

KMXP SERIES

Anisotropic Magneto-Resistive (AMR) Linear Position Sensors

Position sensors play an increasingly important role in many industrial, robotic and medical applications. Advanced applications in harsh environments need sensors that perform well, even when exposed to oil, dirt and dust.

The TE Connectivity KMXP position sensor is the right choice to meet those needs thanks to its Magneto Resistive technology and available form factors. The KMXP sensor provides greater precision than commonly used Hall sensors and is designed to provide reliable and accurate measurements in harsh environments including high temperatures.

The sensor measuring principle is based on the anisotropic magneto resistance effect (AMR effect).

The sensors are offered in two different DFN packages for multiple orientation options. These packages can be easily integrated to almost any automated assembly process.

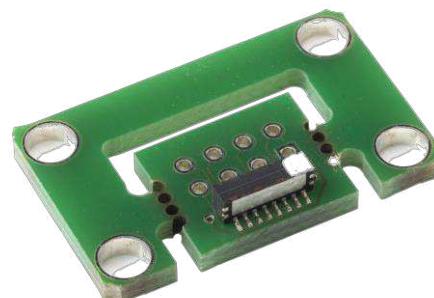
FEATURES

- High Resolution and high precision – Magneto Resistive (MR) sensor with contactless measurement which provides accuracy of 10-50 μm in ranges between 1 – 5 mm.
- Easy Assembly – DFN package ideal for any PCB assembly processes.
- Tape & Reel packaging for easy integration
- Design Freedom – Perpendicular or flat soldering versions and a small sensor wall thickness for large application air gaps.
- Superior Performance – Up to 150°C, EMC proof in any dirty environment and insensitive to dirt, oil or dust.

APPLICATIONS

Contactless linear or angular position measurement in applications like:

- Industrial machinery like sawing or drilling equipment
- Medical high precision mechanical controls like bed control, advanced prosthesis steering, precision catheters, X-ray equipment, or syringe pumps
- Robotics in industrial automation



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MEASUREMENT PRINCIPLE

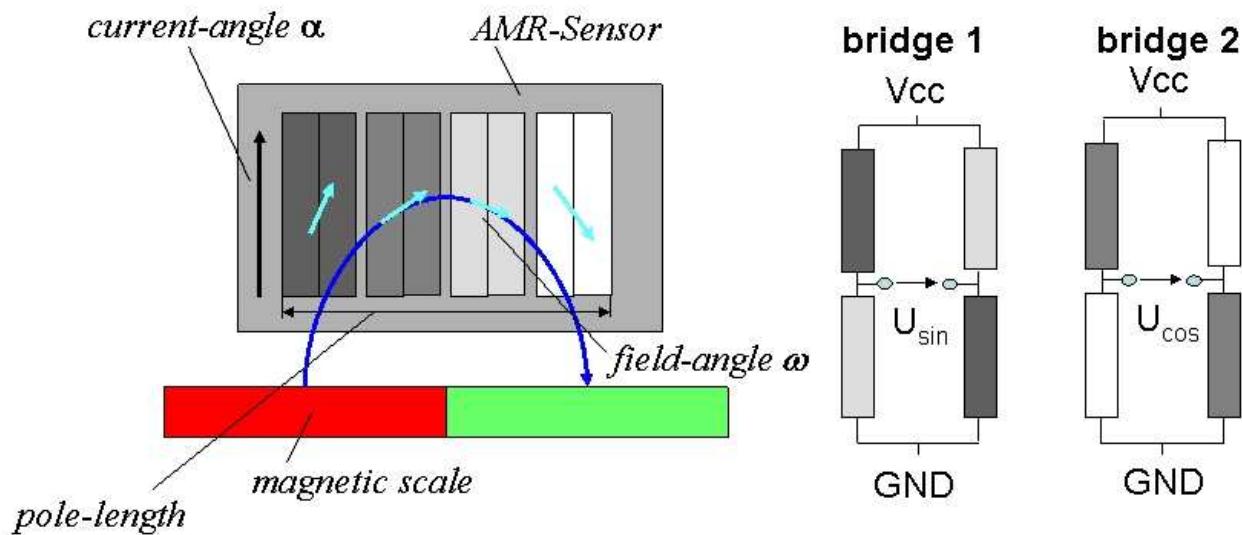


Figure 1: principle function of the sensor

The KMXP sensors consist of two magneto resistive Wheatstone bridges, whose resistors are placed in a such 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.

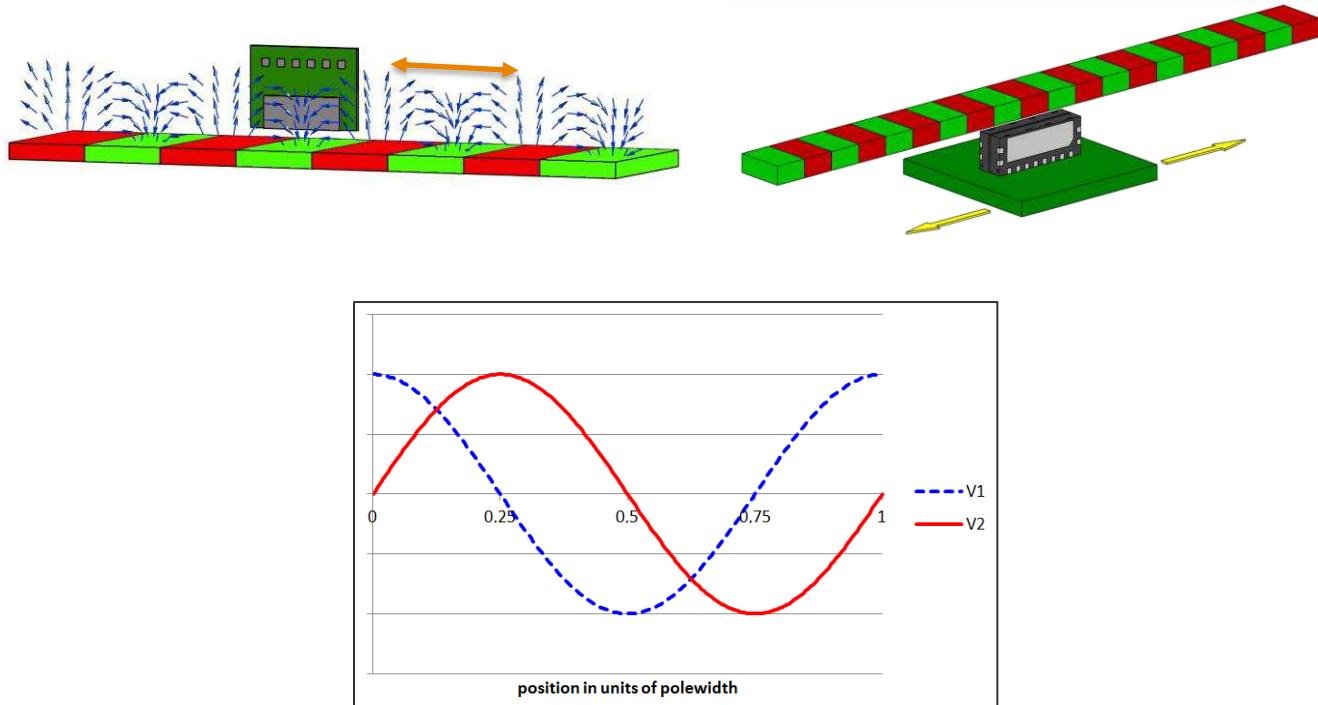


Figure 2: typical application of a PCB mounted KMXP sensor moving relative to a magnetic pole and the corresponding output signal voltage depending on sensor position

PERFORMANCE SPECIFICATIONS

PARAMETER	SYMBOL	COND.	TYPE	MIN	TYP	MAX	UNIT
1. Operating Limits							
Max. supply voltage	$V_{cc,max}$		all			10	V
Max. current (both bridges)	$I_{cc,max}$		KMXP100x KMXP200x/500x			5 10	mA
Operating temperature	T_{op}		all	-40		+150	°C
Storage temperature	T_{st}		all	-40		+150	°C
2. Sensor Specifications (T=25 °C)							
Supply voltage	V_{cc}		all		5		V
Pole pitch 1)	p		KMXP100x KMXP200x KMXP500x		1000 2000 5000		μm
Air gap package front – magnetic scale 2)	D		KMXP100x KMXP200x KMXP500x	0.1 0.2 0.5	0.4 0.8 2	0.8 1.8 4	mm
Resistance (both bridges)	R_b		KMXP100x KMXP200x/500x	2000 1000	3000 1500	4000 2000	Ω
Output signal range	$\Delta V_n/V_{cc}$	A, B	all	18	22	26	mV/V
Offset voltage	$V_{n off}$	A, B	all	-1	0	+1	mV/V
3. Sensor Specifications							
TC of amplitude	TCSV	A, C	All		-0.35		%/K
TC of resistance	TCBR	A, C	All		+0.35		%/K
TC of offset	TCVoff	A, C	all	-4	0	+4	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.

MEASUREMENT SET UP CONDITIONS

PARAMETER	SYMBOL	UNIT	CONDITION
A. Set Up Conditions			
Ambient temperature	T	°C	T = 25 °C (unless otherwise noted)
Supply voltage	V_{cc}	V	$V_{cc} = 5$ V
Applied magnetic field	H	kA/m	$H > 10$ kA/m
B. Sensor Specifications (T=25 °C, 360° turn, H=25 kA/m, $V_{o max} > 0$, $V_{o min} < 0$)			
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	$V_{off n}$	mV/V	$V_{off n} = (V_{n max} + V_{n min}) / V_{cc}$
C. Sensor Specifications (T=-25°C, +125°C)			

Ambient temperatures	T	°C	$T_1 = -25 \text{ }^\circ\text{C}, T_0 = +25 \text{ }^\circ\text{C}, T_2 = +125 \text{ }^\circ\text{C}$
TC of amplitude	TCSV	%/K	$TCV = \frac{1}{(T_2 - T_1)} \cdot \frac{\frac{\Delta V_n(T_2) - \Delta V_n(T_1)}{V_{cc}}}{\frac{\Delta V_n(T_1)}{V_{cc}}} \cdot 100\%$
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	$\mu\text{V}/(\text{VK})$	$TCV_{off} = \frac{V_{off_n}(T_2) - V_{off_n}(T_1)}{(T_2 - T_1)}$

n = 1;2 (bridge number)

BLOCK DIAGRAM

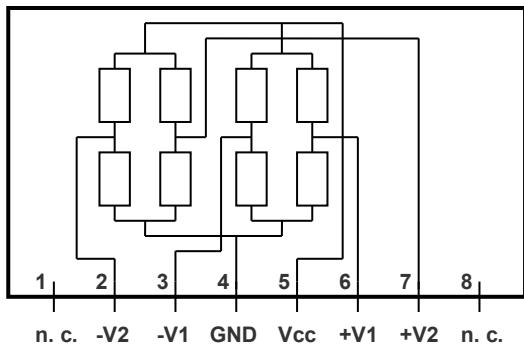


Figure 3a: KMXP1000 / KMXP2000

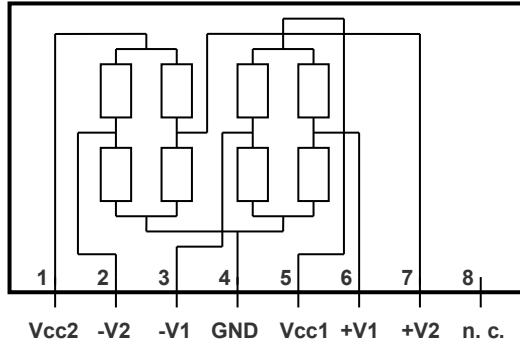


Figure 3b: KMXP5000

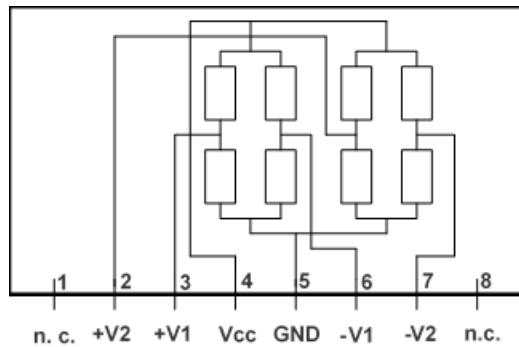


Figure 3c: KMXP1002 / KMXP2002

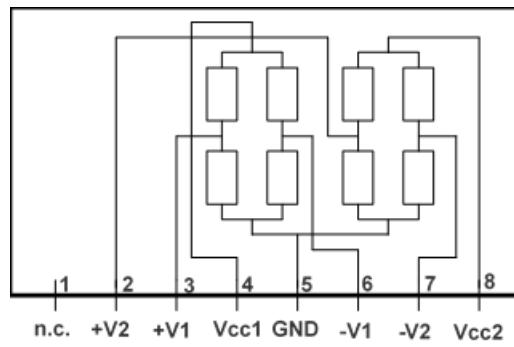


Figure 3d: KMXP5002

EXAMPLE OF PRINTED CIRCUIT BOARD ASSEMBLY



Figure 4a: Flat mounted KMXP on a PCB

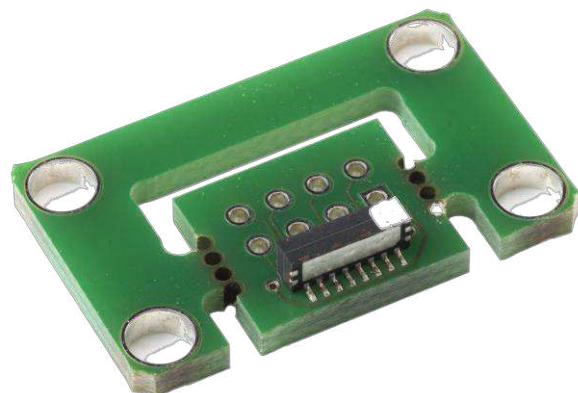


Figure 4b: Perpendicular mounted KMXP on a PCB

PIN ASSIGNMENT

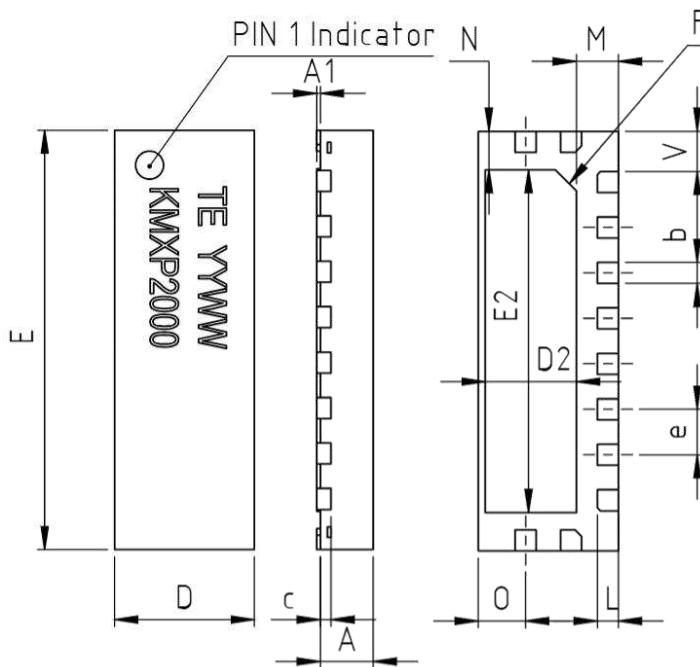
The pin assignment is pin compatible for all KMXP_{N000} types and allows a common PCB layout for all types:

Pin	1	2	3	4	5	6	7	8	9	10	11	12
KMXP5000	V _{CC2}	-V ₂	-V ₁	GND	V _{CC1}	+V ₁	+V ₂	N/C	N/C	N/C	N/C	N/C
KMXP2000	N/C	-V ₂	-V ₁	GND	V _{CC}	+V ₁	+V ₂	N/C	N/C	N/C	N/C	N/C
KMXP1000	N/C	-V ₂	-V ₁	GND	V _{CC}	+V ₁	+V ₂	N/C	N/C	N/C	N/C	N/C

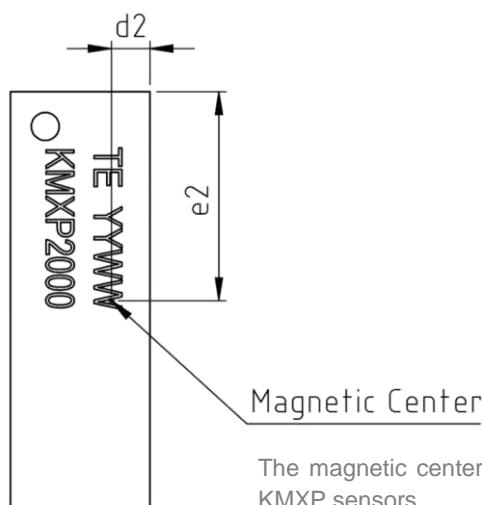
The pin assignment is pin compatible for all KMXP_{N002} types and allows a common PCB layout for all types:

Pin	1	2	3	4	5	6	7	8	9 -16		
KMXP5002	N/C	+V ₂	+V ₁	V _{CC1}	GND	-V ₁	-V ₂	V _{CC2}	N/C		
KMXP2002	N/C	+V ₂	+V ₁	V _{CC}	GND	-V ₁	-V ₂	N/C	N/C		
KMXP1002	N/C	+V ₂	+V ₁	V _{CC}	GND	-V ₁	-V ₂	N/C	N/C		

PHYSICAL DIMENSIONS FOR KMXPN000



REF.	DIMENSION MM		
	MIN.	NOM.	MAX.
A	0.70	0.75	0.80
A1	--	--	0.05
b	--	0.30	--
c	--	0.20	--
D	1.90	2.00	2.10
D2	1.20	1.30	1.40
d2	--	0.55	--
E	5.90	6.00	6.10
E2	4.80	4.90	5.00
e	--	0.65	--
e2	--	3.00	--
F	0.3 x 45°		
L	0.25	0.30	0.35
M	--	0.60	--
N	--	0.55	--
O	--	0.675	--
V	--	0.575	--



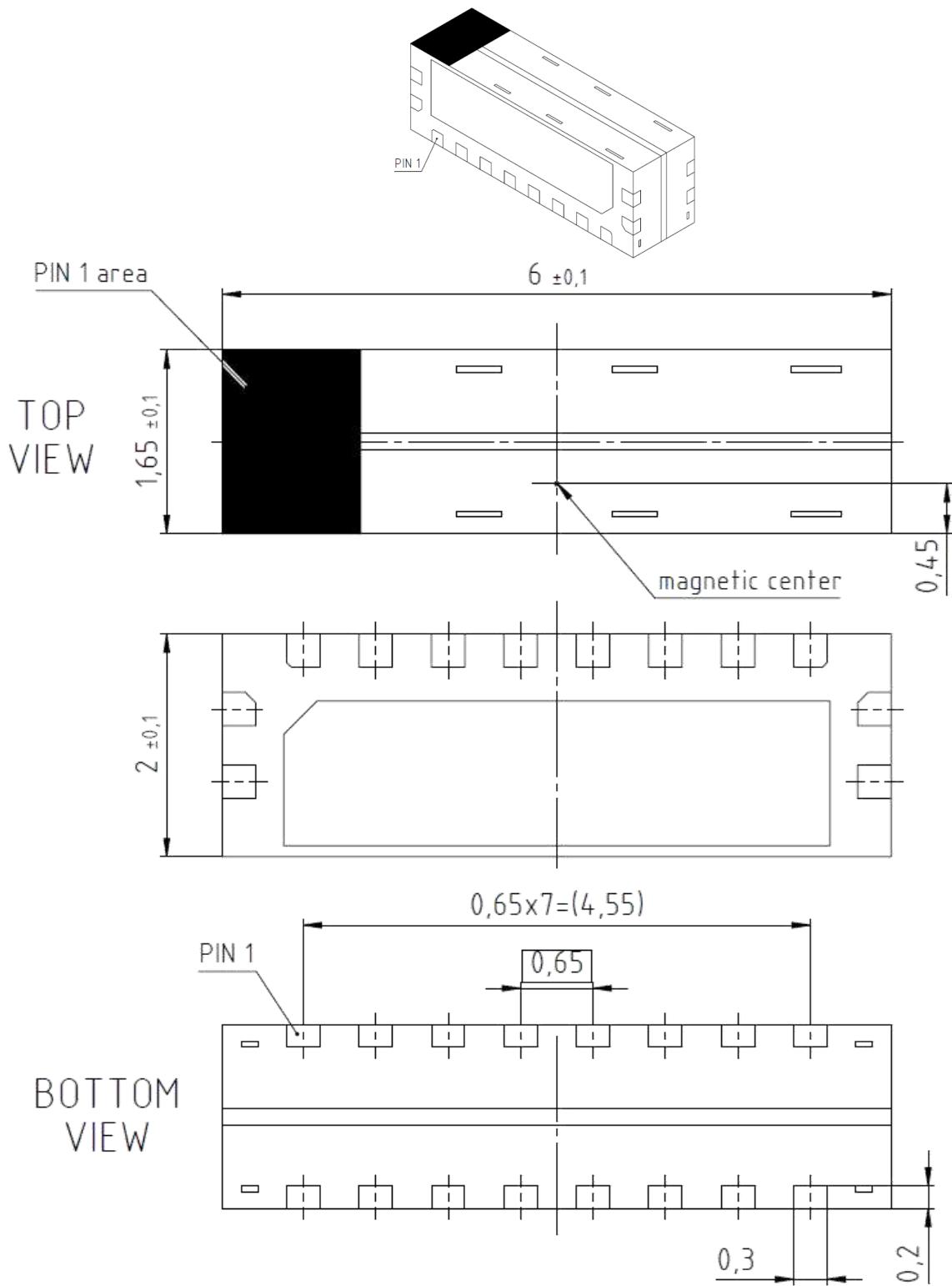
The magnetic center point is the same for all KMXP sensors

Fig. 5: Physical dimensions of sensor package

Quality information

This product has been qualified in accordance with the Automotive Electronics Council (AEC) standard Q101 - Failure mechanism-based stress test for discrete semiconductor.

PHYSICAL DIMENSIONS FOR KMXPN002



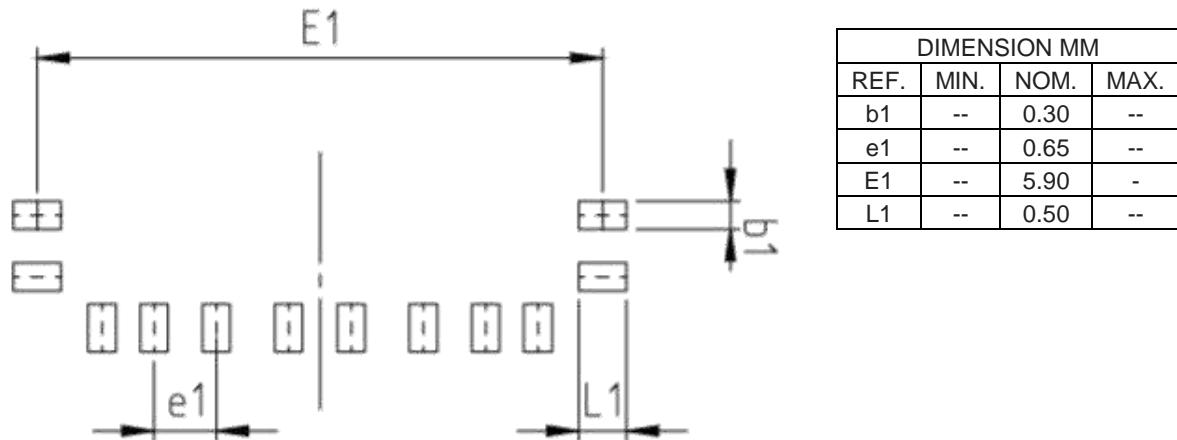
Quality information

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Recommended Land Pattern

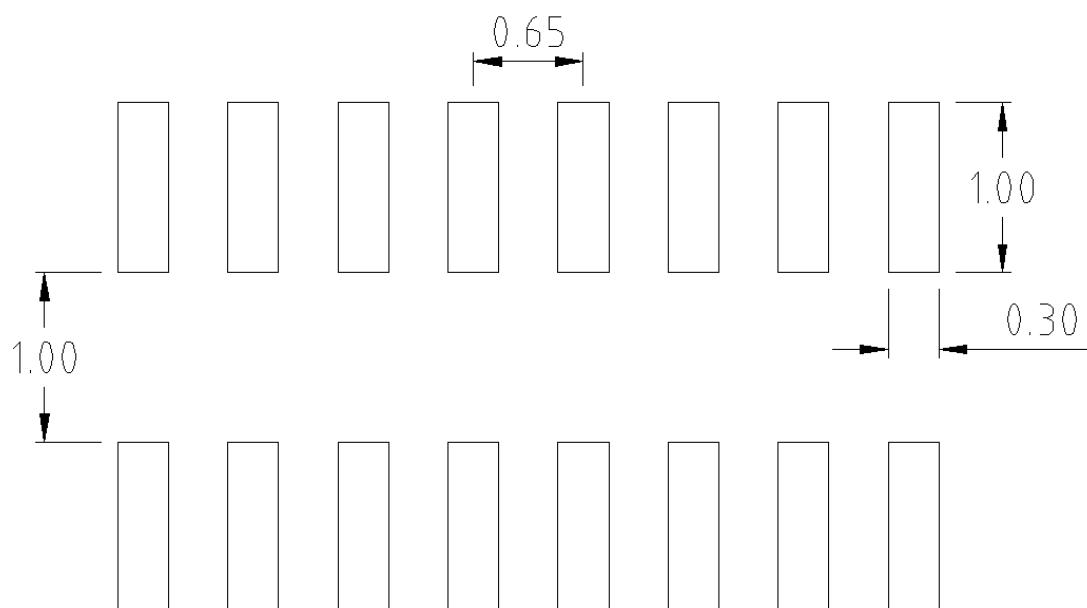
KMXP_N000

Package: 12L TDFN 6 x 2

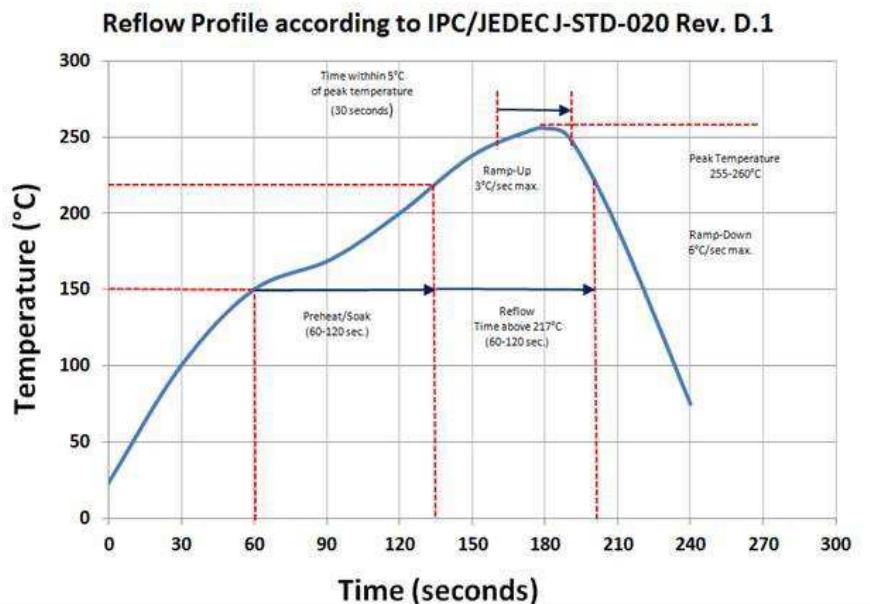


KMXP_N002

Package: 16L PDFN 6 x 1.65



Solder Profile



Moisture Sensitivity Level for KMXP000: MSL1 @ 260°C

Moisture Sensitivity Level for KMXP002: MSL1 @ 260°C

Tape and Reel Packaging Information

Description	Reel size	Units/reel	Pin 1 orientation	Note
KMXP1000 KMXP2000 KMXP5000	7"	1,000	Top-left of sprocket hole side	
KMXP1002 KMXP2002 KMXP5002	7"	500	Left of sprocket hole side	

APPLICATION EXAMPLE

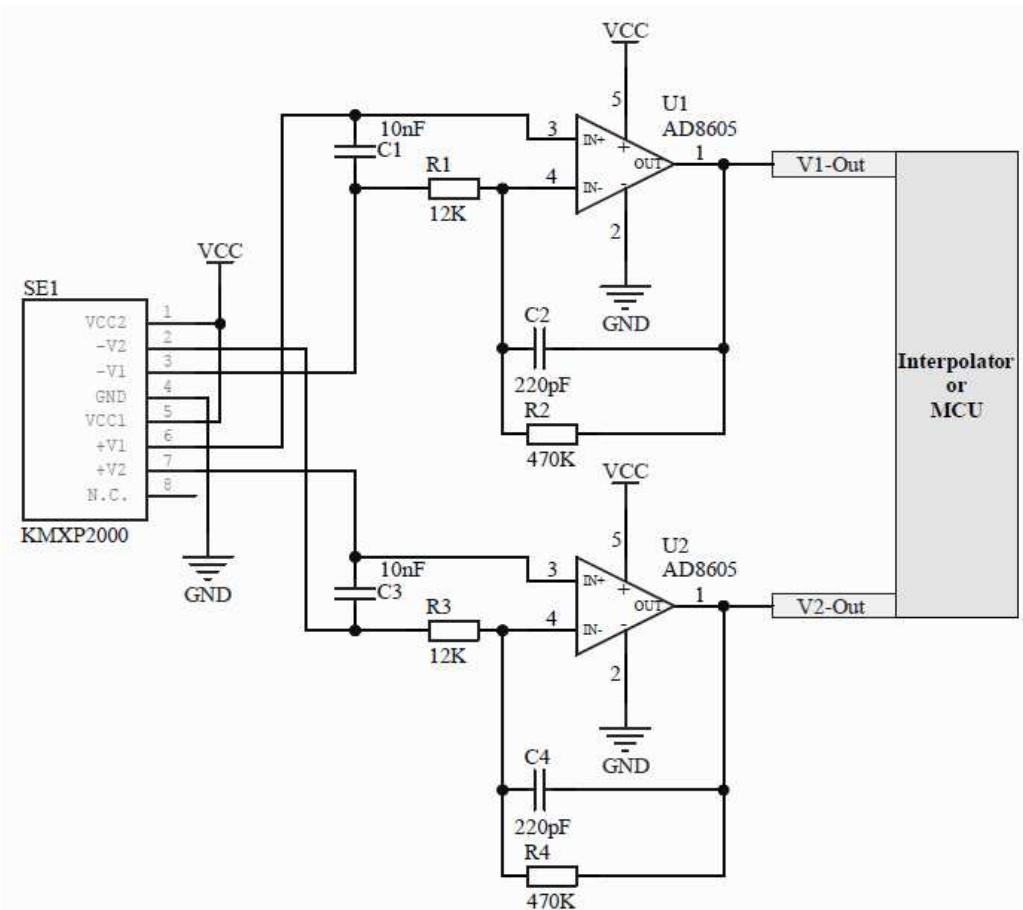


Fig. 6: Exemplary hardware configuration for the usage with a conventional microcontroller using an Analog Devices AD8605 amplifier for the preprocessing of the sensor signals.

Ordering Information

Description	Pole Pitch	Part Number
KMXP1000 MLS 1MM PITCH DFN	1 mm	G-MRCO-051
KMXP2000 MLS 2MM PITCH DFN	2 mm	G-MRCO-050
KMXP5000 MLS 5MM PITCH DFN	5 mm	G-MRCO-052
KMXP1002 1MM PITCH VERTICAL	1 mm	G-MRCO-055
KMXP2002 2MM PITCH VERTICAL	2 mm	G-MRCO-056
KMXP5002 5MM PITCH VERTICAL	5 mm	G-MRCO-057

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