Low Cost Linear Hall Sensor

1. Features

- Single current source output
- Low noise output, no filtering required
- Responds to positive and negative magnetic fields
- Resistant to mechanical stress
- Wide operating temperature range from -40℃ to 105℃
- PKG Type
  - TO-92S
  - SOT23-3L
  - DFN1616

2. Applications

- Linear keyboards
- Motor control
- Position detection
- Current detection
- Weighing and liquid level detection

3. Description

The SC4011 is a compact, cost-effective linear Hall sensor chip whose output voltage is proportional to the supply voltage and the magnetic field strength it senses.

The zero output voltage (no magnetic field) of the SC4011 defaults to half of the supply voltage, with a typical sensitivity of 2.9mV/Gs at a 5.0V supply voltage and 1.6mV/Gs at a 3.3V supply voltage.

The chip typically operates at 3.3V or 5.0V, with a maximum voltage of 25V, and supports an operating temperature range of -40℃ to 105℃, making it suitable for commercial, consumer, and industrial applications.

These devices are available in 3-pin TO-92S (UA), 3-pin SOT-23L (SO), and 6-pin DFN1616 (DN) packages. Both packages are lead-free with 100% matte tin lead frame plating.

Not To Scale

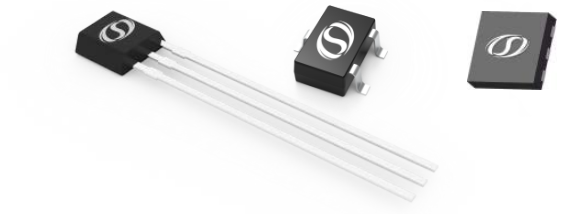

Fig.1 TO-92S(Left) & SOT23-3L(Mid) & DFN1616(Right)

Package Outline

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4. Terminal Configuration

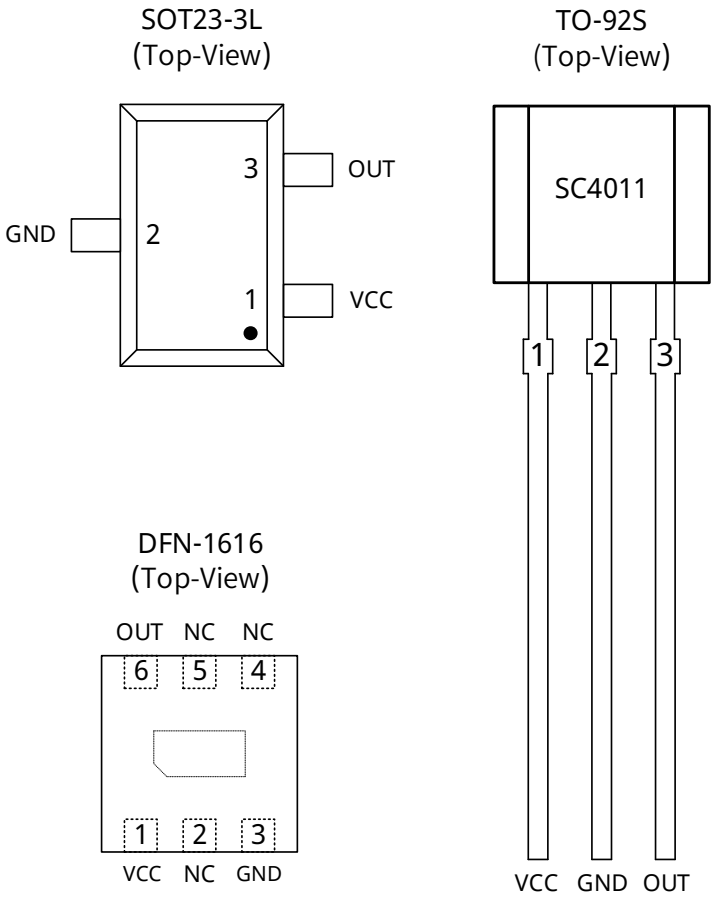


Fig.2 SOT23 & DFN1616(Left) and DTO-92S(Right)Pin Description

Name	Number			Description
	DFN1616	SOT23-3L	SOT23	
VCC	1	1	1	Power supply
GND	3	2	2	Ground
OUT	6	3	3	Output
NC	2	-	-	Not connection
NC	4	-	-	Not connection
NC	5	-	-	Not connection

5. Ordering Information

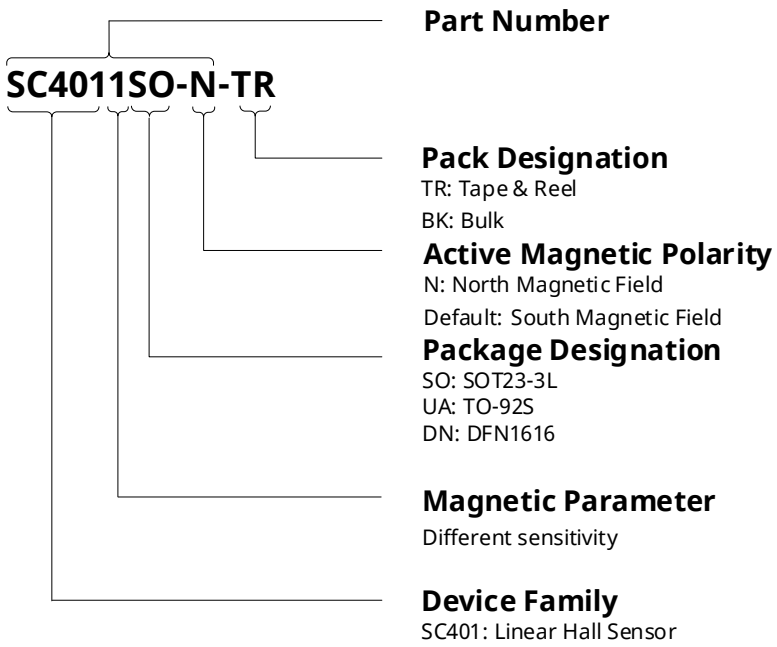
Ordering Information	Sens(mV/Gs) (1)	Ambient, T_A(℃)	Package	Packing	Quantity
SC4011UA-BK(2)	1.6	-40-105	TO-92S	BK	1000
SC4011SO-N-TR	1.6	-40-105	SOT23-3L	TR	3000
SC4011DN-TR	1.6	-40-105	DFN1616	TR	4000

Note:

(1) This sensitivity data is available under 3.3v application conditions

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

5.1. 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°C	-0.3	25.0	V
V_{OUT}	Output Withstand Voltage	B = 0mT，T_A = 25°C	-0.3	25.0	V
I_{CC}	Supply Current	B = 0mT，T_A = 25°C	-	15	mA
I_{OUT}	Current Output	B = 0mT，T_A = 25°C	-	2	mA
T_A	Operating Temperature Range		-40	105	℃
T_J	Storage Temperature Range		-50	165	℃
T_{STG}	Maximum Junction Temperature		-65	165	℃

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(1)	-4	+4	kV
V_{ESD_CDM}	CDM	Refer to ANSI/ESDA/JEDEC JS-002 standard(2)	-750	+750	V

Note：
(1) JEDEC document JEP155 states that 4000V HBM allows safe manufacturing using standard ESD control processes.
(2) JEDEC document JEP157 states that 740V CDM allows safe manufacturing using standard ESD control processes.

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	166	℃/W
	SOT23-3L		313	
	DFN1616		186	

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

9. Operating Characteristics

（TA=-40℃~105℃, VDD=2.5V~5.5V, unless otherwise noted）

Symbol	Parameter	Test Condition	Min	TYP	MAX	Unit
V_{CC}	Operating Voltage	$T_J<T_{J(Max)}$	2.2	5.0	5.5	V
I_{CC}	Operating Current	V_{CC}=5.0V, T_A=25℃	-	2.5	6.0	mA
R_L	Output load resistance	OUT to GND	4	-	-	kΩ
$V_{OUT(H)}$	Output Voltage Range	V_{CC}=5V, T_A=25℃, B=1000Gs	4.0	4.3	-	V
		V_{CC}=3.3V, T_A=25℃, B=1000Gs	2.3	2.6	-	
$V_{OUT(L)}$		V_{CC}=5V, T_A=25℃, B=-1000Gs	0.75	0.8	0.95	
		V_{CC}=3.3V, T_A=25℃, B=-1000Gs	0.75	0.8	0.95	
$V_{OUT(Q)}$	Static Output Voltage	V_{CC}=5V, B=0Gs, T_A=25℃	-	2.5	-	V
		V_{CC}=3.3V, B=0Gs, T_A=25℃	-	1.65	-	V
S	Sensitivity	V_{CC}=5V, T_A=25℃	2.3	2.9	3.5	mV/Gs
		V_{CC}=3.3V, T_A=25℃	1.2	1.6	2.0	mV/Gs
T_{RESP}	Response time	Delay the output signal reaching 90%	-	1	-	μs
T_{PO}	Power-on time		-	-	0.8	μs

10. Block Diagram

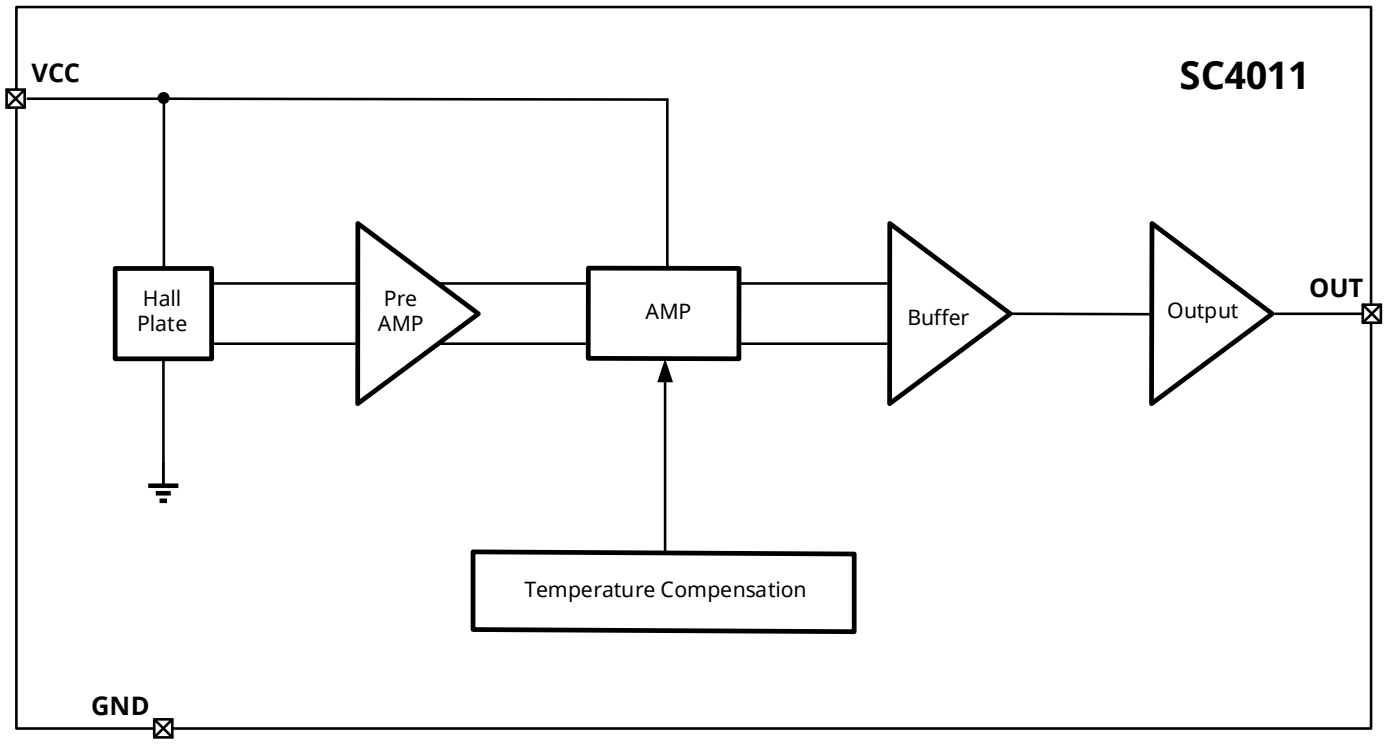


Fig.3 Block Diagram

11. Function Description

Magnetic Field Direction Definition: DFN1616(DN) & 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}): Quiescent Output Voltage indicates the output voltage of the IC when there is no magnetic field.

Sensitivity(S)

$$Sens = [VOUT(B1) - VOUT(B2)]/(B1 - B2)$$

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

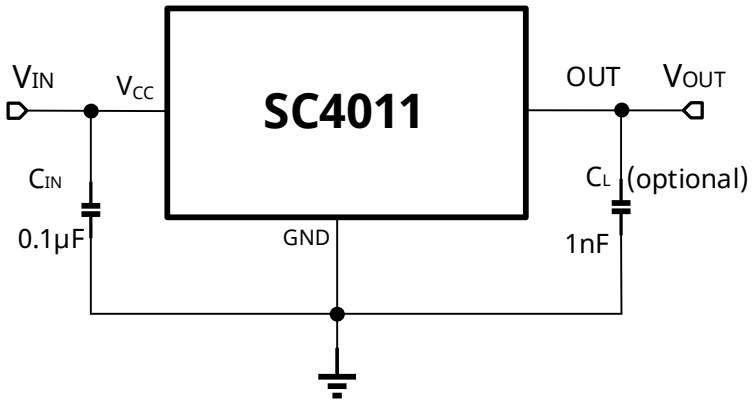


Fig.4 Typical Application Circuit

The static (zero field strength) output voltage of the chip, VQ, 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. The maximum output voltage of the chip at room temperature is VCC-0.7V, and the minimum output voltage is 0.8V, where the linear range is 0.8V~VCC~4.2V.

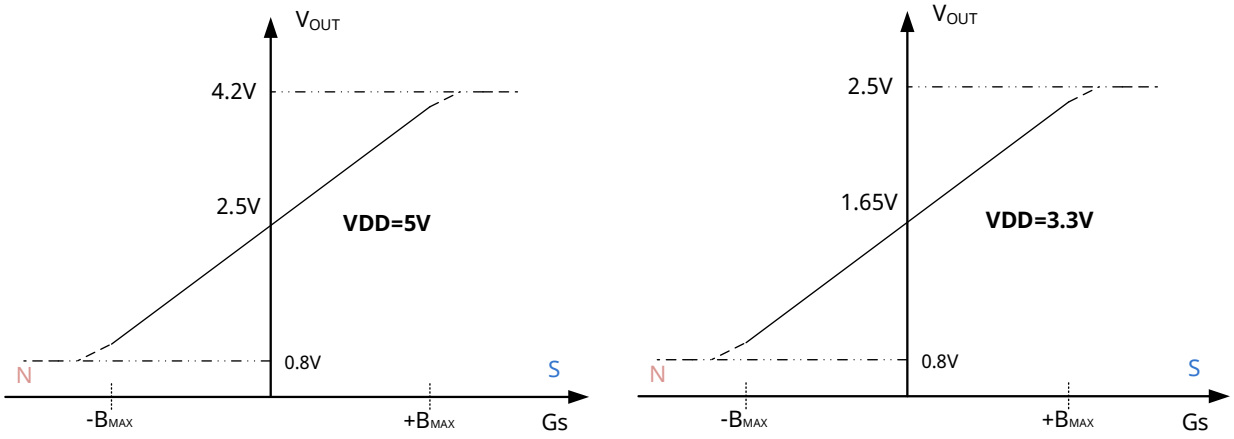
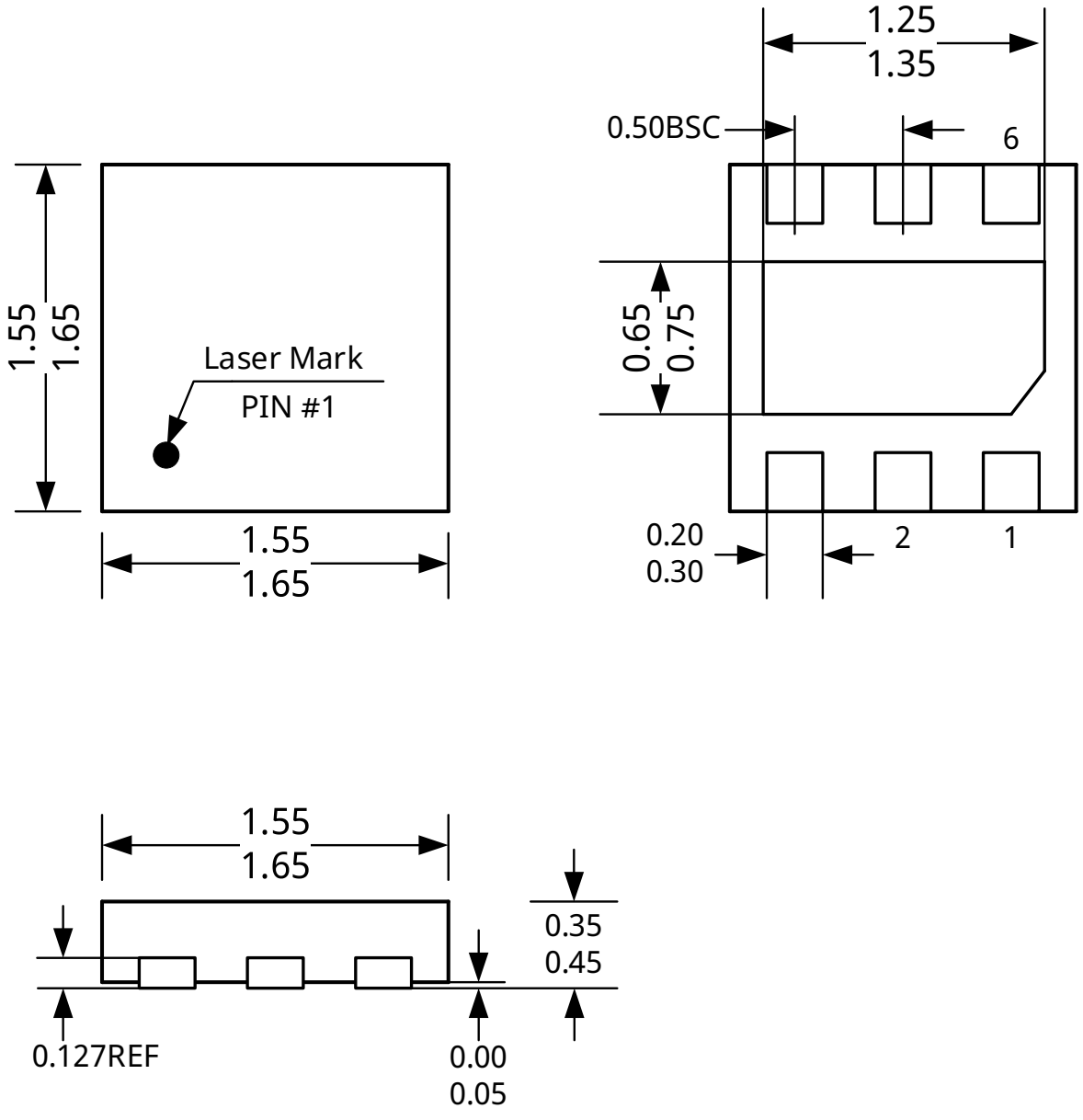


Fig.5 Output function

13. Package Information "DFN1616(DN)"

6-Pin DFN1616 Package

Unit: mm



Notes:

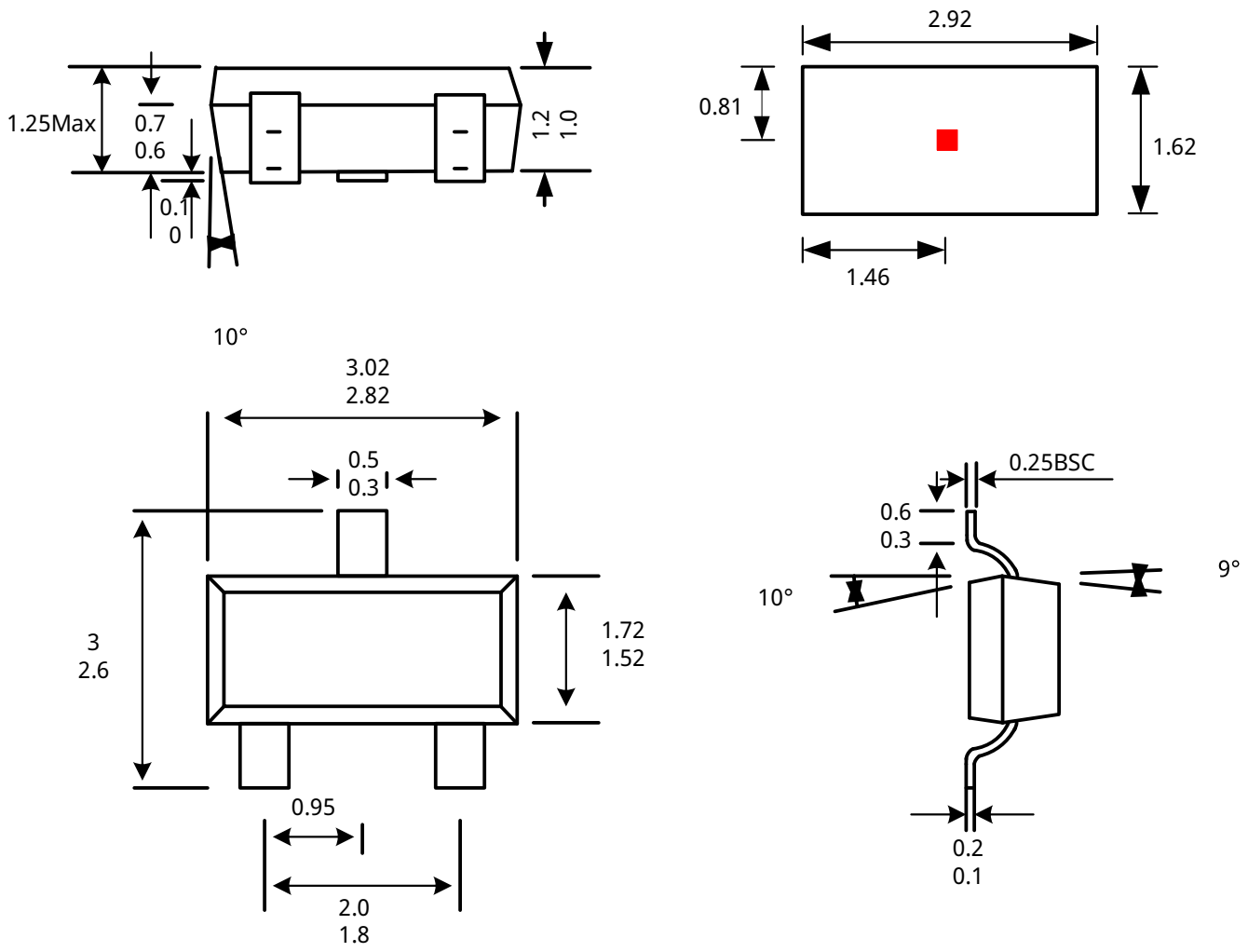
1. Exact body and lead configuration at vendor's option within limits shown.
2. Height does not include mold gate flash.

Where no tolerance is specified, dimension is nominal.

14. Package Information "SOT23-3L(SO)"

3-PIN
SOT23-3L
Package

Unit：mm



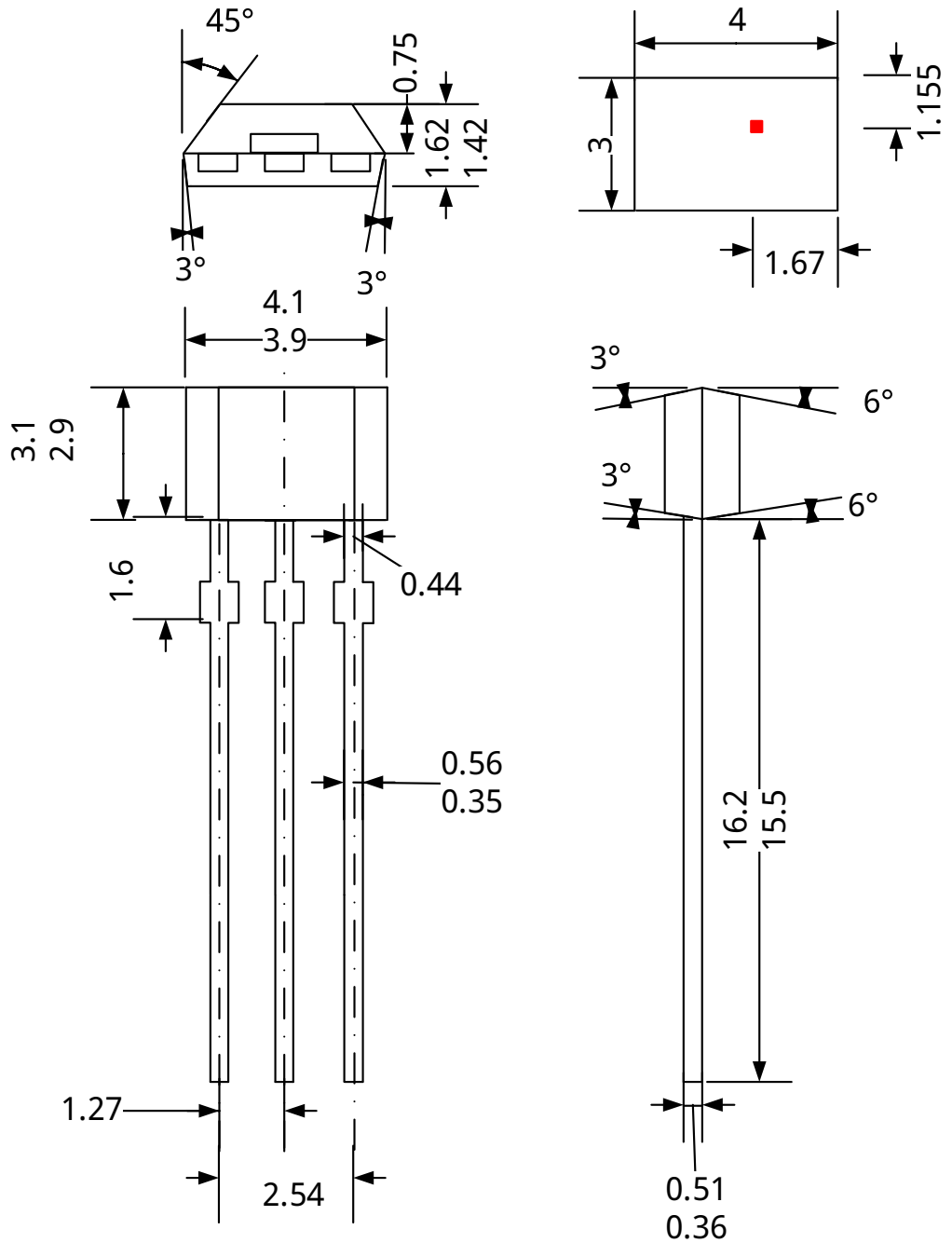
Notes:

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.

15. Package Information "TO-92S(UA)"

TO-92S PKG **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.

16. Revision History

Revision	Date	Description
Rev.0.1	2020-07-25	Preliminary datasheet
Rev.A1.0	2020-12-19	Unified datasheet format
Rev.A1.1	2024-02-18	Added parameters: power-on time & Added DFN package information
Rev.A1.2	2024-11-28	Add order information
Rev.A1.3	2025-01-27	Format modification