



INTEGRATED CIRCUIT

TECHNICAL DATA

TA7317P

TOSHIBA BIPOLAR LINEAR INTEGRATED CIRCUIT

SILICON MONOLITHIC

PROTECTION CIRCUIT FOR OCL POWER AMPLIFIER AND SPEAKER

- Over current detecting circuit
Operation at the time of over load, such as a speaker terminal short.
- DC voltage detecting circuit
Operation at the time when positive or negative DC voltage ($\pm 1.1V$ of detection level) has generated at output terminals.
- Muting circuit
Transient noise protection when power is ON-OFF.
- Relay driver circuit (Drive current of 130mA at Max.)
- Operation by dual power supply.

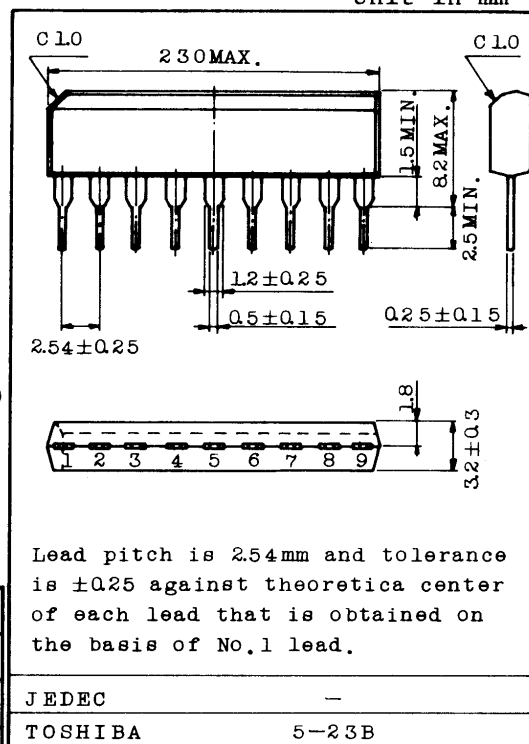
MAXIMUM RATINGS ($T_a=25^\circ C$)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Supply Voltage	V_{CC}	60	V
Relay Driver Output Current	I_{OUT}	130	mA
Power Dissipation	P_D	500	mW
Operating Temperature	T_{opr}	$-20 \sim 75$	$^\circ C$
Storage Temperature	T_{stg}	$-55 \sim 150$	$^\circ C$

ELECTRICAL CHARACTERISTICS ($V_{CC}=\pm 50V$, $T_a=25^\circ C$)

CHARACTERISTIC	SYMBOL	TEST CIR- CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Supply Current	$I_{CC ON}$	-	$V_1 IN=-5V$, $\pm V_{DC}=0V$, SW:OFF	-	54	-	mA
	$I_{CC OFF}$	-	$V_1 IN=0V$, $\pm V_{DC}=0V$, SW:OFF	1.5	2.4	4	
DC Detector Voltage	$+V_{DC}$	-	Note 1	0.9	1.1	1.3	V
	$-V_{DC}$	-	Note 1	-0.9	-1.1	-1.3	
Output Voltage	$V_{OUT(ON)}$	-	$V_1 IN=-5V$, $\pm V_{DC}=0V$, SW:OFF	-	1	2	V
	$V_{OUT(OFF)}$	-	$V_1 IN=0V$, $\pm V_{DC}=0V$, SW:OFF	-	50	-	
Muting Time at Power ON	M.T ($V_{CC ON}$)	-	Note 2	-	4	-	sec
Muting Time with Load Shorted	M.T	-	Note 3	-	3.5	-	sec
Pin 8 Entering Current	I_8	-	-	2	8	-	μA
Pin 9 Terminal Voltage	V_9	-	-	-	3.1	-	V
Pin 1 Terminal Voltage	V_1	-	-	-	0.75	-	V
Pin 5 Terminal Voltage	V_5	-	-	-	-0.75	-	V

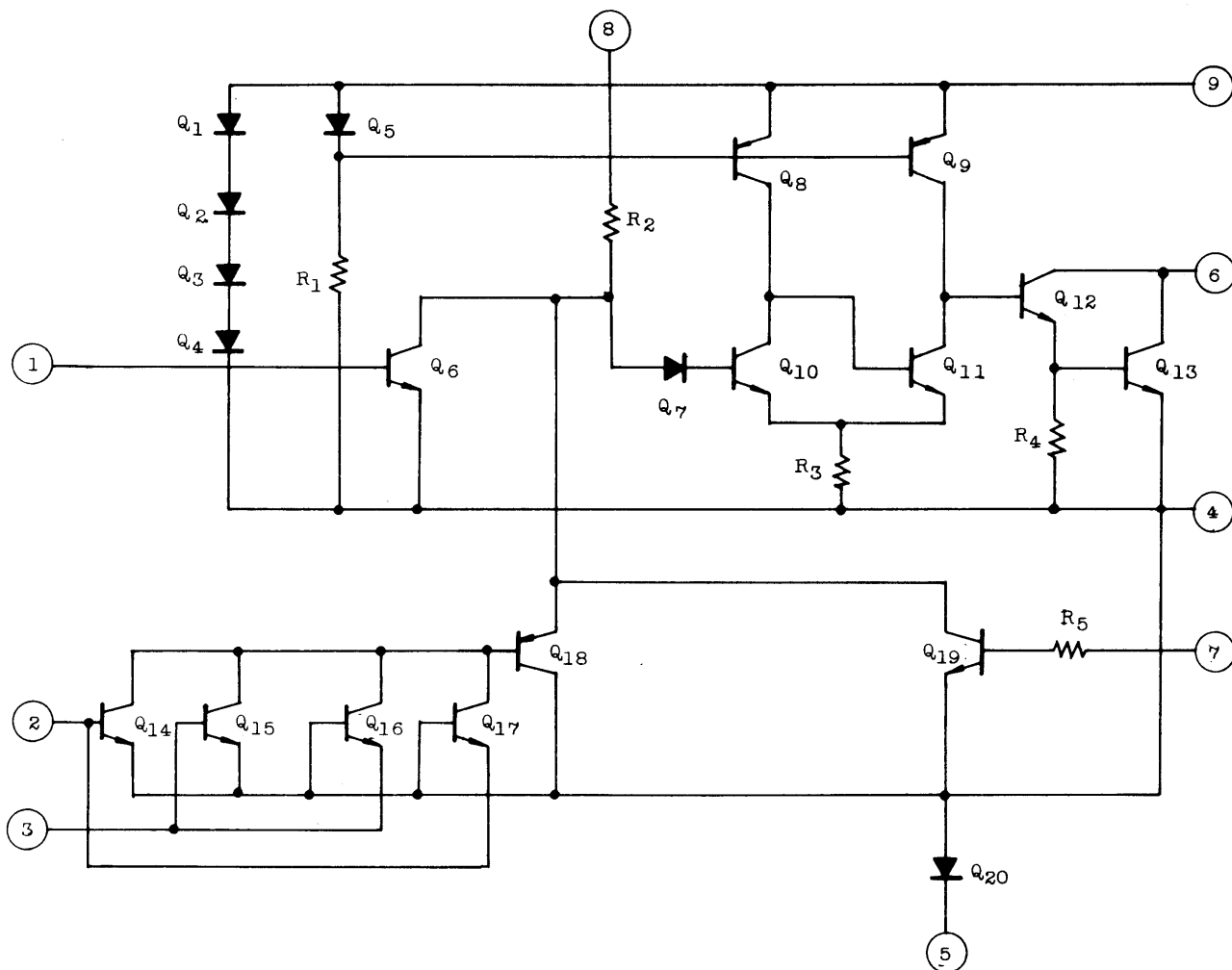
Unit in mm



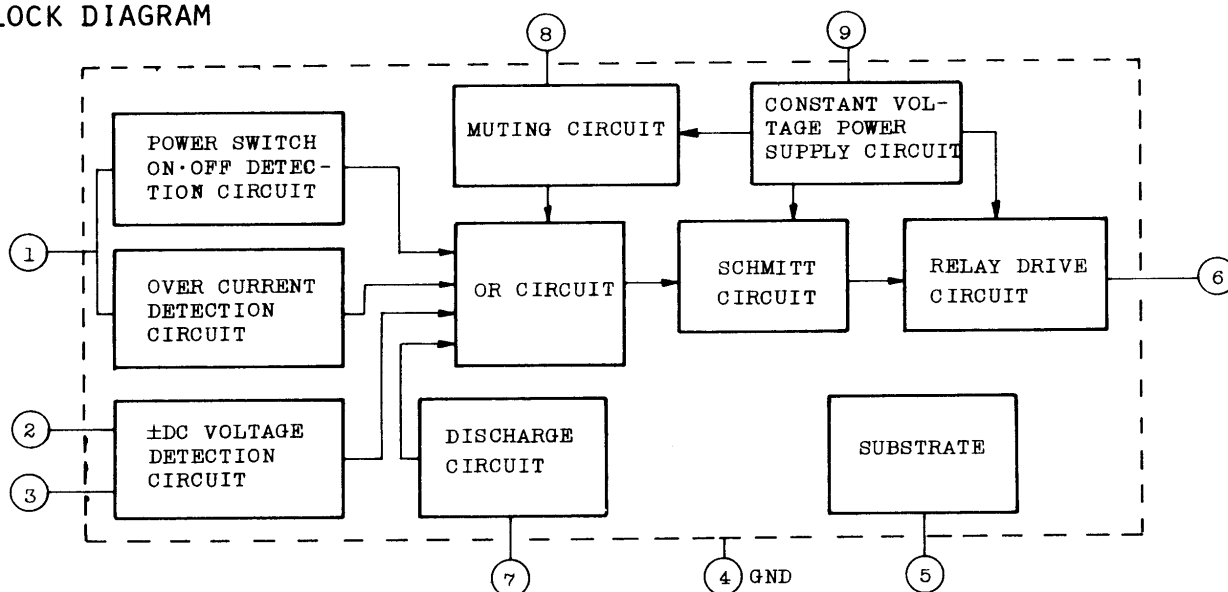
MAXIMUM INTO OR OUT CURRENT

CHARACTERISTIC	SYMBOL	RATING	UNIT
Pin 1 Current	I_1	± 1.0	mA
Pin 2 Current	I_2	± 1.0	mA
Pin 3 Current	I_3	± 1.0	mA
Pin 5 Current	I_5	-6.0	mA
Pin 7 Current	I_7	1.0	mA
Pin 9 Current	I_9	5.0	mA

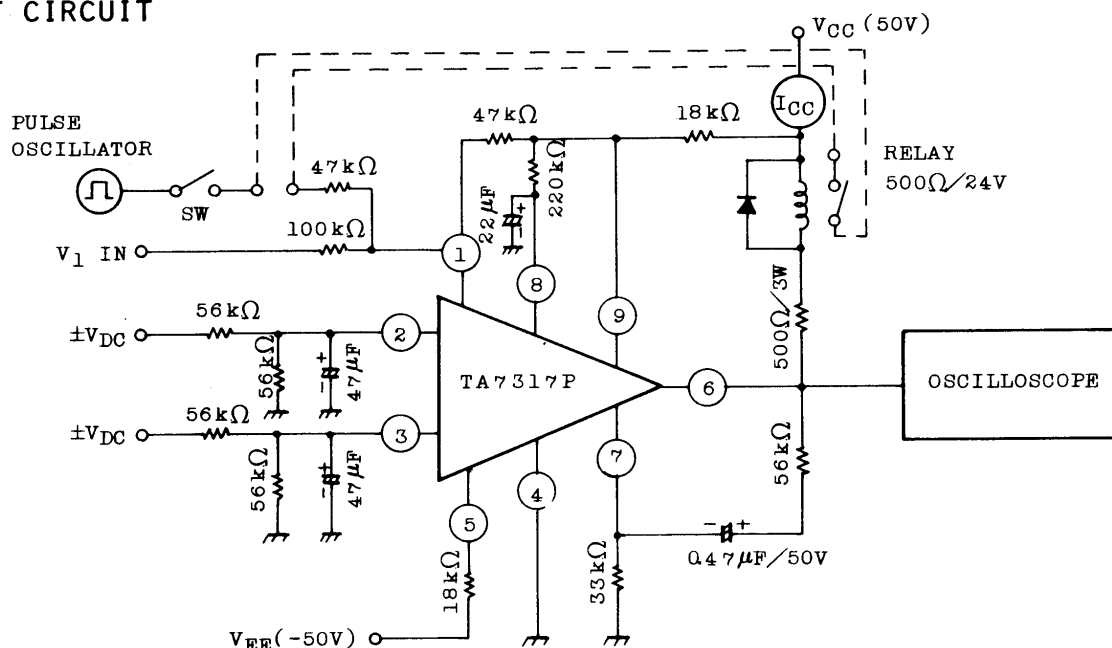
EQUIVALENT CIRCUIT



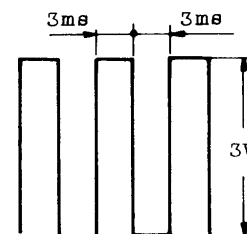
BLOCK DIAGRAM



TEST CIRCUIT

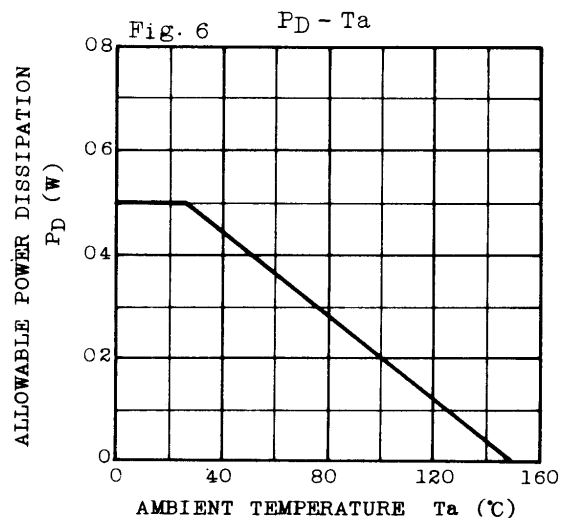
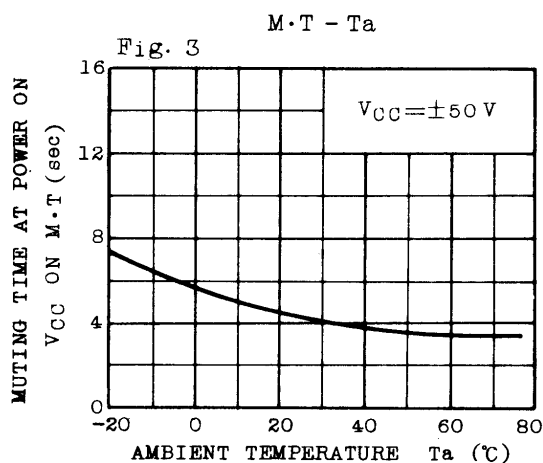
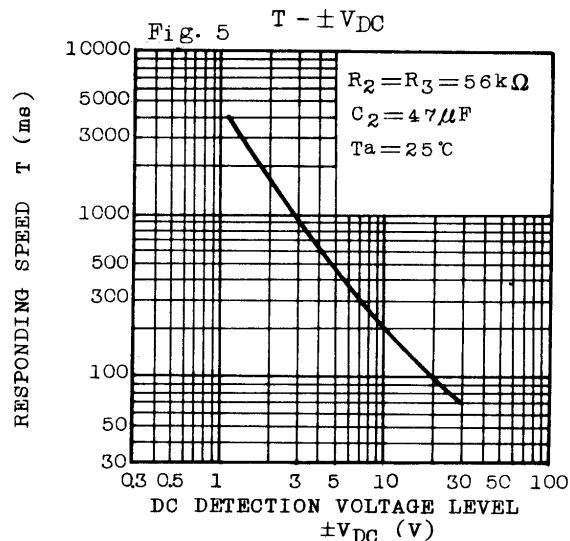
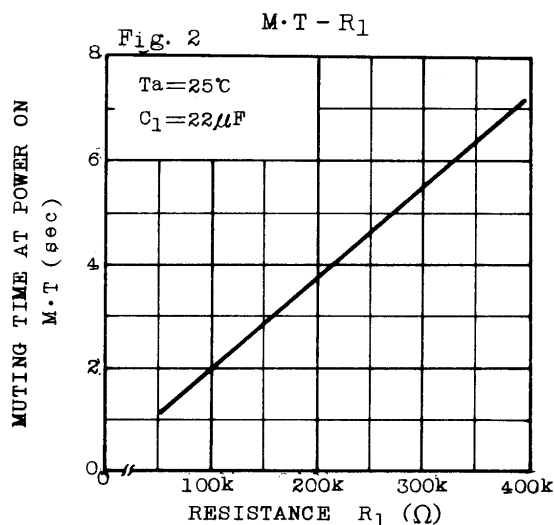
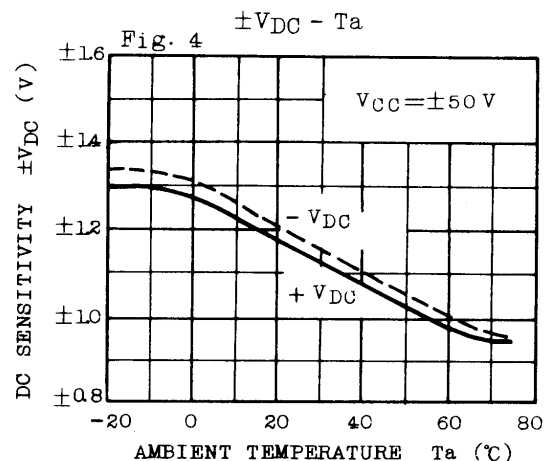
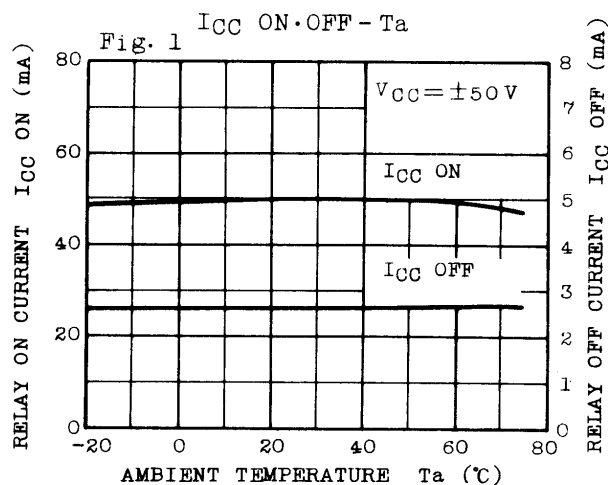


- (Note) 1. The value of $\pm V_{DC}$ at the time when the relay is turned from ON to OFF in the condition of $V_1 \text{ IN} = -5V$ and SW-OFF.
2. The time required for the relay being turned from OFF to ON at $+V_{CC}$ ON in the condition of $V_1 \text{ IN} = -5V$, $\pm V_{DC} = 0V$, and SW-OFF.
3. The duration of the relay being able to keep OFF when SW is turned ON in the condition of $V_1 \text{ IN} = -5V$ and $\pm V_{DC} = 0V$. At that time input pulse is 3ms -3V.

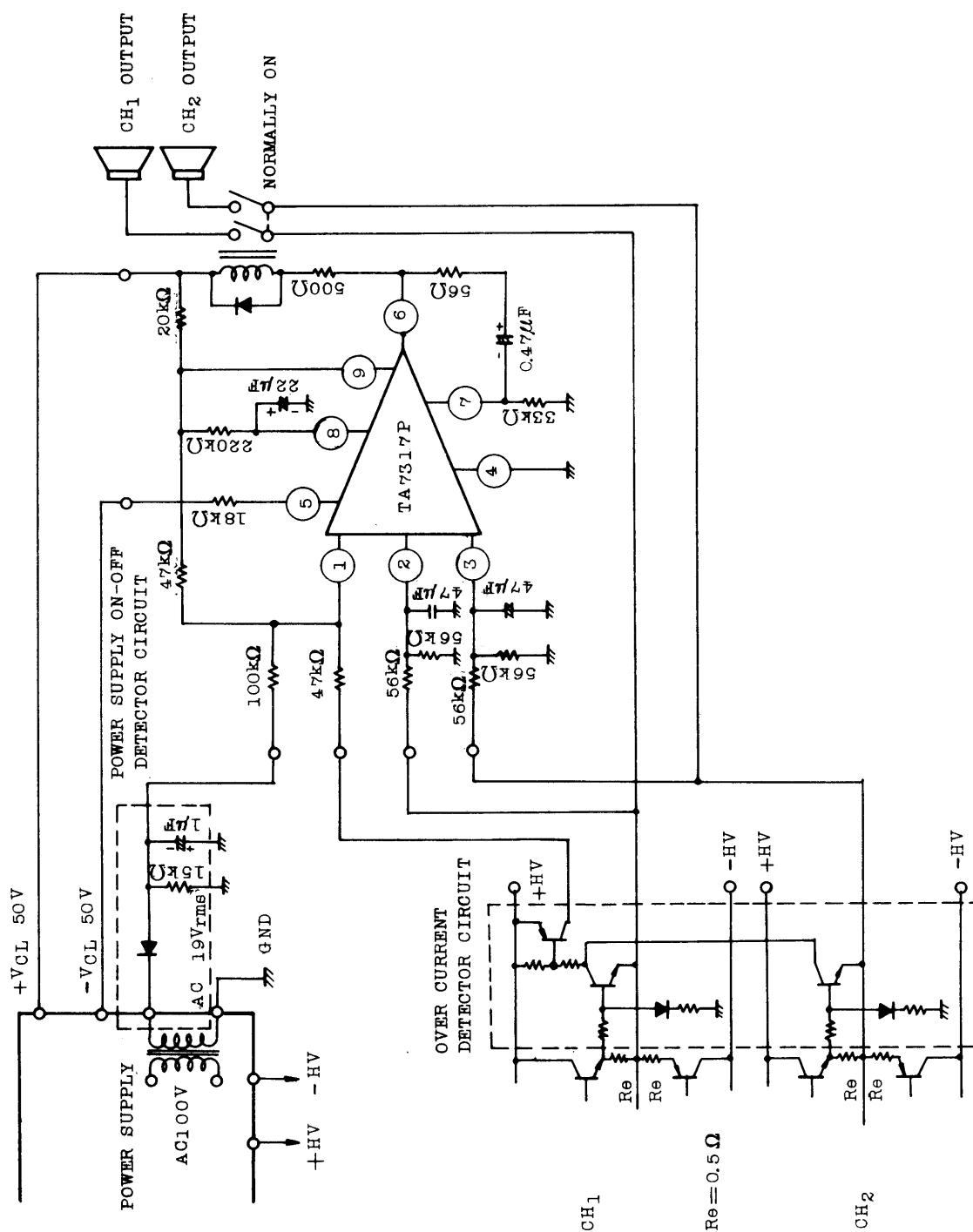


TECHNICAL DATA

* Figs.1,3,4 shows that C_1, C_3 and relay are in the state of room temperature.

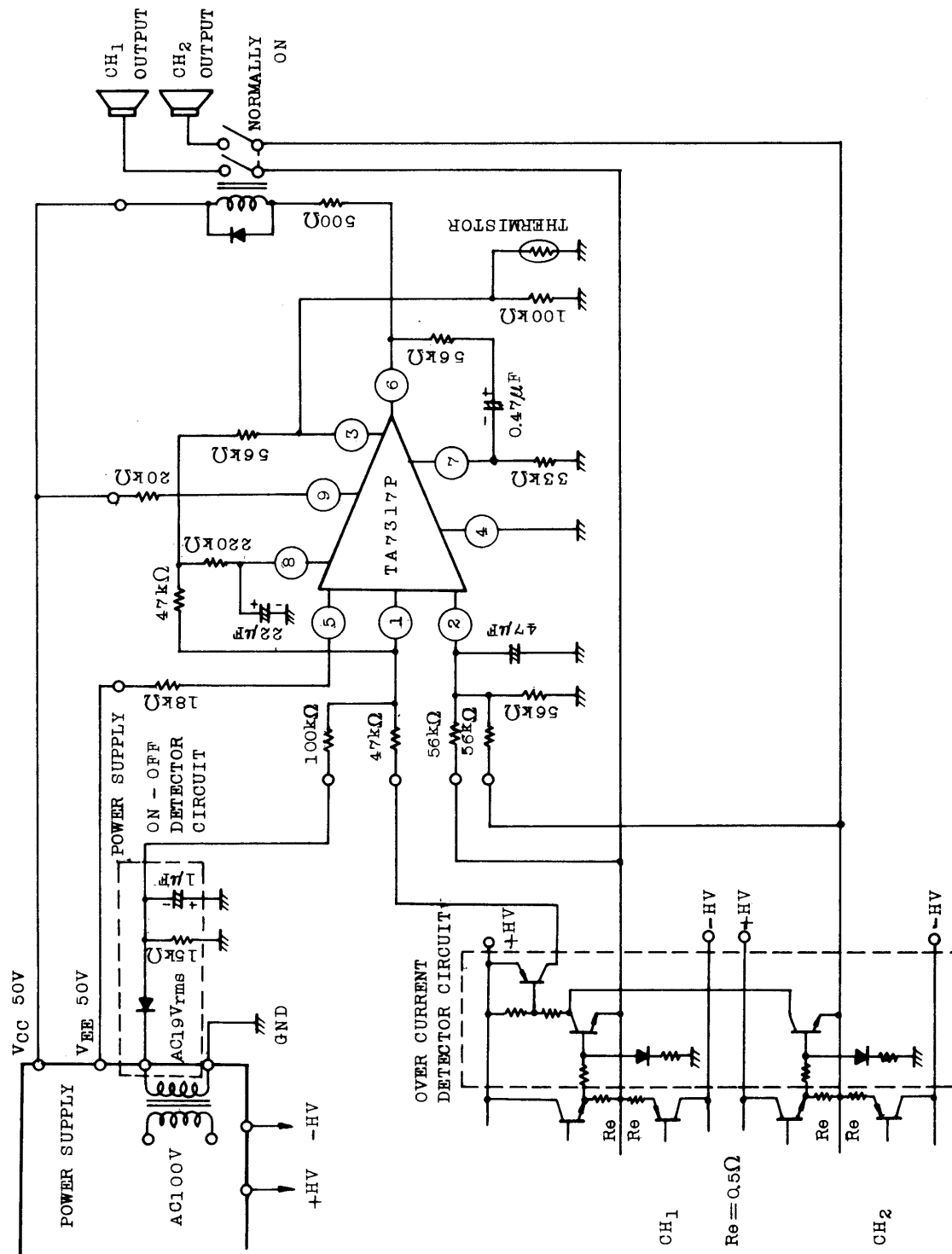


EXAMPLE OF APPLICATION CIRCUIT 1.

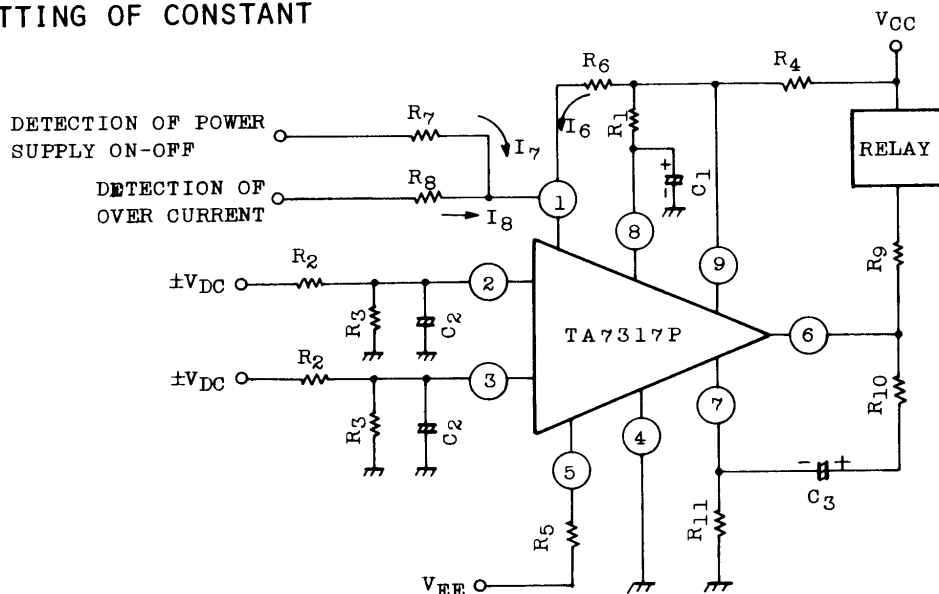


APPLICATION CIRCUIT 2.

(In case where 3 pin is used for detecting temperature)



SETTING OF CONSTANT



1. Setting of R_1 and C_1

The muting time (MT) at the time when the power supply is turned on, is determined by the time constants of R_1 and C_1 . The approximate value can be obtained from the following theoretical formula:

$$MT = C_1 R_1 \ln \left(\frac{1}{1 - \frac{V_8}{V_9}} \right),$$

where V_9 is made into a constant voltage in the IC, and $V_9 = 3.1V$.

When V_8 has become about 1.3V, the relay is turned ON.

However, since the discharge circuit connected to pin 7 at the instant the power supply has been turned ON, there is some difference between the actual value and the theoretical value.

Fig. 2 shows the measured value of R_1 to the muting time (MT) in case of $C_1 = 22\mu F$.

2. Setting of R_2 , R_3 and C_2

The R_2 , R_3 and C_2 not only determine the level sensitivity (time) detecting the DC voltage, but also operate as a filter bypassing an AC signal.



The time constant of this filter is $T=C_2R_2R_3/(R_2+R_3)$; therefore, let the lowest frequency of the desired amplifier be f_L , this time constant should be selected to $f_L \gg \frac{1}{2\pi T}$. And, the DC detecting voltage is so set that relay is ON when the absolute value of pin 2-voltage (or pin 3-voltage) is increased more than about 0.6V~0.8V;

accordingly, the level should be set so that $\frac{R_3}{R_2+R_3} V_{DC} > 0.6V \sim 0.8V$.

As an example, Fig.5 shows the DC voltage detecting level corresponding sensitivity (with the relay ON).

3. Setting of R_4 and R_5

R_4 is a resistance to determine a current flowing into Pin 9. The current value should be set so as to become 2~3mA.

When these resistances are used under the condition that $+V_{CC}=50V$, since V_9 is 3.1V fixed, then

$$V_{CC}-V_9=46.9V$$

Let the flowing current be 2.5mA,

$$R_4 = \frac{46.9V}{2.5mA} = 17.96k\Omega \dots\dots 18k\Omega \text{ should be used for } R_4.$$

R_5 determines a current to (pull) draw from the substrate so that the current become 3mA. If it is used under the condition that $V_{EE}=-50V$, $V_5 \approx -0.75V$ because V_5 is the value in the forward voltage of Q20. If I_5 is 3mA, because $V_5-(V_{EE})=49.25V$:

$$R_5 = \frac{49.25V}{3mA} = 16.42k\Omega \dots\dots 18k\Omega \text{ should be used for } R_5.$$

4. Setting of R₆, R₇ and R₈

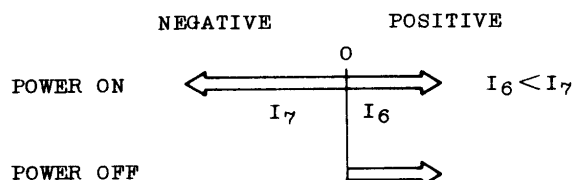
R₆ and R₇ can determine the power supply ON or OFF, and R₈ can determine the over current. R₆ should be so designed that the current approx.

50 A fully driving Q₈ can be flown.

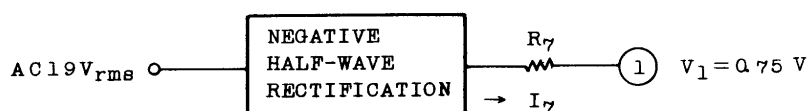
Since V₉=3.1V and V₁=0.75V, V₉-V₁=2.35V, therefore;

$$R_6 = \frac{2.35V}{50\mu A} = 47k\Omega \dots\dots 47k\Omega \text{ should be used } R_6.$$

The currents flowing to R₆, R₇ and R₈ be I₆, I₇ and I₈ respectively, the current relation at time of the detection of power supply ON and OFF is as follows: (The current flowing in Pin 1 is considered as a positive current).



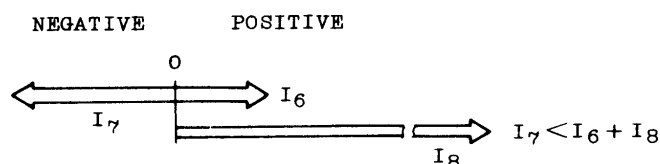
Therefore, R₇ create form I₇ which satisfies I₆ < I₇. For example, when detection is made from AC 19V_{rms}, if I₇ is 260 A, R₇ is as follows:



$$19V_{rms} = \sqrt{2} \ 19V_{p-p} \doteq 26V_{p-p}$$

$$R_7 = \frac{26}{0.26mA} = 100k\Omega \dots\dots 100k\Omega \text{ is used for } R_7.$$

Similarly, at time of load detection, the current relation is as follows:





Compared I₈ with I₆ and I₇, it is a larger current; therefore, R₈ functions a protector for detection circuit input. Here, 47kΩ is used for R₈.

5. Setting of R₉

R₉ determines the current to flow to the relay. The relay specification be 500Ω/24V, and the current of approx. 50mA be flown, V_{CC}=50V, and V₆=V_{CE(sat)} Q₁₃≈1V

Therefore, $(R_9 + 500\Omega) = \frac{49V}{50mA} = 1k\Omega \dots\dots 500\Omega$ is used for R₉.

6. Setting of R₁₀, R₁₁ and C₃

R₁₀ and C₃ are a resistance and a capacitor which function to allow the discharge circuit to operate instantly. The time constants of them should be extremely short. Here, R₁₀=56kΩ and C₃=0.47μF are used.

R₁₁ is a resistance for mis-operating of discharge circuit, in which R₁₁=33kΩ.

7. The response time of output transistor (relay driver) is designed so as to operate more quickly and more stably by means of Schmitt circuit; in case of OFF→ON, the response time is approx. 0.5μs, while, in case of ON→OFF, the response time is approx. 0.2μs,

8. The power dissipation of IC can be obtained from the following formular:

$$P_D \doteq V_{OUT(ON)} \cdot \frac{V_{CC} - V_{OUT(ON)}}{R_R + R_S} + I_{CC(OFF)} \cdot V_9$$

R_R : Relay DC resistance

R_S : Series resistance

V₉ : 9-pin voltage (3.1V TYP.)

In case V_{CC}=50V, R_R=500Ω, R_S=500Ω,

$$P_D \doteq 111.5(mV)$$