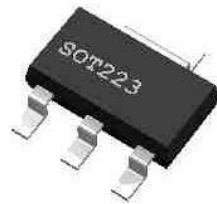


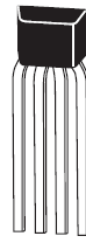
# KMY/KMZ Linear Magnetic Field Sensors



KMY22



KMY20

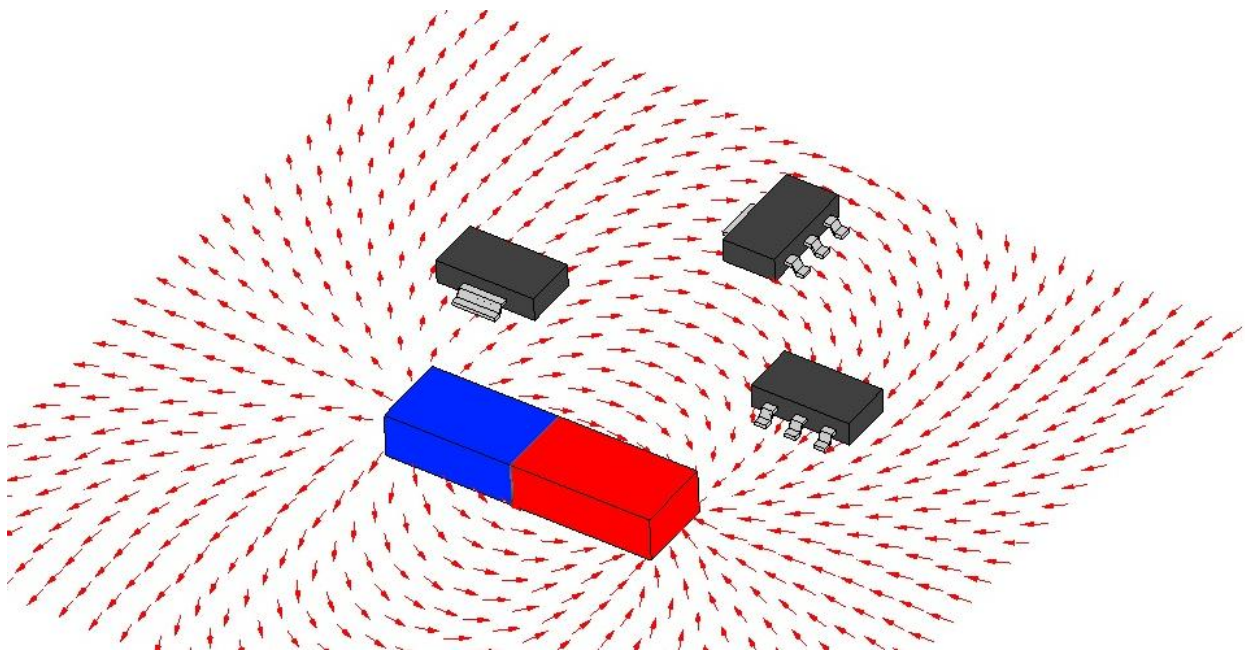


KMZ20

- AMR sensor
- Very high sensitivity
- Almost no hysteresis
- Various applications
- Available with internal magnet
- Available in several packages

## 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, and position measurement.



An uniaxial linear magnetic field will generate a linear output within the specified magnetic field range.

## 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 ferromagnetic gears
- Contactless switch
- Contactless displacement / position sensor

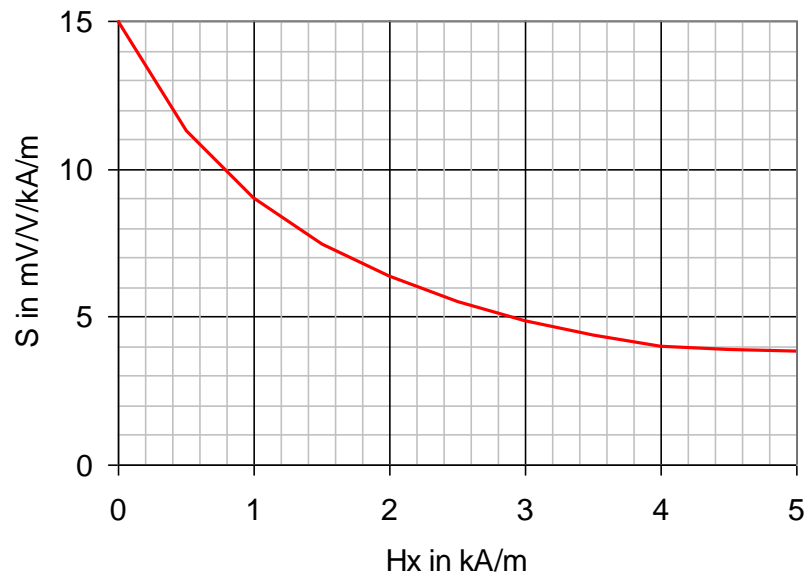
# KMY/KMZ Linear Magnetic Field Sensors

## DESCRIPTION

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 **KMY 20 M**, **KMY 21 M** and **KMZ 20 M** sensor types contain intrinsic magnets which provide an auxiliary magnetic field (in x-direction) at the sensor die which prevents magnetic domains from flipping irregularly.

### Auxiliary Field Dependence

If the dies **MR174B** or the components **KMY22**, **KMY20S** or **KMZ20S** 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 aside.



**Figure 1:** Sensitivity dependence on auxiliary field strength

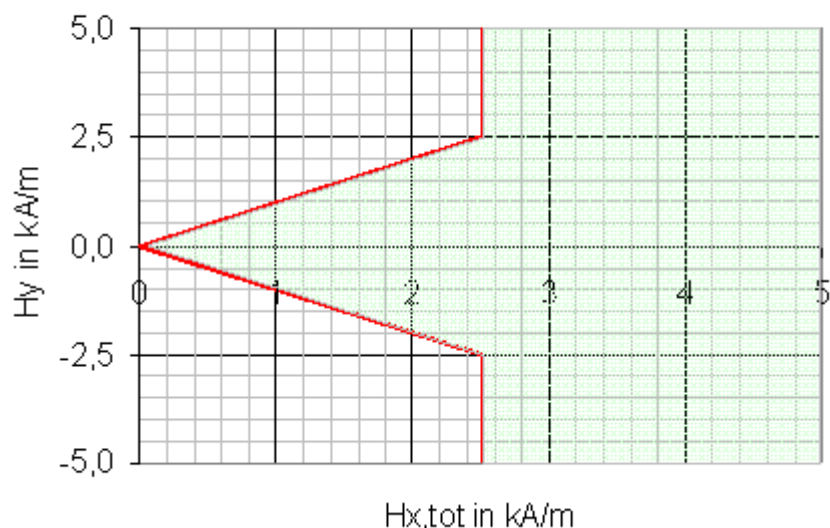
Auxiliary field strengths below  $H_x < 1.5$  kA/m are not recommended, as small disturbances may flip the magnetization domains. Sometimes, the magnetic conditions in the application may provide enough  $H_x$  bias field stabilization. MEAS Germany can provide advise for customer specific magnet arrangements.

If a bias field  $H_x$  is not applied or  $H_x$  is less than 2.5 kA/m, the sensor may be used only in a limited field range  $H_y$ , depending on the present total bias field  $H_{x,tot}$ . In this case, it is strongly recommended to 'premagnetize' the sensor, i.e. align all magnetic domains consistently, prior to the measurement.

$H_{x,tot}$  is the sum of all acting magnetic fields in x direction at the sensor die.

**Do not use the sensor outside the safe operating area.** Leaving the safe operating area can destroy an existing premagnetization and therefore will lead to unreproducible sensor signals.

### Safe Operating Area



**Figure 2:** Safe operating area

# KMY/KMZ Linear Magnetic Field Sensors

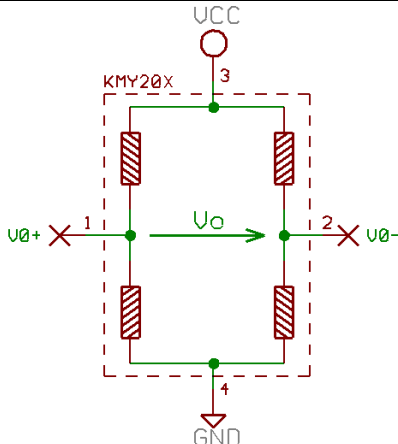
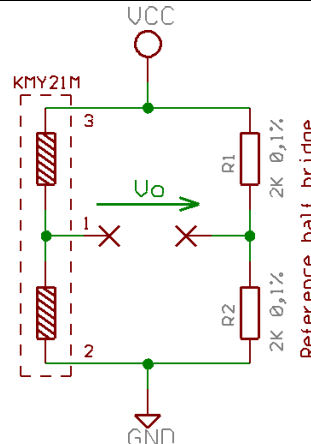
## CHARACTERISTIC VALUES / SENSOR SPECIFICATIONS

Parameter	Symbol	Condition	Min	Typ	Max	Unit
<b>Operating Limits</b>						
max. supply voltage	$V_{cc,max}$				<b>10</b>	V
max. current	$I_{cc,max}$				<b>9</b>	mA
operating temperature	$T_{op}$		<b>-40</b>		<b>+150</b>	°C
storage temperature	$T_{st}$		<b>-40</b>		<b>+150</b>	°C
<b>General Sensor Specifications</b>						
TC of amplitude	TCSV	Condition A, C	<b>-0.36</b>	<b>-0.32</b>	<b>-0.28</b>	%/K
TC of resistance	TCBR	Condition A, C	<b>+0.27</b>	<b>+0.32</b>	<b>+0.37</b>	%/K
TC of offset	TCVoff	Condition A, C	<b>-4</b>	<b>0</b>	<b>+4</b>	µV/V/K
<b>Sensor Specifications KMY 20 S, KMZ 20 S (T=25 °C, Hx=3 kA/m externally)</b>						
Supply voltage	$V_{cc}$	Condition A, B		<b>5</b>		V
Bridge resistance	$R_b$	Condition A, B	<b>1200</b>	<b>1700</b>	<b>2200</b>	Ω
Output signal range	$\Delta V_0/V_{cc}$	Condition A, B	<b>16</b>	<b>20</b>	<b>24</b>	mV/V
Offset voltage	$V_{off}/V_{cc}$	Condition A, B	<b>-1</b>	<b>0</b>	<b>+1</b>	mV/V
Sensitivity	S	Condition A, B	<b>3.7</b>	<b>4.7</b>	<b>5.7</b>	mV/V/kA/m
Hysteresis	$V_H/V_{cc}$	Condition A, B	-	-	<b>50</b>	µV/V
<b>Sensor Specifications KMY 20 M, KMZ 20 M (T=25 °C, Hx=1.5±0.5 kA/m internally)</b>						
Supply voltage	$V_{cc}$	Condition A, B		<b>5</b>		V
Bridge resistance	$R_b$	Condition A, B	<b>1200</b>	<b>1700</b>	<b>2200</b>	Ω
Output signal range	$\Delta V_0/V_{cc}$	Condition A, B	<b>16</b>	<b>20</b>	<b>24</b>	mV/V
Offset voltage	$V_{off}/V_{cc}$	Condition A, B	<b>-1.5</b>	<b>0</b>	<b>+1.5</b>	mV/V
Sensitivity	S	Condition A, B	<b>4</b>	<b>5.5</b>	<b>7</b>	mV/V/kA/m
Hysteresis	$V_H/V_{cc}$	Condition A, B	-	-	<b>50</b>	µV/V
<b>Sensor Specifications KMY 21 M (T=25 °C, Hx=2.5±1.0 kA/m internally)</b>						
Supply voltage	$V_{cc}$	Condition A, B		<b>5</b>		V
Bridge resistance	$R_b$	Condition A, B	<b>1100</b>	<b>1500</b>	<b>1900</b>	Ω
Output signal range	$\Delta V_0/V_{cc}$	Condition A, B	<b>8</b>	<b>9.5</b>	<b>12</b>	mV/V
Offset voltage	$V_{off}/V_{cc}$	Condition A, B	<b>48</b>	<b>50</b>	<b>52</b>	%Vcc
Sensitivity	S	Condition A, B	<b>2.05</b>	<b>2.50</b>	<b>3.10</b>	mV/V/kA/m
Hysteresis	$V_H/V_{cc}$	Condition A, B	-	-	<b>50</b>	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.

# KMY/KMZ Linear Magnetic Field Sensors

## MEASUREMENT CONDITIONS

Parameter	Symbol	Unit	Condition
Condition A: Set Up Conditions			
Ambient temperature	T	°C	23±5 Measurement results are extrapolated to 25°C by using the given temperature coefficients
Supply voltage	V <sub>cc</sub>	V	5
Output voltage	V <sub>O</sub> V <sub>O</sub> /V <sub>cc</sub>	mV mV/V	V <sub>O</sub> =(V <sub>O+</sub> -V <sub>O-</sub> ) 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> ; measure MR half bridge against reference half bridge
Reference half bridge			2* 2 kΩ 0.1% (KMY21M only)
for full bridge sensors (KMY20S, KMY20M, KMY22, KMZ20S, KMZ20M)			for half bridge sensors (KMY 21 M)
			
			The output voltage of the MR half bridge is measured against a reference half bridge
Condition B: Sensor Specifications (T=25 °C, S-Type: H <sub>x</sub> =3.0±0.5 kA/m)			
Output voltage range	ΔV <sub>O</sub> /V <sub>cc</sub>	mV/V	H <sub>y</sub> = -7 ... +7 kA/ m; ΔV <sub>O</sub> = (V <sub>O,max</sub> - V <sub>O,min</sub> )
Offset voltage	V <sub>off</sub> /V <sub>cc</sub>	mV/V	H <sub>y</sub> = 0; V <sub>off</sub> = V <sub>O</sub> (H <sub>y</sub> )
Sensitivity	S	(mV/V)/(kA/m)	H <sub>y</sub> = 1kA/ m; S := $\frac{V_0(+H_y) - V_0(-H_y)}{2 \cdot V_{cc}}$
Hysteresis	V <sub>H</sub> /V <sub>cc</sub>	μV/V	Hy in kA/m (V <sub>0</sub> (H <sub>y</sub> = 0; H <sub>y</sub> = -1 → +1) - V <sub>0</sub> (H <sub>y</sub> = 0; H <sub>y</sub> = +1 → -1))/V <sub>cc</sub>

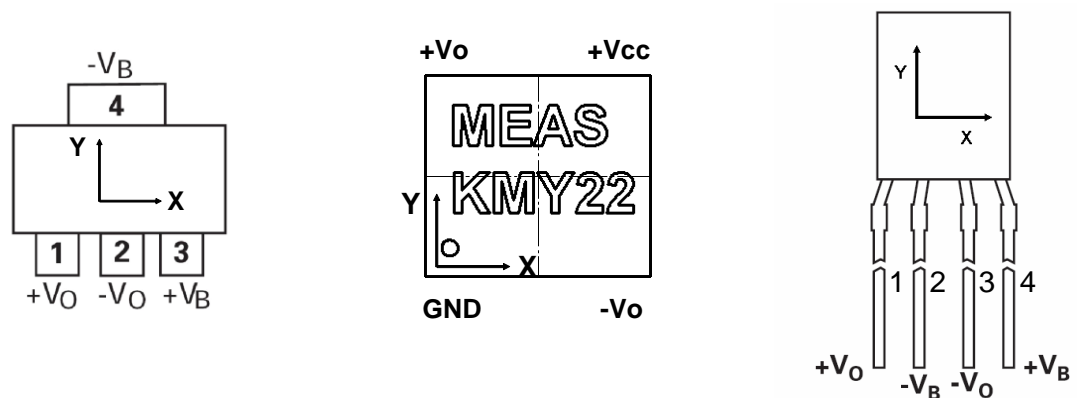
# KMY/KMZ Linear Magnetic Field Sensors

Condition C: Sensor Specifications (reference temperatures T=-25°C, +125°C)			
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	$TCV_{off} = \frac{V_{off}(T_2) - V_{off}(T_1)}{(T_2 - T_1)}$

## SENSOR MODELS

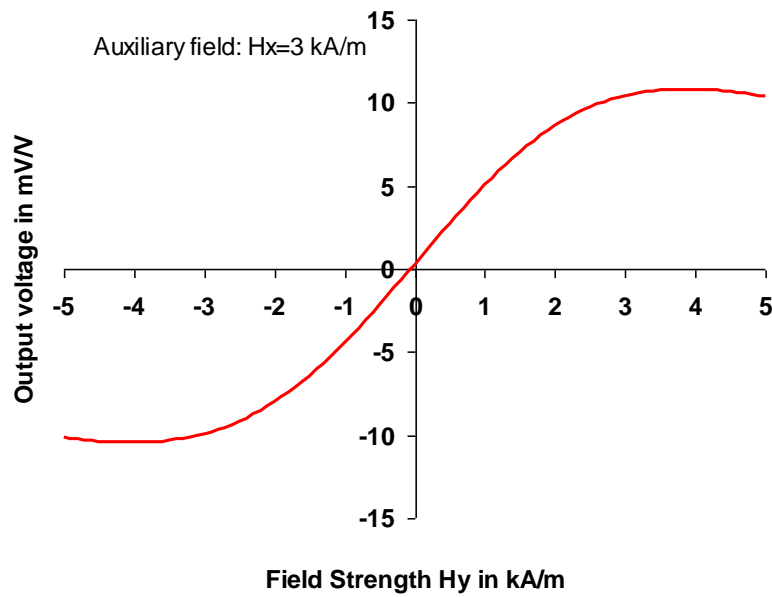
### KMY 20 / KMY 22 / KMZ 20

The KMY and KMZ sensors are highly sensitive magnetic field sensors which utilize the anisotropic magneto resistance effect. The KMY 20 and KMZ 20 sensors contain a Wheatstone bridge.



**Figure 3:** Pad annotation and definition of field direction for KMY & KMZ

## KMY/KMZ Linear Magnetic Field Sensors

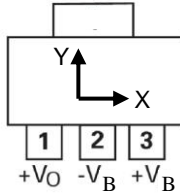


**Figure 4:** Characteristic output curve of KMY 20 S resp. KMZ 20 S for an auxiliary field strength of  $H_x = 3 \text{ kA/m}$

# KMY/KMZ Linear Magnetic Field Sensors

## KMY 21

In contrast to the KMY20 sensor products, the **KMY 21 M** 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.

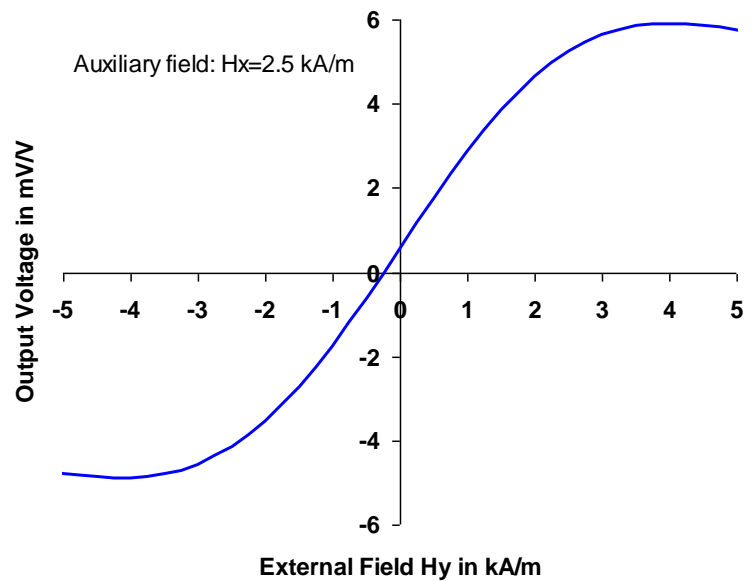


Figure 5: Characteristic curve for KMY21M

## TEMPERATURE DEPENDENCIES

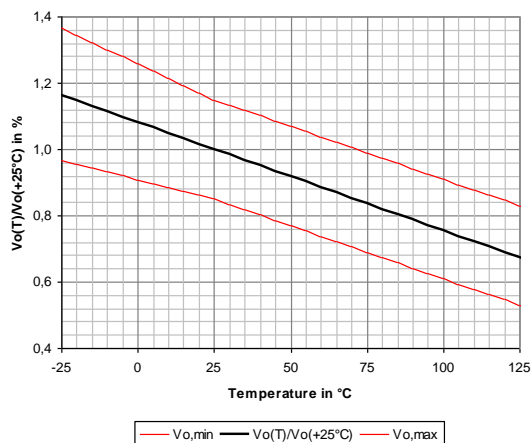


Figure 6: signal amplitude related to room temperature value

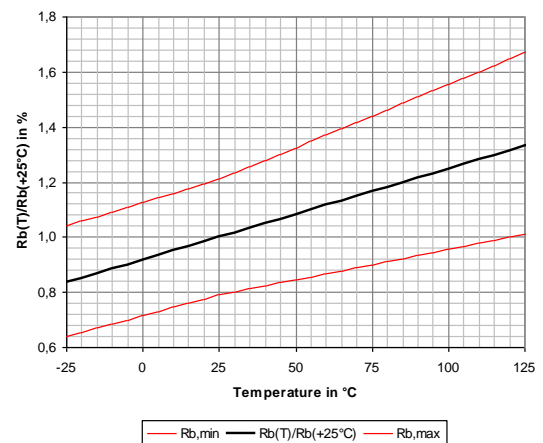
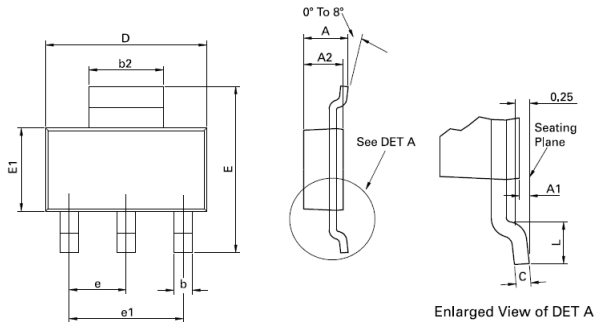


Figure 7: bridge resistance related to room temperature value

# KMY/KMZ Linear Magnetic Field Sensors

## PACKAGES

### SOT223

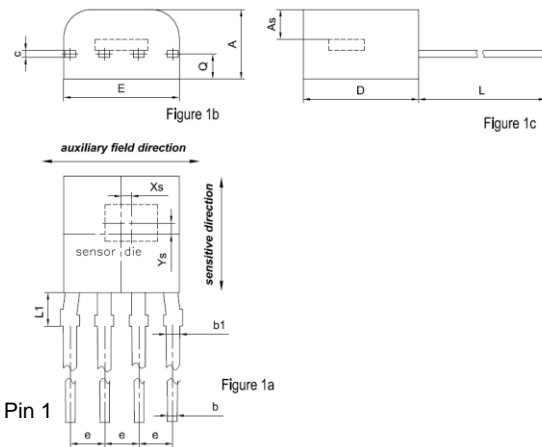


Recommended solder reflow process for all packages according to IPC/JEDEC J-STD-020D (Pb-Free Process)

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

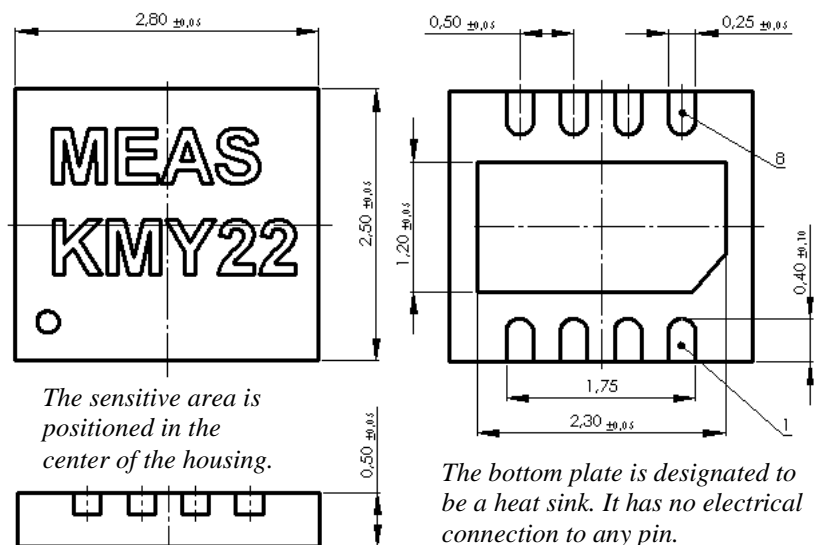


DIE POS.	Millimeter			Inches		
	KMZ20S	KMZ20M	tolerances	KMZ20S	KMZ20M	tolerances
Xs	+0.05	+0.05	+/-0.10	+0.002	+0.002	+/-0.004
Ys	+0.50	+0.50	+/-0.10	+0.02	+0.02	+/- 0.004
As	1.05	1.05	+/-0.10	0.041	0.041	+/-0.004

DIM	Millimeter			Inches		
	min.	typ.	max.	min.	typ.	max.
A	2.4		2.8	0.094		0.110
b	0.35		0.48	0.0138		0.0189
b1	0.45		0.60	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
L	12.0		14.0	0.472		0.551
e	NOM. 1.25			NOM. 0.049		
L1	1.1		1.3	0.043		0.051

### UTDFN8 2.5X2.8 MM



### DIE

Die layout and dimensions on request.



# KMY/KMZ Linear Magnetic Field Sensors

## ORDERING CODE

DEVICE	DIE	PACKAGE	INTERNAL MAGNET	PART NUMBER
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
KMY 22	full bridge	UTDFN8	NO	on request

## ORDERING INFORMATION

NORTH AMERICA	EUROPE	ASIA
Measurement Specialties, Inc. 1000 Lucas Way Hampton, VA 23666 United States Phone: +1-800-745-8008 Fax: +1-757-766-4297 Email: <a href="mailto:sales@meas-spec.com">sales@meas-spec.com</a> Web: <a href="http://www.meas-spec.com">www.meas-spec.com</a>	MEAS Deutschland GmbH Hauert 13 D-44227 Dortmund Germany Phone: +49-(0)231-9740-0 Fax: +49-(0)231-9740-20 Email: <a href="mailto:info.de@meas-spec.com">info.de@meas-spec.com</a> Web: <a href="http://www.meas-spec.com">www.meas-spec.com</a>	Measurement Specialties China Ltd. No. 26, Langshan Road High-tech Park (North) Nanshan District, Shenzhen 518057 China Phone: +86-755-33305088 Fax: +86-755-33305099 Email: <a href="mailto:info.cn@meas-spec.com">info.cn@meas-spec.com</a> Web: <a href="http://www.meas-spec.com">www.meas-spec.com</a>

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