JW18288B/JW18288C
JW18288D/JW18288E

PWM Dimmable
Non-isolated Buck LED Regulator

Parameters Subject to Change Without Notice

DESCRIPTION

JW®18288B/JW18288C/JW18288D/JW18288E (JW18288X series) is a non-isolated PWM dimmable constant current LED regulator with high current accuracy which applies to single stage step-down LED drivers.

JW18288X series is supplied from the line directly without auxiliary winding or external capacitor, which can lower the system BOM cost. Patented algorithms ensure good current accuracy and excellent line/load regulations.

With unique sampling techniques, JW18288X series has multi-protection functions which can largely enhance the safety and reliability of the system, including LED short protection, LED open protection and over-temperature protection.

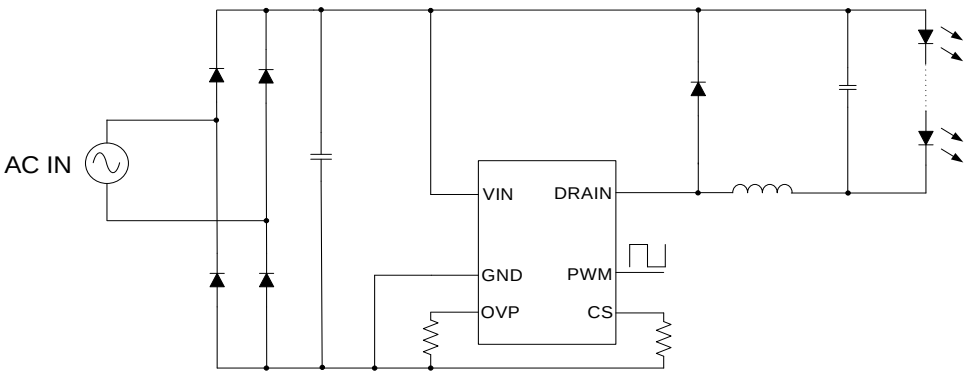
FEATURES

- No Auxiliary Winding
- Excellent Line/load Regulation
- Internal PWM to Analog Dimming
- High Efficiency
- LED Short Protection
- LED Open Protection
- DIP7 Package

APPLICATIONS

- LED Driver

TYPICAL APPLICATION



ORDER INFORMATION

DEVICE[1)]	PACKAGE	TOP MARKING[2)]	ENVIRONMENTAL[3)]
JW18288BDIPA#TB	DIP7	JW18288B YW□□□□□	Green
JW18288CDIPA#TB	DIP7	JW18288C YW□□□□□	Green
JW18288DDIPA#TB	DIP7	JW18288D YW□□□□□	Green
JW18288EDIPA#TB	DIP7	JW18288E YW□□□□□	Green

Note：

1) JW□□□□#TB
- TB means tube
- Package Code
- Part No.

2) Line1: JW □□□□
- Product code
- Joulwatt LOGO

Line2: YW□□□□□
- Lot number
- Week code
- Year code

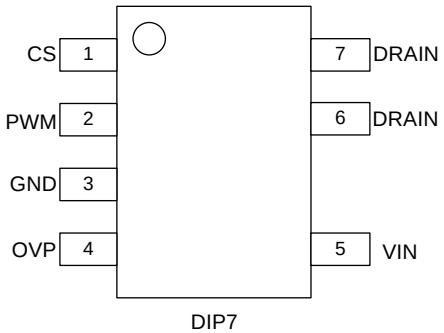
3) All Joulwatt products are packaged with Pb-free and Halogen-free materials and compliant to RoHS standards.

DEVICE INFORMATION

DEVICE	MOS BV	MOS RDSON
JW18288BDIPA#TB	500V	6Ω
JW18288CDIPA#TB	500V	2.9Ω
JW18288DDIPA#TB	500V	2.2Ω
JW18288EDIPA#TB	500V	1.8Ω

PIN CONFIGURATION

TOP VIEW



DIP7

ABSOLUTE MAXIMUM RATING[1)]

VIN Voltage..... 700V
DRAIN Voltage..... 500V
Other Pins..... -0.3V to 8V
Junction
Temperature[2)3)].....150ºC
Storage Temperature.....-65ºC to +150ºC

RECOMMENDED OPERATING CONDITIONS

VIN Voltage 500V
DRAIN Voltage 400V
Other Pins..... -0.3V to 5V
PWM Dimming Signal Frequency.....500HZ to 10KHZ
Operating Junction Temperature .....-25ºC to 125ºC

RECOMMENDED OUTPUT VOLTAGE

JW18288X series.....>10V

THERMAL PERFORMANCE[4)]

	θ_{JA}	θ_{JC}
DIP7	80	45ºC/W

Note：

1) Exceeding these ratings may damage the device. These stress ratings do not imply function operation of the device at any other conditions beyond those indicated under RECOMMENDED OPERATING CONDITIONS.

2) The JW18288X series includes thermal protection that is intended to protect the device in overload conditions. Continuous operation over the specified absolute maximum operating junction temperature may damage the device.

3) The device is not guaranteed to function outside of its operating conditions.

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

ELECTRICAL CHARACTERISTICS

T_A=25℃, unless otherwise stated

Item		Symbol	Condition	Min.	Typ.	Max.	Units
Power Supply							
VIN Breakdown Voltage		BV		700			V
Threshold of VIN Power On[5)]		V_{INST}	V_{IN} rising		12.5		V
VIN Quiescent Current		I_Q			250	320	μA
Iq at Standby Mode		I_{SB}	VIN=300V		32	42	μA
Reference and Current Control							
Maximum Peak Voltage		V_{PKMX}		680	725	760	mV
Minimum Peak Voltage		V_{PKMN}			150		mV
Output Current Reference		Vref	PWM =100%	291	300	309	mV
Dimming Output Current Reference[5)]		Vrefd	PWM =3%	8	9	10	mV
Other Parameters							
CS Minimum Voltage for Neon Switch		CSmin			50		mV
Neon Switch VIN Sink Current		I_{NNSK}			1	1.25	mA
MOS Max On Time		T_{ONMAX}		28	40	52	μs
MOS Min On Time[5)]		T_{ONMIN}		0.4	0.6	0.8	μs
MOS Max Off Time		T_{OFFMAX}		280	400	520	μs
MOS Min Off Time[5)]		Toffmin		0.5	0.7	0.9	μs
Protections							
OVP Threshold		V_{OVP1}	R_{OVP} = Float	198	220	232	V
		V_{OVP2}	R_{OVP} = Short	108	120	132	V
		V_{OVP3}	R_{OVP} = 510K	81	90	99	V
OVP Hic-cup Time[5)]		T_{OVP_HC}			560	620	ms
Thermal Protection Threshold[5)]		OTP		140	150	160	℃
PWM Dimming							
PWM High Level		VPH		1.6			V
PWM Low Level		VPL				0.8	V
Maximum Switching Period		T_{SW}			1.2	1.6	ms
Power MOSFET							
Drain-source Voltage	JW18288X series	BV_{DSS}	Vg=0V Ids=250μA	500			V
MOS R_{DSON}	JW18288B	R_{DS_ON}	Vg=15V		6	7	ohm

	JW18288C		Ids=0.5A		2.9	3.5	
	JW18288D				2.2	2.6	
	JW18288E				1.8		
DS Leakage Current	JW18288X series	I_{DSS}	Vg=0V Vds=500V		1	5	μA

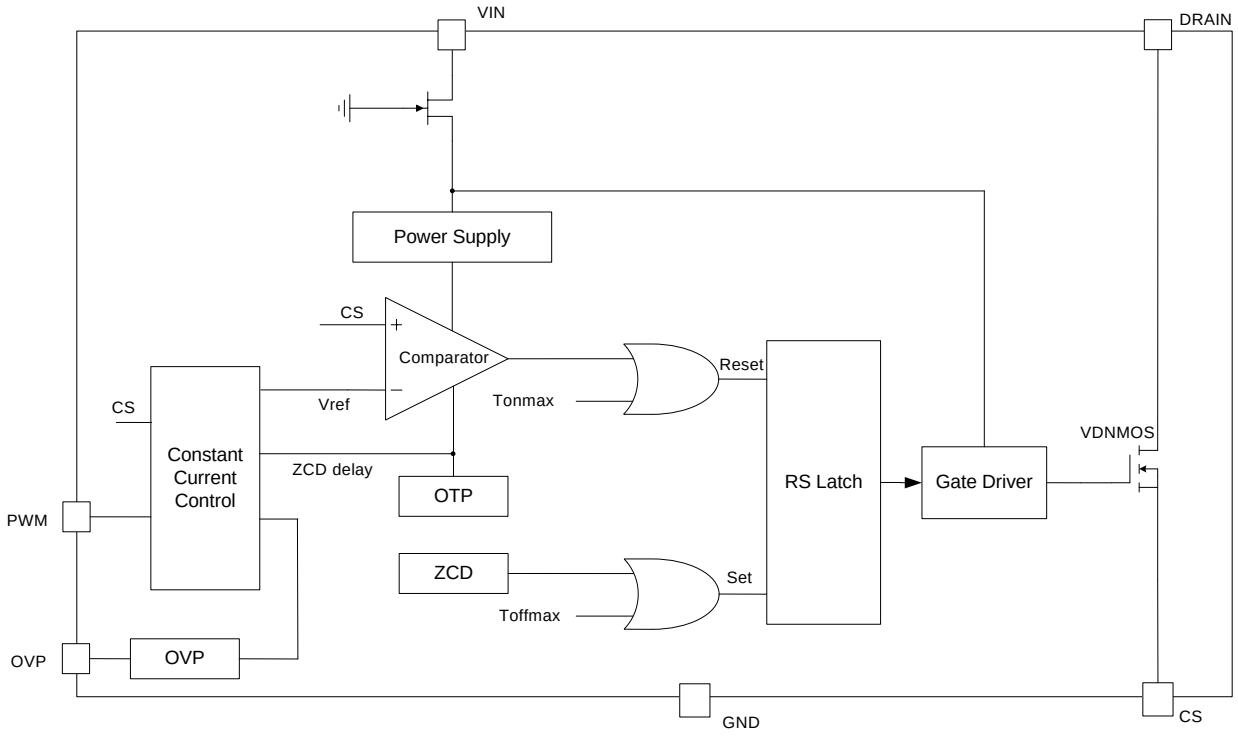
Notes:

5) Guaranteed by design.

PIN DESCRIPTION

Pin	Name	Description
1	CS	Current sensing pin
2	PWM	PWM dimming signal input
3	GND	Ground pin
4	OVP	OVP set pin
5	VIN	Power supply
6,7	DRAIN	The drain of internal power MOSFET

BLOCK DIAGRAM



FUNCTIONAL DESCRIPTION

The JW18288X series is a constant current LED regulator, which applies to non-isolation PWM dimmable step-down LED system. JW18288X series can achieve excellent line and load regulation, high efficiency and low system cost with few peripheral components.

Start Up

When the VIN exceeds the turn-on threshold, the gate driver will start to switch after a 5mS' delay.

PWM Dimming

JW18288X series controls the output current from the information of the current sensing resistor and the injected PWM dimming signal.

The output LED average current can be calculated as:

$$I_{LED} = Duty*V_{REF} /R_S$$

Where,

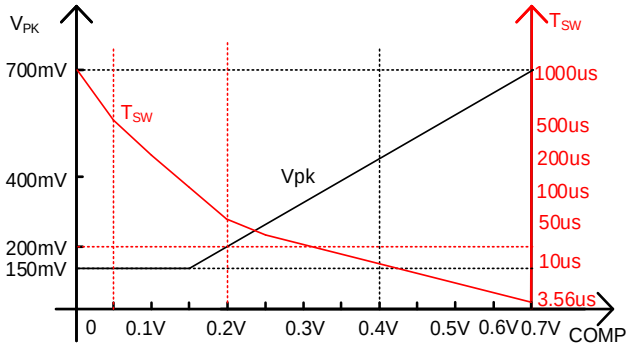
Duty – duty of the PWM dimming signal.

V_{REF} – the reference voltage.

R_S – the sensing resistor connected between the pin CS and chip GND.

JW18288X series incorporates a frequency foldback and variable peak current control strategy to regulate the output current according to the duty of PWM dimming signal.

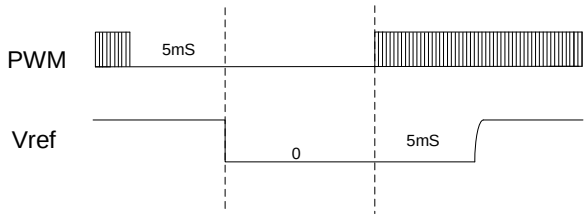
The frequency foldback and variable peak current control all relies on the internal COMP voltage as the figure shows below.



To minimize the audible noise, the peak current decreases to lower than one-third of the maximum peak voltage.

Standby Mode

When the PWM duty equals 0 for continuous 5mS in typical, the chip works at standby mode, in which there is no switching and the quiescent current of the chip decreases to its minimum.



Over Temperature Protection

When the junction temperature is higher than OTP, JW18288X series decreases the output current by decreasing the output current to help the chip cooling.

LED Open Protection

In the LED open condition, the output voltage increases and the duty of each cycles increases accordingly. When the VIN*D is larger than V_{O_OVP} (Setup by R_{OVP} connected to OVP pin), the power MOSFET is shut down and restarts after T_{OVP_HC} (560ms typical). The following table shows the V_{O_OVP} design guide:

OVP Pin	V_{O_OVP}(V)
R_{OVP} =510K	90V
R_{OVP} = short	120V
R_{OVP} = open	220V

LED Short Protection

When the output is shorted, JW18288X series stops switching for T_{OFFMAX} until the next pulse.

PCB Layout Guidelines

1. Make the area of the power loop as small as possible in order to reduce the EMI radiation.
2. JW18288X series should be kept away from noisy and heating components, such as power inductor and freewheel diode.

APPLICATION REFERENCE

This reference design is suitable for 10~20W non-isolated step-down LED driver, using JW18288B, with high efficiency, excellent line regulation.

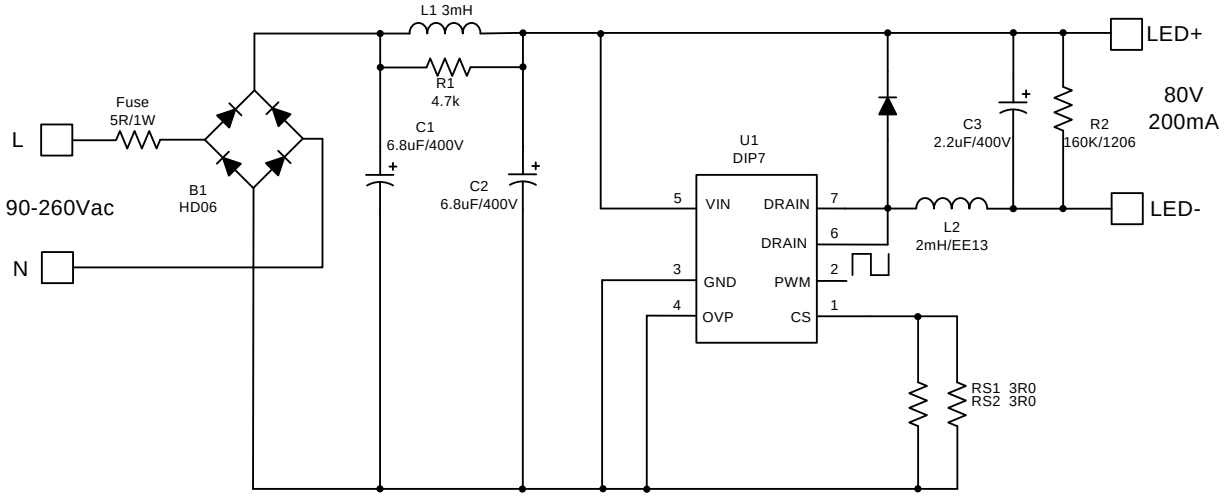
Reference ：

V_{IN}: 90VAC~260VAC

V_{OUT}: 80V

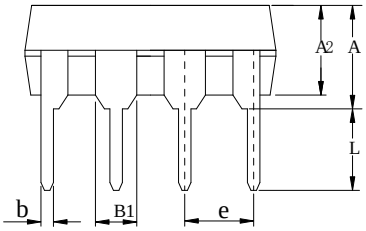
I_{OUT}: 200mA

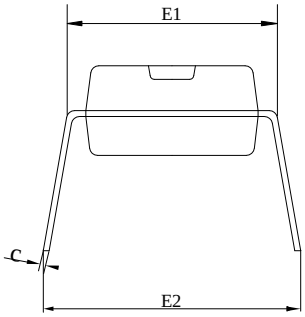
PF: >0.5

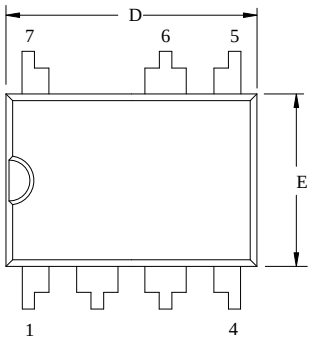


PACKAGE OUTLINE

DIP7 UNIT: mm







SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	3.71	—	4.80
A2	3.15	—	3.60
b	0.38	0.46	0.57
B1	1.42	1.52	1.62
c	0.20	0.25	0.36
D	9.00	—	9.45
E	6.10	—	6.60
E1	7.32	—	8.25
e	2.54BSC		
E2	8.00	—	9.30
L	2.92	—	3.81

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