

To all our customers

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## **Regarding the change of names mentioned in the document, such as Mitsubishi Electric and Mitsubishi XX, to Renesas Technology Corp.**

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The semiconductor operations of Hitachi and Mitsubishi Electric were transferred to Renesas Technology Corporation on April 1st 2003. These operations include microcomputer, logic, analog and discrete devices, and memory chips other than DRAMs (flash memory, SRAMs etc.)

Accordingly, although Mitsubishi Electric, Mitsubishi Electric Corporation, Mitsubishi Semiconductors, and other Mitsubishi brand names are mentioned in the document, these names have in fact all been changed to Renesas Technology Corp. Thank you for your understanding. Except for our corporate trademark, logo and corporate statement, no changes whatsoever have been made to the contents of the document, and these changes do not constitute any alteration to the contents of the document itself.

Note : Mitsubishi Electric will continue the business operations of high frequency & optical devices and power devices.

Renesas Technology Corp.  
Customer Support Dept.  
April 1, 2003

# M5294P

## SYSTEM RESET IC WITH LOW INPUT-OUTPUT VOLTAGE DIFFERENTIAL TYPE $\pm 5V$ REGULATOR, AND 3.0V REGULATOR FOR MUTE FUNCTION

### DESCRIPTION

M5294P is a semiconductor integrated circuit designed for dual tracking type voltage regulator, which includes system reset circuit, and 3.0V regulator for mute function.

Since the output voltage ( $\pm 5V$ , 3V) are fixed inside, and this IC includes pull-up resistor ( $10k\Omega$ ) of reset output, User can omit the outside parts.  $\pm 5V$  output is low power dissipation type, that is to say, this is able to operate even if input-output voltage difference is very low status such as 0.2V ( $I_O = \pm 100mA$ ). Therefore, User can shrink the input transformer.

User can prevent making a noise by means of operating mute function before Power supply ( $\pm 5V$ ) of Amplifier starts up, for 3.0V regulator for mute function starts up earlier than  $\pm 5V$  output.

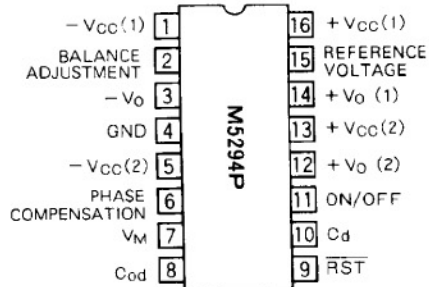
### FEATURES

- Fixed output voltage
- Power supply for mute function
- Very low input-output voltage differential operation
- Current limiting circuit
  - $\pm 5V$  output . . . . . short circuit protection with current fold back
  - mute output . . . . . short circuit protection
- Thermal protection circuit
- Capable on/off control (11-pin terminal)
- Internal system reset circuit with pull-up resistor, hysteresis detectable voltage . . . . . 3.9V (delay time is variable by connecting capacity at 7-pin terminal)

### APPLICATION

CD, VCR and dual power supply power system

### PIN CONFIGURATION (TOP VIEW)

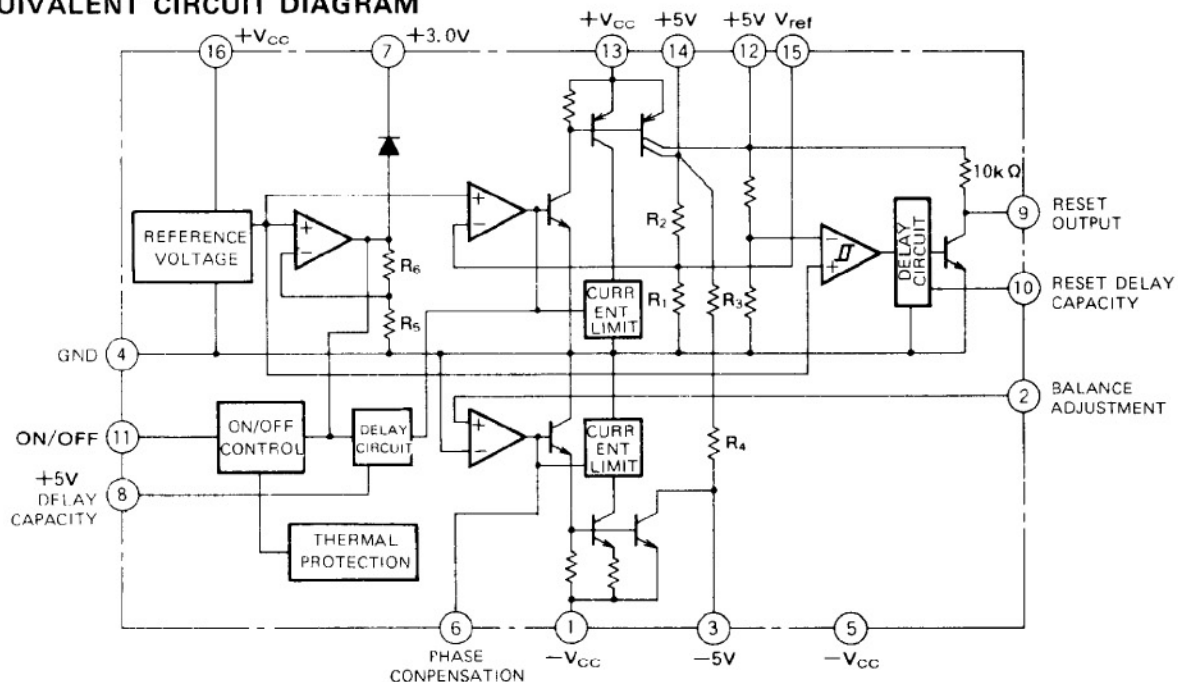


Outline 16P4

Note 1: Please use the capacitor not to depend on the ambient temperature.

2: Please connect  $-V_{CC}(1)$  and  $-V_{CC}(2)$ ,  $+V_{CC}(1)$  and  $+V_{CC}(2)$ ,  $+V_O(1)$  and  $+V_O(2)$ , firmly each other.

### EQUIVALENT CIRCUIT DIAGRAM

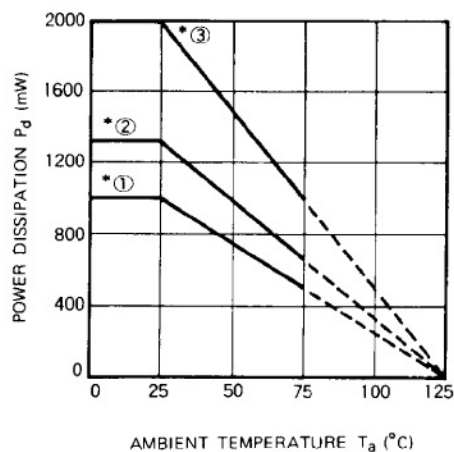


**SYSTEM RESET IC WITH LOW INPUT-OUTPUT VOLTAGE DIFFERENTIAL  
TYPE  $\pm 5V$  REGULATOR, AND 3.0V REGULATOR FOR MUTE FUNCTION**

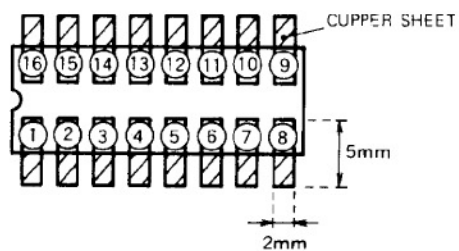
**ABSOLUTE MAXIMAM RATINGS** ( $T_a = 25^\circ\text{C}$ , unless otherwise noted)

| Symbol          | Parameter                       | Conditions                  | Ratings                                         | Unit                 |
|-----------------|---------------------------------|-----------------------------|-------------------------------------------------|----------------------|
| $V_{CC}$        | Supply voltage                  |                             | $\pm 15(30)$                                    | V                    |
| $I_{LP\oplus}$  | Positive load current           |                             | + 200                                           | mA                   |
| $I_{LP\ominus}$ | Negative load current           |                             | - 200                                           | mA                   |
| $I_{LPM}$       | Mute regulator load current     |                             | 10                                              | mA                   |
| $V_{DIF}$       | Input/Output voltage difference |                             | $\pm 10$                                        | V                    |
| $P_d$           | Power dissipation               |                             | 1.0<br>without sheet for<br>setting free fever  | W                    |
| $K_\theta$      | Thermal derating                | $T_a \geq 25^\circ\text{C}$ | 10.0<br>without sheet for<br>setting free fever | mW/ $^\circ\text{C}$ |
| $T_{opr}$       | Ambient temperature             |                             | $-20 \sim +75$                                  | $^\circ\text{C}$     |
| $T_{stg}$       | Storage temperature             |                             | $-55 \sim +125$                                 | $^\circ\text{C}$     |

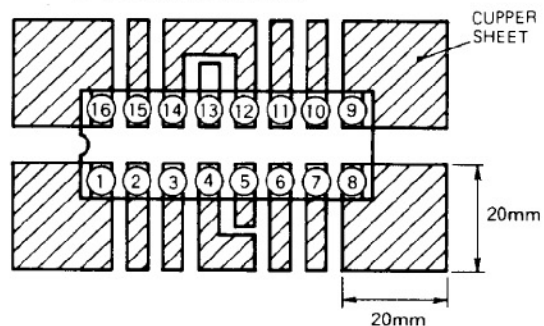
**THERMAL DELATING**



\*① Condition as follow



\*② Condition as follow



\*③ Allowable Power dissipation in setting free fever  
infinitely

When the Power loss in the IC is large, please design for  
setting free fever not to be  $125^\circ\text{C}$  at junction.

**SYSTEM RESET IC WITH LOW INPUT-OUTPUT VOLTAGE DIFFERENTIAL  
TYPE  $\pm 5V$  REGULATOR, AND 3.0V REGULATOR FOR MUTE FUNCTION****ELECTRICAL CHARACTERISTICS** ( $V_{IN} = \pm 7V$ ,  $I_{O+} = 100mA$ ,  $I_{O-} = -100mA$ ,  $T_a = 25^\circ C$ )

| Symbol       | Parameter                | Test conditions   | Limits |      |      | Unit |
|--------------|--------------------------|-------------------|--------|------|------|------|
|              |                          |                   | Min    | Typ  | Max  |      |
| $I_{CC+}$    | Positive circuit current | without load      | —      | 6    | 10   | mA   |
| $I_{CC-}$    | Negative circuit current | without load      | —      | -1.5 | -5.0 | mA   |
| $I_{LOSS+1}$ | Loss current             | $I_{O+} = 100mA$  | —      | 10   | 30   | mA   |
| $I_{LOSS+2}$ |                          | $I_{O+} = 200mA$  | —      | 30   | 90   | mA   |
| $I_{LOSS-1}$ |                          | $I_{O-} = -100mA$ | —      | -2   | -20  | mA   |
| $I_{LOSS-2}$ |                          | $I_{O-} = -200mA$ | —      | -5   | -40  | mA   |

**REGULATOR PART**

| Symbol                     | Parameter                         | Test conditions                        | Limits     |           |            | Unit          |
|----------------------------|-----------------------------------|----------------------------------------|------------|-----------|------------|---------------|
|                            |                                   |                                        | Min        | Typ       | Max        |               |
| $V_O$                      | Output voltage                    |                                        | $\pm 4.75$ | $\pm 5.0$ | $\pm 5.25$ | V             |
| REG-in                     | Input voltage rejection           | $V_{CC} \pm 6 \sim \pm 10V$            | —          | 0.05      | 0.2        | %/V           |
| REG-o                      | Load voltage rejection            | $I_O = 1 \sim 100mA$                   | —          | 20        | 100        | mV            |
| R.R(+)                     | Positive ripple rejection         | $C_{REF} = 1\mu F$ , $f = 120Hz$       | 60         | 85        | —          | dB            |
| R.R(-)                     | Negative ripple rejection         | $C_{REF} = 1\mu F$ , $f = 120Hz$       | 50         | 60        | —          | dB            |
| $\Delta V(\oplus \ominus)$ | Dual voltage tracking             |                                        | —          | 0.5       | 5          | %             |
| $V_{NO}$                   | Output noise voltage              | $f = 20Hz \sim 100kHz$                 | —          | 20        | —          | $\mu V_{rms}$ |
| $V_{O(off)}$               | Output cut-off voltage            | $0V \leq \text{pin voltage} \leq 0.2V$ | —          | —         | 0.1        | V             |
| $V_{ref}$                  | Reference input voltage           |                                        | 1.13       | 1.24      | 1.35       | V             |
| $V_{DIF+}$                 | Input-Output voltage differential | $I_{O+} = 100mA$                       | —          | 0.2       | 0.5        | V             |
| $V_{DIF-}$                 | Input-Output voltage differential | $I_{O-} = -100mA$                      | —          | 0.2       | 0.5        | V             |
| $T_{od}$                   | Output delay time *1              | $C_{od} = 0.1\mu F$                    | 4.5        | 9         | 18         | mS            |
| $I_{OS+}$                  | Output short current              | $T_J = 125^\circ C$                    | —          | 30        | —          | mA            |
| $I_{OS-}$                  |                                   | $T_J = 125^\circ C$                    | —          | 30        | —          | mA            |

**MUTE REGULATOR PART**

| Symbol     | Parameter                       | Test conditions | Limits |     |     | Unit |
|------------|---------------------------------|-----------------|--------|-----|-----|------|
|            |                                 |                 | Min    | Typ | Max |      |
| $V_M$      | Mute output voltage             | $I_{LM} = 3mA$  | 2.7    | 3.0 | 3.3 | V    |
| $V_{DIFM}$ | Input/Output voltage difference | $I_{LM} = 3mA$  | —      | 2.5 | 3.2 | V    |

**RESET PART**

| Symbol       | Parameter                 | Test conditions   | Limits |     |      | Unit |
|--------------|---------------------------|-------------------|--------|-----|------|------|
|              |                           |                   | Min    | Typ | Max  |      |
| $V_S$        | Detected voltage          |                   | 3.70   | 3.9 | 4.10 | V    |
| $\Delta V_S$ | Hysteresis voltage        |                   | 50     | 100 | 200  | mV   |
| $T_{pd}$     | Delay time *2             | $C_d = 0.1\mu F$  | 5.5    | 11  | 22   | mS   |
| $V_{sat}$    | Output saturation voltage | $R_L = 10k\Omega$ | —      | 0.2 | 0.4  | V    |

\*1. The period by when +5V output starts up since MUTE Reg. rises up to 1.5V.

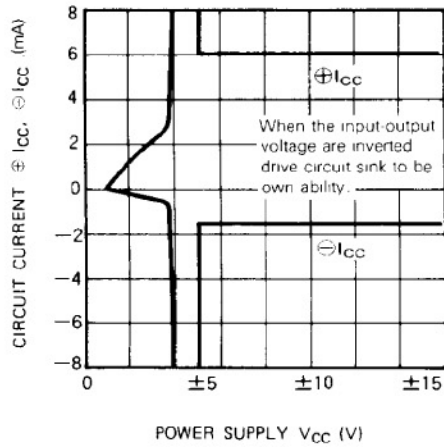
\*2. Reset output includes resistor (10k $\Omega$ ) from the +5V output, but output saturation voltage is condition with outside resistor (10k $\Omega$ ).



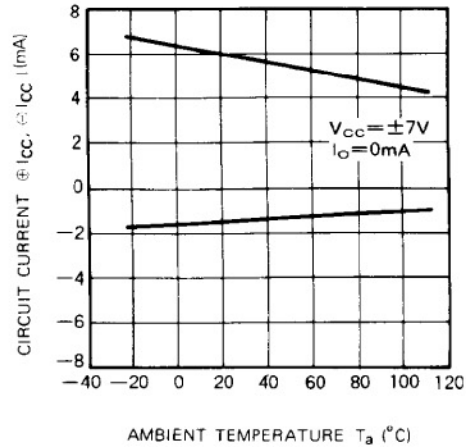
**SYSTEM RESET IC WITH LOW INPUT-OUTPUT VOLTAGE DIFFERENTIAL  
TYPE  $\pm 5\text{V}$  REGULATOR, AND 3.0V REGULATOR FOR MUTE FUNCTION**

**TYPICAL CHARACTERISTICS**

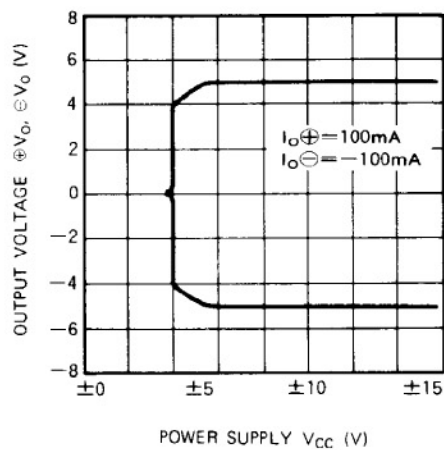
**CIRCUIT CURRENT VS.  
POWER SUPPLY**



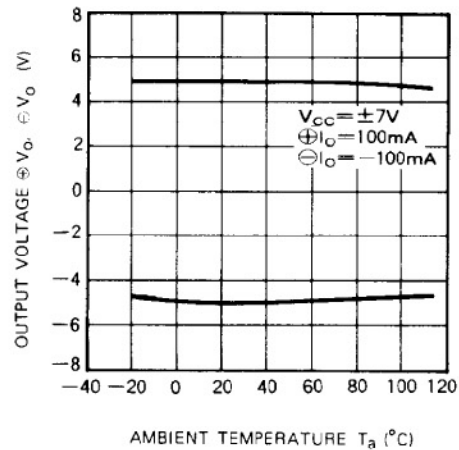
**CIRCUIT CURRENT VS.  
AMBIENT TEMPERATURE**



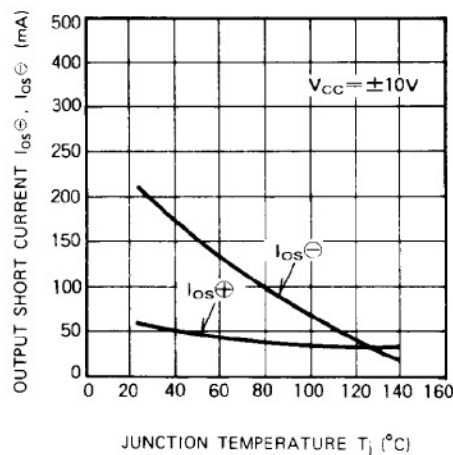
**OUTPUT VOLTAGE VS.  
POWER SUPPLY**



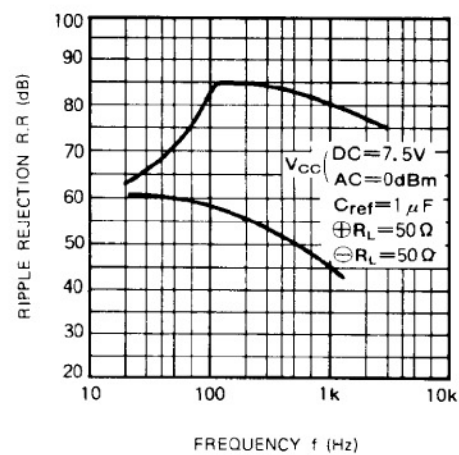
**OUTPUT VOLTAGE VS.  
AMBIENT TEMPERATURE**



**OUTPUT SHORT CURRENT VS.  
JUNCTION TEMPERATURE**

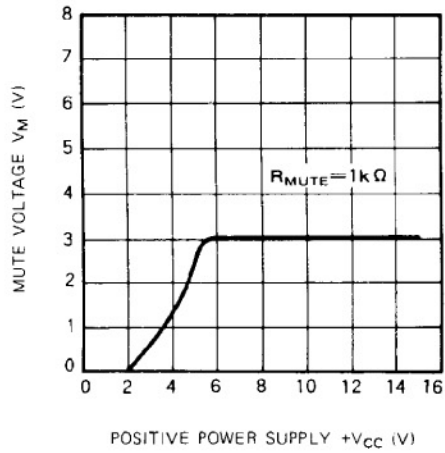


**RIPPLE REJECTION VS. FREQUENCY**

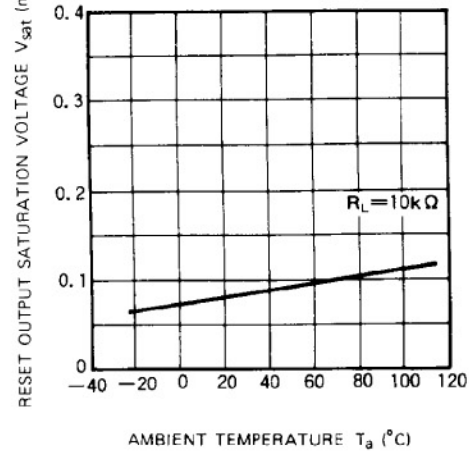


**SYSTEM RESET IC WITH LOW INPUT-OUTPUT VOLTAGE DIFFERENTIAL  
TYPE  $\pm 5V$  REGULATOR, AND 3.0V REGULATOR FOR MUTE FUNCTION**

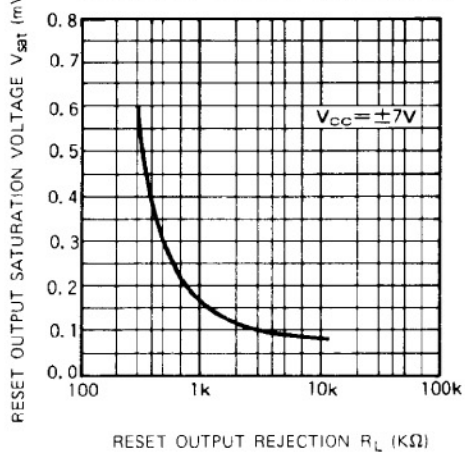
**MUTE VOLTAGE VS. POWER SUPPLY**



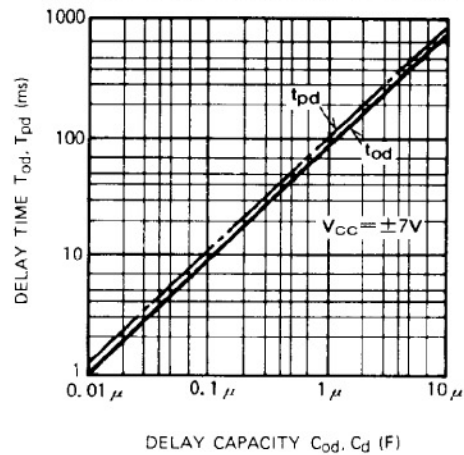
**RESET OUTPUT SATURATION VOLTAGE  
VS. AMBIENT TEMPERATURE**



**RESET OUTPUT SATURATION VOLTAGE  
VS. RESET OUTPUT REJECTION**

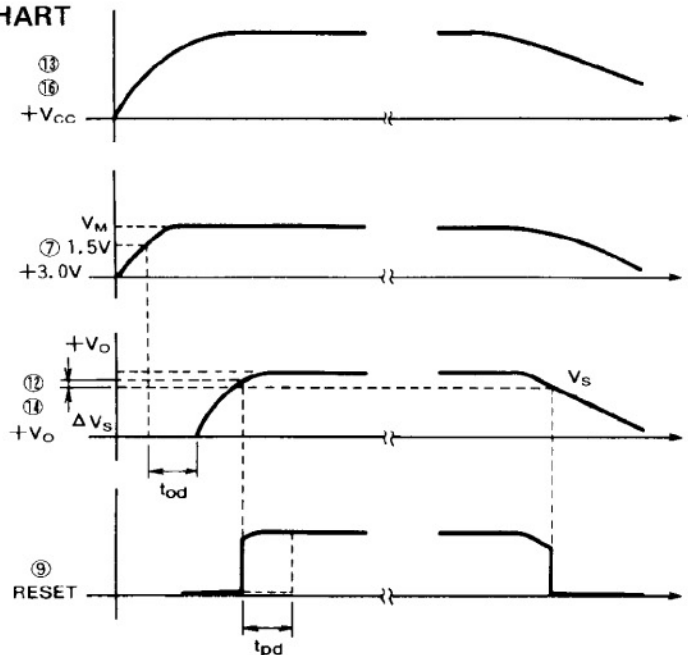


**DELAY TIME VS. DELAY CAPACITY**



# SYSTEM RESET IC WITH LOW INPUT-OUTPUT VOLTAGE DIFFERENTIAL TYPE $\pm 5V$ REGURATOR, AND 3.0V REGULATOR FOR MUTE FUNCTION

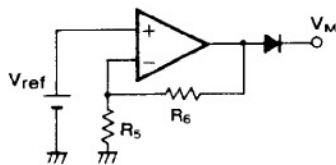
## OUTPUT TIMING CHART



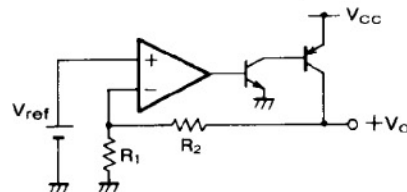
## OPERATING EXPLANATION

- M5294P amplifies the stable reference voltage, and it makes Mute voltage  $V_M$  (3.0V) and Positive output voltage  $+V_O$  (5.0V).

$$V_M = V_{ref} \times \left(1 + \frac{R_6}{R_5}\right) - V_F$$

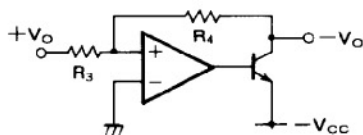


$$+V_O = V_{ref} \times \left(1 + \frac{R_2}{R_1}\right)$$



$+V_O$  is inverted by this IC, and makes  $-V_O$ . (Therefore,  $-V_O$  depend on  $+V_O$ )

$$-V_O = -\frac{R_4}{R_3} \times V_O$$

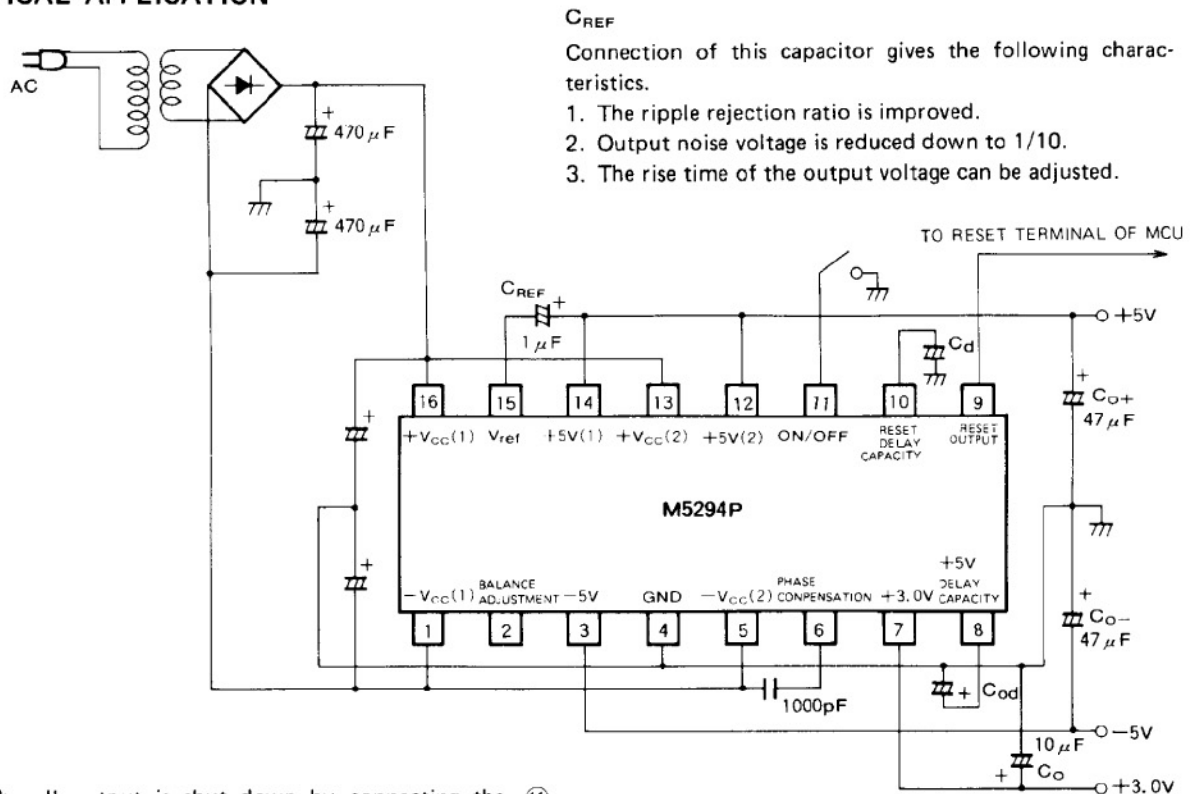


Each  $\pm V_O$  includes the short-circuit protection with current foldback.

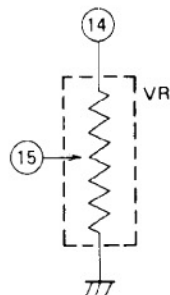
$\pm V_M$  includes the short-circuit protection without current foldback.

- $+V_O$  ( $\pm 5V$ ) output rise up since  $V_M$  (1.5V) rises up to 1.5V.  
 $+V_O$  output delay time  $T_{od}$  is set by adding external capacitor  $C_{od}$ .  
 $T_{od} = 9 \times 10^4 \times C_{od}$  (s)
- Low Reset output is cancelled when  $+V_O$  output rises up to  $V_S + \Delta V_S$  (4.0V TYP). The delay time  $T_{pd}$  is set by adding external capacitor  $C_d$ .  
 $T_{pd} = 11 \times 10^4 \times C_d$  (s)
- $V_M$  is composed through the diode, therefore the transient time rises varies by external capacity and load condition. Consequently,  $\pm V_O$  had been down, and if your system needs MUTE voltage, you have to increase the external capacity.
- The Reset output is low when the  $+V_O$  is down to  $V_S$  (3.9V).

## TYPICAL APPLICATION



1. In adjusting the output voltage (use ⑮ pin)



2. In adjusting the tracking voltage (user ② pin)

