

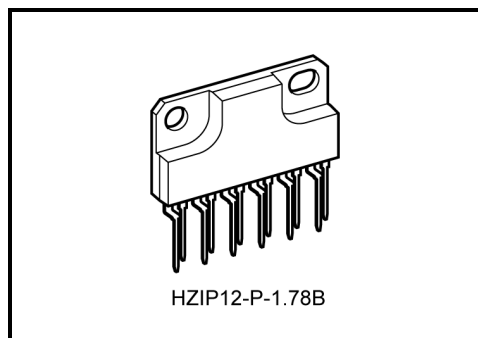
# TA8051P

## 3A MOTOR DRIVER WITH BRAKE FUNCTION

The TA8051P is a bidirectional DC motor driver with a current capacity of 3A. Inputs DI1 and DI2 are combined to select one of forward, reverse, stop, and brake modes. The inputs are TTL-compatible, and separate power supplies are provided for the logic and output sections. The IC also incorporates standby and various protective functions.

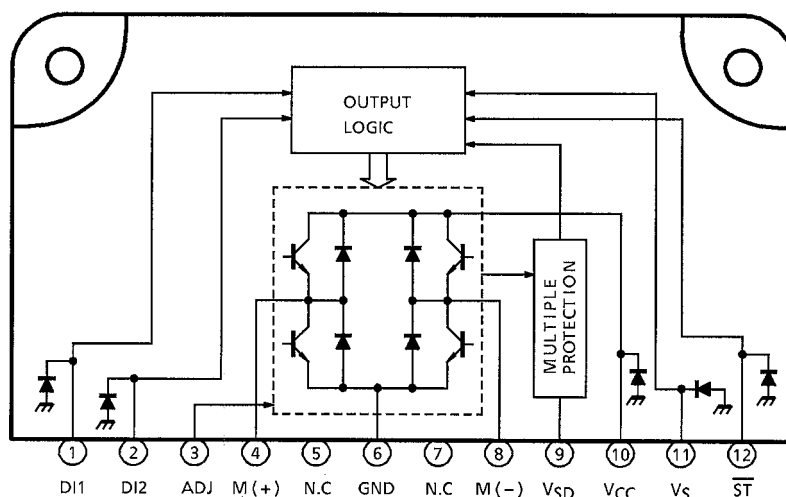
### FEATURES

- Output current capacity : 3A (max.)
- Small standby current consumption : 100μA (max.)
- Separate VCC supplies for output and logic control sections
- Four modes : Forward, reverse, stop, and brake
- Multiple protective functions : Short-circuit protection, thermal shutdown, and overvoltage shutdown
- Built-in diode for counteracting counter electromotive force
- Recommended operating supply voltage range: VCC = 6V to 16V, Vs = 6V to 16V
- Operating temperature range : -40 to 110°C
- Plastic package HZIP-12 pin



Weight: 4.0 g (typ.)

### BLOCK DIAGRAM AND PIN LAYOUT



**PIN DESCRIPTION**

PIN No.	SYMBOL	DESCRIPTION
1 2	DI1 DI2	Output status control pin. Connects to a PNP-type voltage comparator.
3	Adj	Overcurrent detection current setup pin. When this pin is grounded, the ISD value is increased by 1A (typically) .
4	M (+)	Connects to the DC motor. Both the sink and the source have a current capacity of 3A. Diodes for absorbing counter electromotive force are contained on the V <sub>CC</sub> and GND sides.
6	GND	Grounded
8	M (-)	Connects to the DC motor together with pin 4 and has the same function as pin 4. This pin is controlled by the inputs from pins 1 and 2.
9	V <sub>SD</sub>	Overvoltage detection pin. When a voltage higher than 27.5V (typically) is applied to this pin, the output turns off (enters stop mode) . Generally, the pin is directly connected to the V <sub>CC</sub> pin (pin 10) . If overvoltage protection is not needed, the pin is opened or grounded.
10	V <sub>CC</sub>	Power supply pin for the output section
11	V <sub>S</sub>	Power supply pin for the control section. This pin is completely separated from the V <sub>CC</sub> pin.
12	$\overline{\text{ST}}$	When this pin is opened or grounded, the output turns off to reduce the current consumption below 100 $\mu$ A. If standby mode is not needed, the pin connected to V <sub>CC</sub> .
5, 7	NC	Not connected. (Electrically, this pin is completely open.)

**TRUTH TABLE**

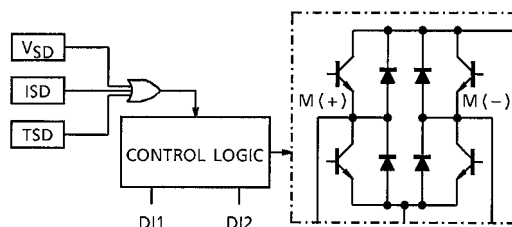
Input		Output			Output Mode
DI1	DI2	ST	M (+)	M (-)	
H	H	H	L	L	BRAKE
L	H	H	L	H	REVERSE
H	L	H	H	L	FORWARD
L	L	H	OFF (high impedance)		STOP
H / L	H / L	L	OFF (high impedance)		STAND-BY

## DESCRIPTION OF MULTI-PROTECTIVE OPERATION

The TA8051P has functions for protection from overvoltage (VSD) , overcurrent (ISD) , and overheat (TSD) . 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 (VSD)

#### • Basic operation

When the voltage supplied to the VCC pin is up to the VSD detection voltage, the output is controlled by the input signals. However, when the VCC voltage exceeds the detection voltage, the output enters high-impedance state regardless of the input signals.

#### • Detailed explanation

The VSD voltage is detected by comparing the Zener voltage with the voltage obtained by dividing VCC 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 protection (TSD)

#### • Basic operation

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

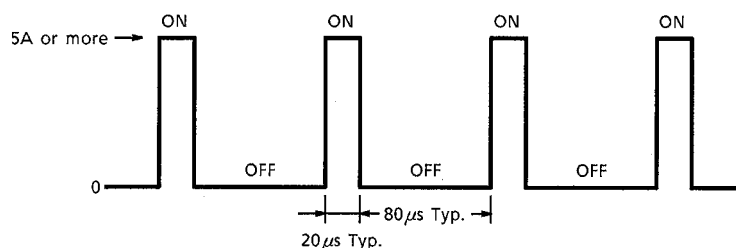
#### • Detailed explanation

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 pins 1 and 2.

### 3. Overcurrent protections (ISD)

#### • Basic operation

When the output current (pin 4 or 8,  $I_{sink}$  or  $I_{source}$ ) is up to the ISD 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 Fig.1.



**Fig.1 Basic Operation**

- Detailed explanation

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 overcurrent condition continues for 20  $\mu$ s (typically) , the protection circuit places the output in high-impedance mode and, 80  $\mu$ s (typically) later, returns the IC to ON mode. The switching-waveform output is repeated until overcurrent condition is no longer present.

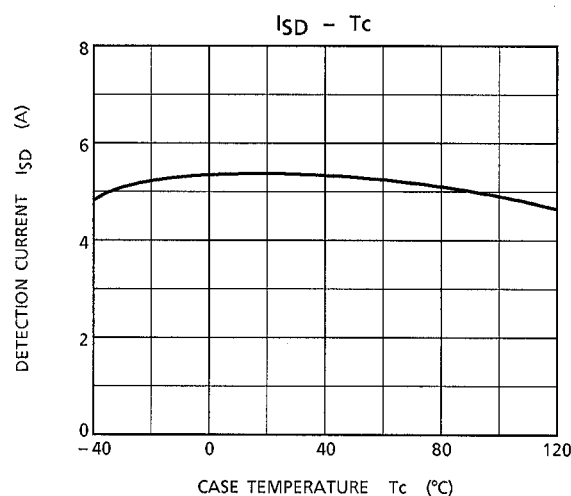
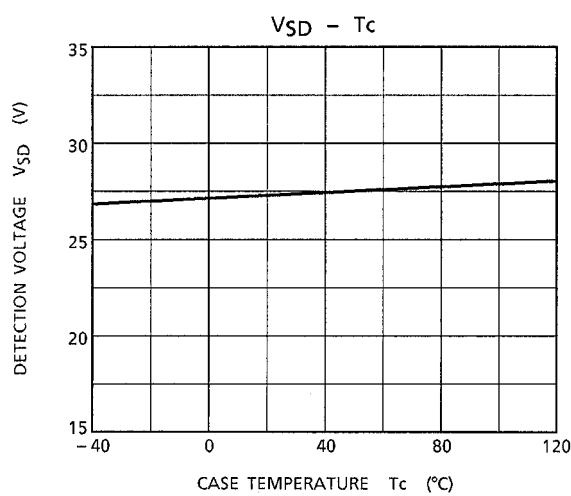
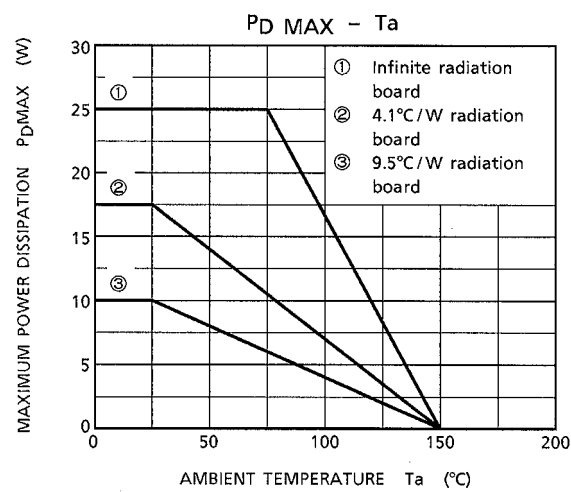
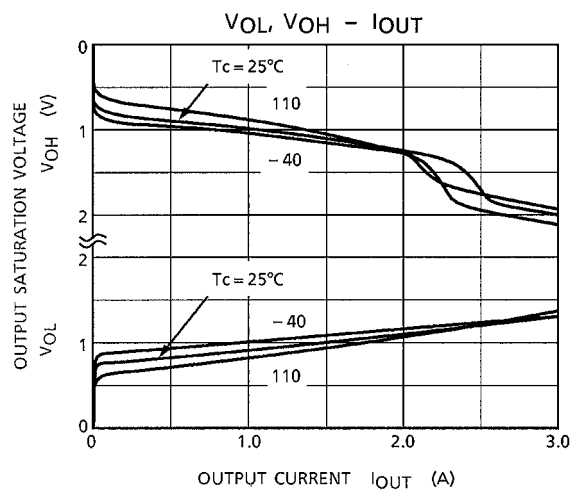
## MAXIMUM RATINGS (Ta = 25°C)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Supply Voltage	V <sub>CC</sub>	30	V
	V <sub>CC</sub>	60 (1s)	
Input Voltage	V <sub>IN</sub>	-0.3 to V <sub>CC</sub>	V
Output Current	I <sub>O AVE</sub>	3.0	A
Operation Temperature	T <sub>opr</sub>	-40 to 110	°C
Storage Temperature	T <sub>stg</sub>	-55 to 150	°C
Power Dissipation	P <sub>D</sub>	25	W
Lead Temperature Time	T <sub>sol</sub>	260 (10s)	°C

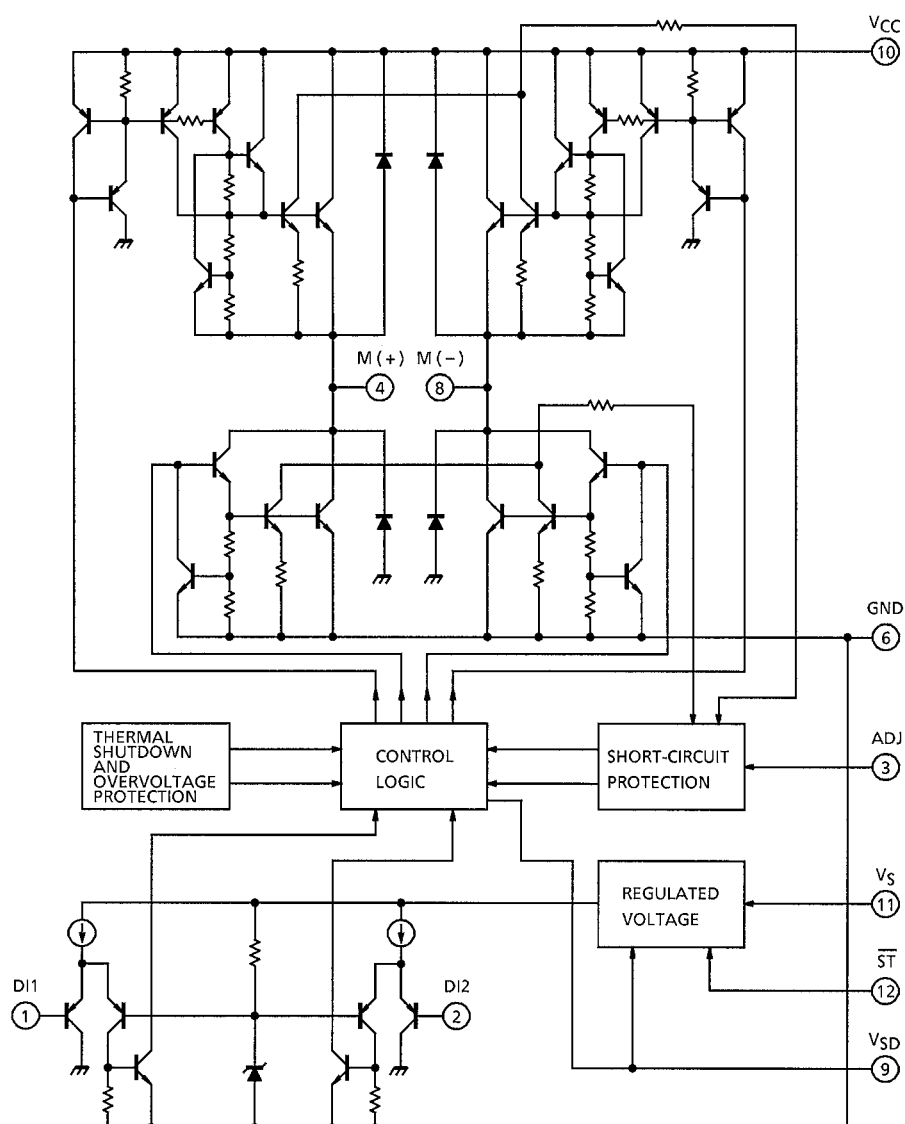
## ELECTRICAL CHARACTERISTICS (V<sub>CC</sub> = 6 to 16V, V<sub>S</sub> = 6 to 16V, T<sub>c</sub> = -40 to 110°C)

CHARACTERISTIC	SYMBOL	PIN	TEST CIR-CUIT	TEST CONDITION	MIN	TYP.	MAX	UNIT
Current Consumption (I)	I <sub>S1</sub>	V <sub>S</sub>	—	Stop	—	6	12	mA
	I <sub>S2</sub>		—	Forward / Reverse	—	20	40	
	I <sub>S3</sub>		—	Brake	—	20	40	
Current Consumption (II)	I <sub>CC1</sub>	V <sub>CC</sub>	—	Stop	—	3	6	mA
	I <sub>CC2</sub>		—	Forward / Reverse	—	16	40	
	I <sub>CC3</sub>		—	Brake	—	3	6	
Input Voltage	V <sub>IL</sub>	DI1/ DI2	—		—	—	0.8	V
	V <sub>IH</sub>		—		2.0	—	—	
Input Current	I <sub>IL</sub>	DI1/ DI2	—	V <sub>IN</sub> = 0.4	—	—	-20	μA
	I <sub>IH</sub>		—	V <sub>IN</sub> = V <sub>CC</sub>	—	—	10	
Input Voltage	V <sub>IL</sub>	$\overline{\text{ST}}$	—		—	—	0.5	V
	V <sub>IH</sub>		—		2.0	—	—	
Input Current	I <sub>IL</sub>	$\overline{\text{ST}}$	—	V <sub>IN</sub> = 0.4	—	—	10	μA
	I <sub>IH</sub>		—	V <sub>IN</sub> = V <sub>CC</sub>	—	—	1	mA
Output Saturation Voltage	V <sub>sat(total)</sub>	M (+) / M (-)	—	I <sub>O</sub> = 1.5A	—	2.1	2.8	V
			—	I <sub>O</sub> = 3.0A	—	3.3	4.1	
Output Leakage Current	I <sub>LEAK-U</sub>	M (+) / M (-)	—	V <sub>O</sub> = 0V	—	—	-100	μA
	I <sub>LEAK-L</sub>		—	V <sub>O</sub> = V <sub>CC</sub>	—	—	100	
Diode Forward Voltage	V <sub>F-U</sub>	M (+) / M (-)	—	I <sub>F</sub> = 3.0A	—	5.0	—	V
	V <sub>F-L</sub>		—	I <sub>F</sub> = 3.0A	—	1.5	—	
Overcurrent Detection	I <sub>SD</sub>		—		3.5	5	6.5	A
			—	Adj = GND	—	6	—	
Shutdown Temperature	T <sub>SD</sub>		—		—	150	—	°C
Overvoltage Detection	V <sub>SD</sub>		—		25	27.5	30	V
Standby Current	I <sub>S</sub>	V <sub>CC</sub> +V <sub>S</sub>	—		—	—	100	μA
Thermal Resistance	R $\theta_{j-c}$		—		—	3	—	°C / W
Transfer Delay Time	t <sub>pLH</sub>		—		—	1	10	μs
	t <sub>pHL</sub>		—		—	1	10	

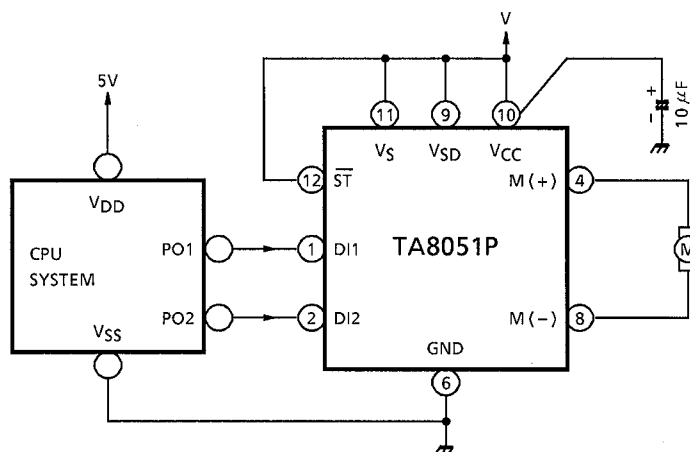
Note: The parameter values above are guaranteed in the operating voltage range of 8V to 16V. If the guaranteed range is exceeded in practical use, make sure that the IC operates normally in application.



## I/O EQUIVALENT CIRCUIT



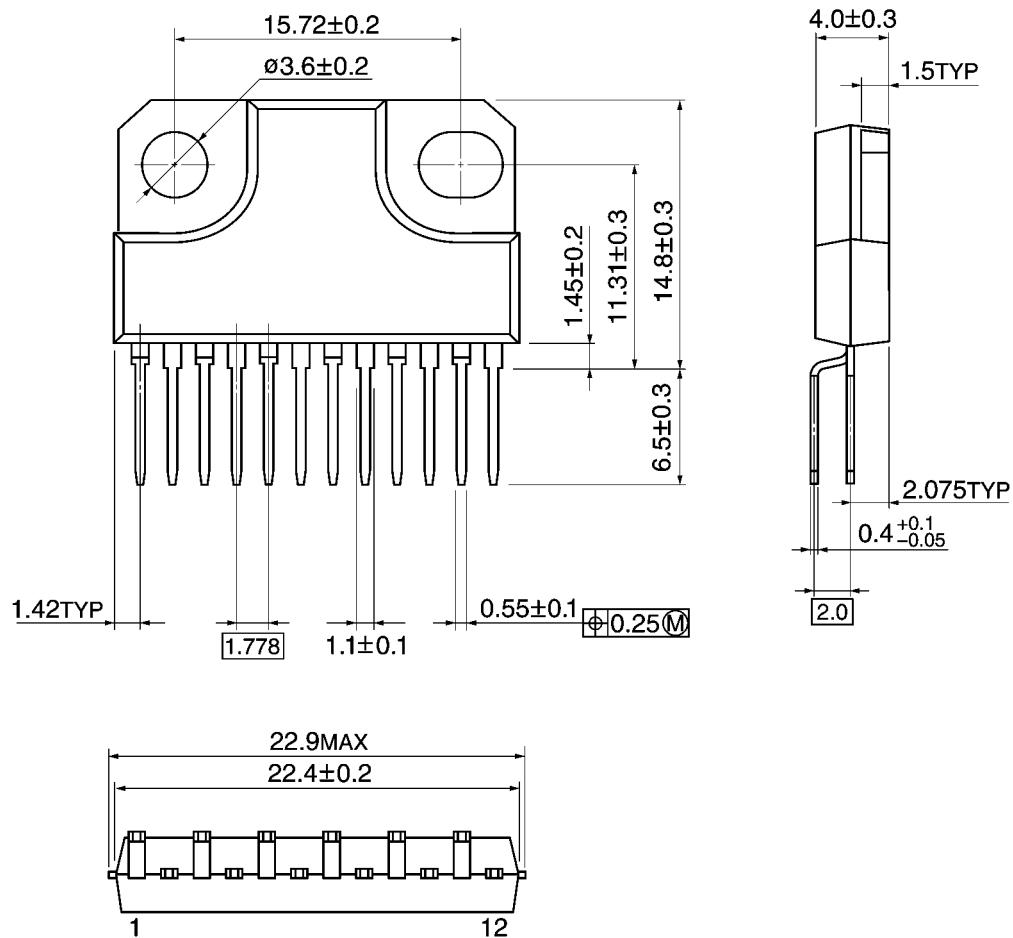
## EXAMPLE OF APPLICATION CIRCUIT



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

## HZIP12-P-1.78B

Unit: mm



Weight: 4.0 g (typ.)



**RESTRICTIONS ON PRODUCT USE**

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