

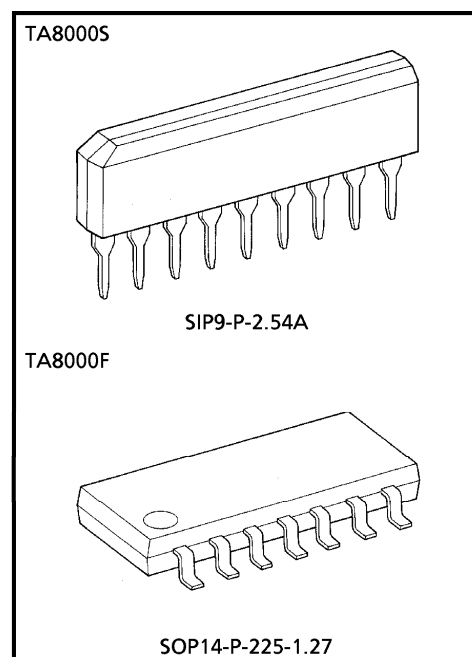
TOSHIBA BIPOLAR LINEAR INTEGRATED CIRCUIT SILICON MONOLITHIC

**TA8000S, TA8000F****5V VOLTAGE REGULATOR WITH WATCHDOG TIMER**

The TA8000S TA8000F is an IC specially designed for automotive microcomputer systems. It produces an output voltage of  $5 \pm 0.25V$  without need for adjustment from its accurate reference voltage and amplifier circuit. At power-on, it outputs a reset signal to reset the system. It will also output a reset signal when the 5V output voltage drops below 85% because of external disturbance or other problem. It also incorporates a watchdog timer for self-diagnosing the system. When the system malfunctions, the IC generates reset pulses intermittently to prevent the system from running away.

**FEATURES**

- Accurate output :  $5 \pm 0.25V$
- Output voltage adjusting pin attached
- Power-on reset timer incorporated
- Watchdog timer incorporated
- Wide operating voltage range : 40V (max.)
- Operating temperature range : from  $-40$  to  $85^{\circ}C$
- Load dump protection : 80V (max.) (1 second)
- Small SIP-9 pin : TA8000S
- SOP-14 pin : TA8000F



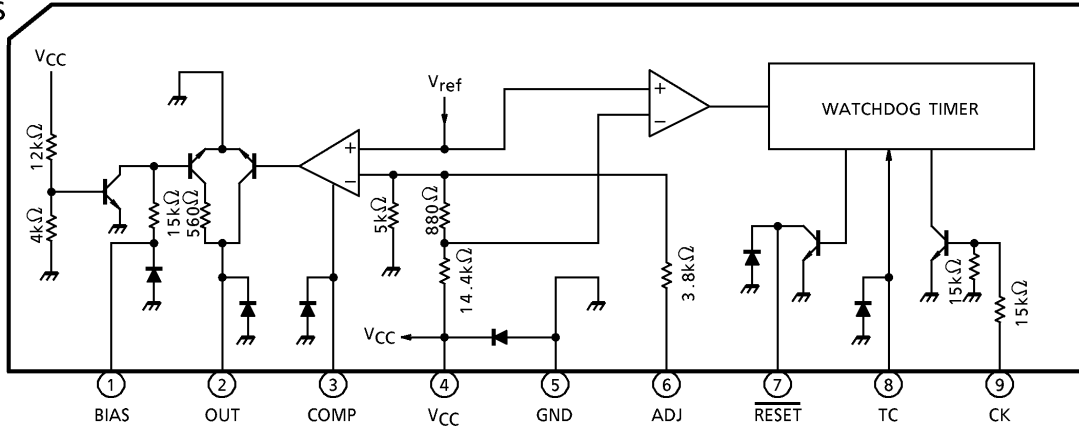
Weight  
 SIP9-P-2.54A : 0.92g (Typ.)  
 SOP14-P-225-1.27 : 0.2g (Typ.)

980910EBA1

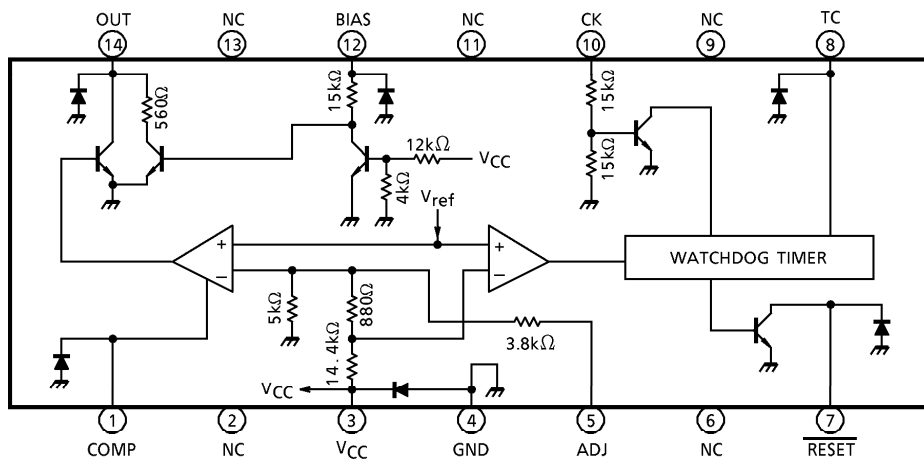
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**BLOCK DIAGRAM AND PIN LAYOUT**

TA8000S



TA8000F

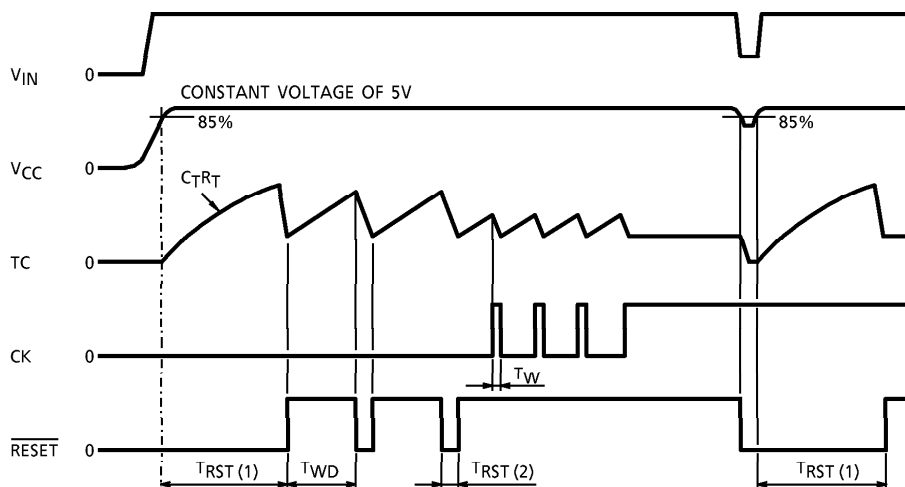


Note : The TA8000S and TA8000F are the same chip; only the packages are different.

## PIN DESCRIPTION

| PIN No. |                 | SYMBOL                    | PIN DESCRIPTION  |
|---------|-----------------|---------------------------|--|
| TA8000S | TA8000F         |                           |  |
| 1       | 12              | BIAS                      | Power supply start pin. The start current is supplied from the input voltage through a resistor. The output current obtained from this start current is as follows:<br>$I_{OUT} (\text{BIAS pin}) \geq 30 \times (V_{IN} - 0.7) / (15 + R1) \text{ (mA)}$<br>where R1 : external resistor connected to BIAS pin (k $\Omega$ )<br>This current is absorbed by an internal circuit when $V_{CC}$ increases above 2.7V, in which case $I_{OUT}$ is supplied from $V_{CC}$ . |
| 2       | 14              | OUT                       | This pin connects to the base of an external PNP transistor for control purposes to stabilize the output voltage. Therefore, the power supply can be designed to suit the load capacitance. Since the recommended current of $I_{OUT}$ is 8mA, the output current that can be flowed is 300mA providing that $H_{FF}$ of the external transistor is 40.  |
| 3       | 1               | COMP                      | This pin is used for phase correction to stabilize the output.   |
| 4       | 3               | $V_{CC}$                  | Internal circuit power supply pin. This pin also is used to detect the output voltage.   |
| 5       | 4               | GND                       | Ground pin.  |
| 6       | 5               | ADJ                       | Output voltage adjusting pin. The voltage can be raised by inserting a resistor between ADJ and GND and lowered by inserting a resistor between ADJ and $V_{CC}$ . When ADJ and GND are shorted, the output voltage is 10V. (See Typical Characteristics.)   |
| 7       | 7               | $\overline{\text{RESET}}$ | NPN transistor open-collector output.<br>(1) This output goes low at 85% or less of the rated output voltage.<br>(2) A reset signal is generated whose time constant is determined by CR of the TC pin.<br>(3) When no clock is fed to the CK input, a reset pulse is generated intermittently. This function can be used as a watchdog timer for microcomputer systems.   |
| 8       | 8               | TC                        | This pin is used to set the time for the reset and watchdog timers. Any desired time can be set using external $R_T$ and $C_T$ .   |
| 9       | 10              | CK                        | Watchdog timer input pin. Pull up this pin to $V_{CC}$ when you are using only the power-on reset timer.   |
| —       | 2, 6, 9, 11, 13 | NC                        | Non-connected pin. (Electrically, this pin is completely open.)  |

**TIMING CHART**



(Note)  $T_{RST}(1)$ ,  $T_{RST}(2)$ ,  $T_{WD}$ ,  $T_W$  : See Electrical Characteristics.

**MAXIMUM RATINGS (Ta = 25°C)**

| CHARACTERISTIC        | SYMBOL     | RATING     | UNIT |
|-----------------------|------------|------------|------|
| Input Voltage         | $V_{IN1}$  | 80 (1s)    | V    |
|                       | $V_{IN2}$  | - 5 ~ + 16 |      |
| Output Current        | $I_{OUT1}$ | 10         | mA   |
|                       | $I_{OUT2}$ | 4          |      |
| Output Voltage        | $V_{OUT1}$ | 80 (1s)    | V    |
|                       | $V_{OUT2}$ | 16         |      |
| Power Dissipation     | $P_D$      | 500 / 280  | mW   |
| Operating Temperature | $T_{opr}$  | - 40 ~ 85  | °C   |
| Storage Temperature   | $T_{stg}$  | - 55 ~ 150 | °C   |
| Lead Temperature-time | $T_{sol}$  | 260 (10s)  | °C   |

(Note)  $V_{IN1}$  : BIAS input  
 $V_{IN2}$  : CK input  
 $I_{OUT1}$ ,  $V_{OUT1}$  : OUT output  
 $I_{OUT2}$ ,  $V_{OUT2}$  :  $\overline{RESET}$  output  
 $P_D$  : TA8000S / TA8000F

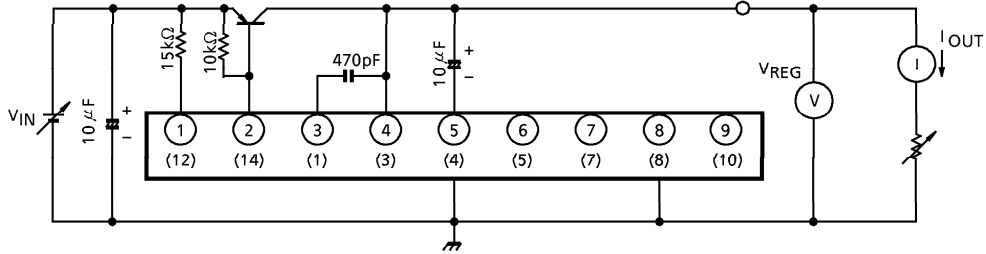
ELECTRICAL CHARACTERISTICS ( $V_{IN} = 6$  to 17V,  $T_a = -40$  to 85°C)

| CHARACTERISTIC          | SYMBOL       | PIN                | TEST CIR-CUIT | TEST CONDITION                 | MIN.                  | TYP.                  | MAX.                  | UNIT    |
|-------------------------|--------------|--------------------|---------------|--------------------------------|-----------------------|-----------------------|-----------------------|---------|
| Output Voltage          | $V_{REG}$    | $V_{CC}$           | 1             | —                              | 4.75                  | 5.0                   | 5.25                  | V       |
| Line Regulation         | —            | $V_{CC}$           | —             | $V_{IN} = 6 \sim 40V$          | —                     | 0.1                   | 0.5                   | %       |
| Load Regulation         | —            | $V_{CC}$           | —             | $I_{LOAD} = 1 \sim 50mA$       | —                     | 0.1                   | 0.5                   | %       |
| Temperature Coefficient | —            | $V_{CC}$           | —             | —                              | —                     | 0.01                  | —                     | % / °C  |
| Output Voltage          | $V_{OL}$     | $\overline{RESET}$ | 2             | $I_{OL} = 2mA$                 | —                     | —                     | 0.5                   | V       |
| Output Leakage Current  | $I_{LEAK}$   | $\overline{RESET}$ | 3             | $V_{OUT} = 10V$                | —                     | —                     | 5                     | $\mu A$ |
| Input Current           | $I_{IN}$     | TC                 | 4             | $V_{IN} = 0 \sim 3.5V$         | -3                    | —                     | 3                     | $\mu A$ |
| Threshold Voltage       | $V_{IH}$     | TC                 | 5             | $\overline{RESET}$ High to Low | —                     | $80\% \times V_{REG}$ | —                     | V       |
|                         | $V_{IL}$     |                    | 5             | $\overline{RESET}$ Low to High | —                     | $40\% \times V_{REG}$ | —                     |         |
| Input Current           | $I_{IN}$     | CK                 | 6             | $V_{IN} = 5V$                  | —                     | 0.3                   | 0.7                   | mA      |
| Input Voltage           | $V_{IH}$     | CK                 | 5             | —                              | 2                     | —                     | —                     | V       |
|                         | $V_{IL}$     | CK                 | 5             | —                              | —                     | —                     | 0.5                   |         |
| Reset Detect Voltage    | —            | $V_{CC}$           | —             | —                              | $82\% \times V_{REG}$ | $85\% \times V_{REG}$ | $88\% \times V_{REG}$ | V       |
| Standby Current         | $I_S$        | $V_{CC}$           | 8             | $V_{IN} = 14V$                 | —                     | 5                     | 6.5                   | mA      |
| Watchdog Timer          | $T_{WD}$     | $\overline{RESET}$ | 7             | —                              | $0.9 \times C_{TRT}$  | $1.1 \times C_{TRT}$  | $1.3 \times C_{TRT}$  | ms      |
| Reset Timer (1)         | $T_{RST(1)}$ | $\overline{RESET}$ | 7             | —                              | $1.3 \times C_{TRT}$  | $1.6 \times C_{TRT}$  | $1.9 \times C_{TRT}$  |         |
| Reset Timer (2)         | $T_{RST(2)}$ | $\overline{RESET}$ | 7             | —                              | $0.15 \times C_T$     | $0.3 \times C_T$      | $0.6 \times C_T$      |         |
| Clock Pulse Width       | $T_W$        | CK                 | —             | —                              | 3                     | —                     | —                     | $\mu s$ |

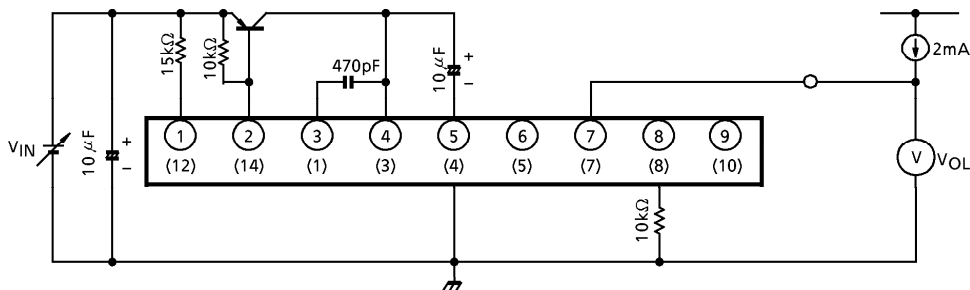
(Note) Reset timer (1) : Power-on reset time  
Reset timer (2) : Watchdog reset time  
The unit for  $C_T$  is  $\mu F$ , the unit for  $R_T$  is  $k\Omega$ .

**TEST CIRCUIT** (Numbers in ○ show pin numbers of the TA8000S; those in ( ) show pin numbers of the TA8000F.)

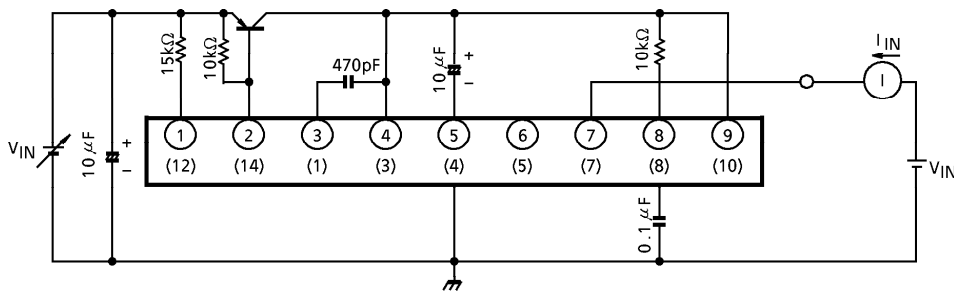
1.  $V_{REG}$



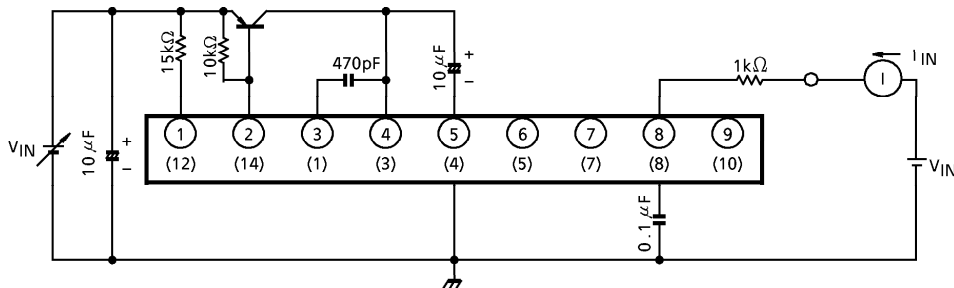
2.  $V_{OL}(\overline{RESET})$



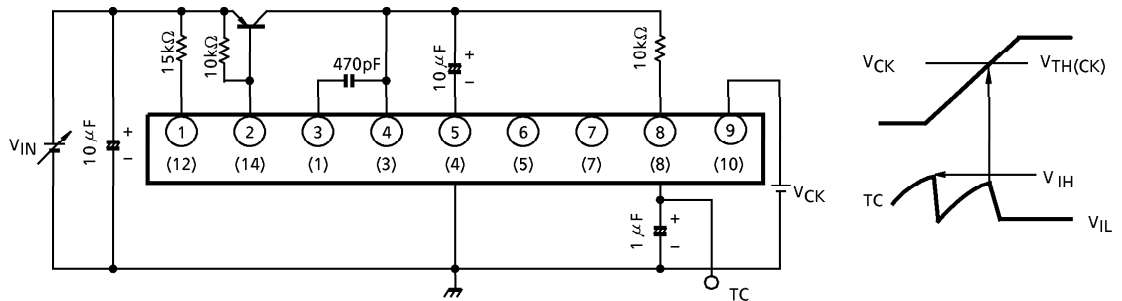
3.  $I_{LEAK}(\overline{RESET})$



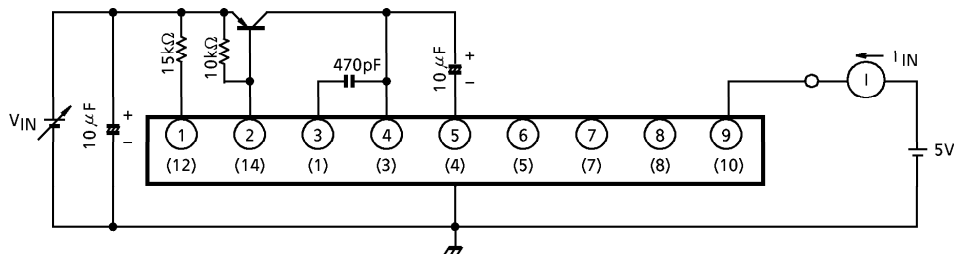
4.  $I_{IN}(TC)$



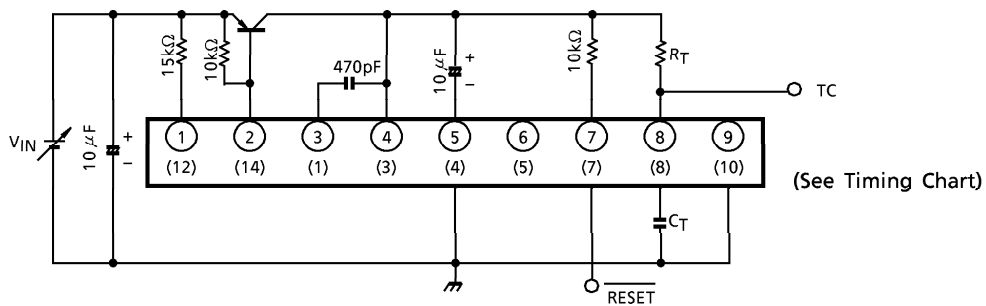
5.  $V_{IH}$ 、 $V_{IL}(TC)$ 、 $V_{IH}$ 、 $V_{IL}(CK)$



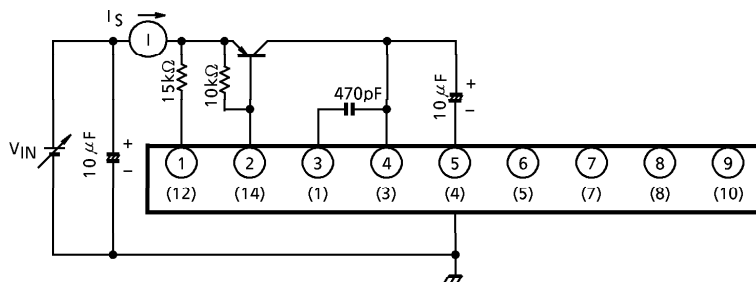
6.  $I_{IN}(CK)$



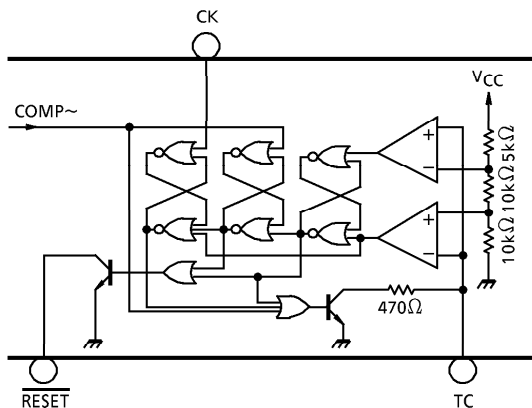
7.  $V_{RESET}$ 、 $T_{WD}$ 、 $T_{RST}(1)$ 、 $T_{RST}(2)$



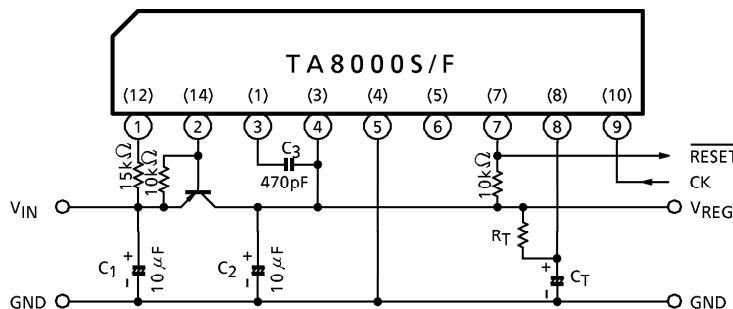
8.  $I_S$



RESET TIMER EQUIVALENT CIRCUIT



EXAMPLE OF APPLICATION CIRCUIT (Numbers in ○ show pin numbers of the TA8000S; those in ( ) show pin numbers of the TA8000F.)



\* Cautions for Wiring

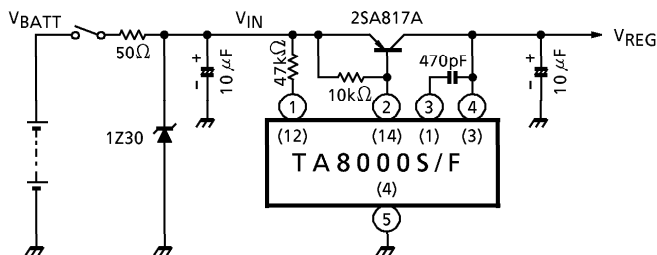
1. C<sub>1</sub> and C<sub>2</sub> are for absorbing disturbance, noise, etc. Connect them as close to the IC as possible.
2. C<sub>3</sub> is for phase compensation. Also, connect C<sub>3</sub> close to the IC.

120 V<sub>peak</sub> LOAD DUMP

Note : No protection is needed if a voltage above 80V is not applied. Therefore, protection by a Zener diode and resistor is unnecessary.

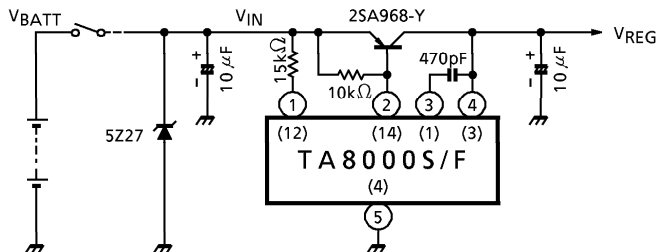
1. Low Output Current Circuit

I<sub>LOAD</sub> = 10mA Max., V<sub>BATT</sub> = 6~17V

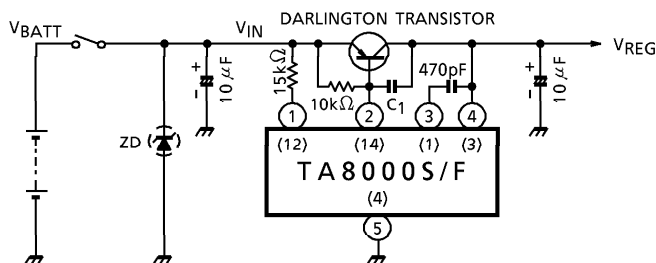


2. High Output Current Circuit

$I_{LOAD} = 300\text{mA Max.}$ ,  $V_{BATT} = 6\sim 17\text{V}$



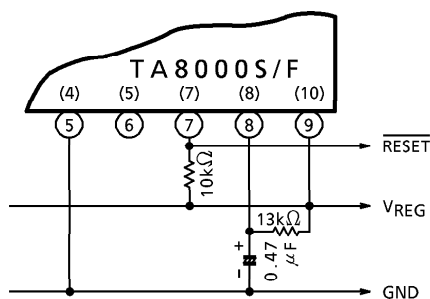
EXAMPLE OF APPLICATION CIRCUIT USING DARLINGTON TRANSISTOR



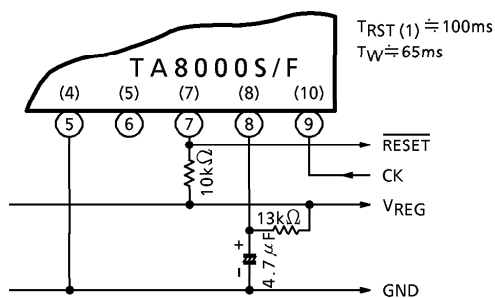
- \* ● Select a C1 value according to the working condition -- typically above 2000pF.
- Insert ZD when necessary.

APPLICATION CIRCUIT OF WATCHDOG / RESET TIMER

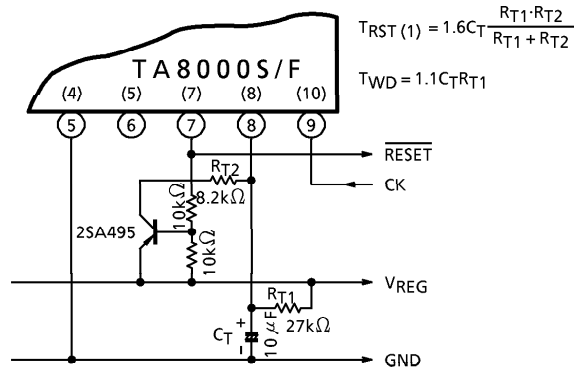
1.  $T_{RST}(1) \cong 10\text{ms}$ .....Power-On Reset Timer



2.  $T_{RST}(1) \cong 1.5T_{WD}$



3.  $T_{RST}(1) \cong 100ms$ ,  $T_{WD} \cong 300ms$

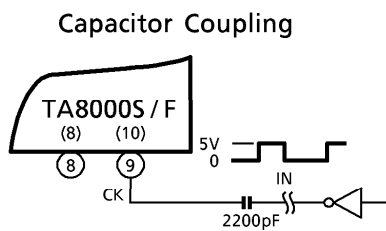


4. Recommended Conditions

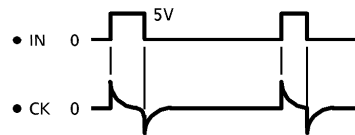
| PART NAME                 | MIN. | MAX. | UNIT      |
|---------------------------|------|------|-----------|
| $C_T$                     | 0.01 | 100  | $\mu F$   |
| $R_T$                     | 5    | 100  | $k\Omega$ |
| $R_{T1}$                  | —    | 100  | $k\Omega$ |
| $R_{T1} // R_{T2}$ (Note) | 5    | —    | $k\Omega$ |

(Note)  $R_{T1} // R_{T2} = (R_{T1} \times R_{T2}) / (R_{T1} + R_{T2})$

CK INPUT APPLICATION CIRCUIT



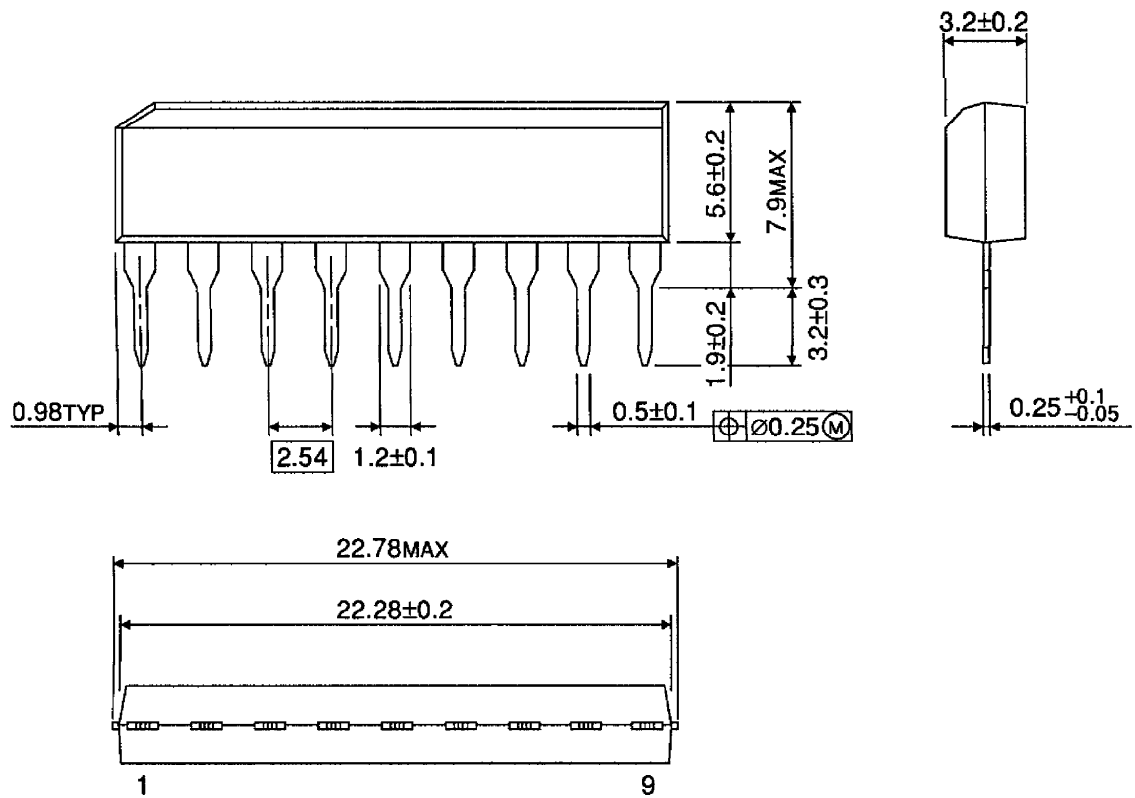
Timing Chart



The capacitor coupling allows reset pulses to be supplied intermittently from the  $\overline{RESET}$  pin whether the input level (IN) is high or low.

**OUTLINE DRAWING**  
SIP9-P-2.54A

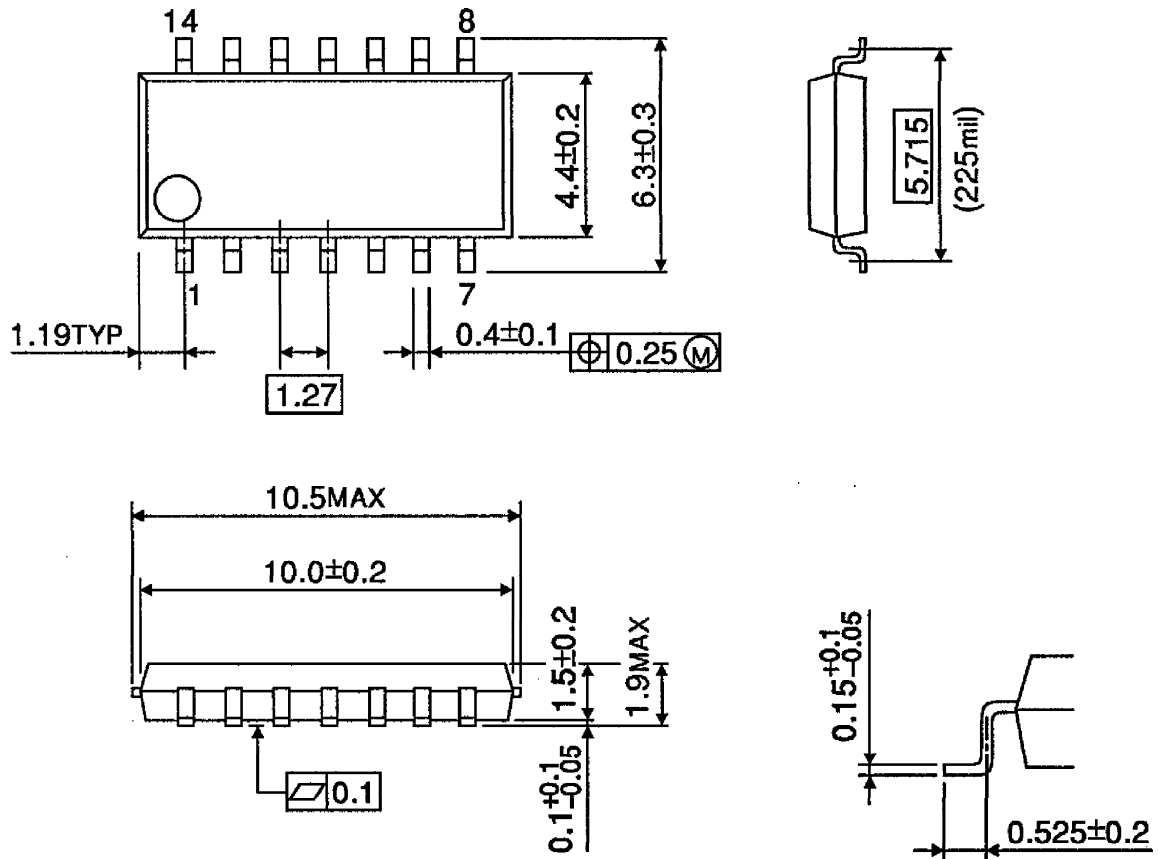
Unit : mm



Weight : 0.92g (Typ.)

**OUTLINE DRAWING**  
SOP14-P-225-1.27

Unit : mm



Weight : 0.2g (Typ.)