High Sensitive Digital-Latch Hall Effect Sensor

FEATURES

- AEC-Q100 qualified production
- Digital latch Hall sensor
- High chopping frequency 800KHZ
- Supports a wide voltage range: 2.5~24V
- Wide operating temperature range:
  -40~150℃
- Factory-programmed at end-of-line for magnetic optimum
- Reverse battery protection (up to 28V)
- Over-voltage protection at all pins
- Solid-state reliability
- Small package
  - 3-pin SIP -(UA)
  - 3-pin SOT23 -(SO)
  - 3-pin SOT23 -(SE)

APPLICATIONS

- Power tools
- Flow meters
- Valve and solenoid status
- BLDC motors with sensors
- Tachometers
- Proximity sensing

DESCRIPTION

The SC244X family, produced with BiC MOS 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 single silicon chip a voltage regulator, Hall-voltage generator, small-signal amplifier, chopper stabilization, Schmitt trigger, and an open-drain output to sink up to 30mA.

An onboard regulator permits with supply voltages of 2.5V to 24V which makes the device suitable for a wide range of industrial and automotive applications

The device is available in a 3-pin SIP package (UA) and a 3-pin SOT-23 style package (SO). Both are lead (Pb) free, with 100% matte tin lead frame plating.

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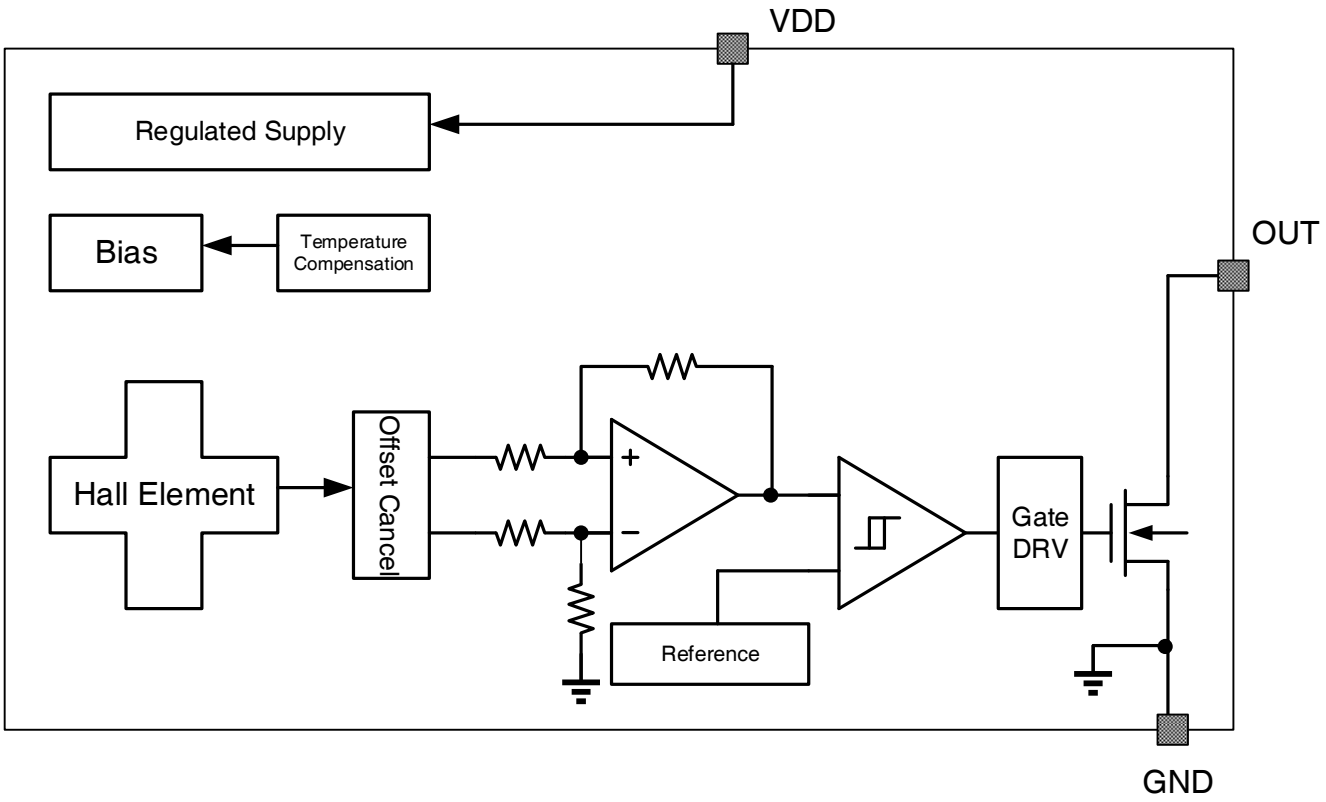
BLOCK DIAGRAM

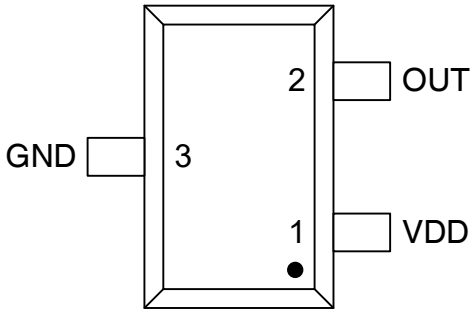


ORDERING INFORMATION

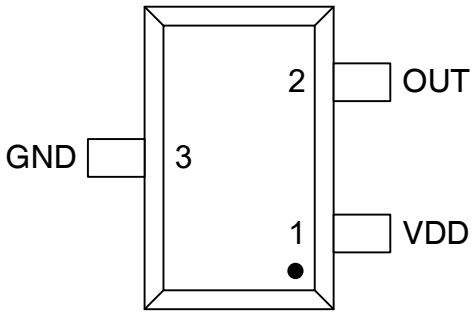
Part Number	Packing	Mounting	Ambient, T_A	B_{OP}(Typ.)	B_{RP}(Typ.)
SC2442UA	Bulk,1000 pcs /bag	3-pin SIP	-40℃ to 150℃	+2.0mT	-2.0mT
SC2442SO	Reel, 3000 pcs /reel	3-pin SOT23			
SC2442SO-N	Reel, 3000 pcs /reel	3-pin SOT23		-2.0mT	+2.0mT
SC2443UA	Bulk,1000 pcs /bag	3-pin SIP	-40℃ to 150℃	+3.0mT	-3.0mT
SC2443SO	Reel, 3000 pcs /reel	3-pin SOT23			
SC2448UA-N	Bulk, 1000 pcs /bag	3-pin SIP	-40℃ to 150℃	-8.0mT	+8.0mT
SC2448SO	Reel, 3000 pcs /reel	3-pin SOT23		+8.0mT	-8.0mT

TERMINAL CONFIGURATION

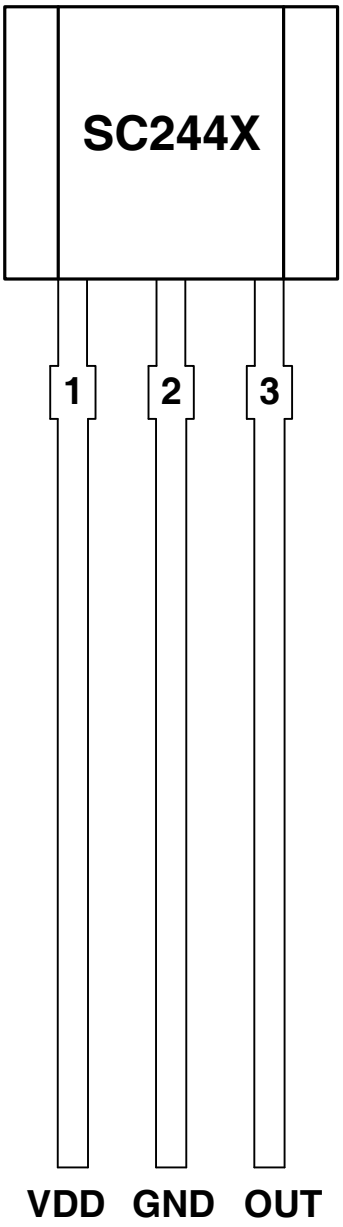
3-Terminal SOT-23
SO Package
(Top View)



3-Terminal SOT-23
SE Package
(Top View)



3-Terminal SIP
UA Package
(Top View)



Terminal				Type	Description
Name	Number				
	UA	SO	SE		
VDD	1	1	1	PWR	2.5 to 24 V power supply
GND	2	3	3	Ground	Ground terminal
OUT	3	2	2	Output	Open-drain output. The open drain requires a pull-up resistor

ABSOLUTE MAXIMUM RATINGS

over operating -40℃--150℃ (unless otherwise noted) (1)

Parameter	Symbol	Min.	Max.	Units
Power supply voltage	VDD	-28(2)	28	V
Output terminal voltage	VOUT	-0.5	28	V
Output terminal current sink	ISINK	0	30	mA
Operating ambient temperature	TA	-40	150	℃
Maximum junction temperature	TJ	-55	165	℃
Storage temperature	TSTG	-65	175	℃

(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) Ensured by design.

ESD PROTECTION

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

Parameter	Symbol	Min.	Max.	Units
ESD-Protection	VESD	-4	4	KV

THERMAL CHARACTERISTICS

Symbol	Parameter	Test Conditions	Rating	Units
$R_{\theta JA}$	UA Package thermal resistance	Single-layer PCB, with copper limited to solder pads	313	℃/W
$R_{\theta JA}$	SO Package thermal resistance	Single-layer PCB, with copper limited to solder pads	313	℃/W
$R_{\theta JA}$	SE Package thermal resistance	Single-layer PCB, with copper limited to solder pads	357	℃/W

OPERATING CHARACTERISTICS

Electric Characteristics

over operating -40℃--150℃ (V_{DD} = 5.0V, unless otherwise noted)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
V_{DD} (1)	Operating voltage (1)	$T_J < T_{J(Max.)}$	2.5	--	24	V
V_{DDR}	Reverse supply voltage		-28	--	--	V
I_{DD}	Operating supply current	V_{DD}=2.5 to 24 V,	1.2	1.6	2.5	mA
t_{on}	Power-on time	$V_{DD} \geqslant 2.5V$	--	35	50	μS
I_{QL}	Off-state leakage current	Output Hi-Z	--	--	3	μA
V_{sat}	Output Saturation Voltage	V_{DD}=5V, I_O=20mA	--	180	500	mV
t_d	Output delay time	B=B_{RP} to B_{OP}	--	15	25	μS
t_r	Output rise time (10% to 90%)	R_L=1Kohm Co=50pF	--	--	0.5	μS
t_f	Output fall time (90% to 10%)	R_L=1Kohm Co=50pF	--	--	0.2	μS

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

Magnetic Characteristics

over operating -40℃--150℃ (unless otherwise noted)

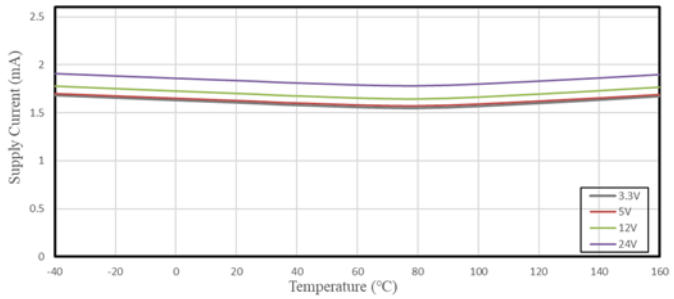
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
f_{BW}	Bandwidth		--	20	--	kHz
SC2442 +2.0 / -2.0 mT						
B_{OP}	Operated point	T_A=-40℃ to 150℃	1.0	2.0	3.0	mT
B_{RP}	Release point		-3.0	-2.0	-1.0	mT
B_{HYS}	Hysteresis		--	4.0	--	mT
B_O	Magnetic offset	$B_O=(B_{OP}+B_{RP})/2$	-1.0	0.0	1.0	mT
SC2443 +3.0 / -3.0 mT						
B_{OP}	Operated point	T_A=-40℃ to 150℃	2.0	3.0	4.0	mT
B_{RP}	Release point		-4.0	-3.0	-2.0	mT
B_{HYS}	Hysteresis		--	6.0	--	mT
B_O	Magnetic offset	$B_O=(B_{OP}+B_{RP})/2$	-1.0	0.0	1.0	mT
SC2448 +8.0 / -8.0 mT						
B_{OP}	Operated point	T_A=-40℃ to 150℃	6.0	8.0	10.0	mT
B_{RP}	Release point		-10.0	-8.0	-6.0	mT
B_{HYS}	Hysteresis		--	16.0	--	mT
B_O	Magnetic offset	$B_O=(B_{OP}+B_{RP})/2$	-2.0	0.0	2.0	mT

(1) 1mT=10Gs

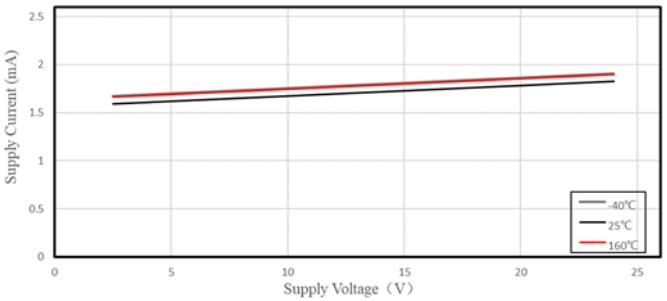
(2) Magnetic flux density, B, is indicated as a negative value for North-polarity magnetic fields, and as a positive value for South-polarity magnetic fields.

TYPICAL CHARACTERISTICS

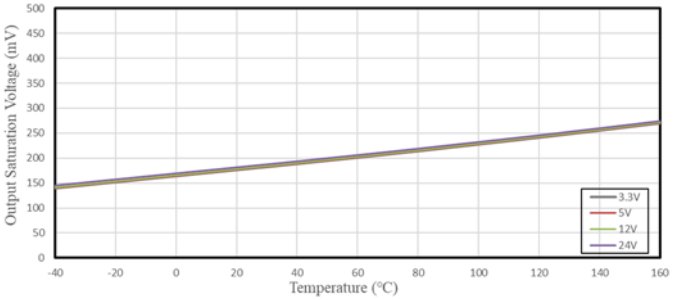
Supply current VS. Temperature



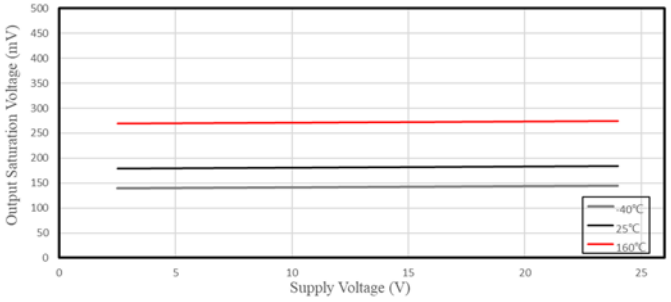
Supply current VS. Supply voltage



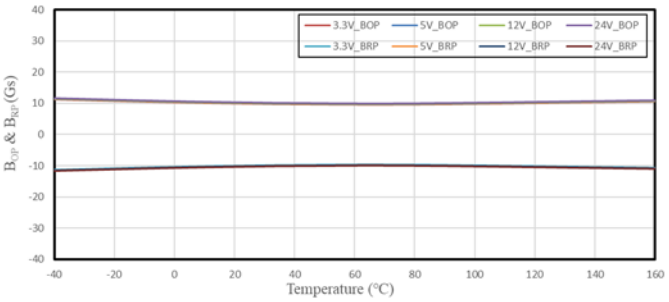
Output Saturation Voltage VS. Temperature



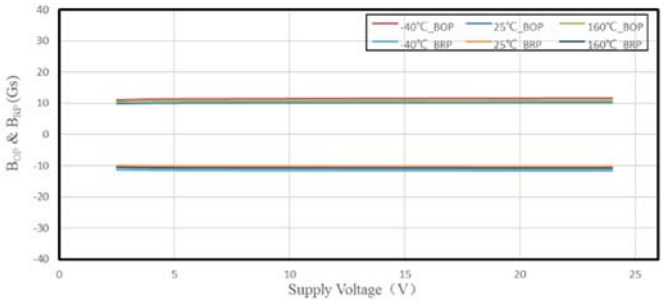
Output Saturation Voltage VS. Supply Voltage



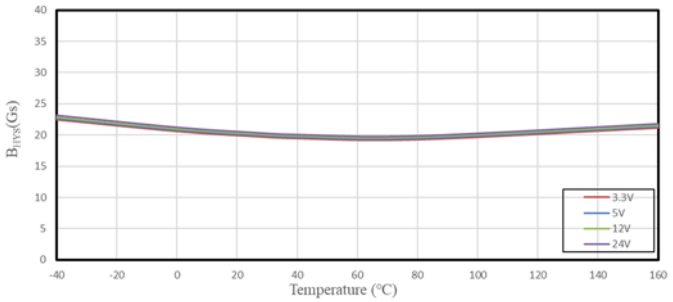
SC2440 B_{OP} & B_{RP} VS. Temperature



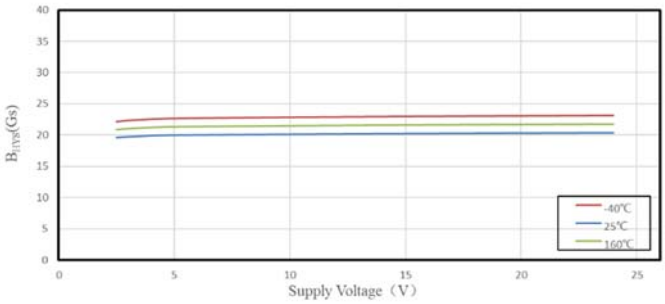
SC2440 B_{OP} & B_{RP} VS. Supply Voltage



SC2440 B_{HYS} VS. Temperature

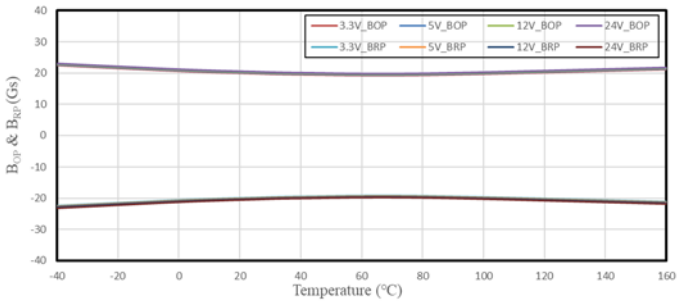


SC2440 B_{HYS} VS. Supply Voltage

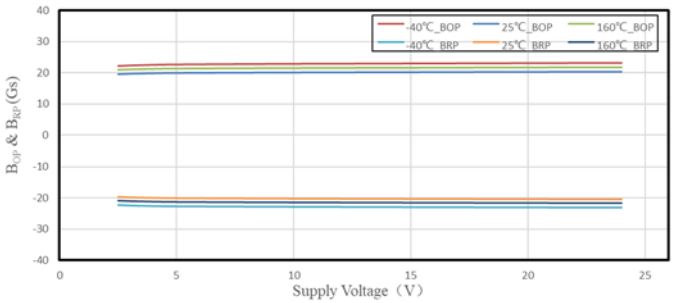


TYPICAL CHARACTERISTICS (continued)

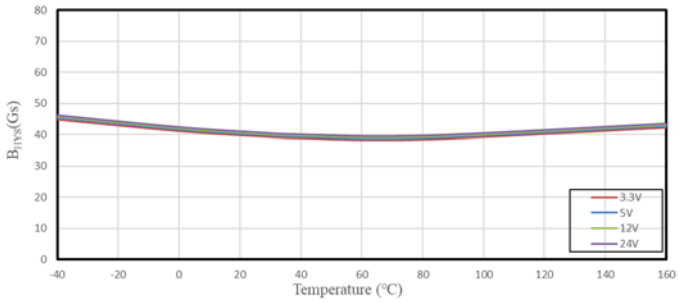
SC2442 B_{OP} & B_{RP} VS. Temperature



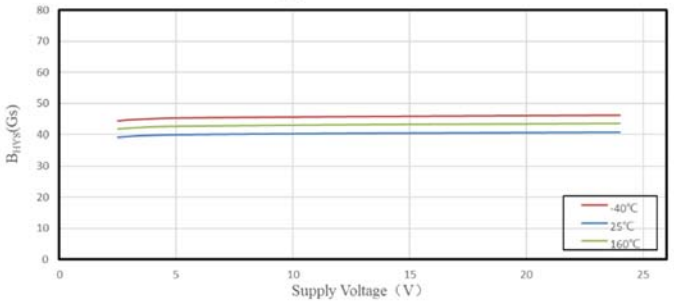
SC2442 B_{OP} & B_{RP} VS. Supply Voltage



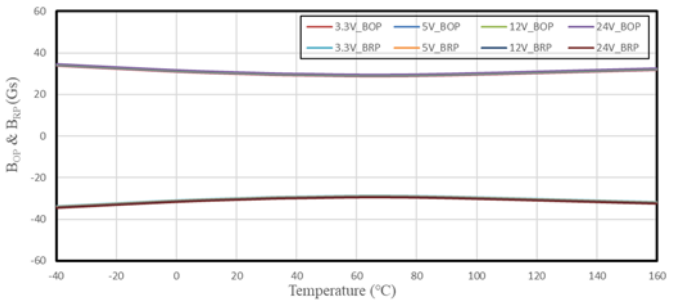
SC2442 B_{HYS} VS. Temperature



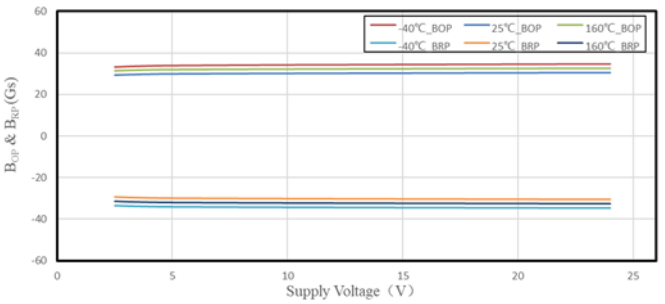
SC2442 B_{HYS} VS. Supply Voltage



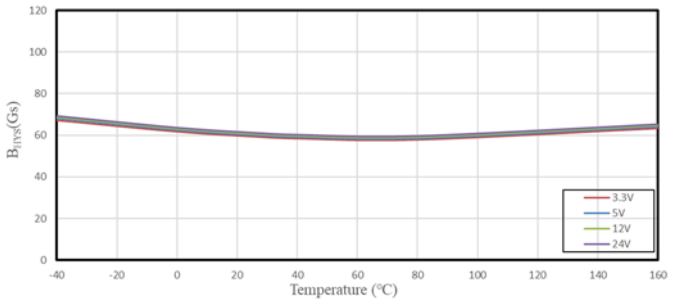
SC2443 B_{OP} & B_{RP} VS. Temperature



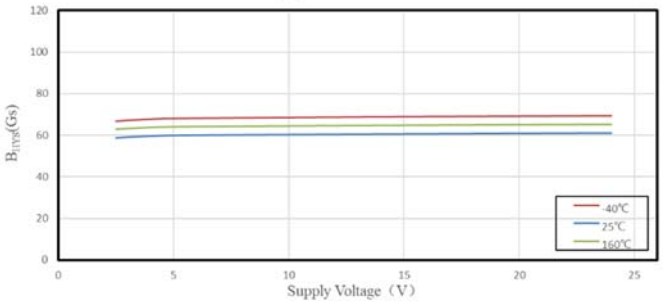
SC2443 B_{OP} & B_{RP} VS. Supply Voltage



SC2443 B_{HYS} VS. Temperature

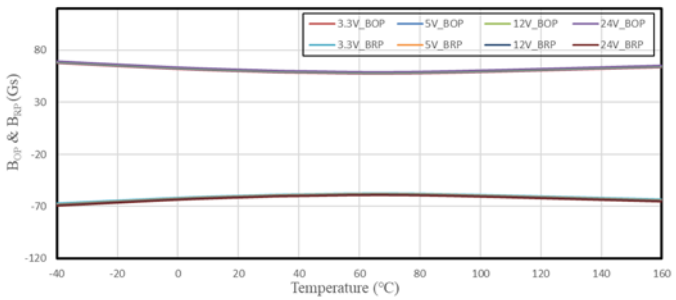


SC2443 B_{HYS} VS. Supply Voltage

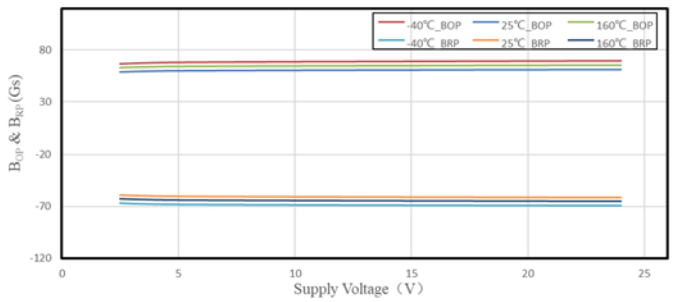


TYPICAL CHARACTERISTICS (continued)

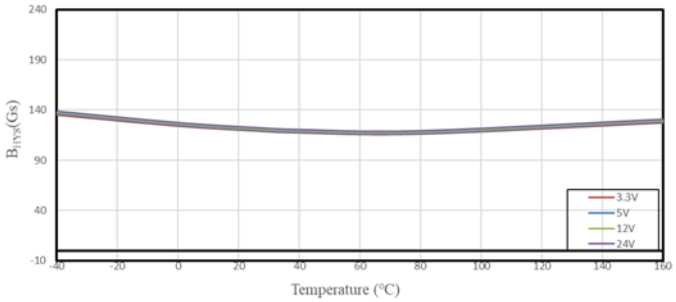
SC2446 B_{OP} & B_{RP} VS. Temperature



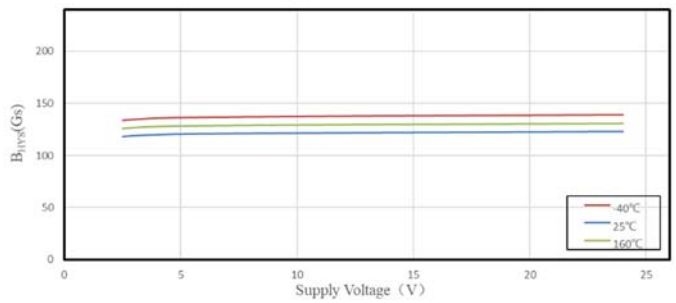
SC2446 B_{OP} & B_{RP} VS. Supply Voltage



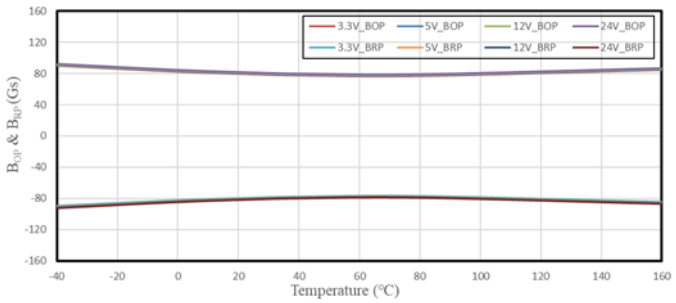
SC2446 B_{HYS} VS. Temperature



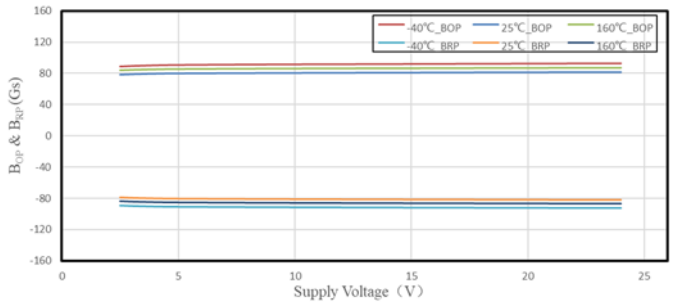
SC2446 B_{HYS} VS. Supply Voltage



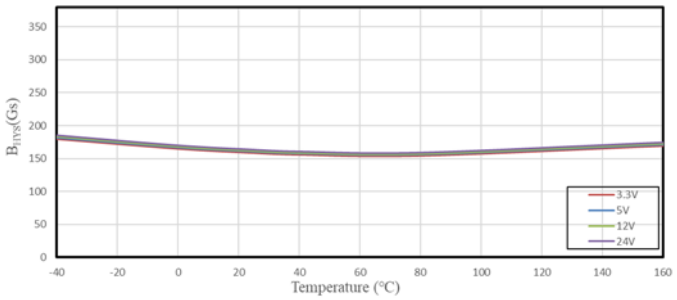
SC2448 B_{OP} & B_{RP} VS. Temperature



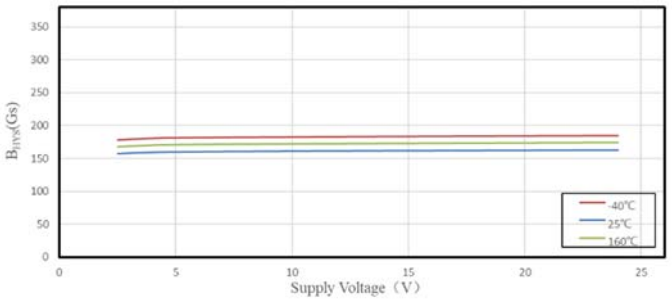
SC2448 B_{OP} & B_{RP} VS. Supply Voltage



SC2448 B_{HYS} VS. Temperature



SC2448 B_{HYS} VS. Supply Voltage



FUNCTION DESCRIPTION

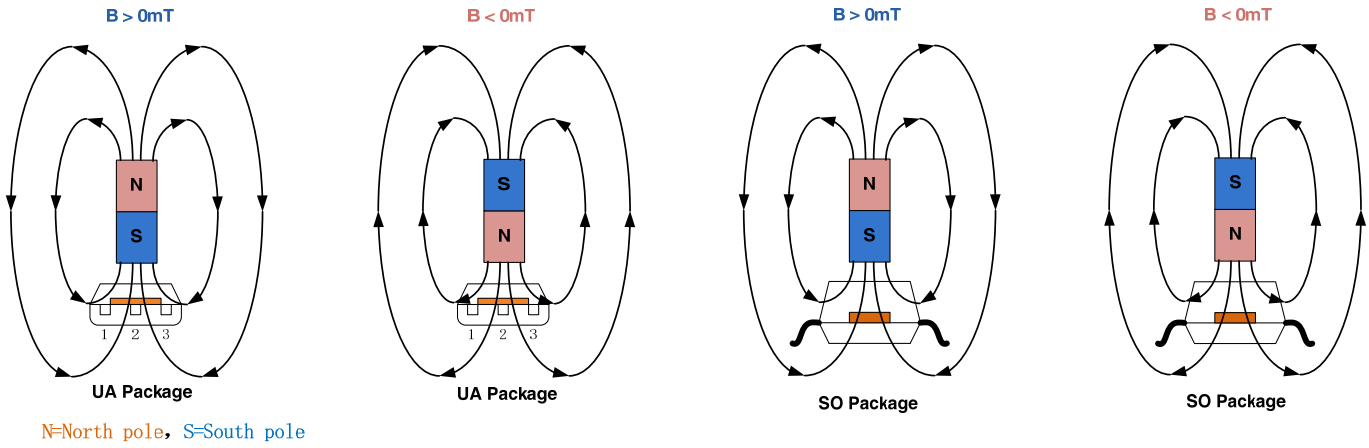
The SC244X device is a chopper-stabilized Hall sensor with a digital latched output for magnetic sensing applications. The device can be powered with a supply voltage between 2.5 and 24V, and continuously survives continuous -28V reverse-battery conditions.

The output of SC244X switches low (turns on) when a magnetic field (South polarity) perpendicular to the Hall element exceeds the operate point threshold, B_{OP}. After turn-on, the output is capable of sinking 20mA 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.

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. This allows for easier interfacing with controller circuits.

Field Direction Definition

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



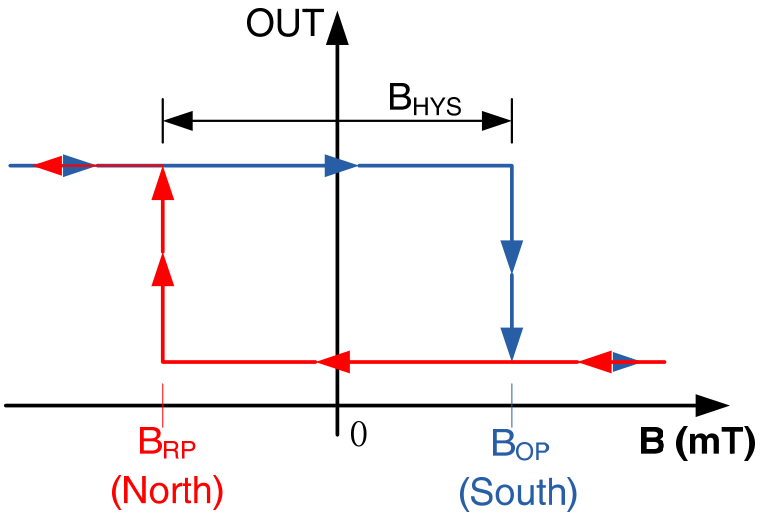
Transfer Function

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.

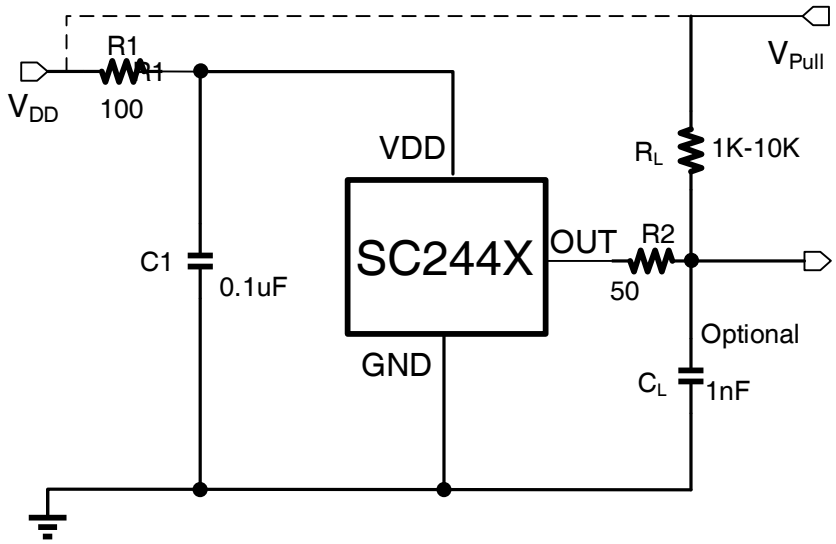
B_{OP}—magnetic threshold for activation of the device output, turning in ON (low) state

B_{RP}—magnetic threshold for release of the device output, turning in OFF (high) state.

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



TYPICAL APPLICATION



** R1&R2 are the current limit resistor for the SC244X chipset application;*

** It is highly recommend to add R1,R2 in application circuit, especially R2..*

The SC244X 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 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.At the same time in the external optional series resistor R1 and output capacitance C_L used for enhanced protection circuit, its typical values for 100 Ω and 1 nF.

The SC244X device output stage uses an open-drain NMOS, and it is rated to sink up to 20mA of current. For proper operation, calculate the value of the pull-up resistor R_L is required. The size of R_L is a tradeoff between OUT rise time and the load capacity when OUT is pulled low. A lower current is generally better, however faster transitions and bandwidth require a smaller resistor for faster switching.

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

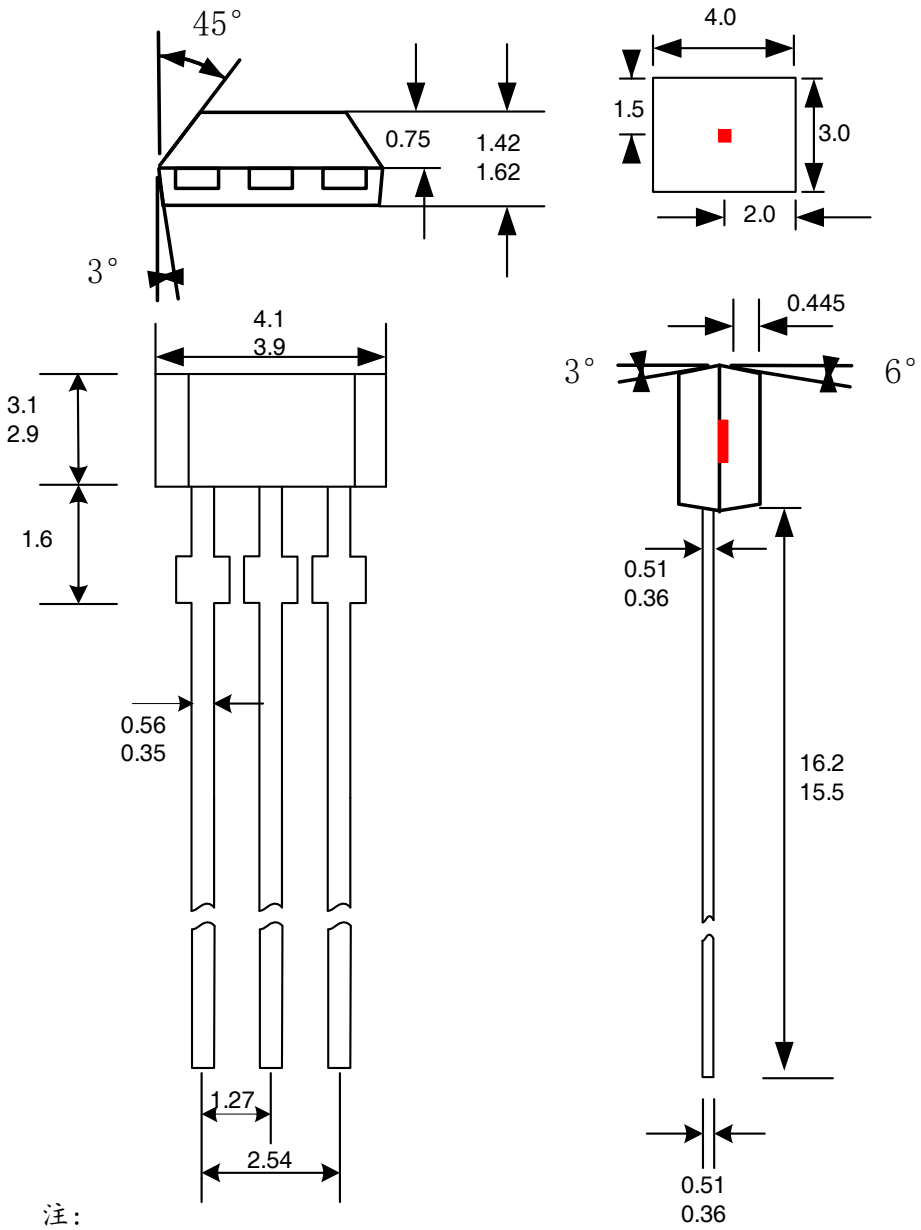
$$CL = \frac{1}{2\pi \times R \times f\ (Hz)}$$

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

PACKAGE INFORMATION "UA"

3-脚
UA 封装

单位:mm

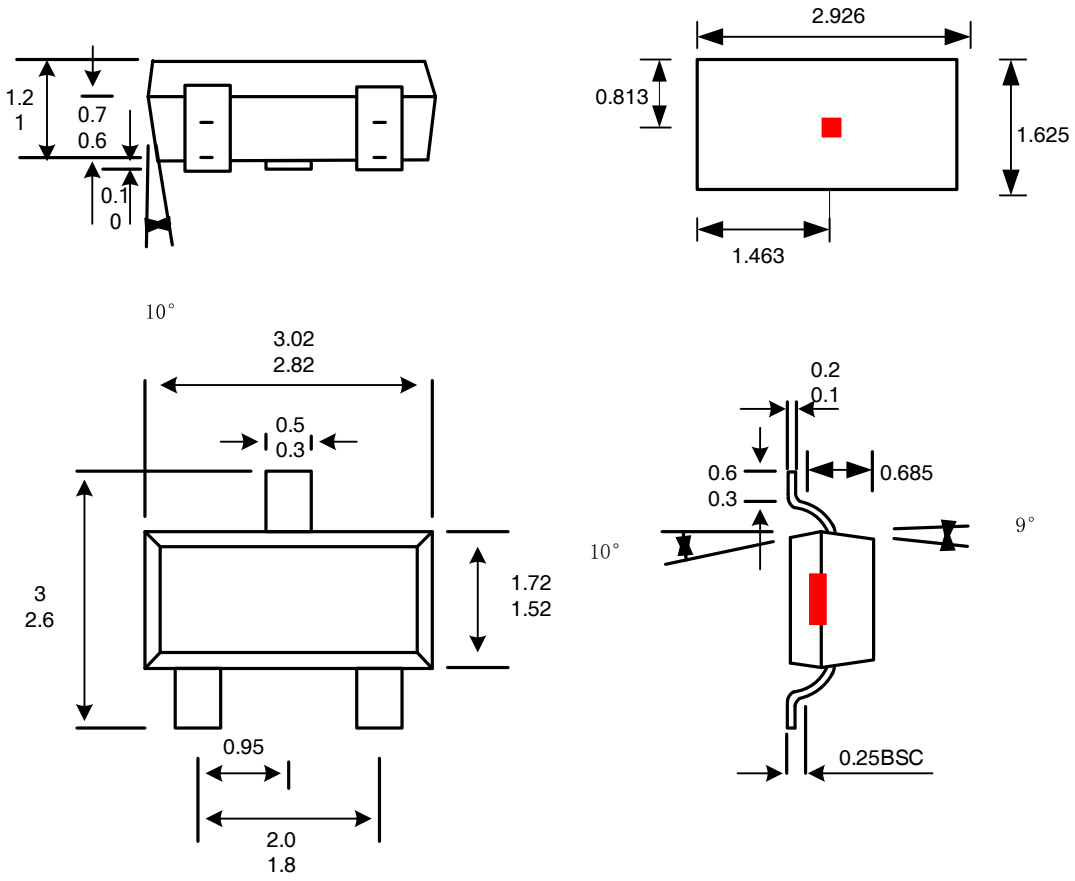


注:
1. 供应商可选的实际本体和管脚形状尺寸位于图示范围内。
2. 高度不包括模具浇口溢料。
3. 红色标记为霍尔元件
如果未指定公差，则尺寸为公称尺寸。

PACKAGE INFORMATION "SO"

3-Terminal
SO Package

Dimension:mm

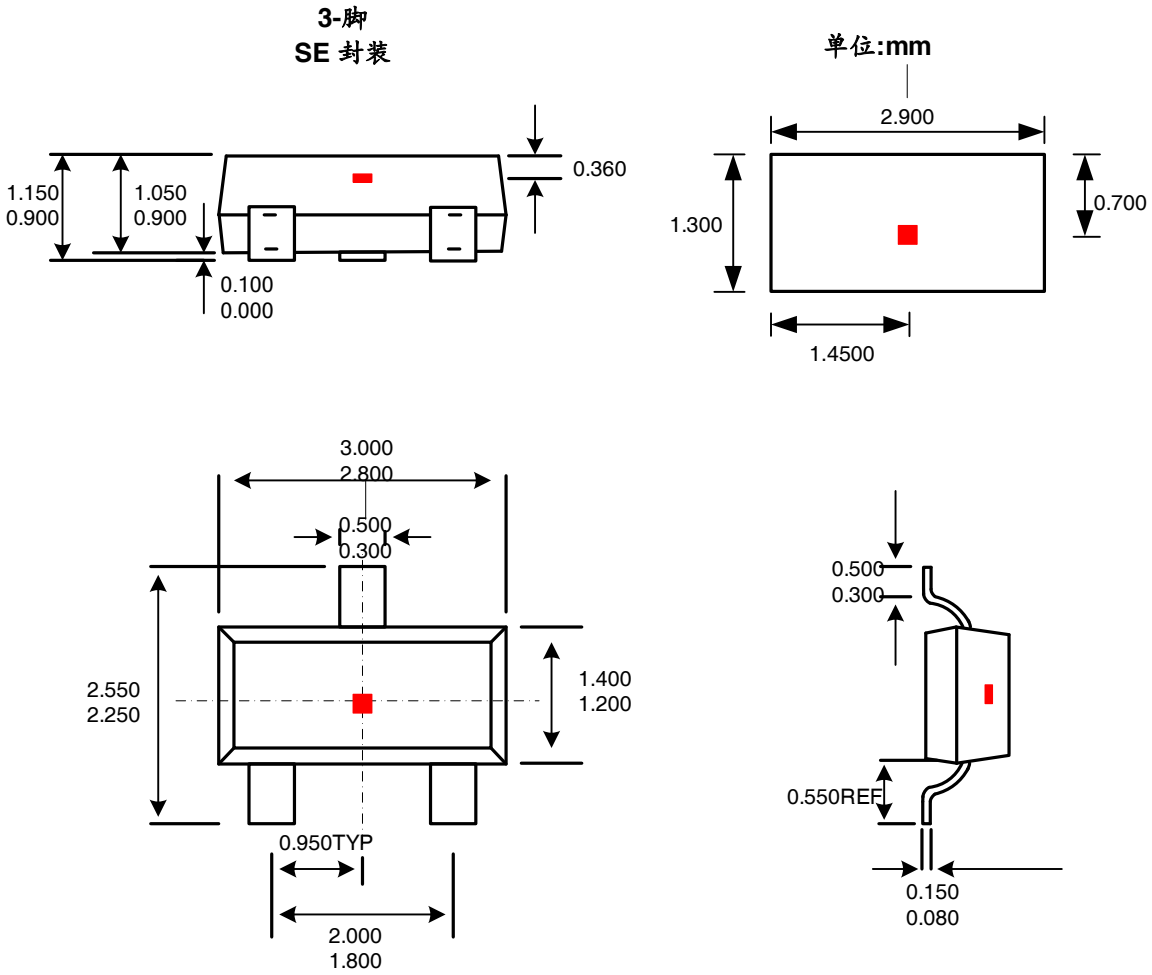


Notes:

1. *Exact body and lead configuration at vendor's option within limits shown.*
2. *Height does not include mold gate flash.*
3. *The red mark is Hale element.*

Where no tolerance is specified, dimension is nominal.

PACKAGE INFORMATION "SE"



Notes:

1. *Exact body and lead configuration at vendor's option within limits shown.*
2. *Height does not include mold gate flash.*
3. *The red mark is Hale element.*

Where no tolerance is specified, dimension is nominal.

REVISION HISTORY

Revision	Date	Description
Rev1.0	2016-05-10	Preliminary Datasheet
Rev1.1	2017-08-06	Add ordering information SC2448SO
Rev2.3	2019-05-06	The final revision of old datasheet
RevA/1.0	2021-10-09	Unified datasheet format, update AEC-Q100
RevA/1.1	2022-04-03	Add ordering information of SC2443SO and SC2443UA
RevA/1.2	2023-02-10	Add I_{DD} Minimum limit / Update sensing point vertical position
RevA/1.3	2023-06-08	Add order information of SC2442SE
RevA/1.4	2023-08-07	Add R2=50 ohm in application circuit
RevA/1.5	2024-05-06	Update part number in order information

单击下面可查看定价，库存，交付和生命周期等信息

>>Semiment (赛卓电子)