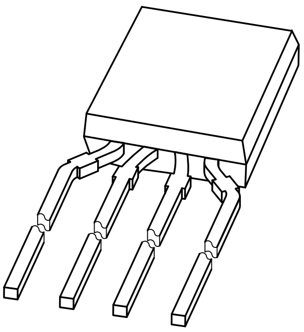
DATA SHEET



KMZ10A1
Magnetic field sensor

Product specification
Supersedes data of 1996 Nov 14
File under Discrete Semiconductors, SC17

1998 Apr 06

Philips
Semiconductors

PHILIPS

Magnetic field sensor KMZ10A1

DESCRIPTION

The KMZ10A1 is an extremely sensitive magnetic field sensor, employing the magnetoresistive effect of thin-film permalloy. Its properties enable this sensor to be used in a wide range of applications such as navigation, current and earth magnetic field measurement etc. The special arrangement of the sensing chip allows the construction of coils for switching the auxiliary field (H_x) along the length axis of the sensor. The sensor can be operated at any frequency between DC and 1 MHz.

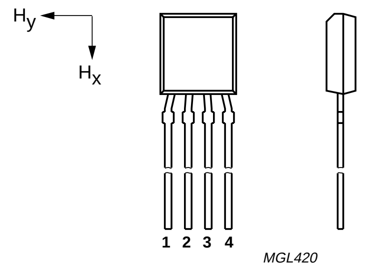


Fig.1 Simplified outline.

PINNING

PIN	SYMBOL	DESCRIPTION
1	$+V_O$	output voltage
2	GND	ground
3	$-V_O$	output voltage
4	V_{CC}	supply voltage

QUICK REFERENCE DATA

SYMBOL	PARAMETER	MIN.	TYP.	MAX.	UNIT
V_{CC}	DC supply voltage	–	5	–	V
H_y	magnetic field strength	–0.5	–	+0.5	kA/m
H_x	auxiliary field	–	0.5	–	kA/m
S	sensitivity	–	14	–	$\frac{mV/V}{kA/m}$
S_s	sensitivity (with switched H_x)	–	22	–	$\frac{mV/V}{kA/m}$
R_{bridge}	bridge resistance	0.85	–	1.75	kΩ
V_{offset}	offset voltage	–1.5	–	+1.5	mV/V

CIRCUIT DIAGRAM

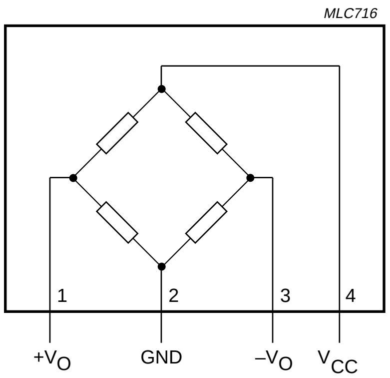


Fig.2 Simplified circuit diagram.

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CC}	DC supply voltage		–	9	V
P_{tot}	total power dissipation	up to T_{amb} = 132 °C	–	100	mW
T_{stg}	storage temperature		–65	+150	°C
T_{bridge}	bridge operating temperature		–40	+150	°C

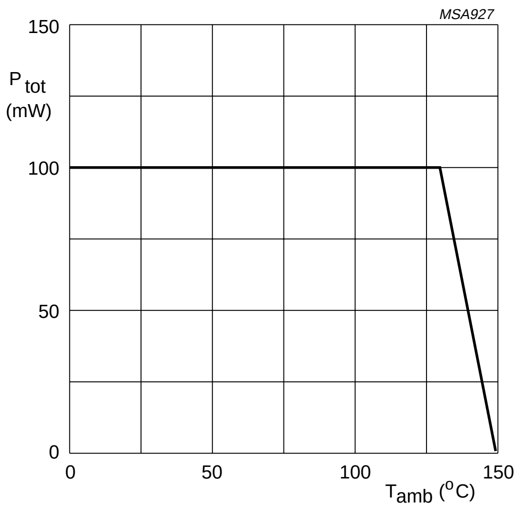


Fig.3 Power derating curve.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	180	K/W

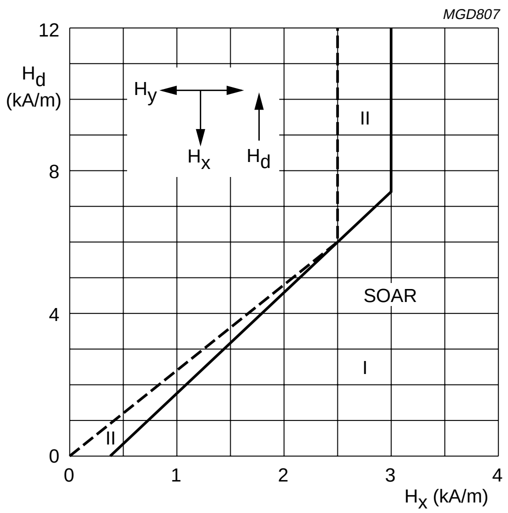
CHARACTERISTICS

T_{amb} = 25 °C and H_x = 0.5 kA/m unless otherwise specified; see notes 1 and 2.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CC}	DC supply voltage		–	5	–	V
H_y	operating range	note 2	–0.5	–	+0.5	kA/m
S	sensitivity	open circuit; notes 2 and 3	11	–	17	$\frac{mV/V}{kA/m}$
TCV_O	temperature coefficient of output voltage at constant supply voltage	V_{CC} = 5 V; T_{amb} = –25 to +125 °C	–	–0.4	–	%/K
VCV_O	temperature coefficient of output voltage at constant supply current	I_B = 3 mA; T_{amb} = –25 to +125 °C	–	–0.15	–	%/K
R_{bridge}	bridge resistance		0.85	–	1.75	kΩ
TCR_{bridge}	temperature coefficient of bridge resistance	T_j = –25 to +125 °C	–	0.25	–	%/K
V_{offset}	offset voltage		–1.5	–	+1.5	mV/V
TCV_{offset}	offset voltage drift	T_{bridge} = –25 to +125 °C	–6	–	+6	$\frac{\mu V/V}{K}$
FL	linearity deviation of output voltage	H_y = 0 to ±0.25 kA/m^{-1}	–	–	0.8	%·FS
		H_y = 0 to ±0.4 kA/m^{-1}	–	–	2.5	%·FS
		H_y = 0 to ±0.5 kA/m^{-1}	–	–	4.0	%·FS
FH	hysteresis of output voltage		–	–	0.5	%·FS
f	operating frequency		0	–	1	MHz
Characteristics with H_x = 0 (switched H_x, see note 4); V_{CC} = 5 V						
H_y	operating range	note 2	–0.05	–	+0.05	kA/m
S_s	sensitivity	slope between H_y = 0 and H_y = 40 A/m	14	–	27	$\frac{mV/V}{kA/m}$

Notes

1. Before first operation or after operation outside the SOAR (Fig.4) the sensor has to be reset by application of an auxiliary field H_x = 3 kA/m.
2. No disturbing field (H_d) allowed; for stable operation under disturbing conditions see Fig.4 (SOAR) and see Fig.5 for decrease of sensitivity.
3. Sensitivity measured as $\Delta V_O/\Delta H_y$ between H_y = 0 and H_y = 0.4 kA/m.
4. See application information.

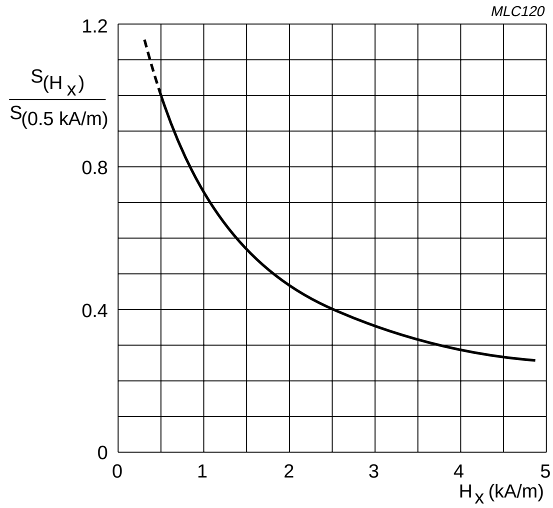


I = Region of permissible operation.

II = Permissible extension if H_y < 0.05 kA/m.

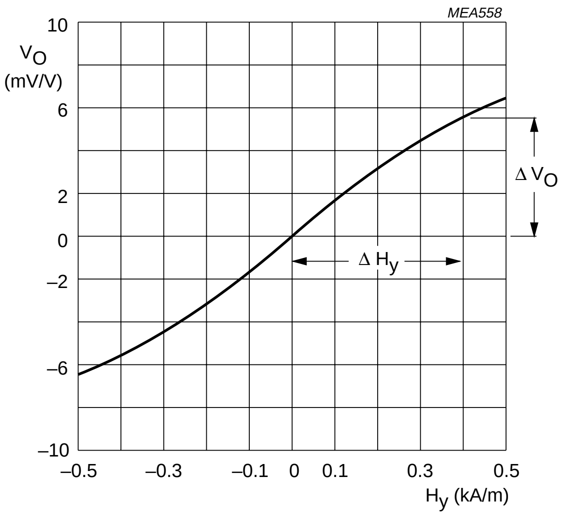
In applications with H_x < 3 kA/m, the sensor has to be reset, after leaving the SOAR, by an auxiliary field of H_x = 3 kA/m.

Fig.4 Safe Operating Area (permissible disturbing field H_d as a component of auxiliary field H_x).



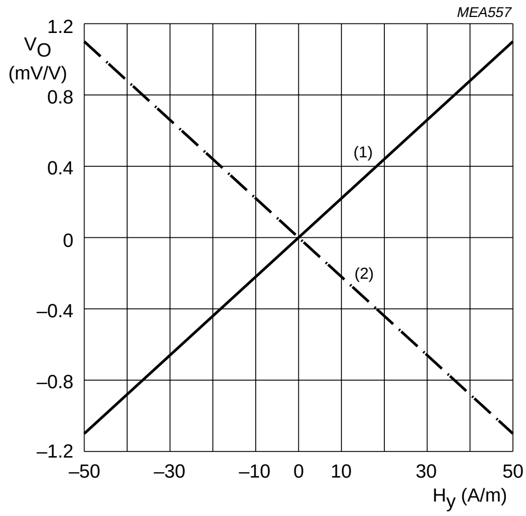
In applications with $H_x \leq 3$ kA/m, the sensor has to be reset by an auxiliary field of H_x = 3 kA/m before use.

Fig.5 Relative sensitivity (ratio of sensitivity at certain H_x and sensitivity at H_x = 0.5 kA/m).



H_x = 0.5 kA/m; T_{amb} = 25 °C; V_{offset} = 0; $S = \Delta V_O / \Delta H_y$.

Fig.6 Sensor output characteristics.



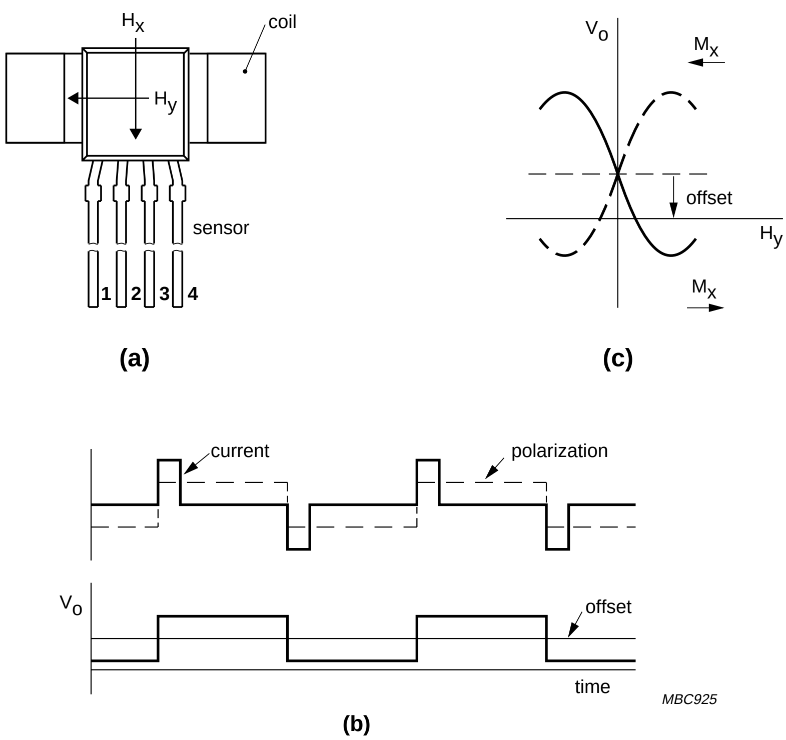
(1) Sensor reset with H_x = 3 kA/m.

(2) Sensor reset with H_x = −3 kA/m.

Fig.7 Output characteristic with H_x = 0 (switched H_x).

APPLICATION INFORMATION

A problem with measuring weak magnetic fields is that precision is limited by drift in both the sensor and amplifier offset. In these instances, it is possible to take advantage of the ‘flipping’ characteristics of the KMZ10 series to generate an output that is independent of offset. The sensor, located in a coil connected to a current pulse generator producing magnetic field pulses periodically reversed by alternate positive and negative going current pulses, is continually flipped from its normal to its reversed polarity and back again. The polarity of the offset however, remains unchanged, so the offset itself can be eliminated by passing the output signal through a filter circuit.

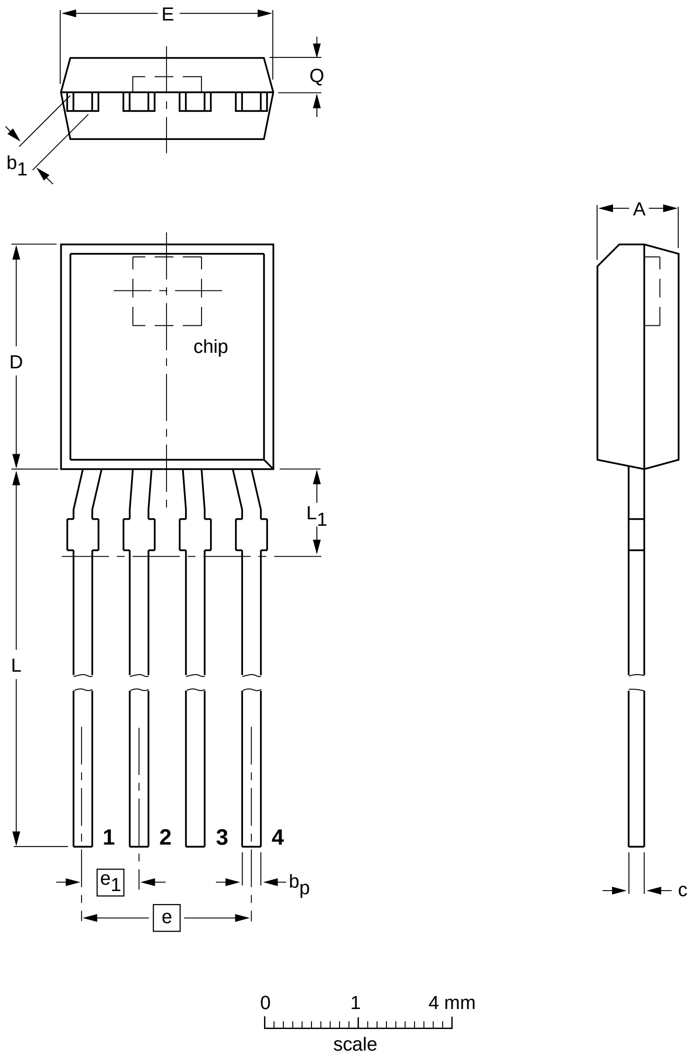


(a) Set-up.
(b) Pulse diagram.
(c) Sensor output characteristics.

Fig.8 Measuring weak magnetic fields with the KMZ10A1.

PACKAGE OUTLINE

Plastic single-ended flat package; 4 in-line leads **SOT195**



DIMENSIONS (mm are the original dimensions)

UNIT	A	b_p	b_1	c	D	E	e	e_1	L	L_1 (1) max.	Q
mm	1.8 1.6	0.48 0.40	0.7 0.5	0.45 0.39	5.2 5.0	4.8 4.4	3.75	1.25	14.5 12.7	2	0.8 0.7

Notes

1. Terminal dimensions within this zone are uncontrolled to allow for flow of plastic and terminal irregularities.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT195						97-06-02

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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