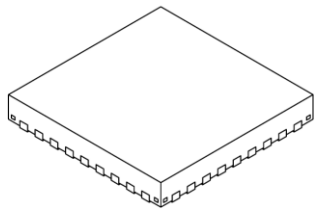
CDMOS Linear Integrated Circuit Silicon Monolithic

TC78B011FTG

Sensorless Sine-wave PWM predriver for 3-phase brushless motor

1. Outline

The TC78B011FTG is a 3-phase PWM chopper predriver for sensorless brushless motor. Motor speed can be controlled by selecting among the PWM duty cycle, analog voltage, and I²C. Non-volatile memory (NVM) is implemented and it can set according to the motors and directions for use. It also realizes closed loop speed control function without an external microcontroller. TC78B011FTG is used with six external MOSFETs inverter to drive sensorless brushless motors of which output range is wide.



P-WQFN36-0505-0.50-001

Weight: 0.06 g (typ.)

2. Applications

Fan, Pump, Portable Vacuum motors

3. Features

- Sine-wave drive
- Sensorless PWM drive
- Capable to drive Delta or Wye configured motors
- Operating voltage: 5.5 to 27V (absolute maximum rating: 30V)
- Predriver for high side and low side N-ch MOSFETs drive
- 8 selectable levels of gate drive current
- Built-in closed loop speed control with adjustable speed curve
- Motor speed control by analog voltage, PWM duty cycle, or I²C
- Serial interface (I²C) for various settings
- Standby mode (by STBY pin)
- Current monitor output (PHBF pin)
- CW/CCW control (CWCCW pin)
- Brake input pin (BRAKE pin)
- Rotation speed output (FG pin)
- Abnormality detection output (ALERT pin)
- Thermal shutdown (TSD)
- Under voltage lockout (UVLO)
- Charge pump low voltage detection (CPVSD)
- Output current limit (OCP)
- Over current detection (ISD)
- Lock protection
- Small QFN36 package

Start of commercial production
2022-01

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Notes on Contents

1. Block Diagrams

Some of the functional blocks, circuits, or constants in the block diagram may be omitted or simplified for explanatory purposes.

2. Equivalent Circuits

The equivalent circuit diagrams may be simplified or some parts of them may be omitted for explanatory purposes.

3. Timing Charts

Timing charts may be simplified for explanatory purposes.

4. Application Circuits

The application circuits shown in this document are provided for reference purposes only. Thorough evaluation is required, especially at the mass production design stage.
Providing these application circuit examples does not grant a license for industrial property rights.

IC Usage Considerations

Notes on handling of ICs

(1) The absolute maximum ratings of a semiconductor device are a set of ratings that must not be exceeded, even for a moment. Do not exceed any of these ratings.
Exceeding the rating(s) may cause the device breakdown, damage or deterioration, and may result injury by explosion or combustion.

(2) Use an appropriate power supply fuse to ensure that a large current does not continuously flow in case of over current and/or IC failure. The IC will fully break down when used under conditions that exceed its absolute maximum ratings, when the wiring is routed improperly or when an abnormal pulse noise occurs from the wiring or load, causing a large current to continuously flow and the breakdown can lead smoke or ignition. To minimize the effects of the flow of a large current in case of breakdown, appropriate settings, such as fuse capacity, fusing time and insertion circuit location, are required.

(3) If your design includes an inductive load such as a motor coil, incorporate a protection circuit into the design to prevent device malfunction or breakdown caused by the current resulting from the inrush current at power ON or the negative current resulting from the back electromotive force at power OFF. IC breakdown may cause injury, smoke or ignition.
Use a stable power supply with ICs with built-in protection functions. If the power supply is unstable, the protection function may not operate, causing IC breakdown. IC breakdown may cause injury, smoke or ignition.

(4) Do not insert devices in the wrong orientation or incorrectly.
Make sure that the positive and negative terminals of power supplies are connected properly.
Otherwise, the current or power consumption may exceed the absolute maximum rating, and exceeding the rating(s) may cause the device breakdown, damage or deterioration, and may result injury by explosion or combustion.
In addition, do not use any device that is applied the current with inserting in the wrong orientation or incorrectly even just one time.

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Points to remember on handling of ICs

(1) Over current Protection Circuit
Over current protection circuits (referred to as current limiter circuits) do not necessarily protect ICs under all circumstances. If the Over current protection circuits operate against the over current, clear the over current status immediately.
Depending on the method of use and usage conditions, such as exceeding absolute maximum ratings can cause the over current protection circuit to not operate properly or IC breakdown before operation. In addition, depending on the method of use and usage conditions, if over current continues to flow for a long time after operation, the IC may generate heat resulting in breakdown.

(2) Thermal Shutdown Circuit
Thermal shutdown circuits do not necessarily protect ICs under all circumstances. If the thermal shutdown circuits operate against the over temperature, clear the heat generation status immediately.
Depending on the method of use and usage conditions, such as exceeding absolute maximum ratings can cause the thermal shutdown circuit to not operate properly or IC breakdown before operation.

(3) Heat Radiation Design
In using an IC with large current flow such as power amp, regulator or driver, please design the device so that heat is appropriately radiated, not to exceed the specified junction temperature (Tj) at any time and condition. These ICs generate heat even during normal use. An inadequate IC heat radiation design can lead to decrease in IC life, deterioration of IC characteristics or IC breakdown. In addition, please design the device taking into considerate the effect of IC heat radiation with peripheral components.

(4) Back-EMF
When a motor reverses the rotation direction, stops or slows down abruptly, a current flow back to the motor's power supply due to the effect of back-EMF. If the current sink capability of the power supply is small, the device's motor power supply and output pins might be exposed to conditions beyond absolute maximum ratings. To avoid this problem, take the effect of back-EMF into consideration in system design.

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