ULTRA HIGH SENSITIVITY DIGITAL OMNIPOLAR HALL-EFFECT SWITCH

Description

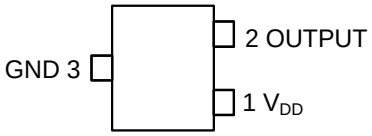
The AH1913 is an ultra-high sensitivity, digital-omnipolar, Hall effect switch IC from Diodes broad Hall effect switches family. Thanks to the hibernating clocking system, the average supply current is only 12μA at 1.8V, which makes the AH1913 a perfect fit for battery-powered consumer products, smart phones, E-meters, smoke detectors, and IoT devices. AH1913 can operate wider range of supply voltage (1.6V to 5.5V) and supports low-voltage system microcontrollers, which provides great flexibility for system design. The advanced chopper-stabilized design provides superior stability on switch-operating point over temperature and supply voltage range. The high ESD level of up to 6KV helps improve the system robustness.

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 (B_{OP}), the output turns on (pulled low) and held until B is lower than release point (B_{RP}).

The AH1913 comes with industry standard SC59 and X1-DFN1216-4 package

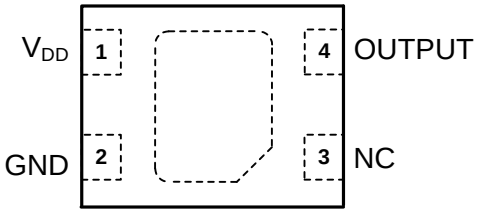
Pin Assignments

SC59



(Top View)

(Top View)



X1-DFN1216-4

Features

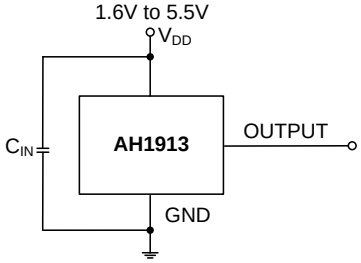
- Omnipolar Operation (North or South Pole)
- Supply Voltage of 1.6V to 5.5V
- Micropower Operation
- Chopper-Stabilized Design Provides:
  - Superior Temperature Stability
  - Minimal Switch Point Drift
  - Enhanced Immunity to Physical Stress
- -40°C to +85°C Operating Temperature
- High ESD Capability of 6kV (Human Body Model)
- Small Low Profile, SC59 and X1-DFN1216-4 Package
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**

Applications

- Smart Cover or Dock Detect for Cellular Phones and Tablets
- Position Detect for Digital Still, Video Cameras, and Handheld Gaming Consoles
- Door, Lids, and Tray Position Detect Switches Home Appliances and Industrial Applications
- Level, Proximity, Position Switches, E-Locks, and Smoke Detectors
- Contactless Switches in Home Appliances and Industrial Applications
- Medical Devices, IoT Systems

Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
2. See https://www.diodes.com/quality/lead-free/ 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.

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

(1) Package: SC59

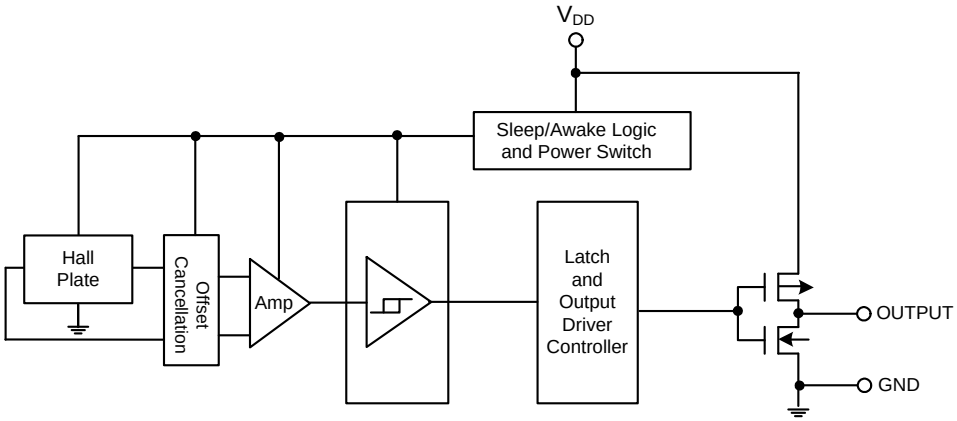
Pin Number	Pin Name	Function
1	V_{DD}	Power Supply Input
2	OUTPUT	Output Pin
3	GND	Ground Pin

(2) Package: X1-DFN1216-4

Pin Number	Pin Name	Function
1	V_{DD}	Power Supply Input
2	GND	Ground Pin
3	NC	No Connection (Note 5)
4	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_A = +25°C, unless otherwise specified.)

Symbol	Parameter		Rating	Unit
V_{DD}	Supply Voltage (Note 7)		6	V
V_{DD_REV}	Reverse Supply Voltage		-0.3	V
I_{OUTPUT}	Output Current (Source and Sink)		1	mA
B	Magnetic Flux Density		Unlimited	
P_D	Package Power Dissipation	SC59 and X1-DFN1216-4	230	mW
Ts	Storage Temperature Range		-65 to +150	°C
T_J	Maximum Junction Temperature		150	°C
ESD HBM	Human Body Model (HMB) ESD Capability		6	kV

Notes: 6. Stresses greater than the *Absolute Maximum Ratings* specified above can 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.

7. 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.

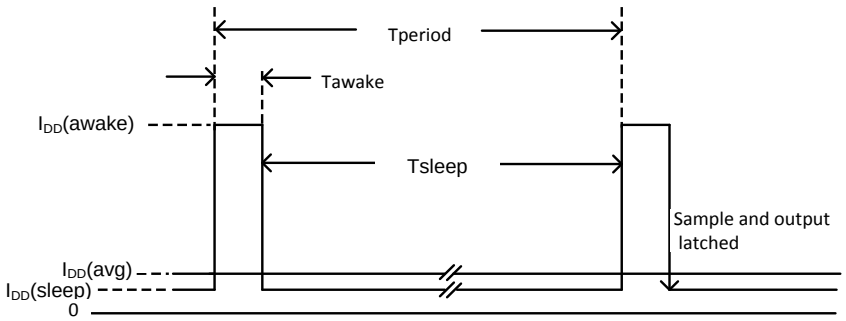
Recommended Operating Conditions (@T_A = +25°C, unless otherwise specified.)

Symbol	Parameter	Conditions	Rating	Unit
V_{DD}	Supply Voltage	Operating	1.6 to 5.5	V
T_A	Operating Temperature Range	Operating	-40 to +85	°C

Electrical Characteristics (@T_A = +25°C, unless otherwise specified.)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{OL}	Output Low Voltage (on)	I_{OUT} = 0.1mA	—	0.1	0.25	V
V_{OH}	Output High Voltage (off)	I_{OUT} = -0.1mA	V_{DD} - 0.25	V_{DD} - 0.1	—	V
I_{DD}(awake)	Supply Current	During 'Awake' Period, V_{DD} = 1.8V	—	0.72	—	mA
I_{DD}(sleep)		During 'Sleep' Period, V_{DD} = 1.8V	—	0.36	—	µA
I_{DD}(avg)	Average Supply Current	V_{DD} = 1.8V	—	12	22	µA
		T_A = -40°C ~ 85°C, V_{DD} =1.6V to 5.5V	—	12	41	µA
Tawake	Awake Time	(Note 7)	30	45	80	µs
Tperiod	Period	(Note 7)	1.4	2.8	5.6	ms
D.C.	Duty Cycle	—	—	1.6	—	%

Note: 7. When power is initially turned on, the operating V_{DD} (1.6V to 5.5V) must be applied to guaranteed the output sampling. The output state is valid after the second operating cycle (typical 5.6ms).

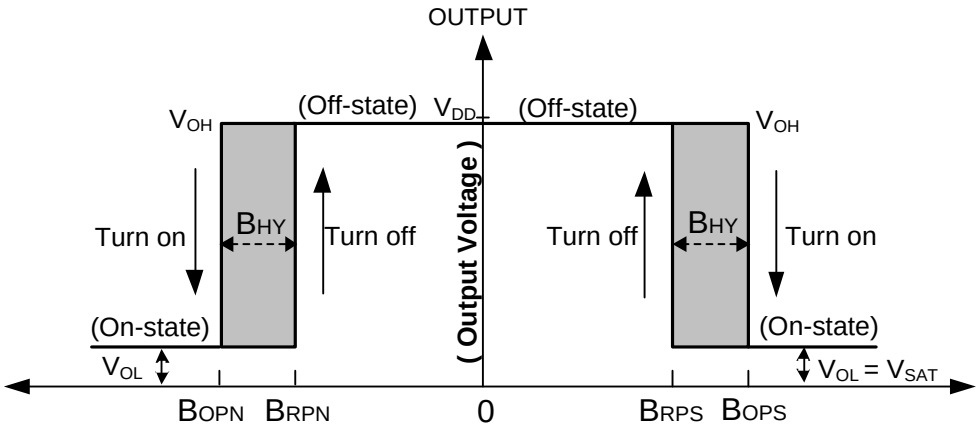


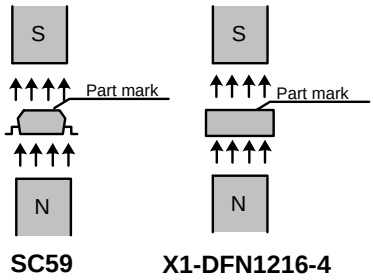
Magnetic Characteristics (Note 8) (T_A = -+25°C , V_{DD} = 3V,, unless otherwise specified)

(1mT=10 Gauss)

Symbol	Characteristics	Test Condition	Min	Typ	Max	Unit
B_{OPS} (South Pole to the Part Marking Side)	Operation Point	—	9	18	27	Gauss
		V_{DD} = 1.6V to 5.5V T_A = -40°C to +85°C	6	18	30	
B_{OPN} (North Pole to the Part Marking Side).		—	-27	-18	-9	
		V_{DD} = 1.6V to 5.5V T_A = -40°C to +85°C	-30	-18	-6	
B_{RPS} (South Pole to the Part Marking Side)	Release Point	—	3	11	20	
		V_{DD} = 1.6V to 5.5V T_A = -40°C to +85°C	2	11	24	
B_{RPN} (North Pole to the Part Marking Side)		—	-20	-11	-3	
		V_{DD} = 1.6V to 5.5V T_A = -40°C to +85°C	-24	-11	-2	
B_{HY} ($\|B_{OPX}\|$ - $\|B_{RPX}\|$)	Hysteresis	—	2	7	-	

Notes: 8. 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 can vary with supply voltage, operating temperature, and after soldering.

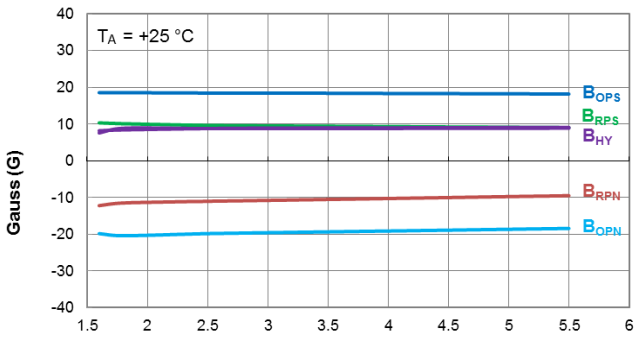




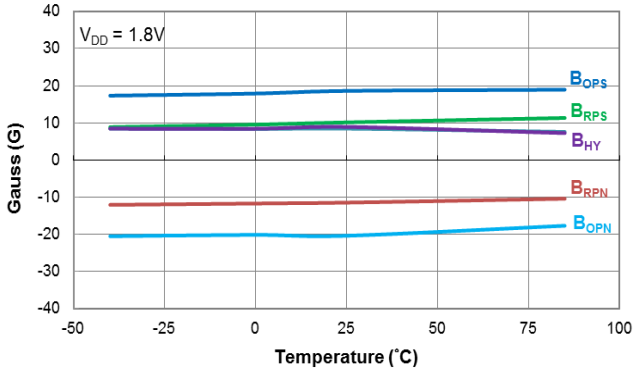
SC59 **X1-DFN1216-4**

Typical Operating Characteristics

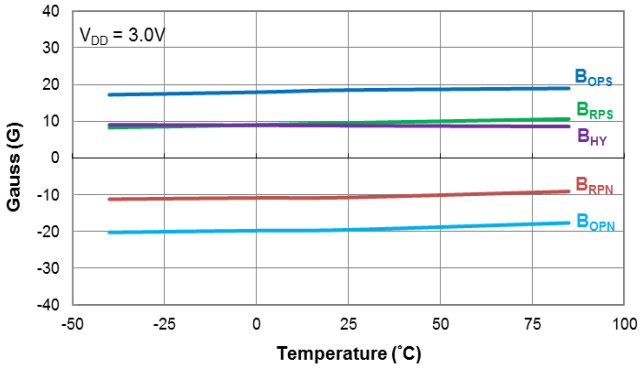
Output Switch Operate and Release Points (Magnetic Thresholds)



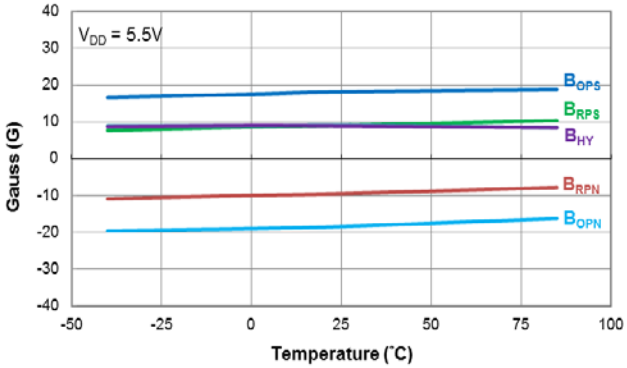
Switch Points vs Supply Voltage



Switch Points vs Temperature

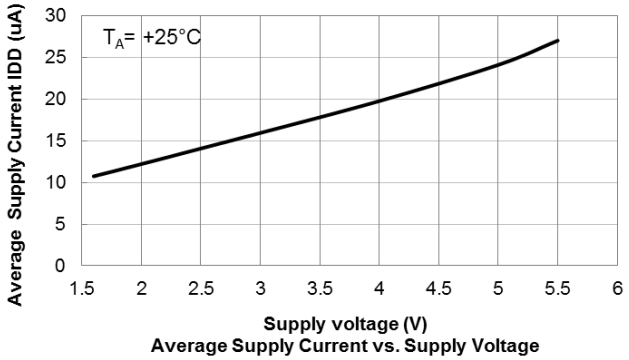


Switch Points vs Temperature

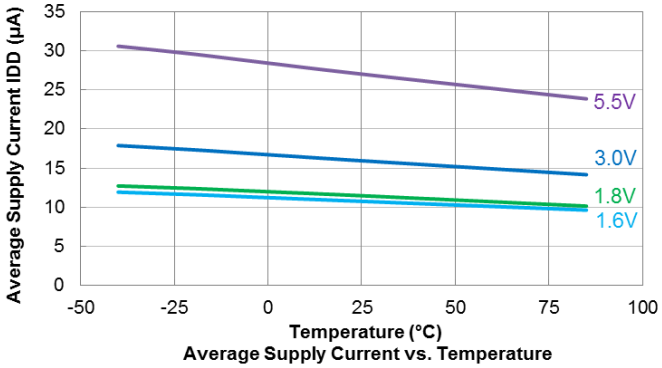


Switch Points vs Temperature

Average Supply Current

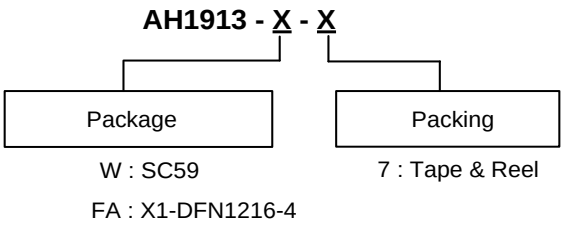


Average Supply Current vs. Supply Voltage



Average Supply Current vs. Temperature

Ordering Information

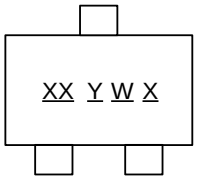


Part Number	Package Code	Packaging	7" Tape and Reel	
			Quantity	Part Number Suffix
AH1913-W-7	W	SC59	3000/Tape & Reel	-7
AH1913-FA-7	FA	X1-DFN1216-4	3000/Tape & Reel	-7

Marking Information

(1) Package Type: SC59

(Top View)

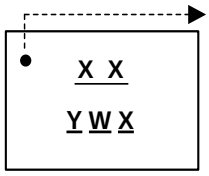


XX : Identification code
Y : Year 0 to 9
W : Week : A to Z : 1 to 26 week;
a to z : 27 to 52 week; z represents
52 and 53 week
X : Internal code

Part Number	Package	Identification Code
AH1913-W-7	SC59	KT

(2) Package Type: X1-DFN1216-4

(Top View)



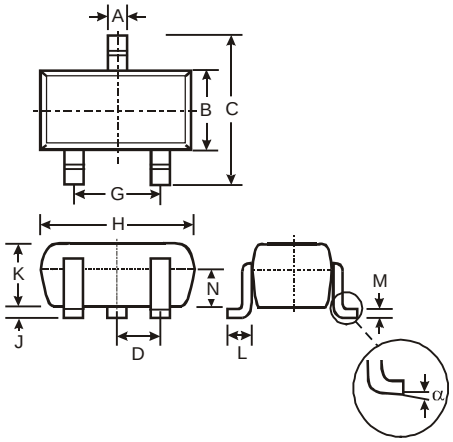
Pin 1 indicator
XX : Identification Code
Y : Year : 0~9
W : Week : A~Z : 1~26 week;
a~z : 27~52 week; z represents
52 and 53 week
X : Internal code

Part Number	Package	Identification Code
AH1913-FA-7	X1-DFN1216-4	KV

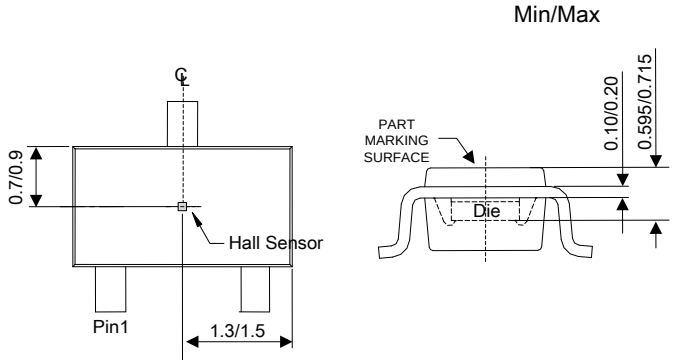
Package Outline Dimensions (All dimensions in mm.)

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

(1) 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
α	0°	8°	-
All Dimensions in mm			

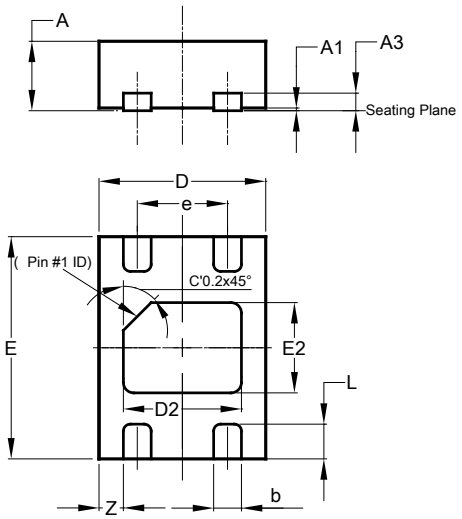


Sensor Location

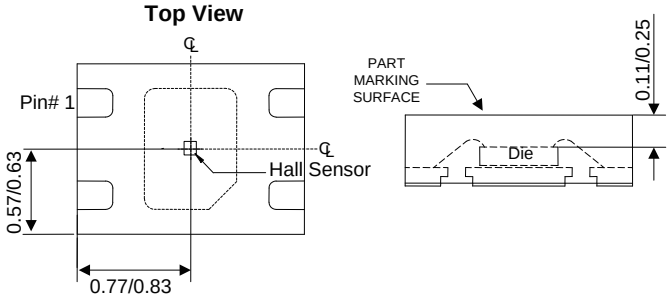
Package Outline Dimensions (All dimensions in mm.)

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

(2) 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			

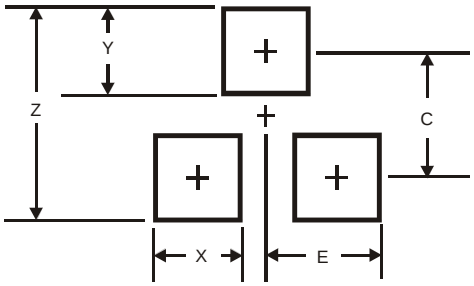


Sensor Location

Suggested Pad Layout

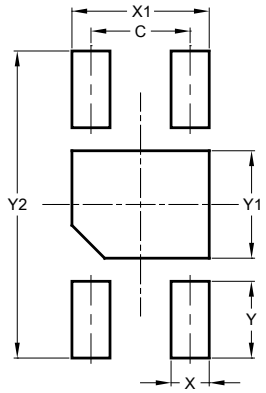
Please see http://www.diodes.com/package-outlines.html for the latest version.

(1) Package Type: SC59



Dimensions	SC59
Z	3.4
X	0.8
Y	1.0
C	2.4
E	1.35

(2) Package Type: X1-DFN1216-4



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

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