Chopper-Stabilized, Precision Hall-Effect Switch

Discontinued Product

This device is no longer in production. The device should not be purchased for new design applications. Samples are no longer available.

Date of status change: November 1, 2010

Recommended Substitutions:

For existing customer transition, and for new customers or new applications, refer to the A1125.

NOTE: For detailed information on purchasing options, contact your local Allegro field applications engineer or sales representative.
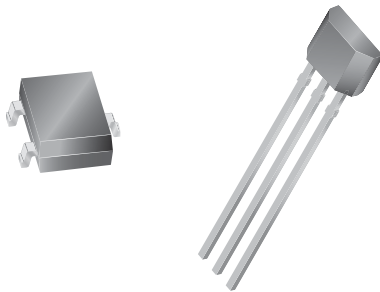
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Chopper-Stabilized, Precision Hall-Effect Switch

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

Description
The A3340 Hall effect switch is an extremely temperature-stable and stress-resistant sensor IC 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.

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

Not to scale

Functional Block Diagram
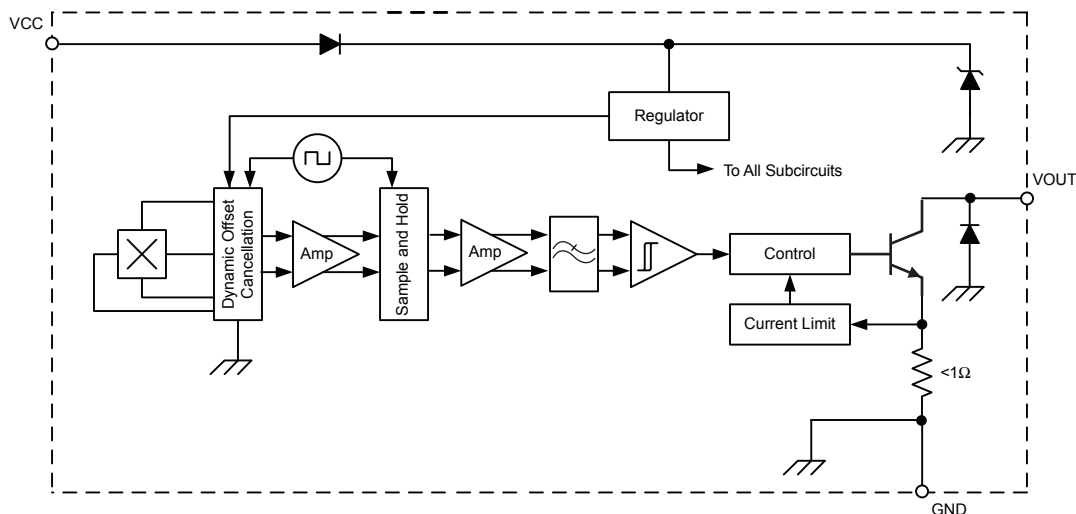
Selection Guide

Part Number	Packing[1]	Mounting	Ambient, T_A	B_{RP} (Min)	B_{OP} (Max)
A3340EUA-T[2]	Bulk, 500 pieces/bag	3-pin SIP through hole	–40ºC to 85ºC	5	50
A3340LUA-T[2]	Bulk, 500 pieces/bag	3-pin SIP through hole	–40ºC to 150ºC		

[1]Contact Allegro for additional packing options.

[2]Variant is in production but has been determined to be LAST TIME BUY. This classification indicates that the variant is obsolete and notice has been given. Sale of the variant is currently restricted to existing customer applications. The variant should not be purchased for new design applications because of obsolescence in the near future. Samples are no longer available. Status date change May 3, 2010. Deadline for receipt of LAST TIME BUY orders is October 29, 2010.

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	ºC
		Range L	–40 to 150	ºC
Maximum Junction Temperature	T_J(max)		165	ºC
Storage Temperature	T_{stg}		–65 to 170	ºC

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, $T_J < 165°C$	4.2	–	24	V
Output Leakage Current	I_{OFF}	$V_{OUT} = 24$ V, $B > B_{OP}$	–	–	10	µA
Output Saturation Voltage	$V_{OUT(SAT)}$	$I_{OUT} = 20$ mA, $B < B_{RP}$	–	270	500	mV
Output Current Limit	I_{OM}	$B < B_{RP}$	30	–	60	mA
Power-On Time	t_{PO}	$V_{CC} > 4.2$ V	–	–	50	µs
Chopping Frequency	f_C		–	340	–	kHz
Output Rise Time	t_r	$R_{LOAD} = 820$ Ω, $C_{LOAD} = 20$ pF	–	0.2	2.0	µs
Output Fall Time	t_f	$R_{LOAD} = 820$ Ω, $C_{LOAD} = 20$ pF	–	0.1	2.0	µs
Supply Current	I_{CC}	$B < B_{RP}$, $V_{CC} = 12$ V	–	3.0	6.0	mA
		$B > B_{OP}$, $V_{CC} = 12$ V	–	4.0	6.0	mA
Reverse Battery Current	I_{RCC}	$V_{RCC} = –30$ V	–	–	-5.0	mA
Zener Voltage	V_{ZD}	$V_Z + V_D$, $I_{CC} = 15$ mA, $T_A = 25°C$	28	32	37	V
Zener Impedance	Z_{ZD}	$Z_Z + Z_D$, $I_{CC} = 15$ mA, $T_A = 25°C$	–	50	–	Ω
Magnetic Characteristics[3]						
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

[1]Typical data are for initial design estimations only, and assume optimum manufacturing and application conditions, such as $T_A = 25°C$ and $V_{CC} = 12$ V. Performance may vary for individual units, within the specified maximum and minimum limits.
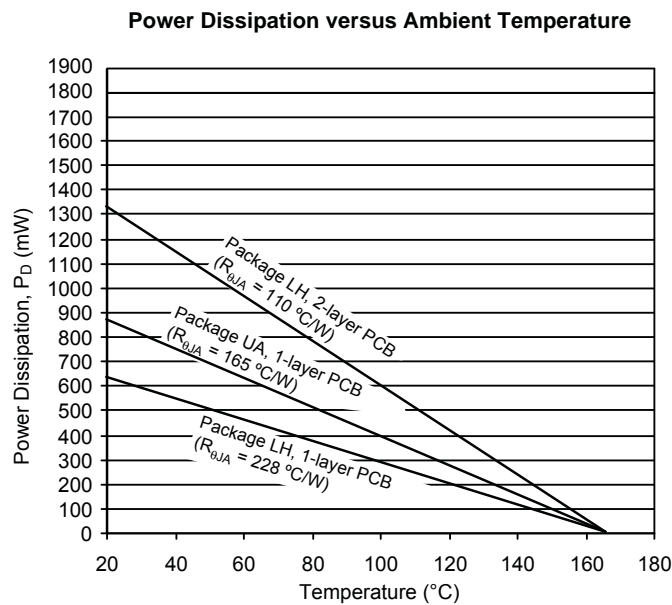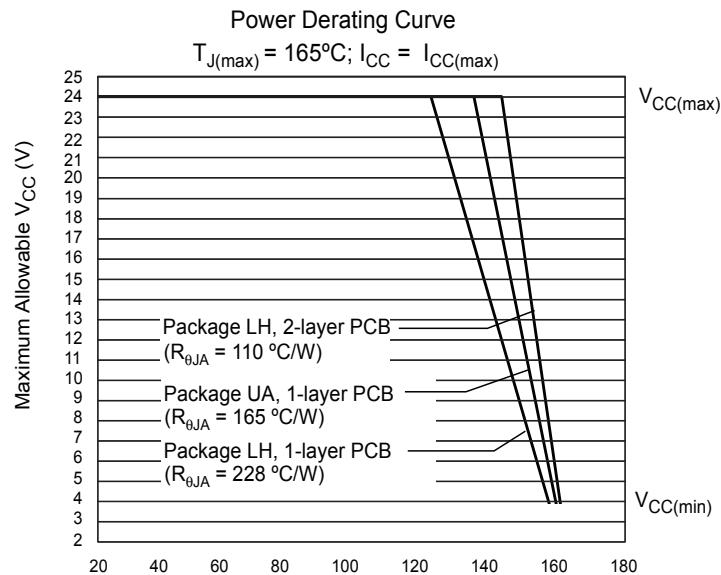[2]Maximum voltage must be adjusted for power dissipation and junction temperature.
[3]1 G (gauss) = 0.1 mT (millitesla).
[4]B_{OP} = operate point (output turns off); B_{RP} = release point (output turns on).

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	ºC/W
		Package LH, 2-layer PCB with 0.463 in^2 of copper area each side connected by thermal vias	110	ºC/W
		Package UA, 1-layer PCB with copper limited to solder pads	165	ºC/W

Power Derating Curve

$T_{J(max)} = 165ºC$; $I_{CC} = I_{CC(max)}$

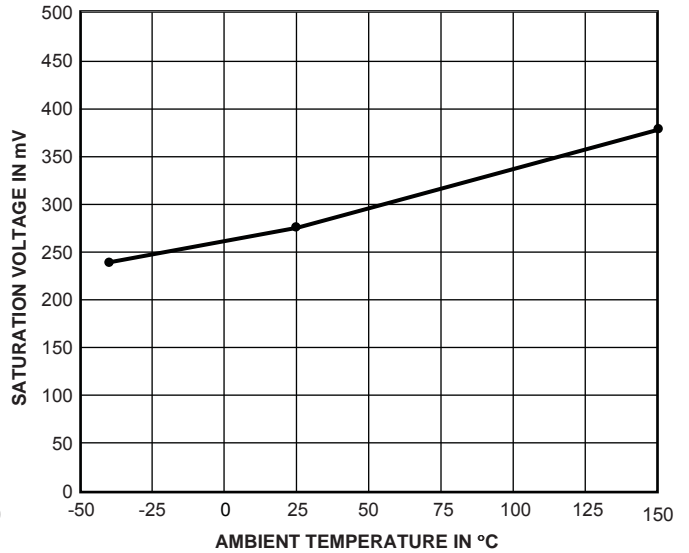Power Dissipation versus Ambient Temperature

TYPICAL OPERATING CHARACTERISTICS
as a function of temperature

SWITCHPOINTS
V_{CC} = 12 V
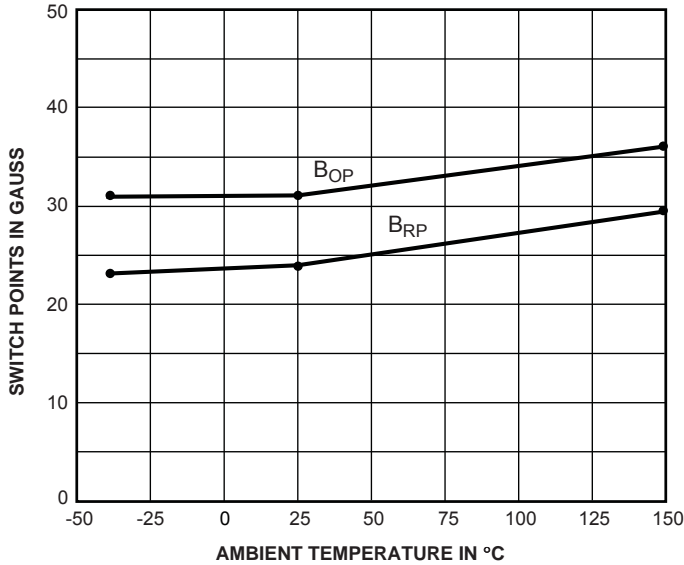
OUTPUT SATURATION VOLTAGE
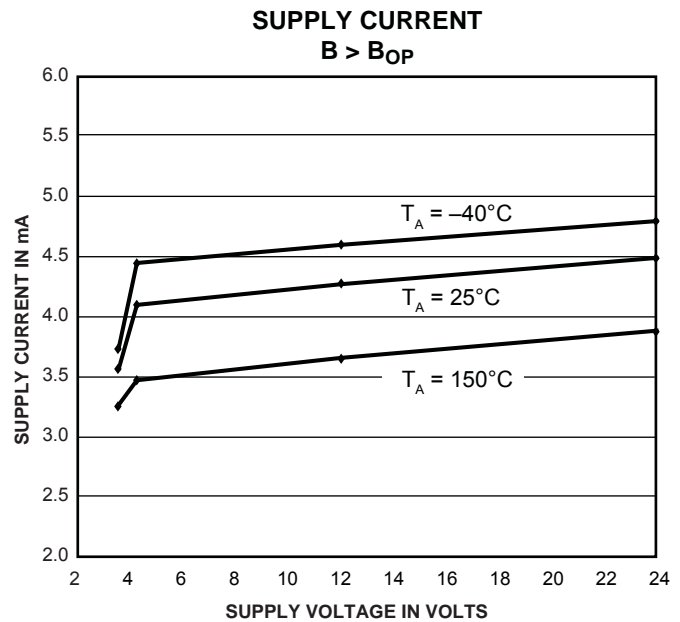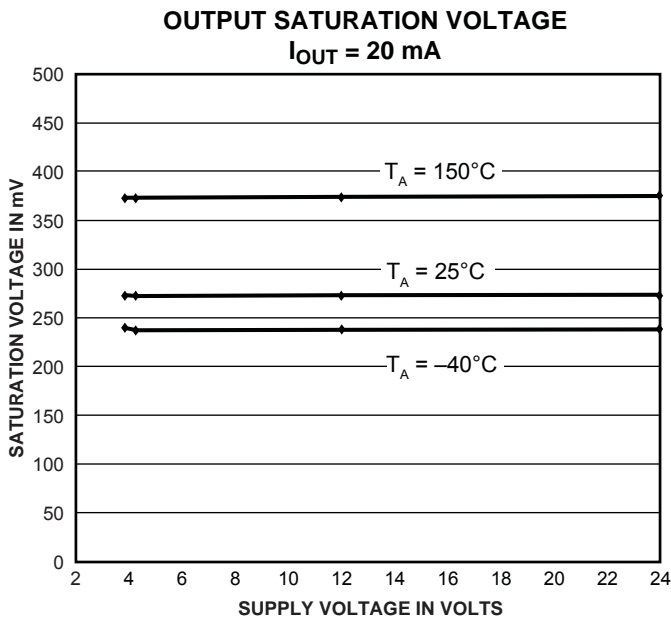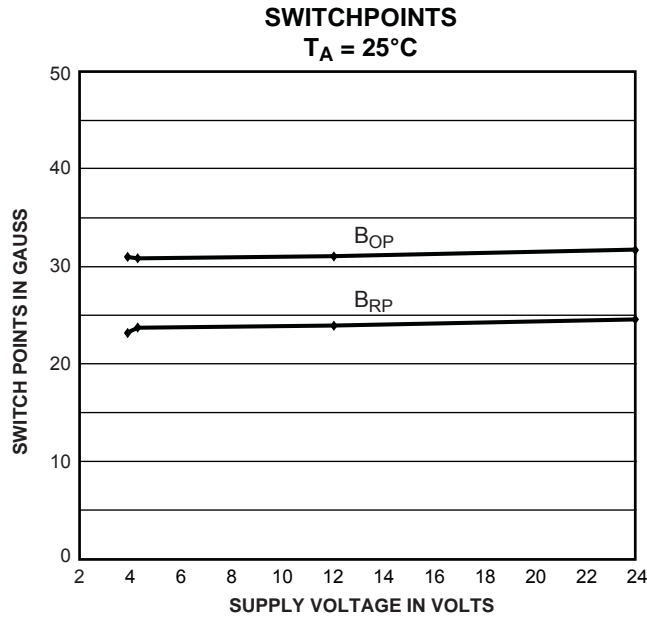V_{CC} = 12 V, I_{OUT} = 20 mA

SUPPLY CURRENT
$B > B_{OP}$
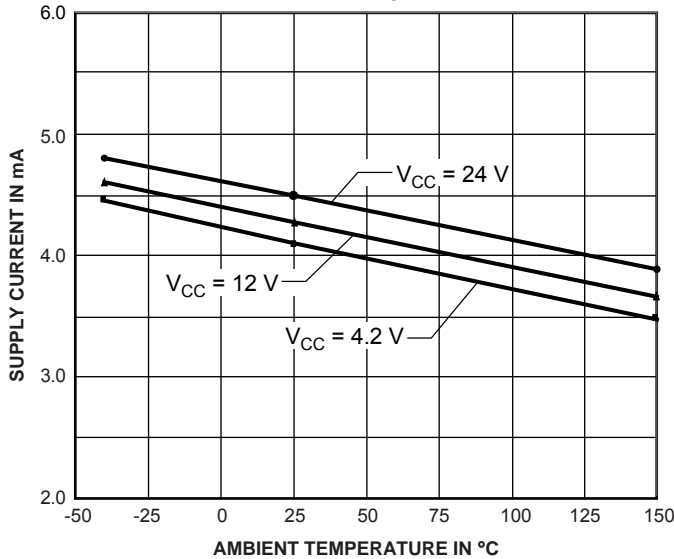
SUPPLY CURRENT
$B < B_{RP}$

5
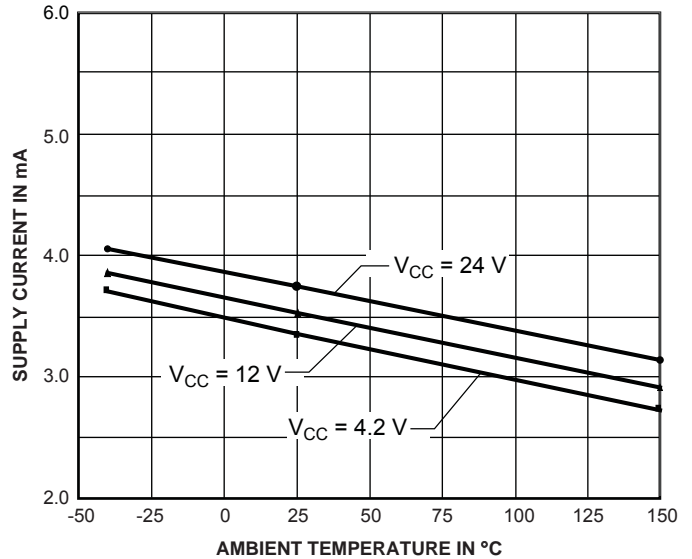
TYPICAL OPERATING CHARACTERISTICS
as a function of supply voltage

SWITCHPOINTS
$T_A = 25°C$

OUTPUT SATURATION VOLTAGE
$I_{OUT} = 20$ mA
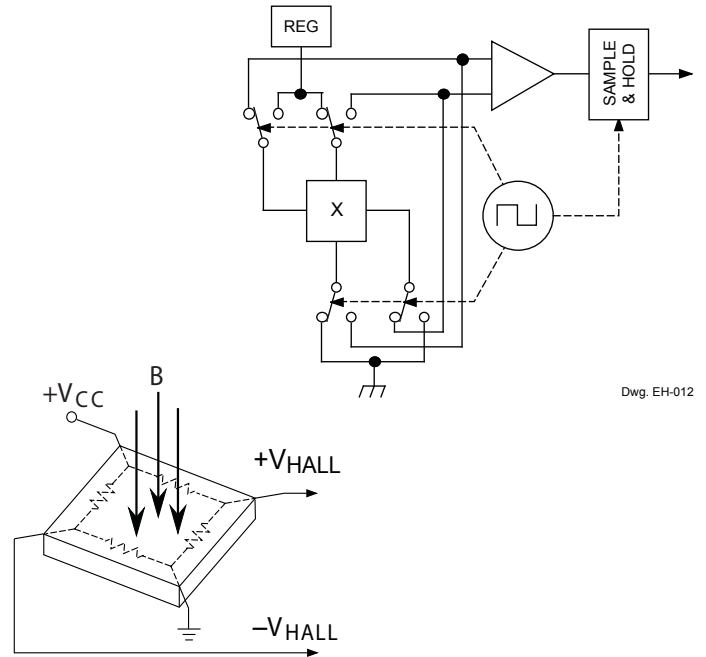

SUPPLY CURRENT
$B > B_{OP}$
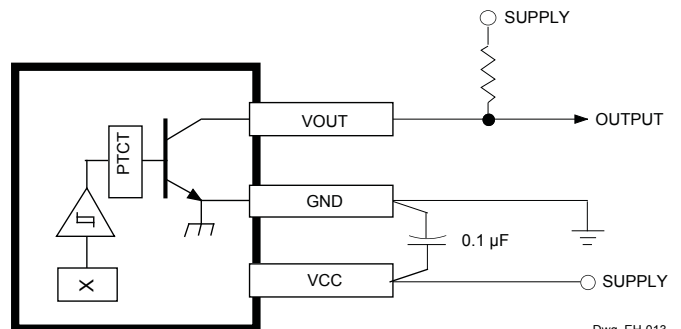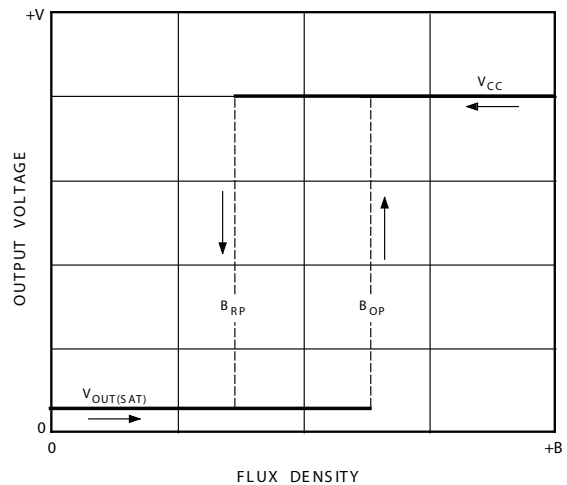
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FUNCTIONAL DESCRIPTION

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 Sensing 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 element 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 element) between the supply and ground of the device to reduce both external noise and noise generated by the chopper stabilization 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 devices is also available in Application Note 27701, or at www.allegromicro.com.
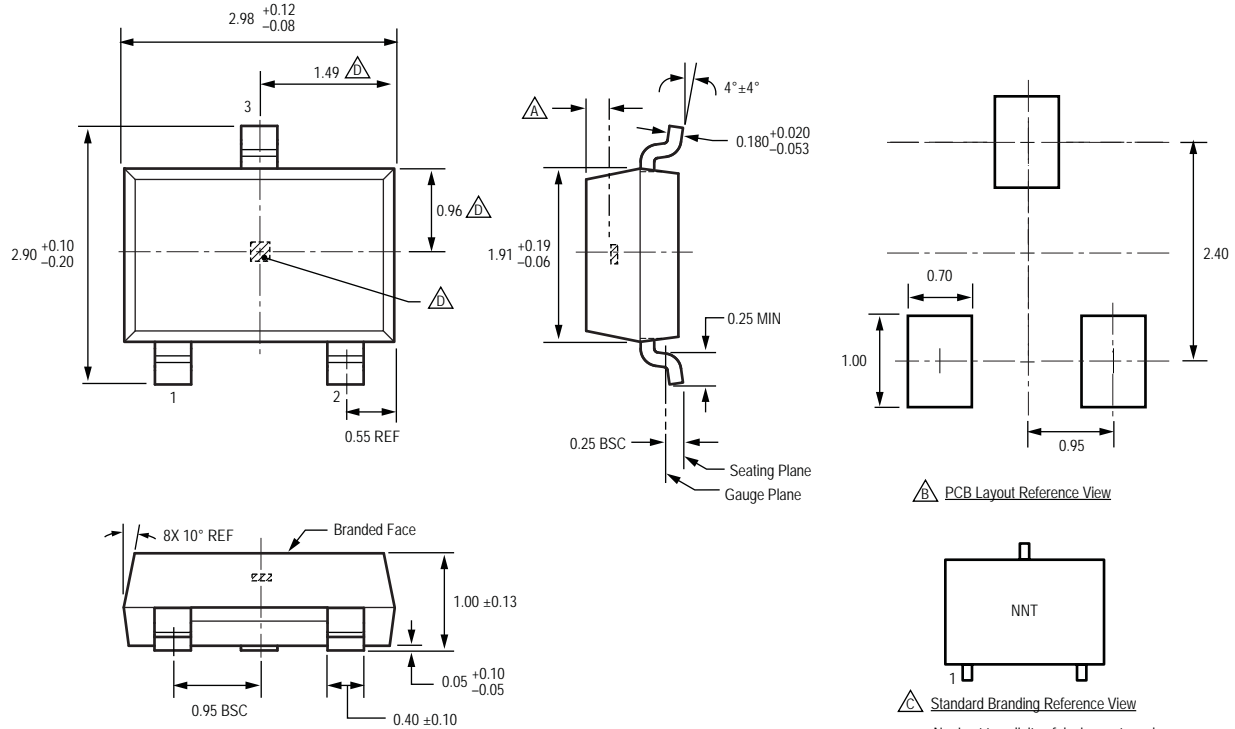

Dwg. EH-012

Dwg. EH-013

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

2.98 $^{+0.12}_{-0.08}$

1.49 Ⓓ

3

2.90 $^{+0.10}_{-0.20}$

0.96 Ⓓ

Ⓓ

1

2

0.55 REF

4°±4°

Ⓐ

0.180 $^{+0.020}_{-0.053}$

1.91 $^{+0.19}_{-0.06}$

0.25 MIN

0.25 BSC

Seating Plane

Gauge Plane

2.40

0.70

1.00

0.95

Ⓑ PCB Layout Reference View

8X 10° REF

Branded Face

1.00 ±0.13

0.95 BSC

0.05 $^{+0.10}_{-0.05}$

0.40 ±0.10

NNT

1

Ⓒ Standard Branding Reference View

N = Last two digits of device part number
T = Temperature code

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
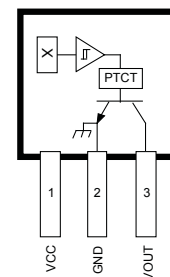
Ⓐ Active Area Depth, 0.28 mm REF

Ⓑ 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
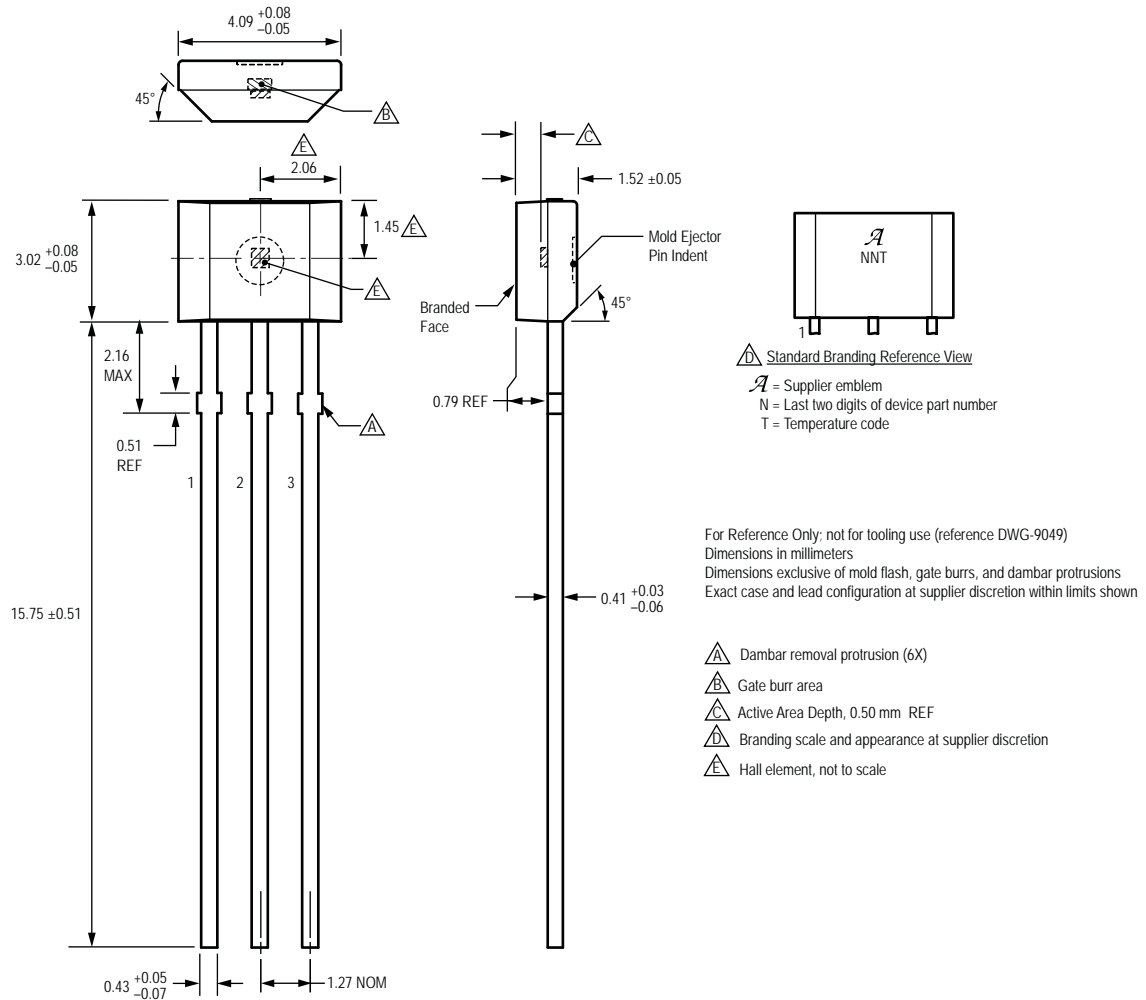
GND

3

PTCT

1

2

Package UA

PTCT

1

2

3

VCC

GND
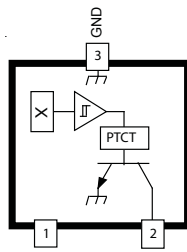
VOUT

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

8

Package UA, 3-Pin SIP

4.09 +0.08 −0.05

45°

2.06

1.45 E

3.02 +0.08 −0.05

E

2.16 MAX

0.51 REF

1 2 3

15.75 ±0.51

0.43 +0.05 −0.07

1.27 NOM

A

C

1.52 ±0.05

Mold Ejector Pin Indent

Branded Face

45°

0.79 REF

0.41 +0.03 −0.06

𝒜
NNT

1

D Standard Branding Reference View

𝒜 = Supplier emblem
N = Last two digits of device part number
T = Temperature code

For Reference Only; not for tooling use (reference DWG-9049)
Dimensions in millimeters
Dimensions exclusive of mold flash, gate burrs, and dambar protrusions
Exact case and lead configuration at supplier discretion within limits shown

A   Dambar removal protrusion (6X)
B   Gate burr area
C   Active Area Depth, 0.50 mm REF
D   Branding scale and appearance at supplier discretion
E   Hall element, not to scale

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