

# AS5304

## Magnet Specification

### Magnetic Multipole Strip MS20-150 Pole Length 2.0mm, 150 Poles

## 1 General

This specification defines the dimensional and magnetic properties of a multipole magnetic strip for use with the AS5304 magnetic linear motion and off-axis rotary angle encoder.

Material: Strontium ferrite bonded

## 2 Dimensional Specification

Parameter	Symbol	Min	Typ	Max	Unit	Note
Strip Length	L		300±2		mm	Active length = 300mm
Strip Width	W		10±0.2		mm	Active width = 10mm
Strip Thickness	T		1,3±0,15		mm	1mm rubber bonded magnet on 0.3mm stainless steel strip
Thermal Expansion			17		$\times 10^{-6}/K$	Mechanical length expansion
Density		3.5 1.43	3.65 4.64	3.8 7.85	$g/cm^3$	magnetic rubber stainless steel
Delivery	Single cut pieces without adhesive, rolls of 25m, 50m (up to 100m max.)					

## 3 Magnet Specification

Parameter	Symbol	Min	Typ	Max	Unit	Note
Pole Length	$L_p$		2.00		mm	Results in pole pair length of 4.0mm (150 poles @ 1.0mm)
Pole Length Deviation			1	1.5	% of $2 \cdot L_p$	Measured at $B_z=0$ , all poles within active area
Amplitude Variation				±10	% of $B_{pk}$	All poles within active area
Number of Poles			150		poles	Excluding poles with $L < L_p$ at the ends of the strip
Resolution	Res		25		$\mu m$	AS5304 @ incremental output
Magnetic Field Amplitude @ 0.8mm Distance	$B_{pk}$				mT	Vertical component of the magnetic field strength in the center of the strip at 25°C
Magnetic Field Temperature Drift	$Tk_{B_r}$		-0.2		%/K	

Parameter	Symbol	Min	Typ	Max	Unit	Note
Cumulative error				40 20 10	μm/m	depending on accuracy grade standard A20 A10
Thermal Expansion				1E-4	1/K	Mechanical length expansion
Temperature Range	Tamb	-40	25	100	°C	scale mounted, no bending

## Magnetization

The MS20-150 magnet strip is magnetized on the top side and bonded on a steel support with elastomer adhesive (bottom). Note that the polarization of the magnet will change when it is rotated as the pole arrangement not symmetric. This will influence the position of the index pulse. An index pulse is generated when the North and South poles are placed over the Hall array as shown in Figure 2.

The incremental output count increases when the magnet is moving to the left, facing the chip with pin#1 at the lower left corner (see Figure 2, top drawing). At the same time, the absolute position information increases.

Likewise, the position information decreases when the magnet is moved in the opposite direction. Note that there is no hysteresis at the absolute output. In order to get a stable 12-bit absolute reading, it may be necessary to filter the values by averaging, e.g. a moving average calculation in the external microcontroller. Averaging 4 readings results in 6dB (=50%) noise and jitter reduction. An average of 16 readings reduces the jitter by a factor of 4.

## Mounting the Magnet Strip

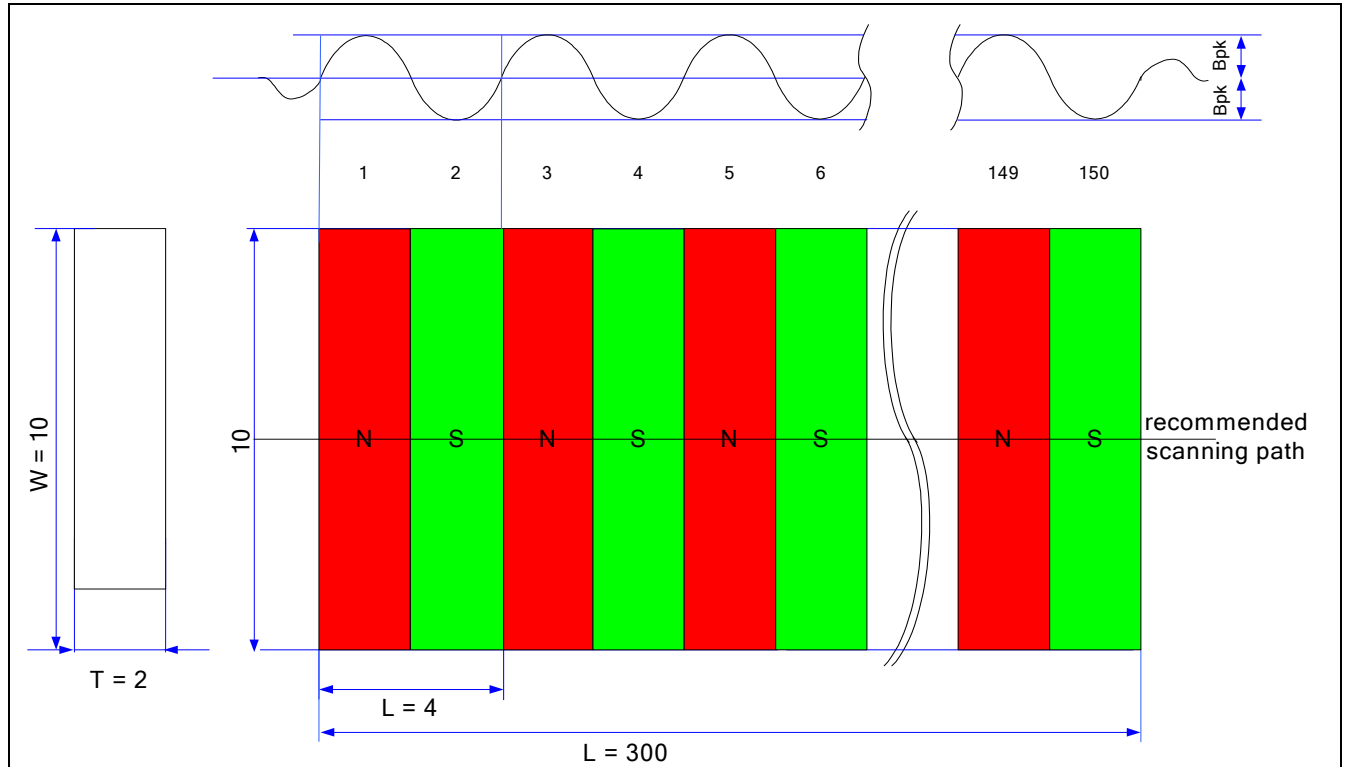
The magnet strip may be mounted directly on magnetic or non-magnetic surfaces. When magnetic surfaces are used, the strip must be mounted on top of the surface, but not immersed in a cavity, as this may weaken the magnetic field of the magnet. When mounting the magnet on a non-magnetic surface, either method is acceptable.

For more rigid demands, magnet suppliers offer customized solutions where the magnet material is directly overmolded on the carrier, e.g. a shaft, bushing, plate, etc..

Please contact your magnet supplier for more information. A list of recommended suppliers is available for download on the austriamicrosystems website.

## 4 Magnet Dimensions

Figure 1: MS20-150 strip dimensions



### Alignment of Magnet Strip and Sensor IC

When aligning the magnet strip to the AS5304 sensor IC, the centerline of the magnet strip should be placed exactly over the Hall array. See Figure 2 for the position of the Hall array relative to Pin #1.

#### Vertical Distance

The vertical distance between the magnet strip and the top of the IC package should be  $\leq 0.8\text{mm}$ . Note that the vertical distance depends on the strength of the magnet. The AS5304 automatically adjusts for fluctuating magnet strength by using an automatic gain control (AGC). There are several indicators for proper magnetic field strength available with the AS5304. The vertical distance should be set such that the AO voltage is between 1.0 and 4.0V.

See the AS5304 datasheet for more details.

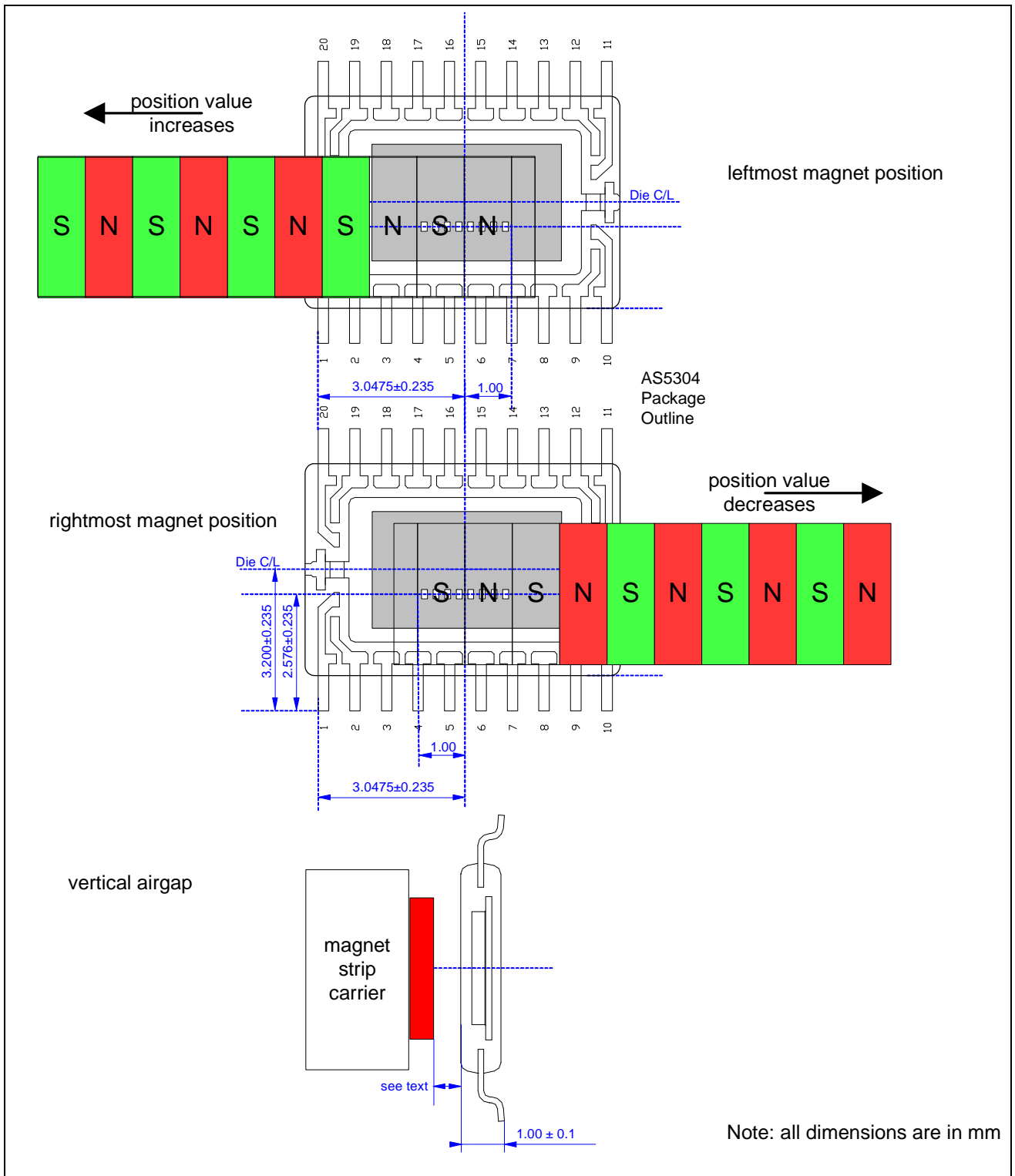
See also **Error! Reference source not found.** for measurement data of the MS20-150 magnetic strip.

#### Lateral Stroke

The lateral movement range (stroke) can cover the active area of the magnetic strip (see Figure 1) as long as all Hall sensors of the IC are covered by the magnet. The Hall array on the AS5304 has a length of 2.0mm, hence the total stroke is



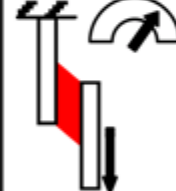
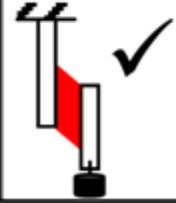
$$\text{Stroke} = \text{Length of active area} - \text{length of Hal array} = 300.0\text{mm} - 2.0\text{mm} = \underline{\underline{298.0\text{mm}}}$$

Figure 2: Alignment of magnet strip with AS5304 sensor IC



Note that the polarization of the magnet will be reversed when it is rotated or flipped (see Magnetization for more details).

## 5 Adhesive Tape Specification

	Adhesive	Acrylic	
	Colour	Transparent	
	Thickness of adhesive tape	0.13 mm	
	Protective cap	Paper	
	Temperature resistance permanently short term	150°C 260°C	
	Peel Force  ASTM D3330, after 72h, 300 mm/Min.; 90°; RT; Steel	131 (N/100mm)	
	Tensile Strength  ASTM D-897, after 72h; Steel 12.7 mm/Min.; 6.45cm²; RT	69 (N/cm²)	
	Shearing Strength Dynamic ASTM D-1002, after 72h; Steel 12.7 mm/Min.; 6,45cm²; RT	55 (N/cm²)	
	Shearing strength static  ASTM D-3654 after 72h; Steel; > 10.000 Min.; 3.23cm²; RT	20°C	1000g
		65°C	1000g
		90°C	1000g
		120°C	1000g
		150°C	500g
		175°C	500g
	Length of reel	55m/165m	
	Roll width minimum maximum	6 mm 1200 mm	
	Cutting tolerance	± 0.4mm	
	Inner core diameter	76.2 mm	

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