High-Performance Dual-Channel Latched Hall Switch IC

1. Features

- AEC-Q100 qualified
- Output Function Option
  - Speed + Direction
  - Speed + Speed
- Supports a wide voltage range:
  - - 2.8V to 40V
- Wide operating temperature range:
  - -40℃ to 150℃
- High sensitivity and high stability of the magnetic switching points
- Excellent matching between the 2 Hall probes
- Hall plate distance: 1.33mm
- The optimum magnetic pitch for 90°phase difference: 2.8mm
- Direction signal switches before the speed signal: 400ns
- Reverse battery protection: -27V
- Output Current Limitation: 40mA
- Integrated cap and TVS(PCB-less)
- Multiple packaging forms are available:
  - SOT23-6L(S6)
  - TO-94(VB)
  - TO-94(PCB-less)

2. Applications

- Automotive, Industrial and Consumer
- Windows lifter with Anti-Pinch feature
- Rotation speed & direction detection
- Angular position detection
- Power closures with Anti-Pinch features

3. Description

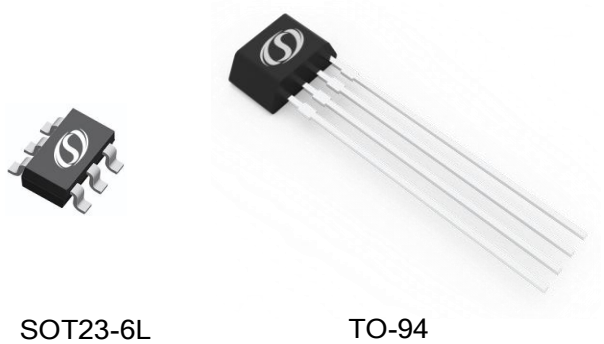
SC252X is a Dual-Channel Hall effect sensor which is designed and manufactured at the advanced 60V BCD process platform. It is ideally suited for speed and direction sensing applications containing encoded ring magnet targets. Precise magnetic switching points and high temperature stability are achieved by adopting active compensation circuits and chopper techniques. For Speed + Direction output option, they provide a speed signal at Q2 for every magnetic pole pair and a direction information at Q1, which is provided 400ns before the speed signal, And for Speed + Speed output option, both Q2 and Q1 are speed signal with 90°phase difference.

An on-chip voltage regulator allows the device to be used over a wide operating voltage range of 2.8V to 40V.

The SC252X Hall elements are spaced 1.33mm apart and are recommended to be used in conjunction with their adapted ring magnets.

The SC252X is available in 6-pin SOT23-6L (S6) and 4-pin TO-94 (VB) packages, with an optional PCB-less 4-pin TO-94 package integrating a capacitor and TVS. It features a 100% lead-free and halogen-free green leadframe, complying with environmental requirements.

Not to scale



SOT23-6L TO-94

Fig.1 The Package Outline

CONTENTS

4. Terminal Configuration

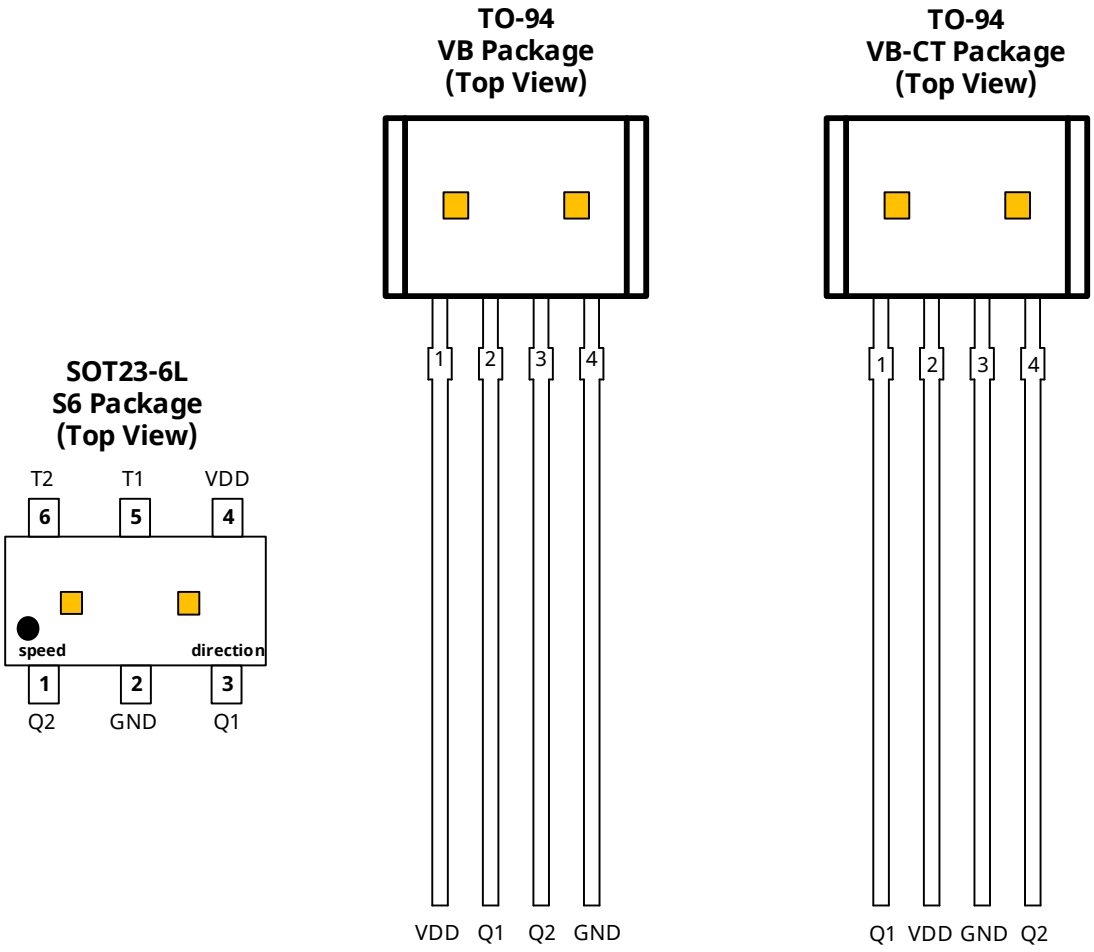


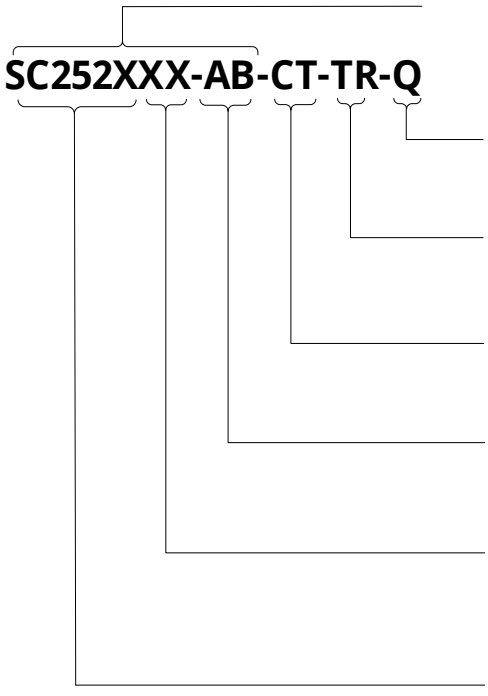
Fig.2 Terminal Configuration

Name	Terminal			Type	Description
	S6	VB	VB-CT		
Q2	1	3	4	Output	Speed
GND	2	4	3	Ground	Ground terminal
Q1	3	2	1	Output	Direction / Speed
VDD	4	1	2	Power	Supply voltage
T1	5	-	-	Test	Test pin, which needs to be grounded during application
T2	6	-	-	Test	Test pin, which needs to be grounded during application

5. Ordering Information

Ordering Information	Mark	Output	B_{OP}(Gs)	B_{RP}(Gs)	Ambient, (℃)	Package	Pack	Quantity
SC2527S6-SD-TR-Q	2527	SD	30	-30	-40~150	SOT23-6L	Reel	3000/reel
SC2527S6-AB-TR-Q	2527	AB	30	-30	-40~150	SOT23-6L	Reel	3000/reel
SC2526VB-SD-BK-Q	2526	SD	-30	30	-40~150	TO-94	Bulk	500 pieces/bag
SC2526VB-SD-CT-BK-Q	2526C	SD	-30	30	-40~150	TO-94	Bulk	500 pieces/bag
SC2526VB-AB-BK-Q	2526	AB	-30	30	-40~150	TO-94	Bulk	500 pieces/bag
SC2526VB-AB-CT-BK-Q	2526C	AB	-30	30	-40~150	TO-94	Bulk	500 pieces/bag

Ordering Information Format



Part Number

Product Grade
Q: Automotive Product

Pack Designation
TR: Tape & Reel
BK: Bulk

Option
CT:With Cap+TVS(PCB-less)

Output Type
AB: Speed + Speed
SD: Speed + Direction

Package Designation
S6: SOT23-6L
VB: TO-94

Device Family
SC252X: High-Performance Dual-Channel Latched Hall Switch IC

6. Absolute Maximum Ratings

Operating temperature range (except as otherwise specified) (1)

Symbol	Parameter	Test Conditions	Min.	Max.	Units
V_{DD}	Power supply voltage	For 5 min @ Rs≥200Ω	-27	60	V
V_{DD}	Power supply voltage	PCB-less (2)	-27	40	V
V_{OUT}	Output voltage	For 5 min @ 1.2 kΩ pull up resistor	-0.5	60	V
V_{OUT}	Output voltage	PCB-less (2)	-0.5	40	V
I_{OUT}	Continuous output current		-	50	mA
T_A	Operating ambient temperature		-40	150	℃
T_J	Maximum junction temperature	For 168h max	-	165	℃
T_{STG}	Storage temperature		-65	175	℃

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.

(2) PCB-less Integrated 40V TVS.

7. ESD Protection

Symbol	Parameter	Test Conditons	Min.	Max.	Units
V_{ESD}	HBM	according to standard AEC-Q100-002 HBM	-4	+4	kV
	ESD(PCB-less) (1)	Test according to lS0 10605 330pF,330Ω	-15	+15	kV
	CDM	according to standard AEC-Q100-011 CDM	-750	+750	V

8. Thermal Characteristics

Symbol	Parameter	Test Conditions	Rating	Units
$R_{\theta JA}$	SOT23-6L Package Thermal Resistance	Single-layer PCBS, JEDEC 2s2p and 1s0p are defined in JESD 51-7 and JESD 51-3	300(1)	℃/W
	TO-94 Package Thermal Resistance		177	

Note:

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

9. Operating Characteristics

9.1. Electrical Characteristics

Within the operating temperature range, V_{DD}=12V (unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.(1)	Max.	Units
V_{DD}	Supply Voltage		2.8	12	40	V
I_{DD}	Supply Current		-	2.0	2.7	mA
I_{DDR}	Reverse Supply Current		-	-	1	mA
$UVLO_H$	Under Voltage Protection (High)		2.2	2.3	2.5	V
$UVLO_L$	Under Voltage Protection (Low)		1.9	-	2.2	V
$UVLO_{HYS}$	Under Voltage Hysteresis		150	-	650	mV
T_{DGL}	Under Voltage Deglitch Time		-	10	-	μs
V_{SAT}	Output Saturation Voltage	V_{DD}=3V, I_{Q1}=20mA, I_{Q2}=20mA, B_{OP}=50G	-	0.2	0.4	V
		V_{DD}=3V, I_{Q1}=30mA, I_{Q2}=30mA, B_{OP}=50G	-	-	0.5	
I_{LKG}	Output Leakage Current	V_{DD}=5V,B<BRP-20G, GND=0V, V_{Q1}=40V, V_{Q2}=40V	-	-	10	μA
I_O	Output Sink Current	V_{DD}=3V, I_{Q1}=2V, I_{Q2}=2V, B_{OP}=50G	30	40	50	mA
t_F(3)	Output Falling Time	V_{DD}=12V, GND=0V, V_{PU}(4)=12V, QX Connected To R_{PU}(4)=2K, B<BRP-20G.	-	-	1	μs
t_R(3)	Output Rising Time	V_{DD}=12V, GND=0V, V_{PU}=12V, QX Connected To R_{PU}=2K, B>BOP+20G.	-	-	1	us
T_{PO}	Enable Time of Q1 Or Q2 After Exceeding Of V_{UV}	V_{DD}: Step Up From 0V To 5V, GND=0V, Q1 And Q2 Connected With RL=2K, B>B_{OP}+20G.	-	20	50	μs
T_D(2)	Systematic Delay Between Magnetic Threshold Reached and Output Switching.	Guaranteed By Design	-	20	40	μs
T_{SAMP}(2)	The Sampling Period	Guaranteed By Design	-	4	-	μs
F_C(2)	The Chopper Frequency	Guaranteed By Design	-	1	-	MHz
T_{DC}	Direction leads speed and time (5)		200	400	600	ns
T_{JIT}(2)	Output Jitter	Typ. value for square wave signal 1 k Magnetic Field.	-	2.6	-	μs_{RMS}

Note:

(1) Typical values are defined at T_A = +25°C and V_{DD}=12V.

(2) Based on device characterization results, not subject to production test.

*(3) Measured between 0.1*V_{PU} *and 0.9*V_{PU}.

(4) R_{PU} and V_{PU} are the external pullup resistor and external pullup voltage.

(5) The update of the direction signal is ahead of the update of the speed signal.

9.2. Magnetic Characteristics

Within the operating temperature range, V_{DD}=12V (unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
f_{BW}	Magnetic Switching Frequency		-	-	20	kHz
dHall	Hall Plate Spacing		-	1.33	-	mm
SC2526 -3mT/+3mT						
B_{OP}	Operating Point	T_A=25℃	-4	-3	-2	mT(1)
B_{RP}	Release Point		+2	+3	+4	mT
B_{HYS}	Magnetic Hysteresis		4	6	8	mT
B_{MATCH}	Magnetic Match	B_{OP1}-B_{OP2} and B_{RP1}-B_{RP2}	-2	-	+2	mT
		(B_{OP}+B_{RP})/2	-2	-	+2	mT
TC (2)	Temperature Coefficient		-	1000	-	ppm/℃
SC2527 +3mT/-3mT						
B_{OP}	Operating Point	T_A=25℃	+2	+3	+4	mT
B_{RP}	Release Point		-4	-3	-2	mT
B_{HYS}	Magnetic Hysteresis		4	6	8	mT
B_{MATCH}	Magnetic Match	B_{OP1}-B_{OP2} and B_{RP1}-B_{RP2}	-2	-	+2	mT
		(B_{OP}+B_{RP})/2	-2	-	+2	mT
TC	Temperature Coefficient		-	1000	-	ppm/℃

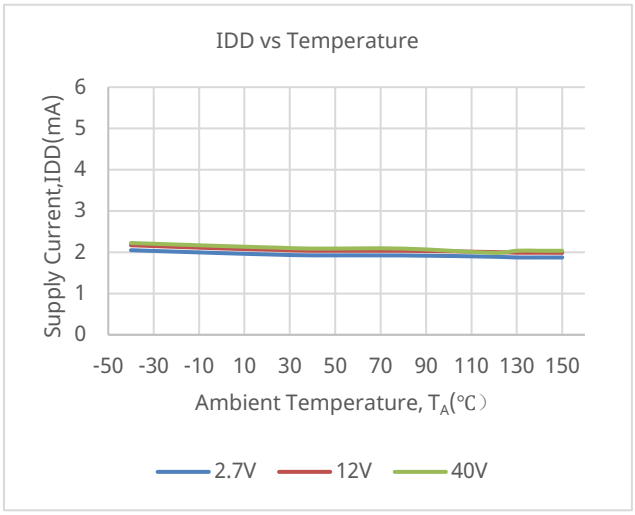
Note:

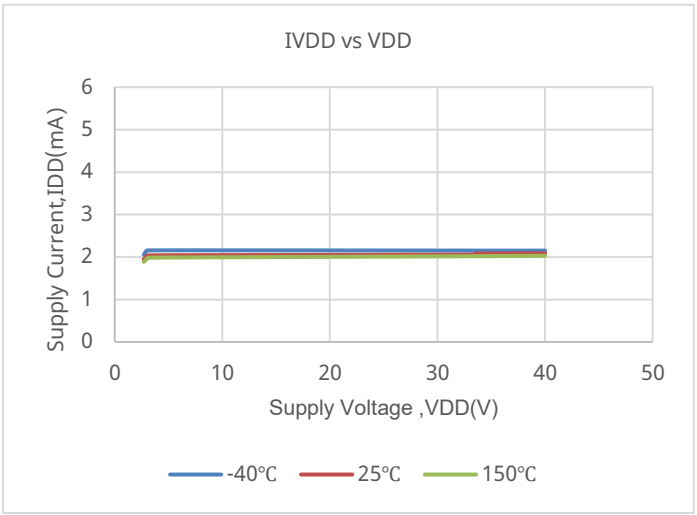
(1) 1mT=10GS.

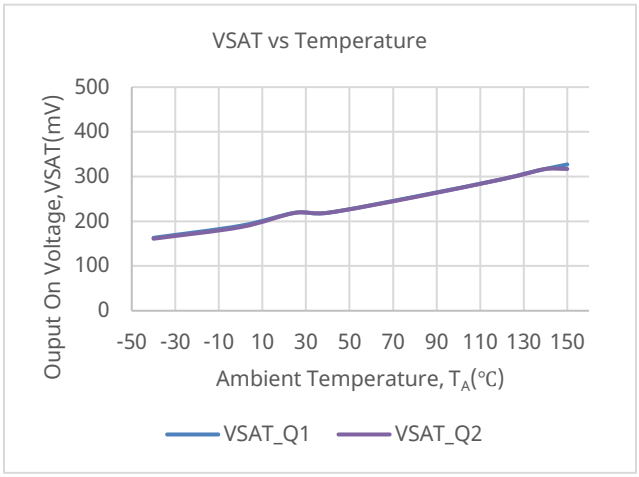
(2) Temperature coefficient value is guaranteed by design and verified by characterization and is calculated using the following formula:

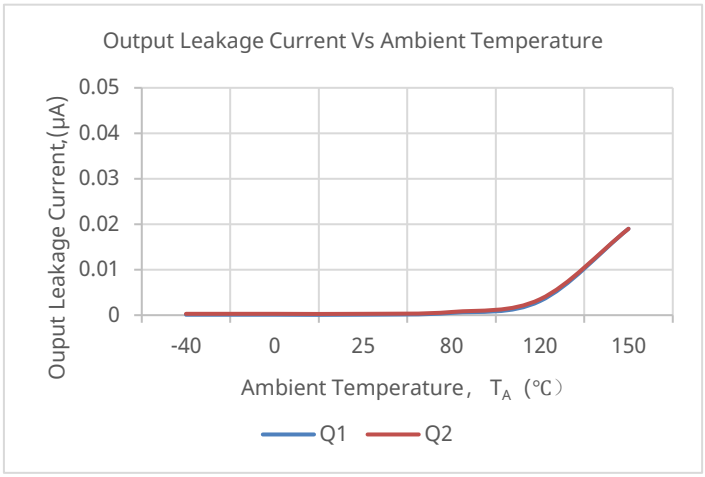
$$TC = \frac{BT2 - BT1}{BT1 \times (T2 - T1)} \times 10^6, ppm/℃, T1 = 25℃, T2 = 150℃$$

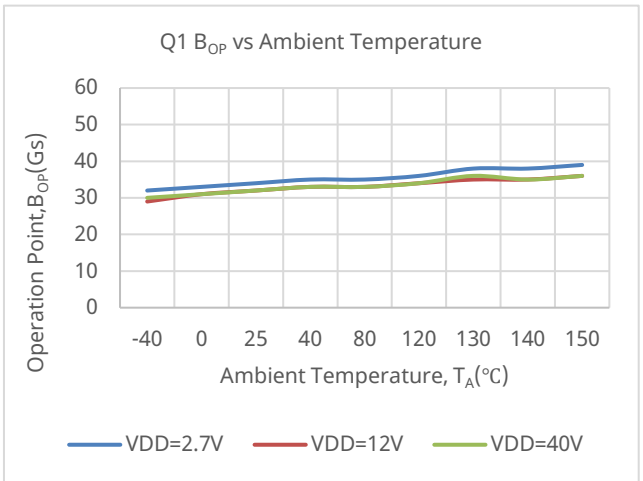
10. Typical Characteristic

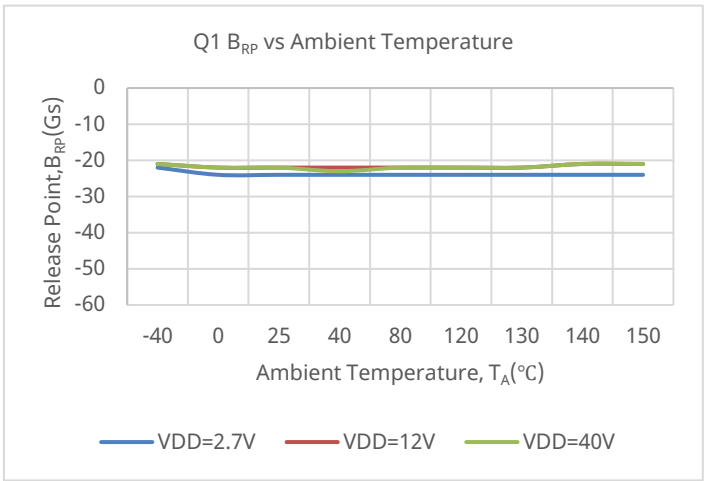


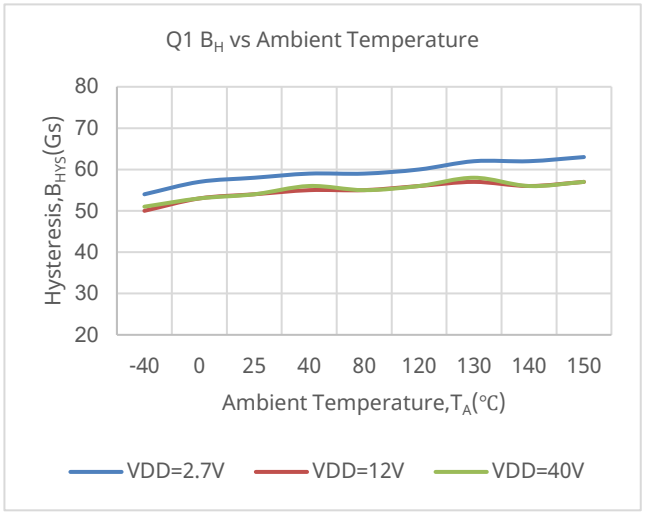


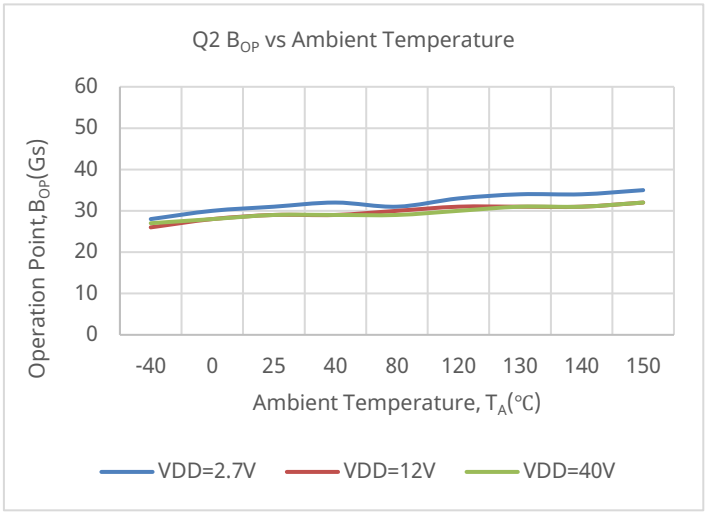


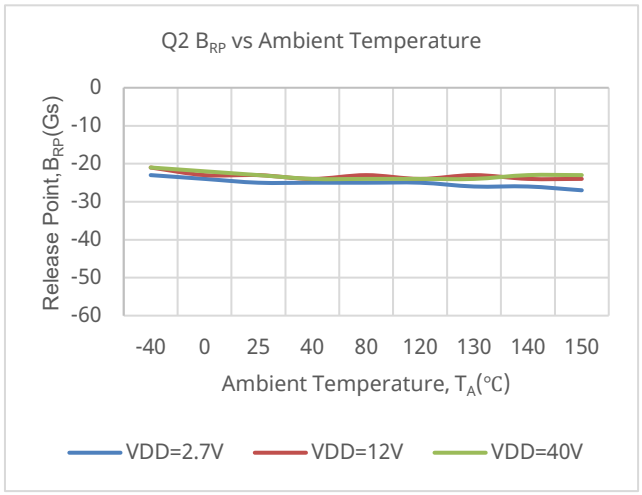


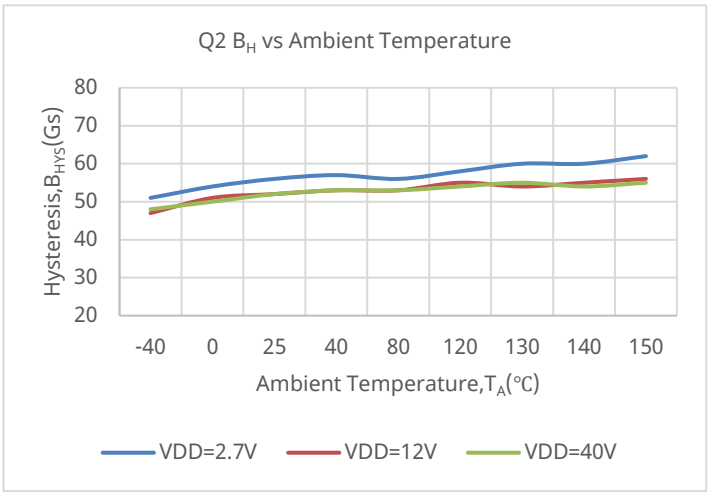


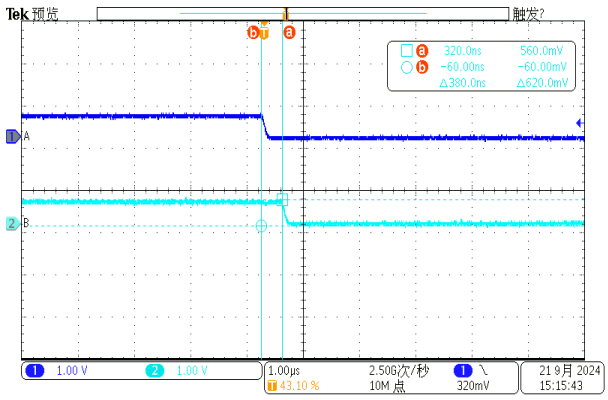




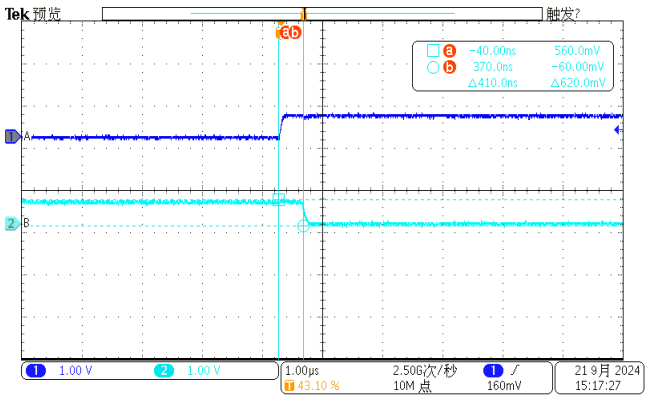








The Direction Ahead 380ns Before Speed



The Direction Ahead 410ns Before Speed

11. Block Diagram

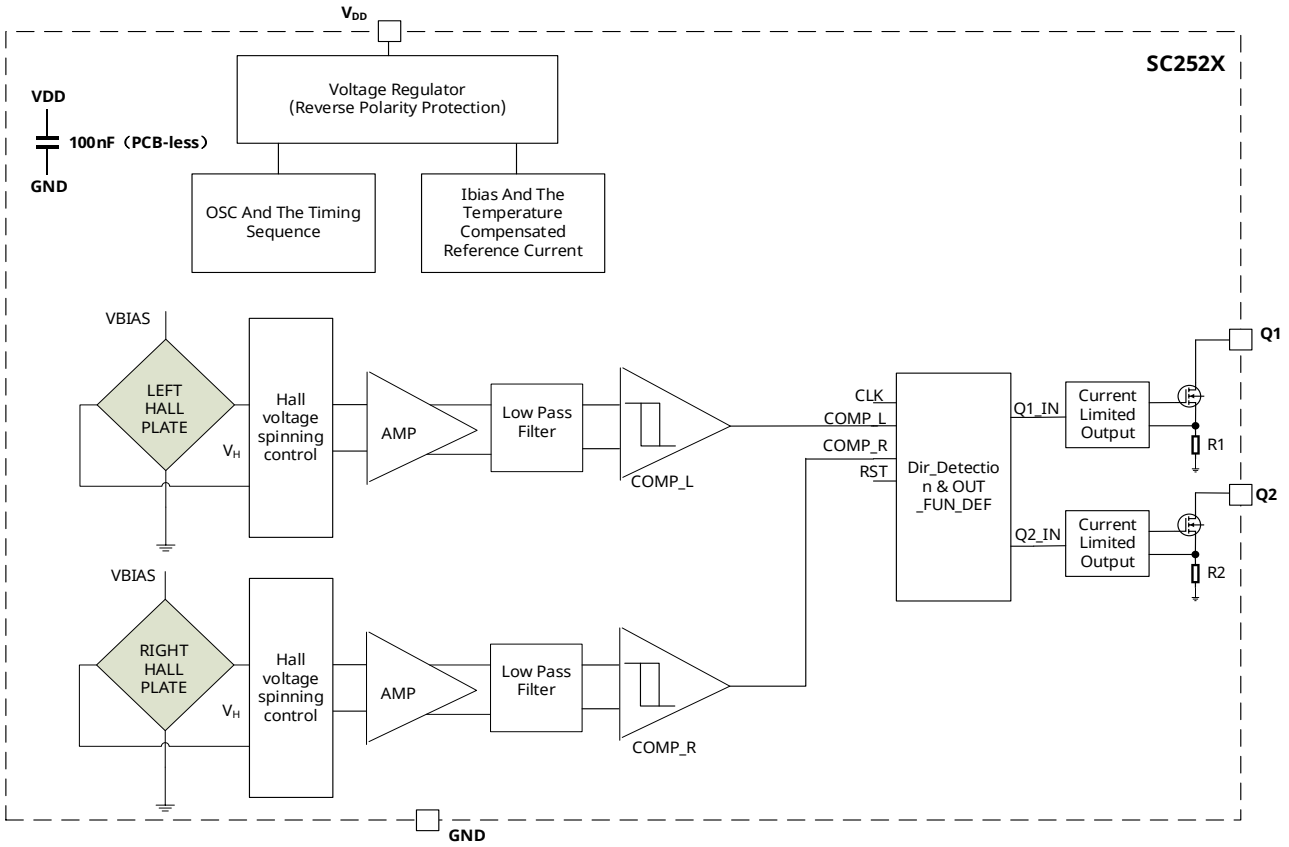


Fig.3 Functional block diagram

12. Function Description

The SC252X is a dual-channel Hall-effect switch with chopper stabilization, primarily designed for detecting the rotational speed and direction of motors in automotive applications. It integrates a voltage regulator, two Hall-effect sensing probes spaced 1.33 mm apart, a bias generation circuit, a compensation circuit, an oscillator, amplifier circuits, filter circuits, hysteresis comparators, and open-drain output circuits with current limiting. The on-chip integrated voltage regulator enables the device to operate over a wide voltage range from 2.8 V to 40 V, and it can continuously withstand a reverse supply voltage of -27 V, meeting the requirements of industrial and automotive applications. The bias generation circuit supplies operating current to the Hall sensing probes and other circuits, while the compensation circuit mitigates the effects of temperature and process variations.

The SC252X features latched magnetic characteristics. When the absolute value of the magnetic field intensity acting perpendicularly on the Hall element exceeds the B_{OP} (Operating Point) threshold, the speed signal outputs a low level (ON), the output pin can sink a current of 20 mA, and the output voltage is the saturation voltage V_{SAT}. When the magnetic field intensity drops below the absolute value of the B_{RP} (Release Point), the device outputs a high level (OFF). The difference between the magnetic operating point and release point is the device's magnetic hysteresis B_{HYS}; this built-in hysteresis enables the device to resist interference from external mechanical vibrations and electrical noise. The output state of the direction signal is determined by the rotational direction of the magnetic field: the signal outputs a high level when the magnetic ring rotates clockwise, and a low level when the magnetic ring rotates counterclockwise.

12.1. Field Direction Definition

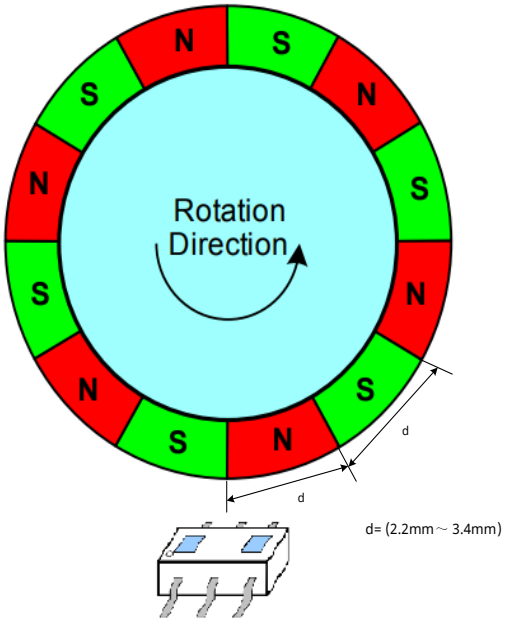


Fig.4 Magnetic field direction definition

Product No.	Rotation Direction	State of Direction Output Q1
SC2527S6-SD-TR-Q	Left to right	Low
	Right to left	High
SC2527S6-AB-TR-Q	N/A	N/A
SC2526VB-SD-BK-Q	Right to left	High
	Left to right	Low
SC2526VB-AB-BK-Q	N/A	N/A
SC2526VB-CT-AB-BK-Q	N/A	N/A

13. Typical Application

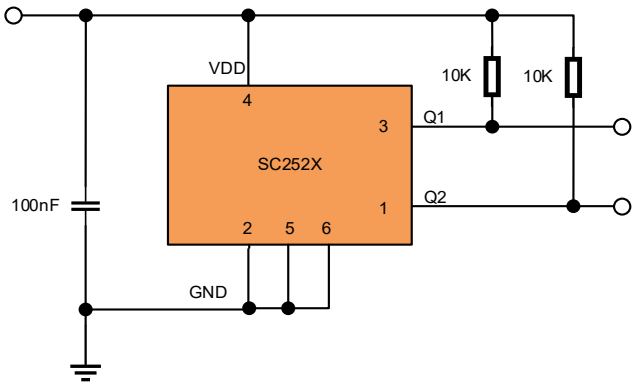


Fig.5 The Typical Application Schematic

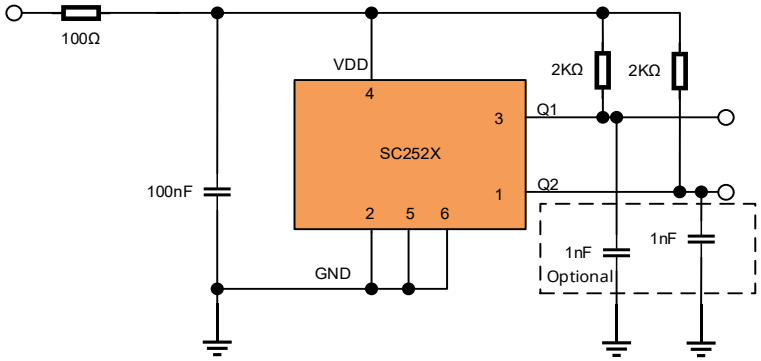


Fig.6 The Recommended Application Schematic for ISO7637-2

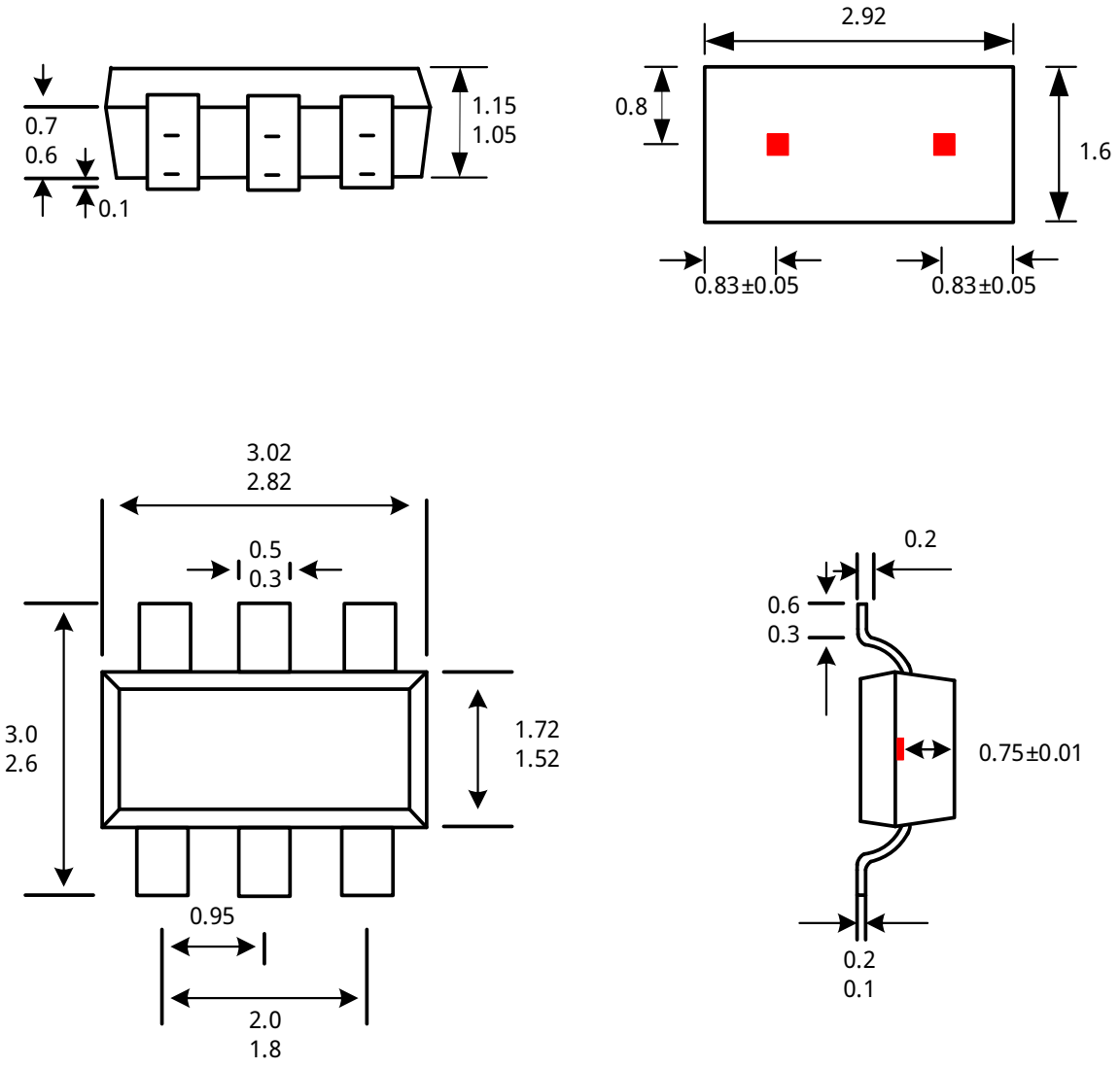
Note:

(1) Recommended schematic for conducted transients on supply line above 40V with duration above 500ms.

(2) Recommended schematic for conducted transients on supply line above 60V.

14. Package Information S6

SOT23-6L Package Outline Dimensions

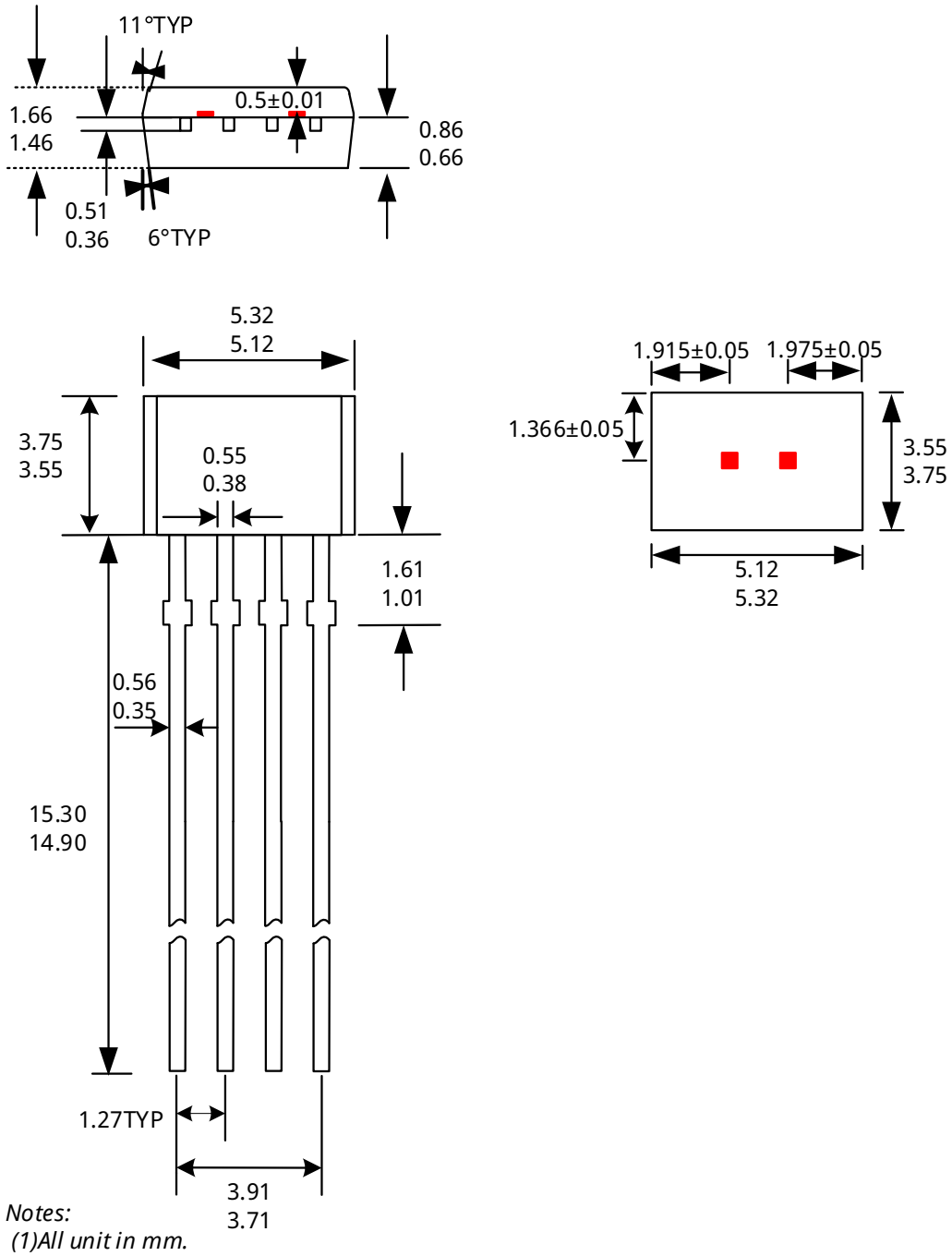


Notes:
(1)All unit in mm.
(2)Red indicates the position of the Hall disk.
(3)Dimension does not include mold flash , protrusions or gate burrs.
(4)Allowable dambar protrusion shall be in excess at maximum material condition.

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

15. Package Information VB/VB-CT

TO-94 Package Outline Dimensions

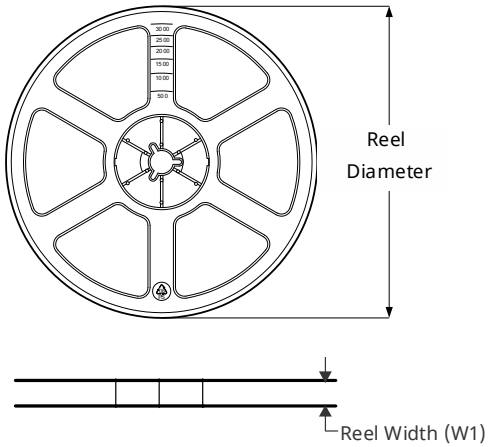


Notes:
(1)All unit in mm.
(2)Red indicates the position of the Hall disk.
(3)Dimension does not include mold flash , protrusions or gate burrs.
(4)Allowable dambar protrusion shall be in excess at maximum material condition.

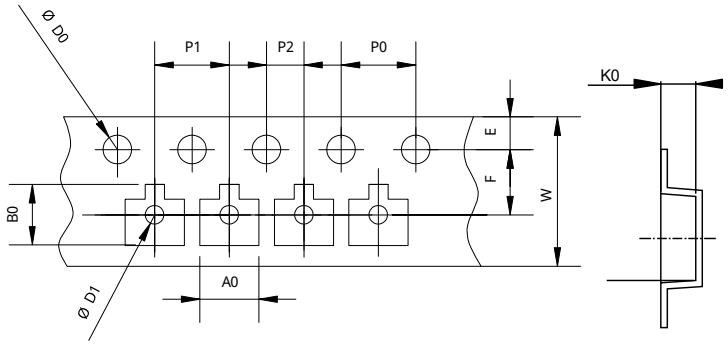
If no tolerance is specified , the dimension shall be theoretical reference value and shall not represent the exact dimension for actual measurement.

16. Tape&Reel Information

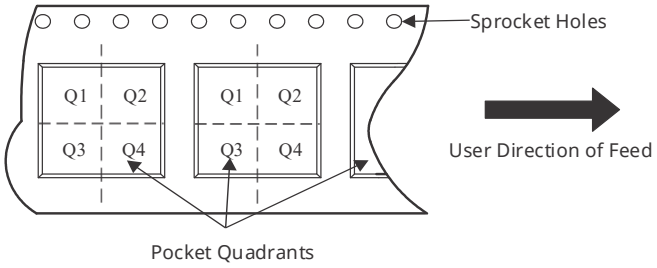
TAPE REEL DIMENSIONS



TAPE DIMENSIONS



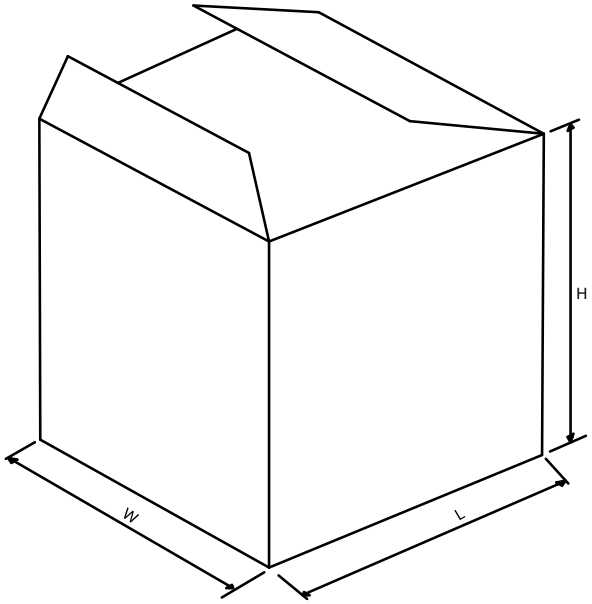
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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
SOT-23-6L	3000	180	8.4	4.00	4.00	2.00	3.20	3.85	1.35	12.00	Q3

17. Tape&Reel Box Dimensions



*All dimensions are nominal

Package Type	SPQ	Length (mm)	Width (mm)	Height (mm)
SOT-23-6L	3000ea*10tape	210	210	210

18. Revision History

Revision	Date	Description
Rev. E0.1	2024-07-25	Preliminary datasheet
Rev. A1.0	2024-11-27	Initial Release
Rev.A1.1	2025-08-05	Add the SC2526VB-CT (PCB-less) model
Rev.A1.2	2026-03-26	Add Packaging Information and Statement

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