1 Features

- Isolated AC/DC offline 100V / 230V
- Line frequency ranges from 47Hz to 64Hz
- Intelligent wall dimmer detections
  - Leading-edge dimmer
  - Trailing-edge dimmer
  - No-dimmer
  - Types: R, R-C, R-L
- Wide dimming range from 2% up to 100%
- Optimized dimming frequency at 900Hz
- No visible flicker
- Resonant control to achieve high efficiency, 85% without dimmer
- Meet the Harmonic requirement , High Power factor 0.9 without dimmer
- Temperature drifting control to adjust the LED brightness
- Small size design
  - low value of input bulk cap
  - low value of output cap
  - smallest transformer
- Primary-only Sensing eliminates opto-isolator feedback and simplifies design
- 10uA start–up current at typical
- Precise LED current control with cross line / LEDs
- LED current control with the LEDs short
- LED over current control
- Multiple protection features: LED open protections,
- Single-fault protections

2 Description

The iW3610 is a high performance AC/DC off-line power supply controller for dimmable LED luminaries, which uses advanced digital control technology to detect the dimmer type and dimmer phase. The collect dimmer conduct phase controlled the LED brightness. The LED brightness is modulated by the scheme of PWM-dimming. The dimming frequency is 360Hz or selectable. There is no visible flicker. iW3610 can fit into all of the wall dimmers includes leading-edge dimmer, trailing-edge dimmer as well as the dimmer configuration such as R-type, R-C type or R-L type. When dimmer is not present, the controller can also be auto-detected.

iW3610 operates in quasi-resonant mode to provide high efficiency along with a number of key built-in protection features while minimizing the external component count, simplifying EMI design and lowering the total bill of material cost. The iW3610 removes the need for secondary feedback circuitry while achieving excellent line and load regulation. It also eliminates the need for loop compensation components while maintaining stability overall operating conditions. Pulse-by-pulse waveform analysis allows for accurate LED current regulations.

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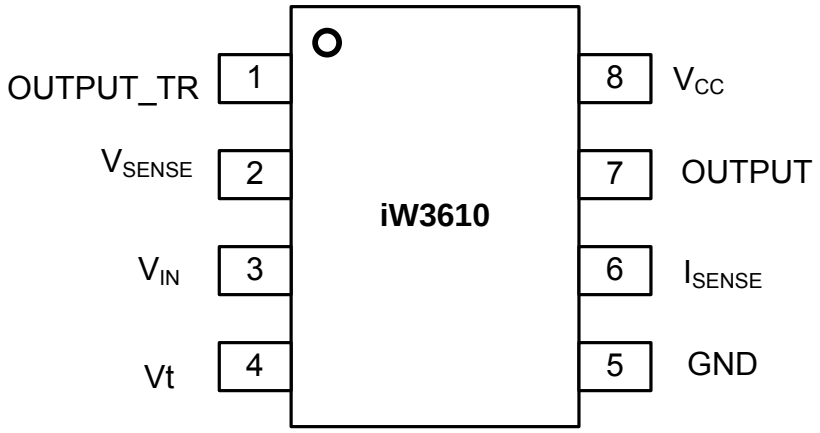
3 Applications

- Dimmable LED luminaries

4 Pin Description



Pin #	Name	Type	Pin Description
1	Output_TR	Output	Gate driver for Chopping MOSFET switch.
2	V_{SENSE}	Analog Input	Aux voltage sense(use for Primary Regulation and ZVS)
3	V_{IN}	Analog Input	Rectified AC line voltage sense
4	Vt	Analog Input	External shut down pin
5	Gnd	Ground	Ground
6	I_{SENSE}	Analog Input	Primary current sense. Used for cycle-by-cycle peak-current control and limit.
7	Output	Output	Gate driver for main MOSFET switch.
8	V_{CC}	Power Input	Power supply for control logic and voltage sense for power-on reset circuitry

5 Electric Characteristic Table

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit	Notes
Vin Section							
Startup-up current	I_{inst}			10	15	uA	
Shutdown high voltage threshold	V_{ovdc}	positive edge	1798	1978	2176	mV	
input impedance	Z_{in}	After start-up		2.5		kΩ	
Vin Range	Vin		0V		1.8V		
Vsense Section							
Input leakage current	I_{bvs}	Vsense = 2V			1	uA	
Nominal voltage threshold	$V_{sense(NOM)}$	negative edge	1.523	1.538	1.553	V	
Output OVP threshold	$V_{sense(max)}$	negative edge	1.683	1.700	1.717	V	
Output Section							
Output low level ON-resistance	$R_{ds\_on(lo)}$	Isink = 5mA		30		Ω	
Output high level ON-resistance 1	$R_{ds\_on\_1}$	Isource = 5mA		60		Ω	Note1
Rise time				50		ns	
Fall time				30		ns	
maximum switching frequency	f_{s_clamp}	Vin < 0.801V		200		kHz	
Vcc Section							
Maximum operating voltage	$V_{cc(max)}$				16	V	
Start-up threshold	$V_{cc(ST)}$		11	12	13	V	

Undervoltage lockout threshold	$V_{cc(UVL)}$		7	7.5	8	V	
Operating current	I_{CCQ}			3.9	4.5	mA	
Zener diode clamped voltage	V_{cc_clamp}			19V			
Isense section							
Ovee Current Limit threshold	V_{ocp}			1.9		V	
Isense short protection reference	V_{rsns}			0.2.		V	
Regulation limit threshold	V_{reg_TH}			1.8		V	
Vt section							
Vt threshold for 100% dimming	V_{vt_100}			2.0		V	
Vt threshold for 10% dimming	V_{vt_10}			0.2		V	
Input leakage current	I_{bvs}	V_{sd} =1V			1	uA	
Pull up current source	I_{sd}		95	100	105	uA	
OUTPUT_TR Section							
Output low level ON-resistance	$R_{ds\_on(lo)}$	Isink = 5mA		100		Ω	
Output high level ON-resistance	$R_{ds\_on\_1}$	Isource = 5mA		200		Ω	
Rise time				60		ns	
Fall time				60		ns	

6 Introduction

iW3610 combines the two functions: 1) Wall Dimmer type detection and dimmer phase measurement; 2) Dimming output LED light. It is using iWatt proprietary digital control technology. The proprietary circuit consists of: 1) Chopping circuits, which is function to the high power factor and dynamic impedance to load the dimmers. 2) Isolated flyback converters. The iW3610 provides a low cost solution to replace the conventional incandescent bulb with the wall dimmers directly. The iW3610 achieves a wide range of dimming. It can detect the leading-edge, trailing-edge dimmer as well as no-dimmers. The controller also operates in Critical Conduction Mode to achieve high power efficiency, as well as the good EMI. It incorporates the proprietary primary-feedback constant current control technology to achieve the tight LED current regulation.

Figure 1 shows the iW3610 typical application diagram. Figure 2 shows the typical block diagrams. The advanced digital control mechanism reduces system design time and improves reliability. The Vcc supply voltage is clamped at maximum 18V after start up. It avoids the voltage swing caused by auxiliary leakage inductance. Start up makes sure the Vcc supply voltage is ready.

The iW3610 provides multiple protection features for current limit, over voltage protection, and over temperature protection. The Vt function provides the temperature drifting dimming solution for LEDs. The external NTC is sensing the LED temperature. When the temperature is high, the LED light becomes dark. When the temperature is over limit, the controller turns off.

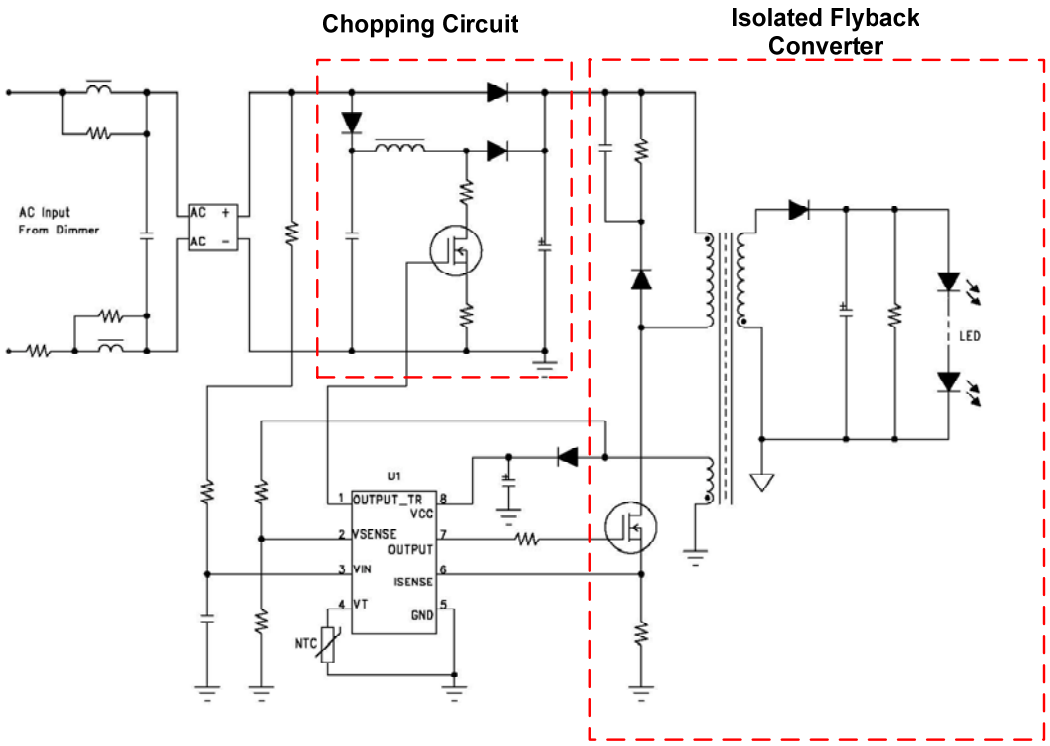


Figure 1 Simplified iW3610 Application Circuit

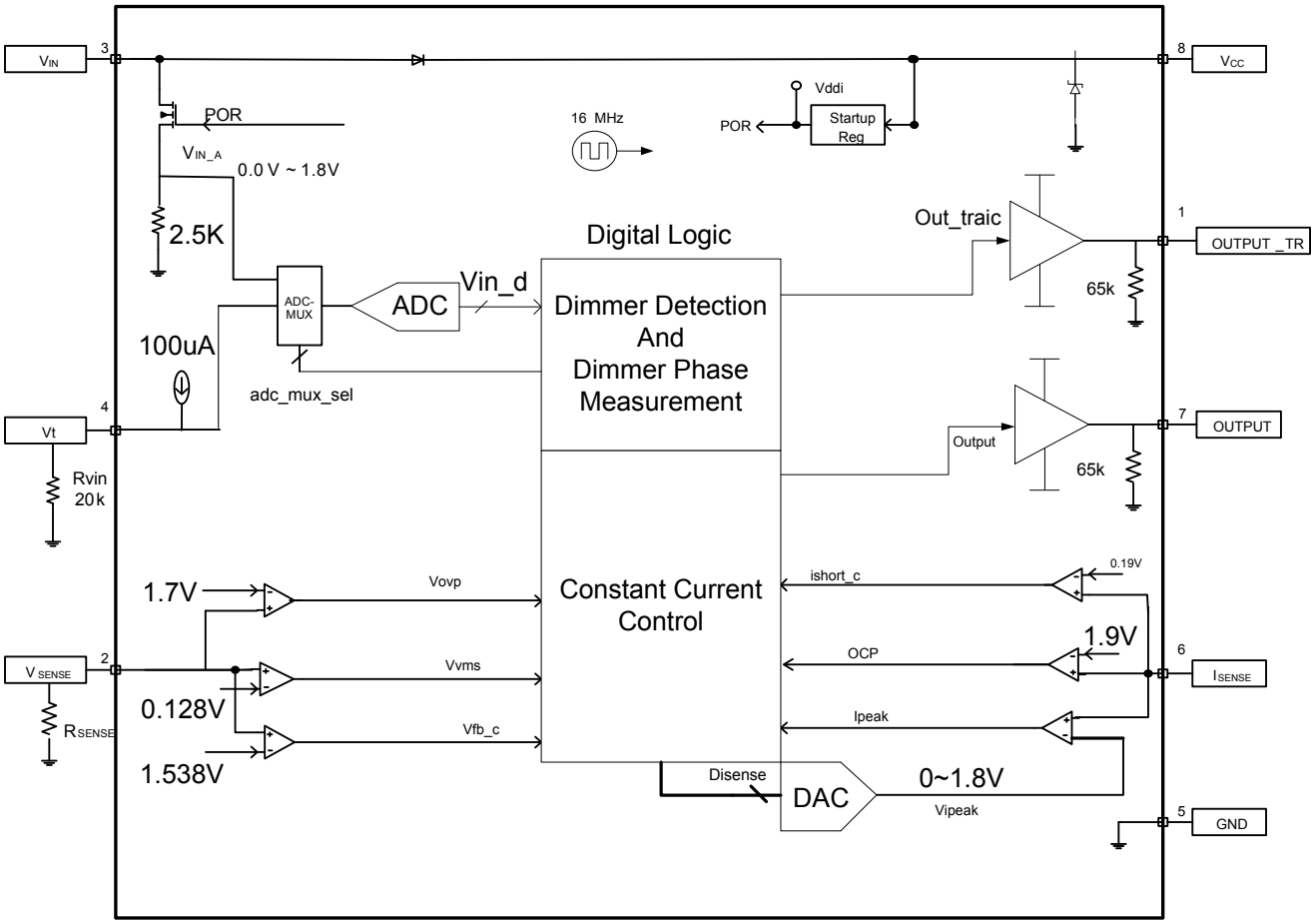


Figure 2 iW3610 Block Diagram

Item	iW3610 Electronic Specification
AC Input	
I/P Voltage (Vacrms)	80 ~ 130, 180~270
Inrush Current (Arms)	Less than 1A
I/P Line Frequency (Hz)	47~63
LED Output	
Numbers of LEDs	No Limits
Voltage (V)	No Limits
Nominal LED Current (A)	Adjustable by current sense resistor
LED Current Tolerance	+/-5%

Current Overshoot	No Overshoot
Voltage Overshoot	No Overshoot
LED Dimming control	
Range	2% to 100%
Flicker	No Visible Flicker
Wall Dimmer	
Dimmer Type	Leading_edge, Trailing_edge, No_dimmer Types: R, RC,RLC,
Temperature Drifting dimming	External pin to sense LED temperature to compensate for LED brightness
Timing	
AC Present Time	< 0.5 sec
Rise time	<5mS
Fall time	<5mS
Protection	
Short Circuit	Auto Recovery
Over Load Protection	100us Delay
Open circuit protection	200us Delay
Over Voltage Protection	110% of nominal LED voltage
Thermal Shutdown	Shut down

9 Typical Application Example

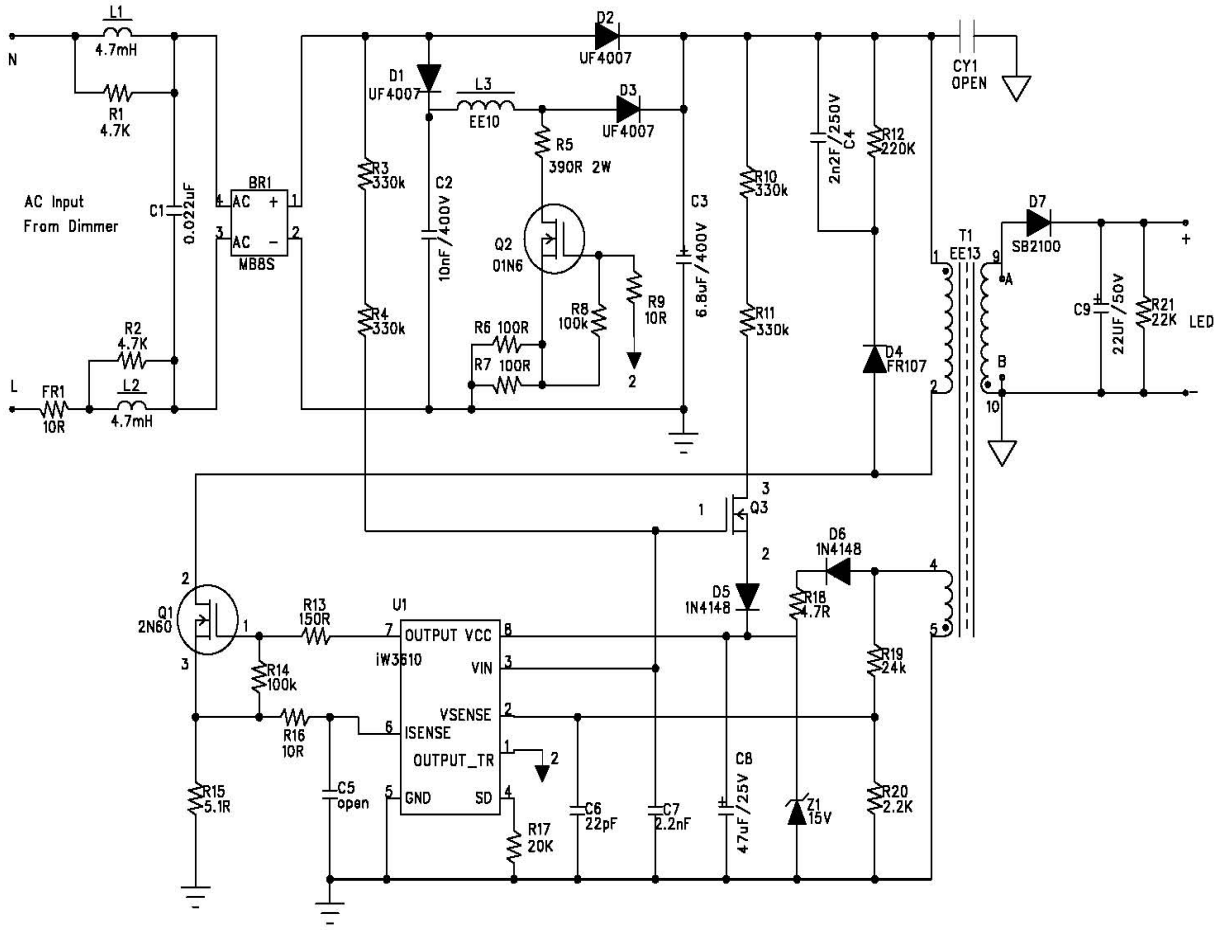
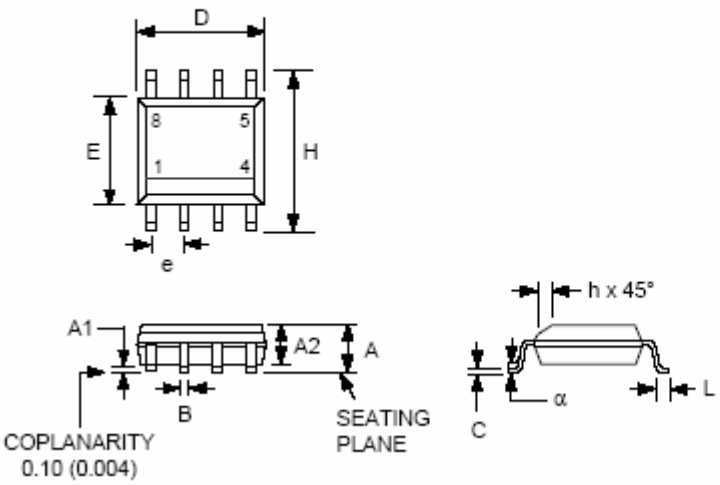


Figure 8 iW3610 typical application schematic

10 Physical Dimensions

8-Lead Small Outline (SOIC) Package



Symbol	Inches		Millimeters	
	MIN	MAX	MIN	MAX
A	0.061	0.068	1.55	1.73
A1	0.0040	0.0098	0.127	0.250
A2	0.055	0.061	1.40	1.55
B	0.0138	0.0192	0.35	0.49
C	0.0075	0.0098	0.19	0.25
D	0.189	0.196	4.80	4.96
E	0.150	0.157	3.81	3.99
e	0.050 BSC		1.27 BSC	
H	0.230	0.244	5.84	6.20
h	0.10	0.016	0.25	0.41
L	0.016	0.040	0.4	1.0
α	0°	8°		

11 About iWatt

iWatt Inc. is a fabless semiconductor company that develops power management ICs for computer, communication, and consumer markets. The company's patented pulseTrain ™ technology, the industry's first truly digital approach to power system regulation, is revolutionizing power supply design.

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