

**Data Sheet**  
**Linear Field Sensors**  
*KMY20, KMY21, KMZ20*

# LINEAR MAGNETIC FIELD SENSORS

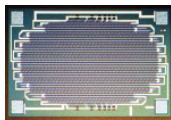
## FEATURES

- output proportional to magnetic field strength with very high sensitivity
- very small hysteresis
- large operating temperature range, from -40°C up to +150 °C
- highly reliable
- with / without internal magnet

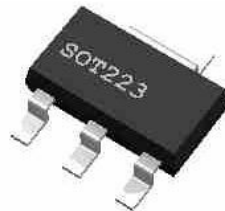
## APPLICATIONS

- detection of very weak magnetic fields, like earth magnetic field, or field generated by small magnetic particles
- detection of objects that distort non-local magnetic fields
- revolution measurement on ferro-magnetic gears
- contactless switch / displacement sensor

## DIES & PACKAGES



dies **MR174B, MRHB**

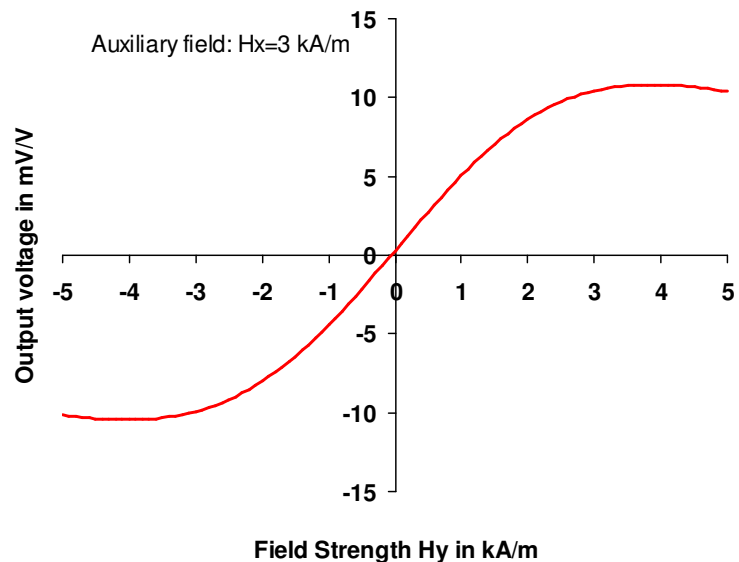
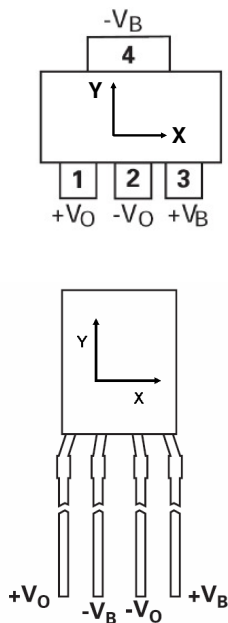


**KMY20M**



E-Line  
**KMZ20M**

## KMY20 / KMZ20M



The **KMY** and **KMZ** sensors are highly sensitive magnetic field sensors which utilize the anisotropic magnetoresistance effect. The **KMY20** and **KMZ20** sensors contain a Wheatstone bridge.

Guangzhou Ankai Electronic Instrument Co., Ltd.

ADD:NO.38 Baogang Road, Songshu St,Haizhu district,Guangzhou,Guangdong Province China PC:510240

Tel:+86-20-34387714

Fax:+86-20-34387724

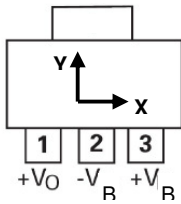
Internet: <http://www.chinaankai.com>

E-mail:sale@chinaankai.com

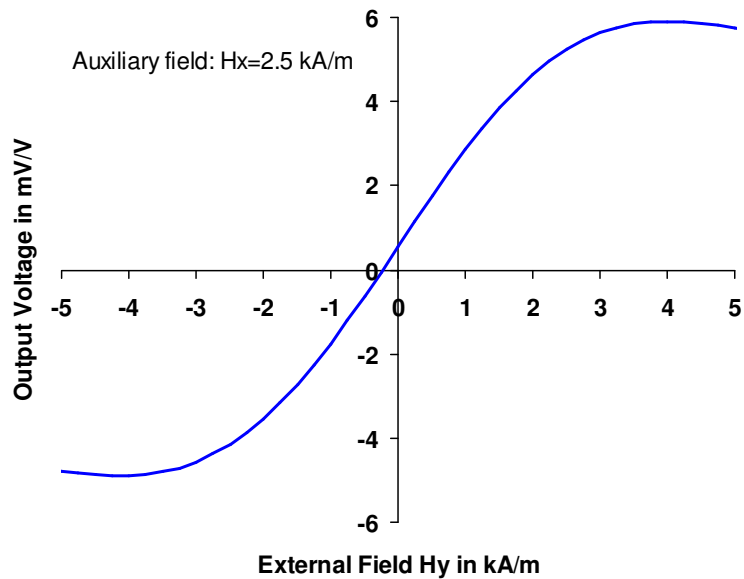
# LINEAR MAGNETIC FIELD SENSORS

## KMY21

In contrast to the KMY20 sensor products, the **KMY21M** consists of a half bridge, making the sensor well suited for dynamic measurements.



It contains an internal magnet, which provides an auxiliary field of approx. 2.5 kA/m.



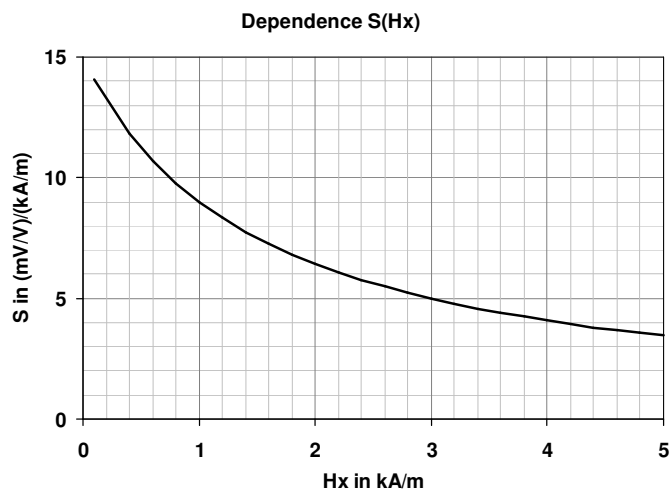
## GENERAL DESCRIPTION

Due to its featured properties - high sensitivity and almost no hysteresis – the **KMY / KMZ** sensors are used in a wide range of applications, like magnetic field measurement, revolution counters, proximity detecting, position measurement.

An uniaxial linear magnetic field in y-direction will generate a linear output within the specified magnetic field range. The sensor is available in two types: the **KMY20 M** and **KMZ20 M** sensor types contain intrinsic magnets which provide an auxiliary magnetic field at the sensor die which prevents magnetic domains from flipping irregularly.

If the dies **MR174B** and **MRHB** or the **KMY20 S** are used, the auxiliary field has to be provided by the user. The dependence of the sensitivity with auxiliary field strength is depicted in the figure.

Auxiliary field strengths below  $H_x < 1.5$  kA/m are not recommended, as small disturbances may flip the magnetization domains. Sometimes, the magnetic conditions in the application may provide enough H<sub>x</sub> bias field stabilization.



# LINEAR MAGNETIC FIELD SENSORS

## CHARACTERISTIC VALUES

PARAMETER	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
<b>Operating Limits</b>						
max. supply voltage	$V_{cc,max}$				10	V
max. current	$I_{cc,max}$	SOT223 E-Line			9	mA
operating temperature	$T_{op}$	SOT223, E-Line	-40		+150	°C
storage temperature	$T_{st}$	SOT223, E-Line	-40		+150	°C
<b>General Sensor Specifications</b>						
TC of amplitude	$TCSV$	Condition A, C	-0.36	-0.32	-0.28	%/K
TC of resistance	$TCBR$	Condition A, C	+0.27	+0.32	+0.37	%/K
TC of offset	$TCVoff$	Condition A, C	-4	0	+4	$\mu V/V/K$

## Sensor Specifications KMY20, KMZ20 (T=25 °C, Hx=3 kA/m)

PARAMETER	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
Supply voltage	$V_{cc}$	Condition A, B		5		V
Bridge resistance	$R_b$	Condition A, B	1200	1700	2200	$\Omega$
Output signal range	$\Delta V_o/V_{cc}$	Condition A, B	16	20	24	mV/V
Offset voltage	$V_{off}/V_{cc}$	Condition A, B	-1	0	+1	mV/V
Sensitivity	$S$	Condition A, B	3.7	4.7	5.7	mV/V/kA/m
Hysteresis	$V_H/V_{cc}$	Condition A, B	-	-	50	$\mu V/V$

## Sensor Specifications KMY21M (T=25 °C, Hx=2.5 kA/m)

PARAMETER	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
Supply voltage	$V_{cc}$	Condition A, B		5		V
Bridge resistance	$R_b$	Condition A, B	1100	1500	1900	$\Omega$
Output signal range	$\Delta V_o/V_{cc}$	Condition A, B	8	9.5	12	mV/V
Offset voltage	$V_{off}/V_{cc}$	Condition A, B	48	50	52	%Vcc
Sensitivity	$S$	Condition A, B	2.05	2.50	3.10	mV/V/kA/m
Hysteresis	$V_H/V_{cc}$	Condition A, B	-	-	50	$\mu V/V$

Stress above one or more of the limiting values may cause permanent damage to the device. Exposure to limiting values for extended periods may affect device reliability.

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ADD:NO.38 Baogang Road, Songshu St,Haizhu district,Guangzhou,Guangdong Province China PC:510240

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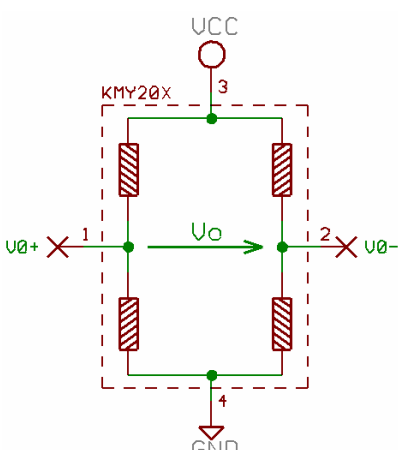
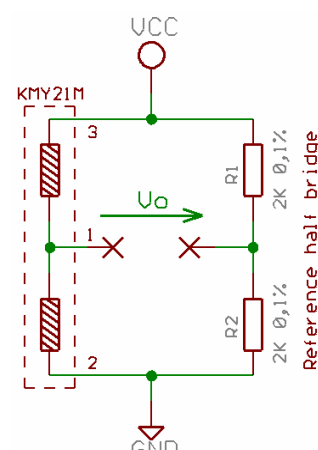
Fax:+86-20-34387724

Internet: <http://www.chinaankai.com>

E-mail:sale@chinaankai.com

# LINEAR MAGNETIC FIELD SENSORS

## MEASUREMENT CONDITIONS

PARAMETER	SYMBOL	UNIT	CONDITION
<b>Condition A: Set Up Conditions</b>			
Ambient temperature	T	°C	23±5
Supply voltage	V <sub>cc</sub>	V	5
Output voltage	V <sub>O</sub>	mV	V <sub>O</sub> =(V <sub>O+</sub> -V <sub>O-</sub> )
	V <sub>O</sub> /V <sub>cc</sub>	mV/V	output voltages are also given independently on supply voltage: example: V <sub>O</sub> /V <sub>cc</sub> =(V <sub>O+</sub> -V <sub>O-</sub> )/V <sub>cc</sub>
Reference half bridge			measure MR half bridge against reference half bridge 2* 2 kΩ 0.1%
<b>for full bridge sensors (KMY20S, KMY20M, KMZ20S, KMZ20M)</b>		<b>for half bridge sensors (KMY21M)</b>	
			
		<i>The output voltage of the MR half bridge is measured against a reference half bridge</i>	
<b>Condition B: Sensor Specifications (T=23±5 °C, Hx=3.0±0.5 kA/m)</b>			
Output voltage range	$\Delta V_O/V_{cc}$	mV/V	$H_y = -7 \dots +7 \text{ kA/m}; \Delta V_O = (V_{O,max} - V_{O,min})$
Offset voltage	V <sub>off</sub> /V <sub>cc</sub>	mV/V	$H_y = 0; V_{off} = V_O(H_y)$
Sensitivity	S	(mV/V)/(kA/m)	$H_y = 1 \text{ kA/m}; S := \frac{V_O(+H_y) - V_O(-H_y)}{2 \cdot V_{cc}}$
Hysteresis	V <sub>H</sub> /V <sub>cc</sub>	μV/V	Hy in kA/m (V <sub>O</sub> (H <sub>y</sub> = 0; H <sub>y</sub> = -1 → +1) - V <sub>O</sub> (H <sub>y</sub> = 0; H <sub>y</sub> = +1 → -1))/V <sub>cc</sub>

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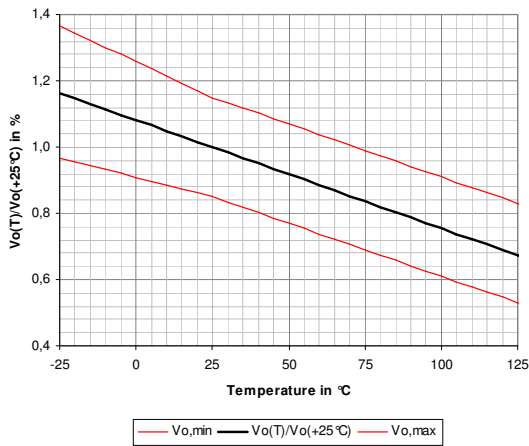
Internet: <http://www.chinaankai.com>

E-mail:sale@chinaankai.com

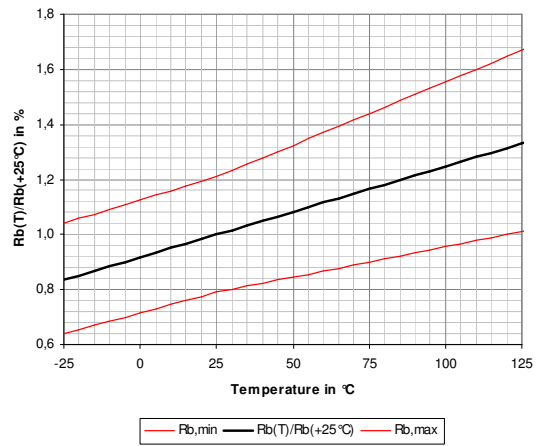
# LINEAR MAGNETIC FIELD SENSORS

PARAMETER	SYMBOL	UNIT	CONDITION
<b>C. Sensor Specifications (T=-25 °C, +125 °C)</b>			
Ambient temperatures	T	°C	T <sub>1</sub> =-25 °C, T <sub>0</sub> =+25 °C, T <sub>2</sub> =+125 °C
TC of amplitude	TCSV	%/K	$TCV = \frac{1}{(T_2 - T_1)} \cdot \frac{\Delta V_0 / V_{cc}(T_2) - \Delta V_0 / V_{cc}(T_1)}{\Delta V_0 / V_{cc}(T_1)} \cdot 100\%$
TC of resistance	TCBR	%/K	$TCR = \frac{1}{(T_2 - T_1)} \cdot \frac{R(T_2) - R(T_1)}{R(T_1)} \cdot 100\%$
TC of offset	TCVoff	(μV/V)/K	$TCVoff = \frac{Voff(T_2) - Voff(T_1)}{(T_2 - T_1)}$

## TEMPERATURE DEPENDENCIES



*signal amplitude related to room temperature value*



*bridge resistance related to room temperature value*

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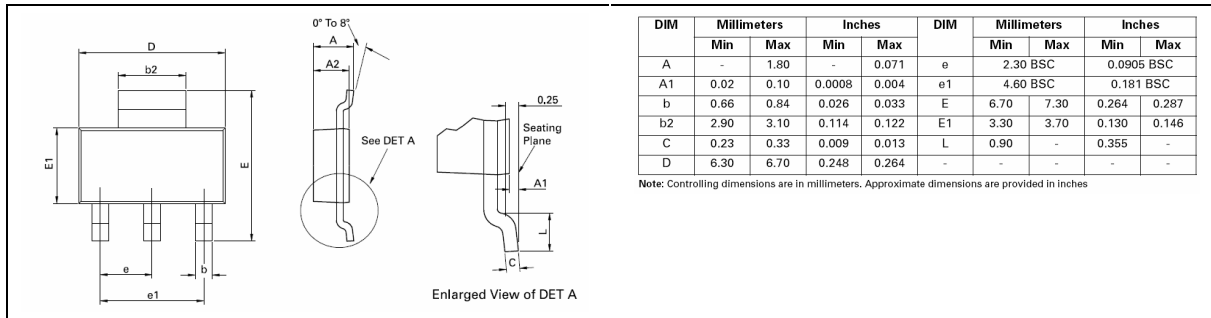
# LINEAR MAGNETIC FIELD SENSORS

## PACKAGES

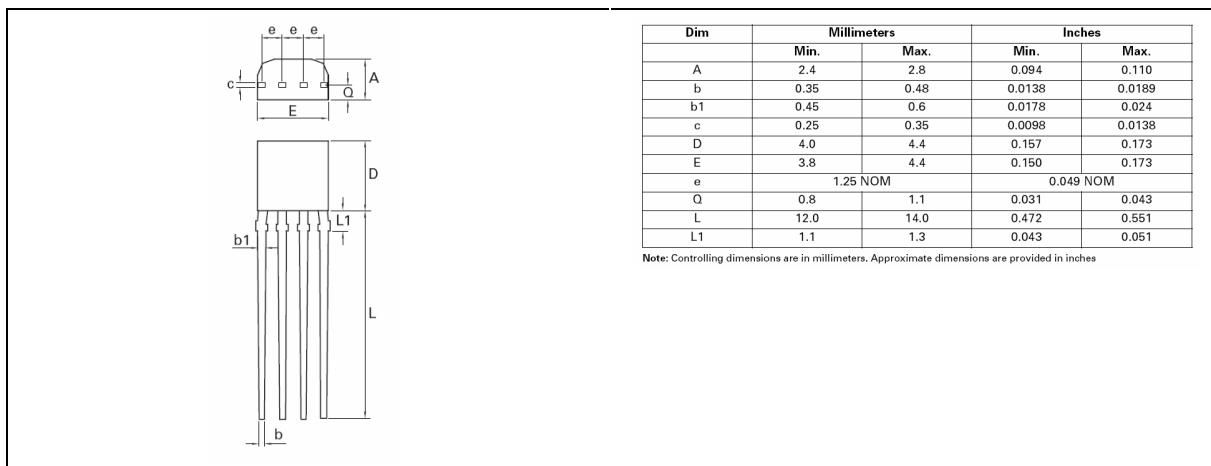
### DIE LAYOUT

Die layout and dimensions on request.

### SOT223



### E-LINE 4 PIN



## ORDERING

DEVICE	DIE	PACKAGE	INTERNAL MAGNET	PART NUMBER
MR174B	full bridge	wafer	n/a	G-MRCH-002
MRHB	half bridge	wafer	n/a	G-MRCH-009
KMY 20 S	full bridge	SOT-223	NO	G-MRCH-006
KMY 20 M	full bridge	SOT-223	YES	G-MRCH-001
KMY 21 M	half bridge	SOT-223	YES	G-MRCH-011
KMZ 20 S	full bridge	E-Line	NO	G-MRCH-007
KMZ 20 M	full bridge	E-Line	YES	G-MRCH-003

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