Introduction

This application note describes how to migrate from the D/A converter of the R8C/36M Group to the D/A converter of the RL78/G14 (with 96-KB or larger flash memory ROM).

Note that a D/A converter is incorporated only in the RL78/G14 products that have 96-KB or larger flash memory ROM. If you are thinking of employing a D/A converter in the RL78 Family product with 64-KB or smaller flash memory ROM, the RL78/G1F or RL78/G11 is recommended.

Target Device

RL78/G14, R8C/36M Group

When using this application note with other Renesas MCUs, careful evaluation is recommended after making modifications to comply with the alternate MCU.
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1. Migration Method from R8C Family to RL78 Family

The following sections describe how to implement the D/A converter of the R8C/36M Group by using the D/A converter of the RL78/G14 with 96-KB or larger flash memory ROM.

Table 1.1 shows the specifications of the D/A converter of the R8C/36M Group.

Table 1.2 shows the specifications of the D/A converter of the RL78/G14.

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>D/A conversion method</td>
<td>R-2R method</td>
</tr>
<tr>
<td>Resolution</td>
<td>8-bit</td>
</tr>
<tr>
<td>Analog output pins</td>
<td>2</td>
</tr>
<tr>
<td>Reference voltage</td>
<td>Vref</td>
</tr>
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<td>D/A conversion method</td>
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<td>8-bit</td>
</tr>
<tr>
<td>Analog output pins</td>
<td>1 or 2 Note</td>
</tr>
<tr>
<td>Reference voltage</td>
<td>VDD</td>
</tr>
<tr>
<td>Operation mode</td>
<td>Normal mode, Real-time output mode</td>
</tr>
</tbody>
</table>

Note: Depends on the package type.

To allow the D/A converter of the RL78/G14 to operate similarly to the D/A converter of the R8C/36M Group, select normal mode for the D/A converter of the RL78/G14.

One of the major differences is the reference voltage of the analog voltage output by the D/A converters.

With the R8C/36M Group, the voltage on the Vref (reference voltage input) pin is used as the reference voltage in determining the analog voltage to be output.

With the RL78/G14, the voltage on the VDD (supply voltage) pin is used as the reference voltage in determining the analog voltage to be output.
2. Differences between RL78/G14 and the R8C/36M Group

This chapter describes the differences of D/A converter between the RL78/G14 and R8C/36M group.

2.1 Differences in D/A converter

Table 2.1 shows the differences between the D/A converter of the R8C/36M Group and D/A converter (normal mode) of the RL78/G14.

<table>
<thead>
<tr>
<th>Item</th>
<th>R8C/36M group D/A converter</th>
<th>RL78/G14 D/A converter Normal mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reference voltage</td>
<td>Vref (Reference voltage input) pin</td>
<td>V_DD (Power Supply) pin</td>
</tr>
<tr>
<td>Output Pins</td>
<td>DA0, DA1</td>
<td>ANO0, ANO1Note</td>
</tr>
</tbody>
</table>

Note: Provided on the products having 32 or more pins.

2.2 Comparison between Registers

Table 2.2 compares the registers for the D/A converter of the R8C/36M group to the corresponding registers for the D/A converter of the RL78/G14.

<table>
<thead>
<tr>
<th>Setting Items</th>
<th>R8C/36M group D/A converter</th>
<th>RL78/G14 D/A converter Normal mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enabling clock supply to peripheral hardware</td>
<td>-</td>
<td>PER1 Register DACEN bit</td>
</tr>
<tr>
<td>Output value of D/A conversion</td>
<td>DAI Register</td>
<td>DACSi Register</td>
</tr>
<tr>
<td>Output enable</td>
<td>DACON Register</td>
<td>DAM Register DACEi bit</td>
</tr>
<tr>
<td>DA0E bit, DA1E bit</td>
<td>DAE0E bit, DA1E bit</td>
<td>DAM Register DACDi bit</td>
</tr>
<tr>
<td>Operation mode selection</td>
<td>-</td>
<td>DAM Register DACDi bit</td>
</tr>
</tbody>
</table>

Remark
-: There are no corresponding registers.
i = 0, 1
3. **Related Application Note**
   - RL78/G14 Setting the D/A Converter's Normal Mode CC-RL (R01AN2672)

4. **Documents for Reference**
   
   **User’s Manual:**
   - RL78/G14 User's Manual: Hardware (R01UH0186)
   - R8C/36M Group User's Manual: Hardware (R01UH0259)
   
   The latest versions can be downloaded from the Renesas Electronics website.

   **Technical Update/Technical News:**
   
   The latest information can be downloaded from the Renesas Electronics website.

   **Migration Guide:**
   
   Migration to CubeSuite+ Integrated Development Environment for RL78 Family (On-chip Debug) - Migration from R8C, M16C to RL78 (R20UT2150)
Website and Support

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<table>
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<tr>
<th>Rev.</th>
<th>Date</th>
<th>Page</th>
<th>Summary</th>
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<tbody>
<tr>
<td>1.00</td>
<td>Sep. 26, 2018</td>
<td>-</td>
<td>First edition issued</td>
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</tbody>
</table>
General Precautions in the Handling of Microprocessing Unit and Microcontroller Unit Products

The following usage notes are applicable to all Microprocessing unit and Microcontroller unit products from Renesas. For detailed usage notes on the products covered by this document, refer to the relevant sections of the document as well as any technical updates that have been issued for the products.

1. Handling of Unused Pins
   Handle unused pins in accordance with the directions given under Handling of Unused Pins in the manual.
   - The input pins of CMOS products are generally in the high-impedance state. In operation with an unused pin in the open-circuit state, extra electromagnetic noise is induced in the vicinity of LSI, an associated shoot-through current flows internally, and malfunctions occur due to the false recognition of the pin state as an input signal become possible. Unused pins should be handled as described under Handling of Unused Pins in the manual.

2. Processing at Power-on
   The state of the product is undefined at the moment when power is supplied.
   - The states of internal circuits in the LSI are indeterminate and the states of register settings and pins are undefined at the moment when power is supplied.
   - In a finished product where the reset signal is applied to the external reset pin, the states of pins are not guaranteed from the moment when power is supplied until the reset process is completed.
   - In a similar way, the states of pins in a product that is reset by an on-chip power-on reset function are not guaranteed from the moment when power is supplied until the power reaches the level at which resetting has been specified.

3. Prohibition of Access to Reserved Addresses
   Access to reserved addresses is prohibited.
   - The reserved addresses are provided for the possible future expansion of functions. Do not access these addresses; the correct operation of LSI is not guaranteed if they are accessed.

4. Clock Signals
   After applying a reset, only release the reset line after the operating clock signal has become stable.
   - When switching the clock signal during program execution, wait until the target clock signal has stabilized.
   - When the clock signal is generated with an external resonator (or from an external oscillator) during a reset, ensure that the reset line is only released after full stabilization of the clock signal.
   - Moreover, when switching to a clock signal produced with an external resonator (or by an external oscillator) while program execution is in progress, wait until the target clock signal is stable.

5. Differences between Products
   Before changing from one product to another, i.e. to a product with a different part number, confirm that the change will not lead to problems.
   - The characteristics of Microprocessing unit or Microcontroller unit products in the same group but having a different part number may differ in terms of the internal memory capacity, layout pattern, and other factors, which can affect the ranges of electrical characteristics, such as characteristic values, operating margins, immunity to noise, and amount of radiated noise. When changing to a product with a different part number, implement a system-evaluation test for the given product.
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