Overview

BP2525X is a patented ultra-low standby power consumption non-isolated step-down constant voltage driver chip. Suitable for 85Vac~265Vac full voltage input non-isolated power supply.

The BP2525X chip integrates a high-voltage power switch, uses a unique voltage and current control technology, and does not require an external loop compensation capacitor, that is It can achieve excellent constant voltage characteristics, which greatly saves the system cost And volume.

The BP2525X chip adopts multi-mode control technology, and has a patented 3.3V output to VCC power supply technology, which effectively reduces system standby Power consumption, improve efficiency, and reduce noise when the system is working under light load.

BP2525X is available in SOT33-5A package.

Features

Low standby power consumption <20mW at 120Vac & 230Vac fixed 3.3Vor 5VOutput voltage, can choose to support direct output 3.3V

Internal integrated high voltage power tube

Integrated high voltage start and power supply circuit

Excellent dynamic response

Amplitude-reducing modulation technology to reduce audio noise

improveEMI Frequency jittering

±5% output voltage accuracy

Built-in soft start

Protective function

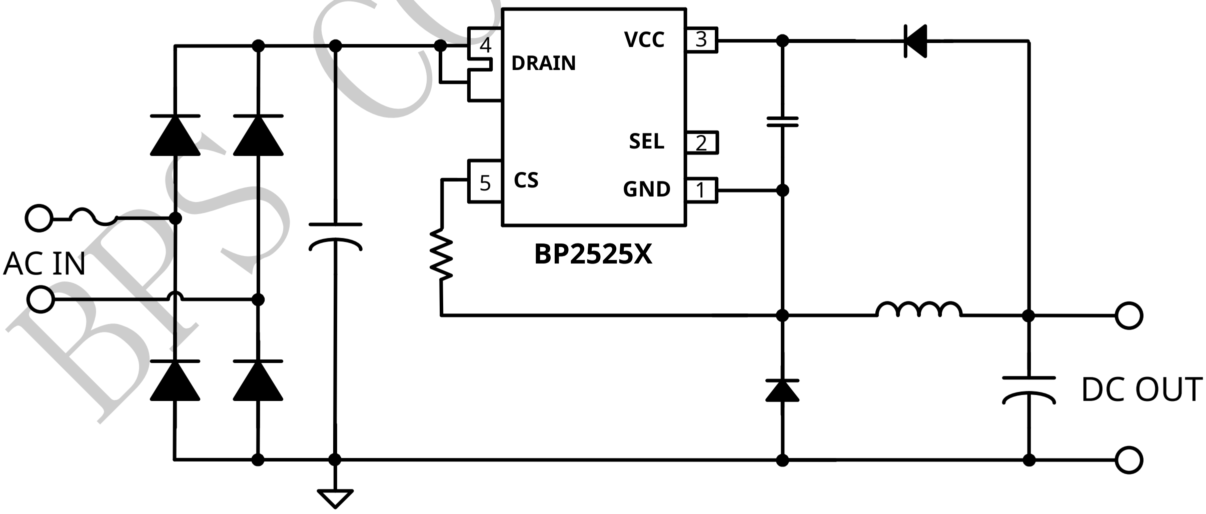
- Overload protection
- Short circuit protection
- Over temperature protection
- Cycle-by-cycle current limit

application

Auxiliary power

other apps

typical application

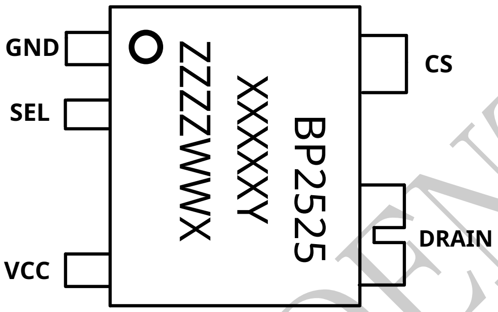


picture 1 BP2525Xtypical application

Order information

Order model	Encapsulation	temperature range	package style	Print
BP2525X	SOT33-5A	-40℃ to 105℃	Taping 7,500 pcs/reel	BP2525 XXXXXY ZZZZWWX

Pin package



XXXXXY: lot code
ZZZZ: Logo
WW: Week number
X: MOS code

Figure 2 Pin package diagram

Pin description

Pin number	Pin name	describe
1	GND	Chip ground
2	SEL	Output voltage selection terminal. Connect to VCC: output 3.3V; connect to GND: output 5V
3	VCC	Chip power terminal
4	DRAIN	The drain of the high-voltage power tube inside the chip
5	CS	Current sampling terminal, the sampling resistor is connected between CS and GND terminal

Limit parameters (Note 1)

symbol	parameter	Parameter range	unit
V_{DS}(B, D, F)	Internal high voltage power tube drain to source peak voltage	-0.3~500	V
V_{DS}(AH, CH, EH)		-0.3~650	V
VCC	VCC voltage	-0.3~7	V
I_{CC_MAX}	Maximum supply current of VCC pin	10	mA
SEL	Output voltage selection terminal	-0.3~6	V
CS	Current sampling terminal	-0.3~6	V
P_{DMAX}	Power consumption (Note 2)	0.4	W
θ_{JA}	Thermal resistance from PN junction to environment	155	℃/W
T_J	Operating junction temperature range	-40 to 150	℃
T_{STG}	Storage temperature range	-55 to 150	℃
	ESD (Note 3)	2	kV

Note 1: The maximum limit value means that if the working range is exceeded, the chip may be damaged. The recommended operating range means that the device functions normally within this range, but it is not completely guaranteed to meet individual performance indicators. Electrical parameters define the DC and AC parameters of the device within the working range and under test conditions that guarantee specific performance indicators. For the parameters for which the upper and lower limits are not given, the specification does not guarantee its accuracy, but its typical value reasonably reflects the performance of the device.

Note 2: The maximum power consumption will definitely decrease when the temperature rises, which is also determined by T_{JMAX}, θ_{JA} And ambient temperature T_A Decided. Maximum allowable power consumption is $P_{DMAX} = (T_{JMAX} - T_A)/\theta_{JA}$ Or the lower value of the numbers given in the limit range.

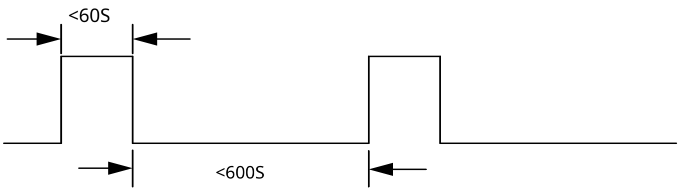
Note 3: Human body model, 100pF capacitor through 1.5KΩResistor discharge.

Limit output current meter

MeasurementTest conditions: loseInput voltage 85Vac-265Vac. * Pulse current holdingContinuedTime <60S, accounting forEmpty ratio <10%.

model	Continuous current Vout=3.3V	Pulse current Vout=3.3V	Continuous current Vout=5V	Pulse current Vout=5V	Internal MOS tube limitation Maximum current	unit
BP2525AH	150	200	150	200	350	mA
BP2525B	200	300	200	300	500	mA
BP2525CH	280	450	280	450	650	mA
BP2525D	300	500	300	500	750	mA
BP2525EH	400	600	400	600	1000	mA
BP2525F	500	700	500	700	1200	mA

Note:BP2525EH 3.3VApplication limit current parameter is inductance 150uHNext test result,5VIs inductance 210uHNext test result;BP2525F 3.3V Application limit current parameter is inductance 130uH Next test result,5V Is inductance 160uH According to the test results, a larger sense will cause the temperature rise to become higher. In order to ensure that the temperature rise of the chip is controlled within a reasonable range, it is recommended that the system work at full load.DCMorBCMmodel.



picture 3 Schematic diagram of instantaneous pulse

Electrical parameters (Note4, 5) (Unless otherwise specified, T_A=25℃)

symbol	describe	condition	Minimum	Typical	maximum value	unit
voltage						
V_{CC}	V_{cc}Pin steady state voltage	SEL = VCC	3.3	3.4	3.5	V
V_{CC}	V_{cc}Pin steady state voltage	SEL= GND	5	5.2	5.4	V
V_{CC_ON}	V_{cc}Turn on voltage	Rising		3.5		V
V_{CC_OFF}	V_{cc}Shut-off voltage	Falling		2.8		V
V_{CC_HYS}	V_{cc}Pin voltage hysteresis			0.7		V
V_{CC_CHRG}	V_{cc}Charging opening voltage	Falling		2.9		V
V_{CLAMP}	V_{cc}Pin clamp voltage	I_{CLAMP}=2mA		6		V
V_{CC_OLP}	Vcc overload protection voltage	Falling/SEL connect to Vcc		3.0		V
		Falling/SEL connect to GND		3.5		V
I_{OP}	V_{cc}Working current	V_{DRAIN}=40V		200	300	uA
I_{cc}	V_{cc}Starting current			2		mA
Oscillator						
F_{OSC_MAX}	Maximum switching frequency	Frequency center value	30	35	40	kHz
D_{MAX}	Maximum duty cycle			64		%
Current sampling						
V_{CS_TH}	Current detection threshold			200		mV
T_{LEB}	Leading edge blanking time			250		ns
T_{ILD}	Current limit delay			100		ns
Power tube						
AH R_{DS_ON}	Power tube on-resistance	Vout=3.3V, I_{DS}=50mA		35		Ω
BR_{DS_ON}				17		Ω
CH R_{DS_ON}				16		Ω
DR_{DS_ON}				9		Ω
EH R_{DS_ON}				9.5		Ω
FR_{DS_ON}				5.6		Ω
I_{DSS}	Power tube turn-off drain leakage current	V_{CC}=5V/V_{DS}=500V			30	uA
B, D, F BV_{DSS}	The breakdown voltage of the power tube	V_{GS}=0V/I_{DS}=250uA	500			V
AH, CH, EH BV_{DSS}			650			V
V_{DS_SUP}	Drain supply voltage		twenty four			V
Overheating protection						
T_{SD}	Overheat protection temperature			155		℃
T_{SD_HYS}	Overheat protection temperature hysteresis			40		℃

Note 4: Typical parameter value is 25°Parameter standard measured under C°.

Note 5: The minimum and maximum specification ranges of the specifications are guaranteed by testing, and the typical values are guaranteed by design, testing or statistical analysis.

Internal structure block diagram

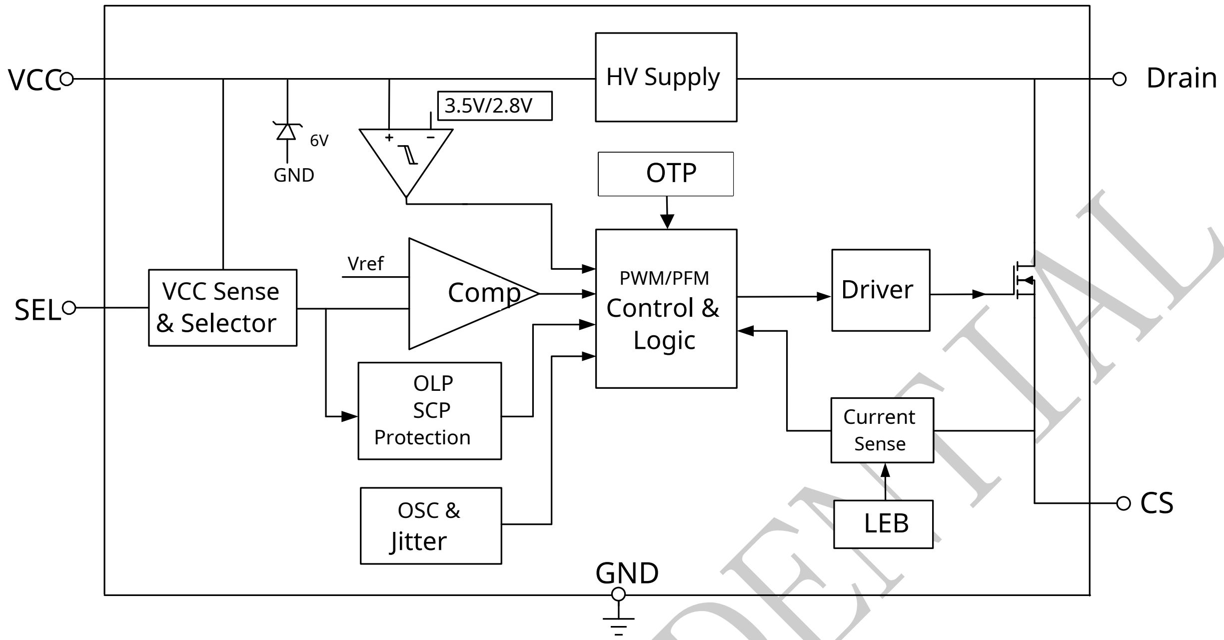


Figure 4 Internal block diagram of BP2525X

Application information

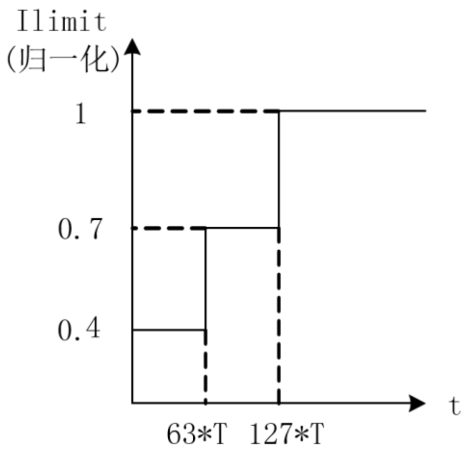
BP2525X is a patented high-voltage input ultra-low standby power consumption step-down constant voltage driver chip, using unique multi-mode control, the chip Integrated high-voltage power switch and output voltage sampling resistor, only need Very few external components can achieve excellent constant voltage characteristics. special Suitable for auxiliary power applications.

start up

After the system is powered on, the bus voltage directly passes through the Drain terminal to V_{CC} The capacitor is charged when V_{CC}When the voltage reaches the chip turn-on threshold, the internal control circuit of the chip starts to work. BP2525X has a built-in 6V voltage regulator tube for clamping V_{CC}Voltage. When the chip is working normally, the required V_{CC}The current is directly supplied from the output, so the chip has low standby power consumption and no auxiliary winding is required. Group power supply.

Soft start

The chip has a soft-start function. During the soft-start process, it will increase in stages The peak current of the primary side is added to reduce the switching stress, and each restart will Go through the process of soft start.



Output inductance

BP2525X can work in CCM, DCM and other operating modes. The selection of inductance includes inductance, peak current and average current. most Finally, the power supply is determined based on the inductor price, inductor size, and system efficiency. The size of the sense. Small inductance inductance can reduce the size and price And improve the dynamic response of the system, but at the same time it will increase the peak of the inductance Value current and output ripple and reduce system efficiency. On the contrary, big Inductive inductance can improve efficiency, because more coils are required, The processing volume will be larger, and the dynamic response will become slower. Comprehensive electricity

Sense of price, size, system efficiency and dynamic response, recommend inductor

Ripple current coefficient r is not less than 25%, working in CCM mode, and then

based on input/output voltage, system switching frequency, full-load output

current and recommended inductor ripple current ΔI_L Estimate the inductance

Quantity, peak current

$$L = \frac{(\ - \ )}{ * \ * \Delta}$$

in

$$\Delta \ = \ *$$

Peak current

When the current ripple coefficient r is determined, the peak current can be calculated

$$I_{L\_PEAK} \quad I_{O\_MAX} \qquad \frac{I_L}{2}$$

$$I_{L\_VALLY} \quad I_{O\_MAX} \qquad \frac{I_L}{2}$$

Also by the I of the chip$_{LIMIT}$ The parameters can be used to calculate the maximum overload current.

Selection of CS resistance

The chip can reasonably set the current limiting peak value of the inductor according to the MOS gear. The actual selection of the CS resistance needs to consider the load current and current ripple, and leave a certain margin.

The CS resistance is calculated as:

$$R_{CS} \quad \frac{\text{twenty two}(0\ mV)}{I_{\lim}(_{it}\ mA)}$$

Note: The internal comparator delay causes the actual CS_TH to be slightly higher than the internal 200mV reference voltage of the chip.

Selection of input capacitance

The purpose of the input capacitor is to filter the input voltage and MOSFET switching spikes. Since the input current of the buck converter is discontinuous, a capacitor is required to absorb the AC current to ensure a stable input

Voltage. In addition, the input capacitor needs to be able to withstand sufficient current ripple.

The effective value of the input ripple current is estimated as follows:

$$I_{IN\_RMS} \quad I_{O\_MAX} \quad D(1\sqrt{D)}$$

$$D \quad \frac{V_{OUT}}{V_{IN}}$$

In order to reduce the noise, it is recommended to select an electrolytic capacitor for the input capacitor.

Selection of output capacitor

The function of the output capacitor is to filter the output voltage and output dynamics

Electricity supply. When the output current is constant, the output ripple is mainly caused by

The ESR and capacity of the output capacitor are determined.

$$V_{RIPPLE} \quad V_{RIPPLE\_ESR} \quad V_{RIPPLE\_C}$$

$$V_{RIPPLE\_ESR} \quad I_L \ ESR$$

$$V_{RIPPLE\_C} \quad \frac{I_L}{8\ C_{OUT} \quad fsw}$$

Diode selection

The diode is used as the freewheeling diode of the BUCK circuit. In order to improve the efficiency, try to use a diode with fast recovery time and low on-voltage drop.

The tube acts as a rectifier diode. The diode reverse breakdown voltage must be greater than

BUCK capacitor input voltage.

Dummy load selection

The function of the dummy load in the system is to prevent the output voltage at no load or light load

Floating high. The false load resistance is too large, which will cause the output voltage to float at no load, while the resistance is too small will affect the actual load capacity and increase the system

Standby power consumption. Therefore, it is necessary to set the dummy load resistance reasonably,

The recommended value of 3.3V is 1.5Kohm, and the recommended value of 5V is 2Kohm.

Multi-mode control

BP2525X chip adopts PWM/PFM multi-mode control technology, which can effectively reduce system standby power consumption, improve efficiency, and reduce system work

Noise at light load.

Output voltage overload, short circuit protection

BP2525X realizes the output voltage overload and short circuit protection through the VCC pin. When the VCC voltage is lower than the set voltage and keeps for 160ms, the chip realizes output overload protection. After protection, the power MOS is turned off, The chip oscillator works at the lowest frequency of 4KHz. After the protection occurs, the chip will re-check the VCC voltage for 1.6 seconds. If the overload or short circuit is released, it will work normally. If it is not released, the protection will continue.

Other protection functions

BP2525X has a variety of built-in protection functions, including over-temperature protection, cycle-by-cycle current limit, etc.

PCB design

When designing the BP2525X PCB, the following suggestions need to be followed:

Bypass capacitor

V_{CC}The bypass capacitor needs to be close to the chip V_{CC}And GND pin.

Chip GND

The wiring between the chip GND and the output inductor should be short and thick to prevent the formation of a transmitting antenna and affecting EMI radiation.

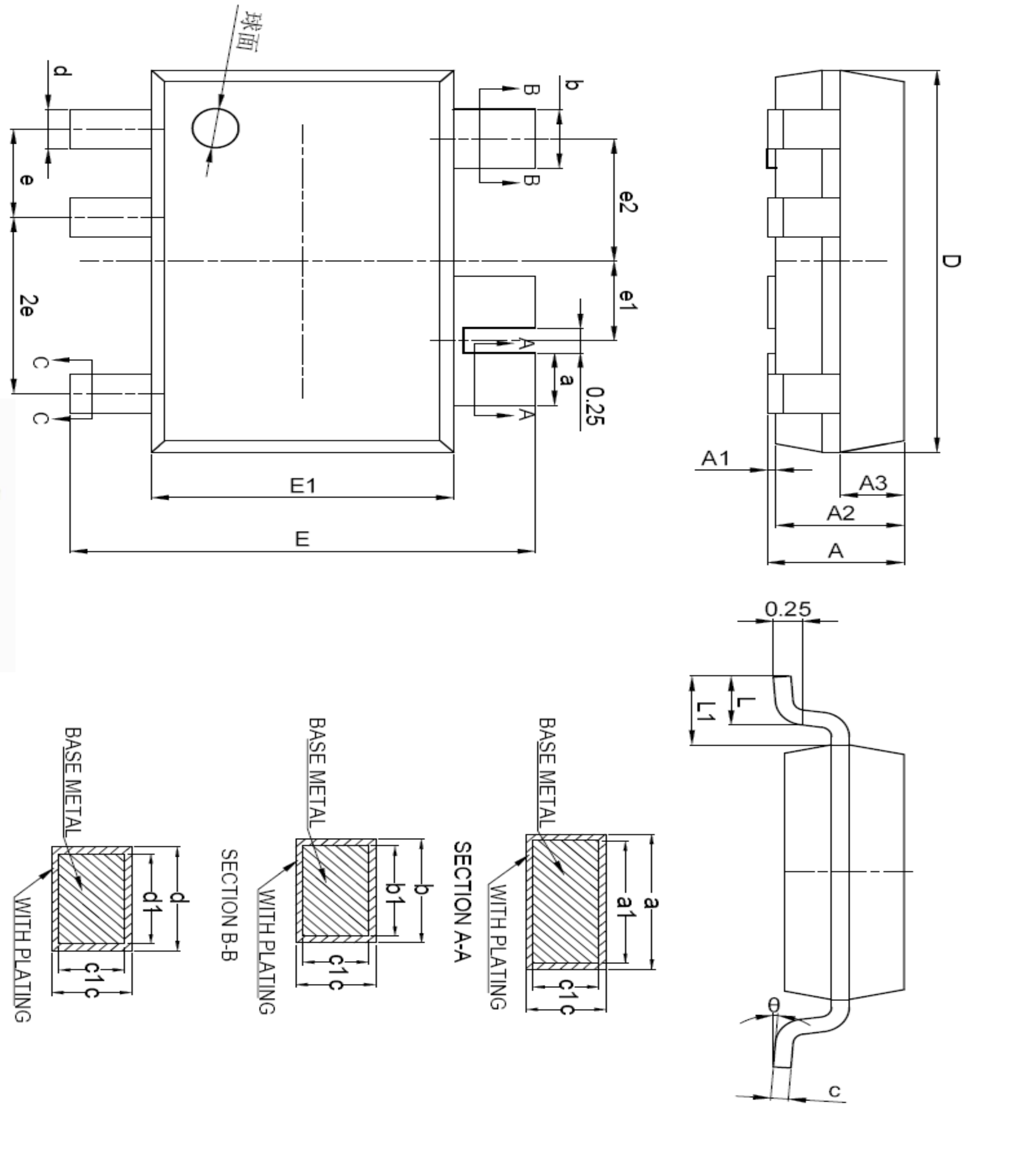
Power loop area

Reduce the area of the power loop, such as the loop between the input bus capacitor, chip DRAIN pin and GND, and the loop between the output capacitor, output inductance, and output rectifier to reduce EMI radiation.

DRAIN pin

Increase the copper area of the DRAIN pin to improve the heat dissipation of the chip. Keep the DRAIN pin away from low-voltage pins and components as much as possible.

Encapsulation



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	—	—	1.30
A1	0.05	—	0.15
A2	1.05	1.10	1.15
A3	0.50	0.55	0.65
a	0.52	—	0.60
a1	0.51	0.54	0.57
b	0.58	—	0.66
b1	0.57	0.60	0.63
c	0.15	—	0.19
c1	0.14	0.15	0.16
d	0.38	—	0.46
d1	0.37	0.40	0.43
D	3.80	3.90	4.00
E1	2.50	2.60	2.70
E	3.80	4.00	4.20
e	0.90BSC		
e1	0.81 BSC		
e2	1.25 BSC		
L	0.40	0.50	0.60
L1	0.70REF.		
θ	0	—	8°