Two-wire current-mode latched Hall switch IC

1. Features

- AEC-Q100 qualified
- ISO26262 ASIL B
- Two-wire current-type output interface
  - 2-wire output interface
  - Interconnect open/short diagnostics
- Up to 1MHz high chopping frequency
- Wide voltage range: 4V to 24V
- Reverse battery protection: -28V
- Wide operating temperature range:
  - -40℃ to 150℃
- Thermal shutdown protection
- High EMC/ESD immunity
- Integrated a 100nF cap (PCB-less)
- Package:
  - 3 pin TO92S(UA)
  - 2 pin TO92S(CUB)-Integrate a 100nF cap

2. Applications

- Automotive and industrial safety system
- Seat Position detection
- Seat belt buckles
- Door latch switch
- Wiper motor switch Wiper motors

3. Description

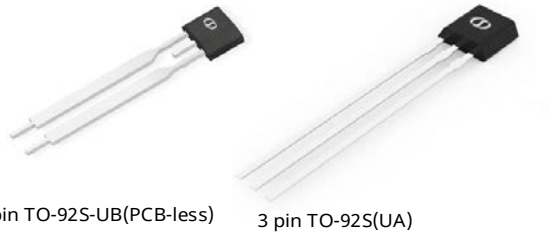
SC25898 is designed and manufactured with a high-voltage BCD process. It is a two-wire current-output latching Hall-effect sensor that delivers professional magnetic sensing solutions. This device boasts excellent stability of sensitivity against temperature drift, and integrates multiple built-in protection functions. Equipped with a two-wire current-type interface, it simplifies wiring layout and supports open-circuit & short-circuit diagnosis efficiently.

SC25898 integrates an internal voltage regulator, supporting an operating input voltage range from 4 V to 24 V. It is well-suited for industrial and automotive applications, and delivers superior EMC immunity with high reliability.

SC25898 adopts dynamic misalignment elimination and temperature compensation technology to reduce misalignment caused by process changes, packaging, and temperature stress, and has stable sensitivity. Internally integrated circuit modules include voltage stabilization module, Hall array, amplification circuit, low-pass filter, hysteresis comparator, and output current control.

SC25898 is available in3-pin TO-92S package (UA), and 2-pin TO-92S package (CUB). All packages use 100% lead-free matte tin-plated lead packages.

Not to scale



2 pin TO-92S-UB(PCB-less) 3 pin TO-92S(UA)

Fig.1 Package Outline

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4. Terminal Configuration

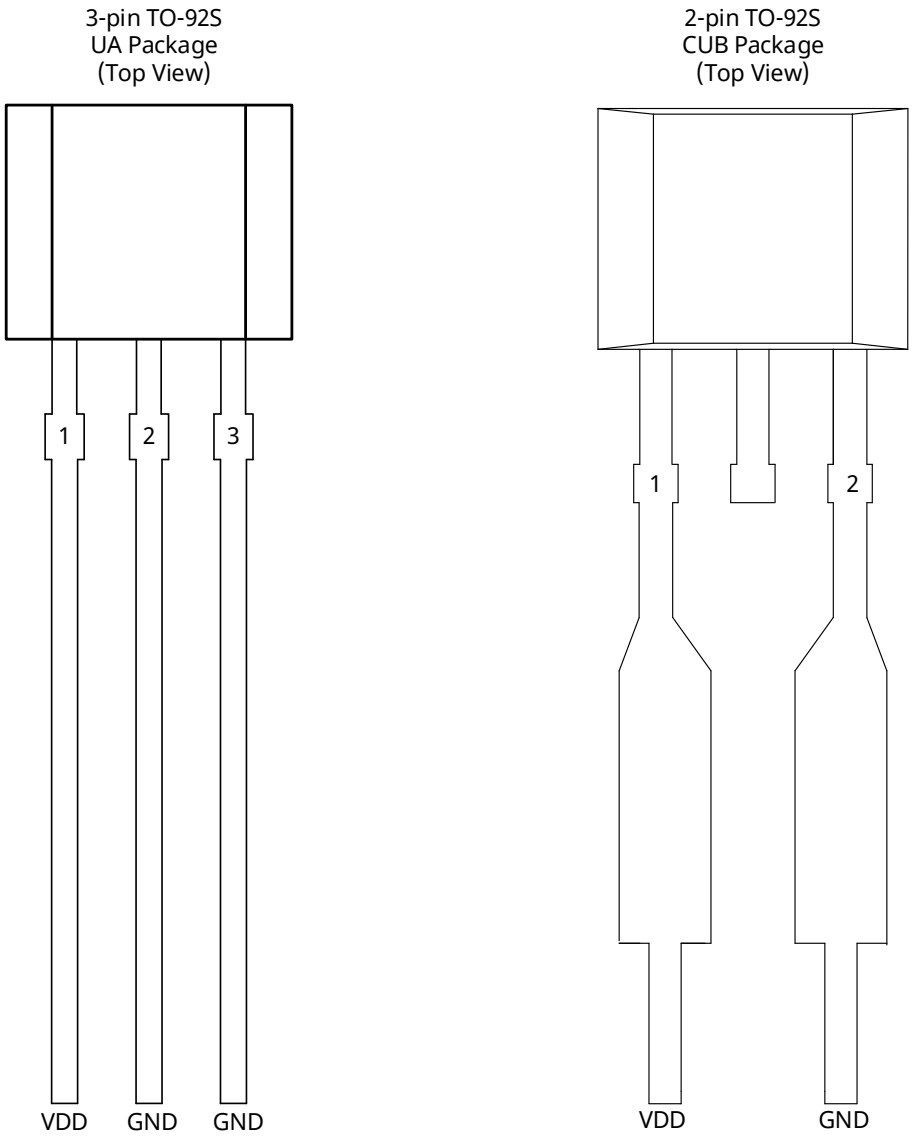


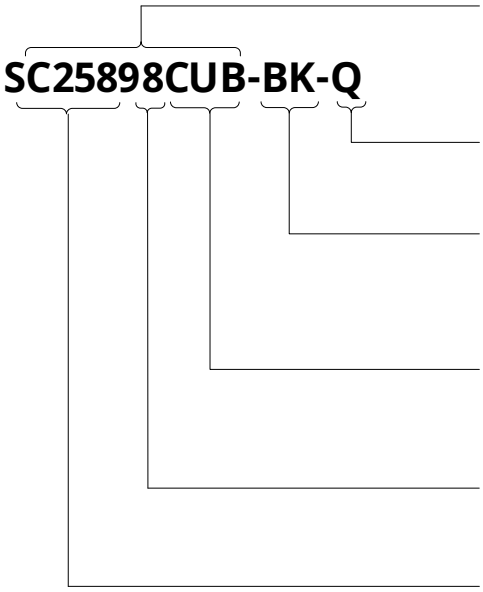
Fig.2 Terminal Configuration Definition

Terminal			Type	Description
Name	UA	CUB		
VDD	1	1	Power	4V to 24V power Supply
GND	2	2	Ground	Ground terminal
GND	3	-	Ground	Ground terminal

5. Ordering Information

Ordering Information	Mark	I_{DDL}(mA)	I_{DDH}(mA)	B_{OP}(mT)	B_{RP}(mT)	Package	Packing	Amount
SC25898UA-BK-Q	25898	4.0	26	-8.0	8.0	TO-92S	Bulk	1000 /bag
SC25898CUB-BK-Q	25898	4.0	26	-8.0	8.0	TO-92S-UB	Bulk	1000 /bag

Ordering Information Format



Part Number

Product Grade
Q: Automotive Product

Pack Designation
TR: Tape & Reel
BK: Bulk

Package Designation
UA: TO-92S
CUB:TO-92S-UB with 100nF cap

Magnetic Parameter
8: B_{OP}: -80Gs, B_{RP}: 80Gs

Device Family
SC25898: Two-wire current-mode 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 (2)	Rs≥200Ω, no more than 5 minutes	-28	60	V
I_{DDR}	Reverse Supply Current		-1	-	mA
T_A	Operating ambient temperature		-40	150(2)	℃
T_J	Maximum junction temperature	No more than 168 hours	-55	165	℃
T_{STG}	Storage temperature		-65	175	℃

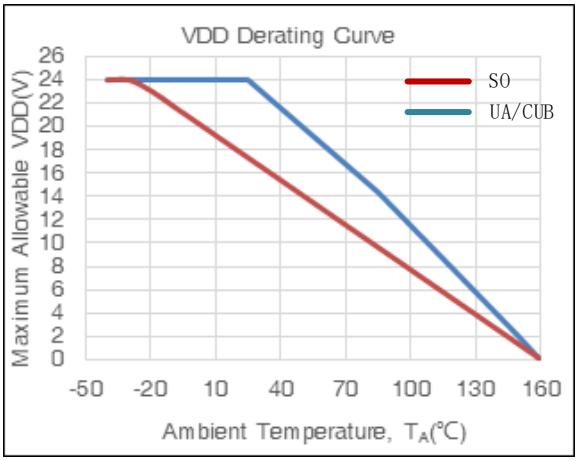
Note:
(1) Stresses above those listed here may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect device reliability
(2) Maximum voltage must be adjusted for power dissipation and junction temperature, see Thermal Characteristics

7. ESD Protection

Symbol	Parameter	Test Condition	Min.	Max.	Units
V_{ESD_HBM}	HBM	According to: standard AEC-Q100-002 HBM	-8	+8	kV
V_{ESD_HBM}	CDM	According to: standard AEC-Q100-011 CDM	-750	+750	V

8. Thermal Characteristics

Symbol	Parameter	Test Conditions	Rating	Units
$R_{\theta JA}$	UA/CUB Package thermal resistance	Single-layer PCB, with copper limited to solder pads	200(1)	℃/W



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

9. Operating Characteristics

9.1. Electrical Characteristics

Within the operating temperature range, V_{DD}=12V (unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.(1)	Max.	Units
V_{DD}	Operating Voltage (2)	$T_J < T_{J(Max.)}$	4	12	24	V
V_{DDR}	Reverse Supply Voltage	I_{DD} < -10mA, T_A=25℃	-28	-	-	V
$UVLO_H$	Under Voltage Lockout High	B>B_{OP}+2.0mT, V_{DD} Rising From 1.5V	-	1.9	-	V
$UVLO_L$	Under Voltage Lockout Low	B>B_{OP}+2.0mT, V_{DD} Decreasing From 2.5V	-	1.7	-	V
$UVLO_{HYS}$	Under Voltage Hysteresis	$UVLO_H$- $UVLO_L$	-	200	-	mV
I_{DDL}	Low Supply Current	V_{DD}=4 to 24 V, T_A=25℃	-	4	-	mA
I_{DDH}	High Supply Current	V_{DD}=4 to 24 V, T_A=25℃	-	26	-	mA
OTP	Over Temperature Protection	Temperature increasing	-	187	-	℃
OTP_{HYS}	Over Temperature Hysteresis		-	13	-	℃
t_{on}	Power-on time	V_{DD}>2.5V	-	50	60	μs
t_d	Output delay time	B=B_{RP} to B_{OP}	-	15	40	μs

Note:

(1) Typical values are defined at T_A = +25°C and V_{DD} = 12V

(2) The maximum operating voltage must meet the requirements of power consumption and junction temperature, See Thermal Characteristics

9.2. Magnetic Characteristics

Within the operating temperature range, V_{DD}=12V (unless otherwise specified)

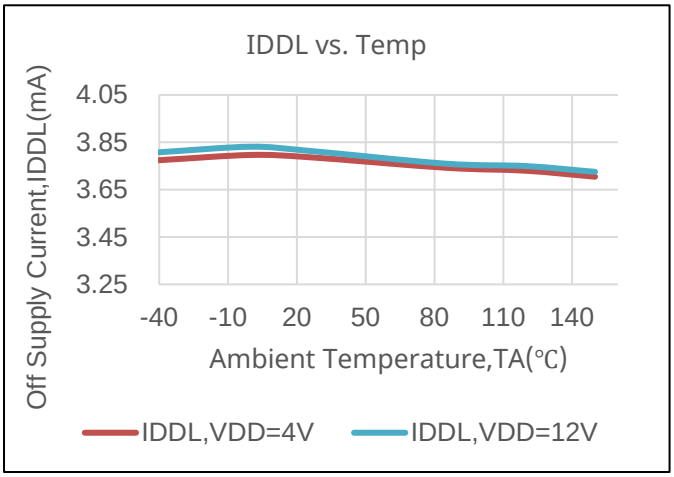
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
f_{BW}	Bandwidth		20			kHz
SC25898UA/CUB -8.0 / 8.0 mT						
B_{OP}	Operated point	T_A=25℃	-10.0	-8.0	-6.0	mT
B_{RP}	Release point		6.0	8.0	10.0	mT
B_{HYS}	Hysteresis		12.0	16.0	20.0	mT
B_O	Magnetic offset	$B_O=(B_{OP}+B_{RP})/2$	-2.0	0	2.0	mT

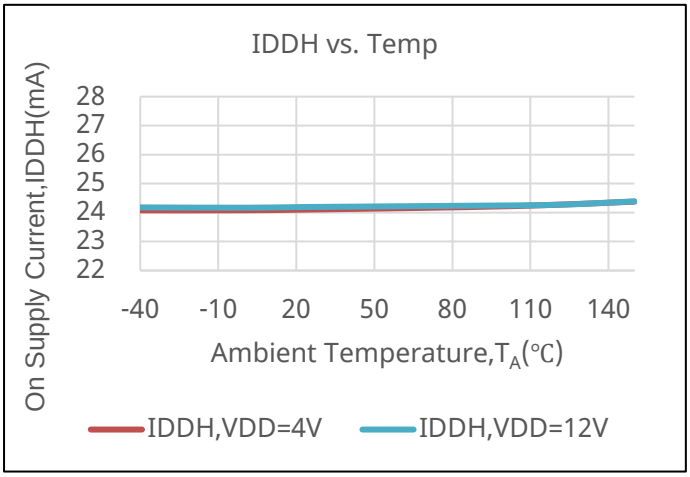
Note:

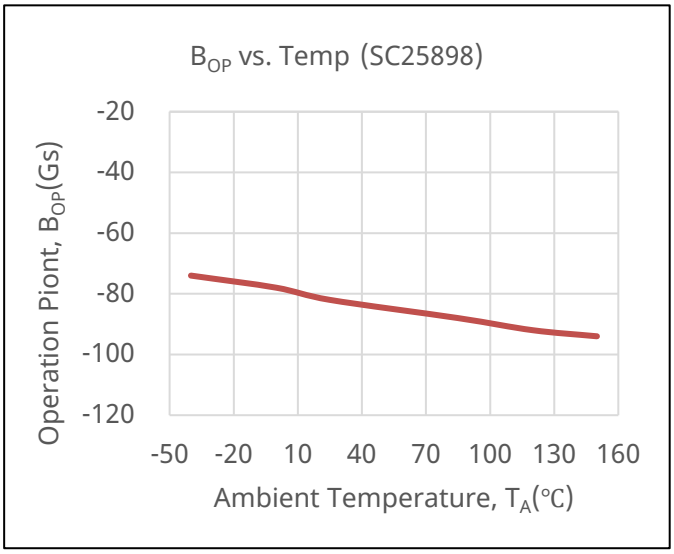
(1)1mT=10Gs

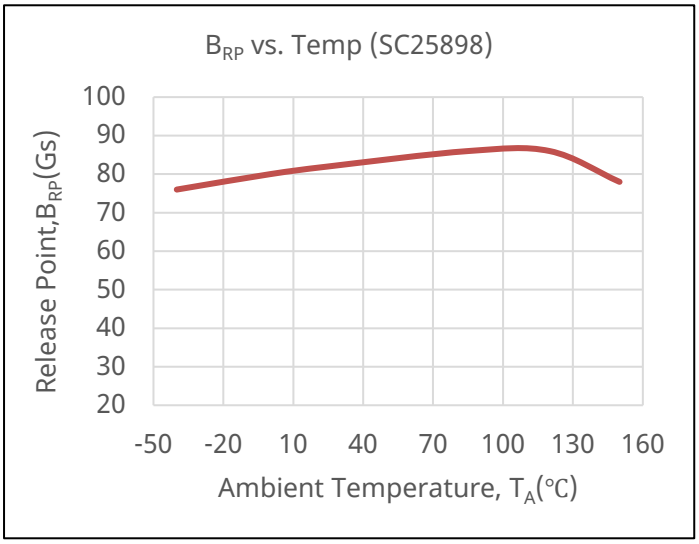
(2) Magnetic flux density, B is indicated as a negative value for North-polarity magnetic fields, and as a positive value for South-polarity magnetic fields

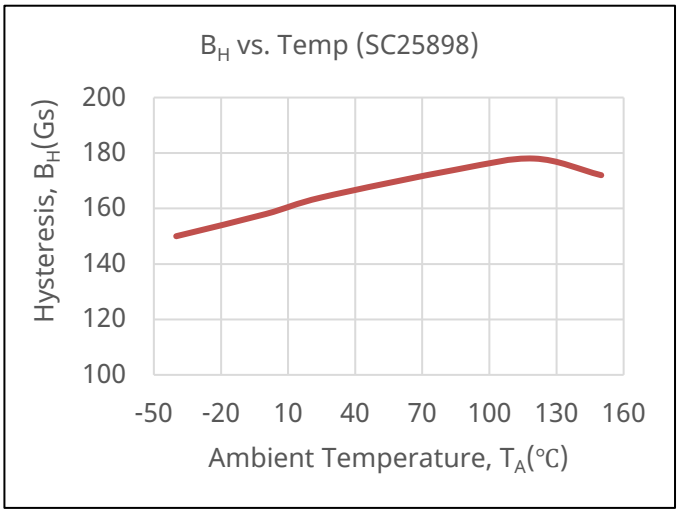
10. Typical Characteristics











11. Block Diagram

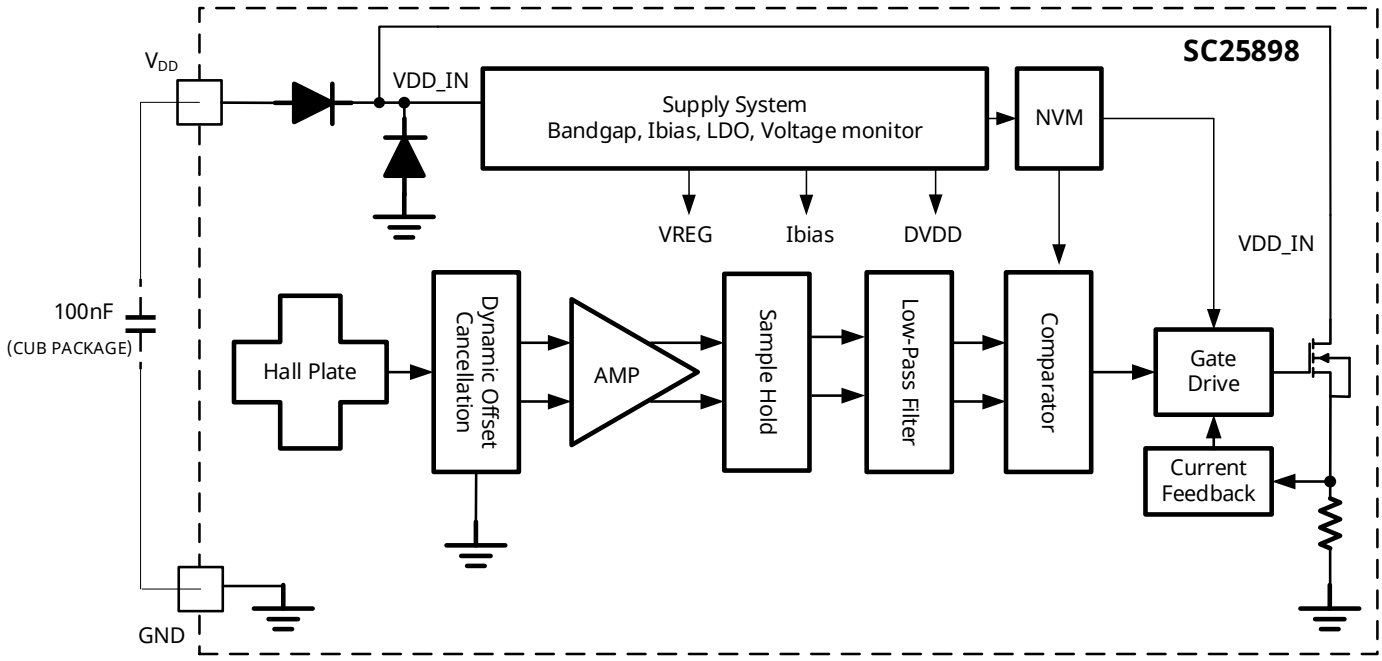


Fig.3 Function Block Diagram

12. Function Description

The SC25898 device is a chopper-stabilized 2-wire Hall sensor with current interface output for magnetic sensing applications. The device can be powered with a supply voltage between 4V to 24V, and continuously survives continuous -28V reverse-battery conditions.

The output of SC25898 series switches to I_{DDH} (turns on) when the absolute value of a magnetic field perpendicular to the Hall element exceeds the absolute value of the operate point threshold, B_{OP}. When the magnetic field is reduced below the absolute value of the release point, B_{RP}, the supply current of the device goes I_{DDL} (turns off). The difference between 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 Magnetic Field Direction Definition

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

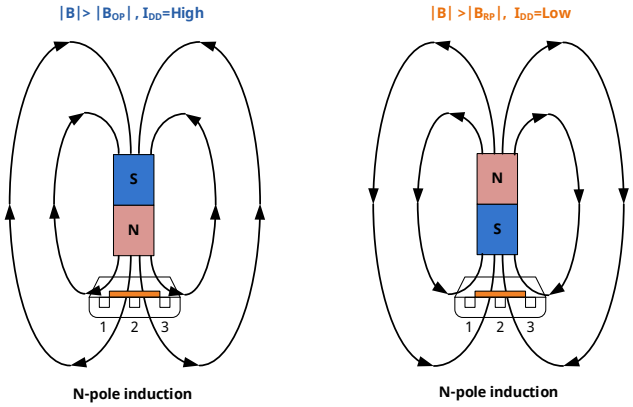


Fig.4 Magnetic Field Direction Definition

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 absolute value of the field strength is greater than the absolute value of B_{OP}, then the supply current is high (I_{DDH}). If the absolute value of the field strength is greater than the absolute value of B_{RP}, the output is released, the supply current is low (I_{DDL}).

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

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

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

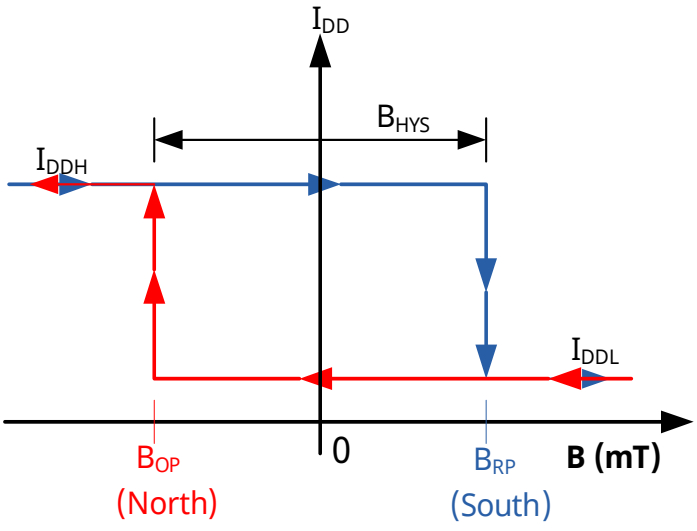


Fig.5 Magnetic Transfer Function

12.3. Diagnostic Features

When properly supplied, SC25898 always has current flowing at a specified level: either I_{DDH} or I_{DDL}. Any current outside of these narrow ranges is a fault condition. If there is a short, current increases so that $I_{DD} > I_{DDH}$ (max), outside the valid I_{DDH} range. If there is an open, the current lowers below the I_{DDL} (min), outside the valid output current range. In this way, connectivity issues between the ECU and the sensor can easily be detected.

13. Typical Application

The typical application circuit is as follow, R_S=100Ω，C_P=100nF

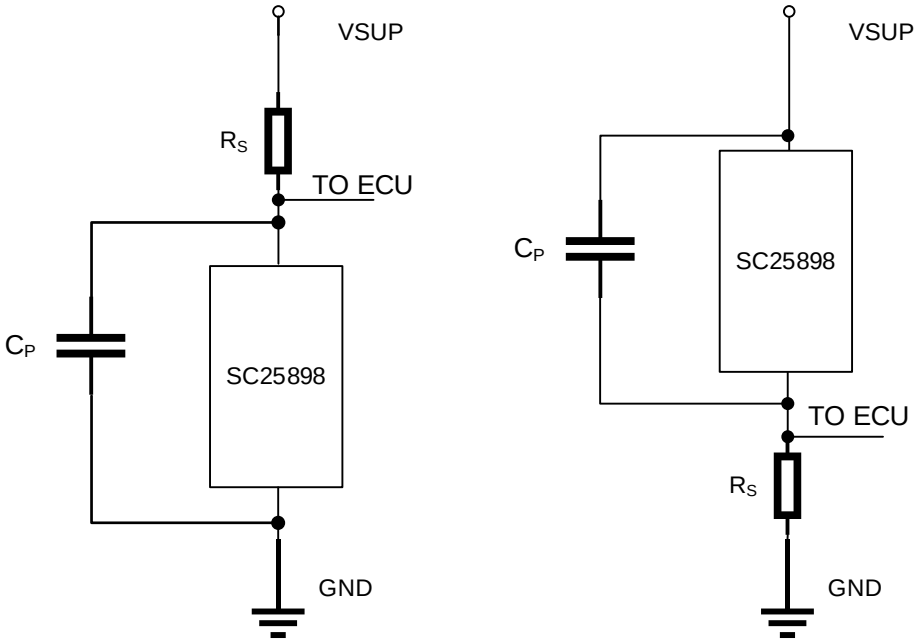
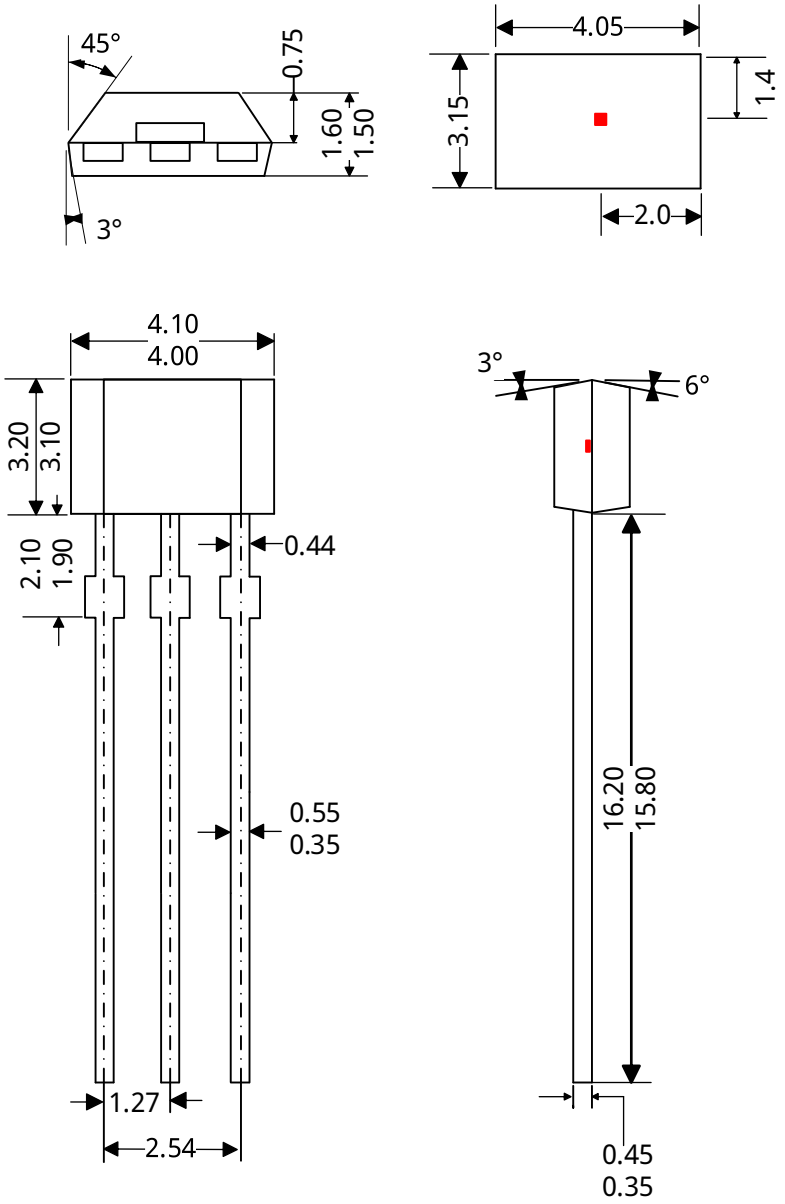


Fig.6 The Typical Application Circuit

The SC25898 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 capacitor C_P (From 10nF to 100nF) to the ground as close as possible to V_{DD} power supply, a typical value is 100nF. At the same time, the external series resistor R_S is needed, the typical value is 100Ω. In addition, when using CUB packaging, since the CUB packaging chip already integrates a 100nF capacitor internally, the external Cp capacitor can be omitted when designing the overall sensor scheme, thus achieving a PCB-less solution without PCBA requirements.

14. Package Information UA

TO-92S Package Outline Dimensions

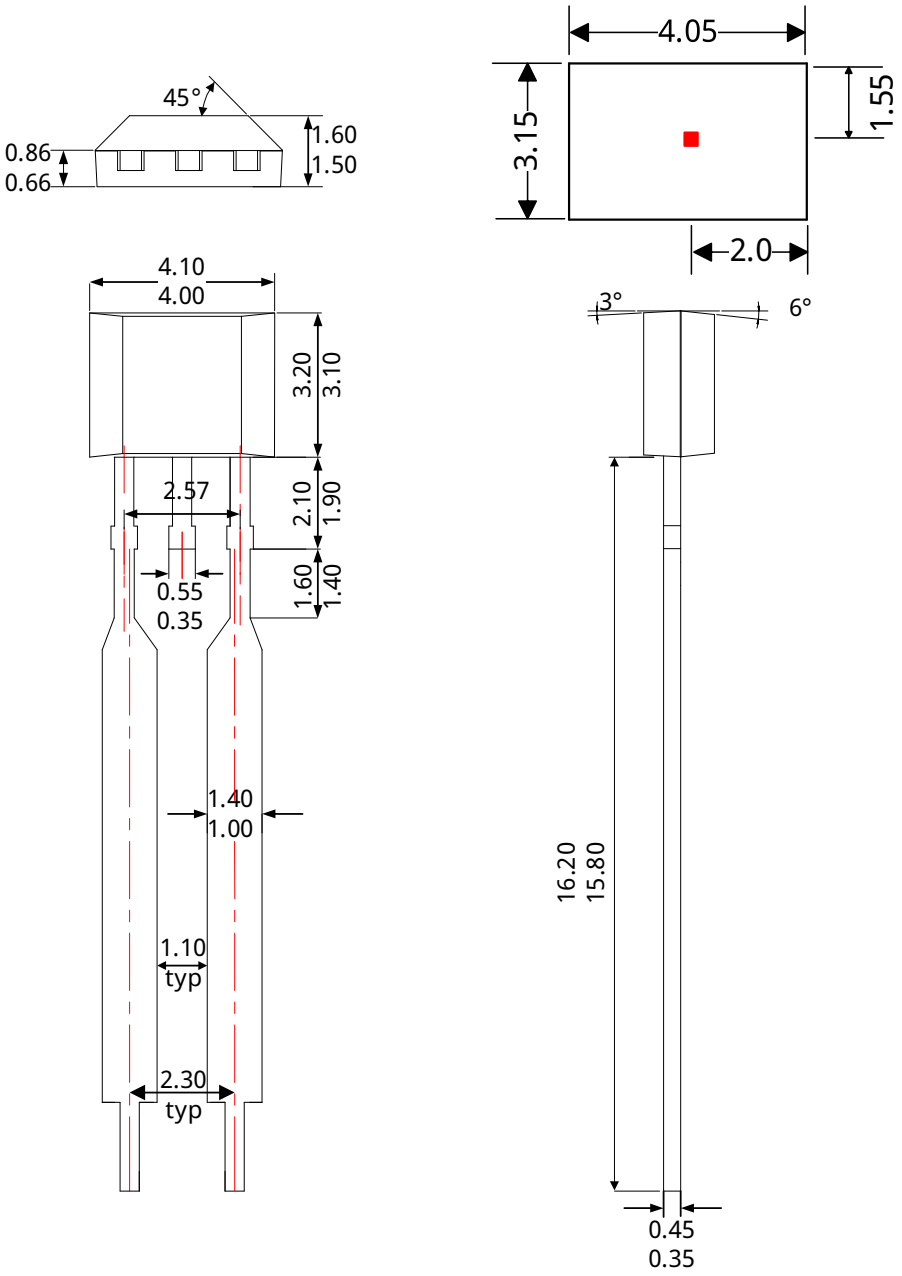


Notes:
(1)All unit in mm.
(2)Dimension does not include mold flash , protrusions or gate burrs.
(3)Allowable dambar protrusion shall be in excess at maximum material condition.

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 CUB

TO-92S-UB 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. Revision History

Revision	Date	Description
Rev.E0.1	2024-12-22	Preliminary datasheet
Rev.A1.0	2025-07-14	Official version release
Rev.A1.1	2026-03-26	Add Important Statement

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