HIGH SENSITIVITY MICROPOWER OMNIPOLAR HALL-EFFECT SWITCH

Description

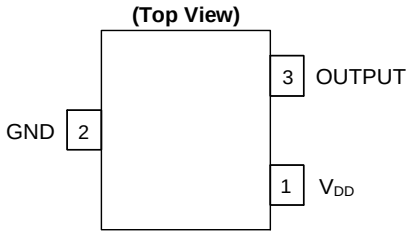
The AH1806 is a high-sensitivity, micro-power Omnipolar Hall effect switch IC, designed for portable and battery powered consumer to home appliance and industrial applications such as smart-meter magnetic tamper detection. Based on two sensitive Hall effect plates and a copper stabilized architecture the AH1806 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 be switched on with either a North or South pole of sufficient field strength. When the magnetic flux density (B) perpendicular to the package is larger than operate point (Bop) the output is switched on (pulled low). The output is turned off when B becomes lower than the release point (Brp). The output will remain off when there is no magnetic field.

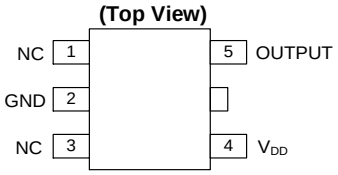
Features

- Omnipolar (North or South Pole) Operation
- High 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 +85°C Operating Temperature
- ESD (HBM) > 6KV
- Small Low Profile SOT553 and Industry Standard SC59, SIP-3 (Ammo Pack) and SIP-3 (Bulk Pack) Packages
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**

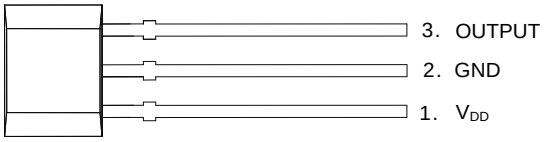
Pin Assignments



SC59



SOT553



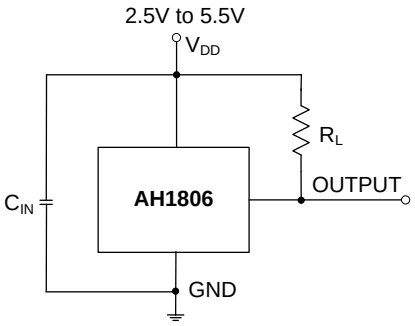
SIP-3 (Bulk Pack)

Applications

- Doors, Lids, Cover and Tray Position Detect Switches
- Display Switch for Portable PCs and Tablets
- On/Off Switch for PDAs and Digital Cameras
- Liquid Level Detection
- Smart Meters
- Position, Proximity and Level Detection Contact-Less Switch in 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) & 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 10nF to 100nF. R_L is the pull-up resistor; the recommended resistance is 10kΩ to 100kΩ.

Pin Descriptions

Packages: SC59 and SIP-3 (Ammo Pack) and SIP-3 (Bulk Pack)

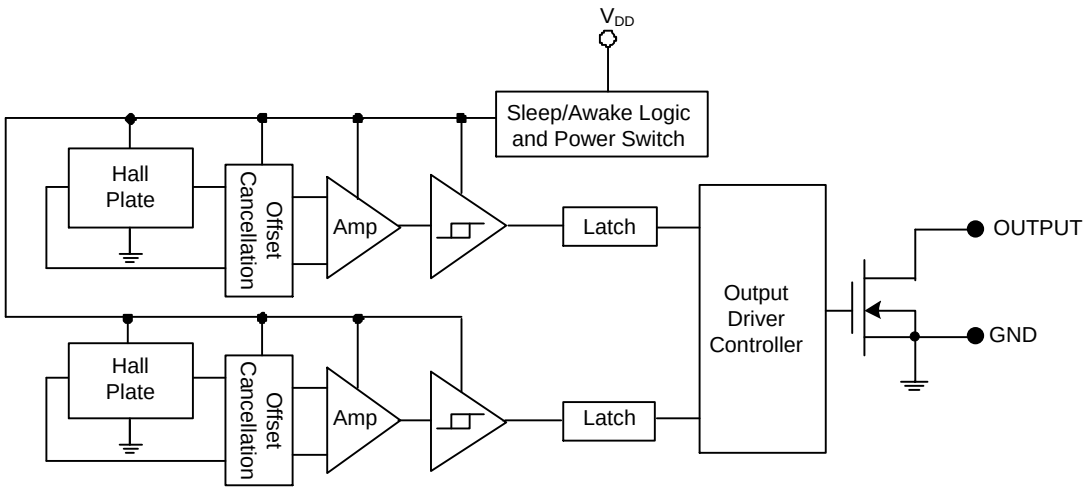
Pin Number	Pin Name	Function
1	V_{DD}	Power Supply Input
2	GND	Ground
3	OUTPUT	Output

Package: SOT553

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

Symbol	Characteristics		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 (Ammo Pack) and SIP-3 (Bulk Pack)	230	mW
T_S	Storage Temperature Range		-65 to +150	°C
T_J	Maximum Junction Temperature		+150	°C
ESD HBM	Human Body Model ESD Capability		6	kV

Notes: 6. 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.

7. 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.

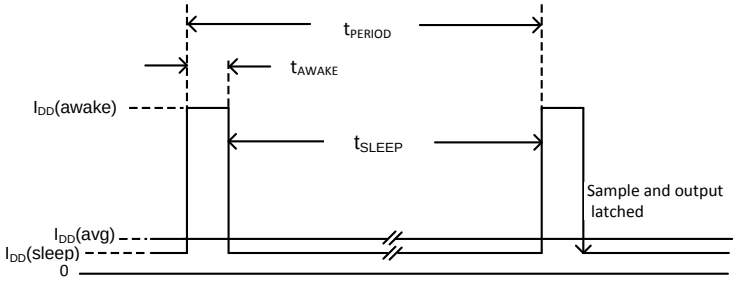
Recommended Operating Conditions (@T_A = +25°C, unless otherwise specified.)

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 +85	°C

Electrical Characteristics (@T_A = +25°C, V_{DD} = 3V, unless otherwise specified.)

Symbol	Characteristic	Conditions	Min	Typ	Max	Unit
V_{OUT_ON}	Output On Voltage (V_{OL})	I_{OUT} = 1mA	—	0.1	0.3	V
I_{OFF}	Output Leakage Current	V_{OUT} = 5.5V, Output off	—	< 0.1	1	µA
I_{DD}(awake)	Supply Current	During 'awake' period, T_A = +25°C, V_{DD} = 3V	—	3	6	mA
		During 'awake' period, T_A = -40 to +85°C, V_{DD} = 2.5V to 5.5V	—	3	12	mA
I_{DD}(sleep)		During 'sleep' period, T_A = +25°C, V_{DD} = 3V	—	5	10	µA
I_{DD}(sleep)		During 'sleep' period, T_A = -40 to +85°C, V_{DD} = 2.5V to 5.5V	—	—	28	µA
I_{DD}(avg)	Average Supply Current	T_A = +25°C, V_{DD} = 3V	—	8	16	µA
		T_A = -40 to +85°C, V_{DD} = 2.5V to 5.5V	—	—	40	µA
t_{AWAKE}	Awake Time	(Note 8)	—	75	125	µs
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).

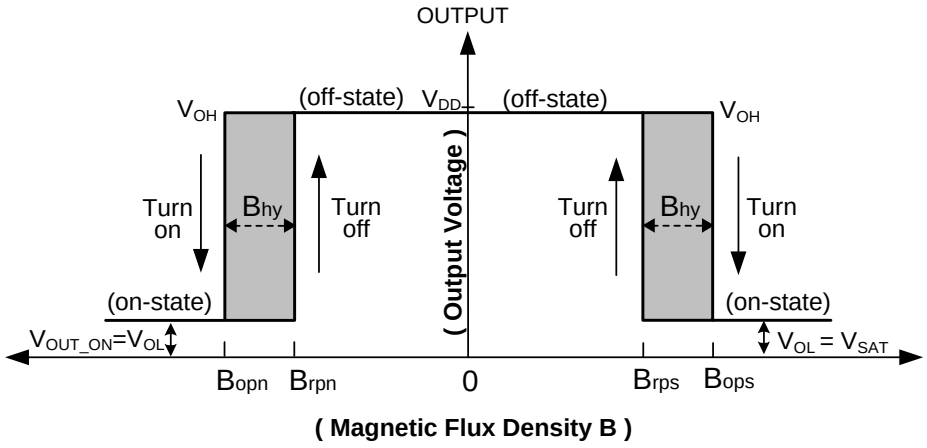


Magnetic Characteristics (Notes 9 & 10) (@T_A = +25°C, V_{DD} = 3V, unless otherwise specified.)

(1mT=10 Gauss)

Symbol	Characteristic	Conditions	Min	Typ	Max	Unit
Bops (south pole to part marking side)	Operation Point	—	15	30	45	Gauss
		V_{DD} = 2.5V to 5.5V	10	30	45	
Bopn (north pole to part marking side)	Operation Point	—	-45	-30	-15	
		V_{DD} = 2.5V to 5.5V	-45	-30	-10	
Brps (south pole to part marking side)	Release Point	—	10	20	40	
		V_{DD} = 2.5V to 5.5V	4	20	40	
Brpn (north pole to part marking side)	Release Point	—	-40	-20	-10	
		V_{DD} = 2.5V to 5.5V	-40	-20	-4	
Bhy (|Bopx|-|Brpx|)	Hysteresis (Note 11)	—	5	10	—	

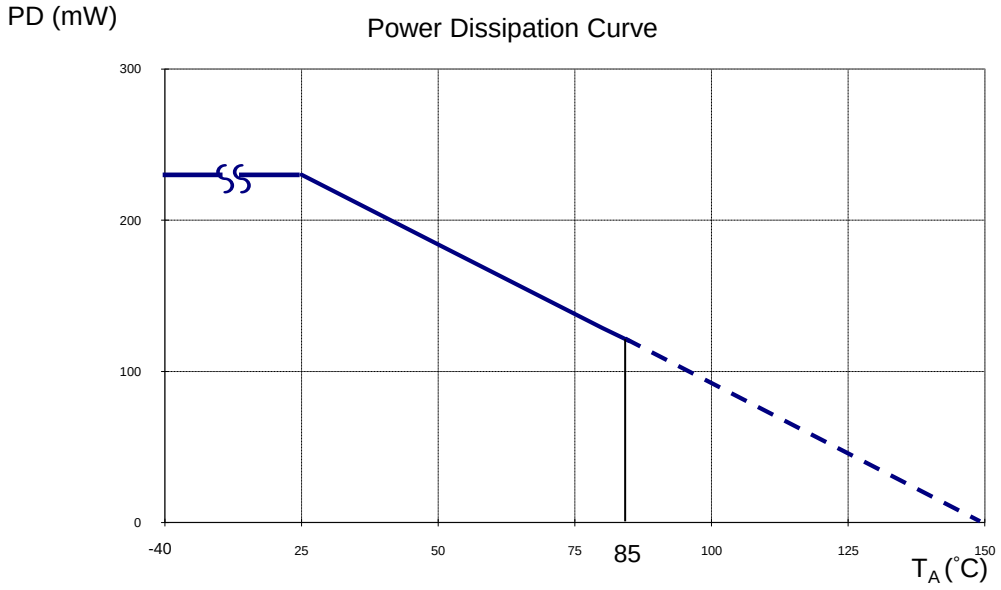
Notes:
9. Typical data is at T_A = +25°C, V_{DD} = 3V, and for design information only.
10. The magnetic characteristics may vary with supply voltage, operating temperature and after soldering.
11. Maximum and minimum hysteresis is guaranteed by design and characterization.



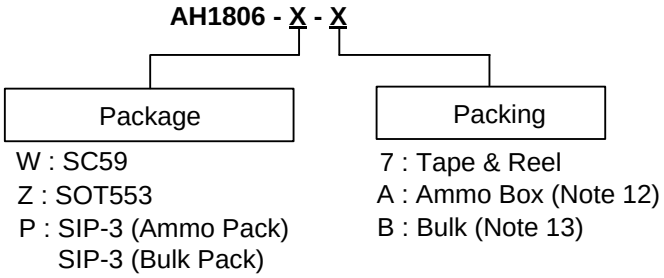
Thermal Performance Characteristics

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

T_A (°C)	25	50	60	70	80	85	90	100	110	120	130	140	150
P_D (mW)	230	184	166	147	129	120	110	92	74	55	37	18	0



Ordering Information



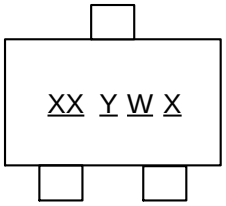
Device	Package Code	Packaging	Bulk		7" Tape and Reel		Ammo Box	
			Quantity	Part Number Suffix	Quantity	Part Number Suffix	Quantity	Part Number Suffix
AH1806-P-A	P	SIP-3 (Ammo Pack)	NA	NA	NA	NA	4,000/Box	-A
AH1806-P-B	P	SIP-3 (Bulk Pack)	1,000	-B	NA	NA	NA	NA
AH1806-W-7	W	SC59	NA	NA	3,000/Tape & Reel	-7	NA	NA
AH1806-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)

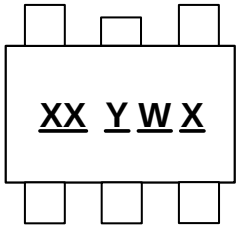


XX : Identification code
Y : Year 0 to 9
W : Week : A to Z : 1 to 26 week;
a to z : 27 to 52 week; z represents
52 and 53 week
X : Internal Code

Part Number	Package	Identification Code
AH1806	SC59	H6

(2) Package Type: SOT553

(Top View)

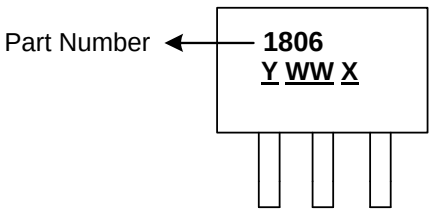


XX : Identification Code
Y : Year : 0 to 9
W : Week : A to Z : 1~26 week;
a to z : 27~52 week; z represents
52 and 53 week
X : Internal code

Part Number	Package	Identification Code
AH1806	SOT553	H6

(3) Package Types: SIP-3 (Ammo Pack) and SIP-3 (Bulk Pack)

(Top View)

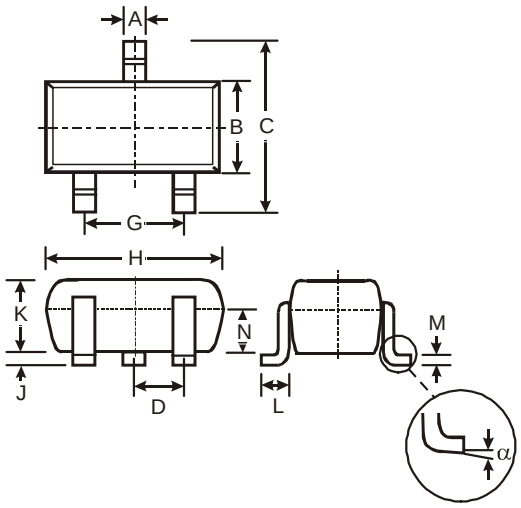


Y : Year : 0~9
WW : Week : 01~52, "52" represents
52 and 53 week
X : Internal Code

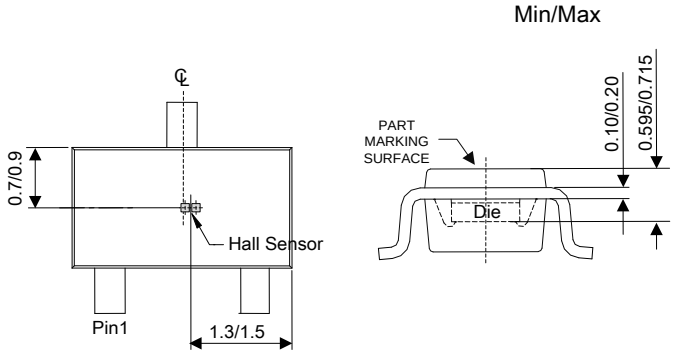
Package Outline Dimensions (All dimensions in mm.)

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			

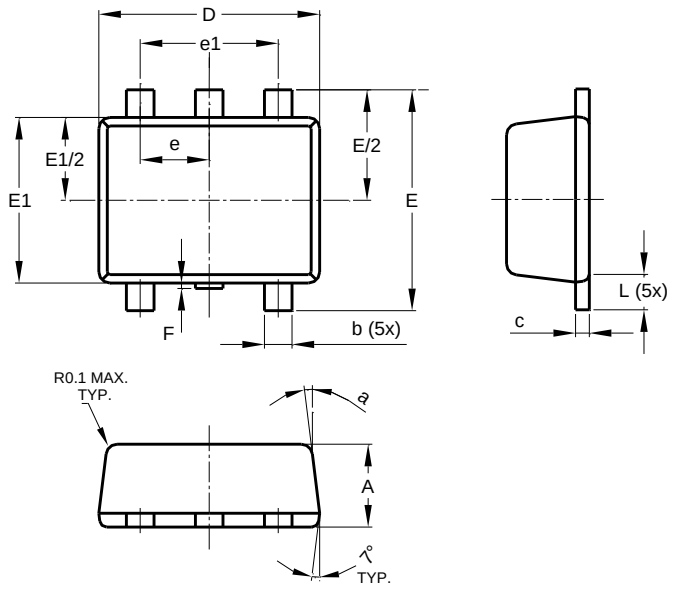


Sensor Location

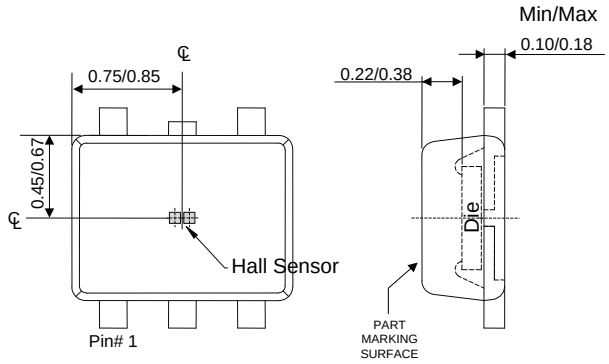
Package Outline Dimensions (Continued) (All dimensions in mm.)

Please see http://www.diodes.com/package-outlines.html 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			

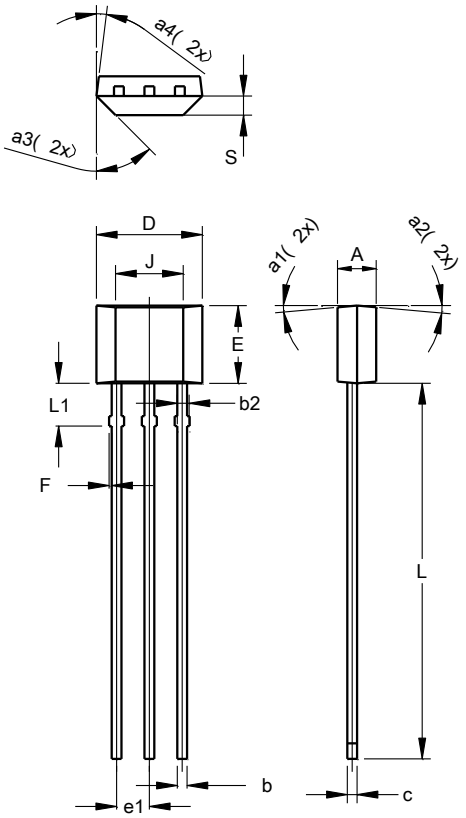


Sensor Location

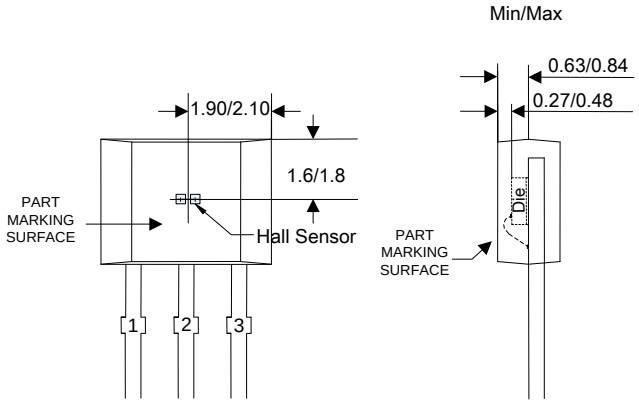
Package Outline Dimensions (Cont.) (All dimensions in mm.)

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

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



SIP-3 (Bulk Pack)			
Dim	**Min**	**Max**	**Typ**
A	1.40	1.60	1.50
b	0.33	0.43	0.38
b2	0.40	0.508	0.46
c	0.35	0.41	0.38
D	3.90	4.30	4.10
E	2.80	3.20	3.00
e1	1.24	1.30	1.27
F	0.00	0.20	--
J	2.62 REF		
L	14.00	15.00	14.50
L1	1.55	1.75	1.65
S	0.63	0.84	0.74
a1	--	--	5°
a2	--	--	5°
a3	--	--	45°
a4	--	--	3°
All Dimensions in mm			

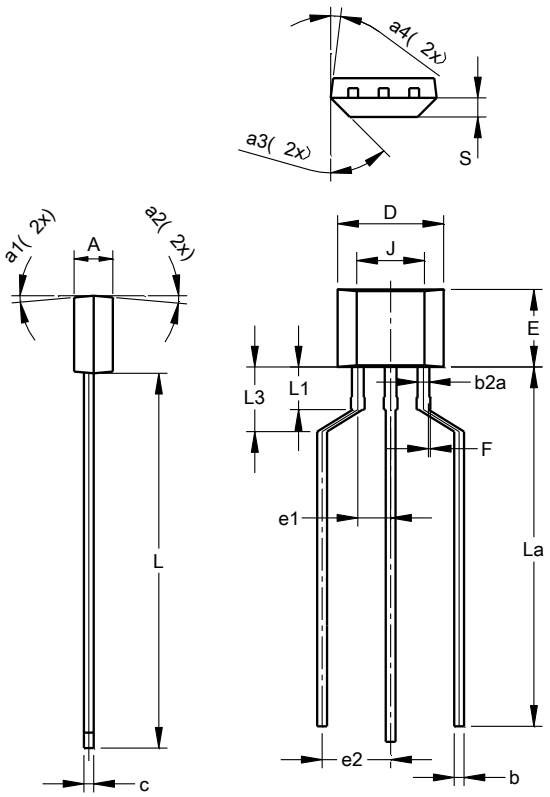


Sensor Location

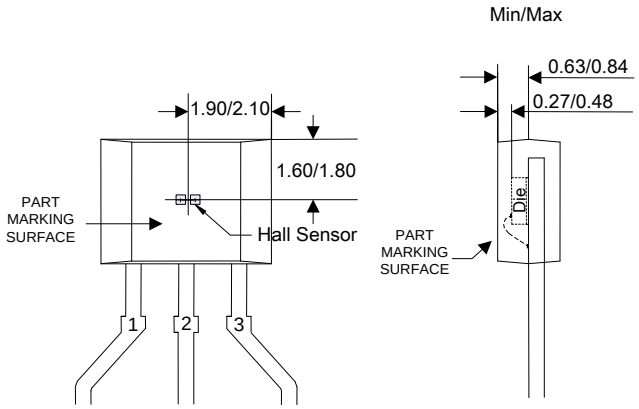
Package Outline Dimensions (Cont.) (All dimensions in mm.)

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

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



SIP-3 (Ammo Pack)			
Dim	**Min**	**Max**	**Typ**
A	1.40	1.60	1.50
b	0.33	0.43	0.38
b2a	0.40	0.52	0.46
c	0.35	0.41	0.38
D	3.90	4.30	4.10
E	2.80	3.20	3.00
e1	1.24	1.30	1.27
e2	2.40	2.90	2.65
F	0.00	0.20	--
J	2.62 REF		
L	14.00	15.00	14.50
La	12.90	14.90	13.90
L1	1.55	1.75	1.65
L3	2.00	3.00	2.50
S	0.63	0.84	0.74
a1	--	--	5°
a2	--	--	5°
a3	--	--	45°
a4	--	--	3°
All Dimensions in mm			

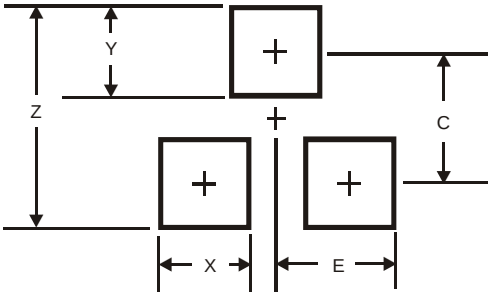


Sensor Location

Suggested Pad Layout

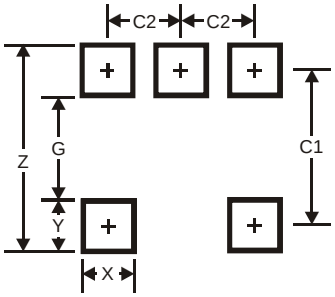
Please see http://www.diodes.com/package-outlines.html for the latest version.

(1) Package Type: SC59



Dimensions	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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