

Description

The AH49F 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 components. 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 +105°C, appropriate for commercial, consumer, and industrial environments.

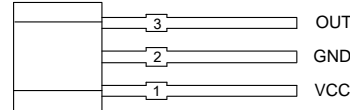
The AH49F is available in standard TO-92S, SC59 and U-DFN2020-6 packages.

Features

- Power Consumption of 3.0mA at $V_{CC} = 5V$ for Energy Efficiency
- Single Current Sourcing Output
- Linear Voltage Output for Circuit Design Flexibility
- Low Noise Output Virtually Eliminates the Need for Filtering
- A Stable and Accurate Output
- Temperature Range: -40°C to +105°C
- Responds to Either Positive or Negative Gauss
- The Maximum Instantaneous Supply Voltage Up to 50V
- High ESD Rating: 6000V (Human Body Model)
600V (Machine Model)
- Small low profile U-DFN2020-6 and Industry Standard SC59 and TO-92S Packages
- **Totally Lead-free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**

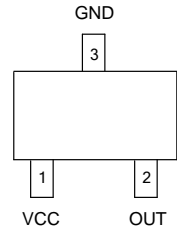
Pin Assignments

(Front View)



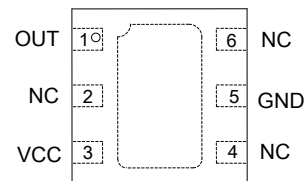
TO-92S

(Top View)



SC59

(Top View)



U-DFN2020-6

Applications

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

Notes:

1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.
2. See http://www.diodes.com/quality/lead_free.html for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.

Pin Descriptions

Package Type: TO-92S

| Pin Number | Pin Name | Description |
|------------|----------|------------------|
| 1 | VCC | Power supply pin |
| 2 | GND | Ground pin |
| 3 | OUT | Output pin |

Package Type: SC59

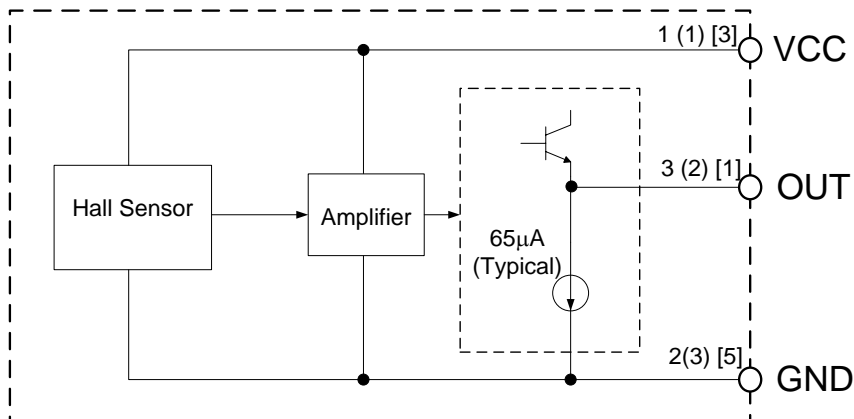
| Pin Number | Pin Name | Description |
|------------|----------|------------------|
| 1 | VCC | Power supply pin |
| 2 | OUT | Output pin |
| 3 | GND | Ground pin |

Package Type: U-DFN2020-6

| Pin Number | Pin Name | Description |
|------------|----------|---|
| 1 | OUT | Output pin |
| 2 | NC | No connection (Note 4) |
| 3 | VCC | Power supply pin |
| 4 | NC | No connection (Note 4) |
| 5 | GND | Ground pin |
| 6 | NC | No connection (Note 4) |
| Pad | Pad | Center exposed pad is internally connected to GND. It can be connected to GND or left open circuit on the PCB. (Note 5) |

Notes: 4. NC is "No Connection" pin and is not connected internally. This pin can be left open or tied to ground.
5. PAD is bottom side exposed pad;

Functional Block Diagram



A(B)[C]
A for TO-92S
B for SC59
C for U-DFN2020-6

Absolute Maximum Ratings (Note 6)

| Symbol | Parameter | Rating | | Unit |
|----------------------|------------------------------|-------------|-----|------|
| V _{CC} | Supply Voltage | 10 | | V |
| V _{CC_INST} | Instantaneous Supply Voltage | 50 | | V |
| P _D | Power Dissipation | TO-92S | 400 | mW |
| | | SC59 | 230 | |
| | | U-DFN2020-6 | 230 | |
| T _A | Ambient Temperature | -40 to +125 | | °C |
| T _{STG} | Storage Temperature | -50 to +150 | | °C |
| – | ESD (Human Body Model) | 6000 | | V |
| – | ESD (Machine Model) | 600 | | V |

Note 6: 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 (@T_A = +25°C)

| Symbol | Parameter | Min | Max | Unit |
|-----------------|-----------------------|-----|------|------|
| V _{CC} | Supply Voltage | 3 | 8 | V |
| T _{OP} | Operating Temperature | -40 | +105 | °C |

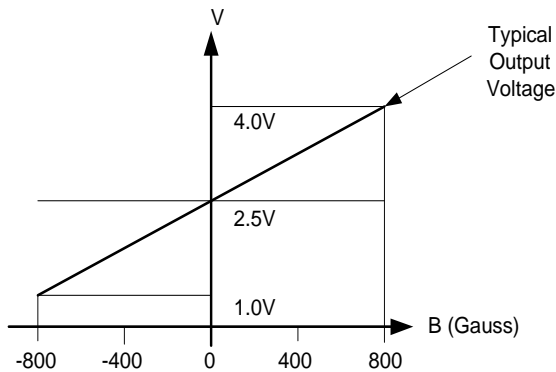
Electrical Characteristics (@V_{CC} = 5V, T_A = +25°C, unless otherwise specified.)

| Symbol | Parameters | Conditions | Min | Typ | Max | Unit |
|--------------------|----------------------------|-------------------------|--------------------------------|--------------------------------|------|----------|
| I _{CC} | Supply Current | – | 2 | 3 | 4 | mA |
| V _{NULL} | Quiescent Output Voltage | B = 0 (Gauss) | 2.25 | 2.5 | 2.75 | V |
| V _{SEN} | Output Voltage Sensitivity | B = 0 to ±600 (Gauss) | 1.7 | 2.1 | 2.5 | mV/Gauss |
| V _{OUT_S} | Output Voltage Span | – | 1.0 to (V _{CC} - 1.0) | 0.8 to (V _{CC} - 0.8) | – | V |
| R _{OUT} | Output Resistor | – | – | 60 | 120 | Ω |
| B | Linear Magnetic Range | – | ±500 | ±800 | – | Gauss |
| – | Linearity of Span | – | – | 0.7 | – | % |
| – | Output Noise | Bandwidth=10Hz to 10kHz | – | 90 | – | μV |

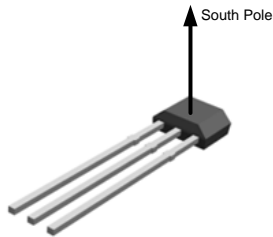
Transferring Characteristics (@ $V_{CC} = 5V$)

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

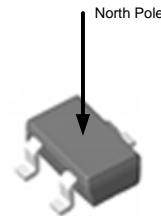
For TO-92S and U-DFN2020-6 packages, if a South magnetic pole approaches the part marking surface (the side with part marking ID) of the Hall effect sensor, the circuit will drive the output voltage higher. In contrary, a North magnetic pole will drive the output voltage lower. The variations of voltage level up or down from the quiescent output voltage (the null voltage) are symmetrical and is proportional to the magnetic flux density. In the SC59 the die is placed underneath the lead frame and therefore when a magnet pole approaches the SC59 part marking surface, the direction of the magnetic field in to the die is reversed compared to TO-92S. This results in a reverse response to the magnetic flux density in SC59 package compared with TO-92S and U-DFN2020-6 packages. (i.e. if the reverse magnetic pole approaches the part marking surface of SC59, the output is the same as TO-92S package.) The largest magnetic sensitivity is obtained with a supply voltage of 8V, 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 a next-level amplifier for further amplifying if the changing frequency of the magnetic field is high.



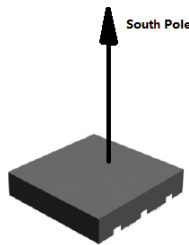
Transfer Characteristic



Magnetic Characteristic (For TO-92S)



Magnetic Characteristic (For SC59)



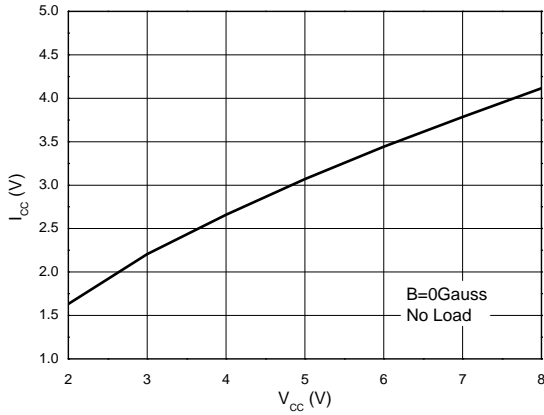
Magnetic Characteristic (For U-DFN2020-6)

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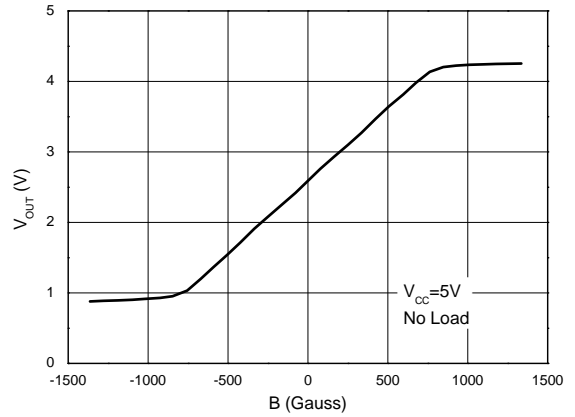
Performance Characteristics

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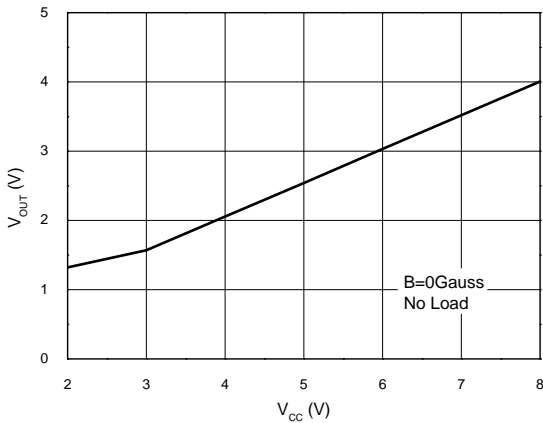
Supply Current vs. Supply Voltage



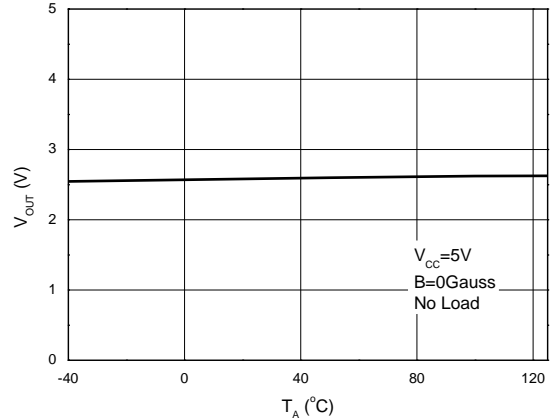
Output Voltage vs. Magnetic Field



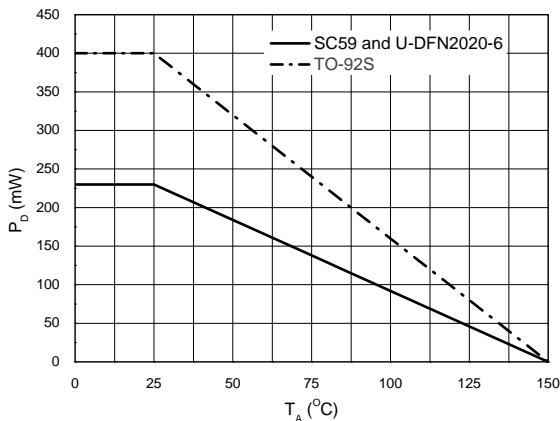
Output Voltage vs. Supply Voltage



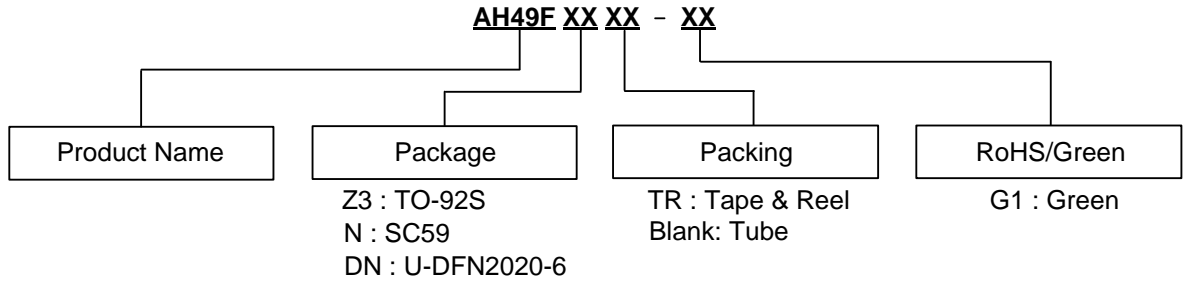
Output Voltage vs. Ambient Temperature



Power Dissipation vs. Ambient Temperature



Ordering Information



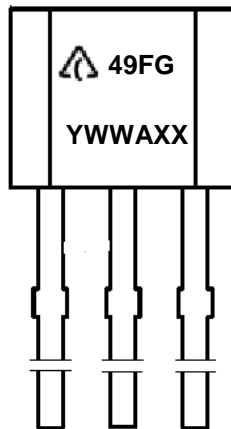
Diodes IC's Pb-free products with "G1" suffix in the part number, are RoHS compliant and green.

| Package | Temperature Range | Part Number | Marking ID | Packing |
|-------------|-------------------|--------------|------------|------------------|
| TO-92S | -40°C to +105°C | AH49FZ3-G1 | 49FG | 1000/Bulk |
| SC59 | | AH49FNTR-G1 | GT6 | 3000/Tape & Reel |
| U-DFN2020-6 | | AH49FDNTR-G1 | CN | 3000/Tape & Reel |

Marking Information

(1) Package Type: TO-92S

(Front View)



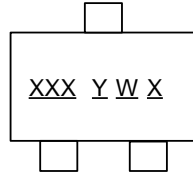
First line: Logo and Identification Code
 Second line: Date Code
 Y: Year 0 to 9
 WW: Week 00 to 52 (Work Week of Molding)
 A: Assembly House Code
 XX: 7th and 8th Digits: Batch No.

| Part Number | Package | Identification Code |
|-------------|---------|---------------------|
| AH49F | TO-92S | 49FG |

Marking Information (Cont.)

(2) Package Type: SC59

(Top View)

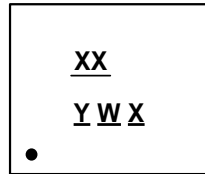


XXX : Identification Code
Y : Year 0 to 9
W : Week : A to Z : 1 to 26 Week;
a to z : 27 to 52 Week; z Represents
52 and 53 week
X : Internal Code

| Part Number | Package | Identification Code |
|-------------|---------|---------------------|
| AH49F | SC59 | GT6 |

(3) Package Type: U-DFN2020-6

(Top View)

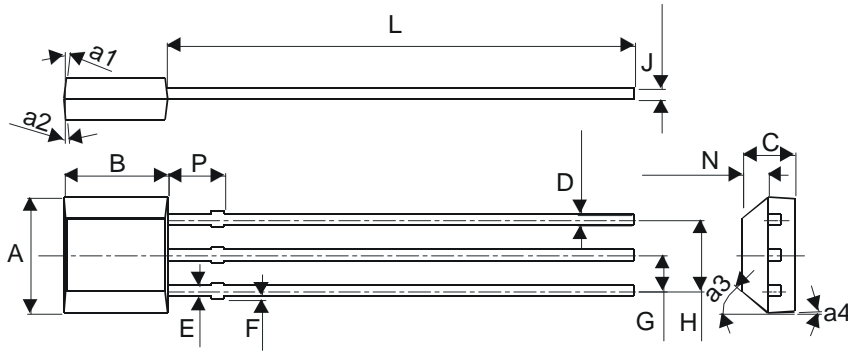


XX : Identification Code
Y : Year : 0~9
W : Week : A~Z : 1~26 Week;
a~z : 27~52 Week; z Represents
52 and 53 Week
X : Internal Code

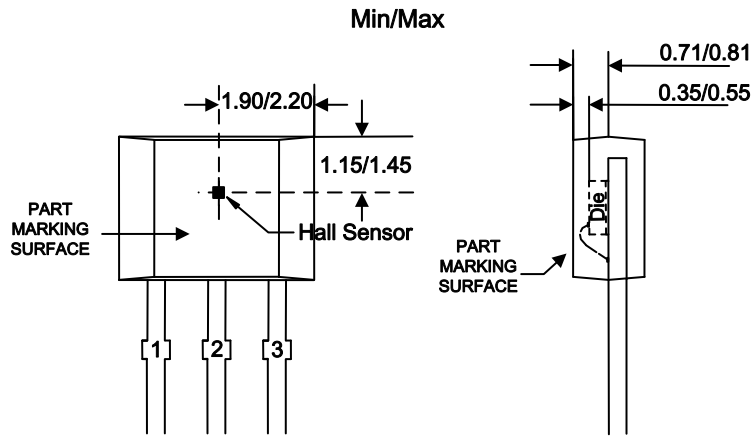
| Part Number | Package | Identification Code |
|-------------|-------------|---------------------|
| AH49F | U-DFN2020-6 | CN |

Package Outline Dimensions

(1) Package Type: TO-92S



| TO-92S | | |
|----------------------|----------|------|
| Dim | Min | Max |
| A | 4.0 | 4.2 |
| a1 | 3° Typ | |
| a2 | 6° Typ | |
| a3 | 45° Typ | |
| a4 | 3° Typ | |
| B | 3.08 | 3.28 |
| C | 1.48 | 1.68 |
| D | 0.36 | 0.56 |
| E | 0.44 Typ | |
| F | -0.05 | 0.20 |
| G | 1.27 Typ | |
| H | 2.54 Typ | |
| J | 0.38 Typ | |
| L | 13.5 | 14.5 |
| N | 0.71 | 0.81 |
| P | 2.60 | 3.00 |
| All Dimensions in mm | | |

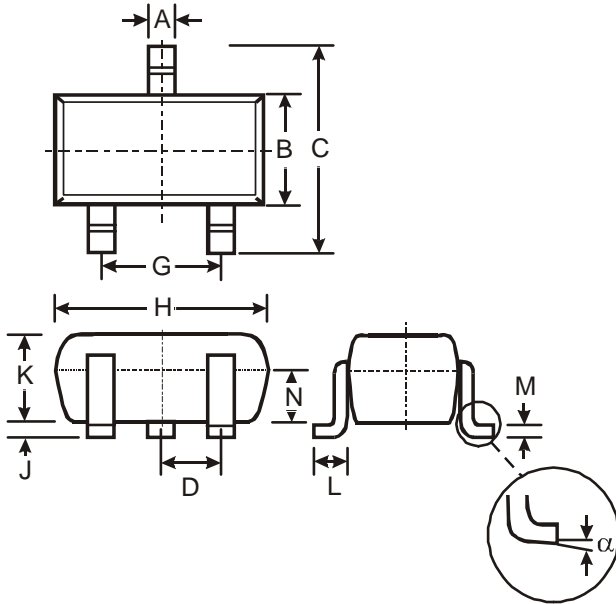


Sensor Location

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Package Outline Dimensions (Cont.)

(2) Package Type: SC59

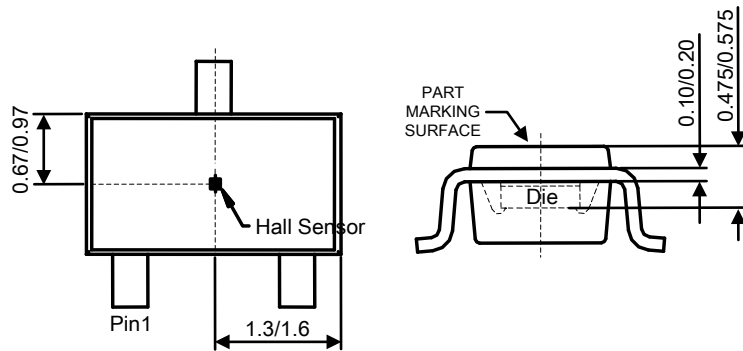


| SC59 | | | |
|------|-------|------|------|
| Dim | Min | Max | Typ |
| A | 0.35 | 0.50 | 0.38 |
| B | 1.50 | 1.70 | 1.60 |
| C | 2.70 | 3.00 | 2.80 |
| D | - | - | 0.95 |
| G | - | - | 1.90 |
| H | 2.90 | 3.10 | 3.00 |
| J | 0.013 | 0.10 | 0.05 |
| K | 1.00 | 1.30 | 1.10 |
| L | 0.35 | 0.55 | 0.40 |
| M | 0.10 | 0.20 | 0.15 |
| N | 0.70 | 0.80 | 0.75 |
| α | 0° | 8° | - |

All Dimensions in mm

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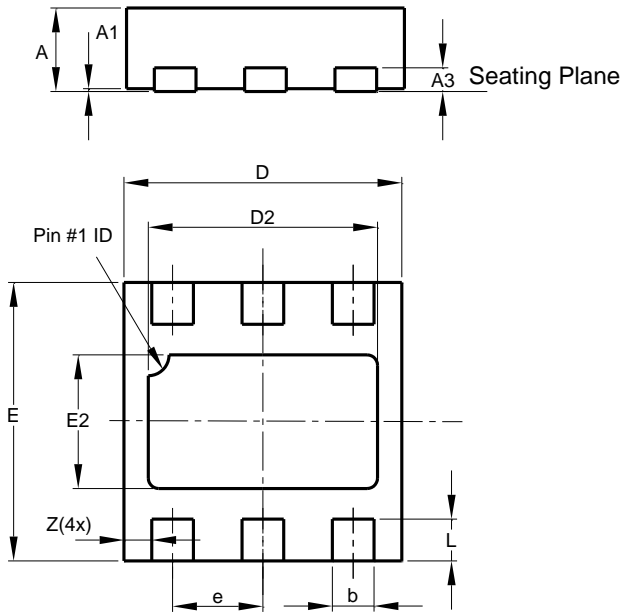
Min/Max



Sensor Location

Package Outline Dimensions (Cont.)

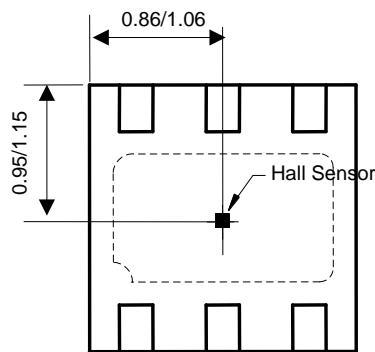
(3) Package Type: U-DFN2020-6



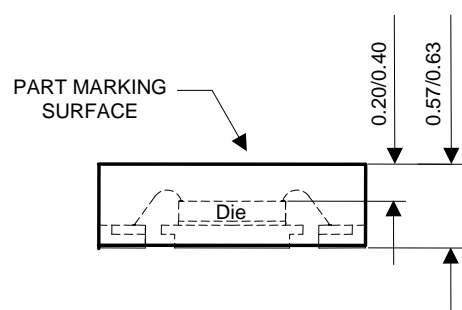
Bottom View

| U-DFN2020-6 Type C | | | |
|-----------------------------|------|-------|------|
| Dim | Min | Max | Typ |
| A | 0.57 | 0.63 | 0.60 |
| A1 | 0.00 | 0.05 | 0.02 |
| A3 | — | — | 0.15 |
| b | 0.25 | 0.35 | 0.30 |
| D | 1.95 | 2.075 | 2.00 |
| D2 | 1.55 | 1.75 | 1.65 |
| E | 1.95 | 2.075 | 2.00 |
| E2 | 0.86 | 1.06 | 0.96 |
| e | — | — | 0.65 |
| L | 0.25 | 0.35 | 0.30 |
| Z | — | — | 0.20 |
| All Dimensions in mm | | | |

Min/Max



Top View

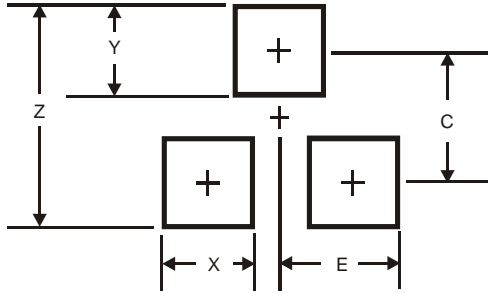


Sensor Location

NEW PRODUCT

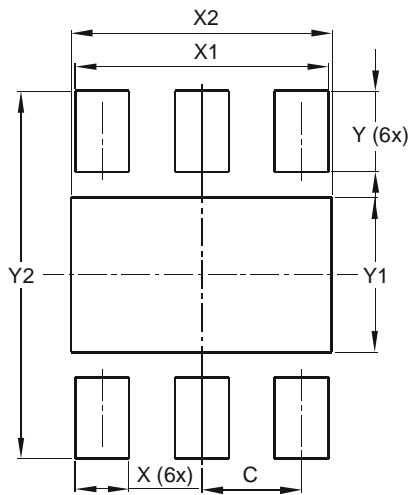
Suggested Pad Layout

(1) Package Type: SC59



| Dimensions | Value (in mm) |
|------------|---------------|
| Z | 3.4 |
| X | 0.8 |
| Y | 1.0 |
| C | 2.4 |
| E | 1.35 |

(2) Package Type: U-DFN2020-6



| Dimensions | Value (in mm) |
|------------|---------------|
| C | 0.650 |
| X | 0.350 |
| X1 | 1.650 |
| X2 | 1.700 |
| Y | 0.525 |
| Y1 | 1.010 |
| Y2 | 2.400 |

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