

Description

The AH372X is a high-voltage, high-sensitivity Hall-effect latch IC designed for brushless DC-motor commutation speed measurement, angular or linear encoders and position sensors in automotive 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 AH372X 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 and switched off with North 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). The output is held latched until magnetic flux density reverses and becomes lower than the release point (B_{RP}).

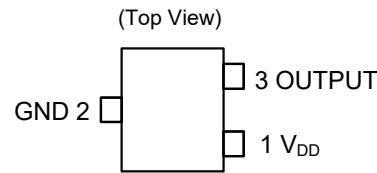
Features

- 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 140G and -25G to -140G (typ)
- Single Open-Drain Output with 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)**
- **An automotive-compliant part is available under a separate datasheet ([AH372XQ](#))**

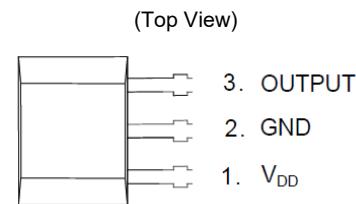
Notes:

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.

Pin Assignments



SC59 and SOT23 (Type S)

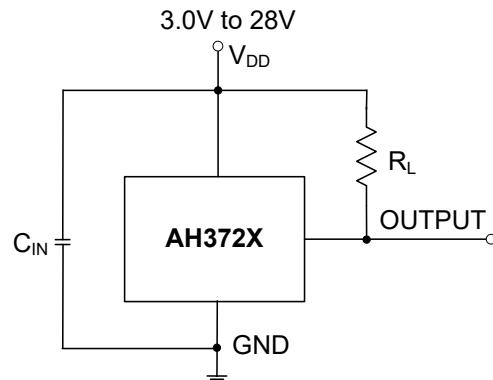


SIP-3 (Ammo Pack) and SIP-3 (Bulk Pack)

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

Typical Applications Circuit



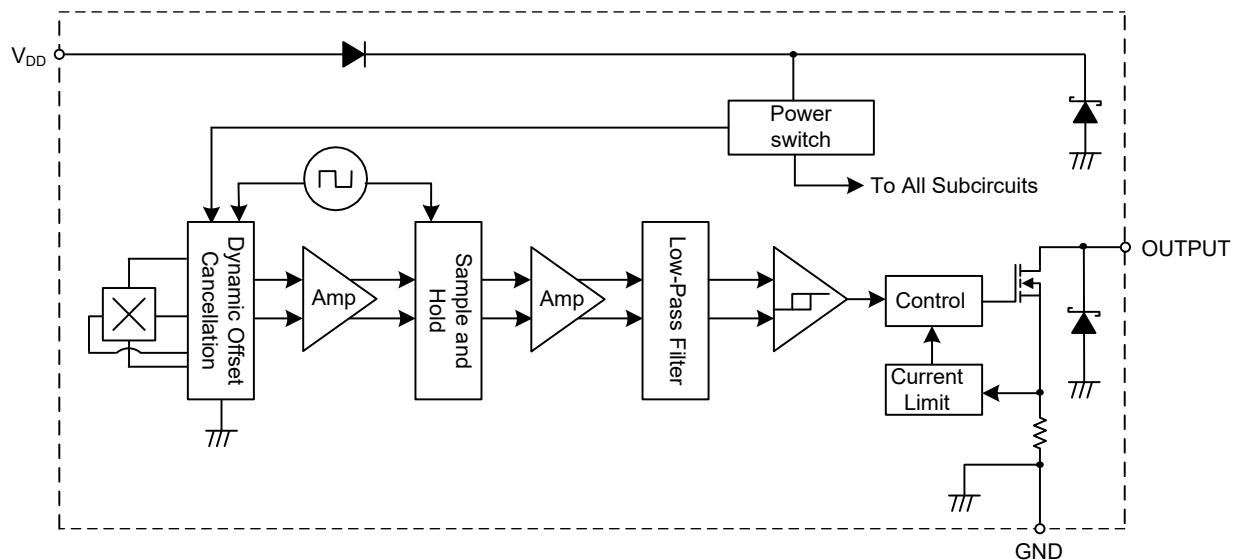
Note: 4. C_{IN} is for power stabilization and to strengthen the noise immunity. The recommended capacitance is 10nF to 100nF. R_L is the pullup resistor.

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) (@ $T_A = +25^\circ\text{C}$, 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)		32V	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)	550	mW
		SIP-3 (Bulk Pack)	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:

- 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 (@ $T_A = -40^\circ\text{C}$ to $+125^\circ\text{C}$, 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) (@ $T_A = -40^\circ\text{C}$ to $+125^\circ\text{C}$, $V_{DD} = 3\text{V}$ to 28V , $C_{IN} = 0.1\mu\text{F}$ unless otherwise specified.)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{OUT_ON}	Output On Voltage	$I_{OUT} = 20\text{mA}$, $B > B_{OP}$	—	0.2	0.4	V
I_{OUT_OFF}	Output Leakage Current	$V_{OUT} = 28\text{V}$, $B < B_{RP}$, output off	—	< 0.1	10	μA
I_{DD}	Supply Current	Output open, $T_A = +25^\circ\text{C}$	—	3	4	mA
		Output open, $T_A = -40^\circ\text{C}$ to $+125^\circ\text{C}$	—	—	5	mA
		$V_{DD} = -18\text{V}$, $T_A = -40^\circ\text{C}$ to $+125^\circ\text{C}$	—	0.01	1	mA
t_{ST}	Device Startup Time	$V_{DD} \geq 3\text{V}$, $B > B_{OP}$ (Note 7)	—	10	—	μs
f_C	Chopping Frequency	$V_{DD} \geq 3\text{V}$	—	500	—	kHz
t_D	The Time Delay 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)	$R_L = 1\text{k}\Omega$, $C_L = 20\text{pF}$ (Note 9)	—	0.2	1	μs
t_F	Output Falling Time (Internal Switch Resistance and Load Capacitance Dependent)	$R_L = 1\text{k}\Omega$, $C_L = 20\text{pF}$ (Note 9)	—	0.1	1	μs
I_{OCL}	Output Current Limit	$B > B_{OP}$ (Note 10)	30	—	55	mA
V_Z	Zener Clamp Voltage	$I_{DD} = 5\text{mA}$, $T_A = +25^\circ\text{C}$	28	—	—	V

Notes:

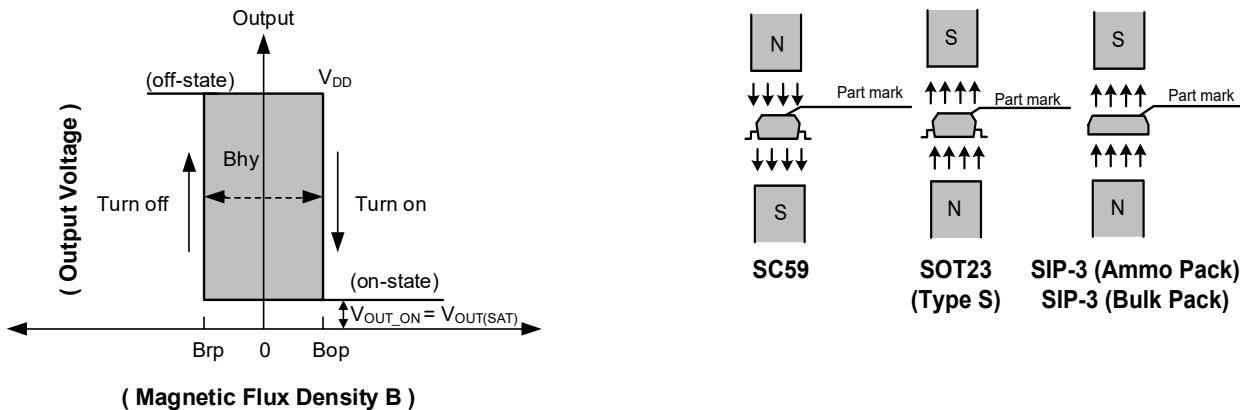
- 7. When power is initially turned on, V_{DD} must be within its correct operating range (3.0V to 28V) to guarantee the output sampling. The output state is valid after the startup time of 10μs typical from the operating voltage reaching 3V.
- 8. Typical values are defined at $T_A = +25^\circ\text{C}$, $V_{DD} = 12\text{V}$. 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) ($T_A = -40^\circ\text{C}$ to $+125^\circ\text{C}$, $V_{DD} = 3.0\text{V}$ to 28V , unless otherwise specified)

Part Number	Symbol	Parameter	Min	Typ	Max	Unit	Output Type
AH3722	B_{OP} (South pole to part-marking side)	Operation Point	10	25	40	Gauss	Open-Drain
	B_{RP} (North pole to part-marking side)	Release Point	-40	-25	-10		
	$B_{HY} (B_{OPX} - B_{RPX})$	Hysteresis (Note 13)	20	50	80		
AH3724	B_{OP} (South Pole to 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	20	40	60	Gauss	Open-Drain
	B_{RP} (North Pole to part marking side for SOT23 (Type S) and SIP-3 (Ammo Pack, SIP-3 (Bulk Pack) packages; North Pole to the non-part marking side for SC59 package. See diagram below)	Release Point	-60	-40	-20		
	$B_{HY} (B_{OPX} - B_{RPX})$	Hysteresis (Note 13)	40	80	120		
AH3725	B_{OP} (South pole to 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	50	70	90	Gauss	Open-Drain
	B_{RP} (North pole to part marking side for SOT23 (Type S) and SIP-3 (Ammo Pack, SIP-3 (Bulk Pack) packages; North pole to the non-part marking side for SC59 package. See diagram below)	Release Point	-90	-70	-50		
	$B_{HY} (B_{OPX} - B_{RPX})$	Hysteresis (Note 13)	100	140	180		
AH3727	B_{OP} (South pole to part marking side)	Operation Point	110	140	170	Gauss	Open-Drain
	B_{RP} (North pole to part marking side)	Release Point	-170	-140	-110		
	$B_{HY} (B_{OPX} - B_{RPX})$	Hysteresis (Note 13)	220	280	340		

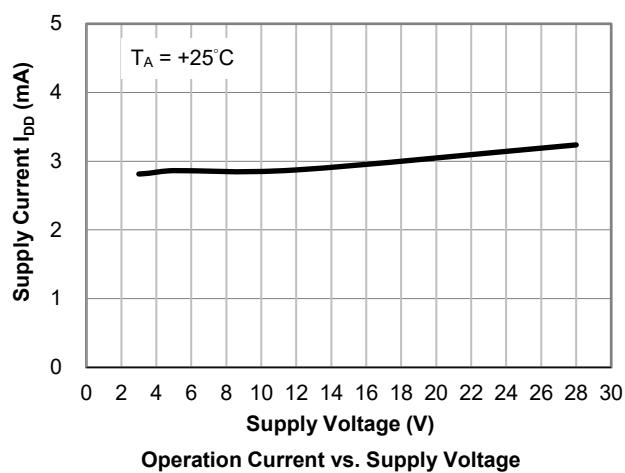
Notes:

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 10 μs typical from the operating voltage reaching 3V.
12. Typical values are defined at $T_A = +25^\circ\text{C}$, $V_{DD} = 12\text{V}$. 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.

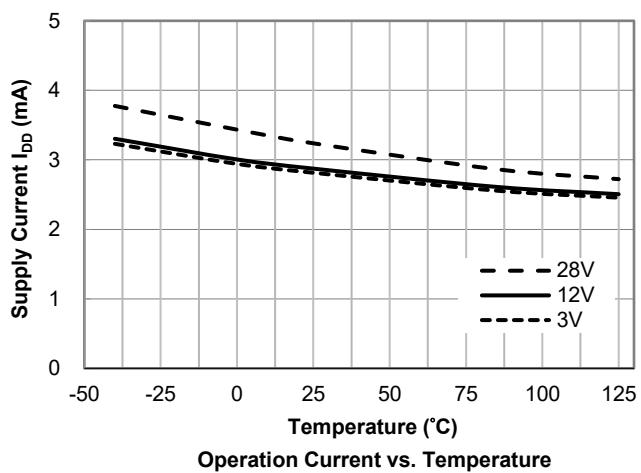


Typical Operating Characteristics

Supply Current

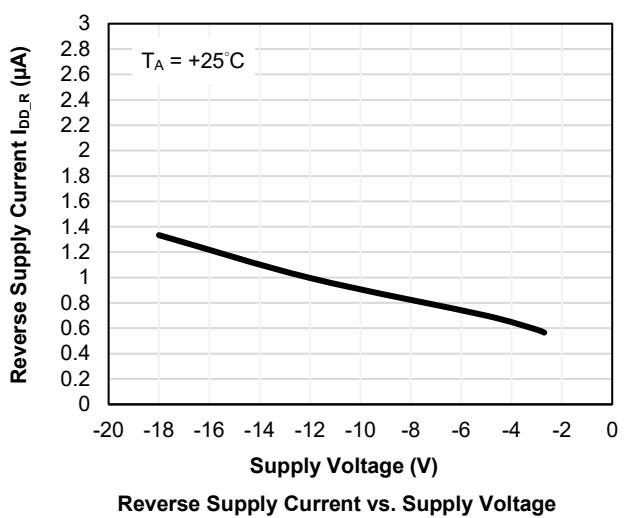


Operation Current vs. Supply Voltage

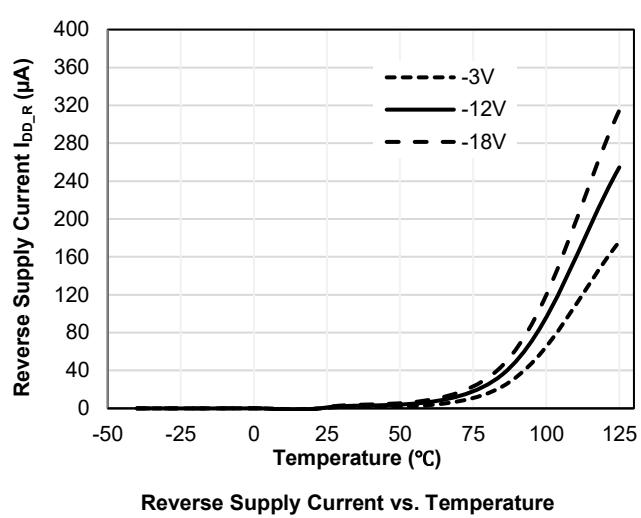


Operation Current vs. Temperature

Reverse Supply Current

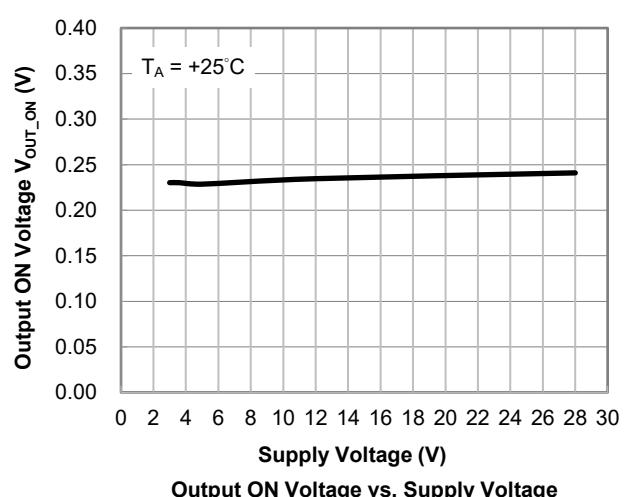


Reverse Supply Current vs. Supply Voltage

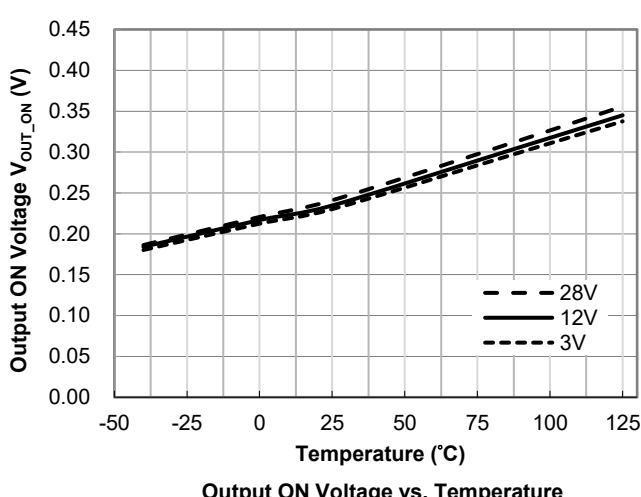


Reverse Supply Current vs. Temperature

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



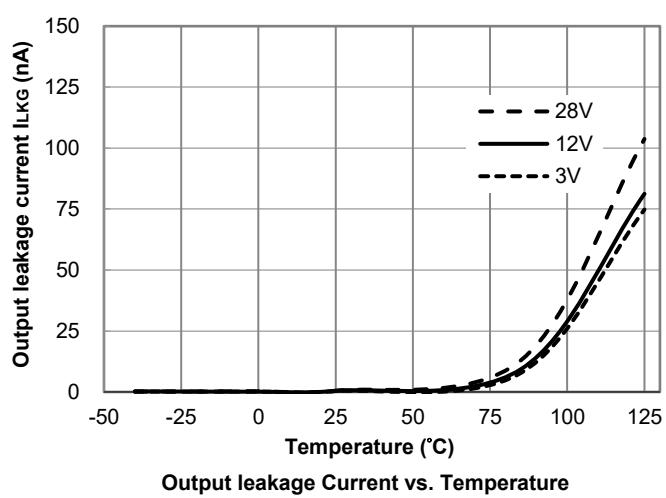
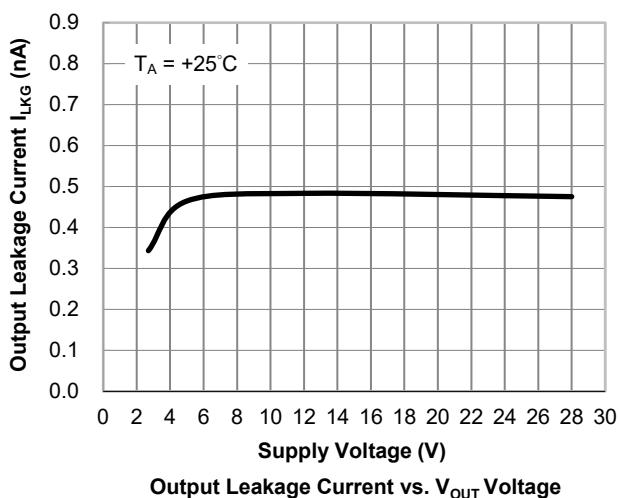
Output ON Voltage vs. Supply Voltage



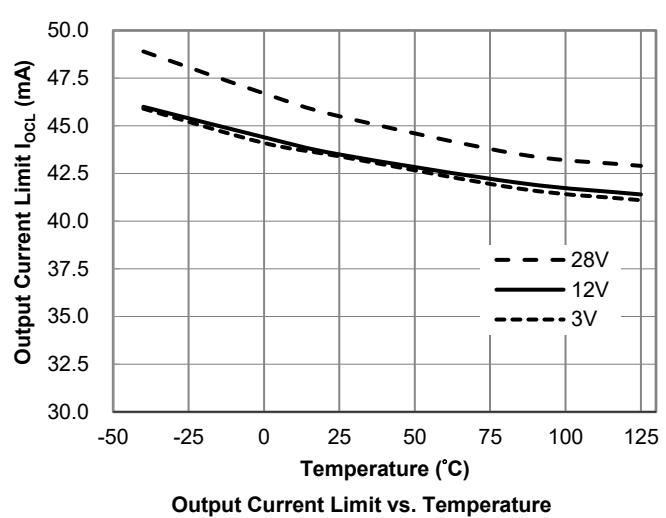
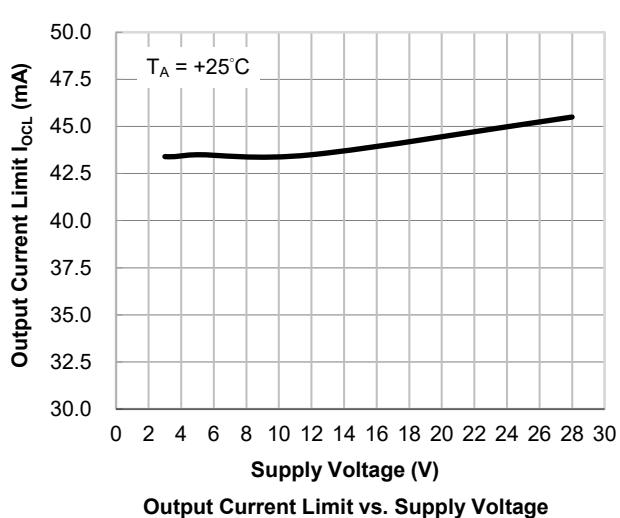
Output ON Voltage vs. Temperature

Typical Operating Characteristics (continued)

Output Leakage Current

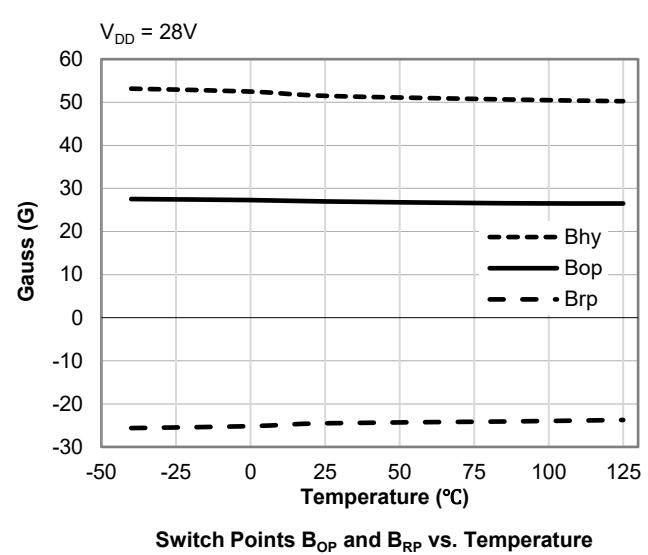
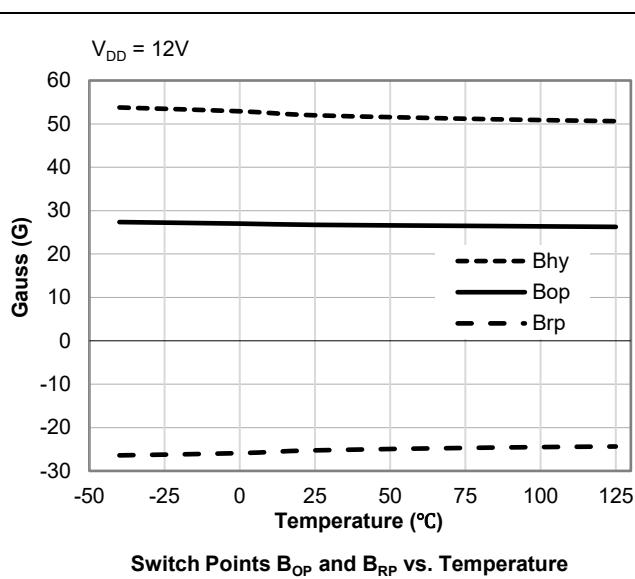
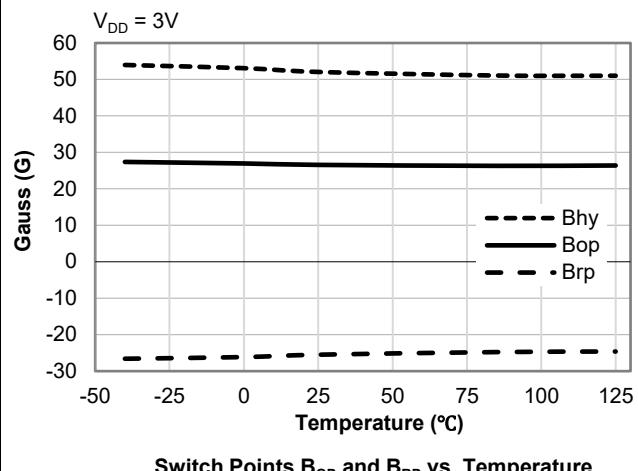
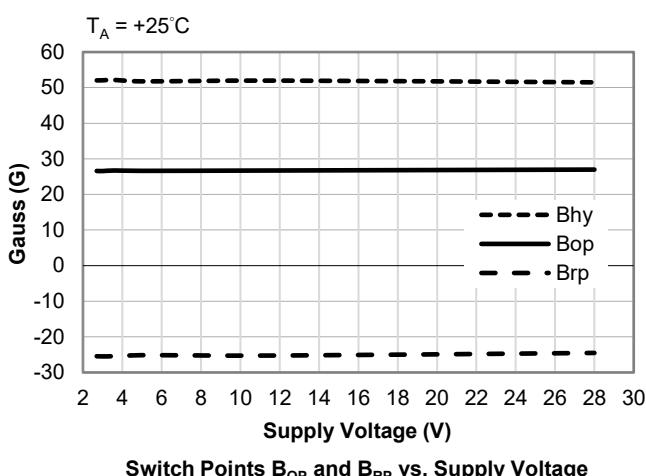


Output Current Limit



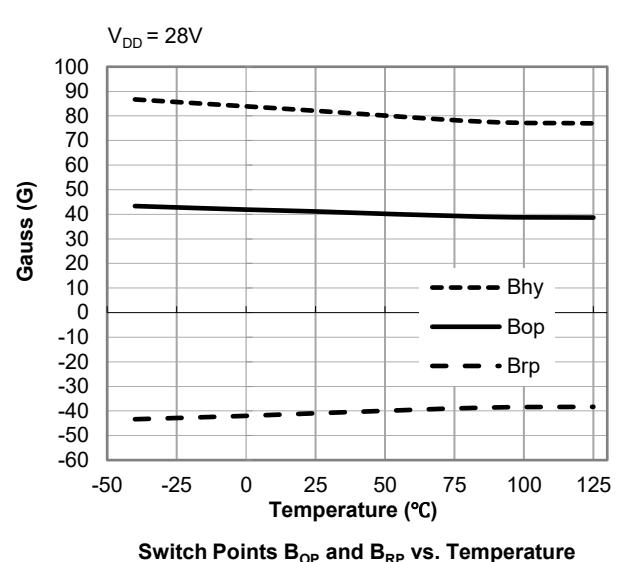
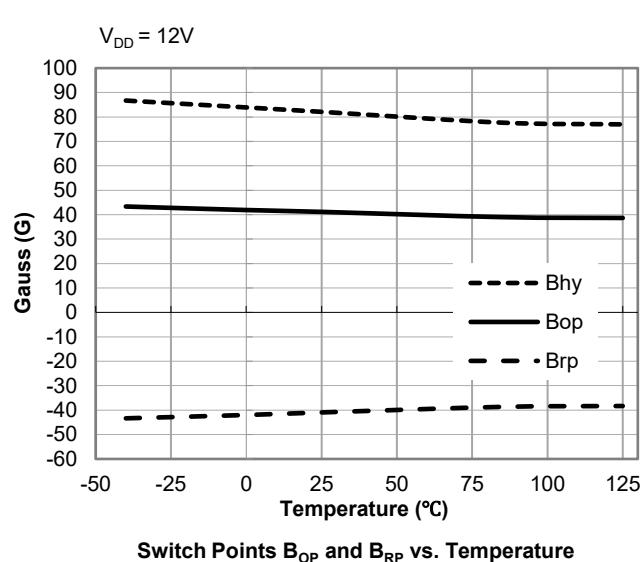
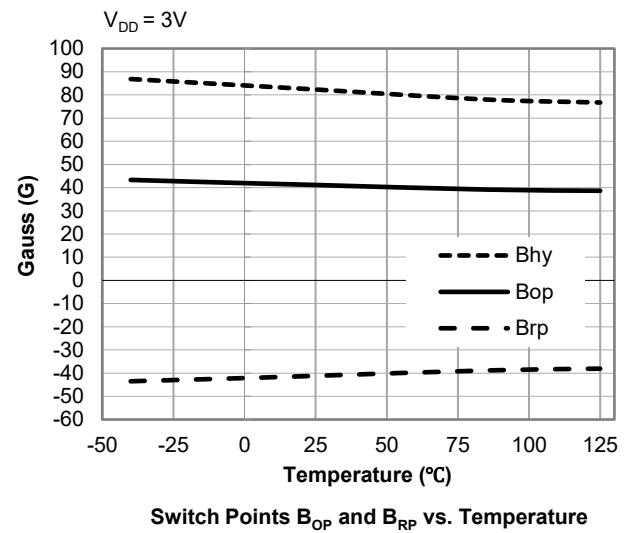
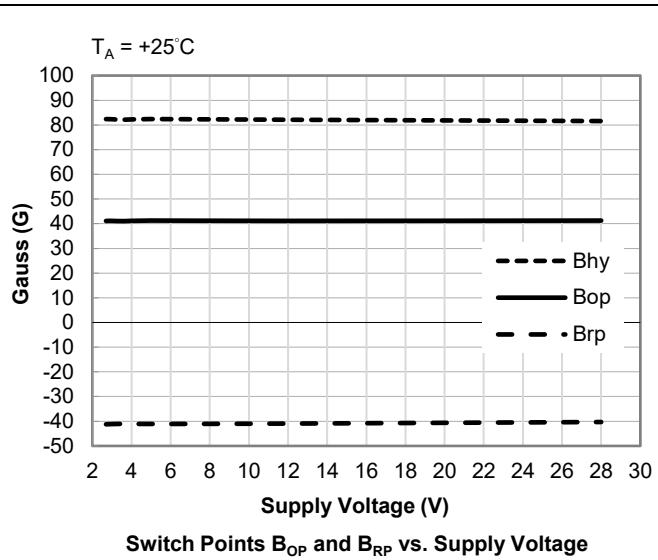
Typical Operating Characteristics (continued)

AH3722 Output Points (Magnetic Thresholds) – B_{OP} and B_{RP}



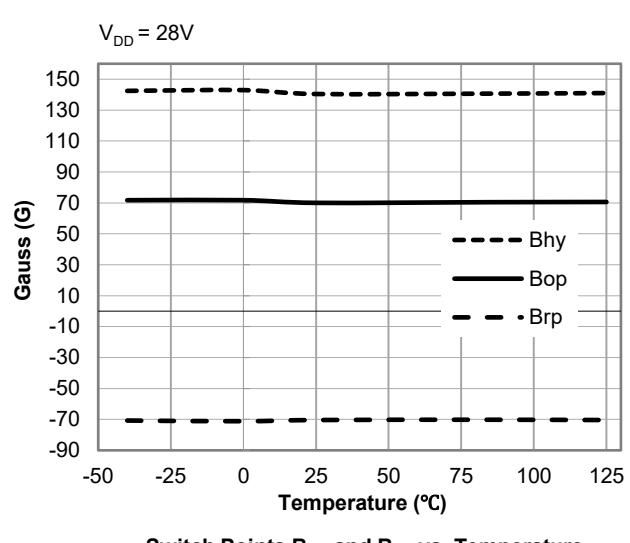
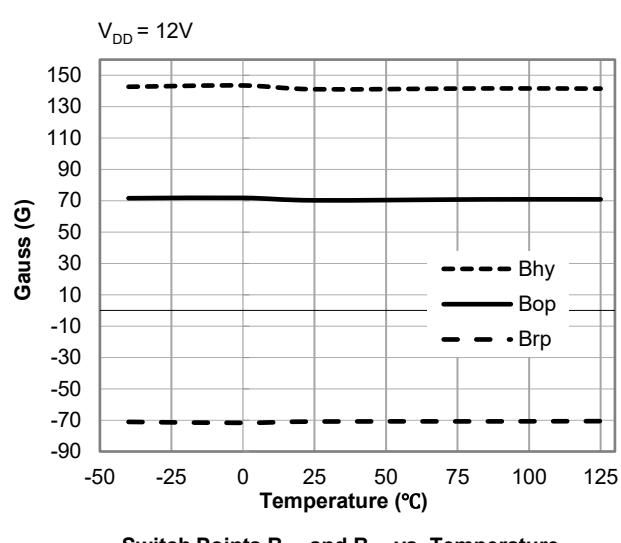
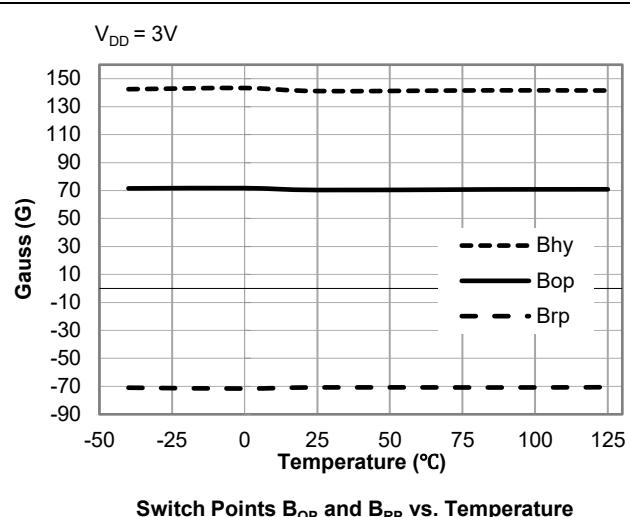
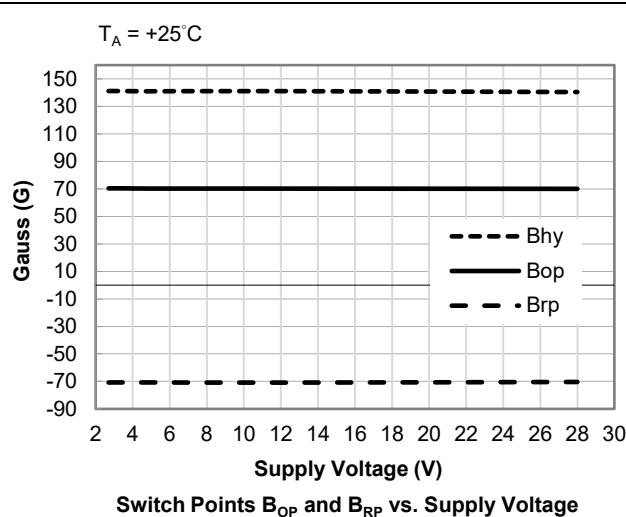
Typical Operating Characteristics (continued)

AH3724 Output Points (Magnetic Thresholds) – B_{OP} and B_{RP}



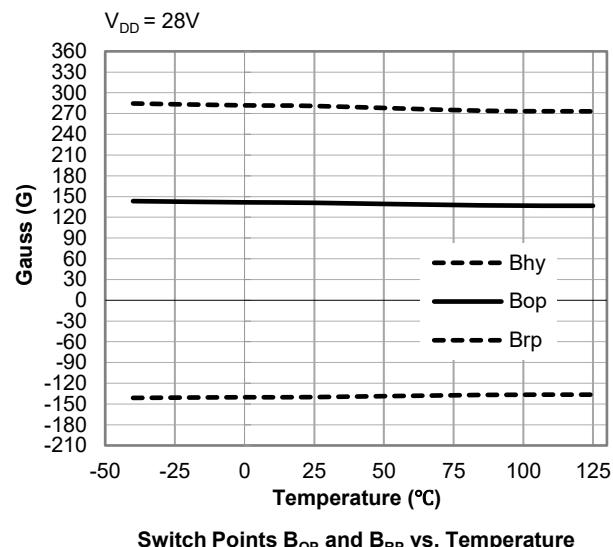
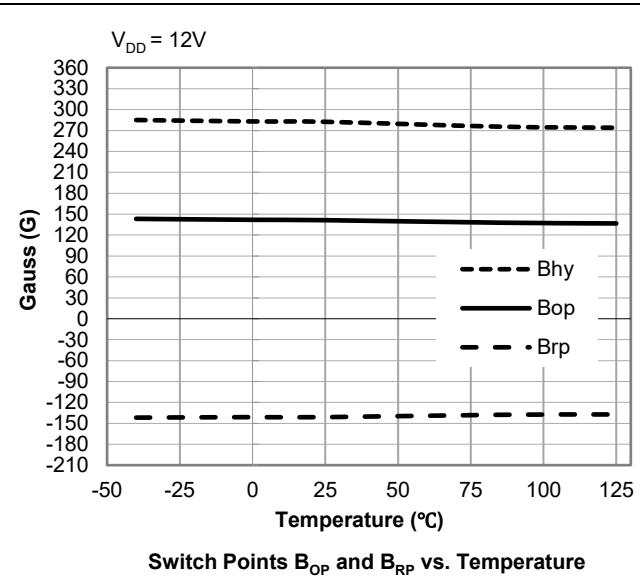
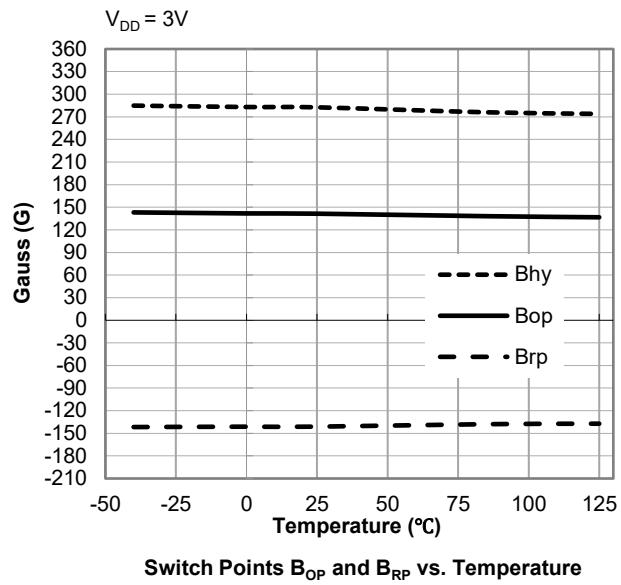
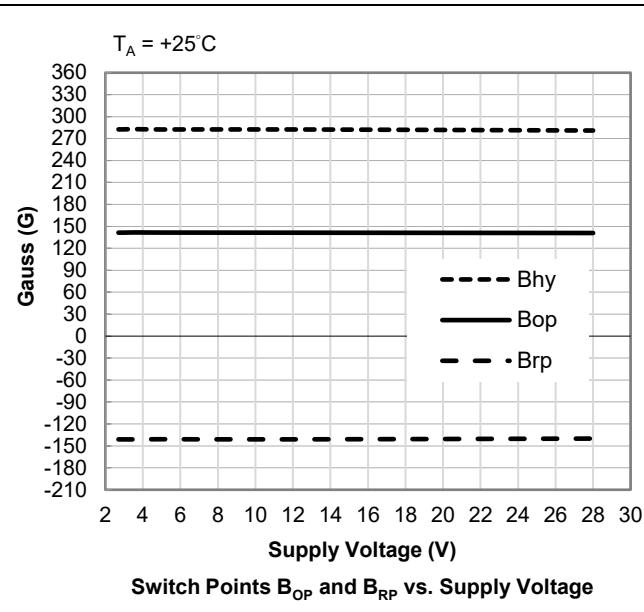
Typical Operating Characteristics (continued)

AH3725 Output Points (Magnetic Thresholds) – B_{OP} and B_{RP}

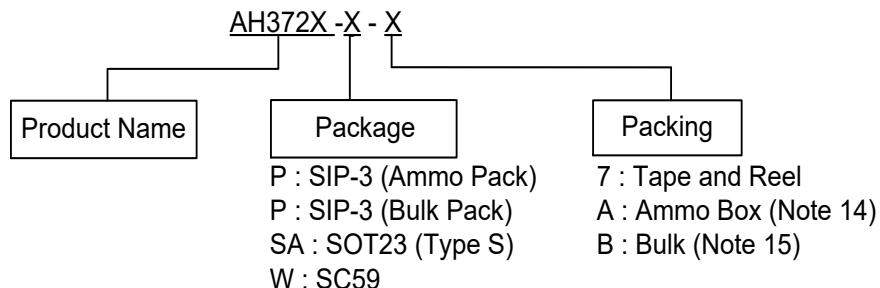


Typical Operating Characteristics (continued)

AH3727 Output Points (Magnetic Thresholds) – B_{OP} and B_{RP}



Ordering Information



Orderable Part Number	Package Code	Package (Note 16)	Part Number Suffix	Packing	
				Qty.	Carrier
AH3722-P-A	P	SIP-3 (Ammo Pack)	-A	4,000	Ammo Box
AH3722-P-B	P	SIP-3 (Bulk Pack)	-B	1,000	Bulk
AH3722-SA-7	SA	SOT23 (Type S)	-7	3,000	7" Tape & Reel
AH3722-W-7	W	SC59	-7	3,000	7" Tape & Reel
AH3724-P-A	P	SIP-3 (Ammo Pack)	-A	4,000	Ammo Box
AH3724-P-B	P	SIP-3 (Bulk Pack)	-B	1,000	Bulk
AH3724-SA-7	SA	SOT23 (Type S)	-7	3,000	7" Tape & Reel
AH3724-W-7	W	SC59	-7	3,000	7" Tape & Reel
AH3725-P-A	P	SIP-3 (Ammo Pack)	-A	4,000	Ammo Box
AH3725-P-B	P	SIP-3 (Bulk Pack)	-B	1,000	Bulk
AH3725-SA-7	SA	SOT23 (Type S)	-7	3,000	7" Tape & Reel
AH3727-P-B	P	SIP-3 (Bulk Pack)	-B	1,000	Bulk

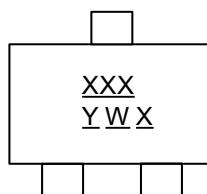
Notes:

- 14. Ammo Box is for SIP-3 Spread Lead.
- 15. Bulk is for SIP-3 Straight Lead.
- 16. For packaging details, go to our website at <https://www.diodes.com/design/support/packaging/diodes-packaging/>.

Marking Information

(1) Package Type: SOT23 (Type S)

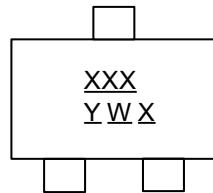
(Top View)



XXX : Identification Code
Y : Year 0 to 9 (ex: 5 = 2025)
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

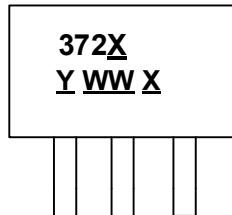
Orderable Part Number	Package	Identification Code
AH3722-SA-7	SOT23 (Type S)	S4A
AH3724-SA-7	SOT23 (Type S)	S4C
AH3725-SA-7	SOT23 (Type S)	S4D

Marking Information (continued)

(2) Package Type: SC59
(Top View)


XXX : Identification Code
Y : Year 0 to 9 (ex: 5 = 2025)
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

Orderable Part Number	Package	Identification Code
AH3722-W-7	SC59	S5A
AH3724-W-7	SC59	S5C

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


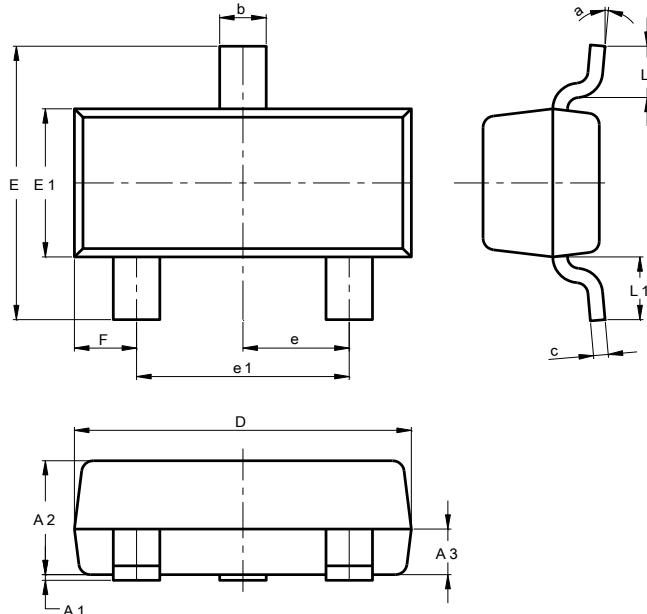
372X : Identification Code
Y : Year : 0 to 9 (ex: 5 = 2025)
WW : Week : 01 to 52, "52" represents
 week 52 and 53
X : Internal Code

Orderable Part Number	Package	Identification Code
AH3722-P-A	SIP-3 (Ammo Pack)	3722
AH3722-P-B	SIP-3 (Bulk Pack)	3722
AH3724-P-A	SIP-3 (Ammo Pack)	3724
AH3724-P-B	SIP-3 (Bulk Pack)	3724
AH3725-P-A	SIP-3 (Ammo Pack)	3725
AH3725-P-B	SIP-3 (Bulk Pack)	3725
AH3727-P-B	SIP-3 (Bulk Pack)	3727

Package Outline Dimensions (All dimensions in mm.)

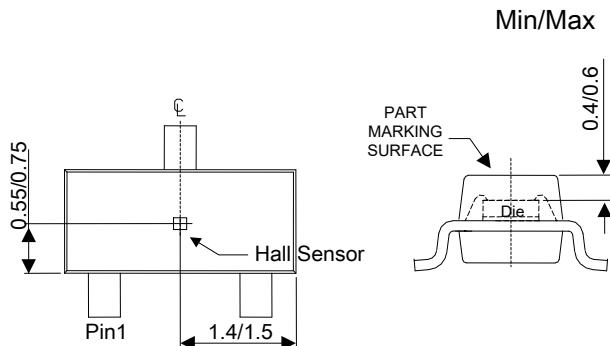
Please see <http://www.diodes.com/package-outlines.html> for the latest version.

(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

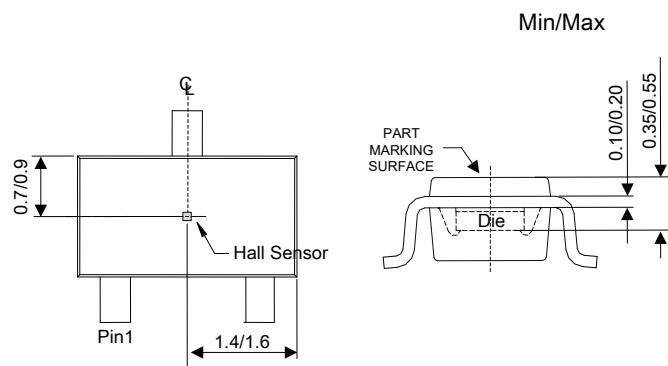
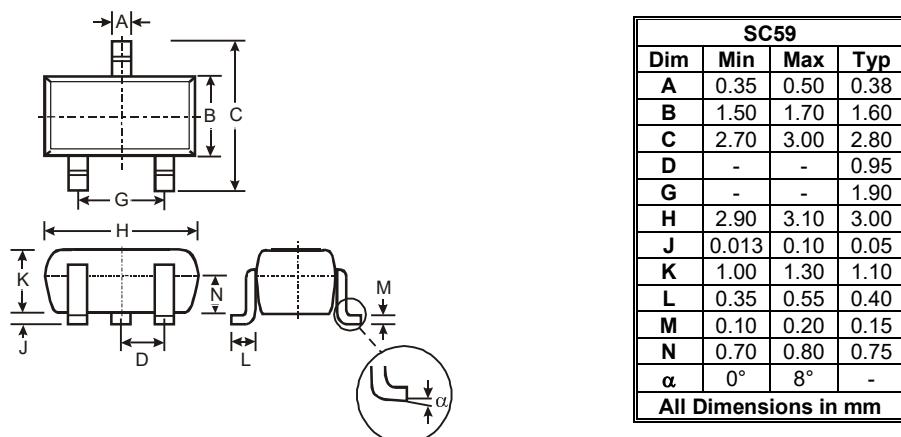


Sensor Location

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

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

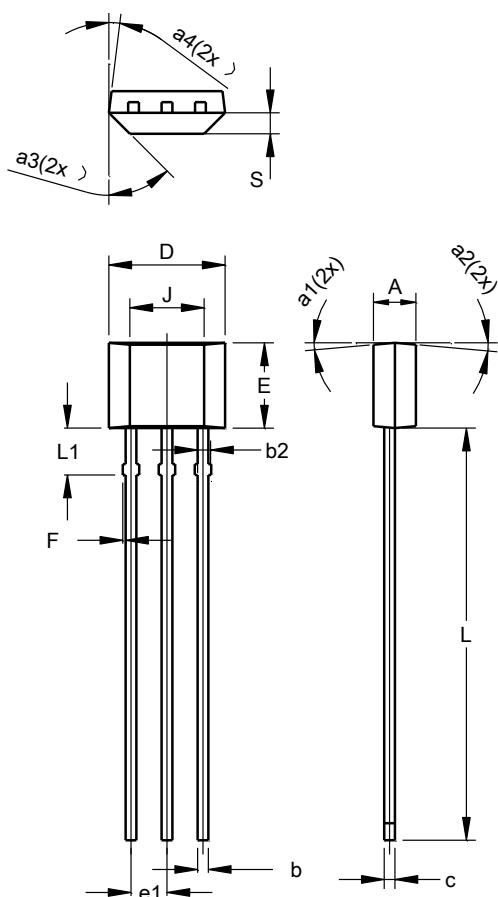
(2) Package Type: SC59



Sensor Location

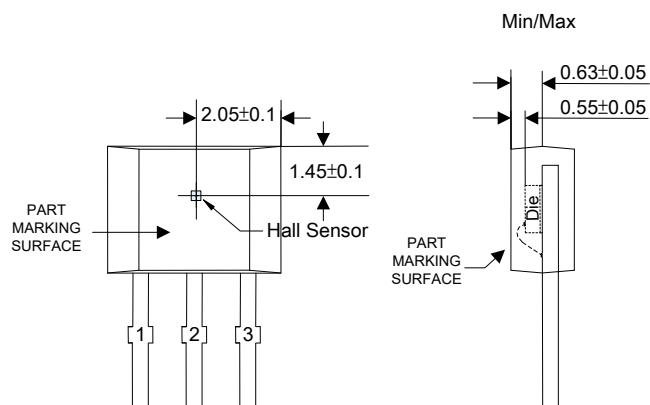
Package Outline Dimensions (All dimensions in mm.) (continued)

 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°

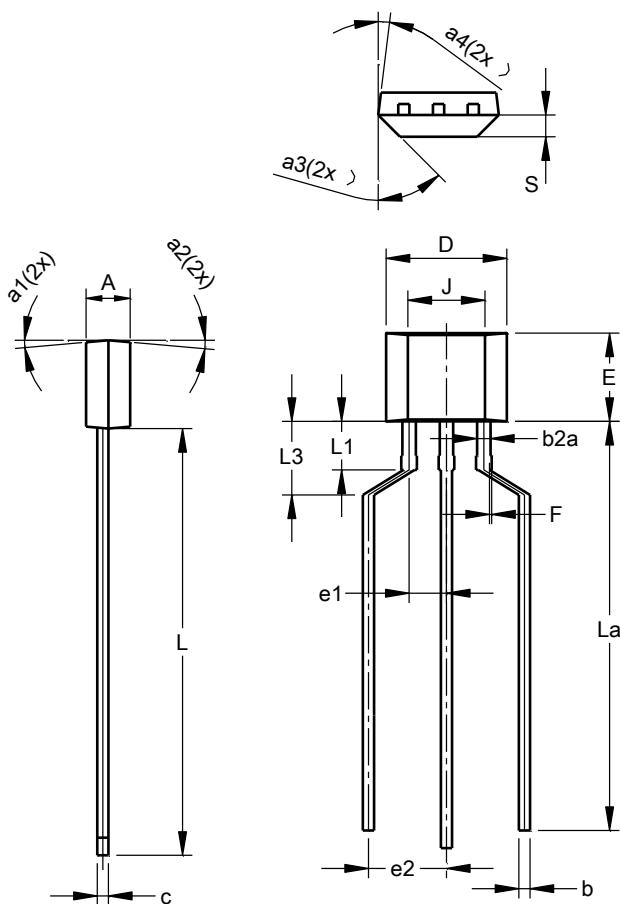
All Dimensions in mm


Sensor Location

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

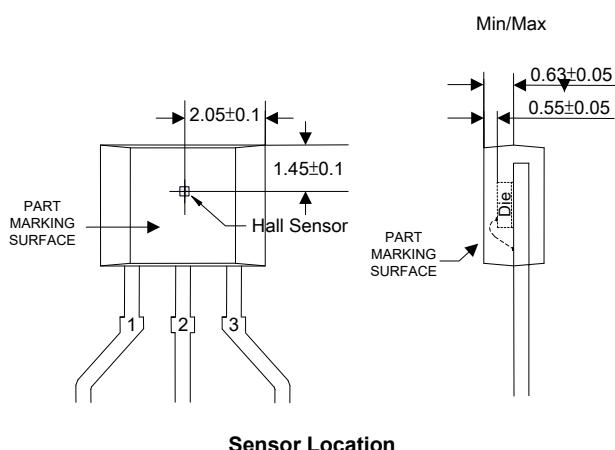
Please see <http://www.diodes.com/package-outlines.html> for the latest version.

(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°

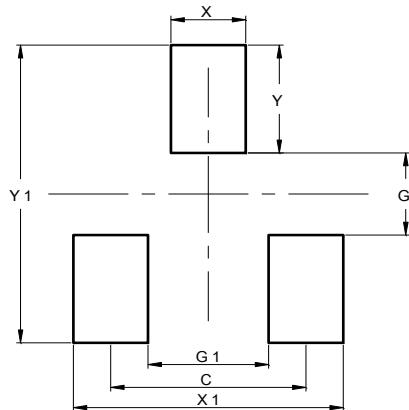
All Dimensions in mm



Suggested Pad Layout

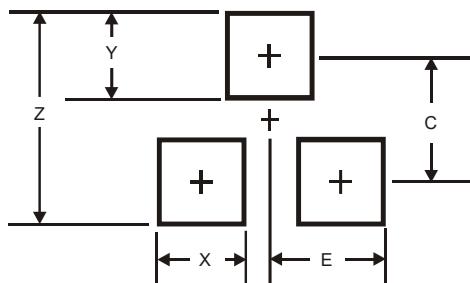
Please see <http://www.diodes.com/package-outlines.html> for the latest version.

(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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