



**THE DATASHEET OF  
AH9280Z4-G1**



**Two Phase Dual-coil High Voltage Smart Fan Motor Driver****AH9280**

## General Description

The AH9280 is a most advanced smart fan controller and Hall IC driver manufactured by special CMOS process. It is designed for 5V and 12V cooling fan. To allow survival in a harsh environment and lower the total system cost, the AH9280 has been designed with many powerful functions while almost eliminating all discrete components, such as, capacitor, resistor, transistor, diode and PC board.

The AH9280 can operate normally in an ambient temperature up to 125°C due to its Hall IC circuitry and power MOSFET output that allow low power dissipation.

When there is no motion for one second, the IC will automatically detect the locked rotor conditions, and enter protection mode, shutting off the motor driver for five seconds. Then, the IC will turn on the motor driver for one second to detect whether there is rotation condition, if fails, the IC will shut off motor driver for five seconds again. This sequence will be repeated until rotation condition is detected, and the IC enters normal operation. This feature can effectively prevent the AH9280 from overheating and damage due to long-time locked rotor condition.

Specially designed for driving large fans, the AH9280 is optimized for low start-up voltage.

The AH9280 is available in TO-94 package.

## Features

- High-sensitivity Integrated Hall Sensor
- Low Start-up Voltage
- 5V and 12V Operation
- Peak Output Current up to 1200mA
- Power-efficient CMOS and Power MOSFETs
- Built-in Output Protection Clamping Diode
- Locked Rotor Shutdown and Auto-restart
- ESD Rating: 6000V (Human Body Model)  
400V (Machine Model)

## Applications

- 5V/12V DC Brushless Motor/Fan
- PC, Server, Laptop Cooling Fan
- Power Supply Cooling Fan
- Large/Small Sized Fan



Figure 1. Package Type of AH9280

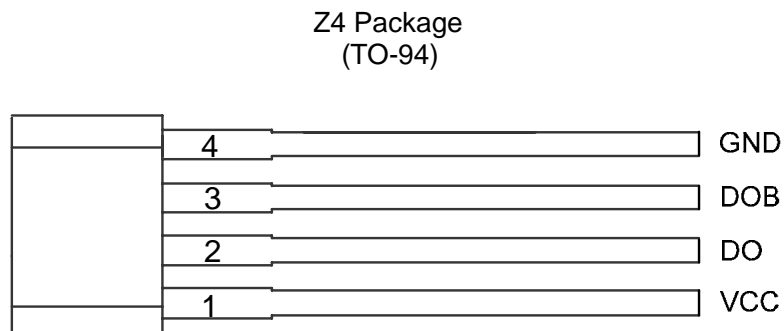
**Two Phase Dual-coil High Voltage Smart Fan Motor Driver****AH9280****Pin Configuration**

Figure 2. Pin Configuration of AH9280 (Front View)

**Pin Description**

| Pin Number | Pin Name | Function         |
|------------|----------|------------------|
| 1          | VCC      | Power supply pin |
| 2          | DO       | Output pin 1     |
| 3          | DOB      | Output pin 2     |
| 4          | GND      | Ground pin       |

**Two Phase Dual-coil High Voltage Smart Fan Motor Driver AH9280**

**Functional Block Diagram**

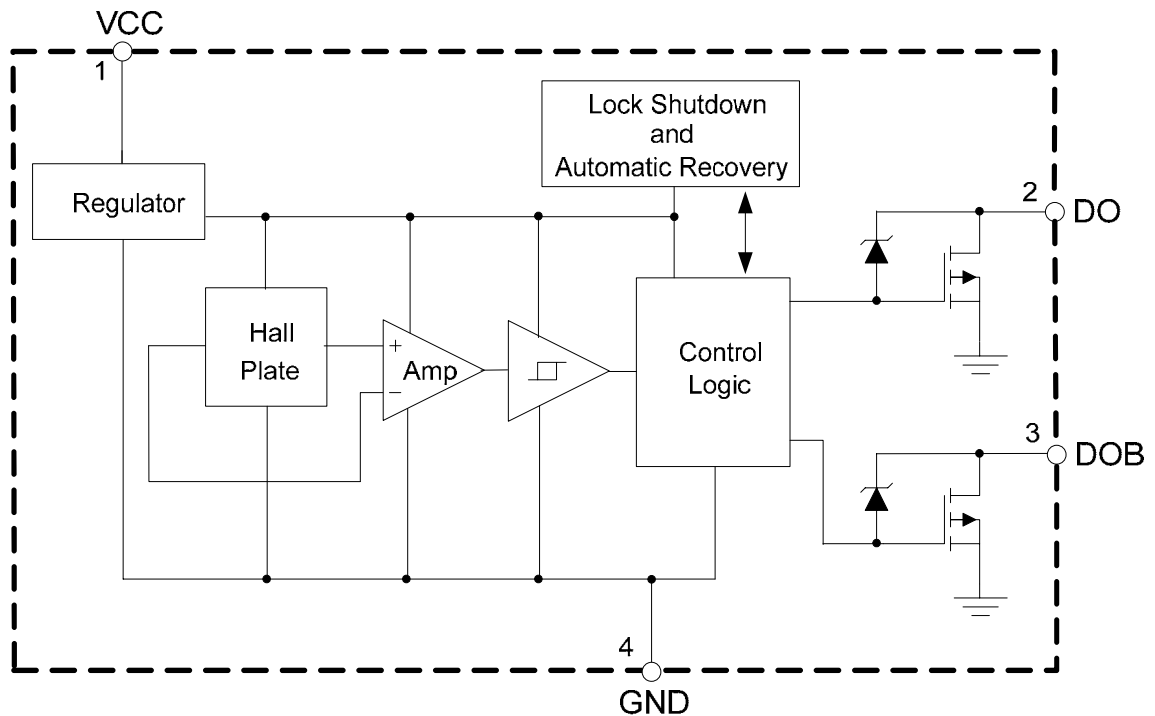
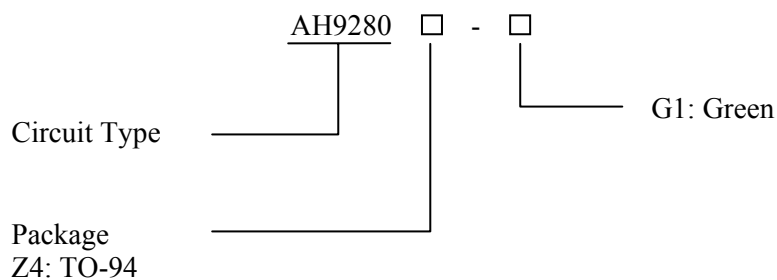


Figure 3. Functional Block Diagram of AH9280

**Ordering Information**



| Package | Temperature Range | Part Number | Marking ID | Packing Type |
|---------|-------------------|-------------|------------|--------------|
| TO-94   | -40 to 125°C      | AH9280Z4-G1 | 9280Z4-G1  | Bulk         |

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

**Two Phase Dual-coil High Voltage Smart Fan Motor Driver****AH9280****Absolute Maximum Ratings (Note 1, T<sub>A</sub>=25°C)**

| Parameter                                | Symbol             | Value      | Unit |
|--|--------------------|------------|------|
| Supply Voltage                           | V <sub>CC</sub>    | 18         | V    |
| Peak Output Current                      | I <sub>OUT_P</sub> | 1200       | mA   |
| Continuous Output Current                | I <sub>OUT_C</sub> | 600        | mA   |
| Supply Current (Fault)                   | I <sub>CC</sub>    | 6          | mA   |
| Power Dissipation                        | P <sub>D</sub>     | 600        | mW   |
| Thermal Resistance (Junction to Ambient) | θ <sub>JA</sub>    | 208        | °C/W |
| Storage Temperature                      | T <sub>STG</sub>   | -55 to 150 | °C   |
| ESD (Human Body Model)                   | ESD                | 6000       | V    |
| ESD (Machine Model)                      | ESD                | 400        | 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**

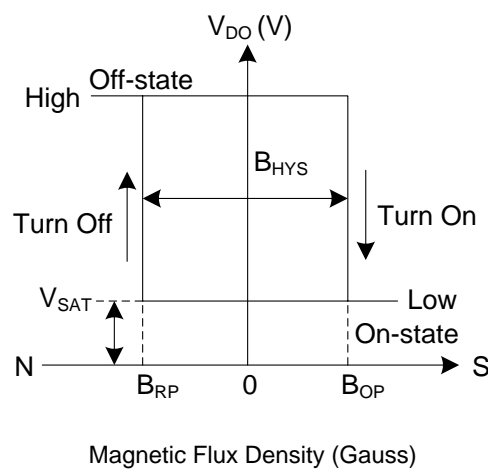
| Parameter           | Symbol          | Min | Max | Unit |
|---------------------|-----------------|-----|-----|------|
| Supply Voltage      | V <sub>CC</sub> | 2.5 | 16  | V    |
| Ambient Temperature | T <sub>A</sub>  | -40 | 125 | °C   |

**Two Phase Dual-coil High Voltage Smart Fan Motor Driver**
**AH9280**
**Electrical Characteristics**
 $V_{CC}=12V$ ,  $T_A=25^{\circ}C$ , unless otherwise specified.

| Parameter                       | Symbol        | Conditions      | Min | Typ | Max  | Unit    |
|---------------------------------|---------------|-----------------|-----|-----|------|---------|
| Supply Voltage                  | $V_{CC}$      | Operating       | 2.5 | 12  | 16   | V       |
| Supply Current                  | $I_{CC}$      | Average         |     | 4   | 6    | mA      |
| Output Current                  | $I_{OUT}$     |                 |     |     | 500  | mA      |
| Output Leakage Current          | $I_{LEAKAGE}$ |                 |     | 0.1 | 10   | $\mu A$ |
| Saturation Voltage              | $V_{SAT}$     | $I_{OUT}=350mA$ |     | 600 | 1000 | mV      |
| Output On Time                  | $T_{ON}$      |                 |     | 0.8 |      | s       |
| Output Off Time                 | $T_{OFF}$     |                 |     | 5   |      | s       |
| Output Zener Break-down Voltage | $V_Z$         |                 |     | 35  |      | V       |

**Magnetic Characteristics**
 $V_{CC}=12V$ ,  $T_A=25^{\circ}C$ , unless otherwise specified.

| Parameter       | Symbol    | Min | Typ | Max | Unit  |
|-----------------|-----------|-----|-----|-----|-------|
| Operating Point | $B_{OP}$  |     | 20  | 50  | Gauss |
| Releasing Point | $B_{RP}$  | -50 | -20 |     | Gauss |
| Hysteresis      | $B_{HYS}$ |     | 40  |     | Gauss |



**Test Circuit**

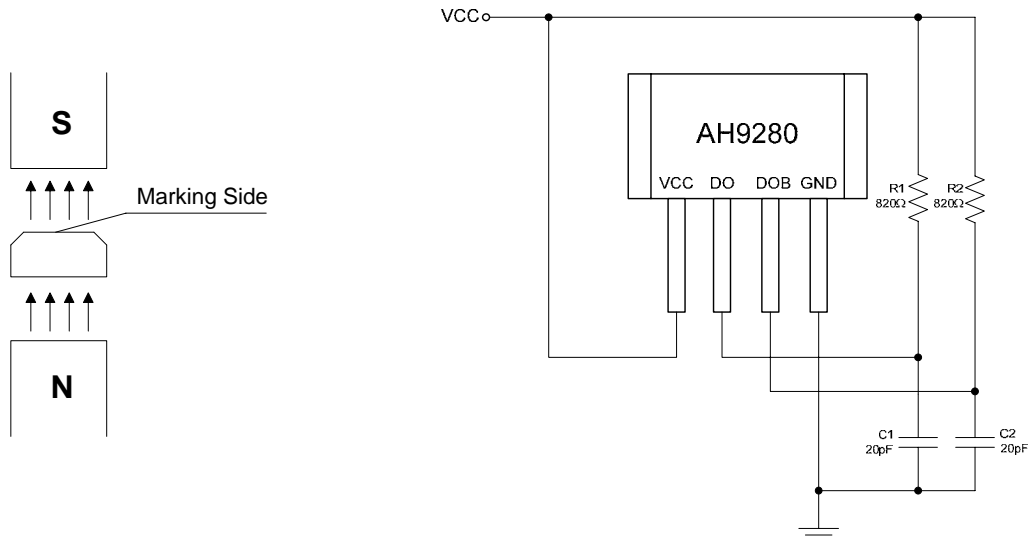


Figure 4. Basic Test Circuit of AH9280

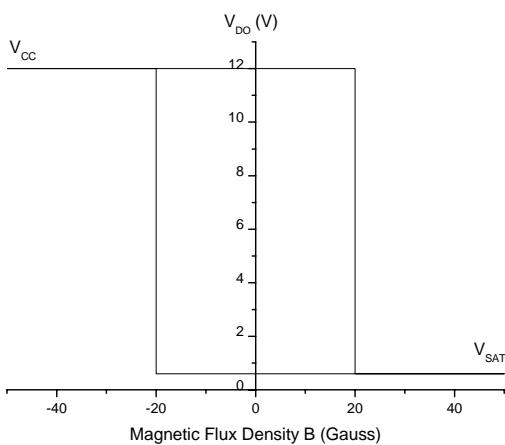


Figure 5.  $V_{DO}$  vs. Magnetic Flux Density

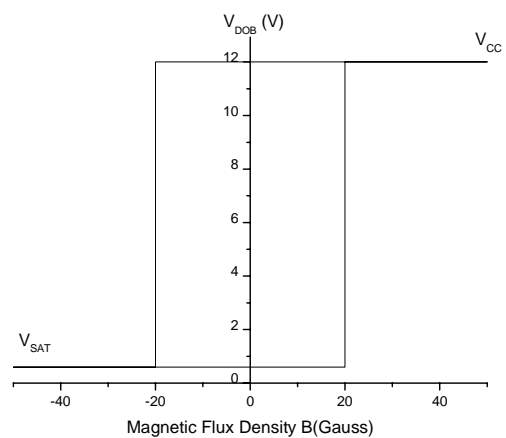


Figure 6.  $V_{DOB}$  vs. Magnetic Flux Density

Typical Performance Characteristics

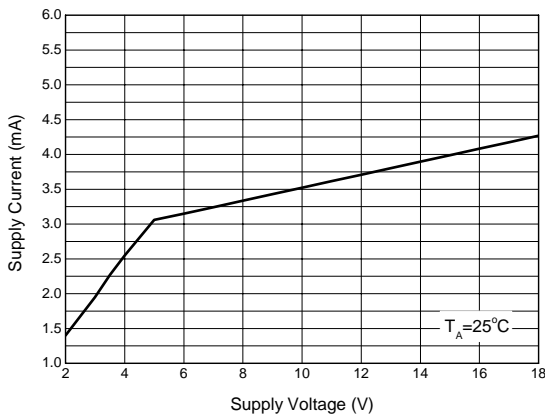


Figure 7. Supply Current vs. Supply Voltage

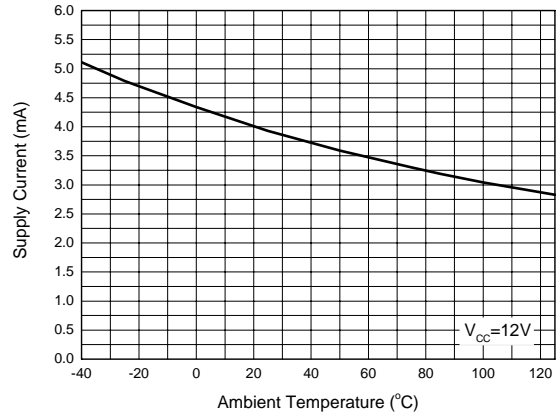


Figure 8. Supply Current vs. Ambient Temperature

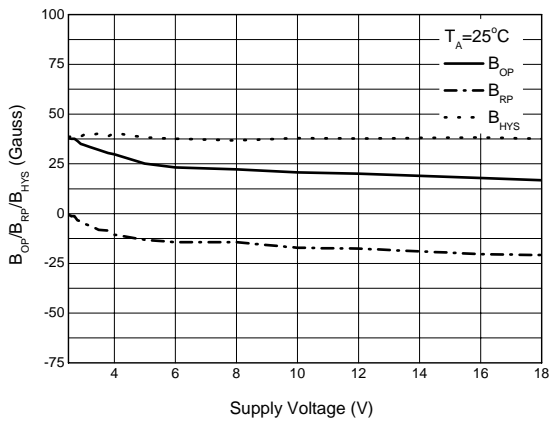


Figure 9. B<sub>OP</sub>/B<sub>RP</sub>/B<sub>HYS</sub> vs. Supply Voltage

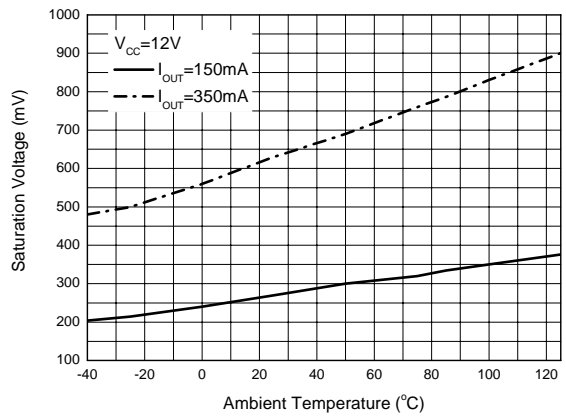


Figure 10. Saturation Voltage vs. Ambient Temperature

**Typical Performance Characteristics (Continued)**

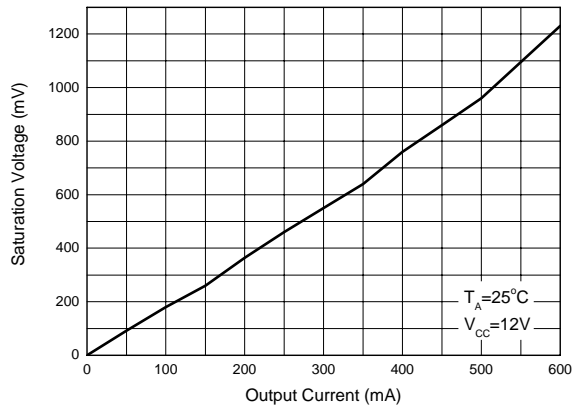


Figure 11. Saturation Voltage vs. Output Current

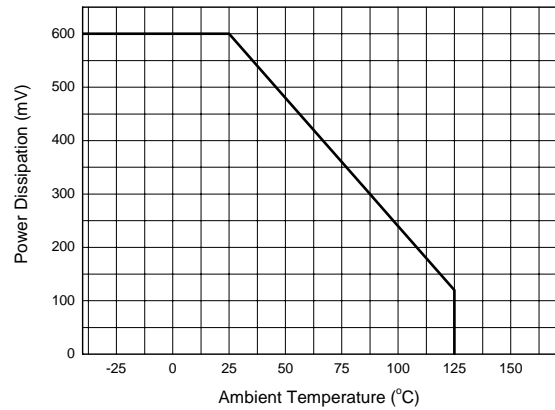


Figure 12. Power Dissipation vs. Ambient Temperature

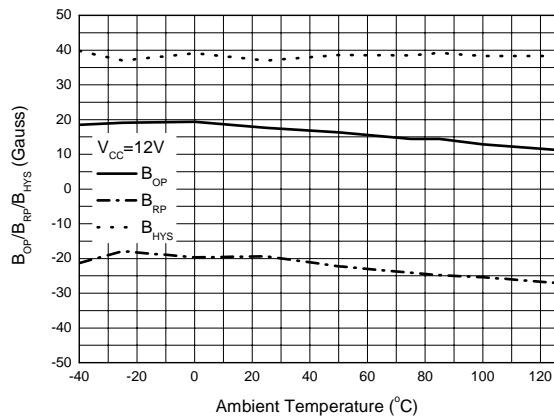


Figure 13. B<sub>OP</sub>/B<sub>RP</sub>/B<sub>HYS</sub> vs. Ambient Temperature

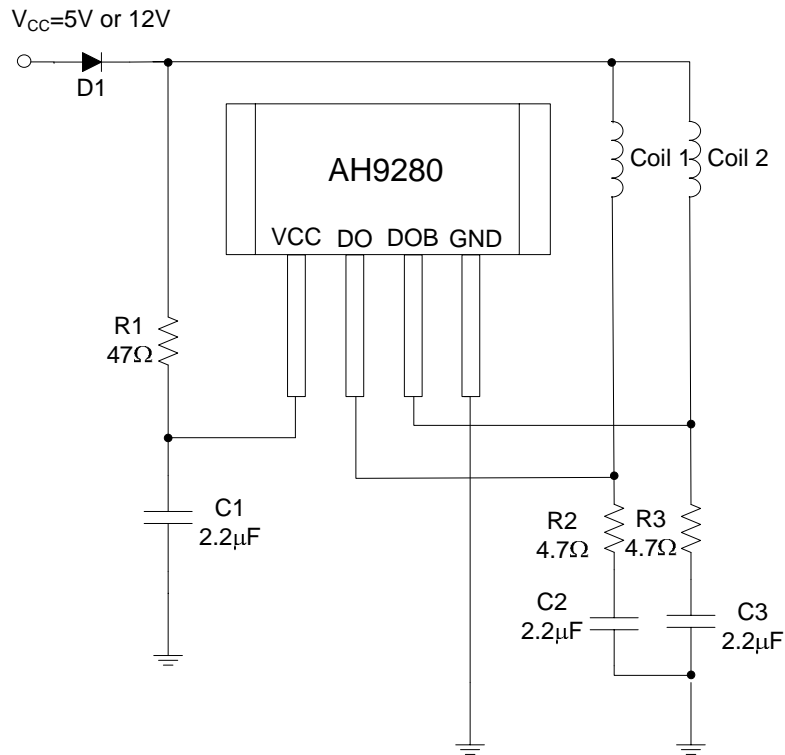
**Two Phase Dual-coil High Voltage Smart Fan Motor Driver**
**AH9280**
**Typical Application**


Figure 14 Typical Application 1 of AH9280 (Note 2)

## Note 2:

1. D1 is an ordinary diode used to filter the noise from VCC and protect IC if VCC and GND are plugged reversed.
2. R1=47Ω typical.
3. C1=C2=C3=2.2μF typical, electrolytic capacitors are better. They should be fine tuned based on system design.
4. R2=R3=4.7Ω typical. They can be removed according to system requirement.

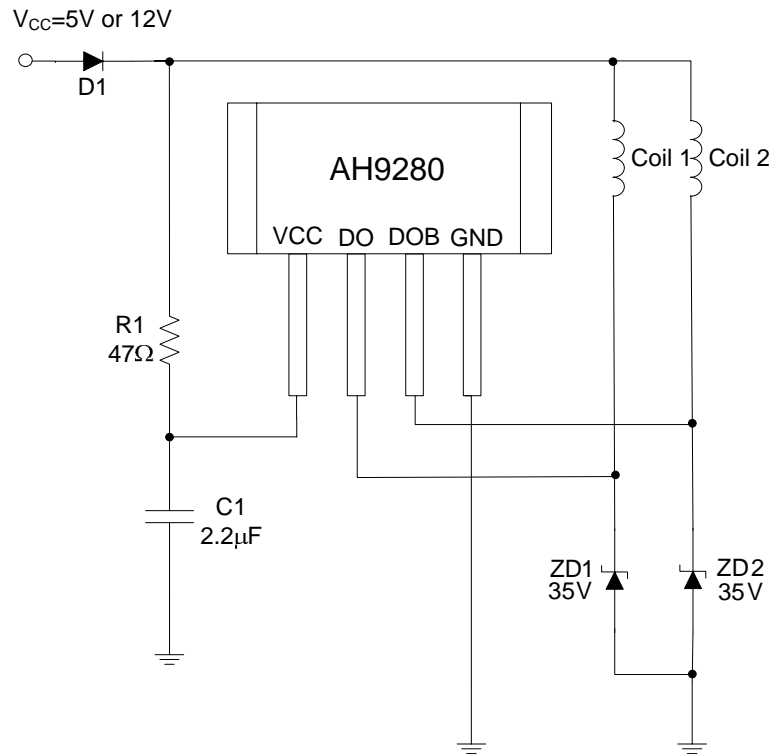
**Typical Application (Continued)**


Figure 15. Typical Application 2 of AH9280 (Note 3)

## Note 3:

1. D1 is an ordinary diode used to filter the noise from VCC and protect IC if VCC and GND are plugged reversed.
2. R1=47Ω typical.
3. C1 =2.2μF typical, electrolytic capacitors are better. They should be fine tuned based on system design.
4. ZD1 and ZD2 breakdown voltage are 35V.

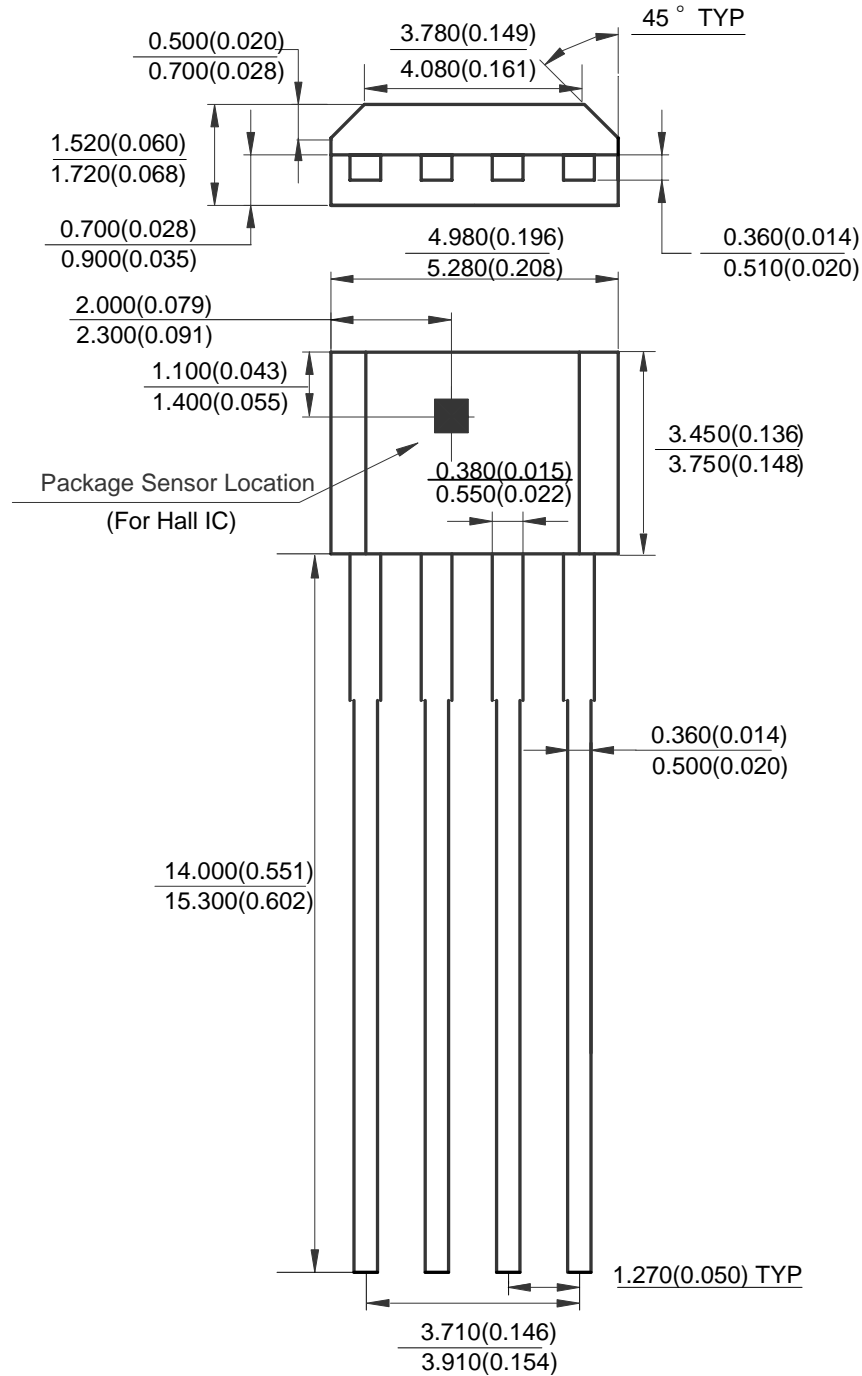
**Two Phase Dual-coil High Voltage Smart Fan Motor Driver**

**AH9280**

**Mechanical Dimensions**

**TO-94**

**Unit: mm(inch)**





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