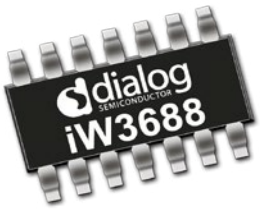
iW3688 Product Summary

AC/DC Advanced Digital Power Controller for Single-Stage Dimmable LED Drivers

1.0 Features

- Isolated/non-isolated off-line120V_{AC}/230V_{AC} LED driver up to 20W output power
- Wide line frequency range (from 45Hz to 66Hz)
- Meets IEC61000-3-2 Current Harmonic requirement
- Total harmonic distortion < 20% with PF > 0.92
- Excellent dimmer compatibility
  - » Leading-edge dimmer
  - » Trailing-edge dimmer
  - » Digital smart dimmer
- Wide dimming range of 1% to 100%
- Intelligent digital control integrating current sink function into power switching circuit
- Advanced IC power management and voltage sensing enables the use of off-the-shelf inductor
- Resonant control to achieve high efficiency (typical > 85% without dimmer)
- Excellent AC line distortion immunity ensures quality of product under real-life circumstances
- Over-temperature LED current foldback and shutdown
- Tight LED current regulation (±5%)
- Fast start-up (< 0.5s without dimmer)
- Multiple protection features that include:
  - » LED open-circuit and short-circuit protection
  - » Current sensing resistor open circuit and short-circuit protection
  - » AC line over-voltage protection
  - » Over-current protection



2.0 Description

The iW3688 is a single-stage, high-performance AC/DC offline power supply controller for dimmable LED luminaires. It applies advanced digital control technology to detect the dimmer type, enabling it to provide dynamic impedance to interface with the dimmer and to control the LED brightness at the same time.

With advanced dimmer detection technology, the iW3688 can operate with most wall dimmers including leading-edge dimmers (R-type or R-L type), trailing-edge dimmers (R-C type), and smart dimmers. In addition, the iW3688's cycle-by-cycle waveform analysis technology allows for fast dimmer transient response.

In no dimmer mode, the iW3688 operates the main power converter that delivers current to the LED load in quasi-resonant mode to provide high power efficiency and low electro-magnetic interference (EMI). When there is no dimmer on the line, the iW3688 optimizes the power factor and minimizes the current harmonic distortion to the AC line. The commonly utilized converter topologies for iW3688 are buck-boost and flyback.

The iW3688 uses patented PrimAccurate™ primary-side sensing technology to achieve excellent LED current regulation under different AC line and LED load voltages, without using a secondary-side feedback circuit and thus eliminating the need for an opto-coupler.

The iW3688 minimizes the external components count by simplifying the EMI filter with Dialog's EZ-EMI® technology, and by integrating current sink, switching, and V_{CC} charging circuit. Additionally, the iW3688 does not require an auxiliary winding, which eliminates the need for a custom inductor. The digital control loop of the iW3688 maintains stable overall operating conditions without the need for loop compensation components.

The iW3688 maintains high performance wide-range dimming and achieves excellent dimmer compatibility with a simple application circuit.

3.0 Applications

- Dimmable LED retrofit lamps up to 20W
- Dimmable LED luminaires up to 20W

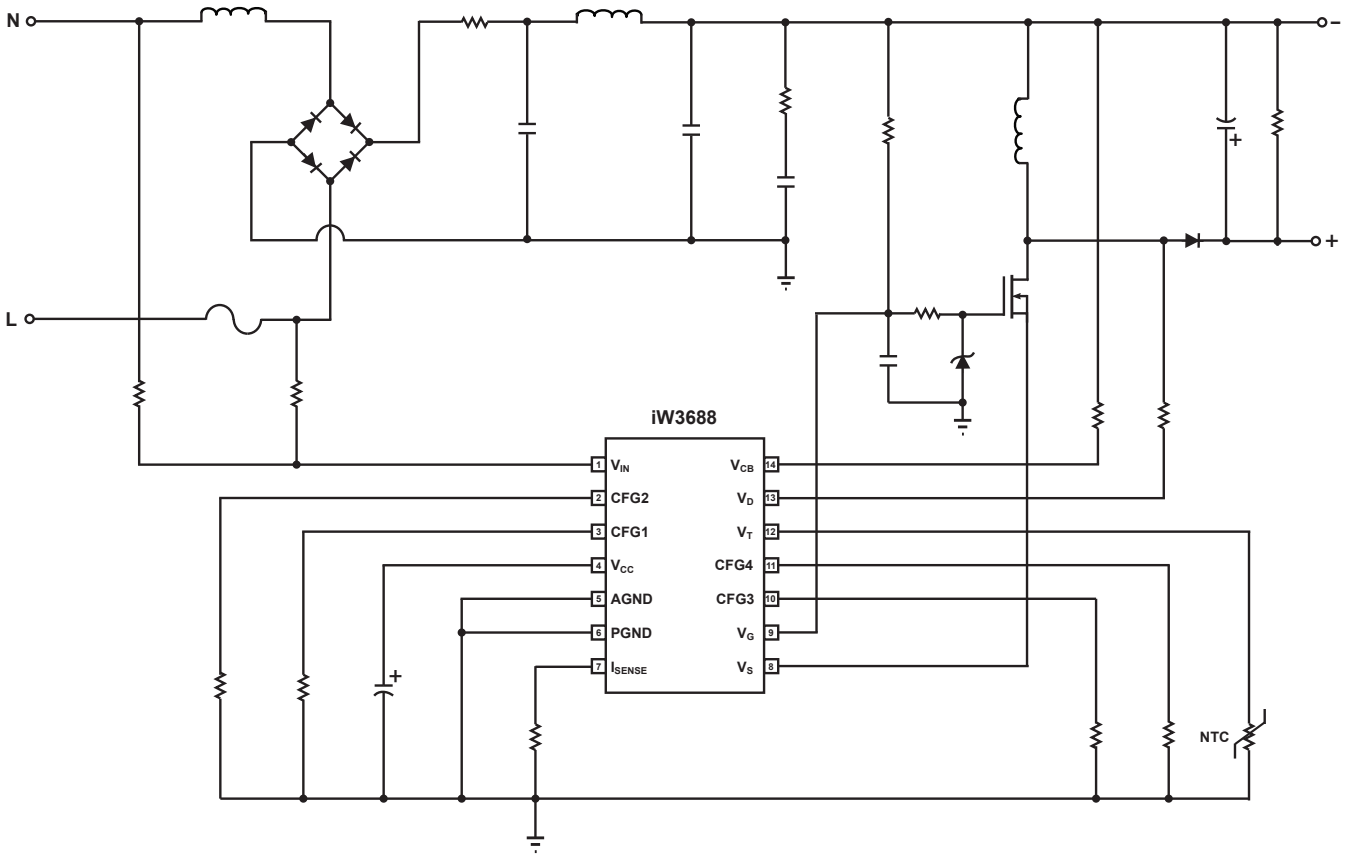


Figure 3.1: iW3688 Simplified Application Circuit

4.0 Pinout Description

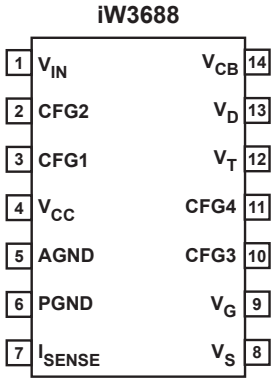


Figure 4.1: 14-Lead SOIC-14 Package

Pin #	Name	Type	Pin Description
1	V_{IN}	Analog Input	Rectified AC line voltage input.
2	CFG2	Analog Input	Reserved for configuration.
3	CFG1	Analog Input	Reserved for configuration.
4	V_{CC}	Power	Power supply for control logic.
5	AGND	Ground	Signal ground. It should be connected to the power ground on PCB.
6	PGND	Ground	Power ground.
7	I_{SENSE}	Analog Input	Current sense.
8	V_S	Analog Input	Source voltage of MOSFET.
9	V_G	Analog Input	Gate voltage of MOSFET.
10	CFG3	Digital Output	Reserved for configuration.
11	CFG4	Digital Input	Reserved for configuration.
12	V_T	Analog Input	External power limit shutdown control and external over-temperature power derating.
13	V_D	Analog Input	Drain voltage of MOSFET
14	V_{CB}	Analog Input	Input capacitor voltage after EMI filter.

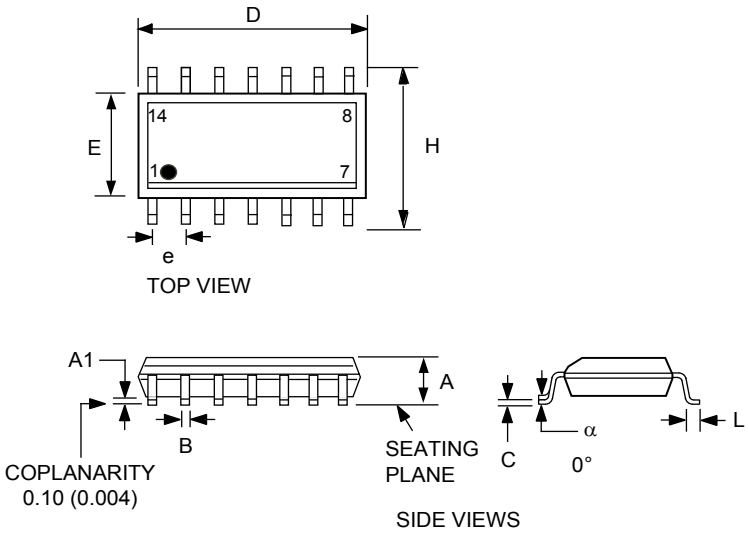
5.0 Absolute Maximum Ratings

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

Parameter	Symbol	Value	Unit
DC supply voltage range (pin 4)	V_{CC}	-0.3 to 6	V
V_{IN} input (pin 1)		-0.3 to 6	V
CFG1 input (pin 3)		-0.3 to 6	V
CFG2 input (pin 2)		-0.3 to 20	V
I_{SENSE} input (pin 7)		-0.3 to 6	V
V_S input (pin 8)		-0.3 to 20	V
V_G input (pin 9)		-0.3 to 20	V
CFG3 input (pin 10)		-0.3 to 6	V
CFG4 input (pin 11)		-0.3 to 20	V
V_T input (pin 12)		-0.3 to 6	V
V_D input (pin 13)		-0.3 to 6	V
V_{CB} input (pin 14)		-0.3 to 6	V
Power dissipation at $T_A \leq 25°C$		TBD	mW
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 [Still Air]	Ψ_{JB}	45	°C/W
ESD rating per JEDEC JESD22-A114		±2,000	V
Latch-up test per JESD78A		±100	mA

6.0 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
E	0.150	0.157	3.80	4.00
e	0.050 BSC		1.27 BSC	
H	0.228	0.244	5.80	6.20
N	0.086	0.094	2.18	2.39
M	0.118	0.126	3.00	3.20
L	0.016	0.050	0.40	1.27
α	0°	8°	0°	8°

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.

7.0 Ordering Information

Part Number	Options	Package	Description
iW3688-00	120V_{AC} Input for 8W – 14W	SOIC-14	Tape & Reel[1]
iW3688-01	230V_{AC} Input for 8W – 14W	SOIC-14	Tape & Reel[1]
iW3688-10	120V_{AC} Input for < 7W	SOIC-14	Tape & Reel[1]
iW3688-11	230V_{AC} Input for < 7W	SOIC-14	Tape & Reel[1]
iW3688-20	120V_{AC} Input for 15W – 20W	SOIC-14	Tape & Reel[1]
iW3688-21	230V_{AC} Input for 15W – 20W	SOIC-14	Tape & Reel[1]

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

AC/DC Advanced Digital Power Controller for Single-Stage Dimmable LED Drivers

Disclaimer

Information in this document is believed to be accurate and reliable. However, Dialog Semiconductor does not give any representations or warranties, expressed or implied, as to the accuracy or completeness of such information. Dialog Semiconductor furthermore takes no responsibility whatsoever for the content in this document if provided by any information source outside of Dialog Semiconductor.

Dialog Semiconductor reserves the right to change without notice the information published in this document, including without limitation the specification and the design of the related semiconductor products, software and applications.

Applications, software, and semiconductor products described in this document are for illustrative purposes only. Dialog Semiconductor makes no representation or warranty that such applications, software and semiconductor products will be suitable for the specified use without further testing or modification. Unless otherwise agreed in writing, such testing or modification is the sole responsibility of the customer and Dialog Semiconductor excludes all liability in this respect.

Customer notes that nothing in this document may be construed as a license for customer to use the Dialog Semiconductor products, software and applications referred to in this document. Such license must be separately sought by customer with Dialog Semiconductor.

All use of Dialog Semiconductor products, software and applications referred to in this document are subject to Dialog Semiconductor's Standard Terms and Conditions of Sale, unless otherwise stated.

RoHS compliance

Dialog Semiconductor complies to European Directive 2001/95/EC and from 2 January 2013 onwards to European Directive 2011/65/EU concerning Restriction of Hazardous Substances (RoHS/RoHS2).
Dialog Semiconductor's statement on RoHS can be found on the customer portal https://support.diasemi.com/. RoHS certificates from our suppliers are available on request.

Contacting Dialog Semiconductor

United Kingdom
Dialog Semiconductor (UK) Ltd
Phone: +44 1793 757700

Germany
Dialog Semiconductor GmbH
Phone: +49 7021 805-0

The Netherlands
Dialog Semiconductor B.V.
Phone: +31 73 640 88 22

Email
info_pcbg@diasemi.com

North America
Dialog Semiconductor Inc.
Phone: +1 408 845 8500

Japan
Dialog Semiconductor K. K.
Phone: +81 3 5425 4567

Taiwan
Dialog Semiconductor Taiwan
Phone: +886 8178 6222

Web site:
www.dialog-semiconductor.com

Singapore
Dialog Semiconductor Singapore
Phone: +65 64849929

Hong Kong
Dialog Semiconductor Hong Kong
Phone: +852 2607 4271

Korea
Dialog Semiconductor Korea
Phone: +82 2 3469 8200

China
Dialog Semiconductor (Shenzhen)
Phone: +86 755 2981 3669

Dialog Semiconductor (Shanghai)
Phone: +86 21 5178 2561