

**2-PHASE HALF-WAVE HIGH VOLTAGE MOTOR PRE-DRIVER****AM4406****General Description**

The AM4406 is a 2-phase, half-wave motor predriver fabricated for fan motors. This IC is equipped with lock shutdown, automatic restart and rotation detection (RD) function. The lock shutdown function turns off the output current when the motor is under lock condition. And when the motor is unlocked, the IC will automatically restart and allow DC fan to run. In addition, the RD function is to detect the motor status.

The AM4406 is available in SOIC-8 package.

**Features**

- Hall Inputs with a Hysteresis
- Lock Shutdown and Automatic Restart
- Rotation Detection (RD) Output
- Supply Voltage: 4 to 28V
- Output Current: 70mA Max.
- Operating Temperature: -30 to 85°C

**Applications**

- High Voltage, High Current Brushless DC Fan
- Power Supply and Switchboards
- Communications Facilities
- Industrial Equipment

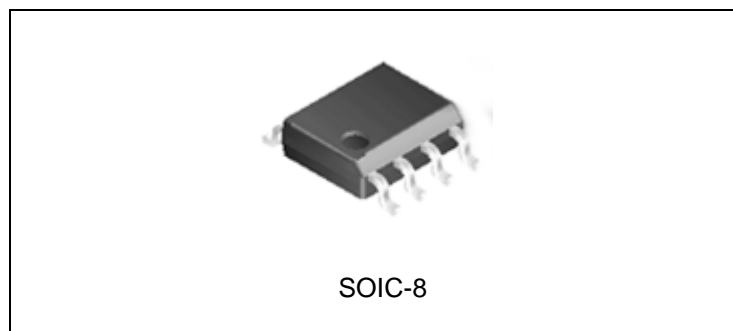


Figure 1. Package Type of AM4406

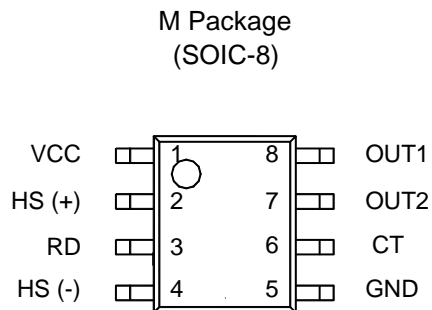
**2-PHASE HALF-WAVE HIGH VOLTAGE MOTOR PRE-DRIVER****AM4406****Pin Configuration**

Figure 2. Pin Configuration of AM4406 (Top View)

**Pin Description**

| Pin Number | Pin Name | Function           |
|------------|----------|--------------------|
| 1          | VCC      | Power supply       |
| 2          | HS (+)   | Hall input (+)     |
| 3          | RD       | Rotation detection |
| 4          | HS (-)   | Hall input (-)     |
| 5          | GND      | Ground             |
| 6          | CT       | Timing capacitor   |
| 7          | OUT2     | Driver output 2    |
| 8          | OUT1     | Driver output 1    |



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**AM4406**

**Functional Block Diagram**

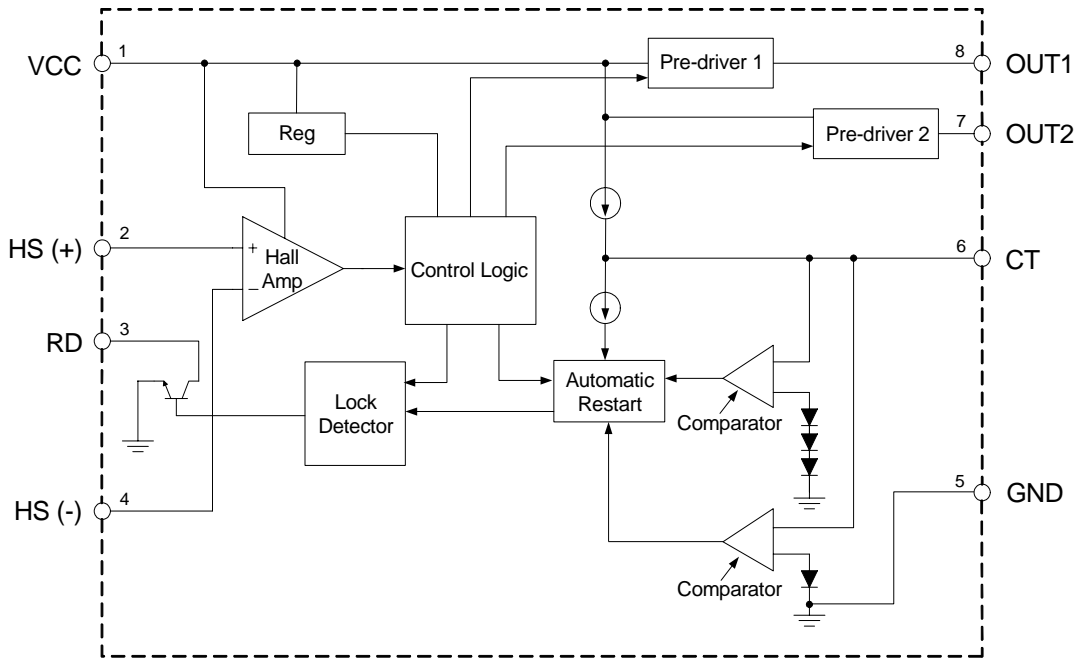


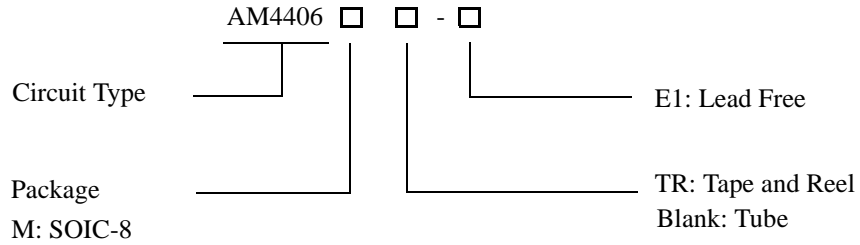
Figure 3. Functional Block Diagram of AM4406



**2-PHASE HALF-WAVE HIGH VOLTAGE MOTOR PRE-DRIVER**

**AM4406**

**Ordering Information**



| Package | Temperature Range | Part Number  | Marking ID | Packing Type |
|---------|-------------------|--------------|------------|--------------|
| SOIC-8  | -30 to 85°C       | AM4406M-E1   | AM4406M    | Tube         |
|         |                   | AM4406MTR-E1 | AM4406M    | Tape & Reel  |

BCD Semiconductor's Pb-free products, as designated with "E1" suffix in the part number, are RoHS compliant.

**2-PHASE HALF-WAVE HIGH VOLTAGE MOTOR PRE-DRIVER****AM4406****Absolute Maximum Ratings (Note 1)**

| Parameter                 | Symbol    | Value        | Unit |
|---------------------------|-----------|--------------|------|
| Supply Voltage            | $V_{CC}$  | 30           | V    |
| Output Current            | $I_{OUT}$ | 70           | mA   |
| Power Dissipation         | $P_D$     | 550 (Note 2) | mW   |
| Storage Temperature Range | $T_{STG}$ | -55 to 125   | °C   |
| ESD (Human Body Model)    | ESD       | 3000         | V    |
| ESD (Machine Model)       | ESD       | 300          | 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.

Note 2: Reduced by 5.5mW/°C when  $T_A$  is over 25°C.

**Recommended Operating Conditions**

| Parameter                       | Symbol      | Min | Max          | Unit |
|---------------------------------|-------------|-----|--------------|------|
| Supply Voltage                  | $V_{CC}$    | 4   | 28           | V    |
| Hall Input Voltage (+) (Note 3) | $V_{HS}(+)$ | 1.0 | $V_{CC}-0.5$ | V    |
| Hall Input Voltage (-) (Note 3) | $V_{HS}(-)$ | 1.0 | $V_{CC}-0.5$ | V    |
| Operating Temperature           | $T_A$       | -30 | 85           | °C   |

Note 3: Hall input voltage range includes the amplitude of signal.

**2-PHASE HALF-WAVE HIGH VOLTAGE MOTOR PRE-DRIVER****AM4406****Electrical Characteristics**(V<sub>CC</sub>=12V, T<sub>A</sub>=25°C, unless otherwise specified.)

| Parameter                           | Symbol               | Conditions                                   | Min  | Typ  | Max  | Unit |
|-------------------------------------|----------------------|--|------|------|------|------|
| Supply Current                      | I <sub>CC</sub>      | No load                                      |      | 3.2  | 5.0  | mA   |
| Hall Amplifier Input Hysteresis (+) | V <sub>HYS</sub> (+) | Zero to peak including offset and hysteresis | 3    |      | 15   | mV   |
| Hall Amplifier Input Hysteresis (-) | V <sub>HYS</sub> (-) | Zero to peak including offset and hysteresis | -3   |      | -15  | mV   |
| CT Charge Current                   | I <sub>CHG</sub>     | V <sub>CT</sub> =1.5V                        | 2    | 3.45 | 5.25 | μA   |
| CT Discharge Current                | I <sub>DHG</sub>     | V <sub>CT</sub> =1.5V                        | 0.35 | 0.8  | 1.45 | μA   |
| CT Charge and Discharge Ratio       | R <sub>CD</sub>      | I <sub>CHG</sub> /I <sub>DHG</sub>           | 3    | 4.5  | 8    |      |
| CT Clamp Voltage                    | V <sub>CL</sub>      |  | 2.2  | 2.6  | 3    | V    |
| CT Comparator Voltage               | V <sub>CP</sub>      |  | 0.4  | 0.6  | 0.8  | V    |
| OUT1 High Level Voltage             | V <sub>OH1</sub>     | I <sub>OUT1</sub> =10mA                      | 10   | 10.5 |      | V    |
| OUT2 High Level Voltage             | V <sub>OH2</sub>     | I <sub>OUT2</sub> =10mA                      | 10   | 10.5 |      | V    |
| RD Output Low Level Voltage         | V <sub>RDL</sub>     | I <sub>RD</sub> =5mA                         |      | 0.2  | 0.5  | V    |
| RD Current Capacity                 | I <sub>RD</sub>      | V <sub>RD</sub> =2V                          | 8    | 18   |      | mA   |



**2-PHASE HALF-WAVE HIGH VOLTAGE MOTOR PRE-DRIVER**

**AM4406**

**Typical Performance Characteristics**

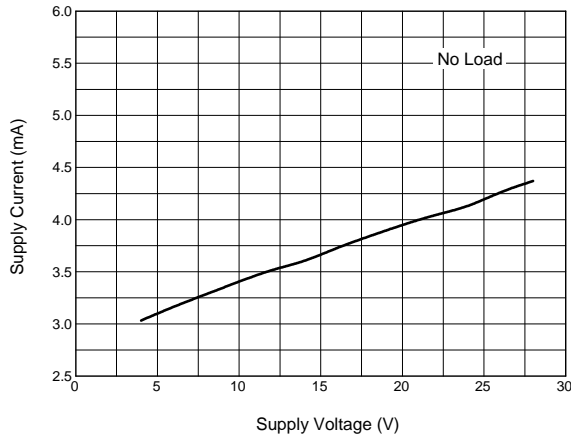


Figure 4. Supply Current vs. Supply Voltage

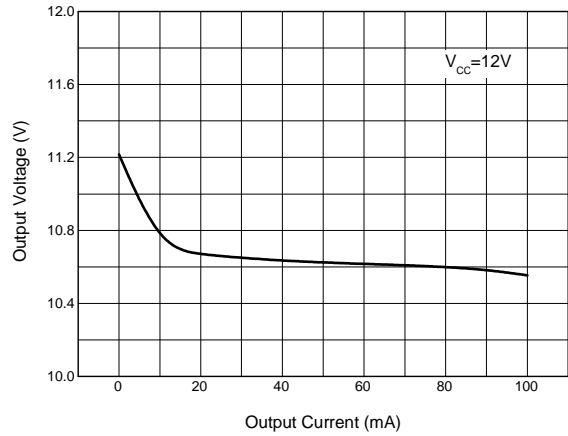


Figure 5. Output Voltage vs. Output Current

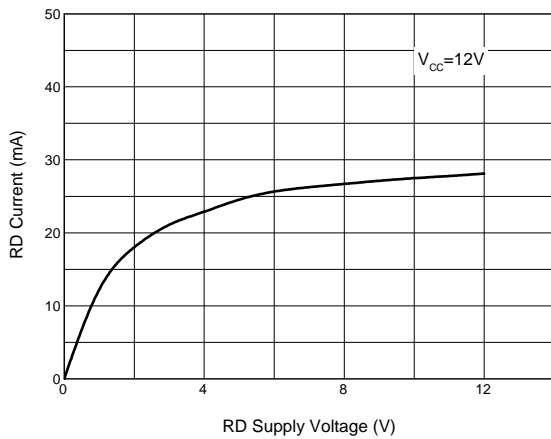


Figure 6. RD Current vs. RD Supply Voltage

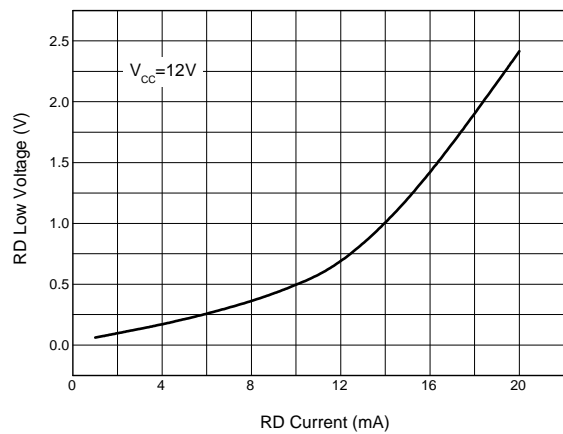


Figure 7. RD Low Voltage vs. RD Current



**2-PHASE HALF-WAVE HIGH VOLTAGE MOTOR PRE-DRIVER**

**AM4406**

**Typical Performance Characteristics (Continued)**

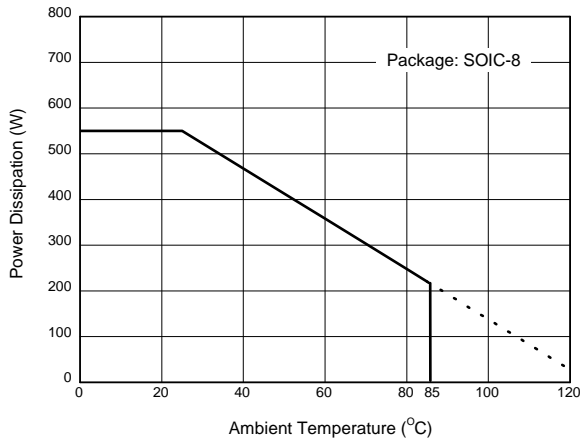
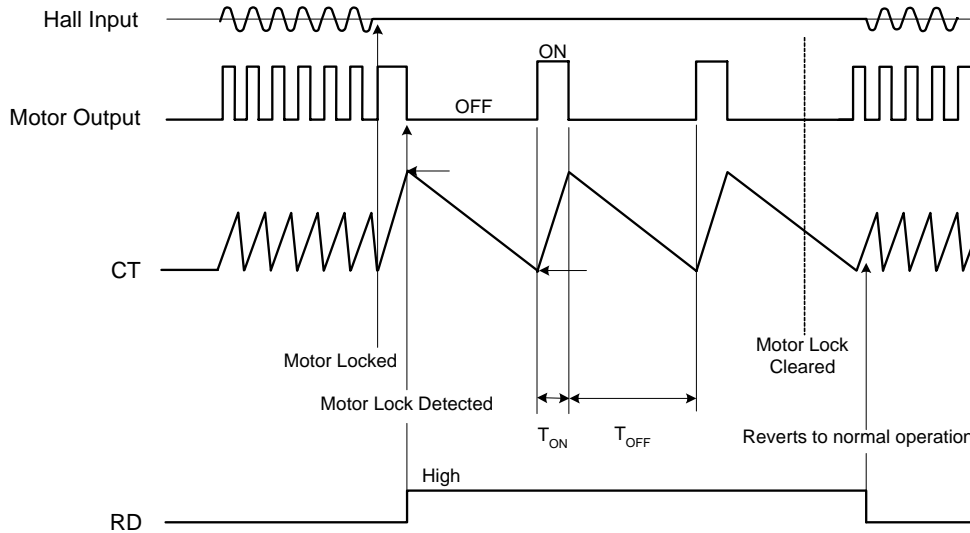


Figure 8. Power Dissipation vs. Ambient Temperature





**Operating Diagram**



Note 4: Automatic restart is performed in the following manner. A motor lock condition is detected when the hall signal stops switching. The output is ON when CT pin is being charged. C2 is the external capacitor of the CT pin. Output ON time and OFF time are determined by the capacitance of C2.

Note 5: RD pin is ON during normal operation, and OFF when the motor is locked. It is an open collector output pin.

$$T_{ON} = \frac{C2 * (V_{CL} - V_{CP})}{I_{CHG}} \text{ (Sec.)}$$

$$T_{OFF} = \frac{C2 * (V_{CL} - V_{CP})}{I_{DHG}} \text{ (Sec.)}$$

Note 6: The RD pin may maintain HIGH level for a few hundred milliseconds when the power is turn on.

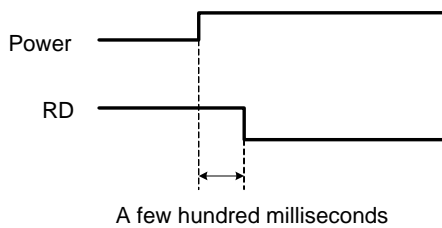


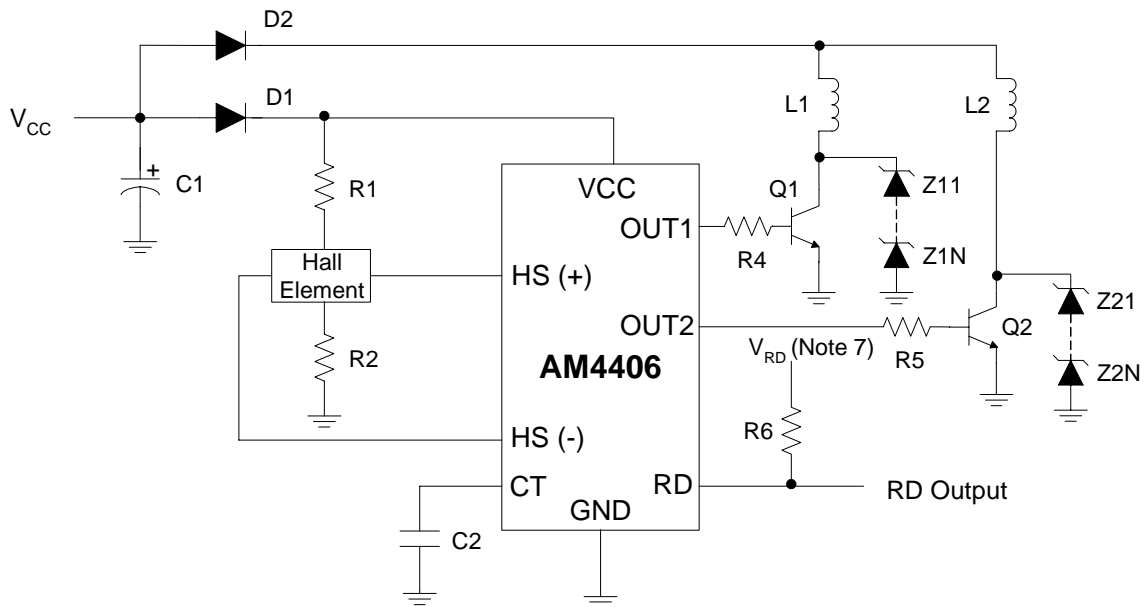
Figure 9. Control Timing Diagram of AM4406



**2-PHASE HALF-WAVE HIGH VOLTAGE MOTOR PRE-DRIVER**

**AM4406**

**Typical Application**



Note 7:  $V_{RD}$  should be equal or smaller than  $V_{CC}$ .

Figure 10. Typical Application of AM4406





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