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## High Performance Dual Channel Hall Effect Sensor

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### FEATURES

- 2.7 V to 40 V supply voltage operation
- Operation from unregulated power supply
- High sensitivity and high stability of the magnetic switching points
- Output Current Limitation
- Reverse battery protection (-27 V)
- Superior temperature stability
- Excellent matching between the 2 Hall probes
- Hall plate distance 1.3 mm
- Output Function Option
  - Speed+Direction
  - Speed+Speed
  - Speed+Directionb
  - Double Speed+Direction
- Direction signal switches before the speed signal
- SMD package SOT23-6

### APPLICATIONS

- Windows lifter with Anti-Pinch feature
- Rotation speed & direction detection
- Linear speed & direction detection
- Angular position detection
- Power closures with Anti-Pinch features

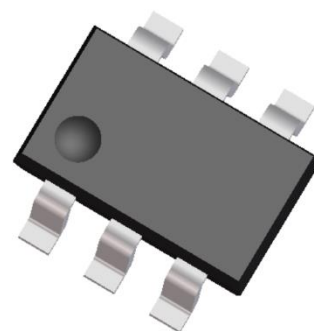
### DESCRIPTION

The SC2527X are the dual-channel Hall effect sensor platform that is ideally suited for speed and direction sensing applications containing encoded ring magnet targets.

The SC2527X provides dual output signals that indicate the speed and direction of target rotation. SC2527X has different sensitivities depending on the target application and is suitable for use in harsh automotive and industrial environments.

The SC2527X Hall elements are spaced 1.3mm apart and are recommended to be used in conjunction with their adapted ring magnets. An integrated low-drift amplifier ensures symmetry between the switches and tight control of the timing sequence of the speed and direction signals. An on-chip voltage regulator allows the device to be used over a wide operating voltage range of 2.7 to 40V.

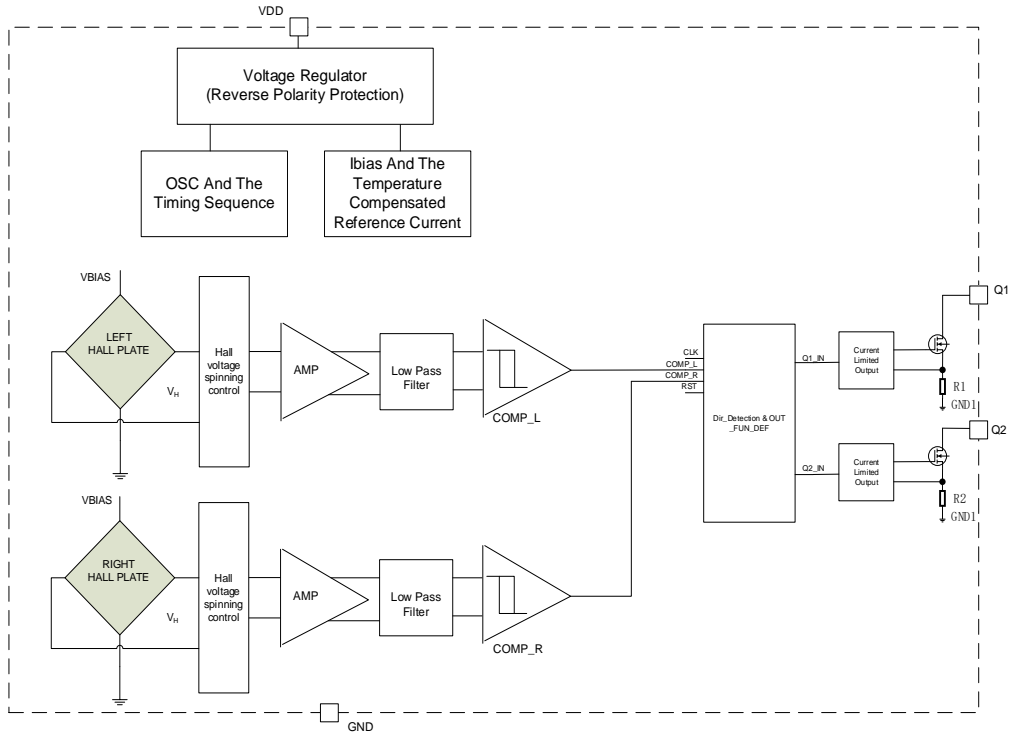
The SC2527X are available in 4-pin SIP and 6-pin SOT23-6 plastic packages. Both packages are 100% lead-free, matte tinned lead packages.



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## 1. BLOCK DIAGRAM.



## 2. ORDERING INFORMATION

Part Number	Packing	Output Mode	Mark	Ambient, T <sub>A</sub>	BOP(Typ.)	BRP(Typ.)
SC25270SO	3000pieces/reel	S+D	270XY	-40°C to 150°C	+3.0mT	-3.0mT
SC25271SO	3000pieces/reel	S+S	271XY	-40°C to 150°C	+3.0mT	-3.0mT
SC25272SO	3000pieces/reel	S+Db	272XY	-40°C to 150°C	+3.0mT	-3.0mT
SC25273SO	3000pieces/reel	DS+D	273XY	-40°C to 150°C	+3.0mT	-3.0mT

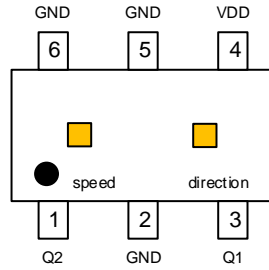
SC25270 is version of speed + direction output with Direction signal ahead of speed signal

SC25271 is version of speed + speed output

SC25272 is version of speed + directionb output with Direction signal ahead of speed signal

SC25273 is version of double speed + direction output with Direction signal ahead of speed signal;

### 3. TERMINAL CONFIGURATION



Terminal		Type	Description
Name	Number		
Q2	1	Output	Speed/Double Speed
GND	2	Ground	GND
Q1	3	Output	Direction / Speed
VDD	4	Power	Supply voltage
GND	5	Ground	GND
GND	6	Ground	GND

## 4. ABSOLUTE MAXIMUM RATINGS

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

Parameter	Symbol	Min.	Max.	Units
Power supply voltage	VDD	-27	50 <sup>(2)</sup>	V
Output voltage	VOUT	-0.5	50 <sup>(2)</sup>	V
Continuous output current	IOUT		50	mA
Operating ambient temperature	TA	-40	150	°C
Maximum junction temperature	TJ	165 <sup>(4)</sup>		°C
Storage temperature	TSTG	-65	175	°C

(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) for 5 min @  $R_s \geq 200\Omega$

(3) for 5 min @ 1.2 k pull up

(4) for 1000 h

## 5. ESD PROTECTION

Human Body Model (HBM) tests according to: standard AEC-Q100-002

Parameter	Symbol	Min.	Max.	Units
ESD1-HBM <sup>1)</sup>	V <sub>ESD</sub>	-4	+4	KV

1) ESD-HBM use bare chip to test

## 6. THERMAL CHARACTERISTICS

Symbol	Parameter	Test Conditions	Rating	Units
$R_{\theta JA}$	SOT Package thermal resistance	Single-layer PCB, with copper limited to solder pads	300	°C/W

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

## 7. OPERATING CHARACTERISTICS

### Electrical Characteristics

DC Operating Parameters  $V_{DD} = 2.7V$  to  $40V$  and  $T_A = -40^{\circ}C$  to  $150^{\circ}C$  (unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Supply Voltage	$V_{DD}$		2.7		40	V
Supply Current	$I_{DD}$			2.04	2.7	mA
Reverse Supply Current	$I_{DDR}$				1	mA
Under Voltage Protection (High)	$UVLO_H$		2.27	2.3	2.5	V
Under Voltage Protection (High)	$UVLO_L$		1.95		2.2	V
Under Voltage Hysteresis	$UVLO_{HYS}$		170		650	mV
Under Voltage Deglitch Time	$T_{DGL}$			10		$\mu S$
Output Saturation Voltage	VOL	$V_{DD}=3V, I_{Q1}=20mA, I_{Q2}=20mA, B_{OP}=50G$		0.2	0.4	mV
		$V_{DD}=3V, I_{Q1}=30mA, I_{Q2}=30mA, B_{OP}=50G$			0.5	
Output Leakage Current	$I_{LKG}$	$V_{DD}$ Open, $GND=0V, I_{Q1}=60V, I_{Q2}=60V$			10	$\mu A$
Output Sink Current	$I_O$	$V_{DD}=3V, I_{Q1}=2V, I_{Q2}=2V, B_{OP}=50G$	35	40	50	mA
Output Falling Time <sup>(3)</sup>	$t_F$	$V_{DD}=12V, GND=0V, QX$ Connected To $RL=10K, B>BOP+20G$ .			1	$\mu S$
Output Rising Time <sup>(3)</sup>	$t_R$	$V_{DD}=12V, GND=0V, QX$ Connected To $RL=10K, B>BRP-20G$ .			1	$\mu S$
Enable Time of Q1 Or Q2 After Exceeding Of $V_{UV}$	$T_{PO}$	$V_{DD}$ : Step Up From $0V$ To $5V, GND=0V, Q1$ And $Q2$ Connected With $RL=10K, B>BOP+20G$ .		20	50	$\mu S$
Systematic Delay Between Magnetic Threshold Reached and Output Switching.	$T_D$	Guaranteed By Design		20	40	$\mu S$
The Sampling Period	$T_{SAMP}$	Guaranteed By Design		4		$\mu S$
The Chopper Frequency	$F_C$	Guaranteed By Design		1		MHz
Count Signal Delay After Direction <sup>(5)</sup>	$T_{DC}$		200	400	600	nS

Output Jitter	T <sub>JIT</sub>	Typ. value for square wave signal 1 k Magnetic Field.		2.6		μS <sub>RMS</sub>
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- 1 Typical values are defined at T<sub>A</sub> = +25°C and V<sub>DD</sub> = 12V
- 2 Based on device characterization results, not subject to production test
- 3 Measured between 0.1\*V<sub>PU</sub> and 0.9\*V<sub>PU</sub>
- 4 R<sub>PU</sub> and V<sub>PU</sub> are respectively the external pull-up resistor and pull-up power supply
- 5 Controlled delay between direction (DIR) signal update and speed (SP) signal update

## Magnetic Characteristics

DC Operating Parameters VDD = 2.7V to 40V and T<sub>A</sub> = -40°C to 150°C (unless otherwise specified)

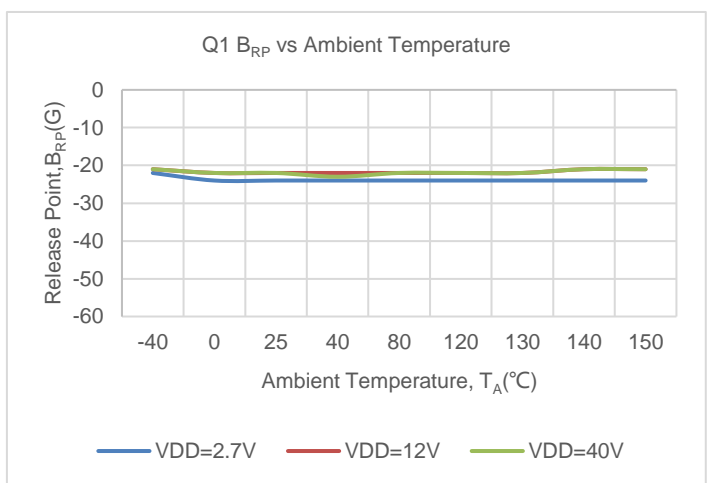
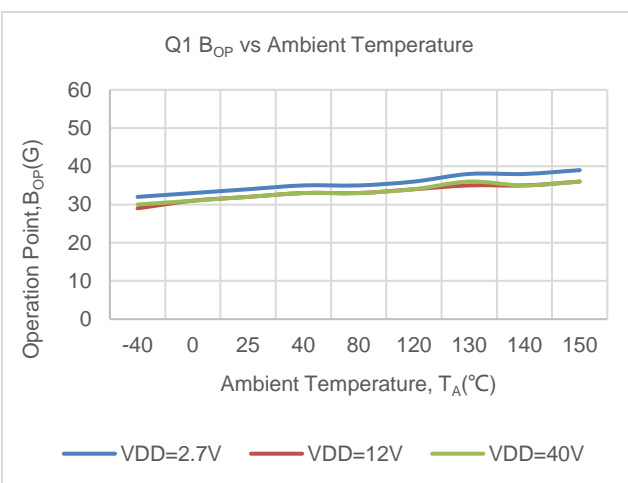
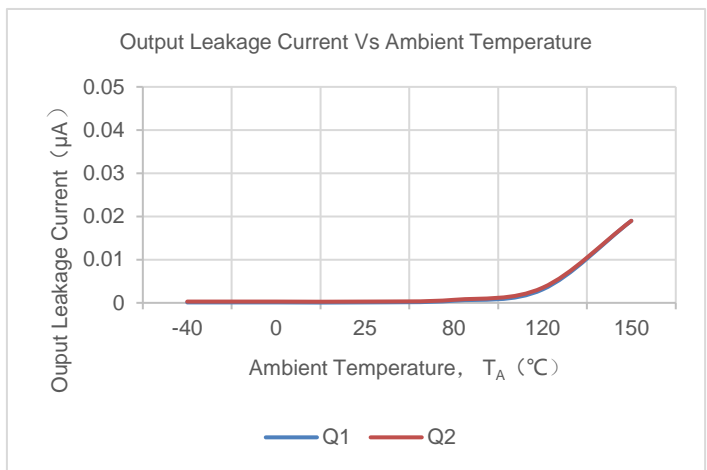
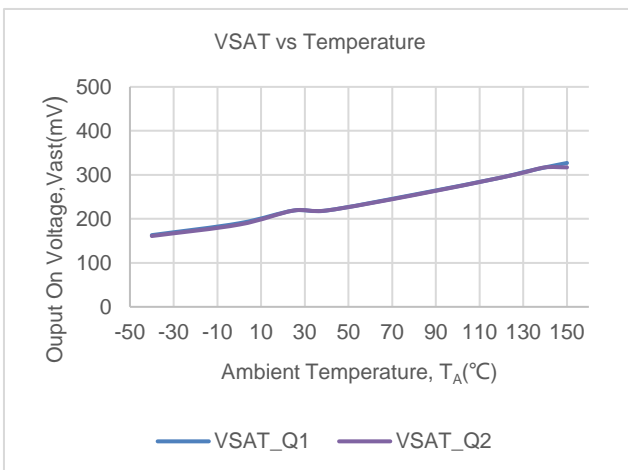
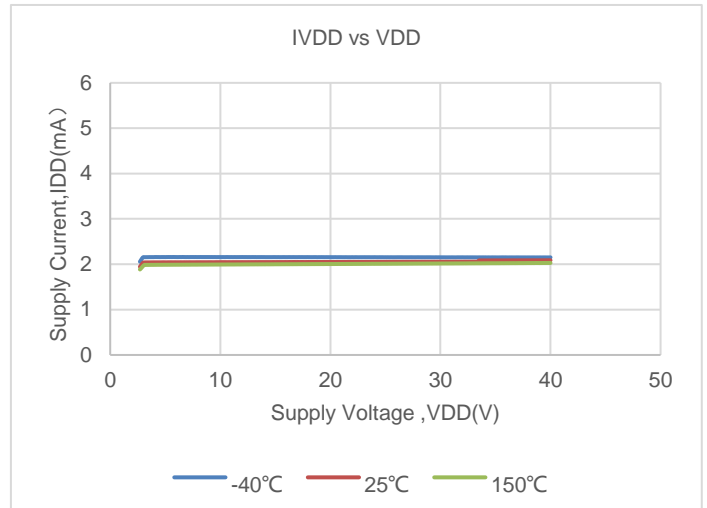
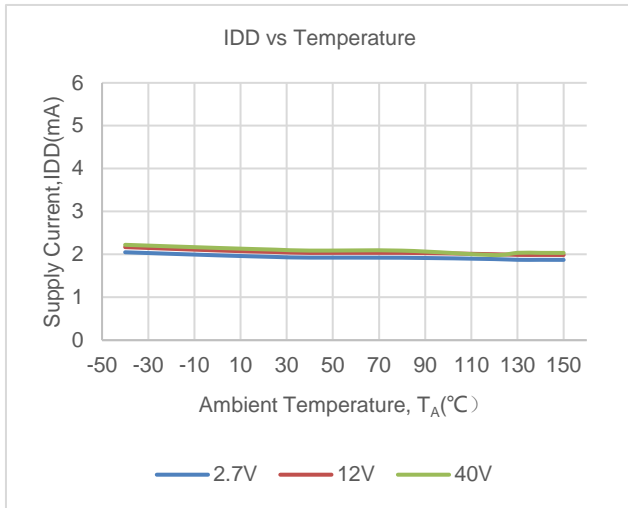
PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Magnetic Switching Frequency					20	KHz
Operating Point	B <sub>OP</sub>		2	3	4	mT
Release Point	B <sub>RP</sub>		-4	-3	-2	mT
Magnetic Hysteresis	B <sub>HYS</sub>		4	6	8	mT
Magnetic Match	B <sub>MATCH</sub>	B <sub>OP1</sub> -B <sub>OP2</sub> and B <sub>RP1</sub> -B <sub>RP2</sub>	-2		2	mT
		(B <sub>OP</sub> +B <sub>RP</sub> )/2	-2		2	mT
Temperature Coefficient				1000		ppm/°C
Hall Plate Spacing				1.3		mm

**Note:**

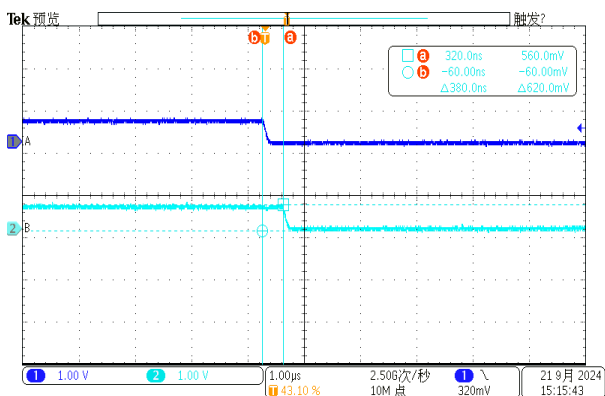
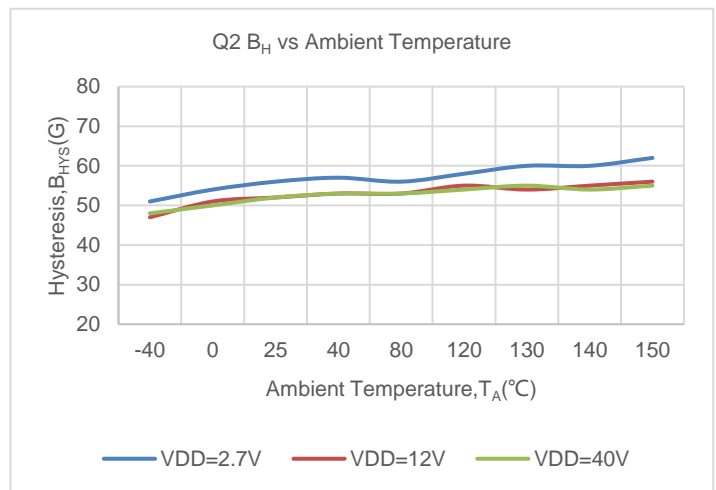
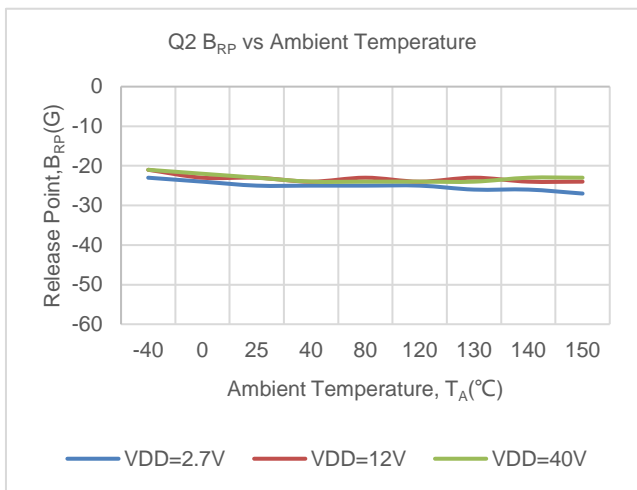
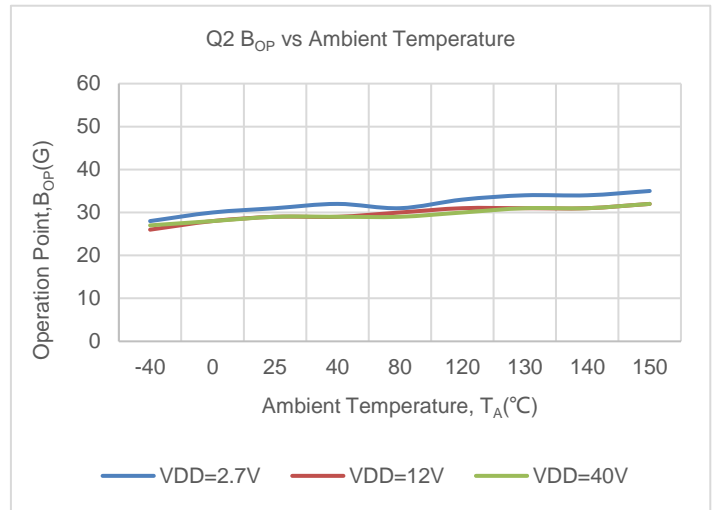
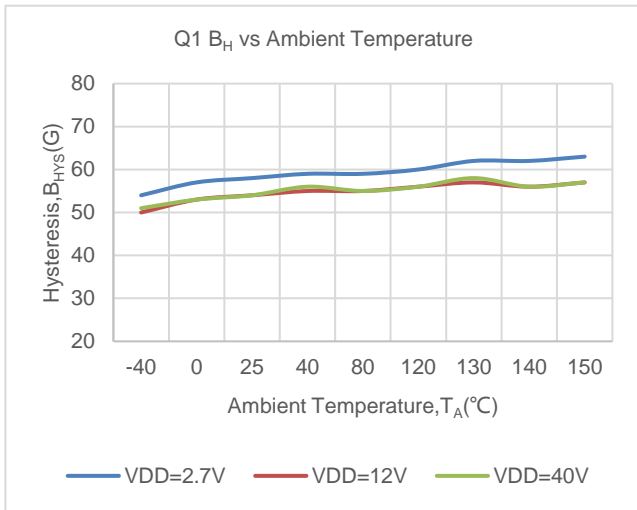
1. 1mT=10GS
2. Temperature coefficient value is guaranteed by design and verified by characterization and is calculated using the following formula:

$$TC = \frac{B_{T2} - B_{T1}}{B_{25^{\circ}C} \times (T_2 - T_1)} * 10^6, ppm/^{\circ}C; T_1 = -40^{\circ}C; T_2 = 150^{\circ}C$$

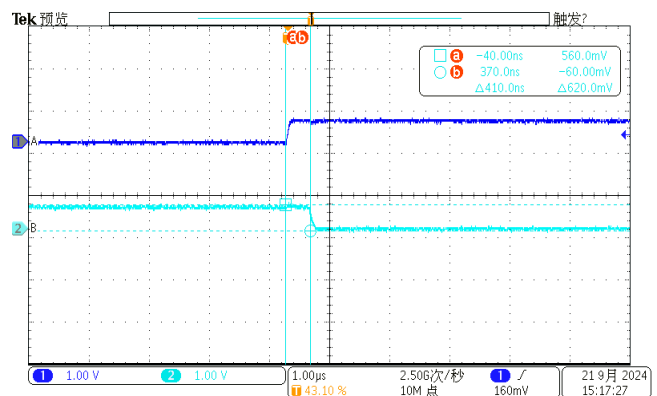
## 8. TYPICAL CHARACTERISTIC







The Direction Ahead 380ns Before Speed



The Direction Ahead 410ns Before Speed

## 9. FUNCTION DESCRIPTION

SC2527X are the new generation dual channel Hall switch platform, mainly aimed at detecting the speed and direction information of DC motor rotation in the automotive application.

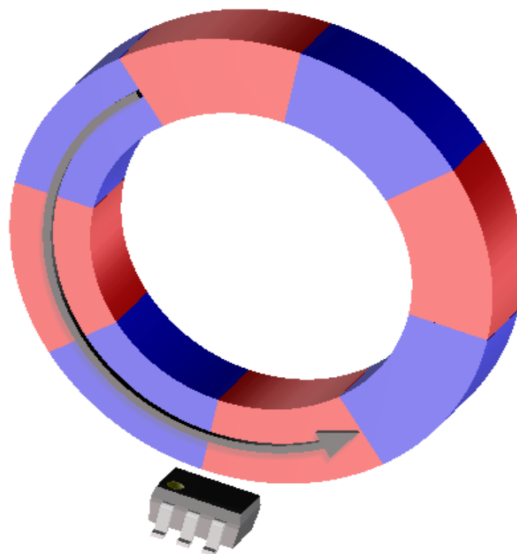
With latching magnetic characteristics, the speed (SP) output is turned low or high respectively with a sufficiently strong South or North pole facing the package top side. When removing the magnetic field, the device keeps its previous state.

The direction (DIR) output is latched in Low or High state depending on the movement direction of the applied magnetic field, as a result of certain magnetic pulse sequence on both Hall sensors.

SC2527X internal diagnostic detection module can meet the requirements of vehicle functional safety ASIL-A.

### Field Direction Definition

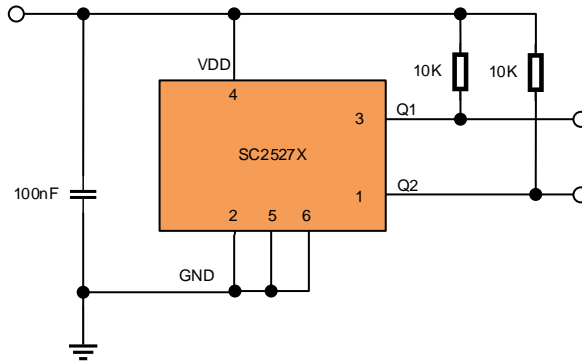
A multipolar magnetic ring is used as the rotate target.



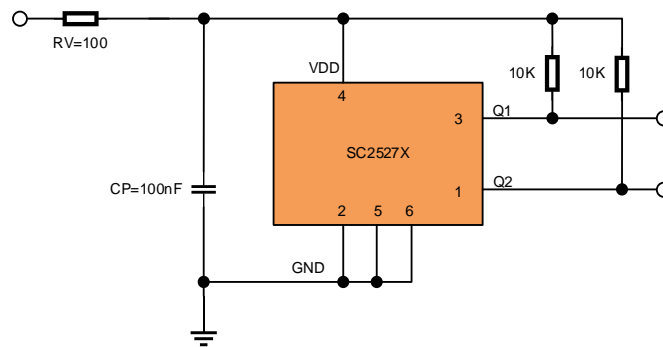
Product No.	Rotation Direction	State of Direction Output Q1
SC25270	Left to right	Low
	Right to left	High
SC25271	N/A	N/A
SC25272	Left to right	High
	Right to left	Low
SC25273	Left to right	Low
	Right to left	High

## 10. TYPICAL APPLICATION

### Default Application Schematic

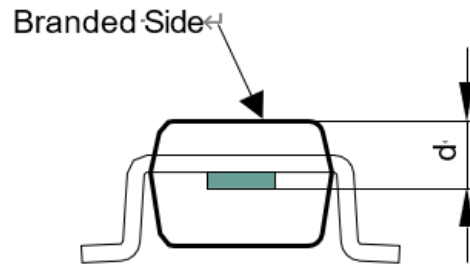
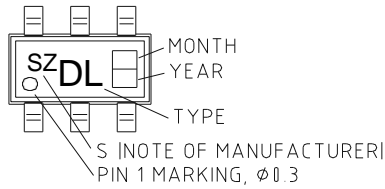


### Recommended Application Schematic for ISO7637-2 (pulses 5b)

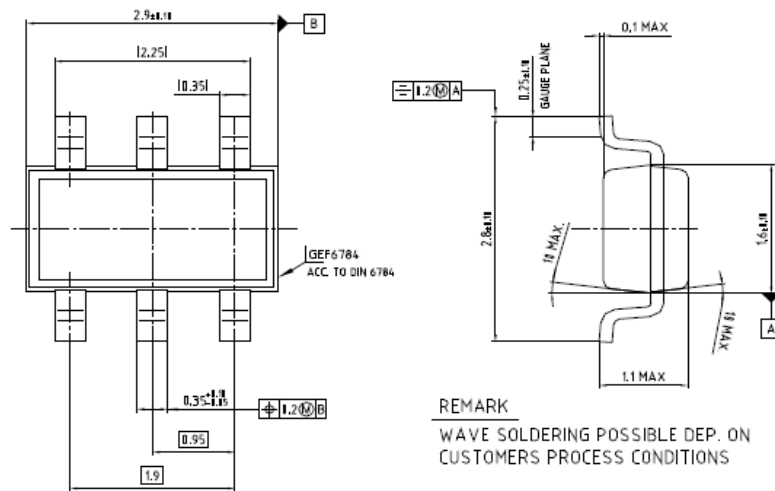


1. Recommended for conducted transients on supply line above 32V with duration above 500ms.
2. Recommended for conducted transients on supply line above 36V.

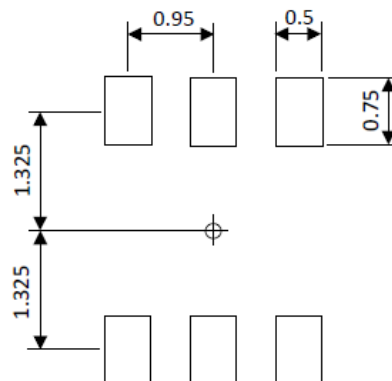
## 11. PACKAGE INFORMATION "SO"



$0.56 \pm 0.1$  mm

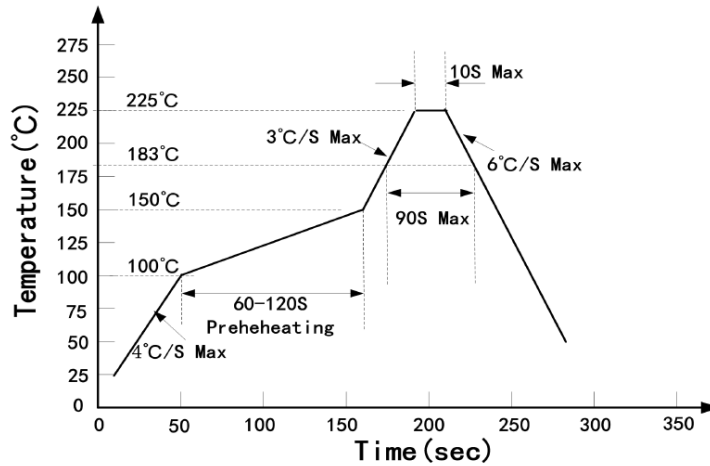


The following picture shows a recommendation for the PCB layout.

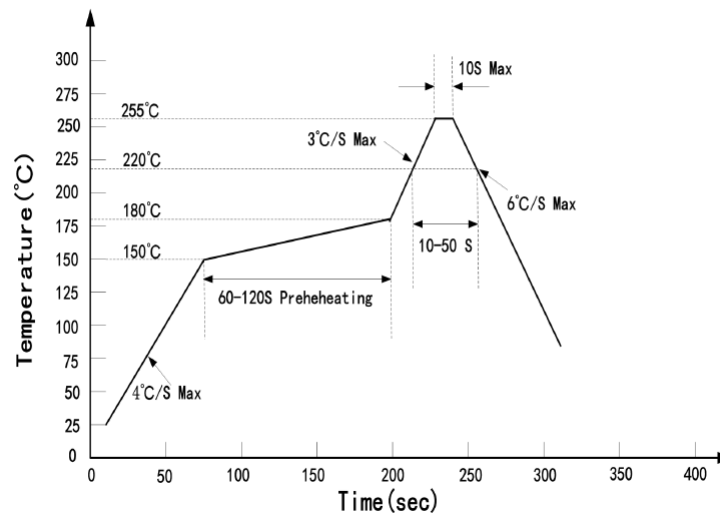


## 12. SOLDERING PROCESS

Reflow soldering



Lead-process



Lead-free process

Soldering iron process

Soldering iron temperature: max 260 °C Soldering time; max 10 Seconds.

### 13. REVISION HISTORY

Revision	Date	Description
Rev 0.0	2024-07-25	Preliminary datasheet
Rev 0.1	2024-09-26	