



KMY22



KMY20



KMZ20

KMY_KMZ

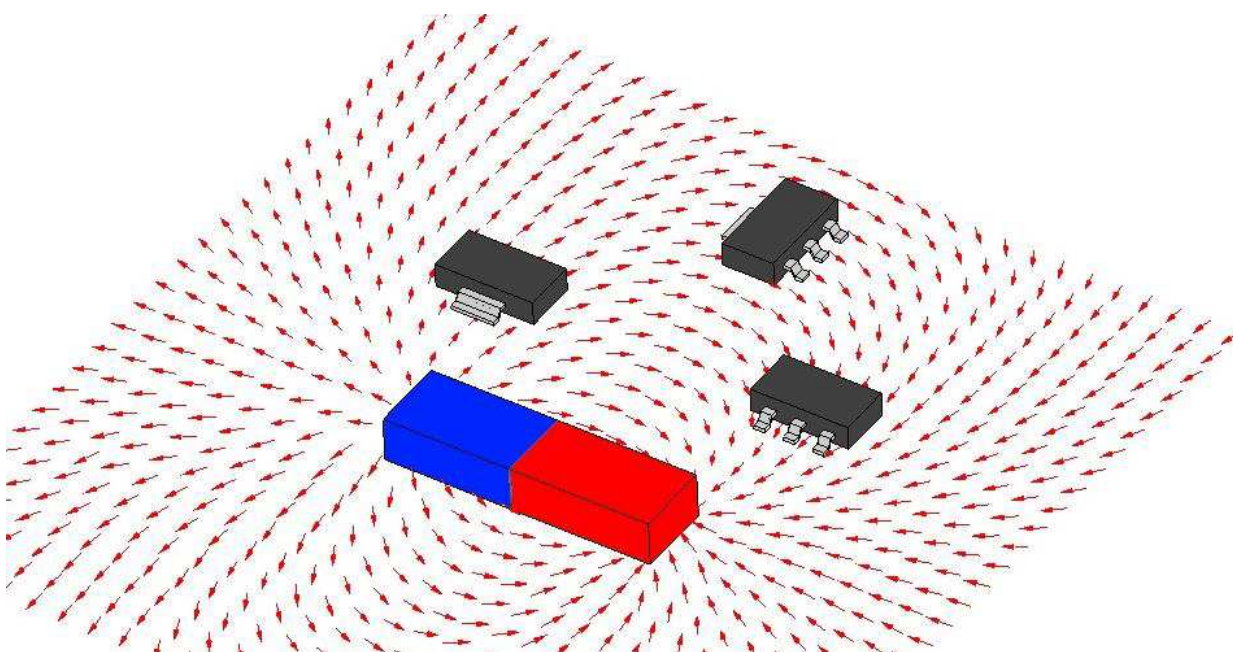
Linear Magnetic Field Sensors

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

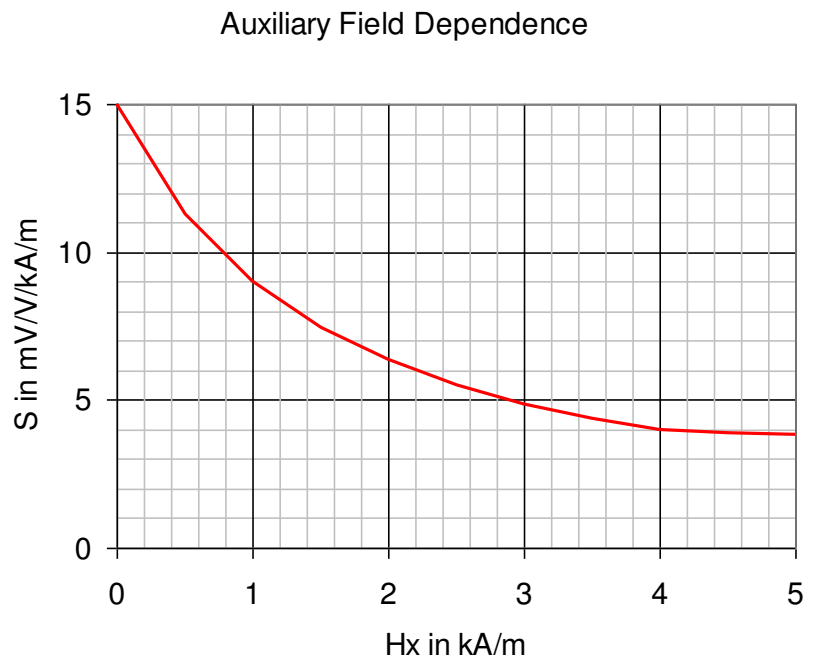
- ✦ Detection of very weak magnetic fields, like earth magnetic field, or field generated by small magnetic particles
- ✦ Detection of objects that distort non-local magnetic fields
- ✦ Revolution measurement on ferromagnetic gears
- ✦ Contactless switch
- ✦ Contactless displacement / position sensor

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 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.

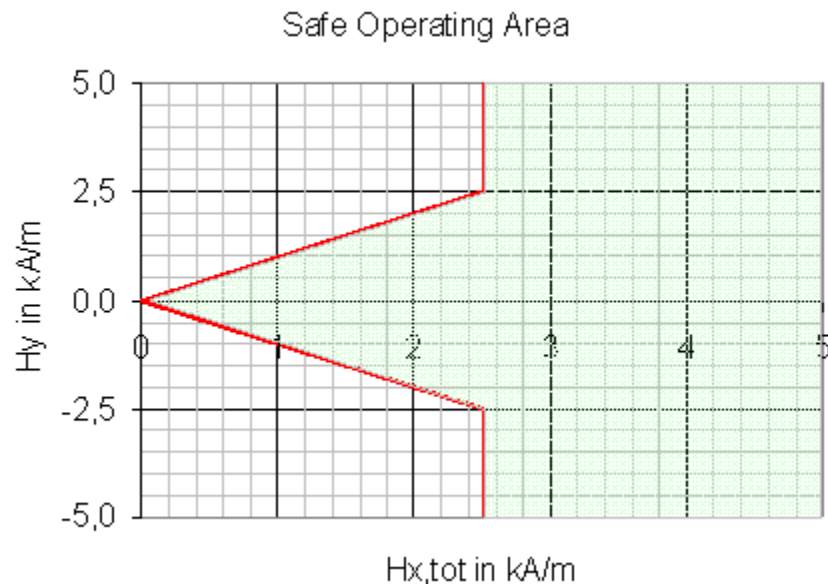


Figure 2: Safe operating area

CHARACTERISTIC VALUES / SENSOR SPECIFICATIONS

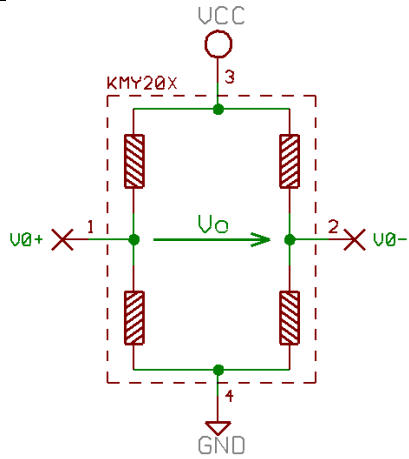
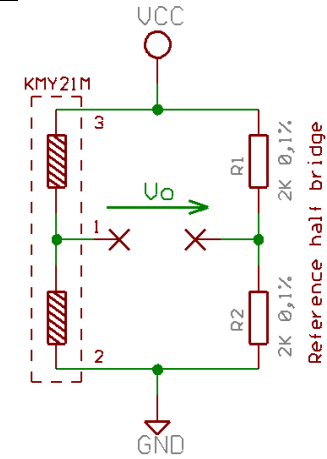
| Parameter | Symbol | Condition | Min | Typ | Max | Unit |
|--|------------------|----------------|------|-------|------|-------------|
| Operating Limits | | | | | | |
| max. supply voltage | $V_{cc,max}$ | | | | 10 | V |
| max. current | $I_{cc,max}$ | | | | 9 | mA |
| operating temperature | T_{op} | | -40 | | +150 | °C |
| storage temperature | T_{st} | | -40 | | +150 | °C |
| General Sensor Specifications | | | | | | |
| 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 | $\mu V/V/K$ |
| Sensor Specifications KMY 20 S, KMZ 20 S, KMY 22 ($T=25$ °C, $H_x=3$ kA/m externally) | | | | | | |
| Supply voltage | V_{cc} | Condition A, B | | 5 | | V |
| Bridge resistance | R_b | Condition A, B | 1200 | 1700 | 2200 | Ω |
| Output signal range | $\pm V_o/V_{cc}$ | 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 KMY 20 M, KMZ 20 M (T=25 °C, Hx=1.5±0.5 kA/m internally) | | | | | | |
|--|------------------|----------------|------|------|------|-----------|
| Supply voltage | V_{cc} | Condition A, B | | 5 | | V |
| Bridge resistance | R_b | Condition A, B | 1200 | 1700 | 2200 | Ω |
| Output signal range | $\pm V_o/V_{cc}$ | Condition A, B | 16 | 20 | 24 | mV/V |
| Offset voltage | V_{off}/V_{cc} | Condition A, B | -1.5 | 0 | +1.5 | mV/V |
| Sensitivity | S | Condition A, B | 4 | 5.5 | 7 | mV/V/kA/m |
| Hysteresis | V_H/V_{cc} | Condition A, B | - | - | 50 | μV/V |
| Sensor Specifications KMY 21 M (T=25 °C, Hx=2.5±1.0 kA/m internally) | | | | | | |
| Supply voltage | V_{cc} | Condition A, B | | 5 | | V |
| Bridge resistance | R_b | Condition A, B | 1100 | 1500 | 1900 | Ω |
| Output signal range | $\pm V_o/V_{cc}$ | 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 | 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.

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_{cc} | V | 5 |
| Output voltage | V_o V_o/V_{cc} | mV mV/V | $V_o = (V_{o+} - V_{o-})$ Output voltages are also given independently on supply voltage: example: $V_o/V_{cc} = (V_{o+} - V_{o-})/V_{cc}$; measure MR half bridge against reference half bridge |
| Reference half bridge | | | 2* 2 k _Ω 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 | $\pm V_O/V_{CC}$ | mV/V | $H_y \bullet \dots kA/m; V_O \bullet V_{O,max} \bullet V_{O,min}$ |
| Offset voltage | V_{off}/V_{CC} | mV/V | $H_y \bullet 0; V_{off} \bullet V_O \bullet H_y$ |
| Sensitivity | S | (mV/V)/(kA/m) | $H_y \bullet 1kA/m; S \bullet \frac{V_0 \bullet H_y \bullet V_0 \bullet H_y}{2 \bullet V_{cc}}$ |
| Hysteresis | V_H/V_{CC} | μV/V | $H_y \text{ in kA/m}$ $(V_0(H_y \bullet 0; H_y \bullet 1) \bullet V_0(H_y \bullet 0; H_y \bullet 1)) / V_{cc}$ |
| Condition C: Sensor Specifications (reference temperatures T=-25°C, +125°C) | | | |
| Ambient temperatures | T | °C | $T_1=-25^\circ C, T_0=+25^\circ C, T_2=+125^\circ C$ |
| TC of amplitude | TCSV | %/K | $TCV \bullet \frac{1}{(T_2 \bullet T_1)} \bullet \frac{V_0/V_{cc}(T_2) \bullet V_0/V_{cc}(T_1)}{V_0/V_{cc}(T_1)} \bullet 100\%$ |
| TC of resistance | TGBR | %/K | $TCR \bullet \frac{1}{(T_2 \bullet T_1)} \bullet \frac{R(T_2) \bullet R(T_1)}{R(T_1)} \bullet 100\%$ |
| TC of offset | TCVoff | (μV/V)/K | $TCV_{off} \bullet \frac{V_{off}(T_2) \bullet V_{off}(T_1)}{(T_2 \bullet T_1)}$ |

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.

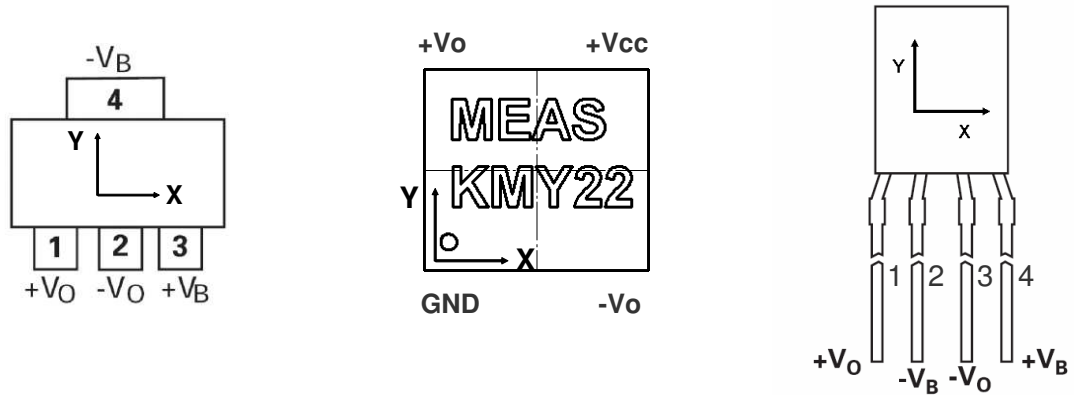


Figure 3: Pad annotation and definition of field direction for KMY & KMZ

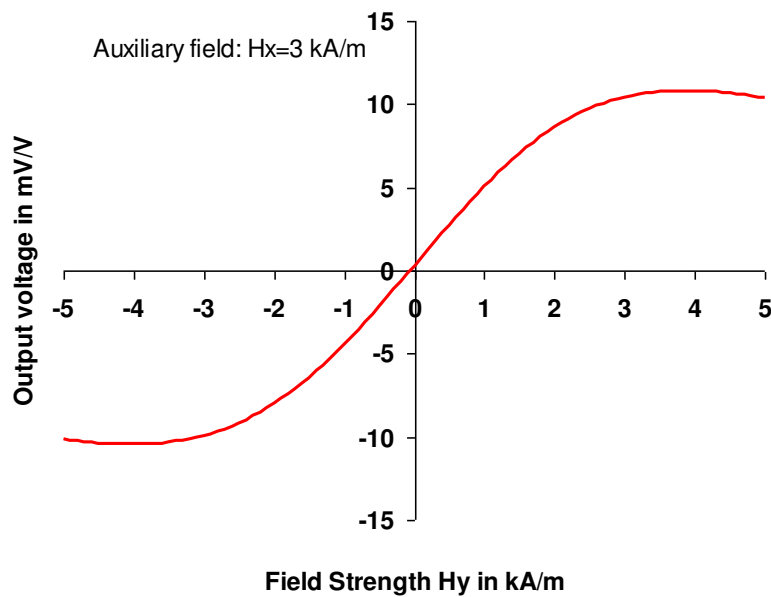
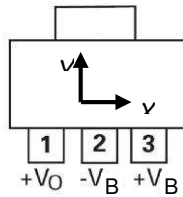


Figure 4: Characteristic output curve of KMY 20 S / KMY 22 / KMZ 20 S for an auxiliary field strength of $H_x=3$ kA/m

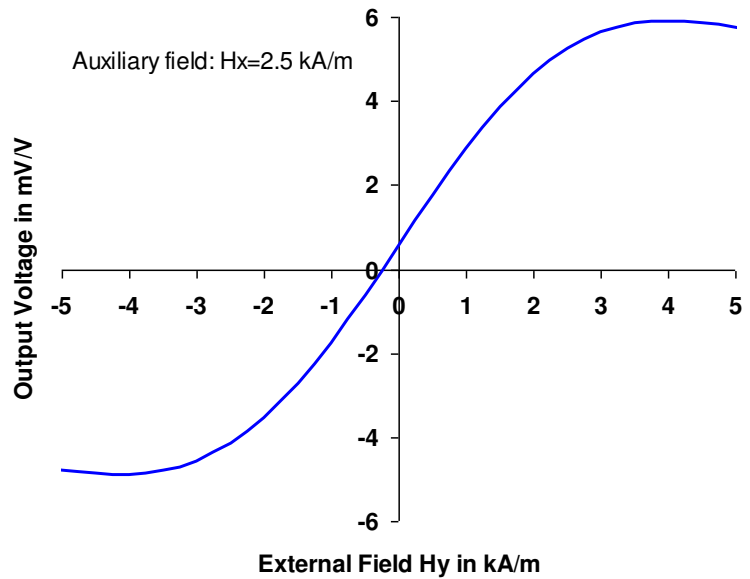
KMY 21

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

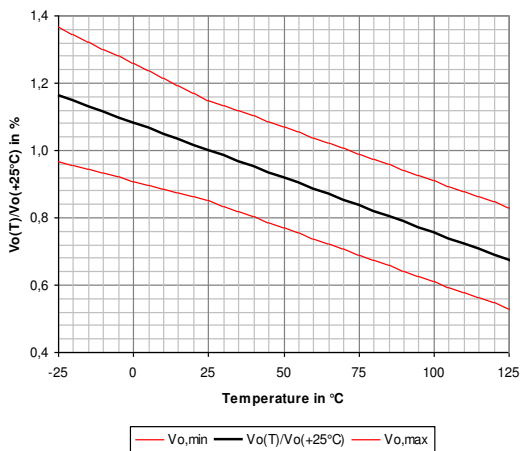


Figure 6: signal amplitude related to room temperature value

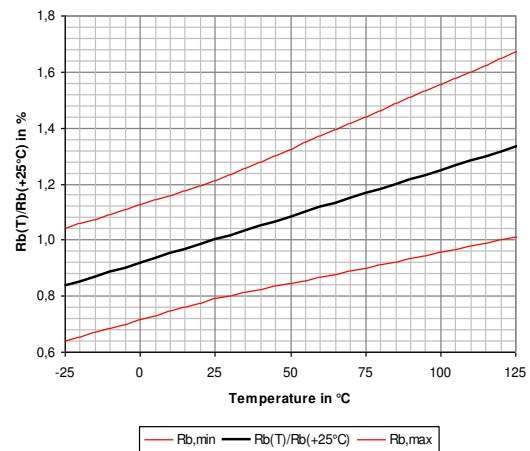
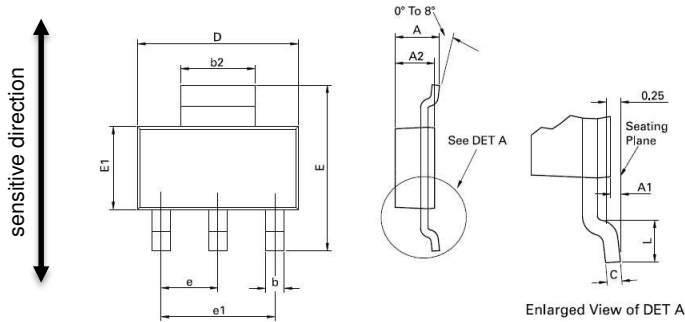


Figure 7: bridge resistance related to room temperature value

PACKAGES

SOT223

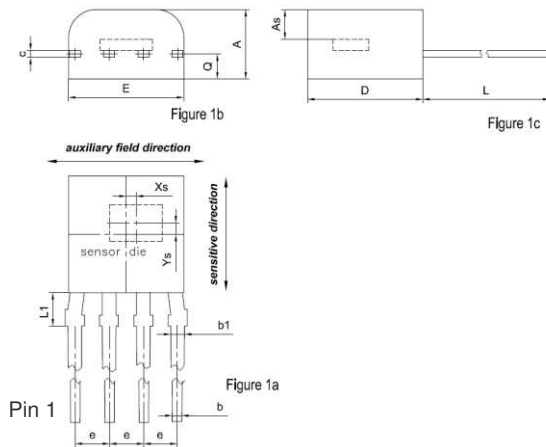
Recommended solder reflow process for all packages according to IPC/JEDEC J-STD-020D (Pb-Free Process)



| 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

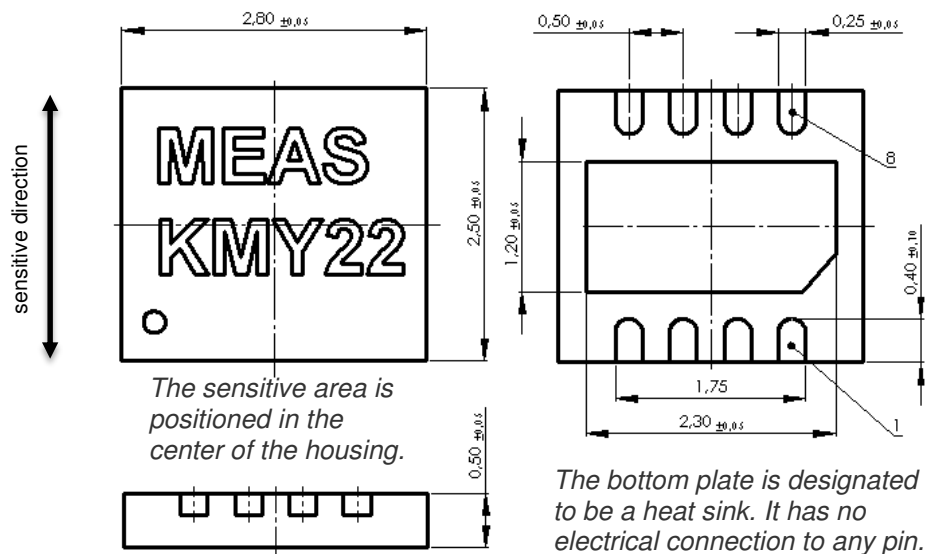
E-LINE 4 PIN



| 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

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

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