IC Sensors
Ultra-Small Hall ICs
for magnetic switch applications

Selection Guide
Hall Effect Switches from ROHM Semiconductor

The demands for extended battery operation, greater reliability and increased features are driving the designs of mobile phones, notebook computers, video cameras, navigation systems and game controllers to use smaller, higher performance components.

Ultra-small, hall effect, non-contact switches from ROHM Electronics can simplify and enhance your designs while offering the benefits of high-reliability and low power consumption. These high performance devices are the ideal choice for a range of switch applications:

- Portable phone or PDA in or out of its carrying case
- Slide-open or closed on cell phone or camera
- Flip phone or laptop cover open or closed
- Cell phone or tablet PC screen orientation
- Track wheel position on MP3 players, toys and games

ROHM’s Hall-effect magnetic switches are fully integrated ICs that pack all of the required functions into a single chip.

ROHM’s advanced packaging options include the industry's smallest BGA chip-scale package as well as low-profile, ultra-small SMT package.

ROHM’s Hall ICs integrate both the Hall element and detection circuit into a single chip. This, combined with the wafer level CSP, decreases mounting space significantly, contributing to end-product miniaturization.

Rohm’s Hall IC detects and converts magnetic fields emanating from magnets into electronic signals (voltages). The Hall element is integrated into a single chip.

High sensitivity for precise magnetic field detection

CMOS output eliminates the need for an external resistor, resulting in lower power consumption

Ultra-small package contributes increased space savings

Low current consumption due to intermittent operation

High accuracy offset cancellation for high efficiency
Hall Effect Switches
from ROHM Semiconductor

Designed for Performance and Reliability

- Single-chip IC with built-in Hall element
  - Eliminates wire-bonding reliability problems
- Low current consumption with CMOS output
  - Eliminates the need for external pull-up resistor
- Intermittent operation for longer battery life
  - Pulsed detection reduces average power consumption
- High detection sensitivity
  - Integrated dynamic offset cancellation yields high performance in small package
- -40°C to +85°C Operating Range
  - Assures worry-free operation under extreme conditions
- 8 kV ESD Withstand
  - High reliability in real-world conditions

Selections for Every Application

Unipolar Operation
- These devices detect the presence of either a N-pole or S-pole magnetic field of sufficient strength, but not both. They offer the lowest power consumption. The output switches state when the magnetic field is removed.

Omnipolar Operation
- These devices detect the presence of either a N-pole or S-pole magnetic field eliminating the need to orient the magnet for detection. This can simplify the manufacturing process. The trade-off is slightly higher power consumption.

Polarity Discrimination
- These devices feature dual outputs, one switches state in the presence of a N-pole magnetic field, the other in the presence of a S-pole. Both outputs revert to the alternative state when the field is removed. These devices are used to detect the combination of operation (open/closed) and position (front/back).

Bipolar Operation
- These devices change output state whenever a magnetic field of the opposite polarity is detected. The output remains fixed in its current state if no magnetic field is present. Applications are in jog wheel or track ball movement detection. They have higher sampling rates and power consumption.
Omnipolar Detection

The application of bipolar detection Hall ICs simplifies product design, assembly and maintenance. These devices can detect both S-pole and N-pole magnetic fields. Magnet management is simplified since the Hall IC will operate properly regardless of magnet orientation.

Polarity Discrimination

Omnipolar detection Hall ICs with built-in polarity discrimination add the capability of both detecting the position and the orientation of the magnet — important in applications where the display orientation of the device can be rotated.
Unipolar Detection

For the most cost-effective and lowest power implementation, unipolar detection Hall ICs provide the answer. The trade off comes from the need to assure proper magnet orientation in the production process.

- Type that outputs ‘Low’ upon detection of N-pole magnetic field

(BUS2003GUL, BUS2013HFV)

Bipolar (Latching) Detection

Bipolar (latching) Hall ICs add the capability of detecting the dynamic movement of devices like jog wheels or track balls. Two of these devices are typically used to detect CW and CCW movement.

- Output changes when magnetic field alternates between S-pole to N-pole

To detect direction of motion, multiple Hall ICs are used:
- 2 required to detect CW/CCW
- 4 required for Quadrature
**Omnipolar Detection Hall ICs**  
Detects both S-pole and N-pole magnetic fields and turns the output ON (active Low).

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Supply Voltage (V)</th>
<th>Operating Magnetic Flux Density (mT)</th>
<th>Hysteresis (mT)</th>
<th>Pulse Driving Cycle (mS)</th>
<th>Current Consumption (Typ.) (µA)</th>
<th>Output</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>BU52001GUL</td>
<td>2.40 - 3.3</td>
<td>±3.7</td>
<td>0.8</td>
<td>50</td>
<td>8.0</td>
<td>CMOS</td>
<td>VCSP50L1</td>
</tr>
<tr>
<td>BU52011HFV</td>
<td>1.65 - 3.3</td>
<td>±3.0</td>
<td>0.9</td>
<td>50</td>
<td>5.0</td>
<td>CMOS</td>
<td>HVSOF5</td>
</tr>
<tr>
<td>BU52015GUL*</td>
<td>1.65 - 3.3</td>
<td>±3.0</td>
<td>0.9</td>
<td>50</td>
<td>5.0</td>
<td>CMOS</td>
<td>VCSP50L1</td>
</tr>
</tbody>
</table>

*The BU52015GUL features reverse output.

**Polarity Discrimination Hall ICs**  
Features two outputs to discriminate between N-pole and S-pole detection.

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<th>Current Consumption (Typ.) (µA)</th>
<th>Output</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>BU52004GUL</td>
<td>2.40 - 3.3</td>
<td>±3.7</td>
<td>0.8</td>
<td>50</td>
<td>8.0</td>
<td>CMOS</td>
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<td>BU52014HFV</td>
<td>1.65 - 3.3</td>
<td>±3.0</td>
<td>0.9</td>
<td>50</td>
<td>5.0</td>
<td>CMOS</td>
<td>HVSOF5</td>
</tr>
</tbody>
</table>

**Key**
- Both S- and N-pole detection
- Both S- and N-pole detection with polarity discrimination output
- S-pole detection only
- N-pole detection only
- Chip Size Package type – thin and ultra-small
- Small surface-mount package
- Magnetic field detection output
- Magnetic field detection output (with reverse output)
- High accuracy offset cancel function built in for high sensitivity
- Intermittent operation for low-power consumption
- 8kV ESD resistance
- CMOS output
- Polarity discrimination output
- Low current consumption
- Wide operating temperature range of -40°C to +85°C
- Operating power supply voltage
## Unipolar Detection Hall ICs
Detects either N-pole or S-pole but not both.

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<th>Supply Voltage (V)</th>
<th>Operating Magnetic Flux Density (mT)</th>
<th>Hysteresis (mT)</th>
<th>Pulse Driving Cycle (mS)</th>
<th>Current Consumption (Typ.) (µA)</th>
<th>Output</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>BU52002GUL</td>
<td>2.40 - 3.3</td>
<td>3.7</td>
<td>0.8</td>
<td>50</td>
<td>6.5</td>
<td>CMOS</td>
<td>VCSP50L1</td>
</tr>
<tr>
<td>BU52003GUL</td>
<td>2.40 - 3.3</td>
<td>-3.7</td>
<td>0.8</td>
<td>50</td>
<td>6.5</td>
<td>CMOS</td>
<td>VCSP50L1</td>
</tr>
<tr>
<td>BU52012HFV</td>
<td>1.65 - 3.3</td>
<td>3.0</td>
<td>0.9</td>
<td>50</td>
<td>3.5</td>
<td>CMOS</td>
<td>HVSOF5</td>
</tr>
<tr>
<td>BU52013HFV</td>
<td>1.65 - 3.3</td>
<td>-3.0</td>
<td>0.9</td>
<td>50</td>
<td>3.5</td>
<td>CMOS</td>
<td>HVSOF5</td>
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### Bipolar (Latching) Detection Hall ICs
Features two outputs to discriminate between N-pole and S-pole detection.

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<th>Hysteresis (mT)</th>
<th>Pulse Driving Cycle (mS)</th>
<th>Current Consumption (Typ.) (µA)</th>
<th>Output</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>BU52040HFV</td>
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<td>±3.0</td>
<td>±6.0</td>
<td>500</td>
<td>300</td>
<td>CMOS</td>
<td>HVSOF5</td>
</tr>
<tr>
<td>BU52013GUL</td>
<td>S</td>
<td>8</td>
<td>1 OUT</td>
<td>High</td>
<td>CMOS</td>
<td>LOW</td>
<td>CMOS</td>
</tr>
</tbody>
</table>

### Key
Both S- and N-pole detection

Both S- and N-pole detection with polarity discrimination output

S-pole detection only

N-pole detection only

Chip Size Package type – thin and ultra-small

Small surface-mount package

Magnetic field detection output

Magnetic field detection output (with reverse output)

Both S- and N-pole outputs

High accuracy offset cancel function built in for high sensitivity

Intermittent operation for low-power consumption

8kV ESD resistance

### Order Guide
CMOS output

Polarity discrimination output

Low current consumption

Wide operating temperature range of -40C to +85C

Operating power supply voltage