DATA SHEET

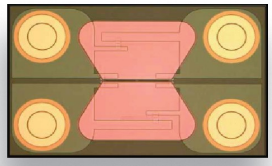
GF705

MagnetoResistive Magnetic Field Sensor

The GF705 is a magnetic fi eld 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 fi elds 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 or vertical package for SMD assembly.



Features

- Based on the GiantMagnetor-Resistive (GMR) effect
- Flip-chip assembly
- Wide temperature range from –40°C up to +125°C

Product Overview

Article description	Package	Delivery Type
GF705ACA-AB [1)]	Bare Die	Waferbox
GF705APA-AB	Flip-Chip	Tape on reel (5000)
GF705AMA-AE	LGA6S	Tape on reel (2000)
GF705AMS-AS	SIL4-D	Tape on reel (tbd.)

[1)] minimum order quantities apply.

Advantages

- Large working distance
- Excellent absolute accuracy
- Large range of magnetic field strength
- Very small size
- Contactless field measurement

Quick Overview

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

Applications

- End-point detection
- Reference monitoring
- Magnetic switches

Absolute Maximum Ratings

The ratings do not imply opening conditions; functional operation is not guaranteed. Beyond these values damage may occur.

Symbol	Parameter	min.	max.	Unit
V_{CC}	Supply voltage	-9.0	9.0	V
T_{amb}	Ambient temperature	-40	+125	°C

ESD

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	-	±25.0	-	mT

[1] At B_{sat} the sensor delivers the maximal output voltage V_{peak}. By exceeding the value B_{sat} the output signal is not 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 coefficciient 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.

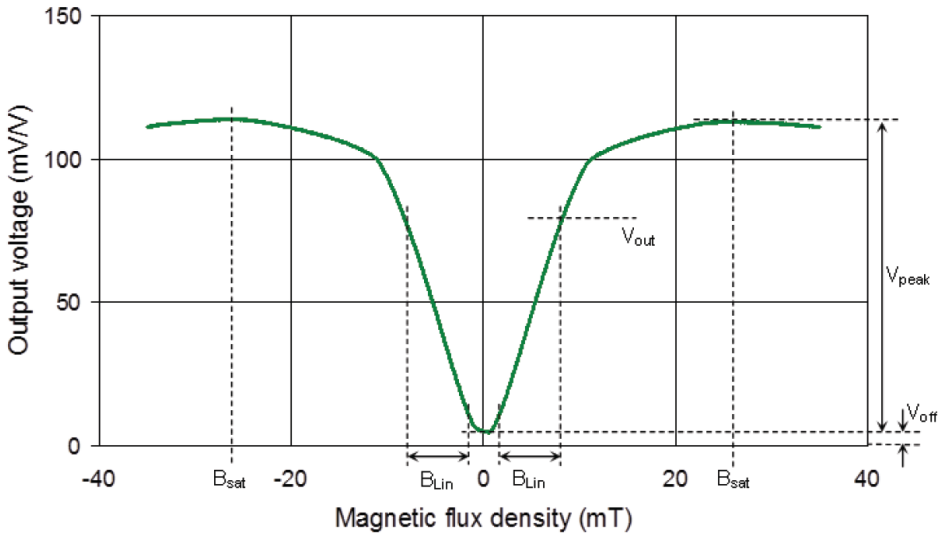


Fig.1: Typical output voltage of the GF705 depending on the magnetic flux density.

Performance Data

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 V_{out}
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}.

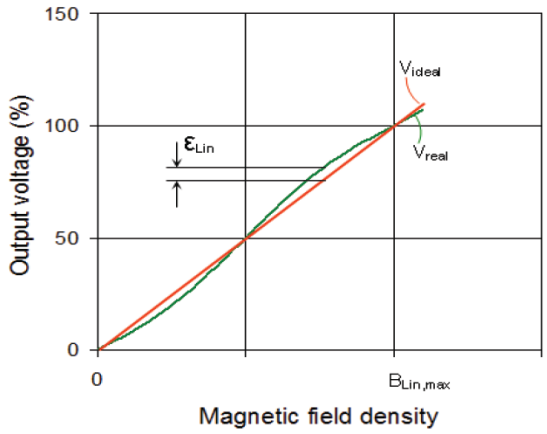


Fig. 2: Definition of linearity error ε_{Lin} (schematic).

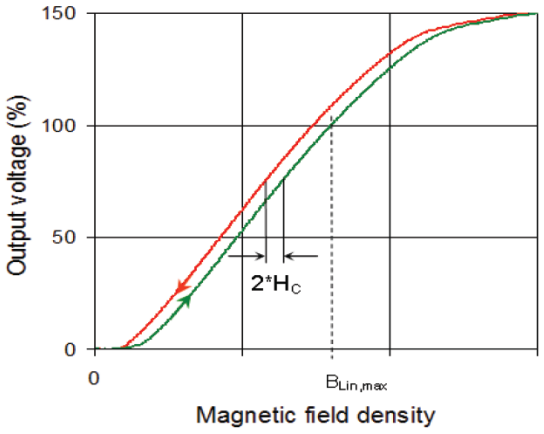


Fig. 3: Definition of hysteresis error H_C (schematic).

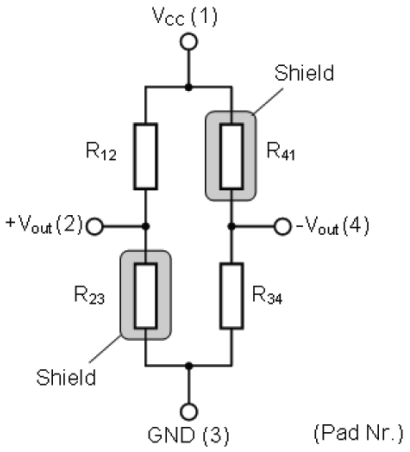


Fig. 4: Simplified circuit diagram.

In Fig. 4 the resistors R23 and R41 are covered by two flux concentrators (shields) to prevent an applied magnetic fi eld from infl uencing them. Therefore, when a fi eld is applied, the resistors R12 and R34 decrease in resistance, while the other two resistors under the fl ux concentrator do not. This imbalance leads to the bridge output.

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

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

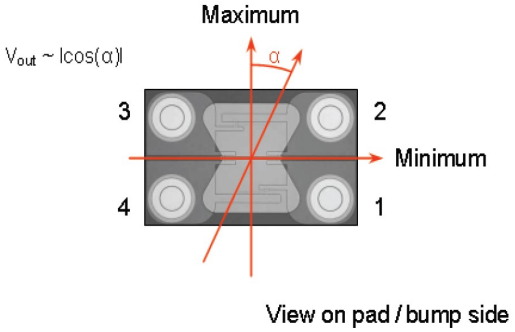


Fig. 5: Top: GF705 on its pad / bump side shown with the direction of its sensitivity. Bottom: Marked side of the flip-chip version only.

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		Pitch c	-	230	-	µm

[1] Diameter of solter balls before reflow

[2] After reflow

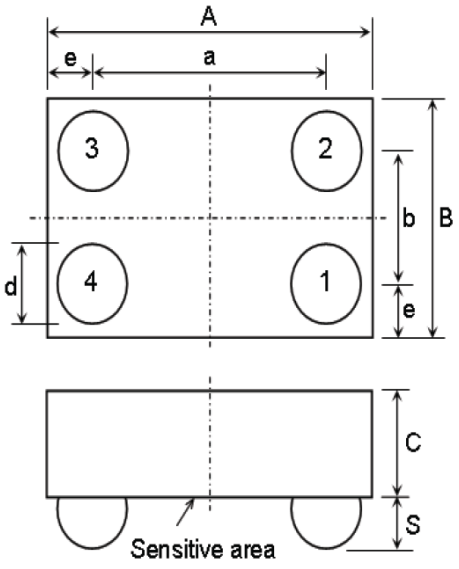


Fig. 6: Chip outline of GF705

Data for Packaging an 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

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

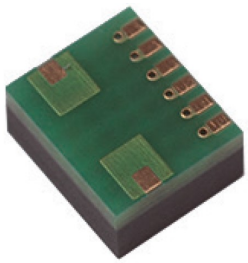


Fig. 7: GF705AMA

Dimensions

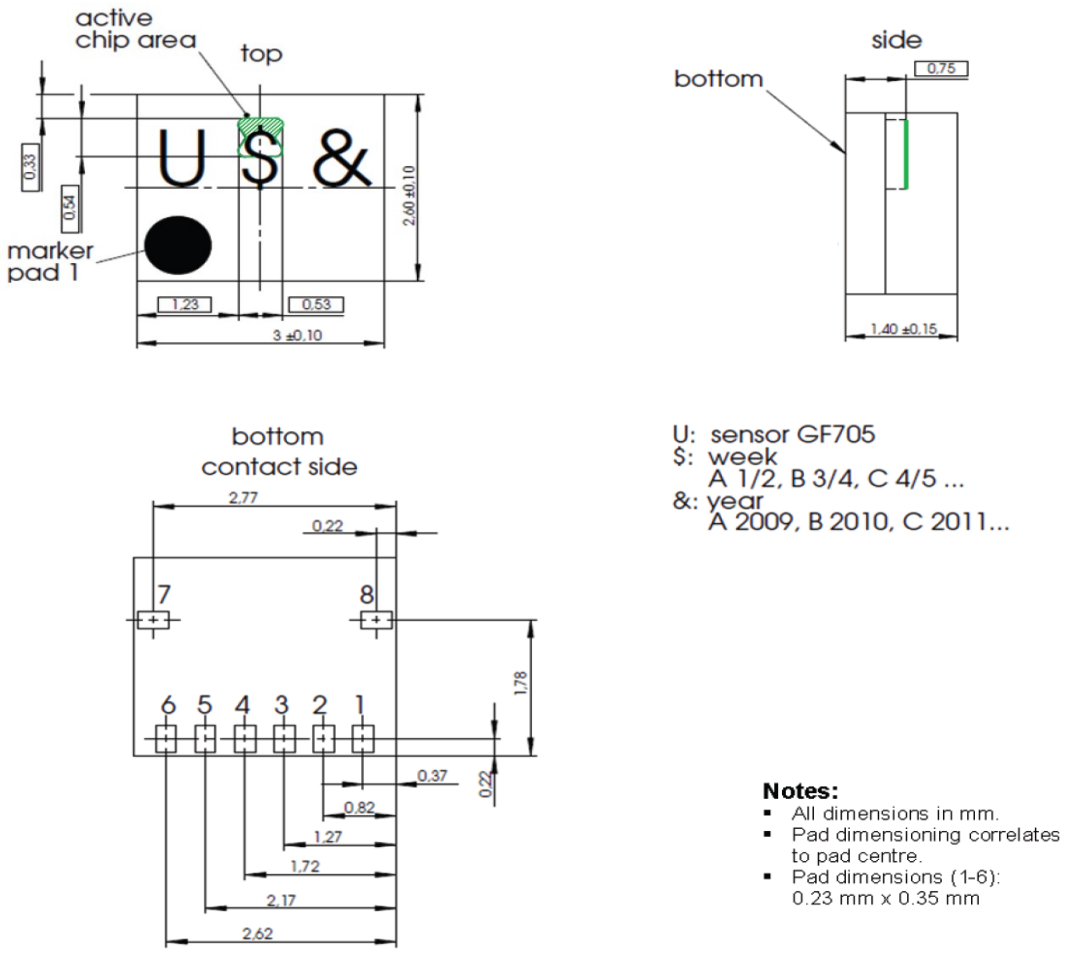


Fig. 8: LGA6S for GF705AMA

SIL4-D

Pinning

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

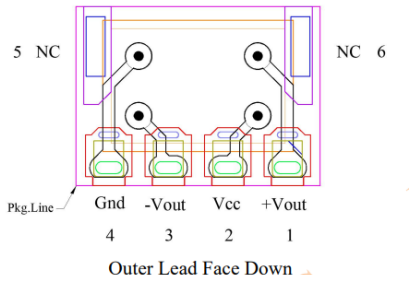
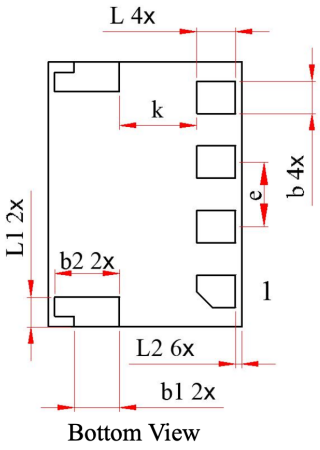
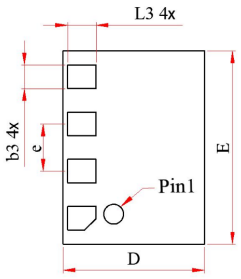


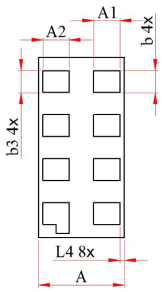
Fig. 9: GF705AMS

Dimensions

➢ **Package Outline Dimensions:**







Symbol	Dimension In Millimeters			Dimension In Inches		
	Normal	Min	Max	Normal	Min	Max
A	--	0.950	1.050	--	0.037	0.0411
A1	--	0.220	0.350	--	0.009	0.014
A2	--	0.220	0.350	--	0.009	0.014
D	1.500	1.450	1.550	0.059	0.057	0.061
E	2.050	2.000	2.100	0.081	0.079	0.083
b	0.250	0.200	0.300	0.010	0.008	0.012
b1	0.350	0.300	0.400	0.014	0.012	0.016
b2	0.500	0.450	0.550	0.020	0.018	0.022
b3	0.250	0.200	0.300	0.010	0.008	0.012
L	0.300	0.250	0.350	0.012	0.010	0.014
L1	0.230	0.180	0.280	0.009	0.007	0.011
L2	0.050	0.010	0.090	0.002	0.000	0.004
L3	0.300	0.250	0.350	0.012	0.010	0.014
L4	0.050	0.010	0.090	0.002	0.000	0.004
k	0.600 REF			0.024 REF		
e	0.500 BSC			0.050 BSC		

Fig. 10: SIL4-D for GF705AMS

General Information

Product Status

Article	Status
GF705ACA-AB	The product is in series production.
GF705APA-AB	The product is in series production.
GF705AMA-AE	The product is in series production.
GF705AMS-AS	The product is under development.
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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General Information

Application Information

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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
GF705.DSE.13	Change of article description (p. 1 product overview) Add new product variant (GF705AMS)	05/2023
GF705.DSE.12	Various textual changes	07/2018
GF705.DSE.11	Various textual changes	04/2017
GF705.DSE.10	Change of corporate design (pp. 1-7)	05/2015
GF705.DSE.00	Original (pp. 1-7)	11/2006

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