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# HIGH SENSITIVITY MICROPOWER OMNIPOLAR HALL-EFFECT SWITCH

## Description

The AH9248 is an ultra-sensitive Hall-effect switch with digital latched output, mainly designed for battery-operation, hand-held equipments.

Special CMOS process is used for low-voltage and low-power requirement. A chopper stabilized amplifier improves stability of magnetic switch points. A sleep-awake logic controls the IC in sleep time or awake time. This function will reduce the average operating current of the IC. During the awake time, the output is changed with the magnetic flux density. During the sleep time, the output is latched in its previous state and the current consumption will reduce to some μA.

The IC switching behaviour is omnipolar, either north or south pole sufficient strength will turn the output on. If the magnetic flux density is larger than operating point ($B_{OP}$), the output will be turned on; if it is less than releasing point ($B_{RP}$), the output will be turned off.

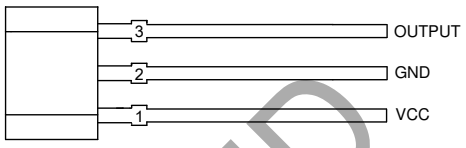
The AH9248 is available in TO-92S-3, SOT-23-3 and DFN-2×2-3 packages which are optimized for most applications.

## Features

- Micropower Operation
- 2.5V to 5.5V Power Supply
- Switching for Both Poles of a Magnet (Omnipolar)
- Stabilized Chopper
- Superior Temperature Stability
- Digital Output Signal
- Built-in Pull-up Resistor (AH9249)
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**

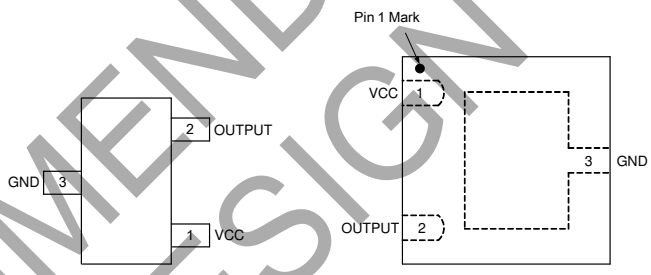
## Pin Assignments

**(Front View)**




**TO-92S-3**

**(Top View)**



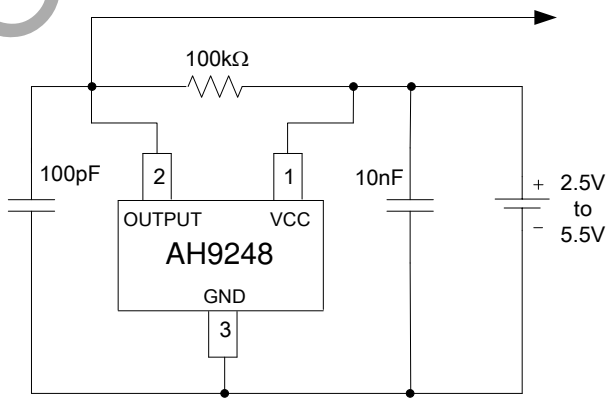

**SOT-23-3** **DFN-2×2-3**

## Applications

- Cover Switch in Notebook PC/PDA
- Handheld Wireless Application Awake Switch
- Magnet Switch in Low Duty Cycle Applications

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

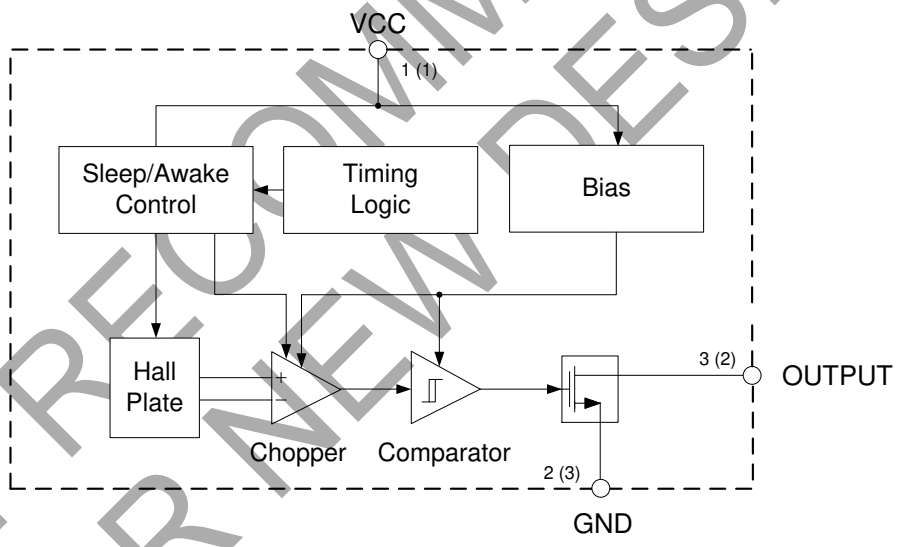


## Pin Descriptions

| Pin Number | | | Pin Name | Function |
|---|---|---|---|---|
| TO-92S-3 | SOT-23-3 | DFN-2×2-3 | | |
| 1 | 1 | 1 | VCC | Power supply pin |
| 2 | 3 | 3 | GND | Ground pin |
| 3 | 2 | 2 | OUTPUT | Output pin |



## Functional Block Diagram




A (B)
A for TO-92S-3
B for SOT-23-3 and DFN-2×2-3

## Absolute Maximum Ratings (@$T_A$=+25°C, Note 4)

| Symbol | Parameter | Rating | | Unit |
|---|---|---|---|---|
| $V_{CC}$ | Supply Voltage | 7 | | V |
| $I_{CC}$ | Supply Current (Fault) | 6 | | mA |
| $V_{OUT}$ | Output Voltage | 7 | | V |
| $I_{OUT}$ | Output Current | 2 | | mA |
| B | Magnetic Flux Density | Unlimited | | Gauss |
| $P_D$ | Power Dissipation | TO-92S-3 | 400 | mW |
| | | SOT-23-3 | 230 | |
| | | DFN-2×2-3 | 230 | |
| $T_{STG}$ | Storage Temperature | -55 to +150 | | °C |
| $T_J$ | Junction Temperature | +150 | | °C |
| ESD | ESD (Machine Model) (Note 5) | 200 | | V |

Notes: 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.
5. Electronic semiconductor products are sensitive to Electro Static Discharge (ESD). Always observe Electro Static Discharge control procedures whenever handling semiconductor products.

## Recommended Operating Conditions

| Symbol | Parameter | Min | Max | Unit |
|---|---|---|---|---|
| $V_{CC}$ | Supply Voltage | 2.5 | 5.5 | V |
| $T_{OP}$ | Operating Temperature | -40 | +85 | °C |

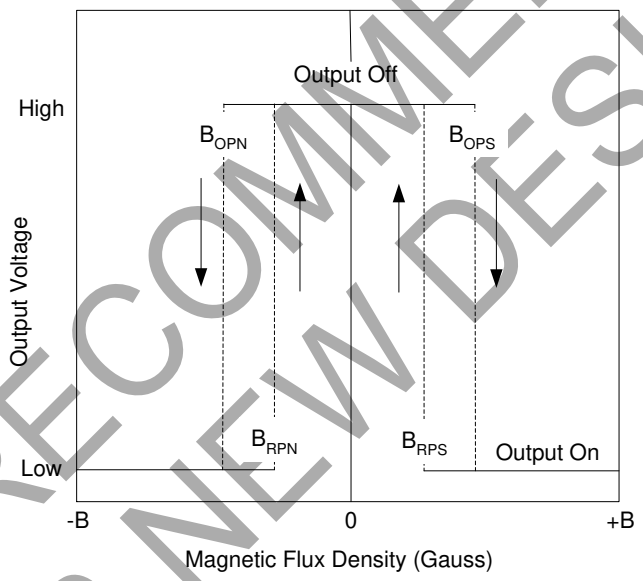
## Electrical Characteristics (@$T_A$=+25°C, $V_{CC}$=3V, unless otherwise specified.)

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{CC}$ | Supply Voltage | Operating | 2.5 | 3 | 5.5 | V |
| $I_{AW}$ | Supply Current | Awake | — | 2 | 4 | mA |
| $I_{SL}$ | | Sleep | — | 6 | 10 | μA |
| $I_{AVG}$ | | Average | — | 10 | 15 | μA |
| $I_{OUT}$ | Output Current | — | — | — | 1.0 | mA |
| $I_{LEAK}$ | Output Leakage Current | B< \| $B_{RP}$ \| | — | <0.1 | 1 | μA |
| $V_{SAT}$ | Saturation Voltage | $I_{OUT}$ =1.0mA | — | — | 0.4 | V |
| $t_{AW}$ | Awake Mode Time | Operating | — | 150 | — | μs |
| $t_{SL}$ | Sleep Mode Time | Operating | — | 90 | 120 | ms |
| D | Duty Cycle | — | — | 0.15 | — | % |
| $f_C$ | Chopper Frequency | — | — | 15 | — | kHz |

## Magnetic Characteristics (@$T_A$=+25°C, $V_{CC}$=3V, unless otherwise specified. Note 6)

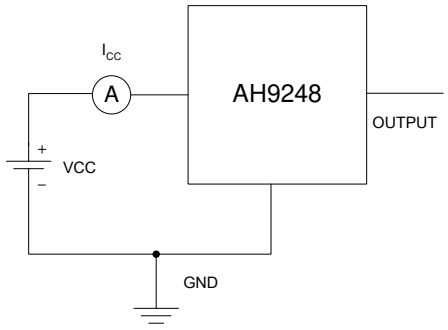
| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $B_{OPS}$ | Operating point | South pole to branded side B>$B_{OPS}$,$V_{OUT}$=low(output on) | — | 30 | 55 | Gauss |
| $B_{OPN}$ | | North pole to branded side B>$B_{OPN}$,$V_{OUT}$=low(output on) | -55 | -30 | — | Gauss |
| $B_{RPS}$ | Releasing Point | South pole to branded side B<$B_{RPS}$,$V_{OUT}$=high(output off) | 5 | 20 | — | Gauss |
| $B_{RPN}$ | | North pole to branded side B<$B_{RPN}$,$V_{OUT}$=high(output off) | — | -20 | -5 | Gauss |
| $B_{HYS}$ | Hysteresis | $\lvert B_{OPX} - B_{RPX} \rvert$ (Note 7) | — | 10 | — | Gauss |

Notes: 6. The specifications stated here are guaranteed by design. 1 Gauss=0.1mT
7. $B_{OPX}$=operating point (output turns on); $B_{RPX}$=releasing point (output turns off)



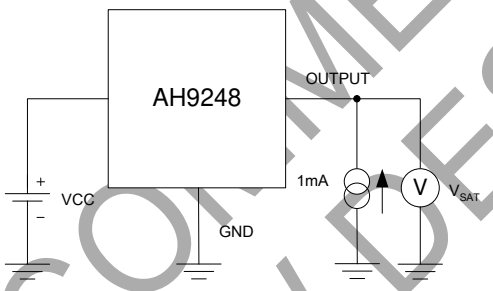

**Output Voltage vs. Magnetic Flux Density**

## Test Conditions



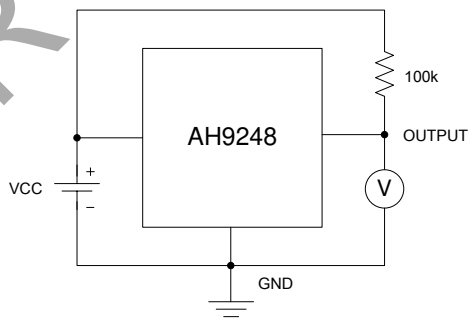

**Average Supply Current (Note 8, Note 9)**

Note 8: $I_{CC}$ represents the average supply current. OUTPUT is open during measurement.
Note 9: The device is put under magnetic field with B<$B_{RP}$.




**Output Saturation Voltage (Note 10, Note 11)**

Note 10: The output saturation voltage $V_{SAT}$ is measured at $V_{CC}$=2.5V and $V_{CC}$=5.5V.
Note 11: The device is put under magnetic field with B>$B_{OP}$.

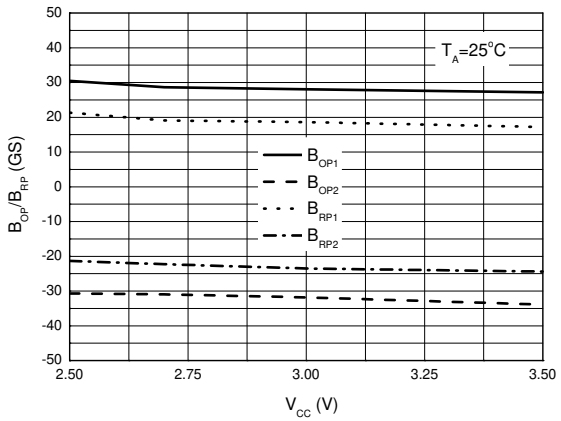



**Magnetic Thresholds (Note 12, Note 13)**

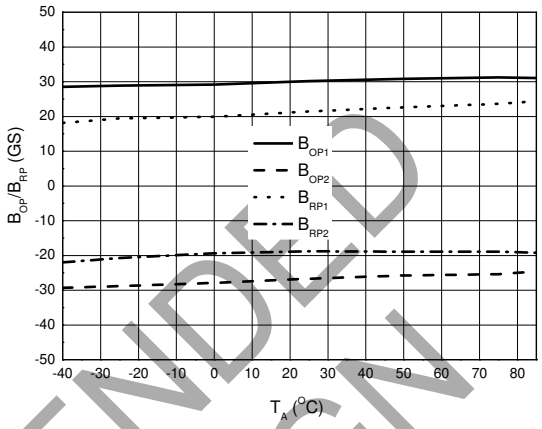
Note 12: $B_{OP}$ is determined by putting the device under magnetic field swept from $B_{RP}$(min) to $B_{OP}$(max) until the output is switched on.
Note 13: $B_{RP}$ is determined by putting the device under magnetic field swept from $B_{OP}$(max) to $B_{RP}$(min) until the output is switched off.

## Performance Characteristics

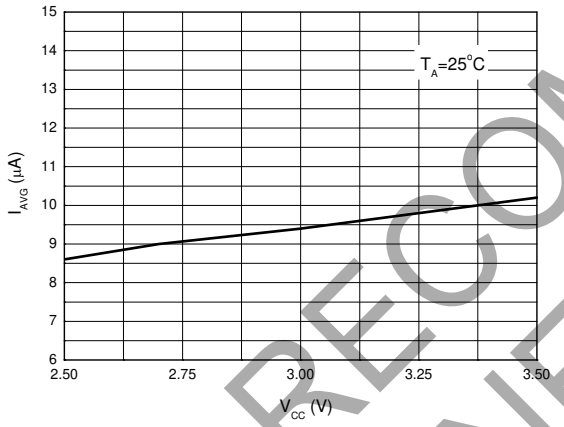
### $B_{OP}/B_{RP}$ vs. Supply Voltage



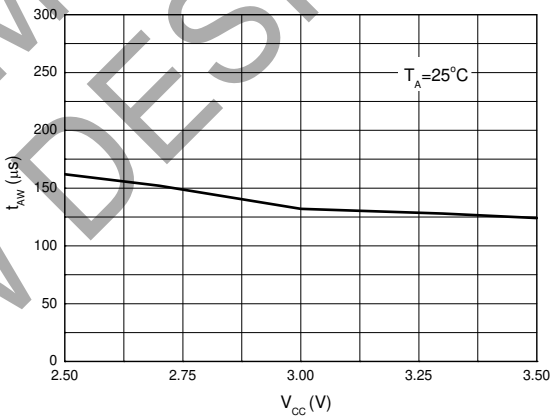

### $B_{OP}/B_{RP}$ vs. Ambient Temperature



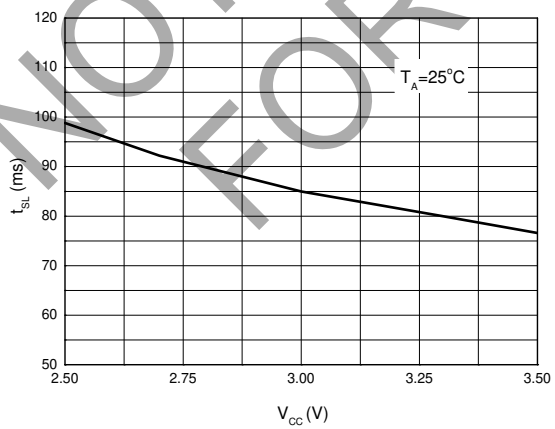

### Average Supply Current vs. Supply Voltage



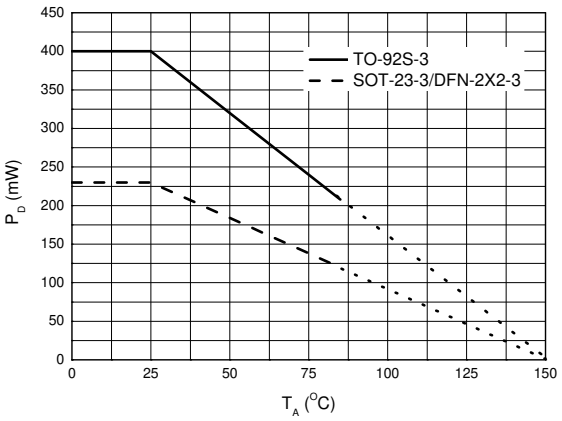

### Awake Mode Time vs. Supply Voltage



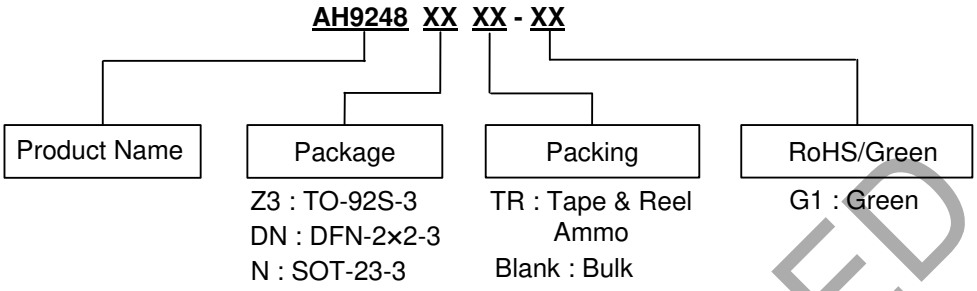

### Sleep Mode Time vs. Supply Voltage




### Power Dissipation vs. Ambient Temperature



## Ordering Information

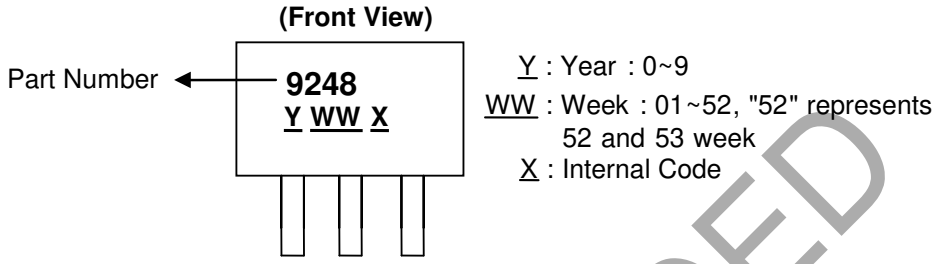



| Device | Status (Note 14) | Package Code | Packaging | Bulk | Ammo | 7" Tape and Reel |
|---|---|---|---|---|---|---|
| | | | | Quantity | Quantity | Quantity |
| AH9248Z3-G1 | NRND | Z3 | TO-92S-3 | 1000/Bulk | NA | NA |
| AH9248Z3TR-G1 | NRND | Z3 | TO-92S-3 | NA | 3000/Ammo | NA |
| AH9248DNTR-G1 | NRND | DN | DFN-2X2-3 | NA | NA | 3000/Tape & Reel |
| AH9248NTR-G1 | NRND | N | SOT-23-3 | NA | NA | 3000/Tape & Reel |

Note 14: NRND = Not Recommended for New Design.

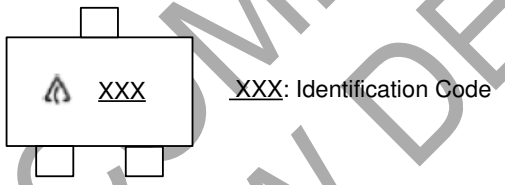
## Marking Information

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



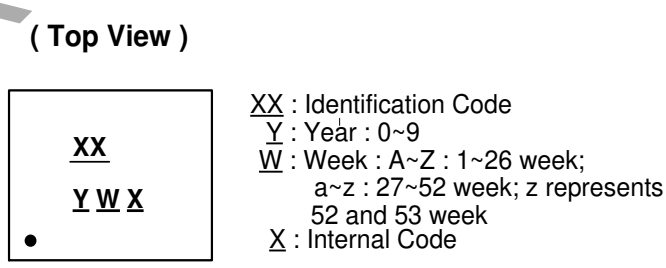

| Part Number | Package | Identification Code |
|---|---|---|
| AH9248 | TO-92S-3 | 9248 |

**(2) Package Type: SOT-23-3**




| Part Number | Package | Identification Code |
|---|---|---|
| AH9248 | SOT-23-3 | GL1 |

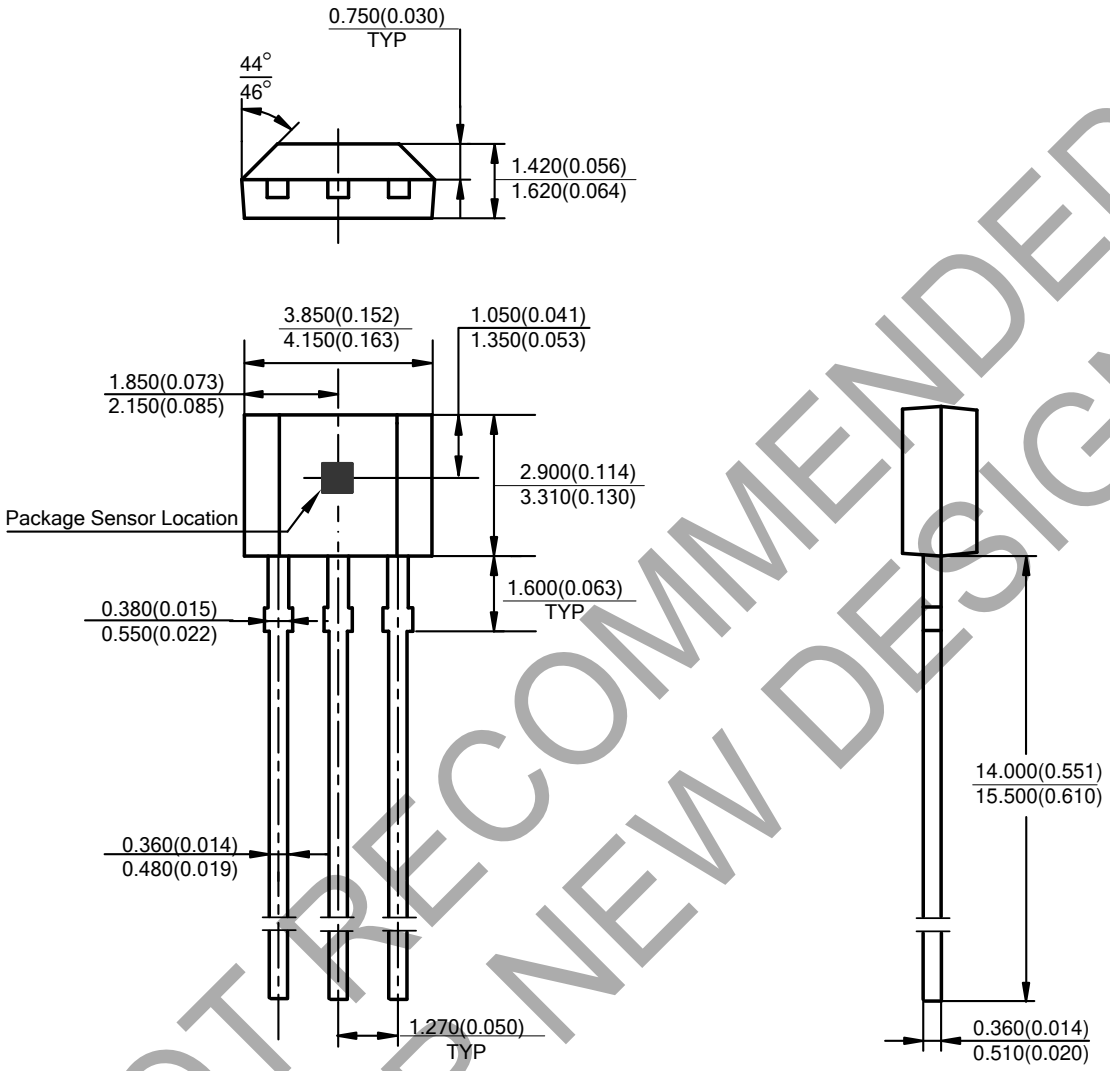
**(3) Package Type: DFN-2X2-3**




| Part Number | Package | Identification Code |
|---|---|---|
| AH9248 | DFN-2X2-3 | JA |

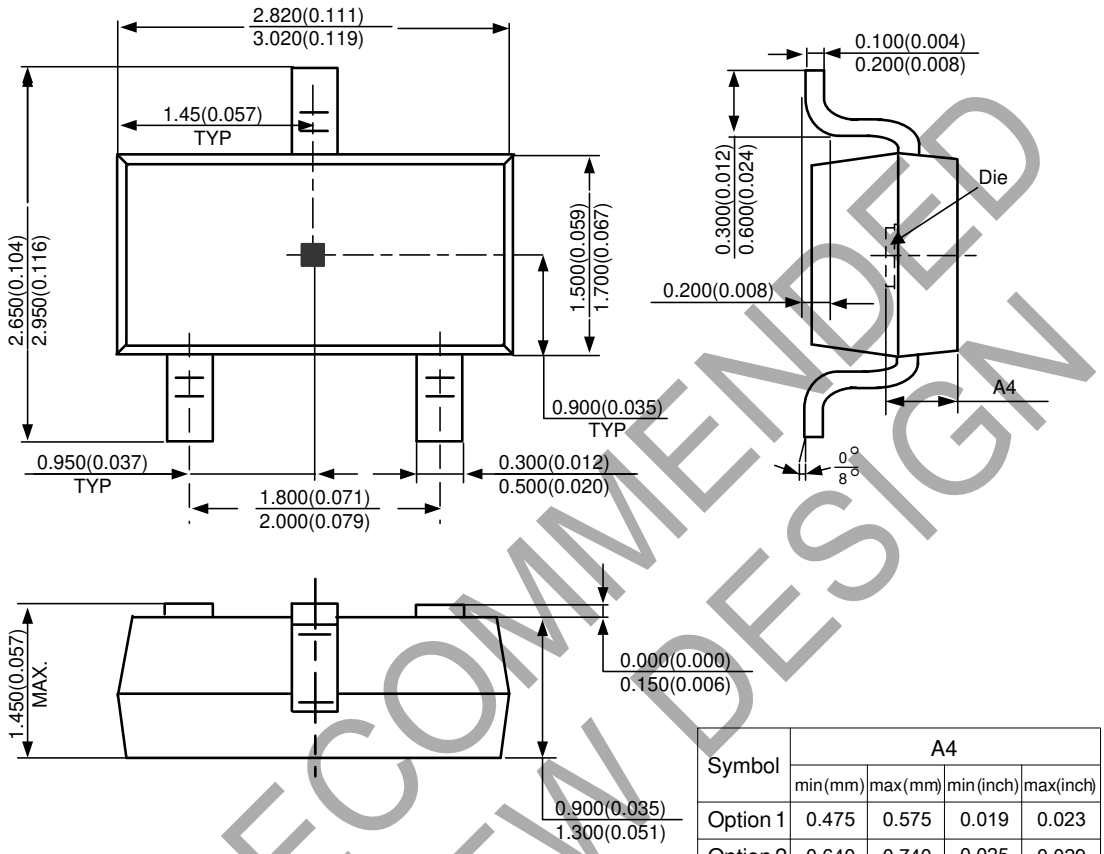
## Package Outline Dimensions (All dimensions in mm(inch).)

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



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

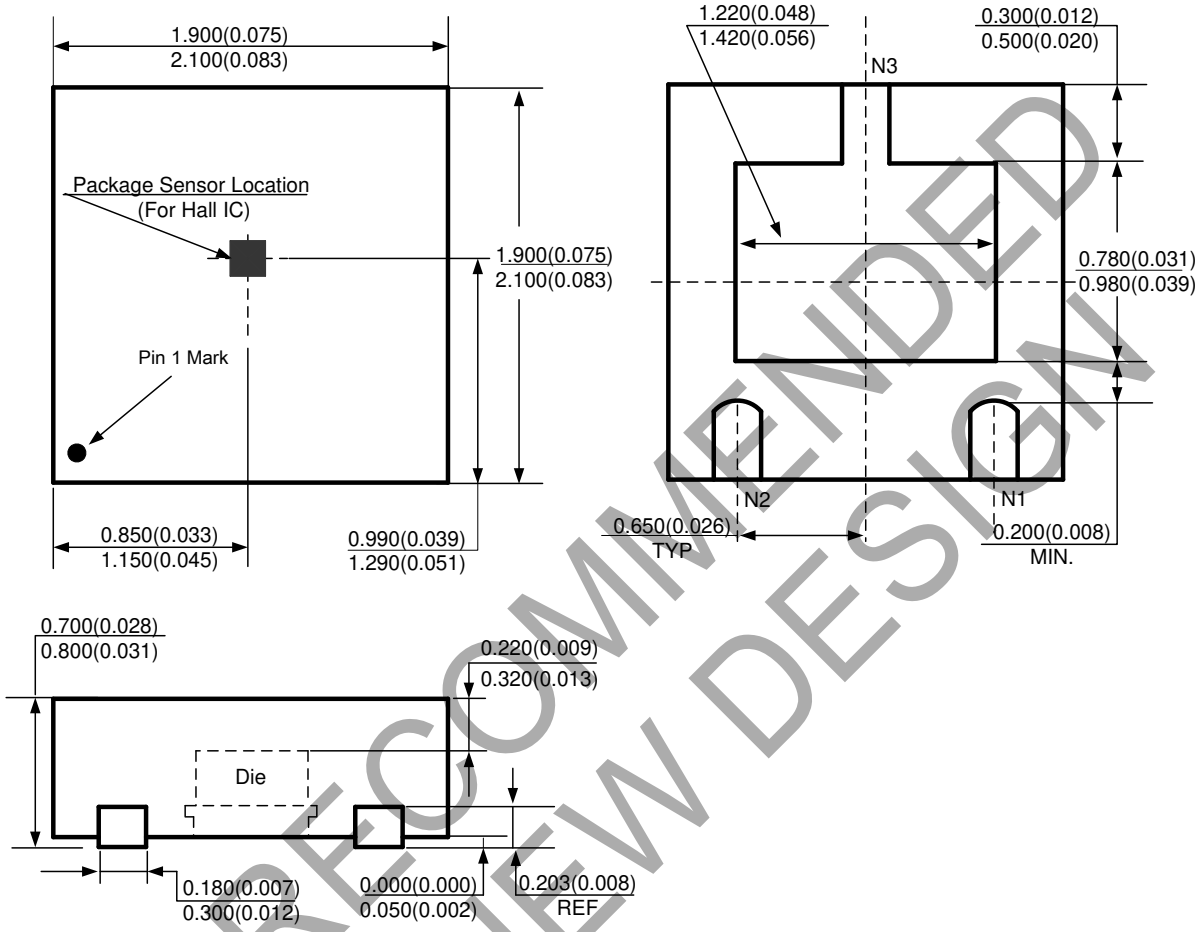
**(2) Package Type: SOT-23-3**




| 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 |

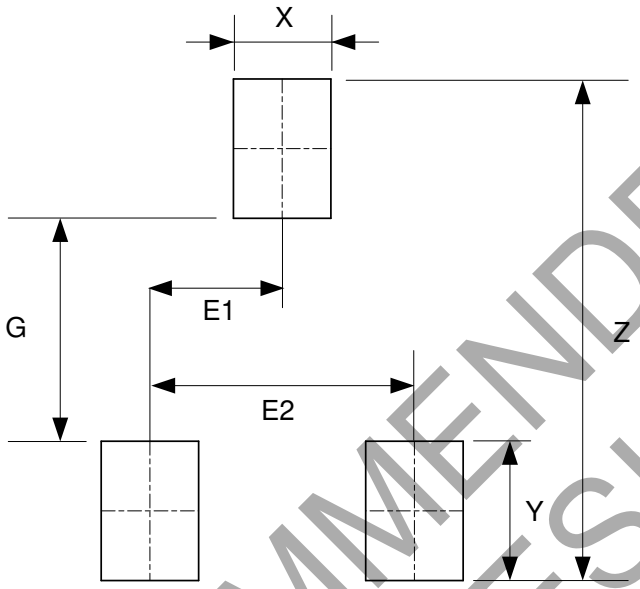
## Package Outline Dimensions (cont.) (All dimensions in mm(inch).)

**(3) Package Type: DFN-2×2-3**



## Suggested Pad Layout

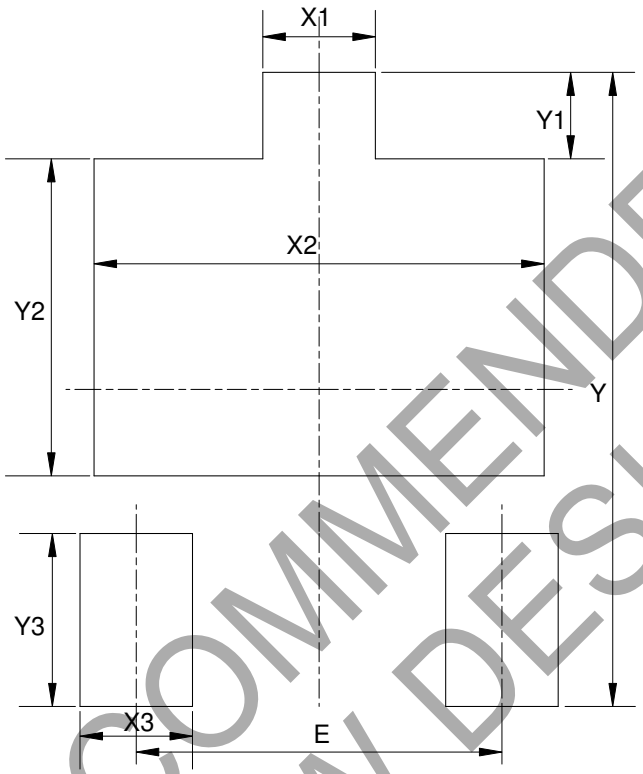
**(1) Package Type: SOT-23-3**




| 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 |

## Suggested Pad Layout (cont.)

**(2) Package Type: DFN-2×2-3**




| Dimensions | Y (mm)/(inch) | X1=X3 (mm)/(inch) | Y1 (mm)/(inch) | X2 (mm)/(inch) | Y2 (mm)/(inch) | Y3 (mm)/(inch) | E (mm)/(inch) |
|---|---|---|---|---|---|---|---|
| Value | 2.200/0.087 | 0.400/0.016 | 0.300/0.012 | 1.600/0.063 | 1.100/0.043 | 0.600/0.024 | 1.300/0.051 |

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