

Toshiba Bi-CMOS Linear Integrated Circuit Silicon Monolithic

TB9051FTG

PWM type single channel H-Bridge DC brushed motor driver for automotive use

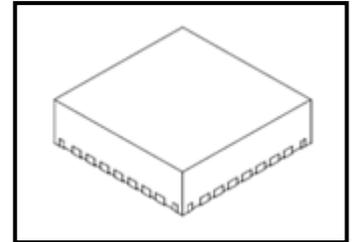
1. Outline

This product is a motor driver IC which incorporates the output driver for the direct drive of a DC brushed motor intended for the automotive use.

The motor drive output can be highly efficient operation by the PWM control which realizes low-on resistance.

Forward / Reverse / brake mode can be selected due to PWM1 signal and PWM2 signal, and the motor operation mode and stop mode can be selected by ENABLE pin.

Moreover, the output current capacity is 5A (max), it is suitable for various automotive applications such as a throttle and valve control, various engine bulbs, storing of door mirrors, and a seat positioning.



P-QFN28-0606-0.65-001

2. Application

Automotive applications such as a throttle and valve control, various engine bulbs, and storing of door mirrors

3. Feature

- Motor driver block: Single channel H-Bridge driver
($R_{on}(Pch+Nch) < 0.45 \Omega$ (Max @ $T_j = 150^\circ\text{C}$, $V_{BAT} = 8\text{ V}$)
- Abnormality detection function: Over-current detection, over-temperature detection, VBAT undervoltage detection, VCC undervoltage detection, and VCC high voltage detection
- Built-in initial diagnosis function: Power supply abnormality detection circuit (VBAT undervoltage, VCC undervoltage and VCC high voltage.)
- Output type: PWM control output
- Motor operation: Forward /Reverse/ Brake
- Current limitation control: Current limiter with chopper type
- Output high-side current monitoring function (OCM pin)
- DIAG output
- Built-in the through current prevention circuit
- Operating voltage range: VBAT = 4.5 to 28 V (Maximum ratings of power supply voltage 40V (max): 0.5 sec.)
- Operating temperature range: $T_a = -40^\circ\text{C}$ to 125°C
- Compact type flat package: P-QFN28-0606-0.65-001

4. Block Diagram

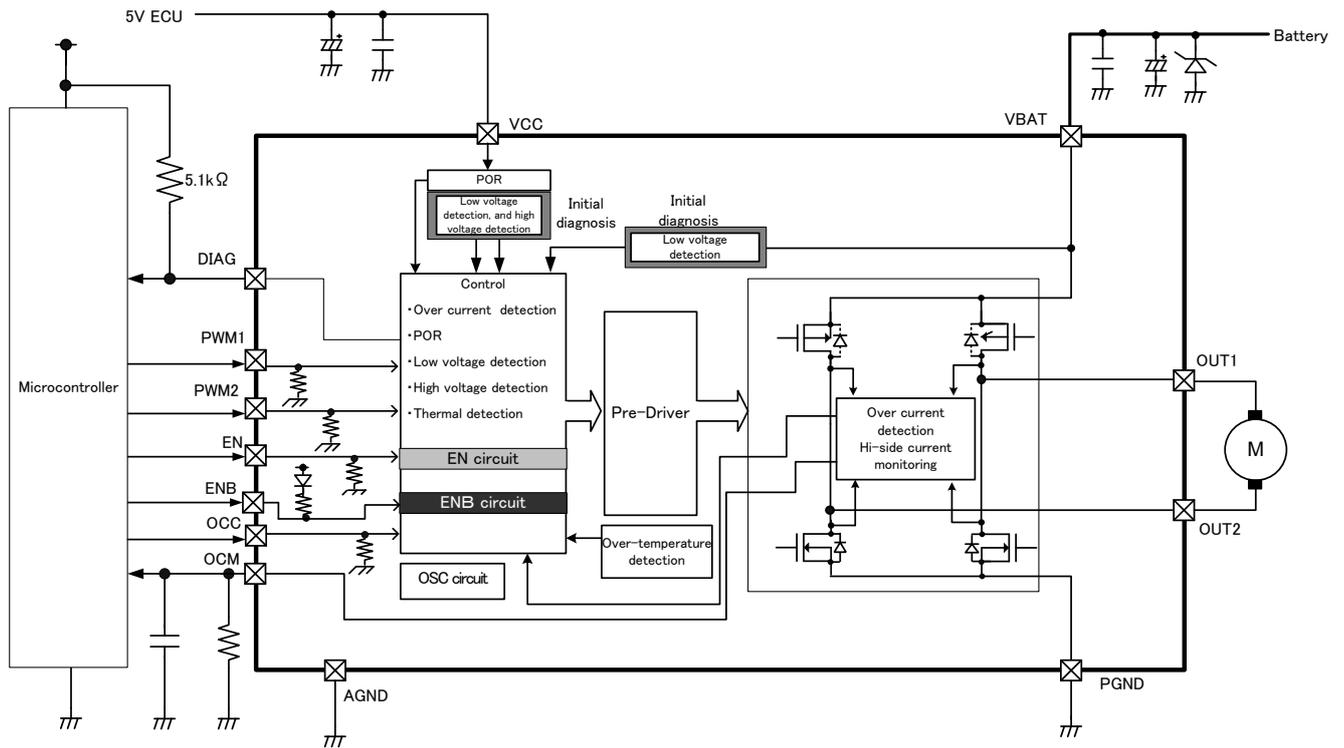


Table 4.1 Block diagram

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

5. Motor Driver Output Circuit Functional

The output circuit operates according to the following function (Table 1,2,3).

Table1 Motor function

	PWM1	PWM2	EN	ENB	DIAG pin	OUT1	OUT2
Forward	H	L	H	L	H	H	L
Short brake	L	L	H	L	H	L	L
Reverse	L	H	H	L	H	L	H
Short brake	H	H	H	L	H	L	L
EN Disable	X	X	L	X	L	Hi-Z	Hi-Z
ENB Disable	X	X	X	H	L	Hi-Z	Hi-Z
EN Disconnected	X	X	Hi-Z	X	L	Hi-Z	Hi-Z
ENB Disconnected	X	X	X	Hi-Z	L	Hi-Z	Hi-Z
PWM1 Disconnected	Hi-Z	L/H	H	L	H	L	L/H
PWM2 Disconnected	L/H	Hi-Z	H	L	H	L/H	L

Table2 Function operation at abnormality detection

	PWM1	PWM2	EN	ENB	DIAG pin	OUT1	OUT2
Over-temperature detection	Output is OFF regardless of input signals.				L	Hi-Z	Hi-Z
Over-current detection					L	Hi-Z	Hi-Z
VBAT undervoltage detection					L	Hi-Z	Hi-Z
VCC undervoltage detection					L	Hi-Z	Hi-Z
VCC high voltage detection					L	Hi-Z	Hi-Z

Table3 Output state

OUT1/2	High-side Driver	Low-Side Driver
H	ON	OFF
L	OFF	ON
Hi-Z	OFF	OFF

6. Example of application circuit

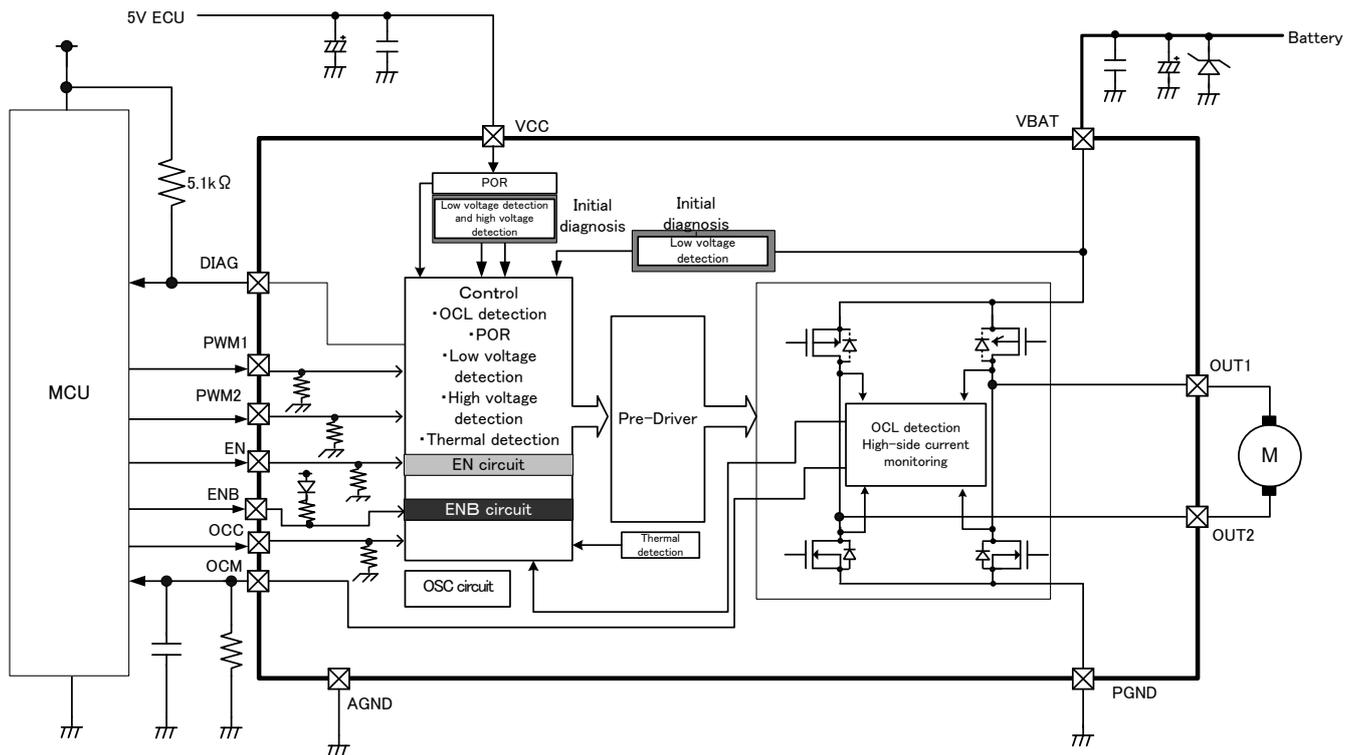


Table 6.1 Example of application circuit

- Note 1: Some of the functional blocks, circuits in the block diagram may be omitted or simplified for explanatory purposes.
- Note 2: Do not insert devices in the wrong orientation or incorrectly. Otherwise, it may cause device breakdown, damage and/or deterioration.
- Note 3: 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.
- Note 4: Careful attention should be paid to the layout of the output line, VBAT, VCC and GND line since IC may be destroyed due to short-circuit between outputs, to the power supply, or to the ground.
- Note 5: For the board design, it is necessary to consider the solid pattern of AGND and PGND.

Back-EMF

While a motor is rotating, there is a timing at which power is fed back to the power supply. At that timing, the motor current is fed back to the power supply owing to the effect of the motor back-EMF. If the power supply does not have enough sink capability, the power supply and output pins of the device might rise above the rated voltages. The magnitude of the motor back-EMF varies with usage conditions and motor characteristics. It must be fully verified that there is no risk that this product or other components will be damaged or fail owing to the motor back-EMF.

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