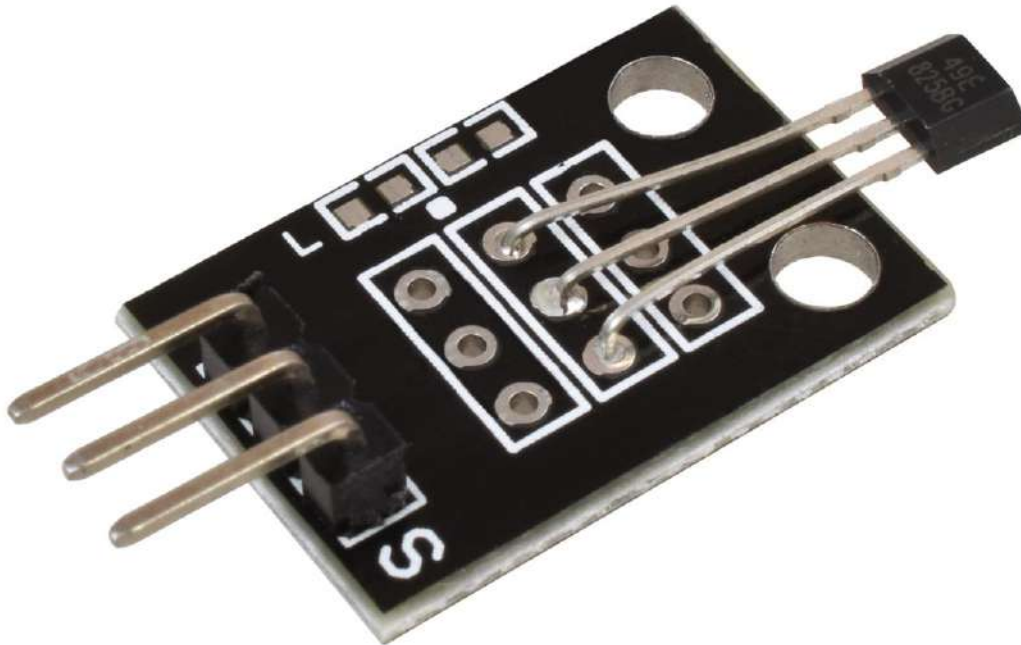


HALL EFFECT ANALOG SENSOR MODULE - HR0030



Specifications	
Function	Magnetic Detection
Model	KY-035 49E
Supply voltage	3 to 6 VDC
Operating current	4 to 8 mA
Output Signal	Analog - Linear
	Low magnetic field - 3.20 V
	High magnetic field - 4.30 V
Response time	3 uS
Output current max	20 mA
Sensor	49E
Dimensions	19 x 15 x 3mm
Mounting hole size	3 mm
Pin connections	
S	Data output
R (Supply Voltage)	3.3 to 5 VDC
G	0 VDC

Using the Magnetic Analog Hall Sensor KY-035 with Arduino

MAGNETIC ANALOG HALL SENSOR KY-035:

The KY-035 Module will be our main component for this tutorial. This module has a 49E Hall-effect switch IC in a TO-92 package and mounted on a breakout board with an LED and resistor. Figure 1 shows the module as seen in fritzing.

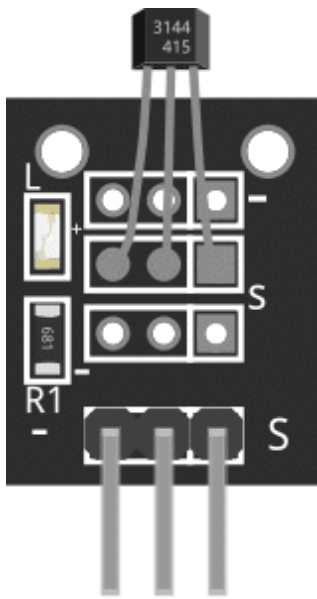


Figure 1: KY-035 Magnetic Hall Sensor

PIN OUT:

The KY-035 module has three pins.

Pin	Description
(-)	GND
Middle Pin	+5V
S	Signal

WHAT IS A HALL-EFFECT SENSOR 49E?

The Hall-Effect Sensor Analog 49E can detect the magnetic pole and relative strength of a magnetic field. In the case of our module, it sends an analog signal whenever it senses a magnetic field nearby. If there is no magnetic field, analog signal is half of the Vcc. Figure 2 shows the Block Diagram of the IC taken from its datasheet.

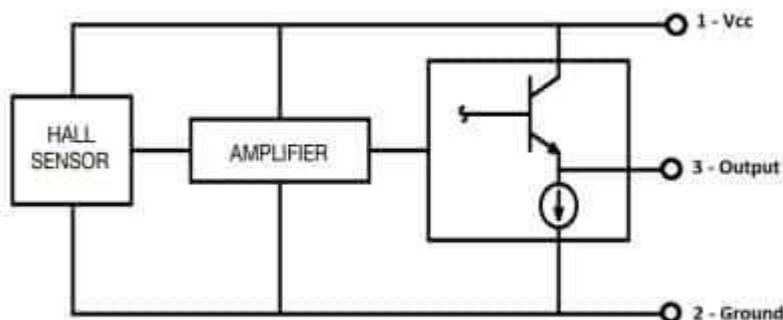


Figure 2: Block Diagram

PROJECT – ARDUINO MAGNETIC FIELD DETECTOR:

After learning about the KY-035 module and the 49E IC, it is now time to build a project using the module. Our project will activate the built-in LED of an Arduino Uno when there is a magnetic field near the KY-035 module.

PROJECT COMPONENTS:

For this project, we need the following components:

- Arduino Uno board (1 pc.)
- KY-035 Magnetic Hall Sensor (1 pc.)
- Jumper wires

WIRING DIAGRAM:

Figure 2 shows the connection between the Arduino Uno and the KY-035 Magnetic Hall Sensor.

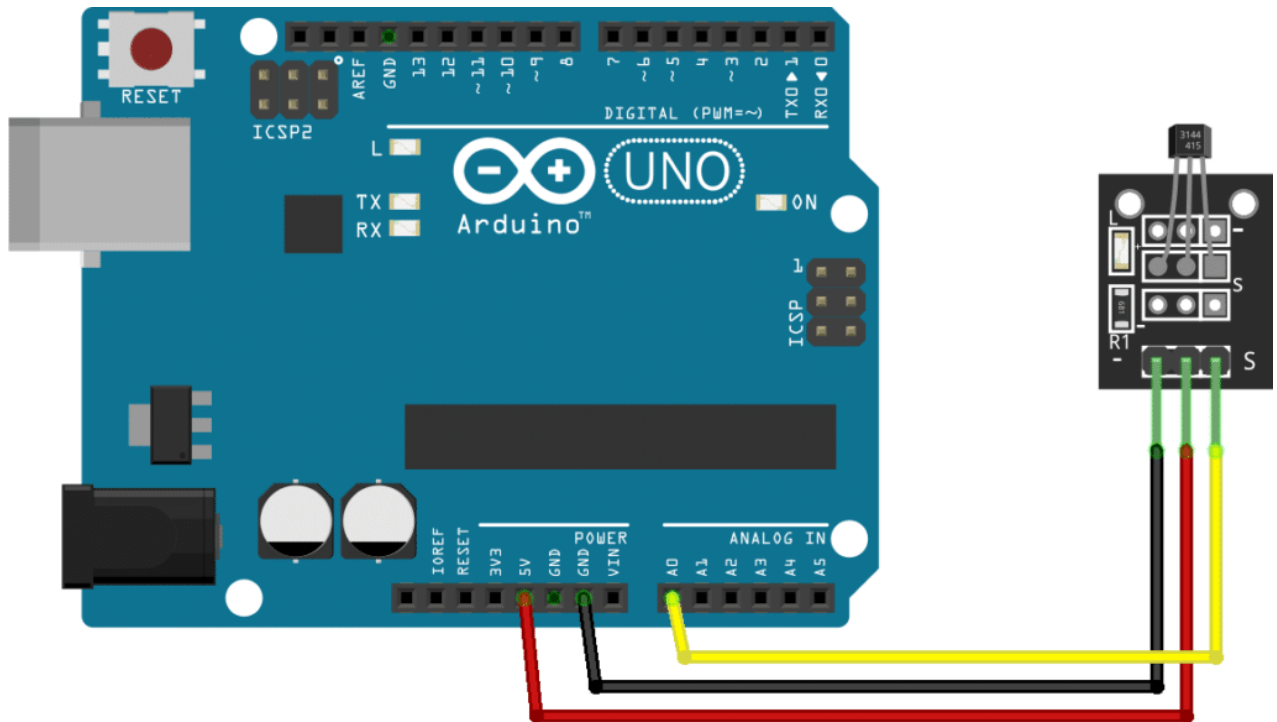


Figure 3: Connection Diagram

The KY-035 module pins are connected to the Arduino Uno board as follows:

Component Pin UNO Board Pin

(-)	GND
Middle Pin	+5V
S	A0

CODE:

Below is the Arduino sketch for our project. I have added comments to explain important parts of the code. Save the code as KY-035.ino and upload it to your Arduino board.

```
// Arduino and KY-035 module

void setup ()
{
  Serial.begin(9600); // initialize serial
}

void loop ()
{
  Serial.print(analogRead(A0)); // display analog and digital values to
  serial
}
```

PROJECT TEST:

Apply power to your Arduino Uno board and open the Serial Monitor. The analog value sent by the module will be displayed in the serial monitor. A value from 0~128 means a negative magnetic polarity while value from 129~255 means a positive magnetic polarity.

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

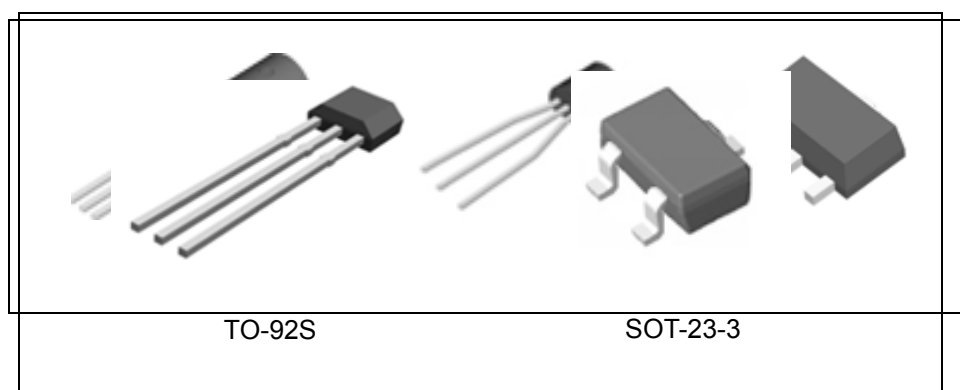


Figure 1. Package Types of AH49E

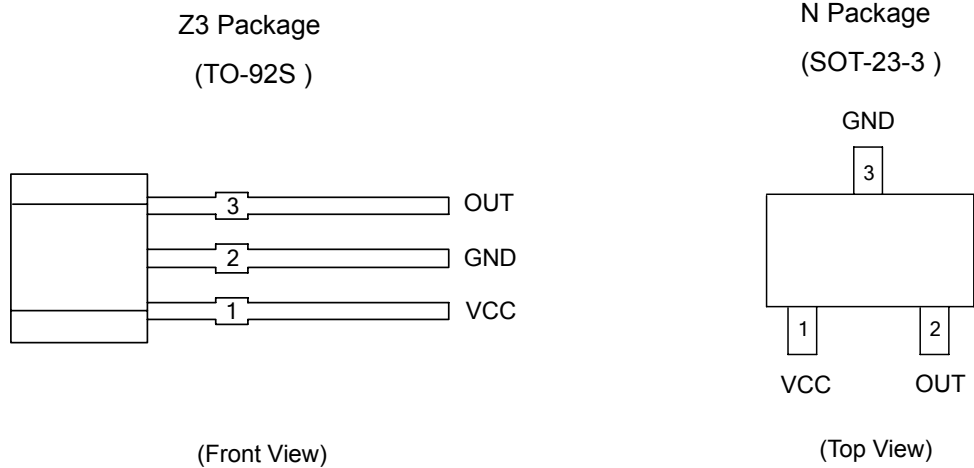
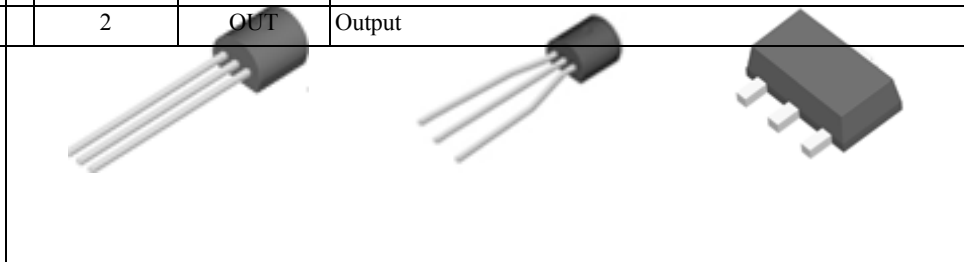
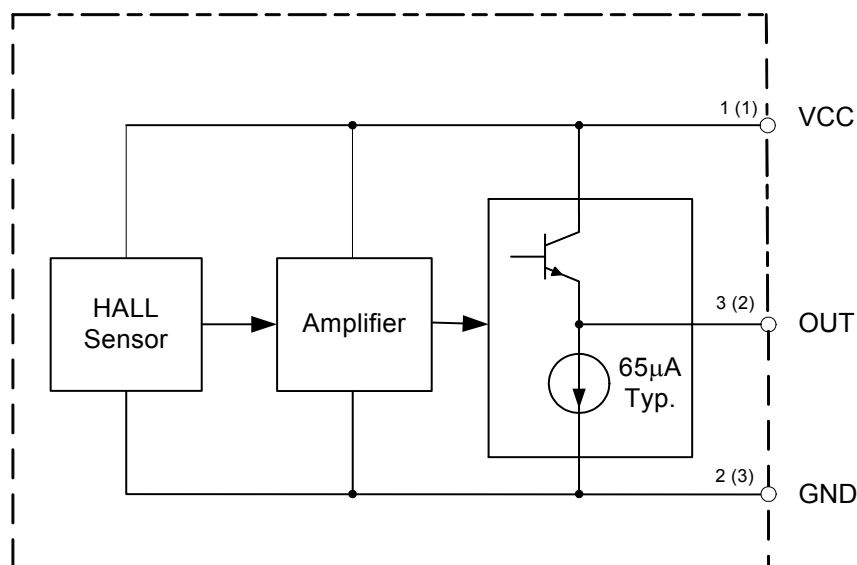
LINEAR HALL-EFFECT IC**AH49E****Pin Configuration**

Figure 2. Pin Configuration of AH49E

Pin Description

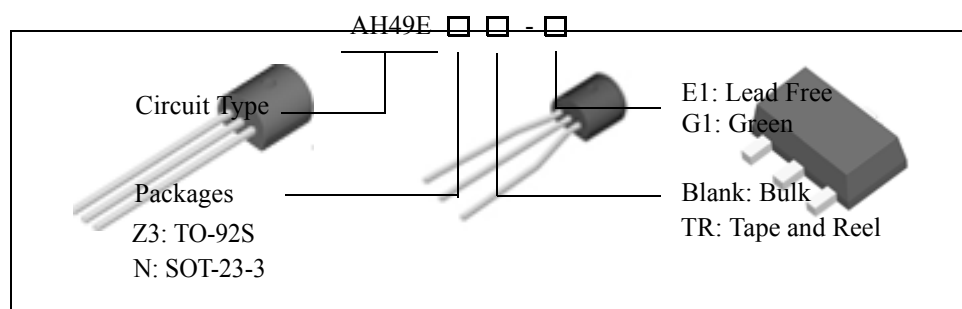
Pin Number		Pin Name	Function
TO-92S	SOT-23-3		
1	1	VCC	Supply voltage
2	3	GND	Ground pin
3	2	OUT	Output



LINEAR HALL-EFFECT IC**AH49E****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.

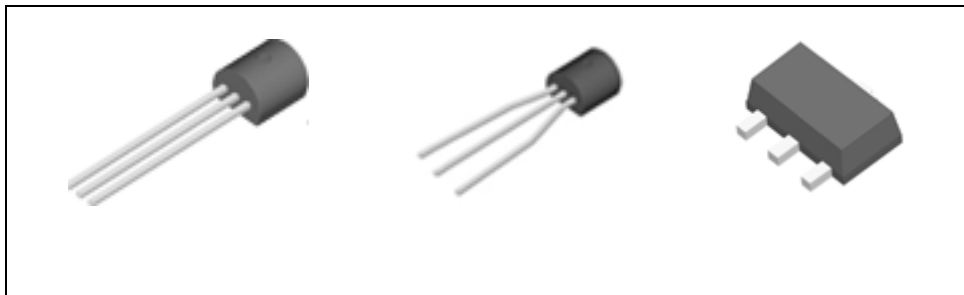
LINEAR HALL-EFFECT IC**AH49E****Absolute Maximum Ratings (Note 1)**

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.

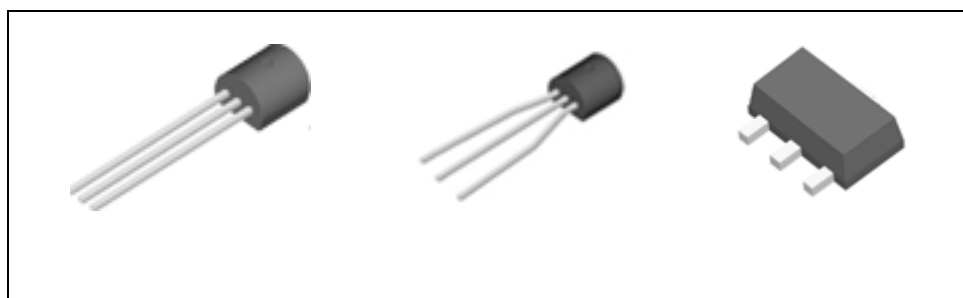
Recommended Operating Conditions

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



LINEAR HALL-EFFECT IC**AH49E****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



LINEAR HALL-EFFECT IC**AH49E****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 approaches 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. Therefore, if the reversed magnetic pole approaches the front face (the side with marking ID), the output is the same as TO-92S package.

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.

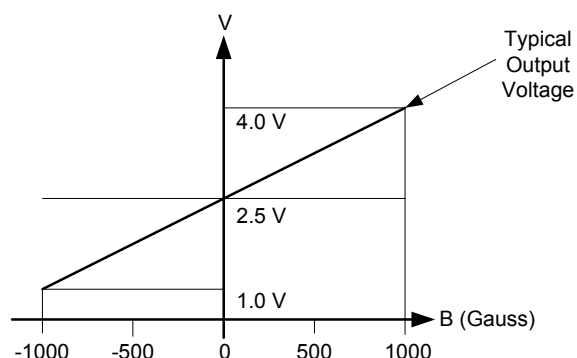
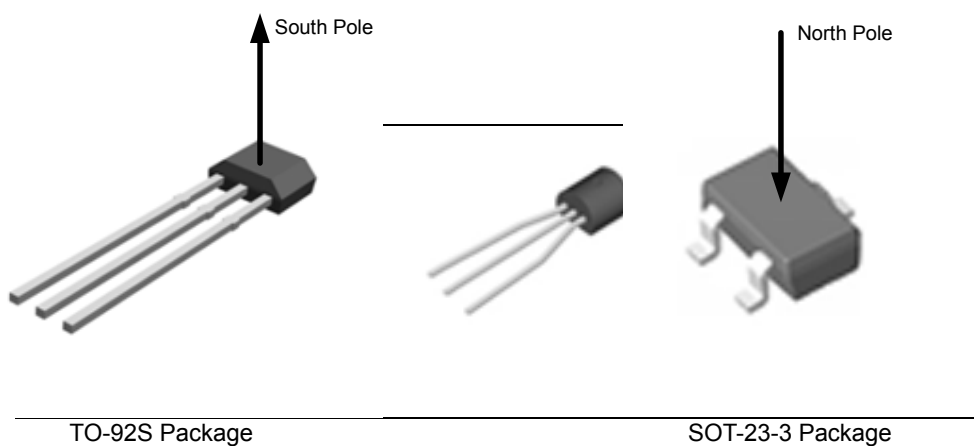


Figure 4. The Transfer Characteristics of AH49E



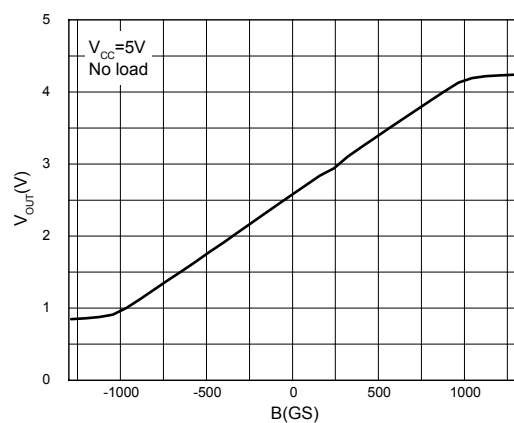
LINEAR HALL-EFFECT IC**AH49E****Typical Performance Characteristics**

Figure 5. Output Voltage vs. Magnetic Field

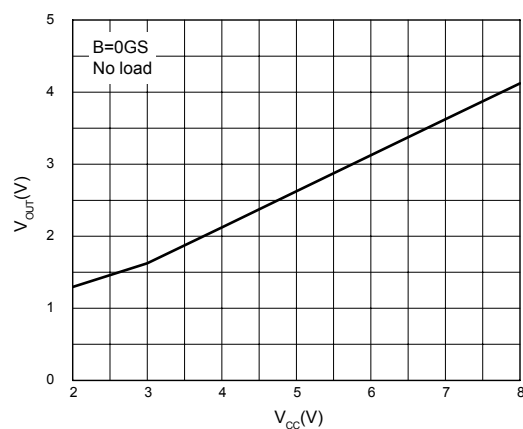


Figure 6. Output Voltage vs. Supply Voltage

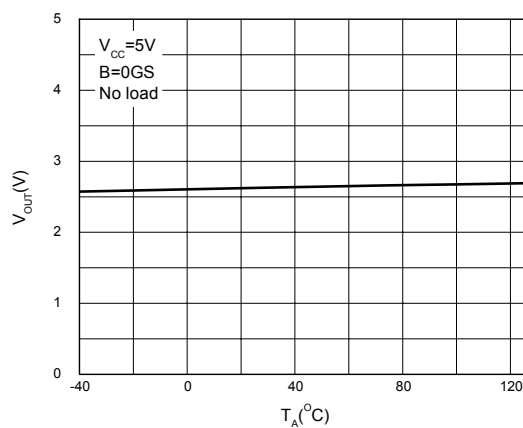
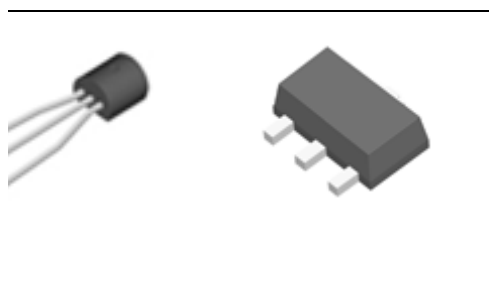
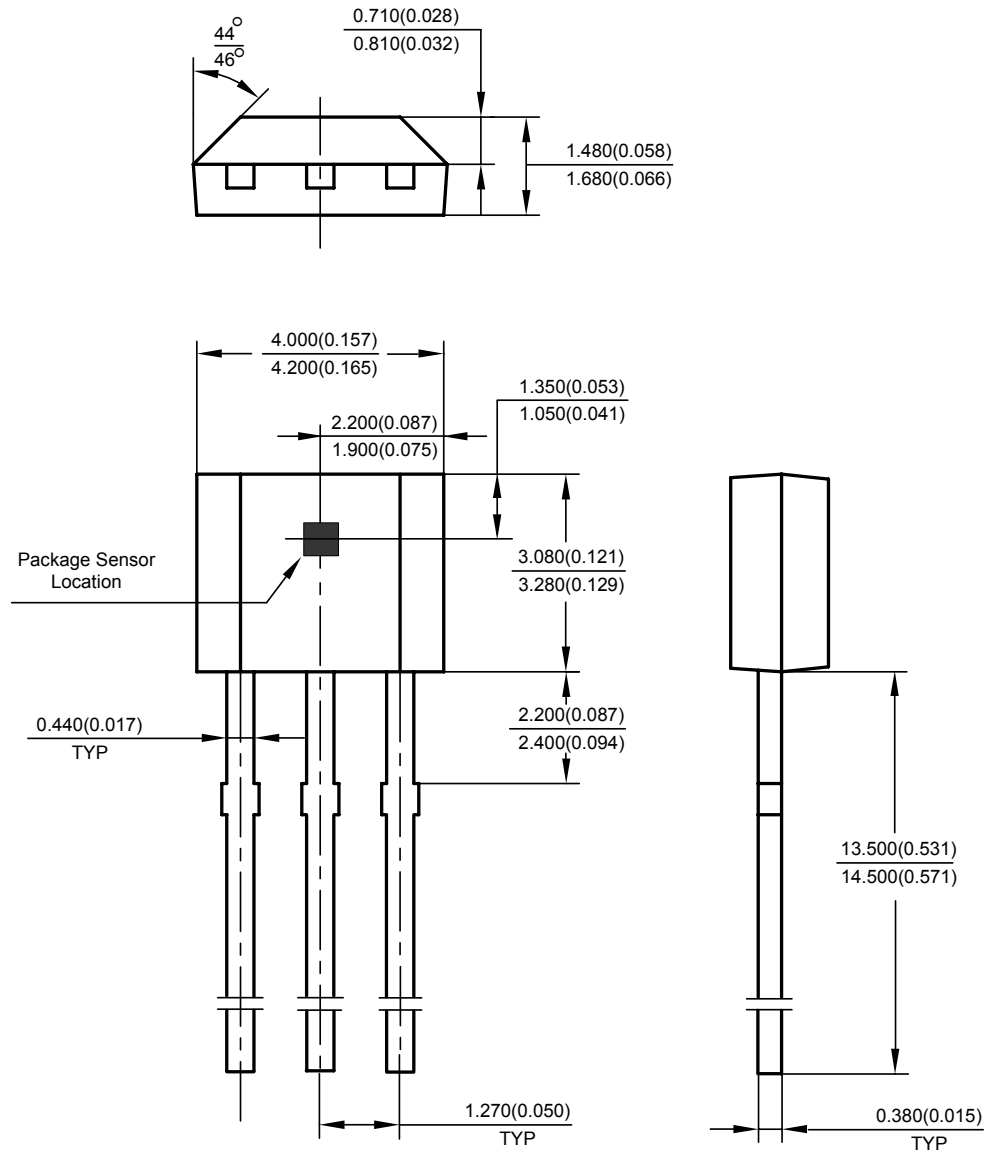


Figure 7. Output Voltage vs. Ambient Temperature



LINEAR HALL-EFFECT IC**AH49E****Mechanical Dimensions****TO-92S****Unit: mm(inch)**

LINEAR HALL-EFFECT IC**AH49E****Mechanical Dimensions (Continued)****SOT-23-3****Unit: mm(inch)**