

RZ/G Verified Linux Package

Version 3.0.0-update1

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Release Note

Introduction

This release note describes the contents, building procedures and important points of the RZ/G Verified Linux Package (hereinafter referred to as “VLP/G”).

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1. Release Items

- **Name and version**

RZ/G Verified Linux Package

Version 3.0.0-update1 (hereinafter referred to as “VLP/G v3.0.0-update1”)

- **Distribution method**

Please visit the site below and create an account to download the packages. This site is for the entire RZ Family which includes the RZ/G series. Basic packages of VLP/G v3.0.0-update1 which are listed in **Table 1** can be downloaded.

RZ Family:

<https://www.renesas.com/products/microcontrollers-microprocessors/rz-arm-based-high-end-32-64-bit-mpus>

You can also download the basic packages of VLP/G v3.0.0-update1 which are listed in **Table 1** from the site below.

RZ/G Marketplace:

<https://www.renesas.com/products/microcontrollers-microprocessors/rz-cortex-a-mpus/rzg-linux-platform>

- **Target board**

Hoperun Technology HiHope RZ/G2H platform (hihope-rzg2h) Rev 4.0

Hoperun Technology HiHope RZ/G2M platform (hihope-rzg2m) Rev 4.0 (*1)

Hoperun Technology HiHope RZ/G2N platform (hihope-rzg2n) Rev 4.0

Silicon Linux RZ/G2E evaluation kit (ek874) Rev C

Silicon Linux RZ/G2E evaluation kit (ek874) Rev E

RZ/G2L Evaluation Board Kit PMIC version (*2):

- RZ/G2L SMARC Module Board v2.1
- RZ SMARC Series Carrier Board v4.0

RZ/G2LC Evaluation Board Kit (*3):

- RZ/G2LC SMARC Module Board v1.0
- RZ SMARC Series Carrier Board v4.0

RZ/G2UL Evaluation Board Kit (*4):

- RZ/G2UL SMARC Module Board v1.0
- RZ SMARC Series Carrier Board v4.0

(*1) There are 2 versions of RZ/G2M LSI devices. There are version 3.0 and 1.3 (hereinafter referred to as “RZ/G2M v3.0” and “RZ/G2M v1.3”).

(*2) “RZ/G2L Evaluation Board Kit” and “RZG2L Evaluation Board Kit PMIC version” includes the RZ/G2L SMARC Module Board and the RZ SMARC Series Carrier Board.

(*3) “RZG2LC Evaluation Board Kit” includes the RZ/G2LC SMARC Module Board and the RZ SMARC Series Carrier Board.

(*4) “RZ/G2UL Evaluation board Kit” includes the RZ/G2UL SMARC Module Board and the RZ SMARC Series Carrier Board.

- **Verified functions**

Linux BSP

- Linux Kernel
- Linux Drivers
- Graphics Libraries
- Codec Libraries

GUI Framework

- Qt (LGPL version)

- **File contents**

VLP/G is delivered by the files listed in **Table 1**.

Table 1. RZ/G Verified Linux Package**Basic files of VLP/G v3.0.0**

File	Description
RTK0EF0045Z0021AZJ-v3.0.0-update1.zip	Verified Linux Package. This file includes the Yocto recipe packages and the necessary documents.
rzg_bsp_v300.tar.gz	Yocto recipe packages
oss_pkg_v3.0.0.7z (2.2GB)	Open source software packages See the Note below before download
r01us0553ej0103-rz-g(Release Note).pdf	This document
r01us0554ej0101-rz-g(Component List).pdf	Component List
r01us0555ej0101-rz-g(Board_StartUp_Guide_RZG2H,M,N,E).pdf	Documents describing booting method and the required settings of bootloader for RZ/G2H, RZ/G2M, RZ/G2N, and RZ/G2E .
r01us0556ej0102-rz-g(Board_StartUp_Guide_smarcEVK).pdf	Documents describing booting method and the required settings of bootloader for RZ/G2L, RZ/G2LC, and RZ/G2UL .

Additional file of VLP/G v3.0.0-update1

File	Description
v300-to-v300update1.patch	This is the patch to update BSP from VLP/Gv3.0.0 to VLP/Gv3.0.0-update1. VLP/Gv3.0.0-update1 includes some bug fixes. Please refer to Appendix.  VLP/G v3.0.0-update1 is not fully tested. It is provided “AS IS” with no warranty.

Note) Open source software packages contain all source codes of OSSs except for Linux kernel. These are the same versions of OSSs used when VLP/G was verified.

If you are just evaluating VLP/G and RZ/G series, open source software packages are not mandatory to use.

Usually, all the software can be built without using these files if your build machine is connected to the Internet.

Open source software packages are required for an “offline” environment. The word “offline” means an isolated environment which does not connect to any network. VLP/G can always build images in this “offline” environment by using these packages without affected from changes of original repositories of OSSs. Also, this “offline” environment always reproduces the same images as the images which were verified by Renesas. Note that if you build without using open source software packages, there are possibilities to use different source codes than Renesas used due to the implicit changes of the repositories of OSSs.

Most bootable images that VLP/G supports can be built on an “offline” environment. Please refer to **2. Build environment**.

Optional packages (*1, 2)

VLP/G v3.0.0		
	File ("XX" is replaced by "EN" or "JP".)	Description
RZ MPU Graphics Library	RTK0EF0045Z13001ZJ-v1.0_XX.zip (Evaluation version) RTK0EF0045Z14001ZJ-v1.0_XX.zip (Unrestricted version)	For RZ/G2L and RZ/G2LC . These provide the graphics function compliant with the OpenGL ES standard. These libraries are tested with VLP/Gv3.0.0.
RZ MPU Video Codec Library	RTK0EF0045Z15001ZJ-v0.56_XX.zip (Evaluation version) RTK0EF0045Z16001ZJ-v0.56_XX.zip (Unrestricted version)	For RZ/G2L . These libraries are tested with VLP/Gv3.0.0.
Multimedia Packages	RTK0EF0045Z0022AZJ-v1.0_XX.zip (Evaluation version) RTK0EF0045Z0023AZJ-v1.0_XX.zip (Unrestricted version)	For RZ/G2H, M, N, E . These include the graphics library and the video codec library. These libraries are tested with VLP/Gv3.0.0.
VLP/G v3.0.0-update1		
	File ("XX" is replaced by "EN" or "JP".)	Description
RZ MPU Graphics Library	RTK0EF0045Z13001ZJ-v1.2_XX.zip (Evaluation version) RTK0EF0045Z14001ZJ-v1.2_XX.zip (Unrestricted version)	For RZ/G2L and RZ/G2LC . This provides graphics function compliant with the OpenGL ES standard.  These libraries are provided "AS IS" with no warranty.
RZ MPU Video Codec Library	RTK0EF0045Z15001ZJ-v0.58_XX.zip (Evaluation version) RTK0EF0045Z16001ZJ-v0.58_XX.zip (Unrestricted version)	RZ MPU Video Codec Library for RZ/G2L .  These libraries are provided "AS IS" with no warranty.

(*1) Evaluation vs Unrestricted Version

There are two release versions: Evaluation and Unrestricted. Please note that both of these packages have the same exact functionality. The only difference is that when you execute an application that uses the evaluation version of the libraries, operation will automatically be stopped after a few hours. The unrestricted version does not have this time limitation. To acquire the unrestricted version, please contact Renesas to start the formal process of acquiring those releases.

(*2) Please refer to the Table 2 to check which combination users can use and which combination is verified.

Table 2. Combination Table of LSI, VLP, Graphics, and Codec

LSI	VLP/G	Graphics	Video Codec	Note
RZ/G2L	v3.0.0	v1.0	v0.56	-
RZ/G2L	v3.0.0-update1	v1.2	v0.58	This combination is only partially tested.
RZ/G2LC	v3.0.0	v1.0	—	-
RZ/G2LC	v3.0.0-update1	v1.2	—	This combination is only partially tested.
RZ/G2UL	v3.0.0	—	—	-
RZ/G2UL	v3.0.0-update1	—	—	This combination is only partially tested.
RZ/G2H, RZ/G2M, RZ/G2N, RZ/G2E	v3.0.0	Multimedia Package v1.0		-
RZ/G2H, RZ/G2M, RZ/G2N, RZ/G2E	v3.0.0-update1	Multimedia Package v1.0		This combination is only partially tested.

Note) Multimedia Package v1.0 includes Graphics and Video Codec libraries.

Additional packages

File	Description
RTK0EF0045Z9006AZJ-v3.0.0.zip	BSP Manual Set for RZ/G2L, RZ/G2LC, and RZ/G2UL.
RTK0EF0045Z9002AZJ-v3.0.0.zip	BSP Manual Set for RZ/G2H, RZ/G2M, RZ/G2N, and RZ/G2E.

Note) Detailed information regarding the configuration (Device tree) and usage of the device drivers contained in this VLP/G can be downloaded from Renesas.com. Please download the "BSP Manual Set".

For RZ/G2L, LC, UL

<https://www.renesas.com/document/oth/rzg2l-group-bsp-manual-set>

For RZ/G2H, RZ/G2M, RZ/G2N, and RZ/G2E

<https://www.renesas.com/document/rzg2-group-bsp-manual-set>

2. Build environment

The environment for building the Board Support Package (hereinafter referred to as “BSP”) is listed in Table 3. Please refer to the below documents for details about setting up the environment:

SMARC EVK of RZ/G2L, RZ/G2LC, RZ/G2UL, RZ/V2L, and RZ/Five Start-up Guide

Reference Boards of RZ/G2H, RZ/G2M, RZ/G2N, and RZ/G2E Start-up Guide

A Linux PC is required for building the software.

A Windows PC can be used as the serial terminal interface with software such as TeraTerm.

Table 3. Equipment and Software Necessary for Developing Environments of RZ/G Linux Platform

Equipment	Description
Linux Host PC	Used as build/debug environment 100GB free space on HDD is necessary
OS	Ubuntu 20.04 LTS 64 bit OS must be used.
Windows Host PC	Used as debug environment, controlling with terminal software
OS	Windows 10
Terminal software	Used for controlling serial console of the target board Tera Term (latest version) is recommended Available at https://tssh2.osdn.jp/index.html.en
VCP Driver	Virtual COM Port driver which enables to communicate Windows Host PC and the target board via USB which is virtually used as serial port. Available at: <ul style="list-style-type: none"> http://www.ftdichip.com/Drivers/VCP.htm (for ek874, Evaluation Board Kit of RZ/G2L, RZ/G2LC, and RZ/G2UL) https://www.silabs.com/products/development-tools/software/usb-to-uart-bridge-vcp-drivers (for hihope-rzg2h, hihope-rzg2m, and hihope-rzg2n) Please install the VCP Driver corresponding to the target board.

Most bootable images VLP/G supports can be built on an “offline” environment.

The word “offline” means an isolated environment which does not connect to any network. Since VLP/G includes all necessary source codes of OSS except for the Linux kernel, VLP/G can always build images in this “offline” environment without affected from changes of repositories of OSS. Also, this “offline” environment reproduces the same images as the images which were verified by Renesas.

Below images can be built “offline”.

- core-image-minimal
- core-image-bsp
- core-image-weston (including the SDK build)
- core-image-qt (including the SDK build)

Below are not available in the “offline” environment. Please connect your Linux Host PC to the internet.

- Preparing a Linux Host PC

3. Build Instructions

3.1 Building images to run on the board

This section describes the instructions to build the Board Support Package.

Before starting the build, run the command below on the Linux Host PC to install packages used for building the BSP.

```
$ sudo apt-get update
$ sudo apt-get install gawk wget git-core diffstat unzip texinfo gcc-multilib \
build-essential chrpath socat cpio python python3 python3-pip python3-pexpect \
xz-utils debianutils iputils-ping libssl1.2-dev xterm p7zip-full libyaml-dev
```

Please refer to the URL below for detailed information:

- <https://docs.yoctoproject.org/3.1.5/brief-yoctoprojectqs/brief-yoctoprojectqs.html>

Run the commands below and set the user name and email address before starting the build procedure. **Without this setting, an error occurs when building procedure runs git command to apply patches.**

```
$ git config --global user.email "you@example.com"
$ git config --global user.name "Your Name"
```

Copy all files obtained from Renesas into your home directory prior to the steps below.

(1) Create a working directory at your home directory, and decompress Yocto recipe package

Run the commands below. The name and the place of the working directory can be changed as necessary.

⚠ To build “**update1**”, you must manually apply a patch file on top of the base v3.0.0 release. Please refer to section 7. **Appendix** at the very end of this document for the instructions.

⚠ Please note that “**update1**” had less testing than the base v3.0.0 release.

```
$ mkdir ~/rzg_vlp_v3.0.0
$ cd ~/rzg_vlp_v3.0.0
$ unzip ~/RTK0EF0045Z0021AZJ-v3.0.0-update1.zip
$ tar zxvf ./RTK0EF0045Z0021AZJ-v3.0.0-update1/rzg_bsp_v3.0.0.tar.gz
```

Note) Please note that your build environment must have 100GB of free hard drive space in order to complete the minimum build. The Yocto BSP build environment is very large. Especially in case you are using a Virtual Machine, please check how much disk space you have allocated for your virtual environment.

Note) If you have a board with the early silicon version, please refer to the **Section 6.1 - (1) Early version of RZ/G2L Evaluation Board Kit** and apply the patch files during this step. Please also confirm how to check which version you use.

(2) Enable Graphics and Video Codec

For RZ/G2L and RZ/G2LC

The graphics package and the video codec package can be used at the same time. And also, one of the packages can be used.

 Note) The video codec package is under development. This is released ASIS with no warranty.

If you want to enable the Graphics on RZ/G2L and RZ/G2LC when building **core-image-weston**, please copy the Graphics package (RTK0EF0045Z13001ZJ-v1.xx_EN.zip or RTK0EF0045Z13001ZJ-v1.xx_JP.zip) to working directory and run the commands below. If you build core-image-minimal, please ignore this step.

```
$ cd ~/rzg_vlp_v3.0.0
$ unzip ~/RTK0EF0045Z13001ZJ-v1.xx_EN.zip
$ tar zxvf RTK0EF0045Z13001ZJ-v1.xx_EN/meta-rz-features.tar.gz
```

For RZ/G2L

If you want to enable the video codec on RZ/G2L when building **core-image-weston** or **core-image-bsp**, please copy the video codec package (RTK0EF0045Z15001ZJ-v0.xx_EN.zip or RTK0EF0045Z15001ZJ-v0.xx_JP.zip) to working directory and run the commands below.

```
$ cd ~/rzg_vlp_v3.0.0
$ unzip ~/RTK0EF0045Z15001ZJ-v0.xx_EN.zip
$ tar zxvf RTK0EF0045Z15001ZJ-v0.xx_EN/meta-rz-features.tar.gz
```

For RZ/G2H, RZ/G2M, RZ/G2N, and RZ/G2E

If you want to enable the Graphics and the video codec on RZ/G2H, RZ/G2M, RZ/G2N, and RZ/G2E when building **core-image-weston**, please copy the Multimedia package (RTK0EF0045Z0022AZJ-v1.xx_EN.zip or RTK0EF0045Z0022AZJ-v1.xx_JP.zip) to working directory and run the commands below. If you build core-image-minimal, please ignore this step.

```
$ cd ~/rzg_vlp_v3.0.0
$ unzip ~/RTK0EF0045Z0022AZJ-v1.xx_EN.zip
$ tar zxvf RTK0EF0045Z0022AZJ-v1.xx_EN/meta-rz-features.tar.gz
```

VLP/G is set video output to LVDS as default setting. In case to use HDMI as a video output, please apply the patch with these commands. This step is only for **RZ/G2H, RZ/G2M, RZ/G2N, and RZ/G2E**.

```
$ cd ~/rzg_vlp_v3.0.0/meta-renesas
$ patch -p1 < ../extra/0001-Add-HDMI-support-for-RZ-G2.patch
$ cd ..
```

After applying above patch, please note the limitations for Audio, Bluetooth and SATA in section 6.2

(3) Setup a build environment

Run the commands below. The environment to build is set by the source command.

```
$ cd ~/rzg_vlp_v3.0.0
$ source poky/oe-init-build-env
```

(4) Prepare the default configuration files for the target board

Run the commands below. Please replace “*board*” by the name below:

HiHope RZ/G2H board:	hihope-rzg2h
HiHope RZ/G2M board:	hihope-rzg2m
HiHope RZ/G2N board:	hihope-rzg2n
EK874 RZ/G2E board:	ek874
RZ/G2L Evaluation Board Kit PMIC version:	smarc-rzg2l
RZ/G2LC Evaluation Board Kit:	smarc-rzg2lc
RZ/G2UL Evaluation Board Kit:	smarc-rzg2ul

```
$ cd ~/rzg_vlp_v3.0.0/build
$ cp ../meta-renesas/docs/template/conf/board/*.conf ./conf/
```

(5) Decompress OSS files to “build” directory (Optional)

Run the commands below. This step is not mandatory and able to go to the step (6) in case the “offline” environment is not required. All OSS packages will be decompressed with this '7z' command.

```
$ cd ~/rzg_vlp_v3.0.0/build
$ 7z x ~/oss_pkg_v3.0.0.7z
```

Note) If this step is omitted and BB_NO_NETWORK is set to “0” in next step, all source codes will be downloaded from the repositories of each OSS via the internet when running bitbake command. Please note that if you do not use an “offline” environment, a build may fail due to the implicit changes of the repositories of OSS.

After the above procedure is finished, the “offline” environment is ready. If you want to prevent network access, please change the line in the “~/rzg_vlp_v3.0.x/build/conf/local.conf” as below:

```
BB_NO_NETWORK = "1"
```

To change BB_NO_NETWORK from “0” to “1”.

Note) In case you use the libraries Graphics v1.2 and Video Codec v0.58, the setting “BB_NO_NETWORK = 0” is necessary.

Note) In case you use the patch for VLP/Gv3.0.0-update1, the setting "BB_NO_NETWORK = 0" is also necessary. Please refer to the Appendix section.

(6) Start a build

Run the commands below to start a build. Building an image can take up to a few hours depending on the user's host system performance.

```
$ bitbake core-image-weston
```

After the build is successfully completed, a similar output will be seen, and the command prompt will return.

```
NOTE: Tasks Summary: Attempted 7427 tasks of which 16 didn't need to be rerun and all succeeded.
```

All necessary files listed in **Table 5** and **Table 6** will be generated by the bitbake command and will be located in the **build/tmp/deploym/images** directory.

Table 5 is for RZ/G2L, RZ/G2LC, and RZ/G2UL.

Table 6 is for RZ/G2H, RZ/G2M, RZ/G2N, and RZ/G2E.

VLP/G can build a few types of images listed in **Table 4**. Please refer to the “Component list” for details about components of each image.

For the booting method and the required settings, please refer to the “SMARC EVK of RZ/G2L, RZ/G2LC, RZ/G2UL, RZ/V2L, and RZ/Five Start-up Guide” and the “Reference Boards of RZ/G2H, RZ/G2M, RZ/G2N, and RZ/G2E Start-up Guide”.

Table 4. Supported images of VLP/G

Image name	Target devices	Purpose
core-image-minimal	RZ/G2L, RZ/G2LC, RZ/G2UL RZ/G2H, M, N, E	Minimal set of components
core-image-bsp	RZ/G2L, RZ/G2LC, RZ/G2UL RZ/G2H, M, N, E	Minimal set of components plus audio support and some useful tools
core-image-weston	RZ/G2L, RZ/G2LC RZ/G2H, M, N, E	Standard image with graphics support
core-image-qt	RZ/G2L, RZ/G2LC RZ/G2H, M, N, E	Enable Qt LGPL version

“RZ/G2H, M, N, E” means the devices of RZ/G2H, RZ/G2M, RZ/G2N, and RZ/G2E.

Table 5 Image files for RZ/G2L, RZ/G2LC, and RZ/G2UL

RZ/G2L PMIC ver	Linux kernel	Image-smarc-rzg2l.bin
	Device tree file	Image-r9a07g044l2-smarc.dtb
	root filesystem	<image name>-smarc-rzg2l.tar.bz2
	Boot loader	<ul style="list-style-type: none"> • bl2_bp-smarc-rzg2l_pmic.srec • fip-smarc-rzg2l_pmic.srec
	Flash Writer	Flash_Writer_SCIF_RZG2L_SMARC_PMIC_DDR4_2GB_1PCS.mot
RZ/G2LC	Linux kernel	Image-smarc-rzg2lc.bin
	Device tree file	Image-r9a07g044c2-smarc.dtb
	root filesystem	<image name>-smarc-rzg2lc.tar.bz2
	Boot loader	<ul style="list-style-type: none"> • bl2_bp-smarc-rzg2lc.srec • fip-smarc-rzg2lc.srec
	Flash Writer	• Flash_Writer_SCIF_RZG2LC_SMARC_DDR4_1GB_1PCS.mot
RZ/G2UL	Linux kernel	Image-smarc-rzg2ul.bin
	Device tree file	Image-r9a07g043u11-smarc.dtb
	root filesystem	<image name>-smarc-rzg2ul.tar.bz2
	Boot loader	<ul style="list-style-type: none"> • bl2_bp-smarc-rzg2ul.srec • fip-smarc-rzg2ul.srec
	Flash Writer	• Flash_Writer_SCIF_RZG2UL_SMARC_DDR4_1GB_1PCS.mot

Table 6. Image files for RZ/G2H, RZ/G2M, RZ/G2N, and RZ/G2E

	Linux kernel	root filesystem	Boot loader
RZ/G2H	Image-hihope-rzg2h.bin	<image name>-hihope-rzg2h.tar.bz2	u-boot-elf-hihope-rzg2h.srec bootparam_sa0.srec bl2-hihope-rzg2h.srec bl31-hihope-rzg2h.srec tee-hihope-rzg2h.srec cert_header_sa6.srec
RZ/G2M v3.0 (*) v1.3 (*)	Image-hihope-rzg2m.bin	<image name>-hihope-rzg2m.tar.bz2	u-boot-elf-hihope-rzg2m.srec bootparam_sa0.srec bl2-hihope-rzg2m.srec bl31-hihope-rzg2m.srec tee-hihope-rzg2m.srec cert_header_sa6.srec
RZ/G2N	Image-hihope-rzg2n.bin	<image name>-hihope-rzg2n.tar.bz2	u-boot-elf-hihope-rzg2n.srec bootparam_sa0.srec bl2-hihope-rzg2n.srec bl31-hihope-rzg2n.srec tee-hihope-rzg2n.srec cert_header_sa6.srec
RZ/G2E	Image-ek874.bin	<image name>-ek874.tar.bz2	u-boot-elf-ek874.srec bootparam_sa0.srec bl2-ek874.srec bl31-ek874.srec tee-ek874.srec cert_header_sa6.srec

<image name> will be the name used in the step (8).

Device tree files

	Type 1	Type 2	Type 3	Type 4
RZ/G2H	Image-r8a774e1- hihope-rzg2h.dtb	Image-r8a774e1- hihope-rzg2h-ex.dtb	Image-r8a774e1- hihope-rzg2h-ex-idk- 1110wr.dtb	Image-r8a774e1- hihope-rzg2h-ex-mipi- 2.1.dtb
RZ/G2M v1.3 (*1)	Image-r8a774a1- hihope-rzg2m.dtb	Image-r8a774a1- hihope-rzg2m-ex.dtb	Image-r8a774a1- hihope-rzg2m-ex-idk- 1110wr.dtb	Image-r8a774a1- hihope-rzg2m-ex- mipi-2.1.dtb
RZ/G2M v3.0 (*1)	Image-r8a774a3- hihope-rzg2m.dtb	Image-r8a774a3- hihope-rzg2m-ex.dtb	Image-r8a774a3- hihope-rzg2m-ex-idk- 1110wr.dtb	Image-r8a774a3- hihope-rzg2m-ex- mipi-2.1.dtb
RZ/G2N	Image-r8a774b1- hihope-rzg2n.dtb	Image-r8a774b1- hihope-rzg2n-ex.dtb	Image-r8a774b1- hihope-rzg2n-ex-idk- 1110wr.dtb	Image-r8a774b1- hihope-rzg2n-ex-mipi- 2.1.dtb
RZ/G2E EK874 Rev C (*2)	Image-r8a774c0- cat874-revc.dtb	Image-r8a774c0- ek874-revc.dtb	Image-r8a774c0- ek874-revc-idk- 2121wr.dtb	Image-r8a774c0- ek874-revc-mipi- 2.1.dtb
RZ/G2E EK874 Rev E (*2)	Image-r8a774c0- cat874.dtb	Image-r8a774c0- ek874.dtb	Image-r8a774c0- ek874-idk-2121wr.dtb	Image-r8a774c0- ek874-mipi-2.1.dtb

There are 4 types of the device tree files. Available devices are different depending on them. Please refer to the following description:

- **Type1:** Main board only
- **Type2:** Main board + Sub board
- **Type3:** Main board + Sub board + LVDS panel
- **Type4:** Main board + Sub board + MIPI/CSI2 cameras

Please note that users who use the combination of main and sub boards need to use type2-4 as a device tree file. **If the dtb files of type1 are used, interfaces on the sub board such as Ethernet are not able to be used.**

(*1) There are 2 types of RZ/G2M LSI (“RZ/G2M v3.0” and “RZ/G2M v1.3”). In case you use the hihope-rzg2m board which has one of them, the same image files can be used, but the same device tree files cannot be used. Please refer to the above table. If the board prints the messages below when turn on the power, RZ/G2M v3.0 is used on your board. In case of RZ/G2M v1.3, “**R8A774A1**” will be displayed.

CPU: Renesas Electronics R8A774A3
--

(*2) There are 2 revisions of the ek874 board (Rev C, E). In case you use the ek874 board, the same image files can be used, but the same device tree files cannot be used. Please refer to the above table. You can check the board revision with the silk printed on the board.

Note) The dtb files listed in the Table 6 cannot be used for the early version of boards. See the section 6.

Notes - (1). In case you use the hihope-rzg2m board which has RZ/G2M v3.0 LSI, the dtb files listed in the Table 6 can be used because the board is the latest version.

3.2 Building SDK

To build Software Development Kit (SDK), run the commands below after the steps (1) – (6) of section 3.1 are finished. The SDK allows you to build custom applications outside of the Yocto environment, even on a completely different PC. The results of the commands below are ‘installer’ that you will use to install the SDK on the same PC, or a completely different PC.

For building general applications:

```
$ cd ~/rzg_vlp_v3.0.0/build
$ bitbake core-image-weston -c populate_sdk
```

For building Qt applications:

```
$ cd ~/rzg_vlp_v3.0.0/build
$ bitbake core-image-qt -c populate_sdk
```

The resulting SDK installer will be located in **build/tmp/deploy/sdk/**

The SDK installer will have the extension .sh

To run the installer, you would execute the following command:

```
$ sudo sh poky-glibc-x86_64-core-image-weston-aarch64-<board>-toolchain-3.1.14.sh
```

Or

```
$ sudo sh poky-glibc-x86_64-core-image-qt-aarch64-<board>-toolchain-3.1.14.sh
```

Please replace *<board>* by the name below:

HiHope RZ/G2H board:	hihope-rzg2h
HiHope RZ/G2M board:	hihope-rzg2m
HiHope RZ/G2N board:	hihope-rzg2n
EK874 RZ/G2E board:	ek874
RZ/G2L Evaluation Board Kit PMIC version:	smarc-rzg2l
RZ/G2LC Evaluation Board Kit:	smarc-rzg2lc
RZ/G2UL Evaluation Board Kit:	smarc-rzg2ul

Note) The SDK build may fail depending on the build environment. At that time, please run the build again after a period of time. Or build it again from scratch with the below commands.

```
$ cd ~/rzg_vlp_v3.0.0/build
$ bitbake core-image-weston -c cleanall
$ bitbake core-image-weston
```

For building general applications:

```
$ bitbake core-image-weston -c populate_sdk
```

For building Qt applications:

```
$ bitbake core-image-qt -c populate_sdk
```

4. Components

Compared to the RZ/G Verified Linux Package (hereinafter referred to as “VLP”) for 64bit kernel and RZ/G2L Group Board Support Package, this version uses different version of Linux kernel. Please also refer to the “Component list” for details.

Table 7. Versions of commonly used components

Components	VLP for 64bit kernel v1.0.10	RZ/G2L Group Board Support Package v1.4	VLP/G v3.0.0-update1
	For RZ/G2H,RZ/G2M, RZ/G2N, RZ/G2E	For RZ/G2L,RZ/G2LC, RZ/G2UL	For RZ/G2 Group
Linux kernel	4.19.198-cip54	4.19.140-cip54	5.10.83-cip1
GCC	7.2.1 (Linaro GCC 7.2-2017.11)	8.3.0 (Arm GCC 8.3-2019.03)	8.3.0 (Arm GCC 8.3-2019.03)
glibc	2.28	2.28	2.28
busybox	1.30.1	1.31.1	1.31.1
openssl	1.1.1d	1.1.1d	1.1.1d
gstreamer1.0	1.12.2	1.16.3	1.16.3
wayland	1.13.0	1.18.0	1.18.0
weston	2.0.0	8.0.0	8.0.0
Python3	3.5.3	3.8.12	3.8.12
Qt (GPL version)	5.6.3	5.6.3	5.6.3
Docker	17.06	19.03.8-ce	19.03.8-ce

Note) RZ/G2 Group includes RZ/G2H, RZ/G2M, RZ/G2N, RZ/G2E, RZ/G2L, RZ/G2LC, and RZ/G2UL.

5. Restrictions

(1) USB camera 3.0

RZ/G2E cannot stream with higher resolution than Full HD when you use a camera with USB 3.0.

(2) CSI40

Disable CSI40 in RZ/G2H, N and G2M v3.0 by default due to SW limitation.

(3) Wifi and Bluetooth

Low performance while using 2.4GHz Wifi/Bluetooth and USB 3.0 device in HiHope RZ/G2H, M, and N at the same time due to noise. If using USB3.0 device, should connect to 5GHz Wifi network.

6. Notes

There are 3 groups of notes in this section. They are listed below. Please refer to them according to your boards.

- Notes for RZ/G2L, RZ/G2LC, and RZ/G2UL
- Notes for RZ/G2H, RZ/G2M, RZ/G2N, and RZ/G2E
- Common Notes for all RZ Platforms

6.1 Notes for RZ/G2L, RZ/G2LC, and RZ/G2UL

(1) Early version of RZ/G2L Evaluation Board Kit

When you use the **early** version of the RZ/G2L LSI, please run the commands below to apply the patch files after step (1) in the section 3.1.

```
$ cd ~/rzg_vlp_v3.0.0/meta-renesas
$ patch -p1 < ../extra/0002-trusted-firmware-a-add-rd-wr-64-bit-reg-workaround.patch
$ patch -p1 < ../extra/0003-recipes-rzg2l-linux-renesas-add-WA-GIC-access-64bit\
.patch
```

Note) If you want to know which version of the RZ/G2L LSI you use, please check the LSI on the board. When “2050KC002” is printed on the LSI, you use the early version.

6.2 Notes for RZ/G2H, RZ/G2M, RZ/G2N, and RZ/G2E

(1) Device tree for RZ/G2M and RZ/G2N

The dtb files listed in the **Table 6** cannot be used for the early revision of Hoperun boards. If you are using revision 2 boards, please use below files. These are automatically generated at the same place as the other image files when building a BSP.

HiHope RZ/G2M board:

- Image-r8a774a1-hihopec-rzg2m-**rev2**.dtb (main board only)
- Image-r8a774a1-hihopec-rzg2m-**rev2**-ex.dtb (main + sub board)
- Image- r8a774a1-hihopec-rzg2m-**rev2**-ex-idk-1110wr.dtb (main + sub board + LVDS-IF)
- Image-r8a774a1-hihopec-rzg2m-**rev2**-ex-mipi-2.1.dtb (main + sub board + MIPI/CSI2 cameras)

HiHope RZ/G2N board:

- Image-r8a774b1-hihopec-rzg2n-**rev2**.dtb (main board only)
- Image-r8a774b1-hihopec-rzg2n-**rev2**-ex.dtb (main + sub board)
- Image- r8a774b1-hihopec-rzg2n-**rev2**-ex-idk-1110wr.dtb (main + sub board + LVDS-IF)
- Image-r8a774b1-hihopec-rzg2n-**rev2**-ex-mipi-2.1.dtb (main + sub board + MIPI/CSI2 cameras)

Silicon Linux RZ/G2E board (EK874):

- Please refer to (7) **Device tree for RZ/G2E** in this section.

Note) Board revision is printed below the Hoperun logo on boards.

(2) Video output

VLP/G is set video output to LVDS as default setting. In case to use HDMI as a video output, please apply the patch with these commands. This step is only for RZ/G2H, RZ/G2M, RZ/G2N, and RZ/G2E.

```
$ cd ~/rzg_vlp_v3.0.0/meta-renesas
$ patch -p1 < ../extra/0001-Add-HDMI-support-for-RZ-G2.patch
```

After applying above patch, please note to below points.

Audio

In case 48kHz audio, please set SW2404 to P1 side in HiHope Rev4 Boards of RZ/G2H, M, and N.

Bluetooth

Firmware of Bluetooth is integrated into the kernel. Therefore, this step is not necessary.

```
hciattach /dev/ttySC1 texas 3000000
```

Instead, this step is required.

```
rfkill unblock bluetooth
```

SATA

SATA interface on HiHope Rev4 Boards of RZ/G2H, N is enabled by setting switches as below. (SATA cannot be supported in the RZ/G2N Rev2 board due to HW limitation).

- SW1001-7 on main board: OFF
- SW43 on sub board: ON

(3) Video playback

Due to the specification of open source software (GStreamer and others) and drivers, multiple GStreamer pipelines with hardware scale cannot run.

Also, below formats of video are not supported.

- NV61
- YUV420
- YUV422
- YUV444
- H.264, 80Mbps

(4) ECC

The ECC function for DRAM has two modes: 8bit data/5bit ECC mode and 64bit data/8bit ECC mode. 8bit data/5bit ECC mode can be evaluated by the following method. When applying the ECC function to products or need other details including the method to enable 64bit data/8bit ECC mode, please contact Renesas.

Enable the function by changing the lines below in the `local.conf`.

Disable:

```
# MACHINE_FEATURES_append = " ecc"
# ECC_MODE = "Partial"
```

Enable:

```
MACHINE_FEATURES_append = " ecc"
ECC_MODE = "Full"
```

This sets 8bit data/5bit ECC mode for all DRAM region. After building, please replace all images including boot loaders.

(5) SDHI

The early revision of EK874 boards cannot detect the insertion of an SD card. Please plugged in a card before turning on the power.

(6) VIN

One camera input is enabled in default settings. Two camera inputs can be enabled in RZ/G2H, N and M v3.0. Please refer to the Video Capture Driver User's Manual that is included in the RZ/G2 Group BSP Manual Set for more details.

VIN on early revision of HiHope RZ/G2M and N boards fails to work. Please use newer boards in case VIN is necessary.

(7) Device tree for RZ/G2E

The dtb files listed in the Table 6 cannot be used for the early version (ES1.0) of RZ/G2E.

If the board prints the messages below when turn on the power, ES1.0 of RZ/G2E is implemented on the board.

```
[ 0.000096] NOTICE: BL2: RZ G2E Initial Program Loader(CA53)
[ 0.004373] NOTICE: BL2: Initial Program Loader(Rev.1.0.23)
[ 0.009991] NOTICE: BL2: PRR is RZG G2E Ver.1.0
```

```
CPU: Renesas Electronics R8A774C0 rev 1.0
```

In this case, please use below dtb files instead. These are built simultaneously when building normal dtb files.

- Image-r8a774c0-es10-cat874.dtb (main board only)
- Image-r8a774c0-es10-ek874.dtb (main + sub board)
- Image-r8a774c0-es10-ek874-idk-2121wr.dtb (main + sub board + LVDS panel)
- Image-r8a774c0-es10-ek874-mipi-2.1.dtb (main + sub board + MIPI/CSI2 cameras)

In case both old and new RZ/G2E LSIs are used in your laboratory at the same time, dtb files can automatically be selected using the environment variable `cut_ver` which is set by u-boot program according to the LSI's information. Please store multiple dtb files in an SD card and set `bootcmd` of u-boot like this.

```
setenv bootcmd 'fatload mmc 0:1 0x48080000 Image; if test "${cut_ver}" = "10"; then
fatload mmc 0:1 0x48000000 Image-r8a774c0-es10-ek874.dtb; else fatload mmc 0:1 0x480
00000 Image-r8a774c0-ek874.dtb ; fi ; booti 0x48080000 - 0x48000000'
```

(8) Wifi

Wifi is disabled in default settings but modules necessary for Wifi functions are installed into rootfs. In case Wifi is necessary, please enable it from a console as below.

```
$ rfkill list
```

If this command shows "Soft blocked: yes", run "unblock" command like this.

```
$ rfkill unblock wlan
```

Then, continue below.

```
$ connmanctl
connmanctl> scan wifi
connmanctl> services
connmanctl> agent on
connmanctl> connect <network_name>
    <input password>
connmanctl> quit
```

You may need to retry the “connect” command few times.

Note that some settings relating about radio waves should be adjusted according to the laws of each region. Please refer to general information in books and websites about Linux networking.

6.3 Common Notes for all RZ Platforms

(1) GPLv3 packages

In this release, the GPLv3 packages are disabled as default in *build/conf/local.conf*:

```
INCOMPATIBLE_LICENSE = "GPLv3 GPLv3+"
```

If you want to use GPLv3, just hide this line:

```
#INCOMPATIBLE_LICENSE = "GPLv3 GPLv3+"
```

(2) Disable libraries of Graphics and Video Codec

When you want to disable the functions of the libraries of the graphics and the video codec, please add the following lines in *build/conf/local.conf*:

- Disable OpenGL ES library in the graphics package (*1)

```
USE_RENESAS_GLES = "0"
```

- Disable OpenCL library in the graphics package (*1)

```
USE_RENESAS_OPENCL = "0"
```

- Disable OpenMAX library for decode in the video codec package (*2)

```
USE_CODEC_DEC = "0"
```

- Disable OpenMAX library for encode in the video codec package (*2)

```
USE_CODEC_ENC = "0"
```

(*1) This library is included in RTK0EF0045Z13001ZJ-v1.0_EN.zip and RTK0EF0045Z13001ZJ-v1.0_JP.zip

(*2) This library is included in RTK0EF0045Z15001ZJ-v0.56_EN.zip and RTK0EF0045Z15001ZJ-v0.56_JP.zip

(3) Docker

Docker is disabled in the default settings of VLP/G. To enable Docker, please uncomment the below line inside the file “~/rzg_vlp_v3.0.x/build/conf/local.conf” before building images.

```
#MACHINE_FEATURES_append = " docker"
```

(4) Real time performance

If you want to use the kernel which improves the real-time performance, please add the line below to the file `"~/rzg_vlp_v3.0.x/build/conf/local.conf"`.

```
IS_RT_BSP="1"
```

(5) LVGL Demo

LVGL demo which is a GUI application framework for embedded devices is disabled in the default settings of VLP/G. The demo is under development, so don't change the below line inside the file `"~/rzg_vlp_v3.0.x/build/conf/local.conf"` before building images. When you change the value, the build fails.

```
INSTALL_RZG2_DEMOS = "0"
```

(6) USB Video Class

USB Video Class (UVC) driver is not installed with the default settings of VLP/G due to its large size.

In case UVC devices such as USB cameras are necessary, please install the driver by adding the line below to `local.conf`.

```
IMAGE_INSTALL_append = " kernel-module-uvcvideo "
```

(7) CIP Core Packages

VLP/G includes Debian 10 (Buster) based CIP Core Packages indicated as "(CIP Core Buster)" in the **Table 7** and is enabled by the default settings. These packages can be replaced with other versions of packages.

Note that network access is required to start the build process when you enable these packages except for Buster which is set as the default setting.

CIP Core Packages are going to be maintained by the Civil Infrastructure Platform project. For more technical information, please contact Renesas.

1. Buster (default):

The following lines are added as default in the `local.conf`:

```
# Select CIP Core packages  
CIP_CORE = "1"
```

2. No CIP Core Packages:

If the CIP Core Packages are unnecessary, comment out and add the following lines to disable CIP Core Packages in the `local.conf`:

```
# Select CIP Core packages  
#CIP_CORE = "1"
```

Note) The above 2 settings disable GPLv3 packages as default. In case the GPLv3 packages are required, please comment out the following line in the `local.conf`.

```
# INCOMPATIBLE_LICENSE = "GPLv3 GPLv3+"
```

By building the BSP, the packages will be replaced as below in the table.

Table 8. Versions of all Buster Debian packages

Package	Buster Debian
attr	2.4.48
busybox	1.31.1
coreutils	6.9
gcc	8.3.0
glib-2.0	2.58.3
glibc	2.28
gnupg	1.4.7
kbd	2.0.4
libassuan0	2.5.2
libgcrypt	1.8.4
libunistring	0.9.10
libnss	0.14.1
openssh	7.9p1
perl	5.30.1
pkgconfig	0.29
quilt	0.65

7. Appendix

• Update patch for VLP/G v3.0.0

Renesas released VLP/G v3.0.0 in the end of March 2022. After that, the patch file is released to update VLP/G v3.0.0 to VLP/G v3.0.0-update1.

 Please note that VLP/G v3.0.0-update1 is not fully tested. It is provided “AS IS” with no warranty.

Update points of VLP/G v3.0.0-update1

- Fix the below vulnerabilities:
 - CVE-2022-0847 (Dirty Pipe)
 - CVE-2022-0778 (Infinite loop in OpenSSL)
- Improve the real-time performance
- (Optional) Upgrade the kernel version from 5.10.83-**cip1** to 5.10.104-**cip3**

Copy the update package file (RTK0EF0045Z0021AZJ-v3.0.0-update1.zip) obtained from Renesas into your home directory prior to the steps below.

• How to use the patch file

Please run the commands below instead of the step (1) in the section 3.1.

```
$ mkdir ~/rzg_vlp_v3.0.0
$ cd ~/rzg_vlp_v3.0.0
$ unzip ~/RTK0EF0045Z0021AZJ-v3.0.0-update1.zip
$ tar zxvf ./RTK0EF0045Z0021AZJ-v3.0.0-update1/rzg_bsp_v3.0.0.tar.gz
$ patch -p1 < ./RTK0EF0045Z0021AZJ-v3.0.0-update1/v300-to-v300update1.patch
```

(Optional)

If you want to use the newer kernel version of 5.10.104-**cip3**, please run the additional commands as below after applying the above patch of “v300-to-v300update1.patch”. VLP/G v3.0.0 and VLP/G v3.0.0-update1 use the 5.10.83-**cip1** kernel as default.

- VLP/G v3.0.0 is fully tested with the 5.10.83-**cip1** kernel.
- VLP/G v3.0.0-**update1** is not tested with the 5.10.104-**cip3** kernel.

```
$ cd ~/rzg_vlp_v3.0.0
$ patch -p1 < ./extra/v300update1-to-v300update1_cip3.patch (*1)
```

(*1) “v300update1-to-v300update1_cip3.patch” is created automatically in the “extra” directory after applying “v300-to-v300update1.patch” to your working directory.

After that, run the step (2) in the section 3.1. Network access is needed to build VLP/Gv3.0.0-update1. Please refer to (5) of the section 3.1 to enable the network access.

8. Revision History

Rev.	Date	Description	
		Page	Summary
1.01	Jun. 6, 2022	-	First edition for VLP/G v3.0.0-update1.
1.02	Jun. 24, 2022	11	Add the "Target devices" column to the Table 4.
		23	Fix the patch file name and the commands.
1.03	Jul 8,2022	5	Update the Graphics and Video codec libraries for RZ/G2L and RZ/G2L.
		15	Add the additional information to the table 7.

Website and Support

Renesas Electronics Website

<http://www.renesas.com/>

Inquiries

<http://www.renesas.com/contact/>

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