Low Power, Dual-Voltage Detector

CN303

General Description

The CN303 is a two-channel voltage detector with 2 low power high accuracy comparators, and is specially designed for monitoring single or multi lithium-ion (Li+) cells, multi-cell alkaline, NiCd, NiMH and multi-cell lead acid batteries.

The CN303's threshold accuracy is ±2%, and offers 7.5% hysteresis which eliminates the output chatter sometimes associated with battery voltage monitors, usually due to input voltage noise or battery terminal voltage recovery after load removal. The CN303 has 2 inputs that can be configured by the external resistor divider. When the voltage at IN1(IN2) rises above the rising threshold, OUT1(OUT2) goes high; When the voltage at IN1(IN2) falls below the falling threshold, OUT1(OUT2) is driven to low.

The device has a low quiescent current of 11uA typical, and offers CMOS outputs.

The device is available in 6 pin SOT23 package.

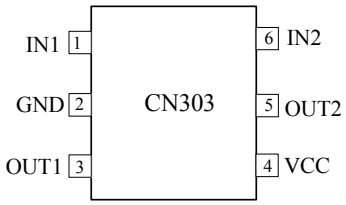
Applications

- Battery-powered Systems
- Multi-cell Batteries Monitoring
- Set-Top Boxes
- DSPs, Microcontrollers Applications
- Cell Phones and PDAs

Features

- Two low power high accuracy comparators
- Precise Threshold: ±2%
- 7.5% Hysteresis to Eliminate the Output Chatter
- CMOS Outputs Can Drive LED or MCU Interface
- 11μA Supply Current @VCC=3.7V
- Power Supply Transient Immunity
- Operating Temperature Range
  -40°C to +85°C
- Available in SOT23-6
- Lead-free, Rohs-compliant and Halogen-free

Pin Assignment



Typical Application Circuit

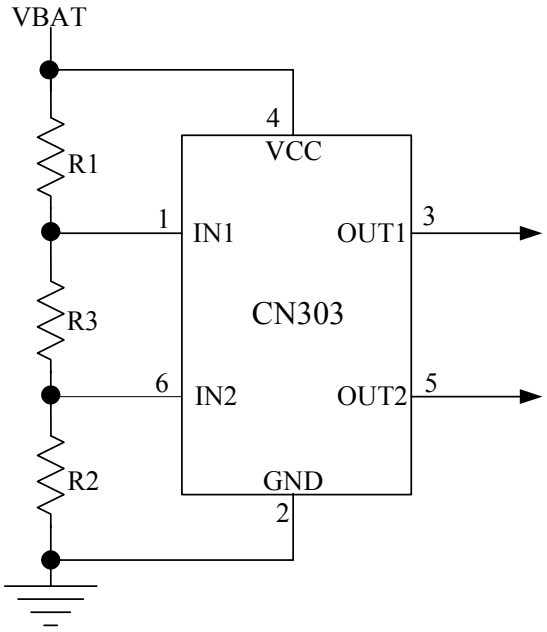


Figure 1　Monitoring Two Voltage Levels

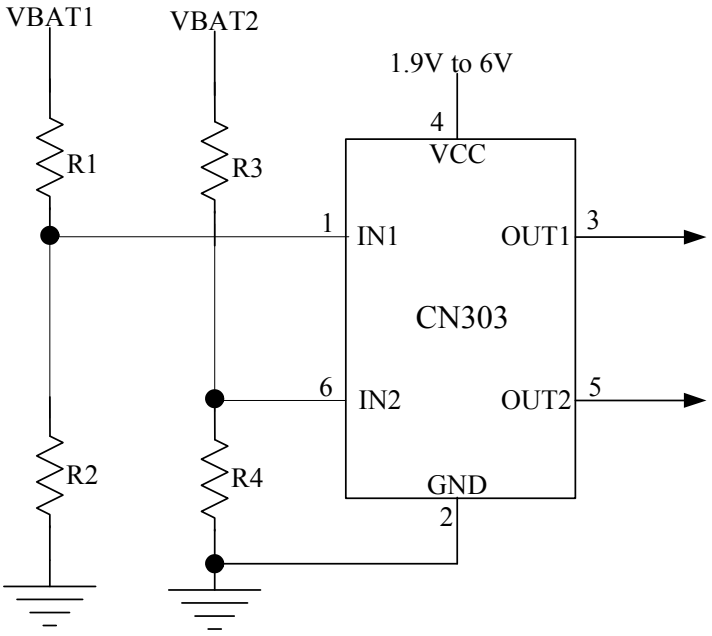


Figure 2　Monitoring Two Independent Voltages

Ordering Information：

Part No.	Package	Shipping	Operating Temperature Range
CN303	SOT23-6	Tape and Reel, 3000/Reel	－40℃ to 85℃

Block Diagram

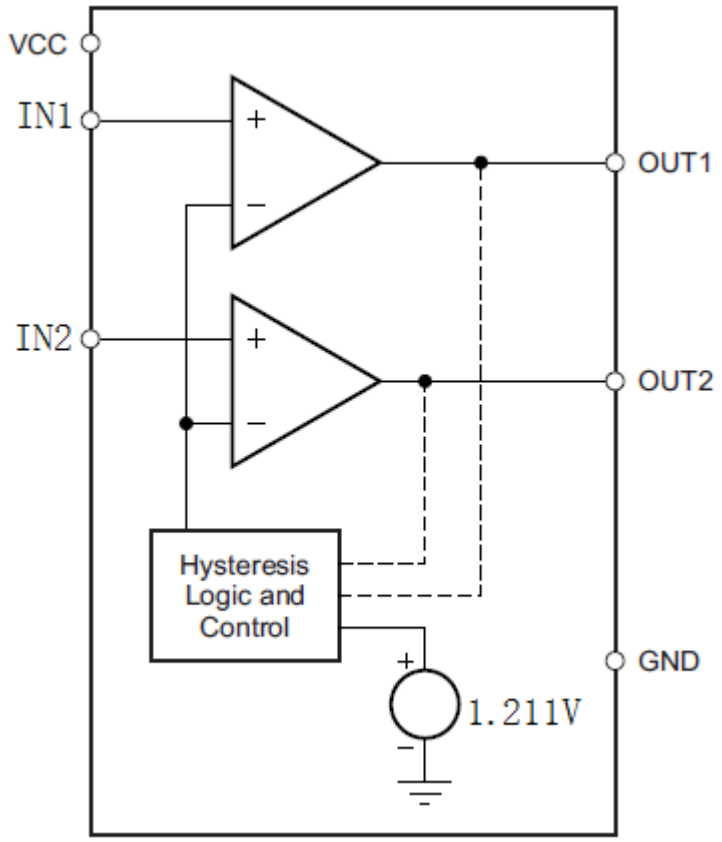


Figure 3 Block Diagram

Pin Description

Pin No.	Symbol	Description
1	IN1	**Voltage Detect Input 1.** Generally IN1 pin should be tied to an external resistor divider to sense the voltage being monitored.
2	GND	Negative Terminal of Power Supply(Ground)
3	OUT1	**Voltage Detect Output 1.** CMOS output. When the voltage at IN1 pin rises above the internal reference voltage, OUT1 becomes high; When the voltage at IN1 pin falls below the internal reference voltage by 7.5%(typical), OUT1 becomes low.
4	VCC	**Positive Terminal of Power Supply.** This pin is the power supply to internal circuit.
5	OUT2	**Voltage Detect Output 2.** CMOS output. When the voltage at IN2 pin rises above the internal reference voltage, OUT2 becomes high; When the voltage at IN2 pin falls below the internal reference voltage by 7.5%(typical), OUT2 becomes low.
6	IN2	**Voltage Detect Input 2.** Generally IN2 pin should be tied to an external resistor divider to sense the voltage being monitored.

ABSOLUTE MAXIMUM RATINGS

Terminal Voltage (With respect to GND)
VCC,IN1,IN2.....….....-0.3V to +6.5V
OUT1,OUT2……..…....-0.3V to VCC
Input/Output Current
All Pins…….....20mA

Thermal Resistance……..300°C/W
Operating Temperature…….……...-40 to +85°C
Storage Temperature.....…….....-65 to +150°C
Lead Temperature (soldering, 10s) .....+260°C

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 Characteristics

(VCC=3V, T_A= －40℃ to 85℃, Typical values are at T_A=25℃, unless otherwise noted.)

Parameters	Symbol	Test Conditions	Min	Typ	Max	Unit
Operating Voltage Range	VCC		1.9		6	V
Operating Current	I_{VCC}	VCC = 1.9V	5	10	15	uA
		VCC = 3.0V	6	11	16	
		VCC = 5.0V	7	12	17	
IN1 Rising Threshold	V_{RTH1}	IN1 voltage rises	1.187	1.211	1.235	V
IN1 Falling Threshold	V_{FTH1}	IN1 voltage falls	1.09	1.12	1.15	
IN2 Rising Threshold	V_{RTH2}	IN2 voltage rises	1.187	1.211	1.235	
IN2 Falling Threshold	V_{FTH2}	IN2 voltage falls	1.09	1.12	1.15	
IN1 Leakage Current	I_{IN1}		－100	0	100	nA
IN2 Leakage Current	I_{IN2}		－100	0	100	nA
IN1 to OUT1 Delay	t_{PD1}	30mV Overdrive		15		us
IN2 to OUT2 Delay	t_{PD2}	30mV Overdrive		15		us
OUT1 and OUT2 Low Voltage	V_{OL}	VCC = 2V, I_{SINK} = 1.5mA			0.3	V
		VCC = 3V, I_{SINK} = 3.2mA			0.3	
		VCC = 5V, I_{SINK}=6mA			0.3	
OUT1 and OUT2 High Voltage	V_{OH}	VCC = 2V, I_{SOURCE}=1.5mA	VCC－0.4			V
		VCC = 3V, I_{SOURCE} = 3mA	VCC－0.4			
		VCC = 5V, V_{LBI} = 1.5V I_{SOURCE} = 5mA	VCC－0.4			
Startup Delay			2.5			ms

Note: During power-up, VCC must exceed 1.9V for the startup delay time before the output is in the correct state.

Detailed Description

The CN303 is a two-channel voltage detector with 2 low power high accuracy comparators, the device consists of 2 comparators, bandgap reference and hysteresis control circuit etc.

If the voltage at IN1(IN2) pin rises above the rising threshold V_{RTH}, OUT1(OUT2) will become high after a short delay(15us typical); If the voltage at IN1(IN2) pin falls below the falling threshold V_{FTH}, OUT1(OUT2) will become low after a delay of 15us typical. The difference between rising threshold and falling threshold is also called hysteresis, which can provide noise immunity and remove the possibility of output chatter due to battery terminal voltage recovery after the load removal. The CN303 offers fixed hysteresis of 7.5%.

The CN303 monitors 2 voltage levels or 2 independent voltages, it is specially designed for monitoring single or multi cell lithium, alkaline, NiCd, NiMH and multi-cell lead acid batteries. The common application of the CN303 is to use one output as the early warning signal and the other as a dead-battery indicator.

The operation of the device can be best understood by referring to Figure 4.

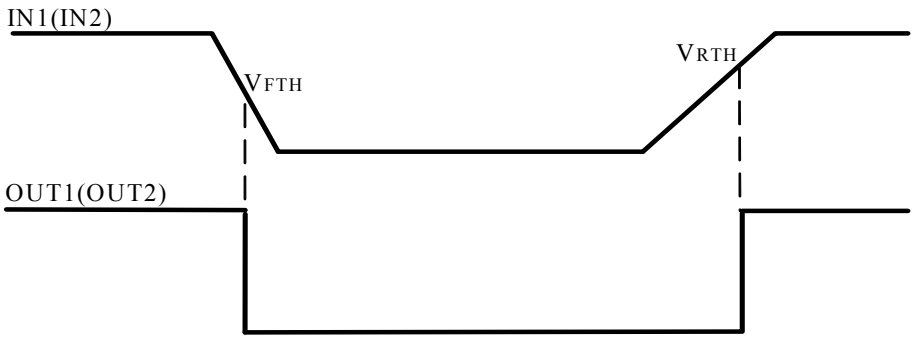


Figure 4 Timing waveform

Applications Information

Resistor Value Selection

Choosing the proper external resistors is a balance between accuracy and current consumption. There is a leakage current into IN1(IN2), and the current travels through the resistor divider, which introduces error. If extremely high resistor value are used, this current introduces significant error. With extremely low resistor value, this error becomes negligible, but the resistor divider draws more current from the power supply.

Adding External Capacitance to Enhance Noise Immunity

If monitoring voltages in a noisy environment, add a bypass capacitor of 0.1μF from battery terminal to GND as close as possible to the device. For systems with large transients, additional capacitance may be required. A small capacitor (<1nF) from IN1 and IN2 pin to GND may provide additional noise immunity.

Negative-Going IN1(IN2) Transients

In addition to issuing a low output at OUT1(OUT2) pin during power-up, power-down and brownout conditions of the monitored voltage, the CN303 is relatively immune to short-duration negative-going IN1(IN2) transients (glitches). As the magnitude of the transient increases (goes farther below the falling threshold), the maximum allowable pulse width decreases. Typically, a IN1(IN2) transient that goes 20mV

below the falling threshold and lasts 5μs or less will not cause a low OUT1(OUT2) output. A bypass capacitor from IN1(IN2) pin to GND provides additional transient immunity.

Choose the Power Supply for CN303

If the monitored voltage is less than 6V, or there is a power supply from 1.9V to 6V in the system, then CN303 can be powered by one of the 2 power supplies. If there is glitch, ripple, etc at the power supply, a low-pass RC filter may be used as shown in Figure 5.

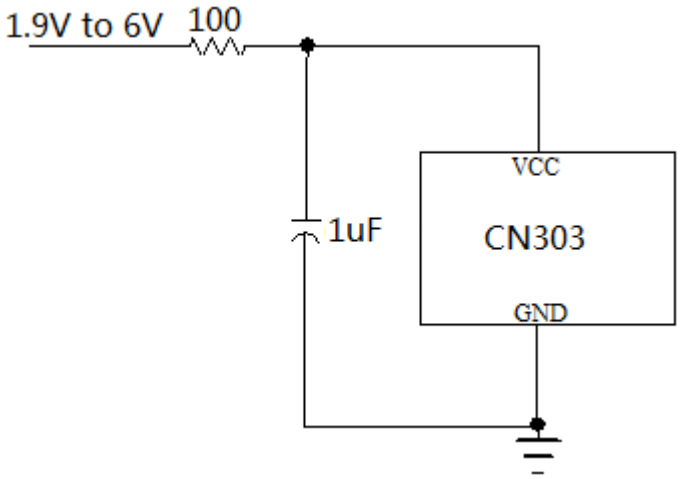


Figure 5 An RC Filter For CN303

If the monitored voltage is higher than 6V, and there is not a power supply from 1.9V to 6V, the circuit in Figure 6 can be used to generate the power supply for CN303. In Figure 6, resistor R4 and R5 are used to generate a voltage between 2.7V to 6V. R4 and R5 should be chosen in such a way that R4 and R5 can not load the battery too much. A 1uF capacitor can be chosen for C1.

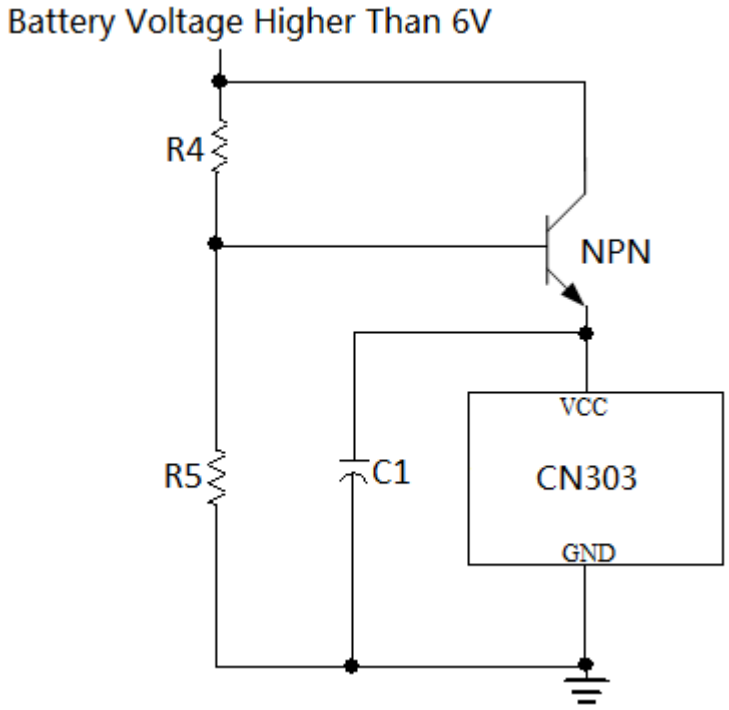


Figure 6 Power CN303 from a Resistor Divider

Use two CN303 for 4-Channel Monitoring Outputs

4-channel monitoring outputs can be obtained by using two CN303, as shown in Figure 7.

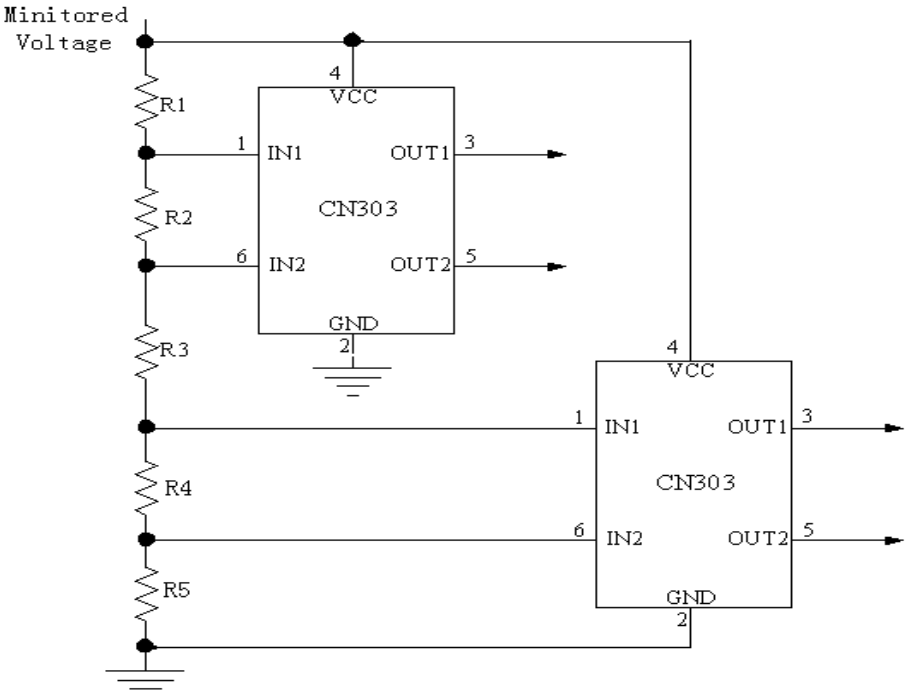
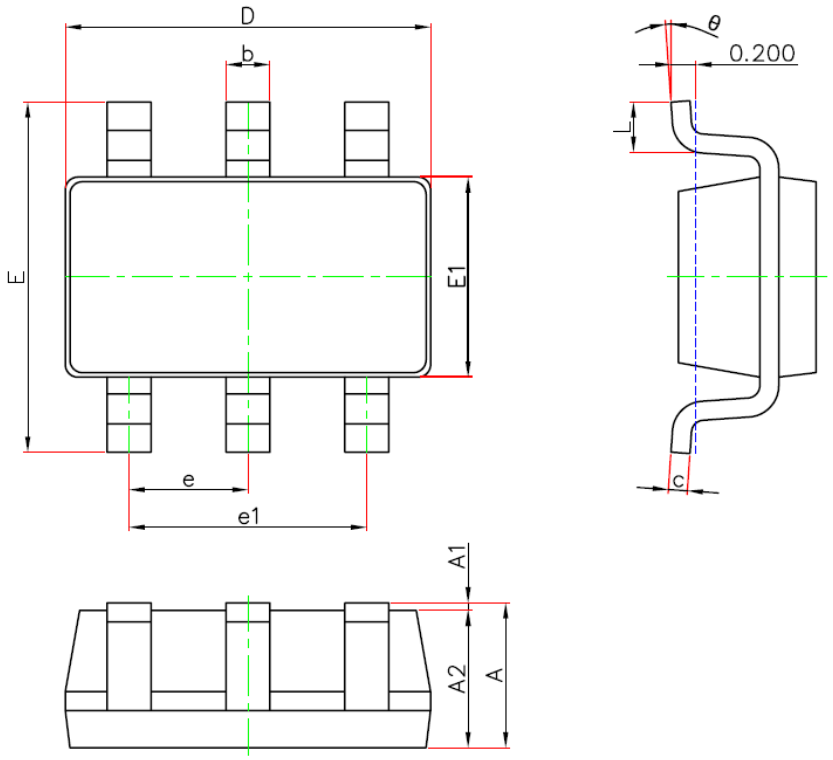


Figure 7 Obtain 4-Channel Monitoring Outputs

Package Information

SOT-23-6L(12R) 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
E1	1.500	1.700	0.059	0.067
E	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°