

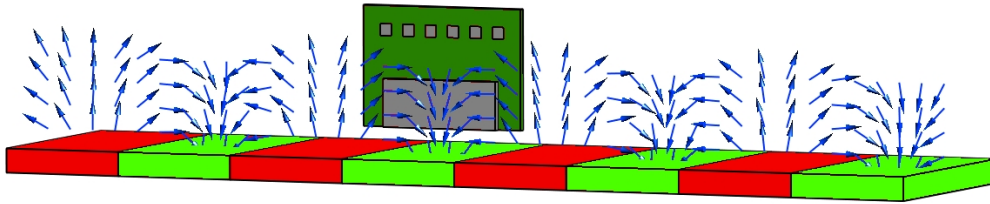
# KMXP MR Position Sensor



- AMR linear position sensor
- 2x6 DFN package, very compact
- Small wall thickness for large air gaps
- High operating temperature of 150°C
- On the edge soldering possible
- ✓RoHS

## DESCRIPTION

Moving a KMXP sensor along a magnetic scale will produce a sine and a cosine output signal as a function of its position. In order to deliver satisfying results, this will be achieved as long as the air gap between sensor edge and magnetic scale surface does not exceed approximately half of the pole pitch. As the sensor principle is based on the anisotropic magneto resistance effect, the signal amplitudes are nearly independent on the magnetic field strength and therefore air gap variations do not have a strong effect on the accuracy. The sensor detects a magnetic gradient field and is thus almost insensitive to homogenous stray fields.



Precise displacement values will be obtained by using an amplifier in combination with a microcontroller or commercial sine/cosine interpolator device. The maximal obtainable precision depends strongly on the accuracy of the magnetic scale and on the distance sensor – magnetic scale. Precision values of <1% of the pole pitch are common.

## FEATURES

- Contactless angular position measurement
- High accuracy
- Low cost, low power
- Failure detection possible
- User has total control over signal evaluation
- Extended temperature range
- REACH, 3TG & ROHS compliant

## APPLICATIONS

- Measurement of linear displacements, movements, velocities in dirty environments
- Very precise angular measurement on the circumference using pole wheels
- Torque measurement in harsh environment

# KMXP Magneto Resistive Position Sensor

## PERFORMANCE SPECS

| PARAMETER                                 | SYMBOL              | COND. | TYPE                                | MIN                                    | TYP                                       | MAX                                  | UNIT   |
|-------------------------------------------|---------------------|-------|-------------------------------------|----------------------------------------|-------------------------------------------|--------------------------------------|--------|
| <b>1. Operating Limits</b>                |                     |       |                                     |                                        |                                           |                                      |        |
| max. supply voltage                       | $V_{cc,max}$        |       | all                                 |                                        |                                           | <b>10</b>                            | V      |
| max. current (both bridges)               | $I_{cc,max}$        |       | KMXP 1000<br>KMXP 2000/5000         |                                        |                                           | <b>5</b><br><b>10</b>                | mA     |
| operating temperature                     | $T_{op}$            |       | all                                 | <b>-40</b>                             |                                           | <b>+150</b>                          | °C     |
| storage temperature                       | $T_{st}$            |       | all                                 | <b>-40</b>                             |                                           | <b>+125</b>                          | °C     |
| <b>2. Sensor Specifications (T=25 °C)</b> |                     |       |                                     |                                        |                                           |                                      |        |
| Supply voltage                            | $V_{cc}$            |       | all                                 |                                        | <b>5</b>                                  |                                      | V      |
| pole pitch 1)                             | p                   |       | KMXP 1000<br>KMXP 2000<br>KMXP 5000 |                                        | <b>1000</b><br><b>2000</b><br><b>5000</b> |                                      | μm     |
| Air gap package front – magnetic scale 2) | D                   |       | KMXP 1000<br>KMXP 2000<br>KMXP 5000 | <b>0.1</b><br><b>0.2</b><br><b>0.5</b> | <b>0.4</b><br><b>0.8</b><br><b>2</b>      | <b>0.8</b><br><b>1.8</b><br><b>4</b> | mm     |
| Resistance (both bridges)                 | $R_b$               |       | KMXP 1000<br>KMXP 2000/5000         | <b>2000</b><br><b>1000</b>             | <b>3000</b><br><b>1500</b>                | <b>4000</b><br><b>2000</b>           | Ω      |
| Output signal range                       | $\Delta V_n/V_{cc}$ | A, B  | all                                 | <b>18</b>                              | <b>22</b>                                 | <b>26</b>                            | mV/V   |
| Offset voltage                            | $V_{n\ off}$        | A, B  | all                                 | <b>-1</b>                              | <b>0</b>                                  | <b>+1</b>                            | mV/V   |
| <b>3. Sensor Specifications</b>           |                     |       |                                     |                                        |                                           |                                      |        |
| TC of amplitude                           | TCSV                | A, C  | All                                 |                                        | <b>-0.35</b>                              |                                      | %/K    |
| TC of resistance                          | TCBR                | A, C  | All                                 |                                        | <b>+0.35</b>                              |                                      | %/K    |
| TC of offset                              | TCVoff              | A, C  | all                                 | <b>-4</b>                              | <b>0</b>                                  | <b>+4</b>                            | μV/V/K |

n = 1;2 (bridge number); Stress above one or more of the limiting values may cause permanent damage to the device. Exposure to limiting values for extended periods may affect device reliability.

1) Other pole pitches on request

2) Typical values for conventional magnetic scales. Air gap for maximum accuracy depends on the used scale.

# KMXP Magneto Resistive Position Sensor

## MEASUREMENT SET UP CONDITIONS

| PARAMETER                                                                                                       | SYMBOL                | UNIT    | CONDITION                                                                                                                                              |
|-----------------------------------------------------------------------------------------------------------------|-----------------------|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>A. Set Up Conditions</b>                                                                                     |                       |         |                                                                                                                                                        |
| ambient temperature                                                                                             | T                     | °C      | T = 25 °C (unless otherwise noted)                                                                                                                     |
| supply voltage                                                                                                  | V <sub>cc</sub>       | V       | V <sub>cc</sub> = 5 V                                                                                                                                  |
| applied magnetic field                                                                                          | H                     | kA/m    | H > 10 kA/m                                                                                                                                            |
| <b>B. Sensor Specifications (T=25 °C, 360° turn , H=25 kA/m , Vo<sub>max</sub>&gt;0, Vo<sub>min</sub>&lt;0)</b> |                       |         |                                                                                                                                                        |
| output signal range                                                                                             | $\Delta V_n / V_{cc}$ | mV/V    | $\Delta V_n / V_{cc} = (V_{n \max} - V_{n \min}) / V_{cc}$                                                                                             |
| signal offset                                                                                                   | V <sub>off n</sub>    | mV/V    | $V_{off n} = (V_{n \max} + V_{n \min}) / V_{cc}$                                                                                                       |
| <b>C. Sensor Specifications (T=-25°C, +125°C)</b>                                                               |                       |         |                                                                                                                                                        |
| ambient temperatures                                                                                            | T                     | °C      | T <sub>1</sub> = -25 °C, T <sub>0</sub> = +25 °C, T <sub>2</sub> = +125 °C                                                                             |
| TC of amplitude                                                                                                 | TCSV                  | %/K     | $TCV = \frac{1}{(T_2 - T_1)} \cdot \frac{\frac{\Delta V_n}{V_{cc}}(T_2) - \frac{\Delta V_n}{V_{cc}}(T_1)}{\frac{\Delta V_n}{V_{cc}}(T_1)} \cdot 100\%$ |
| TC of resistance                                                                                                | TCBR                  | %/K     | $TCR = \frac{1}{(T_2 - T_1)} \cdot \frac{R_n(T_2) - R_n(T_1)}{R_n(T_1)} \cdot 100\%$                                                                   |
| TC of offset                                                                                                    | TCVoff                | μV/(VK) | $TCVoff_n = \frac{Voff_n(T_2) - Voff_n(T_1)}{(T_2 - T_1)}$                                                                                             |

n = 1;2 (bridge number)

## BLOCK DIAGRAM

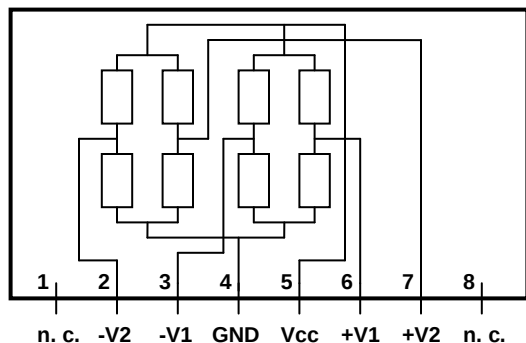


Figure 1a: KMXP 1000/2000

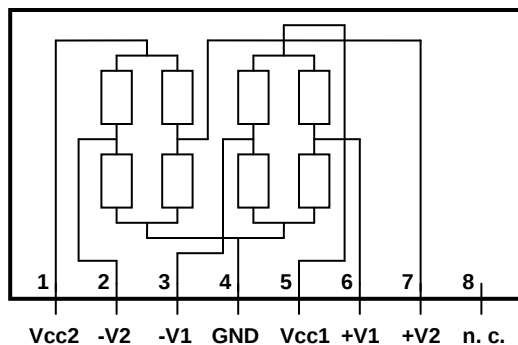


Figure 1b: KMXP 5000

# KMXP Magneto Resistive Position Sensor

## TYPICAL PERFORMANCE CURVES

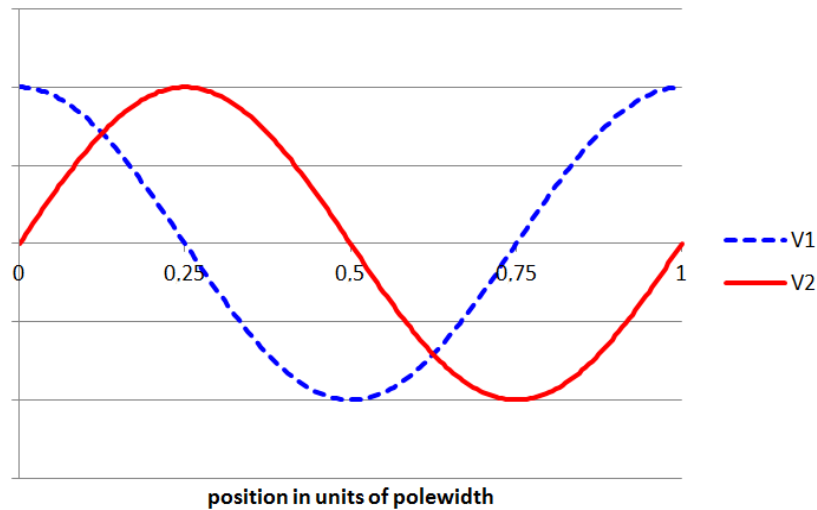


Figure 2: typical output signal voltage depending on sensor position

## FUNCTION

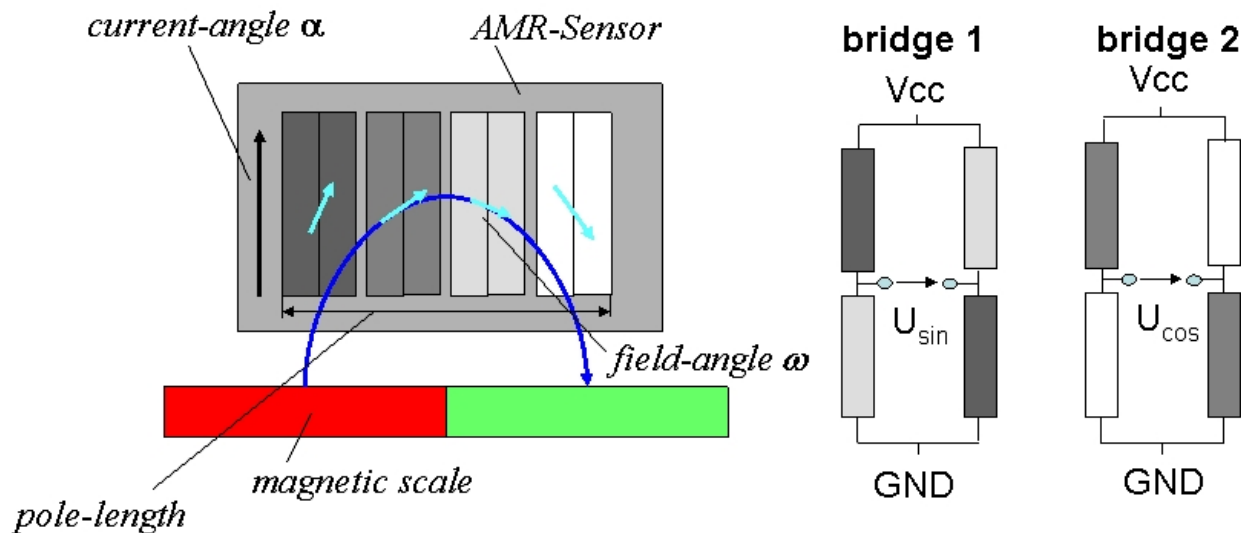
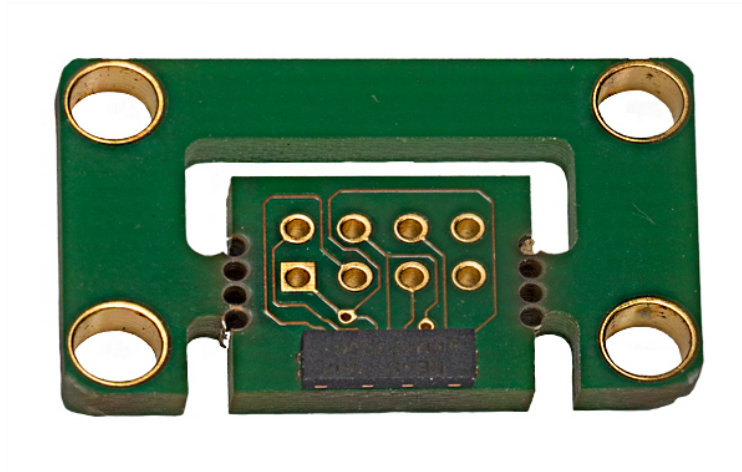


Figure 3: principle function of the sensor

The KMXP sensors consists of two magneto resistive Wheatstone bridges, whose resistors are placed in a way that the characteristic magnetic field distribution of a magnetic scale with matching pole pitch produces a sine and a cosine signal output, when the sensor is moved along the scale. In addition, some sensor types integrate over more than one pole in order to improve sensor performance.

# KMXP Magneto Resistive Position Sensor

## EXAMPLE FOR A PRINTED CIRCUIT BOARD ASSEMBLY



## PIN ASSIGNMENT

The pin assignment is pin compatible for all KMXP types and allows a common PCB layout for all types:

| Pin      | 1    | 2   | 3   | 4   | 5    | 6   | 7   | 8   | 9   | 10  | 11  | 12  |
|----------|------|-----|-----|-----|------|-----|-----|-----|-----|-----|-----|-----|
| KMXP5000 | Vcc2 | -V2 | -V1 | GND | Vcc1 | +V1 | +V2 | N/C | N/C | N/C | N/C | N/C |
| KMXP2000 | N/C  | -V2 | -V1 | GND | Vcc  | +V1 | +V2 | N/C | N/C | N/C | N/C | N/C |
| KMXP1000 | N/C  | -V2 | -V1 | GND | Vcc  | +V1 | +V2 | N/C | N/C | N/C | N/C | N/C |

# KMXP Magneto Resistive Position Sensor

## PHYSICAL DIMENSIONS

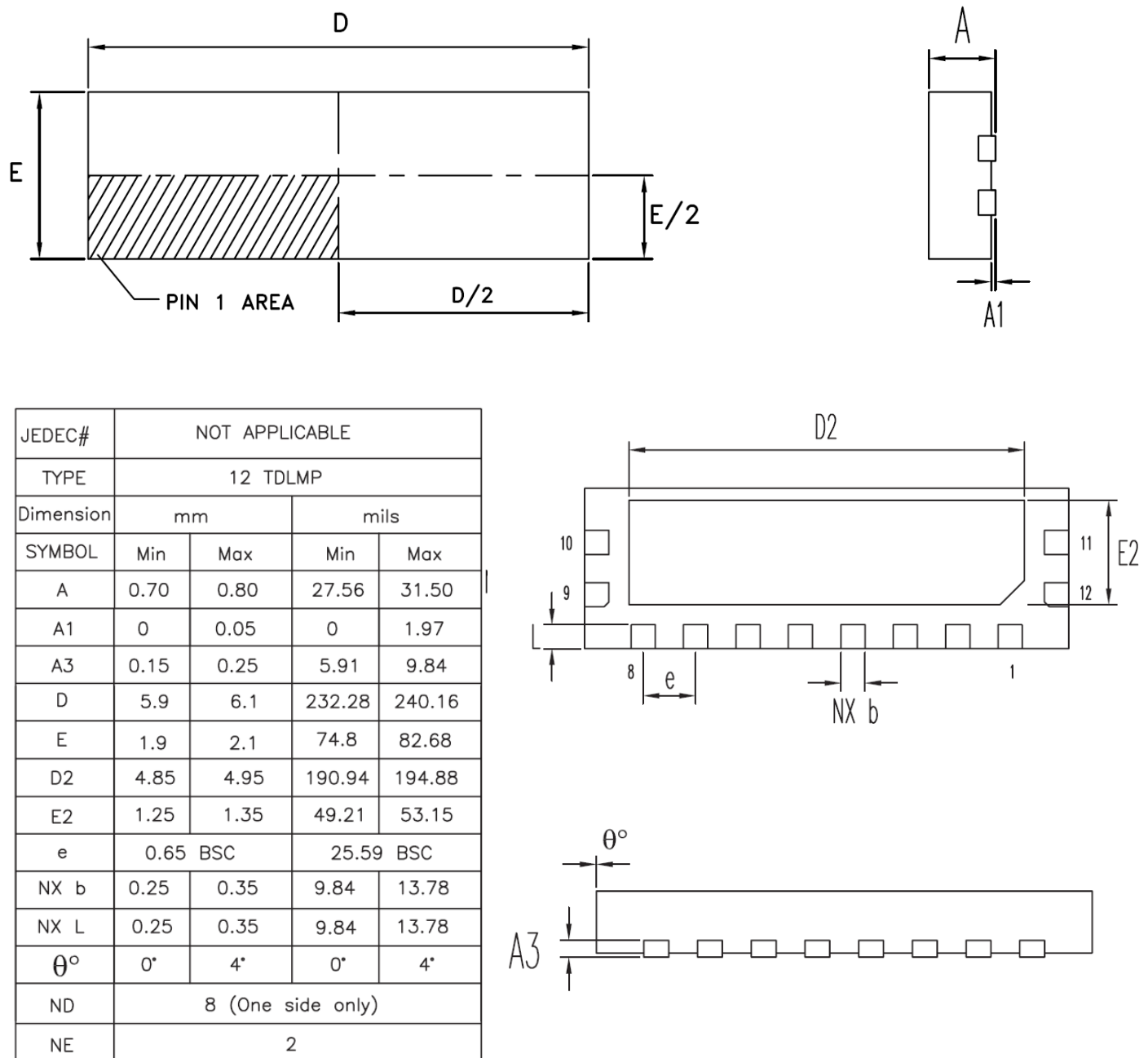


Fig. 4: Physical dimensions of sensor package

Reflow profile for this package according to IPC/JEDEC J-STD-020 Revision D.1 (March 2008).

# KMXP Magneto Resistive Position Sensor

## APPLICATION EXAMPLE

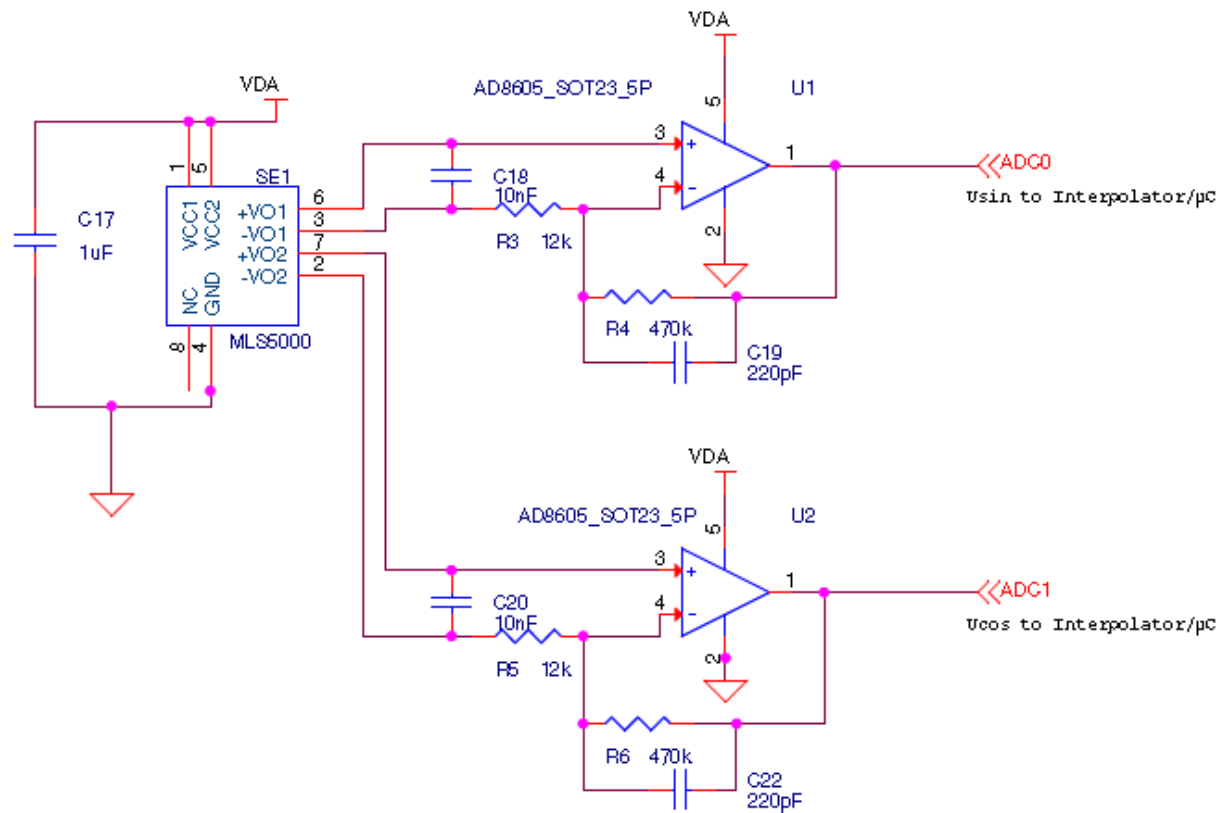


Fig. 5: Exemplary hardware configuration for the usage with a conventional microcontroller using an Analog Devices AD8605 amplifier for the preprocessing of the sensor signals.

# KMXP Magneto Resistive Position Sensor

## ORDERING CODES

| Name           | KMXP 1000  | KMXP 2000  | KMXP 5000  |
|----------------|------------|------------|------------|
| Pole pitch     | 1 mm       | 2 mm       | 5 mm       |
| Article number | on request | G-MRCO-050 | G-MRCO-052 |

## TECHNICAL CONTACT INFORMATION

| NORTH AMERICA                                                                                                                                                                                                                                                                   | EUROPE                                                                                                                                                                                                                                                               | ASIA                                                                                                                                                                                                                                                                                                                                |
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