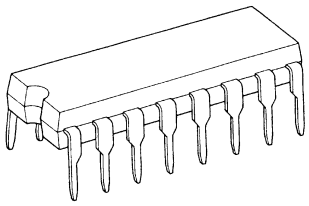
TOSHIBA Bipolar Linear Integrated Circuit Silicon Monolithic

TA8400P/PG

Sequential Dual-Bridge Driver (Driver for Switching between Forward and Reverse Rotation) for DC Motors

A bridge driver ideal for switching between forward and reverse rotation, the TA8400P/PG can control a DC motor in four different modes: forward rotation, reverse rotation, stop, and brake.
The IC can deliver an output current of 0.4 A (ave.) and 1.0 A (peak). It can adjust the motor voltage easily because it has a circuit configuration especially well suited for VCR front loading and tape loading, separate power supply pins for the two sections (output and control), and a V_{ref} pin at the output for controlling the motor voltage. In addition, it can be connected directly to CMOS devices due to its low input current.



DIP16-P-300-2.54A

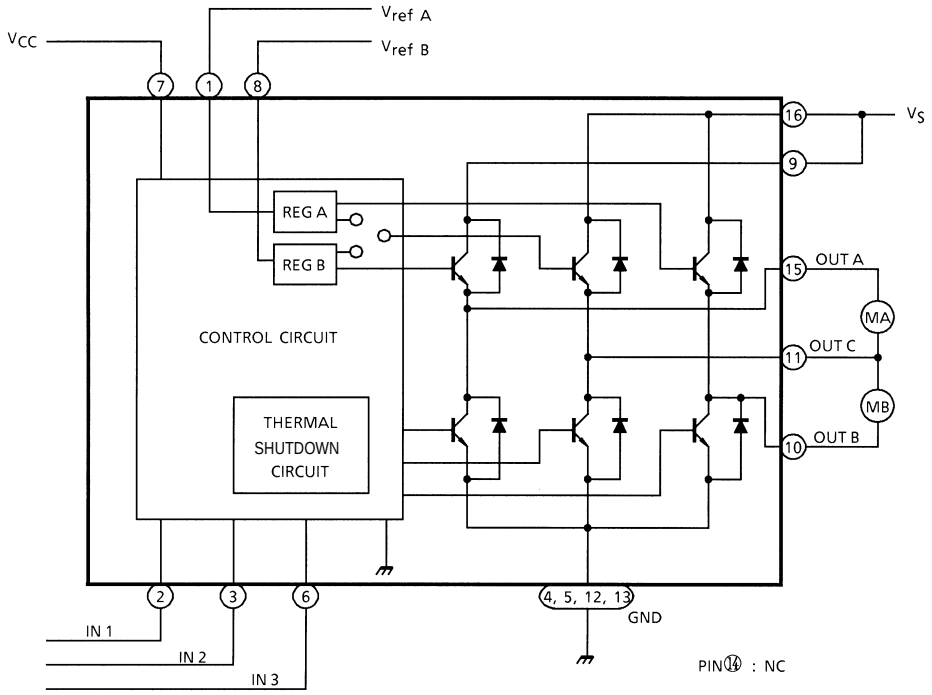
Weight: 1.11 g (typ.)

Features

- Wide range of operating voltage: V_{CC} (opr.) = 4.5 to 18 V
  V_S (opr.) = 0 to 22 V
  V_{ref} (opr.) = 0 to 22 V
  No malfunction occurs even if V_{CC} is higher than V_S or vice versa. However, ensure $V_{ref} \leq V_S$.
- Output current up to 0.4 A (ave.) and 1.0 A (peak)
- Built-in thermal shutdown circuit
- Punch-through current restriction circuit
- Built-in back electromotive force absorber diode
- Hysteresis for all inputs

The TA8400PG is a Pb-free product.
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
   *number of times = once
   *use of R-type flux

Block Diagram



Pin Description

Pin No.	Symbol	Functional Description
1	$V_{ref\,A}$	Supply voltage terminal for control circuit
2	IN 1	Logic input terminal
3	IN 2	Logic input terminal
4	GND	GND terminal
5	GND	GND terminal
6	IN 3	Logic input terminal
7	V_{CC}	Supply voltage terminal for logic
8	$V_{ref\,B}$	Supply voltage terminal for control circuit
9	V_S	Supply voltage terminal for motor driver
10	OUT B	Output terminal
11	OUT C	Output terminal
12	GND	GND terminal
13	GND	GND terminal
14	NC	No connection
15	OUT A	Output terminal
16	V_S	Supply voltage terminal for motor driver

Functions

Input			Output			Mode	
IN 1	IN 2	IN 3	OUT C	OUT A	OUT B	MA	MB
0	0	1/0	∞	∞	∞	STOP	STOP
1	0	0	H	L	∞	CW/CCW	STOP
1	0	1	L	H	∞	CCW/CW	STOP
0	1	0	H	∞	L	STOP	CW / CCW
0	1	1	L	∞	H	STOP	CCW / CW
1	1	1/0	L	L	L	BRAKE	BRAKE

∞: High impedance
Note: Inputs are all low active type.

Maximum Ratings (Ta = 25°C)

Characteristic		Symbol	Rating	Unit
Supply voltage		V_{CC}	25	V
Motor drive voltage		V_S	25	V
Reference voltage		V_{ref}	25	V
Output current	PEAK	$I_{O\ (PEAK)}$	1.0 (Note 1)	A
	AVE.	$I_{O\ (AVE.)}$	0.4	
Power dissipation		P_D	1.4 (Note 2)	W
Operating temperature		T_{opr}	−30 to 75	°C
Storage temperature		T_{stg}	−55 to 150	°C

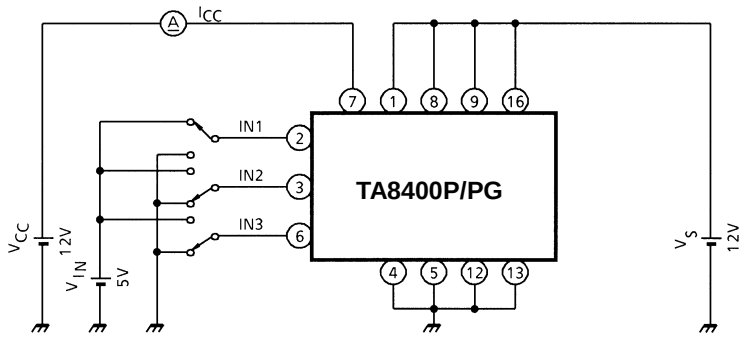
Note 1: Duty 1/10, 100 ms
Note 2: No heat sink

Electrical Characteristics
(unless otherwise specified, Ta = 25°C, V_{CC} = 12 V, V_S = 12 V)

Characteristic		Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Supply current		I_{CC1}	1	Output open, CW/CCW mode	—	25	38	mA
		I_{CC2}	1	Output open, brake mode	—	25	38	
		I_{CC3}	1	Output open, stop mode	—	10	20	
Input voltage	1 (High)	$V_{IN\,1}$	2	T_j = 25°C, pin 2, 3, 6	3.5	—	5.5	V
	2 (Low)	$V_{IN\,2}$	2	T_j = 25°C, pin 2, 3, 6	GND	—	1.2	
Input current		I_{IN}	2	V_{IN} = GND, source mode	6	12	60	μA
Input hysteresis voltage		ΔV_T	2	—	—	0.7	—	V
Saturation voltage	Upper	$V_{SAT\,U-1}$	3	V_{ref} = V_S, I_O = 0.4 A, V_{OUT}-V_S measure	—	1.0	1.5	V
	Lower	$V_{SAT\,L-1}$	3	V_{ref} = V_S, I_O = 0.4 A, V_{OUT}-GND measure	—	0.3	—	
	Upper	$V_{SAT\,U-2}$	3	V_{ref} = V_S, I_O = 1.0 A, V_{OUT}-V_S measure, ON LOAD: 20 ms	—	2.0	2.5	
	Lower	$V_{SAT\,L-2}$	3	V_{ref} = V_S, I_O = 1.0 A, V_{OUT}-GND measure, ON LOAD: 20 ms	—	0.8	1.3	
Output voltage		$V_{SAT\,U-1'}$	3	V_{ref} = 8 V, I_O = 0.4 A, V_{OUT}-GND measure	8.2	8.8	9.3	V
		$V_{SAT\,U-2'}$	3	V_{ref} = 8 V, I_O = 1.0 A, V_{OUT}-GND measure, ON LOAD: 20 ms	8.1	8.6	9.2	
Output transistor leakage current	Upper	$I_{L\,U}$	—	V_S = 25 V	—	—	200	μA
	Lower	$I_{L\,L}$	—	V_S = 25 V	—	—	200	
Diode forward voltage	Upper	$V_{F\,U}$	4	I_F = 1.0 A	—	3.6	—	V
	Lower	$V_{F\,L}$	4	I_F = 1.0 A	—	0.9	—	
Reference current		I_{ref}	2	V_{ref} = 8 V, source mode	—	0.45	0.7	mA
Thermal shutdown operating temperature		T_{SD}	—	Junction temperature	110	130	150	°C

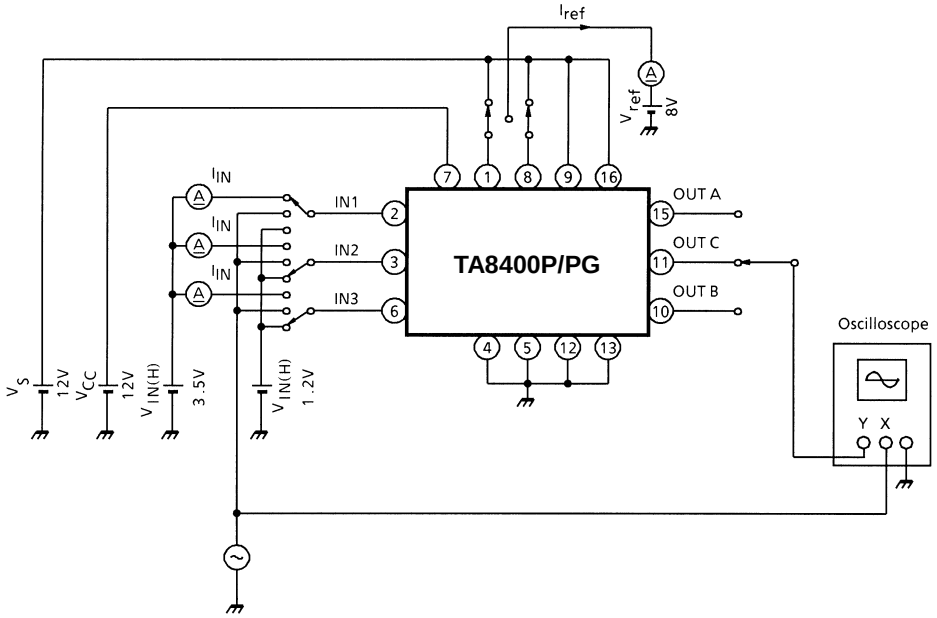
Test Circuit 1

$I_{CC1, 2, 3}$



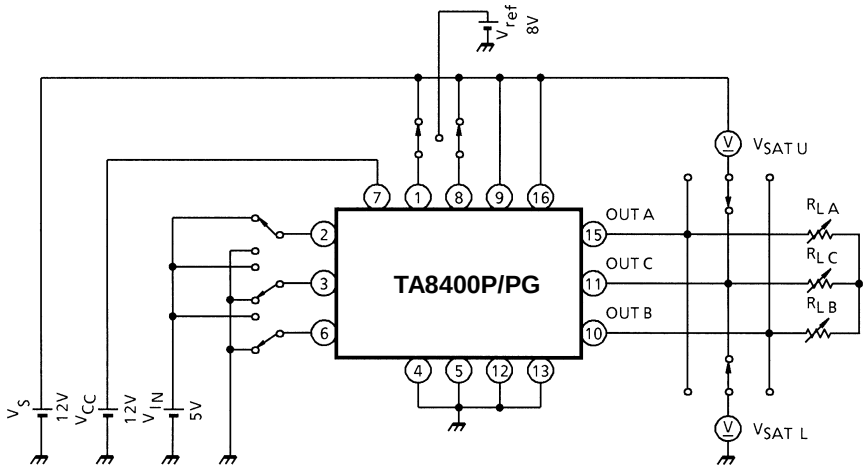
Test Circuit 2

$V_{IN1, 2}$, I_{IN}, ΔV_T, I_{ref}



Test Circuit 3

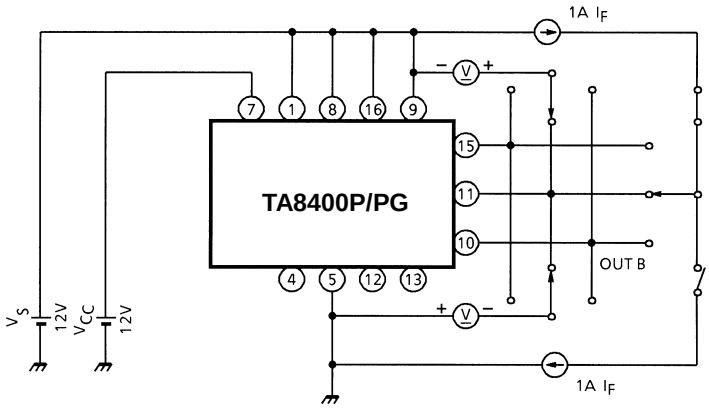
$V_{SAT\ U-1,\ L-1,\ U-2,\ L-2,\ U-1',\ U-2'}$

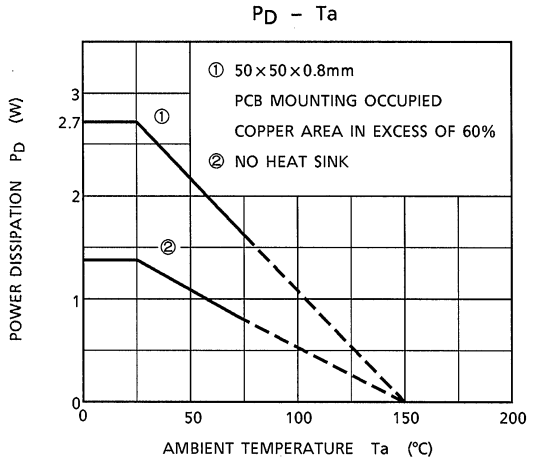


Note: Calibrate I_{OUT} to 0.4 / 1.0A by R_{LA}, R_{LB} and R_{LC}.

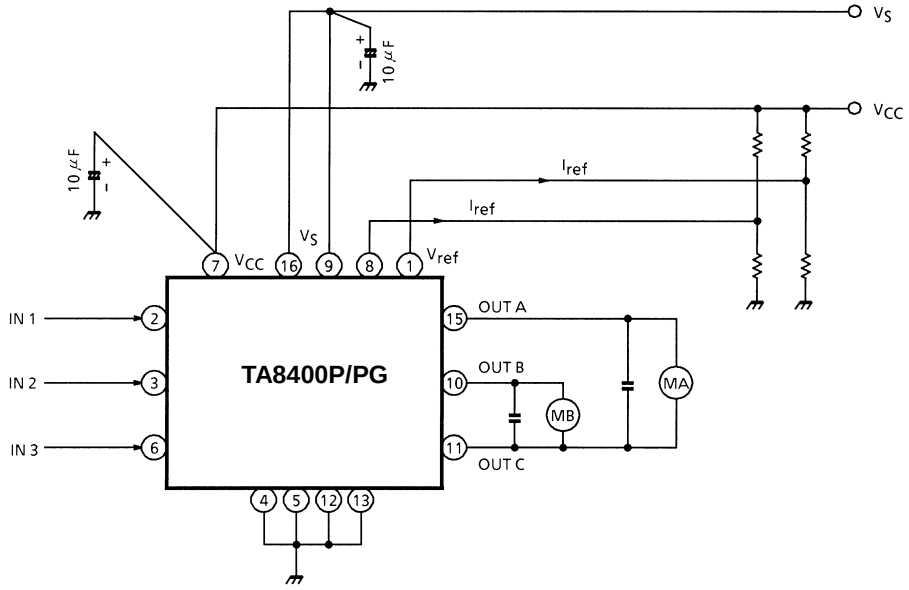
Test Circuit 4

$V_{F\ U,\ L}$





Application Circuit



Note: Pin 16 is required to connect to pin 9.

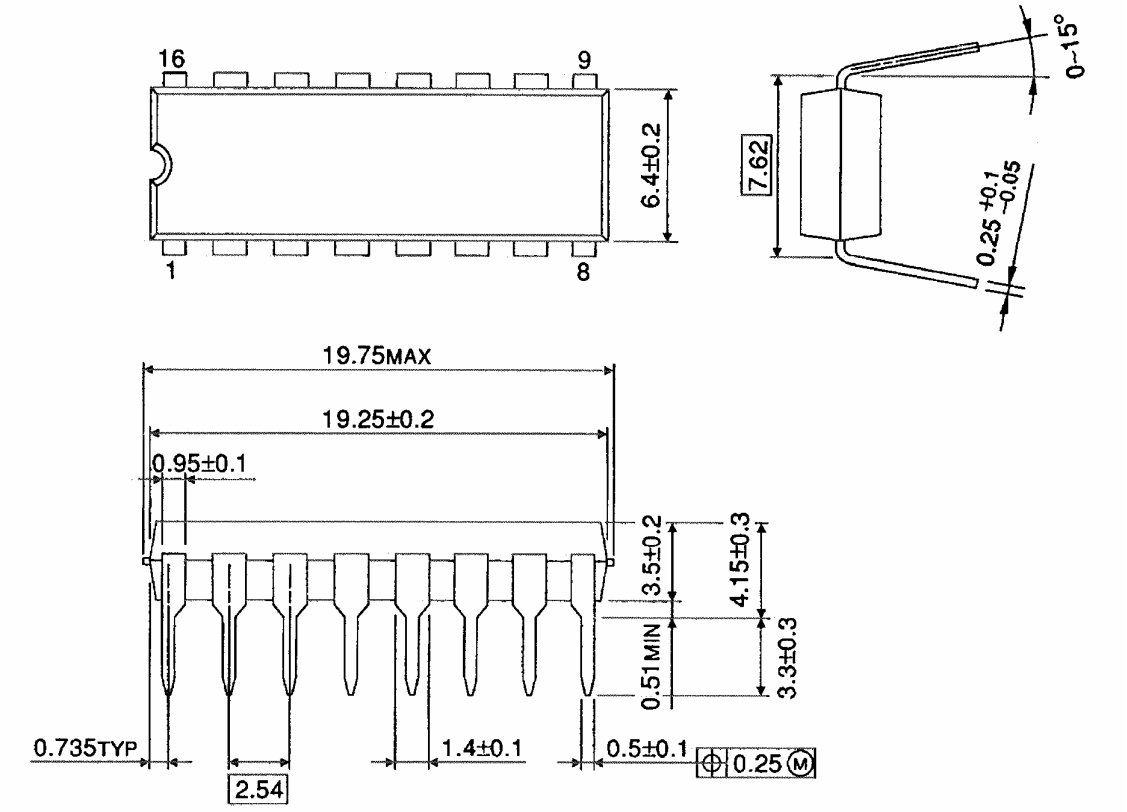
Note 1: Be sure to connect the V_S pins (pins 16, 9) directly to each other.

Note 2: A short circuit between outputs, an output voltage fault, and a ground fault may cause the IC to break down and supply an overvoltage and overcurrent to components around them. Be very careful when designing the output, V_{CC}, V_S, and ground lines.
Bear in mind that mounting the IC in the reverse orientation may also cause a breakdown.

Note 3: When turning on the power for the IC, apply V_S after V_{CC} (or V_{CC} and V_S simultaneously). When shutting off the power, drop V_S before V_{CC} (or V_S and V_{CC} simultaneously).
When turning on the power (V_{CC}), keep both the inputs (IN1 and IN2) at a low level.

Package Dimensions

DIP16-P-300-2.54A Unit : mm



Weight: 1.11 g (typ.)

Notes on Contents

1. Block Diagrams

Some functional blocks, circuits, or constants may be omitted or simplified in the block diagram 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 that 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, any exceeding of the ratings during operation may cause breakdown, damage and/or degradation in other equipment. Applications using the device should be designed so that no maximum rating will ever be exceeded under 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 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.

Handling of ICs

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

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. Ensure, therefore, that there is no error in or damage to the IC or peripheral circuits resulting from counter-electromotive force.

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