RZ/V2M ISP Support Package Version.1.41

Release Note

Introduction

This release note describes the contents of the RZ/V2M ISP Support Package and how to construct its operating environments.

Contents

1. Release Items

The release items in the RZ/V2M ISP Support Package are as following.

- **Name and Version**

    RZ/V2M ISP Support Package Version.1.41

- **Target Board**

    Evaluation kit for RZ/V2M

    Note: For the settings of Evaluation kit for RZ/V2M, please refer to "3.2 Board Setting" of the RZ/V2M
    Linux Package Start-Up Guide. Refer to "5.1 Preparation" for necessary equipment other than the
    Evaluation kit for RZ/V2M.

- **Features**

    1. Firmware that controls ISP (Provided as binary)
        This firmware is for using RZ/V2M ISP functions.

        Major updates:

            Captured image adjustment APIs are added.

    2. Patch for RZ/V2M Linux Package for ISP control
        This is a patch for RZ/V2M Linux Package to control ISP from Linux.

        Major updates:

            The additional ISP APIs are supported.

- **File Contents**

Table 1-1 shows the list of contents in this package. Table 1-2 shows the list of contents in meta-rz-features.tar.gz.

Table 1-1 File Contents

Folder / Filename	Explanation
core1_firmware.bin	Firmware binary file on core1.
r01an6542ej0141-rzv2m-isp-control-sw-specifications_IMX415.pdf	API specification for ISP control.
meta-rz-features.tar.gz	Recipe to add ISP support to Linux Package.
r01an5978ej0141-rzv2m_isp-support-package_ver1.41_IMX415release-note.pdf	This document.

Table 1-2 Contents of meta-rz-features.tar.gz

Directory			Explanation
meta-rz-features			meta-layer top folder.
	meta-rz-isp		meta-isp-layer top folder
		classes/	There is a yocto classes file inside.
		conf/	meta-rz-features configuration files.
		recipes-isp/	recipes-layer files to add ISP Support Package to Linux Package.
		recipes-comctl/	Command control library* Recipe.
		recipes-core/	There is a core-image-bsp bb file inside.
		recipes-kernel/	Kernel patches required to apply this meta-layer.
		recipes-openamp/	OpenAMP** bare metal library Recipe.
	recipes-openamp/		recipes-layer files to add OpenAMP** support to Linux Package.

* The command control library is the library that supports ISP control API from Linux application.

** The OpenAMP open-source software provides asymmetric multiprocessing functions.

- **Related Packages**

    1. Linux Package [VLP 3.0. 4]

    2. RZ/V2M DRP-AI Support Package V7. 4.0

- **Related Documents**

    1. RZ/V2M Linux Package Release Note (R01AN5971EJ0140)

    2. RZ/V2M Linux Package Start-Up Guide (R01US0527EJ0140)

    3. RZ/V2M DRP-AI Support Package Release Note (R11AN0530EJ0740)

    4. RZ/V2M DRP-AI Sample Application Note

2. System Configuration

The following illustration represent the system configuration when this package is applied to the Linux Package.
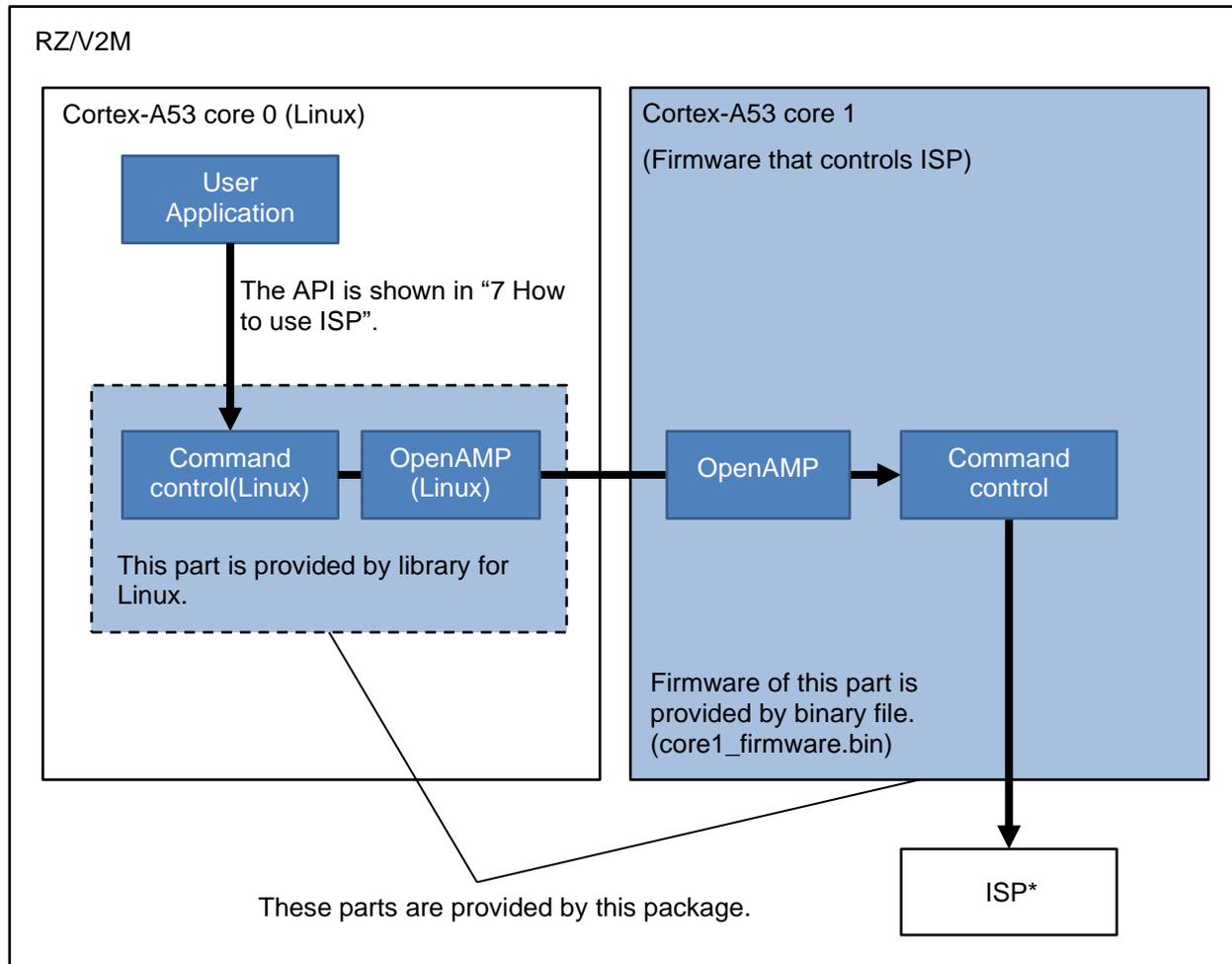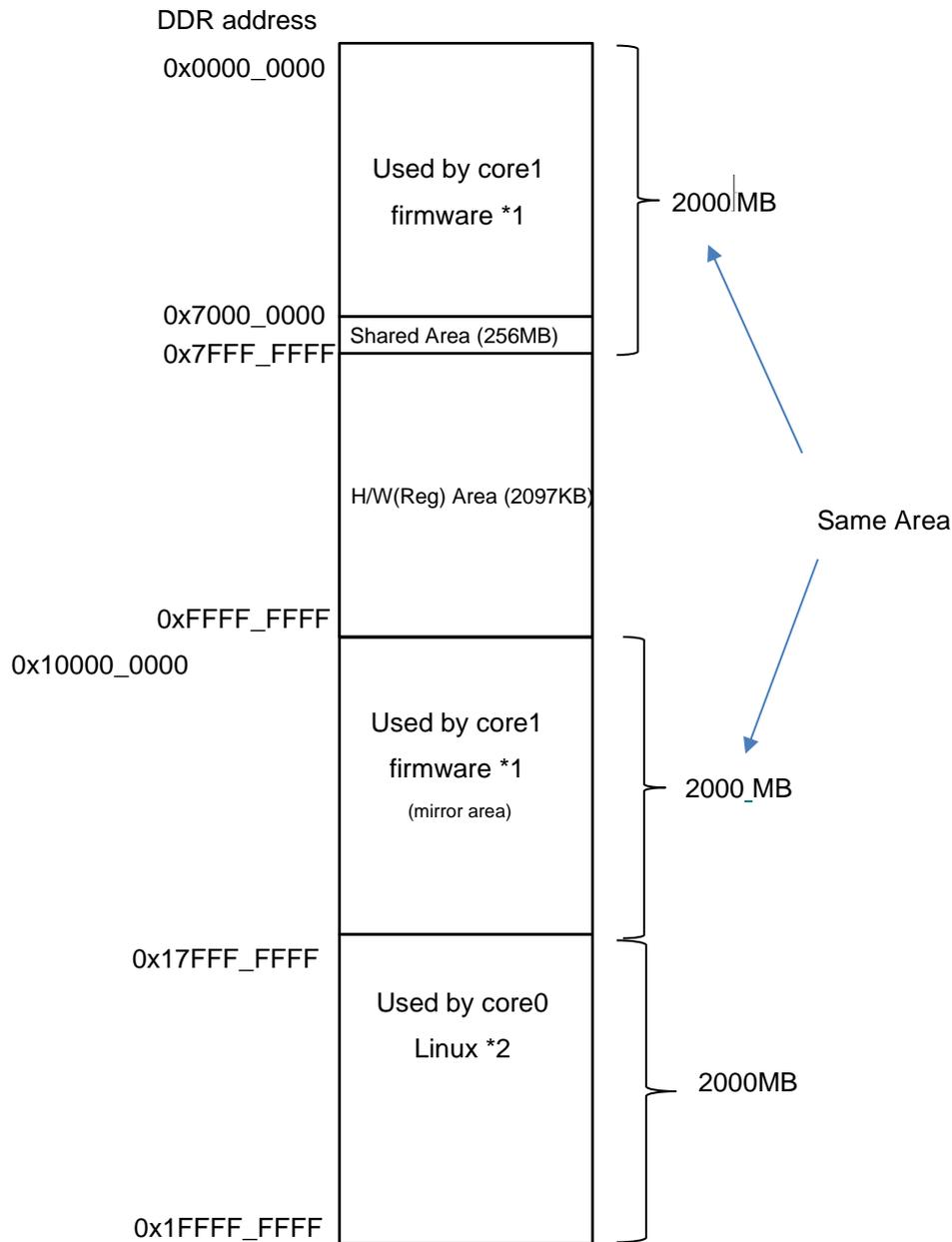

* Image Signal Processor of RZ/V2M.

Refer to r01an6542ej0141-rzv2m-isp-control-sw-specifications_IMX415.pdf   for explanation of ISP.

Figure 2-1 System configuration

3. Memory Map

The following illustration represent DDR memory map when this package is applied to the Linux Package.

DDR address

Address	Region	Size
0x0000_0000	Used by core1 firmware *1	2000 MB
0x7000_0000	Shared Area (256MB)	
0x7FFF_FFFF		
	H/W(Reg) Area (2097KB)	
0xFFFF_FFFF		
0x10000_0000	Used by core1 firmware *1 (mirror area)	2000 MB
0x17FFF_FFFF	Used by core0 Linux *2	2000MB
0x1FFFF_FFFF		

Same Area

*1 The area used by the core1 firmware that controls ISP for MIPI camera images, etc.

*2 Please refer to the "5.1 Memory Map" of "RZ/V2M Linux Package Release Note" for a detailed breakdown.

Figure 3-1 Memory Map

4. Build

This chapter will explain how to build the RZ/V2M ISP Support Package. The following packages are required to build this package.

1. RZ/V2M Linux Package
2. RZ/V2M DRP-AI Support Package

Note: Before executing bitbake commands, apply all above recipes.

4.1 Preparation

Refer to the "RZ/V2M DRP-AI Support Package Release Note" and follow the steps described in the "3. Build" chapter.

4.2 Add the Environmental Variable

As in the "RZ/V2M DRP-AI Support Package Release Note", set the working directory as the environmental variable.

```
$ export WORK=/home/user/user_work
```

Note: Specify the working directory in red above according to your machine. The example above uses "user/user_work".

4.3   Extract the ISP Support Package recipe

Go to the working directory and extract the ISP Support Package contained in this package.

```
$ cd $WORK
$ tar xzvf meta-rz-features.tar.gz
```

After the command executed, meta-rz-features will be shown in the working directory.

```
$WORK/
    build/
    meta-gplv2/
    meta-openembedded/
    meta-renesas/
    meta-rz-features/
    poky/
```

Note: The directories in red are added when the recipe of ISP Support Package is extracted.

4.4 Set the build environment variables

Run the following command to set the environment variable for the build.

Note: The environmental variable will be reset if the terminal is closed. Please run the command for each time you open the terminal.

```
$ cd $WORK

$ TEMPLATECONF=$PWD/meta-renesas/meta-rzv2m/docs/template/conf/ source poky/oe-init-
build-env build
```

4.5 Confirm the configuration

Confirm the bblayers.conf and local.conf files look like below.

```
$ tail conf/bblayers.conf

  ${TOPDIR}/../meta-linaro/meta-linaro-toolchain \

  ${TOPDIR}/../meta-linaro/meta-optee \

  ${TOPDIR}/../meta-openembedded/meta-oe \

  ${TOPDIR}/../meta-openembedded/meta-python \

  ${@'${TOPDIR}/../meta-openembedded/meta-filesystems' if '${VIRTUALIZATION_CHECK}'
== 'True' else ''} \

  ${@'${TOPDIR}/../meta-openembedded/meta-networking' if '${VIRTUALIZATION_CHECK}' ==
'True' else ''} \

  ${@'${TOPDIR}/../meta-openembedded/meta-python' if '${VIRTUALIZATION_CHECK}' ==
'True' else ''} \

  ${@'${TOPDIR}/../meta-virtualization' if '${VIRTUALIZATION_CHECK}' == 'True' else
''} \

  ${TOPDIR}/../meta-rz-drpai \
  "

$ tail conf/local.conf


# Configuration for Docker

#MACHINE_FEATURES_append = " docker"


DL_DIR = "${TOPDIR}/oss_packages"

BB_NO_NETWORK = "0"


TOOLCHAIN_TARGET_TASK_append = " kernel-devsrc"


IMAGE_INSTALL_append =" ai-eva-sw "
```

Note: The parts written in red are the parts changed in RZ/V2M DRP-AI Support Package.

4.6   Build

Run the bitbake command to build the Linux Package.

```
$ cd $WORK/build
$ MACHINE=rzv2m bitbake core-image-bsp
```

After the Build, the following files will be generated under $WORK/build/tmp/deploy/images/rzv2m.

Table 4-1 Generated Files after Build

Filename	Name
Image	Linux Kernel Image
r9a09g011gbg-evaluation-board.dtb	Linux Device Tree File
core-image-bsp-rzv2m.tar.bz2	A set of root filesystem

5. Boot

This chapter will explain how to boot the system applied by RZ/V2M ISP Support Package.

There are two ways to boot.

- ・**the network boot**
- ・**boot from the SD Card.**

5.1 Preparation

Refer to "4.2 Preparation" or "5.2 Preparation" of "RZ/V2M DRP-AI Support Package Release Note" to prepare for booting.

- ・"4.2 Preparation" : the preparation for Network booting
- ・ "5.2 Preparation": the preparation for SD Card booting.

In addition, prepare the sensor board Sensor-IMX415 Board attached to the Evaluation kit for RZ/V2M. with CS mount lens and video monitor connecting by HDMI cable.

Table 5-1 lists necessary equipment for network booting and

Table 5-3 lists necessary equipment for SD Card booting.

The RZ/V2M Evaluation Board connected sensor board and video monitor looks like below.
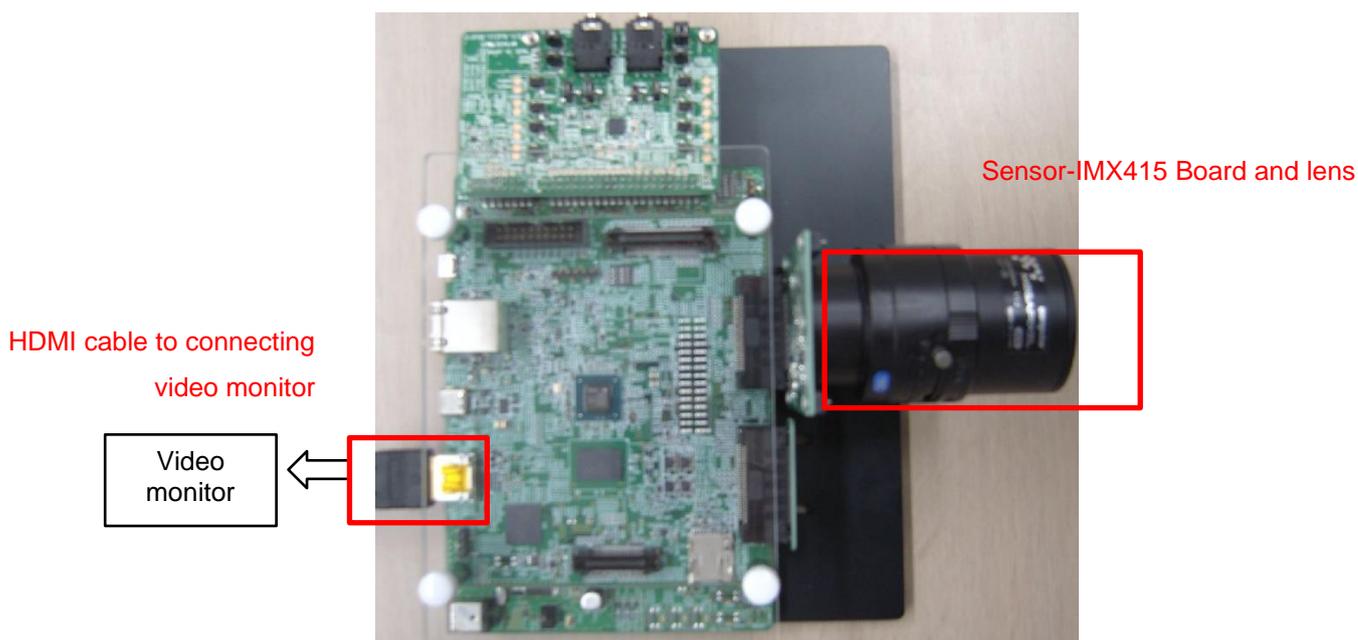
Table 5-1 Necessary Equipment for Booting

Equipment	Details
RZ/V2M Evaluation Kit	Evaluation kit for RZ/V2M.
- RZ/V2M Board (Main)	Target board. Main functional components for RZ/V2M are mounted on this board. Note that the boot loader and U-Boot images are pre-written to the eMMC (THGBMJG7C1LBAIL).
- RZ/V2M Base Board (Base)	Connected to CN12 and CN 13 on the RZ/V2M Board. Board for the generation and supply of power.
- Sensor-462 Board	Attached to the Evaluation kit for RZ/V2M
Serial to Micro USB Cable	Used for serial communication between PC and board.
Ethernet crossover cable	Used for ethernet communication between Linux PC and board.
CS mount lens	Used for sensor board lens.
HDMI cable	(Optional) Used for connecting video monitor.
Video monitor	(Optional) Used for monitoring sensor images. Requires support for HDMI input and Full HD display.

Note: The parts written in red are necessary equipment to add to RZ/V2M DRP-AI Support Package.

Table 5-2 Necessary Equipment for Network Booting

Equipment	Details
Linux PC	Used as build/debug environment for RZ/V2M Linux software. Max 100GB free space on HDD is necessary.
- OS	Ubuntu 20.04 LTS 64-bit OS must be used.
- TFTP server	Used for downloading the Linux kernel to board.
- NFS server	Used for mounting rootfs via NFS.

Table 5-3 Necessary Equipment for SD Card Booting

Equipment	Details
Linux PC	Used as build/debug environment for RZ/V2M Linux software. Used for creating microSD card. Max 100GB free space on HDD is necessary.
- OS	Ubuntu 20.04 LTS 64-bit OS must be used.
- SD card reader	Used for creating microSD card.
Windows PC	Used for Serial communication display.
- OS	Windows 10
- Terminal software	Used for controlling serial console of the target board. Operation Environment: Tera Term
- Serial port driver	Virtual COM Port driver which enables to communicate Windows PC and the target board via USB which is virtually used as serial port.
microSD card	Used for SD Card Booting. Only SDHC is supported. Operation Environment: Transcend Ultimate 600x 8GB

.

5.2   Network Booting

Refer to the "RZ/V2M DRP-AI Support Package Release Note" and follow the steps described in the "4. Network Booting" chapter with the following two additions:

1. Copy the binary file of firmware on core1 to TFTP directory in the "4.3.2 Setup the Files for TFTP Server" chapter of "RZ/V2M DRP-AI Support Package Release Note".

```
$ sudo cp <PATH_TO_FILE>/core1_firmware.bin /tftpboot
```

2. Use the following U-boot environment variables and boot command in the "4.4 Boot" chapter of "RZ/V2M DRP-AI Support Package Release Note".

```
=> env default -a

=> setenv ipaddr 192.168.1.11

=> setenv serverip 192.168.1.10

=> setenv core1_vector 0x02000000

=> setenv core1addr 0x02000000

=> setenv core1_firmware core1_firmware.bin

=> setenv bootargs_nfs 'setenv bootargs root=/dev/nfs rw
nfsroot=${serverip}:/nfs/rzv2m,nfsvers=3
ip=${ipaddr}:${serverip}::${netmask}:rzv2m:eth0'

=> setenv bootnfs 'run bootargs_nfs;tftp ${core1addr} ${core1_firmware};tftp
${loadaddr} ${kernel};tftp ${fdt_addr} ${fdt_file};wakeup_a53core1
${core1_vector};booti ${loadaddr} - ${fdt_addr}'

=> setenv bootcmd 'run bootnfs'

=> saveenv

=> boot
```

Note:

The above U-boot environment variable settings are required only when using this package for the first time or when the boot method is switched from SD Card booting.

ipaddr: IP address of Evaluation kit for RZ/V2M.

serverip: IP address of Ubuntu PC.

5.3   SD Card Booting

Refer to the "RZ/V2M DRP-AI Support Package Release Note" and follow the steps described in the "5. SD Card Booting" chapter with the following two additions:

1. Copy binary file of firmware on core1 to partition 1 of SD Card in the "2. Setup the partition 1" of "5.3.1 Setup the SD Card" chapter of "RZ/V2M DRP-AI Support Package Release Note".

```
$ sudo cp <PATH_TO_FILE>/core1_firmware.bin /mnt/sd
```

2. Use following U-boot environment variables and boot command in the "5.4 Boot" chapter of "RZ/V2M DRP-AI Support Package Release Note".

```
=> env default -a

=> setenv core1_vector 0x02000000

=> setenv core1addr 0x02000000

=> setenv core1_firmware core1_firmware.bin

=> setenv bootsd 'run bootargs_sd;fatload mmc 0:1 ${core1addr}
${core1_firmware};fatload mmc 0:1 ${loadaddr} ${kernel};fatload mmc 0:1 ${fdt_addr}
${fdt_file};wakeup_a53core1 ${core1_vector};booti ${loadaddr} - ${fdt_addr}'

=> setenv bootcmd 'run bootsd'

=> saveenv

=> boot
```

Note:

　The above U-boot environment variable settings are required only when using this package for the first time or when the boot method is switched from network booting.

6. Sample Application

6.1 SDK

Before building the SDK, refer "4 Build" and apply DRP-AI Support Package and this package in advance.
Refer to "6. SDK" chapter of the "RZ/V2M DRP-AI Support Package Release Note" for explanation on how to construct the Compile Environment, SDK, which is necessary to compile a RZ/V2M Linux application.

7.   How to use ISP

This chapter describes how to use ISP. The ISP operated by ISP control API.
Refer to r01an6542ej0141-rzv2m-isp-control-sw-specifications_IMX415.pdf for ISP control API specifications.
ISP control API can be used by linking libcomctl.so.

7.1   How to link libcomctl.so

Link libcomctl.so to use "-lcomctl" option of compiler when building the application that uses ISP control API. See Makefile of "DRP-AI Sample Application for Darknet Tiny YOLOv2 MIPI-HDMI version" or "DRP-AI Sample Application for Darknet Tiny YOLOv2 MIPI-VCD version" for linking libcomctl.so. See "RZ/V2M DRP-AI Sample Application Note" for detail of the sample applications.

Version History

Ver.	Date	Description	
		Page	**Summary**
0.50	12 Feb, 2021	-	Issued.
0.60	17 May, 2021	-	Updated contents included this package from Version.0.50 to Version.0.60.
		3	Updated related packages. - Updated RZ/V2M Linux Package from Version.0.8.5 to Version.0.9.0. - Updated RZ/V2M DRP-AI Support Package from Version.2.10 to Version.3.00.
		5	Added memory map.
		12	Changed usage of command control from API to daemon.
1.00	30 Jun, 2021	-	Updated contents included this package from Version.0.60 to Version 1.00.
		2	Added the tool that image-quality-tuning to "Features".
		3	Added the tool that image-quality-tuning to "File Contents".
		3	Updated related packages. - Updated RZ/V2M Linux Package from Version.0.9.0 to Version.1.0.0. - Updated RZ/V2M DRP-AI Support Package from Version.3.00 to Version.4.10.
		17	Since it is no longer necessary to use daemon, deleted "7.2 How to run the command controller daemon".
1.10	8 Oct,2021	-	Updated contents included this package from Version.0.60 to Version 1.10.
		2	Name and Version; Update release packages from Version1.0 to 1.10.
		3	File Contents; Update file version from V100 to V110. Related Packages; Update version. Related Documents; Update Documents version.
		4	Figure 2-1 System configuration modified.
		7	4.3 Extract the ISP Support Package recipe; Update version of file name.
		8	4.5 Confirm the configuration is modified.
		11	5.Boot; summary contents is modified. 5.2 Preparation is modified.
		12	Table 5-1 Necessary Equipment for booting is modified. Table 5-2 Necessary Equipment for network Booting is added.
		13	Table 5-3 Necessary Equipment for SD Card Booting is modified.

Ver.	Date	Description	
		Page	**Summary**
1.20	8 Jan,2022	-	Updated contents included this package from Version.1.10 to Version 1.20.
		3	File Contents; Update file version from V110 to V120. Related Packages; Update version. Related Documents; Update Documents version.
		4	Figure 2-1 System configuration modified.
		5	Figure 3-1 Memory Map is modified
		7	4.3 Extract the ISP Support Package recipe; Update version of file name.
		8	4.5 Confirm the configuration is modified.
		9	4.6 Apply the patch is modified.
		10	4.7 Build is modified.
		12	Table 5-2 Necessary Equipment for Network Booting is modified. Table 5-3 Necessary Equipment for SD Card Booting is modified.
		13	5.3 Network Booting is modified
		14	5.4 SD Card Booting is modified
1.21	28 Aug,2022	-	Updated contents included this package from Version.1.10 to Version 1.21.
		11、12	Changed description of compatible sensors
1.22	27 Sep,2022	-	Updated contents included this package from Version.1.21 to Version 1.22.
		11、12	Changed description of compatible sensors
1.30	24 Oct,2022	-	Updated contents included this package from Version.1.22 to Version 1.30.
		3、8	Changed directory structure
		3、4、11、12	Changed description of compatible sensors
		10	Deleted chapter 4.6
		13、14	Deleted execution command description
1.31	10 Nov,2022	-	Updated contents included this package from Version.1.30 to Version 1.31.
		5	Changed memory map
		12、13	Added u-boot configuration instructions
1.41	10 Jul,2023	-	Updated contents included this package from Version.1.31 to Version 1.41.
		3	Table 1-2 Contents of meta-rz-features.tar.gz Changed the folder structure.
		8	4.4 Set the build environment variables Changed the command 4.5 Confirm the configuration Changed folder path
		9	4.6 Build Changed the command

RENESAS

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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.).

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