Over Voltage Protection Controller IC

CN36B

General Descriptions:

The CN36B overvoltage protection controller is used with an external P-channel MOSFET to isolate sensitive electronic devices from destructive voltage spikes and surges. It is specially designed to prevent large voltage transients from damaging sensitive circuitry, the voltage transients may be associated with powering up, load dumping, etc.

When potentially damaging voltage levels on input supply are detected by the CN36B, the input supply is disconnected from the load before any damage can occur.

Internal circuitry includes a band-gap reference, oscillator, timer, over-voltage comparator, under-voltage comparator and control logic. CN36B's over-voltage threshold is 6.9V typically, and under-voltage threshold is 3.43V typically. which makes CN36B very suitable for 5V input supply. When the input voltage is above the over-voltage protection threshold, or below the under-voltage threshold, CN36B's GATE pin transitions to logic high to turn off the external P-channel MOSFET.

CN36B is available in 3-pin SOT23 package.

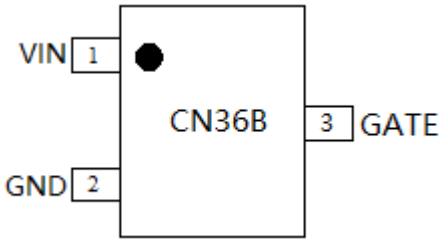
Applications:

- Electrical Appliances
- Portable Devices
- Medical Equipment
- Audio Systems

Features:

- Input Voltage up to 32V
- Over-voltage Protection Threshold: 6.9V
- Under-voltage Threshold: 3.43V
- Operating Current: 68uA@VIN=5V
- External P-channel MOSFET Driven by GATE pin
- Over-voltage Turn-off Time: 1.2uS with 2nF Capacitor between VIN and GATE pin
- GATE pin Logic High: VIN
- GATE pin Logic Low: 0V
- Operating Temperature Range:－40℃ to 85℃
- Available in SOT23-3 Package
- Lead-free, rohs-Compliant and Halogen Free

Pin Assignment:



Typical Application Circuit

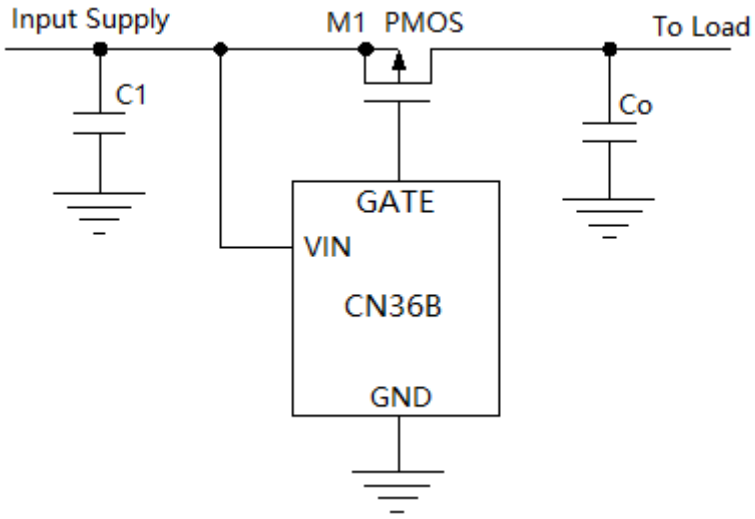


Figure 1 Typical Application Circuit

Ordering Information:

Part No.	Package	Top Marking	Shipping	Operating Temp
CN36B	SOT23-3	36B	Tape &Reel, 3000/Reel	－40℃ to 85℃

Block Diagram

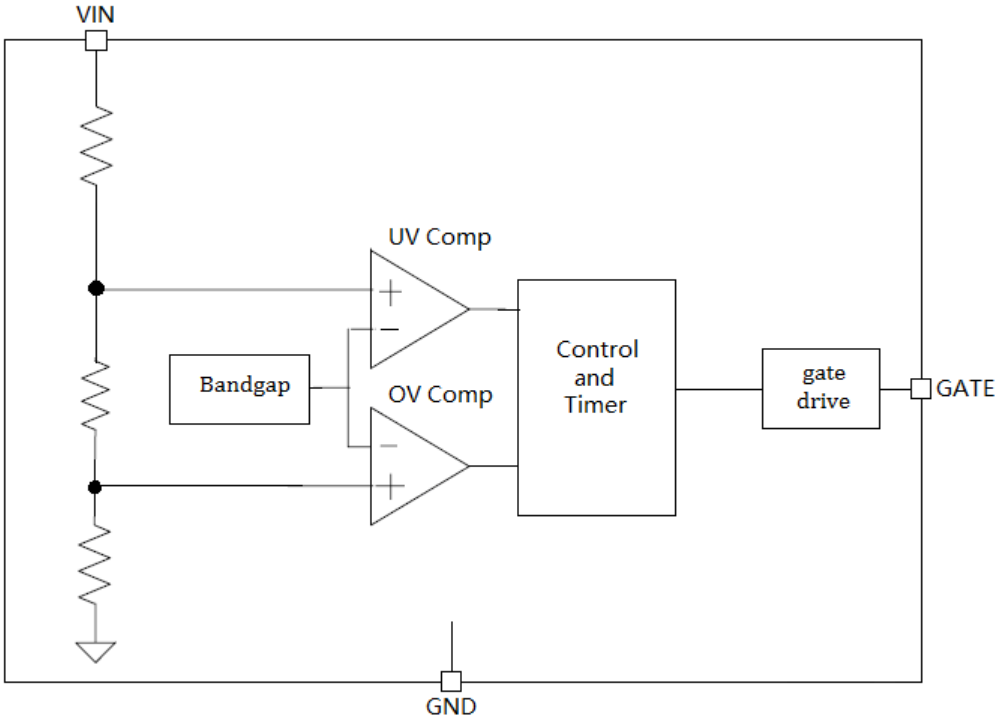


Figure 2 Block Diagram

Pin Description:

No.	Name	Description
1	VIN	**The Positive Terminal of Input Supply.** The power supply of the internal circuitry.
2	GND	**Ground.** The negative terminal of input power supply.
3	GATE	**Gate Drive Output.** Connect this pin to the gate of external P-channel MOSFET. When the voltage at VIN pin is above over-voltage protection threshold or below under-voltage threshold, GATE pin assumes logic high; When the voltage at VIN pin is between over-voltage protection threshold and under-voltage threshold, GATE pin assumes logic low after the deglitch time.

ABSOLUTE MAXIMUM RATINGS

VIN Voltage…….....…－0.3V to 36V
GATE Voltage……..….....…－0.3V to VIN
Storage Temperature…….….....－65℃ to 150℃
Maximum Junction Temperature…..……...150℃
Operating Temperature Range.....－40℃ to 85℃
Lead Temperature(Soldering,10s)……...260℃

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

ELECTRICAL CHARACTERICS：

(VIN =5V, TA＝－40℃ to +85℃, Typical values are at T_A＝+25℃, unless otherwise noted)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Input Voltage Range	VIN				32	V
Operating Current	I_{VIN}		51	68	85	uA
Under-voltage Threshold	V_{UV}	VIN rises	3.36	3.43	3.5	V
Hysteresis of Under-voltage Threshold	H_{UV}		0.1	0.13	0.16	V
Over-voltage Protection Threshold	V_{OVP}	VIN rises	5.83	6.9	6.97	V
Hysteresis of Over-voltage Threshold	H_{OVP}		0.205	0.25	0.295	V
Deglitch Time	$t_{deglitch}$	V_{UV}＜VIN＜V_{OVP}	15	22	29	mS
Gate Drive (GATE Pin)						
GATE Sourcing Current	I_{SRC}	VIN=6.2V, V_{GATE}=3.1V	28	50	72	mA
GATE Sinking Current	I_{SINK}	VIN=5V, V_{GATE}=1V	9.5	13.5	17.5	uA
GATE Output High	V_{GATEH}	VIN＜V_{UV}, or VIN＞V_{OVP}			VIN	V
GATE Output Low	V_{GATEL}	V_{UV}＜VIN＜V_{OVP}	0			V
GATE Turn-off Time	t_{OFF}	VIN steps to 6.2V from 5V, C_{GATE}=2nF			1.2	uS
GATE Pull-up Resistance		Pull up to VIN		312		KΩ

Detailed Descriptions:

The CN36B overvoltage protection controller is used with an external P-channel MOSFET to isolate sensitive electronic devices from destructive voltage spikes and surges. It is specially designed to prevent large voltage transients from damaging sensitive circuitry, the voltage transients may be associated with powering up, load dumping, etc.

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Internal circuitry includes a band-gap reference, oscillator, timer, over-voltage comparator, under-voltage comparator and control logic. CN36B's over-voltage threshold is 6.9V typically, and under-voltage threshold is 3.43V typically, which makes CN36B very suitable for 5V input supply. When the input voltage (VIN) is above the over-voltage protection threshold, or below the under-voltage threshold, CN36B's GATE pin transitions to logic high to turn off the external P-channel MOSFET. Only when VIN voltage is between under-voltage threshold and over-voltage protection threshold (Normal operating window), GATE pin will assume logic low after deglitch time expires. The deglitch time is designed to avoid erroneous operation caused by the noise, disturbance, or power switch contact bounce, etc.

Application Information:

Input Voltage Range

The CN36B is designed to operate from a 5V input supply, its maximum operating voltage is 32V.

Under-voltage Shutdown

When the voltage at VIN pin goes below under-voltage threshold, GATE pin will assume logic high to turn off the external P-channel MOSFET, then the load is isolated from the input supply.

The internally fixed under-voltage threshold (V_{UV}) is 3.43V typical.

Over-voltage Protection

When the voltage at VIN pin goes above over-voltage protection threshold, GATE pin will assume logic high to turn off the external P-channel MOSFET, then the load is isolated from the input supply.

The internally fixed over-voltage protection threshold (V_{OVP}) is 6.9V typical.

Normal Operating Window

Only when the voltage at VIN pin is between under-voltage threshold and over-voltage protection threshold, GATE pin assumes logic low so that the load is connected to the input supply. The above-mentioned voltage range is called normal operating window.

Deglitch Time ($t_{deglitch}$)

After the voltage at VIN pin goes back into normal operating window, the voltage at GATE pin will not begin to go down until the 22ms (Typical) deglitch time expires. The deglitch time is designed to avoid erroneous operation caused by the noise, disturbance, or power switch contact bounce, etc.

Controlling the Load Inrush Current

After the voltage at VIN pin is back into normal operating window, and after the deglitch time expires, GATE pin begins to transition to logic low. The CN36B charges the gate capacitance of the external P-channel MOSFET with a 20uA current sink, the voltage at GATE pin gradually becomes logic low, the external P-channel MOSFET becomes fully turned on from off state gradually, hence the inrush current to the load is under the control of the gradual transition process of GATE voltage.

Operating Profile

The graph in Figure 3 best illustrates the operation of CN36B.

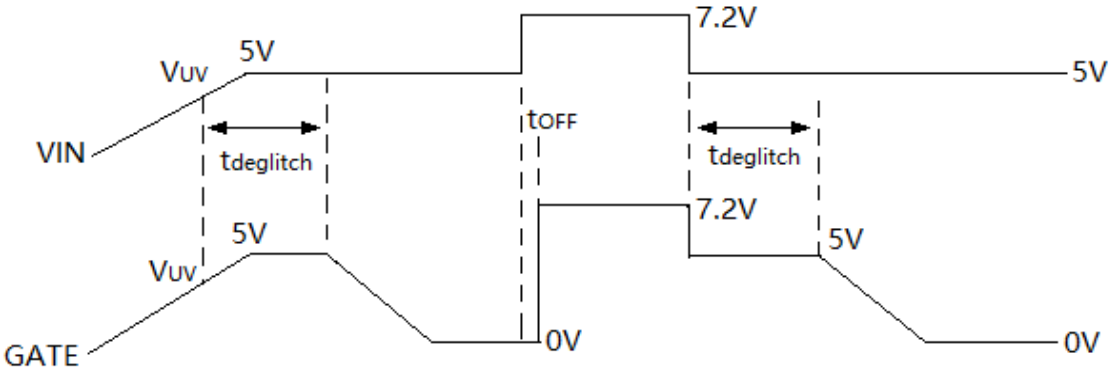


Figure 3 Operating Profile

Input Capacitor (C1 in Figure 1)

C1 in Figure 1 is the bypass capacitor for input power supply, C1 should be determined by input power supply's characteristics, cable length, load transient characteristics, etc..

Output Capacitor (Co in Figure 1)

Co is the load bypass capacitor, when designing the products, Co's selection is determined by the load transient characteristics, cable length, etc..

MOSFET Selection

The CN36B uses an external P-channel MOSFET. The MOSFET must be selected to meet the power dissipation requirements as well as the maximum temperature of the MOSFET.

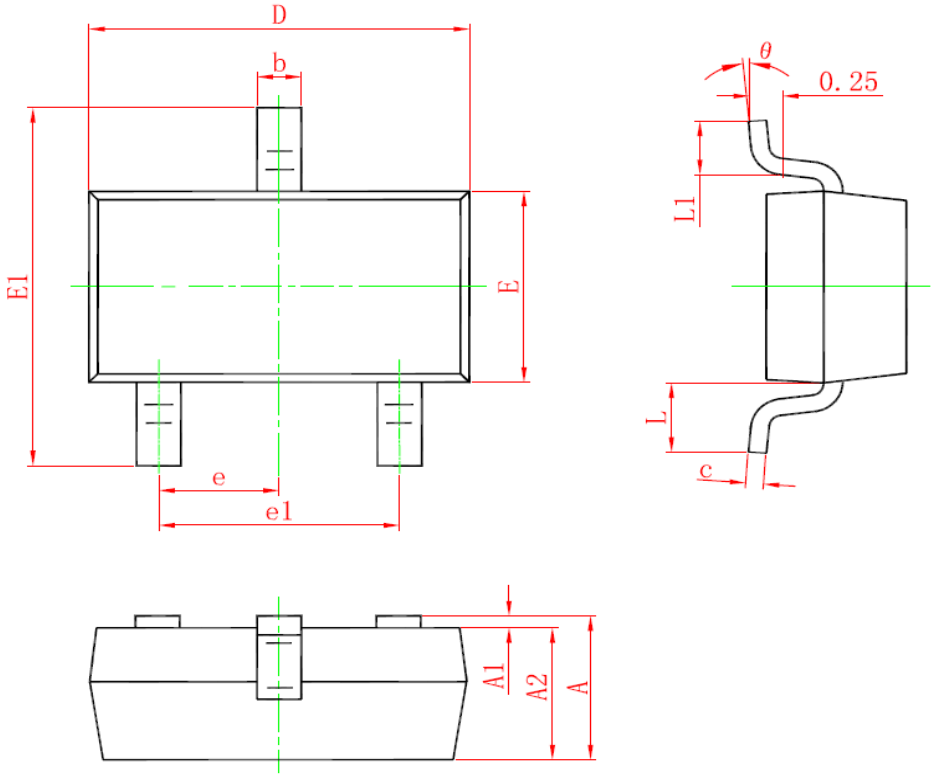
The peak-to-peak gate drive voltage is set internally, this voltage is typically as same as VIN, the maximum value is 7V. Consequently, logic-level threshold MOSFETs must be used. Pay close attention to the BV_{DSS} specification for the MOSFET as well;

Selection criteria for the P-channel MOSFET includes the on-resistance Rdson, total gate charge Qg, reverse transfer capacitance C_{RSS}, input voltage and maximum current.

PCB Design Consideration

Parts placement must be driven by power flow in a point-to-point manner from input to output. Avoid leakage paths from GATE to GND or from GATE to VIN, which might load down the small GATE output current.

Package Information (SOT23-3)



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.900	1.150	0.035	0.045
A1	0.000	0.100	0.000	0.004
A2	0.900	1.050	0.035	0.041
b	0.300	0.500	0.012	0.020
c	0.080	0.150	0.003	0.006
D	2.800	3.000	0.110	0.118
E	1.200	1.400	0.047	0.055
E1	2.250	2.550	0.089	0.100
e	0.950 TYP.		0.037 TYP.	
e1	1.800	2.000	0.071	0.079
L	0.550 REF.		0.022 REF.	
L1	0.300	0.500	0.012	0.020
θ	0°	8°	0°	8°

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