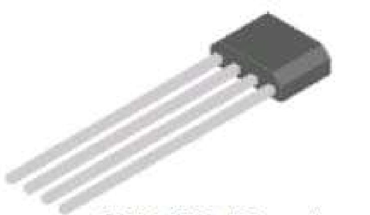
H211 2 Phase DC Motor Drive IC



TO-94 (SIP-4L)
Fig.1 Package Type

General Description

The H211, a one-chip composed of hall sensor and output coil drivers, applied to 2-phase brush-less DC motor. The device includes an on-chip Hall sensor for magnetic sensing, an amplifier that amplifies the Hall voltage, a Schmitt trigger to provide switch hysteresis for noise rejection, a temperature compensation circuit to compensate the temperature drift of Hall sensitivity, two complementary open-collector drivers for sinking large load current. It also includes an internal band-gap regulator which is used to provide bias voltage for internal circuits.

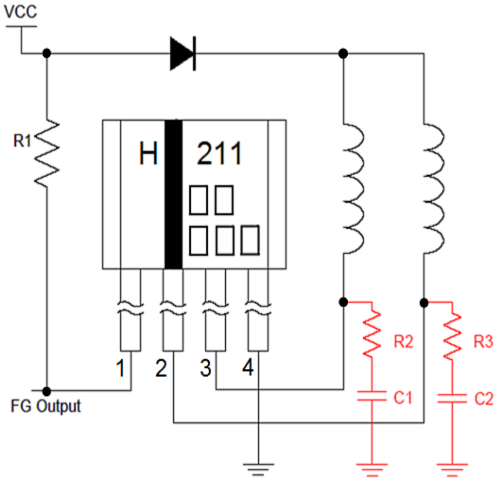
The high sensitivity of Hall Effect sensor is suitable for motors from mini-type CPU coolers to blowers and DC fans. Typical operation current is 0.3A with wide range of operating voltage. FG single, an open collector, provides a square waveform output for the detection of the motor speed.

Place the device in a variable magnetic field, while the magnetic flux density is larger than threshold B_{OP}, NO will be turned on (low) and SO (and FG) will be turned off (high). This output state is held till the magnetic flux density reversal falls below B_{RP} causing NO to be turned off (high) and SO (and FG) turned on(low).

Features

- On-chip Hall Sensor/Drivers
- 4V to 20V Supply Voltage
- Output Sink Current up to 0.4A
- Low Quiescent Supply Current under 5mA
- Built-in FG Output
- Low Profile TO-94 (SIP-4L) Package

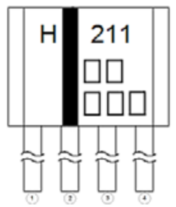
Typical Application Circuit



C1, C2, R2, R3 is optional for reduce electromagnetism noise. R2, R3 must be greater than 50 ohm.

Fig.2 H211 Typical Application Circuit

Pin Configuration

	Pin No.	Pin Name	P/I/O	Description
 Mark View	1	FG	O	Rotation speed output (O.C.)
	2	NO	O/P	Coil driver output/Power input. It is low state during the N magnetic field.
	3	SO	O/P	Coil driver output/Power input. It is low state during the S magnetic field.
	4	GND	P	IC Ground

Block Diagram

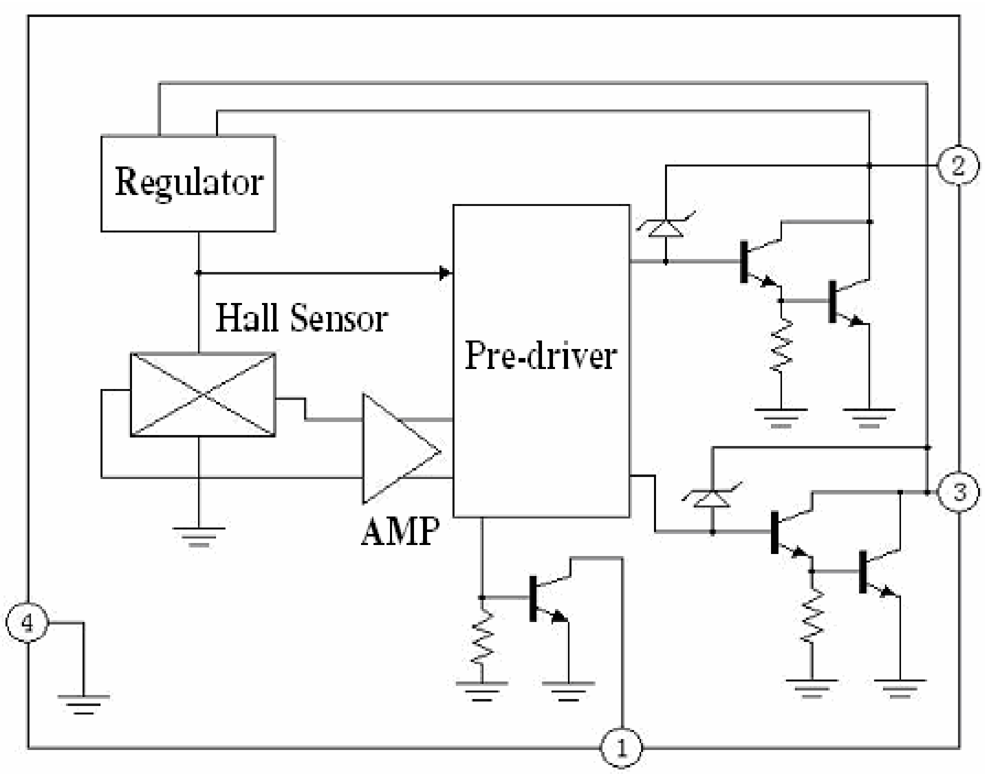


Fig.3 Functional Block Diagram of H211

Absolute Maximum Ratings

Characteristics		Symbol	Value	Unit
Zener Breakdown Voltage		V_Z	35	V
NO/SO Pin Voltage		V_O	30	V
Output Current	Hold	I_O	500	mA
	Continuous		350	mA
Peak Reverse Current		I_R	100	mA
FG pin OFF voltage		V_{FG}	30	V
FG sink current		I_{FG}	20	mA
Power Dissipation		P_D (Ta=25℃)	600	mW
		P_D (Ta=70℃)	450	mW
Operating Temperature Range		T_{OP}	-20~85	℃
Storage Temperature Range		T_S	-65~150	℃
Junction Temperature		T_J	150	℃
Lead Temperature (Soldering，10 sec)			260	℃

Electrical Characteristics

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
Operating Voltage	V_{CP}	I_{CC} < 10mA (fig.1)	4		20	V
Quiescent Supply Current	I_{CC}	V_{CC}: 3~20V (fig.1)	2		7	mA
NO/SO Saturation Voltage	V_{SAT}	Io=300mA (fig.1)			1.5	V
FG Leakage Current	I_{OFF}	V FG=30V (fig.1)			1	uA
FG Saturation Voltage	I_{ON}	I FG=5mA (fig.2)		0.2	0.5	V
Rise Time	T_R	RL=1K CL=10PF		3.0	10	uS
Fall Time	T_F	RL=1K CL=10PF		0.3	10	uS

Note: No use pin is open when the device is under test.

Magnetic Characteristics (T_A =-20℃～85℃)

Characteristics		Symbol	Min	Max	Unit	Rank
H211A	Operate Point	B_{OP}	5	50	G	A
	Release Point	B_{RP}	-50	-5	G	
H211B	Operate Point	B_{OP}	-	70	G	B
	Release Point	B_{RP}	-70	-	G	
H211C	Operate Point	B_{OP}	-	90	G	C
	Release Point	B_{RP}	-90	-	G	
H211D	Operate Point	B_{OP}	-	130	G	D
	Release Point	B_{RP}	-130	-	G	

H211 Hysteresis Characteristics Curve

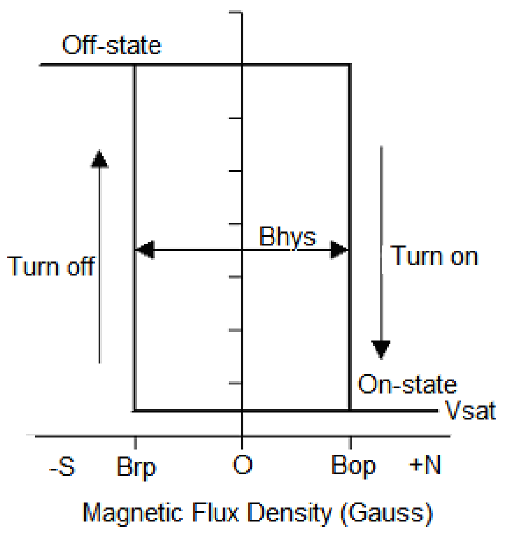


Fig.4 V_{NO} vs. Magnetic Flux Density

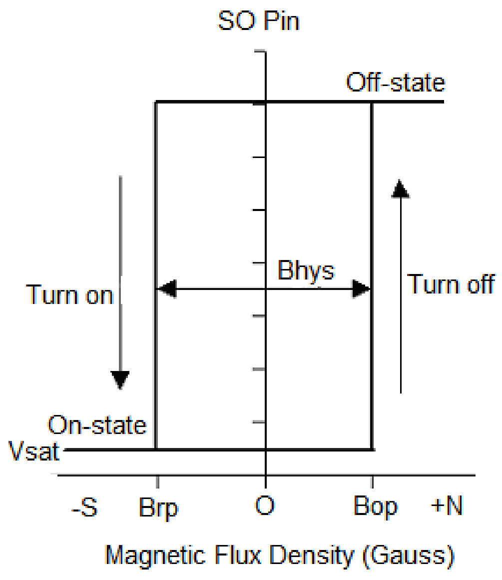


Fig.5 V_{SO} vs. Magnetic Flux Density

Typical Performance Characteristics

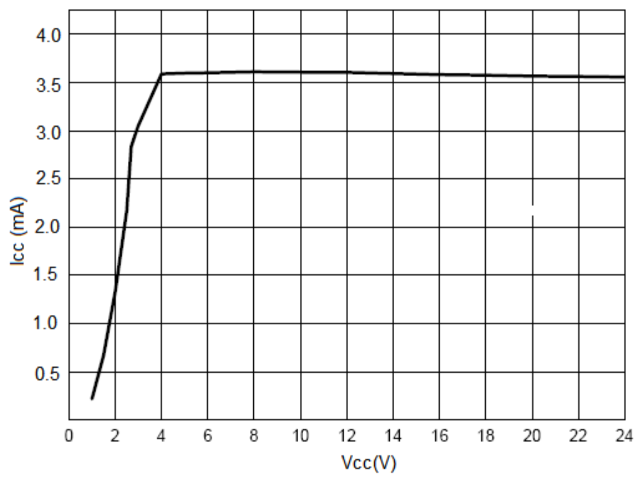


Fig.6 I_{CC} vs. V_{CC}

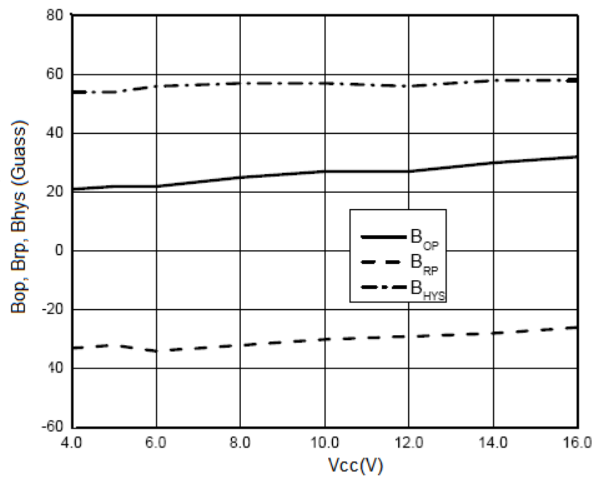


Fig.7 B_{OP} / B_{RP} / B_{HYS} vs. V_{CC}

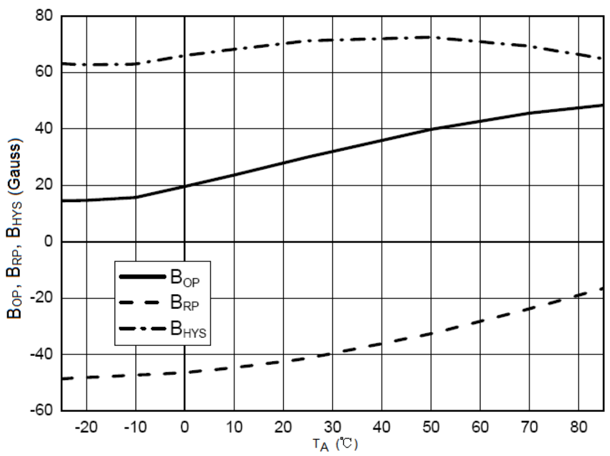


Fig.8 B_{OP} / B_{RP} / B_{HYS} vs. Ambient Temperature

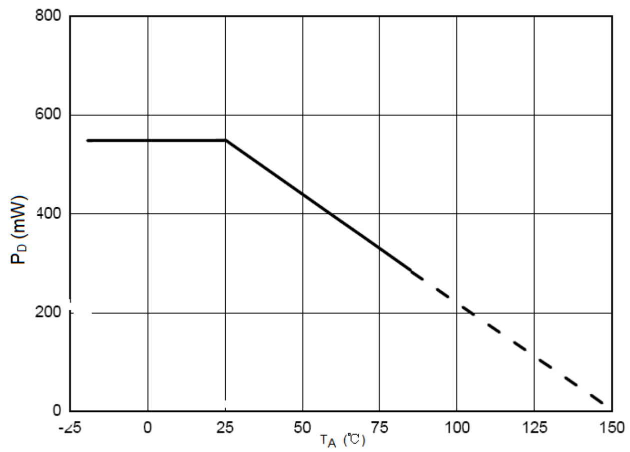


Fig.9 P_D vs. Ambient Temperature

Typical Performance Characteristics (Continued)

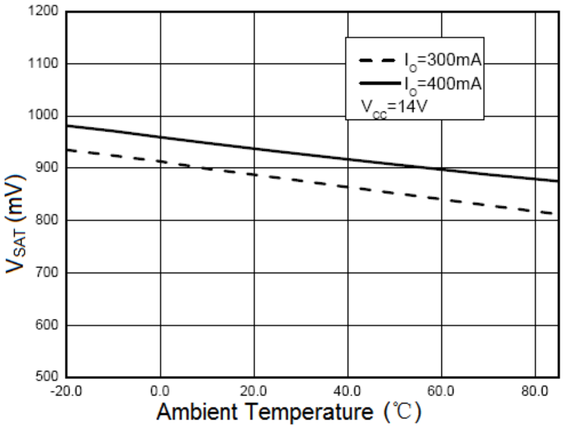


Fig.10 V_{SAT} vs. Ambient Temperature

Test Circuits

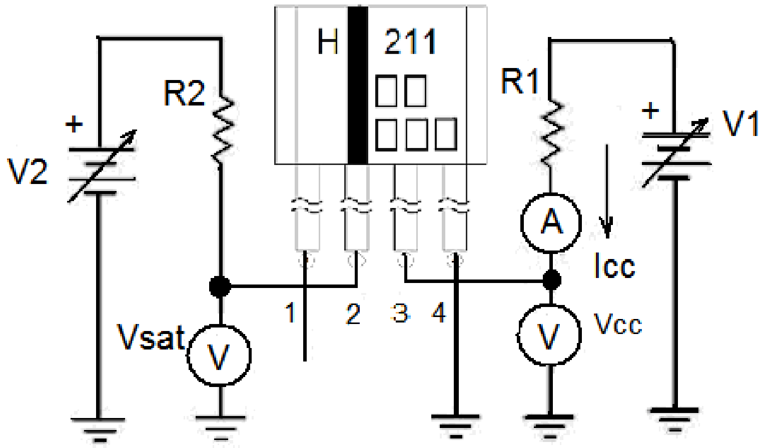


Fig.11 Test Circuit 1 (Under N Magnetic field)

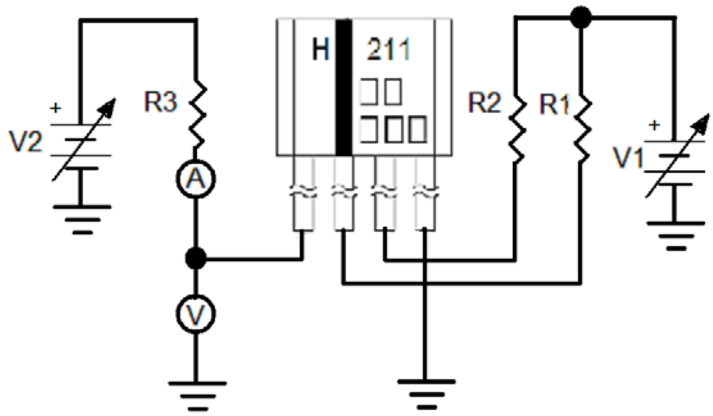
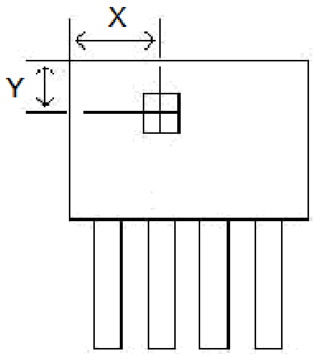


Fig.12 Test Circuit 2

Application Information

1). Hall Sensor Location

The Fig.13 is the hall sensor location, where marks the IC number. The best sensitivity, which can be intensified as much as possible, depends on the vertical distance and position between magnetic pole and the hall sensor (Fig.14). For the 2-phase motor, this design is very important.



		Unit
X	2.0	mm
Y	1.25	mm

Fig.13 H211 Hall Sensor Location

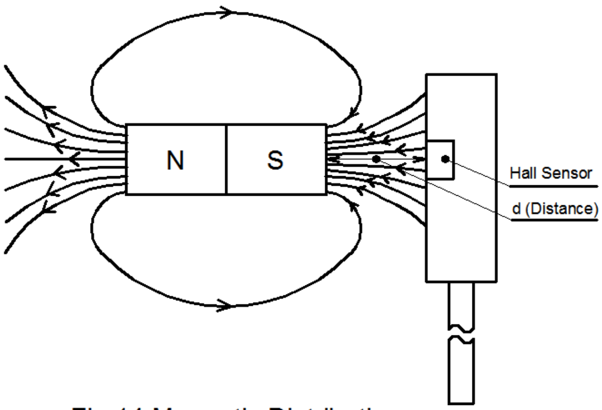


Fig.14 Magnetic Distribution

2). Darlington-pair Transistor Output

The Fig.15 is the circuit diagram of Darlington-pair transistor. Under the heavy current loading, the power loss of the high saturation voltage can be calculated into the following formula:

$P_C=(V_{BEQ1}+V_{CE(SAT)Q2})*I_O$ . . . . (1)

According to the IC package and the curve of the power loss, the P_C should be applied to and within the safety value. 30V is the voltage of Zener breakdown diode. However, if the voltage, excluding that of the power supply, is more than 30V under the long-time operation, the diode will be destroyed, and meanwhile, the device will de destroyed.

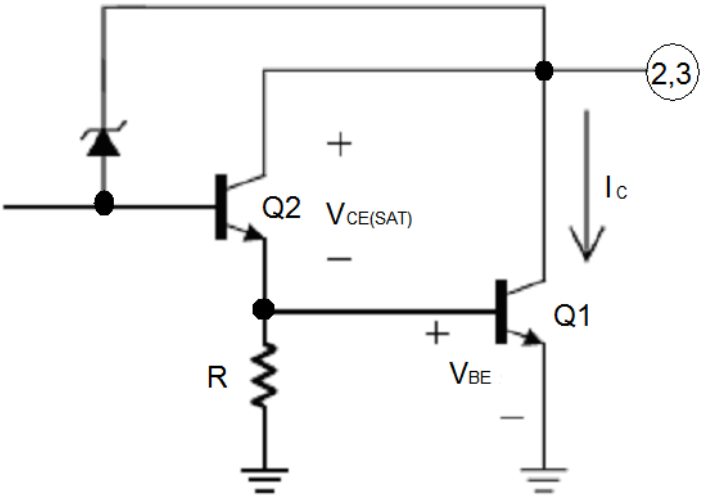
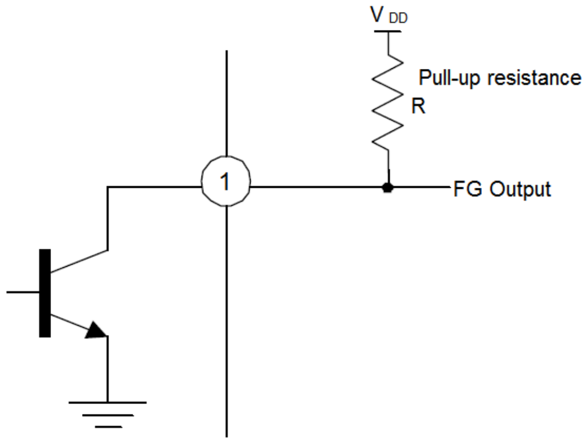


Fig.15 H211 Darlington-pair Transistor Output

3). FG Output: The Circuit Diagram of Open Collector Transistor

Fig.16 the small signal transistor output connected with the pull-up resistance is to limit the current and confirm the voltage level of rotation speed. The situation of the long-time operation with the high voltage or with the high current will do damage to the transistor and cause FG malfunction.

Fig.17 illustrates the relation between dynamic magnetic field and FG.



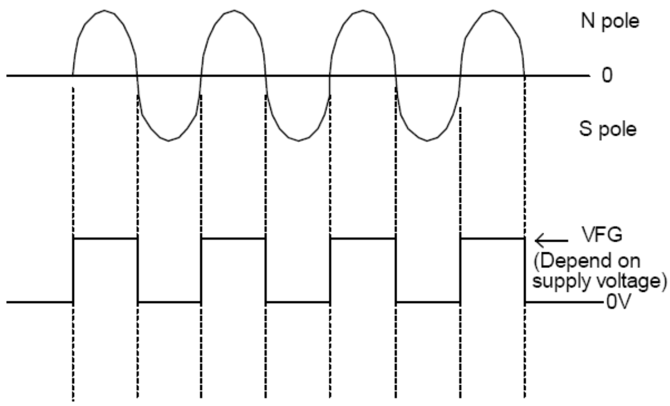


Fig.16 H211 FG Circuit Diagram

Fig.17 H211 FG Waveform

4). Application Note

Fig.18 is the example of typical application circuit. The red, yellow, and black wires are the input points of the motor system: red, the input of power supply; yellow, the output of FG; black, the ground signal. R_C is an external pull-up resistance for the use of measuring FG signal. In view of the design, the value of R_C could be decided by the transistor saturation voltage (Von), sink current (Ic), and off-level voltage (Vc). The formula is:

Rc=(Vc-Von)/Ic . . . . (2)

For example：

Vc=+5V for TTL level,

Ic=5mA at 0.5V saturation voltage (IC specification).

The safety value of Rc=1kΩ.

D1 is the reverse protection diode. As if the red and black wires reversely are connected with the power source, the current will flow through the ground via IC and coils L1 and L2 to power supply. Under such kind of circumstance, the IC and coils are easy to be burned out. Therefore, D1, the reverse protection diode, is necessary for the design. However, D1 will also cause an extra voltage drop on the supply voltage.

C1 is a capacitor to reduce the ripple noise caused during the transient of the output stages. The volume of the ripple noise depends on the coil impedance and characteristics.

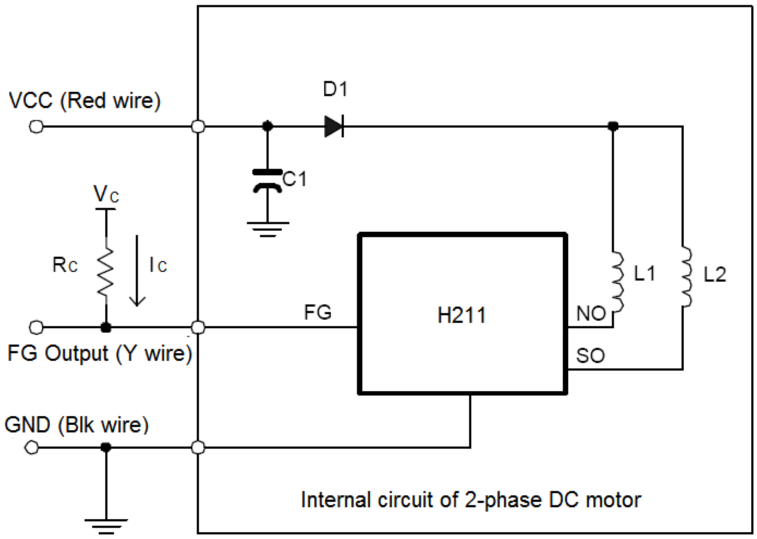
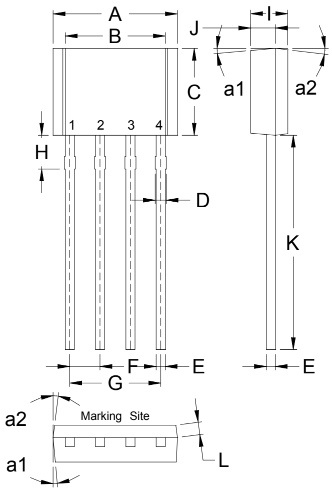


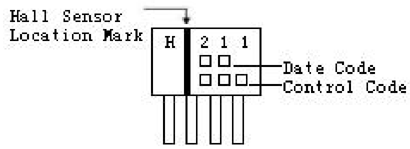
Fig.18 H211 Typical Application Circuit

Package Dimensions



4-Lead SIP-4L
Plastic Package
HSMC Package Code: AD

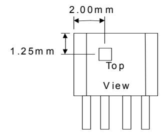
Marking:



Note: Green label is used for pb-free packing

Pin Style: 1.VCC 2.Vout1 3.Vout2 4.GND

Hall Sensor Location:



Material:
- Lead solder plating: Sn60/Pb40 (Normal), Sn/3.0Ag/0.5Cu or Pure-Tin (Pb-free)
- Mold Compound: Epoxy resin family, flammability solid burning class: UL94V-0

DIM	Min.	Max.
A	5.12	5.32
B	4.10	4.30
C	3.55	3.75
D	0.43	0.49
E	0.35	0.41
F	1.24	1.30
G	3.78	3.84
H	1.32	1.52
I	1.45	1.65
J	0.93	1.13
K	13.00	15.50
L		
a1	3º	5º
a2	5º	7º

*: Typical, Unit: mm

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