

## 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.

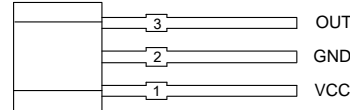
The AH49F is available in standard TO-92S, SC59 and U-DFN2020-6 packages.

## 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)**

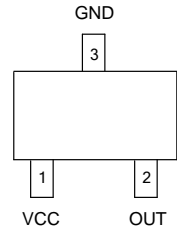
## Pin Assignments

(Front View)



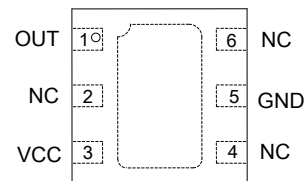
**TO-92S**

(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](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

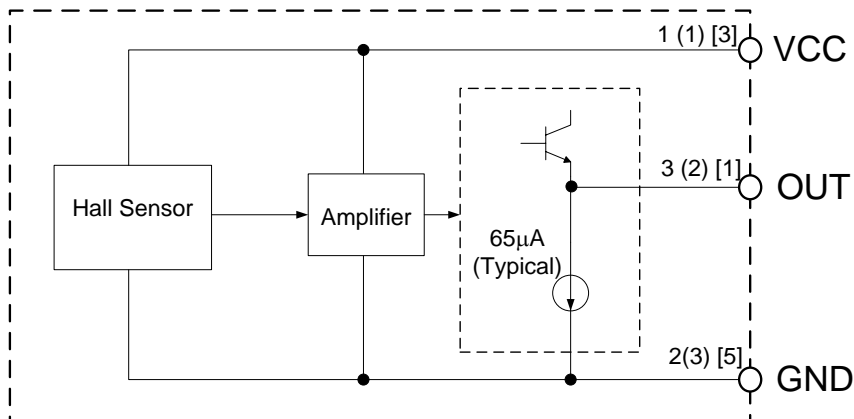
Pin Number	Pin Name	Description
1	VCC	Power supply pin
2	OUT	Output pin
3	GND	Ground pin

### 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 <sub>CC</sub>	Supply Voltage	10		V
V <sub>CC_INST</sub>	Instantaneous Supply Voltage	50		V
P <sub>D</sub>	Power Dissipation	TO-92S	400	mW
		SC59	230	
		U-DFN2020-6	230	
T <sub>A</sub>	Ambient Temperature	-40 to +125		°C
T <sub>STG</sub>	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<sub>A</sub> = +25°C)

Symbol	Parameter	Min	Max	Unit
V <sub>CC</sub>	Supply Voltage	3	8	V
T <sub>OP</sub>	Operating Temperature	-40	+105	°C

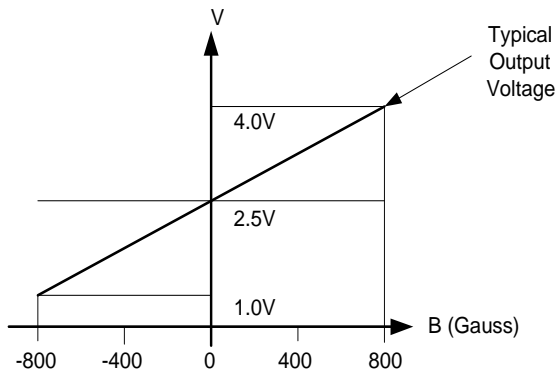
## Electrical Characteristics (@V<sub>CC</sub> = 5V, T<sub>A</sub> = +25°C, unless otherwise specified.)

Symbol	Parameters	Conditions	Min	Typ	Max	Unit
I <sub>CC</sub>	Supply Current	–	2	3	4	mA
V <sub>NULL</sub>	Quiescent Output Voltage	B = 0 (Gauss)	2.25	2.5	2.75	V
V <sub>SEN</sub>	Output Voltage Sensitivity	B = 0 to ±600 (Gauss)	1.7	2.1	2.5	mV/Gauss
V <sub>OUT_S</sub>	Output Voltage Span	–	1.0 to (V <sub>CC</sub> - 1.0)	0.8 to (V <sub>CC</sub> - 0.8)	–	V
R <sub>OUT</sub>	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

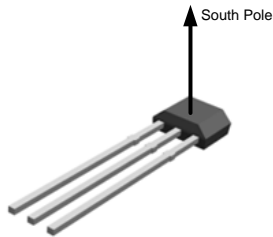
**Transferring Characteristics** (@ $V_{CC} = 5V$ )

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

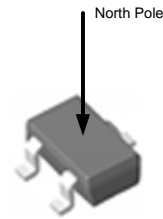
For TO-92S and U-DFN2020-6 packages, if a South magnetic pole approaches the part marking surface (the side with part marking ID) of the Hall effect sensor, the circuit will drive the output voltage higher. In contrary, a North magnetic pole will drive the output voltage lower. The variations of voltage 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.



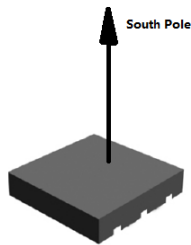
**Transfer Characteristic**



**Magnetic Characteristic (For TO-92S)**



**Magnetic Characteristic (For SC59)**



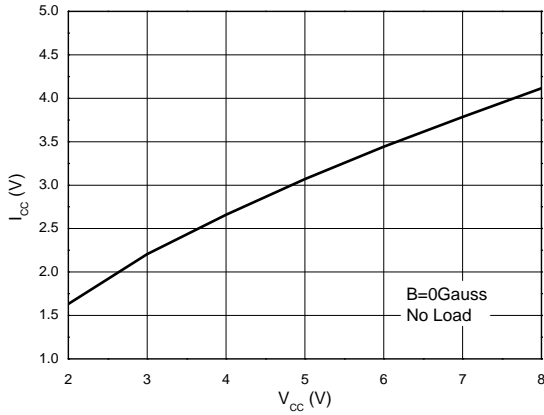
**Magnetic Characteristic (For U-DFN2020-6)**

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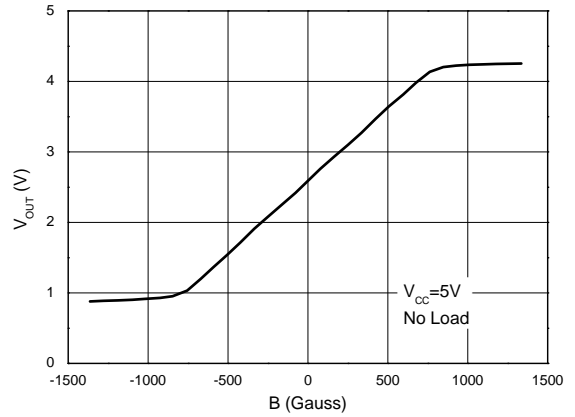
**Performance Characteristics**

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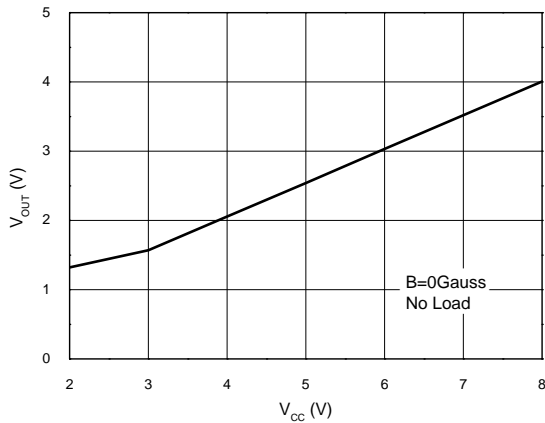
**Supply Current vs. Supply Voltage**



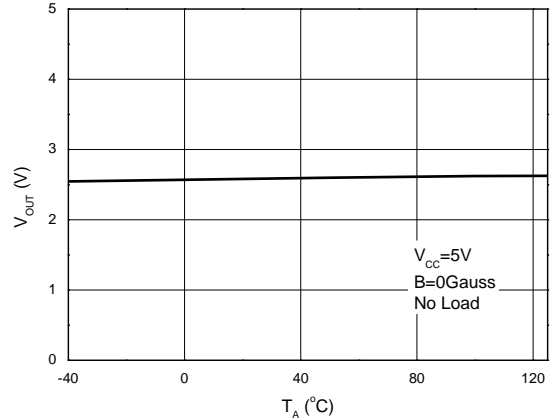
**Output Voltage vs. Magnetic Field**



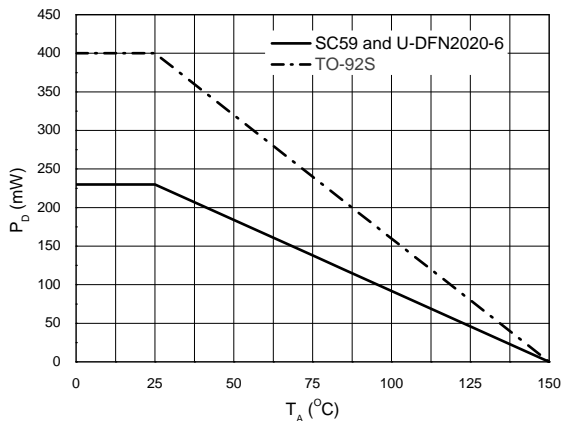
**Output Voltage vs. Supply Voltage**



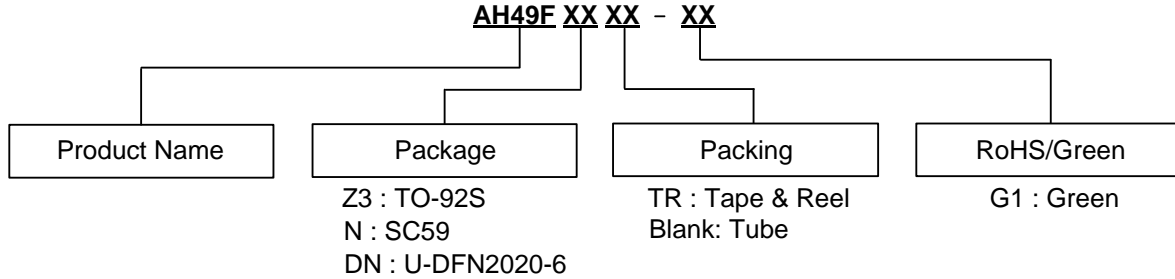
**Output Voltage vs. Ambient Temperature**



**Power Dissipation vs. Ambient Temperature**



**Ordering Information**



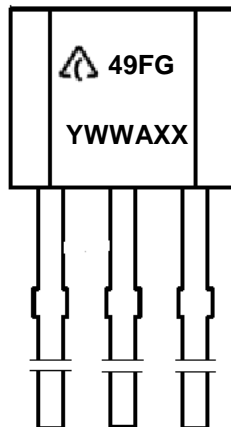
Diodes IC's Pb-free products with "G1" suffix in the part number, are RoHS compliant and green.

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)



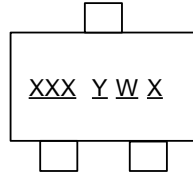
First line: Logo and Identification Code  
 Second line: Date Code  
 Y: Year 0 to 9  
 WW: Week 00 to 52 (Work Week of Molding)  
 A: Assembly House Code  
 XX: 7<sup>th</sup> and 8<sup>th</sup> Digits: Batch No.

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

**Marking Information** (Cont.)

(2) Package Type: SC59

( Top View )

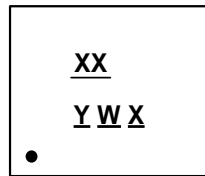


XXX : Identification Code  
Y : Year 0 to 9  
W : Week : A to Z : 1 to 26 Week;  
a to z : 27 to 52 Week; z Represents  
52 and 53 week  
X : Internal Code

Part Number	Package	Identification Code
AH49F	SC59	GT6

(3) Package Type: U-DFN2020-6

( Top View )

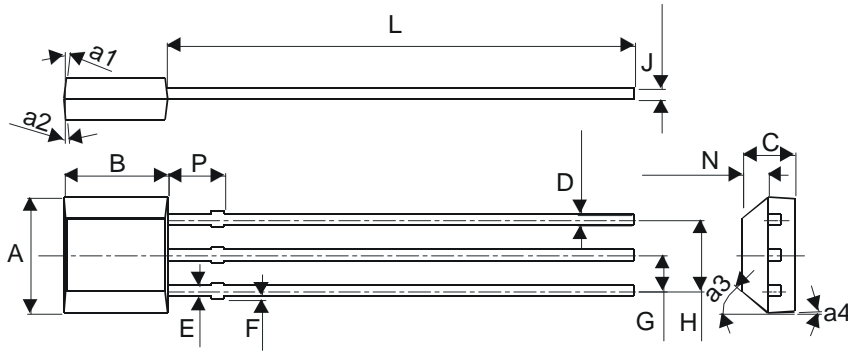


XX : Identification Code  
Y : Year : 0~9  
W : Week : A~Z : 1~26 Week;  
a~z : 27~52 Week; z Represents  
52 and 53 Week  
X : Internal Code

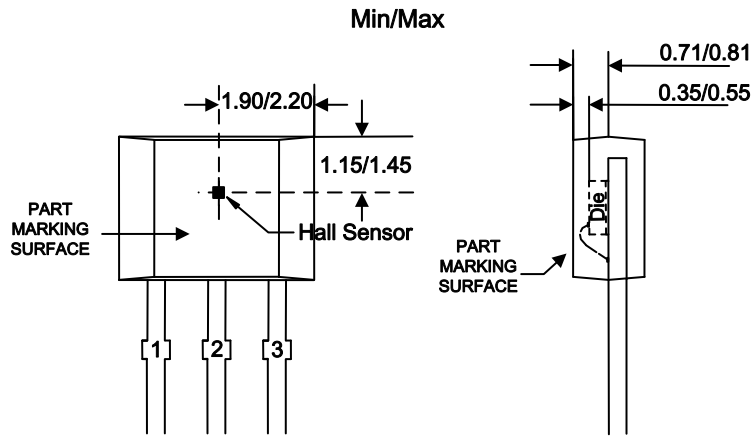
Part Number	Package	Identification Code
AH49F	U-DFN2020-6	CN

**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		



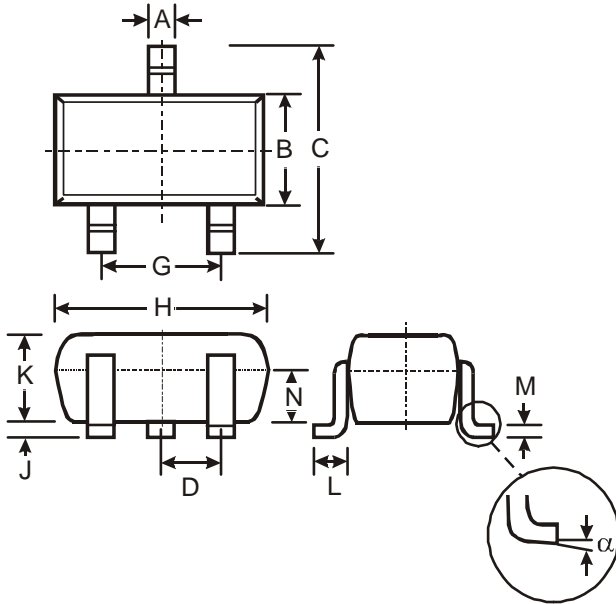
Sensor Location

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**Package Outline Dimensions (Cont.)**

(2) Package Type: SC59

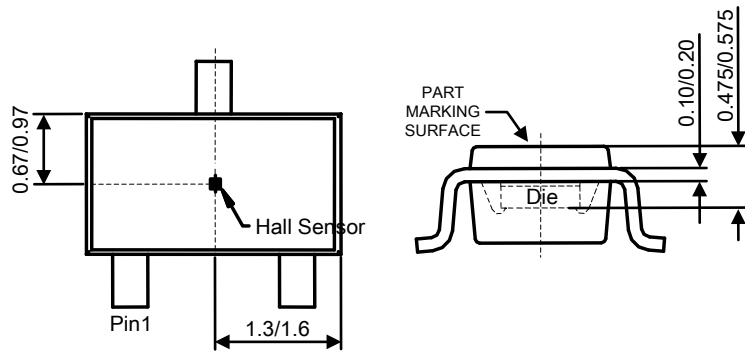


SC59			
Dim	Min	Max	Typ
A	0.35	0.50	0.38
B	1.50	1.70	1.60
C	2.70	3.00	2.80
D	-	-	0.95
G	-	-	1.90
H	2.90	3.10	3.00
J	0.013	0.10	0.05
K	1.00	1.30	1.10
L	0.35	0.55	0.40
M	0.10	0.20	0.15
N	0.70	0.80	0.75
$\alpha$	0°	8°	-

All Dimensions in mm

NEW PRODUCT

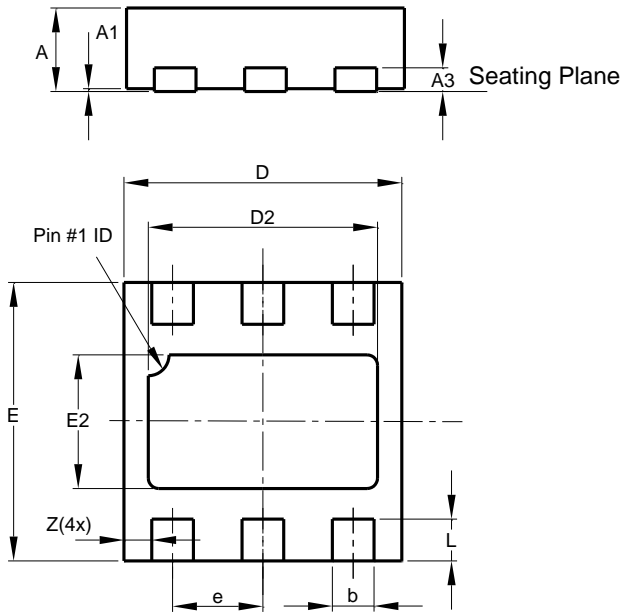
**Min/Max**



**Sensor Location**

**Package Outline Dimensions (Cont.)**

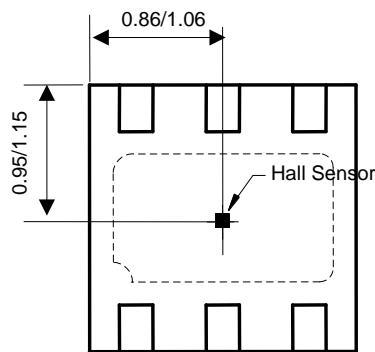
(3) Package Type: U-DFN2020-6



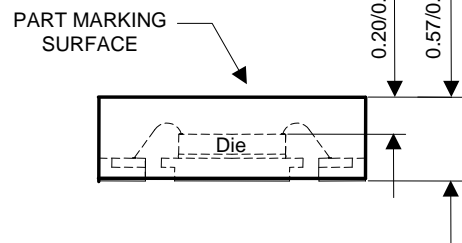
**Bottom View**

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**

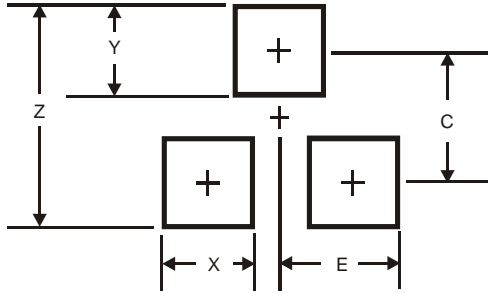


**Sensor Location**

NEW PRODUCT

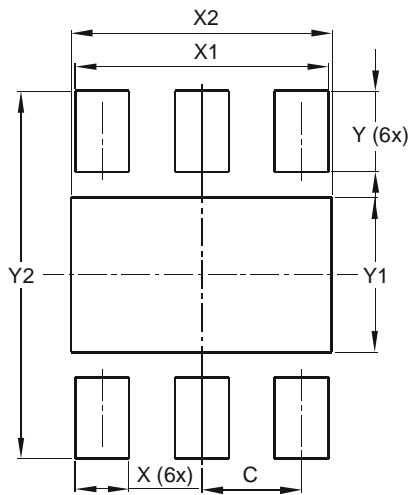
## Suggested Pad Layout

(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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