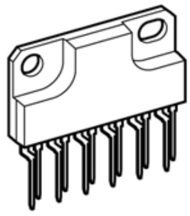
TOSHIBA Bipolar Linear Integrated Circuit Silicon Monolithic

TA8440H/HQ

Full-bridge Driver (H-Switch) for DC Motor (Driver for Switching between Forward and Reverse Rotation)

The TA8440H/HQ is a full-bridge driver for selecting the forward and reverse running of a motor with brushes and can control four modes: forward, reverse, stop and braking.
The motor driving unit and the control unit have a separate power supply line, and the TA8440H/HQ can also be used as a stepping motor driver.



HZIP12-P-1.78B

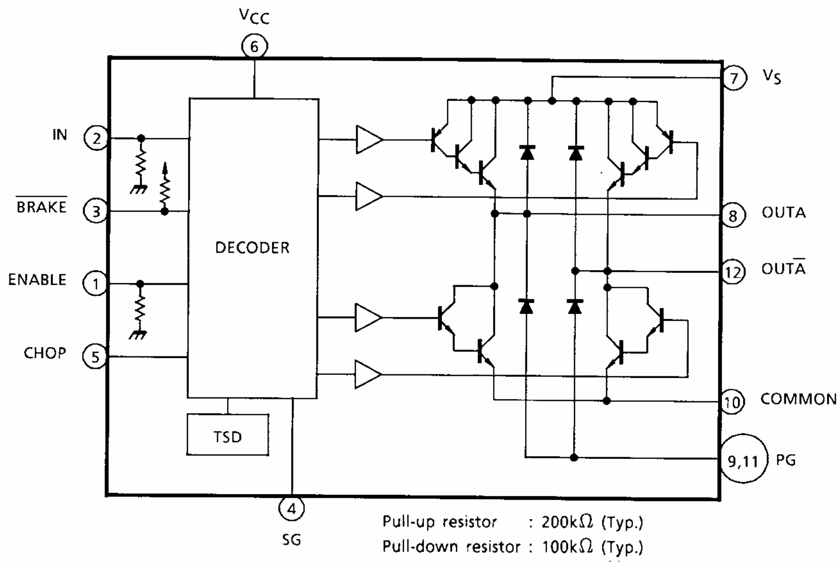
Weight: 4.04 g (typ.)

Features

- Output current is up to 1.5 A (AVE.) and 3.0 A (PEAK).
- 4 modes of forward, reverse, stop, and braking are available and a back-electromotive force absorbing diode has been built-in.
- Thermal shutdown circuit incorporated
- Input is compatible with CMOS.
- Built-in input pull-up resistor. BRAKE = 200 kΩ (typ.)
- Built-in input pull-down resistor. IN, ENABLE = 100 kΩ (typ.)

The TA8440HQ:
The TA8440HQ is Sn plated product including Pb
The following conditions apply to solderability:
*Solderability
1. Use of Sn-63Pb 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
   *the number of times = once
   *use of R-type flux

Block Diagram



Pin Function

Pin No.	Symbol	Functional Description
1	ENABLE	ENABLE terminal output is OFF when L
2	IN	Forward rotation/reverse rotation switch terminal
3	$\overline{\text{BRAKE}}$	BRAKE terminal output is OFF when L
4	SG	Signal GND
5	CHOP	PWM signal input terminal
6	V_{CC}	Power voltage supply terminal for control
7	V_S	Power voltage supply terminal for motor driver
8	OUTA	Output terminal
9	PG	Power GND
10	COMMON	COMMON terminal
11	PG	Power GND
12	OUT $\overline{\text{A}}$	Output terminal

TA8440F: 3, 6, 8, 10, 11, 12, 19, 20 pin is No connection.

Function

Input				Output		Mode
IN	$\overline{\text{BRAKE}}$	ENABLE	CHOP	OUTA	OUT $\overline{\text{A}}$	Motor
H	H	H	L	H	L	CW/CCW
L	H	H	L	L	H	CCW/CW
*	*	L	*	∞	∞	Stop
*	L	H	*	L	L	Brake
H	H	H	H	∞	L	Chop
L	H	H	H	L	∞	Chop

* : Don't care ∞: High impedance

Maximum Rating (Ta = 25°C)

Characteristics		Symbol	Rating	Unit
Supply voltage		V_{CC}	7	V
		V_S	50	
Input voltage		V_{IN}	−0.3 to V_{CC}	V
Output current	AVE.	$I_{O\ (AVE.)}$	1.5	A
	PEAK	$I_{O\ (PEAK)}$	3.0	A
Power dissipation		P_D	2.25 (Note 1)	W
			25.0 (Note 2)	
Operating temperature		T_{opr}	−30 to 75	°C
Storage temperature		T_{stg}	−55 to 150	°C

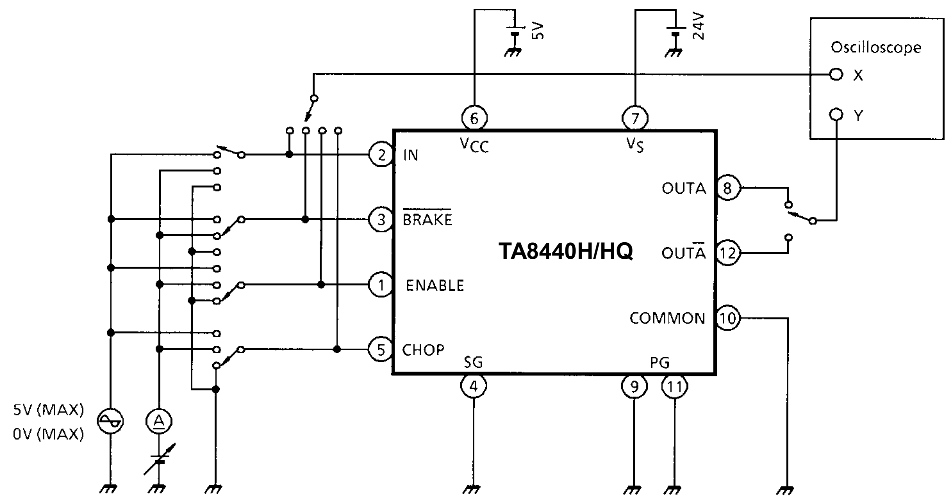
Note 1: No heat sink

Note 2: Tc = 75°C

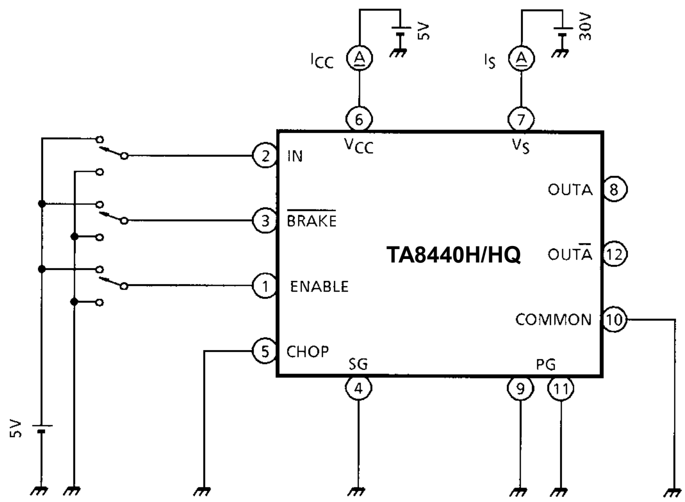
Electrical Characteristics (V_{CC} = 5 V, V_S = 24 V, Ta = 25°C)

Characteristics		Symbol	Test Circuit	Test Condition		Min	Typ.	Max	Unit
Input voltage	High	$V_{IN\ (H)}$	1	IN, CHOP, ENABLE, $\overline{\text{BRAKE}}$		3.5	—	V_{CC}	v
	Low	$V_{IN\ (L)}$				GND	—	1.5	
Input current	High	$I_{IN-1\ (H)}$	1	CHOP	V_{IN} = 5 V	—	5	52	μA
		$I_{IN-2\ (H)}$		IN, ENABLE		—	40	60	
		$I_{IN-3\ (H)}$		$\overline{\text{BRAKE}}$		—	0	5.5	
Input current	Low	$I_{IN-1\ (L)}$		CHOP	V_{IN} = 0 V Source type	—	0	5.5	
		$I_{IN-2\ (L)}$		IN, ENABLE		—	0	5.5	
		$I_{IN-3\ (L)}$		$\overline{\text{BRAKE}}$		—	25	52	
Current consumption (I)		I_{CC1}	2	Stop		—	6	10.5	mA
		I_{CC2}		Forward/reverse		—	10	14.5	
		I_{CC3}		Brake		—	14	18.5	
Current consumption (II)		I_{S1}	2	Stop		—	2	4.2	mA
		I_{S2}		Forward/reverse		—	3.5	5.0	
		I_{S3}		Brake		—	2.5	3.7	
Output saturation voltage	Upper side	V_{sat-U1}	3	I_{OUT} = 1.5A		1.5	2.0	2.7	V
	Under side	V_{sat-L1}				0.7	1.25	1.9	
	Upper side	V_{sat-U2}		I_{OUT} = 3.0A		2.7	3.0	3.9	
	Under side	V_{sat-L2}				1.7	2.0	2.9	
Diode forward orientation voltage	Upper side	V_{F-U1}	—	I_{OUT} = 1.5A		—	3.5	—	V
	Under side	V_{F-L1}				—	1.3	—	
Output leakage Current	Upper side	I_{OH}	4	V_S = 30V		—	—	200	μA
	Under side	I_{OL}				—	—	100	
Shut down temperature		T_{SD}	—	—		—	170	—	°C
Transfer time		t_{pLH}	—	IN−OUT		—	2.7	—	μs
		t_{pHL}				—	1.2	—	
		t_{pLH}		CHOP−OUT		—	0.7	—	
		t_{pHL}				—	2.5	—	
		t_{pLH}		ENABLE−OUT		—	2.9	—	
		t_{pHL}				—	1.1	—	
		t_{pLH}		$\overline{\text{BRAKE}}$ −OUT		—	45	—	
		t_{pHL}				—	45	—	

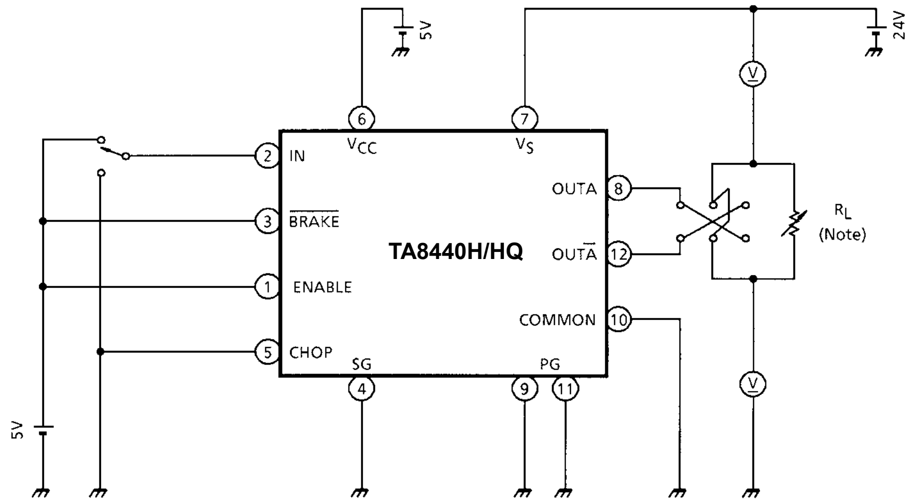
Test Circuit 1 $V_{IN\ (H)}$, $V_{IN\ (L)}$, $I_{IN\ (H)}$, $I_{IN\ (L)}$



Test Circuit 2 I_{CC1}, I_{CC2}, I_{CC3}, I_{S1}, I_{S2}, I_{S3}

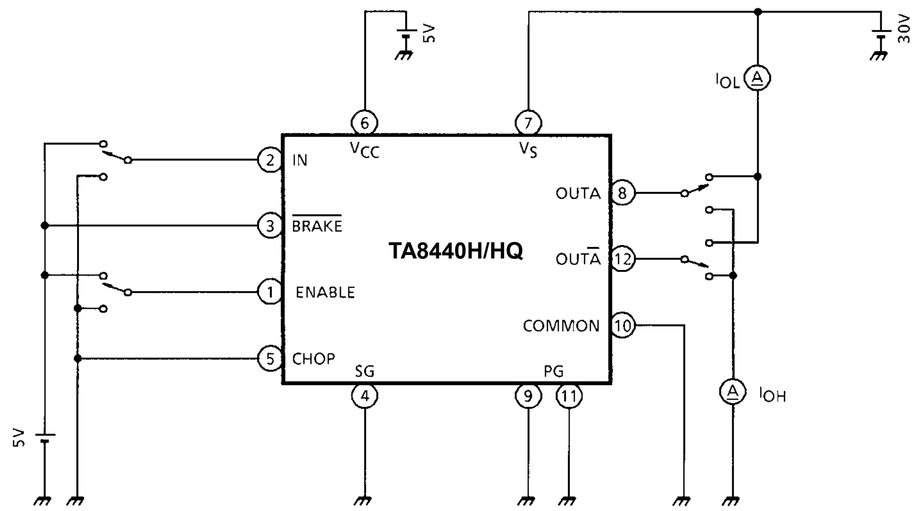


Test Circuit 3 V_{sat-L}, V_{sat-U}

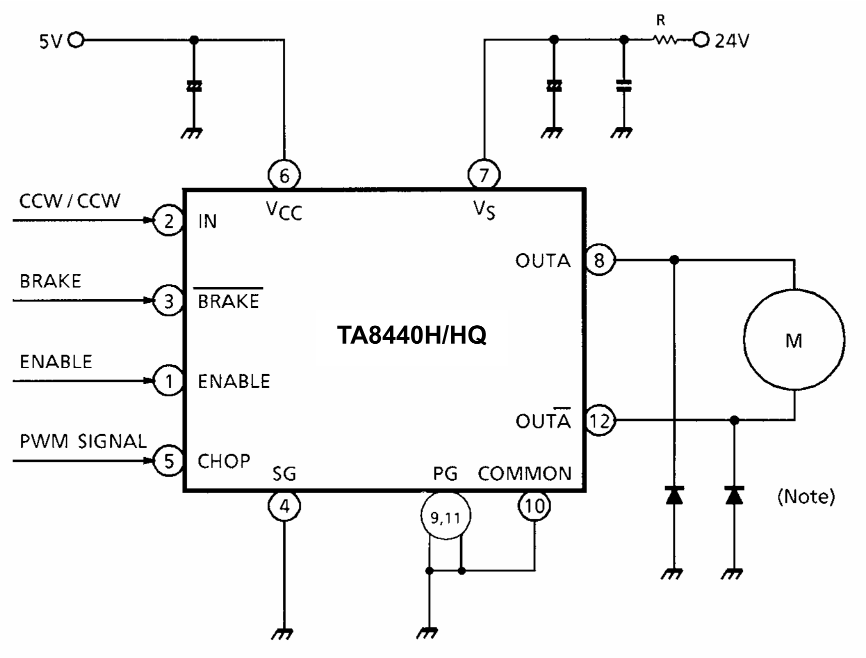


Note: Calibrate I_{OUT} to 1.5 / 3.0 A by R_L.

Test Circuit 4 I_{OH}, I_{OL}



Application Circuit



Note 1: Connect a Schottky diode (Toshiba 2GWJ42 or equivalent) for pass-through current prevention between each of the two outputs and a ground.

Note 2: When turning on the power for the IC, raise V_S after V_{CC} has been raised to its rated level (or V_{CC} and V_S simultaneously). When shutting off the power, drop V_{CC} after V_S (or V_S and V_{CC} simultaneously).

Note 3: Keep the control pins (IN, BRAKE, ENABLE, and CHOP) low before the supply voltage V_{CC} has been raised to its rated level. (Alternatively, raise all these voltages simultaneously.)

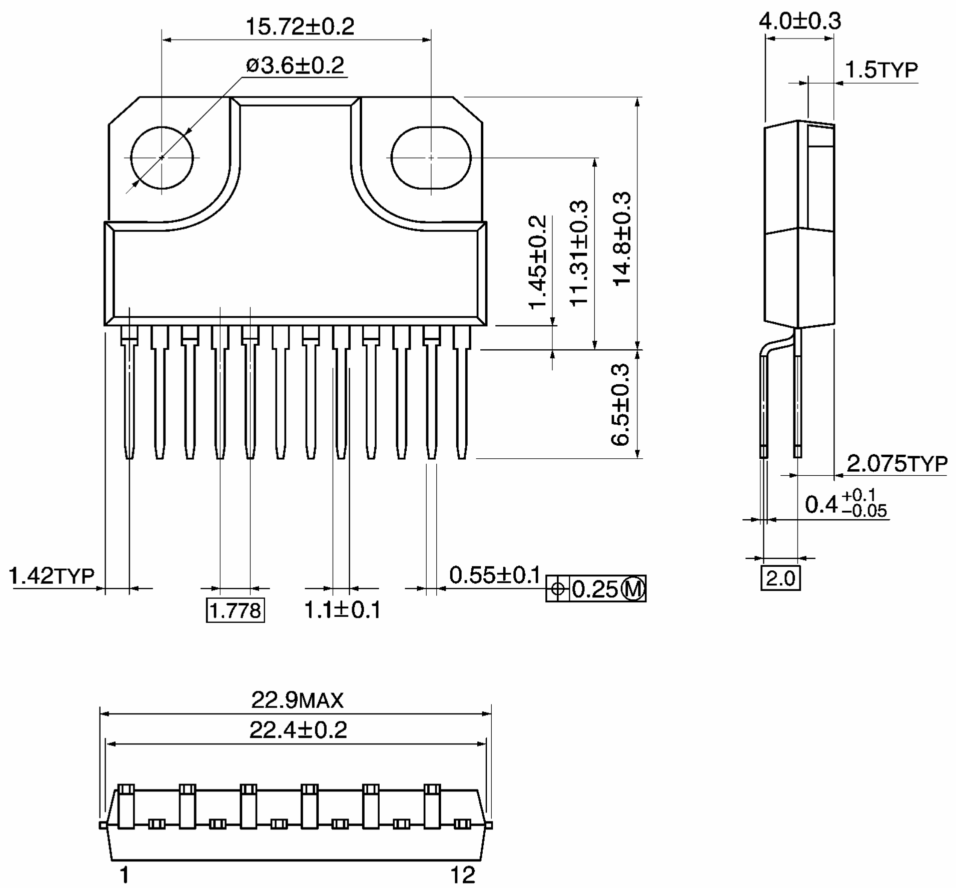
Note 4: Insert a current limiting resistor (R) or fuse for over-current protection.

Note 5: The IC contains a thermal circuit breaker. However, if the IC operates over its maximum rating, breakdown may occur before the protection circuit starts operating.

Note 6: Utmost care is necessary in the design of the output line, V_{CC}, V_S, and GND line since the IC may be damaged due to short circuits between outputs, supply faults, or ground faults.

Package Dimensions

HZIP12-P-1.78B Unit: mm



Weight: 4.04 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. Maximum Ratings

The absolute maximum ratings of a semiconductor device are a set of specified parameter values which must not be exceeded during operation, even for an instant.
If any of these ratings are exceeded during operation, the device electrical characteristics may be irreparably altered and the reliability and lifetime of the device can no longer be guaranteed.
Moreover, these operations with exceeded ratings may cause breakdown, damage and/or degradation to other equipment. Applications using the device should be designed so that each maximum rating will never be exceeded in any operating conditions.
Before using, creating and/or producing designs, refer to and comply with the precautions and conditions set forth in this document.

5. 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.

6. Test Circuits

Components in the test circuits are only used 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.

About the handling of ICs

Install the product correctly to avoid breakdown, damage and/or degradation to the product or equipment.

About overcurrent protection and heat protection circuits

These protection functions are intended to guard against certain output short circuits or other abnormal conditions with only temporary effect, and are not guaranteed to prevent the IC from being damaged.
These protection features may not be effective if the product is operated outside the guaranteed operating ranges, and some output short circuits may result in the IC being damaged.
The overcurrent protection feature is only intended to protect the IC from a temporary short circuit.
Short circuits of longer duration may damage the IC through undue stress. The systems must be configured so that any overcurrent condition will be eliminated as soon as possible.

Counter-electromotive force

When the motor reverses or stops, counter-electromotive force in the motor may influence the current to flow to the power source. If the power source lacks sink capability, the IC power and output pins may exceed the rating. The counter-electromotive force of the motor varies depending on the conditions of use and the features of the motor.
Therefore ensure that there is no damage to the IC or problem in operation, and no error in or damage to peripheral circuits resulting from counter-electromotive force.

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