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## Voltage-type Square Output High Accuracy Speed Sensor IC

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### 1. Features

- Support zero crossing or threshold crossing
- South and North pole pre-induction possible
- Large air gap
- Single chip solution
- 3.8V~26V power supply voltage range
- -40°C to 150°C operating temperature range
- Protection against overvoltage
- Protection against reversed polarity
- AEC-Q100 Grade0 qualified.
- Package: TO-94

### 2. Product Application

- Crankshaft position sensor
- Speed sensor

### 3. Description

Differential Hall effect sensor IC SC962X has two hall induction points inside, and the magnetic field induced by it will perform differential calculation, so that the chip has high sensitivity and large detection air gap characteristics. Magnetic ring or back magnetic detection gear can be detected. It has a wide operating voltage range and operating temperature range, as well as a high EMC robustness, and passes the AECQ100 Grade0 assessment, so it is very suitable for speed detection in automobiles, such as crankshaft sensor, transmission.

The SC9621 is an output flip when the differential magnetic field is zero, and has hysteresis judgment to prevent false triggering, thus guaranteeing its excellent repeatability and reliable accuracy. If the back magnetic detects the gear, the flip point is in the center of the tooth.

The SC9625 is flipped when the differential magnetic field reaches a positive or negative threshold, resulting in excellent repeatability and accuracy. If the back magnetic detects the gear, the flip point is on the edge of the tooth.

The device is packaged in a TS-94. It is lead (Pb) free, with 100% matte tin-plated lead frame.



Fig.1 TO-94 Package Outline

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## 4. Terminal Configuration

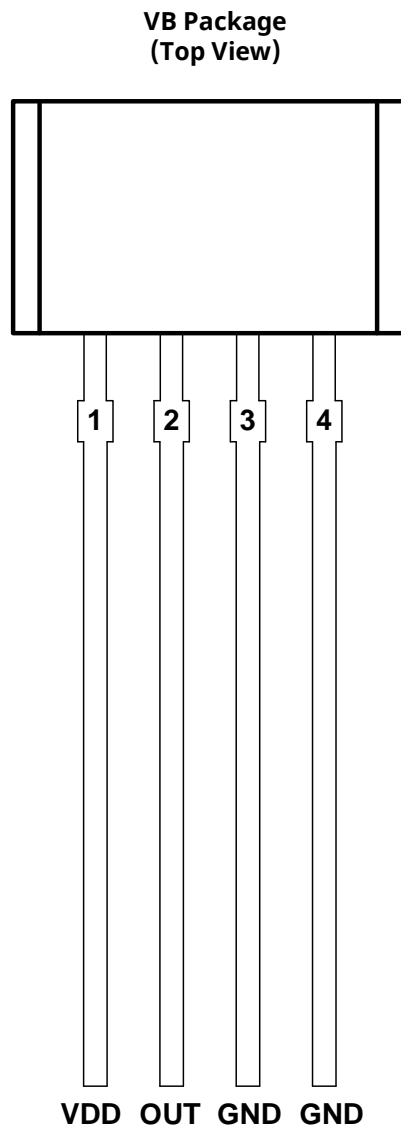


Fig.2 Pin Description

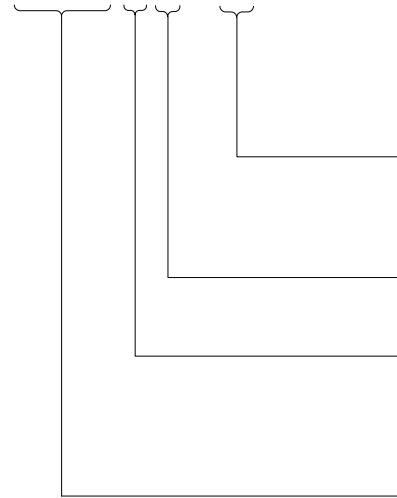
Terminal		Type	Description
Name	Number		
VDD	1	PWR	3.8V ~ 26 V power supply
OUT	2	OUT	Open-drain output required a pull-up resistor
GND	3	Ground	Ground
GND	4	Ground	Ground

## 5. Ordering Information

Ordering Information	Marking	Trigger mode	Class	Ambient, T <sub>A</sub> (°C)	Package	Packing	Quantity
SC9621VB-BK	9621	Zero	-	-40 ~ 150	TO-94	Bulk	500/bag
SC9625VB-BK	9625	Threshold	-	-40 ~ 150	TO-94	Bulk	500/bag

### Ordering Information Format

**SC9621VB-BK**



#### Packing Designation

BK: Bulk

#### Package Designation

#### Option

1: Zero crossing

5: Threshold crossing

#### Device Family

## 6. Absolute Maximum Ratings

over operating free-air temperature range

Symbol	Parameter	Test conditions	Min.	Max.	Units
$V_{DD}$	Power supply reverse Voltage	$T_j < 150^\circ\text{C}$	-30	30	V
$V_{OUT}$	Output voltage	$T_j < 150^\circ\text{C}$	-0.5	30	V
$I_{Sink}$	Output sink current		-	40	mA
$T_A$	Operating ambient temperature		-40	150	$^\circ\text{C}$
$T_j$	Maximum junction temperature	5000h	-55	150	$^\circ\text{C}$
$T_j$	Maximum junction temperature	2500h	-55	160	$^\circ\text{C}$
$T_j$	Maximum junction temperature	1000h	-55	170	$^\circ\text{C}$
$T_{STG}$	Storage Temperature		-65	175	$^\circ\text{C}$

*Note:*  
Stresses above those listed here may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

## 7. ESD Protection

Symbol	Parameter	Test conditions	Min.	Max.	Units
$V_{ESD\_HBM}$	HBM	Refer to AEC-Q100-002E HBM standard, $R=1.5\text{k}\Omega$ , $C=100\text{pF}$	-4	+4	KV
$V_{ESD\_CDM}$	CDM	Refer to AEC-Q100-011C CDM standard	-750	750	V

## 8. Operating Characteristics

over operating free-air temperature range ( $V_{DD}=5V$ , unless otherwise noted)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
<b>Electrical parameters</b>						
$V_{DD}$	Operating voltage	$T_J < T_{J(max)}$	3.8	5	26	V
$I_{DD}$	Operating supply current	$V_{DD}=3.8V$ to 26 V	2.5	3.5	4.5	mA
$V_{Qsat}$	Output saturation voltage	$I_Q=20mA$	-	0.15	0.4	V
$I_{QL}$	Output leakage current	Output state=high, $V_{OUT}<30V$	-	-	10	uA
$V_{DZ}$	Overvoltage protection at VDD termina	$I_{DD} = 10mA$	30	35	40	V
$V_{OZ}$	Overvoltage protection at OUT terminal	$V_Q = High, I_Q = 1mA$	30	35	40	V
$t_{po}$	Power-on time	$V_{DD}>3.8V$	-	3.8	9	ms
$t_{settle}$	Settle time	$V_{DD}>3.8V, f=1KHz$	-	-	50	ms
$t_{response}^{(1)}$	Response time	$V_{DD}>3.8V, f=1KHz$	3.8	-	59	ms
$t_r$	Output rise time	$R_{PU}=1K\Omega, C_Q=20pF$	-	-	0.2	us
$t_f$	Output fall time	$R_{PU}=1K\Omega, C_Q=20pF$	-	-	0.2	us
$f_{cu}$	Upper corner frequency	-3dB, single pole	-	-	20	kHz
$f_{cl}$	Lower corner frequency	-3dB, single pole	5	-	-	Hz
<b>Magnetic Characteristics</b>						
$B_{Back}$	Pre-induction		-500	-	500	mT <sup>(2)</sup>
$B_{diff}$	Differential induction	$f=1KHz$	-100	-	100	mT
<b>SC9621</b>						
$B_{OP}$	Operate point	$f=1KHz, B_{diff}=5mT$	-	-	0	mT
$B_{RP}$	Release point	$f=1KHz, B_{diff}=5mT$	0	-	-	mT
$B_{HYS}$	Hysteresis	$f=1KHz, B_{diff}=5mT$	0.4	0.8	2.0	mT
<b>SC9625</b>						
$B_{OP}$	Operate point	$f=1KHz, B_{diff}$ increasing	0.3	0.45	0.6	mT
$B_{RP}$	Release point	$f=1KHz, B_{diff}$ decreasing	-0.6	-0.45	-0.3	mT
$B_{HYS}$	Hysteresis	$f=1KHz, B_{diff}=5mT$	0.6	0.9	1.2	mT
$\Delta B_M$	Center of switch points	$(B_{OP}+B_{RP})/2$	-1	0	1	mT

Note:

(1)  $t_{response} = t_{po} + t_{settle}$

(2) 1mT=10GS

## 9. Typical Characteristics

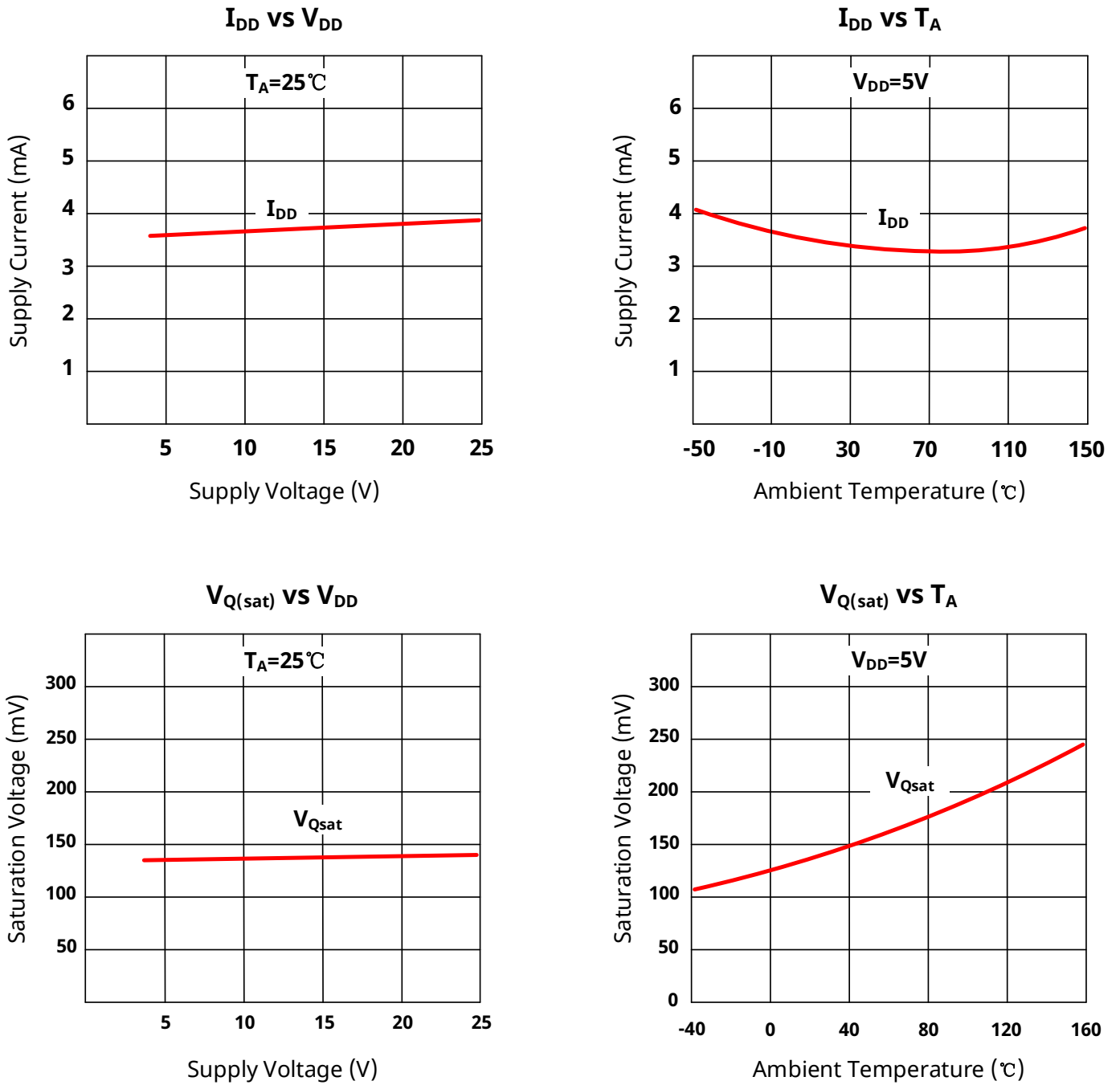
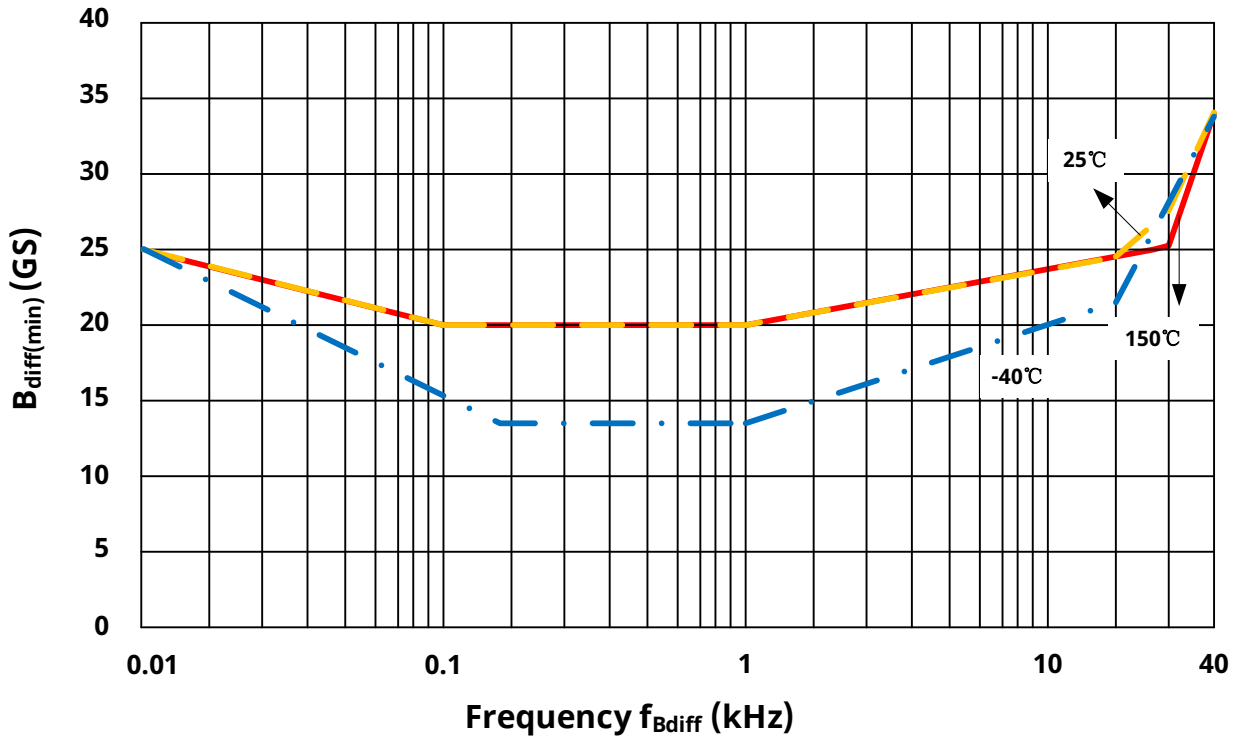


Fig.3  $I_V$  and  $V_{Qsat}$  Characteristics

### Minimum Switch Fields versus Frequency



### Typical Phase Shift versus Frequency

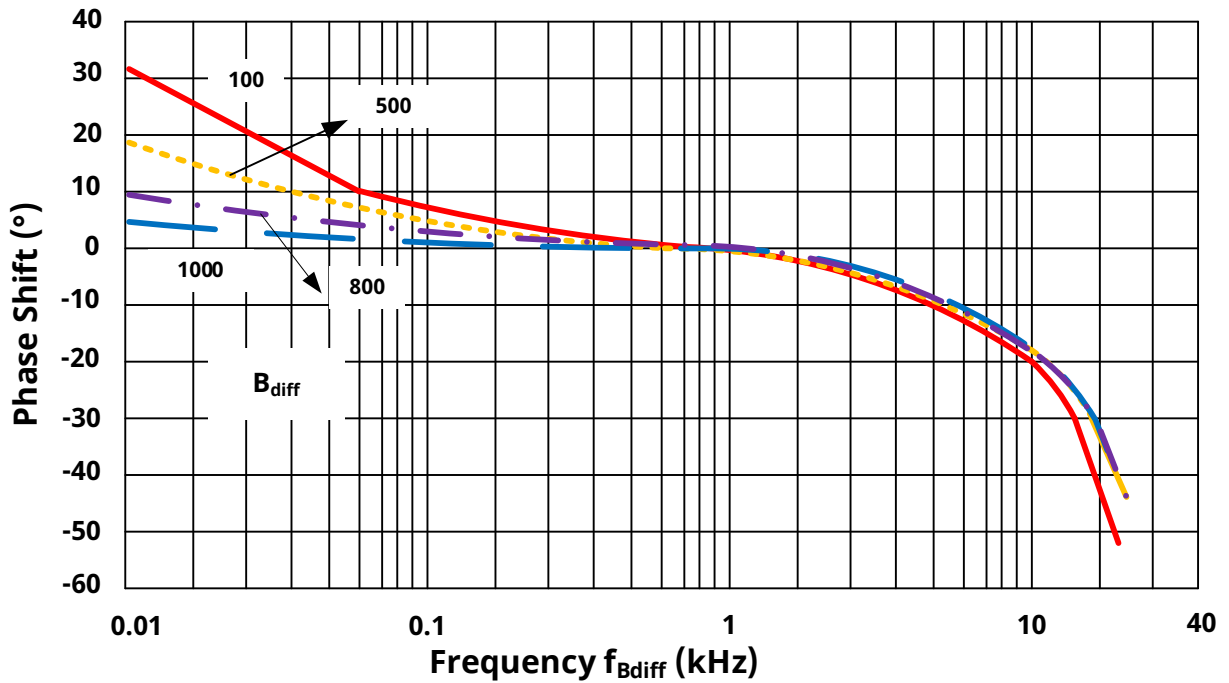


Fig.4 Differential Magnetic Characteristics

## 10. Block Diagram

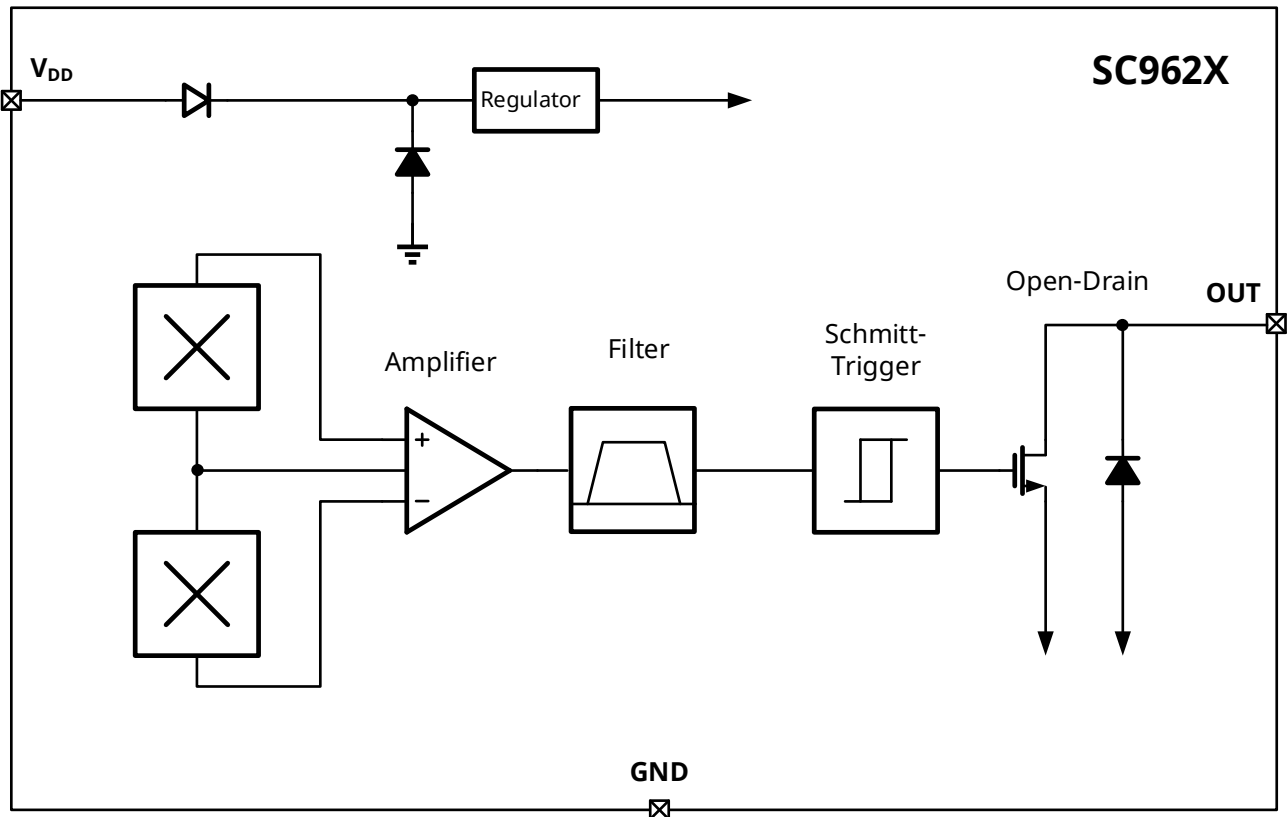


Fig.5 Block Diagram

## 11. Function Description

SC962X is a multi-functional, high-precision differential Hall effect chip that can be widely used to detect the movement of magnetic rings or ferromagnetic gears.

The SC962X contains two integrated Hall induction points. When the magnetic ring or ferromagnetic gear rotates, the magnetic flux received by the two Hall induction points is differentially calculated to obtain a differential magnetic field approximating sine and cosine.

The SC9621 is a zero-cross trigger, and there are two separate comparators inside the chip, both of which use the same reference point 0GS to ensure high precision, one of which is positive hysteresis  $B_{HYS1}$  and the other is negative hysteresis  $B_{HYS2}$ . Therefore, one comparator is triggered when the differential magnetic field decreases to zero, and the output turns down. The other comparator is triggered when the differential magnetic field increases past zero, and the output turns higher, as shown in Figure 6. Hysteresis on each comparator prevents false switching noise or target jitter.

SC9625 is the threshold trigger. When the differential magnetic field is detected to rise past  $B_{HYS1}$ , the output increases. When the differential magnetic field is detected to drop and pass  $B_{HYS2}$ , the output turns down, as shown in Figure 7.

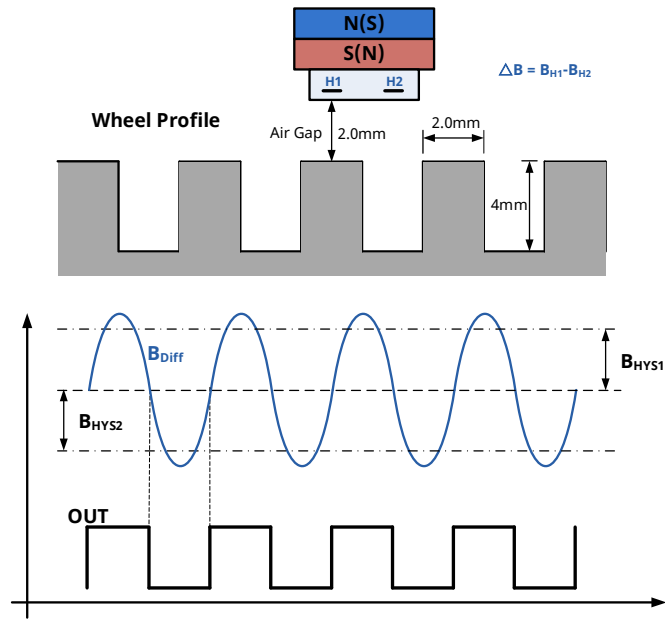


Fig.6 SC9621 Gear position-differential magnetic field-output response diagram

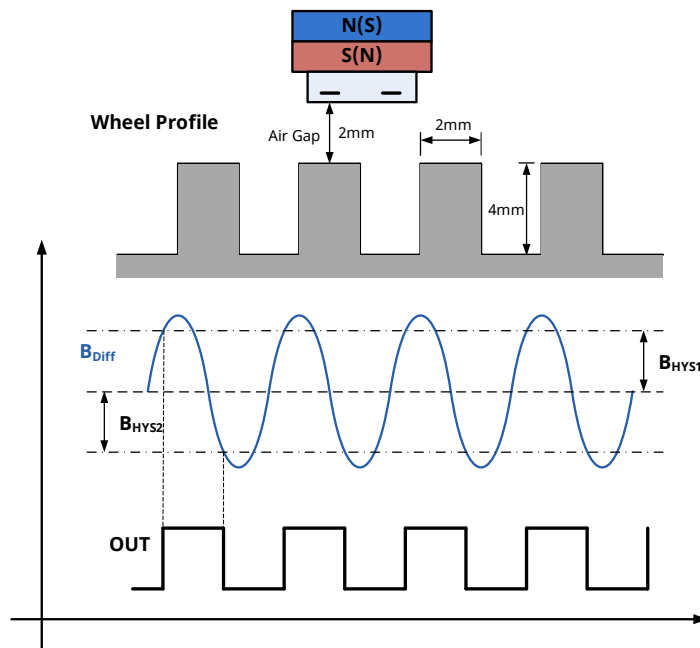


Fig.7 SC9625 Gear position-differential magnetic field-output response diagram

## 12. Typical Application

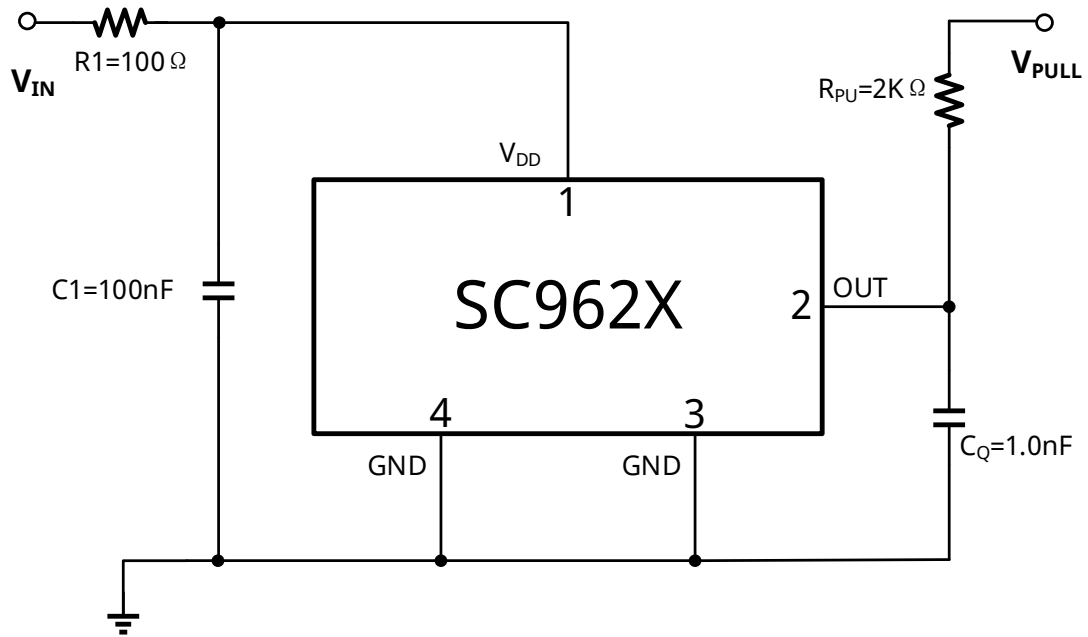
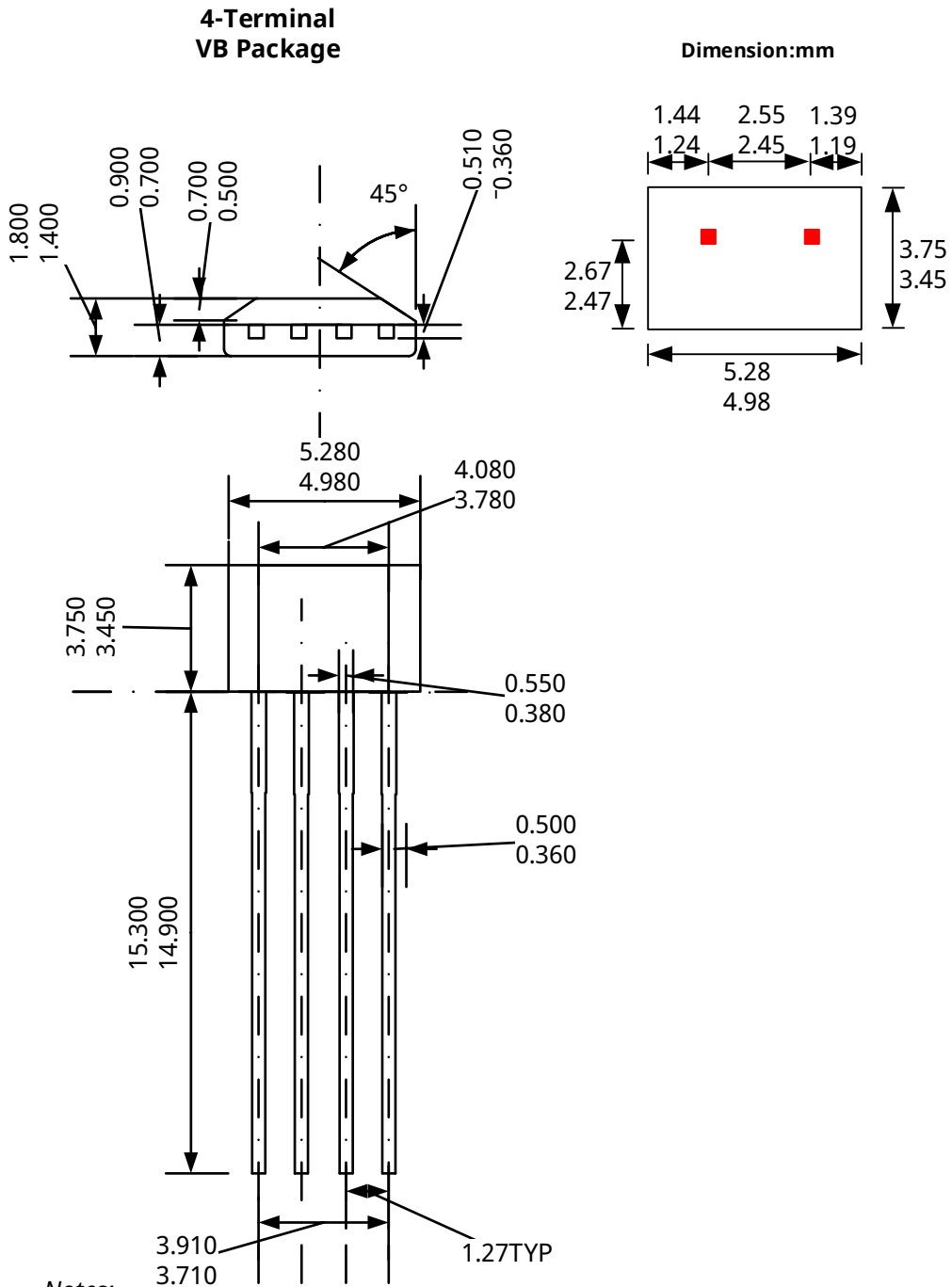


Fig.8 Typical Application

### 13. Package Information "TO-94"



**Notes:**

1. Exact body and lead configuration at vendor's option within limits shown.
2. Height does not include mold gate flash.
3. The plating thickness is 7-17um
4. Fine dimension information reference POD-TO94-231229-001

Where no tolerance is specified, dimension is nominal.

Fig.9 Package Dimensions

## 14. Revision History

Revision	Date	Description
Rev.0.1	2017-09-23	The old revision
Rev.2.3	2018-11-07	The final revision of old datasheet
Rev.A1.0	2020-11-19	Unified datasheet format, Separate datasheet for SC9621 and SC9625
Rev.A1.1	2025-01-24	Update ordering information, Put together into one datasheet

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