

## LOW SENSITIVITY MICROPOWER OMNIPOLAR HALL-EFFECT SWITCH

### Description

The AH1815 is a low-sensitivity, micro-power Omnipolar Hall effect switch IC, designed for portable and battery powered consumer equipment for home appliance and industrial applications such as smart-meter magnetic-tamper detection. Based on two sensitive Hall effect plates and a chopper-stabilized architecture, the AH1815 provides a reliable solution over the whole operating range. To support portable and battery powered equipment, the design has been optimized to operate over the supply range of 2.5V to 5.5V and consumes only 24μW with a supply of 3V.

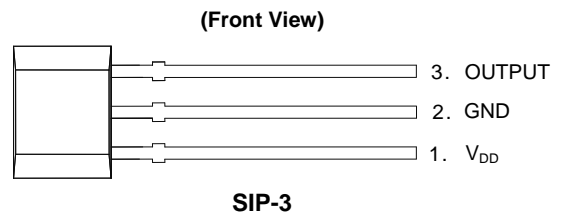
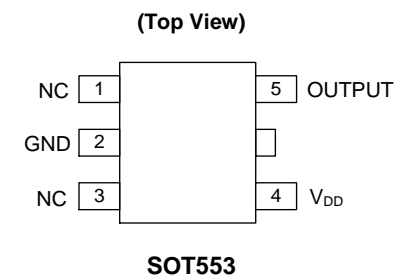
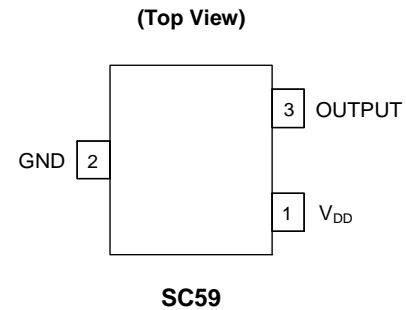
The single open drain output can switch on with either a north or south pole of sufficient strength. When the magnetic flux density (B) perpendicular to the package is larger than operating point (Bop) the output is switched on (pulled low). The output is turned off when B becomes lower than the releasing point (Brp). The output will remain off when there is no magnetic field.

### Features

- Omnipolar (North or South pole) Operation
- Low Sensitivity
- Single Open Drain Output
- Micropower Operation
- 2.5V to 5.5V Operating Range
- Chopper Stabilized Design Provides Superior Temperature Stability  
Minimal Switch Point Drift  
Enhanced Immunity to Stress
- Good RF Noise Immunity
- -40°C to +125°C Operating Temperature
- ESD (HBM) > 6KV
- Small Low Profile SOT553 and Industry Standard SC59 and SIP-3 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.

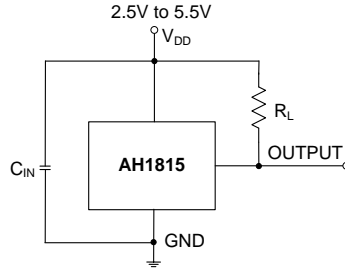
### Pin Assignments



### Applications

- Doors, Lids, Covers and Tray Position Detect Switches
- Display Switch for Portable PCs and Tablets
- On/Off Switch for PDAs and Digital Cameras
- Liquid Level Detection for Coffee Machines
- Smart Meters
- Position, Proximity and Level Detection Contactless Switch in Battery Powered Consumer, Home Appliances and Industrial Applications

**Typical Applications Circuit** (Note 4)



Note: 4.  $C_{IN}$  is for power stabilization and to strengthen the noise immunity, the recommended capacitance is 10nF to 100nF.  
 $R_L$  is the pull-up resistor, the recommended resistance is 10k $\Omega$  to 100k $\Omega$ .

**Pin Descriptions**

Packages: SC59 and SIP-3

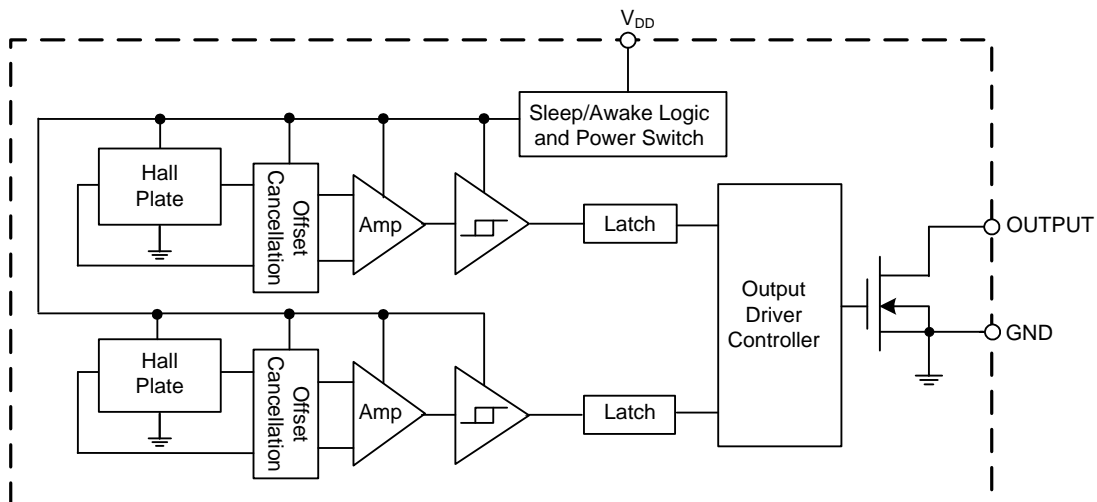
Pin Number	Pin Name	Function
1	V <sub>DD</sub>	Power Supply Input
2	GND	Ground
3	OUTPUT	Output

Package: SOT553

Pin Number	Pin Name	Function
1	NC	No Connection (Note 5)
2	GND	Ground
3	NC	No Connection (Note 5)
4	V <sub>DD</sub>	Power Supply Input
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) (@ $T_A = +25^\circ\text{C}$ , unless otherwise specified.)

Symbol	Parameter	Values	Unit	
$V_{DD}$	Supply Voltage (Note 7)	7	V	
$V_{OUT}$	Output Pin Voltage (Note 7)	7	V	
$V_{DD\_REV}$	Reverse Supply Voltage	-0.3	V	
$V_{OUT\_REV}$	Reverse Output Pin Voltage	-0.3	V	
$I_{OUTPUT}$	Output Current (Source and Sink)	2.5	mA	
B	Magnetic Flux Density	Unlimited		
$P_D$	Package Power Dissipation	SC59 and SOT553	230	mW
		SIP-3	230	mW
$T_{STG}$	Storage Temperature Range	-65 to +150	$^\circ\text{C}$	
$T_J$	Maximum Junction Temperature	+150	$^\circ\text{C}$	
ESD HBM	Human Body Model ESD capability	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  $V_{DD}$  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.

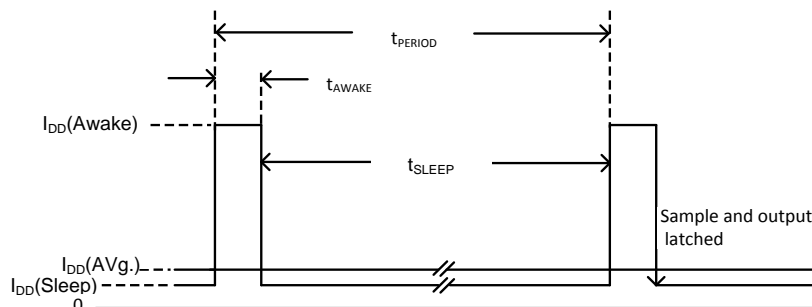
**Recommended Operating Conditions** (@ $T_A = +25^\circ\text{C}$ , unless otherwise specified.)

Symbol	Characteristic	Conditions	Rating	Unit
$V_{DD}$	Supply Voltage	Operating	2.5 to 5.5	V
$V_{OUT\_MAX}$	Maximum Output Pin Voltage	Operating	5.5	V
$T_A$	Operating Temperature Range	Operating	-40 to +125	$^\circ\text{C}$

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

Symbol	Characteristic	Conditions	Min	Typ	Max	Unit
$V_{OUT\_ON}$	Output On Voltage	$I_{OUT} = 1\text{mA}$	—	0.1	0.3	V
$I_{OFF}$	Output Leakage Current	$V_{OUT} = 5.5\text{V}$ , Output off	—	< 0.1	1	$\mu\text{A}$
$I_{DD}$ (Awake)	Supply Current	During awake period, $T_A = +25^\circ\text{C}$ , $V_{DD} = 3\text{V}$	—	3	6	mA
		During awake period, $T_A = -40^\circ\text{C}$ to $+125^\circ\text{C}$ , $V_{DD} = 2.5\text{V}$ to $5.5\text{V}$	—	3	12	mA
$I_{DD}$ (Sleep)	Supply Current	During sleep period, $T_A = +25^\circ\text{C}$ , $V_{DD} = 3\text{V}$	—	5	10	$\mu\text{A}$
$I_{DD}$ (Sleep)		During sleep period, $T_A = -40^\circ\text{C}$ to $+125^\circ\text{C}$ , $V_{DD} = 2.5\text{V}$ to $5.5\text{V}$	—	—	28	$\mu\text{A}$
$I_{DD}$ (Avg.)	Average Supply Current	$T_A = +25^\circ\text{C}$ , $V_{DD} = 3\text{V}$	—	8	16	$\mu\text{A}$
		$T_A = -40^\circ\text{C}$ to $+125^\circ\text{C}$ , $V_{DD} = 2.5\text{V}$ to $5.5\text{V}$	—	—	40	$\mu\text{A}$
$t_{AWAKE}$	Awake Time	(Note 8)	—	75	125	$\mu\text{s}$
$t_{PERIOD}$	Period	(Note 8)	—	75	125	ms
D.C.	Duty Cycle	—	—	0.1	—	%

- Note: 8. When power is initially turned on, the operating  $V_{DD}$  must be within its correct operating range (2.5V to 5.5V) to guarantee the output sampling. The output state is valid after the second operating cycle (typical 150ms).

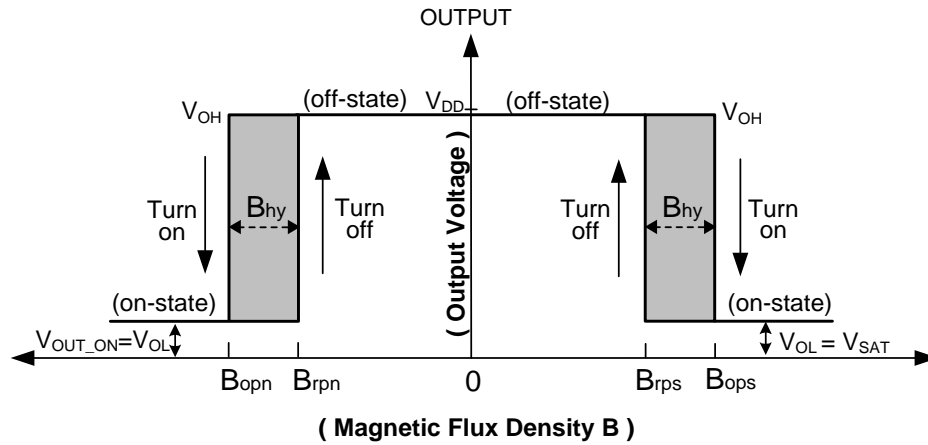


**Magnetic Characteristics** (Notes 9 & 10) (@ $T_A = -40^\circ\text{C}$  to  $+125^\circ\text{C}$ ,  $V_{DD} = 2.5\text{V}$  to  $5.5\text{V}$ , unless otherwise specified.)

(1mT=10 Gauss)

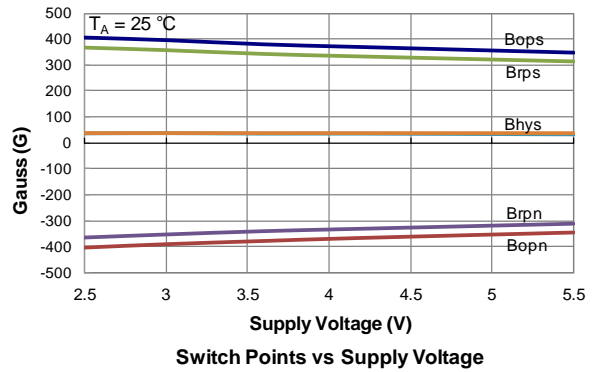
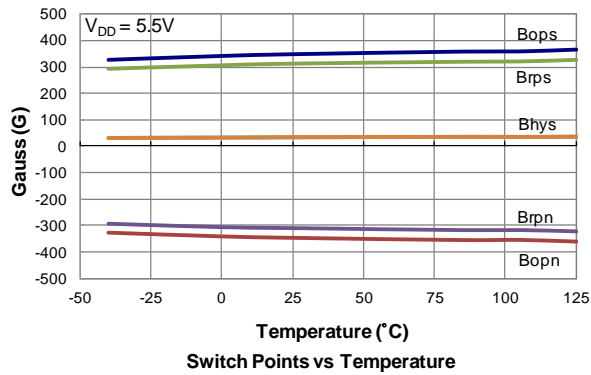
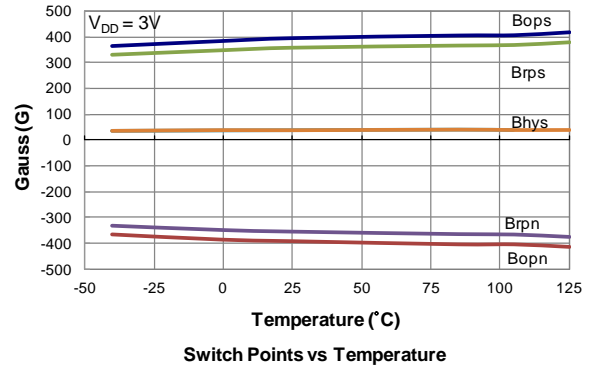
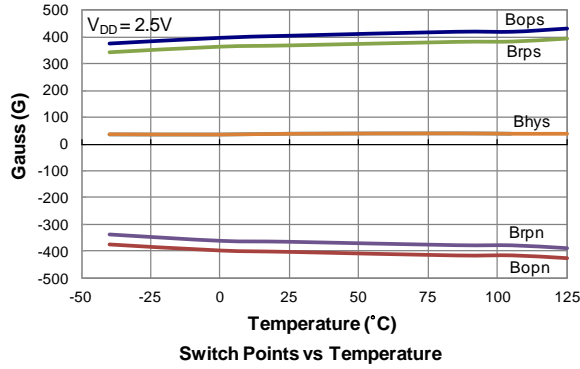
Symbol	Characteristic	Conditions	Min	Typ	Max	Unit
Bops (South Pole to Part Marking Side)	Operating Points	$V_{DD} = 2.5\text{V}$ to $5.5\text{V}$ , $T_A = -40^\circ\text{C}$ to $+125^\circ\text{C}$ ,	255	395	540	Gauss
Bopn (North Pole to Part Marking Side)			-540	-395	-255	
Brps (South Pole to Part Marking Side)	Releasing Points	$V_{DD} = 2.5\text{V}$ to $5.5\text{V}$ , $T_A = -40^\circ\text{C}$ to $+125^\circ\text{C}$ ,	230	355	490	
Brpn (North Pole to Part Marking Side)			-490	-355	-230	
Bhy ( $ B_{opx}  -  B_{rpx} $ )	—	Hysteresis (Note 11)	—	40	—	

- Notes:
- Typical data is at  $T_A = +25^\circ\text{C}$ ,  $V_{DD} = 3\text{V}$ , and for design information only.
  - Maximum and minimum parameters values over the 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.
  - Maximum and minimum hysteresis is guaranteed by design and characterization.

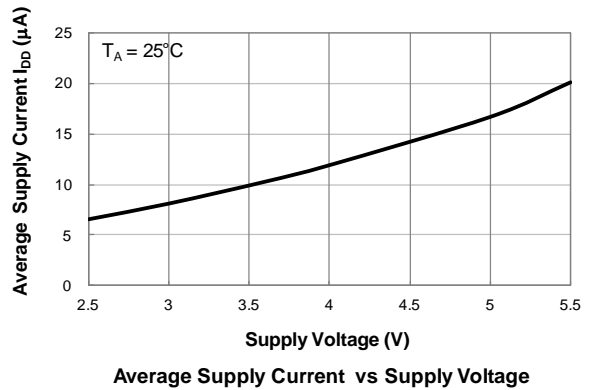
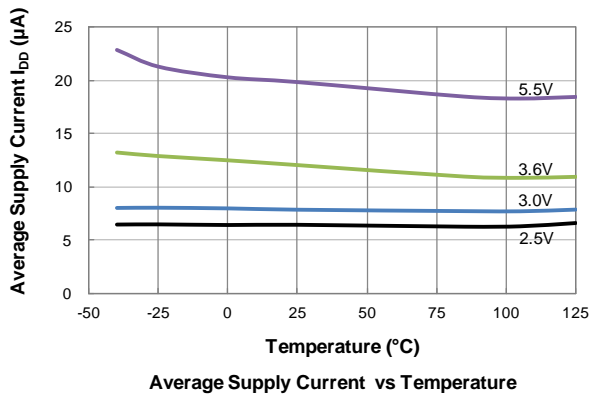


## Typical Operating Characteristics

### Magnetic Operating Switch Points – Bop and Brp



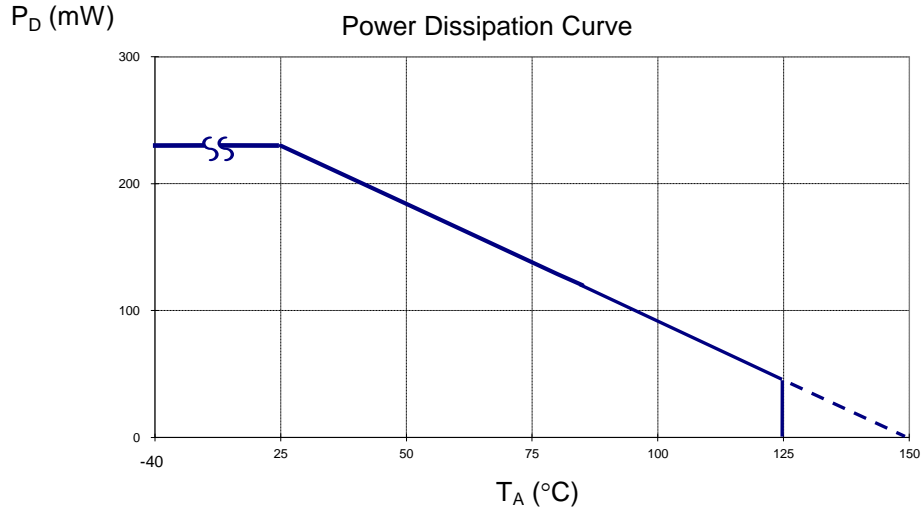
### Average Supply Current



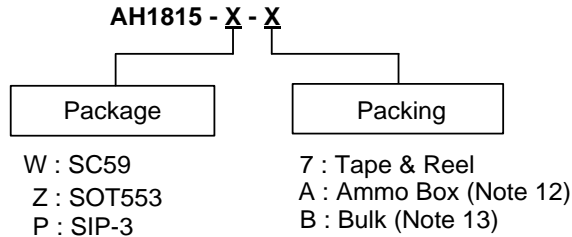
**Thermal Performance Characteristics**

(1) Package Types: SC59, SOT553 and SIP-3

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



**Ordering Information**



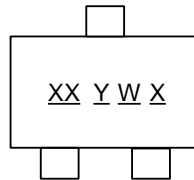
Device	Package Code	Packaging	Bulk		7" Tape and Reel		Ammo Box	
			Quantity	Part Number Suffix	Quantity	Part Number Suffix	Quantity	Part Number Suffix
AH1815-P-A	P	SIP-3	NA	NA	NA	NA	4,000/Box	-A
AH1815-P-B	P	SIP-3	1000	-B	NA	NA	NA	NA
AH1815-W-7	W	SC59	NA	NA	3,000/Tape & Reel	-7	NA	NA
AH1815-Z-7	Z	SOT553	NA	NA	3,000/Tape & Reel	-7	NA	NA

Notes: 12. Ammo Box is for SIP-3 Spread Lead.  
13. Bulk is for SIP-3 Straight Lead.

**Marking Information**

(1) Package Type: SC59

( Top View )

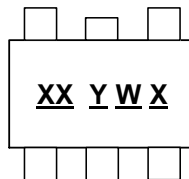


XX : Identification Code  
Y : Year 0 to 9  
W : Week : A to Z : 1 to 26 week;  
a to z : 27 to 52 week; z represents  
52 and 53 week  
X : Internal Code

Part Number	Package	Identification Code
AH1815	SC59	AG

(2) Package Type: SOT553

( Top View )

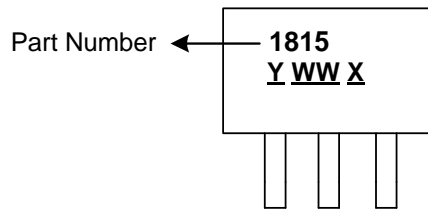


XX : Identification Code  
Y : Year : 0 to 9  
W : Week : A to Z : 1~26 week;  
a to z : 27~52 week; z represents  
52 and 53 week  
X : Internal code

Part Number	Package	Identification Code
AH1815	SOT553	AG

(3) Package Type: SIP-3

(Front View)

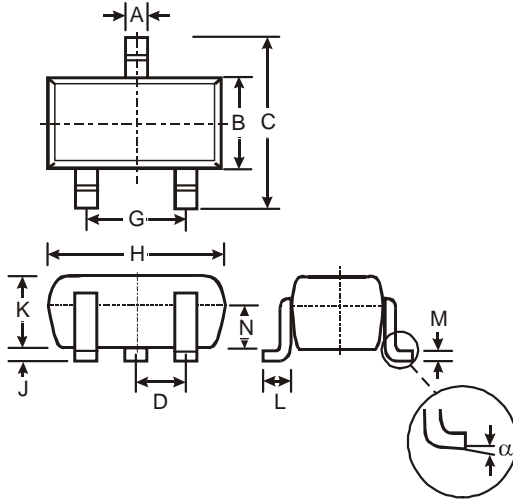


Y : Year : 0 to 9  
WW : Week : 01~52, "52" represents  
52 and 53 week  
X : Internal Code

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

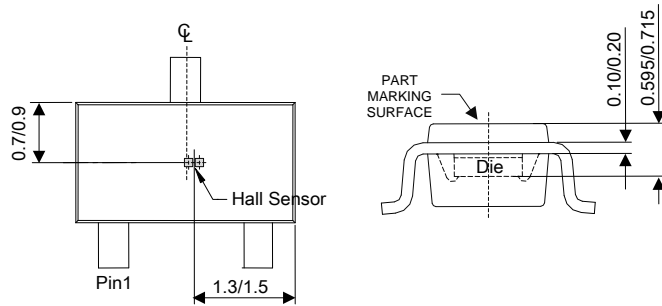
Please see AP02002 at <http://www.diodes.com/datasheets/ap02002.pdf> for the latest version.

(1) Package Type: 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			

Min/Max



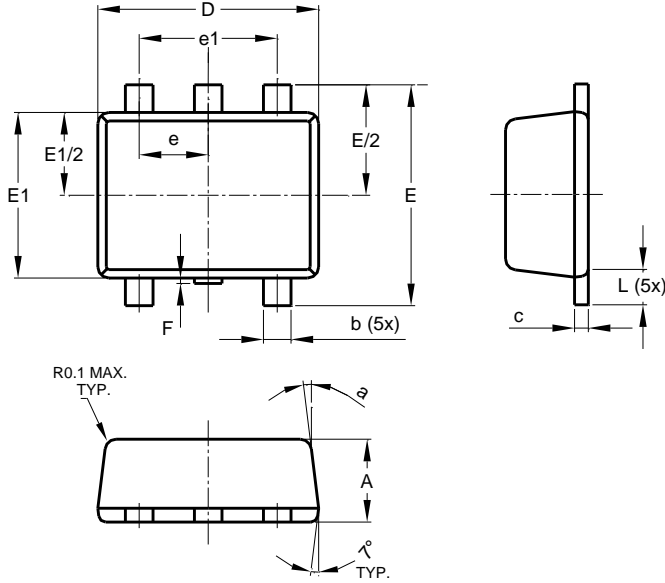
Sensor Location



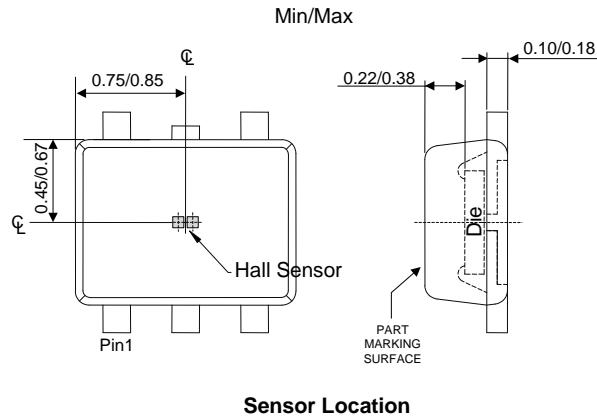
**Package Outline Dimensions** (cont.) (All dimensions in mm.)

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

(2) Package Type: SOT553



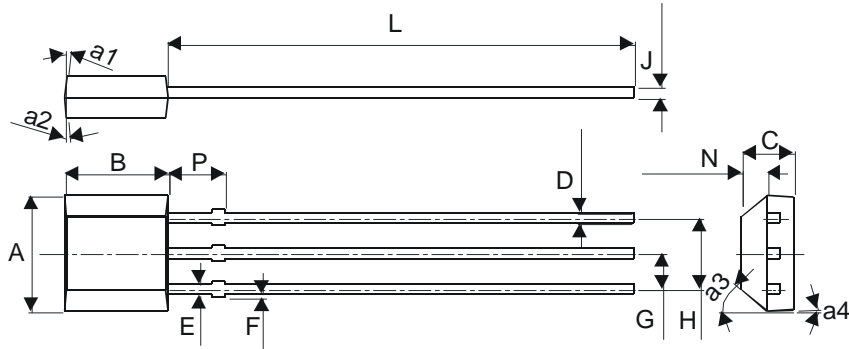
SOT553			
Dim	Min	Max	Typ
A	0.55	0.62	0.60
b	0.15	0.30	0.20
c	0.10	0.18	0.15
D	1.50	1.70	1.60
E	1.55	1.70	1.60
E1	1.10	1.25	1.20
e	0.50 BSC		
e1	1.00 BSC		
F	0.00	0.10	—
L	0.10	0.30	0.20
a	6°	8°	7°
All Dimensions in mm			



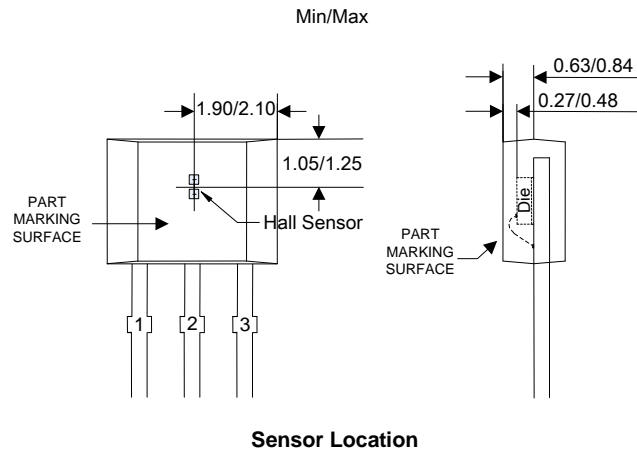
**Package Outline Dimensions** (cont.) (All dimensions in mm.)

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

**(3) Package Type: SIP-3 (Bulk Pack)**



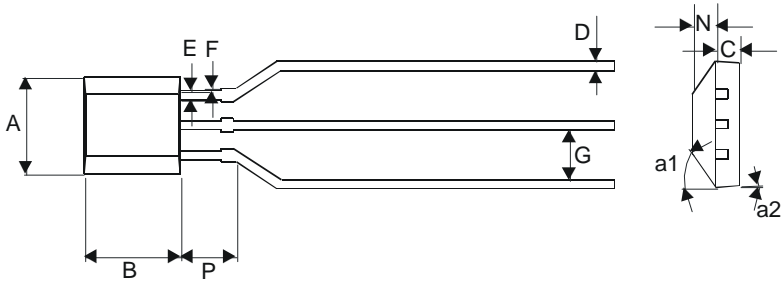
SIP-3 (Bulk Pack)		
Dim	Min	Max
A	3.9	4.3
a1	5° Typ	
a2	5° Typ	
a3	45° Typ	
a4	3° Typ	
B	2.8	3.2
C	1.40	1.60
D	0.33	0.432
E	0.40	0.508
F	0	0.2
G	1.24	1.30
H	2.51	2.57
J	0.35	0.43
L	14.0	15.0
N	0.63	0.84
P	1.55	-
<b>All Dimensions in mm</b>		



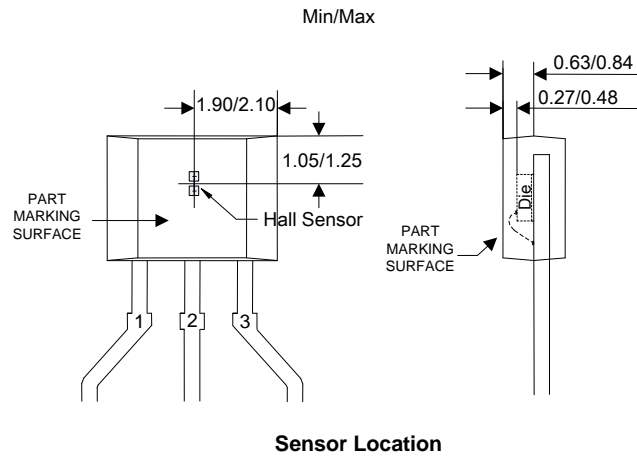
**Package Outline Dimensions** (cont.) (All dimensions in mm.)

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

**(4) Package Type: SIP-3 (Ammo Pack)**



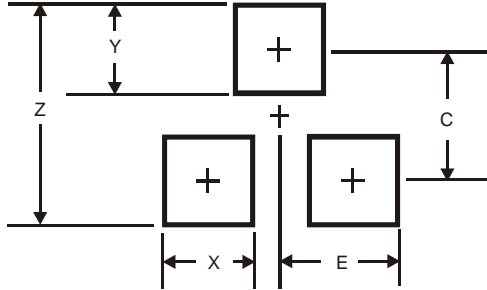
SIP-3 (Ammo Pack)		
Dim	Min	Max
A	3.9	4.3
a1	45° Typ	
a2	3° Typ	
B	2.8	3.2
C	1.40	1.60
D	0.35	0.41
E	0.43	0.48
F	0	0.2
G	2.4	2.9
N	0.63	0.84
P	1.55	-
<b>All Dimensions in mm</b>		



## Suggested Pad Layout

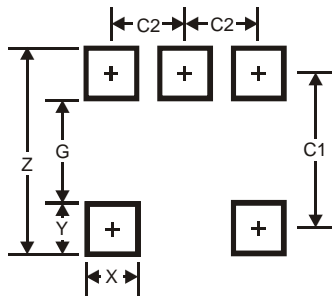
Please see AP02001 at <http://www.diodes.com/datasheets/ap02001.pdf> for the latest version.

(1) Package Type: SC59



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

(2) Package Type: SOT553



Dimensions	Value (in mm)
Z	2.2
G	1.2
X	0.375
Y	0.5
C1	1.7
C2	0.5

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