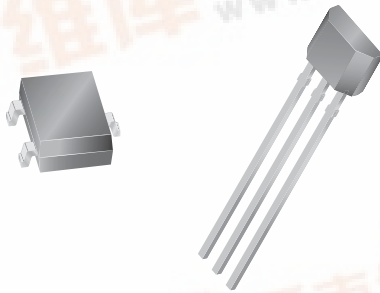


Chopper-Stabilized, Precision Hall-Effect Switch

Features and Benefits

- Resistant to physical stress
- Superior temperature stability
- Output short-circuit protection
- Operation from unregulated supply
- Reverse battery protection
- Solid-state reliability
- Small size

Packages: 3 pin SOT23W (suffix LH), and 3 pin SIP (suffix UA)



Not to scale

Description

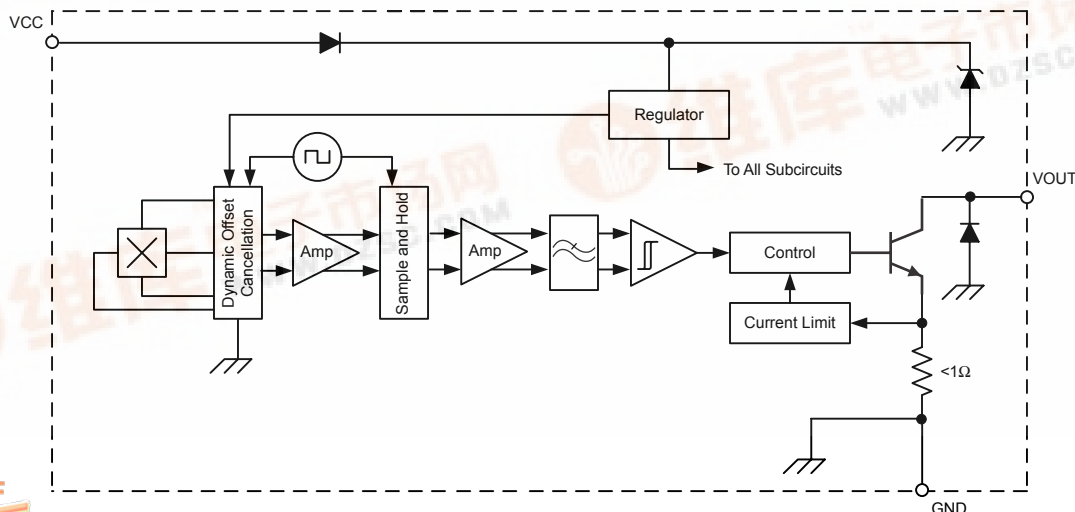
The A3340 Hall effect switch is an extremely temperature-stable and stress-resistant sensor especially suited for operation over extended temperature ranges up to 150°C. Superior high-temperature performance is made possible through dynamic offset cancellation, which reduces the residual offset voltage normally caused by device overmolding, temperature dependencies, and thermal stress.

The device includes on a single silicon chip a voltage regulator, Hall-voltage generator, small-signal amplifier, chopper stabilization, Schmitt trigger, and a short-circuit protected open-collector output to sink up to 25 mA. A south pole of sufficient strength will turn the output off. An on-board regulator permits operation with supply voltages of 4.2 to 24 volts.

Two package styles provide a magnetically optimized package for most applications. Suffix LH is an SOT23W surface mount package and while suffix UA is a three-lead ultramini SIP for through hole mounting.

The A3340 complements the A3240, which offers the same features, but with the opposite output polarity.

Functional Block Diagram



A3340

Chopper-Stabilized, Precision Hall-Effect Switch

Selection Guide					
Part Number	Packing*	Mounting	Ambient, T _A	B _{RP} (Min)	B _{OP} (Max)
A3340ELHLT-T	7-in. reel, 3000 pieces/reel	3-pin SOT23W surface mount	−40°C to 85°C	5	50
A3340EUA-T	Bulk, 500 pieces/bag	3-pin SIP through hole			
A3340LLHLT-T	7-in. reel, 3000 pieces/reel	3-pin SOT23W surface mount	−40°C to 150°C		
A3340LUA-T	Bulk, 500 pieces/bag	3-pin SIP through hole			

*Contact Allegro for additional packing options.



Absolute Maximum Ratings

Characteristic	Symbol	Notes	Rating	Units
Supply Voltage	V_{CC}		26.5	V
Reverse Supply Voltage	V_{RCC}		-30	V
Output Off Voltage	V_{OUT}		26	V
Reverse Output Voltage	V_{ROUT}		-0.5	V
Continuous Output Current	I_{OUT}	Internal current limiting (intended to protect the device from output short circuits)	25	mA
Reverse Output Current	I_{ROUT}		-50	mA
Magnetic Flux Density	B		Unlimited	G
Operating Ambient Temperature	T_A	Range E	-40 to 85	°C
		Range L	-40 to 150	°C
Maximum Junction Temperature	$T_J(max)$		165	°C
Storage Temperature	T_{stg}		-65 to 170	°C

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Chopper-Stabilized, Precision Hall-Effect Switch

Operating Characteristics, valid over T_A , unless otherwise noted

Characteristic	Symbol	Test Conditions	Min.	Typ. ¹	Max.	Units
Electrical Characteristics						
Supply Voltage Range ²	V_{CC}	Operating, $T_J < 165^\circ\text{C}$	4.2	–	24	V
Output Leakage Current	I_{OFF}	$V_{OUT} = 24\text{ V}$, $B > B_{OP}$	–	–	10	μA
Output Saturation Voltage	$V_{OUT(SAT)}$	$I_{OUT} = 20\text{ mA}$, $B < B_{RP}$	–	185	500	mV
Output Current Limit	I_{OM}	$B > B_{OP}$	30	–	60	mA
Power-On Time	t_{PO}	$V_{CC} > 4.2\text{ V}$	–	–	50	μs
Chopping Frequency	f_C		–	340	–	kHz
Output Rise Time	t_r	$R_{LOAD} = 820\ \Omega$, $C_{LOAD} = 20\text{ pF}$	–	0.2	2.0	μs
Output Fall Time	t_f	$R_{LOAD} = 820\ \Omega$, $C_{LOAD} = 20\text{ pF}$	–	0.1	2.0	μs
Supply Current	I_{CC}	$B < B_{RP}$, $V_{CC} = 12\text{ V}$	–	3.0	6.0	mA
		$B > B_{OP}$, $V_{CC} = 12\text{ V}$	–	4.0	6.0	mA
Reverse Battery Current	I_{RCC}	$V_{RCC} = -30\text{ V}$	–	–	-5.0	mA
Zener Voltage	V_{ZD}	$V_Z + V_D$, $I_{CC} = 15\text{ mA}$, $T_A = 25^\circ\text{C}$	28	32	37	V
Zener Impedance	Z_{ZD}	$Z_Z + Z_D$, $I_{CC} = 15\text{ mA}$, $T_A = 25^\circ\text{C}$	–	50	–	Ω
Magnetic Characteristics³						
Operate Point ⁴	B_{OP}		–	35	50	G
Release Point ⁴	B_{RP}		5.0	25	–	G
Hysteresis	B_{hys}	$B_{OP} - B_{RP}$	–	6	–	G

¹Typical data are for initial design estimations only, and assume optimum manufacturing and application conditions, such as $T_A = 25^\circ\text{C}$ and $V_{CC} = 12\text{ V}$. Performance may vary for individual units, within the specified maximum and minimum limits.

²Maximum voltage must be adjusted for power dissipation and junction temperature.

³1 G (gauss) = 0.1 mT (millitesla).

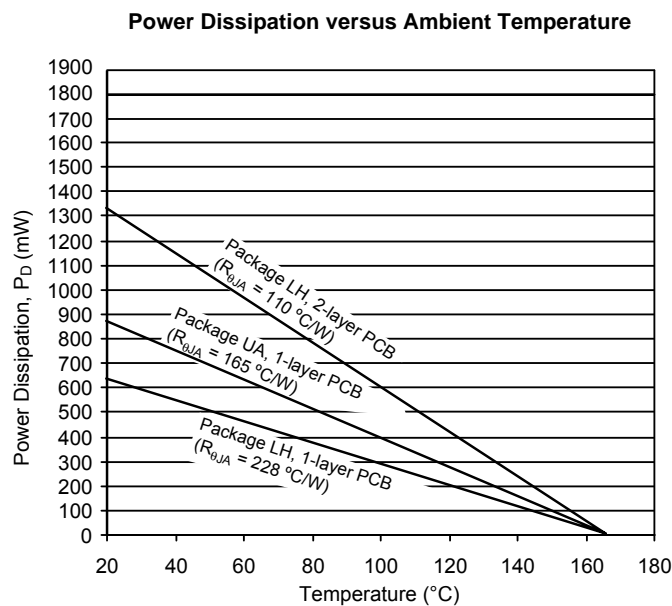
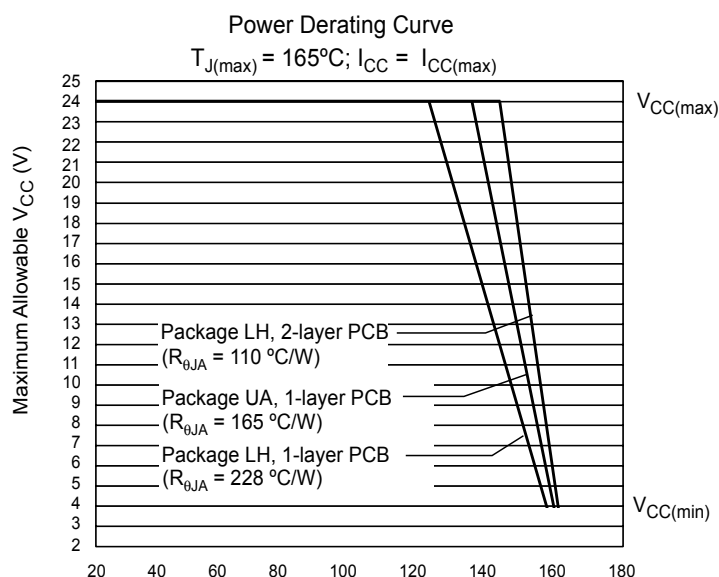
⁴ B_{OP} = operate point (output turns off); B_{RP} = release point (output turns on).

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Chopper-Stabilized, Precision Hall-Effect Switch

THERMAL CHARACTERISTICS may require derating at maximum conditions, see application information

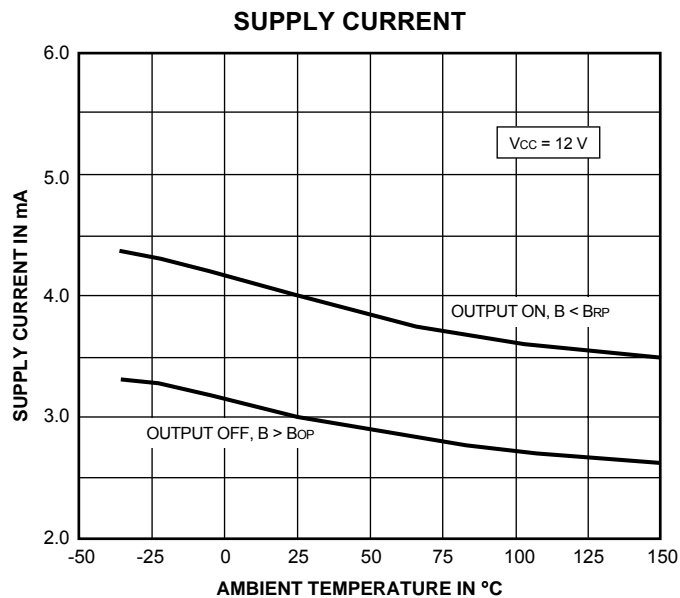
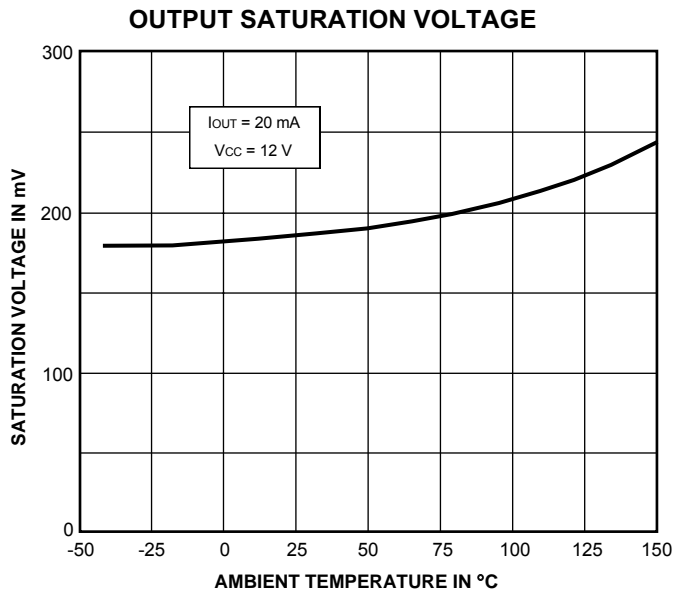
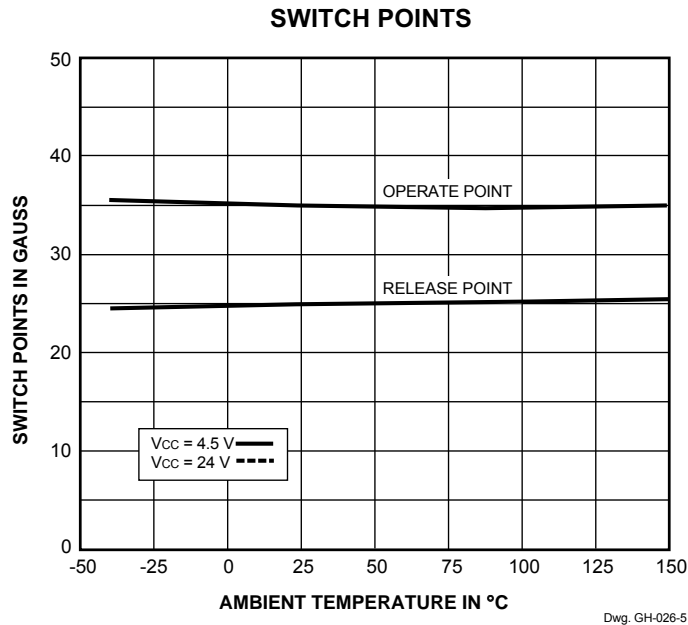
Characteristic	Symbol	Test Conditions	Value	Units
Package Thermal Resistance	$R_{\theta JA}$	Package LH, 1-layer PCB with copper limited to solder pads	228	$^{\circ}\text{C}/\text{W}$
		Package LH, 2-layer PCB with 0.463 in. ² of copper area each side connected by thermal vias	110	$^{\circ}\text{C}/\text{W}$
		Package UA, 1-layer PCB with copper limited to solder pads	165	$^{\circ}\text{C}/\text{W}$



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Chopper-Stabilized, Precision Hall-Effect Switch

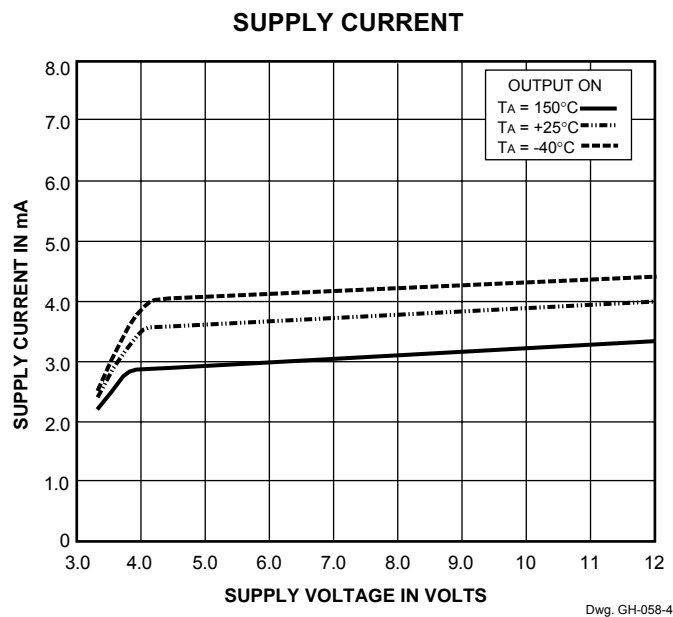
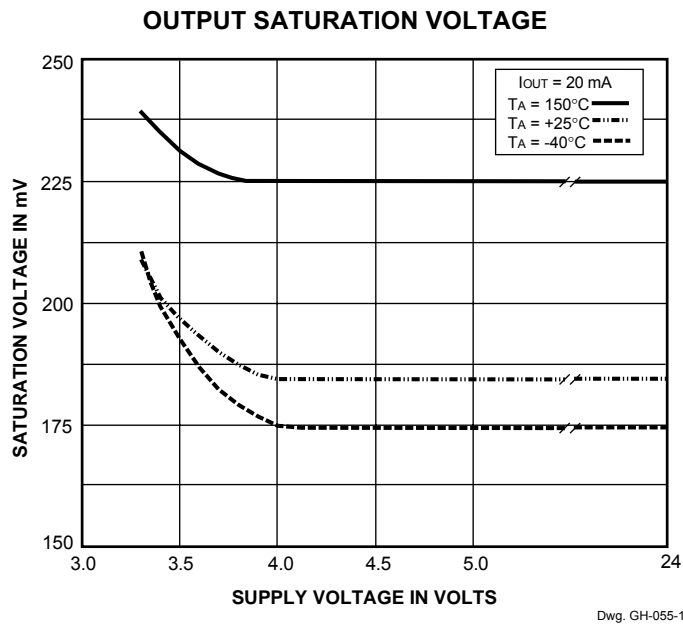
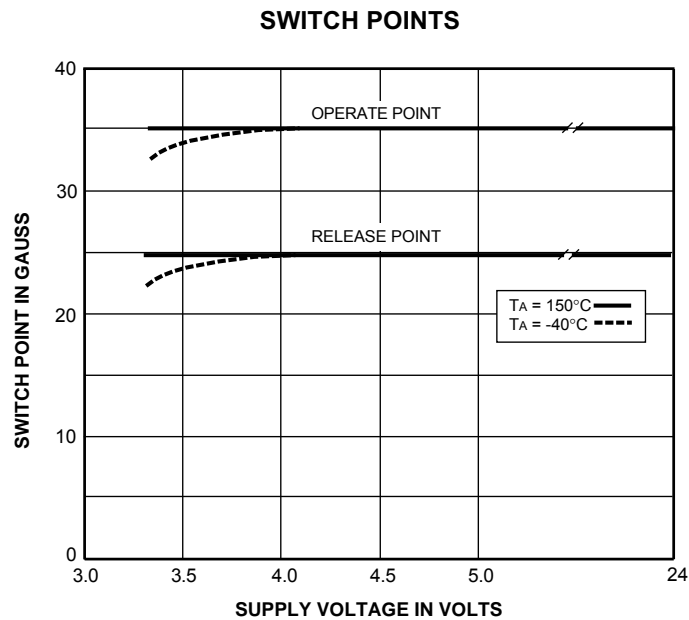
TYPICAL OPERATING CHARACTERISTICS
as a function of temperature



A3340

Chopper-Stabilized, Precision Hall-Effect Switch

TYPICAL OPERATING CHARACTERISTICS
as a function of supply voltage

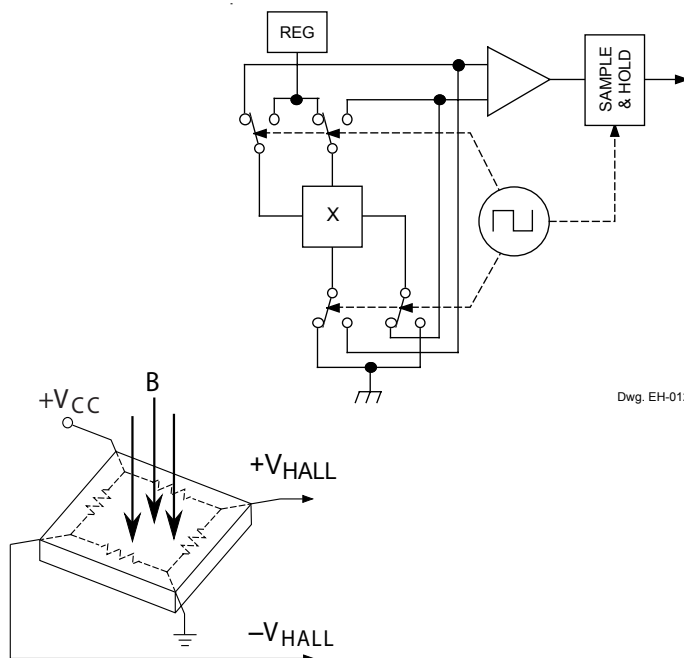


FUNCTIONAL DESCRIPTION

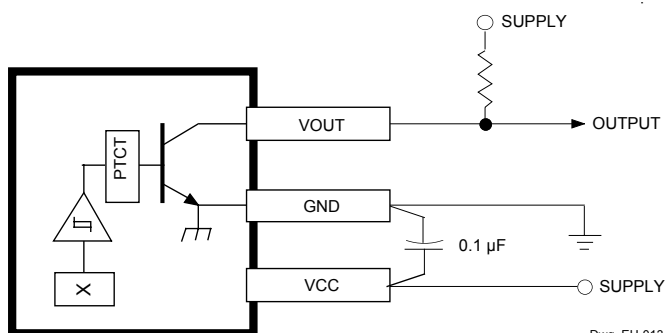
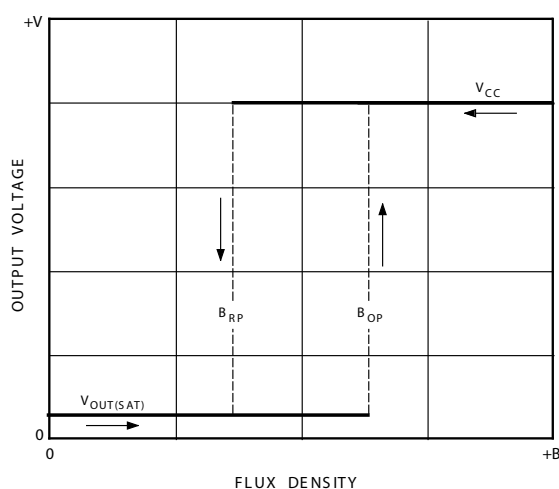
Chopper-Stabilized Technique. The Hall element can be considered as a resistor array similar to a Wheatstone bridge. A large portion of the offset is a result of the mismatching of these resistors. These devices use a proprietary dynamic offset cancellation technique, with an internal high-frequency clock to reduce the residual offset voltage of the Hall element that is normally caused by device overmolding, temperature dependencies, and thermal stress. The chopper-stabilizing technique cancels the mismatching of the resistor circuit by changing the direction of the current flowing through the Hall plate using CMOS switches and Hall voltage measurement taps, while maintaining the Hall-voltage signal that is induced by the external magnetic flux. The signal is then captured by a sample-and-hold circuit and further processed using low-offset bipolar circuitry. This technique produces devices that have an extremely stable quiescent Hall output voltage, are immune to thermal stress, and have precise recoverability after temperature cycling. This technique will also slightly degrade the device output repeatability. A relatively high sampling frequency is used in order that faster signals can be processed.

More detailed descriptions of the circuit operation can be found in: Technical Paper STP 97-10, *Monolithic Magnetic Hall Sensor Using Dynamic Quadrature Offset Cancellation* and Technical Paper STP 99-1, *Chopper-Stabilized Amplifiers With A Track-and-Hold Signal Demodulator. Operation.* The output of these devices switches high (turns off) when a magnetic field (south pole) perpendicular to the Hall sensor exceeds the operate point threshold (B_{OP}). When the magnetic field is reduced below the release point (B_{RP}), the device output goes low (turns on). After turn-on, the output is capable of sinking 25 mA and the output voltage is $V_{OUT(SAT)}$. The difference in the magnetic operate and release points is the hysteresis (B_{hys}) of the device. This built-in hysteresis allows clean switching of the output even in the presence of external mechanical vibration and electrical noise. Applications. It is strongly recommended that an external bypass capacitor be connected (in close proximity to the Hall sensor) between the supply and ground of the device to reduce both external noise and noise generated by the chopperstabilization technique.

The simplest form of magnet that will operate these devices is a ring magnet. Other methods of operation, such as linear magnets, are possible. Extensive applications information on magnets and Hall-effect sensors is also available in Application Note 27701, or at www.allegromicro.com.



Dwg. EH-012

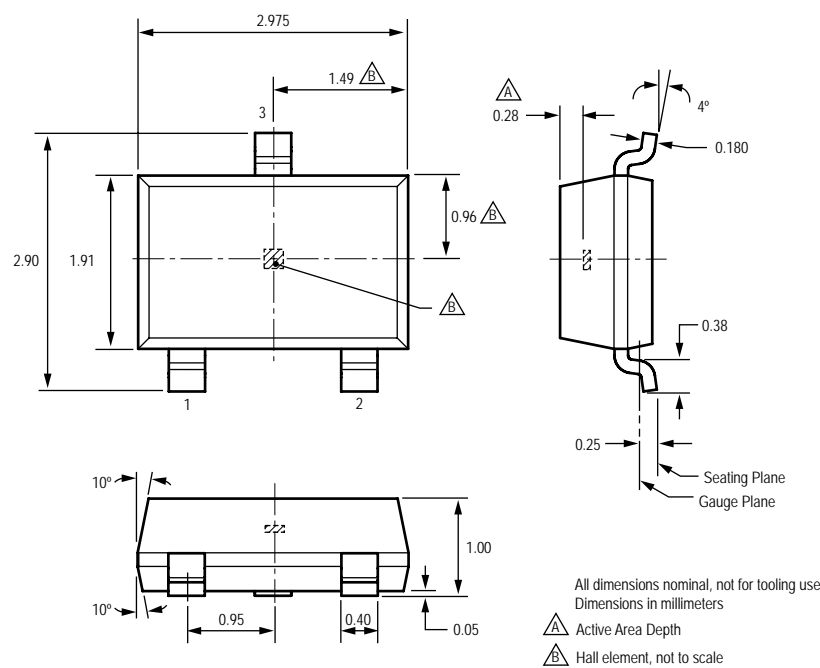


Dwg. EH-013

A3340

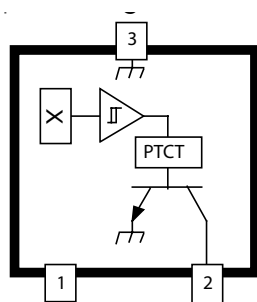
Chopper-Stabilized, Precision Hall-Effect Switch

Package LH, 3-Pin (SOT-23W)

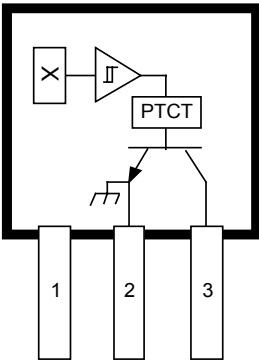


Pin-out Diagrams

Package LH



Package UA

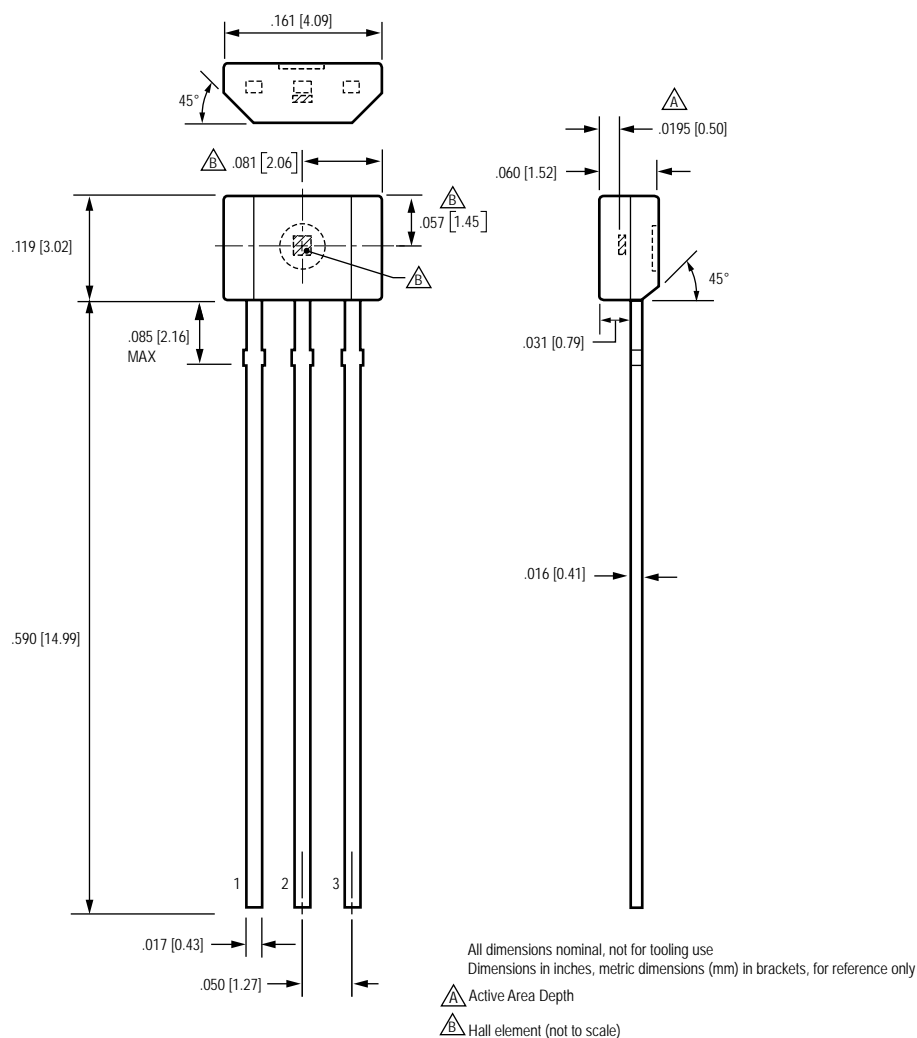


Name	Description	Number	
		Package LH	Package UA
VCC	Connects power supply to chip	1	1
VOUT	Output from circuit	2	3
GND	Ground	3	2

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Chopper-Stabilized, Precision Hall-Effect Switch

Package UA, 3-Pin SIP



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The products described herein are manufactured under one or more of the following U.S. patents: 5,045,920; 5,264,783; 5,442,283; 5,389,889; 5,581,179; 5,517,112; 5,619,137; 5,621,319; 5,650,719; 5,686,894; 5,694,038; 5,729,130; 5,917,320; and other patents pending.

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