

# iW3630

## AC/DC Digital Power Controller for High Power Factor Analog and 0-10V Dimmable LED Drivers



### 1.0 Features

- Isolated/non-isolated offline 100V<sub>AC</sub>/277V<sub>AC</sub> LED driver controller
- Meets IEC61000-3-2 requirements
- Total harmonic distortion < 15% with Power Factor > 0.95
- Analog input dimming level control
- Built-in 0-10V isolation transformer driver
- Under 10% output ripple current
- Wide dimming range from 1% to 100%
- Flickerless™ LED dimming technology
- Quasi-resonant control to achieve high efficiency (typical > 85%)
- Small size
  - » Two-stage topology enables small-size input and output filter capacitors
  - » 200kHz maximum switching frequency enables small transformer
- Primary-side sensing eliminates the need for opto-isolator feedback
- Tight LED current regulation
- Supports wide LED output voltage range
- Multiple protection features:
  - » LED open-circuit and short-circuit protection
  - » Over-current protection
  - » Current sense resistor short-circuit protection
  - » AC line over-voltage/frequency protection

### 2.0 Description

The iW3630 is a two-stage, high-performance AC/DC offline power supply controller for dimmable LED luminaires with analog dimming interface. It controls LED current based on analog input voltage on the dimming pin. It also has a built-in 0-10V isolation transformer driver which can work directly with 0-10V dimming system without adding extra driver circuit and micro-controller. The iW3630 uses iWatt's unique digital Flickerless™ technology to eliminate visible flicker in the entire dimming range and to minimize low frequency output ripple current.

The iW3630 operates the main power converter that delivers constant current to the LED load in quasi-resonant mode to provide high power efficiency and minimize electro-magnetic interference (EMI). It uses iWatt'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 eliminating the need for an opto-coupler.

The iW3630 minimizes the external components count by simplifying the EMI filter with iWatt's EZ-EMI® technology. Additionally, the digital control loop of the iW3630 maintains stability over all operating conditions without the need for loop compensation components.

### 3.0 Applications

- Dimmable LED ballast with analog input for dimming control
- Dimmable LED ballast with 0-10V interface for dimming control
- Output power up to 45W



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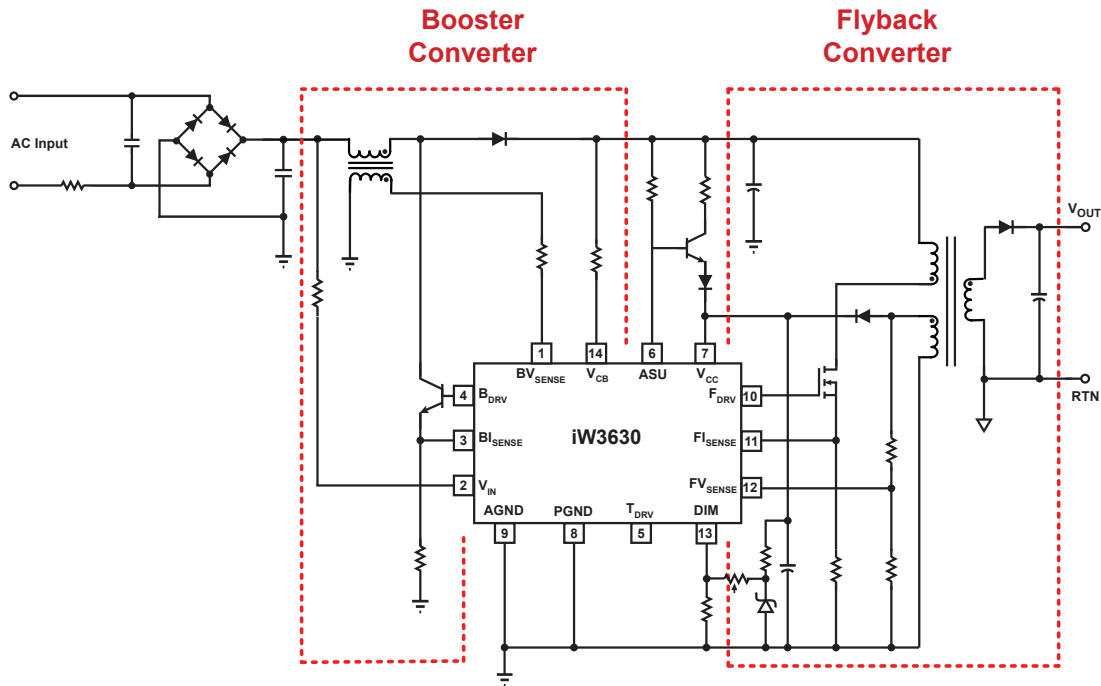


Figure 3.1: iW3630 Analog Dimming Simplified Schematic

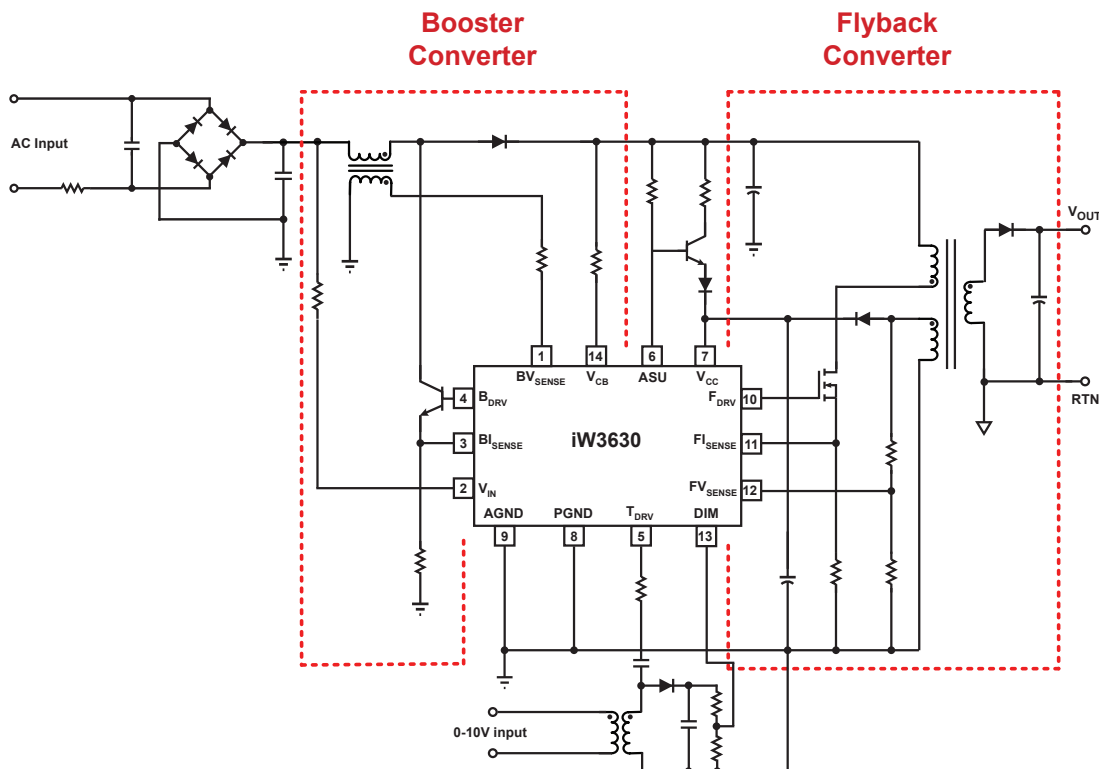


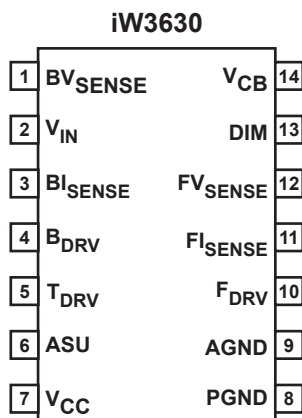
Figure 3.2: iW3630 0-10V Dimming Simplified Schematic

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### 4.0 Pinout Description



Pin #	Name	Type	Pin Description
1	BV <sub>SENSE</sub>	Analog Input	Boost inductor voltage feedback input
2	V <sub>IN</sub>	Analog Input	Rectified AC line voltage input
3	BI <sub>SENSE</sub>	Analog Input	Boost current sense input
4	B <sub>DRV</sub>	Output	Base drive output for boost BJT
5	T <sub>DRV</sub>	Output	0-10V isolation transformer drive output
6	ASU	Output	Active start-up and bleeder control
7	V <sub>CC</sub>	Power	Power supply for control logic and voltage sense for power-on reset circuit
8	PGND	Ground	Power ground
9	AGND	Ground	Signal ground. It should be connected to the power ground on PCB.
10	F <sub>DRV</sub>	Output	Gate drive output for flyback MOSFET
11	FI <sub>SENSE</sub>	Analog Input	Flyback current sense (used for cycle-by-cycle peak current control and limit)
12	FV <sub>SENSE</sub>	Analog Input	Flyback voltage sense (used for primary-side regulation and ZVS)
13	DIM	Analog Input	Dimming level control input
14	V <sub>CB</sub>	Analog Input	Boost output voltage feedback input

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### 5.0 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 6.0.

Parameter	Symbol	Value	Units
DC supply voltage range (pin 7, $I_{CC} = 20\text{mA max}$ )	$V_{CC}$	-0.3 to 18	V
DC supply current at $V_{CC}$ pin	$I_{CC}$	20	mA
$F_{DRV}$ output (pin 10)		-0.3 to 18	V
$B_{DRV}$ output (pin 4)		-0.3 to 4.0	V
$T_{DRV}$ output (pin 5)		-0.3 to 18	V
$FV_{SENSE}$ input (pin 12, $I_{FVSENSE} \leq 10\text{mA}$ )		-0.7 to 4.0	V
$BV_{SENSE}$ input (pin 1, $I_{BVSENSE} \leq 3\text{mA}$ )		-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
DIM input (pin 13)		-0.3 to 4.0	V
Power dissipation at $T_A \leq 25^\circ\text{C}$		900	mW
Maximum junction temperature	$T_{JMAX}$	150	$^\circ\text{C}$
Storage temperature	$T_{STG}$	-65 to 150	$^\circ\text{C}$
Lead temperature during IR reflow for $\leq 15$ seconds	$T_{LEAD}$	260	$^\circ\text{C}$
Thermal Resistance Junction-to-PCB Board Surface Temperature	$\psi_{JB}$ (Note 1)	45	$^\circ\text{C/W}$
ESD rating per JEDEC JESD22-A114		2,000	V
Latch-up test per JEDEC 78		$\pm 100$	mA

#### Notes:

Note 1.  $\psi_{JB}$  [Psi Junction to Board] provides an estimation of the die junction temperature relative to the PCB surface temperature. This data is measured at the ground pin (pin 8 and pin 9) without using any thermal adhesives.

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### 6.0 Electrical Characteristics

$V_{CC} = 12\text{ V}$ ,  $-40^{\circ}\text{C} \leq T_A \leq 85^{\circ}\text{C}$ , unless otherwise specified (Note 1)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
<b>V<sub>IN</sub> SECTION</b>						
Start-up voltage threshold (Note 2)	$V_{IN\_ST}$	$T_A = 25^{\circ}\text{C}$		0.283		V
Brown-out voltage threshold (Note 3)	$V_{BR\_TH}$	$T_A = 25^{\circ}\text{C}$		0.283		V
Over-voltage shutdown threshold	$V_{IN\_OVP}$	$T_A = 25^{\circ}\text{C}$	1.512	1.68	1.848	V
Input impedance	$Z_{IN}$	After start-up		15		k $\Omega$
$V_{IN}$ range	$V_{IN}$		0		1.8	V
$V_{IN}$ frequency range	$f_{IN}$	$T_A = 25^{\circ}\text{C}$	47		63	Hz
<b>V<sub>CB</sub> SECTION</b>						
Over-voltage shutdown threshold	$V_{CB\_OVP}$	$T_A = 25^{\circ}\text{C}$ , positive edge	1.62	1.8	1.98	V
Input impedance	$Z_{CB}$	After start-up		15		k $\Omega$
$V_{CB}$ range	$V_{CB}$		0		1.8	V
<b>FV<sub>SENSE</sub> SECTION</b>						
Input leakage current	$I_{BVS(FVSENSE)}$	$V_{SENSE} = 2\text{V}$			1	$\mu\text{A}$
Normal voltage threshold	$V_{SENSE(NOM)}$	$T_A = 25^{\circ}\text{C}$ , negative edge	1.521	1.536	1.551	V
Output OVP threshold (default)	$V_{SENSE(MAX)}$	$T_A = 25^{\circ}\text{C}$ , negative edge	1.683	1.7	1.717	V
<b>BV<sub>SENSE</sub> SECTION</b>						
Input leakage current	$I_{BVS(BVSENSE)}$	$V_{SENSE} = 0.1\text{V}$			1	$\mu\text{A}$
<b>F<sub>DRV</sub> SECTION</b>						
Output low level ON-resistance	$R_{DS\_ON\_LO(FDRV)}$	$I_{SINK} = 5\text{mA}$		16		$\Omega$
Output high level ON-resistance	$R_{DS\_ON\_HI(FDRV)}$	$I_{SOURCE} = 5\text{mA}$		25		$\Omega$
Maximum switching frequency (Note 4)	$f_{SW\_FDRV(MAX)}$			200		kHz
<b>B<sub>DRV</sub> SECTION</b>						
Output low level ON-resistance	$R_{DS\_ON\_LO(BDRV)}$	$I_{SINK} = 5\text{mA}$		1		$\Omega$
Maximum switching frequency (Note 5)	$f_{SW\_BDRV(MAX)}$	if $V_{IN\_A} < 130\text{mV}$		200		kHz
		if $V_{IN\_A} > 130\text{mV}$		90		kHz
<b>ASU SECTION</b>						
Resistance between $V_{CC}$ and ASU	$R_{VCC\_ASU}$			830		k $\Omega$

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### 6.0 Electrical Characteristics (cont.)

$V_{CC} = 12\text{ V}$ ,  $-40^{\circ}\text{C} \leq T_A \leq 85^{\circ}\text{C}$ , unless otherwise specified (Note 1)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
<b>V<sub>CC</sub> SECTION</b>						
Maximum operating voltage	$V_{CC(MAX)}$				17	V
Start-up threshold	$V_{CC(ST)}$		11.5	12.5	13.5	V
Under-voltage lockout threshold	$V_{CC(UVL)}$		6.0	6.5	7.0	V
Operating current	$I_{CCQ}$			6.5		mA
ASU turn-off threshold	$V_{CC\_ASU\_OFF}$			16.25		V
<b>FI<sub>SENSE</sub> SECTION</b>						
CC regulation threshold limit	$V_{REG\_TH(FLYBACK)}$			1.4		V
I <sub>SENSE</sub> short protection reference	$V_{RSENSE(FLYBACK)}$			0.16		V
Over-current limit threshold	$V_{OCP(FLYBACK)}$			1.5		V
<b>BI<sub>SENSE</sub> SECTION</b>						
Over-current limit threshold	$V_{OCP(BOOST)}$			1.9		V
<b>DIM SECTION</b>						
Maximum current threshold	$V_{DIM(MAX)}$			1.5		V
Minimum current threshold	$V_{DIM(MIN)}$			0.3		V
Input leakage current	$I_{DIM(LK)}$	$V_{DIM} = 1.0\text{V}$			1	$\mu\text{A}$
<b>T<sub>DRV</sub> SECTION</b>						
Nominal switching frequency	$F_{TDRV}$			30		kHz
Duty ratio	$D_{TDRV}$			25		%
Output low level ON-resistance	$R_{DS\_ON\_LO(TDRV)}$	$I_{SINK} = 5\text{mA}$		30		$\Omega$
Output high level ON-resistance	$R_{DS\_ON\_HI(TDRV)}$	$I_{SOURCE} = 5\text{mA}$		50		$\Omega$
Output high level voltage	$T_{OUT(HI)}$		$V_{CC}-0.7$			V
Output low level voltage	$T_{OUT(LO)}$				0.7	V

#### Notes:

Note 1. Adjust  $V_{CC}$  above the start-up threshold before setting at 12V.

Note 2.  $V_{IN}$  pin voltage is greater than  $V_{IN\_ST}$  for more than three milliseconds.

Note 3. Once  $V_{IN}$  pin maximum voltage is less than  $V_{BR\_TH}$ , IC will shut down immediately.

Note 4. Operating frequency varies based on the line and load conditions. See the Theory of Operation section for more details.

Note 5. These parameters refer to digital preset values, and they are not 100% tested.

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### 7.0 Typical Performance Characteristics

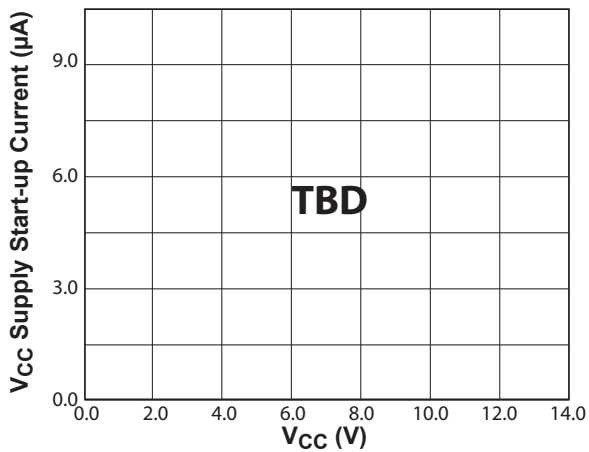


Figure 7.1 : V<sub>CC</sub> vs. V<sub>CC</sub> Supply Start-up Current

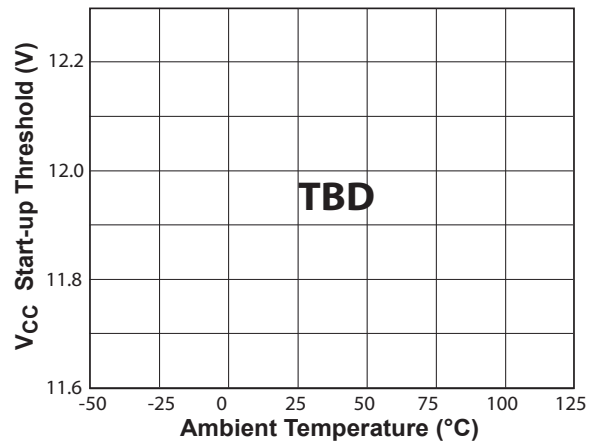


Figure 7.2 : Start-Up Threshold vs. Temperature

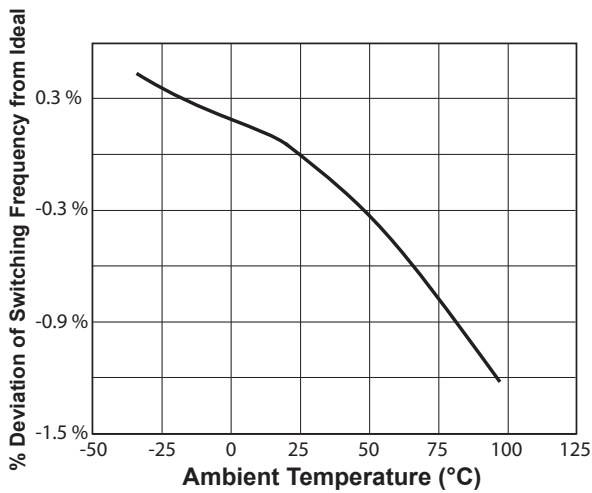


Figure 7.3 : % Deviation of Switching Frequency to Ideal Switching Frequency vs. Temperature

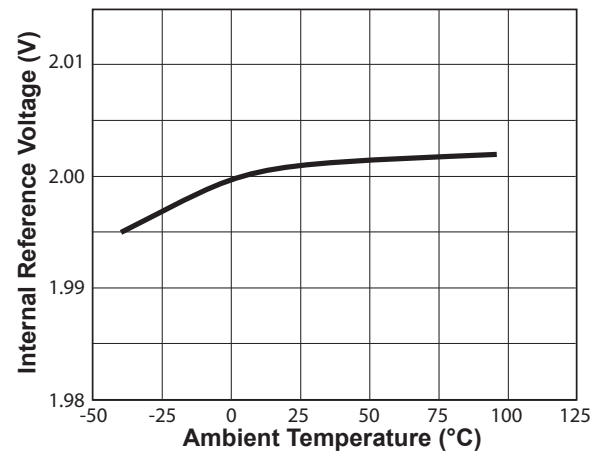


Figure 7.4 : Internal Reference vs. Temperature

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### 8.0 Functional Block Diagram

The iW3630 consists of two function blocks:

- Power factor correction
- LED current regulation and dimming control

The power factor correction (PFC) block controls the boost converter as the first power stage in the iW3630 system (shown in Figure 3.1). The block switches the boost BJT ( $B_{DRV}$  pin) for PFC and stores the energy in the boost output capacitor. The PFC operation is based on the input voltage ( $V_{IN}$  pin), the boost output voltage ( $V_{CB}$  pin), and the magnetic flux status of the boost inductor ( $BV_{SENSE}$  pin).

The LED current regulation and dimming control block control the flyback or buck/boost converter as the second power stage (shown in Figure 3.1). It switches the flyback MOSFET ( $F_{DRV}$  pin) to supply constant current to LED load from the energy stored in the boost output capacitor. The constant current regulation algorithm is based on the information of the transformer primary-side peak current ( $FI_{SENSE}$  pin) and magnetic flux status of transformer ( $FV_{SENSE}$  pin). The block also dims LEDs by adjusting the output current based on the DIM pin voltage. (refer to Section 9.2 for details).

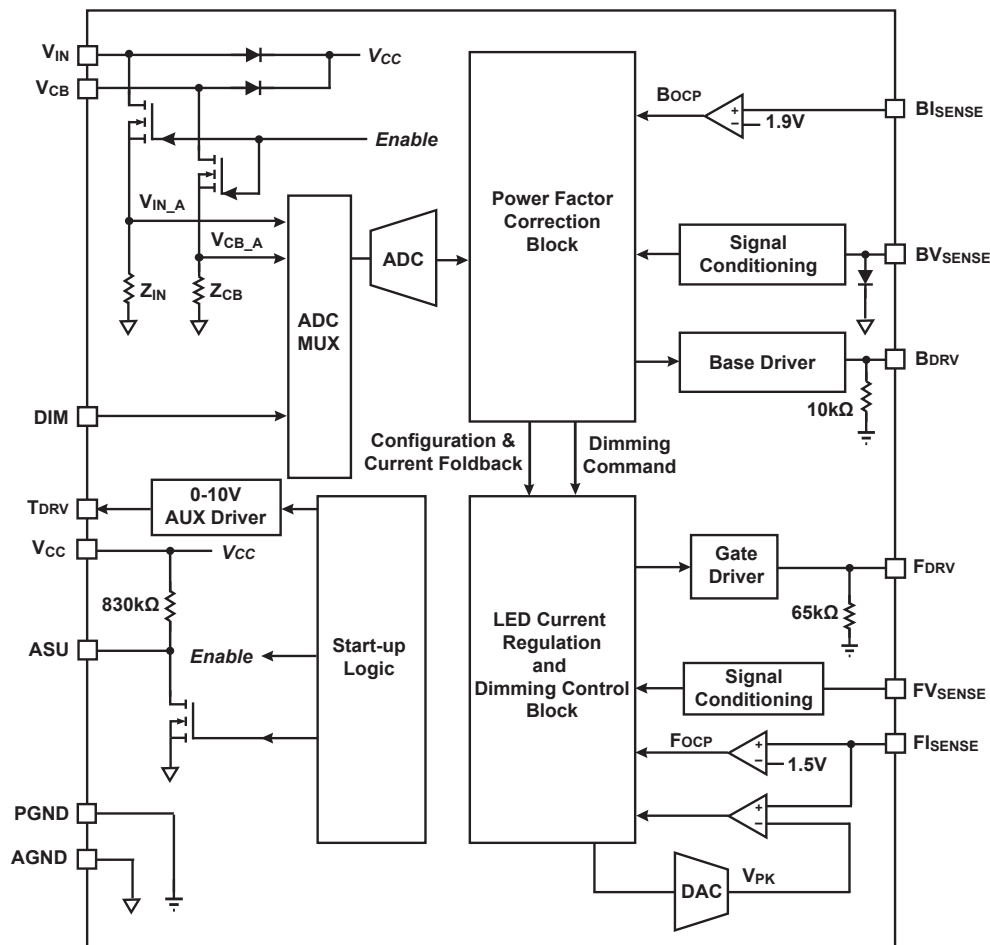


Figure 8.1 : iW3630 Functional Block Diagram



### 9.0 Theory of Operation

#### 9.1 System Start Up

This section provides information about iW3630 system start up, which include the IC startup and the LED current soft start.

##### 9.1.1 IC Startup

When AC voltage is applied, the boost output capacitor is charged to the peak of line voltage. ASU pin is open by default so that ASU switch is turned on and  $V_{CC}$  capacitors is charged through ASU resistor and ASU switch. When the  $V_{CC}$  voltage reaches start-up threshold  $V_{CC(ST)}$ , the iW3630's control logic is activated and the IC starts up. The ASU pin is kept open and the ASU circuit continues charging  $V_{CC}$  until 50ms after the main flyback converter starts.

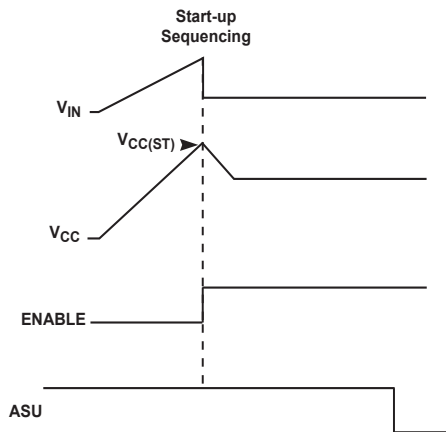


Figure 9.1 : Start-up Sequencing Diagram

##### 9.1.2 LED Current Soft-Start

After the iW3630 qualifies the AC input signal, the flyback converter will immediately start to deliver current to the LED load. A soft-start algorithm is applied to the flyback converter to gradually ramp up the LED current, thus reducing the stress on the LEDs. The output current will ramp up to the target current level within several AC half cycles.

PFC circuit will also start working simultaneously with the flyback circuit.

#### 9.2 Dimming Interface and Dimming Curve

The iW3630 will set up the output current level according to the DIM voltage. It can work directly with any analog dimming system (Figure 3.1) or 0-10V dimming system (Figure 3.2).

##### 9.2.1 Analog Interface

An analog voltage between 0 and 1.8V can be sent to the DIM pin to set up the output current level according to the dimming curve shown in Figure 9.2.

##### 9.2.2 Working with the 0-10V Interface

With a built-in driver, the iW3630 can simply be connected to work with the 0-10V interface as shown in Figure 3.2. After start up, the  $T_{DRV}$  pin will send out 30kHz, 25% duty ratio square wave to drive the 0-10V isolation transformer. The isolation transformer is forward configured so the dimmer voltage at the secondary side of the transformer can be detected by the primary winding voltage, which is read by a peak detector and is sent to the DIM pin through the voltage divider. The output current changes linearly as the dimmer changes.

##### 9.2.3 Dimming Curve

The iW3616 dims the LED by reducing the output current to a certain percentage of the LED current level based on the DIM pin voltage. Figure 9.2 shows the dimming curve. Output current changes linearly between 1% to 100% when the DIM voltage changes between the  $V_{DIM(MIN)}$  and  $V_{DIM(MAX)}$ . Output current will be clamped to 100% when the DIM voltage is higher than  $V_{DIM(MAX)}$  and 1% when the DIM voltage is lower than  $V_{DIM(MIN)}$ . See Figure 9.2.

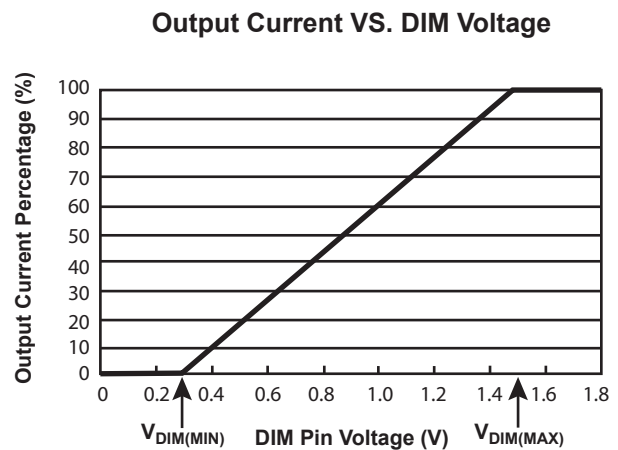


Figure 9.2 : Dimming Curve

### 9.3 Power Factor Correction Block Operation

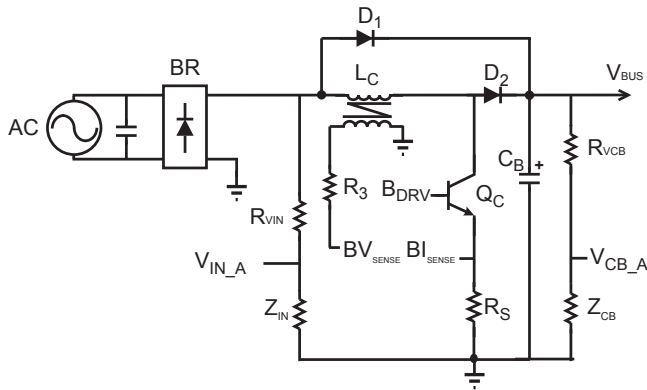


Figure 9.3 : Boost Schematic

The boost converter is operated in PFC mode for optimal power factor and minimum harmonic distortion. The iW3630 switches the boost BJT in valley mode switching to minimize the switching loss and EMI. Input current will follow the input voltage as shown in Figure 9.4.

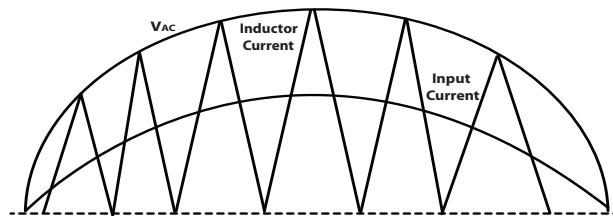


Figure 9.4 : Boost Mode Operation

The iW3630's PFC algorithm is based on fixed on-time switching with the compensation of dead-time after the boost inductor resets. The dead-time is measured from the moment that boost inductor resets (determined by  $BV_{SENSE}$  pin) to the following boost BJT turn-on moment (determined by  $B_{DRV}$  pin).

#### 9.3.1 $V_{IN}$ and $V_{CB}$ Resistors

The  $V_{IN}$  and  $V_{CB}$  pin resistors are chosen primarily to scale down the AC line voltage and input bulk capacitor voltage of the flyback circuit. The typical scale factor  $K_{CB}$  and  $K_{IN}$  is:

- $K_{CB}$  and  $K_{IN} = 0.004$  for 230  $V_{AC}$
- $K_{CB}$  and  $K_{IN} = 0.033$  for 277  $V_{AC}$

The scale factor can be adjusted to optimize efficiency and power factor. The  $R_{VIN}$  and  $R_{VCB}$  resistance can be equated by

$$R_{VIN} = Z_{IN} / K_{IN} - Z_{IN} \quad \text{and} \quad R_{VCB} = Z_{CB} / K_{CB} - Z_{CB}$$

The internal impedance  $Z_{IN}$  is  $15k\Omega \pm 5\%$ ,  $Z_{CB}$  is  $15k\Omega \pm 5\%$ . For example, with  $V_{IN}(\text{rms}) = 230V$ , the  $V_{IN}$  and  $V_{CB}$  pin resistors should add up to

$$R_{VIN} = 15k\Omega / 0.004 - 15k\Omega = 3735k\Omega$$

$$R_{VCB} = 15k\Omega / 0.004 - 15k\Omega = 3735k\Omega$$

The relationship between  $V_{IN}$  and  $V_{CB}$  pin voltage for boost output voltage regulation is:

$$V_{CB\_A} = V_{IN\_A(\text{MAX})} + 0.12V$$

The DC bus voltage is determined by:

$$V_{BUS} = V_{CB\_A} / K_{CB}$$

$V_{CB\_A}$  regulation range is from 0.8V to 1.48V (for example, when  $K_{CB} = 0.004$ ,  $V_{BUS}$  will be clamped to a minimum of  $0.8/0.004 = 200V$ ).

### 9.4 LED Current Regulation and Dimming Control Block Operation

This section provides information about iW3630 LED current regulation and dimming control block operation.

#### 9.4.1 Cycle-by-Cycle LED Current Regulation

The LED current regulation and dimming control block incorporates the iWatt-patented PrimAccurate™ technology. Constant current is guaranteed regardless of the input voltage (boost output capacitor voltage) or the output voltage (LED load forward voltage) of the flyback converter. Figure 9.5 shows the basic principle of this constant current regulation algorithm.

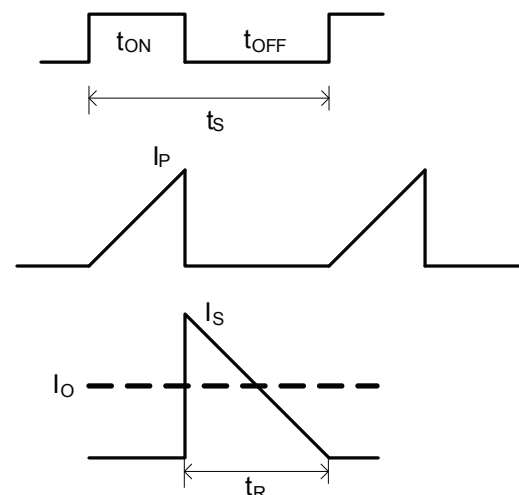


Figure 9.5 : Constant Current Regulation

The flyback converter is operated in discontinuous conduction mode (DCM). When the flyback MOSFET turns on, the transformer primary winding current ramps up linearly and energy builds up in the transformer. The iW3630 turns off the MOSFET when the primary winding current reaches the peak current regulation level. At this moment, the transformer maintains the magnetic flux so that the energy in the transformer generates the secondary winding current that equals the peak primary winding current multiplied by the primary-secondary turns-ratio. Then the secondary winding current ramps down linearly until all the energy in transformer is discharged. After the energy in the transformer is discharged, the iW3630 starts the next switching cycle. The LED load current is the average of the saw-tooth shaped secondary winding current.

The LED load current can be determined by an equation as shown below.

$$I_{OUT} = 0.5 \times N_{TR} \times I_{PK} \times T_R / T_P \quad (9.1)$$

where  $I_{PK}$  is the peak of primary winding current.  $N_{TR}$  is the primary-secondary turns ratio.  $T_R$  is the secondary winding current ramp-down time, or the transformer reset time.  $T_P$  is the entire switching period.

The  $I_{PK}$  is determined by the voltage generated on the current-sense resistor:  $I_{PK} = V_{PK} / R_S$ . Therefore, the equation can be written as:

$$I_{OUT} = 0.5 \times N_{TR} / R_S \times (V_{PK} \times T_R / T_P) \quad (9.2)$$

The iW3630 measures  $T_R$  and  $T_P$  on a cycle-by-cycle basis and controls  $V_{PK}$  so that the  $K_{CC} = V_{PK} \times T_R / T_P$  is always a constant. The  $K_{CC}$  is an internally defined constant that equals to 0.7V. Therefore,  $I_{OUT}$  can be determined by the turns-ratio and current sense resistor at the design time of the application circuit.

### 9.4.2 Dimming Control

The iW3630 has two dimming scheme options depending on the dimming level.

From 100% to 25% output current dimming range, the iW3630 employs the same constant current regulation algorithm as described in section 9.4.1 while reducing the  $K_{CC}$  constant. As a result, the  $I_{OUT}$  will proportionally decrease as the  $K_{CC}$  decreases. In this process, the switching frequency of the flyback converter will increase. The maximum switching frequency is clamped at 200kHz.

Below 25% output current dimming range, the iW3630 switches to the PFM mode, which keeps the peak regulation

voltage and increases the switching period  $T_p$  to achieve further dimming.

## 9.5 Protection Features

This section provides information about iW3630 protection features.

### 9.5.1 Output Over-Voltage/LED Open Protection

The iW3630 includes a function that protects against an output over-voltage.

The output voltage is monitored by the  $FV_{SENSE}$  pin. The ratio between the  $FV_{SENSE}$  pin voltage and output voltage is equal to the transformer auxiliary to secondary winding turns-ratio multiplied by the  $FV_{SENSE}$  resistor divider ratio. If the voltage at the  $FV_{SENSE}$  pin exceeds  $V_{SENSE(MAX)}$ , the iW3630 shuts down immediately. After the shutdown, the iW3630 remains powered on, which discharges the  $V_{CC}$ . In order to avoid over-charging the output voltage, the iW3630 employs an extended discharge time as described below.

Under the fault condition, the iW3630 tries to start up three consecutive times. If all three start-up attempts fail, the iW3630 enters inactive mode, during which the iW3630 does not respond to the  $V_{CC}$  power-on requests. The iW3630 is activated again after it sees 29 start-up attempts. The iW3630 can also be reset to the initial condition if the  $V_{CC}$  is completely discharged. Typically, this extended discharge time is around three to five seconds, and allows the iW3630 to support hot-plug LED modules without causing output over-voltage while allowing a quick recovery when the fault is removed.

### 9.5.2 Output Short Protection

The iW3630 includes a function that protects against an output short-circuit fault.

If the voltage at the  $FV_{SENSE}$  pin is below 0.228V, the iW3630 shuts down immediately. After the shutdown, the iW3630 remains powered on, which discharges the  $V_{CC}$ . In order to avoid excessive power stress due to auto-restart, the iW3630 employs an extended discharge time (as described in Section 9.5.1).

To support applications with large output capacitance, output short protection is not activated during the initial LED current soft start period. This allows the voltage to build up in the output capacitor without triggering the protection.

### 9.5.3 Over-Current Protection

Over-current protection (OCP) is a built-in feature for the iW3630.

With the  $FI_{SENSE}$  pin, the iW3630 is able to monitor the primary peak current of the flyback converter. This allows for cycle-by-cycle peak current control and limit. When the primary peak current multiplied by the  $FI_{SENSE}$  sense resistor is greater than  $V_{OCP(FLYBACK)}$ , over-current is detected and the iW3630 immediately turns off the gate drive until the next switching cycle. The  $F_{DRV}$  pin sends out switching pulse in the next switching cycle, and the switching pulse continues if the  $V_{OCP(FLYBACK)}$  is not reached; or, the switching pulse turns off again if the  $V_{OCP(FLYBACK)}$  is reached again.

The  $BI_{SENSE}$  pin provides the same protection mechanism for the boost converter. The  $BI_{SENSE}$  OCP threshold is  $V_{OCP(BOOST)}$ .

### 9.5.4 Sense Resistor Short Protection

If the  $FI_{SENSE}$  sense resistor is shorted there is a potential danger of the over-current condition not being detected. Thus the iW3630 is designed to detect a sense-resistor short fault. If the voltage on the  $FI_{SENSE}$  pin is below  $V_{RSENSE(FLYBACK)}$  after 15.6 $\mu$ s of turning on, the sense-resistor short protection is triggered and the iW3630 shuts down immediately. After the shutdown, the  $V_{CC}$  is discharged since the iW3630 remains powered on. The iW3630 employs an extended discharge time (as described in Section 9.5.1).

### 9.5.5 BVsense Short-Protection

The boost inductor is protected from a short condition. If the  $BV_{SENSE}$  pin is not able to see the reset of the boost inductor,

a boost inductor short is detected. The iW3630 will shut down immediately.

### 9.5.6 AC Input and Boost Output Over-Voltage Protection

The iW3630 supports over-voltage protection of the AC input voltage and the boost output voltage.

If the  $V_{IN}$  pin voltage is higher than  $V_{IN\_OVP}$  for 2ms within every 16ms period, and this condition lasts for eight consecutive AC half cycles, the iW3630 shuts down both the boost and flyback converters. After the shutdown, the  $V_{CC}$  is discharged since the iW3630 remains powered on. When  $V_{CC}$  drops below  $V_{CC(UVL)}$ , the iW3630 resets itself and then initiates a new soft-start cycle.

If the  $V_{CB}$  pin voltage is higher than  $V_{CB\_OVP}$  for 128ms, then the iW3630 shuts down both the boost and flyback converters. After the shutdown, the  $V_{CC}$  is discharged since the iW3630 remains powered on. When  $V_{CC}$  drops below  $V_{CC(UVL)}$ , the iW3630 resets itself and then initiates a new start cycle.

Under both the AC input and boost output over-voltage fault condition, the iW3630 employs an extended discharge time (as described in Section 9.5.1) before restart.

### 9.5.7 Input Voltage Brown-Out Protection

After start up, if the  $V_{IN}$  pin voltage is below  $V_{BR(TH)}$ , the iW3630 will shut down the PFC and flyback circuit. The iW3630 will employ the extended discharge time and initial a new start up sequence.

# iW3630

## AC/DC Digital Power Controller for High Power Factor Analog and 0-10V Dimmable LED Drivers



### 10.0 Physical Dimensions

#### 14-Lead SOIC Package

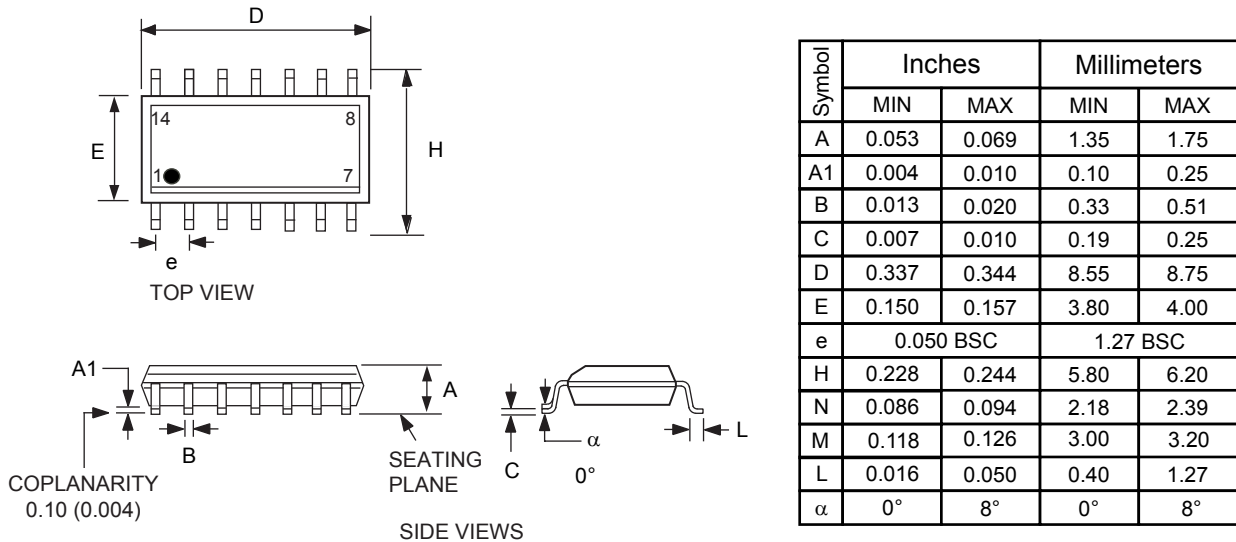


Figure 10.1 : Physical dimensions, 8-lead SOIC package

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 < 270°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.

### 11.0 Ordering Information

Part Number	Options	Package	Description
iW3630-00	Universal input, 0-10V dimmable	SOIC-14	Tape & Reel <sup>1</sup>

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

# iW3630

## AC/DC Digital Power Controller for High Power Factor Analog and 0-10V Dimmable LED Drivers



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