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Single Phase Low Noise Smart Motor Driver

AH9479/80/81

General Description

The AH9479/80/81 is a single chip solution for driving single coil brushless DC motors. It combines a motor driver with a high sensitivity Hall sensor, which simplifies the PCB design and makes the fabrication of small-size motors possible.

The AH9480 has an open-drain tachometer output FG that follows the Hall sensor latching output. The AH9481 has an open-drain rotation detection output RD that is active low when the motor is spinning and goes high when blocked.

When there is no motion about 0.4 second, the IC will automatically detect the locked rotor conditions, and enter protection mode, shutting off the motor driver for 4 seconds. Then, the IC will turn on the motor driver for 0.4 second to detect whether there is rotation condition, if fails, the IC will shut off motor driver for four seconds again. This sequence will be repeated until rotation condition is detected, and the IC enters normal operation. This feature can effectively prevent the IC from overheating and damage due to long-time locked rotor condition. “Soft-switch” is used to reduce the vibration and acoustic noise. Thermal-shutdown protection ensures that the motor driver operates under specified temperature ranges.

The AH9479 is packaged in TO-94, and the AH9480/81 is packaged in TO-95 and MSOP-8.

Features

- Full Bridge Driver
- High Sensitivity Integrated Hall Sensor
- Soft-switching for Low Noise
- Low Supply Voltage: 2.5V
- Locked Rotor Protection and Auto-restart
- Thermal Protection
- Output Over-current Protection
- Short Circuit Protection
- Tachometer Output Signal (AH9480)
- Alarm Output Signal (AH9481)

Applications

- 5V/12V Low Noise BLDC Cooling Fans
- Low Voltage / Low Power BLDC Motors
- Notebook DC Fans / Blowers
- Automotive Low Noise Climate Control Fans
- Micro-motors

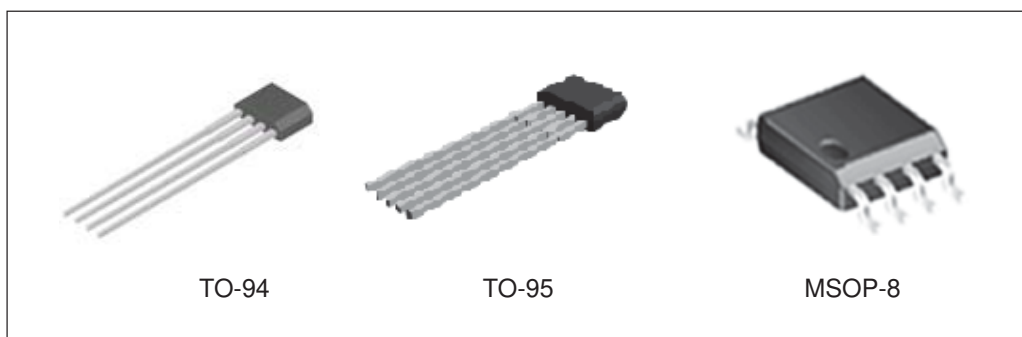


Figure 1. Package Types of AH9479/80/81

Single Phase Low Noise Smart Motor Driver

AH9479/80/81

Pin Configuration

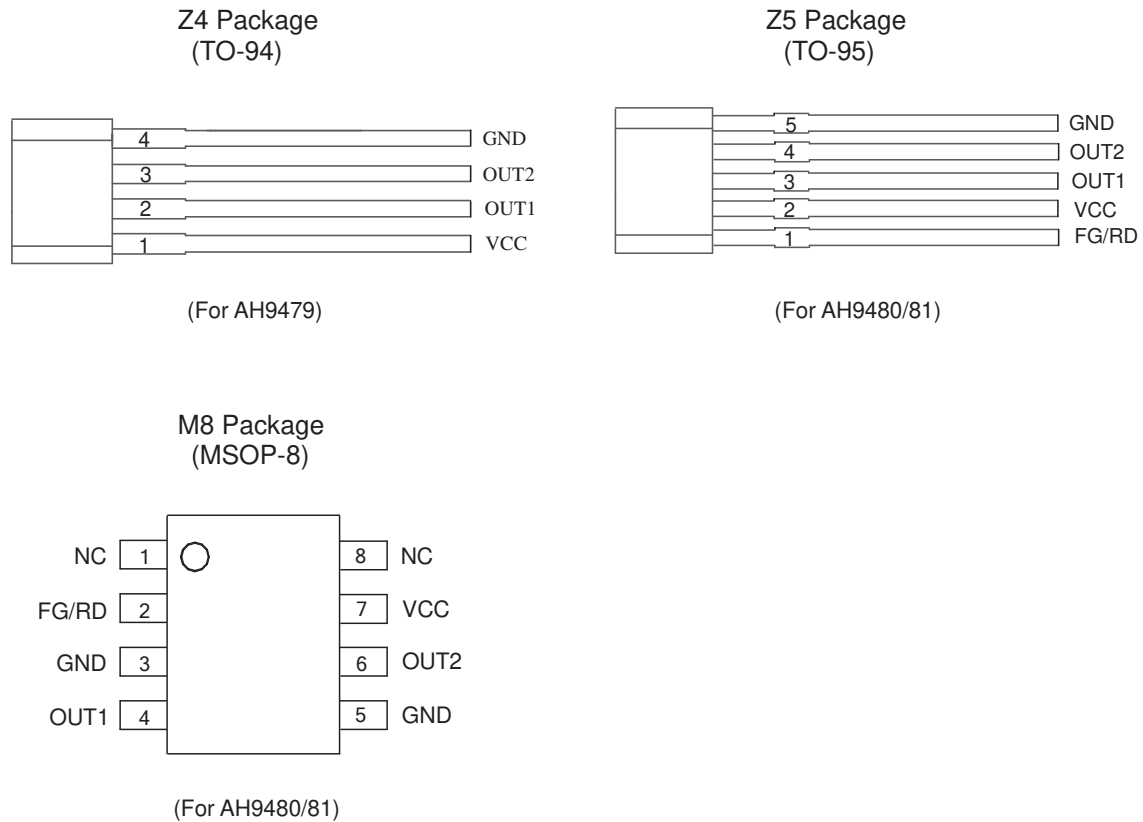
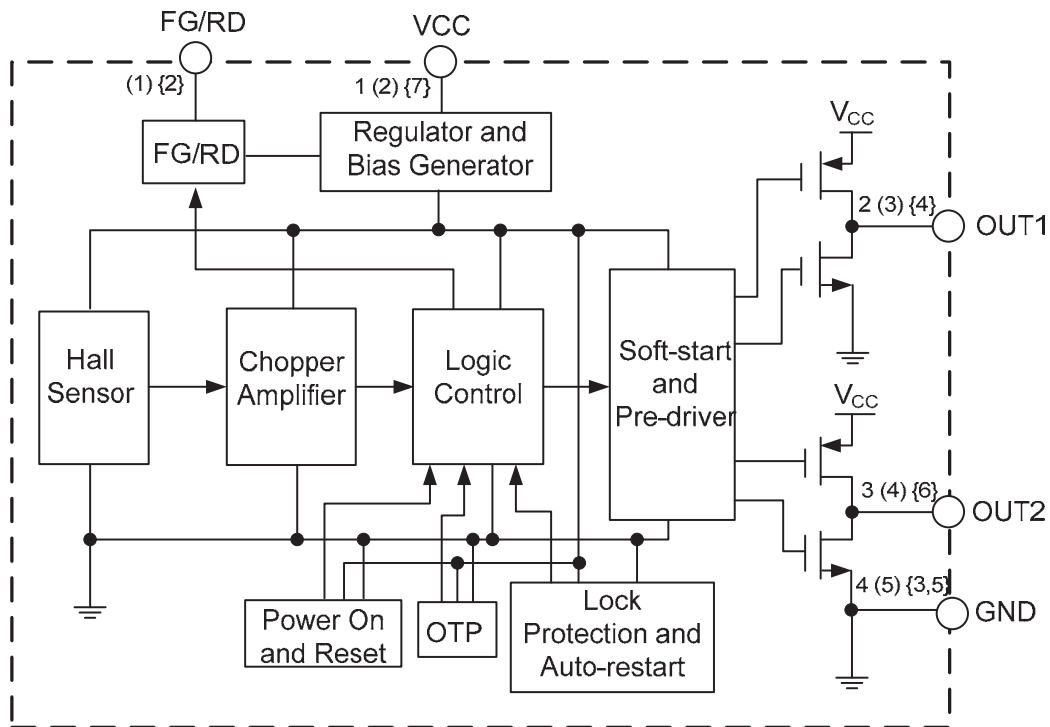


Figure 2. Pin Configuration of AH9479/80/81

Pin Description

| Pin Number | | | Pin Name | Function |
|------------|-------|--------|----------|--|
| TO-94 | TO-95 | MSOP-8 | | |
| | 1 | 2 | FG/RD | Frequency generator (rotation detection) open drain output |
| 1 | 2 | 7 | VCC | Power supply pin |
| 2 | 3 | 4 | OUT1 | Output pin 1 |
| 3 | 4 | 6 | OUT2 | Output pin 2 |
| 4 | 5 | 3, 5 | GND | Ground pin |
| | | 1, 8 | NC | No connection |

Functional Block Diagram



A (B) {C}
A for TO-94
B for TO-95
C for MSOP-8

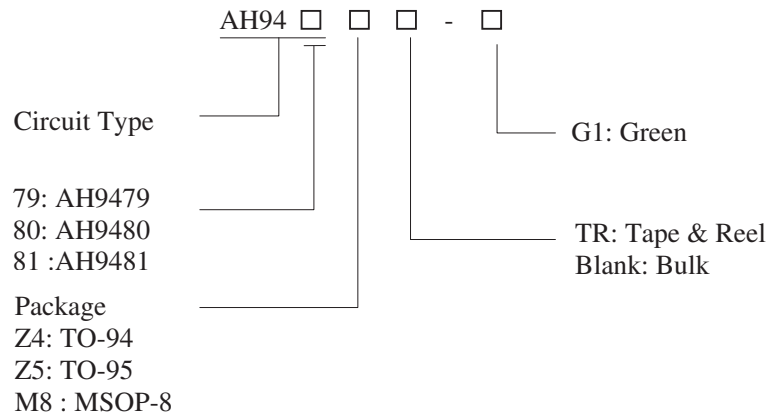
Figure 3. Functional Block Diagram of AH9479/80/81



Single Phase Low Noise Smart Motor Driver

AH9479/80/81

Ordering Information



| Package | Temperature Range | Output Signal | Part Number | Marking ID | Packing Type |
|---------|-------------------|---------------|---------------|------------|--------------|
| TO-94 | -40 to 85°C | | AH9479Z4-G1 | 9479Z4-G1 | Bulk |
| TO-95 | | FG | AH9480Z5-G1 | 9480Z5-G1 | Bulk |
| | | RD | AH9481Z5-G1 | 9481Z5-G1 | Bulk |
| MSOP-8 | | FG | AH9480M8TR-G1 | 9480M8-G1 | Tape & Reel |
| | | RD | AH9481M8TR-G1 | 9481M8-G1 | Tape & Reel |

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

**Single Phase Low Noise Smart Motor Driver****AH9479/80/81****Absolute Maximum Ratings (Note 1)**

| Parameter | Symbol | Value | | Unit |
|---|-----------------|------------|-----|------|
| Supply Voltage | V_{CC} | 18 | | V |
| Peak Output Current | I_{OUT_P} | 500 | | mA |
| Continuous Output Current | I_{OUT_C} | 300 | | mA |
| FG/RD Pull-up Voltage | V_{FG}/V_{RD} | 18 | | V |
| FG/RD Output Current | I_{FG}/I_{RD} | 10 | | mA |
| Power Dissipation | P_D | TO-94 | 550 | mW |
| | | TO-95 | 600 | |
| | | MSOP-8 | 585 | |
| Operating Ambient Temperature | T_A | -40 to 85 | | °C |
| Storage Temperature | T_{STG} | -55 to 150 | | °C |
| Thermal Resistance (Junction to Ambient) | θ_{JA} | TO-94 | 227 | °C/W |
| | | TO-95 | 208 | |
| | | MSOP-8 | 214 | |
| ESD (Human Body Model) | ESD | 6000 | | V |
| ESD (Machine Model) | ESD | 200 | | 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_{CC} | 2.5 | 16 | V |
| Operating Ambient Temperature | T_A | -40 | 85 | °C |

**Single Phase Low Noise Smart Motor Driver****AH9479/80/81****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, $R_{COIL}=100\Omega$ | 2.5 | | 16 | V |
| Supply Current | I_{CC} | | | 4.3 | 12 | mA |
| ON Resistance ($R_{PMOS}+R_{NMOS}=R_S$) | $R_{DSON1,2}$ | $V_{CC}=12V, T_A=25^{\circ}C, I_{OUT}=300mA$ | | 3.3 | | Ω |
| | | $V_{CC}=12V, T_J=125^{\circ}C, I_{OUT}=300mA$ | | 3.3 | | Ω |
| FG/RD Output Low Voltage | V_{OL} | $I_{OL}=5mA$ | | 0.18 | 0.5 | V |
| FG/RD Output Leakage Current | $I_{LEAKAGE}$ | $V_{FG}(V_{RD})=5V$ | | 0.15 | 10 | μA |
| Locked Rotor Period (ON) | t_{ON} | $V_{CC}>7V$ | | 0.4 | | s |
| Locked Rotor Period (OFF) | t_{OFF} | $V_{CC}>7V$ | | 4 | | s |
| Protection Temperature | T_{OTP} | | | 175 | | $^{\circ}C$ |

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

| Parameter | Symbol | Min | Typ | Max | Unit |
|-----------------|-----------|-----|-----|-----|-------|
| Operating Point | B_{OP} | 0 | 20 | 50 | Gauss |
| Releasing Point | B_{RP} | -50 | -20 | 0 | Gauss |
| Hysteresis | B_{HYS} | | 40 | | Gauss |

Test Circuit

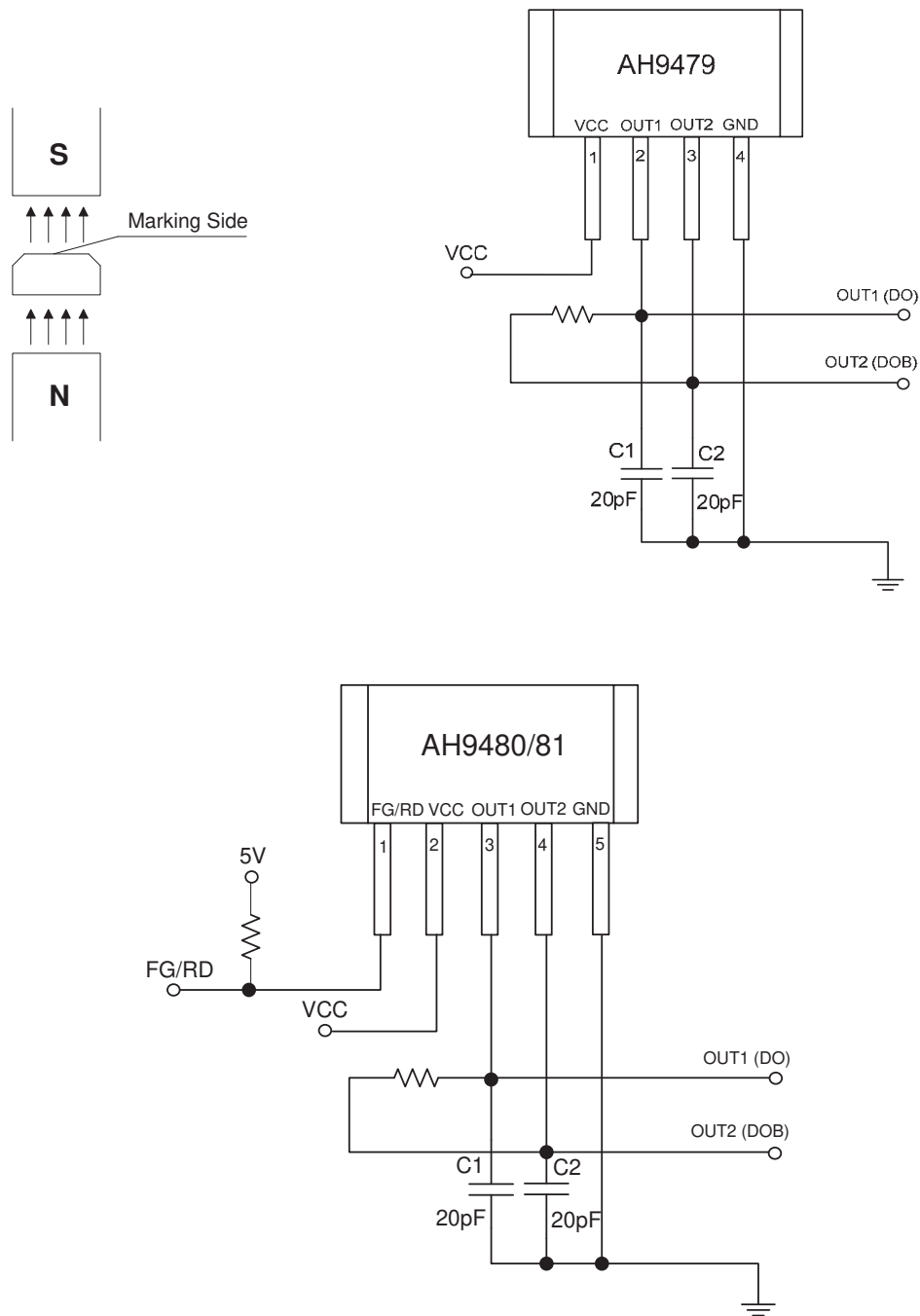


Figure 4. Basic Test Circuit of AH9479/80/81



Hysteresis Characteristics

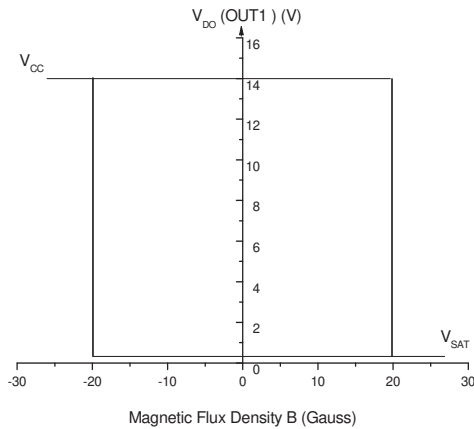


Figure 5. V_{DO} vs. Magnetic Flux Density

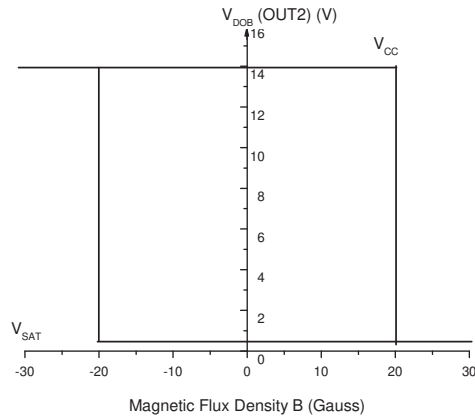


Figure 6. V_{DOB} vs. Magnetic Flux Density

Typical Performance Characteristics

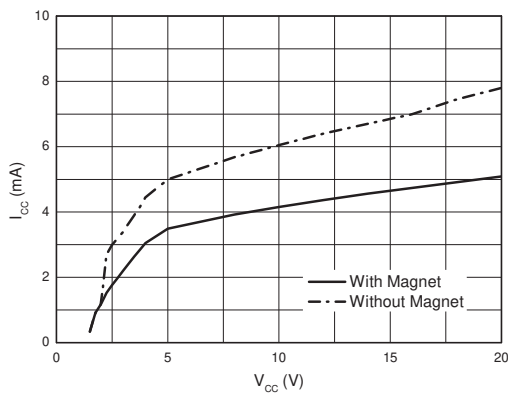


Figure 7. I_{CC} vs. V_{CC}

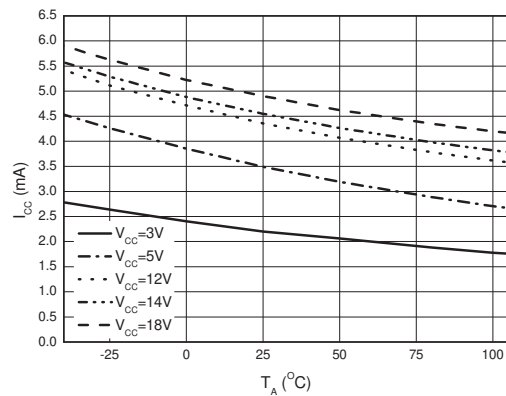


Figure 8. I_{CC} vs. T_A



Typical Performance Characteristics (Continued)

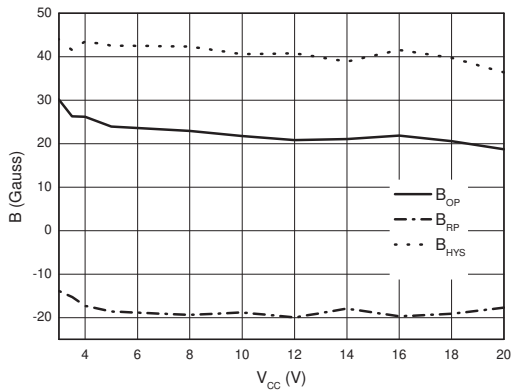


Figure 9. B_{OP}/B_{RP}/B_{HYS} vs. V_{CC}

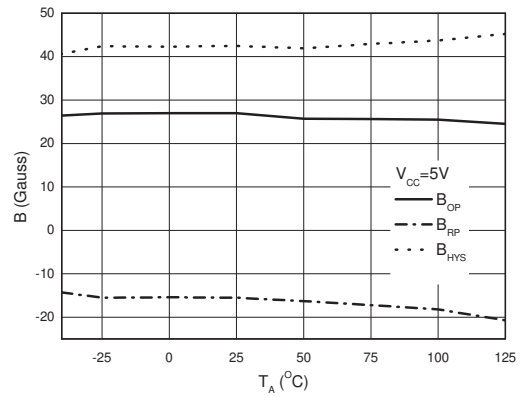


Figure 10. B_{OP}/B_{RP}/B_{HYS} vs. T_A (V_{CC}=5V)

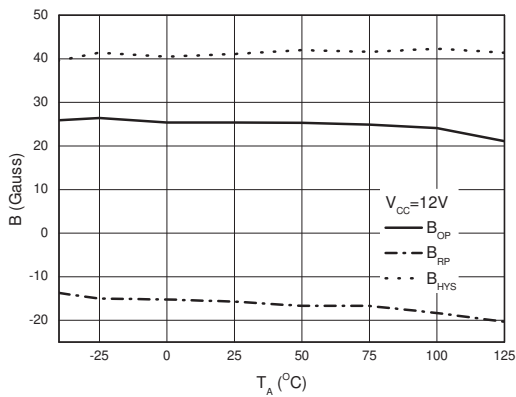


Figure 11. B_{OP}/B_{RP}/B_{HYS} vs. T_A (V_{CC}=12V)

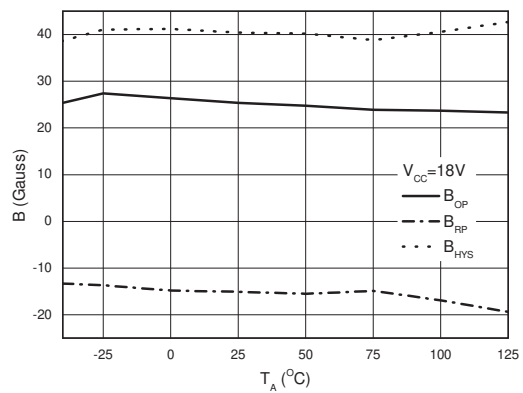


Figure 12. B_{OP}/B_{RP}/B_{HYS} vs. T_A (V_{CC}=18V)



Typical Performance Characteristics (Continued)

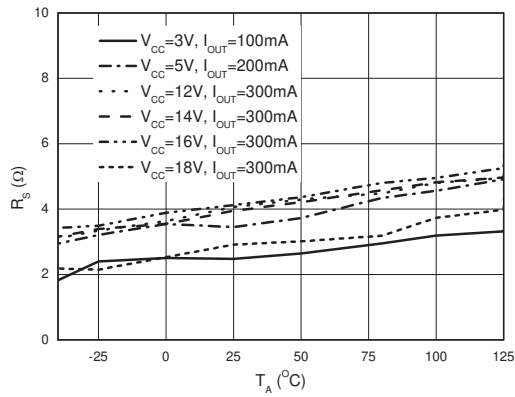


Figure 13. R_S vs. T_A

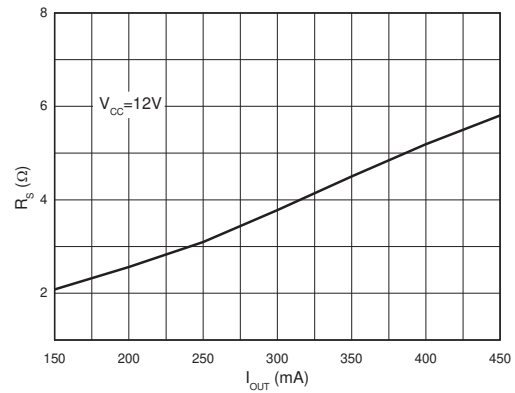


Figure 14. R_S vs. I_{OUT}

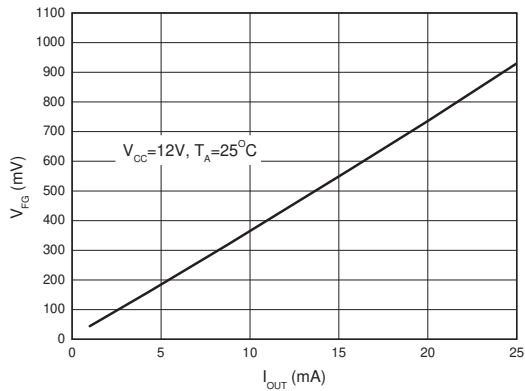


Figure 15. V_{FG} vs. I_{OUT}

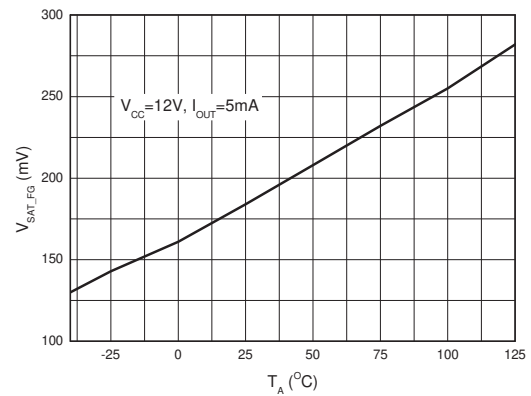


Figure 16. V_{SAT_FG} vs. T_A



Typical Performance Characteristics (Continued)

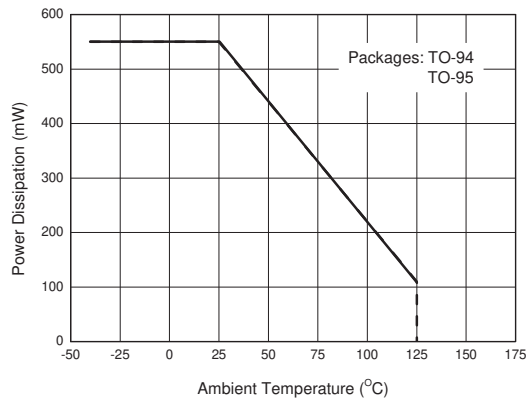


Figure 17. Power Dissipation vs. T_A

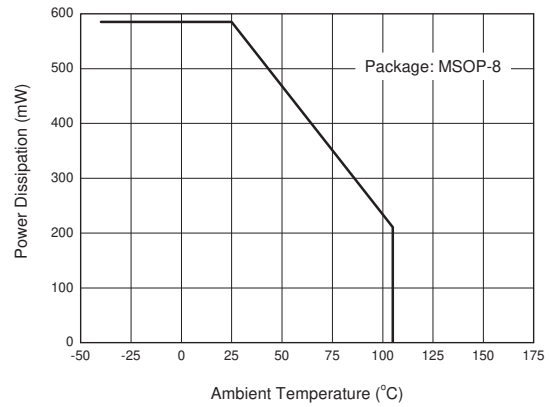
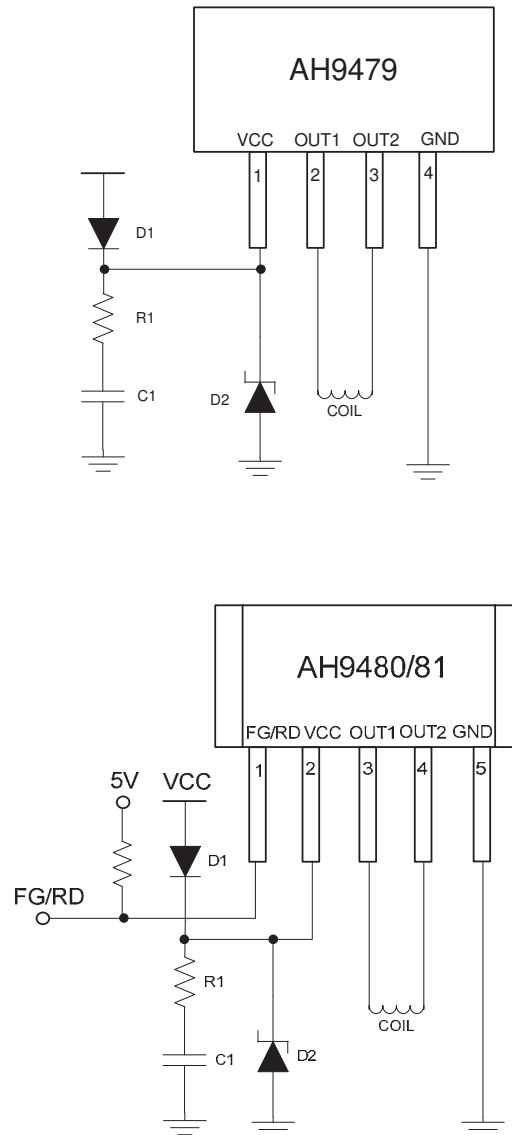


Figure 18. Power Dissipation vs. T_A

Typical Application



Note 2: C1 should be at least larger than 2.2 μ F, R1=0 to 10 Ω .

Figure 19. Typical Application of AH9479/80/81

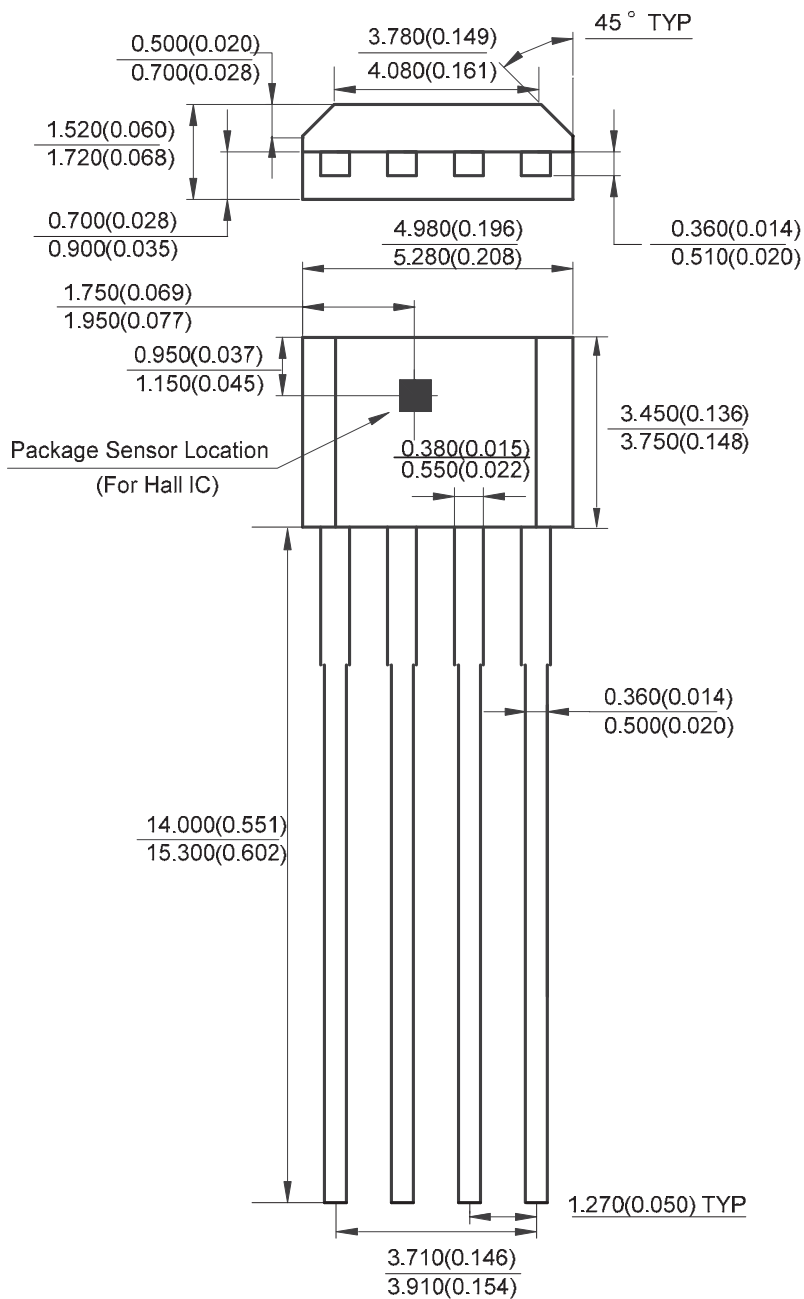
Single Phase Low Noise Smart Motor Driver

AH9479/80/81

Mechanical Dimensions

TO-94

Unit: mm(inch)





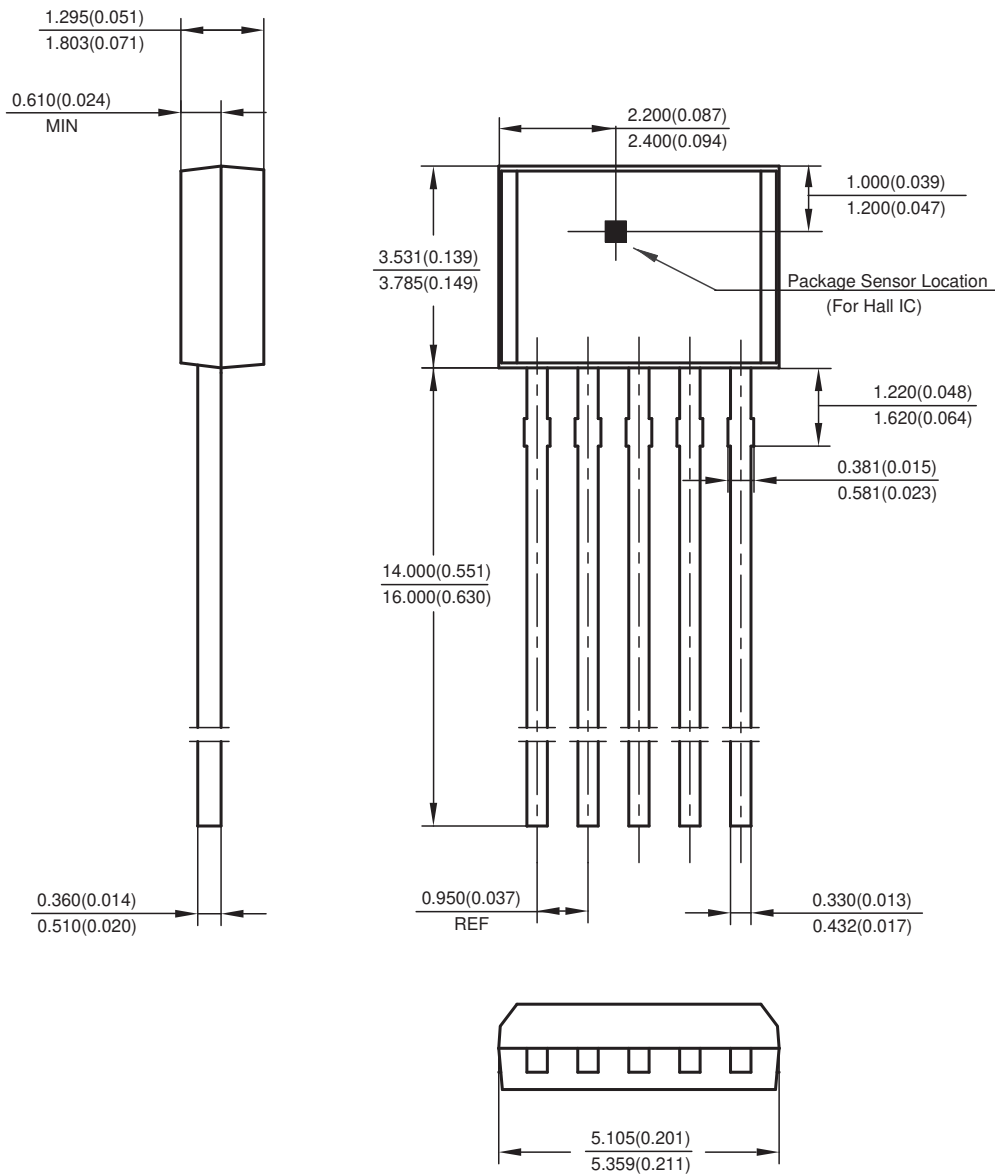
Single Phase Low Noise Smart Motor Driver

AH9479/80/81

Mechanical Dimensions (Continued)

TO-95

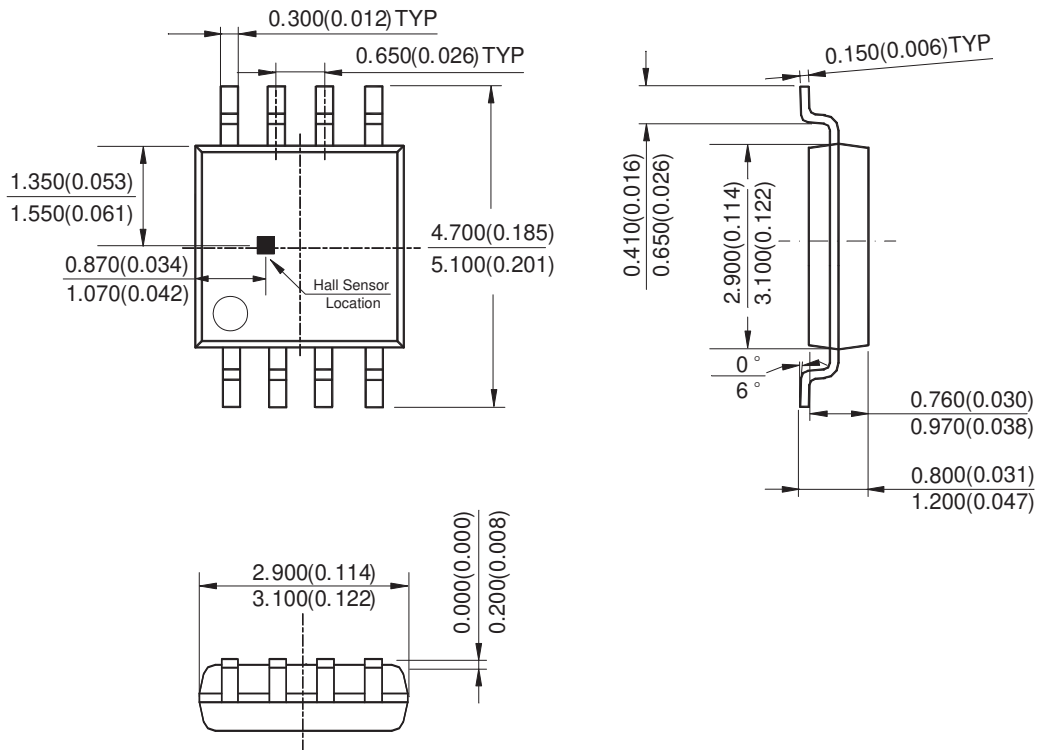
Unit: mm(inch)



Mechanical Dimensions (Continued)

MSOP-8

Unit: mm(inch)



Note: Eject hole , oriented hole and mold mark is optional



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