

TOSHIBA Bi-CMOS INTEGRATED CIRCUIT SILICON MONOLITHIC

# TB6501P

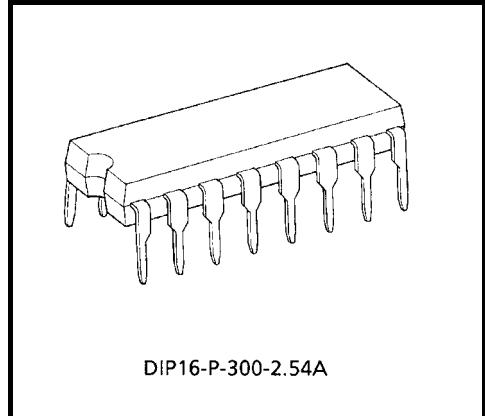
## Bridge Driver with Rotation Detector

The TB6501P is Bridge Driver.

Forward Rotation, Reverse Rotation, Stop and Breaking Operations are available.

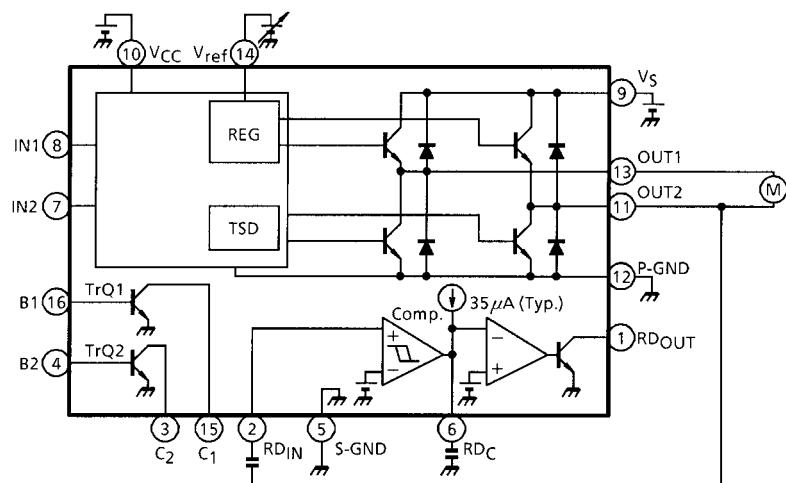
### FEATURES

- TB6501P has RD (Rotation Detector).
- Output current up to 0.4A (AVE.) to 1.0A (PEAK).
- Wide Range of Operating Supply Voltage  
 $V_{CC}$  (opr.) = 4.5~20 V (6.0 to 20 V when RD is used.)  
 $V_S$  (opr.) = 0~20 V  
 $V_{ref}$  (opr.) = 0~20 V ( $V_{ref} \leq V_S$ )  
 Can be operated with any combination of  $V_{CC}$  and  $V_S$  voltages within the range
- Thermal shutdown, Over current protector, and Standby circuit built in.



Weight: 1.11g (Typ.)

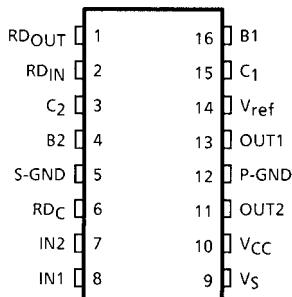
### BLOCK DIAGRAM



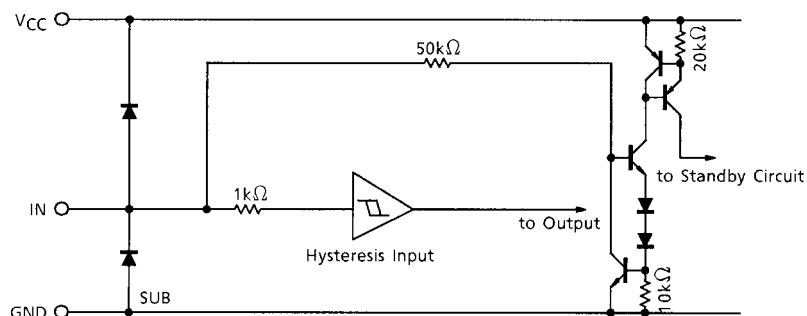
## PIN FUNCTION

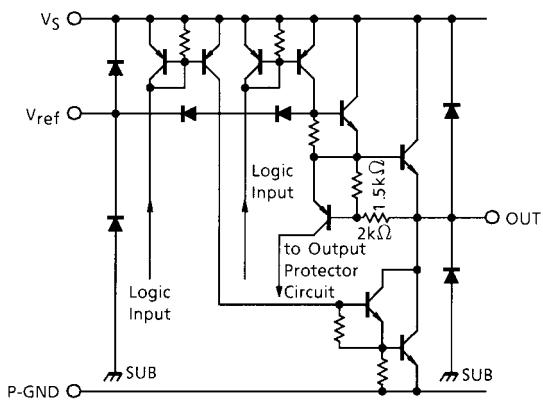
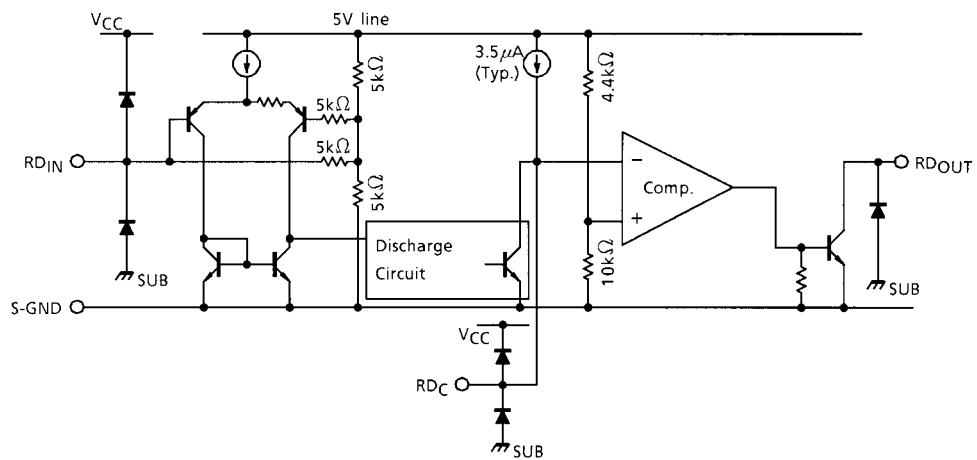
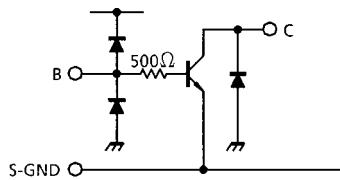
PIN No.	SYMBOL	FUNCTIONAL DESCRIPTION
1	RD <sub>OUT</sub>	Rotation detector output terminal
2	RD <sub>IN</sub>	Rotation detector input terminal
3	C <sub>2</sub>	NPN transistor collector terminal
4	B <sub>2</sub>	NPN transistor base terminal
5	S-GND	Signal GND terminal
6	R <sub>DC</sub>	Rotation detector capacitor connection terminal
7	IN <sub>2</sub>	Input 2 terminal
8	IN <sub>1</sub>	Input 1 terminal
9	V <sub>S</sub>	Power voltage supply terminal for motor driver
10	V <sub>CC</sub>	Power voltage supply terminal for logic
11	OUT <sub>2</sub>	Output 2 terminal
12	P-GND	Power GND terminal
13	OUT <sub>1</sub>	Output 1 terminal
14	V <sub>ref</sub>	Power voltage supply terminal for controller
15	C <sub>1</sub>	NPN transistor collector terminal
16	B <sub>1</sub>	NPN transistor base terminal

## PIN CONNECTION



## INPUT CIRCUIT



**OUTPUT CIRCUIT****ROTATION DETECTOR CIRCUIT****TrQ1, TrQ2 CIRCUIT**

## FUNCTION

INPUT		OUTPUT		MODE
IN1	IN2	OUT1	OUT2	MOTOR
0	0	$\infty$	$\infty$	STOP
1	0	H	L	CW / CCW
0	1	L	H	CCW / CW
1	1	L	L	BRAKE

$\infty$ : High Impedance

Note: Inputs are all high active type.

## MAXIMUM RATINGS (Ta = 25°C)

CHARACTERISTICS		SYMBOL	RATING	UNIT
Supply Voltage		V <sub>CC</sub>	25	V
Motor Drive Voltage		V <sub>S</sub>	25	V
Reference Voltage		V <sub>ref</sub>	25	V
Output Current	PEAK	I <sub>O</sub> (PEAK)	1.0 (Note)	A
	AVE.	I <sub>O</sub> (AVE.)	0.4	
	RD	I <sub>RD</sub> (PEAK)	20 (Note)	mA
	TR	I <sub>TR</sub> (PEAK)	50 (Note)	
Power Dissipation		P <sub>D</sub>	1.2	W
Operating Temperature		T <sub>opr</sub>	-30~75	°C
Storage Temperature		T <sub>stg</sub>	-55~150	°C

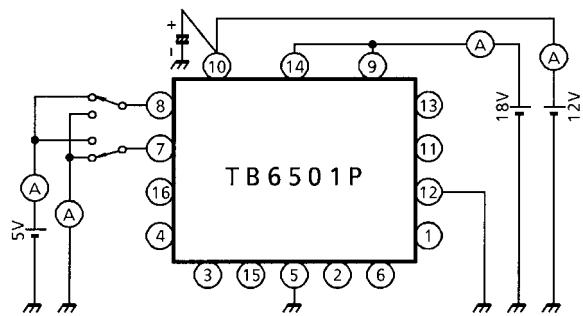
Note: t = 0.1s

## ELECTRICAL CHARACTERISTICS (Ta = 25°C, VCC = 12V, VS = 18V)

CHARACTERISTIC		SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN	TYP.	MAX	UNIT	
Supply Current		I <sub>CC1</sub>	—	Output open CW / CCW mode	—	8.2	12	mA	
		I <sub>CC2</sub>	—	Output open STOP mode	—	400	750	μA	
		I <sub>CC3</sub>	—	Output open BREAK mode	—	8.2	12	mA	
		I <sub>S1</sub>	—	Output open CW / CCW mode V <sub>ref</sub> = V <sub>S</sub>	—	5.2	11	mA	
		I <sub>S2</sub>	—	Output open STOP mode V <sub>ref</sub> = V <sub>S</sub>	—	0	50	μA	
		I <sub>S3</sub>	—	Output open BREAK mode V <sub>ref</sub> = V <sub>S</sub>	—	6.8	13	mA	
Input OperatiLng Voltage	1 (High)	V <sub>IN1</sub>	—	T <sub>j</sub> = 25°C	3.5	—	5.5	V	
	2 (Low)	V <sub>IN2</sub>	—	T <sub>j</sub> = 25°C	GND	—	0.8		
Input Current		I <sub>IN</sub>	—	Sink V <sub>IN</sub> = 5V	—	37	80	μA	
Input Hysteresis Voltage		ΔV <sub>T</sub>	—	—	—	0.55	—	V	
Saturation Voltage		V <sub>SAT U-1</sub>	—	V <sub>ref</sub> = V <sub>S</sub> I <sub>O</sub> = 0.2 A	Output V <sub>S</sub> CW / CCW mode	—	1.6	—	V
		V <sub>SAT L-1</sub>	—	V <sub>ref</sub> = V <sub>S</sub> I <sub>O</sub> = 0.2 A	Output GND CW / CCW mode	—	0.8	—	V
		V <sub>SAT U-2</sub>	—	V <sub>ref</sub> = V <sub>S</sub> I <sub>O</sub> = 0.4 A	Output V <sub>S</sub> CW / CCW mode	—	1.75	2.3	V
		V <sub>SAT L-2</sub>	—	V <sub>ref</sub> = V <sub>S</sub> I <sub>O</sub> = 0.4 A	Output GND CW / CCW mode	—	0.9	1.3	V
		V <sub>SAT U-3</sub>	—	V <sub>ref</sub> = V <sub>S</sub> I <sub>O</sub> = 1.0 A	Output V <sub>S</sub> CW / CCW mode	—	2.25	2.6	V
		V <sub>SAT L-3</sub>	—	V <sub>ref</sub> = V <sub>S</sub> I <sub>O</sub> = 1.0 A	Output GND CW / CCW mode	—	1.2	1.6	V
Output Voltage		V <sub>SAT U-1'</sub>	—	V <sub>ref</sub> = 10 V I <sub>O</sub> = 0.2 A	Output GND CW / CW mode	9.3	10	10.7	V
		V <sub>SAT U-2'</sub>	—	V <sub>ref</sub> = 10 V I <sub>O</sub> = 0.4 A	Output GND CW / CCW mode	9.3	10	10.7	V
Leaking Current		I <sub>LU</sub>	—	V <sub>L</sub> = 25 V	—	0	50	μA	
		I <sub>LL</sub>	—	V <sub>L</sub> = 25 V	—	0	50		
Diode Forward Voltage	Upper	V <sub>F</sub> U-1	—	I <sub>F</sub> = 0.4 A	—	1.5	—	V	
		V <sub>F</sub> U-2	—	I <sub>F</sub> = 1 A	—	2.5	—		
	Lower	V <sub>F</sub> L-1	—	I <sub>F</sub> = 0.4 A	—	1.0	—		
		V <sub>F</sub> L-2	—	I <sub>F</sub> = 1 A	—	1.3	—		
Reference Current		I <sub>ref</sub>	—	V <sub>ref</sub> = 10 V Source Typ.	—	1	—	mA	
RD Output Saturation Voltage		V <sub>SAT RD</sub>	—	I <sub>RD</sub> = 5 mA	—	0.18	0.35	V	
TR Output Saturation Voltage		V <sub>SAT TR</sub>	—	I <sub>TR</sub> = 10 mA	—	4	0.65	V	
RDC Charge Current		I <sub>RDC</sub>	—	—	21	35	55	μA	
RD Detective Sensitivity	Detective Level	R <sub>D</sub> (ON)	—	AC coupling sine wave input RDC = 10 μF	14	—	—	mV	
	Undetective Level	R <sub>D</sub> (OFF)	—		—	—	7		
Thermal Shutdown Operating Temperature		T <sub>TSD</sub>	—	T <sub>j</sub>	160	—	—	°C	

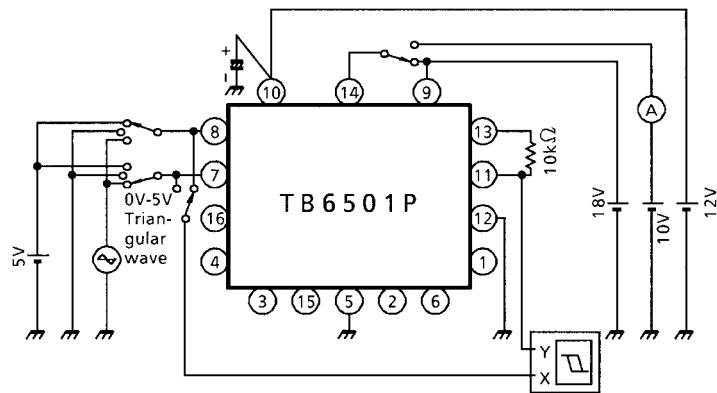
## TEST CIRCUIT 1

$I_{CC1}$ ,  $I_{CC2}$ ,  $I_{CC3}$ ,  $I_{IN}$ ,  $I_{S1}$ ,  $I_{S2}$ ,  $I_{S3}$



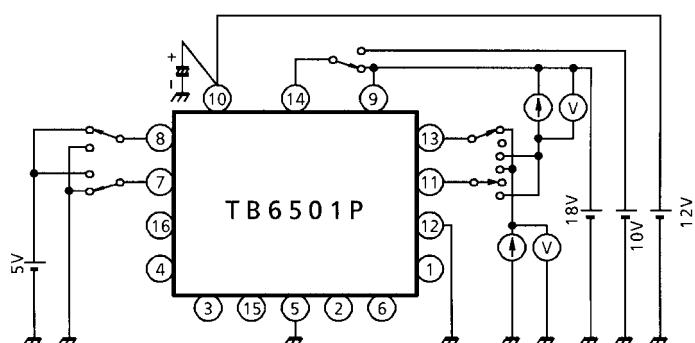
## TEST CIRCUIT 2

$V_{IN1}$ ,  $V_{IN2}$ ,  $\Delta V_T$



## TEST CIRCUIT 3

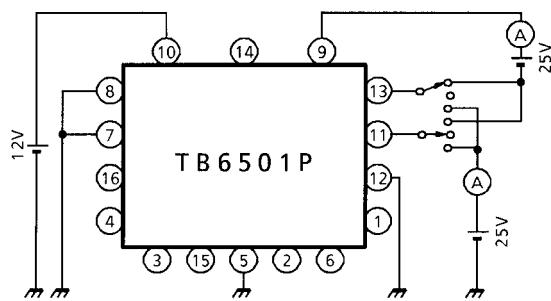
$V_{SAT\ U-1, 2, 3}$   $V_{SAT\ L-1, 2, 3}$   $V_{SAT\ U-1', 2'}$



Note: Calibrate  $I_O$  to 0.2 / 0.4 / 1.0 A by  $R_L$ .

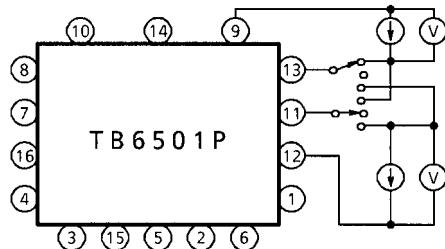
## TEST CIRCUIT 4

$I_{LU}$ ,  $I_{LL}$



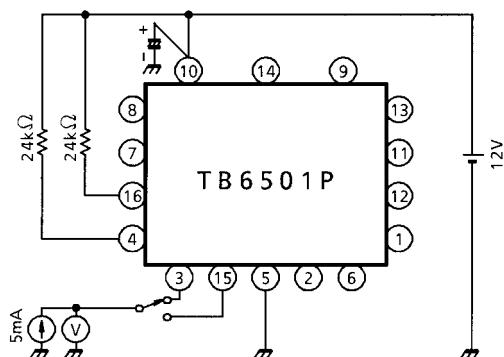
## TEST CIRCUIT 5

$V_{FU-1,2}$   $V_{FL-1,2}$



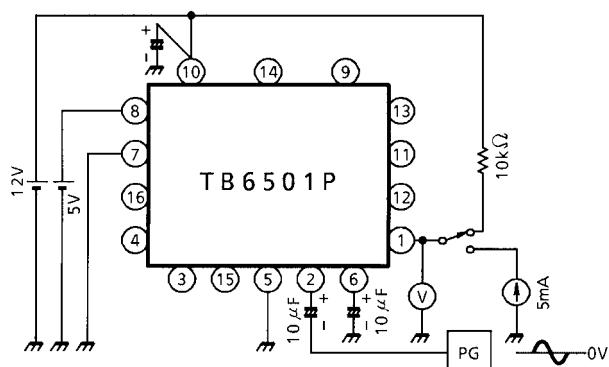
## TEST CIRCUIT 6

$V_{SAT\ TR.}$



## TEST CIRCUIT 7

$V_{SAT\ RD}$  RD Sensitivity

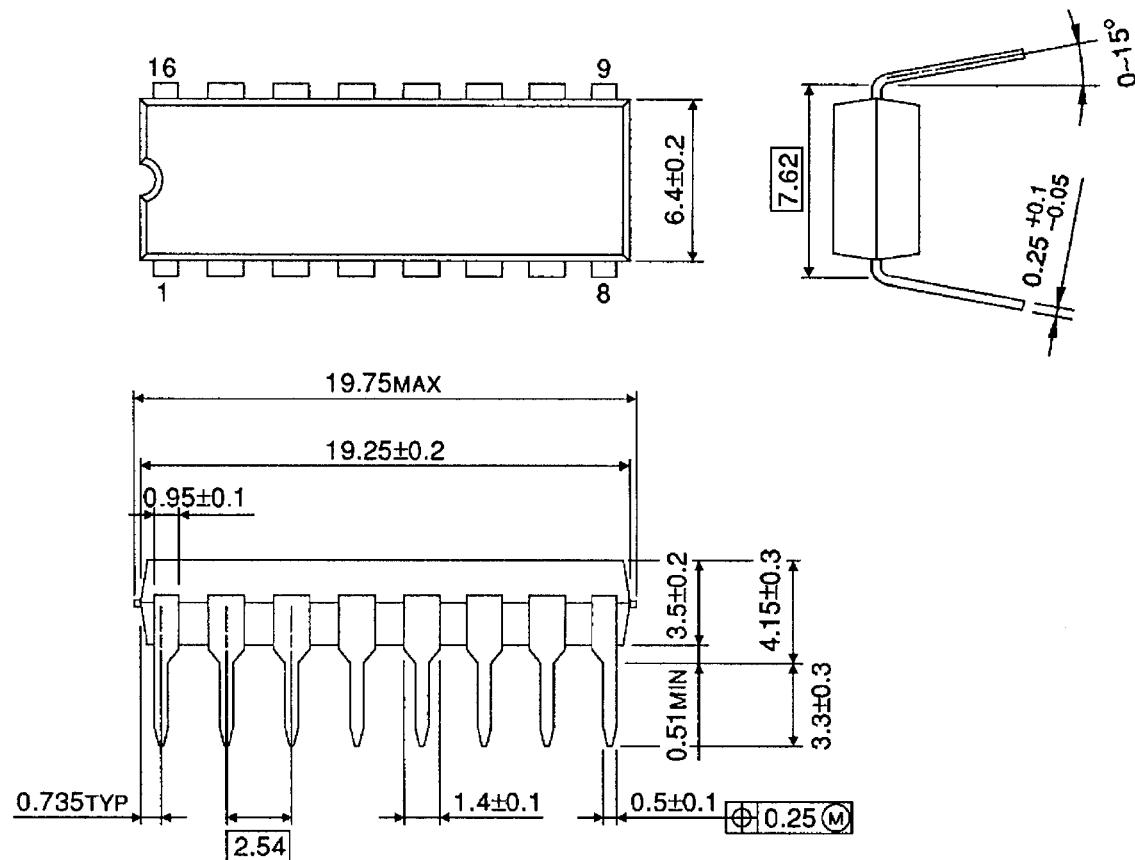


Note: Utmost care is necessary in the design of the output line,  $V_S$ ,  $V_{CC}$  and GND line since IC may be destroyed due to short-circuit between outputs, air contamination fault, or fault by improper grounding.

## PACKAGE DIMENSIONS

DIP16-P-300-2.54A

Unit: mm



Weight: 1.11 g (Typ.)

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