AH332X

HIGH-VOLTAGE HALL-EFFECT UNIPOLAR SWITCH

Description

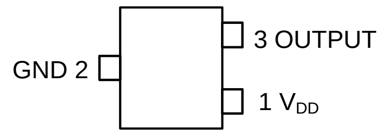
The AH332X is a high-voltage high-sensitivity Hall-effect Unipolar switch IC designed for proximity, position and level sensing in industrial and consumer home appliances and personal care applications. To support a wide range of the demanding applications, the design has been optimized to operate over the supply range of 3.0V to 28V. With chopper stabilized architecture and an internal bandgap regulator to provide temperature compensated supply for internal circuits, the AH332X provides a reliable solution over the whole operating range. For robustness and protection, the device has a reverse blocking diode with a Zener clamp on the supply. The output has an overcurrent limit and a Zener clamp.

The single open-drain output can be switched on with South pole of sufficient strength. When the magnetic flux density (B) perpendicular to the package is larger than the operate point (B_{OP}) the output is switched on (pulled low) and is held on until the magnetic flux density B is lower than the release point (B_{RP}).

The magnetic operating and release polarity is opposite for SOT23 (Type S) and SC59 packages. The SOT23 (Type S), SIP-3 (Ammo Pack) and SIP-3 (Bulk Pack) packages require south pole to the part marking side to operate while SC59 requires south pole to the non-part marking side.

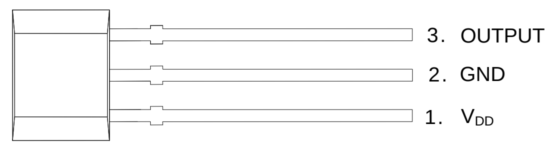
Pin Assignments

(Top View)



SC59 and SOT23 (Type S)

(Top View)



SIP-3 (Ammo Pack) and SIP-3 (Bulk Pack)

Features

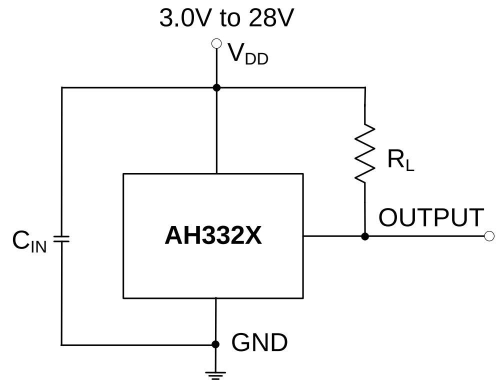
- Unipolar Operation
- High Sensitivity: B_{OP} and B_{RP} of 30G to115G and 20G to 90G Typical
- Single Open-Drain Output with Overcurrent Limit
- 3.0V to 28V Operating Voltage Range
- Resistant to Physical Stress
- Chopper Stabilized Design Provides
  - Superior Temperature Stability
  - Minimal Switch Point Drift
  - Enhanced Immunity to Stress
- Good RF Noise Immunity
- Reverse Blocking Diode
- Zener Clamp on Supply and Output Pins
- -40°C to +125°C Operating Temperature
- High ESD HBM: 8kV
- Industry Standard SC59, SOT23 (Type S), 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)**
- **For automotive applications requiring specific change control (i.e. parts qualified to AEC-Q100/101/104/200, PPAP capable, and manufactured in IATF 16949 certified facilities), please contact us or your local Diodes representative. https://www.diodes.com/quality/product-definitions/**

Applications

- Position and proximity sensing in consumer home appliances, building automation, office equipment and industrial applications
- Open and close detection
- Position detection
- Level detection
- Flow meters
- Contactless switches

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



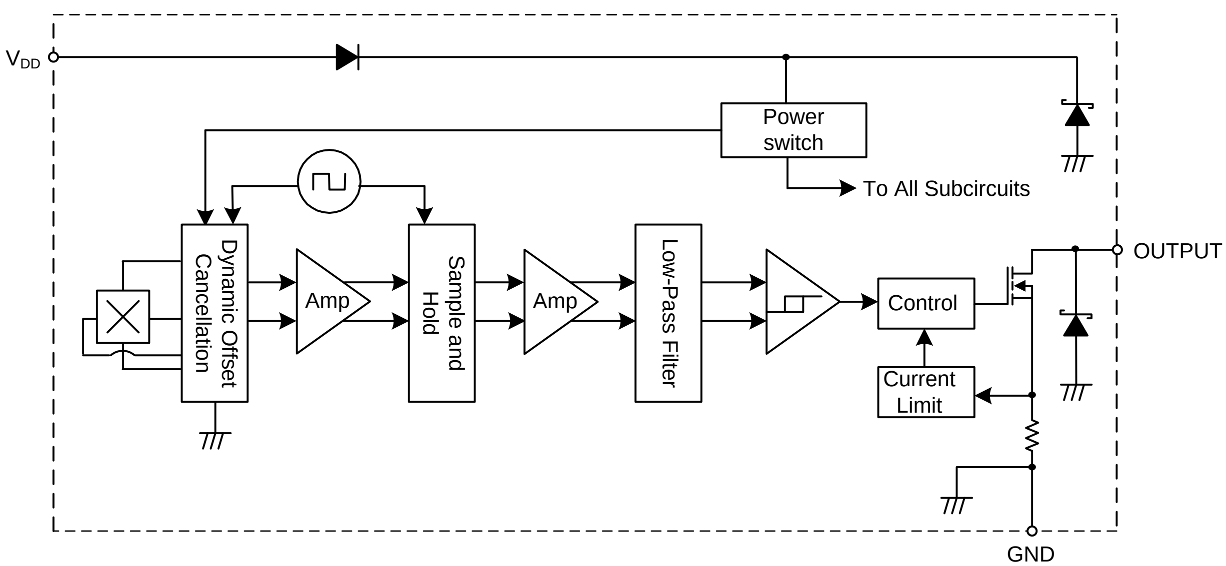
Note: 4. C_{IN} is for power stabilization and to strengthen the noise immunity. The recommended capacitance is 10nF to 100nF. R_L is the pullup resistor.

Pin Descriptions

Packages: SC59, SOT23 (Type S), 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 Pin

Functional Block Diagram



Absolute Maximum Ratings (Notes 5 & 6) (@T_A = +25°C, unless otherwise specified.)

Symbol	Characteristic		Value	Unit
V_{DD}	Supply Voltage (Note 6)		32	V
V_{DDR}	Reverse Supply Voltage		-18	V
V_{OUT_MAX}	Output Pin Off Voltage (Note 6)		32	V
I_{OUT}	Continuous Output Current		60	mA
I_{OUT_R}	Reverse Output Current		-50	mA
B	Magnetic Flux Density		Unlimited	
P_D	Package Power Dissipation	SIP-3 (Ammo Pack) SIP-3 (Bulk Pack)	550	mW
		SC59 and SOT23 (Type S)	230	mW
T_S	Storage Temperature Range		-65 to +165	°C
T_J	Maximum Junction Temperature		+150	°C
ESD HBM	Electrostatic Discharge Withstand Capability—Human Body Model		8	kV

Notes: 5. Stresses greater than those listed under *Absolute Maximum Ratings* can cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Conditions* is not implied. Exposure to *Absolute Maximum Ratings* for extended periods can affect device reliability.
6. The absolute maximum V_{DD} of 32V 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 = -40°C to +125°C, unless otherwise specified.)

Symbol	Parameter	Conditions	Rating	Unit
V_{DD}	Supply Voltage	Supply voltage, between V_{DD} and GND pins	3.0 to 28	V
T_A	Operating Temperature Range	Operating ambient temperature range	-40 to +125	°C

Electrical Characteristics (Notes 7 & 8) (@T_A = -40°C to +125°C, V_{DD} = 3V to 28V, unless otherwise specified.)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{OUT_ON}	Output On Voltage	I_{OUT} = 20mA, B > B_{OP}	—	0.2	0.4	V
I_{LKG}	Output Leakage Current (When Output Is Off)	V_{OUT} = 28V, B < B_{RP}, output off	—	< 0.1	10	µA
I_{DD}	Supply Current	Output open, T_A = +25°C	—	3	4	mA
		Output open, T_A = -40°C to +125°C	—	—	5	mA
I_{DD_R}	Reverse Supply Current	V_{DD} = -18V, T_A = -40°C to +125°C	—	-0.01	1.5	mA
t_{P_ON}	Device Power-On Time (Startup Time)	V_{DD} ≥ 3V, B > B_{OP} (Note 7)	—	10	—	µs
f_C	Chopping Frequency	V_{DD} ≥ 3V	—	500	—	kHz
t_D	Response Time Delay (Time from Magnetic Threshold Reached to the Start of the Output Rise or Fall)	(Note 9)	—	4	—	µs
t_R	Output Rising Time (External Pullup Resistor R_L and Load Capacitance Dependent)	R_L = 1kΩ, C_L = 20pF (Note 9)	—	0.2	1	µs
t_F	Output Falling Time (Internal Switch Resistance and Load Capacitance Dependent)	R_L = 1kΩ, C_L = 20pF (Note 9)	—	0.1	1	µs
I_{OCL}	Output Current Limit	B > B_{OP} (Note 10)	30	—	55	mA
V_Z	Zener Clamp Voltage	I_{DD} = 5mA, T_A = +25°C	28	—	—	V

Notes: 7. When power is initially turned on, V_{DD} must be within its correct operating range (3.0V to 28V) to guarantee the output sampling. The output state is valid after the startup time of 10µs typical from the operating voltage reaching 3V.
8. Typical values are defined at T_A = +25°C, V_{DD} = 12V. Maximum and minimum values over the operating temperature range is not tested in production but guaranteed by design, process control and characterization
9. Guaranteed by design, process control, and characterization. Not tested in production.
10. The device limits the output current I_{OUT} to current limit of I_{OCL}.

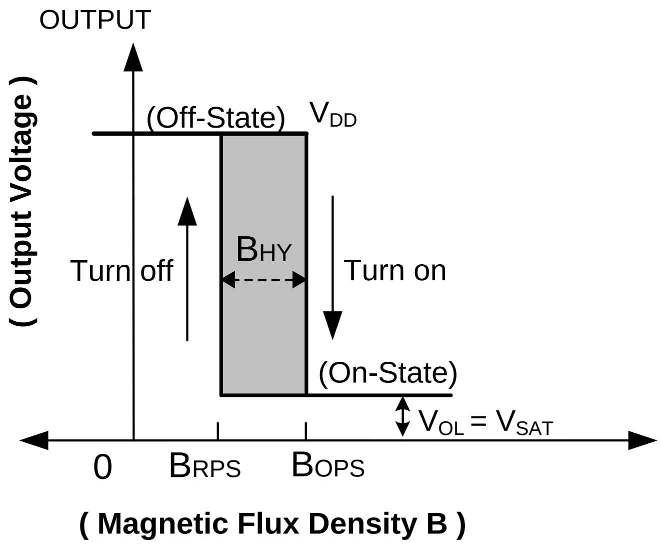
Magnetic Characteristics (Notes 11 & 12) (T_A = -40°C to +125°C, V_{DD} = 3.0V to 28V, unless otherwise specified)

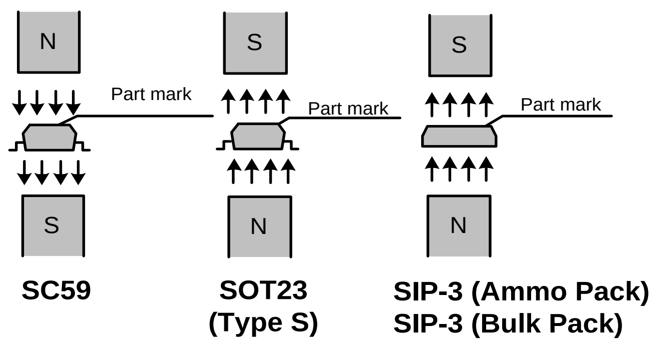
Part Number	Symbol	Parameter	Min	Typ	Max	Unit	Output Type
AH3322	B_{OPS} (South pole to the part marking side for SOT23 (Type S) and SIP-3 (Ammo Pack), SIP-3 (Bulk Pack) packages; South pole to the non-part marking side for SC59 package. See diagram below)	Operation Point	15	30	45	Gauss	Open-Drain
	B_{RPS} (South pole to the part marking side for SOT23 (Type S) and SIP-3 (Ammo Pack), SIP-3 (Bulk Pack) packages; South pole to the non-part marking side for SC59 package. See diagram below)	Release Point	5	20	35		
	B_{HY} ($\lvert B_{OPX}\rvert$ - $\lvert B_{RPX}\rvert$)	Hysteresis (Note 13)	5	10	17		
AH3323	B_{OPS} (South pole to the part marking side for SOT23 (Type S) and SIP-3 (Ammo Pack), SIP-3 (Bulk Pack) packages; South pole to the non-part marking side for SC59 package. See diagram below)	Operation Point	38	55	72	Gauss	Open-Drain
	B_{RPS} (South pole to the part marking side for SOT23 (Type S) and SIP-3 (Ammo Pack), SIP-3 (Bulk Pack) packages; South pole to the non-part marking side for SC59 package. See diagram below)	Release Point	20	35	50		
	B_{HY} ($\lvert B_{OPX}\rvert$ - $\lvert B_{RPX}\rvert$)	Hysteresis (Note 13)	14	20	26		
AH3326	B_{OPS} (South pole to the part marking side for SOT23 (Type S) and SIP-3 (Ammo Pack), SIP-3 (Bulk Pack) packages; South pole to the non-part marking side for SC59 package. See diagram below)	Operation Point	65	100	135	Gauss	Open-Drain
	B_{RPS} (South pole to the part marking side for SOT23 (Type S) and SIP-3 (Ammo Pack), SIP-3 (Bulk Pack) packages; South pole to the non-part marking side for SC59 package. See diagram below)	Release Point	50	85	120		
	B_{HY} ($\lvert B_{OPX}\rvert$ - $\lvert B_{RPX}\rvert$)	Hysteresis (Note 13)	8	15	25		
AH3327	B_{OPS} (South pole to the part marking side for SOT23 (Type S) and SIP-3 (Ammo Pack), SIP-3 (Bulk Pack) packages; South pole to the non-part marking side for SC59 package. See diagram below)	Operation Point	95	115	140	Gauss	Open-Drain
	B_{RPS} (South pole to the part marking side for SOT23 (Type S) and SIP-3 (Ammo Pack), SIP-3 (Bulk Pack) packages; South pole to the non-part marking side for SC59 package. See diagram below)	Release Point	70	90	120		
	B_{HY} ($\lvert B_{OPX}\rvert$ - $\lvert B_{RPX}\rvert$)	Hysteresis (Note 13)	18	25	36		

Notes:

11. When power is initially turned on, V_{DD} must be within its correct operating range (3.0V to 28V) to guarantee the output sampling. The output state is valid after the startup time of 10µs typical from the operating voltage reaching 3V.
12. Typical values are defined at T_A = +25°C, V_{DD} = 12V. Maximum and minimum values over the operating temperature range is not tested in production but guaranteed by design, process control, and characterization.
13. Maximum and minimum hysteresis is guaranteed by design, process control, and characterization.

Magnetic Characteristics (Notes 11 & 12) (T_A = -40°C to +125°C, V_{DD} = 3.0V to 28V, unless otherwise specified) (continued)

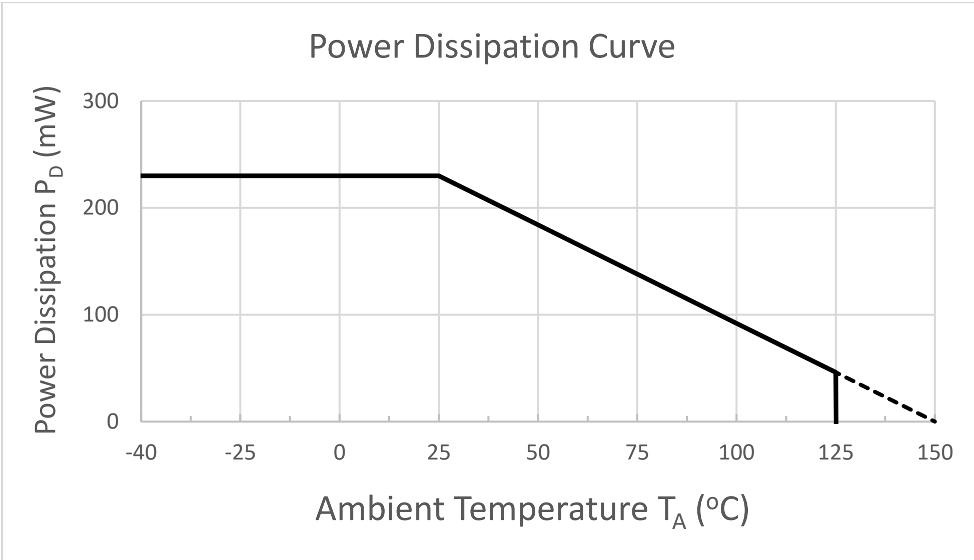




Thermal Performance Characteristics

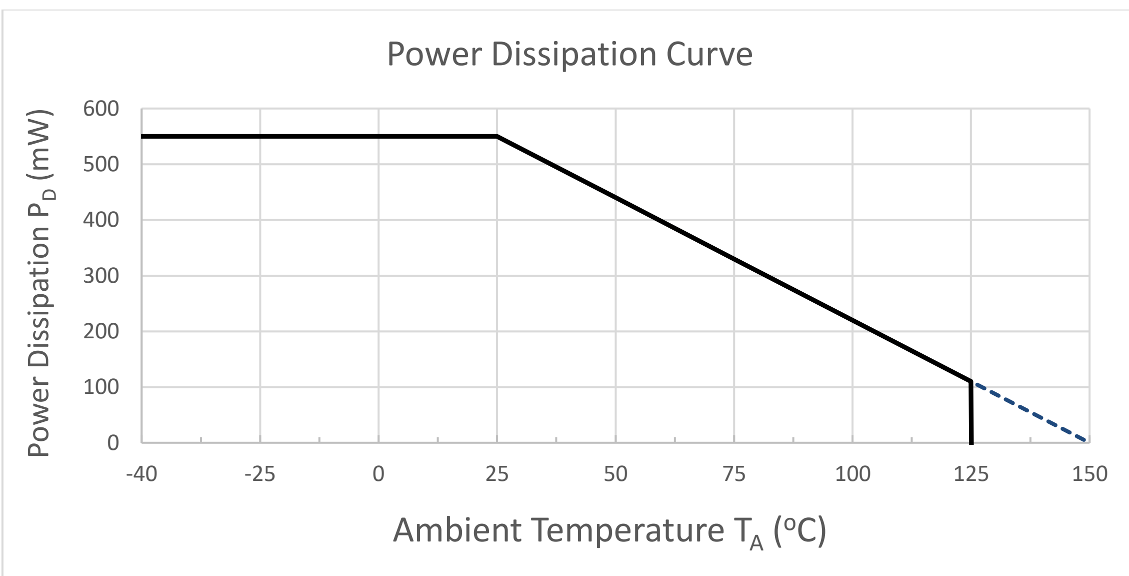
(1) Package Types: SC59 and SOT23 (Type S)

T_A (°C)	25	50	60	70	80	85	90	100	105	110	120	125	130	140	150
P_D (mW)	230	184	166	147	129	120	110	92	83	74	55	46	37	18	0



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

T_A (°C)	25	50	60	70	80	85	90	100	105	110	120	125	130	140	150
P_D (mW)	550	440	396	362	308	286	264	220	198	176	132	110	88	44	0



Ordering Information

AH332X -X - X

Product Name

Package
P : SIP-3 (Ammo Pack)
P : SIP-3 (Bulk Pack)
SA : SOT23 (Type S)
W : SC59

Packing
7 : Tape and Reel
A : Ammo Box (Note 14)
B : Bulk (Note 15)

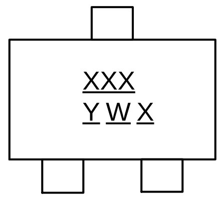
Part Number	Package Code	Package	Part Number Suffix	Packing	
				Qty.	Carrier
AH3322-P-A	P	SIP-3 (Ammo Pack)	-A	4,000	Ammo Box
AH3322-P-B	P	SIP-3 (Bulk Pack)	-B	1,000	Bulk
AH3322-SA-7	SA	SOT23 (Type S)	-7	3,000	7" Tape & Reel
AH3322-W-7	W	SC59	-7	3,000	7" Tape & Reel
AH3323-P-A	P	SIP-3 (Ammo Pack)	-A	4,000	Ammo Box
AH3323-P-B	P	SIP-3 (Bulk Pack)	-B	1,000	Bulk
AH3323-SA-7	SA	SOT23 (Type S)	-7	3,000	7" Tape & Reel
AH3323-W-7	W	SC59	-7	3,000	7" Tape & Reel
AH3326-P-A	P	SIP-3 (Ammo Pack)	-A	4,000	Ammo Box
AH3326-P-B	P	SIP-3 (Bulk Pack)	-B	1,000	Bulk
AH3326-SA-7	SA	SOT23 (Type S)	-7	3,000	7" Tape & Reel
AH3326-W-7	W	SC59	-7	3,000	7" Tape & Reel
AH3327-P-A	P	SIP-3 (Ammo Pack)	-A	4,000	Ammo Box
AH3327-P-B	P	SIP-3 (Bulk Pack)	-B	1,000	Bulk
AH3327-SA-7	SA	SOT23 (Type S)	-7	3,000	7" Tape & Reel
AH3327-W-7	W	SC59	-7	3,000	7" Tape & Reel

Notes: 14. Ammo Box is for SIP-3 Spread Lead.
15. Bulk is for SIP-3 Straight Lead.

Marking Information

(1) Package Type: SOT23 (Type S)

(Top View)

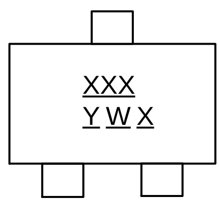


XXX : Identification Code
Y : Year 0 to 9 (ex: 3 = 2023)
W : Week : A to Z : week 1 to 26;
a to z : week 27 to 52; z represents
week 52 and 53
X : Internal Code

Part Number	Package	Identification Code
AH3322-SA-7	SOT23 (Type S)	S2A
AH3323-SA-7	SOT23 (Type S)	S2B
AH3326-SA-7	SOT23 (Type S)	S2E
AH3327-SA-7	SOT23 (Type S)	S2F

(2) Package Type: SC59

(Top View)

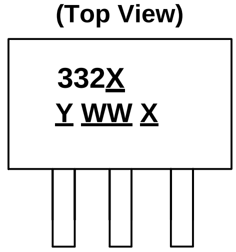


XXX : Identification Code
Y : Year 0 to 9 (ex: 3 = 2023)
W : Week : A to Z : week 1 to 26;
a to z : week 27 to 52; z represents
week 52 and 53
X : Internal Code

Part Number	Package	Identification Code
AH3322-W-7	SC59	S3A
AH3323-W-7	SC59	S3B
AH3326-W-7	SC59	S3E
AH3327-W-7	SC59	S3F

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

(Top View)



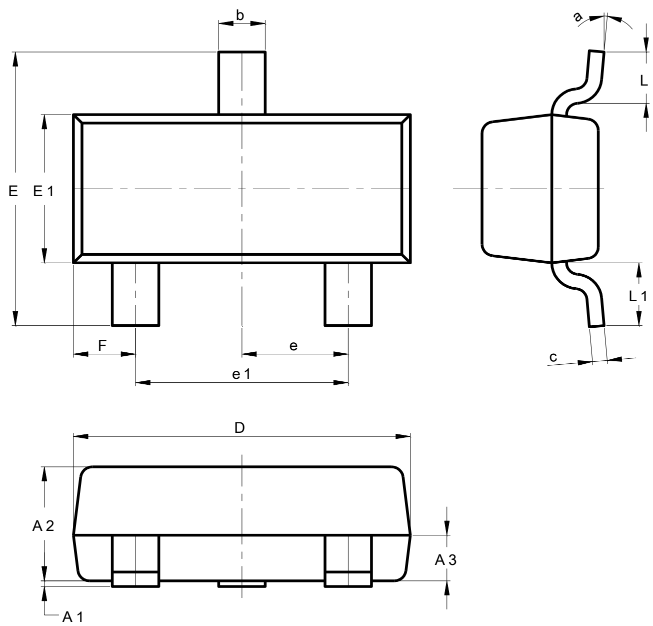
332X : Identification Code
Y : Year : 0 to 9 (ex: 3 = 2023)
WW : Week : 01 to 52, "52" represents
week 52 and 53
X : Internal Code

Part Number	Package	Identification Code
AH3322-P-A	SIP-3 (Ammo Pack)	3322
AH3322-P-B	SIP-3 (Bulk Pack)	3322
AH3323-P-A	SIP-3 (Ammo Pack)	3323
AH3323-P-B	SIP-3 (Bulk Pack)	3323
AH3326-P-A	SIP-3 (Ammo Pack)	3326
AH3326-P-B	SIP-3 (Bulk Pack)	3326
AH3327-P-A	SIP-3 (Ammo Pack)	3327
AH3327-P-B	SIP-3 (Bulk Pack)	3327

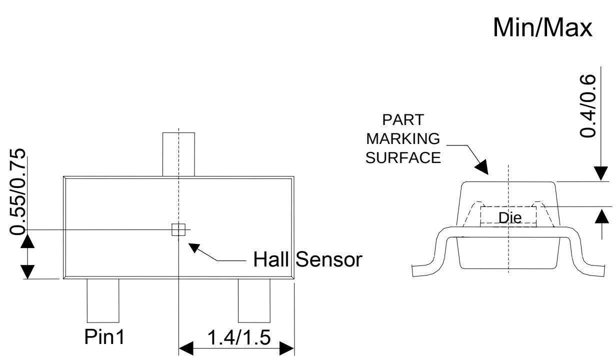
Package Outline Dimensions (All dimensions in mm.)

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

(1) Package Type: SOT23 (Type S)



SOT23 (Type S)			
Dim	**Min**	**Max**	**Typ**
A1	0.013	0.10	0.05
A2	0.90	1.025	1.00
A3	0.375	0.425	0.40
b	0.37	0.51	0.40
c	0.10	0.18	0.125
D	2.80	3.00	2.90
E	2.30	2.50	2.40
E1	1.20	1.40	1.30
e	0.89	1.03	0.915
e1	1.78	2.05	1.83
F	0.45	0.60	0.535
L1	0.45	0.61	0.55
L	0.25	0.55	0.40
a	0°	8°	--
All Dimensions in mm			

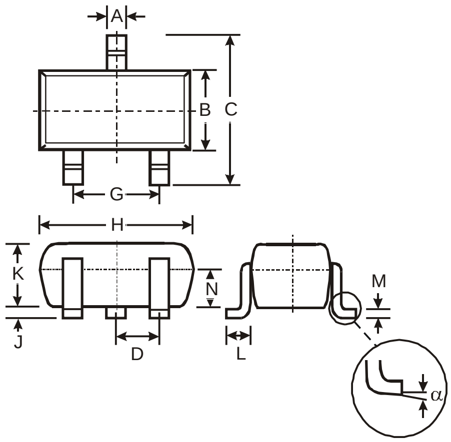


Sensor Location

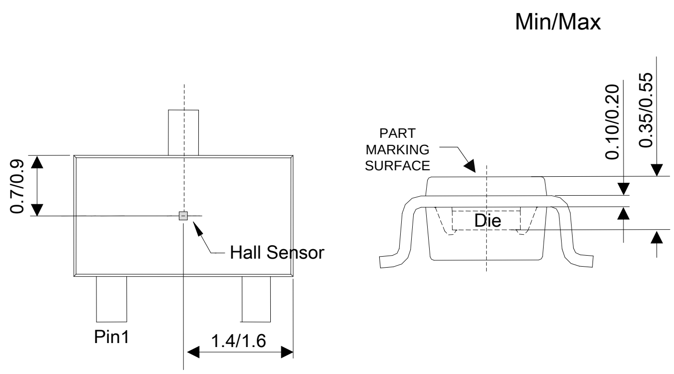
Package Outline Dimensions (All dimensions in mm.) (continued)

Please see http://www.diodes.com/package-outlines.html 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
α	0°	8°	-
All Dimensions in mm			

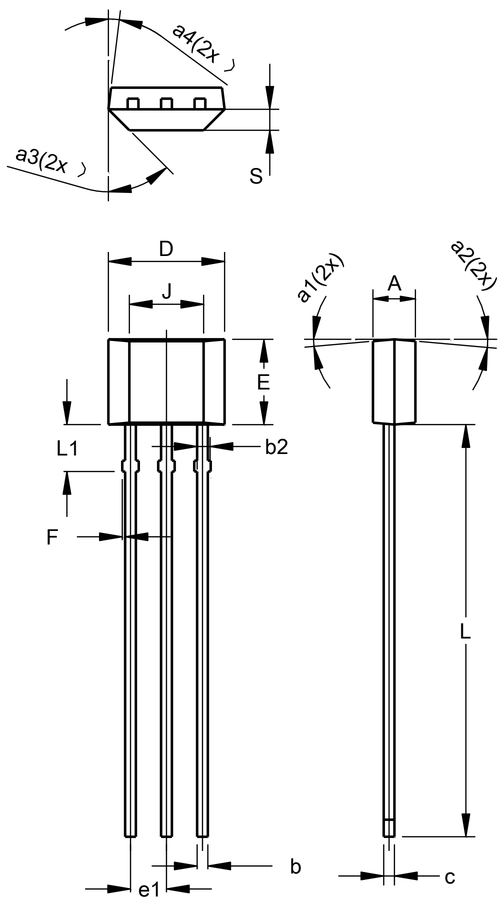


Sensor Location

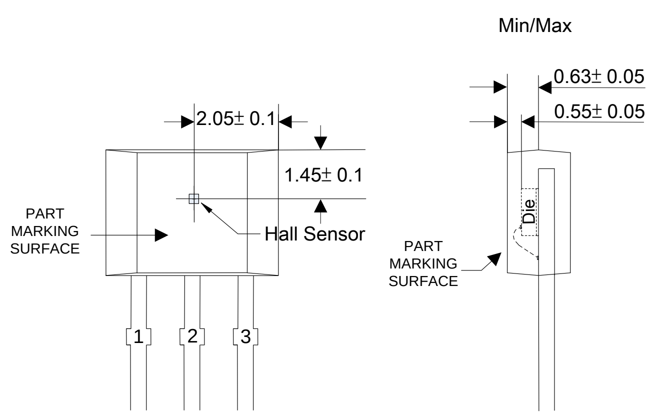
Package Outline Dimensions (All dimensions in mm.) (continued)

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			

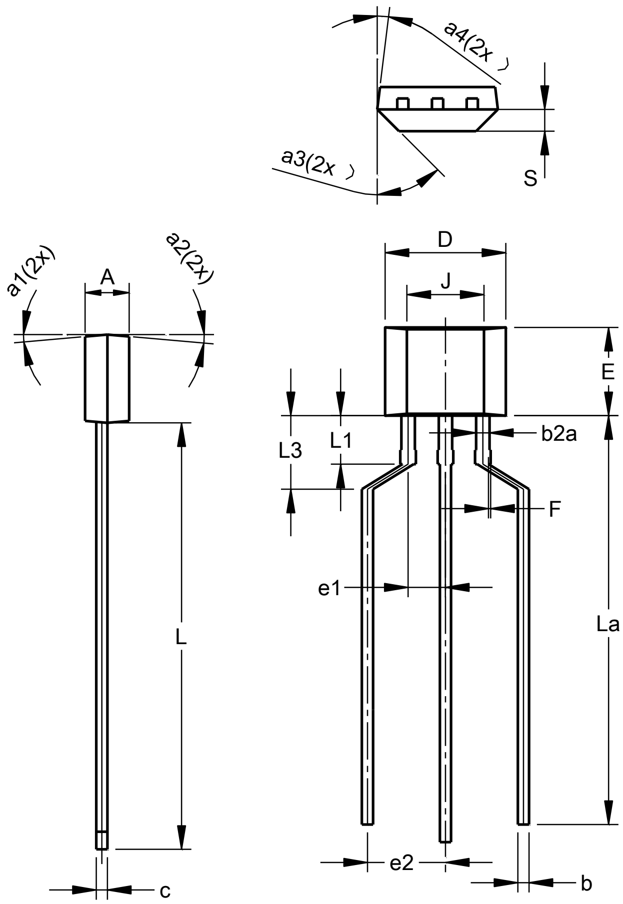


Sensor Location

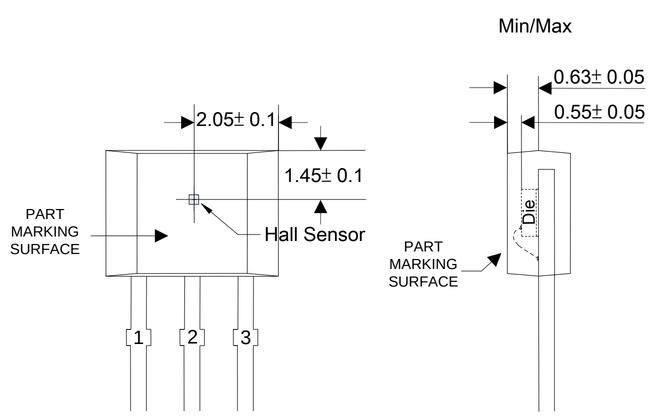
Package Outline Dimensions (All dimensions in mm.) (continued)

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			

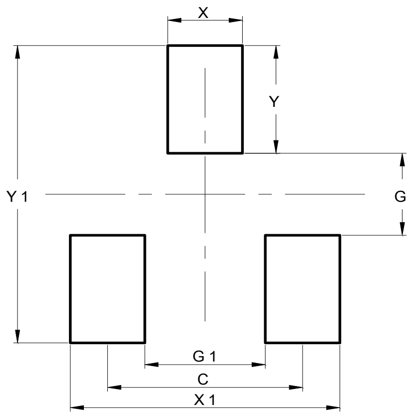


Sensor Location

Suggested Pad Layout

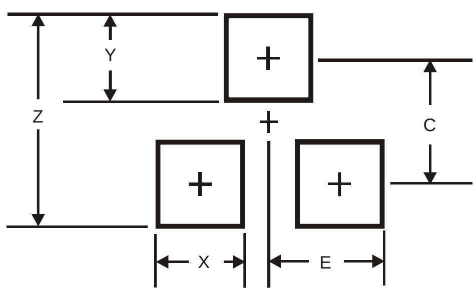
Please see http://www.diodes.com/package-outlines.html for the latest version.

(1) Package Type: SOT23 (Type S)



Dimensions	Value (in mm)
C	1.830
G	0.800
G1	1.130
X	0.700
X1	2.530
Y	1.050
Y1	2.900

(2) Package Type: SC59



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

Mechanical Data

- Moisture Sensitivity: SOT23 (Type S)/SC59 – Level 1 per J-STD-020
- Terminals: Finish – Matte Tin Plated Leads, Solderable per MIL-STD-202, Method 208 e3
- Weight: SIP-3 (Ammo Pack)/SIP-3 (Bulk Pack) – 0.077 grams (Approximate)
  SOT23 (Type S) – 0.009 grams (Approximate)
  SC59 – 0.015 grams (Approximate)

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