

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

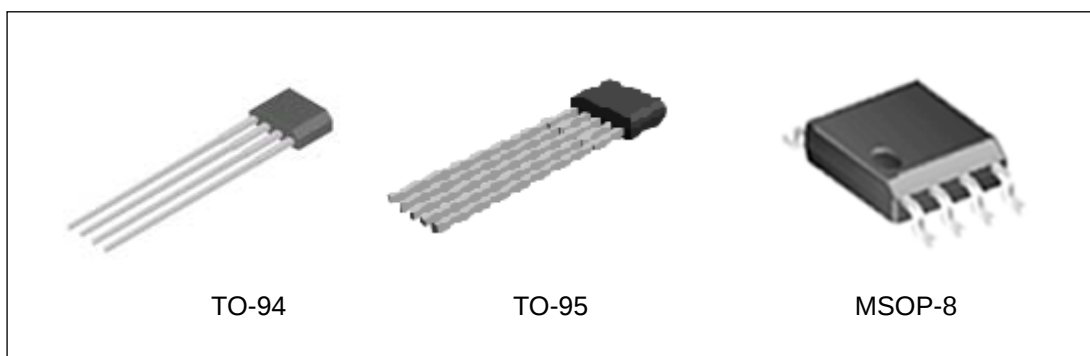


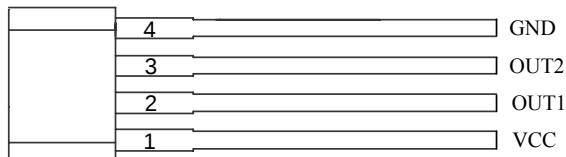
Figure 1. Package Types of AH9479/80/81

Single Phase Low Noise Smart Motor Driver

AH9479/80/81

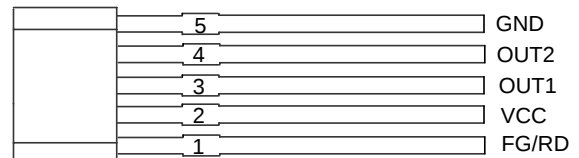
Pin Configuration

Z4 Package
(TO-94)



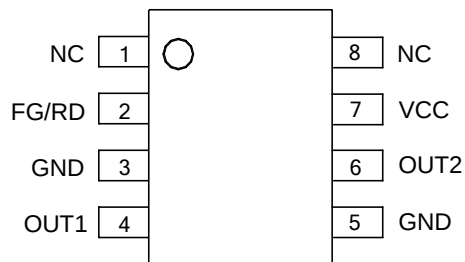
(For AH9479)

Z5 Package
(TO-95)



(For AH9480/81)

M8 Package
(MSOP-8)



(For AH9480/81)

Figure 2. Pin Configuration of AH9479/80/81

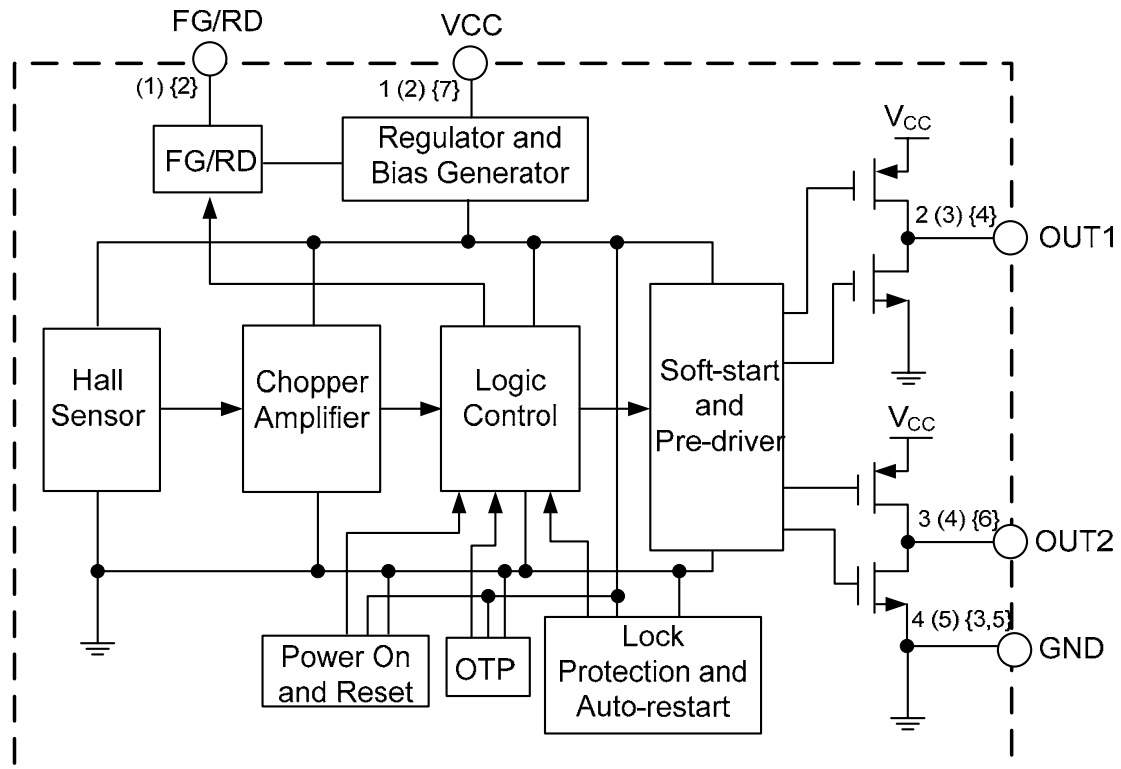
Pin Description

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

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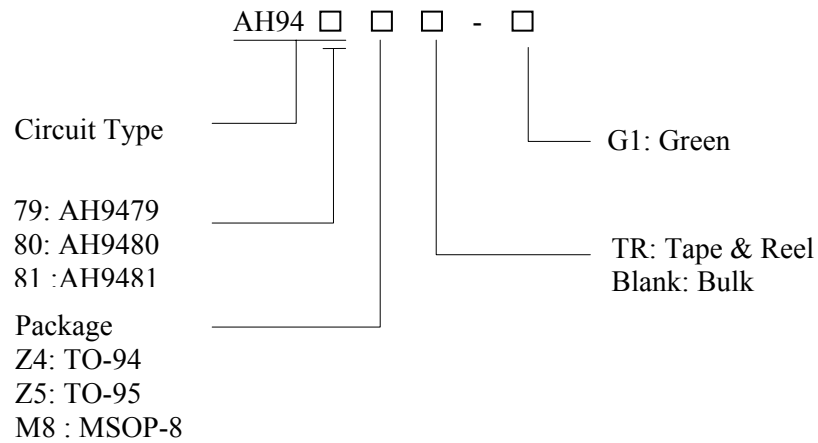
AH9479/80/81

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 ($R_{PMOS}+R_{NMOS}=R_S$)	$R_{DS(ON)1,2}$	$V_{CC}=12V, T_A=25^{\circ}C, I_{OUT}=300mA$		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

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Test Circuit

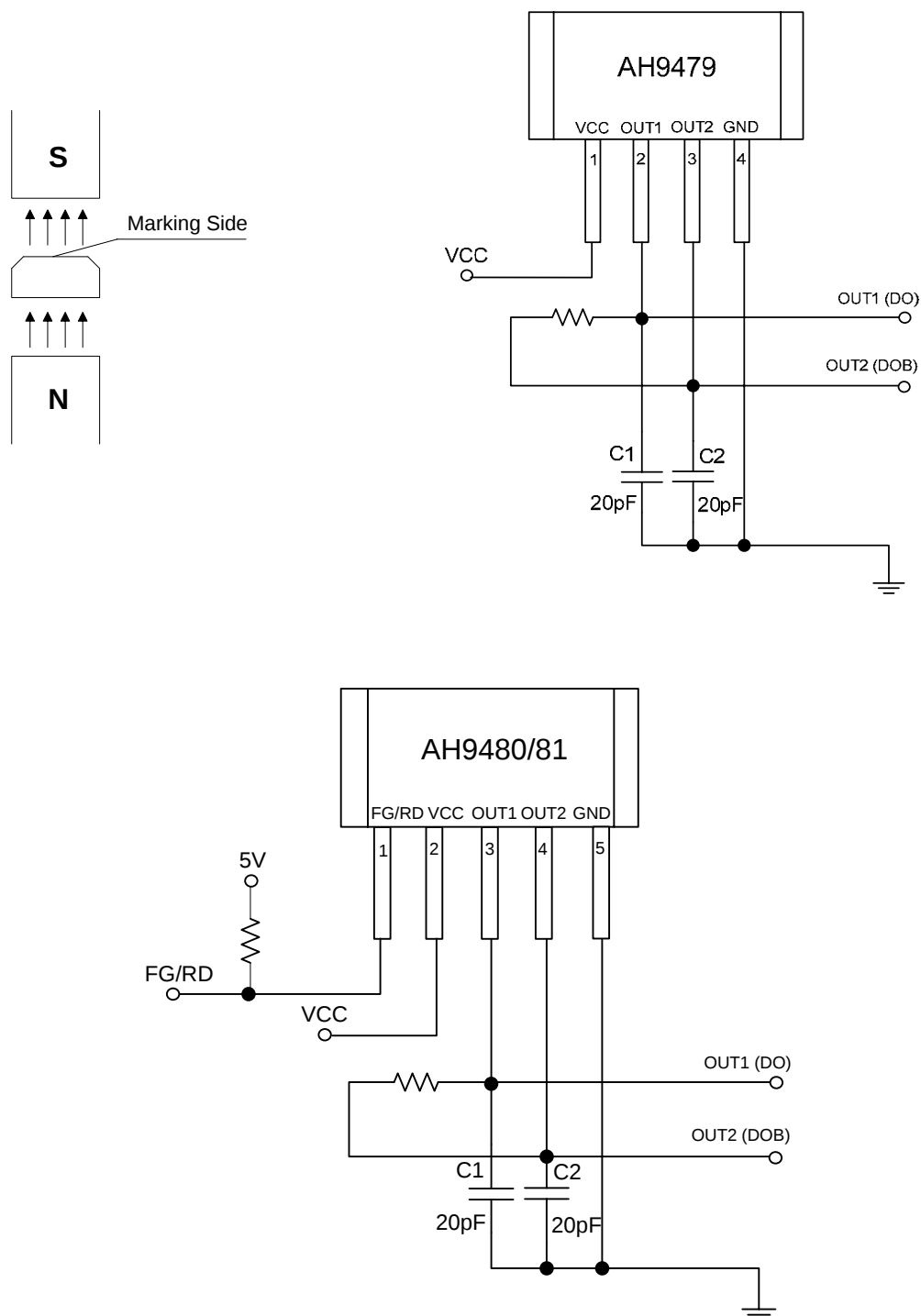
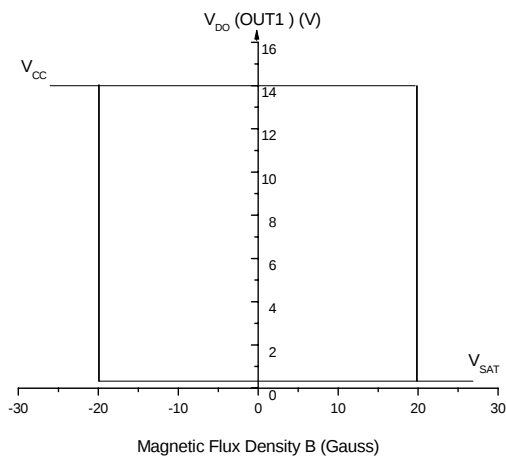
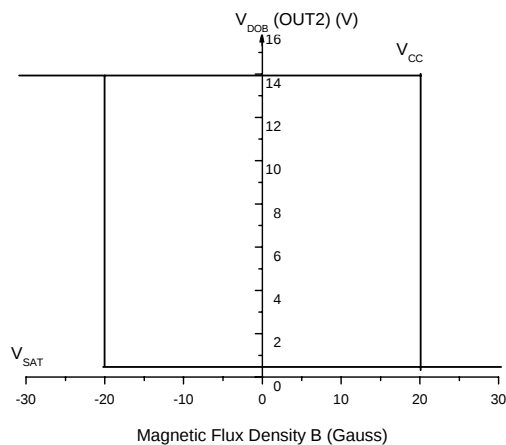


Figure 4. Basic Test Circuit of AH9479/80/81

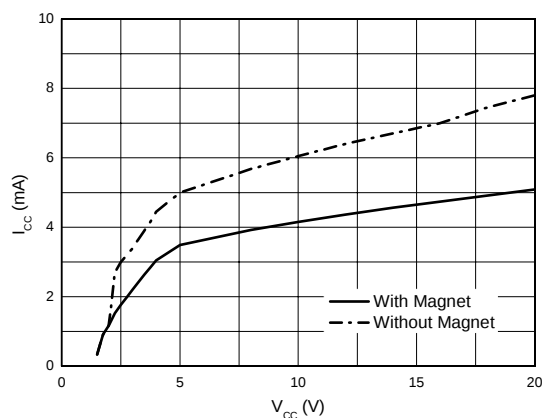
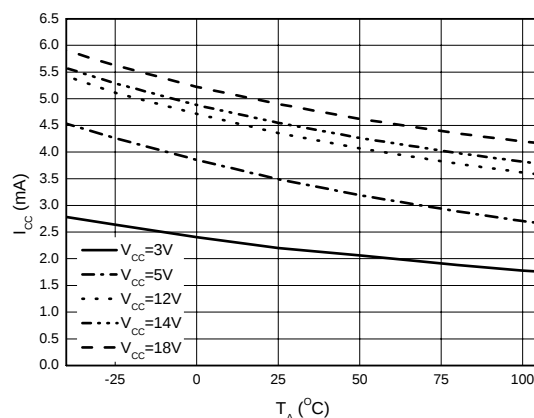
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Hysteresis Characteristics


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

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Typical Performance Characteristics (Continued)

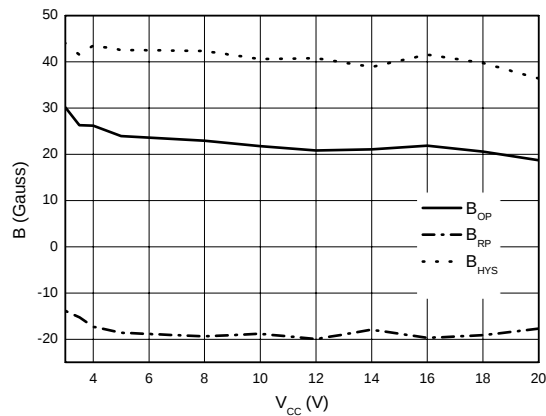


Figure 9. B_{OP}/B_{RP}/B_{HYS} vs. V_{CC}

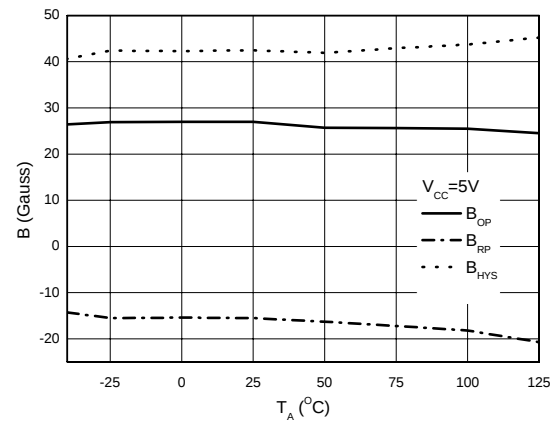


Figure 10. B_{OP}/B_{RP}/B_{HYS} vs. T_A (V_{CC}=5V)

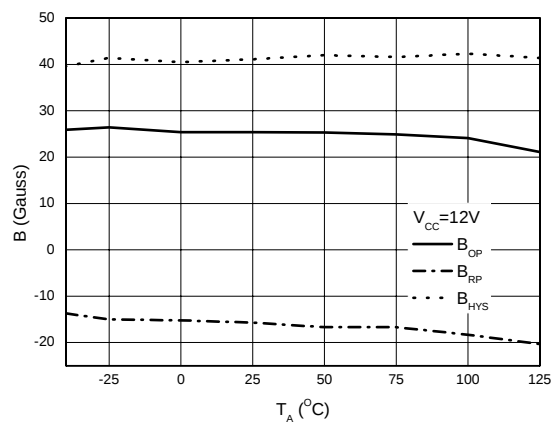


Figure 11. B_{OP}/B_{RP}/B_{HYS} vs. T_A (V_{CC}=12V)

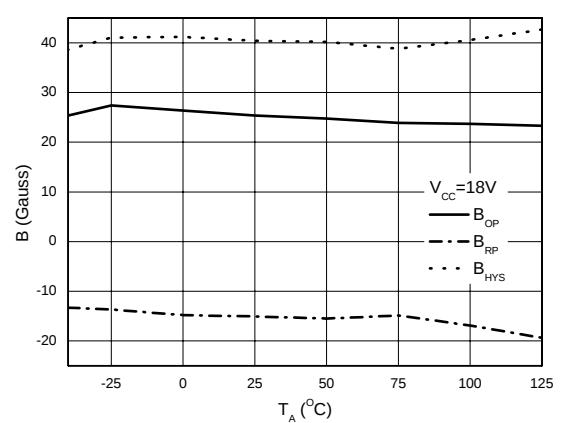
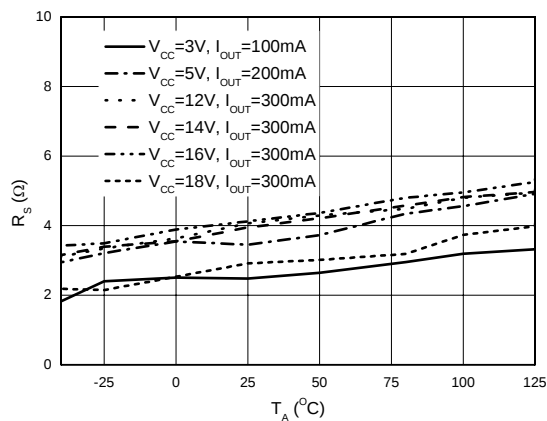
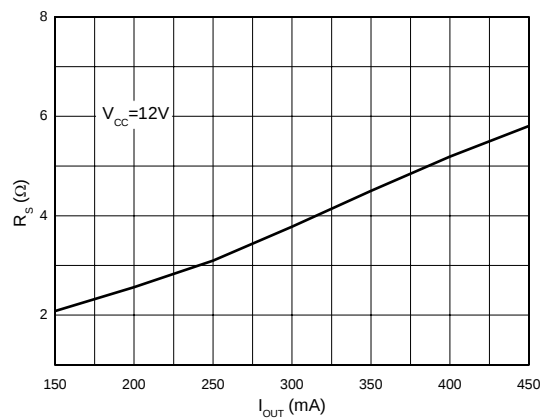
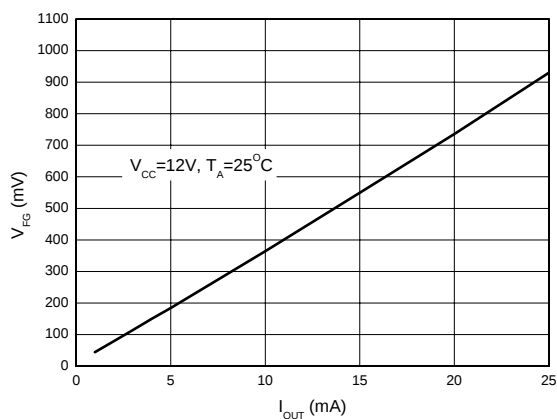
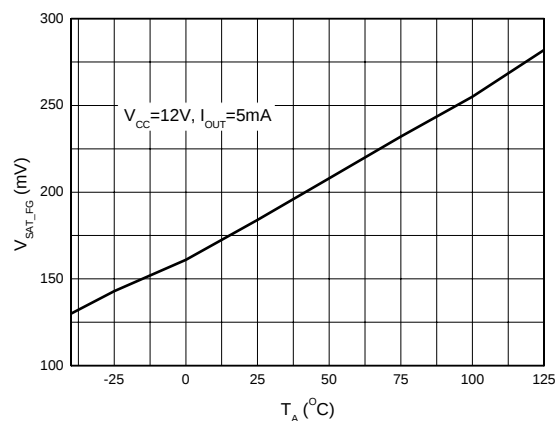


Figure 12. B_{OP}/B_{RP}/B_{HYS} vs. T_A (V_{CC}=18V)

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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

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Typical Performance Characteristics (Continued)

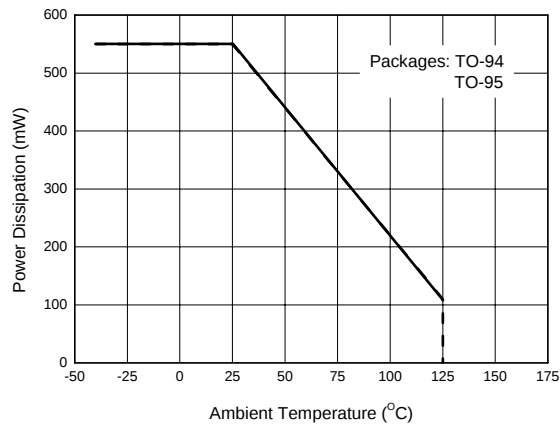


Figure 17. Power Dissipation vs. T_A

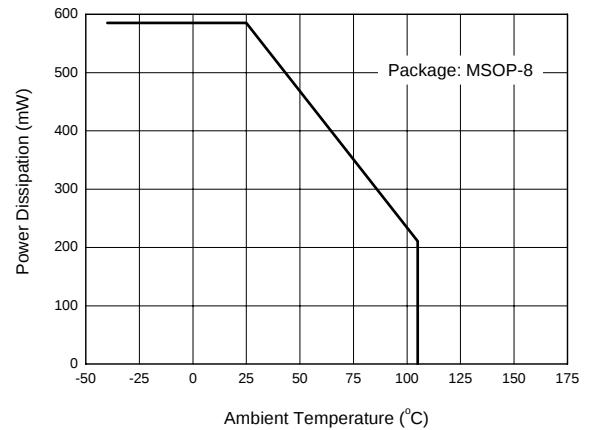
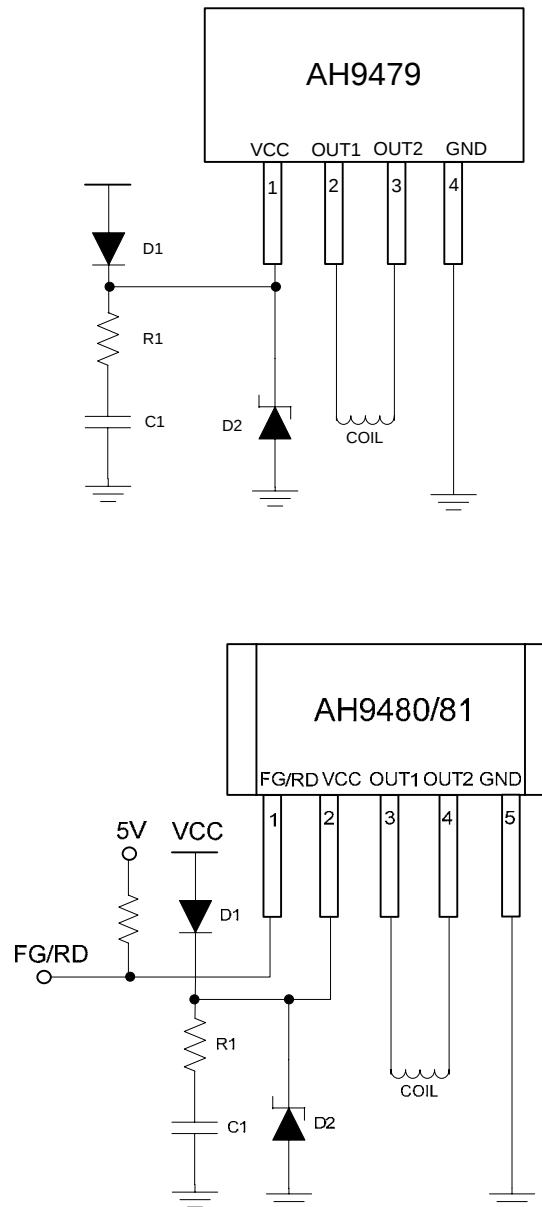


Figure 18. Power Dissipation vs. T_A

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Typical Application



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

Figure 19. Typical Application of AH9479/80/81

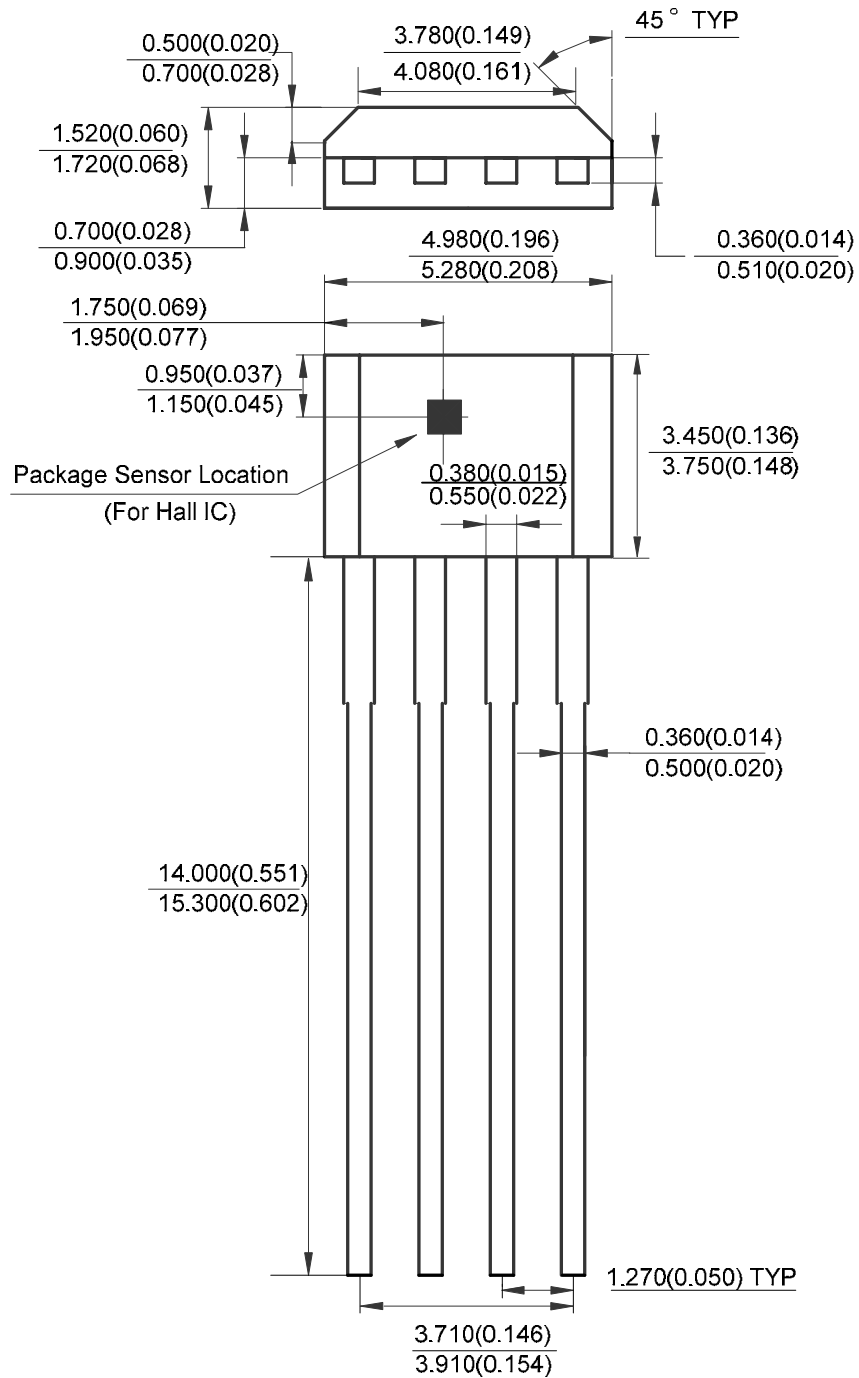
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Mechanical Dimensions

TO-94

Unit: mm(inch)



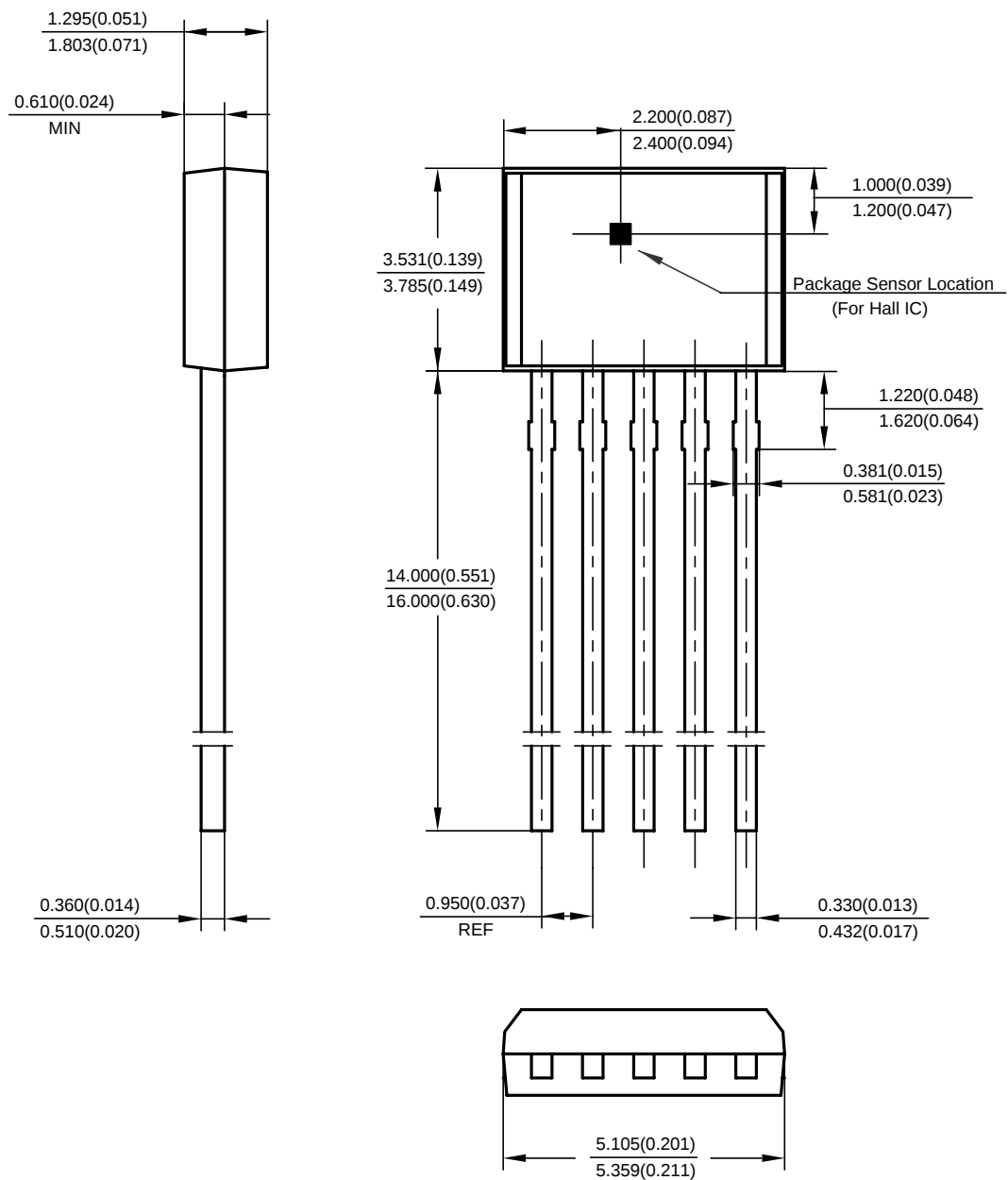
Single Phase Low Noise Smart Motor Driver

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Mechanical Dimensions (Continued)

TO-95

Unit: mm(inch)



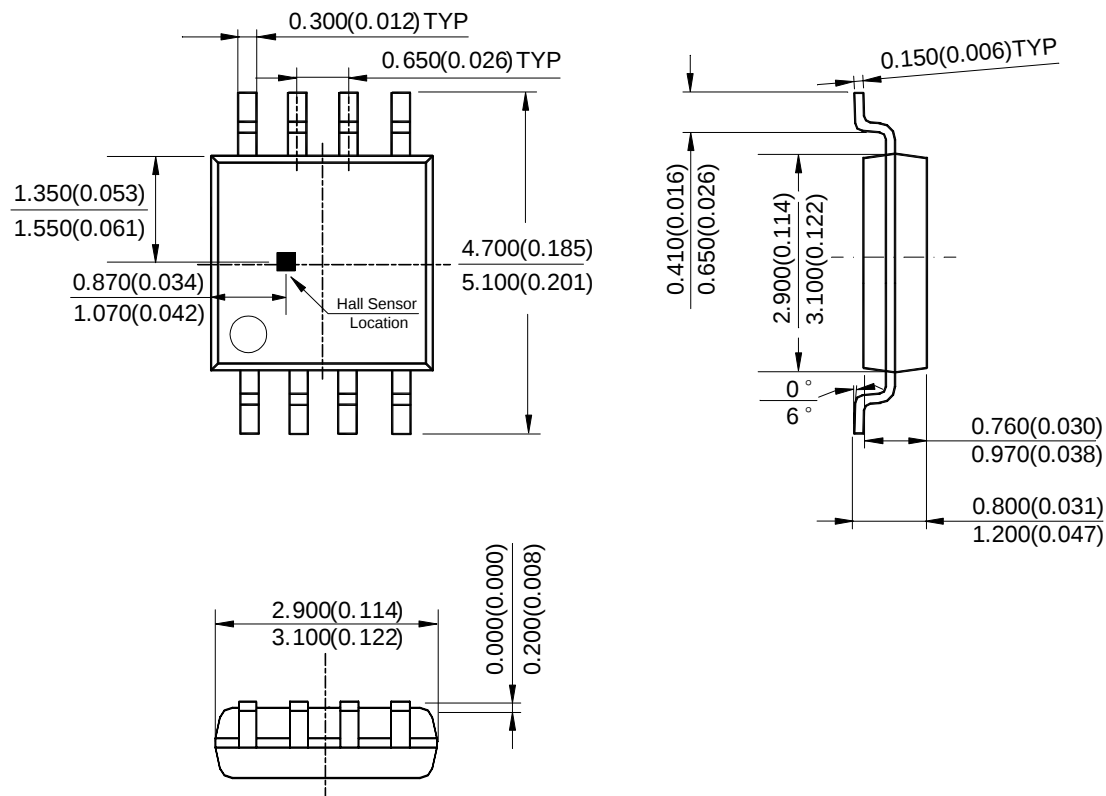
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Mechanical Dimensions (Continued)

MSOP-8

Unit: mm(inch)



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



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