# Adjustable Current Switch Device

## Features:

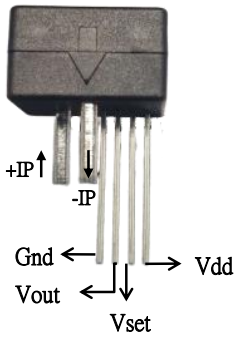
- Current switch, current measurement and on-site calibration
- Response time 10us
- High accuracy ±35mA
- Wide sensing current range 0~30 A
- Output "High" when $V_{IP} > V_{set}$
- Output "Low" when $V_{IP} < V_{set}$
- Wide operating voltage range 3.0~12 V
- Nearly zero magnetic hysteresis
- 23K Hz Bandwidth
- Isolation voltage 1000V
- 0.5 mΩ internal conductor resistance
- "Output voltage" is 1/2 supply voltage at zero current


## Functional Description :

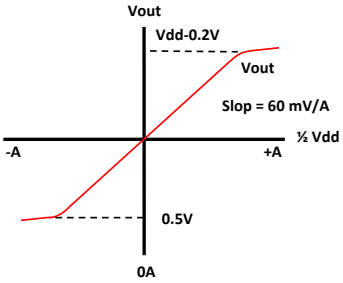
The Winson WCS2320 is a current switch designed for current switching and current measuring. The current switching can be adjusted through providing reference voltage to the $V_{set}$ Pin. The output voltage ($V_{out}$) turns to high voltage level when the internal voltage ($V_{IP}$) is greater than 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 WCS2320 consists of a precise, low-temperature drift linear hall sensor IC with temperature compensation circuit and a current path with 0.5 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 WCS2320 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.




**Vout VS. Primary Current**




## Absolute Maximum Range

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

Pass Current, IP ---------- **60A**

Pass Current (10ms pulse), Ipulse ---------- **150A**

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

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

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

Operating Temperature Range, Ta ----------

---------- **-20ºC to +125ºC**

Storage Temperature Range, Ts ----------

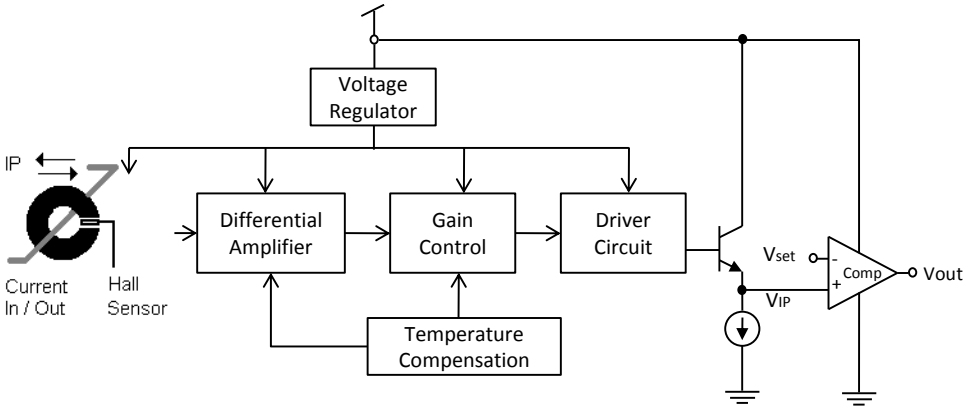
---------- **-65ºC to +150ºC**

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

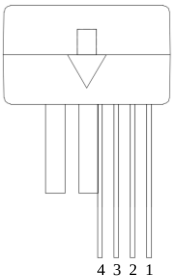
**( Vdd = 5V )**

| Function | Current Range | Resolution | Sensitivity |
|---|---|---|---|
| Switch | DC:±0~30A | ±35 mA | |
| Linear | DC:±0~30A | | 60 mV/A |
| | AC:rms 20A | | |

## 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 | $IP_{Resolution}$ | — | — | ±35 | — | mA |
| Adjustable Current Range | PR | DC Mode | — | ±30 | — | A |
| Response Time (low to high level) | $T_{RP}$ | With 3.75A overdrive $C_{Load}$ = 15pF (1) (2) (3) | — | 6 | — | uS |
| | | With 3.75A overdrive $C_{Load}$ = 0.01uF (1) (2) (3) | — | 25 | — | |
| Response Time (high to low level) | | With 3.75A overdrive $C_{Load}$ = 15pF (1) (2) (3) | — | 8.5 | — | |
| | | With 3.75A overdrive $C_{Load}$ = 0.01uF (1) (2) (3) | — | 125 | — | |
| Rising Time | $T_{RISE}$ | With 3.75A overdrive $C_{Load}$ = 15pF (1) (2) (3) | — | 0.3 | — | uS |
| Fall Time | $T_{FALL}$ | With 3.75A 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 7.5A(450mV) input step with 3.75A(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 )

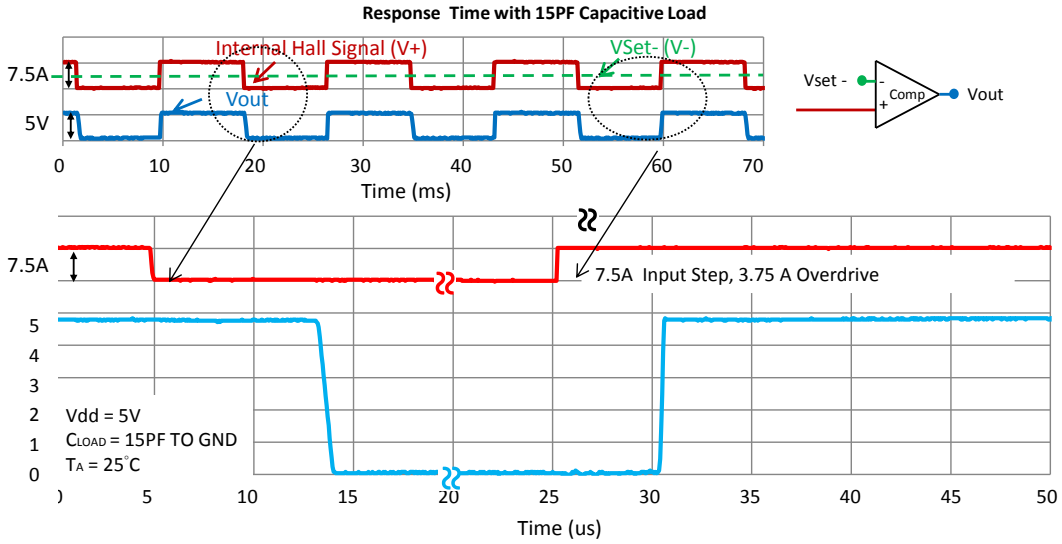
| Characteristic | Symbol | Test Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| Zero Current Vout | VIP | IP =0 A | 2.35 | 2.5 | 2.65 | V |
| Sensitivity | Sens | IP= +-10 A | 51 | 60 | 69 | mV/A |
| Bandwidth | BW | — | — | 10 | — | kHz |
| Measurable Current Range | MR | Vdd=5V (DC Mode) | — | ±30 | — | A |
| | | Vdd=5V (AC RMS ) | — | 20 | — | |
| 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 | — | |

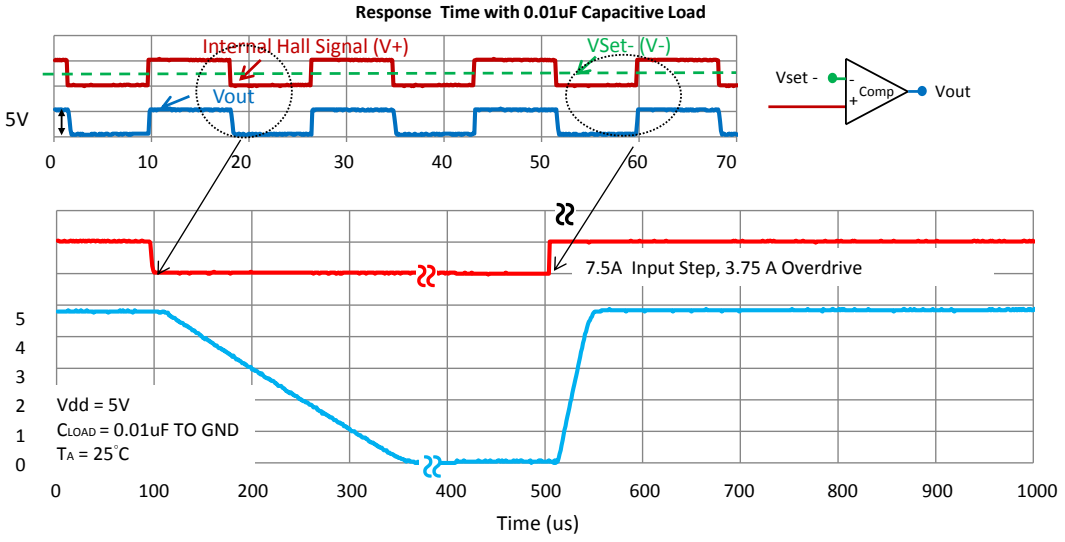
1. All output-voltage measurements are made with a voltmeter having an input impedance which is at least 100kΩ
2. Connect ‘capacitive load’ (0.01uF) in parallel at output pin.
   Do not apply any ‘resistor load’ on output pin, it will degrade IC’s performance.

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

## Characteristic Diagrams:

### (1)Switch

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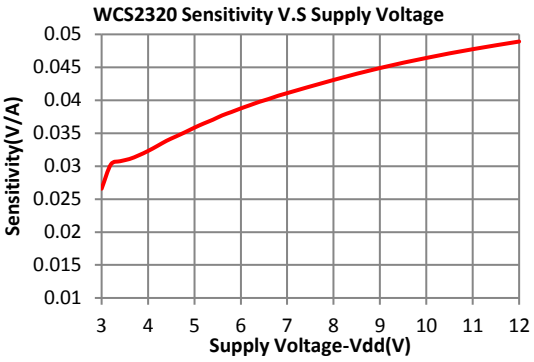
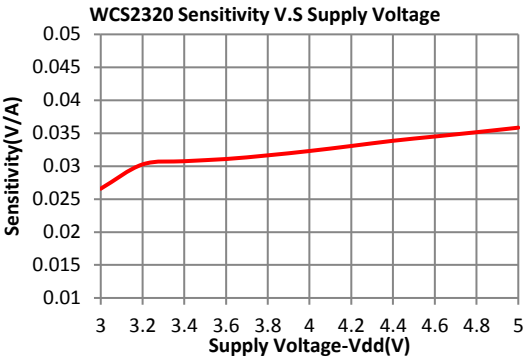
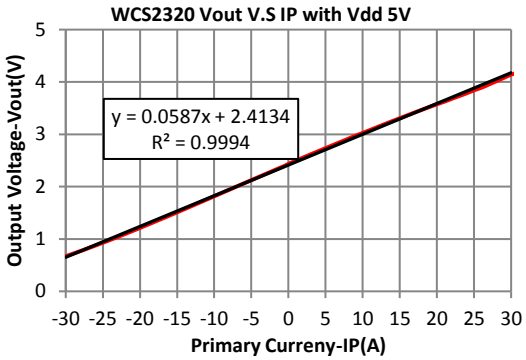
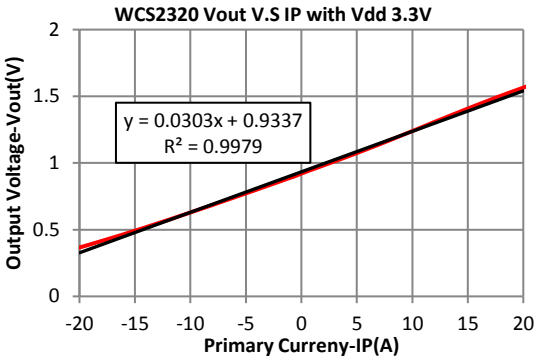
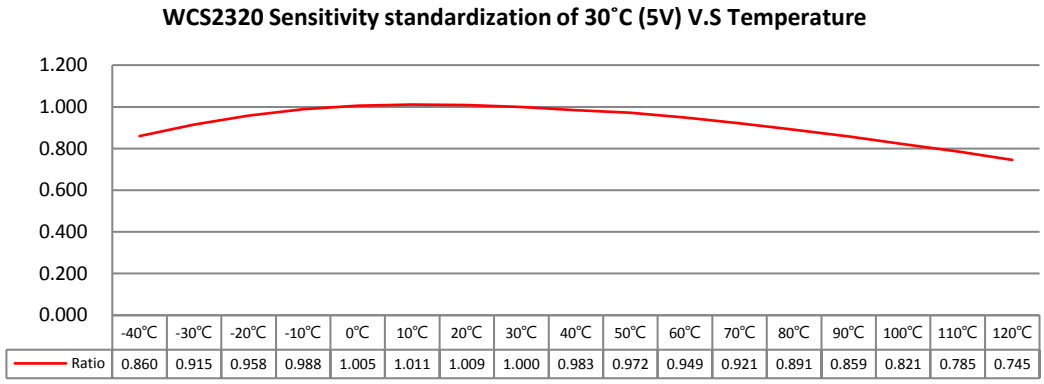
## (2)Linear



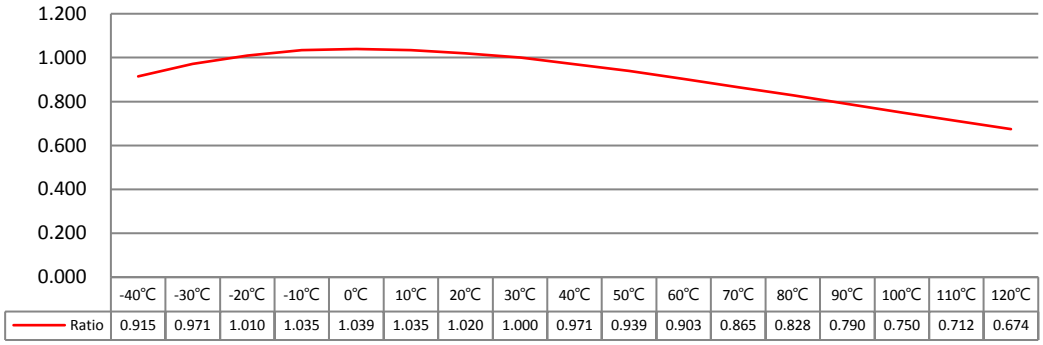



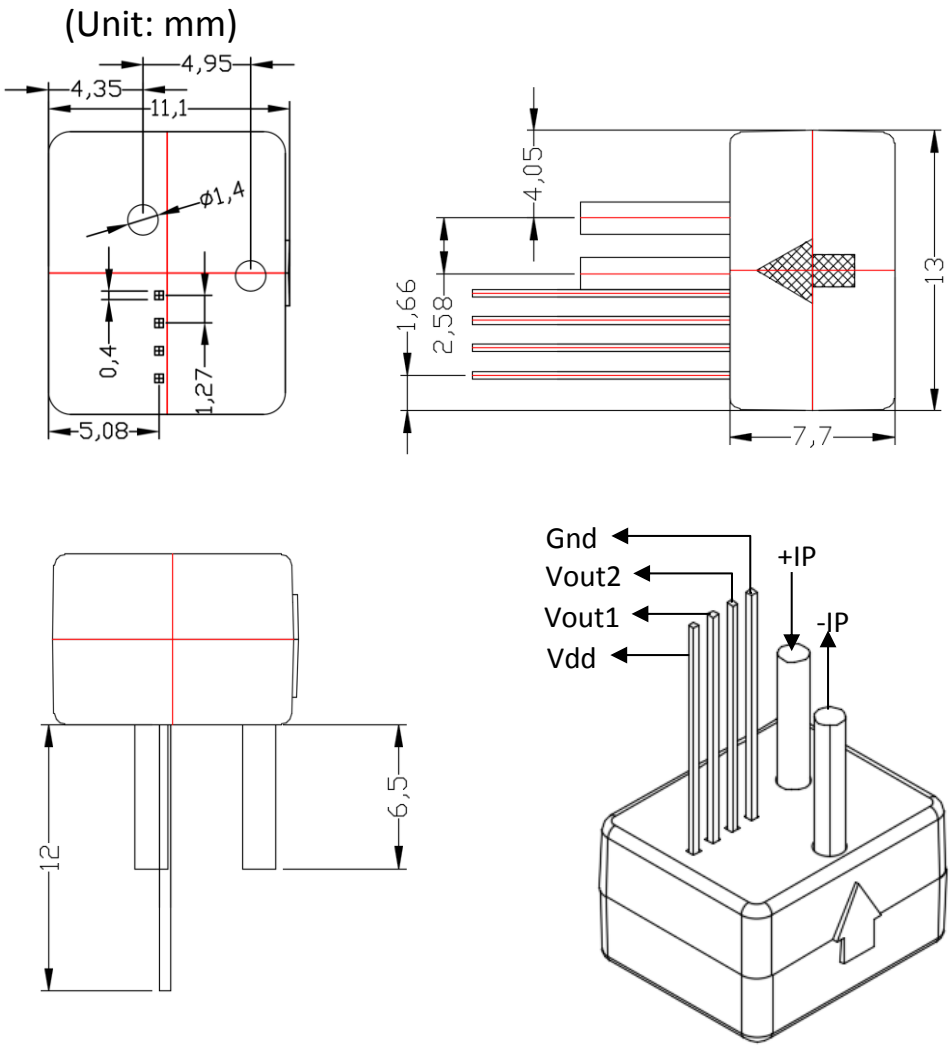



**WCS2320 Sensitivity standardization of 30˚C (3.3V) V.S Temperature**

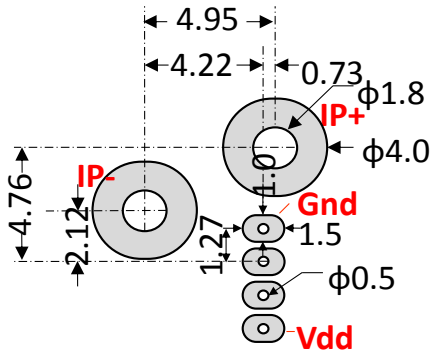



| | -40℃ | -30℃ | -20℃ | -10℃ | 0℃ | 10℃ | 20℃ | 30℃ | 40℃ | 50℃ | 60℃ | 70℃ | 80℃ | 90℃ | 100℃ | 110℃ | 120℃ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ratio | 0.915 | 0.971 | 1.010 | 1.035 | 1.039 | 1.035 | 1.020 | 1.000 | 0.971 | 0.939 | 0.903 | 0.865 | 0.828 | 0.790 | 0.750 | 0.712 | 0.674 |

## 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.

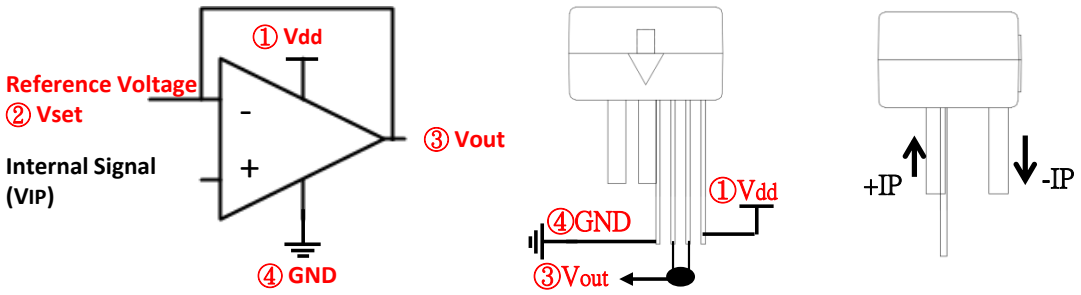


Fig. 1

**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.

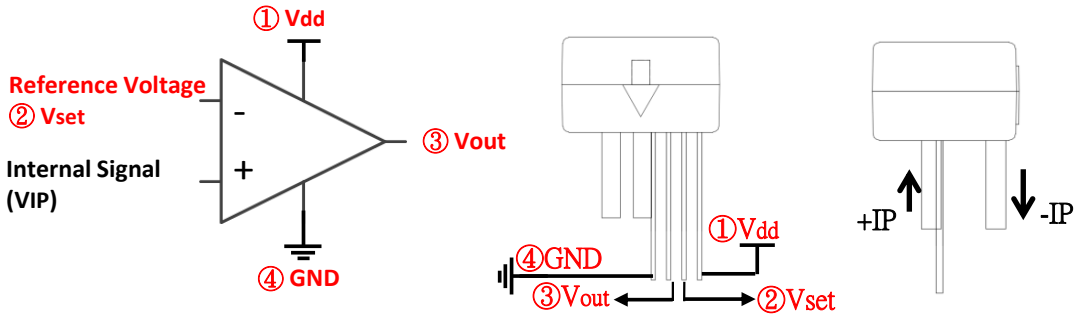


Fig. 2

**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 $V_{set}$**:, WCS2320 sensitivity is about **60mV/A** under the supply voltage 5V.

(ΔV = Current ∗ Sensitivity)

Example 1: the overcurrent value is 1A

$V_{set} = V_{10A} = (V_{0A}+\Delta V) = 2.5+(10*0.06) \fallingdotseq 3.1$

Example 2: the overcurrent value is -1A

$V_{set} = V_{-10A} = (V_{0A}-\Delta V) = 2.5-(10*0.06) \fallingdotseq 1.9V$

Example 3: the overcurrent value is 2A

$V_{set} = V_{20A} = (V_{0A}+\Delta V) = 2.5+(20*0.06) \fallingdotseq 3.7V$

**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.)

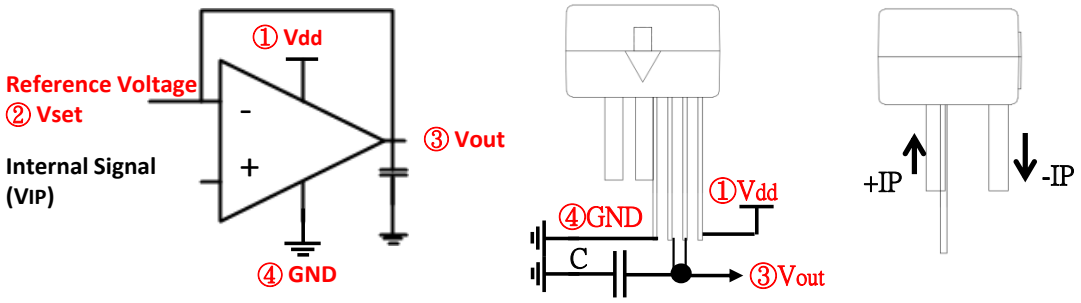


Fig. 3

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