

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

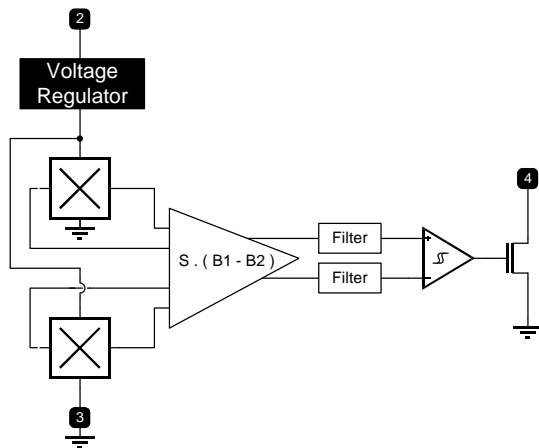
Applications

Crankshaft sensor
Camshaft sensor
ABS sensor
Gear tooth sensor
Speed sensor

Ordering Information

Part No.	Temperature Suffix	Package Code
MLX90254	L (-40°C to 150°C)	VA (4 leads)

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.

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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

Supply Voltage, V_{DD}	24 V
Reverse Voltage Protection	-0.3 V
Output Current, I_{OUT}	25 mA
Output Short-Circuit Current	150 mA
Output Voltage	24 V
Operating Temperature Range, T_A	-40 °C to 150°C
Storage Temperature Range, T_S	-55 °C to 165°C
Maximum Junction Temperature	175 °C
Magnetic Flux Density	Infinite

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°C , $V_{DD} = 4\text{V}$ to 24V (unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Supply Voltage	V_s		4	12	24	V
Supply Current (1)	I_s		5	8.5	12	mA
Output Voltage	V_{out}	Output state: OFF			24	V
Output DC Current	I_{out}	$V_{out} < 1\text{V}$			25	mA
Output Saturation Voltage	V_{sat}	Output state: ON $I_{out} = 25\text{ mA}$			500	mV
Output Short-Circuit Current	I_{scprot}	Output state: ON $V_{out} > 2\text{V}$	10	45	70	mA
Output Leakage Current	I_{leak}	Output state: OFF			10	μA
Output Rise Time	T_r	$V_{out} = 12\text{ V}$ $R_{pull-up} = 600\ \Omega$ No Load Capacitor			0.1	μs
Output Fall Time	T_f	$V_{out} = 4.5 \dots 24\text{ V}$ $C_{load} = 1\text{ nF}$ $R_{pull-up} = 1\text{ k}\Omega$			0.5	μs
Startup Time (2)	$T_{power-on}$				150	ms
Frequency (3)	f		15		30000	Hz
Supply Rise Time	T_{sr}	$V_s = 0 \dots 24\text{ V}$	100			ns

(1) Supply current can rise-up to 20 mA max. in the 3-4 volts V_{dd} 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 $T_A = -40^{\circ}\text{C}$ to 150°C , $V_{DD} = 4\text{V}$ to 24V (unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Preinduction	B_{DC}		-500		500	mT
Differential Induction(4)	ΔB_{AC}		6		100	mT
Operating Point	B_{op}		-0.5	0	0.5	mT
Release Point	B_{rp}		-0.5	0	0.5	mT
Positive margin	M +		0.5	2	3	mT
Negative margin	M -		-3	-2	-0.5	mT
Magnetic Hysteresis	B_{hyst}			0		mT

(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 B_{op} and B_{rp} threshold and the result of that comparison commands the open drain output transistor.

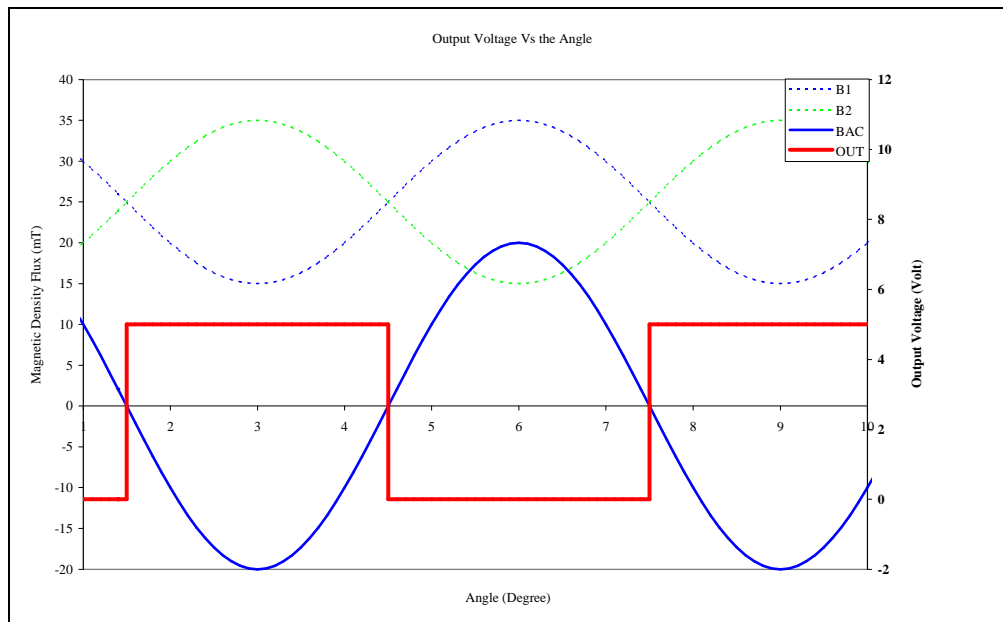
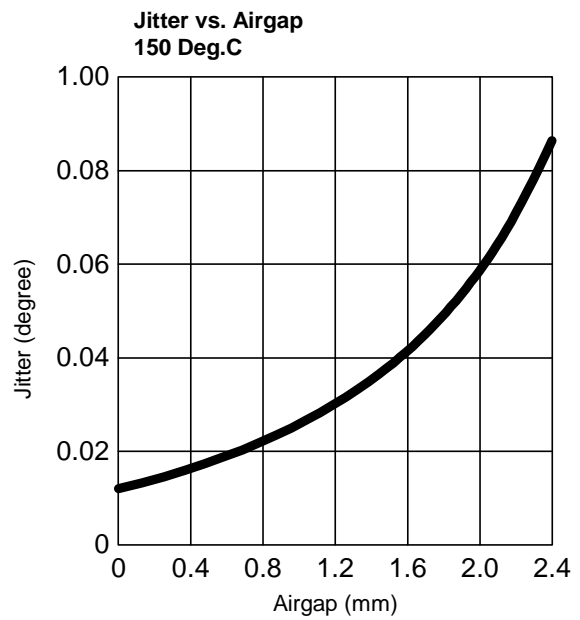
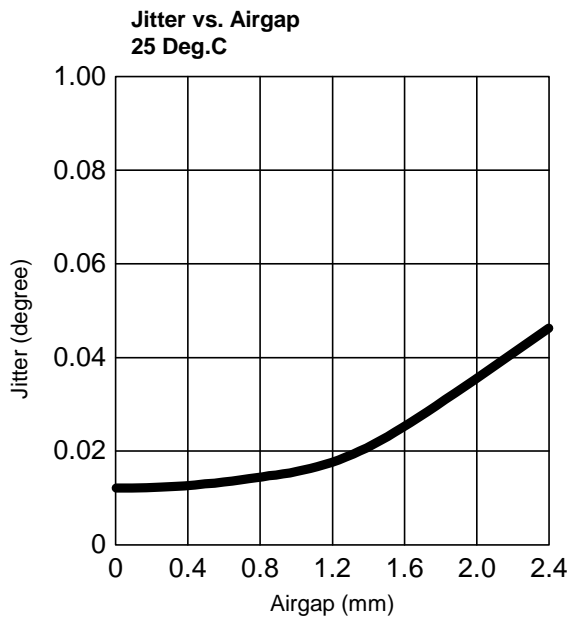


Figure 1: Output toggling according to the differential magnetic signal.

8. Performance Graphs



9. Reliability Information

This Melexis device is classified and qualified regarding soldering technology, solderability and moisture sensitivity level, as defined in this specification, according to following test methods:

- 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)
- CECC00802
Standard Method For The Specification of Surface Mounting Components (SMDs) of Assessed Quality
- EIA/JEDEC JESD22-B106
Resistance to soldering temperature for through-hole mounted devices
- EN60749-15
Resistance to soldering temperature for through-hole mounted devices
- MIL 883 Method 2003 / EIA/JEDEC JESD22-B102
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.

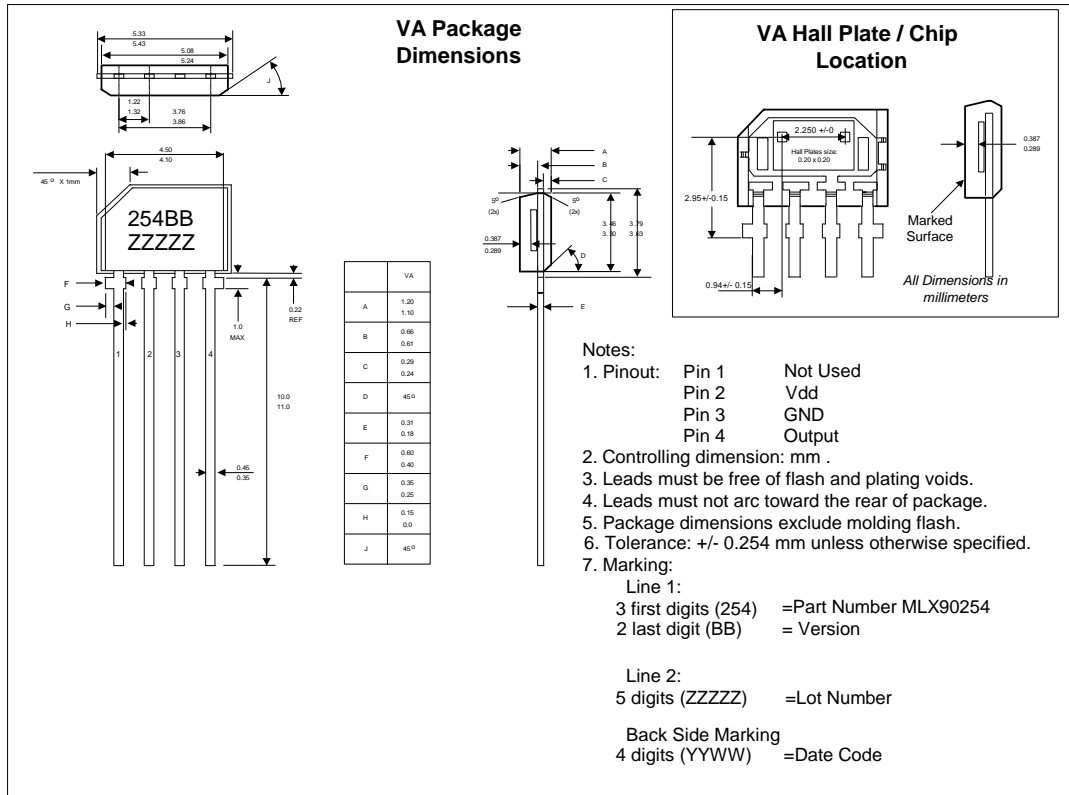
Based on Melexis commitment to environmental responsibility, European legislation (Directive on the Restriction of the Use of Certain Hazardous substances, RoHS) and customer requests, Melexis has installed a Roadmap to qualify their package families for lead free processes also. Various lead free generic qualifications are running, current results on request.

For more information on manufacturability/solderability see quality page at our website:
<http://www.melexis.com/html/pdf/MLXleadfree-statement.pdf>

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



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.

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