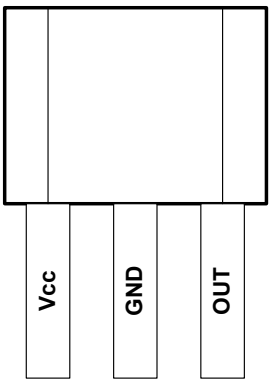
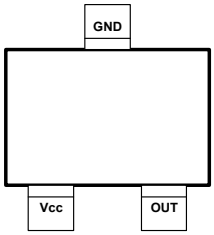
3290 and 3291

CHOPPER STABILIZED HALL-EFFECT LATCHES FOR ULTRA SENSITIVE AND STABLE OPERATION

Advanced Information
(Subject to change without notice)
Dec. 1998





ABSOLUTE MAXIMUM RATINGS
at T_A =+25°C

Supply Voltage, V_{CC} ..... **24 V**
Reverse Battery Voltage, V_{RCC} ..... **-24 V**
Magnetic Flux Density, B ..... **Unlimited**
Output OFF Voltage, V_{OUT} ..... **24 V**
Reverse Output Voltage, V_{OUT} ..... **-0.5 V**
Continuous Output Current,
I_{OUT} ..... **Limited on chip**
Operating Temperature Range, T_A
Suffix 'S–' ..... **-20°C to +85°C**
Suffix 'X–' ..... **-20°C to +115°C**
Storage Temperature Range,
T_S ..... **-65°C to +170°C**

The A3290 and A3291 Hall effect devices comprise a family of extremely high precision latches designed to operate over an extended temperature range. These devices use a chopper stabilization technique to eliminate inherent and environmental chip offsets providing improved magnetic sensitivity and guaranteeing latching behavior over the full operating temperature range. These devices are designed for use with multipole ring magnets. A south pole of sufficient strength will turn the output ON. A north pole magnetic field is necessary to turn the output OFF.

The family is lead by the extremely sensitive A3290 latch which is ideal for use in high density ring magnet applications such as in integrated bearing sensors. The family also includes a highly sensitive latch, the A3291 device. All of these devices exhibit the extremely stable switch points achievable with chopper stabilization. Each device includes a voltage regulator, zener clamping supply transient protection, a Hall element, a signal amplifier, a Schmitt trigger, temperature compensation circuitry, and an open-collector output with short circuit protection on a single silicon chip. The on-board regulator permits operation with supply voltages from 4.2 to 24 volts. The zener clamps, along with the use of an external current-limiting resistor, provide supply transient protection. A chopper stabilization technique reduces offset drift caused by temperature and stress, allowing extremely sensitive, symmetrical switch points and guaranteeing latching behavior.

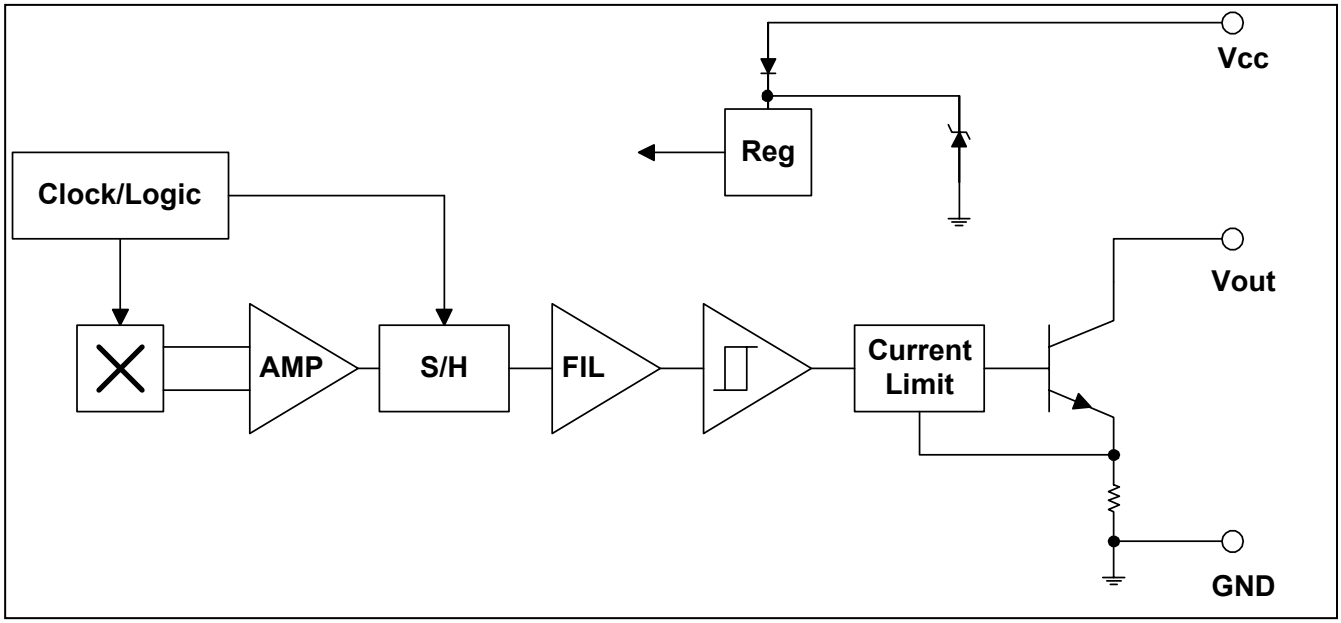
The first character of the part number suffix determines the device operating temperature range; suffix 'S–' is for -20°C to +85°C and 'X–' is -20°C to +115°C. They are supplied in three lead SIP (suffix –UA) or newly developed small surface mount SOHED (suffix –LH).

FEATURES

- All in one chip for high reliability
- Chopper stabilization technique
  - Guaranteed latch behavior
  - Extremely low symmetry drift
  - Stress insensitivity
- On-chip protection
  - Supply transient protection
  - Output short circuit protection
- 4.2 V to 24 V Operation
- On-board Voltage Regulator
- Reverse Battery Protection
- Small Size

115 Northeast Cutoff, Box 15036
Worcester, Massachusetts 01615-0036 (508) 853-5000

FUNCTIONAL BLOCK DIAGRAM



ELECTRICAL CHARACTERISTICS

over operating voltage and temperature range (unless otherwise specified).

Characteristics	Symbol	Test Conditions	Limits			
			Min.	Typ.	Max.	Units
Supply Voltage	V_{CC}	Operating	4.2	-	24	V
Output Saturation Voltage	$V_{OUT(SAT)}$	I_{OUT}=20mA, B>B_{OP}	-	185	500	mV
Output Leakage Current	I_{OFF}	V_{OUT}=24V, B<B_{RP}	-		10	µA
Supply Current	I_{CC}	B<B_{RP}(Output OFF)	-	3.0	7.0	mA
		B>B_{OP}(Output ON)	-	4.0	8.0	mA
Output Rise Time	t_r	R_L=820Ω, C_L=20pF	-	200	-	ns
Output Fall Time	t_f	R_L=820Ω, C_L=20pF		100		ns
Chopping Frequency	Fc			340		KHz
Power-up time	t_{on}			50		µS
Power-up state	POS	V_{CC}=0 to 5V, B=0		High		
Output Current Limit		On Chip Current limit	30		50	mA
V_{CC} Clamp Voltage	V_Z	I_{CC}=35mA	-	33	-	V
Reverse Battery Current	RI_{CC}	V_{RCC}=-30V			-5	mA

115 Northeast Cutoff, Box 15036
Worcester, Massachusetts 01615-0036 (508) 853-5000

MAGNETIC CHARACTERISTICS

over operating supply voltage and Temperature range.

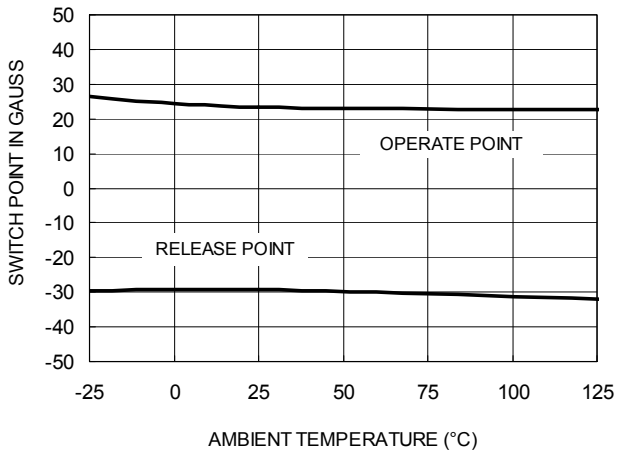
Characteristic	Symbol	3290			3291			Units
		Min.	Typ.	Max.	Min.	Typ.	Max.	
Operate Point	B_{OP}	5	22	50	10	50	100	G
Release Point	B_{RP}	-50	-23	-5	-100	-50	-10	G
Hysteresis	B_{hys}		45			100		G

Notes: B_{OP}=operate point (output turns ON);B_{RP}=release point (output turns OFF); B_{hys}=hysteresis (B_{OP}-B_{RP}).
As used here, negative flux densities are defined as less than zero (algebraic convention).
Typical values are at T_A=+25°C and V_{CC}=12V.

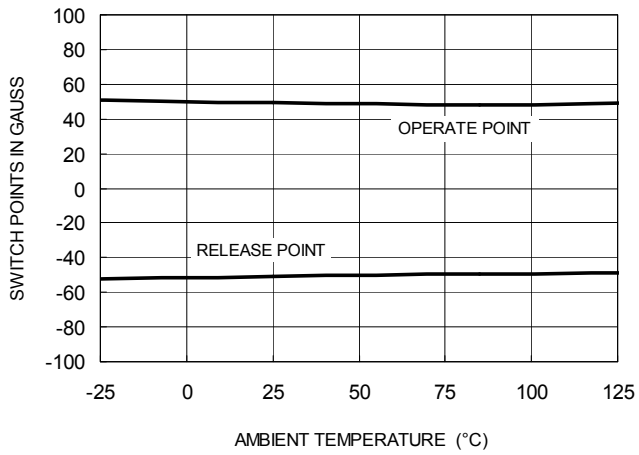
115 Northeast Cutoff, Box 15036
Worcester, Massachusetts 01615-0036 (508) 853-5000

TYPICAL OPERATING CHARACTERISTICS

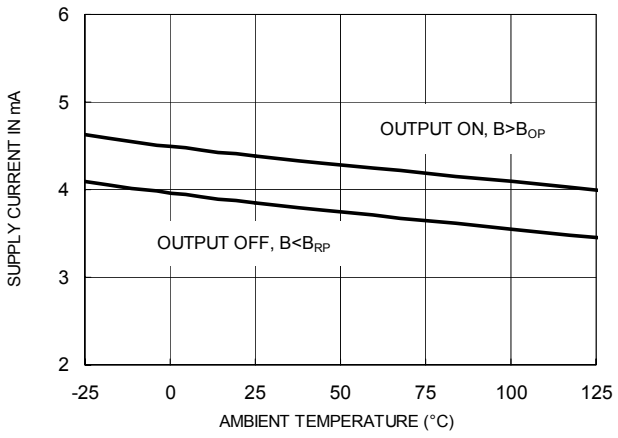
A3290 SWITCH POINTS



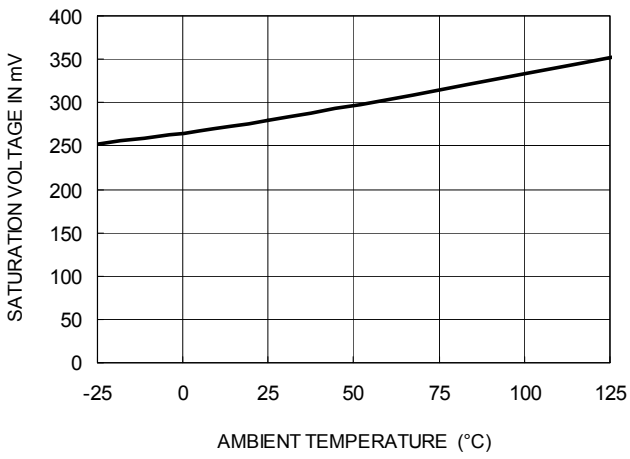
A3291 SWITCH POINTS



SUPPLY CURRENT



SATURATION VOLTAGE

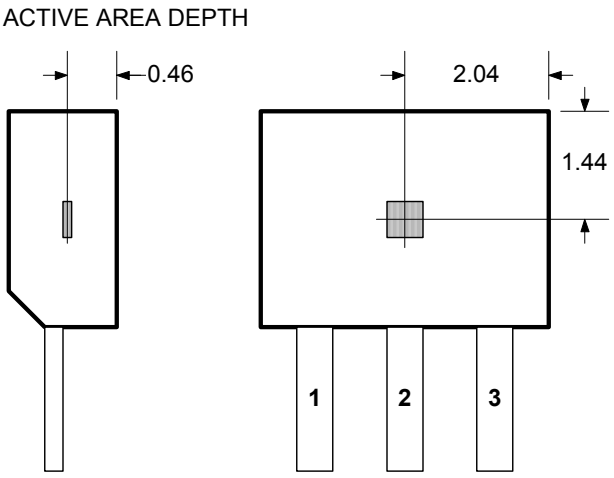


115 Northeast Cutoff, Box 15036
Worcester, Massachusetts 01615-0036 (508) 853-5000

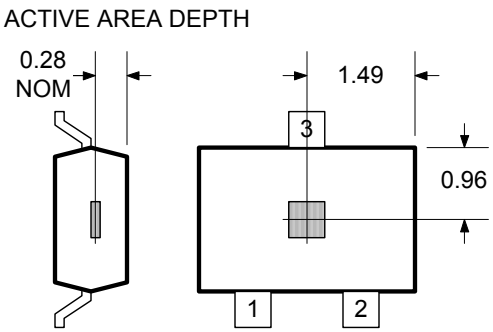
SENSOR LOCATIONS in Millimeters

(±0.005" [0.13 mm] die placement)

Suffix "UA"



Suffix "LH"



OPERATION

The output of these devices (pin 3) switches low when the magnetic field at the Hall sensor exceeds the operate point threshold (B_{OP}). At this point, the output voltage is $V_{OUT(SAT)}$. When the magnetic field is reduced to below the release point (B_{RP}) the device output goes high. Note especially that release can occur when the magnetic field is removed but to ensure release, a field reversal is required. The difference in the magnetic operate and release points is called 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 chopper stabilization technique.

115 Northeast Cutoff, Box 15036
Worcester, Massachusetts 01615-0036 (508) 853-5000

FUNCTIONAL DESCRIPTION

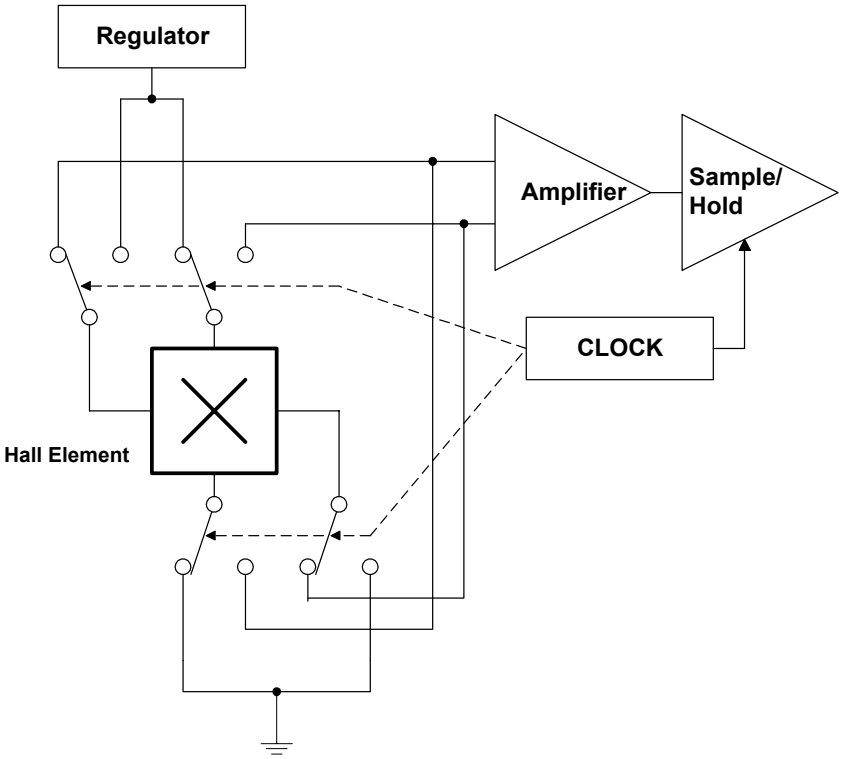
Chopper stabilized Technique

A Proprietary dynamic offset cancellation technique, with an internal high-frequency clock, reduces the residual offset voltage of the Hall element, which is normally caused by device overmolding, temperature dependencies, and thermal stress. This technique produces devices that have an extremely stable quiescent Hall output voltage, are immune to mechanical stress, and have precise recoverability after temperature cycling. Many problems normally associated with low-level analog signals are minimized by having the Hall element and amplifier in a single chip. Switch point precision is obtained by trim adjustments during the manufacturing process.

The hall element is considered as resistor array. A large portion of the offset is belonging to the mis-matching of these resistor arrays. The concept of the chopper stabilizing technique is to cancel the mis-matching of the resistor by changing the direction of the current flowing of the Hall plate and Hall voltage measurement tap, maintaining the Hall voltage signal that is induced by external magnetic flux. The analog signal is, then, captured by sample and hold circuit for the next stage of the circuit to be averaged.

The device is using Allegro's advanced wafer process, DABICIV (Digital Analog BiCmos), which allow to implement CMOS switch and other precision analog and digital functions without using large area of Si chip.

Concept of Chopper stabilizing technique

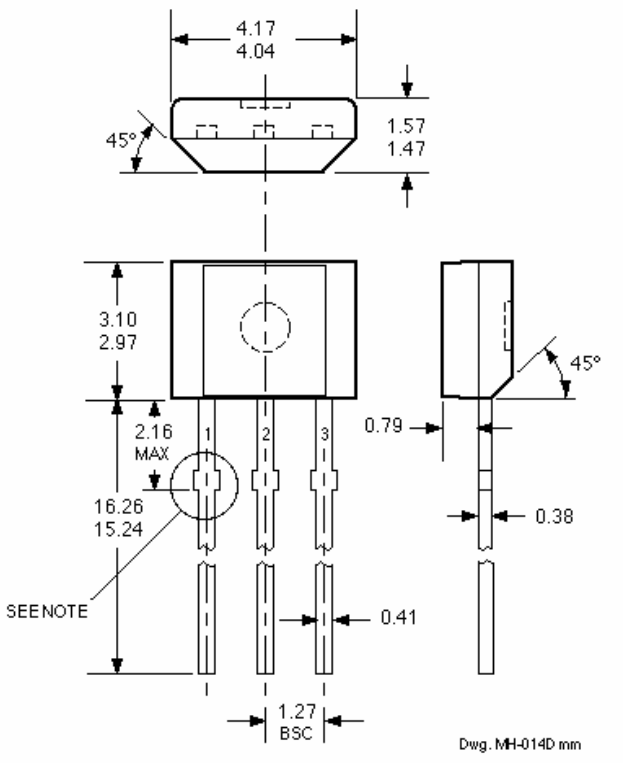


115 Northeast Cutoff, Box 15036
Worcester, Massachusetts 01615-0036 (508) 853-5000

PACKAGE INFORMATION

Dimensions in Millimeters
(Based on 1”=25.4mm)

Suffix “UA”



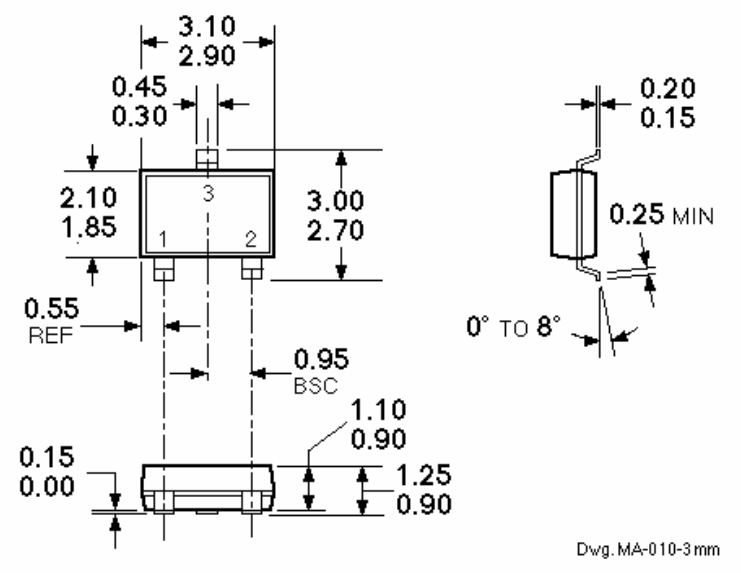
Pin1: VCC
Pin2: GND
Pin3: OUT

NOTES:
1. Tolerances on package height and width represent allowable mold offsets. Dimensions given are measured at the widest point (parting line).
2. Exact body and lead configuration at vendor’s option within limits shown.
3. Height does not include mold gate flash.
4. Recommended minimum PWB hole diameter to clear transition area is 0.035" (0.89 mm).
5. Where no tolerance is specified, dimension is nominal.

115 Northeast Cutoff, Box 15036
Worcester, Massachusetts 01615-0036 (508) 853-5000

Dimensions in Millimeters
(Based on 1”=25.4mm)

Suffix “LH”



Pin1: VCC
Pin2: OUT
Pin3: GND

115 Northeast Cutoff, Box 15036
Worcester, Massachusetts 01615-0036 (508) 853-5000