User's Manual

RZ/V2L Yocto Recipe Start-up Guide

User's Manual: Software

RZ/V2L Group

Specifications common to RZ/V Series Products
RZ/V2L

Renesas Electronics
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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. Precaution against Electrostatic Discharge (ESD)
   A strong electrical field, when exposed to a CMOS device, can cause destruction of the gate oxide and ultimately degrade the device operation. Steps must be taken to stop the generation of static electricity as much as possible, and quickly dissipate it when it occurs. Environmental control must be adequate. When it is dry, a humidifier should be used. This is recommended to avoid using insulators that can easily build up static electricity. Semiconductor devices must be stored and transported in an anti-static container, static shielding bag or conductive material. All test and measurement tools including work benches and floors must be grounded. The operator must also be grounded using a wrist strap. Semiconductor devices must not be touched with bare hands. Similar precautions must be taken for printed circuit boards with mounted semiconductor devices.
2. Processing at power-on
   The state of the product is undefined at the time 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 time 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 time 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 time when power is supplied until the power reaches the level at which resetting is specified.
3. Input of signal during power-off state
   Do not input signals or an I/O pull-up power supply while the device is powered off. The current injection that results from input of such a signal or I/O pull-up power supply may cause malfunction and the abnormal current that passes in the device at this time may cause degradation of internal elements. Follow the guideline for input signal during power-off state as described in your product documentation.
4. 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 the 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.
5. Clock signals
   After applying a reset, only release the reset line after the operating clock signal becomes stable. When switching the clock signal during program execution, wait until the target clock signal is 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. Additionally, 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.
6. Voltage application waveform at input pin
   Waveform distortion due to input noise or a reflected wave may cause malfunction. If the input of the CMOS device stays in the area between V_{IL} (Max.) and V_{IH} (Min.) due to noise, for example, the device may malfunction. Take care to prevent chattering noise from entering the device when the input level is fixed, and also in the transition period when the input level passes through the area between V_{IL} (Max.) and V_{IH} (Min.).
7. Prohibition of access to reserved addresses
   Access to reserved addresses is prohibited. The reserved addresses are provided for possible future expansion of functions. Do not access these addresses as the correct operation of the LSI is not guaranteed.
8. Differences between products
   Before changing from one product to another, for example to a product with a different part number, confirm that the change will not lead to problems. The characteristics of a microprocessing unit or microcontroller unit products in the same group but having a different part number might differ in terms of 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.

How to Use This Manual

1. Purpose and Target Readers

This manual is designed to provide the user with an understanding of the hardware functions and electrical characteristics of the MCU. It is intended for users designing application systems incorporating the MCU. A basic knowledge of electric circuits, logical circuits, and MCUs is necessary in order to use this manual.

The manual comprises an overview of the product; descriptions of the CPU, system control functions, peripheral functions, and electrical characteristics; and usage notes.

> Particular attention should be paid to the precautionary notes when using the manual. These notes occur within the body of the text, at the end of each section, and in the Usage Notes section.

> The revision history summarizes the locations of revisions and additions. It does not list all revisions. Refer to the text of the manual for details.

The following documents apply to the RZ/V2L Group. Make sure to refer to the latest versions of these documents. The newest versions of the documents listed may be obtained from the Renesas Electronics Web site.

Document Type	Description	Document Title	Document No.
User's manual for Software	RZ/V2L Yocto Recipe Start-up Guide	RZ/V2L Group User's Manual: Software	R01US0494EJ0100

2. List of Abbreviations and Acronyms

Abbreviation	Full Form

Table of Contents

1. Introduction

1.1 About RZ/V2L Group Linux BSP

This start-up guide explains how to build the RZ/V2L Linux BSP and how to deploy the images on RZ/V2L boards.

Please refer to the page below for more detailed information about document, boards and tools for the RZ/V2L Group product.

https://www.renesas.com/us/en/products/microcontrollers-microprocessors/rz-arm-based-high-end-32-64-bit-mpus/rzv2l-general-purpose-microprocessor-equipped-renesas-original-ai-dedicated-accelerator-drp-ai-12ghz-dual

The RZ/V2L Yocto build system is a basic package to download and build a kernel and middle-ware that will operate on the RZ/V2L boards.

The Yocto version supported for RZ/V2L is **v3.1(dunfell)**. For more information about Yocto please refer to https://www.yoctoproject.org

Note: Currently, the RZ/V2L Evaluation Kit (codename: **smarc-rzv2l**) is the supported platform. Additional products will be supported in the future.

For reference manual, please find in **Table 1-1**

Table 1-1. Reference Documents

Document	Version
RZ/V2L Group User's Manual: Hardware	-

1.2 Building environment

In this topology, we use Linux (Ubuntu) Host PC as build machine; Window PC is used to deploy binary files to target board and log in terminal console, RZ/V2L Evaluation Kit is a target board and all connected through a Router by Ethernet cable.

Table 2-2. Build environment ‘s devices

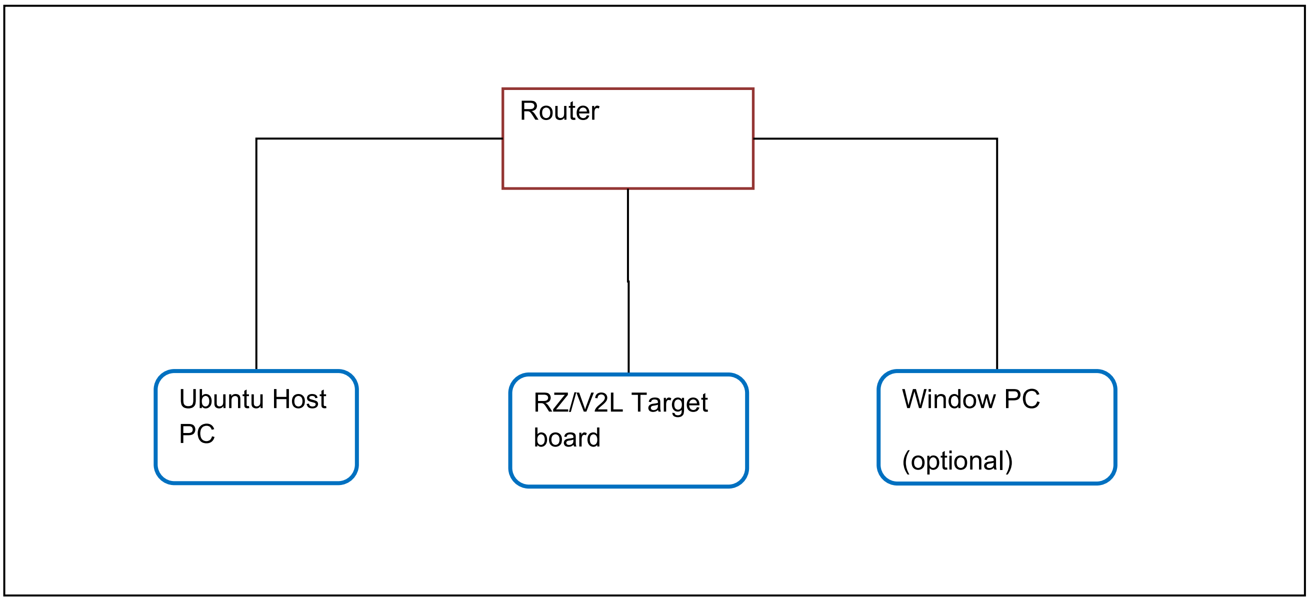

Figure 1-1 Build & Deployment environment

Device	Description
Linux (Ubuntu) Host PC	Recommended Ubuntu 20.04 LTS(64-bit) as Host PC. Host PC is the x86-64 machine works as building PC and deploying to RZ/V2L Target board. The PC should support: • TFTP server: for remote download files • NFS server: use PC to keep target’s filesystem.
Window PC	Recommended Window 10. User can optionally use Window PC to deploy kernel, filesystem, or connect to board for control and debugging over UART, Ethernet port. Notice that in this guide, we use Window Host PC for deploying BSP on RZ/V2L Target board. Required software: • Tera Term: Terminal software, for connect over UART port. Available at http://sourceforge.jp/projects/ttssh2
Router	For interconnect among devices by Ethernet ports.
RZ/V2L Target	Target devices

If user are familiar with Linux, he can use Linux Host PC to deploy, debug using similar terminal tools such as minicom, picocom… instead of Window PC. The topology is simpler.

2. Building Instruction

The Yocto Project was intended to create your own personal BSP or 'distribution'. Please execute following steps in a ${WORK} directory on your Linux Host PC. The following instructions were used for testing the current BSP package at Renesas. Please note that Renesas has not been verified any other build configurations or modified recipes except "core-image-minimal" configuration which is based on upstream Yocto Project downloads and some additional packages correspond to GStreamer.

Note) Renesas executed following instructions with a clean ${WORK}/build directory. You may use wipe-sysroot and/or bitbake -c cleansstate to reflect modifications of your configuration files for recipes as explained in Yocto Project's documentation, however Renesas strongly recommends to use these recipes with a clean ${WORK}/build directory for each configurations because there are some implicit dependency for header files that exist to keep compatibility between application build schemes with/without proprietary software.

2.1 Ubuntu Host Preparation

Ubuntu should be used as the Linux Host PC OS since the Yocto Project Quick Start specifies Ubuntu as one of the supported distributions. In that case, you can install the required packages by using the commands below.
https://www.yoctoproject.org/docs/latest/ref-manual/ref-manual.html#ubuntu-packages

```
$ sudo apt-get install gawk wget git-core diffstat unzip texinfo gcc-multilib \
build-essential chrpath socat cpio python3 python3-pip python3-pexpect \
xz-utils debianutils iputils-ping python3-git python3-jinja2 \
libegl1-mesa libsdl1.2-dev pylint3 xterm
```

2.2 Build BSP using Yocto

- Clone and checkout corresponding commit

```
$ cd ${WORK}
$ git clone https://git.yoctoproject.org/git/poky
$ cd poky
$ git checkout -b dunfell-23.0.5 dunfell-23.0.5
$ git cherry-pick 9e444
$ cd ..

$ git clone https://github.com/openembedded/meta-openembedded
$ cd meta-openembedded
$ git checkout -f cc6fc6b1641ab23089c1e3bba11e0c6394f0867c
$ cd ..

$ git clone https://github.com/renesas-rz/meta-rzv.git
$ cd meta-rzv
$ git checkout dunfell/rzv2l

$ git clone https://git.yoctoproject.org/git/meta-gplv2 -b dunfell
$ cd meta-gplv2
$ git checkout 60b251c25ba87e946a0ca4cdc8d17b1cb09292ac
```

Note: If you would like to run the DRP-AI Support Package sample applications, please change checkout tag from "dunfell/rzv2l" to "dunfell/rzv2l_lp" for meta-rzv.

- [Optional] Install MMP package. This option is for the case building core-image-weston and need Graphic/ Codec.

  Note: Please contact Renesas to download the MMP package (meta-rz-features).

- Setting build environment

```
$ cd ${WORK}
$ source poky/oe-init-build-env
```

- Edit build configuration

```
$ cd ${WORK}/build
$ cp ../meta-rzv/docs/template/conf/smarc-rzv2l/*.conf ./conf
```

Users can edit the file *bblayers.conf*, *local.conf* for their own purpose.

In *local.conf*, if you want to build libraries that are compatible with CIP core packages, please set as below:

CIP_CORE = "1"

- Build BSP

```
$ bitbake core-image-<image_type>
```

Where <image_type> : minimal or weston

After building, the output files are included:

- bl2_bp-smarc-rzv2l_pmic.srec : BL2 S-record file.
- fip-smarc-rzv2l_pmic.srec : BL31 and U-boot package in S-record format
- Image-smarc-rzv2l.bin : kernel image
- r9a07g054l2-smarc.dtb : RZ/V2L Evaluation Kit device tree
- core-image-<image_type>-smarc-rzv2l.tar.bz2: root filesystem
- Flash_Writer_SCIF_RZV2L_SMARC_PMIC_DDR4_2GB_1PCS.mot : Flash Writer

2.3 Build Application SDK (Optional)

After building Yocto BSP, if you want to continue to build SDK, please do as below:

```
$ cd ${WORK}/build
$ bitbake core-image-<image_type> -c populate_sdk
```

Which is:

- *<image_type>*: minimal, weston

When building finished, you can get the core-image-minimal based SDK at ***tmp/deploy/sdk/poky-glibc-x86_64-core-image-minimal-aarch64-smarc-rzv2l-toolchain-3.1.5.sh***

Later, if you want to to install the SDK, just run:

```
$ sudo {SDK_DIR}/poky-glibc-x86_64-core-image-<image_type>-aarch64-<board_name>-toolchain-3.1.5.sh
Poky (Yocto Project Reference Distro) SDK installer version 3.1.5
================================
Enter target directory for SDK (default: /opt/poky/3.1.5):
The directory "/opt/poky/3.1.5" already contains a SDK for this architecture.
If you continue, existing files will be overwritten! Proceed [y/N]? y
[sudo] password for::
Extracting SDK.........................................................done
Setting it up...done
SDK has been successfully set up and is ready to be used.
Each time you wish to use the SDK in a new shell session, you need to source the environment setup
script e.g.
 $ . /opt/poky/3.1.5/environment-setup-aarch64-poky-linux
```

Then every time you want to use SDK, just export the corresponding environment variables

```
$ source /opt/poky/3.1.5/environment-setup-aarch64-poky-linux
```

3. Deploy BSP

3.1 Writing firmware

3.1.1 Hardware setting

Table 3-1. Reference Documents

Filename	Program Load Address	Flash Saved Address	Description
bl2_bp-smarc-rzv2l_pmic.srec	0x00011E00	0x00000000	Loader
fip-smarc-rzv2l_pmic.srec	0x00000000	0x0001D200	ARM Trusted Firmware and U-boot

For RZ/V2L Evaluation Kit

Table 3-2. SCIF Boot Mode setting

Switch	Pin1	Pin2	Pin3	Pin4
SW11	OFF	ON	OFF	OFF

Table 3-3. SPI Flash Boot Mode setting

Switch	Pin1	Pin2	Pin3	Pin4
SW11	OFF	OFF	ON	ON

3.1.2 How to write

In this guideline, we use Teraterm on Window PC as terminal console over UART port. User can also use similar tool in Ubuntu Linux PC such as minicom but the guideline is not mentioned here.

About the writing sequence, first we load and FlashWriter utility by SCIF boot mode, then in FlashWriter, we write BL2, BL31, u-boot to SPI Flash. After all, we select boot mode as SPI Flash boot mode and board will boot to U-boot console every time the board resets.

- **Step 1: Setting the terminal software**
  Connect USB connector of Windows Host PC into USB debug port on RZ/V2L target board. You can refer board manual to select the right port.
  Open Teraterm on Window PC, select VCOM port and setting UART configuration: baud rate 115200, 8bit data, parity none, stop 1 bit, flow control none.
- **Step 2: Write data file to SPI Flash**
  A file is written in SPI Flash in the following procedures.
  - Set dip switch “SCIF download mode”.
  - Reset board then start SCIF download mode.
  - After “Please send !” displayed, In case of Tera Term, transmit file FlashWriter (Flash_Writer_SCIF_RZV2L_SMARC_PMIC_DDR4_2GB_1PCS.mot) by "File -> Send file (S)".
  - Execute xls2 command (load program to flash).

```
> SCIF Download mode
 (C) Renesas Electronics Corp.
-- Load Program to System RAM ---------------
please send !

Flash writer for RZ/V2 Series V1.00 Sep.17,2021
Product Code : RZ/V2L
>xls2
===== Qspi writing of RZ/V2 Board Command =============
Load Program to Spiflash
Writes to any of SPI address.
 Micron : MT25QU512
Program Top Address & Qspi Save Address
===== Please Input Program Top Address ============
  Please Input : H'
```

After "Please Input Program Top Address" is displayed, input Program Top Address in 3.1 and "Enter".

- After "Please Input Qspi/HyperFlash Save Address" is displayed, input Flash Save Address in 3.1 and "Enter".
- After "Please send ! ('.' & CR stop load)" is displayed, In case of Tera Term, transmit files in 3.1 by "File -> Send file (S)".
- If there are some data in writing area, "SPI Data Clear(H'FF) Check :H'00000000-0003FFFF Clear OK?(y/n)" is displayed. Then input "y".
- After "SAVE SPI-FLASH .... complete!" is displayed, the prompt returns. It means finish.
- Please repeat the xls2 command, if other files are written.
- Power OFF.
- Set dip switch to “Boot Mode”.

3.2 Deploy kernel image, device tree and filesystem

User can deploy BSP binary on microSD card or eMMC. In this guide, we assume that user deploy kernel and filesystem on an micro SDCard 8GB. Ubuntu Host PC is connected to a card reader and first we do partition for the card with 2 EXT4 partitions: the first partition keeps kernel and device tree, the second are file system and copy kernel image, device tree, filesystem to the micro SD card.

Now the micro SD card is ready. We power on the target board in SPI Flash boot mode, then use U-boot command to load kernel and boot to filesystem. For detail about these steps, please refer below.

- On Linux Host PC, do partition and format for the micro SD card.

  After doing partition successfully, user can check the result with “fdisk” command. The result is similar as below.

```
Welcome to fdisk
Changes will remain in memory only, until you decide to write them.
Be careful before using the write command.

Command (m for help): p
Disk /dev/sdc: 7.5 GiB, 8031043584 bytes, 15685632 sectors
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disklabel type: dos
Disk identifier: 0x9a51e263

Device     Boot   Start      End  Sectors  Size Id Type
/dev/sdc1          2048  2048000  2045953  999M 83 Linux
/dev/sdc2       2050048 15685631 13635584  6.5G 83 Linux
```

- Copy kernel Image and device tree to the first partition (/dev/sdc1 as above). Copy and un-compress file core-image-<image_type>-smarc-rzv2l.tar.bz2 to the second partition. Now the micro SD card is ready. Unplug the card reader out of Linux Host PC and attach the micro SD card to RZ/V2L Target board.

- Boot up target board

  Select RZ/V2L board in “SPI Flash boot mode” as Table **3.3**, power up and the board boot to U-boot console. Then we set bootargs, load kernel, device tree and boot the kernel as below.

  Notice that in RZ/V2L Evaluation Kit, micro SD card slot is corresponding to SDHI1.

```
> setenv bootargs rw rootwait earlycon root=/dev/mmcblk1p2 video=HDMI-A-1:1280x720@60

> ext4load mmc 1:1 0x48080000 Image-smarc-rzv2l.bin
> ext4load mmc 1:1 0x48000000 r9a07g054l2-smarc.dtb
> booti 0x48080000 - 0x48000000
```

4. Memory map

(TBD)

5. U-Boot command

Please refer to U-Boot user's manual about available U-Boot command for RZ/V2 Linux BSP.
The help or “?” command shows U-Boot command list, but be careful that it includes some unsupported command.

6. Limitation

- Below driver has issue when perform One Pass Test:
    - RSPI (Renesas Serial Peripheral Interface):
        - Cannot transmit message from Master to Slave.

- MMP also has some issues in this release version:
    - v4l2src:
        - use io-mode=userptr: Do not support. Workaround: TBD.
        - use io-mode=dmabuf: Can run but randomly stop display at first frame. Frequent: ~30%.
          + Workaround: Reset board and running pipeline again.
    - omxh264dec:
        - Multiple stream playing parallel: Does not support.
        - Below issues can be solved by next omx library version:
          + Dmabuf issue: Noise when running with dmabuf-use. Workaround: Running in no-copy mode.
          + Random pending when playing stream.

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		Page	Summary
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