The merits to select Real Time Clock ICs

1. Lower than the software control types in consumption current.
   Clock function can be also operated by software control. But Real Time Clock ICs is lower than the software control in consumption current.
   As smaller back-up devices are available, so high density mounting ICs on board is possible.

2. Easier to develop the software
   It is very hard to develop clock and calendar software. The end date of months including leap year have to be calculated in calendar.
   And furthermore it has to be calculated by sexagesimal and the base 24 system.
   The Real Time Clock ICs incorporates the circuit can support to develop such a software.

3. Easier to design a oscillation circuit
   The Real Time Clock ICs involve an oscillation circuit without a crystal.
   By simply using a crystal, layout of oscillation circuit can be configured.
   Anti-noise measurement can be made easily.

### Back-up time measurement (R2051S01)

<table>
<thead>
<tr>
<th>Back-up device</th>
<th>Back-up start voltage (5V)</th>
<th>Back-up start voltage (3V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coin cell primary battery (CR2032)</td>
<td>10 years (calculated time)</td>
<td>10 years (calculated time)</td>
</tr>
<tr>
<td>Electric double layered capacitor (1F)</td>
<td>130 days</td>
<td>116 days</td>
</tr>
<tr>
<td>Electric double layered capacitor (0.1F)</td>
<td>21 days</td>
<td>15 days</td>
</tr>
<tr>
<td>Aluminum electrolytic capacitor (470μF)</td>
<td>20 hours</td>
<td>12 hours 30 minutes</td>
</tr>
<tr>
<td>Aluminum electrolytic capacitor (47μF)</td>
<td>2 hours</td>
<td>1 hour 15 minutes</td>
</tr>
<tr>
<td>Aluminum electrolytic capacitor (47μF)</td>
<td>12 months</td>
<td>7 months 30 days</td>
</tr>
</tbody>
</table>

### RICOH Real Time Clock ICs superior facilities 1

RICOH Real Time Clock ICs have following functions.

1. High-precision Oscillation
   The oscillation adjustment circuit is configured to change time counts of 1 second on the basis of the setting of the oscillation.
   The adjustment is registered once in 20 seconds or 60 seconds.
   The maximum range is approximately ±189 ppm (or ±63 ppm).

   *) R202Sx and R204SSS don’t involve the adjustment function in 60 seconds.

A tuning fork type crystal oscillator can output stable frequency.
But the frequency is changed easily by the capacitances on a board.
Generally, the capacitances have to be evaluated on PCB which is used in Mass-production.
RICOH Real Time Clock ICs have settable registers to adjust time gain or loss.
Furthermore it is useful to compensate the crystal frequency deviation.
**RICOH Real Time Clock ICs superior facilities 2**

1. **Confirming the potential invalidation of time data.**

   - **4-Wire (SPI Bus)** R2043x/R2243x*/R2296L*  
   - **3-Wire** R2033x/R2061x/R2062L/R2262x  
   - **2-Wire (I²C Bus)** R2023x/R2051x/R2221x/R2223x/R2251L*/R2286L*

   The power-on reset flag and the oscillation halt sensing circuit are configured to confirm the established invalidation of time data in constant to the supply voltage monitoring circuit intended to confirm the potential invalidation of time data. The supply voltage monitoring circuit can be applied to battery supply voltage monitoring.

   - **Power on reset**  
     Power on reset function reset the control registers when the system is powered on from 0V. At the same time, the fact is memorized to the registers as a flag, thereby identifying whether they are powered on from 0V or battery back-up.

   - **Oscillation halt sensing function**  
     An oscillation halt sensing function records any past oscillation with internal registers. Thereby identifying whether any past oscillation halted.

   - **Supply voltage monitoring function**  
     Supply voltage monitoring function records any drop in supply voltage of a certain threshold value with internal registers.

2. **Battery back-up switch-over function**

   - **4-Wire (SPI Bus)** R2296L*  
   - **3-Wire** R2061x/R2062L/R2262x  
   - **2-Wire (I²C Bus)** R2051x/R2251L*/R2286L*

   The back-up switch-over function is needed when the main power supply fell. But the configuration for back-up switch-over function is needed the measurements, due to the external diodes causing a voltage descent and the increasing of the consumption current.

   These products incorporate battery back-up switch-over circuits, any outside parts are not required.

   It can switch automatically between a main power supply and back-up power supplies.

   R2062L does not incorporate VSB-pin and SW2.

   In the case of R2262x, VSB pin replace BAT pin. SW2 is keeping enable except for the time of registering “OFF”.

3. **High precision Real Time Clock IC Module**

   - **4-Wire (SPI Bus)** R2045S  
   - **2-Wire (I²C Bus)** R2025x

   R2025x/R2045S incorporate the crystal unit. The oscillation frequency is adjusted to high precision. (0±5ppm:at 25°C) It corresponds to ±15 seconds/month (at 25°C).

   The website for RICOH Real Time Clock ICs

   There are many useful information on our website. Please refer to P31 about the website.

   Example
   - Oscillator frequency calibration with CL=12.5pF crystal and RICOH RTC IC.  
   - Technical Tips to use backup switch over circuit of R2051/61.  
   - Formula adjusts binary code for oscillation adjustment resister.  
   - RTC Compensation Simulator  
   - User Manual RTC Compensation Simluator  
   - Design Guide for the clock circuit with a crystal and RICOH RTC IC.