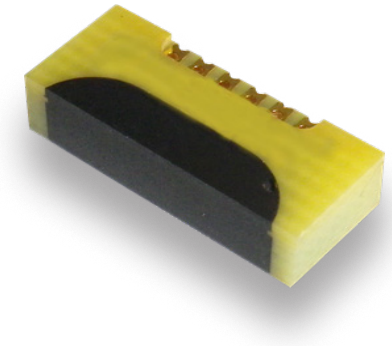
SENSITEC
MAGNETORESISTIVE SENSORS

GLM700ASB Family

Tooth Sensor Module with Integrated Magnet



The sensor modules of the GLM700ASB-Ax family are designed for use with passive measurement scales. The modules combine a GiantMagnetoResistive (GMR) tooth sensor with an integrated bias magnet in a compact SMD housing, to reduce the design and assembly effort of the user. In addition, the integration of sensor and magnet provides a very high quality of the sensor signals.

Adapted to a variety of tooth pitches, the integrated GMR sensors apply the FixPitch technology. This means that the sensor chip is matched to a given tooth pitch.

In use with a ferromagnetic scale and a matching pitch, the module delivers two 90 degree phase shifted analogue signals (sine and cosine).

The table “Product overview” on page 7 shows the modules available with the according pitch.

Product Overview

Article description	Package
GLM7xxASB-Ax [1]	Module Combining a sensor and a magnet for a variety of tooth pitches with sine and cosine output signal.

[1] For order information see page 7.

Quick Reference Guide

Symbol	Parameter	Min.	Typ.	Max.	Unit
V_{CC}	Supply voltage	-	5.0	-	V
V_{peak}	Signal amplitude per V_{CC} [2]	4.0	9.0	20.0	mV/V
T_{amb}	Ambient temperature	-40	-	+125	°C
f	Frequency range	1	-	-	MHz

[2] The amplitude depends on the distance between sensor and scale. For further information see Fig. 6 (page 4).

Absolute Maximum Ratings

In accordance with the absolute maximum rating system (IEC60134).

Symbol	Parameter	Min.	Max.	Unit
V_{CC}	Supply voltage	-9.0	+9.0	V
T_{amb}	Ambient temperature	-40	+125	°C
T_{stg}	Storage temperature	-40	+125	°C
MSL	Moisture sensitivity level	2		

Stresses beyond those listed under “Absolute maximum ratings” may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Features

- Gear tooth sensor with integrated magnet
- Differential sine and cosine output signals
- Ambient temperature range from -40 °C to +125 °C
- Designed for vertical or horizontal mounting
- High signal quality due to FixPitch technology
- Contactless, wear-free measurement

Advantages

- Allows use of simple passive toothed structures as measurement scale; so reducing design, manufacturing and assembly effort
- Flexible design options due to identical pin arrangements
- Reliable operation in difficult environments
- High interpolation possible within tooth pitch for high resolution and high accuracy
- Minimal offset voltage
- Low power consumption for battery-driven applications

Applications

Incremental encoder for linear or rotary motion in various industrial applications, for example:

- Linear position measurement
- Linear and rotary bearings

ESD

RoHS-Compliant www.sensitec.com

Electrical Data

T_{amb} = 25 °C; unless otherwise specified.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_{CC}	Supply voltage		-	5.0	-	V
TC_{RB}	Temperature coefficient of R_B and R_S [1]	T_{amb} = (-40...+125) °C	-	0.12	-	%/K
TC_{Voff}	Temperature coefficient of V_{off} [2]	T_{amb} = (-40...+125) °C	-3.0	-	+3.0	µV/V/K
T_{amb}	Ambient temperature		-40	-	+125	°C
V_{peak}	Signal amplitude per V_{CC} [3]		4.0	9.0	20.0	mV/V
TC_{Vpeak}	Temperature coefficient of V_{peak} [4]	T_{amb} = (-40...+125) °C	-0.08	-0.12	-0.16	%/K
f	Frequency range [5]		1	-	-	MHz

[1] $TC_R = 100 \cdot \frac{R_{(T2)} - R_{(T1)}}{R_{(T=j)} \cdot (T_2 - T_1)}$ with $T_1 = -40°C, T_2 = +125°C$ and $T_{=j} = +25°C$

[2] $TC_{V_{off}} = 100 \cdot \frac{V_{=j,(T2)} - V_{=j,(T1)}}{T_2 - T_1}$ with $T_1 = -40°C, T_2 = +125°C$

[3] The amplitude depends on the distance between sensor and scale. See Fig. 1 (page 4) for more information.

[4] $TC_{V_{peak}} = 100 \cdot \frac{V_{peak(T2)} - V_{peak(T1)}}{V_{peak(Tmeas)} \cdot (T_2 - T_1)}$ with $T_1 = +25°C, T_2 = +125°C$

[5] No significant amplitude loss in this frequency range.

Product Type Specific Data

Article description	Pitch	Offset Voltage	Bridge Resistance [6]	Sensor Resistance [7]	Air Gap [8]
GLM711ASB-Ax	1 mm	± 3.0 mV/V	5.5 kΩ	2.75 kΩ	200 µm
GLM712ASB-Ax	2 mm	± 3.5 mV/V	5.7 kΩ	2.85 kΩ	400 µm
GLM713ASB-Ax	3 mm	± 3.5 mV/V	5.7 kΩ	2.85 kΩ	600 µm
GLM714ASB-Ax	0.94 mm (module 0.3)	± 3.0 mV/V	5.6 kΩ	2.80 kΩ	190 µm
GLM715ASB-Ax	1.57 mm (module 0.5)	± 3.0 mV/V	5.8 kΩ	2.90 kΩ	310 µm

[6] Bridge resistance between pad 1 and 5, 2 and 6. Resistor tolerance ±15 %.

[7] Sensor resistance between pad 3 and 4. Resistor tolerance ±15 %.

[8] Optimal air gap between sensor and scale - for further information see Fig. 6 (page 4).

Additional Sensor Information

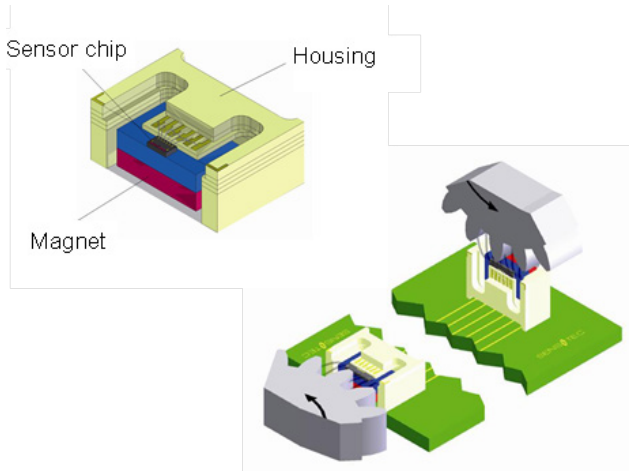


Fig. 1: Design of the GLM module.

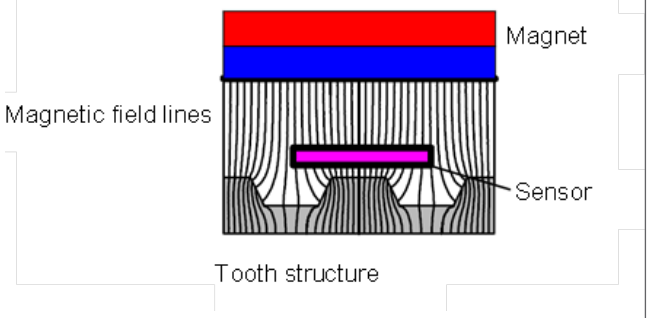


Fig. 2: Functional principle of tooth sensor module.

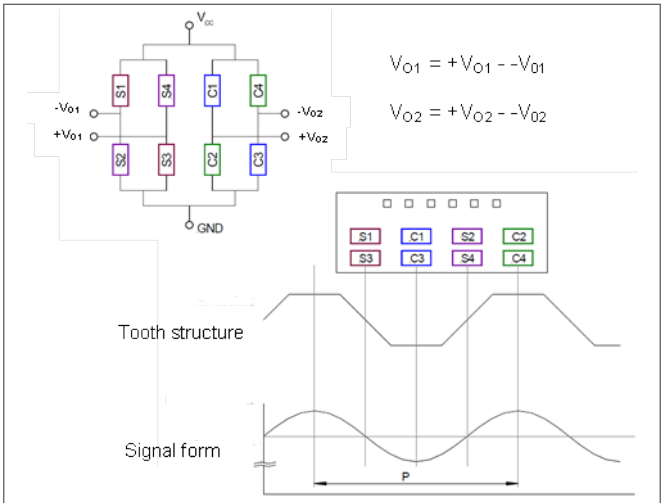


Fig. 3: Allocation of the sensor resistors.

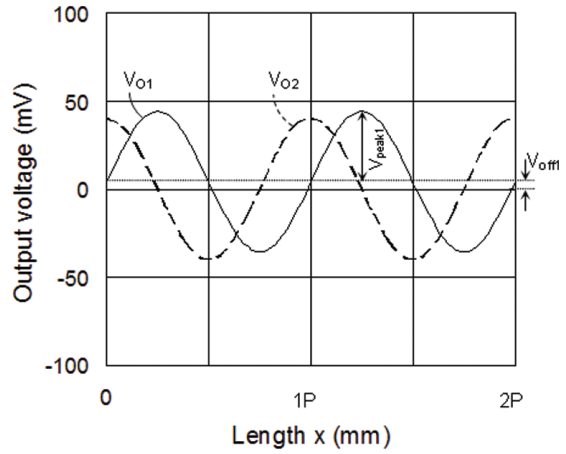


Fig. 4: Typical output signals (V_{CC} = 5 V).

Fig. 5: Passive measurement scales. In addition to gear teeth a variety of other tooth-like structures can be used with the GLM tooth sensor module.

Module vs. Tooth Pitch

To calculate the modules or the tooth pitch you can use these formula:

$$m = \frac{d}{z} = \frac{p}{\pi}$$

m = module of the gearwheel
d = reference diameter (in mm)
z = number of teeth on the perimeter
p = tooth pitch (in mm)

Typical Performance Graphs

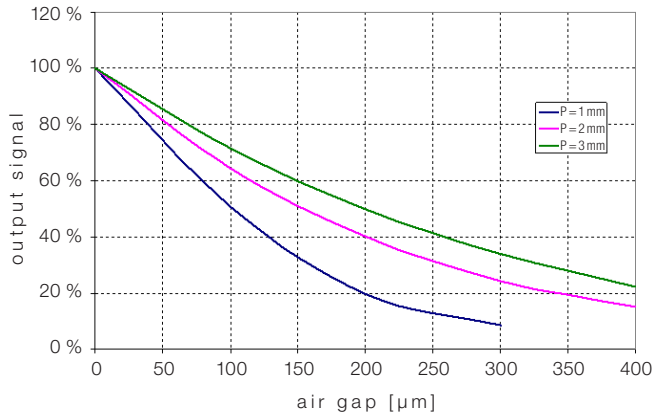


Fig. 6: Typical sensor output signal at a rectangular shaped tooth structure as a function of the air gap (distance between the sensor module and the tooth structure).

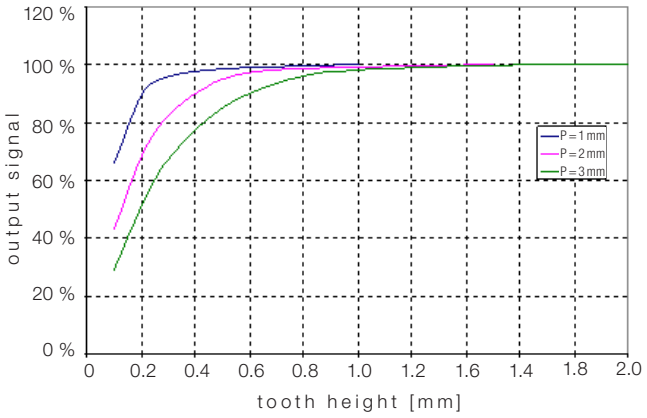


Fig. 7: Typical sensor output signal at a rectangular shaped tooth structure as a function of the tooth height.

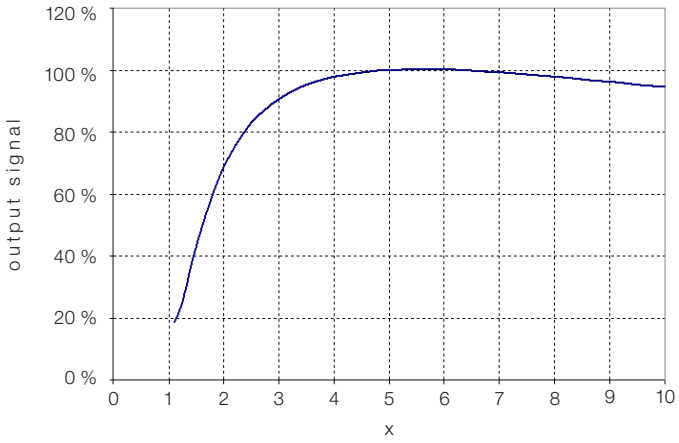


Fig. 8: Typical sensor output signal at a rectangular shaped tooth structure as a function of the land-pitch-factor x = P/w. [*P: pitch w: tooth topland width*]

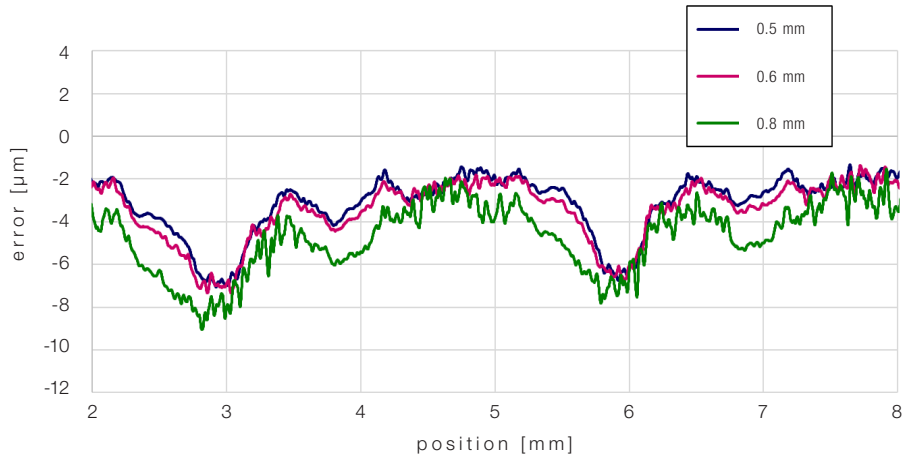


Fig. 9: Typical position error GLM713 vs. air gap with offset and amplitude adjustment.

Pinning

Pad	Symbol	Parameter
1	$+V_{O1}$	Positive output voltage bridge 1
2	$+V_{O2}$	Positive output voltage bridge 2
3	V_{CC}	Supply voltage
4	GND	Ground
5	$-V_{O1}$	Negative output voltage bridge 1
6	$-V_{O2}$	Negative output voltage bridge 2

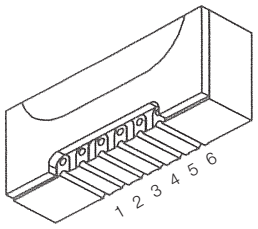
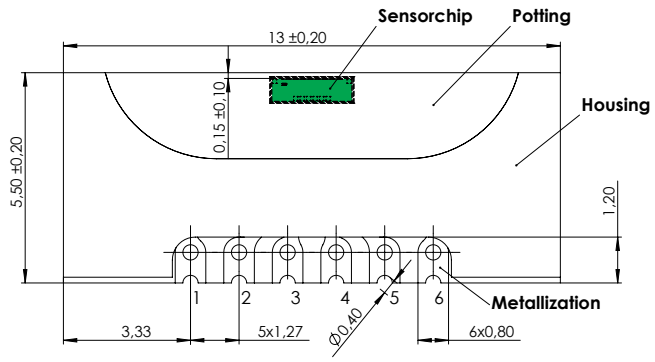


Fig. 10: Pinning of GLM700ASB.

Dimensions

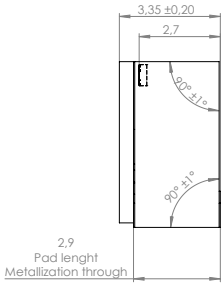
top view



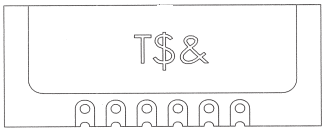
active sensor area

Housing material	FRA HAT IS420
Metallization	0.05-0.1 µm AU max. 4 µm Ni

side view



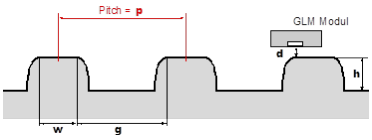
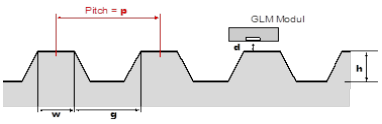
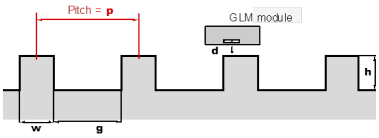
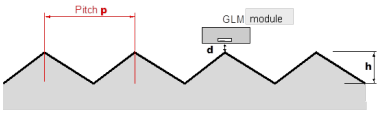
bottom view



Sensor type	(T)
GLM711	B
GLM712	E
GLM713	F
GLM714	A
GLM715	D

Marking	
T	Sensor type
$	Calendar week (A: ½, B: ¾, ...)
&	Year (E: 2013, F: 2014, ...)

Fig. 11: PCB outline (all dimensions in mm unless otherwise specified).

Recommended tooth profiles	h tooth height	w tooth top land width	g tooth gap	d air gap	signal quality
	$\geq \frac{p}{4}$	$\sim \frac{p}{3}$	$\sim \frac{2p}{3}$	$\sim \frac{p}{5}$	+++
	$\geq \frac{p}{4}$	$\sim \frac{p}{3}$	$\sim \frac{2p}{3}$	$\sim \frac{p}{5}$	+++
	$\geq \frac{p}{4}$	$\sim \frac{p}{3}$	$\sim \frac{2p}{3}$	$\sim \frac{p}{5}$	+++
	$\geq \frac{p}{3}$	–	–	$\sim \frac{p}{5}$	++

Magnetically soft materials are to be used for the measurement scale, e. g.:

Material Short Designation	Material Number according DIN 17007 T1
St37	(1.0037)
St44	(1.0044)
9SMnPb28	(1.0718)
9SMnPb29	(1.0737)
20MnV6	(1.5217)

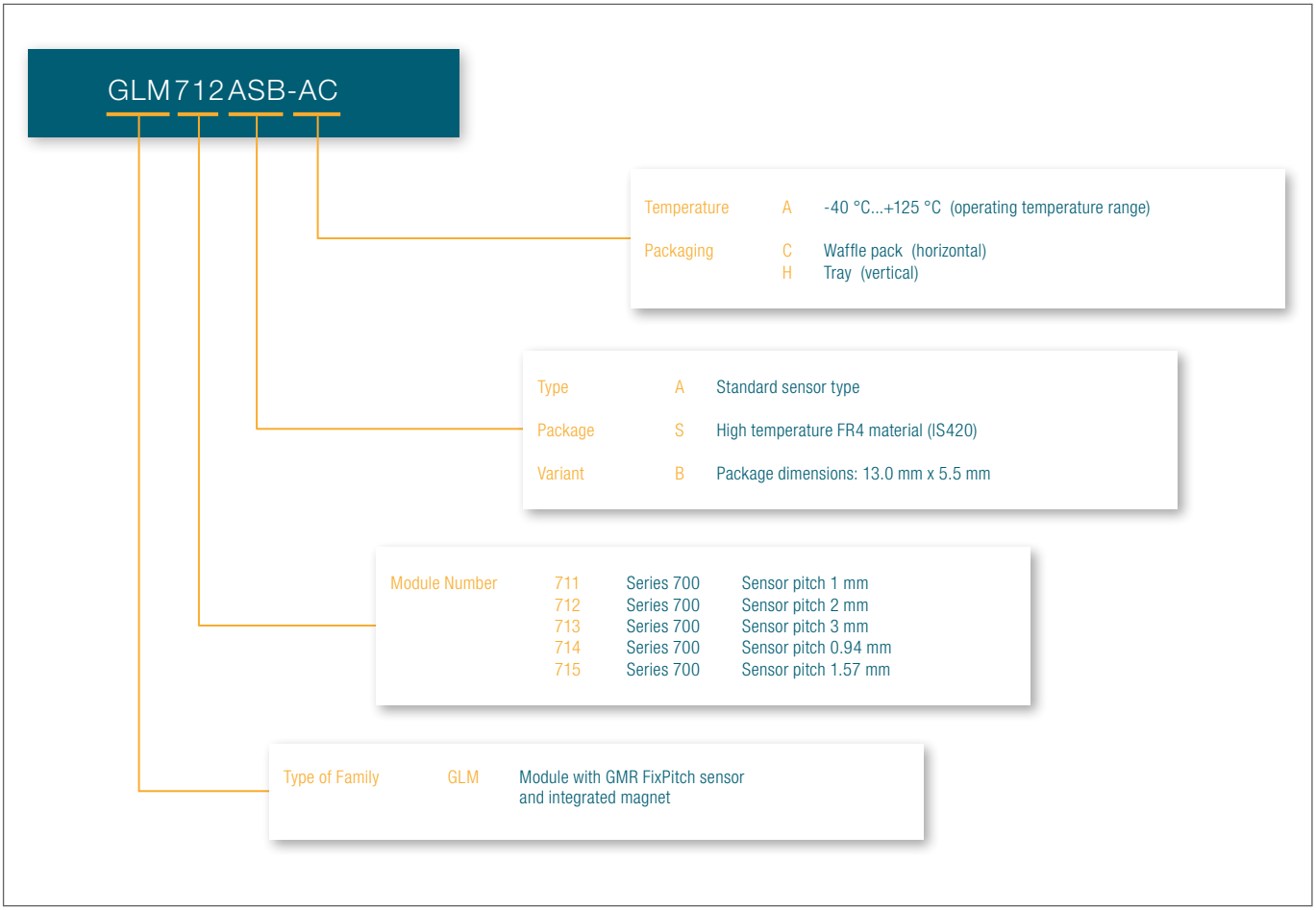
Material Short Designation	Material Number according DIN 17007 T1
X20Cr13	(1.4021)
X30Cr13	(1.4028)
X46Cr13	(1.4034)
X6Cr17	(1.4016)
X14CrMoS17	(1.4104)
X17CrNi16 2	(1.4057)
X39CrMo17 1	(1.4122)
X90CrMoV18	(1.4112)

The tooth gap can be filled by a chrome coating or by other non-ferromagnetic materials if the application requires a smooth surface. This table is intended only as a rough guide. Please contact your sales engineer for further details.

Purchased Parts Package and Delivery Form

Quantity	Part	Description
20	GLM7xxASB-AC	Waffle pack for horizontal mounting
120	GLM7xxASB-AH	Tray for vertical mounting

Order Code



Product Overview

Article description	Pitch	Marking [1]	Delivery form [2]	Article number
GLM711ASB-AC	1 mm	B$&	Waffle Pack	5102.2211.2
GLM712ASB-AC	2 mm	E$&	Waffle Pack	5102.2212.2
GLM713ASB-AC	3 mm	F$&	Waffle Pack	5102.2213.2
GLM714ASB-AC	0.94 mm (module 0.3)	A$&	Waffle Pack	5102.2214.2
GLM715ASB-AC	1.57 mm (module 0.5)	D$&	Waffle Pack	5102.2215.2
GLM715ASB-AH	1.57 mm (module 0.5)	D$&	Tray	5102.2225.1

[1] $ - calender week (A:1/2, B:3/4, …), & - Year (E:2013, F:2014, …).

[2] The delivery form „Tray“ is used for the automatic vertical assembly of the GLM module.

Note: For all GLM700 types delivery form „Tray“ (for vertical mounting) is available on request.

Special Design Features

PerfectWave

Sensors with PerfectWave design provide the best signal quality, highest accuracy and optimal sensor linearity by filtering out higher harmonics in the signal. The linearity of the sensor is assured, even for weak magnetic field measurement.

FixPitch

FixPitch sensors are adapted to the pole length (pitch) of the measurement scale. The linearity of the sensor is optimized and the influence of interference fields is minimized.

General Information

Product Status

Article	Status
GLM7xxASB-Ax	The product is in series production.
Note	The status of the product may have changed since this data sheet was published. The latest information is available on the internet at www.sensitec.com.

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Life Critical Applications

These products are not qualified for use in life support appliances, aeronautical applications or devices or systems where malfunction of these products can reasonably be expected to result in personal injury.

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Changelist

Version	Description of the Change	Date
GLM700ASB.DSE.14	Disclaimer supplement	06/2022
GLM700ASB.DSE.13	Change of corporate design (pp. 1-10)	01/2022
GLM700ASB.DSE.12	Change in thickness tolerance (p. 5)	12/2020
GLM700ASB.DSE.11	Various textual changes	07/2019

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