Two-Stage, Flickerless™ Digital Off-Line LED Driver with High PF and Low THD

1 Description

The iW3629 is a high-performance AC/DC off-line digital power supply controller for LED luminaires up to 120W or above. The two-stage design combines high power factor (PF > 0.95), low total harmonic distortion (THD <10%) and negligible line frequency ripple (< 5%) to make the iW3629 ideal for high-power non-dimmable LED lamps and luminaires.

The two-stage approach allows the first-stage boost converter to convert the rectified AC voltage ($90V_{AC}$ to $277V_{AC}$) to an intermediate voltage while correcting for power factor. The second-stage flyback converter then provides the constant current regulation to the LEDs. The combination of an active start-up circuit and fast yet smooth soft-start for both boost and flyback stages results in a start-up time (AC plug-in to 90% of set LED current) of less than a half second and fast power factor settling time.

The iW3629 operates in a quasi-resonant mode to provide high efficiency and uses Dialog's ***PrimAccurate***™ advanced primary-side sensing technology to achieve excellent line and load regulation without secondary-feedback components. And, by using Dialog's ***Flickerless***™ technology, virtually all flicker is removed from the output. The digital control algorithms used by the iW3629 maintain stability over all operating conditions without the need for any external loop compensation components, minimizing the BOM cost.

2 Features

- Supports universal, $90V_{AC}$-$277V_{AC}$ input voltage range and output power up to 120W or above
- Two-stage design (boost and flyback)
  - » High PF (> 0.95) and low THD (< 10%) over entire input voltage range and 50%-100% load current
- Under 5% 100Hz/120Hz output current ripple
- Quasi-resonant control for both boost and flyback stages to achieve high efficiency
- Over-temperature derating protection with external NTC to program derating start temperature
- Fast yet smooth boost start-up scheme to achieve short PF settling time
- Fast line transient response ensures minimal bulk voltage overshoot within the capacitor safety limit
- Small size design
  - » Small size input bulk capacitor
  - » Small size output capacitor
  - » Small transformer
- ***Flickerless*** technology - removes virtually all flicker
- ***PrimAccurate*** primary-side sensing eliminates the need for optocoupler feedback and simplifies design
- Tight LED current regulation (± 5%)
- Under 0.5s start-up time
- Hot-plug LED module support
- Multiple protection features:
  - » LED open circuit protection
  - » Single-fault protection
  - » Over-current protection
  - » LED short-circuit protection
  - » Current sense-resistor-short-circuit protection
  - » Input over-voltage and brown-out protection
  - » Internal junction temperature-based over-temperature protection

3 Applications

- Non-dimmable LED lamps and luminaires
- Output power up to 120W or above

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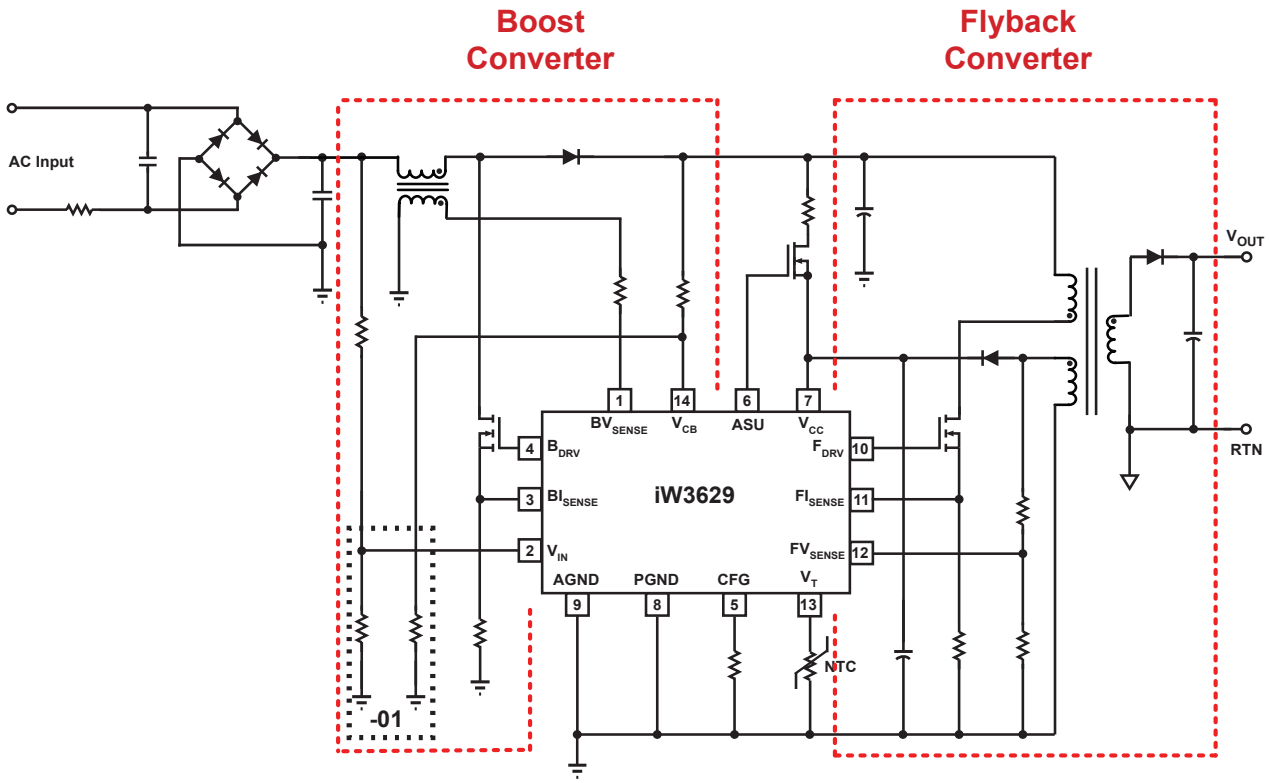


Figure 3.1 : iW3629 Typical Application Circuit with Internal (-00) or External (-01) Sensing

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4 Pinout Description

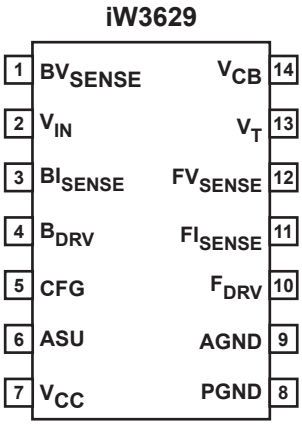


Figure 4.1 : 14-Lead SOIC-14 Package

Pin Number	Pin Name	Type	Pin Description
1	BV_{SENSE}	Analog Input	Boost inductor voltage feedback used for valley mode switching.
2	V_{IN}	Analog Input	Rectified AC line voltage feedback. -00 uses internal resistor (15kΩ typically) to sense line voltage; -01 needs an external resistor connected from this pin to GND.
3	BI_{SENSE}	Analog Input	Boost current sense (only used for cycle-by-cycle peak current limit). Connect an approximately 1kΩ resistor to the source of the boost MOSFET switch to improve noise immunity.
4	B_{DRV}	Output	Gate drive for boost MOSFET.
5	CFG	Analog In/Out	Chooses input start-up voltage and brown-out shutdown voltage.
6	ASU	Output	Control signal for active start-up device. This signal is pulled low after start-up is finished to cut off the active device. If not using active start-up device, leave this pin floating.
7	V_{CC}	Power	Power supply for control logic and voltage sense for power-on reset circuitry. A decoupling capacitor of 0.1µF or so should be connected between the V_{CC} pin and GND.
8	PGND	Ground	Power ground.
9	AGND	Ground	Signal ground.
10	F_{DRV}	Output	Gate drive for Flyback MOSFET.
11	FI_{SENSE}	Analog Input	Primary current sense (used for cycle-by-cycle peak current control and limit). Connect an approximately 1kΩ resistor to the source of the flyback MOSFET switch to improve noise immunity.
12	FV_{SENSE}	Analog Input	Auxiliary voltage sense (used for primary-side regulation and valley mode switching).
13	V_T	Analog Input	Output power limit and shutdown control. An NTC resistor connected from this pin to GND provides over-temperature derating protection.
14	V_{CB}	Analog Input	Boost output voltage feedback. -00 uses internal resistor (15kΩ typically) to sense line voltage; -01 needs an external resistor connected from this pin to GND.

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5 Absolute Maximum Ratings

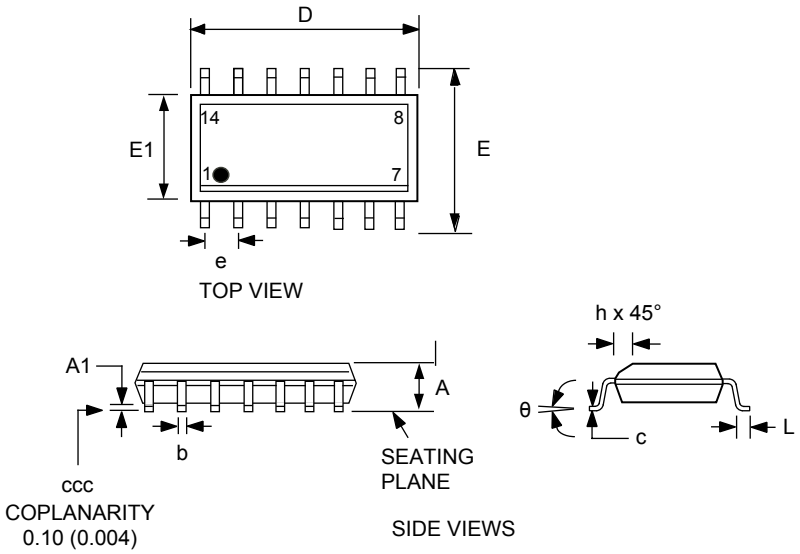
Absolute maximum ratings are the parameter values or ranges which can cause permanent damage if exceeded.

Parameter	Symbol	Value	Units
DC supply voltage range (pin 7)	V_{CC}	-0.3 to 18	V
F_{DRV} output (pin 10)		-0.3 to 18	V
B_{DRV} output (pin 4)		-0.3 to 18	V
CFG input (pin 5)		-0.3 to 4.0	V
FV_{SENSE} input (pin 12, I ≤ 10mA)		-0.7 to 4.0	V
BV_{SENSE} input (pin 1, I ≤ 3mA)		-0.7 to 4.0	V
V_{IN} input (pin 2)		-0.3 to 18	V
V_{CB} input (pin 14)		-0.3 to 18	V
FI_{SENSE} input (pin 11)		-0.3 to 4.0	V
BI_{SENSE} input (pin 3)		-0.3 to 4.0	V
ASU output (pin 6)		-0.3 to 18	V
V_T input (pin 13)		-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-PCB Board Surface Temperature	ψ_{JB}	45	°C/W
ESD rating per JEDEC JESD22-A114		±2,000	V

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6 Physical Dimensions

14-Lead SOIC Package



Symbol	Inches		Millimeters	
	MIN	MAX	MIN	MAX
A	0.053	0.069	1.35	1.75
A1	0.004	0.010	0.10	0.25
b	0.013	0.020	0.33	0.51
c	0.007	0.010	0.19	0.25
D	0.337	0.344	8.55	8.75
E1	0.150	0.157	3.80	4.00
E	0.228	0.244	5.80	6.20
e	0.050 BSC		1.27 BSC	
L	0.016	0.050	0.40	1.27
h	0.010	0.020	0.25	0.50
θ	0°	8°	0°	8°
ccc	0.004		0.10	

Compliant to JEDEC Standard MS12F

Controlling dimensions are in inches; millimeter dimensions are for reference only

This product 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; package 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 0.15 mm per end. Dimension E does not include interlead flash or protrusion. Interlead flash or protrusion shall not exceed 0.25 mm per side.

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

Figure 6.1 : Physical Dimensions of 14-Pin SOIC Package

7 Ordering Information

Part Number	Options	Package	Description
iW3629-00	Internal sensing for V_{IN} and V_{CB}; Z_{IN} = 15kΩ and Z_{CB} = 15kΩ	SOIC-14	Tape & Reel[1]
iW3629-01	External sensing for V_{IN} and V_{CB}	SOIC-14	Tape & Reel[1]

Note 1: Tape & Reel packing quantity is 2,500/reel. Minimum ordering quantity is 2,500.

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