

# FAN8404D

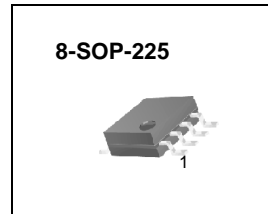
## 2 Phase Half Wave BLDC Motor Driver

### Features

- A wide range of operation voltage: 4V to 15V
- Built-in motor lock detector.
- Automatic restart function
- Alarm output for a motor lock detection
- Built-in thermal shut down circuits
- Built-in reverse current protection diode
- Compact package: 8-SOP-225

### Description

The FAN8404D is a monolithic integrated circuit, and suitable for DC cooling fan motors.



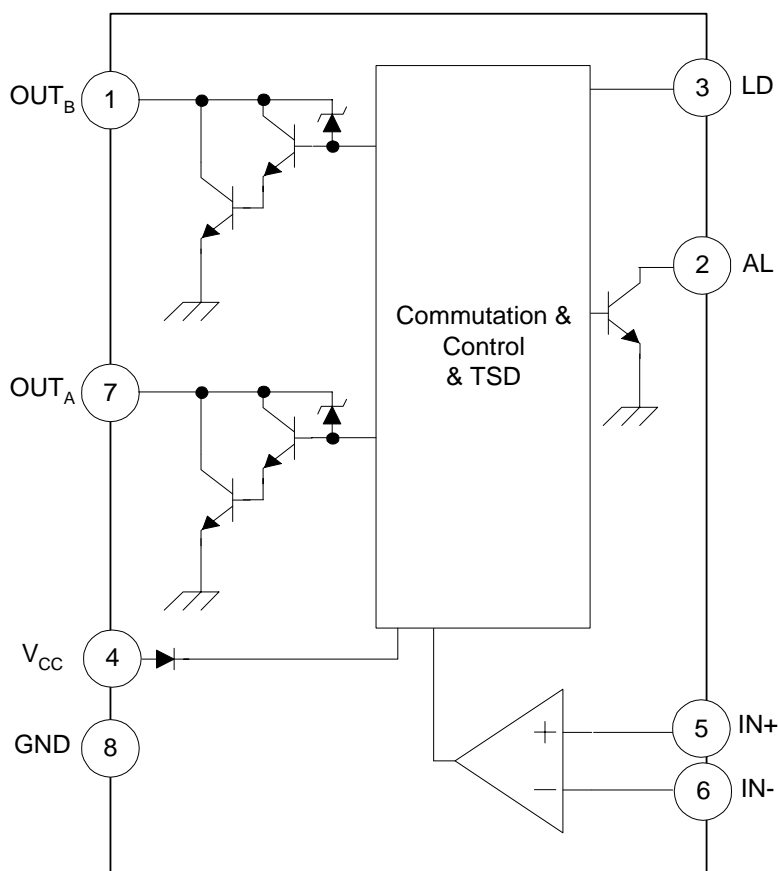
### Typical Applications

- DC cooling fan motor

### Ordering Information

Device	Package	Operating Temp.
FAN8404D	8-SOP-225	-25°C ~ 85°C
FAN8404DTF	8-SOP-225	-25°C ~ 85°C

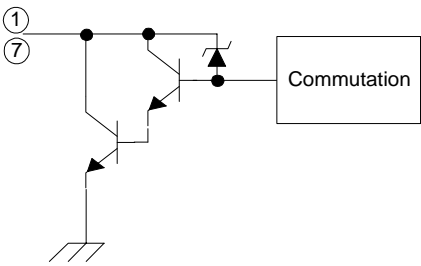
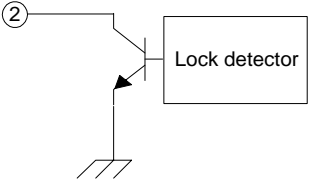
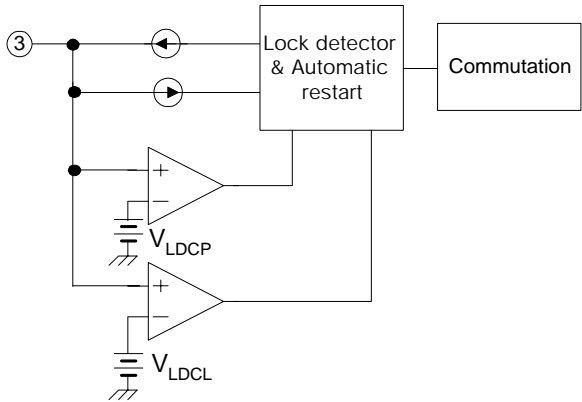
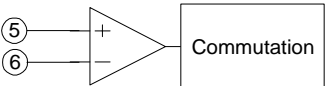
## Block Diagram



## Pin Definitions

Pin Number	Pin Name	I/O	Pin Function Description	Remark
1	OUTB	O	Motor output B	-
2	AL	O	Alarm output	Open Collector
3	LD	-	Triangle pulse generator for lock detector and automatic restart	-
4	VCC	-	Supply voltage	-
5	IN+	I	Hall input +	-
6	IN-	I	Hall input -	-
7	OUTA	O	Motor output A	-
8	GND	-	Ground	-

## Equivalent Circuits

Description	Pin No.	Internal Circuit
OUT <sub>B</sub>	1	
OUT <sub>A</sub>	7	
AL	2	
LD	3	
IN <sub>+</sub>	5	
IN <sub>-</sub>	6	

## Absolute Maximum Ratings (Ta = 25°C)

Parameter	Symbol	Value	Unit
Maximum power supply voltage	VCCMAX	18	V
Maximum power dissipation <sup>note1</sup>	PDMAX	429 <sup>note2</sup>	mW
		620 <sup>note3</sup>	
Thermal resistance <sup>note1</sup>	$\Theta_{JA}$	291.61 <sup>note2</sup>	°C/W
		201.52 <sup>note3</sup>	
Maximum output voltage	VOMAX	30	V
Maximum output current	IOMAX	1.2 <sup>note4</sup>	A
Alarm output current	I <sub>AL</sub>	10	mA
Alarm output withstanding voltage	V <sub>AL</sub>	36	V
Maximum hall input AC level	V <sub>HACMAX</sub>	6	V
Operating temperature	TOPR	-25 ~ 85	°C
Storage temperature	T <sub>STG</sub>	-55 ~ 150	°C

### Note1:

PCB Condition: Thickness (1.6mm), Dimension (76.2mm \* 114.3mm)

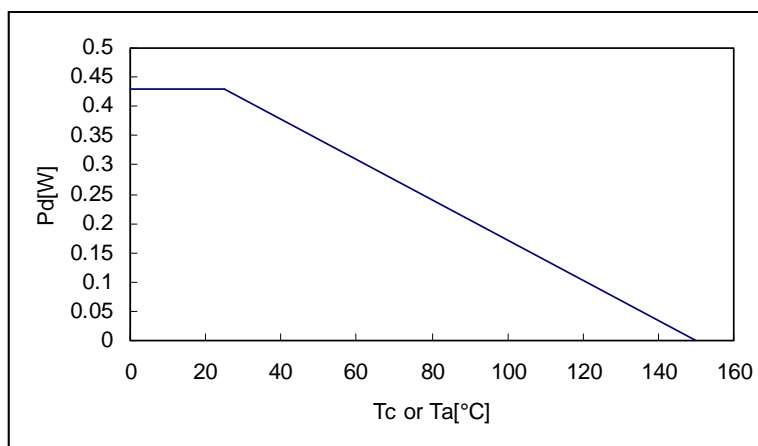
Refer: EIA/J SED 51-3 & EIA/J SED 51-7

Note2: Air condition (0m/s)

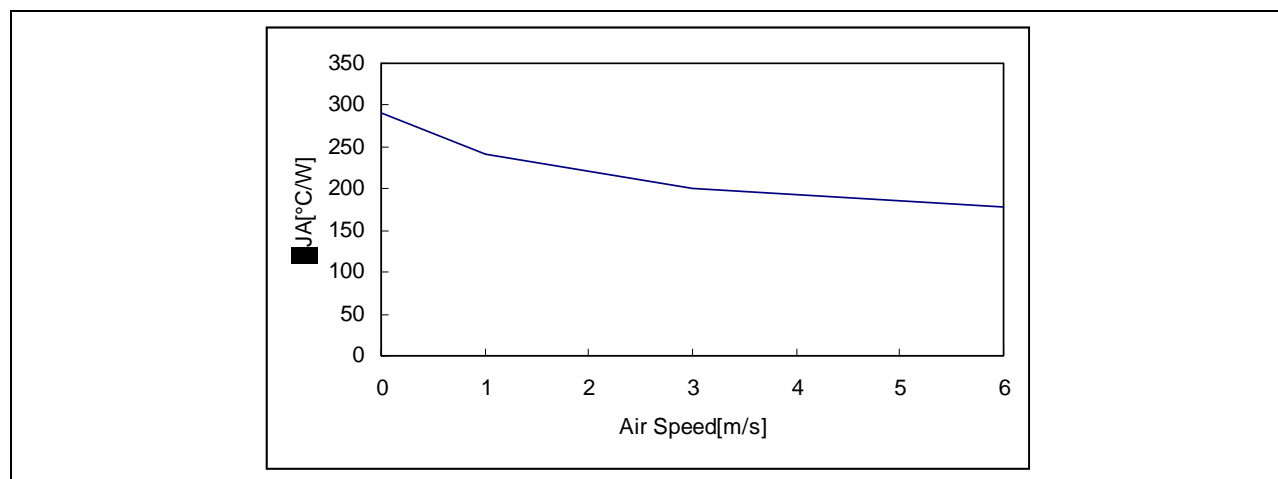
Note3: Air condition (3m/s)

Note4: Should not exceed P<sub>D</sub> or ASO value

## Power Dissipation Curve (Air condition = 0m/s)



## Air Speed & $\Theta_{JA}$



## Recommended Operating Conditions (Ta = 25°C)

Parameter	Symbol	Min.	Typ.	Max.	Unit
Function compensation operating voltage	V <sub>CC</sub>	4.0	–	15.0	V

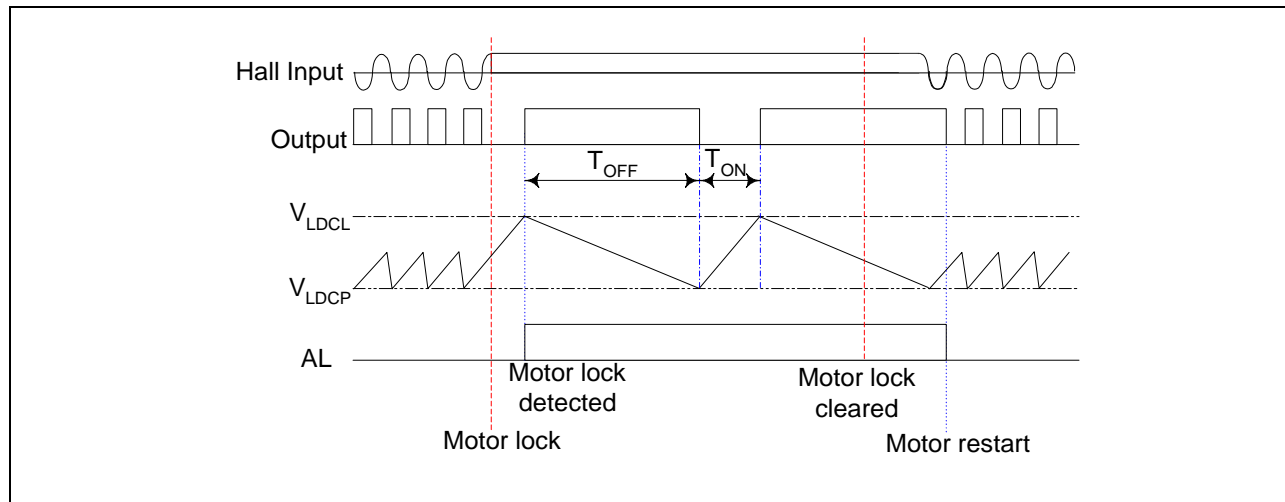
## Electrical Characteristics

(Ta=25°C, V<sub>CC</sub>=12V unless otherwise specified)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Supply current	I <sub>CC</sub>	When output is off.	-	-	3.0	mA
Lock detector charging current	I <sub>LDC</sub>	V <sub>LD</sub> =1.8V	2.38	3.40	4.42	μA
Lock detector discharging current	I <sub>LDD</sub>	V <sub>LD</sub> =1.8V	0.48	0.68	0.88	μA
Lock detector charging/discharging ratio	R <sub>CD</sub>	R <sub>CD</sub> =I <sub>LDC</sub> /I <sub>LDD</sub>	3.0	5.0	7.0	–
Lock detector capacitor clamp voltage	V <sub>LDCL</sub>	-	2.4	2.85	3.3	V
Lock detector capacitor comparator voltage	V <sub>LDLCP</sub>	-	0.7	0.99	1.2	V
Output low level voltage	V <sub>OL</sub>	I <sub>O</sub> =200mA	-	0.9	1.2	V
Output leakage current	I <sub>OL</sub>	-	-	0	10	μA
Output zener voltage	V <sub>OZ</sub>	Clamp current=10mA	28	30	32	V
Alarm output pin low level voltage	V <sub>ALL</sub>	I <sub>O</sub> =10mA	-	0.2	0.5	V
Alarm output pin leakage current	I <sub>ALL</sub>	-	-	0	10	μA
Hall input DC range	V <sub>HDC</sub>	-	1	-	V <sub>CC</sub> -2V	V
Hall Input Offset	V <sub>HOF</sub>	V <sub>REF</sub> =6V	-10	-	10	mV

## Application Information

### 1. Lock Detection & Automatic Restart



FAN8404D features a lock detection and an automatic restart. The functions can be operated as follows.

- 1) When the hall signal stop switching, a motor can be locked.
- 2) The voltage,  $V_{LD}$  on pin 3, is increasing until it reaches  $V_{LDCL}$ .
- 3) When the voltage,  $V_{LD}$  reaches  $V_{LDCL}$ , the alarm output (AL) becomes high as a motor lock has been detected.
- 4) If LD pin is connected to GND, the lockup protection is disabled.
- 5) While a motor is locked, the output repeats switching ON / OFF, but the other output is always OFF. The switching time can be determined by an external capacitor on charging / discharging time of the capacitor, switching ON / OFF time can be calculated as follows.

$$T_{ON} = \frac{C_{LD} \times (V_{LDCL} - V_{LDCLP})}{I_{LDC}}$$

$$T_{OFF} = \frac{C_{LD} \times (V_{LDCL} - V_{LDCLP})}{I_{LDD}}$$

Where, The  $C_{LD}$  is an external capacitor connected to pin 3, LD.

The  $V_{LDCL}$  is the clamp voltage on pin 3, LD.

The  $V_{LDCLP}$  is the comparator voltage on pin 3, LD.

The  $I_{LDC}$  is the charging current on pin 3, LD.

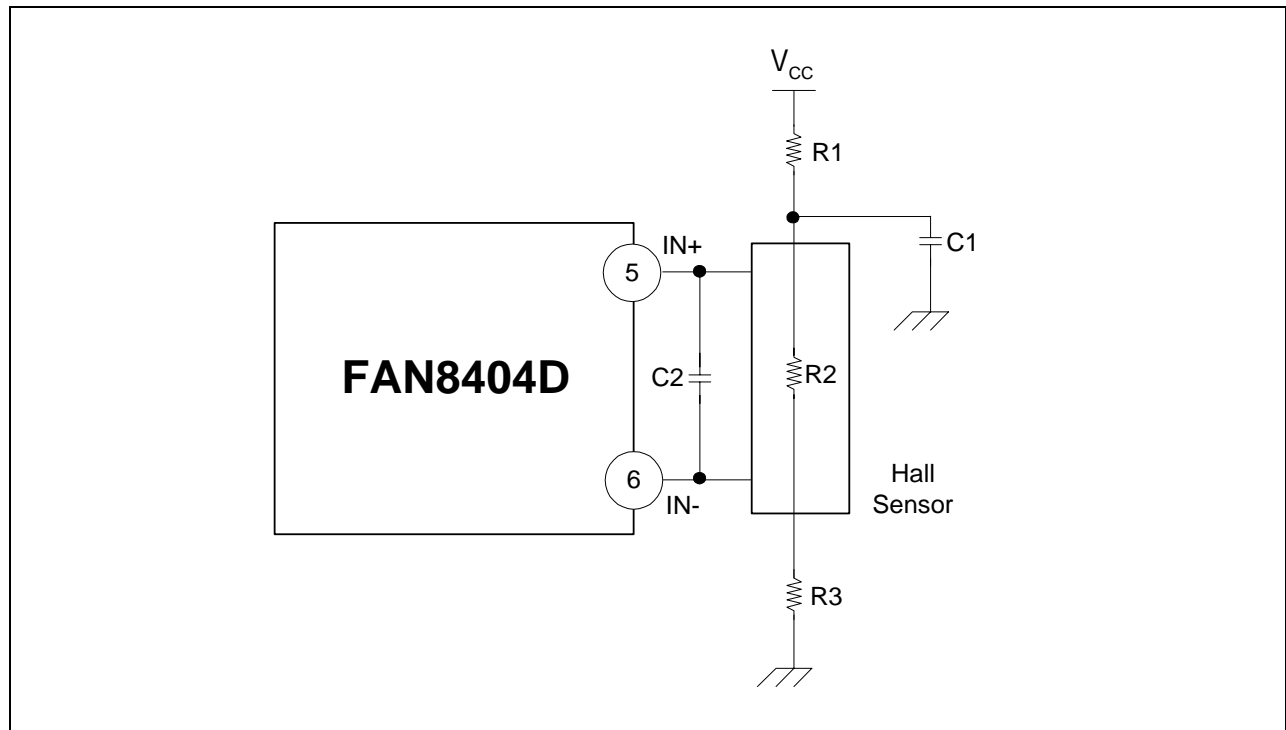
The  $I_{LDD}$  is the discharging current on pin 3, LD.

### 2. Thermal Shut Down

TSD On: All the outputs are off. (Typ. 175°C)

TSD Off: The circuit can be reactivated and begin to operate in a normal condition. (Typ. 150°C)

### 3. Hall Amplifier Input Block



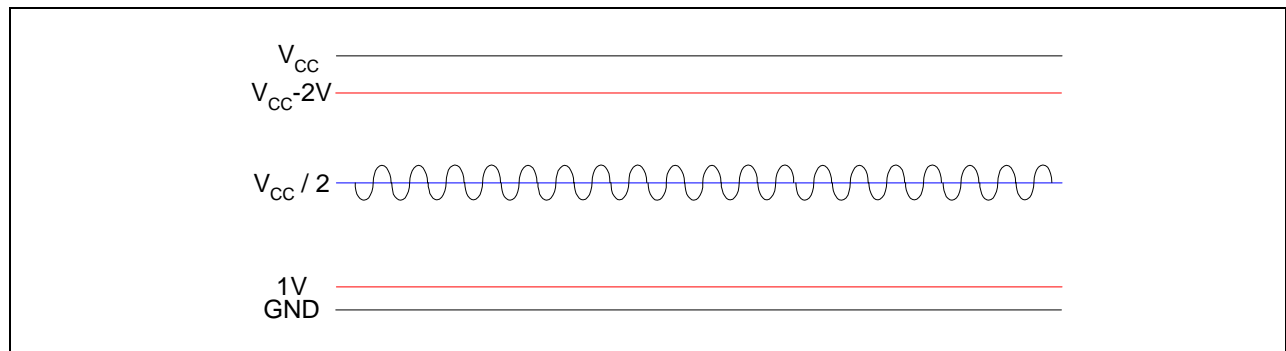
The hall current ( $I_H$ ) is determined by R1, R2 and R3.

$$I_H = \frac{V_{CC}}{R1 + R2 + R3}$$

Where, the R2 is the impedance of hall sensor.

An external capacitor, C1, can be used to reduce a power supply noise. In addition, C2 is to remove a noise which is caused in case the line is long from the hall sensor output to the hall input (pin 5 / 6) of the device.

The input bias voltage of hall amplifier is between 1V and  $V_{CC}-2V$  as following figure.

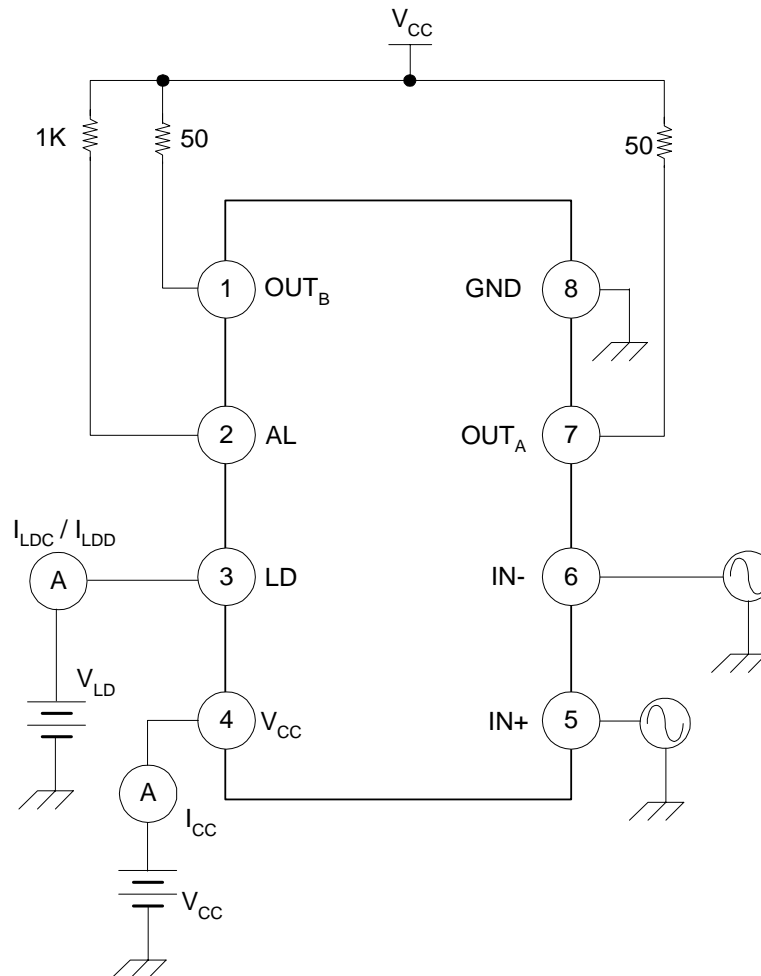


It is recommended that R1 and R3 should have the same value to make the output signal of hall sensor centered as  $V_{CC}/2$ .

## Operation Truth Table

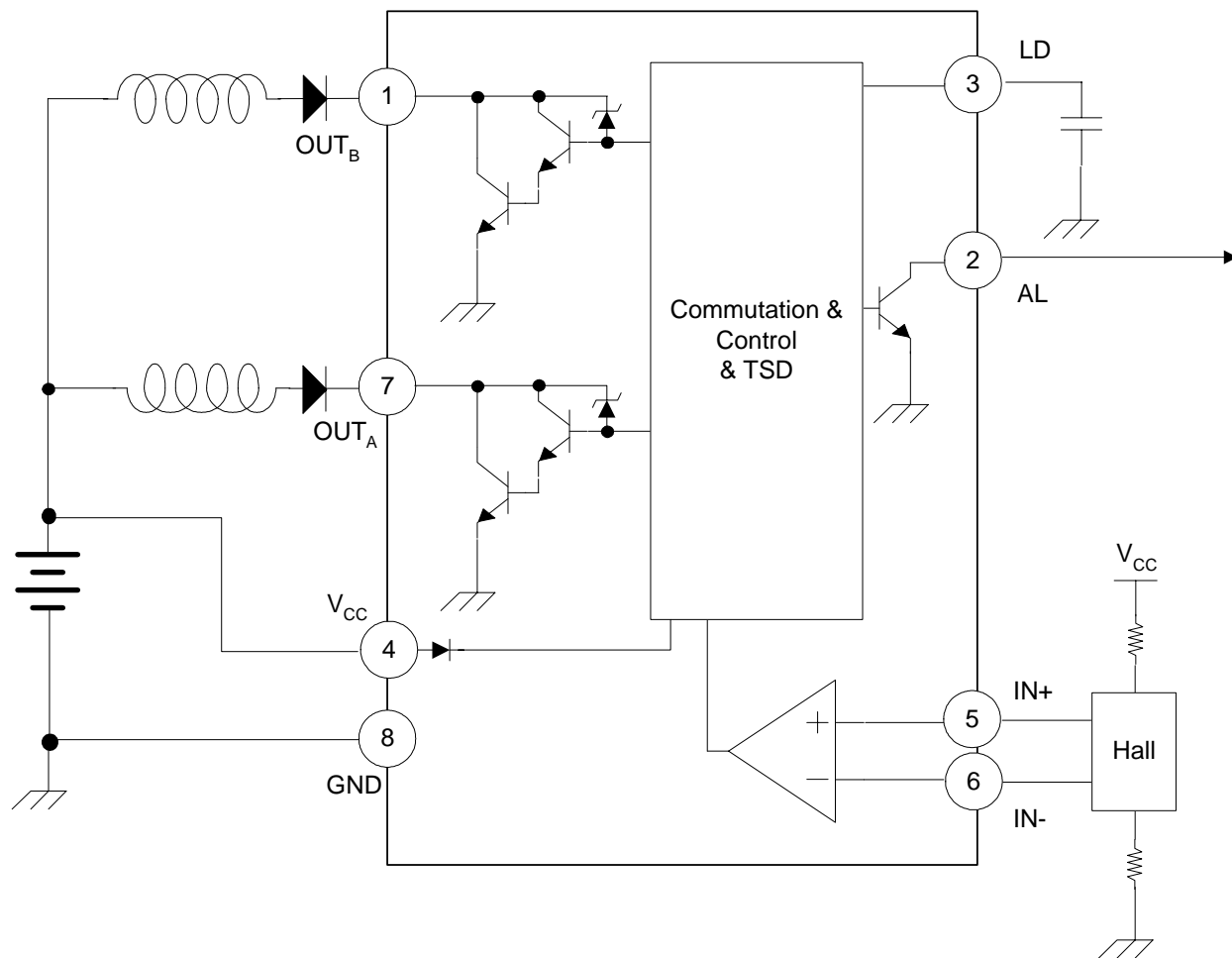
IN+	IN-	OUTA	OUTB
High	Low	High	Low
Low	High	Low	High

## Test Circuits





## Typical Application Circuits

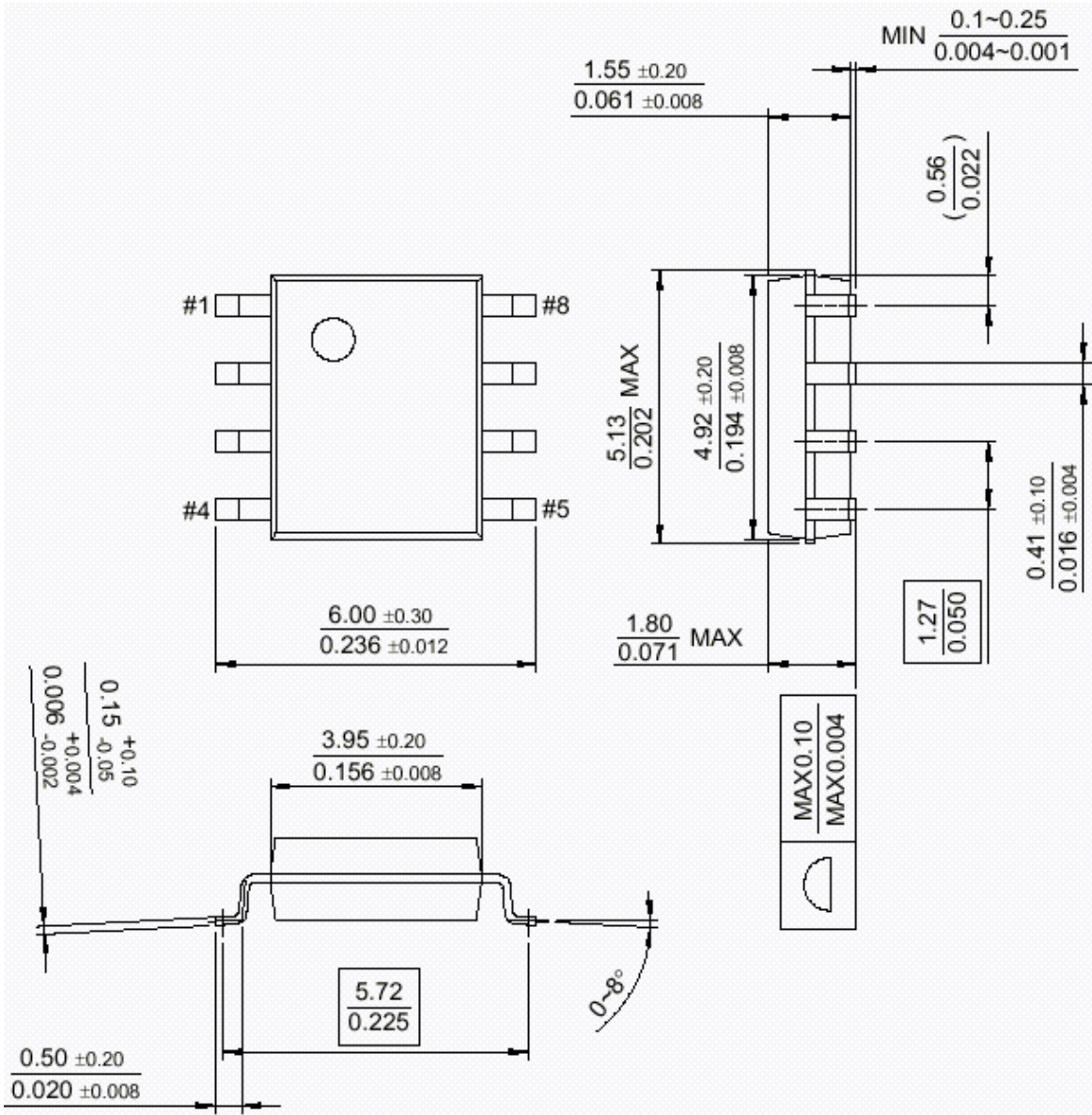


### Precaution

In case of improper connection (change between power and ground), diodes are required to protect motor.

Package Dimensions (Unit: mm)

8-SOP-225





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