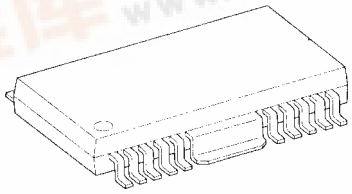
TOSHIBA Bipolar Linear Integrated Circuit Silicon Monolithic

TA8050F

1.5 A DC Motor Driver with Brake Function

The TA8050F is a 1.5 A motor driver which directly drives a bidirectional DC motor. Inputs DI1 and DI2 are combined to select one of forward, reverse, stop, and brake modes. Since the inputs are TTL-compatible, this IC can be controlled directly from a CPU or other control system. The IC also has various protective functions.



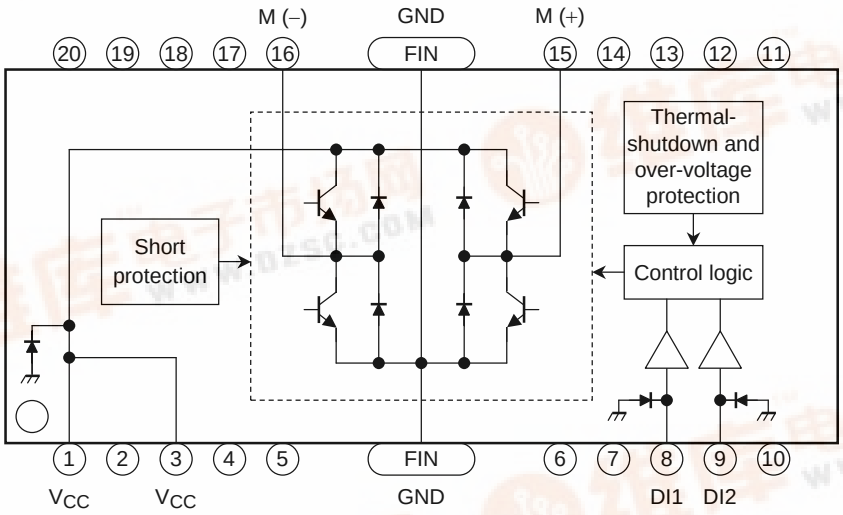
HSOP20-P-450-1.00

Weight: 0.79 g (typ.)

Features

- Bidirectional DC motor driver
- Current capacity : 1.5 A
- Four modes : Forward, Reverse, Stop, and Brake
- Recommended operating supply voltage range : V_{CC} = 6~16 V
- Protective functions : Thermal Shutdown, Short Circuit Protection, and Overvoltage Shutdown
- Built-in diode for counteracting counter electromotive force
- HSOP-20 Pin power flat package

Block Diagram and Pin Layout



Pin Description

Pin No.	Symbol	Description
1 3	V_{CC}	Power supply pin. This pin has a function to turn off the output when the applied voltage exceeds 27.5 V, thus protecting the IC and the load.
FIN	GND	Grounded
8 9	DI1 DI2	Output status control pin. Connects to a PNP-type voltage comparator.
15	M (+)	Connects to the DC motor. Both the sink and the source have a current capacity of 1.5 A. Diodes for absorbing counter electromotive force are contained on the V_{CC} and GND sides.
16	M (–)	Connects to the DC motor together with pin 15 and has the same function as pin 3. This pin is controlled by the inputs from pins 8 and 9.
2, 4~7 10~14 17~20	NC	Not connected. (Electrically, this pin is completely open.)

Truth Table Input/Output

Input		Output		
DI1	DI2	M (+)	M (–)	
H	H	L	L	(Note 1)
L	H	L	H	
H	L	H	L	
L	L	OFF (high impedance)		(Note 2)

Note 1: Brake mode comes into effect when both M (+) and M (–) go low.

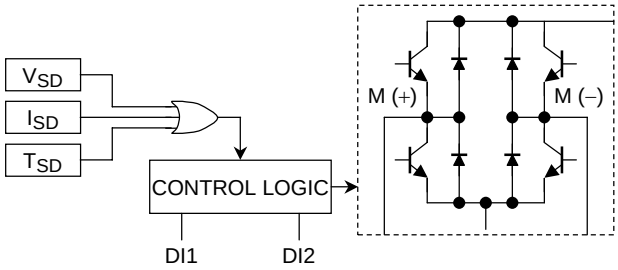
Note 2: Stop mode comes into effect when both M (+) and M (–) turn OFF.

Description of Multi-Protective Operation

The TA8050F has functions for protection from overvoltage (V_{SD}), overcurent (I_{SD}), and overheat (T_{SD}). These functions protect the IC (and the motor load in some cases) from deterioration or destruction due to power-related overstress.

The three functions work independently.

Each function is explained below.



1. Overvoltage protection (V_{SD})

- **Basic operation**

  When the voltage supplied to the V_{CC} pin is up to the V_{SD} detection voltage, the output is controlled by the input signals. However, when the V_{CC} voltage exceeds the detection voltage, the output enters high-impedance state regardless of the input signals.

- **Detailed explanation**

  The V_{SD} voltage is detected by comparing the Zener voltage with the voltage obtained by dividing V_{CC} with a resistor. When the center voltage of the resistor is higher than the Zener voltage, a transistor-off instruction is issued to the control logic. When it is lower than the Zener voltage, the logic is controlled by the input signals from DI1 and DI2.

2. Overheat protection (T_{SD})

- **Basic operation**

  When the junction (chip) temperature is up to the T_{SD} detection temperature, the output is controlled by the input signals. When it exceeds the T_{SD} detection temperature, the output enters high-impedance state regardless of the input signals.

- **Detailed explanation**

  The temperature is detected by monitoring V_F of a diode on the chip. When the diode V_F is lower than the internal reference voltage, an output transistor-off instruction is issued to the control logic. When it is higher than the internal reference voltage, the logic is controlled by the input signals from DI1 and DI2.

3. Overcurrent protections (I_{SD})

- **Basic operation**

When the output current (M (+) or M (–)、 Isink or Isource) is up to the I_{SD} detection current, the output is controlled by the input signals. When it exceeds the detection current, the output assumes a switching waveform as shown in Figure 1.

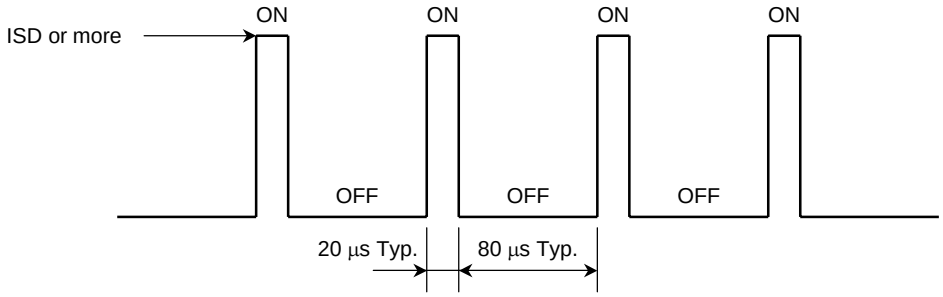


Figure 1 Basic operation

- **Detailed explanation**

The output current is detected by monitoring the V_{BE} from each output transistor. One detection circuit connects to one of the output transistors and leads to the short-circuit protection circuit. When a current exceeding the I_{SD} detection current flows through one of the four output transistors, the short-circuit protection circuit is activated. This circuit contains a timer. When overcurrent condition continues for 20 μs (typically) , the protection circuit places the output in high-impedance mode and, 80 μs (typically) later, returns the IC to ON mode. The switching-waveform output is repeated until overcurrent condition is no longer present.

Maximum Ratings (Ta = 25°C)

Characteristics	Symbol	Rating	Unit
Supply voltage	V_{CC}	30	V
	V_{CC}	60 (1 s)	
Input voltage	V_{IN}	−0.3~V_{CC}	V
Output current	$I_{O•AVE}$	1.5	A
Operation temperature	T_{opr}	−40~110	°C
Storage temperature	T_{stg}	−55~150	°C
Lead temperature time	T_{sol}	260 (10 s)	°C

HSOP20-P-450-1.00 Thermal Resistance Data (Ta = 25°C)

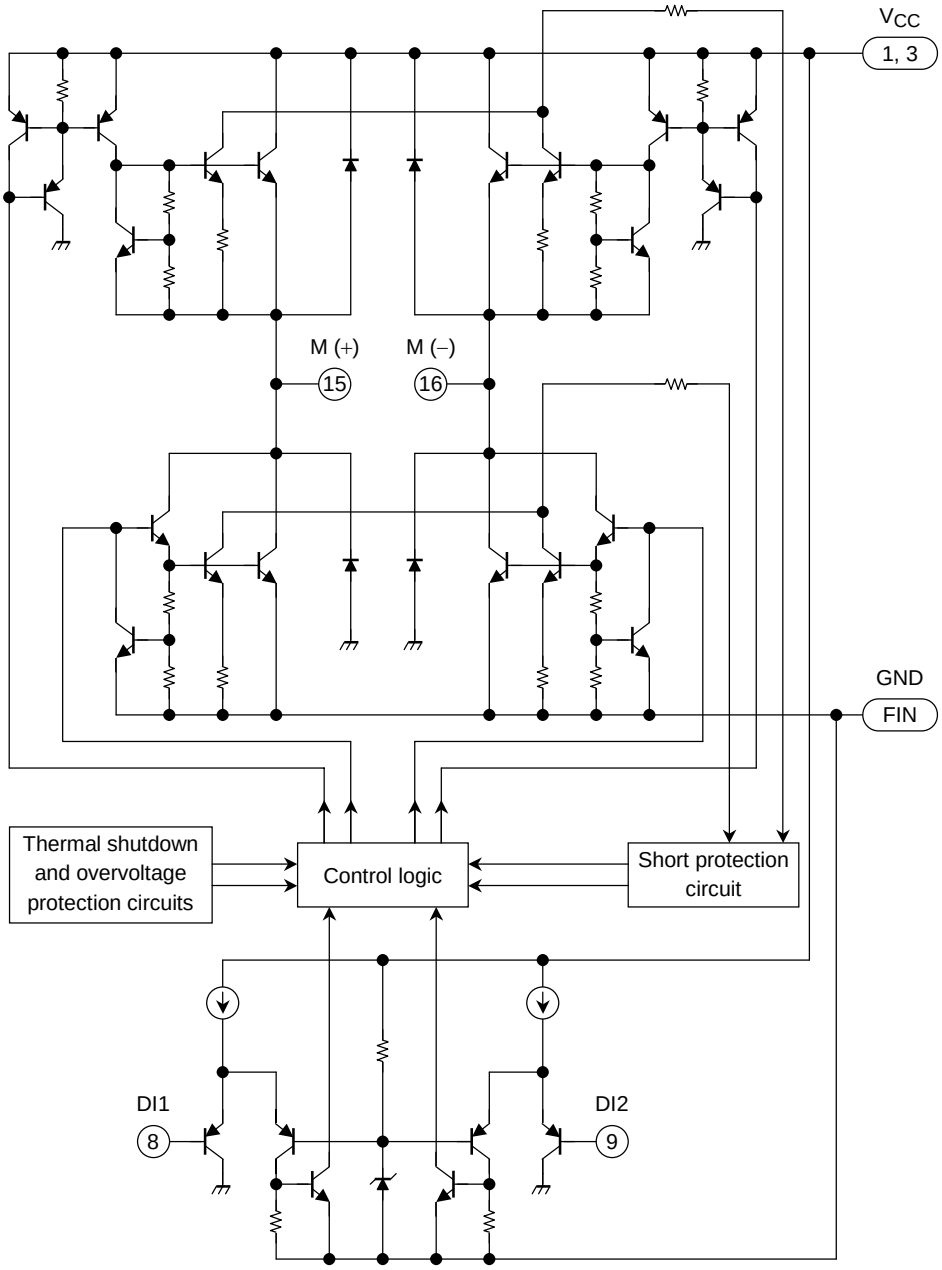
Characteristics	Rating	Unit	Test Condition
Rθj-a	125	°C/W	—
Rθj-c	13	°C/W	—
PD1	1.0	W	Without radiation board
PD2	1.5	W	60 × 30 × 1.6 mm 50%Cu mounted
PD3	3.2	W	50 × 50 × 1.0 mm Iron board mounted
PD4	9.6	W	Infinite radiation board mounted

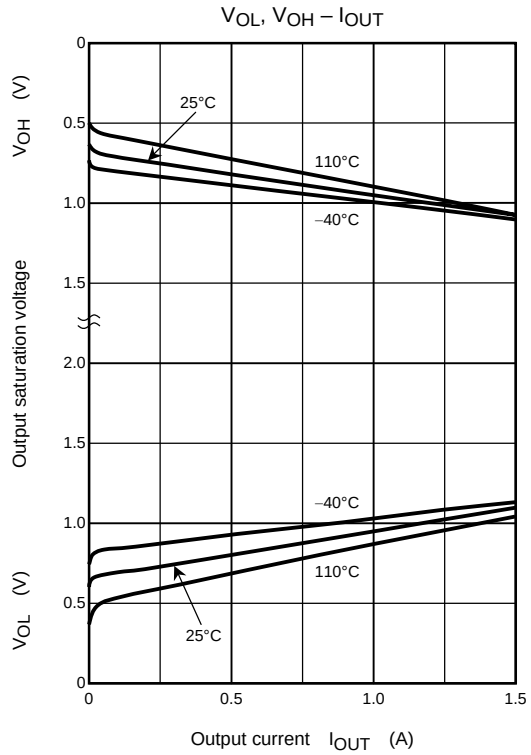
Electrical Characteristics (Unless otherwise specified, V_{CC} = 6~16 V, Tc = −40~110°C)

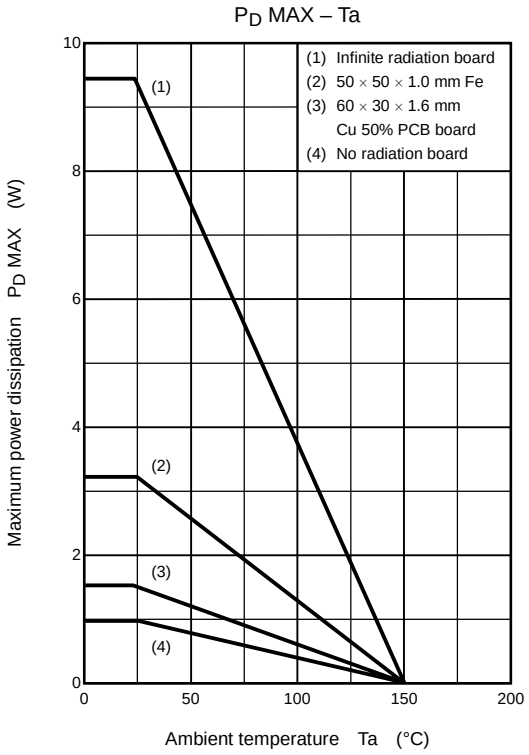
Characteristics	Symbol	Pin	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Current consumption	I_{CC1}	V_{CC}	—	Stop	—	8	15	mA
	I_{CC2}		—	Forward/Reverse	—	27	50	
	I_{CC3}		—	Brake	—	16	30	
Input voltage	V_{IL}	DI1/DI2	—	—	—	—	0.8	V
	V_{IH}		—	—	2.0	—	—	
Input current	I_{IL}	DI1/DI2	—	V_{IN} = 0.4 V	—	—	−100	μA
	I_{IH}		—	V_{IN} = V_{CC}	—	—	100	
Output saturation voltage	$V_{sat\ (total)}$	M (+)/M (−)	—	I_O = 1.5 A, Tc = 25°C	—	2.2	2.9	V
			—	I_O = 1.5 A, Tc = 110°C	—	2.2	2.8	
Output leakage current	I_{LEAK-U}	M (+)/M (−)	—	V_O = 0 V	—	—	−100	μA
	I_{LEAK-L}		—	V_O = V_{CC}	—	—	100	
Diodes forward voltage	V_{F-U}	M (+)/M (−)	—	I_F = 1.5 A	—	2.6	—	V
	V_{F-L}				—	1.5	—	
Over-current detection	I_{SD}		—	—	1.8	3	4	A
Shutdown temperature	T_{SD}		—	—	—	150	—	°C
Over-voltage detection	V_{SD}		—	—	25	27.5	30	V
Transfer delay time	t_{PLH}		—	—	—	1	10	μS
	t_{PHL}		—	—	—	1	10	

Note 3: The parameter values above are guaranteed in the operating voltage rage of 6 V to 16 V. If the guaranteed range is exceeded in practical use, make sure that the IC operates normally in application.

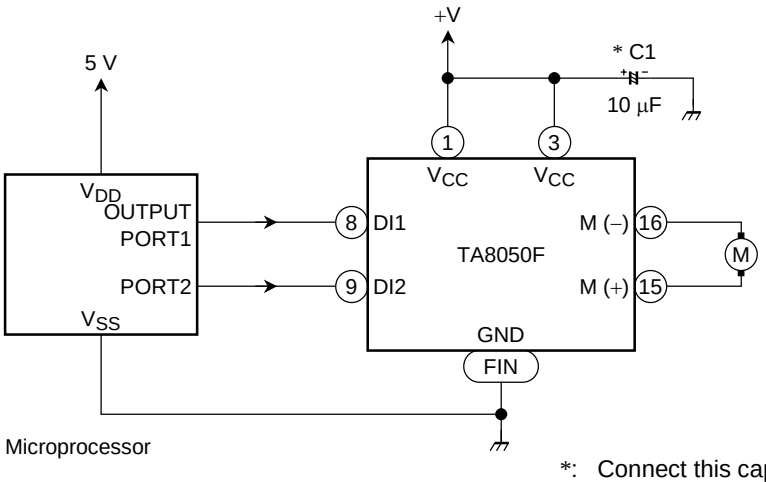
I/O Equivalent Circuit







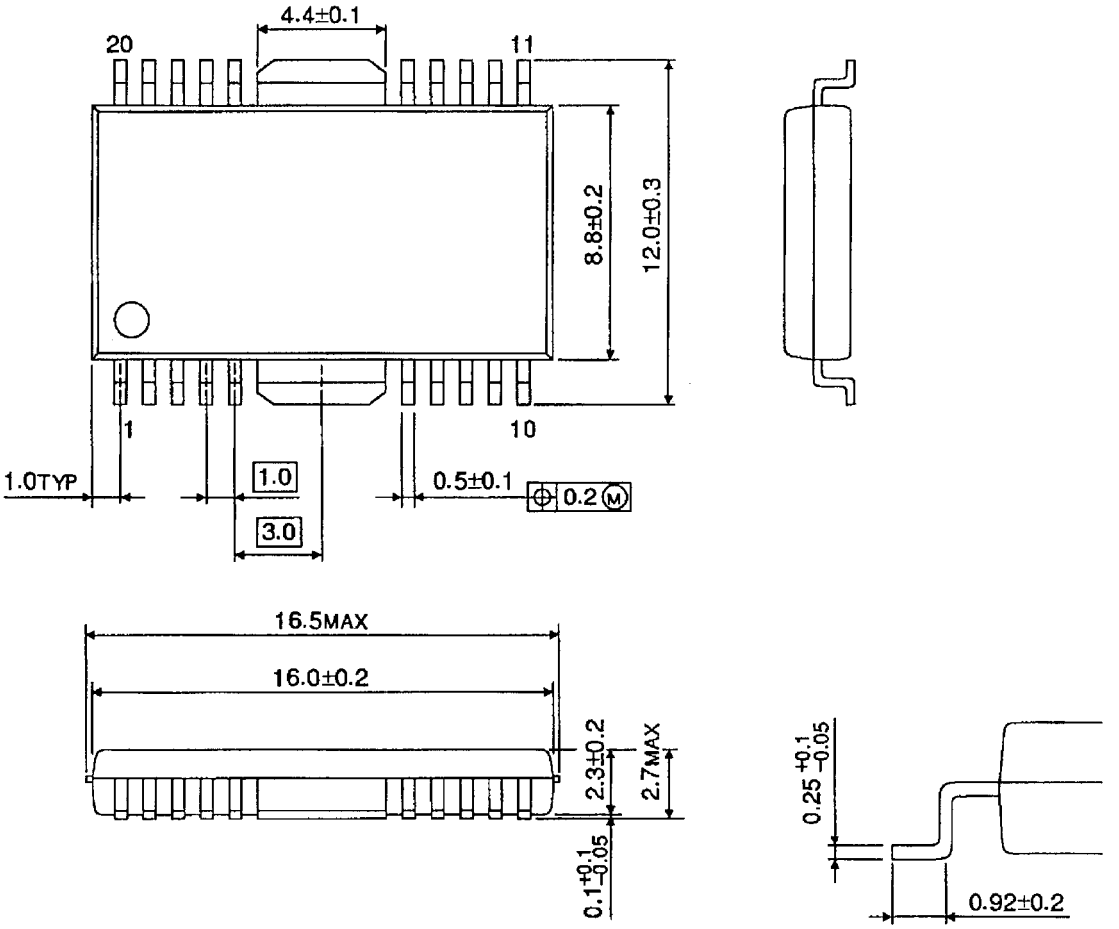
Example of Application Circuit



*: Connect this capacitor as close to the IC as possible.

Package Dimensions

HSOP20-P-450-1.00 Unit : mm



Weight: 0.79 g (typ.)

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