

**PROGRAMMABLE HIGH SENSITIVITY  
MICROPOWER OMNIPOLAR HALL-EFFECT SWITCH**

## Description

The AH1894 is a high sensitivity micropower magnetic range selectable Omnipolar Hall effect switch IC with internal pull up and pull down capability. Designed for portable and battery powered equipment such as cellular phones and portable PCs to home appliances and industrial applications, the average power consumption is only 8uW at 1.85V. To support portable equipment the AH1894 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 AH1894 is available in small low profile X1-DFN1216-4 and SOT553 packages.

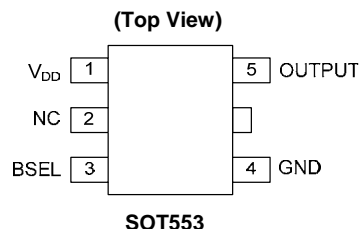
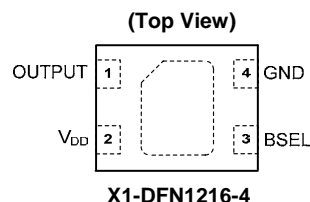
The output is activated with either a north or south pole of sufficient magnetic field strength. The user can select one of two magnetic sensitivity bands via the BSEL pin without the addition of any external components allowing a flexible but small solution. The band select can be hardwired or be changed on the fly via a logic source such as a micro-controller. When the magnetic flux density (B) 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)
- Programmable Operate and Release Points
- Supply Voltage of 1.6V to 3.6V
- 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) on V<sub>DD</sub>, GND and OUTPUT Pins
- Small Low Profile X1-DFN1216-4 and SOT553 Packages
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**

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.

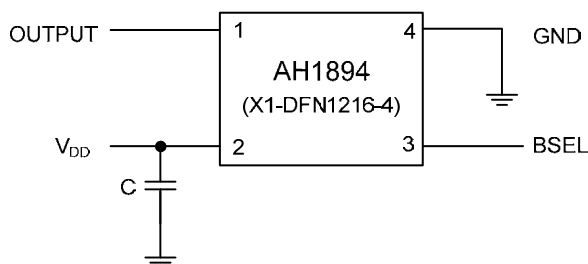
## Pin Assignments



## Applications

- Open and Close Detect for Cellular Phones
- Holster or cover detect for cellular phones and Tablet PCs
- Cover or Display Switches in Portable PCs
- 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.

## Pin Descriptions

Package: X1-DFN1216-4

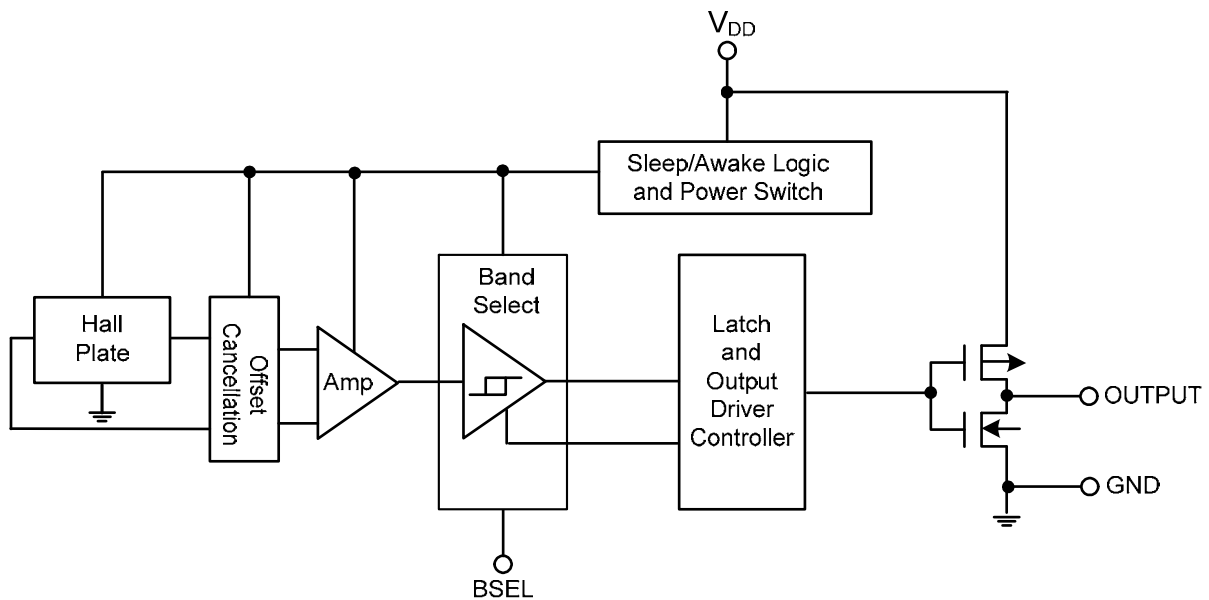
| Pin Number | Pin Name        | Function           |
|------------|-----------------|--------------------|
| 1          | OUTPUT          | Output Pin         |
| 2          | V <sub>DD</sub> | Power Supply Input |
| 3          | BSEL            | Band Select        |
| 4          | GND             | Ground Pin         |

Package: SOT553

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

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)      | 3.5                      | mA     |
| B                   | Magnetic Flux Density                 | Unlimited                |        |
| P <sub>D</sub>      | Package Power Dissipation             | X1-DFN1216-4             | 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 (HBM) ESD capability | VDD, GND and OUTPUT pins | 8 kV   |
|                     |                                       | BSEL pin                 | 6 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.)

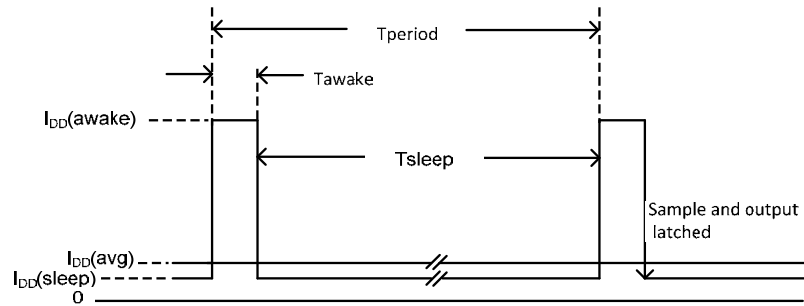
| Symbol          | Parameter                   | Conditions | Rating       | Unit |
|-----------------|-----------------------------|------------|--------------|------|
| V <sub>DD</sub> | Supply Voltage              | Operating  | 1.6V to 3.6V | V    |
| T <sub>A</sub>  | Operating Temperature Range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

## Electrical Characteristics (@T<sub>A</sub> = +25°C, V<sub>DD</sub> = 1.85V, 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   |
| V <sub>SEL_LB</sub>    | BSEL pin input voltage – Low Band    |  | 0                    | —                    | 0.5 | V    |
| V <sub>SEL_HB</sub>    | BSEL pin input voltage – High Band   |  | 1.4                  | —                    | 3.6 | V    |
| R <sub>PD_BSEL</sub>   | BSEL pin internal pull-down resistor | (Note 8)   | —                    | 50                   | —   | kΩ   |
| 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                  | —   | mA   |
| I <sub>DD(avg)</sub>   | Average Supply Current               | T <sub>A</sub> = +25°C, V <sub>DD</sub> = 1.85V                        | —                    | 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 9)   | —                    | 50                   | 100 | μs   |
| T <sub>period</sub>    | Period                               | (Note 9)   | —                    | 50                   | 100 | ms   |
| D.C.                   | Duty Cycle                           | (Note 10)  | —                    | 0.1                  | —   | %    |

- Notes:
- BSEL pin internal pull-down resistor is only active during AWAKE time
  - When power is initially 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 phase (typical 100ms).
  - Transition time varies dependant on the timing of BSEL activation during the sleep and awake phases.

## Electrical Characteristics (cont.)



## Magnetic Characteristics (Note 11 & 12) ( $T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$ , $V_{DD} = 1.85\text{V}$ , unless otherwise specified)

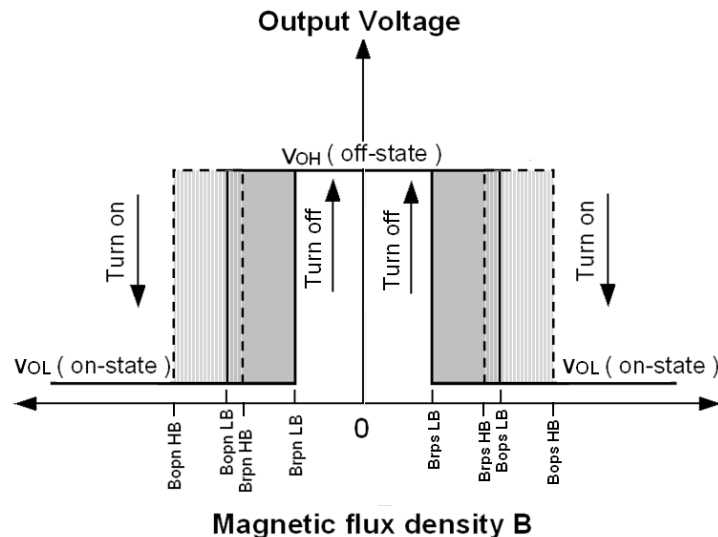
(1mT=10 Gauss)

| BSEL | Symbol   | Characteristics             | Min | Typ | Max | Unit  |
|------|--|-----------------------------|-----|-----|-----|-------|
| Low  | Bops <sub>LB</sub> (South pole to part marking side) | Low Band - Operation Point  | 15  | 30  | 45  | Gauss |
| Low  | Bopn <sub>LB</sub> (North pole to part marking side) |                             | -45 | -30 | -15 |       |
| Low  | Brps <sub>LB</sub> (South pole to part marking side) | Low Band - Release Point    | 10  | 20  | 35  |       |
| Low  | Brpn <sub>LB</sub> (North pole to part marking side) |                             | -35 | -20 | -10 |       |
| High | Bops <sub>HB</sub> (South pole to part marking side) | High Band - Operation Point | 25  | 40  | 55  |       |
| High | Bopn <sub>HB</sub> (North pole to part marking side) |                             | -55 | -40 | -25 |       |
| High | Brps <sub>HB</sub> (South pole to part marking side) | High Band - Release Point   | 20  | 30  | 45  |       |
| High | Brpn <sub>HB</sub> (North pole to part marking side) |                             | -45 | -30 | -20 |       |
| —    | Bhy ( $ B_{opx}  -  B_{rpx} $ )                      | Hysteresis                  | —   | 10  | —   |       |

Notes: 11. Typical data is at  $T_A = +25^\circ\text{C}$ ,  $V_{DD} = 1.85\text{V}$ .

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

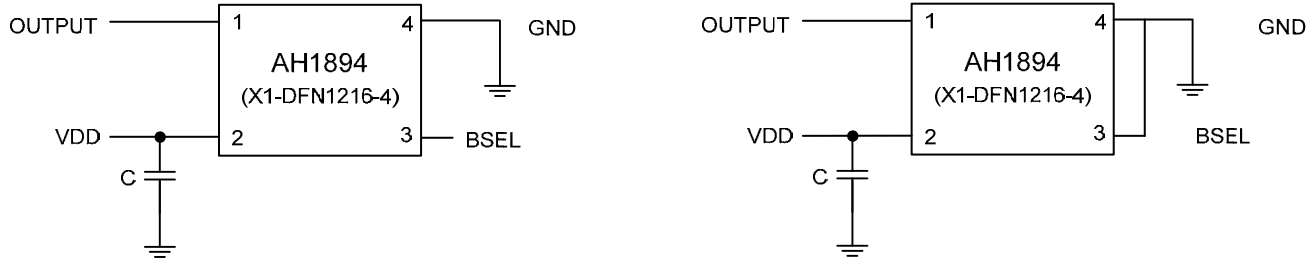
The AH1894 includes a band select pin (BSEL) so that the operate (Bops and Bopn) and release (Brps and Brpn) points can be adjusted between two pre-defined ranges. The BSEL can be hard wired within the application circuit or the band can be selected on the fly by using the BSEL pin as a logic input. This feature allows the AH1894 sensitivity to be changed by firmware within the application without the addition of any external components. If the BSEL pin is left open circuit the AH1894 defaults to low band.



## Application Notes

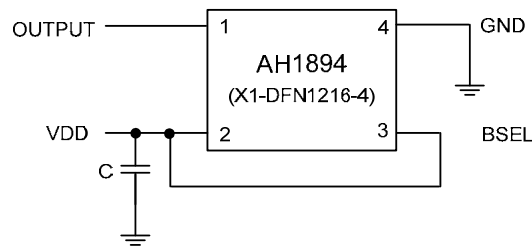
### Applications Circuit 1 – Low Band

Leaving the BSEL pin unconnected or connecting the BSEL pin to ground permanently configures the AH1894 into its high sensitivity mode (lower switching thresholds), requiring a reduced magnetic flux density to activate its output (Low Band).



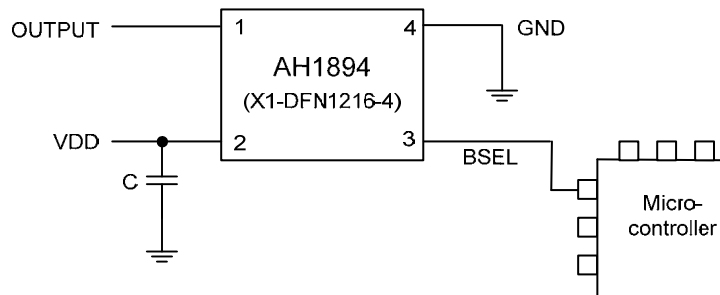
### Applications Circuit 2 – High Band

Connecting the BSEL pin to  $V_{DD}$  or applying a voltage greater than 1.4V configures the AH1894 into its low sensitivity mode (higher switching threshold), requiring a higher magnetic flux density to activate its output (High Band).



### Applications Circuit 3 – Adjustable Sensitivity

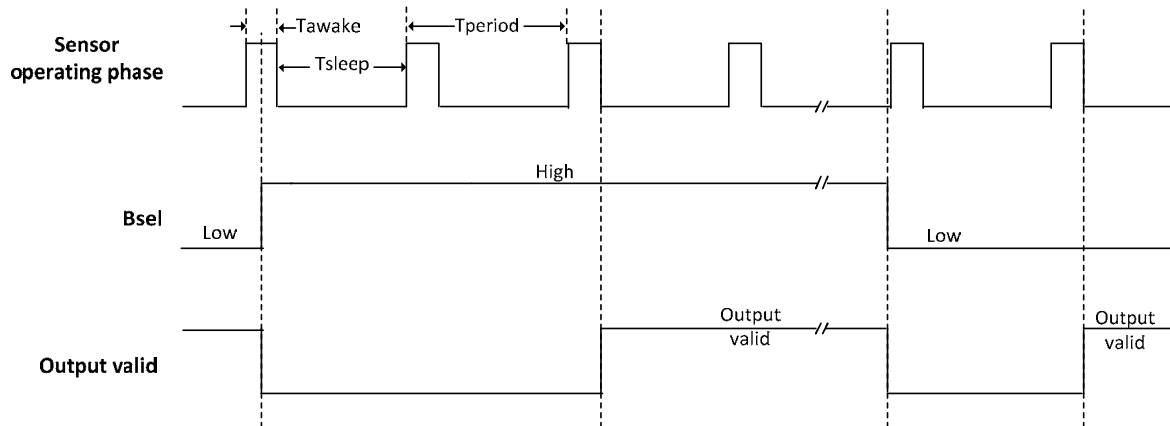
To enhance the flexibility within the application the sensitivity can be adjusted with a standard logic signal allowing it to be controlled by a micro-controller or a logic source. This allows the sensitivity to be changed within the application without a hardware change. Whenever the sensitivity band selection is changed, allow for band selection changeover to complete and output to be valid.



## Application Notes (cont.)

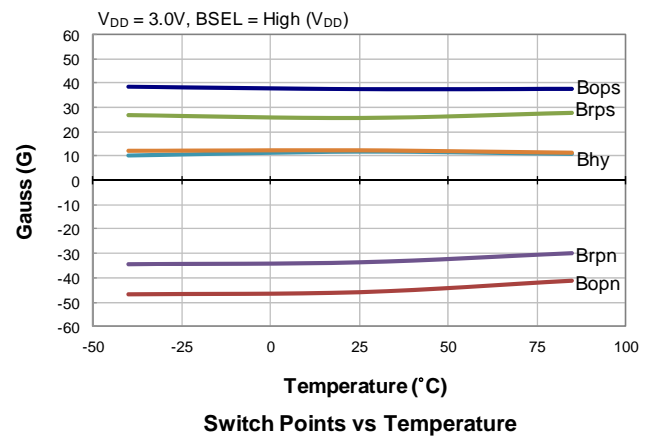
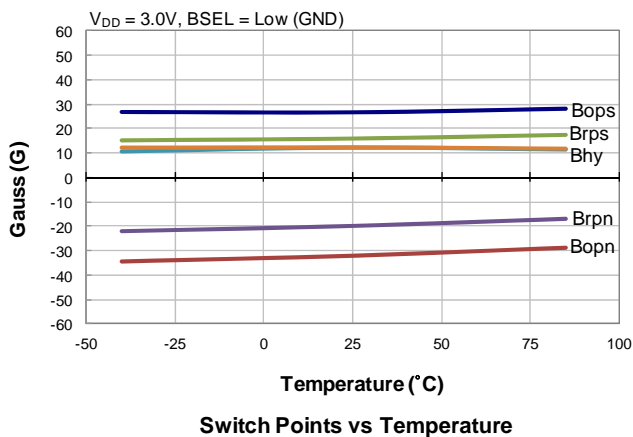
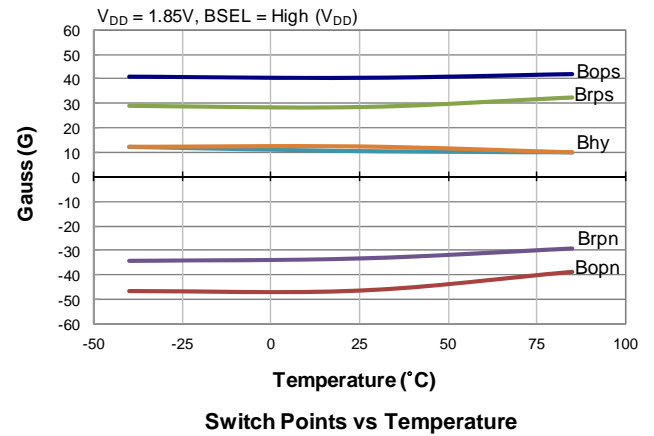
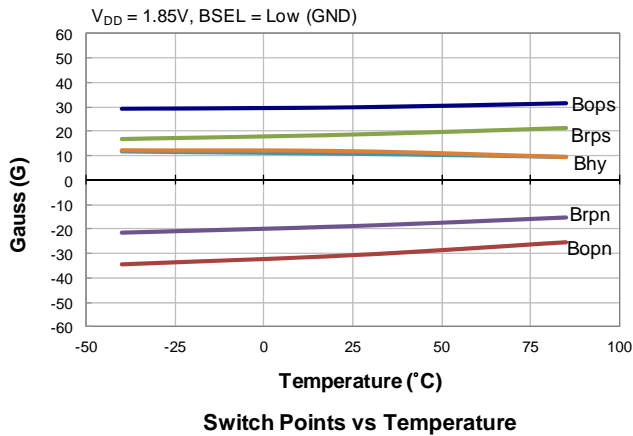
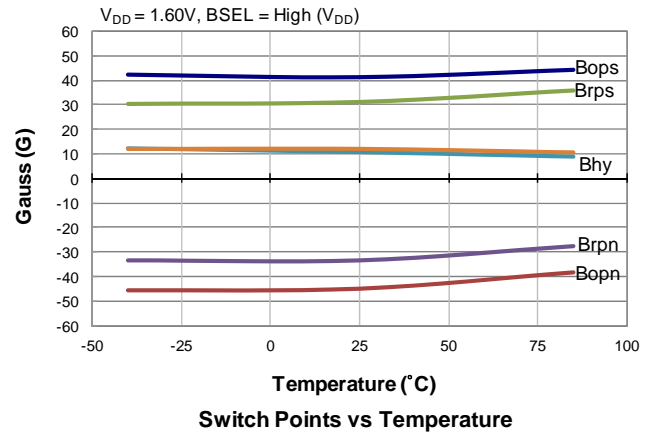
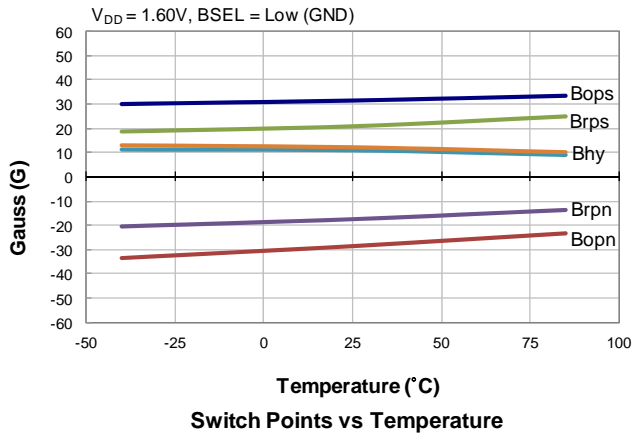
### Bands Select Change Timing and Valid Output

Whenever band selection BSEL pin input is changed, allow for band selection changeover to complete and stabilize. The output is valid only after the second complete operating 'awake' phase after the band selection change is complete. Time taken for the output to be valid, after the BSEL change, depends on timing of BSEL change during the sleep and awake phase; this time is up to 100ms typical and 200.1ms maximum (TBC).



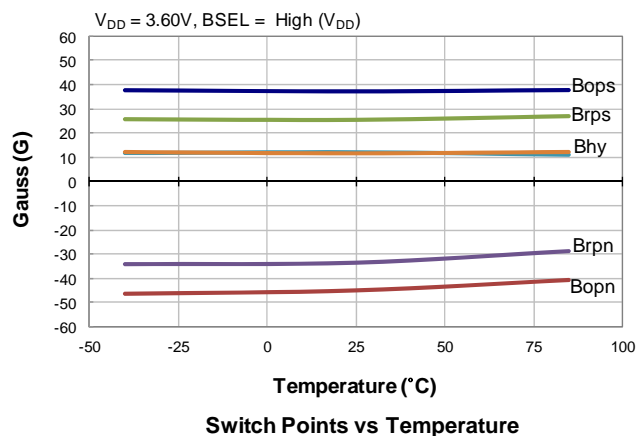
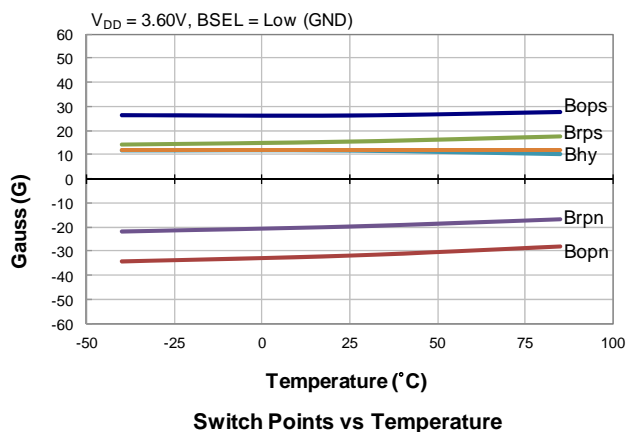
## Typical Operating Characteristics

### Typical Switch Points Characteristics in Low Band (BSEL = Low) and High Band (BSEL = High)

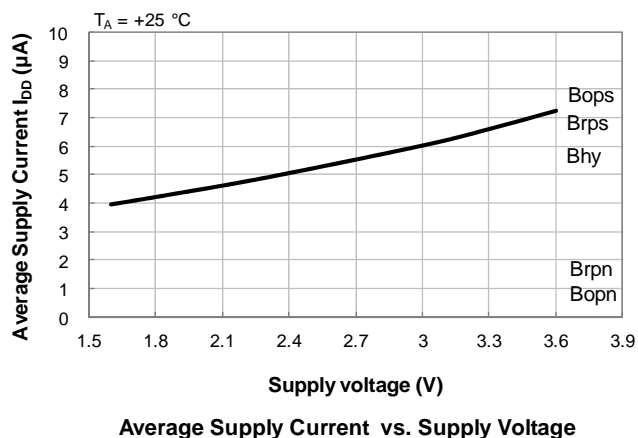
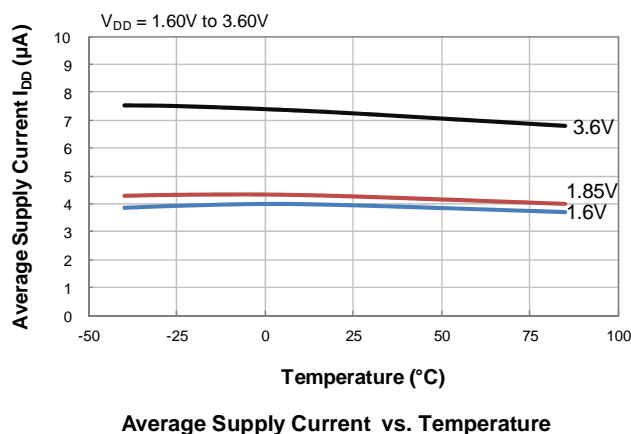


## Typical Operating Characteristics (cont.)

### Typical Switch Points Characteristics in Low Band (BSEL = Low) and High Band (BSEL = High)



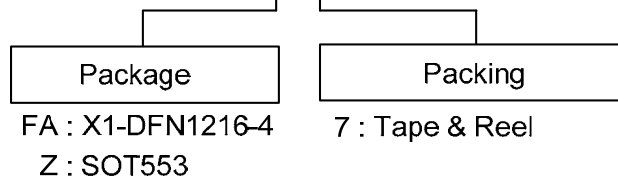
### Average Supply Current $I_{DD}$ (avg)





## Ordering Information

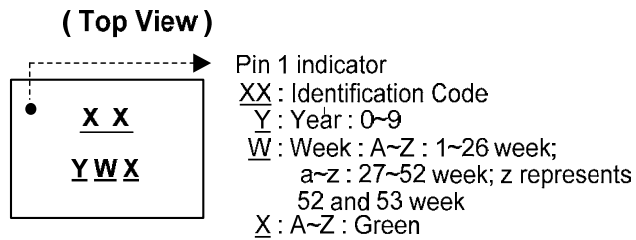
### AH1894 - XXX - X



| Part Number | Package Code | Packaging    | 7" Tape and Reel |                    |
|-------------|--------------|--------------|------------------|--------------------|
|             |              |              | Quantity         | Part Number Suffix |
| AH1894-FA-7 | FA           | X1-DFN1216-4 | 3000/Tape & Reel | -7                 |
| AH1894-Z-7  | Z            | SOT553       | 3000/Tape & Reel | -7                 |

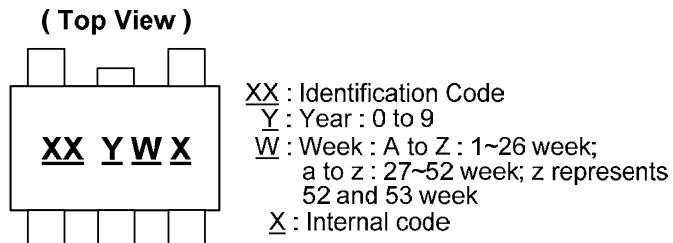
## Marking Information

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



| Part Number | Package      | Identification Code |
|-------------|--------------|---------------------|
| AH1894-FA-7 | X1-DFN1216-4 | B4                  |

### (2) Package Type: SOT553

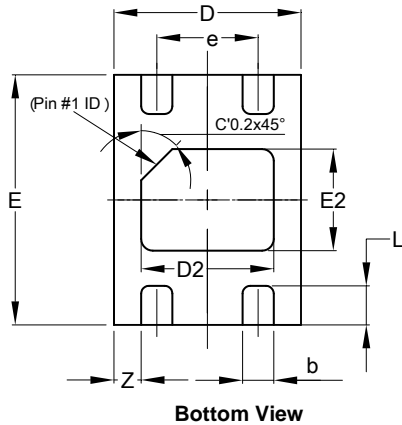
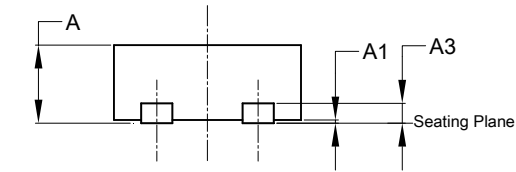


| Part Number | Package | Identification Code |
|-------------|---------|---------------------|
| AH1894-Z-7  | SOT553  | B4                  |

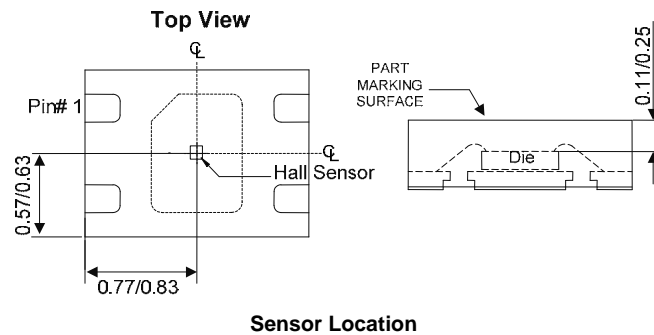
# Package Outline Dimensions (All dimensions in mm.)

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

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



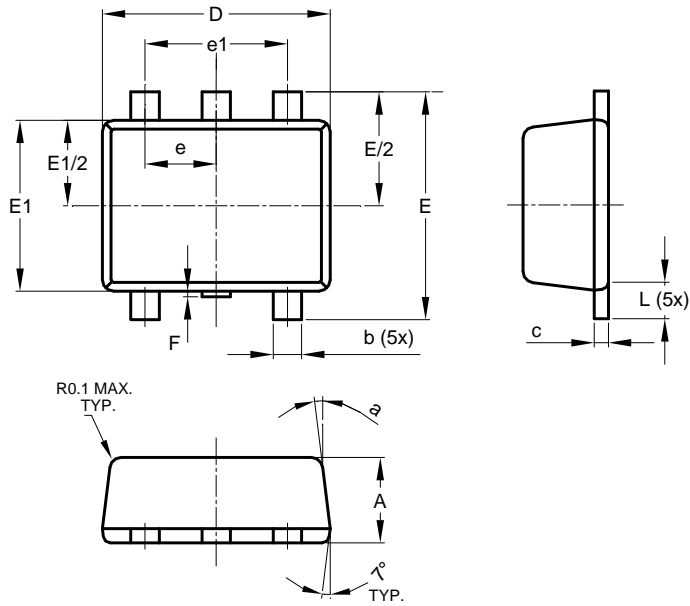
| X1-DFN1216-4         |      |      |       |
|----------------------|------|------|-------|
| Dim                  | Min  | Max  | Typ   |
| A                    | 0.47 | 0.53 | 0.50  |
| A1                   | 0.00 | 0.05 | 0.02  |
| A3                   | --   | --   | 0.13  |
| b                    | 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 |      |      |       |



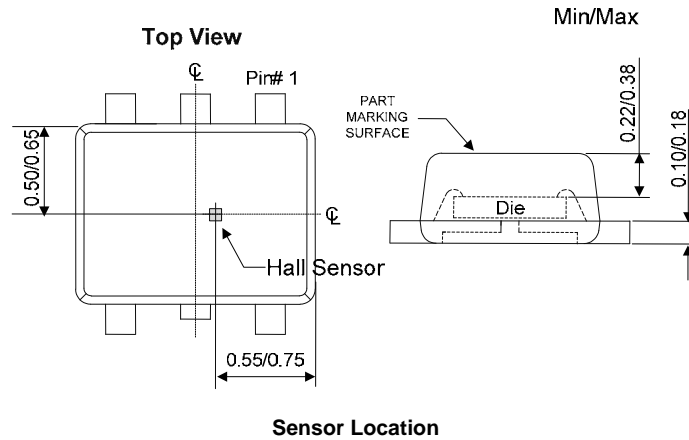
Sensor Location

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

(2) Package Type: SOT553



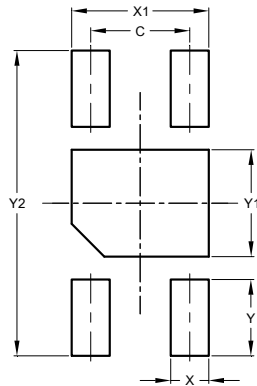
| SOT553               |          |      |      |
|----------------------|----------|------|------|
| Dim                  | Min      | Max  | Typ  |
| A                    | 0.55     | 0.62 | 0.60 |
| b                    | 0.15     | 0.30 | 0.20 |
| c                    | 0.10     | 0.18 | 0.15 |
| 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 |          |      |      |



## Suggested Pad Layout

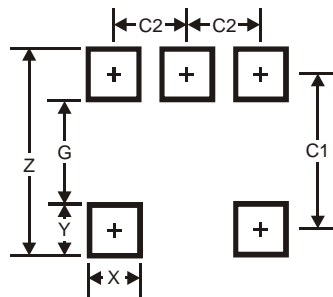
Please see AP02001 at <http://www.diodes.com/datasheets/ap02001.pdf> for the latest version.

### (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: 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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Вы можете разместить у нас заказ для любого Вашего проекта, будь то серийное производство или разработка единичного прибора.

В нашем ассортименте представлены ведущие мировые производители активных и пассивных электронных компонентов.

Нашей специализацией является поставка электронной компонентной базы двойного назначения, продукции таких производителей как XILINX, Intel (ex.ALTERA), Vicor, Microchip, Texas Instruments, Analog Devices, Mini-Circuits, Amphenol, Glenair.

Сотрудничество с глобальными дистрибьюторами электронных компонентов, предоставляет возможность заказывать и получать с международных складов практически любой перечень компонентов в оптимальные для Вас сроки.

На всех этапах разработки и производства наши партнеры могут получить квалифицированную поддержку опытных инженеров.

Система менеджмента качества компании отвечает требованиям в соответствии с ГОСТ Р ИСО 9001, ГОСТ РВ 0015-002 и ЭС РД 009

### Офис по работе с юридическими лицами:

105318, г.Москва, ул.Щербаковская д.3, офис 1107, 1118, ДЦ «Щербаковский»

Телефон: +7 495 668-12-70 (многоканальный)

Факс: +7 495 668-12-70 (доб.304)

E-mail: [info@moschip.ru](mailto:info@moschip.ru)

Skype отдела продаж:

moschip.ru

moschip.ru\_4

moschip.ru\_6

moschip.ru\_9