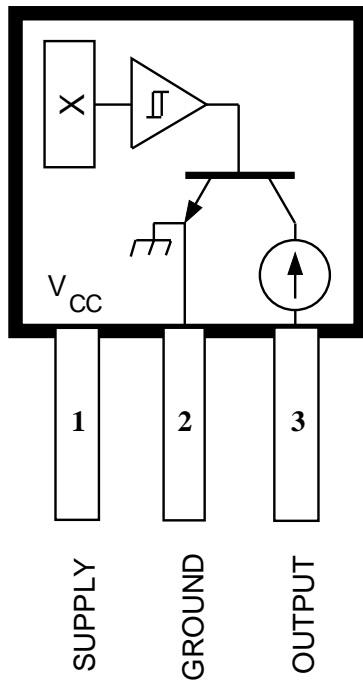


3161

HALL-EFFECT SWITCH FOR 2-WIRE APPLICATIONS



Pinning is shown viewed from branded side.

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

| | |
|-------------------------------------|-----------------|
| Supply Voltage, V_{CC} | |
| Continuous | 28 V |
| Surge ($t_w \leq 100$ ms) | 40 V |
| Reverse Battery Voltage, V_{RCC} | |
| Continuous | -25 V |
| Surge ($t_w \leq 100$ ms) | -40 V |
| Magnetic Flux Density, B | Unlimited |
| Output OFF Voltage, V_{OUT} | 28 V |
| Operating Temperature Range, | |
| T_A | -40°C to +85°C |
| Storage Temperature Range, | |
| T_S | -65°C to +170°C |

This Hall-effect switch is a monolithic integrated circuit designed to operate continuously over extended temperatures to +85°C. The unipolar switching characteristic makes this device ideal for use with a simple bar or rod magnet. The A3161ELT and A3161EUA are identical except for package.

Each device includes a voltage regulator for operation with supply voltages of 3.5 to 25 volts, reverse battery protection diode, quadratic Hall-voltage generator, temperature compensation circuitry, small-signal amplifier, Schmitt trigger, and a constant-current open-collector output. Noise radiation is limited by control of the output current slew rate.

Two package styles provide a magnetically optimized package for most applications. Suffix 'LT' is a miniature SOT-89/TO-243AA transistor package for surface-mount applications; suffix 'UA' is a three-lead ultra-mini SIP for through-hole mounting.

FEATURES and BENEFITS

- Internal Current Regulator for 2-Wire Operation
- Output Slew Rate Controlled
- 3.5 V to 25 V Operation ... Needs Only An Unregulated Supply
- Reverse Battery Protection
- Excellent Temp. Stability
- Activate with Small, Commercially Available Permanent Magnets
- Small Size
- Solid-State Reliability ... No Moving Parts
- Resistant to Physical Stress

Always order by complete part number, e.g., **A3161ELT**.

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HALL-EFFECT SWITCH FOR 2-WIRE APPLICATIONS

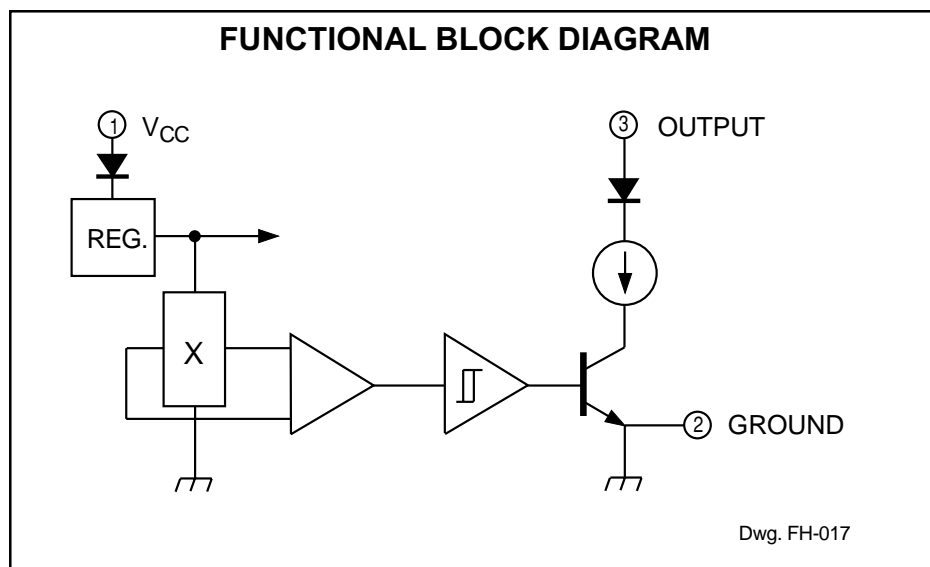
ELECTRICAL CHARACTERISTICS over operating voltage and temperature ranges.

| Characteristic | Symbol | Test Conditions | Limits | | | |
|--------------------------------------|--------------------|---|--------|------|------|-------------------|
| | | | Min. | Typ. | Max. | Units |
| Supply Voltage | V_{CC} | Operating | 3.5 | — | 25 | V |
| Load Current (2-wire application) | $I_{OUT} + I_{CC}$ | $3.5\text{ V} \leq V_{OUT} < 12\text{ V}, B < B_{RP}$ | 12 | 15 | 17 | mA |
| | | $V_{OUT} \geq 12\text{ V}, B < B_{RP}$ | 12 | 15 | 19 | mA |
| | | $B > B_{OP}$ | — | 3.5 | 5.0 | mA |
| Output Current | I_{OUT} | $B < B_{RP}$ | — | 12 | — | mA |
| | I_{OFF} | $V_{OUT} = 24\text{ V}, B > B_{OP}$ | — | <1.0 | 10 | μA |
| Output Saturation Voltage | V_{OUT} | $I_{OUT} = 5\text{ mA}, B < B_{RP}$ | — | 0.9 | 1.5 | V |
| Output Slew Rate | di/dt | $C_L = 20\text{ pF}$ | — | 7.0 | 20 | mA/ μs |
| Output Settling Time | t_{sd} | $C_L = 20\text{ pF}$ | — | — | 20 | μs |

MAGNETIC CHARACTERISTICS over operating supply voltage range.

| Characteristic | Symbol | Limits | | | | | | Units |
|----------------------------------|-----------|------------------------------|------|------|------------------------|------|------|-------|
| | | At $T_A = +25^\circ\text{C}$ | | | Over Oper. Temp. Range | | | |
| | | Min. | Typ. | Max. | Min. | Typ. | Max. | |
| Operate Point (output turns OFF) | B_{OP} | — | 130 | 160 | — | 130 | 160 | G |
| Release Point (output turns ON) | B_{RP} | 30 | 110 | — | 30 | 110 | — | G |
| Hysteresis ($B_{OP} - B_{RP}$) | B_{hys} | 5.0 | 20 | — | 5.0 | 20 | 80 | G |

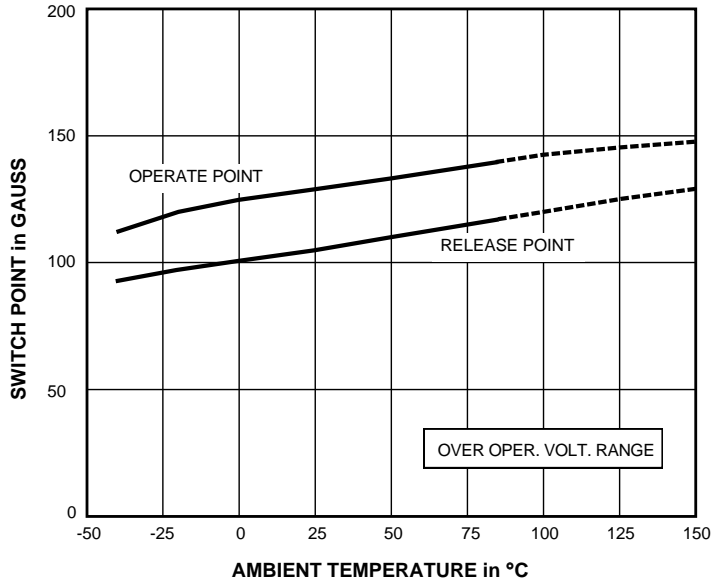
NOTE: Typical values are at $T_A = +25^\circ\text{C}$ and $V_{CC} = 12\text{ V}$.



3161 HALL-EFFECT SWITCH FOR 2-WIRE APPLICATIONS

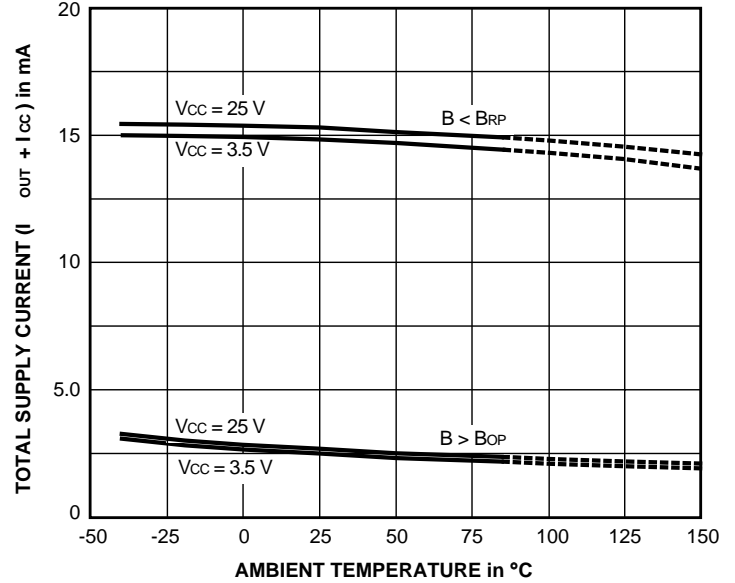
TYPICAL OPERATING CHARACTERISTICS

SWITCH POINTS



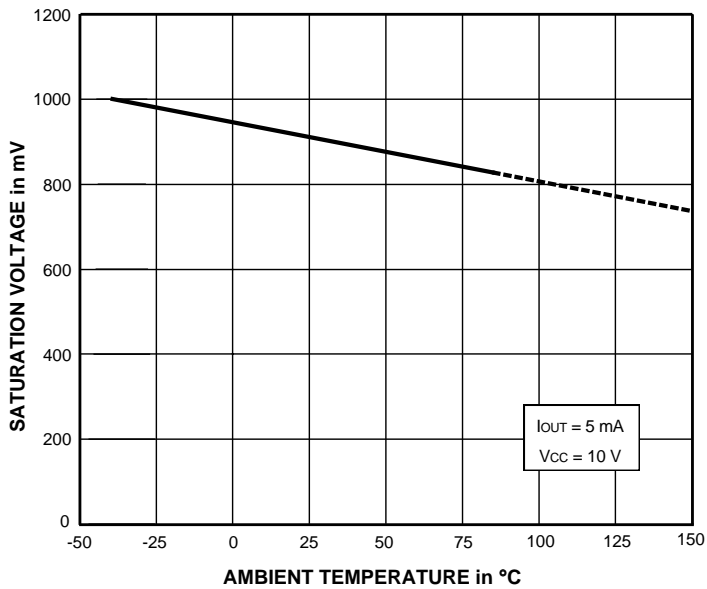
Dwg. GH-044-1

TOTAL SUPPLY CURRENT



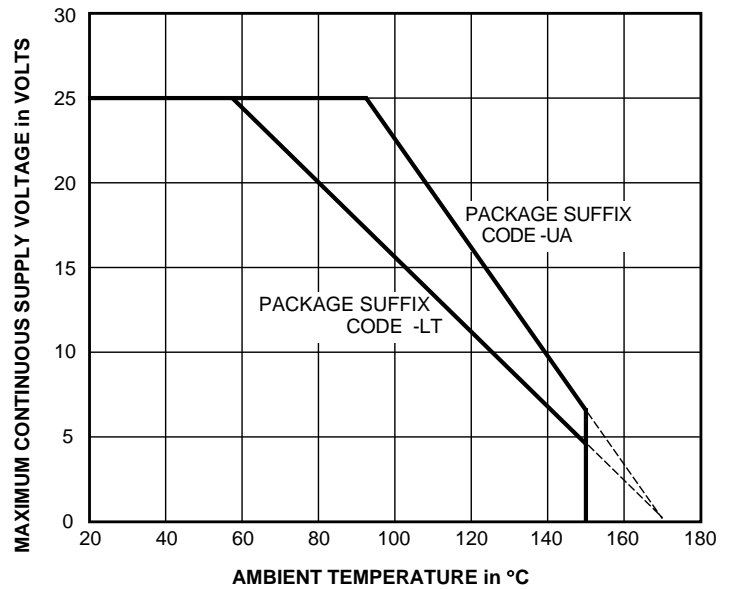
Dwg. GH-028-4

OUTPUT SATURATION VOLTAGE



Dwg. GH-029-3

SAFE OPERATING AREA

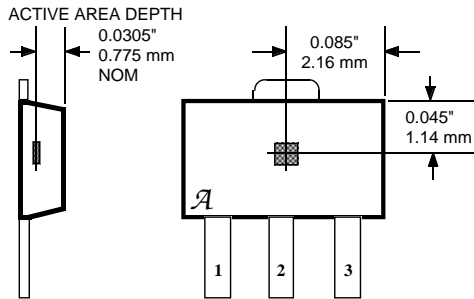


Dwg. GH-068

3161 HALL-EFFECT SWITCH FOR 2-WIRE APPLICATIONS

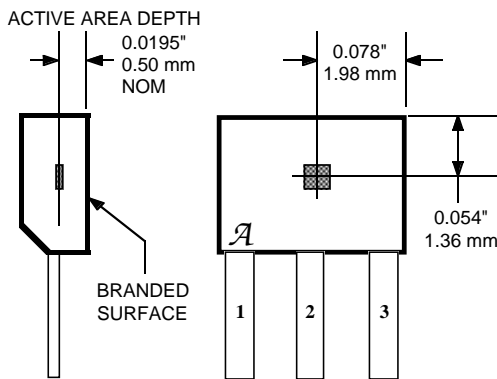
SENSOR LOCATIONS

Suffix "LT"



Dwg. MH-008-7A

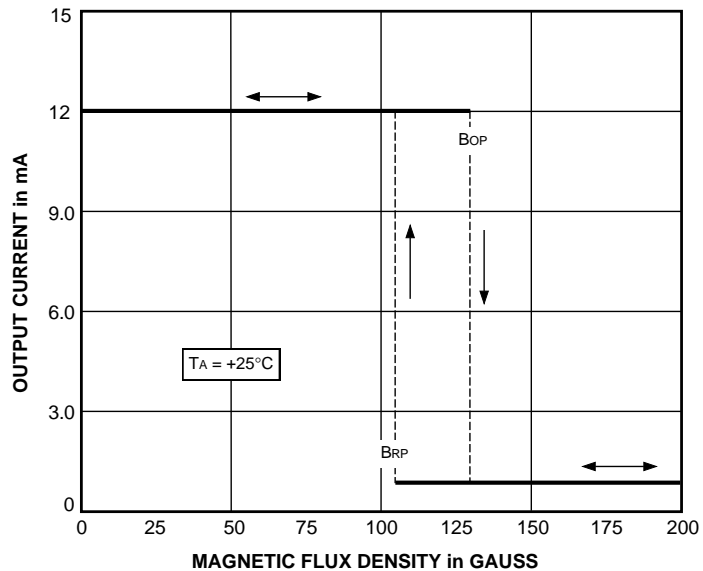
Suffix "UA"



Dwg. MH-011-8A

OPERATION

The output of these devices (pin 3) switches OFF when the magnetic field at the Hall sensor exceeds the operate point threshold (B_{OP}). When the magnetic field is reduced to below the release point threshold (B_{RP}), the device output switches ON. 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.



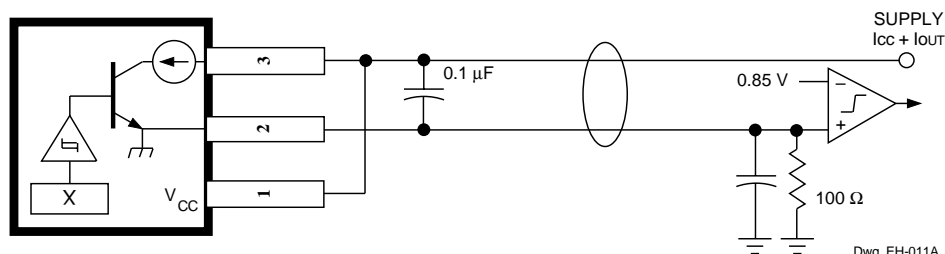
Dwg. GH-007-1

APPLICATIONS INFORMATION

These devices are normally operated in a 2-wire mode, where the supply terminal and the output terminal are tied together. An external comparator detects the change in total supply current by the addition (output off, $B > B_{OP}$) or subtraction (output on, $B < B_{RP}$) of I_{OUT} .

Hall effect applications information is available in the "Hall-Effect IC Applications Guide", which can be found in the latest issue of the *Allegro MicroSystems Electronic Data Book*, AMS-702 or *Application Note 27701*, or at www.allegromicro.com.

TYPICAL 2-WIRE APPLICATION

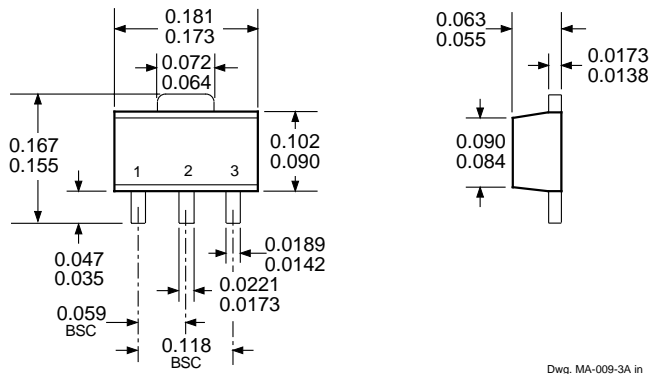


Dwg. EH-011A

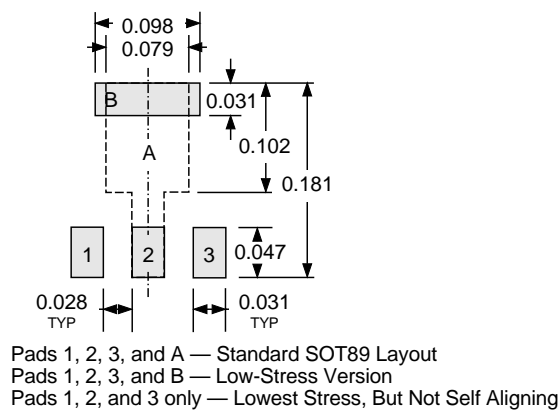
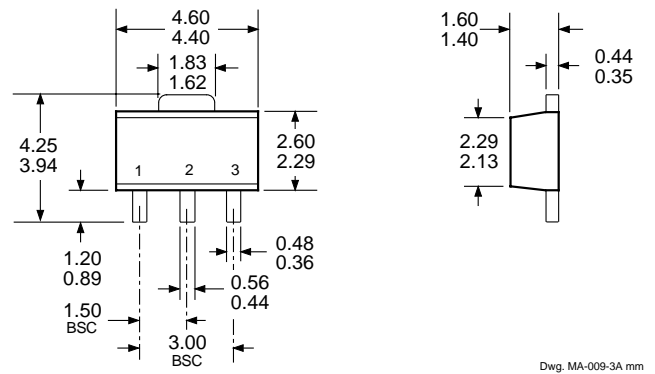
3161 HALL-EFFECT SWITCH FOR 2-WIRE APPLICATIONS

PACKAGE DESIGNATOR 'LT' (SOT89/TO-243AA)

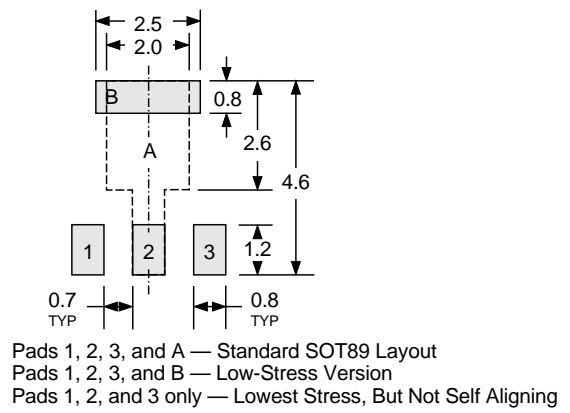
Dimensions in Inches
(for reference only)



Dimensions in Millimeters
(controlling dimensions)



Pads 1, 2, 3, and A — Standard SOT89 Layout
Pads 1, 2, 3, and B — Low-Stress Version
Pads 1, 2, and 3 only — Lowest Stress, But Not Self Aligning



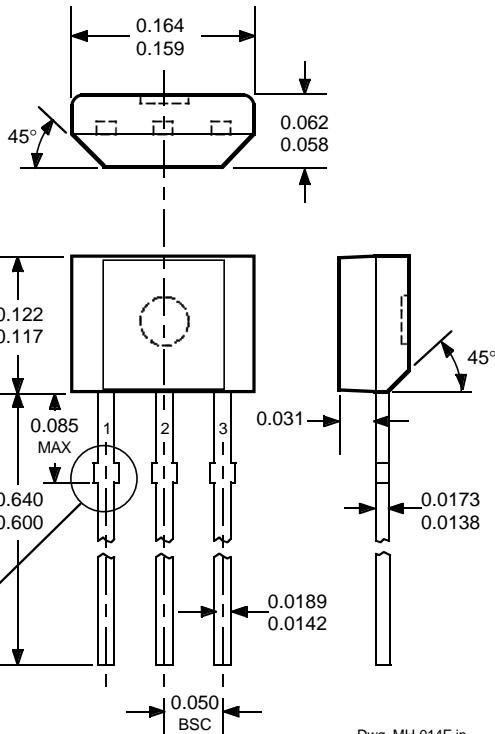
Pads 1, 2, 3, and A — Standard SOT89 Layout
Pads 1, 2, 3, and B — Low-Stress Version
Pads 1, 2, and 3 only — Lowest Stress, But Not Self Aligning

- NOTES: 1. Exact body and lead configuration at vendor's option within limits shown.
2. Supplied in bulk pack (500 pieces per bag) or add "TR" to part number for tape and reel.
3. Only low-temperature ($\leq 240^{\circ}\text{C}$) reflow-soldering techniques are recommended for SOT89 devices.

3161 HALL-EFFECT SWITCH FOR 2-WIRE APPLICATIONS

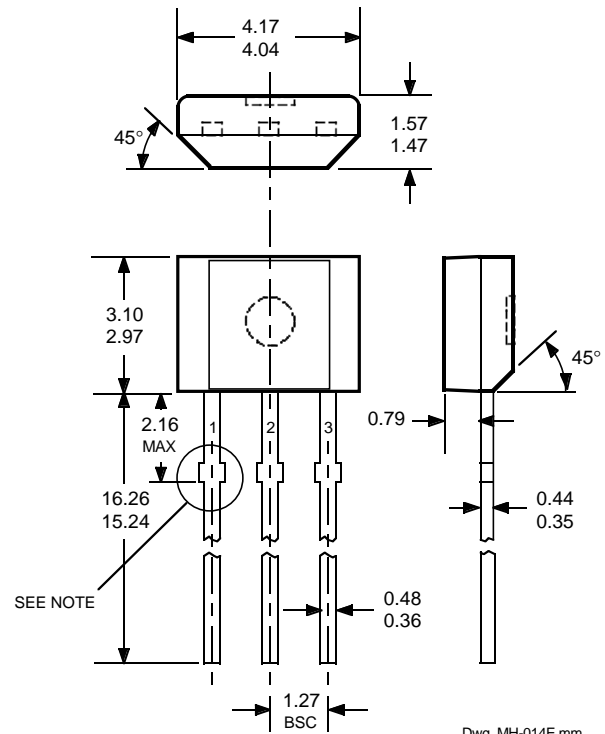
PACKAGE DESIGNATOR 'UA'

Dimensions in Inches
(controlling dimensions)



Dwg. MH-014E in

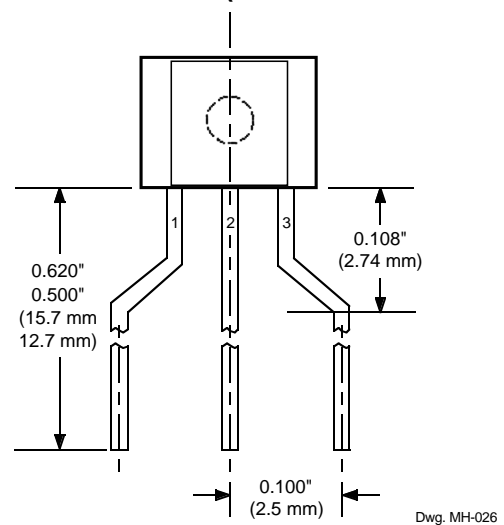
Dimensions in Millimeters
(for reference only)



Dwg. MH-014E 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. Recommended minimum PWB hole diameter to clear transition area is 0.035" (0.89 mm).
 5. Where no tolerance is specified, dimension is nominal.
 6. Supplied in bulk pack (500 pieces per bag).

Radial Lead Form (order A3161EUA-LC)



Dwg. MH-026

NOTE: Lead-form dimensions are the nominals produced on the forming equipment. No dimensional tolerance is implied or guaranteed for bulk packaging (500 pieces per bag).

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HALL-EFFECT SWITCH
FOR 2-WIRE APPLICATIONS

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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HALL-EFFECT SWITCH
FOR 2-WIRE APPLICATIONS

HALL-EFFECT SENSORS

| UNIPOLAR HALL-EFFECT DIGITAL SWITCHES | | | | | | |
|---------------------------------------|---|------------------------------------|-------------------------|-------------|------------|---|
| Partial Part Number | Operate Point (G) Over Oper. Voltage | Release Point (G) & Temp. Range | Hysteresis (G) Range | Oper. Temp. | Packages | Replaces and Comments |
| A3121x | 220 to 500 | 80 to 410 | 60 to 150 | E, L | LT, UA | 3019, 3113, 3119 |
| A3122x | 260 to 430 | 120 to 360 | 70 to 140 | E, L | LT, UA | |
| A3123x | 230 to 470 | 160 to 330 | 70 to 140 | E, L | LT, UA | |
| A3141x | 30 to 175 | 10 to 145 | 20 to 80 | E, L | LT, UA | 3040, 3140 |
| A3142x | 115 to 245 | 60 to 190 | 30 to 80 | E, L | LT, UA | |
| A3143x | 205 to 355 | 150 to 300 | 30 to 80 | E, L | LT, UA | |
| A3144x | 35 to 450 | 25 to 430 | >20 | E, L | LT, UA | 3020, 3120 |
| A3161E | <160 (Typ 130) | >30 (Typ 110) | 5 to 80 | E | LT, UA | 2-wire operation |
| A3240x | <50 (Typ 35) | >5 (Typ 25) | Typ 10 | E, L | LH, LT, UA | chopper stabilized |
| A3361E | <125 | >40 | 5 to 30 | E | LH, LT, UA | 2-wire, chopper stabilized, output normally high |
| A3362E | <125 | >40 | 5 to 30 | E | LH, LT, UA | 2-wire, chopper stabilized, output normally low |

Notes: 1) Typical data is at $T_A = +25^\circ\text{C}$ and nominal operating voltage.

2) "x" = Operating Temperature Range [suffix letter or (prefix)]: S (UGN) = -20°C to $+85^\circ\text{C}$, E = -40°C to $+85^\circ\text{C}$, J = -40°C to $+115^\circ\text{C}$, K (UGS) = -40°C to $+125^\circ\text{C}$, L (UGL) = -40°C to $+150^\circ\text{C}$.