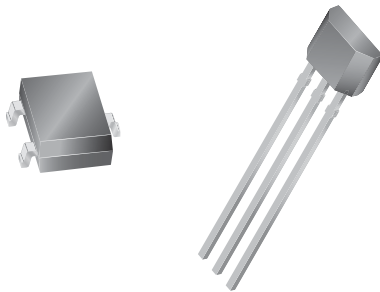


# Chopper-Stabilized, Precision Hall-Effect Switch

## 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

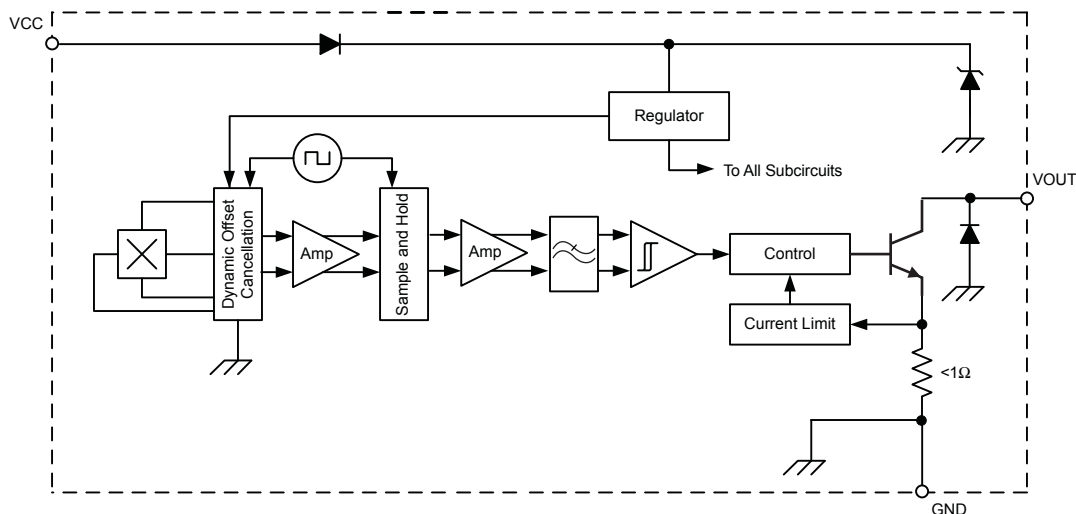
The A3340 Hall effect switch is an extremely temperature-stable and stress-resistant sensor especially suited for operation over extended temperature ranges up to 150°C. Superior high-temperature performance is made possible through dynamic offset cancellation, which reduces the residual offset voltage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



Selection Guide					
Part Number	Packing <sup>1</sup>	Mounting	Ambient, T <sub>A</sub>	B <sub>RP</sub> (Min)	B <sub>OP</sub> (Max)
A3340ELHLT-T <sup>2</sup>	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			

<sup>1</sup>Contact Allegro for additional packing options.

<sup>2</sup>Variant is in production but has been determined to be NOT FOR NEW DESIGN. This classification indicates that sale of the variant is currently restricted to existing customer applications. The variant should not be purchased for new design applications because obsolescence in the near future is probable. Samples are no longer available. Status change: November 1, 2008.



### Absolute Maximum Ratings

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

**Operating Characteristics, valid over  $T_A$ , unless otherwise noted**

Characteristic	Symbol	Test Conditions	Min.	Typ. <sup>1</sup>	Max.	Units
<b>Electrical Characteristics</b>						
Supply Voltage Range <sup>2</sup>	$V_{CC}$	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	$\mu\text{A}$
Output Saturation Voltage	$V_{OUT(SAT)}$	$I_{OUT} = 20\text{ mA}$ , $B < B_{RP}$	–	270	500	mV
Output Current Limit	$I_{OM}$	$B < B_{RP}$	30	–	60	mA
Power-On Time	$t_{PO}$	$V_{CC} > 4.2\text{ V}$	–	–	50	$\mu\text{s}$
Chopping Frequency	$f_C$		–	340	–	kHz
Output Rise Time	$t_r$	$R_{LOAD} = 820\ \Omega$ , $C_{LOAD} = 20\text{ pF}$	–	0.2	2.0	$\mu\text{s}$
Output Fall Time	$t_f$	$R_{LOAD} = 820\ \Omega$ , $C_{LOAD} = 20\text{ pF}$	–	0.1	2.0	$\mu\text{s}$
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	–	$\Omega$
<b>Magnetic Characteristics<sup>3</sup></b>						
Operate Point <sup>4</sup>	$B_{OP}$		–	35	50	G
Release Point <sup>4</sup>	$B_{RP}$		5.0	25	–	G
Hysteresis	$B_{hys}$	$B_{OP} - B_{RP}$	–	6	–	G

<sup>1</sup>Typical 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.

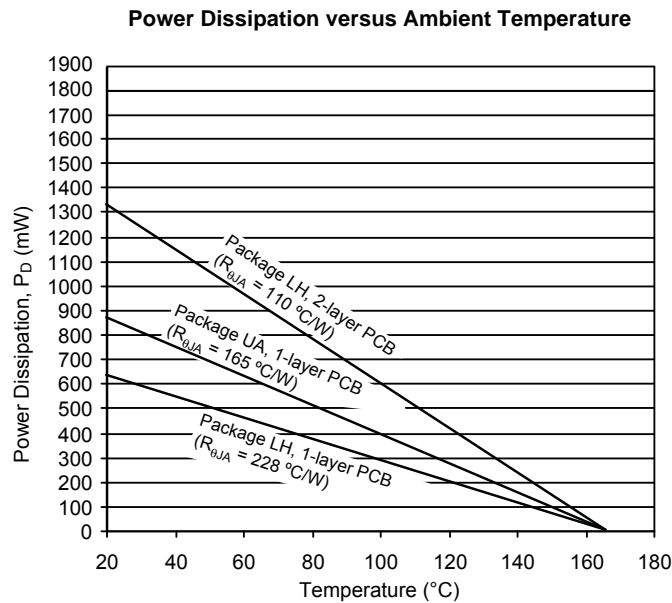
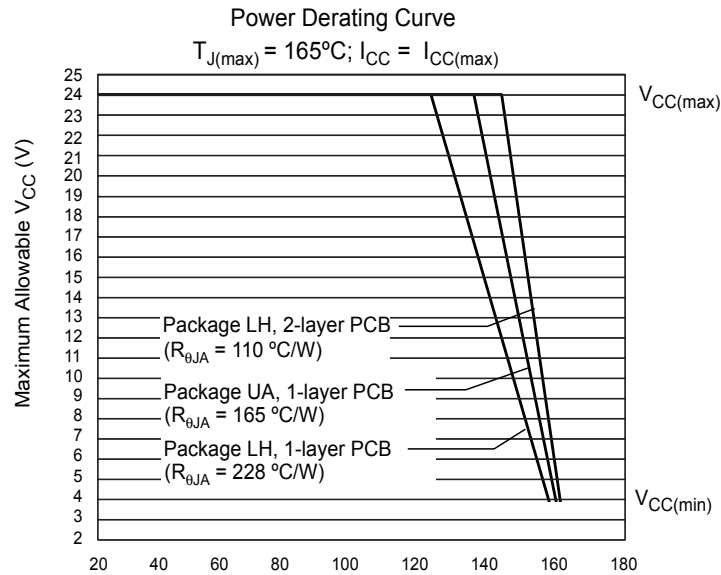
<sup>2</sup>Maximum voltage must be adjusted for power dissipation and junction temperature.

<sup>3</sup>1 G (gauss) = 0.1 mT (millitesla).

<sup>3</sup> $B_{OP}$  = operate point (output turns off);  $B_{RP}$  = release point (output turns on).

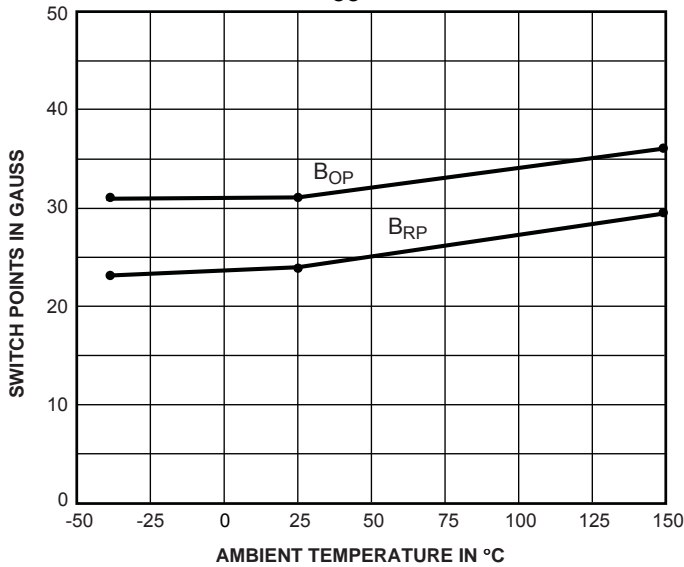
THERMAL CHARACTERISTICS may require derating at maximum conditions, see application information

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 <sup>2</sup> 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	$^{\circ}\text{C}/\text{W}$

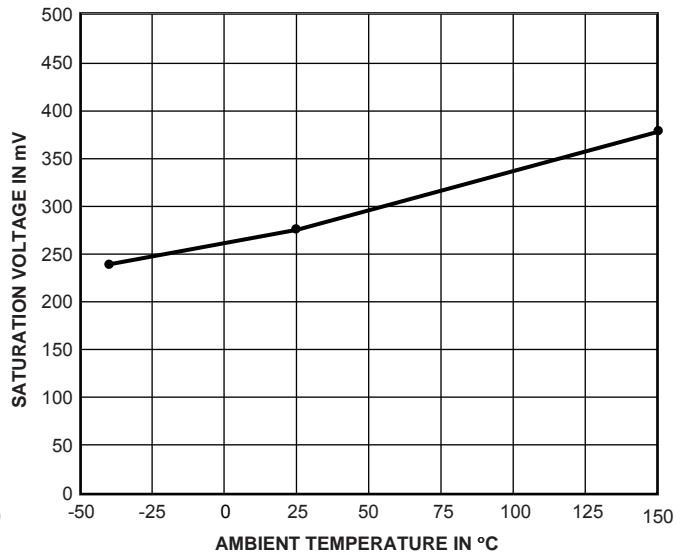


TYPICAL OPERATING CHARACTERISTICS  
as a function of temperature

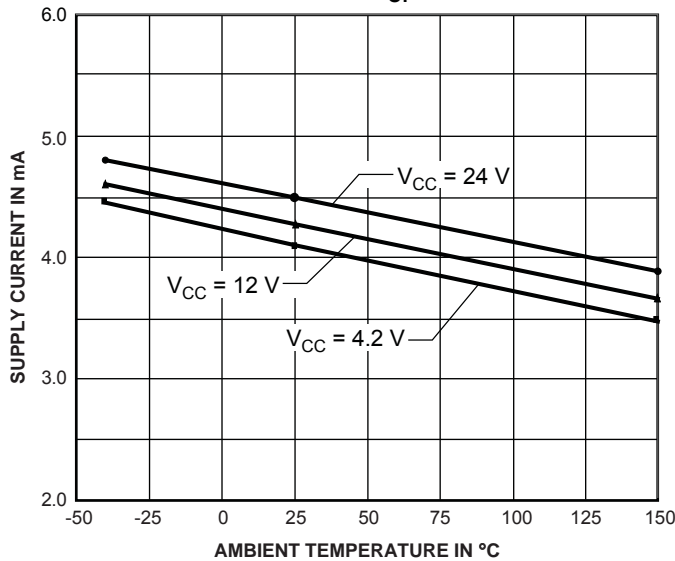
SWITCHPOINTS  
 $V_{CC} = 12\text{ V}$



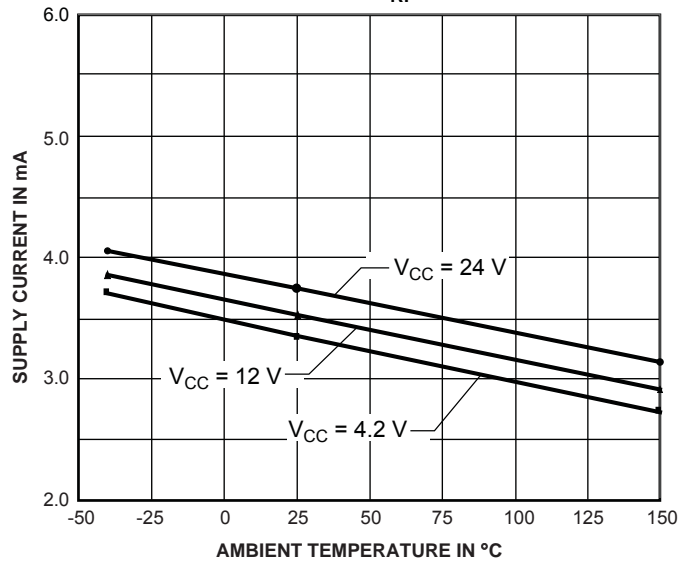
OUTPUT SATURATION VOLTAGE  
 $V_{CC} = 12\text{ V}, I_{OUT} = 20\text{ mA}$



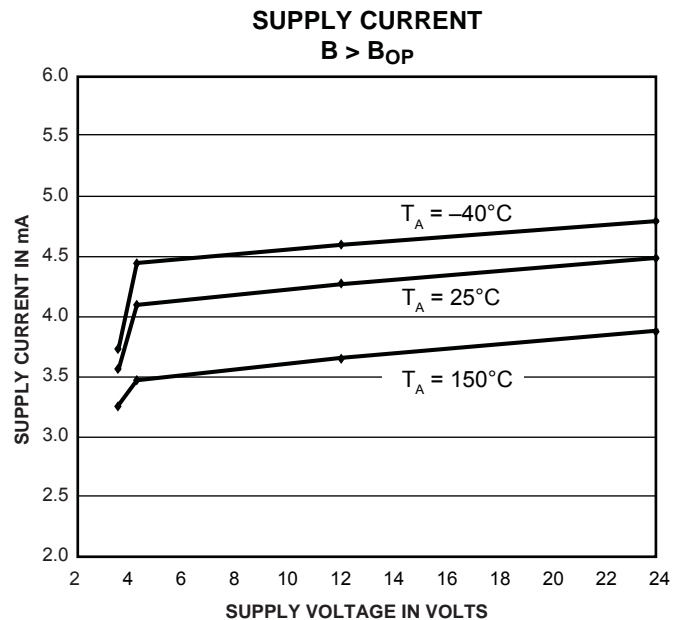
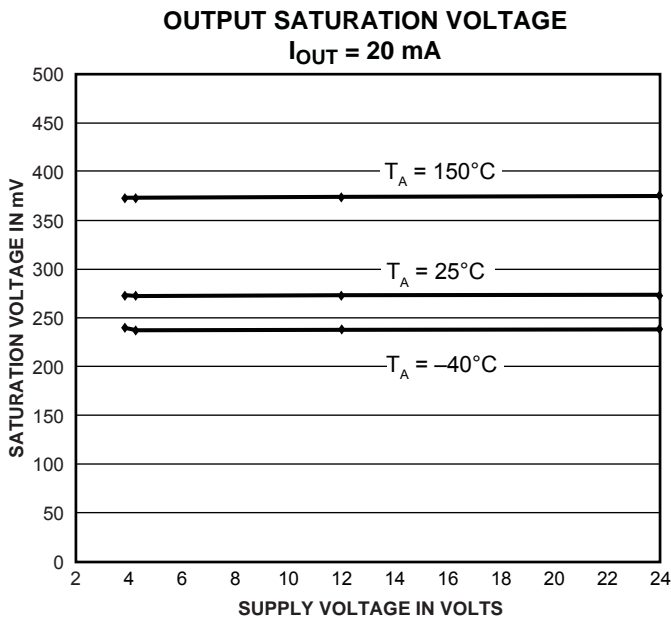
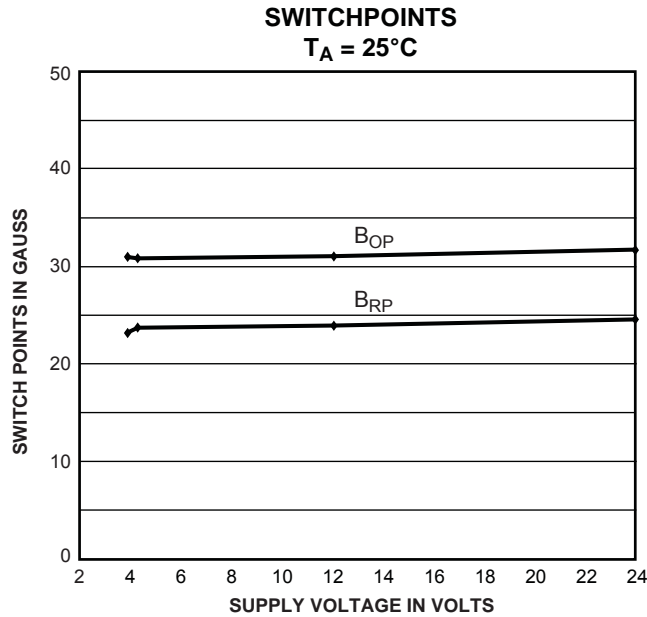
SUPPLY CURRENT  
 $B > B_{OP}$



SUPPLY CURRENT  
 $B < B_{RP}$



TYPICAL OPERATING CHARACTERISTICS  
as a function of supply voltage

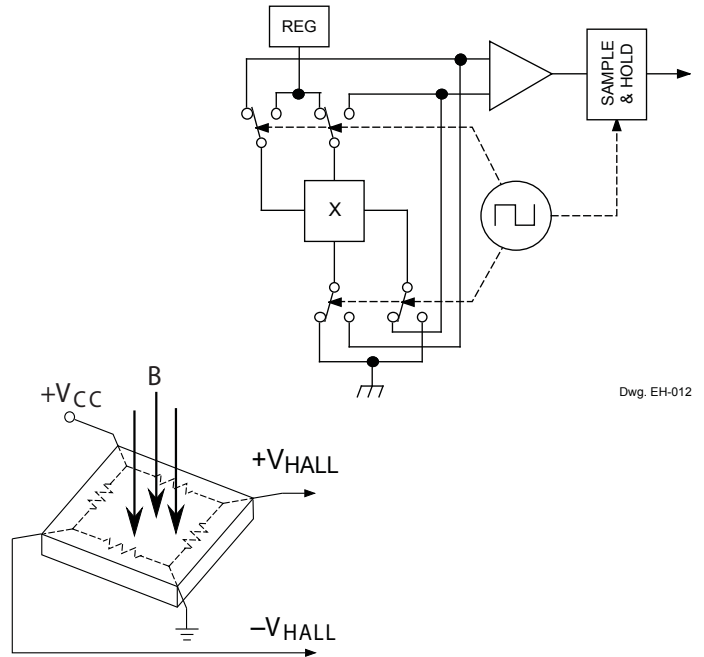


FUNCTIONAL DESCRIPTION

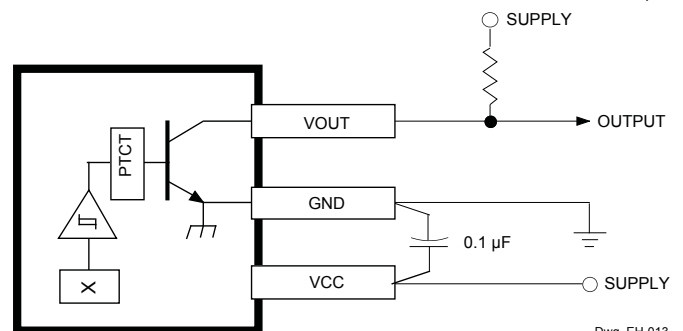
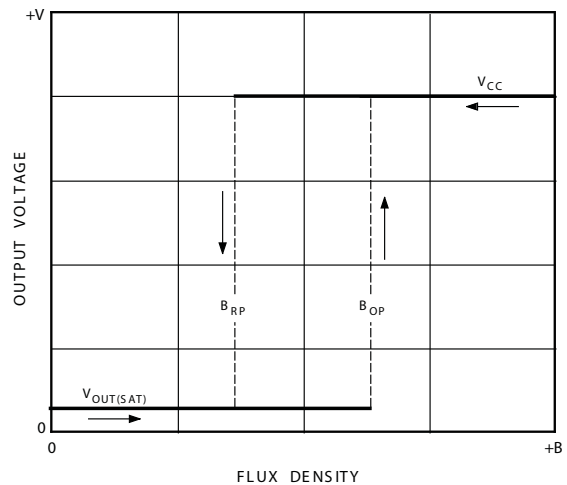
**Chopper-Stabilized Technique.** The Hall element can be considered as a resistor array similar to a Wheatstone bridge. A large portion of the offset is a result of the mismatching of these resistors. These devices use a proprietary dynamic offset cancellation technique, with an internal high-frequency 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](http://www.allegromicro.com).

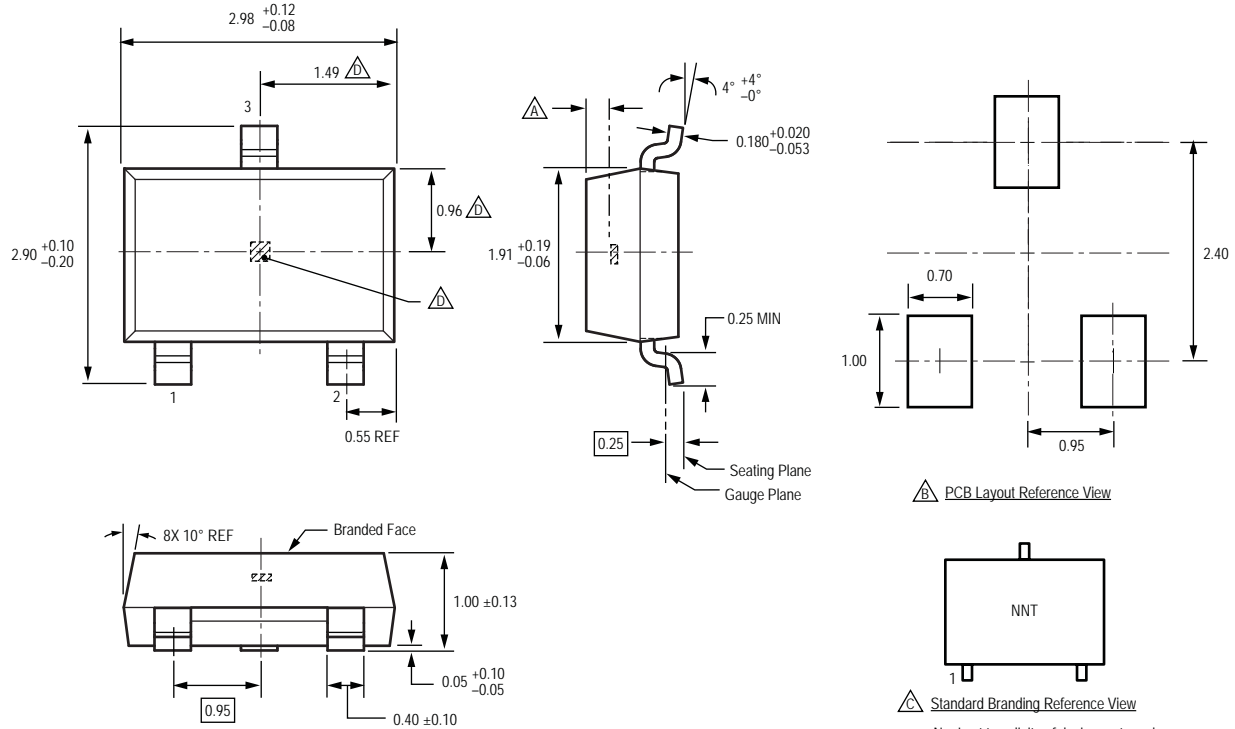


Dwg. EH-012



Dwg. EH-013

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

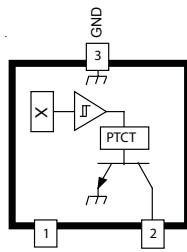


For Reference Only; not for tooling use (reference dwg. 802840)  
 Dimensions in millimeters  
 Dimensions exclusive of mold flash, gate burrs, and dambar protrusions  
 Exact case and lead configuration at supplier discretion within limits shown

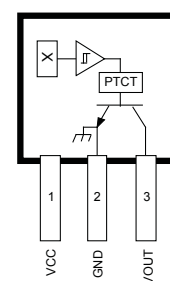
- Active Area Depth, 0.28 mm REF
- Reference land pattern layout  
All pads a minimum of 0.20 mm from all adjacent pads; adjust as necessary to meet application process requirements and PCB layout tolerances
- Branding scale and appearance at supplier discretion
- Hall element, not to scale

## Pin-out Diagrams

### Package LH



### Package UA

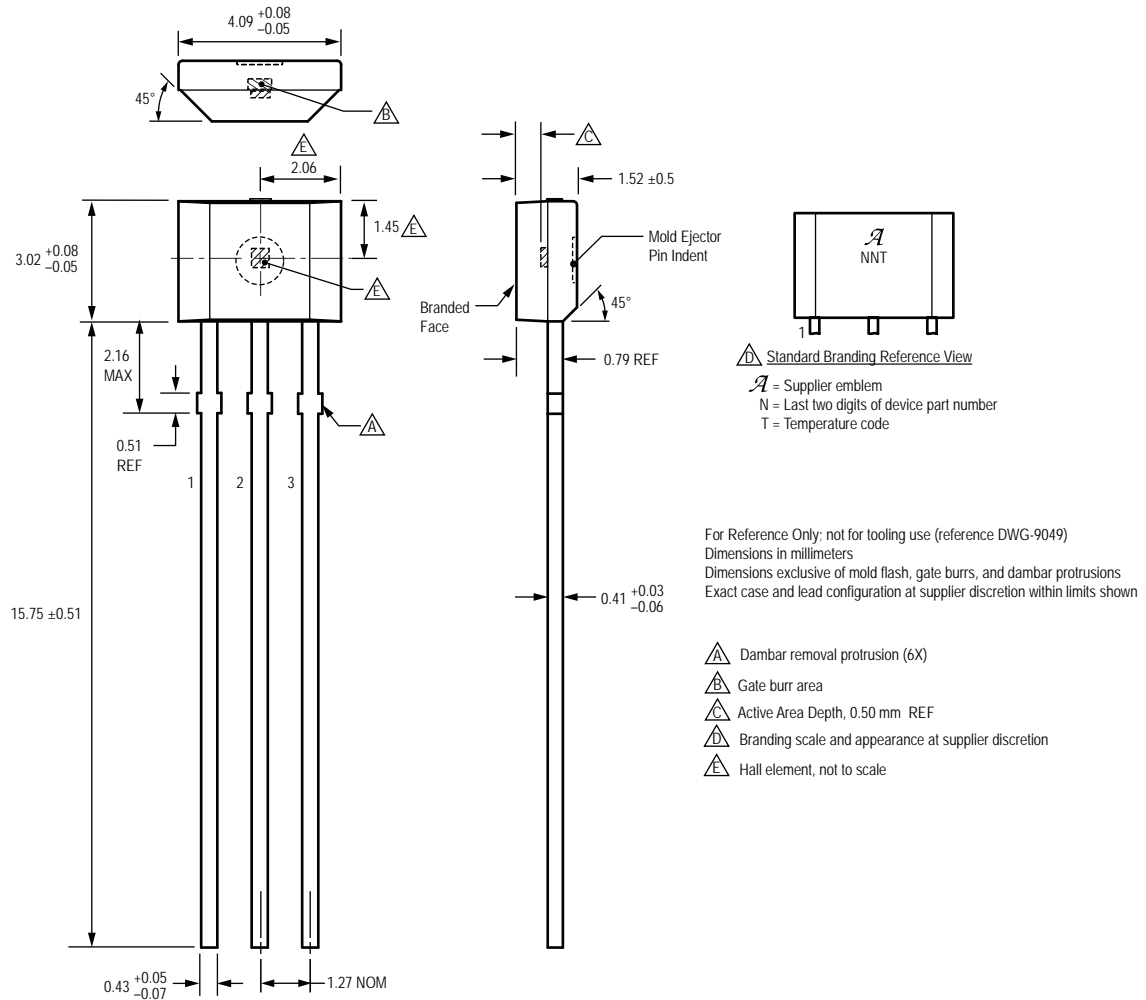


### Terminal List

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



**Package UA, 3-Pin SIP**



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