Two-Wire Unipolar Hall Effect Switches

FEATURES

- High chopping frequency
- AEC-Q100 qualified product
- ASIL-A Level
- Support wide voltage range
  - 3.3V to 24V
  - Operation from unregulated supply
- Wide operating temperature range
  - -40˚C to 150˚C
- Reverse-Voltage protection
- Output short-circuit protection
- High EMC immunity protection
- Package
  - 3-pin SOT23 -(SE)
  - 3-pin TO-92-(UA)

APPLICATIONS

- Seat position detection
- Seat belt status
- Wiper motors
- Roof motor module

DESCRIPTION

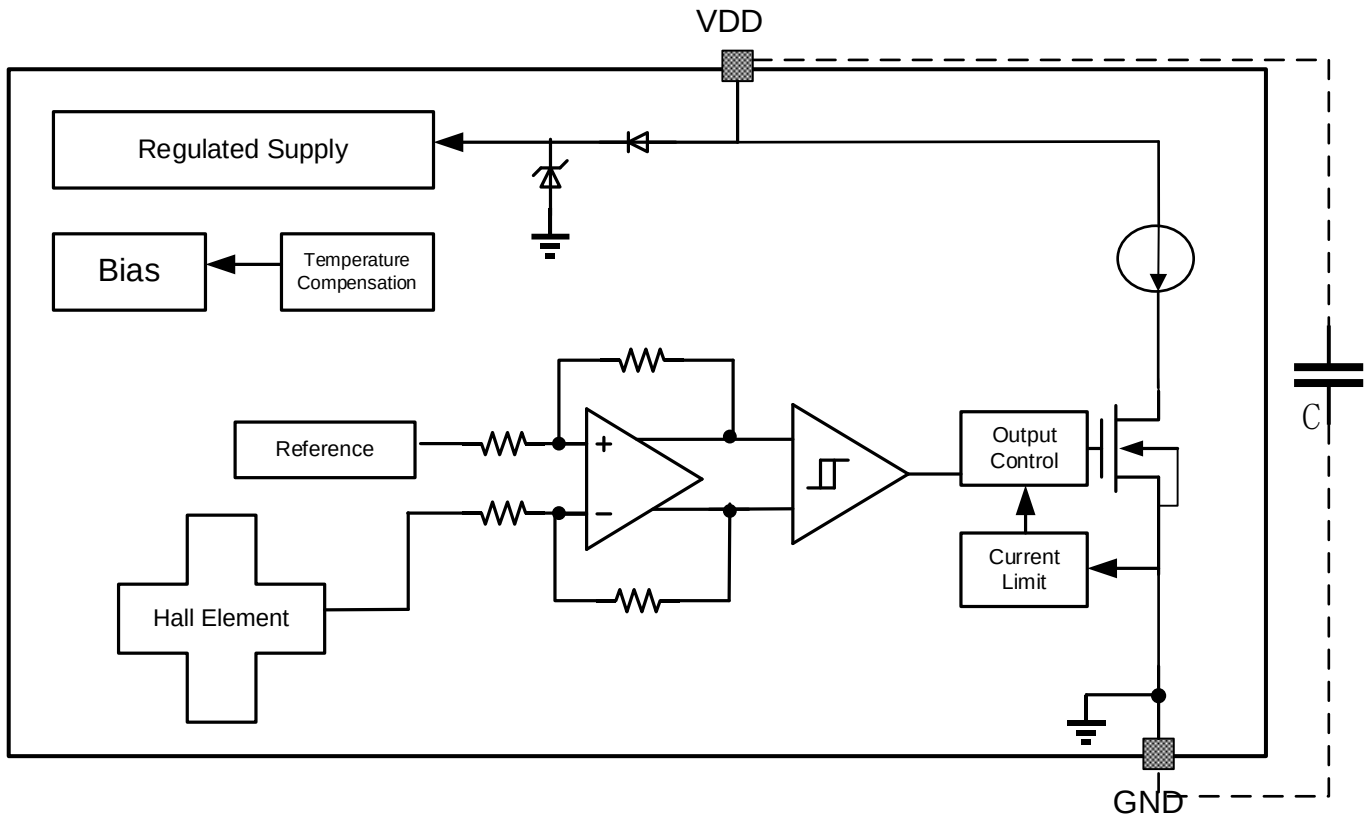
The SC25891 is a Hall-effect unipolar switch designed in BCD process technology. The device integrates a voltage regulator, Hall sensor with dynamic offset cancellation system, Schmitt trigger and an open-drain output driver, all in a single package.

The wide operating voltage range and extended choice of temperature range make it suitable for use in automotive, industrial applications.

The device is available in a 3-pin SOT-23 (SE) and TO-92(UA) package. Both are lead (Pb) free, with 100% matte tin lead frame plating.

CONTENTS

BLOCK DIAGRAM.

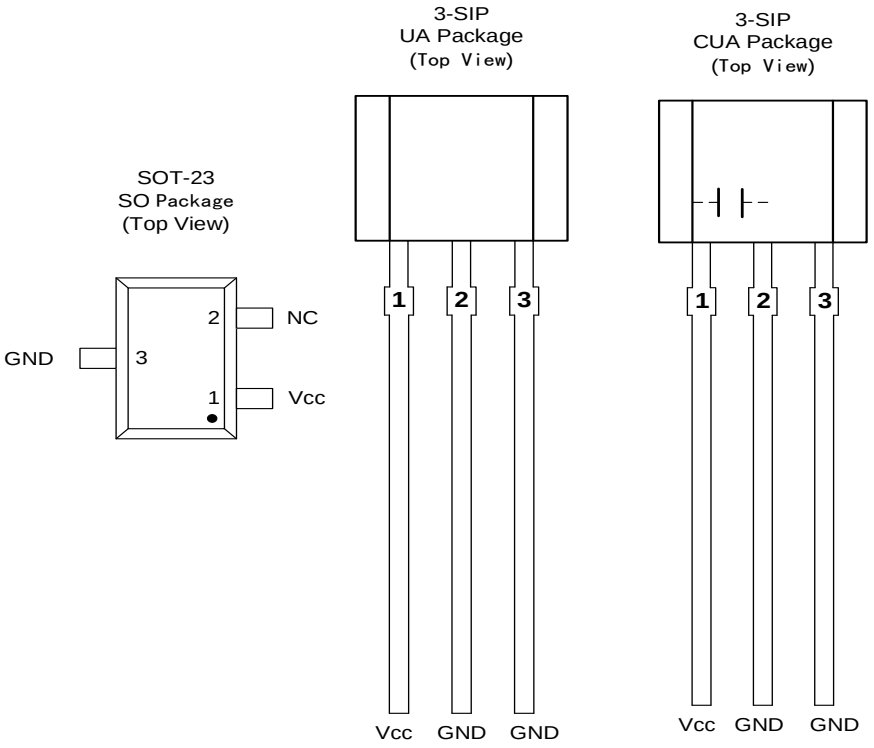


Comments：Only TO-92 CUA contain C=100nF internally，others do not.

ORDERING INFORMATION

Part Number	Package	Icc_Low	Icc_High	B_{OP}(Typ.)	B_{RP}(Typ.)
SC25891SE-A	SOT23	6mA	14mA	+9.0mT	+7.5mT
SC25891CUA-A	TO-92	6mA	14mA	+9.0mT	+7.5mT
SC25891UA-A	TO-92	6mA	14mA	+9.0mT	+7.5mT

TERMINAL CONFIGURATION



Terminal				Type	Description
Name	Number				
	SE	UA	CUA		
VCC	1	1	1	PWR	3.3V to 24V power supply
GND	3	2,3	2,3	GND	GND
NC	2			GND	Recommended to GND

ABSOLUTE MAXIMUM RATINGS

T_J = (-40 ~ 165℃) (unless otherwise noted) (1)

Parameter	Symbol	Min.	Max.	Units
Power supply voltage	VCC		28	V
Supply current	ICC		50(2)	mA
Reverse supply voltage	VCCREV	-18		V
Reverse supply current	ICCREV	-30(2)(3)		mA
Operating ambient temperature	T_A	-40	150	℃
Maximum junction temperature	T_J		165	℃
Storage temperature	T_{STG}	-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) For maximum 500ms

(3) Through production device

ESD PROTECTION

ESD tests according to: standard AEC-Q100-002

Parameter	Symbol	Rating	Units
ESD-Protection （HBM）	V_{ESD}	±8	KV
ESD-Protection （CDM）	V_{ESD}	±2	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	200	℃/W
$R_{\theta JA}$	SE Package thermal resistance	Single-layer PCB, with copper limited to solder pads	300	℃/W

OPERATING CHARACTERISTICS

Electrical Characteristics

T_J=(-40℃ to 165℃) (VCC = 3.3V to 24V, unless otherwise noted)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
SUPPLY CHARACTERISTICS						
VCC	Operating voltage (1)	TJ < TJ(Max.)	3.3	--	24	V
ICC_{Low}	Operating supply current	VCC= 3.3V to 24V	5	6	7	mA
ICC_{High}	Operating supply current	VCC= 3.3V to 24V	12	14	17	mA
t_{on}	Power-on time	VPULL=5V，Rpull=1KΩ，C=20pF，B=150Gs	--	35	50	μS
OUTPUT CHARACTERISTICS						
t_d	Output delay time	VCC=12V，Rpull=1KΩ，C=20pF，B=±150Gs	--	--	25	μS
Sr	Output Slew Rate	VCC=12V，Rsen=100Ω，CBYP=100nF，Clord=20pF，TA=-40℃~150℃	0.1	0.5	1	μS
Fsw	Maximum switching frequency	VCC=12V，Bop set up to 150Gs, 1KHz~50KHz，Step 1KHz	20	-	-	KHz
Fc	Chopping frequency	VCC=12V		800		KHz

Magnetic Characteristics

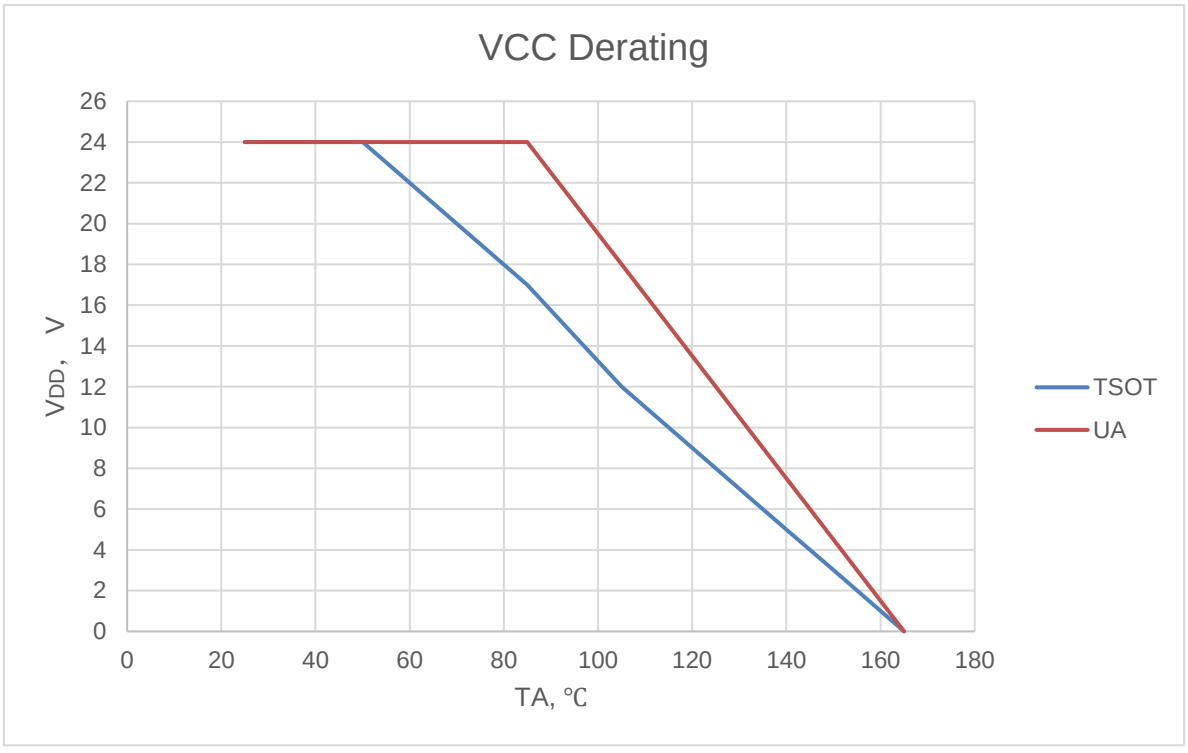
T_J=(-40℃ to 165℃) (VCC = 3.3Vto 24VV, unless otherwise noted)

SC25891xxx						
B_{OP}	Operated point	T_J=-40℃ to 165℃	6.0	9.0	12.0	mT
B_{RP}	Release point		5.0	7.5	10.0	mT
B_{HYS}	Hysteresis		-	1.5	-	mT

1mT=10GS

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.

VCC-Derating



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

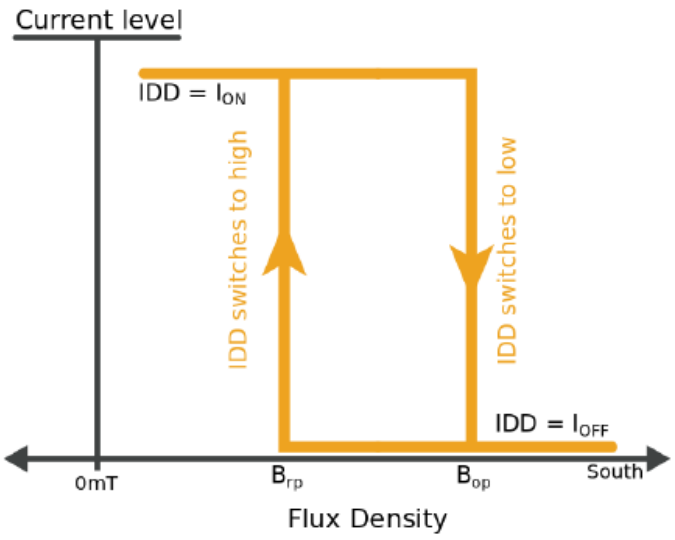
FUNCTION DESCRIPTION

The SC25891 device is a chopper-stabilized Hall sensor with a digital output for magnetic sensing applications. The device can be powered with a supply voltage between 3.3V and 24V. The device does not operate when -18V to 2.5V is applied to the VCC terminal (with respect to the GND terminal). In addition, the device can withstand voltages up to 28V for transient durations.

The output of SC25891 switches low (turns on) when a magnetic field (South polarity) perpendicular to the Hall element exceeds the operating point threshold, B_{OP}. When the magnetic field is reduced below the release point, B_{RP}, the device output goes high (turns off). The difference in the magnetic operation 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.

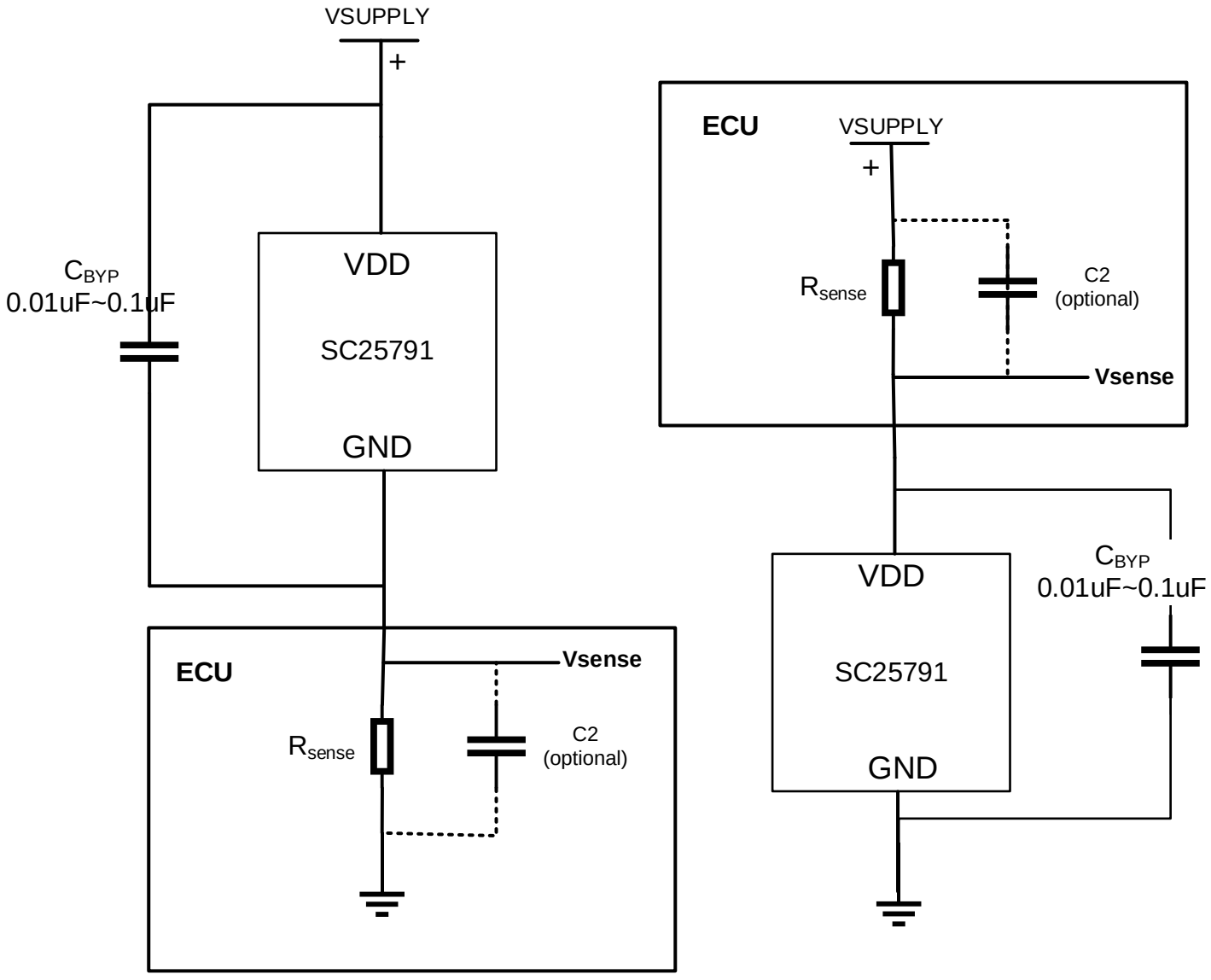
Transfer Function

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.

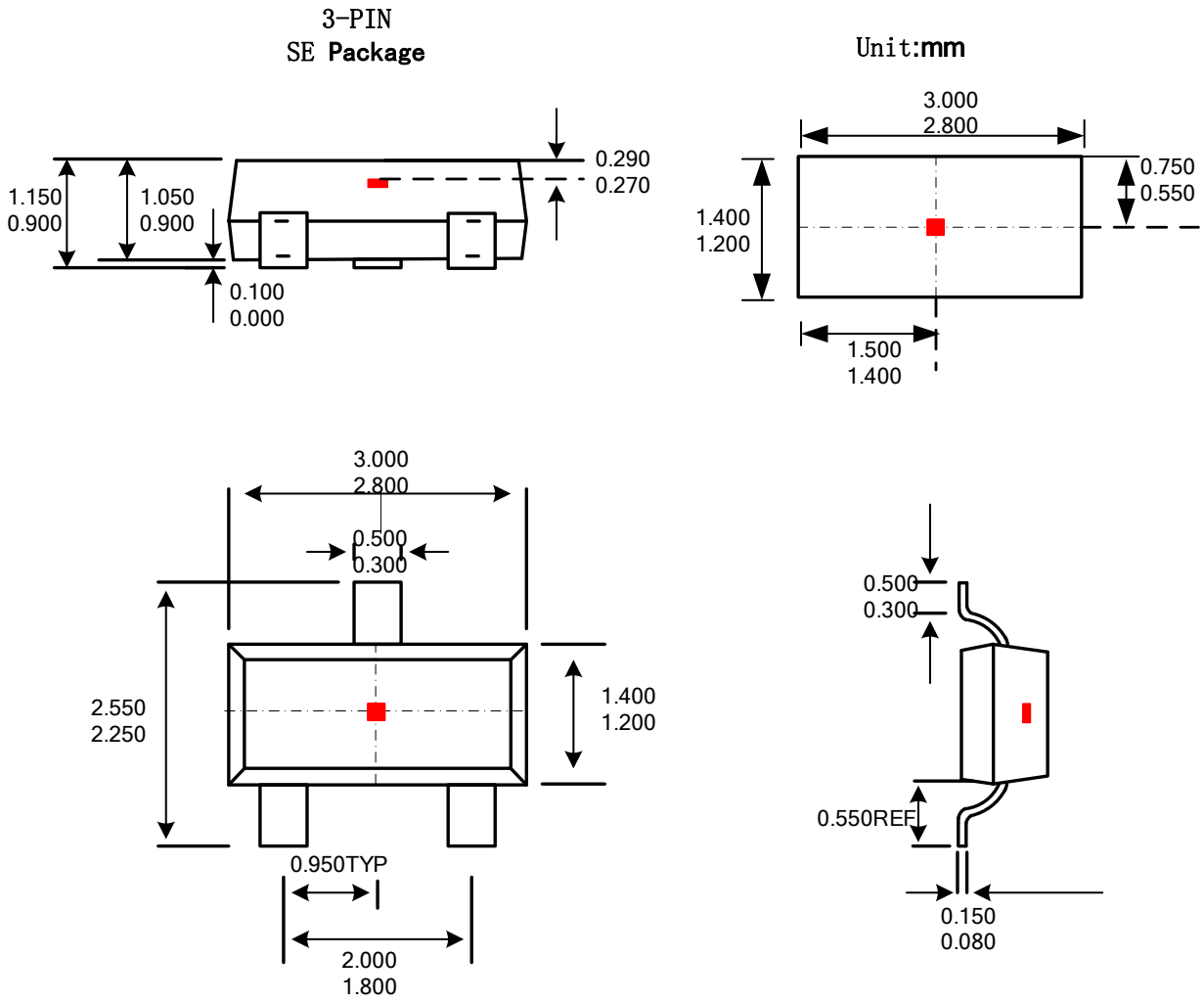


TYPICAL APPLICATION CIRCUIT

It is strongly recommended that an external bypass capacitor, CBYP, be connected (in close proximity to the Hall sensor) between the supply and ground of the device to guarantee correct performance under harsh environmental conditions and to reduce noise from internal circuitry(UA &SE Package). As is shown in Figure Below, a 0.01 μF capacitor is typical. Use of a larger bypass capacitor may result in a slower output slew rate and should be evaluated according to the requirements set forth by the application. Additionally, an optional output load capacitor may be added in parallel with the sense resistor for increased signal filtering and EMC immunity.



PACKAGE INFORMATION “SE



Notes:

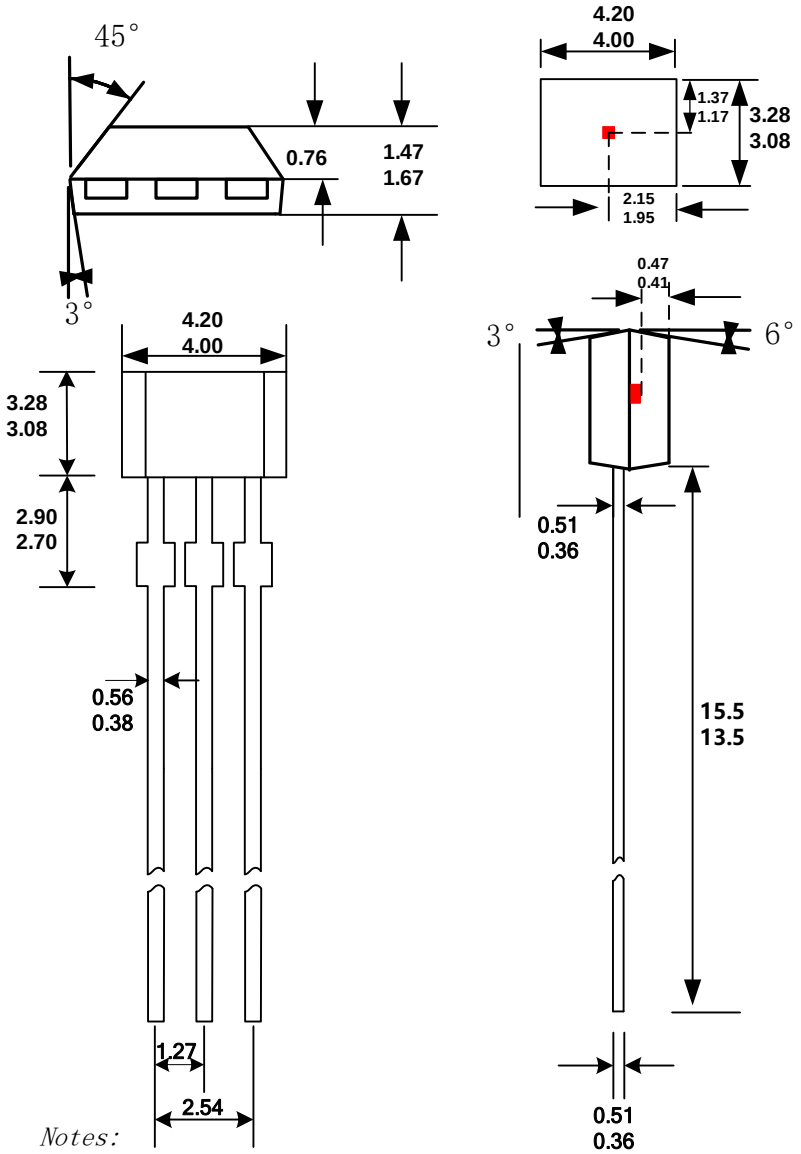
1. Exact body and lead configuration at vendor’ s option within limits shown.
2. Height does not include mold gate flash.
3. Red mark is Hall element

Where no tolerance is specified, dimension is nominal.

PACKAGE INFORMATION “UA”

3-Terminal
UA Package

Dimension:mm



Notes:

1. Exact body and lead configuration at vendor’s option within lim shown.

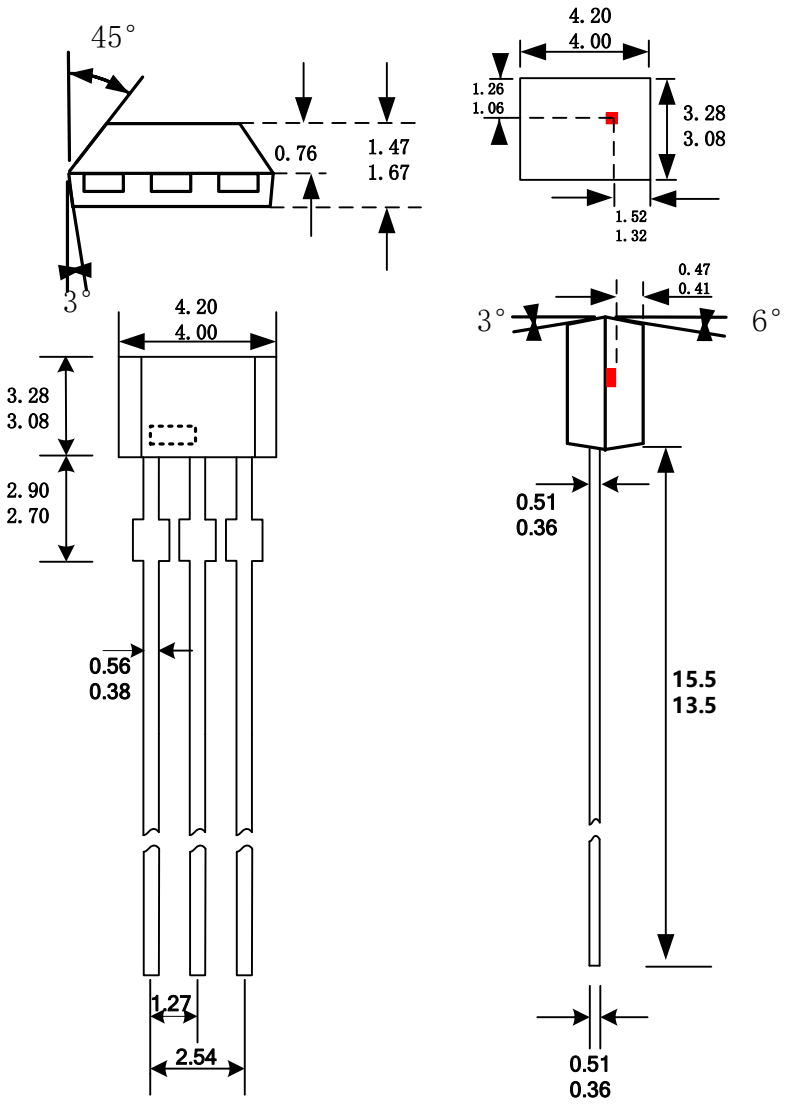
2. Height does not include mold gate flash.

Where no tolerance is specified, dimension is nominal.

PACKAGE INFORMATION “CUA”

3-Terminal
CUA 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.

REVISON HISTORY

Revision	Date	Description
Revision	**Date**	**Description**
Rev0.1	2022-9-08	Preliminary datasheet
Rev0.2	2022-12-5	Preliminary datasheet update
Rev0.3	2023-01-06	Publish datasheet update
Rev E1.0	2023-04-10	Unified datasheet format
Rev E1.1	2023-06-27	Update VCC de-rating curve
Rev E1.2	2023-07-03	Add TO-92　Package
Rev E1.3	2023-11-24	Add CUA TO-92 Package
Rev A1.0	2023-11-28	Formal version release