JW1531M/JW1531B

BUCK CC/CV Driver Without AuxiliaryWinding

Parameters Subject to Change Without Notice

DESCRIPTION

The JW®1531B/JW1531M is a constant voltage constant currentdriver with high accuracy.

JW1531M/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.

JW1531M/JW1531B has multi-protection functions which largely enhance the safety and reliability of the system, including VCC over-voltage protection, VCC UVLO, LED short protectionand over-temperature protection.

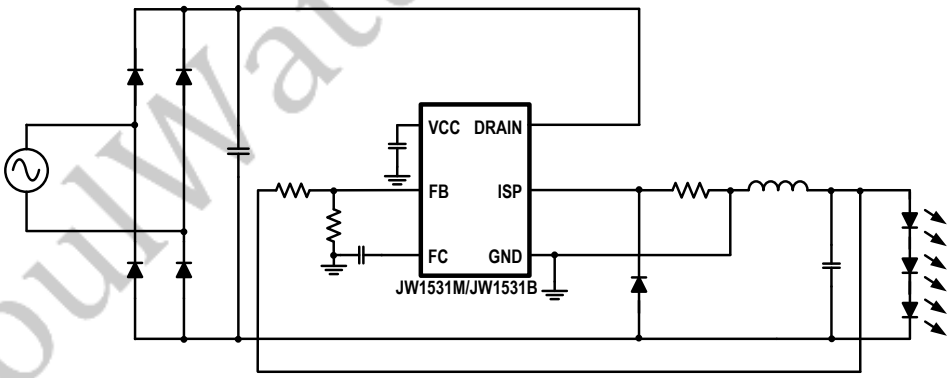
FEATURES

- 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

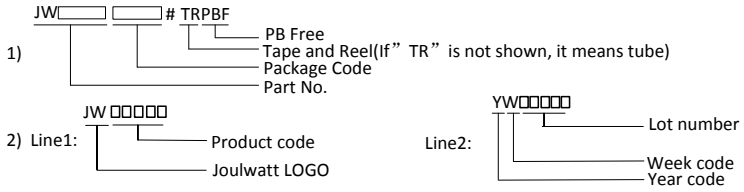
TYPICAL APPLICATION



ORDER INFORMATION

DEVICE[1)]	PACKAGE	TOP MARKING[2)]
JW1531MSOPA#TRPBF	SOP7	JW1531M YW□□□□□
JW1531BSOPA#TRPBF	SOP7	JW1531B YW□□□□□

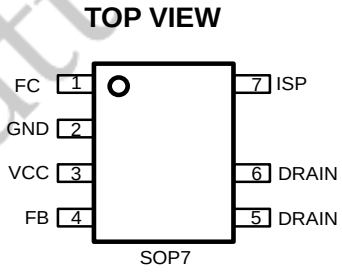
Notes:



DEVICE INFORMATION

DEVICE	MOS BV	MOS RDSON
JW1531MSOPA#TRPBF	500V	15Ω
JW1531BSOPA#TRPBF	500V	6Ω

PIN CONFIGURATION



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 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
MOS R_{dson}[5)]	JW1531M	R_{dson}	V_{gs}=10V		15		Ω
	JW1531B				6		Ω
MOS Breakdown Voltage	JW1531M	BV		500			V
	JW1531B			500			V
Over Thermal Protection Threshold[5)]		$Temp_{OTP}$			145		℃

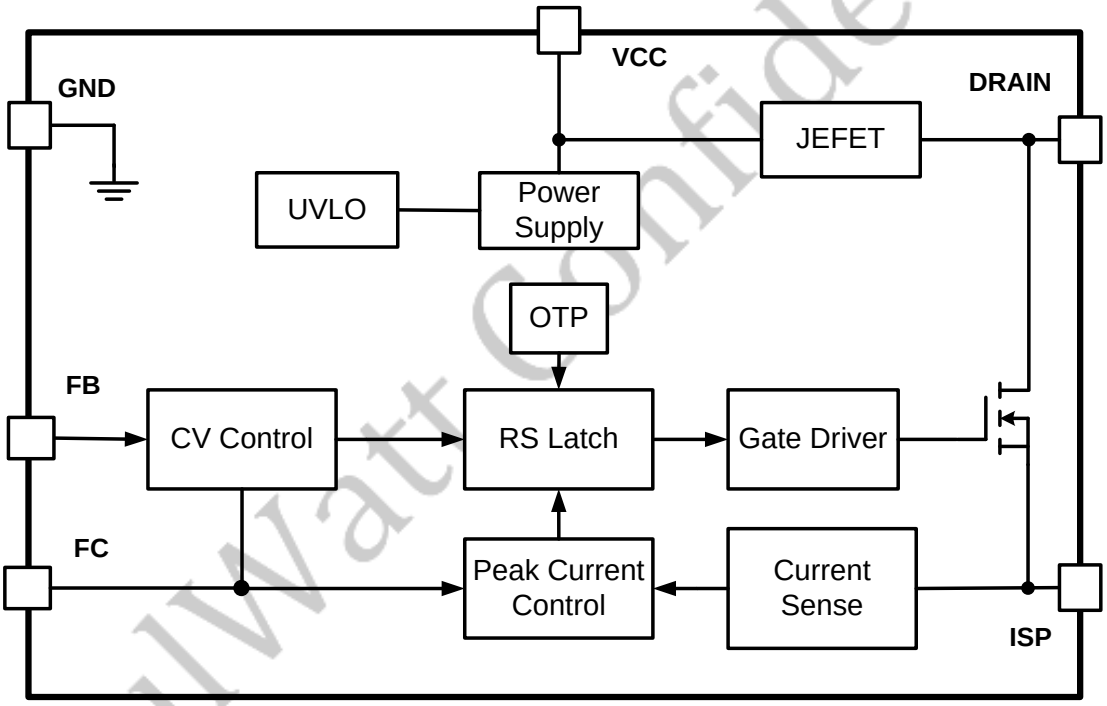
Note:

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

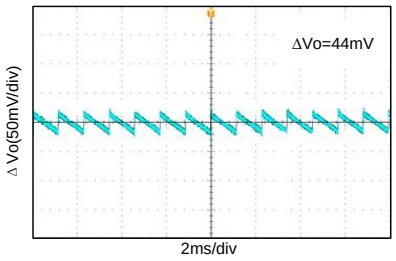


TYPICAL PERFORMANCE CHARACTERISTICS

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

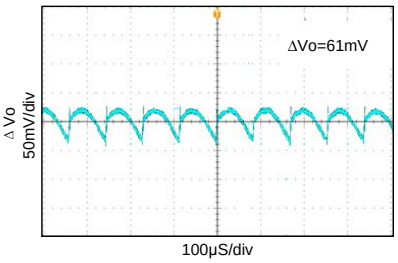
Steady State

Io=0



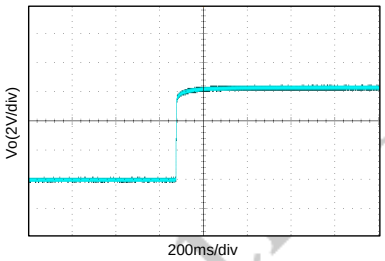
Steady State

Io=450mA



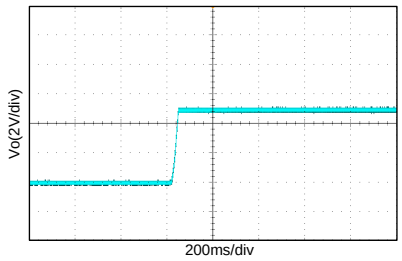
Power on

Io=0



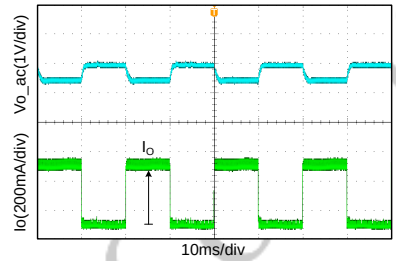
Power on

Io=450mA

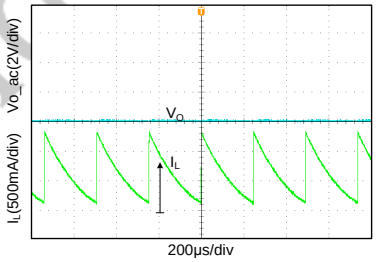


Load transient

0 Load to 450mA Load to 1 Load



Output short protection

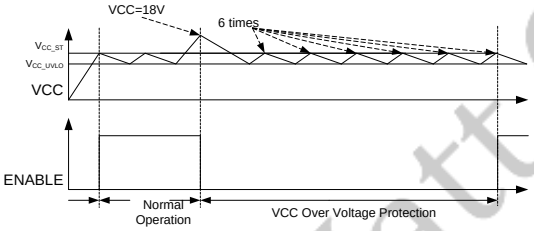


FUNCTIONAL DESCRIPTION

JW1531M/JW1531B is a constant voltage constant currentdriver.Theunique high precision CV/CC control with high level protection features makes it suitable for smart LED lighting applications.

Start Up

JW1531M/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, JW1531M/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 JW1531M/JW1531B controls the output current from the information of the sensed resistor voltage. The output LED maximum mean current can be calculated as:

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

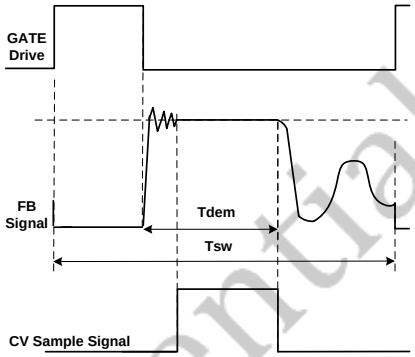
Where

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

V_{ISP_REF}–ISP Reference Voltage

Constant Voltage Control

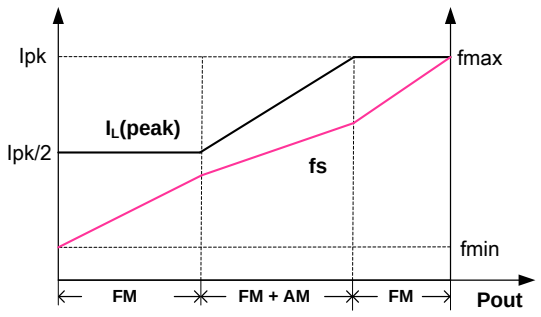
The output voltage can be sensed by FB pin. The figure shows below illustrates the CV sampling signal timing waveform in JW1531M/JW1531B. To achieve an accurate representation of the output voltage, the CV sampling signal blocks the FB ringing.



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 JW1531M/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.

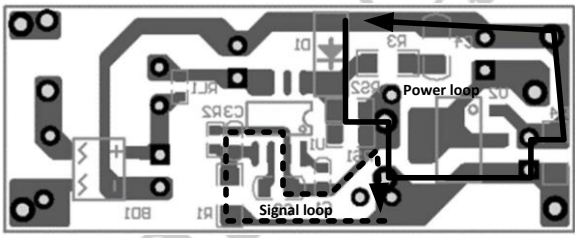
LED Over Temperature Protection

When internal temperature of the chip exceeds 145°C, JW1531M/JW1531B decrease the output current to help the chip cooling.

PCB Design

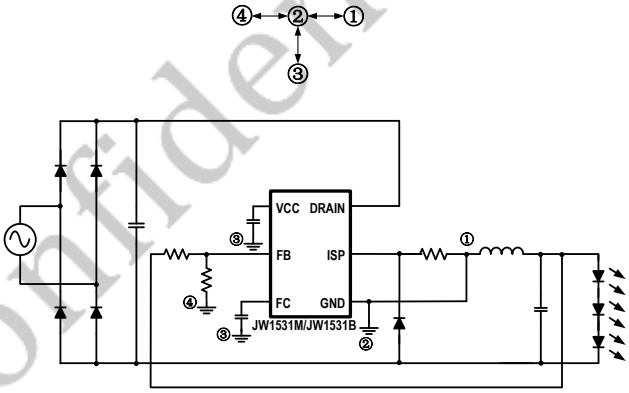
When designing the PCB of the JW1531M/JW1531B system, please follow the directions to guarantee the key signal sampling reliability:

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.



Black thick line: power loop
Black dotted line: signal loop

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 inductor 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.



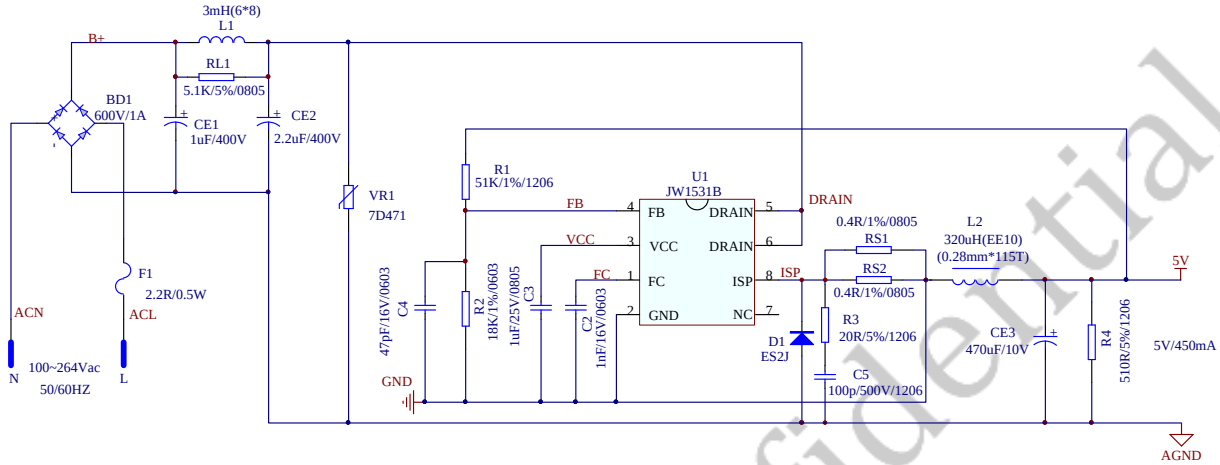
REFERENCE DESIGN

Reference 1：

V_{IN}: 90VAC~264VAC

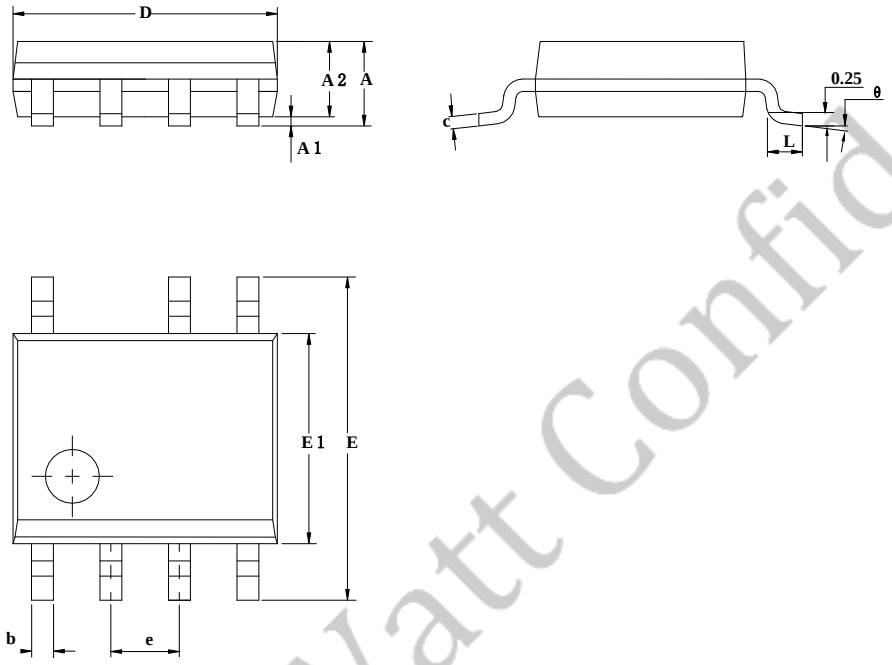
V_{OUT}: 5V

I_{OUT}: 0~450mA



PACKAGE OUTLINE

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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