

## Description

The AH3376 is a high voltage low 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 wide range of 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 AH3376 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 over current 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<sub>OP</sub>**) the output is switched on (pulled low) and is held on until magnetic flux density **B** is lower than the release point (**B<sub>RP</sub>**). The output remains switched off for North pole fields to or no magnetic fields.

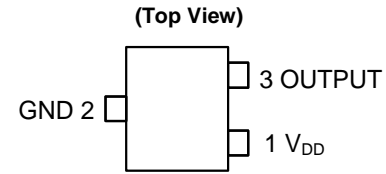
The magnetic operating and release polarity is opposite for SOT23 and SC59 packages. The SOT23 and SIP-3 (Ammo Pack), SIP-3 (Bulk Pack) packages will require south pole to the part marking side to operate while the SC59 will require south pole to the non-part marking side.

## Features

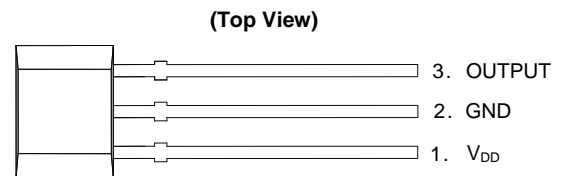
- Unipolar Operation
- Low Sensitivity:  $B_{OP}$  and  $B_{RP}$  of +100G and +85G Typical
- Single Open Drain Output with Over Current Limit
- 3.0V to 28V Operating Voltage Range
- Chopper Stabilized Design Provides
  - Superior Temperature Stability
  - Minimal Switch Point Drift
  - Enhanced Immunity to Stress
- Good RF Noise Immunity
- Reverse Blocking Diode
- Zener Clamp on Supply and Output Pins
- -40°C to +125°C Operating Temperature
- ESD: HBM > 6kV
- Industry Standard SC59, SOT23 and SIP-3 (Ammo Pack), SIP-3 (Bulk Pack) 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) & 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

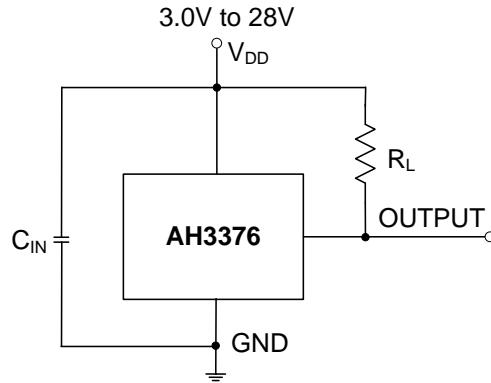


SIP-3 (Bulk Pack)

## Applications

- Position and Proximity Sensing in Consumer Home Appliances, Building Automation, Office Equipments and Industrial Applications
- Open and Close Detect
- Position Detect
- Level Detect
- Flow Meters
- Contact-less Switches

**Typical Applications Circuit** (Note 4)



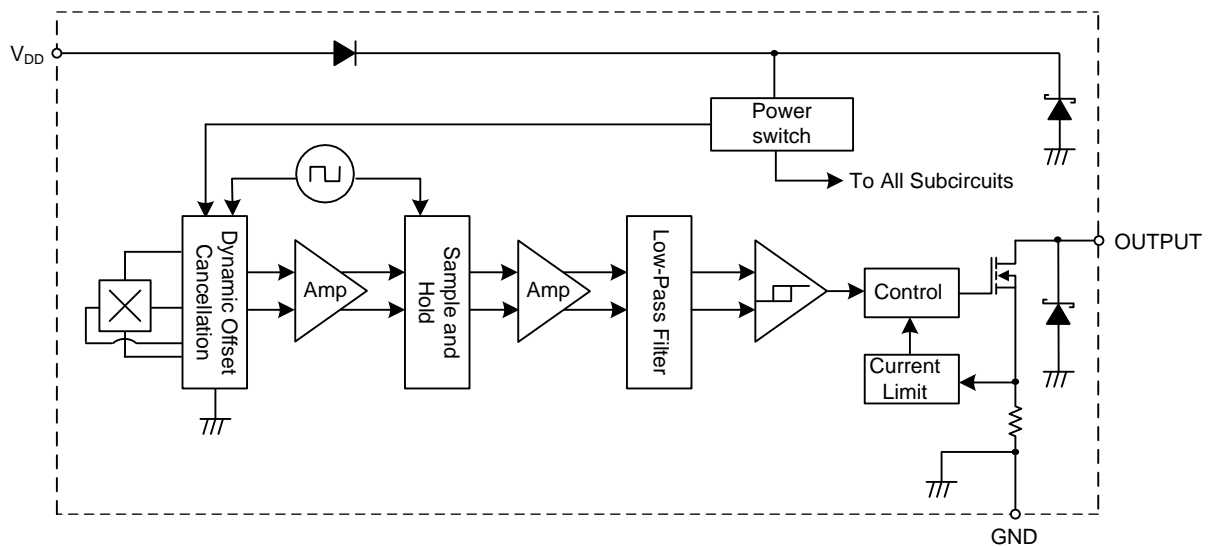
Note: 4.  $C_{IN}$  is for power stabilization and to strengthen the noise immunity, the recommended capacitance is 10nF ~ 100nF.  
 $R_L$  is the pull-up resistor.

**Pin Descriptions**

Package: SC59, SOT23 and SIP-3 (Ammo Pack), 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** (Note 5 & 6) (@T<sub>A</sub> = +25°C, unless otherwise specified.)

Symbol	Characteristic	Value	Unit	
V <sub>DD</sub>	Supply Voltage (Note 6)	32	V	
V <sub>DDR</sub>	Reverse Supply Voltage (Note 6)	-32	V	
V <sub>OUT_MAX</sub>	Output Off Voltage (Note 6)	32	V	
I <sub>OUT</sub>	Continuous Output Current	60	mA	
I <sub>OUT_R</sub>	Reverse Output Current	-50	mA	
B	Magnetic Flux Density	Unlimited		
P <sub>D</sub>	Package Power Dissipation	SIP-3 (Ammo Pack), SIP-3 (Bulk Pack)	550	mW
		SC59 and SOT23	230	
T <sub>s</sub>	Storage Temperature Range	-65 to +165	°C	
T <sub>J</sub>	Maximum Junction Temperature	+150	°C	
ESD HBM	Electrostatic Discharge Withstand - Human Body Model (HBM)	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<sub>DD</sub> 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<sub>A</sub> = -40°C to +125°C, unless otherwise specified.)

Symbol	Parameter	Condition	Rating	Unit
V <sub>DD</sub>	Supply Voltage	Operating	3.0 to 28	V
T <sub>A</sub>	Operating Temperature Range	Operating	-40 to +125	°C

**Electrical Characteristics** (Note 7 & 8) (@T<sub>A</sub> = -40°C to +125°C, V<sub>DD</sub> = 3V to 28V, unless otherwise specified.)

Symbol	Parameter	Condition	Min	Typ	Max	Unit
V <sub>OUT_ON</sub>	Output ON Voltage	I <sub>OUT</sub> = 20mA, B > B <sub>OP</sub>	-	0.2	0.4	V
I <sub>LKG</sub>	Output Leakage Current (When output is off)	V <sub>OUT</sub> = 28V, B < B <sub>RP</sub> , Output off	-	<0.1	10	µA
I <sub>DD</sub>	Supply Current	Output open, T <sub>A</sub> = +25°C	-	3	3.5	mA
		Output open, T <sub>A</sub> = -40°C to +125°C	-	-	4	mA
I <sub>DD_R</sub>	Reverse Supply Current	V <sub>DD</sub> = -18V, T <sub>A</sub> = -40°C to +125°C	-	-0.01	1	mA
		V <sub>DD</sub> = -28V, T <sub>A</sub> = -40°C to +125°C	-	-0.01	1.5	mA
t <sub>P_ON</sub>	Device Power-On Time (Start-up time)	V <sub>DD</sub> ≥ 3V, B > B <sub>OP</sub> (Note 7)	-	10	-	µs
f <sub>C</sub>	Chopping Frequency	-	-	800	-	kHz
t <sub>D</sub>	Response Time Delay (Time from magnetic threshold reached to the start of the output rise or fall)	(Note 9)	-	3.75	-	µs
t <sub>R</sub>	Output Rising Time (External pull-up resistor R <sub>L</sub> and load capacitance dependent)	R <sub>L</sub> = 1kΩ, C <sub>L</sub> = 20pF	-	0.2	1	µs
t <sub>F</sub>	Output Falling Time (Internal switch resistance and load capacitance dependent)	R <sub>L</sub> = 1kΩ, C <sub>L</sub> = 20pF	-	0.1	1	µs
I <sub>OCL</sub>	Output Current Limit	B > B <sub>OP</sub> , (Note 10)	30	-	55	mA
V <sub>Z</sub>	Zener Clamp Voltage	I <sub>DD</sub> = 5mA	28	-	-	V

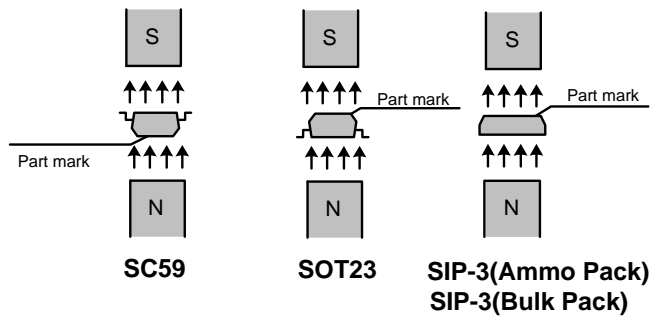
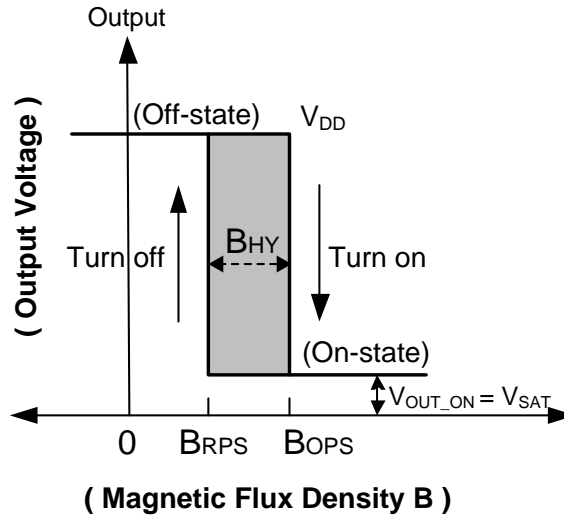
- Notes:
- When power is initially turned on, V<sub>DD</sub> must be within its correct operating range (3.0V to 28V) to guarantee the output sampling. The output state is valid after the start-up time of 10µs typical from the operating voltage reaching 3V.
  - Typical values are defined at T<sub>A</sub> = +25°C, V<sub>DD</sub> = 12V. Maximum and minimum values over the operating temperature range is not tested in production but guaranteed by design, process control and characterization.
  - Guaranteed by design, process control and characterization, Not tested in production.
  - The device will limit the output current I<sub>OUT</sub> to current limit of I<sub>OCL</sub>.

**Magnetic Characteristics** (Note 11 &12) ( $T_A = -40^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$ ,  $V_{DD} = 3.0\text{V}$  to  $28\text{V}$ , unless otherwise specified.)

(1mT=10 Gauss)

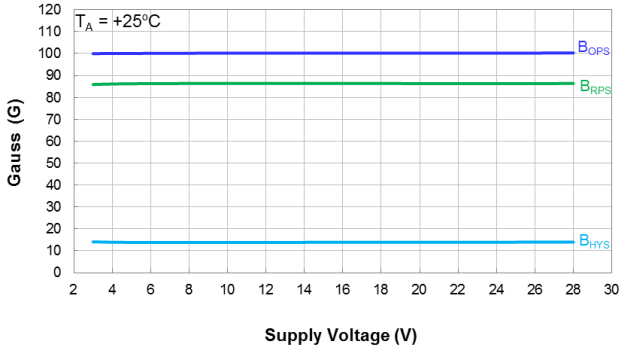
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$B_{OPS}$ (South pole to the part marking side for SOT23 and SIP-3 (Ammo Pack), SIP-3 (Bulk Pack) packages; South pole to the non-part marking side for SC59 package. See diagram below)	Operation Point	$V_{DD} = 12\text{V}$ , $T_A = +25^{\circ}\text{C}$	-	100	-	Gauss
		$T_A = -40^{\circ}\text{C}$ to $+150^{\circ}\text{C}$	65	100	135	
$B_{RPS}$ (South pole to the part marking side for SOT23 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	$V_{DD} = 12\text{V}$ , $T_A = +25^{\circ}\text{C}$	-	85	-	
		$T_A = -40^{\circ}\text{C}$ to $+150^{\circ}\text{C}$	50	85	120	
$B_{HY}$ ( $ B_{OPX}  -  B_{RPX} $ )	Hysteresis (Note 13)	$V_{DD} = 12\text{V}$ , $T_A = +25^{\circ}\text{C}$	-	15	-	
		$T_A = -40^{\circ}\text{C}$ to $+125^{\circ}\text{C}$	8	15	25	

- Notes:
- 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 start-up time of 10us typical from the operating voltage reaching 3V.
  - 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.
  - Maximum and minimum hysteresis is guaranteed by design, process control and characterization.

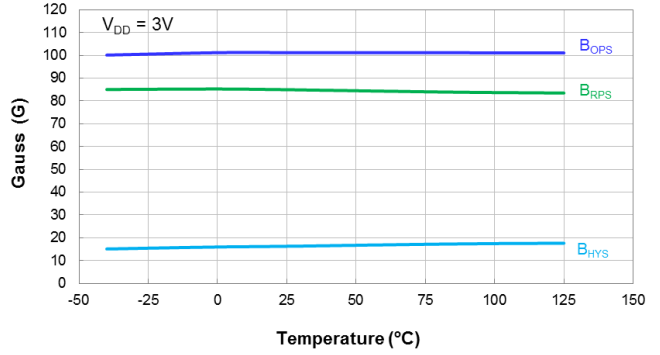


**Typical Operating Characteristics**

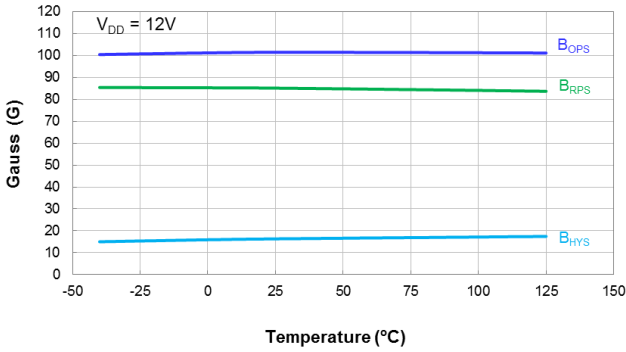
**Output Switch Operate and Release Points (Magnetic Thresholds) –  $B_{OPS}$  and  $B_{RPS}$**



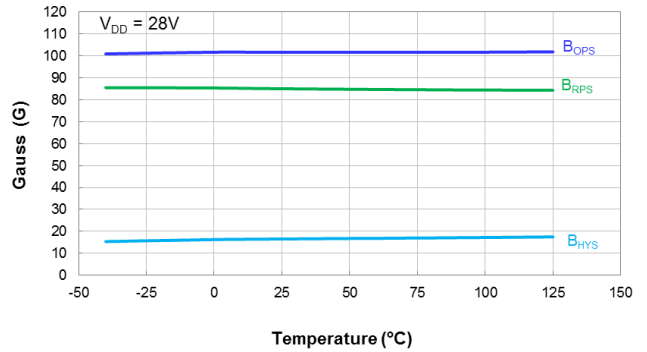
Switch Points  $B_{OPS}$  and  $B_{RPS}$  vs Supply Voltage



Switch Points  $B_{OPS}$  and  $B_{RPS}$  vs Temperature

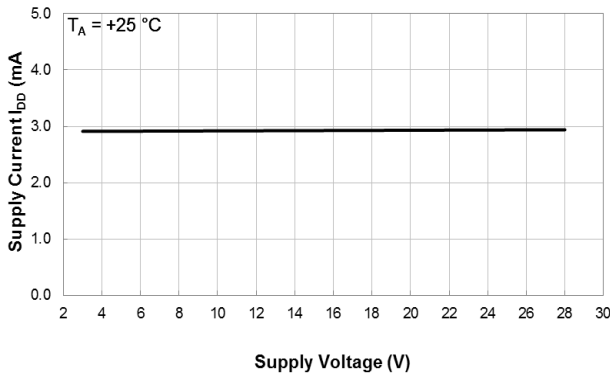


Switch Points  $B_{OPS}$  and  $B_{RPS}$  vs Temperature

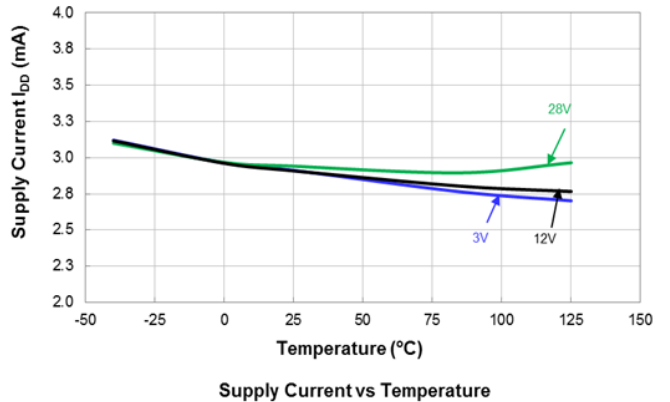


Switch Points  $B_{OPS}$  and  $B_{RPS}$  vs Temperature

**Supply Current**



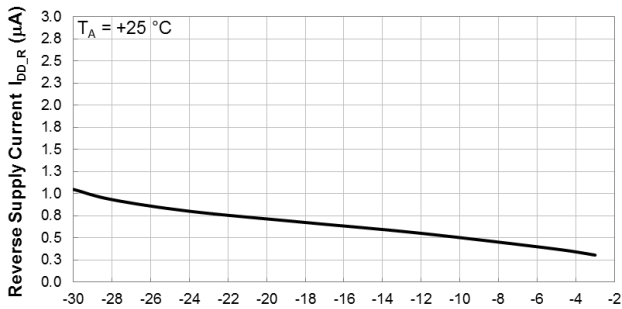
Supply Current vs Supply Voltage



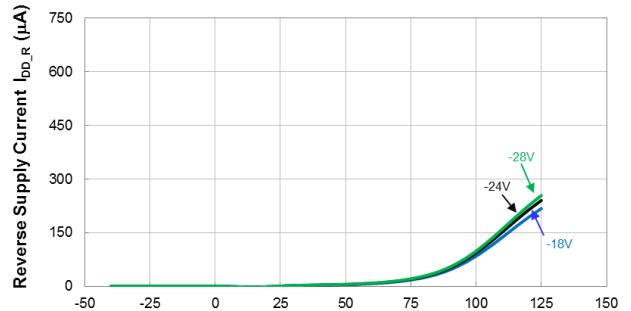
Supply Current vs Temperature

**Typical Operating Characteristics (Cont.)**

**Supply Reverse Current**

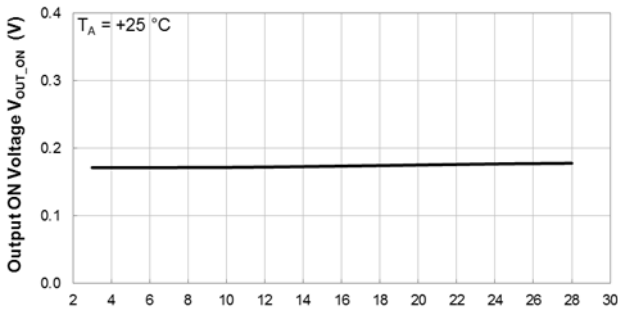


Reverse Supply Current vs Supply Voltage

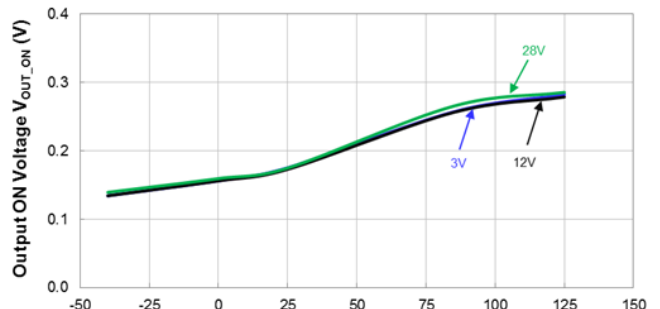


Reverse Supply Current vs Temperature

**Output Switch On Voltage**

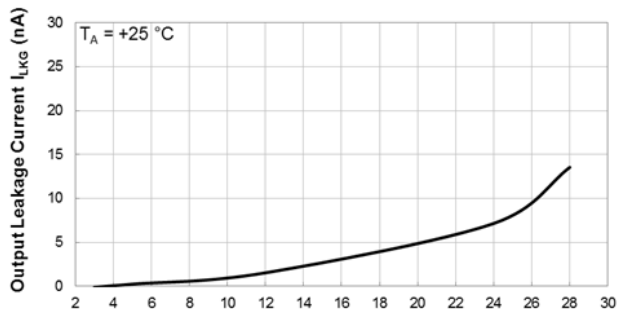


Output ON Voltage vs Supply Voltage

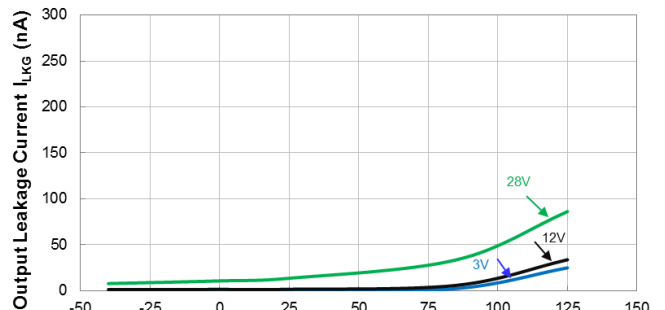


Output ON Voltage vs Temperature

**Output Switch Leakage Current**



Output Leakage Current vs Supply Voltage

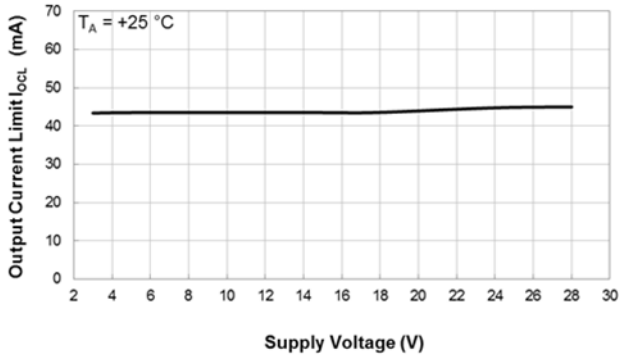


Output Leakage Current vs Temperature

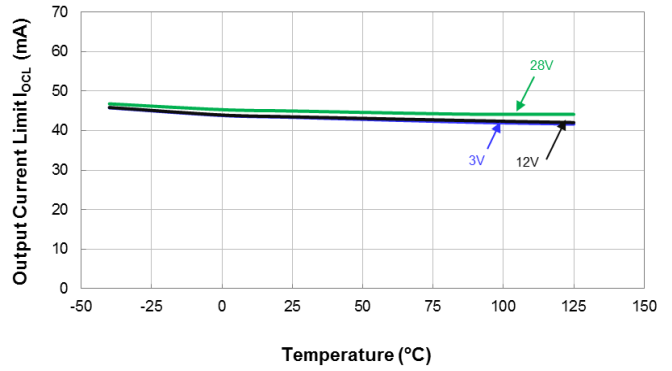
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**Typical Operating Characteristics** (Cont.)

**Output Current Limit**



Output Current Limit vs Supply Voltage



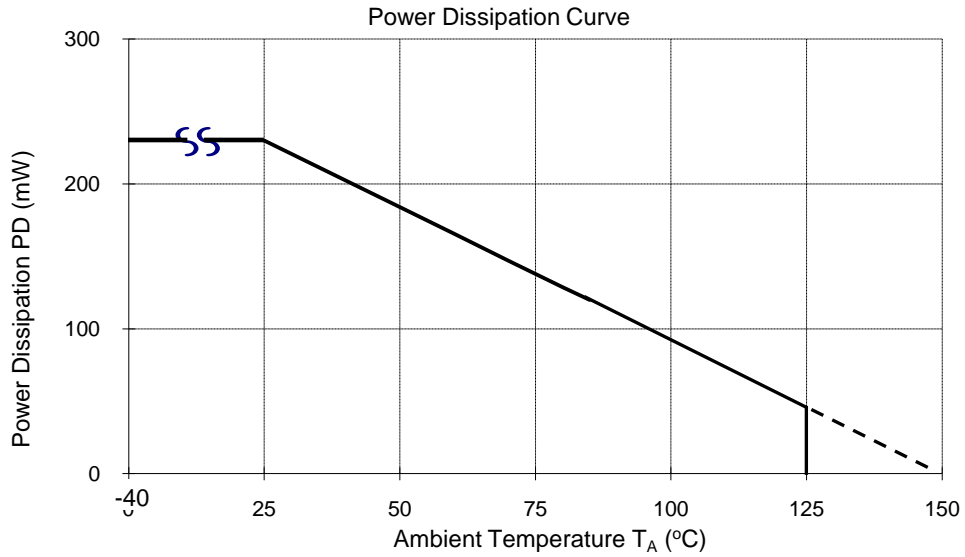
Output Current Limit vs Temperature

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**Thermal Performance Characteristics**

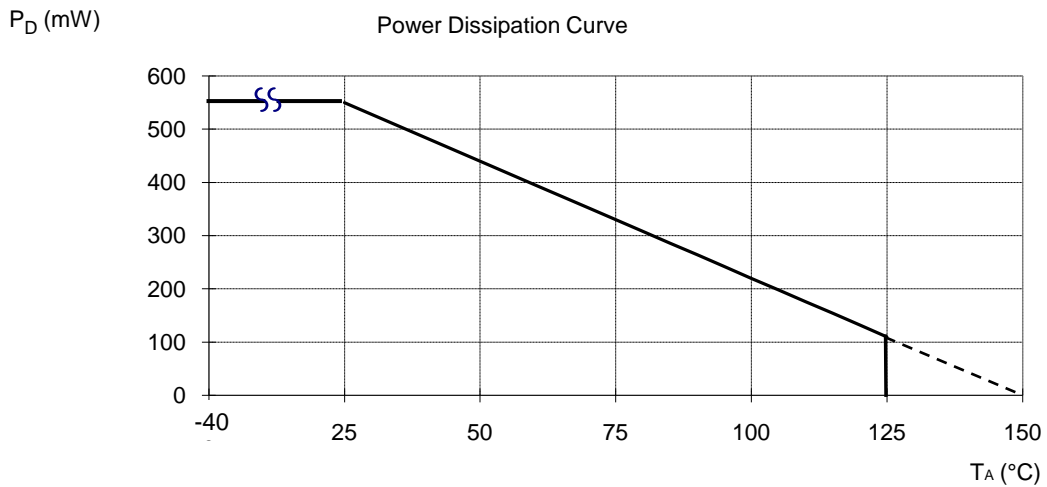
(1) Package Type: SC59 and SOT23

T <sub>A</sub> (°C)	25	50	60	70	80	85	90	100	105	110	120	125	130	140	150
P <sub>D</sub> (mW)	230	184	166	147	129	120	110	92	83	74	55	46	37	18	0



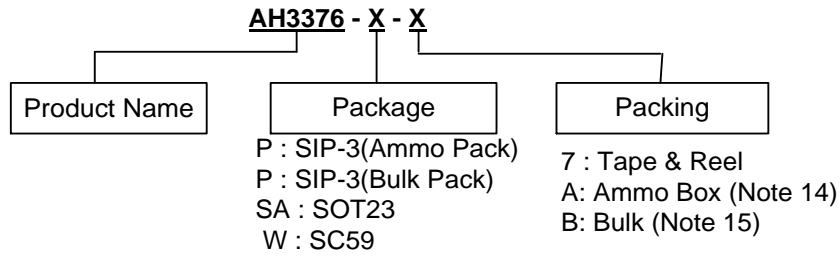
(2) Package Type: SIP-3 (Ammo Pack), SIP-3 (Bulk Pack)

T <sub>A</sub> (°C)	25	50	60	70	80	85	90	100	105	110	120	125	130	140	150
P <sub>D</sub> (mW)	550	440	396	362	308	286	264	220	198	176	132	110	88	44	0





## Ordering Information

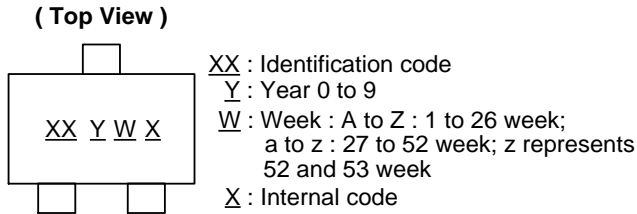


Part Number	Package Code	Packaging	Bulk		7" Tape and Reel		Ammo Box	
			Quantity	Part Number Suffix	Quantity	Part Number Suffix	Quantity	Part Number Suffix
AH3376-P-A	P	SIP-3 (Ammo Pack)	NA	NA	NA	NA	4000/Box	-A
AH3376-P-B	P	SIP-3 (Bulk Pack)	1000	-B	NA	NA	NA	NA
AH3376-SA-7	SA	SOT23	NA	NA	3000/Tape & Reel	-7	NA	NA
AH3376-W-7	W	SC59	NA	NA	3000/Tape & Reel	-7	NA	NA

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

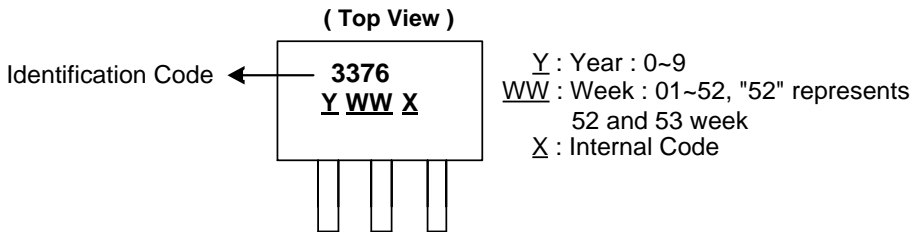
## Marking Information

### (1) Package Type: SC59 and SOT23



Part Number	Package	Identification Code
AH3376	SC59	DC
AH3376	SOT23	MZ

### (2) Package Type: SIP-3 (Ammo Pack), SIP-3 (Bulk Pack)

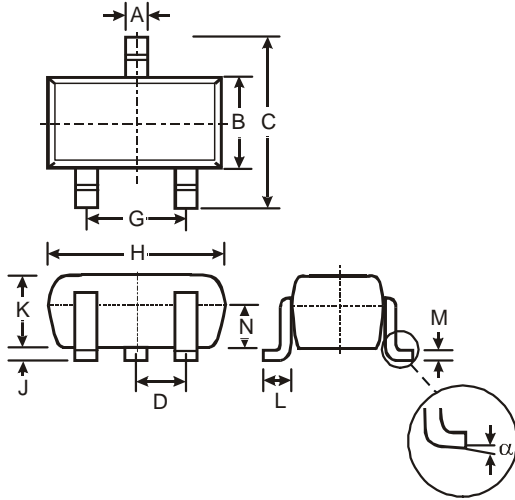


Part Number	Package	Identification Code
AH3376	SIP-3 (Ammo Pack)	3376
AH3376	SIP-3 (Bulk Pack)	3376

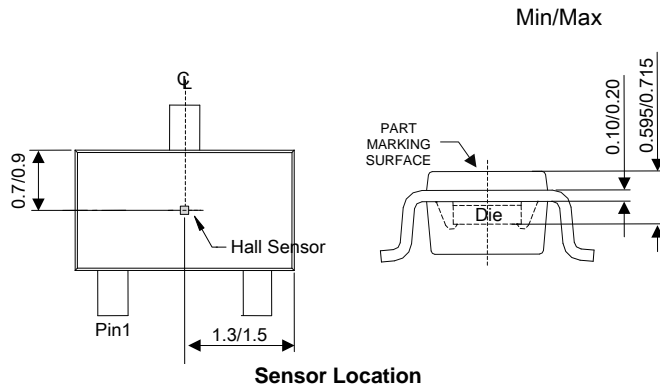
**Package Outline Dimensions** (All dimensions in mm.)

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

(1) Package Type: SC59



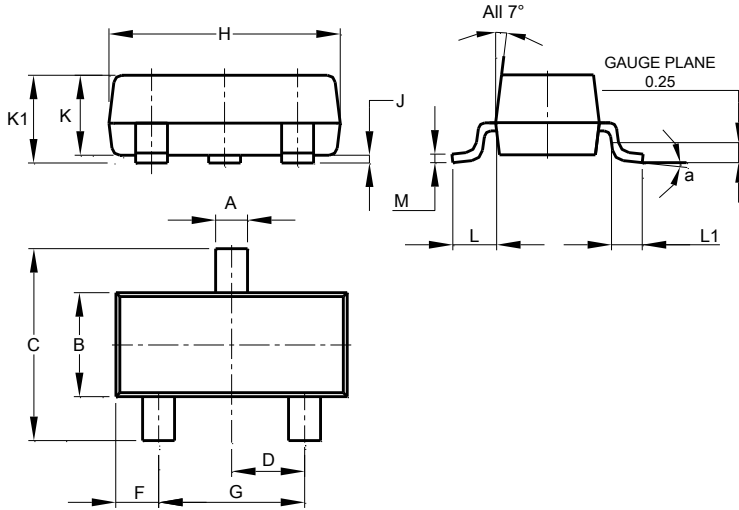
SC59			
Dim	Min	Max	Typ
A	0.35	0.50	0.38
B	1.50	1.70	1.60
C	2.70	3.00	2.80
D	-	-	0.95
G	-	-	1.90
H	2.90	3.10	3.00
J	0.013	0.10	0.05
K	1.00	1.30	1.10
L	0.35	0.55	0.40
M	0.10	0.20	0.15
N	0.70	0.80	0.75
α	0°	8°	-
All Dimensions in mm			



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

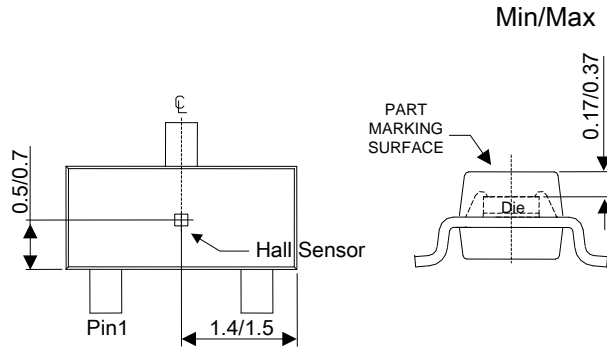
Please see <http://www.diodes.com/package-outlines.html> for the latest version.

(2) Package Type: SOT23



SOT23			
Dim	Min	Max	Typ
A	0.37	0.51	0.40
B	1.20	1.40	1.30
C	2.30	2.50	2.40
D	0.89	1.03	0.915
F	0.45	0.60	0.535
G	1.78	2.05	1.83
H	2.80	3.00	2.90
J	0.013	0.10	0.05
K	0.890	1.00	0.975
K1	0.903	1.10	1.025
L	0.45	0.61	0.55
L1	0.25	0.55	0.40
M	0.085	0.150	0.110
a	0°	8°	--

All Dimensions in mm



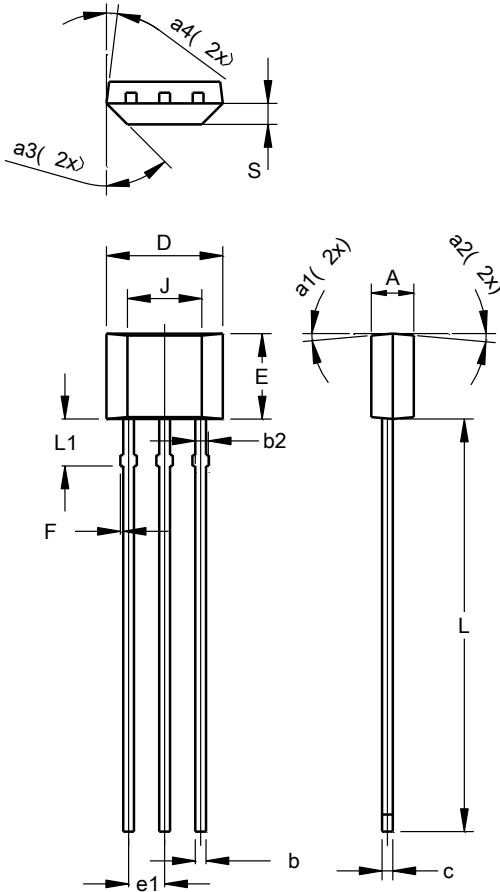
Sensor Location

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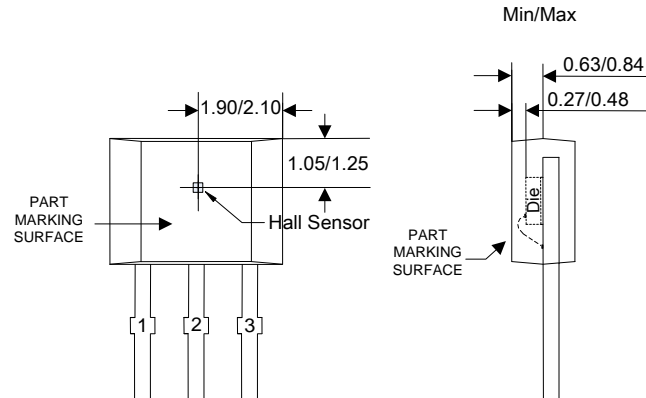
**Package Outline Dimensions** (Cont.) (All dimensions in mm.)

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			



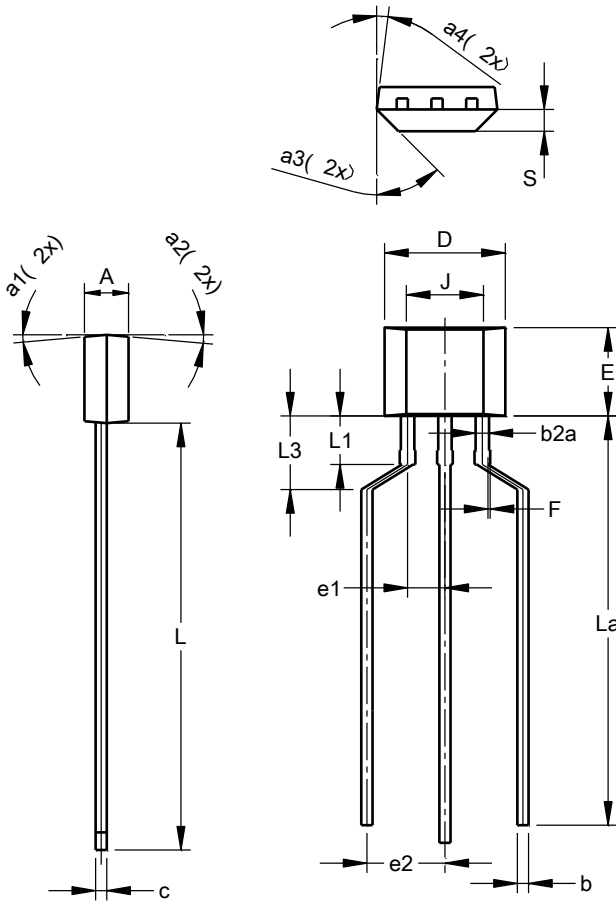
Sensor Location

NEW PRODUCT

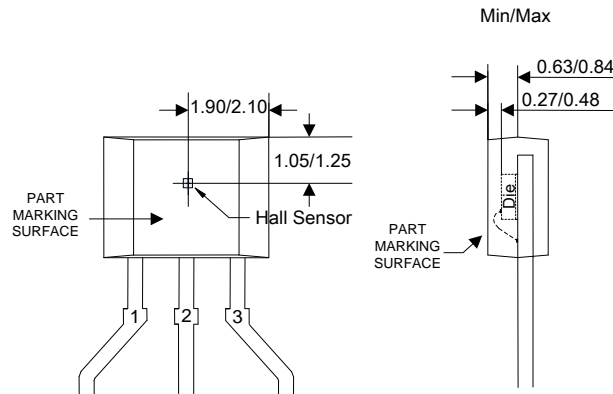
**Package Outline Dimensions** (Cont.) (All dimensions in mm.)

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			



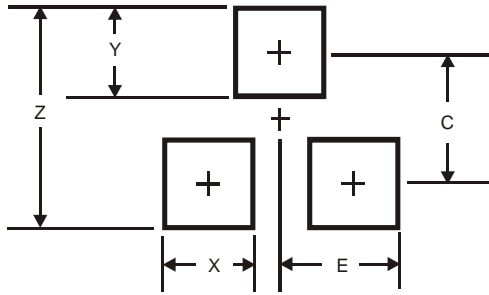
Sensor Location

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**Suggested Pad Layout**

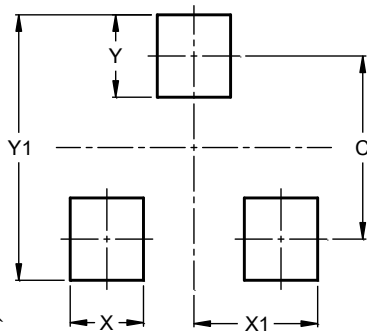
Please see <http://www.diodes.com/package-outlines.html> for the latest version.

(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: SOT23



Dimensions	Value (in mm)
C	2.0
X	0.8
X1	1.35
Y	0.9
Y1	2.9

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