

## High Performance Step-Down DC/DC Regulator with High-Resolution True DC Dimming for LED Lighting up to 65V

### 1 Description

The iW388 is a DC/DC step-down regulator with tight current regulation and exceptional dimming performance for LED lighting. It is designed to be used in the high-side switching buck topology up to 65V input voltage and up to 98% of output voltage/input voltage ratio. With its advanced digital control, the iW388 offers Renesas' True DC Dimming from 100% down to 0.0625% with 0.0625% resolution and guaranteed linearity.

The iW388 features unique dual-dimming pins that significantly simplify application designs where multi-level maximum current settings are needed. The maximum LED current can be programmed through one dimming pin via the analog voltage level or an adjustable resistor. The other dimming port can be used for auto-detectable 3-in-1 dimming: analog voltage, PWM duty or resistor dimming. Internally, the iW388 processes the dimming inputs and regulates the output current percentage by  $DIM1\% \times DIM2\%$ .

A dedicated light-off mode in the iW388 turns off the output current when the dimming signal input is less than the light-off threshold. In the light-off mode, the iW388 consumes minimum power while still monitoring the dimming inputs. If the dimming signal input becomes higher than the light-on threshold, the iW388 can immediately wake up and resume output current regulation.

The iW388 provides flexibility to optimize dimming resolution and dimming signal noise immunity. When a noisy analog dimming level or jittering PWM dimming duty is supplied to the iW388, the iW388 can keep the output current stable with some tradeoff to dimming resolution by configuration. Also, the iW388 has configurable minimum startup voltage. This feature can effectively prevent light flicker/flash at power off across different applications.

### 2 Features

- Input DC voltage range: 22V ~ 65V
- Output/input voltage ratio: up to 98%
- Output power up to 40W
- Multiple operating mode product options:
  - Constant-current (CC) mode
  - Constant-voltage/constant-current (CV/CC) mode
  - Constant-power/constant-current (CP/CC) mode
- True DC dimming
  - Max dimming range: 0.0625% ~ 100%
  - Highest dimming resolution: 0.0625%
- CC line and load regulation <  $\pm 3\%$
- CV line and load regulation <  $\pm 3\%$
- Light-off current consumption < 1mA
- Over temperature current de-rating
- 3-in-1 dimming on both dimming ports
  - RSET resistor
  - PWM Dimming
  - Analog voltage
- Auto dimming signal types detection
- Configurable dimming signal hysteresis
- Configurable startup voltage
- Rich protections:
  - Output over voltage (OVP)
  - Output short circuit (OSP)
  - $V_{VIN}$  over/under voltage
  - Over current protection (OCP)
  - Sense resistor short protection
  - Over temperature protection (OTP)

### 3 Applications

- Two-stage AC/DC general LED lighting drivers
- Two-stage AC/DC LED light strip drivers
- DC/DC general LED lighting drivers

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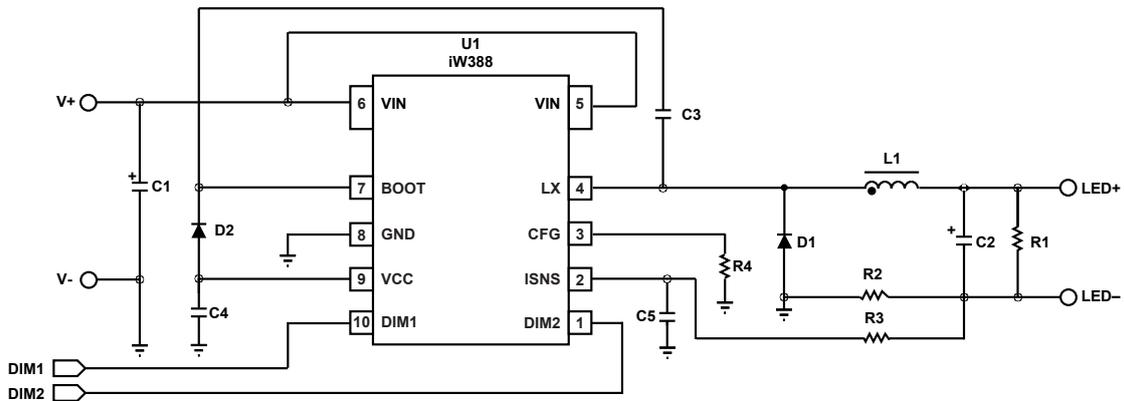


Figure 3.1 : iW388 Typical Application Circuit for CC only and CP/CC variants

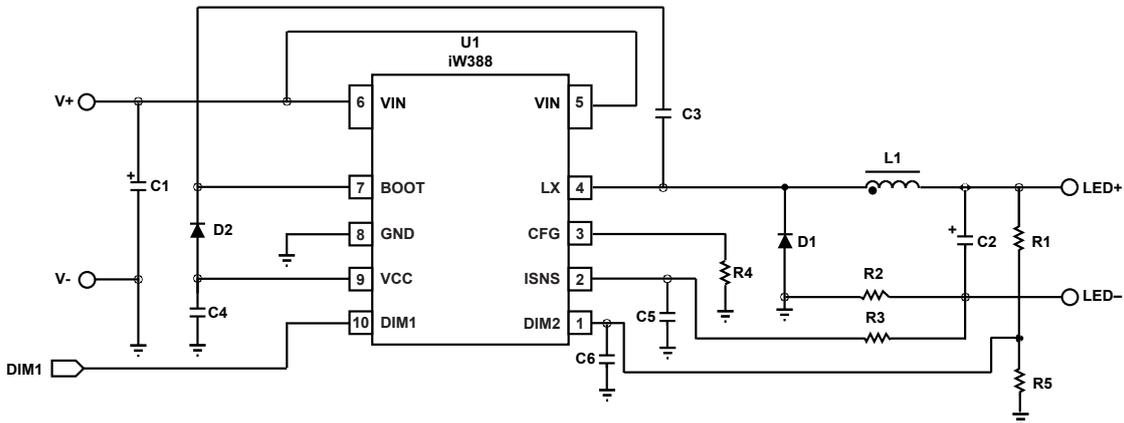


Figure 3.2 : iW388 Typical Application Circuit for CV/CC variants

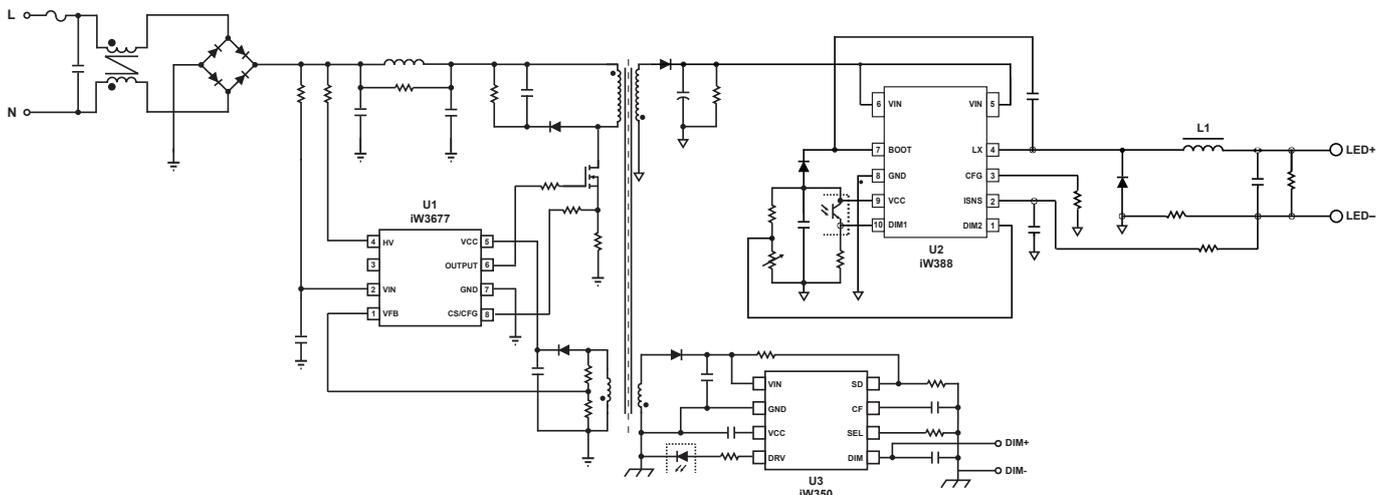


Figure 3.3 : iW388 Dimmable LED Driver Application with iW3677 Front-End Power Factor Correction Flyback and iW350 Interface IC

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### 4 Pinout Description

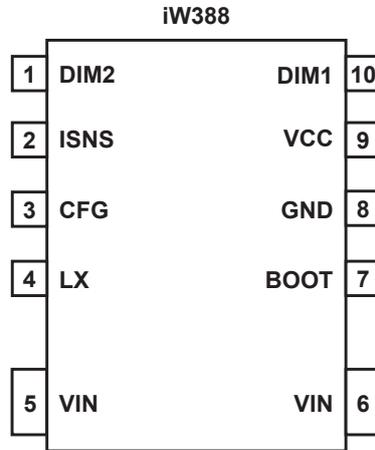


Figure 4.1 : 10-Lead SOIC Batwing Package

Pin Number	Pin Name	Type	Pin Description
1	DIM2	Analog Input	Dimming signal input port 2
2	ISNS	Analog Input	Buck inductor current sensing
3	CFG	Analog Input	Configuration input
4	LX	Analog Input	Buck switching node, high-side internal power MOSFET source
5	VIN	Power	Power source and input voltage sensing
6			
7	BOOT	Power	Bootstrap high-side driver power supply
8	GND	Ground	Ground reference
9	VCC	Power	IC power supply
10	DIM1	Analog Input	Dimming signal input port 1

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### 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	$V_{VCC}$	-0.3 to 6.5	V
Continuous DC supply at VCC pin	$I_{VCC}$	20	mA
VIN pin		-0.3 to 70	V
DIM1 and DIM2 pin		-0.3 to 6.5	V
ISNS pin		-0.3 to 6.5	V
CFG pin		-0.3 to 6.5	V
LX pin		-0.7 to 70	V
HSG pin (Note 1)		-0.3 to 75	V
BOOT pin (Note 1)		-0.3 to 75	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	$\theta_{JA}$	135	°C/W
ESD rating per JEDEC JS-001-2017		±2000	V
Latch-up test per JESD78E		±100	mA

**Note 1.** BOOT pin and HSG pin respect to LX pin < 6.5V.

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### 6 Physical Dimensions

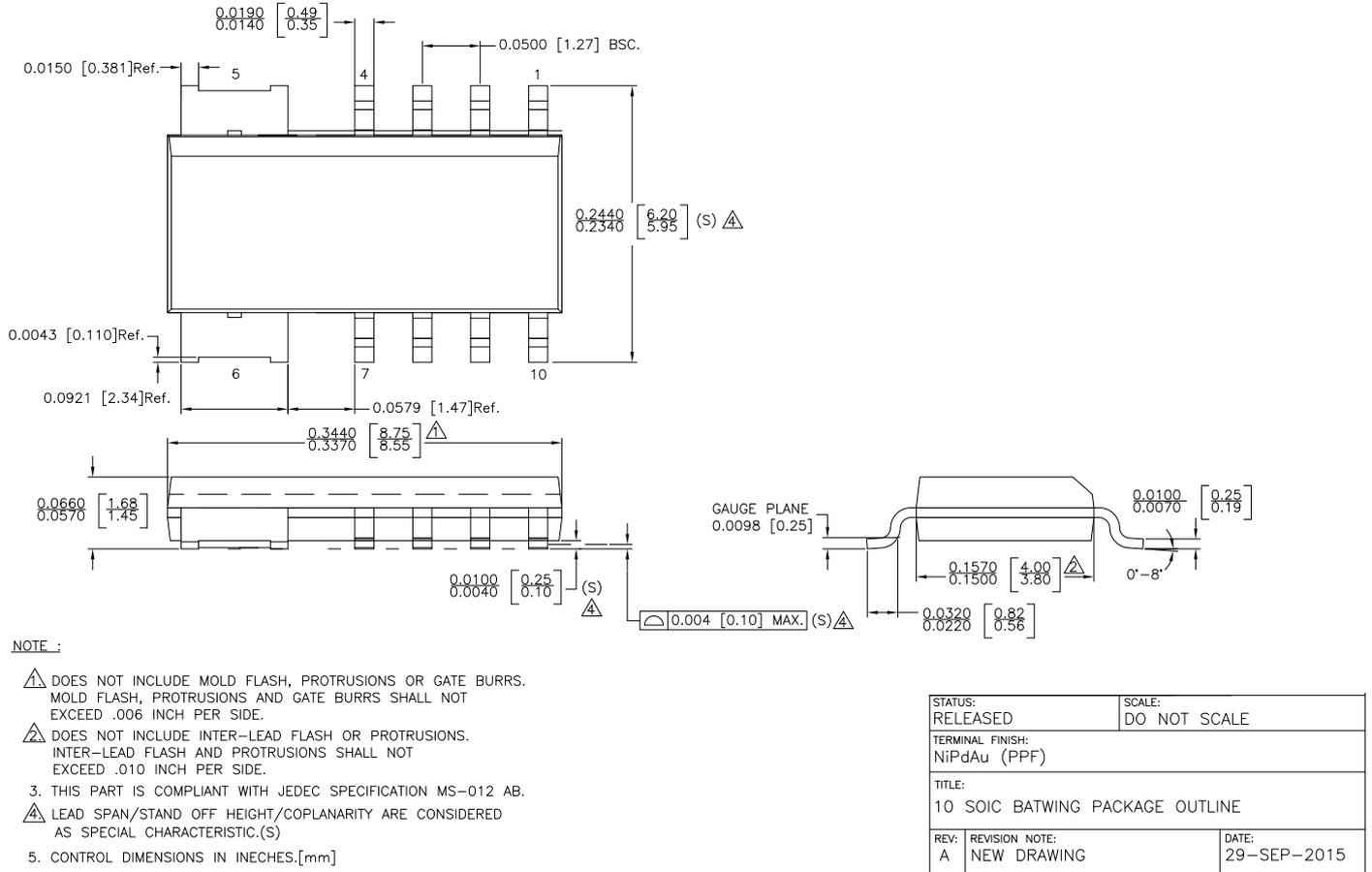


Figure 6.1 : 10-Lead SOIC Batwing Package Outline Drawing

### 7 Ordering Information

Part Number	Status	Options	Package	Description
iW388-00	Active	CC only	SO-10 Batwing	Tape & Reel <sup>1</sup>
iW388-00B	Recommended for New Designs	CC only	SO-10 Batwing	Tape & Reel <sup>1</sup>
iW388-01	Active	CC only, 0.125% lowest dimming startup threshold	SO-10 Batwing	Tape & Reel <sup>1</sup>
iW388-01B	Recommended for New Designs	CC only, 0.125% lowest dimming startup threshold	SO-10 Batwing	Tape & Reel <sup>1</sup>
iW388-20B	Active	CV/CC variant, DIM2 as feedback	SO-10 Batwing	Tape & Reel <sup>1</sup>
iW388-30B	Active	CP/CC variant, CP constant = 50%	SO-10 Batwing	Tape & Reel <sup>1</sup>
iW388-31B	Active	CP/CC variant, CP constant = 70%	SO-10 Batwing	Tape & Reel <sup>1</sup>

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

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