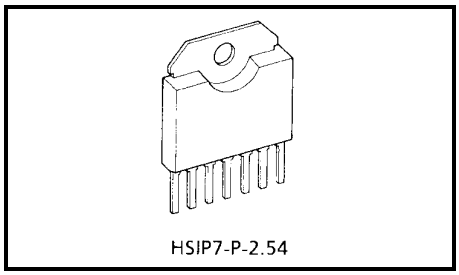
TOSHIBA Bipolar Linear Integrated Circuit Silicon Monolithic

TA8050P

1.5 A Motor Driver with Brake Function

The TA8050P is a 1.5 A motor driver that 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.

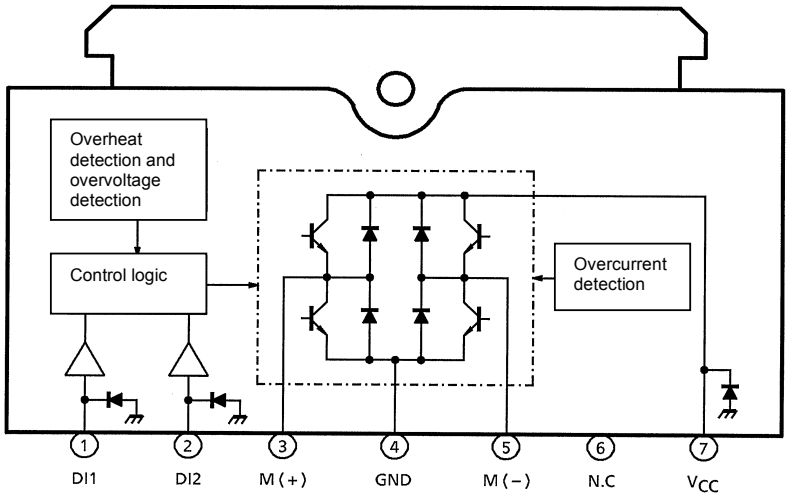


Weight: 1.9 g (typ.)

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 V to 16 V
- Detection functions : Overheat Detection, Overcurrent Detection, and Overvoltage Detection
- Built-in diodes for absorbing counter-electromotive force
- Plastic HSIP-7 pin

Block Diagram and Pin Layout



Note : Some functional blocks, circuits, or constants have been omitted or simplified in the block diagram to clarify the descriptions of the relevant features.

Pin Description

Pin No.	Symbol	Description
1 2	DI1 DI2	Output status control pin. Connects to a PNP-type voltage comparator.
3	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.
4	GND	Grounded
5	M (−)	Connects to the DC motor together with pin 3 and has the same function as pin 3. This pin is controlled by the inputs from pins 1 and 2.
6	NC	Not connected. (Electrically, this pin is completely open.)
7	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.

Truth Table

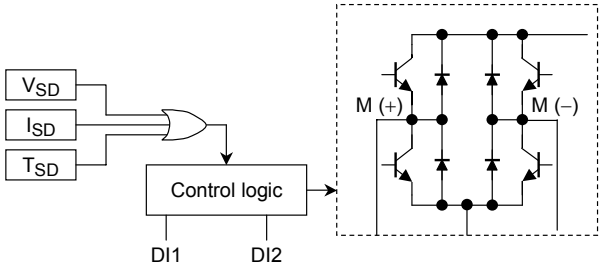
Input		Output		
DI1	DI2	M (+)	M (−)	
H	H	L	L	(Note)
L	H	L	H	
H	L	H	L	
L	L	OFF (high impedance)		(Note)

Note: Brake mode comes into effect when both M (+) and M (−) go Low; Stop mode comes into effect when both M (+) and M (−) turn OFF.

Description of Multi-detection Operation

The TA8050P has functions for detecting overvoltage (V_{SD}), overcurrent (I_{SD}), and overheating (T_{SD}). These functions temporarily protect the IC (and the motor load in some cases) from deterioration or destruction due to power-related overstress.

The three functions work independently and each function is explained below.



Note 1: These functions are intended to protect the IC from instantaneous faults, including output short circuits, and are not designed to protect the IC from all types of faults.

Note 2: If the IC is used beyond the maximum ratings, it may be damaged before the detection circuits are activated.

Note 3: These functions are not activated if the operating voltage is less than 6 V. In this range, short-circuiting the output can cause damage to the IC.

1. Overvoltage detection (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 description
  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 pins 1 and 2.

2. Overheat detection (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 description
  The temperature is detected by monitoring the 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 pins 1 and 2.

3. Overcurrent detections (I_{SD})

- Basic operation
  When the output current (pin 3 or 5, I sink or I source) 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.

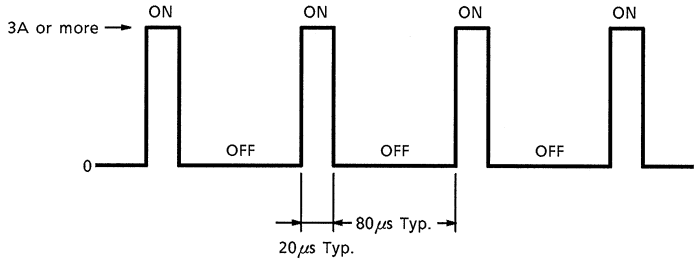


Figure 1. Basic Operation

- Detailed description
  The output current is detected by monitoring the VBE 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 ISD detection current flows through one of the four output transistors, the short-circuit protection circuit is activated. This circuit contains a timer. When the 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 the overcurrent condition is no longer present.

Maximum Ratings (Ta = 25°C)

Characteristic	Symbol	Rating	Unit
Supply voltage	V_{CC}	30	V
	V_{CC}	60 (1s)	
Input voltage	V_{IN}	−0.3 to V_{CC}	V
Output current	$I_{O\text{-}AVE}$	1.5	A
Operation temperature	T_{opr}	−40 to 110	°C
Storage temperature	T_{stg}	−55 to 150	°C
Power dissipation	P_D	12.5	W

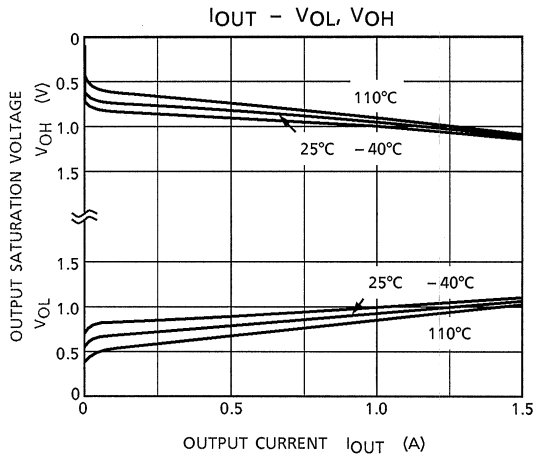
Note: The absolute maximum ratings of a semiconductor device are a set of specified parameter values which must not be exceeded during operation, even for an instant.
If any of these levels is exceeded during operation, the device's electrical characteristics may be irreparably altered and the reliability and lifetime of the device can no longer be guaranteed, possibly causing damage to any other equipment with which it is used. Applications using the device should be designed such that the maximum ratings will never be exceeded in any operating conditions.
Ensuring that the parameter values remain within these specified ranges during device operation will help to ensure that the integrity of the device is not compromised.

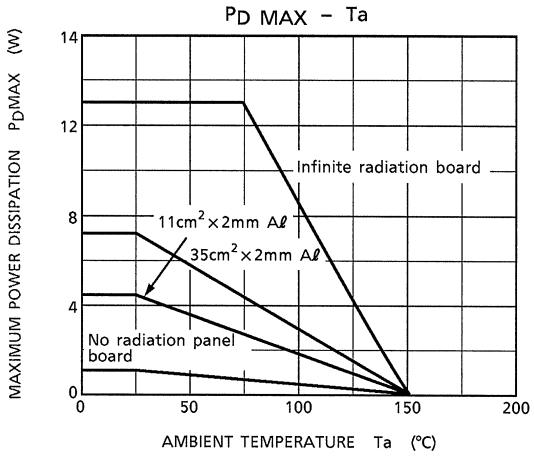
Electrical Characteristics (V_{CC} = 6 to 16 V, Tc = −40 to 110°C)

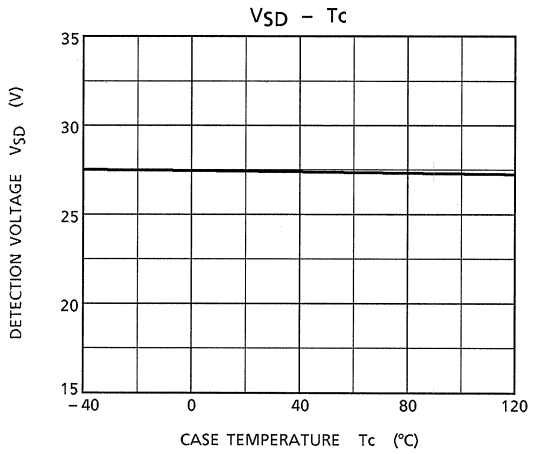
Characteristic	Symbol L	Pin	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Current consumption	I_{CC1}	V_{CC}	—	Stop	—	8	15	mA
	I_{CC2}		—	Forward / Reverse	—	27	50	
	I_{CC3}		—	Brake	—	16	30	
Input voltage	V_{IL}	DI1 / DI2	—		—	—	0.8	V
	V_{IH}		—		2.0	—	—	
Input current	I_{IL}	DI1 / DI2	—	V_{IN} = 0.4 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	$I_{LEAK\text{-}U}$	M (+) / M (−)	—	V_O = 0 V	—	—	−100	µA
	$I_{LEAK\text{-}L}$		—	V_O = V_{CC}	—	—	100	
Diodes forward voltage	$V_{F\text{-}U}$	M (+) / M (−)	—	IF = 1.5 A	—	2.6	—	V
	$V_{F\text{-}L}$		—		—	1.5	—	
Overcurrent detection	I_{SD}		—		1.8	3	4	A
Shutdown temperature	T_{SD}		—		—	150	—	°C
Overvoltage detection	V_{SD}		—		25	27.5	30	V
Thermal resistance	$R\theta_{j\text{-}c}$		—		—	4	—	°C / W
Transfer delay time	t_{pLH}		—		—	1	10	µs
	t_{pHL}		—		—	1	10	

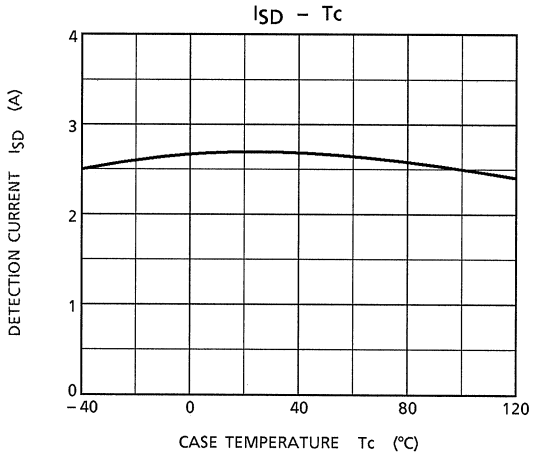
Note: The parameter values above are guaranteed in the operating voltage range of 6 V to 16 V. If the guaranteed range is exceeded, the performance of the IC must be tested thoroughly in its application. It is the customer's responsibility to evaluate the use of the IC.

Reference Characteristics

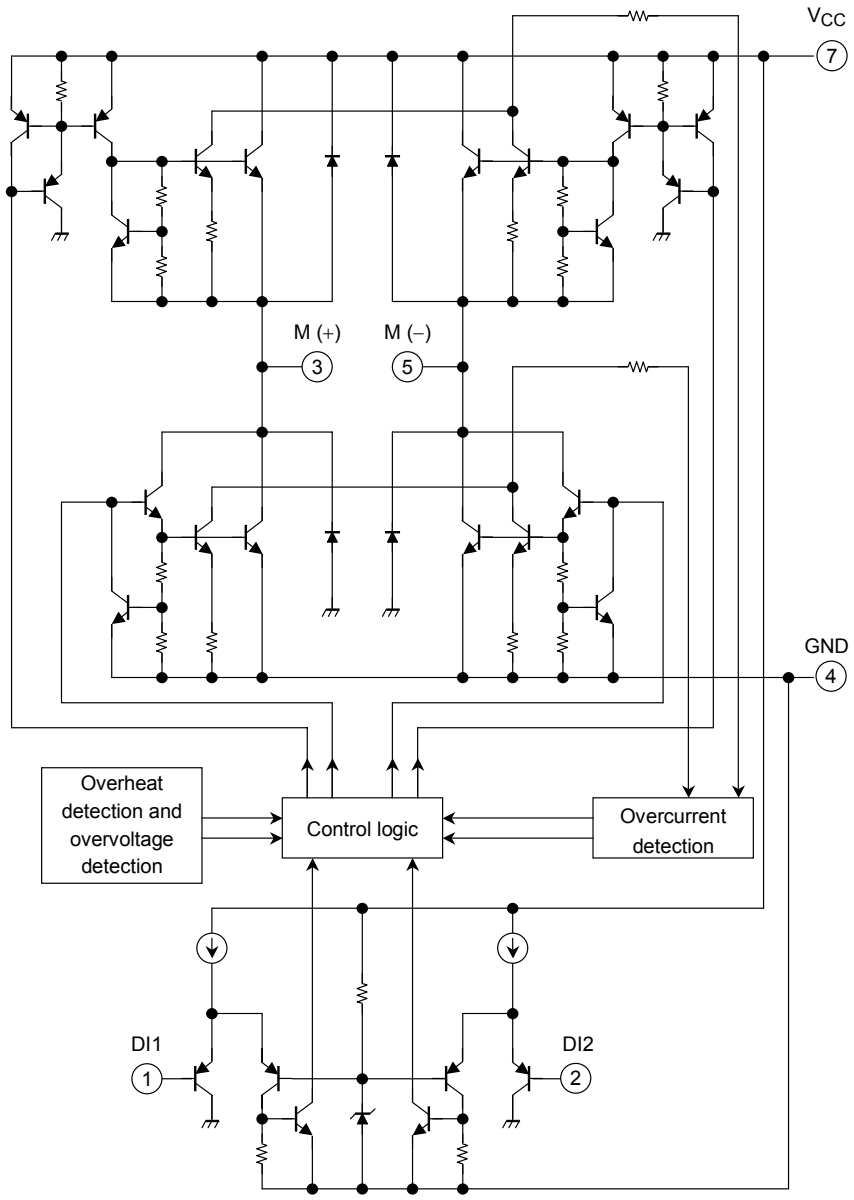






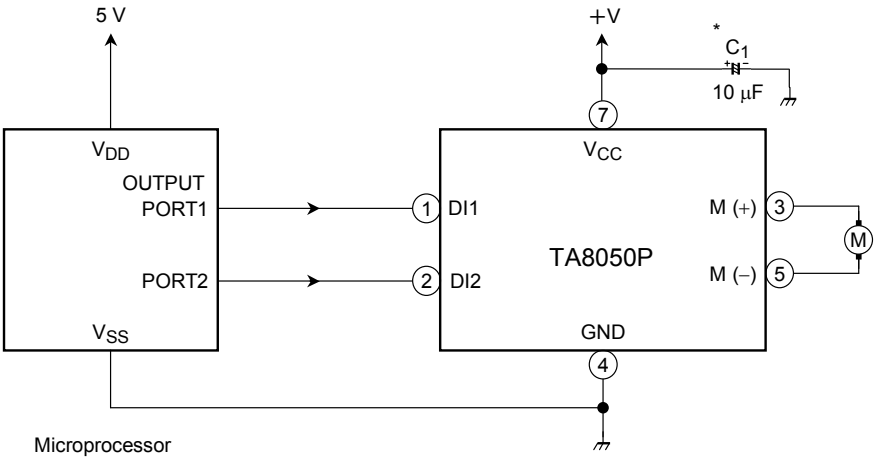


I / O Equivalent Circuit



Note: The equivalent circuit diagrams may be simplified or some parts of them may be omitted for explanatory purposes.

Example Application Circuit



Caution on Wiring

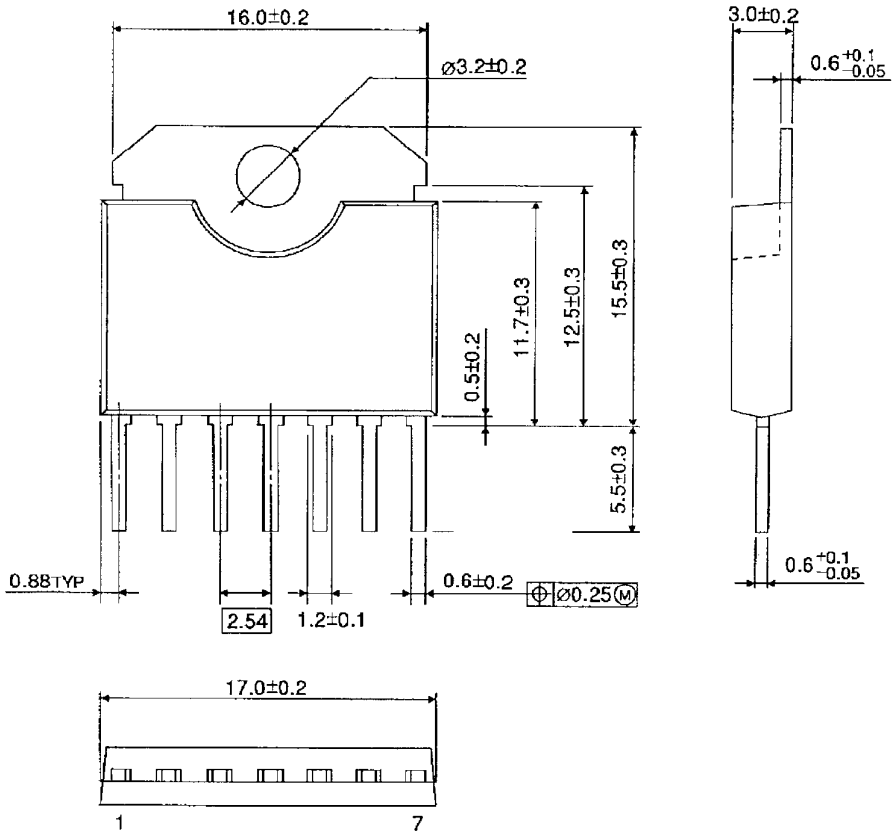
Note 1: The capacitors C1 are for absorbing noise, etc. Connect each capacitor as close to the IC as possible.

Note 2: Ensure that the IC is mounted correctly. Failing to do so may result in the IC or target equipment being damaged.

Note 3: The application circuit shown above is not intended to guarantee mass production. A thorough evaluation is required when designing an application circuit for mass production.

Package Dimensions

HSIP7-P-2.54 Unit : mm



Weight: 1.9 g (typ.)

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