

Rail to Rail Analog Output Linear Hall Sensor

1. Features

- Rail to rail analog output
- The minimum operation voltage: 2.5V
- Quiescent voltage output:
 - Half of V_{CC} for SC4901 and SC4903
 - 90% of V_{CC} for SC4923
- $V_{DD}=3.3V$ Sensitivity:
 - 1.65mV/G_S for SC4901
 - 3.3mV/G_S for SC4923 and SC4903
- Output voltage proportional to magnetic
- flux density
- -40°C to 125°C wide ambient temperature range
- Fast power-on time
- 3-pin SIP and SOT23 package are available

2. Applications

- Magnetic Keyboard
- Position sensing
- BLDC motor current monitoring
- Weigh and liquid level sensing

3. Description

The SC49XX are high performance small versatile linear Hall-Effect devices which are operated by the magnetic field from a permanent magnet or an electromagnet. The radiometric output voltage is set by the supply voltage and varies in proportion to the strength of the magnetic. The quiescent output voltage of the SC4901 and SC4903 are 50% of the supply voltage and the quiescent output voltage of SC4923 is 90% of the supply voltage. and the sensitivity is 1.65mV/G_S (SC4901) and 3.3mV/G_S (SC4923/SC4903) respectively.

The SC49XX provides low-noise output with temperature compensation. The linear position sensor ICs have an operating temperature range of -40°C to 125°C, appropriate for industrial environments. These devices are available in a 3-pin TO-92S(UA) and SOT23(SO) packages. Both packages are lead (Pb) free, with 100% matte tin lead frame plating.

Not To Scale



Fig.1 TO-92S(Left) & SOT23-3L(Right) PKG Outline

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4. Terminal Configuration

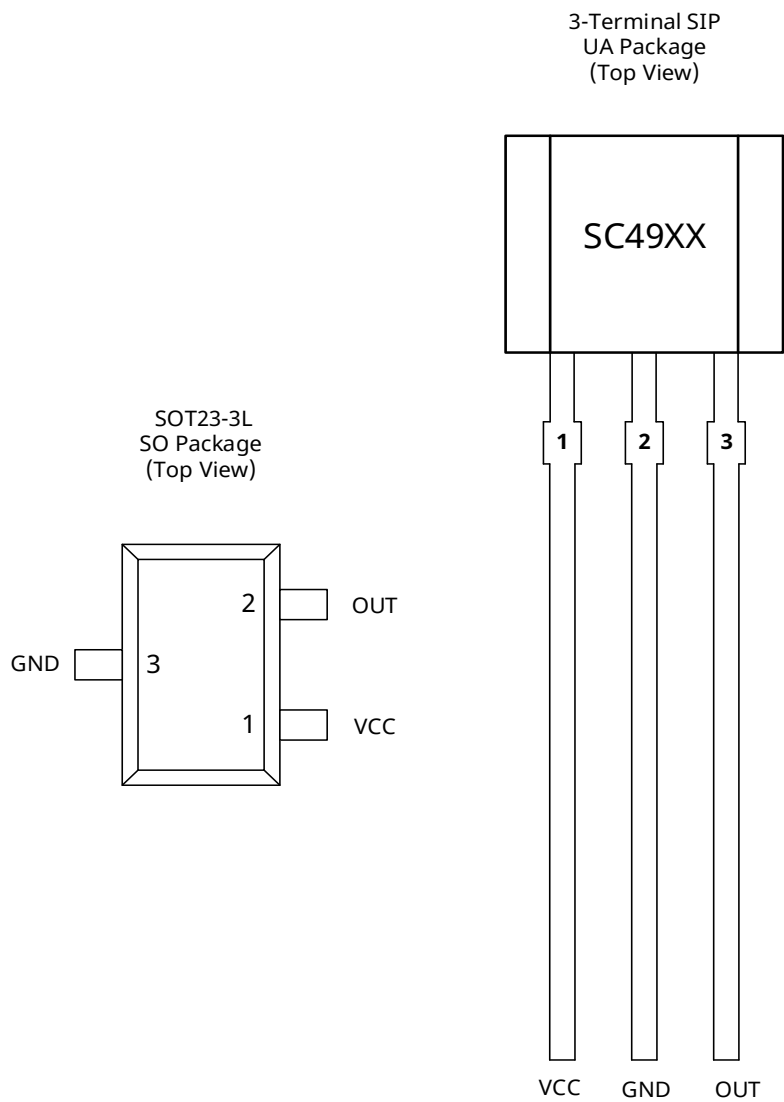


Fig.2 SOT23-3L & TO-92S(Right)Pin Description

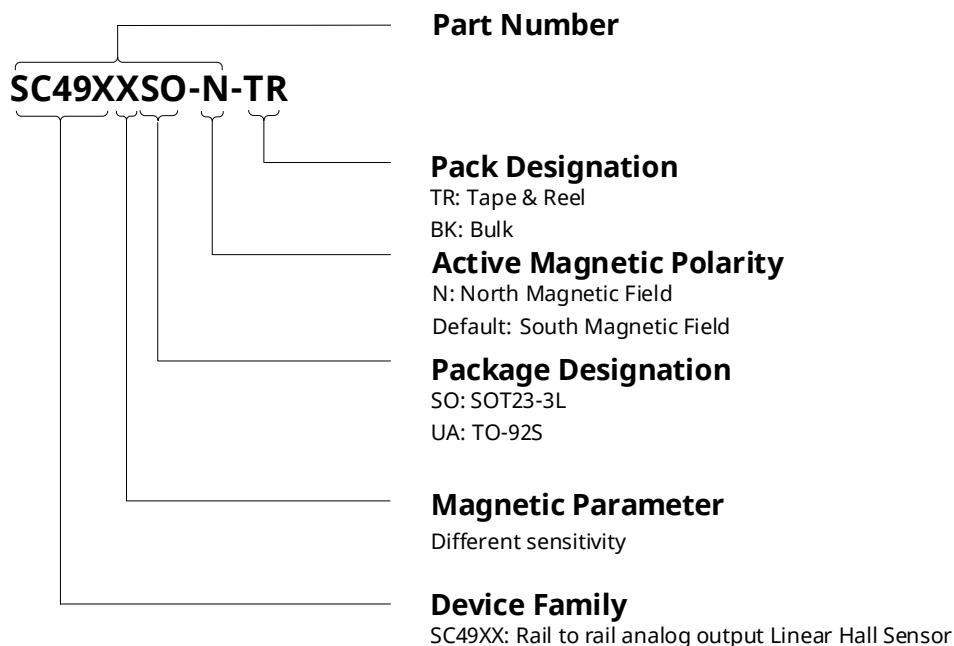
Terminal			Type	Description
Name	UA	SO		
V _{CC}	1	1	PWR	Power supply
OUT	2	2	Output	Output terminal
GND	3	3	Ground	Ground terminal

5. Ordering Information

Ordering Information	Sens(mV/Gs)	Ambient (°C)	Package	Packing	Amount
SC4901SO-N-TR ⁽¹⁾	1.65	-40-125	SOT23-3L	TR	3000ea/reel
SC4901UA-BK	1.65	-40-125	TO92S	BK	1000ea/bag
SC4923SO-N-TR	3.3	-40-125	SOT23-3L	TR	3000ea/reel
SC4923UA-BK	3.3	-40-125	TO92S	BK	1000ea/bag
SC4903SO-N-TR	3.3	-40-125	SOT23-3L	TR	3000ea/reel
SC4903UA-BK	3.3	-40-125	TO92S	BK	1000ea/bag

Note:

(1) TR=Tape & Reel, BK=Bulk.



6. Absolute Maximum Ratings

over operating free-air temperature range

Symbol	Parameter	Min.	Max.	Units
V_{CC}	Power supply voltage	-0.5	30.0	V
V_{OUT}	Output terminal voltage	-0.3	30.0	V
I_{CC}	Supply current	-	20	mA
I_{OUT}	Output current	-	2	mA
T_A	Operating ambient temperature	-40	125	°C
T_J	Operating junction temperature	-50	165	°C
T_{STG}	Storage temperature	-65	175	°C

Note:

(1) 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

Human Body Model (HBM) tests according to standard AEC-Q100-002

Symbol	Parameter	Min.	Max.	Units
V_{ESD}	HBM ESD stress voltage	-4	+4	kV

Note:

(1) Maximum voltage must be adjusted for power dissipation and junction temperature, see Thermal Characteristics

8. Thermal Characteristics

Symbol	Parameter	Test Conditions	Rating ⁽¹⁾	Units
$R_{\theta JA}$	Package thermal resistance TO-92S	Single-layer PCB, with copper limited to solder pads	166	°C/W
	Package thermal resistance SOT23-3L		313	

Note:

(1) Maximum voltage must be adjusted for power dissipation and junction temperature, see Thermal Characteristics

9. Operating Characteristics

($V_{CC}=3.3V$, $T_A=25^{\circ}C$, unless otherwise noted)

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Supply voltage	V_{CC}	$T_J < T_{J(Max)}$	2.5	3.3	5.5	V
Supply current	I_{CC}	$V_{CC}=3.3V$, $T_A=25^{\circ}C$	-	2.2	3	mA
Output load resistance	R_L	OUT to V_{CC}	2	-	-	k Ω
		OUT to GND	2	-	-	
Output voltage range	$V_{OUT(H)}$	$T_A=25^{\circ}C$, $B=1000Gs^{(1)}$	3.1	3.2	-	V
	$V_{OUT(L)}$	$T_A=25^{\circ}C$, $B=-1000Gs$	-	0.1	0.2	V
Quiescent voltage output	$V_{OUT(Q)}$	$B=0Gs$, $T_A=25^{\circ}C$, SC4901	1.5	1.65	1.8	V
		$B=0Gs$, $T_A=25^{\circ}C$, SC4923	2.8	2.97	3.12	
		$B=0Gs$, $T_A=25^{\circ}C$, SC4903	1.5	1.65	1.8	
Sensitivity	Sens	$T_A=25^{\circ}C$, SC4901	1.4	1.65	1.9	mV/Gs
		$T_A=25^{\circ}C$, SC4923	2.8	3.3	3.8	
		$T_A=25^{\circ}C$, SC4903	2.8	3.3	3.8	
Linearity	Lin		-1	-	+1	%
Delta sensitivity vs. temp.	$\Delta Sens$	$T_A = -40^{\circ}C$ to $125^{\circ}C$	-10	-	+10	%
Bandwidth	F_{BW}		-	1	-	Mhz
Power-on time	T_{ON}	$B = 0$ mT, 10pF Load Capacitor	-	4.5	-	μs
Step response time	t_{resp}	Delay the output signal reaching 90%	-	1	-	μs
Output-referred noise	V_N	SC4901, BW = 10Khz	-	1.5	-	mV _{VPP}
		SC4903, SC4923, BW = 10Khz	-	3	-	mV _{VPP}

Note:

(1) $1Gs = 0.1mT$

10. Block Diagram

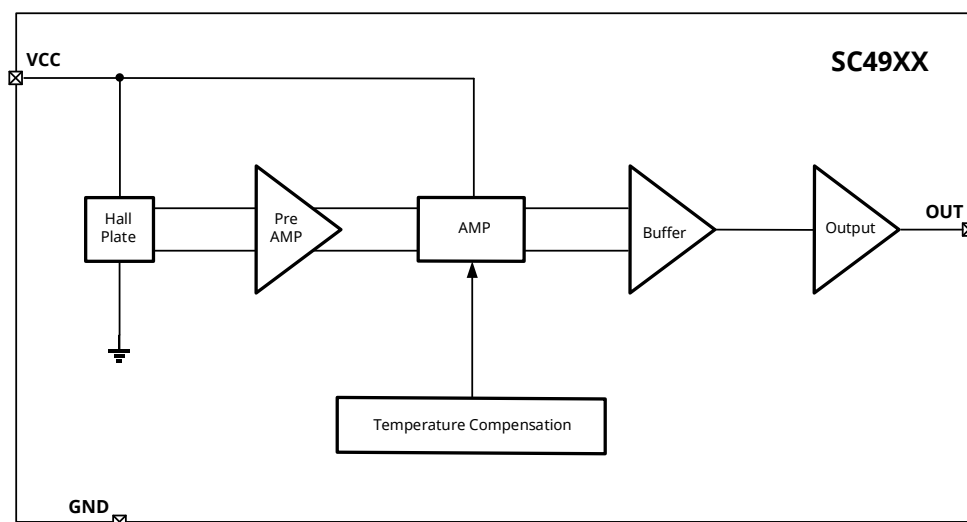
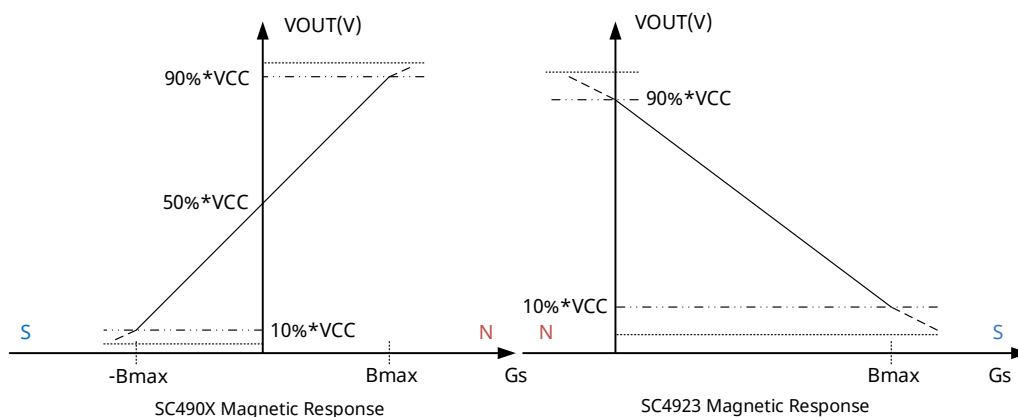


Fig.3 Block Diagram

11. Function Description

Magnetic Field Direction Definition: TO-92S(UA) package, the magnetic field S pole is defined as the positive magnetic field on the chip screen; SOT23-3L(SO) package, the magnetic field S pole is defined as a negative magnetic field on the marking.

Quiescent Output Voltage (V_{OUTQ}): In the quiescent state (that is, with no significant magnetic field: $B=0$), the output, $V_{OUT(Q)}$, equals to 50% of the supply voltage for SC4901 and SC4903, and 90% of the supply voltage for SC4923, throughout the entire operating range of V_{CC} . The presence of a South-polarity magnetic field perpendicular to the branded surface of the package increases the output voltage from its quiescent value toward the supply voltage rail. The amount of the output voltage increase is proportional to the magnitude of the magnetic field applied. Conversely, the application of a North polarity field will decrease the output voltage from its quiescent value. The devices magnetic sensitivity at $V_{IN}=3.3V$ are 1.65mV/Gs(SC4901) and 3.3mV/Gs(SC4903/SC4923).



12. Typical Application

SC49XX is a very robust linear position sensor for applications such as magnetic keyboard, weight and liquid level sensing. SC49XX can be used as current monitoring too. The typical application circuit is as follow, the shunt capacitor from V_{IN} to ground is recommended. The typical value is $0.1\mu\text{F}$.

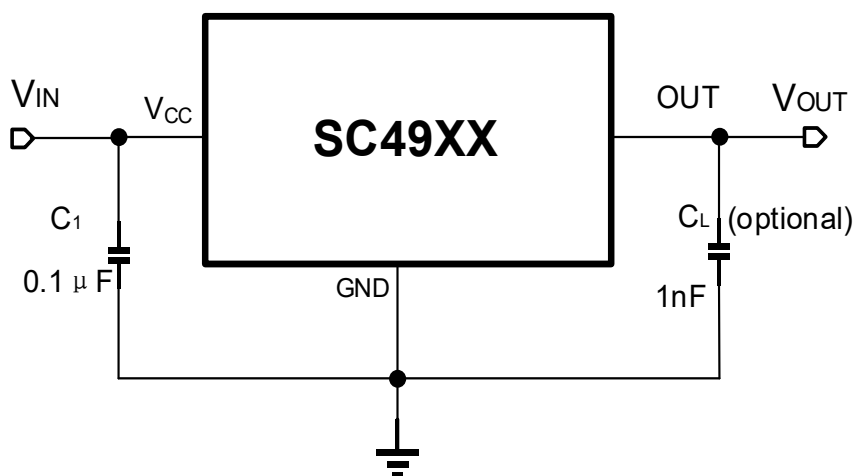
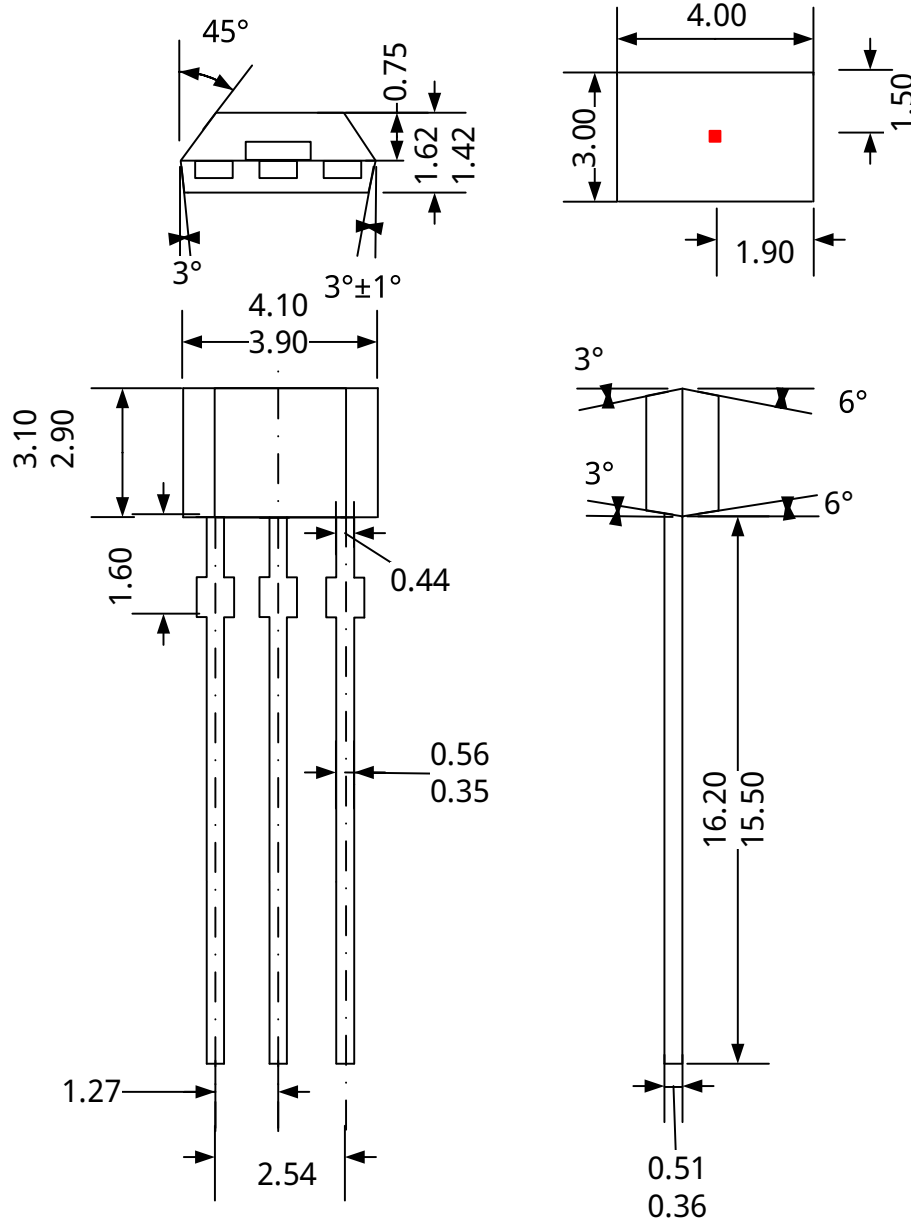


Fig.4 Typical Application Circuit

13. Package Information (UA)

**3-Terminal
UA Package**

Dimension: mm



Notes:

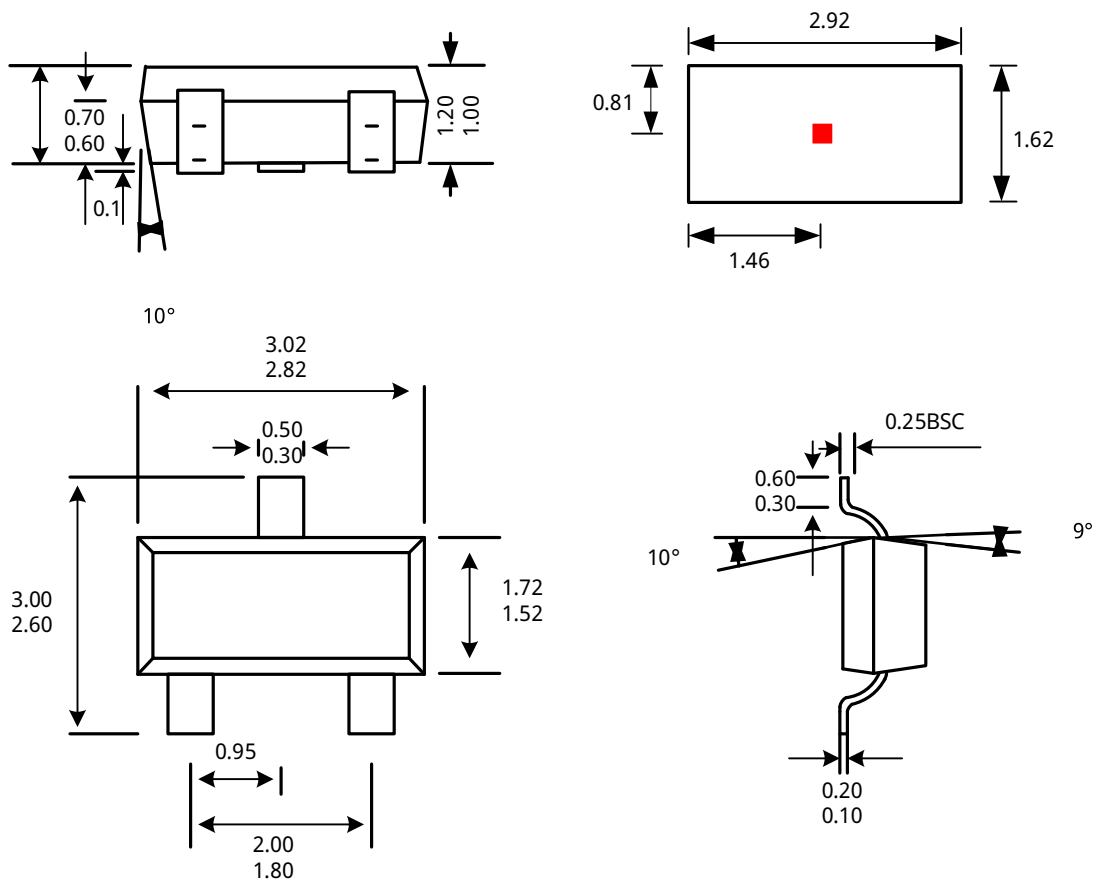
1. Exact body and lead configuration at vendor's option within limits shown.
2. Height does not include mold gate flash.

Where no tolerance is specified, dimension is nominal.

14. Package Information (SO)

**3-Terminal
SO Package**

Dimension:mm



Notes:

1. Exact body and lead configuration at vendor's option within limits shown.
2. Height does not include mold gate flash.

Where no tolerance is specified, dimension is nominal.

15. Revision History

Revision	Date	Description
Rev.E0.1	2024-4-21	Preliminary Datasheet
Rev.A1.0	2024-6-26	Initial Version