

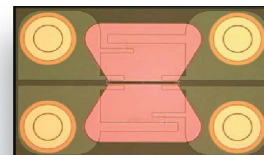
# GF705

## 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 or vertical package for SMD assembly.



### Product Overview

| Article description       | Package   | Delivery Type       |
|---------------------------|-----------|---------------------|
| GF705ACA-AB <sup>1)</sup> | 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.) |
| GF705 Evalboard           | Evalboard | ESD-Box             |

<sup>1)</sup> minimum order quantities apply.

### Quick Overview

| Symbol           | Parameter                     | min. | typ. | max. | Unit        |
|------------------|-------------------------------|------|------|------|-------------|
| V <sub>CC</sub>  | Supply voltage                | -    | 5.0  | -    | V           |
| B <sub>Lin</sub> | Linear magnetic range         | 1.8  | -    | 8.0  | mT          |
| S                | Sensitivity (in linear range) | 8    | 10   | 13   | mV/V/<br>mT |
| R <sub>B</sub>   | Bridge resistance             | 4.0  | 5.0  | 7.0  | kΩ          |

### 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 <sub>CC</sub>  | Supply voltage      | -9.0 | 9.0  | V    |
| T <sub>amb</sub> | Ambient temperature | -40  | +125 | °C   |

### Features

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

### Advantages

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

### Applications

- End-point detection
- Reference monitoring
- Magnetic switches



## 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 <sup>1)</sup> | See Fig. 1 | -    | $\pm 25.0$ | -    | mT   |

<sup>1)</sup> 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

$T_{amb} = +25^{\circ}\text{C}$ , unless otherwise specified

| Symbol     | Parameter                                                                             | Conditions                               | min.  | typ.  | max.  | Unit        |
|------------|---------------------------------------------------------------------------------------|------------------------------------------|-------|-------|-------|-------------|
| $V_{CC}$   | Supply voltage                                                                        |                                          | -     | 5.0   | -     | V           |
| $S$        | Sensitivity                                                                           | $B = (1.8...8) \text{ mT}$               | 8     | 10    | 13    | mV/V/<br>mT |
| $TC_S$     | Temperature coefficient of Sensitivity <sup>2)</sup>                                  | $T_{amb} = (-40...+125)^{\circ}\text{C}$ | -0.26 | -0.22 | -0.18 | %/K         |
| $R_B$      | Bridge resistance <sup>3)</sup>                                                       |                                          | 4.0   | 5.0   | 7.0   | k $\Omega$  |
| $TC_{RB}$  | Temperature coefficient of $R_B$ <sup>4)</sup>                                        | $T_{amb} = (-40...+125)^{\circ}\text{C}$ | 0.17  | 0.20  | 0.23  | %/K         |
| $V_{peak}$ | Maximum output voltage <sup>5)</sup>                                                  | See Fig. 1                               | -     | 110   | -     | mV/V        |
| $V_{out}$  | Voltage output delta <sup>6)</sup><br>$V_{OUT(3 \text{ mT})} - V_{OUT(0 \text{ mT})}$ | 0 mT @90 deg<br>3 mT @0 deg              | 12.3  | -     | 27.4  | mV/V        |

$$^2) \quad TC_S = 100 \cdot \frac{S_{(T_2)} - S_{(T_1)}}{S_{(T_1)} \cdot (T_2 - T_1)} \quad \text{with } T_1 = 25^{\circ}\text{C}; T_2 = 125^{\circ}\text{C}.$$

<sup>3)</sup> Bridge resistance between pads 1 and 3 and 2 and 4.

$$^4) \quad TC_{RB} = 100 \cdot \frac{R_{B(T_2)} - R_{B(T_1)}}{R_{B(T_1)} \cdot (T_2 - T_1)} \quad \text{with } T_1 = 25^{\circ}\text{C}; T_2 = 125^{\circ}\text{C}.$$

<sup>5)</sup> Maximal output voltage at  $B_{sat}$ .

<sup>6)</sup> Parameter checked on 96 samples.

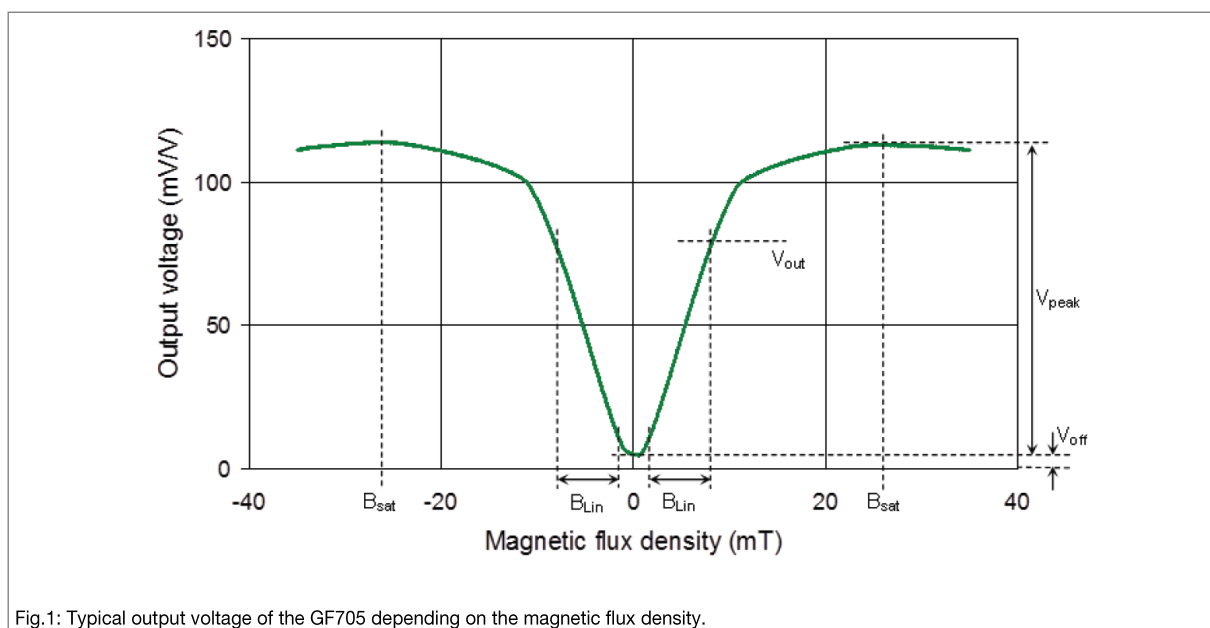


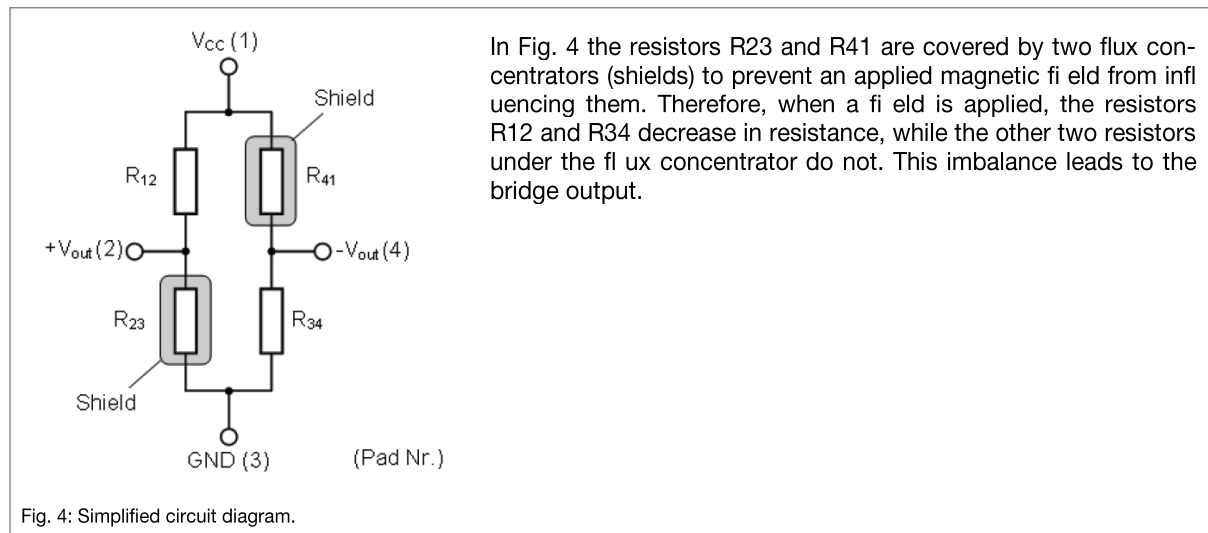
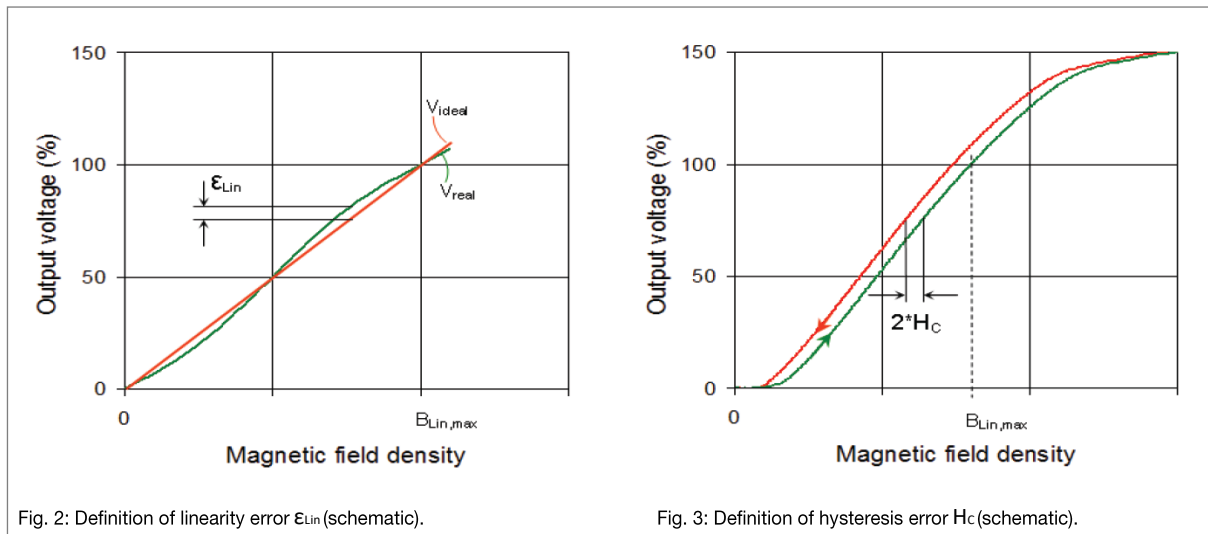
Fig.1: Typical output voltage of the GF705 depending on the magnetic flux density.

## Performance Data

$T_{amb} = +25^{\circ}\text{C}$ , 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              |
| $TC_{V_{off}}$   | Temperature coefficient of $V_{off}$ | $T_{amb} = (-40...+125)^{\circ}\text{C}$ | -20  | 7    | +25  | $\mu\text{V/V/K}$ |
| $\epsilon_{Lin}$ | Linearity error                      | $B = (1.8...8) \text{ mT}$ ; see Fig. 2  | -    | 2    | 5    | % of $V_{out}$    |
| $H_C$            | Hysteresis error <sup>1)</sup>       | See Fig. 3                               | -    | 0.05 | 0.1  | mT                |

<sup>1)</sup> 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  $B_{Lin}$ .



## 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 defined by its long and short side.

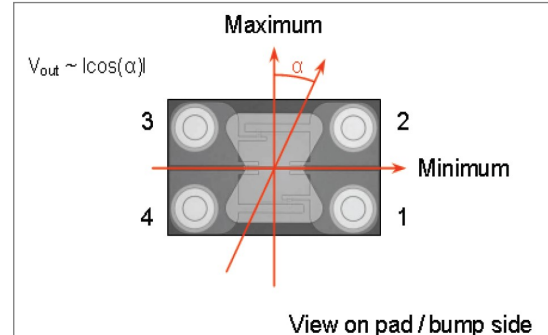


Fig. 5: Top: GF705 on its pad / bump side shown with the direction of its sensitivity. Bottom: Marked side of the flip-chip version only.

### 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 <sup>1)</sup> | -    | 300  | -    | μm   |
| S      |           | Standoff <sup>2)</sup> | -    | 240  | -    | μm   |
| a      |           | Pitch a                | -    | 1000 | -    | μm   |
| b      |           | Pitch b                | -    | 500  | -    | μm   |
| e      |           | Pitch c                | -    | 230  | -    | μm   |

<sup>1)</sup> Diameter of solder balls before reflow

<sup>2)</sup> After reflow

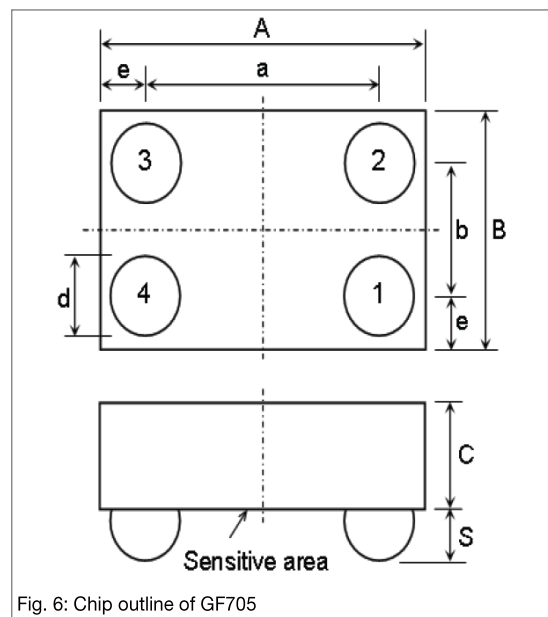


Fig. 6: Chip outline of GF705

### 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 <sub>out</sub> | Positive output voltage |
| 2   | NC                | Not connected           |
| 3   | GND               | Ground                  |
| 4   | V <sub>CC</sub>   | Supply voltage          |
| 5   | -V <sub>out</sub> | Negative output voltage |
| 6-8 | NC                | Not connected           |

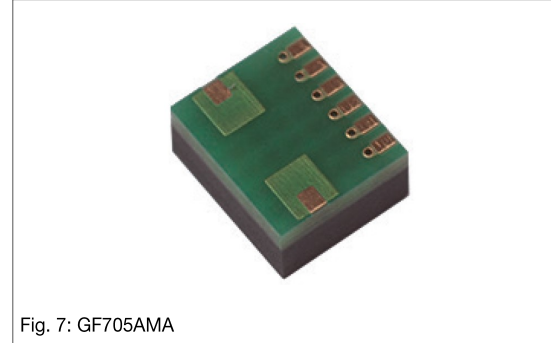


Fig. 7: GF705AMA

### Dimensions

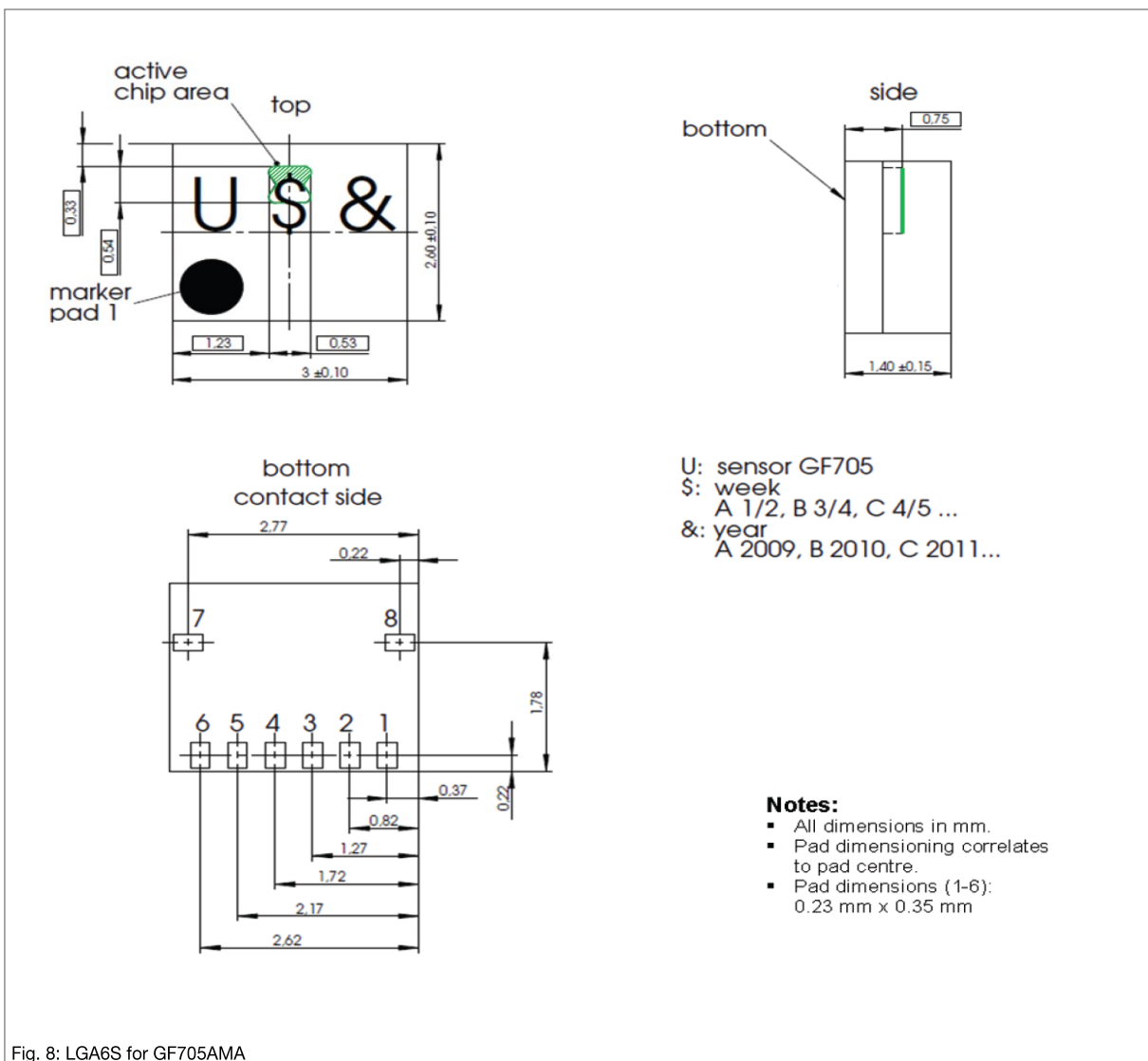
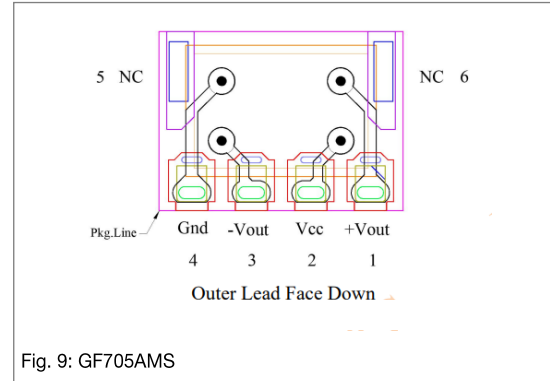


Fig. 8: LGA6S for GF705AMA

## SIL4-D

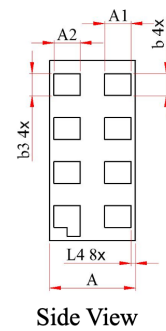
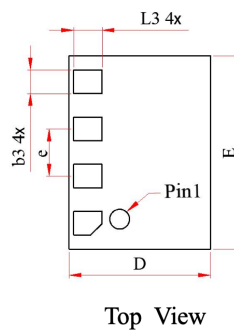
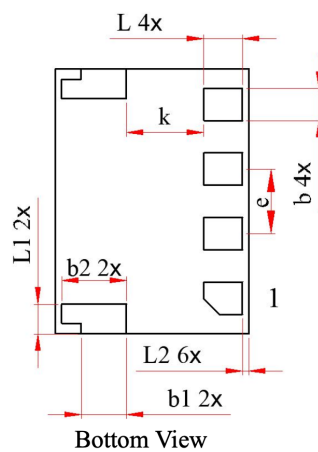
### Pinning

| Pad | Symbol            | Parameter               |
|-----|-------------------|-------------------------|
| 1   | +V <sub>out</sub> | Positive output voltage |
| 2   | V <sub>CC</sub>   | Supply voltage          |
| 3   | -V <sub>out</sub> | Negative output voltage |
| 4   | GND               | Ground                  |
| 5-6 | NC                | Not connected           |



### 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

## Evalboard with GF705AMA-AE

## Pinout

| Pad | Symbol           | Parameter                        |
|-----|------------------|----------------------------------|
| 1   | +V <sub>O1</sub> | Positive output voltage bridge 1 |
| 2   | +V <sub>O2</sub> | Positive output voltage bridge 2 |
| 3   | GND              | Ground                           |
| 4   | V <sub>CC</sub>  | Supply voltage                   |
| 5   | -V <sub>O1</sub> | Negative output voltage bridge 1 |
| 6   | -V <sub>O2</sub> | Negative output voltage bridge 2 |

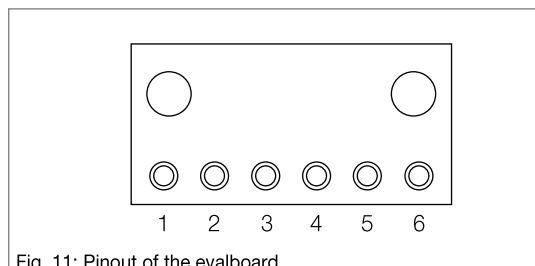


Fig. 11: Pinout of the evalboard

## Dimensions

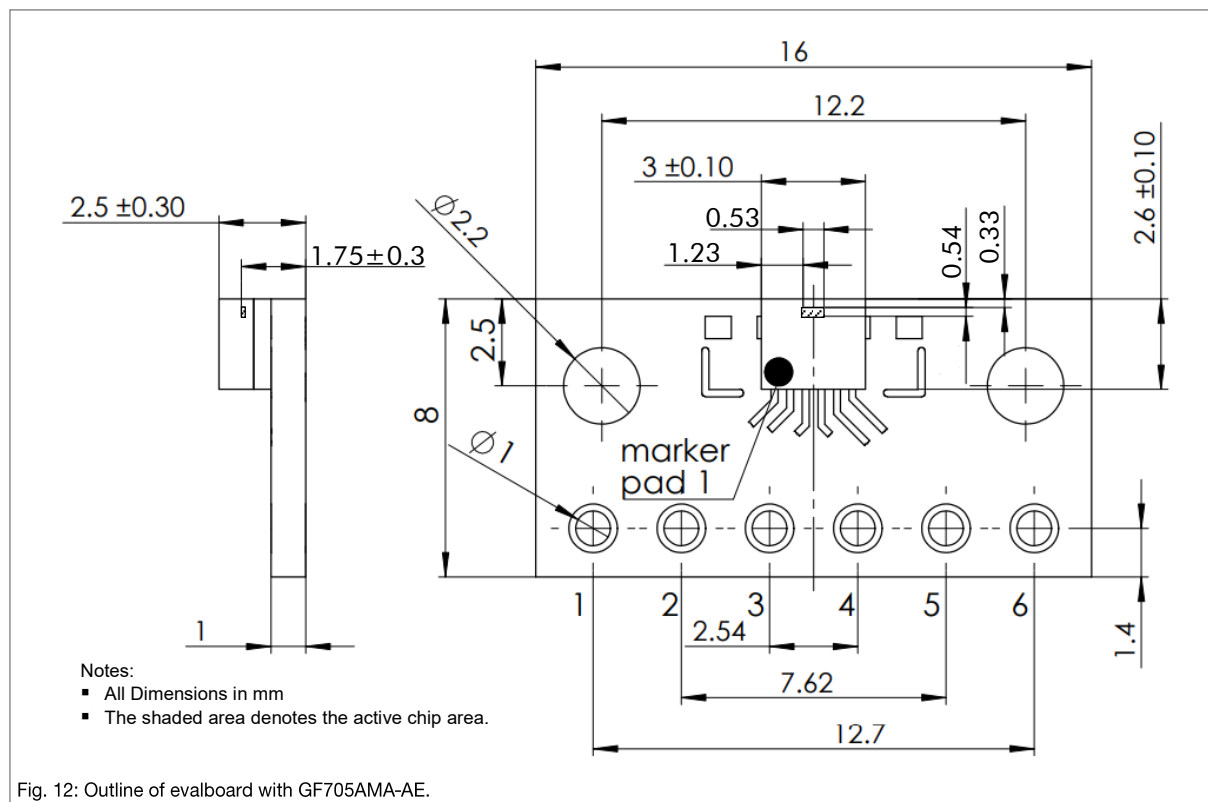


Fig. 12: Outline of evalboard with GF705AMA-AE.

## 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.                                                                                                                                                               |
| GF705 Evalboard | This product is for evaluation of the GF705AMA-AE sensor.                                                                                                                                       |
| <b>Note</b>     | The status of the product may have changed since this data sheet was published. The latest information is available on the internet at <a href="http://www.sensitec.com">www.sensitec.com</a> . |

### Disclaimer

Sensitec GmbH reserves the right to make changes, without notice, in the products, including software, described or contained herein in order to improve design and/or performance. Information in this document is believed to be accurate and reliable. However, Sensitec GmbH does not give any representations or warranties, expressed or implied, as to the accuracy or completeness of such information and shall have no liability for the consequences of use of such information. Sensitec GmbH takes no responsibility for the content in this document if provided by an information source outside of Sensitec products. In no event shall Sensitec GmbH be liable for any indirect, incidental, punitive, special or consequential damages (including but not limited to lost profits, lost savings, business interruption, costs related to the removal or replacement of any products or re-work charges) irrespective the legal base the claims are based on, including but not limited to tort (including negligence), warranty, breach of contract, equity or any other legal theory. Notwithstanding any damages that customer might incur for any reason whatsoever, Sensitec product aggregate and cumulative liability towards customer for the products described herein shall be limited in accordance with the General Terms and Conditions of Sale of Sensitec GmbH. Nothing in this document may be interpreted or construed as an offer to sell products that is open for acceptance or the grant, conveyance or implication of any license under any copyrights, patents or other industrial or intellectual property rights. Unless otherwise agreed upon in an individual agreement Sensitec products sold are subject to the General Terms and Conditions of Sales as published at [www.sensitec.com](http://www.sensitec.com). The use and/or application of our products in a military end use is explicitly prohibited. In the event of infringements, we reserve the right to take legal action, including but not limited to the assertion of claims for damages and/or the immediate termination of the business relationship.

## General Information

### Application Information

Applications that are described herein for any of these products are for illustrative purposes only. Sensitec GmbH makes no representation or warranty – whether expressed or implied – that such applications will be suitable for the specified use without further testing or modification. Customers are responsible for the design and operation of their applications and products using Sensitec products, and Sensitec GmbH accepts no liability for any assistance with applications or customer product design. It is customer's sole responsibility to determine whether the Sensitec product is suitable and fit for the customer's applications and products planned, as well as for the planned application and use of customer's third party customer(s). Customers should provide appropriate design and operating safeguards to minimize the risks associated with their applications and products. Sensitec GmbH does not accept any liability related to any default, damage, costs or problem which is based on any weakness or default in the customer's applications or products, or the application or use by customer's third party customer(s). Customer is responsible for doing all necessary testing for the customer's applications and products using Sensitec products in order to avoid a default of the applications and the products or of the application or use by customer's third party customer(s). Sensitec does not accept any liability in this respect.

### 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.

### Copyright © by Sensitec GmbH, Germany

All rights reserved. No part of this document may be copied or reproduced in any form or by any means without the prior written agreement of the copyright owner. The information in this document is subject to change without notice. Please observe that typical values cannot be guaranteed. Sensitec GmbH does not assume any liability for any consequence of its use.

### Changelist

| Version      | Description of the Change                                                                   | Date    |
|--------------|---------------------------------------------------------------------------------------------|---------|
| GF705.DSE.14 | Add evalboard                                                                               | 10/2025 |
| GF705.DSE.13 | Change of article description (p. 1 product overview)<br>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 |

### Sensitec GmbH

Schanzenfeldstr. 2 • 35578 Wetzlar • Germany  
 Tel +49 (0) 6441 5291-0 • Fax +49 (0) 6441 5291-117  
 sensitec@sensitec.com • www.sensitec.com