

## FEATURES

- Ultra-low power consumption
  - 1.2  $\mu$ A with 3.0 V
- 1.65V to 5.5V operating range
- Push-Pull output
- SOT-23, SOT553, TO-92 package options
- $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$  operating temperature range

## APPLICATIONS

- Battery-critical position sensing
- Electricity meter tamper detection
- Cell Phone, laptop, or tablet case sensing
- E-locks, smoke detectors, appliances
- Medical devices, IoT systems
- Valve or solenoid position detection
- Contactless diagnostics or activation

## DESCRIPTION

The SC203X family is an ultra-low-power Uni-polar switch Hall effect sensor, designed for the most compact and battery-sensitive systems. The device is offered in multiple magnetic thresholds, sampling rates, output drivers, and packages to accommodate various applications.

When the applied magnetic flux density exceeds the BOP threshold, the device outputs a low voltage. The output stays low until the flux density decreases to less than BRP, and then the output either drives a high voltage or becomes high impedance, depending on the device version. By incorporating an internal oscillator, the device samples the magnetic field and updates the output at a rate of 20 Hz for the lowest current consumption. Unipolar magnetic responses are available.

The device operates from a  $V_{DD}$  range of 1.65 V to 5.5 V, and is packaged in a standard SOT-23, TO-92, and SOT553.



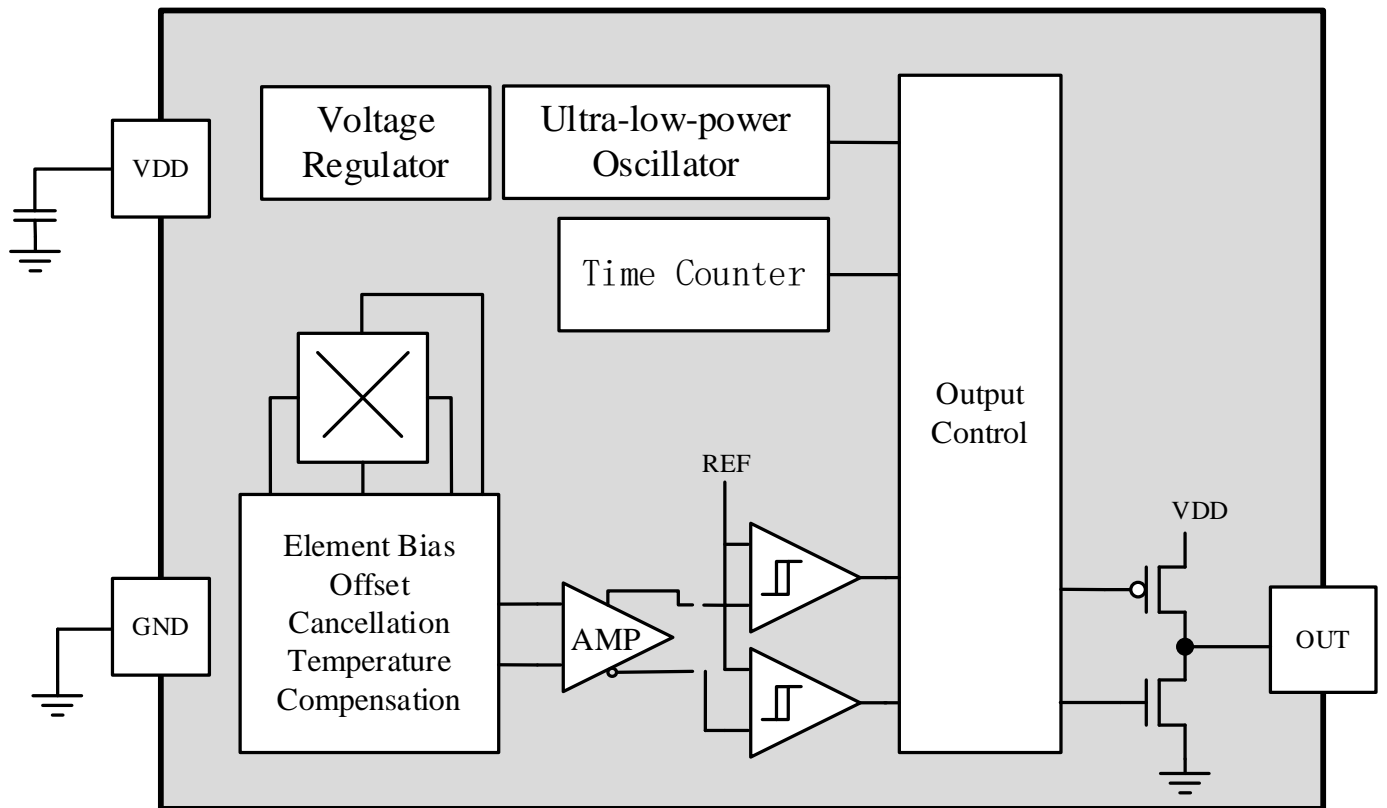
## ORDERING INFORMATION

Part Num.	VDD (V)	ICC ( $\mu$ A)	BOP (Gs)	BRP (Gs)	BHYS (Gs)	MagType	Polarity	Output	Fs (Hz)	Package
SC2033UA	1.65~5.5	1.2	22	18	4	Unipolar	S	Push-Pull	20	TO92
SC2033UA-N	1.65~5.5	1.2	-22	-18	-4	Unipolar	N	Push-Pull	20	TO92
SC2033SO	1.65~5.5	1.2	22	18	4	Unipolar	S	Push-Pull	20	SOT23
SC2033SO-N	1.65~5.5	1.2	-22	18	-4	Unipolar	N	Push-Pull	20	SOT23
SC2033NSO5	1.65~5.5	1.2	22	18	4	Unipolar	S	Push-Pull	20	SOT553
SC2033SSO5	1.65~5.5	1.2	-22	-18	-4	Unipolar	N	Push-Pull	20	SOT553

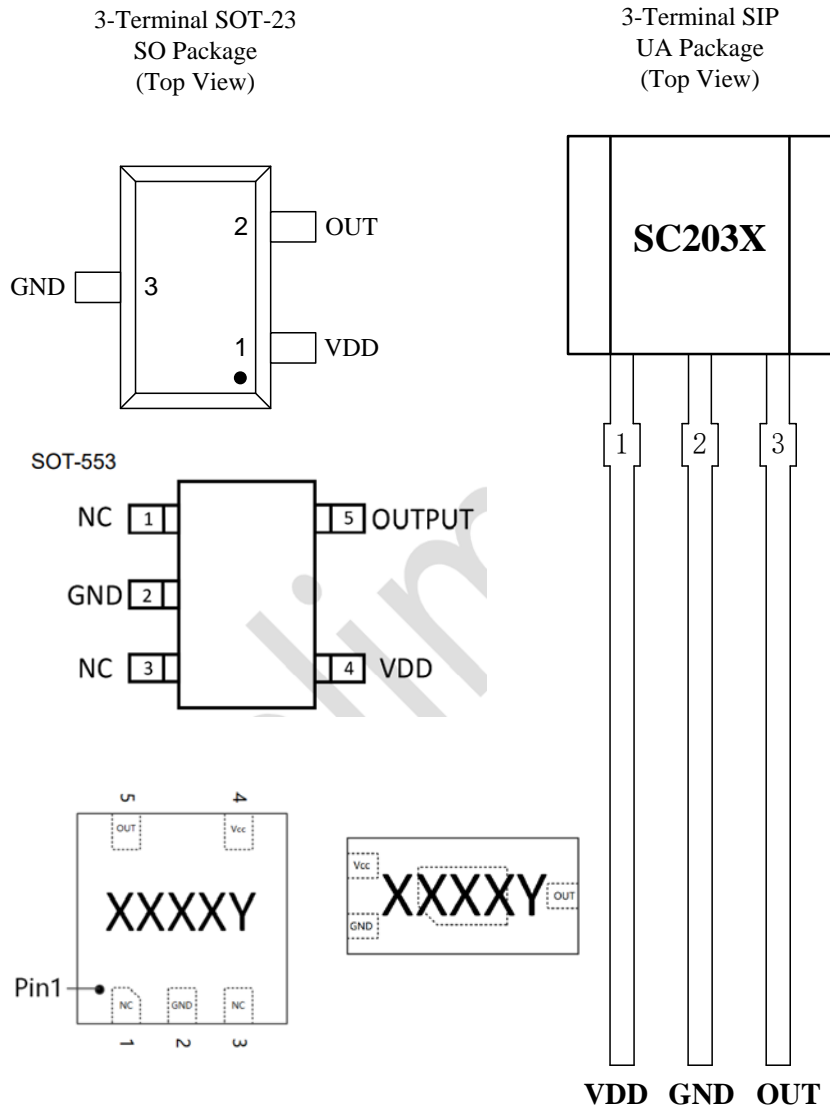
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## BLOCK DIAGRAM



## TERMINAL CONFIGURATION



Name	Terminal Number			Type	Description
	UA	SO	ST		
VDD	1	1	4	PWR	1.65V to 5.5V power supply
GND	2	3	2	Ground	Ground terminal
OUT	3	2	5	Output	Push-Pull output

## ABSOLUTE MAXIMUM RATINGS

over operating free-air temperature range (unless otherwise noted) <sup>(1)</sup>

Parameter	Symbol	Min.	Max.	Units
Power supply voltage	V <sub>DD</sub>	-0.3	6	V
Output terminal voltage	V <sub>OUT</sub>	-0.3	6	V
Operating ambient temperature	T <sub>A</sub>	-40	85	°C
Maximum junction temperature	T <sub>J</sub>	-55	125	°C
Storage temperature	T <sub>STG</sub>	-65	125	°C

<sup>(1)</sup> 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.

## ESD PROTECTION

Human Body Model (HBM) tests according to: standard ANSI/ESDA/JEDEC JS-001

Parameter	Symbol	HBM	Units
ESD-Protection	V <sub>ESD</sub>	±6	KV

## THERMAL CHARACTERISTICS

Symbol	Parameter	Test Conditions	Rating	Units
R <sub>θJA</sub>	UA Package thermal resistance	Single-layer PCB, with copper limited to solder pads	166	°C/W
R <sub>θJA</sub>	SO Package thermal resistance	Single-layer PCB, with copper limited to solder pads	228	°C/W

## OPERATING CHARACTERISTICS

### Electrical Characteristics

over operating free-air temperature range (V<sub>DD</sub> = 1.8V, unless otherwise noted)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
<b>Operating Characteristics</b>						
$V_{DD}$	Operating voltage <sup>(1)</sup>	$T_J < T_{J(Max.)}$	1.65	--	5.5	V
$t_{V_{DD}Slope}$	$t_{V_{DD}Slope} = 0 \rightarrow 0.9 \cdot V_{DD}$	$V_{DD}=1.65V$ to $5.5V$	--	--	100	$\mu S$
$I_{DD(Average)}$	Average current consumption	$V_{DD}=1.8V$	--	1.0	1.7	$\mu A$
		$V_{DD}=3V$	--	1.2	1.9	$\mu A$
		$V_{DD}=5V$	--	1.6	2.6	$\mu A$
$I_{DD(peak)}$	Peak current consumption	$V_{DD}=1.65V$ to $5.5V$	1.1	1.4	1.8	mA
$t_{ACTIVE}$	Active time	$V_{DD}=1.65V$ to $5.5V$	25	35	55	$\mu S$
$t_{ON(2)}$	Power on time	$V_{DD}=1.65V$ to $5.5V$	--	40	55	$\mu S$
$f_S$	Frequency of magnetic sampling	$V_{DD}=1.65V$ to $5.5V$	10	20	30	Hz
$t_S$	Period of magnetic sampling	$V_{DD}=1.65V$ to $5.5V$	33	50	100	mS
<b>Push Pull Output Characteristics</b>						
$V_{OH}$	High-level output voltage	$I_{OUT} = -1$ mA	$V_{DD}-0.35V$	$V_{DD}-0.1V$	--	V
$V_{OL}$	Low-level output voltage	$I_{OUT} = 1$ mA	--	0.1	0.3	V

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

(2) Guaranteed by design

## Magnetic Characteristics

over operating free-air temperature range (unless otherwise noted)

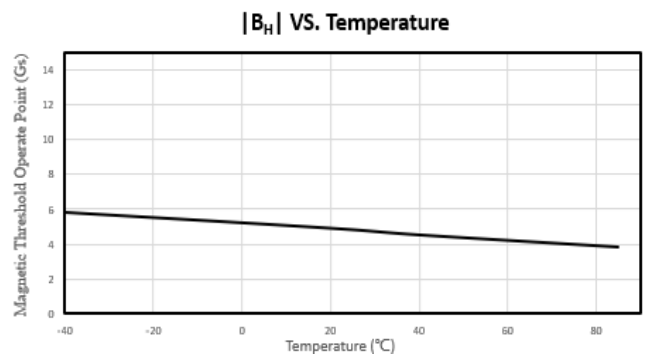
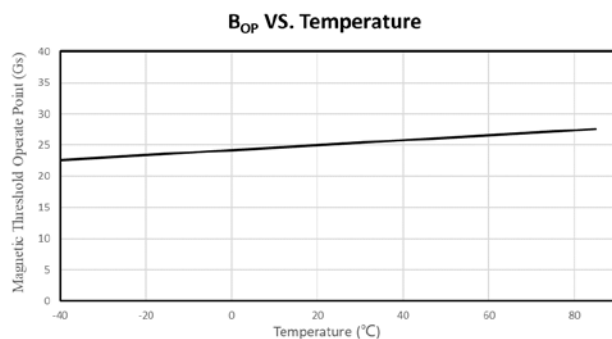
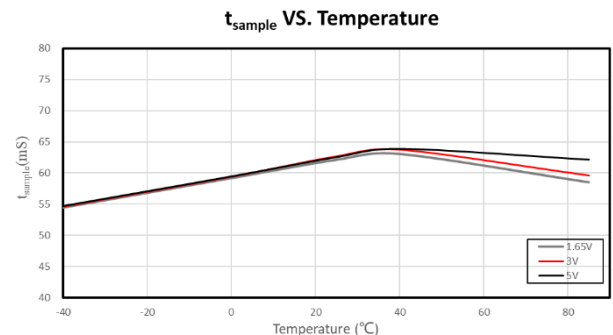
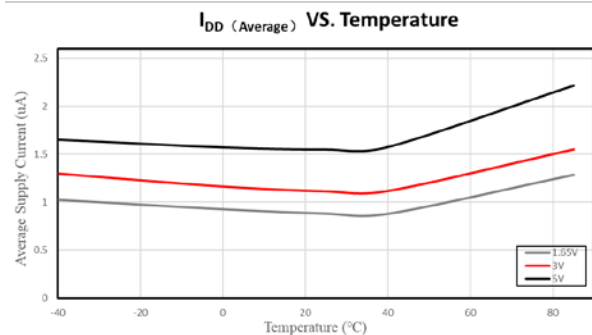
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
<b>S Polarity</b>						
$B_{OP}$	Operated point	$T_A=25^\circ C$	1.0	2.2	3.2	mT
$B_{RP}$	Release point		0.9	1.8	2.8	mT

$B_{HYS}$	Hysteresis		0.1	0.4	1.1	mT
N Polarity						
$B_{OP}$	Operated point	$T_A=25^\circ\text{C}$	-3.2	-2.2	-1.0	mT
$B_{RP}$	Release point		-2.8	-1.8	-0.9	mT
$B_{HYS}$	Hysteresis		-1.1	-0.4	-0.1	mT

1mT=10GS

Magnetic flux density,  $B$ , is indicated as a negative value for North-polarity magnetic fields, and as a positive value for South-polarity magnetic fields.

## TYPICAL CHARACTERISTIC



## FUNCTION DESCRIPTION

The SC203X device is a magnetic sensor with a digital output that indicates when the magnetic flux density threshold has been crossed. The device integrates a Hall effect element, analog signal conditioning, and a low-frequency oscillator that enables ultra-low average power consumption. By operating from a 1.65V to 5.5V supply, the device periodically measures magnetic flux density, updates the output, and enters a low-power sleep state.

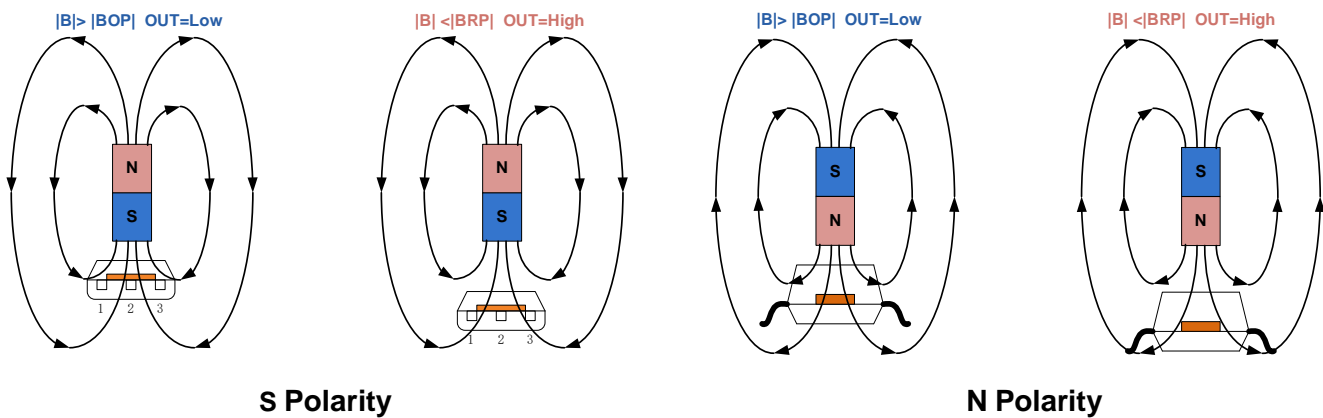
The output of SC203X switches low (turns on) when a magnetic field (South or North polarity)



perpendicular to the Hall element exceeds the operate point threshold, BOP. When the magnetic field is reduced below the release point, BRP, the device output goes high (turns off). The difference in the magnetic operate and release points is the hysteresis, BHYS, of the device. This built-in hysteresis allows clean switching of the output even in the presence of external mechanical vibration and electrical noise.

## Field Direction Definition

A positive magnetic field is defined as a South Pole near the marked side of the package.

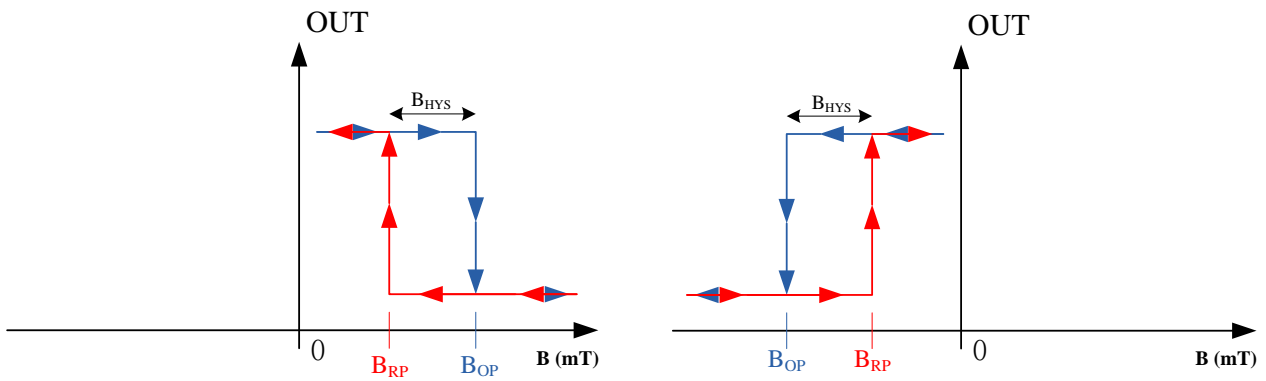


## Transfer Function

The SC203X exhibits “Unipolar” magnetic characteristics. It means the device reacts to both North and South magnetic pole. The purpose is to detect the presence of any magnetic field applied on the device. This mode of operation simplifies customer production processes by avoiding the need to detect the Hall sensor pole active on the magnet used in the application. Therefore, the “Unipolar” magnetic behavior helps customers by removing the need of magnet pole detection system during production phase.

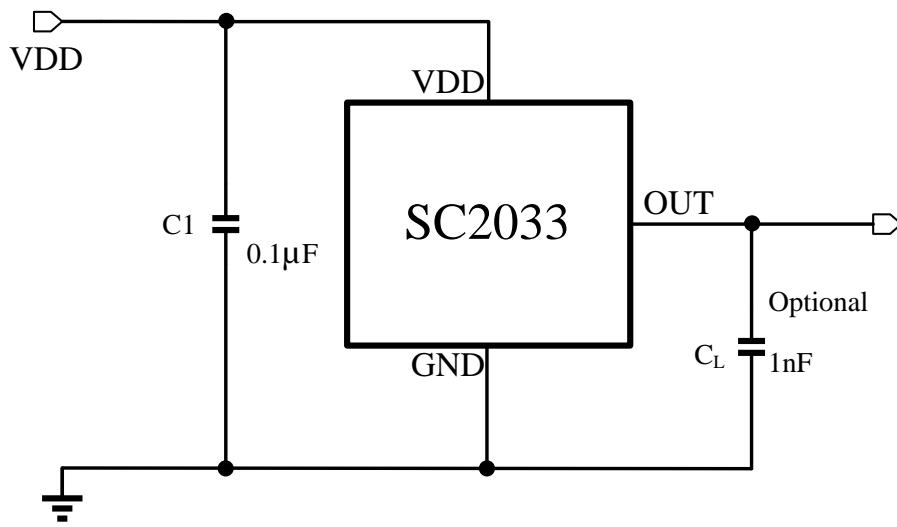
Powering-on the device in the hysteresis region, less than  $B_{OP}$  and higher than  $B_{RP}$ , allows an indeterminate output state. The correct state is attained after the first excursion beyond  $B_{OP}$  or  $B_{RP}$ . If the field strength is greater than  $B_{OP}$ , then the output is pulled low. If the field strength is less than

$B_{RP}$ , the output is released.



## TYPICAL APPLICATION

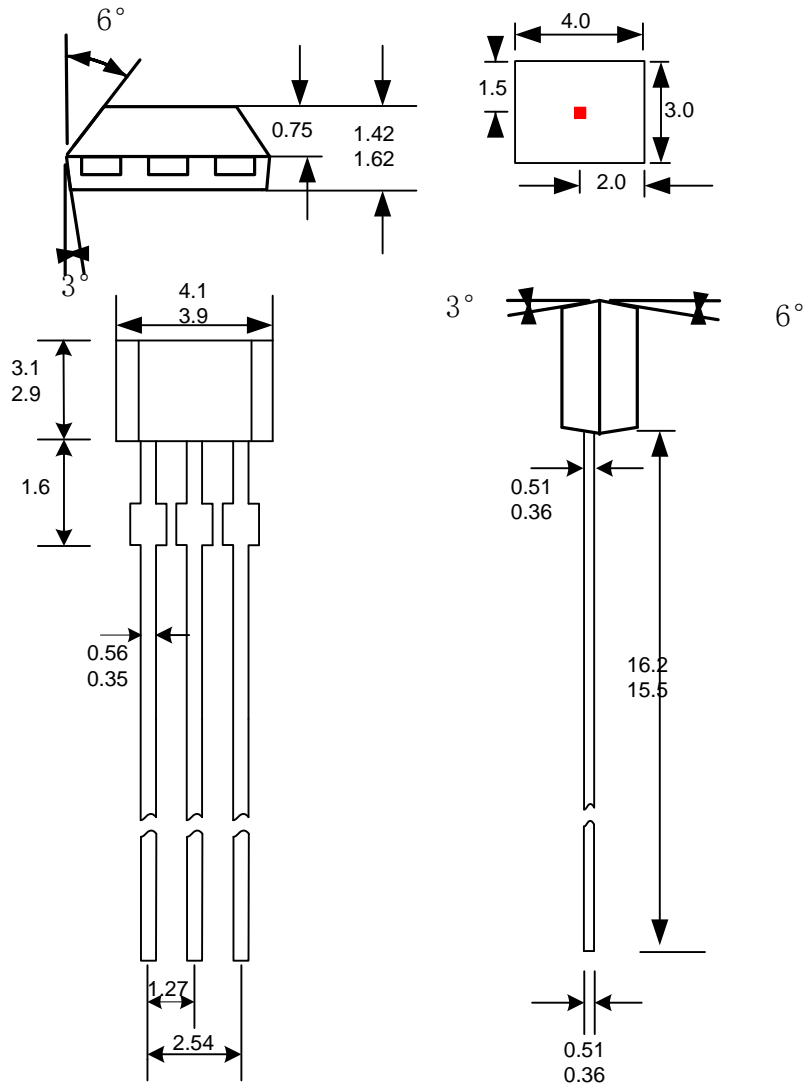
Push Pull Output



# PACKAGE INFORMATION “UA”

**3-Terminal  
UA Package**

**Dimension:mm**



**Notes:**

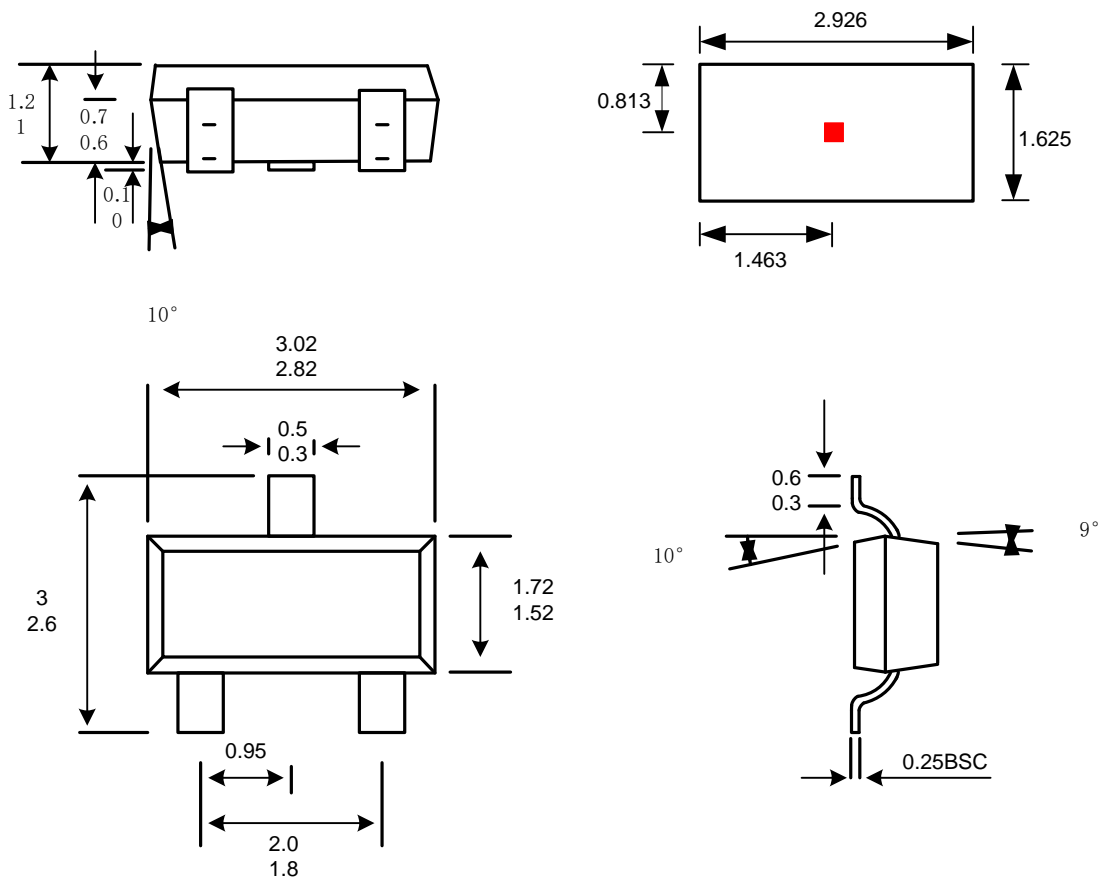
1. Exact body and lead configuration at vendor's option within limits shown.
2. Height does not include mold gate flash.

Where no tolerance is specified, dimension is nominal.

## 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.

## REVISION HISTORY

Revision	Date	Description
Rev0.1	2022-09-19	Preliminary Datasheet
Rev1.0	2023-03-28	Release datasheet
Rev1.1	2024-05-11	Update EC table