

Low Cost Linear Hall Effect Sensor

1. Features

- 4.5 to 5.5V wide supply voltage range
- Single current sourcing output
- Low noise output eliminates the need for filtering
- -40°C to 125°C wide ambient temperature range
- Responds to either positive or negative gauss
- Resistant to mechanical stress
- PKG Type
 - TO-92S(UA)
 - SOT23-3(SE)

2. Applications

- Motor control
- Position sensing
- Current sensing
- Magnetic code reading
- Ferrous metal detector
- Weigh and liquid level sensing

3. Description

SC4001 is a small, economical, linear Hall sensor chip whose output voltage varies proportionally to the supply voltage and to the intensity of the magnetic field it induces.

The SC4001's zero output voltage (without magnetic field) defaults to half of the supply voltage, with a typical sensitivity of 1.4 mV/Gs.

The typical working voltage of the chip is 5.0V, the limit voltage can be up to 30V, the working temperature range supports -40-125 °C, suitable for commercial, consumer and industrial fields.

These devices are available in a TO-92S(UA) and SOT23-3(SE). Both packages are lead (Pb) free, with 100% matte tin lead frame plating

Not to scale



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

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4. Terminal Configuration

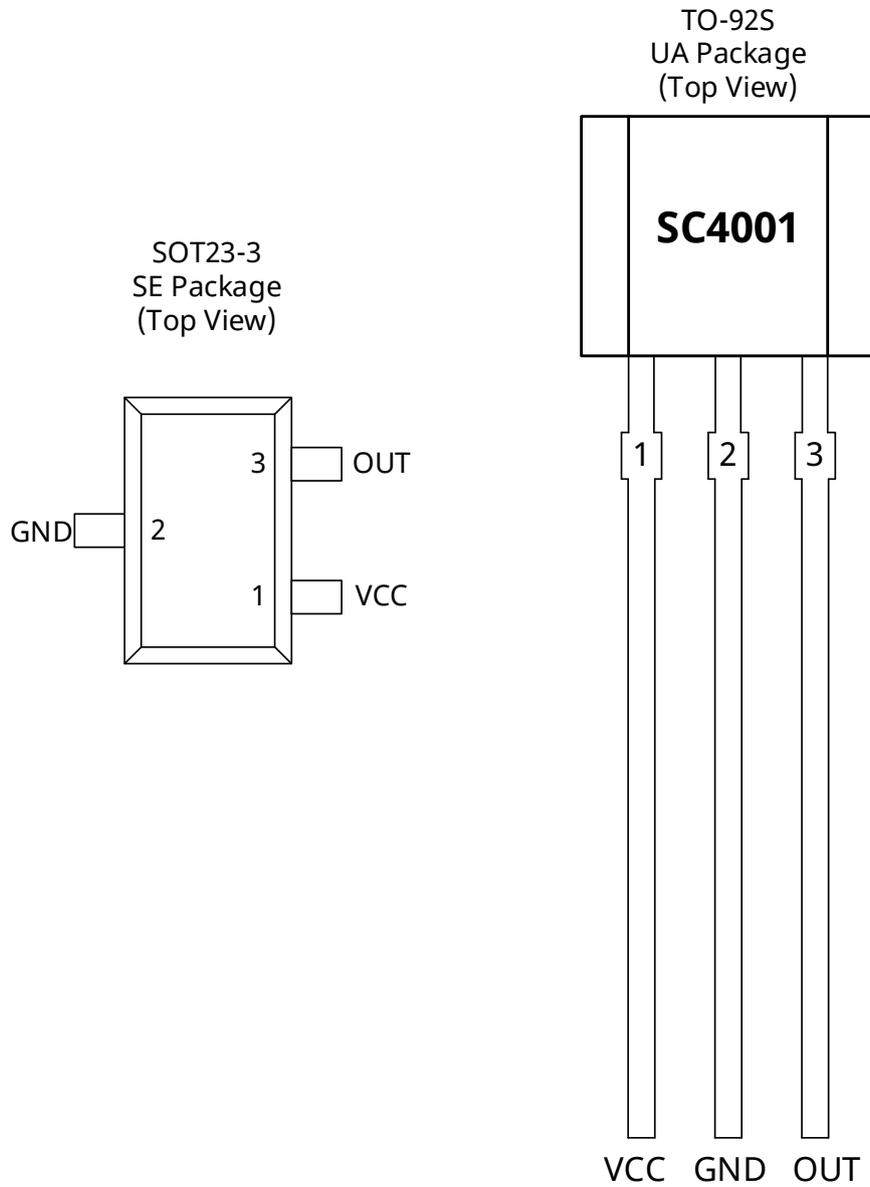


Fig.2 SOT23-3 (Left) and TO-92S(Right)Pin Description

Name	SOT23-3 & TO-92S	
	Number	Description
VDD	1	Power supply
GND	2	Ground
OUT	3	Output

5. Ordering Information

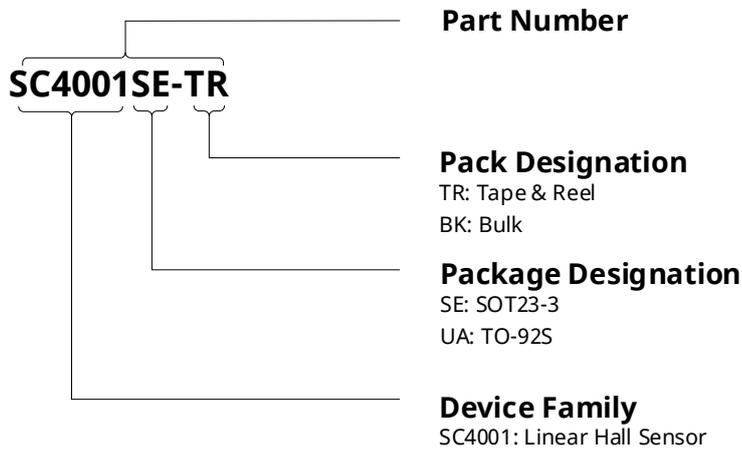
Ordering Information	Sens(mV/Gs) ⁽¹⁾	Ambient, T _A (°C)	Package	Packing	Quantity
SC4001UA-BK ⁽²⁾	1.4	-40-125	TO-92S	BK	1000
SC4001SE-TR	1.4	-40-125	SOT23-3	TR	3000

Note:

(1) This sensitivity data is available under 5v application conditions

(2) TR: Tape & Reel; BK: Bulk

Order information format description



6. Absolute Maximum Ratings

Symbol	Parameter	Notes	Min.	Max.	Units
V_{CC}	Power End Withstand Voltage	$B = 0mT, T_A = 25^{\circ}C$	-0.5	10.0	V
V_{OUT}	Output Withstand Voltage	-	-0.3	10.0	V
I_{CC}	Supply Current	$V_{CC} = 5.0V, B = 0mT$	-	15	mA
I_{OUT}	Current Output	-	-	2	mA
T_A	Operating Temperature Range	-	-40	125	$^{\circ}C$
T_J	Storage Temperature Range	-	-50	165	$^{\circ}C$
T_{STG}	Maximum Junction Temperature	-	-65	175	$^{\circ}C$

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 ANSI/ESDA/JEDEC JS-001 standard	-4	+4	kV
V_{ESD_CDM}	CDM	Refer to ANSI/ESDA/JEDEC JS-002 standard	-750	+750	V

8. Thermal characteristics

Symbol	Parameter	Test conditions	Value ⁽¹⁾	Units
$R_{\theta JA}$	TO-92S	Single-layer PCBs, JEDEC 2s2p and 1s0p are defined in JESD 51-7 and JESD 51-3	177	$^{\circ}C/W$
	SOT23-3L		313	

Note:

(1) The maximum operating voltage must meet the requirements of power consumption and junction temperature, refer to thermal characteristics

9. Operating Characteristics

($T_A = -40^\circ\text{C} \sim 125^\circ\text{C}$, $V_{DD} = 4.5\text{V} \sim 5.5\text{V}$, unless otherwise noted)

Symbol	Parameter	Test Condition	Min	TYP	MAX	Unit
V_{CC}	Operating Voltage	$T_J < T_{J(\text{Max})}$	4.5	5.0	5.5	V
I_{CC}	Operating Current	$V_{CC} = 5.0\text{V}$, $T_A = 25^\circ\text{C}$	-	6.5	10.0	mA
R_L	Output load resistance	OUT to VCC	4	-	-	k Ω
$V_{\text{OUT(H)}}$	Output Voltage Range	$T_A = 25^\circ\text{C}$, $B = 1000\text{Gs}$	4.0	4.2	-	V
$V_{\text{OUT(L)}}$		$T_A = 25^\circ\text{C}$, $B = -1000\text{Gs}$	0	0.8	1.0	V
$V_{\text{OUT(Q)}}$	Static Output Voltage	$V_{CC} = 5\text{V}$, $B = 0\text{Gs}$, $T_A = 25^\circ\text{C}$	2.375	2.5	2.625	V
S	Sensitivity	$V_{CC} = 5\text{V}$, $T_A = 25^\circ\text{C}$	1.0	1.4	1.9	mV/Gs
Lin	Linearity	-	-5	-	+5	%
ΔSens	Sensitivity	$T_A = -40^\circ\text{C}$ to 105°C	-20	-	+20	%
T_{RESP}	Step response time	The delayed output signal reaches 90%	-	1	-	μs

10. Block Diagram

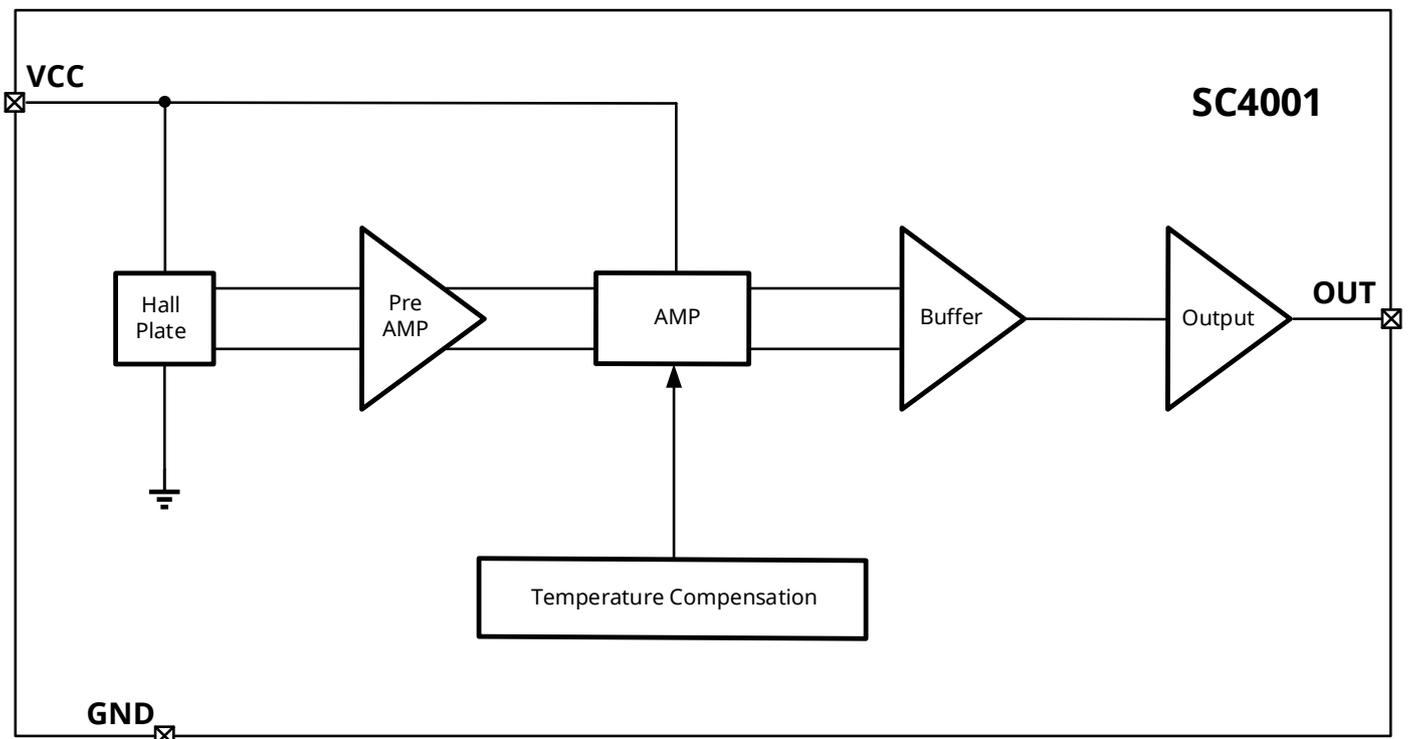


Fig.3 Block Diagram

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; SOT23-3(SE) package, the magnetic field S pole is defined as a negative magnetic field on the marking.

Quiescent Output Voltage (V_{OUTQ}): Quiescent Output Voltage indicates the output voltage of the IC when there is no magnetic field.

Sensitivity(S)

$$Sens = [V_{OUT}(B1) - V_{OUT}(B2)] / (B1 - B2)$$

When the South Pole magnetic field perpendicular to the chip tagged side approaches, the output voltage increases proportionally, until it reaches supply voltage. Conversely, when the North Pole magnetic field perpendicular to the chip tagged side approaches, the output voltage decreases proportionally, until it reaches ground level. Sensitivity is defined as the specific value of the output voltage variation and the magnetic field variation, commonly in mV/Gs or mV/mT.

12. Typical Application

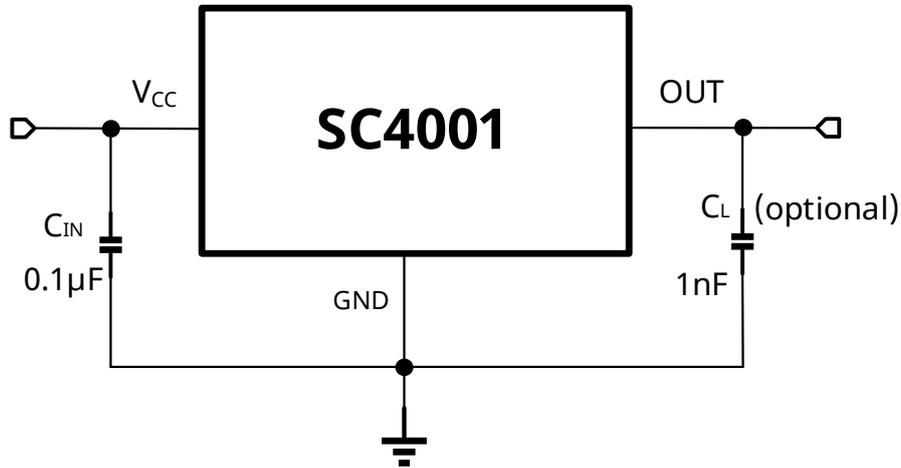


Fig.4 Typical Application Circuit

The static (zero field strength) output voltage of the chip, V_Q , is usually half of the power supply voltage in the operating voltage range of the power supply. When the S-pole magnetic field perpendicular to the screen surface of the chip increases, the output voltage of the chip increases proportionally. In contrast, when the N electrode is applied to the silkscreen surface of the chip, the output voltage drops synchronously in the same proportion.

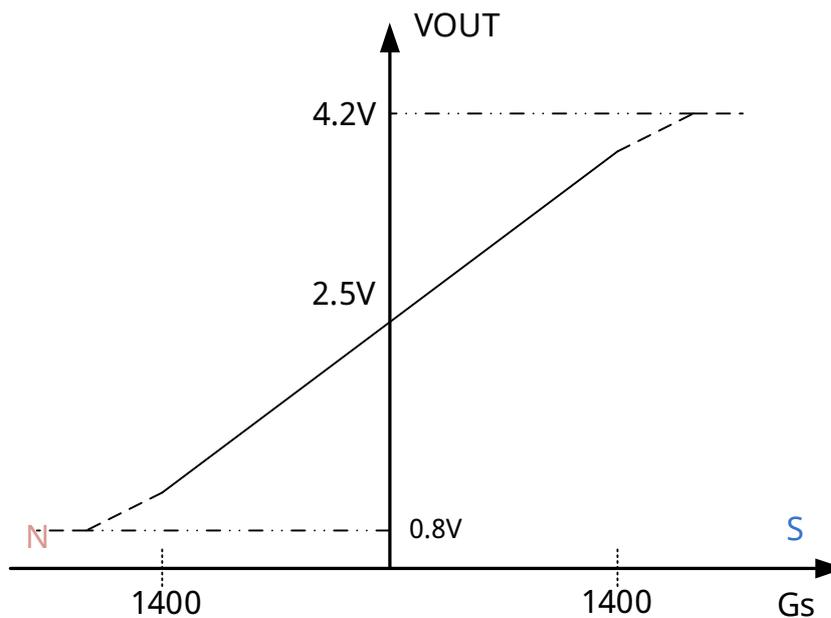
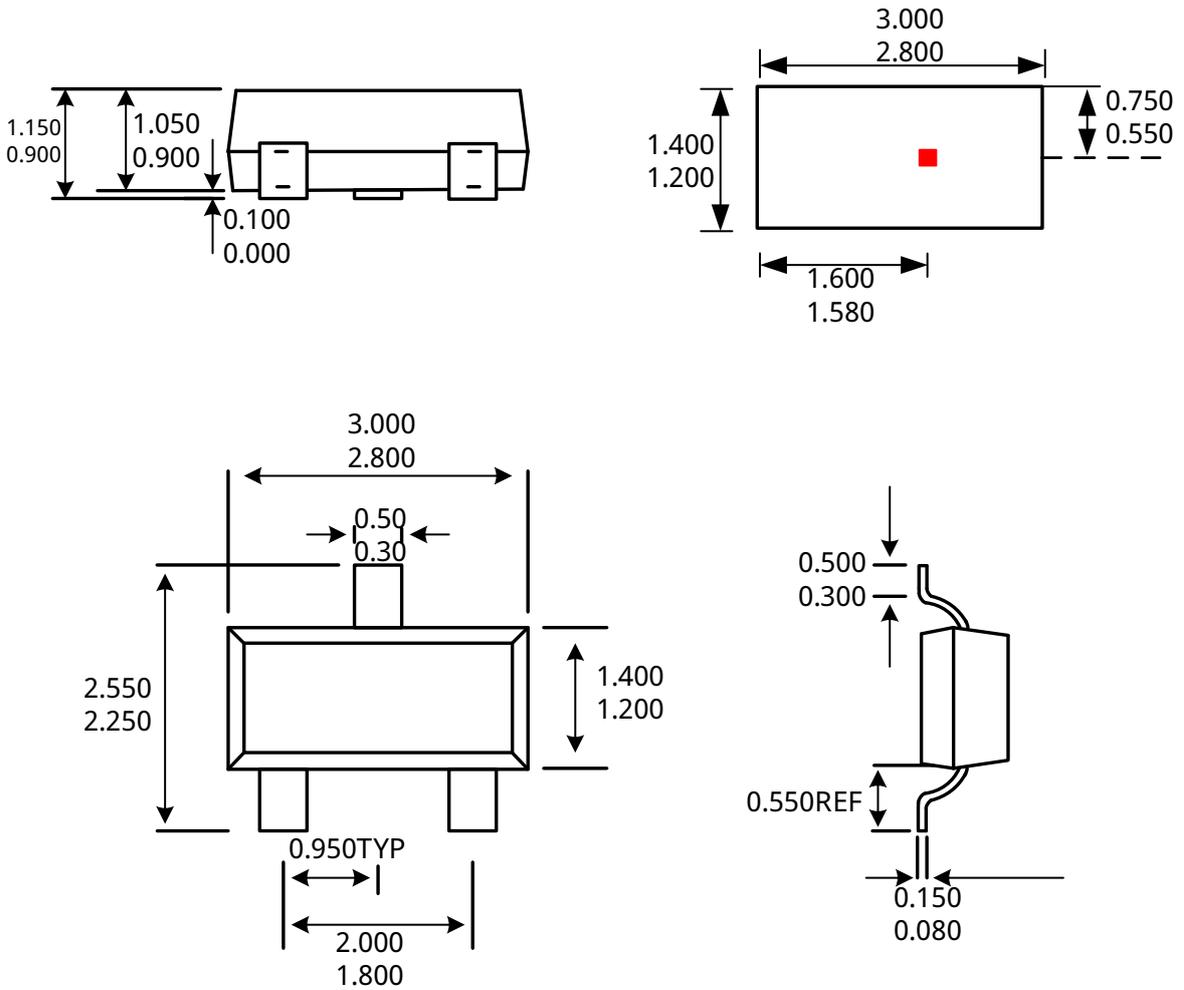


Fig.5 Output function

13. Package Information “SOT23-3(SE)”

**3-PIN
SOT23-3
Package**

Unit: mm

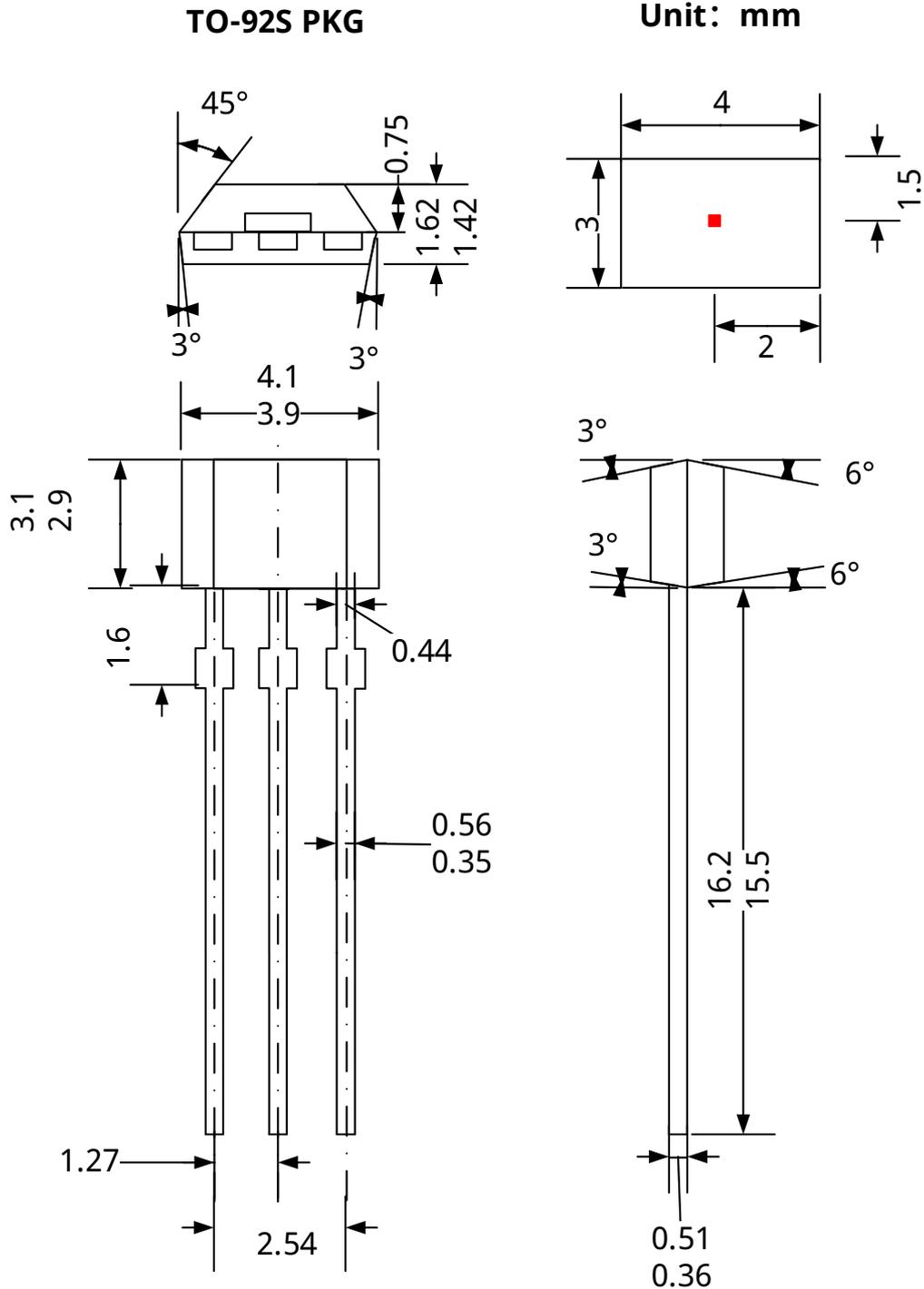


Notes:

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 “TO-92S(UA)”



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	2017-11-14	Preliminary datasheet
Rev.E0.5	2018-09-11	Unified datasheet format
Rev.E0.9	2019-05-04	Final datasheet revision
Rev.A1.0	2020-11-19	Publish uniform format
Rev.A1.1	2025-01-27	Format modification