

**TWO PHASE HALL-EFFECT SMART FAN MOTOR CONTROLLER**

NEW PRODUCT

**Description**

The AH2985 is a single-chip solution for driving two-coil brushless direct current (BLDC) fans and motors. The device includes a Hall-effect sensor, dynamic offset correction and two complementary open-drain output drivers with internal Zener diode protection. It is optimized for low start-up voltage.

To help protect the motor coils, the AH2985 provides Rotor Lock Protection which shuts down output drives if rotor lock is detected. The device automatically re-starts when the rotor lock is removed. Over temperature shutdown provides thermal protection for the device.

The AH2985 is available in TO94 package.

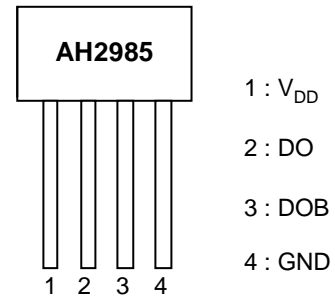
**Features**

- Single-Chip Solution
- Operating Voltage: 2.5V to 15V
- Built-in Hall Sensor and Input Amplifier
- Rotor Lock Protection (Lock Detection, Output Shutdown and Automatic re-Start)
- Built-in Reverse Voltage Protection Diode
- Built-in Zener Protection for Output Drivers
- Average Output Current up to 500mA
- Package: TO94
- "Green" Molding Compound
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**

- 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](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.

**Pin Assignments**

(Top View)

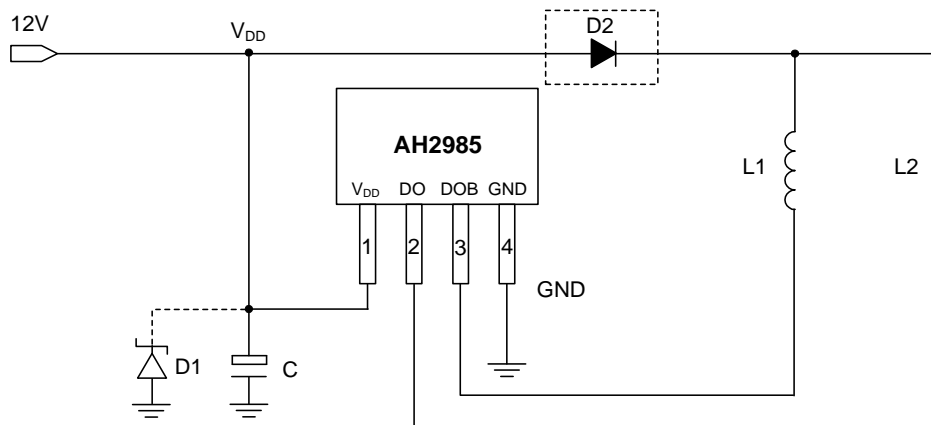


TO94

**Applications**

- Two-Coil BLDC Cooling Fans
- Low Voltage/ Low Power BLDC Motors

**Typical Applications Circuit (Note 4)**



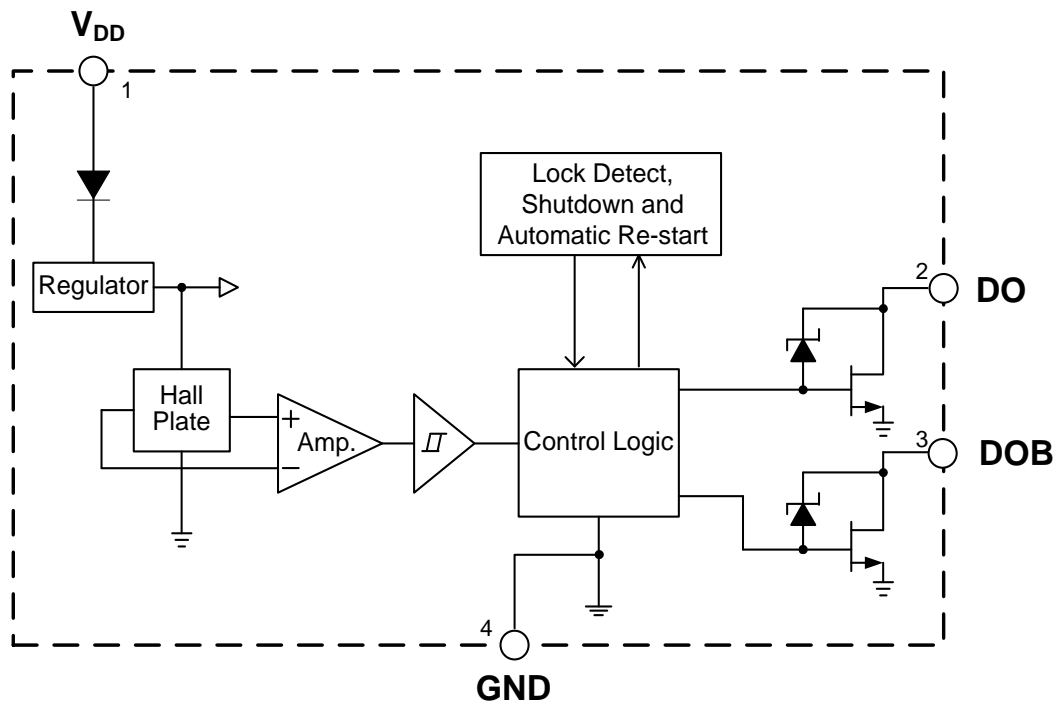
**12V Brushless DC Fan**

Note: 4. D1 (Zener Diode) and Capacitor C are for power stabilization. Recommended value of C is 1µF/ 50V (E-Cap). Diode D2 is optional and helps to protect the device and fan coils from reverse power conditions. The AH2985 also includes an internal reverse blocking diode at VDD pin.

**Pin Descriptions**

| Pin Number | Pin Name        | Function    |
|------------|-----------------|-------------|
| 1          | V <sub>DD</sub> | Input Power |
| 2          | DO              | Output Pin  |
| 3          | DOB             | Output Pin  |
| 4          | GND             | Ground      |

**Functional Block Diagram**



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### Absolute Maximum Ratings (@T<sub>A</sub> = +25°C, unless otherwise specified.) (Note 5)

| Symbol                       | Parameter                                | Rating      | Unit |
|------------------------------|--|-------------|------|
| V <sub>DD</sub>              | Supply Voltage                           | 18          | V    |
| V <sub>RDD</sub>             | Reverse V <sub>DD</sub> Polarity Voltage | -15         | V    |
| I <sub>O(AVE)</sub>          | Output Current (Note 6)                  | 500         | mA   |
| I <sub>O(peak as hold)</sub> |  | 800         |      |
| P <sub>D</sub>               | Power Dissipation                        | 550         | mW   |
| T <sub>STG</sub>             | Storage Temperature                      | -55 to +150 | °C   |
| T <sub>J</sub>               | Maximum Junction Temperature             | +150        | °C   |
| θ <sub>JA</sub>              | Thermal Resistance                       | 227         | °C/W |
| θ <sub>JC</sub>              | Thermal Resistance                       | 49          | °C/W |

Notes: 5. 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.  
 6. Shall not exceed P<sub>D</sub> and Safety Operation Area.

### Recommended Operating Conditions (@T<sub>A</sub> = +25°C, unless otherwise specified.)

| Symbol          | Parameter                              | Condition | Min | Max  | Unit |
|-----------------|--|-----------|-----|------|------|
| V <sub>DD</sub> | Supply Voltage                         | Operating | 2.5 | 15   | V    |
| T <sub>A</sub>  | Operating Ambient Temperature (Note 6) | Operating | -40 | +105 | °C   |

### Electrical Characteristics (@T<sub>A</sub> = +25°C, V<sub>DD</sub> = 12V, unless otherwise specified.)

| Symbol              | Parameter                      | Condition                          | Min | Typ  | Max | Unit |
|---------------------|--------------------------------|------------------------------------|-----|------|-----|------|
| I <sub>DD</sub>     | Supply Current                 | Operating, V <sub>DD</sub> = 12V   | –   | 1    | 5   | mA   |
| t <sub>ON</sub>     | Locked Protection On Time      | –                                  | –   | 0.45 | –   | s    |
| t <sub>OFF</sub>    | Locked Protection Off Time     | –                                  | –   | 2.7  | –   | s    |
| R <sub>DUTY</sub>   | Locked Protection Duty Ratio   | t <sub>OFF</sub> / t <sub>ON</sub> | –   | 6    | –   | –    |
| R <sub>DS(ON)</sub> | Output On Resistance           | I <sub>O</sub> = 300mA             | –   | 1    | 1.6 | Ω    |
|                     |                                | I <sub>O</sub> = 500mA             | –   | 1    | 1.8 |      |
| V <sub>Z</sub>      | Output Zener-Breakdown Voltage | (Note 7)                           | 20  | 28   | 36  | V    |

Note: 7. The V<sub>Z</sub> value is in D.C. voltage measurement. The V<sub>Z</sub> may vary with coils in A.C. voltage measurements.

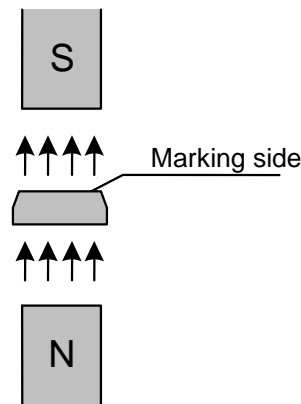
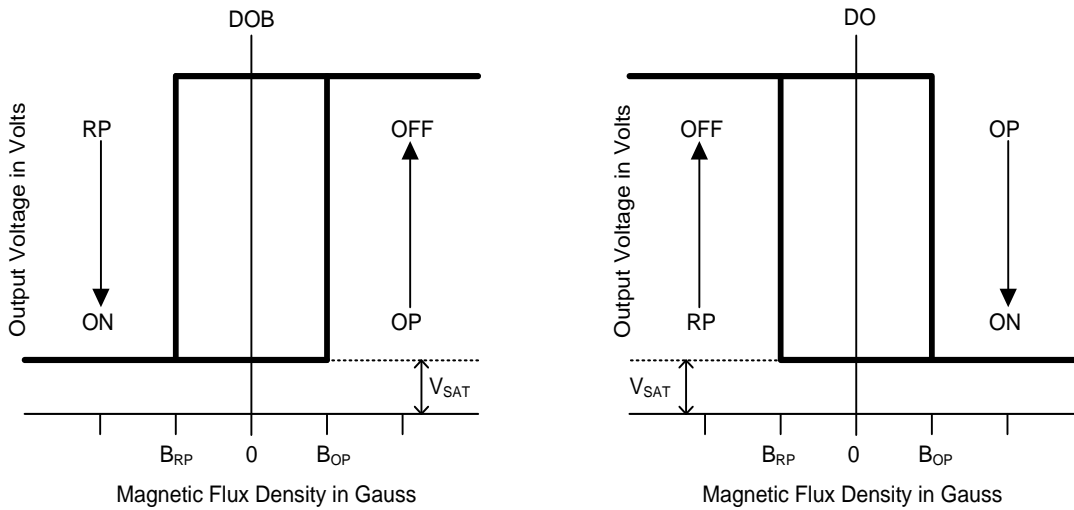
**Magnetic Characteristics** ( $T_A = +25^\circ\text{C}$ ,  $V_{DD} = 2.5\text{V to }15\text{V}$ , Note 8)

(1mT=10 Gauss)

| Symbol          | Parameter     | Min | Typ | Max | Unit  |
|-----------------|---------------|-----|-----|-----|-------|
| B <sub>OP</sub> | Operate Point | 5   | 30  | 60  | Gauss |
| B <sub>RP</sub> | Release Point | -60 | -30 | -5  | Gauss |
| B <sub>HY</sub> | Hysteresis    | 20  | 60  | 120 | Gauss |

Note: 8. The magnetic characteristics may vary with supply voltage, operating temperature and after soldering.

**Operating Characteristics**



**(TO94)**

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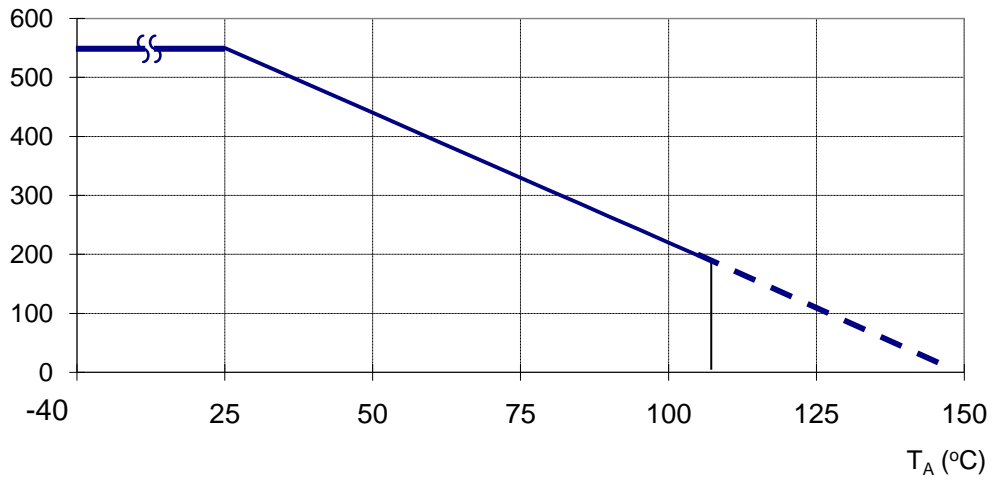
**Performance Characteristics**

(1) TO94

|                         |            |            |            |            |            |            |            |            |            |
|-------------------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| $T_A(^{\circ}\text{C})$ | <b>25</b>  | <b>50</b>  | <b>60</b>  | <b>70</b>  | <b>80</b>  | <b>85</b>  | <b>90</b>  | <b>95</b>  | <b>100</b> |
| $P_D(\text{mW})$        | 550        | 440        | 396        | 352        | 308        | 286        | 264        | 242        | 220        |
| $T_A(^{\circ}\text{C})$ | <b>105</b> | <b>110</b> | <b>115</b> | <b>120</b> | <b>125</b> | <b>130</b> | <b>135</b> | <b>140</b> | <b>150</b> |
| $P_D(\text{mW})$        | 198        | 176        | 154        | 132        | 110        | 88         | 66         | 44         | 0          |

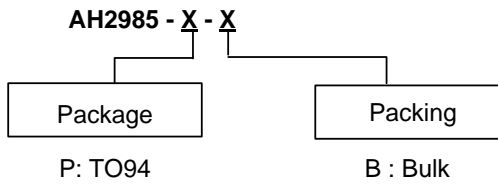
$P_D$  (mW)

Power Dissipation Curve



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**Ordering Information** (Note 9)

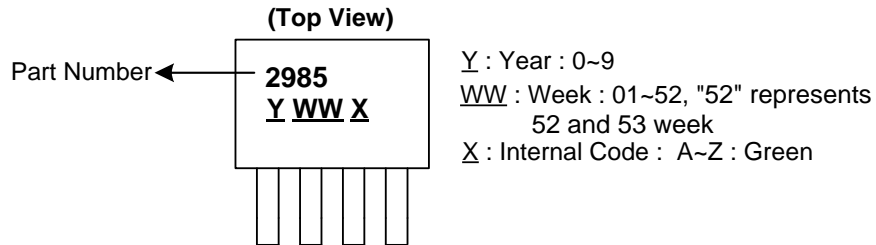


| Part Number | Package Code | Packaging (Note 9) | Bulk     |                    |
|-------------|--------------|--------------------|----------|--------------------|
|             |              |                    | Quantity | Part Number Suffix |
| AH2985-P-B  | P            | TO94               | 1000     | -B                 |

Note: 9. For packaging details, go to our website at <http://www.diodes.com/products/packages.html>.

**Marking Information**

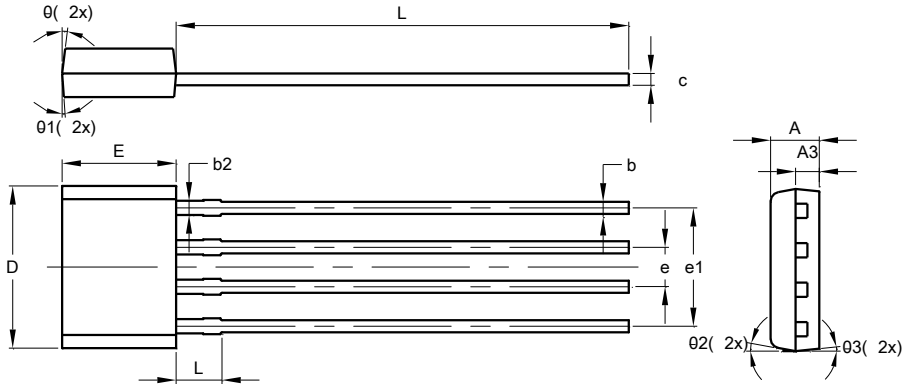
(1) TO94



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

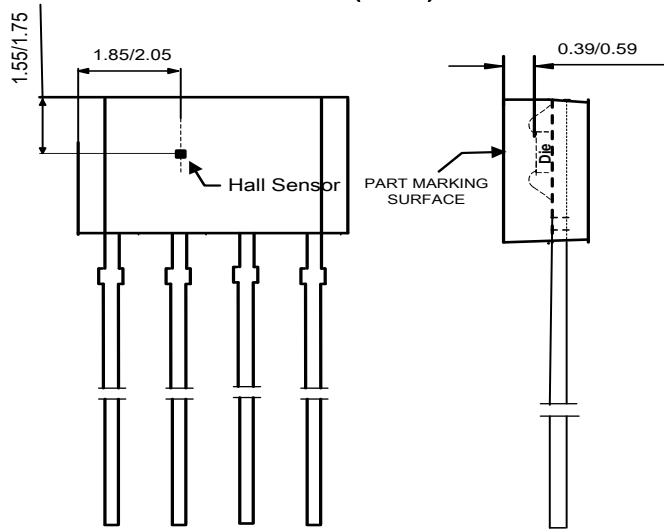
Please see AP02002 at <http://www.diodes.com/datasheets/ap02002.pdf> for the latest version.

(1) Package Type: TO94



| TO94                 |       |       |       |
|----------------------|-------|-------|-------|
| Dim                  | Min   | Max   | Typ   |
| A                    | 1.46  | 1.66  | 1.56  |
| A3                   | -     | -     | 0.76  |
| b                    | 0.35  | 0.56  | 0.39  |
| b2                   | -     | -     | 0.46  |
| c                    | 0.36  | 0.51  | 0.38  |
| D                    | 5.12  | 5.32  | 5.22  |
| E                    | 3.55  | 3.75  | 3.65  |
| e                    | -     | -     | 1.27  |
| e1                   | -     | -     | 3.81  |
| L                    | 13.50 | 15.50 | 14.50 |
| L1                   | -     | -     | 1.42  |
| S                    | 0.63  | 0.83  | 0.73  |
| $\theta$             | -     | -     | 6°    |
| $\theta_1$           | -     | -     | 4°    |
| $\theta_2$           | -     | -     | 11°   |
| $\theta_3$           | -     | -     | 6°    |
| All Dimensions in mm |       |       |       |

Min/Max(in mm)



NEW PRODUCT

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