Off-Line Digital Constant-Voltage LED Driver with Power Factor Correction

1 Description

The iW3627 is a high-performance single-stage AC/DC constant voltage (CV) controller with high power factor correction. It supports most commonly used isolated and non-isolated topologies including flyback, buck-boost, and buck. The device operates in constant on-time mode to achieve high power factor (>0.9) across a wide load range. It can achieve excellent output voltage regulation over line and load variation without the need for a secondary feedback circuit. It also eliminates the need for external loop compensation while maintaining stability over all operating conditions with different types of loads, including downstream DC-DC converter, constant current (CC) load, LED load, and constant resistive (CR) load. The iW3627 integrates a proprietary technique that adaptively adjusts output voltage limits to maintain overshoot and undershoot transients to less than 10% of the nominal output voltage for any load transient. The iW3627 operates in pulse-frequency-modulation (PFM) mode at light load to eliminate audible noise, and at the same time achieving less than 200mW no-load standby power consumption.

Dialog's innovative proprietary technology maximizes the iW3627 performance in a tiny SOT-23 package. The iW3627 provides maximum design flexibility by providing two multi-function pins that allow users to configure maximum and minimum switching frequencies with no cost or size impact. In addition to providing input voltage sensing for input under-voltage protection, the V_{IN} pin also enables the active start-up scheme to achieve the shortest possible start-up time without sacrificing active efficiency.

2 Features

- All-in-one low-cost off-line high power factor (PF) constant voltage (CV) controller supports flyback, buck-boost, and buck topologies in isolated or non-isolated designs
- Primary-side control achieves very tight line and load regulation (±3%)
- Enhanced MOSFET driver supports output power up to 90W or above in a tiny SOT-23 package
- User-configurable minimum switching frequency (600Hz/1kHz) ensures no-load standby power consumption < 200mW or below
- Internal loop compensation ensures stable operation with different types of loads: downstream DC-DC converter, constant current (CC) load, LED load, and constant resistive (CR) load
- Supports wide range of output capacitance (with output voltage ripple ranging from 1% to 20% at full load)
- Supports universal AC input ($90V_{AC} – 277V_{AC}$) and DC input
- Adaptively adjusted output voltage limits accommodating different load conditions ensures <10% overshoot and undershoot for any load transient
- User-configurable maximum PWM switching frequency (90kHz or 120kHz)
- Built-in soft-start achieves fast and smooth start-up for all different operating conditions
- Active start-up scheme enables fastest possible start-up
- Built-in single-point fault protection features: output over-load, output over-voltage, output short and input voltage under-voltage protections
- Built-in over-temperature protection
- No audible noise over entire operating range

3 Applications

- Smart LED lighting
- LED lighting ballast
- Front-end pre-regulator

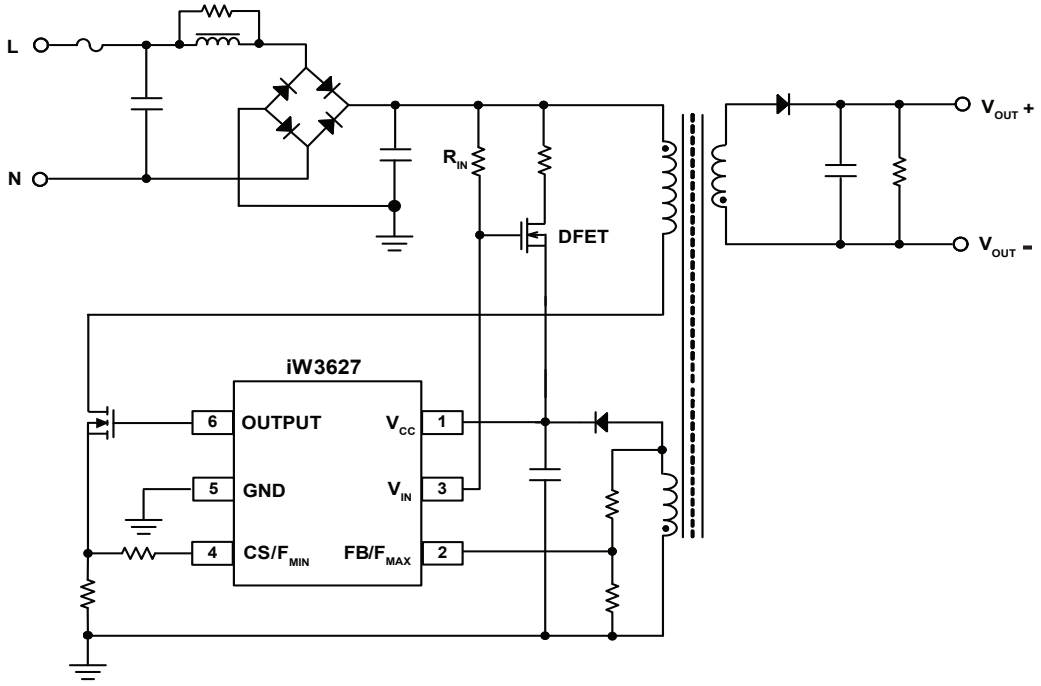


Figure 3.1 : iW3627 Typical Application Circuit (Isolated Flyback Application)

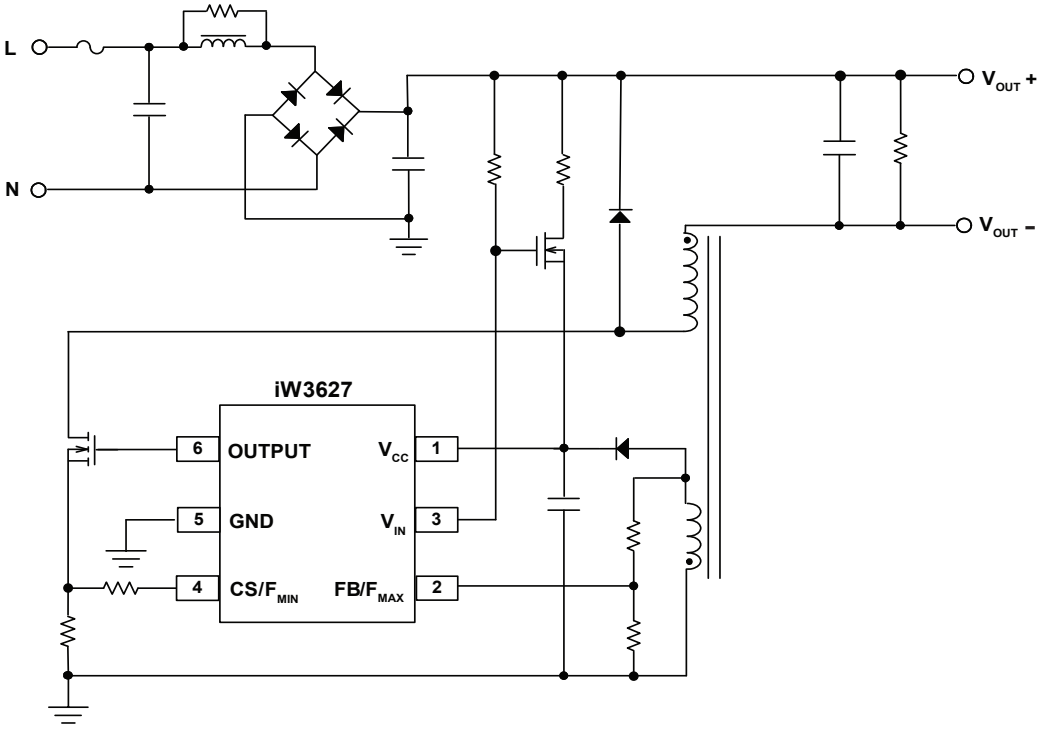


Figure 3.2 : iW3627 Typical Application Circuit (Buck Application)

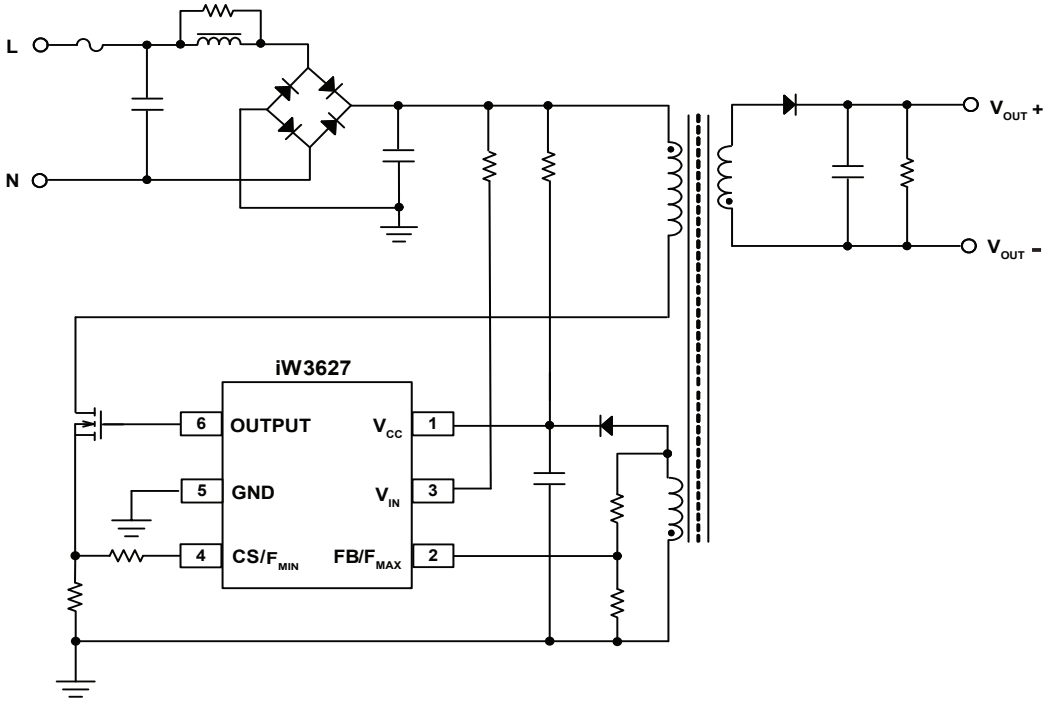


Figure 3.3 : iW3627 Typical Application Circuit (Isolated Flyback Application Without Using Active Start-up Device)

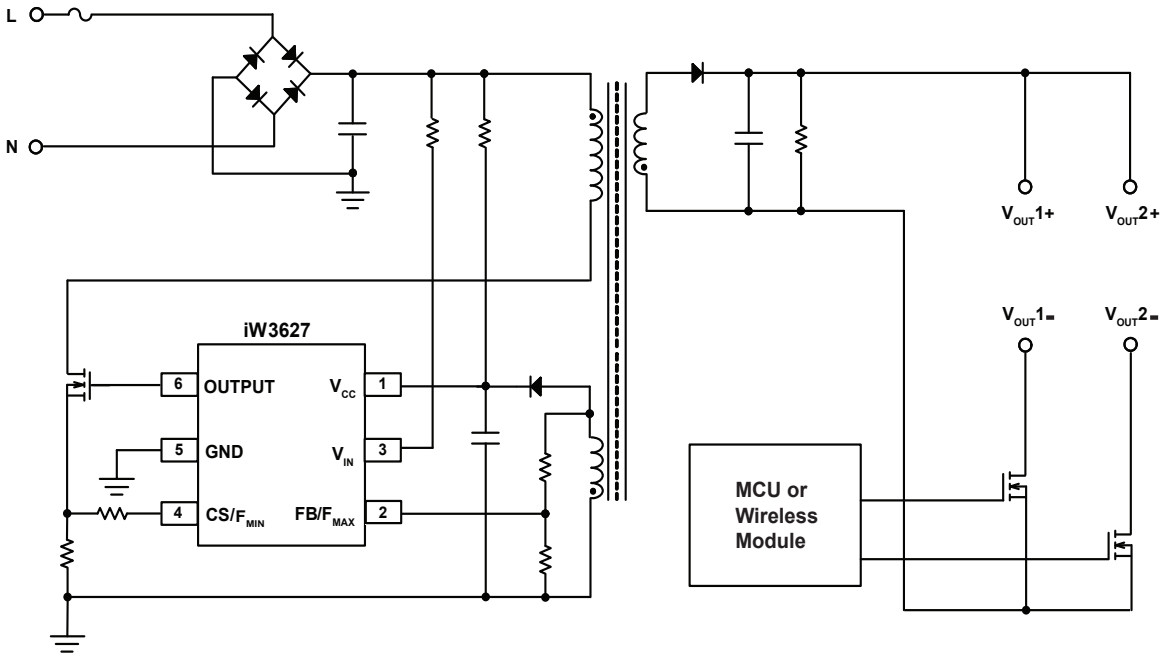


Figure 3.4 : iW3627 Typical Application Circuit (Smart Lighting)

4 Pinout Description

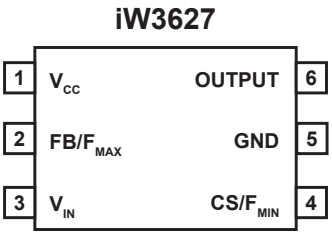


Figure 4.1 : 6-Lead SOT23 Package

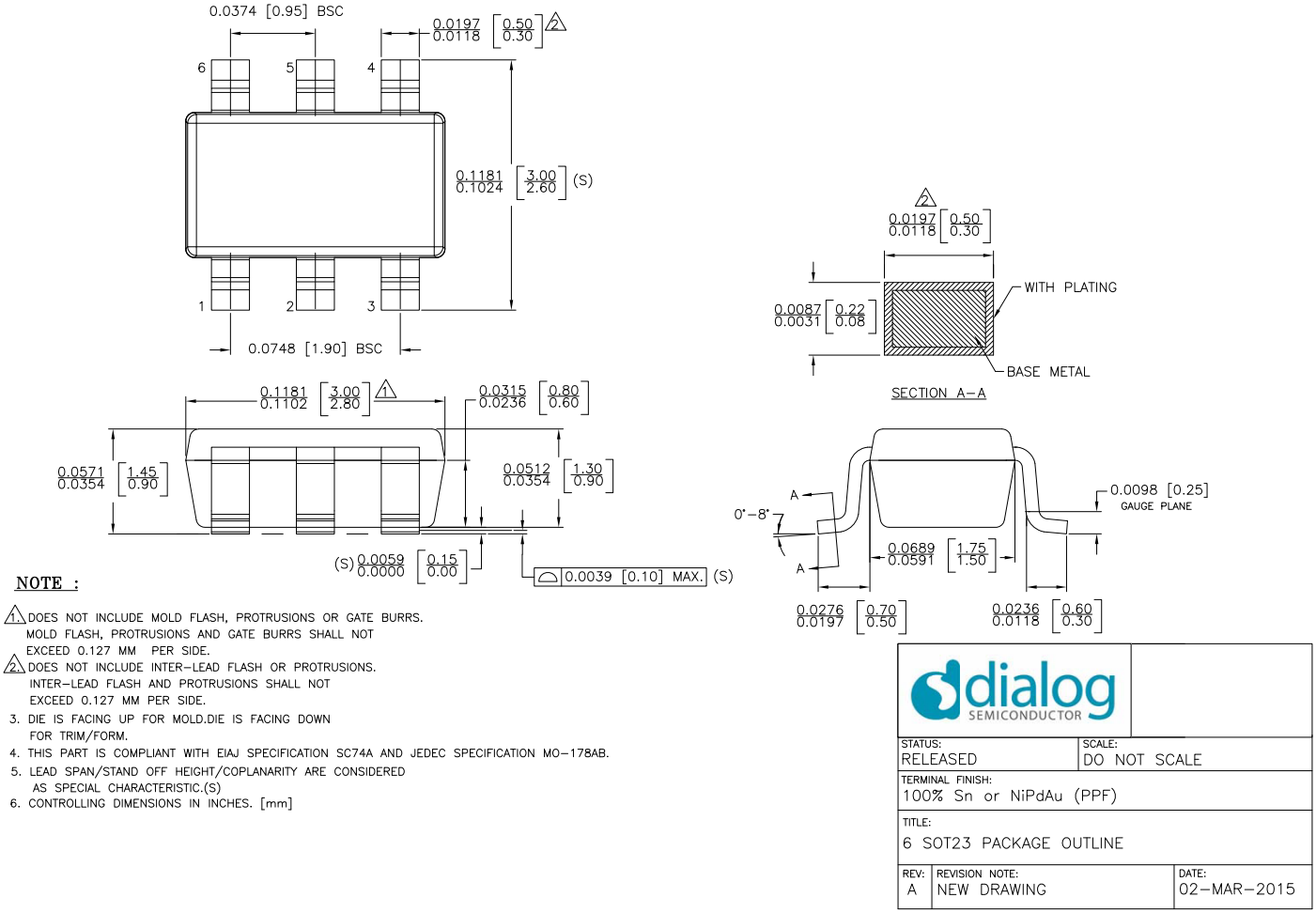
Pin Number	Pin Name	Type	Pin Description
1	V_{CC}	Power Input	Power supply to control logic and MOSFET drive.
2	FB/F_{MAX}	Analog Input	Multi-function pin. Used to configure maximum switching frequency (F_{MAX}), and to enable/disable over-load protection (OLP) at the beginning of start-up. It also provides output voltage sense for primary regulation during normal operation.
3	V_{IN}	Analog Input	Multi-function pin. Used to control active start-up device and sense line voltage.
4	CS/F_{MIN}	Analog Input	Multi-function pin. Used to configure minimum switching frequency (F_{MIN}) at the beginning of the start-up. It also provides 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.

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
V_{IN} (pin 3)		-0.3 to 18.0	V
OUTPUT (pin 6)		-0.3 to 18.0	V
FB/F_{MAX} input (pin 2, $I_{FB/OTP}$ ≤ 10mA)		-0.7 to 4.0	V
CS/F_{MIN} 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 JESD22-A114		±2,000	V
Latch-up test per JESD78D		±100	mA

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]

dialog SEMICONDUCTOR	
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

7 Ordering Information

Part Number	Description	Package	Description
iW3627-00	$V_{IPK(LOW)}$ = 0.16V, maximum NV_O up to 90V	SOT-23	Tape & Reel[1]
iW3627-01	$V_{IPK(LOW)}$ = 0.2V, maximum NV_O up to 145V	SOT-23	Tape & Reel[1]

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

IMPORTANT NOTICE AND DISCLAIMER

RENESAS ELECTRONICS CORPORATION AND ITS SUBSIDIARIES (“RENESAS”) PROVIDES TECHNICAL SPECIFICATIONS AND RELIABILITY DATA (INCLUDING DATASHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES “AS IS” AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, WITHOUT LIMITATION, ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for developers skilled in the art designing with Renesas products. You are solely responsible for (1) selecting the appropriate products for your application, (2) designing, validating, and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, or other requirements. These resources are subject to change without notice. Renesas grants you permission to use these resources only for development of an application that uses Renesas products. Other reproduction or use of these resources is strictly prohibited. No license is granted to any other Renesas intellectual property or to any third party intellectual property. Renesas disclaims responsibility for, and you will fully indemnify Renesas and its representatives against, any claims, damages, costs, losses, or liabilities arising out of your use of these resources. Renesas’ products are provided only subject to Renesas’ Terms and Conditions of Sale or other applicable terms agreed to in writing. No use of any Renesas resources expands or otherwise alters any applicable warranties or warranty disclaimers for these products.

RoHS Compliance

Dialog Semiconductor’s suppliers certify that its products are in compliance with the requirements of Directive 2011/65/EU of the European Parliament on the restriction of the use of certain hazardous substances in electrical and electronic equipment. RoHS certificates from our suppliers are available on request.

(Rev.1.0 Mar 2020)

Corporate Headquarters

TOYOSU FORESIA, 3-2-24 Toyosu
Koto-ku, Tokyo 135-0061, Japan
www.renesas.com

Contact Information

For further information on a product, technology, the most up-to-date version of a document, or your nearest sales office, please visit:
www.renesas.com/contact/

Trademarks

Renesas and the Renesas logo are trademarks of Renesas Electronics Corporation. All trademarks and registered trademarks are the property of their respective owners.