

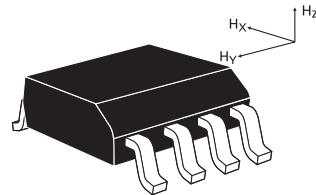
## DUAL MAGNETIC FIELD SENSOR

### DESCRIPTION

This device is a special tangential field difference sensor with two AMR (Anisotropic Magneto-Resistive) bridges for field movement measurements or field comparative measurements.

The ZMX40M contains two extremely sensitive magnetic sensor chips, mounted parallel to each other in an SM8 package, employing the magneto-resistive effect of thin film permalloy. It allows the measurement of magnetic fields or the detection of magnetic parts. The sensors each consist of a chip covered with thin film permalloy stripes which form a Wheatstone bridge, whose output voltage is proportional to the magnetic field component  $H_y$ . A field  $H_x$ , which is perpendicular to  $H_y$ , is necessary to suppress the hysteresis and to bias the sensors into the linear region. This field  $H_x$  is provided by an internal permanent magnet.

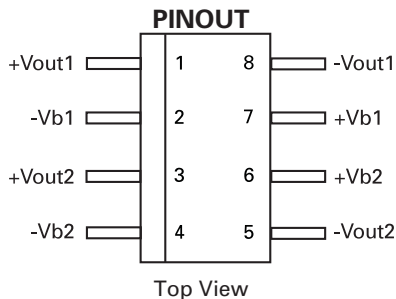
The chips are mounted in the package 3mm apart. If a magnet travels horizontally above the sensor, each chip will give an output which will peak as the magnet passes above it and the two peaks will be spatially separated by 3mm.



When the two peaks are the same amplitude, the magnet must be mid-way between the two chips. Therefore this double sensor can be used to measure position of, for example, a wheel tooth very accurately for automotive and machine-tool applications. With calibration to allow for the tolerances on the bridge outputs being slightly different, the ZMX40M has been used in machine tool applications to resolve distances down to 30µm. By comparing the two outputs and adding some hysteresis, a large-geometry magnetic tape reader (for example for a magnetic tape ruler) can be made. By combining both bridge outputs a current sensor can be also made by adding an external current loop over or under the ZMX40M. This loop is outside the package and therefore provides excellent galvanic isolation.

### FEATURES

- Output voltage proportional to magnetic field  $H_y$  across each chip
- Both chips are in the same orientation and chip centres are 3mm apart in Y direction
- Magnetic fields vertical to the chip level  $H_z$  are not effective
- Disturbing fields  $H_x$  up to 30 kA/m are allowed
- Extremely small chip distance from the top side of package for accurate measurement
- Internal magnet each chip for creation of auxiliary field  $H_x$



### APPLICATIONS

- Linear position measurement for process control, door interlocks, proximity detectors and precision machine tools
- H-field movement measurement for a magnetic tape recognition
- High voltage isolated current measurement up to many amps range by using a suitable current loop over or under the IC
- Detection of rotating magnets in the presence of a disturbing field by comparisons of maximum values of individual sensors

### DEVICE MARKING

- ZMX40M

### CONNECTION DIAGRAM

**AMR chip 1:** supply voltage between +Vb1 and -Vb1  
output voltage of bridge between +Vout1 and -Vout1

**AMR chip 2:** supply voltage between +Vb2 and -Vb2  
output voltage of bridge between +Vout2 and -Vout2

# ZMX40M

## ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	LIMIT	UNIT
Supply voltage for each sensor chip (1,2)	$V_B$	12	V
Total power dissipation	$P_{TOT}$	240	mW
Operating temperature range	$T_{amb}$	-25 to +125	°C
Storage temperature range	$T_{stg}$	-25 to +125	°C

## ELECTRICAL CHARACTERISTICS (at $T_{amb}=25^{\circ}\text{C}$ and $H_X=3\text{ kA/m}$ unless otherwise stated)

PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT	TEST CONDITIONS
Bridge resistance	$R_{br}$	1.4	-	2.2	$k\Omega$	
Output voltage range	$V_O/V_B$	12	-	24	mV/V	
Open circuit sensitivity	S	3.0	-	5.0	(mV/V)/(kA/m)	$V_B=\text{const.}$
Hysteresis of output voltage	$V_{OH}/V_B$	-	-	50	$\mu\text{V/V}$	
Offset voltage	$V_{off}/V_B$	-1.5	-	+1.5	mV/V	
Operating frequency	$f_{max}$	0	-	1	MHz	
Temp. coeff. of offset voltage	$TCV_{off}$	-3	-	+3	( $\mu\text{V/V}$ )/K	$T_{amb} = -25\text{ to }+125^{\circ}\text{C}$
Temp. coeff. of bridge resistance	$TCR_{br}$	+0.25	+0.3	+0.35	%/K	$T_{amb} = -25\text{ to }+125^{\circ}\text{C}$
Temp. coeff. of open circuit sensitivity $V_B=5\text{V}$	$TCS_V$	-0.25	-0.3	-0.35	%/K	$T_{amb} = -25\text{ to }+125^{\circ}\text{C}$
Temp. coeff. of open circuit sensitivity $I_B=3\text{mA}$	$TCS_I$	-	-0.1	-	%/K	$T_{amb} = -25\text{ to }+125^{\circ}\text{C}$

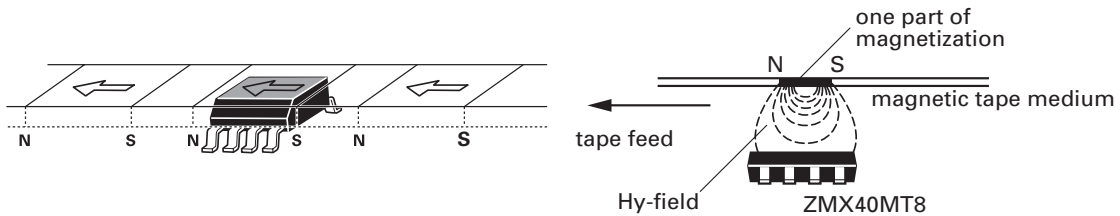
## ORDERING INFORMATION

DEVICE	REEL SIZE	TAPE WIDTH	QUANTITY PER REEL
ZMX40MT8TA	7"	12mm	1000 units
ZMX40MT8TC	13"	12mm	4000 units

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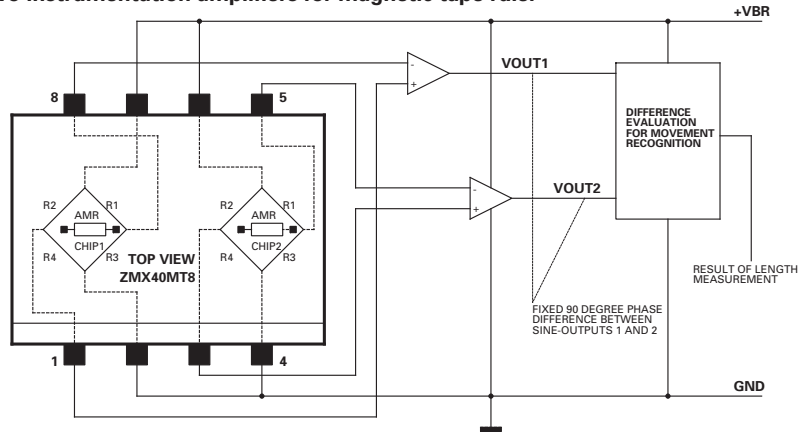
## TYPICAL APPLICATIONS

Magnetic tape scanning (field movement measurement for magnetic tape ruler):

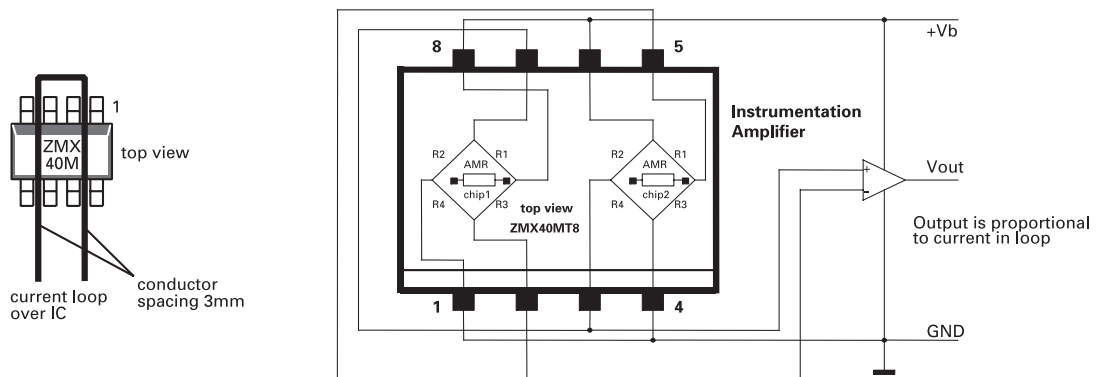


The changing voltage peaks in both AMR bridges are used for the tape movement measurement.

### ZMX40M plus two instrumentation amplifiers for magnetic tape ruler



### Current sensor (by combining both bridge outputs and a high isolation voltage)



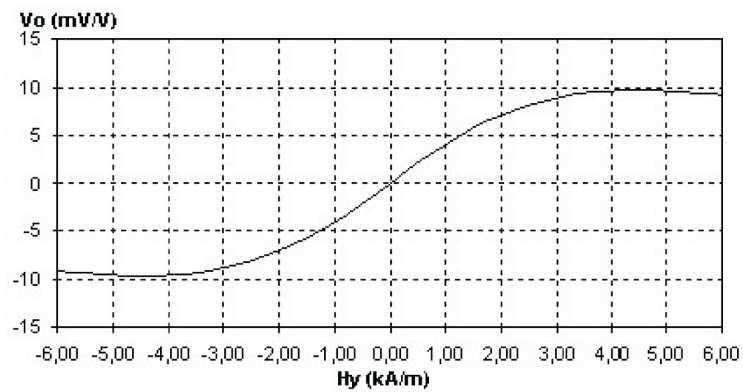
This double chip solution with the current loop conductor guarantees good rejection of external fields and a high isolation voltage.

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## Sensor output characteristic

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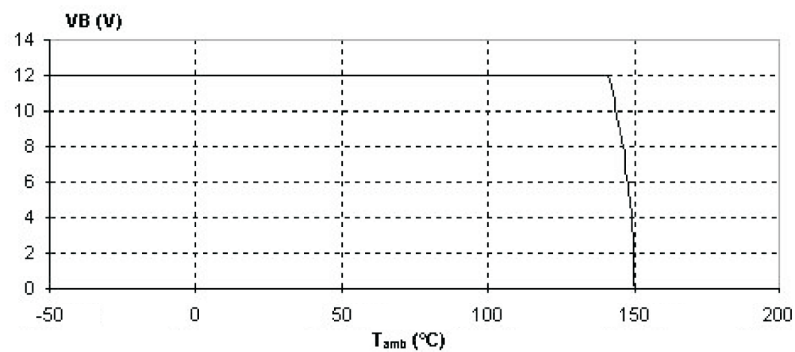
$$V_o = f(H_y) \text{ typ.}$$



## Supply voltage (maximum) derating curve

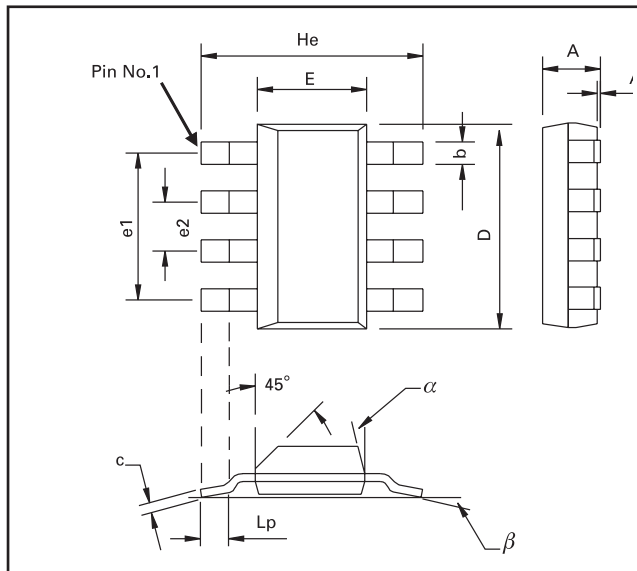
ZMX40M

$$V_{bmax} = f(T_{amb})$$



# ZMX40M

## PACKAGE OUTLINE



## PACKAGE DIMENSIONS

DIM	Millimeters			Inches			DIM	Millimeters			Inches		
	Min	Max	Typ.	Min	Max	Typ.		Min	Max	Typ.	Min	Max	Typ.
A	-	1.7	-	-	0.067	-	e1	-	-	4.59	-	-	0.1807
A1	0.02	0.1	-	0.008	0.004	-	e2	-	-	1.53	-	-	0.0602
b	-	-	0.7	-	-	0.0275	$H_e$	6.7	7.3	-	0.264	0.287	-
c	0.24	0.32	-	0.009	0.013	-	$L_p$	0.9	-	-	0.035	-	-
D	6.3	6.7	-	0.248	0.264	-	$\alpha$	-	15°	-	-	15°	-

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