

TOSHIBA BIPOLAR LINEAR INTEGRATED CIRCUIT SILICON MONOLITHIC

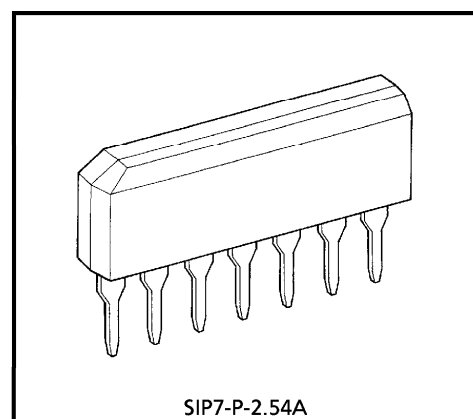
TA8002S, TA8002AS

5V VOLTAGE REGULATOR WITH RESET TIMER

The TA8002S is an IC specially designed for automotive microcomputer systems. It produces an output voltage of $5 \pm 0.5V$ 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. Since it is also designed to have a small bias current, power consumption on the system can be reduced.

The TA8002AS produces an output voltage of $5 \pm 0.25V$.



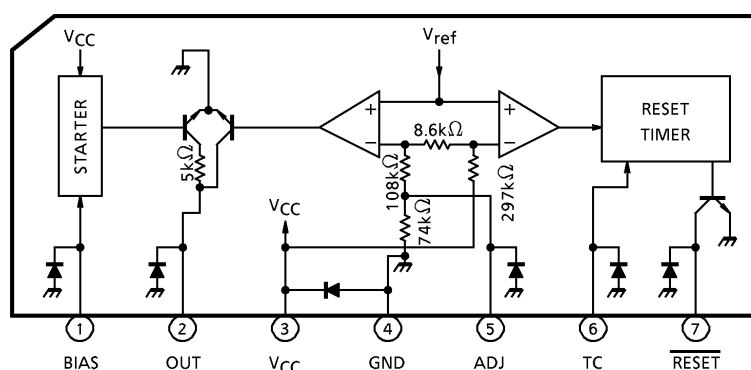
SIP7-P-2.54A

Weight : 0.7g (Typ.)

FEATURES

- Accurate output : $5 \pm 0.5V$ (TA8002AS : $5 \pm 0.25V$)
- Standby output : 3.5V
- Low bias current : $150\mu A$ (Typ.)
- Power-on reset timer
- Operating temperature range : from -40 to $85^\circ C$
- Wide operating voltage range : 40V (max.)
- Small SIP-7 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 : $I_{OUT}(\text{Bias Pin}) \geq 30 \times (V_{IN} - 0.7) / (200 + R_1) \text{ (mA)}$ where R_1 is the external resistance attached to Bias Pin ($k\Omega$). When V_{CC} rises above 2.7V, the starting current is absorbed in the internal circuit ; instead, the output current OUT is supplied via V_{CC} .									
2	OUT	Connected to the base of an external PNP transistor so that the output voltage is stabilized.									
3	V_{CC}	Power supply pin for internal circuit. The output voltage can also be detected at this pin.									
4	GND	Grounded									
5	ADJ	The output voltage can be adjusted by inserting a resistor between ADJ and GND or between ADJ and V_{CC} . <table border="1"> <thead> <tr> <th>Mode</th><th>ADJ Pin</th><th>Output Voltage V_{REG}</th></tr> </thead> <tbody> <tr> <td>Standby</td><td>OPEN</td><td>3.5V</td></tr> <tr> <td>Normal</td><td>GND</td><td>5.0V</td></tr> </tbody> </table>	Mode	ADJ Pin	Output Voltage V_{REG}	Standby	OPEN	3.5V	Normal	GND	5.0V
Mode	ADJ Pin	Output Voltage V_{REG}									
Standby	OPEN	3.5V									
Normal	GND	5.0V									
6	TC	Time setting pin for reset timer. Use external R_T and C_T to set the time.									
7	$\overline{\text{RESET}}$	NPN transistor open-collector output. This pin supplies a reset signal when the output drops below 92% of the specified level. After the output voltage increases above 92% of the specified level, the reset signal will be output for a period of time set at the TC pin.									

FUNCTIONAL DESCRIPTION

The TA8002S/AS incorporates a constant-voltage 5V power supply function to feed the 5V logic circuits and a reset function to ensure stable operation of the system. 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.

The output voltage of 5V is obtained by shorting the ADJ pin to GND. The output voltage is reduced to 3.5V by leaving this pin open, allowing for a further reduction in the amount of current consumed by the entire system during standby.

(2) System reset function (See Timing Chart)

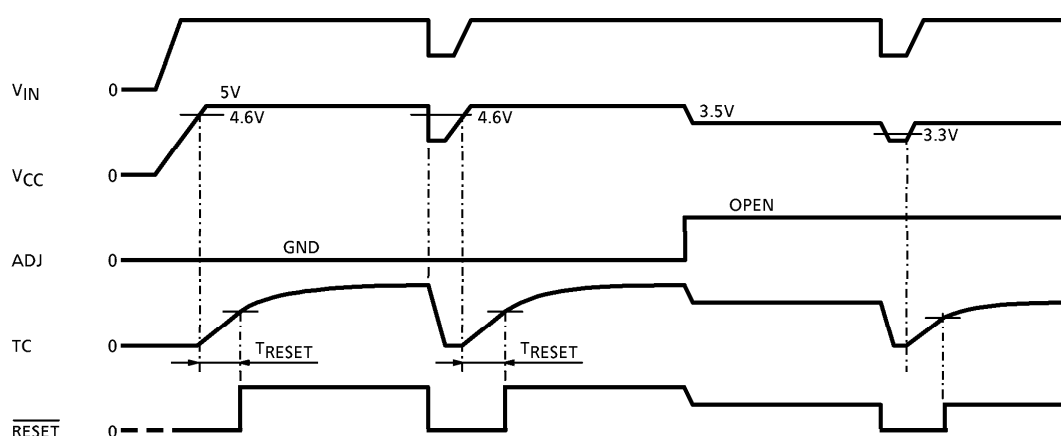
- Voltage monitoring function

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 prevent the circuit system from operating erratically at power-on, 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 charging voltage exceeds 1.7V, the reset signal is inverted to deactivate the reset.

TIMING CHART



(Note) T_{RESET} : Reset timer time

MAXIMUM RATINGS (Ta = 25°C)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Input Voltage	V _{IN}	40	V
Output Current	I _{OUT1}	0.5	mA
	I _{OUT2}	1	mA
Output Voltage	V _{OUT1}	40	V
	V _{OUT2}	16	V
Power Dissipation	P _D	500	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_{IN} : BIAS input
 I_{OUT1}, V_{OUT1} : OUT output
 I_{OUT2}, V_{OUT2} : RESET output

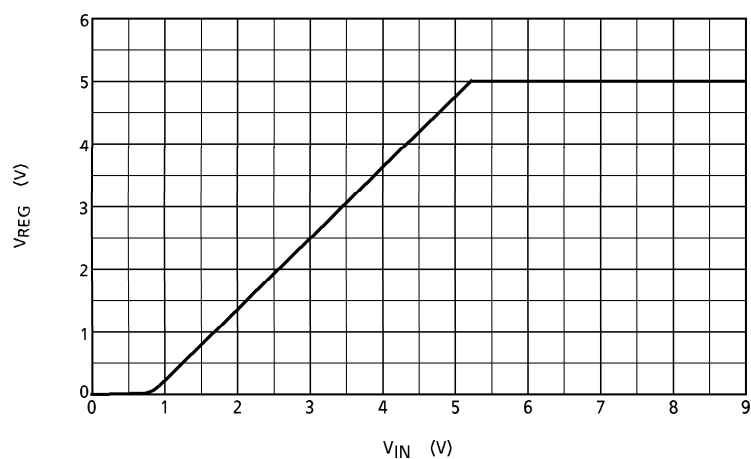
ELECTRICAL CHARACTERISTICS (V_{IN} = 7 to 17V, Ta = – 40 to 85°C, I_{LOAD} = 5mA)

CHARACTERISTIC	SYMBOL	PIN	TEST CIR- CUIT	TEST CONDITION		MIN.	TYP.	MAX.	UNIT
Output Voltage	V _{REG}	V _{CC}	1	—	TA8002S	4.5	5.0	5.5	V
			1		TA8002AS	4.75	5.0	5.25	
Line Regulation	—	V _{CC}	—	V _{IN} = 7~40V		—	0.1	0.5	%
Load Regulation	—	V _{CC}	—	I _{LOAD} = 2~10mA		—	0.1	0.5	%
Temperature Coefficient	—	V _{CC}	—	—		—	0.01	—	% / °C
Output Voltage	V _{OL}	RESET	2	I _{OL} = 300μA		—	—	0.4	V
Output Leakage Current	I _{LEAK}	RESET	3	V _{OUT} = 10V		—	—	5	μA
Input Current	I _{IN}	TC	4	V _{IN} = 0~V _{REG}		− 2	—	2	μA
Threshold Voltage	V _{TH}	TC	5	TC : Low to High		—	1.7	—	V
Reset Detect Voltage	—	V _{CC}	5	V _{REG} = 5V		—	4.6	—	V
Standby Voltage	V _S	V _{CC}	6	—		3.1	3.5	3.9	V
Standby Current	I _S	V _{CC}	7	V _{IN} = 14V		—	150	300	μA
Reset Timer	T _{RESET}	RESET	5	—		—	0.4 × C _{TRT}	—	ms

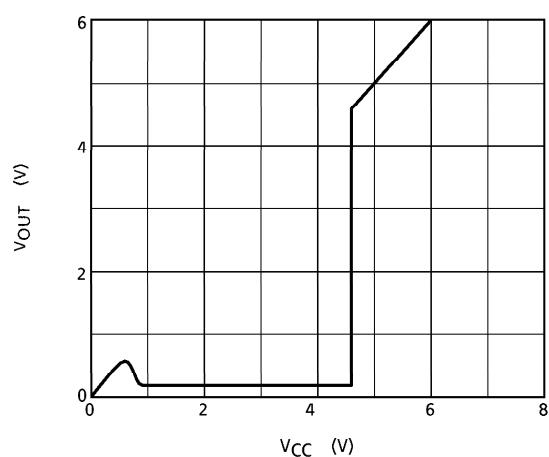
Note : The unit for C_T is μF, the unit for R_T is kΩ.

TYPICAL CHARACTERISTICS

1. Input-Output Characteristic ($R_L = 500\Omega$, external transistor 2SA817A)

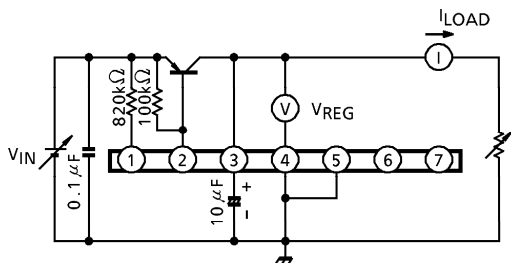


2. Reset Characteristic

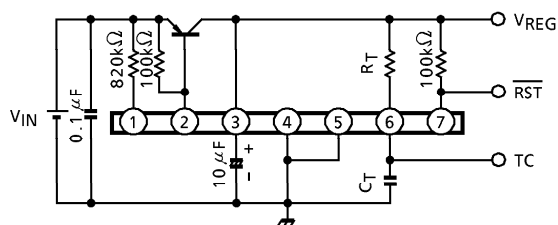


TEST CIRCUIT

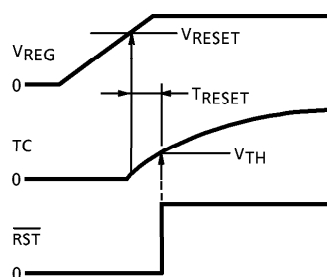
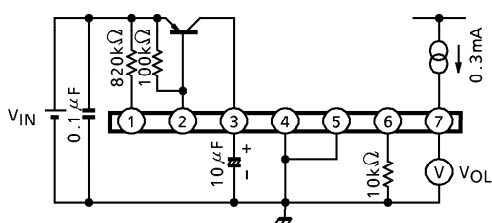
1. V_{REG}



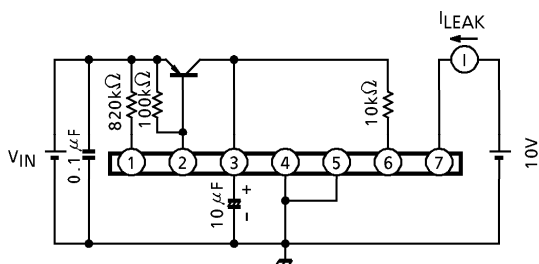
5. V_{RESET} , V_{TH} , T_{RESET}



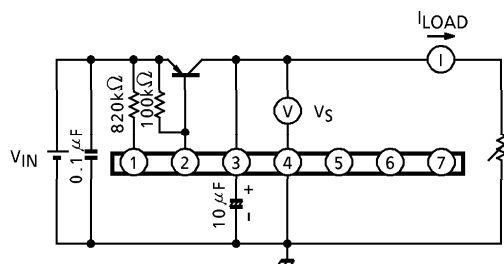
2. $V_{OL}(\overline{RESET})$



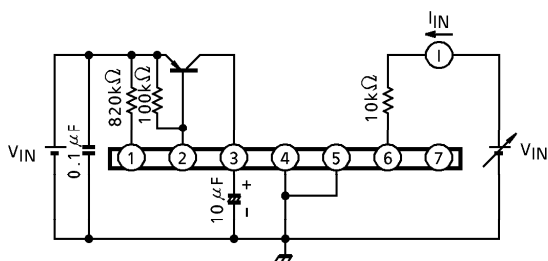
3. $I_{LEAK}(\overline{RESET})$



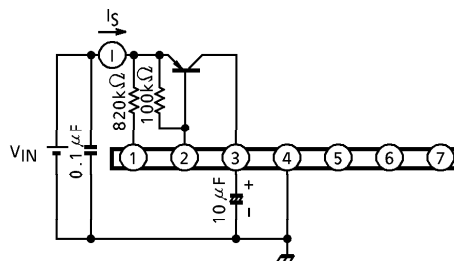
6. V_S



4. $I_{IN}(TC)$



7. I_S



$I_{LOAD} = 10mA$ Max. $V_{BATT} = 6 \sim 17V$ (LOAD DUMP 120Vpeak, 200ms)

$I_{LOAD} = 10\text{mA Max.}$ $V_{BATT} = 6 \sim 17\text{V}$ (LOAD DUMP 120V_{peak}, 200ms)

 $V_{BATT} =$ 

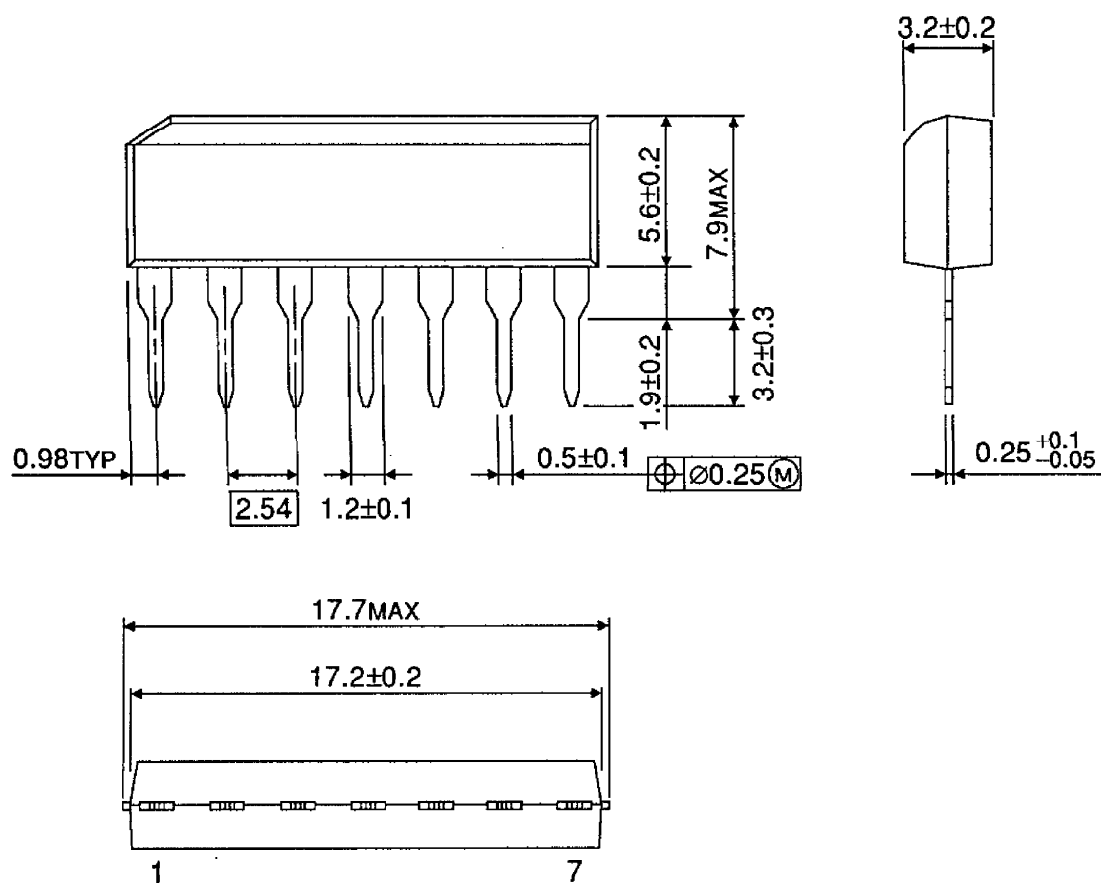
The circuit diagram shows the TA8002S/AS inverter. The input is V_{BATT} , which is connected to a switch (SW) and a 50Ω resistor. The switch is controlled by a 1230 diode and a 10μF capacitor. The output of the switch is connected to the base of a 2SA817A transistor through an 820kΩ resistor. The transistor's emitter is connected to ground, and its collector is connected to the output V_{REG} through a 100kΩ resistor. The TA8002S/AS chip is connected to the output V_{REG} through a 120kΩ resistor and a 100kΩ resistor. The chip's input is connected to the output of the switch through a 10kΩ resistor. The chip's output is connected to the output V_{REG} through a 100kΩ resistor. The chip's ground is connected to ground through a 0.22μF capacitor. The chip's output is also connected to a 100kΩ resistor, which is connected to the output V_{REG} . The chip's output is also connected to a 100kΩ resistor, which is connected to the output V_{REG} . The chip's output is also connected to a 100kΩ resistor, which is connected to the output V_{REG} .

Timing waveforms for SW and OUTPUT are shown below the circuit. The SW waveform shows a transition from OFF to ON. The OUTPUT waveform shows a transition from 3.5V to 5V.

1999-05-10 7/8

OUTLINE DRAWING
SIP7-P-2.54A

Unit : mm



Weight : 0.7g (Typ.)