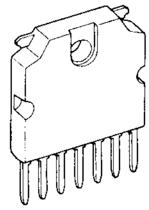
TOSHIBA BIPOLAR LINEAR INTEGRATED CIRCUIT SILICON MONOLITHIC

TA8080K

1.0A MOTOR DRIVER WITH BRAKE FUNCTION

The TA8080K is a 1.0A 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.

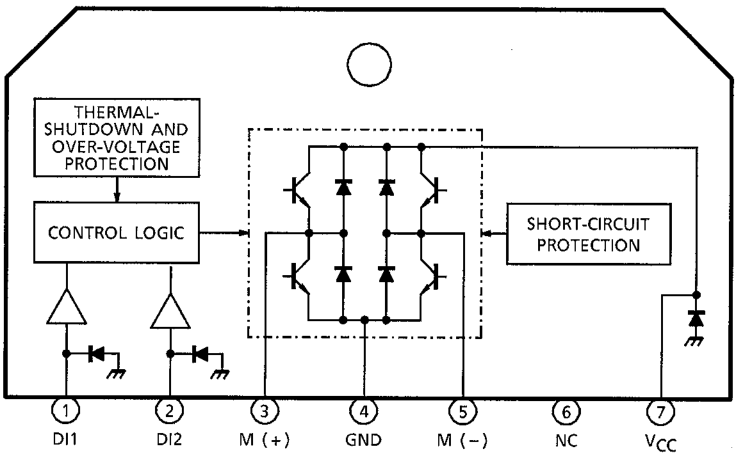


Weight: 2.2 g (typ.)

FEATURES

- Bidirectional DC motor driver.
- 1.0A current capacity.
- Four operation modes : Forward, reverse, stop, and brake.
- Recommended operating supply voltage range: V_{CC} = 6V to 16V
- Protective functions : Thermal-shutdown, short-circuit protection, and over-voltage shutdown.
- Built-in counter electromotive force absorption diodes.
- Plastic package HSIP-7pin.

BLOCK DIAGRAM AND PIN LAYOUT



PIN DESCRIPTION

PIN No.	SYMBOL	DESCRIPTION
1	DI1	Output status control pin. Connects to a PNP-type voltage comparator.
2	DI2	
3	M (+)	Connects to the DC motor. Both the sink and the source have a current capacity of 1.0A. 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 30.0 V, thus protecting the IC and the load.

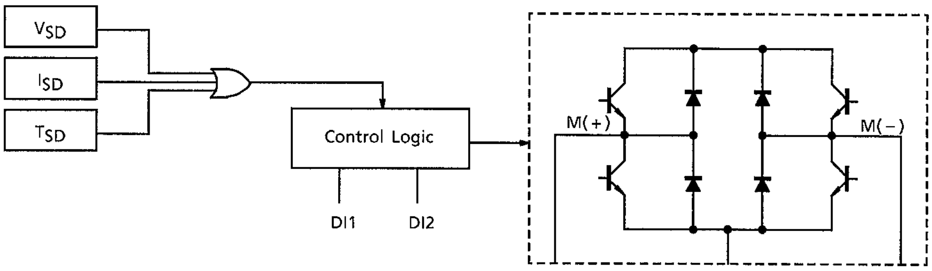
TRUTH TABLE

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.

MUTLI PROTECTIVE FUNCTIONS

The TA8080K contains three protective functions: Overvoltage (V_{SD}), Overcurrent (I_{SD}), and Overheat (T_{SD}). All these functions are incorporated to protect the IC (even including the motor load) against degradation and breakdown due to power-derived overstresses. These three functions operate independently of each other. The following explains each function.



1. Overvoltage Protection (V_{SD})

- Basic Operation

  When the voltage applied to the V_{CC} pin is below the V_{SD} detection level, output is controlled by input signals. However, when the V_{CC} voltage exceeds the detection level, output goes to a high-impedance state irrespective of the input signal.

- Functional Description

  The V_{SD} voltage detection is accomplished by comparing the Zener and the V_{CC} voltages. When the V_{CC} voltage is higher than the Zener voltage, an instruction is forwarded to the control logic unit to turn off the output transistors. When it is lower than the Zener voltage, the logic unit is controlled by input signals, DI1 and DI2.

2. Overheat Protection (T_{SD})

- Basic Operation

  When the junction temperature (chip temperature) is below the T_{SD} detection level, output is controlled by input signals. However, when the junction temperature exceeds the detection level, output goes to a high-impedance state irrespective of the input signal.

- Functional Description

  The temperature detection is accomplished by monitoring VF of the on-chip diode. The diode V_F is compared with the internal reference voltage and if it is found below the reference voltage, an instruction is forwarded to the control logic unit to turn off the output transistors. When it is higher than the reference voltage, the logic unit is controlled by input signals, DI1 and DI2.

3. Overcurrent Protection (I_{SD})

- Basic Operation

When the output current (I_{sink} or I_{source} on pin 3 or pin 5) is below the I_{SD} detection level, output is controlled by input signals. However, when the output current exceeds the detection level, output changes to a switching waveform like the one shown in Figure 1 below.

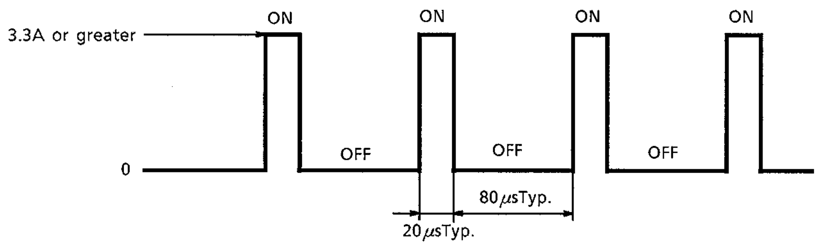


Figure1. Basic Operation

- Functional Description

The output current detection is accomplished by monitoring VBE of each output transistor. The detection sensor is connected to each output transistor, as well as to the short-circuiting protection circuit. If a current greater than the I_{SD} detection level flows in any one of the four output transistors, the short-circuiting protection circuit is actuated.
This circuit contains a timer, so that when the overcurrent condition continues for 20 μ s (typ.), output is placed in the high-impedance state (output OFF). Then, 80 μ s (typ.) later, output is returned to output-ON mode. If the overcurrent condition still exists at this time, the above switching mode is repeated until the overcurrent condition is removed.

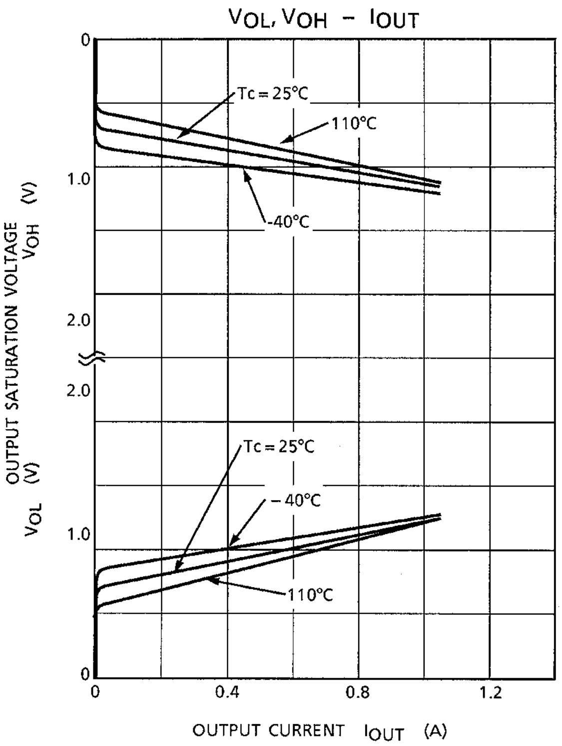
MAXIMUM RATINGS (Ta = 25°C)

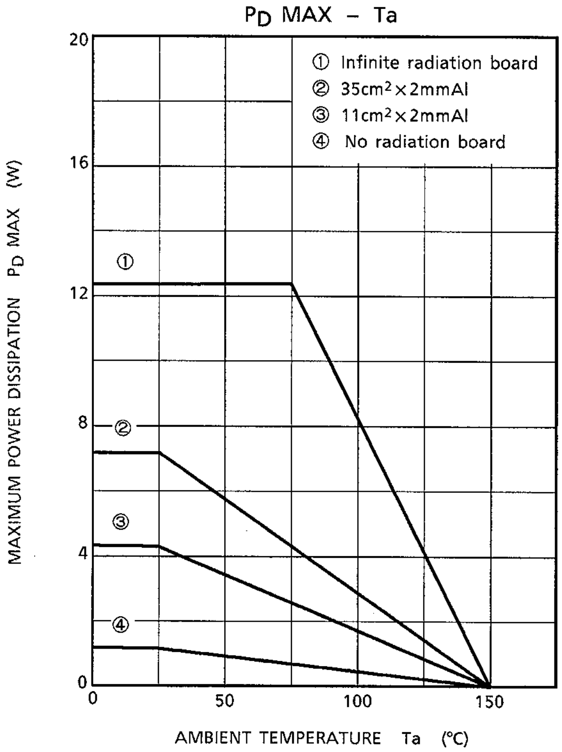
CHARACTERISTIC	SYMBOL	RATING	UNIT
Power Supply Voltage	V_{CC}	30	V
	V_{CC}	60 (1s)	
Input Voltage	V_{IN}	-0.3~V_{CC}	V
Output Current	$I_{O\text{-}AVE}$	1.0	A
Power Dissipation	P_D	12.5	W
Operation Temperature	T_{opr}	−40~110	°C
Storage Temperature	T_{stg}	−55~150	°C
Lead Temperature Time	T_{sol}	260 (10s)	°C

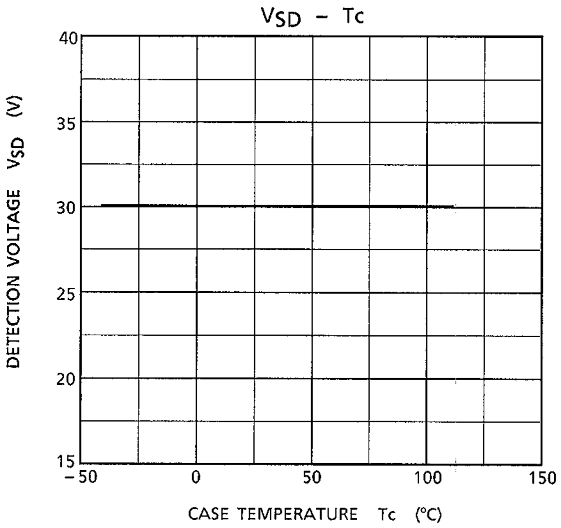
ELECTRICAL CHARACTERISTICS (V_{CC} = 6~16V, Tc = −40~110°C)

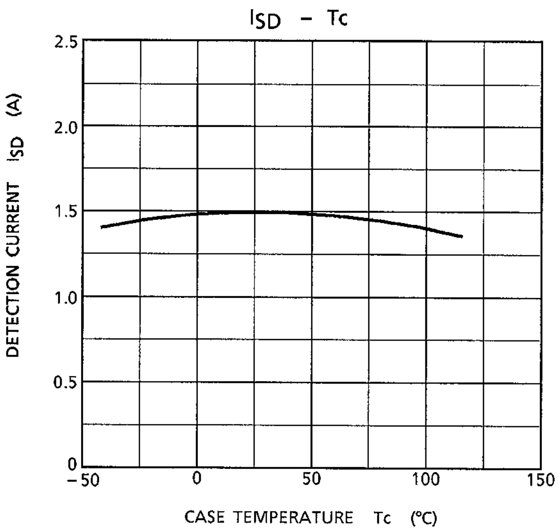
CHARACTERISTIC	SYMBOL	PIN	TEST CIR-CUIT	TEST CONDITION	MIN	TYP.	MAX	UNIT
Power Supply Current	I_{CC1}	V_{CC}	—	Stop	—	8	15	mA
	I_{CC2}		—	Forward / Reverse	—	20	40	
	I_{CC3}		—	Brake	—	12	25	
Input Voltage	V_{IL}	DI1 / DI2	—		—	—	0.8	V
	V_{IH}		—		2.0	—	—	
Input Current	I_{IL}	DI1/ DI2	—	V_{IN} = 0.4V	−100	—	10	μA
	I_{IH}		—	$V_{IN} = V_{CC}$	−10	—	10	
Output Saturation Voltage	V_{sat} (total)	M (+) / M (−)	—	I_O = 1.0A, Tc = 25°C	—	2.0	2.5	V
			—	I_O = 1.0A, Tc = 110°C	—	2.0	2.5	
Output Leakage Current	$I_{LEAK\text{-}U}$	M (+) / M (−)	—	V_{OUT} = 0V	—	—	−10	μA
	$I_{LEAK\text{-}L}$		—	$V_{OUT} = V_{CC}$	—	—	10	
Diode Forward Voltage	$V_{F\text{-}U}$	M (+) / M (−)	—	I_F = 1.0A	—	2.0	—	V
	$V_{F\text{-}L}$				—	1.2	—	
Over-current Detection	I_{SD}		—		1.2	1.7	2.3	A
Shutdown Temperature	T_{SD}		—		—	150	—	°C
Over-voltage Detection	V_{SD}		—		27	30	33	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 6V to 16V. If the guaranteed range is exceeded in practical use, make sure that the IC operates normally in application.

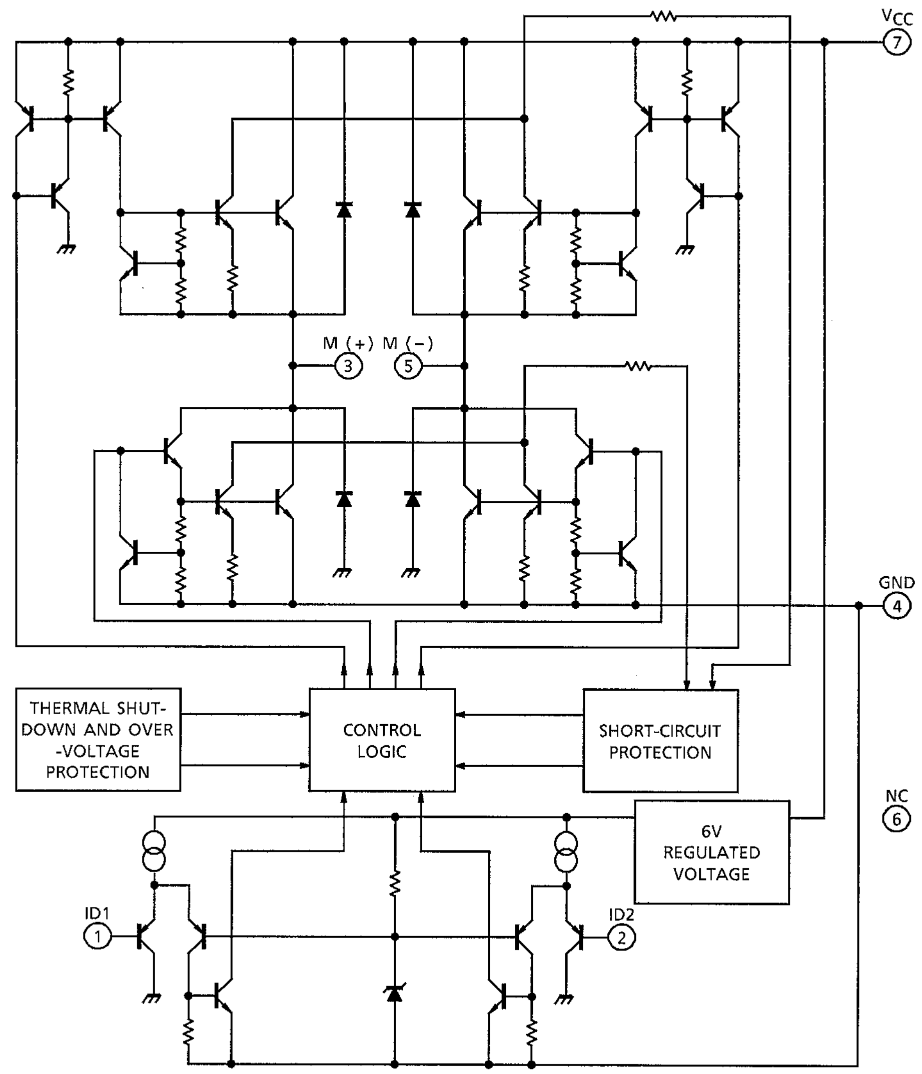

VOL, VOH – IOUT
OUTPUT SATURATION VOLTAGE VOH (V)
VOL (V)
Tc = 25°C
110°C
-40°C
− 40°C
OUTPUT CURRENT IOUT (A)
0
1.0
2.0
0.4
0.8
1.2


PD MAX – Ta
① Infinite radiation board
② 35cm² × 2mmAl
③ 11cm² × 2mmAl
④ No radiation board
MAXIMUM POWER DISSIPATION PD MAX (W)
AMBIENT TEMPERATURE Ta (°C)
0
4
8
12
16
20
50
100
150

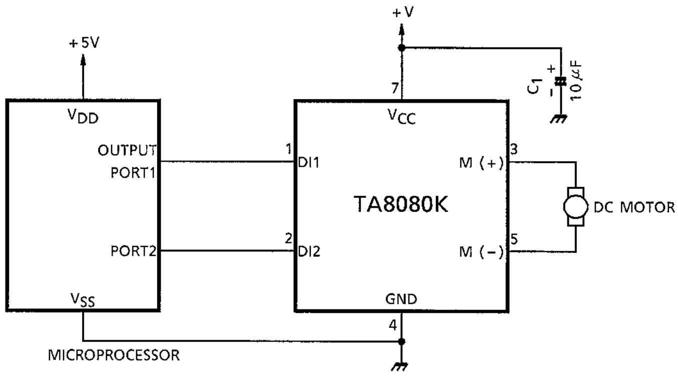

VSD – Tc
DETECTION VOLTAGE VSD (V)
CASE TEMPERATURE Tc (°C)
15
20
25
30
35
40
− 50
0
50
100
150


ISD – Tc
DETECTION CURRENT ISD (A)
CASE TEMPERATURE Tc (°C)
0
0.5
1.0
1.5
2.0
2.5
− 50
0
50
100
150

I / O EQUIVALENT CIRCUIT



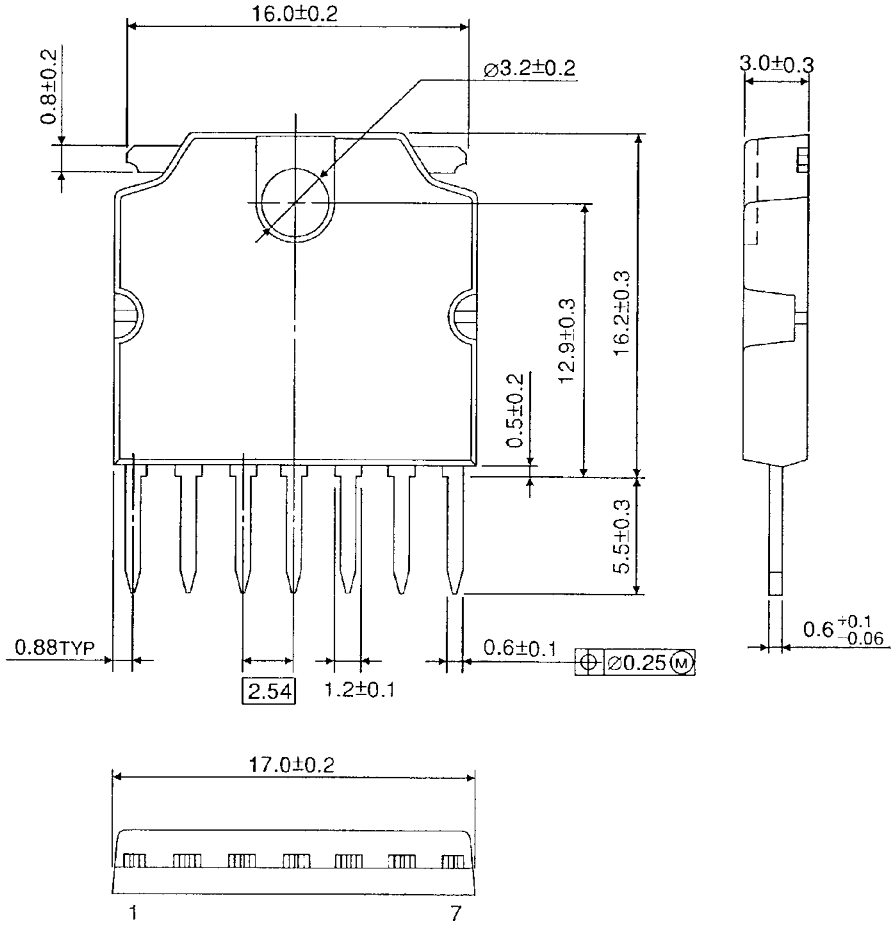
EXAMPLE OF APPLICATION CIRCUIT



Cautions for Wiring : C_1 is for absorbing disturbance, noise etc.
Connect it as close to the IC as possible.

PACKAGE DIMENSIONS

HSIP7-P-2.54A Unit : mm



Weight: 2.2 g (Typ.)

RESTRICTIONS ON PRODUCT USE

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