MLX91204 Triaxis® Resolver (Sine/Cosine)

Datasheet

Features and Benefits

- Absolute Rotary Position Sensor IC
- Tria⊗is Hall Technology
- Hi-Speed Operation
- Sine/Cosine Outputs
- Simple & Robust Magnetic Design
- Excellent Thermal Stability
- Very Low Hysteresis
- SOIC-8 Package (RoHS)



SOIC-8

Application Examples

- Absolute Rotary Position Sensor
- BLDC Motor Position Sensor (for Commutation)
- Contactless potentiometers
- Contactless encoder

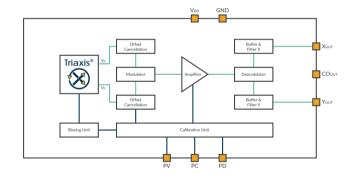
Description

The Triaxis® rotary position sensor MLX91204 detects the absolute angular position of a small magnet that is positioned above the device surface.

The MLX91204 reports two analog, linear, orthogonal (quadrature) and ratiometric output voltages proportional to the applied magnetic flux density parallel to the chip surface (thanks to the Integrated Magneto Concentrator – IMC® – added on the top of the sensitive Hall elements).

The MLX91204 is ideally suited for hi-speed rotary position sensing in harsh automotive and industrial environments.

The angular position is computed off-chip from both sine and cosine signals.









Ordering Information

Product	Temperature	Package	Option Code	Packing Form
MLX91204	K	DC	ABA-001	RE
MLX91204	K	DC	ABA-002	RE

Legend:

Temperature Code:	K: from -40°C to 125°C
Package Code:	"DC" for SOIC-8 package
Option Code:	ABA-xxx: die Version xxx-003: 3: Magnetic Field Range 1: High magnetic field (25 V/T typ) 2: Medium magnetic field (50 V/T typ)
Packing Form:	"RE" for Reel
Ordering Example:	"MLX91204KDC-ABA-001-RE" For a high magnetic field in SOIC-8 package, delivered in Reel.

Table 1 – Ordering information legend

Datasheet



Contents

Features and Benefits	. 1
Application Examples	. 1
Description	. 1
Ordering Information	. 2
1. Functional Diagram	. 4
2. Glossary of Terms	. 5
3. Absolute Maximum Ratings	. 5
4. Pinout and Function	. 5
5. MLX91204 General Electrical Specification	. 6
6. MLX91204 Sensor Specification	. 6
7. Recommended Application Diagrams	. 9
7.1. Single Ended Mode	9
7.2. Differential Mode	9
8. Standard information regarding manufacturability of Melexis products with different soldering processes	10
9. ESD Precautions	10
10. Package Information	11
10.1. Package Dimensions	11
10.2. Pinout and Marking	12
10.3. Hall Plate Positioning	12
11. Contact	13
12 Disclaimer	13



1. Functional Diagram

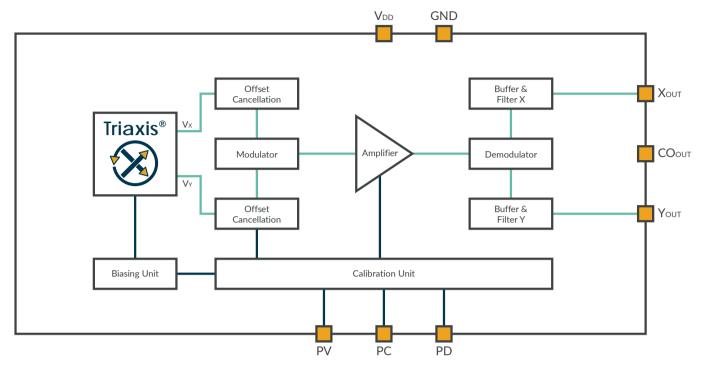


Figure 1 – MLX91204 Block Diagram



2. Glossary of Terms

- Gauss (G), Tesla (T): Magnetic flux density units where 1 mT = 10 G.
- Triaxis[®]: This technology refers to the Melexis Hall technology which allows the realization of Hall effect sensors able to sense the flux density along the 3 axis (i.e. X, Y & Z). In particular, it enables the realization of position sensors able to sense the magnetic flux density parallel to the IC surface and consequently the magnetic vector over 360 degrees.
- IMC: Integrated Magneto Concentrator. It concentrates the magnetic flux lines and bends them at the extremity under the planar Hall plates. Furthermore, it provides some magnetic gain factor.

3. Absolute Maximum Ratings

Parameter.	Units
Supply Voltage, VDD (overvoltage)	+ 6 V
Reverse Voltage Protection	- 0.5 V
Operating Temperature Range T _A	-40 to +125 Deg.C.
Storage Temperature Range, T _S	-40 to +150 Deg.C.

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

4. Pinout and Function

Pin #	Pin Name	Function
1	CO_ _{OUT}	Output Common (VDD/2)
2	PC	Factory programming pin. Connect to $V_{\text{\tiny DD}}$
3	V_{DD}	Supply Voltage (+)
4	Y _оит	Analog Output Y
5	X_out	Analog Output X
6	PD	Factory programming pin. Connect to GND
7	PV	Factory programming pin. Connect to V_{DD}
8	GND	Ground



5. General Electrical Specification

DC Operating Parameters TA = -40 Deg.C. to +125 Deg.C., VDD = 5.0 V (unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Тур	Max	Units
Nominal Supply Voltage	V_{DD}		4.5	5	5.5	V
Supply Current	I _{DD}	I _{OUT} = 0 mA		16.5	19	mA
Common Output	CO_out	Referring to V _{DD} /2, unloaded	- 2	0	2	%V _{DD}
Output Current CO_out and X_out and Y_out	lоит	Drop is typically 80mV/mA	- 1		1	mA
Output Load Resistance	RL		5			kΩ
Output Load Capacitance	CL				1000	pF
Start-up cycle	t startup			150	200	μs

6. Sensor Specification

DC Operating Parameters T_A = -40 Deg.C. to 125 Deg.C., VDD = 5.0 V, differential output (unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Тур	Max	Units
Offset Voltage	Voq	T _A = 25 Deg.C. – B = 0 mT X_out & Y_out	-10	0	10	mV
Offset Temperature Drift	ΔVοα/ΔΤ	$B = 0mT - X_{OUT} & Y_{OUT}^{(1)}$	-0.10	0	+0.10	mV/Deg.C.
Sensitivity	S	T = 25 Deg.C. Option Code : ABA-001	16	25	34	V/T
		T = 25 Deg.C. Option Code : ABA-002	32	50	68	V/T
Sensitivity Temperature Drift	ΔS/[SΔΤ]	(1)	-0.08	-0.05	-0.01	%/Deg.C.
Sensitivity Mismatch	Sxy	$S_{XY} = S_X/S_Y$	-3	0	3	%
Sensitivity Mismatch Temperature Drift	$\Delta(S_{XY})/\Delta T$	(1)	-0.012	0	0.012	%/Deg.C.
Phase Mismatch	∠Sx-∠S _Y		-1	0	1	Degree

Datasheet



Parameter	Symbol	Test Conditions	Min	Тур	Max	Units
Hysteresis	Нуѕт	(1)	-20	±8	20	μΤ
Full Scale Magnetic		Option Code: ABA-001			58.8	mT
Field Range (± 2 V Output Swing)	B _{FS}	Option Code: ABA-002			29.4	mT
Max. Output Voltage Swing	Voutmax	B > B _{FS} — X_оит &Y_оит Іоит = 0 mA	0.25		4.75	V
Angular Speed	ω	2 poles magnet			100k	RPM
Bandwidth (-3dB)	BW	$R_L > 1 M\Omega - C_L < 10 pF$		15		kHz
Spectral Noise Density	$\Delta B_{ ext{NOISE}}$				750	nT/Hz½

(1) Characterized

From the previous table and the ageing data, the intrinsic angular linearity error (in Degree) can be derived from the individual contributions as it follows:

Total Constitution	D	Output		
Test Conditions	Parameters	± 1 V	± 2 V	Unit
	Offset	± 0.8	± 0.4	Degree
Room Temperature	Sensitivity Mismatch	± 0.84	± 0.84	Degree
(T _A = 25 Deg.C.)	Phase Mismatch	± 1	± 1	Degree
	Total	± 2.64	± 2.24	Degree
	Offset	± 0.8	± 0.4	Degree
Temperature Range	Sensitivity Mismatch	± 0.34	± 0.34	Degree
(T _A = -40 125 Deg.C.)	Phase Mismatch	± 0.12	± 0.12	Degree
	Total	± 1.26	± 0.86	Degree
	Offset	± 0.8	± 0.4	Degree
Lifetime/Ageing	Sensitivity Mismatch	± 0.1	± 0.1	Degree
(HTOL 1000 hours – 5.0 V – 150 Deg.C.)	Phase Mismatch	± 0.1	± 0.1	Degree
	Total	± 1.00	± 0.60	Degree
Overall Linearity Error	Excl. Ageing	± 3.90	± 3.10	Degree
Overall Linearity Error	Incl. Ageing	± 4.90	± 3.70	Degree

Datasheet



The intrinsic linearity error refers only to the linearity error associated to the MLX91204. The linearity error associated to the magnetic and mechanical (off-axis, eccentricity) design is not included and should be considered as an additional contribution.

For more information, please refer to the application note:

https://www.melexis.com/en/documents/documentation/application-notes/application-note-mlx90316-magnet-selection

The total error can be reduced either statically (room temperature compensation) or dynamically (continuous compensation) through the off-chip signal processing performing the angular computation i.e. $arctan(Y_{OUT}/X_{OUT})$. The compensation is applied prior to computing the arctangent function: offset, gain and phase correction can be applied.

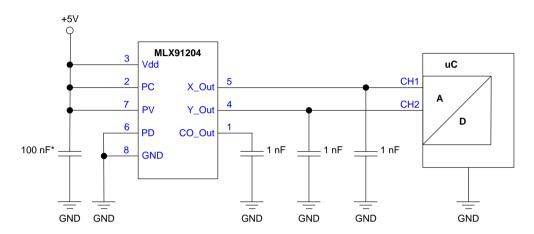


7. Recommended Application Diagrams

7.1. Single Ended Mode

The output voltages $X = (X_{OUT} - GND)$ and $Y = (Y_{OUT} - GND)$ are within 0.5V to 4.5V with an offset of 2.5V (VDD/2)

For reliable operation within the specifications the sensor must be connected as follows:

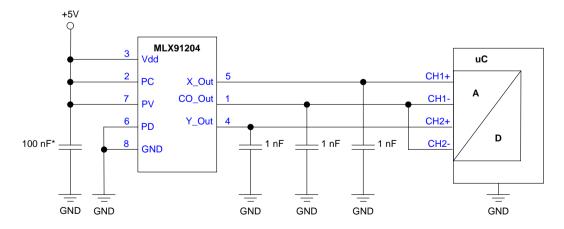


^{*} if the supply voltage is disturbed by EMI it can be useful to place a second capacitor (100 pF ceramic) parallel to the 100nF capacitor.

7.2. Differential Mode

The output voltages $X = (X_{OUT} - CO_{OUT})$ and $Y = (Y_{OUT} - CO_{OUT})$ are within ± 2 V around "virtual ground" (i.e. $CO_{OUT} = 2.5$ V = VDD/2)

For reliable operation within the specifications the sensor must be connected as follows:



^{*} if the supply voltage is disturbed by EMI it can be useful to place a second capacitor (100pF ceramic) parallel to the 100 nF capacitor.



8. 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 standards in place in Semiconductor industry.

For further details about test method references and for compliance verification of selected soldering method for product integration, Melexis recommends reviewing on our web site the General Guidelines soldering recommendation (http://www.melexis.com/en/quality-environment/soldering)

For all soldering technologies deviating from the one mentioned in above document (regarding peak temperature, temperature gradient, temperature profile etc.), additional classification and qualification tests shall be agreed upon with Melexis.

For package technology embedding trim and form post-delivery capability, Melexis recommends consulting the dedicated trim & forming recommendation application note: lead trimming and forming recommendations (http://www.melexis.com/en/documents/documentation/application-notes/lead-trimming-and-forming-recommendations).

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/en/quality-environment.

9. ESD Precautions

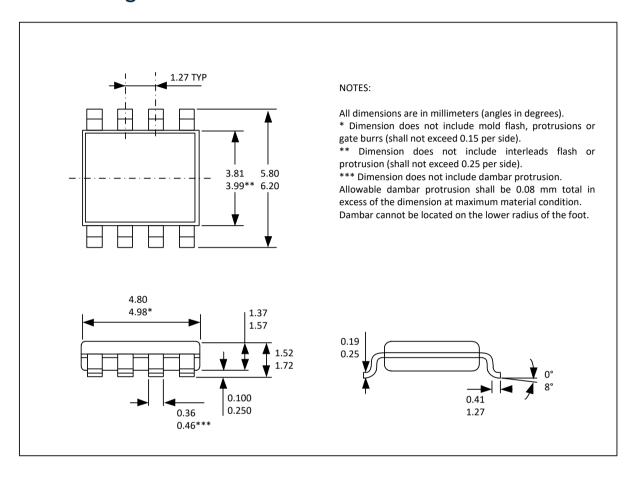
Electronic semiconductor products are sensitive to Electro Static Discharge (ESD).

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



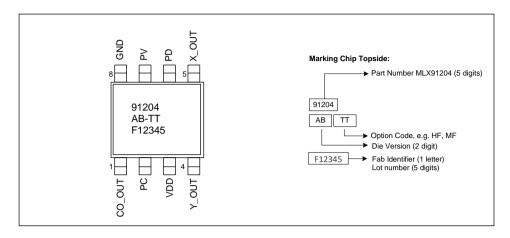
10. Package Information

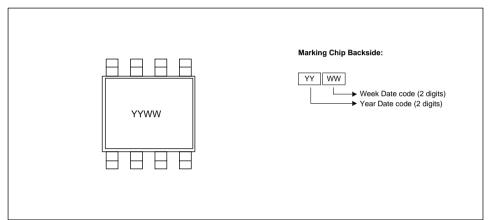
10.1. Package Dimensions



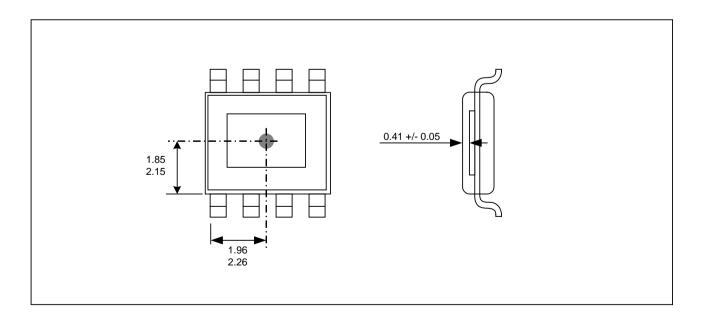


10.2. Pinout and Marking





10.3. Hall Plate Positioning



Datasheet



11. Contact

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

For additional information, please contact our Direct Sales team and get help for your specific needs:

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