HIGH SENSITIVITY CMOS HALL-EFFECT LATCH

Description

The AH920 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 open-drain output.

An on-board regulator permits operation with supply voltage from 3.5V to 20V.

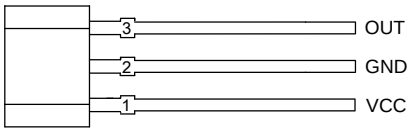
The AH920 is available in TO-92S-3 and SOT-23-3 packages, which are optimized for most applications.

Features

- Wide Operating Voltage Range from 3.5V to 20V
- Symmetrical Switch Points
- Chopper-stabilized Amplifier Stage
- Superior Temperature Stability
- Open-drain Output
- Wide Operating Temperature Range: -40ºC to +125ºC
- ESD Rating: 6000V (Human Body Model)
- **Totally Lead-free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**

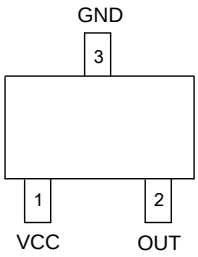
Pin Assignments

(Front View)



TO-92S-3

(Top View)



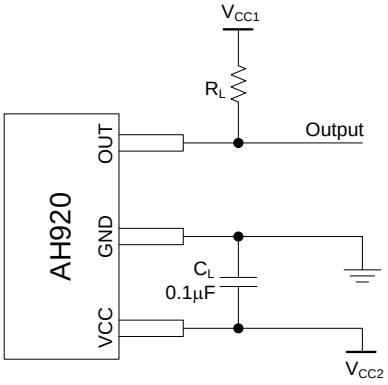
SOT-23-3

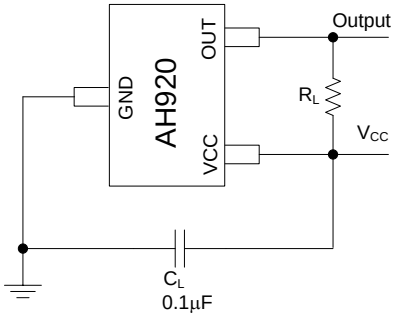
Applications

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

Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.
2. See http://www.diodes.com/quality/lead_free.html for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.

Typical Applications Circuit

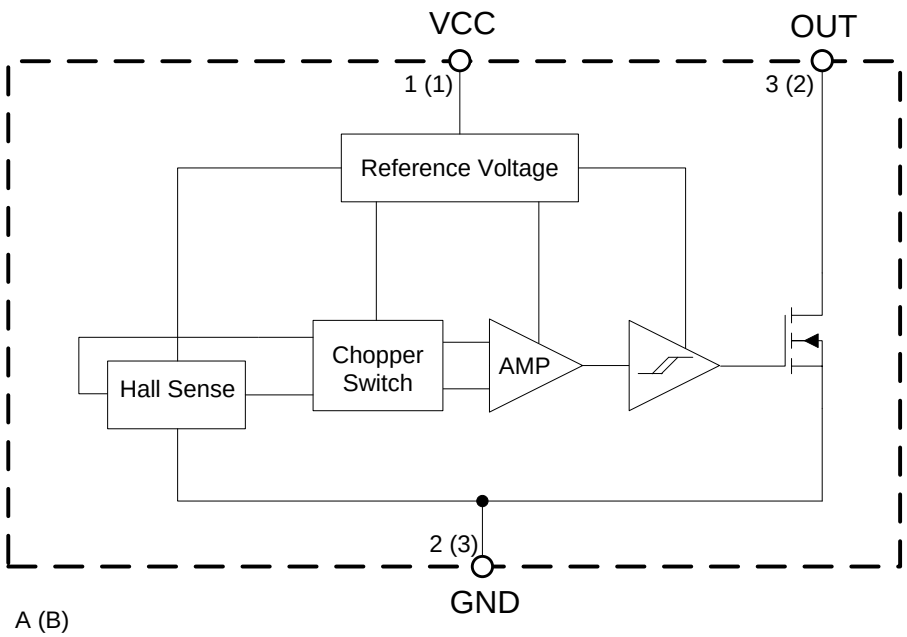




Pin Descriptions

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



A (B)
A for TO-92S-3
B for SOT-23-3

Absolute Maximum Ratings (Note 4)

Symbol	Parameter	Rating		Unit
V_{CC}	Supply Voltage	20		V
I_{CC}	Supply Current (Fault)	5		mA
I_{OUT}	Output Current (Continuous)	25		mA
P_D	Power Dissipation	TO-92S-3	400	mW
		SOT-23-3	230	
T_A	Operation Temperature	-50 to +150		ºC
T_{STG}	Storage Temperature	-65 to +150		ºC
T_J (Max)	Maximum Junction Temperature	+165		ºC
ESD	ESD (Human Body Model)	6000		V

Note 4: 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

Symbol	Parameter	Min	Max	Unit
V_{CC}	Supply Voltage	3.5	20	V
T_A	Operating Ambient Temperature	-40	+125	ºC

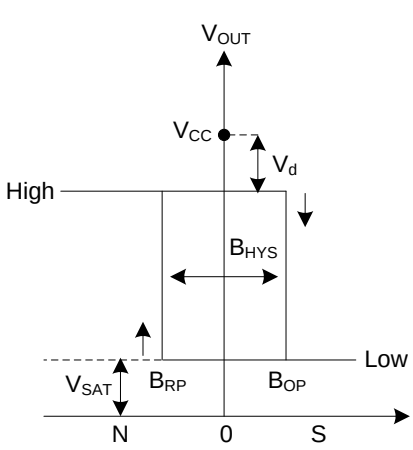
Electrical Characteristics (@V_{CC} =12V, T_A =+25°C, unless otherwise specified. Notes 5 & 6)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I_{CC}	Supply Current	B<B_{RP}	–	3.0	5.0	mA
		B>B_{OP}	–	3.0	5.0	
V_{SAT}	Saturation Voltage	V_{CC}=3.5V, I_{OUT}=5mA, B>B_{OP} (Note 7)	–	45	120	mV
		I_{OUT}=20mA, B>B_{OP} (Note 7)	–	185	500	mV
		V_{CC}=20V, I_{OUT}=20mA, B>B_{OP} (Note 7)	–	185	500	mV
$I_{LEAKAGE}$	Output Leakage Current	V_{OUT}=20V, B<B_{RP} (Note 8)	–	0.1	10	μA
t_{RISING}	Output Rising Time	R_L=1kΩ,C_L=20pF	–	0.4	2	μs
$t_{FALLING}$	Output Falling Time	R_L=1kΩ,C_L=20pF	–	0.4	2	μs

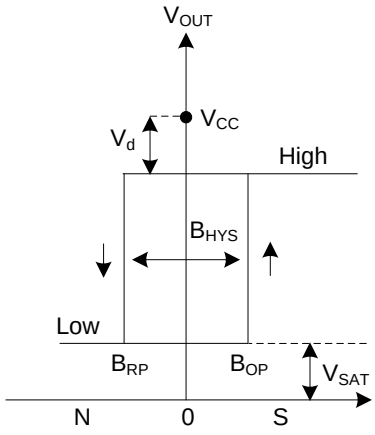
Notes: 5. Output initial status is low when powering on.
6. The supply current I_{CC} represents the average supply current. The output is open during measurement.
7. The device is put under the magnetic field: B>B_{OP}.
8. The device is put under the magnetic field: B<B_{RP}.

Magnetic Characteristics (@V_{CC}=12V, T_A=+25°C, unless otherwise specified.)

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



For TO-92S-3



For SOT-23-3

Figure 1. Magnetic Flux Density of AH920

Magnetic Characteristics (Cont.)

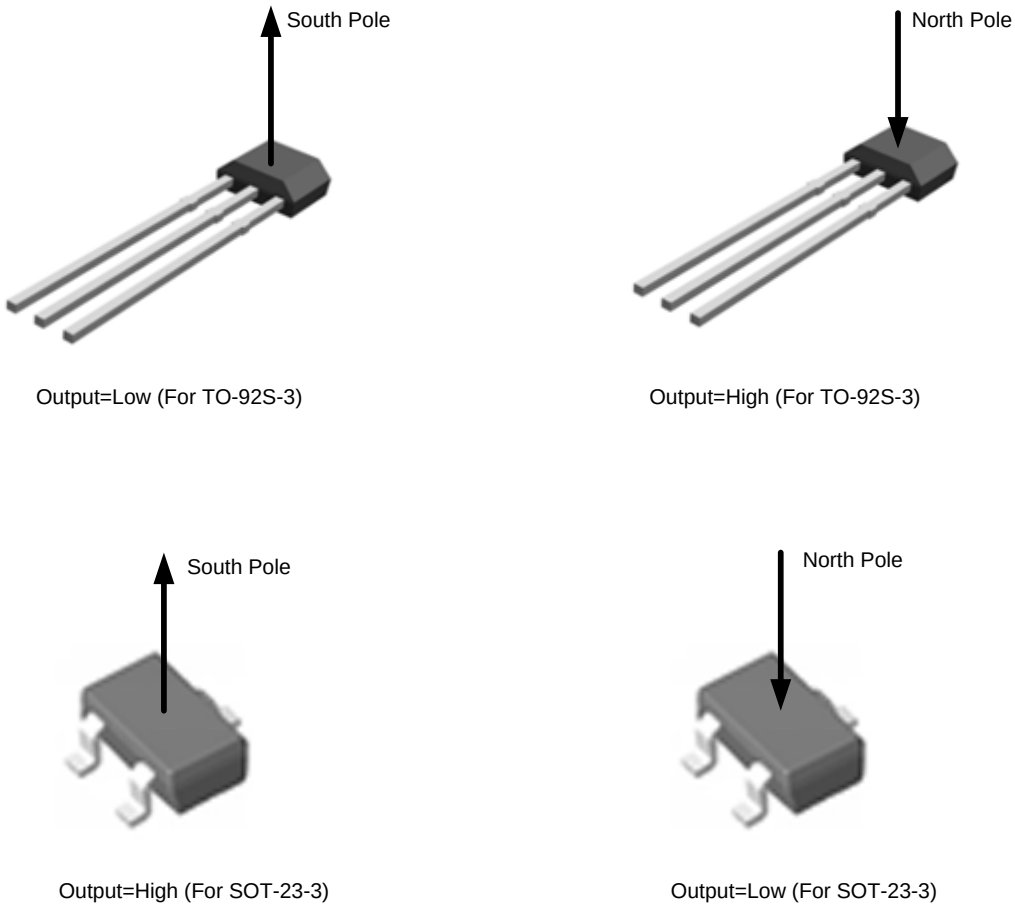


Figure 2. Output Status vs. Magnetic Pole

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 (Cont.)

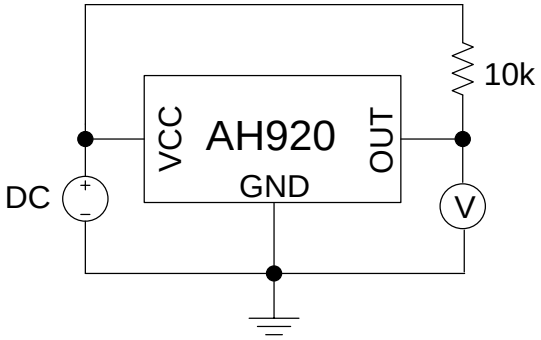


Figure 3. Magnetic Thresholds

Test Circuit and Test Conditions

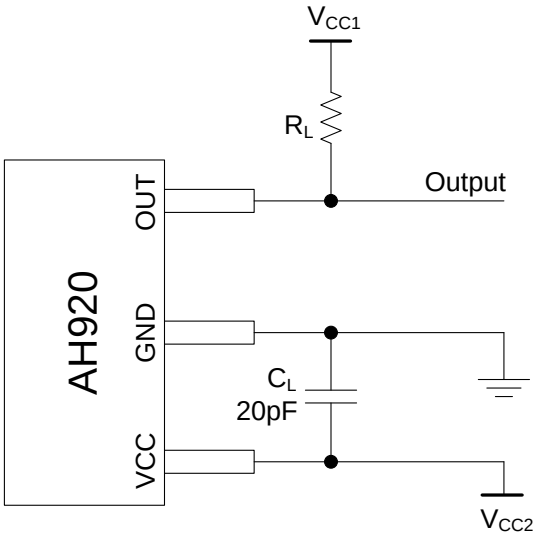


Figure 4. Test Circuit of AH920

Test Circuit and Test Conditions (Cont.)

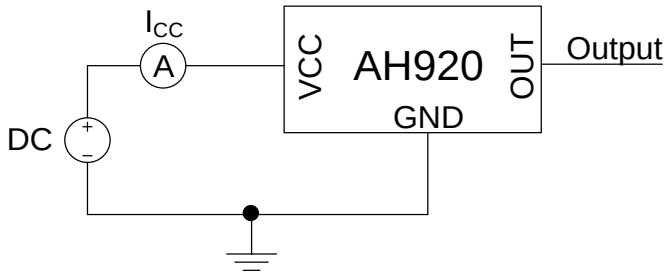


Figure 5. Test Condition of AH920 (Supply Current)

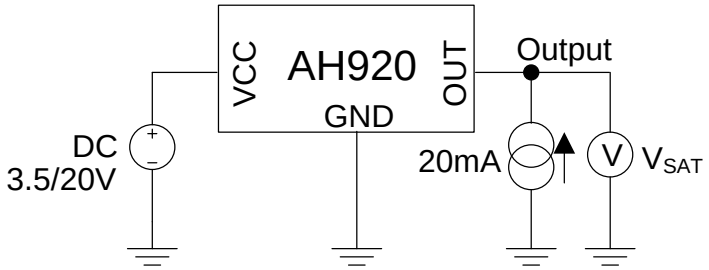


Figure 6. Test Condition of AH920 (Output Saturation Voltage)

Test Circuit and Test Conditions (Cont.)

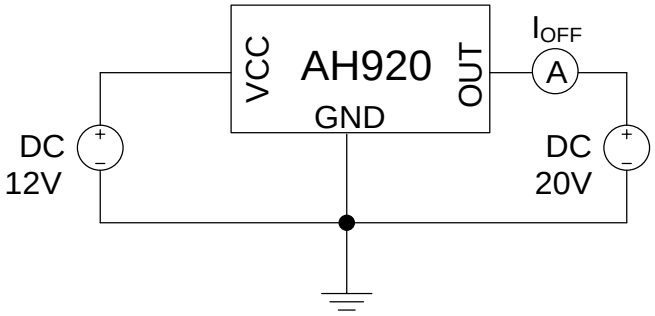
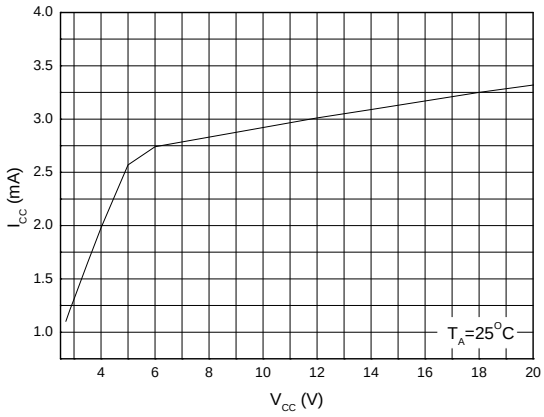


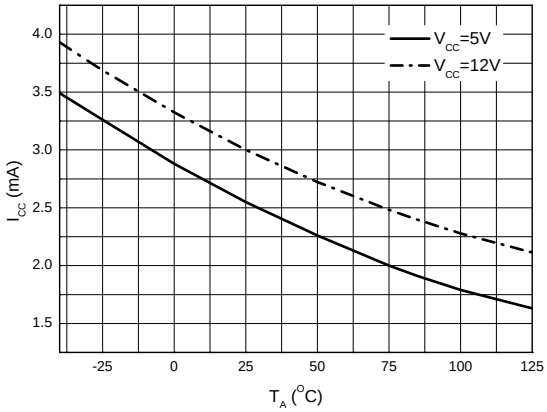
Figure 7. Test Condition of AH920 (Output Leakage Current)

Performance Characteristics

I_{CC} vs. V_{CC}

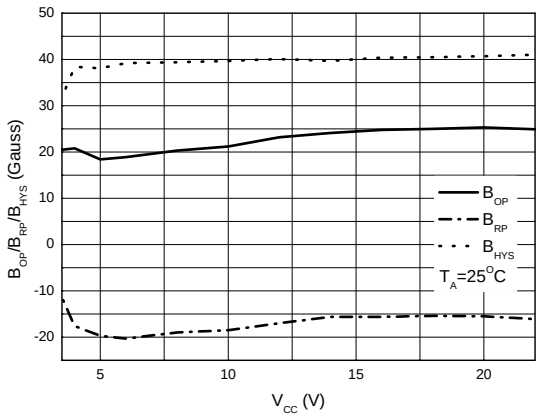


I_{CC} vs. T_A

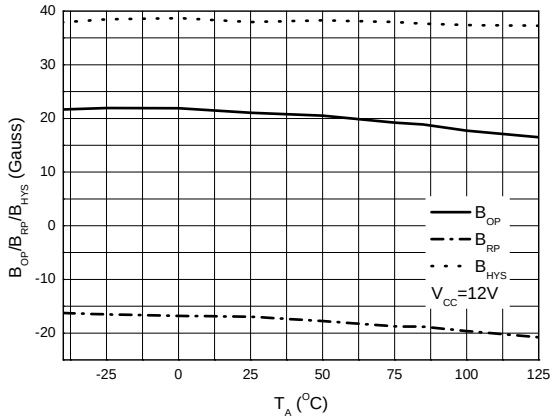


Performance Characteristics (Cont.)

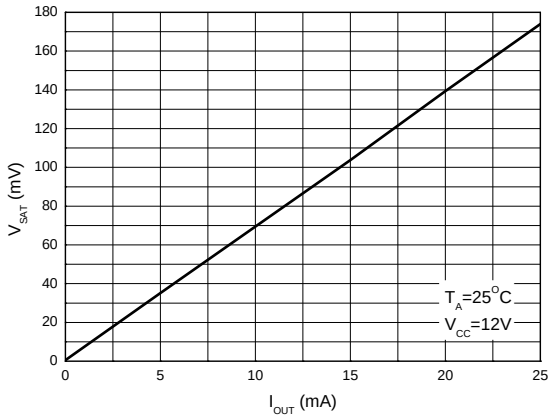
$B_{OP}/B_{RP}/B_{HYS}$ vs. V_{CC}



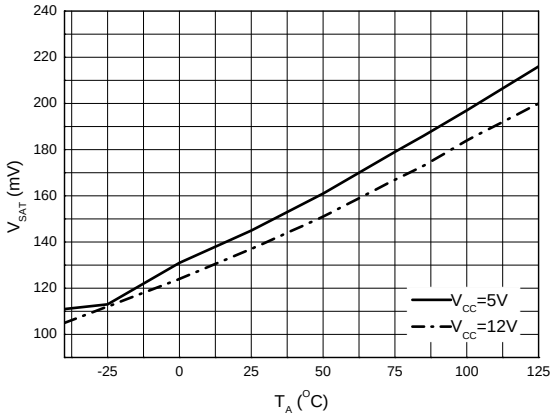
$B_{OP}/B_{RP}/B_{HYS}$ vs. T_A



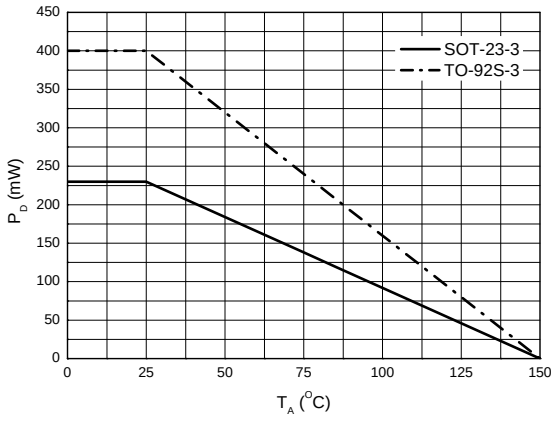
V_{SAT} vs. I_{OUT}



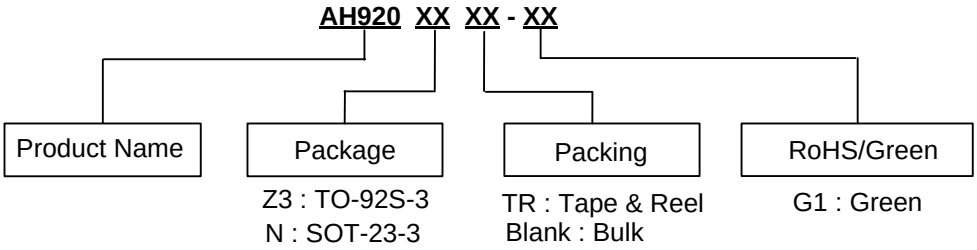
V_{SAT} vs. T_A



P_D vs. T_A



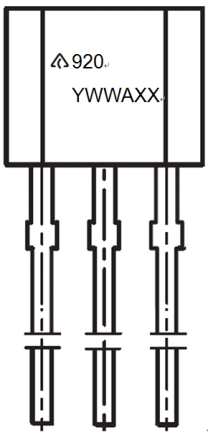
Ordering Information



Package	Temperature Range	Part Number	Marking ID	Packing
TO-92S-3	-40 to +125°C	AH920Z3-G1	920	1000/Bulk
SOT-23-3	-40 to +125°C	AH920NTR-G1	GS7	3000/Tape & Reel

Marking Information

TO-92S-3 (Front View)



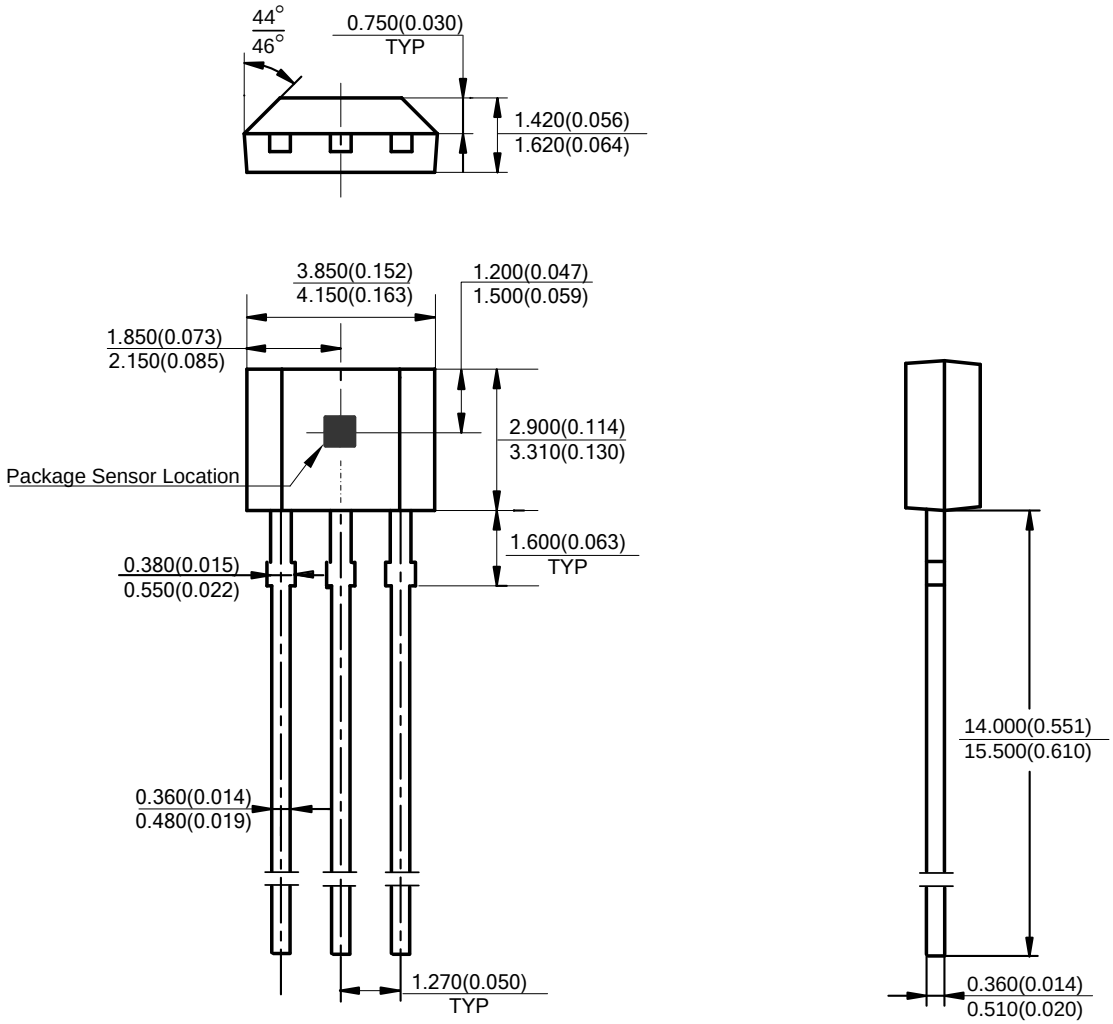
First Line: Logo and Marking ID
Second Line: Date Code
Y: Year
WW: Work Week of Molding
A: Assembly House Code
XX: 7th and 8th Digits of Batch No.

SOT-23-3 (Top View)

: Logo
GS7: Marking ID

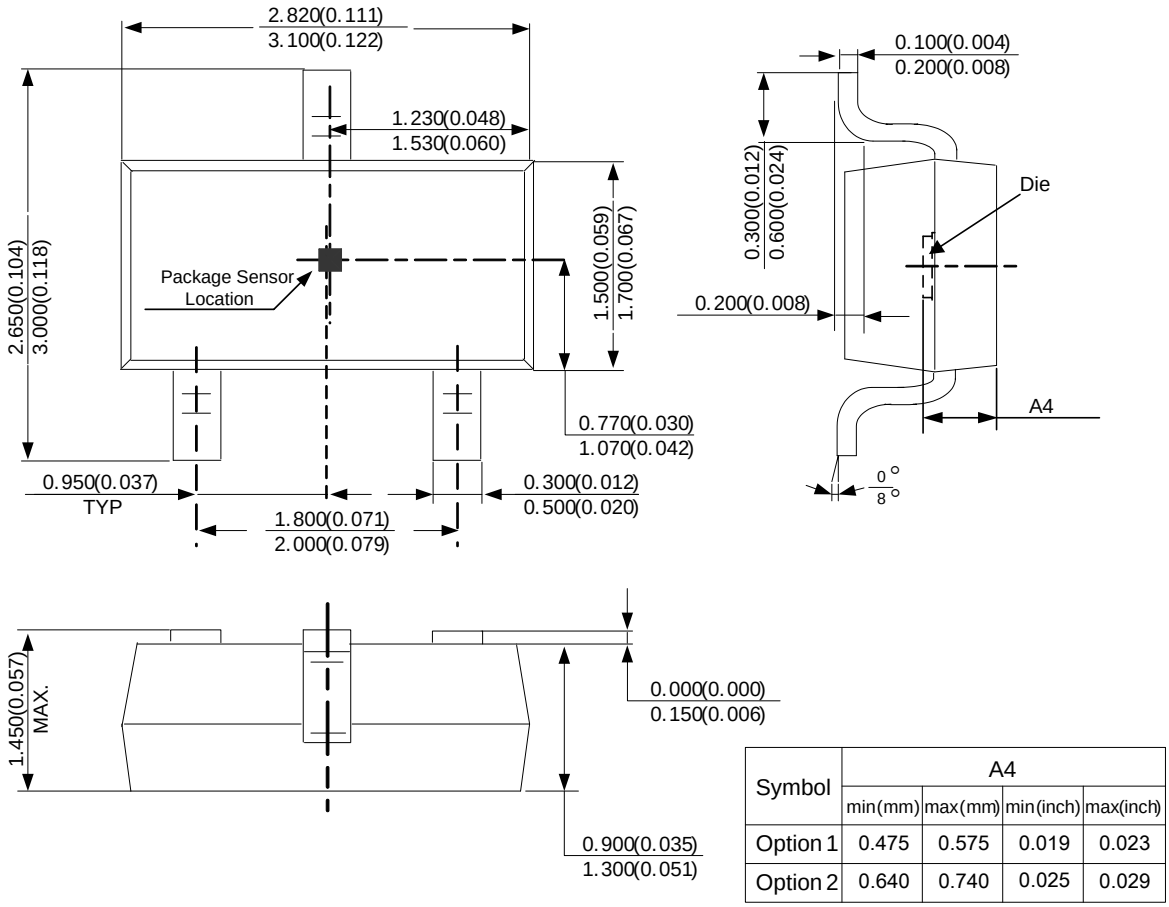
Package Outline Dimensions (All dimensions in mm(inch).)

(1) Package Type: TO-92S-3



Package Outline Dimensions (All dimensions in mm(inch). Cont.)

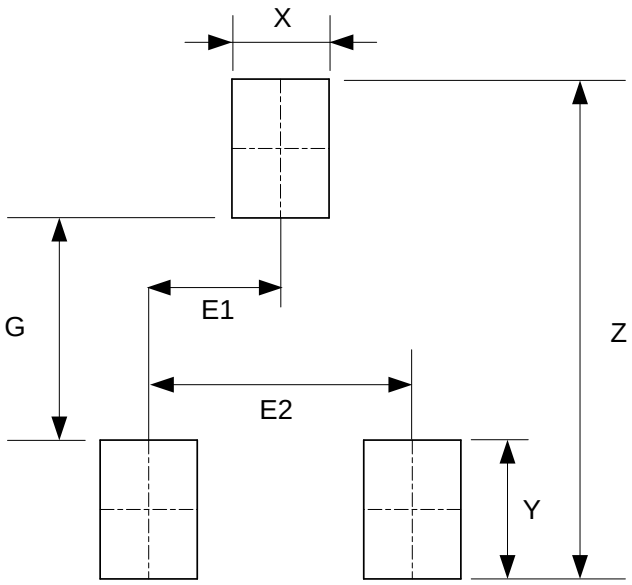
(2) Package Type: SOT-23-3



Symbol	A4			
	min(mm)	max(mm)	min(inch)	max(inch)
Option 1	0.475	0.575	0.019	0.023
Option 2	0.640	0.740	0.025	0.029

Suggested Pad Layout

(1) Package Type: SOT-23-3



Dimensions	Z (mm)/(inch)	G (mm)/(inch)	X (mm)/(inch)	Y (mm)/(inch)	E1 (mm)/(inch)	E2 (mm)/(inch)
Value	3.600/0.142	1.600/0.063	0.700/0.028	1.000/0.039	0.950/0.037	1.900/0.075

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