CONSONANCE

Under-voltage, Current Sense Comparator IC

CN200

General Descriptions：

CN200 is an integrated circuit with the functions of under voltage protection and overcurrent protection or current sense, it is formed by reference voltage, an under voltage comparator, a current sense comparator and a timer. CN200 consumes little current and is easy to use, it is ideally suitable for the applications of overcurrent protection, current sense or battery discharge management.

CN200 enters under-voltage state if the VCC voltage is below under-voltage threshold for 100ms or above, in which OD pin becomes high, and $\overline{OD}$ pin becomes low. CN200 will not recover from under-voltage state until VCC becomes higher than under voltage threshold by 0.21V for 100ms or above. Once CN200 recovers from under voltage state, OD pin outputs low and $\overline{OD}$ pin outputs high.

If the voltage drop between current sense positive terminal CSP and negative terminal CSN is larger than overcurrent threshold (38mV Typ.) for 9ms or above, CN200 enters overcurrent state, in which OD pin outputs high, and $\overline{OD}$ pin outputs low.

Both under voltage state and overcurrent state are referred to as over discharge state.

CN200 is available in 6 pin SOT-23 package.

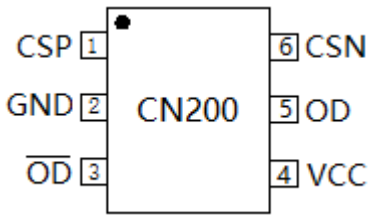
Features：

- Low Current Consumption: 4uA
- Internally Fixed Under-voltage Threshold
- Valid Output with VCC down to 1.1V
- Under-voltage Threshold: 1.808V (VCC falls)
- Under-voltage Threshold Accuracy: ±1%
- Deglitch Time of Under Voltage Detection: 100ms
- Overcurrent Threshold: 38mV
- Input Common Mode Voltage of overcurrent detection: 0V to VCC
- Deglitch Time of Overcurrent Detection: 9ms
- Active-high and Active-low Outputs
- Available in SOT-23-6 Package
- Operating Temperature Range －40°C to +85°C
- Lead-free, Rohs-compliant and Halogen-free

Applications：

- Over-current Protection
- Current Sense Comparator
- Battery Discharge Management for 2-cell NIMH batteries
- Battery Discharge Management For single-cell Lithium Titanate Battery

Pin Assignment:



Typical Application Circuit:

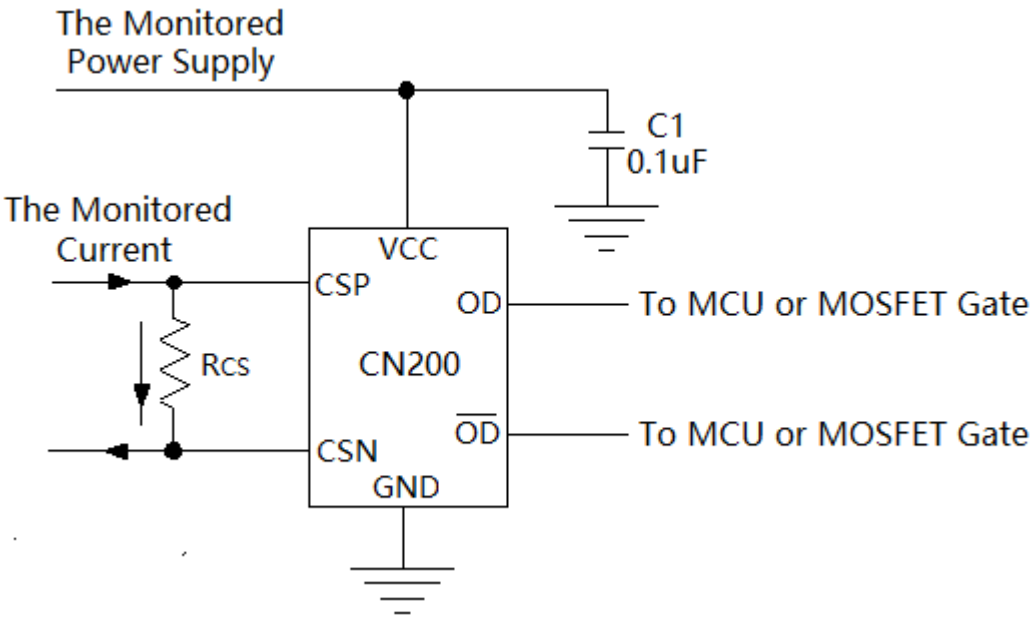


Figure 1 Typical Application Circuit

Ordering Information：

Part No.	Package Type	Top Marking	Shipment
CN200	SOT-23-6	200	Tape and Reel, 3Kpcs/Reel

Block Diagram:

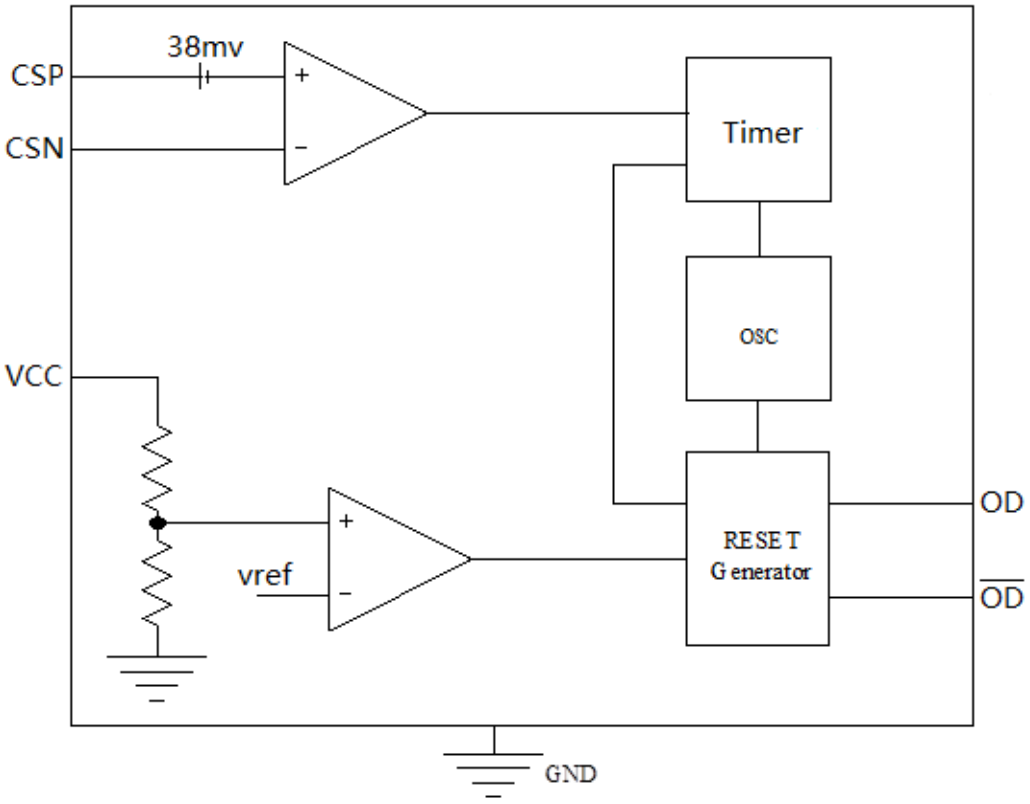


Figure 2 Block Diagram

Pin Descriptions:

No.	Symbol	Descriptions
1	CSP	**Positive Input of Current Sense.** CSP pin should be connected to the positive terminal of external current sense resistor.
2	GND	**Negative Terminal of Power Supply.** CN200's grounding terminal (GND).
3	$\overline{OD}$	**Active-low Output of Over Discharge.** CMOS output. When the voltage at VCC pin falls below under-voltage threshold for over 100ms or the voltage drop between CSP pin and CSN pin is above overcurrent threshold for over 9ms, CN200 enters over discharge state, $\overline{OD}$ outputs low. In the other state, $\overline{OD}$ outputs high.
4	VCC	**Positive Terminal of Power Supply.** CN200 is powered through VCC pin. The VCC voltage is monitored and compared with under-voltage threshold.
5	OD	**Active-high Output of Over Discharge.** CMOS output. When the voltage at VCC pin falls below under-voltage threshold for over 100ms or the voltage drop between CSP pin and CSN pin is above overcurrent threshold for over 9ms, CN200 enters over discharge state, OD outputs high. In the other state, OD outputs low.
6	CSN	**Negative Input of Current Sense.** CSN pin should be connected to the negative terminal of external current sense resistor.

Absolute Maximum Ratings：

Terminal Voltage(With respect to GND)：
VCC……-0.3V to 6.5V
Other Inputs ……..……..-0.3V to VCC
Terminal Current
VCC…….20mA
All I/O Pins……...…..20mA

Thermal Resistance……..……220℃/W
Storage Temperature…….....－65℃ to 150℃
Maximum Junction Temperature…….....150℃
Operating Temperature……..－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 Parameters

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

Parameters	Symbol	Test Conditions	Min	Typ	Max	Unit
Operating Voltage Range	VCC		1.1		6.5	V
Operating Current	I_{VCC}	Measure VCC current	2.8	4	5.2	uA
Under Voltage Threshold	V_{UV}	VCC voltage falls	1.79	1.808	1.826	V
Hysteresis of Under Voltage Threshold	H_{UV}			0.21		V
Deglitch Time for Under Voltage Detection	t_{UV}		60	100	140	ms
$\overline{OD}$ and OD Output Voltage	V_{OH}	I_{SOURCE}=1mA	VCC－1			V
		I_{SOURCE}=8uA,VCC=1.1V	1.0			
	V_{OL}	I_{SINK}=3.2mA			0.3	V
		I_{SINK}=150uA,VCC=1.1V			0.3	
Current Sense Comparator						
CSP Bias Current	I_{CSP}		-50		+50	nA
CSN Bias Current	I_{CSN}		-50		+50	nA
Input Common Mode Voltage	V_{CM}		0		VCC	V
Overcurrent Threshold	V_{OC}	Measure（V_{CSP}－V_{CSN}）	28	38	48	mV
Deglitch Time for Current Sensing	t_{OC}		6.5	9	11.7	ms

Detailed Descriptions：

CN200 is an integrated circuit with the functions of under voltage protection and overcurrent protection or current sense, it is formed by reference voltage, an under voltage comparator, a current sense comparator and a timer. CN200 consumes little current and is easy to be used, it is ideally suitable for the applications of overcurrent protection, current sense or battery discharge management.

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If the voltage drop between current sense positive terminal CSP and negative terminal CSN is larger than overcurrent threshold (38mV Typ.) for 9ms or above, CN200 enters overcurrent state, OD pin outputs high, and $\overline{OD}$ pin outputs low. CN200 will recover from overcurrent state once the voltage drop between CSP pin and CSN pin falls below overcurrent threshold for 9ms or above. Once the CN200 recovers from overcurrent state, OD pin outputs low and $\overline{OD}$ pin outputs high.

Both under voltage state and overcurrent state are referred to as over discharge state.

In normal state, if VCC voltage being lower than under-voltage threshold and (V_{CSP} – V_{CSN}) being larger than overcurrent threshold occurs simultaneously, the overcurrent detection has the higher priority, namely, once (V_{CSP} – V_{CSN}) becomes larger than overcurrent threshold, the on-chip timer is cleared and start a new timing of typical 9ms regardless of whether the under-voltage timing is ongoing, When the timer runs out, over discharge state is asserted, OD outputs high, and $\overline{OD}$ outputs low.

Over Discharge Outputs OD and $\overline{OD}$

Over discharge outputs OD and $\overline{OD}$ are CMOS outputs, Which can be directly connected to MCU input ports, or shut-down input of downstream circuit block, or can be used to control the external N-channel MOSFET or P-channel MOSFET.

OD and $\overline{OD}$ outputs can stay in valid until VCC is down to 1.1V.

Application Information

CN200 Used For Battery Discharge Management

CN200 can be used to manage the discharge of 2-cell NIMH batteries and single-cell Lithium-Titanate battery. Once under-voltage or overcurrent conditions are detected, CN200 enters over discharge state, OD outputs high, and $\overline{OD}$ outputs low, which can be used to control MOSFET to break off the discharge path.

Figure 3 is the application circuit to monitor battery discharge current by high-side current sensing, while Figure 4 is the application circuit by low-side current sensing.

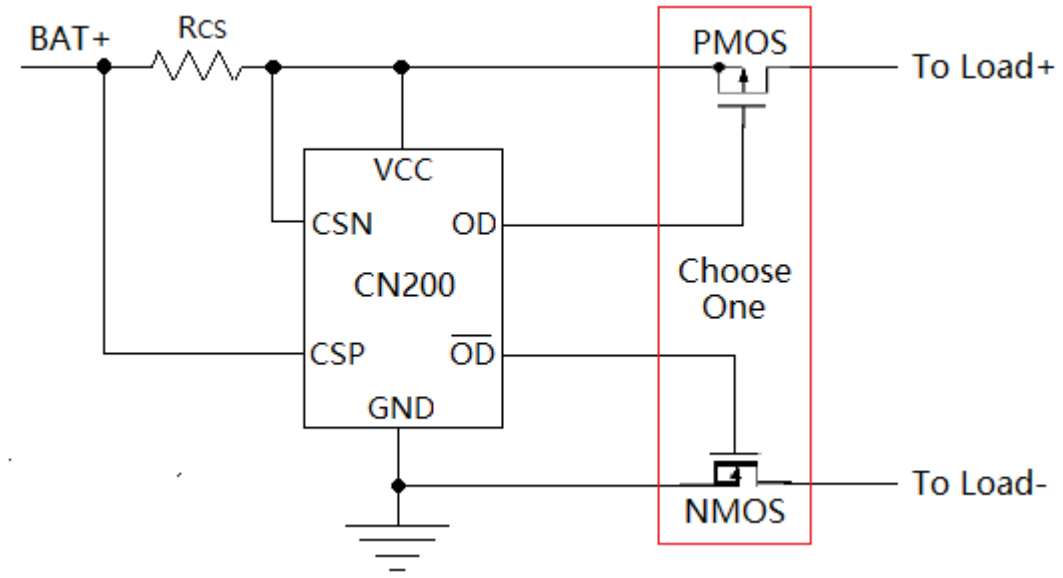


Figure 3 Battery Discharge Management(High-side Current Sensing)

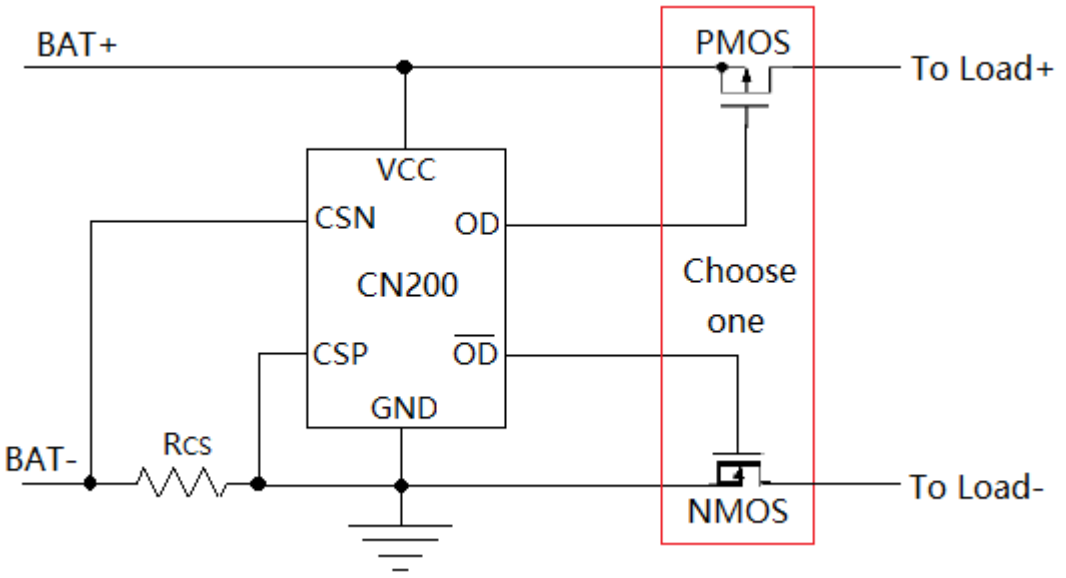


Figure 4 Battery Discharge Management(Low-side Current Sensing)

Input Bypass Capacitor

As shown in Figure 1, a bypass capacitor from VCC to GND is a help for CN200 to function properly, especially when there is noise or glitch at VCC pin. Depending on the input supply's characteristics and cable length, a ceramic capacitor between 0.1uF and 1uF can meet the requirement.

Filtering out the noise for the Monitored Voltage

If there is significant noise, glitch or ripple at the monitored voltage at VCC pin, a low-pass RC filter may be used as shown in Figure 5.

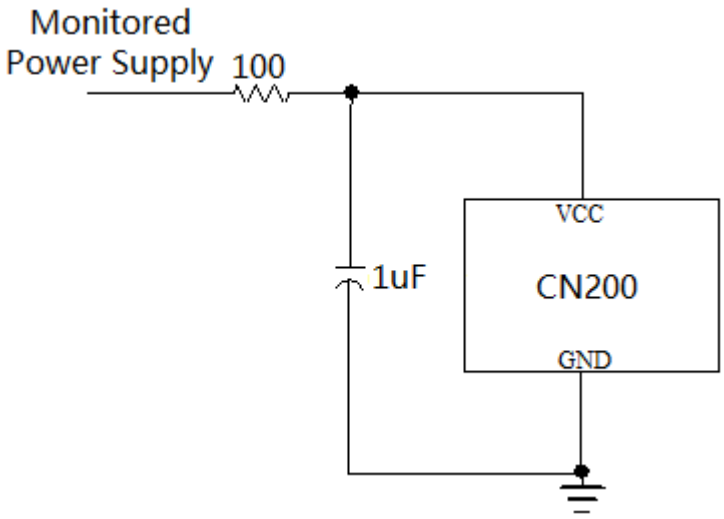


Figure 5 An RC Filter For Monitored Power Supply

Ensuring Valid Over Discharge Outputs Down to VCC=0V

When VCC falls below 1.1V, the CN200 $\overline{OD}$ and OD outputs no longer sinks or sources current, it becomes an open circuit, hence the 2 outputs are at undetermined voltage. If a pull-down resistor is added from $\overline{OD}$ pin to GND and a pull-up resistor is added from OD pin to VCC as shown in Figure 6, then $\overline{OD}$ and OD outputs will be held at active state. The resistor's value is not critical. it should be around several hundred kilo-ohm., large enough not to load OD and $\overline{OD}$, small enough to pull the outputs to active level.

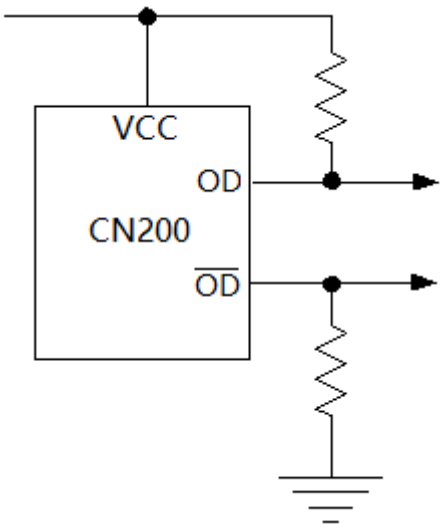
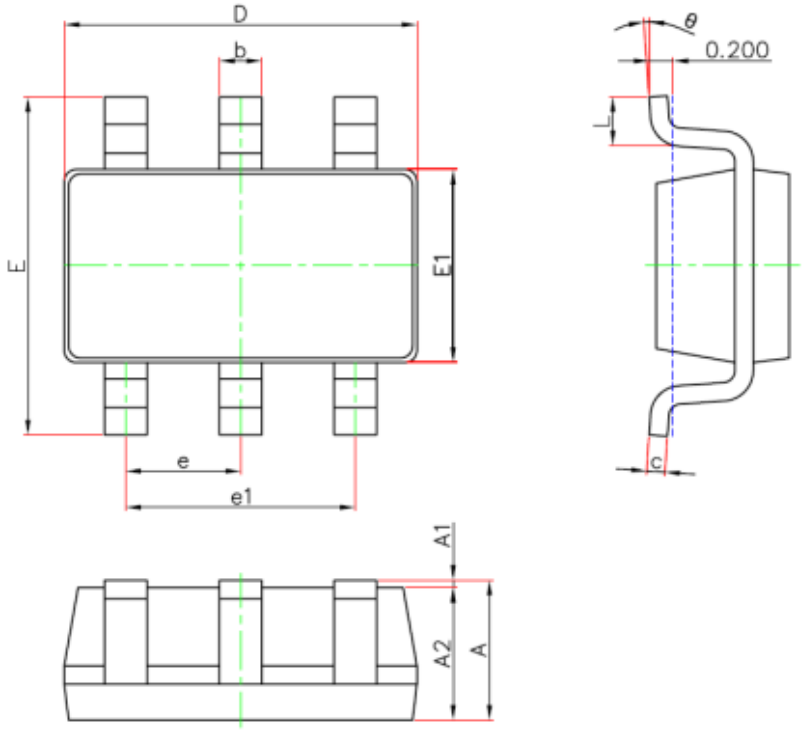


Figure 6 To Ensure Valid Outputs Down to VCC=0V

Package Information

SOT-23-6L 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°