

Low-Power Omnipolar Hall Switch IC

1. Features

- Low-Power Omnipolar Hall Switch
- Typical power consumption at 3.3V supply:
 - 1.8 μ A
- Wide voltage range: 1.8V to 5.5V
- High Sensitivity
- Selectable push-pull and open-drain output
- Wide operating temperature range:
 - -40°C to 85°C
- Package:
 - TO-92S (UA)
 - SOT23-3L (SO)

2. Applications

- Smart Home Appliances
- TWS earphone open/close detection
- Lid (or flip) open/close detection for phones and notebooks
- Valve position detection
- Liquid level detection
- Flowmeter

3. Description

SC206X is a low-power omnipolar Hall switch IC fabricated by CMOS process, featuring high sensitivity and excellent temperature stability.

SC206X is specially designed for ultra-compact and power-sensitive battery-powered systems, supporting a wide operating voltage range from 1.8V to 5.5V. The device offers multiple options for magnetic threshold, sampling rate, output drive mode and package specifications, making it adaptable to a variety of application scenarios. It operates within the temperature range of -40°C to 85°C, making it ideal for consumer electronics and home appliance applications.

SC206X is available in 3-pin in-line TO-92S package (UA) and 3-pin SMD SOT23-3L package (SO), featuring 100% lead-free matte tin-plated lead packaging.



Fig.1 Package Outline

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4. Terminal Configuration

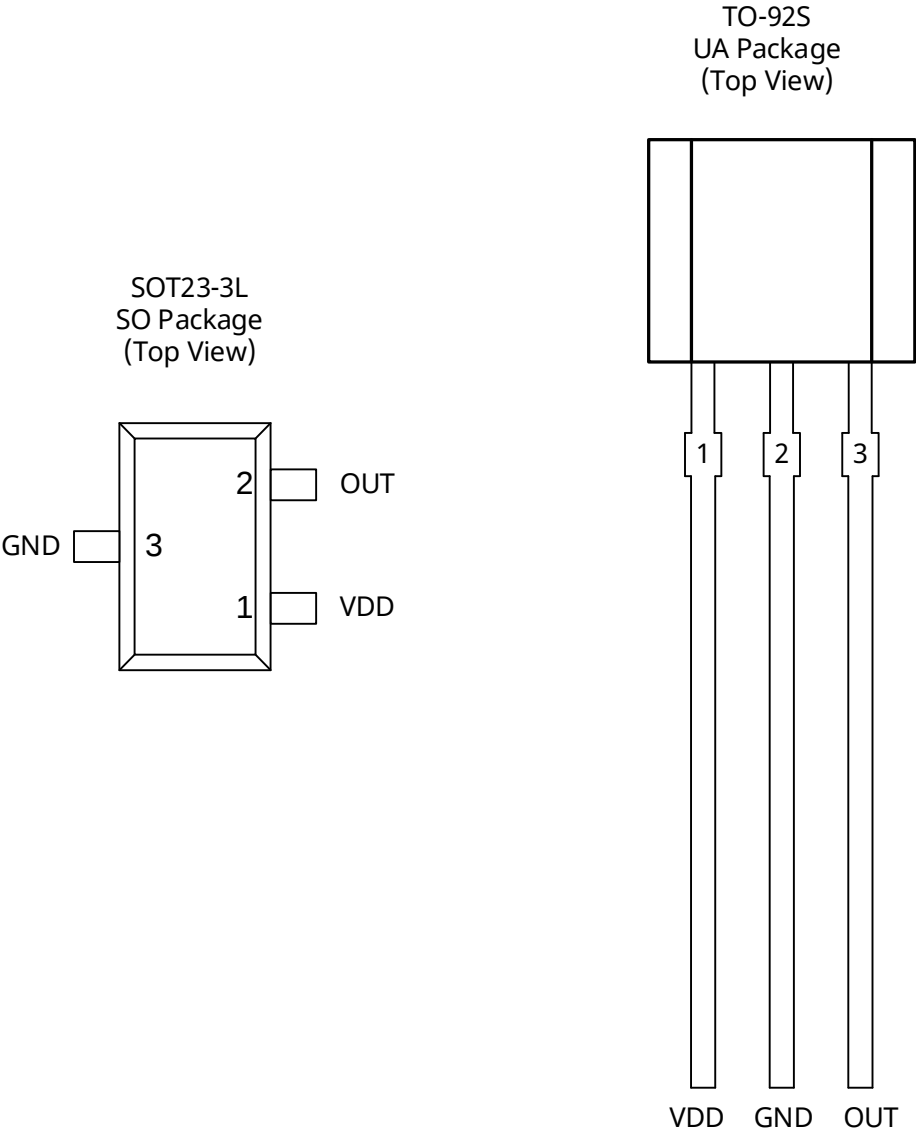


Fig.2 Pin Definition Diagram

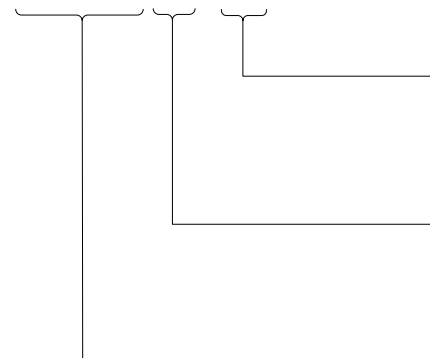
Terminal			Type	Description
Name	UA	SO		
VDD	1	1	Power	1.8V to 5.5V power supply
GND	2	3	Ground	Ground terminal
OUT	3	2	Output	Push-Pull or Open-drain output. The open drain requires a pull-up resistor

5. Ordering Information

Ordering Information	Marking	Output	B _{OP} (mT)	B _{RP} (mT)	Ambient, T _A (°C)	Package	Packing	Quantity
SC2061SO-TR	2061	Push-pull	±2.0	±1.0	-40~85	SOT23-3L	Reel	3000/reel
SC2061UA-BK	2061	Push-pull	±2.0	±1.0	-40~85	TO-92S	Bulk	1000/bag
SC2062SO-TR	2062	Open-drain	±2.0	±1.0	-40~85	SOT23-3L	Reel	3000/reel
SC2062UA-BK	2062	Open-drain	±2.0	±1.0	-40~85	TO-92S	Bulk	1000/bag
SC2063SO-TR	2063	Push-pull	±3.0	±2.0	-40~85	SOT23-3L	Reel	3000/reel
SC2063UA-BK	2063	Push-pull	±3.0	±2.0	-40~85	TO-92S	Bulk	1000/bag
SC2064SO-TR	2064	Open-drain	±3.0	±2.0	-40~85	SOT23-3L	Reel	3000/reel
SC2064UA-BK	2064	Open-drain	±3.0	±2.0	-40~85	TO-92S	Bulk	1000/bag

Ordering Information Format

SC206XSO-TR



Pack Designation

TR: Tape & Reel
BK: Bulk

Package Designation

SO: SOT23-3L
UA: TO-92S

Device Family

SC206X: Low-Power Omnipolar Hall Switch Sensor IC

6. Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted) ⁽¹⁾

Symbol	Parameter	Test Conditions	Min.	Max.	Units
V_{DD}	Power supply voltage		-0.3	6.0	V
V_{OUT}	Output terminal voltage		-0.3	6.0	V
I_{SINK}	Output terminal current sink		0	5	mA
T_A	Operating ambient temperature		-40	85	°C
T_J	Maximum junction temperature		-55	150	°C
T_{STG}	Storage temperature		-55	165	°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

Symbol	Parameter	Test Conditions	Min.	Max.	Units
V_{ESD_HBM}	HBM	According to: standard AEC-Q100-002 HBM	-2	+2	kV
V_{ESD_CDM}	CDM	According to: standard AEC-Q100-011 CDM	-750	+750	V

8. Thermal Characteristics

Symbol	Parameter	Test Conditions	Rating	Units
$R_{\theta ja}$	UA Package thermal resistance	Single-layer PCB, with copper limited to solder pads	200 ⁽¹⁾	°C/W
$R_{\theta ja}$	SO Package thermal resistance	Single-layer PCB, with copper limited to solder pads	300 ⁽¹⁾	°C/W

Note:

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

9. Operating Characteristics

9.1. Electrical Characteristics

over operating free-air temperature range $V_{DD}=3.3V$ (unless otherwise noted) ⁽¹⁾

Symbol	Parameter	Test Conditions	Min.	Typ. ⁽¹⁾	Max.	Units
V_{DD}	Operating voltage ⁽²⁾	$T_J < T_{J(Max.)}$	1.8	3.3	5.5	V
$I_{DD(Average)}$	Average current consumption	$V_{DD}=3.3V, T_A=25^\circ C$	-	1.8	5.0	μA
		$V_{DD}=3.3V, T_A=85^\circ C$	-	3.0	8.0	μA
t_{on}	Power on time	$V_{DD} \geq 3.3V$	-	30	50	μs
t_{ACTIVE}	Active time	$V_{DD}=1.8V$ to $5.5V$	25	40	60	μs
f_S	Frequency of magnetic sampling	$V_{DD}=1.8V$ to $5.5V, T_A=25^\circ C$	-	20	-	Hz
t_S	Period of magnetic sampling	$V_{DD}=1.8V$ to $5.5V, T_A=25^\circ C$	30	50	100	ms
t_d	Output Delay Time	$B=B_{RP}$ to B_{OP}	-	15	25	μs
t_r	Output rise time (10% to 90%)	$R_L=1k\Omega, C_o=50pF$	-	0.2	1.0	μs
t_f	Output fall time (90% to 10%)	$R_L=1k\Omega, C_o=50pF$	-	0.1	1.0	μs
Push Pull Output Characteristics						
V_{OH}	High-level Output Voltage	$I_{OUT}=-1mA$	$V_{DD}-0.35V$	$V_{DD}-0.1V$	-	V
V_{OL}	Low-level Output Voltage	$I_{OUT}=1mA$	-	0.1	0.3	V
Open Drain Output Characteristics						
I_{LINK}	Output Leakage Current	$V_{DD}=5.5V, OUT=5.5V$	-	-	100	nA
V_{OL}	Low-level Output Voltage	$I_{OUT}=1mA$	-	0.1	0.3	V

Note:

(1) Typical values are defined at $T_A=25^\circ C, V_{DD}=3.3V$

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

9.2. Magnetic Characteristics

over operating free-air temperature range, $V_{DD}=3.3V$ (unless otherwise noted)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
SC2061/SC2062 2.0 ⁽¹⁾ /-2.0mT ⁽²⁾						
B _{OP}	Operated point	T _A =25°C	±1.0	±2.0	±3.5	mT
B _{RP}	Release point		±0.5	±1.0	±3.0	mT
B _{HYS}	Hysteresis		-	±1.0	-	mT
SC2063/SC2064 3.0/-3.0mT						
B _{OP}	Operated point	T _A =25°C	±1.5	±3.0	±4.5	mT
B _{RP}	Release point		±1.0	±2.0	±3.0	mT
B _{HYS}	Hysteresis		-	±1.0	-	mT

Note:

(1) 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

(2) $1mT=10Gs$

10. Block Diagram

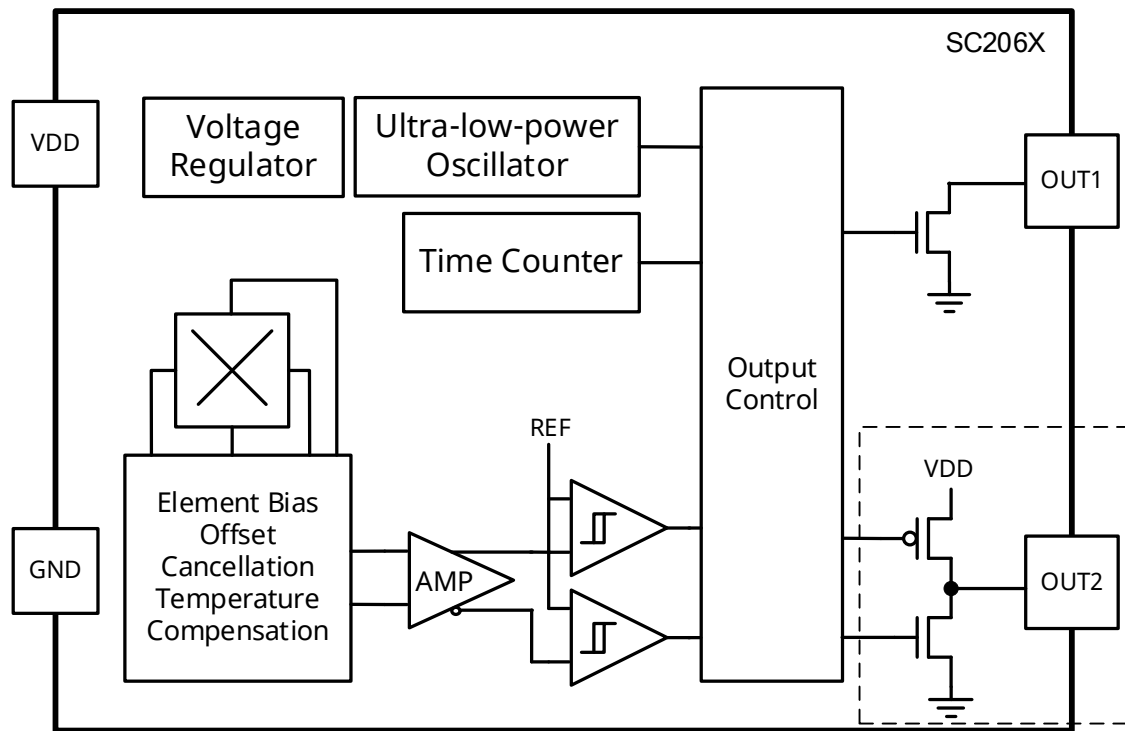


Fig. 3 Functional block diagram

11. Function Description

SC206X is a low-power omnipolar Hall-effect switch sensor designed for magnetic field sensing. It responds to both south and north magnetic poles, allowing direct detection of magnetic fields of any polarity and eliminating the need for pole discrimination. The device integrates a Hall-effect element, analog signal conditioning circuitry, and a low-frequency oscillator. Operating from a supply voltage range of 1.8V to 5.5V, it achieves extremely low average power consumption by periodically sampling the magnetic flux density, updating the output state, and entering a low-power sleep mode.

When the absolute value of the magnetic field strength applied perpendicularly to the Hall element exceeds the operating point (B_{OP}) threshold, the SC206X outputs a low level (ON state). When the magnetic field strength decreases below the absolute value of the release point (B_{RP}), the device outputs a high level (OFF state). The difference between the magnetic operating point and the release point is the magnetic hysteresis (B_{HYS}) of the device. This internal hysteresis makes the device immune to interference from external mechanical vibration and electrical noise.

SC206X offers both push-pull output and open-drain output options. For open-drain output operation, an external pull-up resistor is required. The output pin can be pulled up to VDD or to a different supply voltage.

11.1. Magnetic Field Direction Definition

A positive magnetic field is defined as the magnetic South pole facing the marked side of the package.

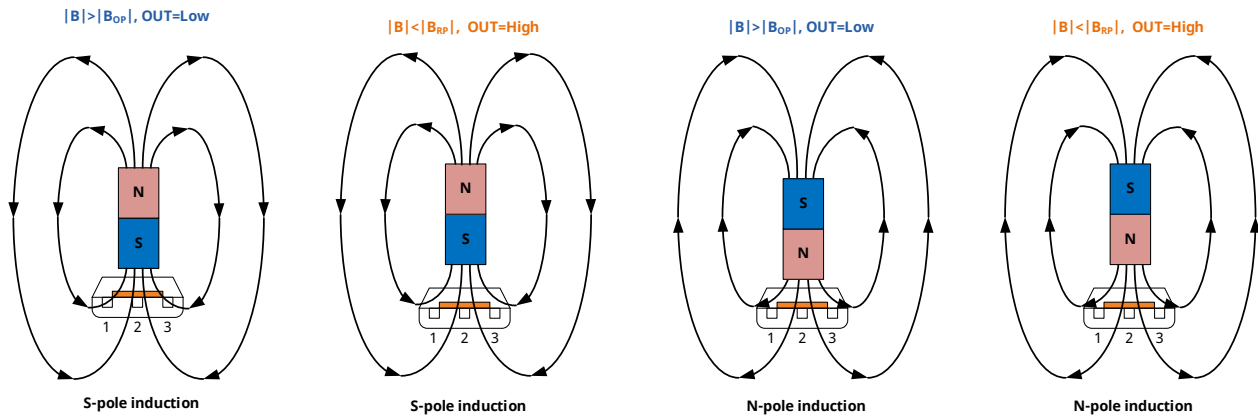


Fig.4 Magnetic Field Direction Definition

12.2. Transfer Function

SC206X features omnipolar magnetic characteristics, meaning the device can be triggered by sensing both south and north magnetic fields. The correct state is reached after the first crossing of BOP or BRP. If the magnetic field strength is greater than BOP, the output is pulled low. If the magnetic field strength is less than BRP, the output is released.

B_{OP} —magnetic threshold for activation of the device output, turning in ON (low) state

B_{RP} —magnetic threshold for release of the device output, turning in OFF (high) state.

$$B_{HYS} = B_{OP} - B_{RP}$$

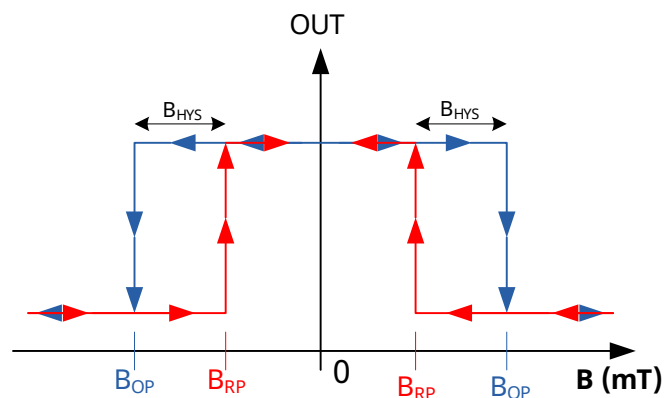
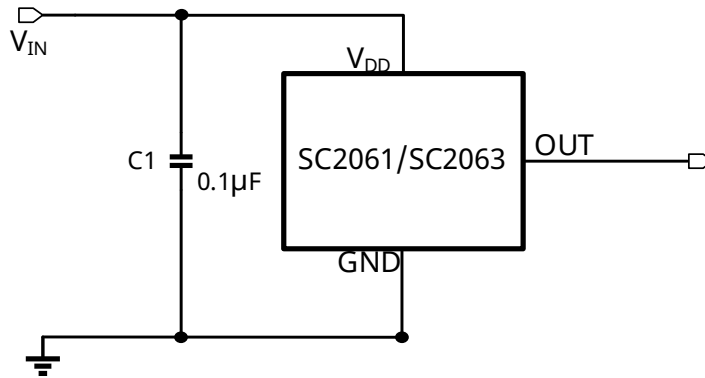


Fig.5 Transfer Characteristic Curve

12. Typical Application

Push-Pull Output



Open-Drain Output

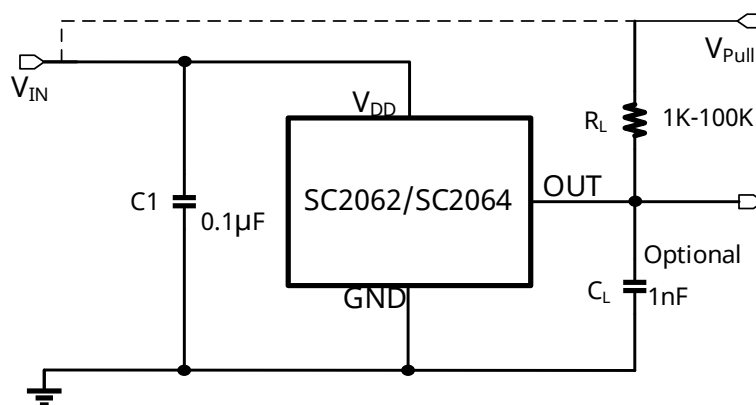
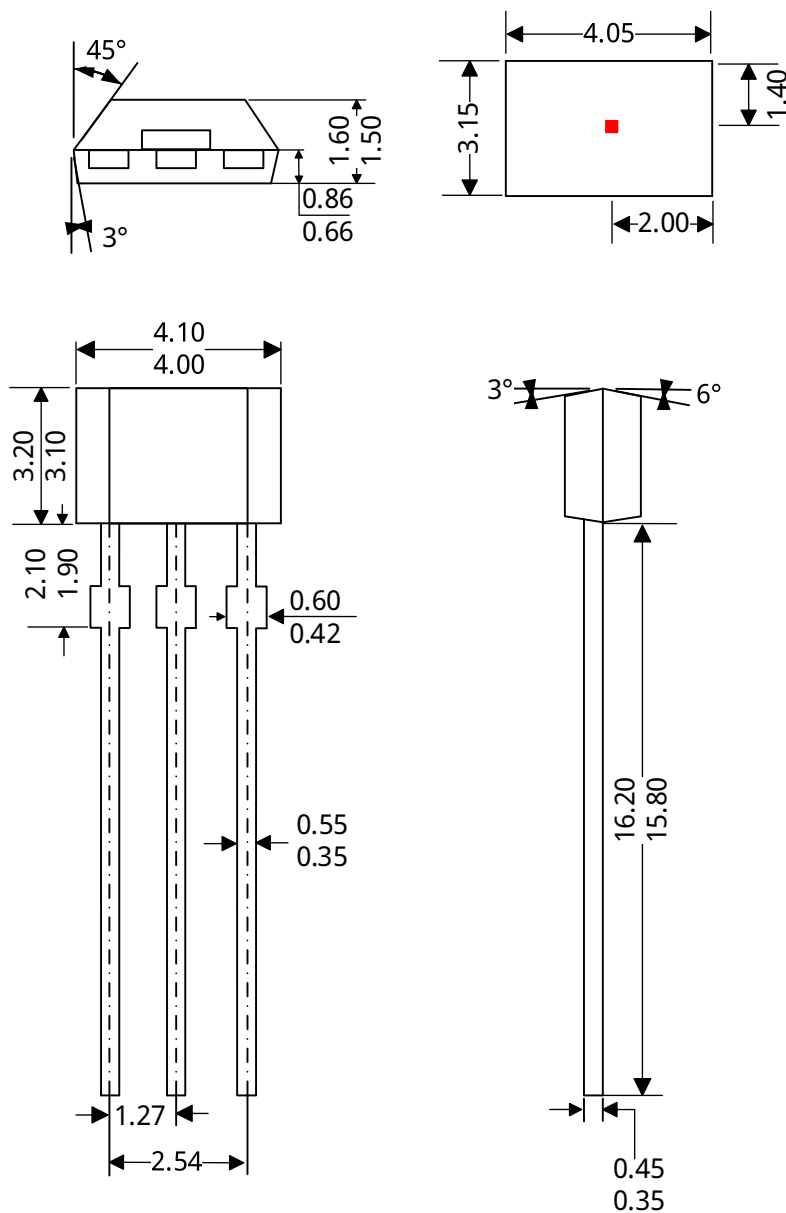


Fig.6 Typical Application Circuit

The SC206X incorporates an internal voltage regulator, enabling operation over a wide supply voltage range. For applications powered by unregulated supplies, external transient protection must be added. Even for applications using regulated power rails, EMI/RFI protection design is still recommended. It is strongly advised to use an external capacitor between the supply and ground to reduce external noise and noise generated by the internal chopper frequency technology. It is recommended to place a capacitor C_1 in parallel from the V_{DD} pin to ground, with a typical value of $0.1 \mu\text{F}$, as close to the IC as possible.

13. Package Information UA

TO-92S Package Outline Dimensions



Notes:

(1) All unit in mm.

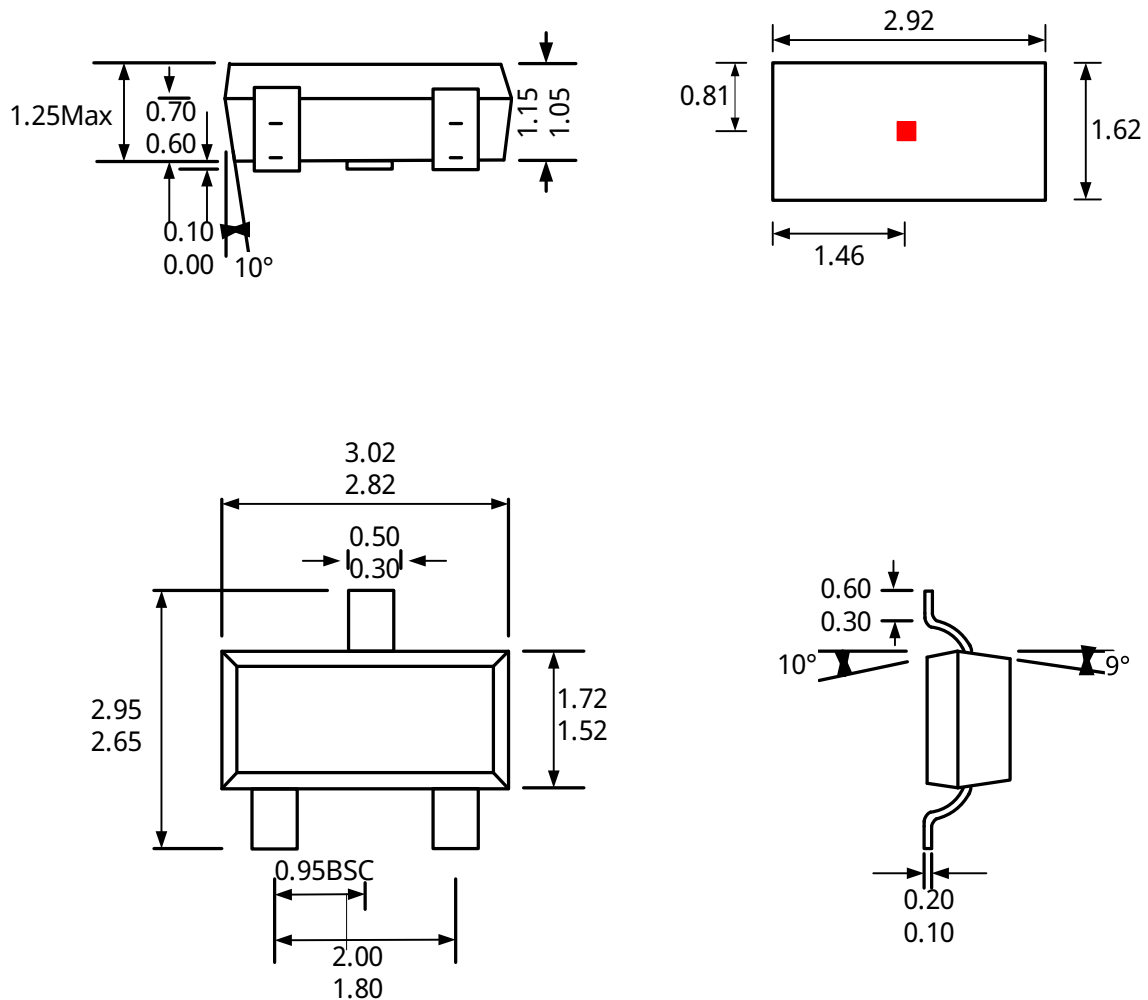
(2) Dimension does not include mold flash, protrusions or gate burrs.

(3) Allowable dambar protrusion shall be in excess at maximum material condition.

If no tolerance is specified, the dimension shall be theoretical reference value and shall not represent the exact dimension for actual measurement.

14. Package Information SO

SOT23-3L Package Outline Dimensions



Notes:

(1) All unit in mm.

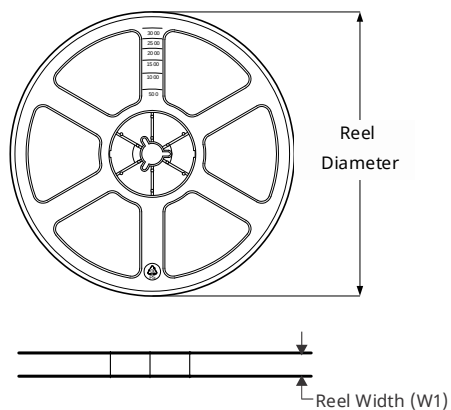
(2) Dimension does not include mold flash, protrusions or gate burrs.

(3) Allowable dambar protrusion shall be in excess at maximum material condition.

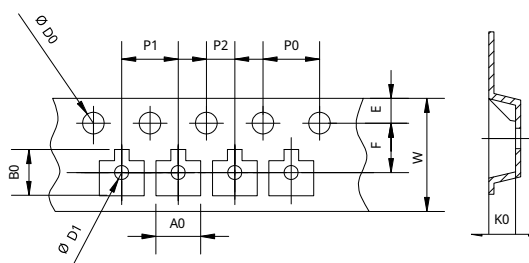
If no tolerance is specified, the dimension shall be theoretical reference value and shall not represent the exact dimension for actual measurement.

15. Tape&Reel Information

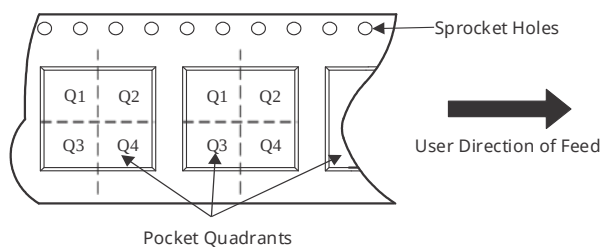
TAPE REEL DIMENSIONS



TAPE DIMENSIONS



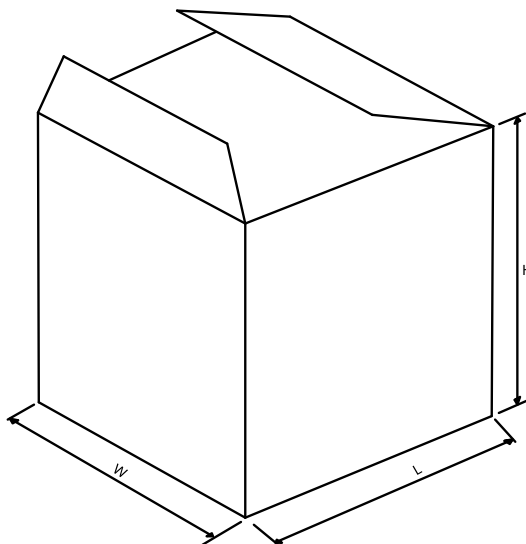
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*All dimensions are nominal

Package Type	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	W (mm)	Pin1 Quadrant
SOT23-3L	3000	180	8.4	4.00	4.00	2.00	3.18	3.28	1.32	8.00	Q3

16. Tape&Reel Box Dimensions



*All dimensions are nominal

Package Type	SPQ	Length (mm)	Width (mm)	Height (mm)
SOT23-3L	3000ea*10tape	210	210	210

17. Revision History

Revision	Date	Description
Rev0.1	2022-03-18	Preliminary datasheet
Rev.V1.0	2022-05-28	Official Version Released
Rev.V1.1	2024-05-11	Add SC2062 product model
Rev.V1.2	2024-11-29	Update Ordering Information
Rev.V1.3	2026-04-28	Add packaging information and update parameters.

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