JW1531B

BUCK CC/CV Driver Without Auxiliary Winding

Parameters Subject to Change Without Notice

DESCRIPTION

The JW®1531B is a constant voltage constant current driver with high accuracy.

JW1531B 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.

JW1531B has multi-protection functions which largely enhance the safety and reliability of the system, including VCC over-voltage protection, VCC UVLO, LED short protection and over-temperature protection.

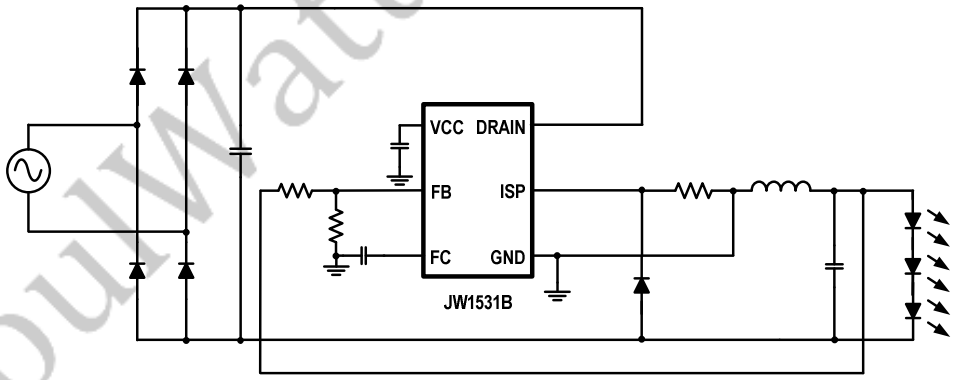
FEATURES

- No auxiliary winding
- Supplied from line voltage directly
- High current accuracy of line and load regulation
- Critical conduction mode
- High efficiency over wide operating range
- LED short protection
- Internal over-temperature protection
- SOP7 package

APPLICATIONS

- Smart LED Lighting
- Home Appliance

TYPICAL APPLICATION



ORDER INFORMATION

DEVICE[1)]	PACKAGE	TOP MARKING[2)]
JW1531BSOPA#TRPBF	SOP7	JW1531B XXXXXXX

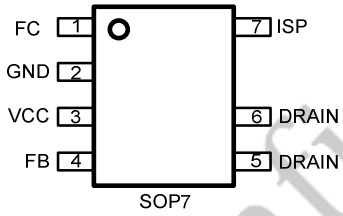
Notes:

1) JW□□□□#TRPBF
   - PB Free
   - Tape and Reel(If "TR" is not shown, it means tube)
   - Package Code
   - Part No.

2) Line 1 of top marking means Part No., and the line 2 of top marking means Date Code.

PIN CONFIGURATION

TOP VIEW



ABSOLUTE MAXIMUM RATING[1)]

VCC 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

VCC Voltage……10V to13V
Operating Junction Temp (T_J) ……-40ºC to 125ºC

THERMAL PERFORMANCE[4)]

	θ_{JA}	θ_{JC}
SOP7	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

T_A=25℃, unless otherwise stated.						
Item	**Symbol**	**Condition**	**Min.**	**Typ.**	**Max.**	**Units**
VCC Start-Up Voltage	V_{CC_ST}		12	13.5	15	V
VCC Shut Down Voltage	V_{CC_UVLO}		8	9.3	11	V
VCC Quiescent Current[5)]	I_{CCQ}	VCC=6V		90		μA
VCC Operational Current	I_{CCO}	VCC=15.5V	180	250	285	μA
VCC Over Voltage Threshold	V_{TH_OVP}		16.7	18.5	20.2	V
VCC Shunt Current	I_{SHUNT}	VCC=18V	2.8	5	7.1	mA
ISP Reference Voltage	V_{ISP_REF}		218	230	242	mV
ISP Minimum Voltage[5)]	V_{ISP_MIN}			120		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
MOS R_{dson}[5)]	R_{dson}	V_{gs}=10V		6		Ω
MOS Breakdown Voltage	BV		500			V
Over Thermal Protection Threshold[5)]	$Temp_{OTP}$			145		℃

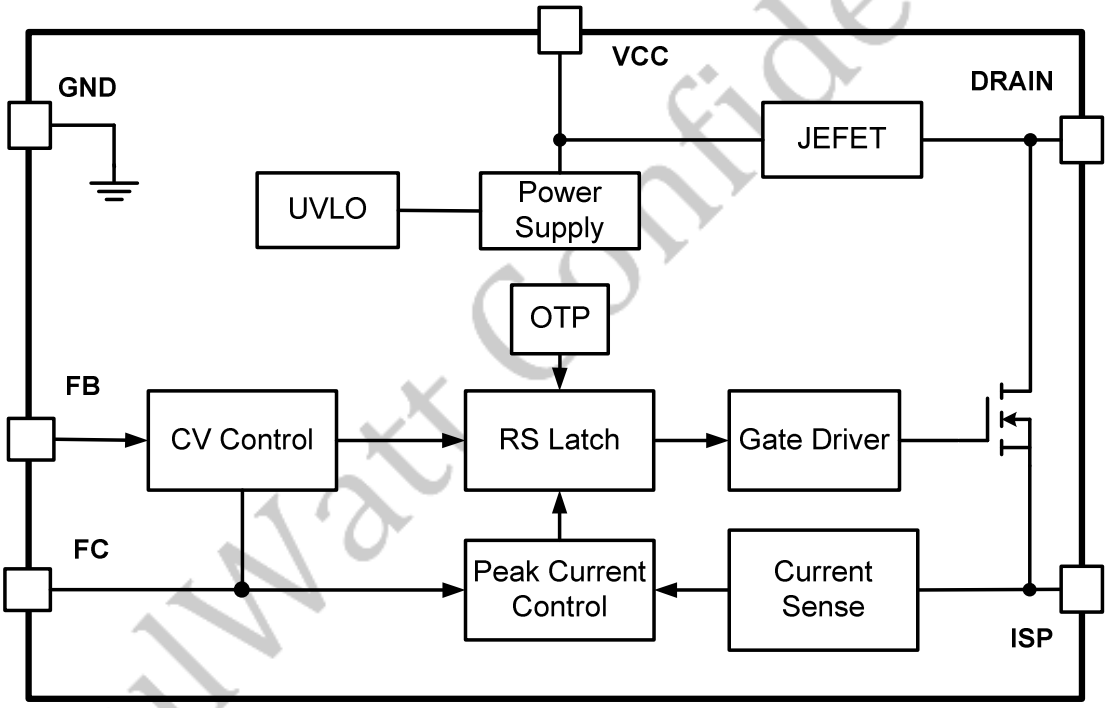
Note:

5) Guaranteed by design.

PIN DESCRIPTION

Pin	Name	Description
1	FC	Output of the error amplifier. This pin must be locally bypassed with a capacitor.
2	GND	Chip ground.
3	VCC	Power supply pin.
4	FB	Voltage loop feedback pin. FB is used to detect the output voltage.
5, 6	DRAIN	Drain of the MOSFET
7	ISP	Output current sense. This pin is used for output current control.

BLOCK DIAGRAM

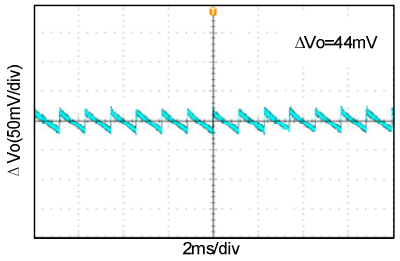


TYPICAL PERFORMANCE CHARACTERISTICS

Waveforms, V_{IN}=230VAC, V_{OUT}=5V, Io=450mA, L=320μH, unless otherwise noted

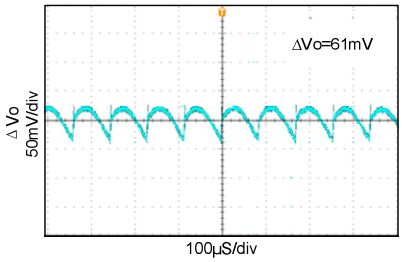
Steady State

Io=0



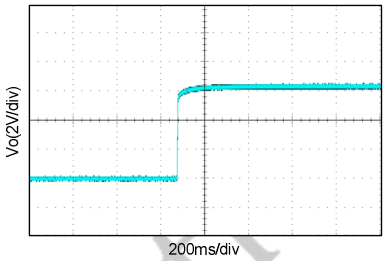
Steady State

Io=450mA



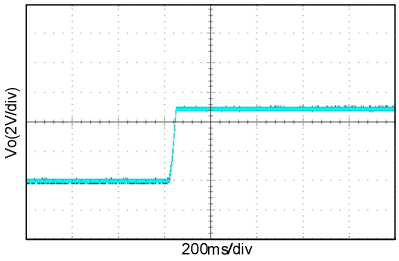
Power on

Io=0



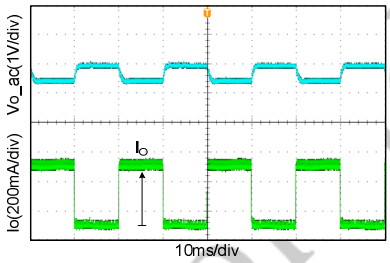
Power on

Io=450mA

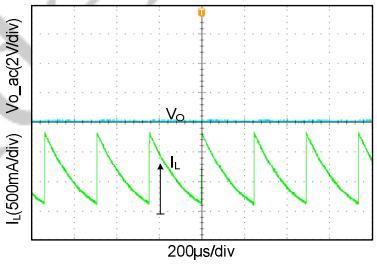


Load transient

0 Load to 450mA Load to 1 Load



Output short protection

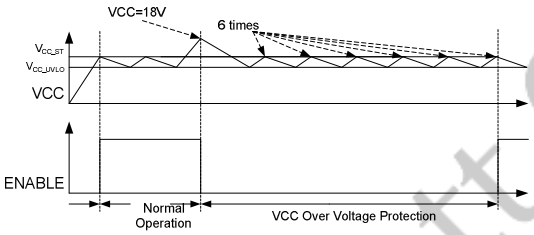


FUNCTIONAL DESCRIPTION

JW1531B is a constant voltage constant current driver. The unique high precision CV/CC control with high level protection features makes it suitable for smart LED lighting applications.

Start Up

JW1531B can be supplied from line voltage directly. When VCC is charged up to VCC Start-Up Voltage(V_{CC_ST}), the GATE driver begins to switch. Also, JW1531B 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 V_{CC_UVLO}. When VCC is charged to V_{CC_ST} for 6 times, the system restarts.



Constant Current Control

The JW1531B controls the output current from the information of the sensed resistor voltage. The output LED maximum mean current can be calculated as:

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

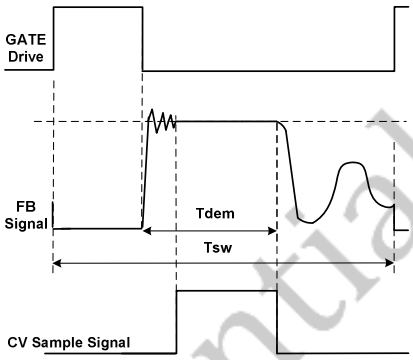
Where

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

V_{ISP_REF}–ISP Reference Voltage

Constant Voltage Control

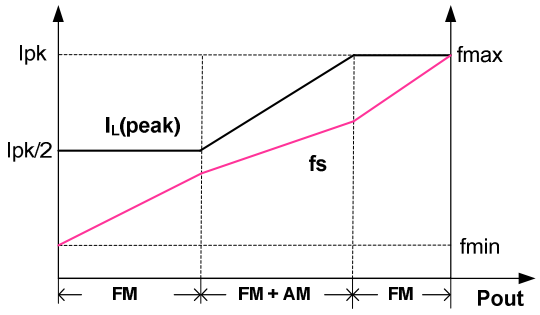
The output voltage can be sensed by FB pin. The figure shows below illustrates the CV sampling signal timing waveform in JW1531B. To achieve an accurate representation of the output voltage, the CV sampling signal blocks the FB ringing.



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 JW1531B 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, JW1531B decrease the output current to help the chip cooling.

PCB Design

When designing the PCB of the JW1531B system, please follow the directions:

1. The VCC pin must be locally bypassed with a capacitor.
2. Make the area of the power loop as small as possible in order to reduce the EMI radiation.
3. The chip should be far away from the heating element, such as the inductor and the freewheel diode.
4. Note the chip ground is not connected to the cathode of the input capacitor as usual.

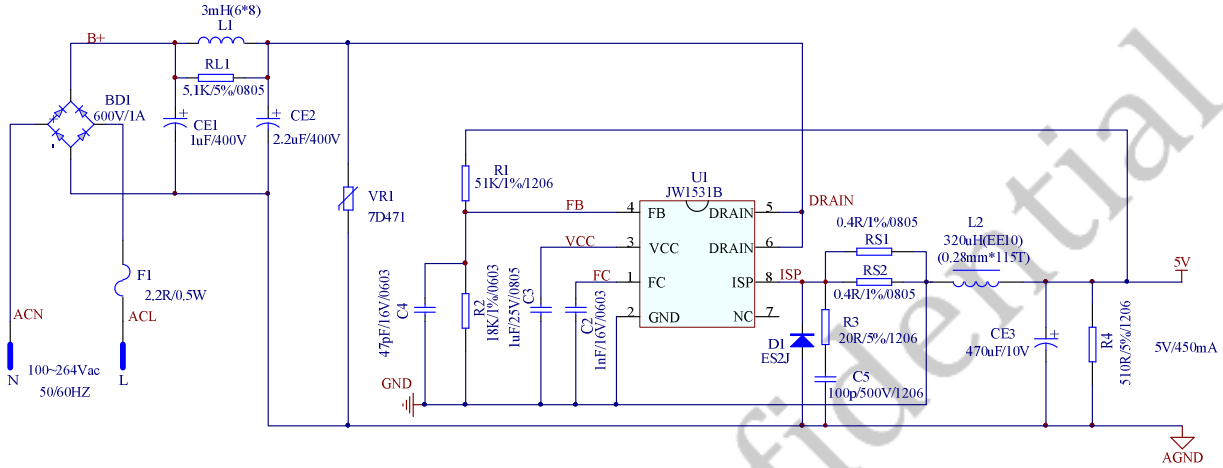
REFERENCE DESIGN

Reference 1：

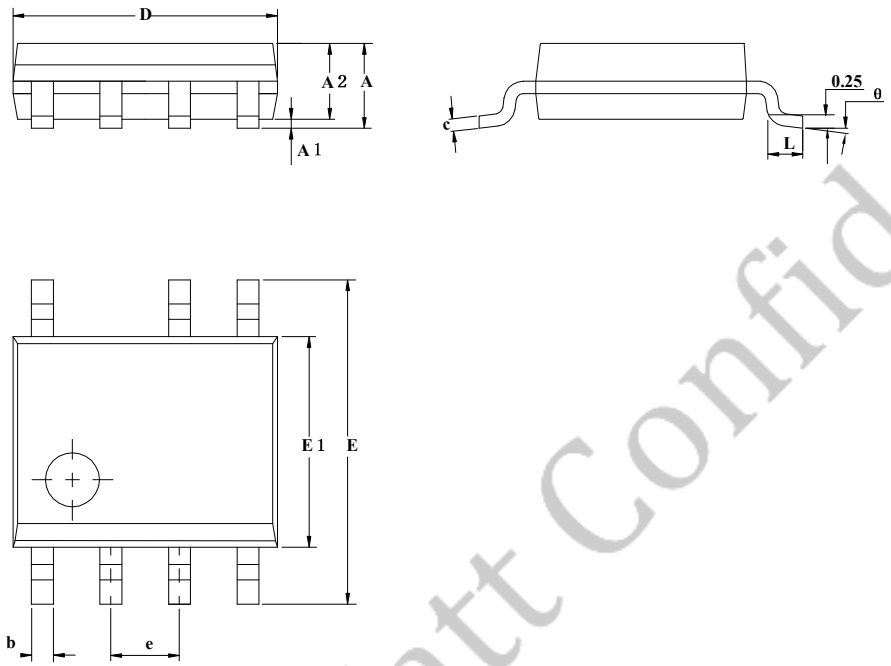
V_{IN}: 90VAC~264VAC

V_{OUT}: 5V

I_{OUT}: 0~450mA



SOP7 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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