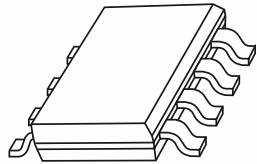


**DISCRETE SEMICONDUCTORS**

# DATA SHEET



## **KMZ51** Magnetic field sensor

Product specification

1998 Mar 24

Supersedes data of 1996 Nov 15

File under Discrete Semiconductors, SC17

## Magnetic field sensor

KMZ51

## FEATURES

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

## APPLICATIONS

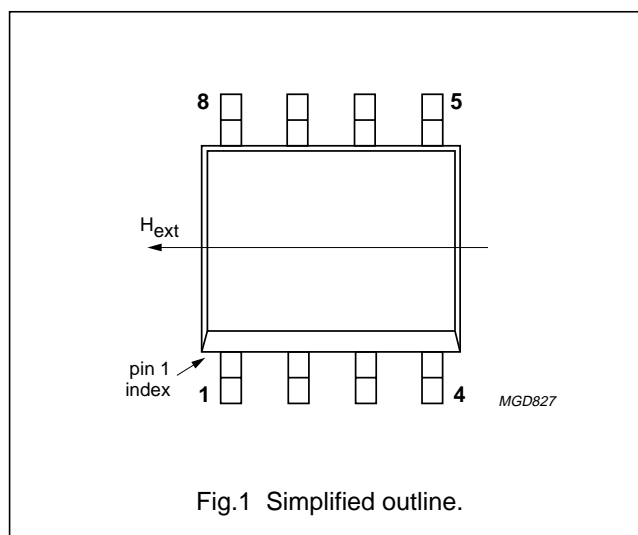
- Navigation
- Current and earth magnetic field measurement
- Traffic detection.

## DESCRIPTION

The KMZ51 is an extremely sensitive magnetic field sensor, employing the magnetoresistive effect of thin-film permalloy. The sensor contains one magnetoresistive Wheatstone bridge and integrated compensation and set/reset conductors. The integrated compensation conductor allows magnetic field measurement with current feedback loops to generate an output that is independent of drift in sensitivity. With the integrated set/reset conductor the orientation of sensitivity may be set or changed (flipped). A short current pulse on this conductor is needed 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, output will become independent of sensor and amplifier offset.

## PINNING

PIN	SYMBOL	DESCRIPTION
1	$+I_{\text{flip}}$	flip coil
2	$V_{\text{CC}}$	bridge supply voltage
3	GND	ground
4	$+I_{\text{comp}}$	compensation coil
5	$-I_{\text{comp}}$	compensation coil
6	$-V_{\text{O}}$	bridge output voltage
7	$+V_{\text{O}}$	bridge output voltage
8	$-I_{\text{flip}}$	flip coil



## QUICK REFERENCE DATA

SYMBOL	PARAMETER	MIN.	TYP.	MAX.	UNIT
$V_{\text{CC}}$	bridge supply voltage	–	5	8	V
S	sensitivity (uncompensated)	12	16	–	$\frac{\text{mV/V}}{\text{kA/m}}$
$V_{\text{offset}}$	offset voltage	–1.5	–	+1.5	mV/V
$R_{\text{bridge}}$	bridge resistance	1	–	3	k $\Omega$
$R_{\text{comp}}$	compensation coil resistance	100	170	300	$\Omega$
$A_{\text{comp}}$	compensation coil field factor; note 1	19	22	25	A/m/mA
$R_{\text{flip}}$	flip coil resistance	1	3	5	$\Omega$
$I_{\text{flip (min)}}$	minimum recommended flipping current; note 2	800	1000	1200	mA
$t_{\text{flip (min)}}$	minimum flip pulse duration; note 2	1	3	100	$\mu\text{s}$

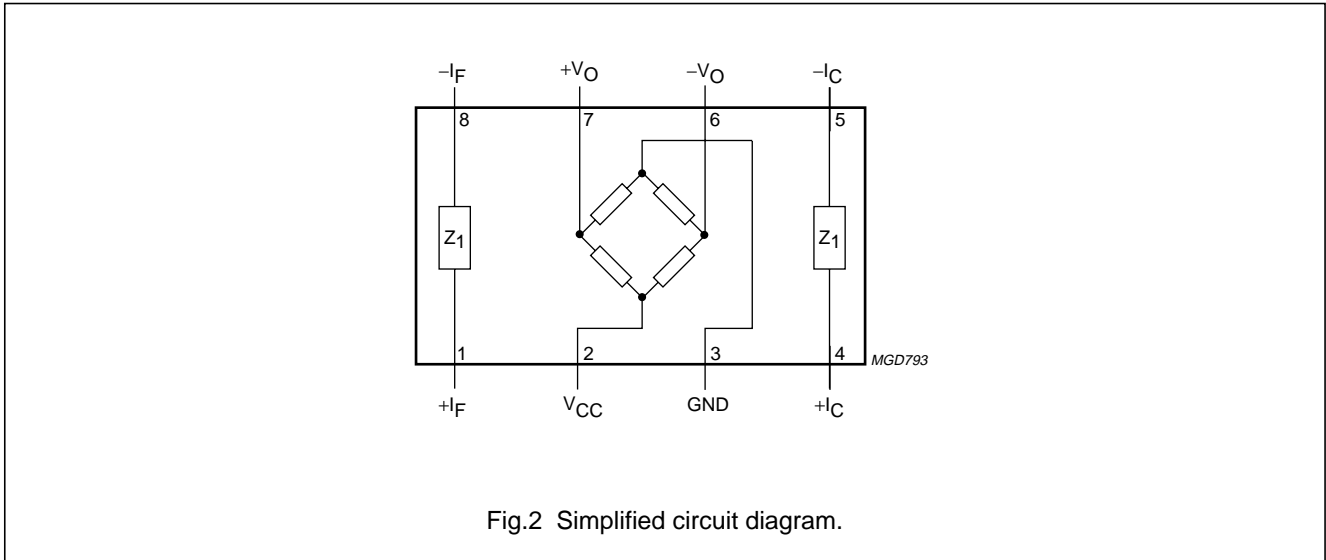
## Notes

1. Compensation conductor will generate a field  $H_{\text{comp}} = A_{\text{comp}} \cdot I_{\text{comp}}$  additional to the external field  $H_{\text{ext}}$ . Sensor output will become zero if  $H_{\text{ext}} = -H_{\text{comp}}$ .
2. Average power consumption in flip conductor, defined by current, pulse duration and pulse repetition rate may not exceed the specified limit, see "Limiting values".

Magnetic field sensor

KMZ51

CIRCUIT DIAGRAM



LIMITING VALUES

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

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
$V_{CC}$	bridge supply voltage	–	9	V
$P_{tot}$	total power dissipation	–	130	mW
$T_{stg}$	storage temperature	–65	+150	°C
$T_{bridge}$	bridge 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 conductor - Wheatstone bridge; compensation conductor - bridge; flip conductor - compensation conductor	–	60	V

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	VALUE	UNIT
$R_{th j-a}$	thermal resistance from junction to ambient	155	K/W

## Magnetic field sensor

KMZ51

## CHARACTERISTICS

 $T_{amb} = 25\text{ °C}$  unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{CC}$	bridge supply voltage		–	5	8	V
$H_y$	operating range in sensitive direction		–0.2	–	+0.2	kA/m
$H_x$	operating range perpendicular to sensitive direction		–0.2	–	+0.2	kA/m
S	sensitivity	open circuit	12	16	–	$\frac{mV/V}{kA/m}$
TCV <sub>O</sub>	temperature coefficient of output voltage	$V_{CC} = 5\text{ V};$ $T_{amb} = -25\text{ to }+125\text{ °C}$	–	–0.4	–	%/K
		$I_{CC} = 3\text{ mA};$ $T_{amb} = -25\text{ to }+125\text{ °C}$	–	–0.1	–	%/K
R <sub>bridge</sub>	bridge resistance	resistance pins 2 to 3	1	–	3	k $\Omega$
TCR <sub>bridge</sub>	temperature coefficient of bridge resistance	$T_{bridge} = -25\text{ to }+125\text{ °C}$	–	0.3	–	%/K
V <sub>offset</sub>	offset voltage		–1.5	–	+1.5	mV/V
TCV <sub>offset</sub>	temperature coefficient of offset voltage	$T_{bridge} = -25\text{ to }+125\text{ °C}$	–3	–	+3	$\frac{\mu V/V}{K}$
FH	hysteresis of output voltage		–	–	2	%FS
R <sub>comp</sub>	resistance of compensation conductor	resistance pins 4 to 5	100	170	300	$\Omega$
A <sub>comp</sub>	field factor of compensation conductor		19	22	25	A/m/mA
R <sub>flip</sub>	resistance of set/reset conductor	resistance pins 1 to 8	1	3	5	$\Omega$
I <sub>flip</sub>	recommended flipping current for stable operation		$\pm 800$	$\pm 1000$	$\pm 1200$	mA
t <sub>flip</sub>	flip pulse duration;		1	3	100	$\mu s$
R <sub>isol</sub>	isolating resistance	resistance pins 1 to 2, 1 to 4, 2 to 4	1	–	–	M $\Omega$
V <sub>isol</sub>	voltage between isolated systems	voltage pins 1 to 2, 1 to 4, 2 to 4	–	–	50	V
f	operating frequency		0	–	1	MHz

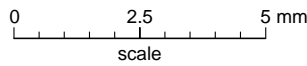
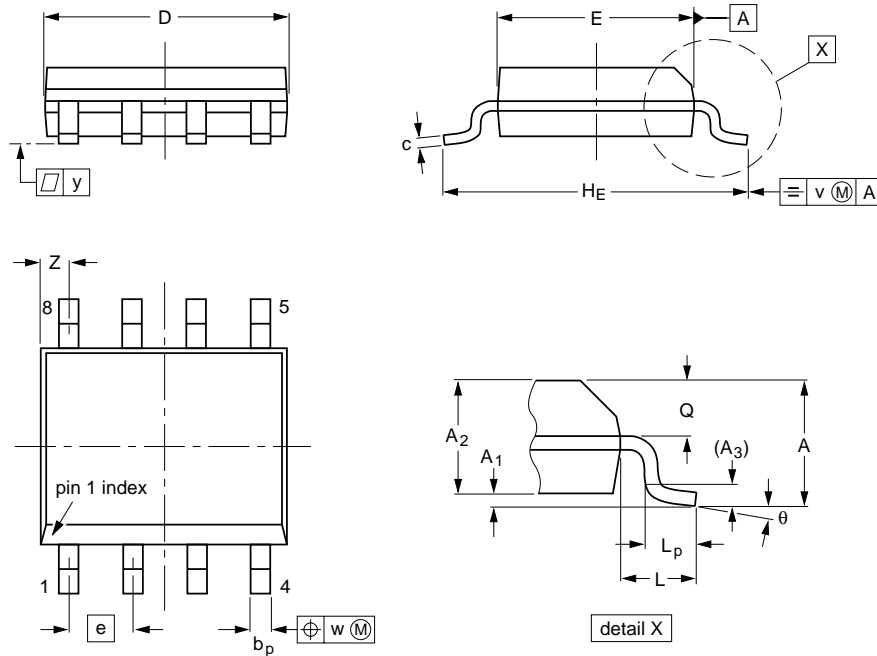
Magnetic field sensor

KMZ51

PACKAGE OUTLINE

SO8: plastic small outline package; 8 leads; body width 3.9 mm

SOT96-1



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

UNIT	A max.	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	b <sub>p</sub>	c	D <sup>(1)</sup>	E <sup>(2)</sup>	e	H <sub>E</sub>	L	L <sub>p</sub>	Q	v	w	y	z <sup>(1)</sup>	θ
mm	1.75	0.25 0.10	1.45 1.25	0.25	0.49 0.36	0.25 0.19	5.0 4.8	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° 0°
inches	0.069	0.010 0.004	0.057 0.049	0.01	0.019 0.014	0.0100 0.0075	0.20 0.19	0.16 0.15	0.050	0.244 0.228	0.041	0.039 0.016	0.028 0.024	0.01	0.01	0.004	0.028 0.012	

Notes

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.
2. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES			EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ		
SOT96-1	076E03S	MS-012AA			95-02-04 97-05-22

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**Magnetic field sensor****KMZ51**

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**DEFINITIONS**

<b>Data Sheet Status</b>	
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.
<b>Limiting values</b>	
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.	
<b>Application information</b>	
Where application information is given, it is advisory and does not form part of the specification.	

**LIFE SUPPORT APPLICATIONS**

These products are not designed for use in life support appliances, devices, or systems where malfunction of these products can reasonably be expected to result in personal injury. Philips customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Philips for any damages resulting from such improper use or sale.

Magnetic field sensor

KMZ51

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# Philips Semiconductors – a worldwide company

**Argentina:** see South America

**Australia:** 34 Waterloo Road, NORTH RYDE, NSW 2113,  
Tel. +61 2 9805 4455, Fax. +61 2 9805 4466

**Austria:** Computerstr. 6, A-1101 WIEN, P.O. Box 213, Tel. +43 160 1010,  
Fax. +43 160 101 1210

**Belarus:** Hotel Minsk Business Center, Bld. 3, r. 1211, Volodarski Str. 6,  
220050 MINSK, Tel. +375 172 200 733, Fax. +375 172 200 773

**Belgium:** see The Netherlands

**Brazil:** see South America

**Bulgaria:** Philips Bulgaria Ltd., Energoproject, 15th floor,  
51 James Bourchier Blvd., 1407 SOFIA,  
Tel. +359 2 689 211, Fax. +359 2 689 102

**Canada:** PHILIPS SEMICONDUCTORS/COMPONENTS,  
Tel. +1 800 234 7381

**China/Hong Kong:** 501 Hong Kong Industrial Technology Centre,  
72 Tat Chee Avenue, Kowloon Tong, HONG KONG,  
Tel. +852 2319 7888, Fax. +852 2319 7700

**Colombia:** see South America

**Czech Republic:** see Austria

**Denmark:** Prags Boulevard 80, PB 1919, DK-2300 COPENHAGEN S,  
Tel. +45 32 88 2636, Fax. +45 31 57 0044

**Finland:** Sinikalliontie 3, FIN-02630 ESPOO,  
Tel. +358 9 615800, Fax. +358 9 61580920

**France:** 51 Rue Carnot, BP317, 92156 SURESNES Cedex,  
Tel. +33 1 40 99 6161, Fax. +33 1 40 99 6427

**Germany:** Hammerbrookstraße 69, D-20097 HAMBURG,  
Tel. +49 40 23 53 60, Fax. +49 40 23 536 300

**Greece:** No. 15, 25th March Street, GR 17778 TAVROS/ATHENS,  
Tel. +30 1 4894 339/239, Fax. +30 1 4814 240

**Hungary:** see Austria

**India:** Philips INDIA Ltd, Band Box Building, 2nd floor,  
254-D, Dr. Annie Besant Road, Worli, MUMBAI 400 025,  
Tel. +91 22 493 8541, Fax. +91 22 493 0966

**Indonesia:** see Singapore

**Ireland:** Newstead, Clonskeagh, DUBLIN 14,  
Tel. +353 1 7640 000, Fax. +353 1 7640 200

**Israel:** RAPAC Electronics, 7 Kehilat Saloniki St, PO Box 18053,  
TEL AVIV 61180, Tel. +972 3 645 0444, Fax. +972 3 649 1007

**Italy:** PHILIPS SEMICONDUCTORS, Piazza IV Novembre 3,  
20124 MILANO, Tel. +39 2 6752 2531, Fax. +39 2 6752 2557

**Japan:** Philips Bldg 13-37, Kohnan 2-chome, Minato-ku, TOKYO 108,  
Tel. +81 3 3740 5130, Fax. +81 3 3740 5077

**Korea:** Philips House, 260-199 Itaewon-dong, Yongsan-ku, SEOUL,  
Tel. +82 2 709 1412, Fax. +82 2 709 1415

**Malaysia:** No. 76 Jalan Universiti, 46200 PETALING JAYA, SELANGOR,  
Tel. +60 3 750 5214, Fax. +60 3 757 4880

**Mexico:** 5900 Gateway East, Suite 200, EL PASO, TEXAS 79905,  
Tel. +9-5 800 234 7381

**Middle East:** see Italy

**Netherlands:** Postbus 90050, 5600 PB EINDHOVEN, Bldg. VB,  
Tel. +31 40 27 82785, Fax. +31 40 27 88399

**New Zealand:** 2 Wagener Place, C.P.O. Box 1041, AUCKLAND,  
Tel. +64 9 849 4160, Fax. +64 9 849 7811

**Norway:** Box 1, Manglerud 0612, OSLO,  
Tel. +47 22 74 8000, Fax. +47 22 74 8341

**Philippines:** Philips Semiconductors Philippines Inc.,  
106 Valero St. Salcedo Village, P.O. Box 2108 MCC, MAKATI,  
Metro MANILA, Tel. +63 2 816 6380, Fax. +63 2 817 3474

**Poland:** Ul. Lukiska 10, PL 04-123 WARSZAWA,  
Tel. +48 22 612 2831, Fax. +48 22 612 2327

**Portugal:** see Spain

**Romania:** see Italy

**Russia:** Philips Russia, Ul. Usatcheva 35A, 119048 MOSCOW,  
Tel. +7 095 755 6918, Fax. +7 095 755 6919

**Singapore:** Lorong 1, Toa Payoh, SINGAPORE 1231,  
Tel. +65 350 2538, Fax. +65 251 6500

**Slovakia:** see Austria

**Slovenia:** see Italy

**South Africa:** S.A. PHILIPS Pty Ltd., 195-215 Main Road Martindale,  
2092 JOHANNESBURG, P.O. Box 7430 Johannesburg 2000,  
Tel. +27 11 470 5911, Fax. +27 11 470 5494

**South America:** Al. Vicente Pinzon, 173, 6th floor,  
04547-130 SÃO PAULO, SP, Brazil,  
Tel. +55 11 821 2333, Fax. +55 11 821 2382

**Spain:** Balmes 22, 08007 BARCELONA,  
Tel. +34 3 301 6312, Fax. +34 3 301 4107

**Sweden:** Kottbygatan 7, Akalla, S-16485 STOCKHOLM,  
Tel. +46 8 632 2000, Fax. +46 8 632 2745

**Switzerland:** Allmendstrasse 140, CH-8027 ZÜRICH,  
Tel. +41 1 488 2686, Fax. +41 1 488 3263

**Taiwan:** Philips Semiconductors, 6F, No. 96, Chien Kuo N. Rd., Sec. 1,  
TAIPEI, Taiwan Tel. +886 2 2134 2865, Fax. +886 2 2134 2874

**Thailand:** PHILIPS ELECTRONICS (THAILAND) Ltd.,  
209/2 Sanpavuth-Bangna Road Prakanong, BANGKOK 10260,  
Tel. +66 2 745 4090, Fax. +66 2 398 0793

**Turkey:** Talatpasa Cad. No. 5, 80640 GÜLTEPE/ISTANBUL,  
Tel. +90 212 279 2770, Fax. +90 212 282 6707

**Ukraine:** PHILIPS UKRAINE, 4 Patrice Lumumba str., Building B, Floor 7,  
252042 KIEV, Tel. +380 44 264 2776, Fax. +380 44 268 0461

**United Kingdom:** Philips Semiconductors Ltd., 276 Bath Road, Hayes,  
MIDDLESEX UB3 5BX, Tel. +44 181 730 5000, Fax. +44 181 754 8421

**United States:** 811 East Arques Avenue, SUNNYVALE, CA 94088-3409,  
Tel. +1 800 234 7381

**Uruguay:** see South America

**Vietnam:** see Singapore

**Yugoslavia:** PHILIPS, Trg N. Pasica 5/v, 11000 BEOGRAD,  
Tel. +381 11 625 344, Fax. +381 11 635 777

**For all other countries apply to:** Philips Semiconductors,  
International Marketing & Sales Communications, Building BE-p, P.O. Box 218,  
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SCA57

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