

## Description

The AH3712 is a high-voltage, high-sensitivity, Hall-effect latch IC designed for commutation of brushless DC motors, flow meters, linear encoders, and position sensors in industrial and consumer home appliances and personal care applications. To support a wide range of demanding applications, the design is optimized to operate over a 3.0V to 27V supply range. With chopper-stabilized architecture and an internal bandgap regulator to provide temperature-compensated supply for internal circuits, the AH3712 provides a reliable solution over the whole operating range. The output also has an overcurrent limit.

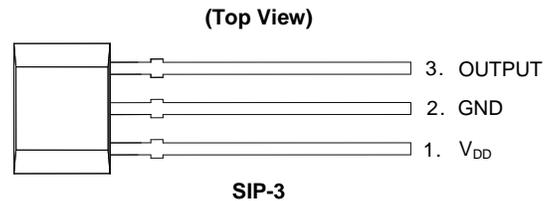
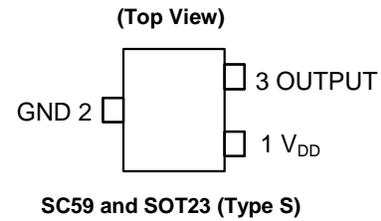
The single open-drain output can be switched on with a South pole of sufficient strength and switched off with a North pole of sufficient strength. When the magnetic-flux density (B) perpendicular to the package is larger than the operate point ( $B_{OP}$ ), the output is switched on (pulled low). The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

## Features

- Bipolar Latch
  - AH3712/AH3712A: South Pole On, North Pole Off
  - AH3712B: South Pole Off, North Pole On
- 3.0V to 27V Operating Voltage Range
- Load Dump Voltage Up to 40V
- High Sensitivity:  $B_{OP}$  and  $B_{RP}$  of  $\pm 25G$  Typical
- Resistant to Physical Stress
- Single Open-Drain (AH3712, AH3712B) or Internal Pull-Up Resistor (AH3712A)
- Output Polarity:
  - Direct: AH3712, AH3712A
  - Inverted: AH3712B (\*Future product)
- Output with Overcurrent Limit
- Chopper-Stabilized Design Provides
  - Superior Temperature Stability
  - Minimal Switch-Point Drift
  - Enhanced Immunity to Stress
- Good RF Noise Immunity
- $-40^{\circ}C$  to  $+125^{\circ}C$  Operating Temperature
- ESD HBM: 8kV, CDM: 1kV
- Industry-Standard SC59, SOT23 (Type S), and SIP-3 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 separate datasheet ([AH3712Q](#))**

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.

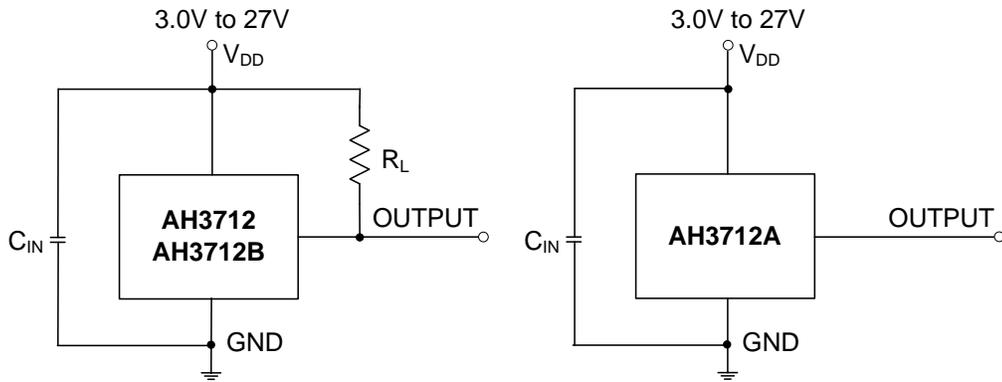
## Pin Assignments



## Applications

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

**Typical Applications Circuit** (Note 4)



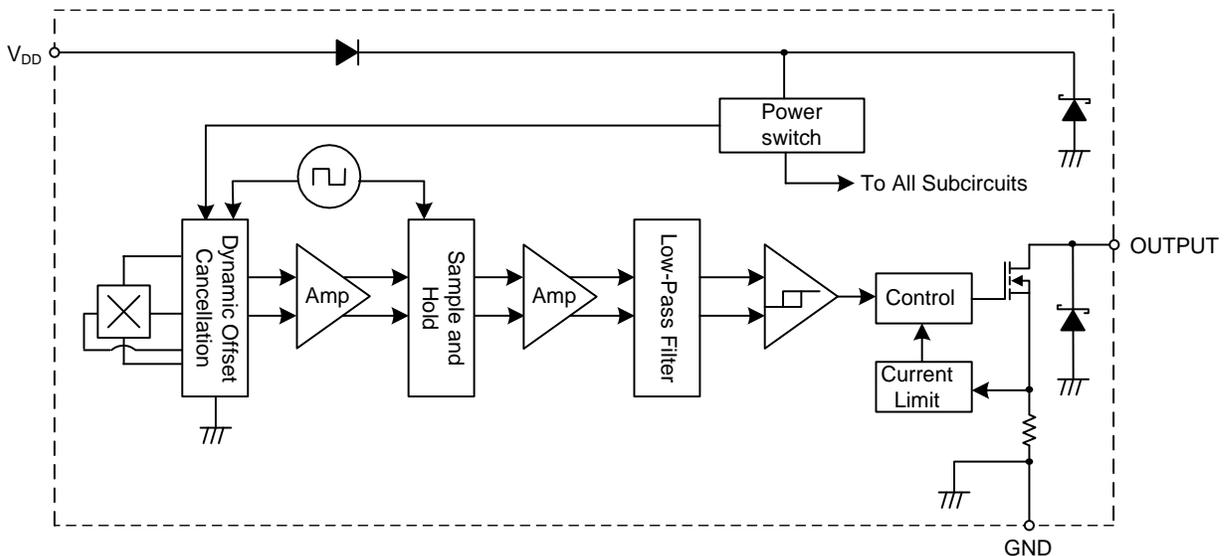
Note: 4.  $C_{IN}$  is for power stabilization and to strengthen the noise immunity, the recommended capacitance is 10nF ~ 100nF.  $R_L$  is the pull-up resistor.

**Pin Descriptions**

Package: SOT23, SC59 and SIP-3

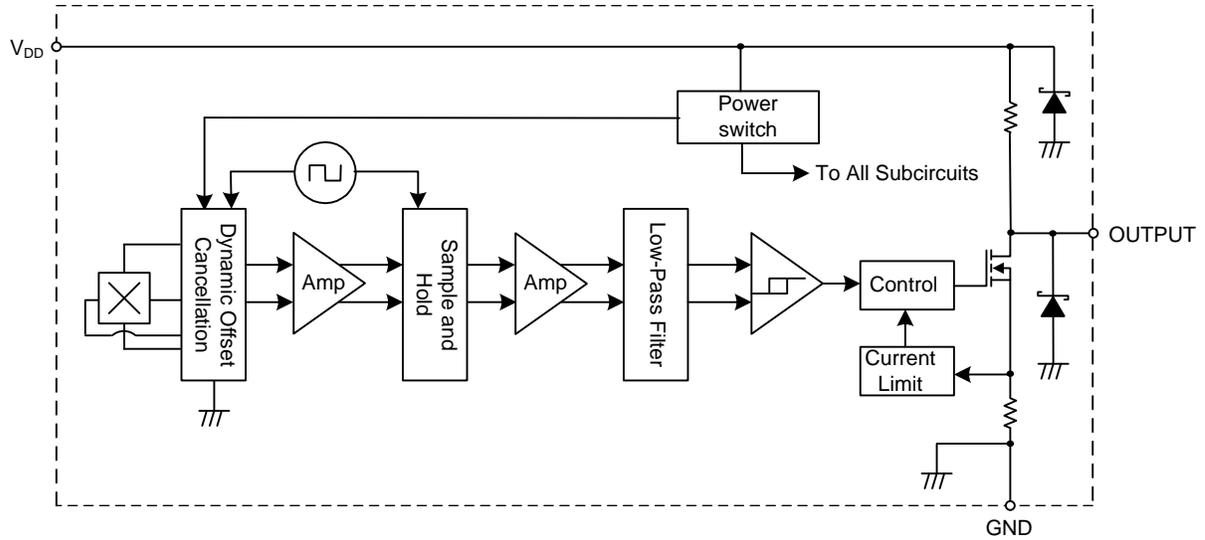
Pin Number	Pin Name	Function
1	V <sub>DD</sub>	Power Supply Input
2	GND	Ground
3	OUTPUT	Output Pin

**Functional Block Diagram**



AH3712, AH3712B

**Functional Block Diagram** (continued)



AH3712A

**Absolute Maximum Ratings** (Notes 5, 6) (@T<sub>A</sub> = +25°C, unless otherwise specified.)

Symbol	Characteristic	Value	Unit
V <sub>DD</sub>	Supply Voltage (Note 6)	40	V
V <sub>DDR</sub>	<b>Reverse Supply Voltage</b> (AH3712 Only)	-18	V
V <sub>OUT_MAX</sub>	Output Pin Voltage (Note 6)	40	V
I <sub>OUT</sub>	Output Current Sink	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	550
		SC59 and SOT23 (Type S)	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 Capability—Human Body Model	8	kV
ESD CDM	Electrostatic Discharge Withstand Capability—Charged Device Model	1	kV

- Notes:
- Stresses greater than the *Absolute Maximum Ratings* specified above can 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 40V 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	Conditions	Rating	Unit
V <sub>DD</sub>	Supply Voltage	Supply voltage, between VDD and GND pins	3.0 to 27	V
T <sub>A</sub>	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  $27\text{V}$ ,  $C_{IN} = 0.1\mu\text{F}$  unless otherwise specified.)

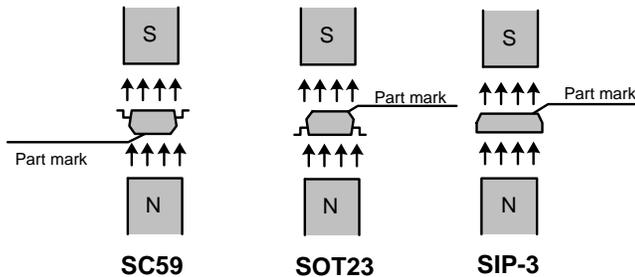
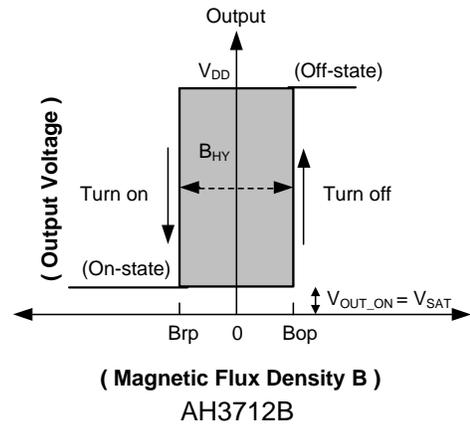
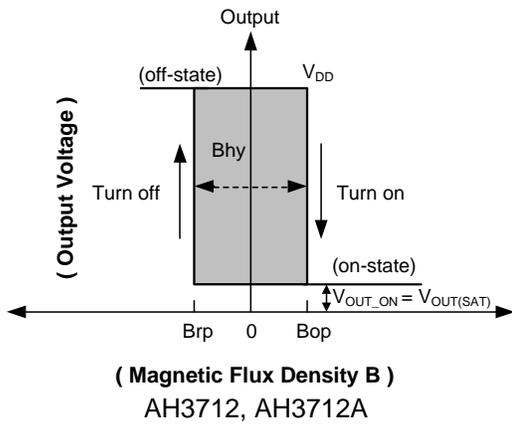
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{OUT\_ON}$	Output On Voltage	$I_{OUT} = 20\text{mA}$ , Output on	—	0.25	0.42	V
$I_{OUT\_OFF}$	Output Leakage Current	$V_{OUT} = 27\text{V}$ , Output off	—	<0.1	10	$\mu\text{A}$
$I_{DD}$	Supply Current	Output off $T_A = +25^{\circ}\text{C}$	—	2.8	3.8	mA
		Output off $T_A = -40^{\circ}\text{C}$ to $+125^{\circ}\text{C}$	—	2.8	4.8	mA
$I_{DD\_R}$	Reverse Battery Current (AH3712/AH3712B)	$V_{DD} = -18\text{V}$ , $T_A = -40^{\circ}\text{C}$ to $+125^{\circ}\text{C}$	—	0.001	1.2	mA
$R_{PU}$	Internal Pull-Up Resistance (AH3712A only)	$T_A = -40^{\circ}\text{C}$ to $+125^{\circ}\text{C}$	10	14	18	k $\Omega$
$t_{ST}$	Device Start-Up Time	$V_{DD} \geq 3\text{V}$ , $B > B_{OP} + 10\text{Gs}$ or $B < BRP - 10\text{Gs}$ (Note 7)	—	13	—	$\mu\text{s}$
$f_c$	Chopping Frequency	$V_{DD} \geq 3\text{V}$ (Note 8)	—	500	—	kHz
$t_d$	The time delay from magnetic threshold reached to the start of the output rise or fall	$B > 3 \cdot B_{OP\_MAX}$ , square wave magnetic field (Note 8)	—	10	—	$\mu\text{s}$
$t_r$	Output Rising Time (external pull-up resistor $R_L$ and load capacitance dependent)	$R_L = 1\text{k}\Omega$ , $C_L = 20\text{pF}$	—	0.1	1	$\mu\text{s}$
$t_f$	Output Falling Time (Internal switch resistance and load capacitance dependent)	$R_L = 1\text{k}\Omega$ , $C_L = 20\text{pF}$	—	0.3	1	$\mu\text{s}$
$I_{OCL}$	Output Current Limit	Output on (Note 9)	30	—	60	mA
$V_Z$	Zener Clamp Voltage	$I_{DD} = 8\text{mA}$ , $T_A = +25^{\circ}\text{C}$ , Output off	36	—	—	V

- Notes:
- When power is initially turned on,  $V_{DD}$  must be within its correct operating range (3.0V to 27V) to guarantee the output sampling. The output state is valid after the start-up time of 13 $\mu\text{s}$  typical from the operating voltage reaching 3V. The VCC slew rate must exceed 3V/ $\mu\text{s}$  from 0 to 3V. A slower slew rate through the specific range may affect device performance.
  - 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
  - The device limits the output current  $I_{OUT}$  to current limit of  $I_{OCL}$ .

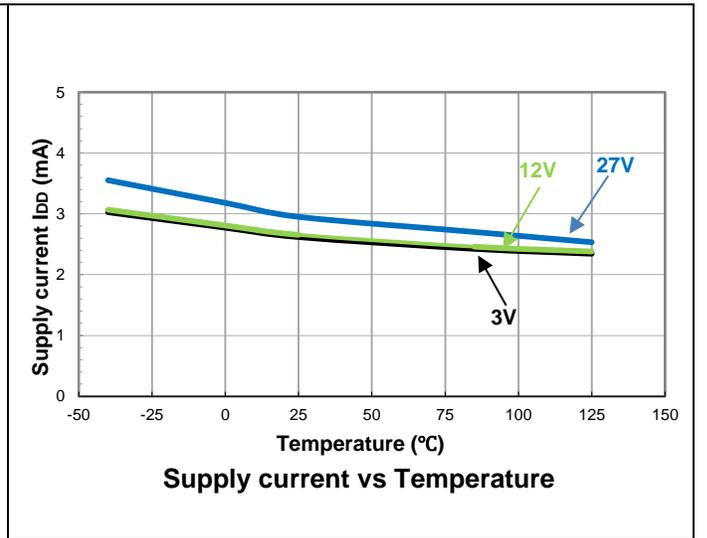
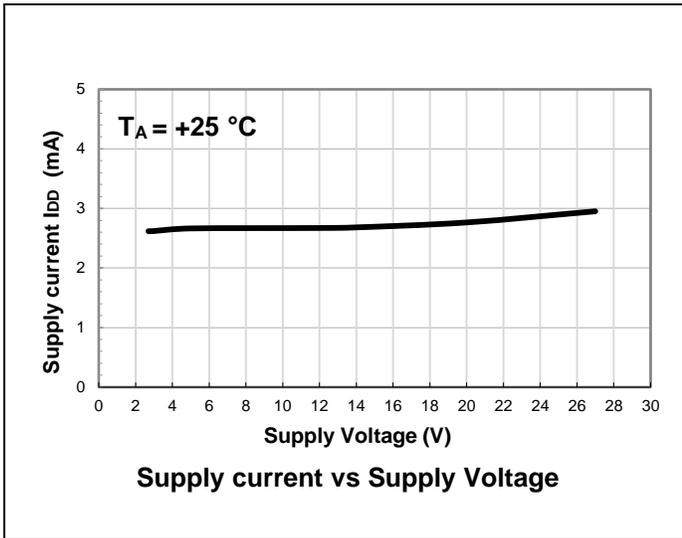
**Magnetic Characteristics** (Note 10) ( $T_A = -40^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$ ,  $V_{DD} = 3.0\text{V}$  to  $27\text{V}$ , unless otherwise specified)

Part Number	Symbol	Parameter	Min	Typ	Max	Unit	Output Polarity	Output Type
AH3712 / AH3712A	$B_{OP}$ (South pole to part-marking side for SOT23 and SIP-3, South pole to non-part marking side for SC59. See diagram below)	Operation Point	10	25	40	Gauss	Direct	Open-Drain / Internal Pull-up Resistor
	$B_{RP}$ (North pole to part-marking side for SOT23 and SIP-3, North pole to non-part marking side for SC59. See diagram below)	Release Point	-40	-25	-10			
	$B_{HY}$ ( $ B_{OPX}  -  B_{RPX} $ )	Hysteresis (Note 11)	20	50	80			
AH3712B	$B_{OP}$ (South pole to part-marking side for SOT23. See diagram below)	Operation Point	10	25	40	Gauss	Inverted	Open-Drain
	$B_{RP}$ (North pole to part-marking side for SOT23. See diagram below)	Release Point	-40	-25	-10			
	$B_{HY}$ ( $ B_{OPX}  -  B_{RPX} $ )	Hysteresis (Note 11)	20	50	80			

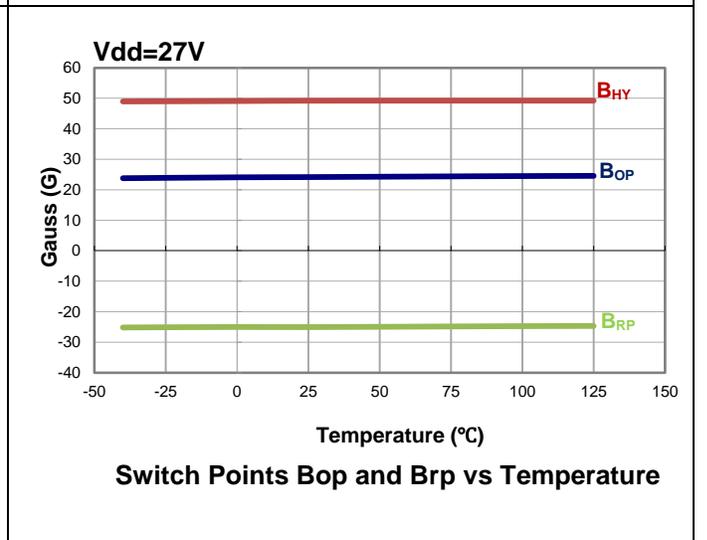
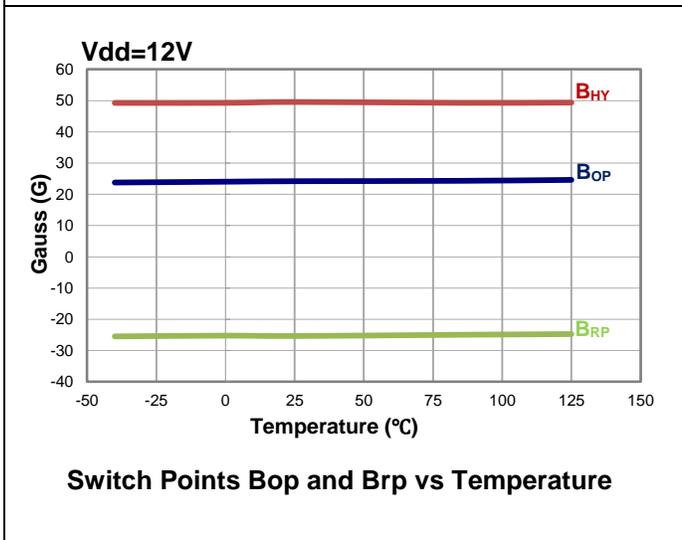
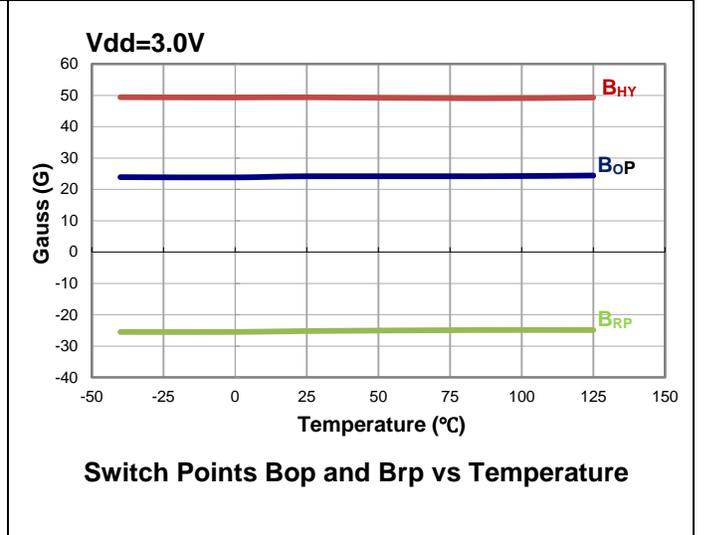
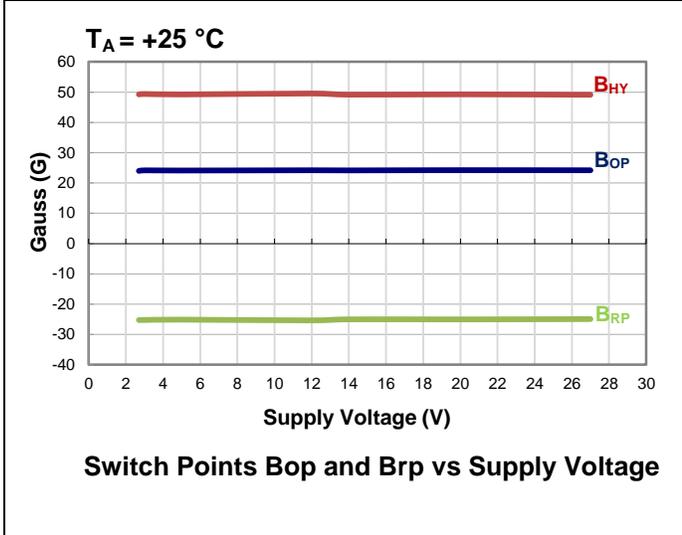
- Notes: 10. When power is initially turned on,  $V_{DD}$  must be within its correct operating range (3.0V to 27V) to guarantee the output sampling. The output state is valid after the start-up time of 13 $\mu\text{s}$  typical from the operating voltage reaching 3V.  
 11. Maximum and minimum hysteresis is guaranteed by design, process control, and characterization.



**Typical Operating Characteristics**

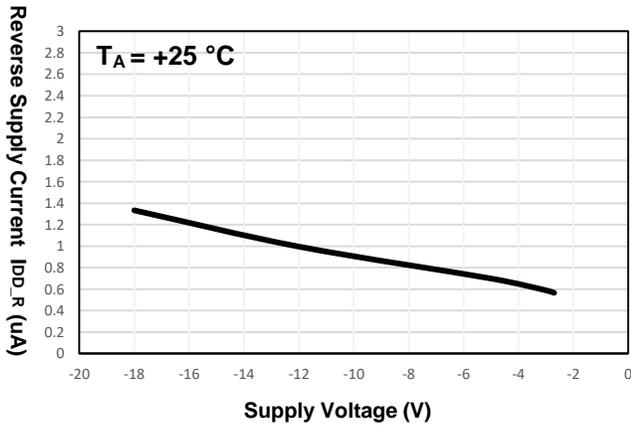


**Output Switch Operate and Release Points (Magnetic Thresholds) – Bop and Brp**

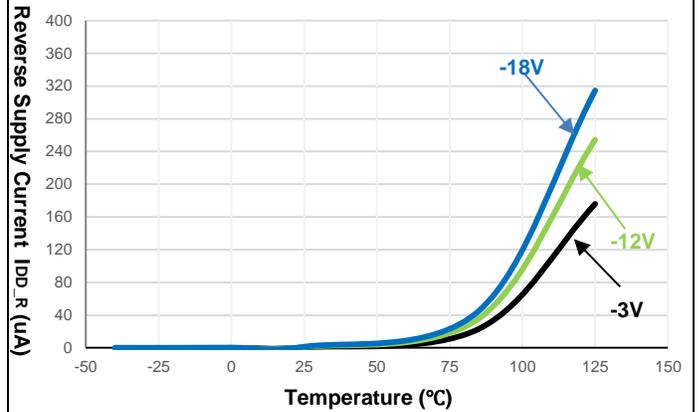


**Typical Operating Characteristics** (continued)

**Reverse Supply Current**

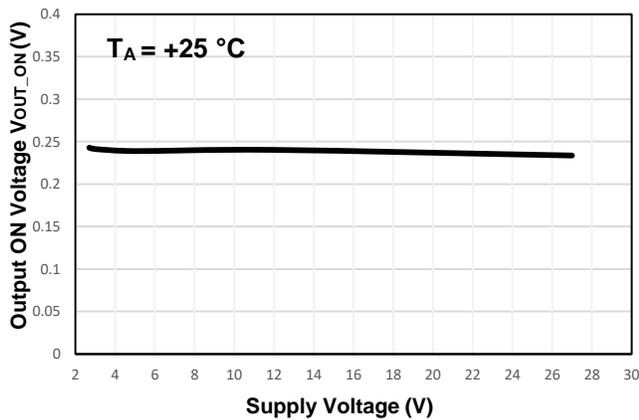


Reverse Supply Current vs Supply Voltage

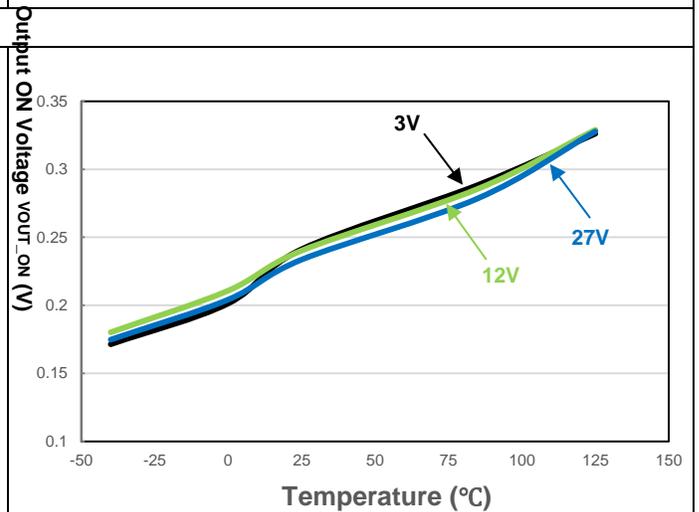


Reverse Supply Current vs Temperature

**Output Switch On Voltage**

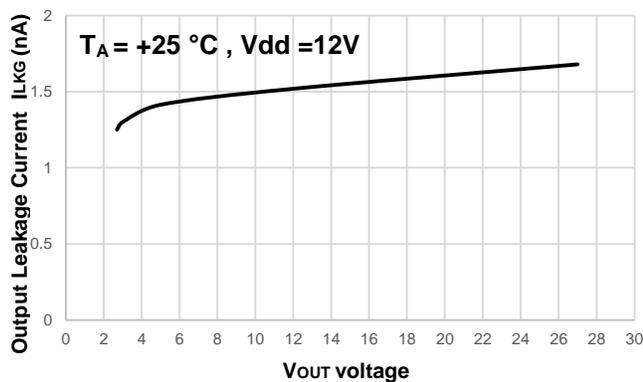


Output ON Voltage vs Supply Voltage

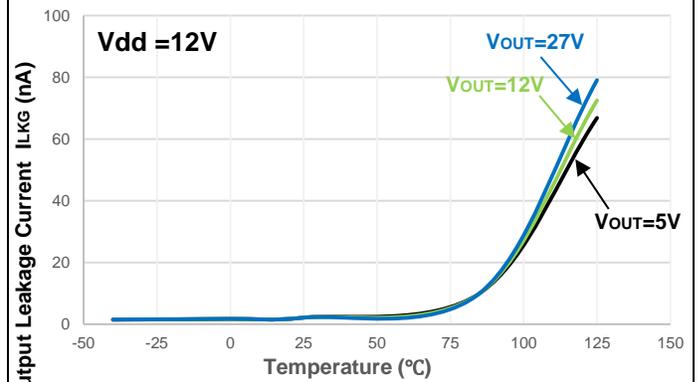


Output ON Voltage vs Temperature

**Output Leakage Current**



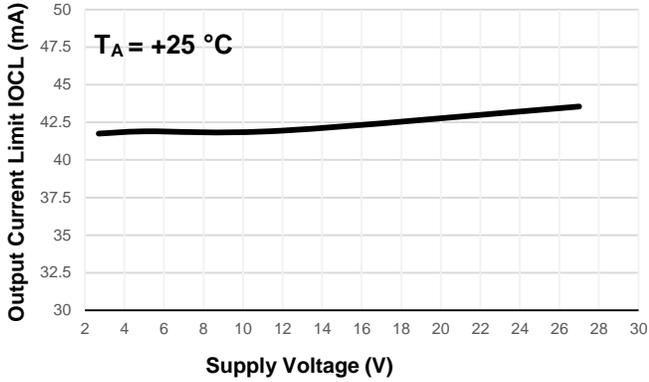
Output Leakage current vs VOUT Voltage



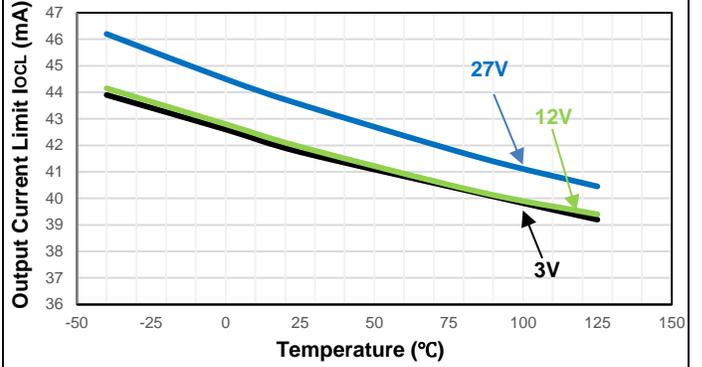
Output Leakage current vs VOUT Voltage

**Typical Operating Characteristics** (continued)

**Output Current Limit**

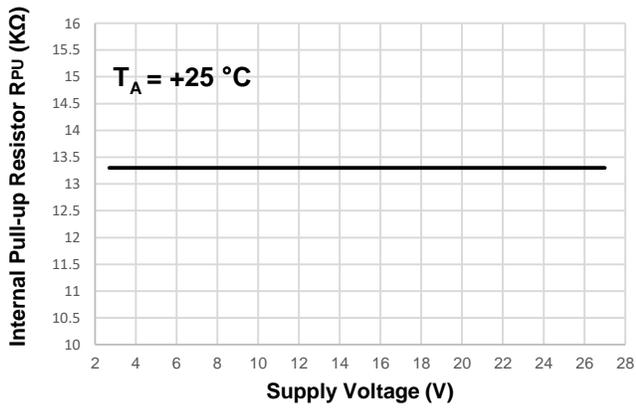


Output Current Limit vs Supply Voltage

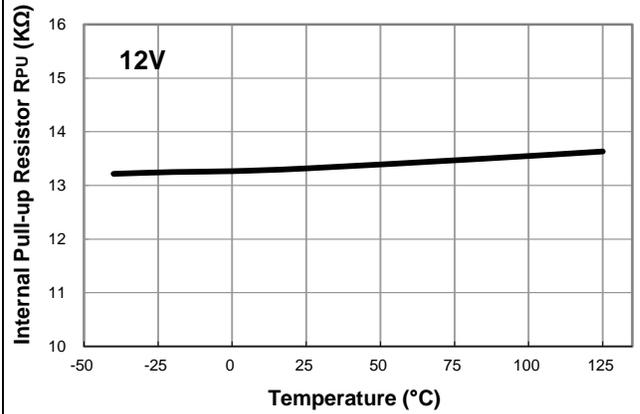


Output Current Limit vs Temperature

**Output Pull-Up Resistor (Internal)**



Internal Output Pull-up Resistor vs Supply Voltage

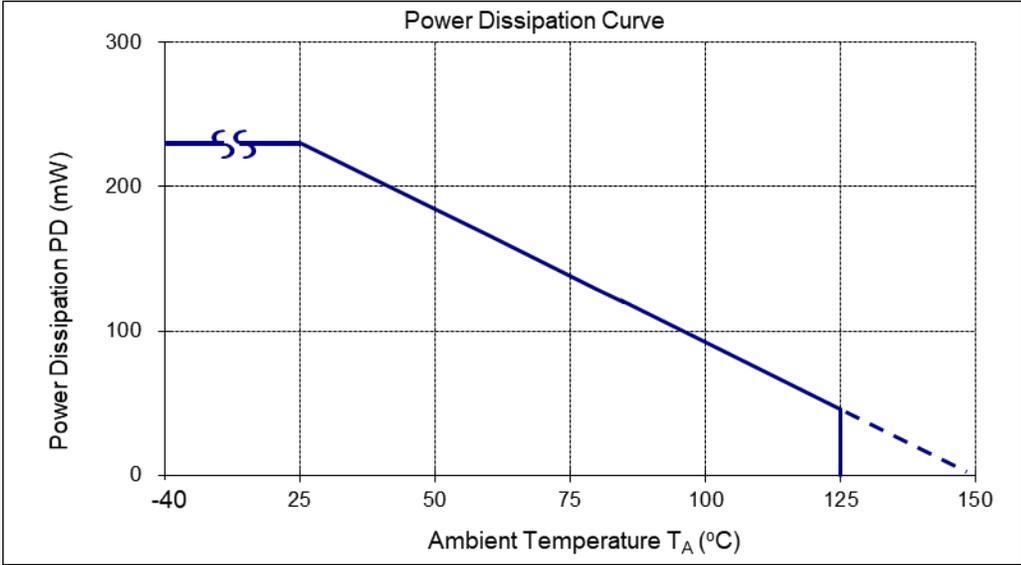


Internal Output Pull-up Resistor vs Temperature

**Thermal Performance Characteristics**

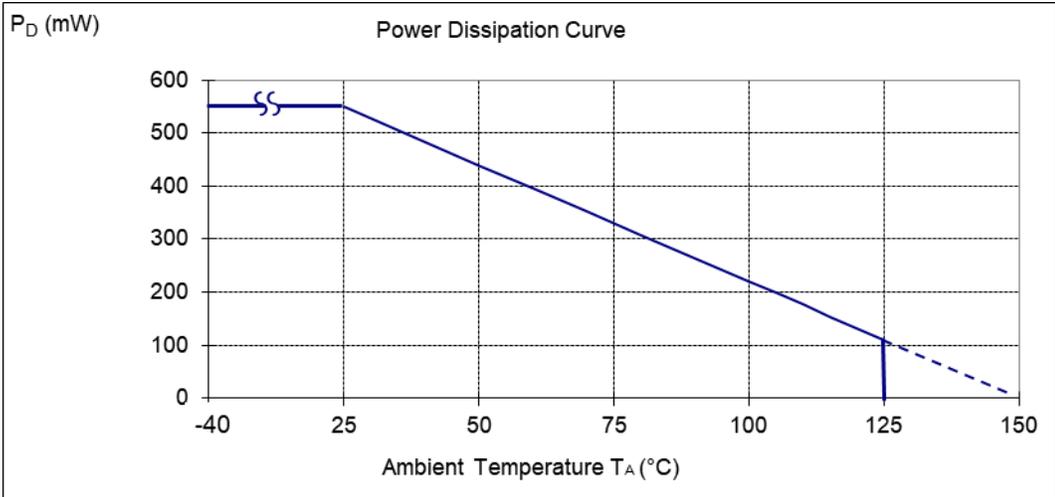
(1) Package : SOT23 (Type S) / SC59

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

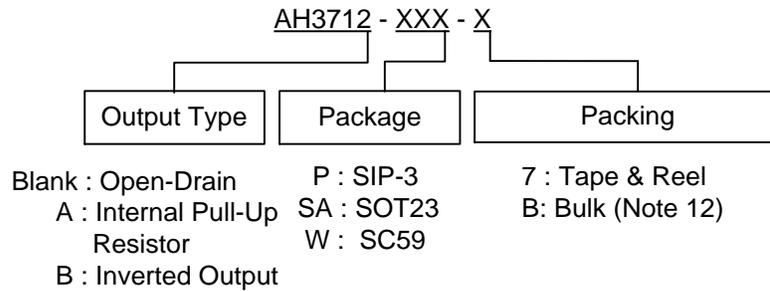


(2) Package : SIP3

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	352	308	286	264	220	198	176	132	110	88	44	0



## Ordering Information



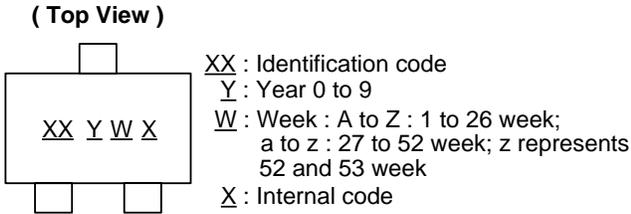
Orderable Part Number	Package Code	Package	Bulk		7" Tape and Reel	
			Quantity	Part Number Suffix	Quantity	Part Number Suffix
AH3712-P-B	P	SIP-3	1,000	-B	—	—
AH3712-SA-7	SA	SOT23	—	—	3,000	-7
AH3712-W-7	W	SC59	—	—	3,000	-7
* AH3712A-P-B	P	SIP-3	1,000	-B	—	—
AH3712A-SA-7	SA	SOT23	—	—	3,000	-7
AH3712A-W-7	W	SC59	—	—	3,000	-7
* AH3712B-SA-7	SA	SOT23	—	—	3,000	-7

\* Future new product

Note: 12. Bulk is for SIP-3 Straight Lead.

**Marking Information**

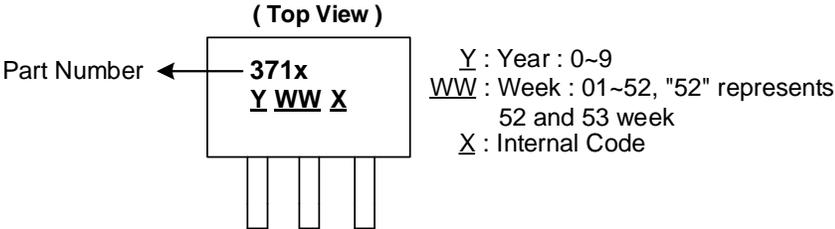
(1) Package Type: SOT23 (Type S) and SC59



Orderable Part Number	Package	Identification Code
AH3712-SA-7	SOT23	N2
AH3712-W-7	SC59	UE
AH3712A-SA-7	SOT23	N8
AH3712A-W-7	SC59	UM
* AH3712B-SA-7	SOT23	UN

\* Future new product

(2) Package Type: SIP-3



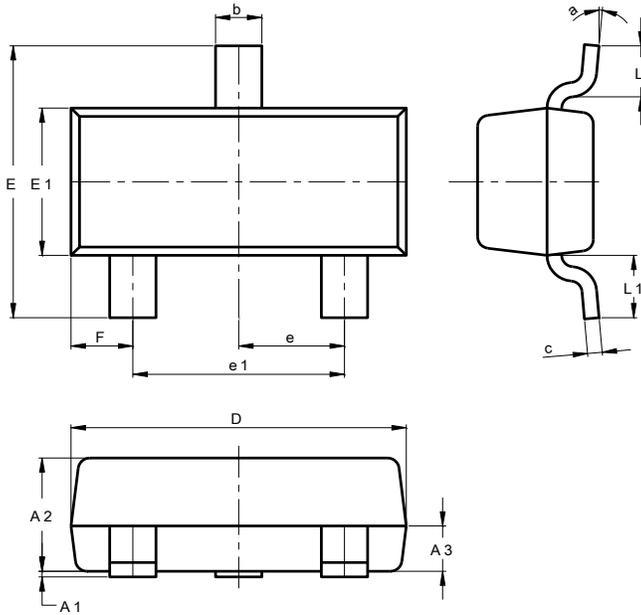
Orderable Part Number	Package	Identification Code
AH3712-P-B	SIP-3	3712
* AH3712A-P-B	SIP-3	3712A

\* Future new product

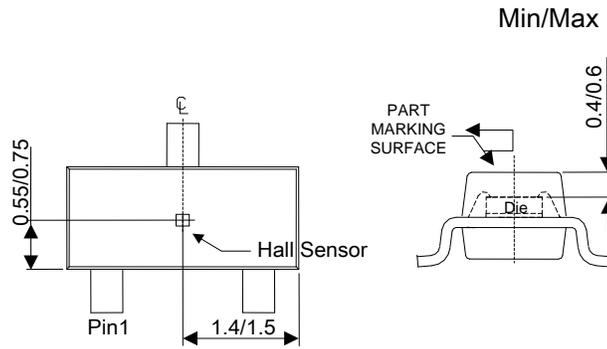
**Package Outline Dimensions** (All dimensions in mm.)

Please see <https://www.diodes.com/design/support/packaging/> 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°	--
<b>All Dimensions in mm</b>			

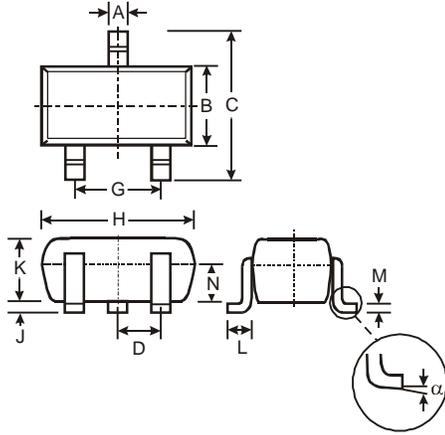


**Sensor Location**

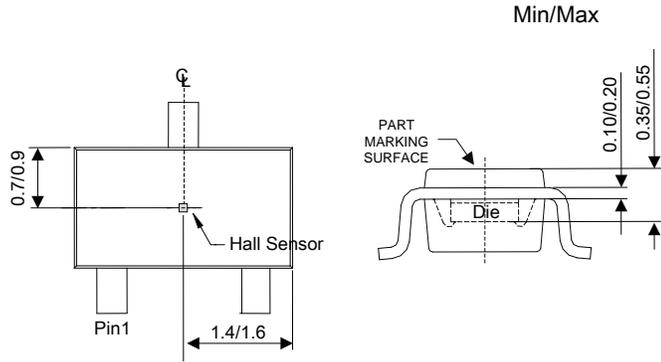
**Package Outline Dimensions** (continued) (All dimensions in mm.)

Please see <https://www.diodes.com/design/support/packaging/> 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			

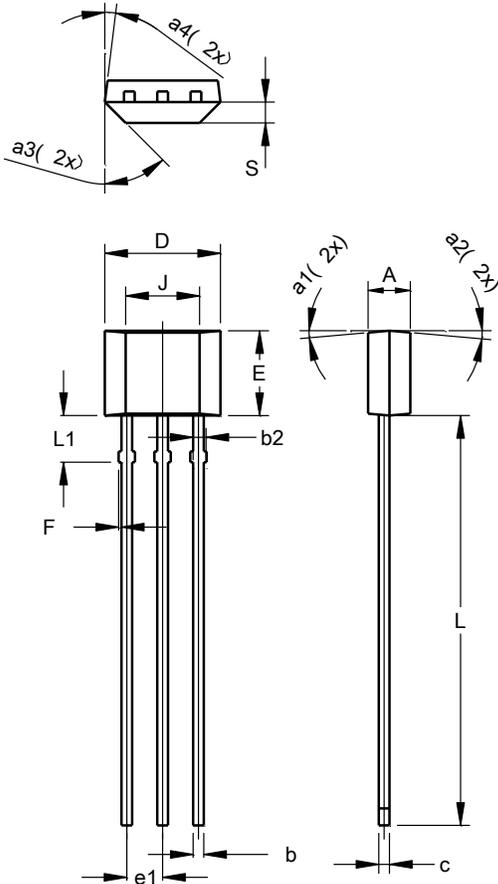


**Sensor Location**

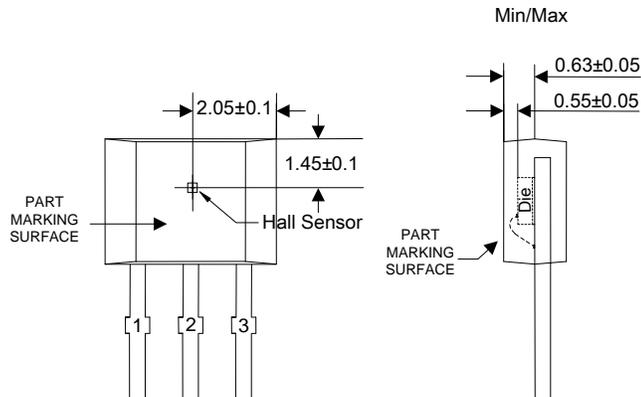
**Package Outline Dimensions** (continued) (All dimensions in mm.)

Please see <https://www.diodes.com/design/support/packaging/> 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			

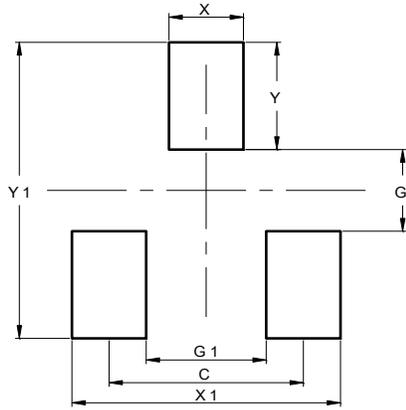


**Sensor Location**

**Suggested Pad Layout**

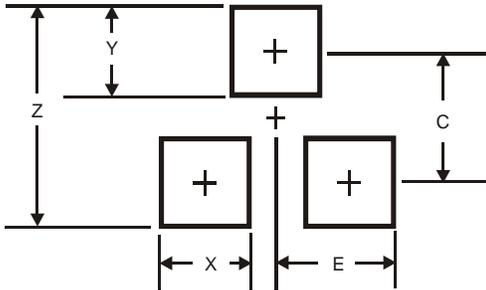
Please see <https://www.diodes.com/design/support/packaging/> for the latest version.

(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: Level 1 per J-STD-020
- Terminals: Finish – Matte Tin Plated Leads, Solderable per MIL-STD-202, Method 208 ③
- Weight: 0.008/9 grams (Approximately)

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