DATA SHEET
HGARPS011A

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1 Product Description 製品説明

1.1 Overview 概要

ALPS Product No.	HGARPS011A
Characteristic	Angle Sensor with Amplifier
Package type	TSSOP-8 (Mold size 3.0x3.0 type)
Supply Voltage	3V to 5.5V
Operating Magnetic Field	10 ~ 120 mT
Operating Temperature	-40 ~ 150 deg.C
Interface	Analog Output
Automotive qualified	AEC Q100 Grade0 :T_A=-40 ~ 150 deg.C (ambient temperature)

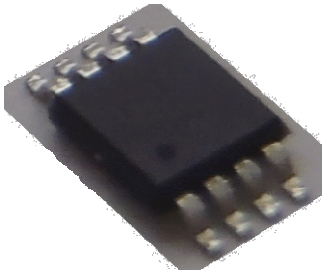

Figure 1-1 Image of TSSOP-8 Package

1.2 Target Applications ターゲットアプリケーション

Automotive
Industrial
Building Automation
Office Automation
Home Appliance

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2 Functional Description 機能説明

2.1 Pin Configuration ピン配置

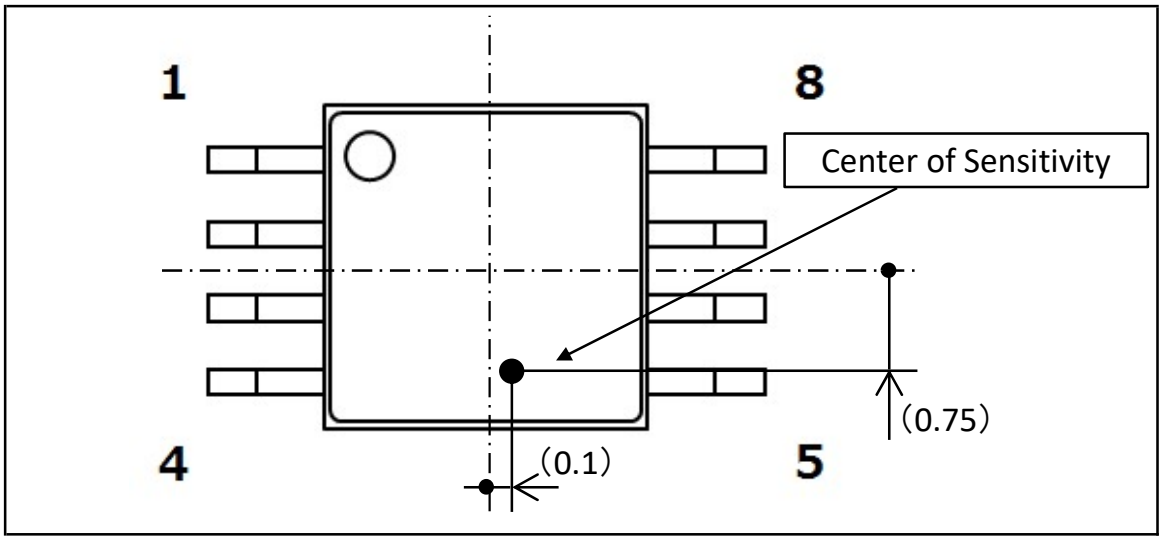

Figure 2-1 Pin Configuration

2.2 Pin Description ピン機能

Table 2-1 Pin Description

Pin No.	Function
1	- sin
2	GND
3	- cos
4	NC
5	NC
6	+ sin
7	VDD
8	+ cos

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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	-0.3	-	6.5	V	
Storage Temperature	Tstg	-40	-	150	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・破壊の可能性があります。

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 Recommended Operating Conditions 推奨動作条件

Table 3-2 Recommended Operating Conditions

Parameter	Symbol	Values			Unit	Note
		Min.	Typ.	Max.		
Operating Voltage	Vop	3	-	5.5	V	
Operating Temperature	Top	-40	-	150	deg.C	
Magnetic Field Strength	Hext*	10	-	120	mT	
		8	-	96	kA/m	

* the applied horizontal magnetic field rotated above the sensor

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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	3.15	3.5	3.85	kOhm	at Room Temp.
Current consumption	Icc	4.0	5.0	6.0	mA	at Room Temp.
Temperature Coefficient of Bridge Resistance	TcR	-	-	1600	ppm/deg.C	-40 ~150deg.C
Temperature Coefficient of Change Rate of Magnetoresistance	Tc⊿R	-3900	-	-	ppm/deg.C	-40 ~150deg.C

3.4 Electric Characteristics 電気特性

Table 3-4 Electric Characteristics

Parameter	Symbol	Values			Unit	Note
		Min.	Typ.	Max.		
Offset Voltage	Voffset	-250	0	250	mV	(1)
Center Voltage	Vcenter	2250	2500	2750	mV	(2)
Peak to Peak Voltage	Vpeak		5650		mVp-p	(3)
Phase Difference	Pdiff	87.5	90	92.5	deg.	(4)
Waveform Distortion	Wd	-	-	84	mV	(5)
		-	-	(130)		(5) @Hext=10mT
Angular Accuracy	Δα	-	0.05	-	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 .

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Definition of Parameter　ﾊﾟﾗﾒｰﾀの定義

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

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

(2) Vcenter = $\frac{(+\sin out\max.)+(+\sin out\min.)}{2}$

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

(3) Vpeak = (+sin out.max.) - (+sin out.min.) + (-sin out.max.) - (-sin out.min.)

* The same calculation is applied to “cos out”.
* Vpeak ratio is defined as ratio of Vpeak_sin and Vpeak_cos.

(4) Pdiff = SinPhase - CosPhase
* SinPhase: Phase of Vsin
* CosPhase: Phase of Vcos
* Vsin and Vcos are ideal curve.

(5) Wd ＝ Max. | Vmeas – Videal |
* Vmeas: measured value
* Videal: ideal curve

(6) Δα:= Max.| αmeas – αideal |
* αmeas ： Atan(Vsin/Vcos), calculated angle from measured value of Vsin and Vcos.
After compensation from Voffset,Vpeak,Pdiff and Wd
* αideal: ideal angle calculated from Vsin-ideal and Vcos-ideal
* Vsin-ideal and Vcos-ideal are ideal curve of Vsin and Vcos 1st harmonic element.
* The calibration method for angular accuracy (Δα) is supported in application note.

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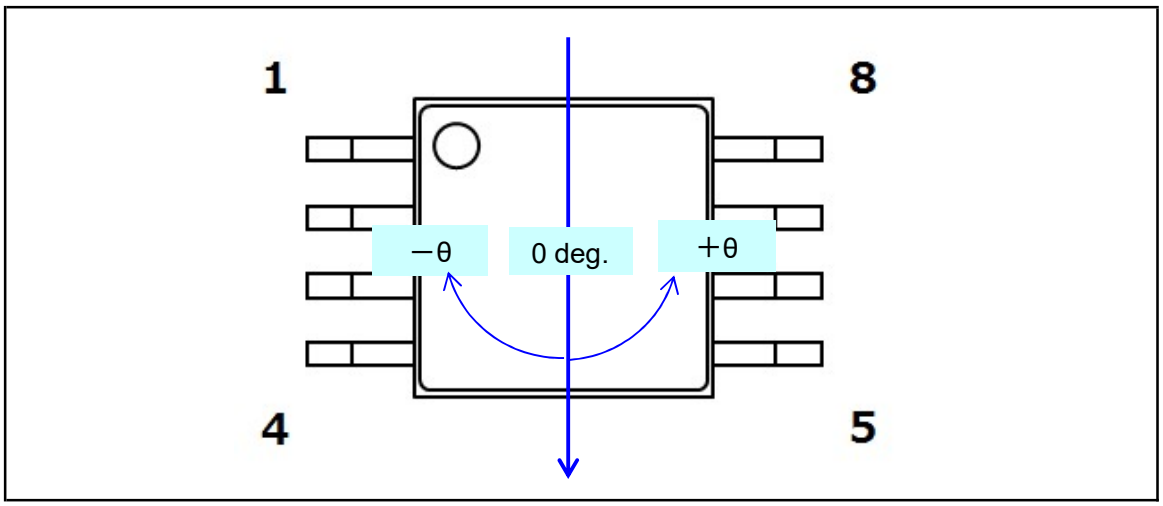

Figure 3-1 Magnetic Field Direction

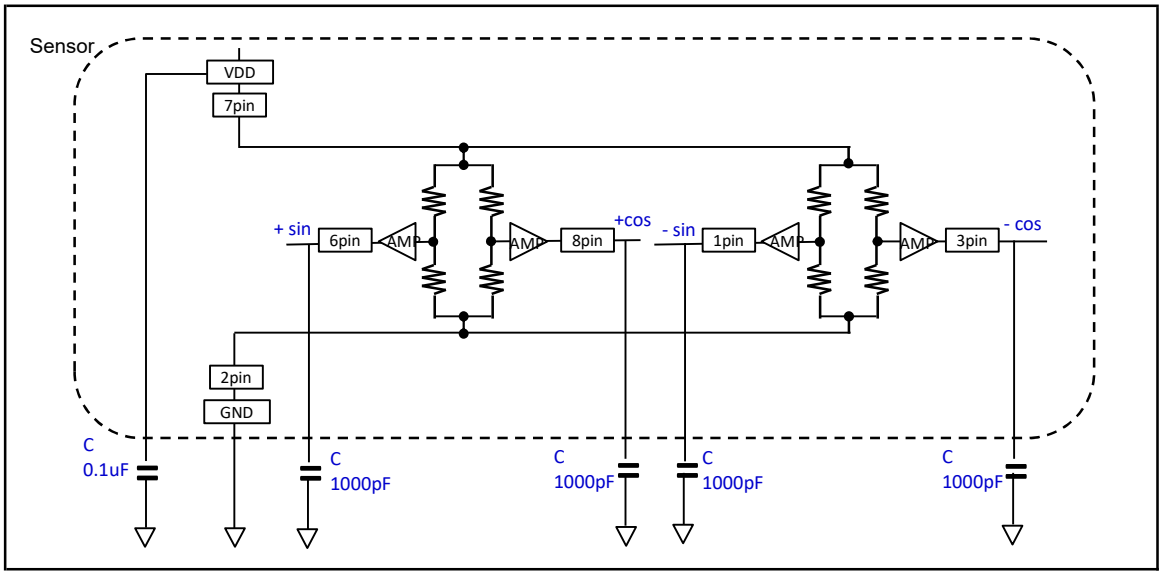

Figure 3-2 Equivalent Circuit & By-pass capacitance recommendation

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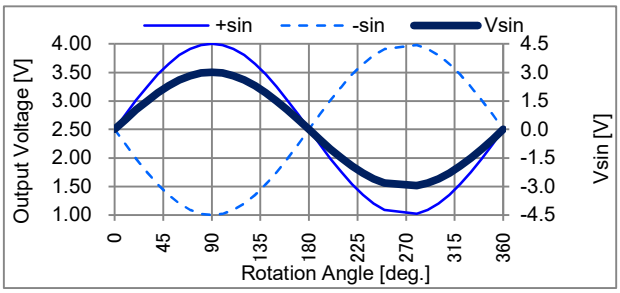
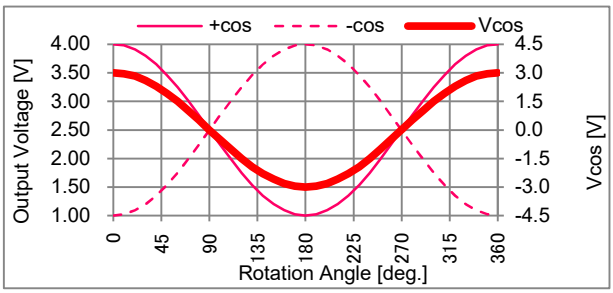
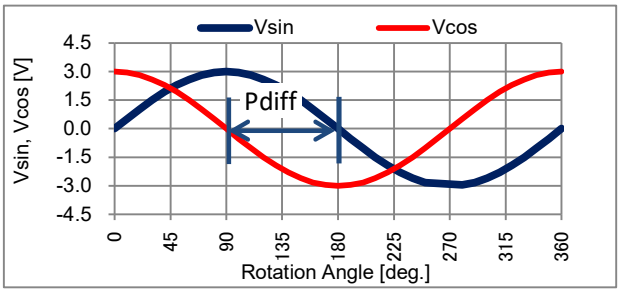


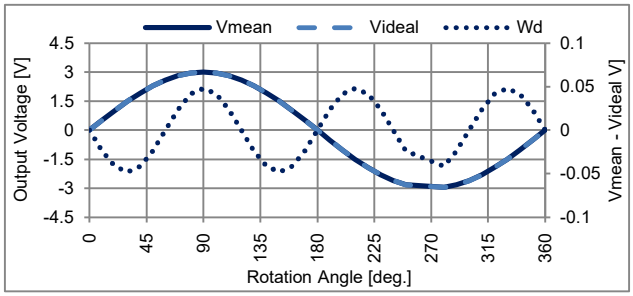
a) Definition of Vsin



b) Definition of Vcos



c) Definition of Pdiff



d) Definition of Wd

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

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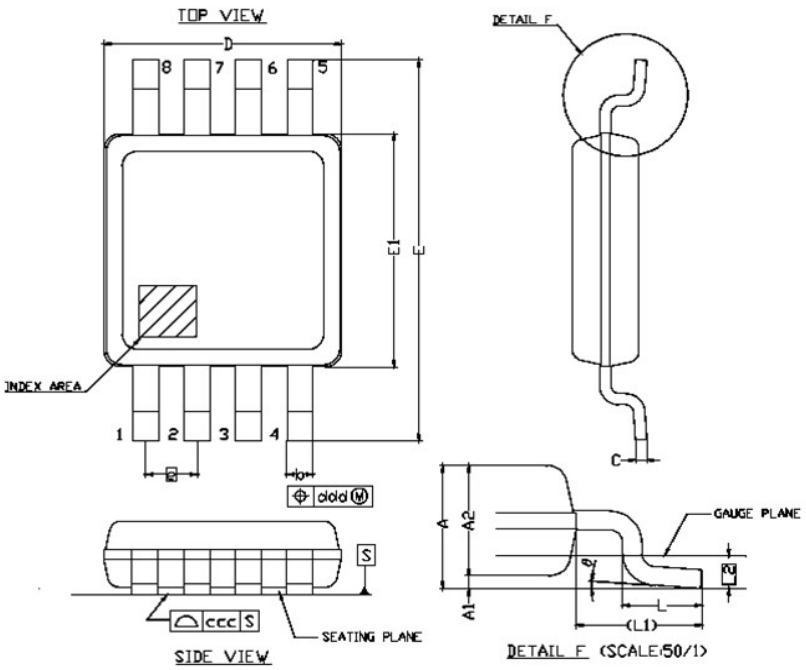
4 Package Information パッケージ情報

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



Item	SPEC		
	MIN.	NOM.	MAX.
A	–	–	1.10
A1	0.00	–	0.15
A2	0.75	(0.85)	0.95
b	0.22	–	0.38
c	0.08	–	0.23
D	2.90	3.00	3.10
E	4.80	4.90	5.00
E1	2.90	3.00	3.10
e	–	0.65	–
L	0.40	0.60	0.80
L1	–	(0.95)	–
L2	–	0.25	–
θ	0°	–	8°
ccc	0.10		
ddd	0.10		

*D,E1寸法には、樹脂バリ含まず

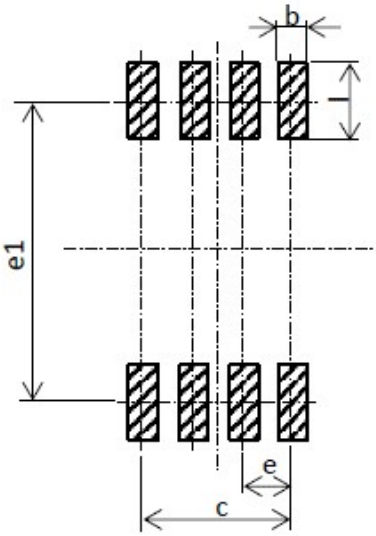
Figure 4-1 Package Outline (All dimensions in mm)

4.3 Recommended land pattern 推奨ランドパターン

Land pattern Layout ランドパターン配置

Unit : mm

PKG typ.	b	l	c	e1	e
TSSOP8	0.38	1.00	1.95	4.30	0.65



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4.4 Recommended Soldering conditions 推奨半田条件

- The N2 reflow is acceptable.
  窒素雰囲気リフロー対応

- Under The following conditions, The frequency of reflow soldering should be within two times.
  以下のプロファイル条件に於いて、リフロー回数2回まで

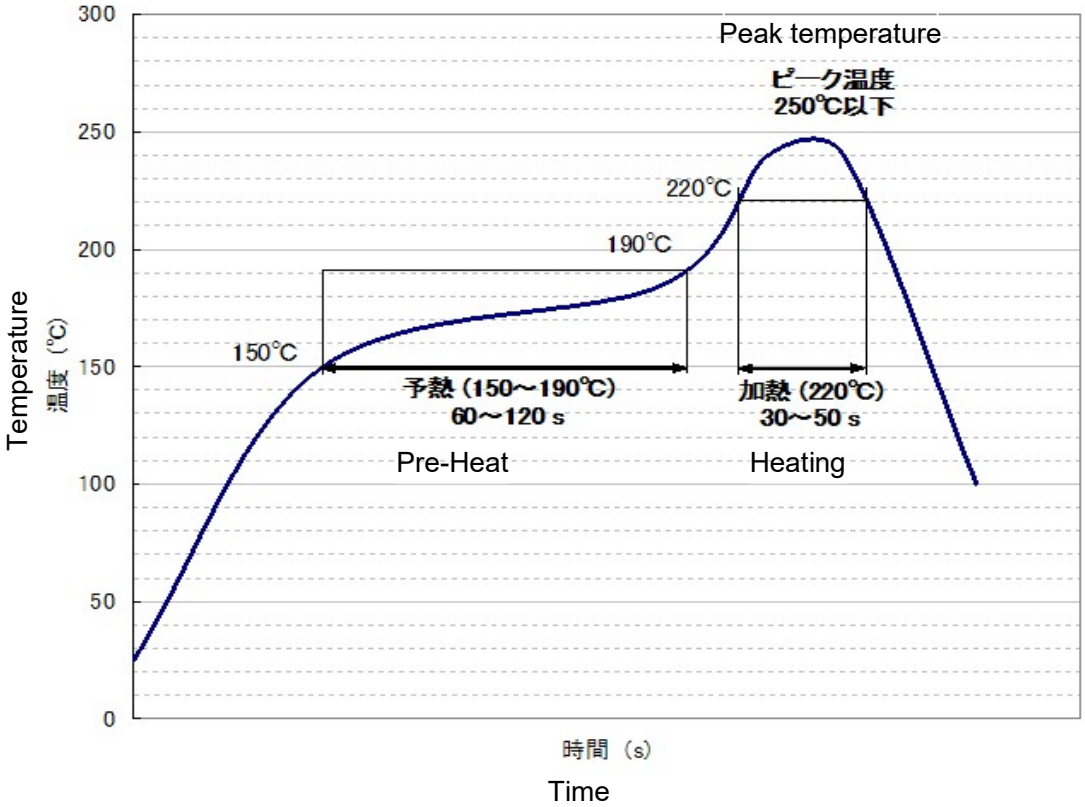

Figure 4-2 Recommended Soldering conditions

- Flow process by direct heat-up to PKG body is unacceptable.
  PKG 本体直接加熱によるフロー非対応

- Hand soldering by direct heat-up to PKG body is unacceptable.
  PKG 本体直接加熱による手はんだ非対応

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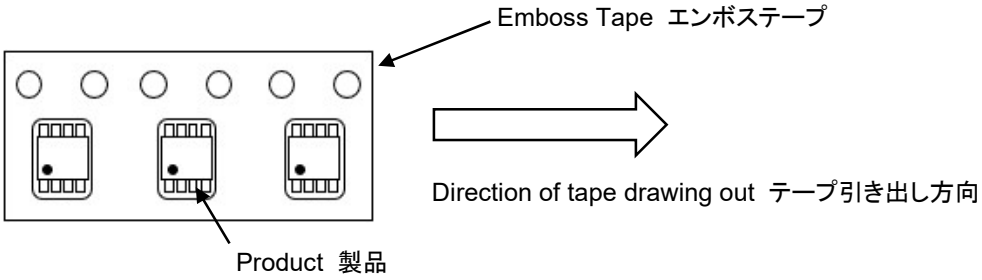
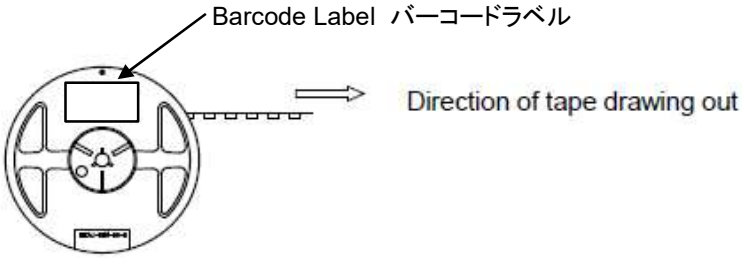
5 Packing specification 包装仕様

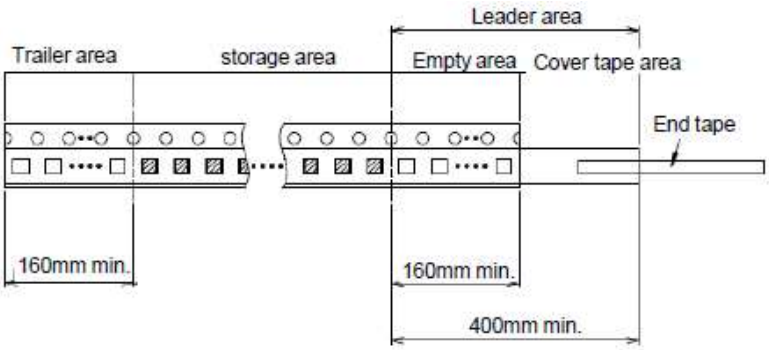
5.1 Component orientation 製品の収納方向



5.2 Direction of tape drawing out テープ引き出し方向



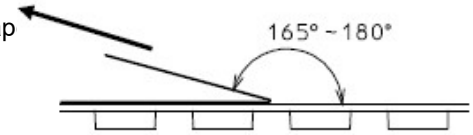
5.3 Taping テーピング



5.4 Peel strength 剥離強度

Peel strength of cover tape shall be 0.1N(10g)~0.7N(70g) for 300mm/min.
エンボステープとトップカバーテープの剥離強度は、300mm/min において、0.1N(10g)～0.7N(70g)とする。

Peel direction of Top cover tap
トップカバーテープ剥離方向



← The emboss tape is fixed.
エンボステープは固定

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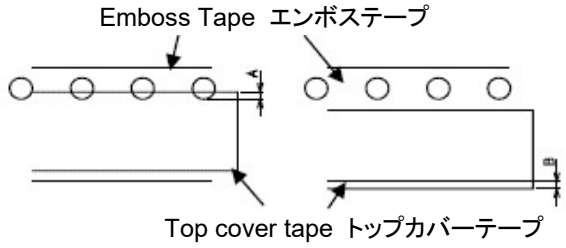
5.5 Top cover tape offset トップカバーテープのズレ



Overlay of cover tape to the hole A = MAX 0.5mm
トップカバーテープ送り穴へのかかり

Bulge of top cover tape B = MAX 0.5mm
トップカバーテープのはみ出し

5.6 Packing 梱包形態

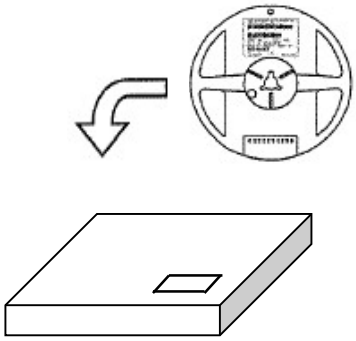
①.This product is delivered by the taping wrapping (3,000 pcs/reel).
本製品はテーピング包装（3,000個／リール）にて納入します。

②.This product is delivered by a non damp-proof packing.
本製品は防湿梱包なしで納入します。

③.The barcode label is put on each reel.
各リールにはバーコードラベルを貼付します。

④.1 reel stored in the carton box. (carton/with 3,000pcs)
箱には、リール1個を収納します。（3,000pcs入り/箱）

⑤.This packing form is adopted to the shipment in Japan.
本梱包は、日本国内の出荷に適用する。



Carton box size : 335 x 350 x 35mm

5.7 MOQ 最小発注単位

3,000 pcs/reel at Units
3,000 個／リール 単位

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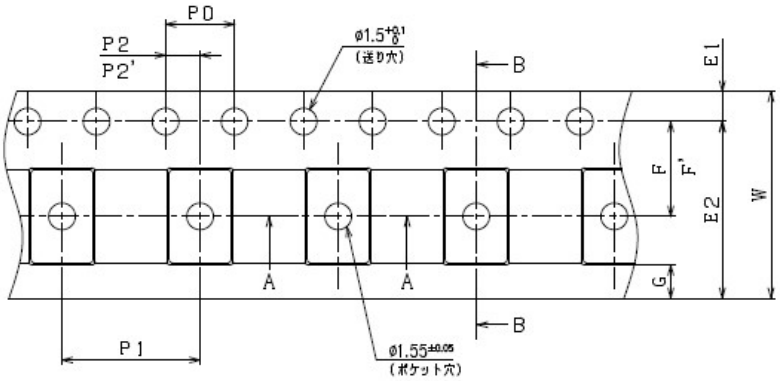
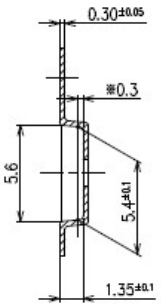
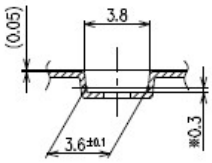
5.8 Emboss Tape Dimensions エンボステープ寸法

Unit 単位: [mm]





B－B断面図

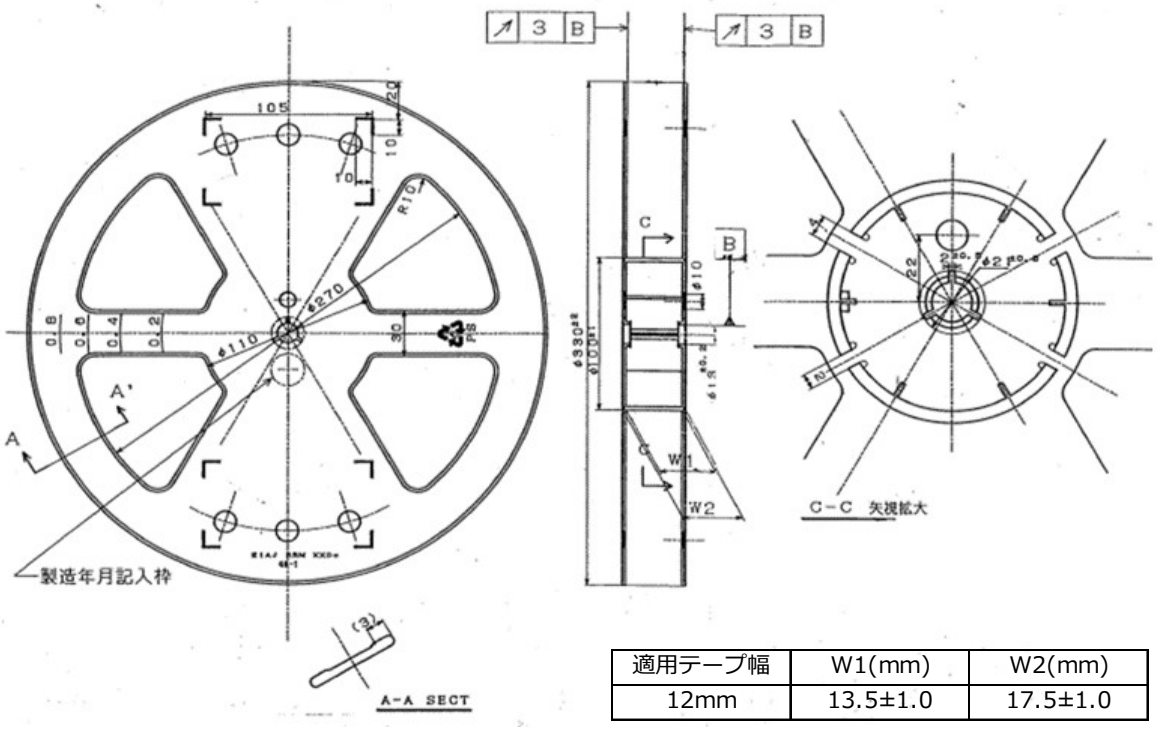


A－A断面図

W	12.0+0.3/−0.1	キャリアテープ幅
E1	1.75±0.1	送り穴の中心からテープ上端
E2		送り穴の中心からテープ下端（10.25mm以上）
F	5.50±0.05	送り穴の中心からエンボス部中心（テープ幅方向）
F'	5.50±0.05	送り穴の中心からエンボス部穴中心
G		テープの下端からエンボス部との間（0.75mm以上）
P0	4.0 ±0.1	送り穴間のピッチ
P1	8.0 ±0.1	エンボス間のピッチ
P2	2.00±0.05	送り穴の中心からエンボス部中心（テープ取り出し方向）
P2'	2.00±0.05	送り穴の中心からエンボス部穴中心

5.9 Reel Dimensions リール寸法

Unit 単位: [mm]



適用テープ幅	W1(mm)	W2(mm)
12mm	13.5±1.0	17.5±1.0

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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℃×24Hr】 ＋ Moisture Absorption【85±5℃85±5%×168Hr】+ Reflow 2times

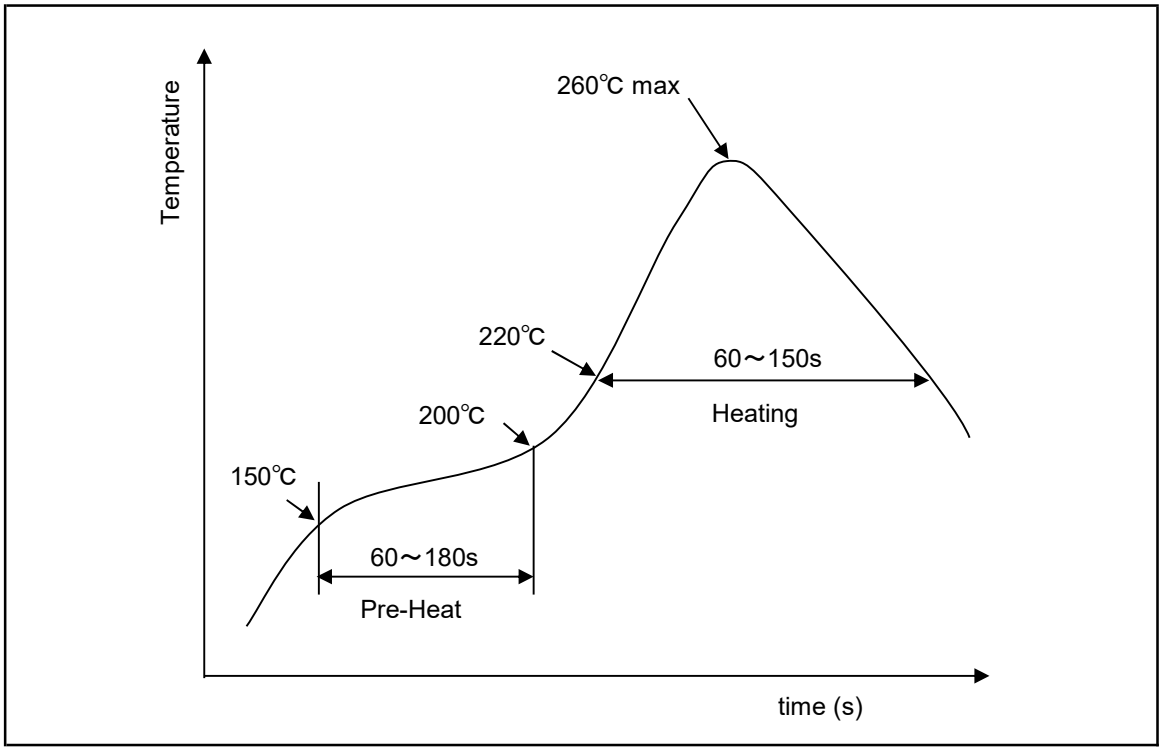

Figure 5-1 Reflow Profile for Pre-Conditioning

6.2 Reliability Test Items 信頼性試験項目

Table 5-1 Package Reliability Test Items

Test Items	Testing Methods / Conditions	Testing Time	Pre-Conditioning
High Temperature Storage Life	+150deg.C	2000Hr	N/A
High Temperature Operating Life	+150degC, VDD=5.5V Bias	1000Hr	Applied
Temperature-Humidity-Bias	+85±5deg.C, 85±5%RH, VDD=5.5V Bias	1000Hr	Applied
Temperature Cycling	1cycle: -50degC(30min)→+150degC(30min)	2000cycle	Applied
ESD	±4kV, 100pF, 1.5kΩ, interval 10sec.	1 times per each terminal	N/A

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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

Every products has built in ESD protect circuit, however 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.

全ての端子に接続されたICについて静電気保護回路を内蔵していますが、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充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充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 6-1)

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、ご注意下さい。(Figure 6-1参照)

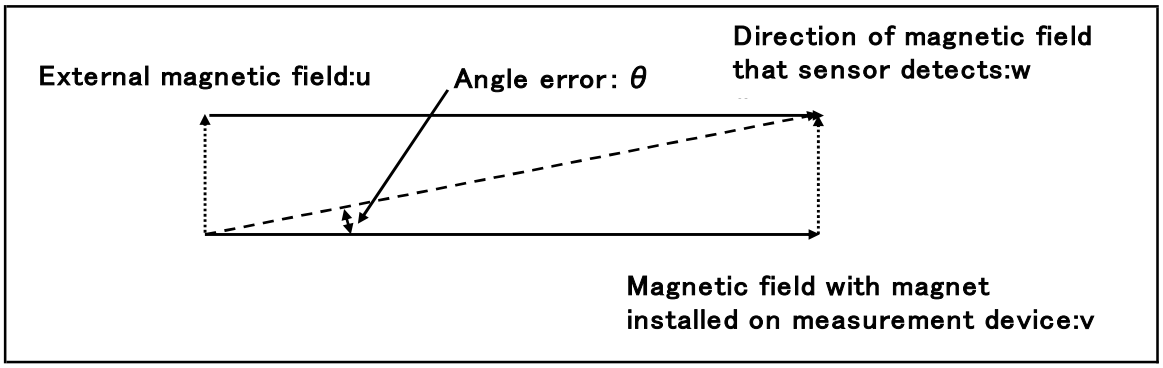

Figure 6-1 Influence on Detection Angle by External Magnetic Field

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8. LEGAL DISCLAIMER

1. 国内外の輸出関連法規により規制されている製品の輸出に際しては、同法規を遵守の上、必要な許可、手続き等をとってください。
   For the export of products which are controlled items subject to foreign and domestic export laws and regulations, you must obtain approval and/or follow the formalities of such laws and regulations.

2. 軍事用途又はテロ等の反社会活動目的では、当製品を一切使用しないでください。
   また、最終的にそれら用途・目的で使用されるおそれがある法人・団体・個人等へも当製品を一切供給しないでください。

   Products must not be used for military and/or antisocial purposes such as terrorism, and shall not be supplied to any party intending to use the products for such purposes.

3. 当製品は、特に用途を指定していないかぎり、本来、AV、家電、事務機、情報機器、通信機器、アミューズメント機器等の一般電子機器用に設計、製造されたものです。
   したがいまして、原子力制御機器、宇宙・航空機で運行にかかわる機器等の用途では一切使用しないでください。
   上記の使用禁止の用途以外で、医療機器、防犯機器、防災機器、海底用機器等の高度の安全性・信頼性を必要とする機器でのご使用の際は、弊社営業担当迄ご相談いただくか、またはセットでの十分な適合性の確認を行っていただいた上で、フェールセーフ設計、保護回路、冗長回路、誤動作防止設計、延焼対策設計等のセットでの安全対策設計を設けてください。

   Unless provided otherwise, the products have been designed and manufactured for application to equipment and devices which are sold to end-users in the market, such as AV (audio visual) equipment, home electric equipment, office and commercial electronic equipment, information and communication equipment or amusement equipment. The products are not intended for use in, and must not be used for, any application of nuclear equipment, driving control equipment for aerospace or any other unauthorized use.
   With the exception of the above mentioned banned applications, for applications involving high levels of safety and liability such as medical equipment, burglar alarm equipment, disaster prevention equipment and undersea equipment, please contact an Alps sales representative and/or evaluate the total system on the applicability. Also, implement a fail-safe design, protection circuit, redundant circuit, malfunction protection and/or fire protection into the complete system for safety and reliability of the total system.

4. 車載対応製品以外の製品を車載用にご使用される場合は、事前に弊社へご相談ください。

   Before using products which were not specifically designed for use in automotive applications, please contact an Alps sales representative.

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History of Revision

Datasheet Rev.	Date	Note
02	20th.Dec.2023	Add AEC Q100 Garade0 Qualified, Change Angular Accuracy 0.05deg. , Add comment in Angular accuracy (6)
01	19th.Jul.2022	First release

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