

TOSHIBA Bi-CMOS INTEGRATED CIRCUIT MULTICHIP

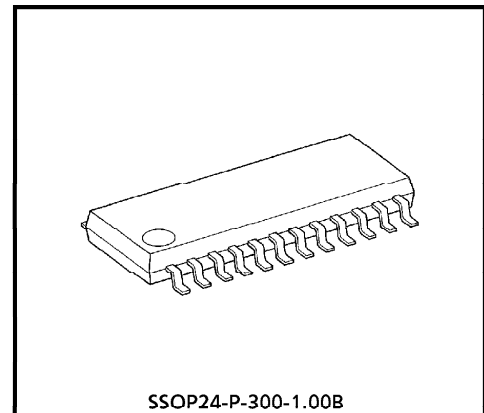
**T B 6 5 1 2 A F****PWM CHOPPER TYPE BIPOLAR STEPPING MOTOR DRIVER**

The TB6512AF is PWM chopper type sinusoidal micro step bipolar stepping motor driver.

Sinusoidal micro step operation is accomplished only a clock signal inputting by means of built-in hard ware.

**FEATURES**

- 1 chip bipolar sinusoidal micro step stepping motor driver.
- Output Current up to 150mA
- PWM chopper type.
- Structured by high voltage Bi-CMOS process technology.
- Forward and reverse rotation are available.
- 1-2, 2W1-2 phase 1 or 2 clock drives are selectable.
- Package : SSOP24-P-300B
- Input Pull-Up Resistor equipped with RESET and ENABLE Terminal :  $R = 500k\Omega$  (Typ.)
- Output Monitor available with  $\overline{MO}$ .  $I_O(\overline{MO}) = \pm 2mA$  MAX.
- Reset and Enable are available with  $\overline{RESET}$  and  $\overline{ENABLE}$ .



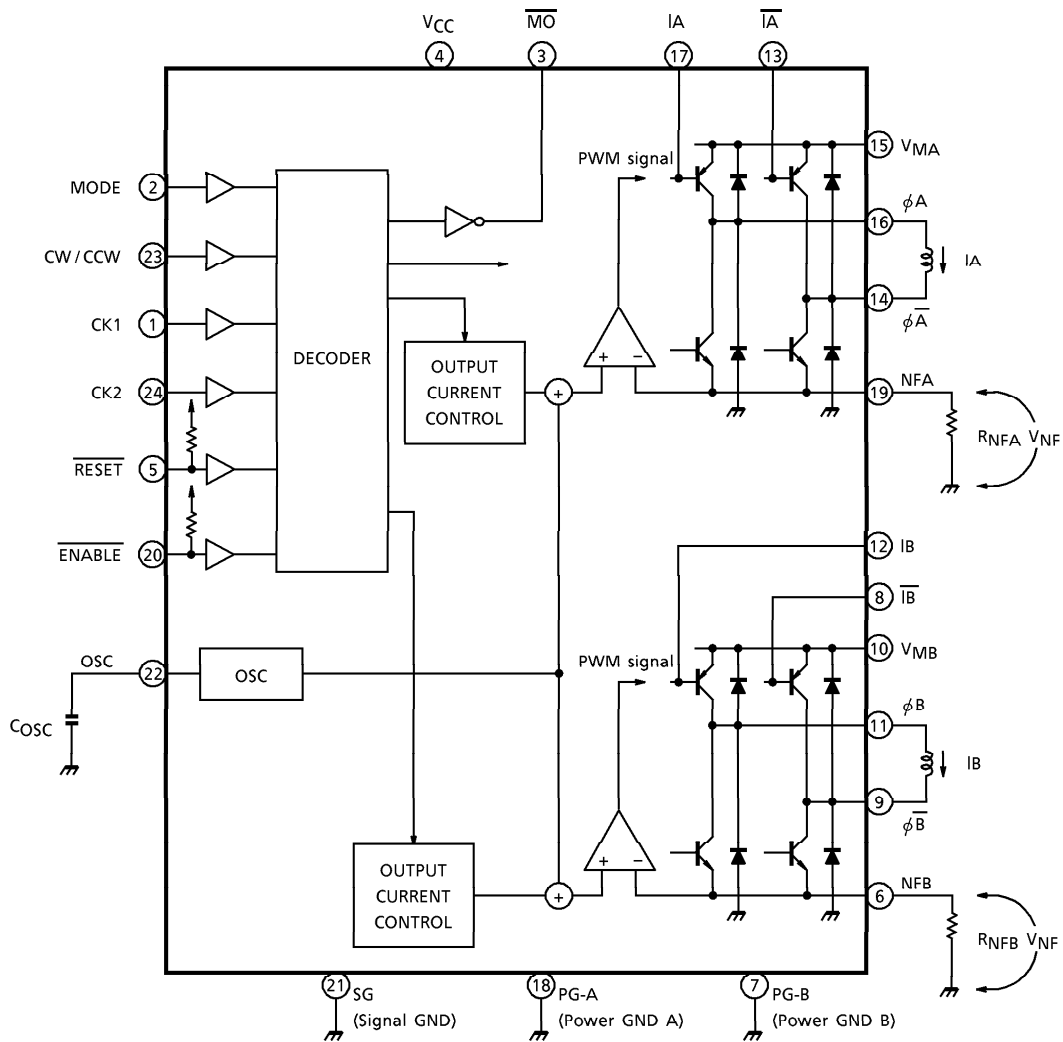
SSOP24-P-300-1.00B

Weight : 0.27g (Typ.)

961001EBA2

- TOSHIBA is continually working to improve the quality and the reliability of its products. Nevertheless, semiconductor devices in general can malfunction or fail due to their inherent electrical sensitivity and vulnerability to physical stress. It is the responsibility of the buyer, when utilizing TOSHIBA products, to observe standards of safety, and to avoid situations in which a malfunction or failure of a TOSHIBA product could cause loss of human life, bodily injury or damage to property. In developing your designs, please ensure that TOSHIBA products are used within specified operating ranges as set forth in the most recent products specifications. Also, please keep in mind the precautions and conditions set forth in the TOSHIBA Semiconductor Reliability Handbook.
- The products described in this document are subject to foreign exchange and foreign trade control laws.
- The information contained herein is presented only as a guide for the applications of our products. No responsibility is assumed by TOSHIBA CORPORATION for any infringements of intellectual property or other rights of the third parties which may result from its use. No license is granted by implication or otherwise under any intellectual property or other rights of TOSHIBA CORPORATION or others.
- The information contained herein is subject to change without notice.

BLOCK DIAGRAM

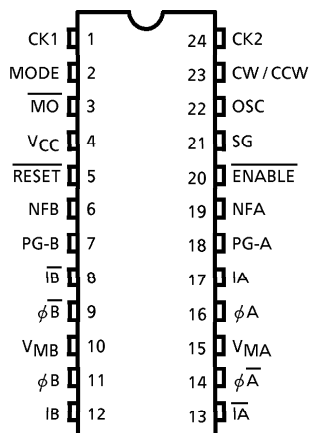


⑤, ⑳ : Pull-up Resistor 500kΩ (Typ.)

**PIN FUNCTION**

| PIN No. | SYMBOL              | FUNCTIONAL DESCRIPTION                            |               |
|---------|---------------------|---|---------------|
| 1       | CK1                 | CLOCK Signal Input terminal                       | Truth table A |
| 2       | MODE                | Excitation Mode Setting terminal                  | Truth table B |
| 3       | $\overline{MO}$     | Monitor Output terminal                           |               |
| 4       | $V_{CC}$            | Power voltage supply terminal for Logic           |               |
| 5       | $\overline{RESET}$  | Reset Signal Input terminal                       | Truth table A |
| 6       | NFB                 | B Channel current detective terminal              |               |
| 7       | PG-B                | Power GND B terminal                              |               |
| 8       | $\overline{IB}$     | Upper PNP Transistor Base terminal                |               |
| 9       | $\phi\overline{B}$  | Output B terminal                                 |               |
| 10      | $V_{MB}$            | Power voltage supply terminal for Motor B         |               |
| 11      | $\phi B$            | Output B terminal                                 |               |
| 12      | IB                  | Upper PNP Transistor Base terminal                |               |
| 13      | $\overline{IA}$     | Upper PNP Transistor Base terminal                |               |
| 14      | $\phi\overline{A}$  | Output A terminal                                 |               |
| 15      | $V_{MA}$            | Power voltage supply terminal for Motor A         |               |
| 16      | $\phi A$            | Output A terminal                                 |               |
| 17      | IA                  | Upper side PNP Transistor Base terminal           |               |
| 18      | PG-A                | Power GND A terminal                              |               |
| 19      | NFA                 | A Channel current detective terminal              |               |
| 20      | $\overline{ENABLE}$ | ENABLE Signal Input terminal                      | Truth table A |
| 21      | SG                  | Signal GND terminal                               |               |
| 22      | OSC                 | Internal Oscillation frequency detective terminal |               |
| 23      | CW / CCW            | Forward rotation / Reverse rotation signal Input  | Truth table A |
| 24      | CK2                 | Clock signal Input terminal                       |               |

**PIN CONNECTION**



**TRUTH TABLE A**

| INPUT |     |          |       |        | MODE    |
|-------|-----|----------|-------|--------|---------|
| CK1   | CK2 | CW / CCW | RESET | ENABLE |         |
|       | H   | L        | H     | L      | CW      |
|       | L   | L        | H     | L      | INHIBIT |
| H     |     | L        | H     | L      | CCW     |
| L     |     | L        | H     | L      | INHIBIT |
|       | H   | H        | H     | L      | CCW     |
|       | L   | H        | H     | L      | INHIBIT |
| H     |     | H        | H     | L      | CW      |
| L     |     | H        | H     | L      | INHIBIT |
| X     | X   | X        | L     | L      | INITIAL |
| X     | X   | X        | X     | H      | Z       |

Z : High Impedance  
X : Don't Care

(Note) Do not use INHIBIT MODE

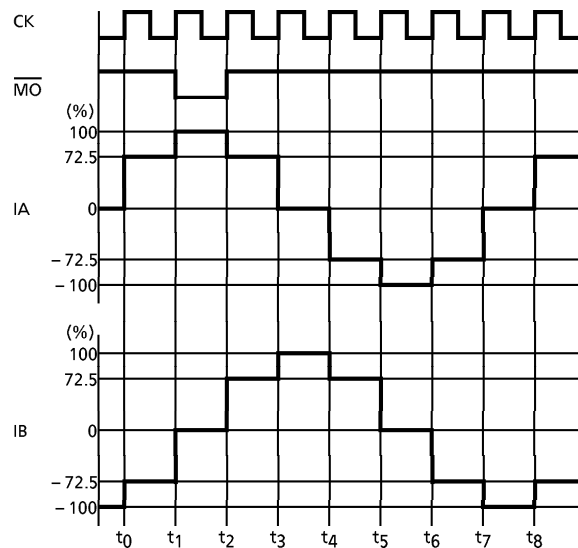
**TRUTH TABLE B**

| INPUT MODE | MODE (EXCITATION) |
|------------|-------------------|
| L          | 1-2 phase         |
| H          | 2W1-2 phase       |

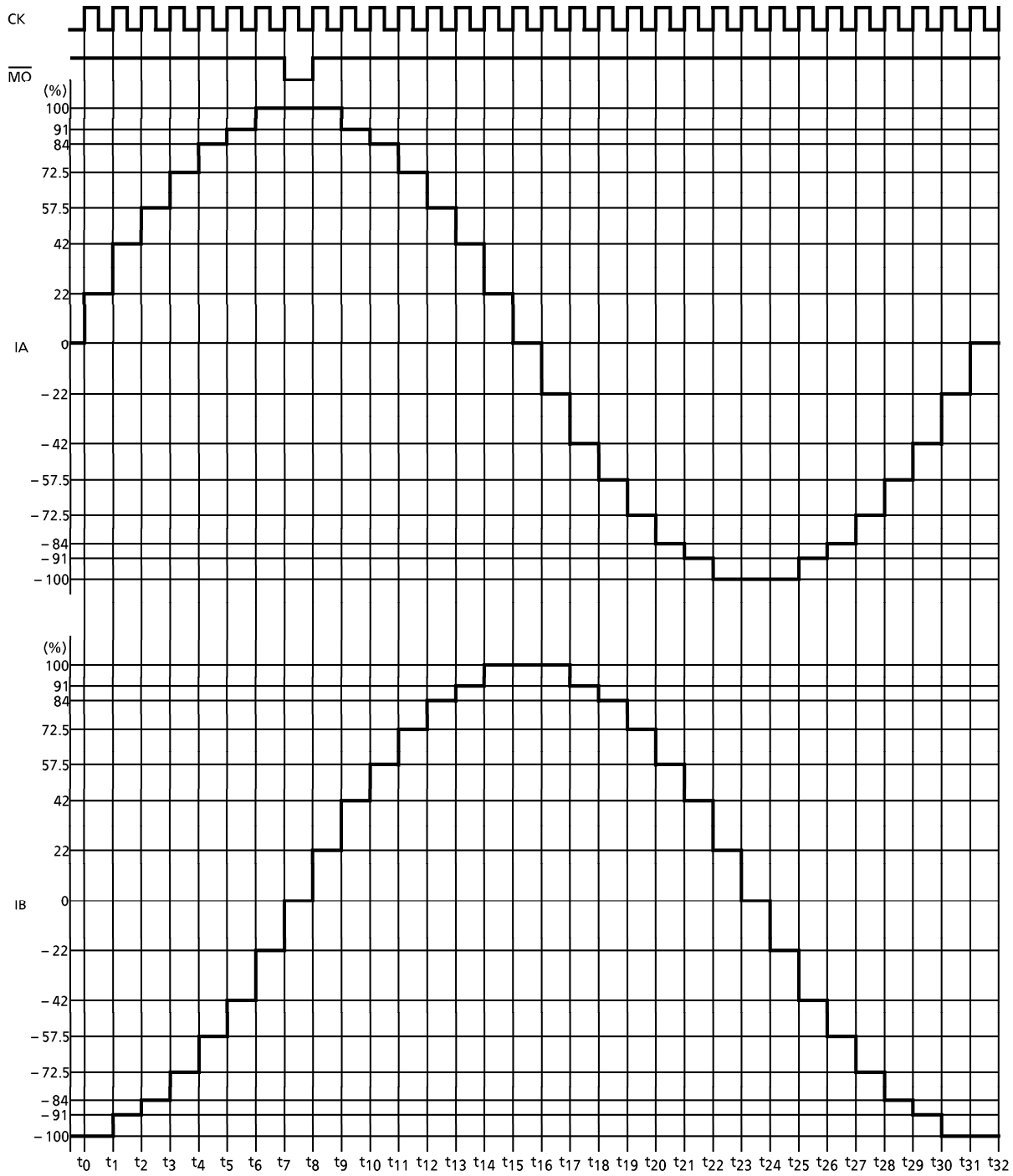
**INITIAL MODE**

| EXCITATION MODE | I <sub>OUT</sub> (A) | I <sub>OUT</sub> (B) |
|-----------------|----------------------|----------------------|
| 1-2 phase       | 100%                 | 0%                   |
| 2W1-2 phase     | 100%                 | 0%                   |

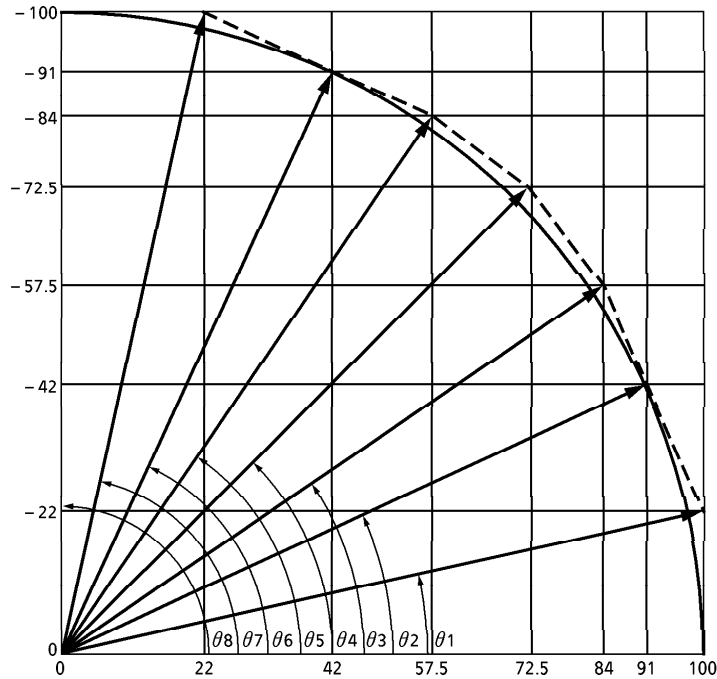
**1-2 PHASE EXCITATION (MODE : L, CW mode)**



2W1-2 PHASE EXCITATION (MODE : H, CW mode)



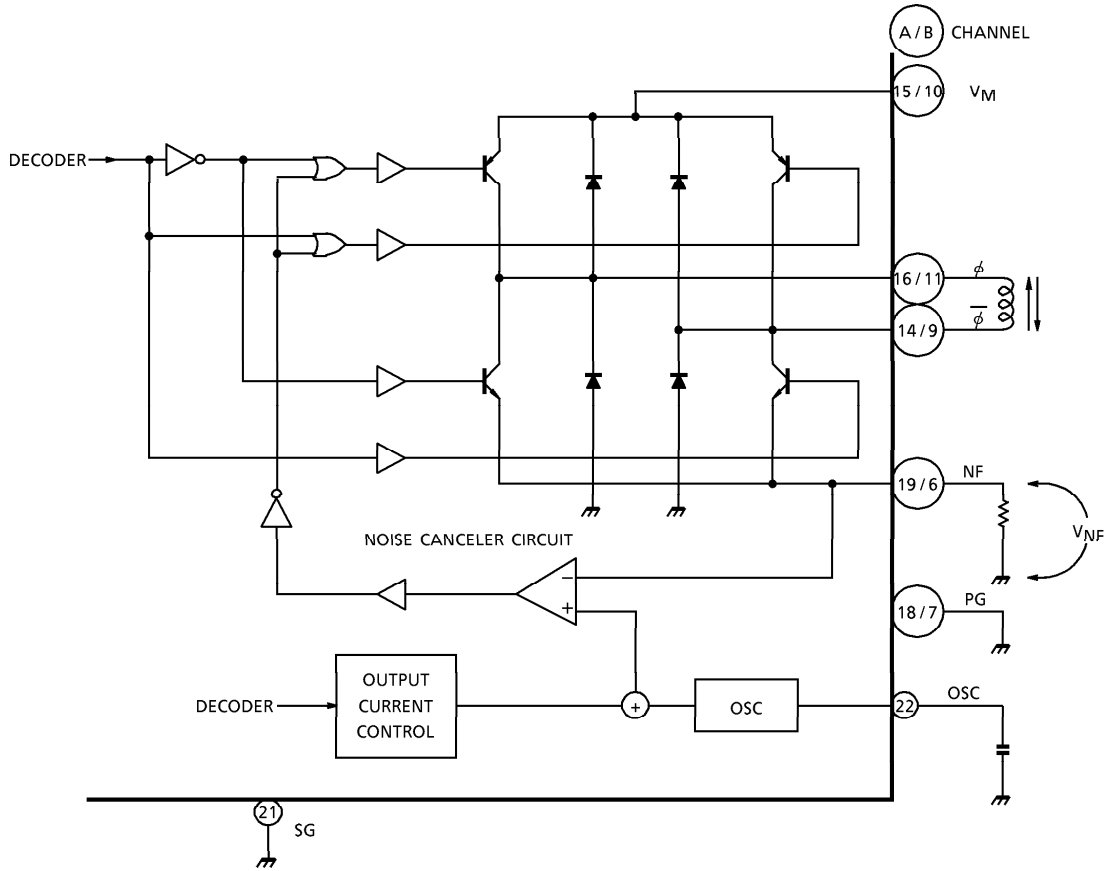
**OUTPUT CURRENT VECTOR OR BIT (Normalize to 90 deg for each one step)**



| $\theta$   | ROTATION ANGLE |          | VECTOR LENGTH |          |
|------------|----------------|----------|---------------|----------|
|            | IDEAL          | TB6512AF | IDEAL         | TB6512AF |
| $\theta_0$ | 0°             | 0°       | 100           | 100.00   |
| $\theta_1$ | 11.25°         | 12.41°   | 100           | 102.39   |
| $\theta_2$ | 22.5°          | 27.78°   | 100           | 100.22   |
| $\theta_3$ | 33.75°         | 34.39°   | 100           | 101.80   |
| $\theta_4$ | 45°            | 45°      | 100           | 102.53   |
| $\theta_5$ | 56.25°         | 55.61°   | 100           | 101.81   |
| $\theta_6$ | 67.5°          | 65.22°   | 100           | 100.22   |
| $\theta_7$ | 78.75°         | 77.59°   | 100           | 102.39   |
| $\theta_8$ | 90°            | 90°      | 100           | 100.00   |

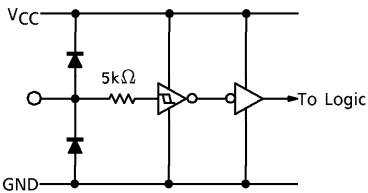
1-2 / 2W1-2 phase

OUTPUT CIRCUIT

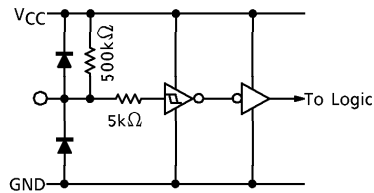


INPUT CIRCUIT

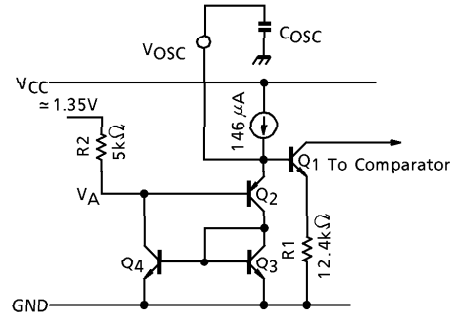
CK1, CK2, CW/CCW,  
MODE Terminals



$\overline{\text{RESET}}$ ,  $\overline{\text{ENABLE}}$  Terminals



OSC Terminals



- OSC frequency calculation

Sawtooth OSC circuit consists of Q<sub>1</sub> through Q<sub>4</sub> and R<sub>1</sub> through R<sub>4</sub>.

Q<sub>2</sub> is turned "off" when V<sub>OSC</sub> is less than the voltage of 2.5V + V<sub>BE</sub> Q<sub>2</sub> approximately equal to 2.05V.

V<sub>OSC</sub> is increased by C<sub>OSC</sub> charging through R<sub>1</sub>.

Q<sub>3</sub> and Q<sub>4</sub> are turned "on" when V<sub>OSC</sub> becomes 2.05V (Higher level.)

Lower level of V<sub>OSC</sub> pin is equal to V<sub>BE</sub> Q<sub>2</sub> + V<sub>SAT</sub> Q<sub>4</sub> approximately equal to 1.4V.

V<sub>OSC</sub> is calculated by following equation.

Assuming that V<sub>OSC</sub> = 1.4V (t = t<sub>1</sub>) and = 2.05 (t = t<sub>2</sub>)

C<sub>OSC</sub> is external capacitance connected to pin<sup>Ⓜ</sup> and R<sub>1</sub> is on-chip 10kΩ resistor.

Therefore, OSC frequency is calculated as follows.

$$t_1 = \frac{1.0 \cdot C_{OSC}}{146 \times 10^{-6}}$$

$$t_2 = \frac{2.05 \cdot C_{OSC}}{146 \times 10^{-6}}$$

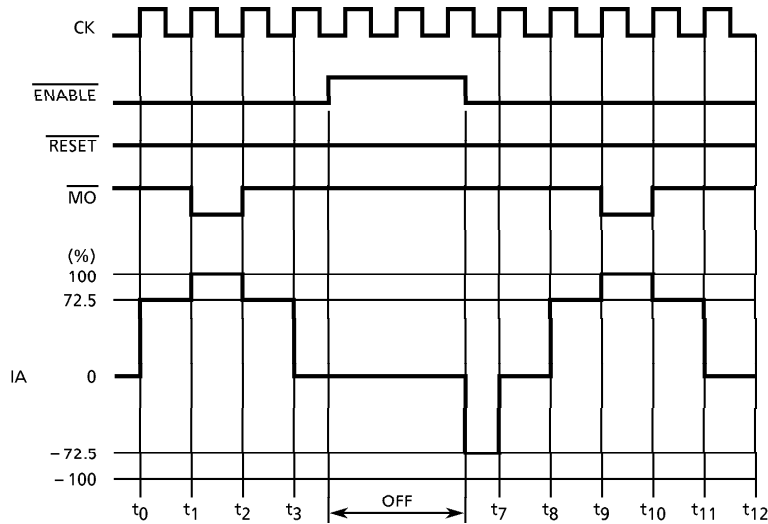
$$f_{OSC} = \frac{1}{t_2 - t_1} = \frac{146 \times 10^{-6}}{C_{OSC} (2.05 - 1.0)}$$

$$= \frac{0.139}{C_{OSC}} \text{ (kHz) (} C_{OSC} \text{ unit} = \mu\text{F)}$$



**ENABLE AND RESET FUNCTION AND MO SIGNAL**

Fig.1. 1-2 phase drive mode (MODE : L)

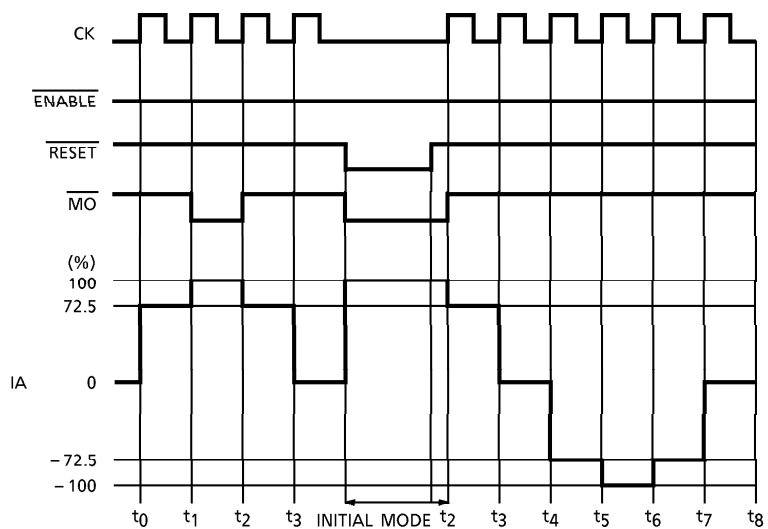


ENABLE signal disables only Output signal. Internal logic functions are proceeded by CK signal without regard to ENABLE signal.

Therefore, Output Current is initiated from the proceeded timing point of internal logic circuit, after release of disable mode.

Fig.1 shows the ENABLE functions, when the system is selected in 1-2 phase drive mode.

Fig.2. 1-2 phase drive mode (MODE : L)



As RESET is low, the decoder is initialized and MO is low.

After RESET is high, the motion is resumed from next clock as show in Fig.2.

MO (Monitor Output) signals is used as rotation and initial signal for stable rotation checking.

**MAXIMUM RATINGS** (Ta = 25°C)

| CHARACTERISTIC        | SYMBOL                                      | RATING           | UNIT |
|-----------------------|---|------------------|------|
| Supply Voltage        | V <sub>CC</sub>                             | 5.5              | V    |
| Output Voltage        | V <sub>M (opr.)</sub>                       | 4.0~10.0         | V    |
|                       | V <sub>M (MAX.)</sub>                       | 12.0             |      |
| Output Current        | I <sub>O (MAX.)</sub>                       | 120              | mA   |
|                       | AVE. I <sub>O (M<math>\bar{O}</math>)</sub> | ±2               |      |
| Input Voltage         | V <sub>IN</sub>                             | ~V <sub>CC</sub> | V    |
| Power Dissipation     | P <sub>D</sub>                              | 0.83 (Note 1)    | W    |
|                       |   | 1.04 (Note 2)    |      |
| Operating Temperature | T <sub>opr</sub>                            | -30~85           | °C   |
| Storage Temperature   | T <sub>stg</sub>                            | -55~150          | °C   |
| Feed Back Voltage     | V <sub>I</sub>                              | 1.0              | V    |

(Note 1) No heat sink

(Note 2) With heat sink (50 × 50 × 1.6mm Cu 10%)

**RECOMMENDED OPERATING CONDITIONS** (Ta = -30~85°C)

| CHARACTERISTIC  | SYMBOL                 | TEST CONDITION | MIN. | TYP. | MAX.            | UNIT |
|-----------------|------------------------|----------------|------|------|-----------------|------|
| Supply Voltage  | V <sub>CC (opr.)</sub> |                | 2.7  | 3.0  | 5.5             | V    |
| Output Voltage  | V <sub>M (opr.)</sub>  |                | 4.0  | —    | 10.0            | V    |
| Output Current  | I <sub>OUT</sub>       |                | —    | —    | 100             | mA   |
| Input Voltage   | V <sub>IN</sub>        |                | —    | —    | V <sub>CC</sub> | V    |
| Clock Frequency | f <sub>CLOCK</sub>     |                | —    | —    | 5               | kHz  |
| OSC Frequency   | f <sub>OSC</sub>       |                | 15   | —    | 80              | kHz  |

**ELECTRICAL CHARACTERISTICS**

Unless otherwise specified, (Ta = 25°C, VCC = 3V, VM = 5V, L = 20mH / R = 0.5Ω)

| CHARACTERISTIC                       |      | SYMBOL                  | TEST CIR-CUIT | TEST CONDITION  | MIN.                     | TYP. | MAX.                     | UNIT |
|--------------------------------------|------|-------------------------|---------------|---|--------------------------|------|--------------------------|------|
| Input Voltage                        | High | V <sub>IN (H)</sub>     | 1             | MODE, CW / CCW, $\overline{\text{ENABLE}}$<br>CK1, CK2, $\overline{\text{RESET}}$                         | V <sub>CC</sub><br>× 0.7 | —    | V <sub>CC</sub><br>+ 0.4 | V    |
|                                      | Low  | V <sub>IN (L)</sub>     |               |   | GND<br>- 0.4             | —    | GND<br>× 0.3             |      |
| Input Hysteresis Voltage             |      | V <sub>H</sub>          |               |   | —                        | 600  | —                        | mV   |
| Input Current                        |      | I <sub>IN-1 (H)</sub>   | 1             | M1, M2, REF IN, V <sub>IN</sub> = 5.0V  | —                        | —    | 100                      | nA   |
|                                      |      | I <sub>IN-1 (L)</sub>   |               | $\overline{\text{RESET}}$ , V <sub>IN</sub> = 0V, $\overline{\text{ENABLE}}$<br>Internal pull-up resistor | 3                        | 6    | 12                       | μA   |
|                                      |      | I <sub>IN-2 (L)</sub>   |               | V <sub>IN</sub> = 0V  | —                        | —    | 100                      | nA   |
| Quiescent Current<br>V <sub>CC</sub> |      | I <sub>CC1</sub>        | 2             | Output open,<br>$\overline{\text{RESET}}$ : H, $\overline{\text{ENABLE}}$ : L,<br>(1-2 phase excitation)  | —                        | 5    | 9                        | mA   |
|                                      |      | I <sub>CC2</sub>        |               | Output open,<br>$\overline{\text{RESET}}$ : H, $\overline{\text{ENABLE}}$ : L<br>(2W1-2 phase excitation) | —                        | 5    | 9                        |      |
|                                      |      | I <sub>CC3</sub>        |               | $\overline{\text{RESET}}$ : L, $\overline{\text{ENABLE}}$ : H   | —                        | 1.3  | —                        |      |
|                                      |      | I <sub>CC4</sub>        |               | $\overline{\text{RESET}}$ : H, $\overline{\text{ENABLE}}$ : H   | —                        | 1.3  | —                        |      |
| Comparator Reference Voltage         |      | V <sub>NF</sub>         | 3             | R <sub>NF</sub> = 2.5Ω, C <sub>OSC</sub> = 0.0033μF   | 0.22                     | 0.25 | 0.28                     | V    |
| Output Diffirencial                  |      | ΔV <sub>O</sub>         | —             | B / A, C <sub>OSC</sub> = 0.0033μF<br>R <sub>NF</sub> = 2.5Ω  | - 10                     | —    | 10                       | %    |
| Maximum OSC Frequency                |      | f <sub>OSC (MAX.)</sub> | —             |   | 100                      | —    | —                        | kHz  |
| Minimum OSC Frequency                |      | f <sub>OSC (MIN.)</sub> | —             |   | —                        | —    | 10                       | kHz  |
| OSC Frequency                        |      | f <sub>OSC</sub>        | —             | C <sub>OSC</sub> = 0.0033μF   | 31                       | 44   | 70                       | kHz  |
| Output Voltage                       |      | V <sub>OH (MO)</sub>    | —             | I <sub>OH</sub> = - 40μA  | 2.5                      | —    | V <sub>CC</sub>          | V    |
|                                      |      | V <sub>OL (MO)</sub>    | —             | I <sub>OL</sub> = 40μA  | GND                      | 0.1  | 0.5                      |      |

Output block

| CHARACTERISTIC                       |              | SYMBOL        | TEST CIR-CUIT | TEST CONDITION   | MIN.   | TYP.           | MAX. | UNIT    |      |   |
|--------------------------------------|--------------|---------------|---------------|--|--|----------------|------|---------|------|---|
| Output Saturation Voltage            | Upper Side   | $V_{SAT\ U1}$ | 4             | $I_{OUT} = 0.12A$                                      | —  | 0.08           | 0.23 | V       |      |   |
|                                      | Lower Side   | $V_{SAT\ L1}$ |               |  | —  | 0.16           | 0.43 |         |      |   |
|                                      | Upper Side   | $V_{SAT\ U2}$ |               | $I_{OUT} = 0.06A$                                      | —  | 0.06           | —    |         |      |   |
|                                      | Lower Side   | $V_{SAT\ L2}$ |               |  | —  | 0.10           | —    |         |      |   |
| Diode Forward Voltage                | Upper Side   | $V_F\ U1$     | 5             | $I_{OUT} = 0.12A$                                      | —  | 1.13           | 1.8  | V       |      |   |
|                                      | Lower Side   | $V_F\ L1$     |               |  | —  | 0.95           | 1.6  |         |      |   |
| Output Dark Current (A + B Channels) |              | $I_{M1}$      | 2             | ENABLE : "H" level<br>RESET : "L" level<br>Output open | —  | —              | 50   | $\mu A$ |      |   |
|                                      |              | $I_{M2}$      |               | ENABLE : "L" level<br>RESET : "H" level<br>Output open | —  | 17             | 28   | mA      |      |   |
| NF Dark Current (1 Channels)         |              | $I_{NF}$      |               |  | ENABLE : "L" level<br>RESET : "H" level<br>Output open | 1              | 2.5  |         | 7    |   |
| A-B Chopping Current (Note)          | 2W1-2 $\phi$ | 1-2 $\phi$    | VECTOR        | 3  | $R_{NF} = 2.5\Omega$<br>$C_{OSC} = 0.0033\mu F$        | $\theta = 0$   | —    | 100     | —    | % |
|                                      | 2W1-2 $\phi$ | —             |               |  |  | $\theta = 1/8$ | —    | 100     | —    |   |
|                                      | 2W1-2 $\phi$ | —             |               |  |  | $\theta = 2/8$ | 86   | 91      | 96   |   |
|                                      | 2W1-2 $\phi$ | —             |               |  |  | $\theta = 3/8$ | 79   | 84      | 89   |   |
|                                      | 2W1-2 $\phi$ | 1-2 $\phi$    |               |  |  | $\theta = 4/8$ | 67.5 | 72.5    | 77.5 |   |
|                                      | 2W1-2 $\phi$ | —             |               |  |  | $\theta = 5/8$ | 52.5 | 57.5    | 62.5 |   |
|                                      | 2W1-2 $\phi$ | —             |               |  |  | $\theta = 6/8$ | 37   | 42      | 47   |   |
|                                      | 2W1-2 $\phi$ | —             |               |  |  | $\theta = 7/8$ | 17   | 22      | 27   |   |

(Note) Maximum current ( $\theta = 0$ ) : 100%  
 2W1-2 $\phi$  : 2W1, 2 phase excitation mode  
 W1-2 $\phi$  : W1, 2 phase excitation mode  
 1-2 $\phi$  : 1, 2 phase excitation mode

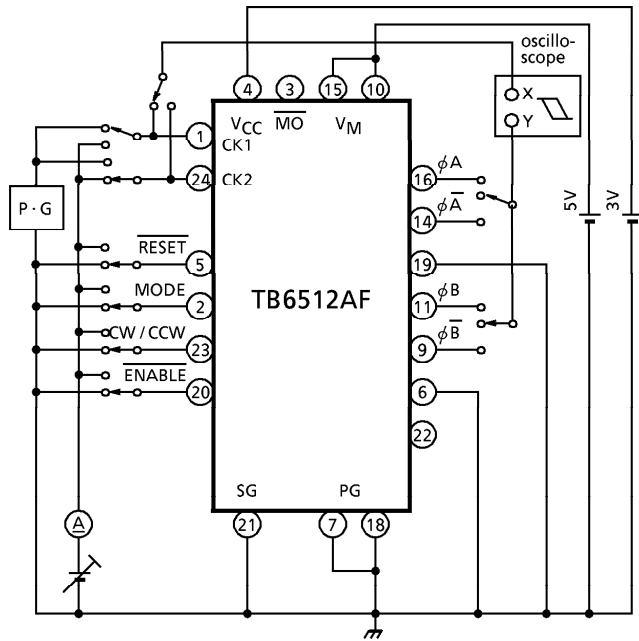
**ELECTRICAL CHARACTERISTICS**

Unless otherwise specified, (Ta = 25°C, VCC = 3V, VM = 5V, L = 20mH / R = 0.5Ω)

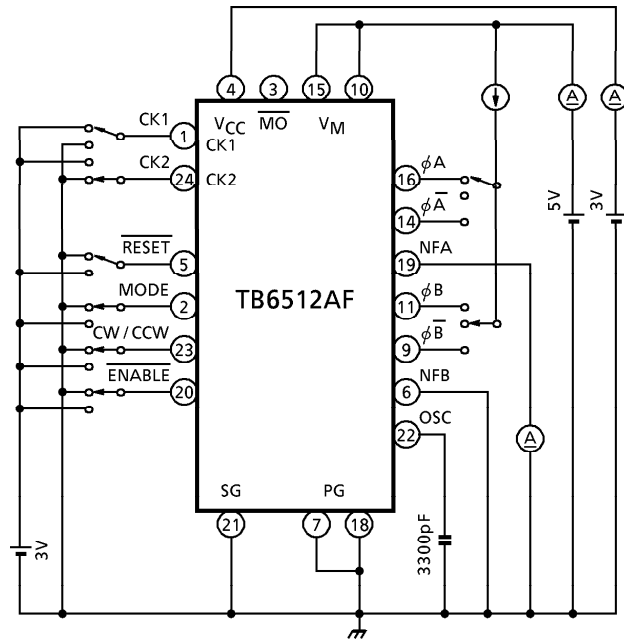
| CHARACTERISTIC                      |            | SYMBOL   | TEST CIRCUIT | TEST CONDITION  | MIN.                       | TYP.          | MAX.  | UNIT    |         |   |     |   |
|-------------------------------------|------------|----------|--------------|---|----------------------------|---------------|-------|---------|---------|---|-----|---|
| A-B Chopping Current (Note)         | 2W1-2φ     | 1-2φ     | 3            | $R_{NF} = 3.3\Omega$<br>$C_{OSC} = 0.0033\mu F$<br>$L = 5mH / R = 50\Omega$ | $\theta = 0$               | —             | 100   | —       | %       |   |     |   |
|                                     | 2W1-2φ     | —        |              |   | $\theta = 1/8$             | —             | 100   | —       |         |   |     |   |
|                                     | 2W1-2φ     | —        |              |   | $\theta = 2/8$             | —             | 91.1  | —       |         |   |     |   |
|                                     | 2W1-2φ     | —        |              |   | $\theta = 3/8$             | —             | 83.6  | —       |         |   |     |   |
|                                     | 2W1-2φ     | 1-2φ     |              |   | $\theta = 4/8$             | —             | 72.6  | —       |         |   |     |   |
|                                     | 2W1-2φ     | —        |              |   | $\theta = 5/8$             | —             | 60.0  | —       |         |   |     |   |
|                                     | 2W1-2φ     | —        |              |   | $\theta = 6/8$             | —             | 44.5  | —       |         |   |     |   |
|                                     | 2W1-2φ     | —        |              |   | $\theta = 7/8$             | —             | 24.3  | —       |         |   |     |   |
| Reference Voltage                   |            |          | 3            | $R_{NF} = 2.5\Omega$<br>$C_{OSC} = 0.0033\mu F$                             | $\Delta\theta = 0/8 - 1/8$ | —             | 0     | —       | mV      |   |     |   |
|                                     |            |          |              |   | $\Delta\theta = 1/8 - 2/8$ | 10            | 22.5  | 35      |         |   |     |   |
|                                     |            |          |              |   | $\Delta\theta = 2/8 - 3/8$ | 5             | 17.5  | 30      |         |   |     |   |
|                                     |            |          |              |   | $\Delta\theta = 3/8 - 4/8$ | 16.25         | 28.75 | 41.25   |         |   |     |   |
|                                     |            |          |              |   | $\Delta\theta = 4/8 - 5/8$ | 25            | 37.5  | 50      |         |   |     |   |
|                                     |            |          |              |   | $\Delta\theta = 5/8 - 6/8$ | 26.25         | 38.75 | 51.25   |         |   |     |   |
|                                     |            |          |              |   | $\Delta\theta = 6/8 - 7/8$ | 37.5          | 50    | 62.5    |         |   |     |   |
| Output Tr Switching Characteristics |            |          | 7            | $R_L = 2\Omega, V_{NF} = 0V, C_L = 15pF$                                    | $t_r$                      | —             | 0.3   | —       | $\mu s$ |   |     |   |
|                                     |            |          |              |   | $t_f$                      | —             | 2.2   | —       |         |   |     |   |
|                                     |            |          |              |   | $t_{pLH}$                  | CK~Output     |       |         |         | — | 1.5 | — |
|                                     |            |          |              |   | $t_{pHL}$                  | CK~Output     |       |         |         | — | 2.7 | — |
|                                     |            |          |              |   | $t_{pLH}$                  | OSC~Output    |       |         |         | — | 5.4 | — |
|                                     |            |          |              |   | $t_{pHL}$                  | OSC~Output    |       |         |         | — | 6.3 | — |
|                                     |            |          |              |   | $t_{pLH}$                  | RESET~Output  |       |         |         | — | 2.0 | — |
|                                     |            |          |              |   | $t_{pHL}$                  | RESET~Output  |       |         |         | — | 2.5 | — |
|                                     |            |          |              |   | $t_{pLH}$                  | ENABLE~Output |       |         |         | — | 5.0 | — |
|                                     |            |          |              |   | $t_{pHL}$                  | ENABLE~Output |       |         |         | — | 6.0 | — |
| Output Leakage Current              | Upper Side | $I_{OH}$ | 6            | $V_M = 12V$   | —                          | —             | 50    | $\mu A$ |         |   |     |   |
|                                     | Lower Side | $I_{OL}$ |              |   | —                          | —             | 50    |         |         |   |     |   |

(Note) Maximum current ( $\theta = 0$ ) : 100%  
 2W1-2φ : 2W1, 2 phase excitation mode  
 W1-2φ : W1, 2 phase excitation mode  
 1-2φ : 1,2 phase excitation mode

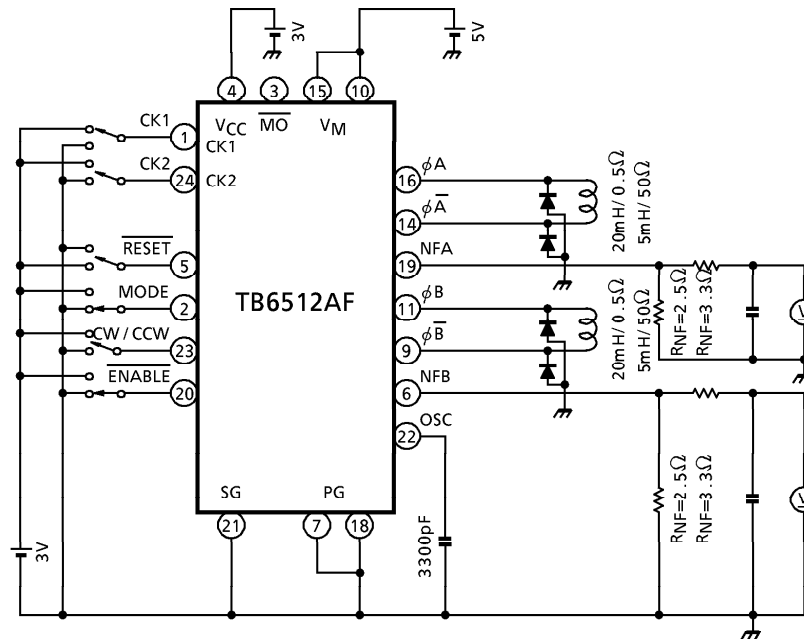
TEST CIRCUIT 1 :  $V_{IN}$  (H), (L),  $I_{IN}$  (H), (L)



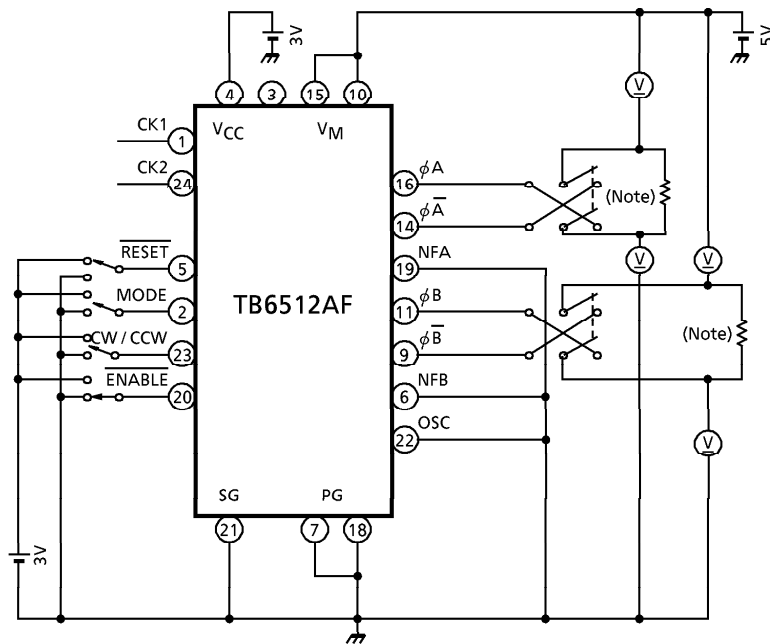
TEST CIRCUIT 2 :  $I_{CC}$ ,  $I_M$ ,  $I_{NF}$



TEST CIRCUIT 3 :  $V_{NF}$

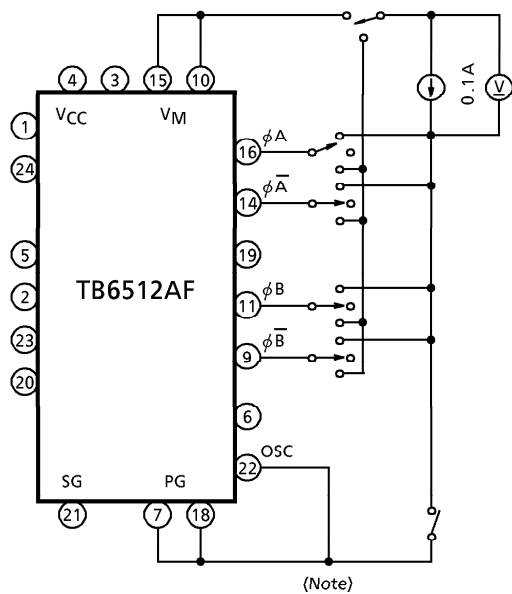


TEST CIRCUIT 4 :  $V_{CE(SAT)}$  Upper, lower

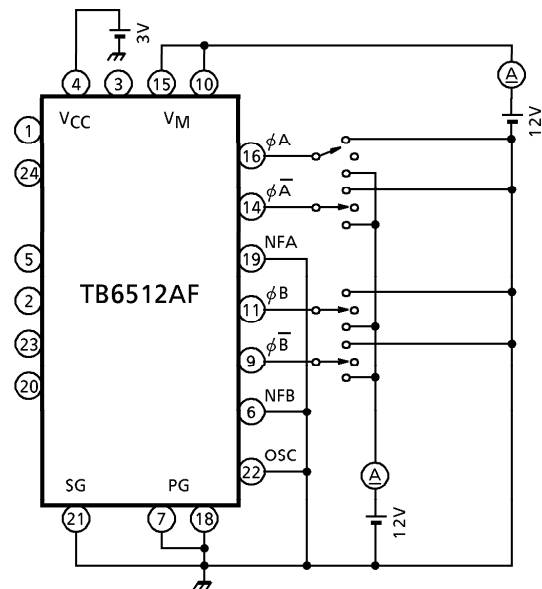


(Note) Calibrate Output Current becomes 0.06A (or 0.10A) with this resistor.

TEST CIRCUIT 5 :  $V_{F-U}$ ,  $V_{F-L}$

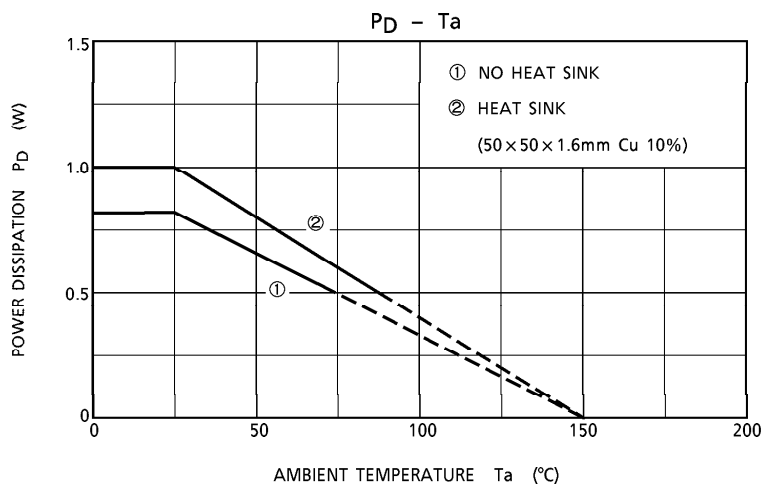
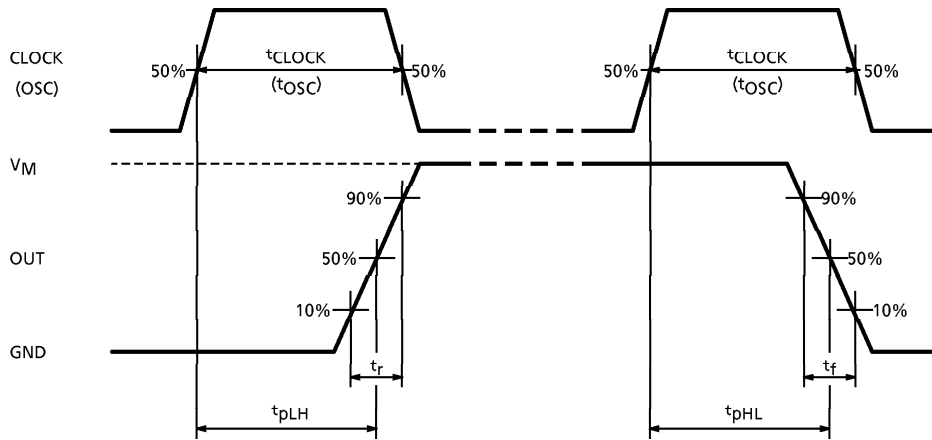


TEST CIRCUIT 6 :  $I_{OH}$ ,  $I_{OL}$



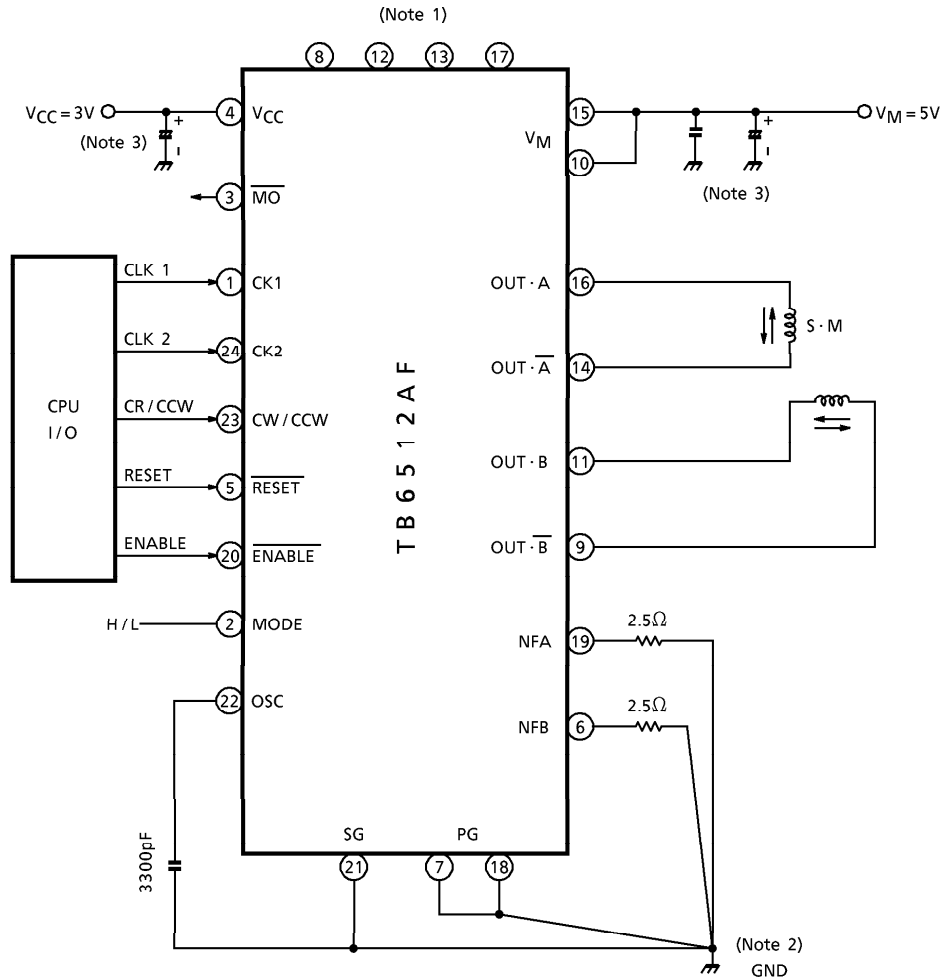
(Note) Not to take a GND with any non-connecting Pins.

AC ELECTRICAL, CHARACTERICAL  
CK (OSC) – OUT



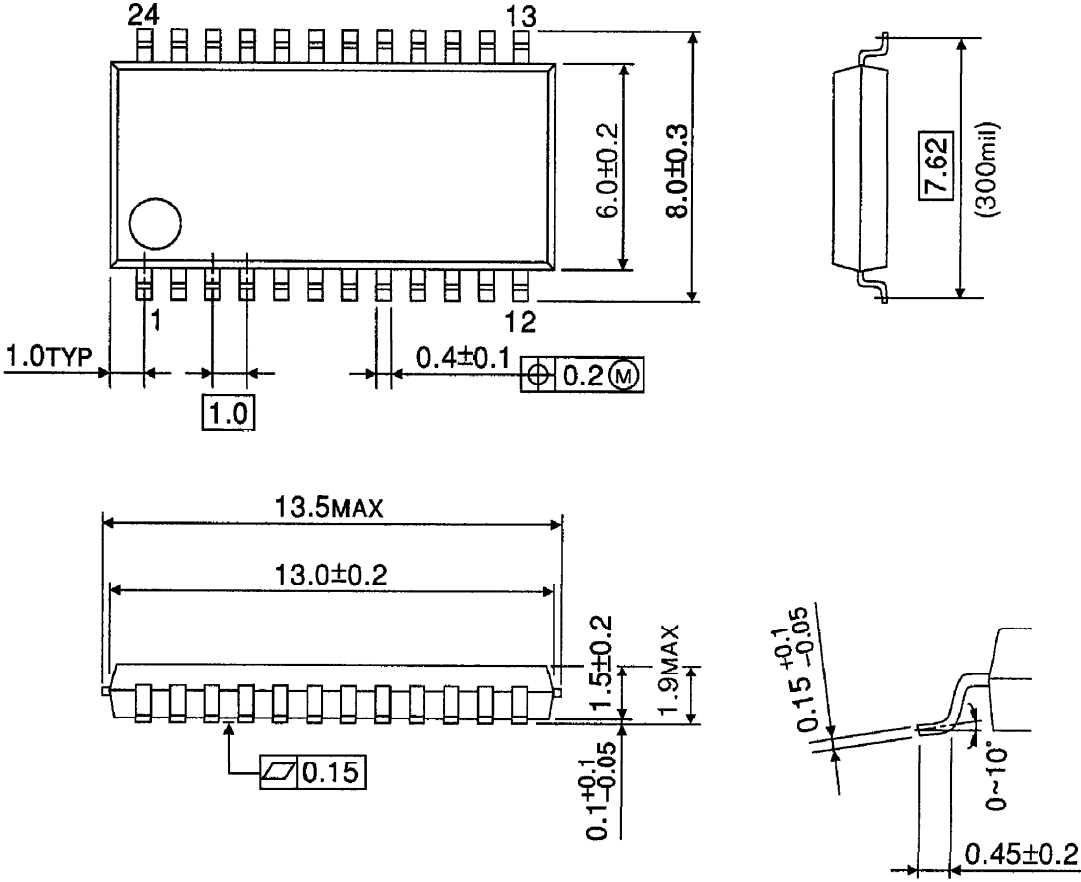


APPLICATION CIRCUIT



OUTLINE DRAWING  
SSOP24-P-300-1.00B

Unit : mm



Weight : 0.27g (Typ.)