

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

1 Description

The iW3609 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, which provides dynamic impedance to interface with the dimmer and control the LED brightness at the same time.

With advanced dimmer detection technology, the iW3609 can operate with most wall dimmers including leading-edge dimmers (R-type or R-L type) and trailing-edge dimmers (R-C type). In addition, the iW3609's cycle-by-cycle waveform analysis technology allows for fast dimmer setting response. When no dimmer is on the line, the iW3609 optimizes the power factor and minimizes the current harmonic distortion to the AC line. Furthermore, in no dimmer condition, output current is regulated at nominal output current value over a wide input voltage range.

The iW3609 operates the main power converter that delivers current to the LED load in quasi-resonant mode to provide high power efficiency and minimize electro-magnetic interference (EMI). The commonly utilized converter topologies for iW3609 are buck-boost and flyback. It uses Dialog's 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 optocoupler.

The iW3609 minimizes the external components count by simplifying the EMI filter with Dialog's **EZ-EMI™** technology. The intelligent dimmer detection technology minimizes the bleeding power loss. Additionally, the digital control loop of the iW3609 maintains stable overall operating conditions without the need for loop compensation components.

2 Features

- Isolated/non-isolated offline 120V_{AC}/230V_{AC} LED driver up to 15W 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
- Wide dimmer compatibility
 - » Leading-edge dimmer
 - » Trailing-edge dimmer
- Selectable dimming range of 1% to 100% or 10% to 100%
- Resonant control to achieve high efficiency (typical > 82% without dimmer)
- Over-temperature LED current foldback
- Small solution size
 - » Single-stage topology reduces part counts
 - » 90kHz maximum switching frequency enables the use of a small transformer
- **PrimAccurate** primary-side sensing eliminates the need for opto-isolator feedback
- Tight LED current regulation (±5%)
- Fast start-up (< 0.5s without dimmer)
- Compatible with NEMA SSL6 dimming curve standard
- Multiple protection features that include:
 - » LED open-circuit and short-circuit protection
 - » Over-current protection
 - » Over-temperature protection
 - » Current sense resistor short-circuit protection
 - » AC line over-voltage protection
- Optional proprietary input current shaping

3 Applications

- Dimmable LED retrofit lamps up to 15W
- Dimmable LED luminaires up to 15W



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

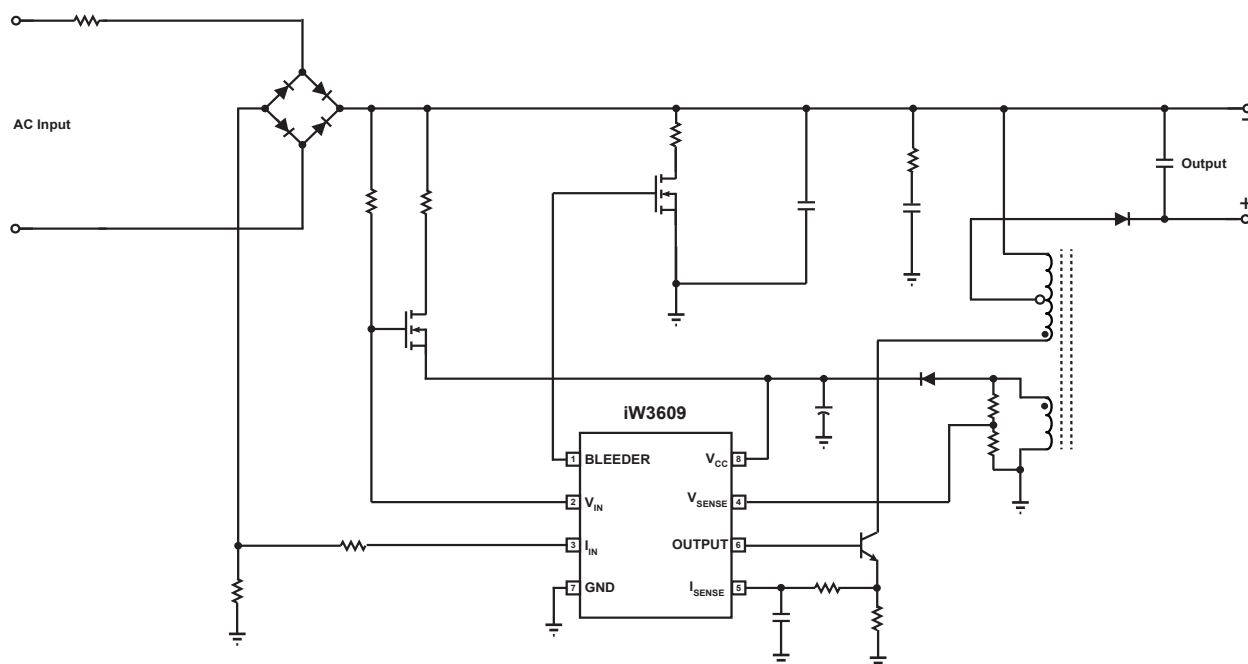


Figure 3.1 : iW3609 Simplified Application Circuit

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

4 Pinout Description

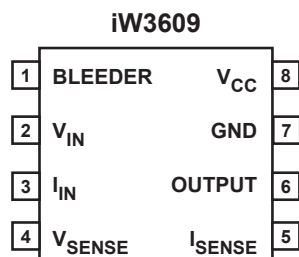


Figure 4.1 : 8 Lead SOIC Package

Pin No.	Pin Name	Type	Pin Description
1	BLEEDER	Output	Gate drive for Bleeder switch
2	V_{IN}	Analog Input	Rectified AC line voltage sense
3	I_{IN}	Analog Input	Rectified AC line current sense
4	V_{SENSE}	Analog Input	Auxiliary winding voltage sense
5	I_{SENSE}	Analog Input	Primary side current sense
6	OUTPUT	Output	Base drive for main BJT switch
7	GND	Ground	Ground
8	V_{CC}	Power	Power supply for control logic

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

5 Absolute Maximum Ratings

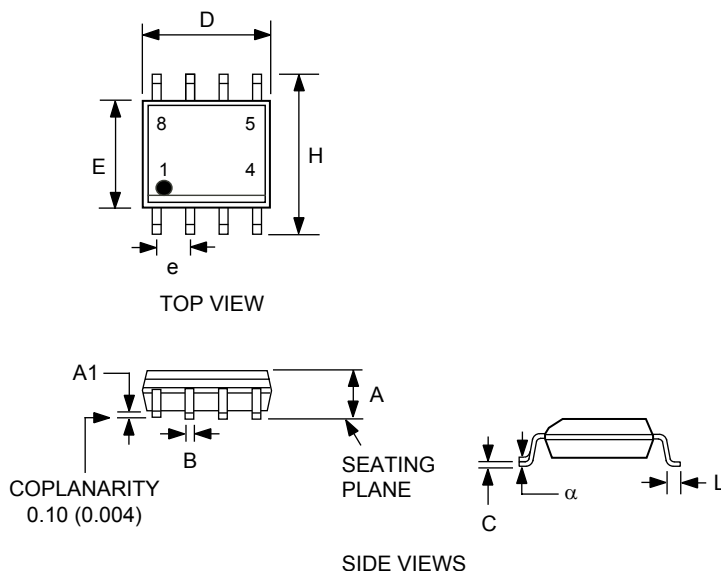
Absolute maximum ratings are the parameter values or ranges which can cause permanent damage if exceeded. For maximum safe operating conditions, refer to Electrical Characteristics in Section 6.

Parameter	Symbol	Value	Units
DC supply voltage range (pin 8)	V_{CC}	-0.3 to 18	V
OUTPUT (pin 6)		-0.3 to 4.0	V
BLEEDER output (pin 1)		-0.3 to V_{CC}	V
V_{SENSE} input (pin 4, $I \leq 10\text{mA}$)		-0.7 to 4.0	V
V_{IN} input (pin 2)		-0.3 to 18	V
I_{SENSE} input (pin 5)		-0.3 to 4.0	V
I_{IN} input (pin 3)		-0.7 to 4.0	V
Maximum junction temperature	T_{JMAX}	150	°C
Storage temperature	T_{STG}	-65 to 150	°C
Thermal Resistance Junction-to-Ambient [Still Air]	θ_{JA} (Note 1)	160	°C/W
ESD rating per JEDEC JS-001-2017		$\pm 2,000$	V
Latch-up test per JESD78E		± 100	mA

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

6 Physical Dimensions

8-Lead Small Outline (SOIC) Package



Symbol	Inches		Millimeters	
	MIN	MAX	MIN	MAX
A	0.053	0.069	1.35	1.75
A1	0.0040	0.010	0.10	0.25
B	0.014	0.019	0.35	0.49
C	0.007	0.010	0.19	0.25
D	0.189	0.197	4.80	5.00
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
L	0.016	0.049	0.40	1.25
α	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 E1 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 E1 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 Ordering Information

Part no.	Options	Package	Description
iW3609-04	230V _{AC} input, lower bleeder loss options	SOIC-8	Tape & Reel ¹
iW3609-10	120V _{AC} input, without current shaping	SOIC-8	Tape & Reel ¹

Note 1: Tape and reel packing quantity is 2,500/reel. Minimum packing quantity is 2,500.

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

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.

© 2023 Renesas Electronics Corporation. All rights reserved.

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.