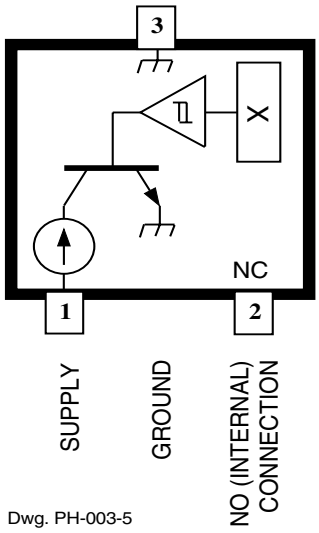
3361 AND 3362

Data Sheet 27621.50

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°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** .

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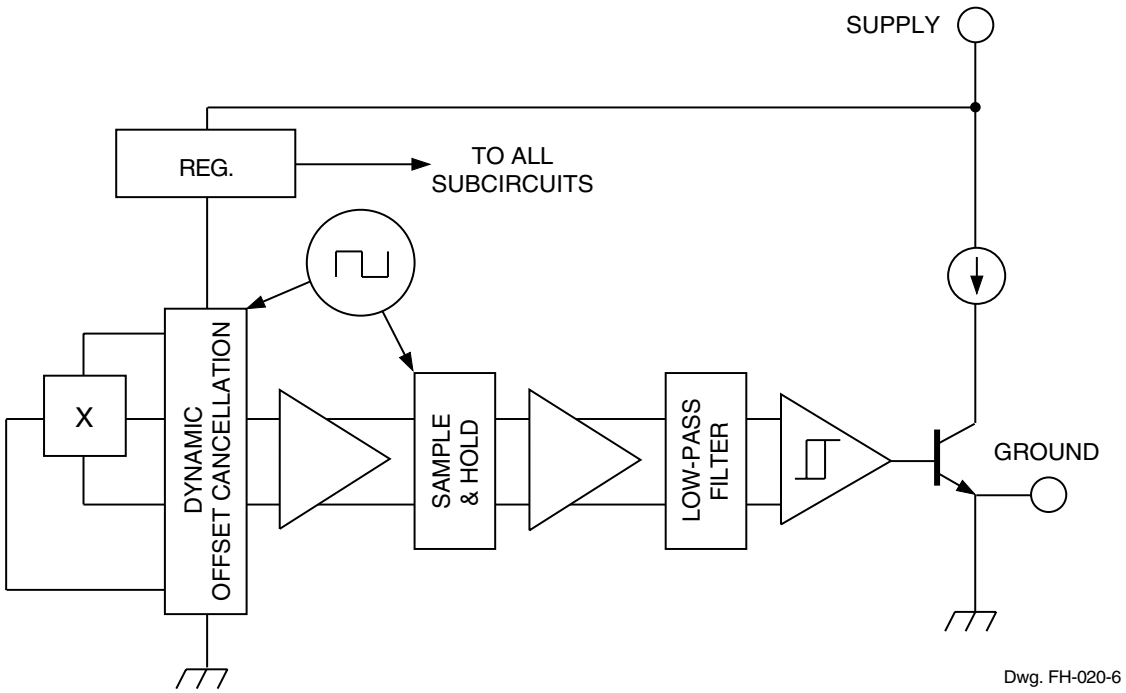
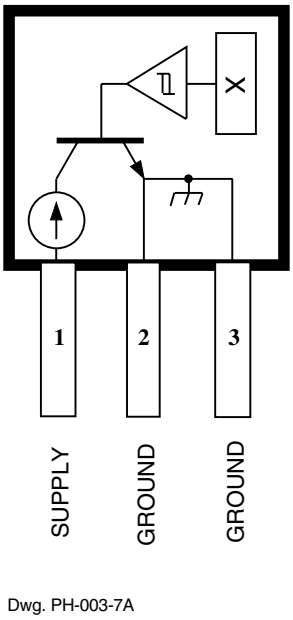
FUNCTIONAL BLOCK DIAGRAM

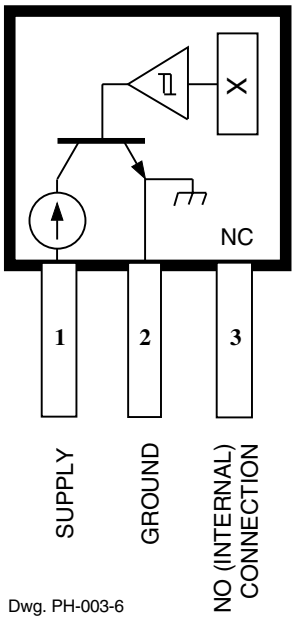


Suffix Code 'UA' Pinning (SIP)



Dwg. PH-003-7A

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



Dwg. PH-003-6

Pinning is shown viewed from branded side.

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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	µs
Output Rise Time	t_r	C_L = 20 pF	–	3.5	–	µs
Output Fall Time	t_f	C_L = 20 pF	–	3.5	–	µs
Reverse Battery Current	I_{CC}	V_{RCC} = -16 V	–	–	-15	mA

NOTE: Typical Data is at T_A = +25°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} = LOW	–	–	125	G
Release Point	B_{RP}	B < B_{RP}, I_{GND} = 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} = HIGH	–	–	125	G
Release Point	B_{RP}	B < B_{RP}, I_{GND} = LOW	40	–	–	G
Hysteresis	B_{hys}	B_{OP} - B_{RP}	5.0	–	30	G

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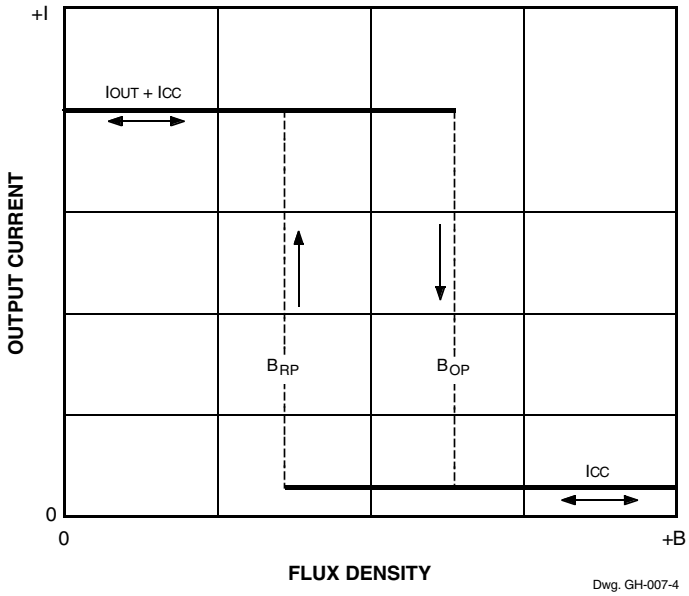
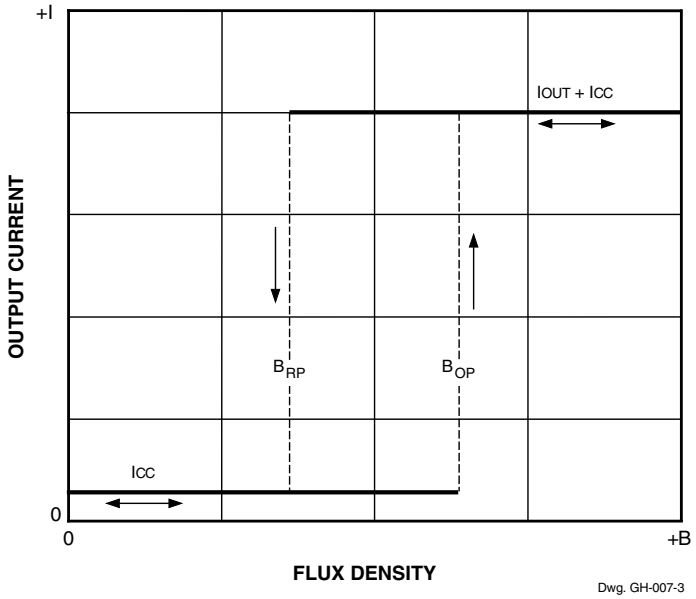
OUTPUT CHARACTERISTICS

A3361x



A3362x



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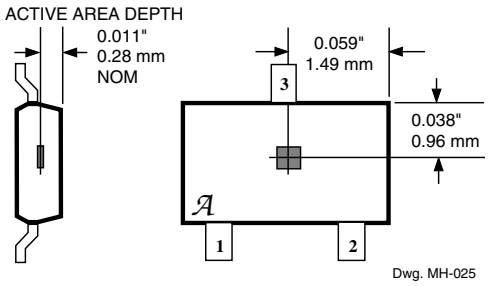
SENSOR LOCATIONS

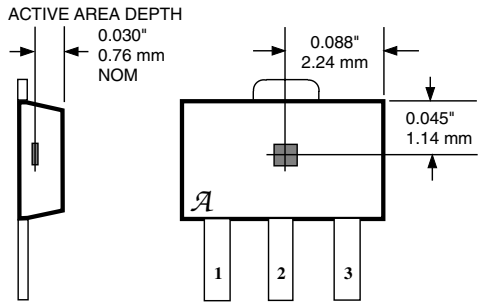
(±0.005” [0.13 mm] die placement)

Package Designator “LH”



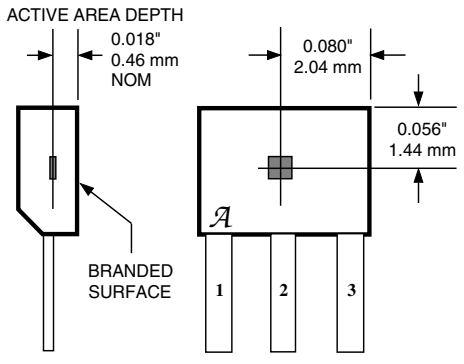
Dwg. MH-025

Package Designator “LT”



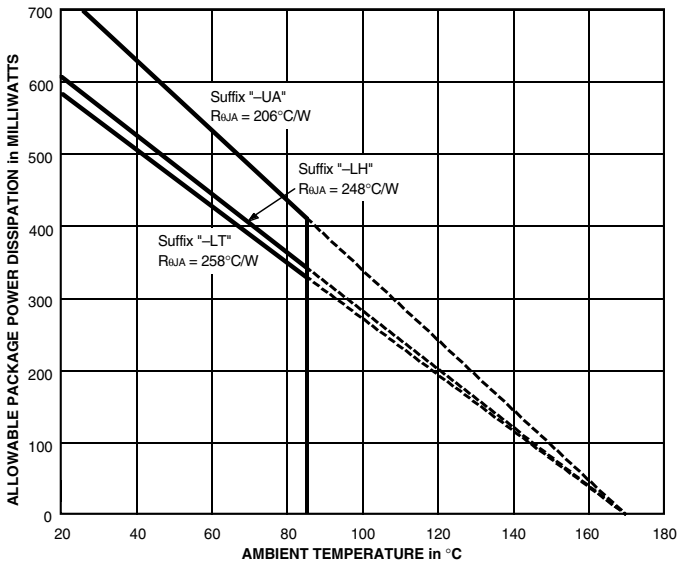
Dwg. MH-008-8

Package Designators “UA” and "UA-TL"



Dwg. MH-011-9A

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



Dwg. GH-046-4

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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°C, RH = 85%	50 hrs	77	V_{CC} = V_{OUT} = 5 V
High-Temperature Operating Life (HTOL)	JESD22-A108, T_A = 150°C, T_J = 165°C	408 hrs	77	V_{CC} = 24 V, V_{OUT} = 20 V
Accelerated HTOL	JESD22-A108, T_A = 175°C, T_J = 190°C	504 hrs	77	V_{CC} = 24 V, V_{OUT} = 20 V
Autoclave, Unbiased	JESD22-A102, Condition C, T_A = 121°C, 15 psig	96 hrs	77	
High-Temperature (Bake) Storage Life	MIL-STD-883, Method 1008, T_A = 170°C	1000 hrs	77	
Temperature Cycle	MIL-STD-883, Method 1010, -65°C to +150°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	

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FUNCTIONAL DESCRIPTION

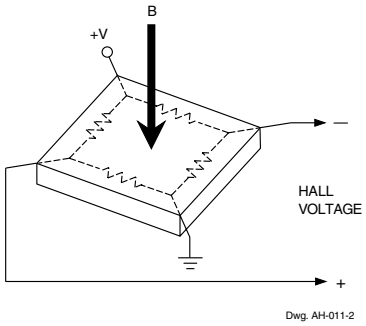
Chopper-Stabilized Technique. The Hall element can be considered as a resistor array similar to a Wheatstone bridge. A large portion of the offset is a result of the mismatching of these resistors. These devices use a proprietary dynamic offset cancellation technique, with an internal high-frequency 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 maintaing 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*.

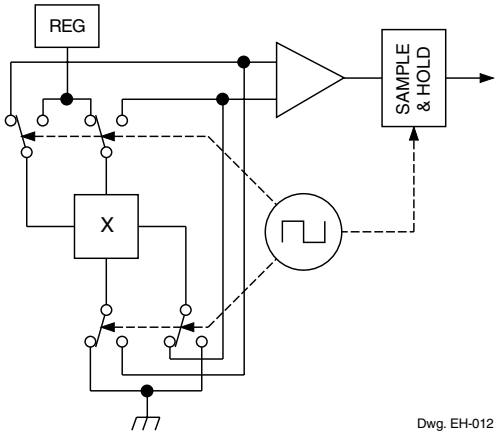
Operation. As shown in the output characteristic graphs, the output of the A3362 turns on when a magnetic field (south pole) perpendicular to the Hall sensor is increased above the operate point threshold (B_{OP}). After turn on, the output will source current equal to the device operating current plus 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.

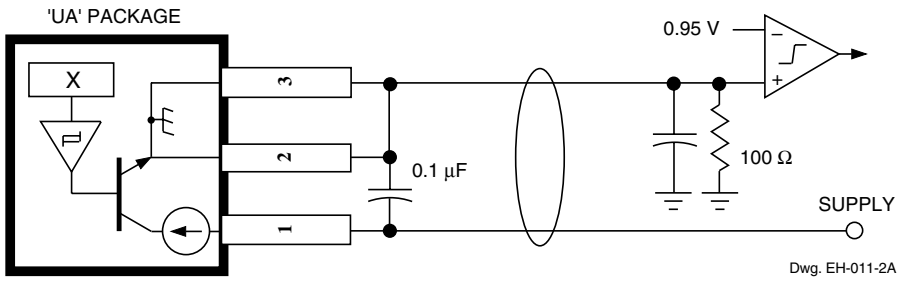
Extensive applications information on magnets and Hall-effect sensors is also available in the *Allegro Electronic Data Book* AMS-702 or *Application Note* 27701 or www.allegromicro.com



Dwg. AH-011-2



Dwg. EH-012



Dwg. EH-011-2A

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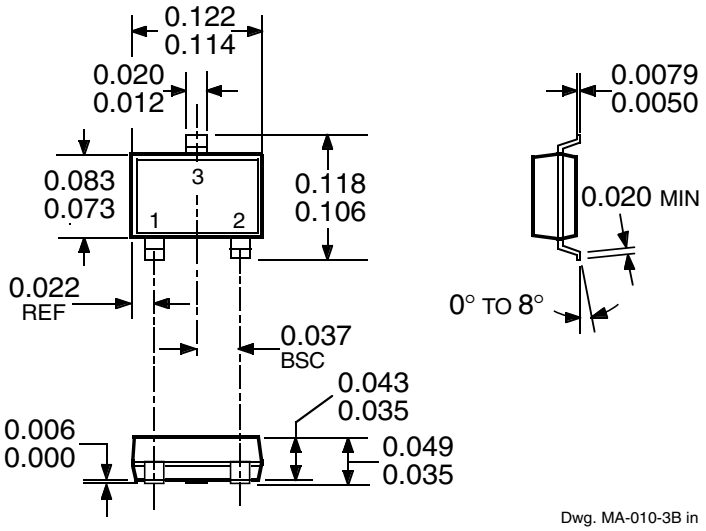
PACKAGE DESIGNATOR 'LH'

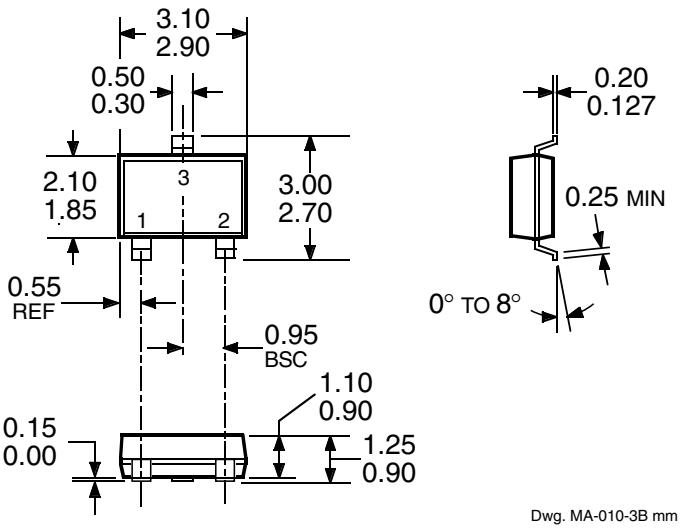
(fits SC-74A solder-pad layout)

Dimensions in Inches
(for reference only)

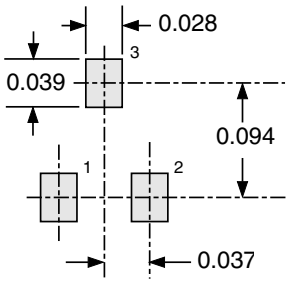


Dwg. MA-010-3B in

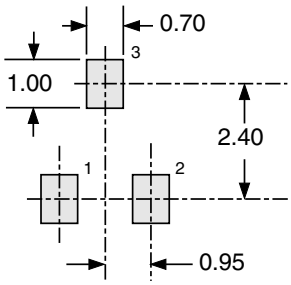
Dimensions in Millimeters
(controlling dimensions)



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.

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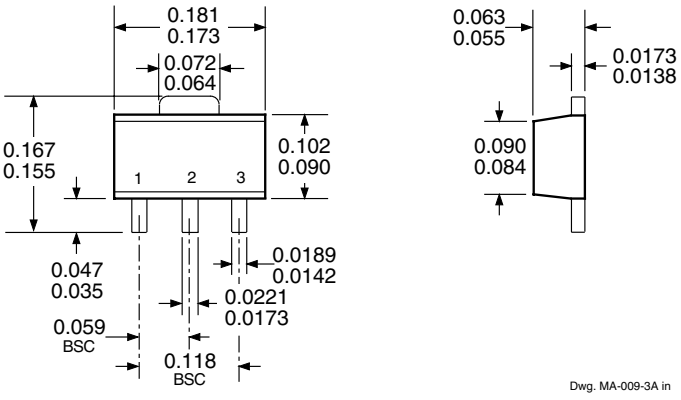
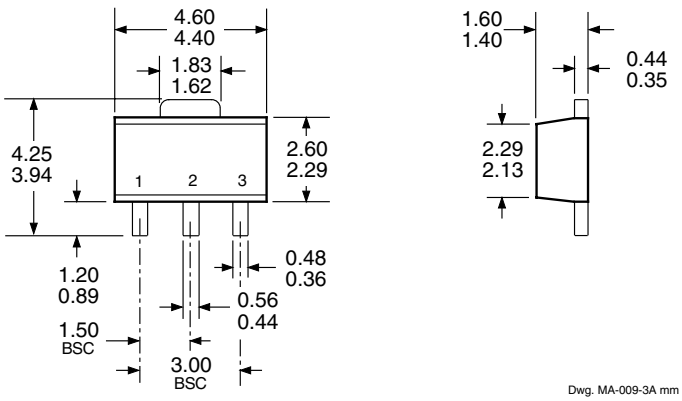
PACKAGE DESIGNATOR 'LT'
(SOT-89/TO-243AA)

Dimensions in Inches
(for reference only)

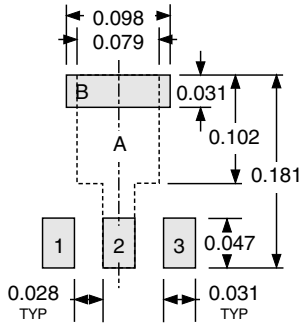


Dwg. MA-009-3A in

Dimensions in Millimeters
(controlling dimensions)

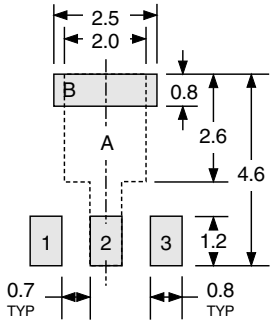


Dwg. MA-009-3A mm



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.

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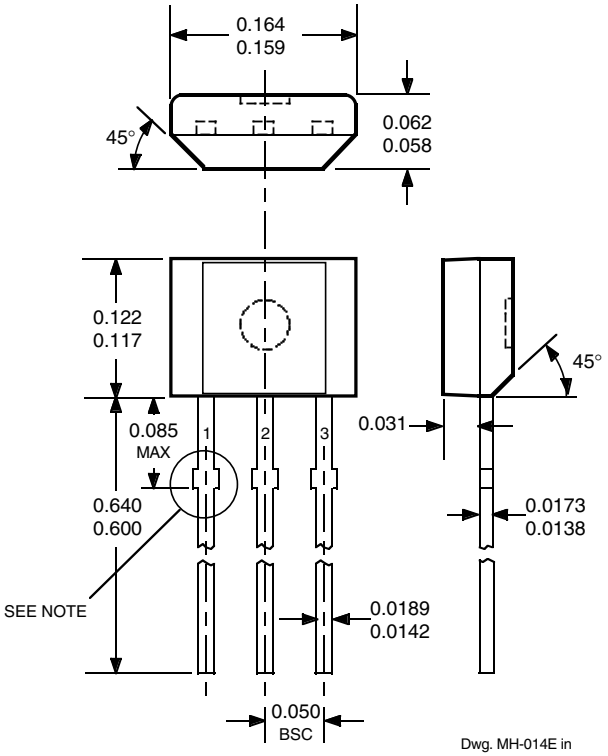
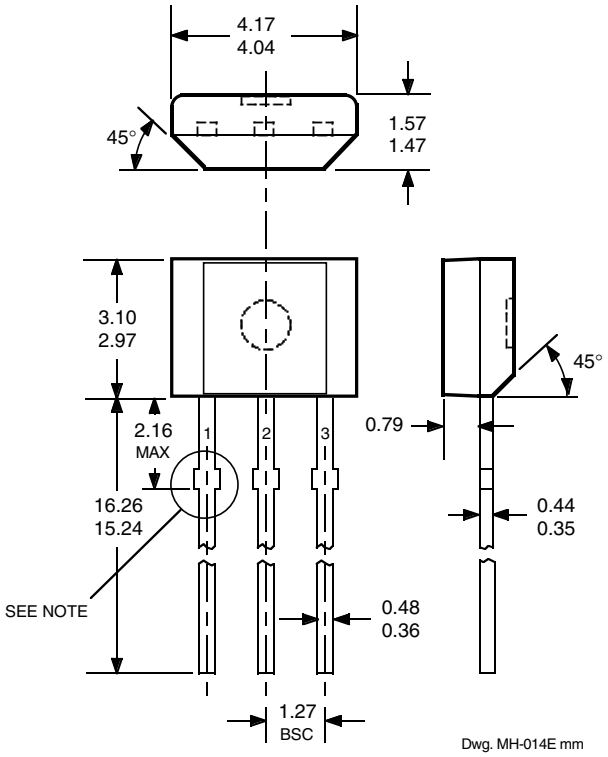
PACKAGE DESIGNATOR 'UA'

Dimensions in Inches
(controlling dimensions)



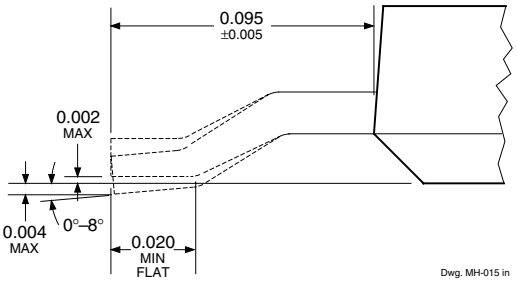
Dwg. MH-014E in

Dimensions in Millimeters
(for reference only)

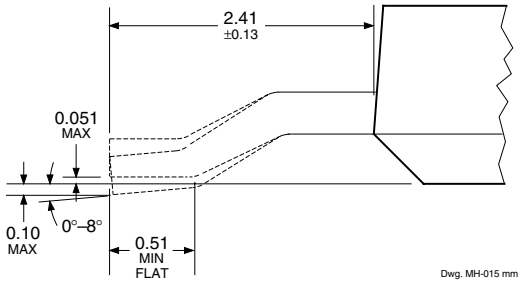


Dwg. MH-014E mm

Surface-Mount Lead Form (order A336xEUA-TL)



Dwg. MH-015 in



Dwg. MH-015 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.

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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 SENSORS

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 & 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.

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