

High Performance Dual Channel Hall Effect Sensor

1. Features

- AEC-Q100 qualified.
- 2.8V to 40V supply voltage operation
- High sensitivity and high stability of the magnetic switching points
- Output Current Limitation: 40mA
- Reverse battery protection: -27V
- Wide operating temperature range:
 - -40°C - 150°C
- Excellent matching between the 2 Hall probes
- Hall plate distance: 1.33mm
- The optimum magnetic pitch for 90°phase difference: 2.8mm
- Output Function Option
 - Speed + Direction
 - Speed + Speed
- Direction signal switches before the speed signal: 400ns
- 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

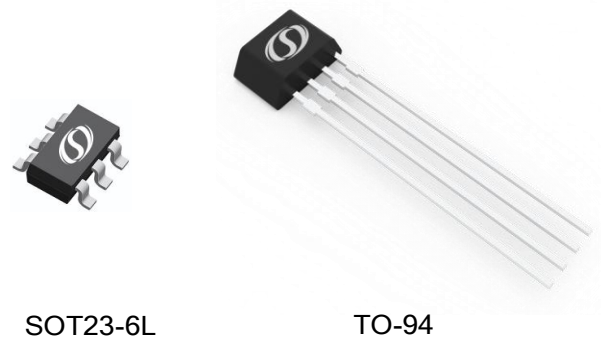
SC252X is a Dual-Channel Hall effect sensor which is designed and manufactured at the advanced 60V BCD process platform. It is ideally suited for speed and direction sensing applications containing encoded ring magnet targets. Precise magnetic switching points and high temperature stability are achieved 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 and 4-pin TO-94 plastic packages which are 100% lead-free, matte tinned lead packages.

Not to scale



SOT23-6L

TO-94

Fig.1 The Package Outline

CONTENTS

1. Features	1	10. Typical Characteristic.....	8
2. Applications	1	11. Block Diagram	10
3. Description	1	12. Function Description	10
4. Terminal Configuration	3	12.1. Field Direction Definition	11
5. Ordering Information.....	4	13. Typical Application	12
6. Absolute Maximum Ratings	5	14. Package Information S6.....	13
7. ESD Protection	5	15. Package Information VB/CVB.....	14
8. Thermal Characteristics	5	16. Revision History.....	15
9. Operating Characteristics	6		
9.1. Electrical Characteristics	6		
9.2. Magnetic Characteristics	7		

4. Terminal Configuration

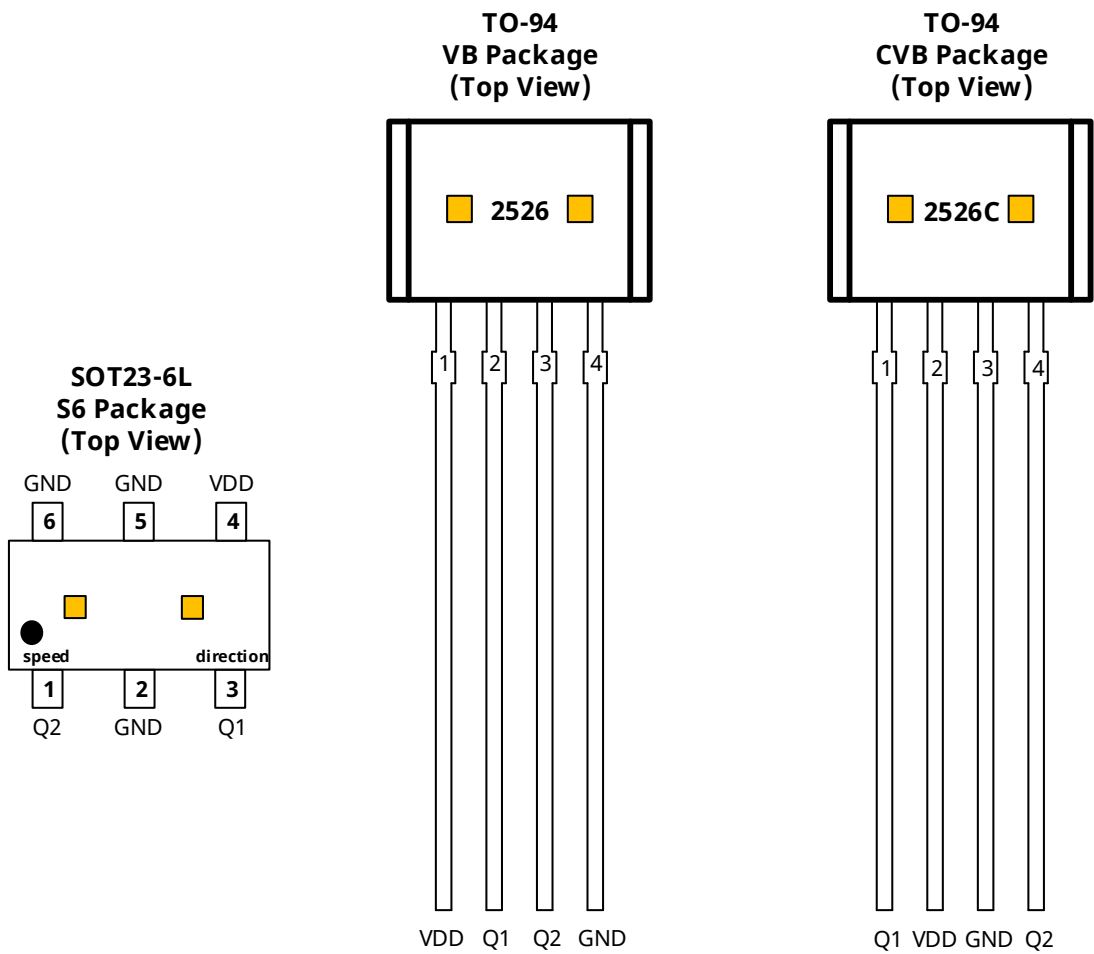


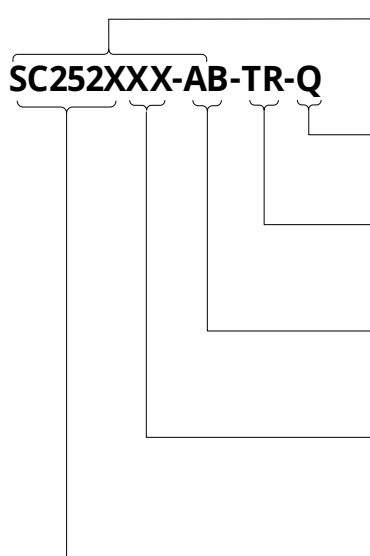
Fig.2 Terminal Configuration

Name	Terminal			Type	Description
	S6	VB	CVB		
Q2	1	3	4	Output	Speed
GND	2	4	3	Ground	GND
Q1	3	2	1	Output	Direction / Speed
VDD	4	1	2	Power	Supply voltage
GND	5	-	-	Ground	GND
GND	6	-	-	Ground	GND

5. Ordering Information

Ordering Information	Mark	Option	B _{OP} (Gs)	B _{RP} (Gs)	Ambient, (°C)	Package	Pack	Quantity
SC2527S6-SD-TR-Q	2527	SD	30	-30	-40-150	SOT23-6L	Reel	3000 pieces/reel
SC2527S6-AB-TR-Q	2527	AB	30	-30	-40-150	SOT23-6L	Reel	3000 pieces/reel
SC2526VB-SD-BK-Q	2526	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
SC2526CVB-AB-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

Output Type

AB: Speed + Speed

SD: Speed + Direction

Package Designation

S6: SOT23-6L

VB: TO-94

CVB: TO94(PCB-Less)

Device Family

SC252X: Dual channel Latch Position Sensor

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 @ R _s ≥200Ω	-27	60	V
V _{OUT}	Output voltage	For 5 min @ 1.2 kΩ pull up resistor	-0.5	60	V
I _{OUT}	Continuous output current		-	50	mA
T _A	Operating ambient temperature		-40	150	°C
T _J	Maximum junction temperature	For 168h max	-	165	°C
T _{STG}	Storage temperature		-65	175	°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	according to standard AEC-Q100-002 HBM	-8	8	kV
	HBM(PCB-less) ⁽¹⁾	according to standard AEC-Q100-002 HBM	-15	15	kV
	CDM	according to standard AEC-Q100-011 CDM	-750	750	V

Note:

(1) VDD-GND HBM ESD>±15KV.

8. Thermal Characteristics

Symbol	Parameter	Test Conditions	Rating	Units
R _{θJA}	SOT23-6L Package Thermal Resistance	Single-layer PCBS, JEDEC 2s2p and 1s0p are defined in JESD 51-7 and JESD 51-3	300 ⁽¹⁾	°C/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, VDD = 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	VDD=3V, I _{Q1} =20mA, I _{Q2} =20mA, B _{OP} =50G	-	0.2	0.4	V
		VDD=3V, I _{Q1} =30mA, I _{Q2} =30mA, B _{OP} =50G	-	-	0.5	
I _{LKG}	Output Leakage Current	VDD=5V, B<BRP-20G, GND=0V, V _{Q1} =40V, V _{Q2} =40V	-	-	10	μA
I _O	Output Sink Current	VDD=3V, I _{Q1} =2V, I _{Q2} =2V, B _{OP} =50G	30	40	50	mA
t _F ⁽³⁾	Output Falling Time	VDD=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	VDD=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}	VDD: Step Up From 0V To 5V, GND=0V, Q1 And Q2 Connected With RL=2K, B>BOP+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}	Count Signal Delay After Direction ⁽⁵⁾		200	400	600	ns
T _{JIT} ⁽²⁾	Output Jitter	Typ. value for square wave signal 1 k Magnetic Field.	-	2.6	-	μSRMS

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) Controlled delay between direction (DIR) signal update and speed (SP) signal update.

9.2. Magnetic Characteristics

Within the operating temperature range, VDD = 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		-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/°C
SC2527, +3mT/-3mT						
B_{OP}	Operating Point		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/°C

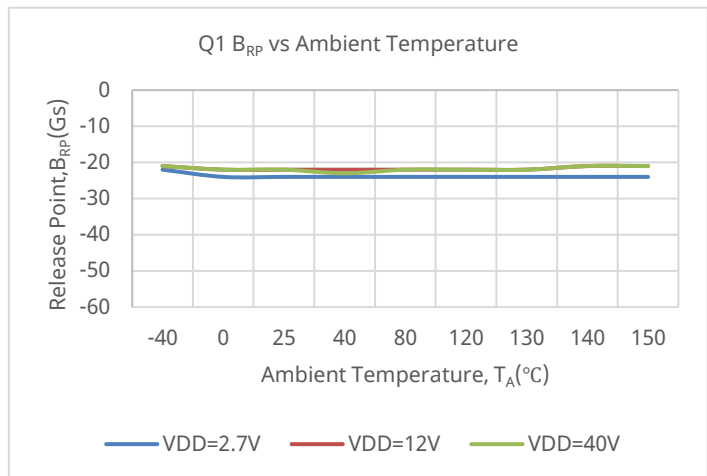
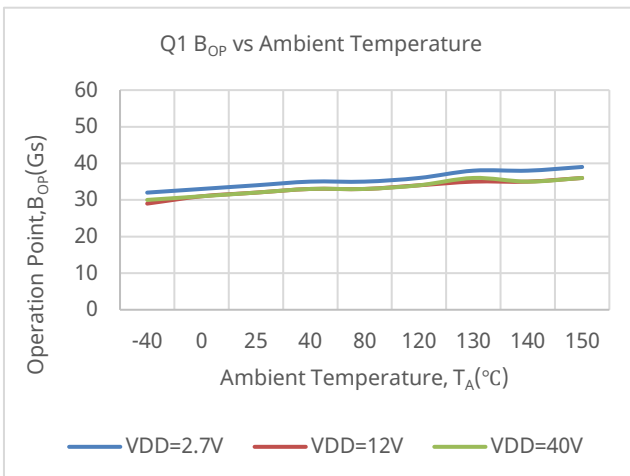
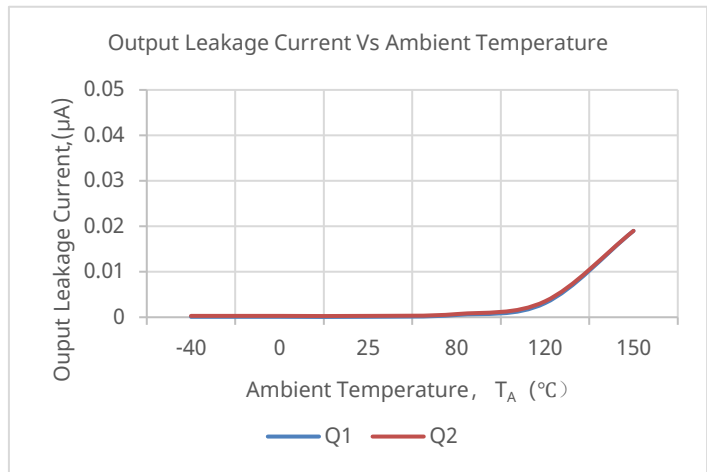
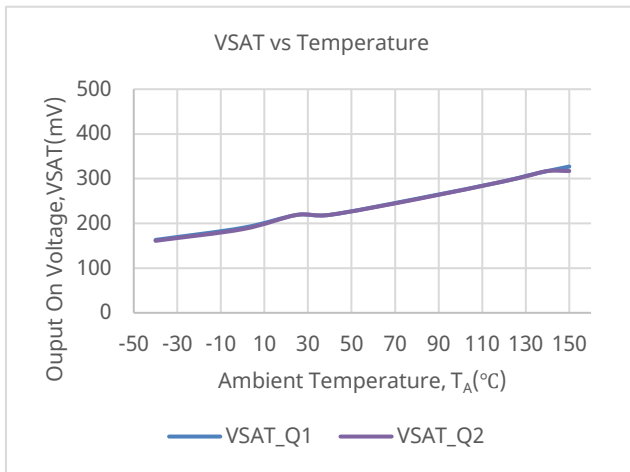
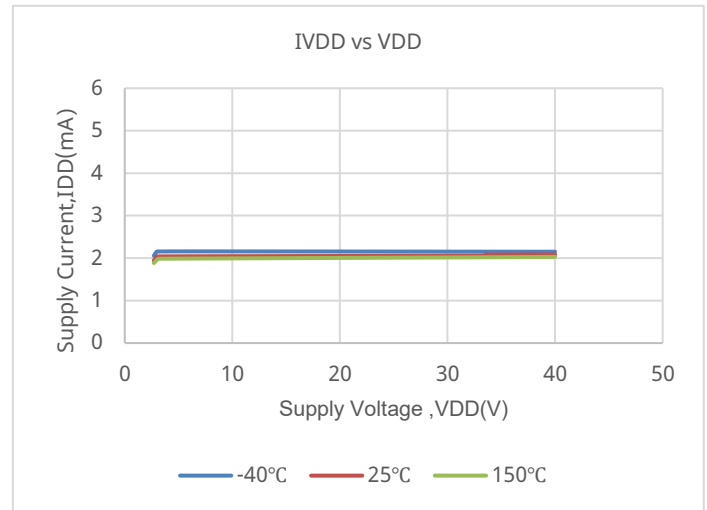
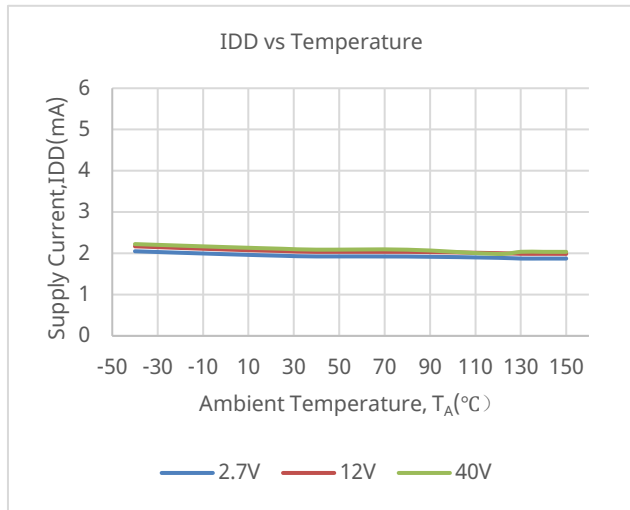
Note:

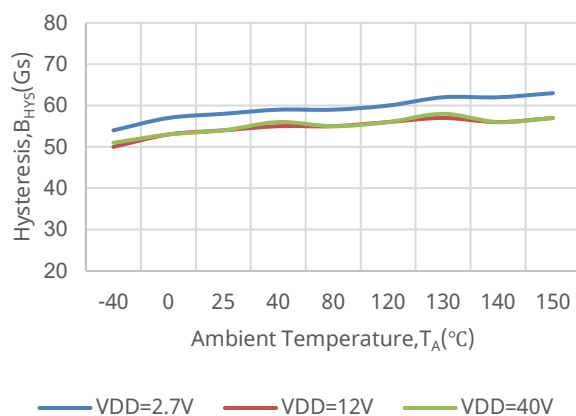
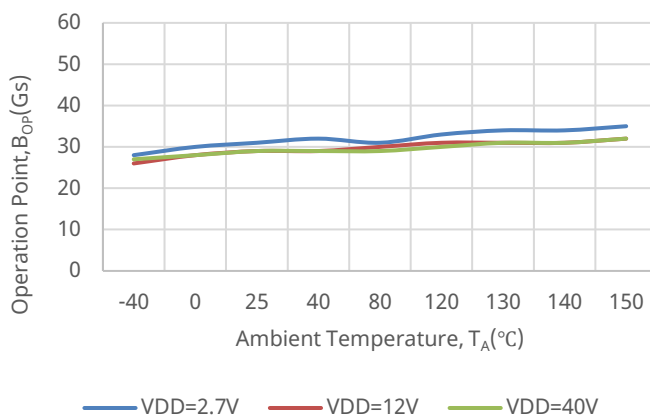
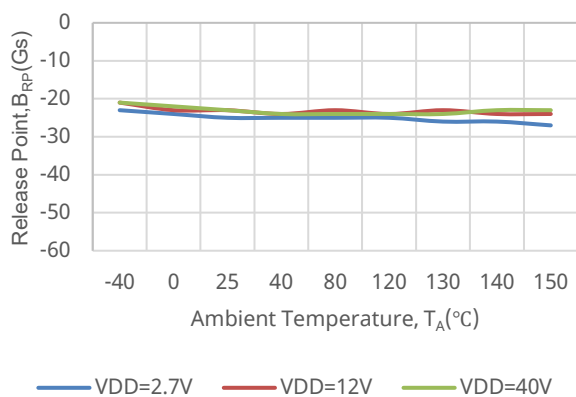
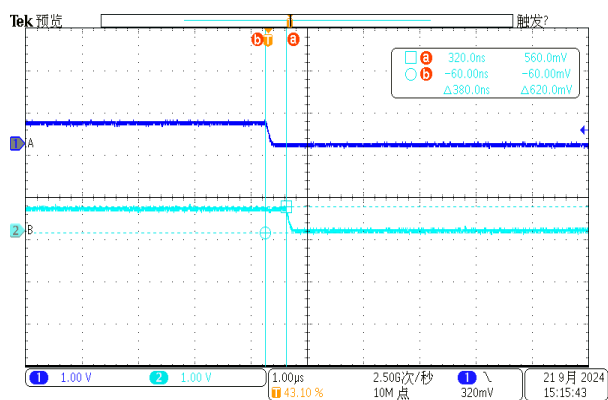
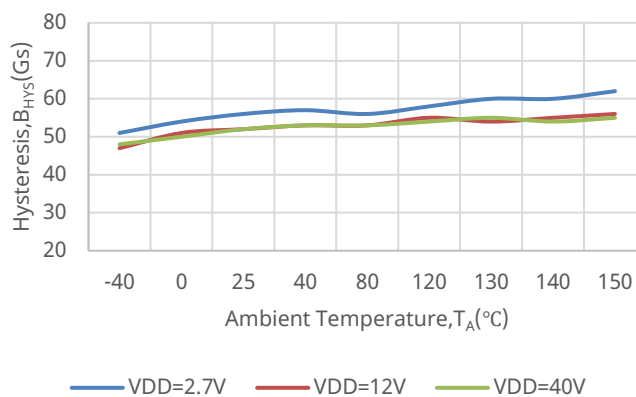
(1) 1mT=10GS.

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

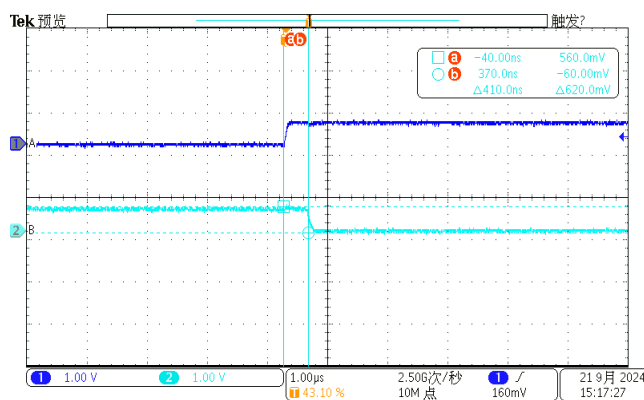
$$TC = \frac{BT_2 - BT_1}{BT_1 \times (T_2 - T_1)} \times 10^6, ppm/^\circ C, T_1 = 25^\circ C, T_2 = 150^\circ C$$

10. Typical Characteristic



Q1 B_H vs Ambient TemperatureQ2 B_{OP} vs Ambient TemperatureQ2 B_{RP} vs Ambient TemperatureQ2 B_H vs Ambient Temperature

The Direction Ahead 380ns Before Speed



The Direction Ahead 410ns Before Speed

11. Block Diagram

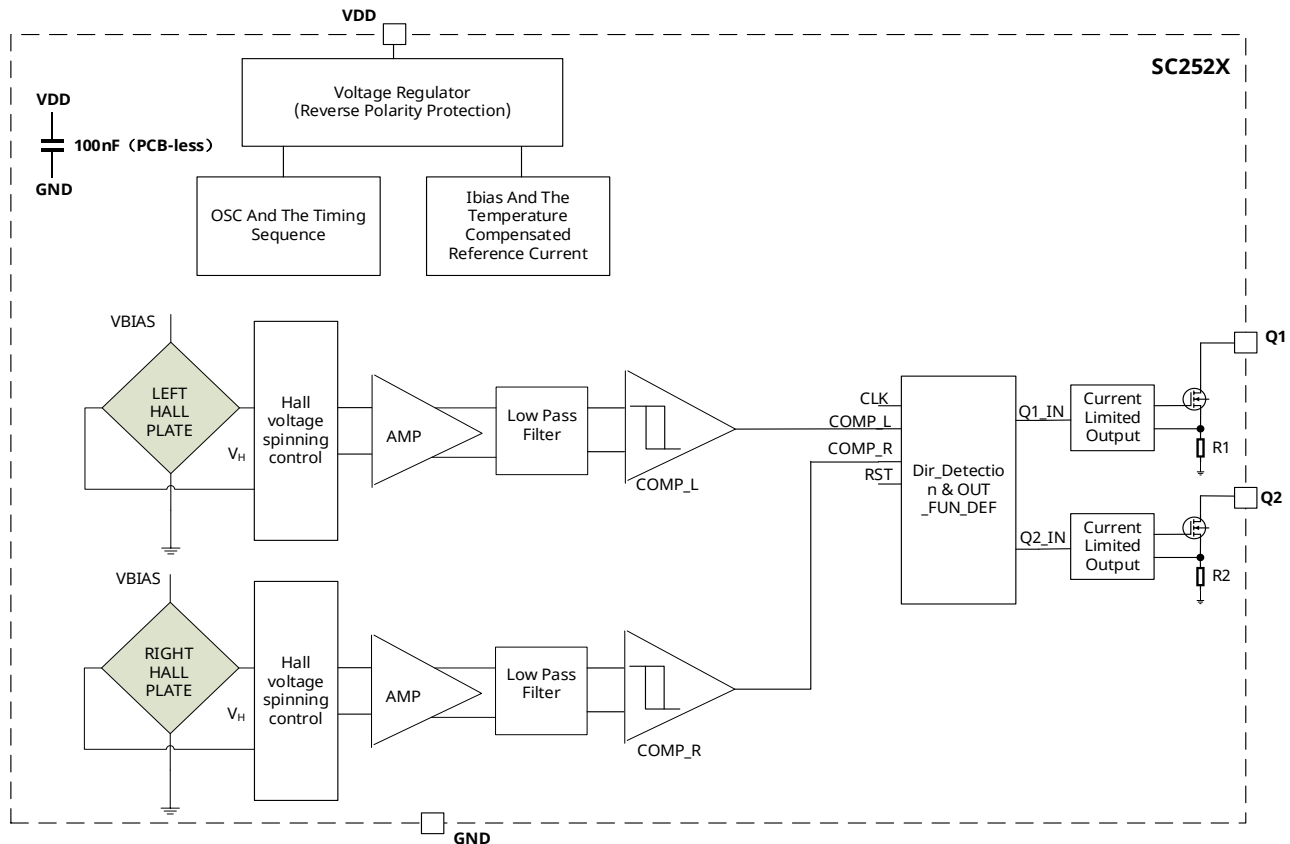


Fig.3 Functional block diagram

12. Function Description

The chopped Double Hall Switch comprises the voltage regulator, two Hall probes, bias generator, compensation circuit, oscillator, amplifier, filter, hysteresis comparator and the current limited open-drain output. An on-chip voltage regulator allows the device to be used over a wide operating voltage range of 2.8V to 40V which makes the device suitable for a wide range of industrial and automotive applications. The bias generator provides currents for the Hall probes and the active circuits, the compensation circuits stabilize the temperature behavior and reduce technology variations. The Hall probe, the amplifier, filter, the hysteresis comparator and the current limited open drain output compose the Hall signal process channel. The Active Error Compensation rejects offsets in signal stages and the influence of mechanical stress on the Hall probes caused by molding and soldering processes and other thermal stresses in the package. This chopper technique together with the threshold generator and the comparator ensures high accurate magnetic switching points.

SC252X is the dual channel Hall switch platform, mainly aimed at detecting the speed and direction of DC motor rotation in the automotive application.

With latching magnetic characteristics, the speed (SP) output is turned low or high respectively with a sufficiently strong South or North pole facing the package top side. When removing the magnetic field, the device keeps its previous state. The direction (DIR) output is latched in Low or High state depending on the movement direction of the applied magnetic field.

12.1. Field Direction Definition

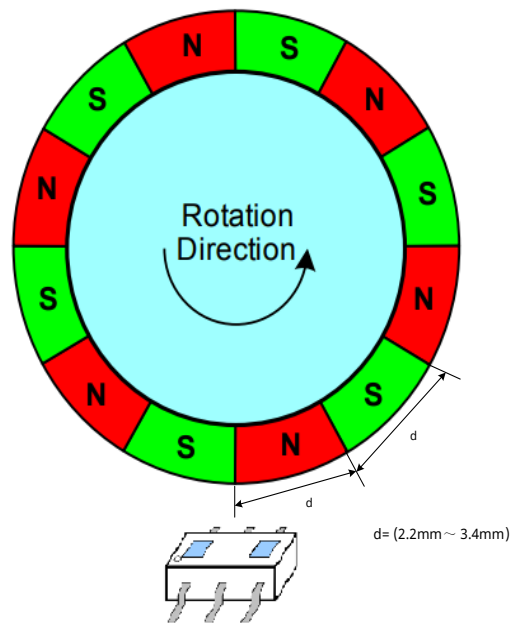


Fig.4 Magnetic Field Direction Definition

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	Left to right	High
	Right to left	Low
SC2526VB-AB-BK-Q	N/A	N/A
SC2526CVB-AB-BK-Q	N/A	N/A

13. Typical Application

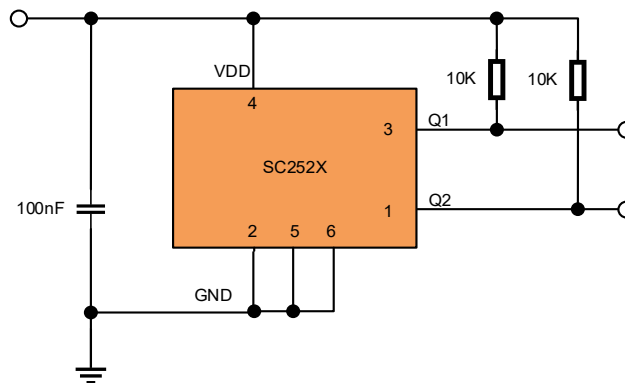


Fig.5 The Typical Application Schematic

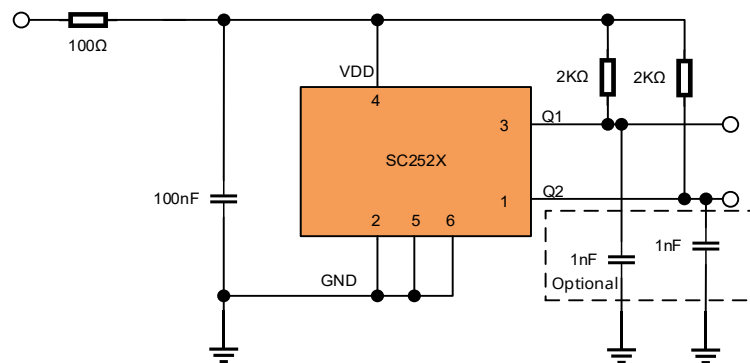


Fig.6 The Recommended Application Schematic for ISO7637-2

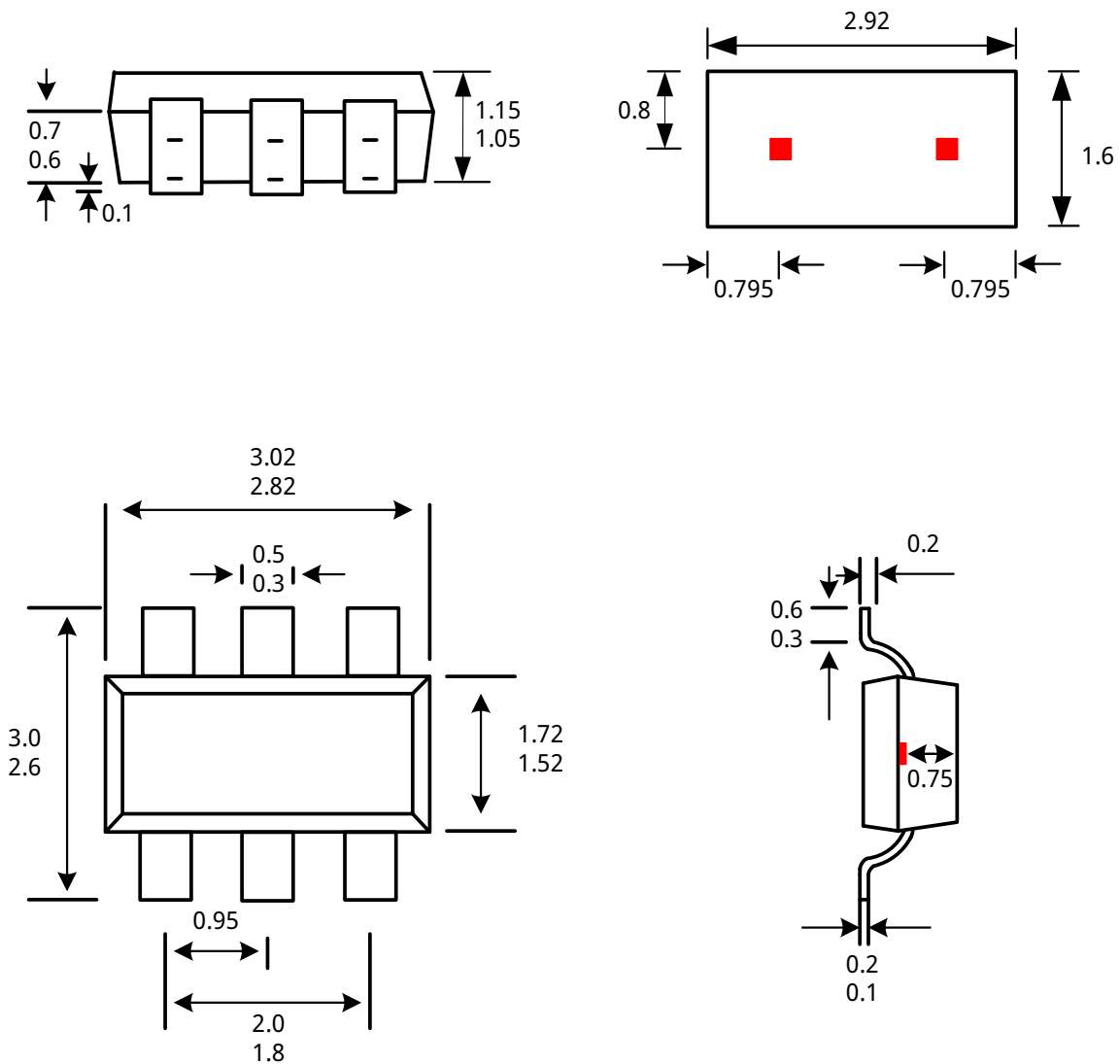
Note:

- (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
S6 Package**

Unit: mm



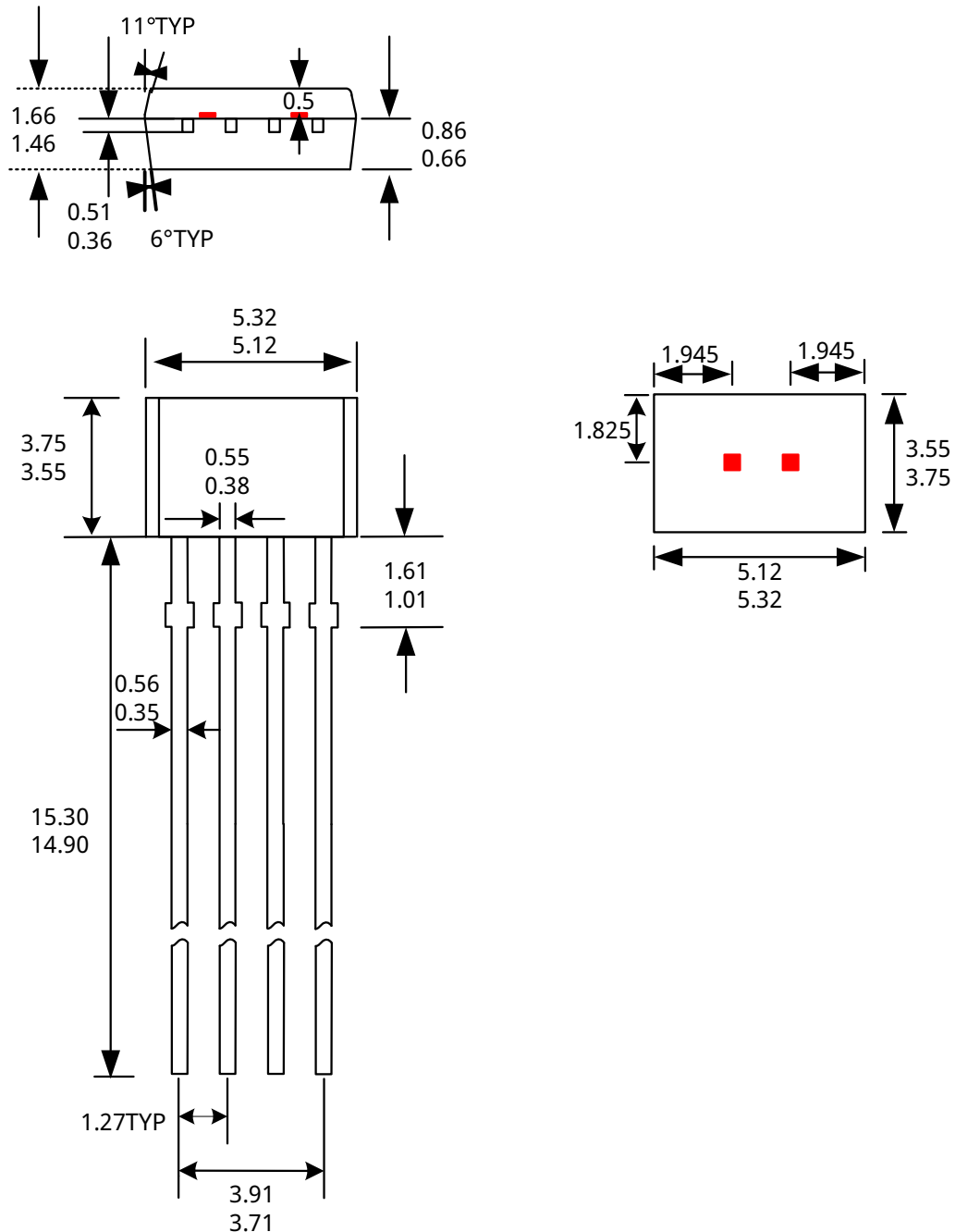
Notes:

- (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 VB/CVB

**TO-94
VB 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.

16. 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 SC2526CVB (PCB - less) model