HIGH-VOLTAGE HIGH-SENSITIVITY HALL-EFFECT LATCH WITH INTERNAL PULLUP RESISTOR

Description

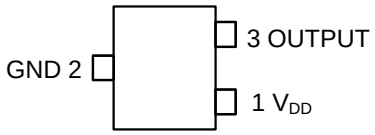
The AH3722A/AH3724A is a high-voltage, high-sensitivity Hall-effect latch IC with internal pullup resistor designed for commutation of brushless DC motors, flow meters, linear encoders and position sensors in industrial, consumer home appliances and personal care applications.

To support a wide range of the demanding applications, the design is 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 AH3722A/AH3724A provides a reliable solution over the whole operating range. For robustness and protection, the device has a Zener clamp on the supply. The output has an overcurrent limit and a Zener clamp.

The internally pulled-up output can be switched on with South pole of sufficient strength and switched off with North pole of sufficient strength. When the magnetic flux density (B) perpendicular to the part marking surface is larger than the operate point (B_{OP}) the output is switched on (pulled low). The output is held latched until the magnetic flux density reverses and becomes lower than the release point (B_{RP}).

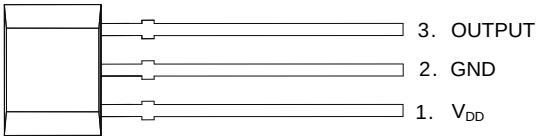
Pin Assignments

(Top View)



SC59 and SOT23 (Type S)

(Top View)



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

Features

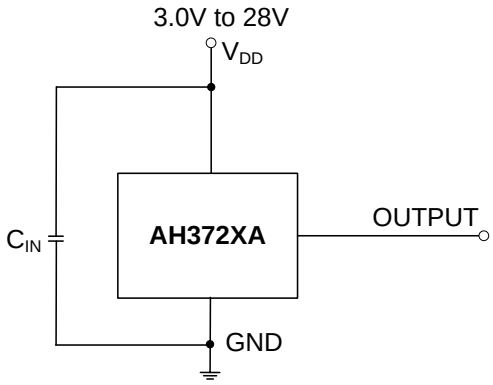
- Bipolar Latch (South Pole: On, North Pole: Off)
- 3.0V to 28V Operating Voltage Range
- High Sensitivity: B_{OP} and B_{RP} of 25G to 40G and -25G to -40G Typical
- Internally Pullup Resistor on the Output Pin
- Resistant to Physical Stress
- Output Overcurrent Limit
- Chopper Stabilized Design Provides
  - Superior Temperature Stability
  - Minimal Switch Point Drift
  - Enhanced Immunity to Stress
- Good RF Noise Immunity
- Reverse Blocking Diode and Zener Clamp on Supply
- -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

- Brushless DC motor commutation
- Revolution per minute (RPM) measurement
- Flow meters
- Angular and linear encoders and position sensors
- Contactless commutation, speed measurement and angular position sensing/indexing in consumer home appliances, office equipment 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

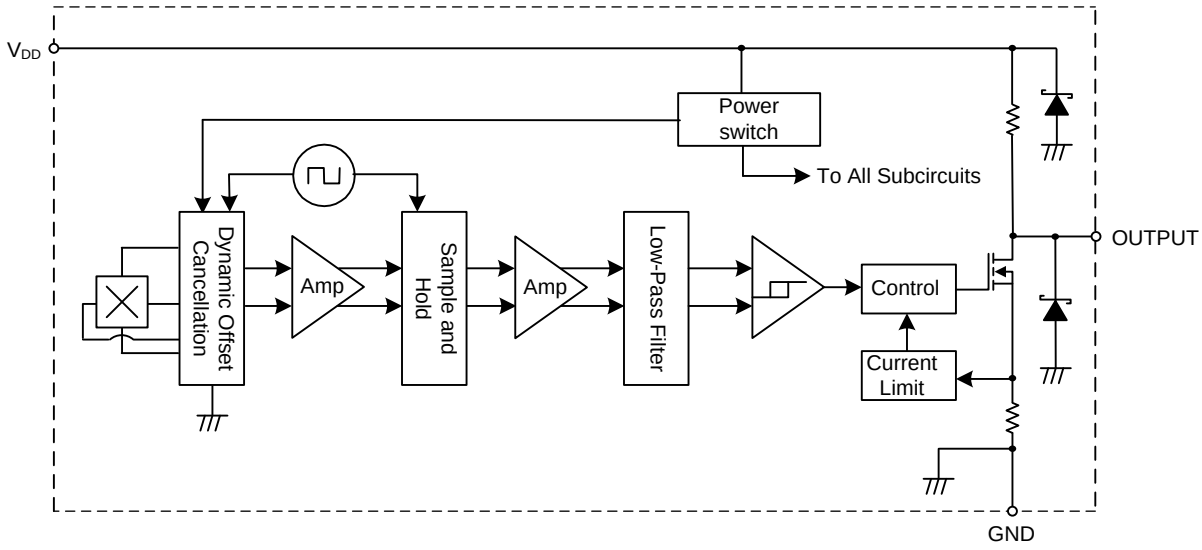


Pin Descriptions

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 4 & 5) (@T_A = +25°C, unless otherwise specified.)

Symbol	Characteristic		Value	Unit
V_{DD}	Supply Voltage (Note 5)		32	V
V_{OUT_MAX}	Output Pin Off Voltage (Note 5)		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
		SOT23 (Type S)	230	
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:
4. 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.
5. 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 6 & 7) (@T_A = -40°C to +125°C, V_{DD} = 3V to 28V, C_{IN} = 0.1µF, unless otherwise specified.)

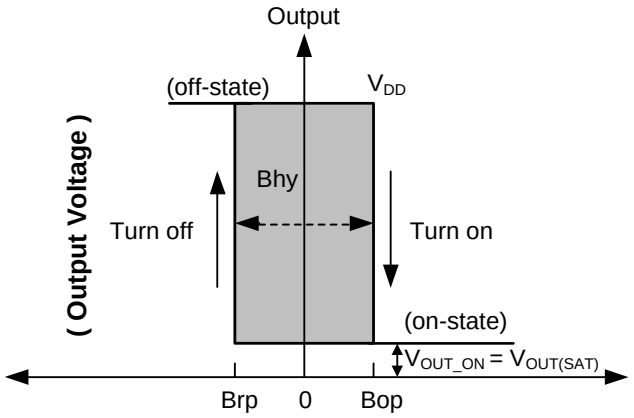
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{OUT_ON}	Output On Voltage	I_{OUT} = 20mA, B > B_{OP}	—	0.2	0.4	V
I_{OUT_OFF}	Output Leakage Current	V_{OUT} = 28V, B < B_{RP}, output off	—	< 0.1	10	µA
I_{DD}	Supply Current	Output open, T_A = +25°C	—	3	4	mA
		Output open, T_A = -40°C to +125°C	—	—	5	mA
R_{PU}	Internal Pullup Resistance	T_A = -40°C to 125°C	10	14	18	kΩ
t_{ST}	Device Startup Time	V_{DD} ≥ 3V, B > B_{OP} or B < B_{RP} (Note 6)	—	10	—	µs
f_C	Chopping Frequency	V_{DD} ≥ 3V (Note 8)	—	500	—	kHz
t_D	The Time Delay from Magnetic Threshold Reached to the Start of the Output Rise or Fall	(Note 8)	—	4	—	µs
t_R	Output Rising Time (External Pullup Resistor R_L and Load Capacitance Dependent)	R_L = 1kΩ, C_L = 20pF (Note 8)	—	0.2	1	µs
t_F	Output Falling Time (Internal Switch Resistance and Load Capacitance Dependent)	R_L = 1kΩ, C_L = 20pF (Note 8)	—	0.1	1	µs
I_{OCL}	Output Current Limit	B > B_{OP} (Note 9)	30	—	55	mA
V_Z	Zener Clamp Voltage	I_{DD} = 5mA, T_A = +25°C	28	—	—	V

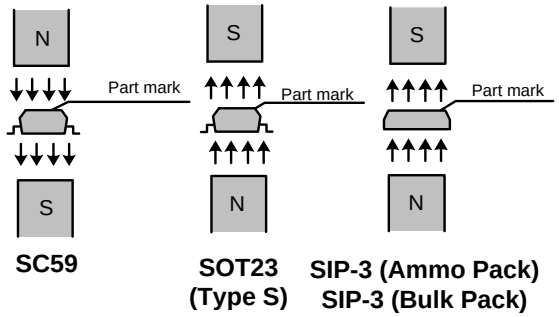
Notes:
6. When power is initially turned on, V_{DD} must be within its correct operating range (3.0V to 28V) to guarantee the output sampling. The output state is valid after the startup time of 10µs typical from the operating voltage reaching 3V.
7. Typical values are defined at T_A = +25°C, V_{DD}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

Magnetic Characteristics (Notes 10 & 11) (T_A = -40°C to +125°C, V_{DD} = 3.0V to 28V, unless otherwise specified)

Part Number	Symbol	Parameter	Min	Typ	Max	Unit
AH3722A	B_{OP} (South pole to part marking side)	Operation Point	10	25	40	Gauss
	B_{RP} (North pole to part marking side)	Release Point	-40	-25	-10	
	B_{HY} ($\|B_{OPX}\|$ - $\|B_{RPX}\|$)	Hysteresis (Note 12)	20	50	80	
AH3724A	B_{OP} (South pole to part marking side)	Operation Point	20	40	60	Gauss
	B_{RP} (North pole to part marking side)	Release Point	-60	-40	-20	
	B_{HY} ($\|B_{OPX}\|$ - $\|B_{RPX}\|$)	Hysteresis (Note 12)	40	80	120	

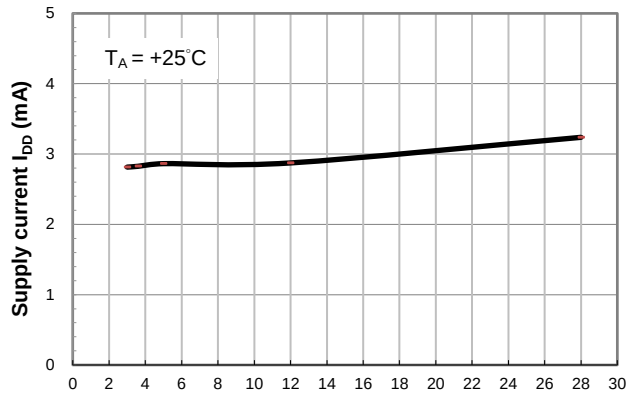
Notes:
10. When power is initially turned on, V_{DD} must be within its correct operating range (3.0V to 28V) to guarantee the output sampling. The output state is valid after the startup time of 10µs typical from the operating voltage reaching 3V.
11. Typical values are defined at T_A = +25°C, V_{DD}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



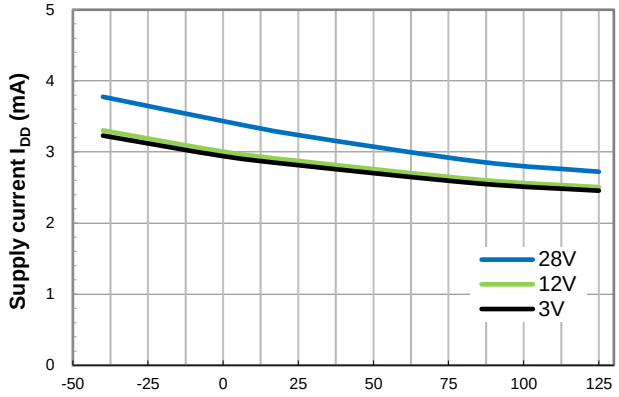


Typical Operating Characteristics

Supply Current

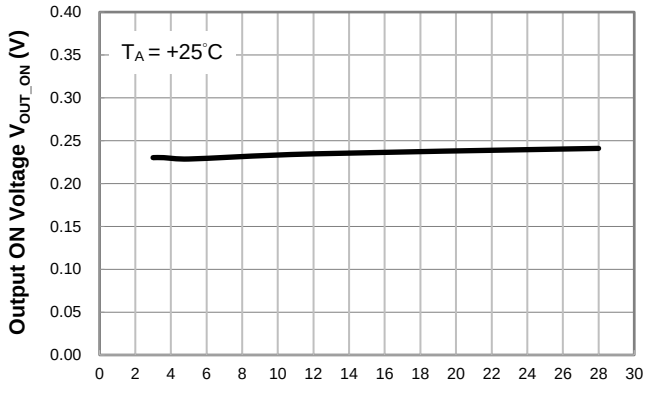


Operation Current vs. Supply Voltage

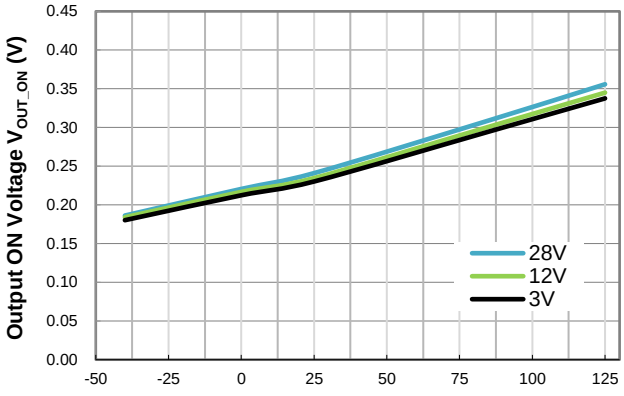


Operation Current vs. Temperature

Output Switch On Voltage , I_{OUT} = 20mA



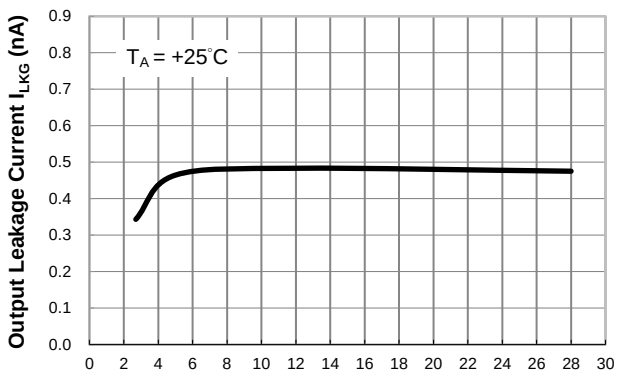
Output ON Voltage vs. Supply Voltage



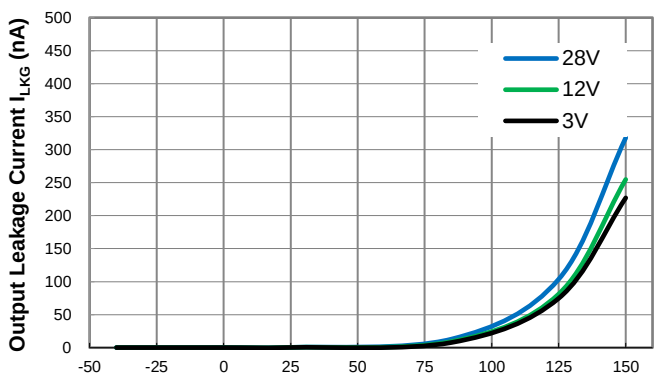
Output ON Voltage vs. Temperature

Typical Operating Characteristics (continued)

Output Leakage Current

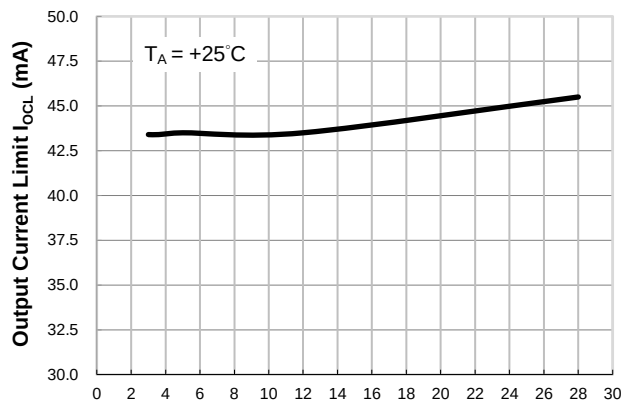


Output Leakage Current vs. V_{OUT} Voltage

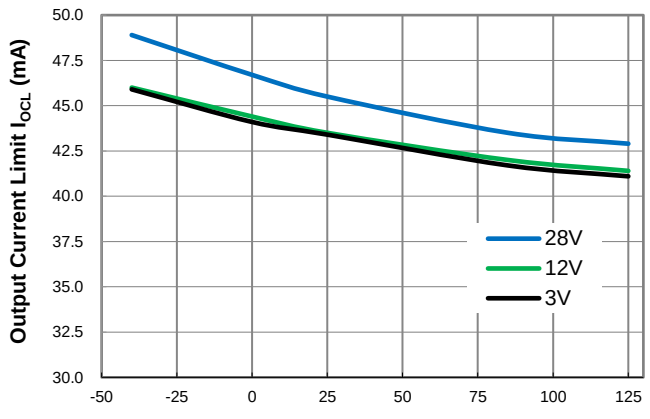


Output Leakage Current vs. Temperature

Output Current Limit

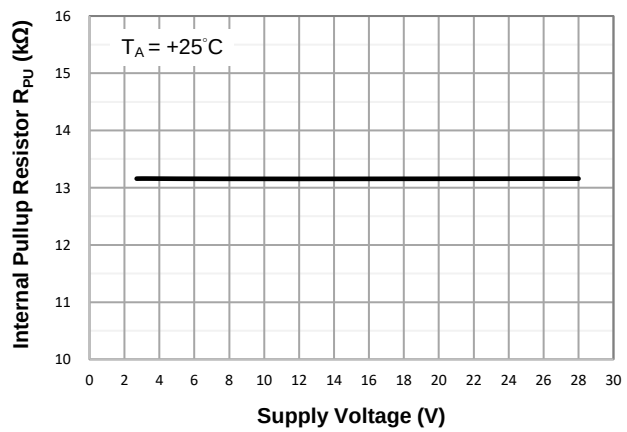


Output Current Limit vs. Supply Voltage

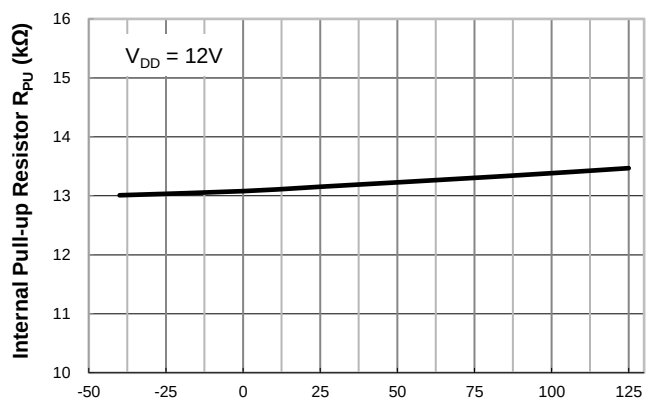


Output Current Limit vs. Temperature

Output Pullup Resistor (Internal)



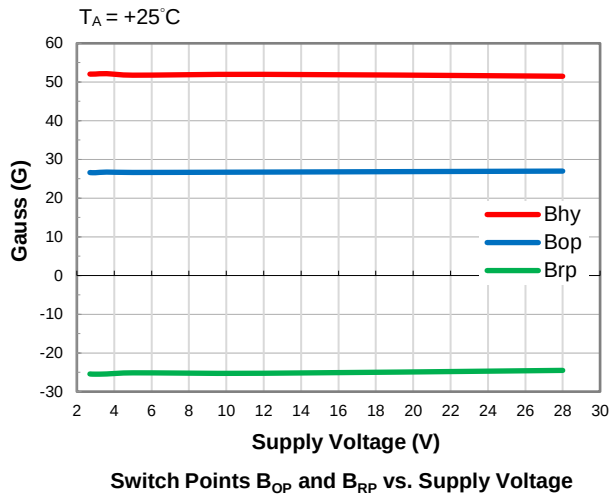
Internal Output Pullup Resistor vs. Supply Voltage



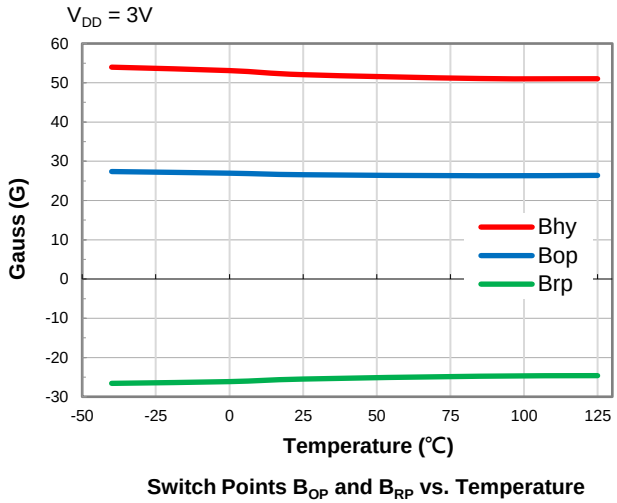
Internal Output Pullup Resistor vs. Temperature

Typical Operating Characteristics (continued)

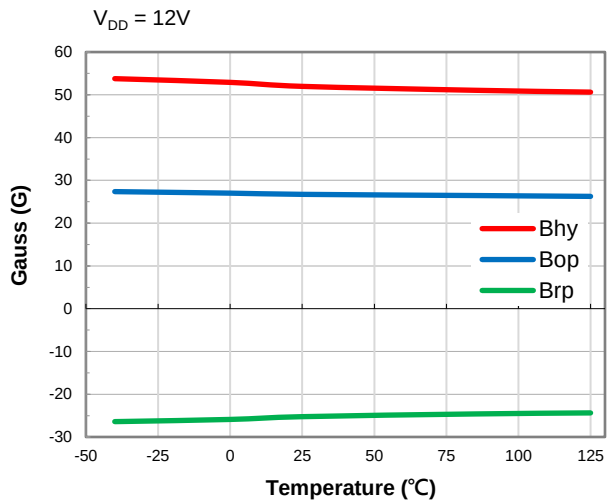
AH3722A Output Points (Magnetic Thresholds) – B_{OP} and B_{RP}



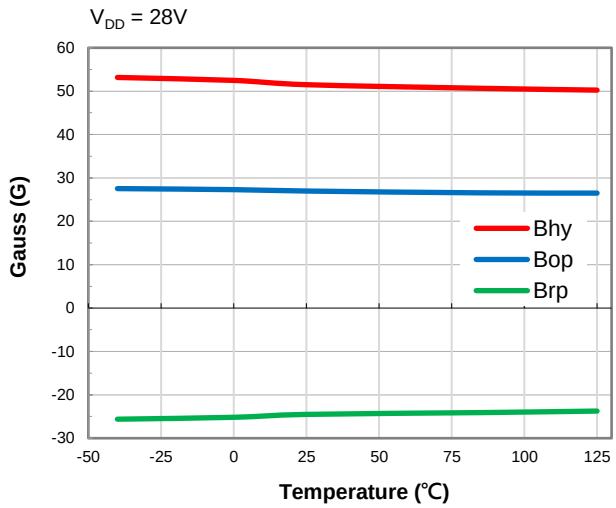
Switch Points B_{OP} and B_{RP} vs. Supply Voltage



Switch Points B_{OP} and B_{RP} vs. Temperature



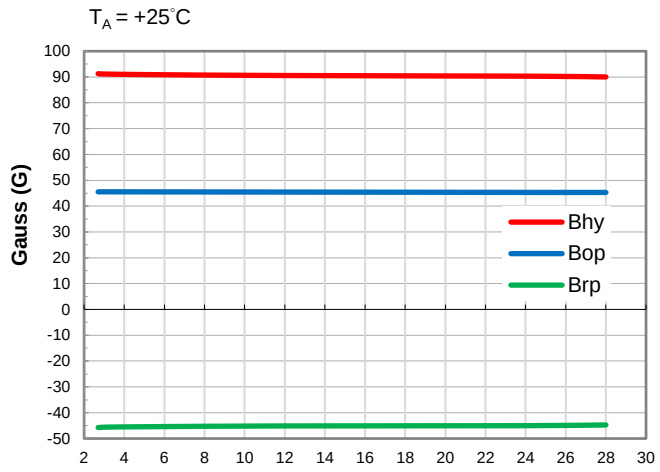
Switch Points B_{OP} and B_{RP} vs. Temperature



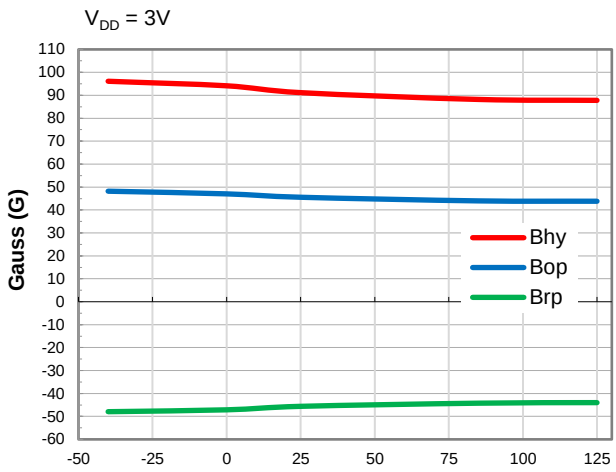
Switch Points B_{OP} and B_{RP} vs. Temperature

Typical Operating Characteristics (continued)

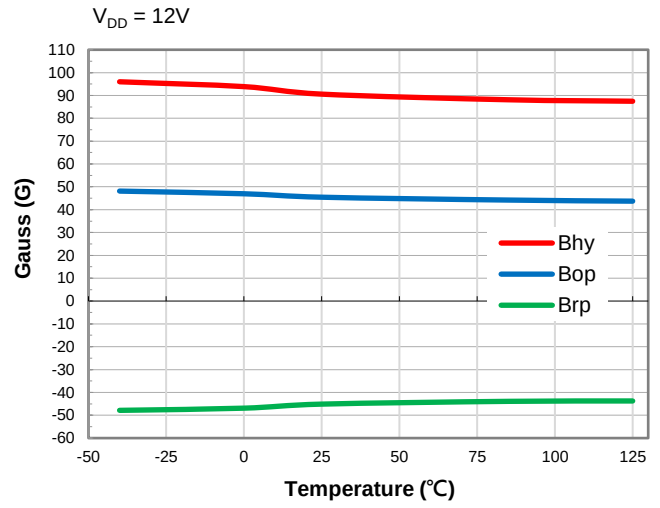
AH3724A Output Points (Magnetic Thresholds) – B_{OP} and B_{RP}



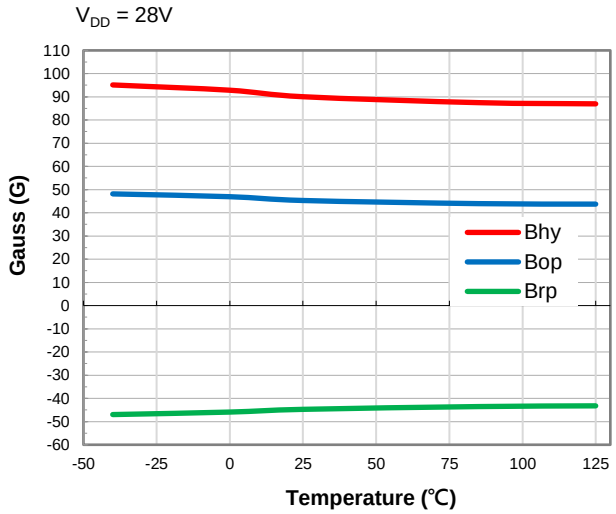
Switch Points B_{OP} and B_{RP} vs. Supply Voltage



Switch Points B_{OP} and B_{RP} vs. Temperature

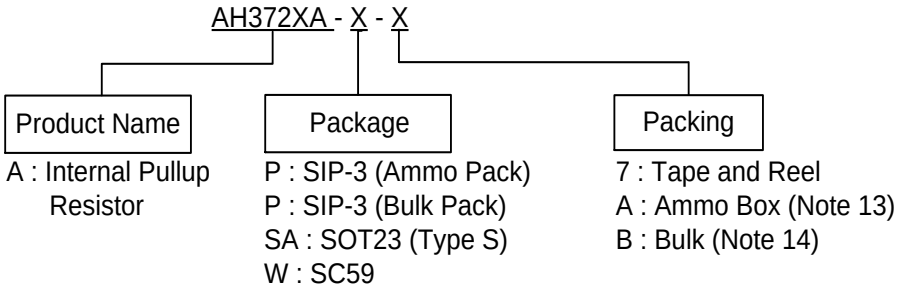


Switch Points B_{OP} and B_{RP} vs. Temperature



Switch Points B_{OP} and B_{RP} vs. Temperature

Ordering Information



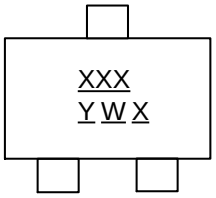
Part Number	Package Code	Package	Part Number Suffix	Packing	
				Qty.	Carrier
AH3722A-P-A	P	SIP-3 (Ammo Pack)	-A	4,000	Ammo Box
AH3722A-P-B	P	SIP-3 (Bulk Pack)	-B	1,000	Bulk
AH3722A-SA-7	SA	SOT23 (Type S)	-7	3,000	7" Tape & Reel
AH3724A-P-B	P	SIP-3 (Bulk Pack)	-B	1,000	Bulk
AH3724A-SA-7	SA	SOT23 (Type S)	-7	3,000	7" Tape & Reel
AH3724A-W-7	W	SC59	-7	3,000	7" Tape & Reel

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

Marking Information

(1) SOT23 (Type S)

(Top View)



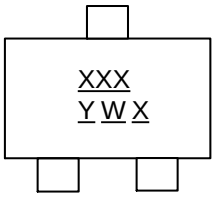
XXX : Identification Code
Y : Year 0 to 9 (ex: 3 = 2023)
W : Week : A to Z : week 1 to 26;
a to z : week 27 to 52; z represents week 52 and 53
X : Internal Code

Part Number	Package	Identification Code
AH3722A-SA-7	SOT23 (Type S)	S4J
AH3724A-SA-7	SOT23 (Type S)	S4M

Marking Information (continued)

(2) SC59

(Top View)

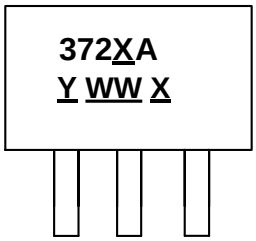


XXX : Identification Code
Y : Year 0 to 9 (ex: 3 = 2023)
W : Week : A to Z : week 1 to 26;
a to z : week 27 to 52; z represents week 52 and 53
X : Internal Code

Part Number	Package	Identification Code
AH3724A-W-7	SC59	S5F

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

(Top View)



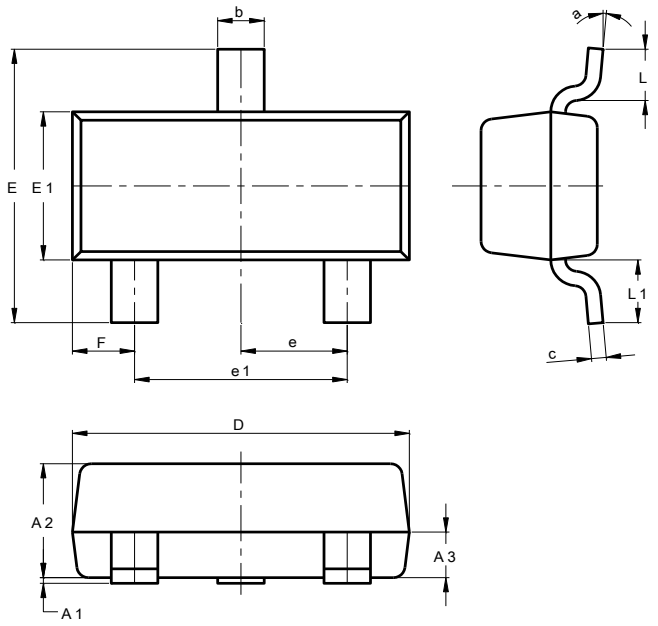
372XA : Identification Code
Y : Year : 0 to 9 (ex: 3 = 2023)
WW : Week : 01 to 52, "52" represents week 52 and 53
X : Internal Code

Part Number	Package	Identification Code
AH3722A-P-A	SIP-3 (Ammo Pack)	3722A
AH3722A-P-B	SIP-3 (Bulk Pack)	3722A
AH3724A-P-B	SIP-3 (Bulk Pack)	3724A

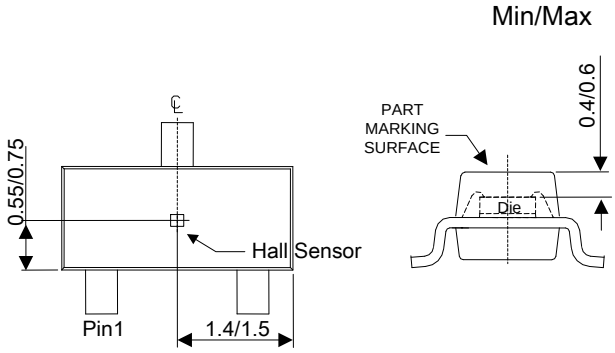
Package Outline Dimensions (All dimensions in mm.)

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			

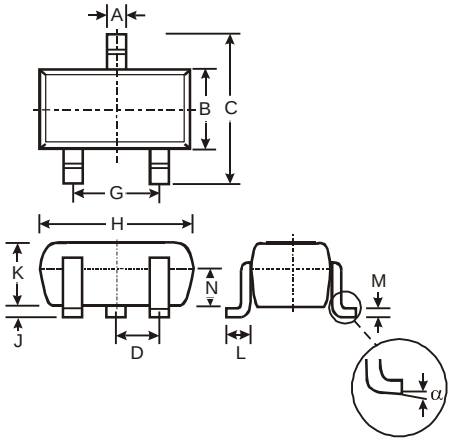


Sensor Location

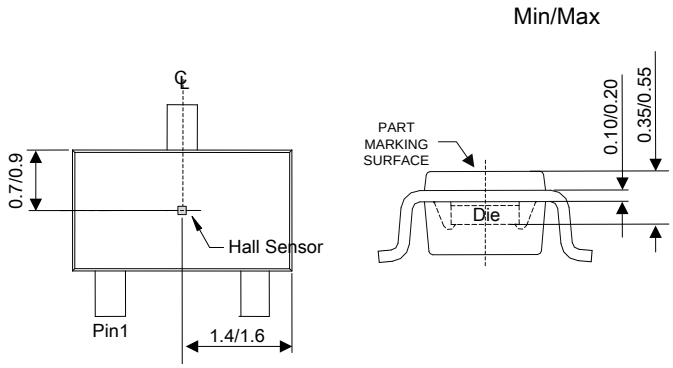
Package Outline Dimensions (All dimensions in mm.) (continued)

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			

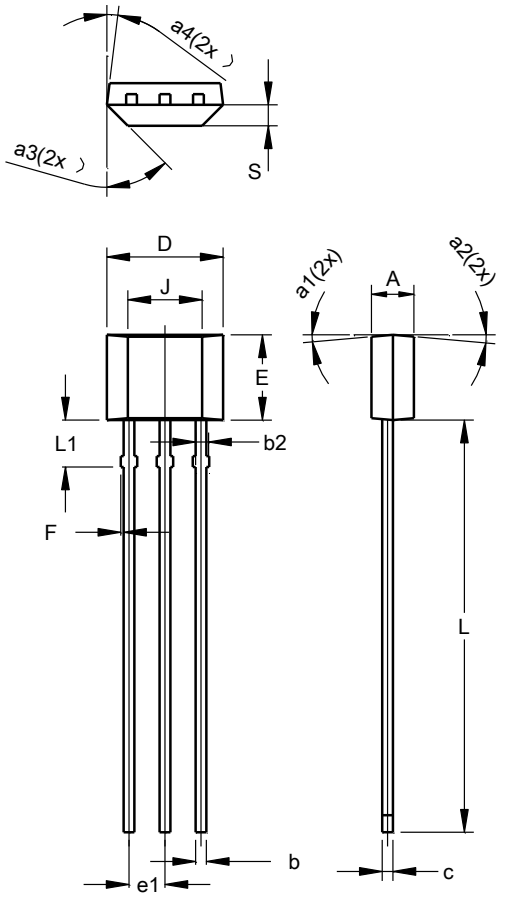


Sensor Location

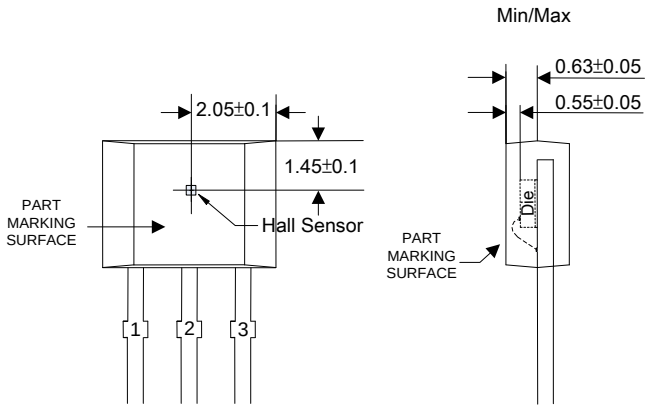
Package Outline Dimensions (All dimensions in mm.) (continued)

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			

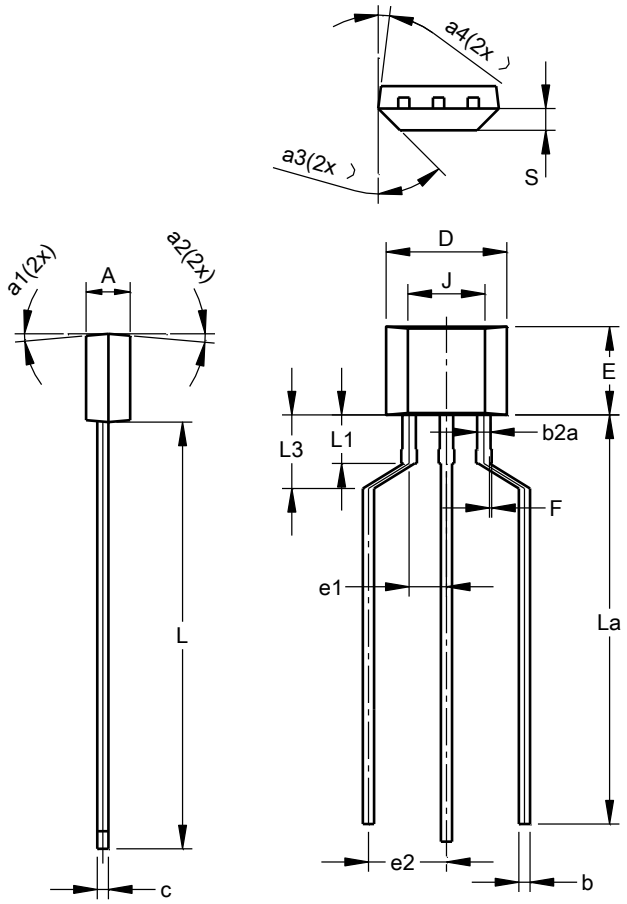


Sensor Location

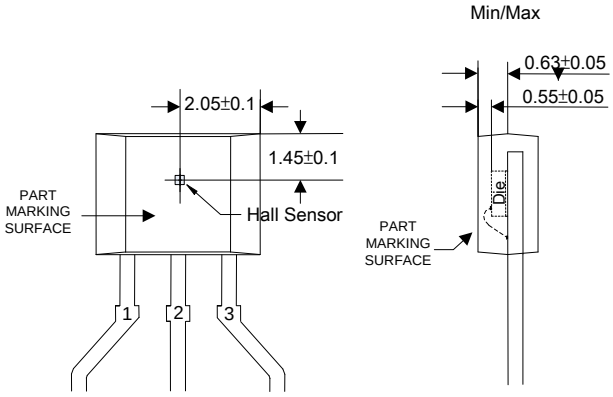
Package Outline Dimensions (All dimensions in mm.) (continued)

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			

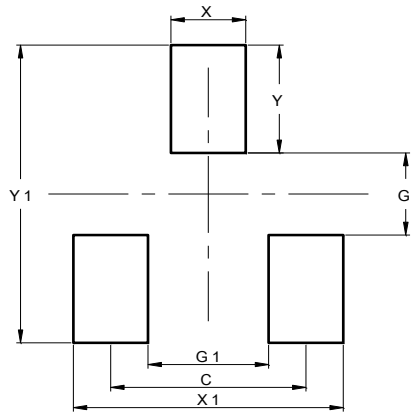


Sensor Location

Suggested Pad Layout

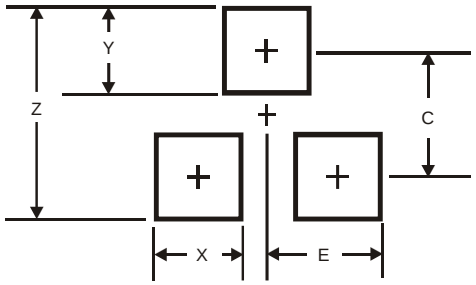
Please see http://www.diodes.com/package-outlines.html for the latest version.

(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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