TB6586BFG

Usage considerations

Summary

The TB6586BFG is a controller IC for three-phase DC brushless motor drive applications. It can drive a motor on a 150 degree commutation system in either of two directions. To change the direction of the motor, first stop the motor rotation before changing the control signals. The rotational direction should not be changed while the motor is rotating. The TB6586BFG is a product intended to be used for fans.

Table of Contents

1. Power supply voltage

Power supply voltage usage range

Characteristic	Symbol	Operating voltage range	Unit
Power supply for control block	V_{cc}	6.5 to 16.5	V

2. Control input (RES, CW/CCW, VSP, LA)

(1) Input method
The RES, CW/CCW, and LA input signals should be open or low, until Vcc has settled.
Settle VM after Vcc is settled.

(2) VSP input
Vsp input voltage range is zero to 7 V. Voltage can be energized regardless of Vcc condition.

3. Oscillation circuit

(1) Operating oscillation range

Item	Condition	Operating voltage range	Unit
Carrier frequency	OSC/C=390 pF, OSC/R=9.1 kΩ	18 to 22	kHz
	OSC/C=390 pF, OSC/R=10 kΩ	16.2 to 19.8	

(2) Connection
Place the capacitor and resisters'GND as close as possible to the IC's GND pin.

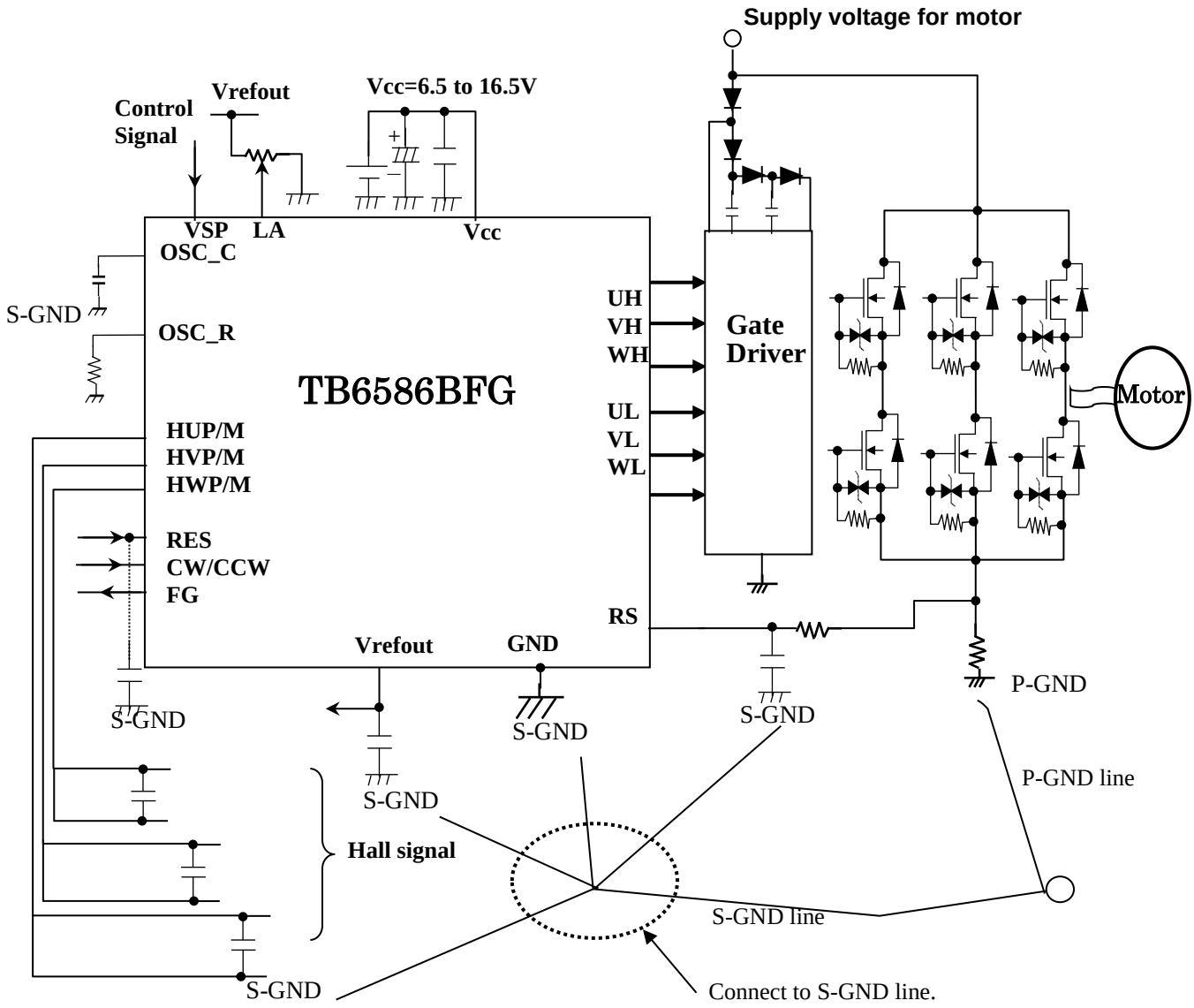
(3) Calculation formula
Typical oscillation frequency can be calculated by the equations below.

$F_{OSC} = 1/\{(2\times Vth\times C/I)\times 1.8\}$ .....I=Vi×G/R
$= 1/\{2\times Vth\times C/(Vi\times G/R)\times 1.8\}$

C = External capacitor (390 pF)
R = External resistance (9.1 kΩ)
Vth = Triangle-wave slesh voltage (Design value: 0.277 V)
Vi = Current switch reference voltage (Design value: 1 V)
G = Constant current amp rate (Design value: 18)

Carrier frequency is determined by the equation below.
Carrier frequency = Fosc / 252
OSC/C, OSC/R is recommended to be set by case (1).

4. Application circuit



(1) Capacitors for power supply
Connect capacitors between Vcc and GND as near the IC as possible.

<Recommended value>

Characteristic	Recommended value	Remarks
Vcc - GND:	10 μF to 33 μF	Electrolytic capacitor
	0.001 μF to 0.22 μF	Ceramic capacitor

(2) Capacitor for Vrefout
Connect capacitors between Vrefout and GND as near the IC as possible.

<Recommended value>

Characteristic	Recommended value	Remarks
Vrefout - GND:	0.22 μF to 1.0 μF	Ceramic capacitor

Vrefout pin line is used as the reference power supply of the IC internal circuit. To prevent parasitic oscillation, be sure to connect a capacitor whether the Vrefout power supply is used or not used. Place the negative side of the capacitor as close as possible to the IC's S-GND.

(3) Capacitors between hall signals
The hall input pin is susceptible to noise because it has high impedance. To prevent malfunction, connect a condenser between upper and under side pins. The capacitance is recommended 0.001 μF to 0.1 μF.

When the hall signal is detected less than 5 Hz, 120°energization and 150°energization is switched. The 5-Hz detection is detected by each hall amplifier output and the edge width, which are judged the upper and lower value of 5 Hz /6 = 33 ms. If the value is less than 33 ms, 150°energization is selected. When the motor starts driving, the noise pulse enters to the hall amplifier output, the driving output according to the pulse width is output with 150°energization if 5 Hz is detected. The noise should not be entered to the hall signals.

(4) Capacitor for RES
The RES pin is susceptible to noise because it has a high impedance. To prevent malfunction, connect a capacitor to the RES pin when necessary. Place the load side of the capacitor as close as possible to the IC's S-GND pin.

(5) Filter RS pin
The RS pin includes a 200 kΩ + 5 pF filter. However, connect a C, R filters from the external IC pin in order to prevent this pin from being affected by noise. Determine the C, R filter values by the noise frequencies to be filtered. Place the negative side of the capacitor as close as the IC's S-GND pin.

(6) GND pattern
Connect the IC's GND pin to signal GND line. Avoid connecting it to the driver's P-GND line (passed through the motor) with a common impedance.

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 Circuit
   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.
   Toshiba does not grant any license to any industrial property rights by providing these examples of application circuits.

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 device breakdown, damage or deterioration, and may result in injury by explosion or combustion.

(2) Use an appropriate power supply fuse to ensure that a large current does not continuously flow in the case of overcurrent 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 to smoke or ignition. To minimize the effects of the flow of a large current in the 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 device breakdown, damage or deterioration, and may result in injury by explosion or combustion.
In addition, do not use any device inserted in the wrong orientation or incorrectly to which current is applied even just once.

Points to remember on handling of ICs

(1) Overcurrent detection Circuit
Overcurrent detection circuits (referred to as current limiter circuits) do not necessarily protect ICs under all circumstances. If the overcurrent detection circuits operate against the overcurrent, clear the overcurrent status immediately.
Depending on the method of use and usage conditions, exceeding absolute maximum ratings may cause the overcurrent detection circuit to operate improperly or IC breakdown may occur before operation. In addition, depending on the method of use and usage conditions, if overcurrent 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, exceeding absolute maximum ratings may cause the thermal shutdown circuit to operate improperly or IC breakdown to occur before operation.

(3) Heat Radiation Design
When using an IC with large current flow such as power amp, regulator or driver, design the device so that heat is appropriately radiated, in order not to exceed the specified junction temperature (TJ) at any time or under any 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, when designing the device, take into consideration the effect of IC heat radiation with peripheral components.

(4) Back EMF
When a motor rotates in the reverse direction, stops or slows abruptly, current flows back to the motor's power supply owing 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 the absolute maximum ratings. To avoid this problem, take the effect of back-EMF into consideration in system design.

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