

TOSHIBA BIPOLAR LINEAR INTEGRATED CIRCUIT SILICON MONOLITHIC

TA8005S,TA8005F

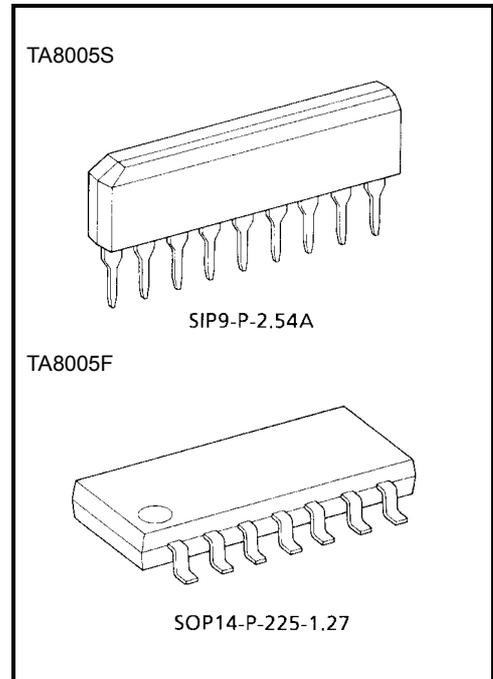
5V VOLTAGE REGULATOR WITH WATCHDOG TIMER

The TA8005S TA8005F is an IC specially designed for micro-computer systems. It incorporates a highly accurate constant-voltage power supply ($5\pm 0.25V$) and various system reset functions. For system reset, it monitors the output voltage of $V_{REG}\times 85\%$ and has a watchdog timer which can self-diagnose the microcomputer system so that program runaway can be prevented.

Since its bias current is as small as 1.4mA (max.) , it can be connected directly to an automotive battery.

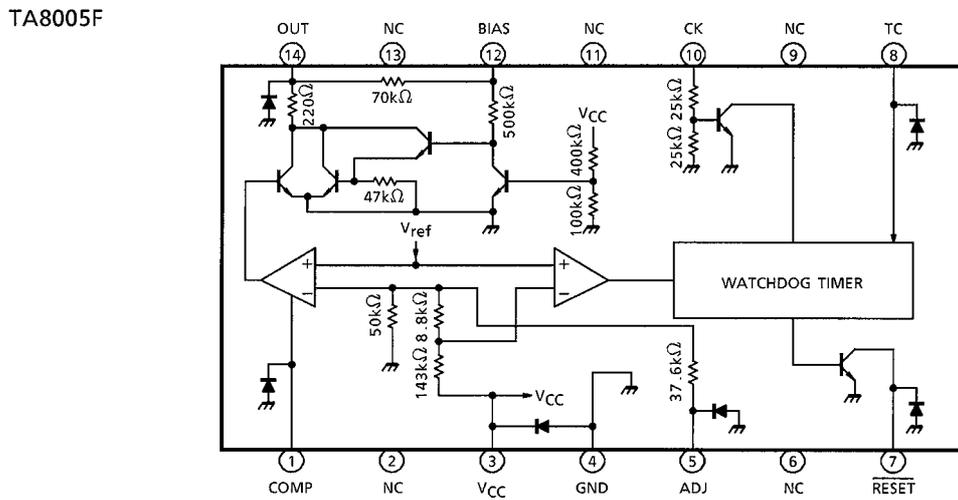
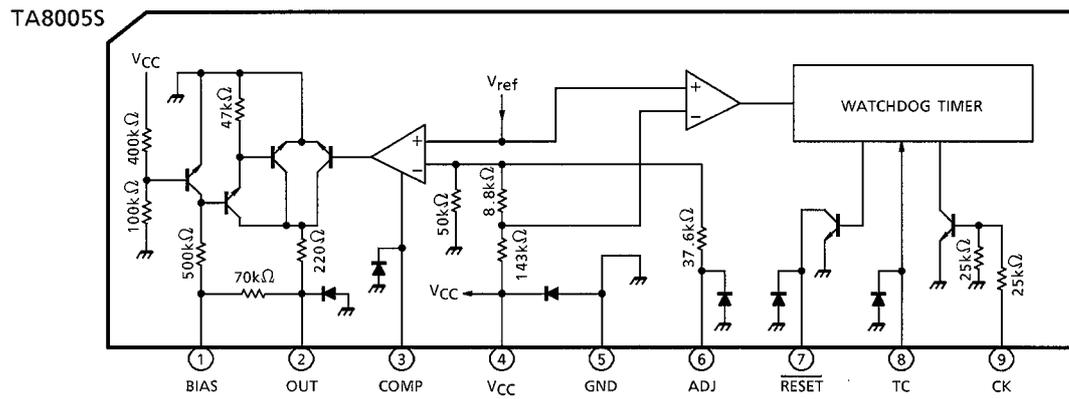
FEATURES

- Accurate output : $5\pm 0.25V$
- Low bias current : 1.4mA (max.)
- Power-on reset timer incorporated
- Watchdog timer incorporated
- Wide operating voltage range : 40V (max.)
- Operating temperature range : from -40 to $85^{\circ}C$
- Output voltage adjusting pin attached
- Small SIP-9 pin (TA8005S)
SOP-14 pin (TA8005F)



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

BLOCK DIAGRAM AND PIN LAYOUT



Note: The TA8005S and TA8005F are the same chip, only the packages are different.

PIN DESCRIPTION

PIN No.		SYMBOL	DESCRIPTION
TA8005S	TA8005F		
1	12	BIAS	Power supply starting pin. The starting current is supplied through a resistor to which the input voltage is applied. When V_{CC} rises above 3.0V, the starting current is absorbed in the internal circuit ; instead, I_{OUT} is supplied via V_{CC} .
2	14	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	1	COMP	Phase compensation pin for output stabilization
4	3	V_{CC}	Power supply pin for internal circuit. The output voltage can also be detected at this pin.
5	4	GND	Grounded
6	5	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} . It will become 10V when ADJ and GND are directly connected.
7	7	$\overline{\text{RESET}}$	NPN transistor open-collector output. (1) The signal goes low when the output drops below 85% 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	8	TC	Time setting pin for the reset and watchdog timers. Any desired time can be set using external R_T and C_T .
9	10	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.
—	2, 6, 9, 11, 13	NC	Non-connected pin. (Electrically, this pin is completely open.)

Functional Description

The TA8005S / F incorporates a constant-voltage 5V power supply function to feed stable power to the CPU and a system reset function 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 4.25V. When powered off, this voltage monitoring function outputs a reset signal immediately when V_{CC} drops below 4.25V. 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 4.25V, 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.

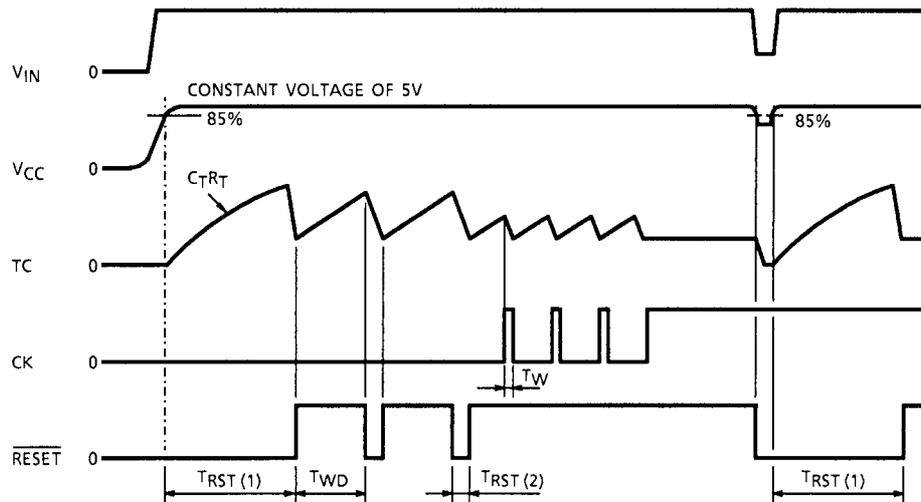
The system starts charging the capacitor when the V_{CC} voltage exceeds 4.25V. When this charge voltage exceeds 4V, the capacitor is discharged by the IC's internal transistor. When the capacitor is discharged down to 2V, the reset signal is inverted to deactivate the reset.

- 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.

TIMING CHART



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

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

CHARACTERISTIC	SYMBOL	RATING	UNIT
Input Voltage	V_{IN1}	60 (1s)	V
	V_{IN2}	-5~ V_{CC}	
Output Current	I_{OUT1}	10	mA
	I_{OUT2}	4	
Output Voltage	V_{OUT1}	60 (1s)	V
	V_{OUT2}	16	
Power Dissipation	P_D	500 / 280	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)	$^\circ\text{C}$

Note: V_{IN1} : BIAS input
 V_{IN2} : CK input
 I_{OUT1} , V_{OUT1} : \overline{OUT} output
 I_{OUT2} , V_{OUT2} : \overline{RESET} output
 P_D : TA8005S / TA8005F

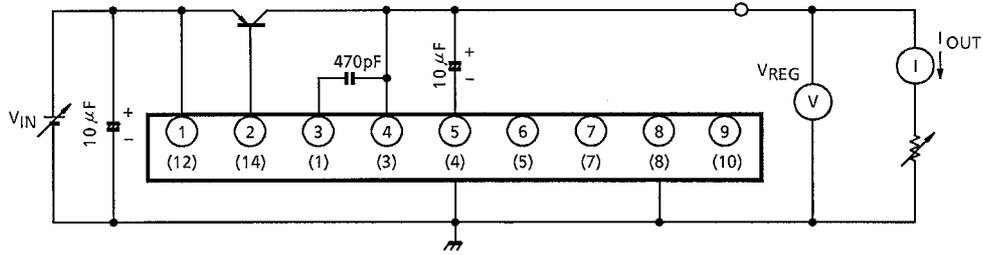
ELECTRICAL CHARACTERISTICS (VIN = 6 to 17V, Ta = -40 to 85°C)

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} = 6~40V	—	0.1	0.5	%
Load Regulation		V _{CC}	—	I _{LOAD} = 1~50mA	—	0.1	0.5	%
Temperature Coefficient		V _{CC}	—		—	0.01	—	% / °C
Output Voltage	V _{OL}	$\overline{\text{RESET}}$	2	I _{OL} = 2mA	—	—	0.5	V
Output Leakage Current	I _{LEAK}	$\overline{\text{RESET}}$	3	V _{OUT} = 10V	—	—	5	μA
Input Current	I _{IN}	TC	4	V _{IN} = 0~3.5V	-3	—	3	μA
Threshold Voltage	V _{IH}	TC	5	$\overline{\text{RESET}}$ High to Low	—	80%× V _{REG}	—	V
	V _{IL}		5	$\overline{\text{RESET}}$ Low to High	—	40%× V _{REG}	—	
Input Current	I _{IN}	CK	6	V _{IN} = 5V	—	0.18	0.4	mA
Input Voltage	V _{IH}	CK	5		2	—	—	V
	V _{IL}	CK	5		—	—	0.5	
Reset Detect Voltage		V _{CC}	—		82%× V _{REG}	85%× V _{REG}	88%× V _{REG}	V
Standby Current	I _S	V _{CC}	8	V _{IN} = 14V	—	0.85	1.4	mA
Watchdog Timer	T _{WD}	$\overline{\text{RESET}}$	7		0.9× C _T R _T	1.1× C _T R _T	1.3× C _T R _T	mS
Reset Timer (1)	T _{RST (1)}	$\overline{\text{RESET}}$	7		1.3× C _T R _T	1.6× C _T R _T	1.9× C _T R _T	
Reset Timer (2)	T _{RST (2)}	$\overline{\text{RESET}}$	7		0.15× C _T	0.3× C _T	0.6× C _T	
Clock Pulse Width	T _W	CK	—		3	—	—	μs

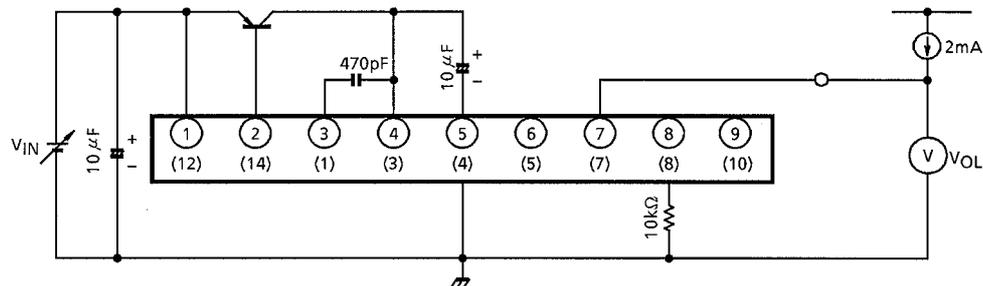
Note : Reset timer (1) : Power-on reset time
 Reset timer (2) : Watchdog reset time
 The unit of C_T is μF, the unit of R_T is kΩ.

TEST CIRCUIT (Numbers in O show pin numbers of the TA8005S; those in () show pin numbers of the TA8005F.)

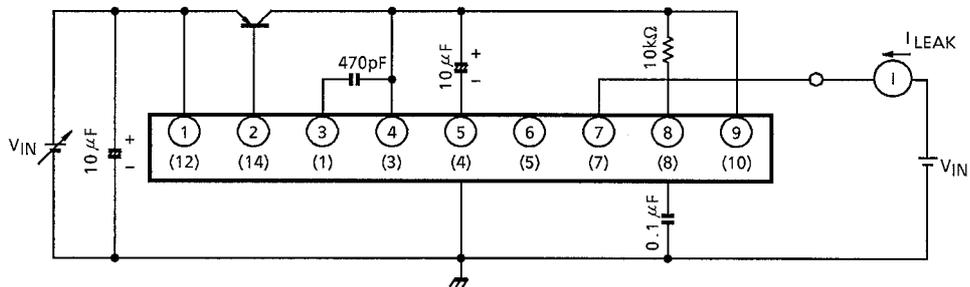
1. V_{REG}



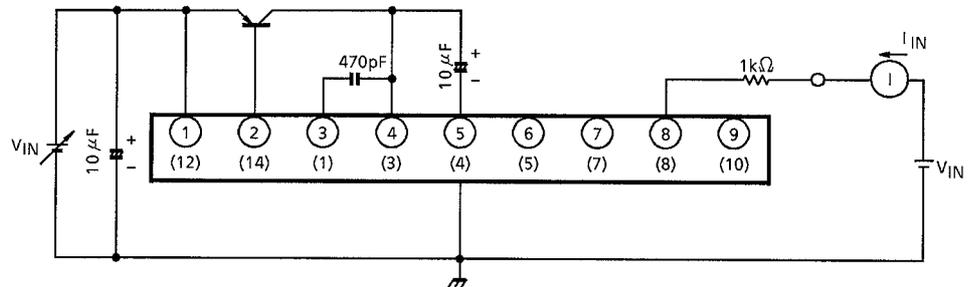
2. $V_{OL}(\overline{RESET})$



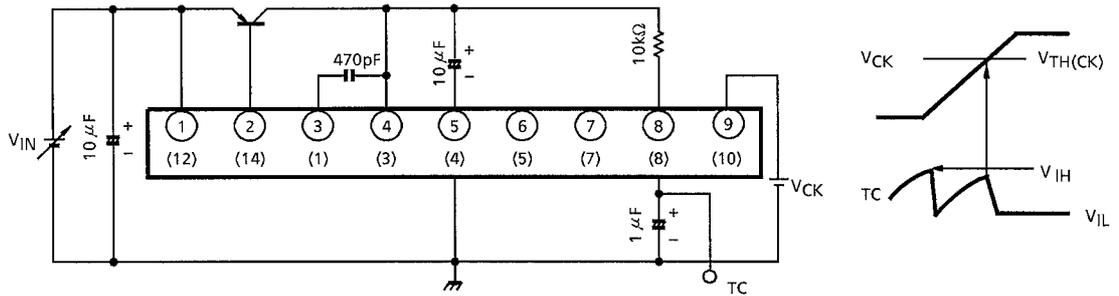
3. $I_{LEAK}(\overline{RESET})$



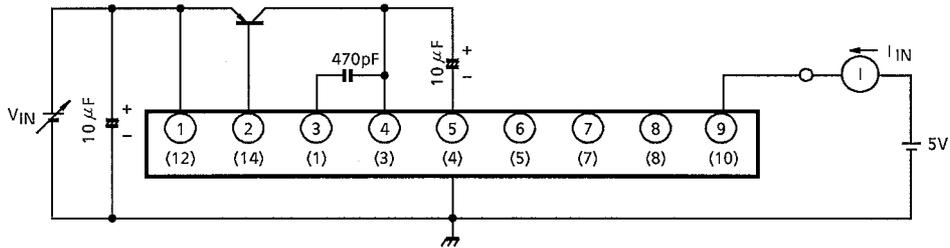
4. $I_{IN}(TC)$



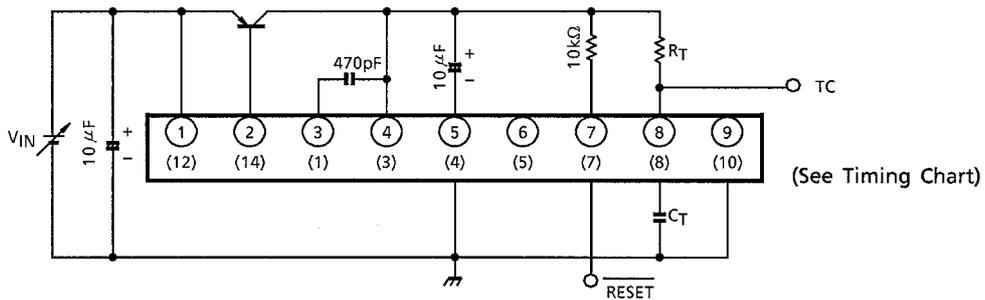
5. $V_{IH}, V_{IL} (TC), V_{IH}, V_{IL} (CK)$



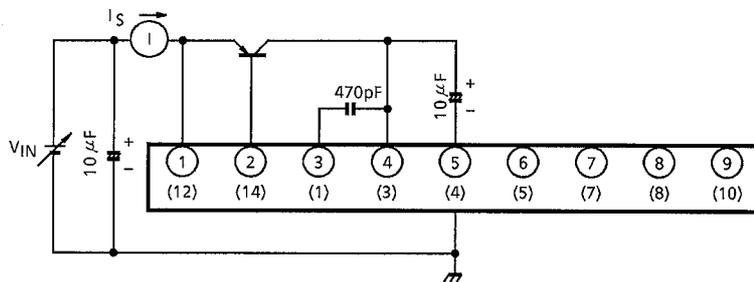
6. $I_{IN} (CK)$



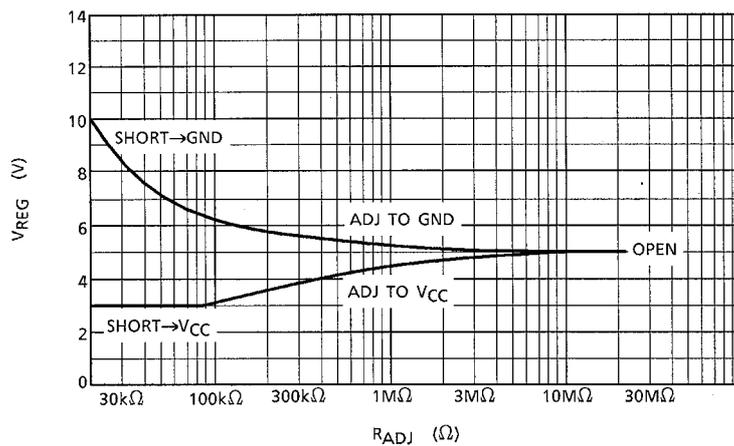
7. $V_{RESET}, T_{WD}, T_{RST} (1), T_{RST} (2)$



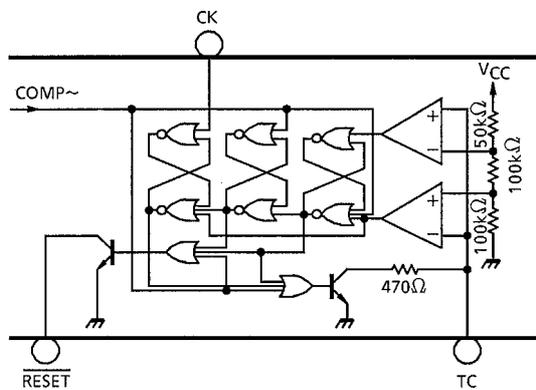
8. I_s



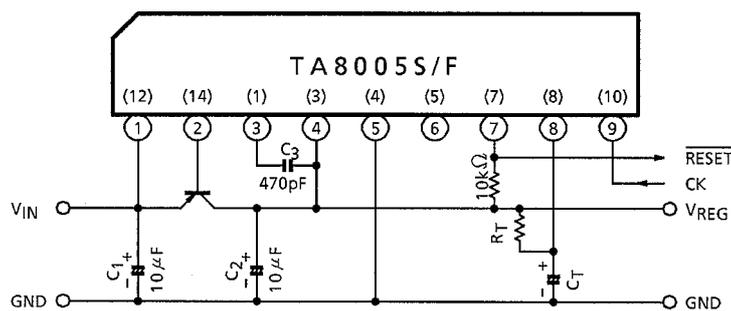
ADJ ADJUSTING RESISTOR DATA



RESET TIMER EQUIVALENT CIRCUIT



EXAMPLE OF APPLICATION CIRCUIT (Numbers in O show pin numbers of the TA8005S; those in () show pin numbers of the TA8005F.)



∗:

Cautions for Wiring

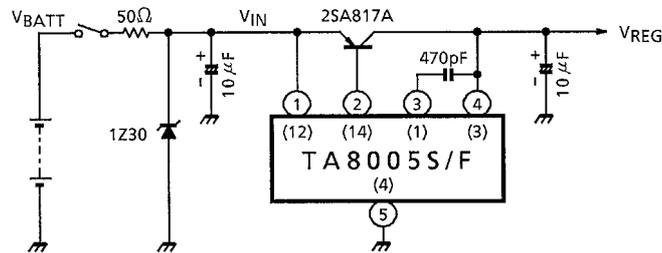
1. C_1 and C_2 are for absorbing disturbance, noise, etc. Connect them as close to the IC as possible.
2. C_3 is for phase compensation. Also, connect C_3 close to the IC.

120 V_{peak} LOAD DUMP

Note: No protection is needed if a voltage above 60V is not applied.

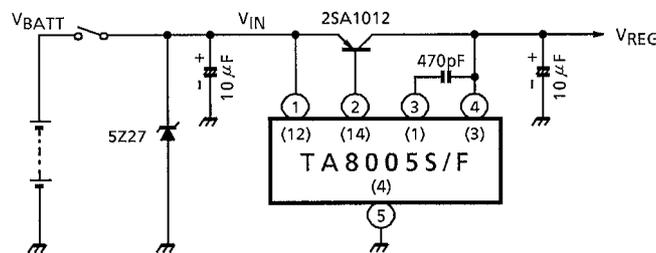
1. Low Output Current Circuit

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

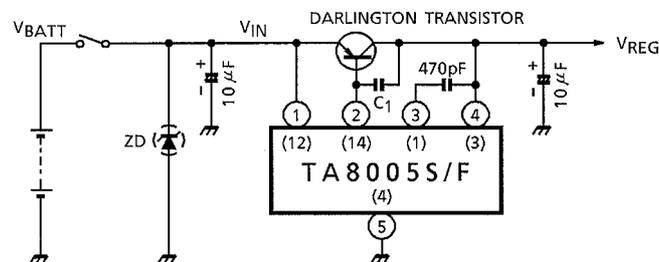


2. High Output Current Circuit

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



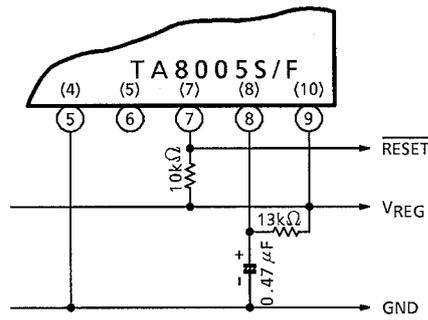
EXAMPLE OF APPLICATION CIRCUIT USING DARLINGTON TRANSISTOR



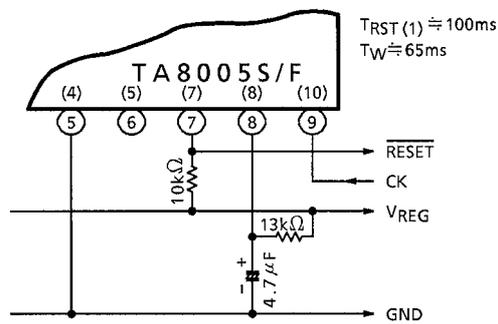
- *:
- Insert a C_1 value according to the working condition -- typically above 2000pF.
 - Insert ZD when necessary.

APPLICATION CIRCUIT OF WATCHDOG / RESET TIMER

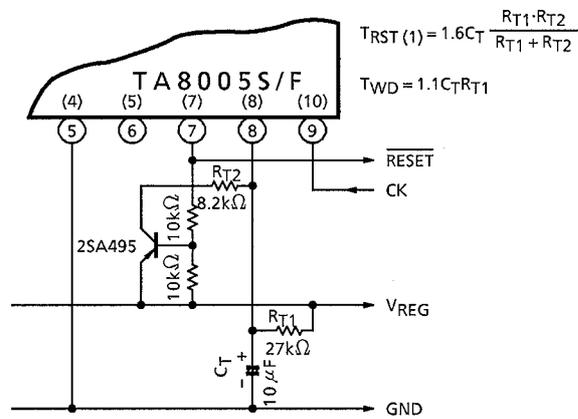
1. $T_{RST}(1) \approx 10ms$Power-On Reset Timer



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



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



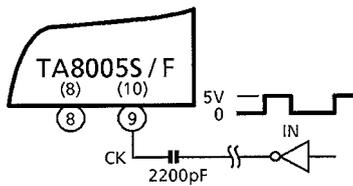
4. Recommended Conditions

PART NAME	MIN	MAX	UNIT
C _T	0.01	100	μF
R _T	5	100	kΩ
R _{T1}	—	100	kΩ
R _{T1} // R _{T2} (Note)	5	—	kΩ

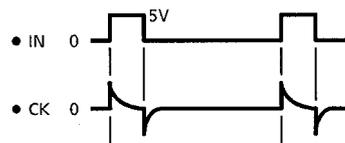
Note: $R_{T1} // R_{T2} = (R_{T1} \times R_{T2}) / (R_{T1} + R_{T2})$

CK INPUT APPLICATION CIRCUIT

Capacitor Coupling



Timing Chart

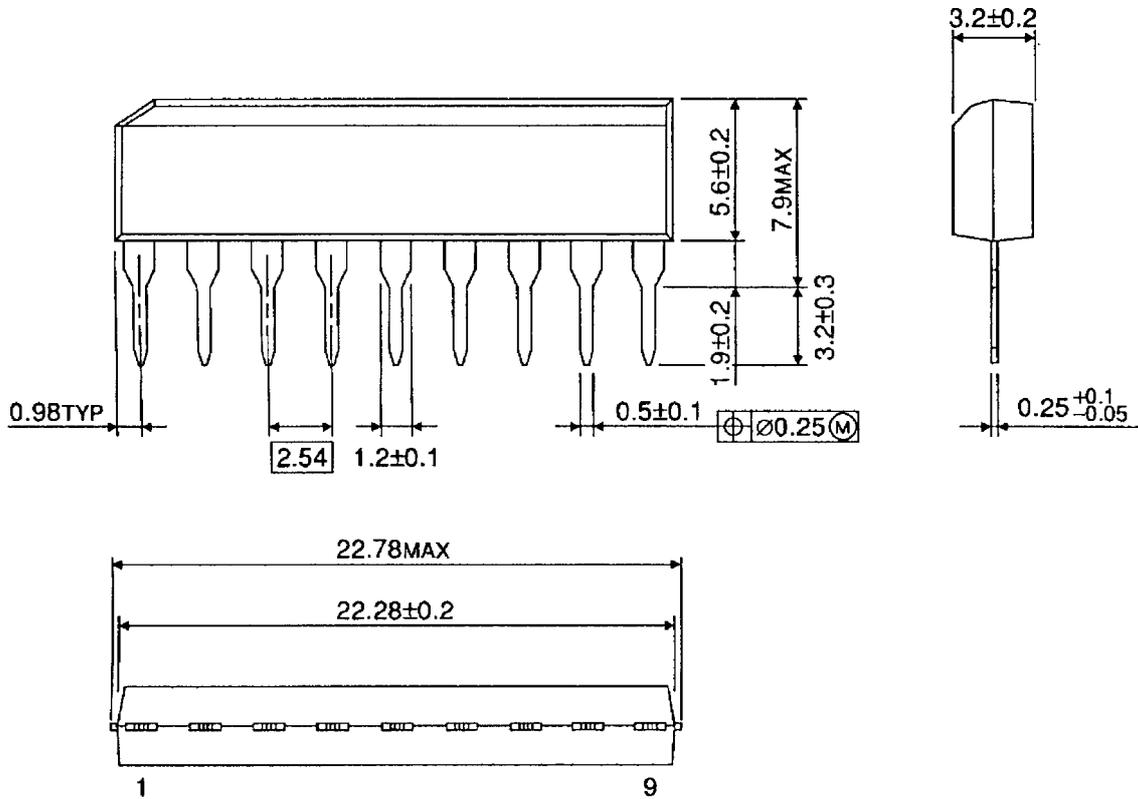


The capacitor coupling allows reset pulses to be supplied intermittently from the $\overline{\text{RESET}}$ pin whether the input level (IN) is high or low.

PACKAGE DIMENSIONS

SIP9-P-2.54A

Unit : mm

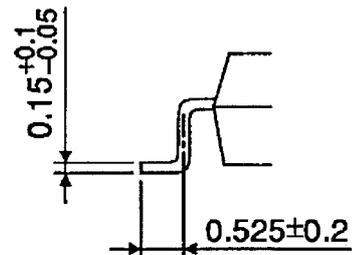
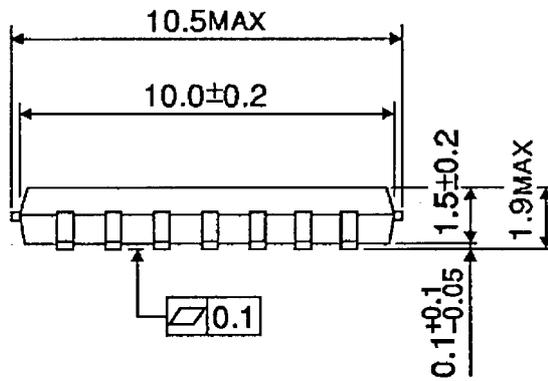
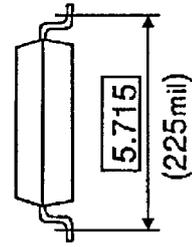
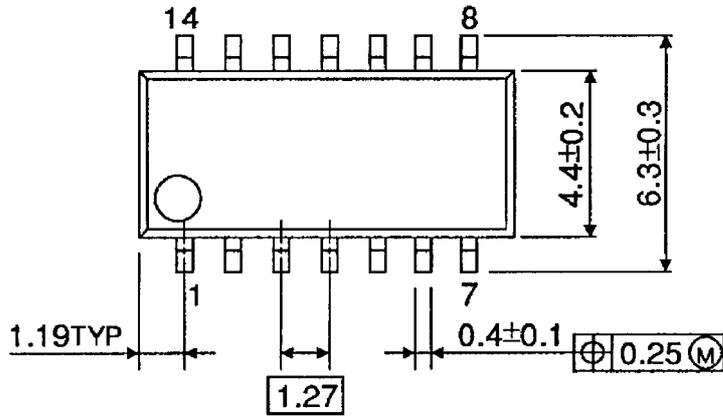


Weight: 0.92g(Typ.)

PACKAGE DIMENSIONS

SOP14-P-225-1.27

Unit : mm



Weight: 0.2g (Typ.)

RESTRICTIONS ON PRODUCT USE

000707EAA_S

- TOSHIBA is continually working to improve the quality and 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 comply with the standards of safety in making a safe design for the entire system, and to avoid situations in which a malfunction or failure of such TOSHIBA products 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 TOSHIBA products specifications. Also, please keep in mind the precautions and conditions set forth in the "Handling Guide for Semiconductor Devices," or "TOSHIBA Semiconductor Reliability Handbook" etc..
- 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.