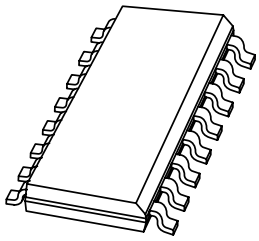
DATA SHEET



KMZ52
Magnetic Field Sensor

Product specification

2000 Jun 09

Philips
Semiconductors

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Magnetic Field Sensor KMZ52

FEATURES

- High sensitivity
- Integrated compensation coil
- Integrated set/reset coil.

APPLICATIONS

- Navigation
- Current and earth magnetic field measurement
- Traffic detection.

DESCRIPTION

The KMZ52 is an extremely sensitive magnetic field sensor, employing the magnetoresistive effect of thin-film permalloy. The sensor contains two magnetoresistive Wheatstone bridges physically offset from one another by 90° and integrated compensation and set/reset coils. The integrated compensation coils allow magnetic field measurement with current feedback loops to generate outputs that are independent of drift in sensitivity. The orientation of sensitivity may be set or changed (flipped) by means of the integrated set/reset coils. A short current pulse should be applied to the compensation coils to recover (set) the sensor after exposure to strong disturbing magnetic fields. A negative current pulse will reset the sensor to reversed sensitivity. By use of periodically alternated flipping pulses and a lock-in amplifier, the output is made independent of sensor and amplifier offset.

PINNING

SYMBOL	PIN	DESCRIPTION
$+I_{flip2}$	1	flip coil
V_{CC2}	2	bridge supply voltage
GND2	3	ground
$+I_{comp2}$	4	compensation coil
GND1	5	ground
$+I_{comp1}$	6	compensation coil
$-I_{comp1}$	7	compensation coil
$-V_{O1}$	8	bridge output voltage
$+V_{O1}$	9	bridge output voltage
$-I_{flip1}$	10	flip coil
$+I_{flip1}$	11	flip coil
V_{CC1}	12	bridge supply voltage
$-I_{comp2}$	13	compensation coil
$-V_{O2}$	14	bridge output voltage
$+V_{O2}$	15	bridge output voltage
$-I_{flip2}$	16	flip coil

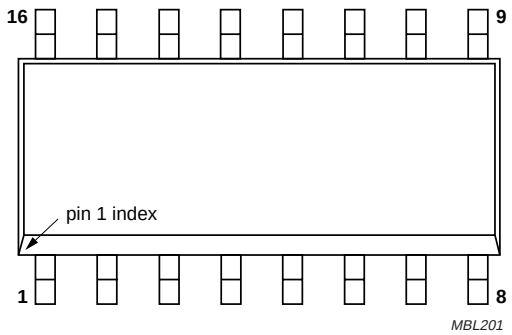


Fig.1 Simplified outline SOT109-1.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	MIN.	TYP.	MAX.	UNIT
V_{CC}	bridge supply voltage	–	5	8	V
S	sensitivity (uncompensated)	12	16	–	$\frac{mV/V}{kA/m}$
V_{offset}	offset voltage per supply voltage	–1.5	0	+1.5	mV/V
R_{bridge}	bridge resistance	1	2	3	kΩ
R_{comp}	compensation coil resistance	100	170	300	Ω
A_{comp}	field factor of compensation coil; note 1	19	22	25	$\frac{A/m}{mA}$
R_{flip}	resistance of set/reset coil	1	2	3	Ω
I_{flip}	recommended flipping current for stable operation; note 2	±800	±1000	±1200	mA
t_{flip}	flip pulse duration; note 2	1	3	100	µs

Notes

1. The compensation coil generates a field $H_{comp} = A_{comp} \times I_{comp}$ in addition to the external field H_{ext}. Sensor output will become zero if $H_{ext} = H_{comp}$.
2. Average power consumption of the flipping coil, defined by current, pulse duration and pulse repetition rate may not exceed the specified limit, see Chapter “Limiting values”.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 60134).

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_{CC}	bridge supply voltage	–	8	V
P_{tot}	total power dissipation	–	130	mW
T_{stg}	storage temperature	–65	+150	°C
T_{amb}	maximum operating temperature	–40	–125	°C
I_{comp}	maximum compensation current	–	15	mA
$I_{flip\ (max)}$	maximum flipping current	–	1500	mA
$P_{flip\ (max)}$	maximum flipping power dissipation	–	50	mW
V_{isol}	voltage between isolated systems: flip coil and Wheatstone bridge; compensation coil and Wheatsone bridge; flip coil and compensation coil	–	60	V

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	VALUE	UNIT
$R_{th\ j\text{-}a}$	terminal resistance from junction to ambient	105	K/W

CHARACTERISTICS

T_{bridge} = 25 °C; V_{CC1} = V_{CC2} = 5 V; unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CC}	bridge supply voltage	note 1	–	5	8	V
H	field strength operating range in sensor plane		–0.2	–	+0.2	kA/m
S	sensitivity	open circuit	12	16	–	$\frac{mV/V}{kA/m}$
TCS	temperature coefficient of sensitivity	T_s = –25 to +125 °C	–	0.31	–	%/K
k_{SX}	sensitivity synchronism	note 2	92	100	108	%
TCV_O	temperature coefficient of output voltage	V_{CC} = 5 V; T_{bridge} = –25 to +125 °C	–	–0.4	–	%/K
R_{bridge}	bridge resistance	note 3	1	2	3	kΩ
TCR_{bridge}	temperature coefficient of bridge resistance	T_{bridge} = –25 to +125 °C; note 4	–	0.3	–	%/K
V_{offset}	offset voltage per supply voltage		–1.5	0	+1.5	mV/V
TCV_{offset}	temperature coefficient of offset voltage	T_{bridge} = –25 to +125 °C; note 5	–3	0	+3	$\frac{\mu V/V}{K}$
FH	hysteresis of output voltage		–	–	2	%FS
R_{comp}	resistance of compensation coil	note 6	100	170	300	Ω
A_{comp}	field factor of compensation coil		19	22	25	$\frac{A/m}{mA}$
R_{flip}	resistance of set/reset coil	note 7	1	2	3	Ω
TCR_{flip}	temperature coefficient of resistance of set/reset coil	T_{flip} = –25 to +125 °C	–	0.39	–	%/K
I_{flip}	recommended flipping current for stable operation		±800	±1000	±1200	mA
t_{flip}	flip pulse duration		1	3	100	µs
R_{isol}	isolating resistance	note 8	1	–	–	MΩ
V_{isol}	voltage between isolated systems	note 8	–	–	50	V
R_{isol_dice}	isolating resistance between dice	die 1 to die 2	1	–	–	MΩ
f	operating frequency		0	–	1	MHz
α	angle die-to-die	note 9	88	90	92	deg
β	angle dice-to-package	note 9	–5	0	+5	deg

Notes

1. Due to the ratiometric output, the same supply voltage (V_{CC}) must be applied to both dice in one KMZ52 device.
2. $k_{SX} = 100 \times \frac{A_{comp1} \times S_1}{A_{comp2} \times S_2}\%$
3. Bridge resistance die 1: between pins 5 and 12; bridge resistance die 2: between pins 2 and 3.
4. $TCR_{bridge} = 100 \frac{R_{bridge(T_2)} - R_{bridge(T_1)}}{R_{bridge(T_1)}(T_2 - T_1)}$ Where $T_1 = -25°C$; $T_2 = 125°C$.

5. $TCV_{offset} = \frac{V_{offset(T_2)} - V_{offset(T_1)}}{(T_2 - T_1)}$ Where $T_1 = -25°C$; $T_2 = 125°C$.
6. Resistance of compensation coil die 1: between pins 6 and 7;
   resistance of compensation coil die 2: between pins 4 to 13.
7. Resistance of set/reset coil die 1: between pins 10 and 11;
   resistance of set/reset coil die 2: between pins 1 to 16.
8. Isolating resistance die 1: pins 7 and 8, 7 and 10 and 8 to 10;
   isolating resistance die 2: pins 1 to 2, 1 to 4 and 2 to 4.
9. Angle die-to-die: die 2 is turned by 90 ±2 degrees in anticlockwise direction with respect to die 1;
   angle dice-to-package: both dice in their fixed die-to-die position are tilted towards the package edges by 0 ±5 degrees.

APPLICATION INFORMATION

If the angle α between external magnetic field H and the long axis of the package is zero, H is parallel to the most sensitive direction of die 2 and perpendicular to the sensitive direction of die 1. A magnetic field turning clockwise (see Fig.2) thus yields an output proportional to cos α (V_{out2}) and an output proportional to sin α (V_{out1}).

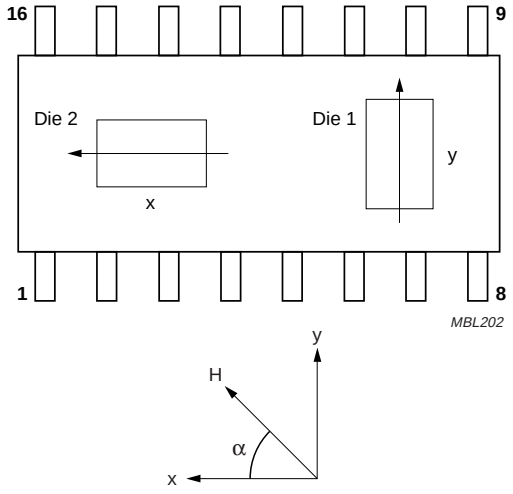


Fig.2 Angular relationship of dice.

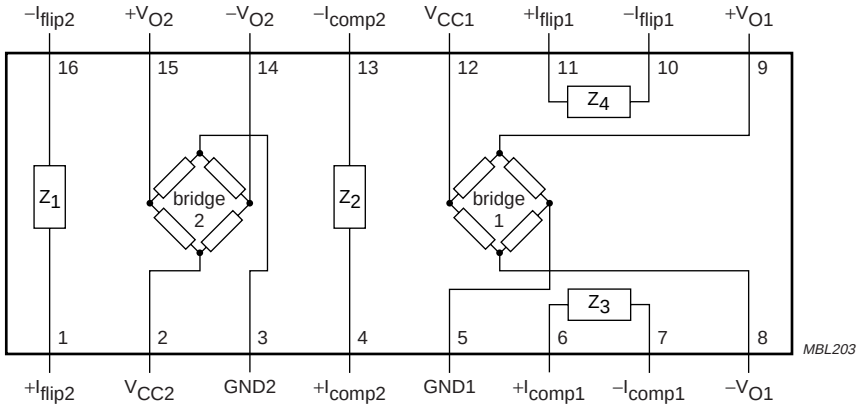
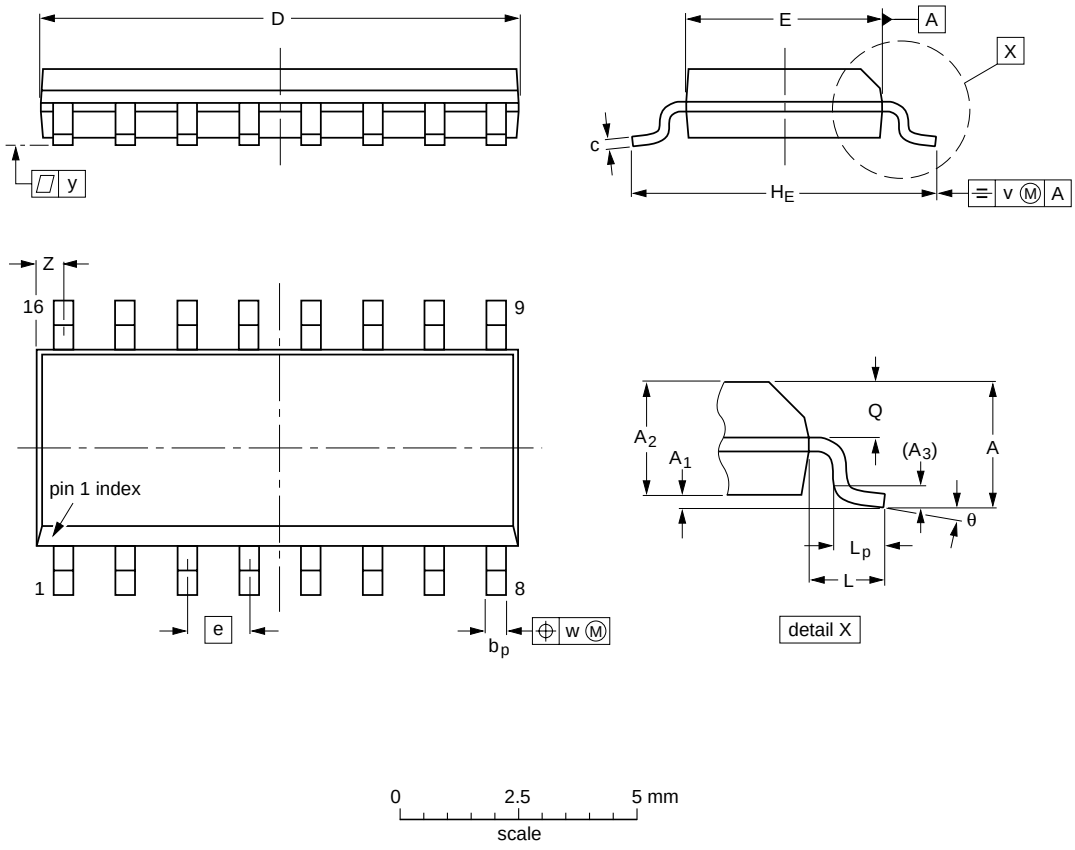


Fig.3 Simplified circuit diagram.

PACKAGE OUTLINE

SO16: plastic small outline package; 16 leads; body width 3.9 mm **SOT109-1**



DIMENSIONS (inch dimensions are derived from the original mm dimensions)

UNIT	A max.	A_1	A_2	A_3	b_p	c	$D^{(1)}$	$E^{(1)}$	e	H_E	L	L_p	Q	v	w	y	$Z^{(1)}$	θ
mm	1.75	0.25 0.10	1.45 1.25	0.25	0.49 0.36	0.25 0.19	10.0 9.8	4.0 3.8	1.27	6.2 5.8	1.05	1.0 0.4	0.7 0.6	0.25	0.25	0.1	0.7 0.3	8^o 0^o
inches	0.069	0.010 0.004	0.057 0.049	0.01	0.019 0.014	0.0100 0.0075	0.39 0.38	0.16 0.15	0.050	0.244 0.228	0.041	0.039 0.016	0.028 0.020	0.01	0.01	0.004	0.028 0.012	

Note

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

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT109-1	076E07	MS-012				~~97-05-22~~ 99-12-27

DATA SHEET STATUS

DATA SHEET STATUS	PRODUCT STATUS	DEFINITIONS [1]
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

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DEFINITIONS

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Limiting values definition — Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 60134). 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.

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