

*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.

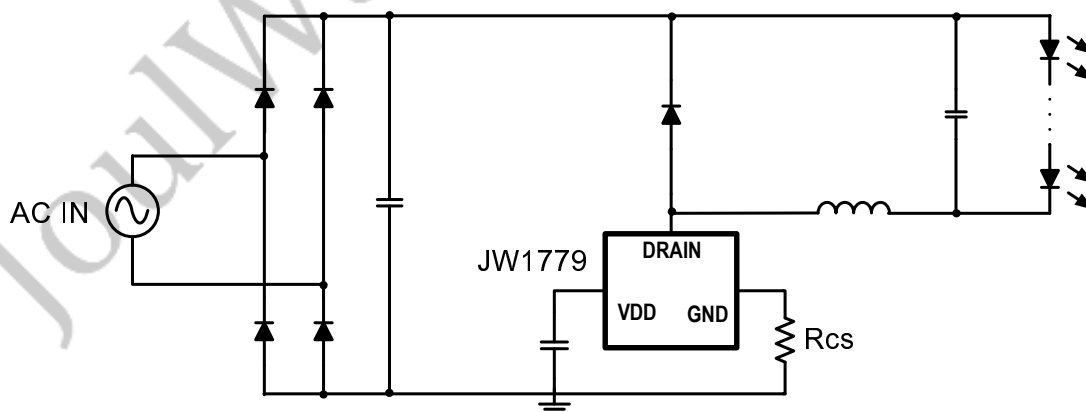
## FEATURES

- Integrate 500V, Low  $R_{ds(on)}$  MOSFET 300hm, 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



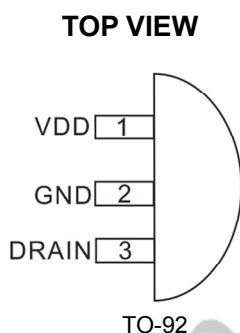
## ORDER INFORMATION

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

## Note:

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

## PIN CONFIGURATION

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

|                                             |                  |
|---------------------------------------------|------------------|
| DRAIN Voltage.....                          | 550V             |
| VDD Voltage.....                            | 5.5V             |
| GND Voltage .....                           | -0.3V to 5.5V    |
| Junction Temperature <sup>2) 3)</sup> ..... | 150°C            |
| Storage Temperature .....                   | -65°C to +150 °C |

## RECOMMENDED OPERATING CONDITIONS

|                               |                |
|-------------------------------|----------------|
| DRAIN Voltage .....           | 500V           |
| Operating Junction Temp. .... | -40°C to 125°C |

THERMAL PERFORMANCE<sup>4)</sup>  $\theta_{JA}$   $\theta_{Jc}$ 

|             |              |
|-------------|--------------|
| TO-92 ..... | 120...60°C/W |
|-------------|--------------|

## Note:

- Exceeding these ratings may damage the device.
- 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.
- 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.
- Measured on JE51-7, 4-layer PCB.

## ELECTRICAL CHARACTERISTICS

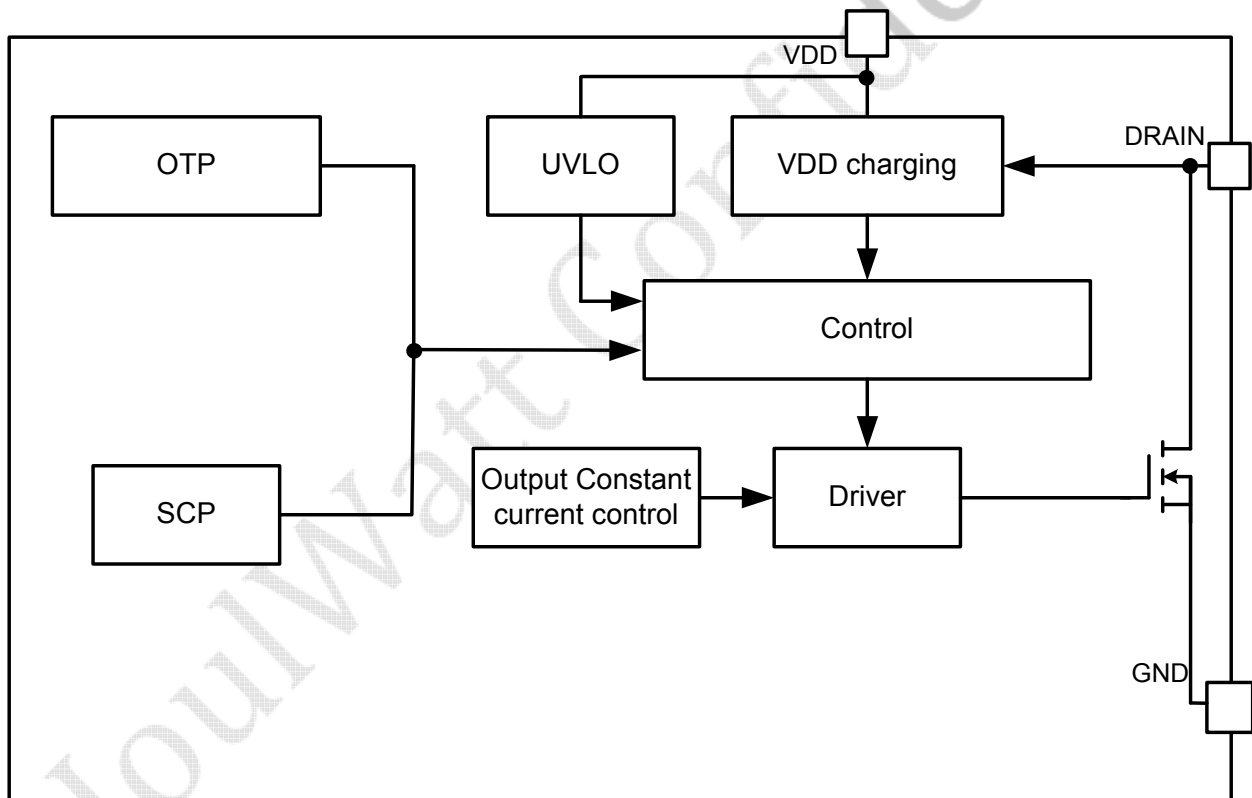
*T<sub>A</sub>=25 °C, unless otherwise stated*

| Item                                  | Symbol               | Condition               | Min. | Typ. | Max. | Units |
|---------------------------------------|----------------------|-------------------------|------|------|------|-------|
| V <sub>DD</sub> Regulation Voltage    | V <sub>DD</sub>      |                         |      | 5.4  |      | V     |
| V <sub>DD</sub> Start Up threshold    | V <sub>DD_ST</sub>   | V <sub>DD</sub> rising  |      | 5.2  |      | V     |
| V <sub>DD</sub> Under Voltage Lockout | V <sub>DD_UVLO</sub> | V <sub>DD</sub> falling |      | 4.4  |      | V     |
| V <sub>DD</sub> IQ                    | I <sub>Q</sub>       | V <sub>DD</sub> =5.4V   |      | 200  |      | uA    |
| MOS Max ON Time                       | T <sub>ONMAX</sub>   |                         |      | 40   |      | us    |
| MOS Min ON Time                       | T <sub>ONMIN</sub>   |                         |      | 0.4  |      | us    |
| MOS Max OFF Time                      | T <sub>OFFMAX</sub>  |                         |      | 400  |      | us    |
| MOS Min OFF Time                      | T <sub>OFFMIN</sub>  |                         |      | 3    |      | us    |
| Leading Edge Blanking Time            | T <sub>LEB</sub>     |                         |      | 400  |      | ns    |
| MOS Max Current                       | I <sub>MAX</sub>     |                         |      | 0.4  |      | A     |
| MOS BV Voltage                        | V <sub>BRDSS</sub>   |                         |      | 550  |      | V     |
| MOS Rdson                             | R <sub>dson</sub>    | I(DRAIN)=50mA,          |      | 30   |      | Ω     |
| Thermal Protection Threshold          | OTP <sub>CHIP</sub>  |                         |      | 135  |      | °C    |

## 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

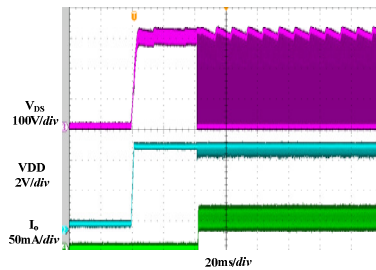


## TYPICAL PERFORMANCE CHARACTERISTICS

Waveforms ,  $V_{IN}=90\sim 260\text{Vac}$ ,  $I_O=50\text{mA}$ ,  $V_O=60\text{V}$  or 20LEDs ( $V_F=3\text{V}$ ) in series

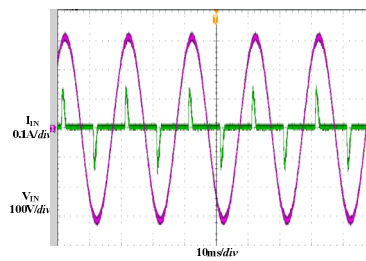
Start Up

$V_{IN}=90\text{Vac}$ ,  $I_O=50\text{mA}$ ,  $P_O=3\text{W}$



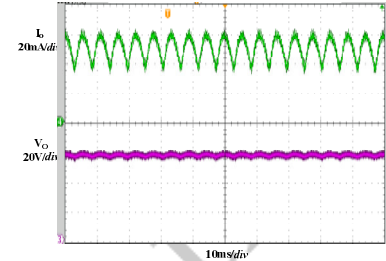
Steady State (Input)

$V_{IN}=220\text{Vac}$ ,  $I_O=50\text{mA}$ ,  $P_O=3\text{W}$



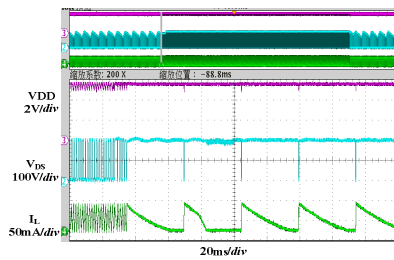
Steady State (Output)

$V_{IN}=220\text{Vac}$ ,  $I_O=50\text{mA}$ ,  $P_O=3\text{W}$



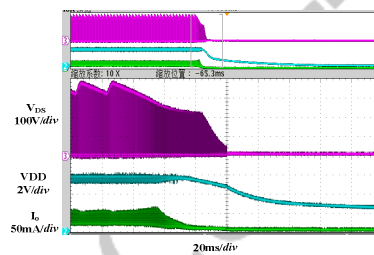
Short Circuit Protection

$V_{IN}=90\text{Vac}$

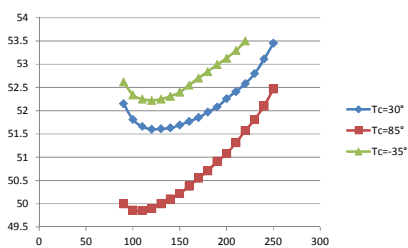


Power Off

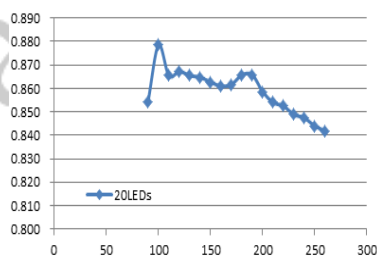
$V_{IN}=260\text{Vac}$ ,  $I_O=50\text{mA}$ ,  $P_O=3\text{W}$



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

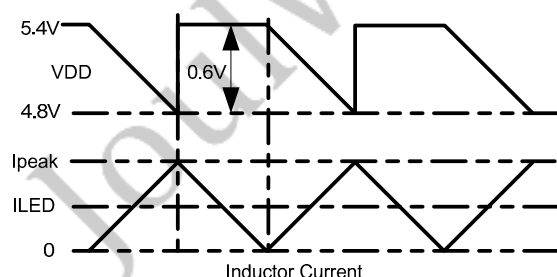
JW1779 controls the output current from the information of the current sensing resistor. The output LED average current can be calculated as:

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

Where,

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

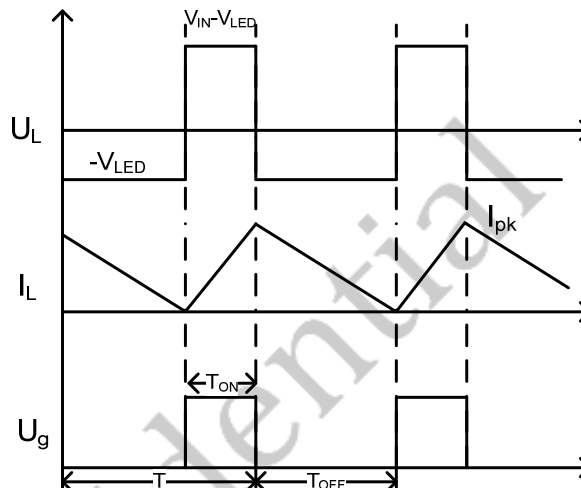
The inductor current and VDD waveforms are as follows:



### 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.

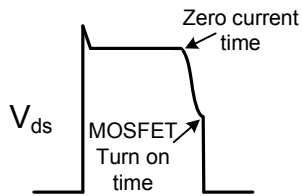
$V_{IN}$  – input voltage after rectification and filtering.

$V_{LED}$  – 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.

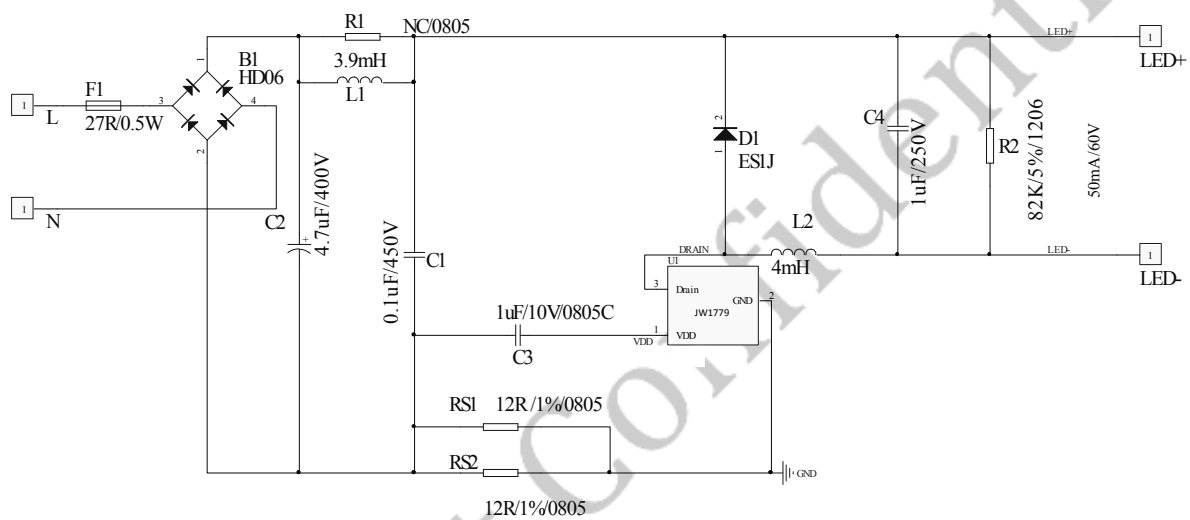
### Reference:

$V_{IN}$ : 90VAC~264VAC

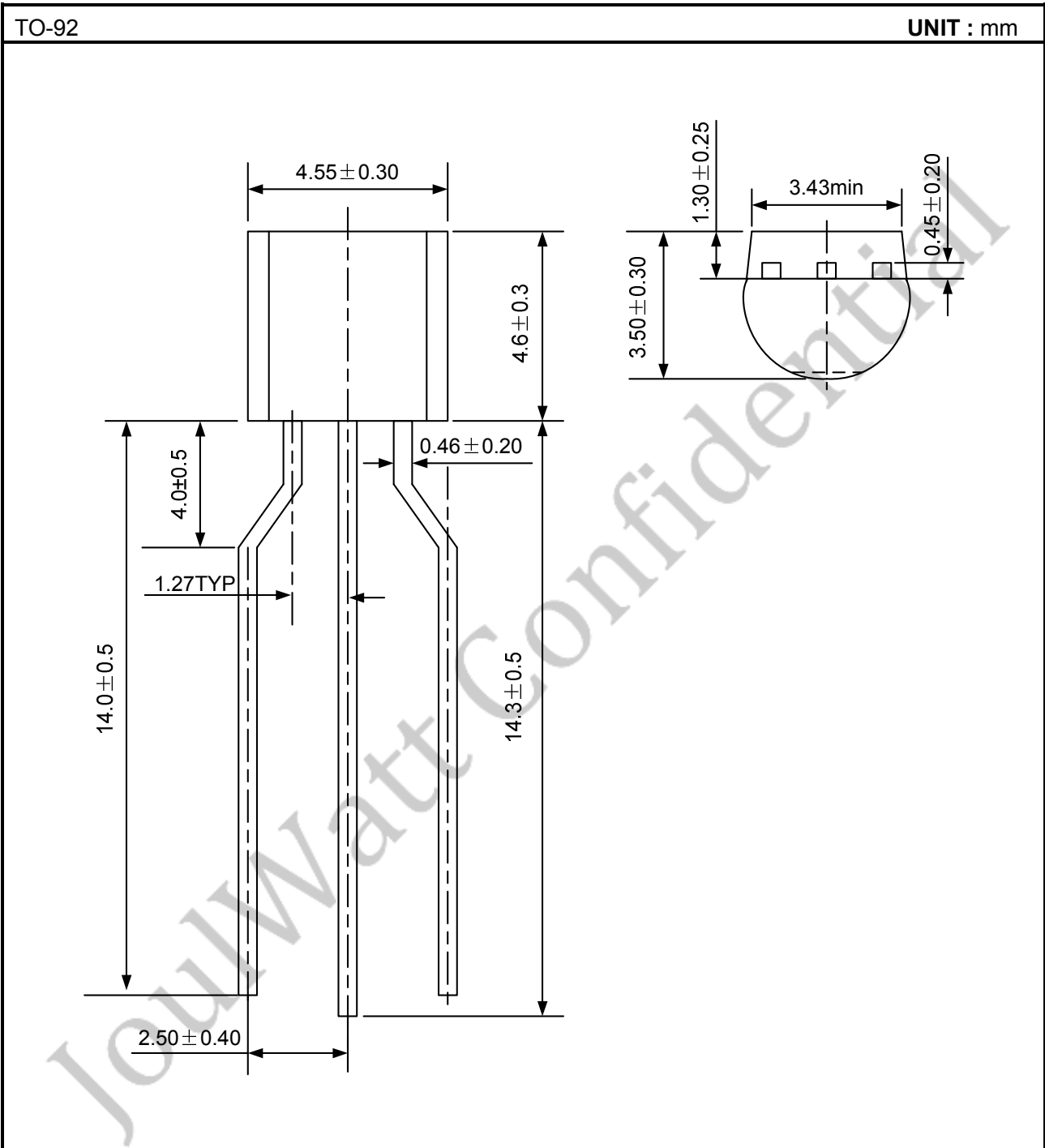
$V_{OUT}$ : 40~60V

$I_{OUT}$ : 50mA

PF: >0.4



PACKAGE OUTLINE



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