

PROGRAMMABLE MICROPOWER OMNIPOLAR HALL-EFFECT SWITCH

Description

The AH1898 is a micropower magnetic range selectable (Bop/Brp) 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 support battery powered equipment and low voltage microcontrollers, the AH1898 can operate over the supply range of 1.6V to 3.6V and uses a hibernating clocking system to minimize the power consumption. The average supply current is only 4.3 μ A typical at 1.80V. The AH1898 has an 8kV ESD rating on the supply and output pins. To minimize PCB space the AH1898 is packaged in the small CSP package (0.81mm x 0.81mm typical).

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**) 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**). The output will remain off when there is no magnetic field.

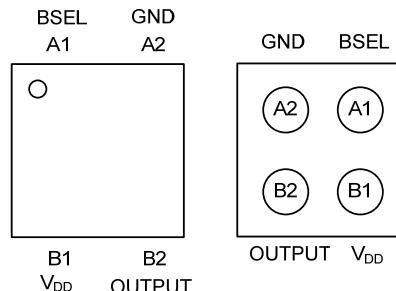
Features

- 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
- 8kV Human Body Model ESD Capability
- Miniature U-WLB0808-4 (CSP 0.81mm x 0.81mm typical)
- **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> 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

(Top View) (Bottom View)

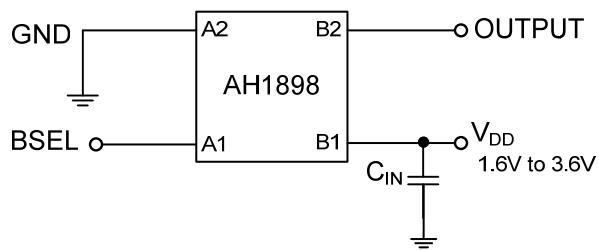


U-WLB0808-4

Applications

- Open and Close Detect for Cellular Phones
- Holster or Cover Detect for Cellular Phones and Tablet PCs
- Cover or Display Switch in Portable PCs
- Digital Still, Video Cameras and Handheld Gaming Consoles
- Proximity and Position Switches

Typical Applications Circuit



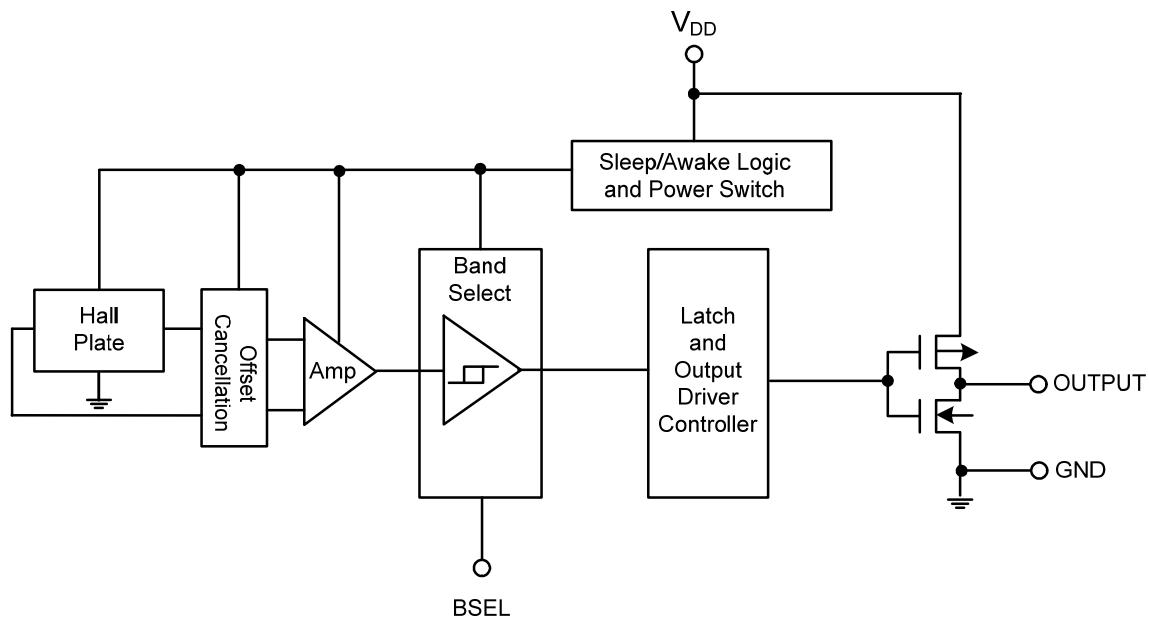
Note: 4. C_{IN} is for power stabilization and to strengthen the noise immunity, the recommended capacitance is 100nF typical.

Pin Descriptions

Package: U-WLB0808-4

Pin Number	Pin Name	Function
A1	BSEL	Band Select Pin to select operating and release gauss points
A2	GND	Ground Pin
B1	V _{DD}	Power Supply Input
B2	OUTPUT	Output Pin

Functional Block Diagram



Absolute Maximum Ratings (Note 5) (@ $T_A = +25^\circ\text{C}$, unless otherwise specified.)

Symbol	Parameter	Rating	Unit
V_{DD}	Supply Voltage (Note 6)	6	V
V_{DD_REV}	Reverse Supply Voltage	-0.3	V
I_{OUTPUT}	Output Current (source and sink)	2.5	mA
B	Magnetic Flux Density	Unlimited	
P_D	Package Power Dissipation	160	mW
T_s	Storage Temperature Range	-65 to +150	°C
T_J	Maximum Junction Temperature	150	°C
ESD HBM	Human Body Model (HBM) ESD capability	8	kV
		6	kV

Notes:

- 5. 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.
- 6. The absolute maximum V_{DD} 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 (@ $T_A = +25^\circ\text{C}$, unless otherwise specified.)

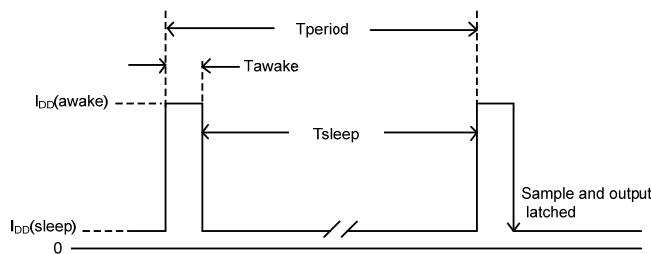
Symbol	Parameter	Conditions	Rating	Unit
V_{DD}	Supply Voltage	Operating	1.6V to 3.6V	V
T_A	Operating Temperature Range	Operating	-40 to +85	°C

Electrical Characteristics (@ $T_A = +25^\circ\text{C}$, $V_{DD} = 1.8\text{V}$, unless otherwise specified.)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{OL}	Output Low Voltage (on)	$I_{OUT} = 1\text{mA}$	—	0.1	0.2	V
V_{OH}	Output High Voltage (off)	$I_{OUT} = -1\text{mA}$	$V_{DD} - 0.2$	$V_{DD} - 0.1$	—	V
V_{SEL_LB}	Bans select voltage for low band		0	—	0.5	V
V_{SEL_HB}	Bans select voltage for high band		1.4	—	3.6	V
R_{PU_BSEL}	BSEL pin internal pull-up resistor	(Note 7)	—	50	—	kΩ
$I_{DD(\text{awake})}$	Supply Current	During 'awake' period	—	2.1	—	mA
$I_{DD(\text{sleep})}$		During 'sleep' period	—	2.5	—	mA
$I_{DD(\text{avg})}$	Average Supply Current	$V_{DD} = 1.8\text{V}$	—	4.3	8	μA
		$V_{DD} = 3.6\text{V}$	—	7.2	13	μA
T_{awake}	Awake Time	(Note 8)	—	50	100	μs
T_{period}	Period	(Note 8)	—	50	100	ms
D.C.	Duty Cycle		—	0.1	—	%
t_{BAND}	Band transition time	(Note 9)	—	100.0	200.1	ms

Notes:

- 7. BSEL pin internal pull-up resistor is only active during AWAKE time.
- 8. When power is initially turned on, the operating V_{DD} (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).
- 9. Transition time varies dependant on the timing of BSEL activation during the sleep and awake phases.



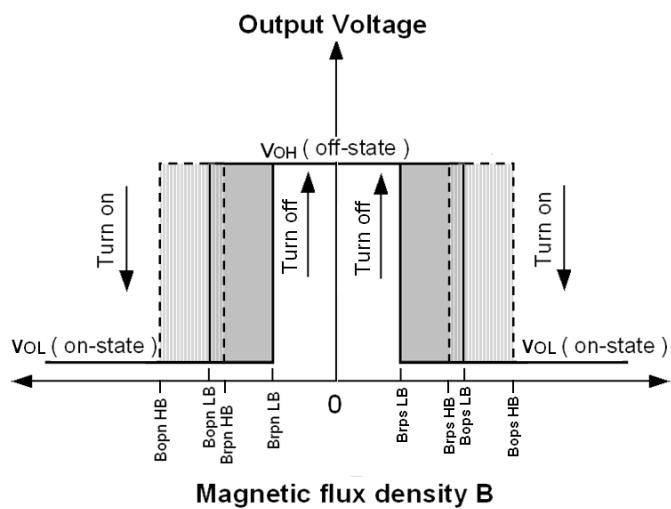
Magnetic Characteristics (Note 10 & 11) ($T_A = +25^\circ\text{C}$, $V_{DD} = 1.6\text{V}$ to 3.6V , unless otherwise specified)

(1mT=10 Gauss)						
BSEL	Symbol	Characteristics	Min	Typ	Max	Unit
Low	Bops _{LB} (south pole to part marking side side)	Low Band - Operation Point	18	35	55	Gauss
Low	Bopn _{LB} (north pole to part marking side side)		-55	-35	-18	
Low	Brps _{LB} (south pole to part marking side side)	Low Band - Release Point	12	25	45	
Low	Brpn _{LB} (north pole to part marking side side)		-45	-25	-12	
High	Bops _{HB} (south pole to part marking side side)	High Band - Operation Point	43	60	80	Gauss
High	Bopn _{HB} (north pole to part marking side side)		-80	-60	-43	
High	Brps _{HB} (south pole to part marking side side)	High Band - Release Point	35	50	70	
High	Brpn _{HB} (north pole to part marking side side)		-70	-50	-35	
	Bhy (Bopx - Brpx)	Hysteresis	—	10	—	

 Notes: 10. Typical data is at $T_A = +25^\circ\text{C}$, $V_{DD} = 1.8\text{V}$.

11. Magnetic characteristics may vary with operating temperature and after soldering.

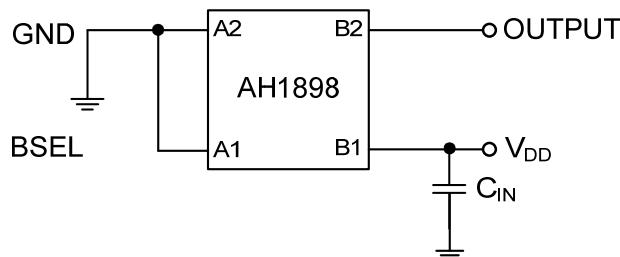
The AH1898 includes a band select pin (BSEL) so that the operate (Bops and Bopn) and release (Brps and Brpn) points can be adjusted between two pre-defined ranges. The BSEL can be hard wired within the application circuit or the band can be selected on the fly by using the BSEL pin as a logic input. This feature allows the AH1898 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 AH1898 defaults to high band.



Application Note

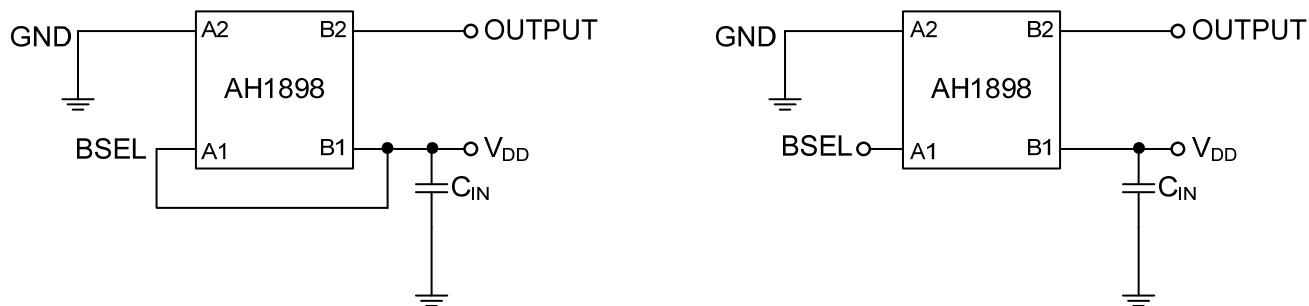
Applications Circuit One – Low Band

Connecting the BSEL pin to ground permanently configures the AH1898 into its high sensitivity mode, requiring a reduced magnetic flux density to activate its output (Low Band).



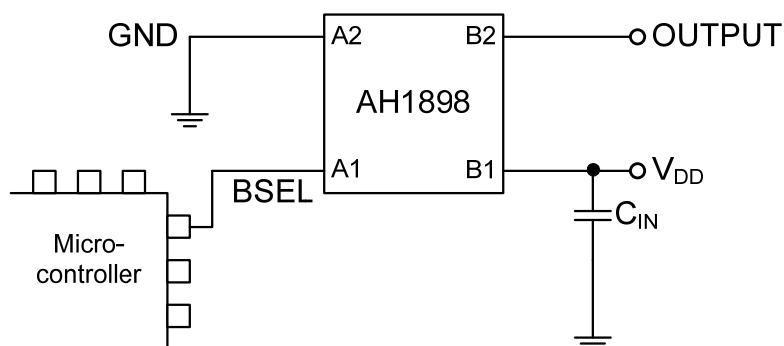
Applications Circuit Two – High Band

Connecting the BSEL pin to V_{DD} or to a voltage greater than 1.4V or leaving the BSEL pin unconnected configures the AH1898 into its low sensitivity mode, requiring a higher magnetic flux density to activate its output (High Band).



Applications Circuit Three – Adjustable Sensitivity

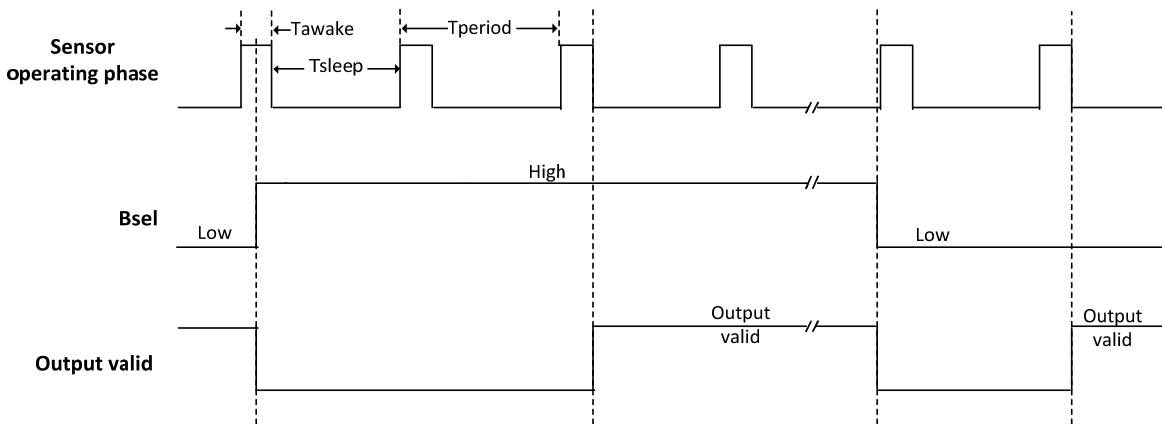
To enhance flexibility within the application, the sensitivity can be adjusted with a standard logic signal allowing it to be controlled by a micro-controller or a logic source. This allows the sensitivity to be changed within the application without a hardware change. Whenever the sensitivity band selection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



Application Note (cont.)

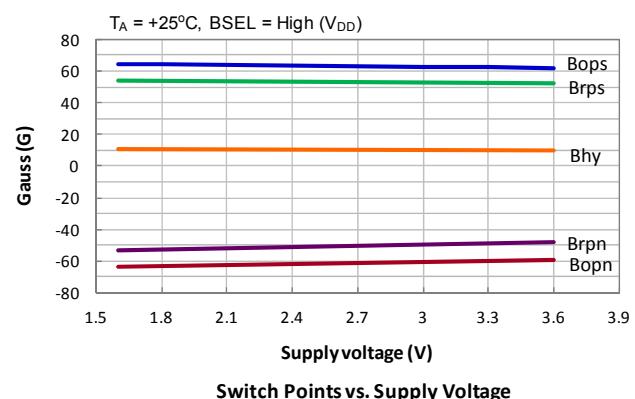
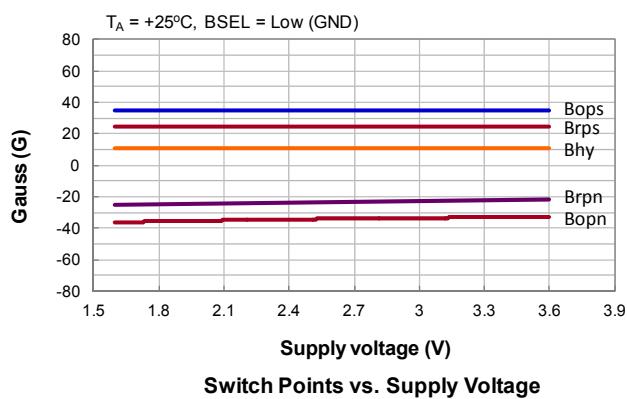
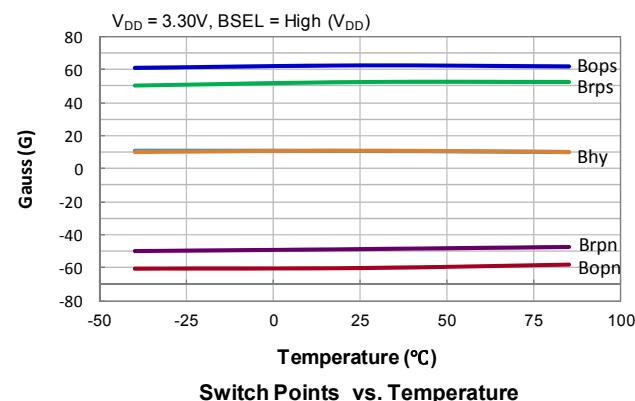
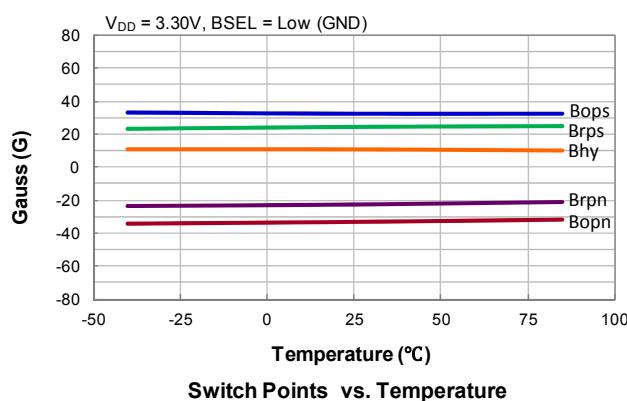
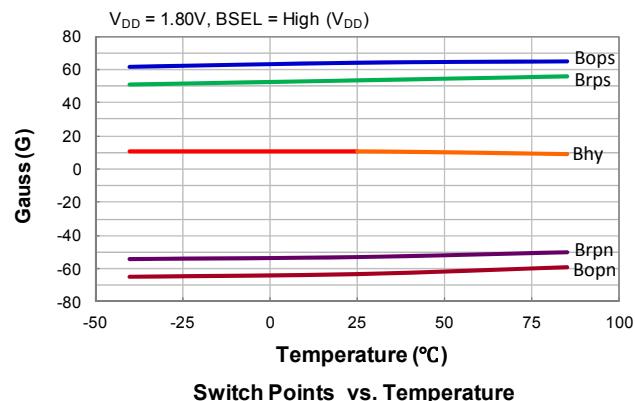
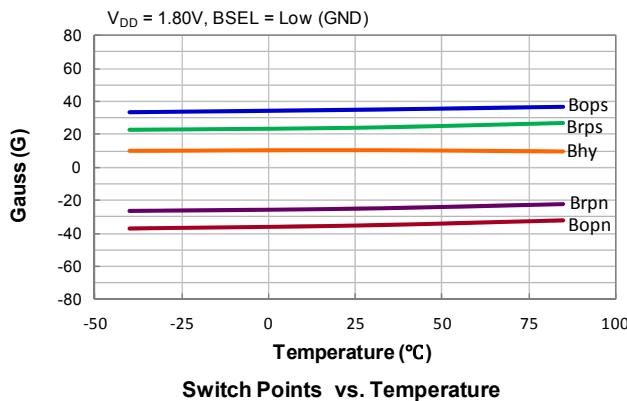
Bands Select Change Timing and Valid Output

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. 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 transition time (t_{BAND}) can range from 100ms typical and 200.1ms maximum.



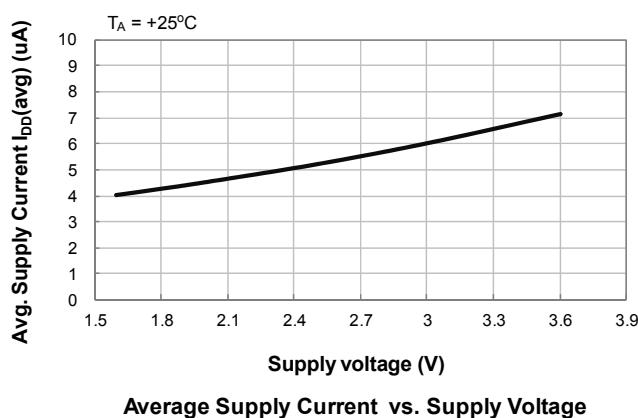
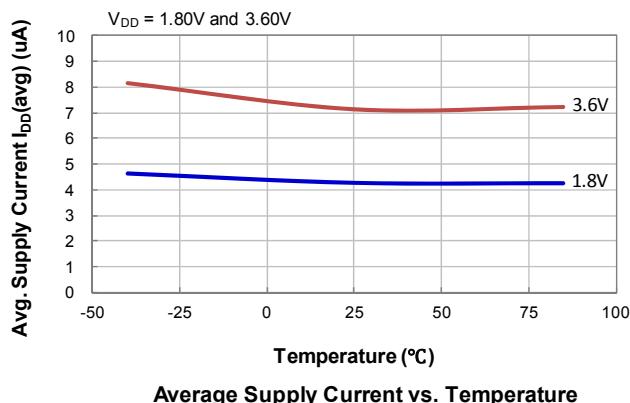
Typical Operating Characteristics

Typical switch points characteristics in low band (BSEL = Low) and high band (BSEL = High)

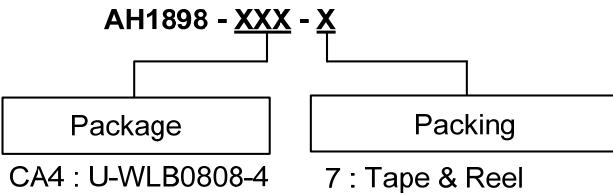


Typical Operating Characteristics (cont.)

Average Supply Current $I_{DD(\text{avg})}$



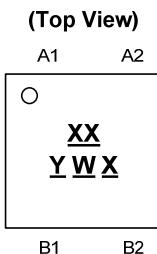
Ordering Information



Part Number	Package Code	Packaging	7" Tape and Reel	
			Quantity	Part Number Suffix
AH1898-CA4-7	CA4	U-WLB0808-4	3000/Tape & Reel	-7

Marking Information

(1) Package Type: U-WLB0808-4



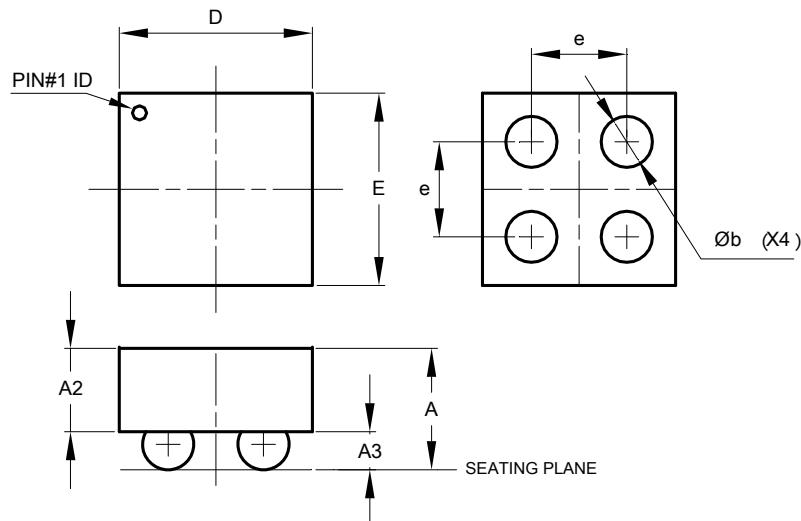
XX : Identification Code
Y : Year : 0~9
W : Week : A~Z : 1~26 week;
 a~z : 27~52 week; z represents
 52 and 53 week
X : Internal Code

Part Number	Package	Identification Code
AH1898-CA4-7	U-WLB0808-4	B8

Package Outline Dimensions (All dimensions in mm.)

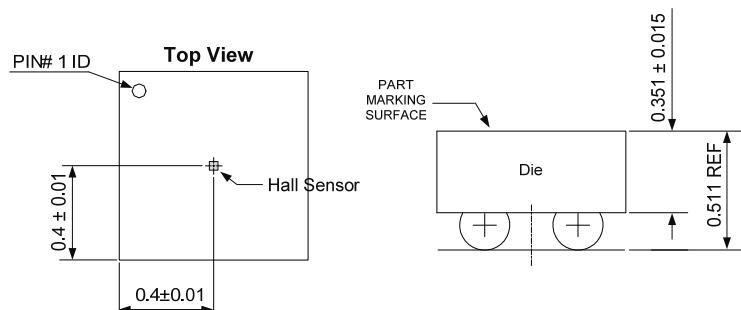
Please see AP02002 at <http://www.diodes.com/datasheets/ap02002.pdf> for latest version.

(1) Package Type: U-WLB0808-4



U-WLB0808-4			
Dim	Min	Max	Typ
A	0.511	REF	
A2	0.336	0.366	0.351
A3	0.15	0.17	0.16
b	0.205	0.225	0.215
D	0.795	0.825	0.81
E	0.795	0.825	0.81
e	-	-	0.40

All Dimensions in mm

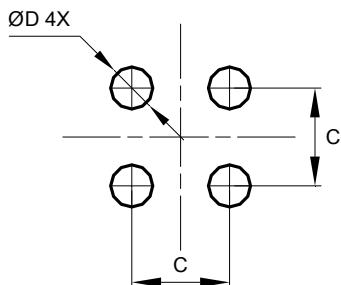


Sensor Location

Suggested Pad Layout

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

(1) Package Type: U-WLB0808-4

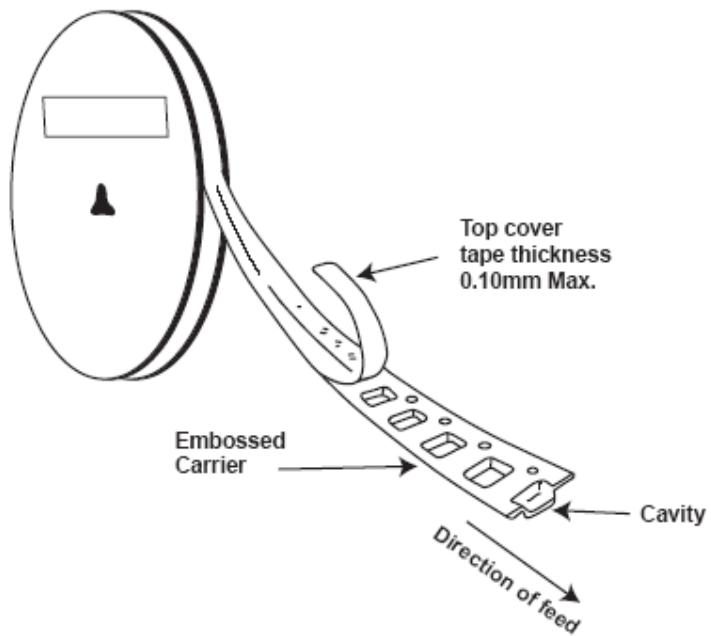
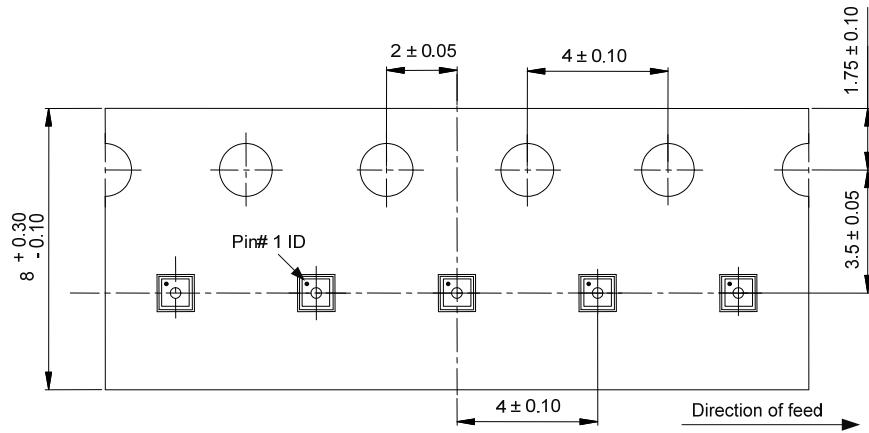


U-WLB0808-4	
Dimensions	Value
C	0.40
D	0.172

All Dimensions in mm

Taping Orientation

Package Type: U-WLB0808-4



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