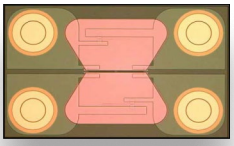
SENSITEC
KÖRBER SOLUTIONS

DATA SHEET

GF705

MagnetoResistive Magnetic Field Sensor



The GF705 is a magnetic field sensor based on the multilayer Giant MagnetoResistive (GMR) effect. The Sensor contains a Wheatstone bridge with on-chip flux concentrators to improve the sensitivity. The sensor is ideal for measuring magnetic fields in a linear range from 1.8 mT up to 8 mT.

A typical application is endpoint detection through a cylinder of stainless steel: A moving magnet inside a thick-walled cylinder is detected by a GF705 sensor from the outside.

The GF705 is available as bond version (bare die) and as flip-chip or LGA-package for SMD assembly.

Product Overview GF705

Article description	Package	Delivery Type
GF705APA-AE	Flip-chip	Tape on reel (5000)
GF705ACA-AB	Die on wafer [1]	Waferbox
GF705AMA-AE	LGA6S	Tape on reel (2500)

[1] Minimum order quantities apply.

Quick Reference Guide

Symbol	Parameter	Min.	Typ.	Max.	Unit
V_{CC}	Supply voltage	-	5.0	-	V
B_{Lin}	Linear magnetic range	1.8	-	8.0	mT
S	Sensitivity (in linear range)	8	10	13	mV/V/mT
R_B	Bridge resistance	4.0	5.0	7.0	kΩ

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

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

- Based on the GiantMagnetoResistive (GMR) effect
- Flip-chip assembly (BGA)
- Temperature range from -40 °C to +125 °C

Advantages

- Large working distance
- Excellent absolute accuracy
- Large range of magnetic field strength
- Very small size
- Contactless field measuring
- Switching with adjustable switching thresholds

Applications

- Endpoint detection in cylinders
- Reference monitoring
- Magnetic switches

ESD

RoHS-Compliant www.sensitec.com

Magnetic Data

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
B_{Lin}	Linear magnetic flux density range (abs)	See Fig.1	1.8	-	8.0	mT
B_{sat}	Saturation magnetic flux density [1]	See Fig.1	-	±25	-	mT

[1] At B_{sat} the sensor delivers the maximal output voltage V_{peak}. By exceeding the value of B_{sat} the output signal is no longer unique.

Electrical Data

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

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_{CC}	Supply voltage		-	5.0	-	V
S	Sensitivity	B = (1.8...8) mT	8	10	13	mV/V/mT
TC_S	Temperature coefficient of Sensitivity [2]	T_{amb} = (-40…+125) °C	-0.26	-0.22	-0.18	%/K
R_B	Bridge resistance [3]		4.0	5.0	7.0	kΩ
TC_{RB}	Temperature coefficient of RB [4]	T_{amb} = (-40…+125) °C	0.17	0.20	0.23	%/K
V_{peak}	Maximum output voltage [5]	See Fig.1	-	110	-	mV/V
V_{OUT}	Voltage output delta [6] $V_{OUT(3\ mT)} - V_{OUT(0\ mT)}$	0 mT @ 90 deg 3 mT @ 0 deg	12.3	-	27.4	mV/V

[2] $TC_S = 100 \cdot \frac{S_{(T2)} - S_{(T1)}}{S_{(T1)} \cdot (T_2 - T_1)}$ with T_1 = 25 °C; T_2 = 125 °C.

[3] Bridge resistance between pads 1 and 3 and 2 and 4.

[4] $TC_{RB} = 100 \cdot \frac{R_{B(T2)} - R_{B(T1)}}{R_{B(T1)} \cdot (T_2 - T_1)}$ with T_1 = 25 °C; T_2 = 125 °C.

[5] Maximal output voltage at B_{sat}.

[6] Parameter checked on 96 samples.

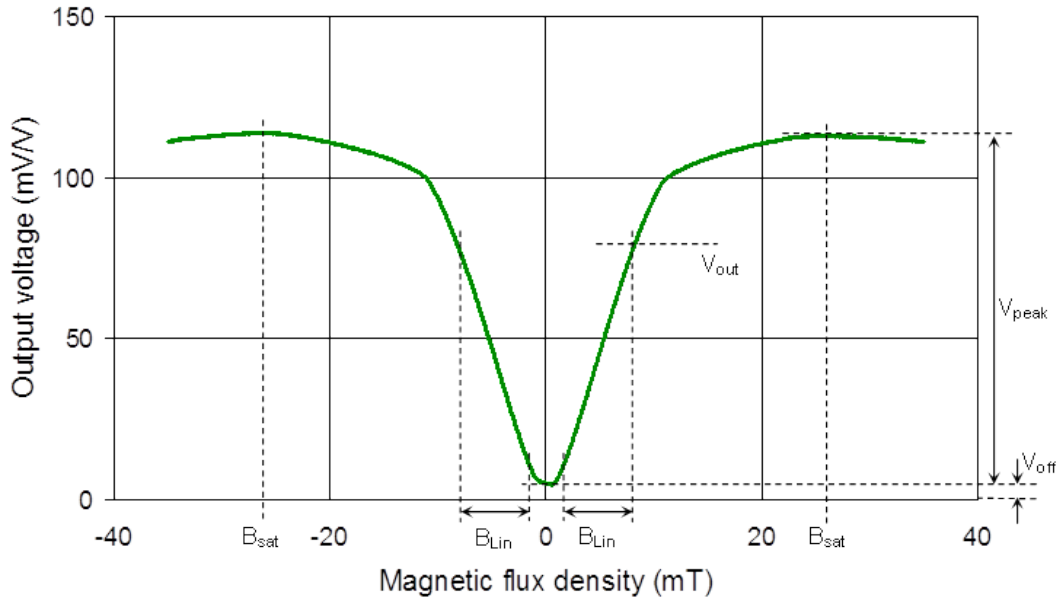


Fig. 1: Typical output voltage of the GF705 depending on the magnetic flux density.

Accuracy

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

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_{off}	Offset voltage per V_{CC}	See Fig. 1	-5.0	-	+5.0	mV/V
TC_{Voff}	Temperature coefficient of V_{off}	T_{amb} = (-40…+125) °C	-20	7	+25	µV/V/K
ε_{Lin}	Linearity error	B = (1.8…8) mT; see Fig. 2	-	2	5	% of Vout
H_C	Hysteresis error [1]	See Fig. 3	-	0.05	0.1	mT

[1] The hysteresis error is ascertained in the magnetic field, ramped from 10 mT to –10 mT and back to 10 mT. The value is specified for the linear range B_{Lin}.

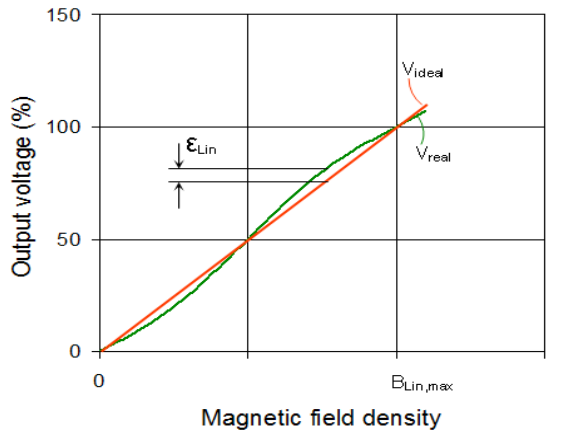


Fig. 2: Definition of linearity error ε_{Lin} (schematic).

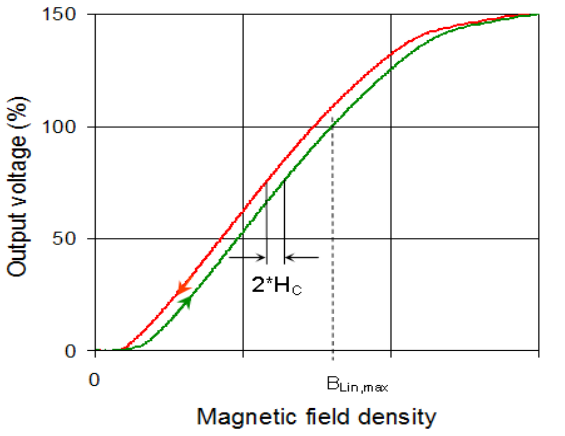


Fig. 3: Definition of hysteresis error H_C (schematic).

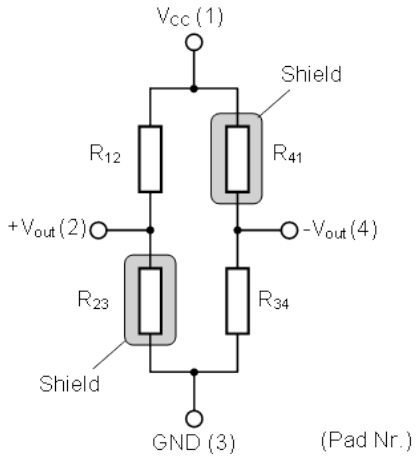


Fig. 4: Simplified circuit diagram.

In Fig. 4 the resistors R_{23} and R_{41} are covered by two flux concentrators (shields) to prevent an applied magnetic field from influencing them. Therefore, when a field is applied, the resistors R_{12} and R_{34} decrease in resistance, while the other two resistors under the flux concentrator do not. This imbalance leads to the bridge output.

GF705 as Bare Die and Flip-Chip

Pinning

Pad	Symbol	Parameter
1	V_{CC}	Supply voltage
2	$+V_{out}$	Positive output voltage
3	GND	Ground
4	$-V_{out}$	Negative output voltage

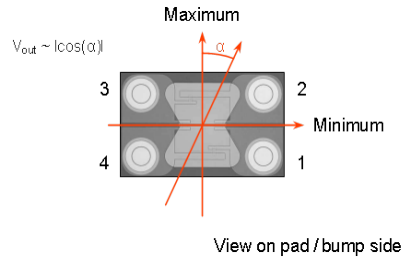


Fig. 5: *Top:* GF705 on its pad / bump side shown with the direction of its sensitivity. *Bottom:* Marked side of the flip-chip version only.

Note:
Pin 1 is not marked on the chip. Since the chip is symmetrical, its orientation is only defined by its long and short side.

Mechanical Data

Symbol	Parameter		Min.	Typ.	Max.	Unit
A	Bare die	Length	1435	1460	1485	µm
B		Width	935	960	985	µm
C		Height	240	250	260	µm
d		Diameter	-	230	-	µm
A	Flip-chip	Length	1425	1460	1485	µm
B		Width	935	960	985	µm
C		Height	400	410	420	µm
d		Diameter [1]	-	300	-	µm
S		Standoff [2]	-	240	-	µm
a	Pitch a		-	1000	-	µm
b	Pitch b		-	500	-	µm
e	Margin		-	230	-	µm

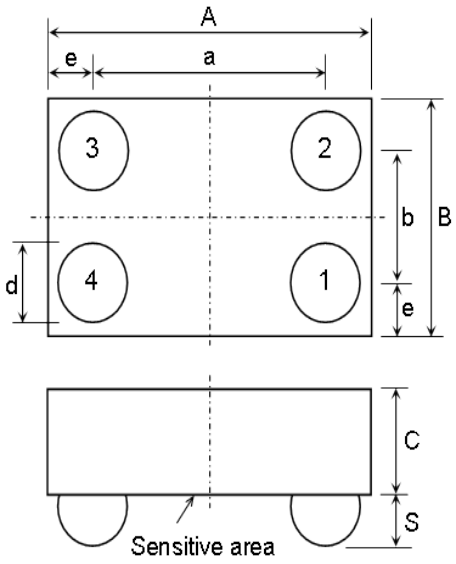


Fig. 6: Chip outline of GF705.

[1] After reflow.

[2] Diameter of solder ball before reflow.

Data for Packaging and Interconnection Technologies

Symbol	Parameter	Conditions	Value	Unit
Bare die	Pad material		Au	-
	Pad thickness		0.4	µm
Flip-chip	Solder ball material		SnAg2.6Cu0.6	-
	Maximum solder temperature	For 6 s	260	°C

GF705AMA LGA6S

Pinning

Pad	Symbol	Parameter
1	$+V_{out}$	Positive output voltage
2	NC	Not connected
3	GND	Ground
4	V_{CC}	Supply voltage
5	$-V_{out}$	Negative output voltage
6-8	NC	Not connected

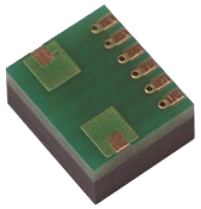


Fig. 7: GF705AKA.

Dimensions

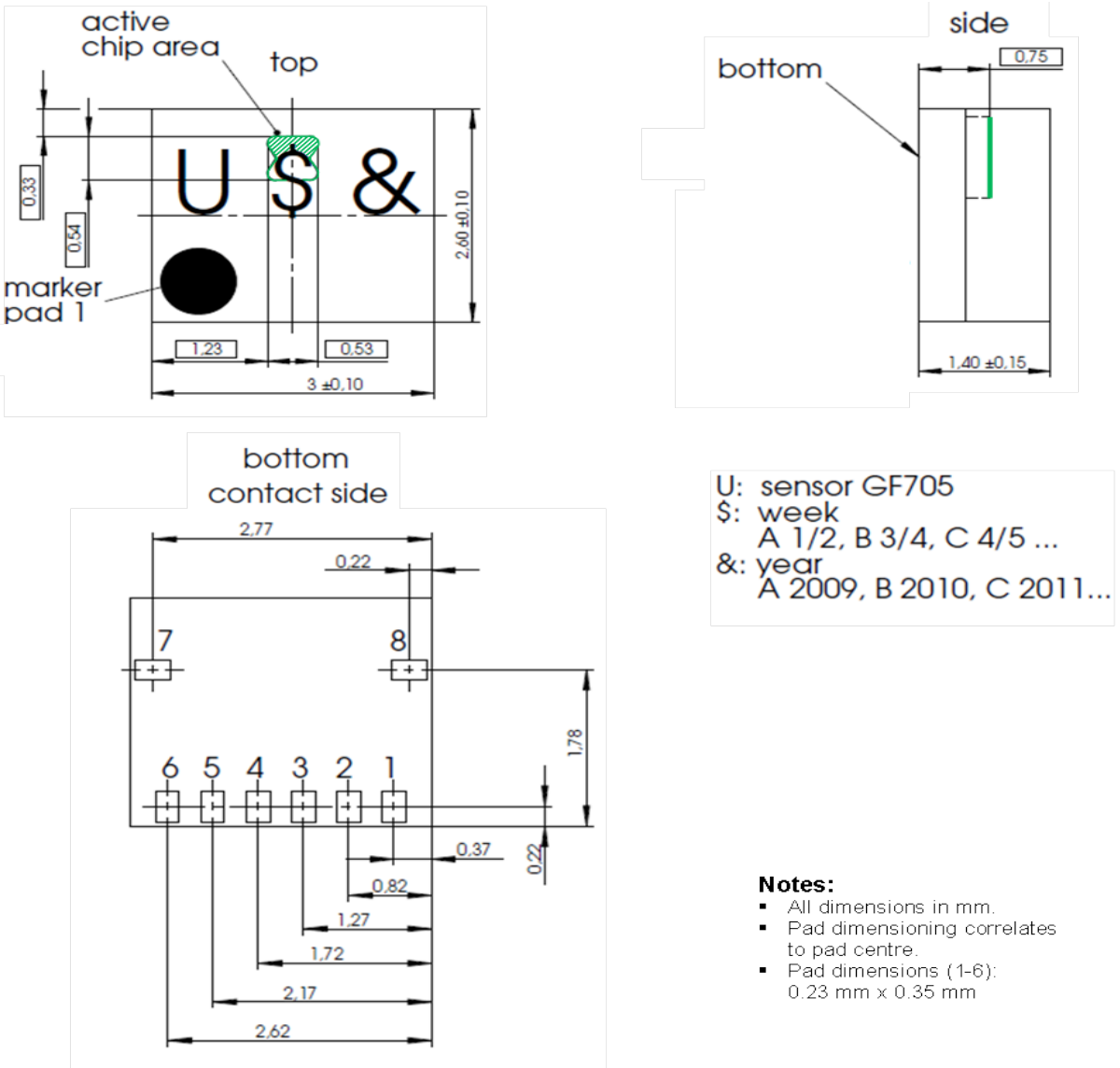


Fig. 8 LGA6S for GF705AMA.

General Information

Product Status

Article	Status
GF705APA-AB	The product is in series production.
GF705ACA-AB	The product is in series production.
GF705AMA-AE	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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