# RZ/A1H Group

## JCU and PFV Driver Example

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## Introduction

This package contains the example driver of JPEG Codec Unit "JCU driver" and the example driver of Pixel Format Converter "PFV driver".

JCU driver uses JPEG codec function in RZ/A1H,M,LU, decodes /expands JPEG compressed image and encodes /compresses to JPEG image. PFV driver uses pixel format convert function in RZ/A1H,M and changes the pixel format of the image. PFV driver uses DMAC_RM driver inside. DMAC_RM driver uses the register mode of direct access controller in RZ/A1 group, inputs the image data to PFV and outputs the image from PFV. PFV can change to the pixel format which can be encoded by JCU.

This example is checked on GENMAI board.

## Target Device

RZ/A1H Group

RZ/A1M Group

RZ/A1LU Group

The following list shows application notes of sample drivers and sample programs in this package.

- RZ/A1H Group JPEG Codec Unit "JCU" Sample Driver (R01AN1862EJ)
- RZ/A1H Group Pixel Format Converter "PFV" Sample Driver (R01AN1880EJ)
- RZ/A1H Group Direct Access Controller "DMAC_RM" Sample Driver (Attached to PFV) (R01AN1888EJ)
- RZ/A1H Group OS porting layer "OSPL" Sample Program (R01AN1887EJ)

When applying the sample program covered in this application note to another microcomputer, modify the program according to the specifications for the target microcomputer and conduct an extensive evaluation of the modified program.

## Sample Program

This sample program operates the following processing.

### (1) R_JCU_SampleDecode function - Decodes JPEG data via JCU unit

decode_sample.c

[ On-Chip RAM >> JCU decompression >> On-Chip RAM ]

Source image is the global variable corresponding to the file

workspace\RZ_A1H_JCU_PFV_Sample\armcc\common\src\samples\jcu\Image\image01.jpg

Size of image is 800x480.

This function decodes to ARGB8888 format frame buffer in Large-Capacity On-Chip RAM.

The address of data before decompression is set to "buffer.source.address" variable.

The address of data after decompression is set to "buffer.destination.address" variable.

### (2) R_JCU_SampleDecodeEncode function - Encodes and decodes JPEG data

decode_encode_sample.c

[ On-Chip RAM >> JCU decompression >> On-Chip RAM >> JCU compression >> On-Chip RAM ]

This is added JPEG decoding based on R_JCU_SampleDecode function.

Compressed data is output to Large-Capacity On-Chip RAM.

The address of data before decompression is set to "buffer.source.address" variable.

The address of data after decompression is set to "buffer.destination.address" variable.

If compressed data was saved as binary, it is the JPEG file.

You can set calculated quantization table (example) by input quality in "QuantizationTable_Generator.html" file.

### (3) R_JCU_SampleDecodeAndShow function - Decodes and play Motion JPEG data and show on the display

decode_show_sample.c

[ On-Chip RAM >> JCU decompression >> On-Chip RAM >> VDC5(OUT) >> Display ]

The movie data is "g_MotionJPEG_Sample" variable which has data copied from attached "MotionJPEG.avi" file. The sample program picks up JPEG data as each frame from AVI format container.

Frames are decoded to YcbCr422 format and other format frame memory in On-Chip RAM and output to D-sub (Opposite RCA connector).

Size of screen is 800x600. Size of frame is 800x480.

Video output of VDC is used. Video signal input is not used.

### (4) R_JCU_SampleVideoEncodeAndShowI function - Encodes and decodes video signal input

video_encode_decode_i_sample.c

[ Camera >> VDC5(IN) >> On-Chip RAM >> JCU compression >> On-Chip RAM
>> JCU decompression >> On-Chip RAM >> VDC5(OUT) >> Display ]

This function continues to encode and decode each top and bottom field of video signal input connected with RCA connector (at left up) by interlace at the same time (60fps). Decoded image is shown through D-sub (opposite to RCA connector).

This program receives events signaled from interrupt handlers at "R_OSPL_EVENT_Wait" function and responds as followings.

1. After external video image was put in the video buffer, JPEG compression is started.

2. After the compression was finished, the JPEG data is started to decompress to the back buffer.

3. After the decompression was finished, this program shows by swapping the back buffer for the front buffer.

The buffer put JPEG data has 1 frame only.

There is 1 frame delay because operations of compression, decompression and showing.

If compressed data was saved as binary, it is the JPEG file.

### (5) R_JCU_SampleVideoEncodeAndShowP function - Encodes and decodes video signal input

video_encode_decode_p_sample.c

[ Camera >> VDC5(IN) >> On-Chip RAM >> JCU compression >> On-Chip RAM
>> JCU decompression >> On-Chip RAM >> VDC5(OUT) >> Display ]

This function continues to encode and decode video signal input connected with RCA connector (at left up) by progressive at the same time (60fps). The other specifications are same as R_JCU_SampleVideoEncodeAndShowI function.

### (6) Sample_PFV_PIO function - Converts pixel format via PFV unit

pfv_sample.c

[ On-Chip RAM >> PFV Conversion >> On-Chip RAM ]

CPU transfers pixel data from the memory to PFV and transfers converted pixel data from PFV to the memory.

This function returns immediately and go to next sample program.

### (7) Sample_PFV_DMAC function - Converts pixel format via PFV unit with DMAC unit

pfv_sample.c

[ On-Chip RAM >> DMAC >> PFV Conversion >> DMAC >> On-Chip RAM ]

DMAC transfers pixel data from the memory to PFV and transfers converted pixel data from PFV to the memory.

This function returns immediately and go to next sample program.

### (8) Sample_PFV_DMAC_Image function - Shows and blinks a image on the display

pfv_sample.c

[ On-Chip RAM >> DMAC >> PFV Conversion >> DMAC >> On-Chip RAM >> VDC5(OUT) >> Display ]

This program changes gain parameter in PFV and change pixel format from ARGB8888 to YCbCr422.

Source image is the global variable corresponding to the file

workspace\RZ_A1H_JCU_PFV_Sample\armcc\common\src\samples\pfv\Image\PFV_Sample.bmp

This program outputs to D-sub (Opposite to RCA connector).

This function returns after several seconds and go to next sample program.

JCU and PFV are available without any display.

For example, Sample_PFV_DMAC function and R_JCU_SampleDecode function do not use VDC5.

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Revision History

| Rev. | Date | Description |
|---|---|---|
| 2.01 | Feb.2, 2018 | Updated JCU version 2.01, PFV version 1.03. |
| 1.02 | Feb.29, 2016 | Added explanation of sample program.<br>Updated JCU version 1.03, PFV version 1.02. |
| 1.01 | Sep.5.2014 | Adjust the byte order in JCU recorder example.<br>Examples were adjusted to be able to run the JCU recorder example after running PFV examples.<br>Only a source file was modified. |
| 1.00 | Jun.20.2014 | First edition issued. |

## General Precautions in the Handling of MPU/MCU Products

The following usage notes are applicable to all MPU/MCU 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.
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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.

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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.

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