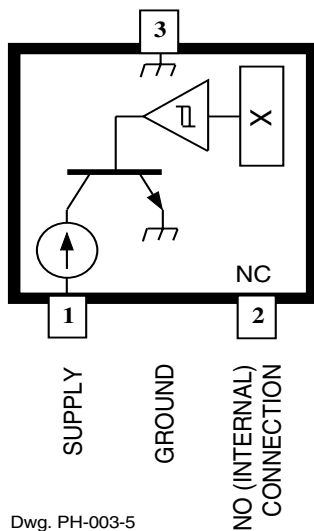


3361 AND 3362

2-WIRE, CHOPPER-STABILIZED, HALL-EFFECT SWITCHES

Suffix Code 'LH' Pinning



Pinning is shown viewed from branded side.

PRELIMINARY INFORMATION (subject to change without notice) August 28, 2000

ABSOLUTE MAXIMUM RATINGS at $T_A=+25^\circ\text{C}$

| | |
|--|-----------------|
| Supply Voltage, V_{CC} | 26.5 V |
| Reverse Battery Voltage, V_{RCC} | -16 V |
| Magnetic Flux Density, B | Unlimited |
| Package Power Dissipation, P_D . See Graph | |
| Junction Temperature, T_j | +170°C |
| Operating Temperature Range, T_A | -40°C to +85°C |
| Storage Temperature Range, T_S | -65°C to +170°C |

The A3361x and A3362x Hall-effect switches are extremely temperature-stable and stress-resistant sensors. Superior performance over temperature is made possible through dynamic offset cancellation, which reduces the residual offset voltage normally caused by device overmolding, temperature dependencies, and thermal stress. The two devices differ only in output polarity; the A3361x output current goes low in the presence of a south pole of sufficient strength; the A3362x output current goes high.

Each device includes on a single silicon chip a voltage regulator, Hall-voltage generator, small-signal amplifier, chopper stabilization, Schmitt trigger, and a constant-current open-collector output. An on-board regulator permits operation with supply voltages of 3.5 to 24 volts. Noise radiation is limited by control of the output current slew rate.

Three package styles provide a magnetically optimized package for most applications. Suffix 'xLH' is a miniature low-profile surface-mount package, 'xLT' is a miniature SOT-89/TO-243AA transistor package for surface-mount applications; while suffix 'xUA' is a three-lead ultra-mini-SIP for through-hole mounting.

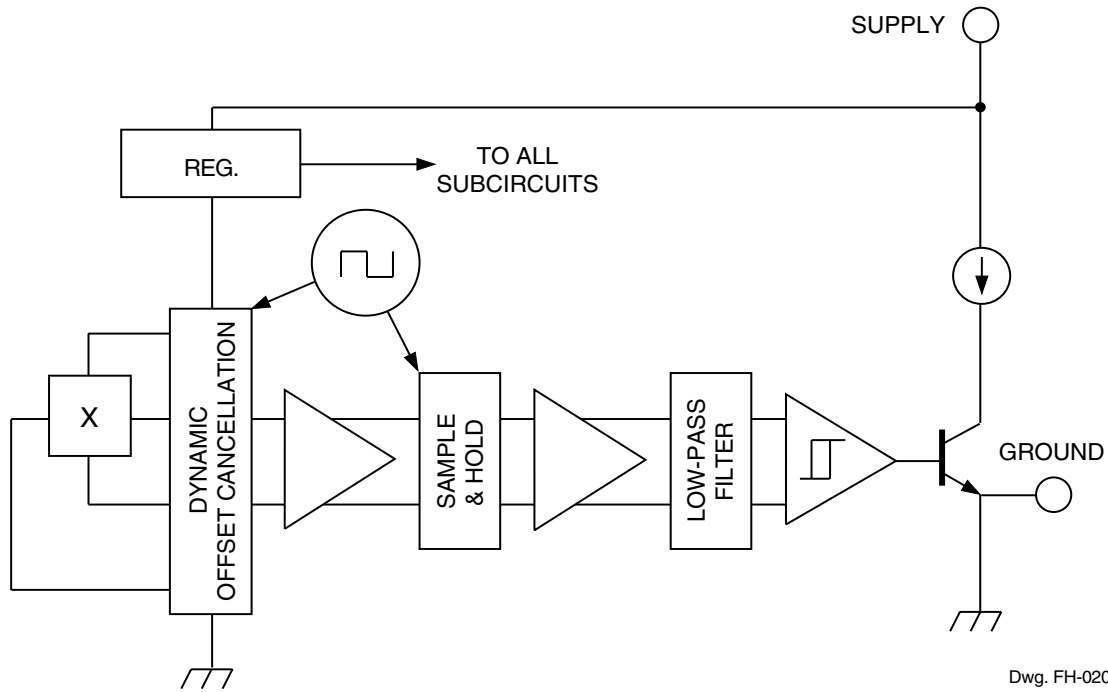
FEATURES

- Internal Current Regulator for 2-Wire Operation
- Resistant to Physical Stress
- Superior Temperature Stability
- Operation From Unregulated Supply
- Solid-State Reliability
- Small Size

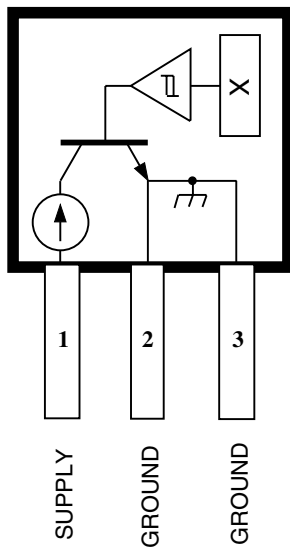
Always order by complete part number: the prefix 'A' + the basic four-digit part number + a suffix to indicate operating temperature range (E) + a two-letter suffix to indicate package style, e.g., **A3361ELH**.

3361 AND 3362
2-WIRE,
CHOPPER-STABILIZED,
HALL-EFFECT SWITCHES

FUNCTIONAL BLOCK DIAGRAM

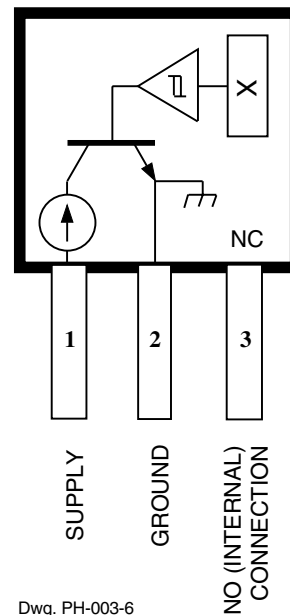


Suffix Code 'UA' Pinning (SIP)



Dwg. PH-003-7A

Suffix Code 'LT' Pinning (SOT-89/TO-243AA)



Dwg. PH-003-6

Pinning is shown viewed from branded side.

3361 AND 3362
2-WIRE,
CHOPPER-STABILIZED,
HALL-EFFECT SWITCHES

ELECTRICAL CHARACTERISTICS over operating temperature range.

| Characteristic | Symbol | Test Conditions | Limits | | | |
|-------------------------|--------------|---------------------|--------|------|------|---------|
| | | | Min. | Typ. | Max. | Units |
| Supply Voltage | V_{CC} | Operating | 3.5 | 12 | 24 | V |
| Output Current | $I_{GND(L)}$ | Output Current Low | 5.0 | – | 6.9 | mA |
| | $I_{GND(H)}$ | Output Current High | 12 | – | 17 | mA |
| Chopping Frequency | f_C | | – | 340 | – | kHz |
| Output Settling Time | t_{sd} | $C_L = 20$ pF | – | – | 50 | μ s |
| Output Rise Time | t_r | $C_L = 20$ pF | – | 3.5 | – | μ s |
| Output Fall Time | t_f | $C_L = 20$ pF | – | 3.5 | – | μ s |
| Reverse Battery Current | I_{CC} | $V_{RCC} = -16$ V | – | – | -15 | mA |

NOTE: Typical Data is at $T_A = +25^\circ\text{C}$ and $V_{CC} = 12$ V and is for design information only.

A3361 MAGNETIC CHARACTERISTICS over operating supply voltage and temperature ranges.

| Characteristic | Symbol | Test Conditions | Limits | | | |
|----------------|-----------|--|--------|------|------|-------|
| | | | Min. | Typ. | Max. | Units |
| Operate Point | B_{OP} | $B > B_{OP}$, $I_{GND} = \text{LOW}$ | – | – | 125 | G |
| Release Point | B_{RP} | $B < B_{RP}$, $I_{GND} = \text{HIGH}$ | 40 | – | – | G |
| Hysteresis | B_{hys} | $B_{OP} - B_{RP}$ | 5.0 | – | 30 | G |

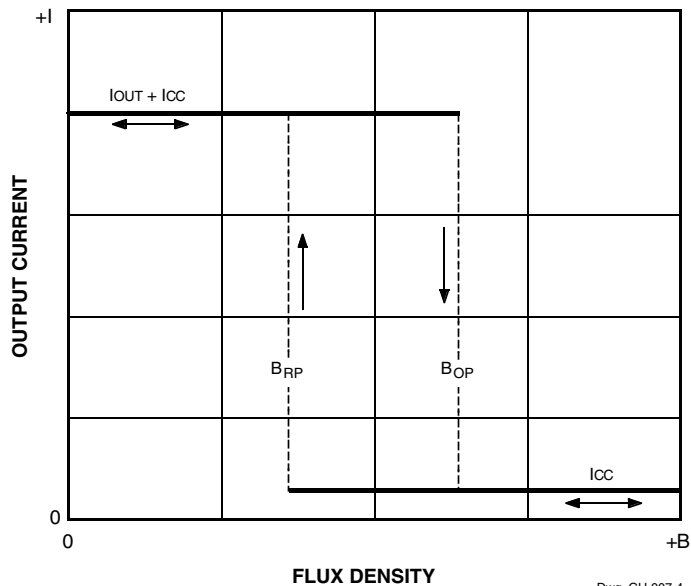
A3362 MAGNETIC CHARACTERISTICS over operating supply voltage and temperature ranges.

| Characteristic | Symbol | Test Conditions | Limits | | | |
|----------------|-----------|--|--------|------|------|-------|
| | | | Min. | Typ. | Max. | Units |
| Operate Point | B_{OP} | $B > B_{OP}$, $I_{GND} = \text{HIGH}$ | – | – | 125 | G |
| Release Point | B_{RP} | $B < B_{RP}$, $I_{GND} = \text{LOW}$ | 40 | – | – | G |
| Hysteresis | B_{hys} | $B_{OP} - B_{RP}$ | 5.0 | – | 30 | G |

3361 AND 3362
2-WIRE,
CHOPPER-STABILIZED,
HALL-EFFECT SWITCHES

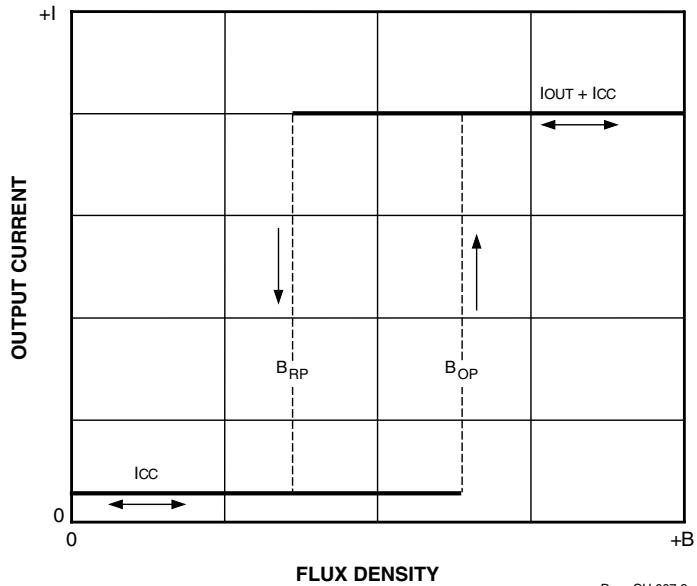
OUTPUT CHARACTERISTICS

A3361x



Dwg. GH-007-4

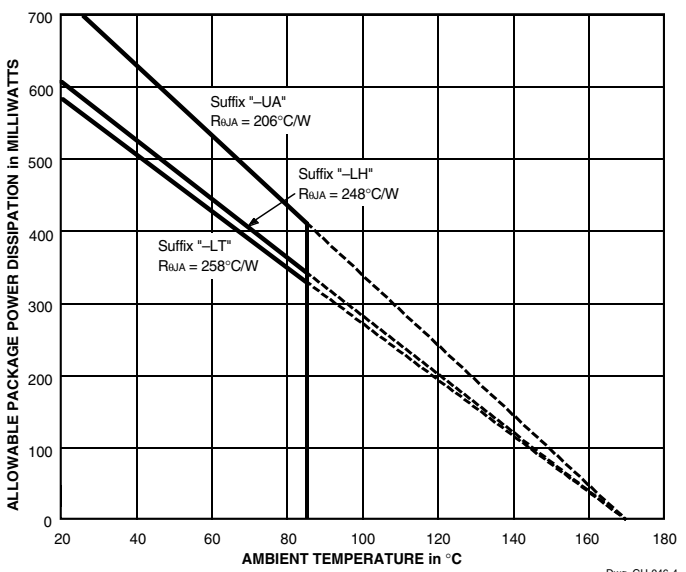
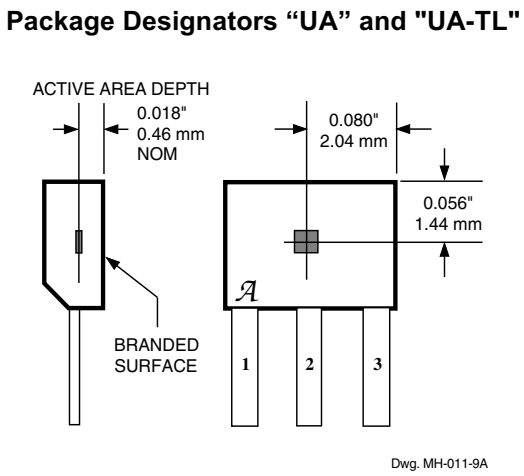
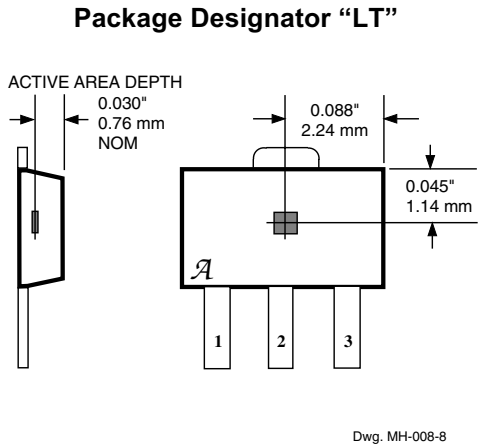
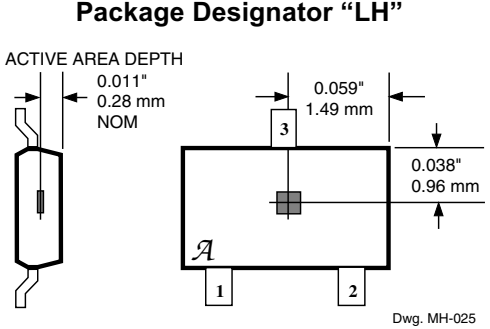
A3362x



Dwg. GH-007-3

3361 AND 3362 2-WIRE, CHOPPER-STABILIZED, HALL-EFFECT SWITCHES

SENSOR LOCATIONS (±0.005" [0.13 mm] die placement)



Although sensor location is accurate to three sigma for a particular design, product improvements may result in small changes to sensor location.

3361 AND 3362
2-WIRE,
CHOPPER-STABILIZED,
HALL-EFFECT SWITCHES

CRITERIA FOR DEVICE QUALIFICATION

All Allegro sensors are subjected to stringent qualification requirements prior to being released to production. To become qualified, except for the destructive ESD tests, no failures are permitted.

| Qualification Test | Test Method and Test Conditions | Test Length | Samples | Comments |
|--|--|------------------|------------|---|
| Biased Humidity (HAST) | $T_A = 130^{\circ}\text{C}$, RH = 85% | 50 hrs | 77 | $V_{CC} = V_{OUT} = 5\text{ V}$ |
| High-Temperature Operating Life (HTOL) | JESD22-A108, $T_A = 150^{\circ}\text{C}$, $T_J = 165^{\circ}\text{C}$ | 408 hrs | 77 | $V_{CC} = 24\text{ V}$, $V_{OUT} = 20\text{ V}$ |
| Accelerated HTOL | JESD22-A108, $T_A = 175^{\circ}\text{C}$, $T_J = 190^{\circ}\text{C}$ | 504 hrs | 77 | $V_{CC} = 24\text{ V}$, $V_{OUT} = 20\text{ V}$ |
| Autoclave, Unbiased | JESD22-A102, Condition C, $T_A = 121^{\circ}\text{C}$, 15 psig | 96 hrs | 77 | |
| High-Temperature (Bake) Storage Life | MIL-STD-883, Method 1008, $T_A = 170^{\circ}\text{C}$ | 1000 hrs | 77 | |
| Temperature Cycle | MIL-STD-883, Method 1010, -65°C to $+150^{\circ}\text{C}$ | 500 cycles | 77 | |
| Latch-Up | — | Pre/Post Reading | 6 | |
| Electro-Thermally Induced Gate Leakage | — | Pre/Post Reading | 6 | |
| ESD, Human Body Model | CDF-AEC-Q100-002 | Pre/Post Reading | x per test | Test to failure, All leads > TBD |
| Electrical Distributions | Per Specification | — | 30 | |

3361 AND 3362 2-WIRE, CHOPPER-STABILIZED, HALL-EFFECT SWITCHES

FUNCTIONAL DESCRIPTION

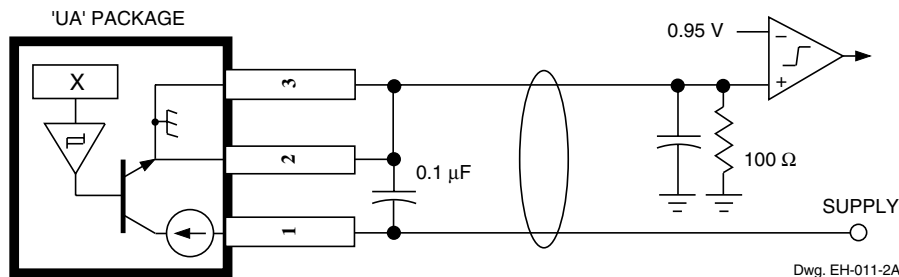
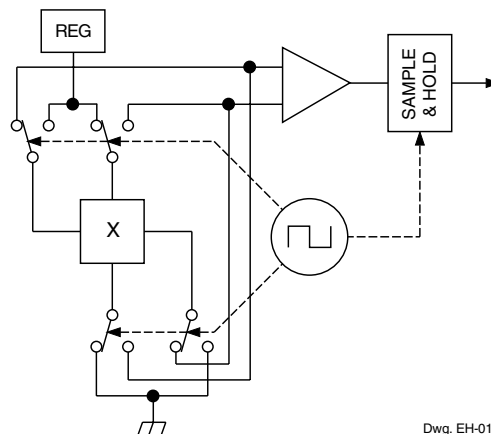
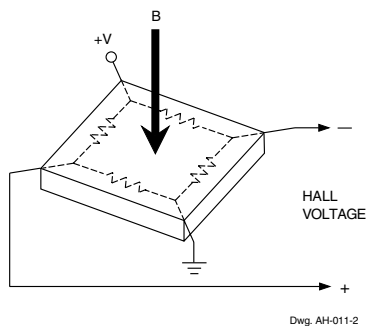
Chopper-Stabilized Technique. The Hall element can be considered as a resistor array similar to a Wheatstone bridge. A large portion of the offset is a result of the mismatching of these resistors. These devices use a proprietary dynamic offset cancellation technique, with an internal high-frequency 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. As shown in the output characteristic graphs, the output of the A3362 turns on when a magnetic field (south pole) perpendicular to the Hall sensor is increased above the operate point threshold (B_{OP}). After turn on, the output will source current equal to the device operating current plus a current source ($I_{GND(H)}$). When the magnetic field is decreased below the release point (B_{RP}), the output turns off and will source current equal only to the Hall-effect sensor operating current ($I_{GND(L)}$). The A3361 output is inverted and the device turns off at B_{OP} and on at B_{RP} . The difference in the magnetic operate and release points is the hysteresis (B_{hys}) of the device. The hysteresis allows clean switching of the output even in the presence of external mechanical vibration or 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.

Extensive applications information on magnets and Hall-effect sensors is also available in the *Allegro Electronic Data Book AMS-702* or *Application Note 27701* or www.allegromicro.com



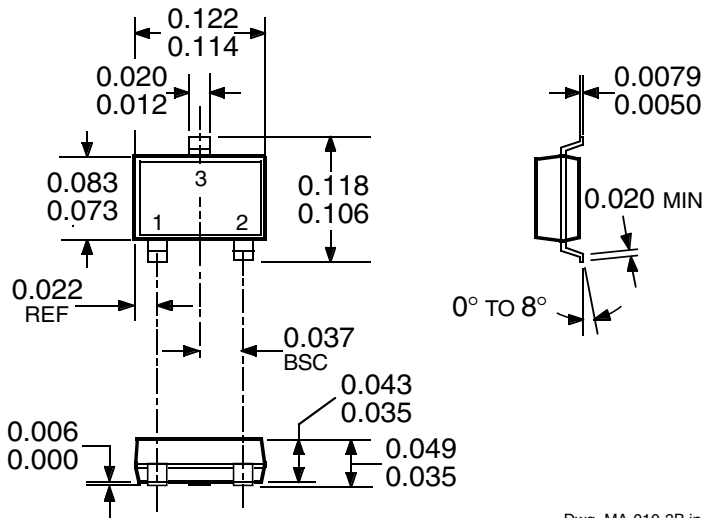
3361 AND 3362

2-WIRE, CHOPPER-STABILIZED, HALL-EFFECT SWITCHES

PACKAGE DESIGNATOR 'LH'

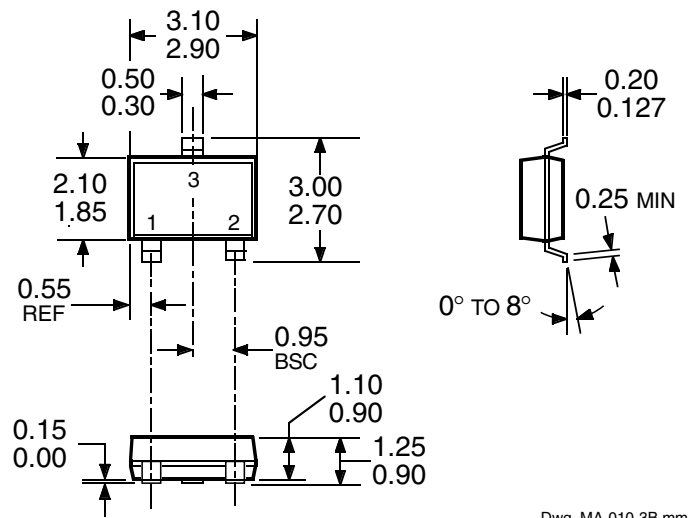
(fits SC-74A solder-pad layout)

Dimensions in Inches
(for reference only)

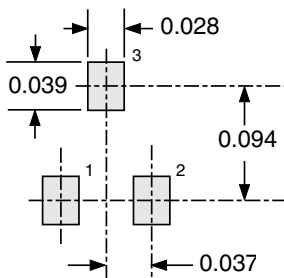


Dwg. MA-010-3B in

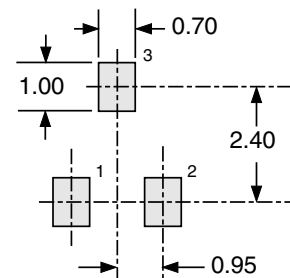
Dimensions in Millimeters
(controlling dimensions)



Dwg. MA-010-3B mm



Dwg. MA-011-3 in



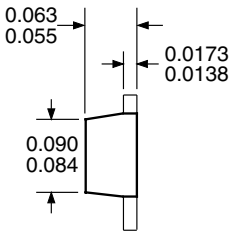
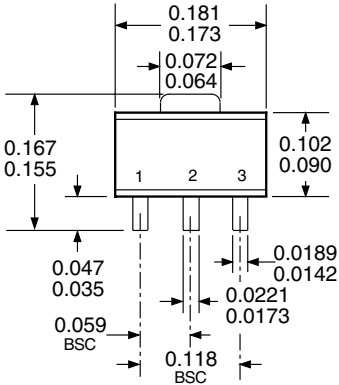
Dwg. MA-011-3 mm

- 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. Where no tolerance is specified, dimension is nominal.

3361 AND 3362 2-WIRE, CHOPPER-STABILIZED, HALL-EFFECT SWITCHES

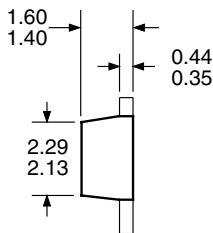
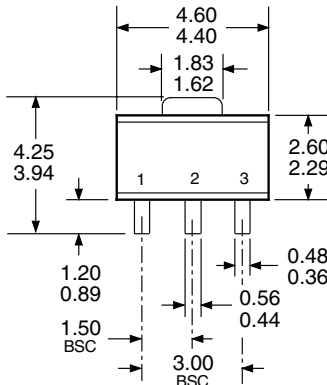
PACKAGE DESIGNATOR 'LT' (SOT-89/TO-243AA)

Dimensions in Inches
(for reference only)

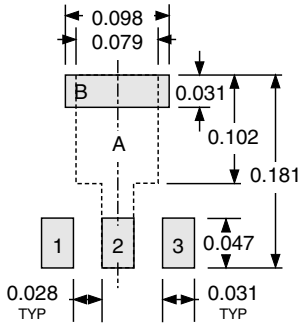


Dwg. MA-009-3A in

Dimensions in Millimeters
(controlling dimensions)

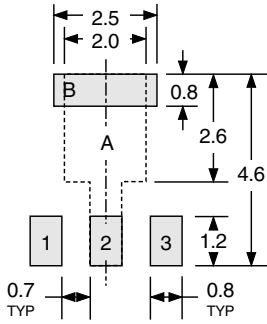


Dwg. MA-009-3A mm



ads 1, 2, 3, and A — Standard SOT-89 Layout
 ads 1, 2, 3, and B — Low-Stress Version
 ads 1, 2, and 3 only — Lowest Stress, But Not Self Aligning

Dwg. MA-012-3 in



Pads 1, 2, 3, and A — Standard SOT-89 Layout
 Pads 1, 2, 3, and B — Low-Stress Version
 Pads 1, 2, and 3 only — Lowest Stress, But Not Self Aligning

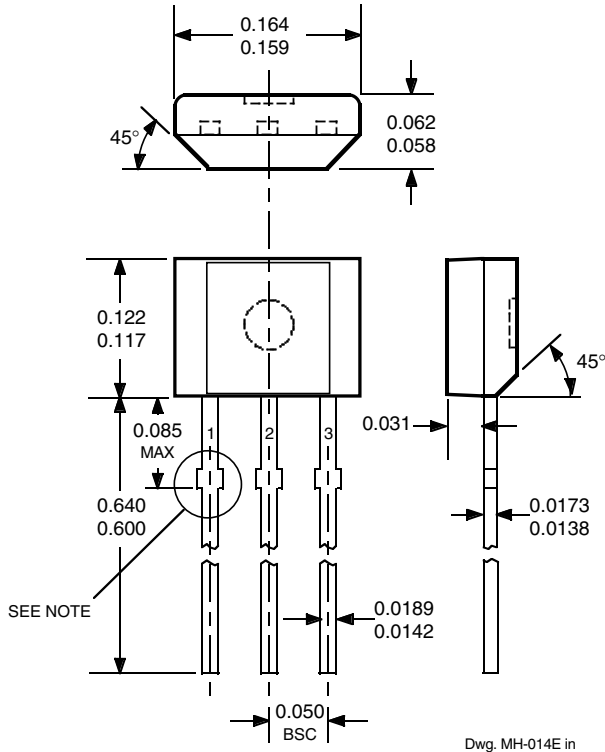
Dwg. MA-012-3 mm

NOTE: Exact body and lead configuration at vendor's option within limits shown.

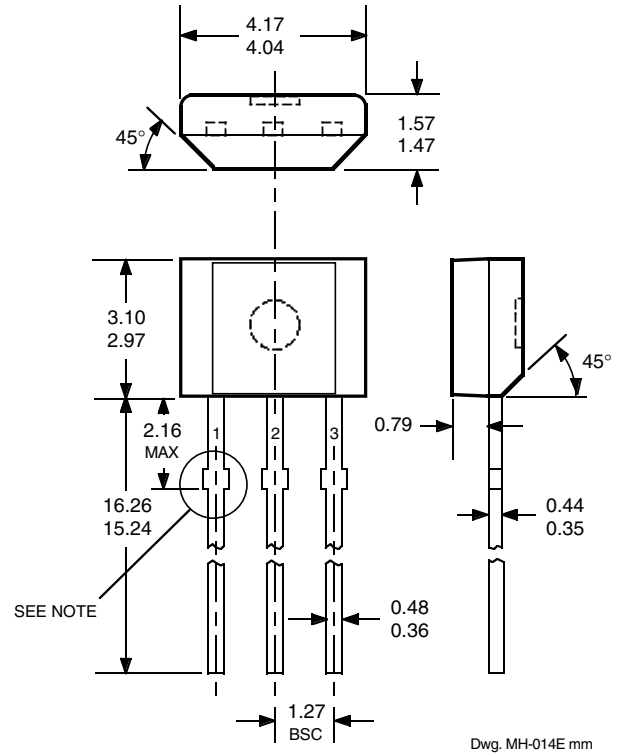
3361 AND 3362 2-WIRE, CHOPPER-STABILIZED, HALL-EFFECT SWITCHES

PACKAGE DESIGNATOR 'UA'

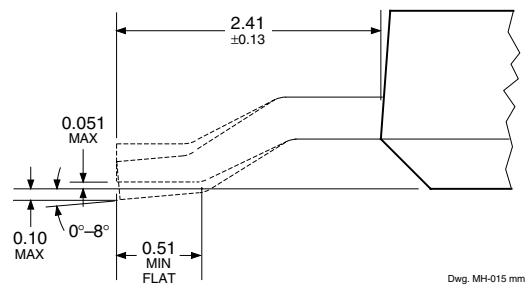
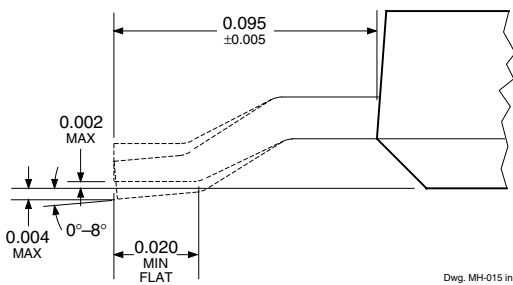
Dimensions in Inches
(controlling dimensions)



Dimensions in Millimeters
(for reference only)



Surface-Mount Lead Form (order A336xEUA-TL)



- 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.

**3361 AND 3362
2-WIRE,
CHOPPER-STABILIZED,
HALL-EFFECT SWITCHES**

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.

Allegro MicroSystems, Inc. reserves the right to make, from time to time, such departures from the detail specifications as may be required to permit improvements in the performance, reliability, or manufacturability of its products. Before placing an order, the user is cautioned to verify that the information being relied upon is current.

Allegro products are not authorized for use as critical components in life-support appliances, devices, or systems without express written approval.

The information included herein is believed to be accurate and reliable. However, Allegro MicroSystems, Inc. assumes no responsibility for its use; nor for any infringements of patents or other rights of third parties that may result from its use.

3361 AND 3362
2-WIRE,
CHOPPER-STABILIZED,
HALL-EFFECT SWITCHES

HALL-EFFECT SENSORS

| Partial Part Number | Avail. Oper. Temp. | Characteristics at T _A = +25°C | | | Features | Notes |
|--|--------------------|---|---------------------|----------------------|---|-------|
| | | B _{OP} max | B _{RP} min | B _{hys} typ | | |
| HALL-EFFECT UNIPOLAR & OMNIPOLAR SWITCHES in order of B_{OP} and B_{hys} | | | | | | |
| 3240 | E/L | +50 | +5.0 | 10 | chopper stabilized | 1 |
| 3209 | E | ±60 | ±5.0 | 7.7 | 400 μW, chopper stabilized | |
| 3210 | E | ±60 | ±5.0 | 7.7 | 25 μW, chopper stabilized | |
| 3361 | E | +110 | +55 | 5.0* | 2-wire, chopper stabilized, inverted output | |
| 3362 | E | +110 | +55 | 5.0* | 2-wire, chopper stabilized | |
| 3161 | E | +160 | +30 | 20 | 2-wire | |
| 3141 | E/L | +160 | +10 | 55 | | |
| 3235 | S | +175 | +25 | 15* | output 1 | 2 |
| | | -25 | -175 | 15* | output 2 | 2 |
| 5140 | E | +200 | +50 | 55 | 300 mA power driver output | 1 |
| 3142 | E/L | +230 | +75 | 55 | | |
| 3143 | E/L | +340 | +165 | 55 | | |
| 3144 | E/L | +350 | +50 | 55 | | |
| 3122 | E/L | +400 | +140 | 105 | | |
| 3123 | E/L | +440 | +180 | 105 | | |
| 3121 | E/L | +450 | +125 | 105 | | |
| HALL-EFFECT LATCHES & BIPOLAR SWITCHES[†] in order of B_{OP} and B_{hys} | | | | | | |
| 3260 | E/L | +30 | -30 | 20 | bipolar switch, chopper stabilized | |
| 3280 | E/L | +40 | -40 | 45 | chopper stabilized | |
| 3134 | E/L | +50 | -50 | 27 | bipolar switch | |
| 3133 | K/L/S | +75 | -75 | 52 | bipolar switch | |
| 3281 | E/L | +90 | -90 | 100 | chopper stabilized | |
| 3132 | K/L/S | +95 | -95 | 52 | bipolar switch | |
| 3187 | E/L | +150 | -150 | 100* | | |
| 3177 | S | +150 | -150 | 200 | | |
| 3625 | S | +150 | -150 | 200 | 900 mA power driver output | 1, 3 |
| 3626 | S | +150 | -150 | 200 | 400 mA power driver output | 1, 3 |
| 3195 | E/L | +160 | -160 | 220 | active pulldown | 1 |
| 3197 | L | +160 | -160 | 230 | | 1 |
| 3175 | S | +170 | -170 | 200 | | |
| 3188 | E/L | +180 | -180 | 200* | | |
| 3283 | E/L | +180 | -180 | 300 | chopper stabilized | |
| 3189 | E/L | +230 | -230 | 100* | | |
| 3275 | S | +250 | -250 | 100* | | 3 |
| 3185 | E/L | +270 | -270 | 340* | | |

Operating Temperature Ranges:

S = -20°C to +85°C, E = -40°C to +85°C, J = -40°C to +115°C, K = -40°C to +125°C, L = -40°C to +150°C

Notes 1. Protected.

2. Output 1 switches on south pole, output 2 switches on north pole for 2-phase, bifilar-wound, unipolar-driven brushless dc motor control. Outputs may be tied together for omnipolar operation.

3. Complementary outputs for 2-phase bifilar-wound, unipolar-driven brushless dc motor control.

* Minimum. ‡ Maximum

† Latches will not switch on removal of magnetic field; bipolar switches may switch on removal of field but require field reversal for reliable operation over operating temperature range.