TOSHIBA BIPOLAR LINEAR INTEGRATED CIRCUIT SILICON MONOLITHIC

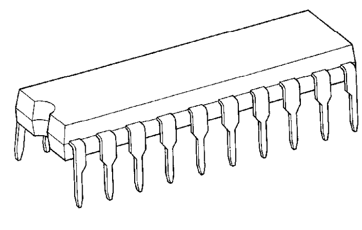
TA7712P, TA7712F

3 PHASE BI-DIRECTIONAL FOR MOTOR CONTROL IC

FEATURES

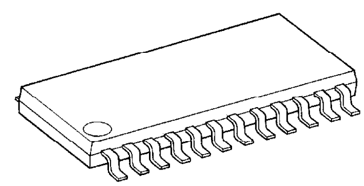
- FG is not required.
  (System for obtaining rotation signal through position sensing)
- Start / stop, CW / CCW and brake functions are provided.
- Gain of position sensing circuit is high, and hysteresis is provided.
- Rotation signal output is provided. (Frequency signal of three times the position sensing output (hall sensor output) can be obtained.)
- External transistor type.

TA7712P



DIP20-P-300-2.54A

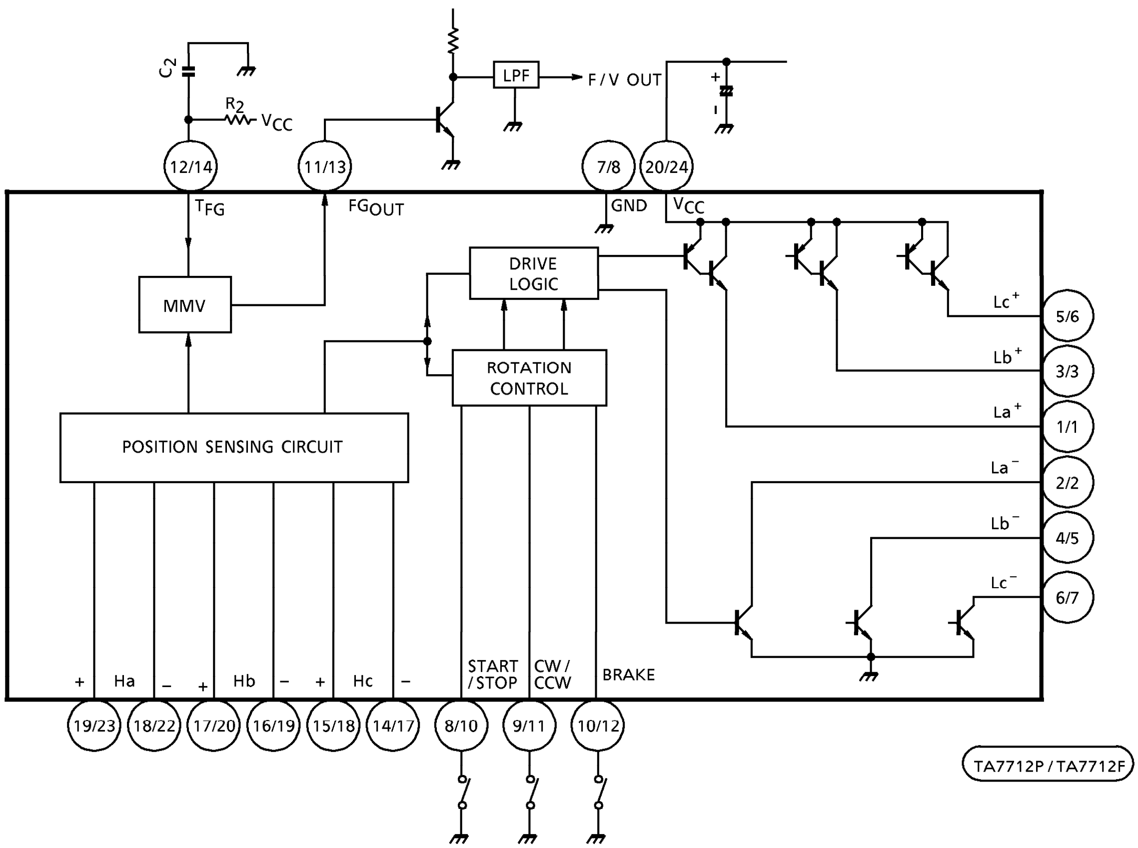
TA7712F



SSOP24-P-300-1.00

Weight
DIP20-P-300-2.54A : 2.25g (Typ.)
SSOP24-P-300-1.00 : 0.32g (Typ.)

BLOCK DIAGRAM



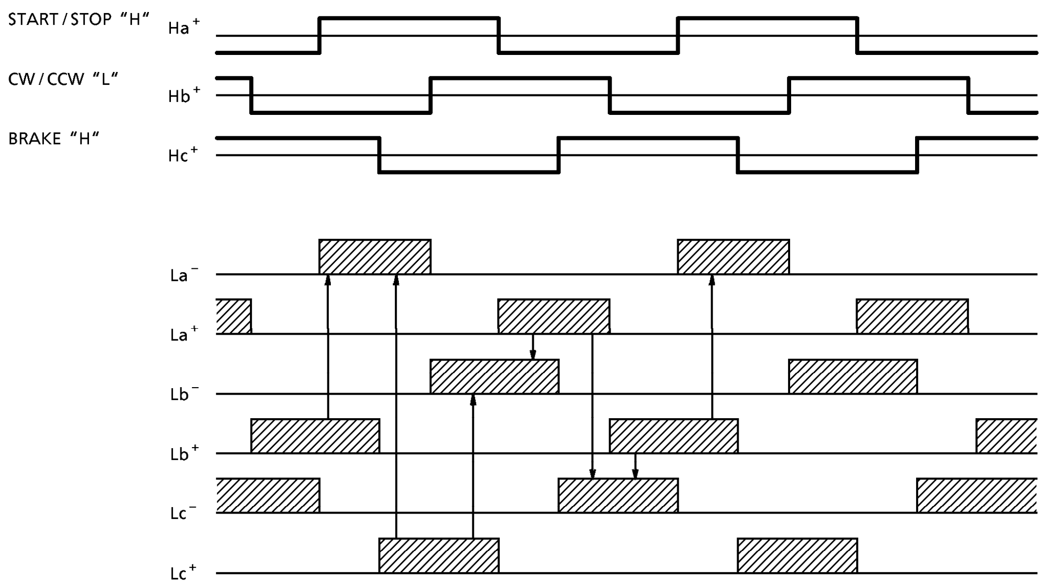
PIN FUNCTION

PIN No.		SYMBOL	FUNCTIONAL DESCRIPTION
P	F		
1	1	La^+	a-phase upper drive output terminal
2	2	La^-	a-phase lower drive output terminal
3	3	Lb^+	b-phase upper drive output terminal
4	5	Lb^-	b-phase lower drive output terminal
5	6	Lc^+	c-phase upper drive output terminal
6	7	Lc^-	c-phase lower drive output terminal
7	8	GND	GND terminal
8	10	START / STOP	START / STOP switch terminal
9	11	CW / CCW	Forward rotation / Reverse rotation switch terminal
10	12	BRAKE	Break terminal
11	13	FG_{OUT}	FG signal output terminal
12	14	T_{FG}	C, R connection terminal
13	—	N. C.	Non connection
14	17	Hc^-	c-phase Hall Amp. negative
15	18	Hc^+	c-phase Hall Amp. positive input terminal
16	19	Hb^-	b-phase Hall Amp. negative input terminal
17	20	Hb^+	b-phase Hall Amp. positive input terminal
18	22	Ha^-	a-phase Hall Amp. negative input terminal
19	23	Ha^+	a-phase Hall Amp. positive input terminal
20	24	V_{CC}	Power supply input terminal

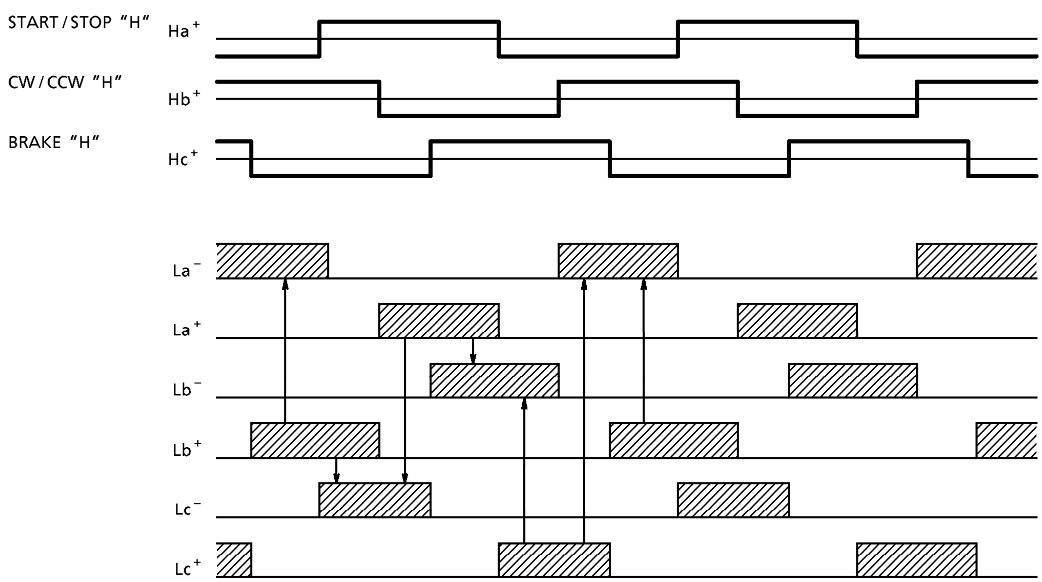
F : ④, ⑨, ⑮, ⑯, ㉑pin : no connection

TIMING CHART

Forward rotation (Position sensing signal advances Ha→Hb→Hc.)



Reverse rotation (Position sensing signal advances Ha→Hc→Hb.)

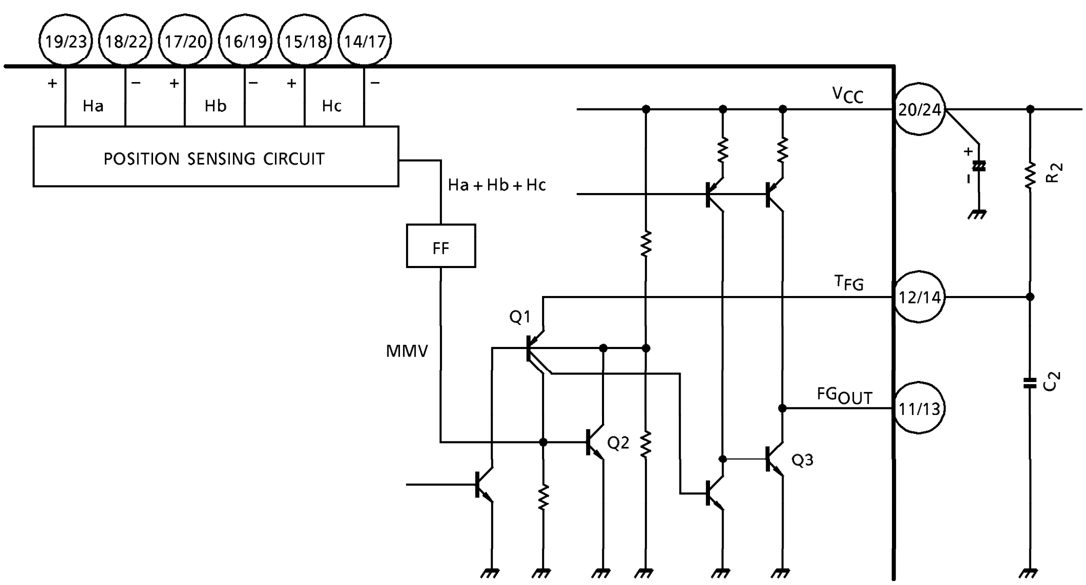


APPLICATION OF TA7712P, TA7712F

Like a video disk player, TA7712P, TA7712F is provided with the stopping function which in a short time, stops the motor having a large inertia, and makes the quick disk-change possible.
To make the frequency generator (FG) unnecessary which was formerly required for fetching the rotation signal, the signal from the position sensing input is ORed and is output to FG output pin (pin⑪ / ⑬).
Therefore, for FG output, three position sensing outputs (Ha, Hb, Hc) are ORed, and the rotation speed signal of the frequency of six times that of one output can be fetched resulting in making it possible to obtain a sufficient controlling characteristic with the F / V (Frequency-Voltage) conversion method of mono-stable type. The difference from TA7713P is that the stop function is automated in TA7713P, however, it is operated by the external signal in TA7712P.
Description is made on the application of TA7713P in the following.

(1) Operation of FG output (pin⑪ / ⑬) and T_{FG} (pin⑫ / ⑭)

In Fig.1, Q1 and Q2 are the monostable multi-vibrator to which gate (Q2 base) the signal from each position sensing input of Ha, Hb and Hc is input after ORed and shaped in waveform by FF.
The pulse width of MMV made by Q1 and Q2 is determined by R_2 and C_2 to be connected to T_{FG} (pin⑫ / ⑭), and the square wave having the pulse width to be determined by C_2 and R_2 is output. Of course, this frequency is proportional to the rotation signal and this frequency is six times the frequency of each position sensing. (6 per 1 electrical rotation)
F / V conversion operation is made through connecting FG_0 output to LPF for integration. However, if R_2 is made variable, the conversion gain can be controlled.



(2) Each control input

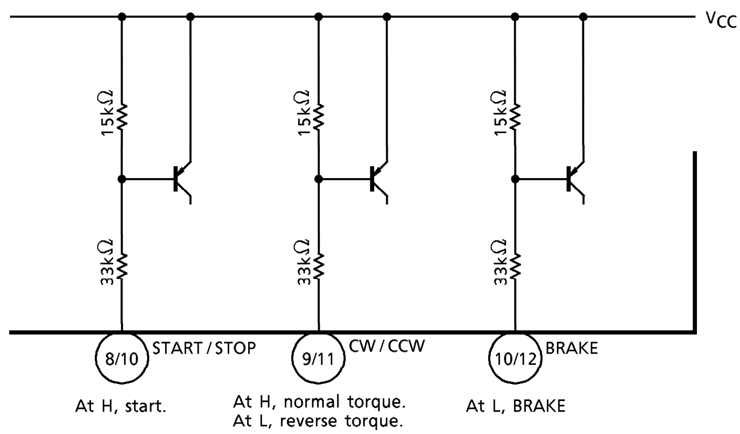


Fig. 2

START / STOP	CW / CCW	BRAKE	OUTPUT
H	H	H	Normal torque mode
H	L	H	Reverse torque mode
H or L	H or L	L	BRAKE mode
L	H or L	H	STOP mode

(Note) In STOP mode, Outputs of $La^+ \sim Lc^+$ and $La^- \sim Lc^-$ are all made OFF.
In BRAKE mode, outputs of $La^+ \sim Lc^+$ are made ON. (source mode)

(3) Output circuit

As shown in the block diagram, in the output circuit, the Darlington emitters of PNP and NPN are provided on the upper side, and the lower side is made as the open collector of NPN.
Connect the external transistor in the same manner as that of the application circuit.

MAXIMUM RATINGS (Ta = 25°C)

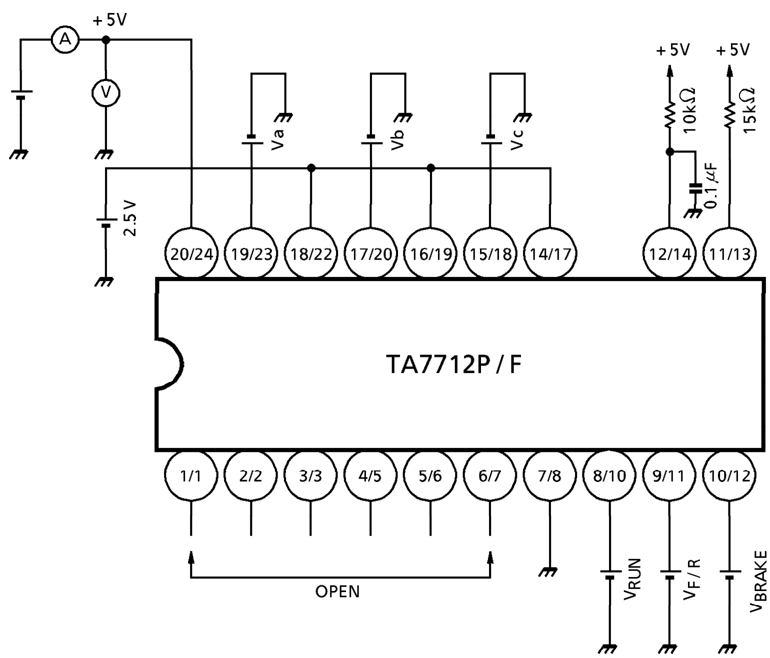
CHARACTERISTIC		SYMBOL	RATING	UNIT
Power Supply Voltage		V_{CC}	18	V
Output Current		I_O	±25	mA
Position Sensing Circuit Input Voltage (T_j = 25°C)		V_H (Note 1)	500	$mV_{p\text{-}p}$
Power Dissipation (Ta = 25°C)	TA8412P	P_D (Note 2)	1.2	W
	TA8412F		0.5	
Operating Temperature		T_{opr}	−30~75	°C
Storage Temperature		T_{stg}	−55~125	°C

(Note 1) Absolute value of difference
(Note 2) No Heat Sink

ELECTRICAL CHARACTERISTICS (Unless otherwise specified, V_{CC} = 5V, Ta = 25°C)

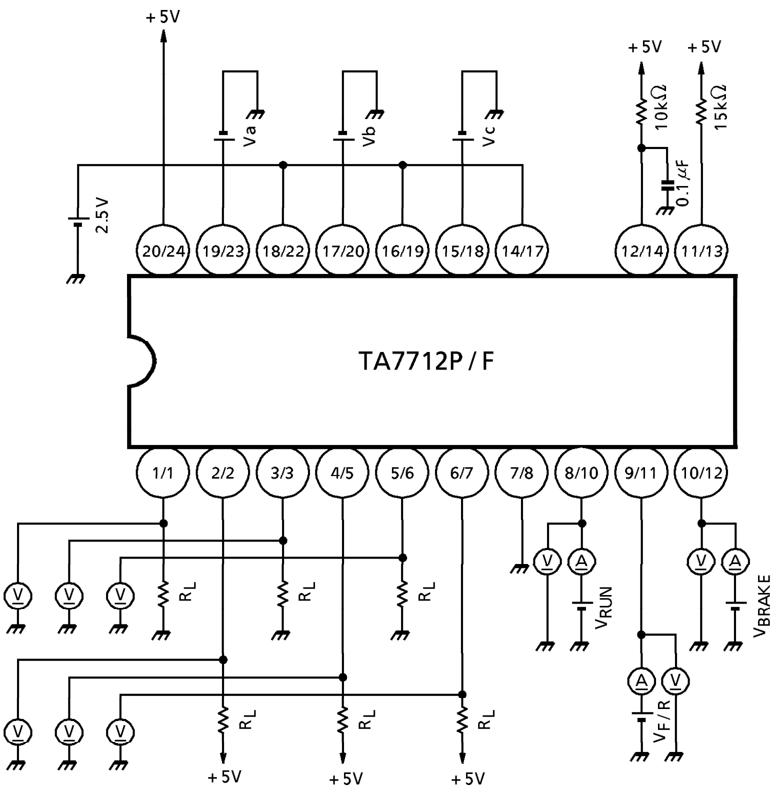
CHARACTERISTIC			SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Operating Supply Voltage			$V_{CC\,(opr)}$	—		4.75	5.00	5.25	V
Power Supply Current			I_{CC1}	1	Stop state	—	3.4	6.0	mA
			I_{CC2}		Output open	—	17.0	26.0	
Saturation Voltage	Upper Side		$V_{SAT\,(U\text{-}1)}$	2	R_L = 200Ω	—	1.3	2.0	V
			$V_{SAT\,(U\text{-}2)}$		R_L = 2kΩ	—	1.0	1.3	
	Lower Side		$V_{SAT\,(L\text{-}1)}$		R_L = 200Ω	—	0.8	1.2	
			$V_{SAT\,(L\text{-}2)}$		R_L = 2kΩ	—	0.18	0.4	
Leak Current	Upper Side		$I_{L\,(U)}$	2		—	—	100	μA
	Lower Side		$I_{L\,(L)}$			—	—	100	
Position Sensing Input	Common Mode Voltage Range		CMR_H	—		2.0	—	4.5	V
	Input Sensitivity		V_H		Absolute value of difference	20	—	—	$mV_{p\text{-}p}$
	Input Hysteresis		V_{H-Hys}			2	7	15	mV
START Input (RUN)	Input Operating Voltage	"H"	$V_{IN\,R\,(H)}$	2		4.0	—	—	V
		"L"	$V_{IN\,R\,(L)}$	2		—	—	1.0	
	Input Current	"L"	$I_{IN\,R}$	2	$V_{IN\,R}$ = 1.0V	—	—	200	μA
CW / CCW Input (FWD / REV)	Input Operating Voltage	"H"	$V_{IN\,C\,(H)}$	2		4.0	—	—	V
		"L"	$V_{IN\,C\,(L)}$			—	—	1.0	
	Input Current	"L"	$I_{IN\,C}$		$V_{IN\,C}$ = 1.0V	—	—	200	μA
BRAKE Input (BRAKE)	Input Operating Voltage	"H"	$V_{IN\,B\,(H)}$	2		4.0	—	—	V
		"L"	$V_{IN\,B\,(L)}$			—	—	1.0	
	Input Current	"H"	$I_{IN\,B}$		$V_{IN\,N}$ = 1.0V	—	—	200	μA
FG Output	Output Current	"H"	I_{FGH}	3		80	—	—	μA
	Output Voltage	"L"	V_{FGL}	3	I_{FG} = 0.3mA	—	—	0.4	V
	Pulse Width		τ_{FG}	3	C = 0.1μF, R = 10kΩ	0.9	1.0	1.1	ms

TEST CIRCUIT 1



	V_{RUN}	$V_{F/R}$	V_{BRAKE}	Va	Vb	Vc	REMARKS
I_{CC1}	1.0V	1.0V	1.0V	2.48V	2.48V	2.52V	Reverse sensing must not be made.
I_{CC2}	4.0V	4.0V	4.0V	2.52V	2.48V	2.52V	

TEST CIRCUIT 2



Hall AMP. Input

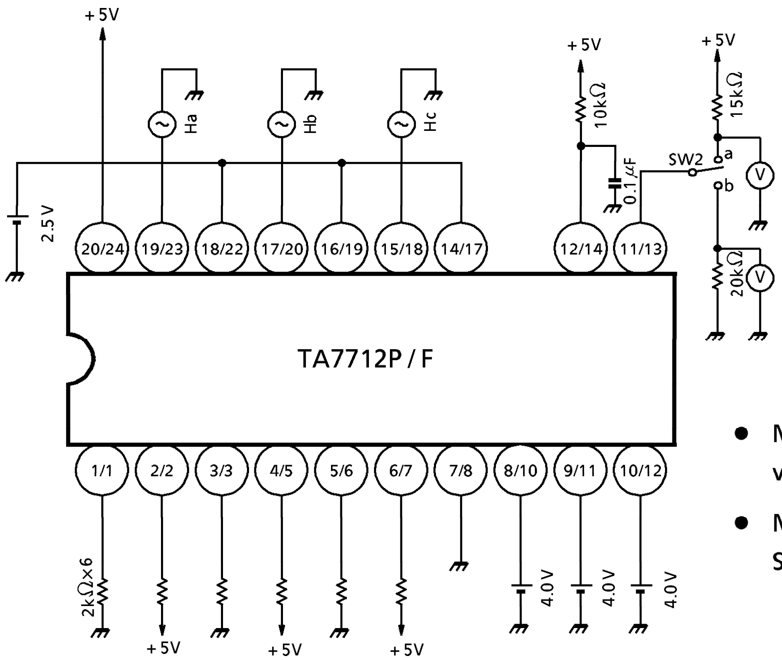
Check input sensitivity and input hysteresis with ±20mV by means of confirming that leak current and saturation voltage described below can be measured.

INPUT CONDITION						MEASUREMENT ITEM					
Va	Vb	Vc	RUN	F / R	BRAKE	La^+	La^-	Lb^+	Lb^-	Lc^+	Lc^-
2.52V	2.48V	2.48V	$V_{IN\ R\ (H)}$	$V_{IN\ C\ (H)}$	$V_{IN\ B\ (H)}$	LEAK	SAT	LEAK	LEAK	SAT	LEAK
2.48V	2.52V	2.48V	—	—	—	SAT	LEAK	—	SAT	LEAK	—
2.48V	2.48V	2.52V	—	—	—	—	—	SAT	—	—	SAT

LEAK : Measurement of leak current
SAT : Measurement of saturation voltage

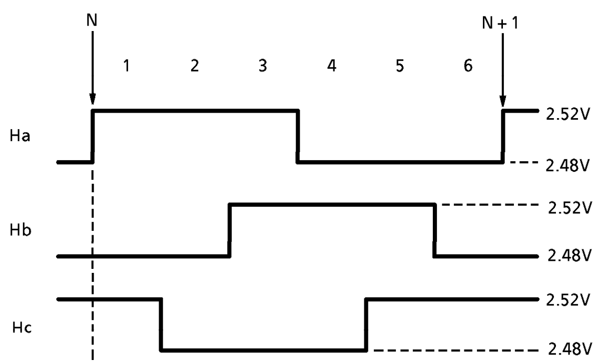
Confirm "L" of each $V_{IN\ R}$, $V_{IN\ C}$ and $V_{IN\ B}$ through reading the output voltage when each terminal is set at 1.0 (V).

TEST CIRCUIT 3



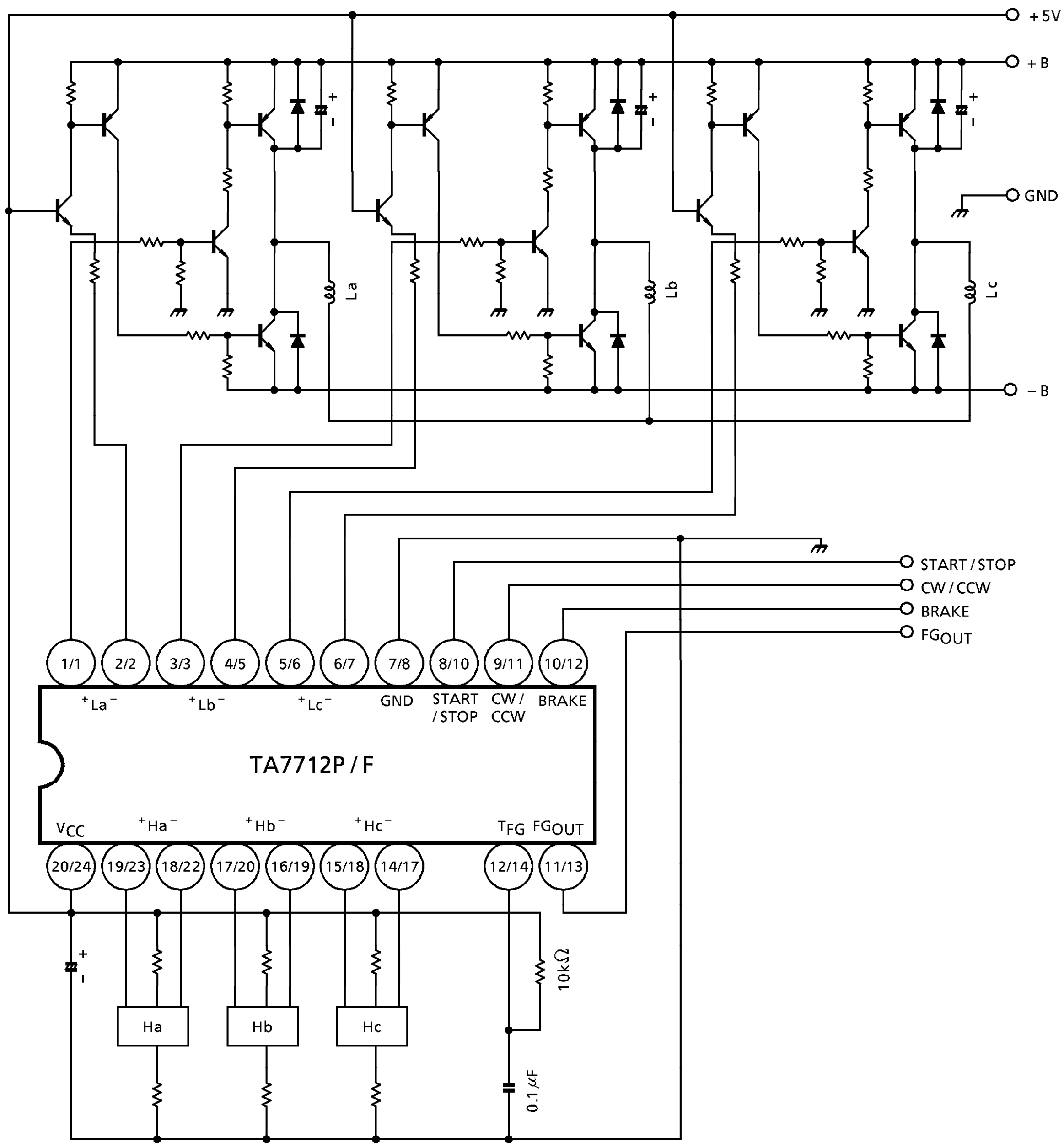
- Measure I_{FGH} with the voltage when SW2 is set at b.
- Measure V_{FGL} and τ_{FG} when SW2 is set at a.

TIME CHART FOR FORWARD ROTATION

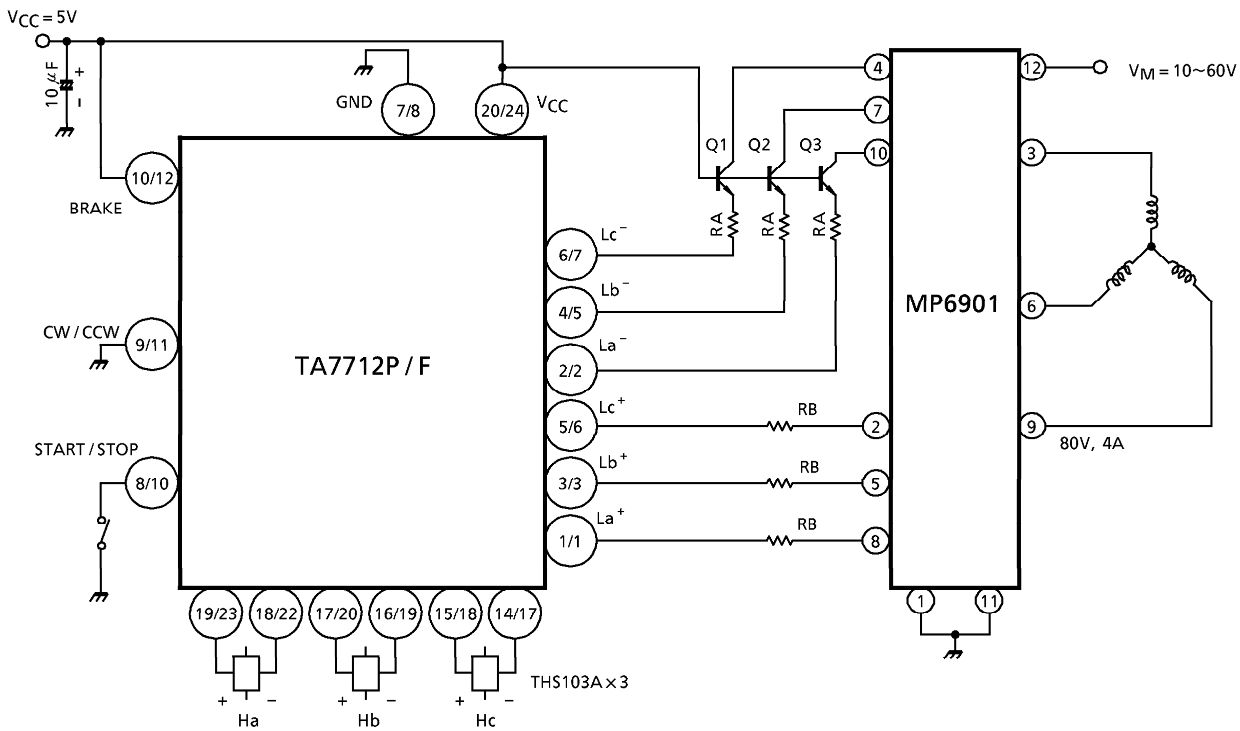


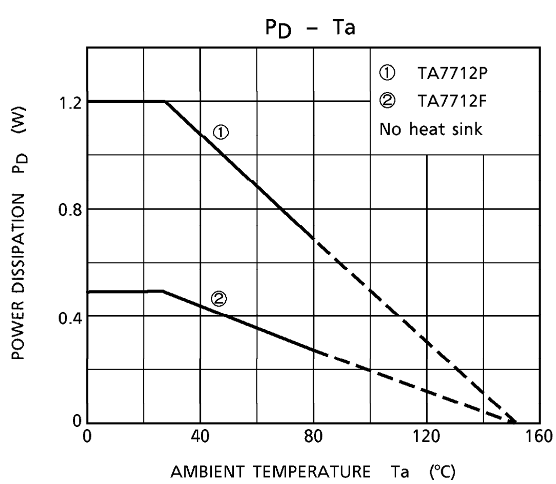
CLOCK 360Hz

BASIC APPLICATION CIRCUIT



APPLICATION CIRCUIT

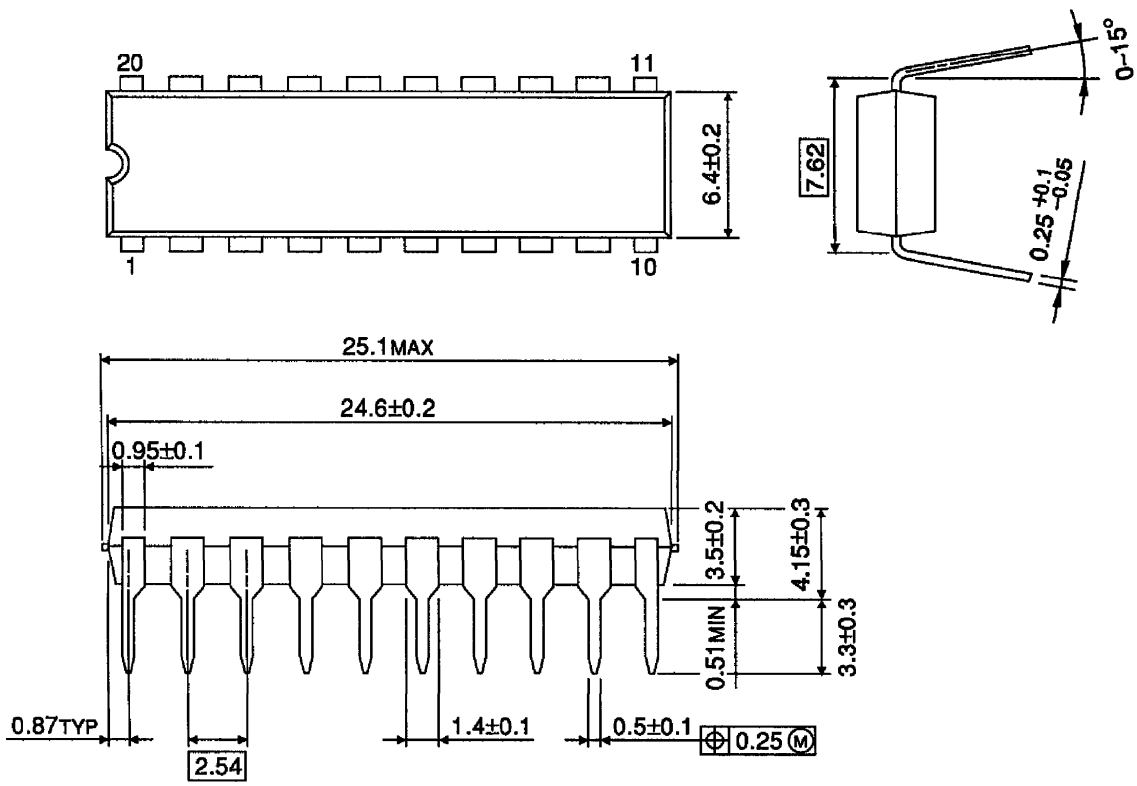




OUTLINE DRAWING

DIP20-P-300-2.54A

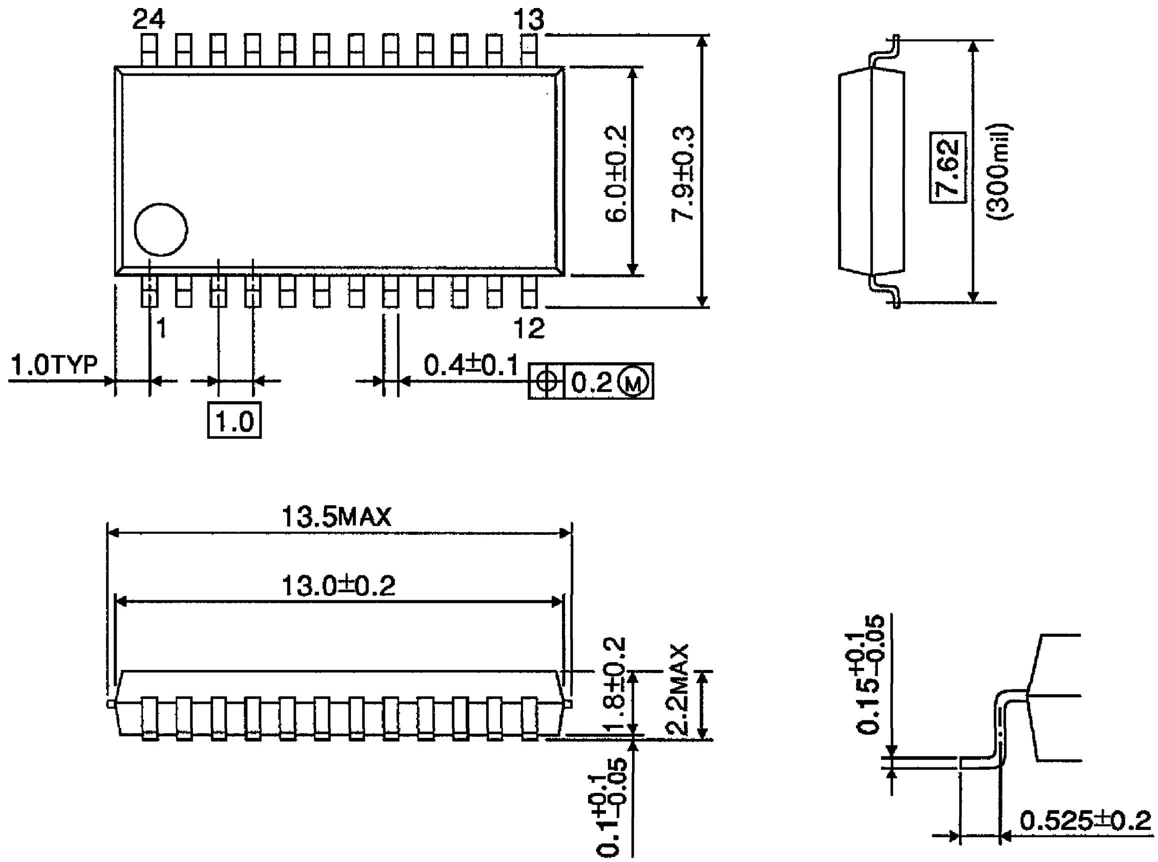
Unit : mm



Weight : 2.25g (Typ.)

OUTLINE DRAWING

SSOP24-P-300-1.00 Unit : mm



Weight : 0.32g (Typ.)