BP2367XS

Non-isolated APFC Buck LED Driver

Description

BP2367XS is a high precision non-isolated APFC buck LED driver, specially designed for universal mains with constant current control. BP2367XS operates in Critical Conduction Mode to reduce the switching loss and optimize the EMI.

BP2367XS 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.

BP2367XS 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
- Integrated current sense resister
- Critical Conduction Mode Operation
- LED Short Protection
- Cycle by Cycle Current Limit
- Thermal Regulation Function
- Available in DIP7 Package

Applications

- LED Bulb
- LED Tube
- Other LED Lighting

Typical Application

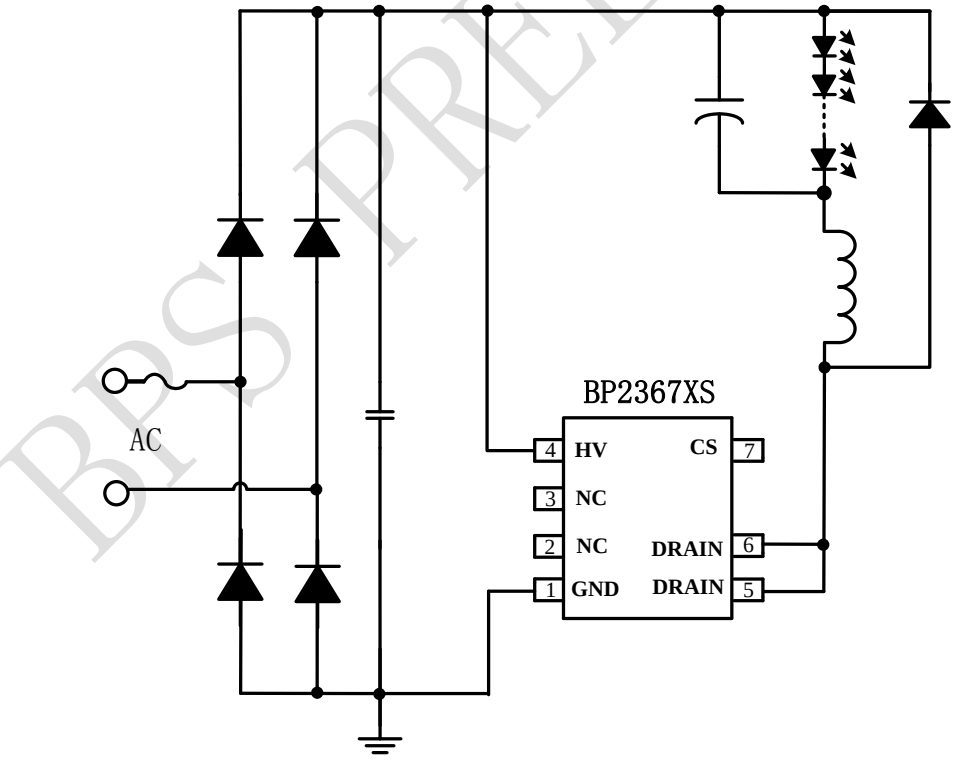
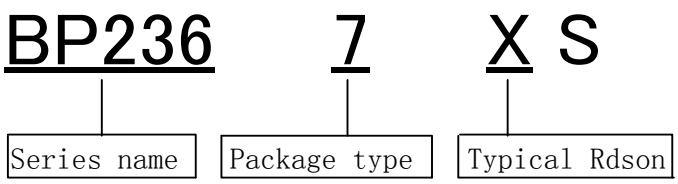


Figure 1 Typical application circuit for BP2367XS

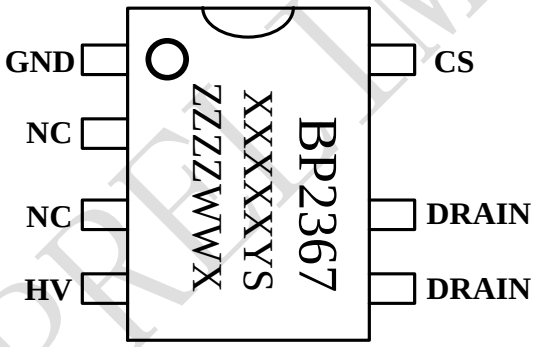
Naming rules



Ordering Information

Part Number	Package	Operating Temperature	Packing Method	Marking
BP2367XS	DIP7	-40 ℃ to 105 ℃	Tube 50 pcs/Tube	BP2367 XXXXXYS ZZZZWWX

Pin Configuration and Marking Information



XXXXXY: Lot Code
ZZZZ: Sign
WW: Week

Figure 2. Pin configuration

Pin Definition

Pin No.	Name	Description
1	GND	Ground.
2,3	NC	No Connection.
4	HV	High Voltage startup and power supply.
5,6	DRAIN	Internal HV Power MOSFET Drain.
7	CS	CS Floating $-I_{LED}$ is fixed internally

Absolute Maximum Ratings (note1)

Symbol	Parameters	Range		Units
DRAIN	Internal HV MOSFET drain voltage	DS	650	V
		FS	650	
HV	IC high voltage power supply	650		V
CS	Current sense pin input voltage	-0.3~6		V
P_{DMAX}	Power dissipation (note2)	0.9		W
θ_{JA}	Thermal resistance (Junction to Ambient)	80		℃/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
Output LED Current (CS)						
I_{LED}	Fixed LED Current			96		mA
Internal Timing Control						
T_{ON_MAX}	Maximum On Time			6.1		μs
T_{OFF_MAX}	Maximum Off Time			200		μs
Current Sense Section						
V_{CS_LIMIT}	CS Peak Voltage Limitation			2		V
T_{LEB_CS}	Leading Edge Blanking Time for Current Sense			300		ns
T_{DELAY}	Switch off Delay Time			200		ns
Compensation Section						
V_{REF}	Internal Reference Voltage			273		mV
OVP Control						
V_{OVP}	Shutdown voltage	L=2mH I_{LED}=96mA		110		V
T_{OVP_RST}	R_{OVP} recovery Time			40		ms
K	OVP Constant			1.5		
Power MOSFET						
DS R_{DS_ON}	Static Drain-source On-resistance	V_{GS}=10V/I_{DS}=0.5A		4.5		Ω
FS R_{DS_ON}				2.2		
DS BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS}=0V/I_{DS}=250uA	650			V
FS BV_{DSS}			650			
DS I_{DSS}	Power MOSFET Drain Leakage Current	V_{GS}=0V/V_{DS}=650V			1	uA
FS I_{DSS}		V_{GS}=0V/V_{DS}=650V				
Thermal Regulation						
T_{REG}	Thermal Regulation Temperature			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

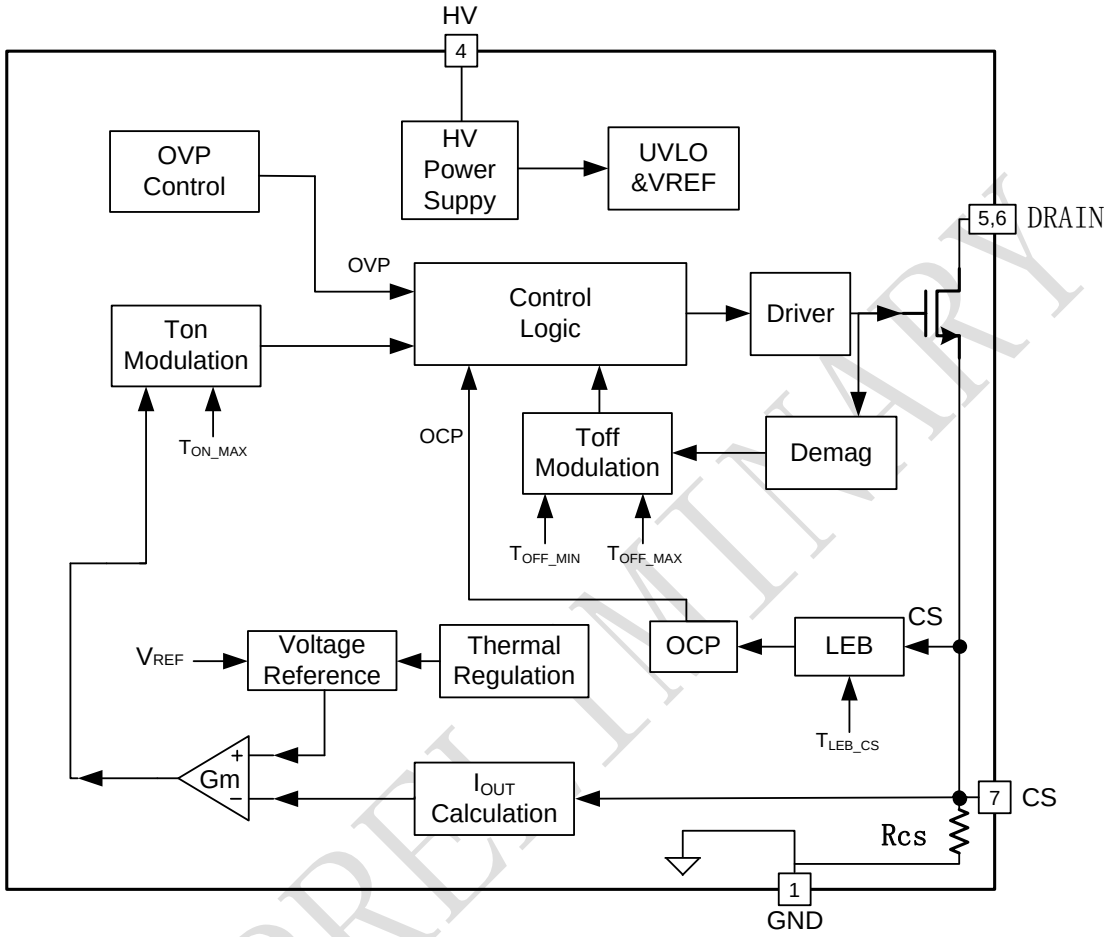


Figure 3. BP2367XS Internal Block Diagram

Application Information

BP2367XS 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

BP2367XS integrate LED current sensing resistor in the IC, The LED current is fixed with 96mA.

The LED current can be calculated by the equation:

$$I_{LED} \approx \frac{V_{REF}}{Rcs} + 96$$

Where,

V_{REF}: Internal reference voltage

R_{CS}: Value of the current sensing resistor

3 Thermal Regulation

BP2367XS 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.

4 Protection Functions

To improve the system reliability, BP2367XS 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 (2V), the power MOSFET will be turned off instantaneously. This cycle by cycle current limitation can help protecting power MOSFET, inductor and output diode.

The R_{OVP} function is also integrated in the IC, the LED open protection voltage is fixed with 128V, with L=2mH. I_{LED}=96mA.The V_{OVP} is given by:

$$Vovp \approx \frac{L(mH) \times I_{LED}(mA)}{K}$$

where，
L is the inductor value
K is constant is 1.5

5 PCB Layouts

The following guidelines should be followed in BP2367XS PCB layout:

Ground Path

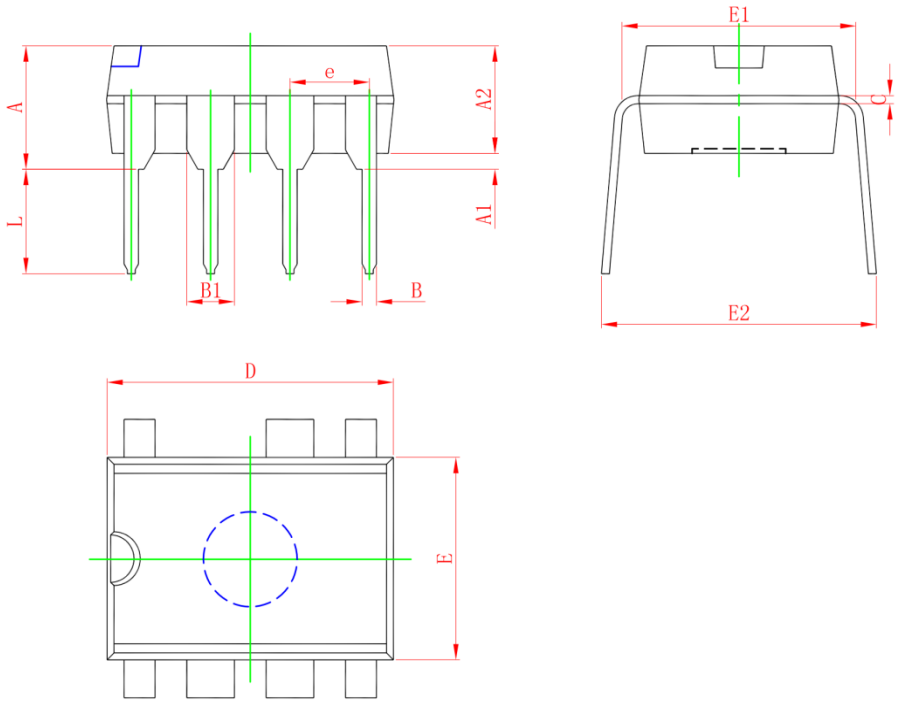
Keep a short and wide ground path for current sense resistor.

The Area of Power Loop

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

Package

DIP7 PACKAGE OUTLINE DIMENSIONS



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	3.710	4.310	0.146	0.170
A1	0.510		0.020	
A2	3.200	3.600	0.126	0.142
B	0.380	0.570	0.015	0.022
B1	1.524(BSC)		0.060(BSC)	
C	0.204	0.360	0.008	0.014
D	9.000	9.400	0.354	0.370
E	6.200	6.600	0.244	0.260
E1	7.320	7.920	0.288	0.312
e	2.540(BSC)		0.100(BSC)	
L	3.000	3.600	0.118	0.142
E2	8.400	9.000	0.331	0.354