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Android 10 Board Support Package Specification Release Note: Software

R-Car H3/M3/M3N Series

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How to use this manual

[Readers]

This manual is intended for engineers who develop products which use the R-Car H3/M3/M3N processor.

[Purpose]

This manual is intended to give users an understanding of the functions of the R-Car H3/M3/M3N processor device driver and to serve as a reference for developing hardware and software for systems that use this driver.

[How to Read This Manual]

It is assumed that the readers of this manual have general knowledge in the fields of electrical engineering, logic circuits, microcontrollers, and Linux.

→ Read this manual in the order of the **CONTENTS**.

To understand the functions of a multimedia processor for R-Car H3/M3/M3N

→ See the **R-Car H3/M3/M3N User's Manual**.

To know the electrical specifications of the multimedia processor for R-Car H3/M3/M3N

→ See the **R-Car H3/M3/M3N Data Sheet**.

[Conventions]

The following symbols are used in this manual.

Data significance: Higher digits on the left and lower digits on the right

Note: Footnote for item marked with **Note** in the text

Caution: Information requiring particular attention

Remark: Supplementary information

Numeric representation: Binary ... xxxx, 0bxxxx, or xxxxB

Decimal ... xxxx

Hexadecimal ... 0xxxxx or xxxxH

Data type: Word ... 32 bits

Half word ... 16 bits

Byte ... 8 bits

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1. Introduction

This software release has been developed and verified using the following software and hardware environment.

- **Based Kernel version**
 - Android: 4.14.175
 - Linux®: 4.14.75
- **Android:** Android 10 based on android-10.0.0_r40
- **External Toolchain:** Linaro GCC 7.3
- **Build Host OS:** Ubuntu 18.04 64-bit
- **Yocto recipe package:** v3.21.0 (Kernel BSP v3.9.9)
 - **Minimum required DDR memory size:** 4GByte
- **Supported SoC and Board:**
 - H3 ver 3.0 with 8GByte DDR memory on Salvator-XS
 - M3 ver 3.0 with 8GByte DDR memory on Salvator-XS
 - M3N ver 1.1 with 4GByte DDR memory on Salvator-XS
- **Android BSP:** v10_2.0 (Final release version)

Yocto recipe package is required by Chapter "[3.1. Flashing IPL](#)".

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R-Car H3/M3/M3N Android 10 Board Support Package Specification Release Note

< Graphic Library and Graphic Device Driver >

R-Car H3

R8A7795 GX6650 OpenGL ES Library for Android	RTM8RC7795ZGG00Q00JPAQE	v1.0.3
R8A7795 GX6650 Device Driver for Android	RCH3G001A1001ZDO	v1.0.3
R8A7795 GX6650 GLSL Offline Compiler for Android	RCH3G002A1001ZNI	v1.0.3

R-Car M3

R8A7796 GX6250 OpenGL ES Library for Android	RTM8RC7796ZGG00Q00JPAQE	v1.0.3
R8A7796 GX6250 Device Driver for Android	RCM3G001A1001ZDO	v1.0.3
R8A7796 GX6250 GLSL Offline Compiler for Android	RCM3G002A1001ZNI	v1.0.3

R-Car M3N

R8A77965 GE7800 OpenGL ES Library for Android	RTM8RC7796ZGG00Q50JPAQE	v1.0.3
R8A77965 GE7800 Device Driver for Android	RCN3G001A1001ZDO	v1.0.3
R8A77965 GE7800 GLSL Offline Compiler for Android	RCN3G002A1001ZNI	v1.0.3

< Multimedia Package >

OMX Media Component Common Library for Android	RTM8RC0000ZMX0LQ00JPAQE	v3.0.23
OMX Media Component Video Decoder Common Library for Android	RTM8RC0000ZMD0LQ00JPAQE	v3.0.23
OMX Media Component H.264 Decoder Library for Android	RTM8RC0000ZMD1LQ00JPAQE	v3.0.23
OMX Media Component MPEG4 Decoder Library for Android	RTM8RC0000ZMD2LQ00JPAQE	v3.0.23
OMX Media Component H.263 Decoder Library for Android	RTM8RC0000ZMD4LQ00JPAQE	v3.0.23
OMX Media Component VP8 Decoder Library for Android	RTM8RC0000ZMD8LQ00JPAQE	v3.0.23
OMX Media Component VP9 Decoder Library for Android	RTM8RC0000ZMD9LQ00JPAQE	v3.0.23
OMX Media Component H.265 Decoder Library for Android	RTM8RC0000ZMDALQ00JPAQE	v3.0.23
OMX Media Component Video Encoder Common Library for Android	RTM8RC0000ZME0LQ00JPAQE	v3.0.23
OMX Media Component H.264 Encoder Library for Android	RTM8RC0000ZME1LQ00JPAQE	v3.0.23
OMX Media Component VP8 Encoder Library for Android	RTM8RC0000ZME8LQ00JPAQE	v3.0.23
UVCS Driver for Android	RTM8RC0000ZMX0DQ00JFAQE	v3.0.23

< ADSP (Audio DSP) Package >

ADSP Interface for Android	RTM8RC0000ZNA1SS00JFAQE	v1.0.18
ADSP Driver for Android	RTM8RC0000ZNA2DS00JFAQE	v1.0.18
ADSP Framework	RTM8RC0000ZNA3SS00JFAQE	v1.0.18
ADSP Reference Plugin	RTM8RC0000ZNA4SS00JFAQE	v1.0.18

< CMS (Color Management System) Package >

CMS Basic Color Management Middleware for Android	RTM8RC0000ZVC1LQ00JPAQE	v2.0.0
CMS VSP2 Dynamic Gamma Correction Middleware for Android	RTM8RC0000ZVC2LQ00JPAQE	v2.0.0
CMS CMM3 Backlight Control Middleware for Android	RTM8RC0000ZVC3LQ00JPAQE	v2.0.0

2. Building from the source

2.1. Tools & Dependency packages

Prerequisite packages for building the Android Filesystem (Note: This is with reference to Ubuntu 18.04 64-bit). Ubuntu 64-bit is required for the cross-compilation of Android Filesystem.

Setup build environment according to Google Android setup guide:

<https://source.android.com/source/initializing.html#setting-up-a-linux-build-environment>

In addition, it's required to **install “python-wand”, “python-crypto” and “liblz4-tool”** package. “python-wand” and “python-crypto” are used into the python script which builds optee-os. “liblz4-tool” package is used into the compress tool which builds a kernel. Below version packages were used to confirm this BSP version.

python-wand	0.3.5-1
python-crypt	2.6.1-4ubuntu0.2 amd64
liblz4-tool	0.0~r114-2ubuntu1

```
$ sudo apt-get install python-wand python-crypto liblz4-tool
```

2.2. Prepare build environment

Download “repo” command and update the environment variables “PATH”.

```
$ bash
$ cd <your work directory>
$ curl http://commondatastorage.googleapis.com/git-repo-downloads/repo > repo
$ chmod +x repo
$ export PATH=$(pwd):${PATH}
```

2.3. Unpack Android Package

Unpack the Renesas Android package to workspace.

```
$ cd <your work directory>
$ unzip RENESAS_RCH3M3M3N_Android_10_ReleaseNote_20yy_mmX.zip
```


2.4. Copy Proprietary Software Library into directory structure

Copy Proprietary Software Packages to pkgs_dir:

```
$ cd RENESAS_RCH3M3M3N_Android_10_ReleaseNote_20yy_mmX
```

```
$ mkdir pkgs_dir
```

```
$ cp <zip of Proprietary OMX and GFX Software Package> pkgs_dir
```

```
pkgs_dir/
|-- adsp
|   |-- RTM8RC0000ZNA1SS00JFAQE_1_0_18.zip
|   |-- RTM8RC0000ZNA2DS00JFAQE_1_0_18.zip
|   |-- RTM8RC0000ZNA3SS00JFAQE_1_0_18.zip
|   |-- RTM8RC0000ZNA4SS00JFAQE_1_0_18.zip
|-- cms
|   |-- RTM8RC0000ZVC1LQ00JPAQE_2_0_0.zip
|   |-- RTM8RC0000ZVC2LQ00JPAQE_2_0_0.zip
|   |-- RTM8RC0000ZVC3LQ00JPAQE_2_0_0.zip
|-- gfx
|   |-- RCH3G001A1001ZDO_1_0_3.zip           // in case of H3
|   |-- RCM3G001A1001ZDO_1_0_3.zip           // in case of M3
|   |-- RCN3G001A1001ZDO_1_0_3.zip           // in case of M3N
|   |-- RTM8RC7795ZGG00Q00JPAQE_1_0_3.zip    // in case of H3
|   |-- RTM8RC7796ZGG00Q00JPAQE_1_0_3.zip    // in case of M3
|   |-- RTM8RC7796ZGG00Q50JPAQE_1_0_3.zip    // in case of M3N
|-- omx
|   |-- RTM8RC0000ZMD0LQ00JPAQE_3_0_23.zip
|   |-- RTM8RC0000ZMD1LQ00JPAQE_3_0_23.zip
|   |-- RTM8RC0000ZMD2LQ00JPAQE_3_0_23.zip
|   |-- RTM8RC0000ZMD3LQ00JPAQE_3_0_23.zip
|   |-- RTM8RC0000ZMD4LQ00JPAQE_3_0_23.zip
|   |-- RTM8RC0000ZMD8LQ00JPAQE_3_0_23.zip
|   |-- RTM8RC0000ZMD9LQ00JPAQE_3_0_23.zip
|   |-- RTM8RC0000ZMDALQ00JPAQE_3_0_23.zip
|   |-- RTM8RC0000ZME0LQ00JPAQE_3_0_23.zip
|   |-- RTM8RC0000ZME1LQ00JPAQE_3_0_23.zip
|   |-- RTM8RC0000ZME8LQ00JPAQE_3_0_23.zip
|   |-- RTM8RC0000ZMX0DQ00JPAQE_3_0_23.zip
|   |-- RTM8RC0000ZMX0LQ00JPAQE_3_0_23.zip
```

2.5. Building Android, IPL, U-Boot, and Kernel sources

```
$ cd RENESAS_RCH3M3M3N_Android_10_ReleaseNote_20yy_mmX
$ export workspace=$(pwd)
$ chmod +x walkthrough.sh
# H3 case
$ ./walkthrough.sh H3
# M3 case
$ ./walkthrough.sh M3
# M3N case
$ ./walkthrough.sh M3N
# ALL(H3, M3 & M3N) case
$ ./walkthrough.sh ALL

# Please confirm directory structure regarding proprietary software
|--RELFILES
|   |-- hardware
|   |   |-- renesas
|   |   |   |-- modules
|   |   |   |   |-- adsp-s492c.tar.gz
|   |   |   |   |-- gfx.tar.gz
|   |   |   |   |-- uvcs.tar.gz
|   |   |   |-- proprietary
|   |   |   |   |-- adsp.tar.gz
|   |   |   |   |-- gfx.tar.gz
|   |   |   |   |-- gfx_prebuilts_common.tar.gz
|   |   |   |   |-- omx.tar.gz
|   |   |   |   |-- renesas-adsp
|   |   |   |   |   |-- adsp_skeleton.tar.gz
|   |   |   |   |   |-- make_hardware.renesas.s492c.sh
|   |   |   |   |   |-- make_renesas-adsp.sh
|   |   |   |   |-- renesas-cms
|   |   |   |   |   |-- cms_skeleton.tar.gz
|   |   |   |   |   |-- make_renesas-cms.sh
|   |   |   |-- renesas-omx
|   |   |   |   |-- make_hardware.renesas.uvcs_km.sh
|   |   |   |   |-- make_renesas-omx.sh
|   |   |   |   |-- omx_skeleton.tar.gz
|   |-- vendor
|   |   |-- renesas
|   |   |   |-- apps
|   |   |   |   |-- cms-test.tar.gz
|   |   |   |-- hal
|   |   |   |   |-- cms.tar.gz

$ export NUM_JOBS=$((($(grep ^processor /proc/cpuinfo | wc -l)*2))
$ cd ${workspace}/mydroid

# Please set TARGET_BOARD_PLATFORM variables
# H3 case
$ export TARGET_BOARD_PLATFORM=r8a7795
# M3 case
$ export TARGET_BOARD_PLATFORM=r8a7796
# M3N case
$ export TARGET_BOARD_PLATFORM=r8a77965

# H3 case
# Please set H3_OPTION variables.
# 4GB DDR case
$ export H3_OPTION=4GB
# 8GB DDR case
$ export H3_OPTION=8GB

# Please set Android build environment
$ source build/envsetup.sh

# Salvator case
$ lunch salvator-userdebug
```

```
# Please set these variables to true.
$ export BUILD_BOOTLOADERS=true
$ export BUILD_BOOTLOADERS_SREC=true

# Build start
$ make -j${NUM_JOBS}

# Build finished

# Please set board name built for
# Salvator case
$ export board_name=salvator

# Please copy output files to <your_images_dir>
$ export images_dir=<your_images_dir>

$ cp ¥
    out/target/product/${board_name}/boot.img ¥
    out/target/product/${board_name}/dtb.img ¥
    out/target/product/${board_name}/dtbo.img ¥
    out/target/product/${board_name}/vbmeta.img ¥
    out/target/product/${board_name}/system.img ¥
    out/target/product/${board_name}/vendor.img ¥
    out/target/product/${board_name}/product.img ¥
    out/target/product/${board_name}/bootloader.img ¥
    out/target/product/${board_name}/odm.img ¥
    out/target/product/${board_name}/ramdisk.img ¥
    out/target/product/${board_name}/ramdisk-debug.img ¥
    out/target/product/${board_name}/boot-debug.img ¥
    out/target/product/${board_name}/super.img ¥
    out/target/product/${board_name}/super_empty.img ¥
    out/target/product/${board_name}/bl2.srec ¥
    out/target/product/${board_name}/bl31.srec ¥
    out/target/product/${board_name}/bootparam_sa0.srec ¥
    out/target/product/${board_name}/cert_header_sa6.srec ¥
    out/target/product/${board_name}/tee.srec ¥
    out/target/product/${board_name}/u-boot-elf.srec ¥
    out/target/product/${board_name}/bl2.bin ¥
    vendor/renesas/utils/fastboot/fastboot.sh ¥
    vendor/renesas/utils/fastboot/fastboot_functions.sh ¥
    out/host/linux-x86/bin/adb ¥
    out/host/linux-x86/bin/mke2fs ¥
    out/host/linux-x86/bin/fastboot ${images_dir}
    ... Please see Note.
```

All *.srec files are used for section 3.1 Flashing IPL. All *.img files, fastboot.sh, and fastboot are used for section 3.2 Flashing images using fastboot.

Note:

Please use “fastboot” (out/host/linux-x86/bin/) command that you built in this procedure. If you use old “fastboot” command which is included in old Android SDK, you might fail to flash an image.

2.6. Disabling IPL booting from eMMC

If there are available BL31, cert_header, optee-os and U-boot(=firmware) on eMMC, BL2 select to run firmware on eMMC as default even if there are firmware on Hyper Flash.

To make sure to run firmware on Hyper Flash, please make the srec files with setting RCAR_SA6_TYPE and RCAR_BOOT_EMMC to 0 by using the command below before executing make command in chapter 2.5. And then please flash the srec files by the procedure of chapter 3.1.

```
# IPL boots from eMMC as default.  
# To disable booting from eMMC, set RCAR_SA6_TYPE and RCAR_BOOT_EMMC to 0 here.  
  
$ export RCAR_SA6_TYPE=0  
$ export RCAR_BOOT_EMMC=0  
  
# Build start  
$ make -j${NUM_JOBS}
```

2.7. Enabling ADSP (Audio DSP)

ADSP is disabled as default. To enable ADSP, set ENABLE_ADSP to “true” by using the command below before executing make command in the chapter 2.5.

```
# ADSP is disabled as default.  
# To enable ADSP, set ENABLE_ADSP to true here.  
  
$ export ENABLE_ADSP=true  
  
# Build start  
$ make -j${NUM_JOBS}
```

2.8. Enabling CMS (Color Management System)

CMS is disabled as default. To enable CMS, set ENABLE_CMS to “true” by using the command below before executing make command in the chapter 2.5. We prepared sample app for CMS named “Color Management”.

```
# CMS is disabled as default.  
# To enable CMS, set ENABLE_CMS to true here.  
  
$ export ENABLE_CMS=true  
  
# Build start  
$ make -j${NUM_JOBS}
```

2.9. Enabling hardware codec of VP8 and VP9

If you want to force enabling or disabling hardware codec of VP8 and VP9, please set RCAR_ENABLE_VIDEO_VP8 and RCAR_ENABLE_VIDEO_VP9 to "true" or "false".

Note: Some devices don't have hardware codec of VP8 and VP9. In the case, you can't decode or encode VP8 and VP9 files.

The default configuration for VP8 and VP9 codec

SoC	VP8 codec	VP9 codec
H3	Hardware	Software
M3	Hardware	Hardware
M3N	Hardware	Hardware

To enable or disable hardware codec of VP8 and VP9, please set RCAR_ENABLE_VIDEO_VP8 and RCAR_ENABLE_VIDEO_VP9 as below.

#To enable hardware codec of VP8 and VP9.

```
$ export RCAR_ENABLE_VIDEO_VP8E=true
$ export RCAR_ENABLE_VIDEO_VP8D=true
$ export RCAR_ENABLE_VIDEO_VP9D=true
```

To disable hardware codec of VP8 and VP9

```
$ export RCAR_ENABLE_VIDEO_VP8E=false
$ export RCAR_ENABLE_VIDEO_VP8D=false
$ export RCAR_ENABLE_VIDEO_VP9D=false
```

Build start

```
$ make -j${NUM_JOBS}
```

3. Flashing binaries

3.1. Flashing IPL

It's needed to update the firmware (*) in the Hyper Flash memory. Especially, it's mandatory to use U-Boot which support "fastboot" command.

(*) firmware: bootparam_sa0.srec, bl2.srec, cert_header_sa6.srec, bl31.srec, tee.srec, u-boot-elf.srec

Salvator case

Update firmware in the way described in Yocto Start-Up Guide, chapter 4
(RENESAS_RCH3M3M3NE3_YoctoStartupGuide_UME_v3.21.0.pdf)

3.2. Flashing images using fastboot

This step should be done after successful IPL and U-Boot flashing.

Regarding to switch settings, please see Yocto recipe Start-Up Guide “2.2 Setting of dip switch”. SW15 can select USB mode of CN9 on Salvator. The default setting of SW15 is Pin1 (USB Host). But you should change SW15 as below.

Switch Number	Switch Name	Pin1	Pin2	Pin3
SW15	USB-SW		Set (USB function)	

- 1) Connect CN9 to host PC with a USB cable for fastboot.
- 2) Power on device and interrupt autoboot.
- 3) Execute below commands on target board

Erase bootloader in eMMC (See [“3.3. Boot sequence of IPL”](#))

```
=> mmc dev 1 1
=> mw.b 4f000000 0 200000
=> mmc write 4f000000 0 1000
```

```
=> mmc dev 1 2
=> mw.b 4f000000 0 200000
=> mmc write 4f000000 0 1000
```

```
=> reset
```

Please interrupt autoboot

Set environment values on U-boot

```
=> env default -a
=> setenv ethaddr <board MAC addr>
=> editenv serialno
```

Set board serial number to serialno: **0000XXXX** (where XXXX = board number like 0585)

```
=> editenv bootargs
```

Edit bootargs: **video=XXXX-X:d init_time=xxxxxxxxxx**

“**video**” variable needs to set parameter related to display configuration. The default setting is below.

Salvator case: **video=LVDS-1:d video=VGA-1:d**

“**init_time**” variable needs to set UNIX time.

You can get it by executing “date +%s” command on host PC.

The board don't have any RTC.

If time and date is not accurate, a few issues will be happened.

```
=> saveenv
```

```
=> reset
```

Interrupt autoboot

```
=> fastboot
```

4) Execute below commands on host PC

Format eMMC partition and write image file to target. Please use “fastboot” command that you built in step 2.5 Building Android, IPL, U-Boot, and Kernel sources. (Of course, fastboot tool included in latest Android SDK is also worked.)

```
$ cd <your_images_dir>
$ chmod a+x fastboot
$ chmod a+x ./fastboot.sh
```

```
$ ./fastboot oem format
$ ./fastboot reboot bootloader
$ ./fastboot.sh --noresetenv
```

... Note. Please use “fastboot” command not “fastboot.sh” here.

... Note. Please use “fastboot.sh” shell script here.

... Note. Please use “--noresetenv” option for executing the script.

Note: The error “fastboot: error: Failed to boot into userspace fastboot; one or more components might be unbootable.” can be output on host PC side due to absence of appropriate udev rules.

Please create 51-android.rules like the below example.

Example)

/etc/udev/rules.d/51-android.rules

```
SUBSYSTEM=="usb", ATTR{idVendor}=="18d1" ATTR{idProduct}=="4ee0",
MODE="0666", GROUP="plugdev" SYMLINK+="android%n"
```


3.3. Boot sequence of IPL

The below figure shows where IPL (=boot_params, BL2, BL31, cert_header, optee-os and U-boot) are written and how they run. bootloader on Hyper Flash are written by flashing srec files (See [“3.1. Flashing IPL”](#)). bootloader on eMMC are written by `./fastboot.sh` (See [“3.2. Flashing images using fastboot”](#)). BL2 detects bootloader on eMMC. If there is available bootloader on eMMC, bootloader boot from eMMC. If there is no available bootloader on eMMC, bootloader boot from Hyper Flash. If you want to boot from Hyper Flash, please erase eMMC bootloader.

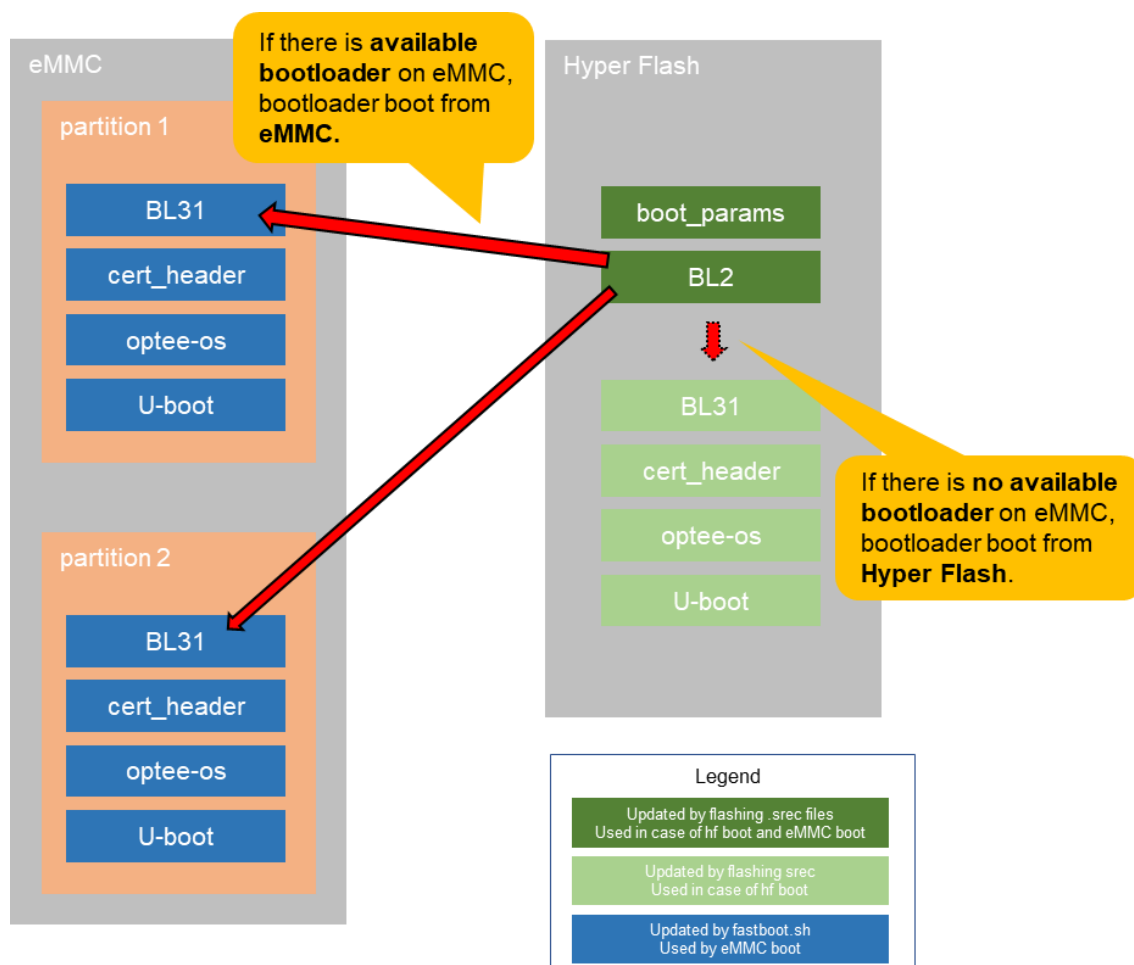
Note: If you face some trouble to boot android, we recommend to erase eMMC bootloader and flash srec disabled booting from eMMC (See chapter [“2.6. Disabling IPL booting from eMMC”](#)). Then bootloader boot from Hyper Flash. After that, please try to boot from eMMC with the default way.

Note: If U-boot is booted from eMMC, there is the message “NOTICE: BL2: eMMC boot from partition (1|2)” in IPL booting log like below log.

```
[ 0.219318] NOTICE: BL2: Normal boot
[ 0.222965] NOTICE: BL2: eMMC boot from partition 1
```

Note: Below error shows that no bootloaders are in partition 2. If you want to delete this log, please execute `“./fastboot.sh —noresetenv”` with `“—slot=b”` option to flash bootloader on partition 2 (See [“3.2. Flashing images using fastboot”](#)).

```
[ 0.383147] ERROR: Bootloader partition 2 corrupted, setting unbootable
```



4. Booting device

The standard configuration is shown in the following figure.

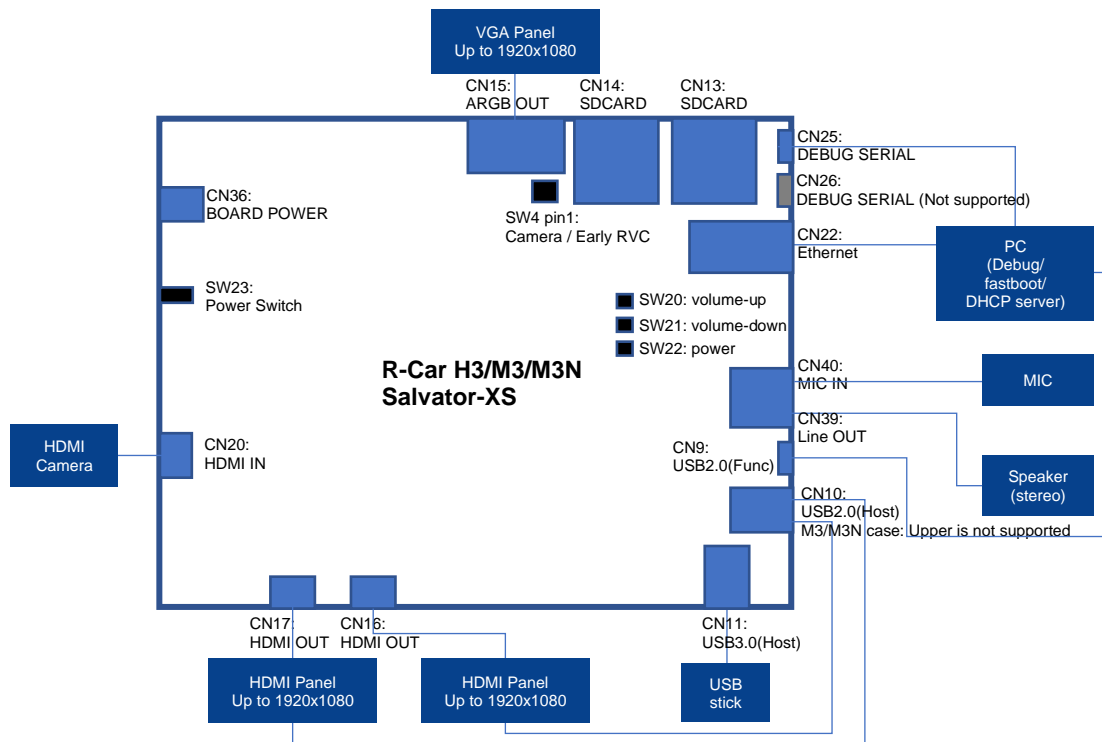


Figure. Android BSP Standard configuration (Salvator-XS)

4.1. Booting and shutdown device

SoC	H3		M3/M3N	
Parameter	video=LVDS-1:d	video=LVDS-1:d video=VGA-1:d	video=LVDS-1:d	video=LVDS-1:d video=VGA-1:d
Primary	VGA	HDMI0	VGA	HDMI0
Externa 1	HDMI0	HDMI1	HDMI0	n/a
Externa 2	HDMI1	n/a	n/a	n/a

Device connection information:

Peripheral	Connector
HDMI0	CN16
HDMI1	CN17 (H3 only)
ARGB	CN15
USB cable for touch panel	CN10
USB cable for serial console	CN25
USB cable for adb	CN9
Ethernet cable	CN22
MIC (via AK4613)	CN40
Speaker (via AK4613)	CN39
Camera	CN20

Start up the device by turning on SW23.

Shutdown the device by 2 ways as below:

Way 1

- 1) \$ reboot -p
- 2) Turn off SW23 after the display show no signal.

Way 2

- 1) Long press the power button SW22
- 2) Tap "power off" item in the display
- 3) Turn off SW23 after the display show no signal

4.2. Configure IP address for Ethernet

If you want to use the Ethernet for networking, please assign IP address by DHCP protocol. Static IP assignment mechanism is not supported. Since it is necessary to change the framework part to support Static IP assignment, we don't have plan to support static IP mechanism.

4.3. Configuration of display

The screen configuration is as below. If you want to change display configuration, please edit bootargs by following way.

- 1) Power on device and interrupt autoboot.
- 2) Edit bootargs.
 => **editenv bootargs**
 # Add "**Parameter**" written on the following table to the end of bootargs look as below example.
 Example)
 bootargs : video=LVDS-1:d
 => **saveenv**

Table of Salvator display configuration (See "[4.1. Booting and shutdown device](#)")

Note: Sometimes fail to connect the display on HDMI panel. The frequency of the issue depends on the HDMI panel.

4.4. Configure device screen resolution

4.4.1. Booting without video parameter set

By default, HWCComposer selects resolution that not higher than FullHD with display aspect ratio.

4.4.2. Booting with video parameter set

- 1) Power on device and interrupt autoboot.
- 2) Execute: **editenv bootargs**
- 3) Set video resolution for example:
(See "[4.1. Booting and shutdown device](#)")
Salvator case
 androidboot.display.res.HDMI1=1280x720-32@60 - for HDMI0 CN16 (up to 1080p)
 androidboot.display.res.HDMI2=1280x720-32@60 - for HDMI1 CN17 (up to 1080p)(H3 only)
 androidboot.display.res.VGA=1920x1080-32@60i - for VGA CN15 (up to 1080i)
 Note: VGA resolution 1080i output may be unstable depending on display panel because VGA resolution 1080i is not part of VESA standard.
- 4) Execute: **saveenv**

4.5. Verified boot setup

In case of verified boot working, "/system" partition is read only even if you run "adb remount" command. If you want to disable verified boot, please operate as below.

- To disable verified boot, please execute the below command
\$ adb root
\$ adb disable-verity
\$ adb reboot
- To enable verified boot, please execute the below command
\$ adb root
\$ adb enable-verity
\$ adb reboot

4.6. GPS/GNSS setup

You can change GPS mode fake (emulated) or normal GPS/GNSS.

4.6.1. Fake GPS/GNSS

- 1) Power on device and interrupt autoboot.
- 2) Edit bootargs.
 => **editenv bootargs**
 Add "**androidboot.gps.mode=fake**" to bootargs.
 => **saveenv**

Note: Emulated GPS uses points from text file placed in /vendor/etc/fake_route.txt

4.6.2. Normal GPS/GNSS

- 1) Please connect GPS dongle or GPS antenna.
 Salvator case: GPS dongle to CN10
- 2) Power on device and interrupt autoboot.
- 3) Edit bootargs.
 => **editenv bootargs**

```
Add below strings to bootargs.  
#Salvator case  
androidboot.gps.mode=tty  
androidboot.gps.tty_dev=dev/ttyACM0  
androidboot.gps.tty_baudrate=4800  
=> saveenv
```

Note: We support only GPS USB dongle has u-blox version 8 chip. We tested GPS with “GN-803G”.
Note: We confirmed using a module with the following specifications. If your USB GPS dongle is not recognized, setup a dongle as below every time.

```
$ su  
# echo 04bb 093c >/sys/bus/usb-serial/drivers/ftdi_sio/new_id
```

“04bb” means “Vendor ID”, “093c” means “Product ID”. You need to change this value according to your GPS device.

4.7. Camera

1) Connection

Salvator: Camera (HDMI out) <-> HDMI cable <-> CN20

Note: Please connect camera and evaluation board before turning on the power.

2) Change SW and display camera image

Table of operation to switch camera image of Salvator

SW4 pin1	Status of display panel
ON	Rear view camera image
OFF	Android GUI

4.8. Deep Sleep (Salvator only)

To enter Deep Sleep, use System Suspend to RAM function. Example of operation for System Suspend to RAM as follows:

1) Change switches setting

SW6: 1 pin side

SW7: 1 pin side

SW8-1: OFF

SW8-2: OFF

SW8-3: OFF

SW8-4: OFF

2) Set to PMIC to backup mode via i2c-tools command on serial console

```
$ su
```

```
# i2cset -f -y 7 0x30 0x20 0x0F b
```

3) Change SW23 to OFF

4) Request System Suspend to RAM

```
# echo mem > /sys/power/state
```

5) Resume from suspend to RAM

Change SW23 to ON

4.9. Multi Display touch setup

Note: This operation needs to disable verified boot. (See ["4.5. Verified boot setup"](#))

There are two different entities in Android: display and touchscreen. If there are primary and external displays, touchscreen will manage external screen by default. Android allows to bind touchscreen to display by writing display id and USB port id to specific file.

- 1) Connect display and touchscreen USB to the board
Display: Refer to 4.3 Configuration of display
Touch screen USB device:
H3 on Salvator-XS : touch screen USB devices (<-> USB hub)<-> CN10 Lower or Upper
M3/M3N on Salvator-XS : touch screen USB devices <-> USB hub <-> CN10 Lower
- 2) Get display id
\$ adb shell su 0 cat "/sys/class/drm/card0-*/connector_id"
- 3) Get USB port id
Please execute the below command and you can find USB port id in line "Location"
\$ adb shell dumphsys input
- 4) Edit "device/renesas/common/input-port-associations-skeleton.xml"
Please edit "port display" and "input" in "device/renesas/common/input-port-associations-skeleton.xml"

```
<ports>
  <port display="63" input="usb-ee0c0000.usb-1/input0" />
  <port display="65" input="usb-ee000000.usb-1/input0" />
</ports>
```
- 5) Push "device/renesas/common/input-port-associations-skeleton.xml" to "/vendor/etc/"
\$ adb push \${workspace}/device/renesas/common/input-port-associations-skeleton.xml
/vendor/etc/input-port-associations.xml

4.10. USB 3.0 host setup

- 1) Connection
Salavtor case
USB 3.0 device <-> CN11
- 2) Power on the evaluation board

4.11. Change SELinux mode

SELinux mode is set "enforcing mode" as default. If you face any failure related to SELinux, try with "permissive mode" by the following procedure.

- 1) Turn on device and interrupt autoboot.
- 2) Edit bootargs.
=> **editenv bootargs**
Add "androidboot.selinux=permissive" to bootargs as below example.
Example)
bootargs : init_time=xxxxxxxxxx **androidboot.selinux=permissive**
=> **saveenv**

4.12. Force booting from HyperFlash

To force booting from HyperFlash, press the button SW21 on Salvator and reboot the board. The board will boot from HyperFlash with appropriate message in console:

```
NOTICE: BL2: Lossy Decomp areas
NOTICE: Entry 0: DCMPCAREACRAx:0x80000540 DCMPCAREACRBx:0x570
NOTICE: Entry 1: DCMPCAREACRAx:0x40000000 DCMPCAREACRBx:0x0
NOTICE: Entry 2: DCMPCAREACRAx:0x20000000 DCMPCAREACRBx:0x0
NOTICE: BL2: Force boot from HyperFlash.
[ 0.325503] NOTICE: BL2: v1.5(release):7f0f07f
[ 0.329993] NOTICE: BL2: Built : 15:34:25, Feb 11 2019
[ 0.335181] NOTICE: BL2: Normal boot
[ 0.380188] NOTICE: BL2: Load dst=0xe6328100
src=(p:1)0x30000(384) len=0x200(1)
```

You can build IPL disabled booting from eMMC. (See chapter [“2.6. Disabling IPL booting from eMMC”](#))

4.13. Video format

Only limited range YUV video format is supported.

4.14. Enabling maps in CarLauncher

Map placeholder at Android Home Screen in Car Launcher doesn't display by default, because of instability of some CTS tests. To enable map placeholder or need to enable ActivityView feature in CarLauncher.

- 1) Turn on device and interrupt autoboot.
- 2) Edit bootargs.
=> **editenv bootargs**
Add below strings to bootargs. As example:
androidboot.carlauncher.activityview=true
=> **saveenv**

4.15. Ion cache configuration

We disabled “ion cache” for CtsMediaTestCases. Disabling “ion cache” may affect performance like video decoder and encoder.

5. Known issues

Nothing detected

Appendix A Feature List

Feature List:

Feature	Status	Comment
Boottime (Actual measurement time)	H3: 19 sec M3: 23 sec M3N: 31 sec	-
GPIO key (Power, Volume up/down)	Supported	-
Basic Car HMI	Supported	-
Display Max	H3 case: 3 M3/M3N case: 2	-
Display Touch	Supported	-
Audio Encoding	Supported	-
Audio Decoding	Supported	-
Internal storage	Supported	-
SD card	Supported	-
3D Graphics	Supported	-
Bluetooth (A2DP)	Supported	-
Bluetooth (PBAP, HFP)	Not supported	We have no plan to support this.
Ethernet	Supported	-
WiFi	Supported	Note: We support only with "USB-AC56"
Fake GPS	Supported	-
GPS/GNSS	Supported	-
Video Decoding	Supported	Note: Please see the below note
Video Encoding	Supported	Note: Please see the below note
ADSP (Audio DSP)	Supported	-
CMS (Color Management System)	Supported	-
Map placeholder	Supported	-
USB 2.0 Func	Supported	-
USB 2.0 Host	Supported	-
USB 3.0 Host	Supported	-
Camera (HDMI IN)	Supported	-
Deep Sleep	Supported	-
Telephony	Not supported	We have no plan to support this.
File Based Encryption	Supported	-
A/B System Updates	Supported	-
Android Verified Boot	Supported	-
SELinux	Supported	-
Multi Display	Supported	-
Energy Aware Scheduler	Supported	-

"Supported" means "just pass sanity check". It does not guarantee the operation of full functionality.

Appendix B Memory map

Memory map of H3 ver3.0 DDR 8GByte

Bank0 (shadow area)	128MB (reserved)	
0x0_40000000 - 0x0_BFFFFFFF	1920MB	
	0x0_48000000 - 0x0_4FDFFFFFF	126MB
ramoops	0x0_4FE00000 - 0x0_4FEFFFFFF	1MB
rambootreason	0x0_4FF00000 - 0x0_4FFF00FF	4KB
	0x0_4FF01000 - 0x0_4FFFFFFF	1020KB
cma	0x0_50000000 - 0x0_53FFFFFF	64MB
lossy_decompress	0x0_54000000 - 0x0_56FFFFFF	48MB
adsp	0x0_57000000 - 0x0_57FFFFFF	16MB
multimedia	0x0_58000000 - 0x0_67FFFFFF	256MB
ion	0x0_68000000 - 0x0_87FFFFFF	512MB
	0x0_80000000 - 0x0_BFFFFFFF	1024MB
Bank1	2048MB	
0x5_00000000 - 0x5_7FFFFFFF		
Bank2	2024MB	
0x6_00000000 - 0x6_7FFFFFFF		
Bank3	2024MB	
0x7_00000000 - 0x7_7FFFFFFF		

Memory map of M3 ver3.0 DDR 8GByte

Bank0 (shadow area)	128MB (reserved)	
0x0_40000000 - 0x0_BFFFFFFF	1920MB	
	0x0_48000000 - 0x0_4FDFFFFFF	126MB
ramoops	0x0_4FE00000 - 0x0_4FEFFFFFF	1MB
rambootreason	0x0_4FF00000 - 0x0_4FFF00FF	4KB
	0x0_4FF01000 - 0x0_4FFFFFFF	1020KB
cma	0x0_50000000 - 0x0_53FFFFFF	64MB
lossy_decompress	0x0_54000000 - 0x0_56FFFFFF	48MB
adsp	0x0_57000000 - 0x0_57FFFFFF	16MB
multimedia	0x0_58000000 - 0x0_67FFFFFF	256MB
ion	0x0_68000000 - 0x0_87FFFFFF	512MB
	0x0_80000000 - 0x0_BFFFFFFF	1024MB
Bank1	2048MB	
0x4_80000000 - 0x4_FFFFFFFF		
Bank2	4096MB	
0x6_00000000 - 0x6_FFFFFFFF		

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Memory map of M3N ver1.1 DDR 4GByte

Bank0 (shadow area) 0x0_40000000 - 0x0_BFFFFFFF	128MB (reserved)	
	1920MB	
	0x0_48000000 - 0x0_4FDFFFFFF	126MB
ramoops	0x0_4FE00000 - 0x0_4FEFFFFFF	1MB
rambootreason	0x0_4FF00000 - 0x0_4FFF00FF	4KB
	0x0_4FF01000 - 0x0_4FFFFFFF	1020KB
cma	0x0_50000000 - 0x0_53FFFFFF	64MB
lossy_decompress	0x0_54000000 - 0x0_56FFFFFF	48MB
adsp	0x0_57000000 - 0x0_57FFFFFF	16MB
multimedia	0x0_58000000 - 0x0_67FFFFFF	256MB
ion	0x0_68000000 - 0x0_87FFFFFF	512MB
	0x0_80000000 - 0x0_BFFFFFFF	1024MB
Bank1 0x4_80000000 - 0x4_FFFFFFFF	2048MB	

Revision History

Revision	Chapter	Description
v7.1.0	-	First edition
v10_1.1	1	Add M3N ver 1.1 to supported SoC
	1	Change based Android version from android-10.0.0_r2 to android-10.0.0_r14
	1, 2.4	Change Graphic library and Graphic Device Driver version from 1.0.0 to 1.0.1
	2.6	Add chapter 2.6 Disabling IPL booting from eMMC
	3.2	Add Note about udev rules to execute fastboot
	4.7, 5	Fix the issue "Android GUI unintentionally change to Camera overlay"
	4.8, 5	Fix the issue "Resume from suspend to RAM doesn't work".
	5	Fix the issue about HWR on running GFX application.
	5	Add the issue about Call trace on running GFX application
	Appendix A	Add Note that we support WiFi only with "USB-AC56"
	Appendix B	Change the memory map
v10_1.2	1	Change based Android version from android-10.0.0_r14 to android-10.0.0_r29
	1, 2.4	Change Graphic library and Graphic Device Driver version from 1.0.1 to 1.0.2
	1, 2.4 Appendix A	Add support for Multimedia Package
	1, 2.4 Appendix A	Add support for ADSP Package
	2.5	Add ALL option to walkthrough.sh
	2.5	Add bl2.bin to needed files for fastboot
	5	Delete the issue [#233016]
v10_2.0	1	Change based Android version from android-10.0.0_r29 to android-10.0.0_r40
	1, 2.4	Change Graphic library and Graphic Device Driver version from 1.0.2 to 1.0.3
	1, 2.4	Change ADSP (Audio DSP) Package version from 1.0.17 to 1.0.18
	1, 2.4, 2.8 Appendix A	Add support for CMS (Color Management System) Package
	1, 2.4	Change Multimedia Package version from 3.0.22 to 3.0.23
	2.9	Add enable or disable hardware codec of VP8 and VP9
	4.14	Add enable map placeholder in CarLauncher
	4.15	Add chapter for "ion cache configuration"
	5	Delete the issue [#245670]
	Appendix B	Change the memory map

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ルネサス エレクトロニクス株式会社 〒135-0061 東京都江東区豊洲3-2-24（豊洲フォレシア）

■技術的なお問合せおよび資料のご請求は下記へどうぞ。
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SALES OFFICES

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Renesas Electronics Corporation

TOYOSU FORESIA, 3-2-24 Toyosu, Koto-ku, Tokyo 135-0061, Japan

Renesas Electronics America Inc. Milpitas Campus

1001 Murphy Ranch Road, Milpitas, CA 95035, U.S.A.

Tel: +1-408-432-8888, Fax: +1-408-434-5351

Renesas Electronics America Inc. San Jose Campus

6024 Silver Creek Valley Road, San Jose, CA 95138, USA

Tel: +1-408-284-8200, Fax: +1-408-284-2775

Renesas Electronics Canada Limited

9251 Yonge Street, Suite 8309 Richmond Hill, Ontario Canada L4C 9T3

Tel: +1-905-237-2004

Renesas Electronics Europe GmbH

Arcadiastrasse 10, 40472 Düsseldorf, Germany

Tel: +49-211-6503-0, Fax: +49-211-6503-1327

Renesas Electronics (China) Co., Ltd.

Room 101-T01, Floor 1, Building 7, Yard No. 7, 8th Street, Shangdi, Haidian District, Beijing 100085, China

Tel: +86-10-8235-1155, Fax: +86-10-8235-7679

Renesas Electronics (Shanghai) Co., Ltd.

Unit 301, Tower A, Central Towers, 555 Langao Road, Putuo District, Shanghai 200333, China

Tel: +86-21-2226-0888, Fax: +86-21-2226-0999

Renesas Electronics Hong Kong Limited

Unit 1601-1611, 16/F., Tower 2, Grand Century Place, 193 Prince Edward Road West, Mongkok, Kowloon, Hong Kong

Tel: +852-2265-6688, Fax: +852 2886-9022

Renesas Electronics Taiwan Co., Ltd.

13F, No. 363, Fu Shing North Road, Taipei 10543, Taiwan

Tel: +886-2-8175-9600, Fax: +886 2-8175-9670

Renesas Electronics Singapore Pte. Ltd.

80 Bendemeer Road, #06-02 Singapore 339949

Tel: +65-6213-0200, Fax: +65-6213-0300

Renesas Electronics Malaysia Sdn.Bhd.

Unit No 3A-1 Level 3A Tower 8 UOA Business Park, No 1 Jalan Pengaturcara U1/51A, Seksyen U1, 40150 Shah Alam, Selangor, Malaysia

Tel: +60-3-5022-1288, Fax: +60-3-5022-1290

Renesas Electronics India Pvt. Ltd.

No.777C, 100 Feet Road, HAL 2nd Stage, Indiranagar, Bangalore 560 038, India

Tel: +91-80-67208700

Renesas Electronics Korea Co., Ltd.

17F, KAMCO Yangjae Tower, 262, Gangnam-daero, Gangnam-gu, Seoul, 06265 Korea

Tel: +82-2-558-3737, Fax: +82-2-558-5338

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