



**THE DATASHEET OF  
AH285-YL-13**



## Description

The AH285 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.

To help protect the motor coils, the AH285 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.

A Tachometer output is provided by open-drain Frequency Generator (FG) Pin which allows external interface to monitor motor rotation or speed. The FG output is the magnetic change frequency.

The AH285 is available in SOT89-5 package.

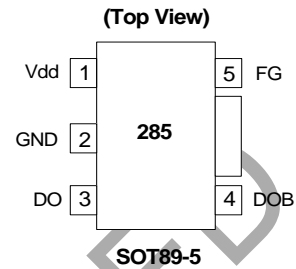
## Features

- Single-chip Solution
- Operating Voltage: 3.8V to 20V
- Built-in Hall Sensor and Input Amplifier
- Tachometer (FG) Output
- Rotor Lock Protection (Lock detection, output shutdown and automatic re-start)
- Built-in Zener Protection for Output Driver
- Average Output Current up to 500mA
- Packaged in SOT89-5
- 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.

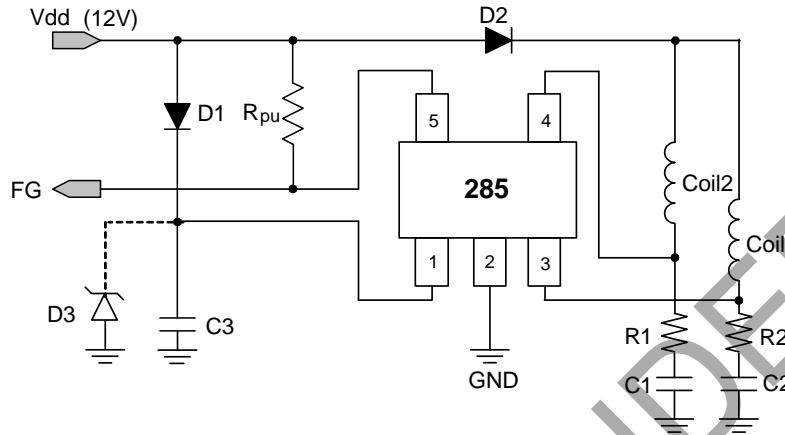
## Pin Assignments



## Applications

- Two-coil BLDC Cooling Fans
- Low to Medium Voltage, Low Power BLDC Motors

**Typical Application Circuit** (Note 4)



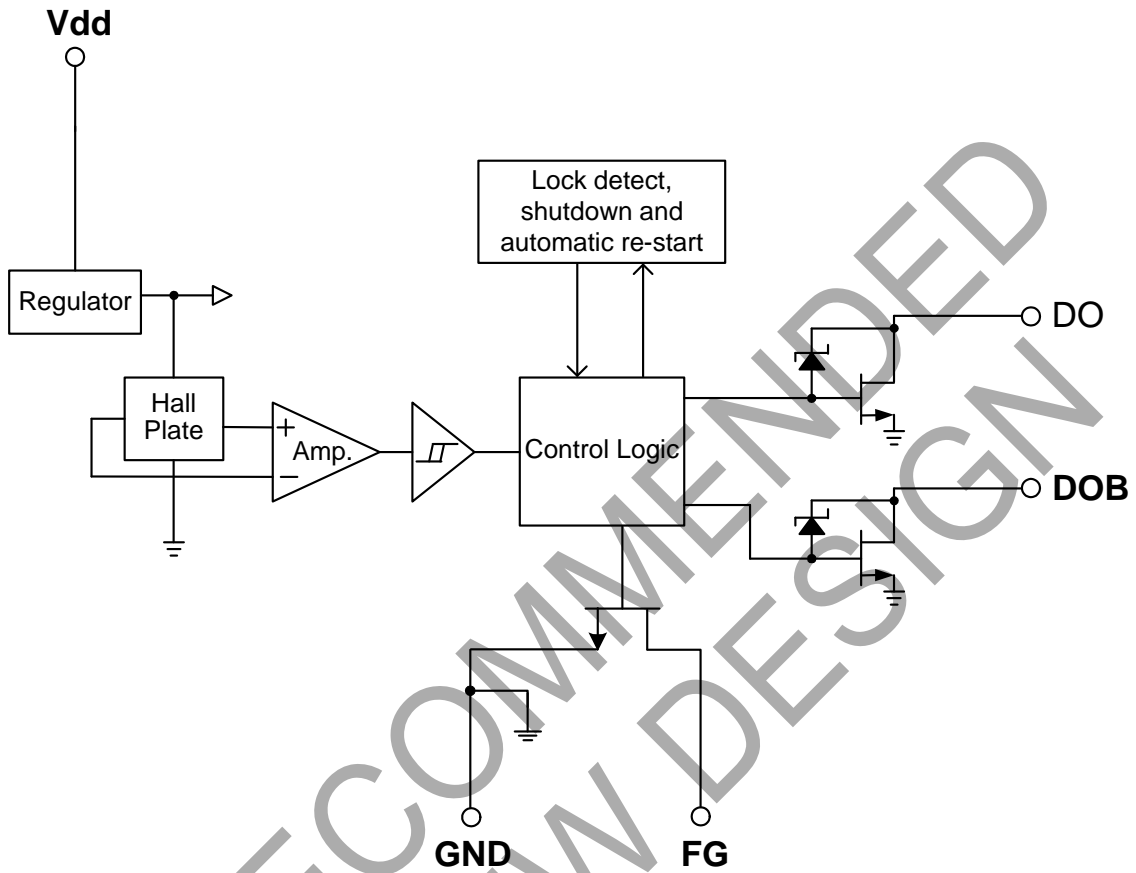
**12V DC Brush-less Fan with FG Output Function**

Notes: 4. Typically it is recommended to use a 56Ω resistor for R1 and R2 and a 2.2μF E-Cap capacitor for C1, C2 and C3. These values may need to be optimized depending on the coils used.  
To help with IC protection it's advised to add a Zener diode between Vdd and ground. The Zener diode should be chosen to help prevent the supply voltage exceeding the maximum rating of the device.

**Pin Descriptions**

| Pin Name | Description          |
|----------|----------------------|
| FG       | Frequency Generation |
| Vdd      | Input Power          |
| DO       | Output Pin           |
| DOB      | Output Pin           |
| GND      | Ground               |

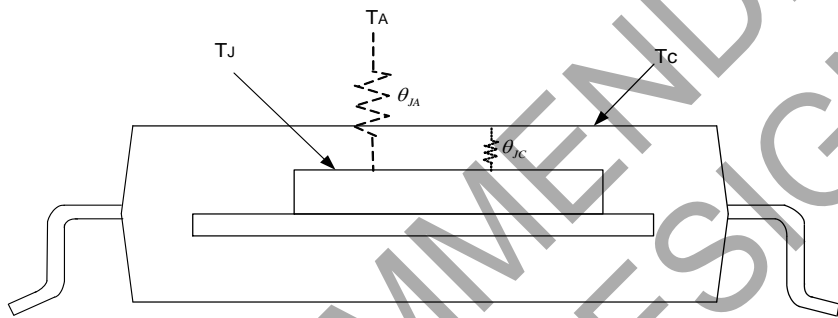
**Functional Block Diagram**



NOT RECOMMENDED FOR NEW DESIGN

**Absolute Maximum Ratings** ( $T_A = +25^\circ\text{C}$ )

| Symbol        | Characteristics                              | Rating       | Unit               |
|---------------|--|--------------|--------------------|
| $V_{DD}$      | Supply Voltage                               | 24           | V                  |
| $I_O$         | Output Current                               | $I_O$ (AVE)  | 500 mA             |
|               |  | $I_O$ (PEAK) | 700 mA             |
| $P_D$         | Power Dissipation                            | 800          | mW                 |
| $T_{ST}$      | Storage Temperature                          | -55 to +150  | $^\circ\text{C}$   |
| $T_J$         | Maximum Junction Temperature                 | +150         | $^\circ\text{C}$   |
| $\theta_{JA}$ | Thermal Resistance Junction to Case (Note 5) | 156          | $^\circ\text{C/W}$ |



Note: 5.  $\theta_{JA}$  should be confirmed with heat sink thermal resistance. If there is no heat sink contact,  $\theta_{JA}$  will almost be the same as  $\theta_{JC}$ .

**Recommended Operating Conditions**

| Symbol   | Characteristic                | Conditions | Min | Max  | Unit             |
|----------|-------------------------------|------------|-----|------|------------------|
| $V_{DD}$ | Supply Voltage                | Operating  | 3.8 | 20   | V                |
| $T_A$    | Operating Ambient Temperature | Operating  | -40 | +100 | $^\circ\text{C}$ |

**Electrical Characteristics** ( $T_A = +25^\circ\text{C}$ ,  $V_{DD} = 12\text{V}$ , unless otherwise specified.)

| Symbol         | Characteristics                | Conditions           | Min | Typ.  | Max  | Unit          |
|----------------|--------------------------------|----------------------|-----|-------|------|---------------|
| $I_{DD}$       | Supply Current                 | Operating            | -   | 2     | 4    | mA            |
| $I_{OFF}$      | Output Leakage Current         | $V_{OUT}=24\text{V}$ | -   | < 0.1 | 10   | $\mu\text{A}$ |
| $t_{RLP-ON}$   | Rotor Lock Protection On Time  | -                    | 0.4 | 0.5   | 0.6  | Sec           |
| $t_{RLP-OFF}$  | Rotor Lock Protection Off Time | -                    | 2.4 | 3     | 3.6  | Sec           |
| $V_{OUT(SAT)}$ | Output Saturation Voltage      | $I_O = 300\text{mA}$ | -   | 375   | 500  | mV            |
|                |                                | $I_O = 500\text{mA}$ | -   | 625   | 900  |               |
| $R_{DS(ON)}$   | Output On Resistance           | $I_O = 300\text{mA}$ | -   | 1.25  | 1.67 | $\Omega$      |
| $V_{OL}$       | FG Output $V_{DS}$             | $I_O = 10\text{mA}$  | -   | 0.5   | -    | V             |
| $V_Z$          | Output Zener-Breakdown Voltage | -                    | 35  | 42    | 60   | V             |

**Truth Table**

| IN- | IN+ | CT | OUT1 | OUT2 | FG | Mode                        |
|-----|-----|----|------|------|----|-----------------------------|
| H   | L   | L  | H    | L    | H  | Rotating                    |
| L   | H   | L  | L    | H    | L  | Rotating                    |
| -   | -   | H  | Off  | Off  | -  | Lockup protection activated |

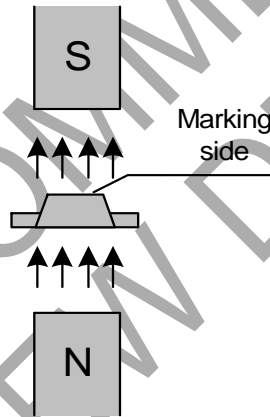
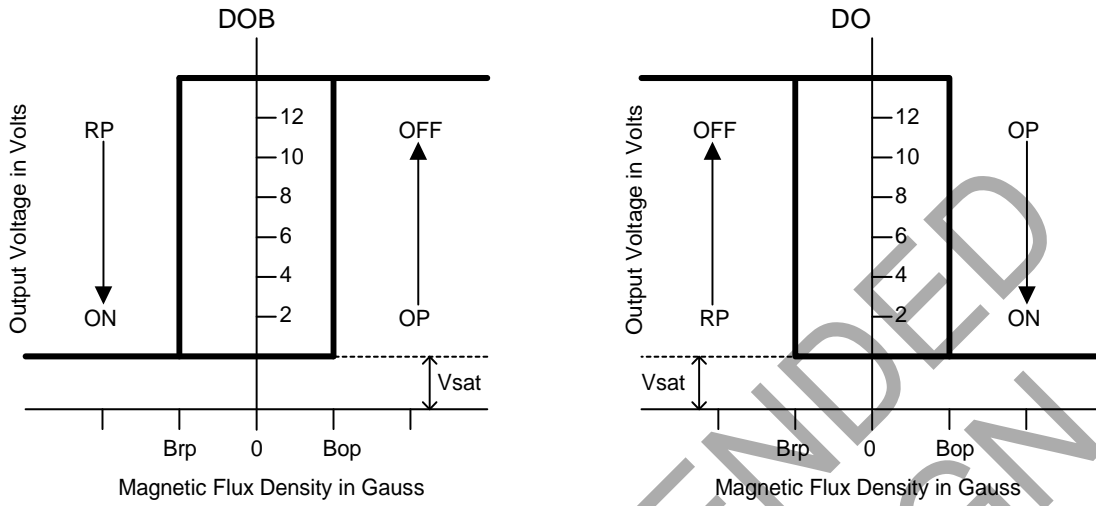
**Magnetic Characteristics** ( $T_A = +25^\circ\text{C}$ ,  $V_{DD} = 12\text{V}$ , unless otherwise specified, Note 6)

(1mT = 10 Gauss)

| Symbol | Characteristics | Min | Typ. | Max | Unit  |
|--------|-----------------|-----|------|-----|-------|
| Bop    | Operation Point | 10  | 30   | 60  | Gauss |
| Brp    | Release Point   | -60 | -30  | -10 | Gauss |
| Bhy    | Hysteresis      | -   | 60   | -   | Gauss |

Note: 6. The magnetic characteristics may vary with supply voltage, operating temperature and after soldering.

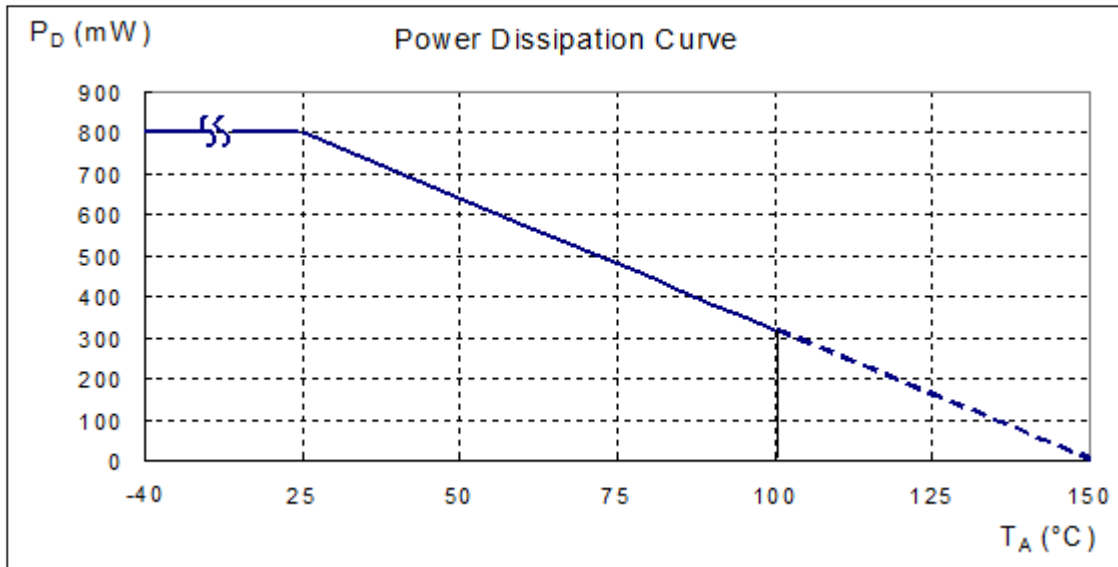
**Operating Characteristics**



( SOT89-5 )

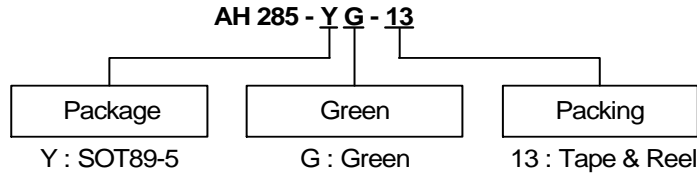
**Performance Characteristics**

|            |     |     |     |     |     |     |     |     |     |     |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| $T_A$ (°C) | 25  | 50  | 60  | 70  | 75  | 80  | 85  | 90  | 95  | 100 |
| $P_D$ (mW) | 800 | 640 | 576 | 512 | 480 | 448 | 416 | 384 | 352 | 320 |
| $T_A$ (°C) | 105 | 110 | 115 | 120 | 125 | 130 | 135 | 140 | 145 | 150 |
| $P_D$ (mW) | 288 | 256 | 224 | 192 | 160 | 128 | 96  | 64  | 32  | 0   |



NOT RECOMMENDED FOR NEW DESIGN

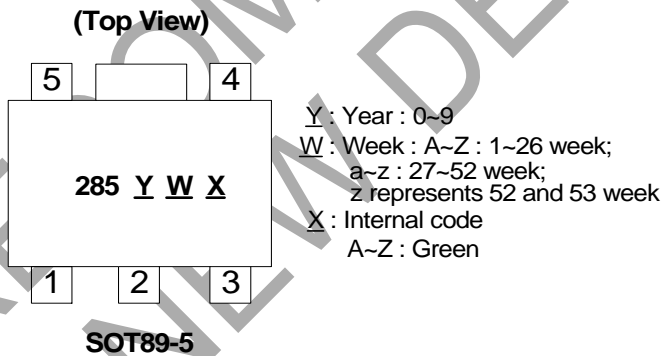
## Ordering Information



| Device      | Status (Note 9) | Package Code | Packaging (Note 7, 8) | Bulk     |                    | 13" Tape and Reel |                    |
|-------------|-----------------|--------------|-----------------------|----------|--------------------|-------------------|--------------------|
|             |                 |              |                       | Quantity | Part Number Suffix | Quantity          | Part Number Suffix |
| AH285-YG-13 | NRND            | Y            | SOT89-5               | NA       | NA                 | 2500/Tape & Reel  | -13                |

- Notes:
7. Pad layout as shown on Diodes Incorporated's suggested pad layout document, which can be found on our website at <http://www.diodes.com/package-outlines.html>.
  8. Reverse taping as shown on Diodes Incorporated's Surface Mount (SMD) Packaging document AP02007, which can be found on our website <http://www.diodes.com/datasheets/ap02007.pdf>.
  9. NRND = Not Recommended for New Design.

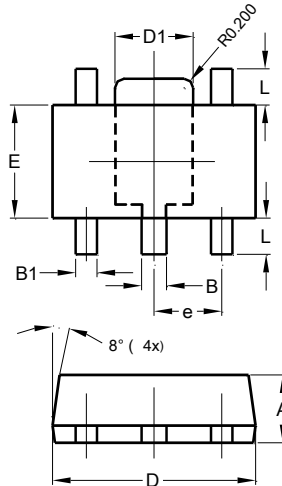
## Marking Information



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

Please see <http://www.diodes.com/package-outlines.html> for the latest version.

SOT89-5

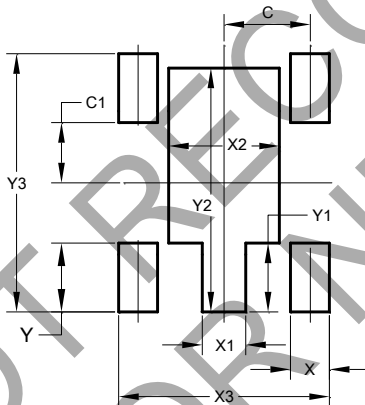


| SOT89-5              |      |      |       |
|----------------------|------|------|-------|
| Dim                  | Min  | Max  | Typ   |
| A                    | 1.40 | 1.60 | 1.50  |
| B                    | 0.50 | 0.62 | 0.56  |
| B1                   | 0.44 | 0.54 | 0.48  |
| C                    | 0.35 | 0.43 | 0.38  |
| D                    | 4.40 | 4.60 | 4.50  |
| D1                   | 1.62 | 1.83 | 1.733 |
| E                    | 2.40 | 2.60 | 2.50  |
| e                    | -    | -    | 1.50  |
| H                    | 3.95 | 4.25 | 4.10  |
| L                    | 0.65 | 0.95 | 0.80  |
| All Dimensions in mm |      |      |       |

**Suggested Pad Layout**

Please see <http://www.diodes.com/package-outlines.html> for the latest version.

SOT89-5



| Dimensions | Value (in mm) |
|------------|---------------|
| C          | 1.500         |
| C1         | 1.050         |
| X          | 0.680         |
| X1         | 0.760         |
| X2         | 1.930         |
| X3         | 3.680         |
| Y          | 1.200         |
| Y1         | 1.200         |
| Y2         | 4.250         |
| Y3         | 4.500         |

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