

# KMZ43T

## Magnetic field sensor

Rev. 05 — 4 March 2009

Product data sheet

## 1. Product profile

### 1.1 General description

The KMZ43T is a sensitive magnetic field sensor, employing the magnetoresistive effect of thin-film permalloy. The sensor contains two galvanic separated Wheatstone bridges, at a relative angle of 45° to one another.

A rotating magnetic field in the x-y plane will produce two independent sinusoidal output signals, one a function of  $+\cos(2\alpha)$  and the second a function of  $+\sin(2\alpha)$ ,  $\alpha$  being the angle between sensor and field direction (see [Figure 2](#)). The KMZ43T is suited to high precision angle measurement applications under low field conditions (saturation field strength 25 kA/m).

The sensor can be operated at any frequency between 0 Hz and 1 MHz.

### 1.2 Features

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

### 1.3 Applications

- Steering angle and torsion
- Headlight adjustment
- Motor positioning
- Window wipers
- Fuel level
- Mirror positioning

### 1.4 Quick reference data

**Table 1. Quick reference data**

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{CC}$	supply voltage		[1] -	5	9	V
$V_{peak}$	peak output voltage	see <a href="#">Figure 2</a>	[1] 60	67	75	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] 2.7	3.2	3.7	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 1 to pin 5 and pin 2 to pin 6.

## 2. Pinning information

Table 2. Pinning

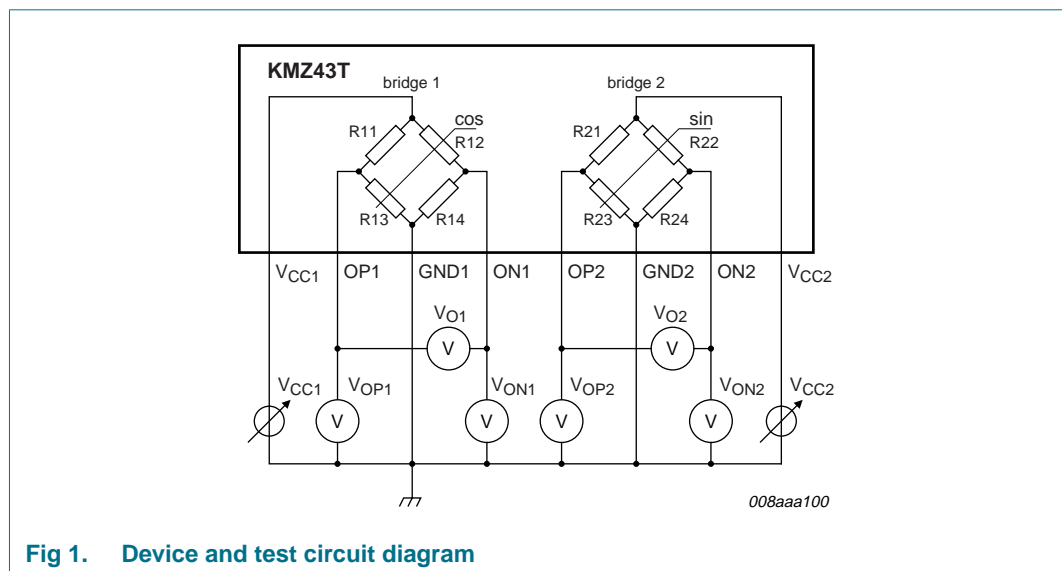
Pin	Symbol	Description	Simplified outline
1	ON1	output voltage bridge 1	
2	ON2	output voltage bridge 2	
3	V <sub>CC2</sub>	supply voltage bridge 2	
4	V <sub>CC1</sub>	supply voltage bridge 1	
5	OP1	output voltage bridge 1	
6	OP2	output voltage bridge 2	
7	GND2	ground 2	
8	GND1	ground 1	

## 3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
KMZ43T	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		25	-	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**

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{CC}$	supply voltage		[1] -	5	9	V
$V_{peak}$	peak output voltage	see Figure 2	[1] 60	67	75	mV
$TC_{V_{peak}}$	temperature coefficient of peak output voltage	$T_{amb} = -40\text{ }^{\circ}\text{C}$ to $+150\text{ }^{\circ}\text{C}$	[1][2] -0.3	-0.36	-0.42	%/K
$R_{bridge}$	bridge resistance		[1][3] 2.7	3.2	3.7	k $\Omega$
$TC_{R_{bridge}}$	temperature coefficient of bridge resistance	$T_{amb} = -40\text{ }^{\circ}\text{C}$ to $+150\text{ }^{\circ}\text{C}$	[1][4] 0.24	0.26	0.29	%/K
$V_{offset}$	offset voltage	per supply voltage; see Figure 2	[1] -2	-	+2	mV/V
$TC_{V_{offset}}$	temperature coefficient of offset voltage	per supply voltage; $T_{amb} = -40\text{ }^{\circ}\text{C}$ to $+150\text{ }^{\circ}\text{C}$ ; see Figure 2	[1][5] -4	-	+4	( $\mu\text{V/V}$ )/K
FH	hysteresis of output voltage	see Figure 3	[1][6] 0	0.05	0.18	%FS
k	amplitude synchronism		[7] 99.5	100	100.5	%
$TC_k$	temperature coefficient of amplitude synchronism	$T_{amb} = -40\text{ }^{\circ}\text{C}$ to $+150\text{ }^{\circ}\text{C}$	[8] -0.01	-	+0.01	%/K
$\Delta\alpha$	angular inaccuracy		[9] 0	0.05	0.1	deg

[1] Applicable for bridge 1 and bridge 2.

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

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

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

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

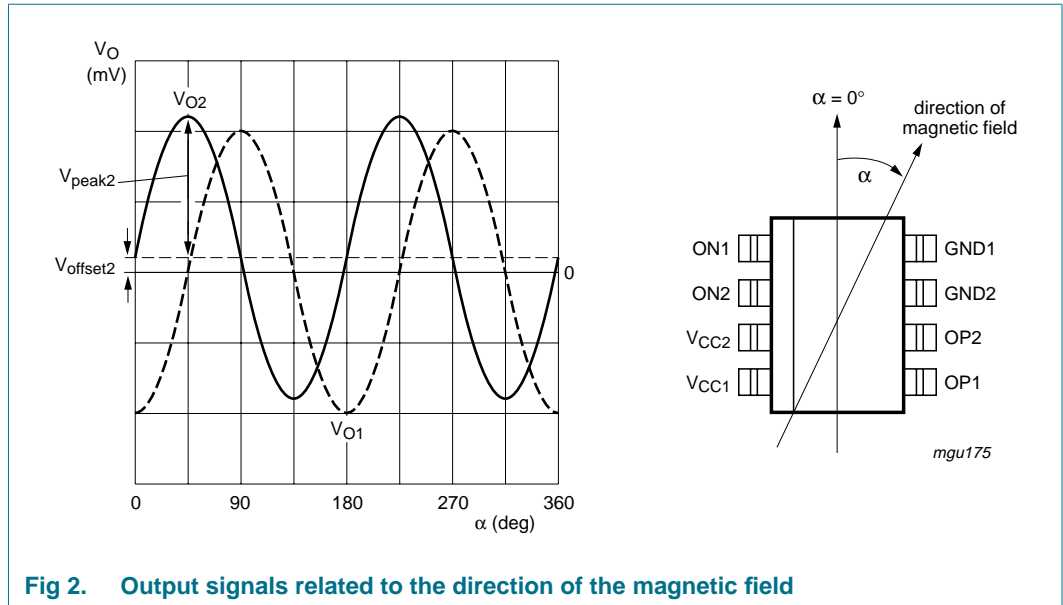
$$[6] \quad FH_1 = 100 \times \left| \frac{V_{O1}(67.5^{\circ})135^{\circ} \rightarrow 45^{\circ} - V_{O1}(67.5^{\circ})45^{\circ} \rightarrow 135^{\circ}}{2 \times V_{peak1}} \right|$$

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

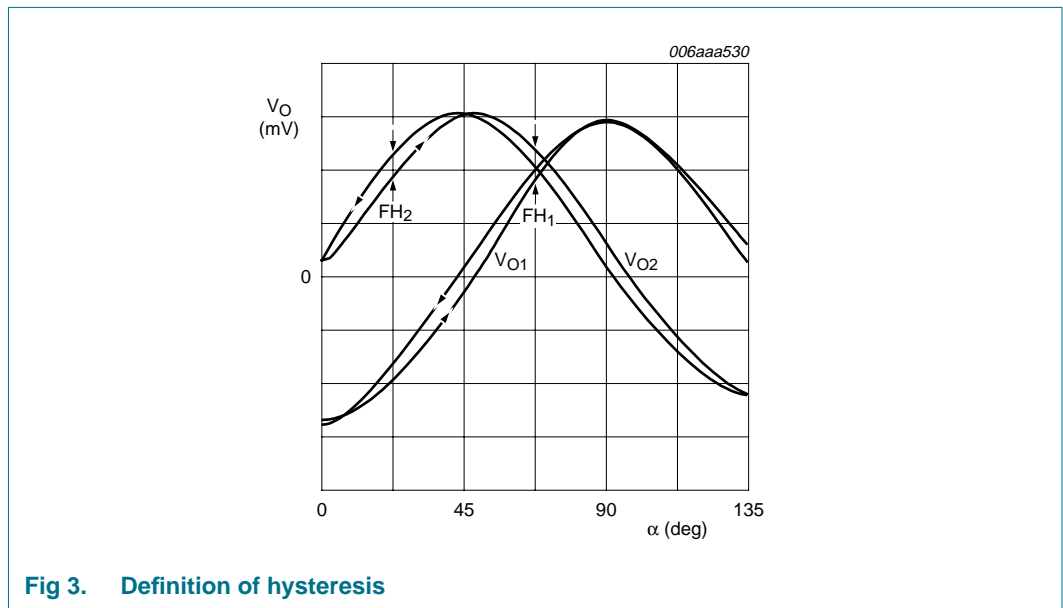
$$[7] \quad k = 100 \times \frac{V_{peak1}}{V_{peak2}}$$

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

[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  $V_O$ .



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



**Fig 3. Definition of hysteresis**

## 8. Package outline

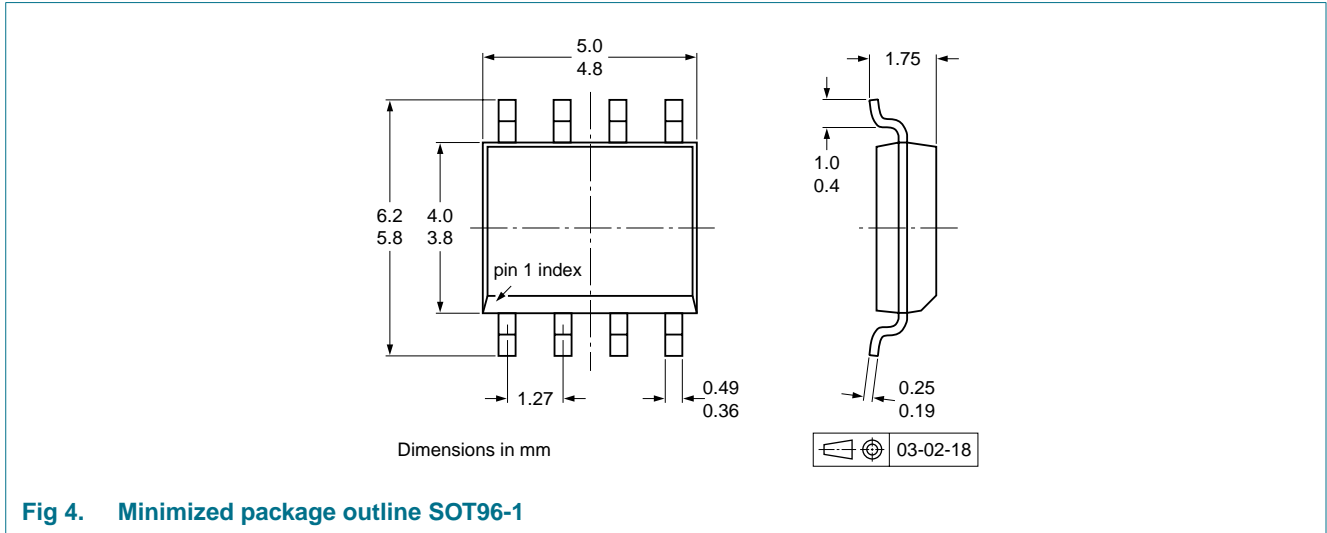


Fig 4. Minimized package outline SOT96-1

## 9. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
KMZ43T_5	20090304	Product data sheet	-	KMZ43T_4
Modifications:	<ul style="list-style-type: none"> <li>Table 6: <math>TC_{V_{peak}}</math> and <math>TC_{R_{bridge}}</math> values adapted to 25 °C reference point</li> </ul>			
KMZ43T_4	20080326	Product data sheet	-	KMZ43T_3
KMZ43T_3	20030915	Product specification	-	KMZ43T_2
KMZ43T_2	20030326	Preliminary specification	-	KMZ43_1
KMZ43_1	20000824	Objective specification	-	-

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### 10.1 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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