BP2362XH

Non-isolated APFC Buck LED Driver

Description

BP2362XH is a high precision non-isolated APFC buck LED driver, specially designed for universal mains with constant current control. BP2362XH operates in Critical Conduction Mode to reduce the switching loss and optimize the EMI.

BP2362XH remove the VCC capacitor, COMP capacitor and R_{CS} resistor to simplify the external BOM. And it utilizes patented current detection, with few external components, it achieves high precision output current, excellent line regulation and load regulation.

BP2362XH offers full of protection functions to improve the system reliability, including LED load short protection. The system reliability is further improved by the thermal regulation function. The output current is reduced when the driver is in condition of over temperature.

Features

- Active-PFC for High PF and Low THD
- No VCC and COMP capacitor
- Critical Conduction Mode Operation
- LED Short Protection
- LED Open Protection (OVP resister ADJ)
- Enable function is compatible with switch color and sensor light
- Cycle by Cycle Current Limit
- Thermal Regulation Function
- Available in SOP7 Package

Applications

- LED Bulb
- LED Tube
- Other LED Lighting

Typical Application

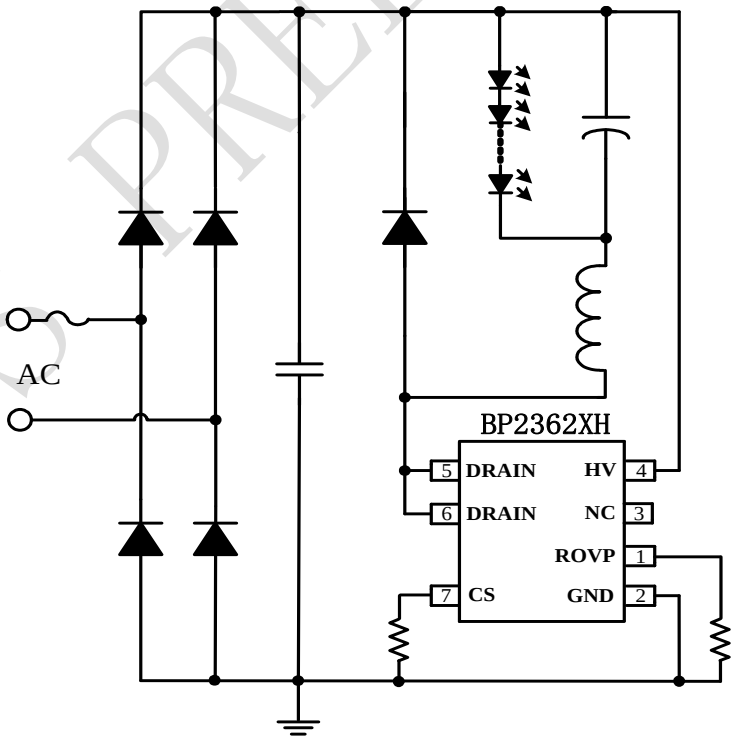
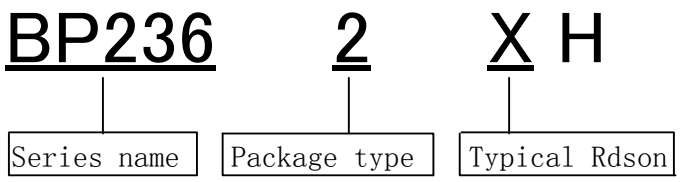


Figure 1 Typical application circuit for BP2362XH

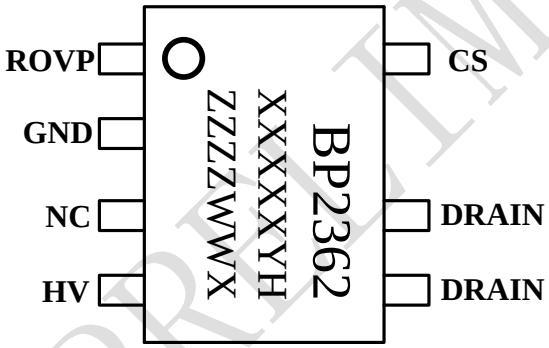
Naming rules



Ordering Information

Part Number	Package	Operating Ambient Temperature	Packing Method	Marking
BP2362XH	SOP7	-40 ℃ to 105 ℃	Tape 4,000 pcs/Reel	BP2362 XXXXXYH ZZZZWWX

Pin Configuration and Marking Information



XXXXXY: Lot Code
ZZZZ: Sign
WW: Week

Figure 2. Pin configuration

Pin Definition

Pin No.	Name	Description
1	ROVP	OVP configure by a resistor between this pin and GND Pin ROVP Floating—No OVP
2	GND	Ground.
3	NC	No Connection.
4	HV	High Voltage startup and power supply.
5,6	DRAIN	Internal HV Power MOSFET Drain.
7	CS	Current Sense Pin. Connect a sense resistor between this pin and GND pin.

Absolute Maximum Ratings (note1)

Symbol	Parameters	Range		Units
DRAIN	Internal HV MOSFET drain voltage	BH CH EH GH	-0.3~500	V
HV	IC high voltage power supply	-0.3~500		V
CS	Current sense pin input voltage	-0.3~6		V
ROVP	OVP set pin	−0. 3~6		V
P_{DMAX}	Power dissipation (note2)	0.45		W
θ_{JA}	Thermal resistance (Junction to Ambient)	145		℃/W
T_J	Operating junction temperature	-40 to 150		℃
T_{STG}	Storage temperature range	-55 to 150		℃

Note 1: *Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. Under "recommended operating conditions" the device operation is assured, but some particular parameter may not be achieved. The electrical characteristics table defines the operation range of the device, the electrical characteristics is assured on DC and AC voltage by test program. For the parameters without minimum and maximum value in the EC table, the typical value defines the operation range, the accuracy is not guaranteed by spec.*

Note 2: *The maximum power dissipation decrease if temperature rise, it is decided by T_{JMAX}, θ_{JA}, and environment temperature (T_A). The maximum power dissipation is the lower one between $P_{DMAX} = (T_{JMAX} - T_A)/\theta_{JA}$ and the number listed in the maximum table.*

Electrical Characteristics (Notes 3, 4) (Unless otherwise specified, HV=100V and T_A=25 ℃)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
High Voltage Power Supply (HV)						
I_{CC}	IC Operating Current	No switching		0.3	0.6	mA
Internal Timing Control						
T_{ON_MAX}	Maximum On Time			20		μs
T_{OFF_MIN}	Minimum Off Time			1.8		μs
T_{OFF_MAX}	Maximum Off Time			200		μs
Current Sense Section						
V_{CS_LIMIT}	CS Peak Voltage Limitation			1.8		V
T_{LEB_CS}	Leading Edge Blanking Time for Current Sense			300		ns
T_{DELAY}	Switch off Delay Time			200		ns
V_{REF}	Internal Reference Voltage			300		mV
OVP Control						
V_{EN}	ROVP Pin enable threshold		Disable threshold+ Hysteresis Voltage			V
	ROVP Pin disable threshold		0.1	0.2	0.3	
	V_{EN} Hysteresis Voltage			0.1		
T_{OVP_RST}	R_{OVP} recovery Time			100		mS
I_{OVP}	ROVP Pin output current			100		uA
Power MOSFET						
BH R_{DS_ON}	Static Drain-source On-resistance	V_{GS}=10V/I_{DS}=0.4A		9		Ω
CH R_{DS_ON}				5.8		
EH R_{DS_ON}				3		
GH R_{DS_ON}				1.9		
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS}=0V/I_{DS}=250uA	500			V
I_{DSS}	Power MOSFET Drain Leakage Current	V_{GS}=0V/V_{DS}=500V			1	uA
Thermal Regulation						
T_{REG}	Thermal Regulation Temperature	IC Surface		140		℃

Note 3: *production testing of the chip is performed at 25°C.*

Note 4: *the maximum and minimum parameters specified are guaranteed by test, the typical values are guaranteed by design, characterization and statistical analysis*

Internal Block Diagram

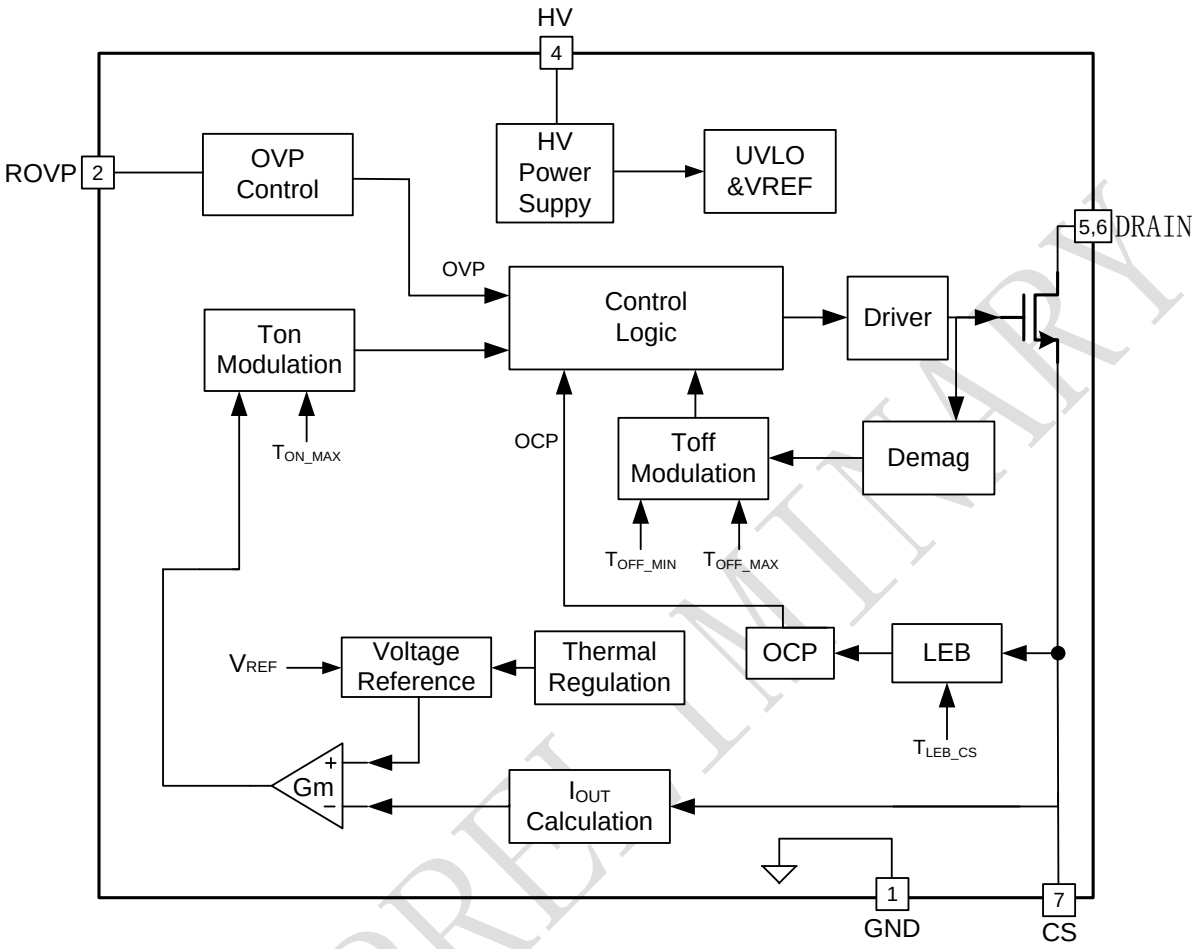


Figure 3. BP2362XH Internal Block Diagram

Application Information

BP2362XH is a high precision non-isolated APFC buck LED driver, specially designed for universal mains with constant current control. The driver with on-chip PFC circuit achieves high power factor, low THD and high efficiency.

1 Startup

After system is powered on, the system starts switching very quickly, and the output voltage rises up gradually, and the inductor peak current also rises up. The LED current hence achieves a soft start without overshoot.

2 Constant Current Control

The BP2362XH samples the peak current of the inductor cycle by cycle. Compared with the internal reference, it realizes closed-loop control and realizes high-precision constant current output.

The LED current can be calculated by the equation:

$$I_{LED} = \frac{V_{REF}}{Rcs}$$

Where,

V_{REF}: Internal reference voltage

R_{CS}: Value of the current sensing resistor

3 R_{OVP} Resistor Value calculate

The OVP voltage is set by the resistor which

connects the ROVP Pin. The current out of the ROVP Pin is 100uA.

When the LED load is open, the output voltage becomes higher and the Toff becomes lower. An open-circuit protection algorithm is integrated inside the chip, and the open-circuit protection voltage VOVP is calculated by an ROVP external resistor.

$$Vovp \approx \frac{13 \times L \times R_{OVP}}{Rcs}$$

where，
L is the inductor value in mH
V_{OVP} is the needed OVP in V

R_{OVP} is the resister connected between ROVP and GND in kΩ

4 Thermal Regulation

BP2362XH integrates thermal regulation function. When the system is over temperature, the output current is gradually reduced; the output power and thermal dissipation are also reduced. The system temperature is regulated and the system reliability is improved.

5 Protection Functions

To improve the system reliability, BP2362XH offers protection functions:

When the LED is shorted circuit, the switching frequency will work under 5 kHz.

When the output is shorted or the inductor is saturated, the CS peak voltage will be relatively high. When CS voltage reaches the internal limitation (1.8V), the power MOSFET will be turned off instantaneously. This cycle by cycle current limitation can help protecting power MOSFET, inductor and output diode.

6 PCB Layouts

The following guidelines should be followed in BP2362XH PCB layout:

Ground Path

Keep a short and wide ground path for current sense resistor.

The Area of Power Loop

The area of main current loop should be as small as possible to reduce EMI radiation.

DRAIN Pin

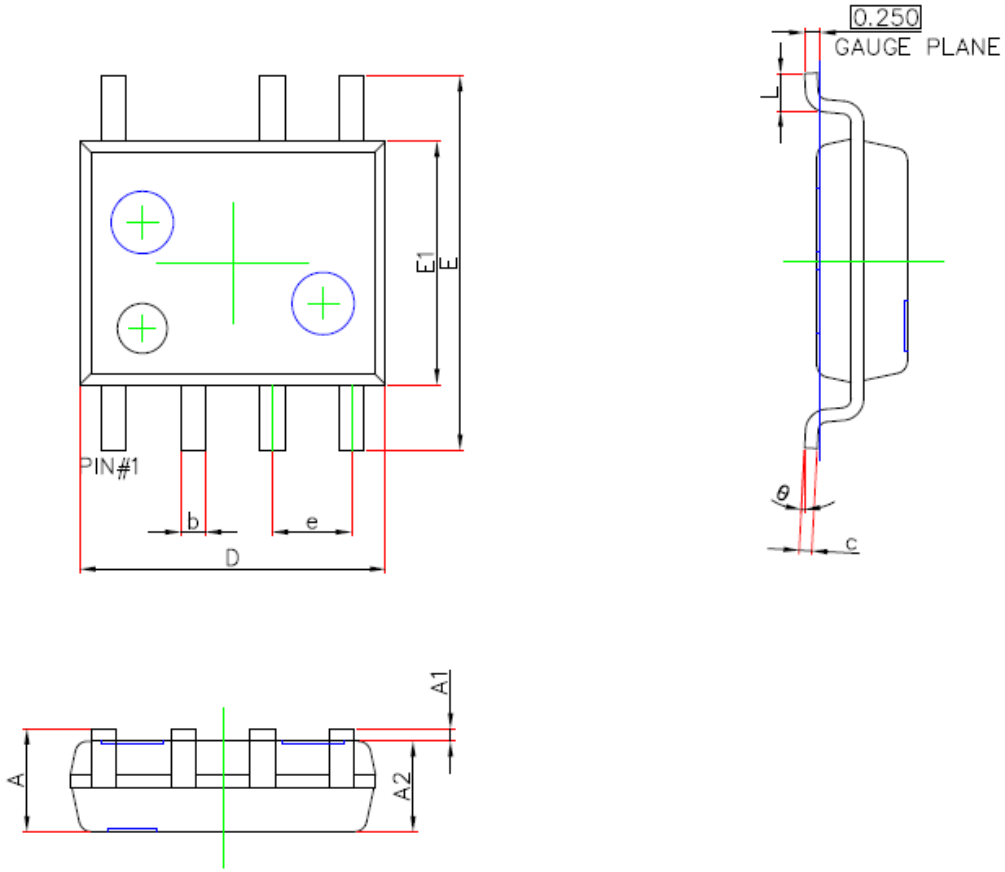
To increase the copper area of DRAIN pin for better thermal dissipation. However too large copper area may compromise EMI performance.

CS Pin

The larger CS pin copper area the better to thermal.

Package

SOP7 PACKAGE OUTLINE DIMENSIONS



Symbol	Dimensions in Millimeters		Dimensions in Inches	
	Min.	Max.	Min.	Max.
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.250	1.650	0.049	0.065
b	0.33	0.51	0.013	0.020
c	0.17	0.25	0.007	0.010
D	4.700	5.100	0.185	0.201
E	5.800	6.200	0.228	0.244
E1	3.700	4.100	0.146	0.161
e	1.270（BSC）		0.050（BSC）	
L	0.400	0.800	0.016	0.038
θ	0°	8°	0°	8°