HIGH SENSITIVITY CMOS HALL-EFFECT LATCH AH921

General Description

The AH921 is a Hall-effect latch designed in mixed signal CMOS technology. It is quite suitable for use in automotive, industrial and consumer applications.

Superior high-temperature performance is made possible through dynamic offset cancellation, which reduces the residual offset voltage normally caused by device over-molding, temperature dependencies, and thermal stress. The device integrates a voltage regulator, Hall-voltage generator, small-signal amplifier, chopper stabilization, schmitt trigger, and is directly drivable by the output.

An on-board regulator permits operation with supply voltage from 3.5V to 24V.

The AH921 is available in TO-92S-3 and SOT-23-3 packages, which are optimized for most applications.

Features

- Wide Operating Voltage Range from 3.5 to 24V
- Symmetrical Switch Points
- Chopper-stabilized Amplifier Stage
- Superior Temperature Stability
- Compact Size
- Built-in Pull-up Resistor
- ESD Rating: 3500V (Human Body Model)

Applications

- Brushless DC Motor Commutation
- Brushless DC Fan
- Solid-state Switch
- Revolution Counting
- Speed Detection
- High Sensitivity and Unconnected Switch

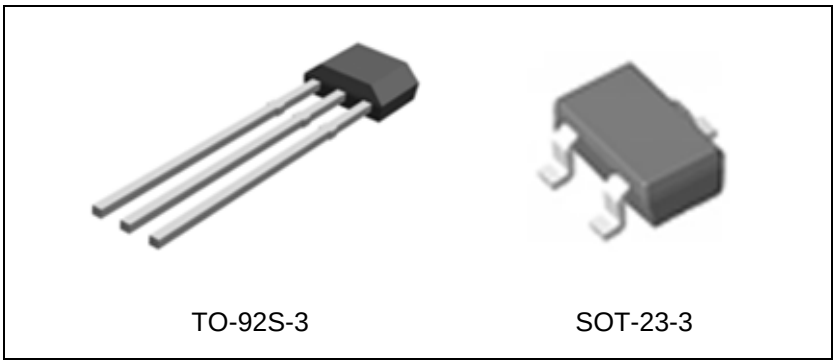
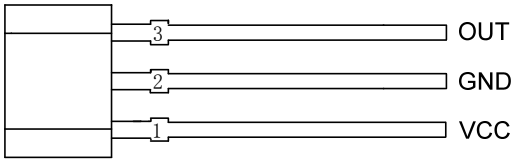


Figure 1. Package Types of AH921

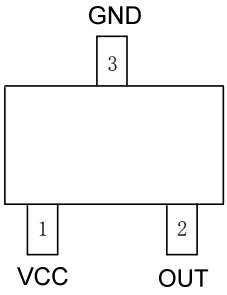
Pin Configuration

Z3 Package
(TO-92S-3)



(Front View)

N Package
(SOT-23-3)



(Top View)

Figure 2. Pin Configuration of AH921

Pin Description

Pin Number		Pin Name	Function
TO-92S-3	SOT-23-3		
1	1	VCC	Supply voltage
2	3	GND	Ground pin
3	2	OUT	Output pin

Functional Block Diagram

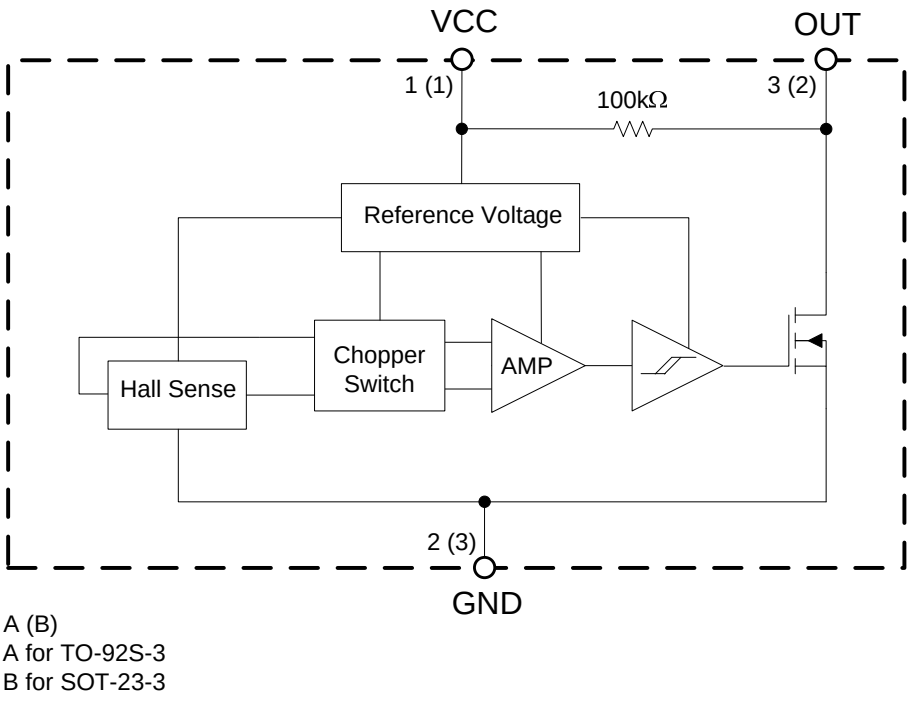
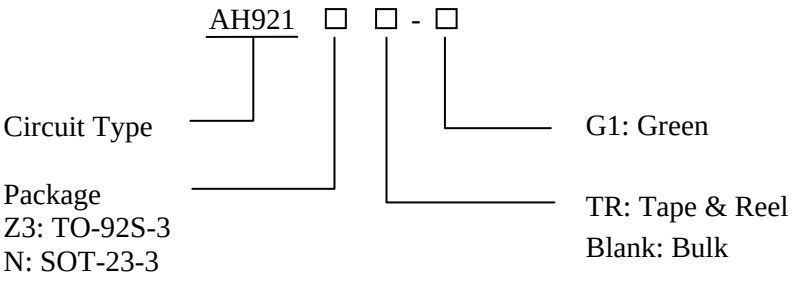


Figure 3. Functional Block Diagram of AH921

Ordering Information



Package	Temperature Range	Part Number	Marking ID	Packing Type
TO-92S-3	-40 to 125°C	AH921Z3-G1	921	Bulk
SOT-23-3		AH921NTR-G1	GS6	Tape & Reel

BCD Semiconductor's Pb-free products, as designated with "G1" suffix in the part number, are RoHS compliant and green.

Absolute Maximum Ratings (Note 1)

Parameter	Symbol	Value		Unit
Supply Voltage	V_{CC}	28		V
Supply Current (Fault)	I_{CC}	5		mA
Output current (Continuous)	I_{OUT}	25		mA
Power Dissipation	P_D	TO-92S-3	400	mW
		SOT-23-3	230	
Operating Temperature	T_A	-50 to 150		°C
Storage Temperature	T_{STG}	-65 to 150		°C
Maximum Junction Temperature	T_J (Max)	165		°C
ESD (Human Body Model)	ESD	3500		V

Note 1: Stresses greater than those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “Recommended Operating Conditions” is not implied. Exposure to “Absolute Maximum Ratings” for extended periods may affect device reliability.

Recommended Operating Conditions

Parameter	Symbol	Min	Max	Unit
Supply Voltage	V_{CC}	3.5	24	V
Operating Temperature	T_A	-40	125	°C

Electrical Characteristics

V_{CC} =12V, T_A=25°C, unless otherwise specified.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Supply Voltage	V_{CC}	Operating	3.5	12	24	V
Supply Current	I_{CC}	V_{CC}=12V, B<B_{RP}		3.0	5.0	mA
		V_{CC}=12V, B>B_{OP}		3.0	5.0	mA
Saturation Voltage	V_{SAT}	I_{OUT}=20mA, B>B_{OP}		185	500	mV
Output Leakage Current	$I_{LEAKAGE}$	V_{CC}=V_{OUT}=24V, B<B_{RP}		0.1	10	μA
Output Rising Time	t_{RISING}	C_L=20pF		0.4	2	μs
Output Falling Time	$t_{FALLING}$	C_L=20pF		0.4	2	μs

Magnetic Characteristics

V_{CC} =12V, T_A=25°C, unless otherwise specified.

Parameter	Symbol	Min	Typ	Max	Unit
Operating Point	B_{OP}	5	22	40	Gauss
Releasing Point	B_{RP}	-40	-22	-5	Gauss
Hysteresis	B_{HYS}		45		Gauss

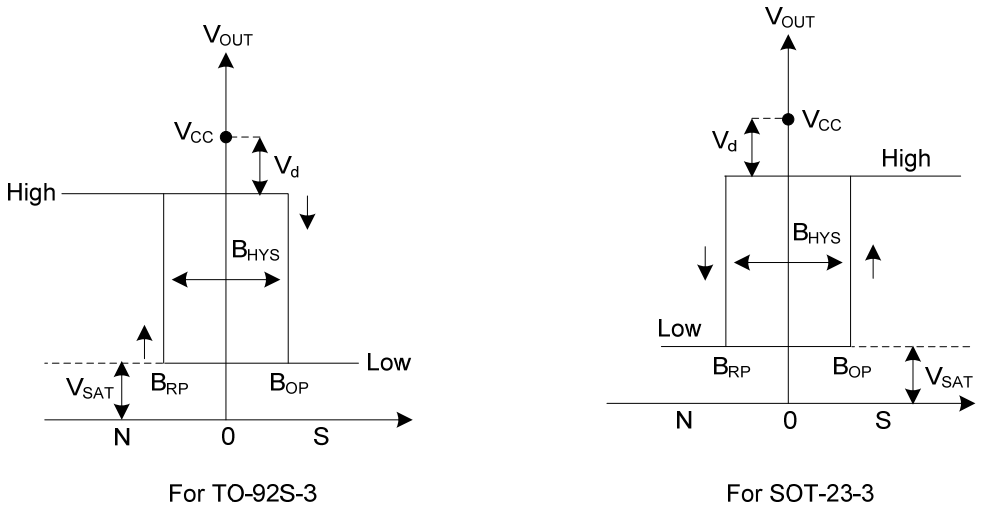


Figure 4. Magnetic Flux Density of AH921

Magnetic Characteristics (Continued)

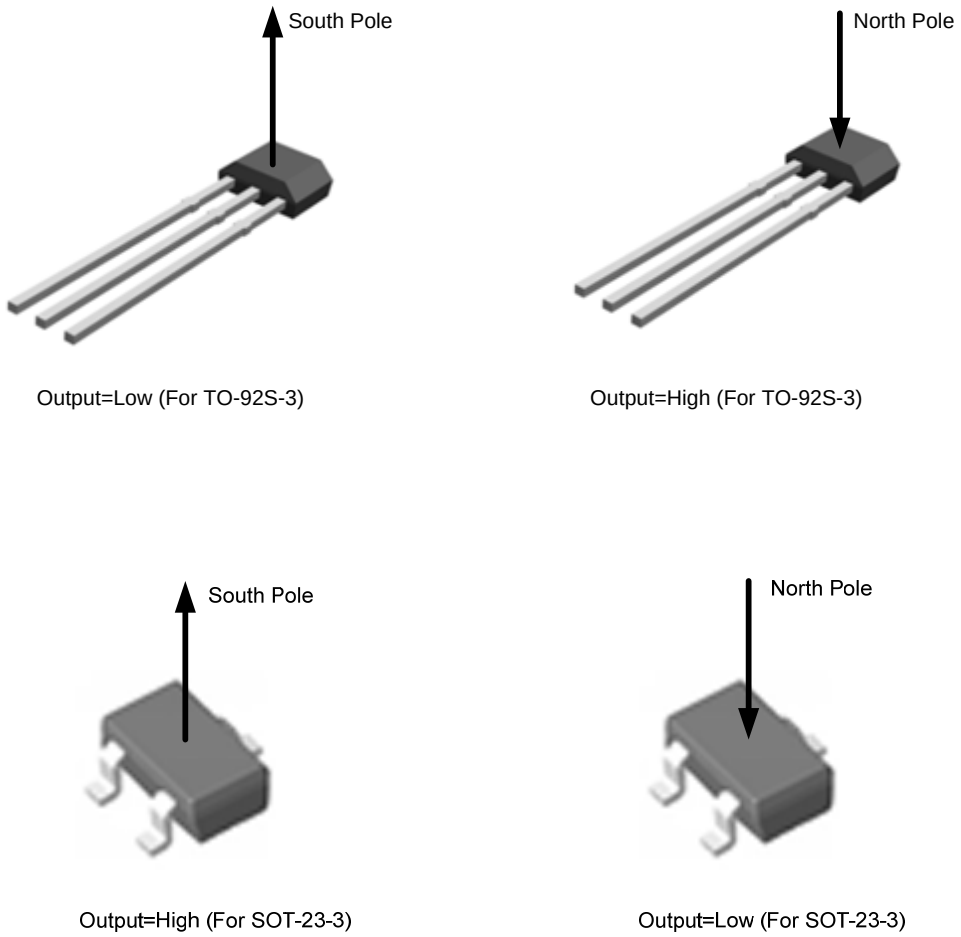


Figure 5. Output Status vs. Magnetic Pole

Package Type	Parameter	Test condition	Output
TO-92S-3	South Pole	$B > B_{OP}$	Low
	North Pole	$B < B_{RP}$	High
SOT-23-3	South Pole	$B > B_{OP}$	High
	North Pole	$B < B_{RP}$	Low

Table 1. Output Status vs. Magnetic Pole

Magnetic Characteristics (Continued)

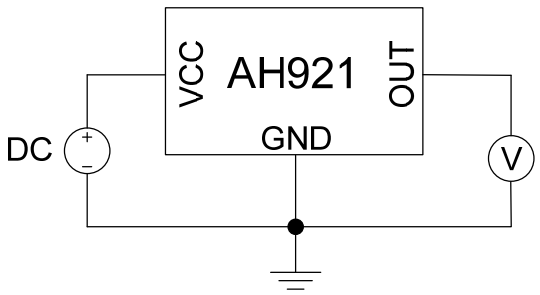


Figure 6. Magnetic Thresholds

Note 2: B_{OP} is determined by putting the device under magnetic field swept from B_{RP}(Min) to B_{OP}(Max) until the output is switched on.
Note 3: B_{RP} is determined by putting the device under magnetic field swept from B_{OP}(Max) to B_{RP}(Min) until the output is switched off.

Test Circuit and Test Conditions

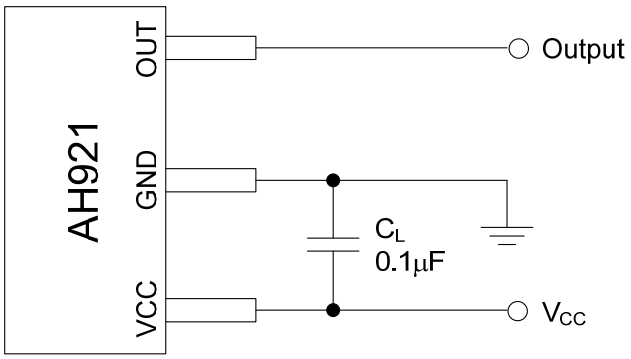


Figure 7. Test Circuit of AH921

Test Circuit and Test Conditions (Continued)

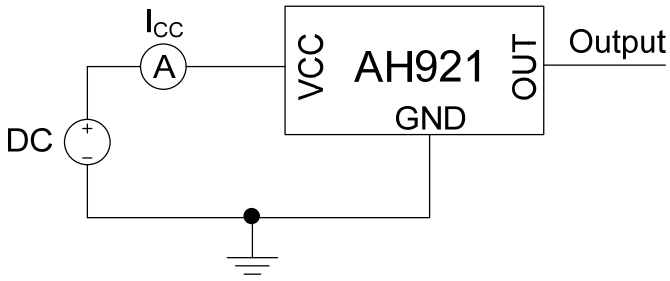


Figure 8. Test Condition of AH921 (Supply Current)

Note 4: Output initial status is low when powering on.
Note 5: The supply current I_{CC} represents the average supply current. The output is open during measurement.
Note 6: The device is put under the magnetic field: $B<B_{RP.}$

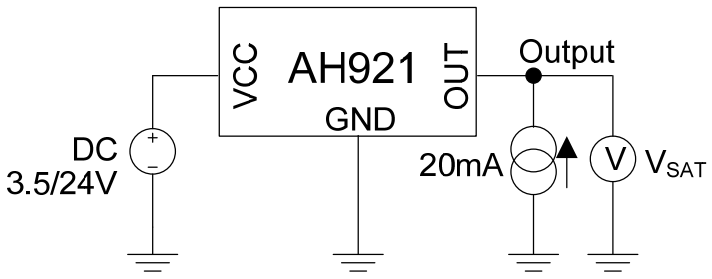


Figure 9. Test Condition of AH921 (Output Saturation Voltage)

Note 7: The output saturation voltage V_{SAT} is measured at V_{CC}=3.5V and V_{CC}=24V.
Note 8: The device is put under the magnetic field: $B>B_{OP.}$

Test Circuit and Test Conditions (Continued)

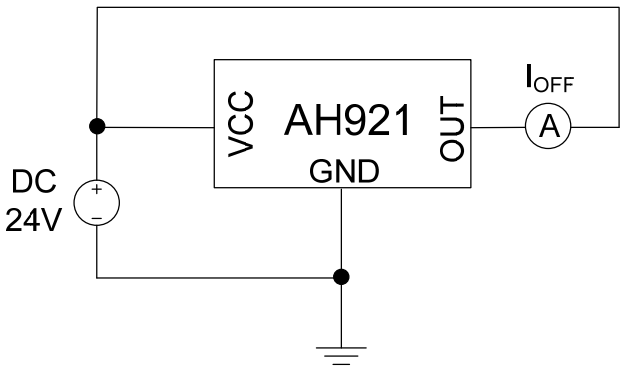


Figure 10. Test Condition of AH921 (Output Leakage Current)

Note 9: The device is put under the magnetic field: $B<B_{RP.}$

Typical Performance Characteristics

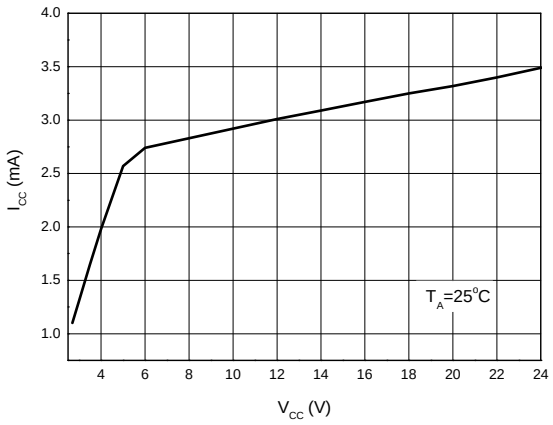


Figure 11. I_{CC} vs. V_{CC}

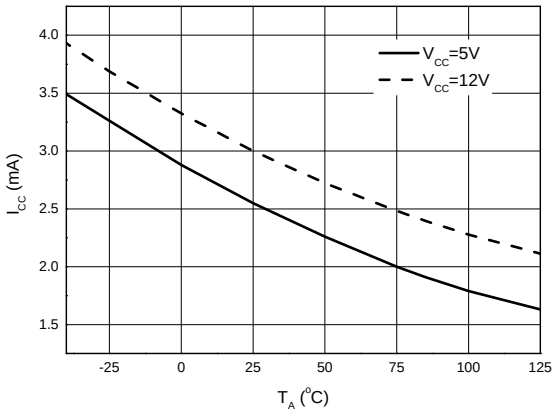


Figure 12. I_{CC} vs. T_A

Typical Performance Characteristics (Continued)

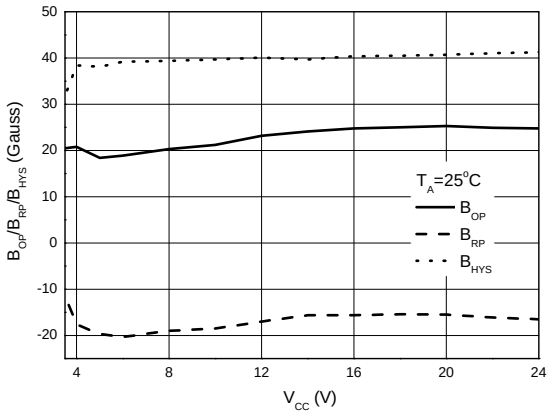


Figure 13. $B_{OP}/B_{RP}/B_{HYS}$ vs. V_{CC}

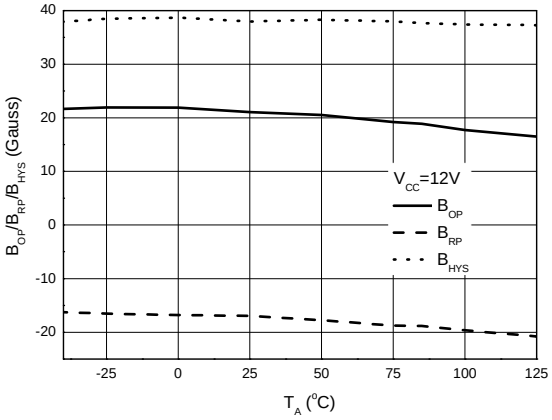


Figure 14. $B_{OP}/B_{RP}/B_{HYS}$ vs. T_A

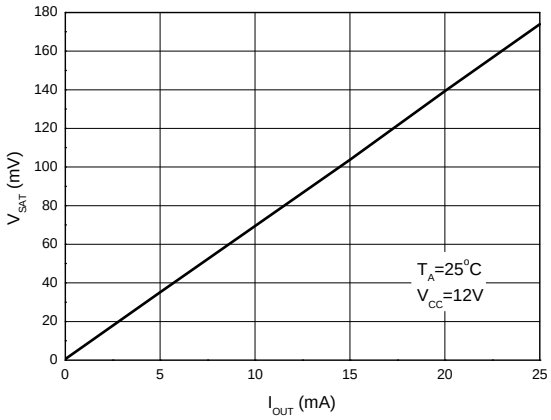


Figure 15. V_{SAT} vs. I_{OUT}

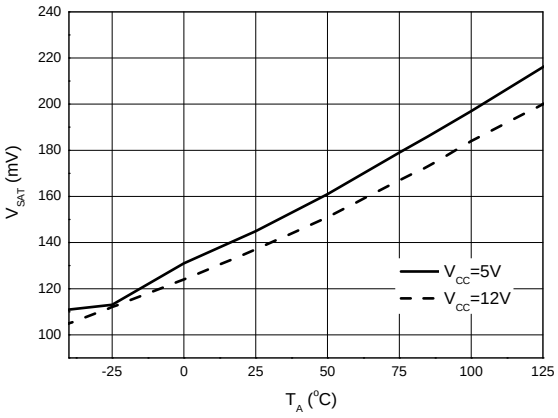


Figure 16. V_{SAT} vs. T_A

Typical Performance Characteristics (Continued)

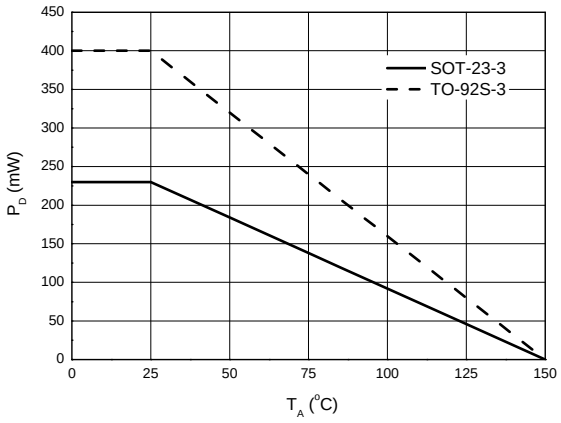


Figure 17. P_D vs. T_A

Typical Application

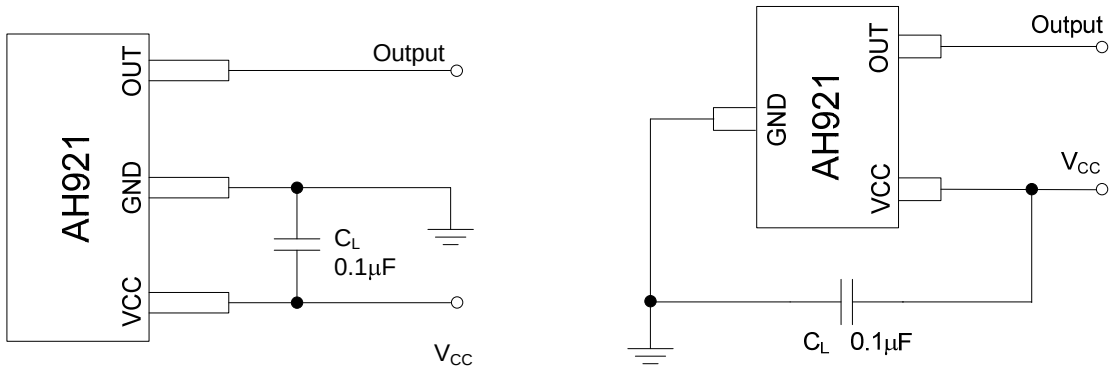
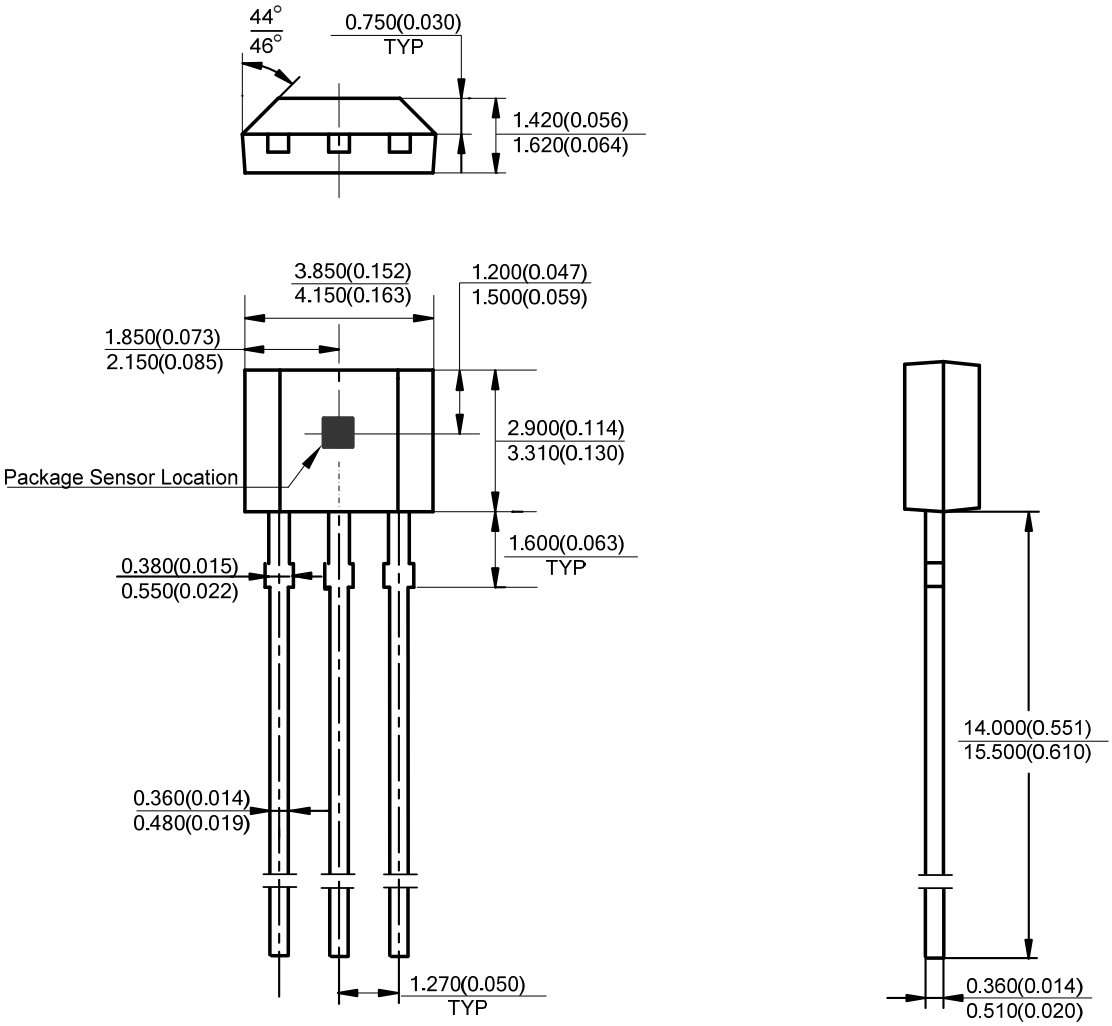


Figure 18. Typical Application Circuit of AH921

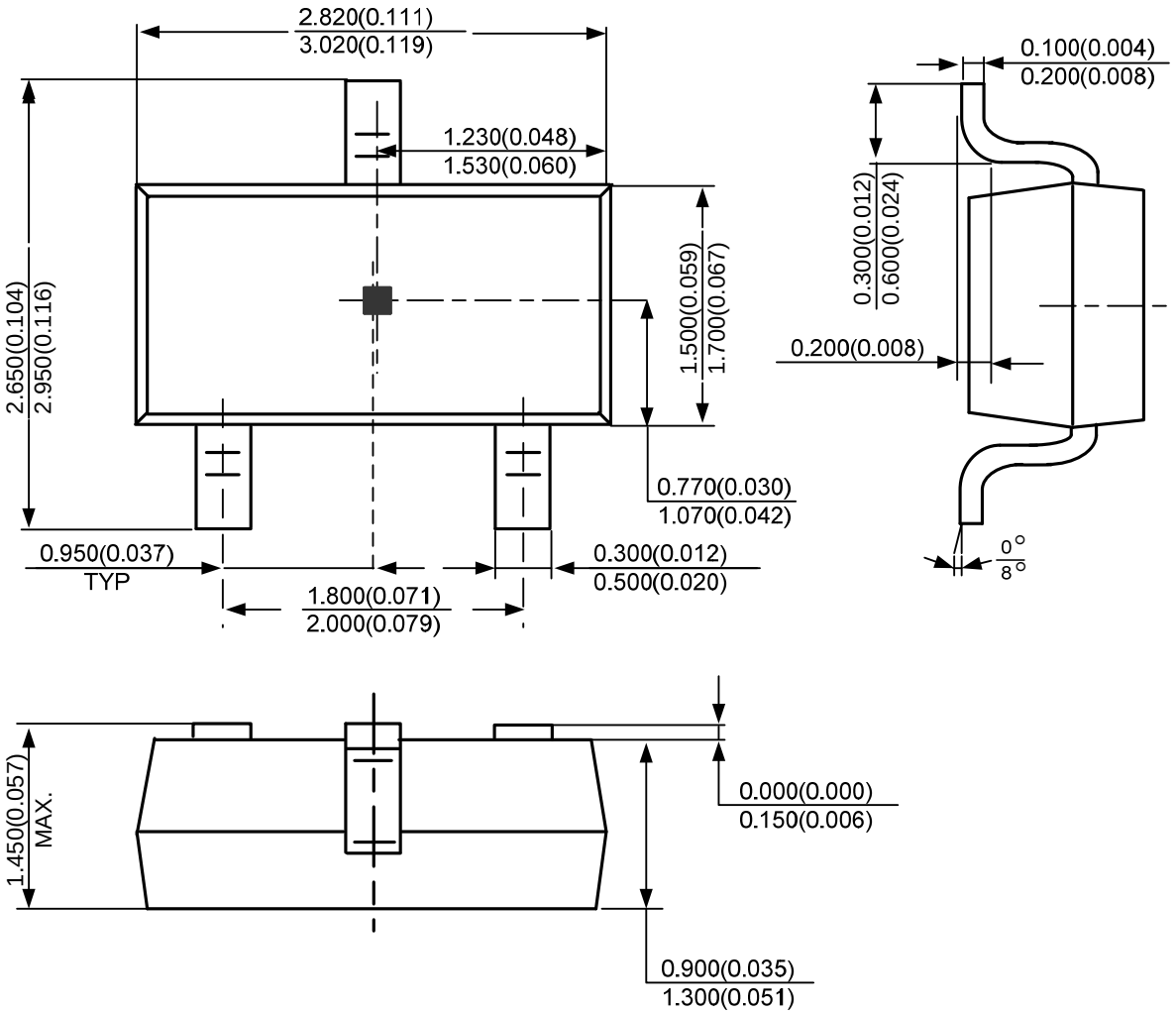
Mechanical Dimensions

TO-92S-3 **Unit: mm(inch)**



Mechanical Dimensions (Continued)

SOT-23-3 **Unit: mm(inch)**



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