

# Date Sheet



The "Huaxin" brand was founded in 2003 and has a history of 18 years. The company is mainly engaged in Hall elements, has a group of senior professional device design, integrated circuit design and test engineers, and has a first-class development and test platform. We have developed a number of high-end products with independent intellectual property rights, such as RF LDMOS series and RF VDMOS series, which represent China's integrated circuit level.

## HX6659

## Linear Hall Element

HX6659-A、HX6659-B、HX6659-C、HX6659-D, a linear Hall-effect sensor, is composed of sensor, linear amplifier and Totem-Pole output stage. It features low noise output, which makes it unnecessary to use external filtering. It also can provide increased temperature accuracy. The linear Hall sensor has a wide operating temperature range of  $-40^{\circ}\text{C}$  to  $+105^{\circ}\text{C}$ , appropriate for commercial, consumer, and industrial environments.

The high sensitivity of Hall-effect sensor accurately tracks extremely weak changes in magnetic flux density. The linear sourcing output voltage is set by the supply voltage and in proportion of vary of the magnetic flux density. Typical operation current is 2.5 mA and operating voltage range is 2.8 volts to 6.0 volts. Trim version is available for an ultra low offset products.

The three package styles available provide magnetically optimized solutions for most applications. Package types SO is an SOT-23(1.1 mm nominal height), SQ is an QFN2020-3(0.5 mm nominal height), a miniature low-profile surface-mount package, while package UA is a three-lead ultra-mini SIP for through-hole mounting.

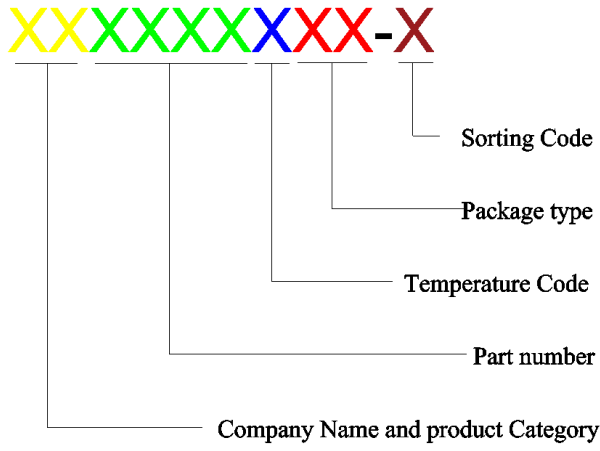
### ***Features and Benefits***

- Operating Voltage Range: 2.8V~6.0V
- Power consumption of 3.3 mA at 5 V<sub>DC</sub> for energy efficiency
- Low-Noise Operation
- Linear output for circuit design flexibility
- Totem-Pole for a stable and accurate output
- Responds to either positive or negative gauss
- Small package for SMD
- Magnetically Optimized Package for UA,SQ,SO
- Robust ESD performance

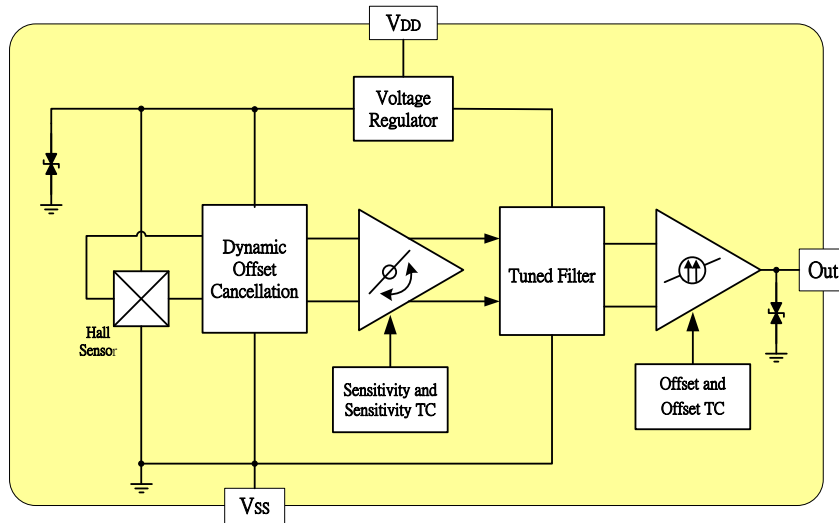
### ***Applications***

- Current sensing
- Motor control
- Position sensing
- Magnetic code reading
- Rotary encoder
- Ferrous metal detector
- Vibration sensing
- Liquid level sensing
- Weight sensing

**Ordering Information**

|   |  |
|---|--|
|  | <p><b>Company Name and Product Category</b><br/>HX:HX Hall Effect/MP:HX Power IC</p> <p><b>Part number</b><br/>6286,6275,6278,6287,6383,6474,6571,6572,6573,6574...<br/>If part # is just 3 digits, the fourth digit will be omitted.</p> <p><b>Temperature range</b><br/>E: 85 °C, I: 105 °C, K: 125 °C, L: 150 °C</p> <p><b>Package type</b><br/>UA:TO-92S,VK:TO-92S(4pin),VF:TO-92S(5pin),SO:SOT-23,<br/>SQ:QFN-3,ST:TSOT-23,SN:SOT-553,SF:SOT-89(5pin),<br/>SS:TSOT-26,SD:DFN-6,SG:SOT-89(3pin)</p> <p><b>Sorting</b><br/>α,β,Blank.....</p> |
|---|--|

| <b>Part No.</b> | <b>Temperature Suffix</b> | <b>Package Type</b> |
|-----------------|---------------------------|---------------------|
| HX6659IUA-A     | I (-40°C to +105°C)       | UA (TO92-3L)        |
| HX6659IUA-B     | I (-40°C to +105°C)       | UA (TO92-3L)        |
| HX6659IUA-C     | I (-40°C to +105°C)       | UA (TO92-3L)        |
| HX6659IUA-D     | I (-40°C to +105°C)       | UA (TO92-3L)        |
| HX6659ISQ-A     | I (-40°C to +105°C)       | SQ (QFN2020-3)      |
| HX6659ISQ-B     | I (-40°C to +105°C)       | SQ (QFN2020-3)      |
| HX6659ISQ-C     | I (-40°C to +105°C)       | SQ (QFN2020-3)      |
| HX6659ISQ-D     | I (-40°C to +105°C)       | SQ (QFN2020-3)      |
| HX6659ISO-A     | I (-40°C to +105°C)       | SO(SOT-23)          |
| HX6659ISO-B     | I (-40°C to +105°C)       | SO(SOT-23)          |
| HX6659ISO-C     | I (-40°C to +105°C)       | SO(SOT-23)          |
| HX6659ISO-D     | I (-40°C to +105°C)       | SO(SOT-23)          |
| HX6659IUA-A-T   | I (-40°C to +105°C)       | UA (TO92-3L)        |
| HX6659IUA-B-T   | I (-40°C to +105°C)       | UA (TO92-3L)        |
| HX6659IUA-C-T   | I (-40°C to +105°C)       | UA (TO92-3L)        |
| HX6659IUA-D-T   | I (-40°C to +105°C)       | UA (TO92-3L)        |
| HX6659ISQ-A-T   | I (-40°C to +105°C)       | SQ (QFN2020-3)      |
| HX6659ISQ-B-T   | I (-40°C to +105°C)       | SQ (QFN2020-3)      |
| HX6659ISQ-C-T   | I (-40°C to +105°C)       | SQ (QFN2020-3)      |
| HX6659ISQ-D-T   | I (-40°C to +105°C)       | SQ (QFN2020-3)      |
| HX6659ISO-A-T   | I (-40°C to +105°C)       | SO(SOT-23)          |
| HX6659ISO-B-T   | I (-40°C to +105°C)       | SO(SOT-23)          |
| HX6659ISO-C-T   | I (-40°C to +105°C)       | SO(SOT-23)          |
| HX6659ISO-D-T   | I (-40°C to +105°C)       | SO(SOT-23)          |

**Functional Diagram**

**Absolute Maximum Ratings At ( $T_a=25^\circ\text{C}$ )**

| Characteristics                        |          | Values      | Unit             |
|--|----------|-------------|------------------|
| Supply Voltage ( $V_{DD}$ )            |          | 8           | V                |
| Reverse Voltage, ( $V_{DDR}$ )         |          | -0.5        | V                |
| Output Voltage, ( $V_{out}$ )          |          | 8           | V                |
| Output current, ( $I_{out}$ )          |          | 5           | mA               |
| Operating Temperature Range, ( $T_A$ ) |          | -40 ~ +125  | $^\circ\text{C}$ |
| Storage temperature Range, ( $T_S$ )   |          | -65 ~ +150  | $^\circ\text{C}$ |
| Maximum Junction Temp ( $T_J$ )        |          | 150         | $^\circ\text{C}$ |
| Package Power Dissipation, ( $P_D$ )   | UA/SO/SQ | 606/230/230 | mW               |

**Note:** Do not apply reverse voltage to  $V_{DD}$  and  $V_{OUT}$  Pin, It may be caused for Miss function or damaged device.

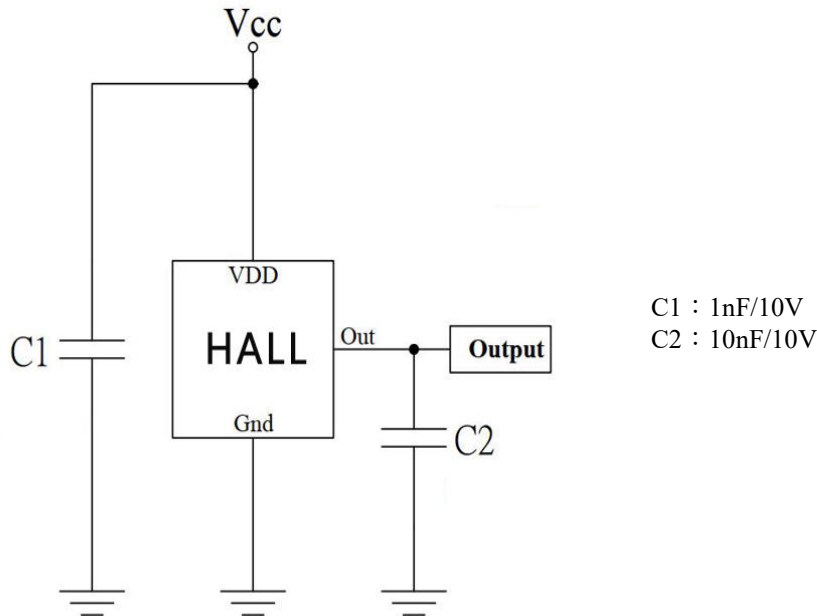
**Electrical Specifications**

DC Operating Parameters :  $T_A=+25^\circ\text{C}$ ,  $V_{CC}=5.0\text{V}$

| Parameters                            | Test Conditions                      | Min              | Typ | Max              | Units         |
|---------------------------------------|--------------------------------------|------------------|-----|------------------|---------------|
| Supply Voltage, ( $V_{DD}$ )          | Operating                            | 2.8              |     | 6.0              | V             |
| Supply Current, ( $I_{DD}$ )          | B= 0 Gauss                           |                  | 3.3 | 5.0              | mA            |
| Output Current, ( $I_O$ )             | A $V_{DD} > 4\text{V}$               | 1.0              | 1.5 |                  | mA            |
| Output Current, ( $I_O$ )             | B、 C、 D $V_{DD} > 3\text{V}$         | 1.0              | 1.5 |                  | mA            |
| Null Output Voltage, ( $V_{NULL}$ )   | B= 0 Gauss,<br>(T type)              | 2.375<br>(2.475) | 2.5 | 2.625<br>(2.525) | V             |
| High Output Voltage, ( $V_{OH}$ )     | B> Max Magnetic Gauss                |                  | 4.9 | 4.99             | V             |
| Low Output Voltage, ( $V_{OL}$ )      | B> Min Magnetic Gauss                | 0.01             | 0.1 |                  | V             |
| Output Voltage Span, ( $V_{OS}$ )     |                                      |                  | 4.8 |                  | V             |
| Output Referred Noise, ( $V_{ON}$ )   | $T_a=25^\circ\text{C}$ , output open |                  | 20  |                  | mV            |
| Power-On Time, ( $T_P$ )              |                                      |                  |     | 100              | $\mu\text{s}$ |
| Output Switch Time, ( $T_{SW}$ )      |                                      |                  |     | 150              | $\mu\text{s}$ |
| Output Switch Frequency, ( $F_{SW}$ ) |                                      | 3                |     |                  | kHz           |
| Magnetic Range Gauss                  | A                                    | $\pm 1600$       |     |                  | Gauss         |
|                                       | B                                    | $\pm 1200$       |     |                  | Gauss         |

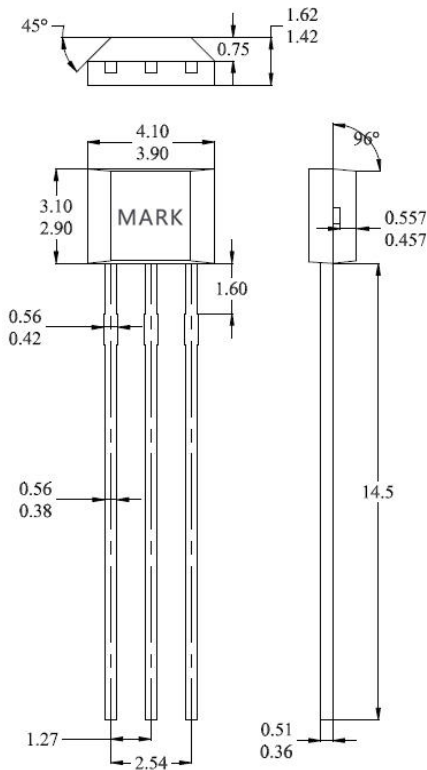
|  |  |                    |              |      |              |       |
|--|--|--------------------|--------------|------|--------------|-------|
|  | C                                      |                    | ±960         |      |              | Gauss |
|  | D                                      |                    | ±800         |      |              | Gauss |
| Ratiometry Null output error, ( $R_{VON}$ )          | Operating voltage range relative to 5V |                    |              | ±1.5 |              | %     |
| Ratiometry Sensitivity error, ( $R_{SEN}$ )          | Operating voltage range relative to 5V |                    |              | ±1.5 |              | %     |
| Linearity, ( $LIN$ )                                 | % of Span                              |                    |              | ±1.5 |              | %     |
| Sensitivity  | A                                      | Standard, (T type) | 1.38 (1.425) | 1.5  | 1.62 (1.575) | mV/G  |
|  | B                                      | Standard, (T type) | 1.84 (1.9)   | 2.0  | 2.16 (2.1)   | mV/G  |
|  | C                                      | Standard, (T type) | 2.3 (2.375)  | 2.5  | 2.7 (2.625)  | mV/G  |
|  | D                                      | Standard, (T type) | 2.76 (2.85)  | 3.0  | 3.24 (3.15)  | mV/G  |
| Sensitivity Temperature Coefficient, ( $TC_{Sens}$ ) | Ta=125°C, relative to Sens@25°C        |                    |              | ±0.1 |              | %/°C  |
| Delta null voltage, ( $\Delta V_{ON}$ )              | Ta=125°C, relative to $V_{ON}$ @25°C   |                    |              | 20   |              | mV    |
| Electro-Static Discharge                             | HBM                                    |                    | 4            |      |              | KV    |

### Typical application circuit

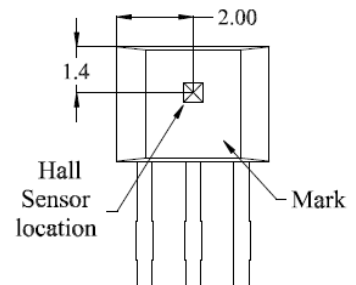


**Sensor Location, Package Dimension and Marking**

**UA package**



**Hall Chip location**

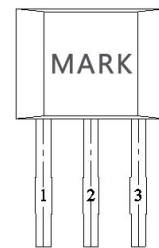


**NOTES:**

1. Controlling dimension: mm
2. Leads must be free of flash and plating voids
3. Do not bend leads within 1 mm of lead to package interface.
4. PINOUT:  
Pin 1 VCC  
Pin 2 GND  
Pin 3 Output
5. 59XX, 1st X = A/B/C/D  
2nd -4th X = Date Code

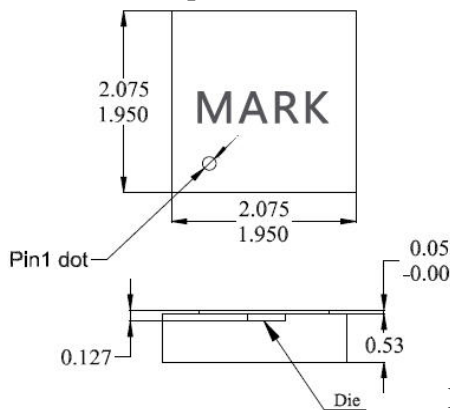
**Output Pin Assignment**

(Top view)



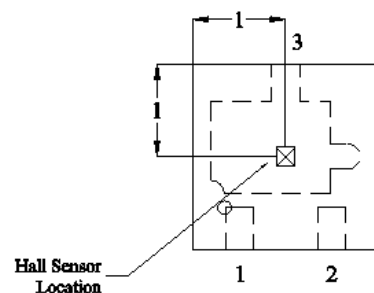
**SQ Package**

(Top View)



**Hall Plate Chip Location**

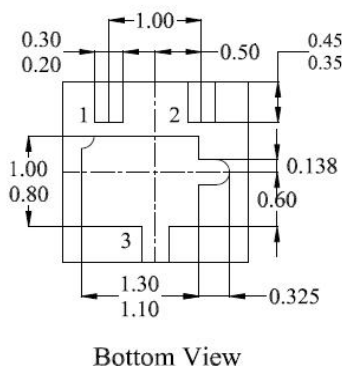
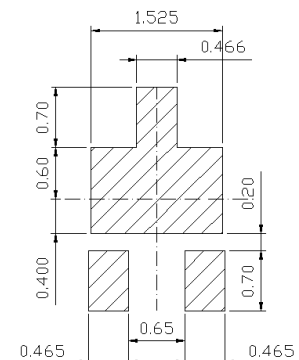
(Top view)



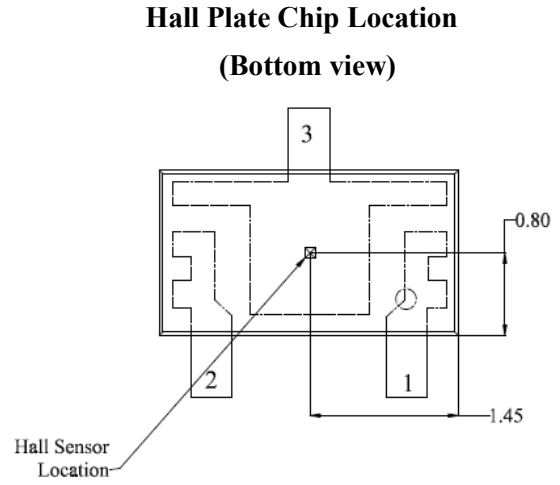
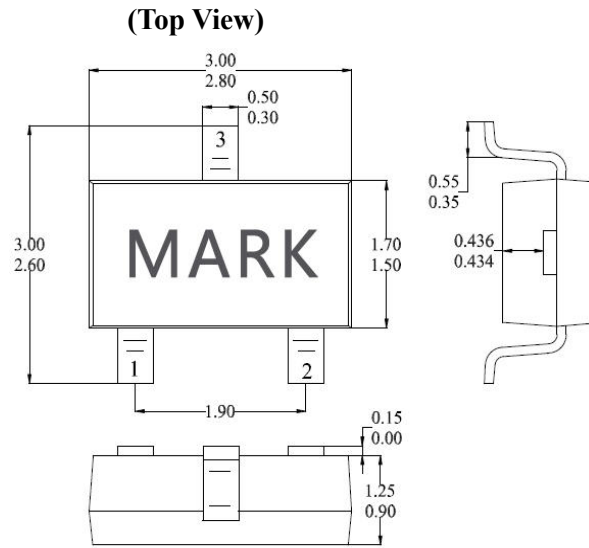
**NOTES:**

1. PINOUT (See Top View at left)  
Pin 1 VDD  
Pin 2 Output  
Pin 3 GND
2. Controlling dimension: mm;
3. Chip rubbing will be 10mil maximum;
4. Chip must be in PKG. center.
5. 59X, X=A/B/C/D
6. XX= Date code

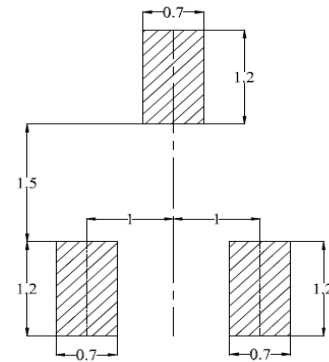
**(For reference only) Land Pattern**



**SO Package**



**(For reference only) Land Pattern**



**NOTES:**

1. PINOUT (See Top View at left :)  
 Pin 1  $V_{DD}$   
 Pin 2 Output  
 Pin 3 GND
2. Controlling dimension: mm
3. Lead thickness after solder plating will be 0.254mm maximum
4. Chip must be in PKG. center.
5. 59X, X= A/B/C/D

### Warm reminder

1. Hall is a sensitive device. Please take electrostatic protection measures during use and storage.

2. During the installation process, the Hall should try to avoid applying mechanical stress to the Hall body. If the pins need to be bent, please operate at a distance of 3 mm from the root of the lead.

3. Recommended soldering temperature: soldering with electric soldering iron, the recommended temperature is 350°C, the longest is 5 seconds.

Wave soldering: The recommended maximum temperature is 260°C, the longest is 3 seconds

Infrared reflow soldering: recommended maximum 245°C, maximum 10 seconds

4. It is not recommended to exceed the parameters in the data sheet. Although the Hall will work normally under the limit parameters, it may cause damage to the Hall or the actual product under extreme conditions for a long time. In order to ensure the normal operation of the Hall and the product For safety and stability, please use it within the scope of the data sheet.

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Or for additional information contact Huaxin Direct:  
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