DATA SHEET

KMI18/2
Integrated rotational speed sensor

Preliminary specification

2000 Sep 05

Philips
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Integrated rotational speed sensor KMI18/2

FEATURES

- Open collector output
- For active target wheel application
- Wide air gap
- Zero speed capability
- Wide temperature range
- Insensitive to vibration.

DESCRIPTION

The KMI18/2 sensor detects rotational speed of active target wheels with magnetic reference marks.

It consists of a magnetoresistive sensor element, an integrated circuit for signal conditioning and a ferrite magnet.

The frequency of the digital voltage output signal is proportional to the rotational speed of the target wheel.

An open collector output gives high flexibility in the design of the subsequent signal conditioning electronics.

CAUTION
Do not press two or more products together against their magnetic forces. Do not expose products to strong magnetic fields of more than 30 kA/m.

PINNING

PIN	SYMBOL	DESCRIPTION
1	V_{CC}	DC supply voltage
2	OUT	open collector output
3	GND	ground

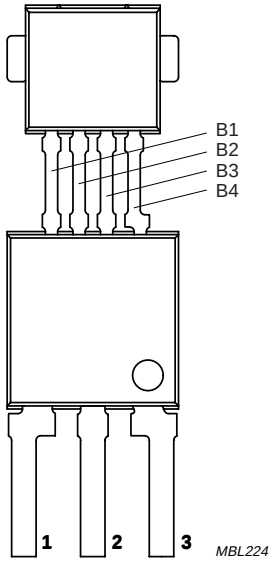


Fig.1 Simplified outline (SOT477A).

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CC}	DC supply voltage	T_{amb} = –40 to +150 °C	4.5	5	16.5	V
I_{CC}	DC supply current	V_{CC} = 5 V	6	7	10	mA
H_{yLH}	magnetic threshold for LH edge		100	250	400	A/m
H_{yHL}	magnetic threshold for HL edge		–400	–250	–100	A/m
T_{amb}	ambient operating temperature	V_{CC} = 5 V; note 1	–40	–	+150	°C

Note

1. Maximum power consumption according to power derating curve, see Fig.3.

LIMITING VALUES

In accordance with Absolute Maximum Rating System (IEC 60134); T_{amb} = –40 to +150 °C; see Fig.4.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CC}	DC supply voltage	not protected against incorrect polarity	–0.5	+16.5	V
V_{OUT}	output voltage	not protected against incorrect polarity	–0.5	+24	V
$I_{OUT(max)}$	maximum output current	low state; note 1	–	20	mA
$I_{OUT(high)}$	output leakage current	high state; note 2; see Fig.5	–	100	µA
		high state; note 2; see Fig.6	–	100	µA
P_{tot}	total power dissipation	V_{CC} = 16.5 V; I_{OUT} = 20 mA	–	300	mW
T_{amb}	ambient operating temperature	V_{CC} = 5 V	–40	+150	°C
T_{stg}	storage temperature		–40	+150	°C
T_{sld}	soldering temperature	t ≤ 10 s	–	260	°C

Notes

1. Low: transistor open (V_{CE} < 1 V).
2. High: transistor closed (V_{CE} > 4 V).

CHARACTERISTICS

T_{amb} = 26 ± 10 °C; V_{CC} = 5 V; f_{rm} = 0 to 25000 Hz; magnetic reading point according to ‘Package outline’; unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Sensor characteristics						
H_{yLH}	magnetic trigger field strength (threshold) for LH-output edge	T_{amb} = 25 °C	100	250	400	A/m
		T_{amb} = –40 to +150 °C	–200	+250	+600	A/m
H_{yHL}	magnetic trigger field strength (threshold) for HL-output edge	T_{amb} = 25 °C	–400	–250	–100	A/m
		T_{amb} = –40 to +150 °C	–600	–250	+200	A/m
H_{y0}	magnetic offset		–150	–	+150	A/m
H_{yh}	magnetic trigger hysteresis		100	500	700	A/m
H_x	auxiliary magnetic field strength		5	8	10	kA/m
f_{rm}	frequency of magnetic reference marks		0	–	25000	Hz
Supply conditions						
I_{CC}	DC supply current	T_{amb} = 26 ± 10 °C; V_{CC} = 5 V	6.5	7.5	8.5	mA
		T_{amb} = –40 to +150 °C; V_{CC} = 5 V	6	7	10	mA
V_{CC}	DC supply voltage	T_{amb} = –40 to +150 °C	4.5	5	16.5	V
Signal output characteristics						
	transfer behaviour	change of magnetic reference field H_y	NS → HL SN → LH			
	power-on state		undefined			
I_{OUT}	output current	low state; note 1	0.1	–	20	mA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$I_{OUT(high)}$	output leakage current	high state; note 2; see Fig.6	–	–	100	µA
V_{OUT}	output saturation voltage	T_{amb} = –40 to +150 °C; low state; note 1				
		I_{OUT} = 1 mA	0.01	0.03	0.1	V
		I_{OUT} = 10 mA	0.1	0.2	0.5	V
		I_{OUT} = 20 mA	0.3	0.5	1	V
$t_{r(OUT)}$	output signal rise time	low 10% to high 90%; see Fig.7	5	12	20	µs
$t_{f(OUT)}$	output signal fall time	high 90% to low 10%; see Fig.7	0.05	0.5	1	µs
$t_{df(OUT)}$	output signal delay time of HL-edge		1.5	2.5	3.5	µs
$d_{tdf(OUT)}$	jitter	measured in harmonic magnetic field in y with $H_{y(max)}$ = 1 kA/m; normalized to cycle of one reference mark	0	–	0.15	%
Environmental conditions						
	external magnetic influence	note 3	–	–	30	kA/m
	ESD protection of sensor pins V_{CC}, OUT and GND	compliance to IEC 0801-2 (IV); note 4	2	–	–	kV
	ESD protection of internal pins B1, B2, B3 and B4	compliance to IEC 0801-2 (IV); note 5	0.3	–	–	kV
	EMC: compliance to ISO 11452-5	A; stripline; 300 V/m; 10 kHz to 400 MHz; 1500 mm				
	interference for pulse: ISO 7637; pulse 4	T = 25 °C; harmonic magnetic field in y with $H_{y(max)}$ = 1 kA/m and f_m = 50 Hz	function A			
Capacity of sensor shield						
C_S	shield capacity	B1 vs. B2 of MR bridge; f = 1 MHz; U_{osc} = 200 mV	37	43	48	pF

Notes

1. Low: transistor open (VCE < 1 V).
2. High: transistor closed (VCE > 4 V).
3. Higher magnetic fields could cause irreversible shifts of parameters.
4. Output pins are designed for electrostatic sensitivity with field strengths up to 2 kV according to Human Body Model (HBM), MIL-STD-883, Method 3015.
5. MR pins are designed for electrostatic sensitivity with field strengths up to 0.3 V according to Human Body Model (HBM), MIL-STD-883, Method 3015.

FUNCTIONAL DESCRIPTION

The KMI18/2 is sensitive to the rotation of an active target wheel with magnetic reference marks. The functional principle is shown in Fig.8. Because of the sensor layout and setup of the measuring system, only movements of reference marks in the y-direction will be sensed (coordinate system see Fig.2).

The electrical output signal of the sensor is amplified, temperature compensated and applied to a Schmitt trigger in the signal conditioning circuit (see Fig.9). An additional housing separates the conditioning circuitry from the magnetorestive sensor element, thereby ensuring optimal sensor performance at high temperatures.

The signal level of the digital output is independent from the sensing distance within the measuring range. Its frequency equals that of the reference marks on the target wheels(1).

An open collector voltage interface ensures accurate transmission (three wires) of the digital sensor signal to the subsequent signal conditioning electronics.

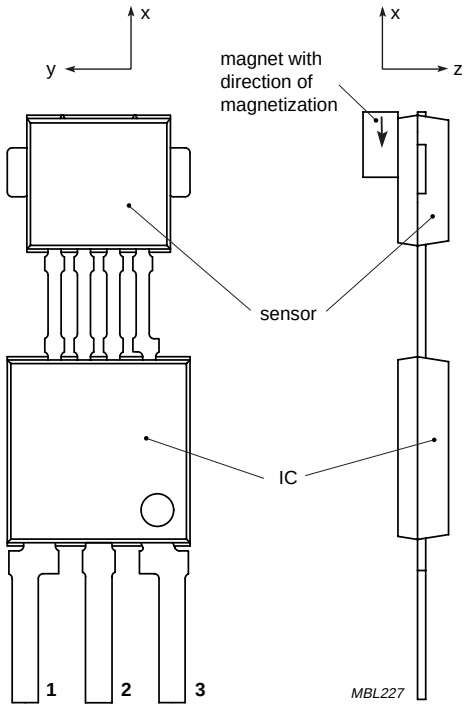


Fig.2 Component detail and coordinate system.

(1) See relevant application notes for specific target wheel data.

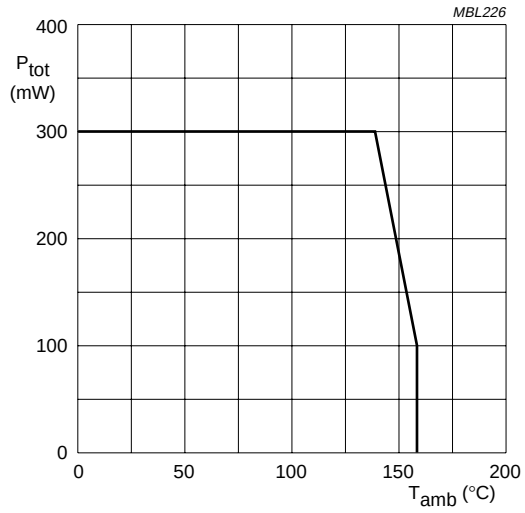


Fig.3 Power derating curve.

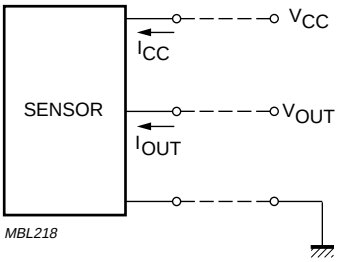


Fig.4 Supply and output.

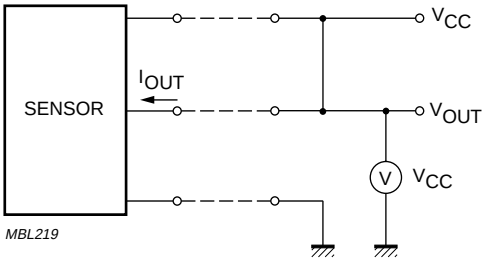


Fig.5 Leakage current test circuit: V_{CC} to OUT.

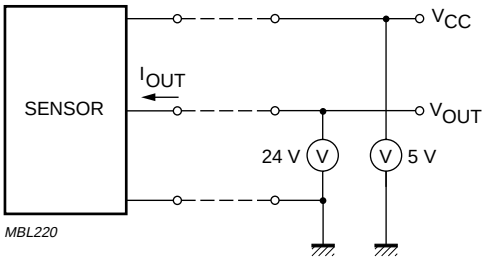


Fig.6 Leakage current test circuit: OUT to GND.

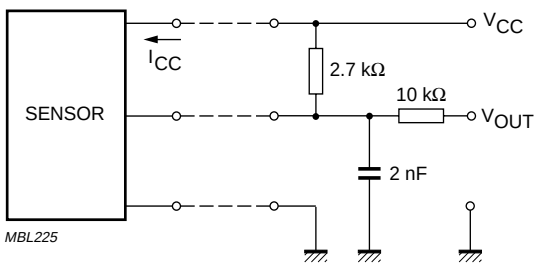


Fig.7 Test and application circuit with additional ceramic capacitor.

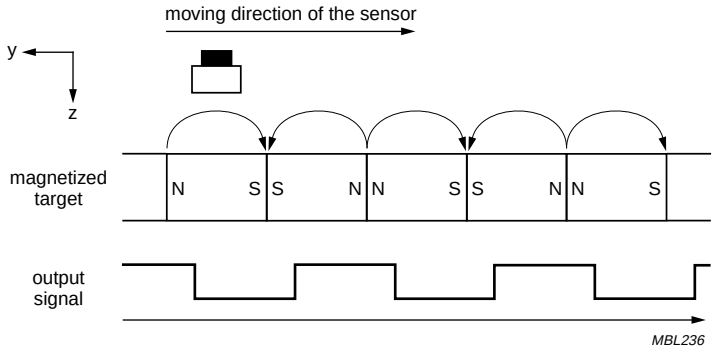


Fig.8 Functional principle.

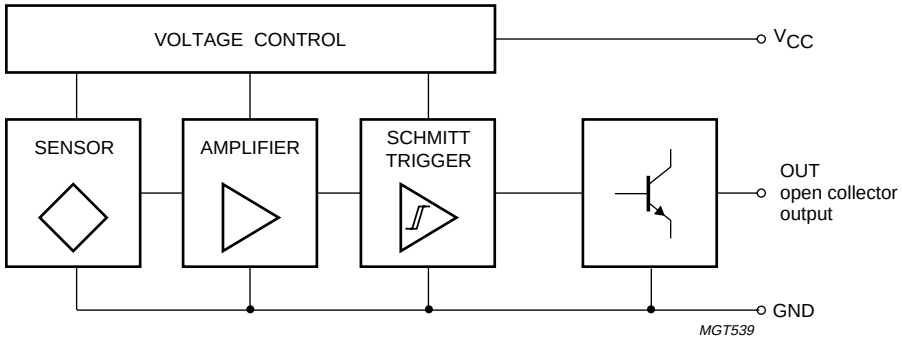
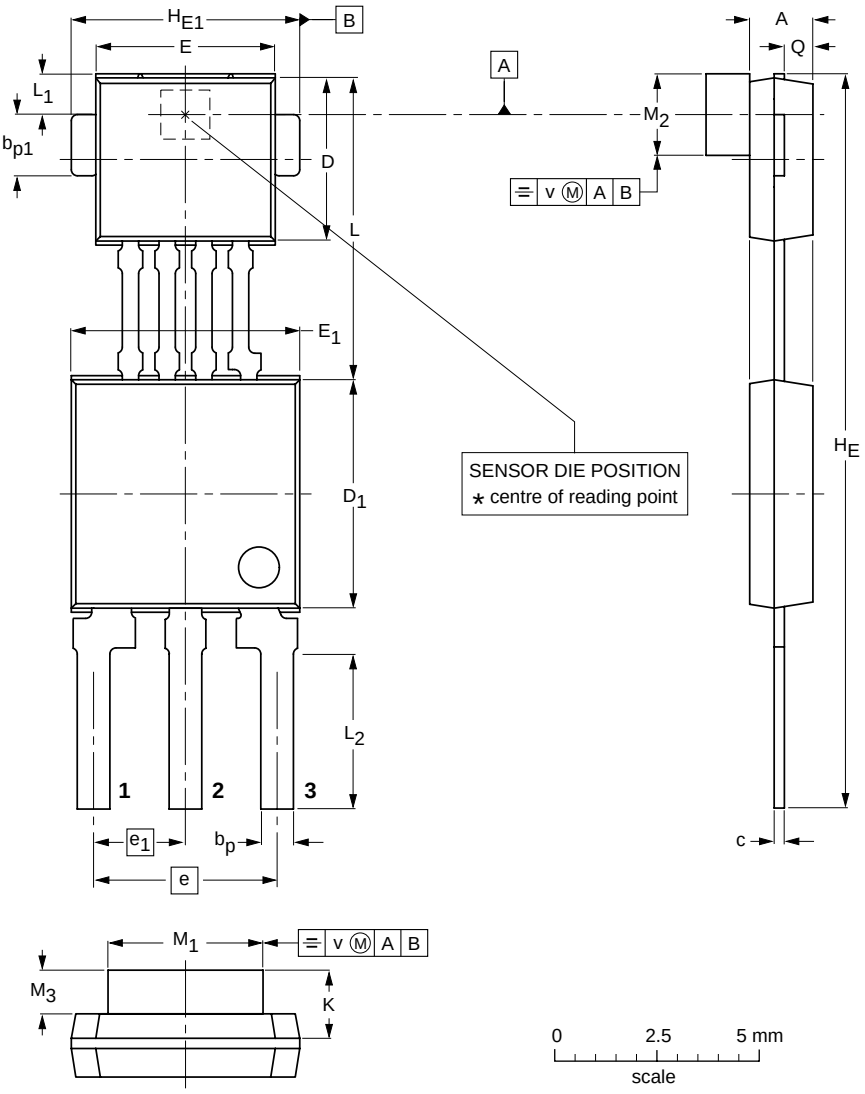


Fig.9 Block diagram.

PACKAGE OUTLINE

Plastic single-ended multi-chip package;
magnetized ferrite magnet (3.8 x 2 x 0.8 mm); 4 interconnections; 3 in-line leads **SOT477A**



DIMENSIONS (mm are the original dimensions)

UNIT	$A^{(1)}$	b_p	b_{p1}	c	$D^{(2)}$	$D_1^{(2)}$	$E^{(2)}$	$E_1^{(2)}$	e	e_1	H_E	H_{E1}	K max.	L	L_1	L_2	M_1	M_2	$M_3^{(1)}$	Q	v
mm	1.7 1.4	0.8 0.7	1.57 1.47	0.3 0.24	4.1 3.9	5.7 5.5	4.5 4.3	5.7 5.5	4.6 4.4	2.35 2.15	18.2 17.8	5.6 5.5	1.67	7.55 7.25	1.2 0.9	3.9 3.5	3.9 3.7	2.1 1.9	0.9 0.75	0.75 0.65	0.25

Notes

1. Glue thickness not included.
2. Plastic or metal protrusions of 0.15 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT477A						00-08-31

DATA SHEET STATUS

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Objective specification	Development	This data sheet contains the design target or goal specifications for product development. Specification may change in any manner without notice.
Preliminary specification	Qualification	This data sheet contains preliminary data, and supplementary data will be published at a later date. Philips Semiconductors reserves the right to make changes at any time without notice in order to improve design and supply the best possible product.
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Note

1. Please consult the most recently issued data sheet before initiating or completing a design.

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