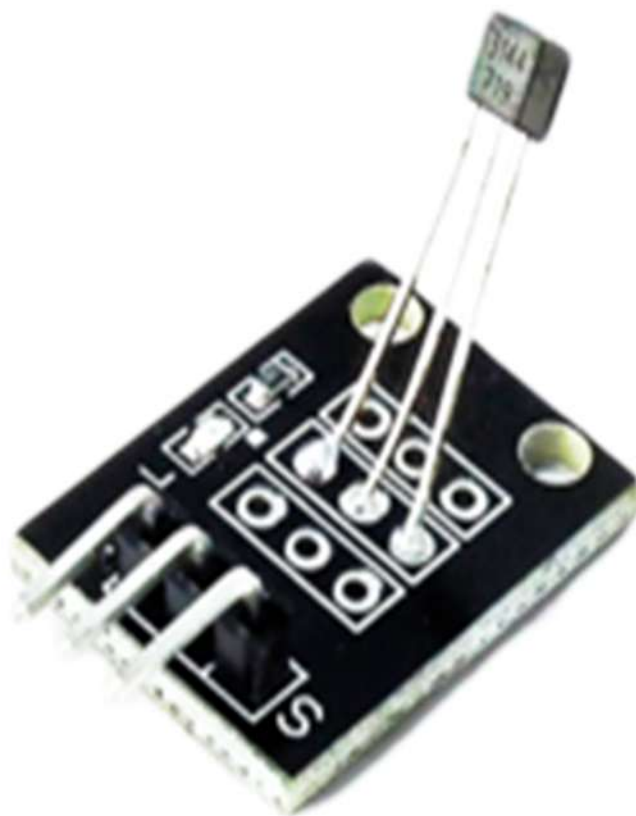


Hall Sensor Module



Contents:

- 1. Descriptions**
- 2. Pinout**
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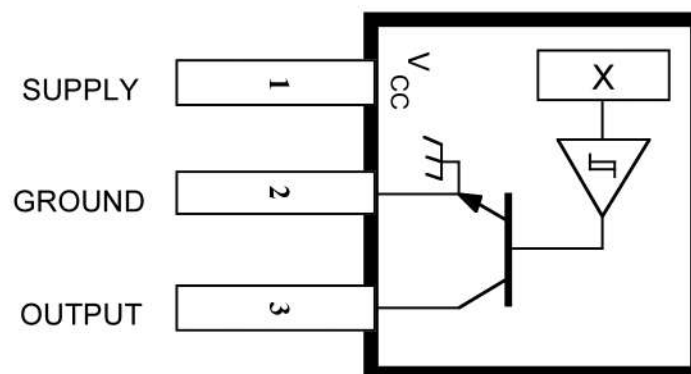
1. Description

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, smallsignal 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 SOT89/TO-243AA transistor package for surface-mount applications; suffix '-UA' is a three-lead ultra-mini-SIP.

2. Pinout



3. Features and Benefits

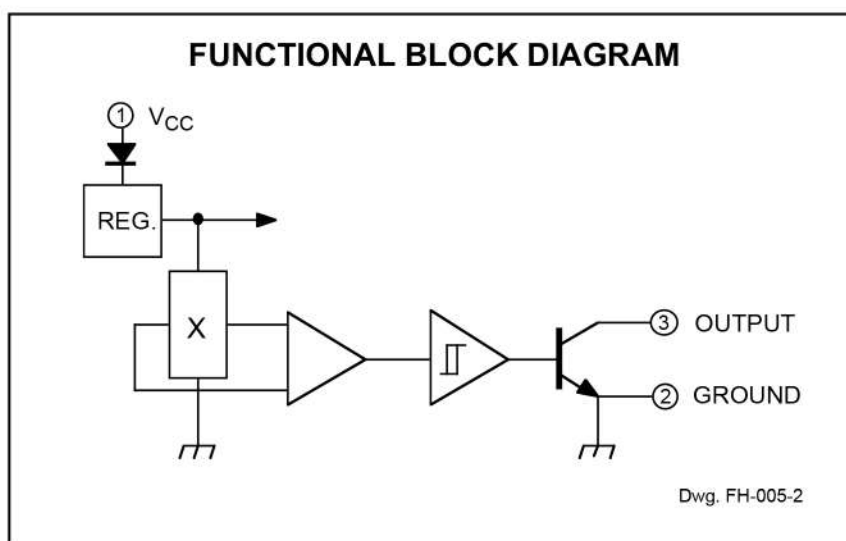
- Superior Temp. Stability for Automotive or Industrial Applications
- 4.5 V to 24 V Operation ... Needs Only An Unregulated Supply
- Open-Collector 25 mA Output ... Compatible with Digital Logic
- Reverse Battery Protection
- Activate with Small, Commercially Available Permanent Magnets
- Solid-State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

4. Absolute Maximum Ratings

At $T_A = +25^\circ\text{C}$

Supply Voltage, VCC	28 V
Reverse Battery Voltage, VRCC	-35 V
Magnetic Flux Density, B	Unlimited
Output OFF Voltage, VOUT	28 V
Reverse Output Voltage, VOUT	-0.5 V
Continuous Output Current, IOOUT	25 mA
Operating Temperature Range, TA	
Suffix 'E-'	-40°C to +85°C
Suffix 'L-'	-40°C to +150°C
Storage Temperature Range, TS .	-65°C to +170°C

5. Functional Block Diagram



6. Electric Characteristics

VCC = 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	$V_{OUT(SAT)}$	$I_{OUT} = 20 \text{ mA}$, $B > B_{OP}$	—	175	400	mV
Output Leakage Current	I_{OFF}	$V_{OUT} = 24 \text{ V}$, $B < B_{RP}$	—	<1.0	10	μA
Supply Current	I_{CC}	$B < B_{RP}$ (Output OFF)	—	4.4	9.0	mA
Output Rise Time	t_r	$R_L = 820 \Omega$, $C_L = 20 \text{ pF}$	—	0.04	2.0	μs
Output Fall Time	t_f	$R_L = 820 \Omega$, $C_L = 20 \text{ pF}$	—	0.18	2.0	μs

7. 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 $T_A = 25^\circ\text{C}$	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 $T_A = 25^\circ\text{C}$	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 $T_A = 25^\circ\text{C}$	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 $T_A = +25^\circ\text{C}$ and $V_{CC} = 8\text{ V}$.

B_{OP} = operate point (output turns ON); B_{RP} = release point (output turns OFF);

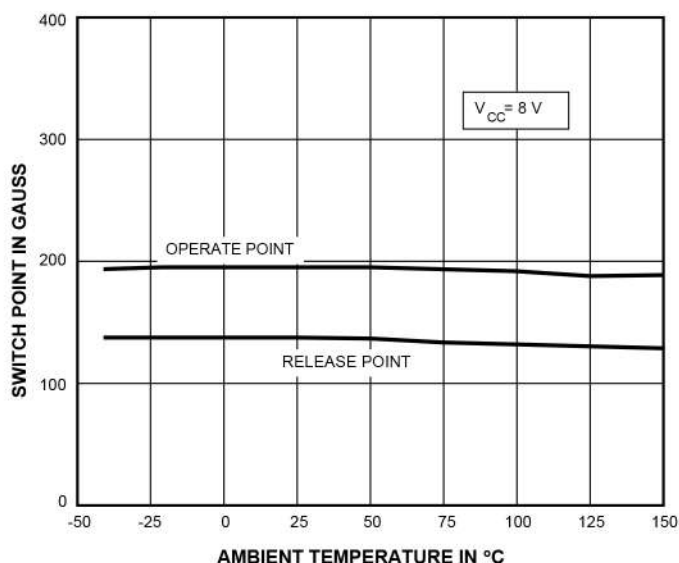
B_{hys} = hysteresis ($B_{OP} - B_{RP}$).

1 gauss (G) is exactly equal to 0.1 millitesla (mT).

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

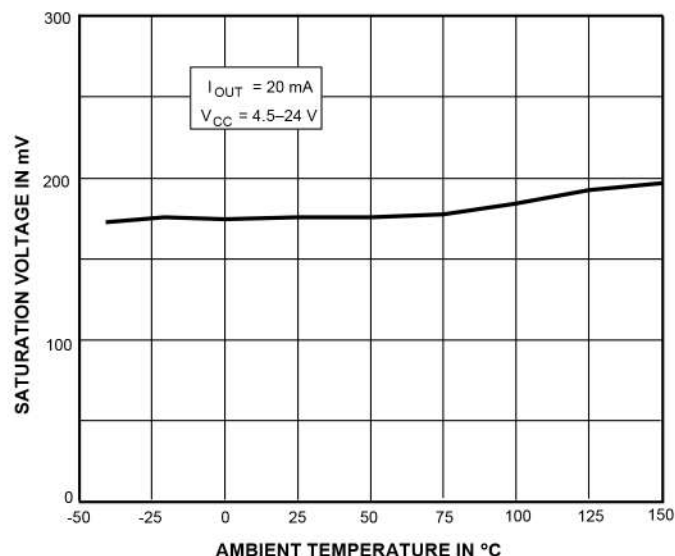
8. Typical Operating Characteristics

A3142– SWITCH POINTS



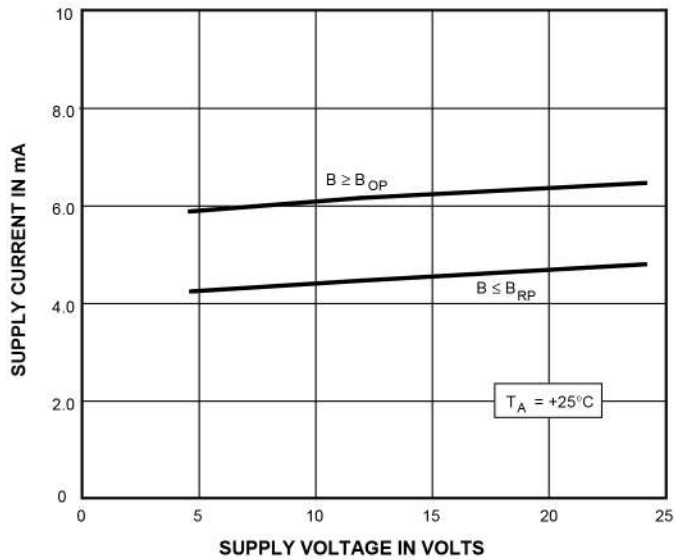
Dwg. GH-044

OUTPUT SATURATION VOLTAGE



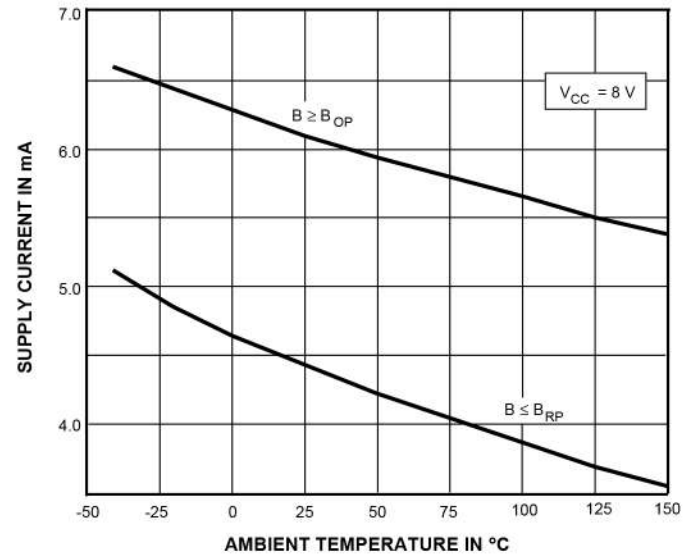
Dwg. GH-040-1

SUPPLY CURRENT



Dwg. GH-041-1

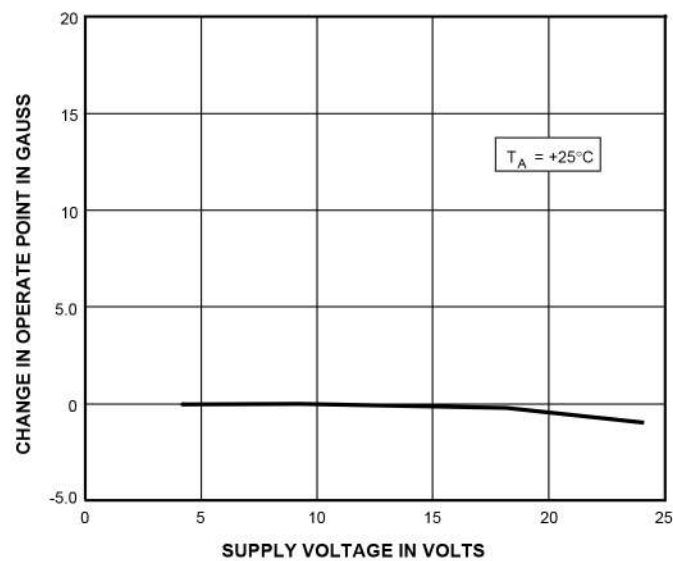
SUPPLY CURRENT



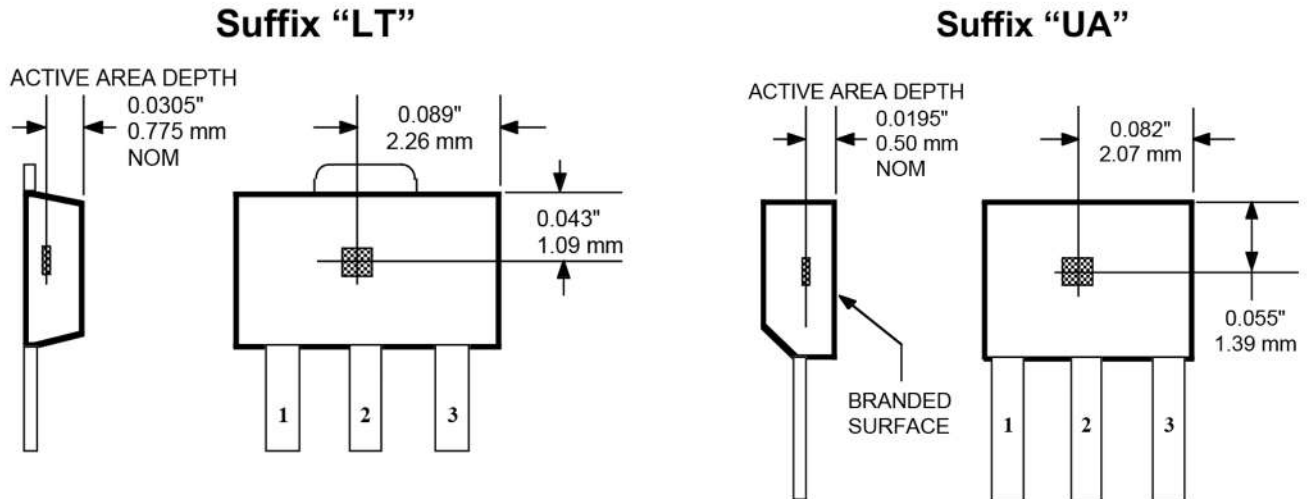
Dwg. GH-039-1

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

CHANGE IN OPERATE POINT



9. Sensor Locations

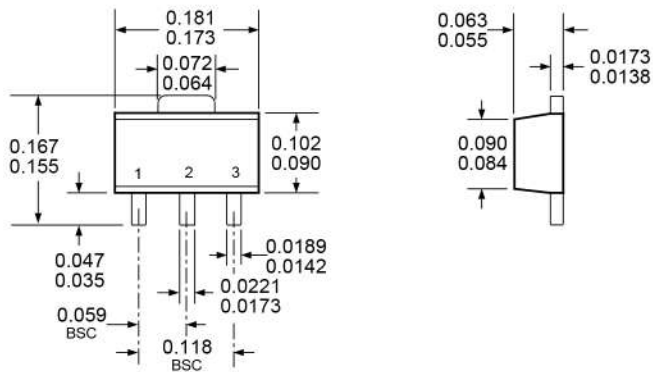


10. Operations

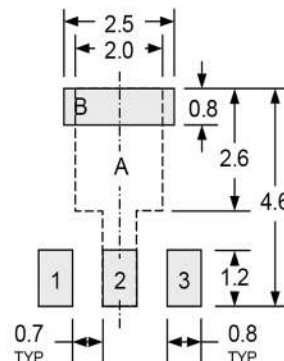
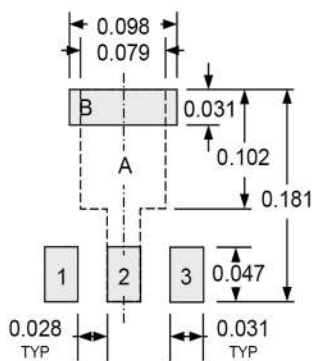
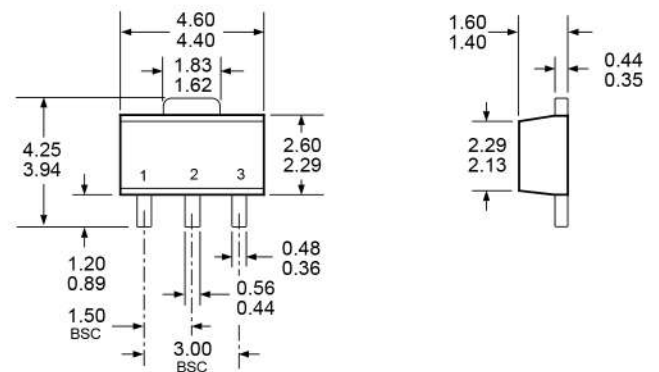
The output of these devices (pin 3) switches low when the magnetic field at the Hall sensor exceeds the operate point threshold (BOP). At this point, the output voltage is $V_{OUT}(SAT)$. When the magnetic field is reduced to below the release point threshold (BRP), the device output goes high. The difference 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

11. Package Designator 'LT'

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

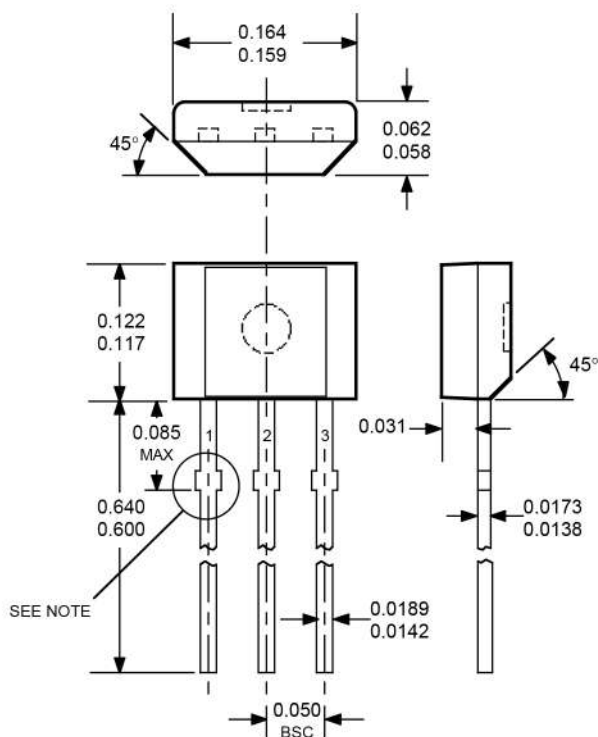
Pads 1, 2, 3, and A – Standard SOT89 Layout
 Pads 1, 2, 3, and B – Low-Stress Version
 Pads 1, 2, and 3 only – Lowest Stress, But Not Self Aligning

NOTES:

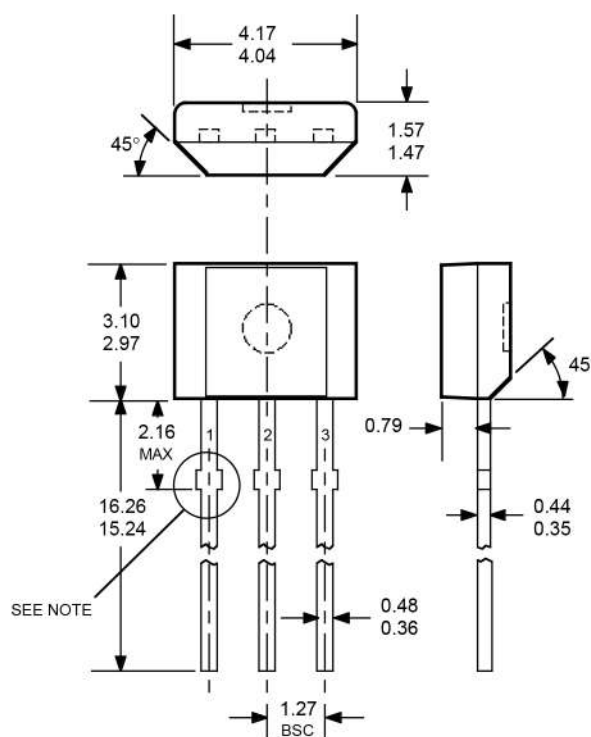
1. Exact body and lead configuration at vendor's option within limits shown.
2. Supplied in bulk pack (500 pieces per bag) or add "TR" to part number for tape and reel.
3. Only low-temperature ($\leq 240^{\circ}\text{C}$) reflow-soldering techniques are recommended for SOT89 devices.

12. Package Designator 'UA'

Dimensions in Inches
(controlling dimensions)



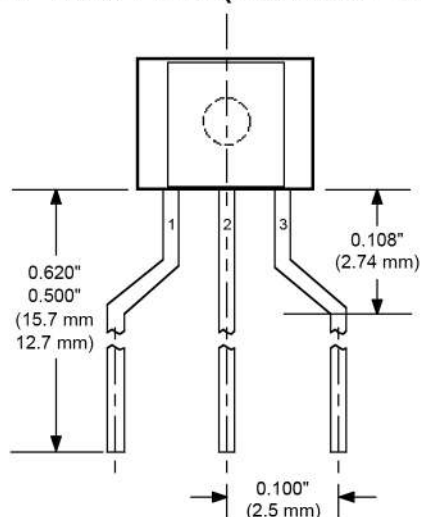
Dimensions in Millimeters
(for reference only)



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 A314xxUA-LC)



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).

13. Switches

UNIPOLAR HALL-EFFECT DIGITAL SWITCHES						
Partial Part Number	Operate Point (G) Over Oper. Voltage & Temp. Range	Release Point (G) Voltage & 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
A3163E	<160 (Typ 98)	>30 (Typ 79)	5 to 40	E	LT, UA	2-wire
A3240x	<50 (Typ 35)	>5 (Typ 25)	Typ 10	E, L	LH, LT, UA	chopper stabilized
A3250x	<50 to >350	—	5 to 35	J, L	UA	programmable, chopper stabilized
A3251x	<50 to >350	—	5 to 35	J, L	UA	programmable, 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
MICROPOWER OMNIPOLAR HALL-EFFECT DIGITAL SWITCHES						
Partial Part Number	Operate Points (G) Over Oper. Voltage & Temp. Range	Release Points (G) Voltage & Temp. Range	Hysteresis (G) Range	Oper. Temp.	Packages	Average Supply Current (µA)
A3209E	>-60, <60	<-5, >5	Typ 7.7	E	LH, UA	<425 (Typ 145)
A3210E	>-60, <60	<-5, >5	Typ 7.7	E	LH, UA	<60 (Typ 8.8)
A3212E	>-55, <55	<-10, >10	Typ. 8	E	LH, UA	<10 (Typ 4.2)
BIPOLAR HALL-EFFECT DIGITAL SWITCHES						
Partial Part Number	Operate Point (G) Over Oper. Voltage & Temp. Range	Release Point (G) Voltage & Temp. Range	Hysteresis (G) Range	Oper. Temp.	Packages	Replaces and Comments
UGx3132	<95 (Typ 32)	>-95 (Typ -20)	>30 (Typ 52)	K, L, S	LT, UA	3030, 3130, 3131
UGx3133	<75 (Typ 32)	>-75 (Typ -20)	>30 (Typ 52)	K, L, S	LT, UA	
UGx3134	-40 to 50	-50 to 40	5 to 55	E, L	LT, UA	
A3260x	<30 (Typ 10)	>-30 (Typ -10)	Typ 20	E, L	LH, LT, UA	2 wire, chopper stabilized

Notes:

1) Typical data is at TA = +25°C and nominal operating voltage.

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