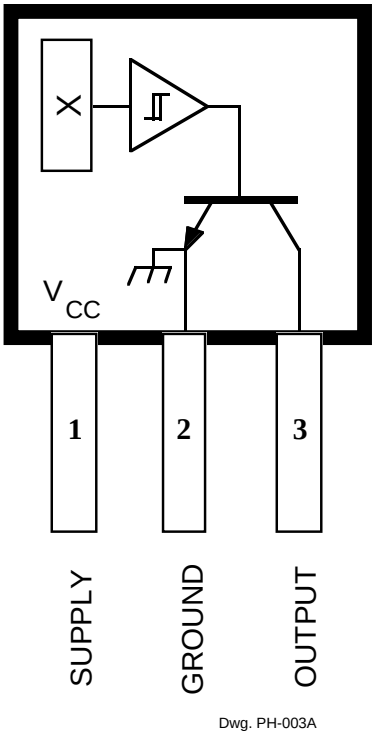
# 3141 THRU 3144

Data Sheet
27621.6A

## *SENSITIVE HALL-EFFECT SWITCHES FOR HIGH-TEMPERATURE OPERATION*




Dwg. PH-003A

Pinning is shown viewed from branded side.

### ABSOLUTE MAXIMUM RATINGS at $T_A$ = +25°C

Supply Voltage, $V_{CC}$ ..... **28 V**
Reverse Battery Voltage, $V_{RCC}$ ..... **-35 V**
Magnetic Flux Density, B ..... **Unlimited**
Output OFF Voltage, $V_{OUT}$ ..... **28 V**
Reverse Output Voltage, $V_{OUT}$ ..... **-0.5 V**
Continuous Output Current, $I_{OUT}$ ..... **25 mA**
Operating Temperature Range, $T_A$
Suffix 'E–' ..... **-40°C to +85°C**
Suffix 'L–' ..... **-40°C to +150°C**
Storage Temperature Range,
$T_S$ ..... **-65°C to +170°C**

These Hall-effect switches are monolithic integrated circuits with tighter magnetic specifications, designed to operate continuously over extended temperatures to +150°C, and are more stable with both temperature and supply voltage changes. The unipolar switching characteristic makes these devices ideal for use with a simple bar or rod magnet. The four basic devices (3141, 3142, 3143, and 3144) are identical except for magnetic switch points.

Each device includes a voltage regulator for operation with supply voltages of 4.5 to 24 volts, reverse battery protection diode, quadratic Hall-voltage generator, temperature compensation circuitry, small-signal amplifier, Schmitt trigger, and an open-collector output to sink up to 25 mA. With suitable output pull up, they can be used with bipolar or CMOS logic circuits. The A3141– and A3142– are improved replacements for the UGN/UGS3140–; the A3144– is the improved replacement for the UGN/UGS3120–.

The first character of the part number suffix determines the device operating temperature range. Suffix 'E–' is for the automotive and industrial temperature range of -40°C to +85°C. Suffix 'L–' is for the automotive and military temperature range of -40°C to +150°C. Three 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 '–U' is a three-lead plastic mini-SIP, while suffix '–UA' is a three-lead ultra-mini-SIP.

### FEATURES and BENEFITS

- Superior Temp. Stability for Automotive or Industrial Applications
- 4.5 V to 24 V Operation … Needs Only An Unregulated Supply
- Open-Collector 25 mA Output … Compatible with Digital Logic
- Reverse Battery Protection
- Activate with Small, Commercially Available Permanent Magnets
- Solid-State Reliability
- Small Size
- Resistant to Physical Stress

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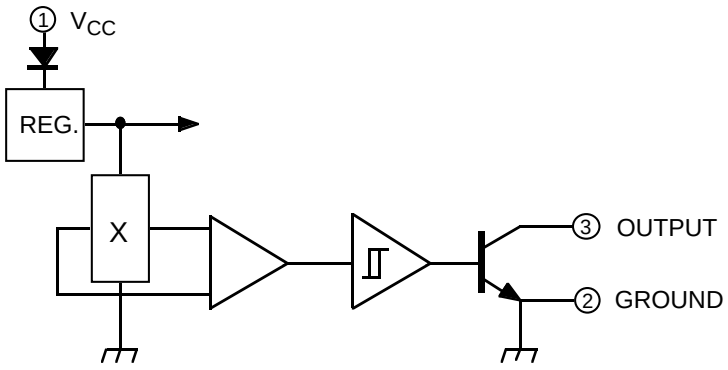
## FUNCTIONAL BLOCK DIAGRAM




Dwg. FH-005-2

## ELECTRICAL CHARACTERISTICS at $V_{CC}$ = 8 V over operating temperature range.

| Characteristic | Symbol | Test Conditions | Limits | | | |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | Units |
| Supply Voltage | $V_{CC}$ | Operating | 4.5 | — | 24 | V |
| Output Saturation Voltage | $V_{OUT(SAT)}$ | $I_{OUT}$ = 20 mA, B > $B_{OP}$ | — | 175 | 400 | mV |
| Output Leakage Current | $I_{OFF}$ | $V_{OUT}$ = 24 V, B < $B_{RP}$ | — | <1.0 | 10 | µA |
| Supply Current | $I_{CC}$ | B < $B_{RP}$ (Output OFF) | — | 4.4 | 9.0 | mA |
| Output Rise Time | $t_r$ | $R_L$ = 820 Ω, $C_L$ = 20 pF | — | 0.04 | 2.0 | µs |
| Output Fall Time | $t_f$ | $R_L$ = 820 Ω, $C_L$ = 20 pF | — | 0.18 | 2.0 | µs |

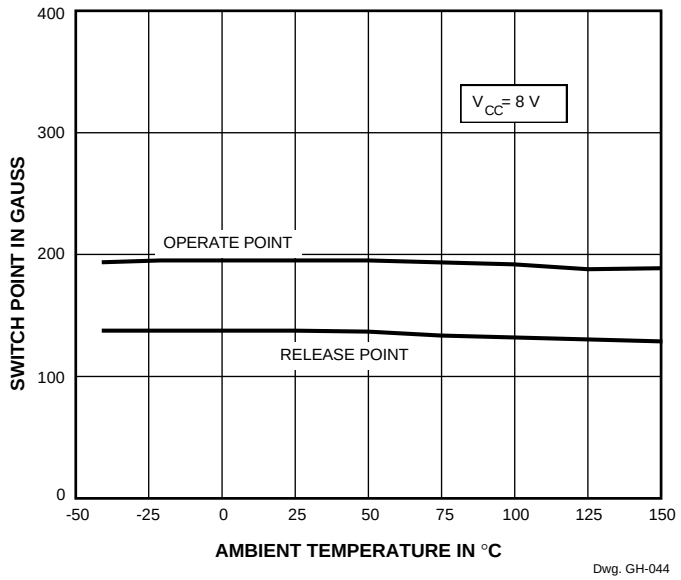
## MAGNETIC CHARACTERISTICS in gauss over operating supply voltage range.

| Characteristic | | Part Numbers* | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A3141– | | | A3142– | | | A3143– | | | A3144– | | |
| | | Min. | Typ. | Max. | Min. | Typ. | Max. | Min. | Typ. | Max. | Min. | Typ. | Max. |
| $B_{OP}$ | at $T_A$ = 25°C | 50 | 100 | 160 | 130 | 180 | 230 | 220 | 280 | 340 | 70 | — | 350 |
| | over operating temp. range | 30 | 100 | 175 | 115 | 180 | 245 | 205 | 280 | 355 | 35 | — | 450 |
| $B_{RP}$ | at $T_A$ = 25°C | 10 | 45 | 130 | 75 | 125 | 175 | 165 | 225 | 285 | 50 | — | 330 |
| | over operating temp. range | 10 | 45 | 145 | 60 | 125 | 190 | 150 | 225 | 300 | 25 | — | 430 |
| $B_{hys}$ | at $T_A$ = 25°C | 20 | 55 | 80 | 30 | 55 | 80 | 30 | 55 | 80 | 20 | 55 | — |
| | over operating temp. range | 20 | 55 | 80 | 30 | 55 | 80 | 30 | 55 | 80 | 20 | 55 | — |

NOTES: Typical values are at $T_A$ = +25°C and $V_{CC}$ = 8 V.
$B_{OP}$ = operate point (output turns ON); $B_{RP}$ = release point (output turns OFF); $B_{hys}$ = hysteresis ($B_{OP}$ - $B_{RP}$).
*Complete part number includes a suffix to identify operating temperature range (E- or L-) and package type ( -LT, -U, or -UA).

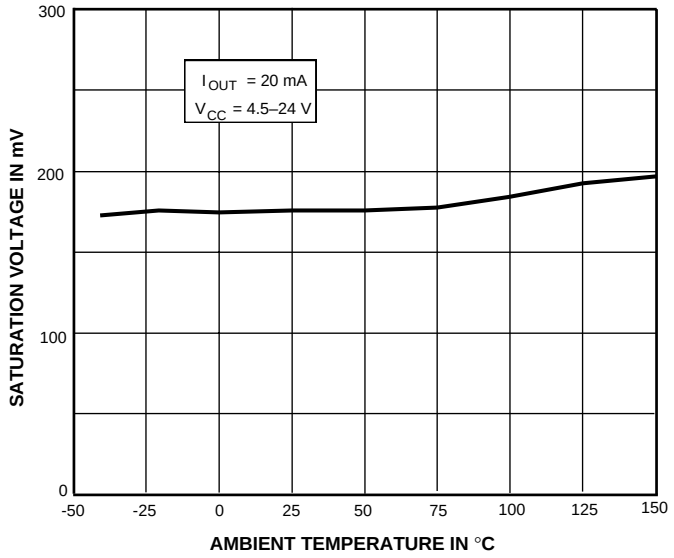
## TYPICAL OPERATING CHARACTERISTICS

### A3142– SWITCH POINTS



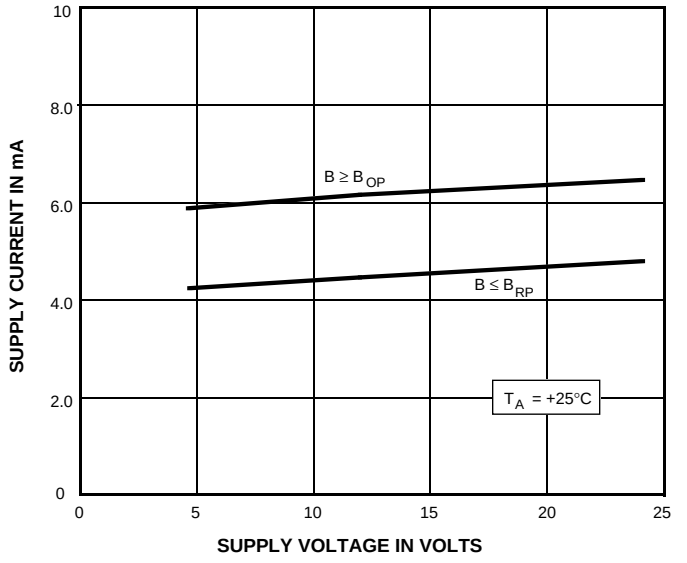

Dwg. GH-044

### OUTPUT SATURATION VOLTAGE



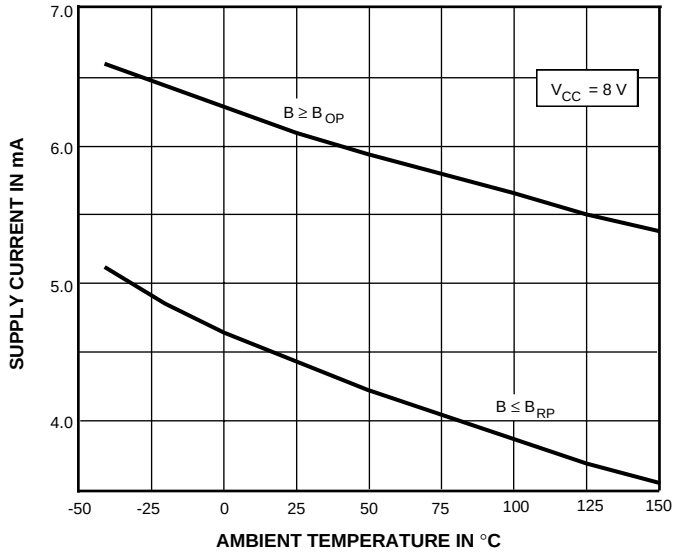

Dwg. GH-040-1

### SUPPLY CURRENT




Dwg. GH-041-1

### SUPPLY CURRENT




Dwg. GH-039-1

* Complete part number includes a suffix denoting operating temperature range (E- or L-) and package type ( -LT, -U, or -UA).

# 3141 THRU 3144
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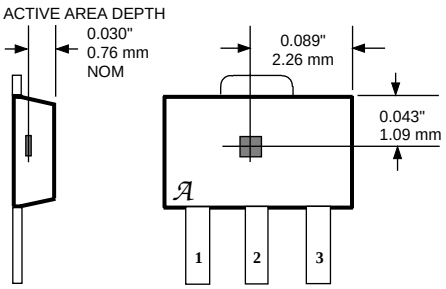
## SENSOR LOCATIONS

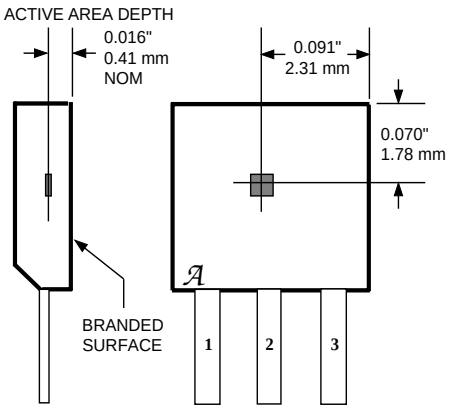
**(±0.005" [0.13 mm] die placement)**

### Suffix "LT"



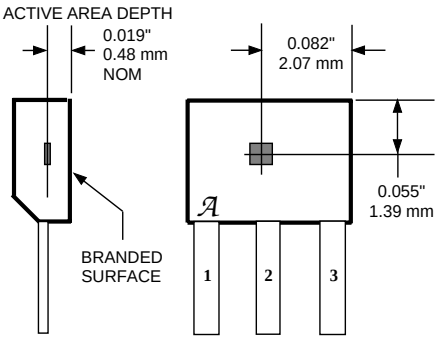

Dwg. MH-008-2C

### Suffix "U"




Dwg. MH-002-2B

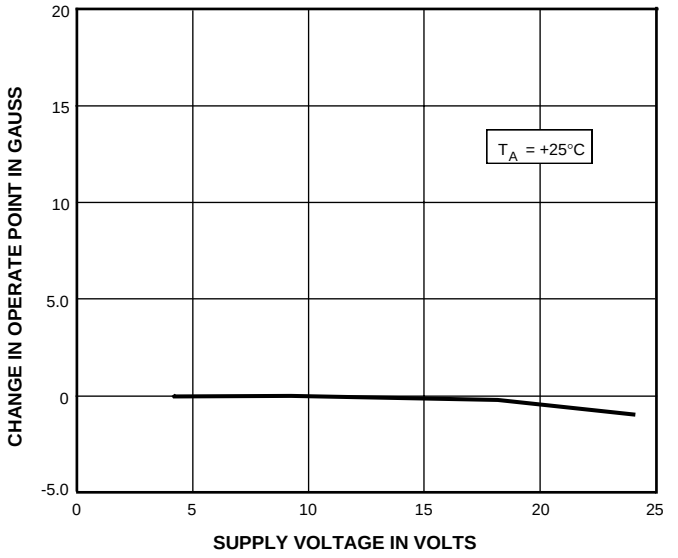
### Suffix "UA"




Dwg. MH-011-10

## TYPICAL OPERATING CHARACTERISTICS (cont.)

### CHANGE IN OPERATE POINT




Dwg. GH-042-1

## 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 threshold ($B_{RP}$), the device output goes high. 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.

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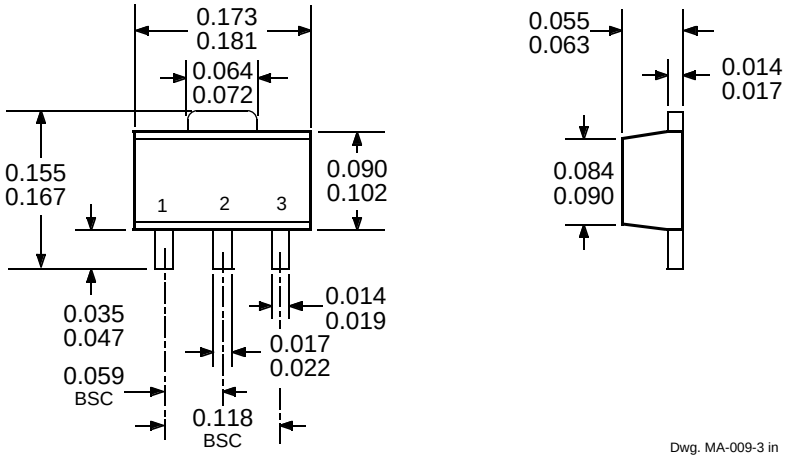
## PACKAGE DESIGNATOR 'LT'

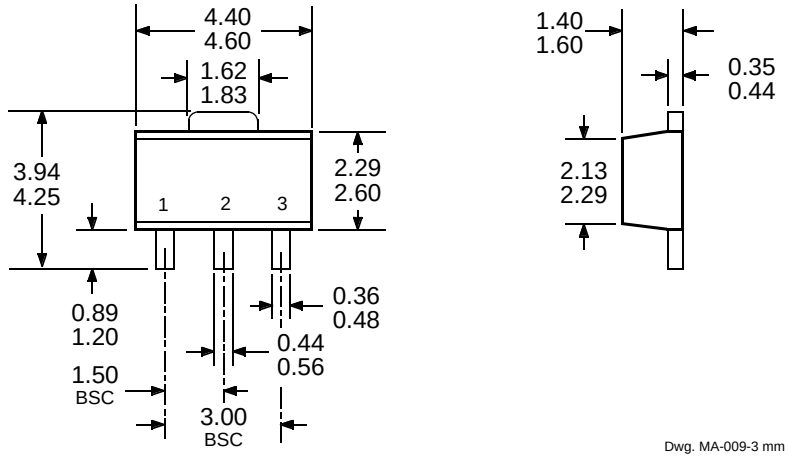
(SOT-89/TO-243AA)

Dimensions in Inches
(for reference only)




Dwg. MA-009-3 in

Dimensions in Millimeters
(controlling dimensions)




Dwg. MA-009-3 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.

# 3141 THRU 3144
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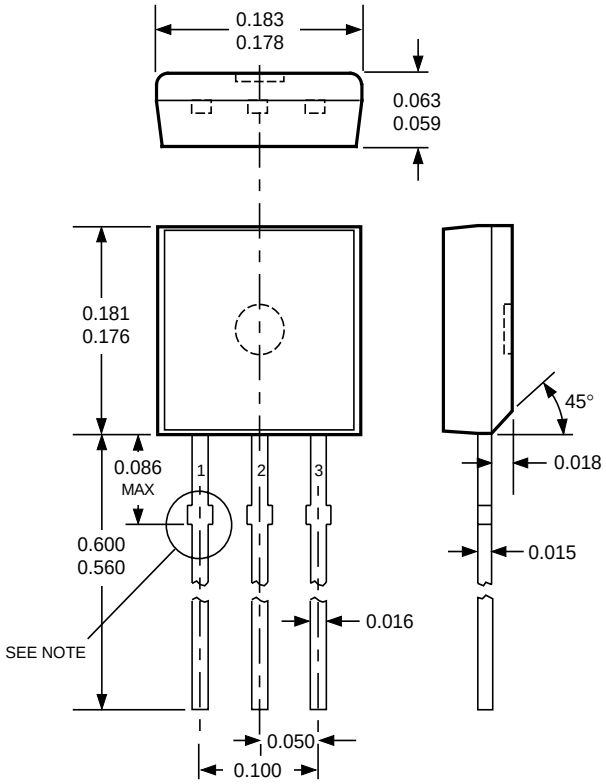
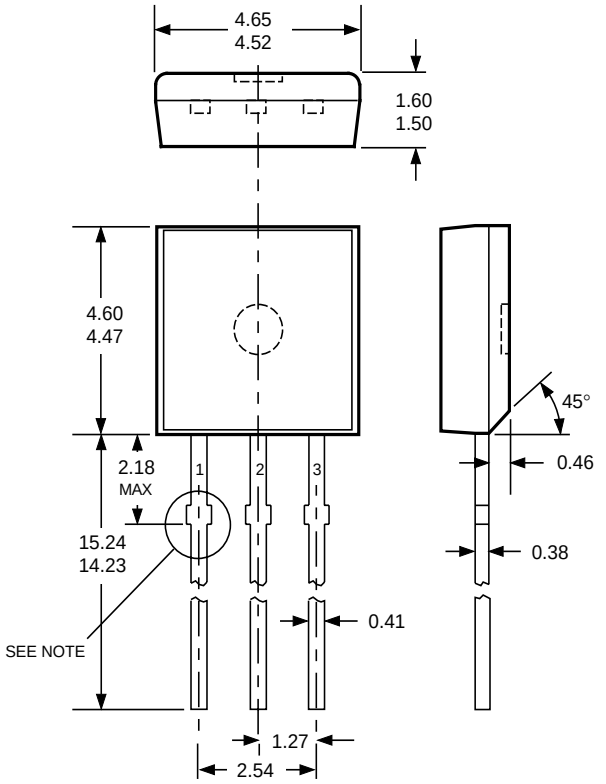
## PACKAGE DESIGNATOR 'U'

Dimensions in Inches
(controlling dimensions)




Dwg. MH-003D in

Dimensions in Millimeters
(for reference only)




Dwg. MH-003D mm

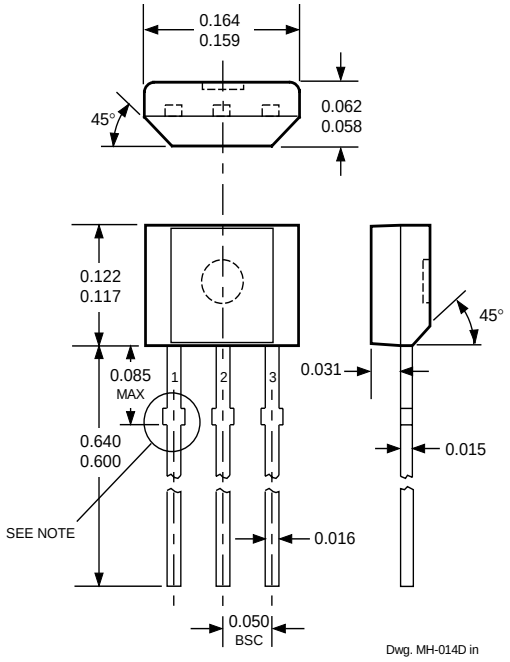
**Devices in the 'U' package are NOT RECOMMENDED FOR NEW DESIGN**

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).

# 3141 THRU 3144
# *SENSITIVE HALL-EFFECT SWITCHES FOR HIGH-TEMP. OPERATION*

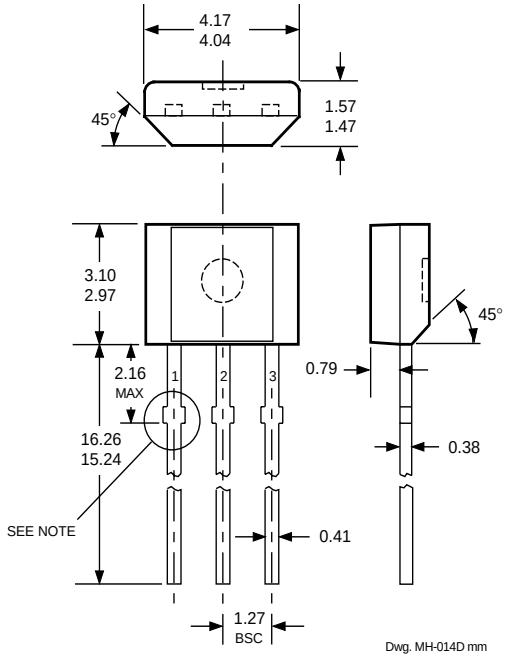
## PACKAGE DESIGNATOR 'UA'

Dimensions in Inches
(controlling dimensions)




Dwg. MH-014D in

Dimensions in Millimeters
(for reference only)




Dwg. MH-014D 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.

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# *SENSITIVE HALL-EFFECT SWITCHES FOR HIGH-TEMP. OPERATION*

# *HALL-EFFECT SENSORS SELECTION GUIDE*

| Partial Part Number | Avail. Oper. Temp. | Characteristics at $T_A$ = +25°C $B_{OP(max)}$ | $B_{RP(min)}$ | $B_{hys(typ)}$ | Features | Notes |
|---|---|---|---|---|---|---|
| **HALL-EFFECT UNIPOLAR SWITCHES in order of $B_{OP}$ and $B_{hys}$** | | | | | | |
| 3240 | E/L | +50 | +5.0 | 10 | chopper stabilized | 1 |
| 3210 | E | ±70 | ±5.0 | 7.7 | micropower, chopper stabilized | |
| 3361 | E | +120 | +50 | 5.0* | 2-wire, chopper stabilized | |
| 3362 | E | +120 | +50 | 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 output | 1, 3 |
| 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 | | |
| 3150 | J | +40 to +850 | – | 20 | programmable, chopper stabilized | 1 |
| **HALL-EFFECT LATCHES & BIPOLAR SWITCHES† in order of $B_{OP}$ and $B_{hys}$** | | | | | | |
| 3260 | E/L | +30 | -30 | 20 | bipolar, 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 outputs | 1, 3, 5 |
| 3626 | S | +150 | -150 | 200 | 400 mA outputs | 1, 3, 5 |
| 3195 | E/L | +160 | -160 | 220 | | 1, 4 |
| 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* | | 5 |
| 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.
3. Power driver output.
4.Active pull down.
5.Complementary outputs for 2-phase bifilar-wound, unipolar-driven brushless dc motor control.

* Minimum.

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.