晶丰明源
Bright Power Semiconductor

BP3336B

High PF PSR LED Driver Controller

Description

BP3336B is a high PF PSR constant current LED driver with high current accuracy. It is integrated with 650V MOSFET and is suitable for 90Vac-277Vac universal input.

BP3336B realizes high PF by constant on time control. With internal THD optimizer, the THD of input current can be lower than 15% under universal input. BP3336B works in BCM mode, which can help to improve switching loss and EMI performance.

With internal HV start up and fast start up control, BP3336B can build up output current within 500ms.

With internal line and load compensation, BP3336B can achieve excellent line and load regulation.

BP3336B can work as floating buck-boost with single-winding inductor or isolated Flyback topology with two or three windings transformer.

BP3336B is available in SOP-8 package

SOP-8 Package

Features

- 90-277Vac universal input
- High PF low THD (PF>0.9，THD<15%)
- Support two-winding for isolated application
- Build in HV start up, start up time <500mS
- High precious current reference (+/-3%)
- Good line and load regulation
- Critical conduction mode
- Low operation current
- VCC UVLO
- Cycle by cycle current limitation
- Output open/short protection
- Thermal fold back
- SOP-8 package

Applications

- External LED driver
- LED Lamps

Typical Application

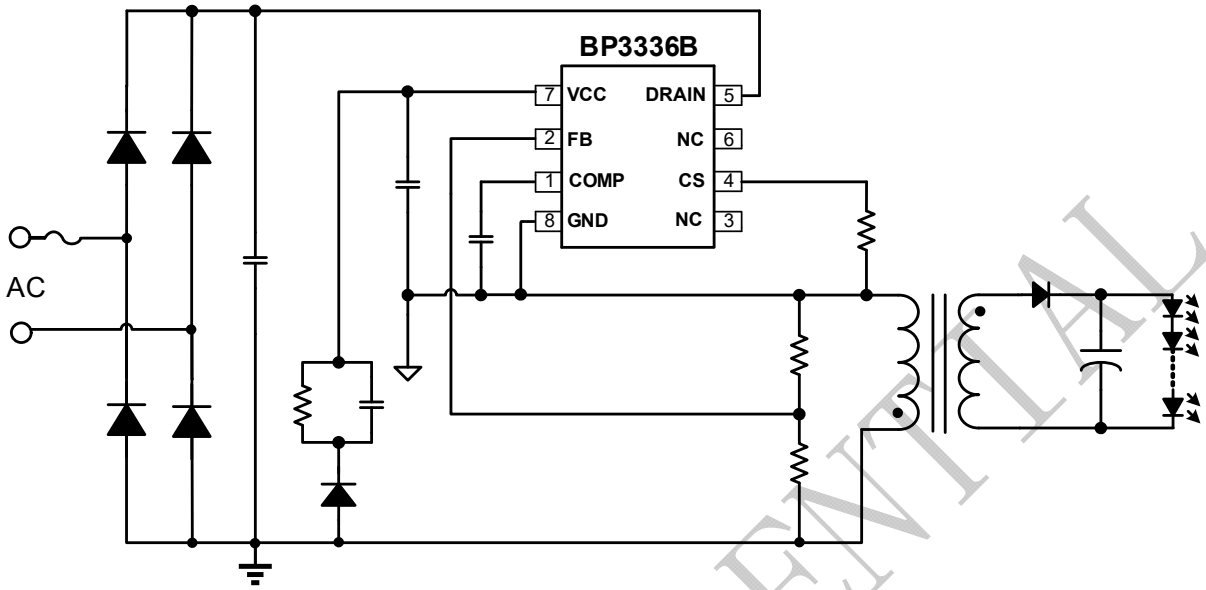


Figure 1 Floating isolated application with two-winding transformer

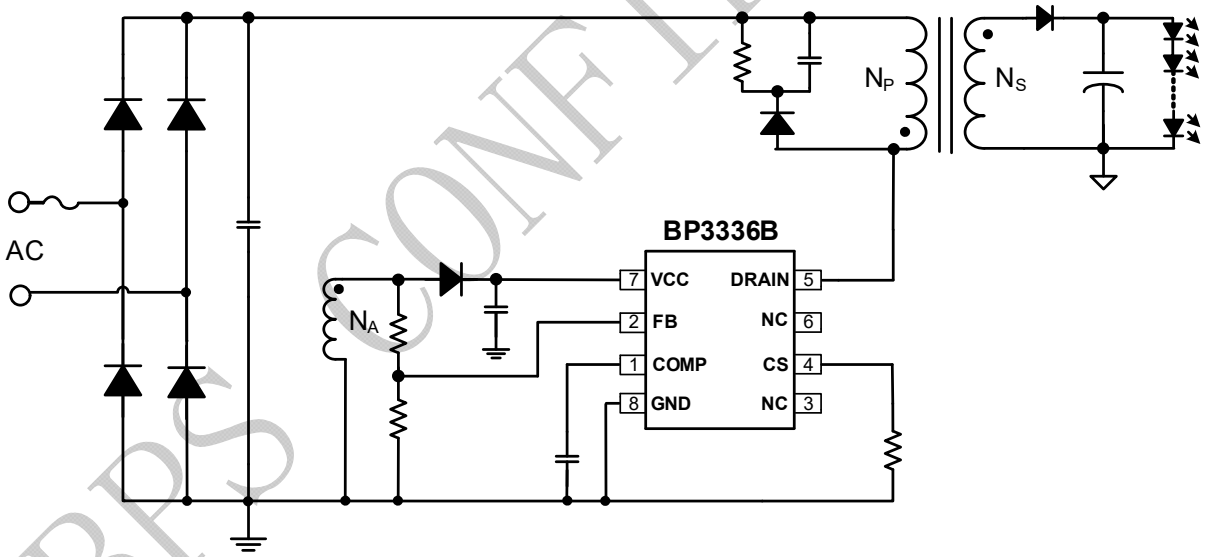
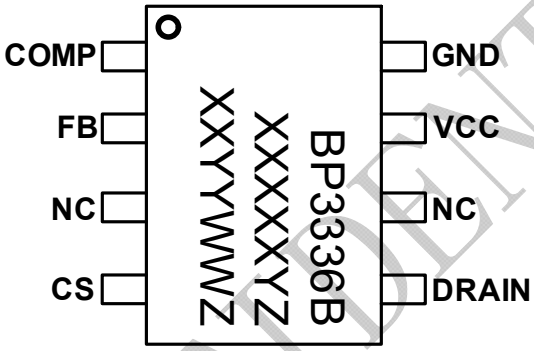


Figure 2 Grounded isolated application with Three-winding transformer

Ordering Information

Part Number	Package	Package Method	Marking
BP3336B	SOP-8	Tape 4,000 pcs/Reel	BP3336B XXXXXYZ XXYYWWZ

Pin Configuration and Marking Information



BP3336B
XXXXXY: Lot Code
XXYY: Sign
WW: Week
Z: Reserved

Figure 3 Pin Configuration

Pin Definition

Number	Name	Description
1	COMP	Loop compensation
2	FB	Feedback
3	NC	Not connected
4	CS	Primary side current sense, connected with sense resistor
5	DRAIN	Drain of internal MOSFET
6	NC	Not connected
7	VCC	Power supply for IC
8	GND	IC ground

Absolute Maximum Value (Note 1)

Symbol	Parameters	Range	Units
I_{CC_MAX}	Maximum current into VCC	10	mA
DRAIN	Drain voltage of internal MOSFET	-0.3~650	V
V_{IO}	Voltage range of CS/FB/COMP	-0.3~6	V
P_{DMAX}	Power dissipation (Note 2)	0.45	W
θ_{JA}	Thermal resistance (Junction to Ambient)	150	°C/W
T_J	Operating junction Temperature	-40 to 150	°C
T_{STG}	Storage temperature	-55 to 150	°C

Note 1: Stresses greater than those listed under "Absolute Maximum Value" may cause permanent damage to the device. Recommend operating range means within this range, device function is normal, but doesn't guarantee completely satisfy the individual performance index. Electrical parameters define the DC and AC parameters' specification under normal working condition and can meet certain performance test. For the parameters without upper and lower limit, the specification can't guarantee its accuracy, but the typical value reasonably reflects the device performance.

Note 2: maximum power dissipation will be reduced with temperature rise, which is defined by T_{JMAX}, θ_{JA}, and ambient temperature T_A. Maximum allowable power dissipation will be the smaller value between $P_{DMAX} = (T_{JMAX} - T_A)/\theta_{JA}$ or the limitation listed in the table of absolute maximum value.

Electrical Parameters (note 3, 4)

Symbol	Description	Conditions	Min	Typ	Max	Units
Power Supply (VCC)						
V_{CC_CLAMP}	V_{CC} clamp voltage	I_{CC}=1mA		17	19	V
V_{CC_ON}	V_{CC} start up voltage	V_{CC} rising	13.5	15	16.5	V
V_{CC_UVLO}	UVLO threshold	V_{CC} falling		7.5		V
I_Q	Quiescent current	No switching			0.27	mA
Error Amplifier(COMP)						
G_m	Transconductance of EA			60		uA/V
V_{COMP}	Linear range of COMP		1.5		4.5	V
V_{REF}	Internal reference		194	200	206	mV
Current Sampling (CS)						
V_{CS_TH}	Current limitation			1		V
T_{LEB}	Blanking time			300		ns
T_{DELAY}	Turn off delay			200		ns
Zero current detection and output open protection (FB)						
V_{FB_FALL}	Falling edge threshold of FB	FB falling		0.1		V
V_{FB_HYS}	FB hysteresis	FB rising		0.1		V
V_{FB_OVP}	Threshold of FB OVP		1.4	1.5	1.6	V
Internal timing						
T_{ON_MAX}	Maximum on time			20		us
T_{OFF_MIN}	Minimum off time			4.5		us
T_{OFF_MAX}	Maximum off time			130		us
Drain of internal MOSFET(DRAIN)						
V_{BR_DSS}	Breakdown voltage of MOSFET Drain		650			V
R_{DS_ON}	MOSFET conduction resistance			4.8		Ω
Thermal fold back						
T_{REG}	Junction temperature of thermal fold back start point			150		°C

Note 3: Typical Value is measured under 25°C.

Note 4: The minimum and maximum value is guaranteed by test, the typical value is guaranteed by design, test or statistical analysis.

Function diagram

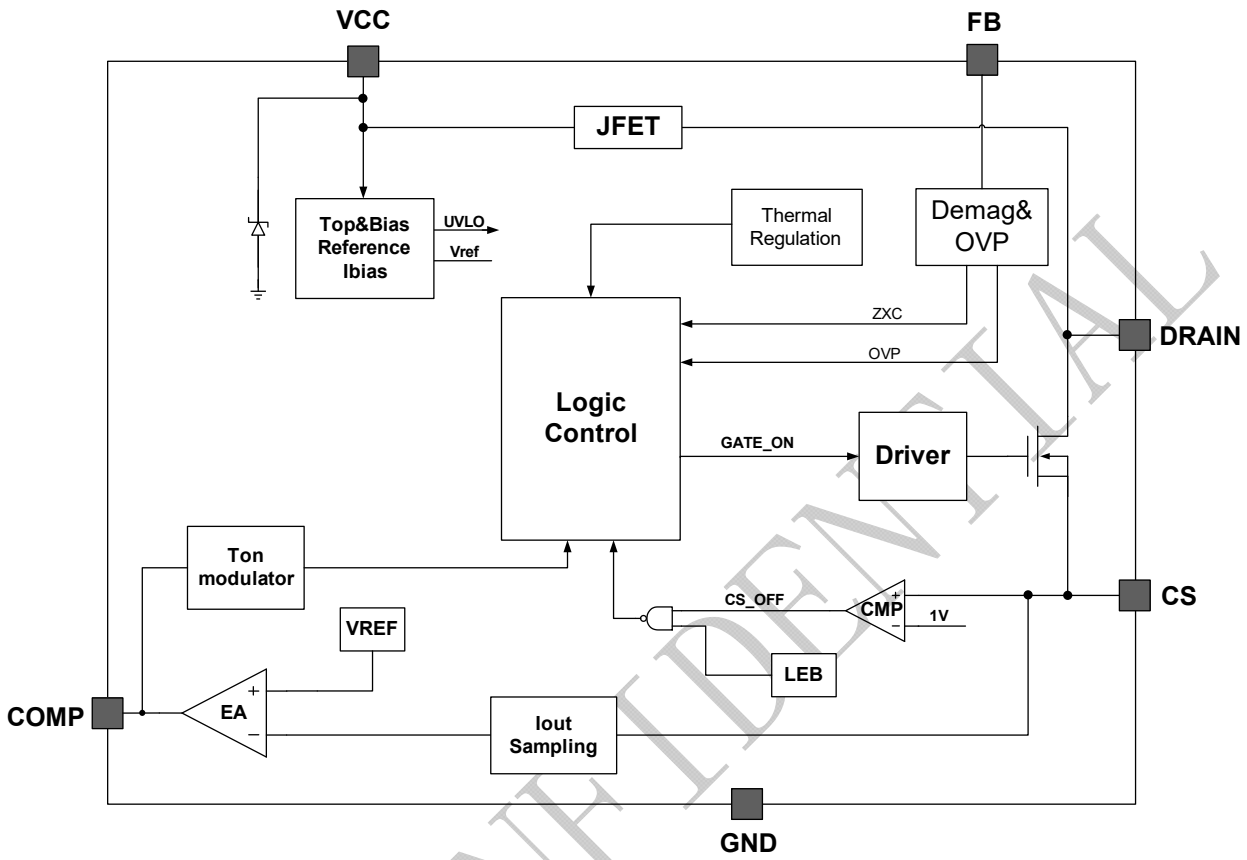


Figure 4 BP3336B internal diagram

Application Information

BP3336B is a high PF PSR constant current LED driver with high current accuracy. It is integrated with 650V MOSFET and is suitable for 90Vac-277Vac universal input, both isolated and non-isolated application.

Start up

When system powers on, VCC capacitor will be charged through internal JFET, when VCC voltage reaches start up threshold, the IC starts to work, COMP voltage will be pulled up to 1.7V internally, BP3336B starts switching. Firstly, the MOSFET will work with maximum on time of 6us. Once the positive voltage on FB pin be more than 0.4V, the system will work in close loop. The internal GM will charge COMP capacitor slowly, realizing soft start.

Output current control and setup

BP3336B adopts primary side regulation, getting rid of secondary side feedback. With special current sampling method, it can realize high precious output current control.

Output current can be calculated as following:

$$I_{out} \approx \frac{V_{REF}}{2 \times R_{cs}} \times \frac{N_P}{N_S}$$

Where,

V_{REF} is the internal reference voltage

N_P is primary winding of transformer

N_S is secondary winding number of transformer

R_{CS} is current sampling resistance.

Feedback network

BP3336B detects output current over zero through FB pin, the threshold is 0.1V for falling edge of FB voltage, with a hysteresis of 0.1V. FB voltage can also be used to detect input voltage and adjust switch on time according to input voltage.

FB pin can also be used for OVP, and the threshold is 1.5V. The resistor divider on FB can be set as:

$$\frac{R_{FBL}}{R_{FBL}+R_{FBH}} \approx \frac{1.5V}{V_{OVP\_FB}} \times \frac{N_S}{N_A}$$

Where,

R_{FBL} is the down resistance of divider

R_{FBH} is the up resistance of divider

V_{OVP_FB} is the set value of OVP

N_S is secondary winding number

N_A is auxiliary winding number

Line compensation

BP3336B is integrated with line voltage compensation, for wide range input voltage. A resistor connected between CS pin and current sensing resistor is used to improve line regulation.

Thermal fold back

There is thermal fold back function in BP3336B, when IC’s temperature is too high, the output current will be decreased to limit output power and temperature rise. This function is helpful to improve reliability of system. The starting point of thermal fold back is 150°C junction temperature.

Protections

BP3336B is integrated with multiple protection to ensure system reliability.

When LED is open, output voltage will increase which will result in higher FB voltage. Once FB voltage reaches OVP threshold of 1.5V, OVP will be triggered, switching will be stopped and IC enter OVP status.

When LED is short, there is no demagnetization signal can be detected on FB, MOSFET will switch at 7kHz. If the short status keeps for 100 switching cycles, IC will enter short protection status.

When system enters fault condition, the VCC will be discharged by 42uA current, until UVLO and then system will be restarted. At the same time, system will detect the fault condition, if it is released, the system will come back to normal operation.

When output is shorted or transformer is saturated, the peak voltage on CS pin will be high. If it reaches internal limitation of 1V, the switching cycle will be stopped at once. This cycle by cycle current limit can help to protect MOSFET, transformer and output freewheeling diode.

PCB design guideline

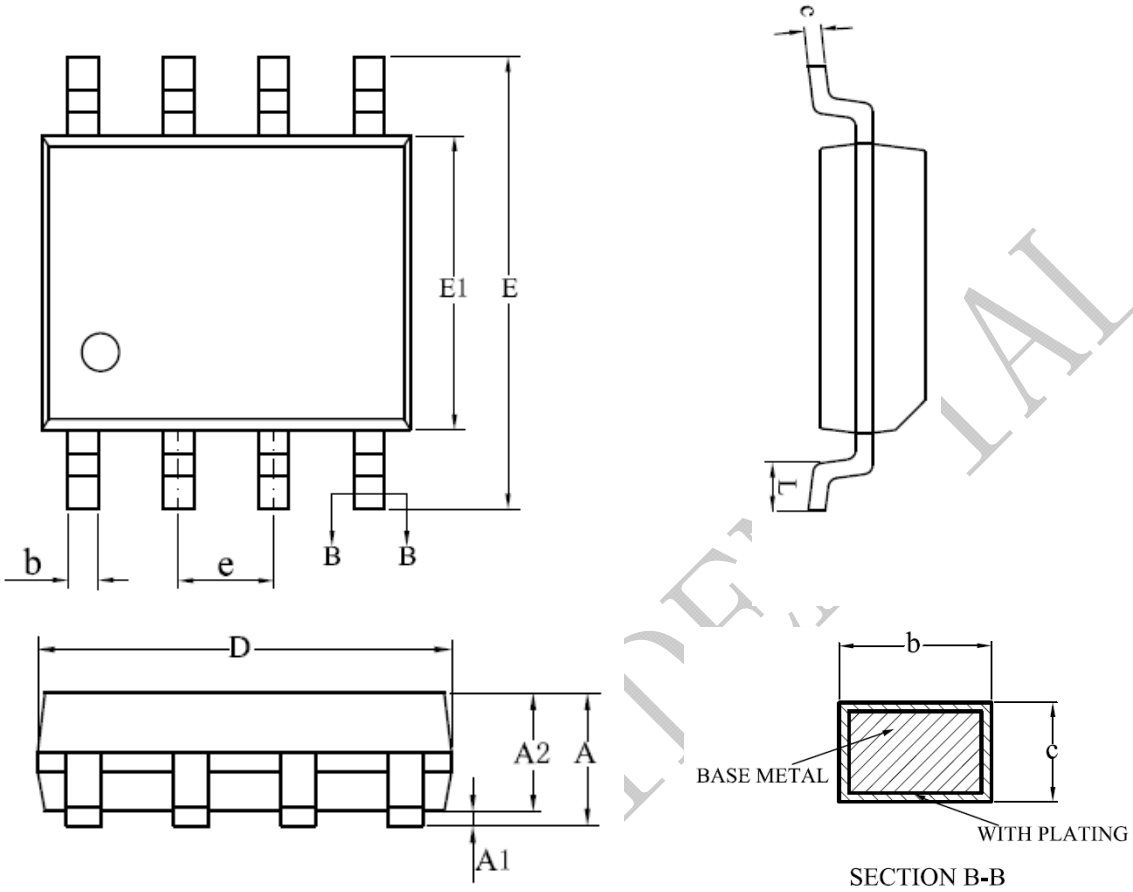
Suggestions for PCB layout of BP3336B application:

1) The bypass capacitor of VCC pin should be placed close to VCC and GND pin as possible.
2) Keep a short and wide trace to connect the current sensing resistor to GND for accurate current sampling, avoiding of a poor output current accuracy in high temperature. Besides, GND of small signal should be connected to IC ground by independent path.
3) The area of main current loop, including area of primary side of transformer, MOSFET and

snubber, and area of secondary side of transformer, freewheeling diode, output capacitor, should be as small as possible, to reduce EMI noise.

4) The down resistor of FB divider should be close to FB pin, and far away from switching node, to avoid mis-triggering of OVP.

Physical Dimension(SOP-8)



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	1.30	—	1.80
A1	0.05	—	0.25
A2	1.25	1.40	1.65
b	0.33	—	0.51
c	0.17	—	0.25
D	4.70	4.90	5.10
E	5.80	6.00	6.20
E1	3.70	3.90	4.10
e	1.27BSC		
L	0.40	—	1.00

Revision Information

Revision	Date	Notes
Rev. 1.1	2020/07	Add Disclaimer
Rev. 1.2	2021/01	Delete Comp Pin open protection

Disclaimer

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