

**GENERAL DESCRIPTION**

The M58479P and M58482P are electronic timer ICs developed by aluminum-gate CMOS technology. Use of these ICs makes possible timer devices without mechanical elements, which have reduced power dissipation, superior reliability, and higher noise immunity. The M58479P is specifically designed for high noise immunity while the M58482P particularly features low power dissipation.

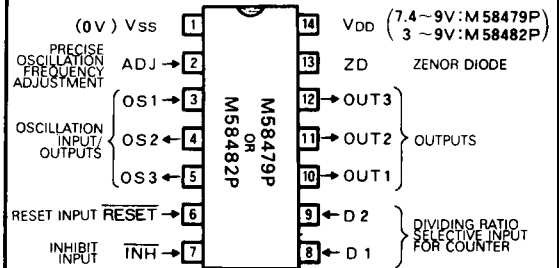
**FEATURES**

- Low power dissipation  
 M58479P: 2mW (typ), 7.5mW (max)  
 M58482P: 200μW (typ), 750μW (max)
- Superior noise immunity
- Single power supply with a zenor diode
- Internal RC oscillator
- Precise oscillation frequency regulating capability
- Extremely broad time-delay range (50ms~4800h)
- Time-delay settable to 10, 60, or 600 times fundamental time (1024 times oscillation period)
- M58479P has automatic-reset function during power engagement
- Built-in reset and inhibit functions
- Residual time display possible by adding Mitsubishi's M53290P and M53242P IC

**APPLICATIONS**

- Electronic timer or counter with broad time-delay range (50ms~4800h)

**PIN CONFIGURATION (TOP VIEW)**



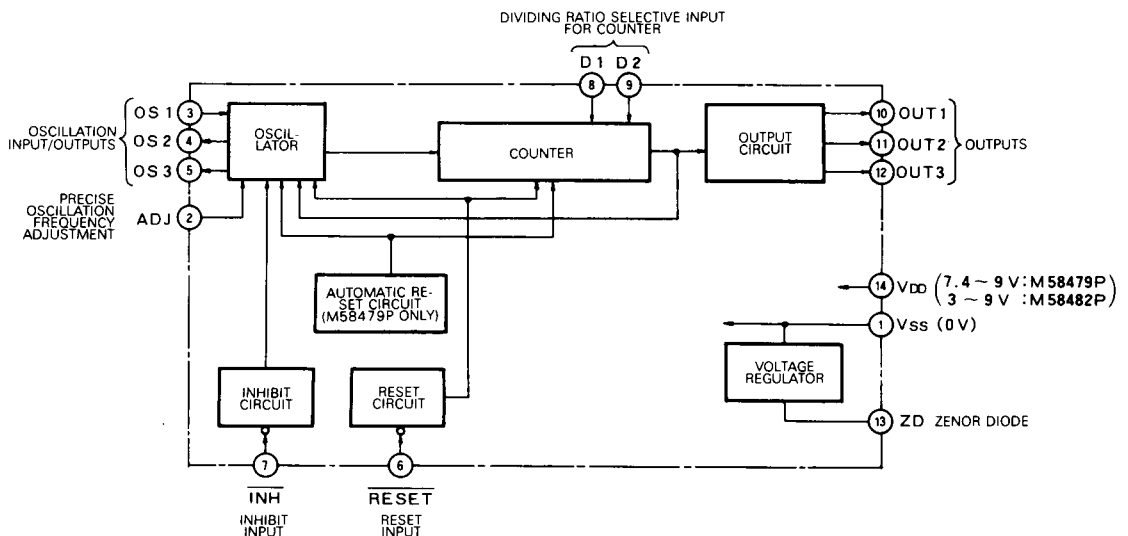
**Outline 14P4**

**SUMMARY OF FUNCTIONS**

These devices make possible extremely long clock performance, by counting pulse signals from the RC oscillator. It has precise oscillation frequency adjustment, automatic-reset, reset, and inhibit functions.

There are three outputs. When the time duration is up, OUT1 turns from low to high and OUT2 from high to low. OUT3 can be connected to M53290P and M53242P TTLs for residual time display.

**BLOCK DIAGRAM**



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**CMOS COUNTER/TIMERS****FUNCTIONAL DESCRIPTION****Voltage Regulator**

A zenor diode is on-chip, making it easy to obtain a constant voltage regulator circuit. Since the zenor diode terminal (ZD) is independent of the power terminal ( $V_{DD}$ ), it can be used as a constant voltage power supply for the total system.

**Oscillator**

Oscillation is obtained by connecting an external resistor (feedback resistor  $R_{FC}$ ) between terminals OS1 and OS3 and an external capacitor (oscillation capacitor  $C_{FC}$ ) between terminals OS1 and OS2. The values of the external resistor and capacitor can then be changed to vary the oscillation period and thus change the time delay. Oscillation period  $T_0$  is obtained by the following equation:

$$T_0 = -R_{FC} \cdot C_{FC} \left\{ \left| n \frac{V_{TR}}{V_{DD} + V_{BE}} \right| + \left| n \frac{V_{DD} - V_{TR}}{V_{DD} + V_{BE}} \right| \right\} \dots (1)$$

Where,

- $R_{FC}$  : Resistance of external resistor
- $C_{FC}$  : Capacitance of external capacitor
- $V_{TR}$  : Transition voltage of the first inverter in the oscillation circuit
- $V_{DD}$  : Supply voltage
- $V_{BE}$  : Forward rising voltage of the diode in terminal OS1 (0.3~0.7V)

**Automatic-Reset Function**

The M58479P has a power-supply-voltage-detection circuit on-chip, so that the counter is automatically reset by the rising edge of the supply voltage when power is turned on. The reset is then released, making the oscillator ready to function and the counter ready to start counting.

The M58482P can also be provided with the same automatic-reset function by connecting capacitor between terminals  $\overline{RESET}$  and  $V_{SS}$ .

**Reset Function**

When the  $\overline{RESET}$  input turns low ( $V_{SS}$ ), oscillation of the oscillator can be stopped and the counter reset.

**Inhibit Function**

When terminal  $\overline{INH}$  turns low ( $V_{SS}$ ) while the timer is in action, the oscillation halts. When input  $\overline{INH}$  is turned high or returned to OPEN afterwards, it starts to count residual time.

**Counter**

This counter consists of an 11-stage 1/2 frequency divider, a 2-stage 1/10 frequency divider and a 1-stage 1/6 frequency divider. As shown in the table below, timer duration can be changed by varying the number of pulses counted according to the combination of the input levels on terminals D1 and D2.

| D1 | D2 | Number of pulses counted            | Time delay                         | Typical time delay applied |
|----|----|-------------------------------------|------------------------------------|----------------------------|
| H  | H  | 1024                                | $T_1$                              | 1 min                      |
| L  | H  | $1024 \times 10$                    | $T_1 \times 10$                    | 10 min                     |
| H  | L  | $1024 \times 10 \times 6$           | $T_1 \times 10 \times 6$           | 1h                         |
| L  | L  | $1024 \times 10 \times 6 \times 10$ | $T_1 \times 10 \times 6 \times 10$ | 10h                        |

Where,  $T_1 = T_0 \times 1024$

$T_0$  is the value obtained from equation (1)

**Output Circuits**

The chips have three outputs: OUT1 changes from low to high and OUT2 from high to low as soon as the time duration is up. Either can be used to drive a transistor by connecting it to the transistor base. OUT1 can drive a thyristor when connected to the thyristor gate.

OUT3 is an open-drain output with period 1/8 of the time delay, and can be used to drive a TTL in a separate (5V) power supply line. Thus, if a M53290P counter and a M53242P binary-to-decimal decoder are connected to OUT3, with their output connected to a light-emitting diode, residual time will be displayed on the LED. When not in use, OUT3 should be connected to  $V_{SS}$ .

**Fine Adjustment of Oscillation Period**

A variable resistor can be connected between terminals ADJ and  $V_{SS}$ , enabling precise adjustment of the period of the oscillator. However, when not used for fine adjustment, ADJ should be connected to  $V_{SS}$ .

**CMOS COUNTER/TIMERS**

**ABSOLUTE MAXIMUM RATINGS**

| Symbol           | Parameter                            | Conditions                      | Limits   | Unit |
|------------------|--------------------------------------|---------------------------------|--|------|
| V <sub>DD</sub>  | Supply voltage                       | With respect to V <sub>SS</sub> | -0.3 ~ 9.5   | V    |
| V <sub>I</sub>   | Input voltage                        |                                 | V <sub>SS</sub> ≤ V <sub>I</sub> ≤ V <sub>DD</sub> | V    |
| P <sub>d</sub>   | Maximum power dissipation            | T <sub>a</sub> = 25°C           | 250  | mW   |
| T <sub>opr</sub> | Operating free-air temperature range |                                 | -30 ~ 75   | °C   |
| T <sub>stg</sub> | Storage temperature range            |                                 | -40 ~ 125  | °C   |

**RECOMMENDED OPERATING CONDITIONS** (T<sub>a</sub> = -30 ~ 75°C, unless otherwise noted.)

| Symbol           | Parameter   | Limits  |     |     | Unit |
|------------------|---|---------|-----|-----|------|
|                  |   | Min     | Nom | Max |      |
| V <sub>DD</sub>  | Supply voltage  | M58479P | 7.4 | 9   | V    |
|                  |   | M58482P | 3   | 9   | V    |
| I <sub>ZD</sub>  | Zenor current   |         |     | 10  | mA   |
| R <sub>FC</sub>  | Feedback resistance                                     | 0.005   |     | 10  | MΩ   |
| C <sub>FC</sub>  | Oscillation capacitance                                 | 0.001   |     | 1   | μF   |
| R <sub>ADJ</sub> | Resistance for fine-adjustment of oscillation frequency | 0       |     | 100 | kΩ   |

**ELECTRICAL CHARACTERISTICS** (T<sub>a</sub> = 25°C, unless otherwise noted.)

| Symbol           | Parameter  | Test conditions  | Limits |      |     | Unit |
|------------------|--|--|--------|------|-----|------|
|                  |  |  | Min    | Typ  | Max |      |
| V <sub>ZD</sub>  | Zenor voltage  | I <sub>ZD</sub> = 2mA  | 7.4    | 8.2  | 9   | V    |
|                  |  | I <sub>ZD</sub> = 10mA   | 7.5    | 8.2  | 9   | V    |
| I <sub>DD</sub>  | Supply current   | M58479P<br>V <sub>DD</sub> = 7.5V, C <sub>FC</sub> = 0.01μF, R <sub>FC</sub> = 1MΩ<br>R <sub>ADJ</sub> = 0Ω, Input/output open |        | 0.25 | 1   | mA   |
|                  |  | M58482P<br>V <sub>DD</sub> = 7.5V, C <sub>FC</sub> = 0.01μF, R <sub>FC</sub> = 1MΩ<br>R <sub>ADJ</sub> = 0Ω, Input/output open |        | 25   | 100 | μA   |
| V <sub>RE</sub>  | Supply voltage at the time of automatic-reset release  | M58479P  | 3.1    |      | 5.4 | V    |
| V <sub>TR</sub>  | Transition voltage of first inverter in the oscillator | V <sub>DD</sub> = 7.5V, R <sub>ADJ</sub> = 0Ω  | 2.9    |      | 4.8 | V    |
| R <sub>I</sub>   | Pull-up resistance, RESET, INH, D1, D2 inputs          | M58479P  | 10     | 20   | 30  | kΩ   |
|                  |  | M58482P  | 25     | 50   | 75  | kΩ   |
| I <sub>OH</sub>  | High-level output current, OUT1 and OUT2 outputs       | V <sub>DD</sub> = 7.5V, V <sub>O</sub> = 0V  | 5      | 10   |     | mA   |
| I <sub>OL</sub>  | Low-level output current, OUT1, OUT2, and OUT3 outputs | V <sub>DD</sub> = 7.5V, V <sub>O</sub> = 7.5V  | 10     | 20   |     | mA   |
| I <sub>0ZH</sub> | Off-state output current, OUT3 output                  | V <sub>DD</sub> = 7.5V, V <sub>O</sub> = 7.5V  |        |      | 1   | μA   |
| I <sub>OL</sub>  | Low-level output current, OUT1, OUT2, and OUT3 outputs | V <sub>DD</sub> = 7.5V, V <sub>O</sub> = 0.4V  | 1.6    |      |     | mA   |
| I <sub>0L</sub>  | Low-level output current, OUT1, OUT2, and OUT3 outputs | M58482P<br>V <sub>DD</sub> = 4.5V, V <sub>O</sub> = 0.4V   | 1.6    |      |     | mA   |
| V <sub>OL</sub>  | Low-level output voltage, OUT1, OUT2, and OUT3 outputs | V <sub>DD</sub> = 7.5V   |        |      | 0.1 | V    |

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# MITSUBISHI LSIs

## M58479P, M58482P

### CMOS COUNTER/TIMERS

#### TYPICAL APPLICATION CIRCUIT

