



KMY22



KMY20



KMZ20

## KMY\_KMZ

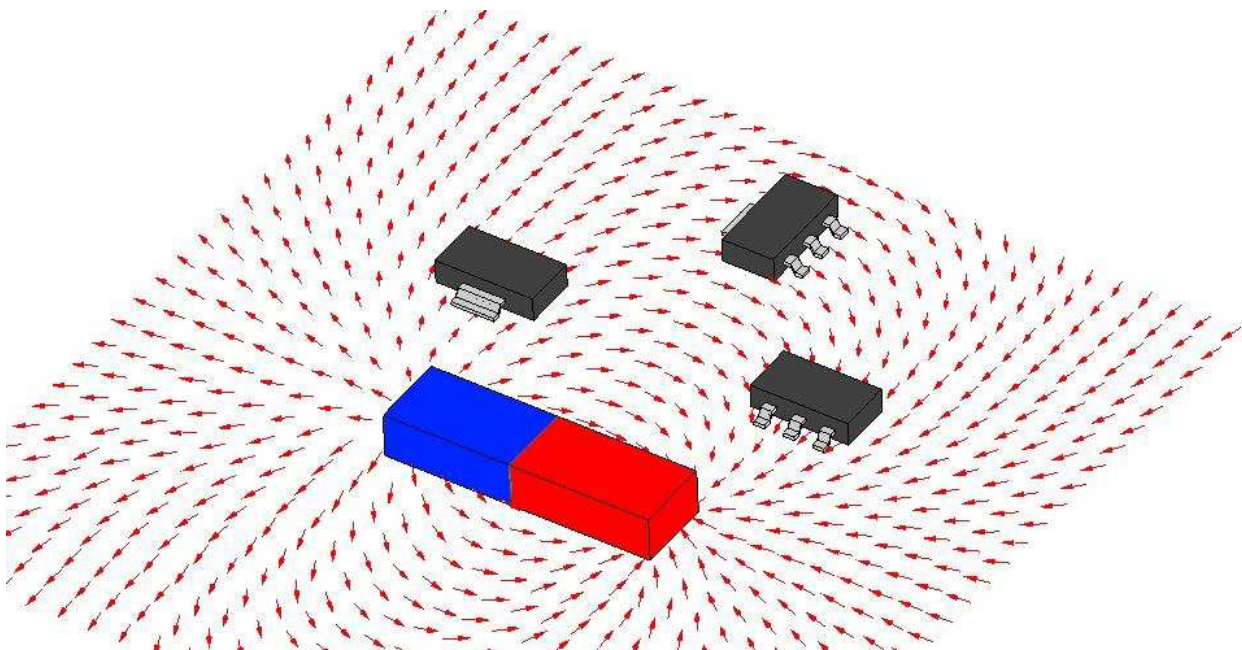
### Linear Magnetic Field Sensors

#### SPECIFICATIONS

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

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

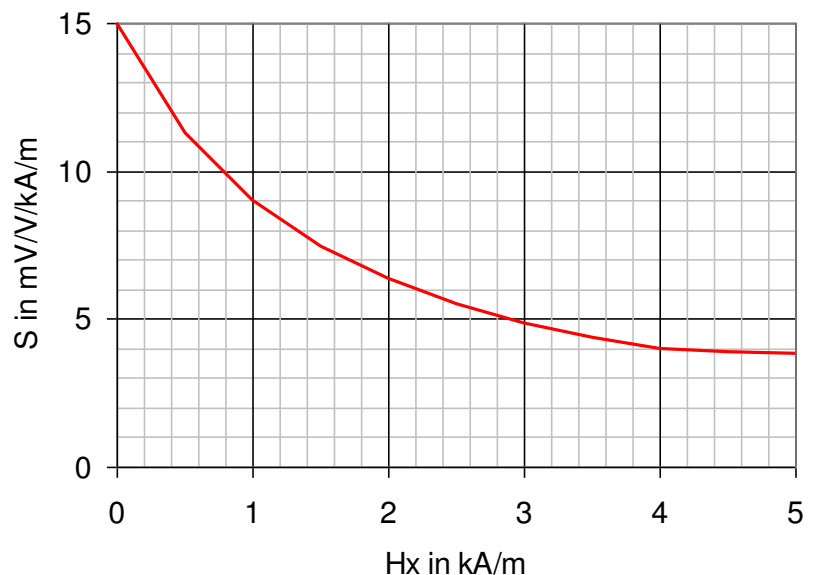
## DESCRIPTION

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.

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 Dependence



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 advice 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.

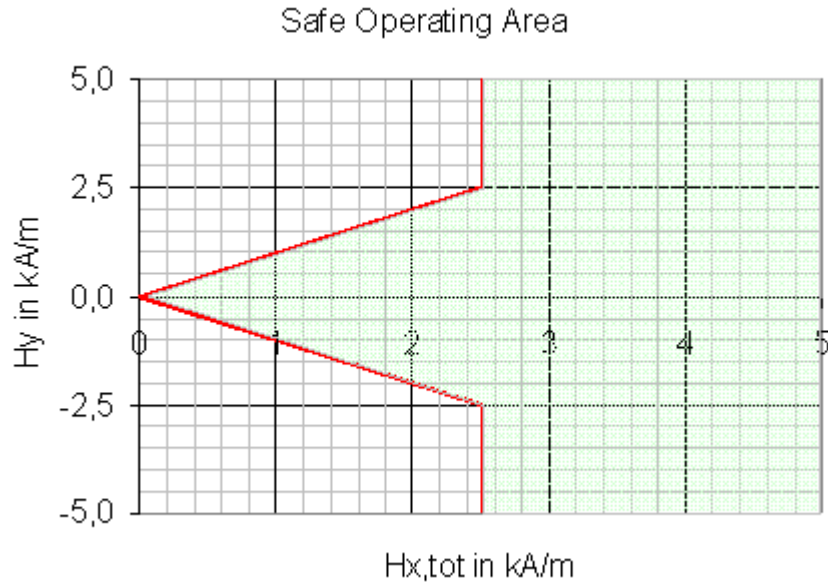


Figure 2: Safe operating area

CHARACTERISTIC VALUES / SENSOR SPECIFICATIONS

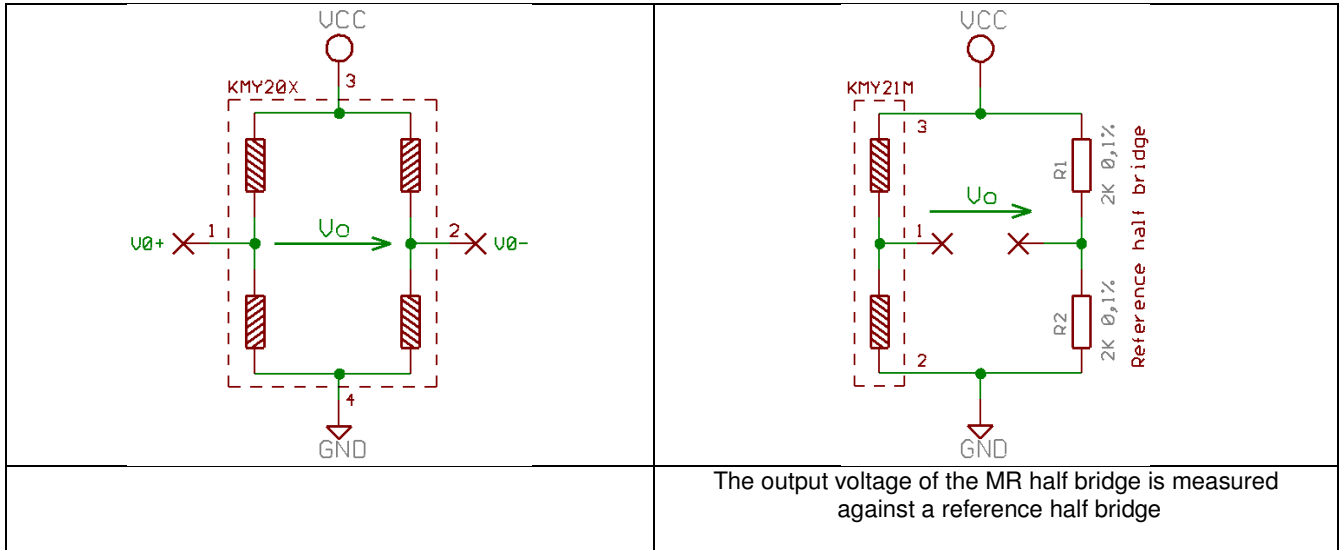
Parameter	Symbol	Condition	Min	Typ	Max	Unit
<b>Operating Limits</b>						
max. supply voltage	$V_{cc,max}$				10	V
max. current	$I_{cc,max}$				9	mA
operating temperature	$T_{op}$		-40		+150	°C
storage temperature	$T_{st}$		-40		+150	°C
<b>General Sensor Specifications</b>						
TC of amplitude	TCSV	Condition A, C		-0.35		%/K
TC of resistance	TCBR	Condition A, C		+0.35		%/K
TC of offset	TCVoff	Condition A, C	-4	0	+4	$\mu$ V/V/K
<b>Sensor Specifications KMY 20 S, KMZ 20 S, KMY 22 (T=25 °C, Hx=3 kA/m externally)</b>						
Supply voltage	$V_{cc}$	Condition A, B		5		V
Bridge resistance	$R_b$	Condition A, B	1200	1700	2200	$\Omega$
Output signal range	$\Delta V_0/V_{cc}$	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	-	-	<b>50</b>	$\mu V/V$
<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>	$\Omega$
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>	$\mu V/V$
<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>	$\Omega$
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>	$\mu V/V$

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.

### MEASUREMENT CONDITIONS

Parameter	Symbol	Unit	Condition
<b>Condition A: Set Up Conditions</b>			
Ambient temperature	T	°C	23±5 Measurement results are extrapolated to 25°C by using the given temperature coefficients
Supply voltage	$V_{CC}$	V	5
Output voltage	$V_O$ $V_O/V_{CC}$	mV mV/V	$V_O=(V_{0+} - V_{0-})$ Output voltages are also given independently on supply voltage: example: $V_O/V_{CC}=(V_{0+} - V_{0-})/V_{CC}$ ; measure MR half bridge against reference half bridge
Reference half bridge			2* 2 k $\Omega$ 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: Hx=3.0±0.5 kA/m)**

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	$V_{off}/V_{cc}$	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	$V_H/V_{cc}$	$\mu\text{V/V}$	$H_y$ in kA/m $(V_o(H_y = 0; H_y = -1 \rightarrow +1) - V_o(H_y = 0; H_y = +1 \rightarrow -1))/V_{cc}$

**Condition C: Sensor Specifications (reference temperatures T=-25°C, +125°C)**

Ambient temperatures	T	°C	$T_1=-25 \text{ °C}, T_0=+25 \text{ °C}, T_2=+125 \text{ °C}$
TC of amplitude	TCSV	%/K	$TCV = \frac{1}{(T_2 - T_1)} \cdot \frac{\Delta V_o / V_{cc}(T_2) - \Delta V_o / V_{cc}(T_1)}{\Delta V_o / V_{cc}(T_1)} \cdot 100\%$
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	( $\mu\text{V/V}$ )/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.

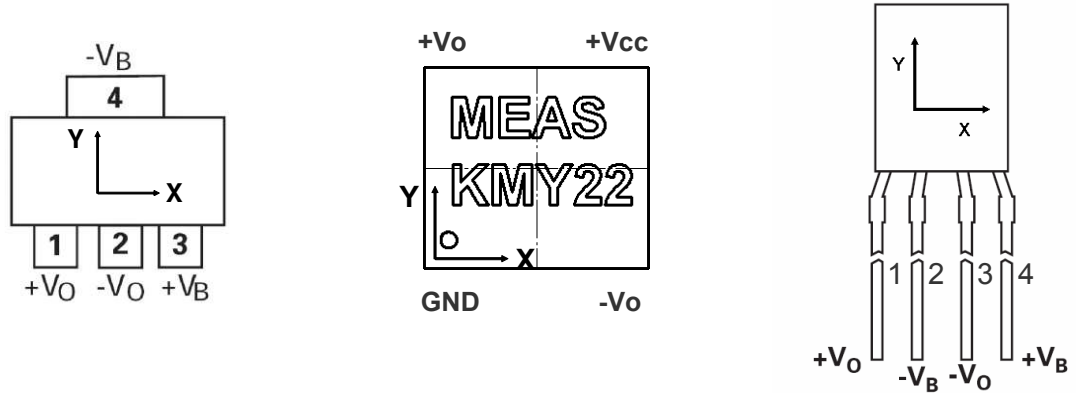


Figure 3: Pad annotation and definition of field direction for KMY & KMZ

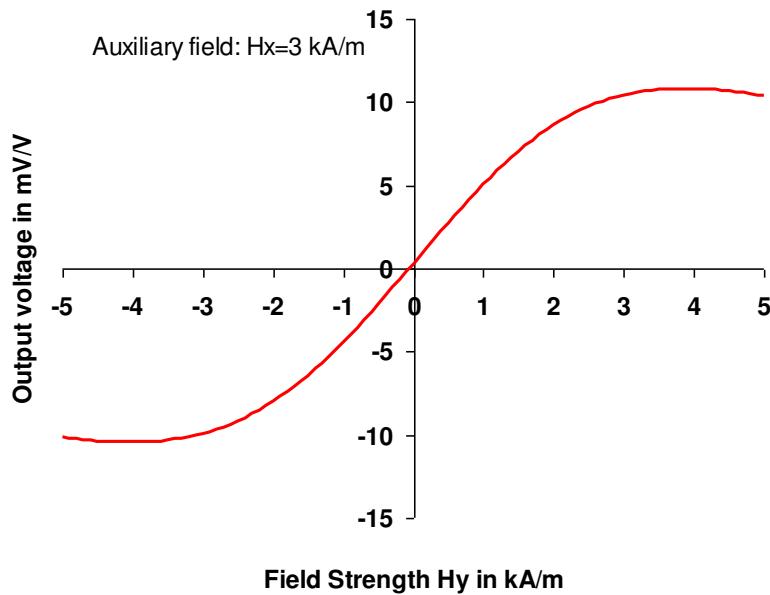
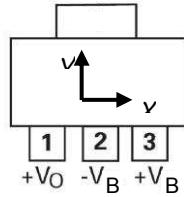


Figure 4: Characteristic output curve of KMY 20 S / KMY 22 / KMZ 20 S for an auxiliary field strength of  $H_x=3$  kA/m

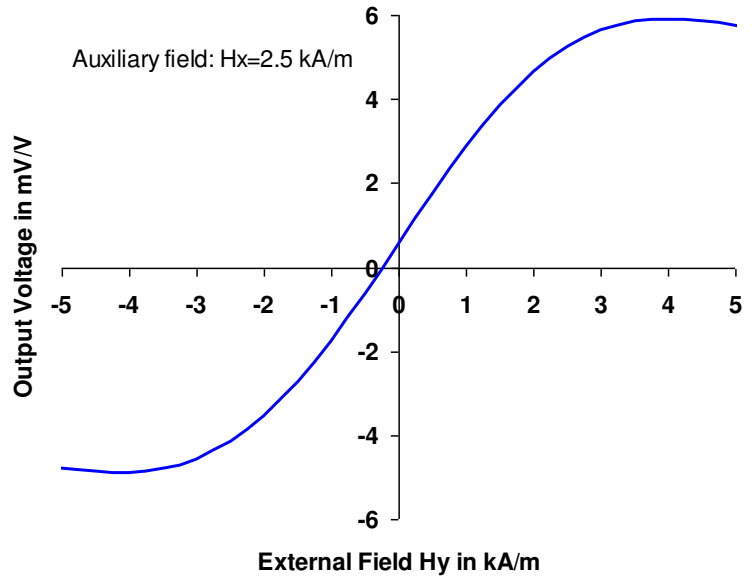
**KMY 21**

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**

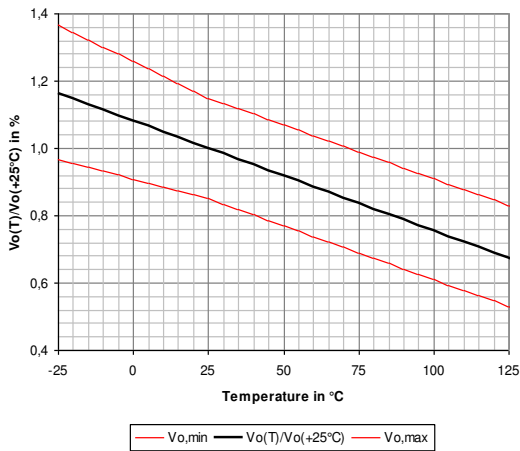


Figure 6: signal amplitude related to room temperature value

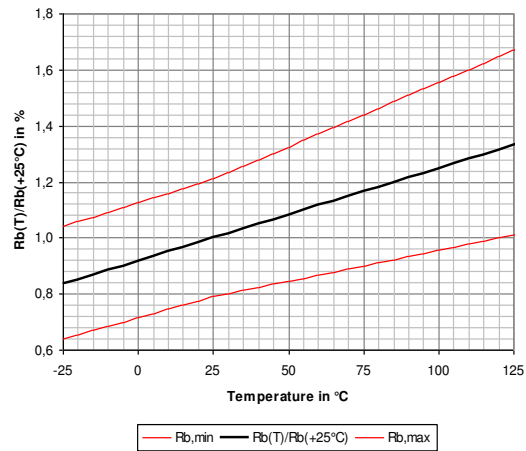
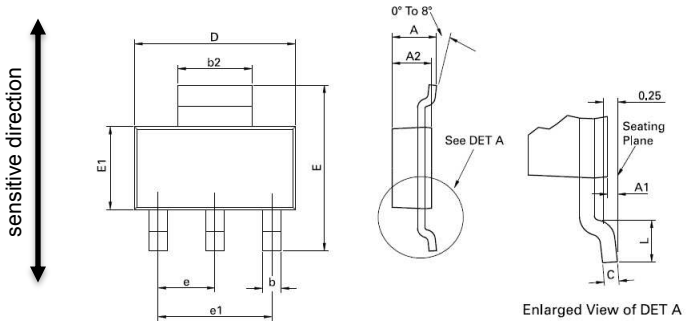


Figure 7: bridge resistance related to room temperature value

PACKAGES

SOT223

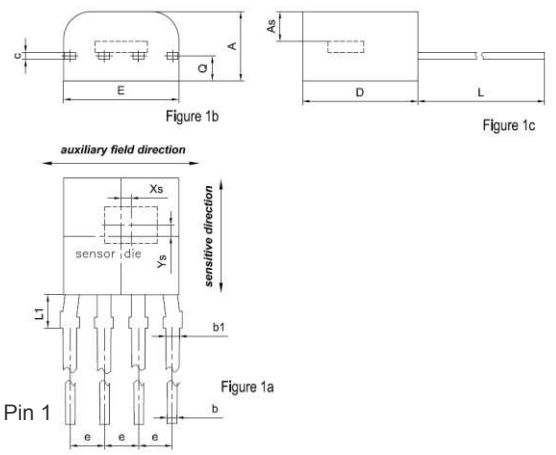
Recommended solder reflow process for all packages according to IPC/JEDEC J-STD-020D (Pb-Free Process)



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

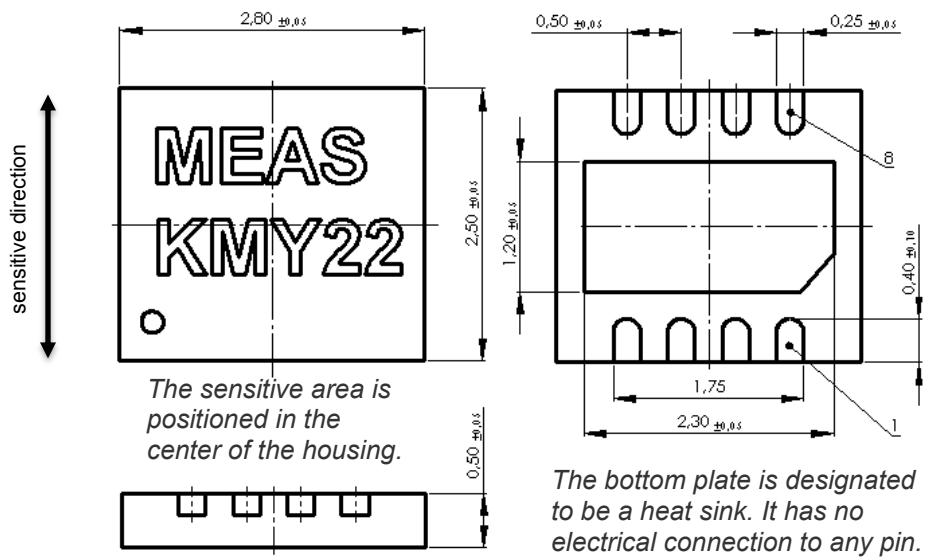
E-LINE 4 PIN



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





**ORDERING CODE**

<b>DEVICE</b>	<b>DIE</b>	<b>PACKAGE</b>	<b>INTERNAL MAGNET</b>	<b>PART NUMBER</b>
<b>KMY20 S</b>	full bridge	SOT-223	NO	<b>G-MRCO-006</b>
<b>KMY20 M</b>	full bridge	SOT-223	YES	<b>G-MRCO-001</b>
<b>KMY21 M</b>	half bridge	SOT-223	YES	<b>G-MRCO-011</b>
<b>KMZ20 S</b>	full bridge	E-Line	NO	<b>G-MRCO-007</b>
<b>KMZ20 M</b>	full bridge	E-Line	YES	<b>G-MRCO-003</b>
<b>KMY22</b>	full bridge	UTDFN8	NO	<i>on request</i>

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