

## TWO PHASE HALL-EFFECT SMART FAN MOTOR CONTROLLER

### 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

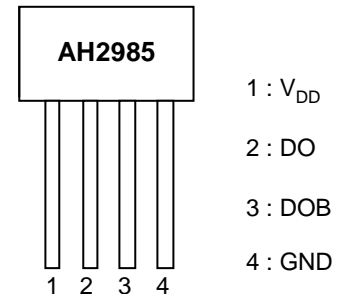
- Single-Chip Solution
- Operating Voltage: 2.5V to 15V
- Built-in Hall Sensor and Input Amplifier
- Rotor Lock Protection (Lock Detection, Output Shutdown and Automatic re-Start)
- Built-in Reverse Voltage Protection Diode
- Built-in Zener Protection for Output Drivers
- Average Output Current up to 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)

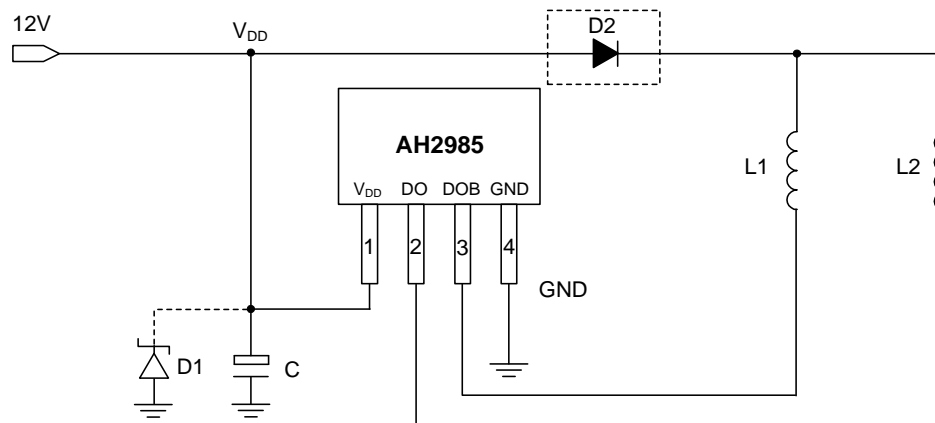


TO94

### Applications

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

### Typical Applications Circuit (Note 4)



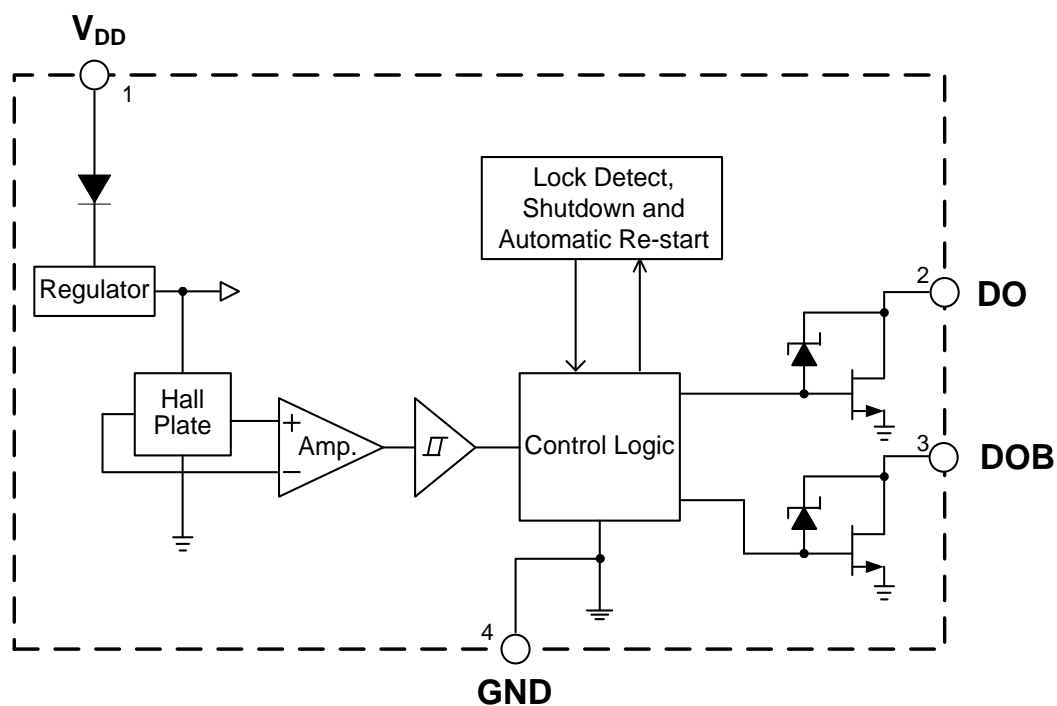
12V Brushless DC Fan

Note: 4. D1 (Zener Diode) and Capacitor C are for power stabilization. Recommended value of C is 1 $\mu$ F/ 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  $V_{DD}$  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



## 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.

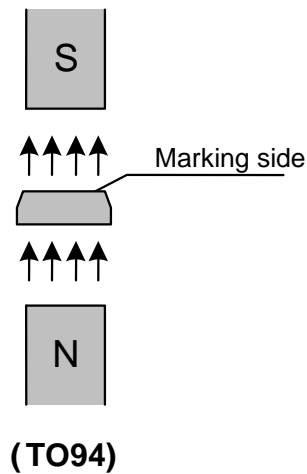
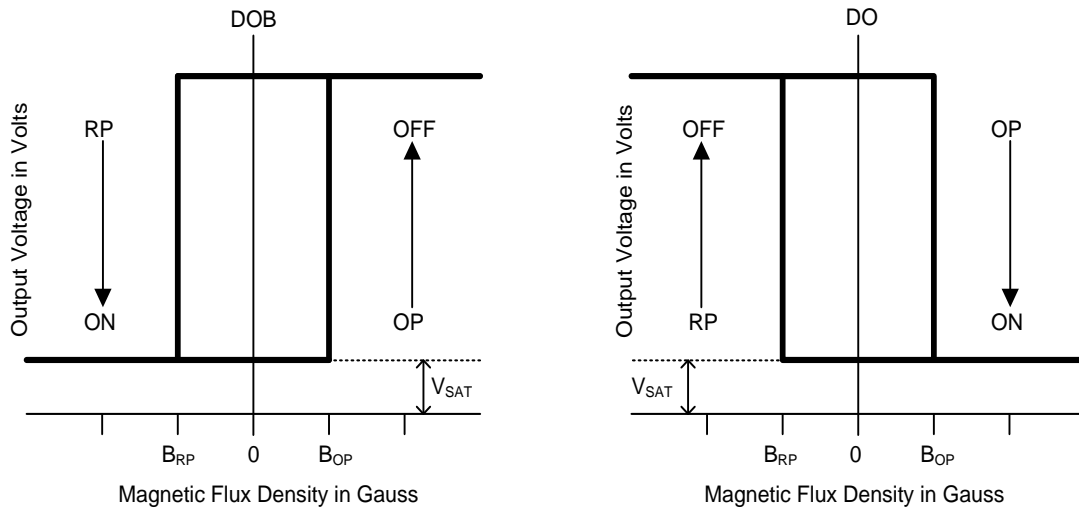
## Magnetic Characteristics ( $T_A = +25^\circ\text{C}$ , $V_{DD} = 2.5\text{V}$ to $15\text{V}$ , Note 8)

(1mT=10 Gauss)

Symbol	Parameter	Min	Typ	Max	Unit
$B_{OP}$	Operate Point	5	30	60	Gauss
$B_{RP}$	Release Point	-60	-30	-5	Gauss
$B_{HY}$	Hysteresis	20	60	120	Gauss

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

## Operating Characteristics



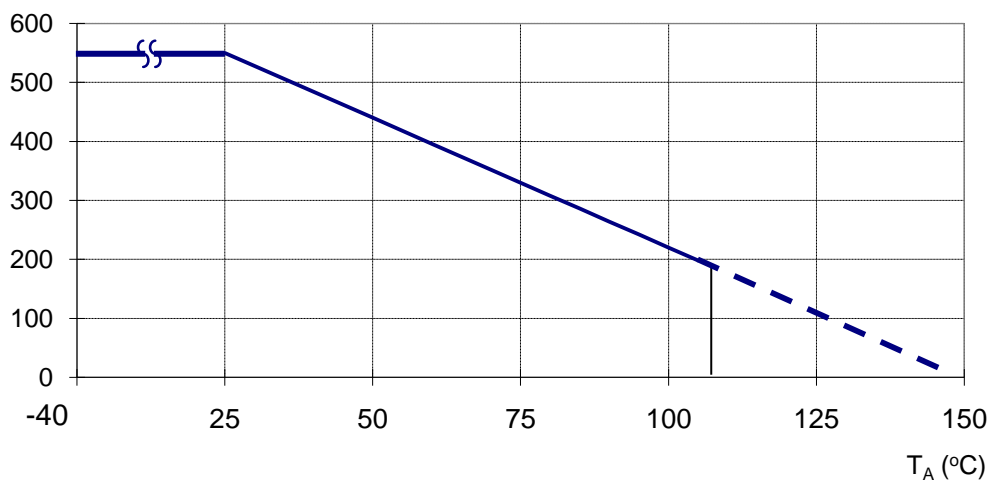
## Performance Characteristics

(1) TO94

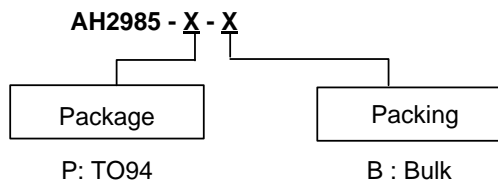
$T_A(^{\circ}\text{C})$	25	50	60	70	80	85	90	95	100
$P_D(\text{mW})$	550	440	396	352	308	286	264	242	220
$T_A(^{\circ}\text{C})$	105	110	115	120	125	130	135	140	150
$P_D(\text{mW})$	198	176	154	132	110	88	66	44	0

$P_D$  (mW)

Power Dissipation Curve



## Ordering Information (Note 9)

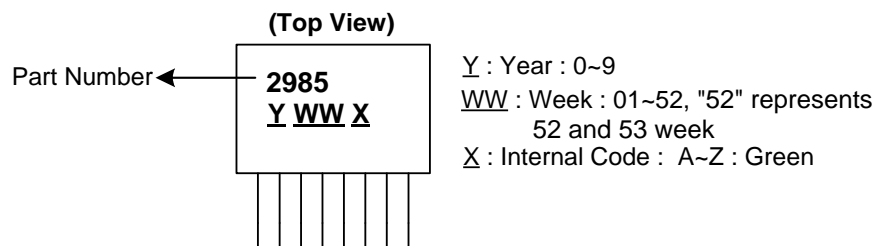


Part Number	Package Code	Packaging (Note 9)	Bulk	
			Quantity	Part Number Suffix
AH2985-P-B	P	TO94	1000	-B

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

## Marking Information

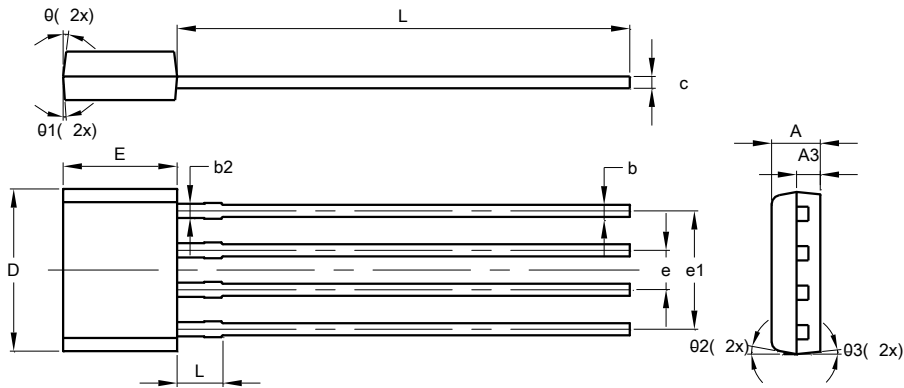
### (1) TO94



# Package Outline Dimensions (All dimensions in mm.)

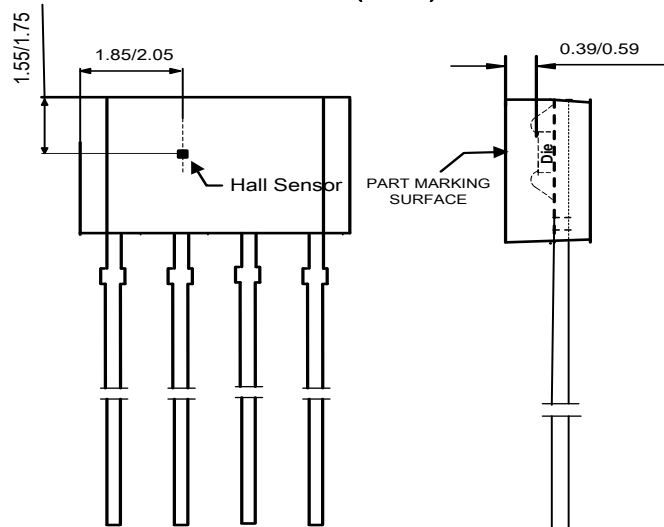
Please see AP02002 at <http://www.diodes.com/datasheets/ap02002.pdf> for the latest version.

## (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°
$\theta1$	-	-	4°
$\theta2$	-	-	11°
$\theta3$	-	-	6°
All Dimensions in mm			

Min/Max(in mm)



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