

## Speed & Direction Hall Sensor

### Introduction

The HK70X / HK71X is a speed&direction Hall sensor family with two Hall sensing elements. It outputs two digital signals for speed and direction processing.

The HK70X/ HK71X internally includes two Hall sensing elements located 1.63mm apart, an on-chip Hall voltage generator, voltage regulator for operation with supply voltage 3.8 to 30V, temperature compensation circuitry, small-signal amplifier, Hall sensor with dynamic offset cancellation system, Schmitt trigger and open-drain output. Signal processing of speed and direction signals is easy.

The HK70X/ HK71X family provides a variety of packages to customers: flat TO-94 for through-hole mount and SOP8 for surface mount. All packages are RoHS compliant.

### Features

- 1.63mm Hall Elements Spacing
- Magnetic Type: Bipolar Switch
- Operating Voltage Range:Supply Voltage 3.8 to 30V
- Highest ESD performance up to  $\pm 5$  kV
- Reverse voltage protection
- Specified Operating Temperature Range:From  $-40^{\circ}\text{C}$  to  $150^{\circ}\text{C}$
- Multiple Magnetic Sensitivity:  
BOP=40Gauss, BRP=-40Gauss  
BOP=75Gauss, BRP=-75Gauss  
BOP=130Gauss, Brp=-130Gauss
- Lead Free Package
- Flat TO94, SOP8
- High ESD Rating
- RoHS Compliant
- 2011/65/EU

### Applications

- Speed detection
- Direction detection
- Magnetic encoder

### Package



TO-94



SOP8

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### Family Members

Part number	Package	Packing	Magnetic points
HK700/HK710	T094/SOP8	Bag: 1k; Tape&reel: 3K	+/-40 Gauss
HK701/HK711	T094/SOP8	Bag: 1k; Tape&reel: 3K	+/-75 Gauss
HK702/HK712	T094/SOP8	Bag: 1k; Tape&reel: 3K	+/-130 Gauss

### Absolute Maximum Ratings

The absolute maximum value is the limiting value when the chip is applied, above which the chip can be damaged. Although the function of the chip is not necessarily damaged when the absolute maximum value is exceeded, the reliability of the chip may be affected if the absolute maximum value is exceeded for a certain time.

Parameter	Symbol	Value	Units
Supply voltage	VCC	40	V
Reverse voltage	VCC	-40	V
Output Sink Current	Isink	30	mA
Output Voltage	Vout	40	V
Operating temperature range	Ta	-40~150	°C
Storage temperature range	Ts	-40~165	°C

### Electrical and magnetic characteristics(Ta=25°C, VCC =5.0V)

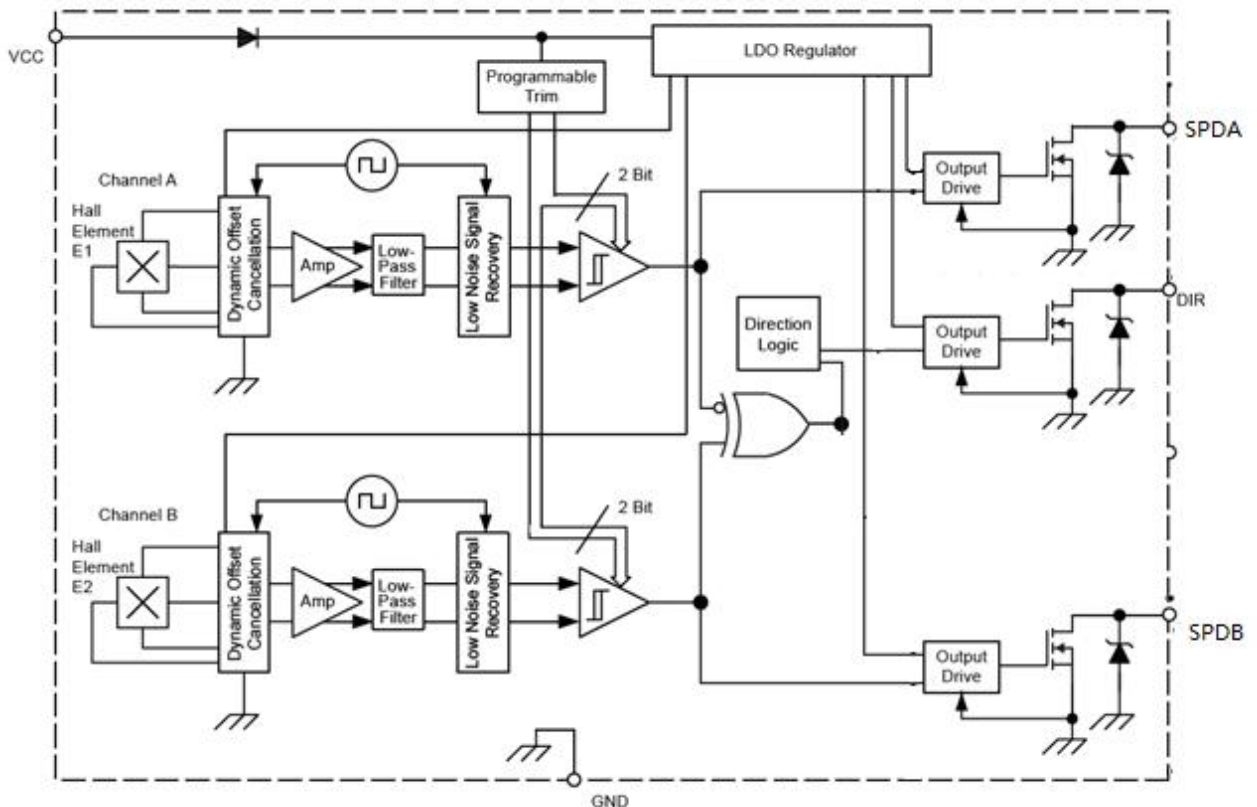
Symbol	Parameter	Test Condition	Min	Type	Max	Units
Vcc	Power supply	Operating	3.8	5	30	V
Is	Current consumption	B<Brp		8		mA
Vsat	Saturation out voltage	B=250Gauss,RL=10K ohms			0.4	V
Ioff	Output leakage current	B<Brp, Vout=24V		0.1	1	uA
Tr	Out rise time	RL=10K ohms, CL=20pF			1	uS
Tf	Out fall time	RL=10K ohms, CL=20pF			1	uS
Bop	HX700/HX710 Operate point	TA=25°C	10	40	70	Gauss
	HX701/HX711, Operate point	TA=25°C	15	75	110	Gauss
	HX702/HX712, Operate point	TA=25°C	25	130	225	Gauss
	HX700/HX710 Release point	TA=25°C	-70	-40	-10	Gauss

## Speed & Direction Hall Sensor

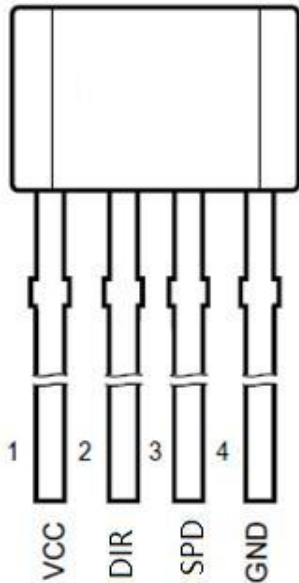
Brp	HK701/HK711, Release point	TA=25°C	-110	-75	-15	Gauss
	HK702/HK712, Release point	TA=25degC	-225	-130	-25	Gauss
Bhys	HK700, Hysteresis	TA=25degC, Bhys=Bop-Brp		80		Gauss
	HK701, Hysteresis	TA=25degC, Bhys=Bop-Brp		150		Gauss
	HK702, Hysteresis	TA=25degC, Bhys=Bop-Brp		260		Gauss
Dis	Distance of two hall elements			1.63		mm

### Function diagram

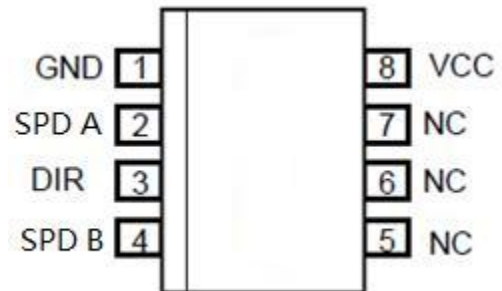
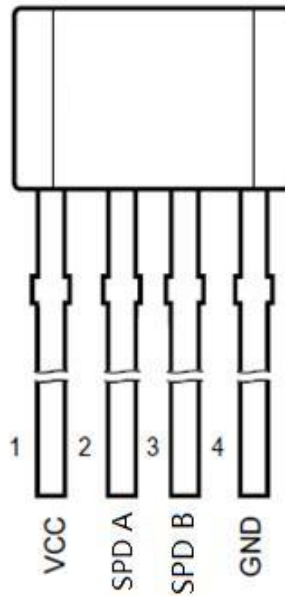
The HK70x/HK71X is a highly sensitive, temperature-stable magnetic sensing device ideal for use in ring-magnet-based speed and direction systems in harsh automotive and industrial environments. It contains two bipolar, Hall-effect switches precisely arranged 1.63 mm apart. The switch outputs are thus in quadrature when interfaced with the proper ring magnet design. Internal logic processes the resulting digital signals to derive speed and direction information that is presented at the device's outputs,



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**TO94**



**SOP8**

### Pin orientation

#### TO94 Pin description

Name	HK70X Pin number	HK71X Pin number	Description
VCC	1	1	Power supply
SPDA		2	Speed A
DIR	2		Direction
SPDB	3	3	Speed B
GND	4	4	Ground

#### SOP8 Pin description

Name	Pin number	Description
GND	1	Ground
SPDA	2	Speed A
DIR	3	Direction
SPD B	4	Speed B
NC	5	No connection
NC	6	No connection
NC	7	No connection
VCC	8	Power supply

## Speed & Direction Hall Sensor

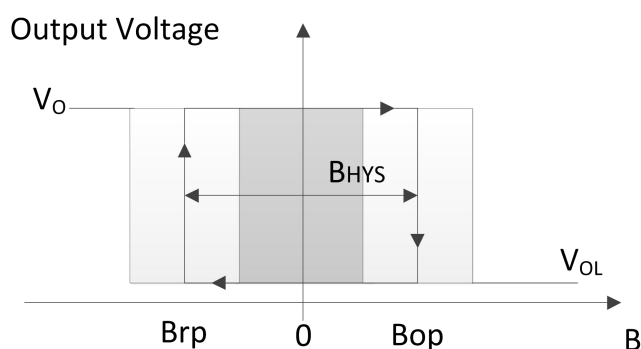
### Definition of Magnetic Parameters

**BOP:** Operating point, magnetic flux density applied on the branded side of the package which turns the output driver ON ( $V_{OUT}=LOW$ )

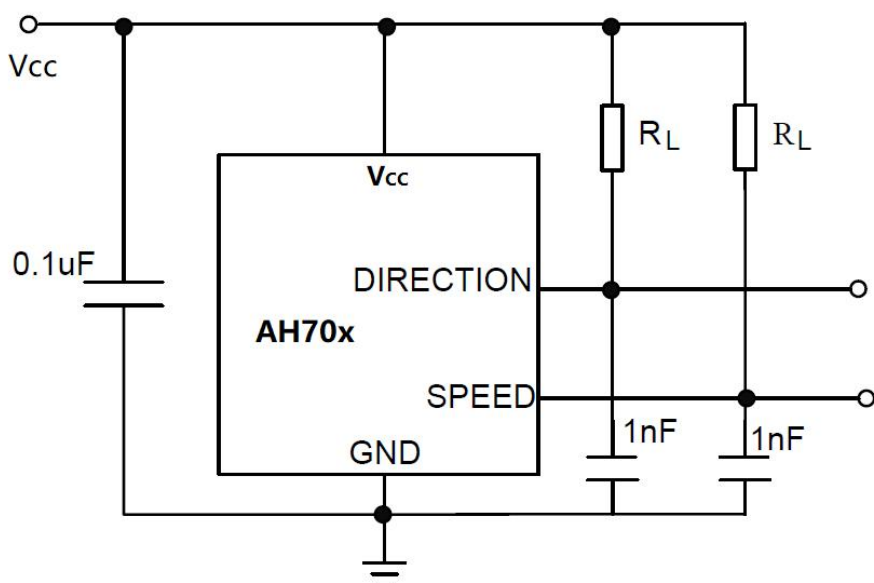
**BRP:** Release point, magnetic flux density applied on the branded side of the package which turns the output driver OFF ( $V_{OUT}=High$ )

**BHYS:** Hysteresis window,  $|BOP-BRP|$

### Output Behavior

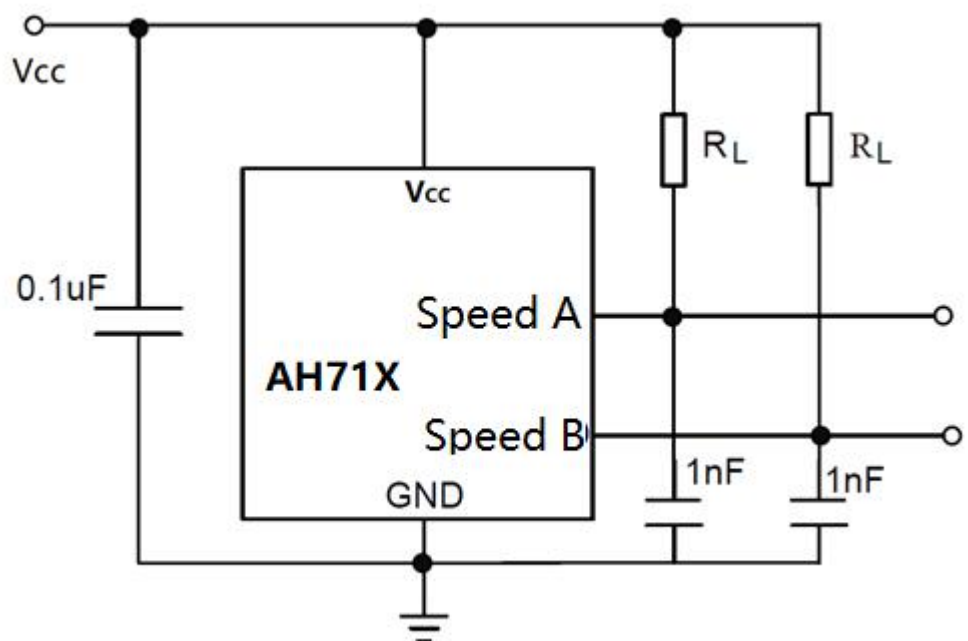


### Typical Application Circuit



**Speed/direction output**

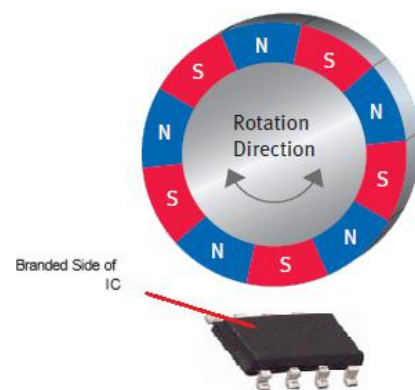
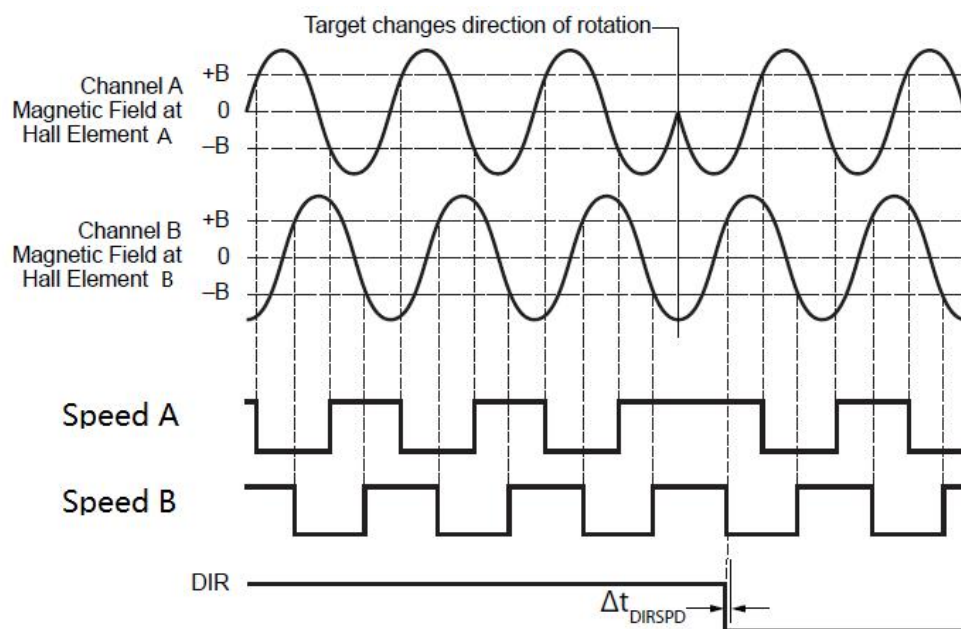
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### Quadrature dual channel speed output

Note:  $R_L$  recommend 1Kohm to 10Kohm

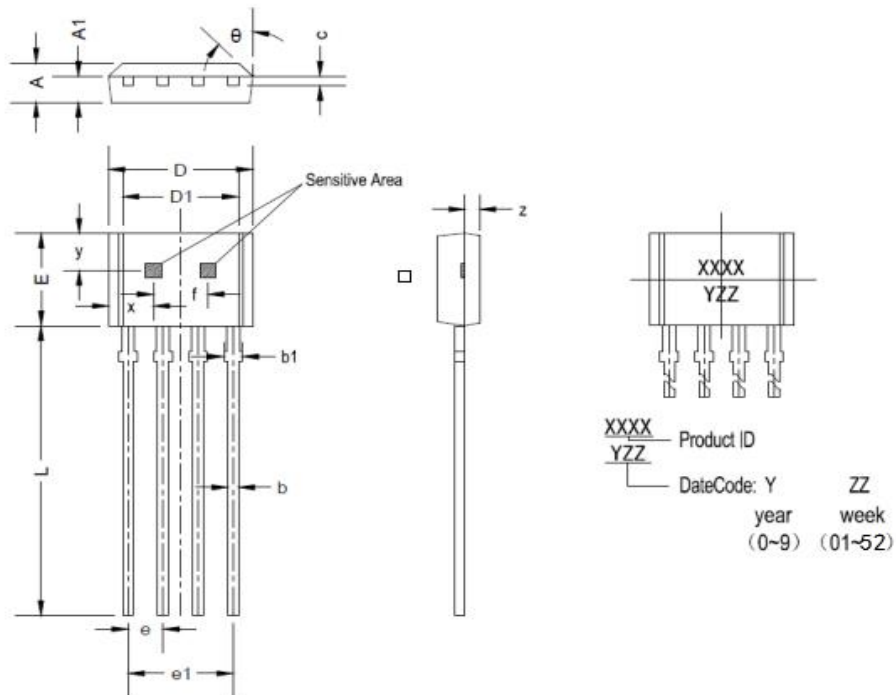
### Typical output waveform



## Speed & Direction Hall Sensor

### Package dimensions

T094 package



Symbol	Dimensions in Millimeters		Dimensions in Inches	
	Min	Max	Min	Max
A	1.420	1.660	0.056	0.065
A1	0.660	0.860	0.026	0.034
b	0.350	0.480	0.014	0.019
b1	0.400	0.650	0.016	0.026
c	0.360	0.510	0.014	0.020
D	5.100	5.300	0.201	0.208
D1	4.100	4.300	0.161	0.169
E	3.550	3.750	0.140	0.147
e	1.267	1.273	0.050	0.050
e1	3.780	3.840	0.149	0.151
L	13.500	15.500	0.531	0.610
f	1.390	1.410	0.055	0.056
x	1.800	2.000	0.071	0.079
y	1.175	1.375	0.046	0.054
z	0.500TYP		0.020TYP	
$\theta$	10°	12°	10°	12°



