

## HIGH SENSITIVITY MICROPOWER OMNIPOLAR HALL-EFFECT SWITCH

### Description

The AH1902 is a high sensitivity micropower Omnipolar Hall effect switch IC with internal pull up and pull down capability. Designed for portable and battery powered consumer equipment such as cellular phones and portable PCs to office equipment, home appliances and industrial applications, the average supply current is only 4.3uA at 1.8V. To support portable equipment the AH1902 can operate over the supply range of 1.6V to 3.6V and uses a hibernating clocking system to minimize the power consumption. To minimize PCB space the AH1902 is available in small low profile X1-DFN1216-4 and X2-DFN2015-6 packages.

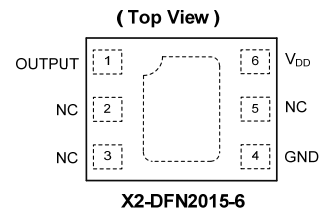
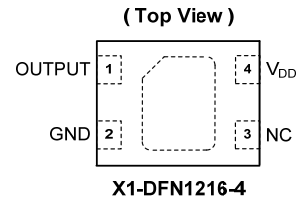
The output is activated with either a north or south pole of sufficient magnetic field strength. When the magnetic flux density (B) perpendicular to the package is larger than operate point (Bop), the output will be turned on (pulled low) and held until B is lower than release point (Brp).

### Features

- Omnipolar Operation (North or South Pole)
- Supply Voltage of 1.6V to 3.6V
- High Sensitivity
- Micropower Operation
- Chopper Stabilized Design Provides:
  - Superior Temperature Stability
  - Minimal Switch Point Drift
  - Enhanced Immunity to Physical Stress
- No External Pull-up Resistors Required
- Good RF Noise Immunity
- -40°C to +85°C Operating Temperature
- High ESD capability of 8kV (Human Body Model)
- Small Low Profile X1-DFN1216-4 and X2-DFN2015-6 Packages
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**

Notes: 1. EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant. All applicable RoHS exemptions applied.  
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.

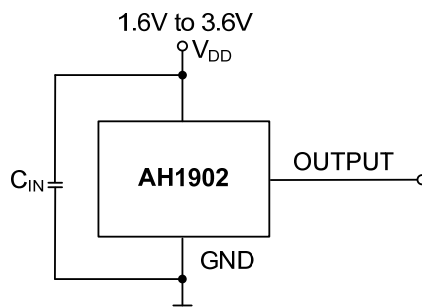
### Pin Assignments



### Applications

- Open and Close Detect for flip/slide Cellular Phones
- Smart Cover or Dock Detect for Cellular Phones and Tablet PCs
- Cover or Display Switch in Portable PCs (eg Ultrabook)
- Digital Still, Video Cameras and Handheld Gaming Consoles
- Door, Lids and Tray Position Switches
- Level, Proximity and Position Switches
- Contact-Less Switches in Home Appliances and Industrial Applications

### Typical Applications Circuit



Note: 4.  $C_{IN}$  is for power stabilization and to strengthen the noise immunity, the recommended capacitance is 100nF typical and should be placed as close to the supply pin as possible.

## Pin Descriptions

### Package: X1-DFN1216-4

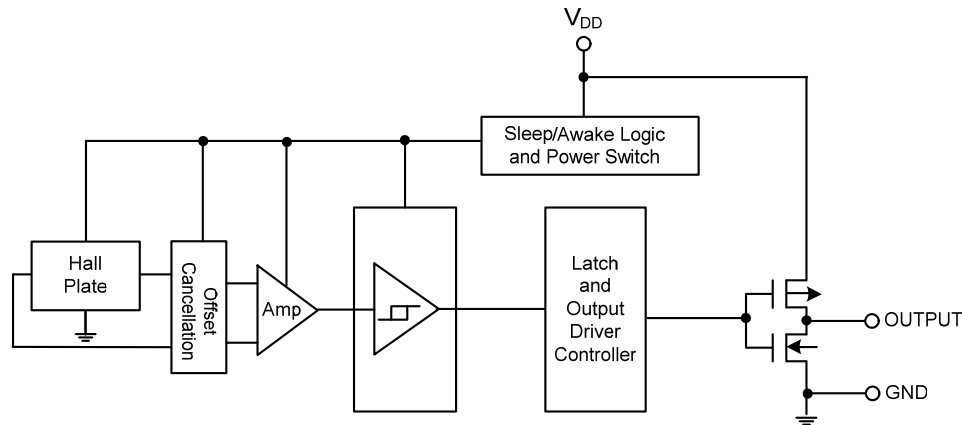
Pin Number	Pin Name	Function
1	OUTPUT	Output Pin
2	GND	Ground Pin
3	NC	No Connection (Note 5)
4	V <sub>DD</sub>	Power Supply Input
Pad	Pad	The center exposed pad - It is internally connected to V <sub>DD</sub> pin and should not be connected to GND or any other signal on the PCB. The exposed pad should be left open (unconnected) on the PCB layout.

### Package: X2-DFN2015-6

Pin Number	Pin Name	Function
1	OUTPUT	Output Pin
2	NC	No Connection (Note 5)
3	NC	No Connection (Note 5)
4	GND	Ground Pin
5	NC	No Connection (Note 5)
6	V <sub>DD</sub>	Power Supply Input
Pad	Pad	The center exposed pad – No connection internally. The exposed pad can be left open (unconnected) or tied to the GND on the PCB layout.

Note: 5. NC is "No Connection" pin and is not connected internally. This pin can be left open or tied to ground.

## Functional Block Diagram



## Absolute Maximum Ratings (Note 6) (@T<sub>A</sub> = +25°C, unless otherwise specified.)

Symbol	Parameter	Rating	Unit
V <sub>DD</sub>	Supply Voltage (Note 7)	6	V
V <sub>DD_REV</sub>	Reverse Supply Voltage	-0.3	V
I <sub>OUTPUT</sub>	Output current (source and sink)	3	mA
B	Magnetic Flux Density	Unlimited	
P <sub>D</sub>	Package Power Dissipation	X1-DFN1216-4	230
		X2-DFN2015-6	230
T <sub>s</sub>	Storage Temperature Range	-65 to +150	°C
T <sub>J</sub>	Maximum Junction Temperature	150	°C
ESD HBM	Human Body Model (HBM) ESD capability	8	kV

- Notes:
- Stresses greater than the 'Absolute Maximum Ratings' specified above may cause permanent damage to the device. These are stress ratings only; functional operation of the device at these or any other conditions exceeding those indicated in this specification is not implied. Device reliability may be affected by exposure to absolute maximum rating conditions for extended periods of time.
  - The absolute maximum V<sub>DD</sub> of 6V is a transient stress rating and is not meant as a functional operating condition. It is not recommended to operate the device at the absolute maximum rated conditions for any period of time.

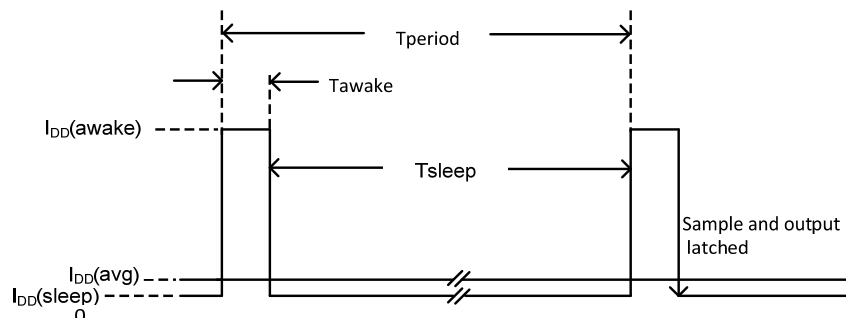
## Recommended Operating Conditions (@T<sub>A</sub> = +25°C, unless otherwise specified.)

Symbol	Parameter	Conditions	Rating	Unit
V <sub>DD</sub>	Supply Voltage	Operating	1.6V to 3.6V	V
T <sub>A</sub>	Operating Temperature Range	Operating	-40 to +85	°C

## Electrical Characteristics (@T<sub>A</sub> = +25°C, V<sub>DD</sub> = 1.8V, unless otherwise specified.)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V <sub>OL</sub>	Output Low Voltage (on)	I <sub>OUT</sub> = 1mA	—	0.1	0.2	V
V <sub>OH</sub>	Output High Voltage (off)	I <sub>OUT</sub> = -1mA	V <sub>DD</sub> -0.2	V <sub>DD</sub> -0.1	—	V
I <sub>off</sub>	Output Leakage Current	V <sub>OUT</sub> = 3.6V, Output off	—	< 0.1	1	μA
I <sub>DD(awake)</sub>	Supply Current	During 'awake' period, T <sub>A</sub> = +25°C, V <sub>DD</sub> = 3V	—	2.1	—	mA
I <sub>DD(sleep)</sub>		During 'sleep' period, T <sub>A</sub> = +25°C, V <sub>DD</sub> = 3V	—	2.5	—	μA
I <sub>DD(avg)</sub>	Average Supply Current	T <sub>A</sub> = +25°C, V <sub>DD</sub> = 1.8V	—	4.3	8	μA
		T <sub>A</sub> = +25°C, V <sub>DD</sub> = 3.6V	—	7.2	13	μA
T <sub>awake</sub>	Awake Time	(Note 8)	—	50	100	μs
T <sub>period</sub>	Period	(Note 8)	—	50	100	ms
D.C.	Duty Cycle		—	0.1	—	%

- Note:
- When power is initially turned on, the operating V<sub>DD</sub> (1.6V to 3.6V) must be applied to guaranteed the output sampling. The output state is valid after the second operating cycle (typical 100ms).



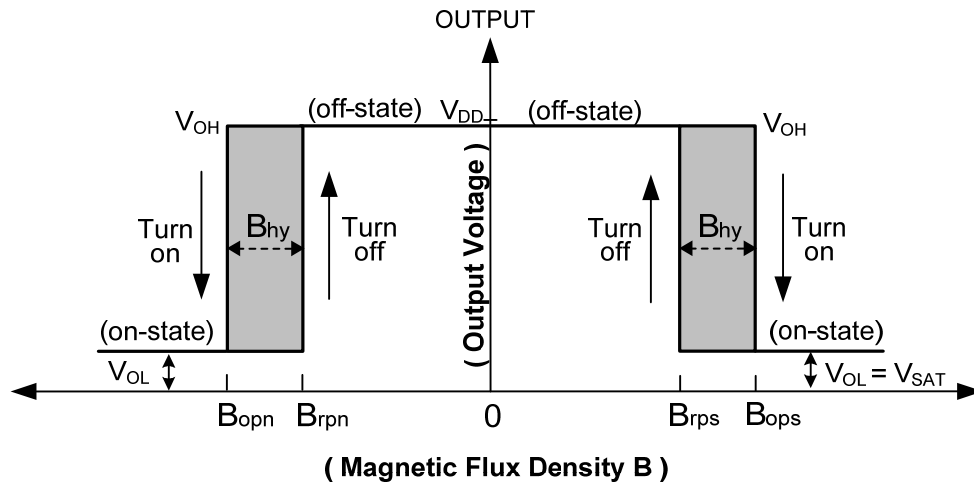
**Magnetic Characteristics** (Note 9 & 10) ( $T_A = +25^\circ\text{C}$ ,  $V_{DD} = 1.8\text{V}$ , unless otherwise specified)

(1mT=10 Gauss)

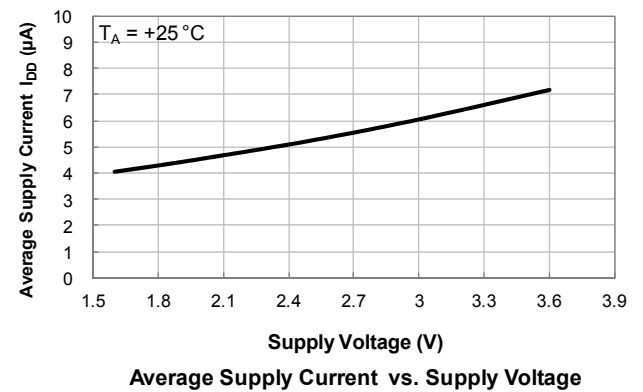
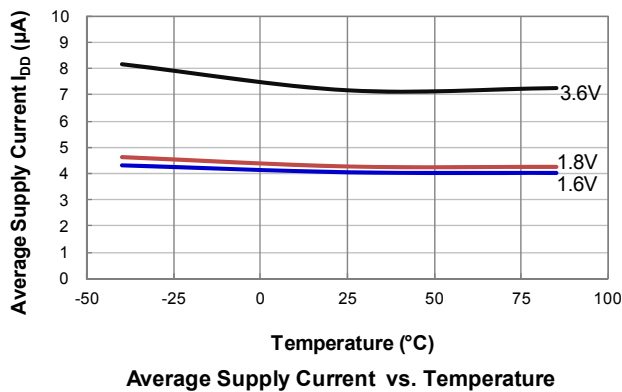
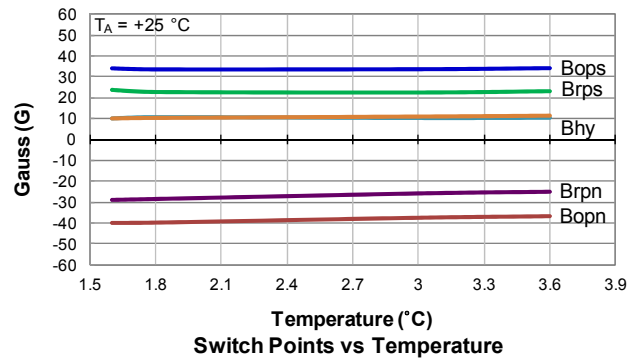
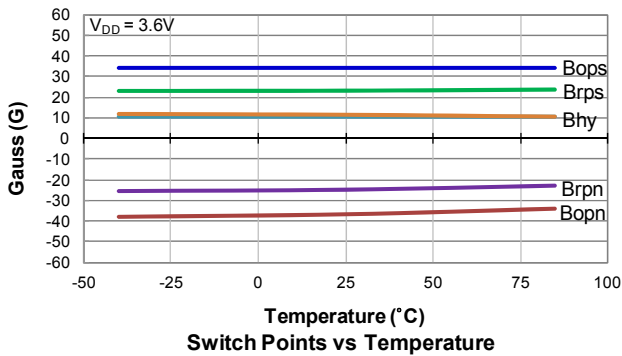
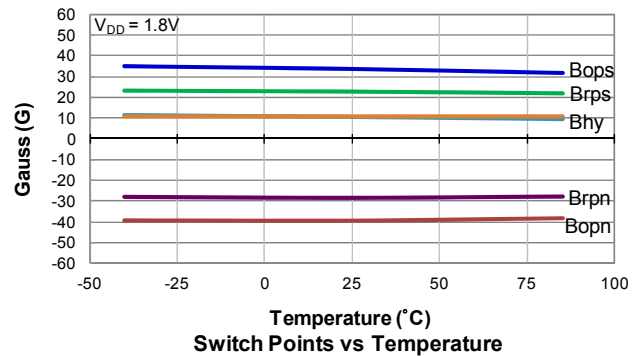
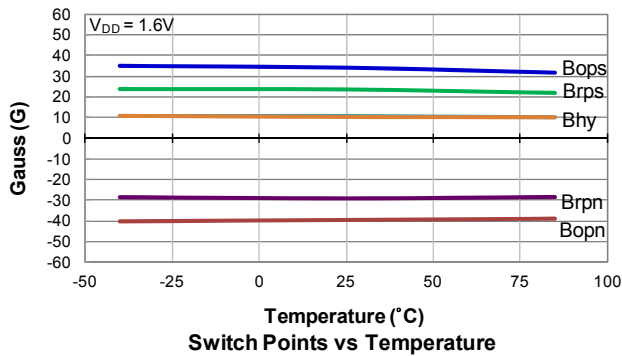
Symbol	Characteristics	Test Condition	Min	Typ	Max	Unit
Bops (south pole to part marking side)	Operation Point	$V_{DD} = 1.6\text{V to } 3.6\text{V}$ $T_A = -40^\circ\text{C to } +85^\circ\text{C}$	23	33	47	Gauss
Bopn (north pole to part marking side)		$V_{DD} = 1.6\text{V to } 3.6\text{V}$ $T_A = -40^\circ\text{C to } +85^\circ\text{C}$	21	33	48	
Brps (south pole to part marking side)		$V_{DD} = 1.6\text{V to } 3.6\text{V}$ $T_A = -40^\circ\text{C to } +85^\circ\text{C}$	-47	-33	-24	
Brpn (north pole to part marking side)	Release Point	$V_{DD} = 1.6\text{V to } 3.6\text{V}$ $T_A = -40^\circ\text{C to } +85^\circ\text{C}$	-48	-33	-21	
Bhys (south pole to part marking side)		$V_{DD} = 1.6\text{V to } 3.6\text{V}$ $T_A = -40^\circ\text{C to } +85^\circ\text{C}$	12	23	35	
Bhpn (north pole to part marking side)		$V_{DD} = 1.6\text{V to } 3.6\text{V}$ $T_A = -40^\circ\text{C to } +85^\circ\text{C}$	9	23	38	
Bhy ( $ B_{opx}  -  B_{rpx} $ )	Hysteresis	$V_{DD} = 1.6\text{V to } 3.6\text{V}$ $T_A = -40^\circ\text{C to } +85^\circ\text{C}$	-35	-23	-12	Gauss
			-38	-23	-9	
			-	10	-	

Notes: 9. Typical data is at  $T_A = +25^\circ\text{C}$ ,  $V_{DD} = 1.8\text{V}$ .

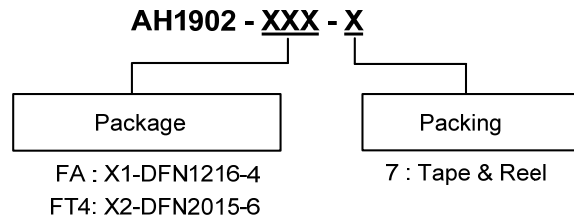
10. Maximum and minimum parameters values over operating temperature range are not tested in production, they are guaranteed by design, characterization and process control. The magnetic characteristics may vary with supply voltage, operating temperature and after soldering.



## Typical Operating Characteristics



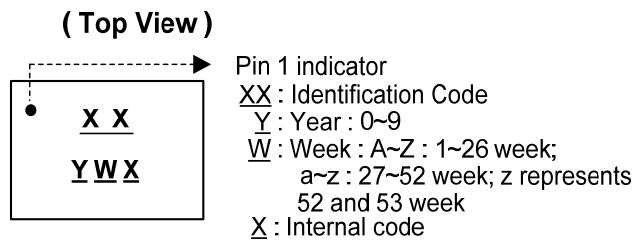
## Ordering Information



Part Number	Package Code	Packaging	7" Tape and Reel	
			Quantity	Part Number Suffix
AH1902-FA-7	FA	X1-DFN1216-4	3000/Tape & Reel	-7
AH1902-FT4-7	FT4	X2-DFN2015-6	3000/Tape & Reel	-7

## Marking Information

(1) Package Type: X1-DFN1216-4 and X2-DFN2015-6

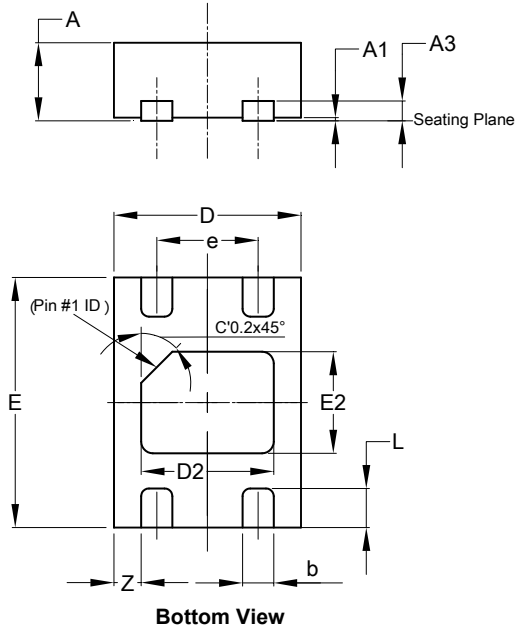


Part Number	Package	Identification Code
AH1902-FA-7	X1-DFN1216-4	F2
AH1902-FT4-7	X2-DFN2015-6	D2

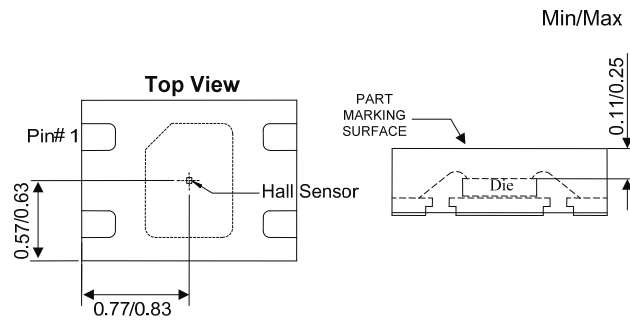
# Package Outline Dimensions (All dimensions in mm.)

Please see AP02002 at <http://www.diodes.com/datasheets/ap02002.pdf> for latest version.

## (1) Package Type: X1-DFN1216-4



X1-DFN1216-4			
Dim	Min	Max	Typ
A	0.47	0.53	0.50
A1	0.00	0.05	0.02
A3	--	--	0.13
b	0.15	0.25	0.20
D	1.15	1.25	1.20
D2	0.75	0.95	0.85
E	1.55	1.65	1.60
E2	0.55	0.75	0.65
e	-	-	0.65
L	0.20	0.30	0.25
Z	-	-	0.175
All Dimensions in mm			

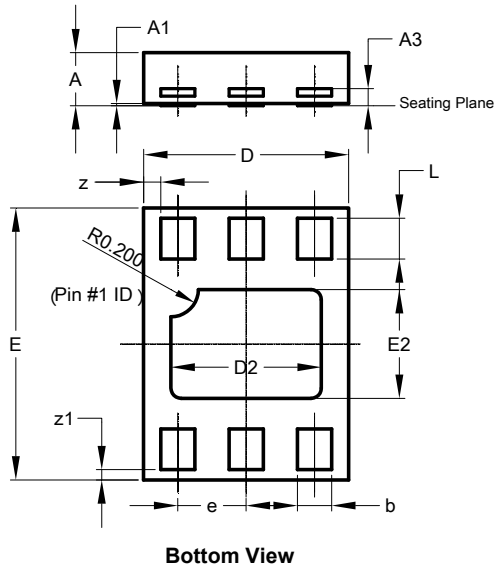


Sensor Location

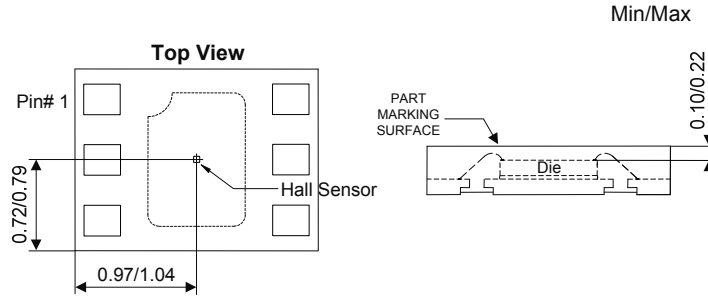
## Package Outline Dimensions (cont.) (All dimensions in mm.)

Please see AP02002 at <http://www.diodes.com/datasheets/ap02002.pdf> for latest version.

### (2) Package Type: X2-DFN2015-6



X2-DFN2015-6			
Dim	Min	Max	Typ
A	0.375	0.40	0.390
A1	0	0.05	0.02
A3	-	-	0.13
b	0.20	0.30	0.25
D	1.45	1.575	1.50
D2	1.00	1.20	1.10
e	-	-	0.50
E	1.95	2.075	2.00
E2	0.70	0.90	0.80
L	0.25	0.35	0.30
Z	-	-	0.125
Z1	-	-	0.075
All Dimensions in mm			



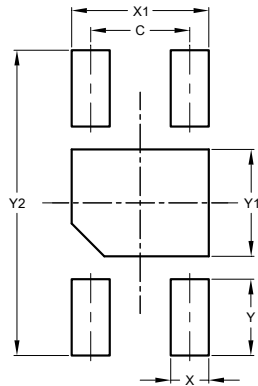
**Sensor Location**



## Suggested Pad Layout

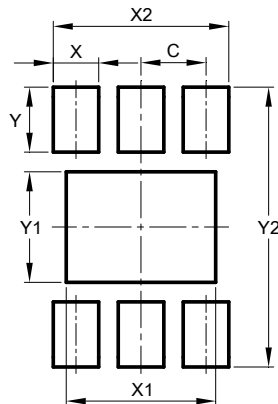
Please see AP02001 at <http://www.diodes.com/datasheets/ap02001.pdf> for the latest version.

### (1) Package Type: X1-DFN1216-4



X1-DFN1216-4	
Dimensions	Value
C	0.65
X	0.25
X1	0.90
Y	0.50
Y1	0.70
Y2	2.00
All Dimensions in mm	

### (2) Package Type: X2-DFN2015-6



X2-DFN2015-6	
Dimensions	Value
C	0.500
X	0.350
X1	1.150
X2	1.350
Y	0.500
Y1	0.850
Y2	2.150
All Dimensions in mm	

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