

## Description

The AH9251 is a medium sensitivity Hall-effect switch with internal pull-up resistor on the output, designed for battery operated handheld equipments to industrial applications.

A chopper stabilized architecture improves stability of magnetic switch points over the whole operating range. A sleep-awake logic controls the sleep and awake time to reduce the average operating current of the device. During the awake time, the output is changed with the magnetic flux density. During the sleep time, the output is latched in its previous state and the current consumption reduces to 4 $\mu$ A typical at 3V. The average current consumption is 8 $\mu$ A at 3V.

The output can be switched on with either north or south pole of sufficient strength. If the magnetic flux density perpendicular to the part marking surface is larger than operating point ( $B_{OP}$ ), the output will be turned on; if it is less than releasing point ( $B_{RP}$ ), the output will be turned off.

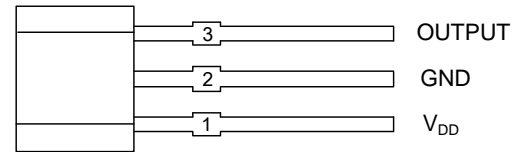
The AH9251 is available in industry standard TO92S and SC59 packages.

## Features

- Omnipolar Operation (Switching with North or South Poles)
- 2.5V to 5.5V Power Supply
- Micropower Operation
- Built in Pull-up Resistor on the Output
- Stabilized Chopper
- Superior Temperature Stability
- Digital Output Signal
- -40°C to +85°C Operating Temperature
- ESD (HBM): 5000V
- Small Low Profile Industry Standard SC59 and TO92S Packages
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**

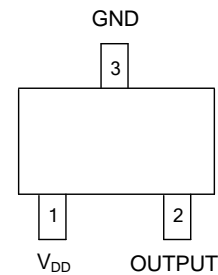
## Pin Assignments

(Front View)



**TO92S**

(Top View)



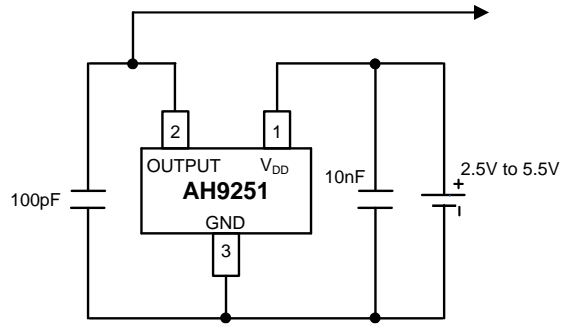
**SC59**

## Applications

- Handheld Wireless Applications Proximity Detection Switches
- Doors, Lids, Covers and Tray Position Detect Switches
- Liquid Level Detection
- Battery Powered Consumer, Home Appliances and Industrial Applications

- 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.

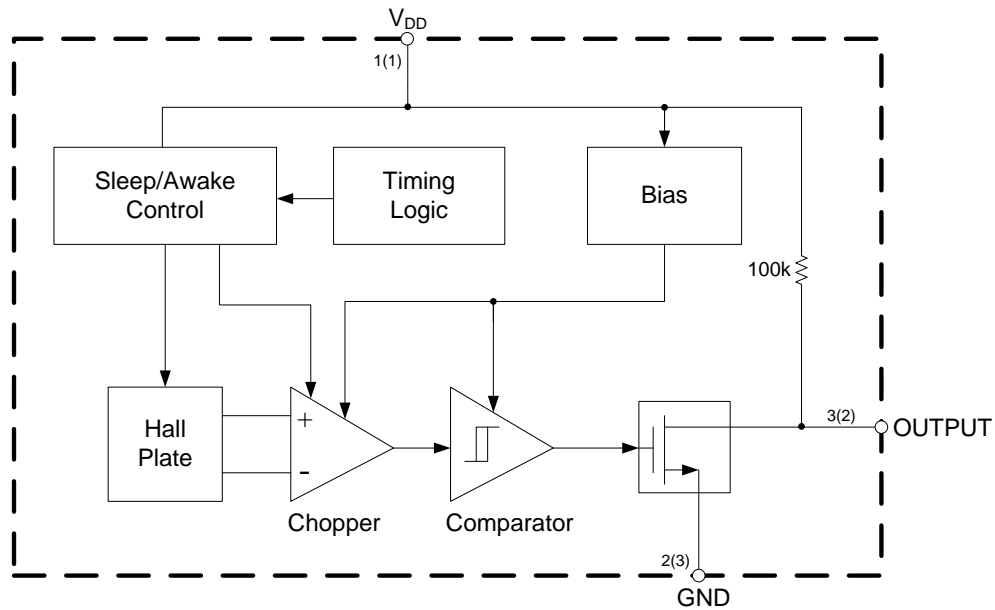
**Typical Applications Circuit**



**Pin Descriptions**

Pin Number		Pin Name	Function
TO92S	SC59		
1	1	V <sub>DD</sub>	Power supply pin
2	3	GND	Ground pin
3	2	OUTPUT	Output pin

**Functional Block Diagram**



A (B)  
A for TO92S  
B for SC59

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**Absolute Maximum Ratings** (Note 4) (@ $T_A = +25^\circ\text{C}$ , unless otherwise specified.)

Symbol	Parameter	Rating		Unit
$V_{DD}$	Supply Voltage (Note 5)	7		V
$I_{DD}$	Supply Current (Fault)	6		mA
$V_{OUT}$	Output Voltage	7		V
$I_{OUT}$	Output Current	2		mA
B	Magnetic Flux Density	Unlimited		Gauss
$P_D$	Power Dissipation	TO92S	230	mW
		SC59	230	
$T_{STG}$	Storage Temperature	-55 to +150		$^\circ\text{C}$
$T_J$	Junction Temperature	+150		$^\circ\text{C}$
–	ESD (Human Body Model) (Note 6)	5000		V
–	ESD (Machine Model) (Note 6)	400		V

- 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  $V_{DD}$  of 7V 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.
  - Electronic semiconductor products are sensitive to Electro Static Discharge (ESD). Always observe Electro Static Discharge control procedures whenever handling semiconductor products.

**Recommended Operating Conditions**

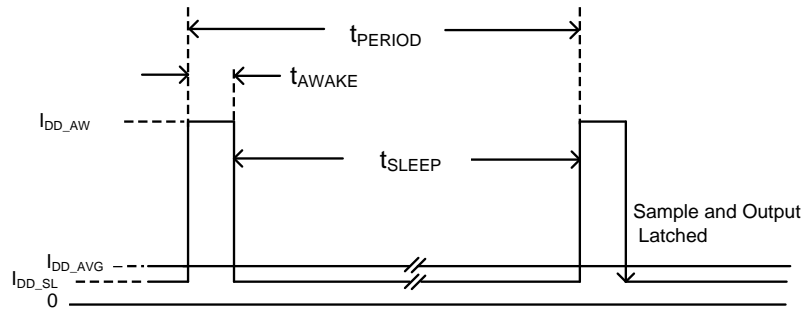
Symbol	Characteristic	Conditions	Min	Max	Unit
$V_{DD}$	Supply Voltage	Operating	2.5	5.5	V
$T_A$	Operating Temperature Range	Operating	-40	+85	$^\circ\text{C}$

**Electrical Characteristics** (Note 7) (@ $T_A = +25^\circ\text{C}$ ,  $V_{DD} = 3\text{V}$ , unless otherwise specified.)

Symbol	Characteristic	Conditions	Min	Typ	Max	Unit
$V_{DD}$	Supply Voltage	Operating	2.5	3	5.5	V
$I_{DD\_AW}$	Supply Current During "Awake" Period	$T_A = -40$ to $+85^\circ\text{C}$ , $V_{DD} = 2.5\text{V}$ to $5.5\text{V}$	–	1.8	3	mA
$I_{DD\_SL}$	Supply Current During "Sleep" Period	$T_A = -40$ to $+85^\circ\text{C}$ , $V_{DD} = 2.5\text{V}$ to $5.5\text{V}$	–	4	10	$\mu\text{A}$
$I_{DD\_AVG}$	Average Supply Current	$T_A = -40$ to $+85^\circ\text{C}$ , $V_{DD} = 2.5\text{V}$ to $5.5\text{V}$	–	8	15	$\mu\text{A}$
$I_{OUT}$	Output Current	–	–	–	1.0	mA
$I_{OFF}$	Output Leakage Current	$V_{OUT} = 5.5\text{V}$ , Output off	–	<0.1	1	$\mu\text{A}$
$V_{OUT(SAT)}$	Output Saturation Voltage	$I_{OUT} = 1.0\text{mA}$ , Output on	–	–	0.4	V
$t_{AW}$	Awake Mode Time	Operating	–	150	–	$\mu\text{s}$
$t_{SL}$	Sleep Mode Time	Operating	–	100	–	ms
D	Duty Cycle	–	–	0.15	–	%
$f_c$	Chopper Frequency	–	–	15	–	kHz

- Note: 7. Parameters values over 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.

**Electrical Characteristics** (Cont.) (@ $T_A = +25^\circ\text{C}$ ,  $V_{DD} = 3\text{V}$ , unless otherwise specified.)



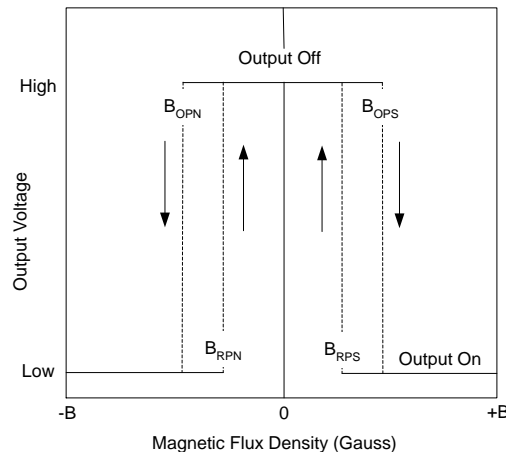
**Magnetic Characteristics** (Notes 8 & 9) (@ $T_A = -40^\circ\text{C}$  to  $+85^\circ\text{C}$ ,  $V_{DD} = 3\text{V}$ , unless otherwise specified.)

(1mT=10 Gauss)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$B_{OPS}$ (South Pole to Part Marking Side)	Operating Point	$B > B_{OPS}, V_{OUT} = \text{Low}$ (output on)	40	60	80	Gauss
$B_{OPN}$ (North Pole to Part Marking Side)		$B > B_{OPN}, V_{OUT} = \text{Low}$ (output on)	-80	-60	-40	Gauss
$B_{RPS}$ (South Pole to Part Marking Side)	Releasing Point	$B < B_{RPS}, V_{OUT} = \text{High}$ (output off)	30	50	70	Gauss
$B_{RPN}$ (North Pole to Part Marking Side)		$B < B_{RPN}, V_{OUT} = \text{High}$ (output off)	-70	-50	-30	Gauss
$B_{HYS}$ (   $B_{OPX} - B_{RPX}$   )	Hysteresis	(Note 9)	-	10	-	Gauss

- Notes:
- 8. Parameters values over 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.
  - 9. Maximum and minimum hysteresis is guaranteed by design and characterization.  
 $B_{OPX}$ =operating point (output turns on);  $B_{RPX}$ =releasing point (output turns off)

**Operating Characteristics**

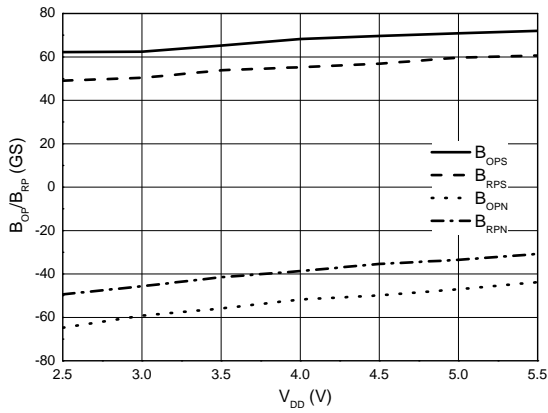


**Output Voltage vs. Magnetic Flux Density**

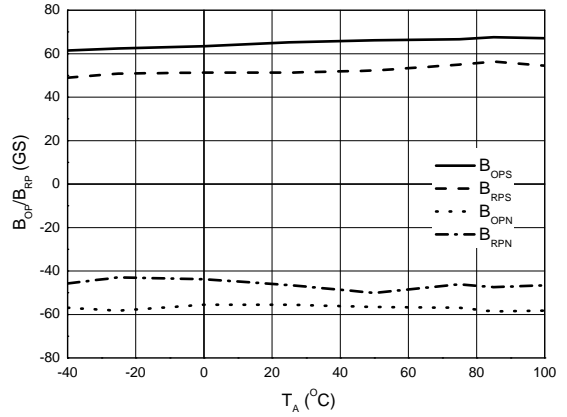
**Performance Characteristics**

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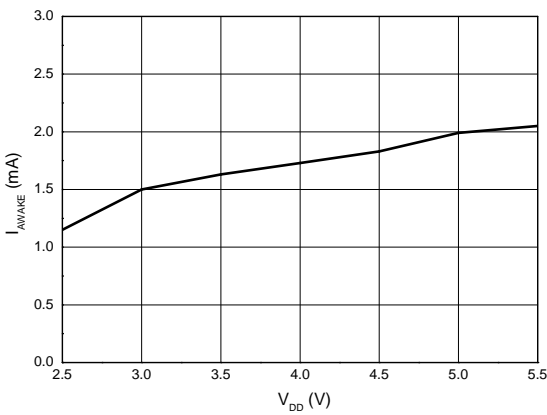
**B<sub>OP</sub>/B<sub>RP</sub> vs. Supply Voltage**



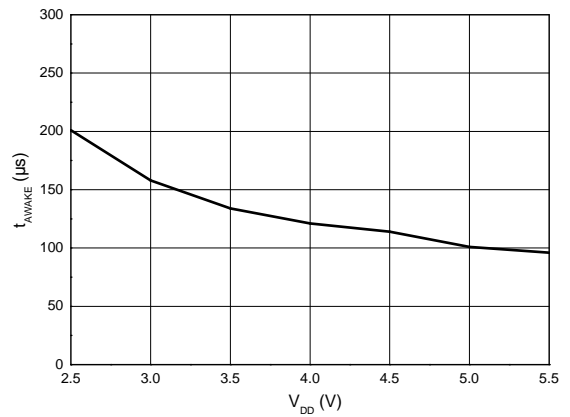
**B<sub>OP</sub>/B<sub>RP</sub> vs. Ambient Temperature**



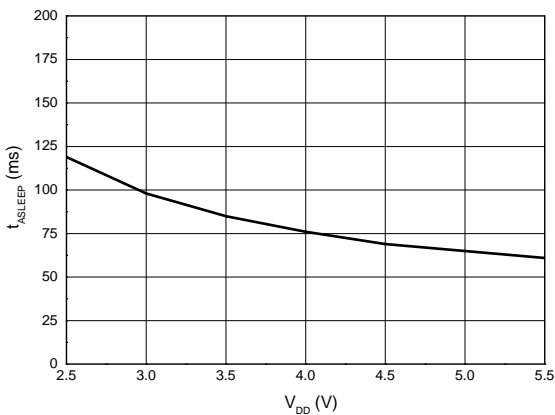
**Average Supply Current vs. Supply Voltage**



**Awake Mode Time vs. Supply Voltage**



**Sleep Mode Time vs. Supply Voltage**

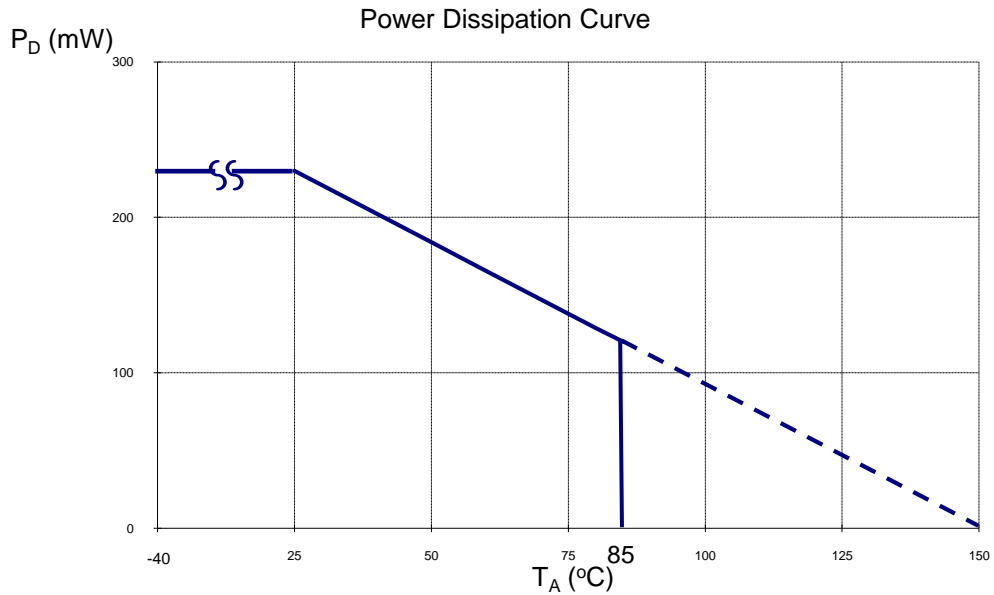


**Thermal Performance**

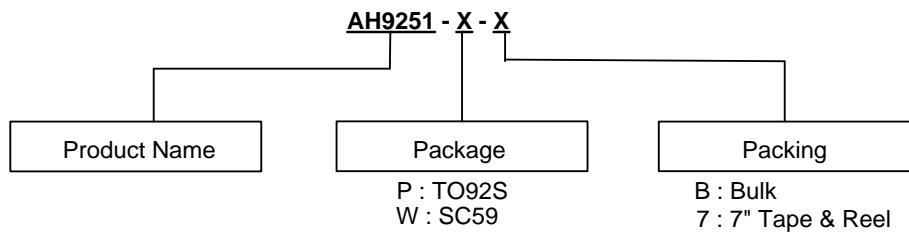
**Power Dissipation De-rating Curve**

(1) Package Types: SC59 and TO92S

T <sub>A</sub> (°C)	-40	0	25	50	60	70	80	85	90	100	110	120	130	140	150
P <sub>D</sub> (mW)	230	230	230	184	166	147	129	120	110	92	74	55	37	18	0



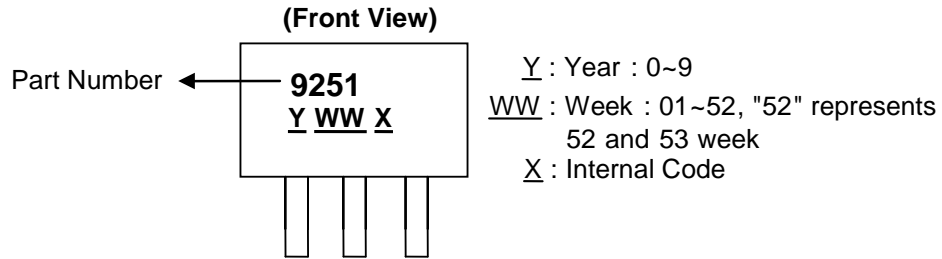
**Ordering Information**



Device	Package Code	Packaging	Bulk	7" Tape and Reel
			Quantity	Quantity
AH9251-P-B	P	TO92S	1000/Bulk	NA
AH9251-W-7	W	SC59	NA	3000/Tape & Reel

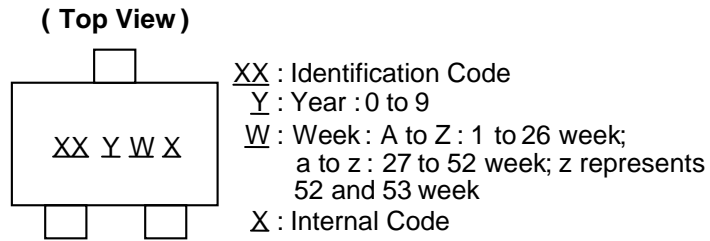
**Marking Information**

(1) Package Type: TO92S



Part Number	Package	Identification Code
AH9251	TO92S	9251

(2) Package Type: SC59



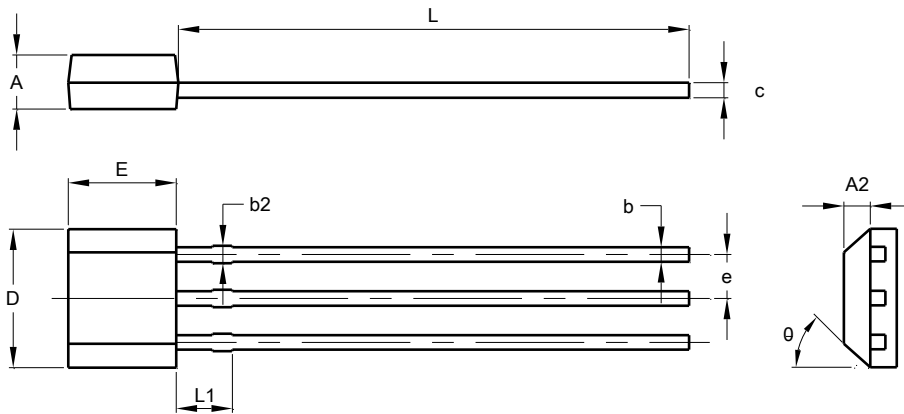
Part Number	Package	Identification Code
AH9251	SC59	HT

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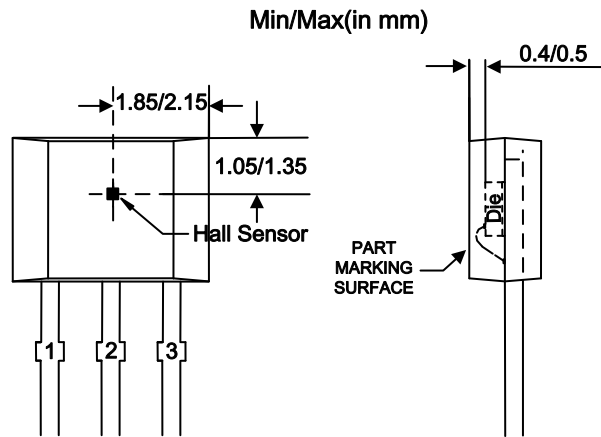
**Package Outline Dimensions** (All dimensions in mm.)

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

(1) Package Type: TO92S(TYPE B)



TO92S (TYPE B)			
Dim	Min	Max	Typ
A	1.420	1.620	-
A2	-	-	0.750
b	0.360	0.480	-
b2	0.380	0.550	-
c	0.360	0.510	-
D	3.850	4.150	-
E	2.900	3.310	-
e	-	-	1.270
L	14.000	15.500	-
L1	-	-	1.600
θ	44°	46°	-
All Dimensions in mm			



**Sensor Location**

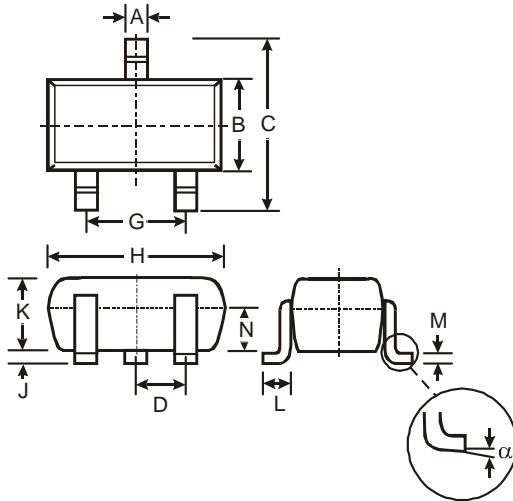
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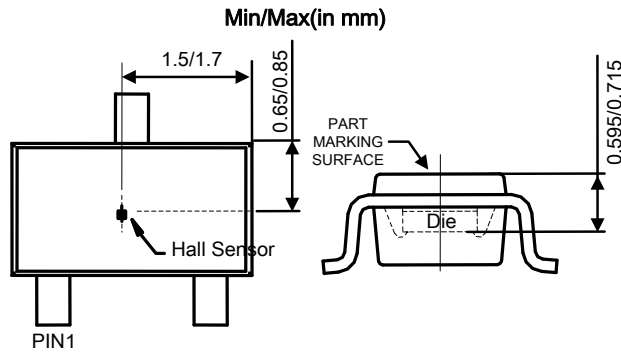
**Package Outline Dimensions** (All dimensions in mm.) (Cont.)

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

(2) 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
$\alpha$	0°	8°	-
All Dimensions in mm			

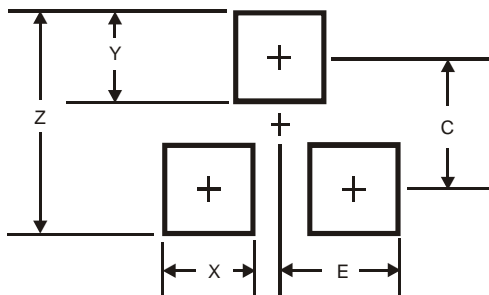


**Sensor Location**

**Suggested Pad Layout**

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

(1) Package Type: SC59



Dimensions	Value (in mm)
Z	3.4
X	0.8
Y	1.0
C	2.4
E	1.35

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