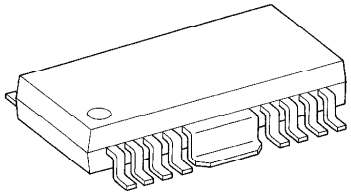
TOSHIBA BIPOLAR LINEAR INTEGRATED CIRCUIT SILICON MONOLITHIC

# TA8430AF

## STEPPING MOTOR DRIVER IC

The TA8430AF is 2 Phase Bipolar Stepping Motor Driver IC designed especially for low operating voltage use FDD and other portable equipments.



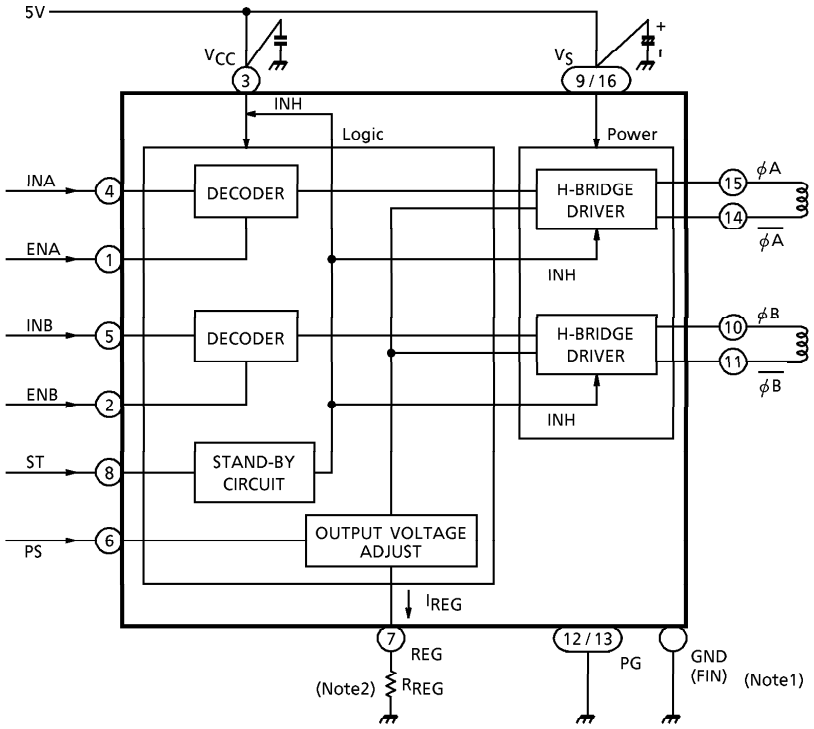
HSOP16-P-300-1.00

Weight : 0.50g (Typ.)

### FEATURES

- 2 Phase Bipolar Stepping Motor Driver
- Low Voltage Use : $V_{CC\ opr} = 4V$ (Min.)
- Power Save and Stand-by Mode available
  $I_{CC}$ stand-by $\leqq 100\mu A$
- Built-in Punch Through Current Restriction Circuit
- 1, 2 and 1-2 Phase Excitation Drive available
- C-MOS Compatible Inputs (INA, INB, PS, ST)
- Output Current up to 400mA (AVE) and 600mA (PEAK)
- Sealed in PFP 16 SM Package
- HEAT SINK is connected with GND with low impedance.

## BLOCK DIAGRAM




(Note 1) GND terminal of 12 / 13 connect to FIN.
(Note 2) Output Voltages, appeared at $\phi$A, $\overline{\phi}$A, $\phi$B and $\overline{\phi}$B, are adjusted by $R_{reg}$ when Power Save function is selected.
(Note 3) Utmost care is necessary in the design of the output line, $V_{CC}$, $V_S$ and GND line since IC may be destroyed due to short-circuit between outputs, air contamination fault, or fault by improper grounding.

## PIN FUNCTION

| PIN No. | SYMBOL | FUNCTION |
|---|---|---|
| 1 | ENA | A channel enable |
| 2 | ENB | B channel enable |
| 3 | $V_{CC}$ | Supply voltage |
| 4 | INA | A channel reciprocal switching |
| 5 | INB | B channel reciprocal switching |
| 6 | PS | Energy-saving signal input |
| 7 | REG | Output voltage setting |
| 8 | ST | Stand-by signal input |
| 9 | $V_S$ | Supply voltage |
| 10 | $\phi$B | B output |
| 11 | $\overline{\phi}$B | $\overline{B}$ output |
| 12 | PG | Power supply GND connection |
| 13 | PG | Power supply GND connection |
| 14 | $\overline{\phi}$A | $\overline{A}$ output |
| 15 | $\phi$A | A output |
| 16 | $V_S$ | Supply voltage |
| FIN | GND | GND connection |

**FUNCTION**

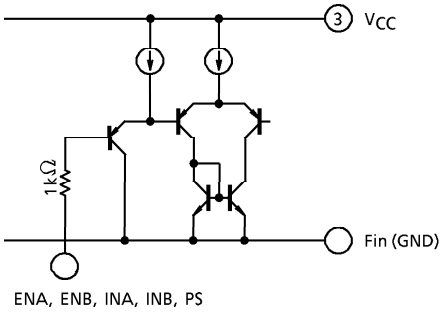
| INPUT | | | | OUTPUT | | |
|---|---|---|---|---|---|---|
| ST | EN | PS | IN | $\phi$ | $\overline{\phi}$ | UPPER SIDE SATURATION VOLTAGE |
| H | H | L | L | L | H | $V_S - V_{CE}$ (SAT) U |
| H | H | L | H | H | L | $V_S - V_{CE}$ (SAT) U |
| H | H | H | L | L | H | $V_{REG}$ (Note) |
| H | H | H | H | H | L | $V_{REG}$ (Note) |

(Note) $V_{REG}$ is a voltage appeared at PIN⑦ and its value becomes approximately equal to $V_{OUT}$ in power operation period.

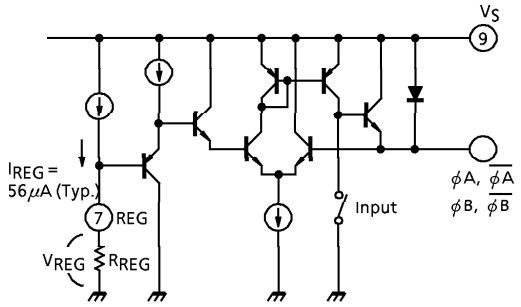
| ST | ENA | ENB | $\phi$A, $\overline{\phi A}$ | $\phi$B, $\overline{\phi B}$ | MODE |
|---|---|---|---|---|---|
| H | L | H | ∞ | ENABLE | OPERATION |
| H | H | L | ENABLE | ∞ | OPERATION |
| H | H | H | ENABLE | ENABLE | OPERATION |
| L | X | X | ∞ | ∞ | STAND-BY |

X : Don't Care
∞ : High Impedance

**INPUT STEP CIRCUIT DIAGRAM**



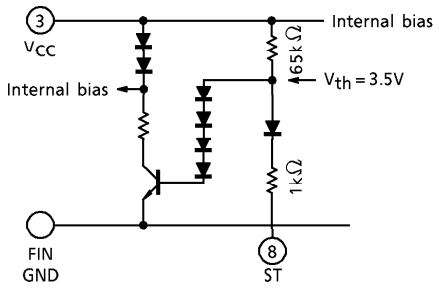

**$V_{REG}$ OUTPUT CIRCUIT DIAGRAM**




$V_{REG}$ output voltage can be selected with $R_{REG}$ exterior resistance.
If $V_{REG}$ is not used (as in the case of double-phase magnetization), use pin⑦ in the open position. (Do not connect to $V_{CC}$ or GND pins.)
Use the following formula to obtain the output voltage.

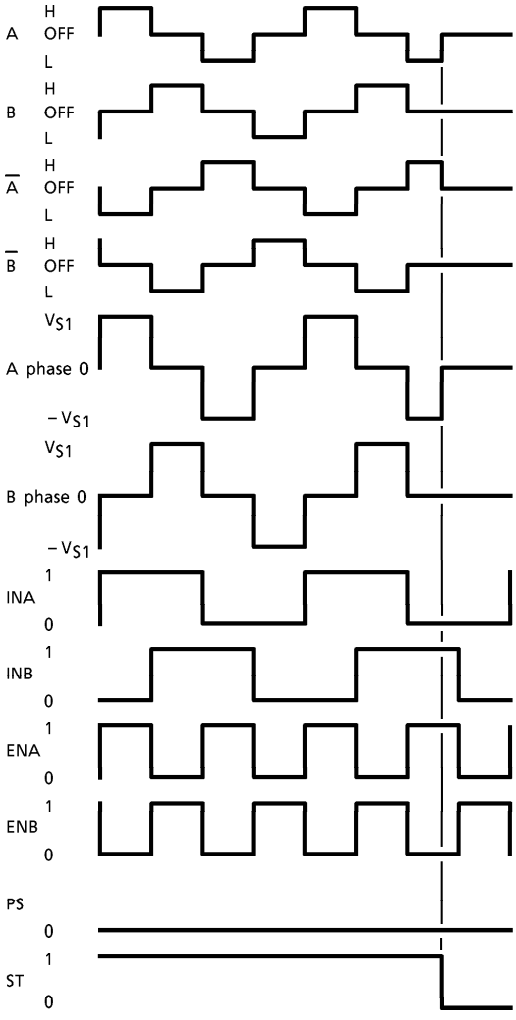
$$V_{OUT} \fallingdotseq V_{REG} \fallingdotseq R_{REG} \times 56 \times 10^{-6}$$

## STAND-BY CIRCUIT DIAGRAM



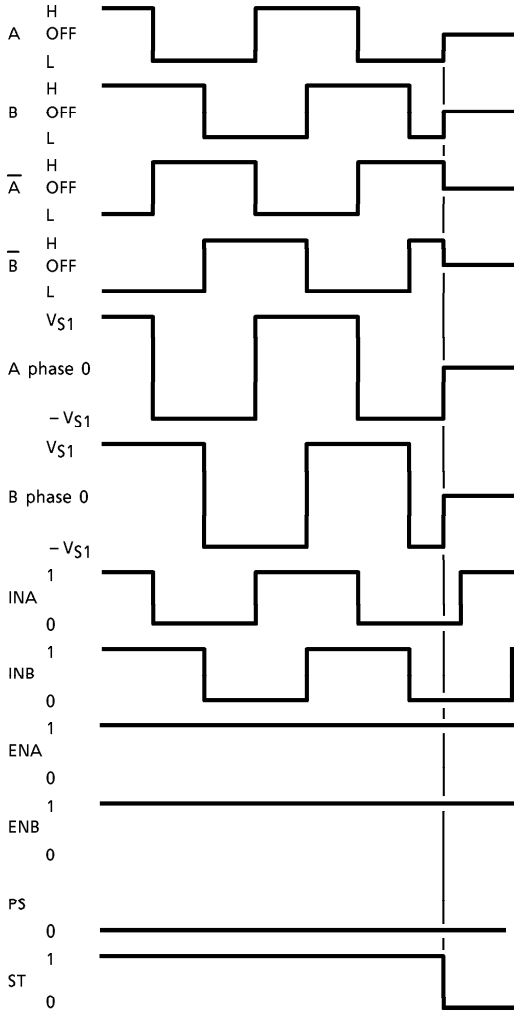

## TIMING CHART

Single-phase magnetization



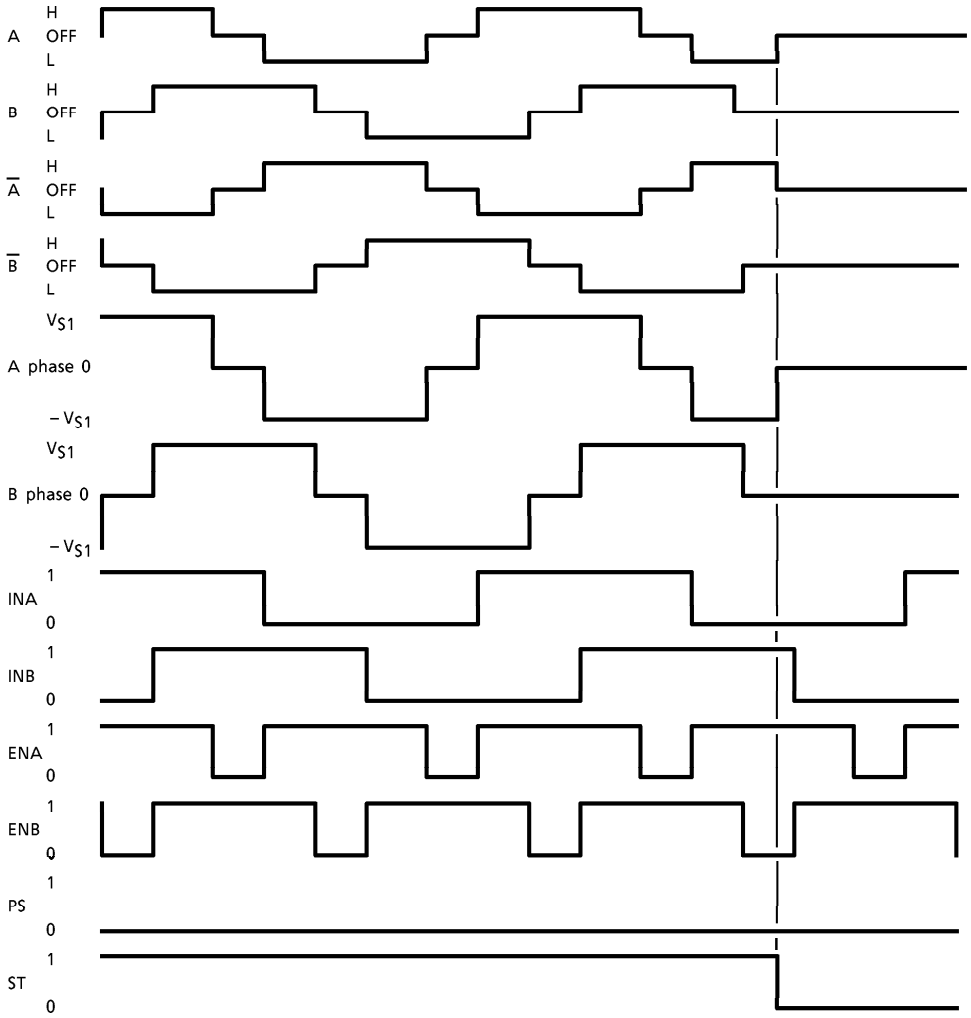

* $V_{S1} = V_S - (V_{SAT\ U} + V_{SAT\ L})$

Double-phase magnetization



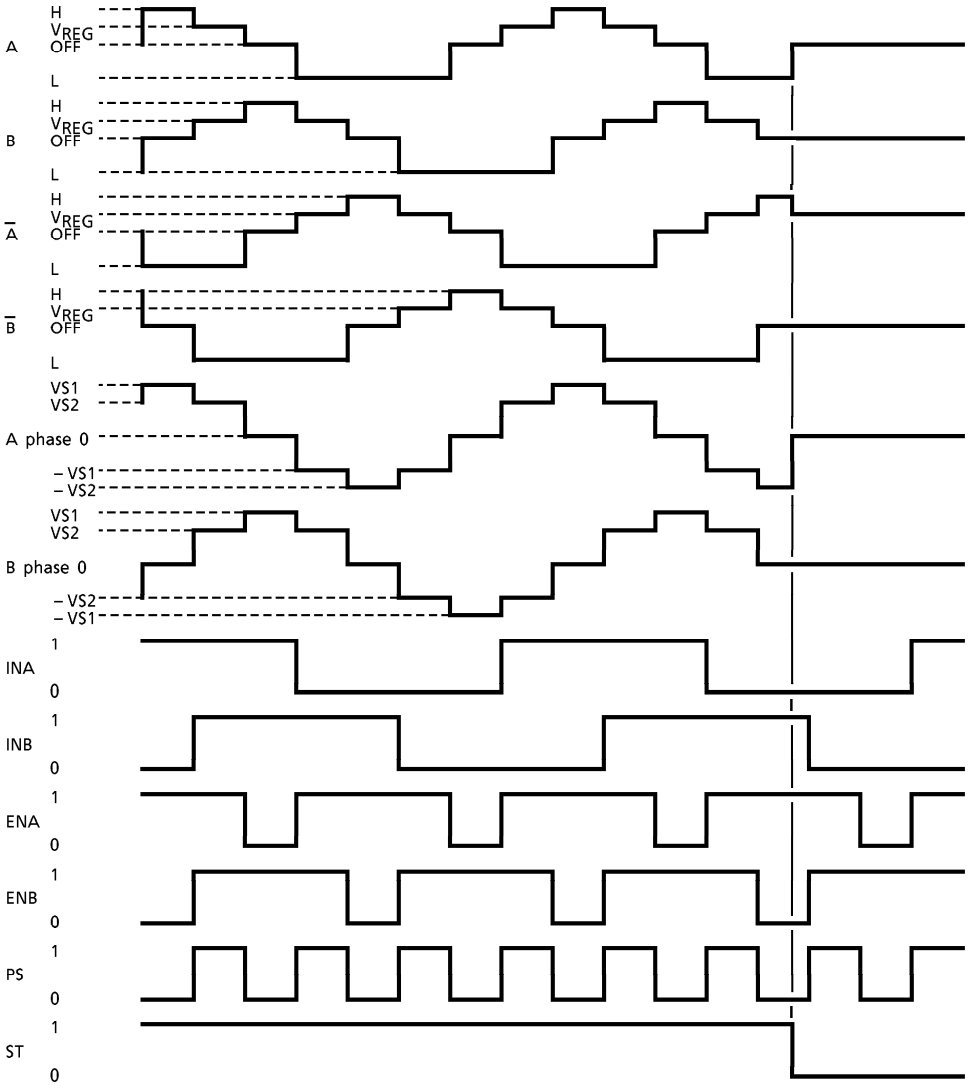

* $V_{S1} = V_S - (V_{SAT\ U} + V_{SAT\ L})$

Single- / double-phase magnetization




* $V_{S1} = V_S - (V_{SAT\ U} + V_{SAT\ L})$

Single- / double-phase magnetization (with energy-saving function)




$V_{S1} = V_S - (V_{SAT\ U} + V_{SAT\ L})$

$V_{S2} = V_{REG} - V_{SAT\ L}$

**MAXIMUM RATINGS** (Ta = 25°C)

| CHARACTERISTIC | SYMBOL | RATING | UNIT |
|---|---|---|---|
| Supply Voltage | $V_{CC}$ | 8.0 | V |
| | $V_S$ | 8.0 | |
| Output Current | $I_O$ (MAX.) | ±600 | mA |
| | $I_O$ (AVE.) | ±400 | |
| Input Voltage | $V_{IN}$, $V_{PS}$ $V_{ST}$, $V_{EN}$ | GND − 0.4~$V_{CC}$ + 0.4 | V |
| Power Dissipation | $P_D$ (Note) | 1.4 | W |
| Operating Temperature | $T_{opr}$ | −40~85 | °C |
| Storage Temperature | $T_{stg}$ | −55~150 | °C |

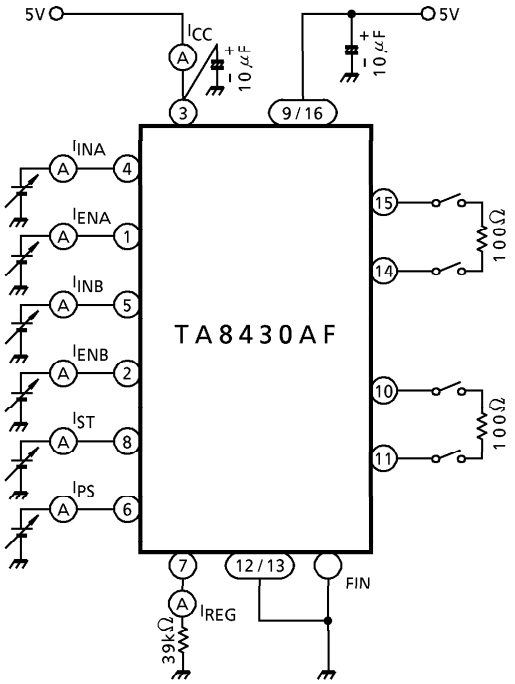
(Note) 60 × 30 × 1.6mm PCB occupied in excess of 50% of copper area, mounting.

**ELECTRICAL CHARACTERISTICS** (Ta = 25°C, $V_{CC}$ = 5V, $V_S$ = 5V, ST = 5V, PS = 0V, EN = 5V)

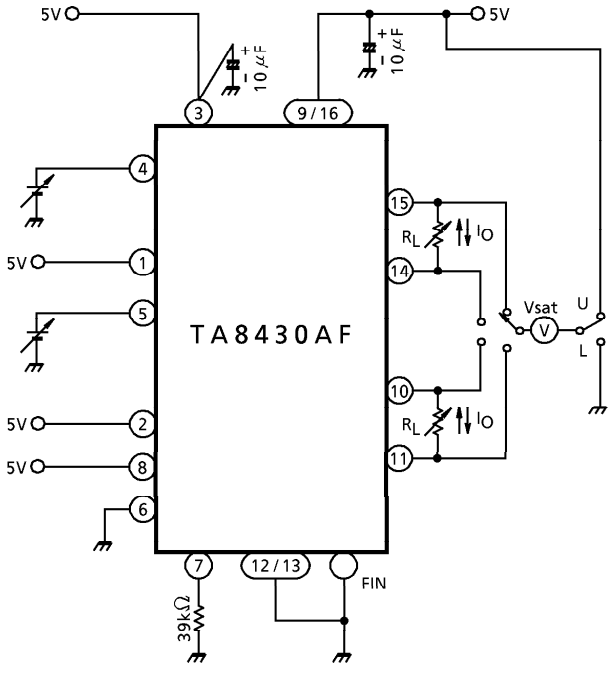
| CHARACTERISTIC | SYMBOL | TEST CIR-CUIT | TEST CONDITION | | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|---|---|
| Supply Current | $I_{CC1}$ | 1 | Output open | | — | 14 | 20 | mA |
| | $I_{CC2}$ | | Output open, PS = 5V | | — | 14 | 20 | |
| | $I_{CC3}$ | | Output open | ENA = 0V, ENB = 5V | — | 9 | 15 | |
| | | | | ENA = 5V, ENB = 0V | | | | |
| | $I_{CC4}$ | | Output open, PS = 5V | ENA = 0V, ENB = 5V | — | 9 | 15 | |
| | | | | ENA = 5V, ENB = 0V | | | | |
| | $I_{CC5}$ | | ST = 0V | | 20 | 65 | 110 | μA |
| Input Voltage | $V_{INH}$ | 1 | ④, ⑤ pin Source type | | 3.5 | — | $V_{CC}$ | V |
| | $V_{INL}$ | | | | GND | — | 1.7 | |
| | $V_{ENH}$, $V_{PSH}$ | | ①, ②, ⑥, ⑧ pin Source type | | 3.5 | — | $V_{CC}$ | |
| | $V_{STH}$ | | | | | | | |
| | $V_{ENL}$, $V_{PSL}$ | | | | GND | — | 1.7 | |
| | $V_{STL}$ | | | | | | | |
| Input Current | $I_{INH}$ | 1 | $V_{IN}$ = 3.5V | ④, ⑤ pin | — | 0 | 0.1 | μA |
| | $I_{INL}$ | | $V_{IN}$ = 0V | | — | 0.25 | 5.0 | |
| | $I_{ENH}$, $I_{PSH}$ | | $V_{EN}$ = $V_{PS}$ = 3.5V | ①, ②, ⑥ pin | — | 0 | 0.1 | |
| | $I_{ENL}$, $I_{PSL}$ | | $V_{EN}$ = $V_{PS}$ = 0V | | — | 0.25 | 5.0 | |
| | $I_{STH}$ | | $V_{ST}$ = 3.5V | ⑧ pin | — | 0 | 0.1 | |
| | $I_{STL}$ | | $V_{ST}$ = 0V | | — | 65 | 110 | |

| CHARACTERISTIC | | SYMBOL | TEST CIR-CUIT | TEST CONDITION | | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|---|---|---|
| Saturation Voltage | | $V_{SAT\ U1}$ | 2 | — | $I_{OUT}$ = 100mA | — | 0.8 | — | V |
| | | $V_{SAT\ U2}$ | | | $I_{OUT}$ = 400mA | — | 0.9 | 1.2 | |
| | | $V_{SAT\ L1}$ | | | $I_{OUT}$ = 100mA | — | 0.1 | — | |
| | | $V_{SAT\ L2}$ | | | $I_{OUT}$ = 400mA | — | 0.2 | 0.4 | |
| Output Control Upper Voltage | | $V_{REG}1$ | — | $R_{REG}$ = 39kΩ | $I_{OUT}$ = 100mA | — | 2.0 | — | V |
| | | $V_{REG}2$ | | | $I_{OUT}$ = 400mA | — | 1.9 | — | |
| Control Circuit Output Current | | $I_{REG}$ | 1 | — | | 41 | 56 | 71 | μA |
| Diode Forward Voltage | | $V_{FU}$ | 3 | IF = 400mA | | — | 1.5 | 2.0 | V |
| | | $V_{FL}$ | | | | — | 1.0 | 2.0 | |
| Operating Supply Voltage Range | | $V_{CC\ (opr.)}$ | — | — | | 4.0 | — | 6.0 | V |
| Propagation Delay Time | IN-φ | $t_{pLH}$ | — | $R_L$ = 8.2Ω<br>$C_L$ = 15pF | | — | 4.5 | — | μs |
| | EN-φ | | | | | — | 3 | — | |
| | PS-φ | | | | | — | 4.5 | — | |
| | ST-φ | | | | | — | 10 | — | |
| | IN-φ | $t_{pHL}$ | | | | — | 0.1 | — | |
| | EN-φ | | | | | — | 10 | — | |
| | PS-φ | | | | | — | 0.2 | — | |
| | ST-φ | | | | | — | 5 | — | |

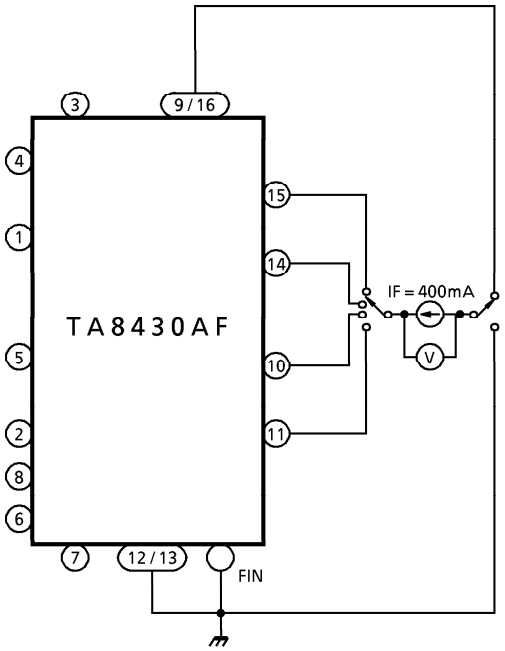
**TEST CIRCUIT 1**

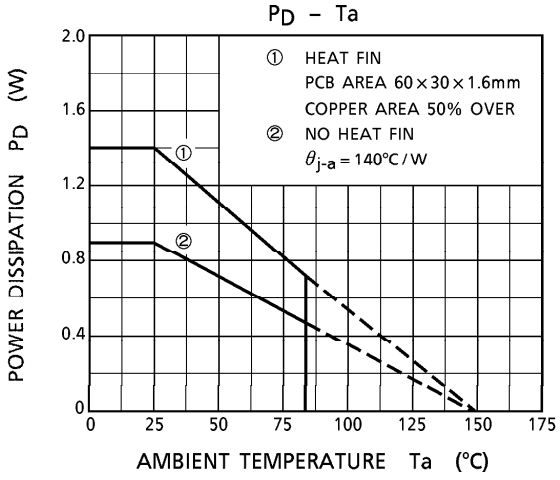


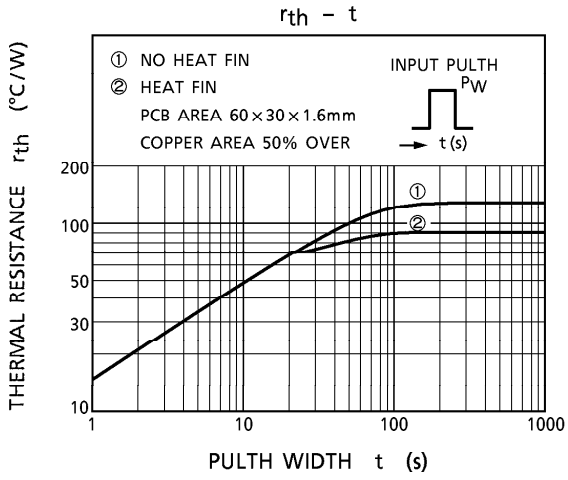

**TEST CIRCUIT 2**



**TEST CIRCUIT 3**

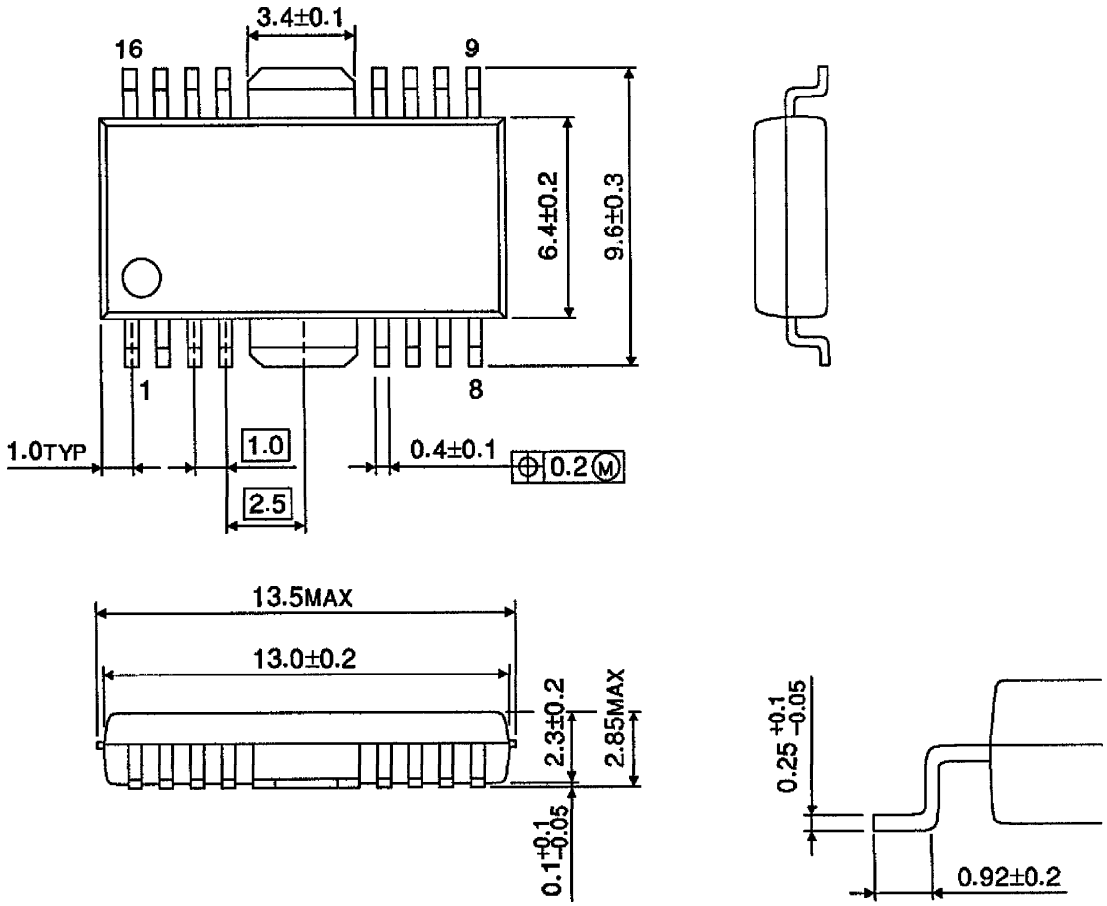


**OUTLINE DRAWING**

HSOP16-P-300-1.00 Unit : mm




Weight : 0.50g (Typ.)