MH253 Hall-effect sensor is a temperature stable, stress-resistant switch. Superior high-temperature performance is made possible through a dynamic offset cancellation that utilizes chopper-stabilization. This method reduces the offset voltage normally caused by device over molding, temperature dependencies, and thermal stress.

MH253 includes the following on a single silicon chip: voltage regulator, Hall voltage generator, small-signal amplifier, chopper stabilization, Schmitt trigger, open-drain output. Advanced CMOS wafer fabrication processing is used to take advantage of low-voltage requirements, component matching, very low input-offset errors, and small component geometries.

MH253 is rated for operation between the ambient temperatures –40°C and +85°C for the E temperature range. The four 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(0.55 mm nominal height), a miniature low-profile surface-mount package, while package UA is a three-lead ultra mini SIP for through-hole mounting.

The package type is in a Halogen Free version was verified by third party Lab.

Features and Benefits

- CMOS Hall IC Technology
- Solid-State Reliability much better than reed switch
- Omni polar output switches with absolute value of North or South pole from magnet
- Low power consumption(2.6mA)
- High Sensitivity for reed switch replacement
- 100% tested at 125°C for K.
- Small Size
- ESD HBM ±4KV Min
- COST competitive

Applications

- Solid state switch
- Lid close sensor for power supply devices
- Magnet proximity sensor for reed switch replacement in high duty cycle applications.
- Safety Key on sporting equipment
- Revolution counter
- Speed sensor
- Position Sensor
- Rotation Sensor
- Safety Key
**MH253**  
High Sensitivity Omni-Polar Hall Effect Switch

**Ordering Information**

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Temperature Suffix</th>
<th>Package Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>MH253KUA</td>
<td>K(-40°C to +125°C)</td>
<td>UA (TO-92S)</td>
</tr>
<tr>
<td>MH253EUA</td>
<td>E(-40°C to +85°C)</td>
<td>UA (TO-92S)</td>
</tr>
<tr>
<td>MH253ESO</td>
<td>E(-40°C to +85°C)</td>
<td>SO (SOT-23)</td>
</tr>
<tr>
<td>MH253ESQ</td>
<td>E(-40°C to +85°C)</td>
<td>SQ (QFN2020-3)</td>
</tr>
</tbody>
</table>

Custom sensitivity selection is available by MST sorting technology

**Functional Diagram**

---

*Note: Static sensitive device; please observe ESD precautions. Reverse $V_{DD}$ protection is not included. For reverse voltage protection, a 100Ω resistor in series with $V_{DD}$ is recommended.*
**Absolute Maximum Ratings**  (Tz=+25˚C)

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Values</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage,  (VDD)</td>
<td>7</td>
<td>V</td>
</tr>
<tr>
<td>Output Voltage,  (VOUT)</td>
<td>6</td>
<td>V</td>
</tr>
<tr>
<td>Reverse voltage,  (VDD)  (VOUT)</td>
<td>-0.3</td>
<td>V</td>
</tr>
<tr>
<td>Magnetic flux density</td>
<td>Unlimited</td>
<td>Gauss</td>
</tr>
<tr>
<td>Output current,  (Iout)</td>
<td>25</td>
<td>mA</td>
</tr>
<tr>
<td>Operating Temperature Range,  (Ta)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>“E” version</td>
<td>-40 to +85</td>
<td>°C</td>
</tr>
<tr>
<td>“K” version</td>
<td>-40 to +125</td>
<td>°C</td>
</tr>
<tr>
<td>Storage temperature range,  (Ts)</td>
<td>-55 to +150</td>
<td>°C</td>
</tr>
<tr>
<td>Maximum Junction Temp,  (Tj)</td>
<td>150</td>
<td>°C</td>
</tr>
<tr>
<td>Thermal Resistance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(θja)  UA / SO / SQ</td>
<td>206 / 543 / 543</td>
<td>°C/W</td>
</tr>
<tr>
<td>(θjc)  UA / SO / SQ</td>
<td>148 / 410 / 410</td>
<td>°C/W</td>
</tr>
<tr>
<td>Package Power Dissipation,  (PD)</td>
<td>606 / 230 / 230</td>
<td>mW</td>
</tr>
</tbody>
</table>

Note: Exceeding the absolute maximum ratings may cause permanent damage to the device. Exposure to absolute Maximum-rated conditions for extended periods may affect device reliability.

**Electrical Specifications**

DC Operating Parameters  Ta=+25 ˚C,  VDD=5.0V

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Test Conditions</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply Voltage,  (VDD)</td>
<td>Operating</td>
<td>2.5</td>
<td>6</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Supply Current,  (Idd)</td>
<td>Average</td>
<td>2.6</td>
<td>6.0</td>
<td>mA</td>
<td></td>
</tr>
<tr>
<td>Output Low Voltage,  (VDSON)</td>
<td>IOUT=10mA</td>
<td></td>
<td>400</td>
<td>mV</td>
<td></td>
</tr>
<tr>
<td>Output Leakage Current,  (Ioff)</td>
<td>Ioff &gt;BRP,  VOUT = 5V</td>
<td></td>
<td>10</td>
<td>uA</td>
<td></td>
</tr>
<tr>
<td>Output Rise Time,  (Tr)</td>
<td>RL=10k  , CL=20pF</td>
<td>0.45</td>
<td></td>
<td>uS</td>
<td></td>
</tr>
<tr>
<td>Output Fall Time,  (Tf)</td>
<td>RL=10k  , CL=20pF</td>
<td>0.45</td>
<td></td>
<td>uS</td>
<td></td>
</tr>
<tr>
<td>Electro-Static Discharge</td>
<td>HBM</td>
<td>4</td>
<td></td>
<td>KV</td>
<td></td>
</tr>
</tbody>
</table>

**Typical Application circuit**

```
C1 : 10nF
C2 : 100pF
R1 : 10K  
```
MH253
High Sensitivity Omni-Polar Hall Effect Switch

MH253 UA/SQ Magnetic Specifications
DC operating parameters: \( T_A = 25^\circ \text{C}, V_{DD}=5.0 \text{ VDC} \) (unless otherwise specified).

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Test Conditions</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Point</td>
<td>( B_{OPS} )</td>
<td>S pole to branded side, ( B &gt; BOP ), Vout On</td>
<td>30</td>
<td>60</td>
<td></td>
<td>Gauss</td>
</tr>
<tr>
<td></td>
<td>( B_{OPN} )</td>
<td>N pole to branded side, ( B &gt; BOP ), Vout On</td>
<td>-60</td>
<td>-30</td>
<td></td>
<td>Gauss</td>
</tr>
<tr>
<td>Release Point</td>
<td>( B_{RPS} )</td>
<td>S pole to branded side, ( B &lt; BRP ), Vout Off</td>
<td>5</td>
<td>25</td>
<td></td>
<td>Gauss</td>
</tr>
<tr>
<td></td>
<td>( B_{RPN} )</td>
<td>N pole to branded side, ( B &lt; BRP ), Vout Off</td>
<td>-25</td>
<td>-5</td>
<td></td>
<td>Gauss</td>
</tr>
<tr>
<td>Hysteresis</td>
<td>( B_{HYS} )</td>
<td>(</td>
<td>BOPx - BRPx</td>
<td>)</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

MH253 Magnetic Specifications
DC Operating Parameters: \( T_A = 25^\circ \text{C}, V_{DD}=5.0 \text{ V} \)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Test Conditions</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Point</td>
<td>( B_{OPS} )</td>
<td>N pole to branded side, ( B &gt; BOP ), Vout On</td>
<td>30</td>
<td>60</td>
<td></td>
<td>Gauss</td>
</tr>
<tr>
<td></td>
<td>( B_{OPN} )</td>
<td>S pole to branded side, ( B &gt; BOP ), Vout On</td>
<td>-60</td>
<td>-30</td>
<td></td>
<td>Gauss</td>
</tr>
<tr>
<td>Release Point</td>
<td>( B_{RPS} )</td>
<td>S pole to branded side, ( B &lt; BRP ), Vout Off</td>
<td>5</td>
<td>25</td>
<td></td>
<td>Gauss</td>
</tr>
<tr>
<td></td>
<td>( B_{RPN} )</td>
<td>N pole to branded side, ( B &lt; BRP ), Vout Off</td>
<td>-25</td>
<td>-5</td>
<td></td>
<td>Gauss</td>
</tr>
<tr>
<td>Hysteresis</td>
<td>( B_{HYS} )</td>
<td></td>
<td>5</td>
<td></td>
<td></td>
<td>Gauss</td>
</tr>
</tbody>
</table>

MH253 UA/SO/SQ Output Behavior versus Magnetic Polar
DC Operating Parameters: \( T_A = -40 \text{ to } 125^\circ \text{C}, V_{DD}=2.5 \text{ to } 6 \text{ V} \)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Test condition</th>
<th>OUT(UA,SO,ST,SQ)</th>
</tr>
</thead>
<tbody>
<tr>
<td>South pole</td>
<td>( B &lt; Bop \ [-(-60)~(-5)] )</td>
<td>Low</td>
</tr>
<tr>
<td>Null or weak magnetic field</td>
<td>( B=0 ) or ( B &lt; BRP )</td>
<td>Open(Pull-up Voltage)</td>
</tr>
<tr>
<td>North pole</td>
<td>( B &gt; Bop \ [60~5] )</td>
<td>Low</td>
</tr>
</tbody>
</table>

![SO package](image1)
![SQ Package](image2)
![UA Package](image3)

![Graph](image4)
Performance Graphs

Typical Supply Voltage ($V_{DD}$) Versus Flux Density

![Graph: Typical Supply Voltage ($V_{DD}$) Versus Flux Density](image)

Typical Temperature ($T_A$) Versus Flux Density

![Graph: Typical Temperature ($T_A$) Versus Flux Density](image)

Typical Temperature ($T_A$) Versus Supply Current ($I_{DD}$)

![Graph: Typical Temperature ($T_A$) Versus Supply Current ($I_{DD}$)](image)

Typical Supply Voltage ($V_{DD}$) Versus Supply Current ($I_{DD}$)

![Graph: Typical Supply Voltage ($V_{DD}$) Versus Supply Current ($I_{DD}$)](image)

Typical Supply Voltage ($V_{DD}$) Versus Output Voltage ($V_{DSON}$)

![Graph: Typical Supply Voltage ($V_{DD}$) Versus Output Voltage ($V_{DSON}$)](image)

Typical Temperature ($T_A$) Versus Output Voltage ($V_{DSON}$)

![Graph: Typical Temperature ($T_A$) Versus Output Voltage ($V_{DSON}$)](image)

Typical Supply Voltage ($V_{DD}$) Versus Output Saturation Voltage ($V_{DSON}$)

![Graph: Typical Supply Voltage ($V_{DD}$) Versus Output Saturation Voltage ($V_{DSON}$)](image)

Typical Temperature ($T_A$) Versus Output Saturation Voltage ($V_{DSON}$)

![Graph: Typical Temperature ($T_A$) Versus Output Saturation Voltage ($V_{DSON}$)](image)
**MH253**  
High Sensitivity Omni-Polar Hall Effect Switch

### Package Power Dissipation

The power dissipation of the Package is a function of the pad size. This can vary from the minimum pad size for soldering to a pad size given for maximum power dissipation. Power dissipation for a surface mount device is determined by $T_{J(max)}$, the maximum rated junction temperature of the die, $R_{\theta JA}$, the thermal resistance from the device junction to ambient, and the operating temperature, $T_a$. Using the values provided on the data sheet for the package, $P_D$ can be calculated as follows:

$$P_D = \frac{T_{J(max)} - T_a}{R_{\theta JA}}$$

The values for the equation are found in the maximum ratings table on the data sheet. Substituting these values into the equation for an ambient temperature $T_a$ of 25°C, one can calculate the power dissipation of the device which in this case is 606 milliwatts.

$$P_D(UA) = \frac{150°C - 25°C}{206^\circ C/W} = 606mW$$

The 206°C/W for the UA package assumes the use of the recommended footprint on a glass epoxy printed circuit board to achieve a power dissipation of 606 milliwatts. There are other alternatives to achieving higher power dissipation from the Package. Another alternative would be to use a ceramic substrate or an aluminum core board such as Thermal Clad. Using a board material such as Thermal Clad, an aluminum core board, the power dissipation can be doubled using the same footprint.
MH253
High Sensitivity Omni-Polar Hall Effect Switch

Sensor Location, package dimension and marking

MH251 Package

**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 \( V_{DD} \)
   - Pin 2 \( GND \)
   - Pin 3 Output

SO Package

**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
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.

MH253    UA (TO-92S) Package Date Code

X    X    X
Year    Week

EX : 2013 Year_8 Week → 308

MH253    SO(SOT-23) / SQ(QFN2020-3) Package Date Code

X    X
Week Code
MH253
High Sensitivity Omni-Polar Hall Effect Switch

EX: 2013 Year_8 Week → QH

Sot-23 package Tape On Reel Dimension

NOTES:
1. Material: Conductive polystyrene;
2. DIM in mm;
3. 10 sprocket hole pitch cumulative tolerance ±0.2;
4. Camber not to exceed 1mm in 100mm;
5. Pocket position relative to sprocket hole measured as true position of pocket, not pocket hole;
**QFN2020-3 Tape On Reel Dimension**

**NOTES:**
1. Material: Conductive polystyrene;
2. DIM in mm;
3. 10 sprocket hole pitch cumulative tolerance ±0.2;
4. Camber not to exceed 1mm in 100mm;
5. Pocket position relative to sprocket hole measured as true position of pocket, not pocket hole;

**IR reflow curve**

**Lead Temperature**
(Soldering, +260°C/10 sec)

**Room Temperature**

**SECOND**
MH253
High Sensitivity Omni-Polar Hall Effect Switch

_UA Soldering Condition_

**Packing specification:**

<table>
<thead>
<tr>
<th>Package</th>
<th>Bag</th>
<th>Box</th>
<th>Carton</th>
</tr>
</thead>
<tbody>
<tr>
<td>TO-92S-3L</td>
<td>1,000pcs/bag</td>
<td>10bags /box</td>
<td>10 boxes/carton</td>
</tr>
<tr>
<td>SOT-23-3L</td>
<td>3,000pcs/reel</td>
<td>10 reels/box</td>
<td>2 boxes/carton</td>
</tr>
<tr>
<td>QFN2020-3</td>
<td>3,000pcs/reel</td>
<td>10 reels/box</td>
<td>2 boxes/carton</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Package</th>
<th>Weight</th>
<th>Package</th>
<th>Weight</th>
<th>Package</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>TO-92S-3L</td>
<td>0.11kg</td>
<td>SOT-23-3L</td>
<td>0.18kg</td>
<td>QFN2020-3</td>
<td>0.13kg</td>
</tr>
<tr>
<td>1000pcs/bag</td>
<td>1.24kg</td>
<td>3000pcs/reel</td>
<td>1.99kg</td>
<td>10 reels/box</td>
<td>1.40kg</td>
</tr>
<tr>
<td>10 bags/box</td>
<td>12.57kg</td>
<td>2 boxes/carton</td>
<td>4.9kg</td>
<td>2 boxes/carton</td>
<td>3.70kg</td>
</tr>
</tbody>
</table>
**Inner box label** : Size: 3.4cm*6.4cm
Bag and inner box Halogen Free Label

![Image of inner box label]

**Carton label** : Size: 5.6 cm * 9.8 cm
Bag and inner box Halogen Free Label

![Image of carton label]

**Combined lots:**
When combining lots, one reel could have two D/C and no more than two DC. One carton could have two devices, no more than two.