JW1779

Integrated 500V MOS Non-isolated Buck LED Driver

Parameters Subject to Change Without Notice

DESCRIPTION

JW1779 is a non-isolated, constant output current step-down LED driver with 500V MOSFET integrated. Operating in the boundary mode makes it high efficiency and low radiation. Patented algorithms ensure good current accuracy and excellent line/load regulations with lowest BOM cost.

JW1779 is supplied from the MOSFET drain directly, so the auxiliary winding is eliminated, which can light up the LED within 100mS.

With unique sampling techniques, JW1779 has multi-protection functions which can largely enhance the safety and reliability of the system, including VDD UVLO, inductor short protection, LED short protection and over-temperature protection.

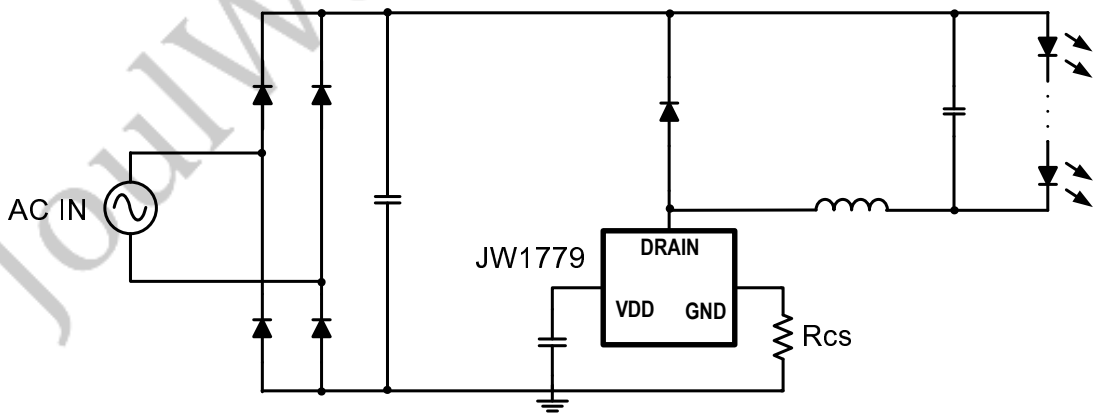
FEATURES

- Integrate 500V, Low R_{dson} MOSFET
  30Ohm,100mA maximum output current
- Excellent line/load regulation
- Boundary mode operation
- High efficiency
- LED SCP
- VDD UVLO
- Over-temperature protection
- Brown Out Protection
- Inductor short protection
- TO-92 package

APPLICATIONS

- LED lighting

TYPICAL APPLICATION



ORDER INFORMATION

LEAD FREE FINISH	TAPE AND REEL	PACKAGE	TOP MARKING
	JW1779TOC#TPBF	TO-92	JW1779

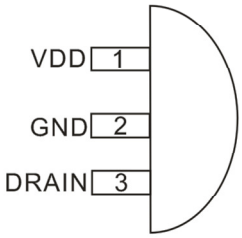
Note：

JWXXXXPPPP#TPBF
- Pb Free
- Tape
- Package Code
- Part Number

JWXXXXPPPP#TRPBF
- Pb Free
- Tape and Reel（If "TR" is not shown, it means Tube）
- Package Code
- Part Number

PIN CONFIGURATION

TOP VIEW



TO-92

ABSOLUTE MAXIMUM RATING[1)]

DRAIN Voltage..... 550V
VDD Voltage..... 5.5V
GND Voltage ..... -0.3V to 5.5V
Junction Temperature[2) 3)].....150ºC
Storage Temperature ..... -65ºC to +150 ºC

RECOMMENDED OPERATING CONDITIONS

DRAIN Voltage 500V
Operating Junction Temp. .....-40ºC to 125ºC

THERMAL PERFORMANCE[4)] θ_{JA} θ_{Jc}

TO-92 .....120...60℃/W

Note：

1) Exceeding these ratings may damage the device.

2) The JW1779 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 JW1779 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 CHARATERISTICS

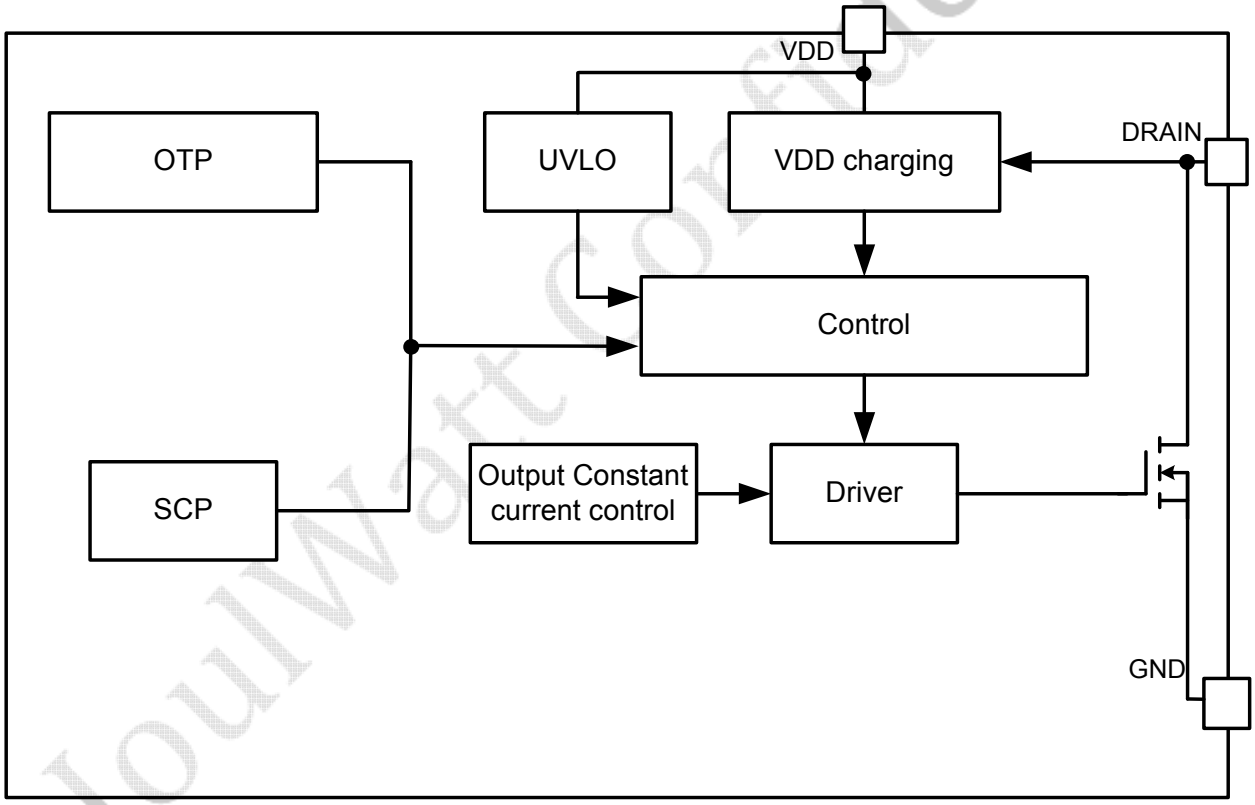
T_A=25℃, unless otherwise stated

Item	Symbol	Condition	Min.	Typ.	Max.	Units
V_{DD} Regulation Voltage	V_{DD}			5.4		V
V_{DD} Start Up threshold	V_{DD_ST}	V_{DD} rising		5.2		V
V_{DD} Under Voltage Lockout	V_{DD_UVLO}	V_{DD} falling		4.4		V
V_{DD} IQ	I_Q	V_{DD}=5.4V		200		uA
MOS Max ON Time	T_{ONMAX}			40		us
MOS Min ON Time	T_{ONMIN}			0.4		us
MOS Max OFF Time	T_{OFFMAX}			400		us
MOS Min OFF Time	T_{OFFMIN}			3		us
Leading Edge Blanking Time	T_{LEB}			400		ns
MOS Max Current	I_{MAX}			0.4		A
MOS BV Voltage	V_{BRDSS}			550		V
MOS Rdson	R_{dson}	I(DRAIN)=50mA,		30		Ω
Thermal Protection Threshold	OTP_{CHIP}			135		℃

PIN DESCRIPTION

Pin	Name	Description
1	VDD	This pin supplies current to the internal start-up circuitry. This pin must be locally bypassed with a capacitor
2	GND	Chip ground
3	DRAIN	The drain of MOSFET

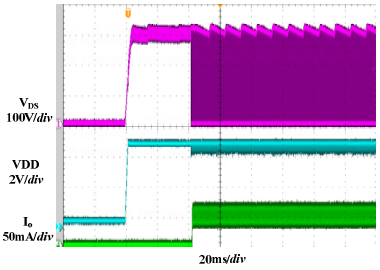
BLOCK DIAGRAM



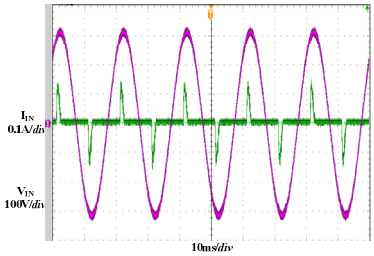
TYPICAL PERFORMANCE CHARACTERISTICS

Waveforms ,V_{IN}=90~260Vac,Io=50mA,Vo=60V or 20LEDs (VF=3V) in series

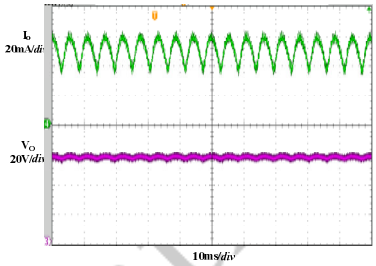
Start Up
V_{IN}=90Vac,I_O=50mA,P_O=3W



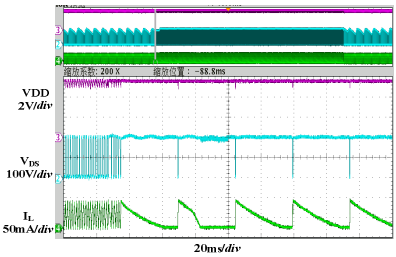
Steady State (Input)
V_{IN}=220Vac,I_O=50mA,P_O=3W



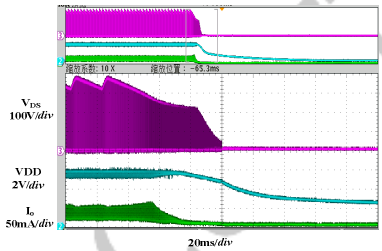
Steady State (Output)
V_{IN}=220Vac,I_O=50mA,P_O=3W



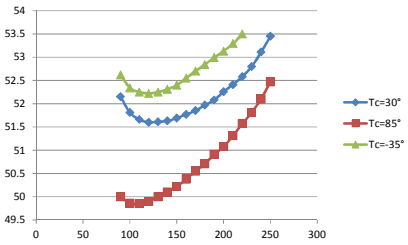
Short Circuit Protection
V_{IN}=90Vac



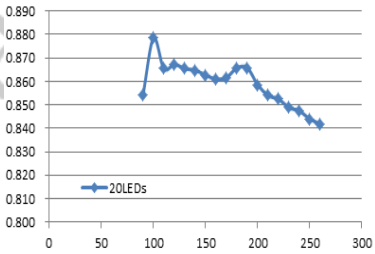
Power Off
V_{IN}=260Vac,I_O=50mA,P_O=3W



Line Regulation



Efficiency VS Input Voltage



FUNCTIONAL DESCRIPTION

The JW1779 is a constant current LED driver which applies to non-isolation step-down LED system. JW1779 can achieve excellent line and load regulation, high efficiency and low system cost with few peripheral components.

Start Up

When the internal high voltage start-up circuit charges VDD up to the turn-on threshold, the gate driver starts to switch. In the normal working state, the current source charges VDD to 5.4V when the power MOSFET is off. Once the voltage of VDD is lower than 4.4V, JW1779 stops switching.

Constant Current Control

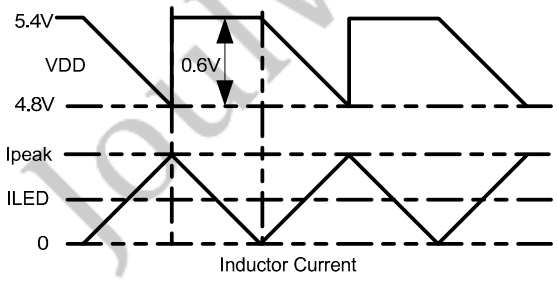
JW1779 controls the output current from the information of the current sensing resistor. The output LED average current can be calculated as:

$$I_{LED} = 0.3 / R_{CS}$$

Where,

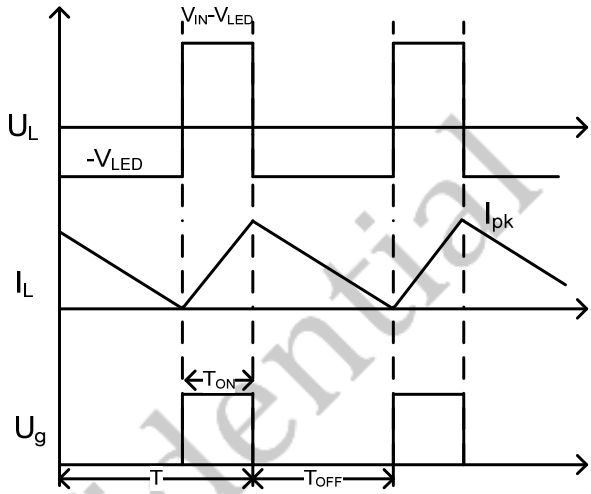
R_{CS} – the sensing resistor connected between chip GND and the VDD capacitor ground.

The inductor current and VDD waveforms are as follows:



Critical Conduction Mode Operation

JW1779 works in the critical conduction mode of the inductor current. When the external 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 led current.

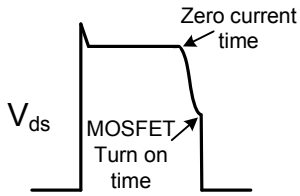
V_{IN} – input voltage after rectification and filtering.

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:

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

JW1779 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. JW1779 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 JW1779 cannot get the zero current signals, the turn off time will be changed to 400uS.



Over Temperature Protection

When JW1779 temperature is higher than 135°C, LED current reduces, and if it is higher than 150°C, the output current reduces to zero.

LED Short Protection

When the output is shorted, JW1779 can't get the zero current signals. JW1779 stops switching for 400uS until the next pulse.

PCB Layout Guidelines

1. The VDD pin must be locally bypassed by a ceramic capacitor.
2. Make the area of the power loop as small as possible in order to reduce the EMI radiation.

REFERENCE DESIGN

This reference design is suitable for 2~ 3W non-isolated Step-down LED driver, using JW1779, with high efficiency, excellent line regulation.

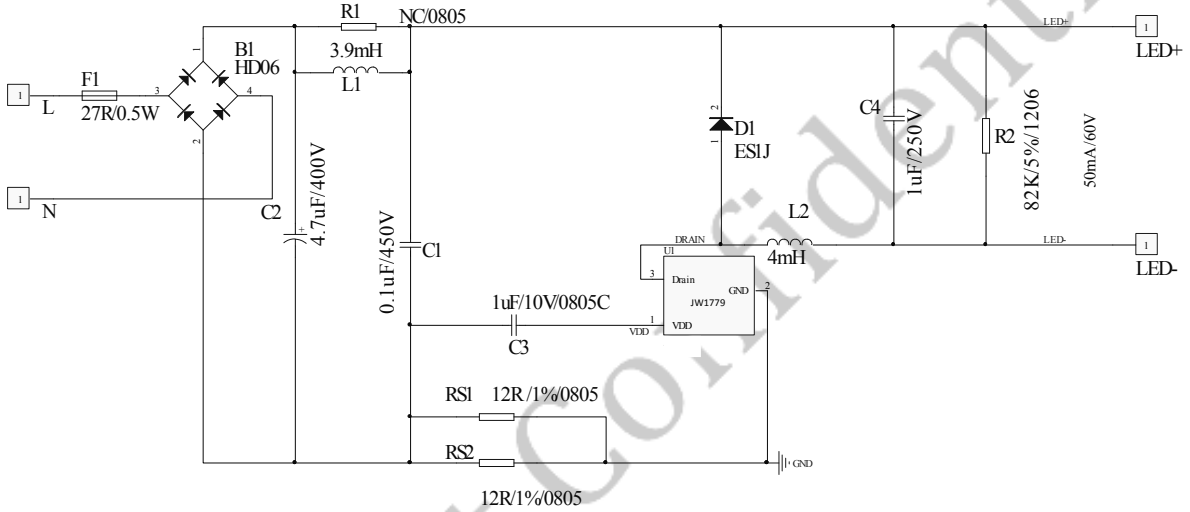
Reference:

V_{IN}: 90VAC~264VAC

V_{OUT}: 40~60V

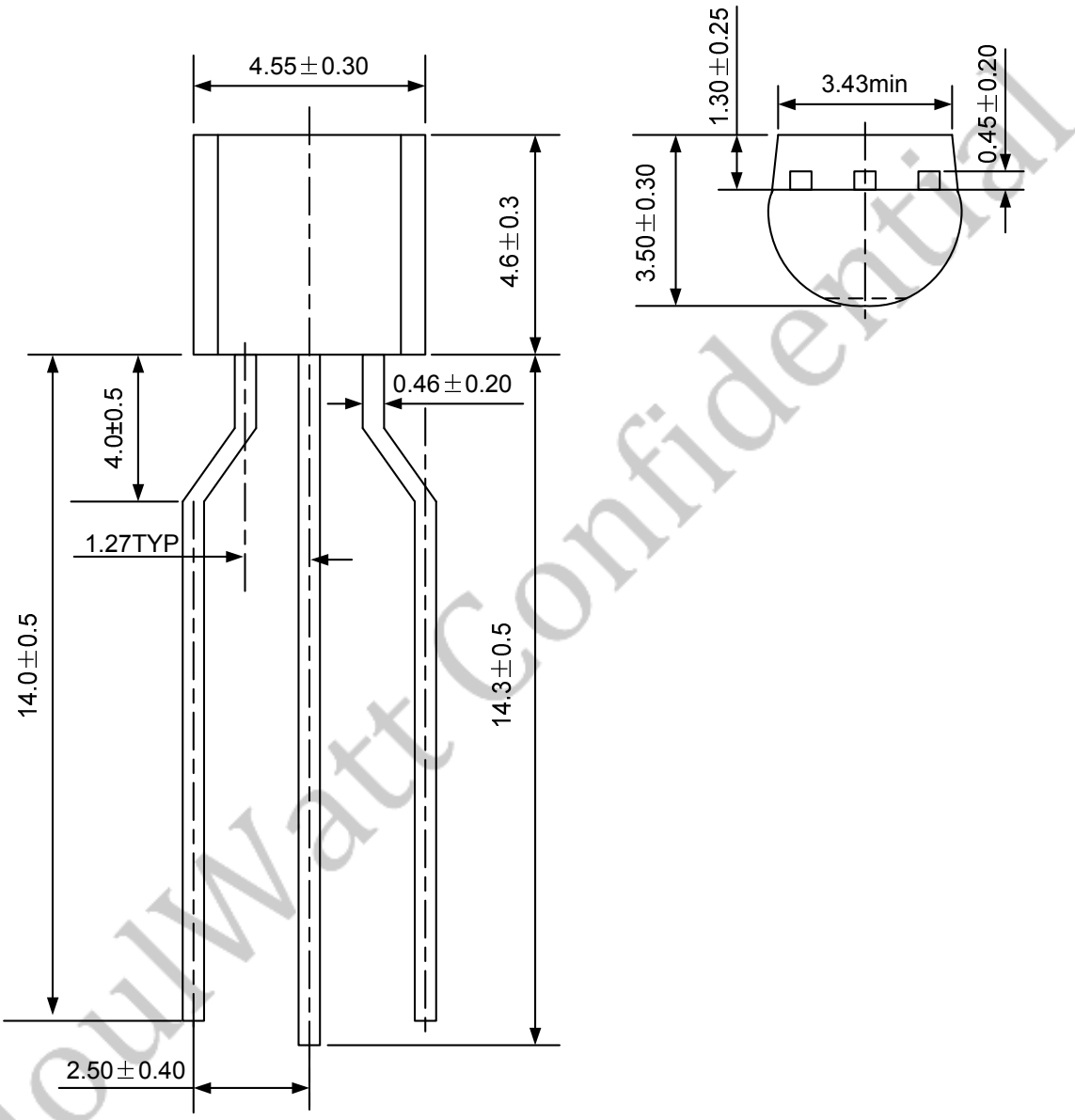
I_{OUT}: 50mA

PF: >0.4



PACKAGE OUTLINE

TO-92 **UNIT :** mm



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