

## 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 4.3μA 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, X2-DFN2015-6 and SOT553 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).

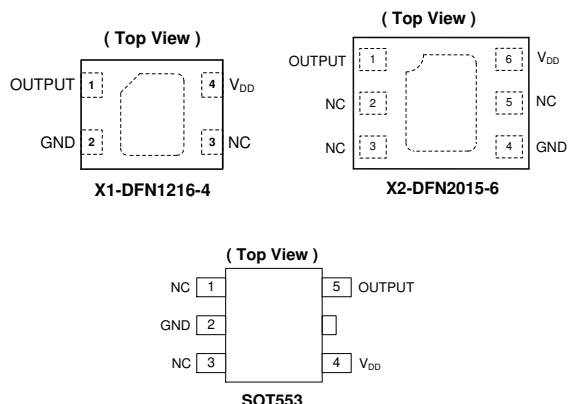
## Features

- 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, X2-DFN2015-6 and SOT553 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.

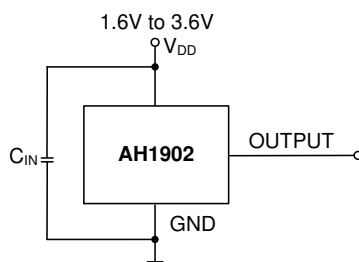
## Pin Assignments



## 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<sub>IN</sub> 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 – No connection internally.<br>The exposed pad can be left open (unconnected to ) on the PCB layout. |

### Package: X2-DFN2015-6

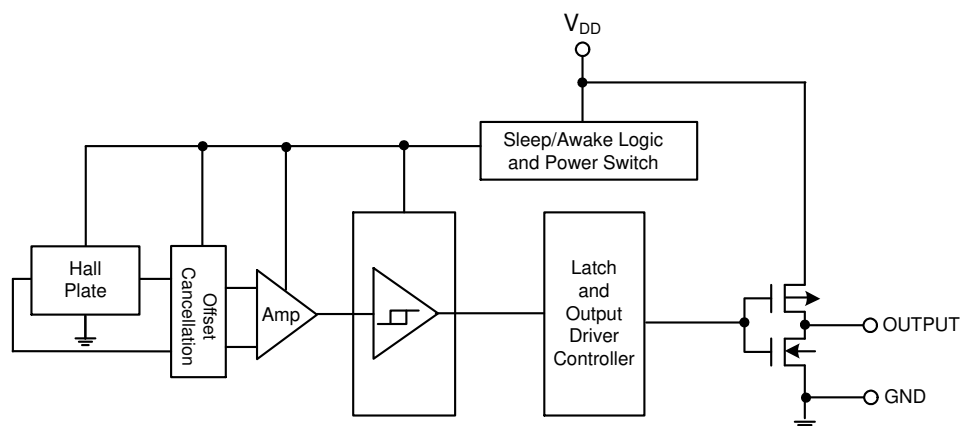
| Pin Number | Pin Name        | Function                                                                                                                   |
|------------|-----------------|----------------------------------------------------------------------------------------------------------------------------|
| 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.<br>The exposed pad can be left open (unconnected to) on the PCB layout. |

### Package: SOT553

| Pin Number | Pin Name        | Function               |
|------------|-----------------|------------------------|
| 1          | NC              | No Connection (Note 5) |
| 2          | GND             | Ground Pin             |
| 3          | NC              | No Connection (Note 5) |
| 4          | V <sub>DD</sub> | Power Supply Input     |
| 5          | OUTPUT          | Output Pin             |

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 and X2-DFN2015-6 | 230         | mW   |
|                     |                                       | SOT553                        | 230         | mW   |
| 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 (HMB) 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.

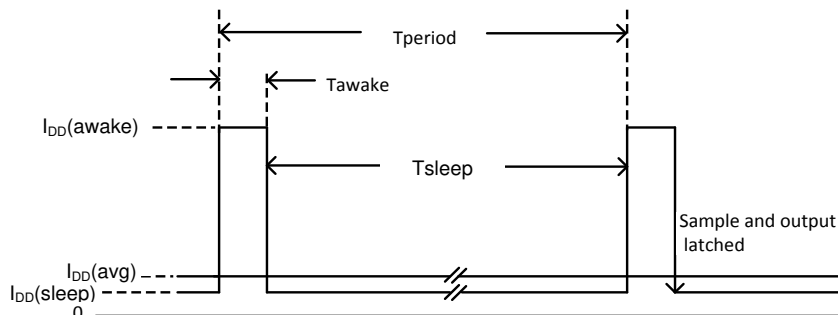
**Recommended Operating Conditions** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

| 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,<br>T <sub>A</sub> = +25°C, V <sub>DD</sub> = 3V | —                    | 2.1                  | —   | mA   |
| I <sub>DD(sleep)</sub> |                           | During 'sleep' period,<br>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 guarantee the output sampling. The output state is valid after the second operating cycle (typical 100ms).



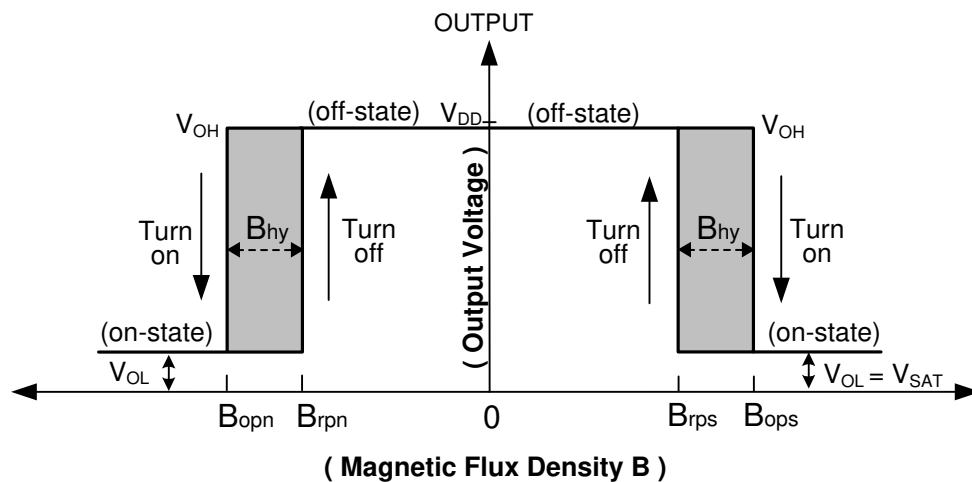
**Magnetic Characteristics** (Note 9 & 10) ( $T_A = +25^\circ\text{C}$ ,  $V_{DD} = 1.8\text{V}$ , unless otherwise specified)

(1mT=10 Gauss)

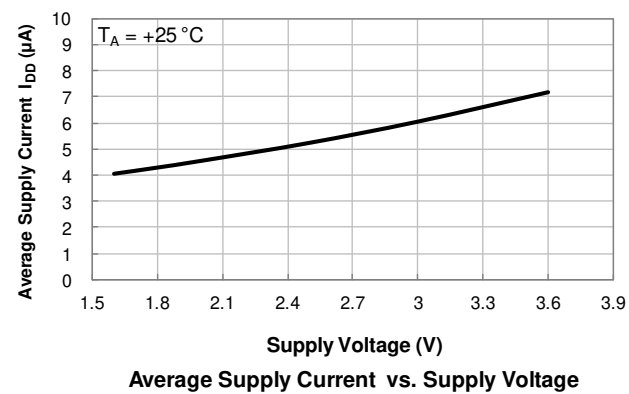
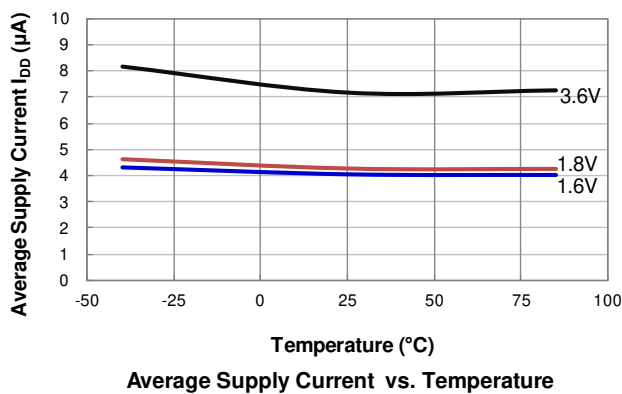
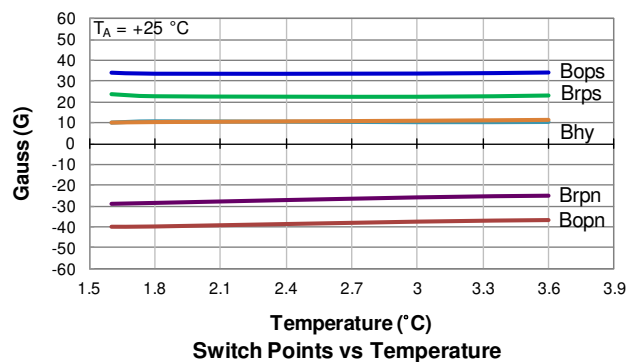
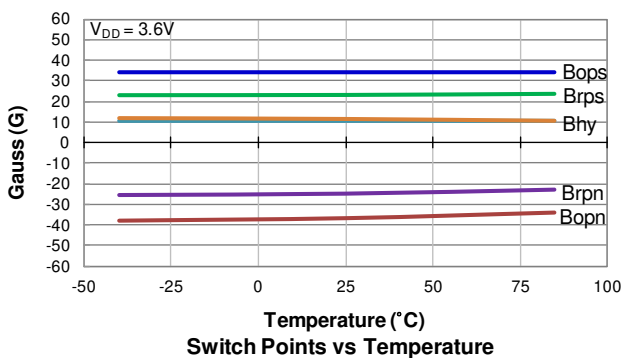
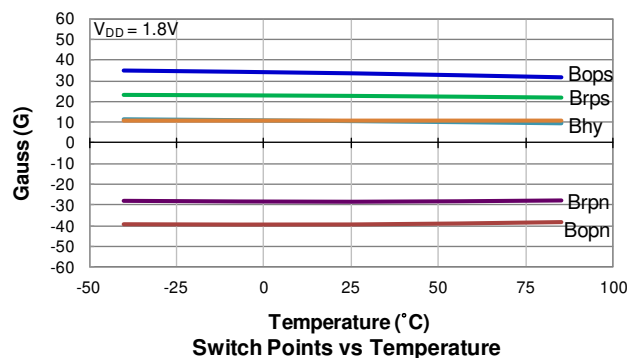
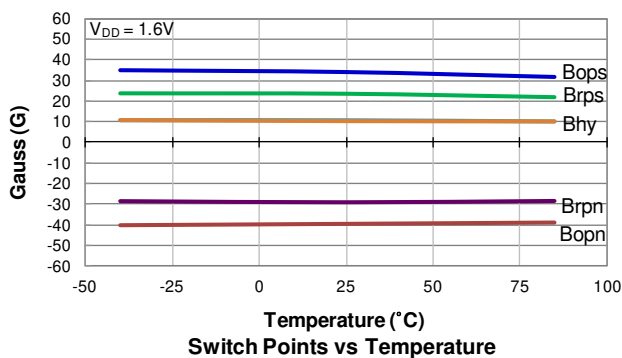
| Symbol                                 | Characteristics | Test Condition                                                                            | Min | Typ | Max | Unit  |
|----------------------------------------|-----------------|-------------------------------------------------------------------------------------------|-----|-----|-----|-------|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

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

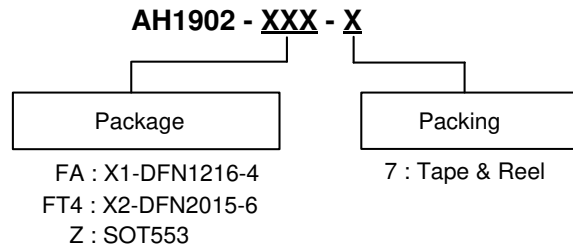
10. Maximum and minimum parameters values over operating temperature range are not tested in production, they are guaranteed by design, characterization and process control. The magnetic characteristics may vary with supply voltage, operating temperature and after soldering.



## Typical Operating Characteristics



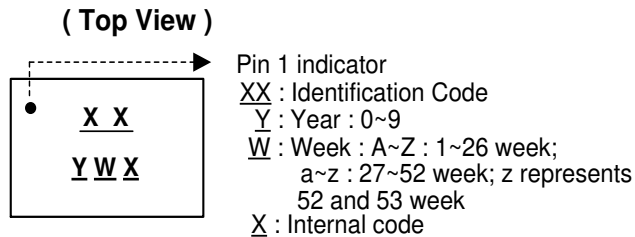
## Ordering Information



| Part Number  | Package Code | Packaging    | 7" Tape and Reel  |                    |
|--------------|--------------|--------------|-------------------|--------------------|
|              |              |              | Quantity          | Part Number Suffix |
| AH1902-FA-7  | FA           | X1-DFN1216-4 | 3,000/Tape & Reel | -7                 |
| AH1902-FT4-7 | FT4          | X2-DFN2015-6 | 3,000/Tape & Reel | -7                 |
| AH1902-Z-7   | Z            | SOT553       | 3,000/Tape & Reel | -7                 |

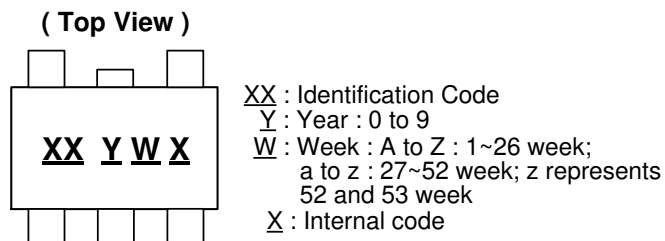
## Marking Information

(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                  |

(2) Package Type: SOT553

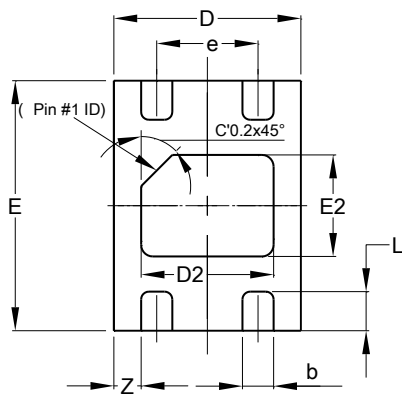
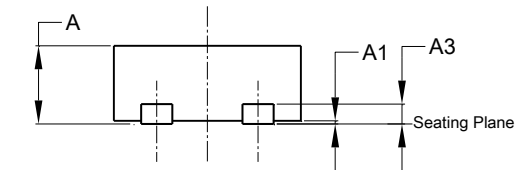


| Part Number | Package | Identification Code |
|-------------|---------|---------------------|
| AH1902-Z-7  | SOT553  | D2                  |

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

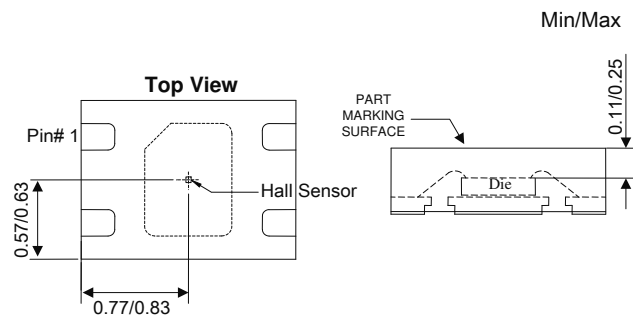
Please see <http://www.diodes.com/package-outlines.html> for the latest version.

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



**Bottom View**

| 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 |      |      |       |

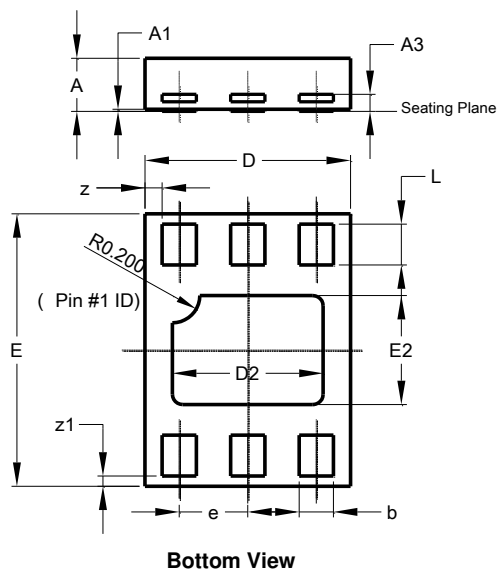


**Sensor Location**

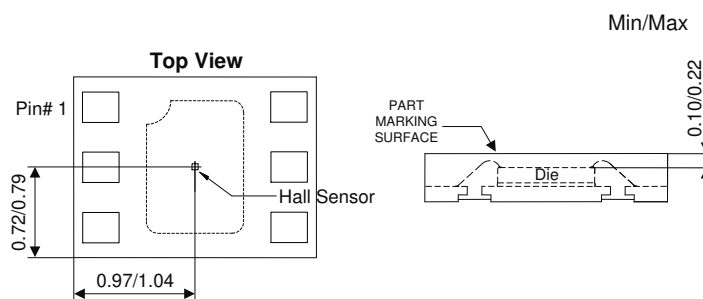
## Package Outline Dimensions (continued) (All dimensions in mm.)

Please see <http://www.diodes.com/package-outlines.html> for the 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 |       |       |       |

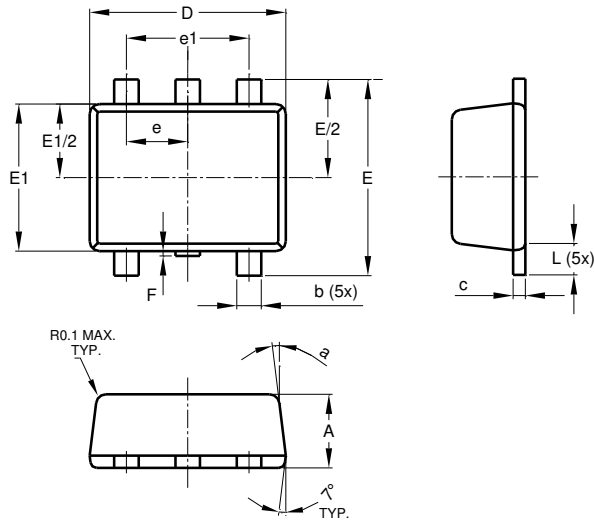


**Sensor Location**

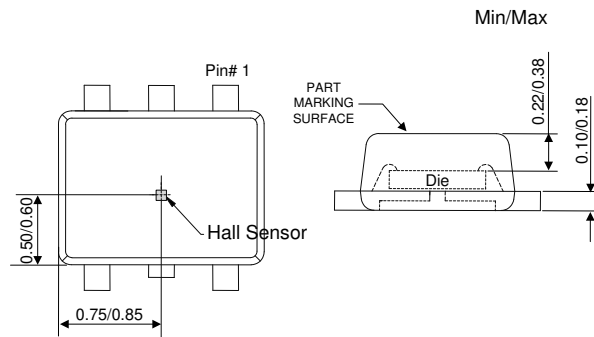
## Package Outline Dimensions (cont.) (All dimensions in mm.)

Please see <http://www.diodes.com/package-outlines.html> for the latest version.

### (3) Package Type: SOT553



| SOT553               |          |      |      |
|----------------------|----------|------|------|
| Dim                  | Min      | Max  | Typ  |
| A                    | 0.55     | 0.62 | 0.60 |
| b                    | 0.15     | 0.30 | 0.20 |
| c                    | 0.10     | 0.18 | 0.15 |
| D                    | 1.50     | 1.70 | 1.60 |
| E                    | 1.55     | 1.70 | 1.60 |
| E1                   | 1.10     | 1.25 | 1.20 |
| e                    | 0.50 BSC |      |      |
| e1                   | 1.00 BSC |      |      |
| F                    | 0.00     | 0.10 | —    |
| L                    | 0.10     | 0.30 | 0.20 |
| a                    | 6°       | 8°   | 7°   |
| All Dimensions in mm |          |      |      |

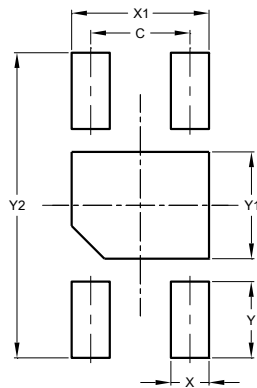


Sensor Location

## Suggested Pad Layout

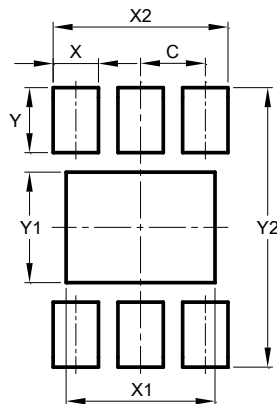
Please see <http://www.diodes.com/package-outlines.html> for the latest version.

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



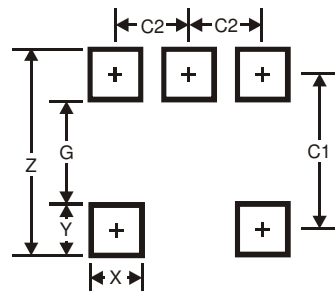
| X1-DFN1216-4         |       |
|----------------------|-------|
| Dimensions           | Value |
| C                    | 0.65  |
| X                    | 0.25  |
| X1                   | 0.90  |
| Y                    | 0.50  |
| Y1                   | 0.70  |
| Y2                   | 2.00  |
| All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

### (3) Package Type: SOT553



| SOT553               |       |
|----------------------|-------|
| Dimensions           | Value |
| Z                    | 2.2   |
| G                    | 1.2   |
| X                    | 0.375 |
| Y                    | 0.5   |
| C1                   | 1.7   |
| C2                   | 0.5   |
| All Dimensions in mm |       |

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