JH5442TL7

Description

The JH5442TL7 is a high precision non-isolated buck driver with active PFC, specially designed for universal input offline constant current LED lighting. The driver with on-chip PFC circuit achieves high power factor and low THD. Operating in critical conduction mode, the power MOSFET switching loss is reduced and the inductor is fully utilized.

The JH5442TL7 integrates a 600V power MOSFET. With few external components, the LED output current can be precisely controlled.

The JH5442TL7 utilizes floating ground structure. The inductor current is sensed during the whole switching cycle. So it achieves high precision output current control, and excellent line regulation and load regulation.

The JH5442TL7 are built-in JFET start-up and IC power supply circuit, which enable the system to quickly start, and reduce the external power supply components, achieve smaller volume.

The JH5442TL7 offers rich protection functions to improve the system reliability, including LED open circuit protection, LED short circuit protection, VCC under voltage protection, CS resistor open circuit protection and cycle by cycle current limit. All the protection functions are auto-recovery. The system reliability is further improved by the thermal regulation function. The output current is reduced when the driver is over temperature.

Available in SOP-7 package.

Features

- Built-in JFET start-up and IC power supply circuit, The VCC power supply resistors and power feedback circuits from LED chips are not needed
- Ultra fast system start
- Ultra low operating current
- Active PFC for High Power Factor and Low THD
- Internal 600V Power MOSFET
- ±3% LED Output Current Accuracy
- Excellent Line and Load Regulation
- Critical Conduction Mode Operation
- LED Short/Open Protection
- Current Sensing Resistor Open Protection
- Cycle by Cycle Current Limit
- VCC Under Voltage Protection
- Auto Fault Recovery
- Thermal Regulation Function

Applications

- LED retrofit lamps, Bulb, Spot Light, GU10/E27
- PAR Lamp
- LED String，LED tube
- Other LED Light

JH5442TL7

Typical Application

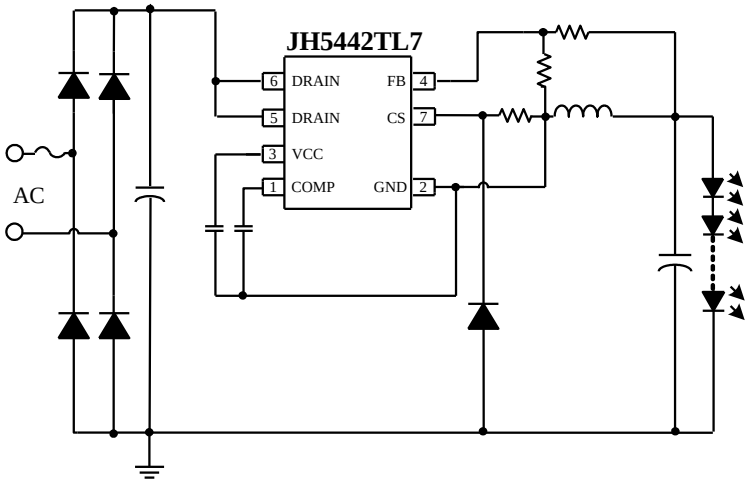
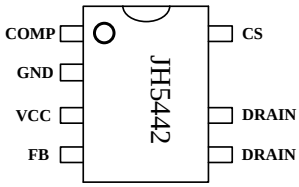


Figure 1. Typical application circuit for JH5442TL7

Ordering Information

Order codes				Marking	Package
Halogen-Tube	Halogen-Free-Tube	Halogen-Reel	Halogen-Free-Reel		
N/A	N/A	N/A	JH5442TL7-LP-AR	JH5442	SOP-7

Pin Configuration and Marking Information



SOP-7

Figure 2. Pin Configuration

Pin Definition

Pin No.	Name	Description
1	COMP	Loop Compensation Node. This pin connects a capacitor to GND for stabilization of the control loop, achieving accurate LED current, high Power Factor and low THD.
2	GND	Ground.
3	VCC	Power Supply Pin. Connect a bypass capacitor from this pin to GND.
4	FB	Feedback Voltage Input Pin. This pin detects the inductor demagnetization signal and the output voltage.
5，6	DRAIN	Internal HV Power MOSFET Drain.

7，8	CS	Current Sense Pin. Connect a resistor to GND to sense the inductor current.

Internal Block Diagram

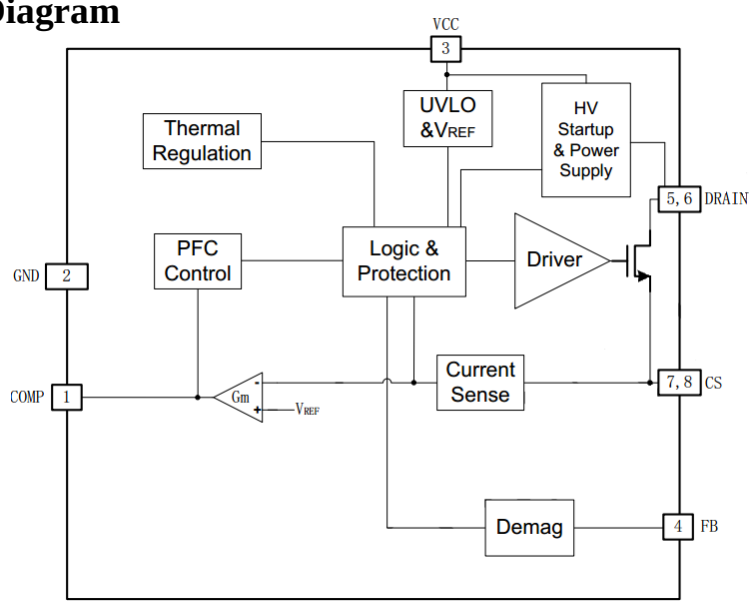


Figure 3. JH5442TL7 Internal Block Diagram

Absolute Maximum Ratings (note1)

Symbol	Parameters	Range	Units
V_{DS}	Internal HV MOSFET Drain to Source voltage	-0.3~600	V
I_{CC_MAX}	VCC pin maximum sink current	20	mA
COMP	Compensation pin voltage	-0.3~6	V
FB	Feedback pin input voltage	-0.3~6	V
CS	Current sense pin input voltage	-0.3~6	V
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	Symbol	Parameter	Input voltage	Range	Unit
JH5442TL7	I_{LED} 1	Output LED current @ Vout=36Vdc	90Vdc～265Vdc	< 250	mA
	I_{LED} 2	Output LED current @ Vout=72Vdc	90Vdc～265Vdc	<180	mA

Electrical Characteristics (Notes 4, 5) (Unless otherwise specified, V_{CC}=12V and T_A=25 ℃)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
Supply Voltage Section						
V_{CC_ON}	VCC Turn On Threshold	V_{CC} Rising		12		V
V_{CC_HIGH}	VCC charging over Threshold Voltage	V_{CC} Rising		12		V
V_{CC_UVLO}	V_{CC} Turn Off Threshold	V_{CC} Falling		7.2		V
I_{CC_UVLO}	V_{CC} Startup Current	V_{CC}= 12V	20	30	50	μA
Feedback Section						
V_{FB_OVP}	FB Over Voltage Protection Threshold			3.2		V
T_{ON_MAX}	Maximum On Time			6		μs
Current Sense Section						
V_{CS_LIMIT}	CS Peak Voltage Limitation			1.4		V
T_{LEB_CS}	Leading Edge Blanking Time for Current Sense			300		ns
Compensation Section						
V_{REF}	Internal Reference Voltage		196	200	204	mV
Power MOSFET Section						
R_{DS_ON}	Static Drain-source On-resistance	V_{GS}=10V/I_{DS}=0.4A		6.5		Ω
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS}=0V/I_{DS}=250uA	600			V
I_{DSS}	Power MOSFET Drain Leakage Current	V_{GS}=0V/V_{DS}=600V			1	μA

HV JFET Section						
I_{JFET}	JFET Current	40V Between JFET Drain and Chip GND		9		mA
BV_{DSS}	JFET Breakdown Voltage		700			V
I_{DSS}	JFET Off Current			45		μA
Thermal Regulation Section						
T_{REG}	Thermal Regulation Temperature			150		℃

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 JH5442TL7 is a high precision Active PFC driver integrating 600V power MOSFET, specially designed for non-isolated buck offline constant current LED lighting.Operating in critical conduction mode, the driver achieves high power factor, low THD and high efficiency.

1 Start Up

The JH5442TL7 built-in JFET start-up and IC power supply circuit, the VCC power supply resistors and power feedback circuits from LED chips are not needed. After system power up, the VCC pin capacitor is charged up by JFET start-up and IC power supply circuit. When the VCC pin voltage reaches the turn on threshold, the internal circuits start working.

The COMP pin voltage is pulled up to 1.65V quickly, the JH5442TL7 starts switching then. The system works at 7kHz frequency at the beginning, the COMP voltage rises up gradually, and the inductor peak current also rises up. The LED current hence achieves a soft start without overshoot.

When the VCC voltage is higher than VCC_HIGH, turn off the JFET, stop charging. When the VCC voltage is lower than VCC_on, open the JFET, restore the charging.

2 Constant Current Control

JH5442TL7 accurately adjusts the LED by detecting the inductance current flow.The LED current can be calculated by the equation:

$I_{LED}=V_{FB}/R_S$,V_{FB} (=200mV) is the internal reference voltage, and R_S is external Current detection resistance.

Also the JH5442TL7 will drop the output current to limit the temperature when the AC input voltage drop too much, the output current curve is show as below fig4. for Vo=80V, Io=100mA application.The curve depends on the duty-cycle and the frequency，which could be change by Lp setting. Suggest Bmax＜0.3.

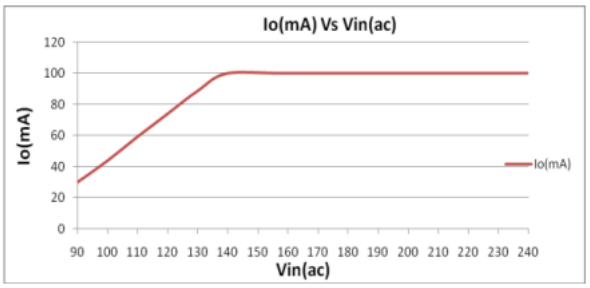


Figure4. Io - Vin relation curve

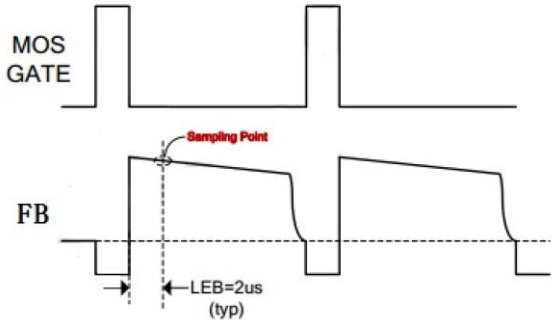


Figure5.Feedback voltage detection

3 Feedback Network

The JH5442TL7 senses the output current zero crossing information through the feedback network, the FB falling threshold voltage is set to 0.2V with 0.15V hysteresis. The FB pin is also used to detect output OVP, the threshold voltage is 3.2V. The ratio of FB upper resistor to lower resistor can be set as:

$$\frac{R_{FBL}}{R_{FBL}+R_{FBH}}=\frac{3.2V}{V_{OVP}}$$

Where,

R_{FBL}: The lower resistor of the feedback network

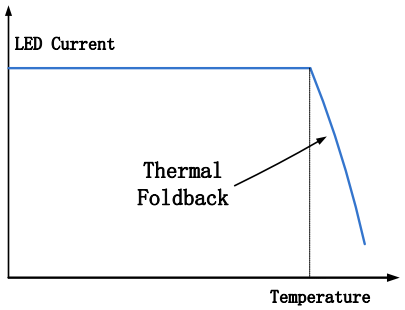
R_{FBH}: The upper resistor of the feedback network

V_{OVP}: Output over voltage setting point

In each switching cycle, when the PWM pulse is switched off,the inductance voltage is fed back to the FB pin to achieve switch logic control, overvoltage protection and short circuit protection. The FB pin detects the inductance voltage through the resistance partial pressure network. To reduce noise interference, the sampling window of the feedback voltage is set at 2 us after the power MOSFET is off.

4 Thermal Regulation

The JH5442TL7 integrates thermal regulation function. When the system is over temperature, the output current is gradually reduced; the output power and thermal dissipation are also reduced. The system temperature is regulated and the system reliability is improved. The thermal regulation temperature is set to 150℃ internally.



5 Protection Functions

JH5442TL7 offers rich protection functions to improve the system reliability.

When the LED is open circuit, the output voltage will gradually rise up. The output voltage is sensed by the FB pin when power MOSFET is turned off. When FB voltage reaches the OVP threshold, it will trigger fault logic and the system stops switching.

After the system enters into fault condition, the VCC voltage will decrease as the internal IC power supply

circuit stopping charging the VCC, until it reaches UVLO threshold. Then the system will restart again. If the fault condition is removed, the system will resume normal operation.

When the LED is shorted circuit, the switching frequency will work under 7 kHz，so the short circuit power consumption will be reduced.

When the output is short circuit or the inductor is saturated, the CS peak voltage will be relatively high. When CS voltage reaches the internal limitation (1.4V), the power MOSFET will be turned off instantaneously. This cycle by cycle current limitation can help protecting the power MOSFET, the inductor and the output diode.

6 PCB Layouts

The following guidelines should be followed in JH5442TL7 PCB layout.

Bypass Capacitor

The bypass capacitor on VCC pin should be as close as possible to the VCC and GND pins.

Ground Path

The power ground path for current sense resistor should be short and wide, and it should be as close as possible to the IC ground (GND), otherwise the LED output current accuracy maybe affected. The IC signal ground should be individually connected to the IC GND pin .

The Area of Power Loop

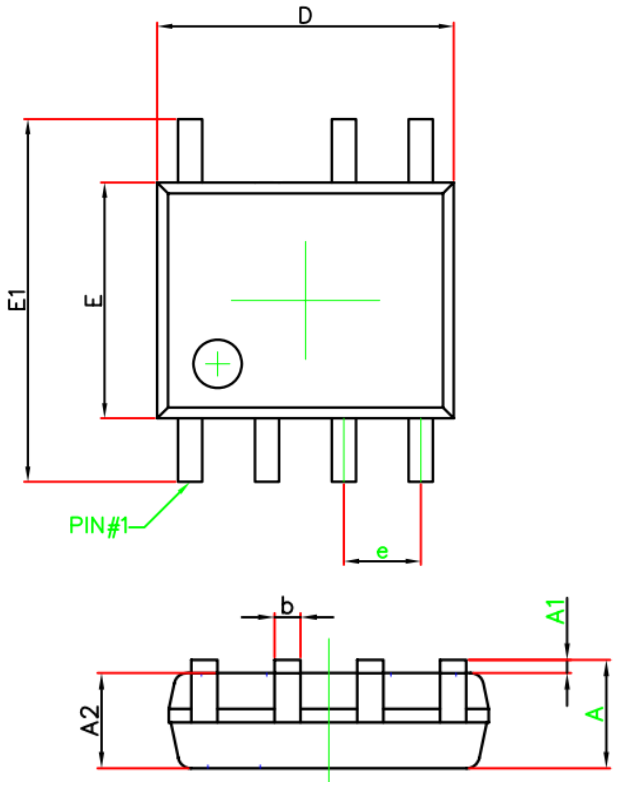
The area of main current loop should be as small as possible to reduce EMI radiation.

FB Pin

The feedback resistor divider should be as close as possible to the FB pin, and the trace must keeps away from dynamic node of the inductor (DRAIN pin trace), otherwise the FB pin OVP function might have risk to be mis-triggered by the system noise.

JH5442TL7

Physical Dimensions SOP-7



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°

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