

[查询FAN8420D3供应商](#)



[捷多邦，专业PCB打样工厂，24小时加急出货](#)

www.fairchildsemi.com

FAN8420D3

3-Phase BLDC Motor Driver

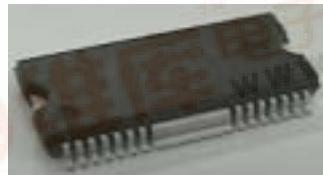
Features

- 3-phase, full-wave, linear BLDC motor driver
- Power save at stop mode
- Built-in current limiter
- Built-in TSD (Thermal shutdown) circuit
- Built-in 3X and 1X hall FG output
- Built-in hall bias circuit
- Built-in rotational direction detector
- Built-in reverse rotation preventer
- Built-in short braker
- Corresponds to 3.3V DSP

Description

The FAN8420D3 is a monolithic IC, suitable for a 3-phase spindle motor driver of a CD-media system.

28-SSOPH-375SG2



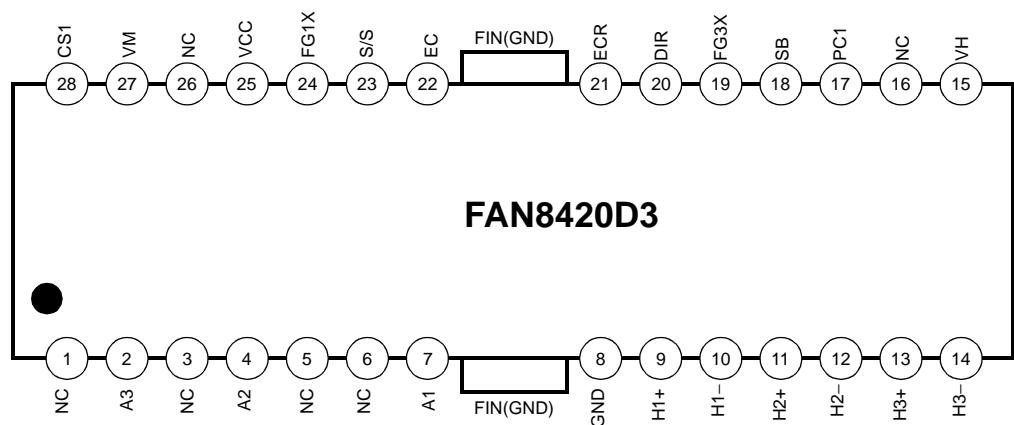
Typical Applications

- Compact disk ROM (CD-ROM) spindle motor
- Compact disk RW (CD-RW) spindle motor
- Digital video disk ROM (DVD-ROM) spindle motor
- Digital video disk RAM (DVD-RAM) spindle motor
- Digital video disk Player (DVDP) spindle motor
- Other compact disk media spindle motor
- Other 3-phase BLDC motor

Ordering Information

Device	Package	Operating Temp.
FAN8420D3	28-SSOPH-375SG2	-25°C ~ +75°C
FAN8420D3TF	28-SSOPH-375SG2	-25°C ~ +75°C

Pin Assignments



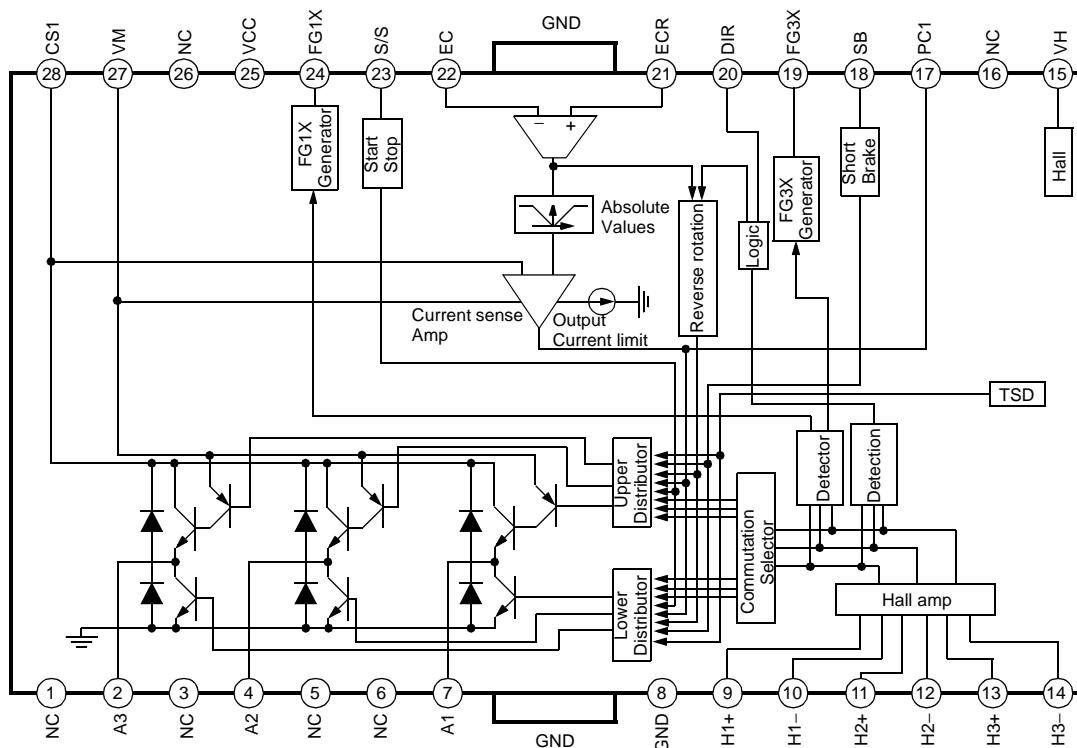
Pin Definitions

Pin Number	Pin Name	I/O	Pin Function Description
1	NC	-	No connection
2	A3	O	Output (A3)
3	NC	-	No connection
4	A2	O	Output (A2)
5	NC	-	No connection
6	NC	-	No connection
7	A1	O	Output (A1)
8	GND	-	Ground
9	H1+	I	Hall signal (H1+)
10	H1-	I	Hall signal (H1-)
11	H2+	I	Hall signal (H2+)
12	H2-	I	Hall signal (H2-)
13	H3+	I	Hall signal (H3+)
14	H3-	I	Hall signal (H3-)
15	VH	I	Hall bias
16	NC	-	No connection
17	PC1	-	Phase compensation capacitor
18	SB	I	Short brake
19	FG3X	O	FG waveform (3X)
20	DIR	O	Rotational direction output
21	ECR	I	Output current control reference
22	EC	I	Output current control voltage

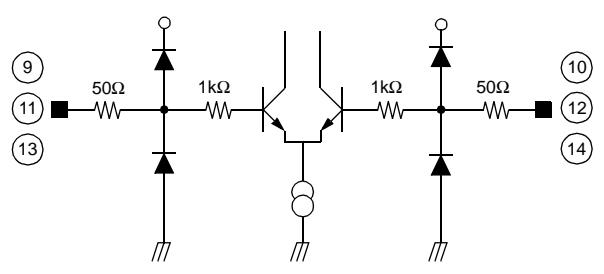
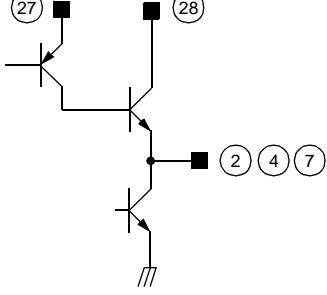
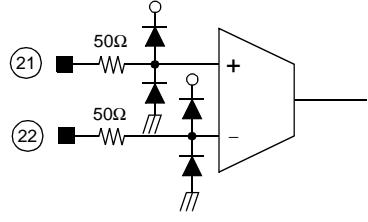
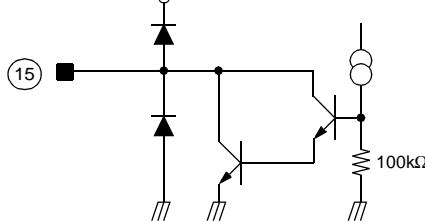
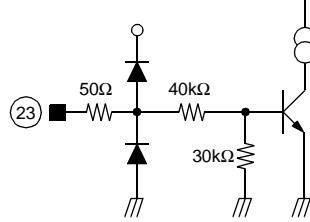
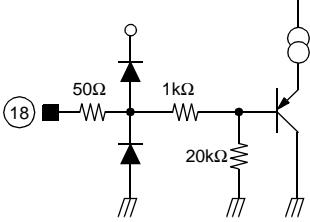
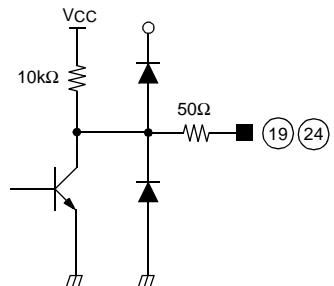
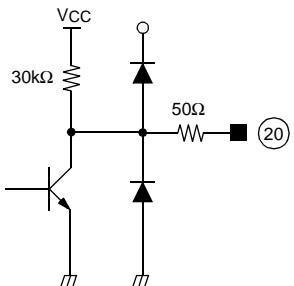
Pin Definitions (Continued)

Pin Number	Pin Name	I/O	Pin Function Description
23	S/S	I	Power save (Start/Stop switch)
24	FG1X	O	FG waveform (1X)
25	VCC	-	Supply voltage (Signal)
26	NC	-	No connection
27	VM	-	Supply voltage (Motor)
28	CS1	-	Output current detection

Internal Block Diagram



Equivalent Circuits

Hall input	Driver output
	
Torque control input	Hall bias input
	
Start / Stop input	Short brake input
	
FG output	Dir output
	

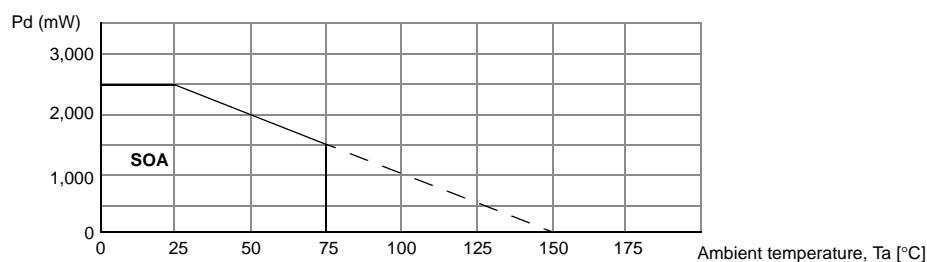
Absolute Maximum Ratings (Ta = 25°C)

Parameter	Symbol	Value	Unit
Maximum supply voltage (Signal)	V _{CCmax}	7	V
Maximum supply voltage (Motor)	V _{Mmax}	15	V
Power dissipation	P _D	2.5 ^{note}	W
Maximum output current	I _{Omax}	1.3	A
Operating temperature range	T _{OPR}	-25 ~ +75	°C
Storage temperature range	T _{STG}	-55 ~ +150	°C

NOTE:

1. When mounted on a 76.2mm × 114mm × 1.57mm PCB (Phenolic resin material).
2. Power dissipation reduces 16.6mW/°C for using above Ta = 25°C
3. Do not exceed P_D and SOA (Safe operating area).

Power Dissipation Curve



Recommended Operating Conditions (Ta = 25°C)

Parameter	Symbol	Min.	Typ.	Max.	Unit
Supply voltage	V _{CC}	4.5	5	5.5	V
Motor supply voltage	V _M	3.0	12	14	V

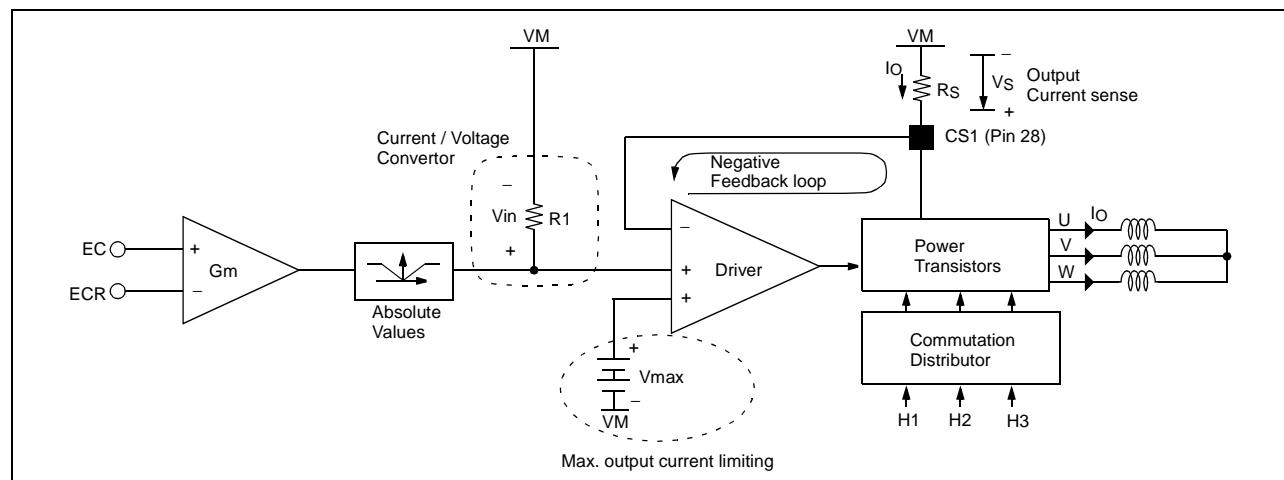
Electrical Characteristics

(Unless otherwise specified, Ta=25°C, V_{CC}=5V, V_M=12V)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Quiescent circuit current 1	I _{CC1}	At stop mode	-	-	0.2	mA
Quiescent circuit current 2	I _{CC2}	At start mode	-	5	10	mA
START / STOP						
On voltage range	V _{SSon}	Output driver on	2.5	-	V _{CC}	V
Off voltage range	V _{SSoff}	Output driver off	0.0	-	1.0	V
HALL BIAS						
Hall bias voltage	V _{HB}	I _{HB} =20mA	0.4	1.0	1.8	V
HALL AMP						
Hall bias current	I _{HA}	-	-	0.5	2	µA
Common-mode input range	V _{HAR}	-	1.0	-	4.0	V
Minimum input level	V _{INH}	-	60	-	-	mVpp
H1 hysteresis level	V _{HYS}	-	5	20	40	mVpp
TORQUE CONTROL						
Ecr Input voltage range	E _{CR}	-	0.2	-	3.3	V
Ec Input voltage range	E _C	-	0.2	-	3.3	V
Offset voltage (-)	E _{Coff-}	E _C =1.9V	-80	-50	-20	mV
Offset voltage (+)	E _{Coff+}	E _C =1.9V	20	50	80	mV
Ec Input current	E _{Cin}	E _C =1.9V	-5	-0.5	-	µA
Ecr Input current	E _{CRin}	E _{CR} =1.9V	-5	-0.5	-	µA
Input / output gain	G _{EC}	E _C =1.9V, RCS=0.5Ω	0.56	0.71	0.84	A/V
FG						
FG output voltage (H)	V _{FGr}	I _{fg} =-10µA	4.5	4.9	-	V
FG output voltage (L)	V _{FGl}	I _{fg} =10µA	-	-	0.5	V
Duty (reference value)		-	-	50	-	%
OUTPUT BLOCK						
Saturation voltage (upper TR)	V _{OH}	I _O =-300mA	-	0.9	1.4	V
Saturation voltage (lower TR)	V _{OL}	I _O =300mA	-	0.4	0.7	V
Torque limit current	I _{TL}	RCS=0.5Ω	560	700	840	mA
DIRECTION DETECTOR						
Dir output voltage (H)	V _{DIRh}	I _{fg} =-10µA	4.5	4.7	-	V
Dir output voltage (L)	V _{DIRl}	I _{fg} =10µA	-	-	0.5	V
SHORT BRAKE						
On voltage range	V _{SBon}	-	2.5	-	V _{CC}	V
Off voltage range	V _{SBoff}	-	0	-	1.0	V

Electrical Characteristics (Continued)

1. Calculation Of Gain & Torque Limit Current



0.355 is GM times R1 and is a fixed value within IC.

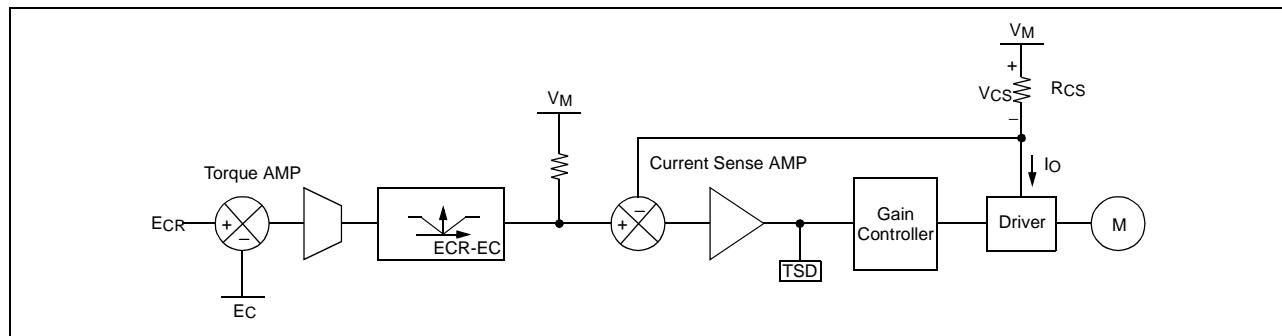
$$\text{Gain} = \frac{0.355}{R_S} [\text{A/V}]$$

Vmax (see above block diagram) is set at 350mV.

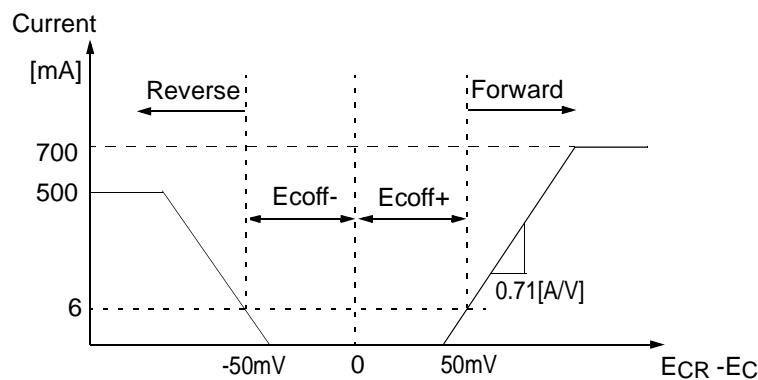
$$|I_t| = \frac{V_{\text{max}}}{R_S} = \frac{350[\text{mV}]}{R_S}$$

Application Information

1. Torque Control & Output Current Control



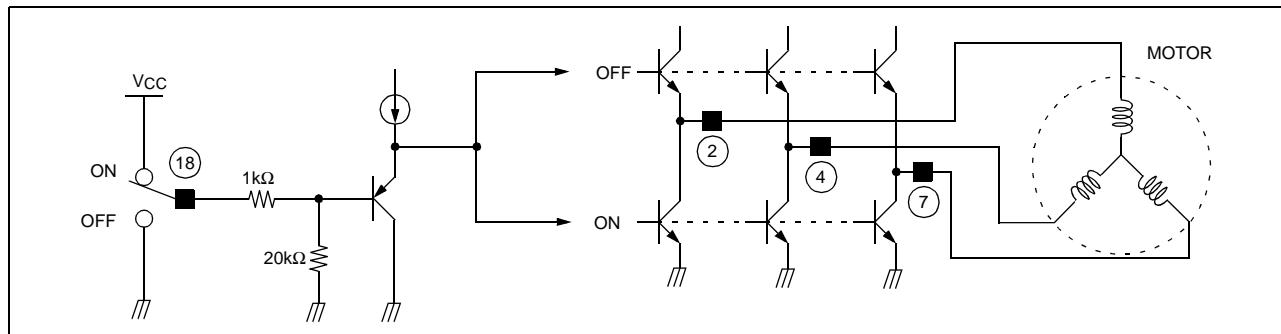
- By amplifying the voltage difference between EC and Ecr from servo IC, the torque sense amp produces the input (VAMP) for the current sense amp.
- The output current (I_O) is converted into the voltage (V_{CS}) through the sense resistor (R_{CS}) and compared with the VAMP. By the negative feedback loop, the sensed output voltage, V_{CS} is equal to the input VAMP. Therefore, the output current (I_O) is linearly controlled by the input VAMP.
- As a result, the signals, EC and ECR can control the velocity of the Motor by controlling the output current (I_O) of the driver.
- The range of the torque voltage is as shown below.



	Rotation
$ECR > Ec$	Forward rotation
$ECR < Ec$	Stop after detecting reverse rotation

The input range of ECR and EC is 0.2 V ~ 3.3 V ($R_{NF} = 0.5[\Omega]$)

2. Short Brake



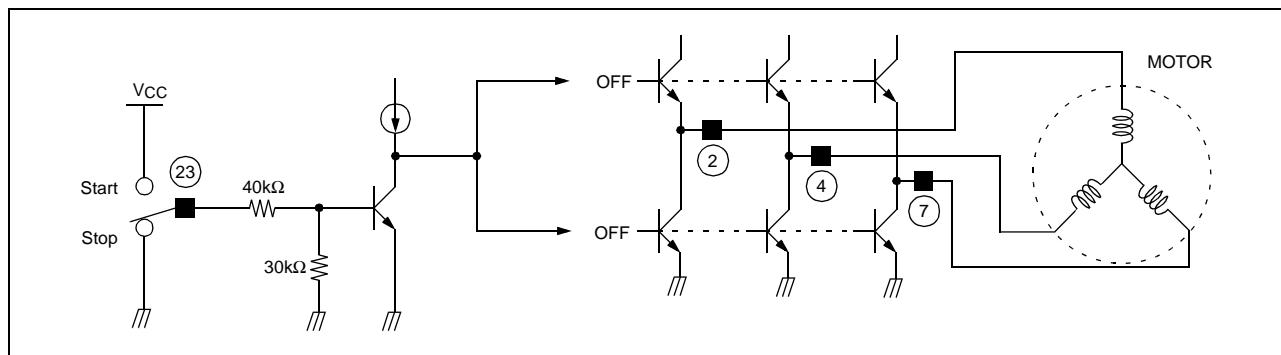
Pin # 18	Short brake
High	On
Low	Off

When the pick-up mechanism moves from the inner to the outer spindle of the CD, the brake function of the reverse voltage is commonly employed to decrease the rotating velocity of the spindle Motor.

However, if the spindle motor rotates rapidly, the brake function of the reverse voltage may produce more heat at the Drive IC.

To remove this shortcoming and to enhance the braking efficiency, the short brake function is added to FAN8420D3. When the short brake function is active, all upper power TRs turn off and all lower power TRs turn on, and the motor slows down. But FG and DIR functions continue to operate normally.

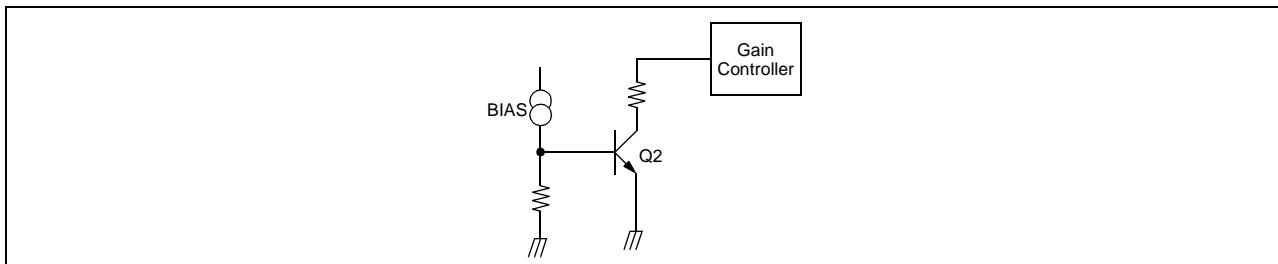
3. Power Save



Pin # 23	Start/Stop
High	Operate
Low	Stop

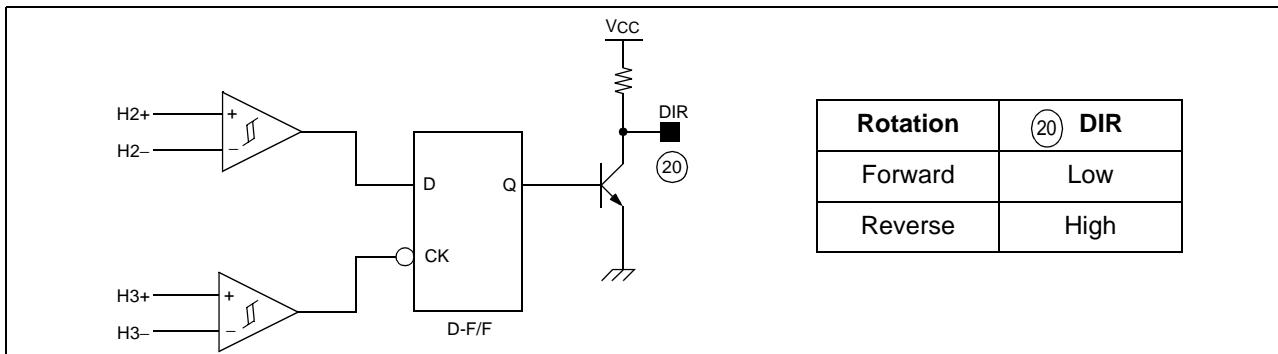
When power save function is active, all power TRs turn off.

4. Tsd (Thermal Shutdown)

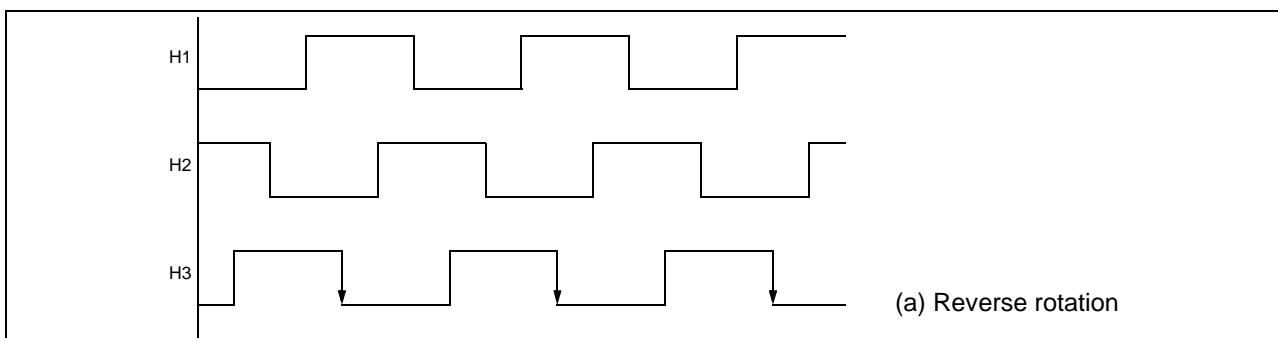


When the chip temperature rises above 175°C , the Q2 turns on and the output driver shuts down. When the chip temperature falls off to about 150°C , then the Q2 turns off and the driver operates normally. TSD has the temperature hysteresis of about 25°C .

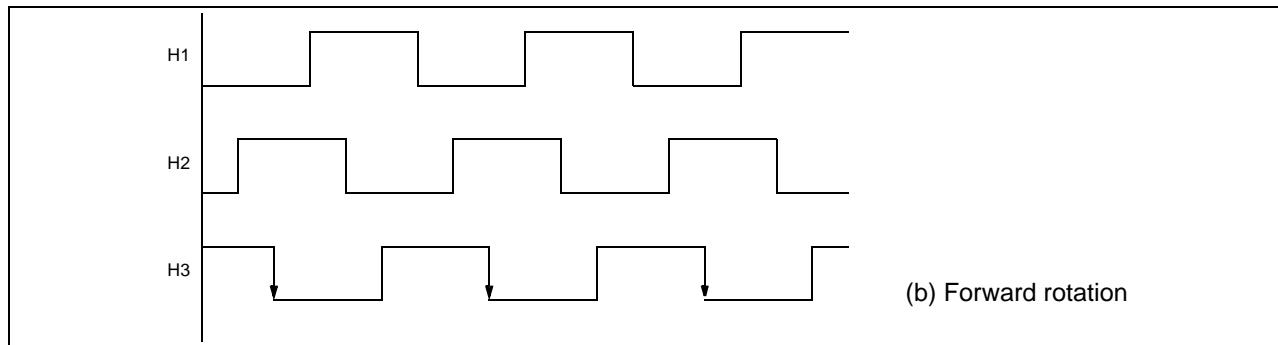
5. Rotational Direction Detection



- The forward and the reverse rotations of the CD are detected by the D-F/F and the truth table is shown in the above.
 - The rotational direction of the CD can be explained by the output waveforms of the Hall sensors. The three outputs of Hall sensors be H1, H2 and H3 respectively.
- When the spindle rotates in reverse direction, the Hall sensor output waveforms are shown in Fig.(a). The phases order are in $\text{H}1 \rightarrow \text{H}2 \rightarrow \text{H}3$ with a 120°C phase difference.

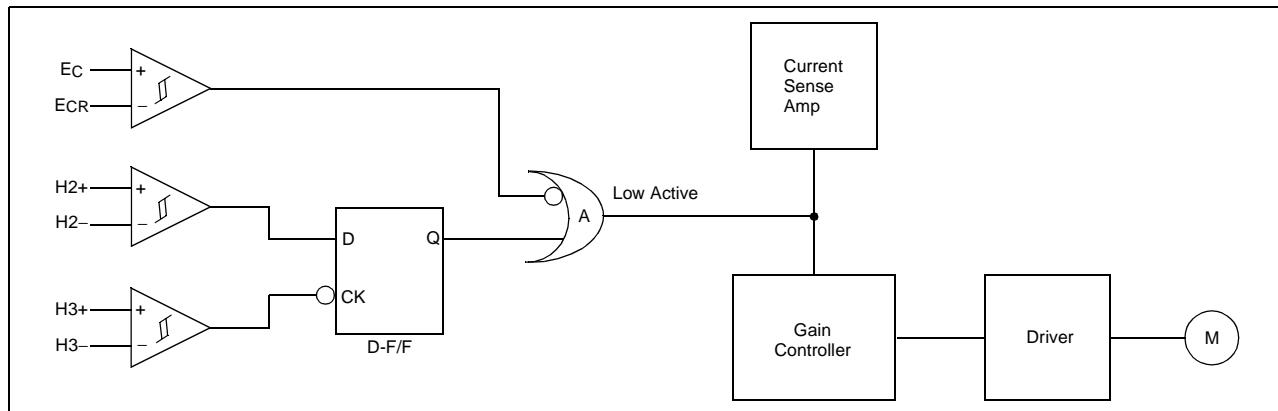


On the other hand, if the spindle rotates in forward rotation, the phase relationship is $\text{H}3 \rightarrow \text{H}2 \rightarrow \text{H}1$ as shown in fig.(b)



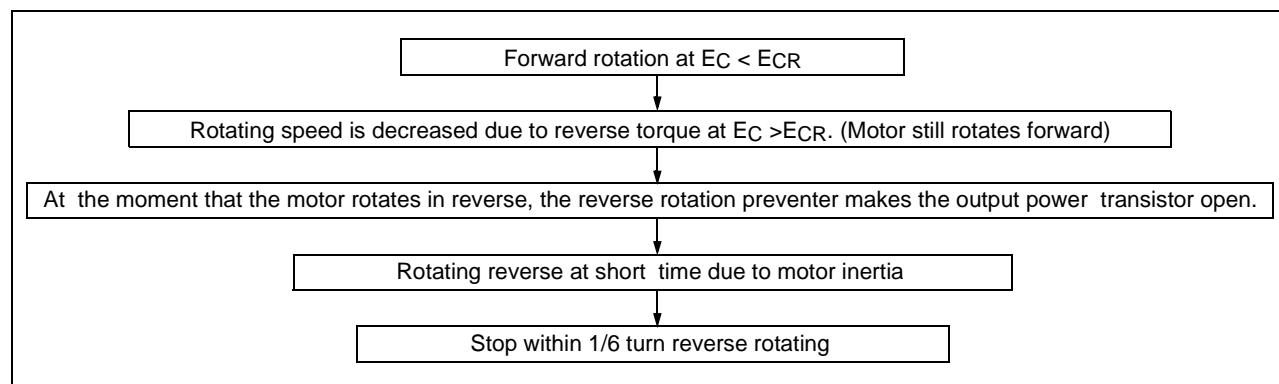
Therefore, the output of the rotational direction detector is low, when the spindle rotates forward, and high in the reverse rotation.

6. Reverse Rotation Prevention

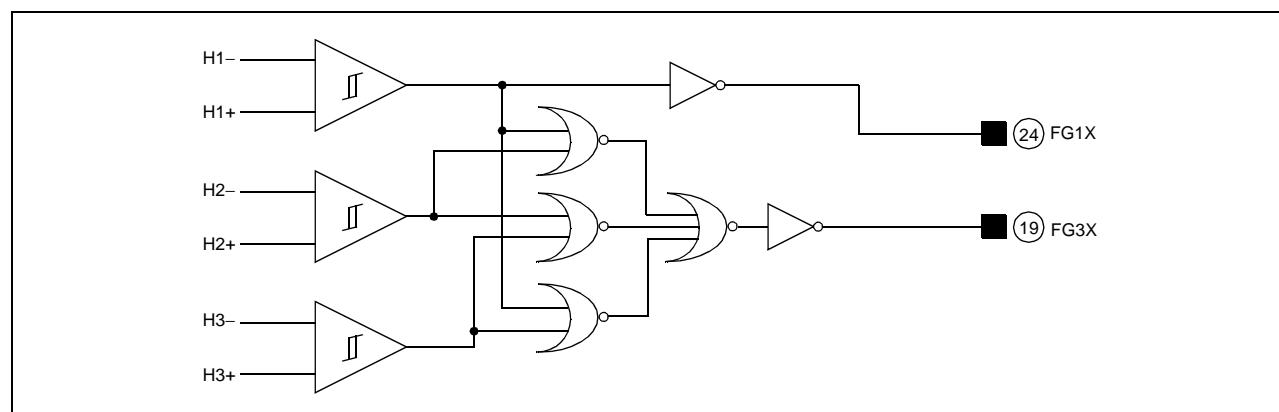


- When the output of the OR Gate, A is LOW, it steers all the output current of the current sense Amp to the Gain Controller zero. The output current of the Driver becomes zero and the motor stops.
- As in the state of the forward rotation, the D-F/F output, Q is HIGH and the motor rotates normally. At this state, if the control input is changed such that $EC > ECR$, then the motor rotates slowly by the reverse commutation in the Driver. When the motor rotates in reverse direction, the D-F/F output becomes Low and the OR Gate output, becomes LOW. This prevents the motor from rotating in reverse direction. The operation principle is shown in the table and the flow chart.

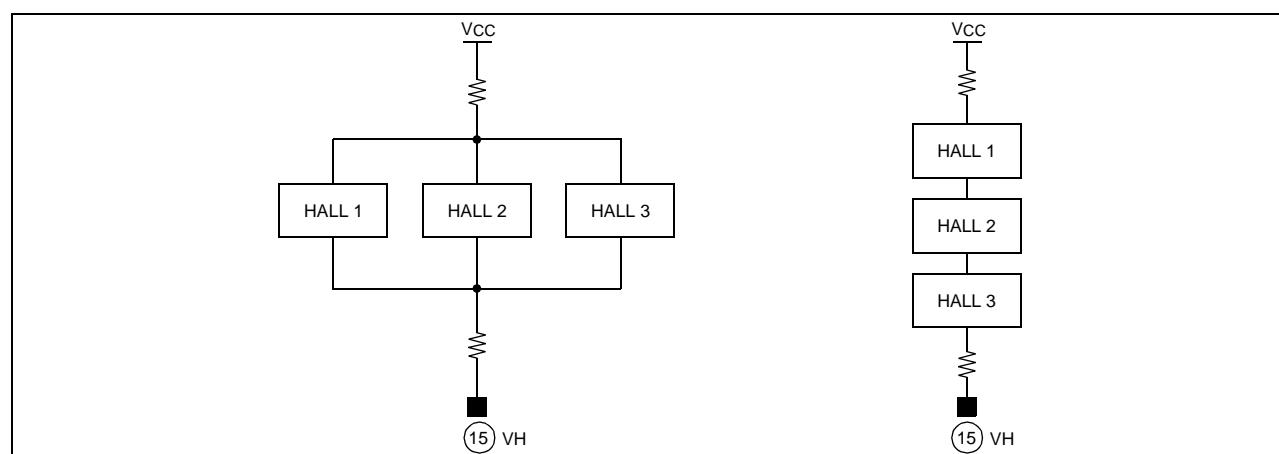
Rotation	H2	H3	D-F/F(Q)	Reverse rotation preventer	
				$EC < ECR$	$EC > ECR$
Forward	H	H → L	H	Forward	-
Reverse	L	H → L	L	-	Brake and stop

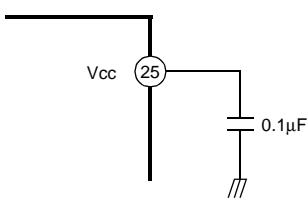


7. Fg Out

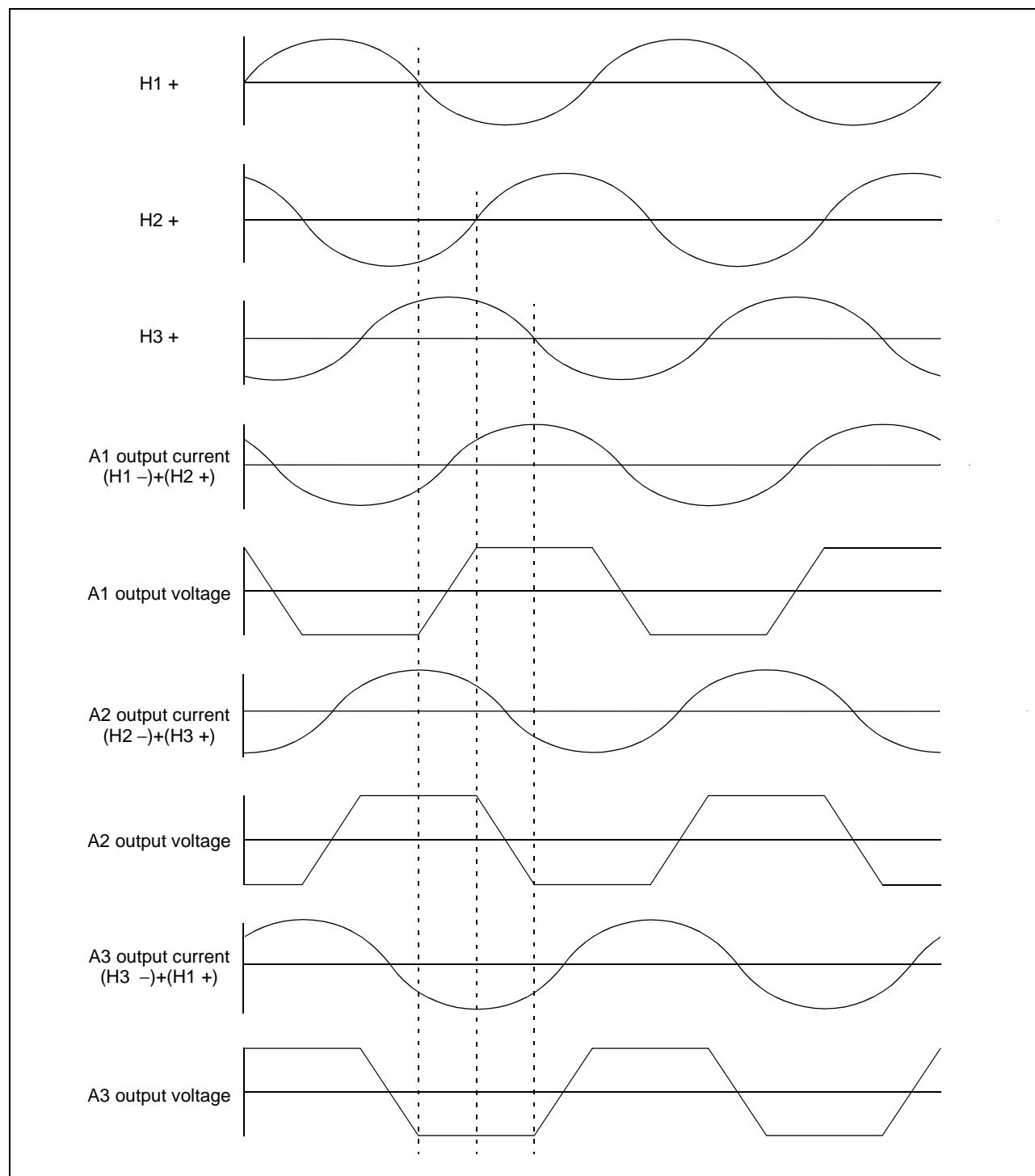


8. Hall Sensor Connection

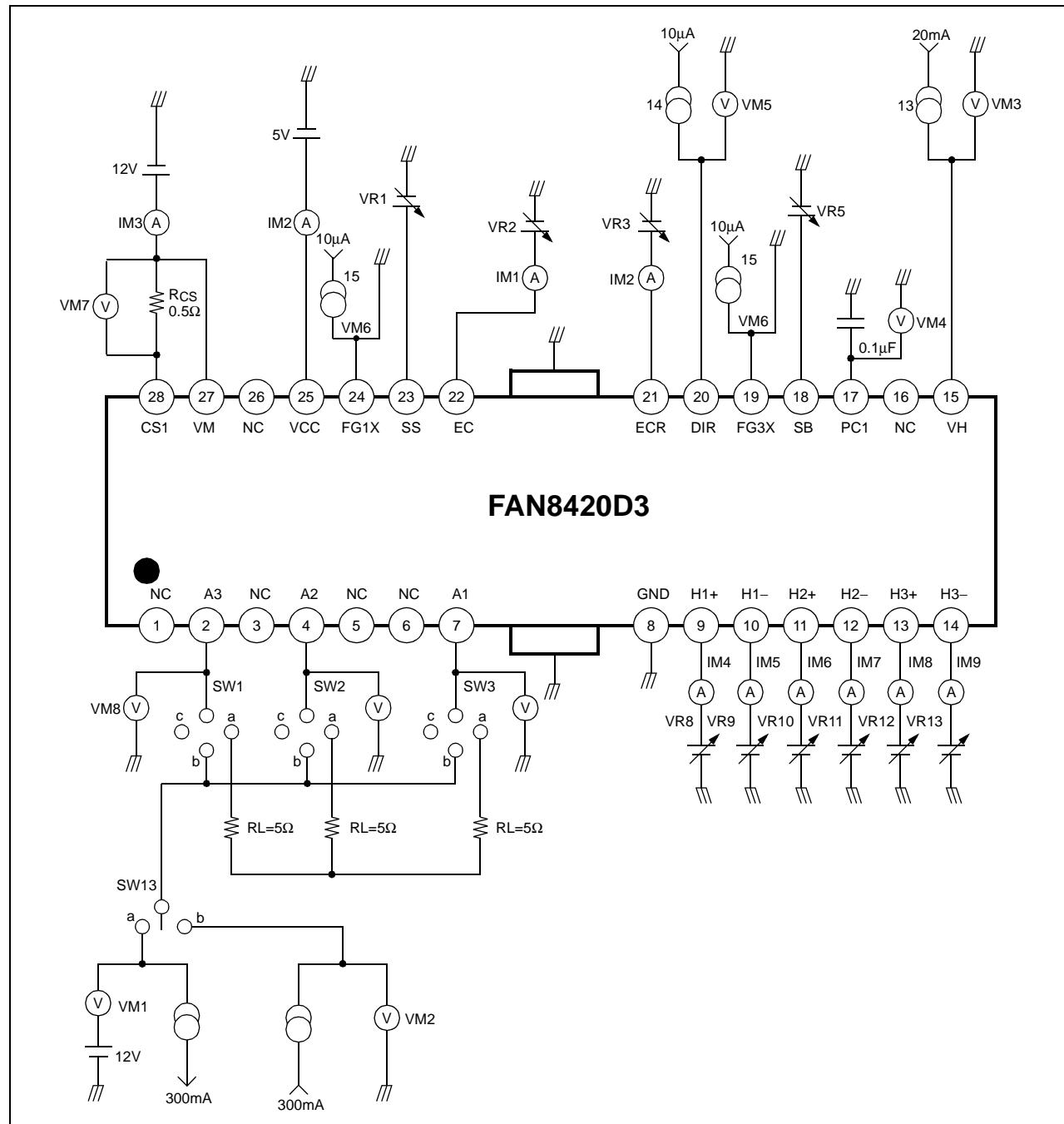


9. Connect A By-pass Capacitor, $0.1\mu\text{F}$ Between The Supply Voltage Source

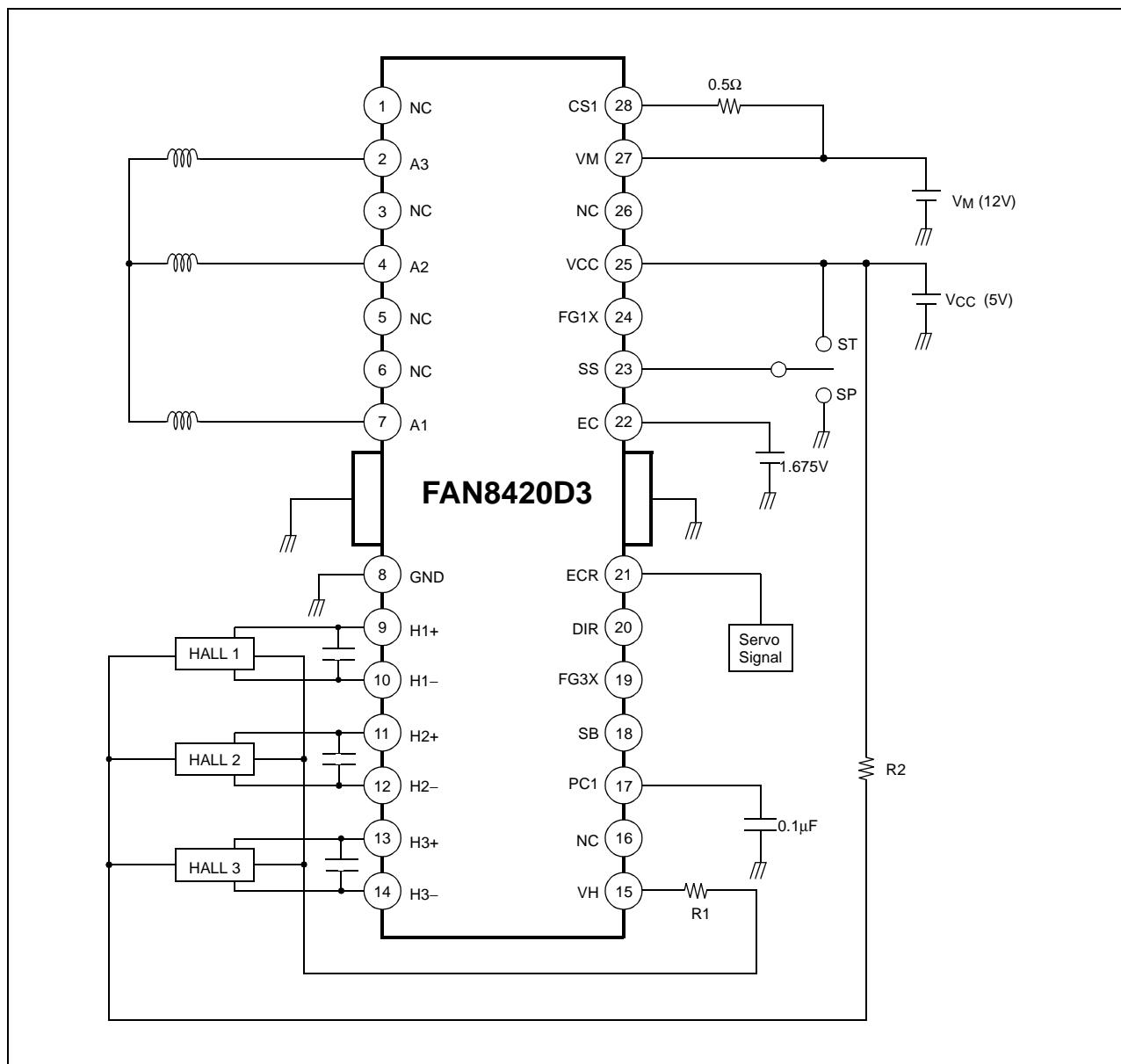
- (1) the heat radiation fin is connected to the internal gnd of the package.
connect that fin to the external gnd.

10. Input-output Timing Chart

Test Circuits



Typical Application Circuits



DISCLAIMER

FAIRCHILD SEMICONDUCTOR RESERVES THE RIGHT TO MAKE CHANGES WITHOUT FURTHER NOTICE TO ANY PRODUCTS HEREIN TO IMPROVE RELIABILITY, FUNCTION OR DESIGN. FAIRCHILD DOES NOT ASSUME ANY LIABILITY ARISING OUT OF THE APPLICATION OR USE OF ANY PRODUCT OR CIRCUIT DESCRIBED HEREIN; NEITHER DOES IT CONVEY ANY LICENSE UNDER ITS PATENT RIGHTS, NOR THE RIGHTS OF OTHERS.

LIFE SUPPORT POLICY

FAIRCHILD'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF THE PRESIDENT OF FAIRCHILD SEMICONDUCTOR INTERNATIONAL. As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury of the user.
2. A critical component in any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.