

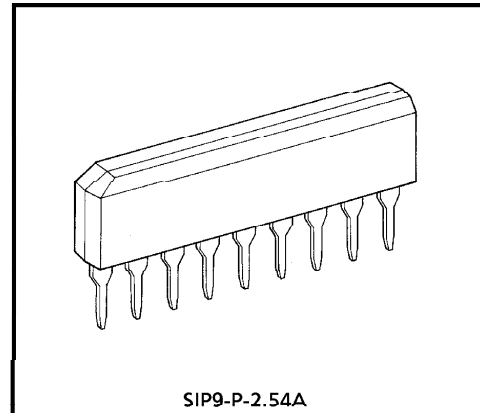
TOSHIBA BIPOLAR LINEAR INTEGRATED CIRCUIT SILICON MONOLITHIC

# TA7900S

## 5V VOLTAGE REGULATOR WITH WATCHDOG TIMER

The TA7900S is an IC specially designed for micro-computer 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 92% 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.

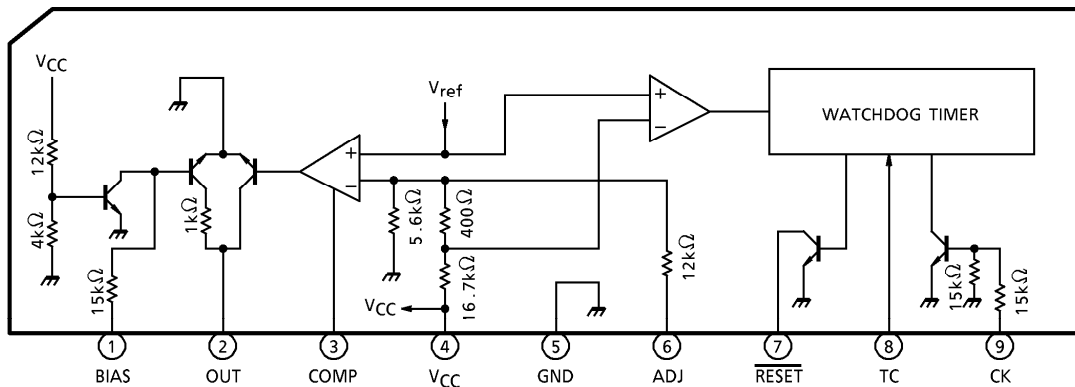


Weight : 0.92g (Typ.)

### FEATURES

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

### BLOCK DIAGRAM AND PIN LAYOUT



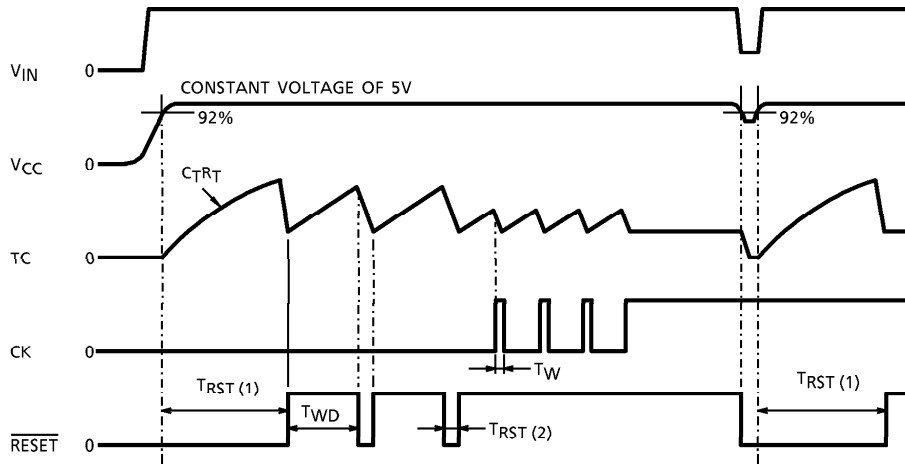
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## PIN DESCRIPTION

PIN No.	SYMBOL	DESCRIPTION
1	BIAS	Power supply starting pin. The starting current is supplied through a resistor to which the input voltage is applied. The output current from this starting current is as follows : $I_{OUT}(\text{pin } 1) \geq 30 \times (V_{IN} - 0.7) / (15 + R_1) \text{ (mA)}$ where $R_1$ is the external resistance attached to pin 1 (k $\Omega$ ). When $V_{CC}$ rises above 2.7V, the starting current is absorbed in the internal circuit ; instead, $I_{OUT}$ is supplied via $V_{CC}$ .
2	OUT	Connected to the base of an external PNP transistor so that the output voltage is stabilized. Power supply design suitable for particular load capacities is thus possible. Since the recommended maximum $I_{OUT}$ is 5mA, an output current of 300mA is assured if the external transistor has an $H_{FE}$ of 60 or more.
3	COMP	Phase compensation pin for output stabilization
4	$V_{CC}$	Power supply pin for internal circuit. The output voltage can also be detected at this pin.
5	GND	Grounded
6	ADJ	Output voltage adjusting pin. The voltage will increase when a resistor is inserted between ADJ and GND. It will reduce when a resistor is inserted between ADJ and $V_{CC}$ . The maximum variable range is $\pm 1V$ .
7	$\overline{\text{RESET}}$	NPN transistor open-collector output. (1) The signal goes low when the output drops below 92% of the specified level. (2) The pin supplies a reset signal determined by the CR combination connected to the TC pin. (3) The pin supplies reset pulses intermittently if no clock is given to the CK pin. This function is useful when the IC is used as a watchdog timer for a microcomputer system.
8	TC	Time setting pin for the reset and watchdog timers
9	CK	Input pin for watchdog timer. The pin is pulled up to $V_{CC}$ if the IC is used only as a power-on reset timer.

TIMING CHART



MAXIMUM RATINGS ( $T_a = 25^\circ\text{C}$ )

CHARACTERISTIC	SYMBOL	RATING	UNIT
Input Voltage	$V_{IN1}$	40	V
	$V_{IN2}$	- 0.3 to + 16	
Output Current	$I_{OUT1}$	10	mA
	$I_{OUT2}$	4	
Output Voltage	$V_{OUT1}$	40	V
	$V_{OUT2}$	16	
Power Dissipation	$P_D$	500	mW
Operating Temperature	$T_{opr}$	- 40 to 85	$^\circ\text{C}$
Storage Temperature	$T_{stg}$	- 55 to 150	$^\circ\text{C}$
Lead Temperature-time	$T_{sol}$	260 (10s)	$^\circ\text{C}$

$V_{IN1}$  : BIAS input  
 $V_{IN2}$  : CK input  
 $I_{OUT1}, V_{OUT1}$  : OUT output  
 $I_{OUT2}, V_{OUT2}$  :  $\overline{RESET}$  output

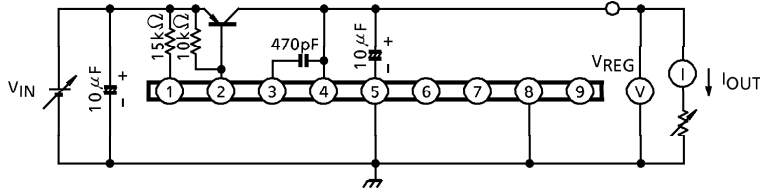
ELECTRICAL CHARACTERISTICS ( $V_{IN}=7$  to 17V,  $T_a = -40$  to 85°C)

CHARACTERISTIC	SYMBOL	PIN	TEST CIRCUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Voltage	$V_{REG}$	$V_{CC}$	1	—	4.75	5.0	5.25	V
Line Regulation	—	$V_{CC}$	—	$V_{IN}=7$ to 40V	—	0.1	0.5	%
Load Regulation	—	$V_{CC}$	—	$I_{LOAD}=1$ to 50mA	—	0.1	0.5	%
Temperature Coefficient	—	$V_{CC}$	—	—	—	0.01	—	%/°C
Output Voltage	$V_{OL}$	RESET	2	$I_{OL}=2$ mA	—	—	0.5	V
Output Leakage Current	$I_{LEAK}$	RESET	3	$V_{OUT}=10$ V	—	—	5	$\mu$ A
Input Current	$I_{IN}$	TC	4	$V_{IN}=0$ to 3.5V	-3	—	3	$\mu$ A
Threshold Voltage	$V_{IH}$	TC	5	RESET "High" to "Low"	—	$80\% \times V_{REG}$	—	V
	$V_{IL}$			RESET "Low" to "High"	—	$40\% \times V_{REG}$	—	
Input Current	$I_{IN}$	CK	6	$V_{IN}=5$ V	—	0.3	0.7	mA
Input Voltage	$V_{IH}$	CK	5	—	2	—	—	V
	$V_{IL}$			—	—	0.5	—	
Reset Detect Voltage	—	$V_{CC}$	—	—	$89\% \times V_{REG}$	$92\% \times V_{REG}$	$95\% \times V_{REG}$	V
Standby Current	$I_S$	$V_{CC}$	8	$V_{IN}=14$ V	—	5	6.5	mA
Watchdog Timer	$T_{WD}$	RESET	7	—	$0.9 \times C_{TRT}$	$1.1 \times C_{TRT}$	$1.3 \times C_{TRT}$	—
Reset Timer (1)	$T_{RST(1)}$	RESET	7	—	$1.3 \times C_{TRT}$	$1.6 \times C_{TRT}$	$1.9 \times C_{TRT}$	—
Reset Timer (2)	$T_{RST(2)}$	RESET	7	—	$150 \times C_T$	$300 \times C_T$	$600 \times C_T$	—
Clock Pulse Width	$T_W$	CK	—	—	3	—	—	$\mu$ s

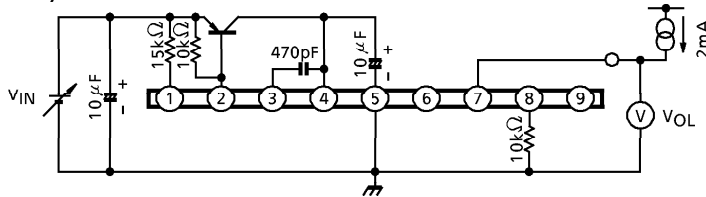
Note : Reset timer (1) : Power-on reset time  
Reset timer (2) : Watchdog reset time

TEST CIRCUIT

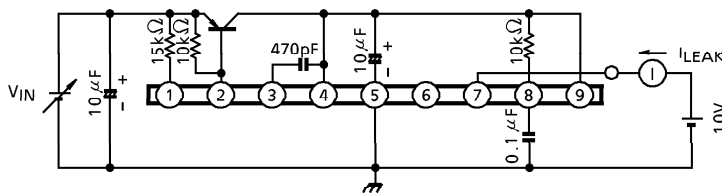
1.  $V_{REG}$



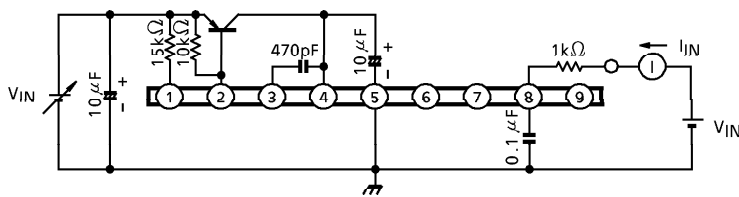
2.  $V_{OL}$  (RESET)



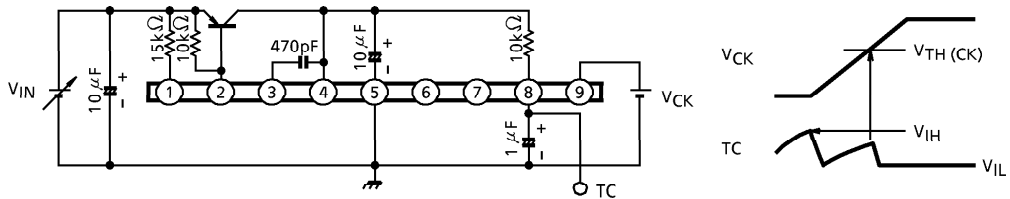
3.  $I_{LEAK}$  (RESET)



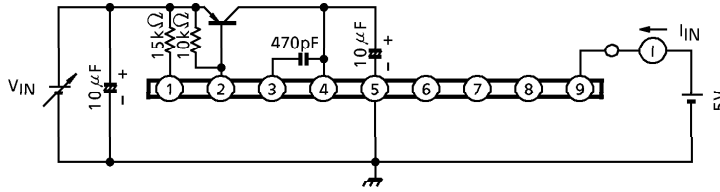
4.  $I_{IN}$  (TC)



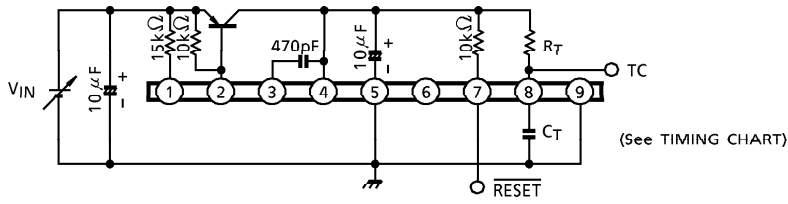
5.  $V_{IH}$ ,  $V_{IL}$  (TC),  $V_{IH}$ ,  $V_{IL}$  (CK)



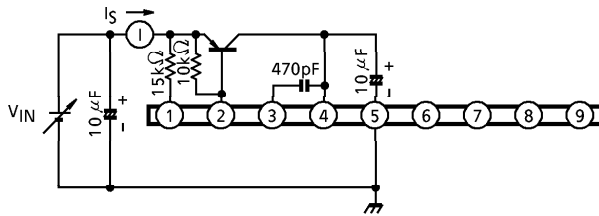
6.  $I_{IN}(CK)$



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

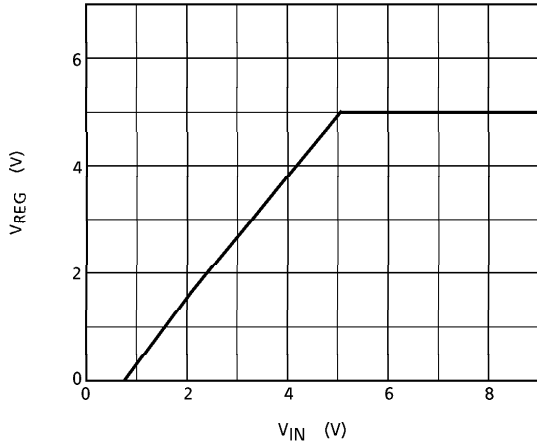


8.  $I_S$

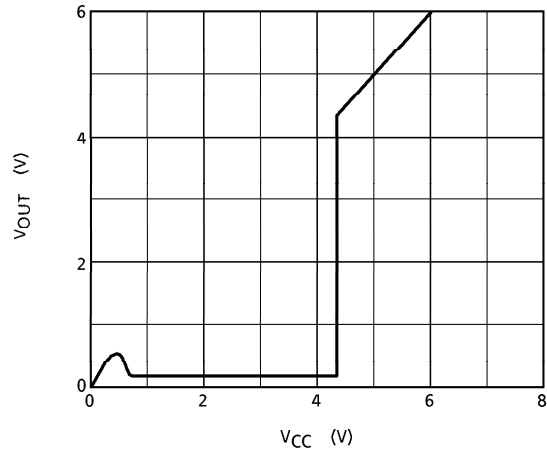


TYPICAL CHARACTERISTICS

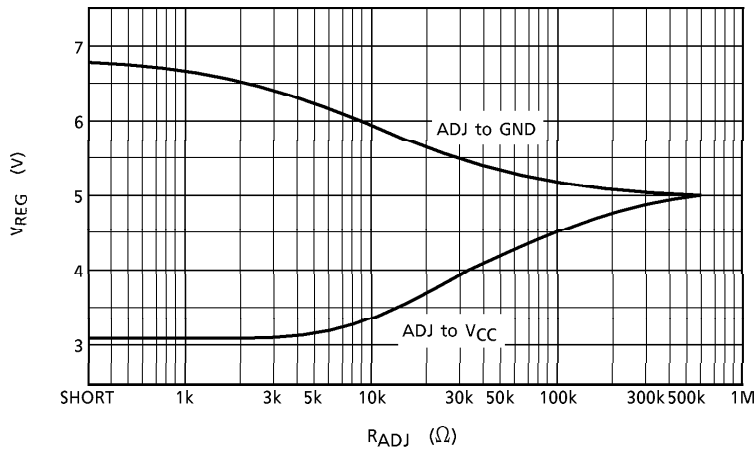
1. Input-output characteristic  
( $R_L = 25\Omega$ , external transistor 2SA968-Y)



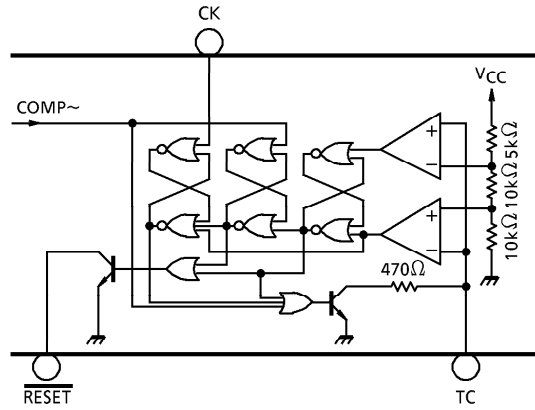
2. Reset Output Characteristic



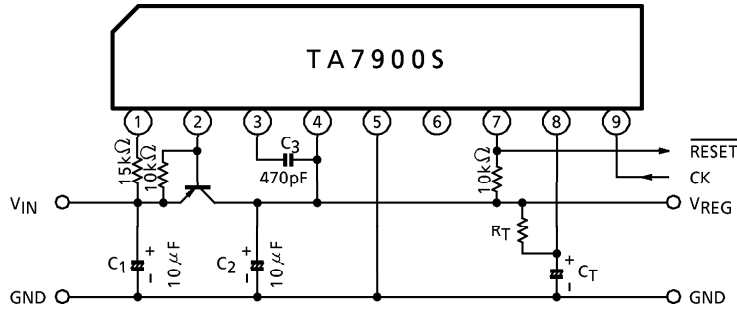
3. Output Adjusting Resistance Characteristic



RESET TIMER EQUIVALENT CIRCUIT



EXAMPLE OF APPLICATION CIRCUIT



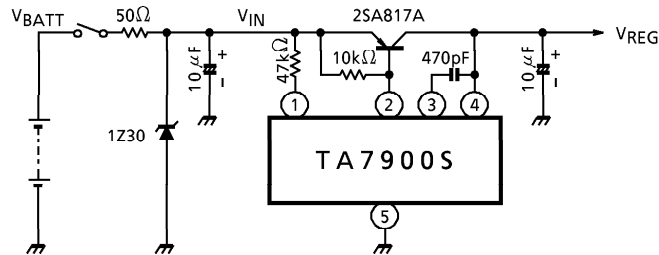
\* Cautions for Wiring

1.  $C_1$  and  $C_2$  are for absorbing disturbance, noise, etc. Connect them as close to the IC as possible.
2.  $C_3$  is for phase compensation. Also, connect  $C_3$  close to the IC.

120 Vpeak (200ms) LOAD DUMP

1. Low Output Current Circuit

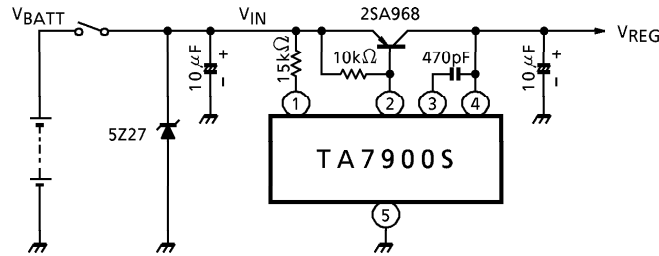
$I_{LOAD} = 10\text{mA Max.}$ ,  $V_{BATT} = 6 \text{ to } 17\text{V}$



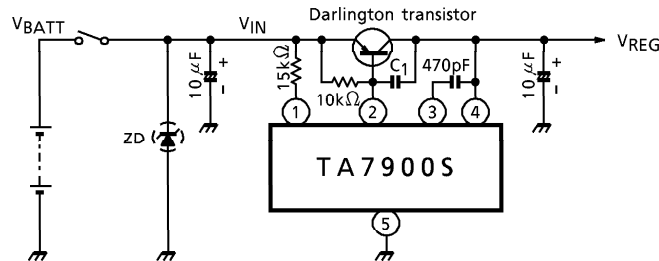


2. High Output Current Circuit

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



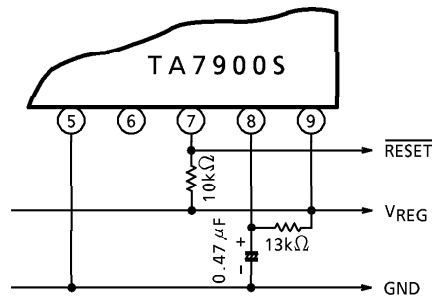
EXAMPLE OF APPLICATION CIRCUIT USING DARLINGTON TRANSISTOR



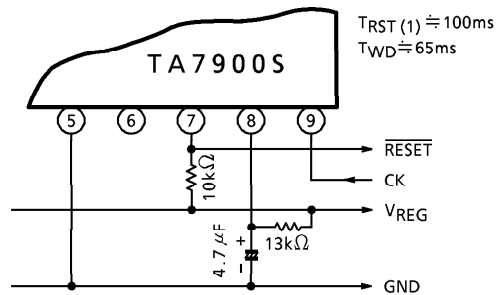
\* Select a  $C_1$  value according to the working condition -- typically above 2000pF.  
Insert ZD when necessary.

APPLICATION CIRCUIT OF WATCHDOG / RESET TIMER

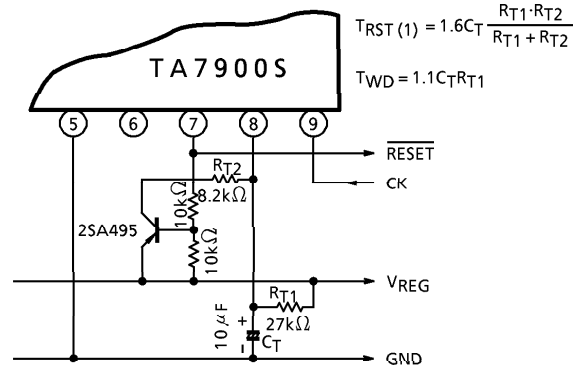
1.  $T_{RST}(1) \cong 10\text{ms}$ .....Power-On Reset Timer



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



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



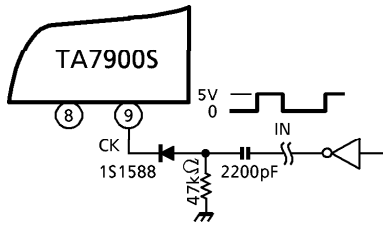
4. Recommended Conditions

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	—	$k\Omega$

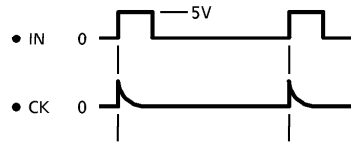
(Note)  $R_{T1} // R_{T2} = (R_{T1} \times R_{T2}) / (R_{T1} + R_{T2})$

CK INPUT APPLICATION CIRCUIT

○ Capacitor Coupling



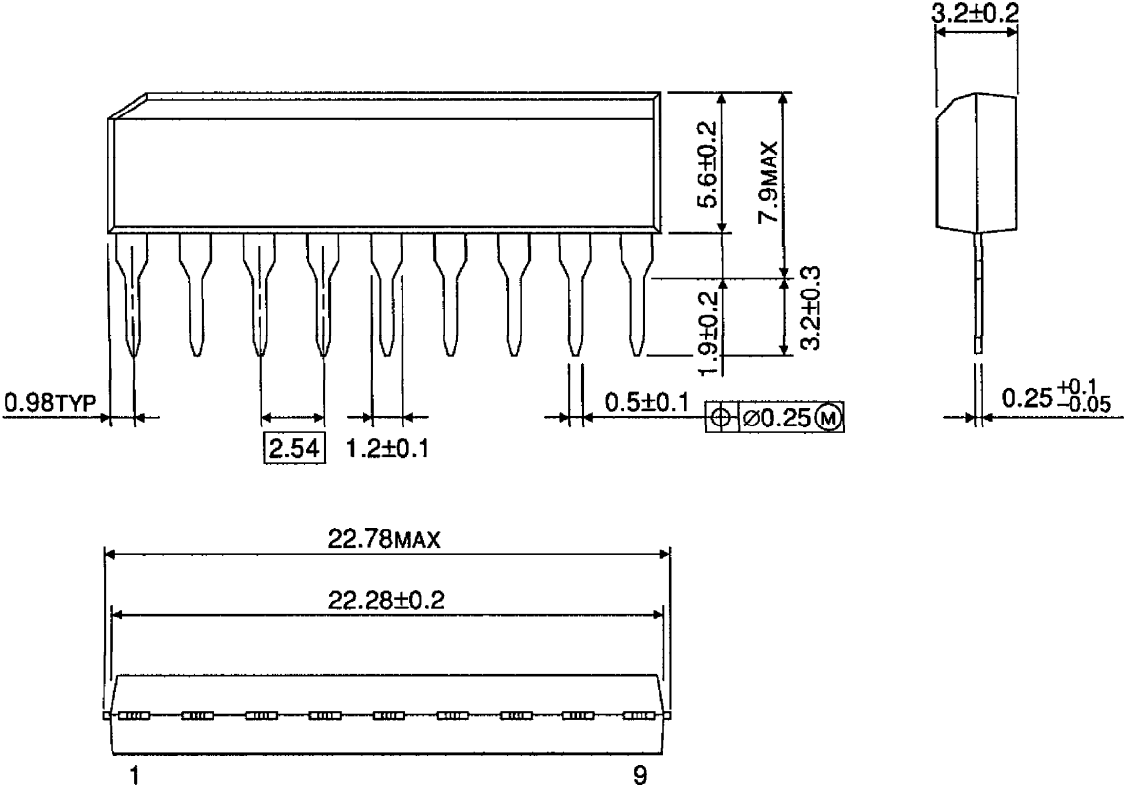
○ Timing Chart



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

OUTLINE DRAWING  
SIP9-P-2.54A

Unit : mm



Weight : 0.92g (Typ.)