

*Parameters Subject to Change Without Notice*

## DESCRIPTION

The JW<sup>®</sup>1738B is a constant current LED regulator with high current accuracy which applies to single stage step-down power factor corrected LED drivers. Power MOS is integrated, which can significantly simplify the design of LED lighting system.

High accuracy of output current is achieved by sampling the output current directly. Critical conduction mode operation reduces the switching losses and largely increases the efficiency. JW1738B is supplied from the output directly, and auxiliary winding is not needed.

JW1738B has multi-protection functions which largely enhance the safety and reliability of the system, including VCC UVLO, short-circuit protection, LED open protection, cycle-by-cycle current limit and over-temperature protection.

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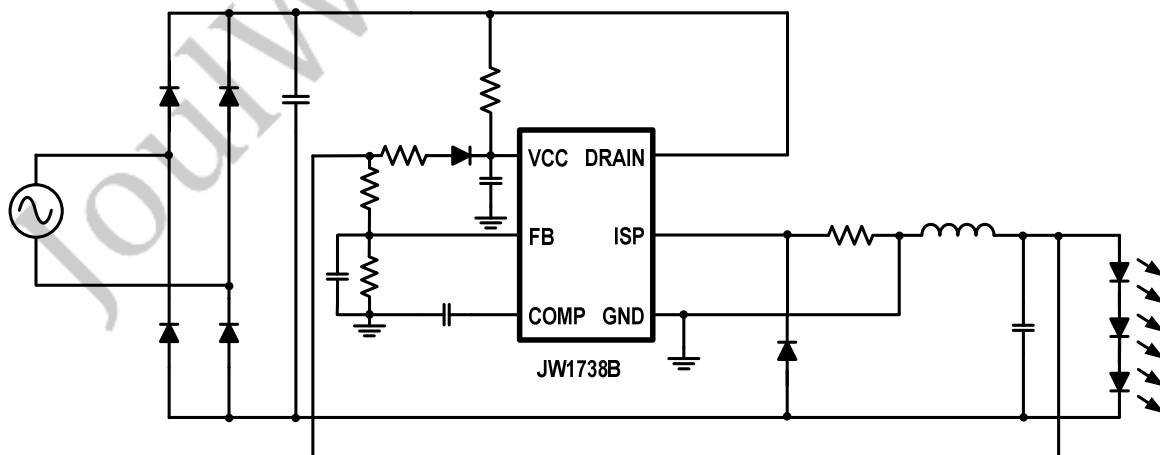
## FEATURES

- No auxiliary winding
- high voltage MOSFET integrated
- EMI friendly
- High current accuracy of line and load regulation
- High power factor with low output current-ripple
- Critical conduction mode
- High efficiency over wide operating range
- Cycle-by-cycle current limit
- LED short protection
- LED open protection
- Over-temperature protection
- Compact SOP7 package

## APPLICATIONS

- Non-isolation Offline LED driver

## TYPICAL APPLICATION



**ORDER INFORMATION**

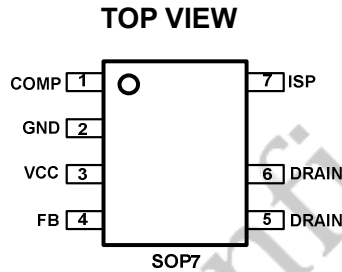
DEVICE <sup>1)</sup>	PACKAGE	TOP MARKING <sup>2)</sup>
JW1738BSOPA#TRPBF	SOP7	JW1738B XXXXXXX

**Notes:**

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

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

**PIN CONFIGURATION**



**ABSOLUTE MAXIMUM RATING<sup>1)</sup>**

VCC PIN.....	43V
All other pins.....	-0.3V to 4.5V
Junction Temperature <sup>2) 3)</sup> .....	150°C
Lead Temperature.....	260°C
Storage Temperature.....	-65°C to +150°C
ESD Susceptibility (Human Body Model) .....	2kV

**RECOMMENDED OPERATING CONDITIONS**

VCC PIN .....	.8V to 30V
FB PIN .....	1.6V to 2.6V
Operating Junction Temp(T <sub>J</sub> ).....	-40°C to 125°C

**THERMAL PERFORMANCE<sup>4)</sup>**

	$\theta_{JA}$	$\theta_{JC}$
SOP7 .....	96.....	45°C/W

**Note:**

- 1) Exceeding these ratings may damage the device.
- 2) JW1738B guarantees robust performance from -40°C to 150°C junction temperature. The junction temperature range specification is assured by design, characterization and correlation with statistical process controls.
- 3) The JW1738B 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 JE51-7, 4-layer PCB.

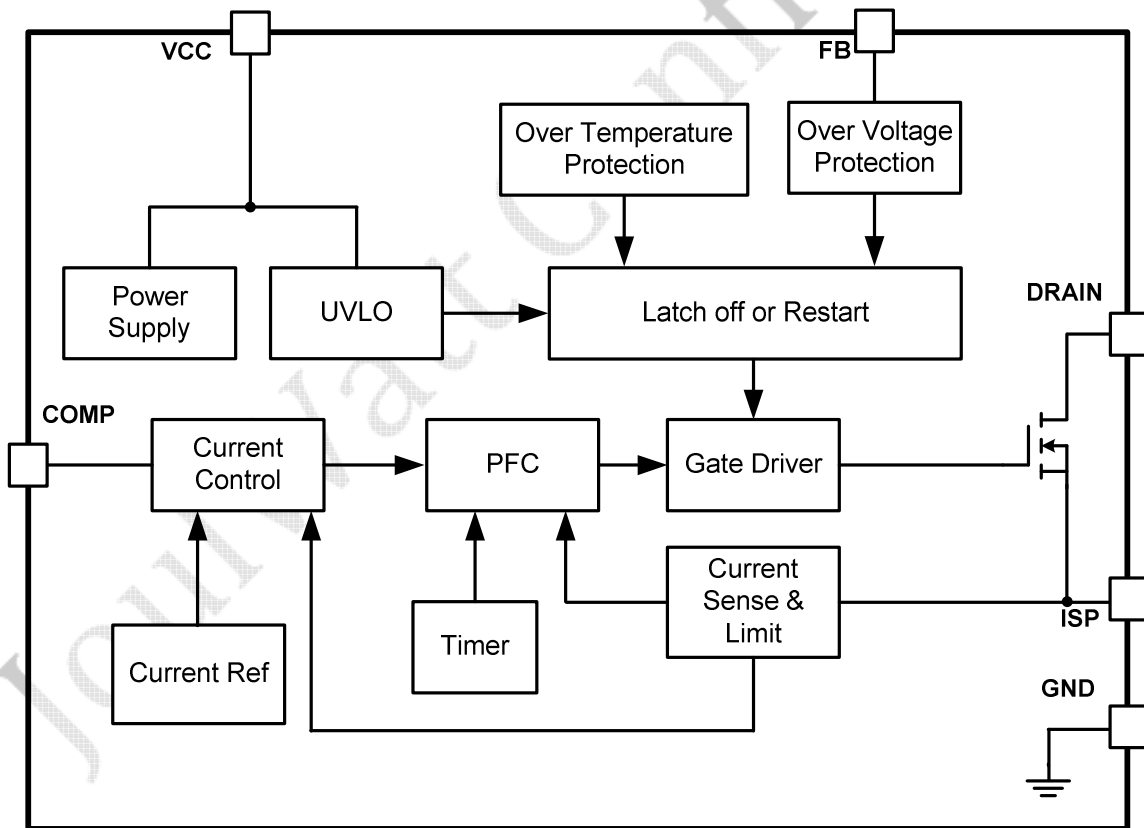
## ELECTRICAL CHARACTERISTICS

<i>V<sub>IN</sub> = 20V, T<sub>A</sub> = 25°C, unless otherwise stated.</i>						
Item	Symbol	Condition	Min.	Typ.	Max.	Units
V <sub>CC</sub> Turn-On Voltage	V <sub>CC_ON</sub>		18	21.0	24	V
V <sub>CC</sub> Turn-off Low Voltage	V <sub>CC_OFF_L</sub>		6	8	10	V
V <sub>CC</sub> Hysteresis	V <sub>CC_HYS</sub>	V <sub>CC_ON</sub> -V <sub>CC_OFF_L</sub>		13		V
V <sub>CC</sub> Clamp	V <sub>CC_CLP</sub>			30		V
V <sub>CC</sub> Shunt Regulator Current Limit	I <sub>CC_SHUNT</sub>	V <sub>CC</sub> = 48V	8	10	13	mA
V <sub>CC</sub> Quiescent Current	I <sub>Q</sub>	V <sub>CC</sub> < V <sub>CC_ON</sub>	22	31	41	uA
FB Pin High Threshold	V <sub>FB_H</sub>		2.95	3.1	3.25	V
V <sub>ISP</sub> Sample Value	V <sub>ISP</sub>		192	200	208	mV
V <sub>ISP</sub> Max Voltage			1.1	1.2	1.3	V
COMP Source Current	I <sub>COMP</sub>		6	8	10	uA
Leading Edge Blanking Time	T <sub>LEB</sub>		500	750	1000	ns
Maximum Frequency	F <sub>MAX</sub>			120	145	kHz
Maximum MOS On Time	T <sub>ONMAX</sub>			30		us
MOS R <sub>dson</sub>	R <sub>dson</sub>	V <sub>gs</sub> =10V		1.8		Ω
Breakdown Voltage	BV		600			V

**PIN DESCRIPTION**

Pin	Name	Description
1	COMP	Compensation Pin for Internal Error Amplifier. Connect a capacitor between the pin and GND to compensate the internal feedback loop.
2	GND	Ground.
3	VCC	Power Supply Pin. This pin supplies current to the internal start-up circuit. This pin must be bypassed with a capacitor nearby.
4	FB	Voltage Loop Feedback Pin. FB is used to detect LED open by sampling the output voltage.
5,6	DRAIN	DARIN of the MOSFET.
7	ISP	Output Current Sense Pin. The pin is used for output current control.

**BLOCK DIAGRAM**



**FUNCTIONAL DESCRIPTION**

The JW1738B is a constant current LED regulator which applies to non-isolation step-down LED system with power factor correction. Power MOS is integrated, which can significantly simplify the design of LED lighting system. JW1738B can achieve excellent line and load regulation, high efficiency and low BOM cost.

**Start Up**

When the pull-up resistor charges VCC up to 21V, the gate drive signal begins to switch, and the output begins to provide power to the VCC pin when the output is enough. An internal voltage clamp is attached to the Vcc pin to prevent VCC from being too high. An internal 10mA current pulls the VCC down when it is above 30V. When VCC is lower than 8V, it stops switching.

**Loop Compensation**

An integrator configuration is applied to the output current feedback loop with a capacitor connected to the COMP pin. For offline applications, the crossover frequency should be set much less than the line frequency of 120Hz or 100Hz. To have a good PFC performance, a capacitor of 1μF connected to COMP pin is recommended.

**Constant Current Control**

The JW1738B controls the output current from the information of the current sensing resistor. The output LED mean current can be calculated as:

$$I_{LED} = V_{ISP} / R_{CS} \quad (A)$$

Where

V<sub>ISP</sub>—200mV typically;

R<sub>CS</sub> – The sensing resistor connected between ISP and GND.

**Critical Conduction Mode Operation**

JW1738B works in the critical conduction mode of the inductor current. When the internal power MOSFET turns on, the inductor current begins to increase from zero. The turn on time of the MOSFET can be calculated as:

$$T_{ON} = I_{PK} \times L / (V_{IN} - V_{LED})$$

Where,

L –inductance.

I<sub>PK</sub> –peak current in one switch period.

V<sub>IN</sub>– input voltage after rectification and filtering.

V<sub>LED</sub> – output LED voltage.

When the power MOSFET turns off, the inductor current begins to decrease. The power MOSFET turns on again when the inductor current is zero. The turn off time of the MOSFET can be calculated as:

$$T_{OFF} = I_{PK} \times L / V_{LED}$$

And the inductance of the system can be calculated as:

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

Where, f is the switching frequency. You may choose the minimum input voltage when you want to set up the minimum switching frequency.

**LED Over Temperature Protection**

When internal temperature of the chip exceeds 145°C, JW1738B decrease the source current of COMP to degrade LED current.

**LED Open Protection**

The output voltage can be detected by the FB pin. When the FB voltage is higher than 3.1V, the LED open protection is triggered and the power MOSFET gate driver stops switching. After several hundred milliseconds, the gate driver starts switching again. The value of FB pull up resistor should not be large than 200K Ω , and FB parallel connection capacitor is

necessary, the value of capacitor is about 15pF.

### **LED short protection**

JW1738B judges LED short from the FB voltage. During a shorted LED condition, JW1738B reduces the internal command current to a very low level and slows down the switching frequency to 1.25 kHz to decrease the output current.

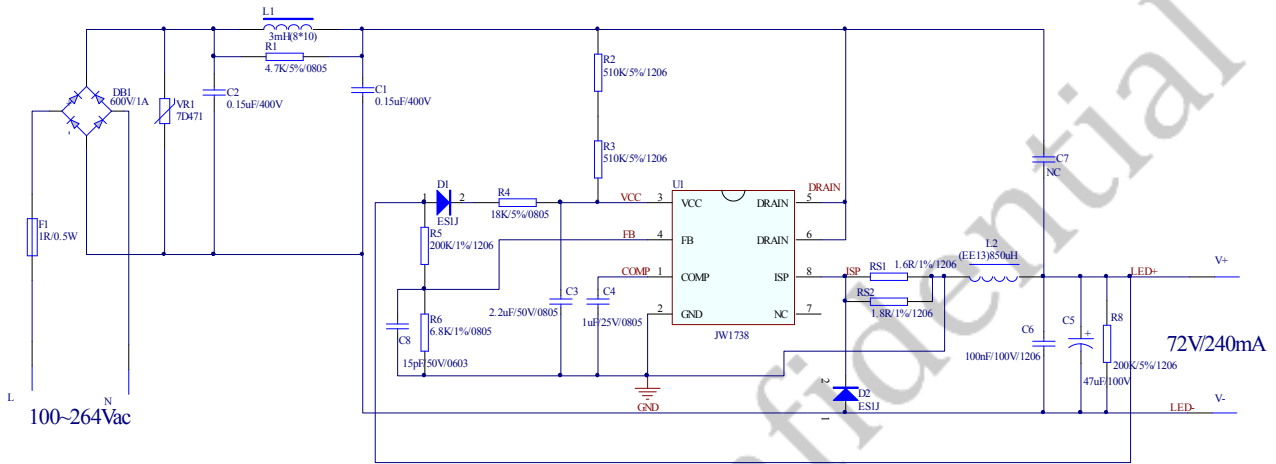
### **PCB Layout Guidelines**

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 components, such as transformer and diode.
4. Note the chip ground is not connected to the cathode of the input capacitor as usual.

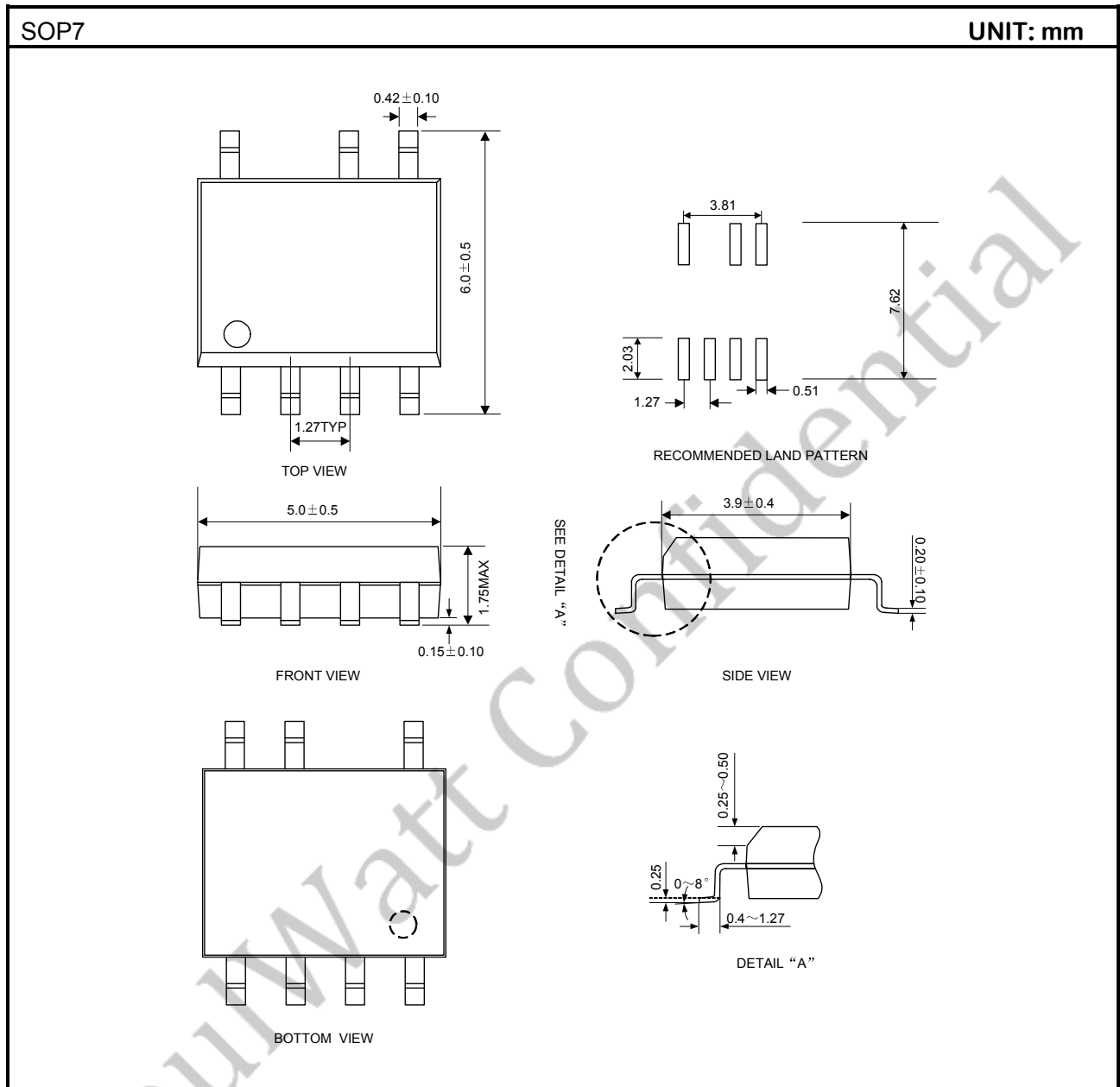
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REFERENCE DESIGN

VIN: 100VAC~264VAC  
 VOUT: 40~70V  
 IOU: 240mA  
 PF: >0.9



PACKAGE OUTLINE





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