JW1531O

BUCK CC/CV Controller Without Auxiliary Winding

Parameters Subject to Change Without Notice

DESCRIPTION

The JW®1531O is a constant voltage constant current controller with high accuracy.

JW1531O integrates high voltage power source, and can be supplied from line voltage directly, and auxiliary winding is not needed, which largely simplifies the system.

Low standby consumption can be achieved with deep pulse frequency modulation. Critical conduction mode operation reduces the switching losses and largely increases the efficiency.

JW1531O has multi-protection functions which largely enhance the safety and reliability of the system, including VCC over-voltage protection, VCC UVLO, LED short protection, pulse-by-pulse current limit and over-temperature protection.

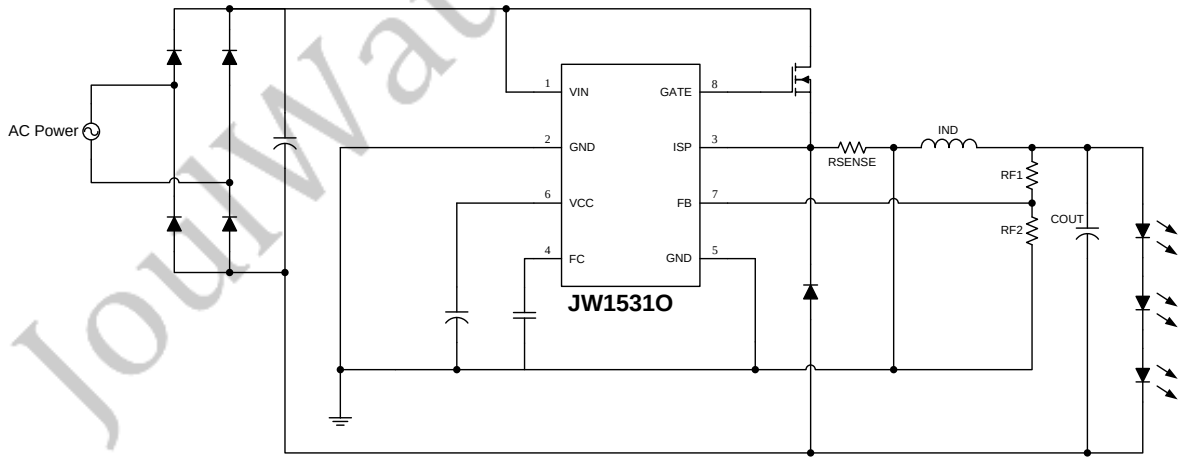
FEATURES

- No auxiliary winding
- Supplied from line voltage directly
- High current accuracy of line and load regulation
- Low output current-ripple
- Critical conduction mode
- High efficiency over wide operating range
- Cycle-by-cycle current limit
- LED short protection
- Internal over-temperature protection
- SOP8 package

APPLICATIONS

- Smart LED Lighting

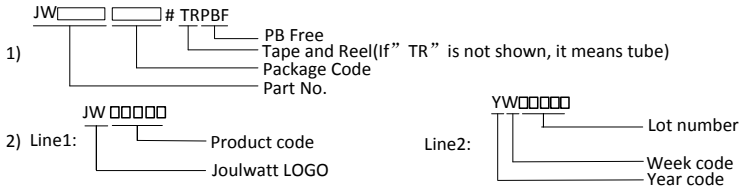
TYPICAL APPLICATION



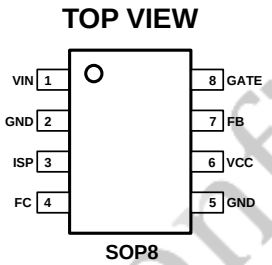
ORDER INFORMATION

DEVICE[1)]	PACKAGE	TOP MARKING[2)]
JW1531OSOPB#TRPBF	SOP8	JW1531O YW□□□□□

Notes:



PIN CONFIGURATION



ABSOLUTE MAXIMUM RATING[1)]

VIN Voltage.....700V
VCC, GATE Voltage.....40V
ISP, FB,FC Voltage.....6V
Junction Temperature[2) 3)] 150ºC
Lead Temperature..... 260ºC
Storage Temperature..... -65ºC to +150ºC
ESD Susceptibility (Human Body Model) 2kV

RECOMMENDED OPERATING CONDITIONS

VIN Voltage.....30V to 550V
VCC Voltage.....10V to13V
Operating Junction Temp (T_J) .....-40ºC to 125ºC

THERMAL PERFORMANCE[4)]

	θ_{JA}	θ_{JC}
SOP8.....	96.....	45ºC/W

Note：

1) Exceeding these ratings may damage the device.

2) Guarantees robust performance from -40°Cto 150°C junction temperature. The junction temperature range specification is assured by design, characterization and correlation with statistical process controls.

3) Includes thermal protection that is intended to protect the device in overload conditions. Thermal protection is active when junction temperature exceeds the maximum operating junction temperature. Continuous operation over the specified absolute maximum operating junction temperature may damage the device.

4) Measured on JESD51-7, 4-layer PCB.

ELECTRICAL CHARACTERISTICS

VIN=20V, T_A=25℃, unless otherwise stated.

Item	Symbol	Condition	Min.	Typ.	Max.	Units
VCC Start-Up Voltage	$V_{CC\_STARTUP}$		12	13.5	15	V
VCC Shut Down Voltage	$V_{CC\_SHUTDOWN}$		8	9.3	11	V
VCC Operational Current	I_{CCO}	VCC=15.5V	180	250	310	μA
VCC Over Voltage Threshold[5)]	V_{TH_OVP}		16.7	18.5	20.2	V
VCC Shunt Current[5)]	I_{SHUNT}	VCC=18V	2.8	5	7.1	mA
ISP Reference Voltage	V_{ISP_REF}		218	230	242	mV
Minimum ON Time[5)]	T_{ON_MIN}			500		ns
Minimum OFF Time[5)]	T_{OFF_MIN}			1		μs
Maximum OFF Time[5)]	T_{OFF_MAX}			800		μs
Maximum Switch Frequency[5)]	F_{MAX}				155	kHz
FB Reference Voltage	V_{FB_REF}		1.52	1.6	1.68	V
Over Thermal Protection Threshold[5)]	$Temp_{OTP}$			145		℃

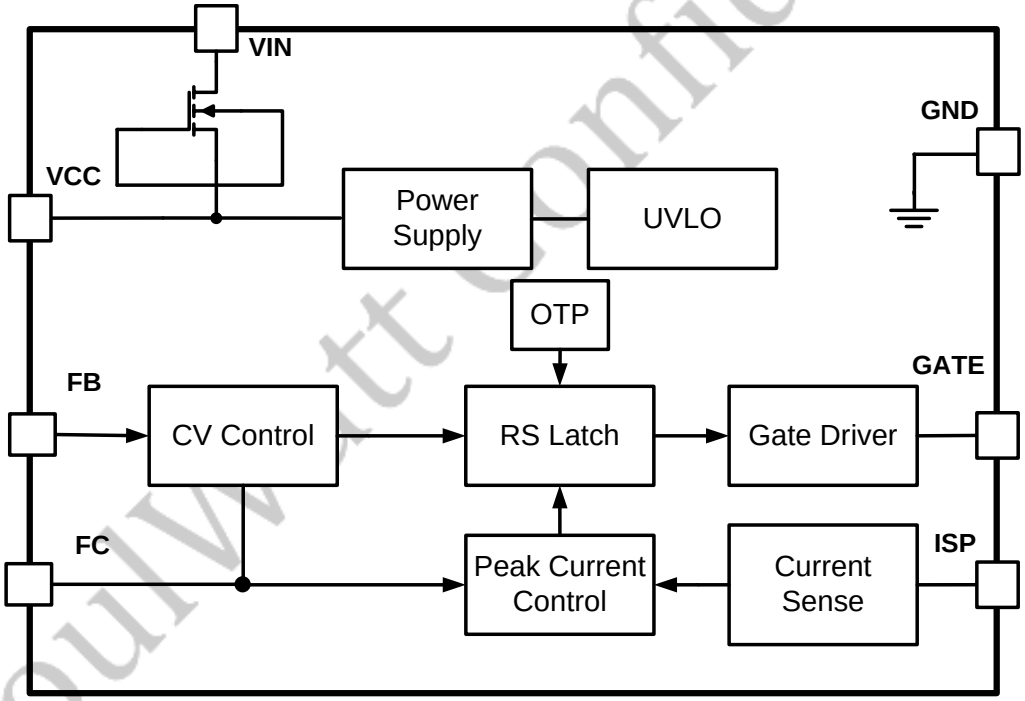
Note:

5) Guaranteed by design.

PIN DESCRIPTION

Pin	Name	Description
1	VIN	Line voltage input.
2,5	GND	Chip ground.
3	ISP	Output current sense. This pin is used for output current control.
4	FC	Output of the error amplifier. This pin must be locally bypassed with a capacitor.
6	VCC	Power supply. This pin supplies current to the internal circuit and must be locally bypassed with a capacitor.
7	FB	Voltage loop feedback pin. FB is used to detect the output voltage.
8	GATE	Gate driver for the external main MOSFET switch.

BLOCK DIAGRAM

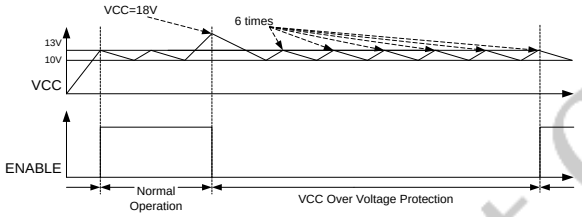


FUNCTIONAL DESCRIPTION

JW1531O is a constant voltage constant current controller. The unique high precision CV/CC control with high level protection features makes it suitable for smart LED lighting applications.

Start Up

JW1531O can be supplied from line voltage directly. When VIN charges VCC up to 13V, the GATE driver begins to switch. Also, JW1531O can be supplied by output voltage. An internal 16V clamp is attached to the VCC pin to prevent VCC from being too high. Once VCC exceeds 18V, system shut down and VCC is charged again after it's pulled down to 10V. When VCC is charged to 13V for 6 times, the system restarts.



Constant Current Control

The JW1531O controls the output current from the information of the sensed resistor voltage. The output LED mean current can be calculated as:

$$I_{LED\_max} = V_{ISP\_REF}/(2R_{SNS})$$

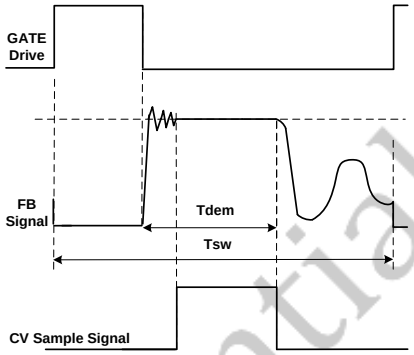
Where

R_{SNS} – The sensing resistor connected between ISP and GND.

V_{ISP_REF}–ISP Reference Voltage

Constant Voltage Control

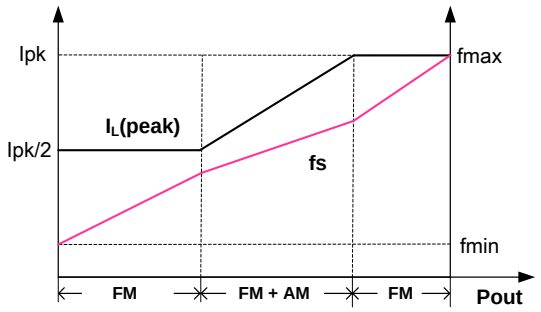
The output voltage can be sensed by FB pin. The figure shows below illustrates the CV sampling signal timing waveform in JW1531O. To achieve an accurate representation of the output voltage, the CV sampling signal blocks the FB ringing.



When the CV sampling process is over, the internal sample/hold (S&H) circuit captures the error signal and amplifies it through the internal Error Amplifier (EA). The output of EA(FC pin) is sent to the Constant Voltage Modulator for CV control. A capacitor, 1nF recommended, should be connected to FC and GND pin to ensure quick response and the stability of the system. When system enters over load condition, the output voltage falls down and the FB sampled voltage will be lower than FB reference voltage (V_{FB_REF}), then system enters CC Mode automatically.

Multi- Mode Control in CV Mode

To meet the tight requirement of averaged system efficiency and no load power consumption, a hybrid of frequency modulation (FM) and amplitude modulation (AM) is adopted in JW1531O which is shown in the figure shows below.



The IC operates in FM+AM mode to achieve excellent regulation and high efficiency from normal to light load conditions. When the system is near zero load, the IC operates in FM again for standby power reduction.

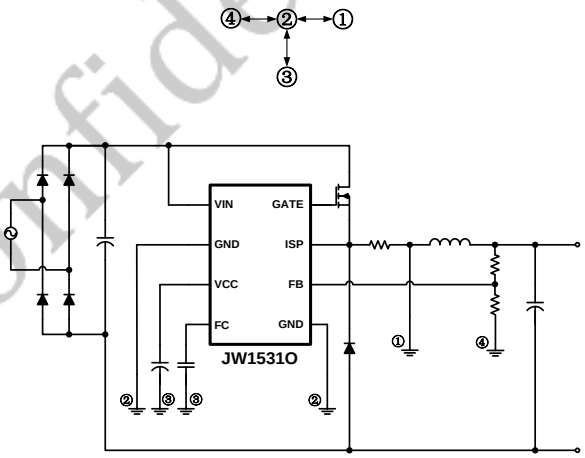
LED Over Temperature Protection

When internal temperature of the chip exceeds 145°C, JW1531O decrease the LED current to help the chip cooling.

PCB Design

When designing the PCB of the JW1531O system, please follow the directions to guarantee the key signal sampling reliability:

1. The two FB divided resistors connection line should be as short as possible, the connection point must be near to IC FB pin. And the GND of down FB divided resistor should be connected to IC GND as short as possible.
2. The VCC pin must be locally bypassed with a capacitor.
3. IC GND and FB signal sampling point should be far away from the freewheel diode and DRAIN pin. Besides, the signal sampling loop and power loop should be separated to avoid the noise disturbance as following layout diagram.
4. Make sure the FB sampling point and layout line do not under the bottom of open magnetic path of non-shield inductors
5. Make the area of the power loop as small as possible in order to reduce the EMI radiation.
6. The chip should be far away from the heating element, such as the MOSFET and the freewheel diode.
7. Note the chip ground is not connected to the cathode of the input capacitor as usual.
8. The connection of IC GND is recommended as following figure.



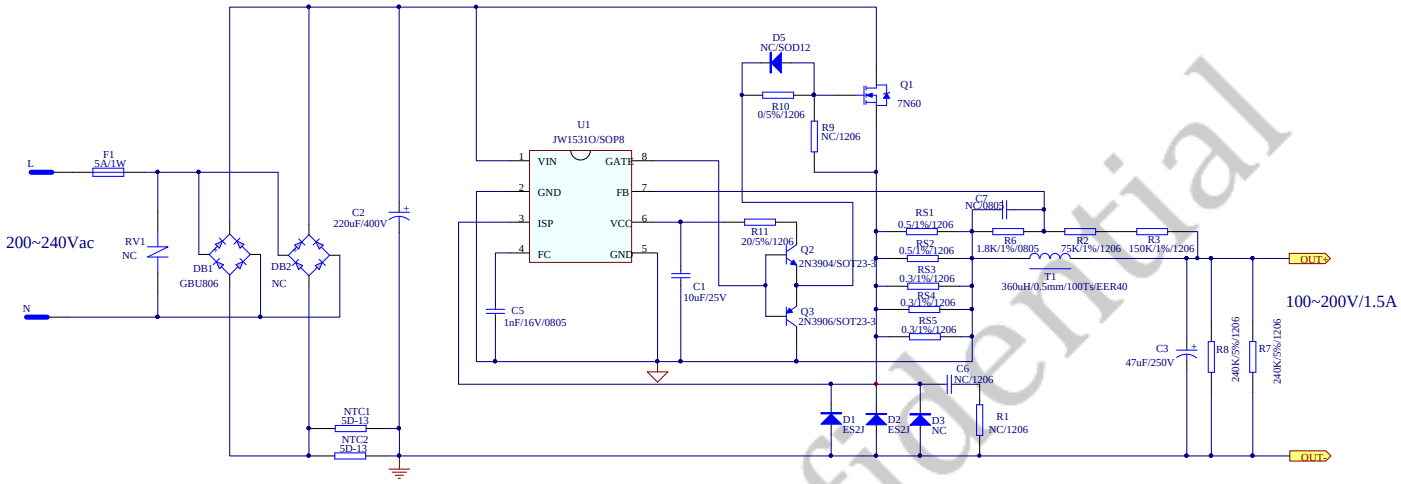
REFERENCE DESIGN

Reference 1：

V_{IN}: 200VAC~240VAC

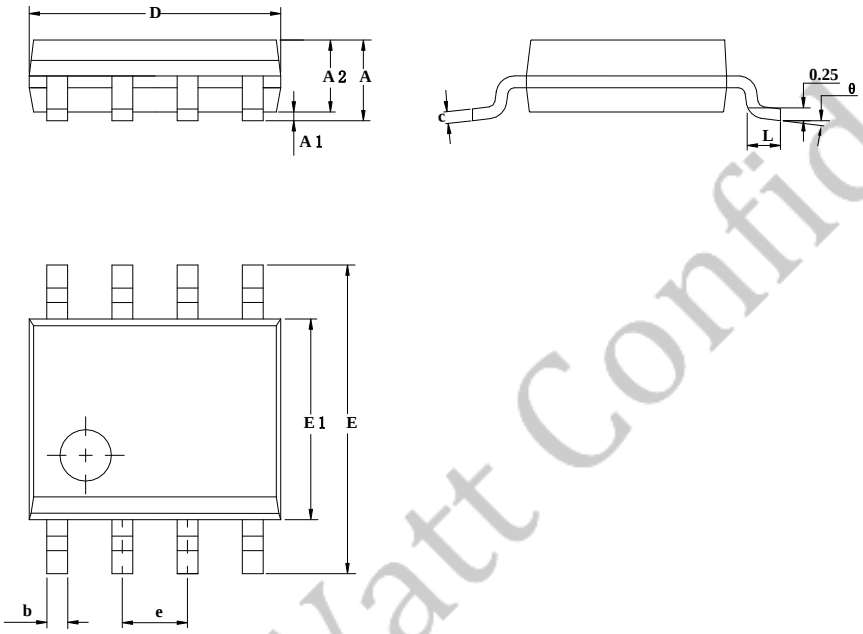
V_{OUT}: 100~200V

I_{OUT}: 0~1.5A



PACKAGE OUTLINE

SOP8 UNIT: mm



Symbol	MILLIMETER		
	MIN	NOM	MAX
A	—	—	1.75
A1	0.05	0.15	0.25
A2	1.25	1.40	1.65
b	0.32	0.42	0.52
c	0.10	0.20	0.30
D	4.50	5.00	5.50
E	5.50	6.00	6.50
E1	3.50	3.90	4.30
e	1.27TYP		
L	0.40	—	1.27
θ	0°	—	8°

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