JW19985M
JW19985A/JW19985B

Non-isolated Buck
LED Driver Regulator

Parameters Subject to Change Without Notice

DESCRIPTION

JW®19985M/JW19985A/JW19985B (JW19985X series) is a non-isolated constant current LED regulator with high current accuracy which applies to step-down LED drivers. Operating in the boundary mode makes it high efficiency and low radiation. Patented algorithms ensure good current accuracy and excellent line/load regulations.

With unique sampling techniques, JW19985X 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.

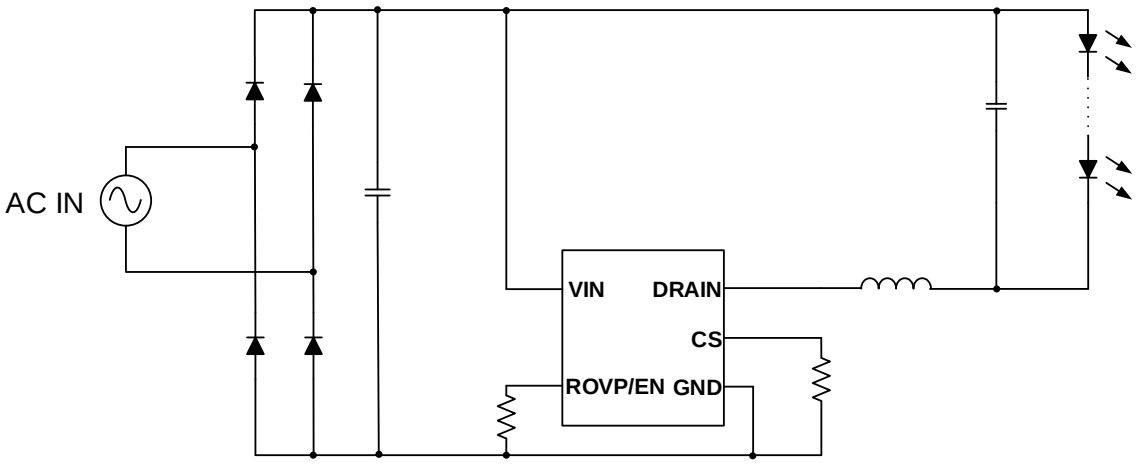
FEATURES

- 600V low V_F freewheeling diode integrated
- 500V MOSFET integrated
- Excellent line/load regulation
- Boundary mode operation
- EN function
- High efficiency
- LED short protection
- LED open protection
- SOP7 package

APPLICATIONS

- LED lighting

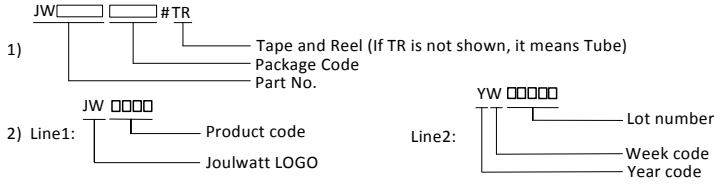
TYPICAL APPLICATION



ORDER INFORMATION

DEVICE[1)]	PACKAGE	TOP MARKING[2)]	ENVIRONMENTAL[3)]
JW19985MSOPA#TR	SOP7	J19985M YW□□□□□	Green
JW19985ASOPA#TR	SOP7	J19985A YW□□□□□	Green
JW19985BSOPA#TR	SOP7	J19985B YW□□□□□	Green

Note：

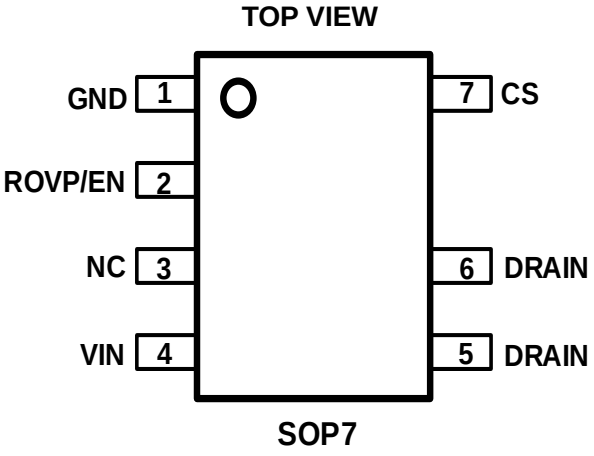


3) All Joulwatt products are packaged with Pb-free and Halogen-free materials and compliant to RoHS standards.

DEVICE INFORMATION

DEVICE	MOS BV	MOS RDSON	OUTPUT CURRENT
JW19985MSOPA#TR	500V	13 Ω	<190mA
JW19985ASOPA#TR	500V	8 Ω	<240mA
JW19985BSOPA#TR	500V	6Ω	<280mA

PIN CONFIGURATION



ABSOLUTE MAXIMUM RATING[1)]

VIN Voltage.....700V
CS Voltage.....-0.3V to 8V
ROVP Voltage..... -0.3V to 8V
DRAIN Pin 500V
Junction Temperature[2)].....150ºC
Storage Temperature.....-65ºC to +150ºC

RECOMMENDED OPERATING CONDITIONS[2)]

VIN Voltage 400V
Operating Junction Temperature.....-25ºC to 125ºC

PN/Package	Limit Output Current (T_J=125℃）[5)]	Recommended MAX Output Current (T_J=125℃）[5)]
JW19985M/SOP-7	<250mA	190mA
JW19985A/SOP-7	<350mA	240mA
JW19985B/SOP-7	<500mA	280mA

RECOMMENDED OUTPUT VOLTAGE

JW19985X.....>15V

THERMAL PERFORMANCE[4)]

	θ_{JA}	θ_{JC}
SOP7	96	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 JW19985X 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.

5) The maximum output current is recommended in the application according to chip junction temperature TJ=125℃. The maximum output current could be increased properly if the heat dissipation is better.

ELECTRICAL CHARACTERISTICS

T_A=25 ℃, unless otherwise stated							
Item		**Symbol**	**Condition**	**Min.**	**Typ.**	**Max.**	**Units**
Threshold of VIN Power On[6)]		V_{IN_ON}	V_{IN} rising		4.5		V
VIN Quiescent Current		I_Q			115	128	μA
Reference Voltage		V_{REF}		390	402	410	mV
MOS Max ON Time		T_{ONMAX}		30	42	55	μs
MOS Min ON Time[6)]		T_{ONMIN}			0.6	0.8	μs
MOS Max OFF Time		T_{OFFMAX}		280	400	528	μs
EN Low Voltage Threshold		V_{EN_L}		0.43	0.5	0.57	V
Vo Over Voltage Protection Threshold[6)]		V_{O_OVP1}	R_{OVP}=200K	66	75	84	V
		V_{O_OVP2}	R_{OVP}=400K	108	120	132	V
		V_{O_OVP3}	R_{OVP} ~float	216	240	264	V
OVP Hic-cup Time[6)]		T_{OVP_HC}			400	440	ms
Drain-source Voltage	JW19985X	BV_{DSS}	Vg=0V Ids=250uA	500			V
MOS R_{DSON}	JW19985M	R_{DS_ON}	Vg=15V Ids=0.5A		13	14	ohm
	JW19985A				8	9	
	JW19985B				6	7	
DS Leakage Current	JW19985X	I_{DSS}	Vg=0V Vds=500V		1	5	uA
Diode Reverse Recovery Time[6)]		T_{RR}	I_F=0.5A,I_R=1A, I_{FF}=0.25A			35	ns
Freewheel Diode BV Voltage[6)]		V_{BRDSD}		600			V
Freewheel Diode Forward Voltage Drop[6)]		V_F	I_F=0.5A			1.68	V
Thermal Protection Threshold[6)]		OTP_{CHIP}		140	150	160	℃

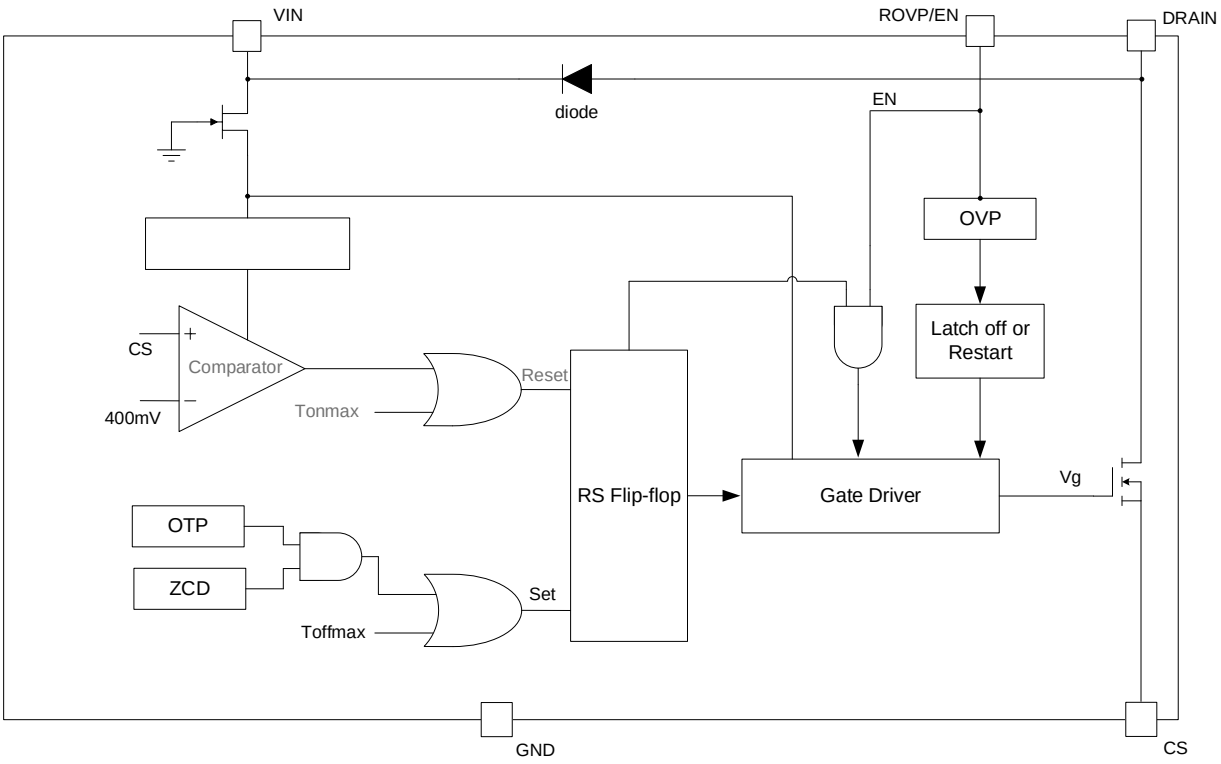
Notes:

6) Guaranteed by design

PIN DESCRIPTION

Pin	Name	Description
1	GND	Chip ground
2	ROVP/EN	LED OVP set pin/ Enable pin
3	NC	Not connected
4	VIN	Power supply
5,6	DRAIN	The drain of internal power MOSFET
7	CS	Current sensing pin

BLOCK DIAGRAM



FUNCTIONAL DESCRIPTION

The JW19985X series is a constant current LED regulator, which applies to non-isolation step-down LED system. JW19985X series can achieve excellent line and load regulation, high efficiency and low system cost with few peripheral components.

Start Up

When the V_{IN} exceeds V_{IN_ON}, the gate driver will start to switch after 10mS delay.

Constant Current Control

JW19985X series controls the output current from the information of the current sensing resistor. The output LED average current can be calculated as:

$$I_{LED} = V_{REF} /(2\ R_{CS})$$

Where,

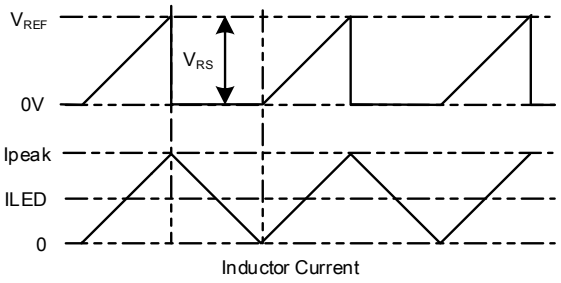
V_{REF} is the reference voltage;

R_{CS} – the sensing resistor connected between the PIN CS and chip GND.

The inductor current and V_{RS} waveforms are as follows:

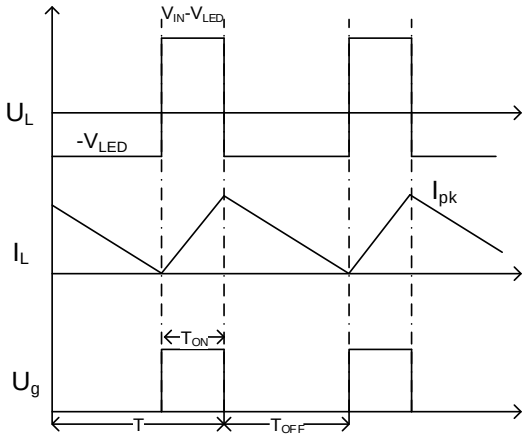
Where,

V_{RS} – the voltage between PIN CS and chip GND.



Critical Conduction Mode Operation

JW19985X series works in the critical conduction mode of the inductor current. When the power MOSFET turns on, the inductor current increases from zero linearly. The turn-on time of the MOSFET can be calculated as:



$$T_{ON} = 2\ I_{LED} \times L\ /\ (V_{IN} – V_{LED})$$

Where,

L –inductance.

I_{LED} – output current of LED.

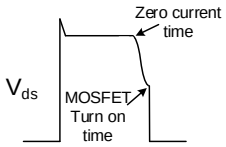
V_{IN} – input voltage after rectification and filtering.

V_{LED} – output voltage.

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

$$T_{OFF} = 2\ I_{LED} \times L\ /\ V_{LED}$$

JW19985X series works in quasi-resonant mode. When the inductor current decreases to zero, resonance takes place between the power inductor, MOSFET output capacitor and stray capacitor. JW19985X series can detect the zero-current signals of the inductor, and turn on the MOSFET in the valley, which can reduce the power loss and the EMI radiation. If JW19985X series cannot get the zero current signals, the turn-off time will be changed to T_{OFFMAX}. The output voltage should be higher than recommended voltage in order to avoid the loss of zero current signals.



Over Temperature Protection

When the junction temperature is higher than OTP_{CHIP}, JW19985X series works in DCM by increasing the MOS off time to decrease the LED current and 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}), the power MOSFET is shut down and restarts after T_{OVP_HC} (400ms typical). The following table shows the V_{O_OVP} design guide:

OVP Pin	V_{O_OVP}(V)
R_{OVP}=200K	75V
R_{OVP}=400K	120V
R_{OVP} Float	240V
R_{OVP} Short	Shut down

LED Short Protection

When the output is shorted, JW19985X 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. JW19985X series should be kept away from noisy and heating components, such as power inductor.

APPLICATION REFERENCE

This reference design is suitable for 10~20W non-isolated step-down LED driver, using JW19985B, with high efficiency, excellent line regulation.

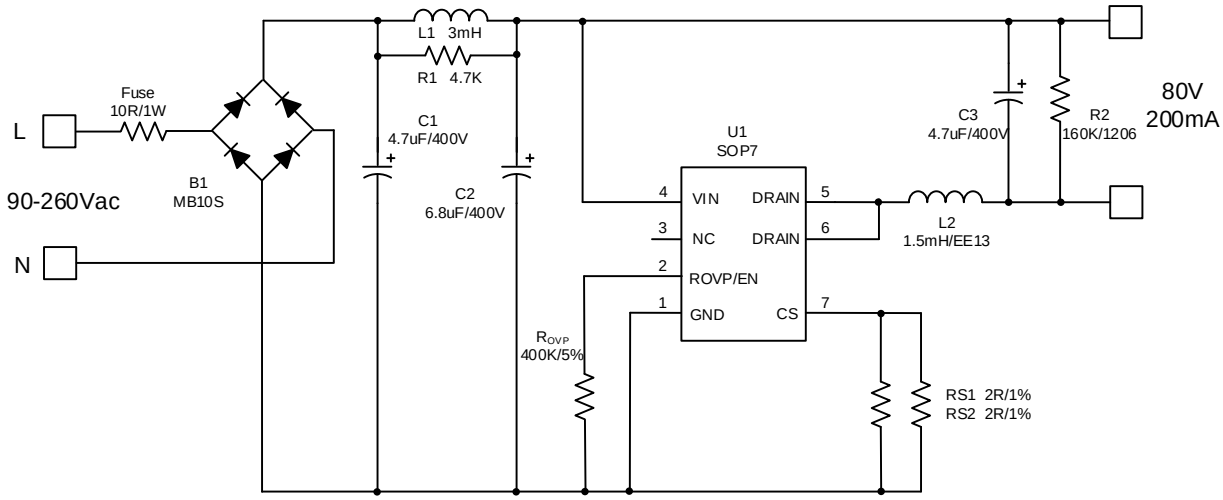
Reference ：

V_{IN}: 90VAC~260VAC

V_{OUT}: 80V

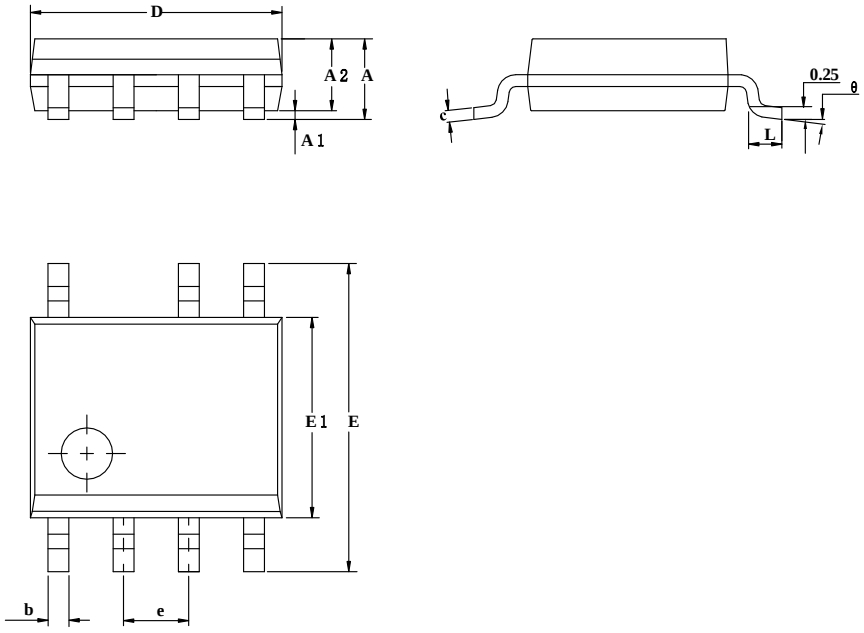
I_{OUT}: 200mA

PF: >0.5



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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