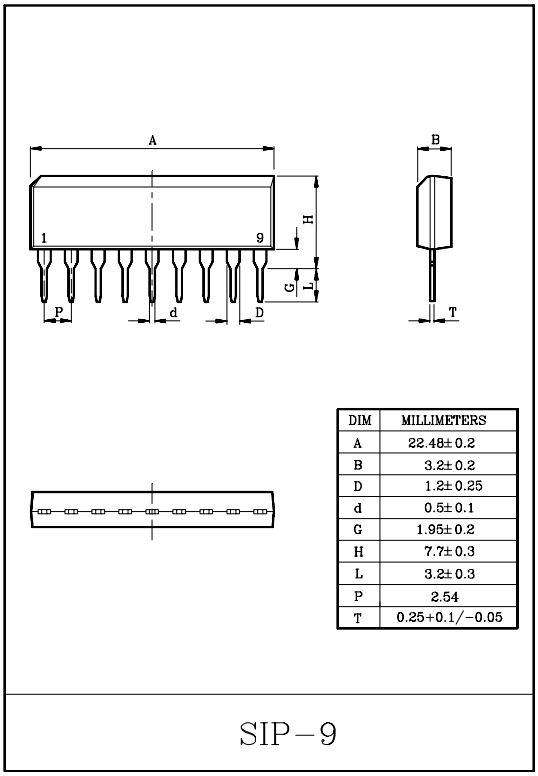
5V VOLTAGE REGULATOR WITH WATCHDOG TIMER

The KIA8000S is an IC specially designed for automotive microcomputer systems.
It produces an output voltage of 5±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.



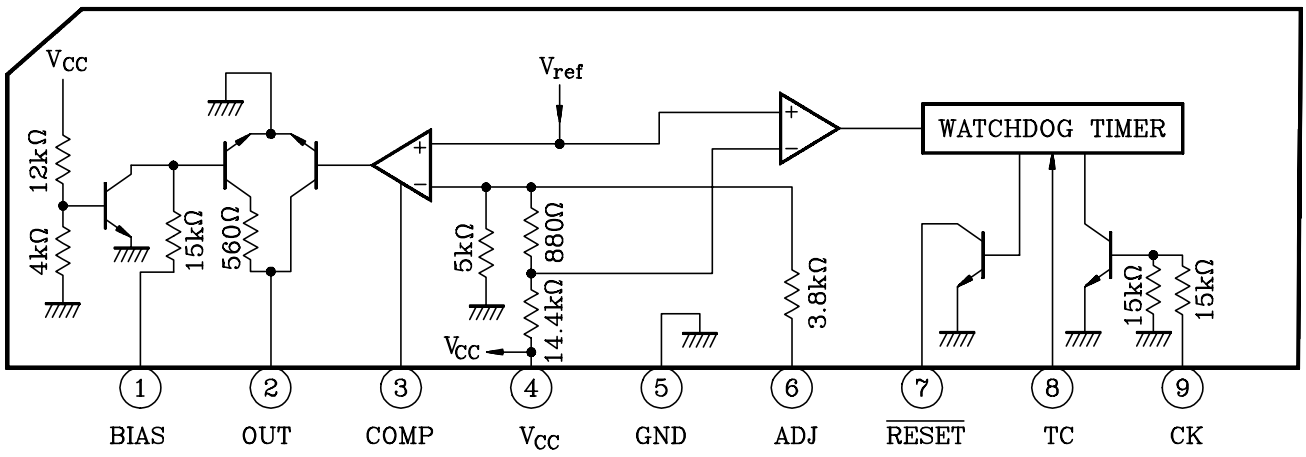
DIM	MILLIMETERS
A	22.48±0.2
B	3.2±0.2
D	1.2±0.25
d	0.5±0.1
G	1.95±0.2
H	7.7±0.3
L	3.2±0.3
P	2.54
T	0.25+0.1/−0.05

SIP-9

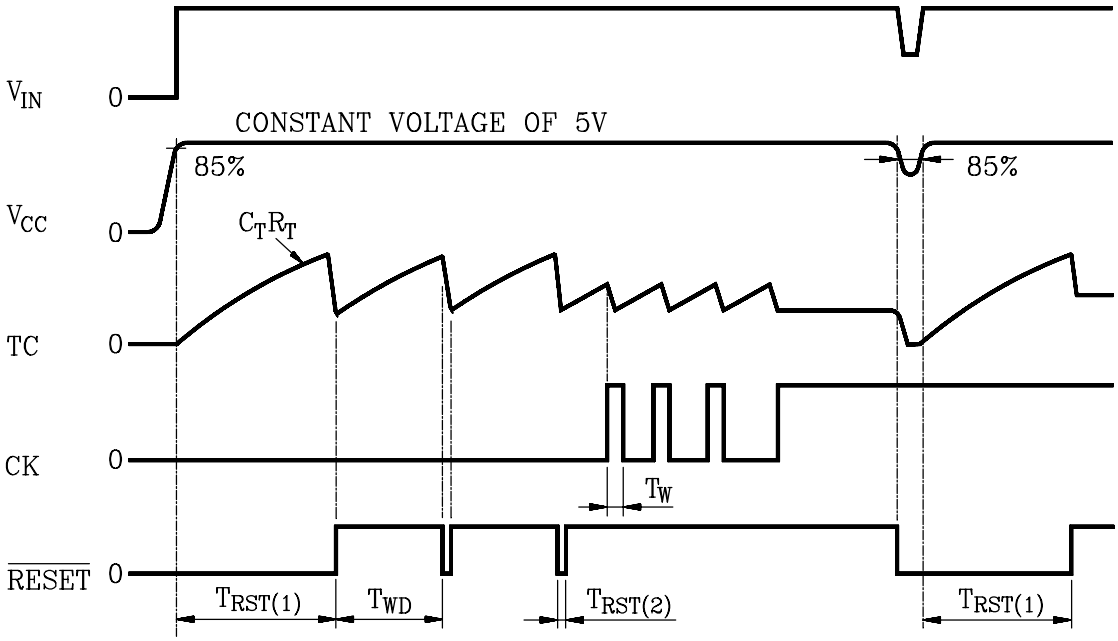
FEATURES

- Accurate output : 5±0.25V.
- Output voltage adjusting pin attached.
- Power-on reset timer incorporated.
- Watchdog timer incorporated.
- Wide operating voltage range : 40V (Max.).
- Wide operating temperature range : from -40~85℃.
- Load dump protection : 80V (Max.) (1 second).
- Small SIP-9 pin.

BLOCK DIAGRAM AND PIN ASSIGNMENT



TIMING CHART



MAXIMUM RATINGS (Ta=25℃)

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	mW
Operating Temperature	T_{opr}	-40~85	℃
Storage Temperature	T_{stg}	-55~150	℃
Lead Temperature-time	T_{sol}	260 (10 s)	℃

Note)
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}=6~17V, Ta=-40~85℃)

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	-	%/℃
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	μA
Input Current		I_{IN}	TC	4	V_{IN}=0~3.5V	-3	-	3	μA
Threshold Voltage		V_{IH}	TC	5	$\overline{RESET}$ "High" to "Low"	-	80% × V_{REG}	-	V
		V_{IL}			$\overline{RESET}$ "Low" to "High"	-	40% × 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}			-	-	-	0.5	
Reset Detecting Voltage		-	V_{CC}	-	-	82% × V_{REG}	85% × V_{REG}	88% × 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 × C_TR_T	1.1 × C_TR_T	1.3 × C_TR_T	-
Reset Timer	1	$T_{RST(1)}$	$\overline{RESET}$	7	-	1.3 × C_TR_T	1.6 × C_TR_T	1.9 × C_TR_T	-
	2	$T_{RST(2)}$	$\overline{RESET}$	7	-	150 × C_T	300 × C_T	600 × C_T	-
Clock Pulse Width		T_W	CK	-	-	3	-	-	μS

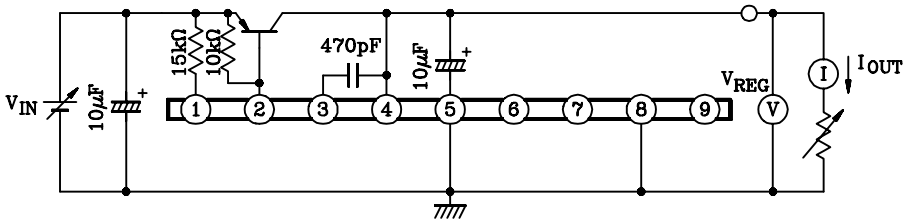
Note) Reset timer (1) : Power-on reset time.
Reset timer (2) : Watchdog reset time.

DESCRIPTION OF PIN

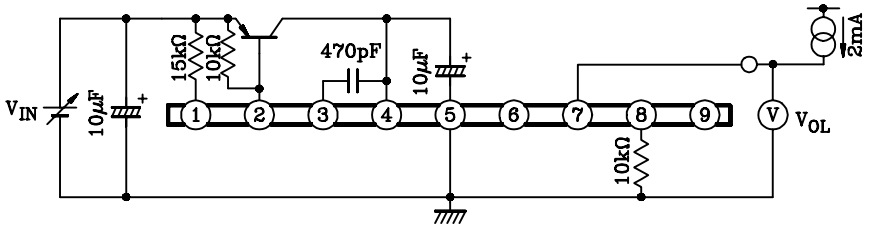
PIN No.	SYMBOL	DESCRIPTION
1	BIAS	Used to start power supply. The starting current is supplied through a resistor by the input voltage. The output current from this starting current is as follows : $I_{OUT(2PIN)} \geqq 30 \times (V_{IN}-0.7)/(15+R_1)$ (mA) R_1 : Resistor (kΩ) installed outside pin 1. This current, if V_{CC} exceeds 2.7V, is absorbed by the internal circuit, and I_{OUT} is supplied by Vcc.
2	OUT	The base of a PNP transistor mounted outside is connected to this pin, which stabilizes output voltage. Therefore, power supply can be designed in accordance with load capacity. Since the recommended current of I_{OUT} is 5mA, an output current of 300mA can be obtained so long as h_{FE} of the transistor mounted outside is 60.
3	COMP	Phase compensation pin used to stabilize output.
4	Vcc	Supplies power to the internal circuit and also detects output Voltage.
5	GND	Ground pin.
6	ADJ	Output voltage adjusting pin. Voltage can be increased with a resistor inserted between pins ADJ and GND, and decreased with a resistor inserted between pins ADJ and V_{CC}. The maximum variable voltage is ±1 volt.
7	$\overline{\text{RESET}}$	Open collector output of an NPN transistor (1) The pin goes low if output voltage is 85% or less of normal output voltage. (2) The pin generates a reset signal that is determined by CR of pin TC. (3) If no clock pulse is input to the input of pin CK, reset pulses are intermittently generated. This function can be used as a watch dog timer for the microcomputer system.
8	TC	Used to set the reset timer and the watch dog timer.
9	CK	Input pin for the watch dog timer. The pin should be pulled up to V_{CC} if it is used only for the power-on reset timer.

TEST CIRCUIT

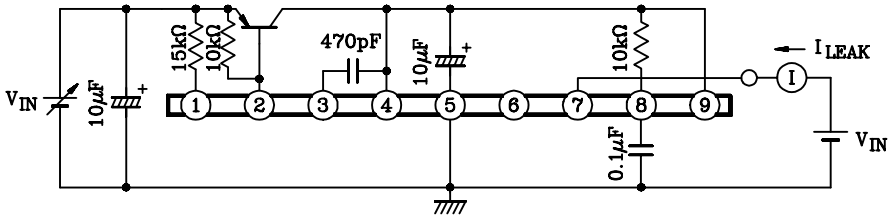
1. V_{REG}



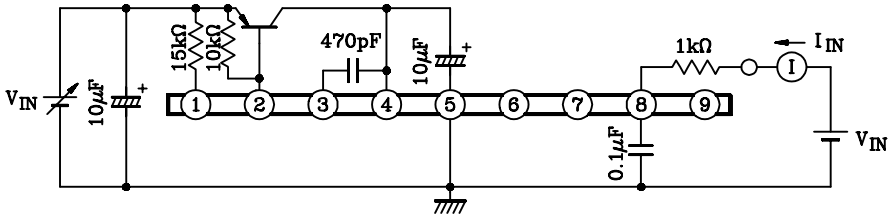
2. $V_{OL(\overline{RESET})}$



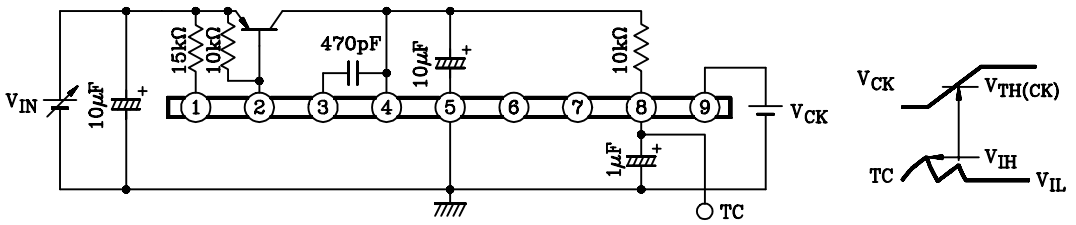
3. $I_{LEAK(\overline{RESET})}$



4. $I_{IN(TC)}$

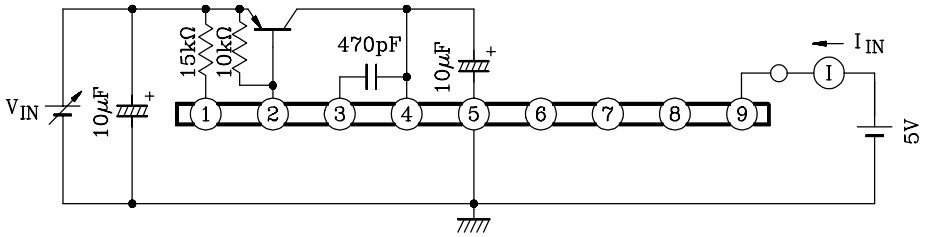


5. V_{IH}, $V_{IL(TC)}$, V_{IH}, $V_{IL(CK)}$

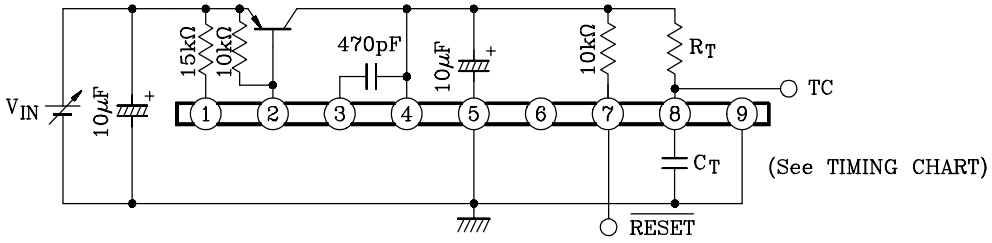


TEST CIRCUIT

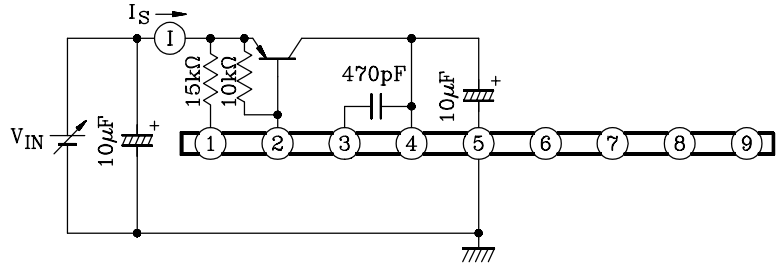
6. $I_{IN(CK)}$



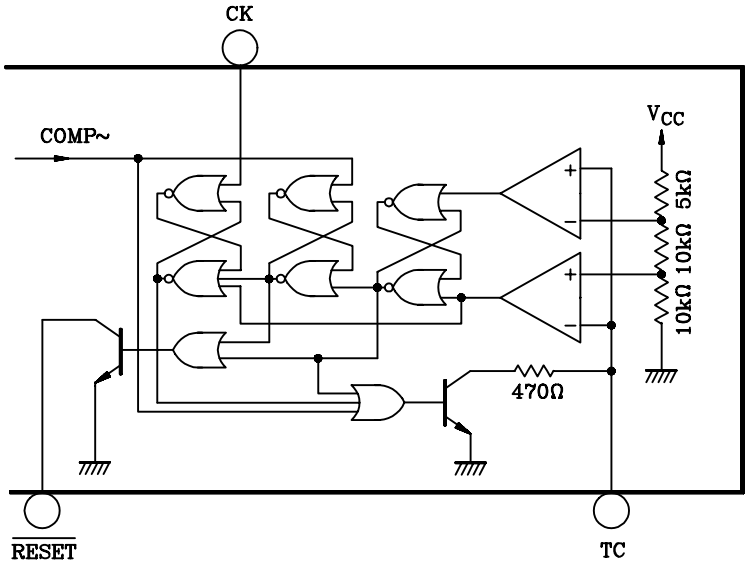
7. V_{RESET}, T_{WD}, $T_{RST(1)}$, $T_{RST(2)}$



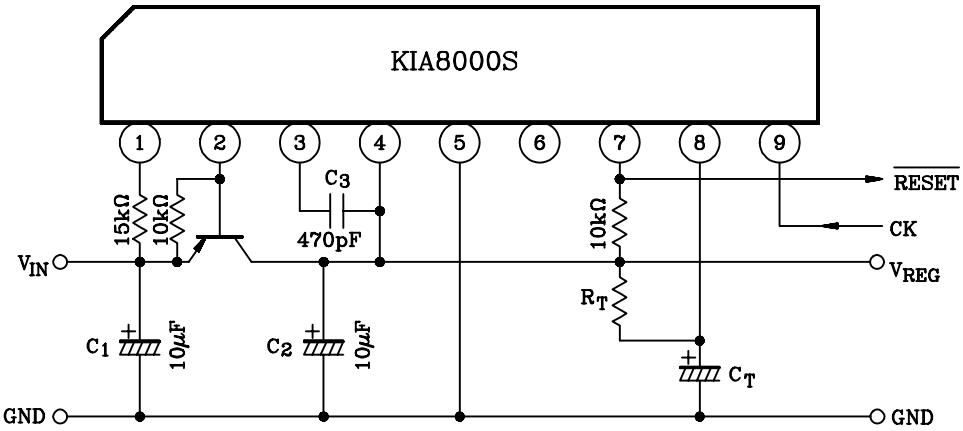
8. I_S



RESET TIMER EQUIVALENT CIRCUIT



EXAMPLE OF APLLICATION CIRCUIT

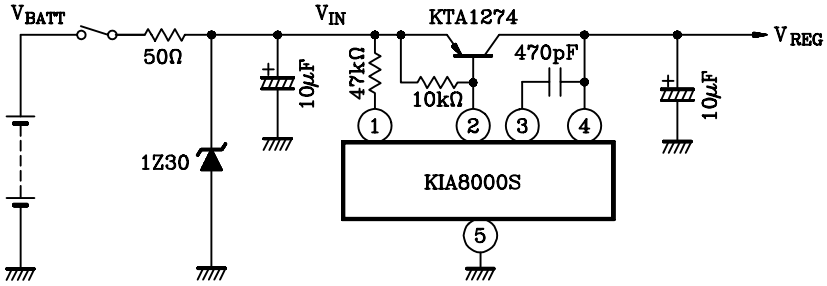


* Cautions for wiring
  1. C_1 and C_2 are for absorbing disturbance, noise, etc. Connect them as close to the IC as possible.
  2. C_3 is for phase compensation. Also, connect C_3 close to the IC.

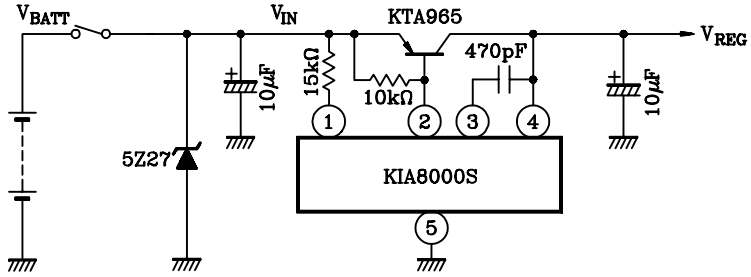
120V Vpeak LOAD DUMP

Note : No protection is needed if a voltage above 80V is not applied.

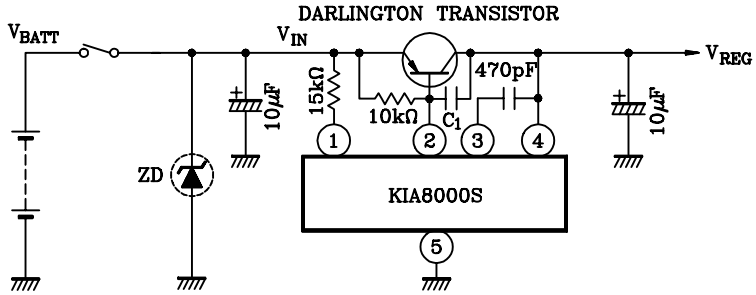
1. Low output current circuit
   I_{LOAD}=10mA Max. V_{BATT}=6~17V



2. High output current circuit.
I_{LOAD}=300mA Max. V_{BATT}=6~17V



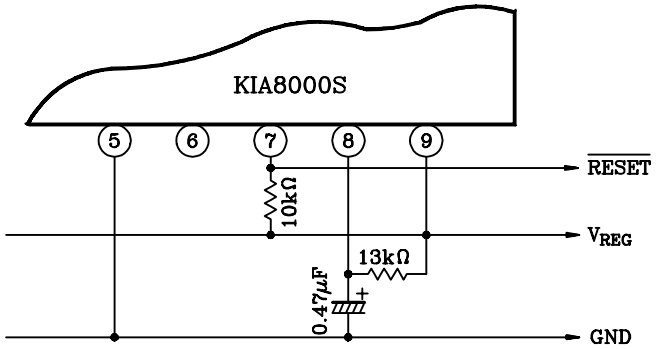
EXAMPLE OF APPLICATION CIRCUIT USING DARLINGTON TRANSISTOR



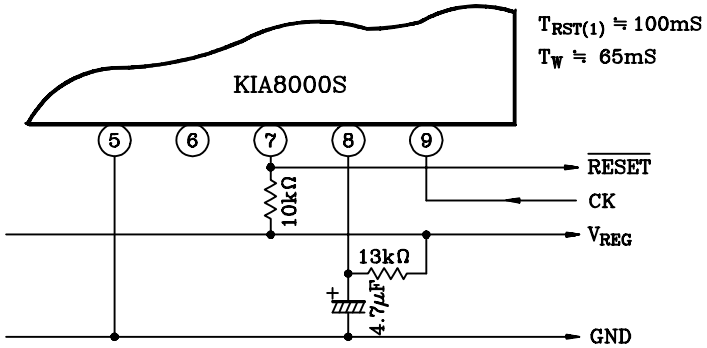
* · Select a C1 value according to the working condition : typically above 2000pF.
· Insert ZD when necessary.

APPLICATION CIRCUIT OF WATCHDOG/RESET TIMER

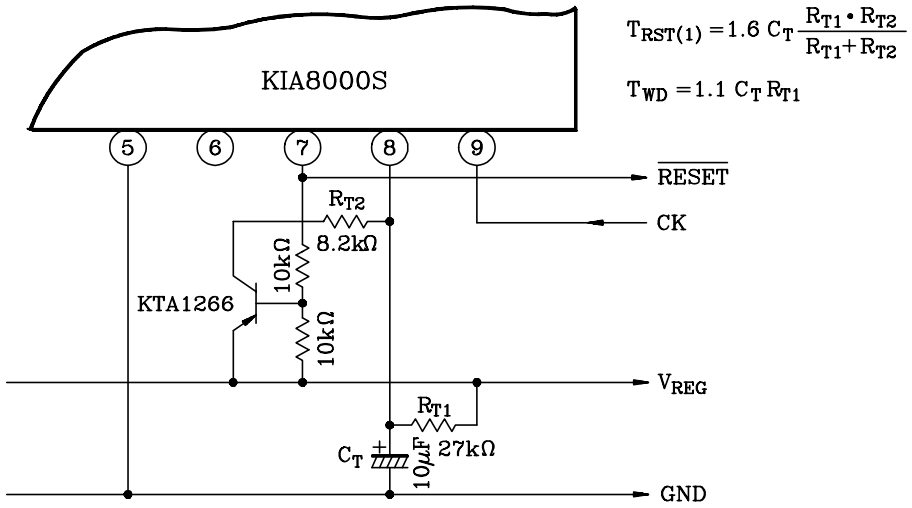
1. $T_{RST(1)}$≒10mS ····· Power On Reset Timer.



2. $T_{RST(1)}$≒1.5T_{WD}



3. $T_{RST(1)} \fallingdotseq 100mS$, $T_{WD} \fallingdotseq 300mS$



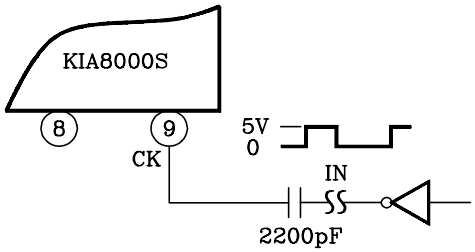
4. RECOMMENDED CONDITIONS

PARTS 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

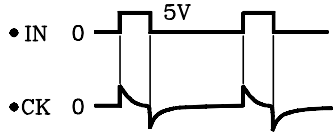
Note : $R_{T1}//R_{T2}=(R_{T1} \times R_{T2})/(R_{T1} + R_{T2})$

APPLICATION CIRCUIT OF CK INPUT

Capacitor Coupling

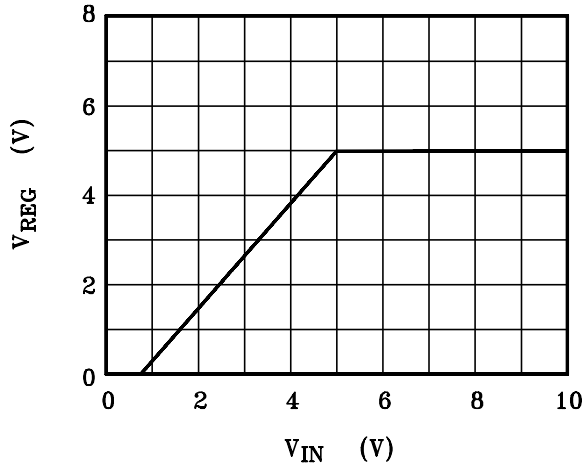


Timing Chart

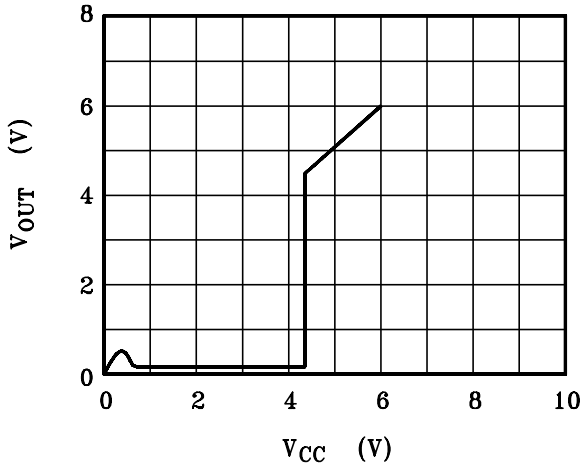


The capacitor coupling allows reset pulses to be supplied intermittenly form the $\overline{RESET}$ pin whether the input level (IN) is high or low.

1. Input-output characteristic
(R_L=25Ω, external transistor KTA965)



2. Reset Output Characteristic



3. Output Adjusting Resistance Characteristic