

High-performance digital Unipolar Hall effect sensor

1. Features

- High-performance unipolar Hall sensor
- Multiple sensitivity ranges available
- High chopping frequency
- Supports a wide voltage range:
 - 2.5V to 24V
- Wide operating temperature range:
 - -40°C to 150°C
- Reverse battery protection: -28V
- Over-voltage protection at all pins
- Small package
 - 3-pin TO-92S (UA)
 - 3-pin SOT23-3L (SO)

2. Applications

- Industrial use
- Household appliances
- Liquid level detection
- Limit switch r
- Pneumatic/hydraulic valve control
- Speed measurement

3. Description

The SC243X family, produced with Bi-CMOS technology, is a chopper-stabilized Hall Effect Sensor that offers a magnetic sensing solution with superior sensitivity stability over temperature and integrated protection features. Superior high-temperature performance is made possible through dynamic offset cancellation, which reduces the residual offset voltage normally caused by device over molding, temperature dependencies, and thermal stress. Each device includes a voltage regulator, Hall-voltage generator, small-signal amplifier, chopper stabilization, Schmitt trigger, and an open-drain output to sink up to 20mA.

The voltage regulator circuit integrated inside the SC243X enables the chip to accept a wide power supply voltage range from 2.5V to 24V, meeting the application requirements of industrial and consumer electronics.

SC243X offers small single in-line through-hole TO-92S (UA) and SOT23-3L (SO) surface mount packages, with 100% lead-free and halogen-free green packaging, meeting environmental protection requirements.

Not To Scale



3 pin TO-92S(UA)



3 pin SOT23-3L(SO)

Fig.1 Package Outline

CONTENTS

1. Features	1	10. Typical Characteristics	8
2. Applications.....	1	11. Block Diagram	9
3. Description	1	12. Function Description	9
4. Terminal Configuration	3	12.1. Field Direction Definition	10
5. Ordering Information	4	12.2. Transfer Function	10
6. Absolute Maximum Ratings	5	13. Typical Application	11
7. ESD Protection	5	14. Package Information UA.....	12
8. Thermal Characteristics	5	15. Package Information SO	13
9. Operating Characteristics.....	6	16. Revision History.....	14
9.1. Electrical Characteristics	6		
9.2. Magnetic Characteristics	7		

4. Terminal Configuration

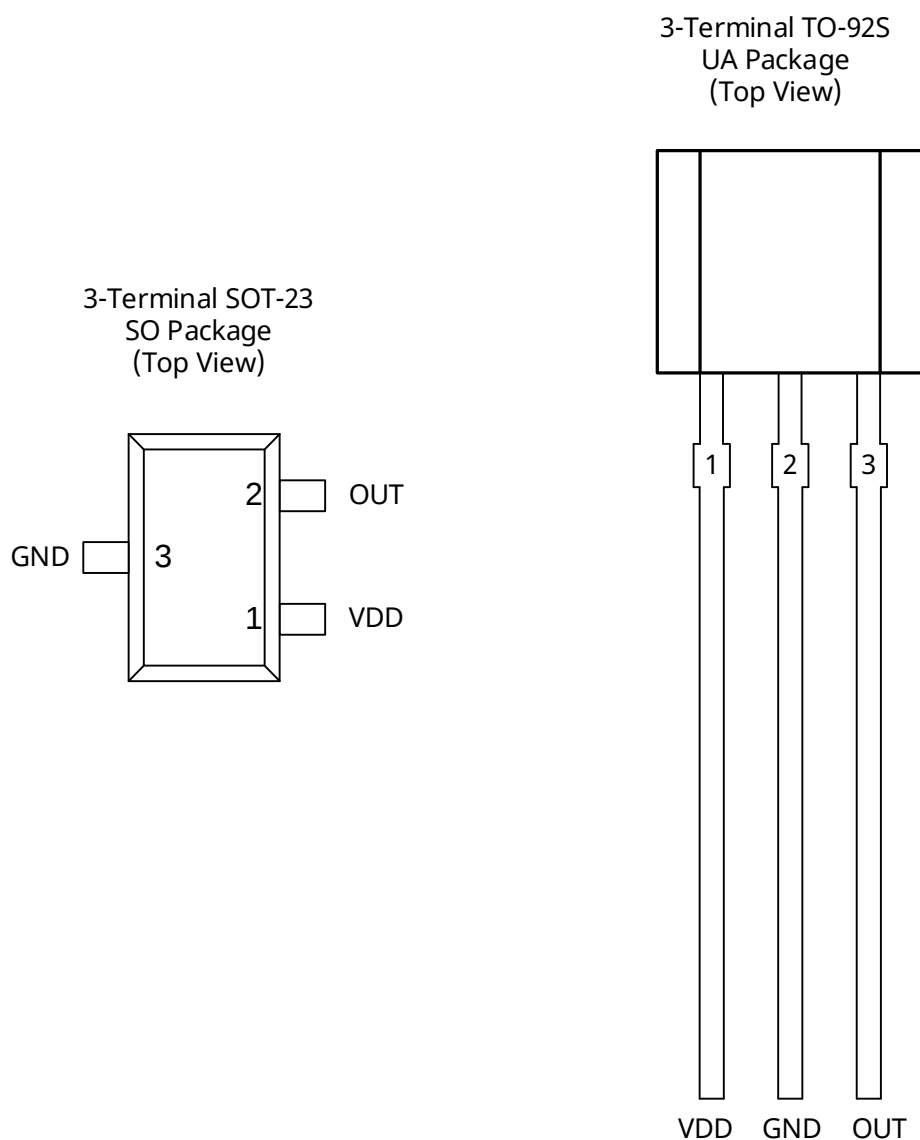


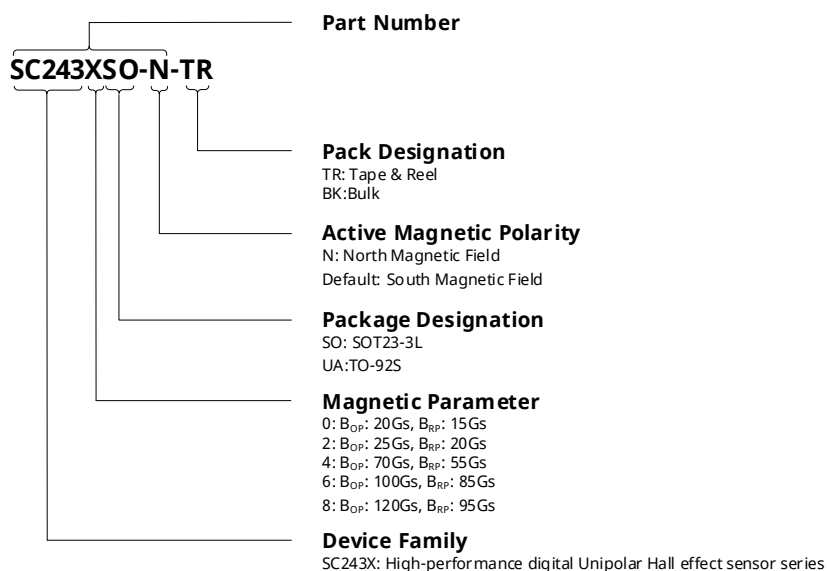
Fig.2 Terminal Configuration

Terminal			Type	Description
Name	UA	SO		
VDD	1	1	Power	2.5V to 24V 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	Mark	Option	B _{OP} (Gs)	B _{RP} (Gs)	Ambient, T _A (°C)	Package	Packing	Quantity
SC2430SO-TR	2430	S	+20	+15	-40~150	SOT23-3L	Reel	3000/reel
SC2430UA-BK	2430	S	+20	+15	-40~150	TO-92S	Bulk	1000/bag
SC2432SO-TR	2432	S	+25	+20	-40~150	SOT23-3L	Reel	3000/reel
SC2432SO-N-TR	2432	N	-25	-20	-40~150	SOT23-3L	Reel	3000/reel
SC2432UA-BK	2432	S	+25	+20	-40~150	TO-92S	Bulk	1000/bag
SC2434SO-TR	2434	S	+70	+55	-40~150	SOT23-3L	Reel	3000/reel
SC2434SO-N-TR	2434	N	-70	-55	-40~150	SOT23-3L	Reel	3000/reel
SC2434UA-BK	2434	S	+70	+55	-40~150	TO-92S	Bulk	1000/bag
SC2436SO-TR	2436	S	+100	+85	-40~150	SOT23-3L	Reel	3000/reel
SC2436UA-BK	2436	S	+100	+85	-40~150	TO-92S	Bulk	1000/bag
SC2438SO-TR	2438	S	+120	+95	-40~150	SOT23-3L	Reel	3000/reel
SC2438UA-BK	2438	S	+120	+95	-40~150	TO-92S	Bulk	1000/bag

Ordering Information Format



6. Absolute Maximum Ratings

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

Symbol	Parameter	Test Condition	Min.	Max.	Units
V _{DD}	Power supply voltage		-28	28	V
V _{OUT}	Output terminal voltage	For 5 Min. @1.2K pull-up resistor	-0.5	28	V
I _{SINK}	Output terminal current sink		0	30	mA
T _A	Operating ambient temperature		-40	150	°C
T _J	Maximum junction temperature		-55	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 Condition	Min.	Max.	Units
V _{ESD_HBM}	HBM	According to: standard AEC-Q100-002 HBM	-4	+4	kV
V _{ESD_CDM}	CDM	According to: standard AEC-Q100-011 CDM	-1	+1	kV

8. Thermal Characteristics

Symbol	Parameter	Test Conditions	Rating	Units
R _{θJA}	UA Package thermal resistance	Single-layer PCBS, JEDEC 1s0p are defined in JESD 51-3	200 ⁽¹⁾	°C/W
	SO Package thermal resistance	Single-layer PCBS, JEDEC 1s0p are defined in JESD 51-3	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⁾	$T_J < T_{J(Max.)}$	2.5	5.0	24	V
I_{DD}	Operating supply current	$V_{DD}=2.5$ to 24 V, $T_A=25^\circ C$	-	1.6	2.5	mA
t_{on}	Power-on time		-	35	50	μs
I_{QL}	Off-state leakage current	Output Hi-Z	-	-	1	μA
$R_{DS(on)}$	FET on-resistance	$V_{DD}=5.0V$, $I_O=10mA$, $T_A=25^\circ C$	-	20	-	Ω
		$V_{DD}=5.0V$, $I_O=10mA$, $T_A=125^\circ C$	-	30	-	Ω
t_d	Output delay time	$B=B_{RP}$ to B_{OP}	-	15	25	μs
t_r	Output rise time (10% to 90%)	$R1=1Kohm$ $C_o=50pF$	-	-	0.5	μs
t_f	Output fall time (90% to 10%)	$R1=1Kohm$ $C_o=50pF$	-	-	0.2	μs

Note:

(1) Typical values are defined at $T_A = 25^\circ C$ and $V_{DD} = 5.0V$

(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, $V_{DD} = 5.0V$ (unless otherwise noted)

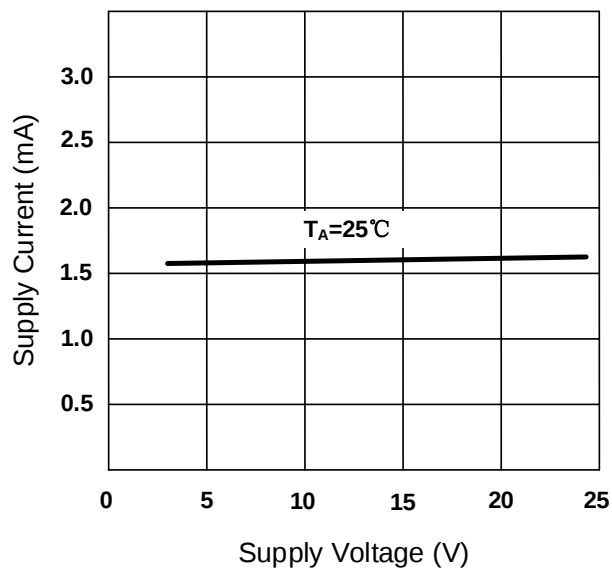
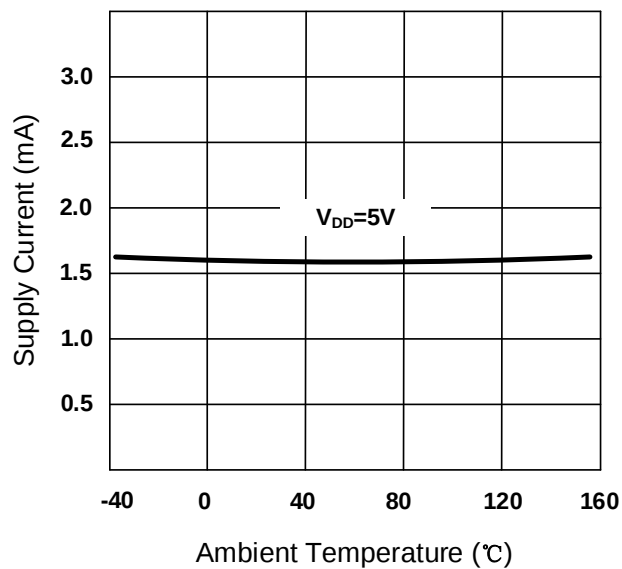
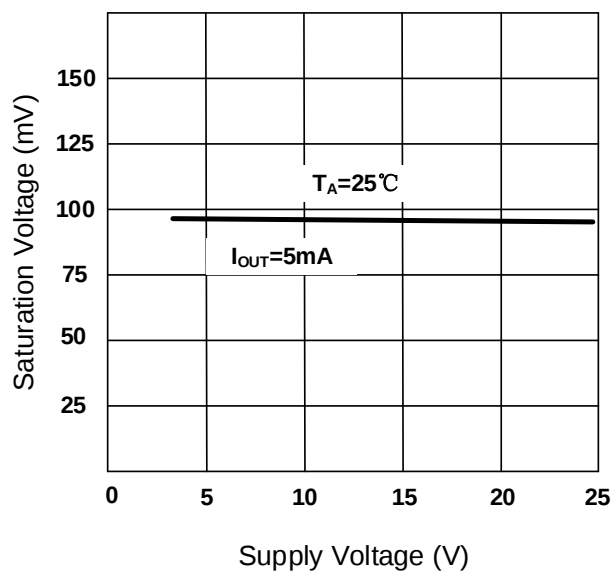
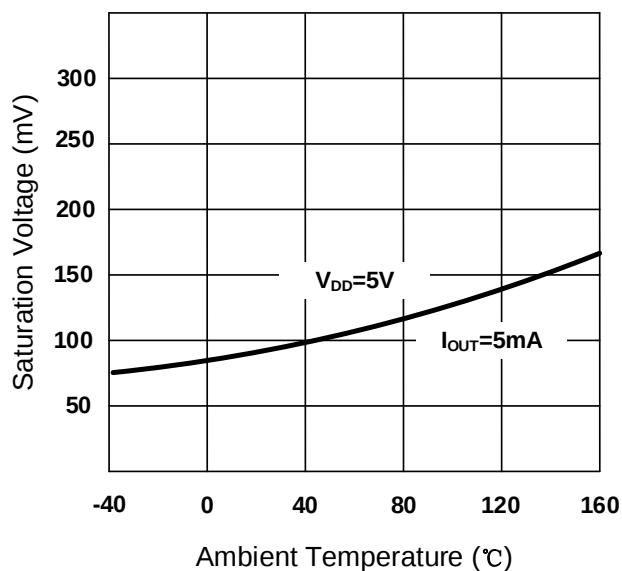
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
f _{BW}	BW		20	-	-	kHz
SC2430 +2.0 ⁽¹⁾ /+1.5mT ⁽²⁾						
B _{OP}	Operating point	T _A =25°C	+1.5	+2.0	+3.5	mT
B _{RP}	Release point		+1.0	+1.5	+2.0	mT
B _{HYS}	Hysteresis		-	0.5	-	mT
SC2432 +2.5 /+2.0 mT						
B _{OP}	Operating point	T _A =25°C	+1.5	+2.5	+3.5	mT
B _{RP}	Release point		+1.0	+2.0	+3.0	mT
B _{HYS}	Hysteresis		-	0.5	-	mT
SC2434 +7.0 /+5.5 mT						
B _{OP}	Operating point	T _A =25°C	+6.0	+7.0	+8.0	mT
B _{RP}	Release point		+4.5	+5.5	+6.5	mT
B _{HYS}	Hysteresis		-	1.5	-	mT
SC2436 +10.0 /+8.5 mT						
B _{OP}	Operating point	T _A =25°C	+9.5	+10.0	+10.5	mT
B _{RP}	Release point		+8.0	+8.5	+9.0	mT
B _{HYS}	Hysteresis		-	1.5	-	mT
SC2438 +12.0 /+9.5 mT						
B _{OP}	Operating point	T _A =25°C	+10.0	+12.0	+14.0	mT
B _{RP}	Release point		+7.5	+9.5	+11.5	mT
B _{HYS}	Hysteresis		-	2.5	-	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. Typical Characteristics

 I_{DD} vs V_{DD}  **I_{DD} vs T_A**  **$V_{Q(sat)}$ vs V_{DD}**  **$V_{Q(sat)}$ vs T_A** 

11. Block Diagram

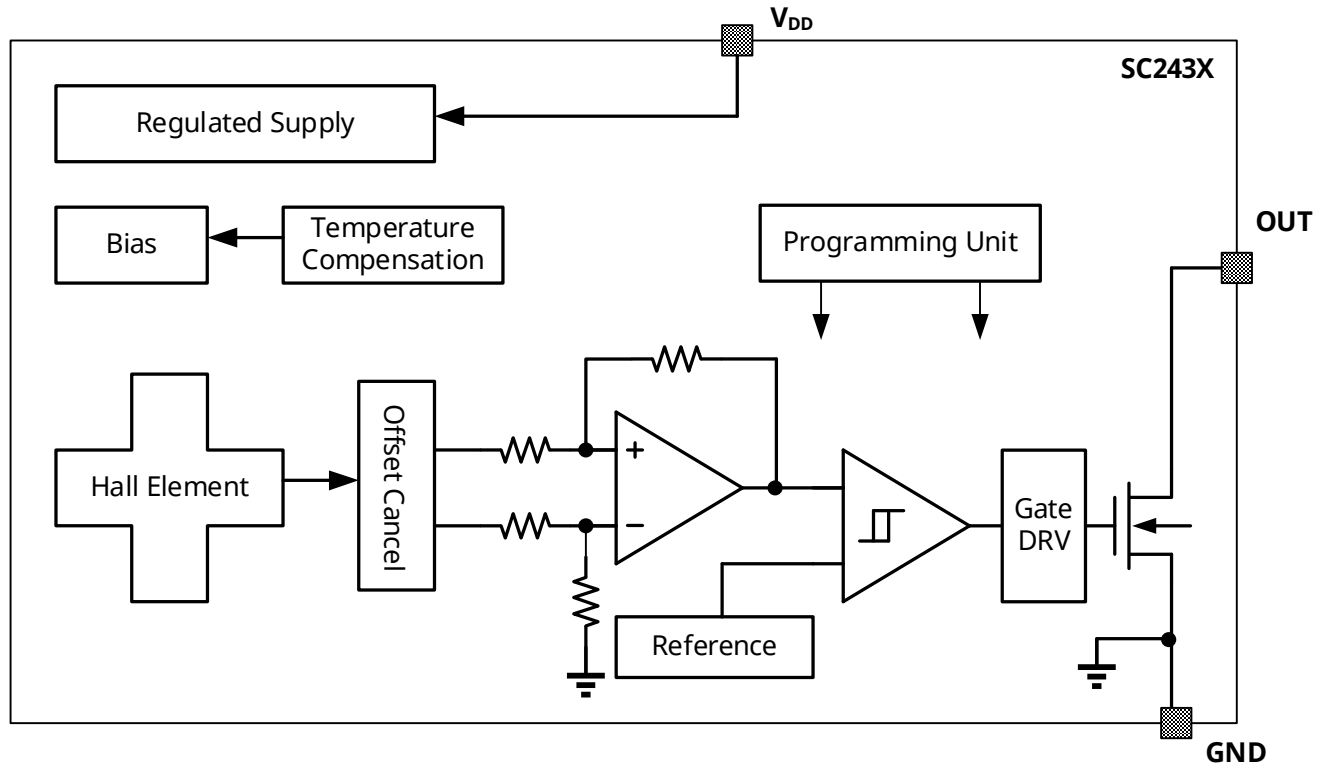


Fig.3 Function Block Diagram

12. Function Description

SC243X is a unipolar Hall effect sensor. With the application of chopper technology, the chip has a stable switching point and is mainly used in magnetic induction applications. It can work normally under a voltage range of 2.5V to 24V and will not be damaged under a reverse connection of -28V.

The SC243X outputs a low level (turns on) when a magnetic field perpendicular to the Hall element increases to the operating point B_{OP} . In the on state, the output can sink a current of 20mA, and the output voltage is $V_{Q(SAT)}$. When the magnetic field weakens to the release point B_{RP} , it outputs a high level (turns off). The difference between the magnetic field's turn-on point and turn-off point is the hysteresis of the switching point. This built-in hysteresis enables the chip to work normally under external mechanical interference and noise.

An external output pull-up resistor is required on the OUT terminal. The OUT terminal can be pulled up to V_{DD} or to a different voltage supply. It is convenient to interface with the controller.

12.1. Field Direction Definition

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

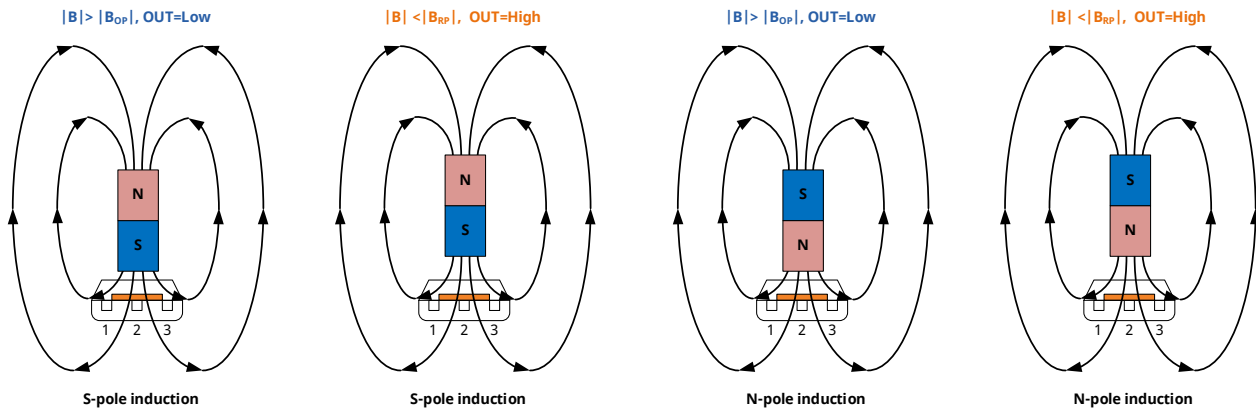


Fig.4 Magnetic Field Direction Definition

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.

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

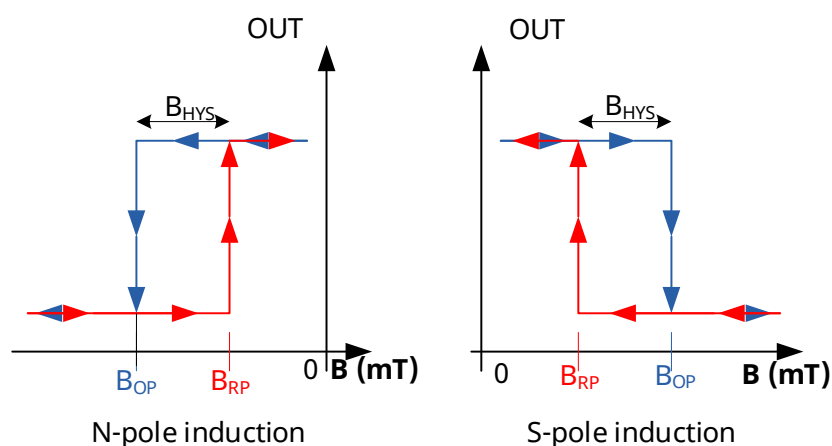


Fig.5 Magnetic Transfer Function

13. Typical Application

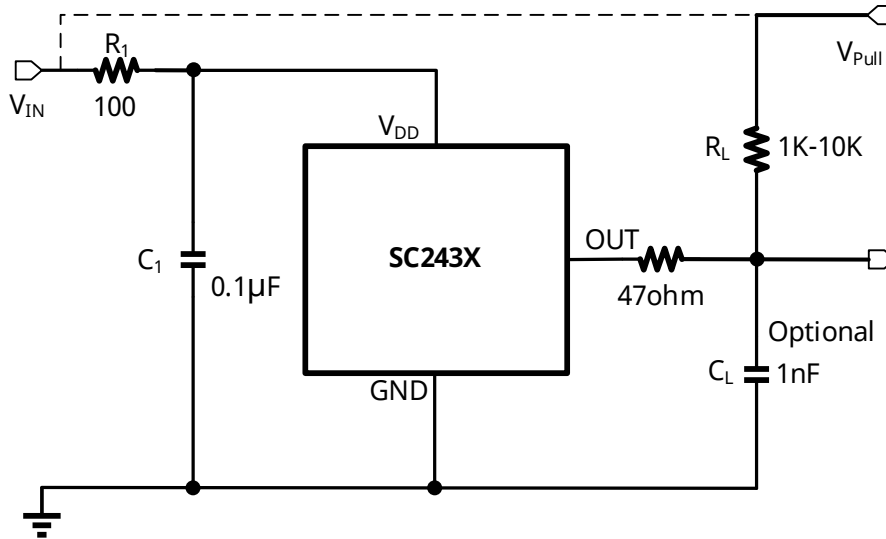


Fig.6 Typical Application Circuit

The SC243X contains an on-chip voltage regulator and can operate over a wide supply voltage range. In applications that operate the device from an unregulated power supply, transient protection must be added externally. For applications using a regulated line, EMI/RFI protection may still be required. It is recommended to shunt C_1 capacitors to the ground near the chip V_{DD} power supply, with a typical value of 0.1 μ F. At the same time in the external optional series resistor R_1 their typical values for 100 Ω . The output capacitor C_L is used as the output filter, typically 1nF.

Select a value for C_L based on the system bandwidth specifications such as:

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

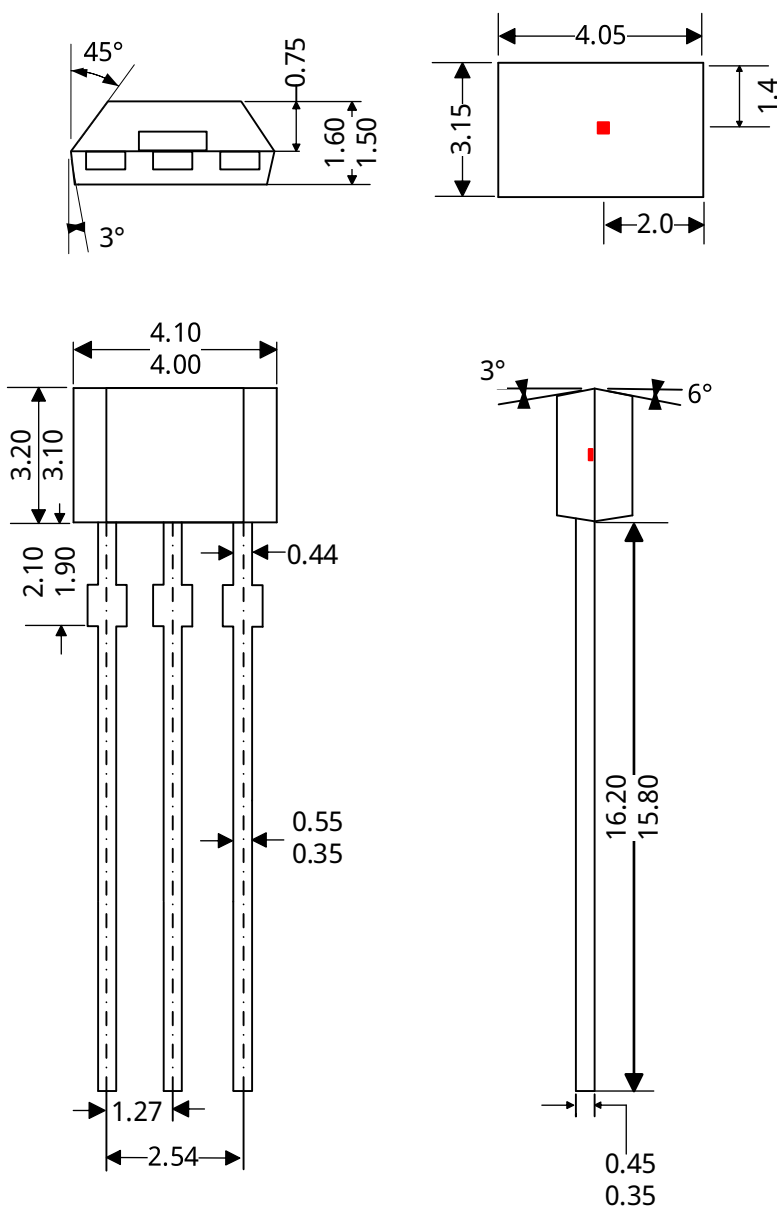
The output stage of the SC243X device is a drain open-circuit NMOS tube, which provides a load capacity of 20mA. Adjust the pull-up resistor R_L to make it work properly. The R_L provides a high level for the leak-opening output. In general, less current is better, but faster transient response and bandwidth are required, with a smaller resistor R_L for faster switching.

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

3-Terminal
UA Package

Unit: mm



Notes:

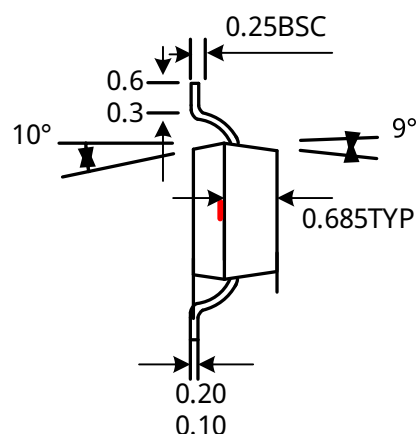
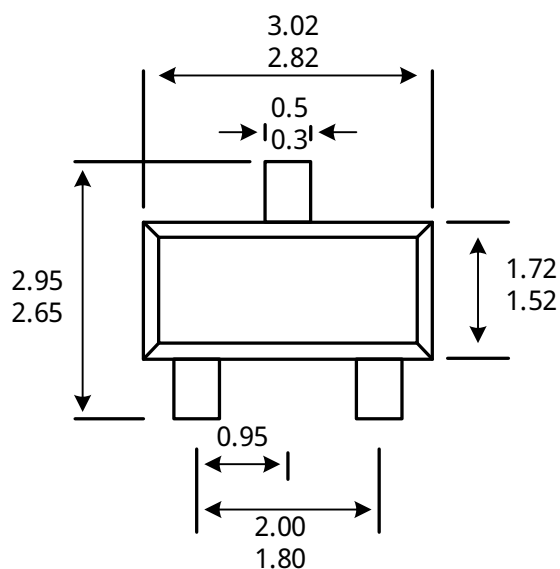
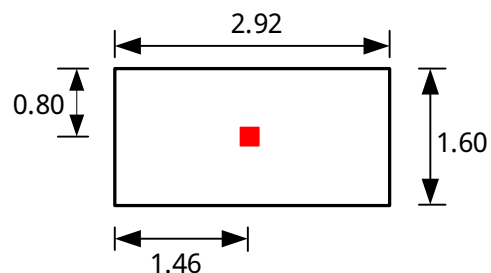
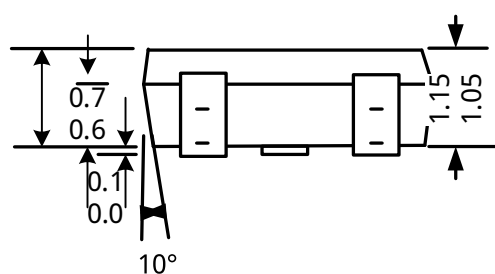
- (1) Exact body and lead configuration at vendor's option within limits shown.
- (2) Height does not include mold gate flash.

Where no tolerance is specified, dimension is nominal.

15. Package Information SO

3-Terminal
SO 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.A1.0	2016-05-10	Preliminary datasheet
Rev.A1.1	2025-07-25	Release in a unified format