

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 ($\pm 3\%$)
- 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 $< 200\text{mW}$ 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



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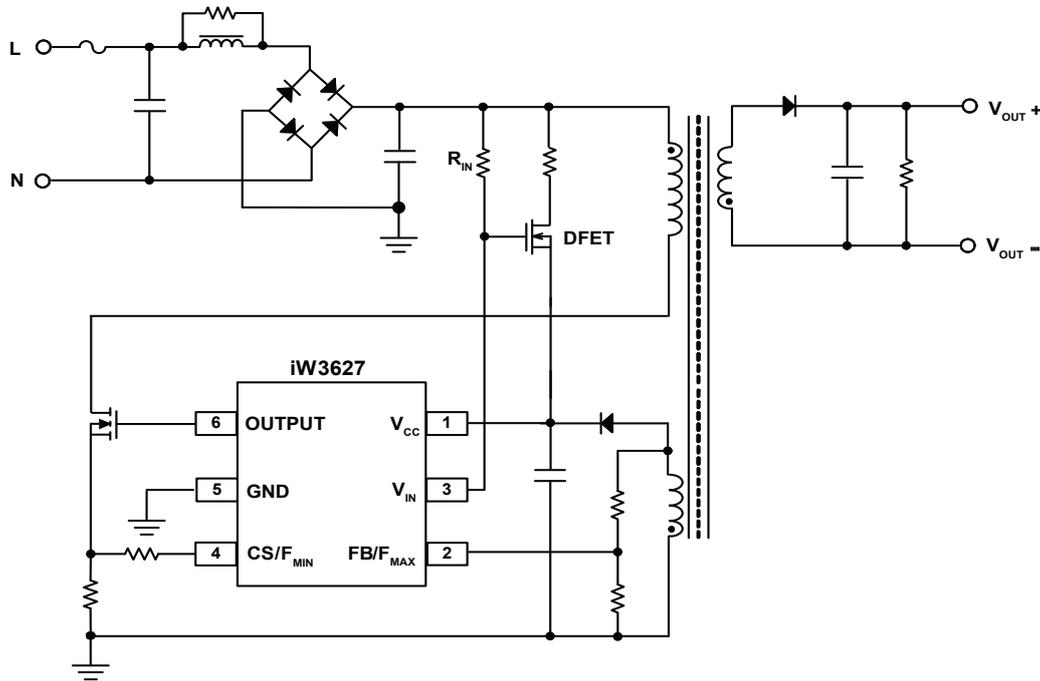


Figure 3.1 : iW3627 Typical Application Circuit (Isolated Flyback Application)

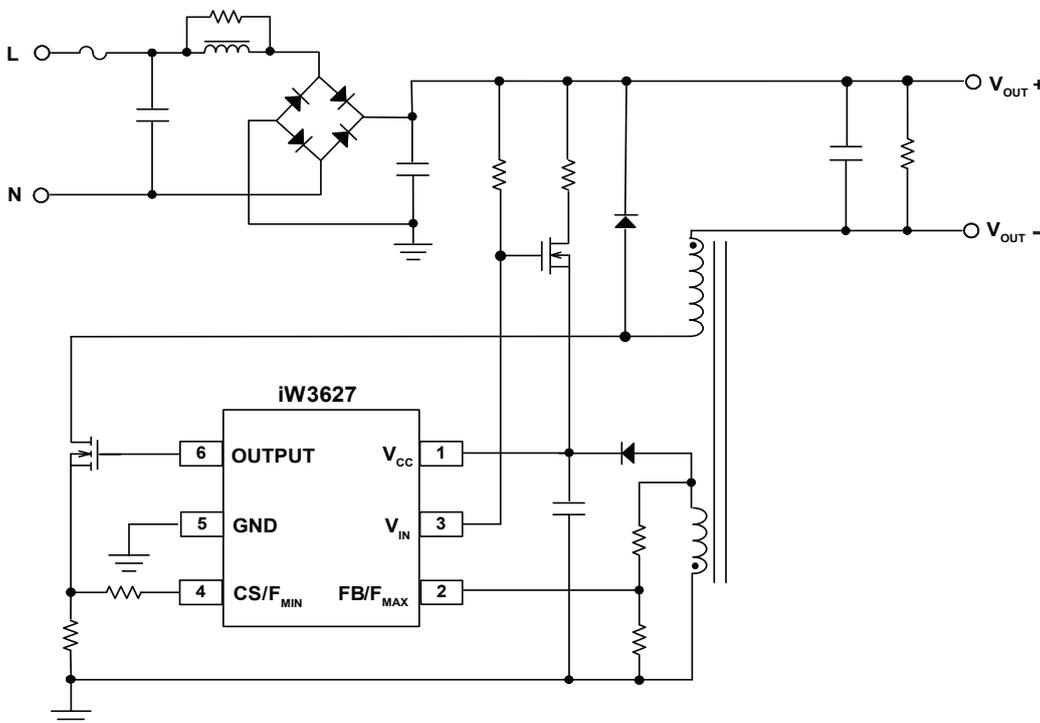


Figure 3.2 : iW3627 Typical Application Circuit (Buck Application)

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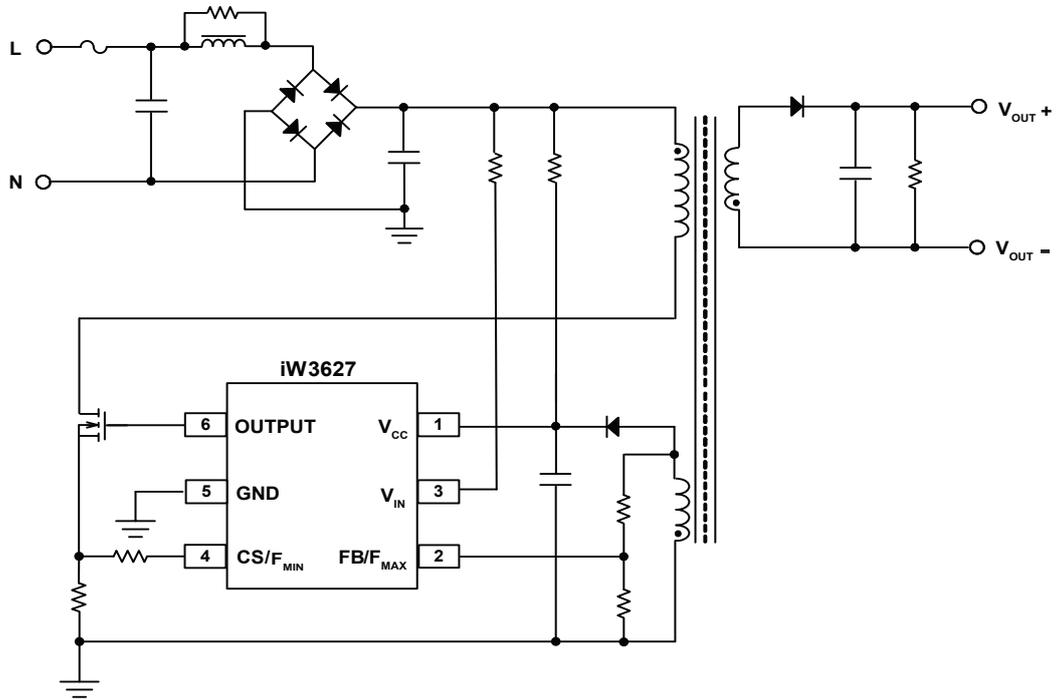


Figure 3.3 : iW3627 Typical Application Circuit (Isolated Flyback Application Without Using Active Start-up Device)

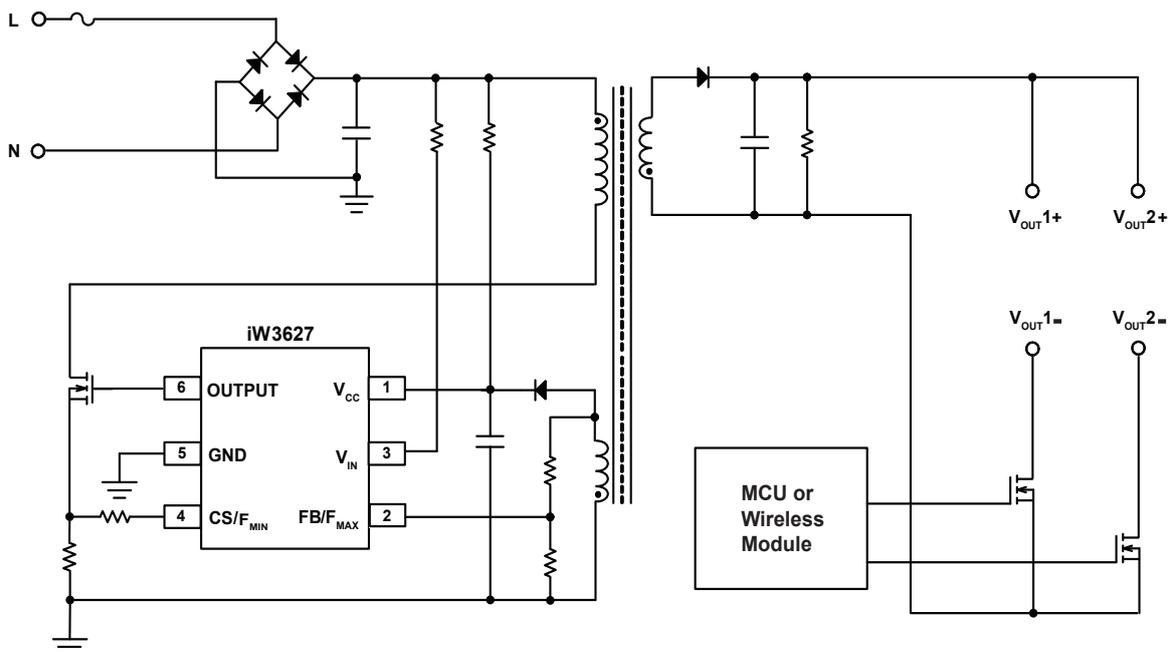


Figure 3.4 : iW3627 Typical Application Circuit (Smart Lighting)

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4 Pinout Description

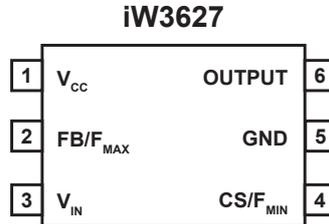


Figure 4.1 : 6-Lead SOT23 Package

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.

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5 Absolute Maximum Ratings

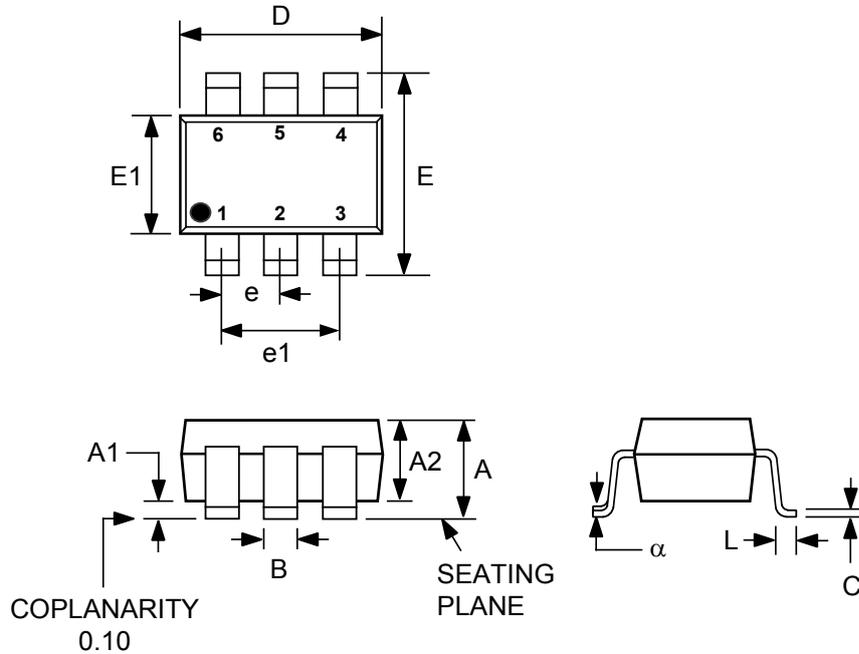
Absolute maximum ratings are the parameter values or ranges which can cause permanent damage if exceeded.

Parameter	Symbol	Value	Units
DC supply voltage range (pin 1, $I_{CC} = 20\text{mA max}$)	V_{CC}	-0.3 to 18.0	V
Continuous DC supply current at V_{CC} pin ($V_{CC} = 15\text{V}$)	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, $I_{FB/OTP} \leq 10\text{mA}$)		-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		$\pm 2,000$	V
Latch-up test per JESD78D		± 100	mA

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6 Physical Dimensions

6-Lead SOT Package



Symbol	Millimeters	
	MIN	MAX
A	-	1.45
A1	0.00	0.15
A2	0.90	1.30
B	0.30	0.50
C	0.08	0.22
D	2.90 BSC	
E	2.80 BSC	
E1	1.60 BSC	
e	0.95 BSC	
e1	1.90 BSC	
L	0.30	0.60
α	0°	8°

Compliant to JEDEC Standard MO-178AB

Controlling dimensions are in millimeters

This package is RoHS compliant and Halide free.

Soldering Temperature Resistance:

- [a] Package is IPC/JEDEC Std 020D Moisture Sensitivity Level 1
- [b] Package exceeds JEDEC Std No. 22-A111 for Solder Immersion Resistance; packages can withstand 10 s immersion < 260°C

Dimension D does not include mold flash, protrusions or gate burrs. Mold flash, protrusions or gate burrs shall not exceed 0.25 mm per side.

The package top may be smaller than the package bottom. Dimensions D and E1 are determined at the outermost extremes of the plastic body exclusive of mold flash, tie bar burrs and interlead flash, but including any mismatch between top and bottom of the plastic body.

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 ordering quantity is 3,000.

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