

Description

The AH3390Q is an AECQ100 qualified high voltage low sensitivity Hall Effect Unipolar switch IC designed for position and proximity sensing in automotive applications such as in seat and seatbelt buckle, steering lock/immobilisation, gear stick, transmission actuator and gear position, HVAC compression, wiper, door/trunk closure, etc. 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 AH3390Q 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.

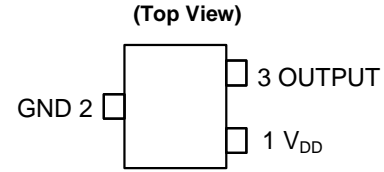
The single open drain output can be switched on with South pole of sufficient strength. When the magnetic flux density (B) perpendicular to the package is larger than the operate point (B_{OP}) the output is switched on (pulled low) and is held on until magnetic flux density B is lower than the release point (B_{RP}). 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 require south pole to the part marking side to operate while SC59 requires south pole to the non-part marking side.

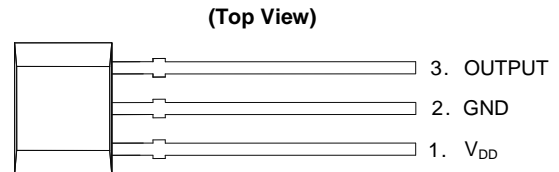
Features

- Unipolar Operation
- Medium Sensitivity: B_{OP} and B_{RP} of 210G and 185G 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 +150°C Operating Temperature
- ESD: HBM > 8kV, CDM: > 2kV
- AECQ100 Grade 0 Qualified
- 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)**

Pin Assignments



SC59 and SOT23



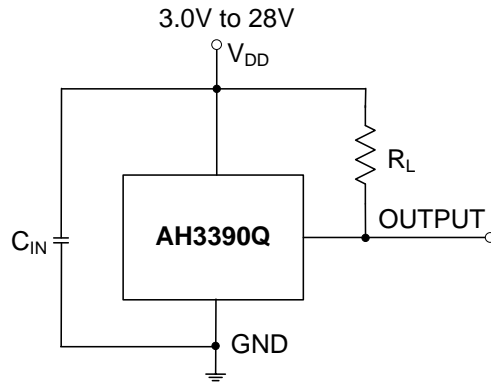
SIP-3 (Bulk Pack)

Applications

- Position and Proximity Sensing in Automotive Applications
- Seat Position
- Seatbelt Buckle
- Steering Lock/Immobilisation
- Gear Stick
- HVAC Compression
- Transmission Actuator
- Transmission Gear Position
- Wipers
- Sunroof and Windows
- Door/Trunk Closure
- Door Locks
- Contact-Less Switches

- Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.
 2. See http://www.diodes.com/quality/lead_free.html 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 (Note 4)



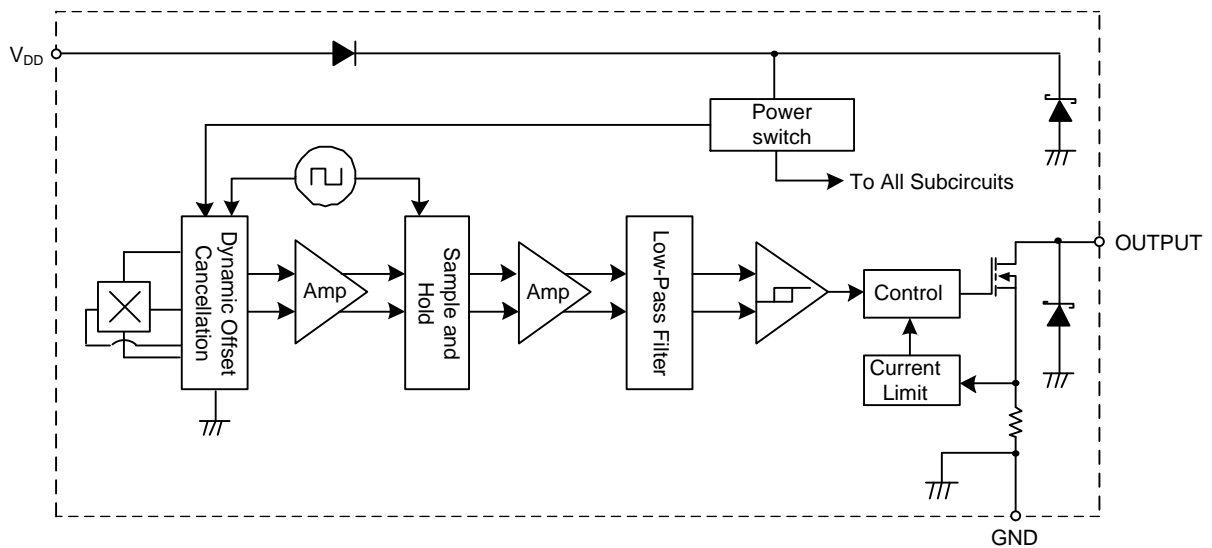
Note: 4. C_{IN} is for power stabilization and to strengthen the noise immunity, the recommended capacitance is 10nF ~ 100nF.
 R_L is the pull-up resistor.

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) (@ $T_A = +25^\circ\text{C}$, unless otherwise specified.)

Symbol	Characteristic		Value	Unit
V_{DD}	Supply Voltage (Note 6)		32	V
V_{DDR}	Reverse Supply Voltage (Note 6)		-32	V
V_{OUT_MAX}	Output 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), SIP-3 (Bulk Pack)	550	mW
		SC59 and SOT23	230	
T_s	Storage Temperature Range		-65 to +165	$^\circ\text{C}$
T_J	Maximum Junction Temperature		+150	$^\circ\text{C}$
ESD HBM	Electros Static Discharge Withstand - Human Body Model (HBM)		8	kV
ESD MM	Electros Static Discharge Withstand - Machine Model (MM)		800	V
ESD CDM	Electros Static Discharge Withstand - Charged Device Model (CDM)		2	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_{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 $+150^\circ\text{C}$, unless otherwise specified.)

Symbol	Parameter	Condition	Rating	Unit
V_{DD}	Supply Voltage	Operating	3.0 to 28	V
T_A	Operating Temperature Range	Operating	-40 to +150	$^\circ\text{C}$

Electrical Characteristics (Note 7 & 8) (@ $T_A = -40^\circ\text{C}$ to $+150^\circ\text{C}$, $V_{DD} = 3\text{V}$ to 28V , unless otherwise specified.)

Symbol	Parameter	Condition	Min	Typ	Max	Unit
V_{OUT_ON}	Output ON Voltage	$I_{OUT} = 20\text{mA}$, $B > B_{op}$	-	0.2	0.4	V
I_{LKG}	Output Leakage Current (When output is off)	$V_{OUT} = 28\text{V}$, $B < B_{rp}$, Output off	-	<0.1	10	μA
I_{DD}	Supply Current	Output open, $T_A = +25^\circ\text{C}$	-	3	3.5	mA
		Output open, $T_A = -40^\circ\text{C}$ to $+150^\circ\text{C}$	-	-	4	mA
I_{DD_R}	Reverse Supply Current	$V_{DD} = -18\text{V}$, $T_A = +25^\circ\text{C}$	-	0.6	-	μA
		$V_{DD} = -18\text{V}$, $T_A = -40^\circ\text{C}$ to $+150^\circ\text{C}$	-	0.6	1500	μA
		$V_{DD} = -28\text{V}$, $T_A = +25^\circ\text{C}$	-	1.6	-	μA
		$V_{DD} = -28\text{V}$, $T_A = -40^\circ\text{C}$ to $+150^\circ\text{C}$	-	1.6	2500	μA
t_{P_ON}	Device Power-On Time (Start-up time)	$V_{DD} \geq 3\text{V}$, $B > B_{op}$ (Note 7)	-	10	-	μs
f_C	Chopping Frequency	-	-	800	-	kHz
t_D	Response Time Delay (Time from magnetic threshold reached to the start of the output rise or fall)	(Note 9)	-	3.75	-	μs
t_R	Output Rising Time (External pull-up resistor R_L and load capacitance dependent)	$R_L = 1\text{k}\Omega$, $C_L = 20\text{pF}$	-	0.2	1	μs
t_F	Output Falling Time (Internal switch resistance and load capacitance dependent)	$R_L = 1\text{k}\Omega$, $C_L = 20\text{pF}$	-	0.1	1	μs
I_{OCL}	Output Current Limit	$B > B_{op}$, (Note 10)	30	-	55	mA
V_Z	Zener Clamp Voltage	$I_{DD} = 5\text{mA}$	28	-	-	V

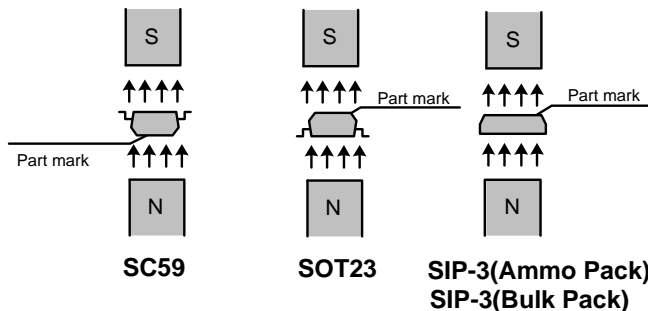
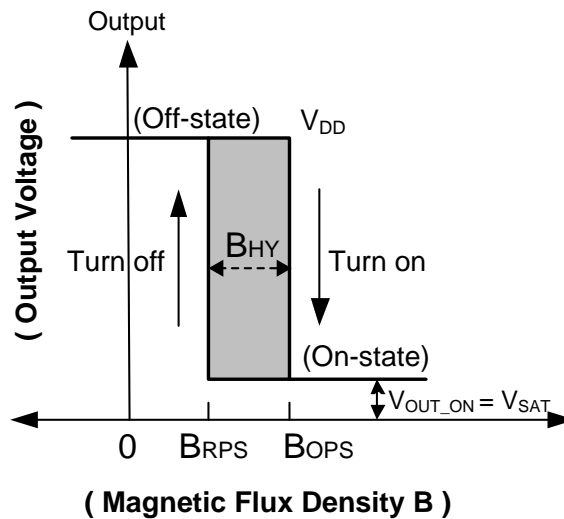
- Notes:
- When power is initially turned on, V_{DD} must be within its correct operating range (3.0V to 28V) to guarantee the output sampling. The output state is valid after the start-up time of 10 μs typical from the operating voltage reaching 3V.
 - Typical values are defined at $T_A = +25^\circ\text{C}$,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

Magnetic Characteristics (Note 11 &12) ($T_A = -40^{\circ}\text{C}$ to $+150^{\circ}\text{C}$, $V_{DD} = 3.0\text{V}$ to 28V , unless otherwise specified.)

(1mT=10 Gauss)

Symbol	Parameter	Condition	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	$V_{DD} = 12\text{V}$, $T_A = +25^{\circ}\text{C}$	-	210	-	Gauss
		$T_A = -40^{\circ}\text{C}$ to $+150^{\circ}\text{C}$	180	210	240	
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	$V_{DD} = 12\text{V}$, $T_A = +25^{\circ}\text{C}$	-	185	-	
		$T_A = -40^{\circ}\text{C}$ to $+150^{\circ}\text{C}$	155	185	220	
B _{HY} ($ B_{OPX} - B_{RPX} $)	Hysteresis (Note 13)	$V_{DD} = 12\text{V}$, $T_A = +25^{\circ}\text{C}$	-	25	-	
		$T_A = -40^{\circ}\text{C}$ to $+150^{\circ}\text{C}$	17	25	35	

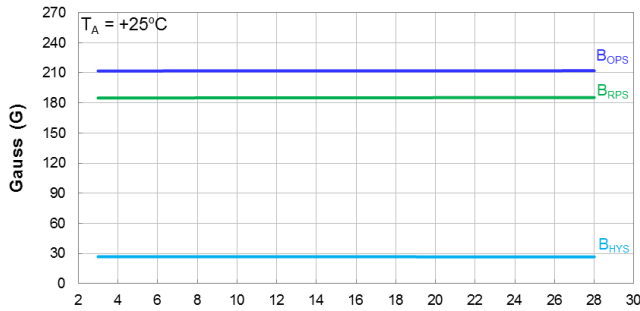
- Notes:
- When power is initially turned on, V_{DD} must be within its correct operating range (3.0V to 28V) to guarantee the output sampling. The output state is valid after the start-up time of 10 μs typical from the operating voltage reaching 3V.
 - Typical values are defined at $T_A = +25^{\circ}\text{C}$,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



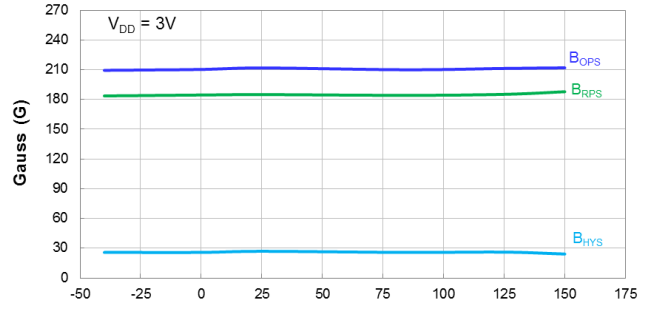
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Typical Operating Characteristics

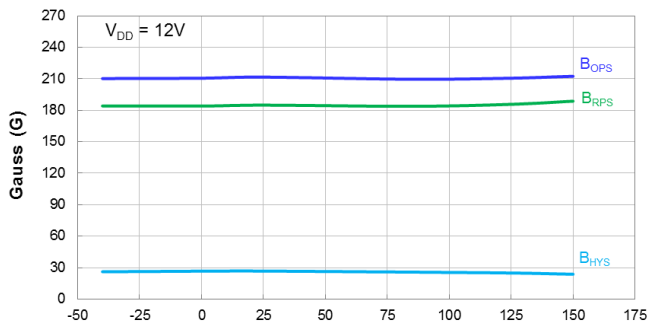
Output Switch Operate and Release Points (Magnetic Thresholds) – B_{OPS} and B_{RPS}



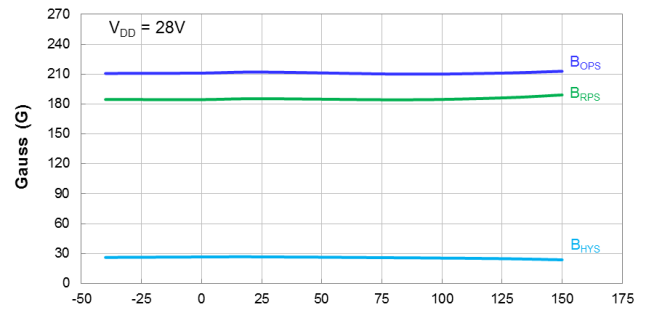
Switch Points B_{OPS} and B_{RPS} vs Supply Voltage



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

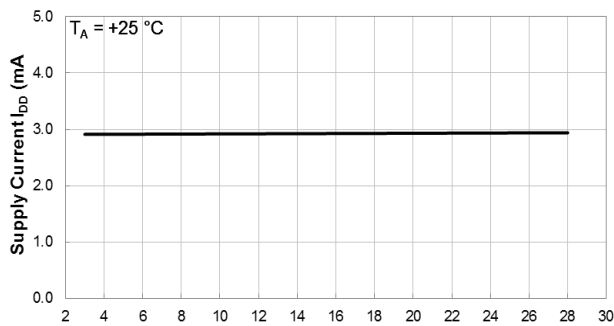


Switch Points B_{OPS} and B_{RPS} vs Temperature

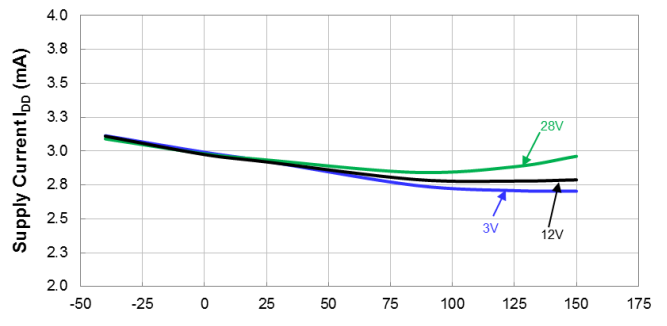


Switch Points B_{OPS} and B_{RPS} vs Temperature

Supply Current



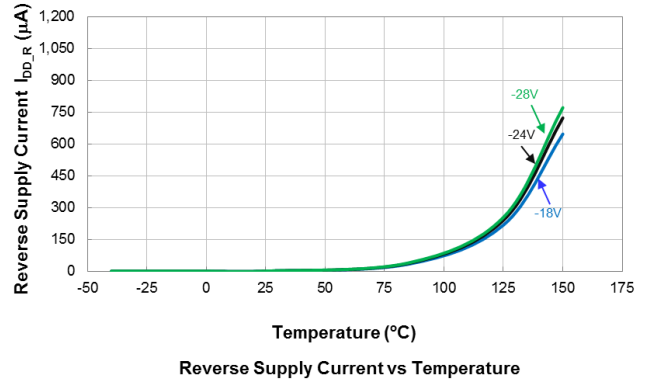
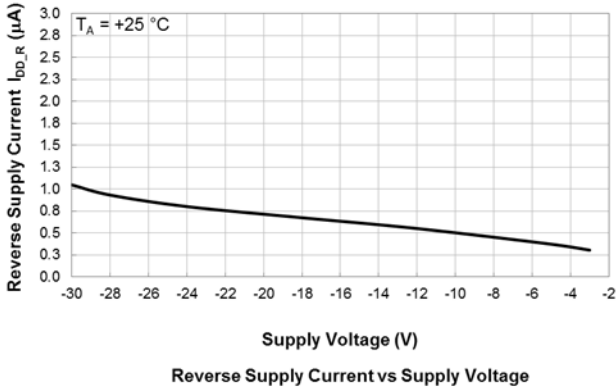
Supply Current vs Supply Voltage



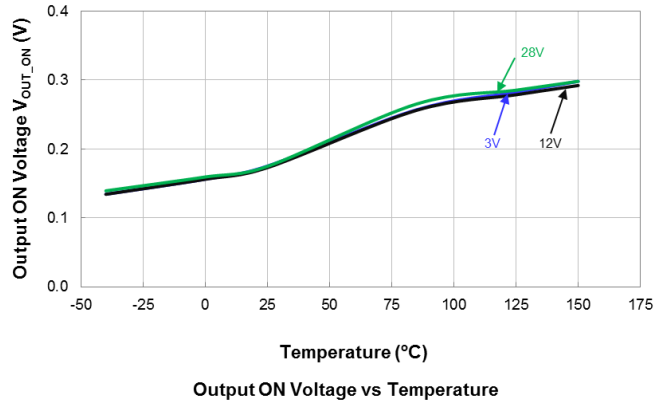
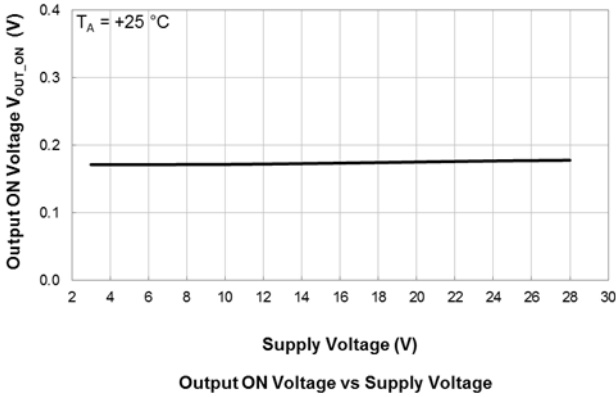
Supply Current vs Temperature

Typical Operating Characteristics (Cont.)

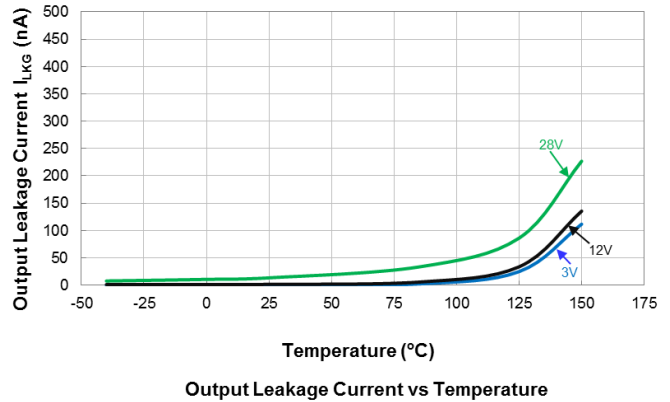
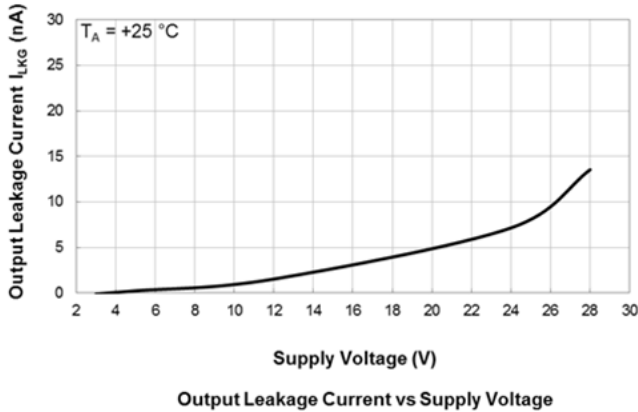
Supply Reverse Current



Output Switch On Voltage

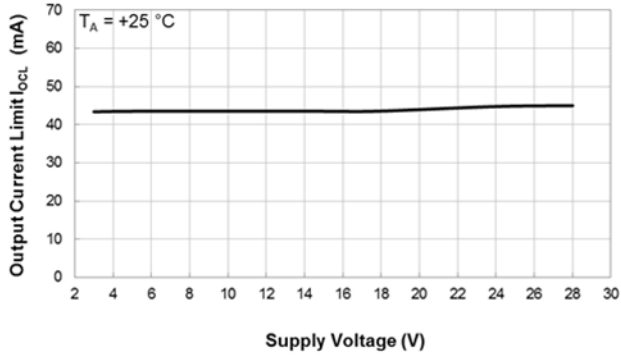


Output Switch Leakage Current

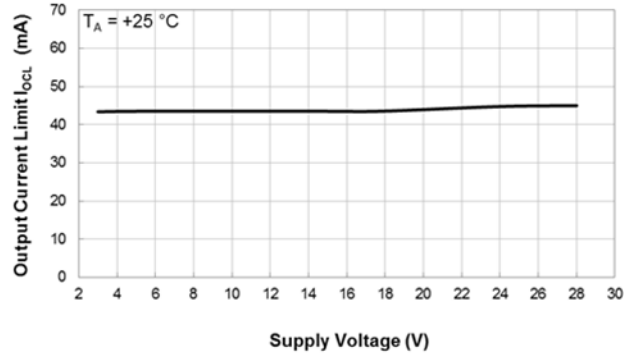


Typical Operating Characteristics (Cont.)

Output Current Limit



Output Current Limit vs Supply Voltage



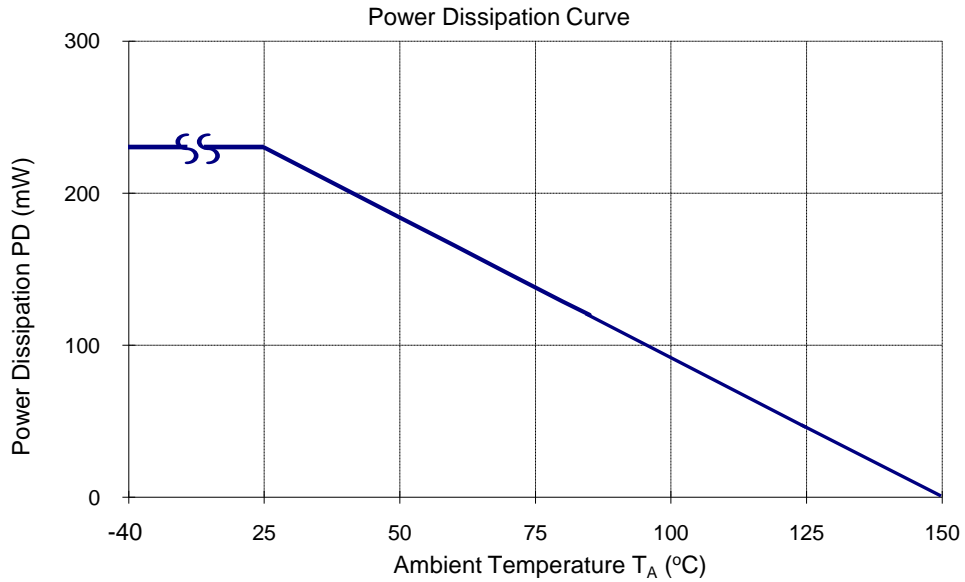
Output Current Limit vs Supply Voltage

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Thermal Performance Characteristics

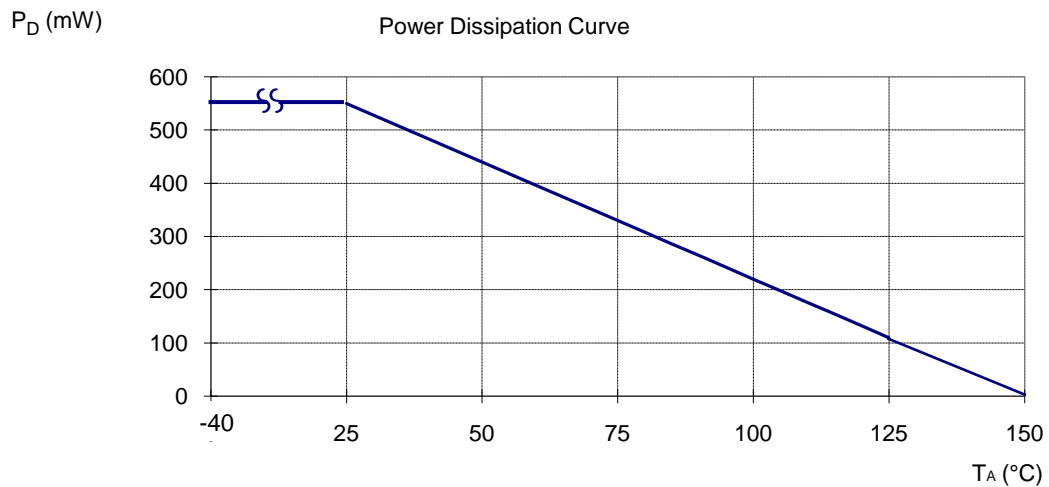
(1) Package type: SC59 and SOT23

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

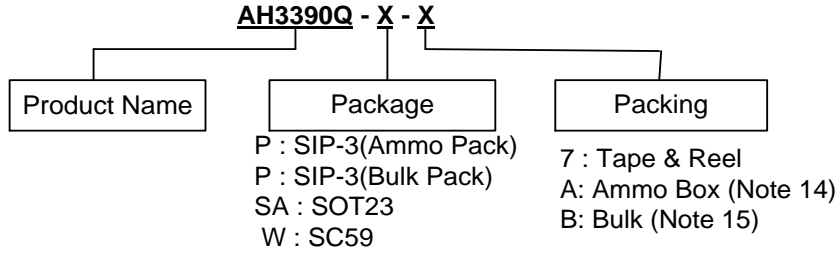


(2) Package type: SIP-3 (Ammo Pack), SIP-3 (Bulk Pack)

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



Ordering Information

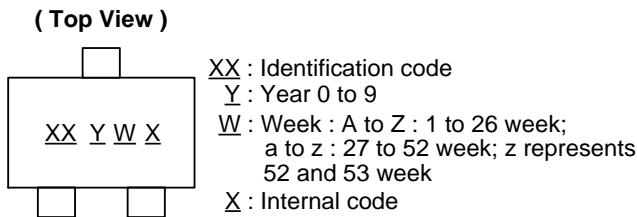


Part Number	Package Code	Packaging	Bulk Box		7" Tape and Reel		Ammo Box	
			Quantity	Part Number Suffix	Quantity	Part Number Suffix	Quantity	Part Number Suffix
AH3390Q-P-A	P	SIP-3 (Ammo Pack)	NA	NA	NA	NA	4000/Box	-A
AH3390Q-P-B	P	SIP-3 (Bulk Pack)	1000	-B	NA	NA	NA	NA
AH3390Q-SA-7	SA	SOT23	NA	NA	3000/Tape & Reel	-7	NA	NA
AH3390Q-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.

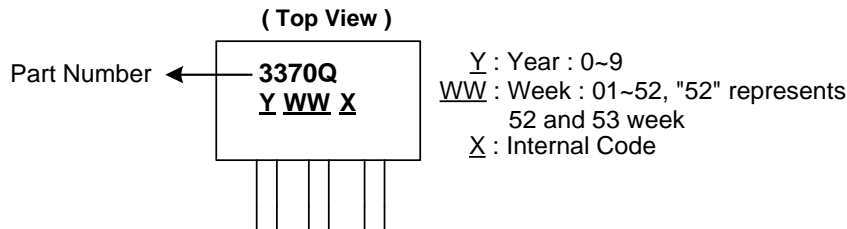
Marking Information

(1) Package Type: SC59 and SOT23



Part Number	Package	Identification Code
AH3390Q	SC59	DA
AH3390Q	SOT23	MX

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

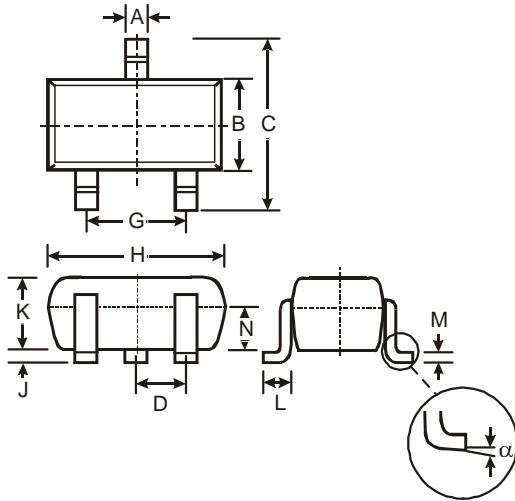


Part Number	Package	Identification Code
AH3390Q	SIP-3	3390Q

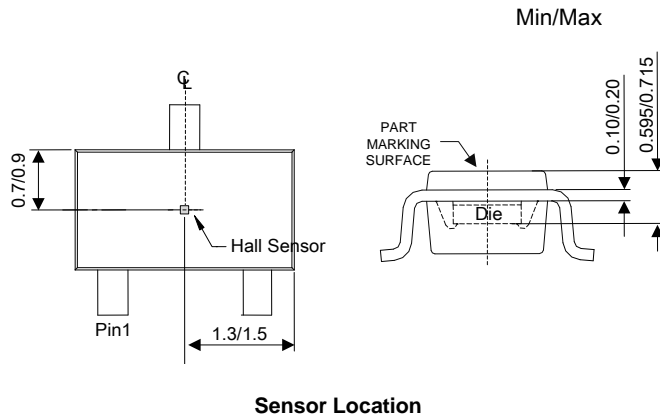
Package Outline Dimensions (All dimensions in mm.)

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

(1) Package Type: SC59



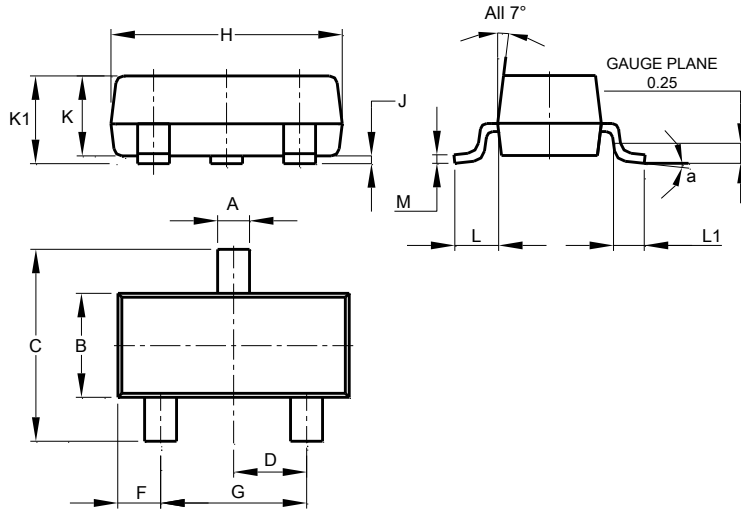
SC59			
Dim	Min	Max	Typ
A	0.35	0.50	0.38
B	1.50	1.70	1.60
C	2.70	3.00	2.80
D	-	-	0.95
G	-	-	1.90
H	2.90	3.10	3.00
J	0.013	0.10	0.05
K	1.00	1.30	1.10
L	0.35	0.55	0.40
M	0.10	0.20	0.15
N	0.70	0.80	0.75
α	0°	8°	-
All Dimensions in mm			



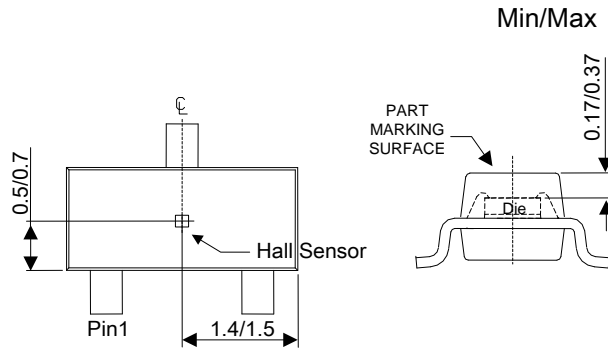
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Package Outline Dimensions (Cont.) (All dimensions in mm.)

(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			

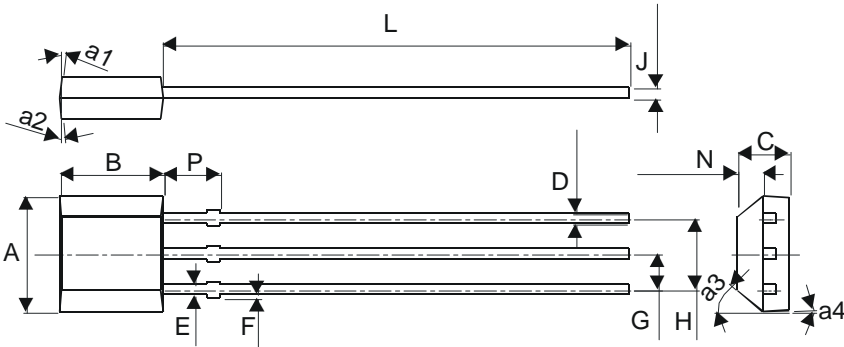


Sensor Location

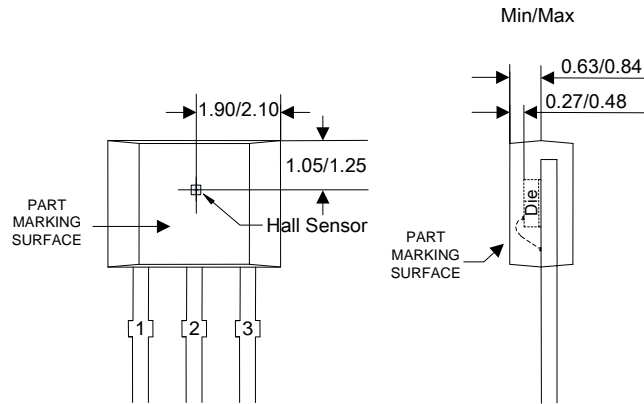
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Package Outline Dimensions (Cont.) (All dimensions in mm.)

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



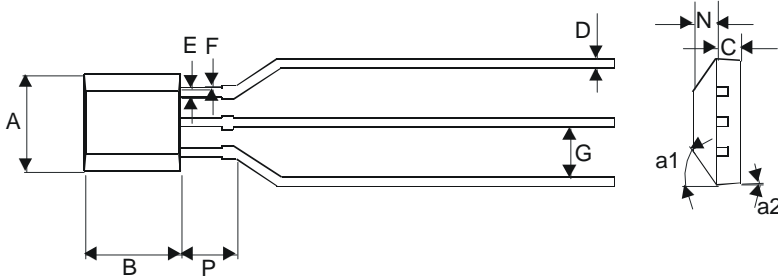
SIP-3 (Bulk Pack)		
Dim	Min	Max
A	3.9	4.3
a1	5° Typ	
a2	5° Typ	
a3	45° Typ	
a4	3° Typ	
B	2.8	3.2
C	1.40	1.60
D	0.33	0.432
E	0.40	0.508
F	0	0.2
G	1.24	1.30
H	2.51	2.57
J	0.35	0.43
L	14.0	15.0
N	0.63	0.84
P	1.55	-
All Dimensions in mm		



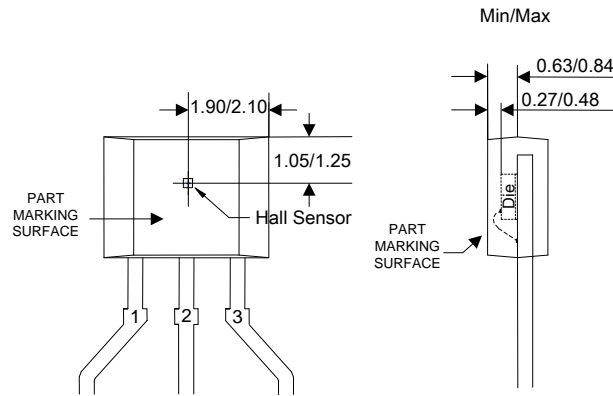
Sensor Location

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

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



SIP-3 (Ammo Pack)		
Dim	Min	Max
A	3.9	4.3
a1	45° Typ	
a2	3° Typ	
B	2.8	3.2
C	1.40	1.60
D	0.35	0.41
E	0.43	0.48
F	0	0.2
G	2.4	2.9
N	0.63	0.84
P	1.55	-
All Dimensions in mm		



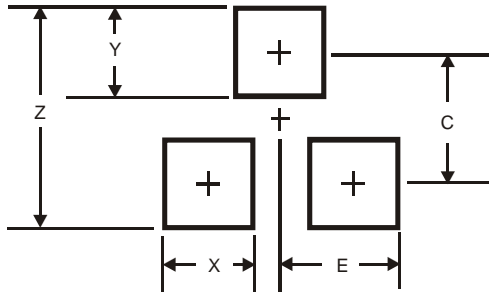
Sensor Location

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Suggested Pad Layout

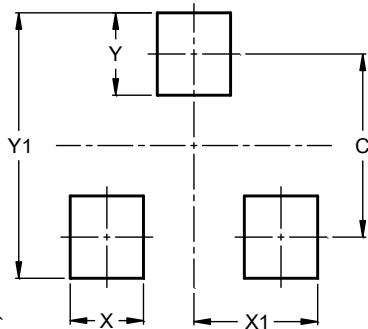
Please see <http://www.diodes.com/package-outlines.html> for the latest version.

(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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1. are intended to implant into the body, or
2. support or sustain life and whose failure to perform when properly used in accordance with instructions for use provided in the labeling can be reasonably expected to result in significant injury to the user.

B. A critical component is any component in a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or to affect its safety or effectiveness.

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