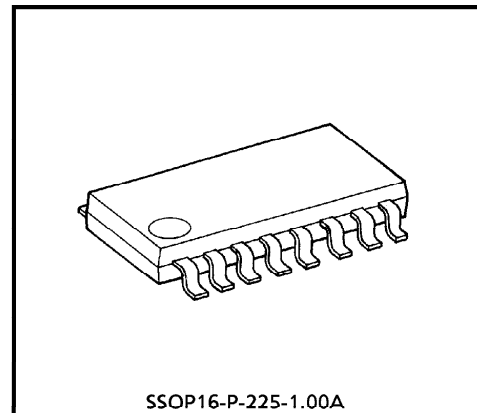TOSHIBA BIPOLAR LINEAR INTEGRATED CIRCUIT   SILICON MONOLITHIC
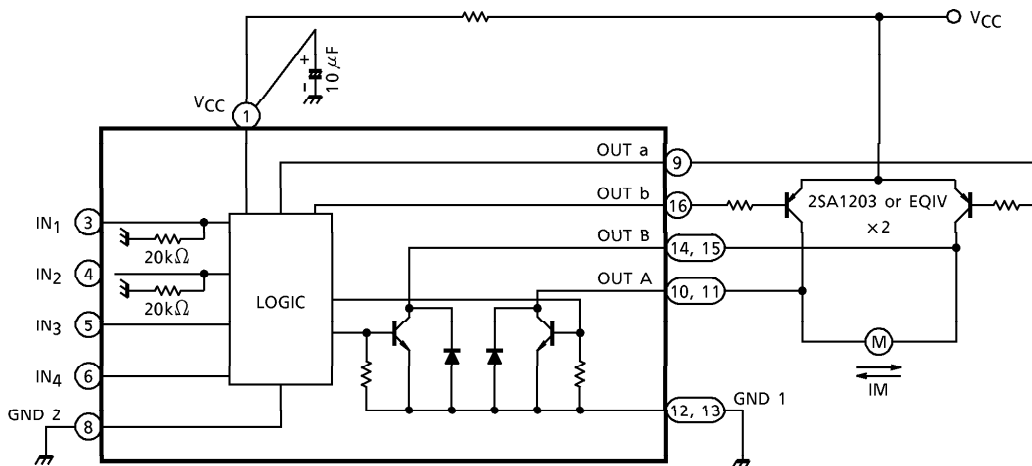
TA8401F

FUNCTIONAL BRIDGE DRIVER

FEATURES

- Wide operating supply voltage range
  : V_{CC} (opr.) = 3.0~15V

- Capsuled in flat package 16pin.

- Forward and reverse rotation, short brake modes are available by means of rotation control signals.

- High efficiency is obtained.

- Can be used as interface driver.

SSOP16-P-225-1.00A

Weight : 0.14g (Typ.)

BLOCK DIAGRAM

PIN FUNCTION

PIN No.	SYMBOL	FUNCTIONAL DESCRIPTION	
1	V_{CC}	Power supply voltage	
2	NC	Non Connection	
3	IN_1	Signal input terminal	Truth table 1
4	IN_2	Signal input terminal	
5	IN_3	Signal input terminal	
6	IN_4	Signal input terminal	
7	NC	Non connection	
8	GND 2	Logic GND terminal	
9	OUT a	Output a	
10	OUT A	Output A	
11	OUT A		
12	GND 1	Power GND terminal	
13	GND 1		
14	OUT B	Output B	
15	OUT B		
16	OUT b	Output b	

FUNCTION
(1)　Bridge driver (Truth table 1)

CONTROL	INPUT MODE				OUTPUT				OPERATING MODE	NOTE
	IN_1	IN_2	IN_3	IN_4	OUT A	OUT B	OUT a	OUT b		
2 Input Control	H	L	H	H	ON (−500mA)	—	ON (−25mA)	—	Forward Rotation	—
	L	H	H	H	—	ON (−500mA)	—	ON (−25mA)	Reverse Rotation	
	H	H	H	H	ON (−500mA)	ON (−500mA)	—	—	Brake	
	L	L	H	H	—	—	—	—	STOP	
1 Input Control	H	L	L	H	ON (−500mA)	—	ON (−25mA)	—	A ON	
	L	L	L	H	—	ON (−500mA)	—	ON (−25mA)	B ON	
	H / L	H	L	H	ON (−500mA)	ON (−500mA)	—	—	AB ON	HIGH 2.0V (MIN)
	—	—	—	L	—	—	—	—	INHIBIT	LOW 0.3V (MAX)

(2)   Interface driver application

If IN_3 and IN_4 connect to "HIGH" OUT A and OUT B can be used as a interface driver output for each inputs.
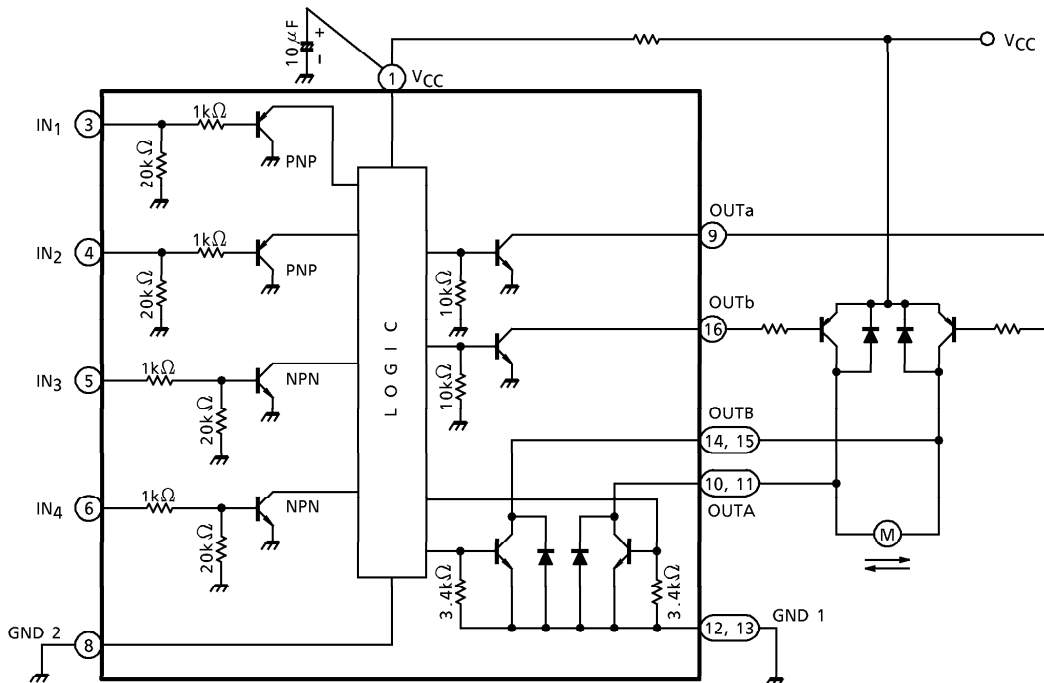(Connect OUT a and OUT b to GND)

P_D – Ta

① No heat sink
② 20×20×0.8mm PCB MOUNTING
   (above 60% of copper area occupied)

POWER DISSIPATION P_D (W)

AMBIENT TEMPERATURE   Ta   (℃)
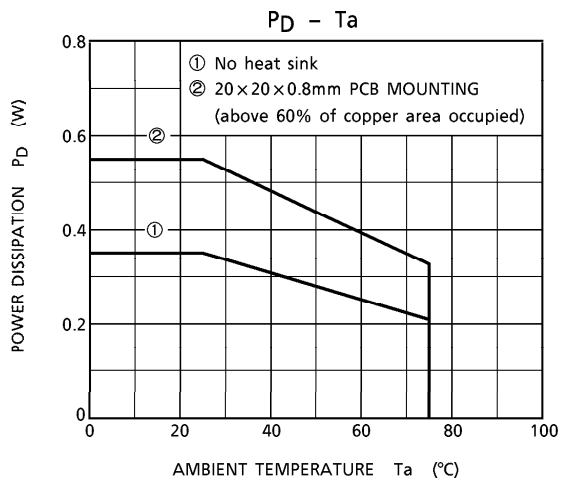
INPUT, OUTPUT CIRCUIT

MAXIMUM RATINGS (Ta = 25°C)

| CHARACTERISTIC	SYMBOL	RATING	UNIT
Peak Supply Voltage	V_{CC}	18	V
Output Current	I_O (AVE.)	0.5	A
Power Dissipation	P_D	350 (Note 1)	mW
		550 (Note 2)	
Operating Temperature	T_{opr}	$-30\sim75$	°C
Storage Temperature	T_{stg}	$-55\sim150$	°C

(Note 1) No heat sink
(Note 2) This rating is obtained by mounting on $20 \times 20 \times 0.8$mm PCB that occupied above 60% of copper area.

## ELECTRICAL CHARACTERISTICS (Unless otherwise specified, Ta = 25°C, V_{CC} = 5V)

CHARACTERISTIC		SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Supply Current		I_{CC1}	1	Output open CW / CCW mode	—	13	20	mA
		I_{CC2}	1	Output open stop mode	—	11	15	
		I_{CC3}	1	Output open brake mode	—	17	26	
		I_{CC4}	1	Inhibit (INPUT4 = "L")	—	2.4	7	
Output Saturation Voltage		V_{sat1}	2	I_{O1} = 500mA, Lower side (Output A, B)	—	0.3	0.5	V
		V_{sat2}	2	I_{O2} = 25mA, Upper side (Output a, b)	—	0.3	0.55	
Output TR Leakage Current		I_L	3	V_C = 15V	—	—	50	μA
Input Voltage	"H" Level	$V_{IN1, 2 (H)}$	—	—	2.0	—	V_{CC}	V
	"L" Level	$V_{IN1, 2 (L)}$	—	—	—	—	0.8	
Input Current	"L" Level	$I_{IN1, 2}$	4	Input "L", V_{IN} = 0V (Source current)	—	—	20	μA
Input Voltage	"H" Level	$V_{IN3, 4 (H)}$	—	—	1.0	—	V_{CC}	V
	"L" Level	$V_{IN3, 4 (L)}$	—	—	—	—	0.3	
Input Current	"H" Level	$I_{IN3, 4}$	4	Input "H" (Sink current) V_{IN} = 1V	—	—	30	μA
Diode Forward Voltage		V_F	5	I_F = 0.5A, V_{CC} = 0V	—	1.3	—	V

TEST CIRCUIT

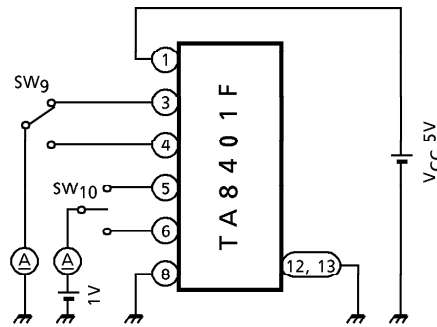### 1. $I_{CC1, 2, 3, 4}$
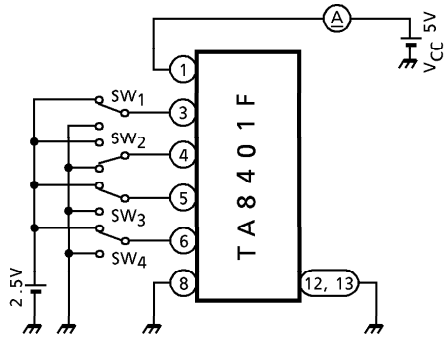
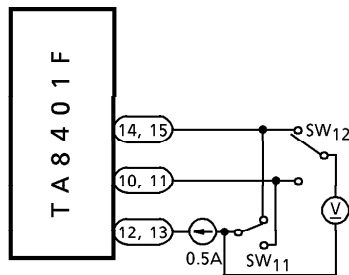### 2. $V_{sat1, 2}$
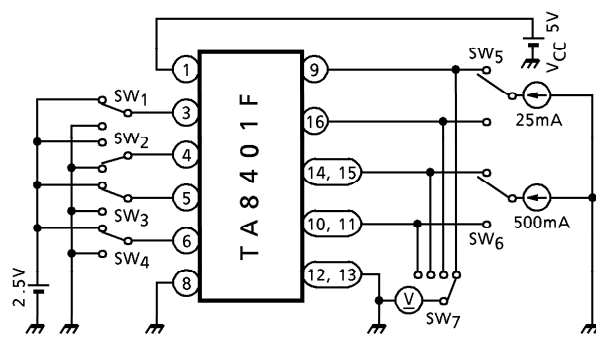
3. I_L
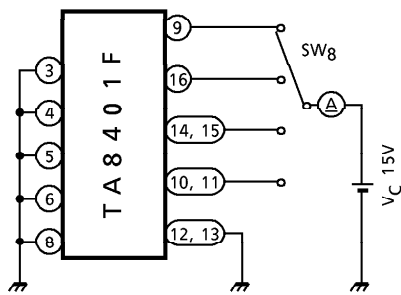

4. I_{IN}

5. V_F

The functionable bridge driver, TA8401F, is an IC specifically developed to control rotation switching in brush motors. This IC has been carefully designed and strengthened to withstand counter-electromotive force or start up rush current, which are problems in driving brush motors.

However, as with other power ICs, application circuits must be designed not to apply surge voltage or excess current that exceeds the standard values. In addition, when designing PCBs, make sure the wiring pattern does not cause oscillation, which can result in equipment malfunction or destruction of the IC.

The following are notes on TA8401F use. These should be reflected at the design stage.

(1)   Power supply voltage

To avoid the motor current affecting the TA8401F control-side power supply, we recommend you use two power supplies : an external transistor power supply, and a TA8401F control-side power supply. However, when using a single power supply, connect as in the diagram below.
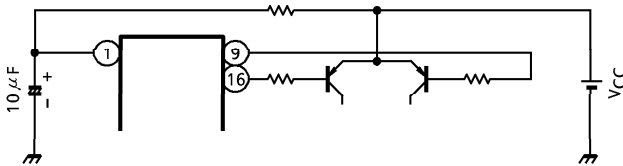
(2)   Maximum voltage and current

The maximum supply voltage (pin①) for TA8401F is 18V. Operating supply voltage is in the range of 1.8~15V. No voltage exceeding this range should be applied to pin①.
The maximum current is 0.5A (AVE.) or 1.5A (PEAK). The circuit should be designed so that rush current at startup does not exceed peak current, and average current at steady operation does not exceed 0.5A.

(3)   External diodes

As the block diagram shows, TA8401F has internal diodes.
The lower two diodes, which are the IC's internal parasitic diodes, have a relatively large capacitance. However, when a motor with a large reactance such as a core motor is driven, the upper two diodes may be damaged by the motors counter-electromotive force. In such a case, connect external diodes in parallel. The lower diodes should not be subjected to high current. Therefore, in such cases as brake operation, external diodes should be connected.

(4)   PCB design

The following points concern the TA8401F pattern design around the power supply line (pin①) and the pattern design of the GND (pin⑧, pin⑫ / ⑬).

a) Ensure that the bypass capacitor between pin①, and GND does not share impedance with other lines.

b) The GND line should not be shared by other circuits.

c) The capacitance of the bypass capacitor should be as large as possible.

(5)   Oscillation remedies

To prevent noise from sparks when using brush motors, a capacitor may be connected between both pins.
When using TA8401F, the capacitor is connected between output pin⑩ / ⑪, pin⑭ / ⑮. This may cause oscillation.
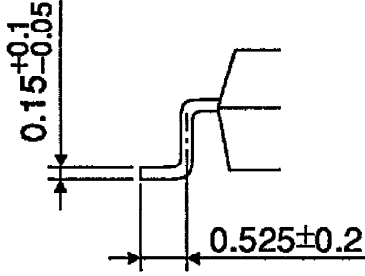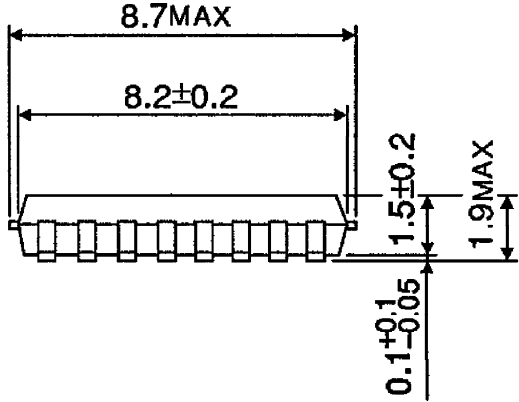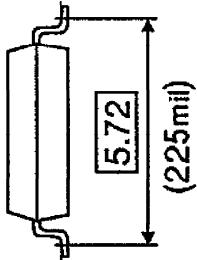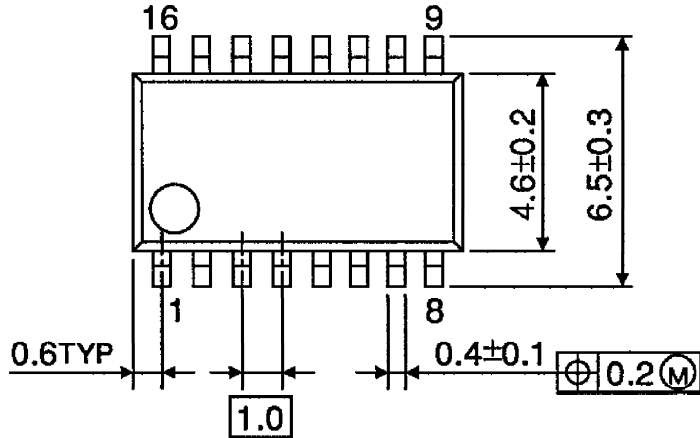Therefore, avoid connecting the capacitor where possible. If connection is necessary to overcome noise, connect resistors in series as shown in the technical data.
The values for the capacitor and resistors must be determined according to the motor.

(Note)   Utmost care is necessary in the design of the output line, V_{CC} and GND line since IC may be destroyed due to short-circuit between outputs, air contamination fault, or fault by improper grounding.

OUTLINE DRAWING
SSOP16-P-225-1.00A   Unit : mm

16   9

4.6±0.2
6.5±0.3

1
8

0.6TYP   0.4±0.1   ⊕ 0.2 Ⓜ

1.0

5.72   (225mil)

8.7MAX

8.2±0.2

1.5±0.2   1.9MAX

$0.1^{+0.1}_{-0.05}$

$0.15^{+0.1}_{-0.05}$

0.525±0.2

Weight : 0.14g (Typ.)