JH3541B

Description

The JH3541B is a high precision Buck constant current LED driver.The device operates in critical conduction mode and is suitable for 85Vac~265Vac universal input offline LED lighting.

The JH3541B integrates a 500V power MOSFET,with proprietary MOSFET driving technique.It doesn't need VCC capacitor and startup resistor.It can achieve excellent constant current performance with very few external components, so the system cost and size are minimized.

The JH3541B operates in critical conduction mode, it can achieve precise output current and excellent line regulation. The driver output current does not change with the inductance and output voltage.

The JH3541B offers protections to improve the system reliability,including LED short circuit protection, and thermal regulation function.

Adopts SOP7 package.

Features

- No VCC Capacitor and Startup Resistor.
- Integrated HV JFET for IC Power Supply.
- Internal 500V Power MOSFET.
- Critical Conduction Mode Operation.
- ±5% LED Output Current Accuracy.
- Configurable OVP by Rovp resistor.
- LED Short Protection.
- Thermal Regulation Function.
- Adopts SOP7 package.

Applications

- LED Bulb.
- LED Tube.
- Other LED Lighting.

Typical Application

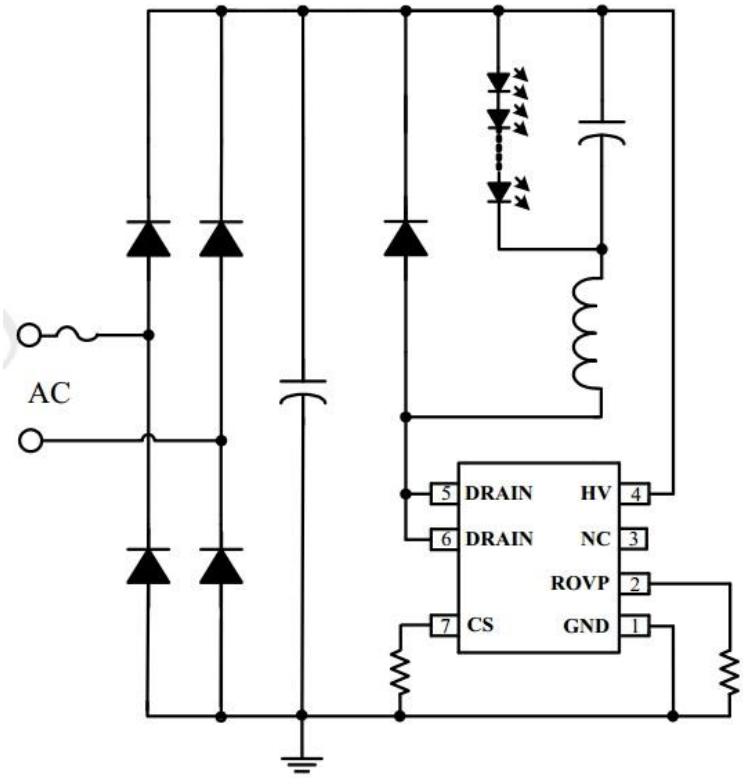


Figure 1. Typical application with Analog Dimming Signal

Ordering Information

Order codes				Marking	Package
Halogen-Tube	Halogen-Free-Tube	Halogen-Reel	Halogen-Free-Reel		
N/A	N/A	N/A	JH3541BL7-LP-AR	JH3541B	SOP7

Pin Configuration and Marking Information

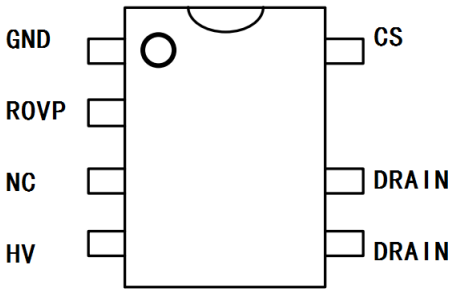


Figure 2. Pin configuration

Pin Definition

Pin No.	Name	Description
1	GND	Ground.
2	ROVP	OVP configure by a resistor between this pin and GND Pin
3	NC	Not connect
4	HV	High voltage power supply Pin
5 6	DRAIN	Internal HV Power MOSFET Drain
7	CS	Current Sense Pin. Connect a sense resistor between this pin and GND pin.

Internal Block Diagram

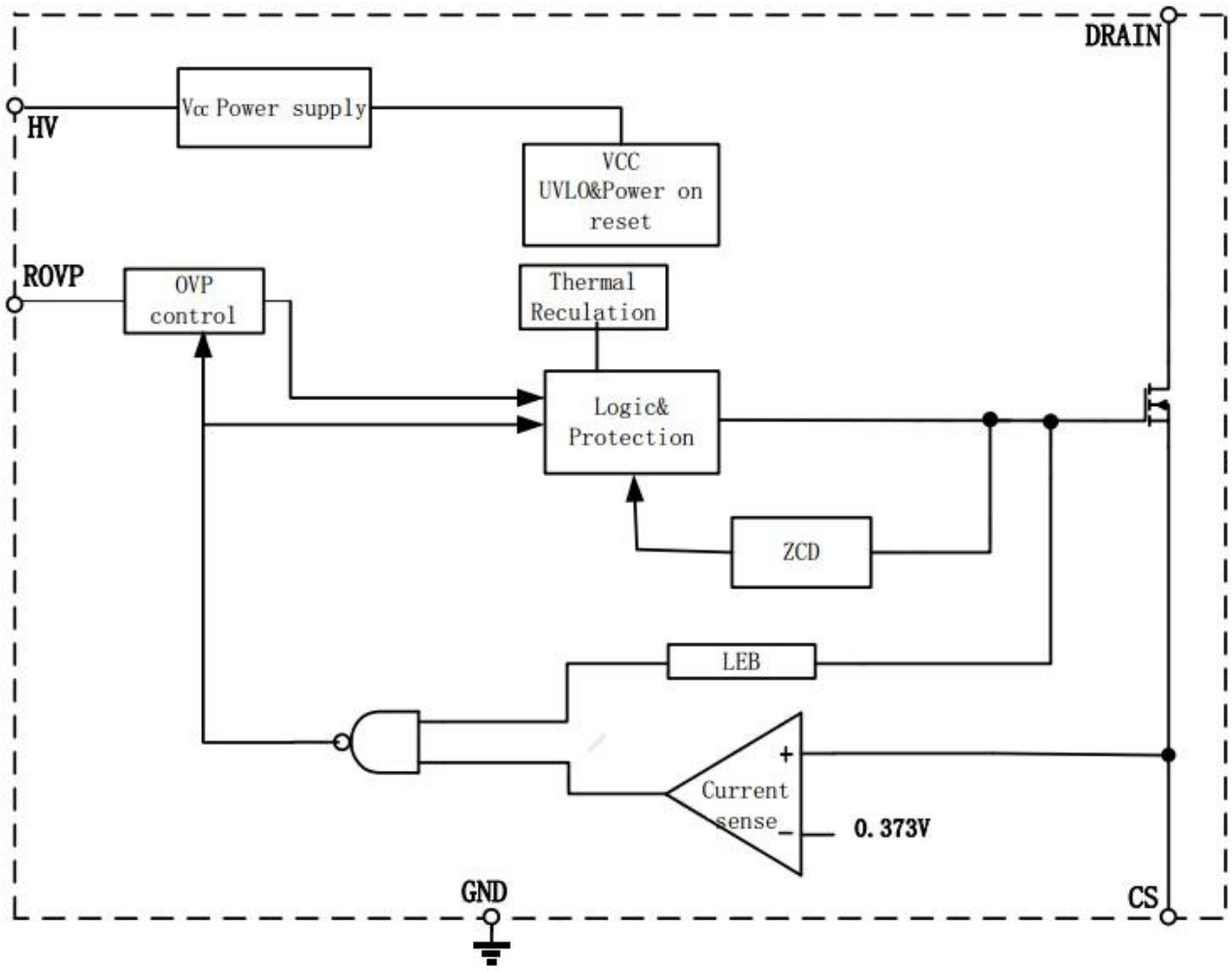


Figure 3. JH3541B Internal Block Diagram

Absolute Maximum Ratings (note1)

Symbol	Parameters	Range	Units
HV	500V High voltage supply Pin	-0.3~500	V
DRAIN	Internal HV MOSFET drain voltage	-0.3~500	V
CS	Current sense pin input voltage	-0.3~8	V
ROVP		-0.3~8	V
IDMAX	Maximum drain current @ TJ=100℃	1000	mA
P_{DMAX}	Power dissipation (note2)	0.45	W
θ_{JA}	Thermal resistance (Junction to Ambient)	145	℃/W
T_J	Operating junction temperature	-40 to 150	℃
T_{STG}	Storage temperature range	-55 to 150	℃
	ESD(Note3)	2	KV

Note 1: Stresses beyond those listed "absolute maximum ratings" may cause permanent damage to the device. Under "recommended operating conditions" the device operation is assured, but some particular parameter may not be achieved. The electrical characteristics table defines the operation range of the device, the electrical characteristics is assured on DC and AC voltage by test program. For the parameters without minimum and maximum value in the EC table, the typical value defines the operation range, the accuracy is not guaranteed by spec.

Note 2: The maximum power dissipation decrease if temperature rise, it is decided by T_{JMAX}, θ_{JA}, and environment temperature (T_A). The maximum power dissipation is the lower one between $P_{DMAX} = (T_{JMAX} - T_A)/ \theta_{JA}$ and the number listed in the maximum table.

Note 3: Human Body mode, 100pF capacitor discharge on 1.5KΩ resistor.

Recommended Operation Conditions

Symbol	Parameters	Range	Units
ILED	Output LED current Vout=72V (Input voltage 176V～265V)	280	mA
ILED max	Maximum Output LED current	450	mA
VLED min	Minimum LED Loading Voltage	>15	V

Electrical Characteristics (Notes 4, 5) (Unless otherwise specified, TA =25 ℃)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
Supply Voltage Section						
I_{CC}	Operating current	FOP=4kHz		250		uA
Current Sensing Section (CS)						
V_{CS_TH}	Threshold Voltage for Peak Current Limit		362	373	384	mV

T_{LEB}	Leading Edge Blanking Time			500		ns
T_{DELAY}	Switch off Propagation Delay			200		ns
Dimming (DIM)						
V_{DIM_ON}	Dimming On Threshold			75		mV
V_{DIM_OFF}	Dimming Off Threshold			37.5		mV
V_{DIM}	Dimming Range		0.075		1.4	V
Rovp						
V_{EN}	OVP Pin enable threshold			0.3		V
I_{OVP}	OVP Pin output current			35		uA
Internal Time Control Section						
T_{ON_MAX}	Maximum On Time			40		us
T_{OFF_MIN}	Minimum Off Time			2.5		us
T_{OFF_MAX}	Maximum Off Time			250		us
T_{OVP_RST}	OVP reset time			10		ms
MOSFET Section						
BVDSS	Drain-Source Breakdown Voltage	VGS=0V/IDS =250uA	500			V
I_{DSS}	Power MOSFET leakage current	VGS=0V/ VGS=500V			1	uA
Rdson	MOSFET conductor resistance	VGS=10V/ID S=0.1A		4.8		Ω
Thermal Regulation Section						
TREG	Thermal Regulation Temp			140		℃

Note 4: production testing of the chip is performed at 25℃.

Note 5: the maximum and minimum parameters specified are guaranteed by test, the typical value are guaranteed by design, characterization and statistical analysis.

Application Information

The JH3541B is a high performance non-isolated Buck converter specially designed for LED lighting.The device integrates a 500V power MOSFET. With very few external components, the converter achieves excellent constant current control.And it can save VCC capacitor and startup resistor.So the system size and cost is greatly reduced.

1 Start Up

When the system powered on, the HV pin supply the power to the IC. Then the IC start working. After the chip operates normally, the HV JFET supplies the working current also.

2 Constant Current Control

Cycle by Cycle current sense is adopted in JH3541B, the CS pin is connected to the internal current sense comparator, and the voltage on CS pin is compared with the internal 0.373V reference voltage. The MOSFET will be switched off when the voltage on CS pin reaches the threshold. The CS comparator includes a 500ns leading edge blanking time.
The peak inductor current is given by:

$$I_{PK} = \frac{373}{R_{CS}}$$

Where, RCS is the current sense resistor value.

The current in LED can be given by:

$$I_{LED} = \frac{I_{PK}}{2}$$

Where, IPK is the peak current of the inductor .

3 Inductor Selection

JH3541B works under inductor current critical conduction mode. When the power MOFET is switched on, the current in the inductor rises up from zero, the on time of the MOSFET is given by:

$$t_{on} = \frac{L \times I_{PK}}{V_{IN} - V_{LED}}$$

Where,
L is the inductor value
VIN is the DC bus voltage after the rectifier bridge
VLED is the voltage on the LED
After the power MOSFET is switched off, the current in the inductor decreases. When the inductor current reaches zero, the power MOSFET is turned on again by IC internal logic. The off time of the MOSFET is given by:

$$t_{off} = \frac{L \times I_{PK}}{V_{LED}}$$

The inductance can be given by:

$$L = \frac{V_{LED} \times (V_{IN} - V_{LED})}{f \times I_{PK} \times V_{IN}}$$

The f is the system switching frequency,which is proportional to the input voltage. So the minimum switching frequency is set at lowest input oltage,and the maximum switching frequency is set at highest input voltage.
The minimum and maximum off time of JH3541B are 2.5us and 250us respectively . Referring to the equation of Toff calculation,if the inductance is too low,the Toff may be lower than the minimum off time,system will operate in discontinuous current mode and the output current will be lower than the designed value.If the inductance is too large,the Toff may be higher than the maximum off time,the system will operate in continuous conduction mode and the output current will be higher than the designed value. So it is important to choose a proper inductance.

4 Rovp Resistor Value calculate

The OVP voltage is set by the resistor which connects the ROVP Pin.The current out of the ROVP Pin is 35uA.

When the LED load is open,the output voltage becomes higher and the Toff becomes lower. So we can get the Tovp by the needed OVP voltage.The Tovp is given by:

$$Tovp \approx \frac{L \times Vcs}{Rcs \times Vovp}$$

Where,Vcs is CS reference voltage（373mV）

Vovp is the needed OVP

Then we can get the Rovp resistor value by the Tovp.

The Rovp is given by:

$$Rovp \approx \frac{150}{Tovp} * 10^{-3}$$

Noted:The Rovp Pin has the enable function. When the ROVP Pin voltage is lower 0.3V, the IC is disabled and the system has no output.So we suggest the ROVP resistor will be higher 15kΩ.If you needn't OVP function you can disconnect the ROVP Pin.

5 Protection Function

JH3541B offers rich protection functions to improve the system reliability,including LED short protection, thermal regulation.

When the LED short circuit is detected, the system works at low frequency (4kHz),so the system power consumption is very low.

JH3541B integrates thermal regulation function.When the system is over temperature,the output current is gradually reduced,so the output power dissipation and thermal are also reduced.The system temperature is regulated and the system reliability is improved. The thermal regulation temperature is set to 140℃ internally.

8 PCB Layout

The following guidelines should be followed in:

CS resistor

The current sense resistor should be short to the bus capacitor ground.And it is separated from other signal ground. Another the bigger copper area of the CS Pin is better for thermal dissipation.

HV Pin

HV trace should be far away from the CS pin trace and other low voltage pin.

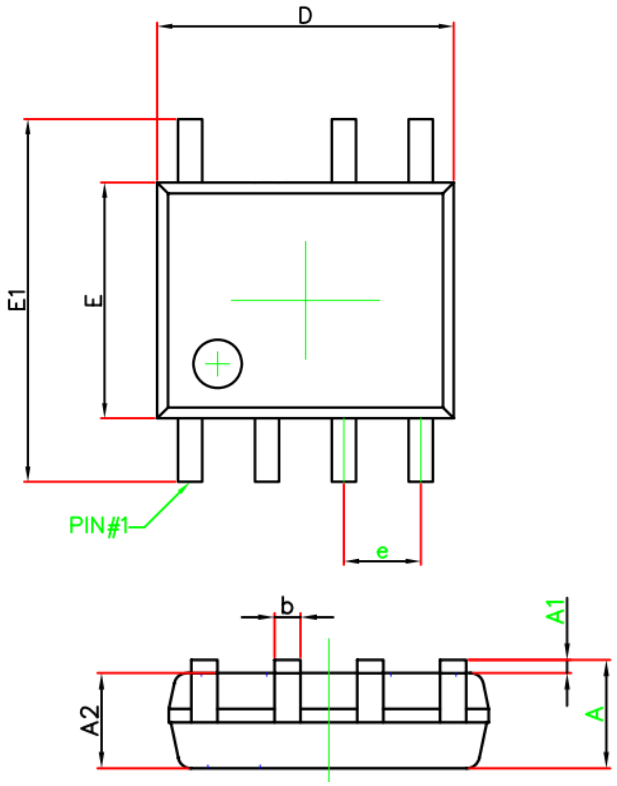
The Area of Power Loop

The area of main current loop should be as small as possible to reduce EMI radiation, such as the inductor,the power MOSFET,the output diode and the bus capacitor loop.

Drain Pin

To increase the copper area of DRAIN pin for better thermal dissipation.However too large copper area may compromise EMI performance.

Physical Dimensions SOP7



SYMBOL	MM	
	MIN	MAX
A	1.350	1.750
A1	0.100	0.250
A2	1.350	1.550
b	0.330	0.510
c	0.170	0.250
D	4.800	5.200
E	3.800	4.200
E1	5.800	6.200
e	1.27(TYP)	
L	0.400	1.270
θ	0°	8°

注意事项

1. 吉林华微电子股份有限公司的产品销售分为直销和销售代理，无论哪种方式，订货时请与公司核实。

2. 购买时请认清公司商标，如有疑问请与公司本部联系。

3. 在电路设计时请不要超过器件的绝对最大额定值，否则会影响整机的可靠性。

4. 本说明书如有版本变更不另外告知。

NOTE

1. Jilin Sino-microelectronics co., Ltd sales its product either through direct sales or sales agent, thus, for customers, when ordering, please check with our company.
2. We strongly recommend customers check carefully on the trademark when buying our product, if there is any question, please don't be hesitate to contact us.
3. Please do not exceed the absolute maximum ratings of the device when circuit designing.
4. Jilin Sino-microelectronics co., Ltd reserves the right to make changes in this specification sheet and is subject to change without prior notice.

联系方式

吉林华微电子股份有限公司

公司地址：吉林省吉林市深圳街 99 号

邮编：132013
总机：86-432-64678411
传真：86-432-64665812
网址：www.hwdz.com.cn

市场营销部
地址：吉林省吉林市深圳街 99 号

邮编：132013
电话： 86-432-64675588
64675688
64678411-3098/3099
传真： 86-432-64671533

CONTACT

JILIN SINO-MICROELECTRONICS CO., LTD.

ADD: No.99 Shenzhen Street, Jilin City, Jilin Province, China.
Post Code: 132013
Tel：86-432-64678411
Fax：86-432-64665812
Web Site：www.hwdz.com.cn

MARKET DEPARTMENT
ADD: No.99 Shenzhen Street, Jilin City, Jilin Province, China.
Post Code: 132013
Tel: 86-432-64675588
64675688
64678411-3098/3099
Fax: 86-432-64671533