
ROVP Voltage	V_{ROVP}	-0.3~7	V
DRAIN Voltage	V_{DRAIN}	-0.3~500	V
HV Voltage	V_H	-0.3~500	V
Junction Temperature Range	T_j	-40~150	°C
Storage Temperature Range	T_S	-55~150	°C

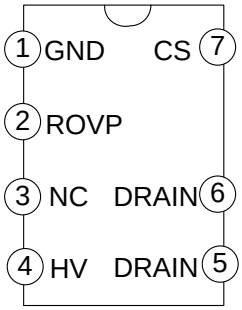
ELECTRICAL CHARACTERISTICS (UNLESS OTHERWISE STATED, HV=40V, T_{amb}=25°C)

Characteristics	Symbol	Test conditions	Min.	Typ.	Max.	Unit
Supply Voltage						
Internal Operating Voltage V_{CC}	V_{CC}	--	--	10	--	V
Operating Current	I_{OP}	HV=40V, CS=0, ROVP is floating	--	150	--	μA
Current Sense						
Current Detection Threshold	V_{cs_TH}	--	388	400	412	mV
Chip off Delay	T_DELAY	--	--	200	--	ns
Time Parameters						
Max. on Time	$T_{ON,MAX}$	--	--	45	--	μs
Min. on Time	$T_{ON,MIN}$	--	--	1.0	--	μs
LEB Time	T_{LEB}	--	--	0.4	--	μs
Max. off Time	$T_{OFF,MAX}$	--	--	350	--	μs
Min. off Time	$T_{OFF,MIN}$	--	--	1.8	--	μs
OVP Parameters						
Typ. OVP Time	T_OVP	ROVP=30K	3.6	4.5	5.4	μs
ROVP Current	I_ROVP	ROVP is connected to GND	--	40	--	μA
OVP Restart time	$T_{restart}$	--	--	10	--	ms
OVP-Disable Threshold Voltage	V_disable	Min. ROVP voltage when OVP is disable	--	2.5	--	V
ROVP Enable Voltage	V_EN	ROVP voltage when output is off during ROVP changing from high to low	--	0.35	--	V

Characteristics		Symbol	Test conditions	Min.	Typ.	Max.	Unit
MOSFET							
On Resistance	SDH7711	R_{DSON}	V_{GS}=10V, I_D=0.1A	--	7.5	8.6	Ω
	SDH7712A			--	6	6.9	
	SDH7712			--	5	5.7	
	SDH7713			--	2.8	3.3	
	SDH7714			--	2	2.3	
Drain-source Breakdown Voltage		BV_{DSS}	V_{GS}=0V, I_D=50μA	500	--	--	V
Zero Gate Voltage Drain Current		I_{DSS}	V_{DS}=500V, V_{GS}=0V	--	--	1	μA
Gate-source Leakage Current		I_{GSS}	V_{GS}=±30V, V_{DS}=0V	--	--	±100	nA
Temperature Characteristics (note 1)							
Regulatory Temperature Threshold Value		T_{REG}	--	--	150	--	°C
Over Temperature Protection Threshold		T_{SD}	--	--	170	--	°C
Over Temperature Protection Recovery Threshold		$T_{RECOVERY}$	--	--	155	--	°C

Note 1: temperature characteristics are the typical junction temperature values.

PIN CONFIGURATIONS



PIN DESCRIPTION

Pin No. SDH771XN	Pin Name	I/O	Description
1	GND	G	Ground
2	ROVP	I	OVP setting pin
3	NC	N	No connection
4	HV	I	HV power supply
5~6	DRAIN	I	Drain of MOSFET
7	CS	O	Current sense pin

Note: pin configurations of SOP-7 and DIP-8A are the same.

FUNCTION DESCRIPTION

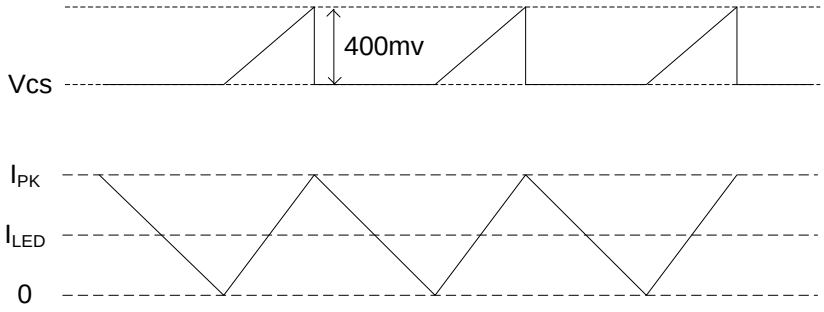
SDH771XN is a non-isolated LED driver IC adopting BUCK structure integrated with a 500V high voltage power MOSFET and a high-voltage startup circuit. Its most prominent feature is that it eliminates the conventional external power supply capacitor and simplifies the system design. The functions are described as below.

Startup control

SDH771XN integrates high-voltage startup power supply circuit, not requiring any startup resistor or auxiliary winding for power supply. The IC takes power from high voltage bus through HV terminal, the special circuit design also enables the IC to work stably without external power supply capacitor, which greatly simplifies the peripheral circuit, as well as shortens the system startup time.

Constant current accuracy control

IC controls the system constant current output according to the voltage on sensing resistor, as shown in following diagram:



The peak current is calculated as $I_{PK}=400/R_{CS}(mA)$, where R_{CS} is resistance of current sensing resistor. LED output current is given by $I_{LED}=I_{PK}/2$.

Boundary-conduction mode

SDH771XN works in boundary-conduction mode with strong anti-interference and high conversion efficiency. Auxiliary winding is unnecessary to detect zero-crossing current and the peripheral circuit is simple. The minimum and maximum demagnetization time is 1.8μS and 350μS respectively. If the inductance of inductor used in the IC is too

small, the system may enter discontinuous mode; if the inductance is too large, the system will enter continuous mode, hence a proper inductance is very important.

Output overvoltage protection (OVP)

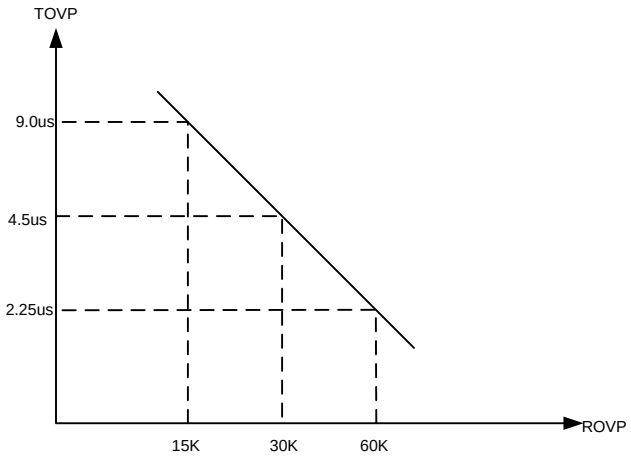
OVP threshold value can be adjusted through the resistor connected between ROVP and GND. When IC works, the current flow through ROVP is 40μA and it brings the voltage VROVP. TOVP is available after calculation from VROVP. if there is open circuit, output voltage increases, when Tdem is lower than TOVP, OVP activates and output is shutdown. IC restarts after 10ms OVP timing.

V_{OVP} is set as:

$$V_{ovp} = \frac{L * V_{cs}}{T_{ovp} * R_{cs}}$$

R_{OVP} is calculated as:

$$R_{OVP} \approx \frac{135}{T_{OVP}(\mu s)} (\text{K ohm})$$



TOVP vs. ROVP

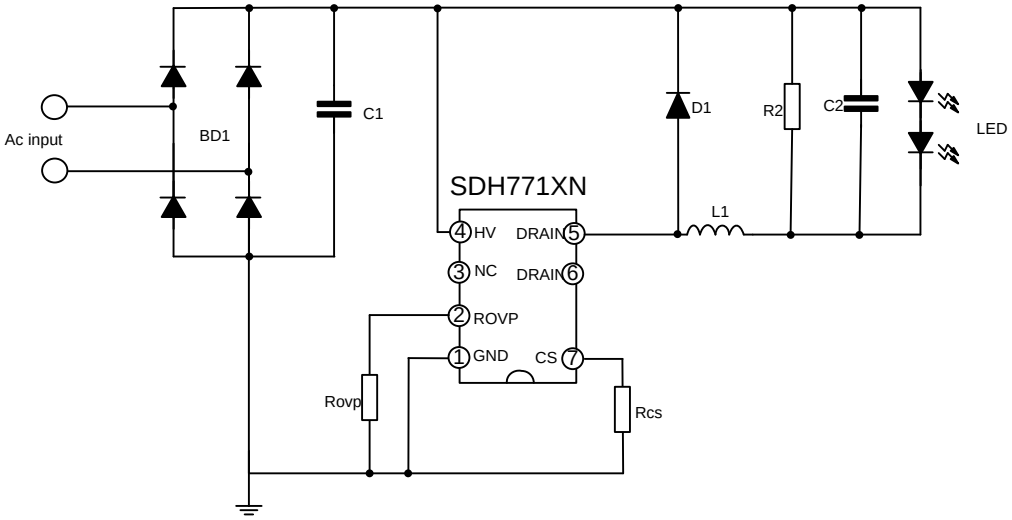
When power off or the input voltage is ultra low, IC works with max. on time, and OVP is disabled to avoid flashing caused by OVP voltage decreasing. OVP will be recovered once IC exits max. on time.

OVP function is available on pin ROVP. OVP function is masked if ROVP voltage is high than 2.5V, hence pin ROVP can be floating when OVP is unused. Output is off and IC enters Disable mode if ROVP voltage is lower than 0.35V, this function can be adopted for color temperature switching and sensor light.

Various protections

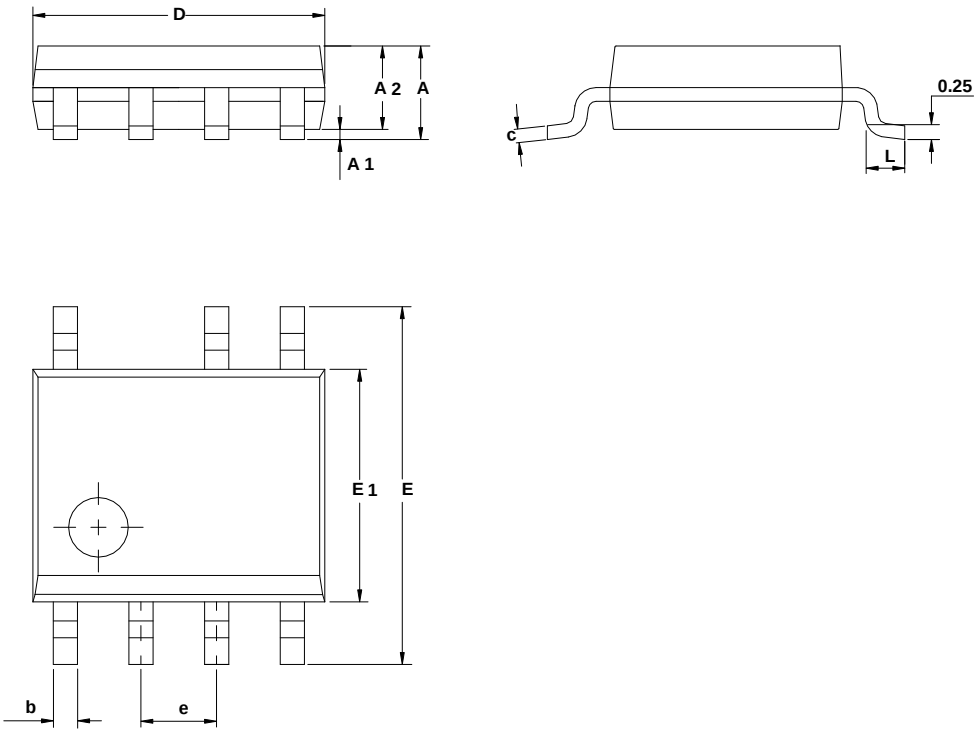
SDH771XN has various protections, including output short/open circuit protection, over temperature regulation, over temperature protection, open circuit protection for sensing resistor, etc. When the output is short circuited, the system works at 3.3kHz for low power dissipation; when the IC internal temperature exceeds 150°C, the output current decreases gradually to ensure the system safety operation. IC enters over temperature protection and output is shutdown when the temperature is higher than 170°C.

TYPICAL APPLICATION CIRCUIT



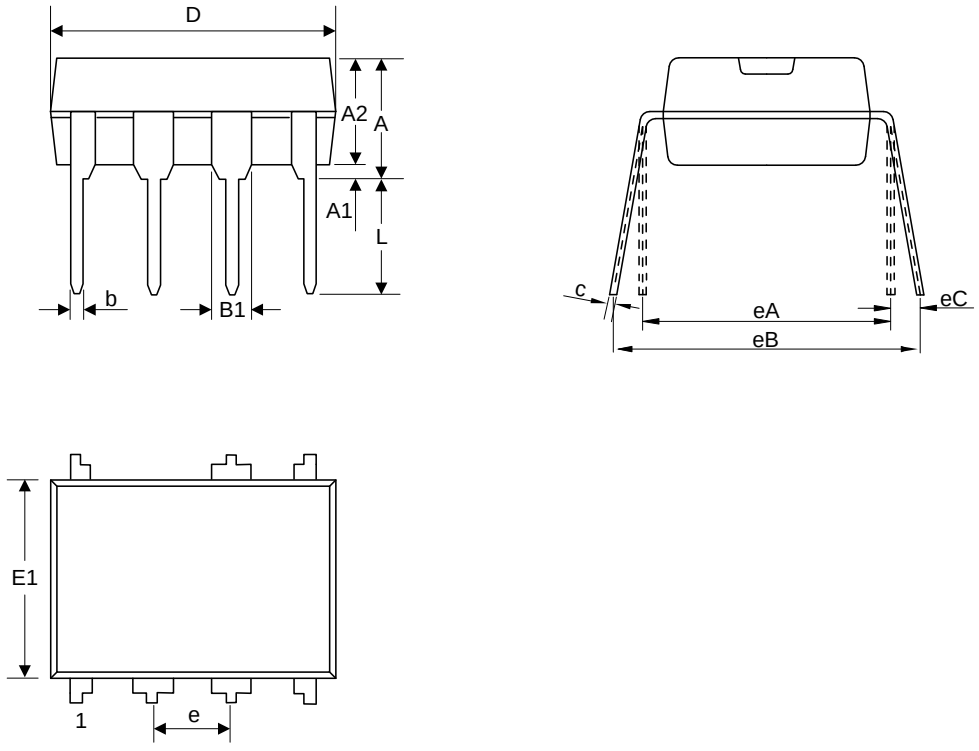
PACKAGE OUTLINE

SOP-7-225-1.27 UNIT: mm



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	—	—	1.80
A1	0.05	0.15	0.25
A2	1.25	—	1.65
b	0.33	0.42	0.51
c	0.17	0.20	0.26
D	4.70	4.90	5.10
E	5.80	6.00	6.20
E1	3.70	3.90	4.10
e	1.27BSC		
L	0.40	—	1.27

DIP-8A-300-2.54 UNIT: mm



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	3.60	—	4.15
A1	0.51	—	—
A2	3.15	3.30	3.40
b	0.40	—	0.55
B1	1.52REF		
c	0.25	0.30	0.35
D	9.00	9.25	9.40
E1	6.20	6.35	6.50
e	2.54BSC		
eA	7.62BSC		
eB	7.62	—	9.30
eC	0	—	0.85
L	3.00	—	—

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.**
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Rev.: 1.4

Revision History:

1. Add SDH7712ASN

Rev.: 1.3

Revision History:

1. Delete SDH7711ASN

Rev.: 1.2

Revision History:

1. Modify the graph of TOVP vs. ROVP

Rev.: 1.1

Revision History:

1. Modify parameter of T_{OVP}
2. Modify the units in the formula of OVP

Rev.: 1.0

Revision History:

1. First release