Adjustable Current Switch Device

Features:

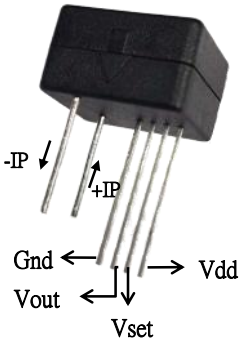
- Current switch, current measurement and on-site calibration
- Response time 10us
- High resolution ±3mA
- Wide sensing current range 0~2.0 A
- Output "High" when $V_{IP} > V_{set}$
- Output "Low" when $V_{IP} < V_{set}$
- Wide operating voltage range 3.0~12 V
- Nearly zero magnetic hysteresis
- 10K Hz Bandwidth
- Isolation voltage 1000V
- 98 mΩ internal conductor resistance
- "Output voltage" is 1/2 supply voltage at zero current

Functional Description :

The Winson WCS2302 is a current switch designed for current switching and current measuring. The current switching can be adjusted through providing reference voltage to the V_{set} Pin. The output voltage (V_{out}) turns to high voltage level when the internal voltage (V_{IP}) is greater than the reference voltage (V_{set}). In contrast, the output turns to the low level. For the current measuring, it provides a precise solution for both DC and AC current sensing in industrial, and users can also adjust the reference voltage value of current switch mode on-site by measuring current mode.

The WCS2302 consists of a precise, low-temperature drift linear hall sensor IC with temperature compensation circuit and a current path with 98 mΩ typical internal conductor resistance. Applied current flowing through this conduction path generates a magnetic field which is sensed by the integrated Hall IC and converted into a proportional voltage.

The terminals of the conductive path are electrically isolated from the sensor leads. This allow the WCS2302 current sensor to be used in applications requiring electrical isolation without the use of opto-isolators or other costly isolation techniques and make system more competitive in cost.



Absolute Maximum Range

Supply Voltage, Vdd ---------- **14V**

Pass Current, IP ---------- **2.5A**

Pass Current (10ms pulse), Ipulse ---------- **5A**

Output Current Sink---------- **50uA**

Output Current Source---------- **1.5mA**

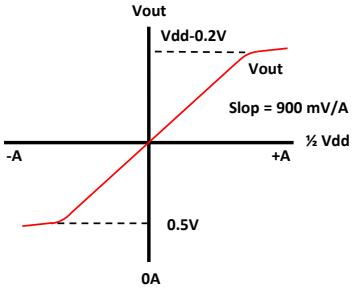
Basic Isolation Voltage ---------- **1000V**

Operating Temperature Range, Ta ----------
---------- **-20ºC to +125ºC**

Storage Temperature Range, Ts ----------
---------- **-65ºC to +150ºC**

Power Dissipation, Pd ----------**1W**

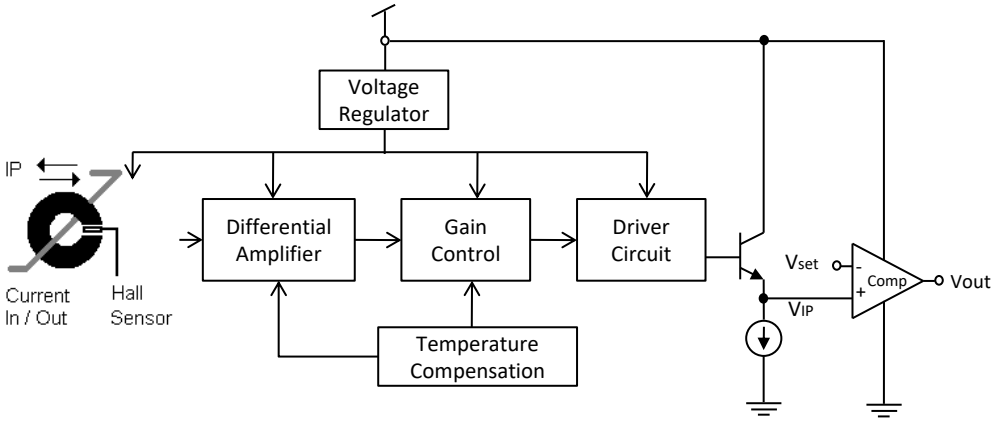
Vout VS. Primary Current



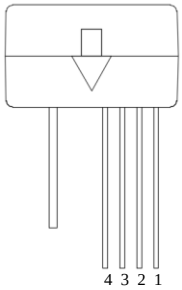
(Vdd = 5V)

Function	Current Range	Resolution	Sensitivity
Switch	DC:±0~2.0A	±3.0 mA	
Linear	DC:±0~2.0A		900 mV/A
	AC:rms 1.5A		

Function Block:



Functional Block Diagram



Number	Name	Description
1	Vdd	Power supply terminal
2	Vset	Setup input terminal
3	Vout	Analog output signal
4	GND	Signal ground terminal

Winson reserves the right to make changes to improve reliability or manufacturability.

Electrical Characteristics: (T=+25˚C, V_{dd}=5.0V)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Units
Supply Voltage	Vdd	—	3.0	—	12	V
Supply Current	Isupply	IP =0 A	—	3.0	6.0	mA

Switching Characteristics: (T=+25˚C, V_{dd}=5.0V)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Units
Output Voltage	V_H	Full Range	Vdd-0.2	—	—	V
	V_L		—	—	0.1	
Resolution	$IP_{Resolution}$	—	—	±3	—	mA
Adjustable Current Range	PR	DC Mode	—	±2	—	A
Response Time (low to high level)	T_{RP}	With 0.25A overdrive C_{Load} = 15pF (1) (2) (3)	—	13	—	us
		With 0.25A overdrive C_{Load} = 0.01uF (1) (2) (3)	—	30	—	
Response Time (high to low level)		With 0.25A overdrive C_{Load} = 15pF (1) (2) (3)	—	10	—	us
		With 0.25A overdrive C_{Load} = 0.01uF (1) (2) (3)	—	140	—	
Rising Time	T_{RISE}	With 0.25A overdrive C_{Load} = 15pF (1) (2) (3)	—	0.4	—	us
Fall Time	T_{FALL}	With 0.25A overdrive C_{Load} = 15pF (1) (2) (3)	—	0.6	—	us

1. C_{Load} includes probe and jig capacitance.
2. The response time is specified for a 0.5A(450mV) input step with 0.25A(225mV) overdrive.
3. Response time can refer to “characteristic Diagrams”.

Linear Characteristics: (T=+25˚C, V_{dd}=5.0V, V_{set} pin and V_{out} pin short)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Units
Zero Current Vout	VIP	IP =0 A	2.35	2.5	2.65	V
Sensitivity	Sens	IP= +-1 A	765	900	1035	mV/A
Bandwidth	BW	—	—	10	—	kHz
Measurable Current Range	MR	Vdd=5V (DC Mode)	—	±2.0	—	A
		Vdd=5V (AC RMS)	—	1.5	—	
Temperature Drift	△Vout	Ip =0 A	—	±0.5	—	mV/℃
Output Noise	$V_{Np-p(0.01F)}$	IP =0 A, C_{Load} = 0.01uF	—	12	—	mV
	$V_{Np-p(0.1uF)}$	IP =0 A, C_{Load} = 0.1uF	—	7.0	—	

1. All output-voltage measurements are made with a voltmeter having an input impedance which is at least 100kΩ
2. Connect ‘capacitive load’ (0.01uF) in parallel at output pin.
   Do not apply any ‘resistor load’ on output pin, it will degrade IC’s performance.

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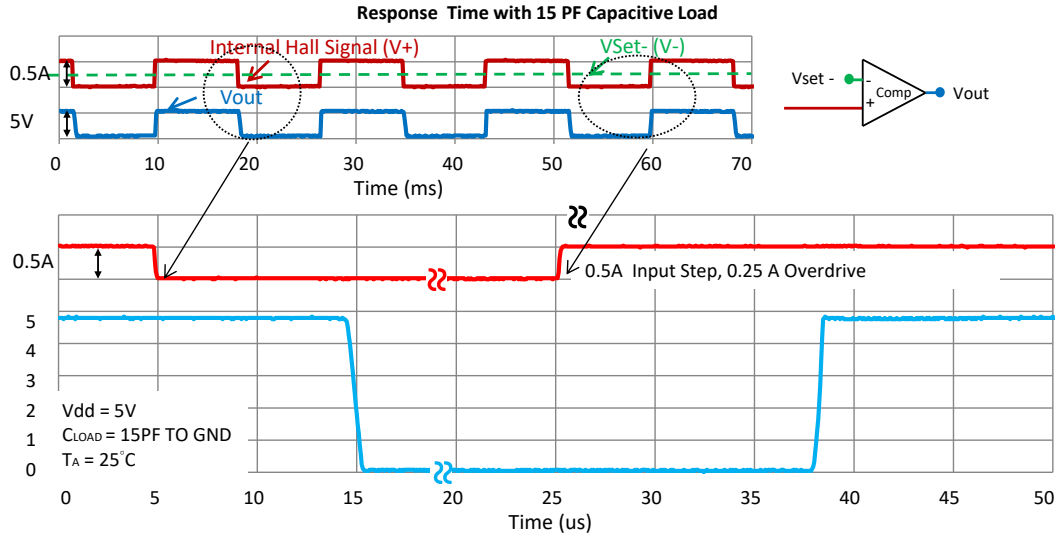
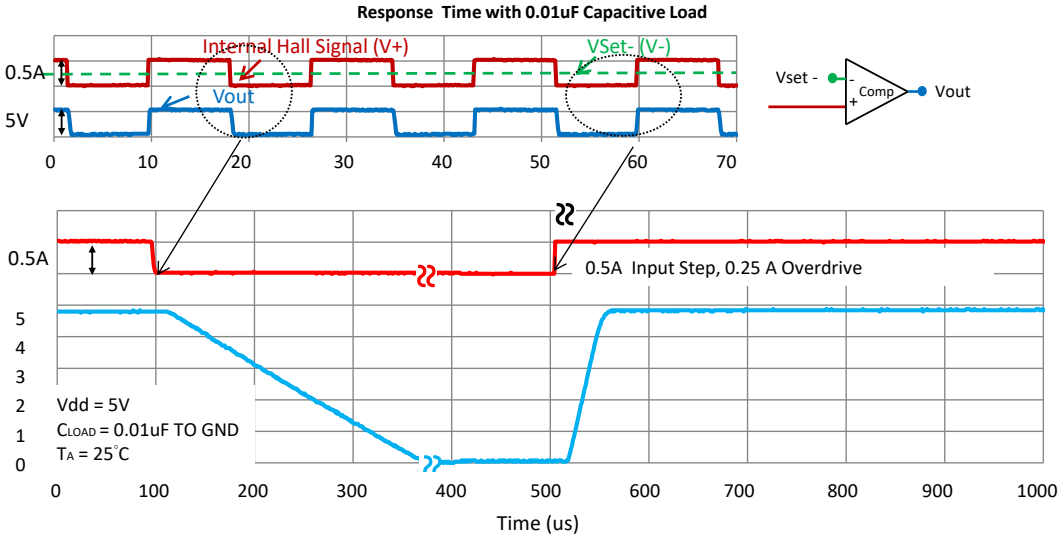
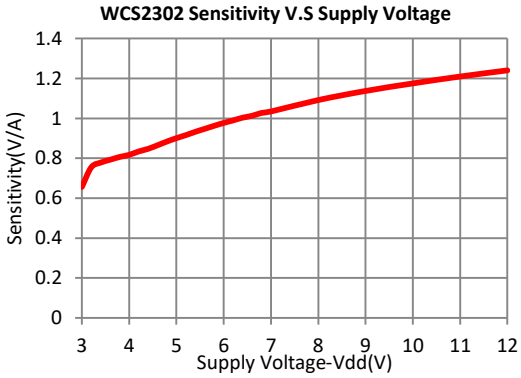
Characteristic Diagrams:

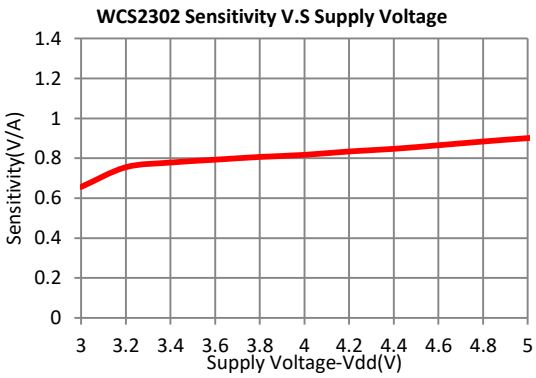
(1)Switch

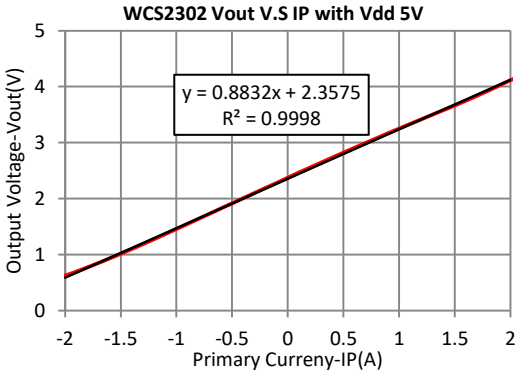


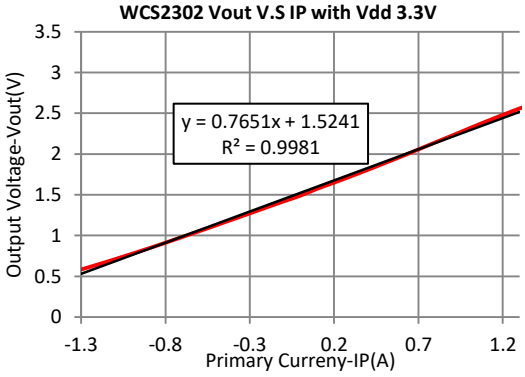


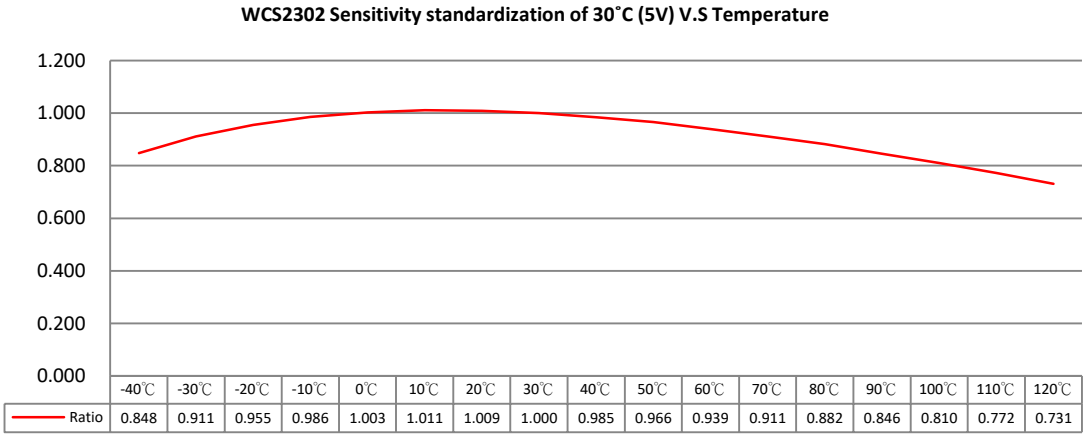
(2)Linear





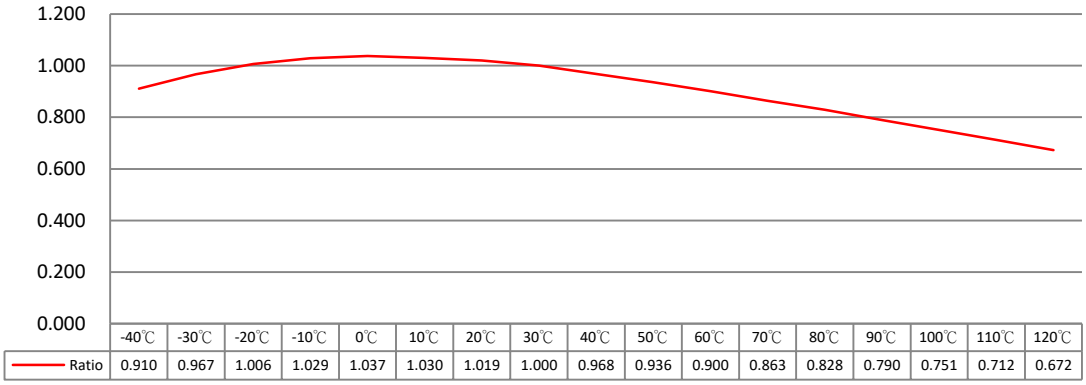






	-40℃	-30℃	-20℃	-10℃	0℃	10℃	20℃	30℃	40℃	50℃	60℃	70℃	80℃	90℃	100℃	110℃	120℃
Ratio	0.848	0.911	0.955	0.986	1.003	1.011	1.009	1.000	0.985	0.966	0.939	0.911	0.882	0.846	0.810	0.772	0.731

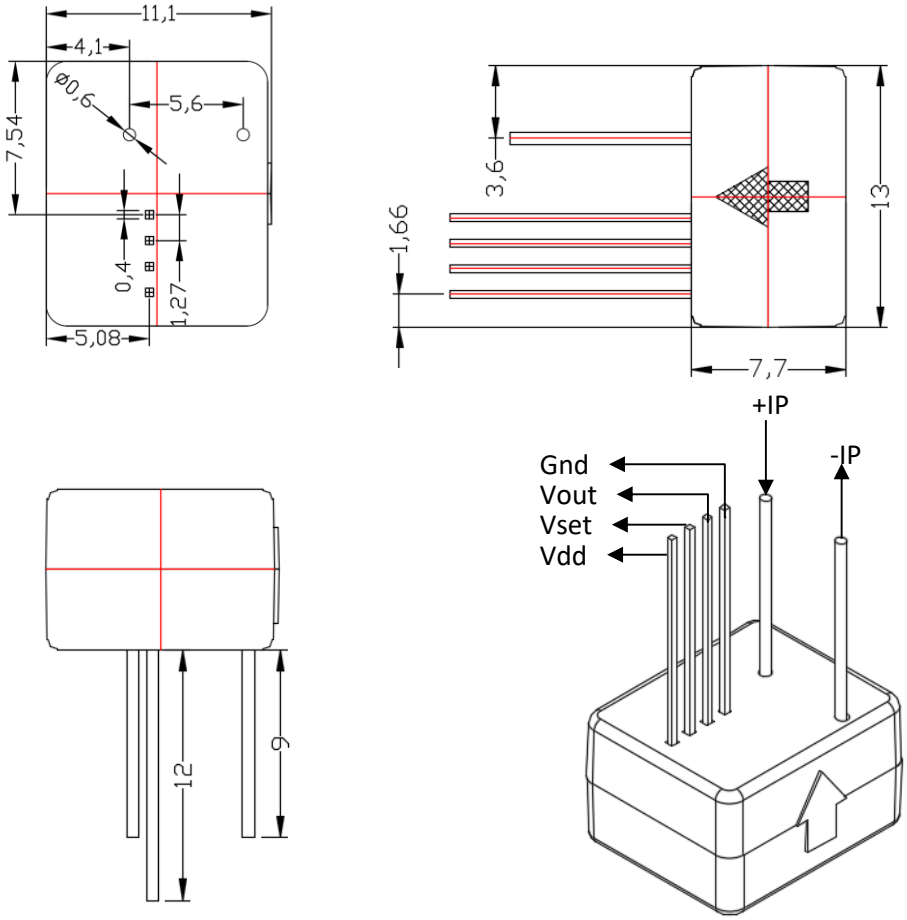
WCS2302 Sensitivity standardization of 30˚C (3.3V) V.S Temperature



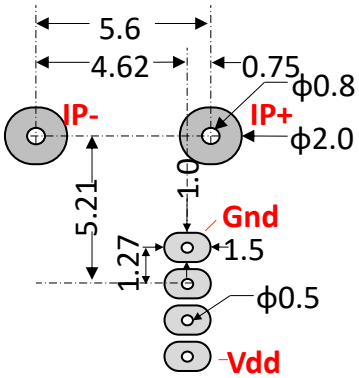
	-40℃	-30℃	-20℃	-10℃	0℃	10℃	20℃	30℃	40℃	50℃	60℃	70℃	80℃	90℃	100℃	110℃	120℃
Ratio	0.910	0.967	1.006	1.029	1.037	1.030	1.019	1.000	0.968	0.936	0.900	0.863	0.828	0.790	0.751	0.712	0.672

Package Information:

(Unit: mm)



PCB Layout Reference View(Top View)



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Application Circuit and Note:

(1)Current Switching - Direct Setting Method:

1.Supply Voltage : apply voltage V_{dd}。

2.Measure the Overcurrent Value : V_{set} pin and V_{out} pin are short-circuited, and output pin does not need to be connected to any load which is as shown in Fig.1. Users can set the IP overcurrent value by putting the target current which is flowing through this hole. Then, measure the output voltage (V_{out}) directly by a multimeter under DC mode and records this voltage.

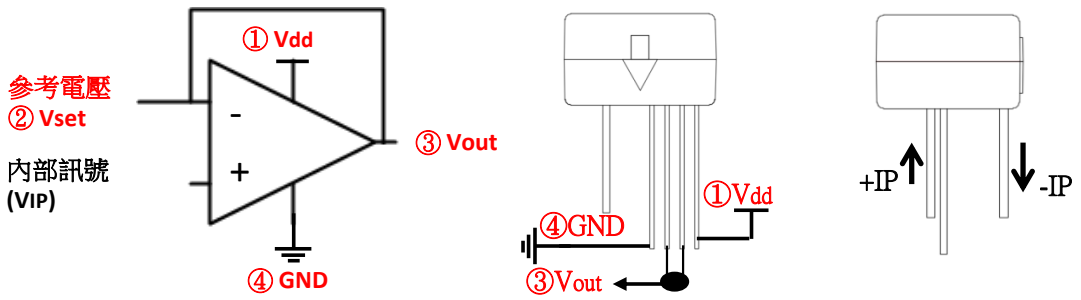

Fig. 1

3.Set the Overcurrent Value : V_{set} pin and V_{out} pin are open-circuited, which is shown in Fig.2. The V_{set} pin input the above-mentioned measured voltage value. The V_{IP} is an internal Hall sensing signal, which converts into a proportional voltage according to the IP current.

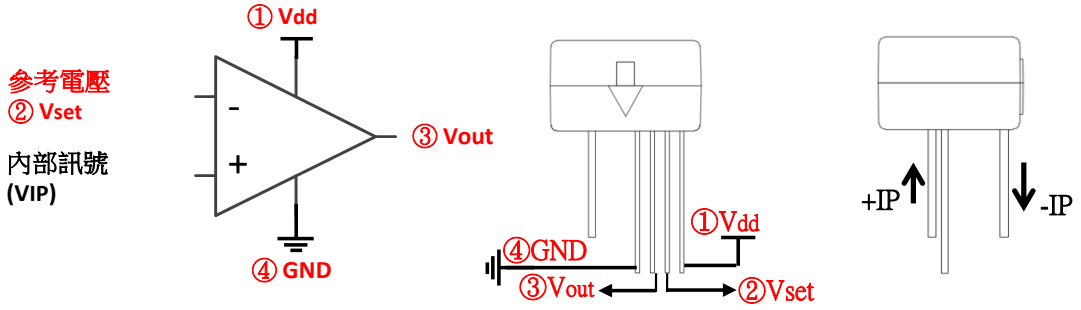

Fig. 2

4.Output : the output voltage levels will change according to the V_{set} voltage.
Output "High" when $V_{IP} > V_{set}$
Output "Low" when $V_{IP} < V_{set}$

(2)Current Switching - Formula Solution Method:

1. The Zero Current Value

1.1 Measure the Zero Current Value V_{0A} : V_{set} pin and V_{out} pin are short-circuited, and output pin does not need to be connected to any load which is as shown in Fig.1. The output voltage (V_{out}) is directly measured by a multimeter under DC mode.

1.2 The Measuring Current ↹ Voltage V_{0A}: measure the output's voltage when no current pass through under the supply voltage 5V and record this voltage.

$V_{IP} = V_{0A} \fallingdotseq 2.5V$

2. The Overcurrent Value

2.1 Set the Reference Voltage V_{set} : V_{set} pin and V_{out} pin are open-circuited, which is as shown in Fig.2. The V_{set} pin input voltage range is 0~V_{dd}.

3.2 The Overcurrent Current Value ↹ Voltage V_{set}:, WCS2302 sensitivity is about **900mV/A** under the supply voltage 5V.

(ΔV = Current ∗ Sensitivity)

Example 1: the overcurrent value is 1A

$V_{set} = V_{10A} = (V_{0A}+\Delta V) = 2.5+(1*0.9) \fallingdotseq 3.4$

Example 2: the overcurrent value is -1A

$V_{set} = V_{-10A} = (V_{0A}-\Delta V) = 2.5-(1*0.9) \fallingdotseq 1.6V$

Example 3: the overcurrent value is 2A

$V_{set} = V_{20A} = (V_{0A}+\Delta V) = 2.5+(2*0.9) \fallingdotseq 4.3V$

3. Output : the output voltage levels will change according to the V_{set} voltage.

(3)Current Measuring

1. **Supply Voltage :**apply voltage V_{dd}。
2. **Measure the Zero Current Output Voltage V_{0A} (Internal Signal, V_{IP})**: V_{set} pin and V_{out} pin are short-circuited, and output pin needs to be connected capacitive load to GND, recommend value is 0.01uF. As shown in Fig.3. (Internal circuit configuration of this device is used a comparator, the phase compensation capacitance for oscillation prevention is not included in the comparator. So users need to connect capacitive load in parallel at output terminal if using in a negative feedback configuration.)

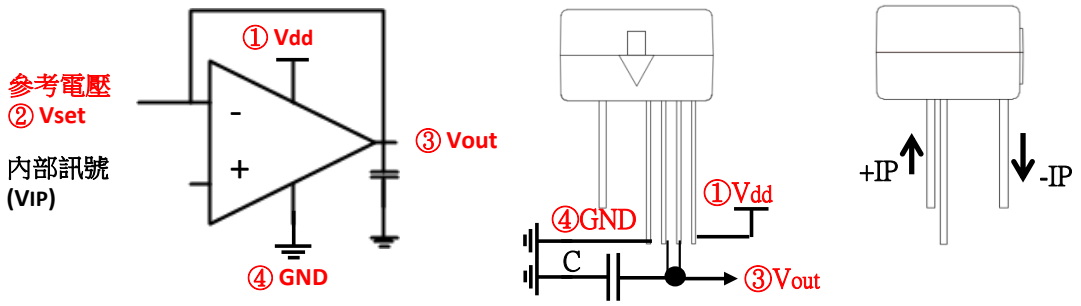

Fig. 3

3. **Calibration :** please refer to Winson Website-> Products->Application Notes-> WCS Application Note: http://www.winson.com.tw/Product/83