

High Performance Programmable Hall Effect Sensor

1. Features

- 3-wire Voltage Mode Interface
- AEC-Q100 qualified
- ISO26262 ASIL-B SEooC
- Programmable Hall Effect Sensor
- Less Than 20uA Average Current In μ -Power Mode
- Wide voltage range 3 to 48V
- Reverse battery protection: -28V
- Open-Drain output
- -40°C to +150°C operating temperature range
- Thermal shutdown protection
- High EMC/ESD immunity
- SOT23-3L and TO-92S package options
- Small package
 - 3-pin TO-92S (UA)
 - 3-pin SOT23-3L (SO)

2. Applications

- Shift lever position check
- E-Door Handle
- Detection of Car Door Lock Status
- Seat position detection
- Sunroof/Tailgate Opener
- Electronic Steering Column Lock
- Smart home and industry

3. Description

The SC245X produced with BiCMOS technology, is a chopper-stabilized 3-wire Hall Effect Sensor that offers a magnetic sensing solution with superior sensitivity stability over temperature and integrated protection features.

Programmable is a key attribute of the SC245X. Customer can select pre-programmed units, or program at end of line to realize the system optimization. Both BOP and BH can be adjusted with small increment across the -24Gs to 24Gs range.

Each device includes on a single silicon chip a voltage regulator, Hall-voltage generator, small-signal amplifier, chopper stabilization, Schmitt trigger, and an output circuit.

An onboard regulator permits with supply voltages of 3 to 48V, which makes the device suitable for a wide range of industrial and automotive applications.

The SC245X is available in SOT23-3L a 3-pin SIP package (UA) surface mount package. package is lead (Pb) free, with 100% matte tin lead frame plating



Fig. 1: Left-TO-92S; Right-SOT23-3L

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4. Terminal Configuration

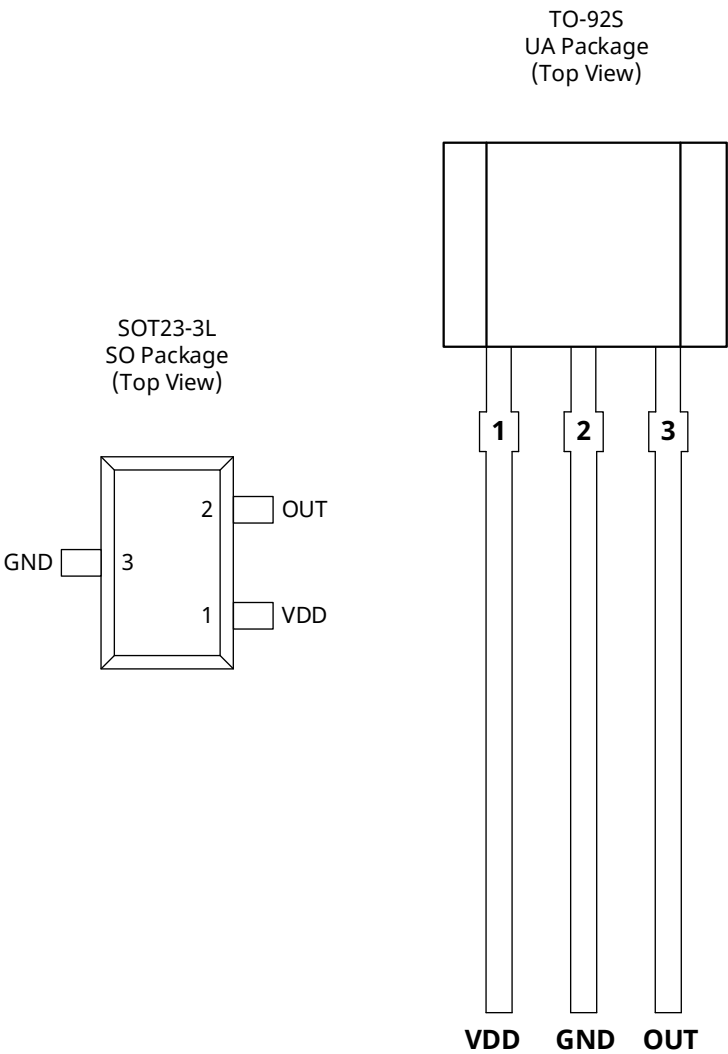


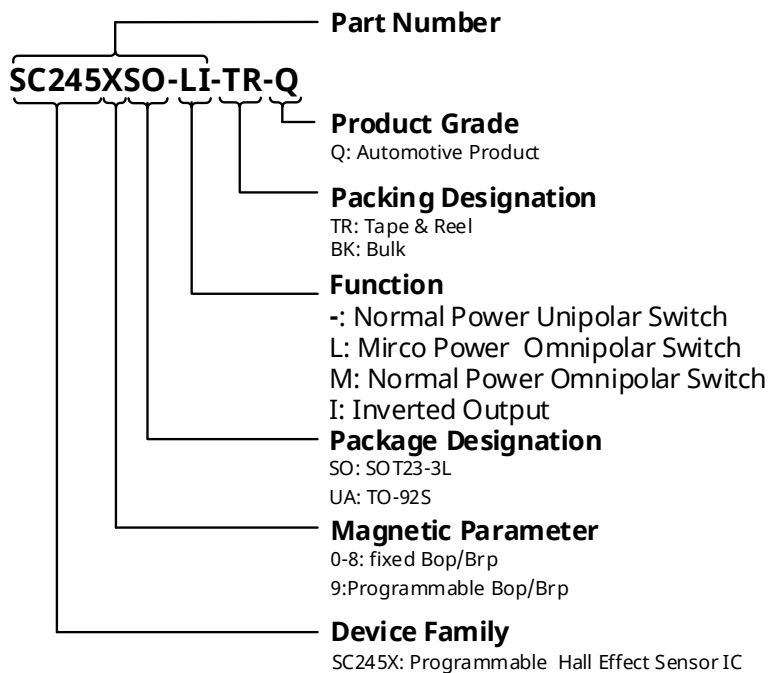
Fig. 2: Pin Definition Diagram

Terminal			Type	Description
Name	Number			
	UA	SO		
VDD	1	1	PWR	3 to 48V power supply
GND	2	3	Ground	Ground terminal
OUT	3	2	Output	Open-Drain output

5. Ordering Information

Ordering Information	Marking	Bop(Gs)	BRP(Gs)	Ambient, (°C)	Package	Packing	Quantity
SC2450SO-L-TR-Q	2450	±25	±15	-40~150	SOT23-3L	TR	3000/reel
SC2450SO-LI-TR-Q	2450	±25	±15	-40~150	SOT23-3L	TR	3000/reel
SC2450UA-L-BK-Q	2450	±25	±15	-40~150	TO-92S	BK	1000/bag
SC2450UA-LI-BK-Q	2450	±25	±15	-40~150	TO-92S	BK	1000/bag
SC2450SO-M-TR-Q	2450	±25	±15	-40~150	SOT23-3L	TR	3000/reel
SC2450UA-M-BK-Q	2450	±25	±15	-40~150	TO-92S	BK	1000/bag
SC2451SO-TR-Q	2451	+100	+85	-40~150	SOT23-3L	TR	3000/reel
SC2452SO-TR-Q	2452	+180	+130	-40~150	SOT23-3L	TR	3000/reel
SC2455SO-TR-Q	2455	+255	+200	-40~150	SOT23-3L	TR	3000/reel
SC2455UA-BK-Q	2455	+255	+200	-40~150	TO-92S	BK	1000/bag
SC2459SO-TR-Q	2459	Programmable	Programmable	-40~150	SOT23-3L	TR	3000/reel
SC2459UA-BK-Q	2459	Programmable	Programmable	-40~150	TO-92S	BK	1000/bag
SC2459SO-L-TR-Q	2459	Programmable	Programmable	-40~150	SOT23-3L	TR	3000/reel
SC2459UA-L-BK-Q	2459	Programmable	Programmable	-40~150	TO-92S	BK	1000/bag

Ordering Information Format



6. Absolute Maximum Ratings

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

Symbol	Parameter	Test Conditions	Min.	Max.	Units
V_{DD}	Power supply voltage	-	-28	60	V
V_{OUT}	Output terminal voltage	For 5 Min. @1.2K pull-up resistor	-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 :

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	Refer to AEC-Q100-002E HBM standard, R=1.5kΩ, C=100pF	-8	+8	KV
	CDM	standard ANSI/ESDA/JEDEC JS-002	-750	750	V

8. Thermal Characteristics

Symbol	Parameter	Test Conditions	Rating	Units
$R_{\theta ja}$	UA Package thermal resistance	Single-layer PCB, with copper limited to solder pads	166 ⁽¹⁾	°C/W
$R_{\theta ja}$	SO Package thermal resistance	Single-layer PCB, with copper limited to solder pads	228 ⁽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.	Max.	Units
Operating Characteristics						
V_{DD}	Operating voltage	$T_J < T_{J(Max.)}$	3.0	5.0	48	V
V_{DDR}	Reverse Supply Voltage		-28	-	-	V
$UVLO_H$	Under Voltage Lockout High	$B > BOP$, V_{DD} Rising From 2V	-	2.8	-	V
$UVLO_L$	Under Voltage Lockout Low	$B > BOP$, V_{DD} Decreasing From 3V	-	2.3	-	V
$UVLO_{HYS}$	Under Voltage Hysteresis	$UVLO_H - UVLO_L$	-	500	-	mV
I_{DD}	Supply Current(Normal Power)	$V_{DD}=3$ to 40 V, $T_A=25^{\circ}C$	2.8	3.3	3.8	mA
I_{DD} (Micro Power)	Average current consumption(Micro Power)	$V_{DD}=3.0$ to 40V, $T_A=25^{\circ}C$	-	15	30	μA
		$V_{DD}=3.0$ to 40V, $T_A=150^{\circ}C$	-	30	50	μA
t_{ON}	Power on time	$V_{DD}= 5.0V$	-	170	300	μS
t_d	Output delay time	$B=B_{RP}$ to B_{OP}	--	15	25	μS
T_{UPD}	Output Update Period	Normal Power Mode		40	45	μS
t_{ACTIVE}	Active time	Micro Power Mode	-	100	200	μS
T_{OP}	Operating (Output Update) Period	Micro Power Mode		50		mS
t_{ACTIVE}	Active time	Micro Power Mode	-	100	200	μS
T_R	Output Failing Time	$R_{PU}=2.2K\Omega$, $V_{DD}=12V$, $V_{PU}=5V$, $C_{LD}=50pF$ to GND	0.3	0.6	1	μS
T_F	Output Rising Time	$R_{PU}=2.2K\Omega$, $V_{DD}=12V$, $V_{PU}=5V$, $C_{LD}=50pF$ to GND	0.3	0.6	1	μS
OTP	Over Temperature Protection	Temperature increasing		197		$^{\circ}C$
OTP_{HYS}	Over Temperature Hysteresis			20		$^{\circ}C$
I_{OLKG}	Output Leakage Current			0.1	10	μA
I_O	Output Current	Normal Power Mode		40	65	mA
V_{OL}	Low Output Voltage	Normal Power Mode, $I_O=20mA$		0.13	0.4	V
		Micro Power Mode, $I_O=10mA$		0.15	0.5	V

9.2. Magnetic Characteristics

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
SC2450-L/SC2450-LI or SC2450-M						
B _{OP}	Operating point	T _A =25°C	±15	±25 ⁽¹⁾	±35	Gs
B _{RP}	Release point		±10	±15	±30	Gs
B _{HYS}	Hysteresis		±5	±10	±15	Gs
SC2451						
B _{OP}	Operating point	T _A =25°C	+80	+100	+120	Gs ⁽²⁾
B _{RP}	Release point		+65	+85	+105	Gs
B _{HYS}	Hysteresis		+5	+15	+25	Gs
SC2452						
B _{OP}	Operating point	T _A =25°C	+160	+180	+200	Gs ⁽²⁾
B _{RP}	Release point		+110	+130	+150	Gs
B _{HYS}	Hysteresis		+30	+50	+70	Gs
SC2455						
B _{OP}	Operating point	T _A =25°C	+235	+255	+275	Gs ⁽²⁾
B _{RP}	Release point		+180	+200	+220	Gs
B _{HYS}	Hysteresis		+35	+55	+75	Gs
SC2459 normal power mode programmable unipolar switch						
B _{OP}	Operating point	T _A =25°C	-260	-	+260	Gs
B _{RP}	Release point		-255	-	+255	Gs
B _{HYS}	Hysteresis		5		100	Gs
B _{OP(STEP)} ⁽²⁾	Average Magnetic Step Size		3	5	7	G
B _{HYS(STEP)} ⁽³⁾	Average Hysteresis Step Size		3	5	7	G
B _{OP(INT)}	Initial Operation Point		60	82	100	G
B _{HYS(INT)}	Initial Hysteresis		10	20	35	G
SC2459 micro power mode programmable omnipolar switch						
B _{OP}	Operating point	T _A =25°C	±5	-	±260	Gs
B _{RP}	Release point		±0	-	±255	Gs
B _{HYS}	Hysteresis		5		100	Gs
B _{OP(STEP)} ⁽²⁾	Average Magnetic Step Size		3	5	7	G
B _{HYS(STEP)} ⁽³⁾	Average Hysteresis Step Size		3	5	7	G
B _{OP(INT)}	Initial Operation Point		±60	±82	±100	G

B _{HYS(INT)}	Initial Hysteresis		±10	±20	±35	G
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- (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) $BOP(STEP)$ is a calculated average from the cumulative programmed bits.
- (3) $BHYS(STEP)$ is a calculated average from the cumulative programmed bits.

9.3. Program Related Specification

(V_{DD} = 12.0V, T_A = -40°C To 150°C, unless otherwise noted)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max	Units
BOPSEL	Operation Point Magnitude Programming			6		BIT
HYSEL	Magnitude Hysteresis Programming			6		BIT
MAG_POL	Magnetic Polarity Selection	The default value is 0.		1		BIT
OMINI	Unipolar/Ominipolar/Lach Selection	The default value is 0.		1		BIT
LTH	Unipolar/Ominipolar/Lach Selection	The default value is 0.		1		BIT
OUT_POL	Output Polarity Selection	The default value is 0.		1		BIT
LPSEL	Micro Power Mode Selection	The default value is 1.		1		BIT

10. Block Diagram

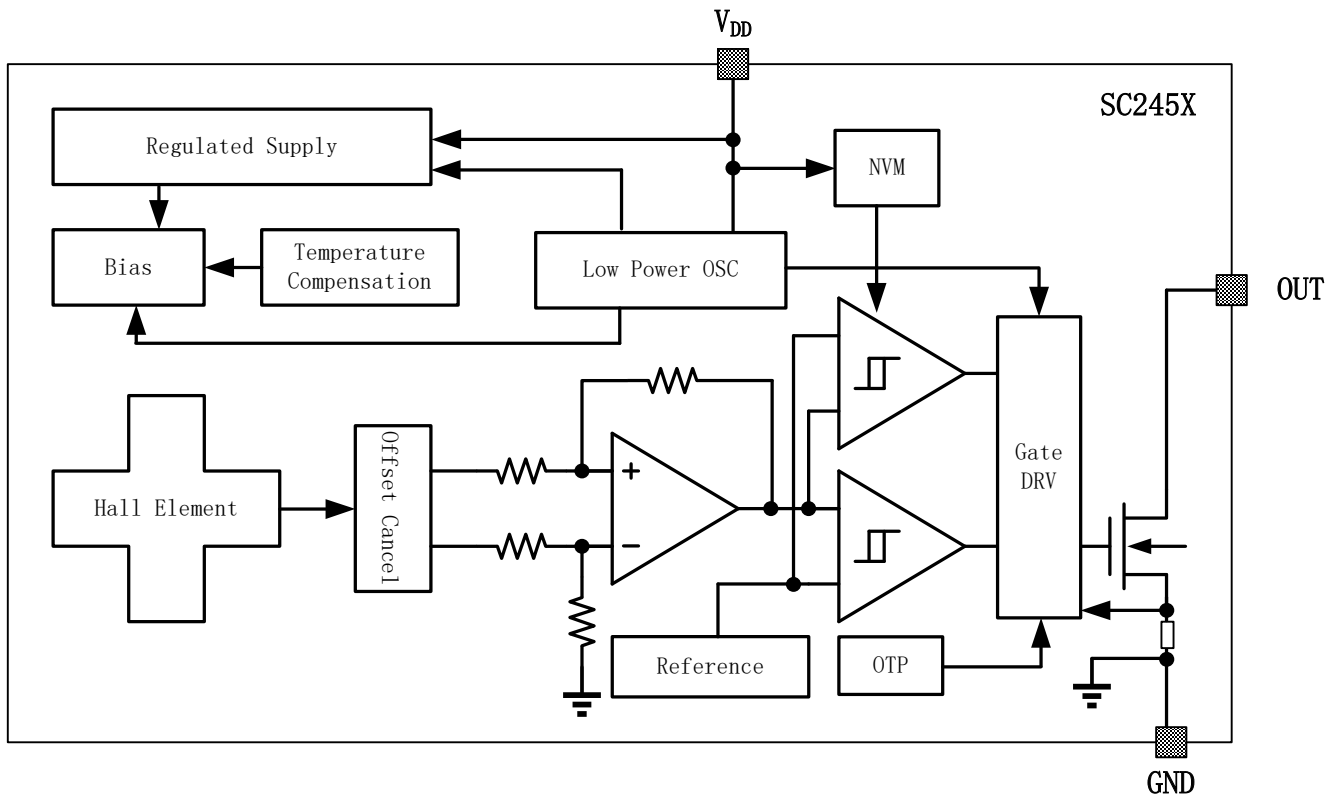


Fig. 3: Functional block diagram

11. Function Description

The SC245X device is a magnetic sensor with a digital output that indicates when the magnetic flux density threshold has been crossed. The device integrates a Hall Effect element, analog signal conditioning, and a low-frequency oscillator that enables ultra-low average power consumption. Operating from a 3 to 48V supply voltage, the device periodically measures magnetic flux density, updates the output, and enters a low-power sleep state.

The output of SC245X switches low (turns on) when a magnetic field (South or North polarity) perpendicular to the Hall element exceeds the operate point threshold, B_{OP} . After turn-on, the output is capable of sinking 5mA and the output voltage is V_Q (sat). When the magnetic field is reduced below the release point, B_{RP} , the device output goes high (turns off). The difference in the magnetic operate and release points is the hysteresis, B_{HYS} , of the device. This built-in hysteresis allows clean switching of the output even in the presence of external mechanical vibration and electrical noise.

11.1. Field Direction Definition

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

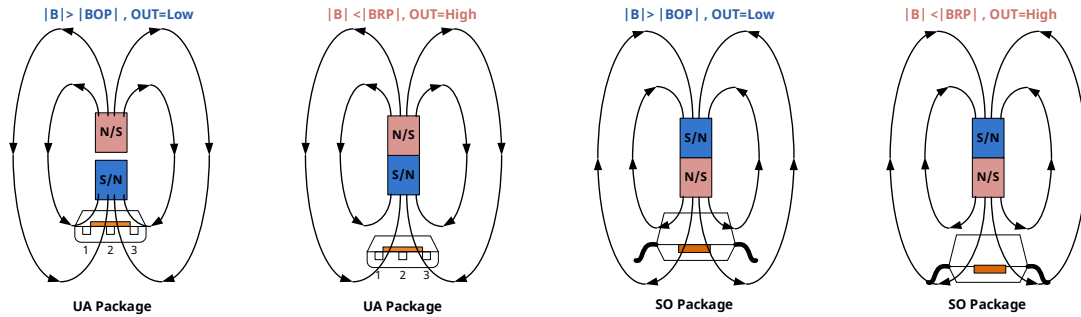


Fig. 4: Field Direction Definition diagram

11.2. Transfer Function

“Omnipolar” magnetic characteristics, it means the device reacts to both North and South magnetic pole. The purpose is to detect the presence of any magnetic field applied on the device.

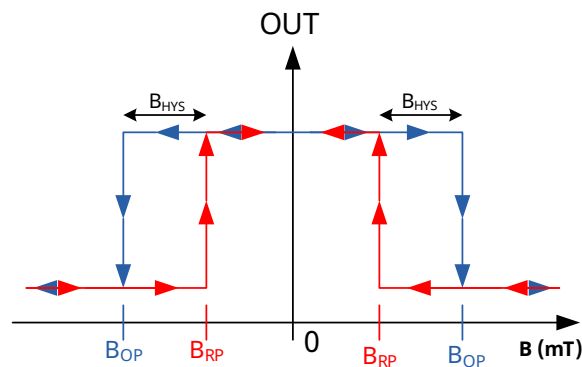


Fig. 5: SC245X (SC2450-L or SC2450-M) Transfer Function diagram

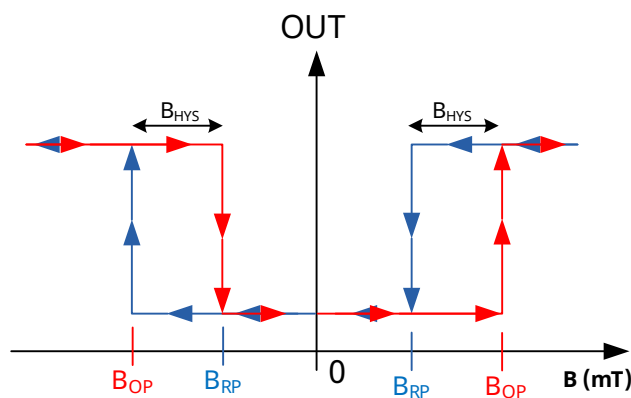


Fig. 6: SC245X (SC2450-LI) Transfer Function diagram

“Unipolar” magnetic characteristics, it means the device only reacts to North or South magnetic pole.

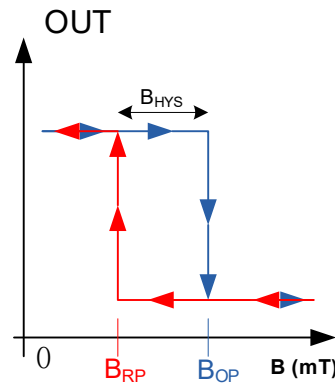


Fig. 7: SC245X (SC2451/SC2452/SC2455) Transfer Function diagram

12. Typical Application

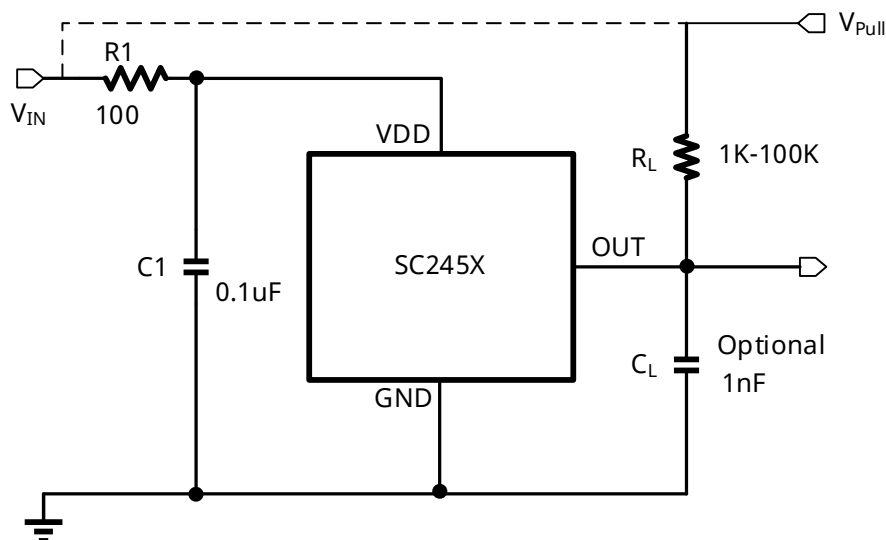


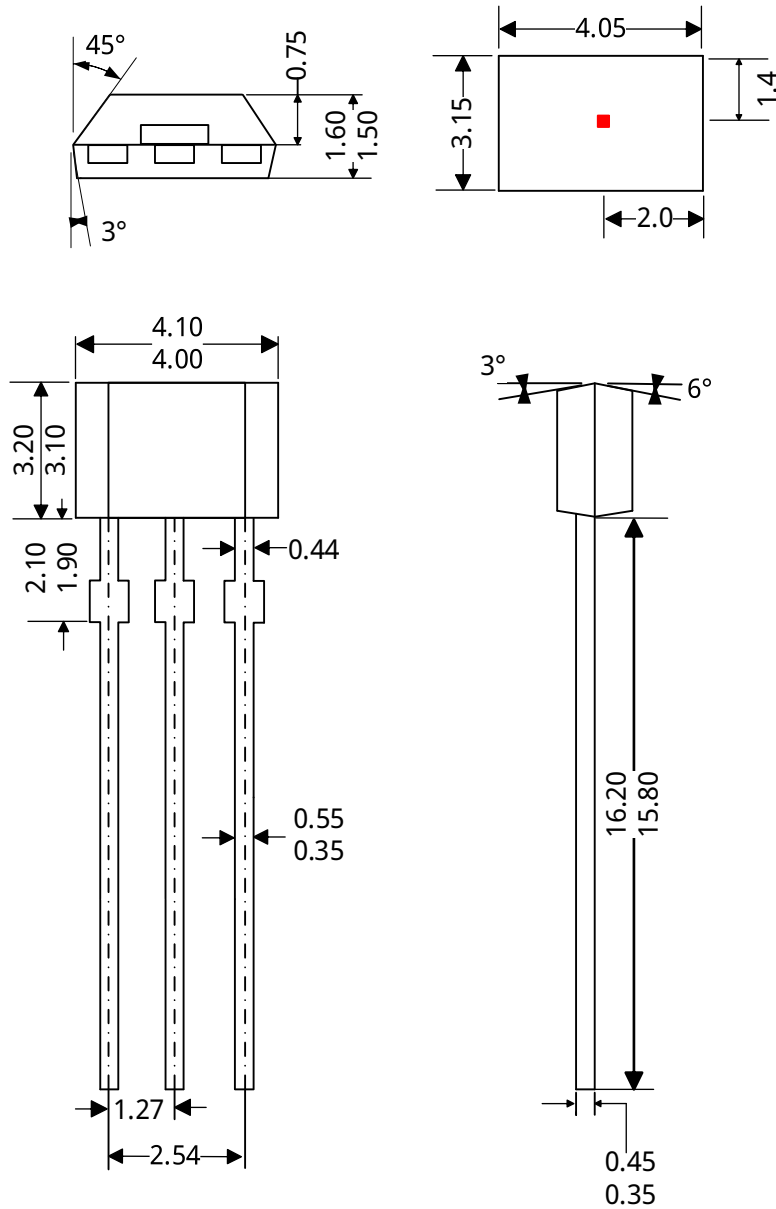
Fig. 8: SC245X Typical Application Circuit

The SC245X contains an on-chip voltage regulator can reduce ripple and noise in the power output. 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 that C1 capacitor be connected to the ground in parallel near the VDD power end of the chip, with a typical value of 0.1uF. R1 recommends a 100Ω current limiting resistor, packaged in SMD lager than 0805 form. R_L selects appropriate pull-up resistors based on actual application requirements. C_L is an optional output capacitor for increase system EMC ability.

13. Package Information “UA”

3-Terminal
UA Package

Dimension:mm



Notes:

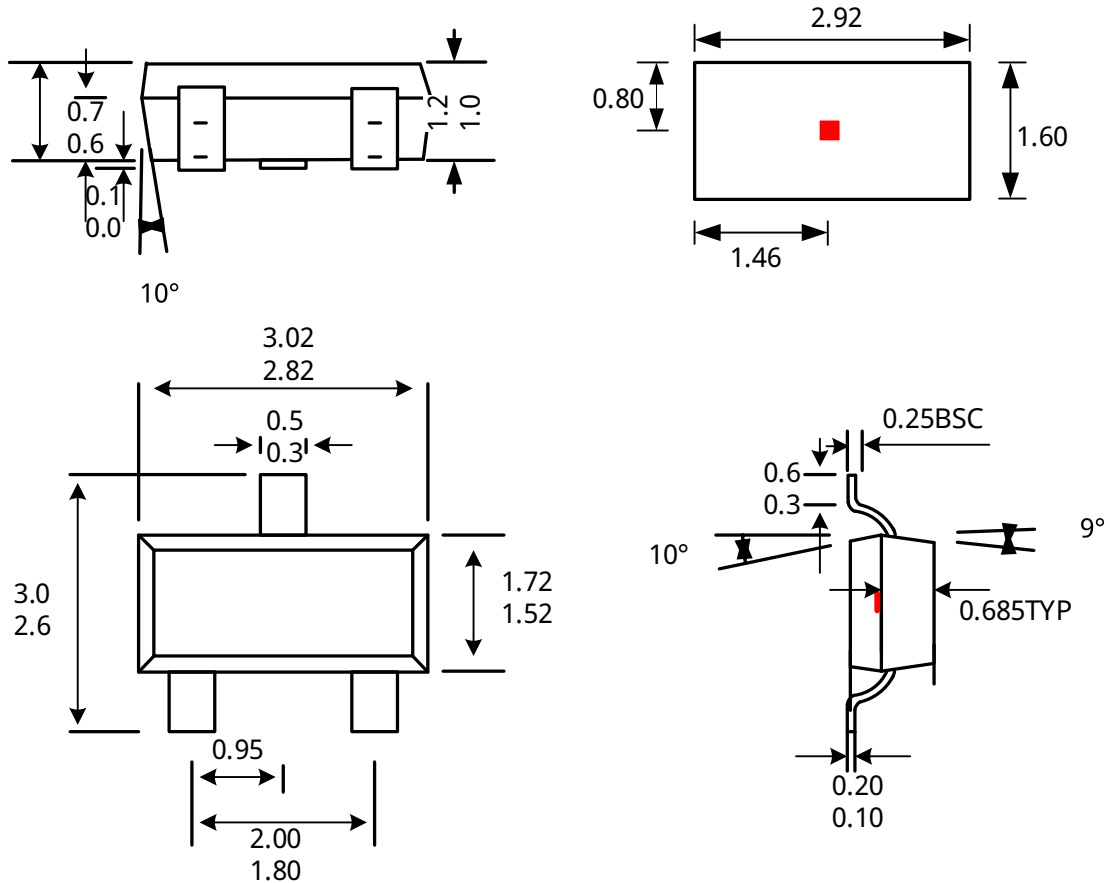
1. Exact body and lead configuration at vendor's option within limits shown.
2. Height does not include mold gate flash.

Where no tolerance is specified, dimension is nominal.

14. Package Information "SO"

3-Terminal
SO Package

Dimension: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. Revision History

Revision	Date	Description
Rev.A1.0	2023-03-10	Preliminary Datasheet
Rev.A1.1	2025-07-14	Add new series devices