

## Low Power Linear Hall Sensor

XL47

### Features

- Specially optimized for unipolar applications of magnetic axis keyboards
- Widelinear range: 0.1V~2.22V@ $V_{DD}=3.3V$
- Low Operation Current: 0.7mA
- Wide Operating Voltage Range: 2.7V~5.5V
- Zero-point (No magnetic field) output voltage: 2.22V@ $V_{DD}=3.3V$
- Sensitivity: 1.99mV/Gs@ $V_{DD}=3.3V$
- Linearity:  $\pm 1\%$
- Low noise output without external capacitor filtering
- Temperature Grade 2:  $-40^{\circ}C$  to  $105^{\circ}C$   
Ambient Operating Temperature Range
- Device HBM ESD Classification Level Class3A
- SOT23-3 package

### Applications

- Magnetic Axis Keyboards

### General Description

The XL47 is a linear Hall-effect sensor specifically engineered for magnetic axis keyboards, featuring low power consumption, wide operating voltage, and extended temperature range, with an output voltage varies proportionally with the strength of the induced magnetic field, and its linear output voltage range follows the variation of the power supply voltage. The XL47's typical operating voltage is 3.3V, the default zero-point output voltage (without magnetic field) at  $V_{DD}=3.3V$  is 2.22V, with low operation current, the operating temperature range supports  $-40^{\circ}C \sim 105^{\circ}C$ .

The XL47 integrates high precision current source, temperature compensation module, Hall array, amplifier, driver module and other circuit modules, which provides high linearity and strong immunity to electromagnetic interference over the full voltage range and full temperature range.

### Typical application schematic

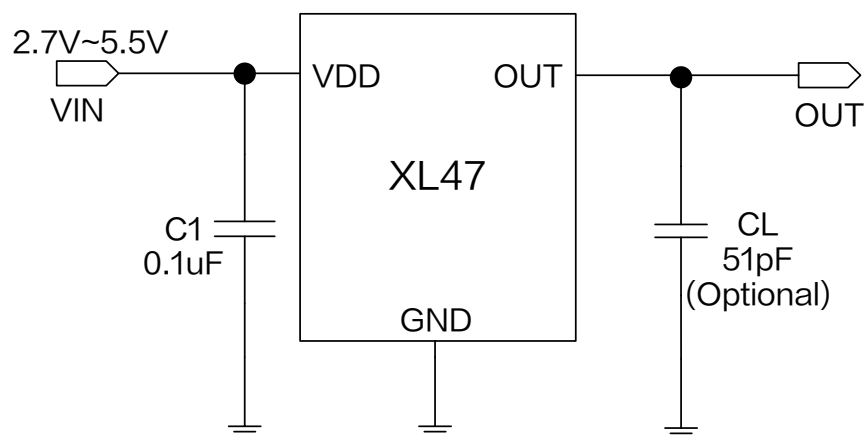


Figure1.XL47 Typical application schematic

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#### Pin Configurations

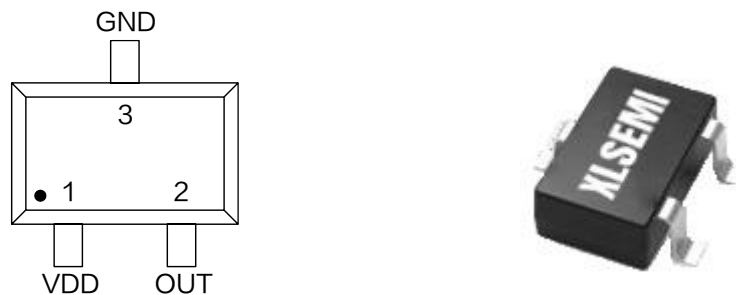


Figure2.Pin Configuration of XL47

Table 1.Pin Description

| Pin Number | Pin Name | Description                                                          |
|------------|----------|----------------------------------------------------------------------|
| 1          | VDD      | Supply Voltage Input Pin. XL47 operates from 2.7V to 5.5V DC voltage |
| 2          | OUT      | Output Pin                                                           |
| 3          | GND      | Ground pin                                                           |

#### Ordering Information

| Order Information | Marking ID | Package Type | Eco Plan  | Packing Type Supplied As |
|-------------------|------------|--------------|-----------|--------------------------|
| XL47              | XL47       | SOT23-3      | RoHS & HF | 3000 Units Per Reel      |

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### Function Block

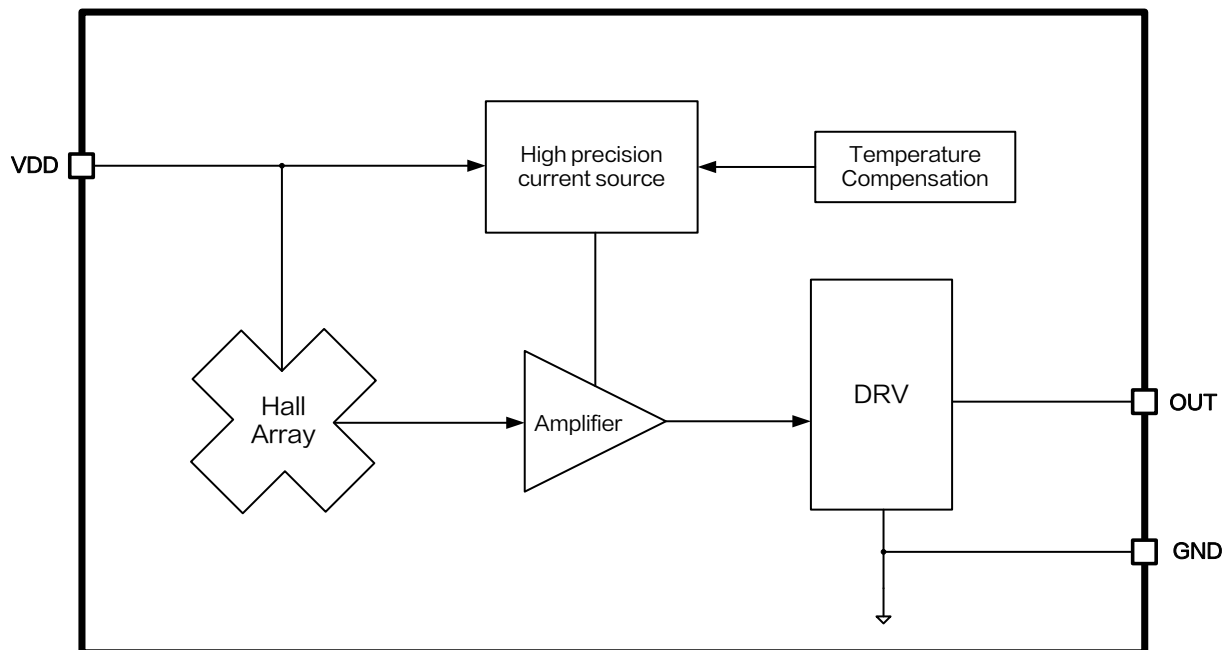


Figure3.Function Block Diagram of XL47

### Absolute Maximum Ratings (Note 1)

| Parameter                                                                    | Symbol     | Value      | Unit |
|------------------------------------------------------------------------------|------------|------------|------|
| Input Pin Voltage                                                            | $V_{DD}$   | -0.3 ~ 6.5 | V    |
| Output Pin Voltage                                                           | $V_{OUT}$  | -0.3 ~ 6.5 | V    |
| Thermal Resistance (SOT23-3)<br>(Junction to Ambient, No Heatsink, Free Air) | $R_{JA}$   | 200        | °C/W |
| Operating Temperature                                                        | $T_A$      | -40 ~ 105  | °C   |
| Operating Junction Temperature                                               | $T_J$      | -40 ~ 125  | °C   |
| Storage Temperature                                                          | $T_{STG}$  | -65 ~ 150  | °C   |
| Lead Temperature (Soldering, 10 sec)                                         | $T_{LEAD}$ | 260        | °C   |
| ESD (HBM)                                                                    | —          | ≥6500      | V    |

**Note 1:** Stresses greater than those listed under Maximum Ratings may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operation is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

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#### XL47 Electrical Characteristics (Note 2)

$T_A = 25^\circ\text{C}$ ,  $V_{DD} = 3.3\text{V}$ , system parameters test circuit figure1, unless otherwise specified.

| Parameters             | Symbol       | Test Condition                                 | Min.  | Typ. | Max.  | Unit          |
|------------------------|--------------|------------------------------------------------|-------|------|-------|---------------|
| Operation Voltage      | $V_{DD}$     | –                                              | 2.7   | 3.3  | 5.5   | V             |
| Operation Current      | $I_{DD}$     | –                                              | 0.5   | 0.7  | 1.0   | mA            |
| Output Load Resistance | $R_L$        | $B = -1200\text{Gs}$                           | 20    | –    | –     | $k\Omega$     |
| Output Voltage Range   | $V_{OUT(H)}$ | $B = +1200\text{Gs}$<br>$V_{DD} = 3.3\text{V}$ | 2.45  | 2.5  | –     | V             |
|                        |              | $B = +1200\text{Gs}$<br>$V_{DD} = 5.0\text{V}$ | 4.15  | 4.2  | –     | V             |
|                        | $V_{OUT(L)}$ | $B = -1200\text{Gs}$<br>$V_{DD} = 3.3\text{V}$ | –     | 0.1  | 0.15  | V             |
|                        |              | $B = -1200\text{Gs}$<br>$V_{DD} = 5.0\text{V}$ | –     | 0.1  | 0.15  | V             |
| Static Output Voltage  | $V_{OUT(Q)}$ | $B = 0\text{Gs}, V_{DD} = 3.3\text{V}$         | 2.086 | 2.22 | 2.354 | V             |
|                        |              | $B = 0\text{Gs}, V_{DD} = 5.0\text{V}$         | –     | 3.18 | –     | V             |
| Linearity              | $Lin$        | –                                              | –1    | –    | 1     | %             |
| Output Settling Time   | –            | $B = 0\text{Gs}$                               | –     | 1.5  | –     | $\mu\text{s}$ |
| Output Noise           | –            | Bandwidth=<br>10Hz to 10kHz                    | –     | 0.7  | –     | mV            |

#### Note 2:

(1) Linearity is the degree to which the static characteristic curve between the input and output quantities deviates from a straight line.

(2) The output settling time is the time interval from when the output voltage begins to establish until it stabilizes at 90% of the steady-state output voltage.

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#### XL47 Magnetic Characteristics (Note 3)

| Parameters  | Symbol | Test Condition | Min.  | Typ. | Max.  | Unit  |
|-------------|--------|----------------|-------|------|-------|-------|
| Sensitivity | Sens   | $V_{DD}=3.3V$  | 1.850 | 1.99 | 2.130 | mV/Gs |
|             |        | $V_{DD}=5.0V$  | –     | 4.58 | –     | mV/Gs |

#### Note 3:

(1) The magnetic South Pole (S) is defined as the positive magnetic field. The sensitivity in the table corresponds to measurements taken with the magnetic field perpendicular to the back side of the chip's marking surface.

(2) XL47 is optimized for unipolar applications of magnetic axis keyboards. When  $V_{DD}=3.3V$ , the sensitivity corresponding to output voltage is in the linear range of 0.1V~2.22V as shown in the table. When  $V_{DD}=5.0V$ , the sensitivity corresponding to output voltage is in the linear range of 0.1V~3.18V as shown in the table.

### Output Characteristics

$T_A = 25^\circ\text{C}$ , system parameters test circuit figure1, unless otherwise specified.

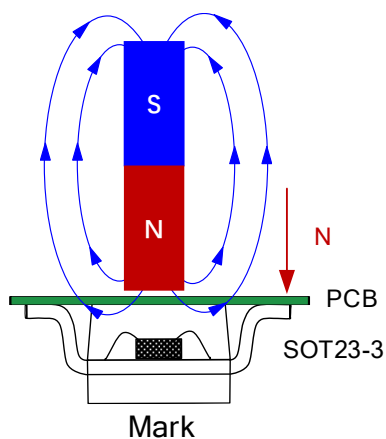


Figure4.Application diagram of XL47

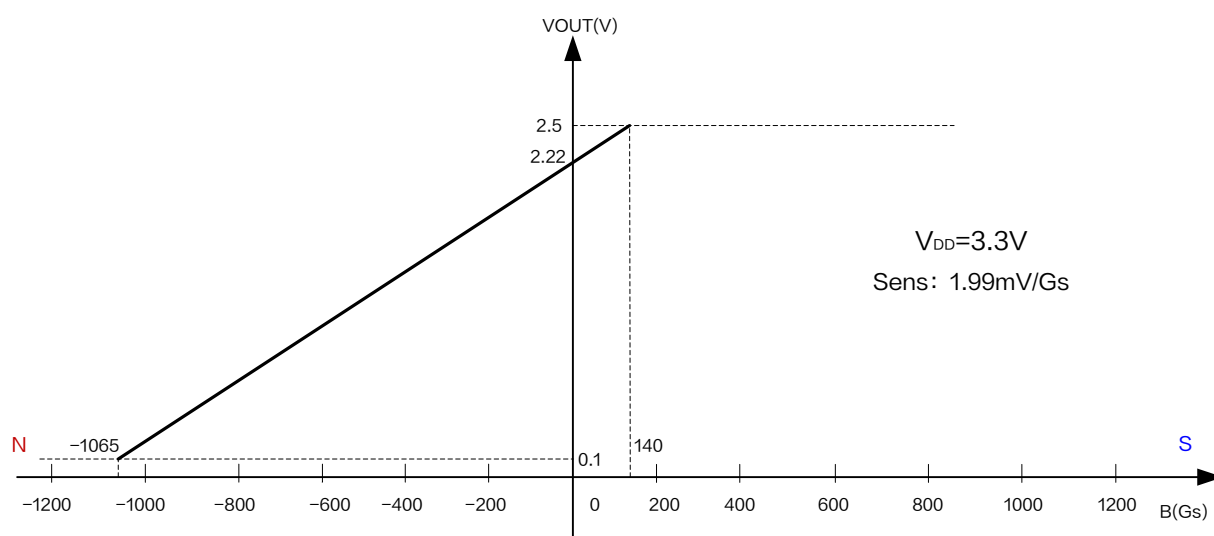


Figure5.XL47 Output characteristic curve ( $V_{DD} = 3.3\text{V}$ )

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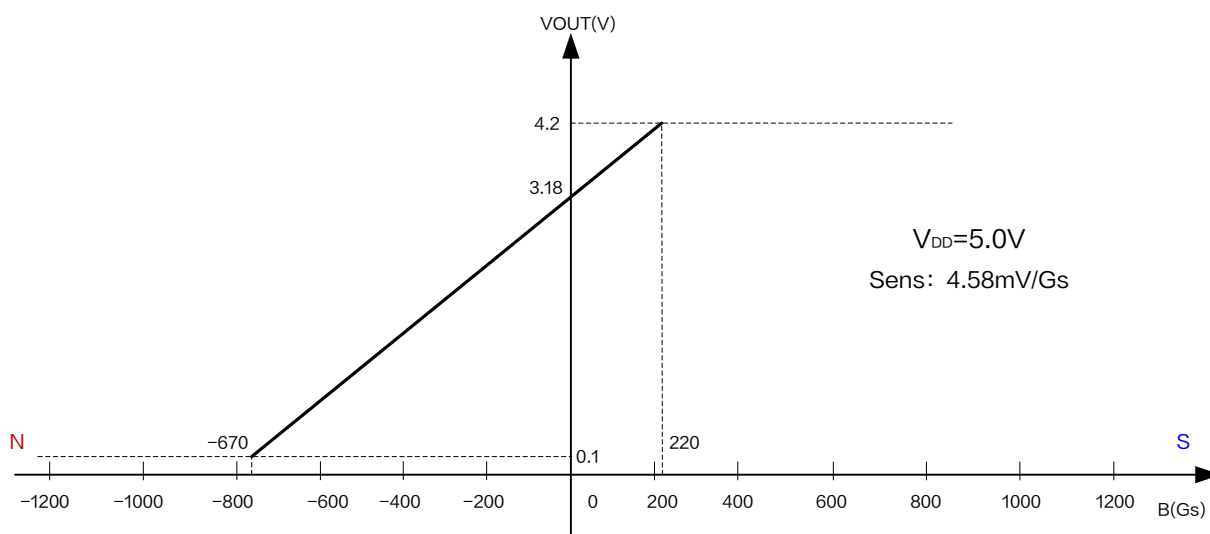


Figure6.XL47 Output characteristic curve ( $V_{DD} = 5.0V$ )

**Note 4:** At room temperature, when  $V_{DD}=3.3V$ , the linear range of chip unipolar is 0.1V~2.22V, when  $V_{DD}=5.0V$ , the linear range of chip unipolar is 0.1V~3.18V.

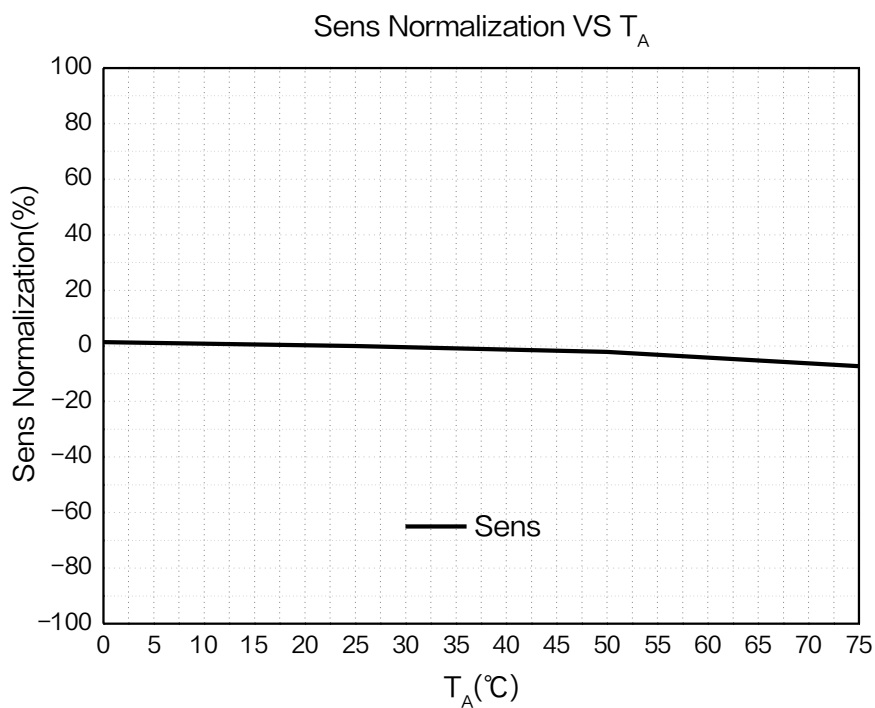


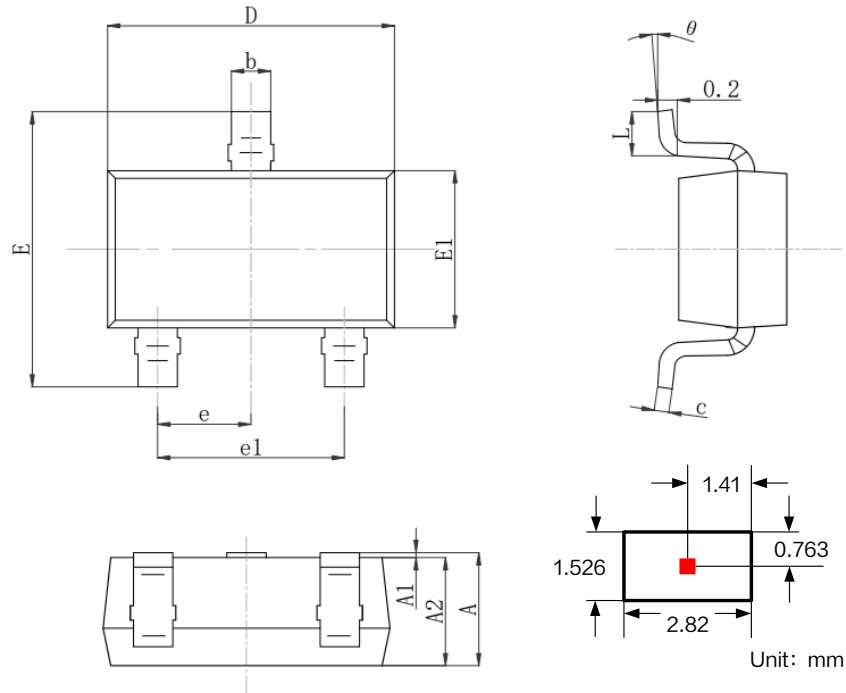
Figure7.Sensitivity versus temperature curve of XL47 ( $V_{DD} = 3.3V$ )

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### Package Information

#### SOT23-3



| Symbol   | Dimensions In Millimeters |       | Dimensions In Inches |       |
|----------|---------------------------|-------|----------------------|-------|
|          | Min.                      | Max.  | Min.                 | Max.  |
| A        | 1.000                     | 1.350 | 0.039                | 0.053 |
| A1       | 0.000                     | 0.150 | 0.000                | 0.006 |
| A2       | 1.000                     | 1.200 | 0.039                | 0.047 |
| b        | 0.300                     | 0.500 | 0.012                | 0.020 |
| c        | 0.100                     | 0.200 | 0.004                | 0.008 |
| D        | 2.820                     | 3.050 | 0.111                | 0.120 |
| E1       | 1.500                     | 1.726 | 0.059                | 0.068 |
| E        | 2.600                     | 3.100 | 0.102                | 0.122 |
| e        | 0.950 REF                 |       | 0.037 REF            |       |
| e1       | 1.800                     | 2.000 | 0.071                | 0.079 |
| L        | 0.300                     | 0.600 | 0.012                | 0.024 |
| $\theta$ | 0°                        | 8°    | 0°                   | 8°    |

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