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

1 Description

The iW3605 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 iW3605 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 iW3605's cycle-by-cycle waveform analysis technology allows for fast dimmer setting response. When no dimmer is on the line, the iW3605 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 iW3605 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 iW3605 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 iW3605 minimizes the external components count by eliminating the secondary feedback circuit and bleeder circuit. Additionally, the digital control loop of the iW3605 maintains stable over all operating conditions without the need for loop compensation components.

2 Features

- Isolated/non-isolated offline120V_{AC}/230V_{AC} LED driver up to 25W 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
- No bleeder needed with output power down to 5W for 120V_{AC}/230V_{AC}
- Resonant control to achieve high efficiency (typical > 82% without dimmer)
- Over-temperature LED current foldback
- Tight LED current regulation (± 5%)
- Small solution size
  - » Single-stage topology reduces part counts
  - » 90kHz maximum switching frequency enables the use of a small transformer
- Fast start-up (< 0.5s without dimmer)
- Primary-side sensing eliminates the need for optocoupler feedback
- 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 sensing resistor short-circuit protection
  - » AC line over-voltage protection

3 Applications

- Dimmable LED retrofit lamps up to 25W
- Dimmable LED luminaires up to 25W

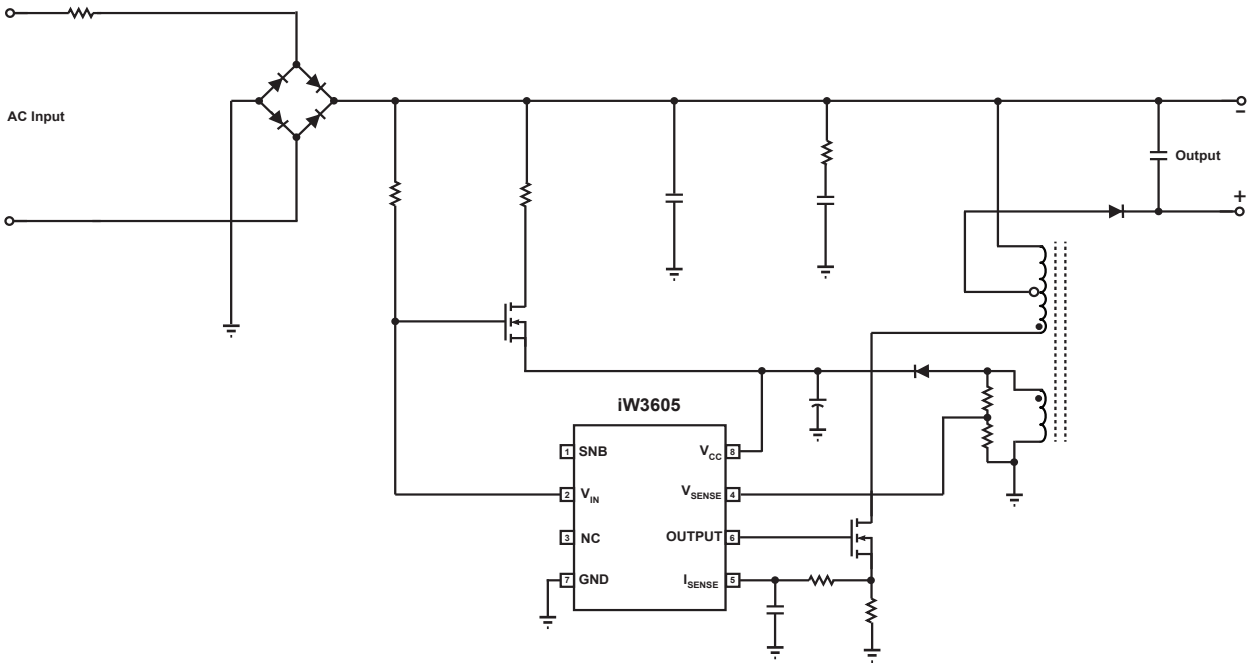


Figure 3.1 : iW3605 Simplified Application Circuit

4 Pinout Description

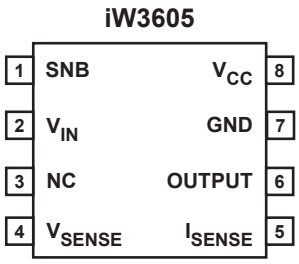


Figure 4.1 : 8-Lead SOIC Package

Pin Number	Pin Name	Type	Pin Description
1	SNB	Output	Gate drive for active snubber switch
2	V_{IN}	Analog Input	Rectified AC line voltage sense
3	NC	–	No connection
4	V_{SENSE}	Analog Input	Auxiliary winding voltage sense
5	I_{SENSE}	Analog Input	Primary side current sense
6	OUTPUT	Output	Gate drive for main MOSFET switch
7	GND	Ground	Ground
8	V_{CC}	Power	Power supply for control logic

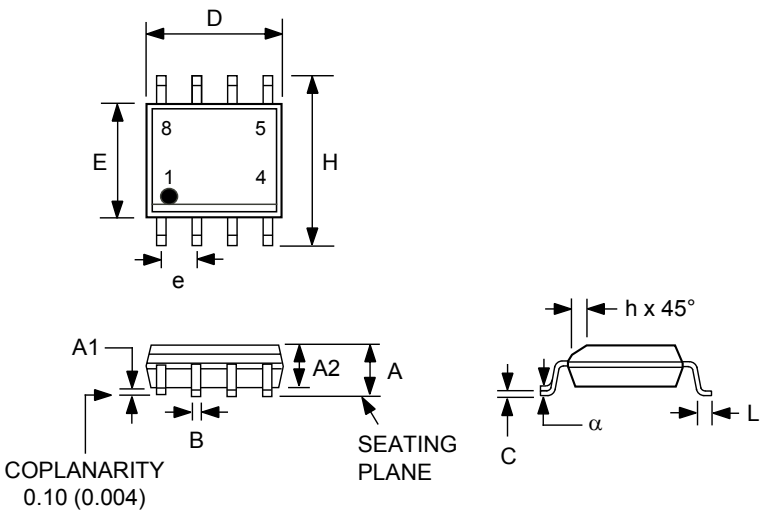
5 Absolute Maximum Ratings

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 8)	V_{CC}	-0.3 to 18	V
OUTPUT (pin 6)		-0.3 to V_{CC}	V
SNB output (pin 1)		-0.3 to V_{CC}	V
V_{SENSE} input (pin 4, I ≤ 10mA)		-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
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]	θ_{JA}	160	°C/W
ESD rating per JEDEC JESD22-A114		±2,000	V
Latch-up test		100	mA

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
A2	0.049	0.059	1.25	1.50
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
h	0.10	0.020	0.25	0.50
L	0.016	0.049	0.4	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
iW3605-02[1] iW3605-02C	I_{SENSE} clamp to 0.3V nominal	SOIC-8	Tape & Reel[2]
iW3605-05[1] iW3605-05C	I_{SENSE} clamp to 0.5V nominal	SOIC-8	Tape & Reel[2]

Note 1: Not recommended for new designs; use the –xxC version.

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

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