1.   Introduction

This manual explains the package contents of R-Car H3/M3/M3N/E3/D3 Linux BSP and restrictions of the current release.

This software is provided based on GPL (GNU General Public License, version 2). Please handle this software according to GPL conditions.

Please use always latest version about Initial Program Loader, U-Boot and Kernel of R-Car H3/M3/M3N/E3/D3 Linux BSP.

2. Package contents

The following is included in this product.

2.1 Software

U-Boot, Kernel and root file system are provided by using the Yocto Project.

2.2 Documentation

The file name includes from H3, M3, M3N to V3U and V3H, etc, the supported devices are listed in the file name. The release notes manage and list all R-Car modules. Therefore, please note that the number of user's manual and the number of user's manual described in the release notes may not match in each release.

Ex) When V3U only is released, user's manual of modules that do not support V3U (modules that support only H3, M3, M3N and E3) are not included.

NO.	Contents	File name	version
1	U-Boot user's manual	RENESAS_RCH3M3M3NE3D3_UBOOT_UME_v3.00.pdf	3.00
2	Kernel user's manual	RENESAS_RCH3M3M3NE3V3UV3H_KernelCore_UME_v3.00.pdf	3.00
3	SCIF/HSCIF driver user's manual	RENESAS_RCH3M3M3NE3D3V3UV3H_SCIF_UME_v3.00.pdf	3.00
4	Display driver user's manual	RENESAS_RCH3M3M3NE3D3V3UV3H_Display_UME_v3.00.pdf	3.00
5	SD/MMC driver user's manual	RENESAS_RCH3M3M3NE3D3V3UV3H_SD_MMC_UME_v3.00.pdf	3.00
6	MSIOF driver user's manual	RENESAS_RCH3M3M3NE3D3V3UV3H_MSIOF_UME_v3.00.pdf	3.00
7	SATA driver user's manual	RENESAS_RCH3M3N_SATA_UME_v3.00.pdf	3.00
8	GPIO driver user's manual	RENESAS_RCH3M3M3NE3D3V3UV3H_GPIO_UME_v3.00.pdf	3.00
9	Ethernet AVB driver user's manual	RENESAS_RCH3M3M3NE3D3_EtherAVB_UME_v3.00.pdf	3.00
10	PTP Clock driver user's manual	RENESAS_RCH3M3M3NE3D3_PTP_UME_v3.00.pdf	3.00
11	Audio driver user's manual	RENESAS_RCH3M3M3NE3D3_Audio_UME_v3.00.pdf	3.00
12	DMA Engine driver user's manual	RENESAS_RCH3M3M3NE3D3V3UV3H_DMAE_UME_v3.00.pdf	3.00
13	I2C driver user's manual	RENESAS_RCH3M3M3NE3D3V3UV3H_I2C_UME_v3.00.pdf	3.00
14	PCIe driver user's manual	RENESAS_RCH3M3M3NE3V3H_PCIEC_UME_v3.00.pdf	3.00
15	PWM driver user's manual	RENESAS_RCH3M3M3NE3D3V3UV3H_PWM_UME_v3.00.pdf	3.00
16	Power Management user's manual	RENESAS_RCH3M3M3NE3D3V3UV3HV3M_PowerManagement_UME_v3.00.pdf	3.00
17	Thermal Sensor driver user's manual	RENESAS_RCH3M3M3NE3D3V3H_ThermalDriver_UME_v3.00.pdf	3.00
18	Video Capture driver user's manual	RENESAS_RCH3M3M3NE3D3V3UV3H_VideoCapture_UME_v3.00.	3.00

		pdf	
19	RWDT driver user's manual	RENESAS_RCH3M3M3NE3D3V3UV3H_RWDT_UME_v3.00.pdf	3.00
20	USB2.0 Host driver user's manual	RENESAS_RCH3M3M3NE3D3_USB2H_UME_v3.00.pdf	3.00
21	USB2.0 Function driver user's manual	RENESAS_RCH3M3M3NE3D3_USB2F_UME_v3.00.pdf	3.00
22	USB3.0 Host driver user's manual	RENESAS_RCH3M3M3NE3_USB3.0H_UME_v3.00.pdf	3.00
23	USB3.0 Function driver user's manual	RENESAS_RCH3M3M3NE3_USB3.0F_UME_v3.00.pdf	3.00
24	MFISLock driver user's manual	RENESAS_RCH3M3M3NE3D3_MFISLock_UME_v3.00.pdf	3.00
25	IPMMU driver user's manual	RENESAS_RCH3M3M3NE3D3V3UV3H_IPMMU_UME_v3.00.pdf	3.00
26	CCREE driver user's manual	RENESAS_RCH3M3M3NE3D3_CCREE_UME_v3.00.pdf	3.00
27	UIO driver user's manual	RENESAS_RCH3M3M3NE3D3_UIO_UME_v3.00.pdf	3.00
28	CMEM driver user's manual	RENESAS_RCH3M3M3NE3D3V3UV3HV3M_CMEM_UME_v3.00.pdf	3.00

Linux Interface Specification BSP Release note | **2.   Package contents**

3.   Notice

3.1   H3/M3/M3N/E3/D3

- Gigabit Ethernet driver
  Please note following for each version.
       - R-Car H3 Ver.1.0 SiP doesn't work with 1Gbps.
       - R-Car H3 Ver.1.1 SiP without chip capacitor doesn't work with 1Gbps.
       - R-Car H3 Ver.1.1 SiP with chip capacitor can work with 1Gbps.
       If you would like to use 1Gbps with Linux, please remove "max-speed = <100>;"
       in arch/arm64/boot/dts/renesas/r8a7795-es1-salvator-x.dts.
       If you would like to use 100Mbps with U-Boot, please disable CONFIG_RAVB_1000BASE.
  If you connect the Board directly to the NFS server during NFS boot with 1Gbps, the Linux Kernel may not start.
  That occurs due to an issue of device between "Microchip KSZ9031RNXVA" device on board and the LAN controller with the following device.
       - ASIX AX88179
       - REALTECK RTL8111/8168/8411

- When a driver returns -EPROBE_DEFER, Linux reloads it later.

- If the memory allocation and release using dma_{alloc,free}_coherent() are repeated for a short period, the processing time in milliseconds may occur periodically on both of memory allocation and release. This phenomenon occurs also with the base kernel of the Linux version v4.9 and before.

- Display driver uses external clock with analog RGB of R-Car M3 in Linux v4.14.75. If you would like to use internal clock, please change device tree as follows.

```
arch/arm64/boot/dts/renesas/r8a7796-salvator-x.dts

/ {
          model = "Renesas Salvator-X board based on r8a7796";
          compatible = "renesas,salvator-x", "renesas,r8a7796";
          …..
+
+         du2_fix_clock: clock {
+                  compatible = "fixed-clock";
+                  #clock-cells = <0>;
+                  clock-frequency = <0>;
+          };
};
  };
  …..
  &du {
          clocks = <&cpg CPG_MOD 724>,
                  …..
                  <&cpg CPG_MOD 722>,
                  <&versaclock5 1>,
                  <&x21_clk>,
-                 <&versaclock5 2>;
+                 <&du2_fix_clock>;
          clock-names = "du.0", "du.1", "du.2",
                          "dclkin.0", "dclkin.1", "dclkin.2";
          …..
  };
```

```
arch/arm64/boot/dts/renesas/r8a7796-salvator-xs.dts

/ {
            model = "Renesas Salvator-X board based on r8a7796";
            compatible = "renesas,salvator-x", "renesas,r8a7796";
            …..
+
+           du2_fix_clock: clock {
+                     compatible = "fixed-clock";
+                     #clock-cells = <0>;
+                     clock-frequency = <0>;
+              };
};
 };
 …..
 &du {
          clocks = <&cpg CPG_MOD 724>,
                       …..
                       <&cpg CPG_MOD 722>,
                       <&versaclock6 1>,
                       <&x21_clk>,
-                      <&versaclock6 2>;
+                      <&du2_fix_clock>;
          clock-names = "du.0", "du.1", "du.2",
                             "dclkin.0", "dclkin.1", "dclkin.2";
          …..
 };
```

- USB3.0 Host driver
  [HW Restriction No.67] (#89011)R-Car M3 Ver.1.0 xHCI port fails in connection of USB2.0 memory. This problem was registered as H/W restriction.
  [HW Restriction No.92] (#85015) To connect the USB 3.0 HUB (USB 2.0 HUB) to the USB 3.0 port of R-Car H3 Ver.1.x and Ver.2.0, set USB 3.0 Host driver to external module and create the udev rule file.

    - Set USB3.0 Host driver to external module

    Make the following "M" setting in make menuconfig.

```
Device Drivers   --->
    [*] USB support   --->
        <M>     xHCI HCD (USB 3.0) support
        <M>       Generic xHCI driver for a platform device
        < >       xHCI support for Mediatek MT65xx
        < >       xHCI support for Marvell Armada 375/38x
        -M-        xHCI support for Renesas R-Car SoCs
```

    The module is created below.

      ./drivers/usb/host/xhci-hcd.ko

      ./drivers/usb/host/xhci-plat-hcd.ko

    After starting Kernel, execute the following.

      insmod xhci-plat-hcd.ko

insmod xhci-hcd.ko

- Create udev rule file

```
/etc/udev/rules.d/99-usb.rules

ACTION=="add", SUBSYSTEM=="usb", TEST=="power/autosuspend", ATTR{product}=="USB2.0 Hub",
ATTR{power/autosuspend}="-1"
ACTION=="add", SUBSYSTEM=="usb", TEST=="power/autosuspend", ATTR{product}=="USB3.0 Hub",
ATTR{power/autosuspend}="-1"
```

If there is a problem with this method, change the value of ATTR {product} to the product ID unique to the HUB product. The product ID can be confirmed with the following command. "x-y" is a USB device number.

```
# cat /sys/bus/usb/devices/x-y/product
```

[HW Restriction No.92] (#85145) To do unbind/bind to the device that is connected to the USB3.0 port in R-Car H3 Ver.1.x and Ver.2.0. You need the following definition.

```
/etc/udev/rules.d/99-usb.rules

ACTION=="add", SUBSYSTEM=="usb", TEST=="power/autosuspend", ATTR{product}=="xHCI Host
Controller", ATTR{power/autosuspend}="-1"
```

- **[HW Restriction No.71 (#1)]** Regarding a driver which supports IPMMU, the driver may act like below when IPMMU is enabled in R-Car H3 Ver.1.x, Ver.2.0 and R-Car M3 Ver.1.x.
  - A message "ipmmu-vmsa xxxx0000.mmu: Unhandled fault: status 0x0000XXXX iova 0xXXXXX000" is outputted.
  - Transferred data is corrupted.
  - An exception occurs because of the corruption.

Especially, a mass storage driver (e.g. USB, SDHI, SATA) which calls map/unmap every time a transfer request occurs may encounter this restriction.

An USB2.0 or USB3.0 device doesn't work at CN9 or CN10 (Lower, Upper) when IPMMU is enabled. (#108378)

- **[H/W Restriction No.71 (#2)]** When two or more dma channels with enabled IPMMU are used at the same time, they don't work correctly in R-Car H3 Ver.1.x, Ver.2.0 and R-Car M3 Ver.1.x.

- SATA driver
  If you use SATA with Salvator-XS board and R-Car H3 Ver.2.0 / R-Car M3N Ver.1.1, please follow the procedure below in Linux v4.14.75.
      - Please enable SATA driver and disable PCIe ch1 driver.

```
arch/arm64/boot/dts/renesas/r8a7795-salvator-xs.dts, r8a77965-salvator-xs.dts

+ &sata {
+          status = "okay";
+ };

arch/arm64/boot/dts/renesas/salvator-common.dtsi

  &pciec1 {
-          status = "okay";
+          /* status = "okay";*/
  };
```

  - Please make SATA driver as kernel module.
  - Please set SW12-pin7 = Off(1).
  - Please input following command after Linux boot up.
      $ i2cset -y -f 4 0x20 0x02 0x00
      $ i2cset -y -f 4 0x20 0x03 0x7f
      $ i2cset -y -f 4 0x20 0x01 0x7f
  - Please install SATA driver module by insmod command.
- Video Capture driver
  - The count value of I/O control REQBUF is set at least 1 with Linux v4.9. If it is 0, it is rounded to 1. Therefore you need to call VIDIOC_QBUF 1 times before calling VIDIOC_STREAMON, even if you set 0 to it.
  - Please not execute following command, because CPG always become to enable forcibly.
      $ echo on > /sys/devices/platform/soc/e6efX000.video/power/control
    If Capture start is executed after executing above command, the following message is output at Capture stop.
      "MSTP status timeout"
- **[HW Restriction No.83]** Video Capture driver cannot capture the data of 640x480@60Hz with HDMI input with R-Car H3 Ver.2.0. It becomes black.
- **[HW Restriction No.84]** Video Capture driver: When CSI40 module is used as 1-Lane or 2-Lane, VIN captures incorrect data. CSI40 Link module violated the interface protocol with VIN. This phenomenon occurs only in M3 Ver.1.0, Ver.1.1, Ver.1.2 and Ver.1.3.

- Power Management
  - ➢ The Draak board does not have a PMIC. Therefore, S2ram is not supported in D3.
  - ➢ **[H/W Restriction No.66]** Please note that R-Car H3 Ver.1.x, R-Car H3 Ver.2.0 and R-Car M3 Ver.1.x always turn on all power domains except CPU. If you don't use any power domains, you can change so that the power domain is always turned off. Please follow the procedure below. It is example for R-Car M3. For R-Car H3, please modify r8a7795-sysc.c.

```
/drivers/soc/renesas/r8a7796-sysc.c

        (PD_NO_CR | PD_ON_ONCE) },
      { "3dg-a",      0x100, 0, R8A7796_PD_3DG_A,      R8A7796_PD_ALWAYS_ON },
      { "3dg-b",      0x100, 1, R8A7796_PD_3DG_B,      R8A7796_PD_3DG_A },
-     { "a3ir",       0x180, 0, R8A7796_PD_A3IR,       R8A7796_PD_ALWAYS_ON,
-       (PD_NO_CR | PD_ON_ONCE) },
+     { "a3ir",       0x180, 0, R8A7796_PD_A3IR,       R8A7796_PD_ALWAYS_ON },
  };
```

  - ➢ From Linux kernel v5.4, default governor of cpufreq is changed from "performance" to "schedutil".

    It means cpufreq is not set max frequency in default as before. This change may affect to performance of some drivers. user can set the maximum frequency with the following command.

```
# echo performance > /sys/devices/system/cpu/cpu0/cpufreq/scaling_governor
```

- RWDT driver
  In case of using EXTAL, Watchdog timer may not work with R-Car H3 Ver.2.0 and R-Car M3 Ver.1.1/Ver.1.2 for H/W restriction. Please use EXTALR by setting SW12-PIN8 OFF(1) with Salvator-XS board. But you can not use EXTALR with Salvator-X board, because its setting is prohibited.
- HSCIF driver
  It is recommended to be used with DMA mode.
- If you run Weston service on userland but do not use it, please disable it as follows, because the Suspend to RAM may not be able to execute.

```
# systemctl mask weston
# reboot
```

- CSI2 driver (which is part of Video Capture driver)
  The offset address of CSI0CLKFCPR register was changed from 0x254 to 0x260 in kernel v4.14.
- USB3.0 Function driver
  When g_ether is used, mounting from board to NFS cannot be used. In case of mounting from board to NFS, use g_ncm.
- SD/MMC driver
  - ➢ The method of setting eMMC driver capability (driver type) is changed. Please refer to 4.4.2 of SD/MMC User's Manual for details.
  - ➢ **[H/W Restriction No.109]** (#186212)R-Car M3 Ver.1.2 or earlier does not support eMMC HS400 mode. It supports up to HS200 mode. This information will be reflected in the "R-Car Series, 3rd Generation User's Manual: Hardware" in the future. Refer to it for details.
  - ➢ In BSP v3.9.3, SD/MMC driver supports multiple SG entries with IOMMU to improve performance. However, it is not support SDIO card and it is disabled by device tree in SD port. Therefore, BSP default configuration is the following.
    - MMC port: Enable
    - SD/SDIO port: Disable
    If you do not connect SDIO card, you can improve performance by adding "no-sdio".

- ➢ The SD driver has not been evaluated on all SD cards. Some cards may not be recognized.
- ➢ The MMC test is verified only at normal temperature. (Not evaluated at other temperatures.)

- Display driver
  - ➢ If the hotplug signal was occurred frequently on the specific monitor (Philips 223V5 monitor etc), the falling edge of the hotplug signal conflicts during the transfer of the SCL clock used for EDID communication, and SCL is fixed to low and it can not be restored. In that case, recovery processing by H/W is not available, EDID can not be acquired.
  - ➢ In the ADV7511 driver of the Ebisu board, depending on the monitor, acquisition of EDID may be unstable possibly.
  - ➢ If executing Suspend to RAM while 9denti is running with heavy load, the display may not return to the 9denti console, may return to the FB console at resume because the resume of FB console may be delayed. As an example to avoid that state, if you use 9denti, it is conceivable to stop the FB console.
- PCIe driver
  PCIe may cause Serror if the PCI card supports ASPM.
- USB2.0 Host driver
  When rebooting the system, the exception may occur from USB2.0 Host driver. But it is no problem because the system is reset after that.
- Kernel
  - ➢ Fix the initial utilization of a new task by backport from upstream with BSP v3.9.0. The fix is correct, but it will produce a slightly negative effect for performance more than previous release version. If you would like to keep the same performance, please revert the commit "sched/fair: Fix util_avg of new tasks for asymmetric systems".
  - ➢ Repeating memory allocate / free of the CMA area may cause "PFNs busy". However, after that, the retry process runs and the allocation of the CMA area succeeds.
  - ➢ If CPUIDLE is enabled, ftrace may not be able to trace interrupt handlers. When using ftrace, please disable CPUIDLE.

- U-boot
  - ➢ According to Upstream's policy in U-Boot v2020.10, we will create binaries for all devices, but since it is not currently working, it will be a conventional individual binary. The build method will be the same as before.
  - ➢ The information from 'clock-frequency' property in 'extal' node and 'max-frequency' property in 'mmc' node are not recognized when reading R-Car H3/M3/M3N Linux device tree blob via fdt command utility in u-boot. However, those properties are confirmed to be retrieved correctly in u-boot/Linux CPG/MMC driver respectively.

4.   Change History

Following change histories are representative lists. Please refer to "git log" for all lists.

4.1   v5.0.0

- Support Linux v5.10.
- Support U-Boot v2020.10
- Support R-Car D3

4.2   v5.1.0

- Support Linux v5.10.41.
- Support CMEM driver
- Support UIO (IMR) driver for CA core side

4.3   v5.1.4

- List fixed bugs from v5.1.4.

No.	Module	Description
#338501	Ether	Fix E3 cannot resume after S2R.
#326621	Display	Fix DU might be black screen when Alpha blend is enabled.
#334104	Display	Fix kernel panic in rcar_du_group_set_dpad_levels fuction.
#319724	Display	Fix "rcar-du feb00000.display: vertical blanking timeout" on E3/D3.
#334100	Kernel	Fix device tree in dts.
#334261	Kernel	Fix CPG The Z-clock do not operate as expectation.
#338422	OP-TEE	Fix allow to freeze while waiting.
#308873	MSIOF	Fix the configure of the MSIOF parent clock for 20 MHz.
#329242	VIN	Fix wrong hsfrequency range selection for phypll register in rcar-csi2.
#334085	VIN	Fix NV12 pixel format does not work correctly.
#308306	Thermal	Fix interrupt handler function.
#336785	PCIe	Fix no limit the DMA range to 32bit.
#334106	Display	Fix cannot disable HDMI connector output by modifying dts.
#336783	PowerManagement	Fix DT about the cup frequent.
#334253	IPMMU	Fix sometime Kernel panic when use SD 3 channel with IPMMU enable.
#341599	PWM	Fix TPU Device registration failed.
#309382	VIN	Fix V4L2_FIELD_ALTERNATE issue.
#332958	VIN	Fix hangup issue when insmod vin driver multiple time.
#317613	MFISLock	Fix invalid interrupt number of 180.
#314085	Display	Fix allow importing non-contiguous dma-buf with VSP.

5. Restrictions

None.