Features and Benefits

- Differential Hall sensor
- Low consumption
- Excellent repeatability performance
- Large airgap range
- Large supply voltage range
- Distance between Hall plates: 2.25 mm

Applications

- Crankshaft sensor
- Speed sensor

Ordering Code

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>MLX90254</td>
<td>L</td>
<td>VA</td>
<td>BBA-000</td>
<td>BU</td>
</tr>
</tbody>
</table>

Legend:

Temperature Code: L for Temperature Range -40°C to 150°C
Package Code: VA for Plastic single line
Packing Form: BU for Bulk

Ordering example: MLX90254LVA-BBA-000-BU
1. Functional Diagram

Pin 1 – Not used
Pin 2 – Vdd (Supply)
Pin 3 – Vss (Ground)
Pin 4 - Output

2. Description

The MLX90254 is a Differential Dynamic Hall Effect Sensor which has been developed for automotive crankshaft and ABS (anti-lock brake system) applications. The IC, combined with a magnet placed at his back, offers speed and position sensing of ferromagnetic tooth-wheels in dynamic operation (non zero speed). Its low hysteresis enables it to operate over a wide range of air gaps from -40°C to 150°C.

The use of two Hall cells makes the operation sensitive to a rotation of the IC around its normal axis.

The output structure is an Open-Drain NMOS transistor with a capability of 25 mA under 24V and protected against short-circuits. The IC is packaged in 4-SIP VA.
Table of CONTENTS

FEATURES AND BENEFITS ....................................................................................................................... 1
APPLICATIONS ............................................................................................................................................ 1
1. FUNCTIONAL DIAGRAM ...................................................................................................................... 2
2. DESCRIPTION ....................................................................................................................................... 2
3. GLOSSARY OF TERMS ....................................................................................................................... 4
4. ABSOLUTE MAXIMUM RATINGS ....................................................................................................... 4
5. MLX90254 ELECTRICAL SPECIFICATIONS .................................................................................... 5
6. MLX90254 SENSOR SPECIFIC SPECIFICATIONS .......................................................................... 6
7. GENERAL DESCRIPTION .................................................................................................................... 6
8. PERFORMANCE GRAPHS ................................................................................................................... 7
9. STANDARD INFORMATION REGARDING MANUFACTURABILITY OF MELEXIS PRODUCTS WITH DIFFERENT SOLDERING PROCESSES .......................................................................................... 8
10. ESD PRECAUTIONS .......................................................................................................................... 8
11. PACKAGE INFORMATION .................................................................................................................. 9
12. DISCLAIMER ....................................................................................................................................... 10
3. Glossary of Terms

1 mT = 10 Gauss: Flux density units.

Pre-induction: the pre-induction is the magnetic field induced by the back bias magnet.

Operating point: the value of the differential flux density when the transistor output turns ON.

Release point: the value of the differential flux density when the transistor output turns OFF.

Margin: the flux density of the magnetic field has to be higher or lower than the margin value to enable the next toggling of the output.

4. Absolute Maximum Ratings

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply Voltage, $V_{DD}$</td>
<td>24 V</td>
</tr>
<tr>
<td>Reverse Voltage Protection</td>
<td>-0.3 V</td>
</tr>
<tr>
<td>Output Current, $I_{OUT}$</td>
<td>25 mA</td>
</tr>
<tr>
<td>Output Short-Circuit Current</td>
<td>150 mA</td>
</tr>
<tr>
<td>Output Voltage</td>
<td>24 V</td>
</tr>
<tr>
<td>Operating Temperature Range, $T_A$</td>
<td>-40 °C to 150°C</td>
</tr>
<tr>
<td>Storage Temperature Range, $T_S$</td>
<td>-55 °C to 165°C</td>
</tr>
<tr>
<td>Maximum Junction Temperature</td>
<td>175 °C</td>
</tr>
<tr>
<td>Magnetic Flux Density</td>
<td>Infinite</td>
</tr>
</tbody>
</table>

Exceeding the absolute maximum ratings may cause permanent damage. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
5. **MLX90254 Electrical Specifications**

DC Operating Parameters $T_A = -40^\circ\text{C}$ to $150^\circ\text{C}$, $V_{DD} = 4\text{V}$ to $24\text{V}$ (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>Supply Voltage</td>
<td>Vs</td>
<td></td>
<td>4</td>
<td>12</td>
<td>24</td>
<td>V</td>
</tr>
<tr>
<td>Supply Current (1)</td>
<td>Is</td>
<td></td>
<td>5</td>
<td>8.5</td>
<td>12</td>
<td>mA</td>
</tr>
<tr>
<td>Output Voltage</td>
<td>Vout</td>
<td>Output state: OFF</td>
<td></td>
<td></td>
<td>24</td>
<td>V</td>
</tr>
<tr>
<td>Output DC Current</td>
<td>Iout</td>
<td>Vout &lt; 1V</td>
<td>25</td>
<td></td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>Output Saturation Voltage</td>
<td>Vsat</td>
<td>Output state: ON Iout=25 mA</td>
<td>500</td>
<td></td>
<td></td>
<td>mV</td>
</tr>
<tr>
<td>Output Short-Circuit Current</td>
<td>Iscprot</td>
<td>Output state: ON Vout &gt; 2V</td>
<td>10</td>
<td>45</td>
<td>70</td>
<td>mA</td>
</tr>
<tr>
<td>Output Leakage Current</td>
<td>Ileak</td>
<td>Output state: OFF</td>
<td>10</td>
<td></td>
<td></td>
<td>µA</td>
</tr>
<tr>
<td>Output Rise Time</td>
<td>Tr</td>
<td>Vout = 12 V Rpull-up = 600 Ω No Load Capacitor</td>
<td>0.1</td>
<td></td>
<td></td>
<td>µs</td>
</tr>
<tr>
<td>Output Fall Time</td>
<td>Tf</td>
<td>Vout = 4.5 .. 24 V Cload = 1 nF Rpull-up = 1 kΩ</td>
<td>0.5</td>
<td></td>
<td></td>
<td>µs</td>
</tr>
<tr>
<td>Startup Time (2)</td>
<td>Tpower-on</td>
<td></td>
<td>150</td>
<td></td>
<td></td>
<td>ms</td>
</tr>
<tr>
<td>Frequency (3)</td>
<td>f</td>
<td></td>
<td>15</td>
<td>30000</td>
<td></td>
<td>Hz</td>
</tr>
<tr>
<td>Supply Rise Time</td>
<td>Tsr</td>
<td>Vs = 0 .. 24 V</td>
<td>100</td>
<td></td>
<td></td>
<td>ns</td>
</tr>
</tbody>
</table>

(1) Supply current can rise-up to 20 mA max. in the 3-4 volts Vdd range.

(2) Start-up time: when the wheel has started spinning, the output signal appears after a few teeth but a delay up to 150 ms could be seen before the highest accuracy/repeatability.

(3) The frequency is linked with the first order high pass filter with a cut-off frequency smaller than 20 Hz.
6. MLX90254 Sensor Specific Specifications

DC Operating Parameters $T_A = -40^\circ C$ to $150^\circ C$, $V_{DD} = 4V$ to $24V$ (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>Preinduction</td>
<td>$B_{DC}$</td>
<td></td>
<td>-500</td>
<td>500</td>
<td></td>
<td>mT</td>
</tr>
<tr>
<td>Differential Induction(4)</td>
<td>$\Delta B_{AC}$</td>
<td></td>
<td>6</td>
<td>100</td>
<td></td>
<td>mT</td>
</tr>
<tr>
<td>Operating Point</td>
<td>Bop</td>
<td></td>
<td>-0.5</td>
<td>0</td>
<td>0.5</td>
<td>mT</td>
</tr>
<tr>
<td>Release Point</td>
<td>Brp</td>
<td></td>
<td>-0.5</td>
<td>0</td>
<td>0.5</td>
<td>mT</td>
</tr>
<tr>
<td>Positive margin</td>
<td>$M^+$</td>
<td></td>
<td>0.5</td>
<td>2</td>
<td>3</td>
<td>mT</td>
</tr>
<tr>
<td>Negative margin</td>
<td>$M^-$</td>
<td></td>
<td>-3</td>
<td>-2</td>
<td>-0.5</td>
<td>mT</td>
</tr>
<tr>
<td>Magnetic Hysteresis</td>
<td>Bhyst</td>
<td></td>
<td>0</td>
<td></td>
<td></td>
<td>mT</td>
</tr>
</tbody>
</table>

(4) The differential field must exceed 6 mT to assure the switching of the output

7. General Description

Let us model the magnetic flux densities by sinusoids. If the wheel confirms a certain geometrical property, the two Hall cells see two magnetic flux densities in phase opposition. They are illustrated by the dashed sinusoid on figure 1.

The difference between the two Hall signals is computed and amplified. The remaining DC offset is removed by the high-pass filter. The noise that is out of the signal bandwidth is attenuated by the low-pass filter in order to minimize the output jitter. The AC differential signal is compared to the Bop and Brp threshold and the result of that comparison commands the open drain output transistor.

![Figure 1: Output toggling according to the differential magnetic signal.](image-url)
8. Performance Graphs

Jitter vs. Airgap
25 Deg.C

Jitter vs. Airgap
150 Deg.C
9. **Standard information regarding manufacturability of Melexis products with different soldering processes**

Our products are classified and qualified regarding soldering technology, solderability and moisture sensitivity level according to following test methods:

**Reflow Soldering SMD’s (Surface Mount Devices)**

- IPC/JEDEC J-STD-020
  Moisture/Reflow Sensitivity Classification for Nonhermetic Solid State Surface Mount Devices
  (classification reflow profiles according to table 5-2)
- EIA/JEDEC JESD22-A113
  Preconditioning of Nonhermetic Surface Mount Devices Prior to Reliability Testing
  (reflow profiles according to table 2)

**Wave Soldering SMD’s (Surface Mount Devices) and THD’s (Through Hole Devices)**

- EN60749-20
  Resistance of plastic- encapsulated SMD’s to combined effect of moisture and soldering heat
- EIA/JEDEC JESD22-B106 and EN60749-15
  Resistance to soldering temperature for through-hole mounted devices

**Iron Soldering THD’s (Through Hole Devices)**

- EN60749-15
  Resistance to soldering temperature for through-hole mounted devices

**Solderability SMD’s (Surface Mount Devices) and THD’s (Through Hole Devices)**

- EIA/JEDEC JESD22-B102 and EN60749-21
  Solderability

For all soldering technologies deviating from above mentioned standard conditions (regarding peak temperature, temperature gradient, temperature profile etc) additional classification and qualification tests have to be agreed upon with Melexis.

The application of Wave Soldering for SMD’s is allowed only after consulting Melexis regarding assurance of adhesive strength between device and board.

Melexis is contributing to global environmental conservation by promoting lead free solutions. For more information on qualifications of RoHS compliant products (RoHS = European directive on the Restriction Of the use of certain Hazardous Substances) please visit the quality page on our website:


10. **ESD Precautions**

Electronic semiconductor products are sensitive to Electro Static Discharge (ESD).
Always observe Electro Static Discharge control procedures whenever handling semiconductor products.
11. Package Information

Notes:
1. Pinout: Pin 1 Not Used
   Pin 2 Vdd
   Pin 3 GND
   Pin 4 Output
2. Controlling dimension: mm
3. Leads must be free of flash and plating voids.
4. Leads must not arc toward the rear of package.
5. Package dimensions exclude molding flash.
6. Tolerance: +/- 0.254 mm unless otherwise specified.
7. Marking:
   Line 1:
   3 first digits (254) = Part Number MLX90254
   2 last digit (BB) = Version
   Line 2:
   5 digits (ZZZZZ) = Lot Number
   Back Side Marking
   4 digits (YYWW) = Date Code

VA Package Dimensions

VA Hall Plate / Chip Location
12. Disclaimer

Devices sold by Melexis are covered by the warranty and patent indemnification provisions appearing in its Term of Sale. Melexis makes no warranty, express, statutory, implied, or by description regarding the information set forth herein or regarding the freedom of the described devices from patent infringement. Melexis reserves the right to change specifications and prices at any time and without notice. Therefore, prior to designing this product into a system, it is necessary to check with Melexis for current information. This product is intended for use in normal commercial applications. Applications requiring extended temperature range, unusual environmental requirements, or high reliability applications, such as military, medical life-support or life-sustaining equipment are specifically not recommended without additional processing by Melexis for each application.

The information furnished by Melexis is believed to be correct and accurate. However, Melexis shall not be liable to recipient or any third party for any damages, including but not limited to personal injury, property damage, loss of profits, loss of use, interrupt of business or indirect, special incidental or consequential damages, of any kind, in connection with or arising out of the furnishing, performance or use of the technical data herein. No obligation or liability to recipient or any third party shall arise or flow out of Melexis’ rendering of technical or other services.

© 2012 Melexis NV. All rights reserved.

For the latest version of this document, go to our website at www.melexis.com

Or for additional information contact Melexis Direct:

Europe, Africa, Asia: America:
Phone: +32 1367 0495 Phone: +1 248 306 5400
E-mail: sales_europe@melexis.com E-mail: sales_usa@melexis.com

ISO/TS 16949 and ISO14001 Certified