FAN8412M

2 Phase Half Wave BLDC Motor Predriver

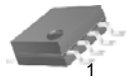
Features

- A Wide Range of Operation Voltage: 4V to 28V
- Locked Motor Protection With Open Collector and Auto Retry
- Compact Package: 8-SOP-225

Description

The FAN8412M is a monolithic integrated circuit, and suitable for DC cooling fan motors predriver.

8-SOP-225



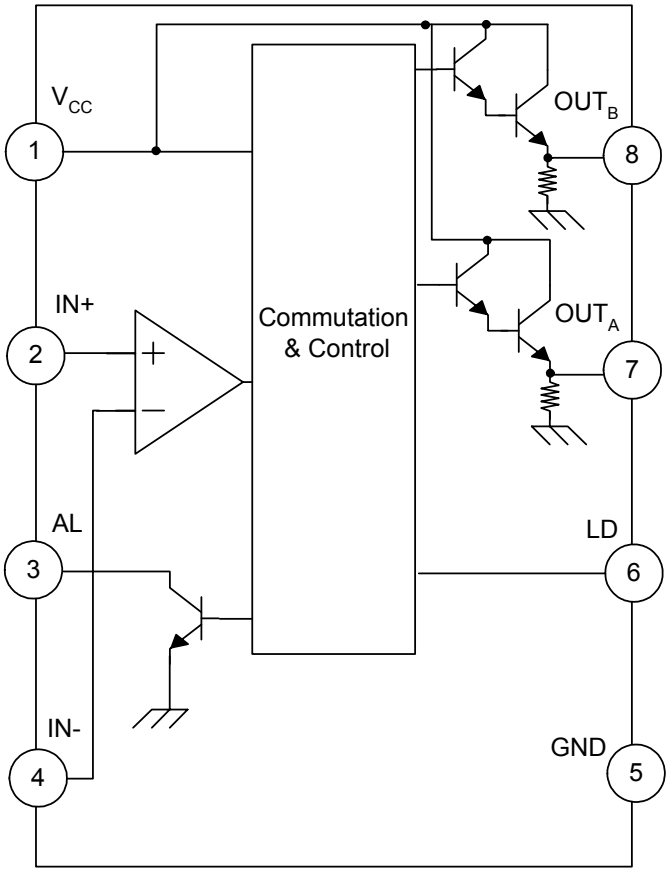
Typical Applications

- DC Cooling Fan Motor

Ordering Information

Device	Package	Operating Temp.
FAN8412M	8-SOP-225	–25°C ~ 85°C
FAN8412MX	8-SOP-225	–25°C ~ 85°C

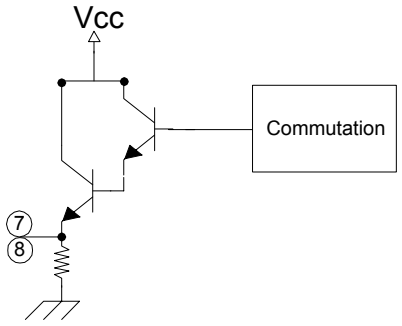
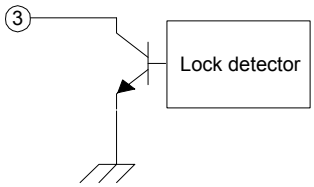
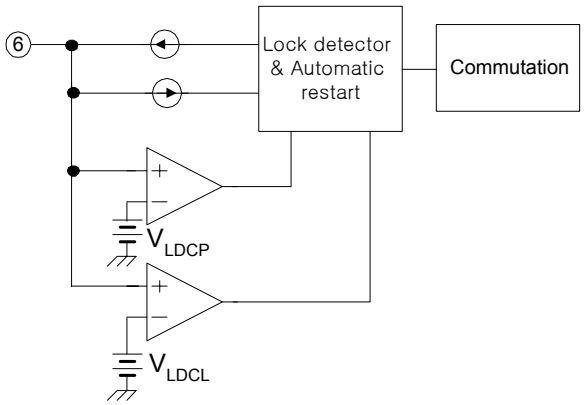
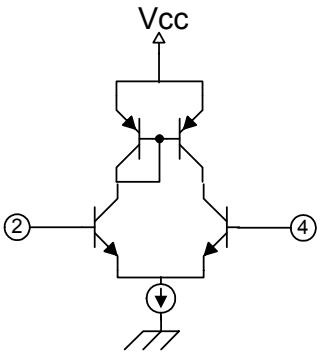
Block Diagram



Pin Definitions

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

Equivalent Circuits

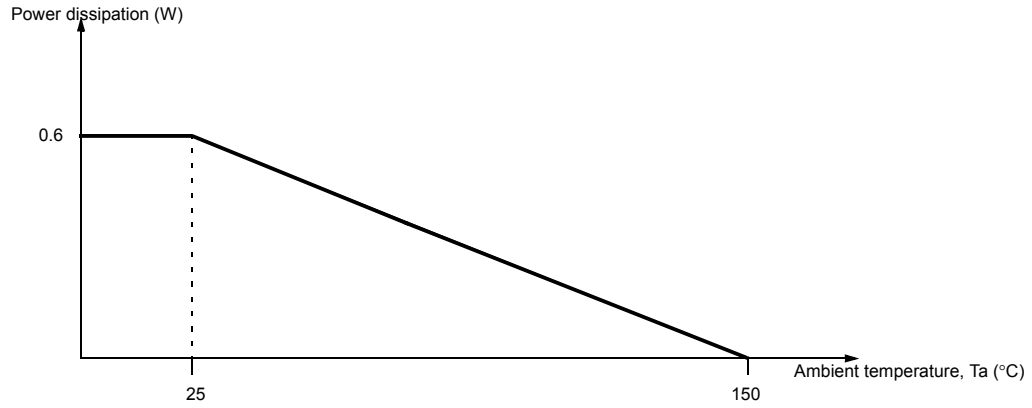
Description	Pin No.	Internal Circuit
OUT_A	7	
OUT_B	8	
AL	3	
LD	6	
IN+	2	
IN-	4	

Absolute Maximum Ratings (Ta = 25°C)

Parameter	Symbol	Value	Unit
Maximum Power Supply Voltage	V_{CCMAX}	32	V
Maximum Power Dissipation[note1]	P_{DMAX}	600	mW
Thermal Resistance[note1]	Θ_{JA}	208	°C/W
Maximum Output Voltage	V_{OMAX}	36	V
Maximum Output Current	I_{OMAX}	0.07	A
Alarm Output Current	I_{AL}	10	mA
Alarm Output Withstanding Voltage	V_{AL}	36	V
Operating Temperature	T_{OPR}	–25 ~ 85	°C
Storage Temperature	T_{STG}	–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
Should not exceed P_D or ASO value

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



Recommended Operating Conditions (Ta = 25°C)

Parameter	Symbol	Min.	Typ.	Max.	Unit
Function Compensation Operating Voltage	V_{CC}	4.0	–	28.0	V

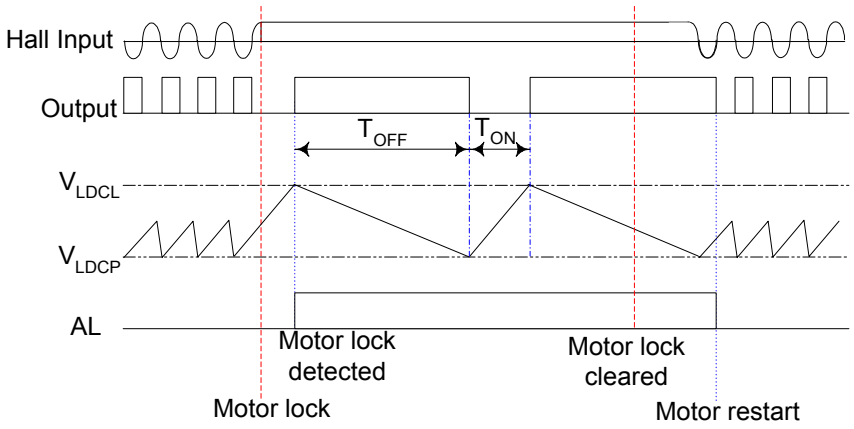
Electrical Characteristics

(Ta=25°C, V_{CC}=12V unless otherwise specified)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
TOTAL						
Supply Current	I_{CC}	When output is off.	-	3.2	5.0	mA
HALL AMPLIFIER INPUT RANGE						
Pin2,4 Hall Input Range	V_{HDC}	-	1	-	Vcc-2	V
Pin2,4 Hall Input Offest	V_{HOF}	-	15	-	-	mV
LOCK DETECTOR & AUTO RESTART						
Pin6 Lock Detector Charging Current	I_{LDC}	V_{LD}=1.5V	2.2	3.8	5.7	μA
Pin6 Lock Detector Discharging Current	I_{LDD}	V_{LD}=1.5V	0.4	0.88	1.6	μA
Pin6 Lock Detector Charging/Discharging Ratio	R_{CD}	$R_{CD}=I_{LDC}/I_{LDD}$	3	5	7	–
Pin6 Lock Detector Capacitor Clamp Voltage	V_{LDCL}	-	2.54	2.94	3.34	V
Pin6 Lock Detector Capacitor Comparator Voltage	V_{LDCP}	-	0.54	0.74	0.94	V
OUTPUT STAGE						
Pin7, 8 Output High Level Voltage	V_{OH}	I_O=10mA	10	10.5	-	V
Pin7, 8 Output Low Level Voltage	V_{OL}	I_O=10mA	-	-	0.5	V
ALARM OUTPUT						
Pin3 Alarm Output Low Level Voltaget	V_{ALL}	I_O=10mA	-	0.2	0.5	V
Pin3 Alarm Output Current Capacity	I_{AL}	V_{AL}=2.0V	8	-	-	mA

Application Information

1. Lock Detection & Automatic Restart



FAN8412M features a lock detection and an automatic restart. The functions can be operated as follows.

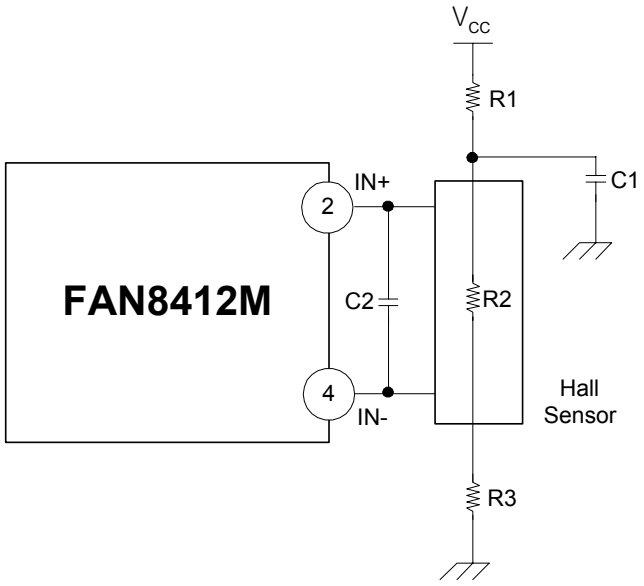
When the rotor is locked, there is no change in input signal of hall amplifier.
A capacitor(C_{LD}) connected LD pin is continually charged by internal current source (I_{LDC}) to intrrnal threshold(V_{LDCL}). When the voltage, V_{CLD} on LD pin, reaches V_{LDCL}, output power TR is turned-off to protect motor during T_{OFF} and alarm output(AL) becomes floating high. When the V_{CLD} reaches upper threshold,V_{LDCL},V_{CLD} starts to decrease with internal current sink(I_{LDD}) to the low threshold,V_{LDCP}. At that time, the V_{CLD} charging repeat until locked condition is removed, or FAN8412M is power down.
The auto-restart time (T_{ON}), the motor protection time(T_{OFF}) are propotional to external capacitor,C_{LD} and each value can be calculated as follow;

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

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

For example,C_{LD}=1uF, then T_{ON}=0.57Sec, T_{OFF}=2.2Sec. This AL output can be used to inform a locked rotor condition to super IO or system controller. Because the AL output is open collector type, end user can pull up this pin with a external resister to the supply voltage of their choice(that is 5 or 3.3V).

2. Hall Amplifier Input Block

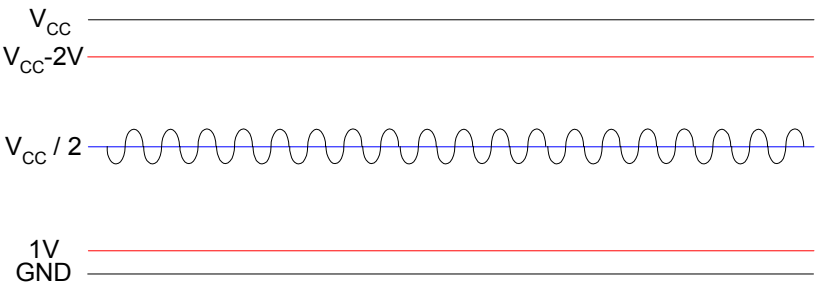


The hall current (I_H) is determined by R1, R2 and R3.

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

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 2 / 4) of the device.
The input bias voltage of hall amplifier is between 1V and V_{CC}-2V as following figure.

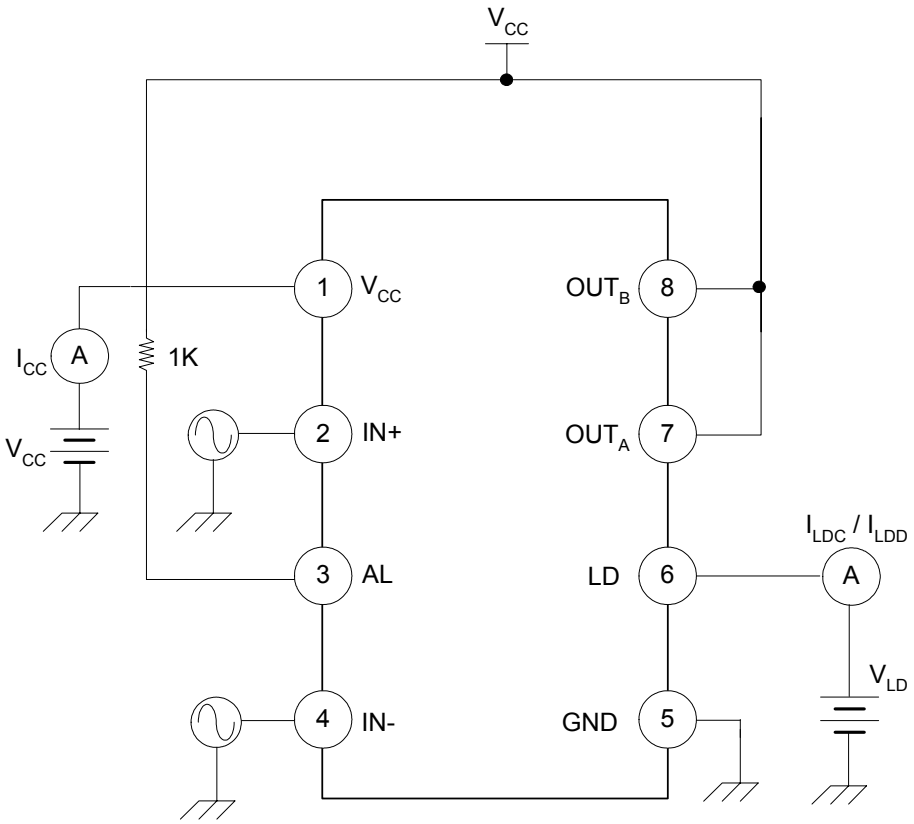


It is recommended that R1 and R3 should have the same value to make the output signal of hall sensor centered as $V_{CC}/2$.

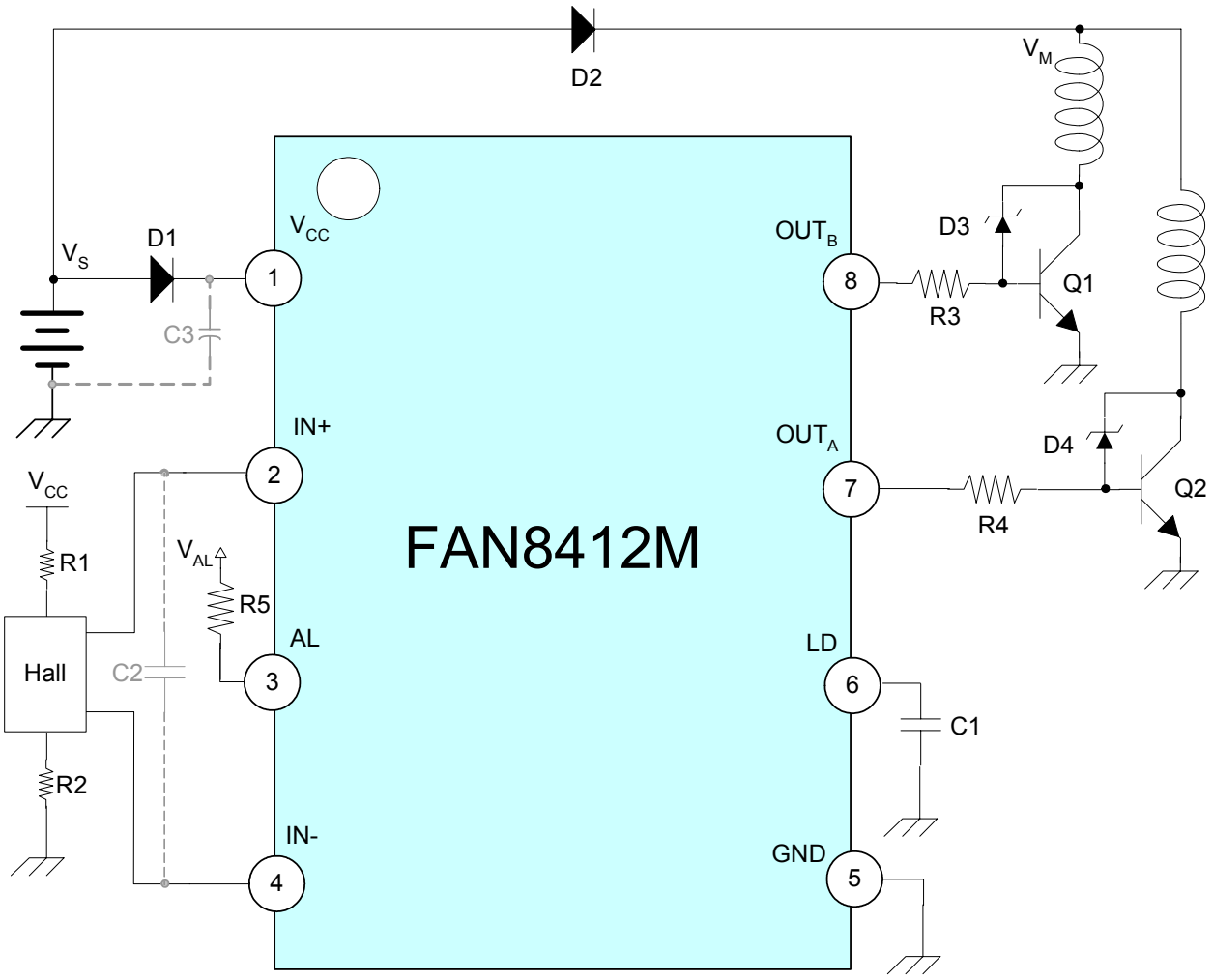
Operation Truth Table

IN+	IN-	OUT_A	OUT_B
High	Low	High	Low
Low	High	Low	High

Test Circuits

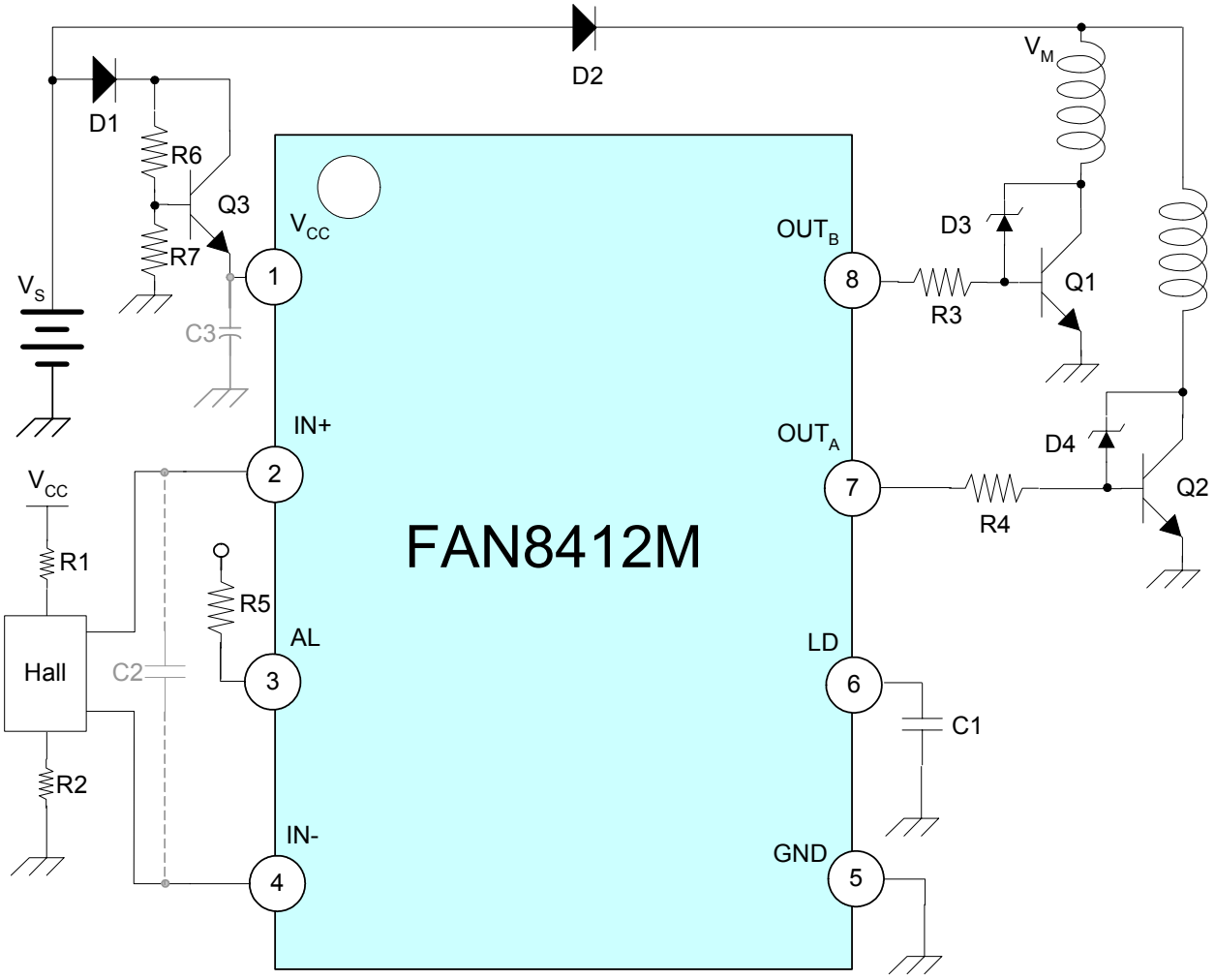


Typical Application Circuits1 (12V / 24V)



1 D1 : A reverse protection diode for IC.
2.D2 : A reverse protection diode for motor coil.
3.D3/D4 : Zener diode for freewheeling.
4.R1/R2 : A resister to set DC hall bias level.
5.R3/R4 : A resister to limit a base current of external power TR.
6. R5 : A pull-up resister for alarm output signal when a fan motor is locked.
7. C1 : A Capacitor for lock protection and detection of a fan motor.
If lock protection and detection functions are not necessary , LD pin should be connect ground.
8.C2 : A capacitor to reduce a noise in hall input stage. This is not necessary in case of no noise.
9.C3 : This is not necessary in case the stable input on V_{CC} is provided.
10.Q1/Q2 : An external power TR .

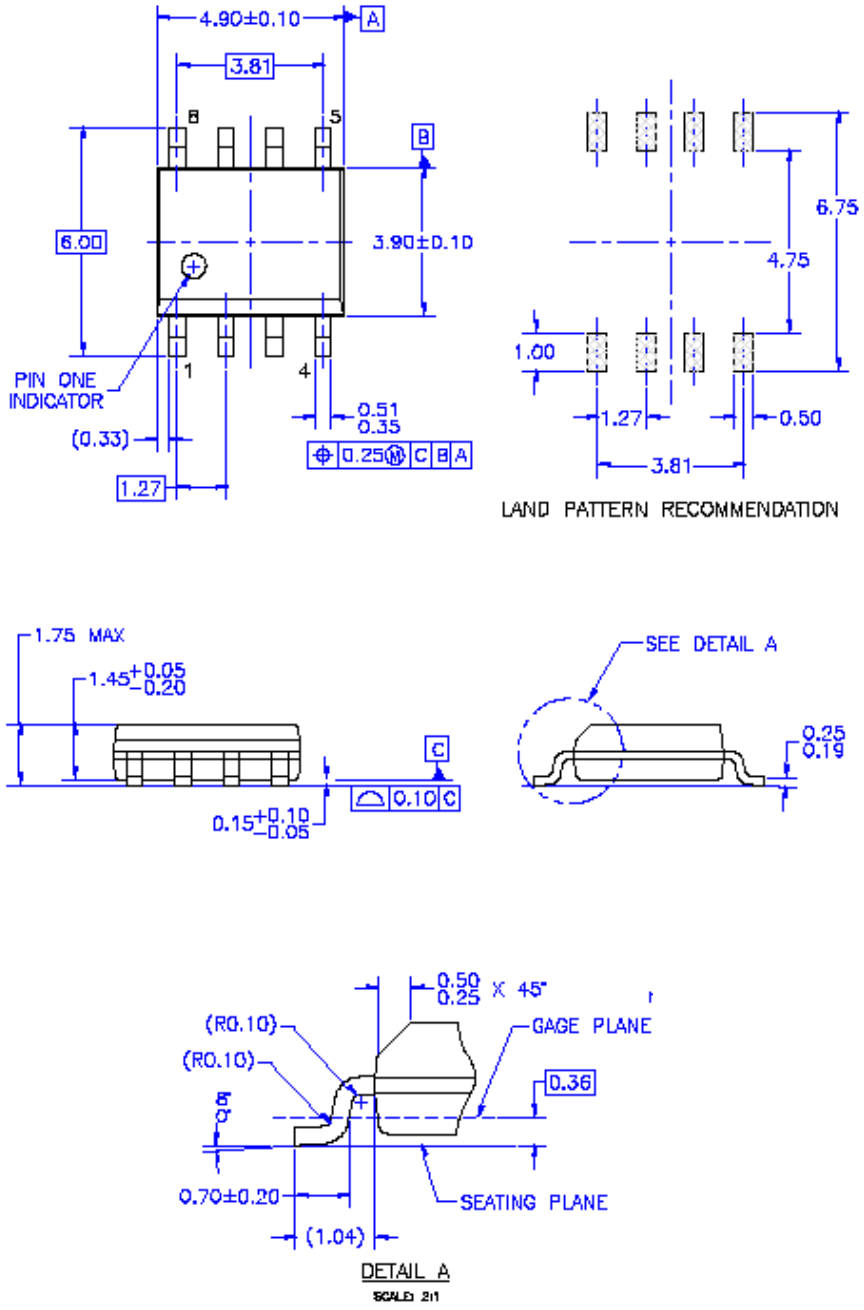
Typical Application Circuits2 (48V)



1 D1 : A reverse protection diode for IC.
2.D2 : A reverse protection diode for motor coil.
3.D3/D4 : Zener diode for freewheeling.
4.R1/R2 : A resister to set DC hall bias level.
5.R3/R4 : A resister to limit a base current of external power TR.
6.R5 : A pull-up resister for alarm output signal when a fan motor is locked.
7.R6/R7 : A resister to set a output voltage of TR(Q3).
8.C1 : A Capacitor for lock protection and detection of a fan motor.
If lock protection and detection functions are not necessary , LD pin should be connect ground.
9.C2 : A capacitor to reduce a noise in hall input stage. This is not necessary in case of no noise.
10.C3 : This is not necessary in case the stable input on V_{CC} is provided.
11.Q1/Q2 : An external power TR .
12.Q3 : An external power TR to control output voltage.

Package Dimensions (Unit: mm)

8-SOP-225



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