

KA2822D

3-Phase BLDC Motor Driver

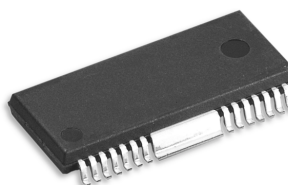
Features

- 3-phase, full-wave, linear BLDC motor driver with 2 hall sensors
- Built-in soft switching drive circuit
- 300 or 360 RPM speed control
- Snubberless
- Built-in chip enable function
- Built-in digital speed control circuit
- Built-in current limit circuit
- Index sensorless
- Built-in TSD (Thermal shutdown)
- Low saturation voltage
- Digital input: TTL, 5V CMOS compatible
- Built-in current-mode control circuit (I_{PEAK}: 1A)

Description

The KA2822D is a monolithic integrated circuit, and suitable for the three-phase spindle motor driver of FDD system.

28-SSOPH-375



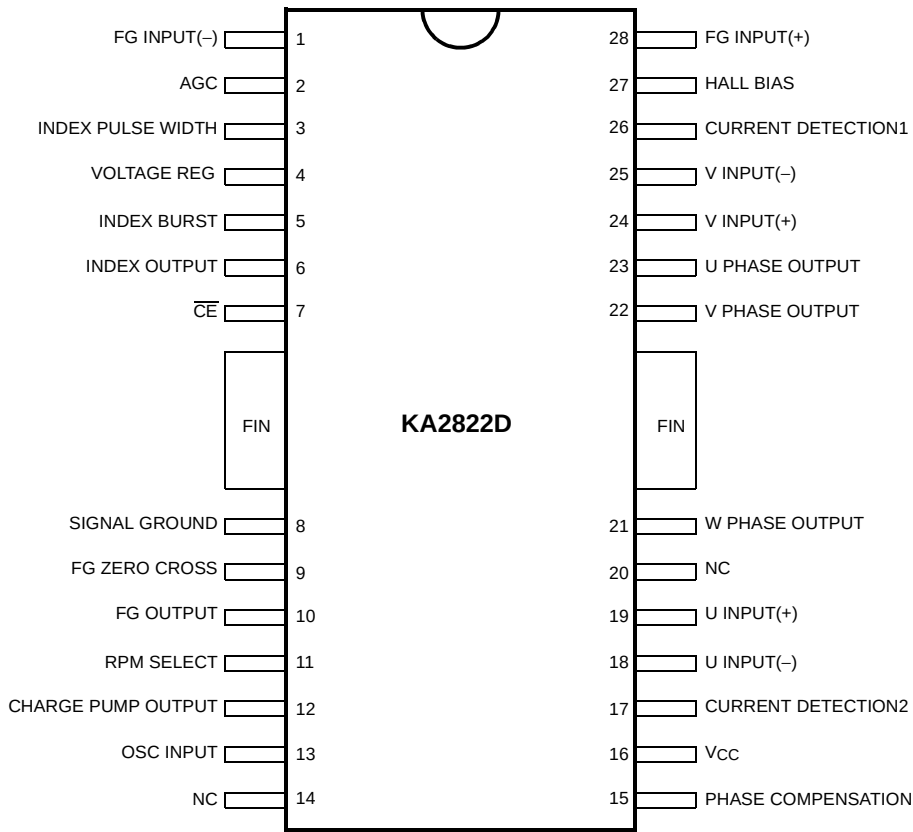
Typical Application

- 3.5-inch floppy disk drive (FDD) spindle motor
- Other 3-phase BLDC motor

Ordering Information

Device	Package	Operating Temp.
KA2822D	28-SSOPH-375	0 ~ 75°C
KA2822DTF	28-SSOPH-375	0 ~ 75°C
KA2822BD	28-SSOPH-375	0 ~ 75°C
KA2822BDTF	28-SSOPH-375	0 ~ 75°C

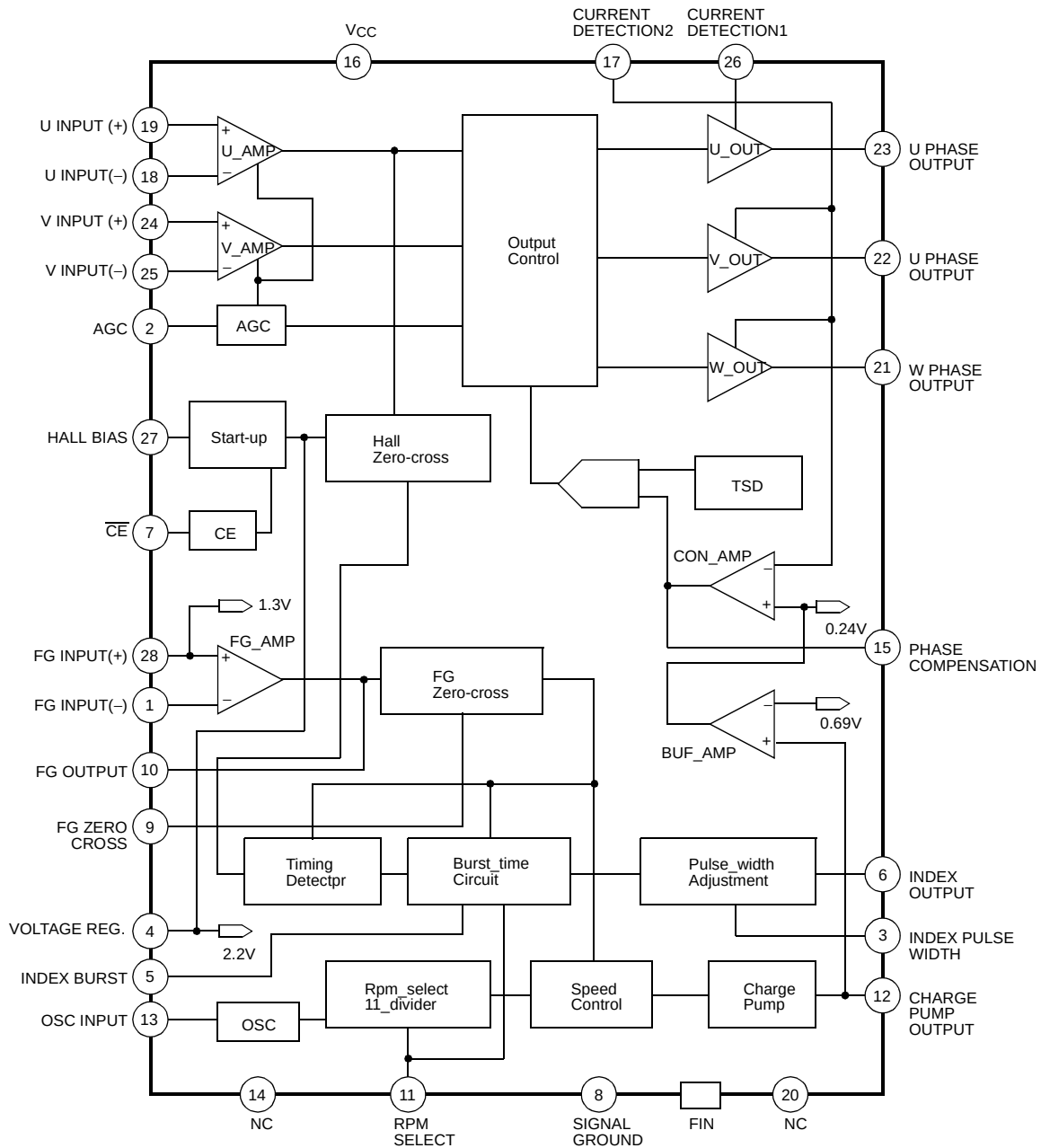
Pin Assignments



Pin Definitions

Pin Number	Pin Name	I/O	Pin Function Description
1	FG_INPUT	I	Negative input pin FG signal amp.
2	AGC	I	Automatic gain control input pin
3	INDEX PULSE WIDTH	O	Index pulse width detection (1.1V) pin
4	VOLTAGE REGULATOR	O	Voltage (2.2V) generator output pin
5	INDEX BURST	O	Index pulse width detection (1.4V) pin
6	INDEX OUTPUT	O	Index pulse output pin
7	CE	I	Chip enable (Active low)
8	SIGNAL GROUND	-	Signal ground
9	FG ZERO CROSS	O	FG signal zero cross detection pin
10	FG OUTPUT	O	FG signal output pin
11	RPM SELECT	I	RPM selection pin (L: 300, H: 360rpm)
12	CHARGE PUMP OUTPUT	O	Charge pump output pin
13	OSC INPUT	I	1MHz oscillation input pin
14	NC	-	No connection
15	PHASE COMPENSATION	I	Phase compensation cap. connection pin
16	Vcc	-	5V power supply pin
17	CURRENT DETECTION2	I	Over current detection pin
18	U INPUT (-)	I	Negative input pin of U phase amp
19	U INPUT (+)	I	Positive input pin of U phase amp
20	NC	-	No connection
21	W PHASE OUTPUT	O	W phase output pin
22	V PHASE OUTPUT	O	V phase output pin
23	U PHASE OUTPUT	O	U phase output pin
24	U INPUT (+)	I	Positive input pin of V phase amp
25	V INPUT (-)	I	Negative input pin of V phase amp
26	CURRENT DETECTION1	I	Over current detection pin
27	HALL BIAS	I	Hall sensor bias input pin
28	FG INPUT (+)	I	Positive input pin of FG signal amp
FIN	POWER GROUND	-	Power ground

Internal Block Diagram



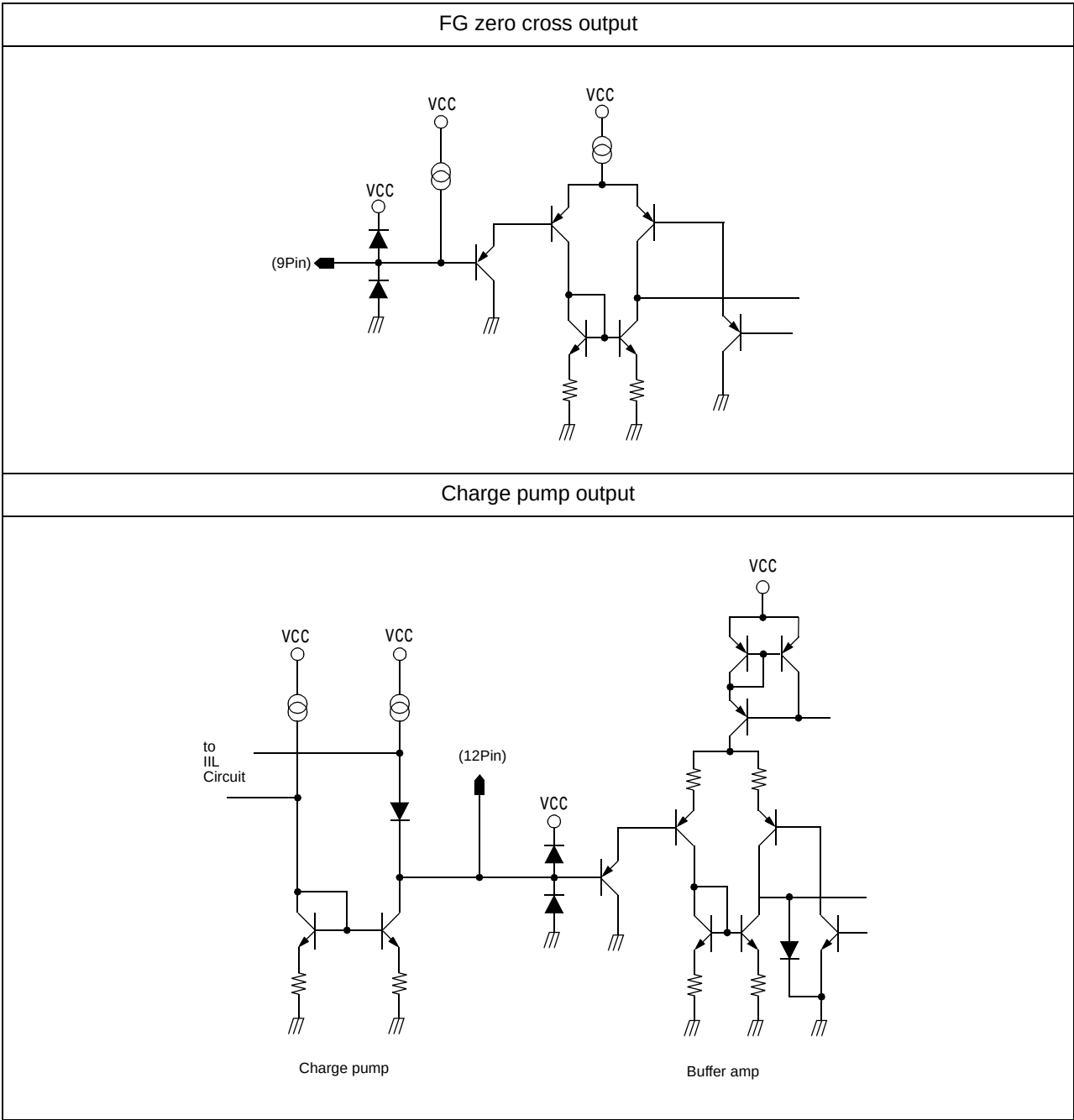
Equivalent Circuits

U_amp, V_amp input	U, V, W drive output and current detection 1, 2
FG input and FG output	OSC input
CE input	Hall bias input and voltage regulator output

Equivalent Circuits (Continued)

Index pulse width detection output	Phase compensation and current detection 1, 2
RPM select input	AGC input
Index output	Index burst output

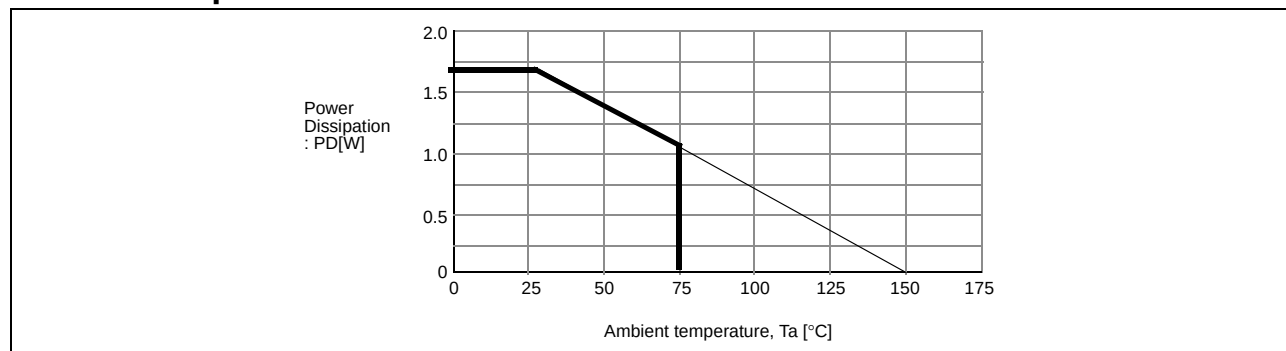
Equivalent Circuits (Continued)



Absolute Maximum Rating (Ta=25°C)

Parameter	Symbol	Value	Unit
Maximum power supply voltage	V _{CCMAX}	7.0	V
Maximum input voltage	V _{INMAX}	0 ~ V _{CC}	V
Maximum output current	I _{OMAX}	1	A
Normal output current	I _O	0.7	A
Power dissipation	P _D	1.5	W
Operating temperature	T _A	0 ~ 75	°C
Junction temperature	T _J	150	°C
Storage temperature	T _{STG}	-55 ~ +125	°C

Power Dissipation Curve



Power dissipation decreases in the rate of 13.5mW / °C when mounted on 50mm × 50mm × 1mm PCB (Phenolic resin material) and used above Ta=25°C.

Recommended Operating Conditions (Ta=25°C)

Parameter	Symbol	Min.	Typ.	Max	Unit
Supply voltage	V _{CC1} , V _{CC2}	10.8	12.0	13.2	V
Supply voltage in logic part	V _{CC3}	4.5	5.0	5.5	V
Ambient operating temperature range	T _a	0	-	+70	°C

Temperature Characteristic

Parameter	Symbol	Min.	Typ.	Max	Unit
Thermal shutdown temperature ^{note}	T _{SD}	125	150	-	°C

NOTE:

Reference value

Electrical Characteristics

(Ta=25°C, V_{CC}=5V)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
SUPPLY CURRENT						
Supply current 1	I _{CCO}	V _{CC} =6.5V CE=H, RPM=L	-	1.0	2.0	mA
Supply current 2	I _{CC}	V _{CC} =6.5V, CE=L	-	15	23	mA
CHIP ENABLE						
Input current	I _{CE}	CE=0~5V	-	5	10	μA
Input low voltage	I _{CE1}	-	-	-	1.0	V
Input high voltage	I _{CEH1}	-	3.5	-	-	V
RPM SELECT						
Input current	I _{RPM}	CE=0~5V	-	5	10	μA
Input low voltage	V _{RPM1}	-	-	-	1.0	V
Input high voltage	V _{RPMH}	-	3.5	-	-	V
HALL AMP						
Input resistance ^{note}	R _{IN}	-	1	10	-	kΩ
Common mode input voltage range ^{note}	V _{COM}	-	2.0	-	V _{CC}	V
Differential input voltage range ^{note}	V _{DIF}	-	100	-	420	mV _{PP}
START-UP						
Hall bias voltage 1	V _{HB1}	I _H =4mA, CE=L	2.3	2.5	2.7	V
Hall bias voltage 2	V _{HB2}	I _H =10mA, CE=L	2.7	2.9	3.1	V
Reference voltage	V _{ref}	I _O =1mA, CE=L	1.7	2.2	2.7	V
Bias off current	I _{HOFF}	V _H =7V, CE=H	-	5	10	μA
OUTPUT AMP						
Leakage current	I _{CER}	-	-	0.5	1	mA
Saturation voltage 1	V _{sat1}	I _O =0.35A	-	1.0	1.2	V
Saturation voltage 2	V _{sat2}	I _O =0.7A	-	1.3	1.8	V
BUFFER & CONTROL AMP						
Voltage gain 1 ^{note}	G _{CT1}	-	-	-11	-	dB
Reference voltage 1 ^{note}	V _{ref1}	Current limiter voltage	0.205	0.208	0.210	V
Reference voltage 2 ^{note}	V _{ref2}	Control begin voltage	-	0.69	-	V

Notes:

Reference value

Electrical Characteristics (Continued)

(Ta=25°C, V_{CC}=5V)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
CHARGE PUMP						
Charge current	I _{CP-}	RPM=L	-15	-20	-25	μA
Discharge current	I _{CP+}	RPM=L	15	20	25	μA
Current ratio ^{note}	I _R	I _{CP+} / I _{CP-}	0.9	1.0	1.1	-
Off current	I _{OFF}	V _{CP} =0.63V	-	-	50	nA
Clamp voltage ^{note}	V _{CLP}	-	-	1.3	1.5	V
FG AMP						
Output DC voltage ^{note}	V _{FG}	-	1.0	1.3	1.6	V
Voltage gain 2	G _{FG}	-	24	34	44	dB
Input voltage range ^{note}	V _{IN}	-	2.0	-	20	mV _{P-P}
Noise margin 1 ^{note}	N _D	Differential noise	-	-	0.5	mV _{P-P}
Noise margin 2 ^{note}	N _C	Common mode noise	-	-	0.5	V _{P-P}
SPEED CONTROL						
Count range 1 ^{note}	N1	RPM=L	-	1666.5	-	-
Count range 2 ^{note}	N2	RPM=H	-	1388.5	-	-
Operating freq.	F _D	-	-	1.0	1.1	MHz
BURST ADJUSTMENT						
Input current	I _{BI}	-	-	1	2	μA
Threshold voltage 1	V _{TH1}	RPM=L	1.2	1.45	1.7	V
Threshold voltage 2	V _{TH2}	RPM=H	1.05	1.3	1.55	V
PULSE WIDTH ADJUSTMENT						
Ct2 charge current	I _{CT2}	-	-19	-25	-36	μA
Threshold voltage 3	V _{TH3}	-	0.9	1.1	1.3	V
INDEX OUTPUT						
Output leakage current ^{note}	I _{OH}	-	-	1	2	μA
Output low voltage	V _{O1}	I _O =1mA	-	0.2	0.4	V

Notes:

Reference value

Application Information

1. CHIP ENABLE

This function turns on or off all blocks by low or high signal.

2. U, V AND W PHASE OUTPUT AMP

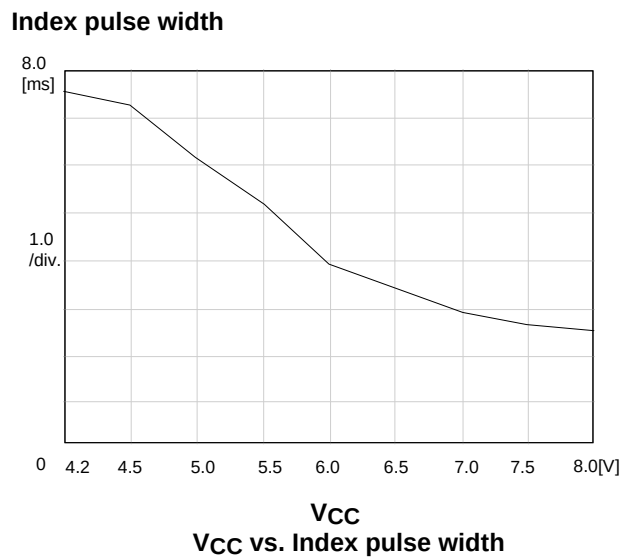
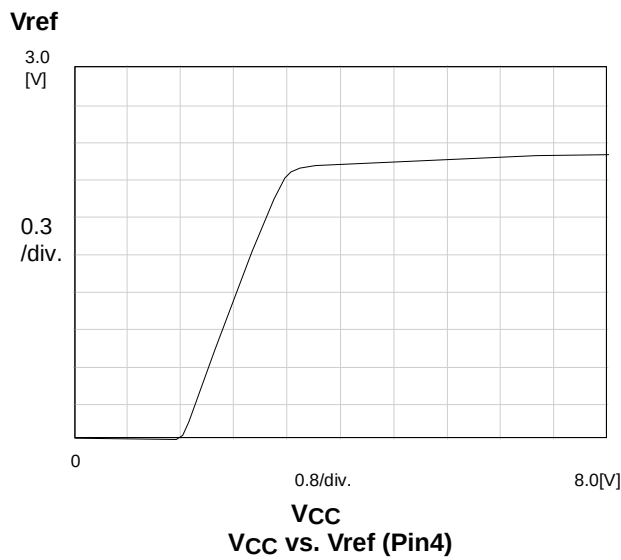
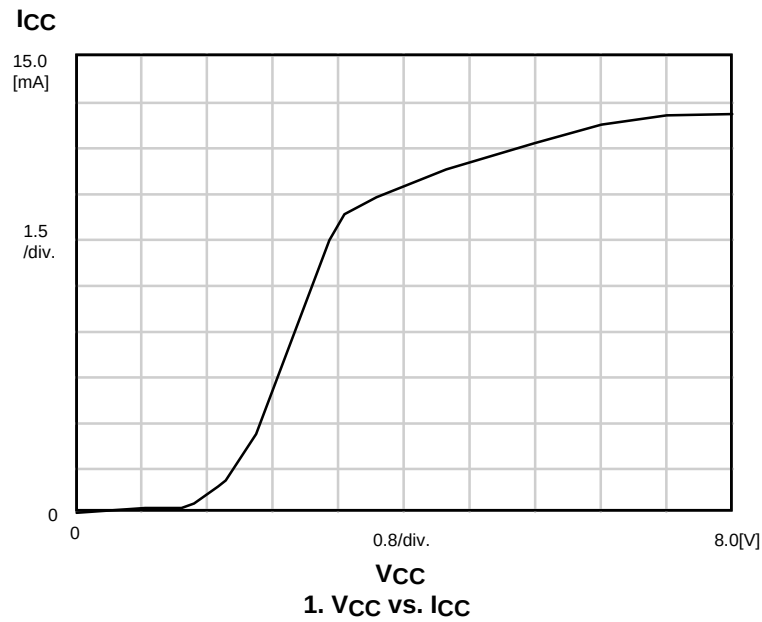
These amplifiers drives three output phases - U, V, and W which have 120(degree) phase differences with each other. The three phase waveforms are made with the two hall sensor signals by synthesizing the third phase signal.

3. SPEED CONTROL PART

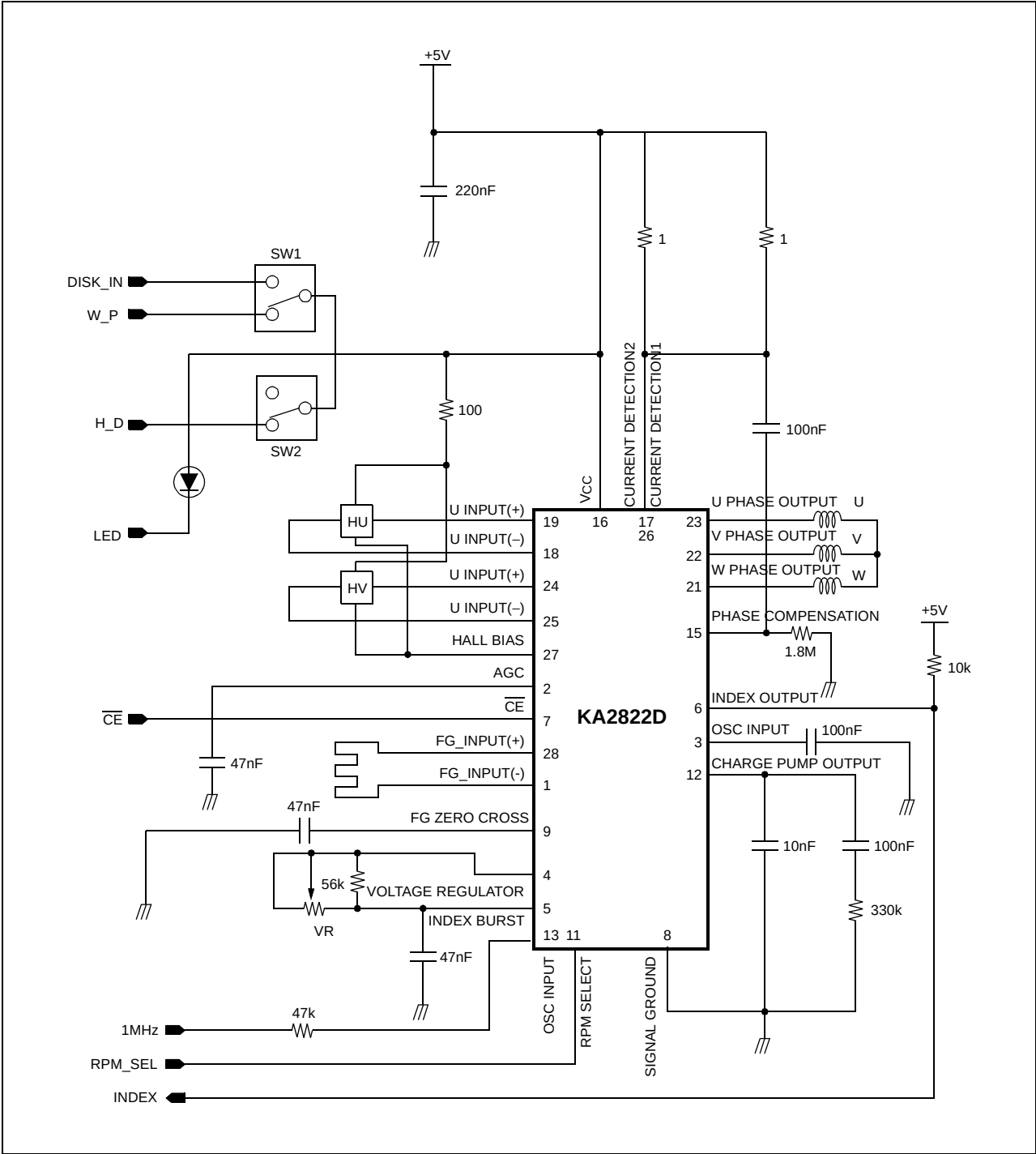
This function compares the real motor rotation frequency with the 300 or 360Hz pulse divided from 1MHz clock pulse for removing speed error when motor is on and speed error is detected by PLL.

The speed error sent to charge pump part which repeats charge and discharge controls the output current of the output amp to keep a stable rotation.

Typical Performance Characteristics



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.