

Description

The AH352XQ is an AEC-Q100-qualified high-voltage, high-sensitivity Hall-effect omnipolar switch IC designed for position and proximity sensing in automotive applications, such as in seat and seatbelt buckle, steering lock/immobilization, gear stick, transmission actuator and gear position, HVAC compression, wiper, door/trunk closure, and so on. 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 AH352XQ 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 or 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) and stays on until the magnetic flux density B is lower than the release point (B_{RP}).

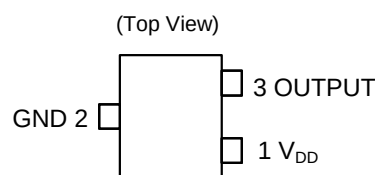
Features

- Omnipolar Operation
- High Sensitivity: B_{OP} and B_{RP} of $\pm 20\text{G}$ to $\pm 40\text{G}$ and $\pm 10\text{G}$ to $\pm 25\text{G}$ Typical
- Single Open-Drain Output with Overcurrent Limit
- Resistant to Physical Stress
- 3.0V to 28V Operating Voltage Range
- 40V Load Dump Protection
- 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 +150°C Operating Temperature
- High ESD HBM: 8kV, CDM: 1kV
- AEC-Q100 Grade 0 Qualified
- Industry Standard 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)**
- **The AH352XQ is suitable for automotive applications requiring specific change control; this part is AEC-Q100 qualified, PPAP capable, and manufactured in IATF16949 certified facilities.**

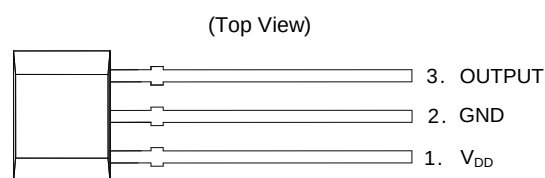
<https://www.diodes.com/quality/product-definitions/>

- 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



SOT23 (Type S)

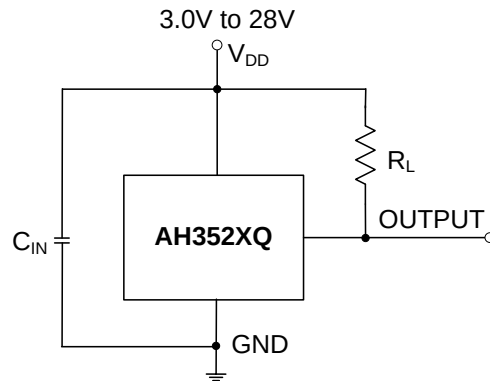


SIP-3 (Ammo Pack)/SIP-3 (Bulk Pack)

Applications

- Position and proximity sensing in automotive applications
- Open and close detection
- Position detection
- Level detection
- Flow meters
- Contactless switches
- Seatbelt buckles
- Seat positions

Typical Applications Circuit



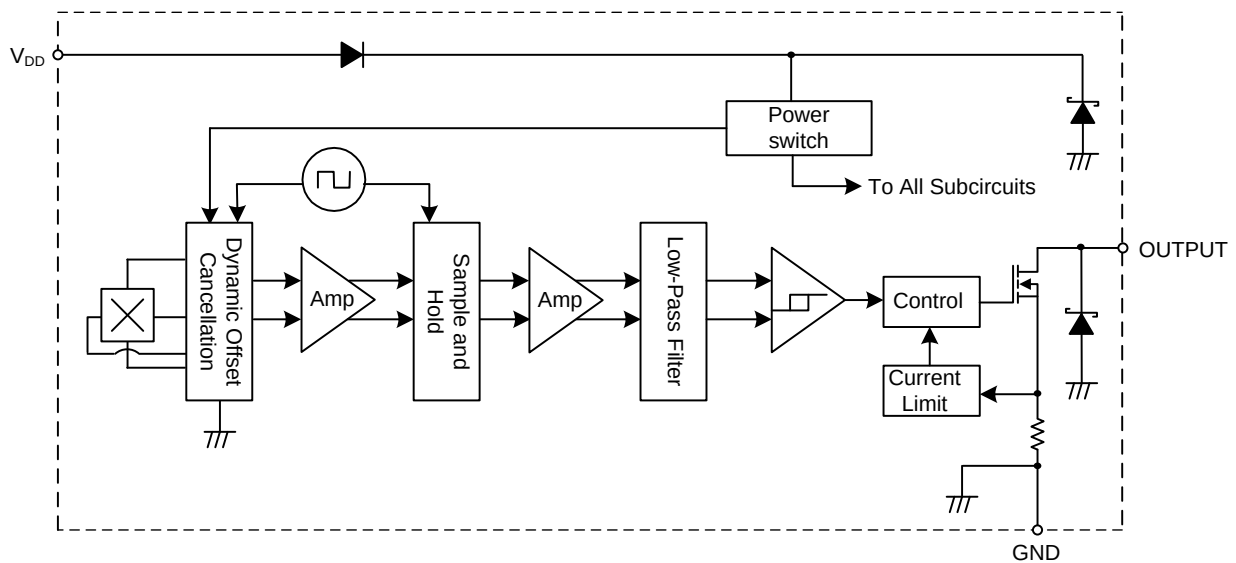
Note: 4. C_{IN} is for power stabilization and to strengthen the noise immunity. The recommended capacitance is 10nF to 100nF. R_L is the pullup resistor.

Pin Descriptions

Packages: SOT23 (Type S), SIP-3 (Ammo Pack) and SIP-3 (Bulk Pack)

Pin Number	Pin Name	Function
1	V _{DD}	Power Supply Input
2	GND	Ground
3	OUTPUT	Output Pin

Functional Block Diagram



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

Symbol	Characteristic	Value	Unit
V _{DD}	Supply Voltage (Note 6)	40	V
V _{DDR}	Reverse Supply Voltage	-18	V
V _{OUT_MAX}	Output Pin Off Voltage (Note 6)	32	V
I _{OUT}	Continuous Output Current	60	mA
I _{OUT_R}	Reverse Output Current	-50	mA
B	Magnetic Flux Density	Unlimited	
P _D	Package Power Dissipation	SIP-3 (Ammo Pack)	mW
		SIP-3 (Bulk Pack)	
		SOT23 (Type S)	
T _S	Storage Temperature Range	-65 to +165	°C
T _J	Maximum Junction Temperature	+170	°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 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.
 - The absolute maximum V_{DD} 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 over 100ms.

Recommended Operating Conditions (@T_A = -40°C to +150°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 +150	°C

Electrical Characteristics (Notes 7 & 8) (@T_A = -40°C to +150°C, V_{DD} = 3V to 28V, unless otherwise specified.)

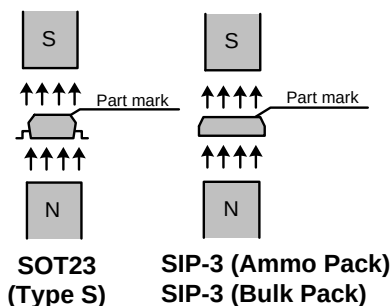
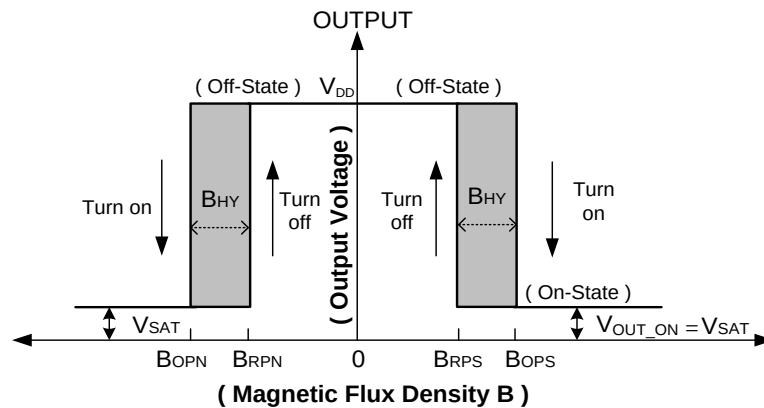
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V _{OUT_ON}	Output On Voltage	I _{OUT} = 20mA, B > B _{OP}	—	0.2	0.4	V
I _{OUT_OFF}	Output Leakage Current (When Output Is Off)	V _{OUT} = 28V, B < B _{RP} , output off	—	< 0.1	10	μA
I _{DD}	Supply Current	Output open, T _A = +25°C	—	3	4	mA
		Output open, T _A = -40°C to +150°C	—	—	5	mA
I _{DD_R}	Reverse Supply Current	V _{DD} = -18V, T _A = +25°C	—	0.001	—	mA
		V _{DD} = -18V, T _A = -40°C to +150°C	—	0.001	2.3	mA
t _{P_ON}	Device Power-On Time (Startup Time)	V _{DD} ≥ 3V, B > B _{OP} (Note 7)	—	10	—	μs
f _C	Chopping Frequency	V _{DD} ≥ 3V (Note 9)	—	500	—	kHz
t _D	Response Time Delay (Time from Magnetic Threshold Reached to the Start of the Output Rise or Fall)	(Note 9)	—	4	—	μs
t _R	Output Rising Time (External Pullup Resistor R _L and Load Capacitance Dependent)	R _L = 1kΩ, C _L = 20pF (Note 9)	—	0.2	1	μs
t _F	Output Falling Time (Internal Switch Resistance and Load Capacitance Dependent)	R _L = 1kΩ, C _L = 20pF (Note 9)	—	0.1	1	μs
I _{OCL}	Output Current Limit	B > B _{OP} (Note 10)	30	—	55	mA
V _Z	Zener Clamp Voltage	I _{DD} = 5mA, T _A = +25°C	28	—	—	V

- Notes:
- 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.
 - 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.
 - Guaranteed by design, process control, and characterization. Not tested in production.
 - 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 $+150^{\circ}\text{C}$, $V_{DD} = 3.0\text{V}$ to 28V , unless otherwise specified)

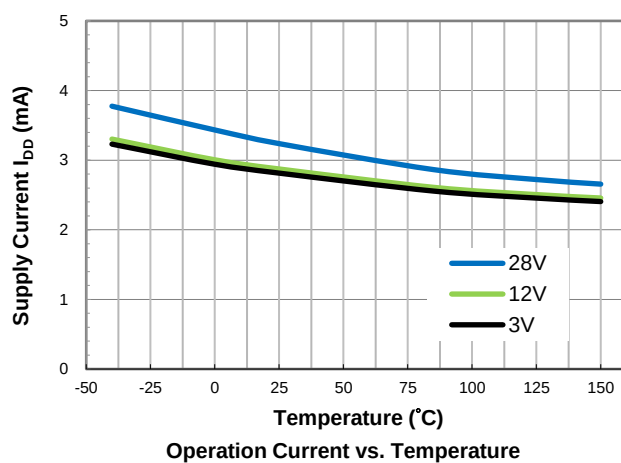
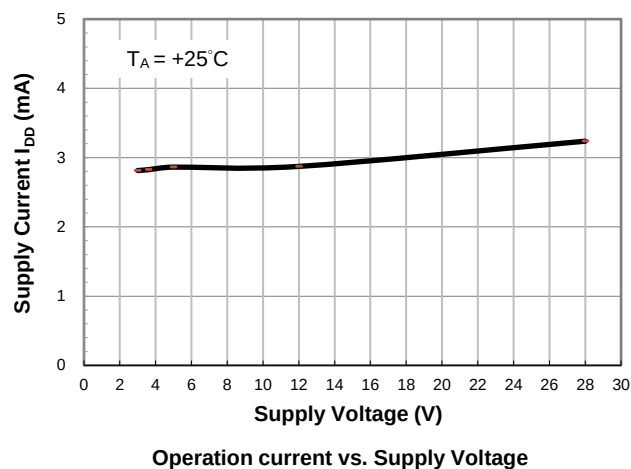
Part Number	Symbol	Parameter	Min	Typ	Max	Unit	Output Type
AH3522Q	B_{OPS} (South Pole to the Part Marking Side)	Operation Point	8	20	30	Gauss	Open-Drain
	B_{OPN} (North Pole to the Part Marking Side)		-30	-20	-8		
	B_{RPS} (South Pole to the Part Marking Side)	Release Point	2	10	25		
	B_{RPN} (North Pole to the Part Marking Side)		-25	-10	-2		
	$B_{HY} (B_{OPX} - B_{RPX})$	Hysteresis (Note 13)	2	10	19		
AH3523Q	B_{OPS} (South Pole to the Part Marking Side)	Operation Point	15	30	45	Gauss	Open-Drain
	B_{OPN} (North Pole to the Part Marking Side)		-45	-30	-15		
	B_{RPS} (South Pole to the Part Marking Side)	Release Point	5	20	35		
	B_{RPN} (North Pole to the Part Marking Side)		-35	-20	-5		
	$B_{HY} (B_{OPX} - B_{RPX})$	Hysteresis (Note 13)	5	10	18		
AH3524Q	B_{OPS} (South Pole to the Part Marking Side)	Operation Point	20	40	60	Gauss	Open-Drain
	B_{OPN} (North Pole to the Part Marking Side)		-60	-40	-20		
	B_{RPS} (South Pole to the Part Marking Side)	Release Point	10	25	45		
	B_{RPN} (North Pole to the Part Marking Side)		-45	-25	-10		
	$B_{HY} (B_{OPX} - B_{RPX})$	Hysteresis (Note 13)	9	15	22		

- 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 startup time of 10 μs 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.

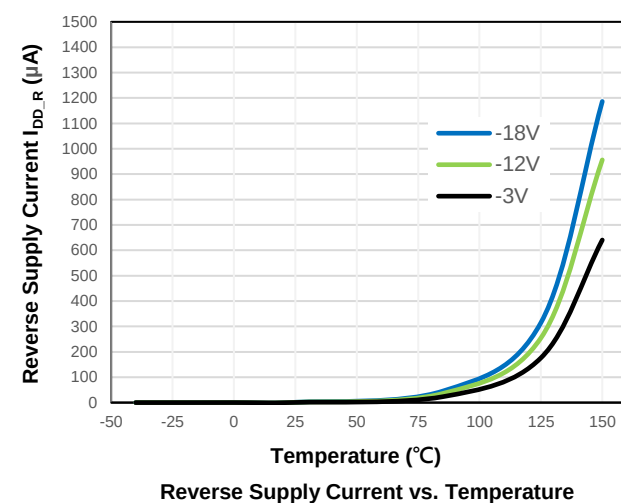
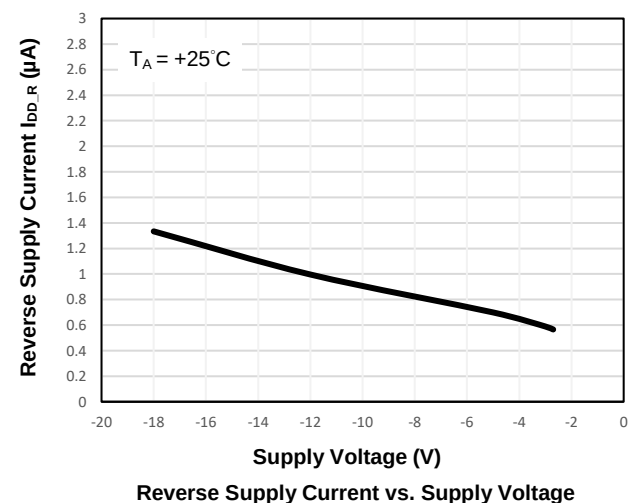


Typical Operating Characteristics

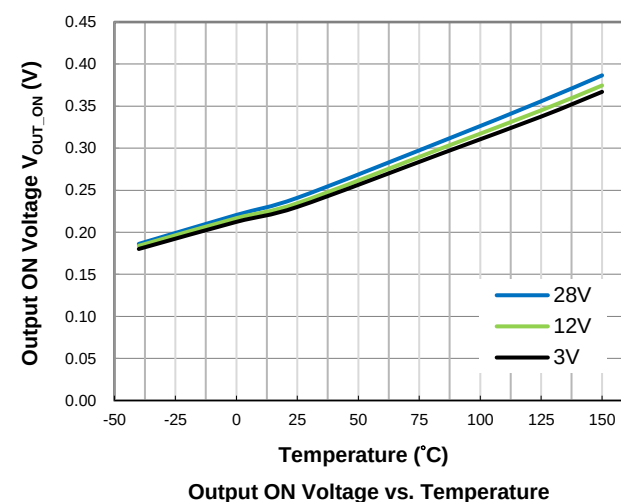
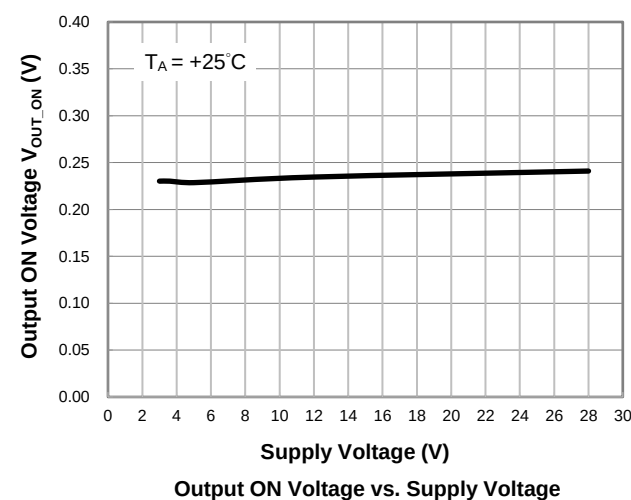
Supply Current



Reverse Supply Current

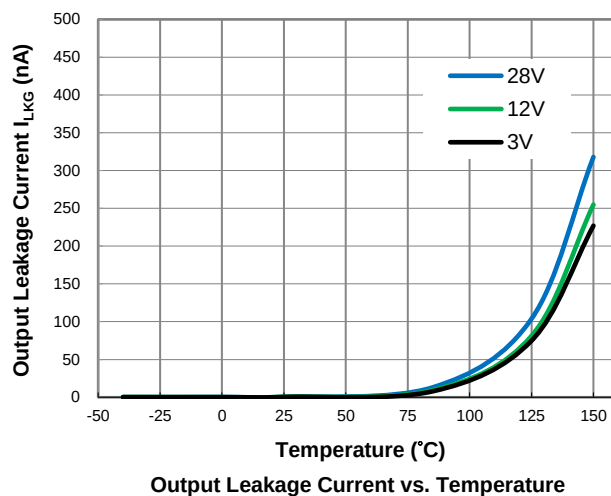
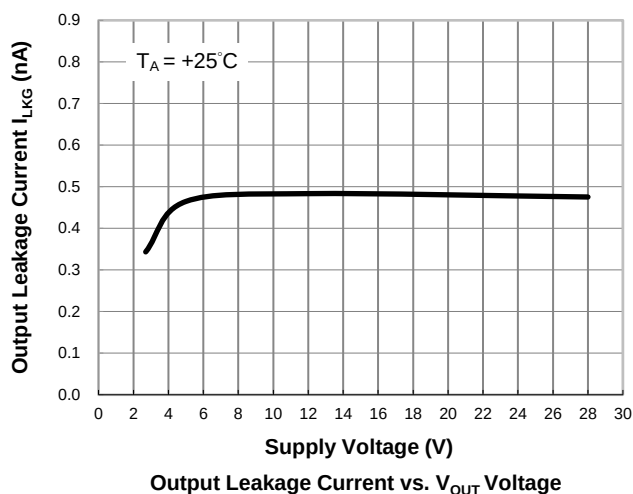


Output Switch On Voltage, $I_{OUT} = 20\text{mA}$

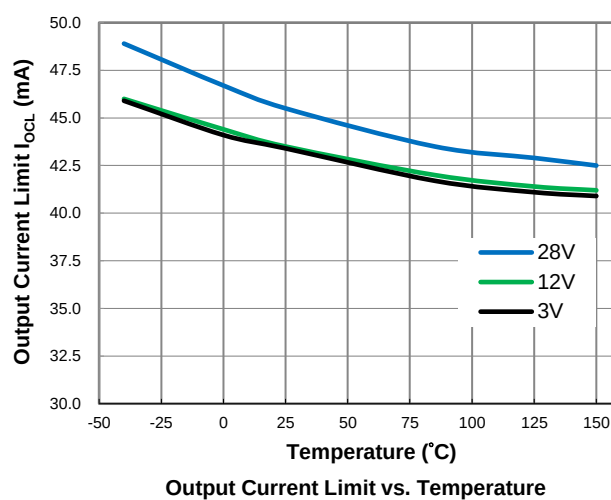
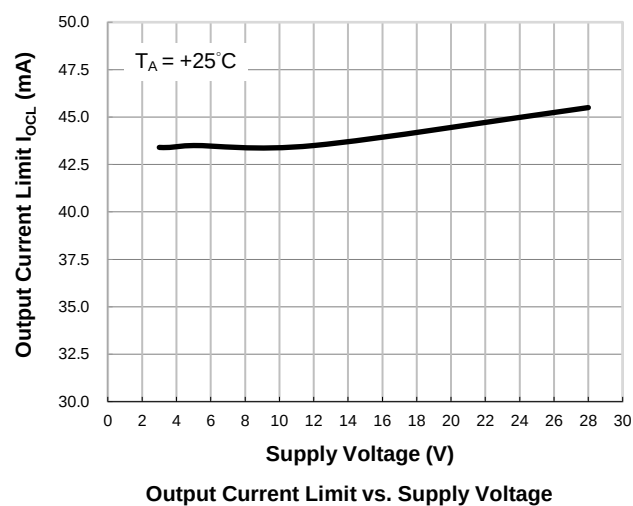


Typical Operating Characteristics (continued)

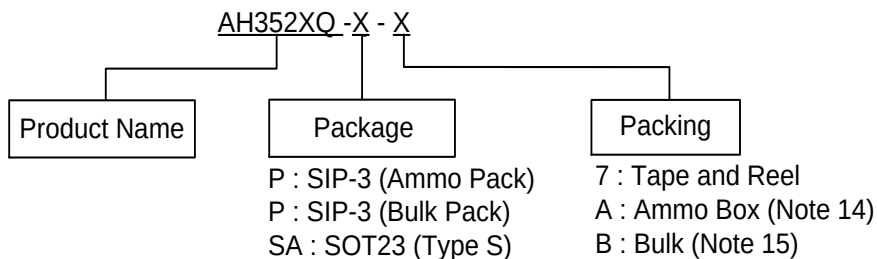
Output Leakage Current



Output Current Limit



Ordering Information



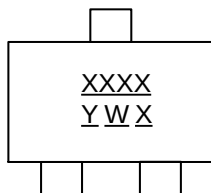
Part Number	Package Code	Package	Part Number Suffix	Packing	
				Qty.	Carrier
AH3522Q-P-A (Future Product)	P	SIP-3 (Ammo Pack)	-A	4,000	Ammo Box
AH3522Q-P-B (Future Product)	P	SIP-3 (Bulk Pack)	-B	1,000	Bulk
AH3522Q-SA-7 (Future Product)	SA	SOT23 (Type S)	-7	3,000	7" Tape & Reel
AH3523Q-P-B	P	SIP-3 (Bulk Pack)	-B	1,000	Bulk
AH3523Q-SA-7	SA	SOT23 (Type S)	-7	3,000	7" Tape & Reel
AH3524Q-P-A	P	SIP-3 (Ammo Pack)	-A	4,000	Ammo Box
AH3524Q-P-B	P	SIP-3 (Bulk Pack)	-B	1,000	Bulk
AH3524Q-SA-7	SA	SOT23 (Type S)	-7	3,000	7" Tape & Reel

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

Marking Information

(1) Package Type: SOT23 (Type S)

(Top View)



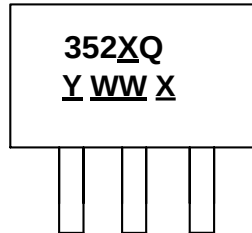
XXXX : Identification Code
Y : Year 0 to 9 (ex: 3 = 2023)
W : Week : A to Z : week 1 to 26;
 a to z : week 27 to 52; z represents
 week 52 and 53
X : Internal Code

Part Number	Package	Identification Code
AH3522Q-SA-7	SOT23 (Type S)	S6AQ
AH3523Q-SA-7	SOT23 (Type S)	S6BQ
AH3524Q-SA-7	SOT23 (Type S)	S6CQ

Marking Information (continued)

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

(Top View)



352XQ : Identification Code

Y : Year : 0 to 9 (ex: 3 = 2023)

WW : Week : 01 to 52, "52" represents
week 52 and 53

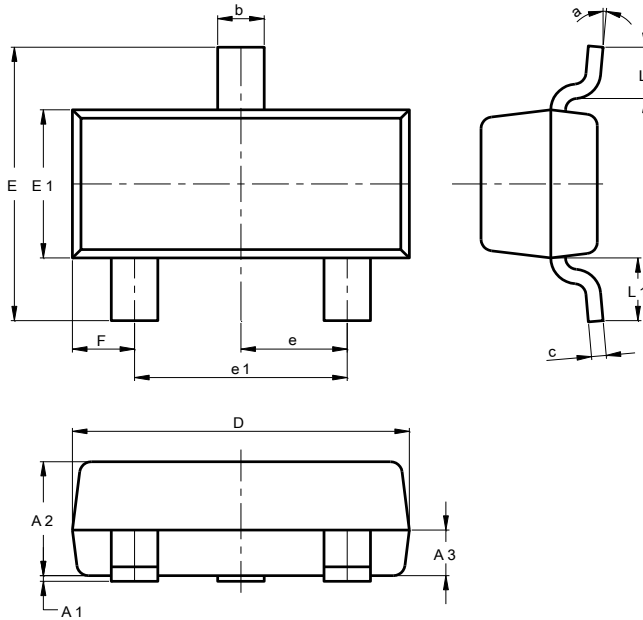
X : Internal Code

Part Number	Package	Identification Code
AH3522Q-P-A	SIP-3 (Ammo Pack)	3522Q
AH3522Q-P-B	SIP-3 (Bulk Pack)	3522Q
AH3523Q-P-B	SIP-3 (Bulk Pack)	3523Q
AH3524Q-P-A	SIP-3 (Ammo Pack)	3524Q
AH3524Q-P-B	SIP-3 (Bulk Pack)	3524Q

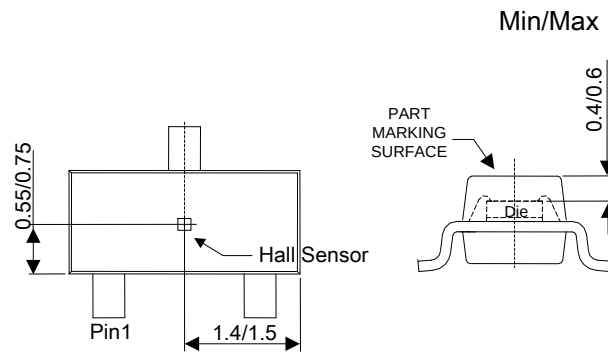
Package Outline Dimensions (All dimensions in mm.)

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			

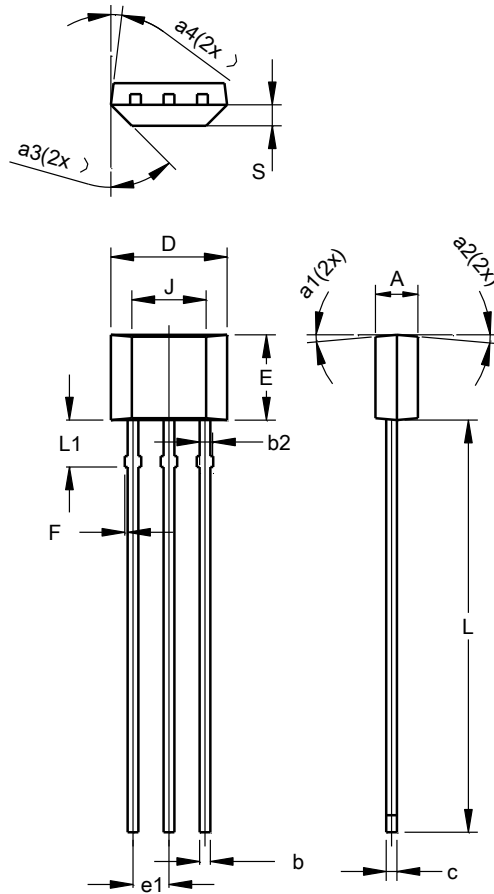


Sensor Location

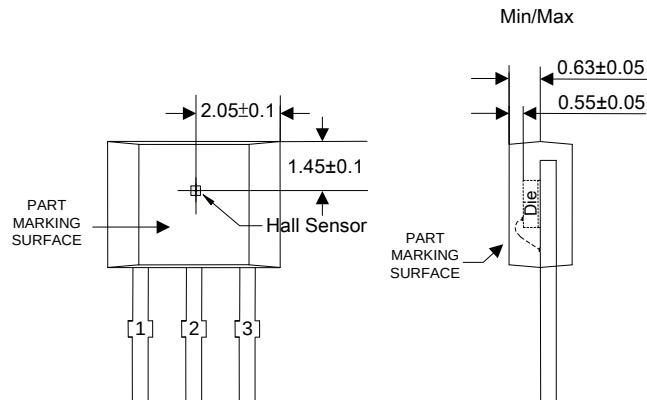
Package Outline Dimensions (All dimensions in mm.) (continued)

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

(2) Package Type: 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			

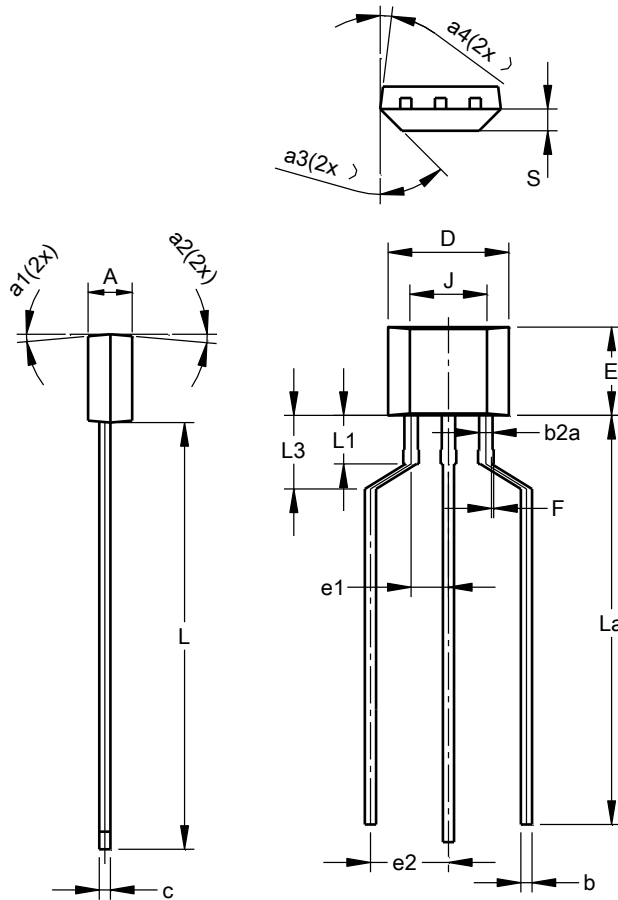


Sensor Location

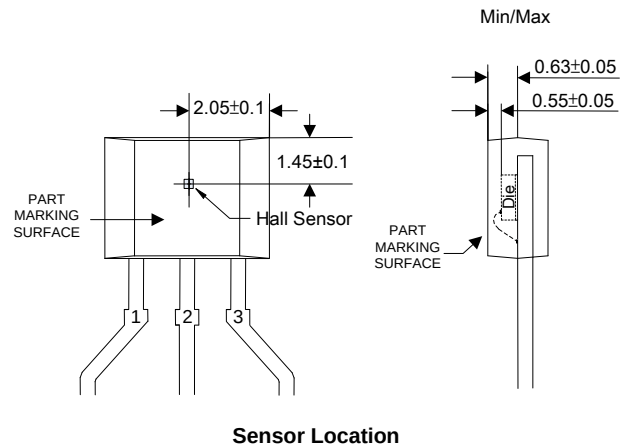
Package Outline Dimensions (All dimensions in mm.) (continued)

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

(3) Package Type: SIP-3 (Ammo Pack)



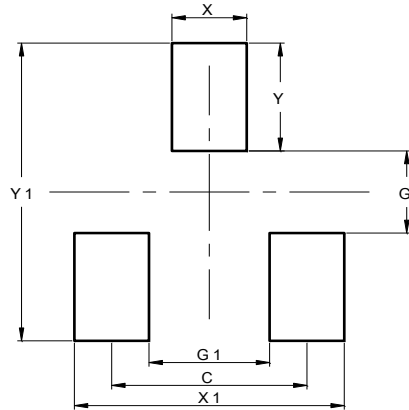
SIP-3 (Ammo Pack)			
Dim	Min	Max	Typ
A	1.40	1.60	1.50
b	0.33	0.43	0.38
b2a	0.40	0.52	0.46
c	0.35	0.41	0.38
D	3.90	4.30	4.10
E	2.80	3.20	3.00
e1	1.24	1.30	1.27
e2	2.40	2.90	2.65
F	0.00	0.20	--
J	2.62 REF		
L	14.00	15.00	14.50
La	12.90	14.90	13.90
L1	1.55	1.75	1.65
L3	2.00	3.00	2.50
S	0.63	0.84	0.74
a1	--	--	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.

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

Mechanical Data

- Moisture Sensitivity: SOT23 (Type S) – Level 1 per J-STD-020
- Terminals: Finish – Matte Tin Plated Leads, Solderable per MIL-STD-202, Method 208 (B3)
- Weight: SIP-3 (Ammo Pack)/SIP-3 (Bulk Pack) – 0.077 grams (Approximate)
SOT23 (Type S) – 0.009 grams (Approximate)

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