TOSHIBA BIPOLAR LINEAR INTEGRATED CIRCUIT   SILICON MONOLITHIC

TA8050AK

1.5A MOTOR DRIVER WITH BRAKE FUNCTION

The TA8050AK is a 1.5A bi-directional DC motor driver and it can switch forward, reverse, stop and brake mode with input DI1 and DI2. Protective functions are built in to protect IC and load from destruction caused of over stress.


HSIP7-P-2.54A

Weight: 2.2 g (typ.)

FEATURES

- Bi-directional DC Motor Driver
- 1.5A Current Capacity
- Low standby current : 100 μ A (Max.)
- 4 Operation mode of forward, Reverse, Stop and Brake
- Recommended operating supply voltage range: V_{CC} = 8V to 16V
- Built-in Protective Functions   : Thermal-Shutdown

    Short-Circuit Protection

    Over-Voltage Protection
- Built-in Counter Electromotive Force Absorption Diodes
- HSIP 7 Pin Bushless Package
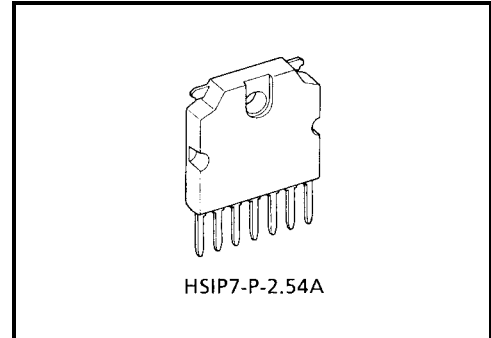
BLOCK DIAGRAM AND PIN LAYOUT
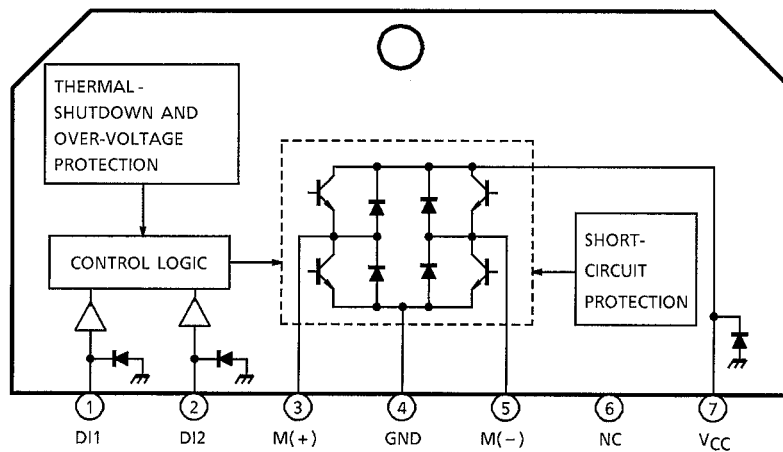
PIN DESCRIPTION

| PIN No.	SYMBOL	DESCRIPTION
1 2	DI1 DI2	This terminal controls output condition.
3	M (+)	DC motor is connected to this terminal. The output current capacity is 1.5A. Diodes for counter electromotive force absorption are built in.
4	GND	Ground Terminal.
5	M (−)	Motor is connected between 3 pin and this terminal. This terminal has the same function as 3 pin and is controlled by 1 pin and 2 pin.
6	NC	Non connection. (Electrically, this pin is completely open.)
7	V_{CC}	Power supply terminal. When the voltage higher than 30.0V is supplied, the output becomes OFF to protect the IC and 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-PROTECTIVE OPERATION

The TA8050AK has 3 protective functions of over voltage (VSD), over current (ISD), and thermal shut down (TSD). The purpose of these functions is to protect IC (including motor load) from destruction caused of over stress. These functions operate independently.
Description of these functions is shown below.
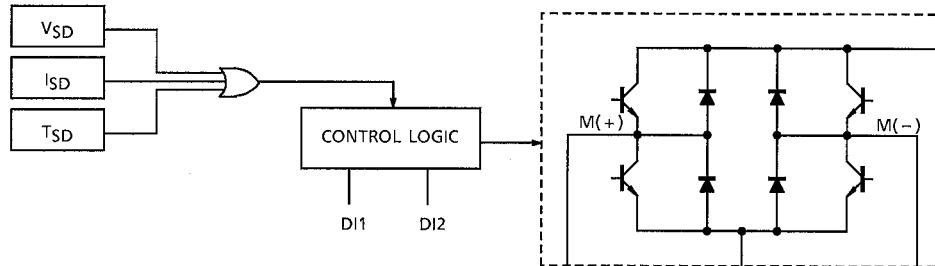
1. Over-Voltage Protection (V_{SD})

• Basic Operation

When the supplied voltage to V_{CC} terminal is lower than the V_{SD} detection voltage, the output is controlled by the input signal and when this voltage is higher than the detection voltage, the output becomes high impedance unrelated to the input signal.

• Detail Description

V_{SD} voltage detection is performed by comparing the voltage of zener and V_{CC}.
When the V_{CC} voltage 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. Thermal-Shutdown (T_{SD})

• Basic Operation

When the junction temperature (chip temperature) is lower than the T_{SD} detection temperature, the output is controlled by the input signal and when it is higher, the output becomes high impedance unrelated to the input signal.

• Detail Description

Temperature detection is performed by watching V_F of an element (diode) on the chip.
When the V_F of the diode is lower than the inside reference voltage, the output is ordered to be OFF and when it is higher, the output is controlled by the input signal of 1 pin and 2 pin.

3. Over-Current Protection (I$_{SD}$)

- Basic Operation

    When the output current (3 pin or 5 pin, Isink or Isource) is lower than the I$_{SD}$ detection current, the output is controlled by the input signal and when it is higher, the output current flows intermittently as shown in Fig.1.
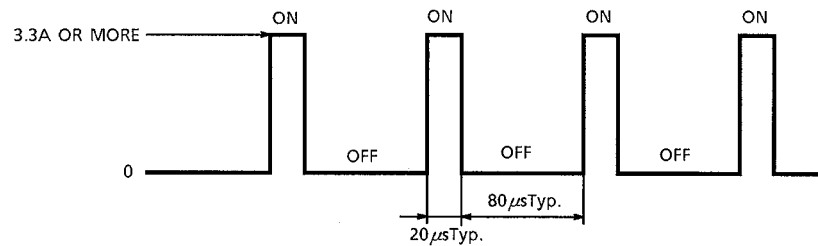

Fig.1   Basic Operation

    The short protective circuit operates when the current, higher than the I$_{SD}$ detection current, flows.

- Detail Description

    Output current detection is performed by watching the V$_{BE}$ of the output transistors.
    An element for the detection is connected to each output Transistor and then connected to the short protective circuit operates.
    This circuit has a timer and when the over current condition is continued for $20\,\mu$s (Typ.), the output becomes high impedance mode and after $80\,\mu$s (Typ.) it becomes ON again. At this time, if the over current condition is still continued, this switching mode is repeated until the over current condition is disappeared.

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~V_{CC}	V
Output Current	I_O-AVE	1.5	A
Power Dissipation	P_D	12.5	W
Operation Temperature	T_{opr}	−40~110	°C
Storage Temperature	T_{stg}	−55~150	°C
Lead Temperature Time	T_{sol}	260 (10s)	°C

ELECTRICAL CHARACTERISTICS (V_{CC} = 8~16V, Tc = −40~110°C)

CHARACTERISTIC	SYMBOL	PIN	TEST CIR-CUIT	TEST CONDITION	MIN	TYP.	MAX	UNIT
Power Supply Current	$I_{CC}1$	V_{CC}	—	STOP (STANDBY)	—	—	0.1	mA
	$I_{CC}2$			FORWARD / REVERSE	—	40	60	
	$I_{CC}3$			BRAKE	—	27	40	
Input Voltage	V_{IL}	DI1 / DI2	—		—	—	0.8	V
	V_{IH}				2.4	—	—	
Input Current	I_{IL}	DI1 / DI2	—	V_{IN} = 0.4V	—	10	20	µA
	I_{IH}			V_{IN} = 5V	80	170	350	
Output Saturation Voltage	V_{sat} (total)	M (+) / M (−)	—	I_O = 1.5A, Tc = 25°C	—	2.2	2.9	V
				I_O = 1.5A, Tc = 110°C	—	2.2	2.8	
Output Leakage Current	I_{LEAK-U}	M (+) / M (−)	—	V_{OUT} = 0V	—	—	−10	µA
	I_{LEAK-L}			V_{OUT} = V_{CC}	—	—	10	
Diodes Forward Voltage	V_F-U	M (+) / M (−)	—	IF = 1.5A	—	2.6	—	V
	V_F-L				—	1.5	—	
Over-Current Detection	I_{SD}		—		2.4	3.3	4.2	A
Shutdown Temperature	T_{SD}		—		—	160	—	°C
Over-Voltage Detection	V_{SD}		—		27	30	33	V
Thermal Resistance	$R\theta_{j-c}$		—		—	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 8V to 16V. If the guaranteed range is exceeded in practical use, make sure that the IC operates normally in application.
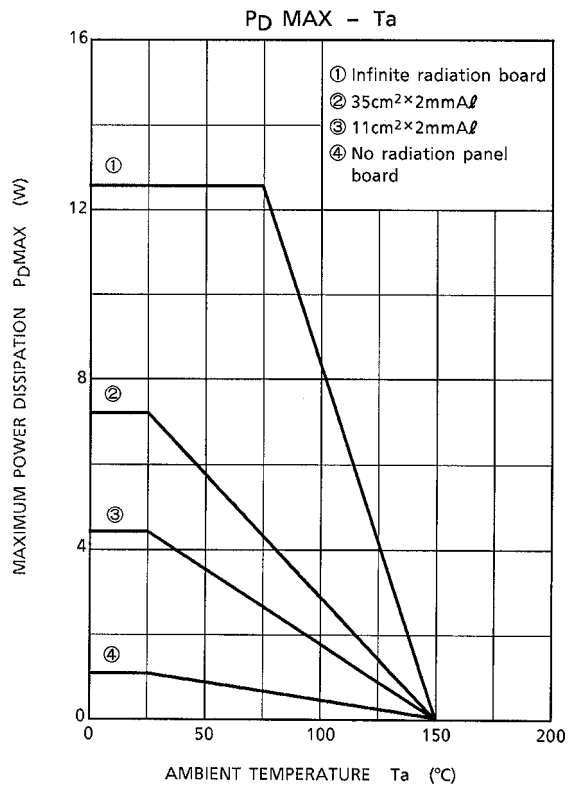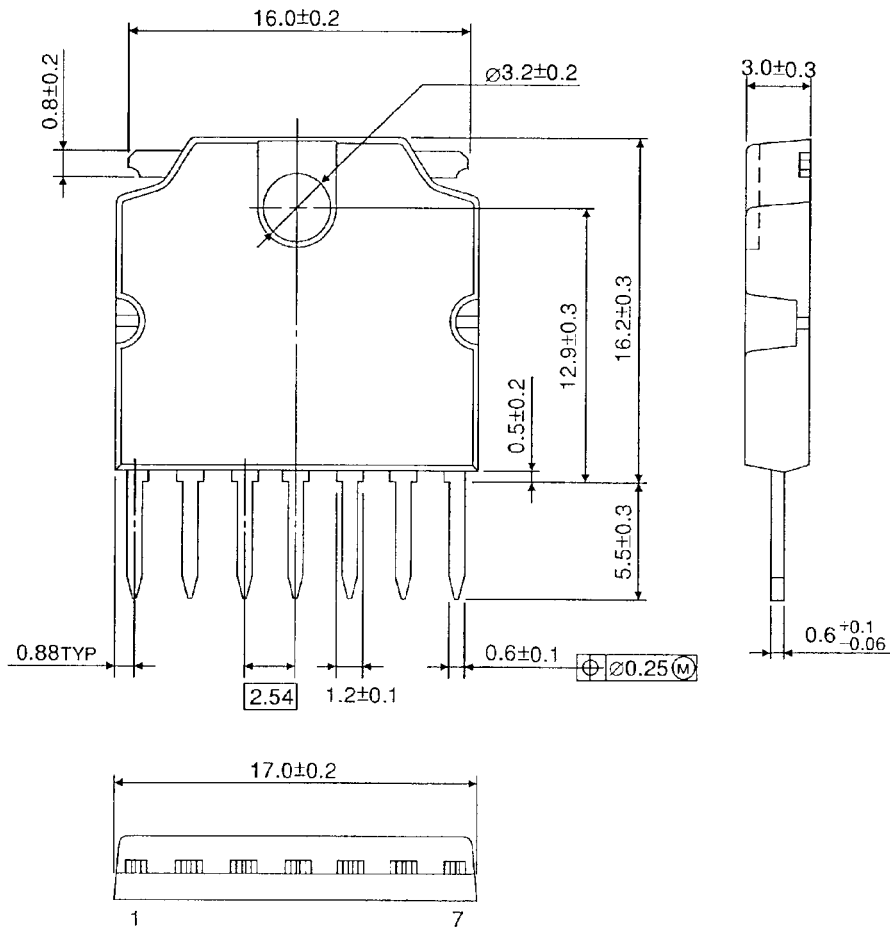
EQUIVALENT CIRCUIT
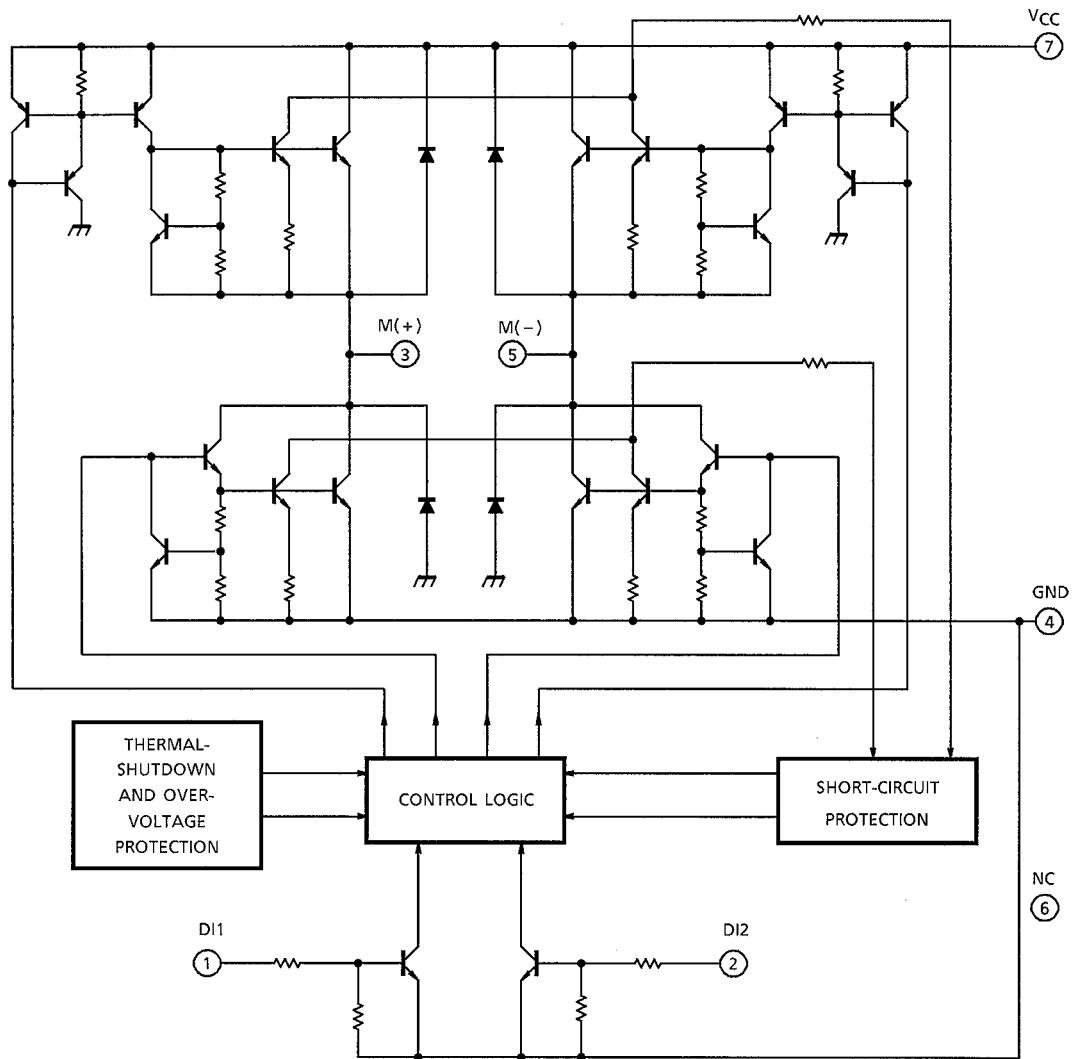
APPLICATION CIRCUIT
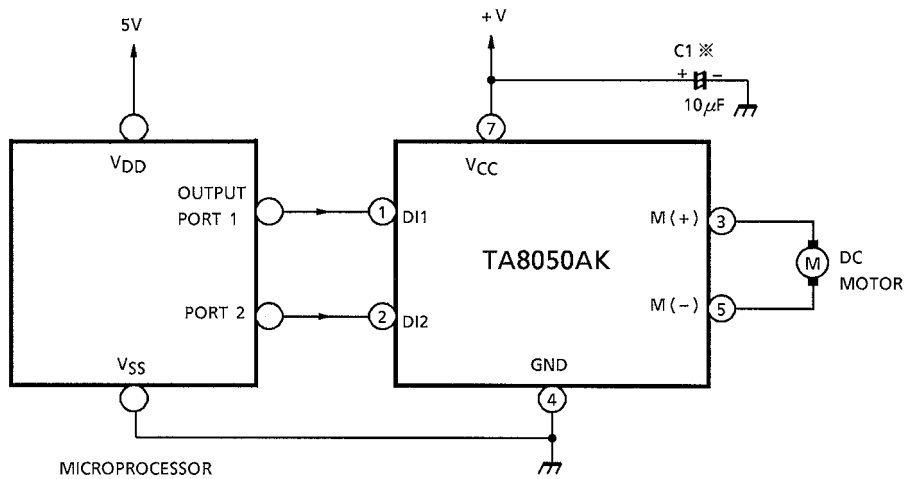
*: Cautions for Wiring
C1 is for absorbing disturbance, noise, etc.
Connect it as close to IC as possible.

P_D MAX − Ta

① Infinite radiation board
② 35cm²×2mmAℓ
③ 11cm²×2mmAℓ
④ No radiation panel board

MAXIMUM POWER DISSIPATION P_DMAX (W)

AMBIENT TEMPERATURE Ta (°C)

PACKAGE DIMENSIONS

HSIP7-P-2.54A   Unit : mm

Weight: 2.2g (Typ.)

RESTRICTIONS ON PRODUCT USE