30V/1.5A High Brightness Step-Down LED Driver

Description

The PT4115A is a high-efficiency step-down LED driver controller with a wide input voltage range of 8V to 30V.

The PT4115A employs a continuous conduction mode architecture that accurately regulates LED current with a feedback coming from an external current-sense resistor. This control scheme optimizes circuit stabilization and fast response time without loop compensation. Its low 100mV average feedback voltage reduces power loss and improves the converter's efficiency.

The PT4115A implements PWM and analog dimming together through the DIM pin.

The PT4115A also Includes thermal regulation protection in case of output overload.

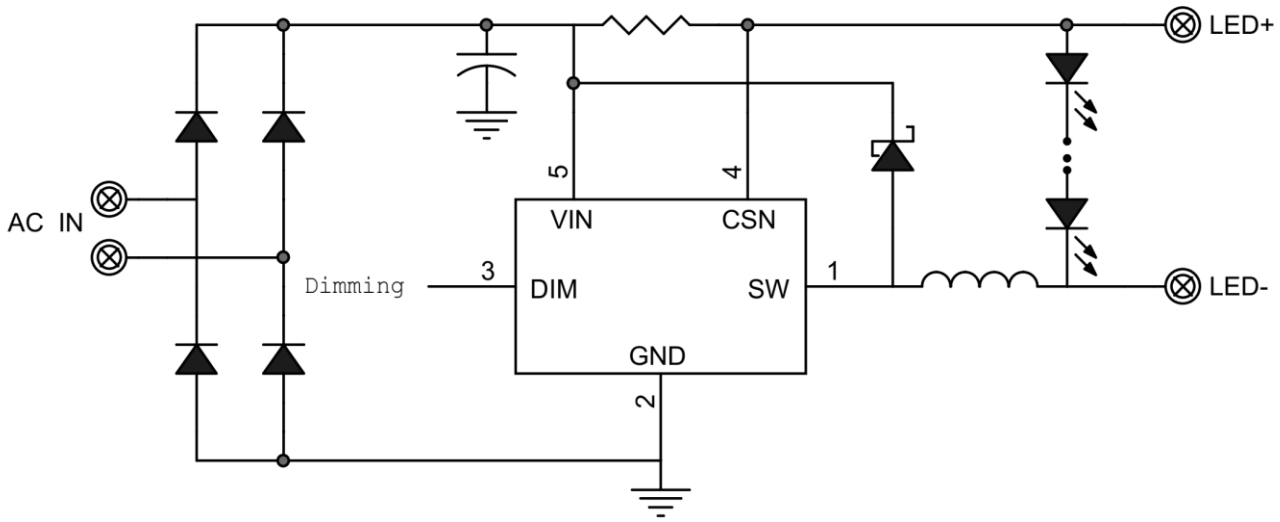
Features

- Wide 8V to 30V Input Range
- Able to Drive <1.5A LED Load
- +-3% output current accuracy
- Up to 1MHz switching frequency
- High Efficiency
- Analog and PWM Dimming
- Open LED Protection
- No need compensation
- Thermal Regulation
- RoHS and Halogen free compliance.
- Available in SOT89-5 Package

Applications

- Low Voltage Halogen Replacement
- DC/DC or AC/DC LED Driver Application
- Automotive/Decorative LED Lighting
- Emergency Lighting
- LED Backlighting

Typical Application

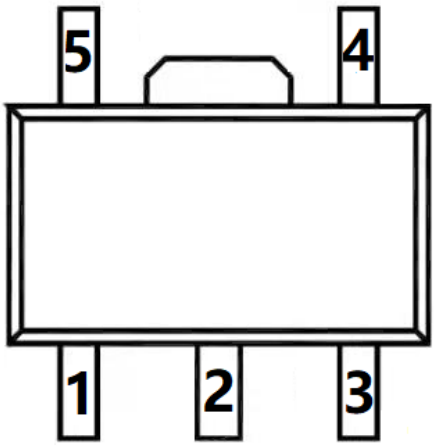


Absolute Maximum Ratings (at TA = 25°C)

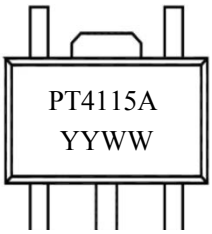
Characteristics	Symbol	Rating	Unit
VIN,CSN to GND		-0.3 to 36	V
SW to GND		-0.3 to 36	V
DIM to GND		-0.3 to +6.5	V
Junction to Ambient Thermal Resistance	$R_{\theta JA}$	45	°C/W
Operation Junction temperature range	T_J	-40~150	℃
Storage Temperature	T_{STG}	-55~150	℃

Pin Function And Descriptions

PIN	Name	Description
1	SW	Drain of the internal NMOS
2	GND	Ground
3	DIM	PWM/Analog Diming Input. Internal week pull up. Drive DIM low to turn off the output
4	CSN	Connect sensor input reference to VIN for measure output current.
5	VIN	Power input



Order information

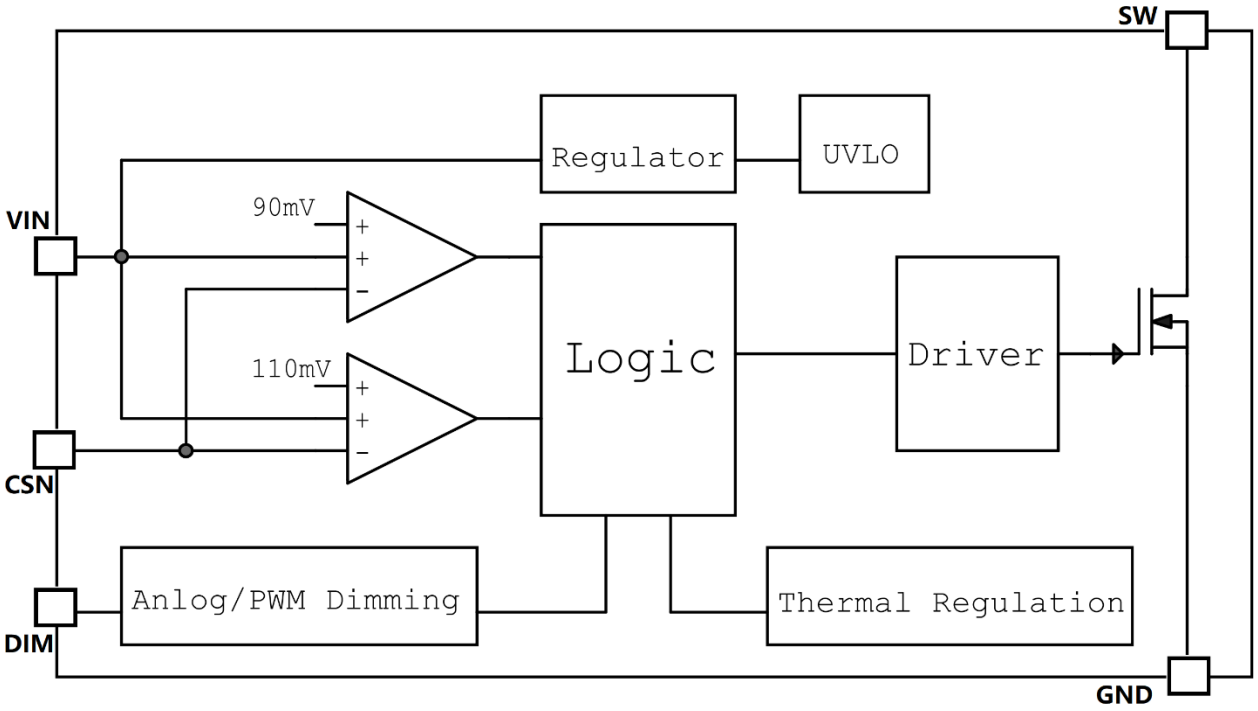
Order Information	Top Marking
PT4115A Product Number	 YY : Year (20=2020,21=2021,…) WW : Weekly (01-53)

Electrical Characteristics

TJ = 25°C. VIN = 12V, unless otherwise noted

Characteristics	Symbol	Conditions	Min	Typ	Max	Units
Input voltage	V_{IN}		8		30	V
VCC UVLO threshold	V_{UVLOTH}	VCC Rising		7.7		V
VCC UVLO hysteresis	$V_{UVLOHYS}$			0.2		V
Quiescent supply current	I_Q	No Switching		270		uA
Current Sense voltage	V_{CS}	VIN-CSN	97	100	103	mV
Current Sense threshold	V_{CS_HY}			15		%
CSN input Current	I_{CSN}			3		uA
DIM floating voltage	V_{DIM_F}			3.8		V
DIM input leakage current	I_{DIM_PU}	IDIM=5V		27		uA
DIM pull up current	I_{DIM_PU}	IDIM=0V		-25		uA
DIM input High	V_{DIM_H}		2.5			V
DIM input Low	V_{DIM_L}				0.3	V
DIM voltage range	V_{DIM}	V_{DIM} Rising	0.5		2.5	V
Min recommended pwm dimming frequency	F_{PWMmin}			0.1		kHz
Max recommended pwm dimming frequency	F_{PWMmax}			20		kHz
Minimum switch frequency	F_{MAX}			1		MHz
MOSFET ON resistance	R_{DSON}			240		mΩ
Thermal Regulate	T_{REG}	Temp Rising		105		℃
Thermal Shutdown	T_{SH}		-	160	-	℃

Block Diagram



Operation

Steady State

The PT4115A is a step-down LED-current convertor that is easily configured for a wide input that ranges from 8V to 30V input. The PT4115A uses a High-side current-sense resistor to detect and regulate LED current. The average voltage across the current-sense resistor is measured and regulated in the 100mV range.

The internal 1.2V reference voltage provides a 0.5V reference to enable the part. When DIM>0.5V, the output of the comparator goes high and enables the other blocks. While the internal DIM pin week pull up to 3V

Dimming Control

The PT4115A allows the DIM pin to control both Analog and PWM dimming. Whenever the voltage on DIM is less than 0.3V, the chip turns off. For analog dimming, when the voltage on DIM is from 0.5V to 2.5V, the LED current will change from 0% to 100% of the maximum LED current. If the voltage on DIM pin is higher than 2.5V, output LED current will equal the maximum LED current. For PWM dimming, the signal amplitude must exceed 2.5V. Choose a PWM frequency in range of 100Hz to 20kHz for good dimming linearity.

Applications Information

Setting the LED Current

The LED current is identical and set by the current sense resistor CS and GND.

R_{SENSE}=100mV/ILED

For R_{SENSE}=0.1Ω, the LED current is set to 1A Selecting the Inductor Lower value of inductance can result in a higher switching frequency, which causes a larger switching loss. Choose a switch frequency between 100kHz to 500kHz for most application. According to switching frequency, inductor value can be estimated as:

$$L = \frac{(1-\frac{V_{OUT}}{V_{IN}}) \times V_{OUT}}{0.3 \times I_{LED} \times f_{SW}}$$

For higher efficiency, choose an inductor with a DC resistance as small as possible.

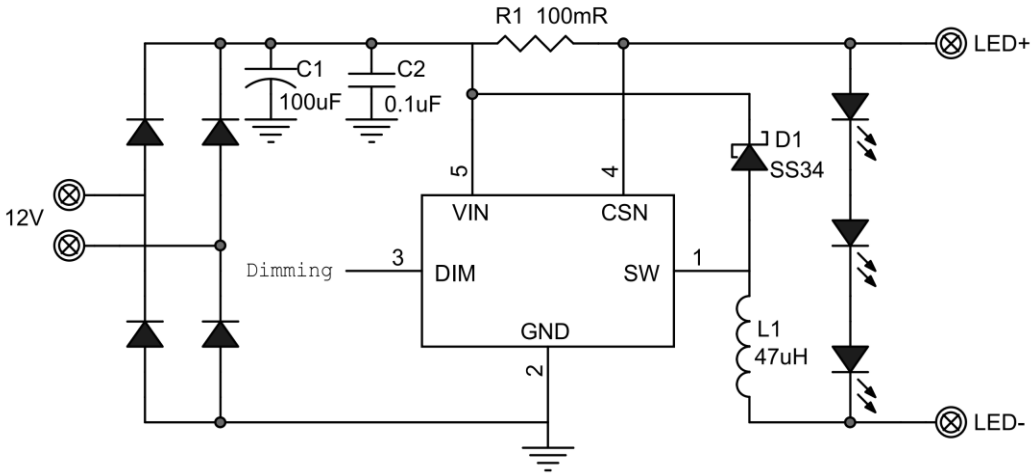
Selecting the Input Capacitor

The input capacitor reduces the surge current drawn from the input supply and the switching noise from the device. Choose a capacitor value of 100μF for most applications. The voltage rating should be greater than the input voltage. Use a low ESR capacitor for input decoupling.

Layout Consideration

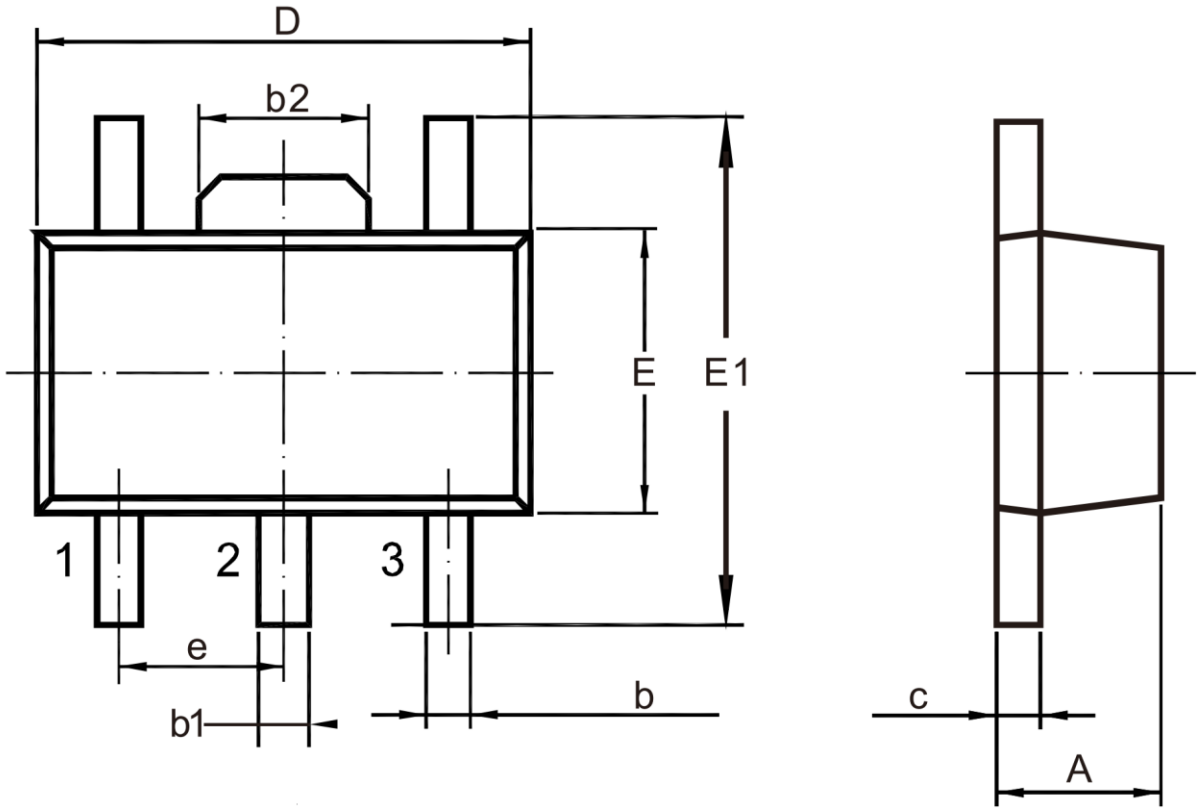
Pay careful attention to the PCB layout and component placement. RSENSE should be placed close to the CS pin and GND pin in order to minimize current sense error. The input loop—including input capacitor, Schottky diode, and MOSFET—should be as short as possible.

Typical Applications



Package Description

Standard Small Outline Package [SOT89-5]



Symbol	Dimensions In Millimeters	
	Min.	Max.
A	1.4	1.6
b	0.35	0.45
b1	0.47	0.53
b2	1.5	1.6
c	0.3	0.5
D	4.4	4.6
E	2.4	2.6
E1	4.3	4.7
e	1.5 (BSC)	