TOSHIBA BIPOLAR LINEAR INTEGRATED CIRCUIT SILICON MONOLITHIC

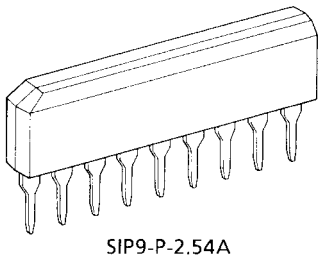
TA8007S,TA8007F

5 V Voltage Regulator With Watchdog Timer

The TA8007S、TA8007F is an IC specially designed for microcomputer systems. It incorporates a highly accurate constant-voltage power supply (5±0.25V) and various system reset functions. For system reset, it monitors the output voltage of V_{REG}×92% and has a watchdog timer which can self-diagnose the microcomputer system so that program runaway can be prevented. It also has other monitor functions for checking the operation of the microcomputer system.

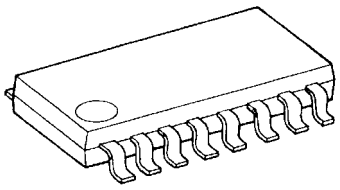
Since its standby current is as small as 1.2mA (max.), it can be connected directly to an automotive battery.
An output voltage of 5±0.15V is obtained for theTA8007F.

TA8007S



SIP9-P-2.54A

TA8007F



SSOP16-P-225-1.00A

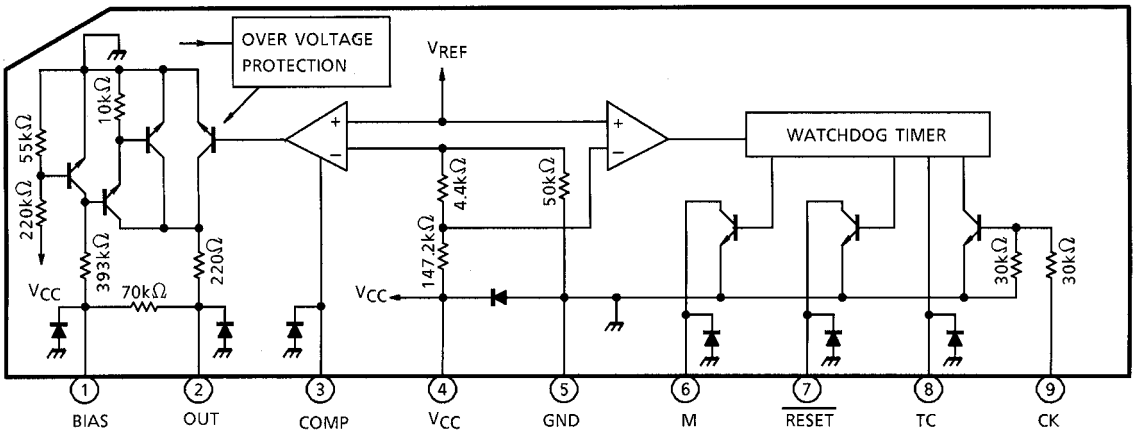
Weight:
SIP9-P-2.54A : 0.92 g (Typ.)
SSOP16-P-225-1.00A : 0.14 g (Typ.)

FEATURES

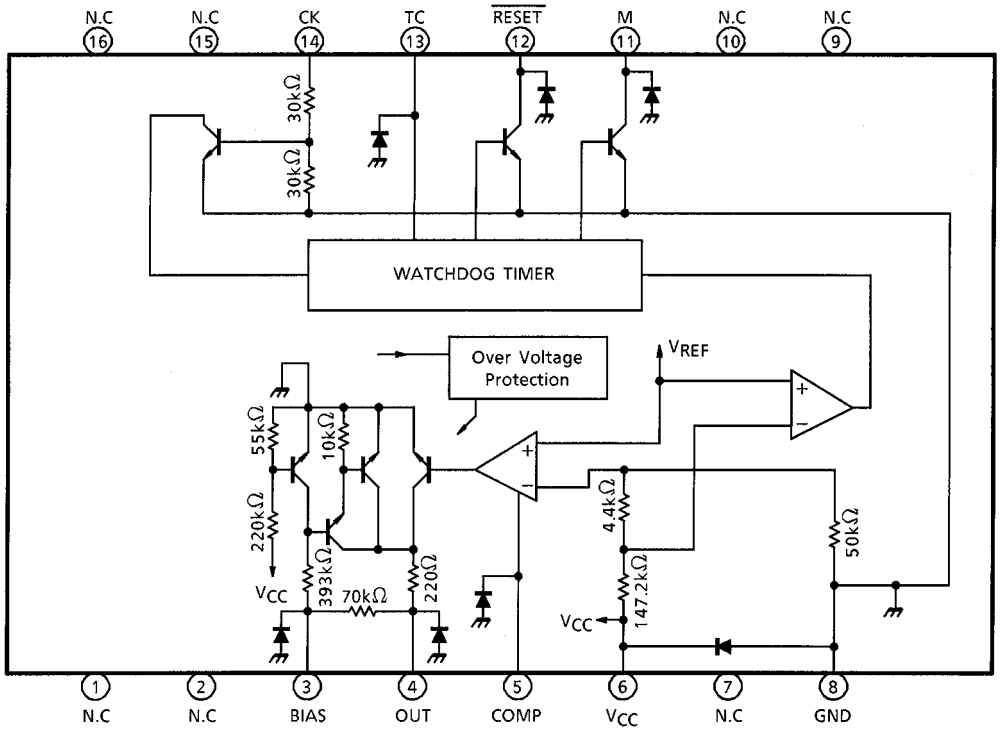
- Accurate output : 5 V±0.25 V (TA8007S)
  : 5 V±0.15 V (TA8007F)
- Low standby current : 1.2 mA (max)
- Power-on reset timer and watchdog timer incorporated, as well as reset and monitor outputs
- Wide operating voltage range:35 V (max)
- Wide operating temperature range :from -40 to 105°C
- Small SIP9−PIN (TA8007S)
  SSOP16−PIN (TA8007F)

BLOCK DIAGRAM AND PIN LAYOUT

TA8007S



TA8007F



Note: The TA8007S and TA8007F are the same chip, only the packages are different.

PIN DESCRIPTION

PIN No.		SYMBOL	DESCRIPTION
TA8007S	TA8007F		
1	3	BIAS	Power supply pin for the start-up circuit which activates the overvoltage detection circuit and the 5V power supply.
2	4	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	5	COMP	Phase compensation pin for output stabilization.
4	6	V_{CC}	Power supply pin for the power supply section and reset timers. The output voltage VREG can also be detected at this pin.
5	8	GND	Grounded
6	11	M	PN transistor open-collector output This signal is low while pulses come from $\overline{\text{RESET}}$ pin (output) ; it becomes high when pulses no longer come from $\overline{\text{RESET}}$ pin. This function can be used for monitoring the operation of the microcomputer system.
7	12	$\overline{\text{RESET}}$	NPN transistor open-collector output. (1) The signal goes low when the output voltage drops below 92%. (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.
8	13	TC	Time setting pin for the reset and watchdog timers. The resistor R_T leads to V_{CC}, and the capacitor C_T leads to GND.
9	14	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.
—	1, 2, 7, 9, 10, 15, 16	NC	Not connected. (Electrically, this pin is completely open.)

Functional Description

The TA8007S/F incorporates a constant-voltage 5V power supply function to feed stable power to the CPU and the system reset and CPU monitor functions to ensure stable operation of the CPU, etc. These functions are explained below.

(1) Constant-voltage 5V power supply function

This constant-voltage function has the reference voltage V_{ref} in the IC that is insusceptible to temperature changes and input voltage fluctuations. The power supply circuit is designed in such a way that this voltage is stepped up to 5V by using an OP amp and a voltage-dividing resistor. These OP amp and dividing resistor and an output transistor connected to the OP amp output together configure a closed loop.
If you are using only the reset timer and not this power supply function, connect the BIAS, OUT, and COMP pins to GND.

(2) System reset function (See Timing Chart)

- Voltage monitoring function

  When powered on, the power-on reset timer starts counting the moment the voltage V_{CC} applied to the CPU exceeds 4.6V. When powered off, this voltage monitoring function outputs a reset signal immediately when V_{CC} drops below 4.6V. A reset signal also is output immediately when V_{CC} drops for some reason during normal operation. Then, when V_{CC} is restored to the normal voltage and exceeds 4.6V, the power-on reset timer starts counting.

- Power-on reset timer function

  To allow the 5V constant voltage to stabilize at power-on, as well as provide a sufficient time for the clock oscillation in the CPU to stabilize, the device remains reset for a predetermined time before being released from the reset state. The duration of this time can be set as desired by choosing appropriate values for the external resistor and capacitor connected to the TC pin.
  The system starts charging the capacitor when the V_{CC} voltage exceeds 4.6V. When this charge voltage exceeds 4V, the capacitor is discharged by the IC's internal transistor. When the capacitor is discharged down to 2V, the reset signal is inverted to deactivate the reset.

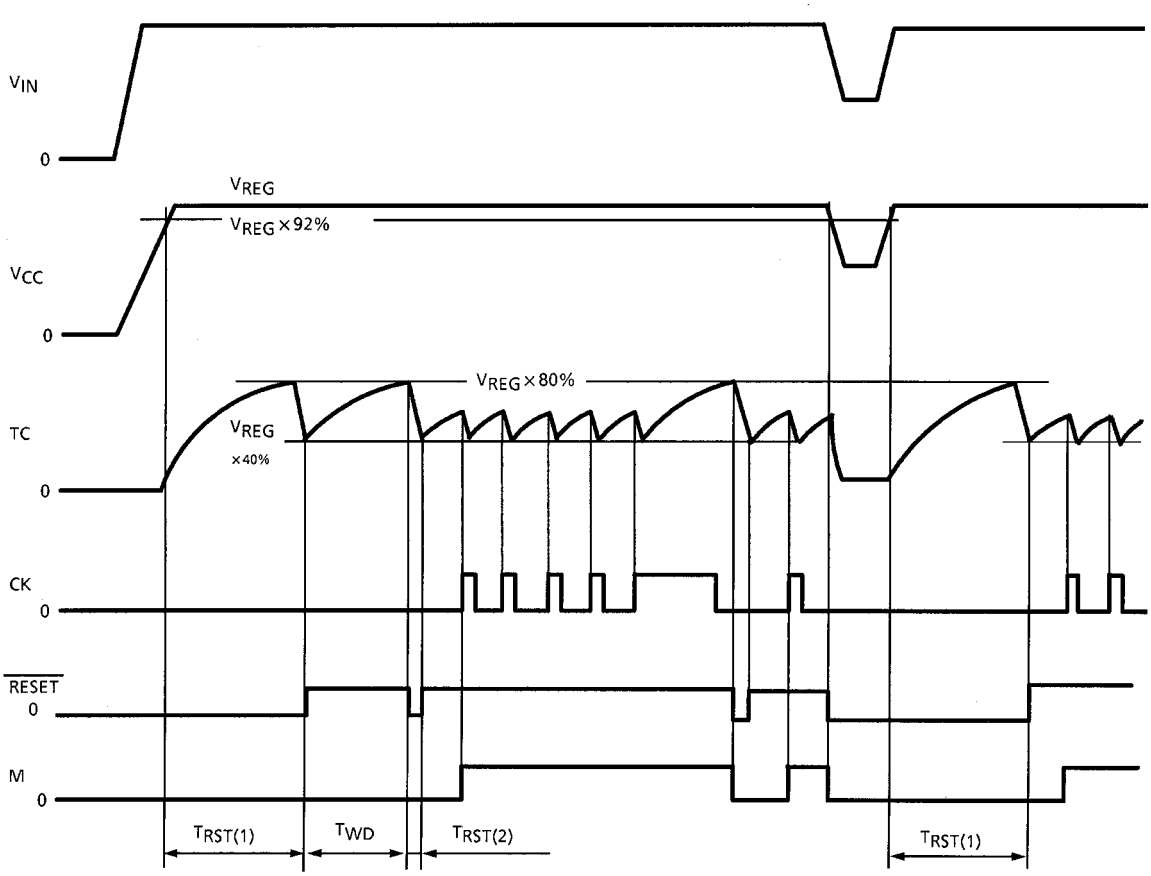
- Watchdog timer function

  Program your system to output a clock each time one program routine is finished in the CPU system software, and input this clock to the CK pin of the IC. The IC's TC pin is repeatedly charged and discharged between 2V and 4V. However, when a clock is input, it switches over and starts discharging in the middle of charging and then starts charging from 2V again. Since the clock is generated at predetermined intervals when the CPU system is operating normally, the TC pin switches over and starts discharging before the charge voltage reaches 4V. However, if no clock is input while being charged from 2V to 4V, the clock is assumed to have stopped, i.e., the CPU system has gone wild, so that a reset signal is output to reset the CPU system.
  The IC's CK pin is connected to the CPU system with a differential circuit. This is to ensure that when an erratic condition occurs in the CPU system, a low signal is always input to the CK pin regardless of whether the clock output from the CPU has stopped in the high or low state. When the CK pin is fixed high, no reset signal is output, in which case only the power-on reset timer is useful.

(3) CPU monitor function

The monitor output (M pin) uses the clock from the CK pin that is fed into the IC and the reset signal that is output from the IC to provide an easy way to verify the operating status of your application system.

The M output is generated by a flip-flop that receives as its inputs the said reset and clock signals. During normal operation, the output is held high by the clock fed to the CK pin. When the clock supply is stopped by an error condition and a reset signal is output from the IC, the flip-flop is inverted by the reset signal, causing the M output to go low. When the error condition is restored and the clock supply to CK restarts, the flip-flop is inverted by that signal again, causing the M output to go high.



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

MAXIMUM RATINGS (Ta = 25°C)

CHARACTERISTIC	SYMBOL	PIN	RATING	UNIT
Input Voltage	V_{IN1}	BIAS	60 (1s)	V
	V_{IN2}	CK	−5~V_{CC}	
Output Current	I_{OUT1}	OUT	10	mA
	I_{OUT2}	$\overline{\text{RESET}}$, M	2	
Output Voltage	V_{OUT1}	OUT	60 (1s)	V
	V_{OUT2}	$\overline{\text{RESET}}$	16	
Power Dissipation	P_D	—	500/600	mW
Operating Temperature	T_{opr}	—	−40~105	°C
Storage Temperature	T_{stg}	—	−55~150	°C
Lead Temperature time	T_{sol}	—	260 (10s)	°C

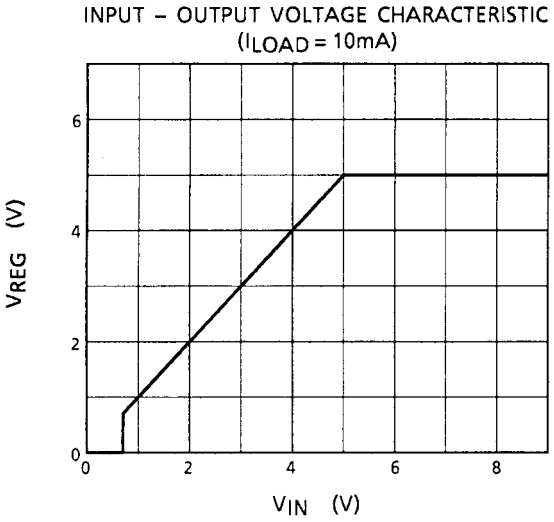
Note: P_D: TA8007S/TA8007F

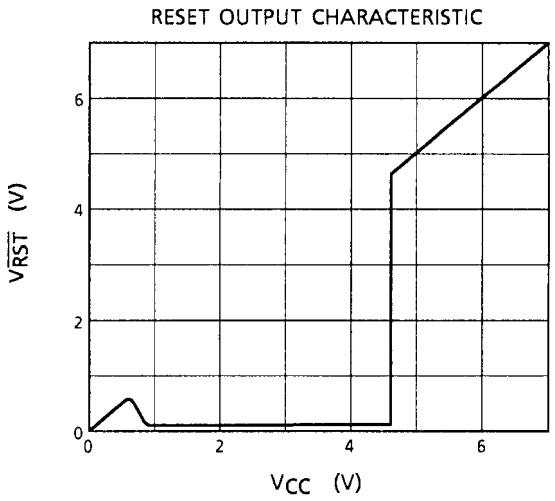
ELECTRICAL CHARACTERISTICS (Unless otherwise specified, V_{IN}=6～18 V, I_{LOAD}= 10 mA, Ta=－40～105℃)

CHARACTERISTIC	SYMBOL	PIN	TEST CIR-CUIT	TEST CONDITION	MIN	TYP.	MAX	UNIT
Output Voltage	V_{REG}	V_{CC}	—	TA8007S	4.75	5.0	5.25	V
				TA8007F	4.85	5.0	5.15	
Line Regulation	V_{LINE}	V_{CC}	—	V_{IN}=5.5～35 V	—	0.1	0.5	%
Load Regulation	V_{LOAD}	V_{CC}	—	I_{LOAD}=1～50 mA	—	0.1	0.5	%
Temperature Coefficient		V_{CC}	—		—	0.01	—	%/°C
Output Voltage	V_{OL}	$\overline{RESET}$, M	—	I_{OL}=1 mA	—	—	0.5	V
Output Leakage Current	I_{LEAK}	$\overline{RESET}$, M	—	V_{OUT}=10 V	—	—	5	μA
Input Current	I_{IN}	TC	—	V_{IN}=0～3.5 V	−3	—	3	μA
Threshold Voltage	V_{IH}	TC	—		—	V_{REG} × 80%	—	V
	V_{IL}				—	V_{REG} × 40%	—	
Input Current	I_{IN}	CK	—	V_{IN}=5 V	—	0.14	0.3	mA
Input Voltage	V_{IH}	CK	—		2	—	—	V
	V_{IL}				—	—	0.5	
Reset Detect Voltage		V_{CC}	—		V_{REG} × 89%	V_{REG} × 92%	V_{REG} × 95%	V
Standby Current	I_{ST}	V_{CC}	—	V_{IN}=14 V	—	0.6	1.2	mA
Overvoltage Detection	V_{SD}	BIAS	—		—	40	—	V
Watchdog Timer	T_{WD}	$\overline{RESET}$	—		0.9 × C_TR_T	1.1 × C_TR_T	1.3 × C_TR_T	ms
Reset Timer (1)	$T_{RST\ (1)}$	$\overline{RESET}$	—		1.3 × C_TR_T	1.6 × C_TR_T	1.9 × C_TR_T	
Reset Timer (2)	$T_{RST\ (2)}$	$\overline{RESET}$	—		0.3 × C_T	0.7 × C_T	1.5 × C_T	
Clock Pulse Width	T_W	CK	—		3	—	—	μs

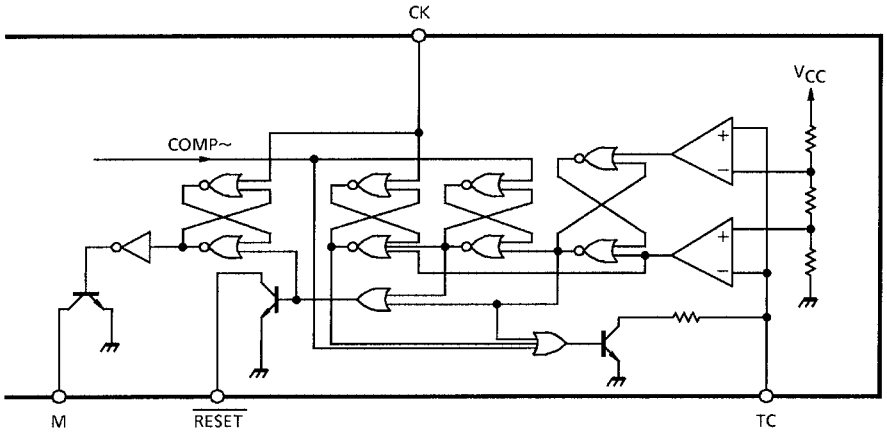
Note: The unit for C_T is μF , the unit for R_T is KΩ

TYPICAL CHARACTERISTICS

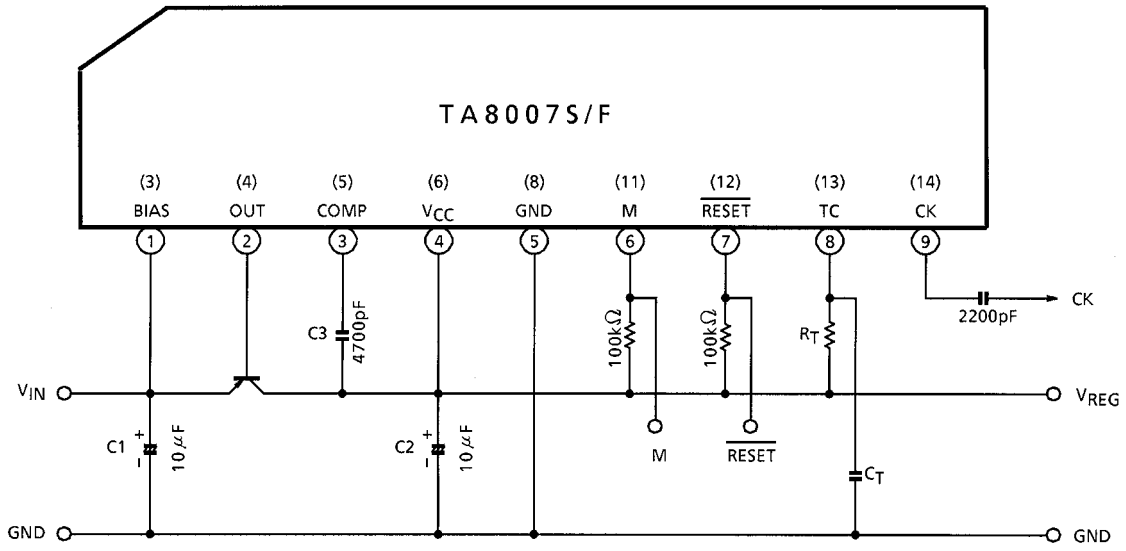




RESET TIMER EQUIVALENT CIRCUIT



EXAMPLE OF APPLICATION CIRCUIT (Number in ○ show pin number of the TA8007S, those in ( ) show pin number of the TA8007F.)



*: Cautions for Wiring

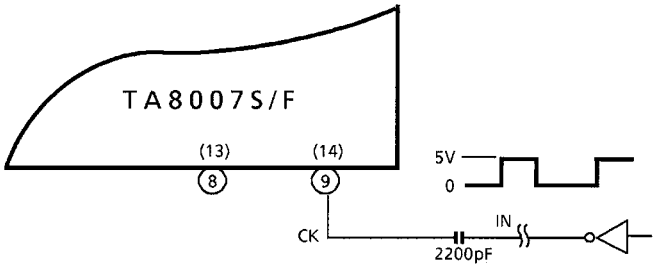
1. C_1 and C_2 are for absorbing disturbance, noise, etc. Connect them as close to the IC as possible.
2. C_3 is for phase compensation. Also, connect C_3 close to the IC.

RECOMMENDED CONDITIONS

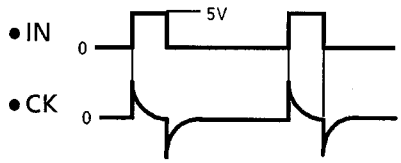
PART NAME	MIN	MAX	UNIT
C_T	0.01	100	μF
R_T	5	100	kΩ

APPLICATION CIRCUIT FOR CK INPUT

Capacitor Coupling



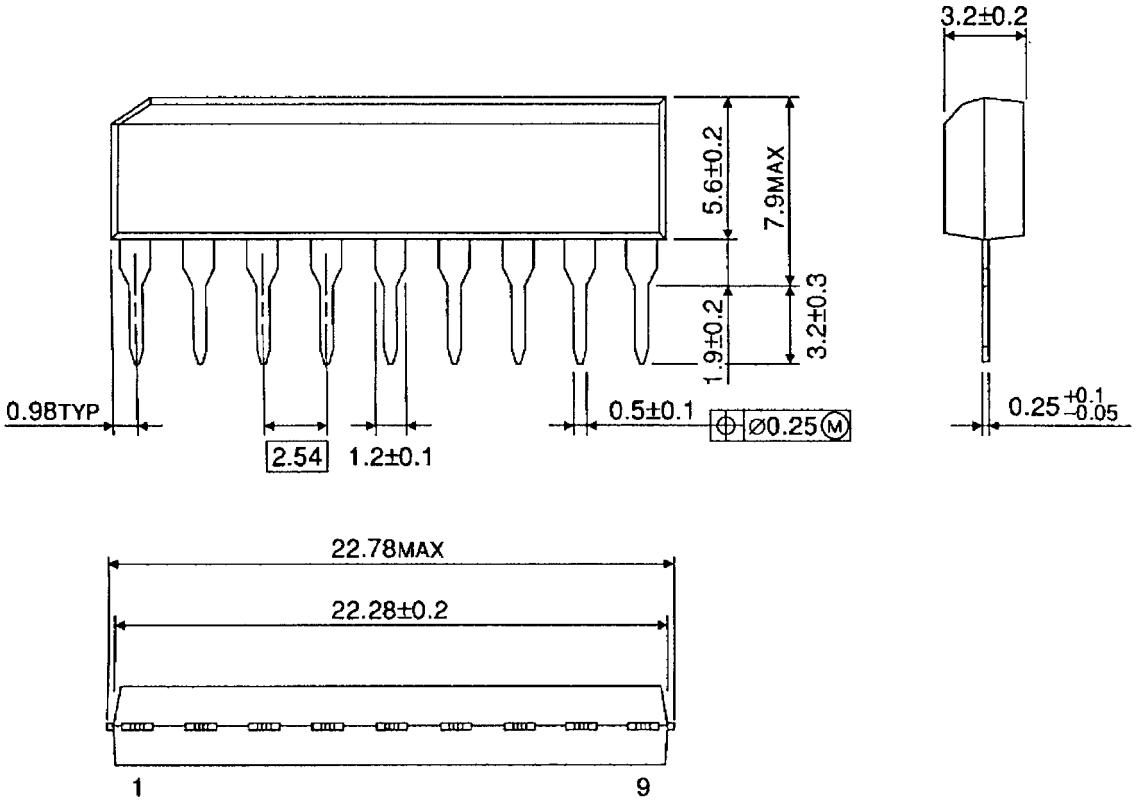
Timing Chart



Even when the input level (IN) is fixed either high or low by capacitor decoupling, a reset pulse can be generated intermittently from the $\overline{\text{RESET}}$ output.

PACKAGE DIMENSIONS

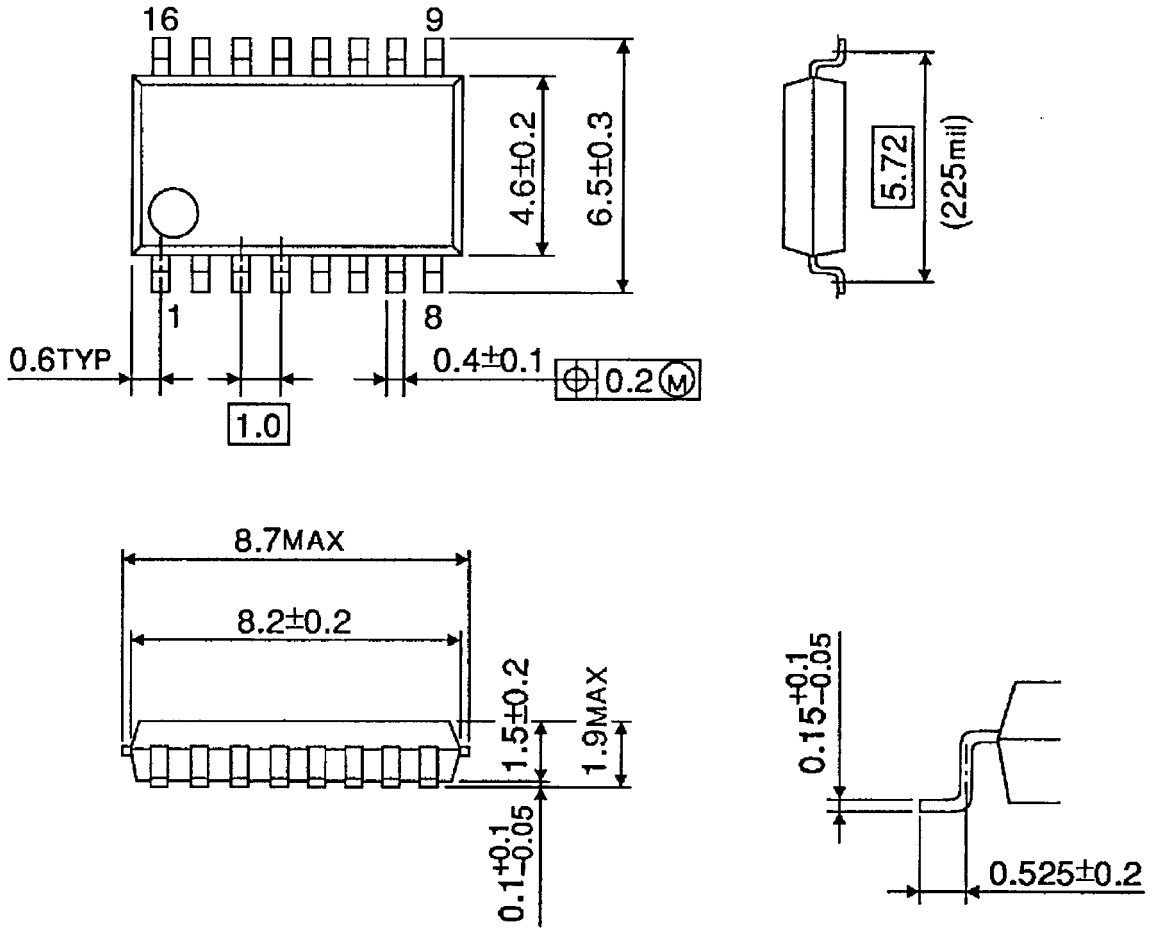
SIP9-P-2.54A Unit : mm



Weight: 0.92g (Typ.)

PACKAGE DIMENSIONS

SSOP16-P-225-1.00A Unit : mm



Weight: 0.14 g (Typ.)

RESTRICTIONS ON PRODUCT USE

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