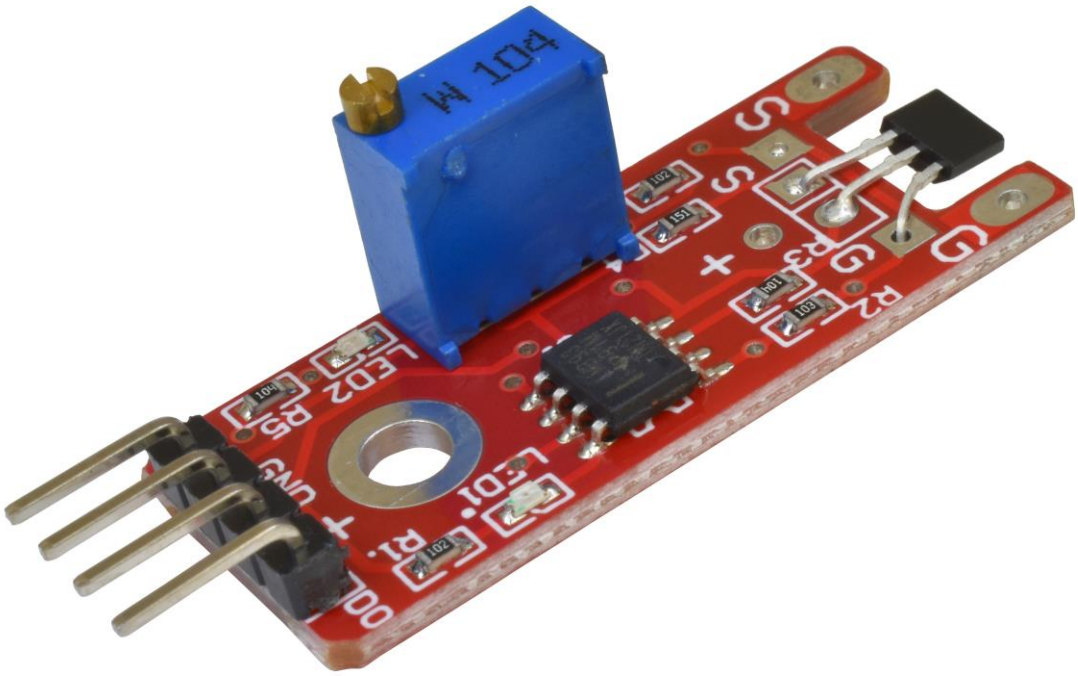
HALL EFFECT ANALOG / DIGITAL SENSOR MODULE - AH49E



The Linear Hall Effect Sensor Module detects both North and South poles and relative strength of a magnetic field and provides both analog and digital outputs.

Key Features of Linear Hall Effect Module

- Uses 49E analog Hall Effect sensor
- Can differentiate between North and South pole of the magnet
- Detects the relative strength of the magnetic field
- Provides analog output representative of relative magnetic strength
- Provides digital output when magnetic strength exceeds the adjustable set-point
- 3.3 or 5V operation

This module incorporates an analog Hall Effect sensor. Hall Effect sensors detect the presence of a magnetic field and are commonly used for measuring the RPM of rotating assemblies where a magnet on the assembly alternately makes and breaks magnetic contact with the sensor as the assembly rotates. They can even be used to detect electrical current flow through conductors in some cases.

Module Operation

The analog output sits at around 50% Vcc with no input, but this varies with the setting of the sensitivity adjustment pot. Any magnetic field picked up by the sensor causes this value to increase or decrease depending on whether the south or north pole of the magnet is coming near. The south pole of the magnet will cause the analog output to linearly ramp towards Linear Hall Effect Sensor Module Schematic Vcc to a maximum of about 4.2V (if Vcc is 5V). If the North Pole is presented, the voltage will linearly ramp towards ground to a minimum of 0.86V. The amount of the voltage change will depend on the strength of the magnetic field.

The digital output which is active HIGH is the result of a LM393 voltage comparator IC comparing the amplitude of the sensor to the level set by the on-board potentiometer. Turning the pot CW increases the sensitivity. An LED is turned on when the output goes active HIGH. If the pot is turned CCW (less sensitive), the LED will eventually always be off and if it is turned CW (more sensitive) it will come on as the magnet comes near.

The board also has a red LED which lights whenever power is applied.

To use this sensor with a microcontroller, if the strength of the field is to be measured, the analog output should be hooked up to an analog input. The output will read 1/2 Vcc with no magnetic field present. With a magnetic field, the voltage will change linearly at a rate of 2.5mV / G. Gauss (G) is the unit of measure for magnetism. If a basic GO / NO GO indication of a magnetic field is desired, the digital output can be connected to a digital input on the microcontroller.

Module Connections

Connections are made via a 4-pin.

GND / G		Ground
'+'		Vcc (3.3 to 5V)
A0		Analog output, connects to analog input on uC
D0		Digital output, connects to digital input on uC

LINEAR HALL-EFFECT IC AH49E

General Description

The AH49E is a small, versatile linear Hall-effect device that is operated by the magnetic field from a permanent magnet or an electromagnet. The output voltage is set by the supply voltage and varies in proportion to the strength of the magnetic field.

The integrated circuitry features low noise output, which makes it unnecessary to use external filtering. It also includes precision resistors to provide increased temperature stability and accuracy. The operating temperature range of these linear Hall sensors is -40°C to 85°C, appropriate for commercial, consumer and industrial applications.

The AH49E is available in standard TO-92S and SOT-23-3 packages.

Features

- Miniature Construction
- Power Consumption of 3.5mA at V_{CC}=5V for Energy Efficiency
- Single Current Sourcing Output
- Linear Output for Circuit Design Flexibility
- Low Noise Output Virtually Eliminates the Need for Filtering
- A Stable and Accurate Output
- Temperature Range of -40°C to 85°C
- Responds to Either Positive or Negative Gauss

Applications

- Current Sensing
- Motor Control
- Position Sensing
- Magnetic Code Reading
- Ferrous Metal Detector
- Vibration Sensing
- Liquid Level Sensing
- Weight Sensing

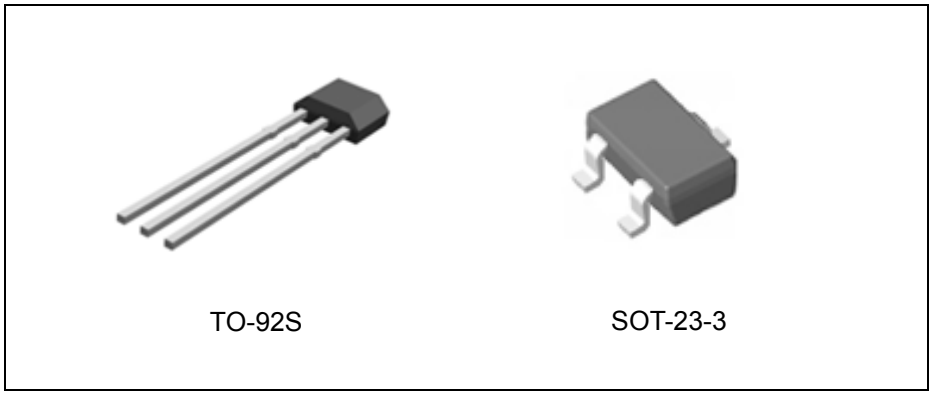


Figure 1. Package Types of AH49E

Pin Configuration

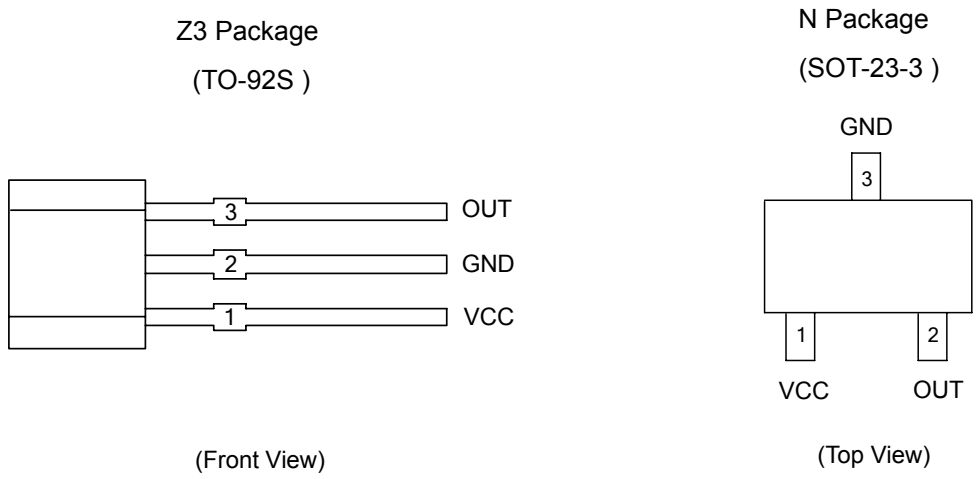
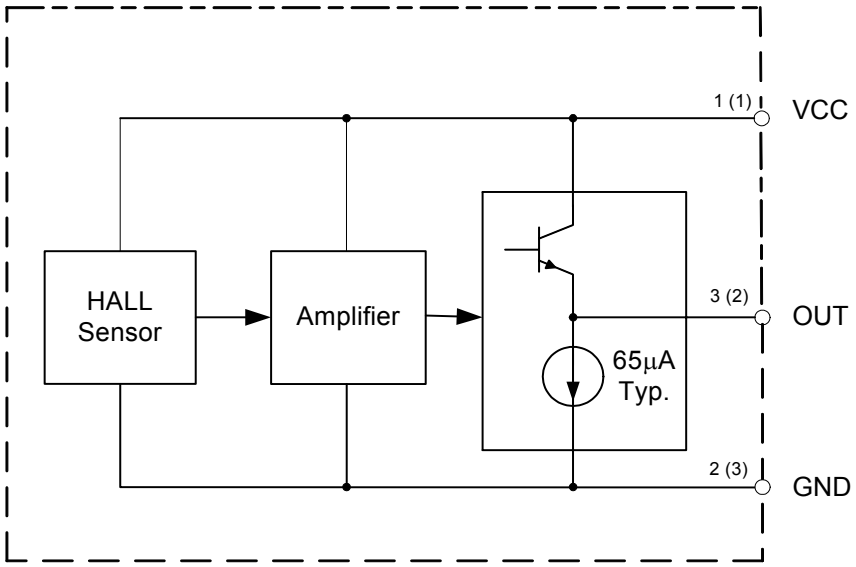


Figure 2. Pin Configuration of AH49E

Pin Description

Pin Number		Pin Name	Function
TO-92S	SOT-23-3		
1	1	VCC	Supply voltage
2	3	GND	Ground pin
3	2	OUT	Output

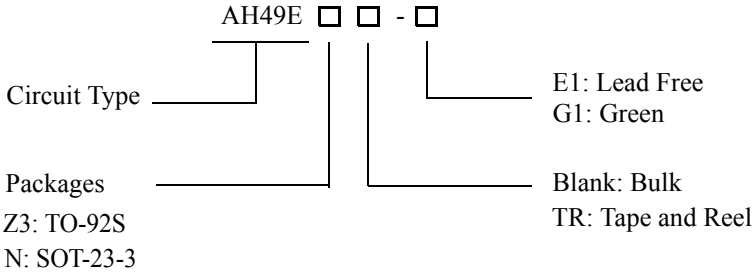
Functional Block Diagram



A (B)
A for TO-92S
B for SOT-23-3

Figure 3. Functional Block Diagram of AH49E

Ordering Information



Package	Temperature Range	Part Number		Marking ID		Packing Type
		Lead Free	Green	Lead Free	Green	
TO-92S	-40 to 85°C	AH49EZ3-E1	AH49EZ3-G1	AH49E	AH49G	Bulk
SOT-23-3			AH49ENTR-G1		GJ1	Tape & Reel

BCD Semiconductor's Pb-free products, as designated with "E1" suffix in the part number, are RoHS compliant. Products with "G1" suffix are available in green package.

Absolute Maximum Ratings (Note 1)

Parameter	Symbol	Value	Unit
Supply Voltage	V_{CC}	8	V
Output Current	I_O	10	mA
Operating Temperature	T_A	-40 to 100	°C
Storage Temperature Range	T_{STG}	-50 to 150	°C
ESD (Human Body Model)		3000	V

Note 1: Stresses greater than those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "Recommended Operating Conditions" is not implied. Exposure to "Absolute Maximum Ratings" for extended periods may affect device reliability.

Recommended Operating Conditions

Parameter	Symbol	Min	Max	Unit
Supply Voltage	V_{CC}	3.0	6.5	V
Operating Temperature	T_{OP}	-40	85	°C

Electrical Characteristics

(V_{CC}=5V, T_A=25°C, unless otherwise specified.)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Supply Current	I_{CC}			3.5	4.5	mA
Quiescent Output Voltage	V_{NULL}	@ B=0GS	2.25	2.5	2.75	V
Output Voltage Sensitivity		B=0GS to ±1000GS	1.1	1.6	2.1	mV/GS
Output Voltage Span	V_{OS}		1.0 to (V_{CC}-1.0)	0.8 to (V_{CC}-0.8)		V
Output Resistor	R_O			60	120	Ω
Magnetic Field Range	B		±650	±1000		GS
Linearity of Span				0.7		%
Output Noise		BW=10Hz to 10kHz		90		μV

Transfer Characteristics (V_{CC}=5V)

When there is no outside magnetic field (B=0GS), the quiescent output voltage is one-half the supply voltage in general.

For TO-92S package, if a south magnetic pole approches to the front face (the side with marking ID) of the Hall effect sensor, the circuit will drive the output voltage higher. Contrary, a north magnetic pole will drive the output voltage lower. The variations of voltage level up or down are symmetrical. Due to SOT-23-3 is reversed packaging with TO-92S, so the magnetic performance is also reversed. Therefor, if the reversed magnetic pole approches to the front face (the side with marking ID), the output is the same as TO-92S package.

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Greatest magnetic sensitivity is obtained with a supply voltage of 6V, but at the cost of increased supply current and a slight loss of output symmetry. So, it is not recommended to work in such condition unless the output voltage magnitude is a main issue. The output signal can be capacitively coupled to an amplifier for boosting further if the changing frequency of the magnetic field is high.

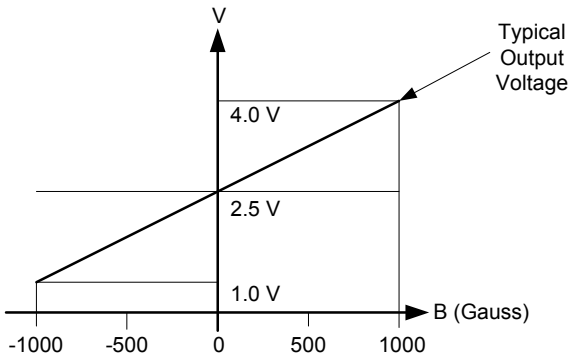
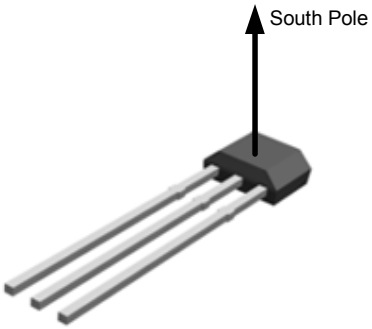
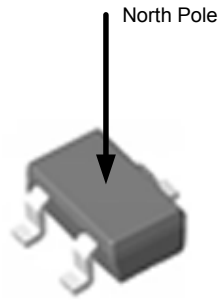


Figure 4. The Transfer Characteristics of AH49E



TO-92S Package



SOT-23-3 Package

Typical Performance Characteristics

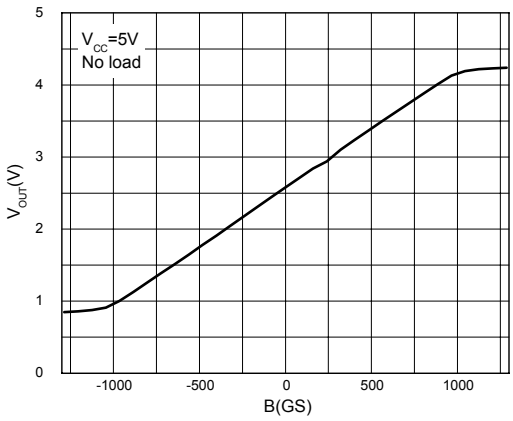


Figure 5. Output Voltage vs. Magnetic Field

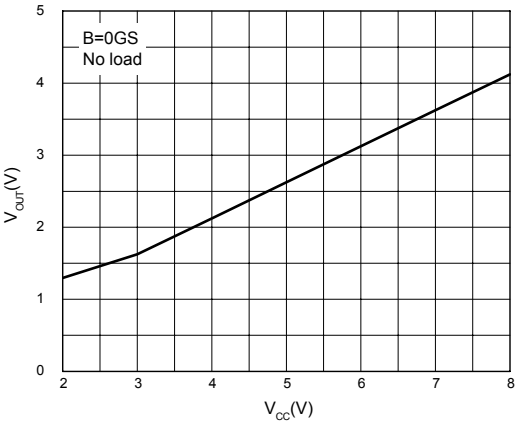


Figure 6. Output Voltage vs. Supply Voltage

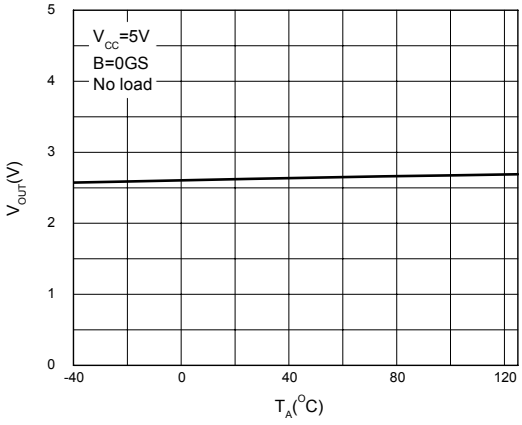
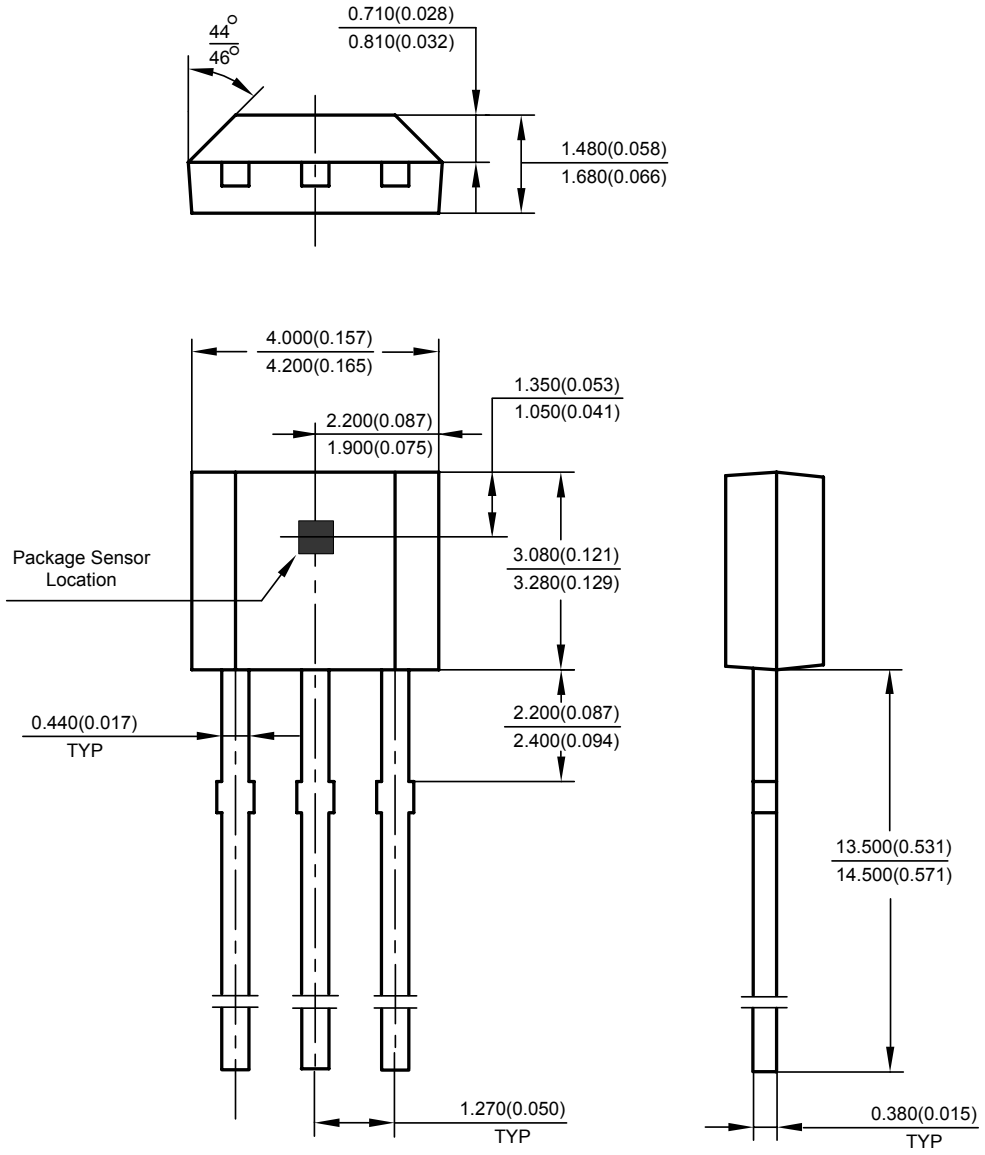


Figure 7. Output Voltage vs. Ambient Temperature

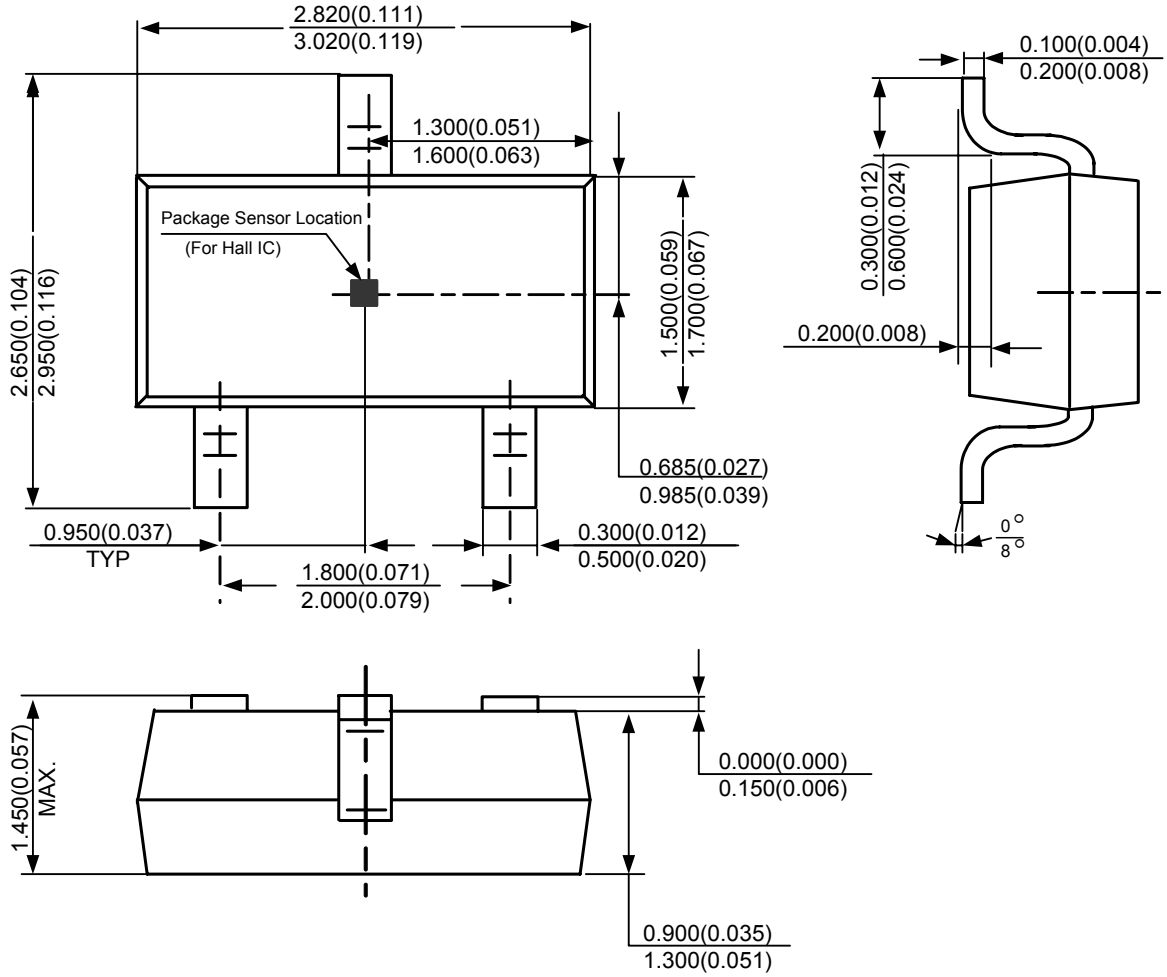
Mechanical Dimensions

TO-92S **Unit: mm(inch)**



Mechanical Dimensions (Continued)

SOT-23-3 **Unit: mm(inch)**



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