

# KMZ41

## Magnetic field sensor

Rev. 05 — 27 November 2006

Product data sheet

## 1. Product profile

### 1.1 General description

The KMZ41 is a sensitive magnetic field sensor, employing the magneto-resistive effect of thin film permalloy. The sensor contains two galvanic separated Wheatstone bridges, which enclose an angle of 45 degrees.

A rotating magnetic field strength  $> 40$  kA/m (recommended field strength  $> 100$  kA/m) in the surface parallel to the chip (x-y plane) will deliver two independent sinusoidal output signals, one following a  $\cos(2\alpha)$  and the second following a  $\sin(2\alpha)$  function.

The sensor can be operated at any frequency between DC and 1 MHz.

Application notes *AN00023* (contactless angle measurement using KMZ41 and UZZ9000) and *AN00004* (contactless angle measurement using KMZ41 and UZZ9001) are available.

### 1.2 Features

- Accurate and reliable angle measurement
- Mechanical robustness, contactless principle
- Wear-free operation
- Accuracy independent on mechanical tolerances
- Extended temperature range

### 1.3 Quick reference data

**Table 1. Quick reference data**

$T_{amb} = 25^\circ\text{C}$  and  $H_{ext} = 100$  kA/m,  $V_{CC} = 5$  V unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{CC}$	supply voltage		[1] -	5	9	V
$V_{peak}$	peak voltage	see <a href="#">Figure 2</a>	[1] 70	78	86	mV
$V_{offset}$	offset voltage	per supply voltage; see <a href="#">Figure 2</a>	[1] -2	-	+2	mV/V
$R_{bridge}$	bridge resistance		[1][2] 2.0	2.5	3.0	k $\Omega$

[1] Applicable for bridge 1 and bridge 2.

[2] Bridge resistance between pin 4 to pin 8, pin 3 to pin 7, pin 5 to pin 1 and pin 6 to pin 2.

## 2. Pinning information

**Table 2. Pinning**

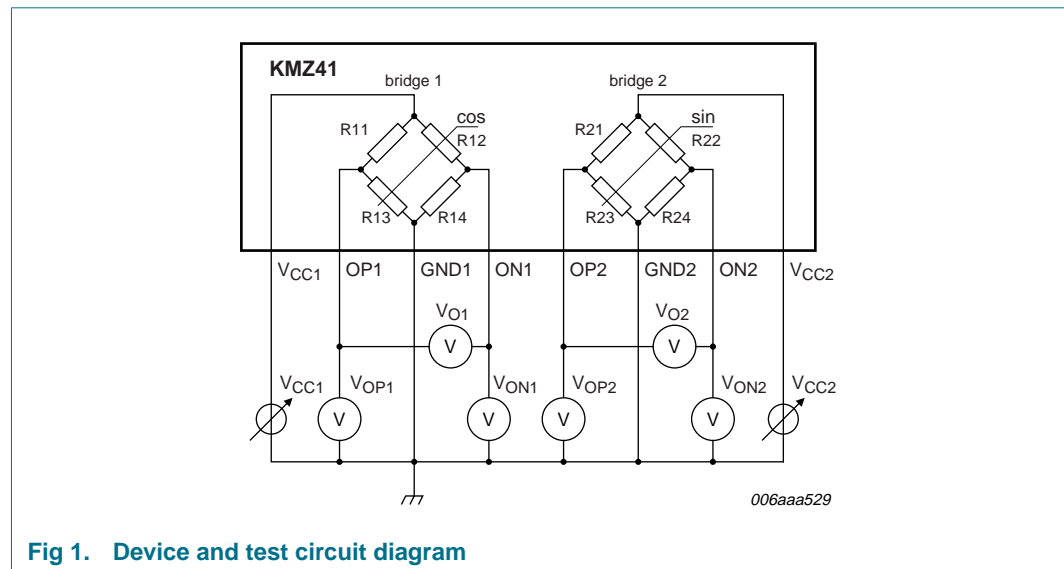
Pin	Symbol	Description	Simplified outline
1	ON1	output voltage bridge 1	
2	ON2	output voltage bridge 2	
3	V <sub>CC2</sub>	supply voltage bridge 2	
4	V <sub>CC1</sub>	supply voltage bridge 1	
5	OP1	output voltage bridge 1	
6	OP2	output voltage bridge 2	
7	GND2	supply voltage bridge 2	
8	GND1	supply voltage bridge 1	

## 3. Ordering information

**Table 3. Ordering information**

Type number	Package		
	Name	Description	Version
KMZ41	SO8	plastic small outline package; 8 leads; body width 3.9 mm	SOT96-1

## 4. Circuit diagram



## 5. Limiting values

**Table 4. Limiting values**

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

Symbol	Parameter	Conditions	Min	Max	Unit
V <sub>CC</sub>	supply voltage	[1]	-	9	V
H <sub>ext</sub>	external magnetic field strength		40	-	kA/m
T <sub>amb</sub>	ambient temperature		-40	+150	°C
T <sub>stg</sub>	storage temperature		-65	+150	°C

[1] Applicable for bridge 1 and bridge 2.

## 6. Thermal characteristics

**Table 5. Thermal characteristics**

Symbol	Parameter	Conditions	Typ	Unit
R <sub>th(j-a)</sub>	thermal resistance from junction to ambient		155	K/W

## 7. Characteristics

**Table 6. Characteristics**

$T_{amb} = 25\text{ °C}$  and  $H_{ext} = 100\text{ kA/m}$ ,  $V_{CC} = 5\text{ V}$  unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{CC}$	supply voltage		[1] -	5	9	V
$V_{peak}$	peak voltage	see Figure 2	[1] 70	78	86	mV
$TCV_{peak}$	temperature coefficient of peak voltage	$T_{amb} = -40\text{ °C}$ to $+150\text{ °C}$	[1][2] -0.38	-0.41	-0.44	%/K
$R_{bridge}$	bridge resistance		[1][3] 2.0	2.5	3.0	k $\Omega$
$TCR_{bridge}$	temperature coefficient of bridge resistance	$T_{amb} = -40\text{ °C}$ to $+150\text{ °C}$	[1][4] 0.31	0.33	0.35	%/K
$V_{offset}$	offset voltage	per supply voltage; see Figure 2	[1] -2	-	+2	mV/V
$TCV_{offset}$	temperature coefficient of offset voltage	per supply voltage; $T_{amb} = -40\text{ °C}$ to $+150\text{ °C}$ ; see Figure 2	[1][5] -2	-	+2	( $\mu$ V/V)/K
FH	hysteresis of output voltage	see Figure 3	[1][6] 0	0.01	0.04	%FS
k	amplitude synchronism		[7] 99	100	101	%
Tck	temperature coefficient of amplitude synchronism	$T_{amb} = -40\text{ °C}$ to $+150\text{ °C}$	[8] -0.005	0	+0.005	%/K
$\Delta\alpha$	angular inaccuracy		[9] 0	0.1	0.25	deg

[1] Applicable for bridge 1 and bridge 2.

$$[2] \quad TCV_{peak} = 100 \times \frac{V_{peak}(at\ 150\text{ °C}) - V_{peak}(at\ -40\text{ °C})}{V_{peak}(at\ 25\text{ °C}) \times (150\text{ °C} - (-40\text{ °C}))}$$

[3] Bridge resistance between pin 4 to pin 8, pin 3 to pin 7, pin 5 to pin 1 and pin 6 to pin 2.

$$[4] \quad TCR_{bridge} = 100 \times \frac{R_{bridge}(at\ 150\text{ °C}) - R_{bridge}(at\ -40\text{ °C})}{R_{bridge}(at\ 25\text{ °C}) \times (150\text{ °C} - (-40\text{ °C}))}$$

$$[5] \quad TCV_{offset} = \frac{V_{offset}(at\ 150\text{ °C}) - V_{offset}(at\ -40\text{ °C})}{150\text{ °C} - (-40\text{ °C})}$$

$$[6] \quad FH_1 = 100 \times \left| \frac{V_{O1}(67.5^\circ)135^\circ \rightarrow 45^\circ - V_{O1}(67.5^\circ)45^\circ \rightarrow 135^\circ}{2 \times V_{peak1}} \right|$$

$$FH_2 = 100 \times \left| \frac{V_{O2}(22.5^\circ)90^\circ \rightarrow 0^\circ - V_{O2}(22.5^\circ)0^\circ \rightarrow 90^\circ}{2 \times V_{peak2}} \right|$$

$$[7] \quad k = 100 \times \frac{V_{peak1}}{V_{peak2}}$$

$$[8] \quad Tck = 100 \times \frac{k(at\ 150\text{ °C}) - k(at\ -40\text{ °C})}{k(at\ 25\text{ °C}) \times (150\text{ °C} - (-40\text{ °C}))}$$

[9]  $\Delta\alpha = |\alpha_{real} - \alpha_{meas}|$ ;  $V_{offset} = 0\text{ V}$ ; inaccuracy of angular measurement due to deviations from ideal sinusoidal characteristics, calculated from the third and fifth harmonics of the spectrum of  $V_O$ .

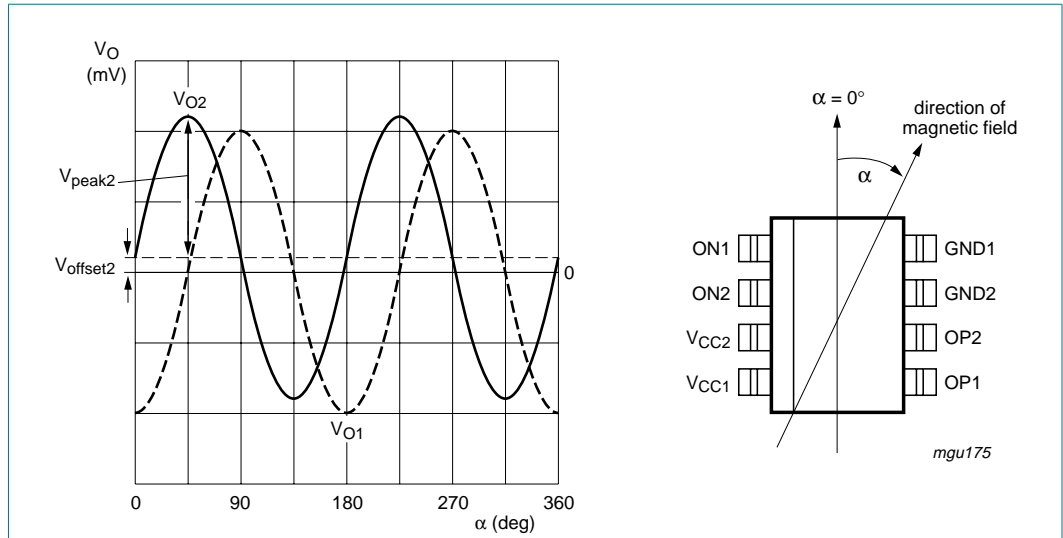


Fig 2. Output signals related to the direction of the magnetic field

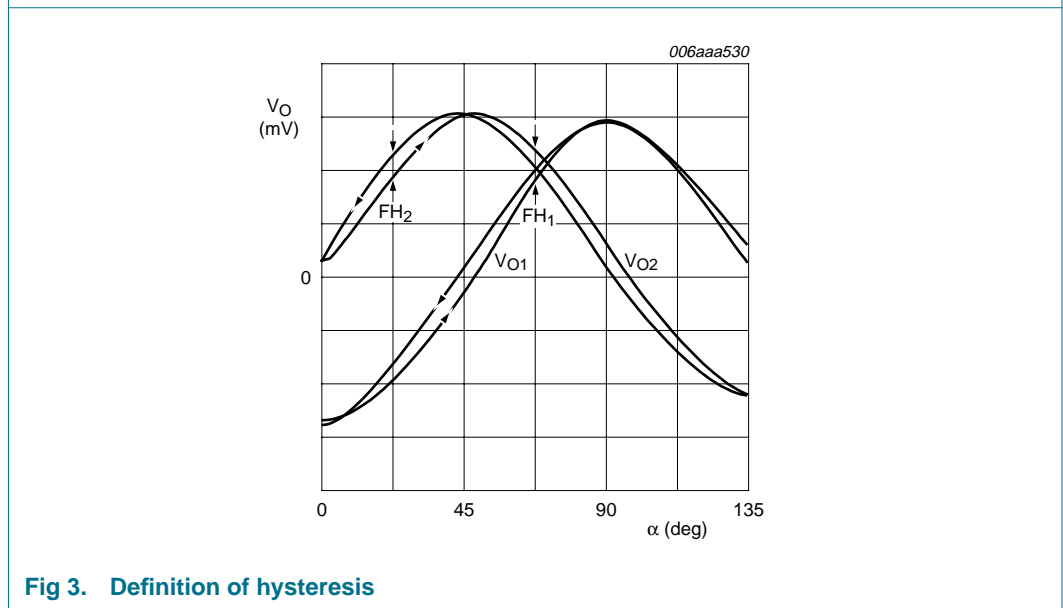


Fig 3. Definition of hysteresis

## 8. Package outline

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

SOT96-1

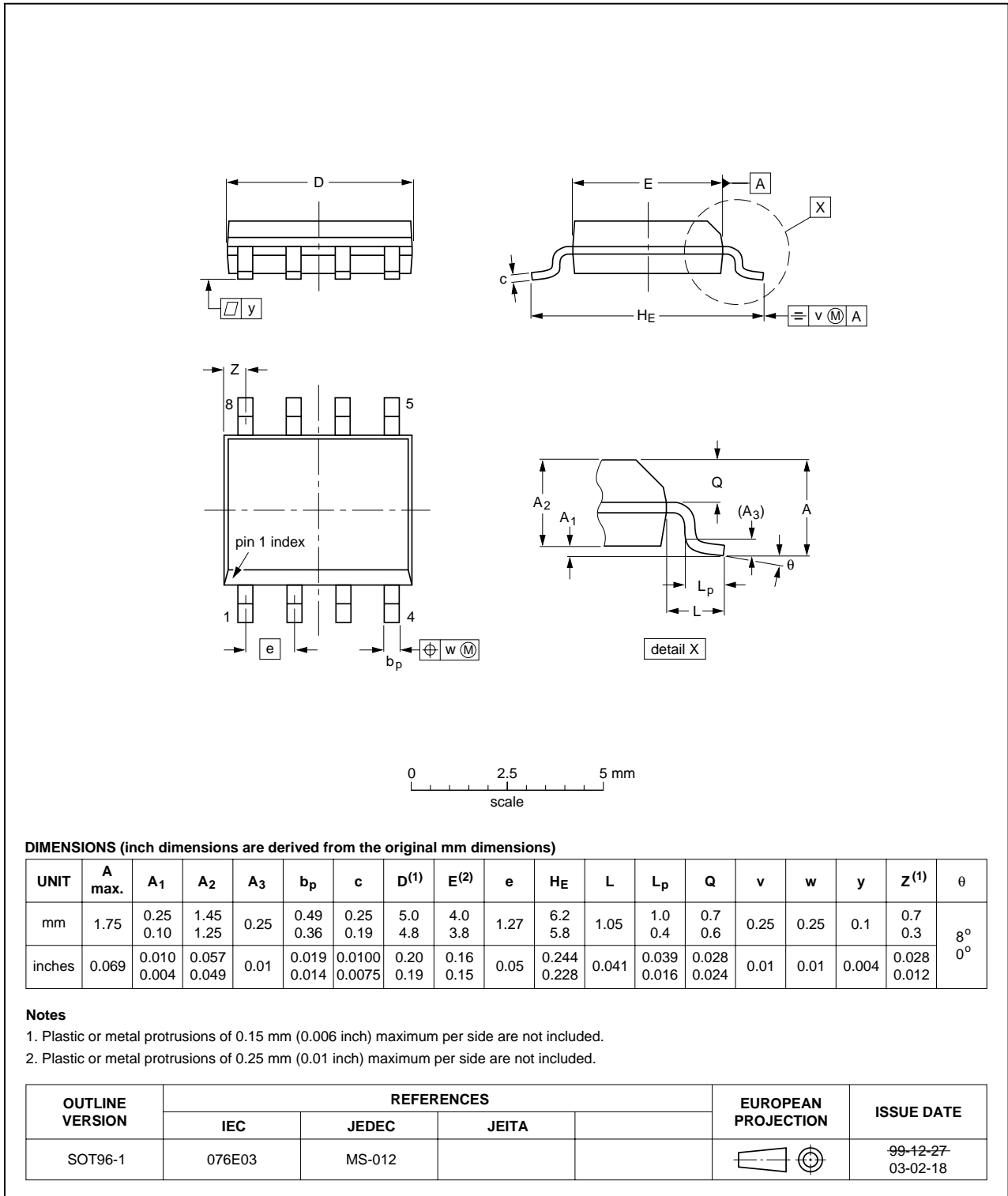


Fig 4. Package outline SOT96-1 (SO8/MS-012)

## 9. Packing information

**Table 7. Packing methods**

The indicated -xxx are the last three digits of the 12NC ordering code.<sup>[1]</sup>

Type number	Package	Description	Packing quantity
			<b>2500</b>
KMZ41	SOT96-1	8 mm pitch, 12 mm tape and reel	-118

[1] 12NC ordering code: 9340 372 10118. For further information and the availability of packing methods, see [Section 12](#).

## 10. Revision history

**Table 8. Revision history**

Document ID	Release date	Data sheet status	Change notice	Supersedes
KMZ41_5	20061127	Product data sheet	-	KMZ41_4
Modifications:	<ul style="list-style-type: none"> <li>• The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors.</li> <li>• Legal texts have been adapted to the new company name where appropriate.</li> <li>• <a href="#">Section 1.1 “General description”</a>: amended</li> <li>• <a href="#">Section 1.2 “Features”</a>: added</li> <li>• <a href="#">Table 1 “Quick reference data”</a>: <math>V_{\text{peak}}</math> peak voltage added</li> <li>• <a href="#">Table 1</a>: <math>R_{\text{bridge}}</math> bridge resistance <a href="#">Table note 2</a> added</li> <li>• <a href="#">Table 2 “Pinning”</a>: amended</li> <li>• <a href="#">Section 3 “Ordering information”</a>: added</li> <li>• <a href="#">Figure 1 “Device and test circuit diagram”</a>: amended</li> <li>• <a href="#">Table 4 “Limiting values”</a>: <math>H_{\text{ext}}</math> external magnetic field strength added</li> <li>• <a href="#">Table 4</a>: <math>T_{\text{bridge}}</math> bridge operating temperature redefined to <math>T_{\text{amb}}</math> ambient temperature</li> <li>• <a href="#">Table 6 “Characteristics”</a>: <math>H_{\text{rotation}}</math> redefined to <math>H_{\text{ext}}</math> external magnetic field strength</li> <li>• <a href="#">Figure 3 “Definition of hysteresis”</a>: added</li> <li>• <a href="#">Section 9 “Packing information”</a>: added</li> </ul>			
KMZ41_4	20000418	Preliminary specification	-	KMZ41_3



## 11. Legal information

### 11.1 Data sheet status

Document status <sup>[1][2]</sup>	Product status <sup>[3]</sup>	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

[1] Please consult the most recently issued document before initiating or completing a design.

[2] The term 'short data sheet' is explained in section "Definitions".

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