

High Performance Digital-Bipolar Hall Effect Sensor

1. Features

- AEC-Q100 qualified
- Latch-type switch Hall
- Optional PCB-less package
- Supply voltage transient up to 60V with 200 Ω R_S resistor
- Support a wide operating voltage range:
 - 2.8V to 40V
- Wide operating temperature range:
 - -40°C to 150°C
- Reverse battery protection: -28V
- Current limited open drain output: 40mA
- High EMC/ESD immunity
- Small package:
 - TO-92S (UA)
 - TO-92S (CUA, with capacitor)
 - SOT23-3L (SO)

2. Applications

- Automotive
- Flow meters
- Valve and solenoid status
- BLDC motor with sensors
- Proximity sensing
- Tachometers

3. Description

The SC2498 series is manufactured using advanced 60V BCD technology. It is a chopper-stabilized Hall effect sensor that provides a magnetic sensing solution with excellent sensitivity stability and integrated protection functions. 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, hysteresis comparator, and the current limited output circuit. An onboard regulator permits with supply voltages of 2.8V to 40V which makes the device suitable for a wide range of industrial and automotive applications.

The device is available in a 3-pin TO92S package (UA) and a 3-pin SOT23-3L style package (SO). Both are lead (Pb) free, with 100% matte tin lead frame plating.



Fig.1 Package Outline

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4. Terminal Configuration

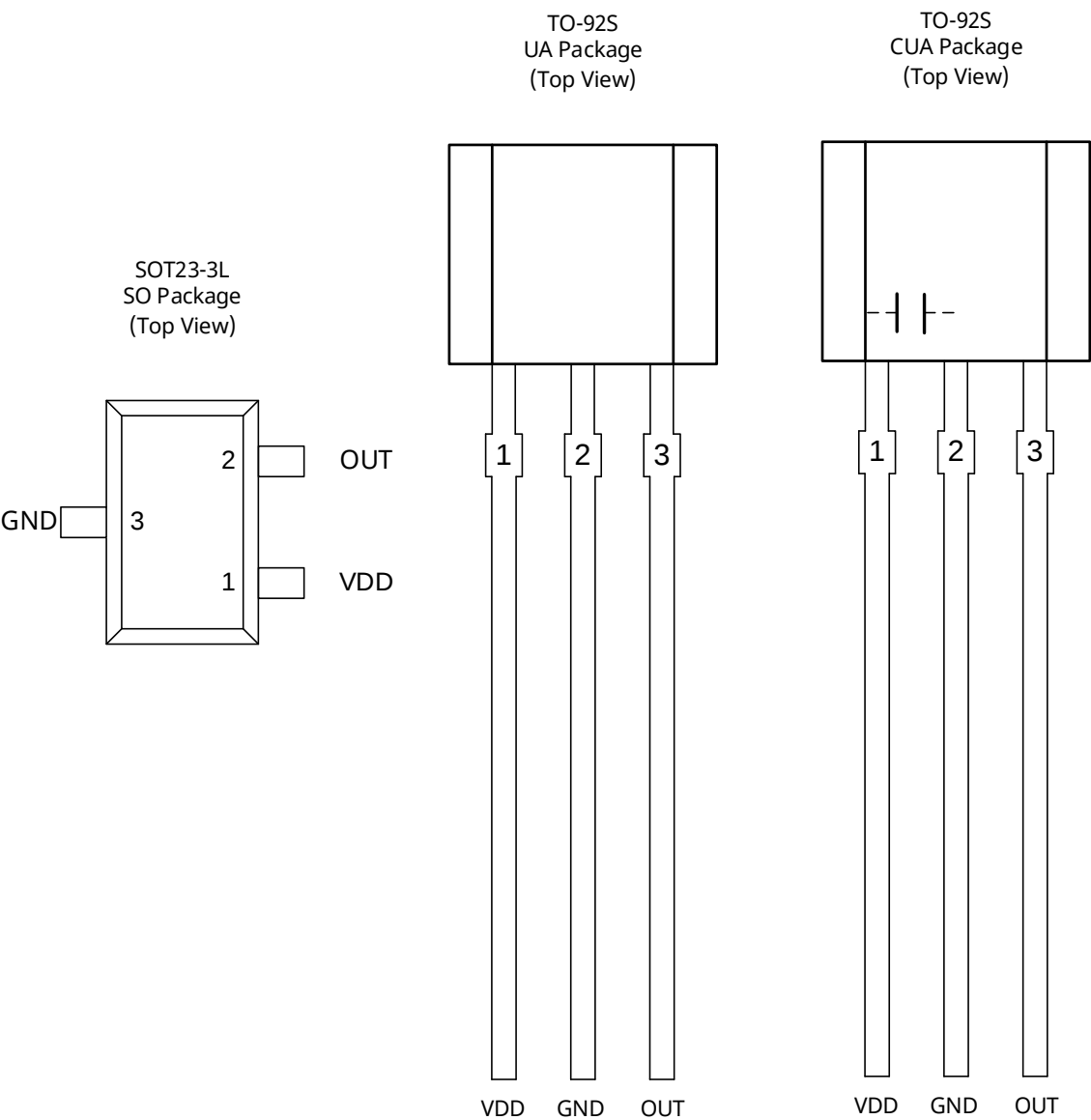


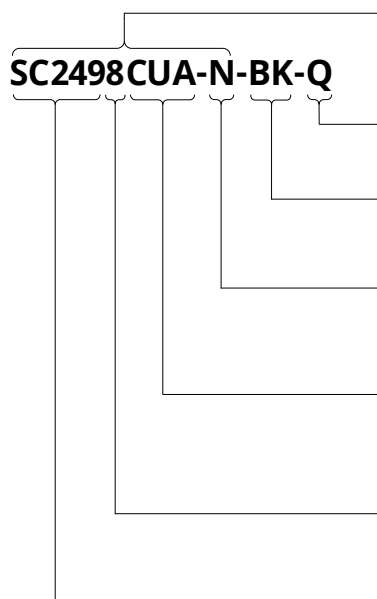
Fig.2 Terminal Configuration

Terminal				Type	Description
Name	UA	CUA	SO		
VDD	1	1	1	PWR	2.8V to 40V power supply
GND	2	2	3	Ground	Ground
OUT	3	3	2	Output	Open-drain output required a pull-up resistor

5. Ordering Information

Order Information	Mark	Option	B _{OP} (Gs)	B _{RP} (Gs)	Ambient, T _A (°C)	Package	Packing	Quantity
SC2498SO-TR-Q	2498	S	+80	-80	-40~150	SOT23-3L	Reel	3000/reel
SC2498UA-N-BK-Q	2498	N	-80	+80	-40~150	TO-92S	Bulk	1000/bag
SC2498CUA-N-BK-Q	2498C	N	-80	+80	-40~150	TO-92S	Bulk	1000/bag

Ordering Information Format



Part Number

Product Grade

Q: Automotive Product

Packing Designation

BK: Bulk

TR: Tape & Reel

Active Magnetic Polarity

N: North Magnetic Field

Default: South Magnetic Field

Package Designation

UA: TO-92S

CUA: TO-92S, with capacitor

SO: SOT23-3L

Magnetic Parameter

B_{OP}: +80Gs, B_{RP}: -80Gs

Device Family

SC2498: High Performance Digital-Bipolar Hall Effect Sensor

6. Absolute Maximum Ratings

Operating temperature range (unless otherwise specified) ⁽¹⁾

Symbol	Parameter	Test conditions	Min.	Max.	Units
V _{DD}	Power supply voltage	Resistance $\geq 200\Omega$, no more than 5 minutes	-28	60	V
V _{OUT}	Output terminal voltage	1.2 k Ω 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	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

(2) SC2498CUA-N-BK-Q V_{DD} integrates a capacitor, so V_{DD} voltage will derate when the temperature exceeds 125 °C. Please contact Semiment for more information

7. ESD Protection

Symbol	Parameter	Test conditions	Min.	Max.	Units
V _{ESD_HBM}	HBM	according to standard AEC-Q100-002 HBM	-8	+8	kV
	HBM(PCB-less)	according to standard AEC-Q100-002 HBM	-12	+12	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/CUA Package thermal resistance	Single-layer PCB, with copper limited to solder pads	200 ⁽¹⁾	°C/W
	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 ⁽¹⁾	$T_J < T_{J(Max.)}$	2.8	5.0	40	V
I_{DD}	Operating supply current	$V_{DD}=2.8$ to $40V$, $T_A=25^\circ C$	3.5	4.1	7.0	mA
$UVLO_H$	Under Voltage Lockout High	$B > B_{OP} + 2.0mT$, V_{DD} Rising From 2.5V	-	2.7	-	V
$UVLO_L$	Under Voltage Lockout Low	$B > B_{OP} + 2.0mT$, V_{DD} Decreasing From 3.0V	-	2.5	-	V
$UVLO_{HYS}$	Under Voltage Hysteresis	$UVLO_H - UVLO_L$	-	0.2	-	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	$V_{DD}=5V$, $I_O=20mA$, $T_A=25^\circ C$	-	0.14	0.4	V
t_d	Output delay time	$B=B_{RP}$ to B_{OP}	-	15	25	μs
OCP	Over current protection	Output on $V_{PULL-UP} < 30V$	30	50	70	mA
t_r	Output rise time (10% to 90%)	$R1=1Kohm$, $Co=50pF$	-	0.2	1	μs
t_f	Output fall time (90% to 10%)	$R1=1Kohm$, $Co=50pF$	-	0.1	1	μs

Note:

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

(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)

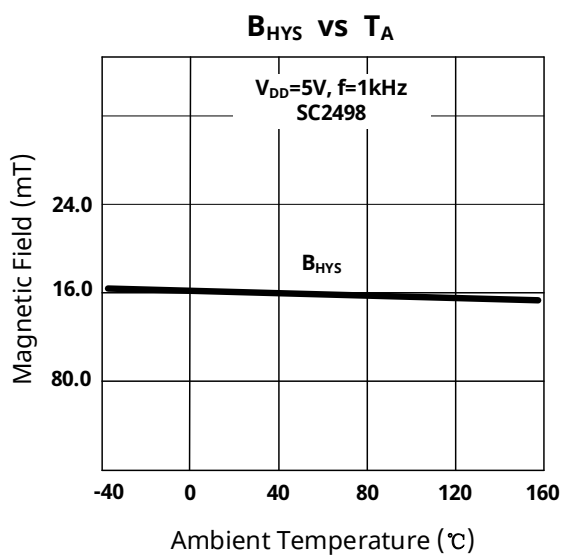
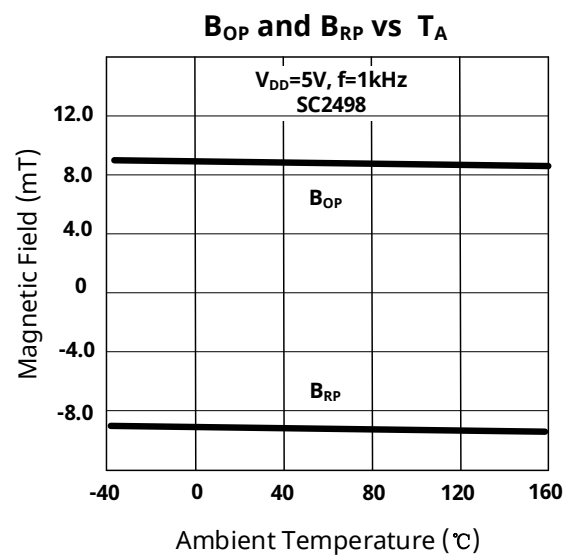
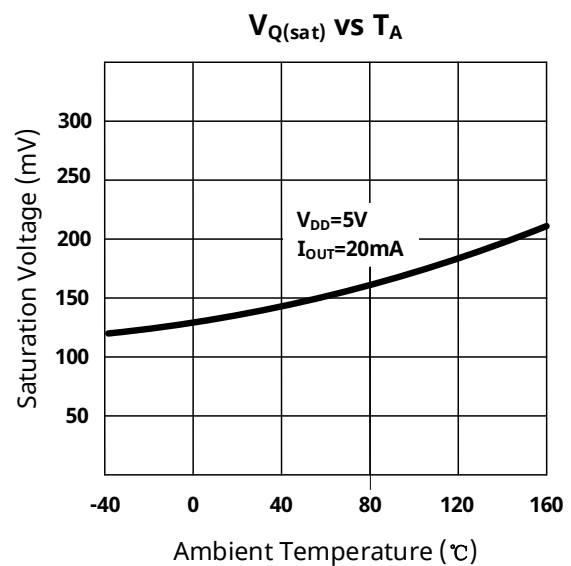
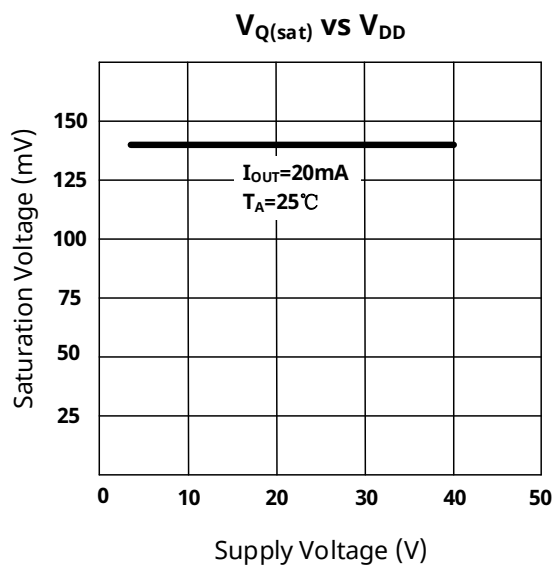
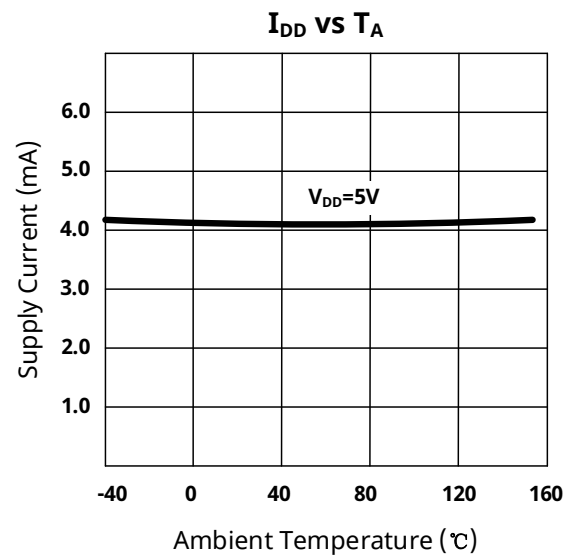
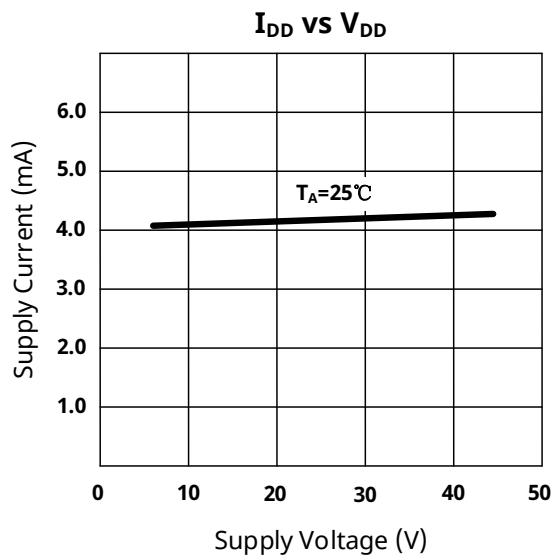
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
f_{BW}	BW		20	-	-	kHz
SC2498 +8.0⁽¹⁾/-8.0 mT⁽²⁾						
B_{OP}	Operating point	$T_A = 25^\circ C$	+6.0	+8.0	+10.0	mT
B_{RP}	Release point		-10.0	-8.0	-6.0	mT
B_{HYS}	Hysteresis		12.0	16	20.0	mT

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. Typical Characteristics



11. Block Diagram

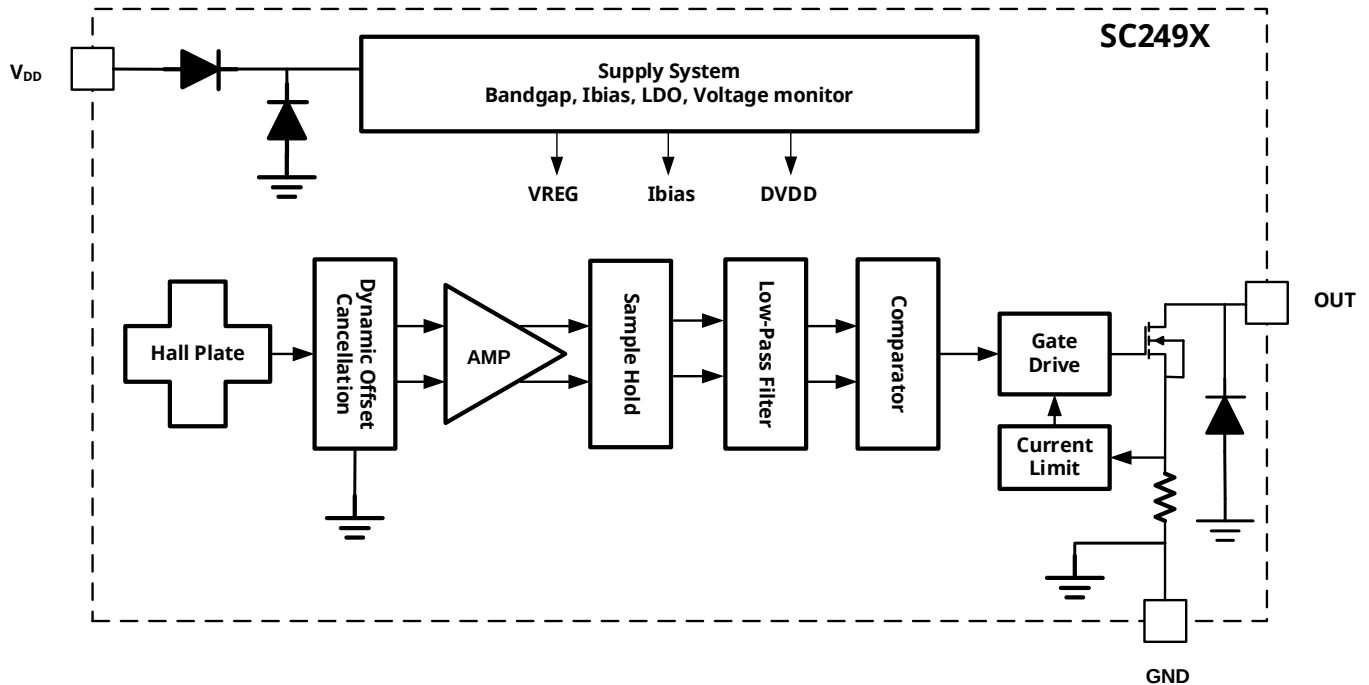


Fig.3 Function Block Diagram

12. Function Description

The SC2498 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 2.8V to 40V, and continuously survives continuous -28V reverse-battery conditions.

The output of SC2498 switches low (turns on) when a magnetic field perpendicular to the Hall element exceeds the absolute value of the operate point threshold, B_{OP} . After turn-on, the output is capable of sinking 44mA and the output voltage is $V_Q(sat)$. When the magnetic field is reduced below the absolute value of 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.

12.1. Field Direction Definition

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

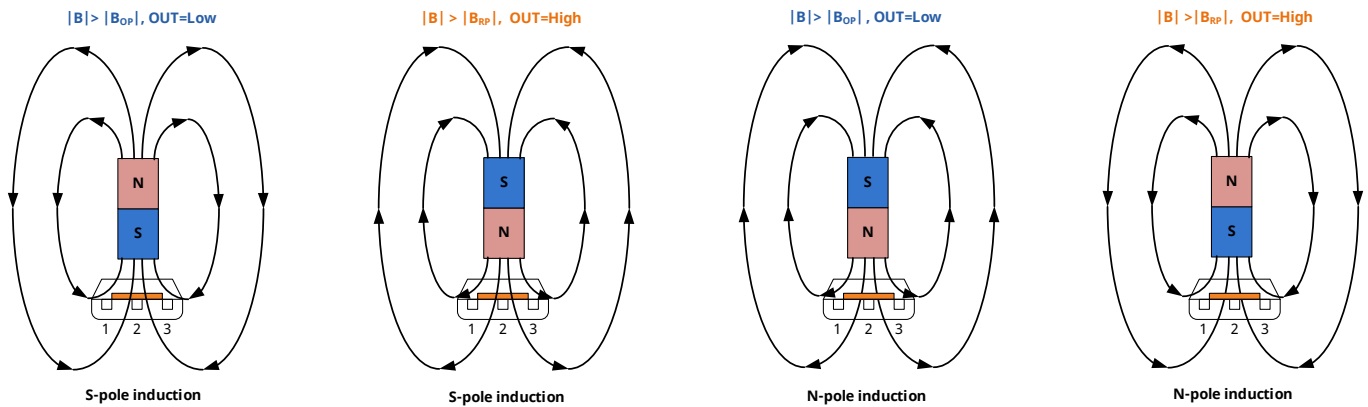


Fig.4 Magnetic Field Direction Definition

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. Resistance $\geq 200\Omega$, no more than 5 minutes

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

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

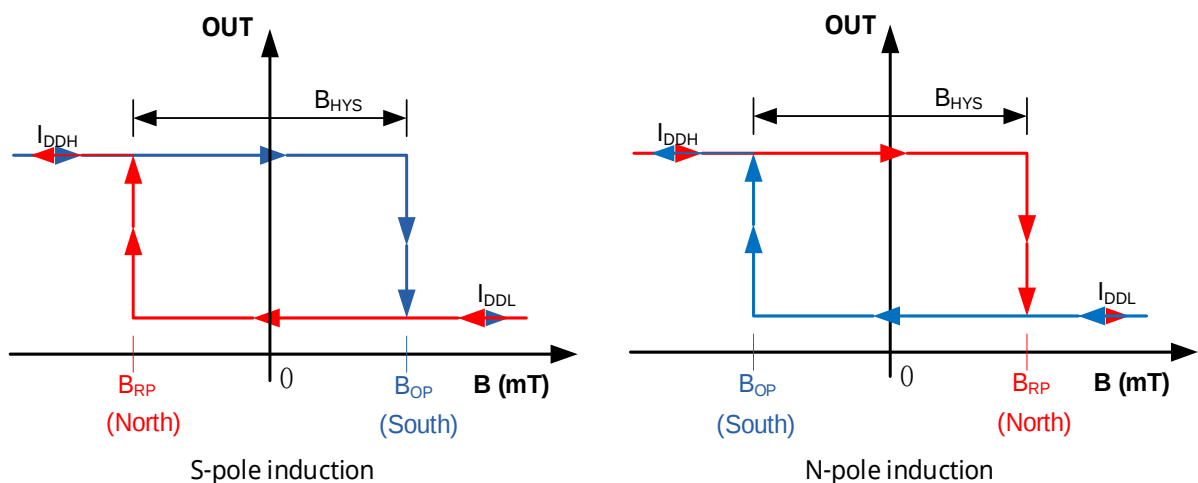


Fig.5 Magnetic Transfer Function

13. Typical Application

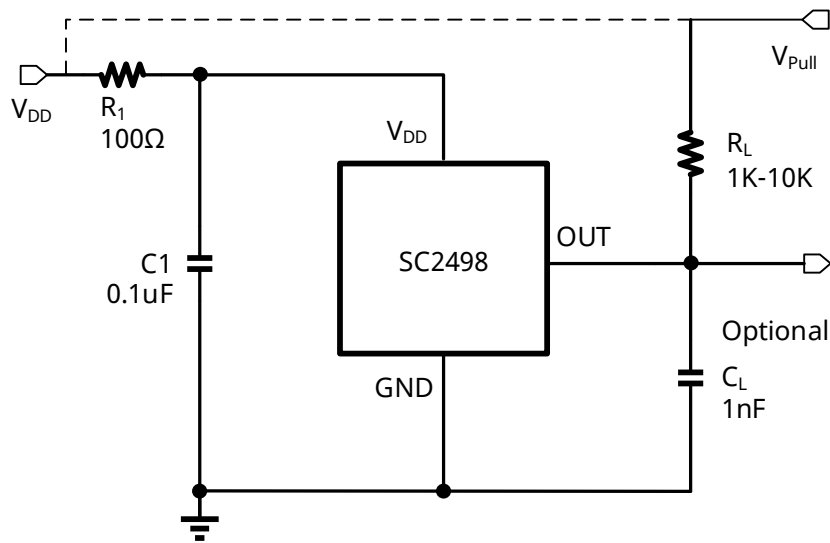


Fig.6 Typical Application Circuit

The SC2498 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 C_1 capacitor be connected to the ground in parallel near the V_{DD} power end of the chip, with a typical value of $0.1\mu\text{F}$. At the same time in the external optional series resistor R_1 and output capacitance C_L used for enhanced protection circuit, its typical values for 100Ω and 1nF .

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

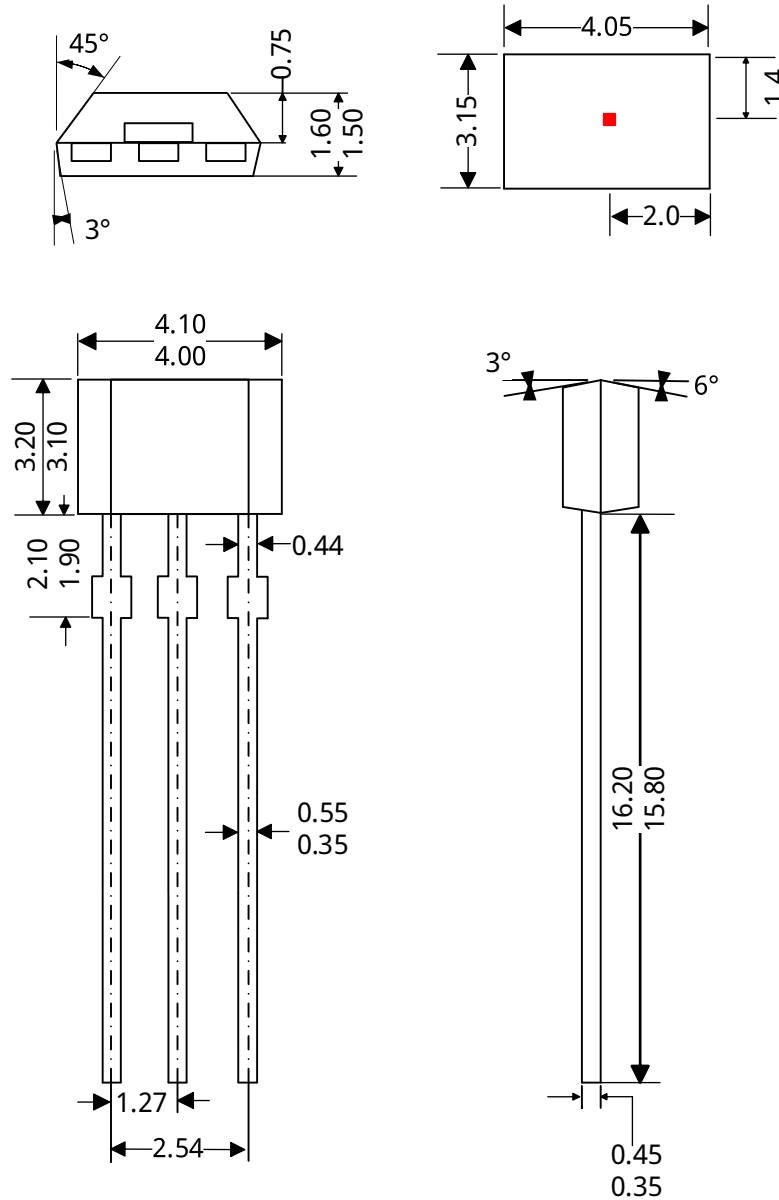
$$C_L < \frac{1}{2\pi \times R_L \times 2 \times f_{BW}(\text{Hz})}$$

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

3-Terminal
S3 Package

Unit:mm

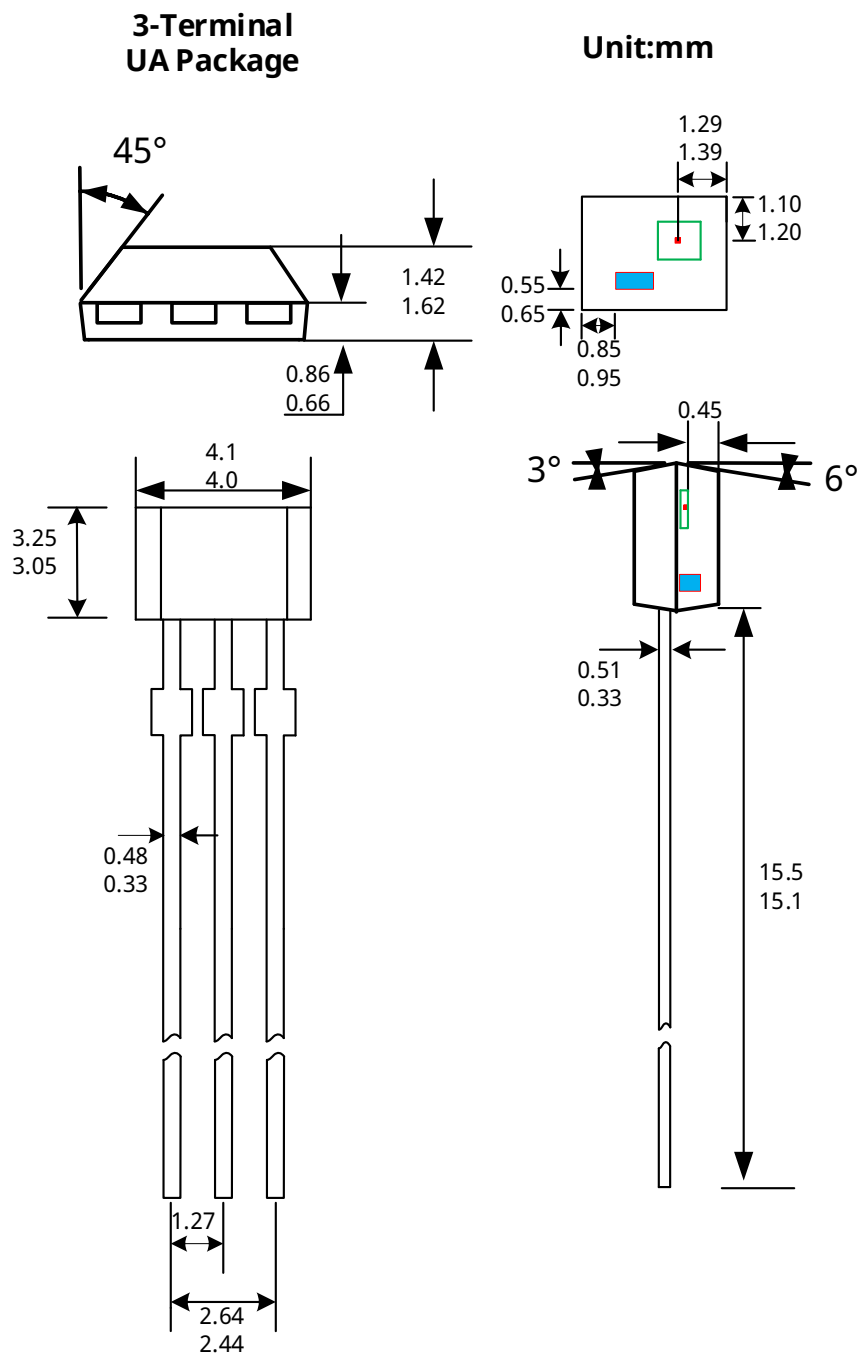


Notes:

- (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 CUA



Notes:

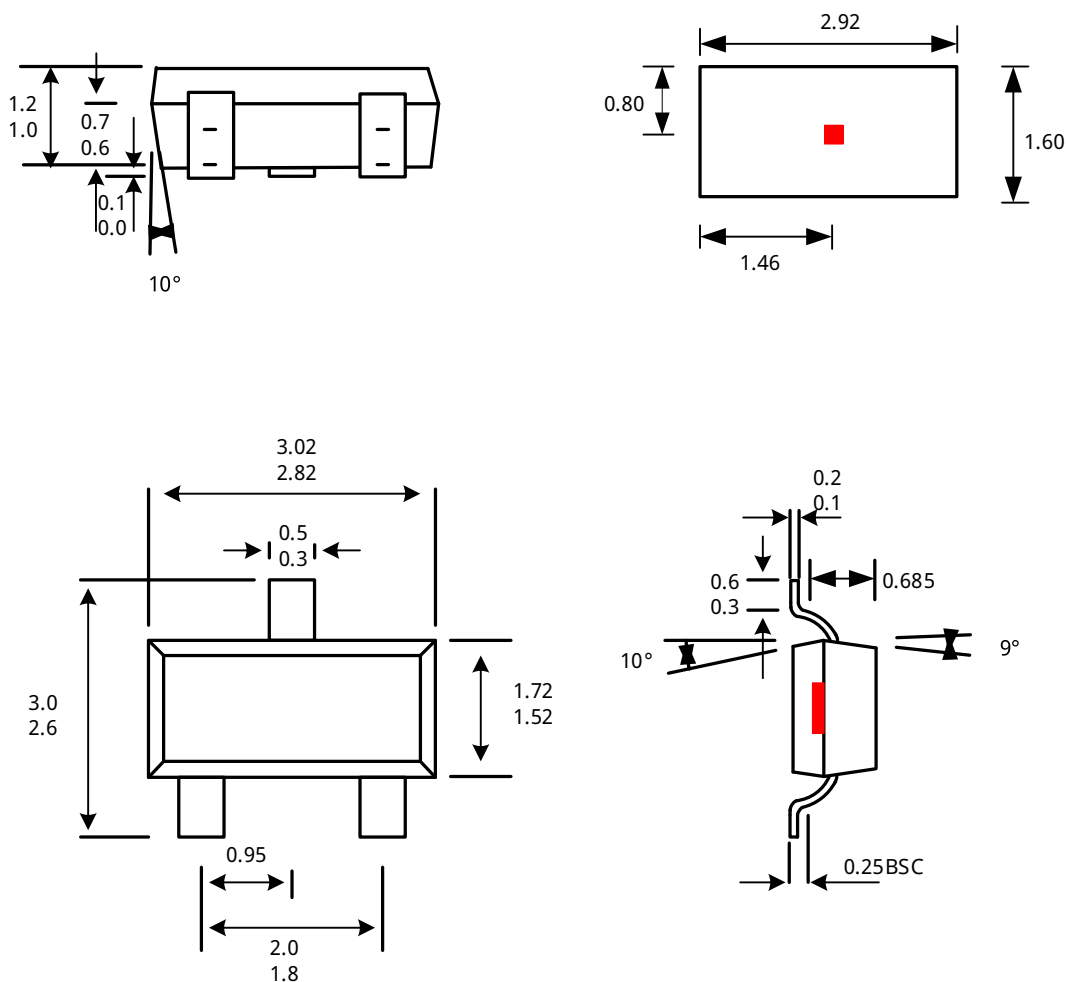
- (1) Exact body and lead configuration at vendor's option within limits shown.
- (2) Height does not include mold gate flash.
- (3) Green is Die; Red is Hall plate; Blue is Cap
- (4) Die Size: 1.14mm*1.02mm*0.3mm; Cap Size: 1.0mm*0.5mm*0.5mm

Where no tolerance is specified, dimension is nominal.

16. 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.
- (3) The red mark is Hall element.

Where no tolerance is specified, dimension is nominal.

17. Revision History

Revision	Date	Description
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Rev.0.1	2022-1-08	Preliminary datasheet
Rev.0.2	2022-04-27	1.Output terminal current sink from 40mA to 35mA 2.Power-on time max from 20us to 10us 3.UA package
Rev.A1.0	2023-08-10	Uniform format and update hall plate position
Rev.A1.1	2024-05-12	Update EC table
Rev.A1.2	2024-06-27	1.Add SC2498CUA-N part 2.Add ordering, ESD, EMC table
Rev.A1.3	2025-02-14	Update ordering information
Rev.A1.4	2025-03-12	Update EC table of Magnetic Characteristics