

1. Features and Benefits

- Wide operating voltage range : from 2.7V to 24V
- Integrated self-diagnostic functions activating dedicated Safe Mode
- Reverse supply voltage protection
- Under-Voltage Lockout protection
- Integrated capacitor

2. Application Examples

- Automotive, Consumer and Industrial
- Brake light switch
- Window lifter
- Doorlock
- Seatbelt buckle
- Seat positioning
- Sunroof/Tailgate opener
- Electrical power steering

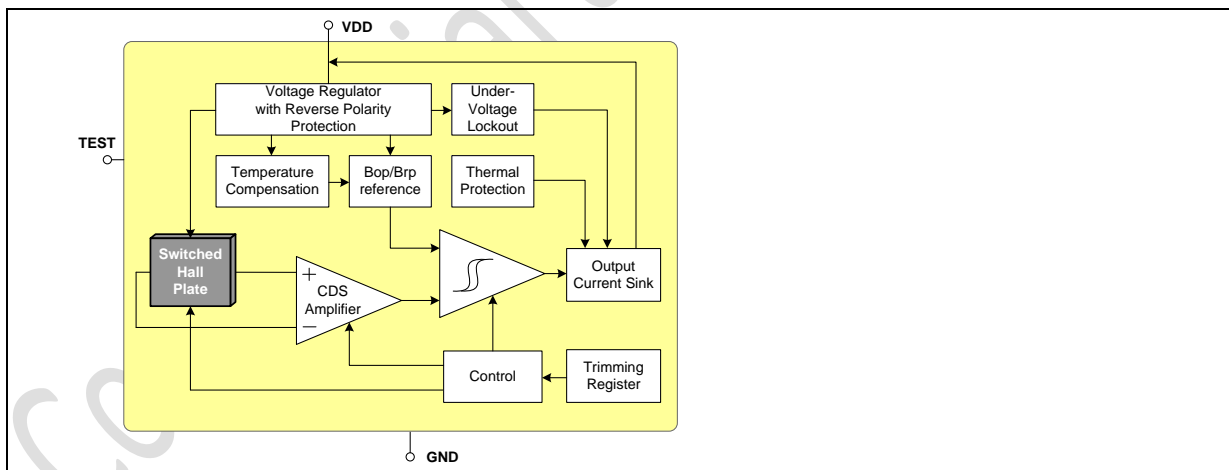
3. Ordering Information

Product Code	Temperature Code	Package Code	Option Code	Packing Form Code
MLX92242	L	UA	AAA-100	BU

Legend:

Temperature Code: K(-40°C to 150°C)
 Package Code: UA=TO-92-3L/
 Option Code: AAA-1xx => Customer programmable Switch / Latch with integrated capacitor
 Packing Form: BU=Bulk
 Ordering example: MLX92242LUA-AAA-100-BU

4. Functional Diagram



5. General Description

The Melexis MLX92242 is based on the Melexis Hall-effect switch latest platform, designed in mixed signal submicron CMOS technology.

The device integrates a voltage regulator, Hall sensor with advanced offset cancellation system and a current sink-configured output driver and integrated capacitor all in a single package.

Based on the proven in use platform, the magnetic core is using an improved offset cancellation system allowing faster and more accurate processing while being temperature insensitive and stress independent. In addition a pre-programmable temperature coefficient is implemented to compensate the natural behavior of certain types of magnets becoming weaker with rise in temperature.

The included voltage regulator operates from 2.7 to 24V, hence covering a wide range of applications. With the built-in reverse voltage protection, a serial resistor or diode on the supply line is not required so that even remote sensors can be specified for low voltage operation down to 2.7V while being reverse voltage tolerant.

In an event of a drop below the minimum supply voltage during operation, the under-voltage lock-out protection will automatically freeze the device, preventing the electrical perturbation to affect the magnetic measurement circuitry. The output current state is therefore only updated based on a proper and accurate magnetic measurement result.

The two-wire interface not only saves one wire, but also allows implementation of diagnostic functions as reverse polarity connection and malfunction detection.

The on-chip thermal protection also switches off the output if the junction temperature increases above an abnormally high threshold. It will automatically recover once the temperature decreases below a safe value.

The MLX92242 is delivered in a Green and RoHS compliant Plastic Single-in-Line (TO-92 flat) for through-hole mount or PCB-less design or in 3-pin Thin Small Outline Transistor (TSOT) for surface mount process.

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7. Glossary of Terms

Tesla	Units for the magnetic flux density, 1 mT = 10 Gauss
TC	Temperature Coefficient in ppm/°C
NC	Not Connected
ADC	Analog-to-Digital Converter
PTC	Programming Through Connector
POR	Power on Reset
INL	Integral Non Linearity
DNL	Differential Non Linearity
PWM	Pulse Width Modulation

8. Absolute Maximum Ratings

Parameter	Symbol	Value	Units
Supply Voltage ^(1, 2)	V _{DD}	+28V	V
Supply Voltage (Load Dump) ^(1, 4)	V _{DD}	+32V	V
Supply Current ^(1, 2, 3)	I _{DD}	+20	mA
Supply Current ^(1, 3, 4)	I _{DD}	+50	mA
Reverse Supply Voltage ^(1, 2)	V _{DDREV}	-24	V
Reverse Supply Voltage ^(1, 4)	V _{DDREV}	-30	V
Reverse Supply Current ^(1, 2, 5)	I _{DDREV}	-20	mA
Reverse Supply Current ^(1, 4, 5)	I _{DDREV}	-50	mA
Maximum Junction Temperature ⁽⁶⁾	T _J	+165	°C
ESD Sensitivity – HBM ⁽⁷⁾	-	8	kV
ESD Sensitivity – Indirect - VW TL82466	-	15	kV
ESD Sensitivity – MM ⁽⁸⁾	-	400	V
ESD Sensitivity – CDM ⁽⁹⁾	-	1000	V
Magnetic Flux Density	B	Unlimited	mT

Table 1: Absolute maximum ratings

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

¹ The maximum junction temperature should not be exceeded

² For maximum 1 hour

³ Including current through protection device

⁴ For maximum 500ms

⁵ Through protection device

⁶ For 1000 hours.

⁷ Human Model according AEC-Q100-002 standard

⁸ Machine Model according AEC-Q100-003 standard

⁹ Charged Device Model according AEC-Q100-011 standard

9. General Electrical Specifications

DC Operating Parameters $V_{DD} = 2.7V$ to $24V$, $T_A = -40^{\circ}C$ to $150^{\circ}C$ (unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ ⁽¹⁾	Max	Units
OFF Supply Current (selectable by a dedicated bit)	I_{OFF}	$V_{DD} = 3.5$ to $24V$	2	-	5	mA
		$V_{DD} = 3.5$ to $24V$	5	-	6.9	mA
ON Supply Current	I_{ON}	$V_{DD} = 3.5$ to $24V$	12	-	17	mA
Output Jitter (p-p) ^(Error! Bookmark not defined., 2)	t_{JITTER}	Over 1000 successive switching events @ 1kHz, Latch, B_{OP} set to 5mT, square wave magnetic field with $B > \pm 20mT$, $t_{RISE} = t_{FALL} \leq 20\mu s$	-	± 4	-	μs
Maximum Switching Frequency ^(Error! Bookmark not defined., 3)	f_{SW}	Latch, B_{OP} set to 5mT, square wave magnetic field with $B > \pm 20mT$	-	50	-	kHz
Under-voltage Lockout Threshold	V_{UVL}		-	-	2.7	V
Under-voltage Lockout Reaction time ^(Error! Bookmark not defined.)	t_{UVL}		-	1	-	μs
Integrated capacitor	C_{int}	Only for option MLX92242LUA-AAA-1xx	-	68	-	nF
Thermal Protection Threshold	T_{PROT}		-	$190^{(4)}$	-	$^{\circ}C$
Thermal Protection Release	T_{REL}		-	$180^{(4)}$	-	$^{\circ}C$

Table 2: General electrical parameters

¹Typical values are defined at $T_A = +25^{\circ}C$ and $V_{DD} = 12V$

² Output jitter is the unpredictable deviation of the Delay time.

³ Maximum switching frequency corresponds to the maximum frequency of the applied magnetic field which is detected without loss of pulses.

⁴ T_{PROT} and T_{REL} are the corresponding junction temperature values

10. Magnetic Specifications

10.1 MLX92242LUA-AAA-100

DC Operating Parameters $V_{DD} = 3.5V$ to $24V$, $T_A = -40^{\circ}C$ to $150^{\circ}C$ (unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Operating Point Programming Range ⁽¹⁾	B_{OP}	$V_{DD} = 5V, T_A = 25^{\circ}C$	-100		100	mT
Operating Point for programming target	B_{OP28}	$V_{DD} = 5V, T_A = 25^{\circ}C$	26	28	30	mT
B_{OP} Polarity Programming			-	1	-	bit
Temperature Coefficient Target Programming Range ⁽²⁾	TC ⁽³⁾	$V_{DD} = 5V$, Latch with $B_{OP} = 28mT, B_{RP} = -28mT$	-2000		0	ppm/ $^{\circ}C$
Switch/Latch Function Selection			-	1	-	bit
Proportional/Absolute Hysteresis			-	1	-	bit
Absolute Hysteresis Programming Range	B_{HYSABS}	Programming step	0		3.1	mT
Output Polarity Selection			-	1	-	bit
V_{DD} Programming Lock			-	1	-	bit

Table 3: Magnetic specification

1. Guaranteed by correlation with production test at $B=28mT$ and verified by characterization
2. The minimum and maximum limits are typical values
3. The Temperature Coefficient is calculated using the following formula:

$$TC = \frac{(B_{OPTA2} - B_{RPTA2}) - (B_{OPTA1} - B_{RPTA1})}{(B_{OPTA1} - B_{RPTA1})} * 10^6, \text{ ppm}/^{\circ}C; T_{A1} = 25^{\circ}C; T_{A2} = 150^{\circ}C$$

11. Magnetic Behavior

11.1 Latch sensor

Pole Active	Remark
South	Fig.1
North	Fig.2

Note: Latch sensors are inherently Direct South or Direct North Pole Active only.

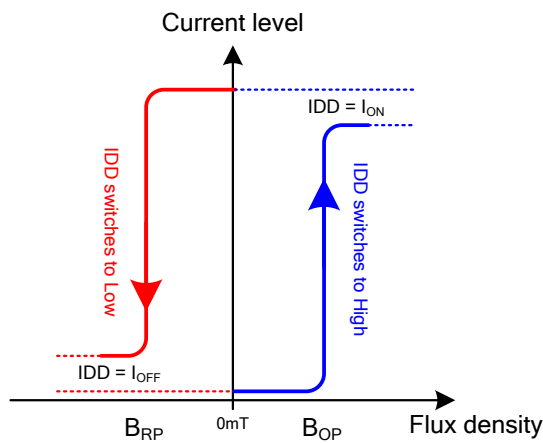


Fig.1 –South Pole Active

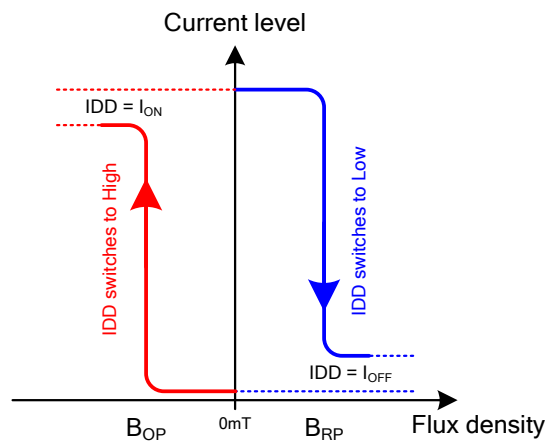


Fig.2 –North Pole Active

11.2 Unipolar Switch sensor

Pole Active	Output Polarity	Remark
South	Direct	Fig.1
South	Inverted	Fig.2
North	Direct	Fig.3
North	Inverted	Fig.4

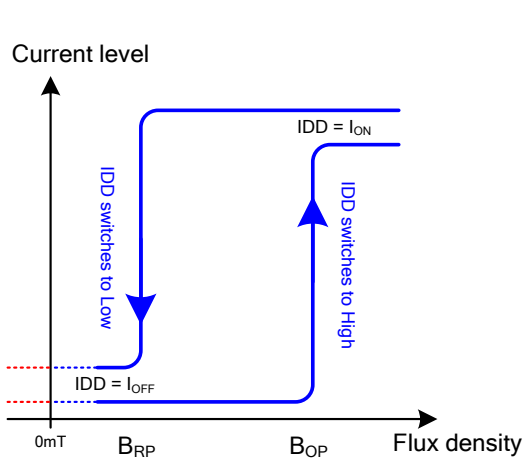


Fig.1 – Direct South Pole Active

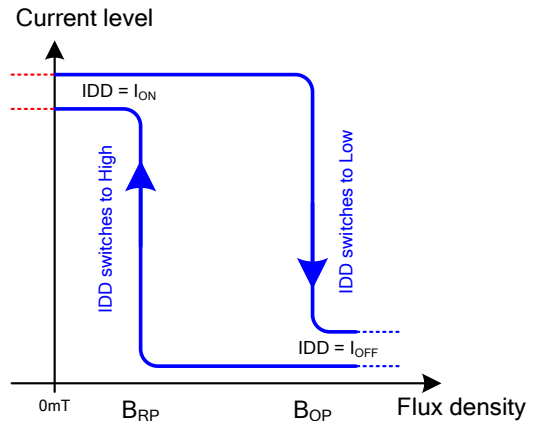


Fig.2 – Inverted South Pole Active

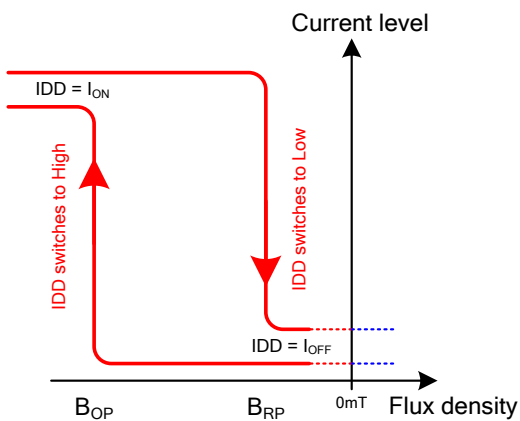


Fig.3 – Direct North Pole Active

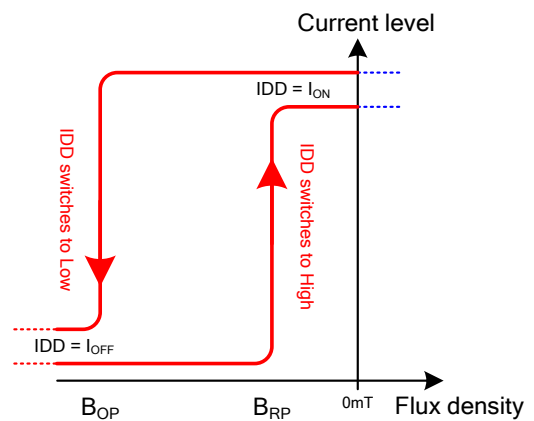
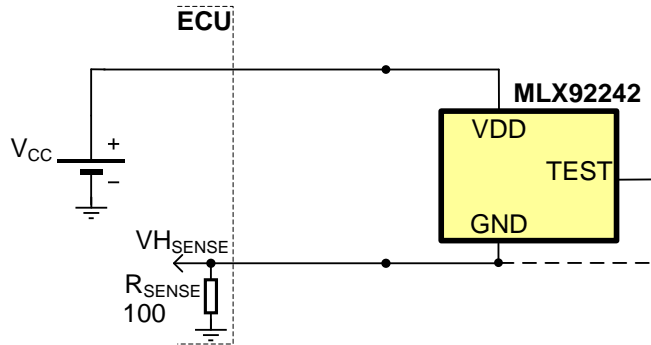


Fig.4 – Inverted North Pole Active

12. Application Information

12.1 Typical Automotive Application Circuit



Notes:

1. The TEST pin is to be connected to GND or left open.

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13. 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 recommends reviewing on our web site the General Guidelines [soldering recommendation](http://www.melexis.com/Quality_soldering.aspx) (http://www.melexis.com/Quality_soldering.aspx) as well as [trim&form recommendations](http://www.melexis.com/Assets/Trim-and-form-recommendations-5565.aspx) (<http://www.melexis.com/Assets/Trim-and-form-recommendations-5565.aspx>).

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: <http://www.melexis.com/quality.aspx>

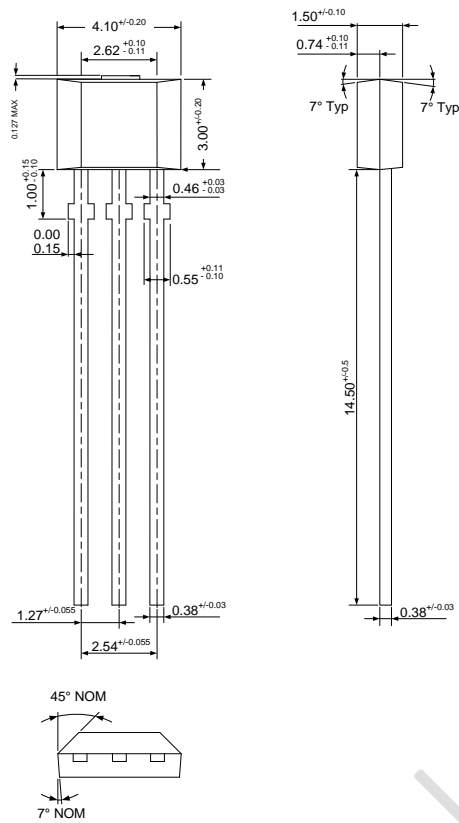
14. ESD Precautions

Electronic semiconductor products are sensitive to Electro Static Discharge (ESD).

Always observe Electro Static Discharge control procedures whenever handling semiconductor products.

15. Package Information

15.1 UA (TO92 - 3L) with integrated capacitor



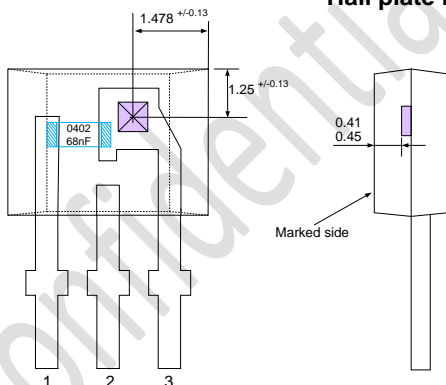
Notes:

1. All dimensions are in millimeters
2. Package dimension exclusive molding flash.
3. The end flash shall not exceed 0.127 mm on the top side.

Marking:

- 1st Line : C1xx – C1 = 68nF
 2nd Line : xxxx

Hall plate location



Notes:

1. All dimensions are in millimeters

Pin №	Name	Type	Function
1	VDD	Supply	Supply Voltage pin
2	TEST	I/O	Analog & Digital I/O
3	GND	Ground	Ground pin

16. 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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17. Contact Information

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:

Phone: +32 1367 0495

E-mail: sales_europe@melexis.com

America:

Phone: +1 248 306 5400

E-mail: sales_usa@melexis.com

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