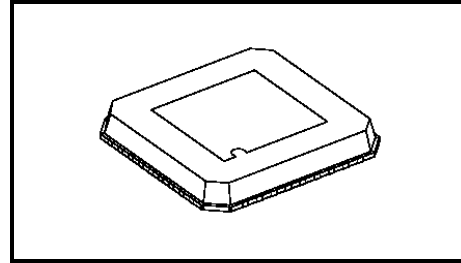


Toshiba Bi-CD Integrated Circuit Silicon Monolithic

# TB6595FL/FLG

Dual-Bridge Driver IC for DC motor

TB6595FL/FLG is a quad-bridge driver IC for DC motor with output transistor in LD MOS structure with low ON-resistor. Two input signals, IN1 and IN2, can chose one of four modes such as CW, CCW, short brake, and stop mode..



Weight  
QON36-P-0606-0.50 : 0.08 g (typ.)

## Features

- Power supply voltage for motor:  $V_M \leq 6$  V (max)
- Power supply voltage for control:  $V_{CC} = 2.7\text{--}6.0$  V
- Output current: : 0.8 A (max)
- Low ON resistor: 1.5  $\Omega$  (typ.@ $V_M=5V, V_{CC}=5V$ )
- Standby (Power save)system
- CW/CCW/short brake/stop function modes.
- Built-in thermal shutdown circuit

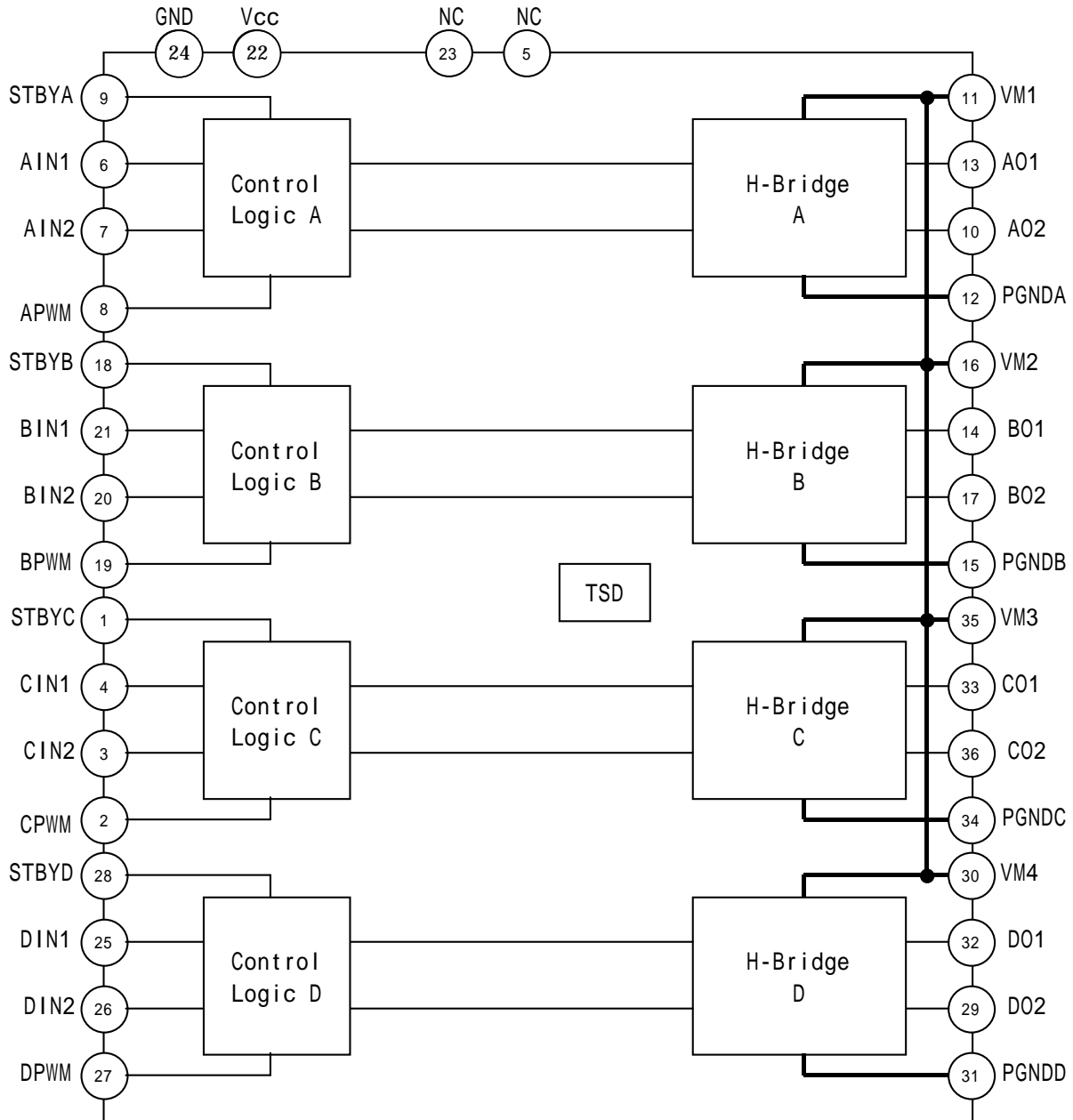
The following conditions apply to solderability:

\*Solderability

1. Use of Sn-37Pb solder bath
  - \*solder bath temperature = 230°C
  - \*dipping time = 5 seconds
  - \*number of times = once
  - \*use of R-type flux
2. Use of Sn-3.0Ag-0.5Cu solder bath
  - \*solder bath temperature = 245°C
  - \*dipping time = 5 seconds
  - \*number of times = once
  - \*use of R-type flux

\* This product has a MOS structure and is sensitive to electrostatic discharge. When handling this product, ensure that the environment is protected against electrostatic discharge by using an earth strap, a conductive mat and an ionizer. Ensure also that the ambient temperature and relative humidity are maintained at reasonable levels.

Block Diagram

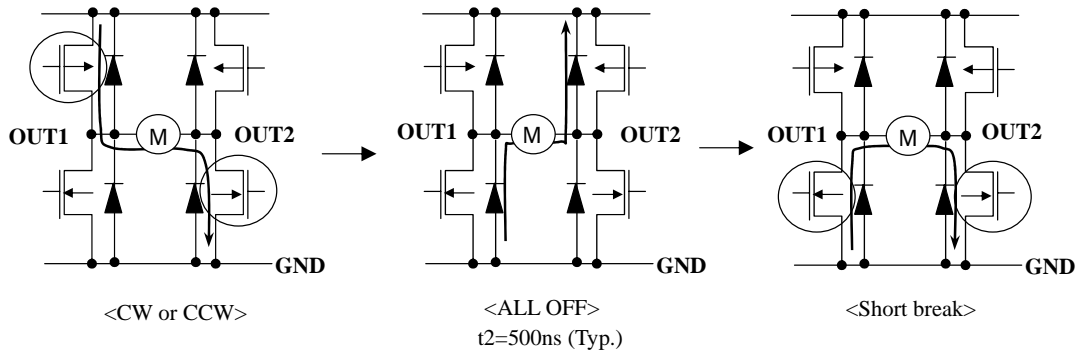


## Input/Output Function

Input				Output		
IN1	IN2	STBY	PWM	OUT1	OUT2	Mode
H	H	H	H	L	L	Short brake
			L			
L	H	H	H	L	H	Forward/reverse
			L	L	L	Short brake
H	L	H	H	H	L	Forward/reverse
			L	L	L	Short brake
L	L	H	H	OFF (High impedance)		Stop
			L			
H/L	H/L	L	H	OFF (High impedance)		Stand-by (Power save)
			L			

## Operating Description

- To prevent penetrating current, dead time  $t$  is provided in the IC.



## Absolute Maximum Ratings (Ta = 25°C)

Characteristics	Symbol	Rating	Unit	Remark
Supply voltage	VM	6	V	
	VCC	6		
Input voltage	VIN	-0.2 to 6	V	IN1, IN2, PWM, STBY
Output current	IOUT	0.8	A	
Power dissipation	PD	0.78	W	Note1
Operating temperature	Topr	-20 to 85	°C	
Storage temperature	Tstg	-55 to 150	°C	

Note 1: This value is obtained by 50 × 30 × 1.6 mm glass-epoxy PCB mounting occupied 40% of copper area.

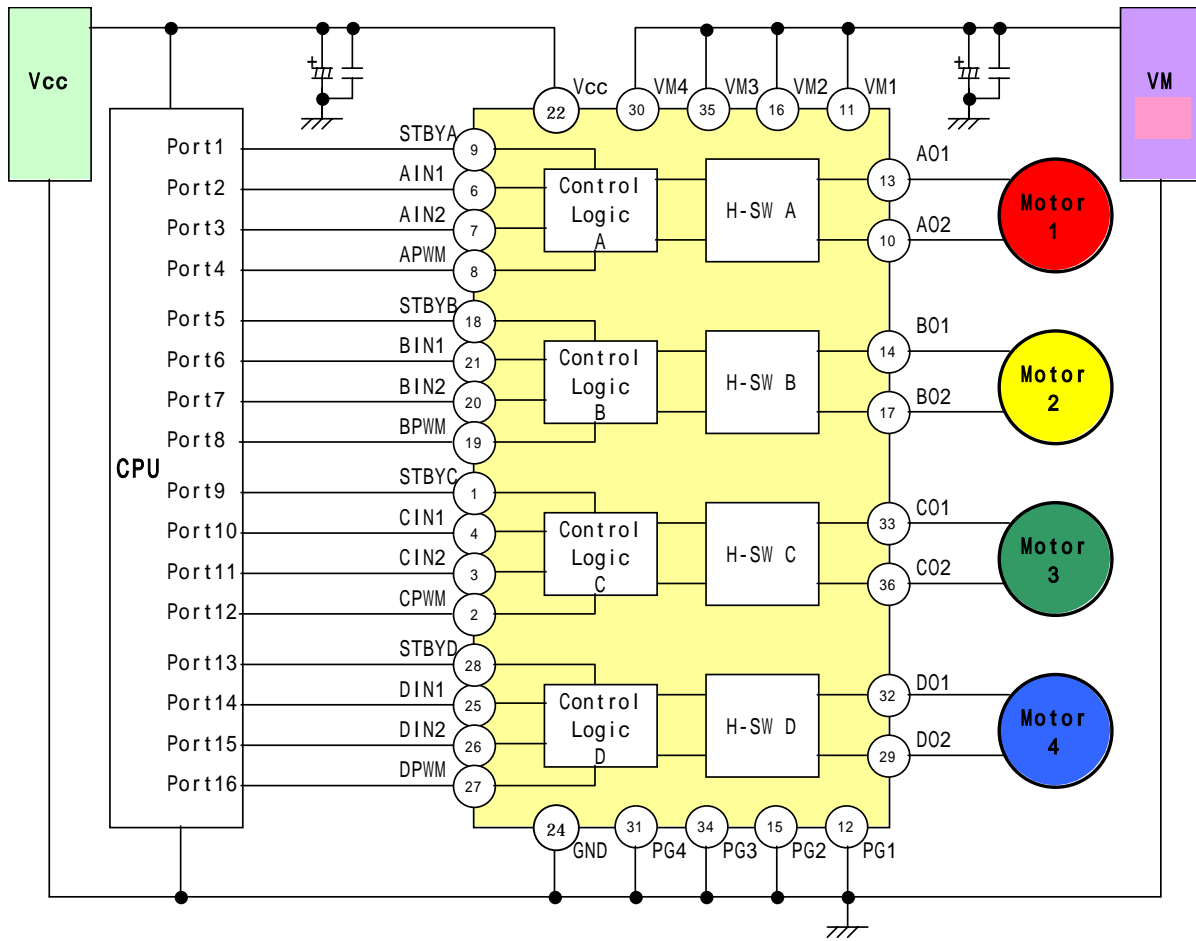
## Operating Range (Ta = -20 to 85°C)

Characteristics	Symbol	Min	Typ.	Max	Unit
Supply voltage (VCC)	VCC	2.7	5	5.5	V
Supply voltage (VM)	VM	2.2	5	5.5	V
Output current	Iout	—	—	0.6	A

## Electrical Characteristics (unless otherwise specified, $V_{CC} = 5\text{ V}$ , $V_M = 5\text{ V}$ , $T_a = 25^\circ\text{C}$ )

Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Supply current		$I_{CC}(\text{STP})$	Stop mode	—	1.3	1.8	mA
		$I_{CC2}(\text{W})$	CW/CCW mode	—	1.3	1.8	
		$I_{CC3}(\text{SB})$	Short break mode	—	1.3	1.8	
		$I_{CC4}(\text{STB})$	Standby(Power save) mode	—	—	10	$\mu\text{A}$
		$I_M(\text{STB})$		—	—	1	
Control circuit	Input voltage	$V_{\text{INH}}$		2	—	$V_{CC} + 0.2$	V
		$V_{\text{INL}}$		-0.2	—	0.8	
	Hysteresis voltage	$V_{\text{IN}}(\text{HIS})$	(Not tested)	—	0.2	—	
	Input current	$I_{\text{INH}}$		5	15	25	$\mu\text{A}$
$I_{\text{INL}}$			—	—	1		
Standby circuit	Input voltage	$V_{\text{INSH}}$		2	—	$V_{CC} + 0.2$	V
		$V_{\text{INSL}}$		-0.2	—	0.8	
	Input current	$I_{\text{INSH}}$		5	10	20	$\mu\text{A}$
		$I_{\text{INSL}}$		—	—	1	
Output saturating voltage		$V_{\text{sat}}(\text{U} + \text{L})$	$I_o = 0.2\text{A}$	—	0.3	0.4	V
			$I_o = 0.6\text{A}$	—	0.9	1.2	
Output leakage current		$I_{\text{L}}(\text{U})$	$V_M = 5.5\text{ V}$	—	—	1	$\mu\text{A}$
		$I_{\text{L}}(\text{L})$		—	—	1	
Diode forward voltage		$V_{\text{F}}(\text{U})$	$I_o = 0.6\text{ A}$	—	1	1.2	V
		$V_{\text{F}}(\text{L})$	$I_o = 0.6\text{ A}$	—	1	1.2	
Thermal shutdown circuit operating temperature		$T_{\text{SD}}$	(Not tested)	—	170	—	$^\circ\text{C}$
Thermal shutdown hysteresis				$\Delta T_{\text{SD}}$	—	20	

## Application example

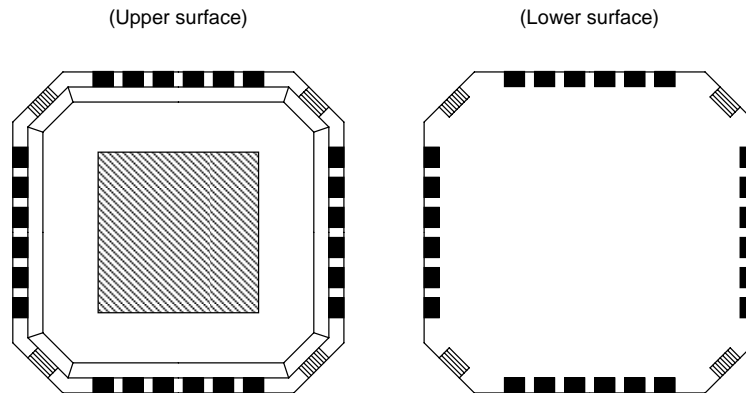


Note)

- VM1, VM2, VM3 and VM4 pins should be connected outside.
- Utmost care is necessary in the design of the output, V<sub>CC</sub>, V<sub>M</sub>, and GND lines since the IC may be destroyed by short-circuiting between outputs, air contamination faults, or faults due to improper grounding, or by short-circuiting between contiguous pins.

## Requests Concerning Use of QON

### Outline Drawing of Package



When using QON, please take into account the following items.

#### Caution

- (1) Do not carry out soldering on the island section in the four corners of the package (the section shown on the lower surface drawing with diagonal lines) with the aim of increasing mechanical strength.
- (2) The island section exposed on the package surface (the section shown on the upper surface drawing with diagonal lines) must be used as (Note 6) below while electrically insulated from outside.

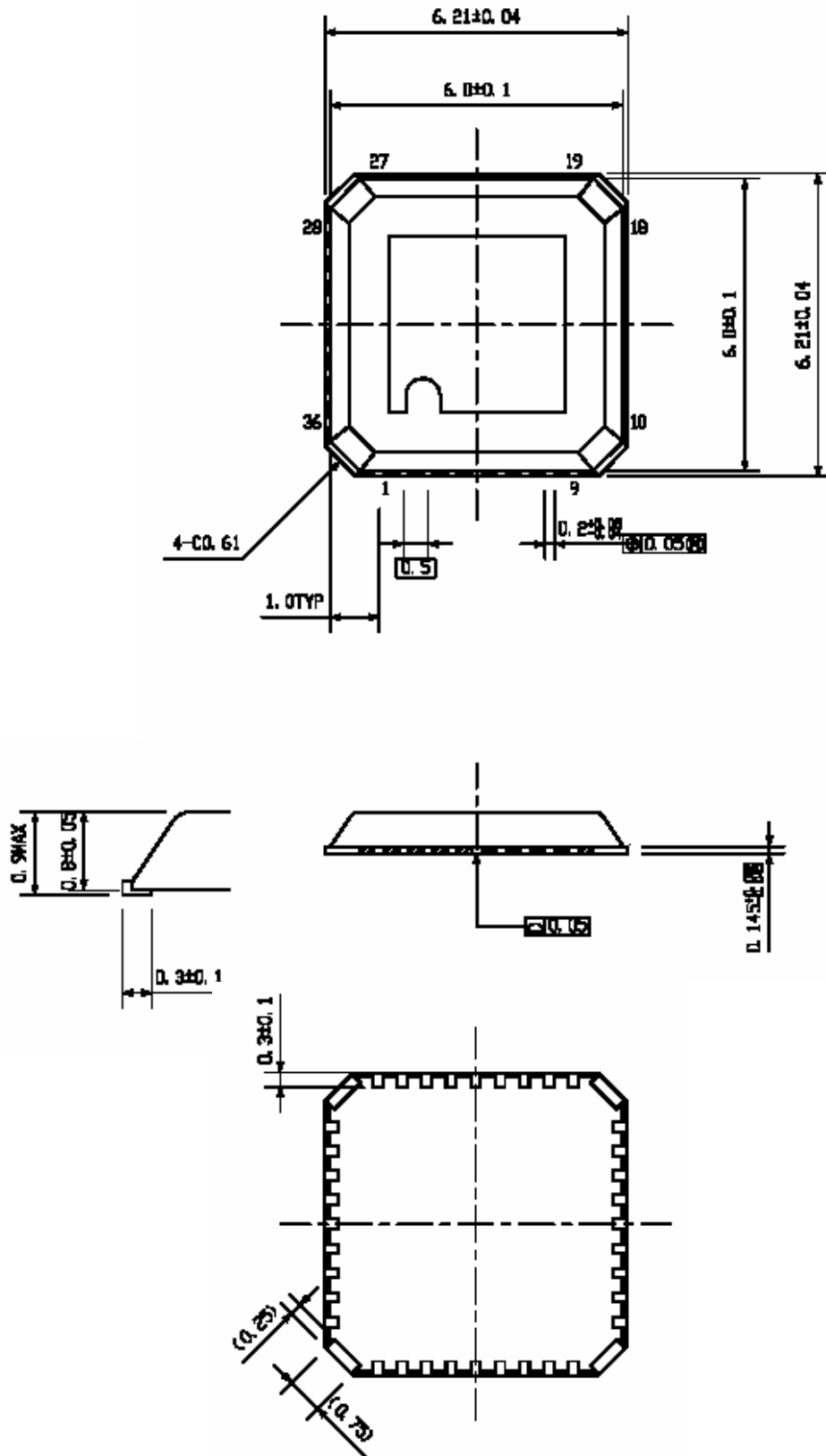
Note 6: Ensure that the island section (the section shown on the lower surface drawing with diagonal lines) does not come into contact with solder from through-holes on the board layout.

- When mounting or soldering, take care to ensure that neither static electricity nor electrical overstress is applied to the IC (measures to prevent anti-static, leaks, etc.).
- When incorporating into a set, adopt a set design that does not apply voltage directly to the island section.

## Package Dimensions

QON-36-P-0606-0.50

Unit : mm



Weight: 0.08 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) 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.

**(2) 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 consideration the effect of IC heat radiation with peripheral components.

**(3) 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 maximum ratings. To avoid this problem, take the effect of back-EMF into consideration in system design.

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