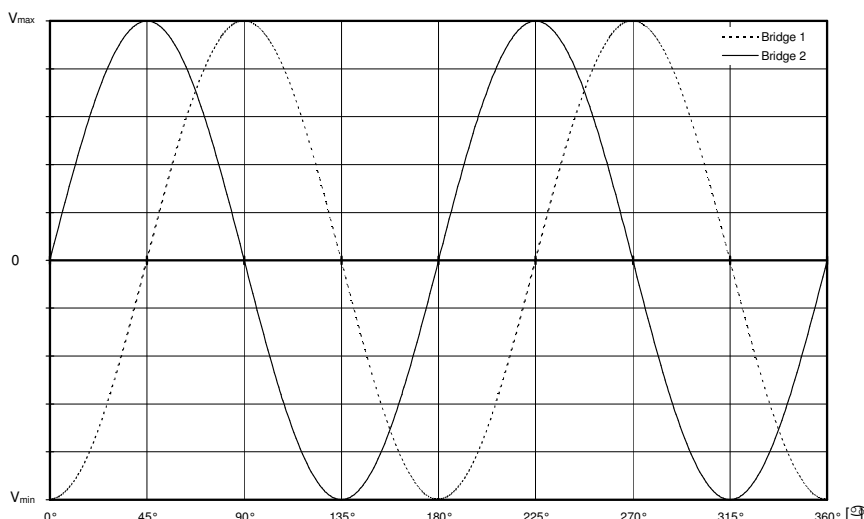


### Function principle

Magneto-resistive materials can change their resistivity in an external magnetic field. The variation of the resistivity is determined by the rotation of magnetisation with respect to the direction of the current flow. Permalloy ( $\text{Ni}_{81}\text{Fe}_{19}$ ) is commercially used as magneto-resistive material. The relative change of resistivity is 2-3 % for this material. The high sensitive and small size sensor consists of a silicon chip coated with thin film permalloy stripes. These stripes form a Wheatstone bridge whose output voltage depends on the magnetic field.

### Characteristic

Magnetic fields vertical to the chip surface have no influence on the output voltage. A strong magnetic field  $H_{\text{rot}} \geq 50 \text{ kA/m}$  parallel to the chip surface causes a sinusoidal output signal which is determined by the angle between field direction and orientation of the permalloy stripes of the Wheatstone bridge. The field  $H_{\text{rot}}$  is created by a permanent magnet which rotates over the sensor. The sensor output gives information about the direction of the magnet. The output characteristic of an additional galvanic separated Wheatstone bridge is  $45^\circ$  phase shifted compared with the other bridge.



**Output voltage of both Wheatstone bridges versus angle  $\alpha$  of the magnetic field direction**

### Application

The KMT 31 allows the contactless counting of the revolutions of a rotating magnet which is mounted on the axis of a wheel. Zero output voltages of the Wheatstone bridges are used as trigger signals. The sense of rotation of the wheel is taken into account by comparing the signal outputs of both Wheatstone bridges which are proportional to  $\sin 2(\alpha)$  or  $\sin 2(\alpha + 45^\circ)$ . The angle can be determined by evaluating these signals. Alternatively it is possible to use the voltage signals of four half bridges which are trimmed on  $V_b/2$ .

## Sensors in thin film technology

HL-Planartechnik GmbH

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### Technical data

Absolute maximum ratings			
Parameter	Symbol	Unit	Value
Supply voltage	$V_B$	V	5
Total power dissipation	$P_{to}$	mW	120
Operating temperature range	$T_{amb}$	°C	-40 ... +125
Storage temperature range	$T_{stg}$	°C	-65 ... +125
Sensor chip alignment error	$\alpha_e$	°	$\leq 2$

Electrical characteristics ( $T_{amb}=25^\circ\text{C}$ , $H_{rot} \geq 25\text{ kA/m}$ )					
Parameter	Symbol	Unit	Value	Condition	
				bridge 2	bridge 1
Bridge resistance	$R_B$	kOhm	$3 \pm 1.0$		
Offset voltage	$V_{OFF}/V_B$	mV/V	$\leq \pm 2.0$	$\alpha=0^\circ$	$\alpha=45^\circ$
Half bridge symmetry	$(V_s/2 - V_o)/V_B$	mV/V	$\leq \pm 2.0$	$\alpha=0^\circ$	$\alpha=45^\circ$
Sensitivity	$S_\alpha$	(mV/V)/°	$> 0.418$	$\alpha=0^\circ$	$\alpha=45^\circ$
Output voltage range	$( V_{max}  +  V_{min} )/V_B$	mV/V	$\geq 24$		
Zero offset angle hysteresis	$\Delta\alpha$	°	$\leq 1$		

Temperature coefficients ( $-25^\circ\text{C} < T_{amb} < 125^\circ\text{C}$ ) of bridge 1 and 2			
Parameter	Symbol	Unit	Value
Bridge resistance	$T_{CBR}$	%/K	$0.30 \pm 0.05$
Open circuit sensitivity	$T_{CSV}$	%/K	$-0.30 \pm 0.05$
	$T_{CSI}$	%/K	$0.00 \pm 0.05$
	$(I_B = \text{const})$		
Offset voltage	$T_{COFF}$	( $\mu\text{V}/\text{V}$ )/K	$\leq \pm 3$

### Housing of KMT31: SM-8

bridge 1:

pin 4: +  $V_B$  (GND)

pin 8: GND (+  $V_B$ )

pin 1: -  $V_0$  (+  $V_0$ )

pin 5: +  $V_0$  (-  $V_0$ )

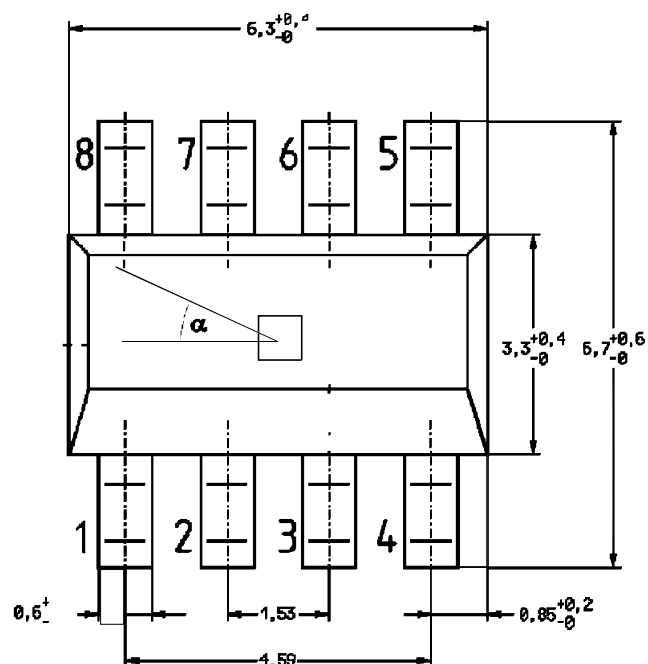
bridge 2:

pin 3: +  $V_B$  (GND)

pin 7: GND (+  $V_B$ )

pin 2: -  $V_0$  (+  $V_0$ )

pin 6: +  $V_0$  (-  $V_0$ )



Assembly is pinning independent. Sensor mirror symmetrically built !

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