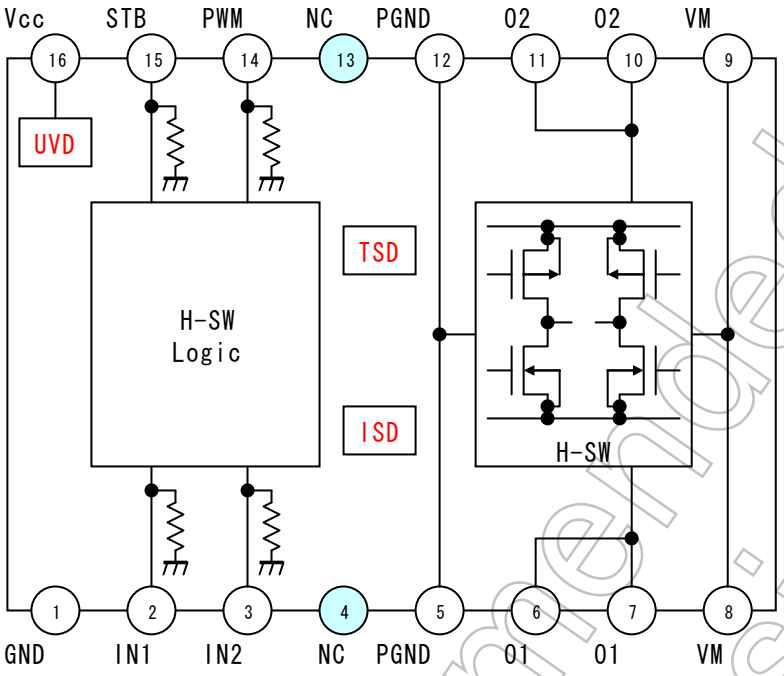
Block Diagram



Pin Functions

Pin No.	Pin name	I/O	Description	Remarks
1	GND	—	Small signal GND	Small signal GND
2	IN1	I	Control signal input 1	With 200 kΩ pull-down R
3	IN2		Control signal input 2	
4	NC	—	Non-connected	
5	PGND	—	Power GND	Motor GND
6	O1	O	Output 1	
7	O1			
8	VM	—	Motor power supply	VM = 2.5 V to 13.5 V
9	VM		Motor power supply	
10	O2	O	Output 2	
11	O2			
12	PGND	—	Power GND	Motor GND
13	NC	—	Non-connected	
14	PWM	I	PWM signal input	With 200 kΩ pull-down R
15	STBY		Stand by signal input	
16	Vcc	—	Small signal power supply	Vcc = 2.7 V to 5.5 V

Absolute Maximum Ratings (Ta = 25°C)

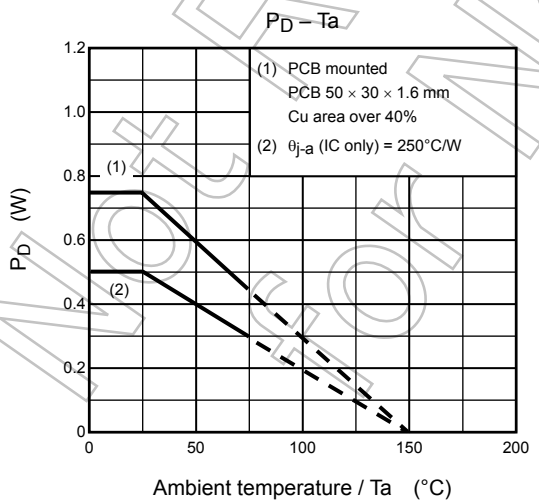
Characteristics	Symbol	Rating	Unit	Remarks
Supply voltage	VM	15	V	
	Vcc	6		
Input voltage	VIN	-0.2 to 6	V	IN1,IN2,PWM,STBY
Output voltage	Vout	-0.2 to 15	V	O1,O2
Output current	Iout	1.2	A	
	Iout (pulse)	3.2		tw = 20 ms(pulse), Duty ≤ 20%、*note
	Iout (peak)	4.5		tw = 50 ms、single pulse, *note
Power dissipation	PD	0.78	W	50 × 50 × 1.6 mm Cu 40% in PCB mounting
		0.5		IC only (θj-a = 250 °C/W)
Operating temperature	Topr	-20 to 85	°C	
Storage temperature	Tstg	-55 to 150	°C	

*Note: not guaranteed by testing

Operating Range (Ta = -20 to 85°C)

Characteristics	Symbol	Min	Typ.	Max	Unit	Remarks
Supply voltage	Vcc	2.7	3	5.5	V	
	VM	2.5	5	13.5	V	
Output current	Iout	—	—	1	A	VM ≥ 4.5 V
		—	—	0.5		2.5 V ≤ VM < 4.5 V
Switching frequency	fPWM	—	—	400	kHz	PWM efficiency ≥ 90%

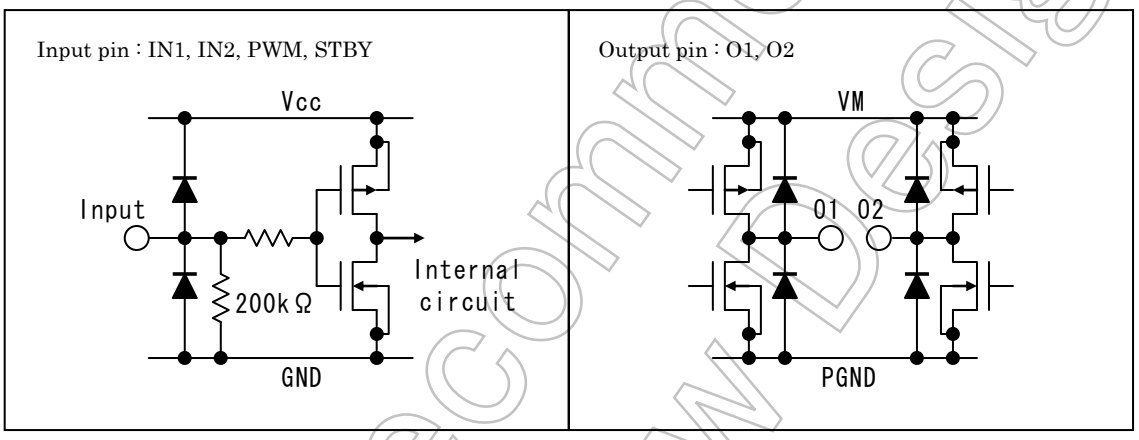
PD-Ta graph (for reference)



Function table

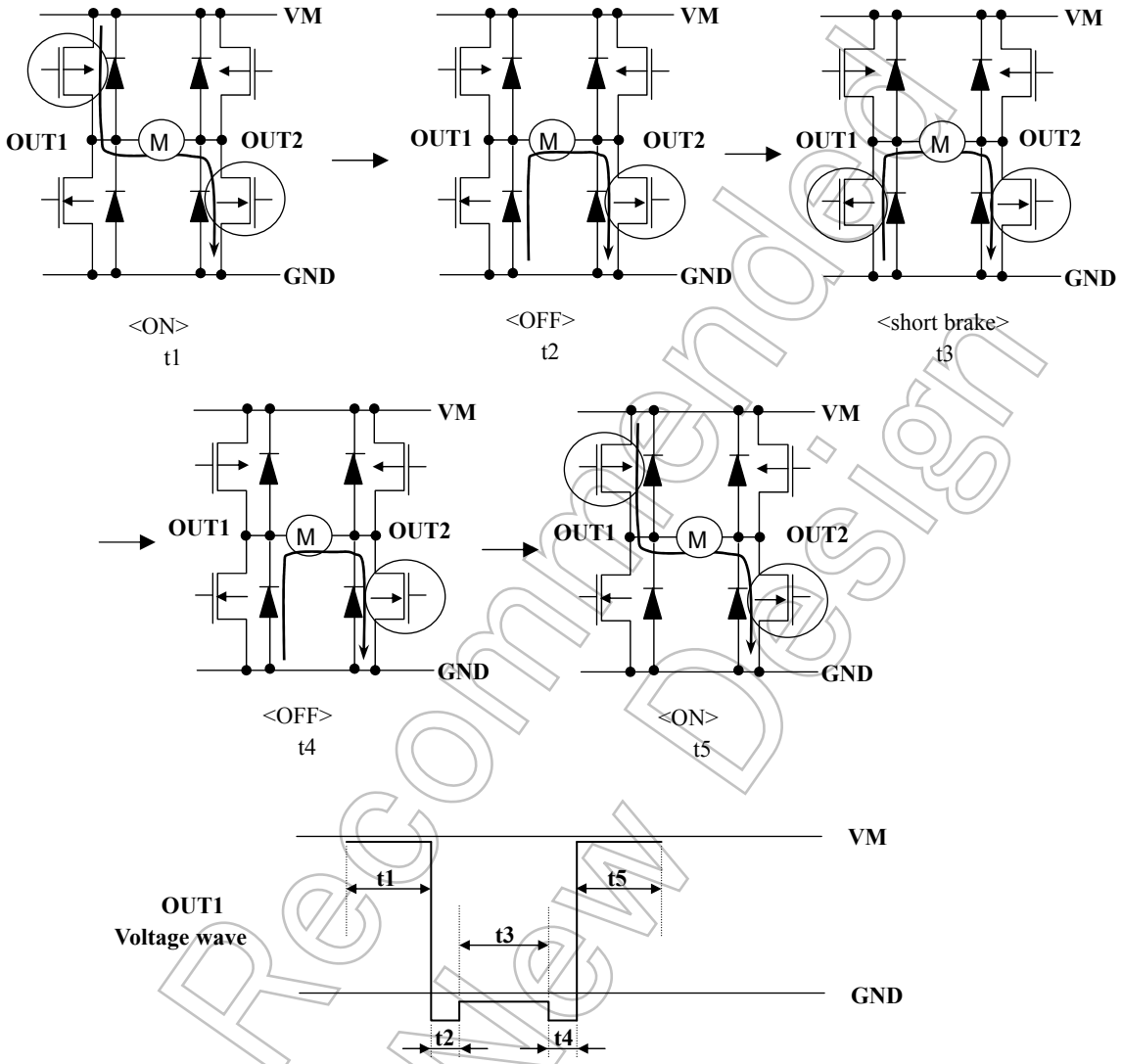
Input				Output		
IN1	IN2	STBY	PWM	O1	O2	Mode
H	H	H	–	L	L	Brake
L	H	H	H	L	H	CW(CCW)
			L	L	L	Brake
H	L	H	H	H	L	CCW(CW)
			L	L	L	Brake
L	L	H	–	OFF(Hi-Z)	OFF(Hi-Z)	Stop
–	–	L	–	OFF(Hi-Z)	OFF(Hi-Z)	Standby

(– : Don't care)



H-SW Operating Description

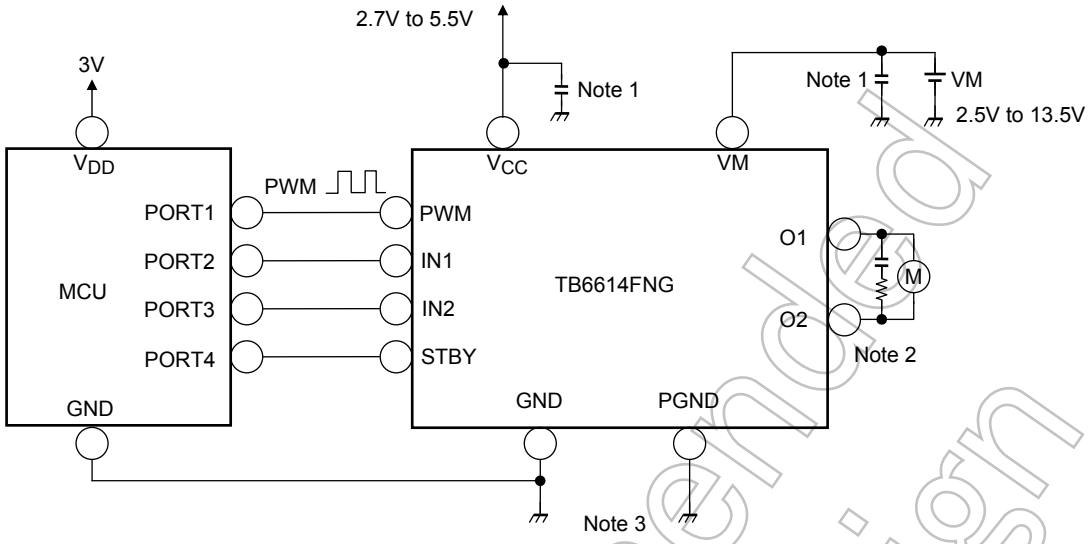
・To prevent penetrating current, dead time t2 and t4(Typ.=80ns) is provided in switching to each mode in the IC.



Electrical Characteristics (unless otherwise specified, Ta = 25°C, Vcc = 3 V, VM = 5 V)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Supply current	Icc	STBY=Vcc	—	1.5	2.5	mA
	Icc(STB)	STBY=0V	—	—	1	μA
	IM(STB)		—	—	1	
Control input voltage	VIH		2	—	Vcc+0.2	V
	VIL		-0.2	—	0.8	
Control input current	IIH	VIN=3V	10	15	22	μA
	IIL	VIN=0V	—	—	1	
Standby input voltage	VIH(STB)		2	—	Vcc+0.2	V
	VIL(STB)		-0.2	—	0.8	
Standby input current	IIH(STB)	VIN=3V	10	15	22	μA
	IIL(STB)	VIN=0V	—	—	1	
Output on-resistance	Ron	Io=1A,Vcc=VM=5V	—	0.3	0.45	Ω
Output leakage current	IL(U)	VM=Vout=15V	—	—	1	μA
	IL(L)	VM=15V,Vout=0V	-1	—	—	
Regenerative diode VF	VF(U)	IF=1A	—	0.9	1.1	V
	VF(L)		—	0.9	1.1	
Low voltage detecting voltage	UVLD	Vcc detection	—	2.0	—	V
Recovering voltage	UVLC		—	2.2	—	
Thermal shutdown circuit operating temperature	TSD		—	175	—	°C
Thermal shutdown hysteresis	ΔTSD		—	20	—	
Over current detecting current	ISD		—	5	—	A

Typical Application Diagram



Note 1: Capacitors for noise absorption of Vcc and VM power supplies should be connected as close as possible to the IC.

Note 2: Add a resistor for charge current limitation, if use the capacitor between the motor terminals to avoid noise.

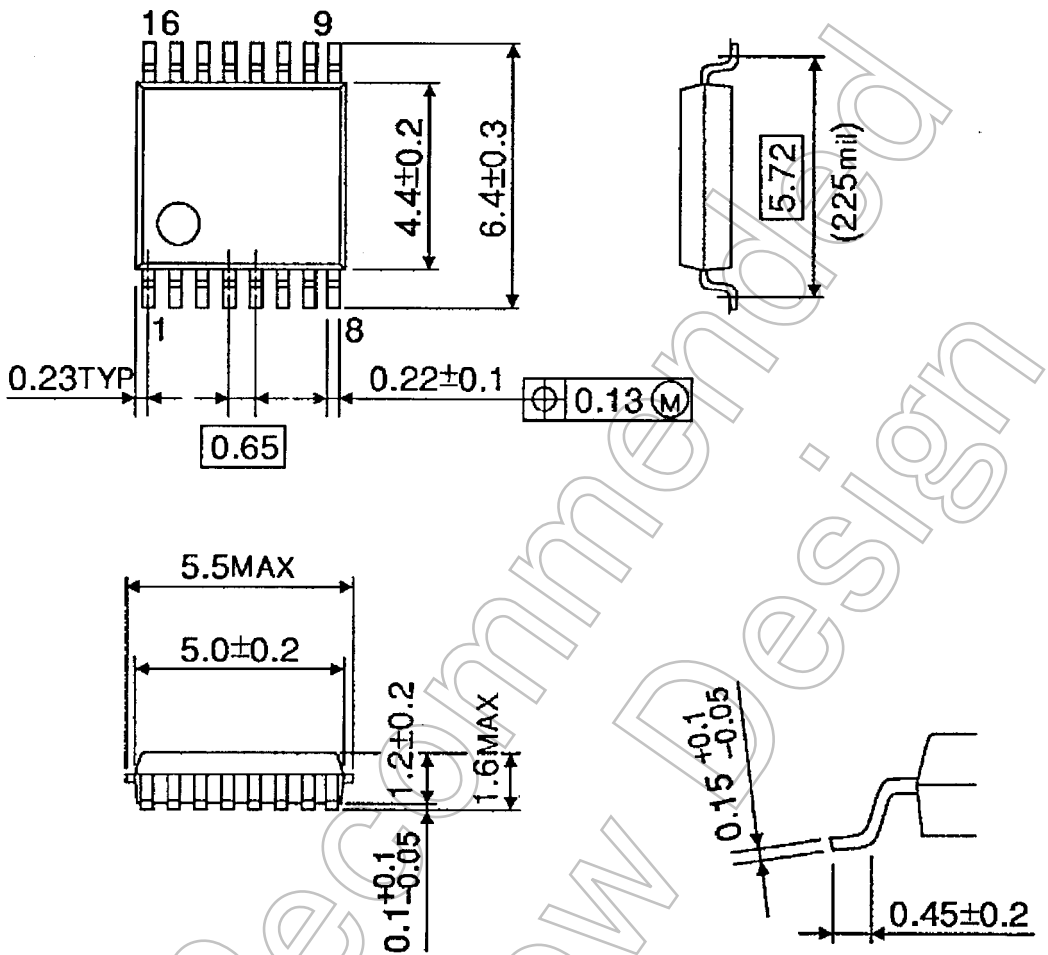
Note 3: Avoid common impedance between GND and PGND as possible.

Others: Design with extra care for Vcc, VM, GND, PGND lines as there is a possibility of IC destruction from short between output pins, power supply to output pin, ground to output pin, or adjacent pins.

Use fuse or current confine device for the application safety, when current beyond Absolute Maximum Rating would generate through IC.

Package Dimensions

SSOP16-P-225-0.65B Unit : mm



Weight: 0.07 g (typ.)

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.

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

5. Test Circuits

Components in the test circuits are used only to obtain and confirm the device characteristics. These components and circuits are not guaranteed to prevent malfunction or failure from occurring in the application equipment.

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.

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 (T_J) 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 rotates in the reverse 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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