

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

**±12V TRACKING REGULATOR WITH RESET CIRCUIT****DESCRIPTION**

M5292 is a semiconductor integrated circuit designed for voltage regulator which is dual tracking type (positive/negative output voltage) with system reset circuit. M5292 is a semiconductor integrated circuit designed for voltage regulator which is dual tracking type (positive/negative output voltage) with system reset circuit.

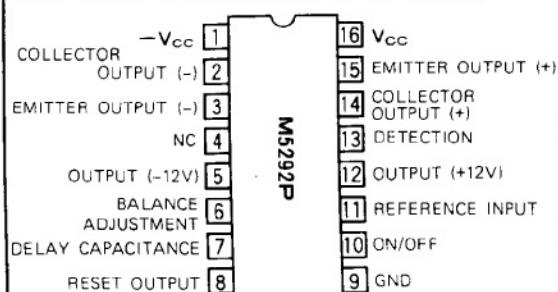
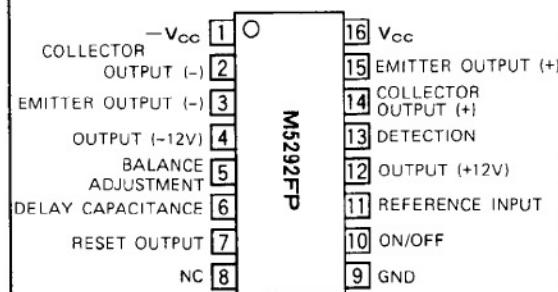
Since the output voltage is fixed inside, User can omit the outside resistors, and this IC includes the system reset circuit for detecting the abnormal status of Power Supply. When Power Supply of system is in abnormal status, this IC sends the system reset output (Low) to the MPU/CPU, so User can make the system operate safely.

**FEATURES**

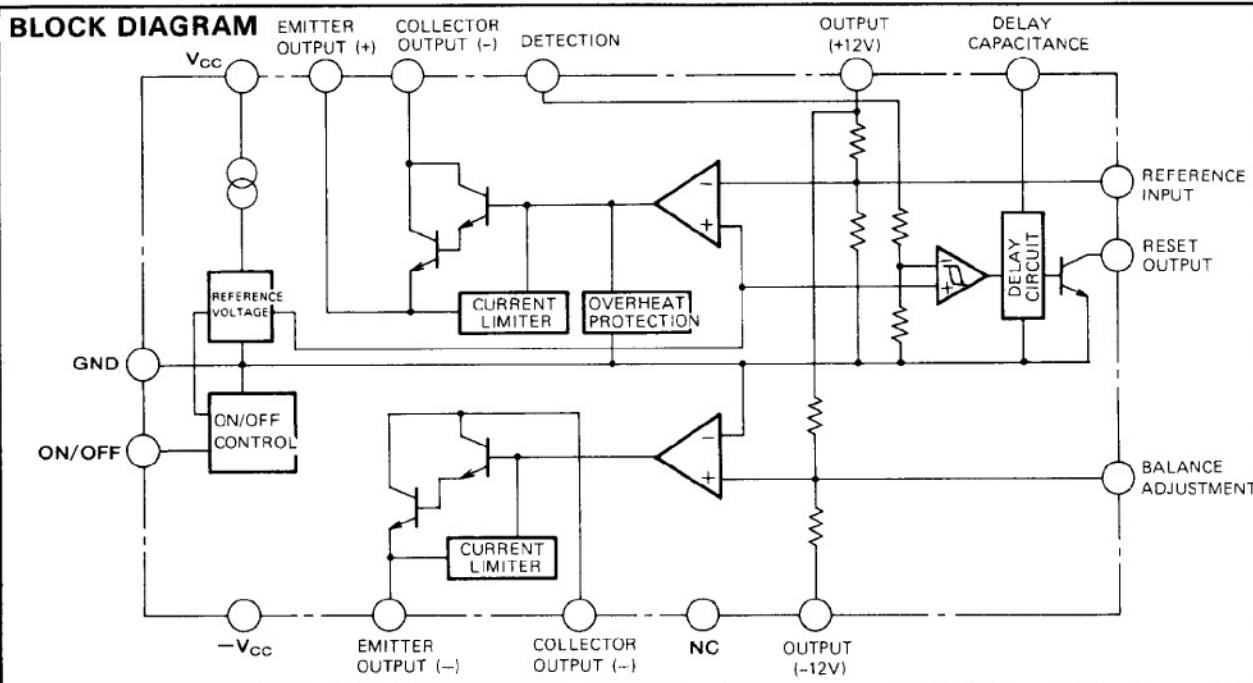
- High input voltage .....  $V_I = \pm 20V$
- Fixed output voltage .....  $V_O = \pm 12V$
- Internal system reset circuit (with hysteresis) detectable voltage ..... 4.2V (delay time is variable by connecting capacity at 7pin (6pin for the FP))
- Current limiting circuit, thermal protection circuit
- Capable of ON/OFF control (10pin)
- Very Low input-output voltage differential operation by using transistor
- Variable output voltage (with external resistors connected between terminals ① and GND and between positive output terminals).

**APPLICATION**

Dual power supply for CD players and stereo set pre-/main-amplifiers

**PIN CONFIGURATION (TOP VIEW)****Outline 16P4****Outline 16P2S-A**

NC: NO CONNECTION

**BLOCK DIAGRAM**

**±12V TRACKING REGULATOR WITH RESET CIRCUIT****ABSOLUTE MAXIMUM RATINGS** (Ta = 25°C, unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
V <sub>CC</sub>	Supply voltage		±20 (40)	V
I <sub>LP</sub>	Load current		±30	mA
V <sub>DIF</sub>	Input/output voltage difference		±15 (30)	V
P <sub>d</sub>	Internal power consumption		1.0 (P) / 0.55 (FP)	W
K <sub>θ</sub>	Thermal derating	T <sub>a</sub> ≥ 25°C	10.0 (P) / 5.5 (FP)	mW/°C
T <sub>opr</sub>	Operating ambient temperature		-20 ~ +75	°C
T <sub>stg</sub>	Storage temperature		-55 ~ +125	°C

**ELECTRICAL CHARACTERISTICS** (Ta = 25°C, V<sub>CC</sub> = ±15V, I<sub>L</sub> = ±10mA, unless otherwise stated)

Symbol	Parameter	Test condition	Limit			Unit
			Min	Typ	Max	
I <sub>CC</sub>	Circuit current	V <sub>13</sub> = 5V		3.0	6.0	mA

**REGULATOR PART**

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
V <sub>IN</sub>	Input voltage		±V <sub>0</sub> ± 2		±20	V
V <sub>O</sub>	Output voltage		±11.4	±12.0	±12.6	V
V <sub>REF</sub>	Reference input voltage		1.15	1.20	1.25	V
△V <sub>O</sub>	Positive/negative voltage tracking			0.5	2	%
R <sub>R</sub>	Ripple rejection	C <sub>REF</sub> = 1μF, f = 120Hz	50	62		dB
Reg-in	Input voltage variation	V <sub>I</sub> = ±15 ~ ±18V		0.05	0.2	%/V
Reg-LO	Load variation	I <sub>L</sub> = 0 ~ 20mA		30	240	mV
V <sub>ND</sub>	Output noise voltage	f = 20Hz ~ 100kHz		15		μVrms
V <sub>O(OFF)</sub>	Output cut-off voltage	Terminal to GND			+0.1	V

**RESET PART**

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
V <sub>S</sub>	Detected voltage		3.95	4.2	4.45	V
ΔV <sub>S</sub>	Hysteresis voltage		50	100	300	mV
t <sub>pd</sub>	Delay time	C <sub>d</sub> = 0.1μF	3	7	14	ms
V <sub>sat</sub>	Output saturation voltage	I <sub>sink</sub> = 3mA		0.2	0.4	V

Note: The employed measurement circuit conforms to application circuit example (1).

## **±12V TRACKING REGULATOR WITH RESET CIRCUIT**

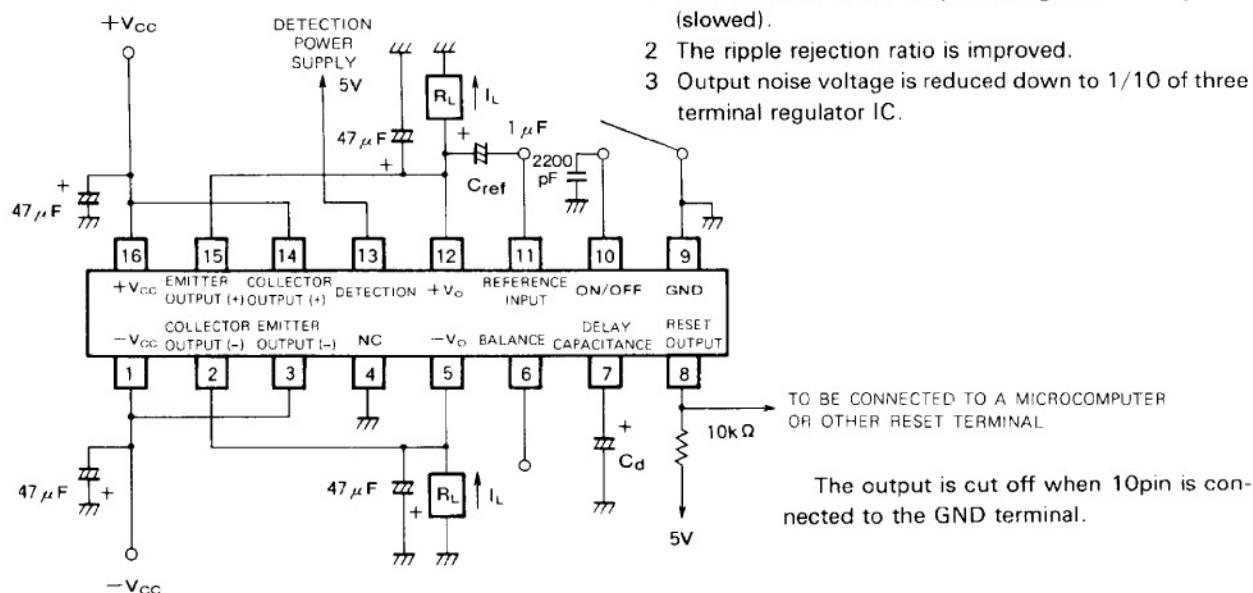
## APPLICATION EXAMPLES

### (1) Standard Application Circuit Example

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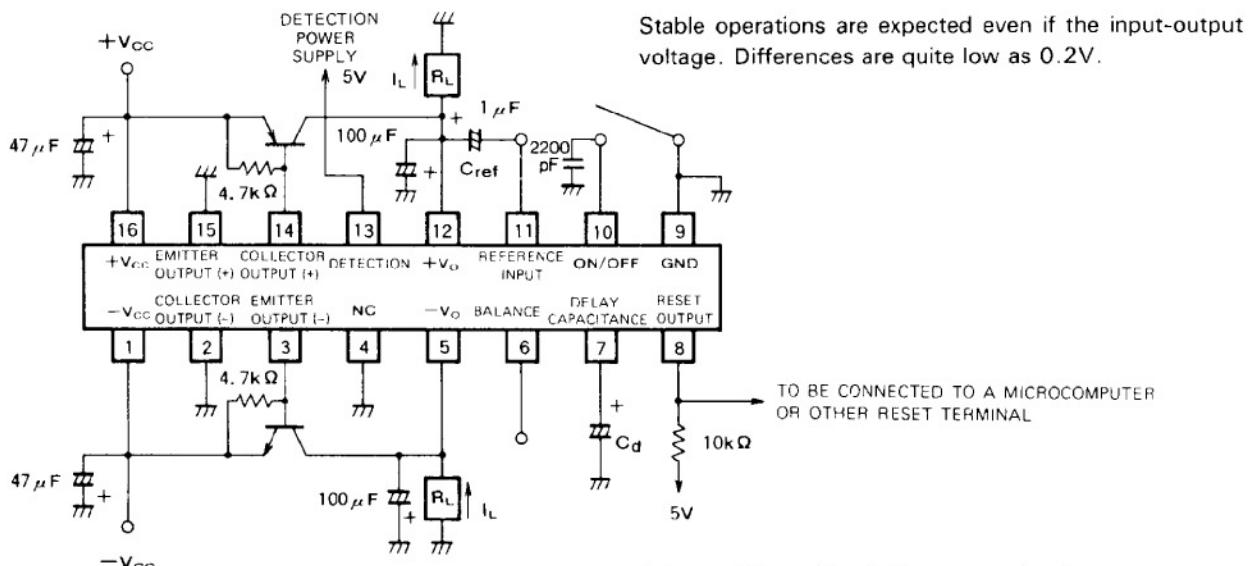
Connection of this capacitor gives the following characteristics.

- 1 The rise time of the output voltage can be adjusted (slowed).
- 2 The ripple rejection ratio is improved.
- 3 Output noise voltage is reduced down to 1/10 of three terminal regulator IC.



**NOTE:** Ensure that the capacitance of the employed capacitor does not significantly vary with the temperature.

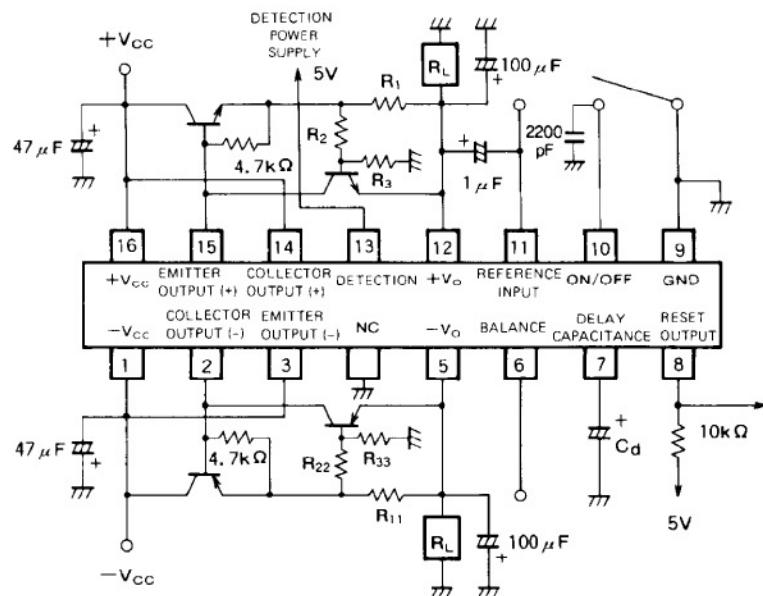
## (2) Very Low Input/Output Voltage Differential Application Example



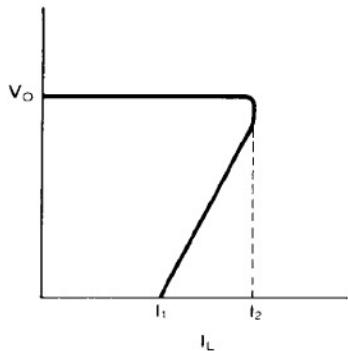
It is possible to drive 1A by connecting Power Transistor. By shorting the 10pin to the GND, the output is shut down.

**±12V TRACKING REGULATOR WITH RESET CIRCUIT****(3) Foldback Protection Circuit Application****Example (M5292P Foldback System)**

The input/output voltage differential  $V_{IO}$  should be adjusted to be high enough considering the voltage difference developed at  $R_1$ .



When two protective transistors are employed, the M5292P/FP can provide foldback characteristic for protection purposes. The  $I_1$  and  $I_2$  values are determined according to the external resistance.



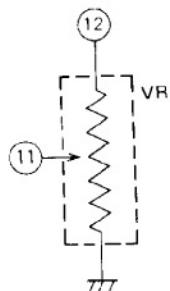
$$I_1 = \frac{R_2 + R_3}{R_1 \cdot R_3} \times 0.65 \text{ (A)}$$

$$I_2 = I_1 + \frac{R_2}{R_1 \cdot R_3} \times 12 \text{ (A)}$$

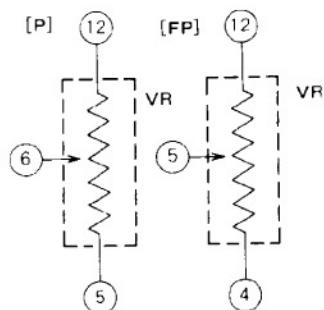
Cases where  $I_{L(Peak)} = I_2 \approx 1.0\text{A}$  and  $I_1 \approx 200\text{mA}$

$R_1 = R_{11} = 4.0\text{k}\Omega$ ,  $R_2 = R_{22} = 1.0\text{k}\Omega$ ,  $R_3 = R_{33} = 3.9\text{k}\Omega$

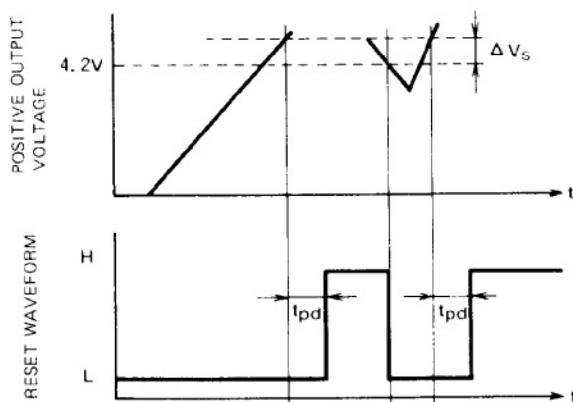
The required input/output voltage differential is 6V or greater.

**±12V TRACKING REGULATOR WITH RESET CIRCUIT****PRECAUTIONS****1. In adjusting the output voltage (use ⑪ pin)**

M5292P, FP is fixed the output voltage by inside resistors, but user can adjust it by using the outside resistor.  
(inside resistor: 2.4kΩ ⑪ to ⑨, 21.7kΩ ⑪ to ⑫)

**2. In adjusting the tracking voltage (use ⑥ pin (⑤ pin on FP))**

M5292P, FP is fixed the tracking voltage by inside resistor, but user can adjust it by using the output resistor.  
(inside resistor: ⑫ to ⑥ ⑥ to ⑤, 10kΩ for the M5292P)  
(⑫ to ⑤ ⑤ to ④, 10kΩ for the M5292FP)

**3. Explaining figure of reset operation**

When the positive output voltage is normal, the Reset output is High.  
If it is lower than 4.2V, the Reset output is low.  
(delay time is variable by connecting capacity at 7pin (6pin for the FP))

$$t_{pd} = 7.0 \times 10^4 \times C \text{ (sec)}$$

C: delay time capacity