晶丰明源半导体

BP2519

PSR Isolated CCCV Driver IC

Description

BP2519 is non-isolated CCCV driver IC. The device is suitable for 85Vac~265Vac universal input offline LED lighting. The BP2519 can perform in high accurate CCCV without external compensation capacitor, benefit to save the BOM size and cost.

The BP2519 supports multiple control mode of PWM and PFM, which contribute to very low standby power, high efficiency and minimum no load noise.

The BP2519 offers rich protection functions to improve the system reliability, including cycle by cycle peak current control, load open/short protection, VCC under/over voltage protection, and over temperature protection.

Features

- Non-Isolated CCCV control
- PWM/PFM multiple mode control
- Standby power <200mW
- ±5% Output Accuracy
- Internal soft startup
- Load open protection
- Load short protection
- VCC under voltage protection
- Over temperature protection
- Cycle by cycle peak current control
- Available in SOT23-5L package

Applications

- Chargers
- Standby/auxiliary power
- LED driving model

Typical Application

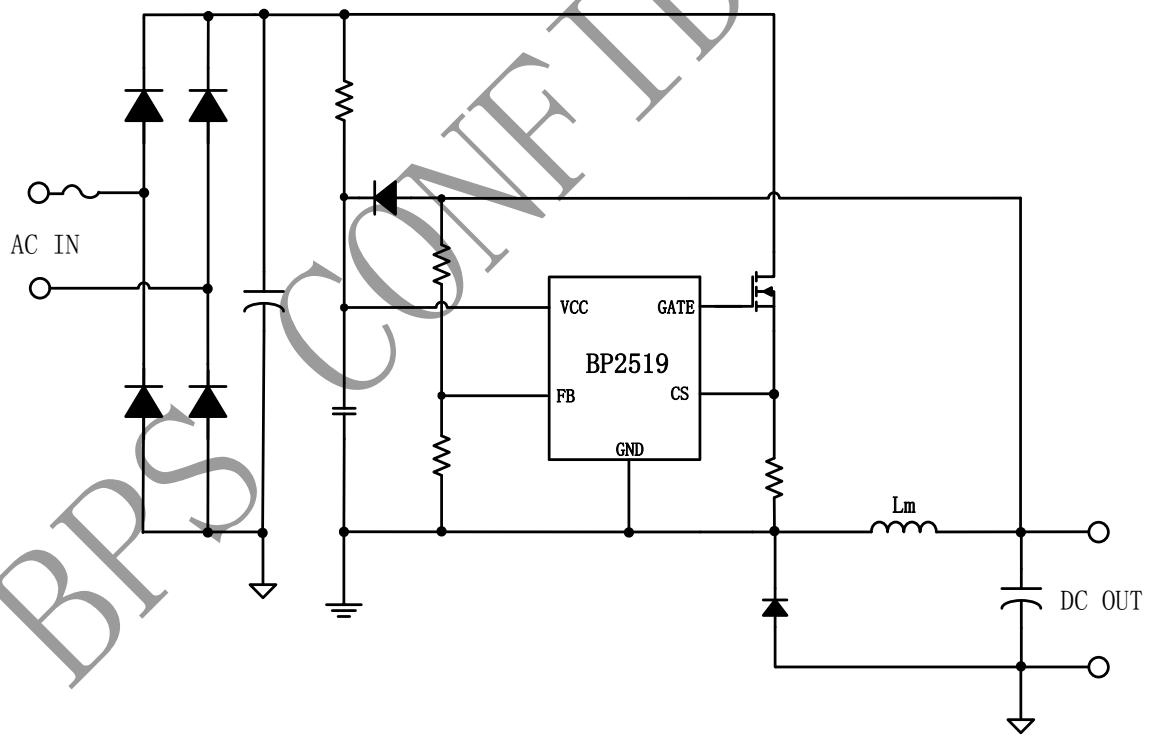


Fig1 Typical application circuit for BP2519

Ordering Information

Part Number	Package	Operating Temperature	Packing Method	Marking
BP2519	SOT23-5L	-40℃ to 105℃	Tape 3,000 Piece/Reel	2519

Pin Configuration and Marking Information

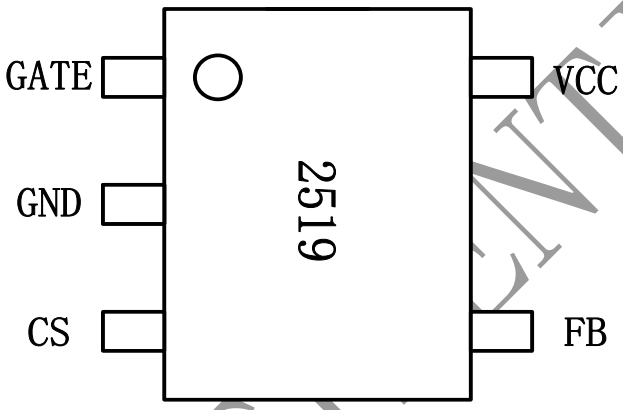


Fig2 Pin configuration

Pin Definition

Pin No.	Name	Description
1	GATE	Gate Driver Pin. Connect it to the gate of external power MOSFET
2	GND	Ground
3	CS	Current Sense Pin. Connect a sense resistor between this pin and GND pin.
4	FB	Feedback pin
5	VCC	Power Supply Pin

Absolute Maximum Ratings (note1)

Symbol	Parameters	Range	Units
V_{CC}	VCC pin voltage	-0.3~30	V
I_{CC_MAX}	VCC pin maximum sink current	10	mA
V_{FB}	Feedback Voltage detection Pin	-0.3~6	V
V_{CS}	Voltage on Current sense pin	-0.3~6	V
V_{GATE}	Gate driver of external power MOSFET	-0.3~20	V
P_{DMAX}	Power dissipation (note2)	0.3	W
θ_{JA}	Thermal resistance (Junction to Ambient)	240	℃/W
T_J	Operating junction temperature	-40 to 150	℃
T_{STG}	Storage temperature range	-55 to 150	℃
	ESD (note3)	2	kV

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.*

Note 3: *Human Body mode, 100pF capacitor discharge on 1.5kΩ resistor.*

Recommended Operation Conditions

Symbol	Parameter	Range	Unit
V_{CC}	Supply voltage	10~ 25	V
F_{OSC_MAX}	Max. operation frequency	100k	Hz

Electrical Characteristics (Notes 4, 5) (Unless otherwise specified, V_{CC}=16V and T_A=25 ℃)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
Supply Voltage Section						
V_{CC_CLAMP}	V_{CC} Clamp Voltage	5mA		26.5		V
V_{CC_OVP}	V_{CC} OVP Threshold			28		V
V_{CC_ON}	V_{CC} Turn On Threshold	V_{CC} Rising		15.3		V
V_{CC_UVLO}	V_{CC} Turn Off Threshold	V_{CC} Falling		7.6		V
I_{ST}	V_{CC} Startup Current	V_{CC}= V_{CC-ON} - 1V		120		uA
I_{OP}	V_{CC} Operating Current	V_{FB}=3V,V_{CS}=0		240		uA
Current Sense Section						
V_{CS_TH}	CS Peak Threshold		582	600	618	mV
T_{LEB}	Leading Edge Blanking			350		ns
Feedback Section						
$V_{FB\_EA\_REF}$	Internal EA Reference Voltage			3		V
V_{FB_OVP}	FB OVP Threshold			4		V
V_{FB_DEM}	FB ZCD Threshold			0.1		V
V_{FB_SHORT}	Output short protection Threshold			0.5		V
F_{OSC_SHORT}	Clamp frequency for output short			20		kHz
T_{SAMPLE_BIG}	Samples time	V_{CS_TH} =600mV		5.8		us
T_{OFF_MAX}	Max. OFF time			1		ms
T_{ON_MAX}	Max. ON time			40		us
Driver Section						
$V_{GATE-CLAMP}$	Gate clamping voltage			13		V
I_{SOURCE_MAX}	GATE pin Maximum Sourcing Current			60		mA
I_{SINK_MAX}	GATE pin Maximum Sinking Current			600		mA
Thermal Regulation Section						
T_{SD}	Thermal shunt down			150		℃

Note 4: *production testing of the chip is performed at 25°C.*

Note 5: *the maximum and minimum parameters specified are guaranteed by test, the typical value are guaranteed by design, characterization and statistical analysis*

Internal Block Diagram

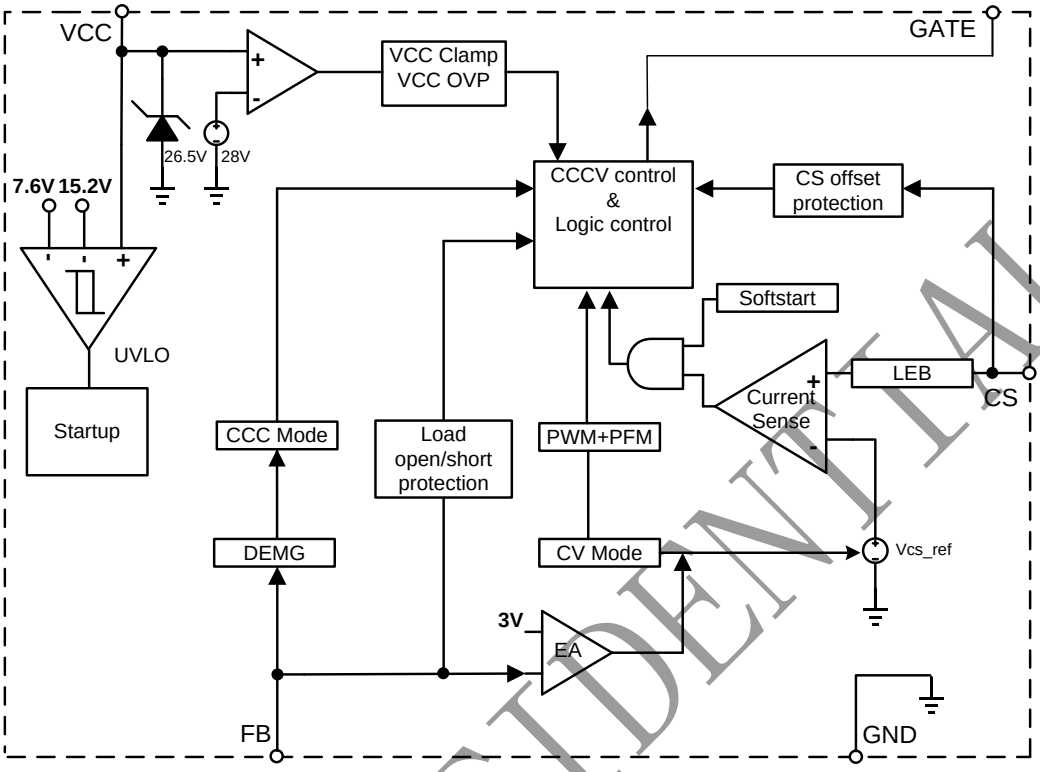


Fig3 BP2519 Internal Block Diagram

Application Information

BP2519 is non-isolated CCCV driver IC. BP2519 can work in multiple control mode of PFM and PWM providing high accurate constant current control and constant voltage control. There is very few external components required in bill of material. BP2519 provides the popular solutions for standby power, LED drivers and any CCCV request.

Start Up

After system powered on, the capacitor on VCC pin is charged up by the startup resistor. When the VCC pin voltage reaches the turn on threshold, the internal circuits start working. After the output voltage is built up, the VCC power is supplied by the output voltage through a diode.

Soft start is also implemented during startup within 1ms timeslot, and activated to increase the primary side peak current in steps. The soft start is available in every restart cycle.

Constant Current Control

The peak current of primary side inductor is sensed cycle by cycle. The CS pin monitors the peak level and inputs into the internal comparator with converted voltage of the switching status; once the voltage above the reference threshold, the switching would be stopped.

The peak current for full load is defined as:

$$I_{P\_PK} = \frac{600}{R_{CS}}(mA)$$

The peak detection has a fixed 350ns lead edge blanking time on CS.

The device operates in critical conduction mode .The

LED current is defined as:

$$I_{OUT} = \frac{I_{PK}}{2}$$

Constant Voltage Control

BP2519 senses the conductor voltage by divider resistor on FB pin. The constant output voltage is ensured by this sense voltage and internal reference in close loop.

The output voltage V_{OUT} is defined as:

$$V_O = \frac{(R_{FBL} + R_{FBH})}{R_{FBL}} * 3$$

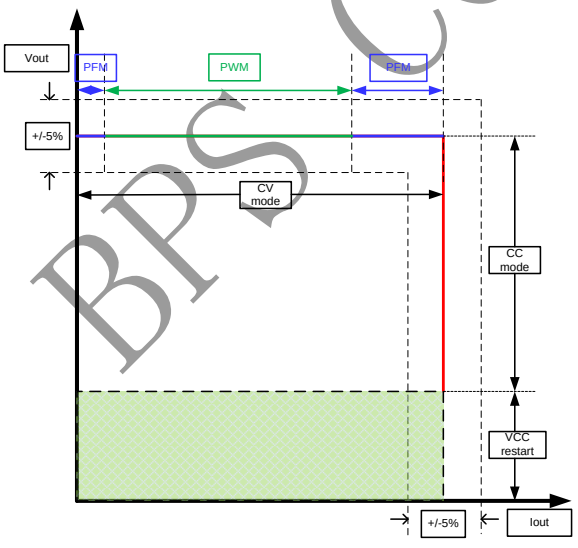
Where,

R_{FBL} is pull down resistor on FB pin;

R_{FBH} is pull high resistor on FB pin;

Multiple mode control: PWM/PFM

BP2519 is to use multiple mode control to improve the performance on efficiency, standby power, and audible noise in low load condition.



Protections

BP2519 offers rich protections to improve the system reliability, including output overvoltage protection, load short protection, Vcc under voltage lock out protection, over temperature protection.

This sense voltage on FB is also serve for load over voltage protection. The detection threshold is 4V on FB, and the Vovp defined as:

$$V_{OVP} = \frac{4*(R_{FBL} + R_{FBH})}{R_{FBL}}$$

Where Vovp is the design expectation on OVP.

When the sense voltage on FB is under 0.5V, as default the system would open guard for short protection and operating frequency clamped to 20kHz, which could save the stress on MOSFET. The system will restart after 48ms timeout.

During any fault condition, the Vcc voltage would be discharged. As well the Vcc voltage under UVLO threshold, the system will restart till shift to normal condition once the fault condition removed.

PCB Design Guide

Suggestions for PCB layout of BP2519 application: 1. Bypass Capacitor on Vcc:

The bypass capacitor on V_{CC} pin should be as close as possible to the V_{CC} Pin and GND pin.

2. Divider resistor for FB pin

Put the divider resistor close to the FB pin as possible, and keep the trace away to the switching node.

3. GND

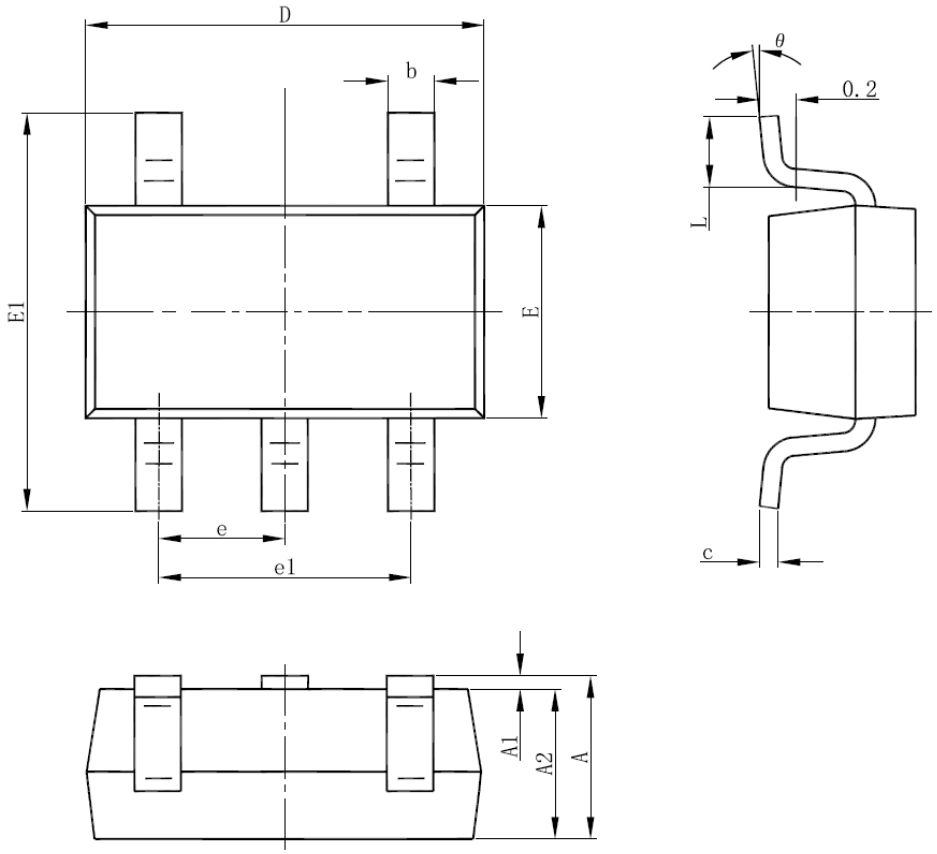
Keep a short and wide ground path for current sense resistor, especially for the main current loop. The IC signal ground for FB components should be connected to the IC GND.

4. The Area of Power Loop

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

Physical Dimensions

SOT-23-5L PACKAGE OUTLINE DIMENSIONS



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950(BSC)		0.037(BSC)	
e1	1.800	2.000	0.071	0.079
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°