Three Phase Sensorless BLDC Motor Controller

Description

The FT3003 is a Three Phase sensorless BLDC Motor controller. Due to its adaptive features and wide power-supply range capabilities, FT3003 is intended to cover a wide range of motor characteristics, while requiring minimal tuning from the user. Two drive modes are provided, namely SBLDC (quasi-sine-wave) modulation or BLDC (120°). Speed can be controlled either by setting the closed speed reference directly or through the adjustment of PWM duty cycle linearly proportional to the output speed. Speed indicator is provided through a Frequency Generator output (FG×3), generating digital pulse with its frequency proportional to the speed of the motor. FT3003 has an automatic internal bootstrap charge management scheme ensuring that the bootstrap capacitor is always sufficiently charged for safe operation of the power MOSFETS.

Protection functions of FT3003 are comprehensive including lock protection and automatic recovery, under voltage, thermal shutdown, current limit and over current protections. These prevent the control circuits and the motor from being damaged, particularly under stressed applications and demanding environments.

Feature

- Position sensorless BLDC controller
- Selectable SBLDC (quasi-sine-wave) or BLDC (120°) drives
- Lead angle control
- Closed loop speed control
- Direct or PWM duty cycle adjusted (linear) closed loop speed control
- FG (Frequency Generator)
- Current limit and over current protection
- Built-in independent operational amplifier
- Built-in lock protection and automatic recovery circuit
- Built-in thermal shutdown protection (TSD)
- Built-in under voltage lock out protection. (UVLO)
- Built-in over voltage protection of motor driver

Block Diagram
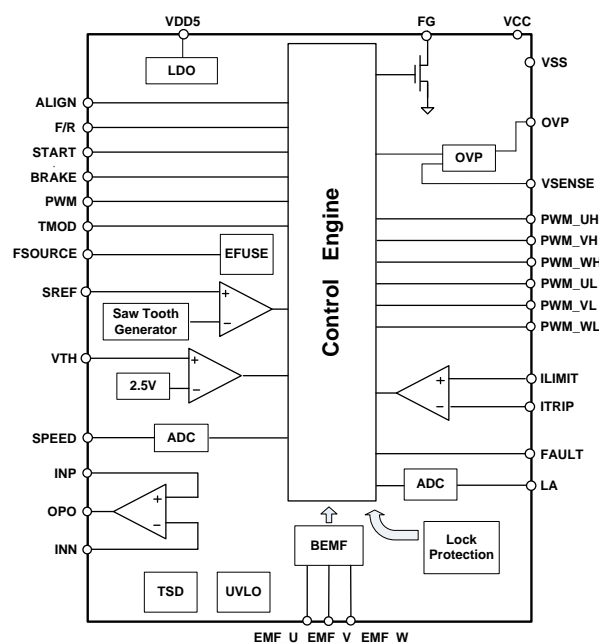
Pin Assignment
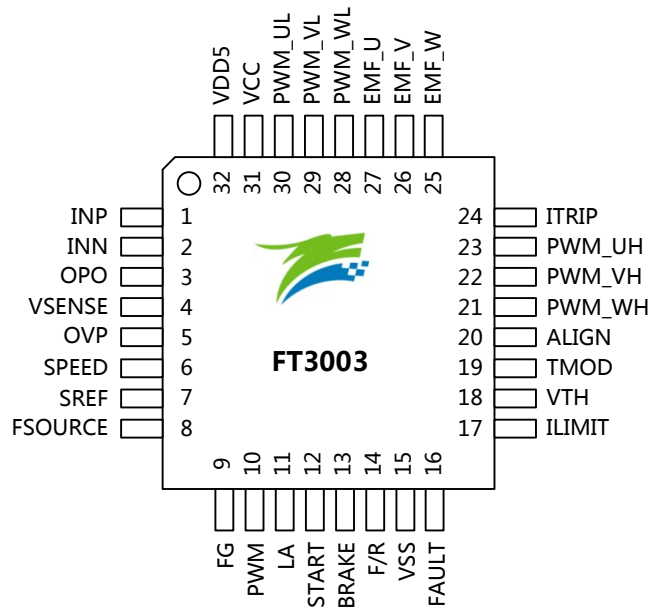
Pin Configuration

PIN NO.	PIN Name	Type	Description
1	INP	I	The positive input of the operational amplifier
2	INN	I	The negative input of the operational amplifier
3	OPO	O	The output of the operational amplifier
4	VSENSE	I	Motor Drive Voltage-Sensing Resistor. Designed for determining the voltage level of over-voltage protections.
5	OVP	O	Motor Drive Over-Voltage Protection Output. It can be connected to an external power transistor for discharging the back EMF.
6	SPEED	I	Reference speed analog input
7	SREF	I	Analog input voltage for linear reference speed adjustment.
8	FSOURCE	I	Test signal input, connect to GND.
9	FG	O	Open drain. Frequency Generator, speed signal output.
10	PWM	I	PWM duty cycle input for linear reference speed adjustment. Internal pull-up.
11	LA	I	Lead angle select analog input
12	START	I	Motor start input. High: Start; Low: Free. Internal pull-up.
13	BRAKE	I	Brake signal input. Low: Brake. Internal pull-up.
14	F/R	I	Motor rotation direction input
15	VSS	GND	Signal and power ground.
16	FAULT	I	Over current protection input. Internal pull-up
17	ILIMIT	I	Current limit analog input

PIN NO.	PIN Name	Type	Description
18	VTH	I	Over-temperature protection
19	TMOD	I	Test mode select, normal application connect to GND
20	ALIGN	I	Choose whether to align the rotor to a known position at first. High: Aligned; Low: Unaligned
21	PWM_W	O	PWM output of phase W, High side.
22	PWM_VH	O	PWM output of phase V, High side.
23	PWM_UH	O	PWM output of phase U, High side.
24	ITRIP	I	Current sensor voltage feedback analog input
25	EMF_W	I	Phase W back EMF.
26	EMF_V	I	Phase V back EMF.
27	EMF_U	I	Phase U back EMF.
28	PWM_WL	O	PWM output of phase W, Low side .
29	PWM_VL	O	PWM output of phase V, Low side .
30	PWM_UL	O	PWM output of phase U, Low side .
31	VCC	POW	Power supply
32	VDD5	O	Digital power output, LDO DC5V output for digital signal.

Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may be damaged or may not function or be operational above these ratings and stressing the device to/above these levels is not recommended. Fortior does not recommend exceeding or designing about the Absolute Maximum Ratings.

Parameter	Symbol	Condition	Ratings	Unit
Power supply voltage	$V_{cc}max$		30.0	V
Logic input pin withstand voltage	$V_{logic}max$		5.5	V
FG output pin withstand voltage	$V_{FG}max$		30.0	V
FG output current	$I_{FG}max$		10	mA
Operating temperature	Topr		-40~+125	℃
Storage temperature	Tstg		-65~+150	℃

Recommended Operating Conditions

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications.

Symbol	Parameter	Min.	Typ.	Max.	Unit
Power supply voltage	V_{cc}	3.7	12	18	V