1. 弊社製品番号
   Product No.
   HSFPAR303A

2. 製品概要
   General description
   本製品は、シリコンダイアフラム上にピエゾ抵抗が形成されており、荷重が加わるとダイアフラムが撓むことでピエゾ抵抗に応力が発生し、抵抗率が変化するピエゾ抵抗効果を利用した荷重センサ。
   • This product is a force sensor using effect of piezo resistive bridge circuit formed on silicon diaphragm.
   • Piezo resistance is changed according to strain by applying force to the diaphragm.

3. 製品の特徴
   Feature
   • 小型低背です。
     PKGサイズが小さくスペースを取らないため、様々な製品デザインに対応出来ます。
   • 感度が高く、直線性に優れます。
     0.01Nレベルの小さな応力から検出可能です。
   • 信頼性に優れます。
     100万回の荷重試験後で、特性の変化は有りません。
   • Small Footprint and Low Profile
     User design flexibility by small package.
   • High Sensitivity and Good Linearity
     Precisely detect micro force less than 0.01 N.
   • High Durability
     No characteristics change after 1 million cycles.
4. Structure

If the overforce is applied to the sensor, the force is limited by the case.

(1) Diaphragm is strained by counterforce.
(2) Resistance of Piezo element on the diaphragm is changed
(3) Differential voltage is outputted in response to the force change.

5. Operating principle

*Please push by the flat one that is wider than the case.

If the overforce is applied to the sensor, the force is limited by the case.
6. Block diagram

*Output = V1 - V2

<table>
<thead>
<tr>
<th>端子番号/Pin No.</th>
<th>記号/Name</th>
<th>機能/Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>No1</td>
<td>Vdd</td>
<td>電源/Supply Voltage</td>
</tr>
<tr>
<td>No2</td>
<td>V1</td>
<td>+出力信号/Output(+)</td>
</tr>
<tr>
<td>No3</td>
<td>V2</td>
<td>-出力信号/Output(-)</td>
</tr>
<tr>
<td>No4</td>
<td>GND</td>
<td>GND</td>
</tr>
</tbody>
</table>

*Output = V1 - V2
7. Full view

## Recommended connector

**Company:** KYOCERA Connector Products Corporation

(http://www.kyocera-connector.com/en/prdct/list/fpcffc/6277-series/)

**Product No:** 6277 series (4pad), 0.5mmPitch

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*Output = V1-V2*
8. Flex specification
9. 推奨回路
Recommended circuit
9-1. アナログ回路例
Example circuit for analog output.

推奨値   Recommended value

<table>
<thead>
<tr>
<th>Source Voltage</th>
<th>Vcc</th>
<th>[V]</th>
<th>3.3</th>
</tr>
</thead>
<tbody>
<tr>
<td>計装アンプ Instrumentation amplifier</td>
<td>-</td>
<td>AD623<em>1, AD8237</em>1, AD8420<em>1, INA317</em>1, INA333*1</td>
<td></td>
</tr>
<tr>
<td>Gain adjustment Resistance</td>
<td>RG</td>
<td>[kΩ]</td>
<td>1.3</td>
</tr>
<tr>
<td>Offset adjustment Resistance</td>
<td>R1</td>
<td>[kΩ]</td>
<td>10.0</td>
</tr>
<tr>
<td></td>
<td>R2</td>
<td>[kΩ]</td>
<td>3.0</td>
</tr>
<tr>
<td>Capacitance</td>
<td>C</td>
<td>[μF]</td>
<td>0.1</td>
</tr>
<tr>
<td>Sensitivity</td>
<td>Sens</td>
<td>[mV/N]</td>
<td>(952)</td>
</tr>
</tbody>
</table>

*1 記載アンプは一例です。
上記リストの製品は当社にて動作を保証するものではございません。
動作は回路設計に依存しますので事前に確認をお願いします。
The listed amplifier is an example.
Our company does not guarantee the operation for the products listed above.
These are depend on the circuit design, please check in advance.

参考   Reference

増幅率   Gain = ( 1 + 100kΩ / RG )
オフセット  Offset voltage = R2 / ( R1+R2 ) * Vcc
出力   OUTPUT = Gain*Vin + Offset voltage
9-2. デジタル回路例
Example circuit for digital output.

*1 システムの要求に合致するように適切なADコンバータを選択下さい。
   Please select the appropriate AD converter to meet the requirements of the system.

*2 必要により計装アンプ及びその他の部品を追加下さい。
   Please add the Instrumentation amplifier or some components as needed.
10. Evaluation example

Notes
• When the gauge is touched to the sensor, it does slowly.
• The gauge is vertically touched to the sensor.
• Force more than the maximum ratings is not added.
11. 電気特性

**Electrical specifications**

<table>
<thead>
<tr>
<th>Item</th>
<th>Symbol</th>
<th>Unit.</th>
<th>Specification</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>最大定格 Absolute Maximum Ratings</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>定格電源電圧 Absolute limits supply voltage</td>
<td>Vlim</td>
<td>[V]</td>
<td>-4.0</td>
<td>-4.0</td>
</tr>
<tr>
<td>最大定格荷重 Max Load Rating</td>
<td>Flim</td>
<td>[N]</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>保存温度範囲 Storage temperature</td>
<td>Tstr</td>
<td>[ºC]</td>
<td>-40</td>
<td>-</td>
</tr>
<tr>
<td>ESD耐圧 ESD</td>
<td>HBM</td>
<td>[V]</td>
<td>-1000</td>
<td>-</td>
</tr>
<tr>
<td>寿命 Durability</td>
<td>Drbl</td>
<td>[Cycles]</td>
<td>1000k</td>
<td>-</td>
</tr>
</tbody>
</table>

**使用条件 Operating conditions**

<table>
<thead>
<tr>
<th>Item</th>
<th>Symbol</th>
<th>Unit.</th>
<th>Specification</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>動作荷重範囲 Force range</td>
<td>Frng</td>
<td>[N]</td>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td>電源電圧 Supply voltage</td>
<td>Vdd</td>
<td>[V]</td>
<td>1.5</td>
<td>-</td>
</tr>
<tr>
<td>動作温度範囲 Operating temperature</td>
<td>Topr</td>
<td>[ºC]</td>
<td>-20</td>
<td>-</td>
</tr>
</tbody>
</table>

**電気的仕様 Electrical specifications (T=25ºC)**

<table>
<thead>
<tr>
<th>Item</th>
<th>Symbol</th>
<th>Unit.</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>感度 Sensitivity</td>
<td>Sens</td>
<td>[mV/V/N]</td>
<td>2.7</td>
</tr>
<tr>
<td>リニアリティー Linearity</td>
<td>Lin</td>
<td>[%FS]</td>
<td>-</td>
</tr>
<tr>
<td>オフセット電圧 Null Offset</td>
<td>V0</td>
<td>[mV/V]</td>
<td>-8</td>
</tr>
<tr>
<td>ブリッジ抵抗 Bridge Resistance</td>
<td>Rbrg</td>
<td>[kΩ]</td>
<td>4.5</td>
</tr>
</tbody>
</table>

![Graph showing linear fitting curve: Output (mV) = Force (N) x Vdd x \( \alpha \) + Vdd x \( \beta \)]

*Linearity : (A+B)/FS x 100
*Sensitivity : \( \alpha \)
*Null Offset : \( \beta \)
12. 梱包仕様
   Packing specification
12-1. トレイ仕様
   Tray specification

* 120pcs / Tray
12-2. トレイの積み重ね
Stacking of the tray

- Tray is stacked in upside down alternately. <Fig.1>
- Stacking of the tray is up to 26 trays (25trays + Cover) and taped it. (3000pcs Max)  <Fig.2>
- It is placed in ESD bag. <Fig.3>
12-3. 梱包箱
Packing box

- This product is packed by tape wrapping (3,000 pcs/bag).
- The barcode label is put on each bag.
- 2 bags are put in 1 carton (max. 6,000 pcs/carton).
- The cushion is stored in the top and bottom of the carton.

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● Recommended storage condition
  MSL1

● Stacking height of carton
  Maximum 5 cartons

● Damp-proof packing
  None

● Minimum Order Quantity
  Maximum 5 cartons

Standard Packing Quantity
3,000 pcs
13. Legal disclaimer

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