MLX90224

Dual Hall Effect Switch

Features and Benefits

Chopper Stabilized Amplifier Stage
CMOS for Optimum Stability, Quality and Cost
Dual Output
5V to 24V Operation
Phase/Direction Detection (option code B)

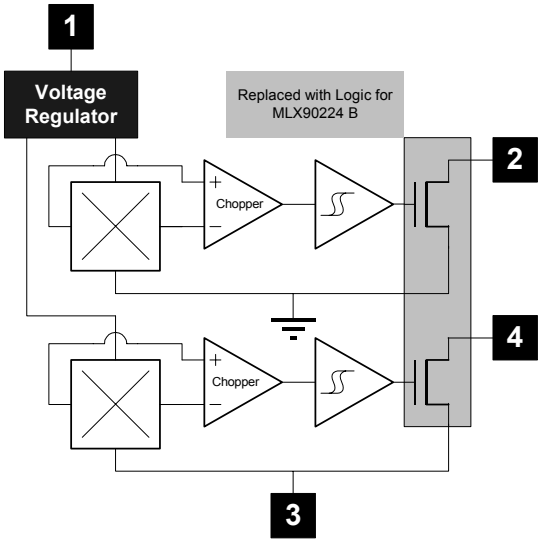
Applications

Direction Detector
Speed Sensor
Shaft Encoding
Position Sensing

Ordering Information

Part No.	Temperature Suffix	Package Code	Option code
MLX90224	E (-40°C to 85°C)	VA	A
MLX90224	E (-40°C to 85°C)	VA	B

1. Functional Diagram



	MLX90224EVA-A	MLX90224EVA-B
Pin 1	V_{DD}	V_{DD}
Pin 2	Switch Plate 1	Speed
Pin 3	GND	GND
Pin 4	Switch Plate 2	Direction

2. Description

The MLX90224 series are dual Hall effect switches. It includes two Hall effect switch functions of which typical thresholds are +/- 2.0 mT. In each switch, the magnetic flux detection is performed by a switched silicon Hall plate. The B_{OP} and B_{RP} are temperature-compensated and give a sensitivity temperature coefficient of 500 ppm/^{o}C to compensate popular magnets.

The MLX90224LVAA output transistor will be “switched on” (B_{OP}) in the presence of a sufficiently strong South pole magnetic field facing the marked side of the package. Similarly, the output will be “switched off” (B_{RP}) in the presence of a North field. Spacing on the plates is 1.85mm.

The MLX90224LVAB serie is designed for direction detection with a high speed chopper.

The output structure is an Open-Drain NMOS transistor with a capability of 25 mA.

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3. Glossary of Terms

Gauss, Tesla: Two units to quantify a magnetic flux density. Conversion: 1 mT = 10 Gauss

Bop: B Operating Point: When the magnetic flux density increases and reaches the Bop value, the output switches on. This value is in Gauss.

Brp: B Release Point: When the magnetic flux density decreases and reaches the Brp value, the output switches off. This value is in Gauss.

4. Absolute Maximum Ratings

Supply Voltage, V_{DD}	24 V
Supply Current, I_{DD}	50 mA
Output Current, I_{OUT}	40 mA
Output Short-Circuit Current	150 mA
Operating Temperature Range, T_A	-40°C to 150°C
Storage Temperature Range, T_S	-65°C to 150°C
Maximum Junction Temp, T_J	+ 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. MLX90224 Electrical Specifications

DC Operating Parameters T_A = -40°C to 85°C, V_{DD} = 5V to 24V (unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Supply Voltage	V_{DD}	Operating	5		24	V
Supply Current	I_{DD}		3.0	7.5	10	mA
Output Current	I_{OUT}	$B>B_{OP}$			20	mA
Saturation Output Voltage	V_{SAT}	$B>B_{OP}$, I_{OUT}=20 mA		200	600	mV
Output Voltage	V_{OUT}	$B<B_{RP}$			24	V
Output Leakage	I_{LEAK}				10	µA
Refresh Time	Tr		7		15	µS

6. MLX90224 Sensor Specific Specifications

DC Operating Parameters T_A = -40°C to 85°C, V_{DD} = 5V to 24V (unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Operate Point	B_{OP}		-	2.5	5.5	mT
Release Point	B_{RP}		-5.5	-2.5	-	mT
Hysteresis	B_{HYS}		1.0	4.0	7.5	mT

Note:

1 mT = 10 Gauss

7. General Description

The MLX 90224 is designed for use with multipole ring magnet targets having evenly distributed North and South magnetic poles on the circumference of the target. An example of the basic physical arrangement of the sensor and magnet is shown in Fig. 1. The MLX90224 is available in 2 versions. The first version provides the user with two digital output signals. Output S1 will provide a speed pulse from the changing magnetic flux at sensing element S1. Output S2 will provide a phase shifted (d = 1.85 mm) output identical in pulse width and period to S1. This version is referred to as MLX90224LVAA. The MLX90224LVAB version provides an output signal that decodes the phase shifted signals to directly provide an output for the speed which is twice the rotation speed of the target. The other output pin represent the direction and changes from logic-high to logic-low when the direction of rotation of the magnet is reversed. It allows to directly see the condition of the speed with twice the resolution of the MLX90224LVAA and to also know directly the direction of rotation of the target. The MLX90224LVAA has switching magnetic Bop and Brp values of typically +/- 2.5 mT as does the internal circuitry of the LVAB.

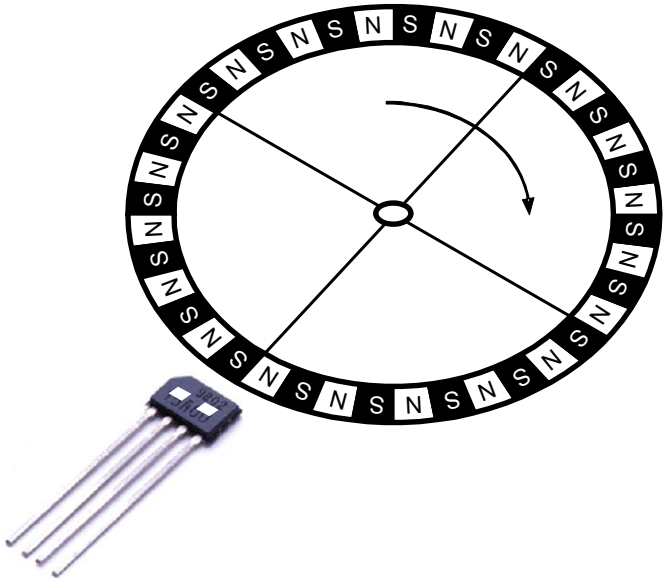
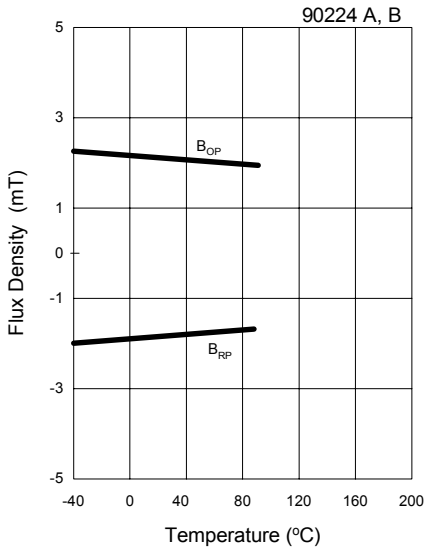


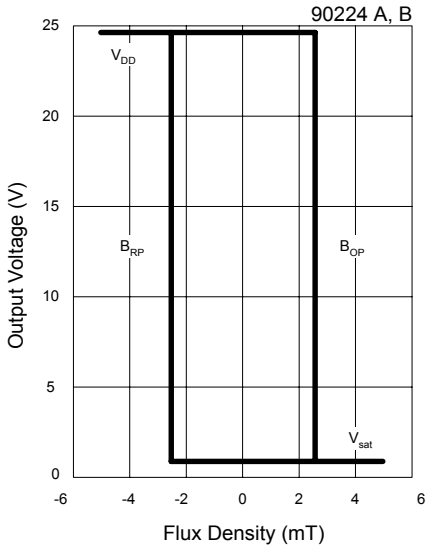
Figure 1: Application with a multipole ring magnet

8. Performance Graphs

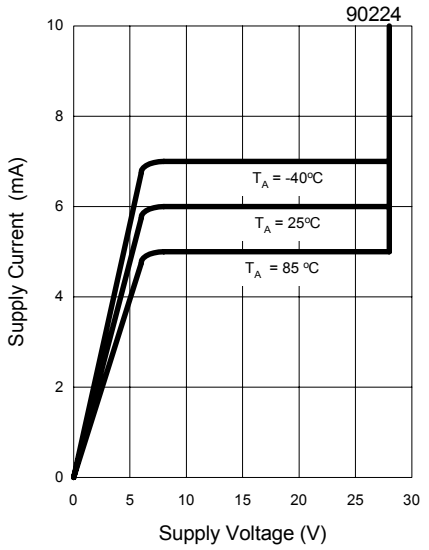
Typical Magnetic Switch Points versus Temperature



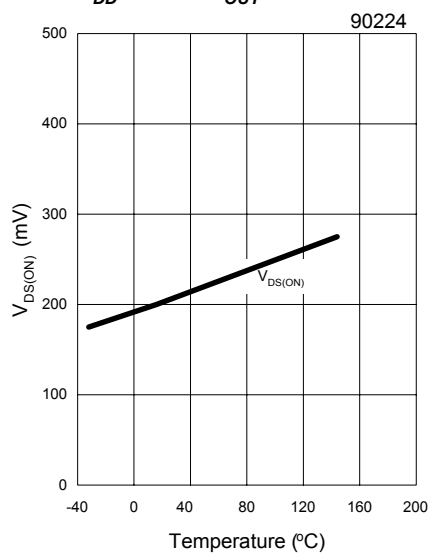
Output Voltage versus Flux Density



Typical Supply Current versus Supply Voltage

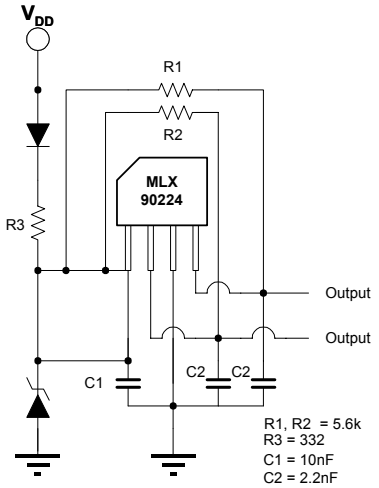


Typical Saturation Voltage versus Temperature
V_{DD} = 12 V, I_{OUT} = 20mA



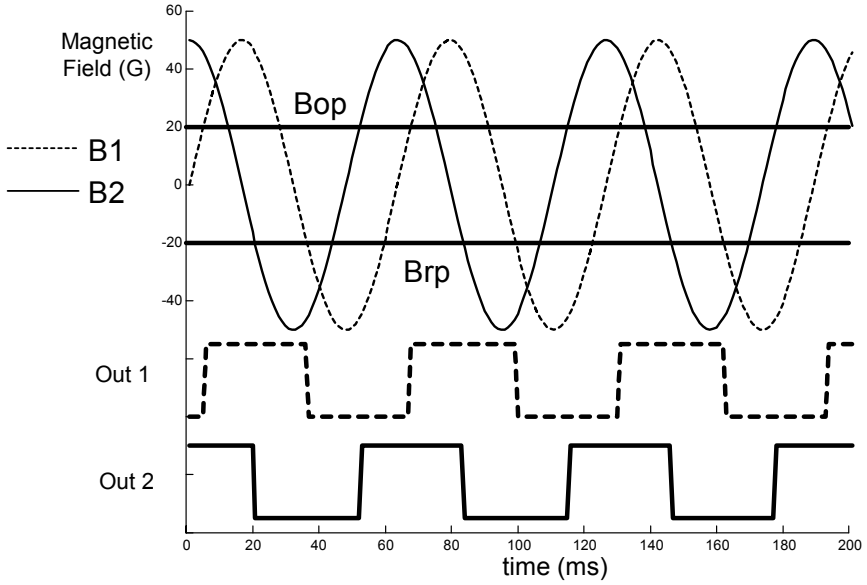
9. Applications Information

Severe Environment and Automotive Protection Circuit

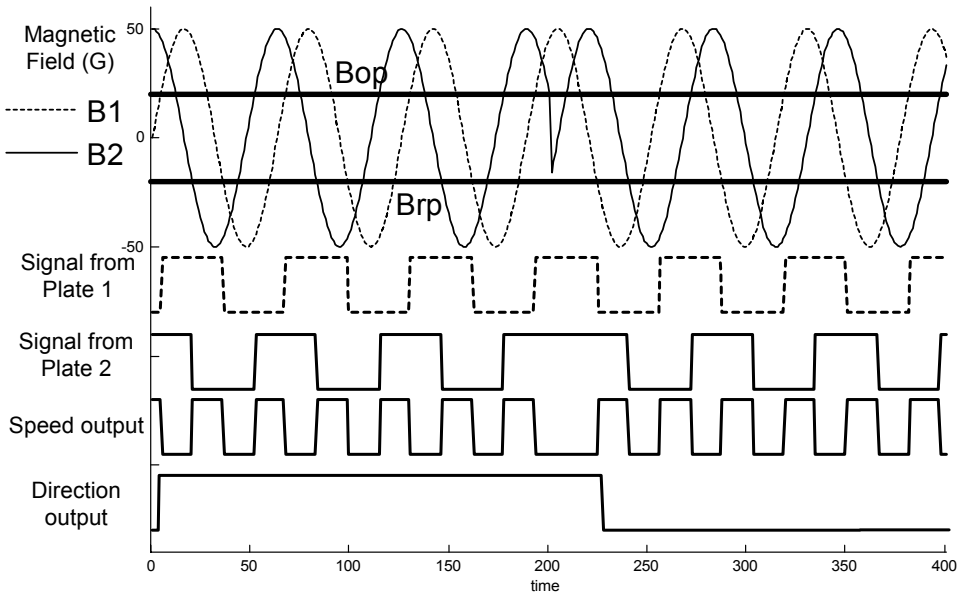


In severe cases it may be necessary to include a Zener diode to clamp positive interference and Schottky diodes to clamp negative excursions.

Timing diagram when applied a B1-B2 quadratic magnetic field on MLX90224, LVAA version



Timing diagram when applied a B1-B2 quadratic magnetic field on MLX90224, LVAB version (direction and speed outputs)



10. Reliability Information

Melexis devices are classified and qualified regarding suitability for infrared, vapor phase and wave soldering with usual (63/37 SnPb-) solder (melting point at 183degC).
The following test methods are applied:

IPC/JEDEC J-STD-020A (issue April 1999)
Moisture/Reflow Sensitivity Classification For Nonhermetic Solid State Surface Mount Devices
CECC00802 (issue 1994)
Standard Method For The Specification of Surface Mounting Components (SMDs) of Assessed Quality
MIL 883 Method 2003 / JEDEC-STD-22 Test Method 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.

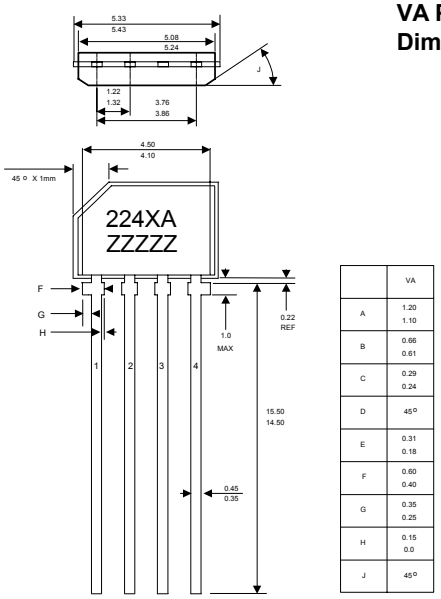
For more information on manufacturability/solderability see quality page at our website:
http://www.melexis.com/

11. ESD Precautions

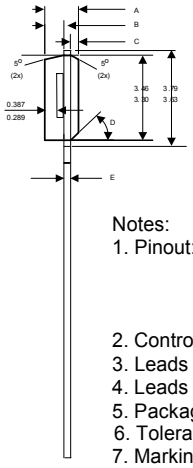
Electronic semiconductor products are sensitive to Electro Static Discharge (ESD).
Always observe Electro Static Discharge control procedures whenever handling semiconductor products.

12. Package Information

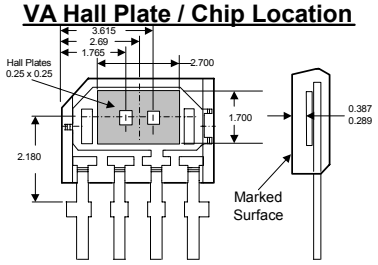
VA Package Dimensions



	VA
A	1.20 1.10
B	0.66 0.61
C	0.29 0.24
D	45°
E	0.31 0.18
F	0.60 0.40
G	0.35 0.25
H	0.15 0.0
J	45°



VA Hall Plate / Chip Location



All Dimensions in millimeters

Notes:

1. Pinout: Pin 1 Vdd
   Pin 2 Latch Plate 1/ Speed
   Pin 3 GND
   Pin 4 Latch Plate 2 / Direction
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 (224) =Part Number MLX90224
   4th and 5th digits (XA) = Version A (double latch)
   (XB) = Version B (Speed-Direction)
   Line 2:
   5 digits (ZZZZZ) =Lot Number

   Back Side Marking
   4 digits (WWYY) =Date Code

13. Disclaimer

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