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

**中国**

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# LINEAR MAGNETIC FIELD SENSORS

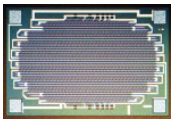
## FEATURES

- 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



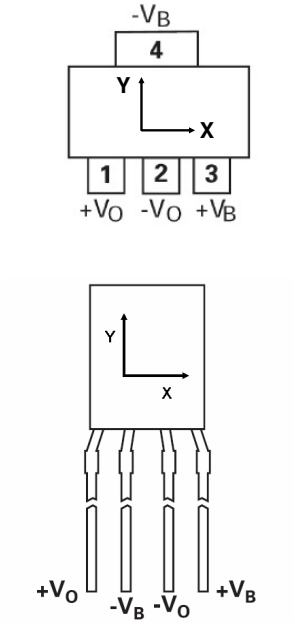
dies **MR174B, MRHB**

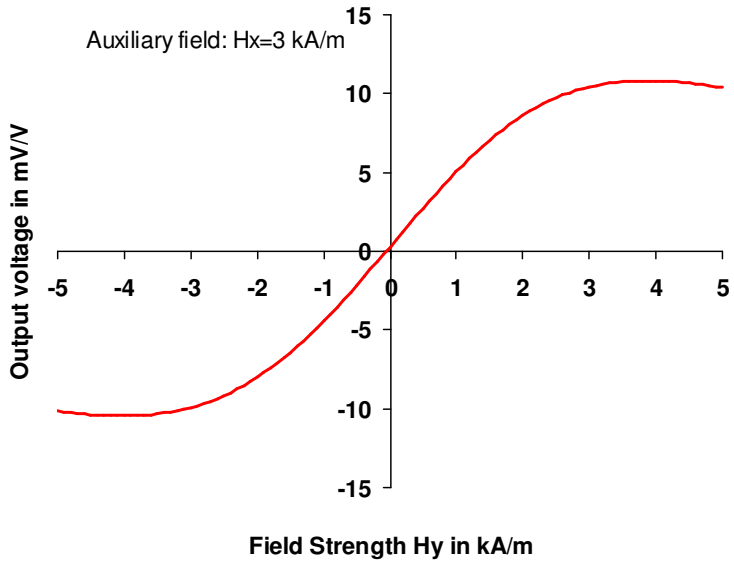

**KMY20M**

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 Weatstone bridge.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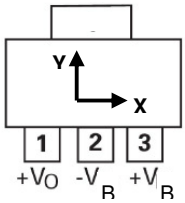
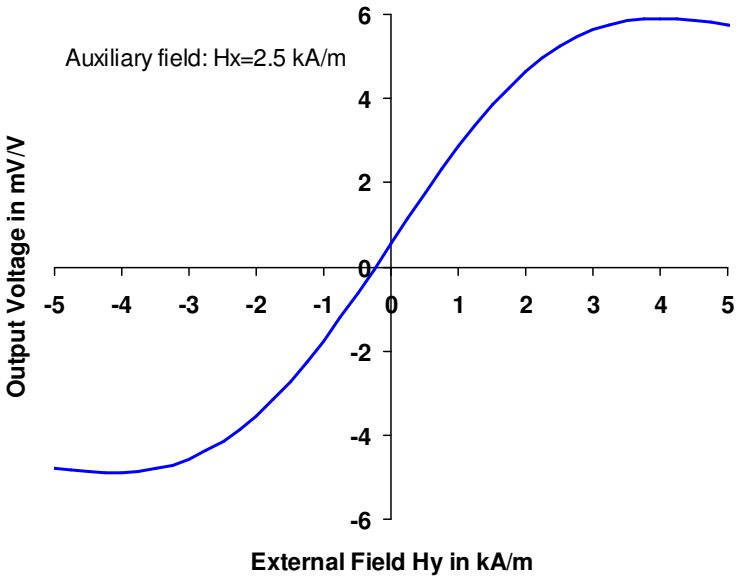
## KMY21

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 filed of approx. 2.5 kA/m.



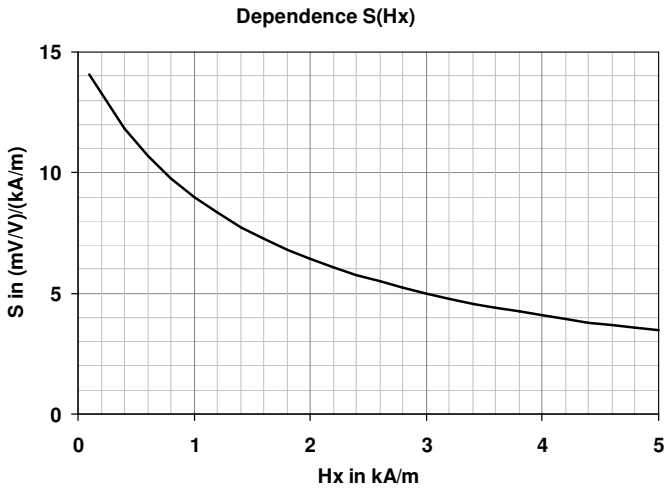

## GENERAL DESCRIPTION

Due to it's 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 dependance of the sensitivity with auxiliary field strength is depicted in the figure.

Auxiliary field strengths below Hx<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 Hx bias field stabilization.

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## CHARACTERISTIC VALUES

| PARAMETER | SYMBOL | CONDITION | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| **Operating Limits** | | | | | | |
| max. supply voltage | $V_{cc,max}$ | | | | 10 | V |
| max. current | $I_{cc,max}$ | SOT223 | | | 9 | mA |
| | | E-Line | | | 9 | mA |
| operating temperature | $T_{op}$ | SOT223, E-Line | -40 | | +150 | °C |
| storage temperature | $T_{st}$ | SOT223, E-Line | -40 | | +150 | °C |
| **General Sensor Specifications** | | | | | | |
| 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 | µV/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 | Ω |
| Output signal range | $\Delta V_0/V_{cc}$ | 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 | µV/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 | Ω |
| Output signal range | $\Delta V_0/V_{cc}$ | 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 | µV/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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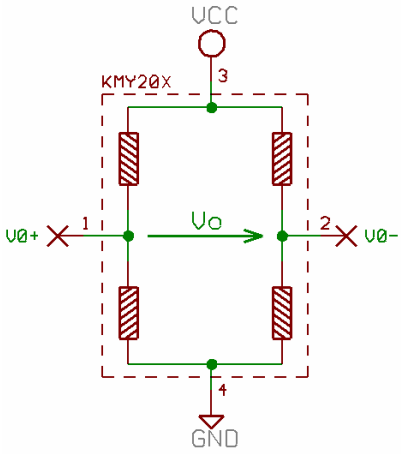
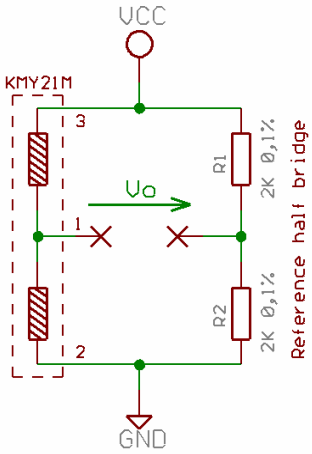
## MEASUREMENT CONDITIONS

| PARAMETER | SYMBOL | UNIT | CONDITION |
|---|---|---|---|
| **Condition A: Set Up Conditions** | | | |
| Ambient temperature | T | ℃ | 23±5 |
| Supply voltage | $V_{cc}$ | V | 5 |
| Output voltage | $V_O$ | mV | $V_O=(V_{0+} - V_{0-})$ |
| | $V_O/V_{cc}$ | mV/V | output voltages are also given independently on supply voltage: example: $Vo/Vcc=(V_{0+} - V_{0-})/Vcc$ |
| | | | measure MR half bridge against reference half bridge |
| Reference half bridge | | | 2* 2 kΩ 0.1% |
| **for full bridge sensors (KMY20S, KMY20M, KMZ20S, KMZ20M)**   | | | **for half bridge sensors (KMY21M)**   *The output voltage of the MR half bridge is measured against a reference half bridge* |
| **Condition B: Sensor Specifications (T=23±5 ℃, Hx=3.0±0.5 kA/m)** | | | |
| Output voltage range | $\Delta V_O/V_{cc}$ | mV/V | $H_y = -7 \ldots +7\ kA/m;\ \Delta V_O = \left(V_{O,\max} - V_{O,\min}\right)$ |
| Offset voltage | $V_{off}/V_{cc}$ | mV/V | $H_y = 0;\ V_{off} = V_O\left(H_y\right)$ |
| Sensitivity | $S$ | (mV/V)/(kA/m) | $H_y = 1kA/m;\ S := \frac{V_0\left(+H_y\right) - V_0\left(-H_y\right)}{2 \cdot V_{cc}}$ |
| Hysteresis | $V_H/V_{cc}$ | µV/V | Hy in kA/m $(V_0(H_y = 0; H_y = -1 \rightarrow +1) - V_0(H_y = 0; H_y = +1 \rightarrow -1))/V_{cc}$ |

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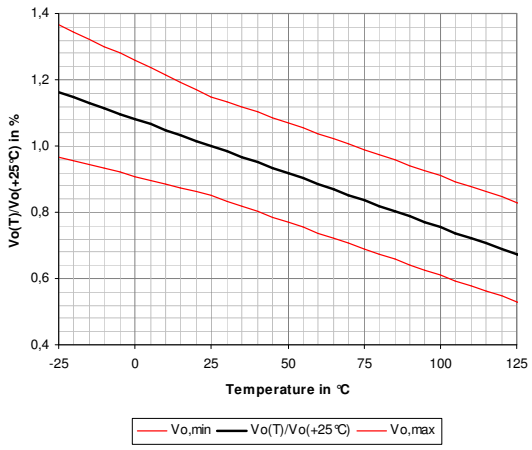
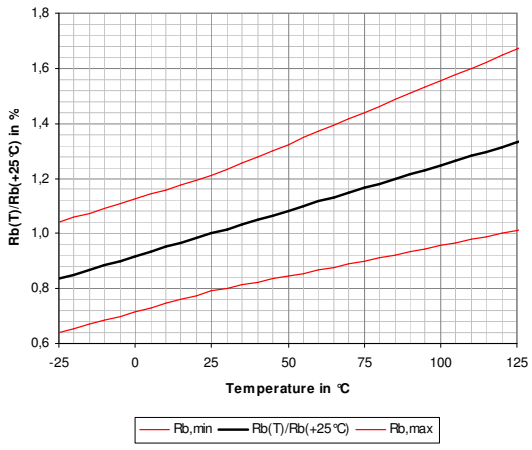
| PARAMETER | SYMBOL | UNIT | CONDITION |
|---|---|---|---|
| **C. Sensor Specifications (T=-25°C, +125°C)** | | | |
| Ambient temperatures | T | °C | $T_1$=-25 °C, $T_0$=+25 °C, $T_2$=+125 °C |
| TC of amplitude | *TCSV* | %/K | $TCV = \frac{1}{(T_2 - T_1)} \cdot \frac{\Delta V_0 / V_{cc}(T_2) - \Delta V_0 / V_{cc}(T_1)}{\Delta V_0 / V_{cc}(T_1)} \cdot 100\%$ |
| 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*

## LEGAL DISCLAIMER

This product is not designed for use in life support appliances, devices or systems where malfunction of this product can reasonably be expected to result in personal injury. HL Planartechnik GmbH customers using or selling this product for use in such applications do so at their own risk and agree to fully indemnify HL Planartechnik GmbH for any damages resulting from such improper use or sale.

This data sheet contains target specifications for product development which my be subject to changes without notice.

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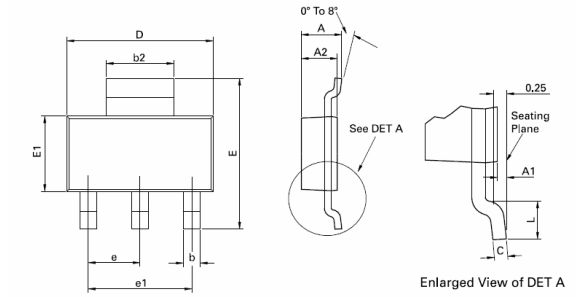
# PACKAGES

## DIE LAYOUT

Die layout and dimensions on request.

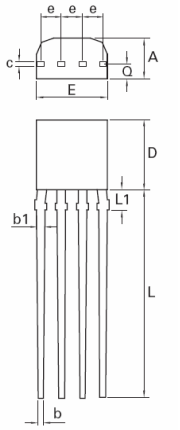
## SOT223




| DIM | Millimeters | | Inches | | DIM | Millimeters | | Inches | |
|---|---|---|---|---|---|---|---|---|---|
| | Min | Max | Min | Max | | Min | Max | Min | Max |
| A | - | 1.80 | - | 0.071 | e | 2.30 BSC | | 0.0905 BSC | |
| A1 | 0.02 | 0.10 | 0.0008 | 0.004 | e1 | 4.60 BSC | | 0.181 BSC | |
| b | 0.66 | 0.84 | 0.026 | 0.033 | E | 6.70 | 7.30 | 0.264 | 0.287 |
| b2 | 2.90 | 3.10 | 0.114 | 0.122 | E1 | 3.30 | 3.70 | 0.130 | 0.146 |
| C | 0.23 | 0.33 | 0.009 | 0.013 | L | 0.90 | - | 0.355 | - |
| D | 6.30 | 6.70 | 0.248 | 0.264 | - | - | - | - | - |

**Note:** Controlling dimensions are in millimeters. Approximate dimensions are provided in inches

## E-LINE 4 PIN




| Dim | Millimeters | | Inches | |
|---|---|---|---|---|
| | Min. | Max. | Min. | Max. |
| A | 2.4 | 2.8 | 0.094 | 0.110 |
| b | 0.35 | 0.48 | 0.0138 | 0.0189 |
| b1 | 0.45 | 0.6 | 0.0178 | 0.024 |
| c | 0.25 | 0.35 | 0.0098 | 0.0138 |
| D | 4.0 | 4.4 | 0.157 | 0.173 |
| E | 3.8 | 4.4 | 0.150 | 0.173 |
| e | 1.25 NOM | | 0.049 NOM | |
| Q | 0.8 | 1.1 | 0.031 | 0.043 |
| L | 12.0 | 14.0 | 0.472 | 0.551 |
| L1 | 1.1 | 1.3 | 0.043 | 0.051 |

**Note:** Controlling dimensions are in millimeters. Approximate dimensions are provided in inches

# 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-MRCO-006 |
| KMY 20 M | full bridge | SOT-223 | YES | G-MRCO-001 |
| KMY 21 M | half bridge | SOT-223 | YES | G-MRCO-011 |
| KMZ 20 S | full bridge | E-Line | NO | G-MRCO-007 |
| KMZ 20 M | full bridge | E-Line | YES | G-MRCO-003 |

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