

High-Voltage Latching Hall Switch IC

1. Features

- AEC-Q100 Grade 0
- ISO26262 ASIL B
- Wide voltage range: 2.8V to 40V
- Latch-type switch Hall
- Reverse battery protection: -28V
- Current limited open drain output: 40mA
- Wide operating temperature range:
 - -40°C to 150°C
- High EMC/ESD immunity
- Small package:
 - 3-pin TO-92S (UA)
 - 3-pin SOT23-3L (SO)

2. Applications

- Automotive and Industrial
- BLDC motor commutation
- Seat motor adjuster
- Window lifter
- Sunroof/Tailgate opener
- Tachometers

3. Description

SC294X is manufactured using advanced 60V BCD technology, which is developed in accordance with the ISO 26262 standard and achieves ASIL B functional safety level. It is a chopper-stabilized Hall-effect sensor that provides a magnetic sensing solution with excellent sensitivity stability and integrated protection features.

SC294X employs dynamic offset cancellation, a technique that reduces residual offset voltage typically caused by device overmolding, temperature dependence, and thermal stress. Each device integrates a Hall voltage generator, small-signal amplifier, chopper stabilization circuit, hysteresis comparator, and current-limited output stage.

SC294X integrates an on-chip voltage regulator, allowing a wide supply voltage range from 2.8V to 40V to meet the requirements of industrial and automotive electronic applications.

SC294X device is available in either a TO-92S package (UA), or a SOT23-3L package (SO). All are lead (Pb) free, with 100% matte tin lead frame plating.



Fig.1 Package Outline

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4. Terminal Configuration

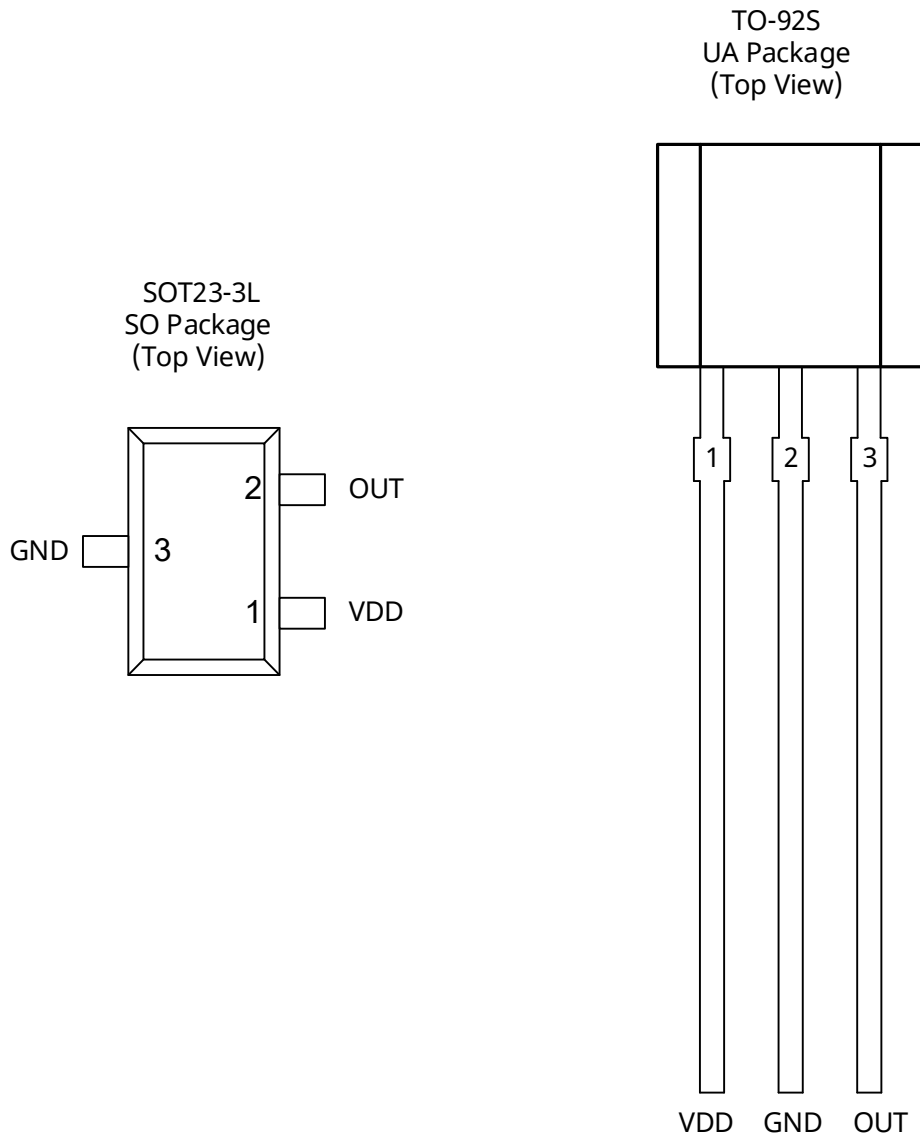


Fig.2 Pin Definition Diagram

Terminal			Type	Description
Name	UA	SO		
VDD	1	1	Power	2.8V to 40V power supply
GND	2	3	Ground	Ground terminal
OUT	3	2	Output	Open-drain output. The open drain requires a pull-up resistor

5. Ordering Information

Ordering Information	Marking	Option	B _{OP} (mT)	B _{RP} (mT)	Ambient, T _A (°C)	Package	Packing	Quantity
SC2943SO-TR-Q*	2943	South	3.0	-3.0	-40~150	SOT23-3L	Reel	3000/reel
SC2943SO-N-TR-Q	2943	North	-3.0	3.0	-40~150	SOT23-3L	Reel	3000/reel
SC2943UA-BK-Q*	2943	South	3.0	-3.0	-40~150	TO-92S	Bulk	1000/bag
SC2948SO-TR-Q*	2948	South	8.0	-8.0	-40~150	SOT23-3L	Reel	3000/reel
SC2948UA-BK-Q	2948	South	8.0	-8.0	-40~150	TO-92S	Bulk	1000/bag

Note:

*Main promoted product model of our company

Ordering Information Format

SC294XSO-N-TR-Q



Product Grade

Q: Automotive Product

Pack Designation

TR: Tape & Reel

BK: Bulk

Active Magnetic Polarity

N: North pole

Default: South pole

Package Designation

SO: SOT23-3L

UA: TO-92S

Magnetic Parameter

3: B_{OP}: 3.0mT, B_{RP}: -3.0mT

8: B_{OP}: 8.0mT, B_{RP}: -8.0mT

Device Family

SC294X: High-voltage latched Hall switch 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	R ≥ 200Ω, not exceed 5 min	-28	60	V
V _{OUT}	Output terminal voltage	1.2 kΩ pull up resistor, not exceed 5 min	-0.5	60	V
I _{SINK}	Output terminal current sink		0	40	mA
T _A	Operating ambient temperature		-40	150	°C
T _J	Maximum junction temperature		-40	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}	HBM	According to: standard AEC-Q100-002 HBM	-8	+8	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 _{θja}	UA Package thermal resistance	Single-layer PCB, with copper limited to solder pads	200 ⁽¹⁾	°C/W
R _{θja}	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 $V_{DD}=5.0V$ (unless otherwise noted)

Symbol	Parameter	Test Conditions	Min.	Typ. ⁽¹⁾	Max.	Units
V_{DD}	Operating Voltage ⁽²⁾	$T_J < T_{J(Max.)}$,	2.8	5	40	V
I_{DD}	Operating current	$V_{DD}=2.8$ to $40V$, $T_A=25^\circ C$,	1.0	1.2	3.0	mA
$UVLO_H$	Under Voltage Lockout High	$B > B_{OP} + 2.0mT$, V_{DD} Rising From 1.5V	2.5	2.7	-	V
$UVLO_L$	Under Voltage Lockout Low	$B > B_{OP} + 2.0mT$, V_{DD} Decreasing From 2.5V	2.3	2.5	-	V
$UVLO_{HYS}$	Under Voltage Hysteresis	$UVLO_H - UVLO_L$	0.1	0.2	0.4	V
t_{on}	Power-on time	$V_{DD} \geq 5V$	-	25	40	μs
I_{QL}	Off-state leakage current	Output Hi-Z	-	-	3	μA
V_{SAT}	Output saturation voltage drop	$B > B_{OP}$, $V_{DD}=5V$, $I_O=20mA$, $T_A=25^\circ C$	-	0.14	0.4	V
OCP	Overcurrent protection	Output on $V_{PULL-UP} < 30V$	30	50	70	mA
t_d	Output delay time	$B = B_{RP}$ to B_{OP}	-	15	25	μs
t_r	Output rise time (10% to 90%)	$V_{PU}=12V$, $R_{PU}^{(3)}=1k\Omega$ $C_L=50pF$	-	0.2	1	μs
t_f	Output fall time (90% to 10%)	$V_{PU}^{(3)}=12V$, $R_{PU}=1k\Omega$ $C_L=50pF$	-	0.1	1	μs

Note:

(1) Typical values are defined at $T_A=25^\circ C$, $V_{DD}=5V$

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

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

9.2. Magnetic Characteristics

over operating free-air temperature range, $V_{DD} = 5.0V$ (unless otherwise noted)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
f_{BW}	BW		20	-	-	kHz
SC2943 3.0⁽¹⁾/-3.0mT⁽²⁾						
B_{OP}	Operated point	$T_A=25^\circ C$	1.5	3.0	4.5	mT
B_{RP}	Release point		-4.5	-3.0	-1.5	mT
B_{HYS}	Hysteresis		3.0	6.0	9.0	mT
B_O	Magnetic offset	$B_O=(B_{OP}+B_{RP})/2$	-1.5	0	1.5	mT
SC2948 8.0/-8.0mT						
B_{OP}	Operated point	$T_A=25^\circ C$	6.0	8.0	10.0	mT
B_{RP}	Release point		-10.0	-8.0	-6.0	mT
B_{HYS}	Hysteresis		12.0	16.0	20.0	mT
B_O	Magnetic offset	$B_O=(B_{OP}+B_{RP})/2$	-2.0	0	2.0	mT

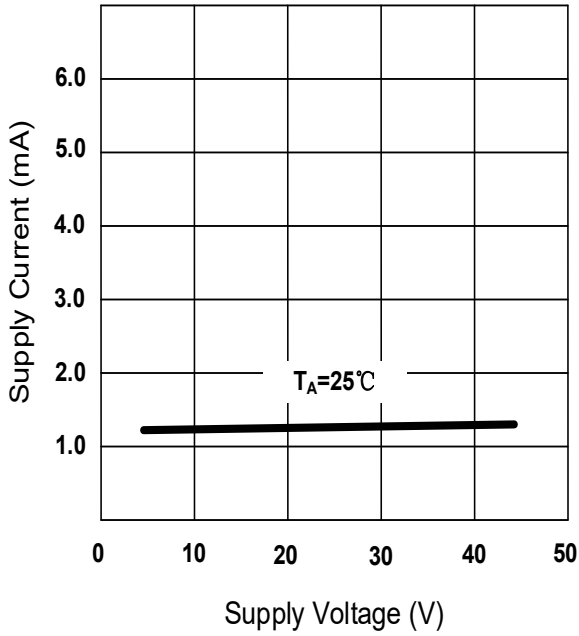
Note:

(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

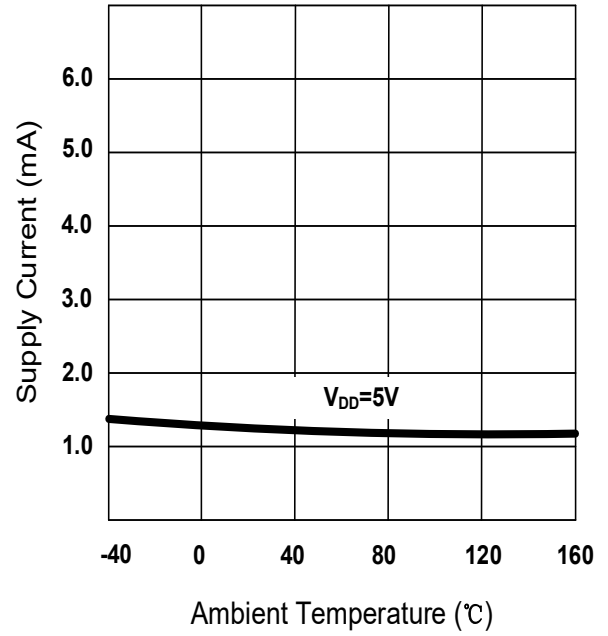
(2) $1mT=10Gs$

10. Characteristic Curves

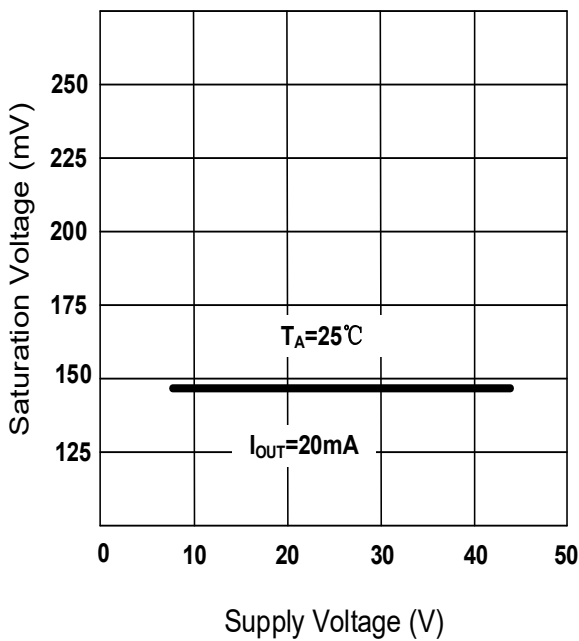
I_{DD} vs V_{DD}



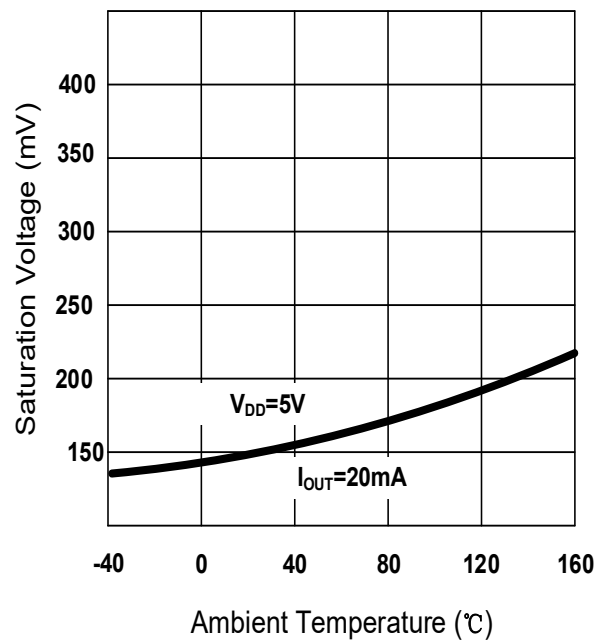
I_{DD} vs T_A



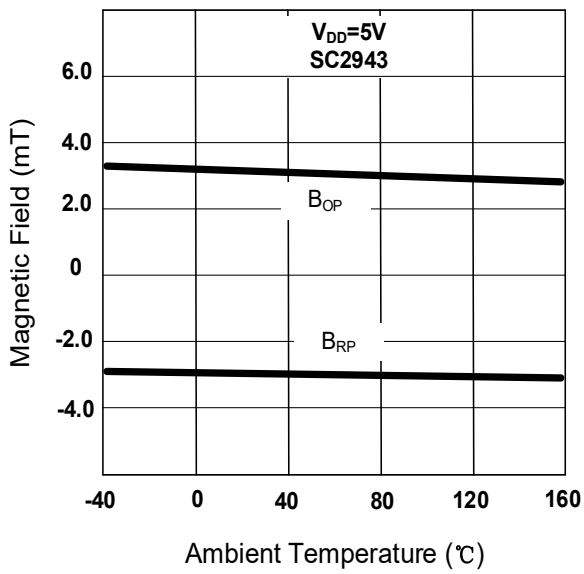
$V_{Q(sat)}$ vs V_{DD}



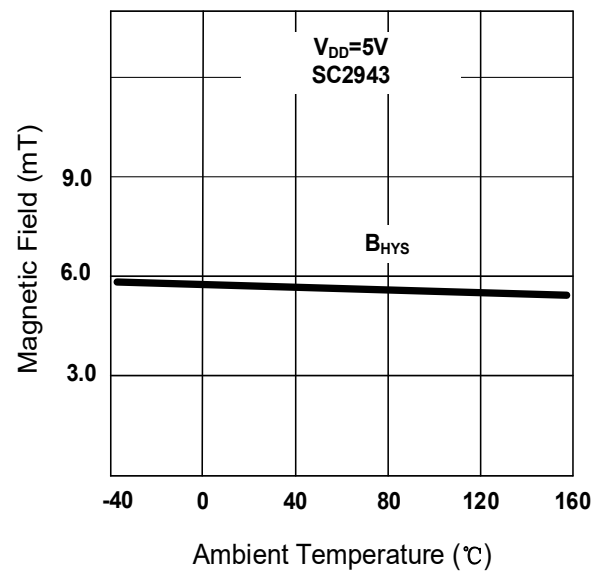
$V_{Q(sat)}$ vs T_A



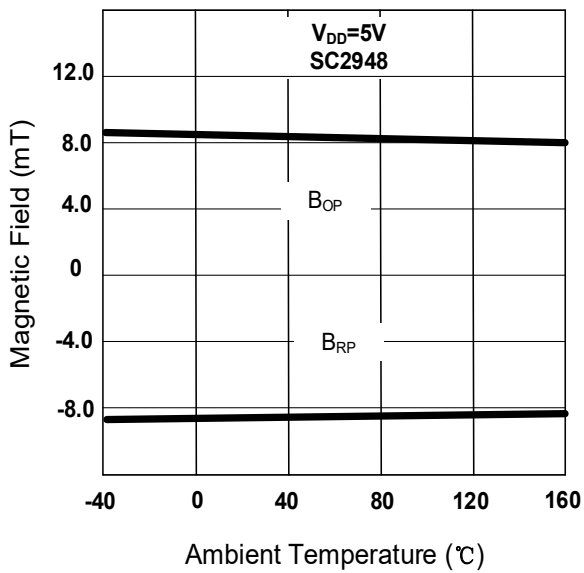
B_{OP} and B_{RP} vs T_A



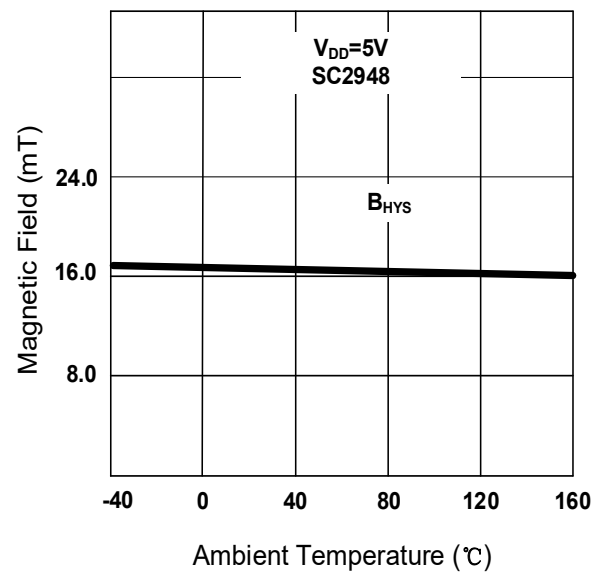
B_{HYS} vs T_A



B_{OP} and B_{RP} vs T_A



B_{HYS} vs T_A



11. Block Diagram

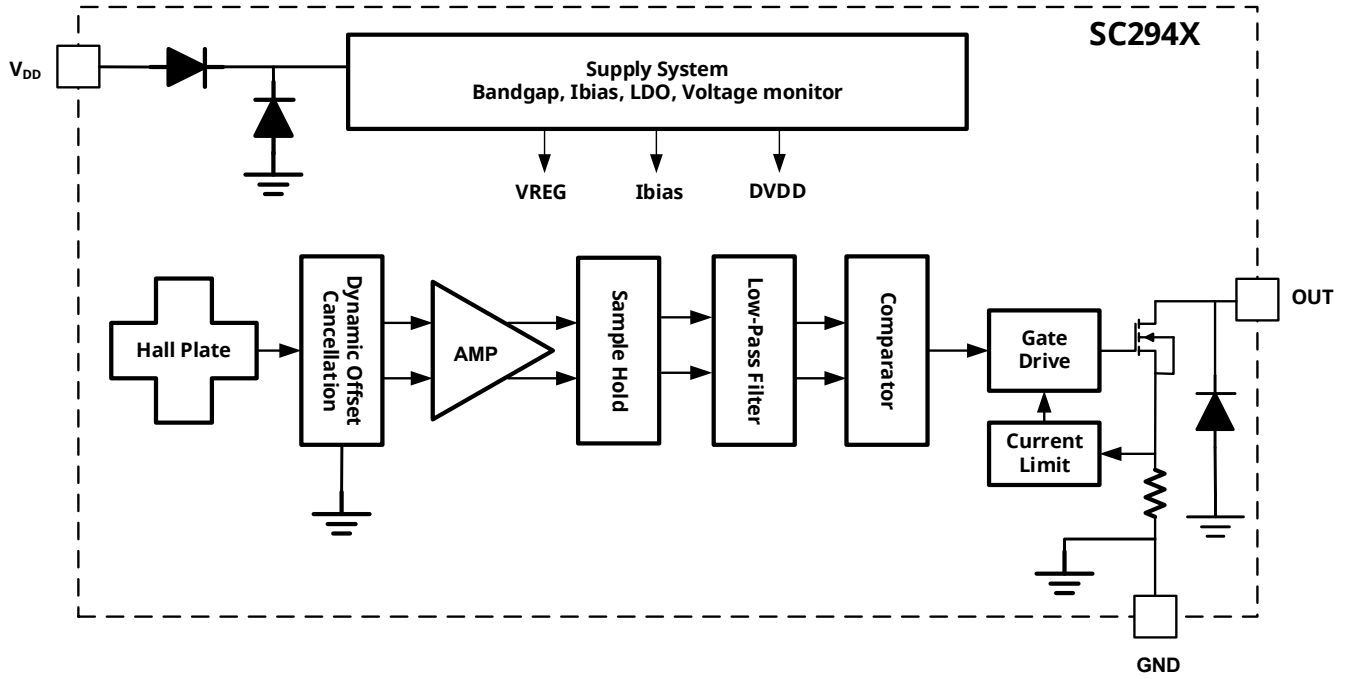


Fig. 3 Functional block diagram

12. Function Description

SC294X is a chopper-stabilized latching Hall-effect sensor designed for magnetic field sensing applications. The device operates over a supply voltage range of 2.8V to 40V and can continuously withstand a reverse supply voltage of -28V.

When the absolute value of the magnetic field intensity applied perpendicularly to the Hall element exceeds the operating point (B_{OP}) threshold, the SC294X outputs a low level (ON state), with the output capable of sinking up to 40 mA at the saturation voltage $V_{Q(sat)}$. When the magnetic field intensity 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 external mechanical vibrations and electrical noise interference.

12.1. Magnetic Field Direction Definition

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

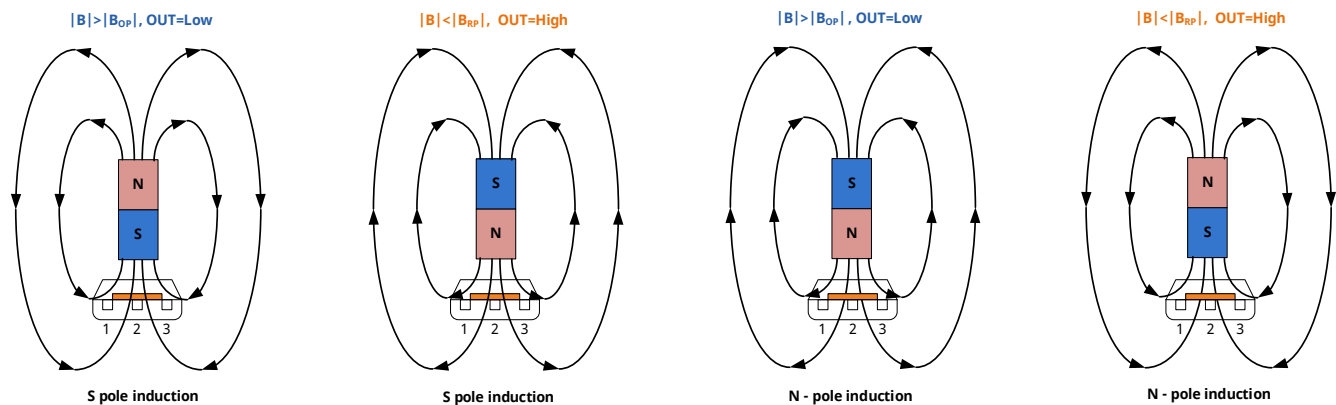


Fig.4 Magnetic Field Direction Definition

12.2. Transfer Function

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.

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.

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

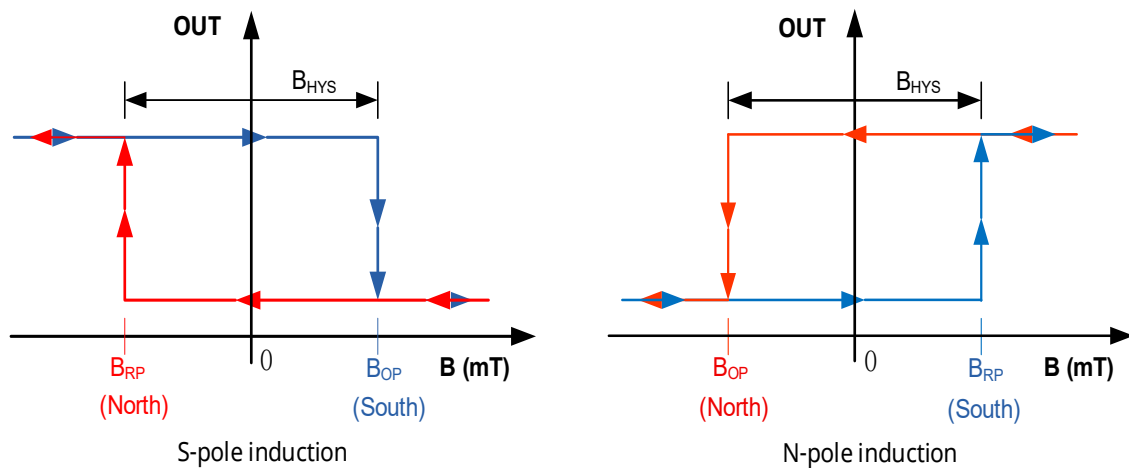


Fig.5 Transfer Characteristic Curve

13. Typical Application

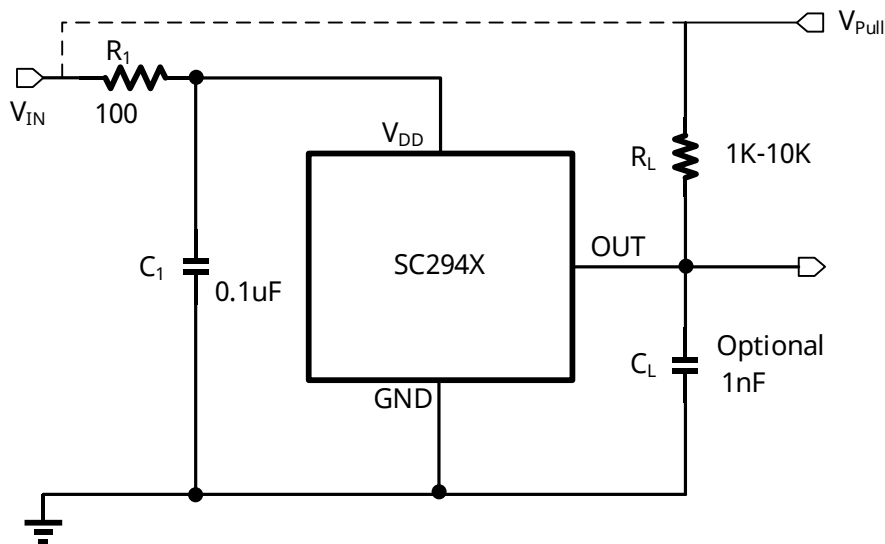


Fig.6 Typical Application Circuit

The SC294X contains an on-chip voltage regulator which makes the device operate over a wide supply voltage range. In the applications that operate on an unregulated power supply, the external line protection should be added. And the applications using a regulated line, for the EMI/RFI protection purpose, to connect the shunt C_1 capacitors which typically is $0.1\mu F$ to the ground near the chip V_{DD} power supply as close as possible and the 100Ω external optional series resistor R_1 . The output capacitor C_L used as the output filter is typically $1nF$.

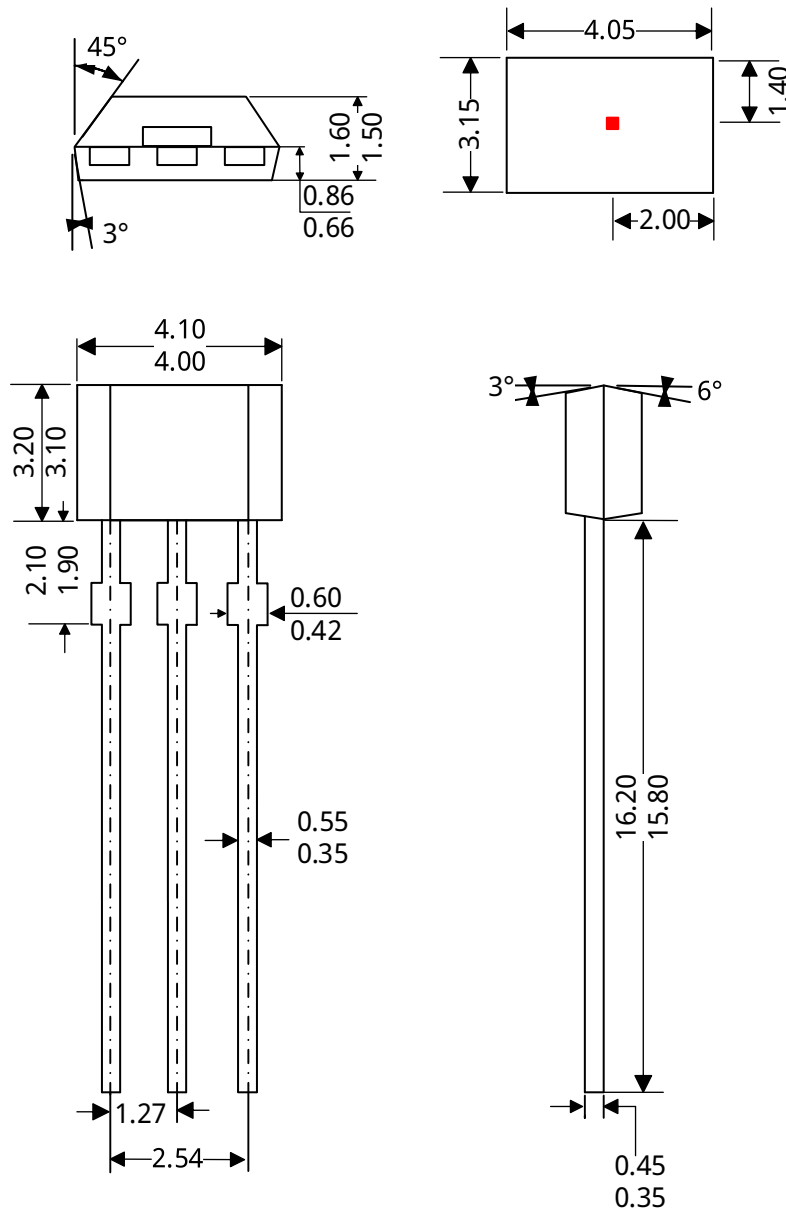
Select a value for C_L based on the system bandwidth specification as follow:

$$C_L < \frac{1}{2\pi \times R_L \times 2 \times f_{BW}(Hz)}$$

V_{PULL} is not restricted to V_{DD} and could be connected to other voltage power supply. The allowable voltage range of this terminal is specified in the Absolute Maximum Ratings.

14. Package Information UA

TO-92S Package Outline Dimensions



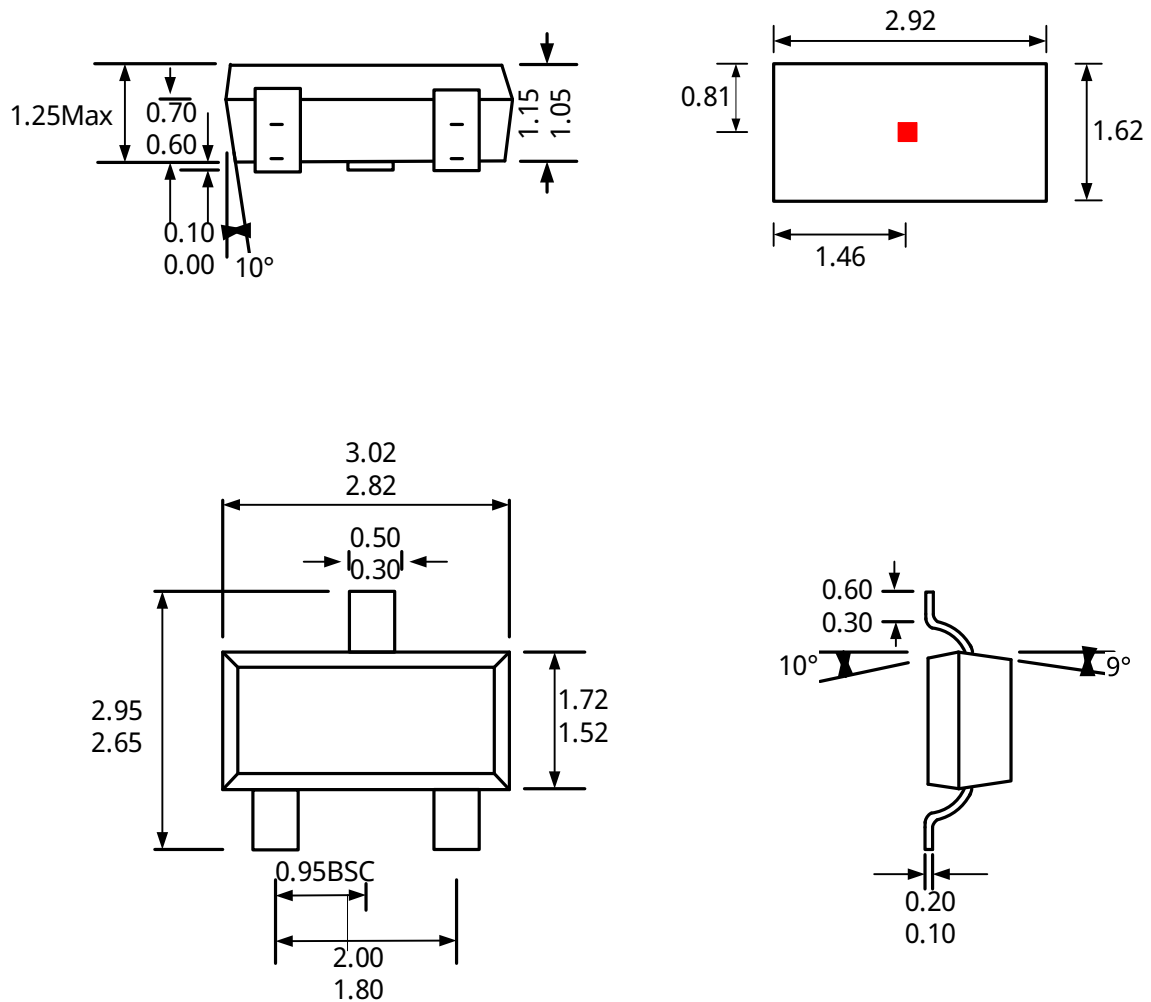
Notes:

- (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.

15. Package Information SO

SOT23-3L Package Outline Dimensions



Notes:

(1) All unit in mm.

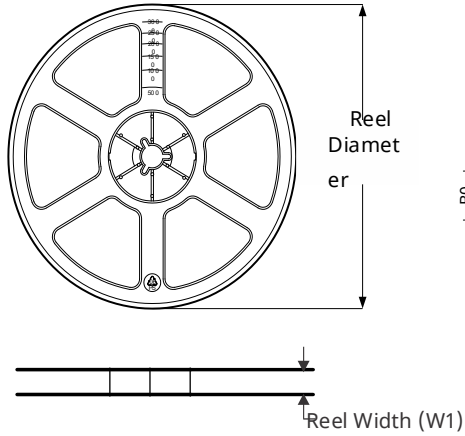
(2) Dimension does not include mold flash, protrusions or gate burrs.

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

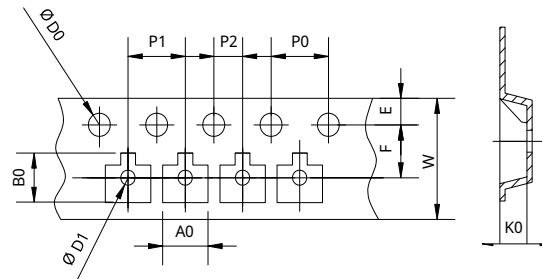
If no tolerance is specified, the dimension shall be theoretical reference value and shall not represent the exact dimension for actual measurement.

16. Tape&Reel Information

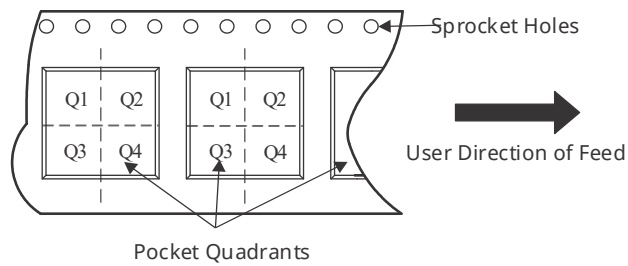
TAPE REEL DIMENSIONS



TAPE DIMENSIONS



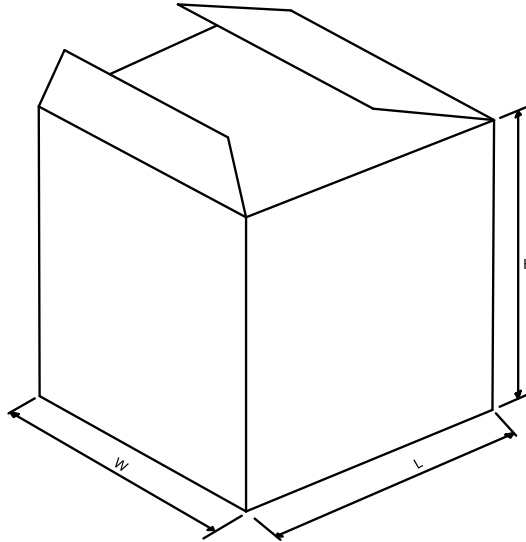
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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-23-3L	3000	180	8.4	4.00	2.00	4.00	3.18	3.28	1.32	8.00	Q3

17. Tape&Reel Box Dimensions



*All dimensions are nominal

Package Type	SPQ	Length (mm)	Width (mm)	Height (mm)
SOT-23-3L	3000ea*10tape	210	210	210

18. Revision History

Revision	Date	Description
Rev.V0.1	2023-03-10	Preliminary datasheet
Rev.V1.0	2025-07-14	Official version release
Rev.V1.1	2026-03-18	Add packaging specifications and declarations

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