

# DATA SHEET

# HGARAN008A

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This specification is subject to change without notice.

## List of Contents

|          |  |                    |           |
|----------|--|--------------------|-----------|
| <b>1</b> | <b>Product Description</b>                       | <b>製品説明</b>        | <b>3</b>  |
| 1.1      | Overview   | 概要                 | 3         |
| 1.2      | Target Applications                              | ターゲットアプリケーション      | 3         |
| <b>2</b> | <b>Functional Description</b>                    | <b>機能説明</b>        | <b>4</b>  |
| 2.1      | Pin Configuration                                | ピン配置               | 4         |
| 2.2      | Pin Description                                  | ピン機能               | 4         |
| <b>3</b> | <b>Specifications</b>                            | <b>仕様</b>          | <b>5</b>  |
| 3.1      | Absolute Maximum Ratings                         | 絶対最大定格             | 5         |
| 3.2      | Operating Conditions                             | 動作条件               | 5         |
| 3.3      | Basic Characteristics                            | 基本特性               | 6         |
| 3.4      | Electric Characteristics                         | 電気特性               | 6         |
| <b>4</b> | <b>Package Information</b>                       | <b>パッケージ情報</b>     | <b>10</b> |
| 4.1      | Appearance                                       | 外観                 | 10        |
| 4.2      | Package Outline                                  | 外形図                | 10        |
| 4.3      | Footprint  | フットプリント            | 11        |
| 4.4      | Package Marking                                  | 捺印                 | 11        |
| 4.5      | Structure  | 構造                 | 12        |
| <b>5</b> | <b>Packing Specifications</b>                    | <b>梱包仕様</b>        | <b>13</b> |
| 5.1      | Packing Information                              | 梱包情報               | 13        |
| 5.2      | Packing Specifications                           | 梱包仕様               | 14        |
| <b>6</b> | <b>Reliability Test Conditions</b>               | <b>信頼性試験条件</b>     | <b>16</b> |
| 6.1      | Preconditioning for Reliability Test             | 信頼性試験の前処理          | 16        |
| 6.2      | Reliability Test Items                           | 信頼性試験項目            | 16        |
| <b>7</b> | <b>Precautions When Handling Magnetic Sensor</b> | <b>製品お取り扱い時の注意</b> | <b>17</b> |
| 7.1      | Storage Environment                              | 保管環境               | 17        |
| 7.2      | Long-term Storage                                | 長期保管               | 17        |
| 7.3      | ESD  | 静電気ESD             | 17        |
| 7.4      | External Magnetic Field                          | 外乱磁場               | 17        |
|          | <b>Appendix</b>                                  |                    |           |
| A1       | List of Figures                                  | 図のリスト              | 18        |
| A2       | List of Tables                                   | 表のリスト              | 18        |
| A3       | Revision History                                 | 改定履歴               | 19        |

**1 Product Description 製品説明****1.1 Overview 概要**

|                          |                              |
|--------------------------|------------------------------|
| ALPS Product No.         | HGARAN008A                   |
| Characteristic           | Angle Sensor                 |
| Package type             | DFN 1.8mm x 1.05mm x t0.65mm |
| Supply Voltage           | max. 5.5V                    |
| Operating Magnetic Field | 20 ~ 60 mT                   |
| Operating Temperature    | -40 ~ 105 deg.C              |
| Interface                | Analog Output                |

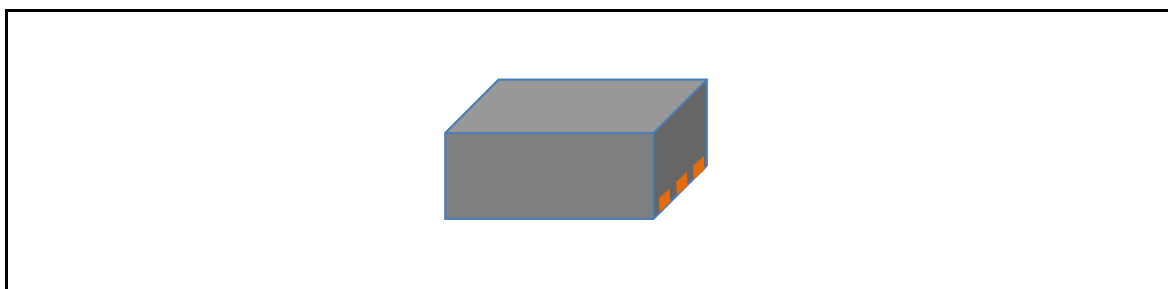


Figure 1-1 Image of HGARAN008A in the DFN Package

**1.2 Target Applications ターゲットアプリケーション**

Home Appliance  
Office Automation  
Industrial

**2 Functional Description 機能説明**

**2.1 Pin Configuration ピン配置**

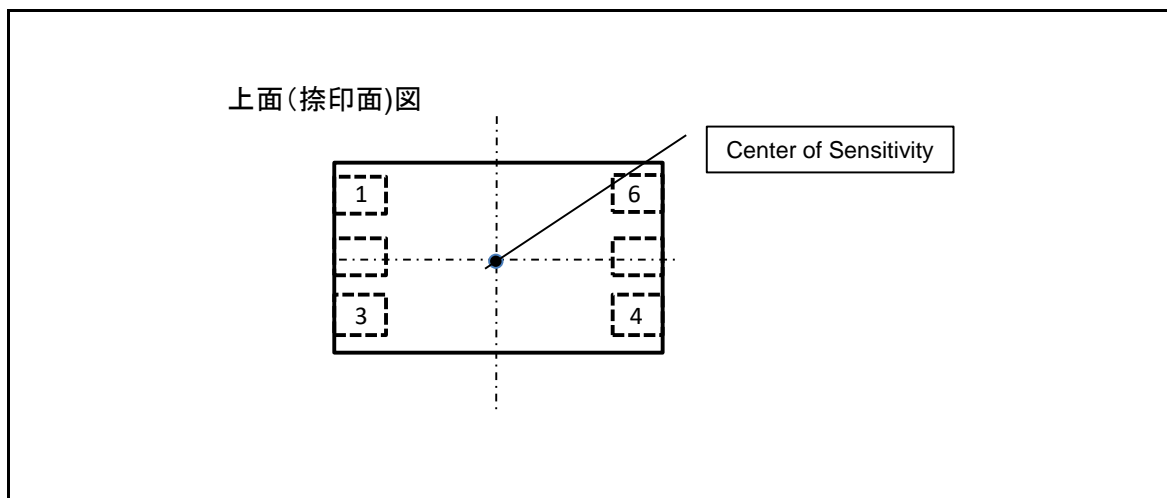


Figure 2-1 Pin Configuration

**2.2 Pin Description ピン機能**

Table 2-1 Pin Description

| Pin No. | Function | Pin No. | Function |
|---------|----------|---------|----------|
| 1       | +Sin out | 4       | -Sin out |
| 2       | +Cos out | 5       | -Cos out |
| 3       | GND      | 6       | VDD      |

### 3 Specifications 仕様

#### 3.1 Absolute Maximum Ratings 絶対最大定格

Table 3-1 Absolute Maximum Rating Parameters

| Parameter               | Symbol | Values |      |      | Unit  | Note          |
|-------------------------|--------|--------|------|------|-------|---------------|
|                         |        | Min.   | Typ. | Max. |       |               |
| Supply Voltage          | VDD    | -      | -    | 5.5  | V     |               |
| Storage Temperature     | Tstg   | -40    | -    | 105  | deg.C |               |
| Magnetic Field Strength | Hext   | -      | -    | 200  | mT    | at Room Temp. |
|                         |        | -      | -    | 160  | kA/m  |               |

[note]

The maximum rating is the value that must not be exceeded it even if it is momentary. There is a possibility of the breakdown and/or destruction when this value is exceeded.

最大定格とは、たとえ瞬間的であっても超えてはならない値であり、この値を超えた場合、故障・破壊の可能性がります。

Even if it is use within the maximum rating, continuous use on a high stress (high temperature and high superimposed voltage/large current drive, etc.) might spoil the product reliability.

最大定格内の使用であっても高負荷(高温および高電圧印加/大電流駆動etc.)での連続使用は製品の信頼性を低下させる恐れがあります。

#### 3.2 Operating Conditions 動作条件

Table 3-2 Operating Conditions

| Parameter               | Symbol | Values |      |      | Unit  | Note |
|-------------------------|--------|--------|------|------|-------|------|
|                         |        | Min.   | Typ. | Max. |       |      |
| Operating Temperature   | Top    | -40    | -    | 105  | deg.C |      |
| Magnetic Field Strength | Hext*  | 20     | -    | 60   | mT    |      |
|                         |        | 16     | -    | 48   | kA/m  |      |

\* the applied horizontal magnetic field rotated above the sensor

**3.3 Basic Characteristics 基本特性**

Table 3-3 Basic Characteristics

| Parameter   | Symbol | Values |      |      | Unit      | Note          |
|---|--------|--------|------|------|-----------|---------------|
|   |        | Min.   | Typ. | Max. |           |               |
| Each Element Resistance                                     | Rel    | 8      | 10   | 12   | kOhm      | at Room Temp. |
| Bridge Resistance   | Rtotal | 4      | 5    | 6    | kOhm      | at Room Temp. |
| Temperature Coefficient of Bridge Resistance                | TcR    | -      | -    | 1600 | ppm/deg.C | -40 ~105deg.C |
| Temperature Coefficient of Change Rate of Magnetoresistance | TcΔR   | -3900  | -    | -    | ppm/deg.C | -40 ~105deg.C |

**3.4 Electric Characteristics 電気特性**

Table 3-4 Electric Characteristics @25deg.C

| Parameter            | Symbol  | Values |      |      | Unit  | Note |
|----------------------|---------|--------|------|------|-------|------|
|                      |         | Min.   | Typ. | Max. |       |      |
| Offset Voltage       | Voffset | -20    | 0    | 20   | mV    | (1)  |
| Center Voltage       | Vcenter | 2.45   | 2.5  | 2.55 | V     | (2)  |
| Peak to Peak Voltage | Vpeak   | 490    | 550  | 610  | mVp-p | (3)  |
| Phase Difference     | Pdiff   | 87.5   | 90   | 92.5 | deg.  | (4)  |
| Waveform Distortion  | Wd      | -      | -    | 7    | mV    | (5)  |
| Angular Accuracy     | Δα      | -      | -    | 1.0  | deg.  | (6)  |

[note]

Unless otherwise specified, measurement condition is as follows.

VDD=5V, Hext=30mT, Top=25deg.C

特に注記ない限り、測定条件は下記の通り

VDD=5V, Hext=30mT, Top=25deg.C .

## Definition of Parameter パラメータの定義

$$(1) V_{\text{offset}} = \frac{(+\sin \text{ out max.}) + (+\sin \text{ out min.})}{2} - \frac{(-\sin \text{ out max.}) + (-\sin \text{ out min.})}{2}$$

\* The same calculation is applied to “+cos out” and “-cos out”.

$$(2) V_{\text{center}} = \frac{(+\sin \text{ out max.}) + (+\sin \text{ out min.})}{2}$$

\* The same calculation is applied to “-sin out”, “+cos out” and “-cos out”.

$$(3) V_{\text{peak}} = (+\sin \text{ out max.}) - (+\sin \text{ out min.}) + (-\sin \text{ out max.}) - (-\sin \text{ out min.})$$

\* The same calculation is applied to “cos out”.

\* V<sub>peak</sub> ratio is defined as ratio of V<sub>peak\_sin</sub> and V<sub>peak\_cos</sub>.

$$(4) P_{\text{diff}} = \text{SinPhase} - \text{CosPhase}$$

\* SinPhase: Phase of V<sub>sin</sub>

\* CosPhase: Phase of V<sub>cos</sub>

\* V<sub>sin</sub> and V<sub>cos</sub> are ideal curve.

$$(5) W_d = \text{Max.} | V_{\text{meas}} - V_{\text{ideal}} |$$

\* V<sub>meas</sub>: measured value

\* V<sub>ideal</sub>: ideal curve

$$(6) \Delta\alpha = \text{Max.} | \alpha_{\text{meas}} - \alpha_{\text{ideal}} |$$

\* α<sub>meas</sub> : calculated angle compensated offset, gain, and P<sub>diff</sub>.

\* α<sub>ideal</sub>: ideal angle calculated from V<sub>sin</sub> and V<sub>cos</sub>

\* V<sub>sin</sub> and V<sub>cos</sub> are ideal curve.

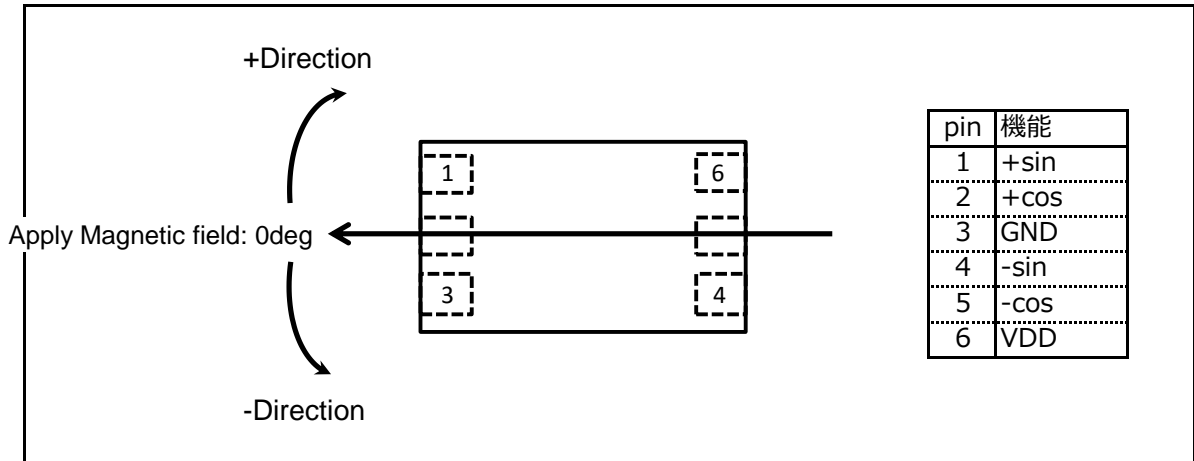


Figure 3-1 Definition of Magnetic Field Direction

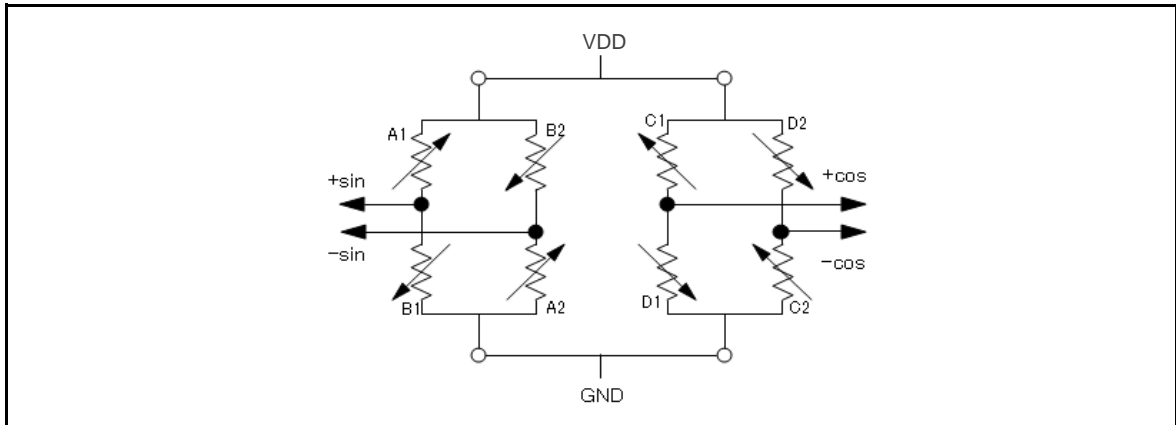


Figure 3-2 Equivalent Circuit



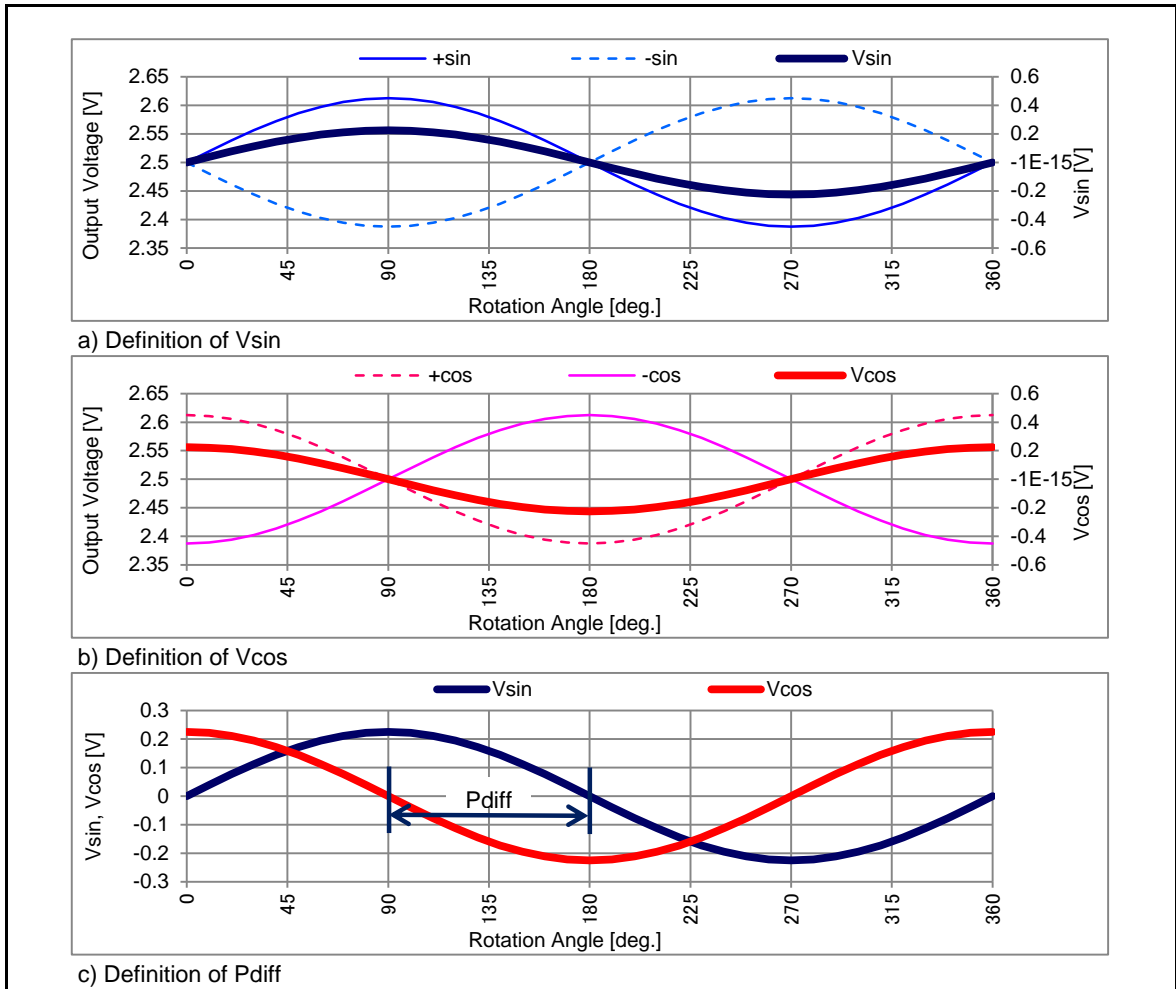


Figure 3-3 Definition of Vsin, Vcos, and Pdiff

**4 Package Information** パッケージ情報

4.1 Appearance 外観

The sensor shall be in good appearance, and have no functional failure or excessive damage such as rust, cracks, and split in any part.

各部の仕上げは良好で機能上有害な錆、傷、割れが有ってはならない。

4.2 Package Outline 外形図

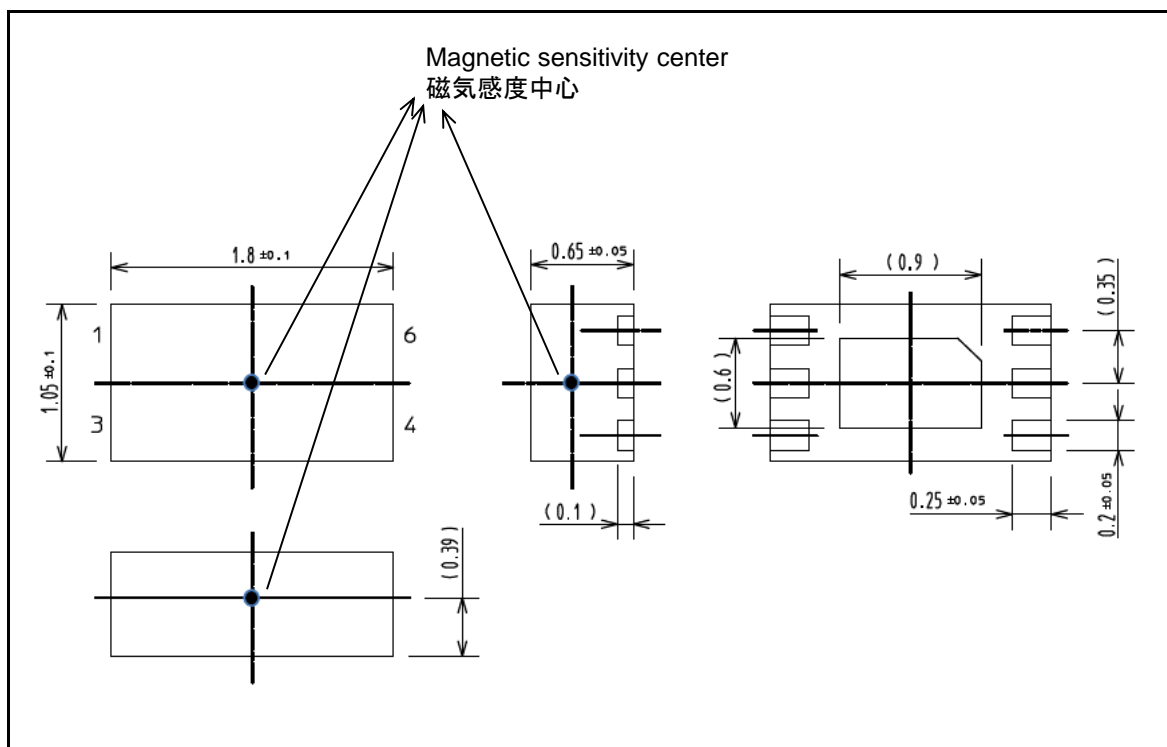


Figure 4-1 Package Outline (All dimensions in mm)

4.3 Footprint フットプリント

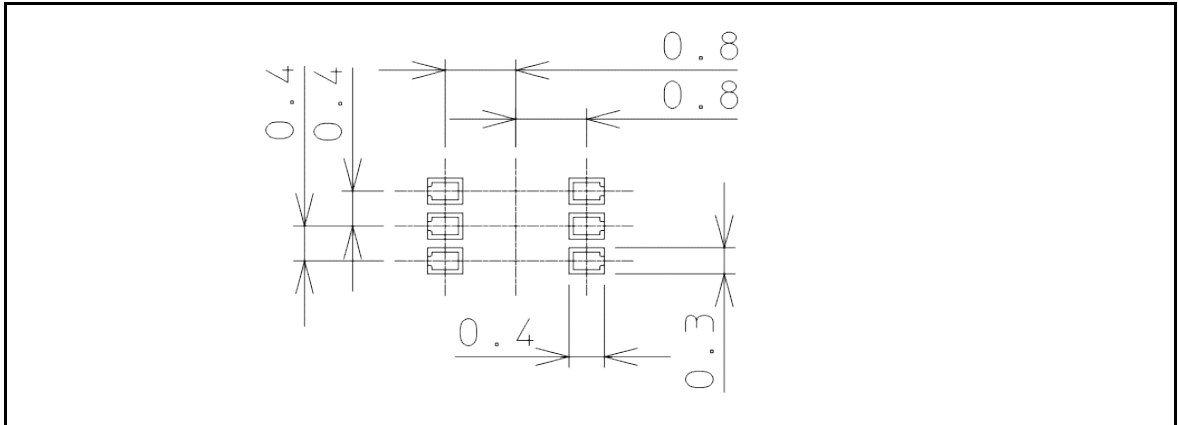


Figure 4-2 Recommended Footprint (Reference)

4.4 Package Marking 捺印

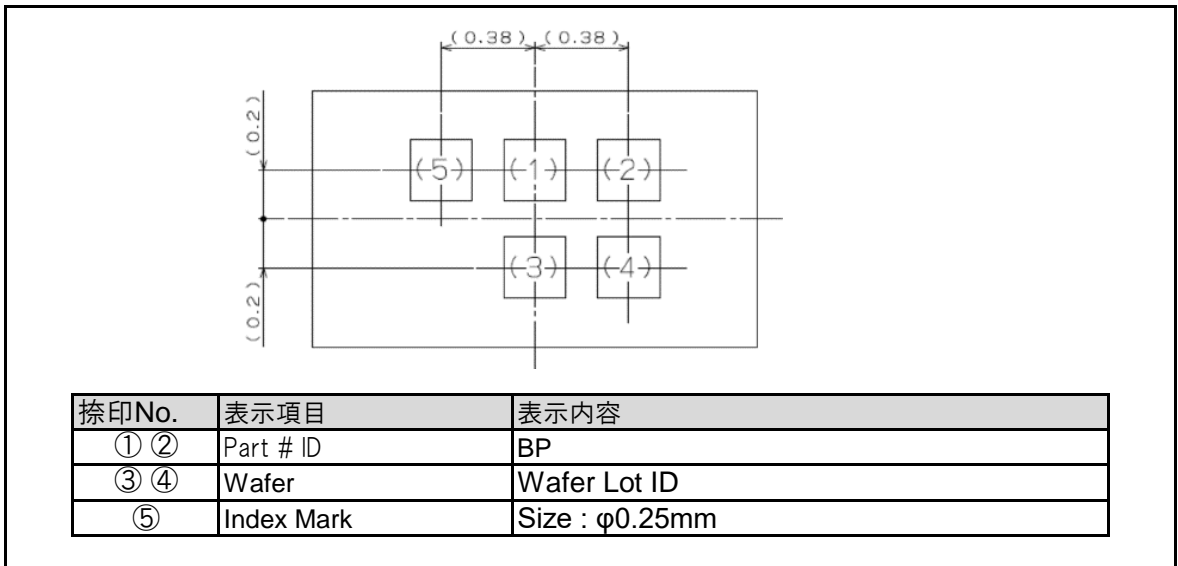


Figure 4-3 Marking of HGARAN008A

4.4 Structure 構造

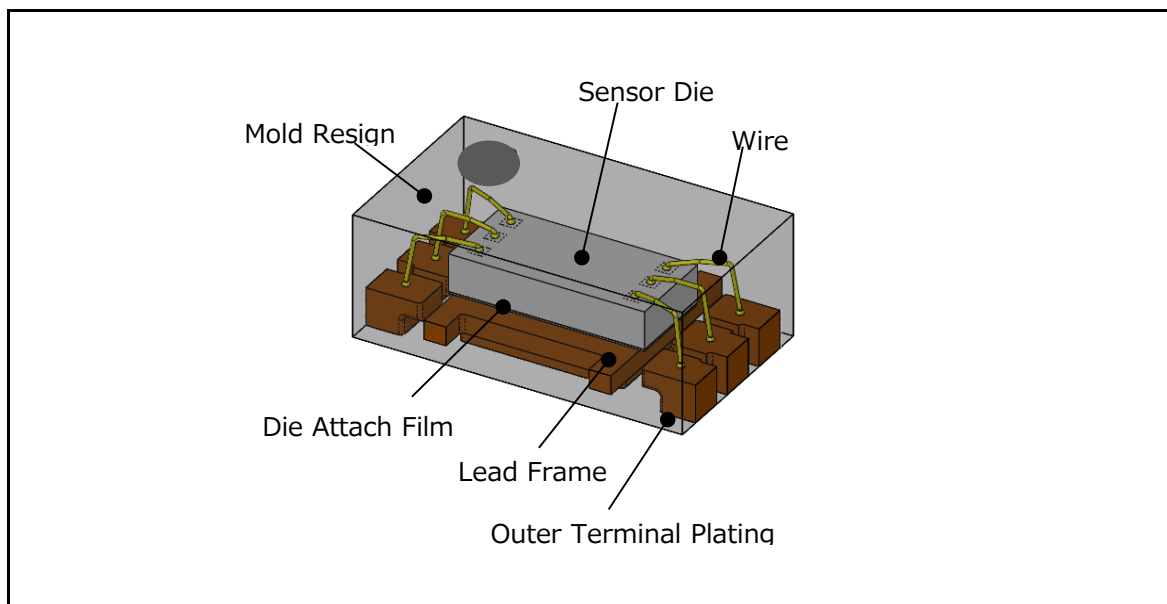


Figure 4-4 Internal Structure

Table 4-1 Components

| Process          | Parts Name             | Materials    |
|------------------|------------------------|--------------|
| Die Mount        | Sensor Chip            | Si           |
|                  | Die Attach Film        | DAF tape     |
|                  | Lead Frame             | Cu, Pd-PPF   |
| Wire Bonding     | Wire                   | Au           |
| Molding          | Mold Resign            | Epoxy Resign |
| Terminal Plating | Outer Terminal Plating | Pd-PPF       |

**5 Packing Specifications 梱包仕様**

**5.1 Packing Information 梱包情報**

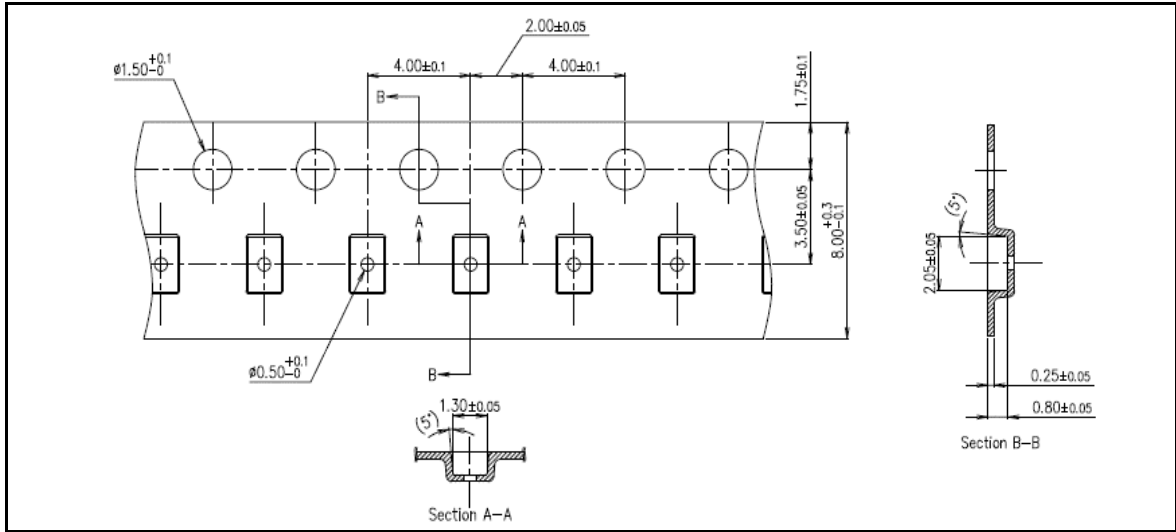


Figure 5-1 Emboss Tape Dimensions

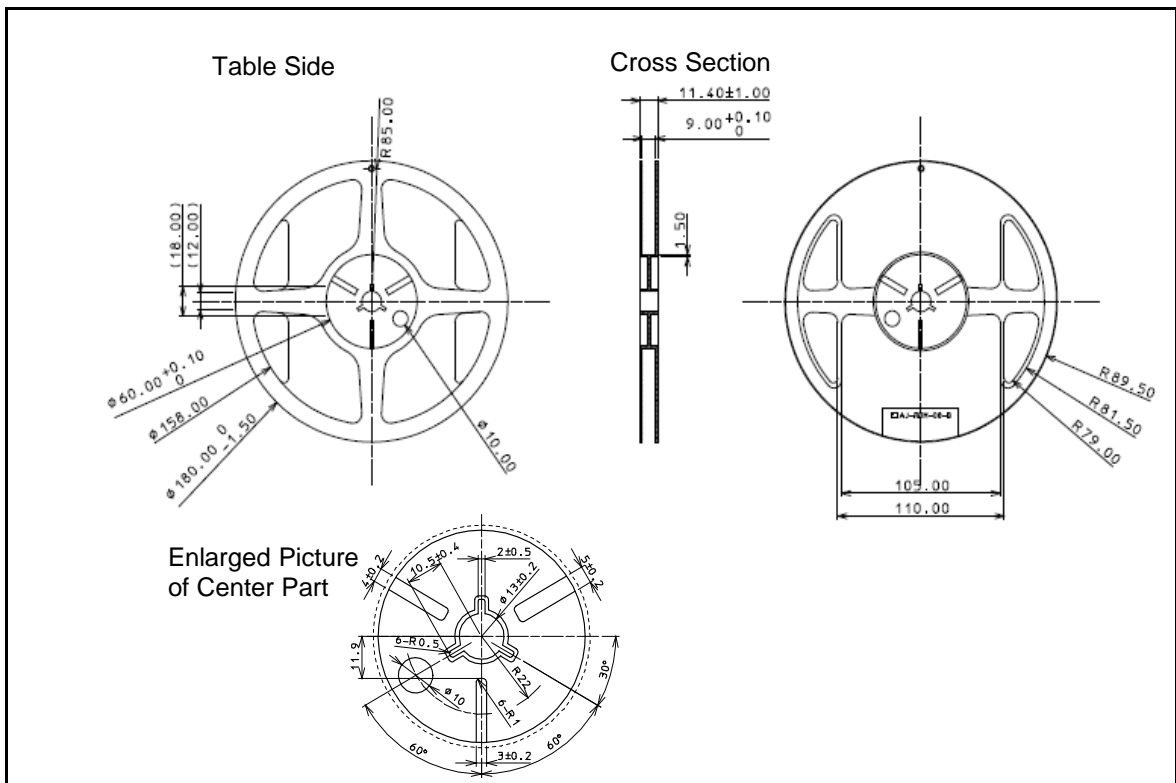


Figure 5-2 Reel Dimensions

5.2 Packing Specifications 梱包仕様

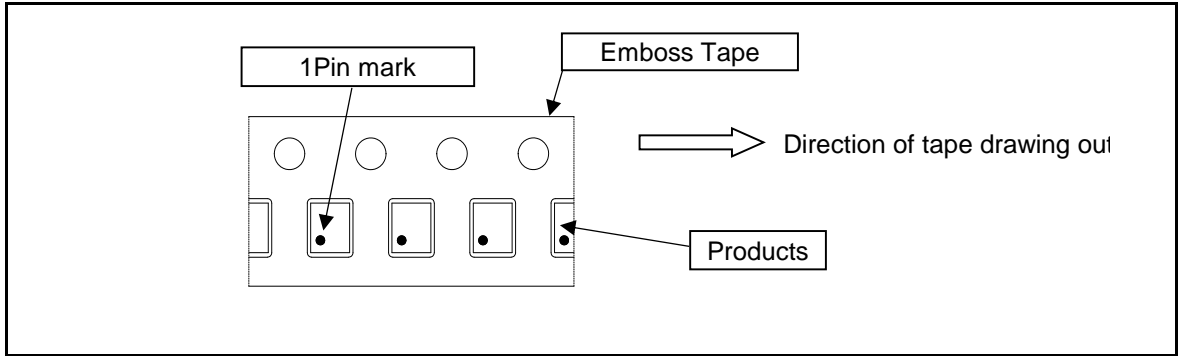


Figure 5-3 Orientation of Product Storing

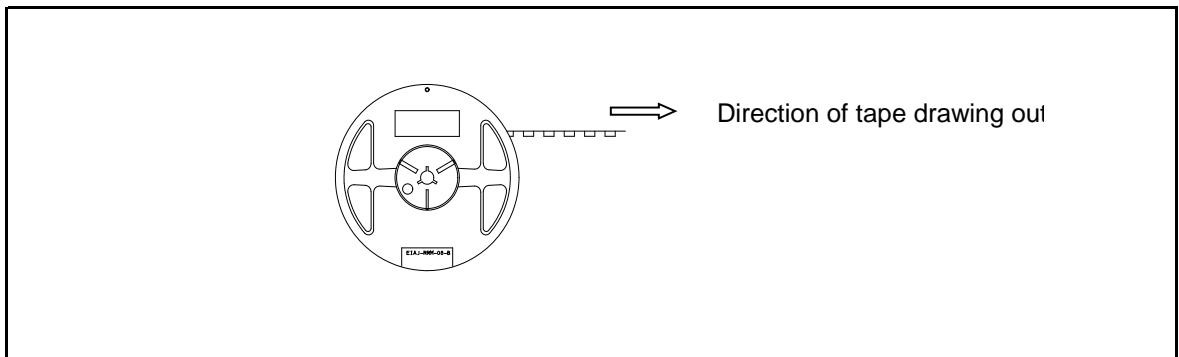


Figure 5-4 Feeding Direction

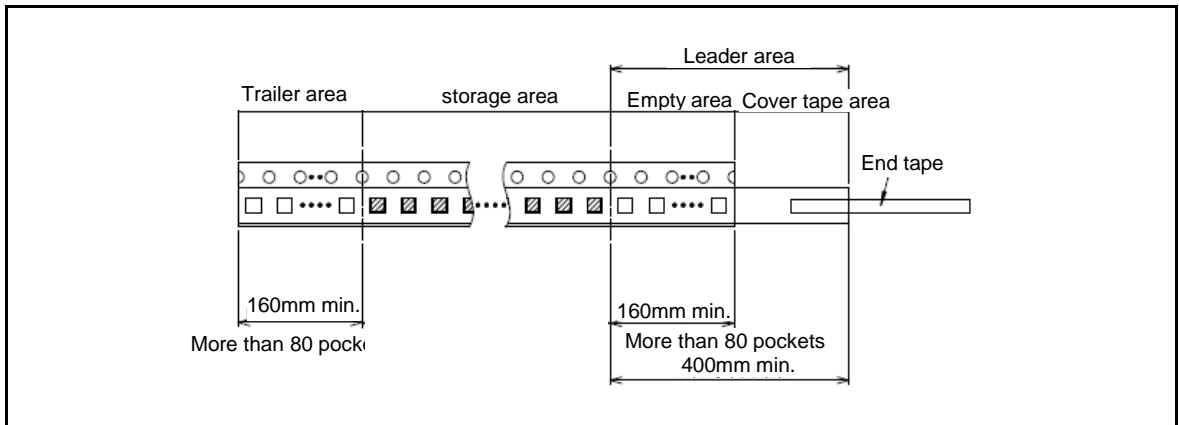


Figure 5-5 Taping Specification

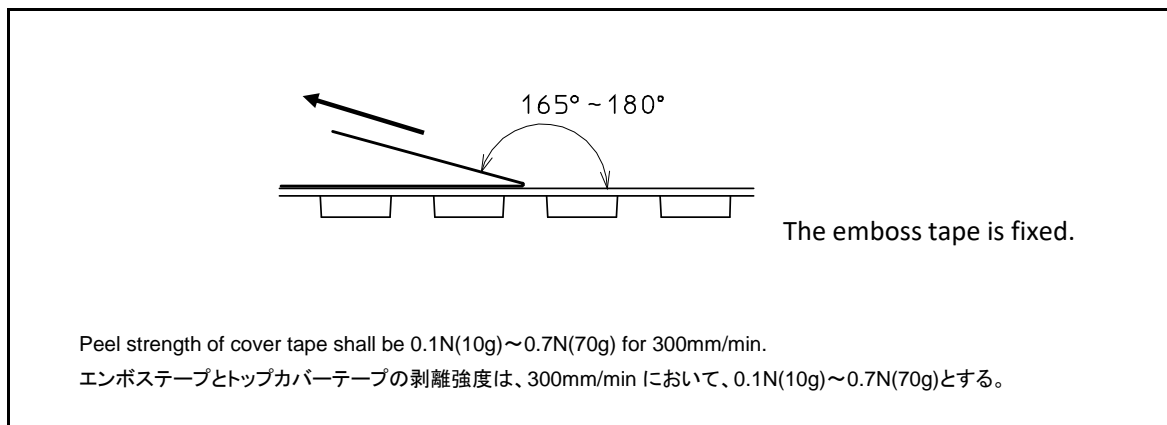


Figure 5-6 Peel Strength

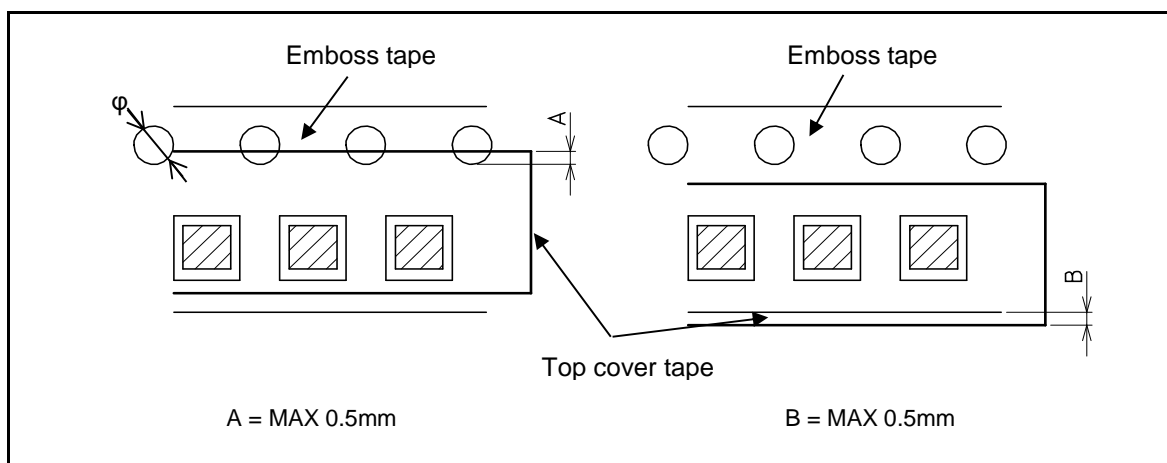


Figure 5-7 Top cover Tape Offset

**6 Reliability Test Conditions 信頼性試験条件**

**6.1 Preconditioning for Reliability Test 信頼性試験の前処理**

Baking [125°C×24Hr] + Moisture Absorption[85±5°C85±5%×168Hr] + Reflow 2times

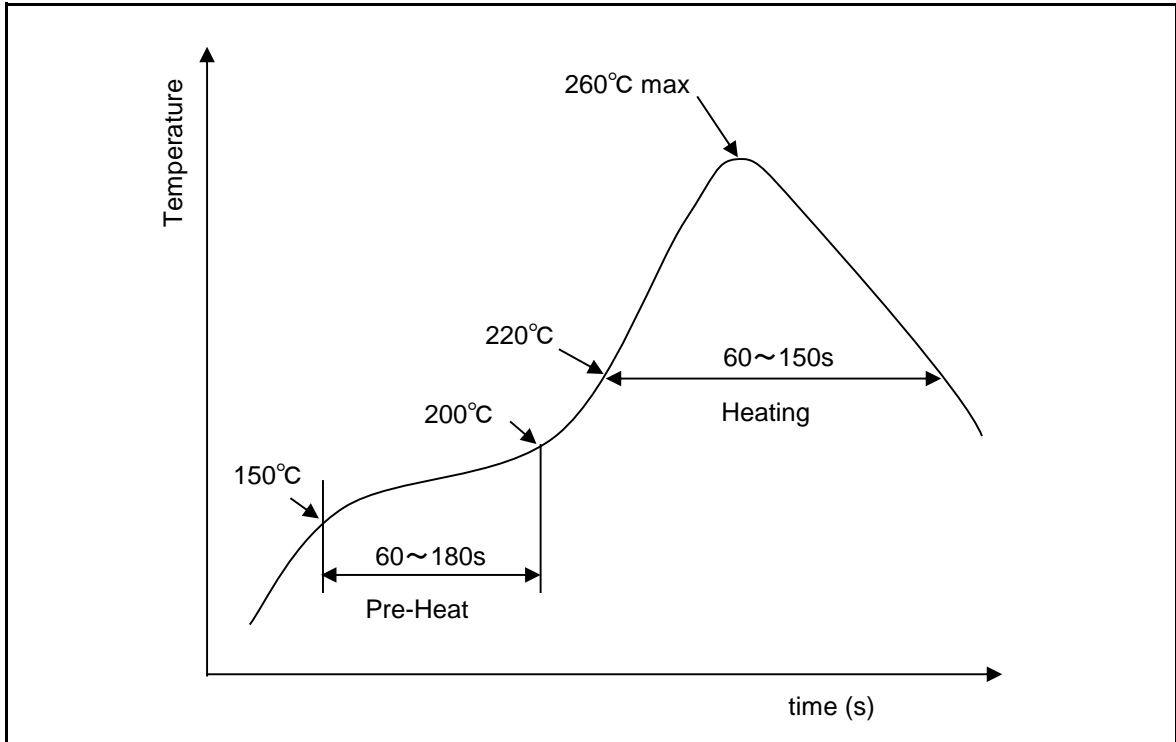


Figure 6-1 Reflow Profile for Pre-Conditioning

**6.2 Reliability Test Items 信頼性試験項目**

Table 6-1 Package Reliability Test Items

| Test Items                    | Testing Methods / Conditions               | Testing Time              | Pre-Conditioning |
|-------------------------------|--|---------------------------|------------------|
| Low Temp. Storage             | -40±5deg.C                                 | 500Hr                     | N/A              |
| High Temp. High Humidity Bias | +85±5deg.C, 85±5%RH, VDD=5±0.5V Bias       | 500Hr                     | Applied          |
| High Temp. Bias               | +105±5degC, VDD=5±0.5V Bias                | 500Hr                     | Applied          |
| Thermal Cycle                 | 1cycle: -40±3degC(30min)→+105±3degC(30min) | 300cycle                  | Applied          |
| ESD                           | ±350V, 150pF, 330Ω, interval 10sec.        | 3 times per each terminal | N/A              |



## 7 Precautions When Handling Magnetic Sensor 製品お取り扱い時の注意

### 7.1 Storage Environment 保管環境

Products should be stored at an appropriate temperature and humidity (Recommended storage condition). Keep products away from chlorine and corrosive gas. There is a thing that influences product features when keeping it in an improper environment.

適切な温度・湿度環境(推奨保管条件)で保管していただけるようお願いいたします。また、塩素や腐食性のあるガスも避けるようお願いいたします。不適切な環境で保管した場合は、製品特性に影響する事があります。

### 7.2 Long-term Storage 長期保管

Long-term storage may result in poor lead solder ability and degraded electrical performance even under proper conditions. For those part that stored more than 1 year, solder ability should be checked before use. For storage longer than 1 year, it is recommended to store in nitrogen atmosphere. Oxygen in atmosphere oxidant leads of products and lead solder ability get worse.

適切な保管環境でも長期に保管した場合は、リード端子の半田付け性が悪くなったり、電気特性が不良になる場合がありますので、長期保管した場合は、半田付け性や電気特性をご確認の上、ご使用下さい。保管が長期(1年以上)に及ぶ場合は、窒素雰囲気中での保管をお勧めします。大気中で保管されますと、大気中の酸素により素子のリード部分が酸化され、リード端子の半田付け性が悪くなります。

### 7.3 ESD 静電気ESD

This products does NOT have built in ESD protect circuit, so it may break if over ESD applied to this circuit. Please take measure for ESD when handle the products. Conducted container is recommended for product conveyance and packing instead of plastic container. Please connect ground line and use non high voltage leakage, when using soldering iron or external measurement circuit.

本製品は静電気保護回路を内蔵していません。その能力を超える静電気が加わった場合には破壊されることがありますので、製品を取り扱う場合には十分な静電気対策を実施してください。包装・運搬容器はプラスチック製を極力避け、導電容器をご使用ください。また製品のハンドリングについても十分に考慮してください。(リストストラップの使用等)はんだごてや測定回路などは高電圧リークのないものを、必ずアースを取ってご使用ください。

### 7.4 External Magnetic Field 外乱磁場

This sensor has detects the direction of the magnetic field that the installed magnet on the measurement device makes. Therefore, please note that an external magnetic field in the system environment influences the angle detection of the sensor. (see Figure 7-1)

本製品は、被測定物に取付けた磁石が作る磁界の方向を検出しています。従って、使用環境における外部磁界が、センサの角度検出に影響を及ぼしますので、ご注意ください。(Figure 7-1参照)

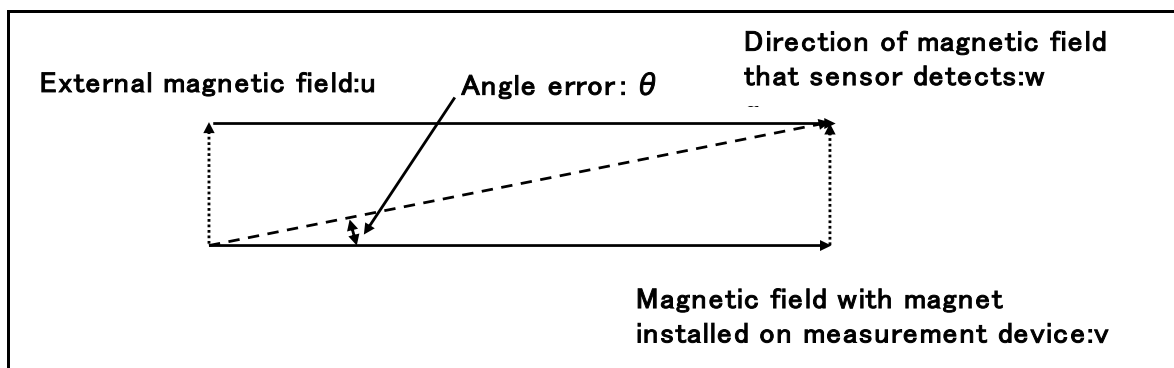


Figure 7-1 Influence on Detection Angle by External Magnetic Field

**Appendix**
**A1 List of Figures 図のリスト**

|            |   |    |
|------------|---|----|
| Figure 1-1 | Image of HGARAN008A in the DFN Package                  | 3  |
| Figure 2-1 | Pin Configuration                                       | 4  |
| Figure 3-1 | Definition of Magnetic Field Direction                  | 8  |
| Figure 3-2 | Equivalent Circuit                                      | 8  |
| Figure 3-3 | Definition of $V_{sin}$ , $V_{cos}$ , and $P_{diff}$    | 9  |
| Figure 4-1 | Package Outline (All dimensions in mm)                  | 10 |
| Figure 4-2 | Recommended Footprint (Reference)                       | 11 |
| Figure 4-3 | Marking of HGARAN008A                                   | 11 |
| Figure 4-4 | Internal Structure                                      | 12 |
| Figure 5-1 | Emboss Tape Dimensions                                  | 13 |
| Figure 5-2 | Reel Dimensions   | 13 |
| Figure 5-3 | Orientation of Product Storing                          | 14 |
| Figure 5-4 | Feeding Direction                                       | 14 |
| Figure 5-5 | Taping Specification                                    | 14 |
| Figure 5-6 | Peel Strength   | 15 |
| Figure 5-7 | Top cover Tape Offset                                   | 15 |
| Figure 6-1 | Reflow Profile for Pre-Conditioning                     | 16 |
| Figure 7-1 | Influence on Detection Angle by External Magnetic Field | 17 |

**A2 List of Tables 表のリスト**

|           |                                    |    |
|-----------|------------------------------------|----|
| Table 2-1 | Pin Description                    | 4  |
| Table 3-1 | Absolute Maximum Rating Parameters | 5  |
| Table 3-2 | Operating Conditions               | 5  |
| Table 3-3 | Basic Characteristics              | 6  |
| Table 3-4 | Electric Characteristics @25deg.C  | 6  |
| Table 4-1 | Components                         | 12 |
| Table 6-1 | Package Reliability Test Items     | 16 |

**Appendix**

## A3 Document Revision History 改定履歴

| Revision | Date         | Description   |
|----------|--------------|---|
| 01       | Jun.13, 2017 | First release   |
| 02       | Nov.22, 2017 | Revised Figure 4-3, Figure 4-4, Table 4-1, Figure 5-1, Figure 5-2<br>Figure 5-3, Figure 5-4, Figure 5-5, Figure 5-7 |

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