DATA SHEET

KM110BH/2270
Angle sensor hybrid circuit

Product specification
Supersedes data of 1996 Nov 12
File under Discrete Semiconductors, SC17

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Philips
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Angle sensor hybrid circuit KM110BH/2270

FEATURES

- Angle measuring range 70°
- Contactless, therefore wear-free and no micro-linearity problems
- Easy to mount, ready for use
- Analog current output signal
- Operating temperatures up to 100 °C
- EMC resistant
- Sample kit with magnet available.

DESCRIPTION

Sensor module for contactless measurement of angular displacements of strong magnetic fields between –35° and +35°. The module is a ready-trimmed (sensitivity and zero point) combination of the magnetoresistive sensor KMZ10B and a signal conditioning circuit in hybrid technology. The KMZ110BH/2270 delivers a sinusoidal current output signal which is a function of the direction of the magnetic field. The module can be used for contactless angle measurement.

PIN OPTIONS

The KMZ110BH/2270 sensor hybrid is available with different electrical contacts.

- Stretched pins (see Fig.8) with a pitch of 2.54 mm. These pins are recommended for connector and/or cable connections.
- Double ‘s’ bent pins (see Fig.6) with a pitch of 5.71 mm. Bent pins are recommended for rigid soldered connections to compensate for mechanical stress. This hybrid circuit is available under type number KM110BH/2270G.

PINNING

PIN	DESCRIPTION
1	ground
2	V_{CC}
3	I_O

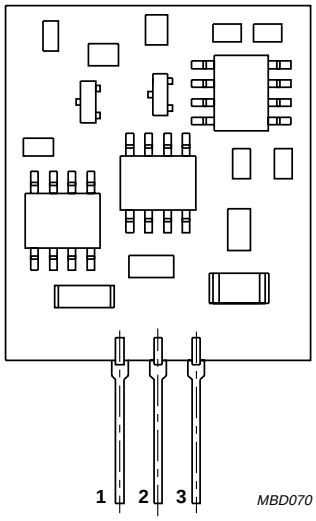


Fig.1 Simplified outline.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	MIN.	TYP.	MAX.	UNIT
V_{CC}	DC supply voltage	–	8.5	–	V
I_O	output current range	–	4 to 20	–	mA
α	angle range	–	–35 to +35	–	deg
T_{op}	operating temperature	–40	–	+100	°C

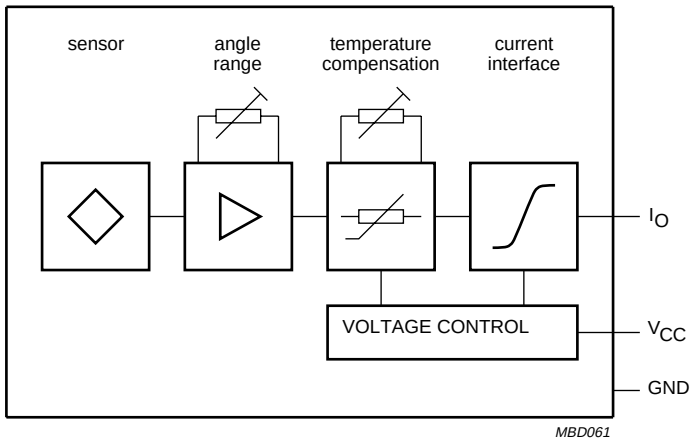


Fig.2 Circuit diagram.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_{CC}	DC supply voltage	8.1	11	V
I_{CC}	supply current	–	40	mA
T_{stg}	storage temperature	–40	+125	°C
T_{op}	operating temperature	–40	+100	°C
	output short-circuit duration	permanent; note 1		

Note

1. If pin 3 is shorted to either pin 1 or pin 2, current may flow permanently, without damage to the device.

CHARACTERISTICS

T_{amb} = 25 °C; V_{CC} = 8.5 V and a homogeneous magnetic field H_{ext} = 100 kA/m in the sensitive layer of the KMZ10B sensor; unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
α	angle range	note 1	–	–35 to +35	–46.5 to +46.5	deg
I_O	output current range	note 2; sinusoidal; see Fig.4	–	4 to 20	3.2 to 20.8	mA
I_{zero}	zero point current	α = 0°	–	12	–	mA
I_{offset}	zero point offset current		–	±120	–	µA
S	sensitivity	α = 0°; note 3	0.289	0.292	0.295	mA/deg
Rp	reproducibility	α = 0°; note 4	–	<0.001	–	deg
Rs	resolution	α = 0°; note 5	–	<0.001	–	deg
Rhy	hysteresis	α = 0°; note 6	–	<0.05	–	deg
SP_{max}	maximum angular speed		–	20	–	deg/ms
R_L	load resistance		–	200	220	Ω
Temperature coefficients (–40 to +85 °C)						
TCI_{zero}	temperature coefficient of zero point current		–	±1.5	–	µA/K
TCS	temperature coefficient of sensitivity		–	±100	–	ppm/K

Notes

1. Refer to Fig.3. The magnetic field H_{ext} = 100 kA/m can be produced by using the magnets listed in Table 1.
2. Maximum values refer to ±46.5° including offset and sensitivity tolerances.
3. The sensitivity will change slightly with +0.33% per 10% magnetic field increase if H_{ext} deviates from 100 kA/m.
4. Difference in output signal (expressed in degrees) between two zero point (α = 0) measurements, in which the zero point is approached from the same side of the measuring range (e.g. cycle: +35° → 0° → +35° → 0°).
5. The smallest detectable change of angle $\Delta\alpha$ for α = 0° (cycle: 0° → $\Delta\alpha$).
6. As note 4, but with the zero point being approached from the upper end and lower end of the measuring range respectively (cycle: +35° → 0° → –35° → 0°).

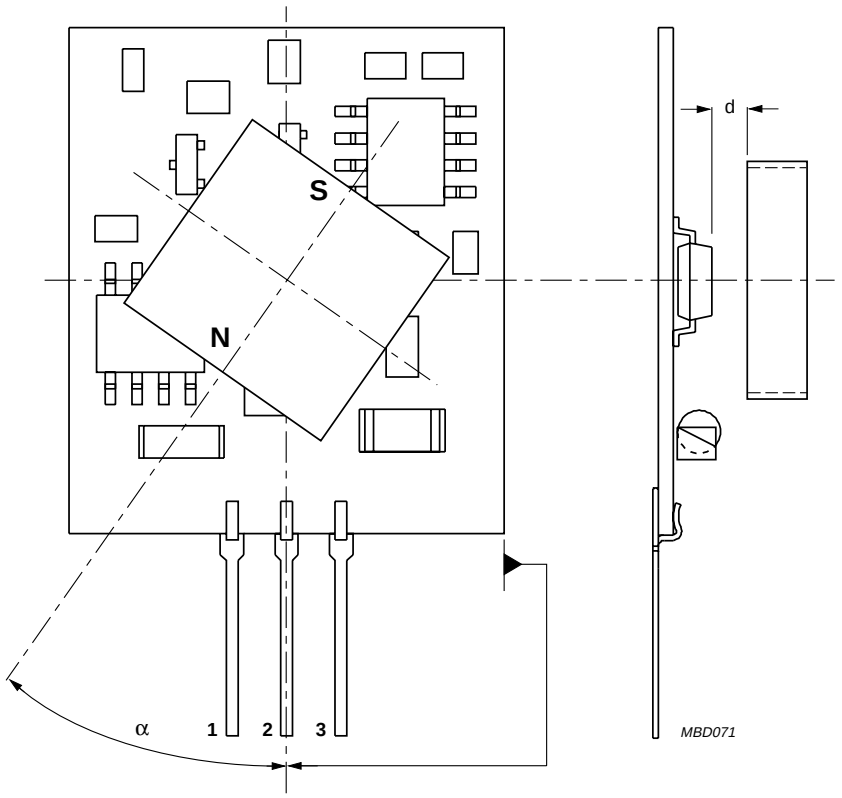


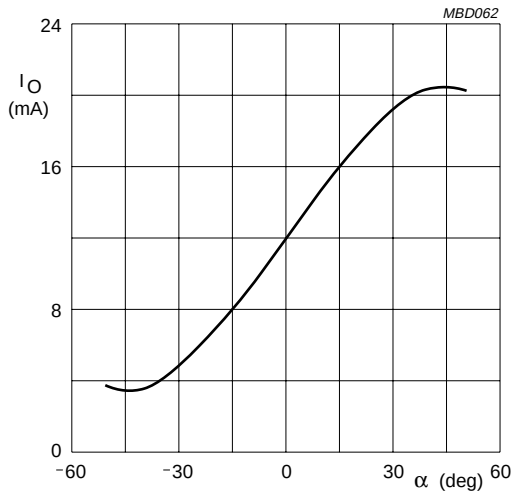
Fig.3 Optimum magnet position relative to the sensor module.

Table 1 Magnets for angle sensor hybrid

MATERIAL	DIMENSIONS(1) (mm)	DISTANCE 'd'(2) (mm)	TOLERANCE OF 'd'(3) (mm)	ECCENTRICITY(4) (mm)	TEMPERATURE RANGE (°C)
Sm_2Co_{17}	$11.2 \times 5.5 \times 8$	2.1	±0.30	±0.25	–55 to +125
	$6 \times 3 \times 5$	0.7	±0.15	±0.15	
	$8 \times 3 \times 7.5$	0.5	±0.30	±0.20	

Notes

1. The magnetization is always parallel to last dimension given in each of the cells in this column.
2. Between magnet and KMZ11B1 sensor front as shown in Fig.3.
3. Maximum deviation of distance 'd' for which the change in sensor output signal is smaller than 0.5% of full scale sensor signal.
4. Maximum deviation of magnet rotational axis to sensor rotational axis for which the change in sensor output signal is smaller than 0.5% of full scale sensor signal.



$I_{o(nom)} = 12 + 8.644 \times \sin(1.935 \times \alpha)$ in the range $-46.5° \leq \alpha \leq +46.5°$.
T_{amb} = 25 °C; V_{CC} = 8.5 V; H_{ext} = 100 kA/m.

Fig.4 Output current as a function of angular displacement.

APPLICATION INFORMATION

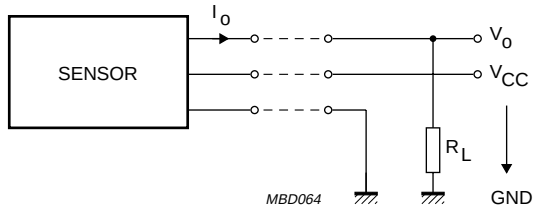
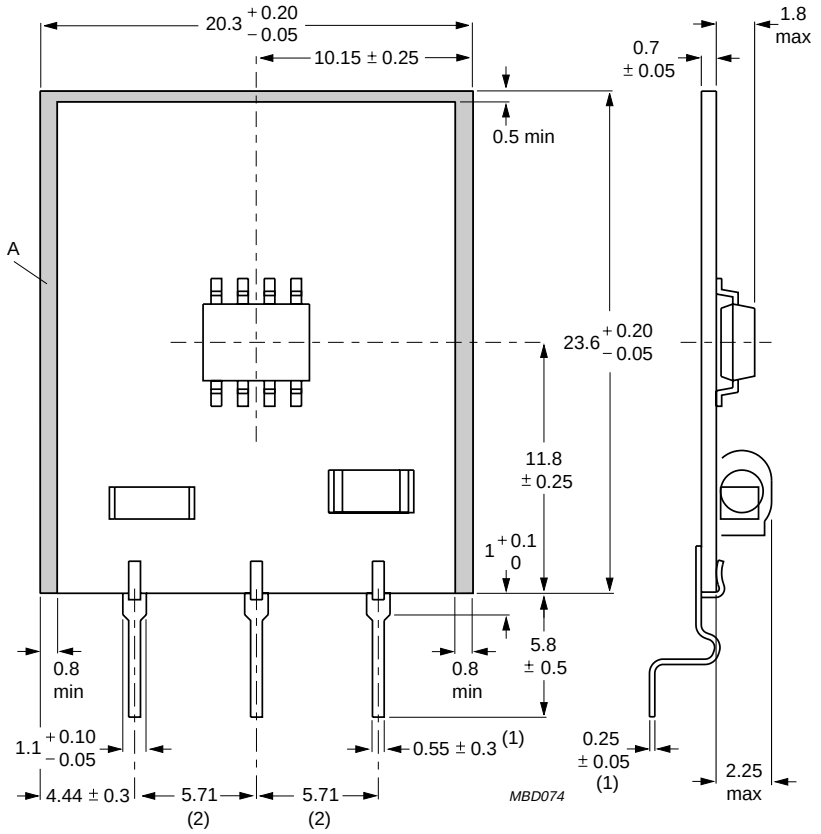


Fig.5 Application example.

PACKAGE OUTLINE - BENT PIN OPTION



Dimensions in mm.

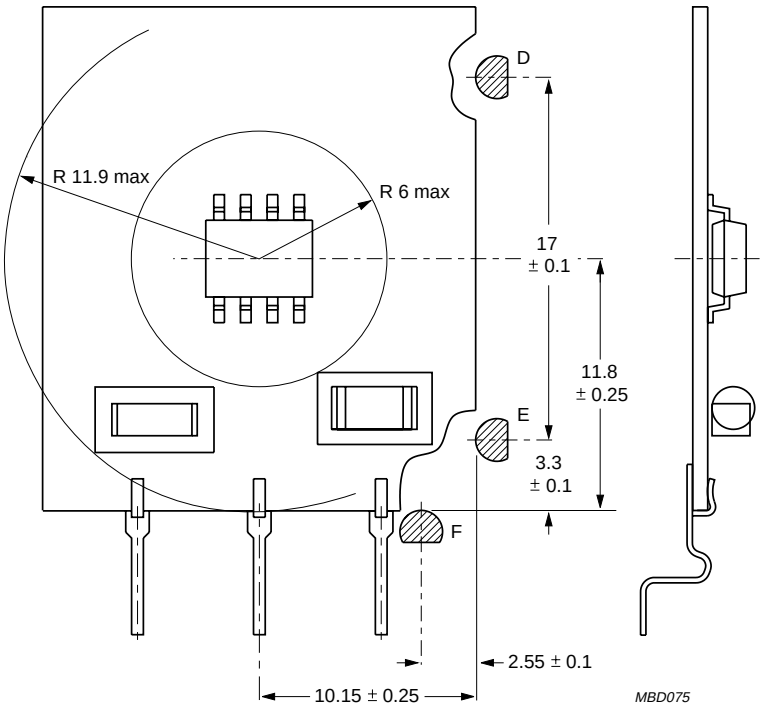
Area ‘A’ (shaded) free of SMD devices.

(1) Dimension before bath soldering; maximum dimension after bath soldering: 0.7 mm.

(2) Pitch tolerance: 0.2 mm.

Fig.6 KM110BH/2270G.

REFERENCE DATA FOR THE ASSEMBLY AND MAGNET POSITIONING - BENT PIN OPTION



Dimensions in mm.

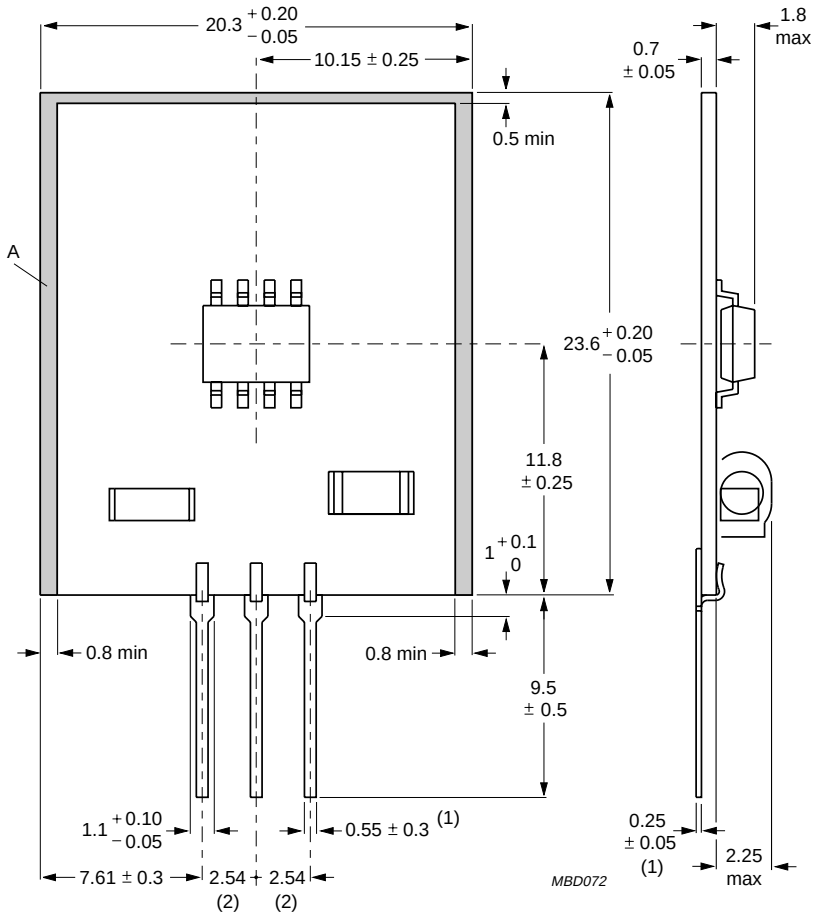
D, E: Definition of reference side for angle α.

D, E, F: Reference points for sensor assembly.

Radii for free rotation of magnets due to height of the components on the hybrid circuit.

Fig.7 KM110BH/2270G.

PACKAGE OUTLINE - STRETCHED PIN OPTION



Dimensions in mm.

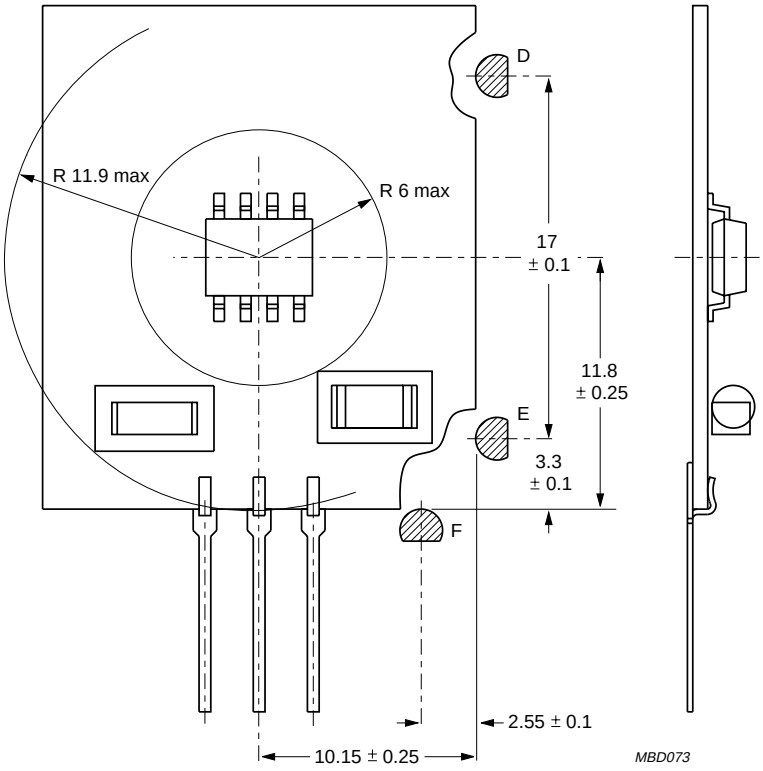
Area ‘A’ (shaded) free of SMD devices.

(1) Dimension before bath soldering; maximum dimension after bath soldering: 0.7 mm.

(2) Pitch tolerance: 0.2 mm.

Fig.8 KM110BH/2270.

REFERENCE DATA FOR THE ASSEMBLY AND MAGNET POSITIONING - STRETCHED PIN OPTION



Dimensions in mm.

D, E: Definition of reference side for angle α.

D, E, F: Reference points for sensor assembly.

Radii for free rotation of magnets due to height of the components on the hybrid circuit.

Fig.9 KM110BH/2270.

DEFINITIONS

Data sheet status	
Objective specification	This data sheet contains target or goal specifications for product development.
Preliminary specification	This data sheet contains preliminary data; supplementary data may be published later.
Product specification	This data sheet contains final product specifications.
Limiting values	
Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.	
Application information	
Where application information is given, it is advisory and does not form part of the specification.	

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