Adjustable Hall Effect Switch IC

Features

- Adjustable Hall Effect Switch with magnetic field measure for on-site calibration
- Response time 500 ns
- High resolution ±0.5 Gauss
- Adjustable magnitude sensing range:
  ±500 Gauss on 5V supplied voltage; ±1000 Gauss on 12V supplied voltage
- Output "High" when V_B > Vset; Output "Low" when V_B < Vset
- Wide operating voltage range 3 V ~ 12 V
- Almost zero hysteresis
- 23 kHz bandwidth

Functional Description

The WSH237 is an adjustable Hall Effect Switch with magnetic field measure function for on-site calibration. The Hall sensing switching point of the magnetic field is adjustable through the input reference voltage of Vset pin. The output voltage (Vout) turns to high voltage level when the internal voltage (V_B) is greater than the reference voltage (Vset). In contrast, Vout turns to low voltage level when V_B is smaller than Vset. This function allows WSH237 to be applied in precision positioning, motion detection, and over-current detection, and etc.

WSH237 also can accurately track extremely small change in magnetic flux density by converting it proportionally into a analog voltage signal. The temperature-dependent bias in WSH237 increases the supply voltage of the hall plates and adjusts the switching points to the decreasing induction of magnets at higher temperatures. Therefore, WSH237 has wide operation temperature range which is from -40℃ to +125℃.

Pin Definition

Name	P / I / O	Pin#	Description
Vdd	P	1	Positive Power Supply
Vset	I	2	Setup input terminal
Vout	O	3	Output Pin
Gnd	O	4	Ground

Electrical Characteristics

(T = +25 ℃)

Characteristic	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Supply Voltage	Vdd	—	3.0	—	12	V
Supply Current	I_{supply}	B = 0 Gauss	—	3.5	6.0	mA

Switching Characteristics

(T = +25 ℃, Vdd = 5V)

Characteristic	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Adjustable Guass Range	B	—	—	±500	—	G
Output Voltage	V_H	Full range.	Vdd-0.2	—	—	V
	V_L		—	—	0.1	
Resolution	B_{Res}	—	—	±0.5	—	G
Response Time (low to high level)	T_{RP}	75mV overdrive C_{load} = 15 pF	—	0.5	—	μs
		75mV overdrive C_{load} = 0.01 pF	—	60	—	μs
Response Time (high to low level)		75mV overdrive C_{load} = 15 pF	—	4	—	μs
		75mV overdrive C_{load} = 0.01 pF	—	900	—	μs
Rising Time	T_{RISE}	75mV overdrive C_{load} = 15 pF	—	0.5	—	μs
Falling Time	T_{FALL}		—	0.3	—	μs

1. C_{Load} includes probe and jig capacitance.
2. The response time is specified for a 150mV input step with 75mV overdrive.
3. Response time can refer to "characteristic Diagrams" Fig.1~3.

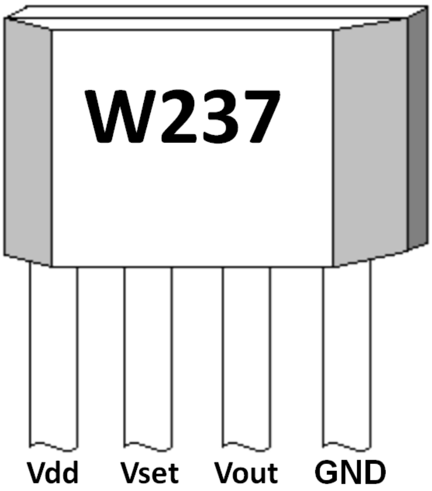
Linear Characteristics

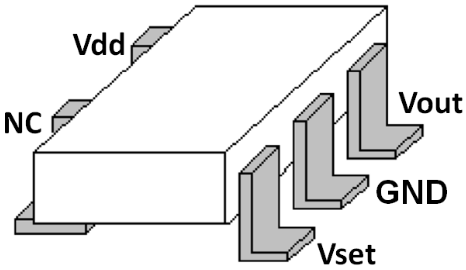
(T = +25 ℃, Vdd = 5V, Vset & Vout short)

Characteristic	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Quiescent Output	V0G	B = 0 Gauss	2.35	2.5	2.65	V
Sensitivity	Sens	B = 250 Gauss	3.5	4	4.5	mV/G
Bandwidth	BW	—	—	23	—	kHz
Temperature Drift	△ Vout	B = 0 Gauss	—	±0.5	—	mV/℃
Output Noise	$V_{Np\text{-}p(0.01\mu F)}$	B = 0 Gauss C_{load} = 0.01 μF	—	12	—	mV
	$V_{Np\text{-}p(0.1\mu F)}$	B = 0 Gauss C_{load} = 0.1 μF	—	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) between output pin and ground. 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.





Absolute Maximum Range

Supply Voltage, Vdd ------------------------------- **14V**
Magnetic Flux Density, B ---------------- **Unlimited**
Output Current Sink, I_{sink} ---------------------- **50μA**
Output Current Source, I_{source} -------------- **1.5mA**
Operating Temperature Range, Ta ------------------
-- **-40°C to +125°C**
Storage Temperature Range, Ts ---------------------
-- **-65°C to +150°C**
Power Dissipation, Pd
TO-94 ----------------------------------- **500mW**
SOT-25 --------------------------------- **400mW**

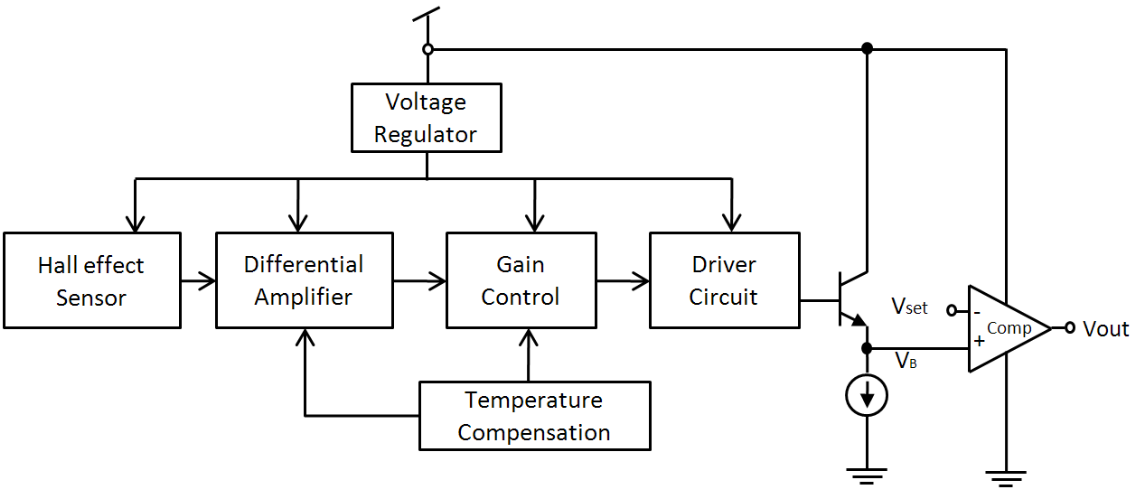
Order Information

WSH237-XPAN (TO-94)
WSH237-XPDN (SOT-25)

Halogen Free

★TO-94 — 1,000/bag , SOT-25 — 3,000/reel

Function Block



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Characteristic Diagram

《**Switching Characteristics**》

Response Time with 15pF Capacitive Load

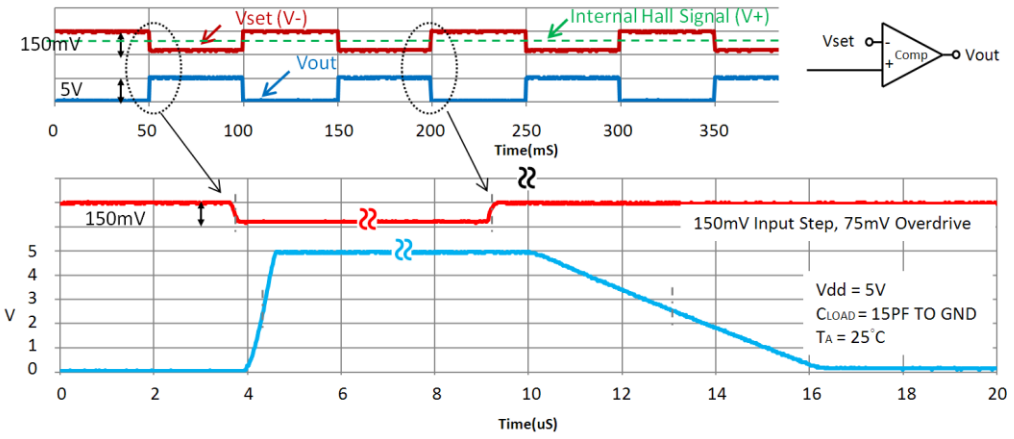


Figure 1

Response Time with 0.01uF Capacitive Load

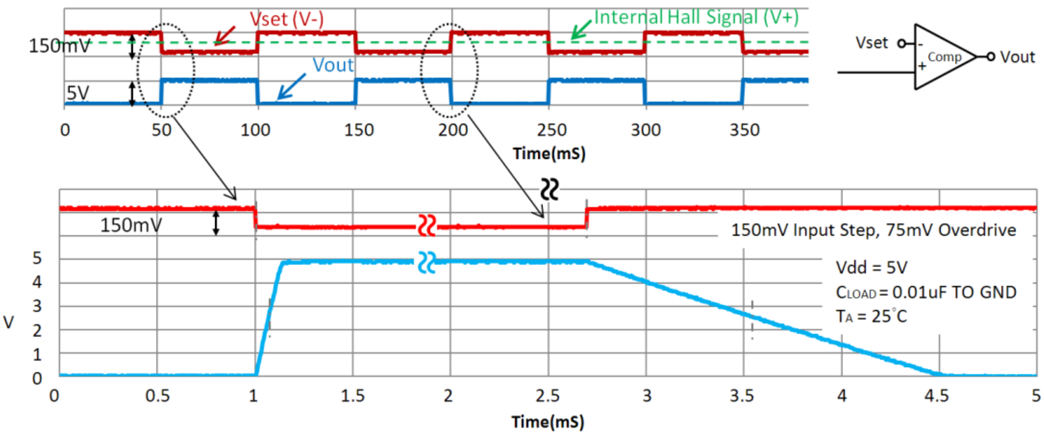


Figure 2

Response Time with 0.1uF Capacitive Load

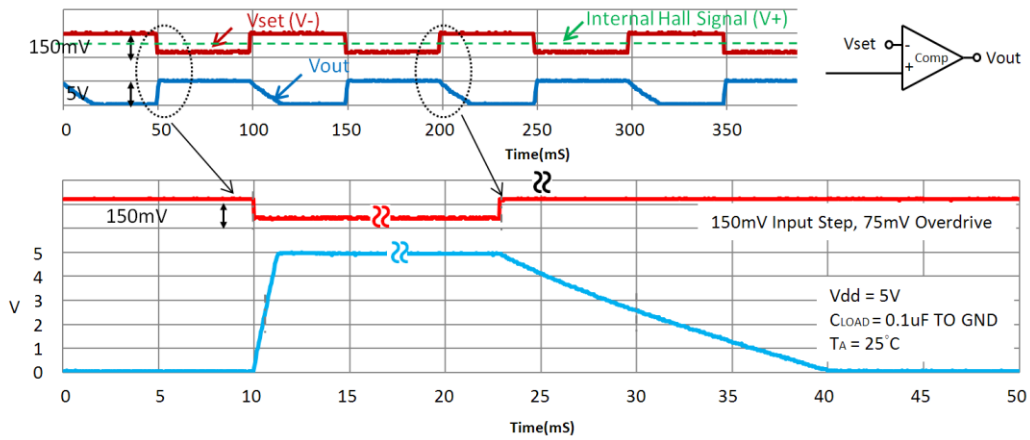
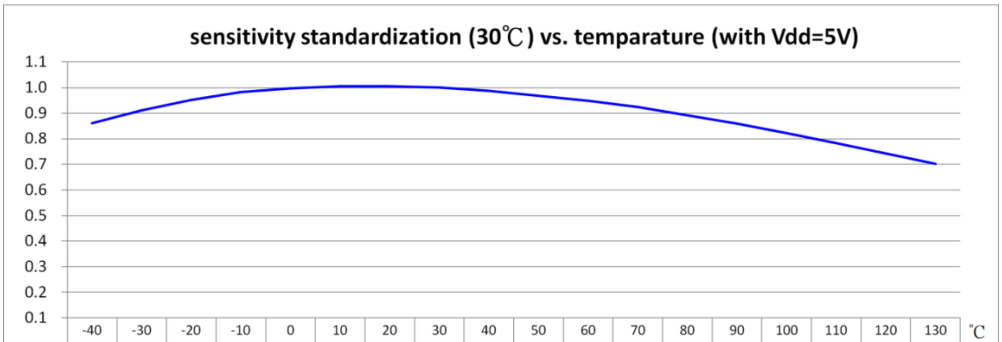
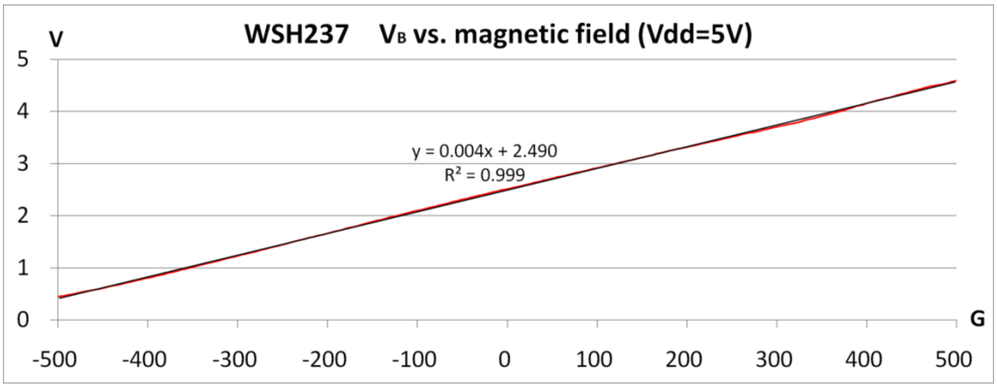


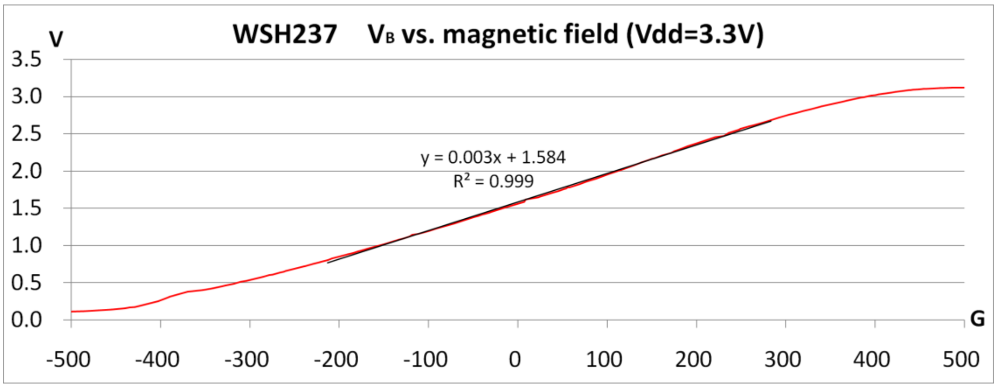
Figure 3

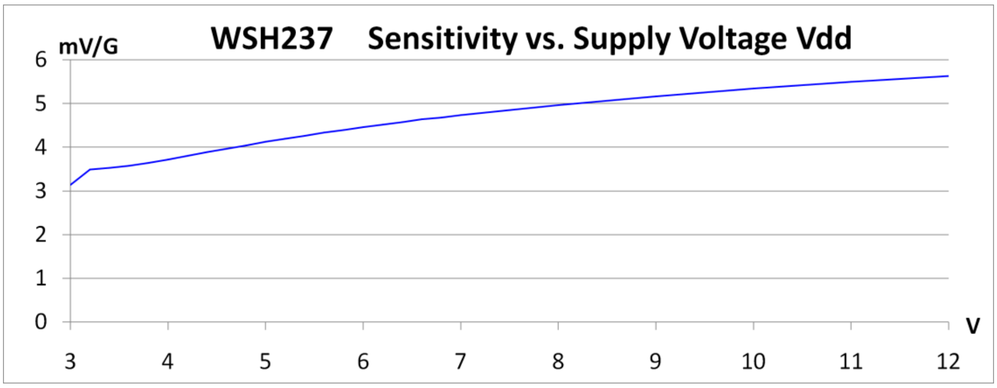
《Linear Characteristics》



	-40	-30	-20	-10	0	10	20	30	40	50	60	70	80	90	100	110	120	130
ratio	0.860	0.910	0.952	0.981	0.996	1.005	1.005	1.000	0.986	0.967	0.949	0.924	0.891	0.858	0.821	0.782	0.743	0.702







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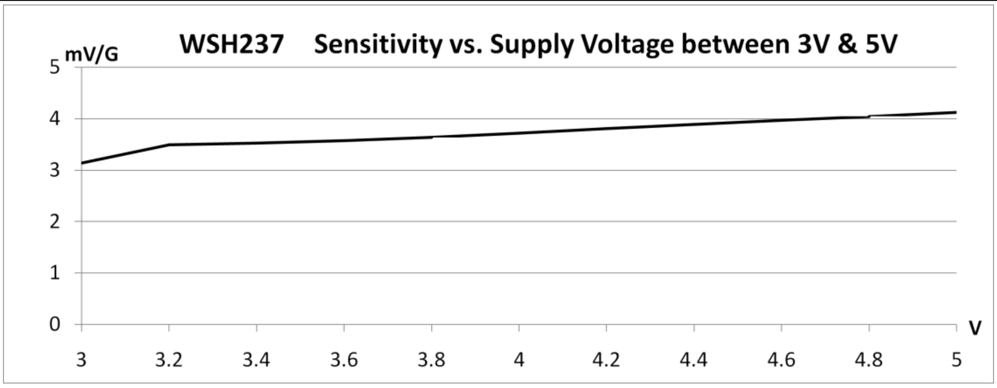
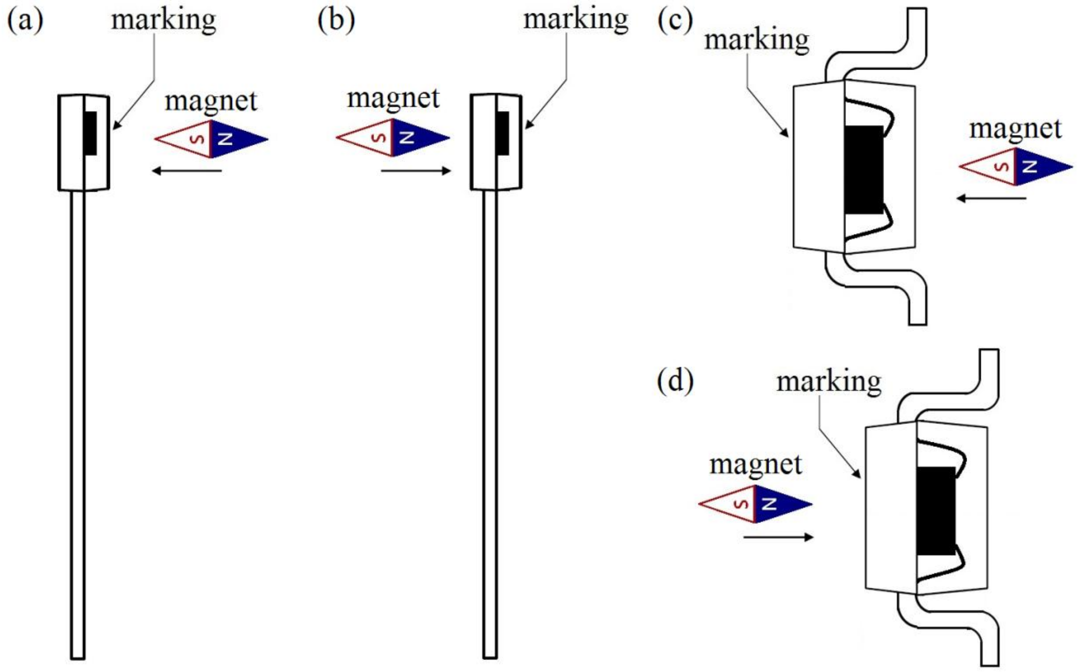
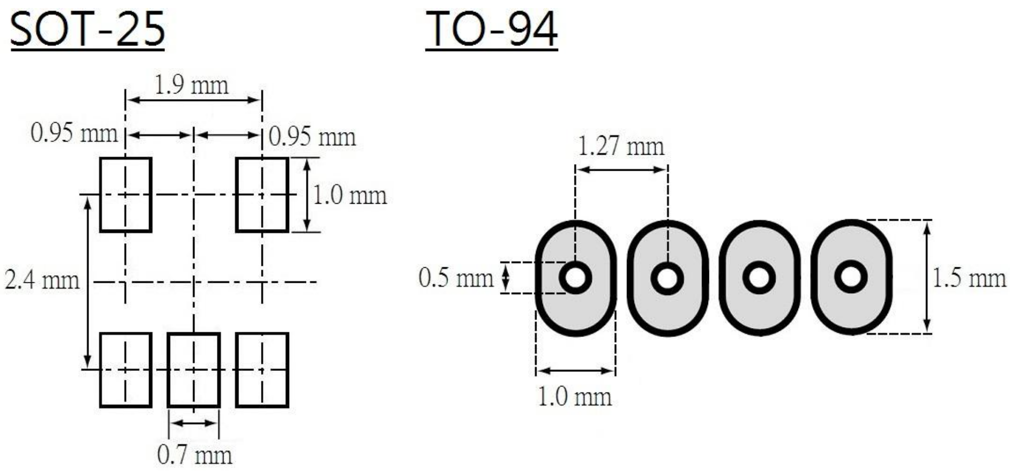


Hall Device Sensing Direction



PCB Layout Reference View



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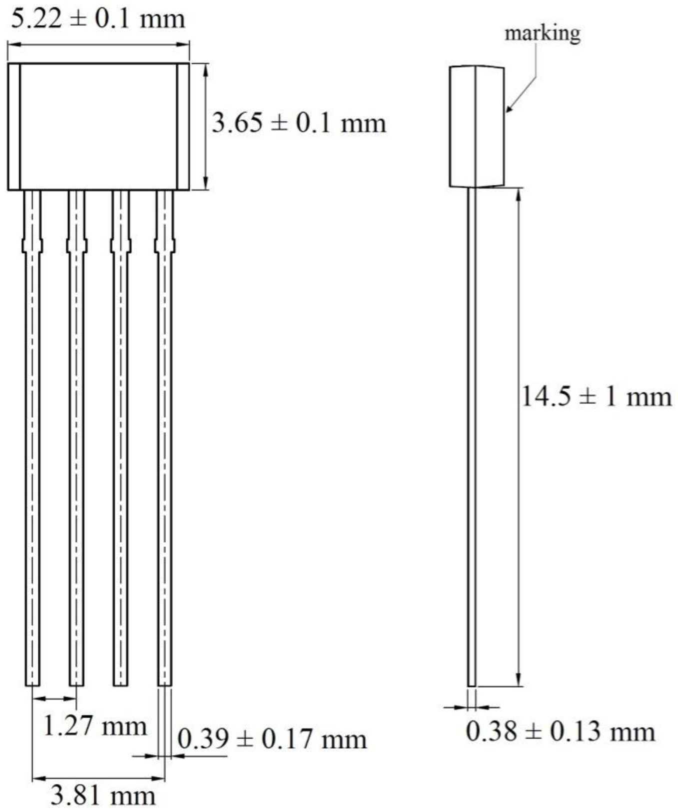
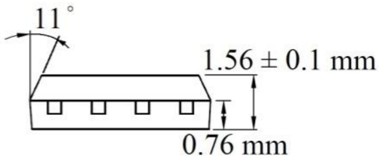
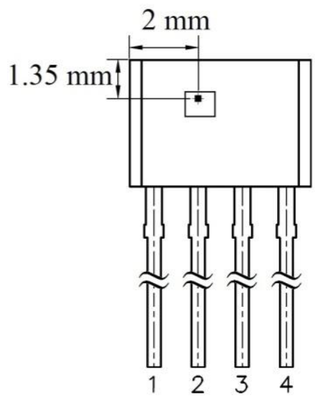
Package Information

《TO-94》

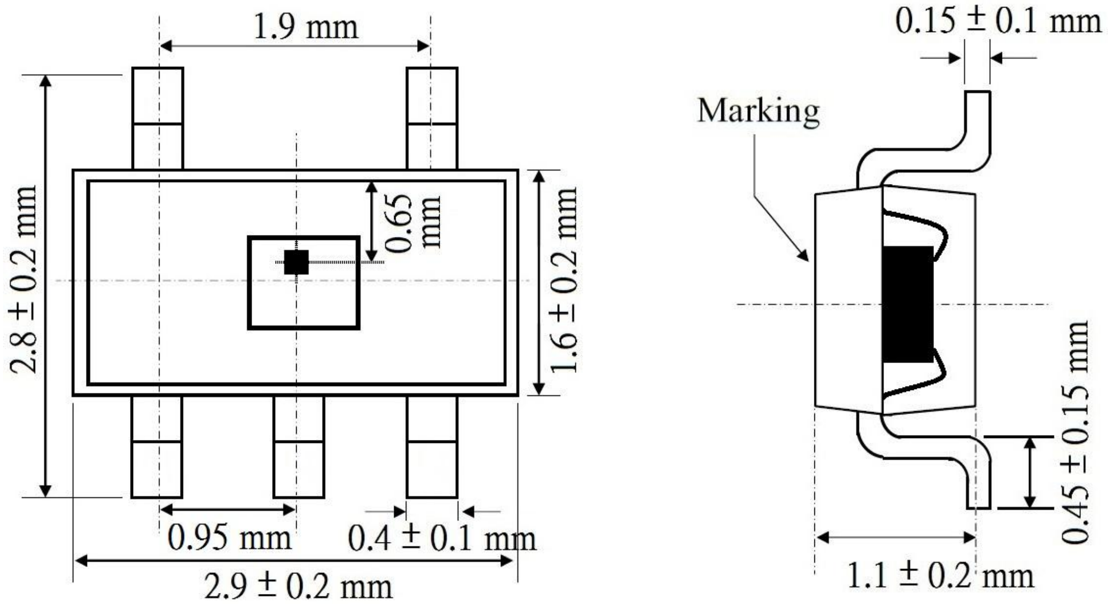




Hall Sensor Location



《SOT-25》



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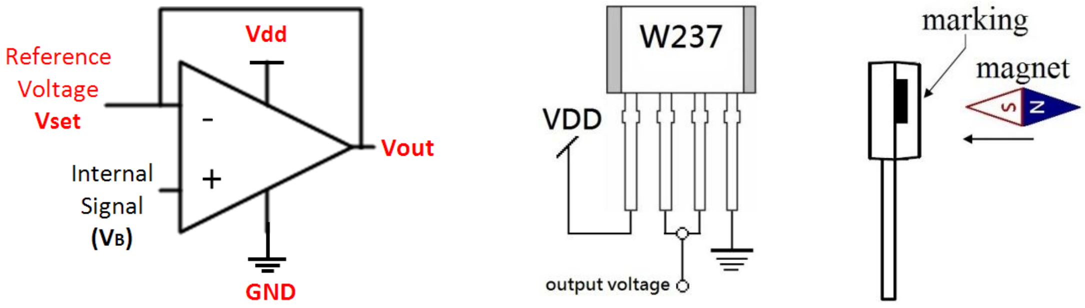
Application Circuit and Note

《Magnetic Switch - Direct Setting Method》

Step 1 Supply voltage Vdd.

Step 2 Vset pin and Vout pin are short-circuited, and provide magnetic field to IC.



Step 3 Measure the output voltage directly by a multimeter under DC mode and records this voltage.

Step 4 Vset pin and Vout pin are open-circuited, and input the measured voltage value mentioned above into Vset pin. Here, V_B is an internal Hall sensing voltage signal which is proportional to magnetic field.

Step 5 The output voltage levels will change according to:
Output "High" when $V_B > Vset$
Output "Low" when $V_B < Vset$

《Magnetic Switch - Formula Solution Method》

Step 1 Supply voltage Vdd. For example, Vdd = 5V.

Step 2 Vset pin and Vout pin are short-circuited, and measure output voltage without magnetic field. For example, V0G ≒ 2.5V under Vdd = 5V.

Step 3 Getting Vset value by calculation:

$$Vset = (\text{magnetic field}) \times (\text{sensitivity}) + V0G$$

For example, intend to set magnetic sensing value at 250G. Here, and the sensitivity is around 4 mV/G under Vdd = 5V.

$$Vset = 250 \times 4 \times 10^{-3} + 2.5 = 3.5\ (V)$$

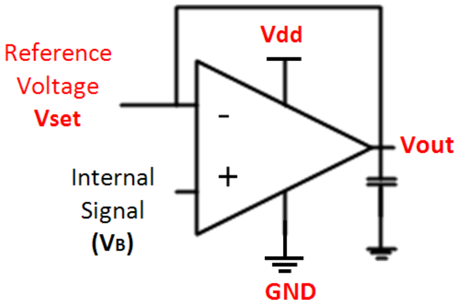
Step 4 Vset pin and Vout pin are open-circuited, and input the calculated voltage value mentioned above into Vset pin.

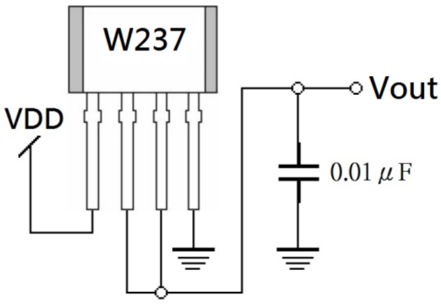
Step 5 The output voltage levels will change according to:
Output "High" when $V_B > Vset$
Output "Low" when $V_B < Vset$

《**Magnetic Field Measurement**》

Step 1 Supply voltage Vdd.

Step 2 Vset pin and Vout pin are short-circuited, and the output pin needs to be connected a capacitive load to GND, and the recommend value is 0.01uF. See the figures below. (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 to output terminal if using in a negative feedback configuration.)





Step 3 Output voltage varies linearly with the change of magnetic field.