TOSHIBA BIPOLAR LINEAR INTEGRATED CIRCUIT SILICON MONOLITHIC

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

: 3A (max.) Output current capacity Small standby current consumption : $100 \mu A$ (max.)

Separate V_{CC} supplies for output and logic control sections

Four modes : Forward, reverse, stop, and brake

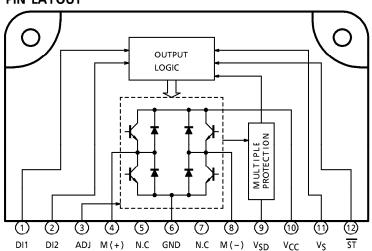
Multiple protective functions : Short-circuit protection, thermal shutdown, and overvoltage

shutdown

Built-in diode for counteracting counter electromotive force

Plastic package HZIP-12 pin

BLOCK DIAGRAM AND PIN LAYOUT



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HZIP12-P-1.78B

Weight: 4.0g (Typ.)

PIN DESCRIPTION

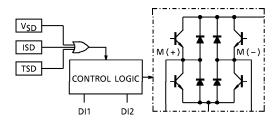
PIN No.	SYMBOL	DESCRIPTION			
1	DI1	Output status control pin.			
2	DI2	Connects to a PNP-type voltage comparator.			
3	Adj	Overcurrent detection current setup pin. When this pin is grounded, the ISD value is increased by 1A (typically).			
4	M (+)	Connects to the DC motor. Both the sink and the source have a current capacity of 3A. Diodes for absorbing counter electromotive force are contained on the V_{CC} and GND sides.			
5	N·C	Not connected			
6	GND	Grounded			
7	N∙C	Not connected			
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 _{SD}	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 _{CC} pin (pin 10). If overvoltage protection is not needed, the pin is opened or grounded.			
10	Vcc	Power supply pin for the output section			
11	VS	Power supply pin for the control section. This pin is completely separated from the V _{CC} pin.			
12	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 VCC.			

DESCRIPTION OF MULTI-PROTECTIVE OPERATION

The TA8051P has functions for protection from overvoltage (V_{SD}), overcurrent (I_{SD}), and overheat (I_{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.



Overvoltage protection (VSD)

• 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 pins 1 and 2.

2. Overheat protection (TSD)

• 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 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 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 Fig.1.

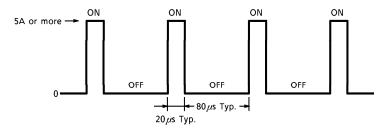


Fig.1 Basic Operation

• 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 $20\mu s$ (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)

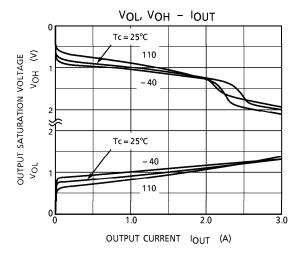
CHARACTERISTIC	SYMBOL	RATING	UNIT	
Supply Voltage	Vcc	30	٧	
Supply Voltage	Vcc	60 (1s)		
Input Voltage	VIN	-0.3 to V _C C	V	
Output Current	IO AVE	3.0	Α	
Operation Temperature	T _{opr}	-40 to 110	°C	
Storage Temperature	T _{stg}	- 55 to 150	°C	
Power Dissipation	P_{D}	25	W	
Lead Temperature-time	Tsol	260 (10s)	°C	

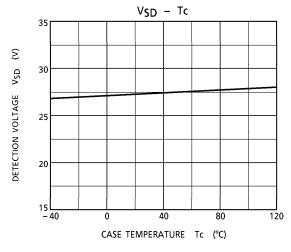
ELECTRICAL CHARACTERISTICS ($V_{CC} = 6$ to 16V, $T_{C} = -40$ to 110°C)

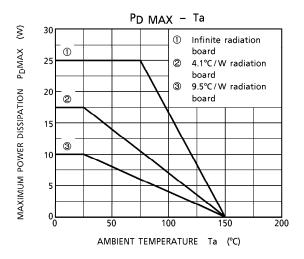
CHARACTERISTIC	SYMBOL	PIN	TEST CIR- CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT	
Command Communication	I _{S1}	I _{S1}		Stop	_	6	12		
Current Consumption (I)	I _{S2}	٧s	_	Forward / Reverse	_	20	40	mΑ	
(1)	I _{S3}		1	Brake 20		40			
Current Consumption	l _{CC1}		l	Stop	_	3	6	mA	
Current Consumption (II)	lcc2	Vcc	_	Forward / Reverse	_	16	40		
(11)	I _{CC3}		_	Brake	_	3	6		
Input Voltage	VIL	DI1	-	<u> </u>	_	_	0.8	.8 V	
Input voltage	V _{IH}	/ DI2	l	_	2.0	_	_		
Input Current	Ē	DI1		V _{IN} = 0.4	_	_	- 20	^	
input Current	ΊΗ	/ DI2		$V_{IN} = V_{CC}$	_	_	10	μΑ	
Input Voltage	۷ _{IL}			_	_	_	0.5	V	
input voitage	V _{IH}	51		_	2.0	_	_	, v	
Input Current	Ι _Ι L	ST	l	V _{IN} = 0.4	_	_	10	μ A	
Input Current	ΊΗ	31	1	V _{IN} = V _{CC}	_	_	1	mΑ	
Output Saturation	V _{sat}	M(+)	1	I _O = 1.5A	—	2.1	2.8	\	
Voltage	(total)	/M(-)	_	I _O = 3.0A	_	3.3	4.1	V	
Output Leakage Current	ILEAK-U	M(+)		V _O = 0V	_	_	- 100	μΑ	
Output Leakage Current	ILEAK-L	/M(-)	l	$V_O = V_{CC}$	_	_	100	μ A	
Diode Forward Voltage	V _{F-U}	M(+)		I _F = 3.0A	_	5.0	_	<	
Diode Forward Voltage	V_{F-L}	/M(-)		I _F = 3.0A	_	1.5		V	
Overcurrent Detection	ent Detection	-	_	_	3.5	5	6.5	Α	
Overcurrent Detection	ISD			Adj = GND	_	6	_		
Shutdown Temperature	T _{SD}	l	-	_	_	150	_	°C	
Overvoltage Detection V _{SD}		_		_	25	27.5	30	V	
Standby Current	IS	Vcc +Vs	_	_	_	_	100	μ A	
Thermal Resistance	$R_{\theta j-c}$				<u>-</u>	3		°C/W	
Transfer Dalay Times	t _{pLH}	_				1	10		
Transfer Delay Time	t _{pHL}	_	_	_		1	10	μ s	

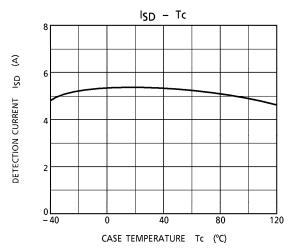
TRUTH TABLE

Inp	out	Output			Output Mada	
DI1	DI2	ST	M(+)	M (-)	Output Mode	
Н	Н	Н	L	L	BRAKE	
L	Н	Н	L	Н	REVERSE	
Н	L	Н	Н	L	FORWARD	
L	L	Н	OFF (high impedance)		STOP	
H/L	H/L	L	OFF (high impedance)		STAND·BY	

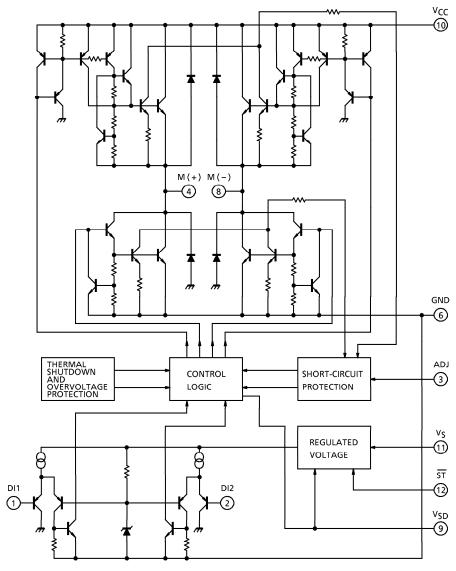






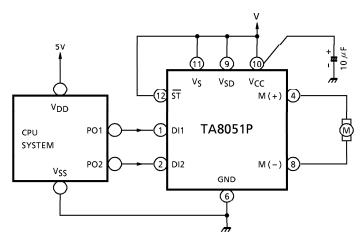


I/O EQUIVALENT CIRCUIT

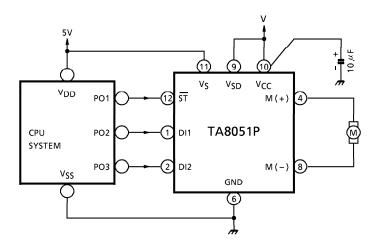


EXAMPLE OF APPLICATION CIRCUIT

1. Standard Circuit

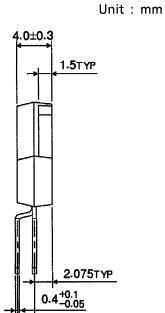


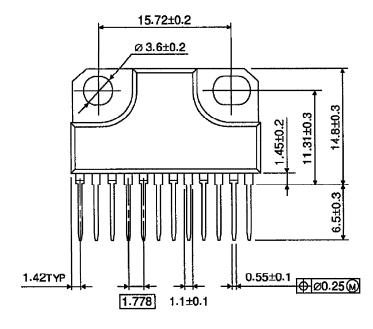
2. Power Supply Separation and Standby Functions

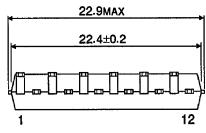


OUTLINE DRAWING

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