Off-Line Digital Power Controller for LED Driver with High Power Factor and Low-Ripple Current

1 Description

The iW3625 is a high performance, single-stage AC/DC power controller for LED luminaires with power factor (PF) correction. The device uses digital control technology to build unique control in PWM buck power supplies to achieve high power factor while minimizing the LED current ripple. This distinctive control approach enables the capability for users to make trade-offs between the PF and LED current ripple in a single-stage design. It can achieve excellent LED current regulation over line and load variation, without the need for secondary feedback circuit. The built-in temperature sensor along with control logic can automatically adjust output current in real-time without visible flicker during the process. Alternatively, the external NTC thermistor is placed close to the hot spots in a design to provide thermal protection in the similar pattern by derating LED current. The iW3625 operates in quasi-resonant mode to provide high efficiency along with a number of key built-in protection features while minimizing the external component count, simplifying EMI design, and lowering the total bill of material cost. It also eliminates the need for loop compensation components while maintaining stability over all operating conditions.

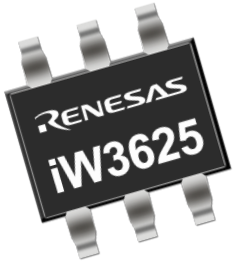
Renesas' innovative proprietary technology maximizes the iW3625 performance in a tiny SOT-23 package. The iW3625 offers two multi-function pins allowing users to configure PF and LED current derating as required with no cost or size impact, thereby providing design flexibility. In addition to providing the temperature sensing via an NTC resistor, the MULTI pin also enables active start-up scheme to achieve the shortest possible start-up time without sacrificing active efficiency.

2 Features

- All-in-one non-dimmable low-cost off-line LED driver
- Supports buck topology for high efficiency (> 90%)
- Supports universal input voltage range (90V_{AC} to 277V_{AC}) and output power up to 45W
- High power factor (PF) with low current-ripple control technology
- User-configurable power factor setting (> 0.7 to > 0.95)
- Able to achieve low THD (< 20%)
- User-configurable internal or external over-temperature protection (OTP) with temperature-current derating
- Tight LED current regulation (±5%) across line and load, and within power inductance tolerance (±20%)
- Stabilized LED current-ripple control without visible shimmer or flicker
- Active start-up scheme enables fastest possible start-up
- 72kHz nominal PWM switching frequency with quasi-resonant operation
- ***EZ-EMI***™ design enhances manufacturability
- Built-in single-point fault protection features: LED open-/short-circuit protection and over-current protection
- No audible noise over entire operating range

3 Applications

- Solid-state LED lighting
- LED lighting ballast



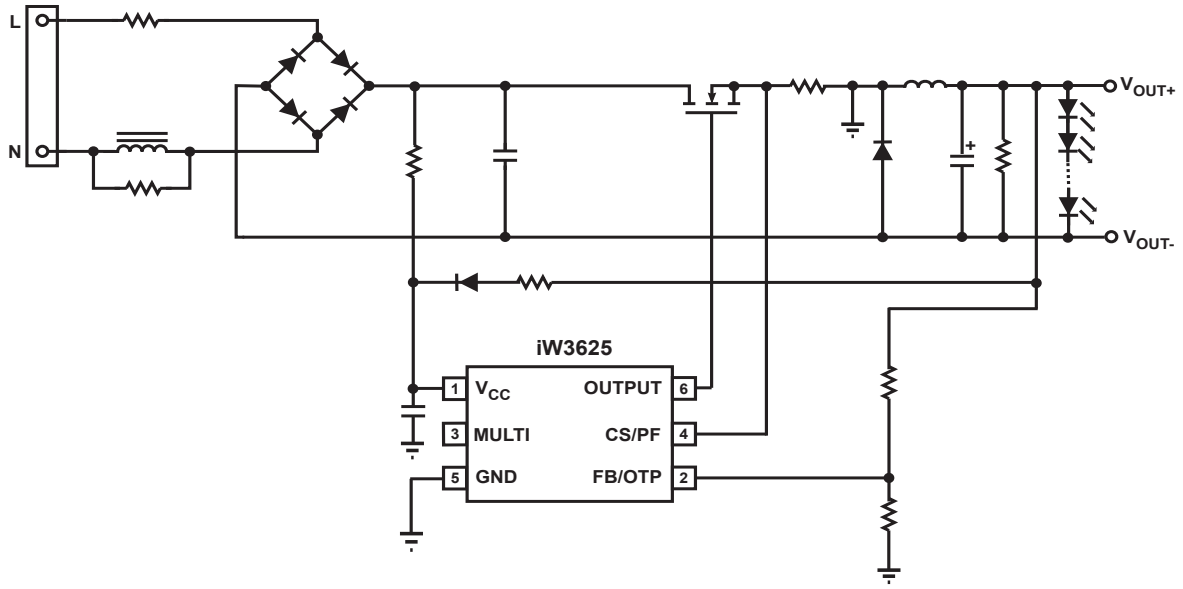


Figure 3.1 : iW3625 Typical Application Circuit (Non-Isolated Floating Buck Application)

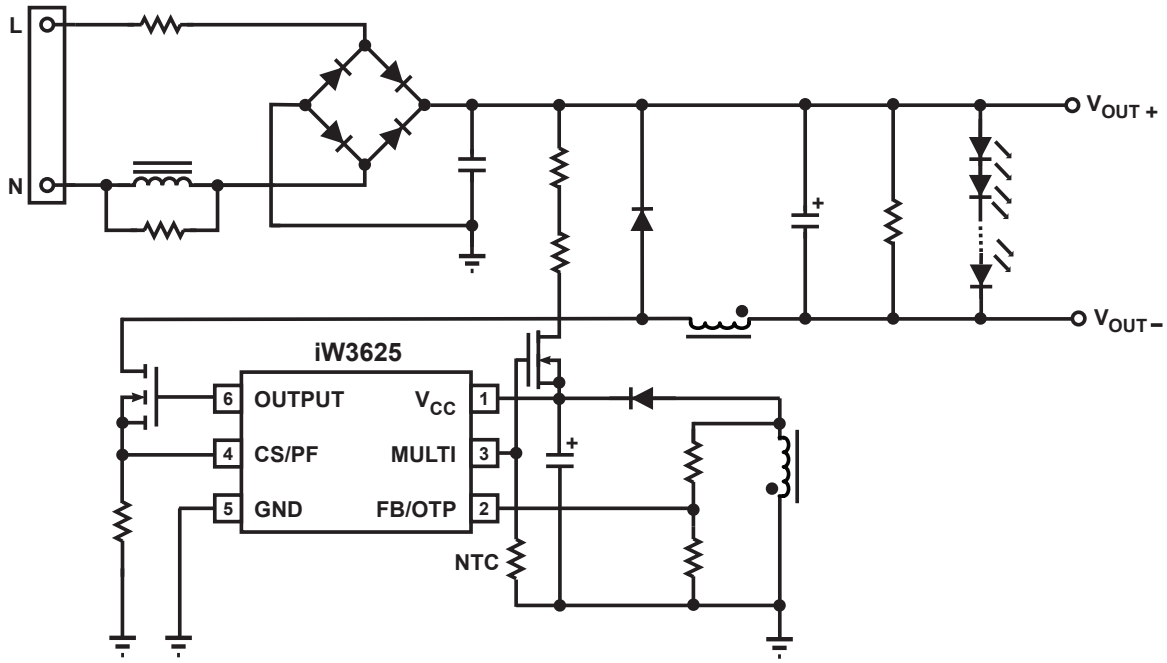


Figure 3.2 : iW3625 Typical Application Circuit (Non-Isolated Non-Floating Buck Application Using Active Start-up Device)

4 Pinout Description

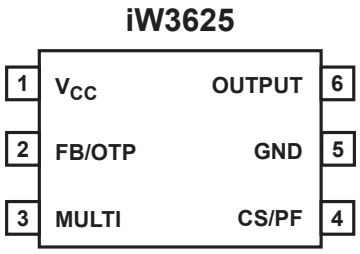


Figure 4.1 : 6-Lead SOT23 Package

Pin Number	Pin Name	Type	Pin Description
1	V_{CC}	Power Input	Power supply for control logic and MOSFET drive.
2	FB/OTP	Analog Input	Multi-function pin. Used for internal or external OTP current derating configuration at the beginning of start-up and to provide output voltage sense for primary regulation during normal operation.
3	MULTI	Output	Multi-function pin. Used to control active start-up device and for external temperature sensing via an NTC resistor.
4	CS/PF	Analog Input	Multi-function pin. Used for PF configuration at the beginning of start-up and to provide primary current sense for cycle-by-cycle peak current control and limit during normal operation.
5	GND	Ground	Ground.
6	OUTPUT	Output	Gate drive for external MOSFET switch.

5 Absolute Maximum Ratings

Absolute maximum ratings are the parameter values or ranges which can cause permanent damage if exceeded. For maximum safe operating conditions, refer to Electrical Characteristics in Section 6.

Parameter	Symbol	Value	Units
DC supply voltage range (pin 1, I_{CC} = 20mA max)	V_{CC}	-0.3 to 18.0	V
Continuous DC supply current at V_{CC} pin (V_{CC} = 15V)	I_{CC}	20	mA
MULTI (pin 3)		-0.3 to 18.0	V
OUTPUT (pin 6)		-0.3 to 18.0	V
FB/OTP input (pin 2, $I_{FB/OTP} \leq$ 10mA)		-0.7 to 4.0	V
CS/PF input (pin 4)		-0.3 to 4.0	V
Maximum junction temperature	T_{JMAX}	150	°C
Operating junction temperature	T_{JOPT}	-40 to 150	°C
Storage temperature	T_{STG}	-65 to 150	°C
Thermal resistance junction-to-ambient	θ_{JA}	190	°C/W
ESD rating per JEDEC JS-001-2017		±2,000	V
Latch-up test per JESD78E		±100	mA

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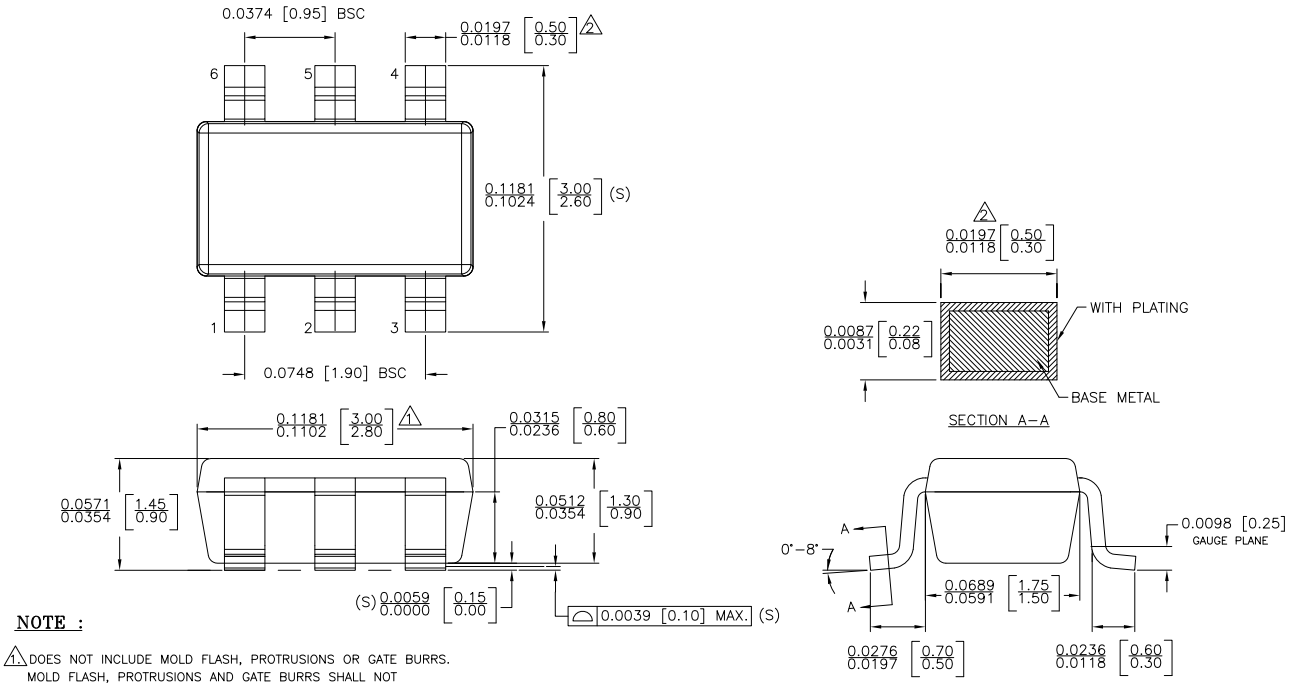
6 Physical Dimensions

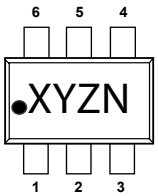


NOTE :

1. DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH, PROTRUSIONS AND GATE BURRS SHALL NOT EXCEED 0.127 MM PER SIDE.
2. DOES NOT INCLUDE INTER–LEAD FLASH OR PROTRUSIONS. INTER–LEAD FLASH AND PROTRUSIONS SHALL NOT EXCEED 0.127 MM PER SIDE.
3. DIE IS FACING UP FOR MOLD.DIE IS FACING DOWN FOR TRIM/FORM.
4. THIS PART IS COMPLIANT WITH EIAJ SPECIFICATION SC74A AND JEDEC SPECIFICATION MO–178AB.
5. LEAD SPAN/STAND OFF HEIGHT/COPLANARITY ARE CONSIDERED AS SPECIAL CHARACTERISTIC.(S)
6. CONTROLLING DIMENSIONS IN INCHES. [mm]

STATUS: RELEASED	SCALE: DO NOT SCALE	
TERMINAL FINISH: 100% Sn or NiPdAu (PPF)		
TITLE: 6 SOT23 PACKAGE OUTLINE		
REV: A	REVISION NOTE: NEW DRAWING	DATE: 02–MAR–2015

SOT23-6 devices are marked with a 4-digit code. Orientation of Pin 1 is shown below:



7 Ordering Information

Part Number	Description	Package	Description
iW3625-00	Internal OTP derating, 72kHz switching frequency	SOT-23	Tape & Reel[1]
iW3625-01	NTC OTP derating, 72kHz switching frequency	SOT-23	Tape & Reel[1]

Note 1: Tape & Reel packing quantity is 3,000/reel. Minimum packing quantity is 3,000.

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