

Parameters Subject to Change Without Notice

DESCRIPTION

The JW[®]1765D is a constant current LED controller with high current accuracy which applies to single stage step-down power factor corrected LED drivers.

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. JW1765D is supplied from the output directly, and auxiliary winding is not needed.

JW1765D has multi-protection functions which largely enhance the safety and reliability of the system, including VCC over-voltage protection, VCC UVLO, short-circuit protection, LED open protection, cycle-by-cycle current limit and over-temperature protection.

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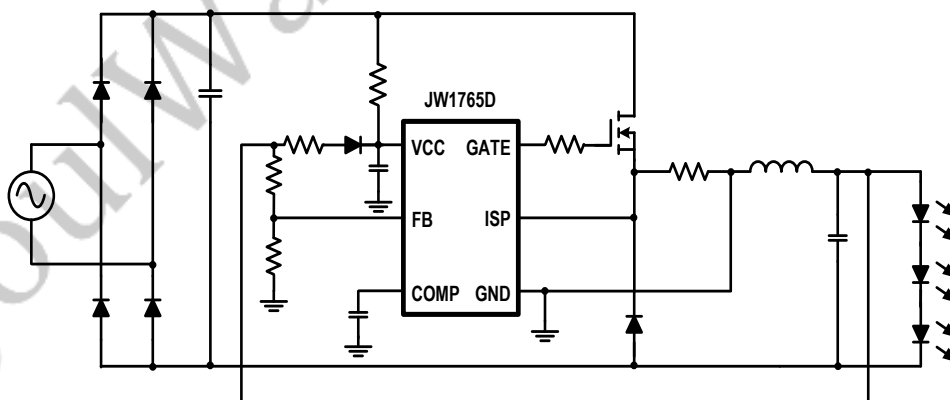
FEATURES

- No auxiliary winding
- High 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 SOT23-6 package

APPLICATIONS

- Non-isolation Offline LED driver

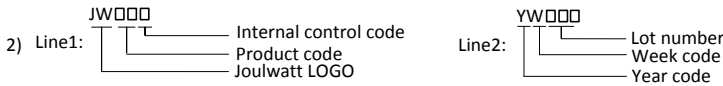
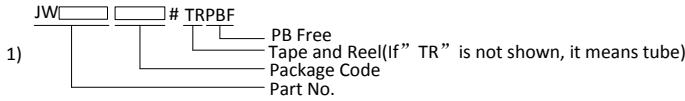
TYPICAL APPLICATION



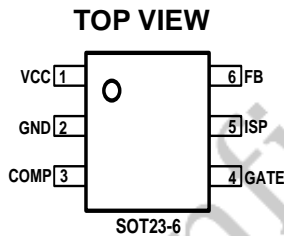
ORDER INFORMATION

DEVICE ¹⁾	PACKAGE	TOP MARKING ²⁾
JW1765DSOTB#TRPBF	SOT23-6	JWEH□ YW□□□

Notes:



PIN CONFIGURATION



ABSOLUTE MAXIMUM RATING¹⁾

VCC PIN.....	43V
COMP, ISP, FB Pins.....	-0.3V to 6.5V
Junction Temperature ^{2) 3)}	150°C
Lead Temperature.....	260°C
Storage Temperature.....	-65°C to +150°C
ESD Susceptibility (Human Body Model)	2kV

RECOMMENDED OPERATING CONDITIONS

FB PIN	0.8V to 1.4V
Operating Junction Temp (T _J)	-40°C to 125°C

THERMAL PERFORMANCE⁴⁾

	θ_{JA}	θ_{JC}
SOT23-6	220.....	130°C/W

Note:

- 1) Exceeding these ratings may damage the device.
- 2) 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) 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 CHARACTERISTICS

T_A = 25°C, unless otherwise stated.

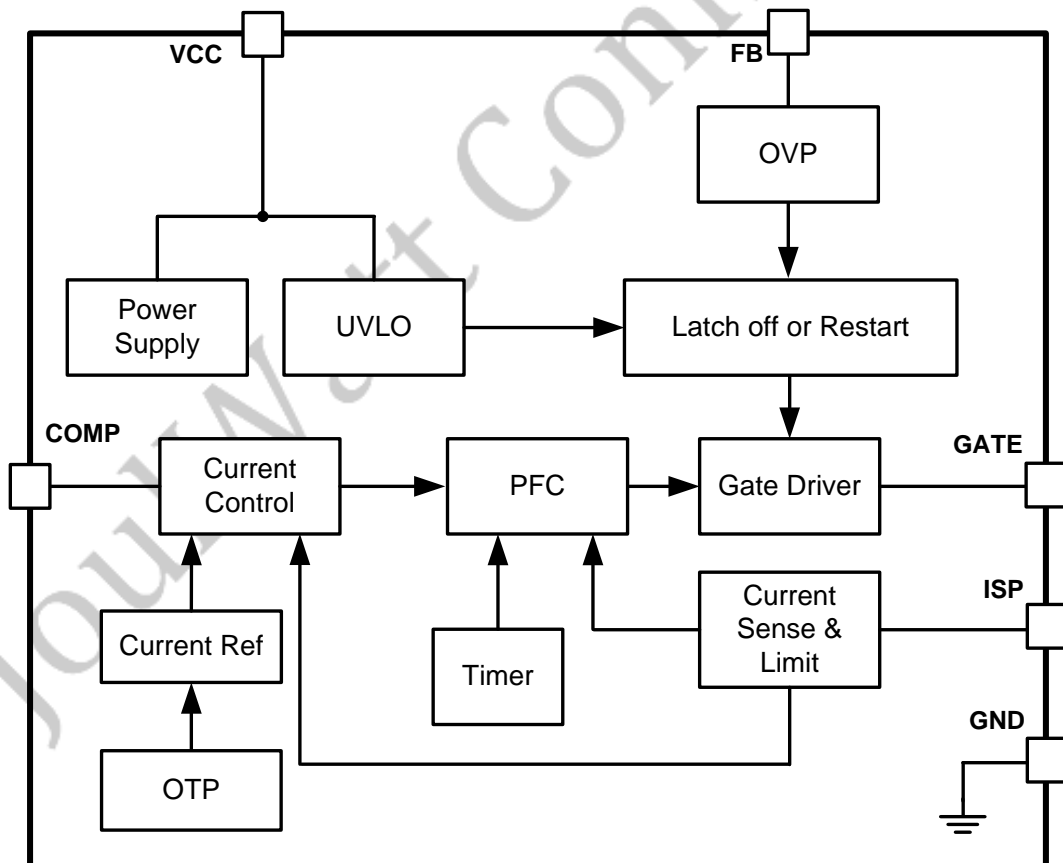
Item	Symbol	Condition	Min.	Typ.	Max.	Units
V _{CC} Turn-On Voltage	V _{CC_ON}			18.2		V
V _{CC} Turn-off Low Voltage	V _{CC_OFF_L}			7.6		V
V _{CC} Hysteresis	V _{CC_HYS}	V _{CC_ON} -V _{CC_OFF_L}		10.6		V
V _{CC} Clamp Voltage	V _{CC_OVTH}			20.4		V
V _{CC} Shunt Regulator Current Limit	I _{CC_SHUNT}	V _{CC} = 24V	4	6	8	mA
V _{CC} Quiescent Current	I _Q	V _{CC} <V _{CC_ON}		45	70	uA
V _{CC} Operation Current	I _O			300	500	uA
FB High Voltage Threshold	V _{FB_H}			1.6		V
FB Low Voltage Threshold	V _{FB_L}			0.2		V
ISP Sample Value	V _{ISP}		0.194	0.200	0.206	V
V _{ISP} Limit Value	V _{ISP_LIMIT}			1		V
Leading Edge Blanking Time	T _{LEB}			350		ns
Maximum Frequency	F _{MAX}			150		kHz
Maximum MOS ON Time	T _{ONMAX}			18		us
Maximum MOS OFF Time	T _{OFFMAX}			150		us
Minimum MOS OFF Time	T _{OFFMIN}			3		us
Over Temperature Protection Threshold ⁵⁾	T _{OTP}			142.5		°C

5) Guaranteed by design.

PIN DESCRIPTION

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

BLOCK DIAGRAM



FUNCTIONAL DESCRIPTION

The JW1765D is a constant current LED controller which applies to non-isolation step-down LED system with power factor correction. JW1765D can achieve excellent line and load regulation, high efficiency and low BOM cost.

Start Up

When the pull-up resistor charges VCC up to VCC Turn-On Voltage (V_{CC_ON}), 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. When VCC is lower than VCC Turn-Off Voltage (V_{CC_OFF}), 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 1 μ F connected to COMP pin is recommended.

Constant Current Control

The JW1765D controls the output current from the information of the current sensing resistor. The output LED mean current can be calculated as:

$$I_{LED} = V_{ISP} / R_{CS}$$

Where

V_{ISP} – ISP sample reference;

R_{CS} – The sensing resistor connected between ISP and GND.

Critical Conduction Mode Operation

JW1765D works in the critical conduction mode of the inductor current. When the external 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_{PK} – peak current in one switch period.

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

V_{LED} – 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.

Over Temperature Protection

When JW1765D is hotter than 142.5 $^{\circ}$ C, the COMP voltage is pulled down by an internal current thus reduces the output current.

LED Open Protection

The output voltage can be detected by the FB pin. When the FB voltage is higher than FB High Voltage Threshold (V_{FB_H}), the LED open protection is triggered and the power MOSFET gate driver stops switching. VCC is discharged and charged repeatedly until the output is recovered to normal state.

The recommended FB pin voltage is about 1.2V at rated output, and its pull-up resistor is typically in hundreds K Ω level.

LED short protection

JW1765D judges LED short from the FB voltage. During a shorted LED condition, JW1765D

reduces the internal command current to a very low level and slows down the switching frequency.

If LED short or LED open protection are false triggered by unreasonable PCB layout, a 20pF capacitor could be paralleled to FB pin and GND.

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 MOSFET, 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

This reference design is suitable for 10 ~ 20W non-isolated Step-down LED driver, using JW1765D, with high efficiency, excellent line regulation.

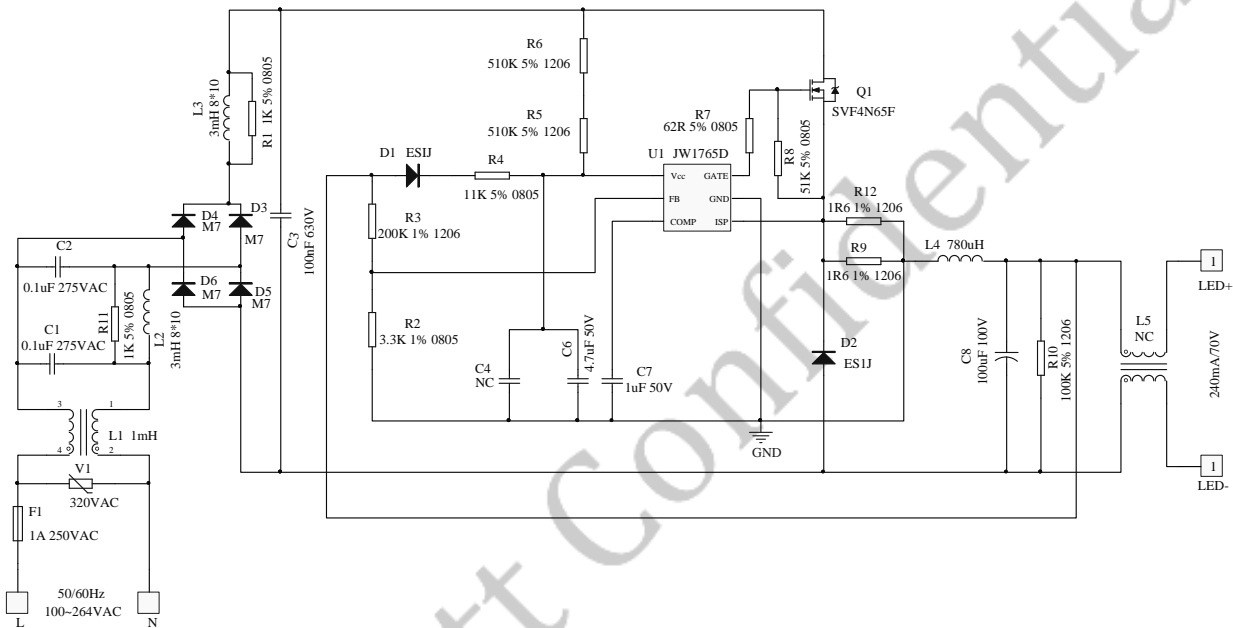
Reference 1:

V_{IN} : 90VAC~264VAC

V_{OUT} : 40~75V

I_{OUT} : 240mA

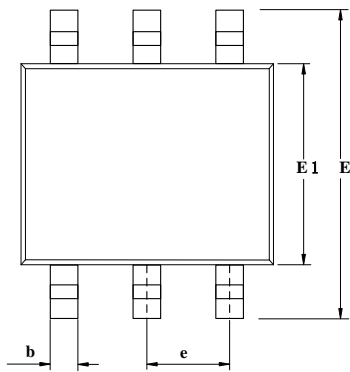
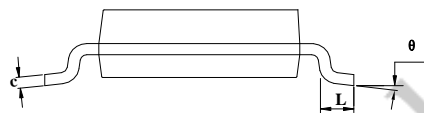
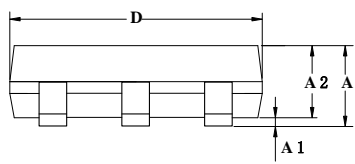
PF: >0.9



PACKAGE OUTLINE

SOT23-6

UNIT: mm



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	1.05	1.15	1.25
A1	0	0.05	0.15
A2	0.95	1.10	1.20
b	0.20	0.40	0.60
c	0.05	—	0.21
D	2.72	2.92	3.12
E	2.60	2.80	3.00
E1	1.40	1.60	1.80
e	0.95 (BSC)		
L	0.30	0.45	0.60
θ	0°	—	8°

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