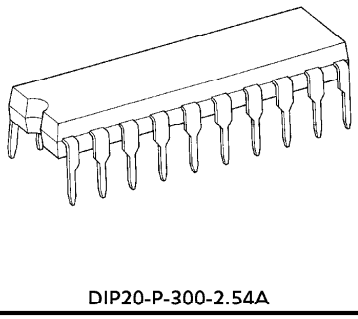
TOSHIBA BIPOLAR LINEAR INTEGRATED CIRCUIT SILICON MONOLITHIC

# TA8413P

## 3 PHASE BI-DIRECTIONAL HALL MOTOR CONTROL IC

### FEATURES

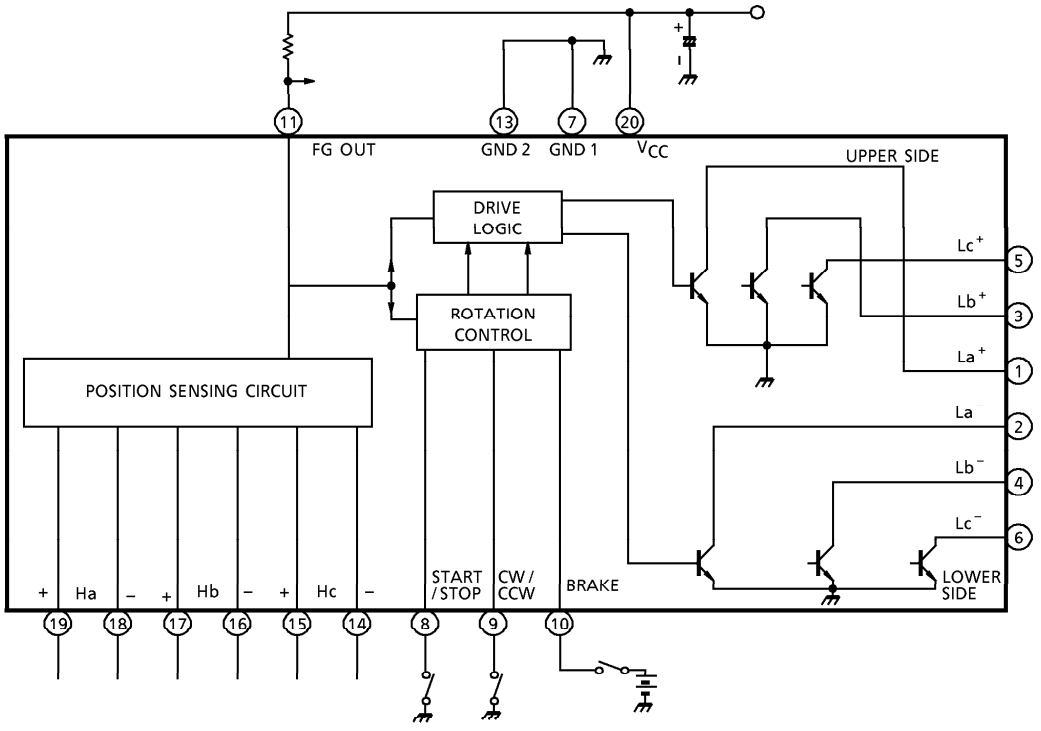
- FG is not required.
  (System for obtaining rotation signal through position sensing)
- Start / stop, CW / CCW and brake function is provided.
- Gain of position sensing circuit is high, and hysteresis is provided.
- Rotation signal output is provided.
  (Frequency signal of three times the position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



DIP20-P-300-2.54A

Weight : 2.25g (Typ.)

### BLOCK DIAGRAM



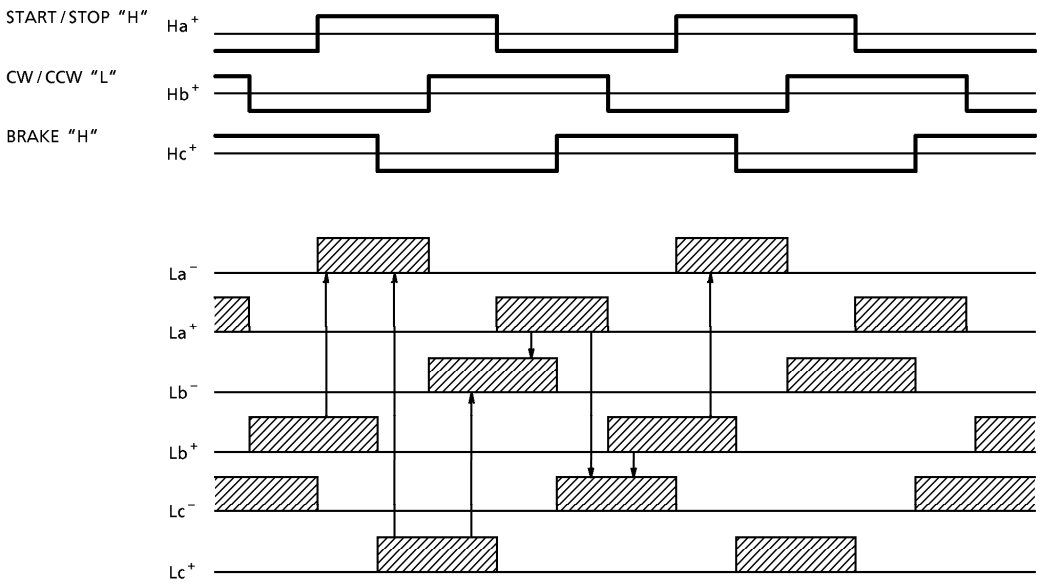

961001EBA2

**PIN FUNCTION**

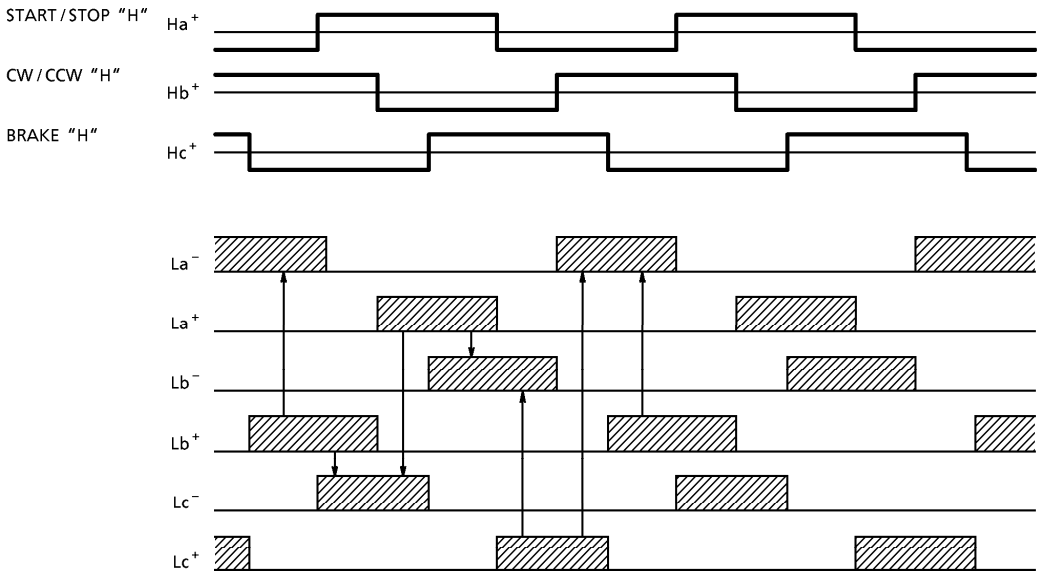
| PIN No. | SYMBOL | FUNCTION DESCRIPTION |
|---|---|---|
| 1 | $La^+$ | a-phase upper drive output terminal. |
| 2 | $La^-$ | a-phase lower drive output terminal. |
| 3 | $Lb^+$ | b-phase upper drive output terminal. |
| 4 | $Lb^-$ | b-phase lower drive output terminal. |
| 5 | $Lc^+$ | c-phase upper drive output terminal. |
| 6 | $Lc^-$ | c-phase lower drive output terminal. |
| 7 | GND1 | GND1 terminal. |
| 8 | START / STOP | Start / stop control terminal. |
| 9 | CW / CCW | Forward / Reverse rotation control terminal. |
| 10 | BRAKE | Breake terminal. |
| 11 | FG OUT | FG signal output terminal. |
| 12 | N. C. | Non connection. |
| 13 | GND2 | GND2 terminal. |
| 14 | $Hc^-$ | c-phase Hall Amp. negative input terminal. |
| 15 | $Hc^+$ | c-phase Hall Amp. positive input terminal. |
| 16 | $Hb^-$ | b-phase Hall Amp. negative input terminal. |
| 17 | $Hb^+$ | b-phase Hall Amp. positive input terminal. |
| 18 | $Ha^-$ | a-phase Hall Amp. negative input terminal. |
| 19 | $Ha^+$ | a-phase Hall Amp. positive input terminal. |
| 20 | $V_{CC}$ | Power supply input terminal. |

**TIMING CHART**

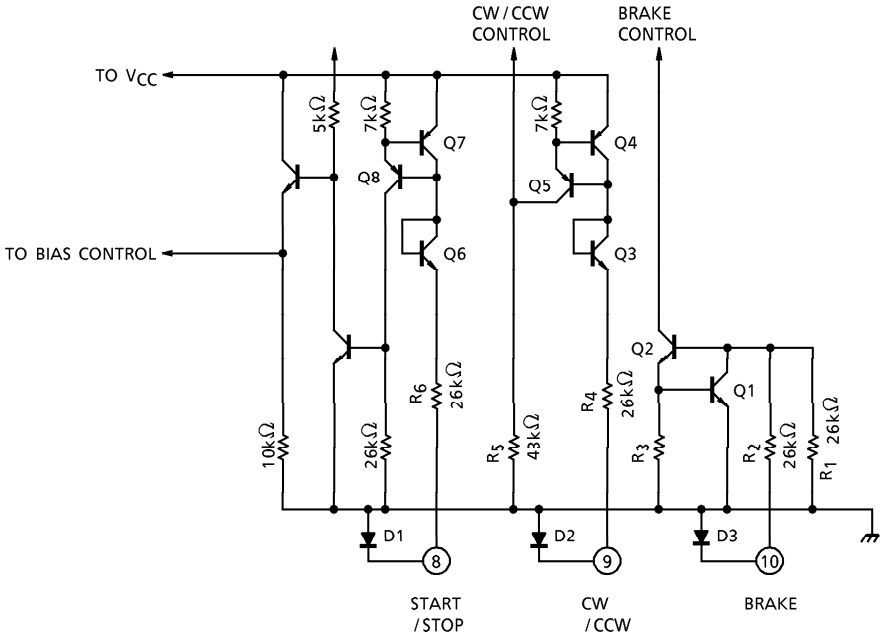
Forward rotation (Position sensing signal advances Ha→Hb→Hc.)




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



(1) Control input circuit




START / STOP and CW / CCW inputs are Low Active and BRAKE input is High Active type. D1~D3 are input protect diodes.
Input current of START / STOP and CW / CCW are calculated by following equations.

$$I_{IN\ C} = \frac{V_{CC} - V_{INC} - V_{BEQ3} - V_{BEQ4} - V_{BEQ5}}{R_4} \fallingdotseq \frac{V_{CC} - V_{INC} - 2.1}{26 \times 10^3} \quad (A)$$

(Pin⑨)

$$I_{IN\ R} = \frac{V_{CC} - V_{INR} - V_{BEQ6} - V_{BEQ7} - V_{BEQ8}}{R_6} \fallingdotseq \frac{V_{CC} - V_{INR} - 2.1}{26 \times 10^3} \quad (A)$$

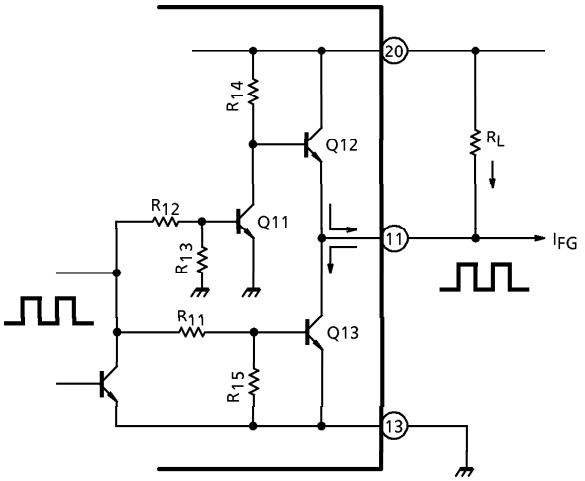
(Pin⑧)

And also input current of BRAKE (Pin⑩) is calculated by following equation.

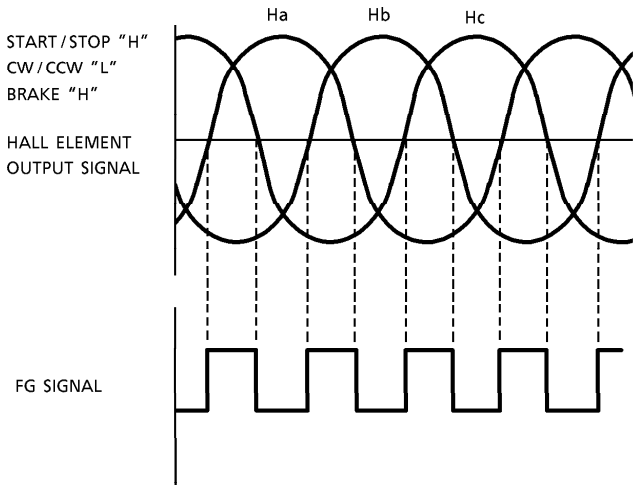
$$I_{IN\ B} = \frac{V_{INB} - V_{BEQ2} - V_{BEQ3}}{R_2} \fallingdotseq \frac{V_{INB} - 1.4}{26 \times 10^3} \quad (A)$$

(Pin⑩)

(2) FG output circuit




FG signal is generated by the using 3 phase hall signals.
FG output transistors of Q12 and Q13 work push-pull.
Specified output voltage generates if load resistor connect to FG output to $V_{CC}$.



**MAXIMUM RATINGS** (Ta = 25°C)

| CHARACTERISTIC | SYMBOL | RATING | UNIT |
|---|---|---|---|
| Power Supply Voltage | $V_{CC}$ | 18 | V |
| Output Current | $I_O$ | ± 100 | mA |
| Position Sensing Circuit Input Voltage ($T_j$ = 25°C) | $V_H$ | 400 | $mV_{p-p}$ |
| Power Dissipation | $P_D$ (Note) | 1.2 | W |
| Operating Temperature | $T_{opr}$ | − 30~75 | °C |
| Storage Temperature | $T_{stg}$ | − 55~150 | °C |

(Note) No heat sink

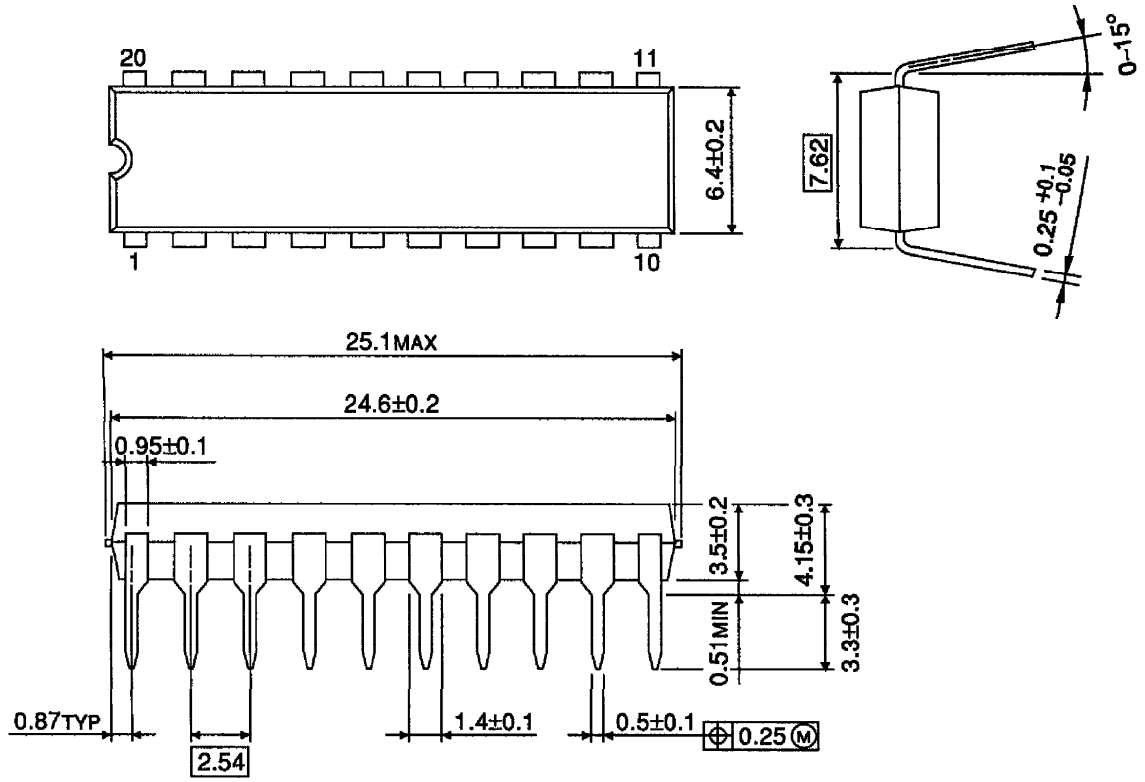
**ELECTRICAL CHARACTERISTICS** (Unless otherwise specified, $V_{CC}$ = 5V, Ta = 25°C)

| CHARACTERISTIC | | | SYMBOL | TEST CIR-CUIT | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|---|---|---|
| Operation Power Supply Voltage | | | $V_{CC\,(opr)}$ | — | | 4.0 | — | 18 | V |
| Power Supply Current | | | $I_{CC1}$ | 1 | Stop state | — | 4 | — | mA |
| | | | $I_{CC2}$ | | Output open | — | 4 | — | |
| Saturation Voltage | Upper Side | | $V_{SAT\,(U-1)}$ | 2 | $I_O$ = 10mA | — | 1.5 | — | V |
| | | | $V_{SAT\,(U-2)}$ | | $I_O$ = 100mA | — | 2.0 | — | |
| | Lower Side | | $V_{SAT\,(L-1)}$ | | $I_O$ = 10mA | — | 0.4 | — | |
| | | | $V_{SAT\,(L-2)}$ | | $I_O$ = 100mA | — | 0.5 | 1.0 | |
| Leak Current | Upper Side | | $I_{L\,(U)}$ | 2 | V = 18V | — | — | 100 | μA |
| | Lower Side | | $I_{L\,(L)}$ | | | — | — | 100 | |
| Position Sensing Input | Common Mode Voltage Range | | $CMR_H$ | — | | 2.0 | — | $V_{CC}$ − 0.5 | V |
| | Input Sensitivity | | $V_H$ | | | 20 | — | — | $mV_{p-p}$ |
| | Input Hysteresis | | $V_{H\,-\,Hys}$ | | | 2 | 7 | 15 | mV |
| START Input (Low Act) | Operation Input Voltage | "H" | $V_{IN\ R\,(H)}$ | 2 | | $V_{CC}$ − 0.9 | — | $V_{CC}$ | V |
| | | "L" | $V_{IN\ R\,(L)}$ | 2 | | — | — | 1.0 | |
| | Input Current | "L" | $I_{IN\ R}$ | 2 | $V_{IN\ R}$ = 1.0V | — | 70 | 200 | μA |
| CW / CCW Input (Low Act) | Operation Input Voltage | "H" | $V_{IN\ C\,(H)}$ | 2 | | $V_{CC}$ − 0.9 | — | $V_{CC}$ | V |
| | | "L" | $V_{IN\ C\,(L)}$ | 2 | | — | — | 1.0 | |
| | Input Current | "L" | $I_{IN\ C}$ | 2 | $V_{IN\ C}$ = 1.0V | — | 70 | 200 | μA |
| BRAKE Input (High Act) | Operation Input Voltage | "H" | $V_{IN\ B\,(H)}$ | 2 | | 4.0 | — | $V_{CC}$ | V |
| | | "L" | $V_{IN\ B\,(L)}$ | 2 | | — | — | 1.0 | |
| | Input Current | "L" | $I_{IN\ B}$ | 3 | $V_{IN\ B}$ = 4V | — | 100 | 250 | μA |
| FG Output | Output Voltage | "H" | $V_{FGH}$ | 3 | $I_{FG}$ = 1mA | $V_{CC}$ − 1.0 | — | — | V |
| | Output Voltage | "L" | $V_{FGL}$ | 3 | | — | — | 0.5 | |

**OUTLINE DRAWING**

DIP20-P-300-2.54A

Unit : mm




Weight : 2.25g (Typ.)