Hardware Manual

M3 Starter Kit

H3 Starter Kit

All information contained in these materials, including products and product specifications, represents information on the product at the time of publication and is subject to change by Renesas Electronics Corp. without notice. Please review the latest information published by Renesas Electronics Corp. through various means, including the Renesas Electronics Corp. website (http://www.renesas.com).

Renesas Electronics
www.renesas.com

Rev.1.1 Apr 2020

Notice

1. Descriptions of circuits, software and other related information in this document are provided only to illustrate the operation of semiconductor products and application examples. You are fully responsible for the incorporation of these circuits, software, and information in the design of your equipment. Renesas Electronics assumes no responsibility for any losses incurred by you or third parties arising from the use of these circuits, software, or information.
2. Renesas Electronics has used reasonable care in preparing the information included in this document, but Renesas Electronics does not warrant that such information is error free. Renesas Electronics assumes no liability whatsoever for any damages incurred by you resulting from errors in or omissions from the information included herein.
3. Renesas Electronics does not assume any liability for infringement of patents, copyrights, or other intellectual property rights of third parties by or arising from the use of Renesas Electronics products or technical information described in this document. No license, express, implied or otherwise, is granted hereby under any patents, copyrights or other intellectual property rights of Renesas Electronics or others.
4. You should not alter, modify, copy, or otherwise misappropriate any Renesas Electronics product, whether in whole or in part. Renesas Electronics assumes no responsibility for any losses incurred by you or third parties arising from such alteration, modification, copy or otherwise misappropriation of Renesas Electronics product.
5. Renesas Electronics products are classified according to the following two quality grades: "Standard" and "High Quality". The recommended applications for each Renesas Electronics product depends on the product's quality grade, as indicated below.

   "Standard": Computers; office equipment; communications equipment; test and measurement equipment; audio and visual equipment; home electronic appliances; machine tools; personal electronic equipment; and industrial robots etc.

   "High Quality": Transportation equipment (automobiles, trains, ships, etc.); traffic control systems; anti-disaster systems; anticrime systems; and safety equipment etc.

   Renesas Electronics products are neither intended nor authorized for use in products or systems that may pose a direct threat to human life or bodily injury (artificial life support devices or systems, surgical implantations etc.), or may cause serious property damages (nuclear reactor control systems, military equipment etc.). You must check the quality grade of each Renesas Electronics product before using it in a particular application. You may not use any Renesas Electronics product for any application for which it is not intended. Renesas Electronics shall not be in any way liable for any damages or losses incurred by you or third parties arising from the use of any Renesas Electronics product for which the product is not intended by Renesas Electronics.
6. You should use the Renesas Electronics products described in this document within the range specified by Renesas Electronics, especially with respect to the maximum rating, operating supply voltage range, movement power voltage range, heat radiation characteristics, installation and other product characteristics. Renesas Electronics shall have no liability for malfunctions or damages arising out of the use of Renesas Electronics products beyond such specified ranges.
7. Although Renesas Electronics endeavors to improve the quality and reliability of its products, semiconductor products have specific characteristics such as the occurrence of failure at a certain rate and malfunctions under certain use conditions. Further, Renesas Electronics products are not subject to radiation resistance design. Please be sure to implement safety measures to guard them against the possibility of physical injury, and injury or damage caused by fire in the event of the failure of a Renesas Electronics product, such as safety design for hardware and software including but not limited to redundancy, fire control and malfunction prevention, appropriate treatment for aging degradation or any other appropriate measures. Because the evaluation of microcomputer software alone is very difficult, please evaluate the safety of the final products or systems manufactured by you.
8. Please contact a Renesas Electronics sales office for details as to environmental matters such as the environmental compatibility of each Renesas Electronics product. Please use Renesas Electronics products in compliance with all applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive. Renesas Electronics assumes no liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations.
9. Renesas Electronics products and technology may not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable domestic or foreign laws or regulations. You should not use Renesas Electronics products or technology described in this document for any purpose relating to military applications or use by the military, including but not limited to the development of weapons of mass destruction. When exporting the Renesas Electronics products or technology described in this document, you should comply with the applicable export control laws and regulations and follow the procedures required by such laws and regulations.
10. It is the responsibility of the buyer or distributor of Renesas Electronics products, who distributes, disposes of, or otherwise places the product with a third party, to notify such third party in advance of the contents and conditions set forth in this document, Renesas Electronics assumes no responsibility for any losses incurred by you or third parties as a result of unauthorized use of Renesas Electronics products.
11. This document may not be reproduced or duplicated in any form, in whole or in part, without prior written consent of Renesas Electronics.
12. Please contact a Renesas Electronics sales office if you have any questions regarding the information contained in this document or Renesas Electronics products, or if you have any other inquiries.

(Note 1) "Renesas Electronics" as used in this document means Renesas Electronics Corporation and also includes its majorityowned subsidiaries.

(Note 2) "Renesas Electronics product(s)" means any product developed or manufactured by or for Renesas Electronics.

(2012.4)

General Precautions in the Handling of Microprocessing Unit and Microcontroller Unit Products

The following usage notes are applicable to all Microprocessing unit and Microcontroller unit products from Renesas. For detailed usage notes on the products covered by this document, refer to the relevant sections of the document as well as any technical updates that have been issued for the products.

1. 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 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. Unused pins should be handled as described under Handling of Unused Pins in the manual.
2. Processing at Power-on
   The state of the product is undefined at the moment 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 moment 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 moment 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 moment when power is supplied until the power reaches the level at which resetting has been specified.
3. Prohibition of Access to Reserved Addresses
   Access to reserved addresses is prohibited.
   — The reserved addresses are provided for the possible future expansion of functions. Do not access these addresses; the correct operation of LSI is not guaranteed if they are accessed.
4. Clock Signals
   After applying a reset, only release the reset line after the operating clock signal has become stable. When switching the clock signal during program execution, wait until the target clock signal has 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. Moreover, 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.
5. Differences between Products
   Before changing from one product to another, i.e. to a product with a different part number, confirm that the change will not lead to problems.
   — The characteristics of Microprocessing unit or Microcontroller unit products in the same group but having a different part number may differ in terms of the internal memory capacity, layout pattern, and other factors, which can affect the ranges of electrical characteristics, such as characteristic values, operating margins, immunity to noise, and amount of radiated noise. When changing to a product with a different part number, implement a system-evaluation test for the given product.

Contents

About this manual 3

1. Overview 4
1.1 Introduction 4
1.2 H3 & M3 Starter Kit Board Major Configuration 5
1.3 H3 & M3 Starter Kit Board Major Specification 6
1.4 H3 & M3 Starter Kit Board Block Diagram 7
1.5 H3 & M3 Starter Kit Board Functions Supported 7
1.6 Major Components 9
1.7 Switches locations 9
1.8 Electrical characteristic 10

2. Quick Start up Guide 11
2.1 Default Switch setting 11
2.2 Cables setup 11
2.2 Procedure 12

3. Functions & Interfaces 13
3.1 Power In 13
3.2 Fan Connector 13
3.3 Debug Serial (via USB) 13
3.4 Debug Serial (via USB) *not used on MP version 14
3.5 QSPI Flash 15
3.6 Micro HDMI 15
3.7 Micro SD-Card 16
3.8 JTAG Coresight Debug 16
3.9 Ethernet 17
3.10 USB 2.0 host 17
3.11 Line Out / MIC Input 18
3.12 CPLD JTAG 18
3.13 Buttons and Switches 19
3.14 On Board LED's 21
3.15 Booting 22
3.16 JTAG SICA Debug Interface 23
3.17 Board to Board Connector (COM Express 440pin) 24
3.18 Power supply and control from add-on boards 26
3.19 CPLD contents 27

4. CE 30

5. Appendix 31
5.1 R-Car_Gen3_StarterKit_schematic_Rev110 31
5.2 R-Car_Gen3_StarterKit_BOM_rev110_(M3) 31
5.3 R-Car_Gen3_StarterKit_BOM_rev110_(H3) 31
5.4 R-Car_Gen3_StarterKit_board_dimensions_drawing_xxx_rev110_(M3&H3) 31
5.5 R-Car_Gen3_StarterKit_board_assembly_drawing_046B_revxxx_(M3&H3) 31
5.6 R-Car_Gen3_StarterKit_CoM_Express_Interfaces_rev110_(M3&H3) 31

About this manual

Purpose and Target Readers

This manual is designed to provide the user with an understanding of the functions and operating specifications of the H3 & M3 Starter Kit board. A basic knowledge of electrical circuits, logical circuits, and microcomputers (SOC) is necessary in order to use this manual.

This manual comprises an overview of the H3 & M3 Starter Kit board; its function, and operating specifications.

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

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

1. Overview

1.1 Introduction

The H3 & M3 Starter Kit boards are designed for evaluating the features and performance of the R-CAR H3 & R-CAR M3 device from
Renesas Electronics and it is also used for developing and evaluating application software for these R-CAR H3 & R-CAR M3

The H3 Starter Kit, based on the R-CAR H3 SIP, comes with LPDDR4@4GB in 2-channel, each 64-bit wide＋Hyperflash @64MB, CSI2 interfaces and several communication interfaces like USB, Ethernet, HDMI and can work standalone or can be adapted to other boards, via 440pin connector on bottom side.
The M3 Starter Kit, based on the R-CAR M3 SIP, comes with LPDDR@2GB in 2-channels, each 32-bit wide. Other features are same as H3 Starter Kit.

It is possible to order 2 different types of H3 Starter Kit Boards, one with Ethernet connection onboard and one with Ethernet connection on ComExpress.
In case of M3 Starter Kit, it is possible to order with Ethernet Connection only.

This will be realized by a specific resistor configuration, and signed onboard with a label.

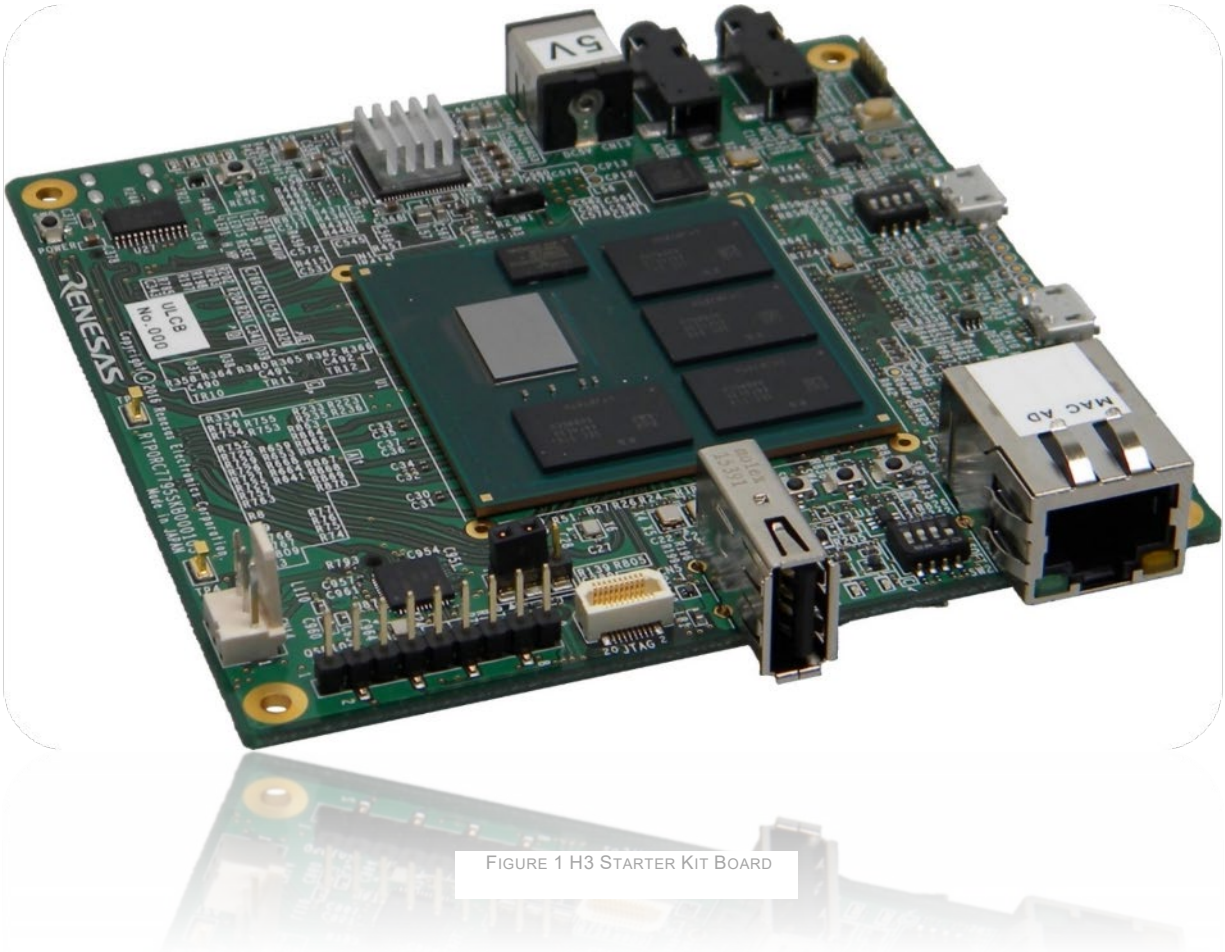


FIGURE 1 H3 STARTER KIT BOARD

1.2 H3 & M3 Starter Kit Board Major Configuration

The figure shows an example of a system configuration using the H3 Starter Kit Board.

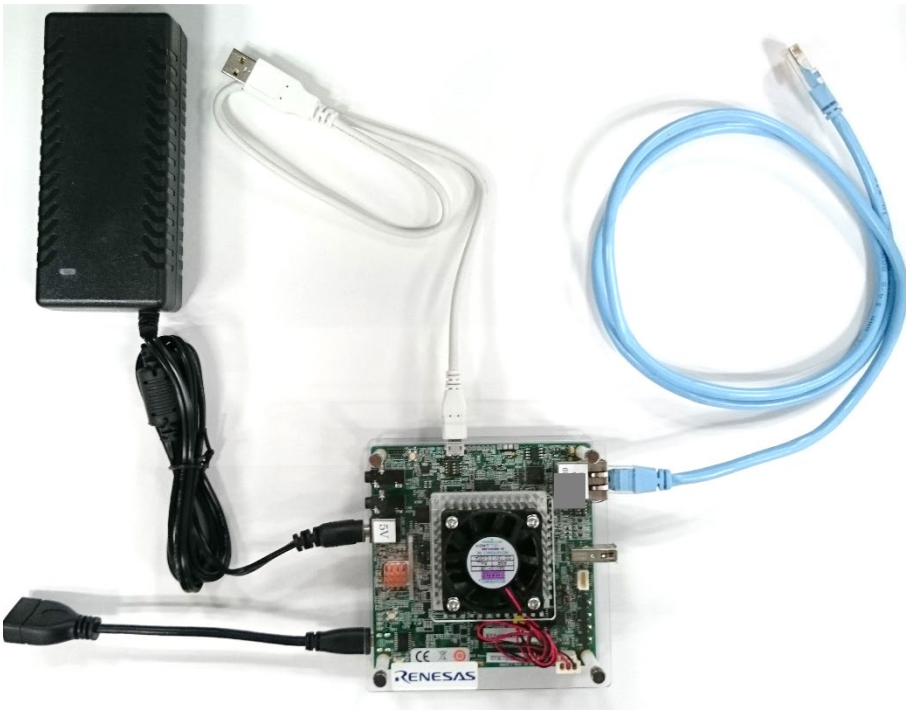


FIGURE 1 STANDART CONFIGURATION

1.3 H3 & M3 Starter Kit Board Major Specification

	H3 Starter Kit	M3 Starter Kit
CPU	R-CAR H3 · ARM CA57 (ARMv8) 1.5 GHz quad core, with NEON/VFPv4, L1$ I/D 48K/32K, L2$ 2MB · ARM CA53 (ARMv8) 1.2 GHz quad core, with NEON/VFPv4, L1$ I/D 32K/32K, L2$ 512K · Memory controller for LPDDR4 in 4 channels, each 32-bit wide · Two- and three-dimensional graphics engines, · Video processing units, · 4 channels Display Output, · 6 channels Video Input, · SD card host interface, · USB3.0 and USB2.0 interfaces, · CAN interfaces · Ethernet AVB · PCI Express Interfaces	R-CAR M3 · ARM CA57 (ARMv8) 1.5 GHz dual core, with NEON/VFPv4, L1$ I/D 48K/32K, L2$ 2MB · ARM CA53 (ARMv8) 1.3 GHz dual core, with NEON/VFPv4, L1$ I/D 32K/32K, L2$ 512K · Memory controller for LPDDR4 in 2 channels, each 32-bit wide · Two- and three-dimensional graphics engines, · Video processing units, · 4 channels Display Output, · 6 channels Video Input, · SD card host interface, · USB3.0 and USB2.0 interfaces, · CAN interfaces · Ethernet AVB · PCI Express Interfaces
Memories	· INTERNAL 384KBYTES SYSTEM RAM · 4 G-BYTE LPDDR4 · 64M-BYTE HYPERFLASH · 16M-BYTE QSPI FLASH · 8G-BYTE EMMC · MICROSD-CARD SLOT	· INTERNAL 384KBYTES SYSTEM RAM · 2 G-BYTE LPDDR4 · 64M-BYTE HYPERFLASH · 16M-BYTE QSPI FLASH · 8G-BYTE EMMC · MICROSD-CARD SLOT
Connectors	· CN1 COM Express type connector 440pin · CN2 QSPI Flash module · CN3 DEBUG JTAG · CN4 Micro HDMI · CN5 USB 2.0 · CN6 Push-Pull microSD Card Socket · CN7 Ethernet, Connector, RJ45 · CN8 LINE Out · CN9 MIC Input · CN10 DEBUG SERIAL(Do Not Stuff) · CN11 CPLD Programming JTAG · CN12 DEBUG SERIAL · CN13 Main Power Supply input (5VDC) · CN14 CPU Fan	
Switches	· SW1 Hyper Flash · SW2 Software Readable DIPSWITCHES (4x) · SW3 Software Readable Push button · SW4 Software Readable Push button · SW5 Software Readable Push button · SW6 Mode Settings · SW7 Reset · SW8 Power · SW9 Reset	
Board specifications	· Dimensions: 95mm × 95mm · Board thickness: 1.6mm · External power supply 5V / 8A max, Ripple & Noise (Vp-p) Full load 200mV · T_{opr} Operating ambient temperature . Free Air room temperature 25deg ave. · Vcc 5V system power supply voltage (range 5V +- 5%) · I_{board} Maximum current consumption 8A.	· Dimensions: 95mm × 95mm · Board thickness: 1.6mm · External power supply 5V / 8A max, Ripple & Noise (Vp-p) Full load 200mV · T_{opr} Operating ambient temperature. Free Air room temperature 25deg ave. · Vcc 5V system power supply voltage (range 5V +- 5%) · I_{board} Maximum current consumption 8A.

TABLE 1 BOARD SPECIFICATIONS

Note: Power supply – connecting the 5V external power supply will be indicated by the LED9. The fan is always on.

Note: Do not remove or disconnect the fan. In addition observe the max ambient temperature.

Caution – hot!!! In case these will not observed.
For safety reason the internal temperature measurement feature of the device should be used to switch off the board in case of any unexpected heat up.

The above Power consumption specification does not cover the max power consumption Automotive Spec of the R-CAR H3 device!

1.4 H3 & M3 Starter Kit Board Block Diagram

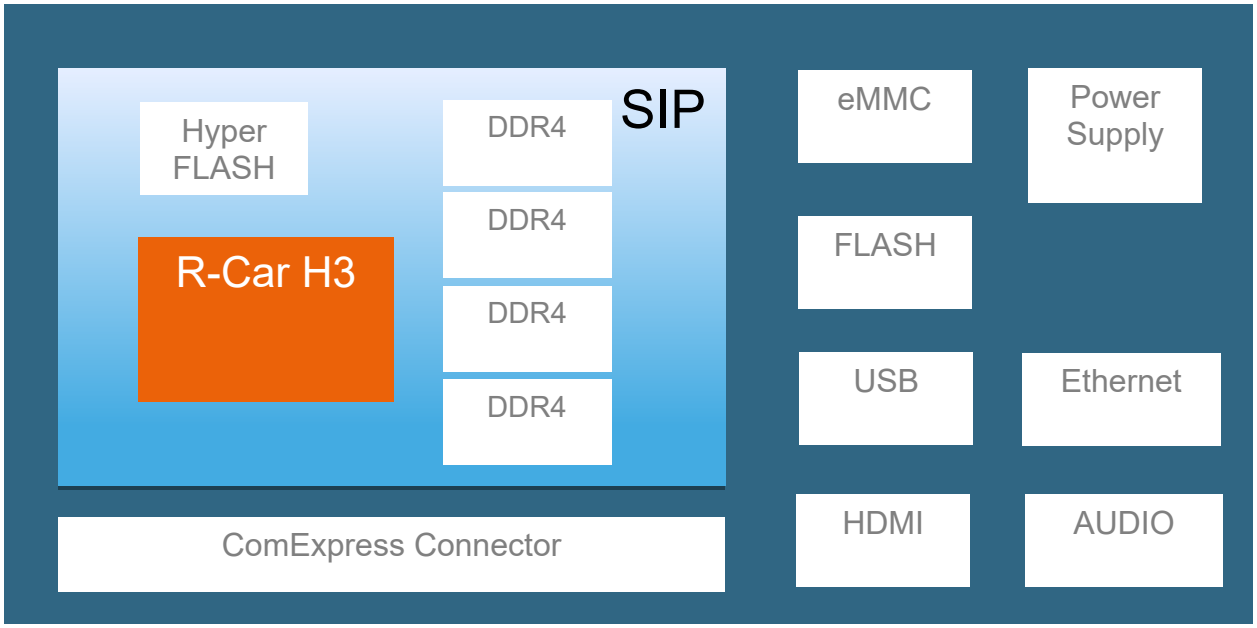


FIGURE 2 H3 STARTER KIT BOARD BLOCK DIAGRAM

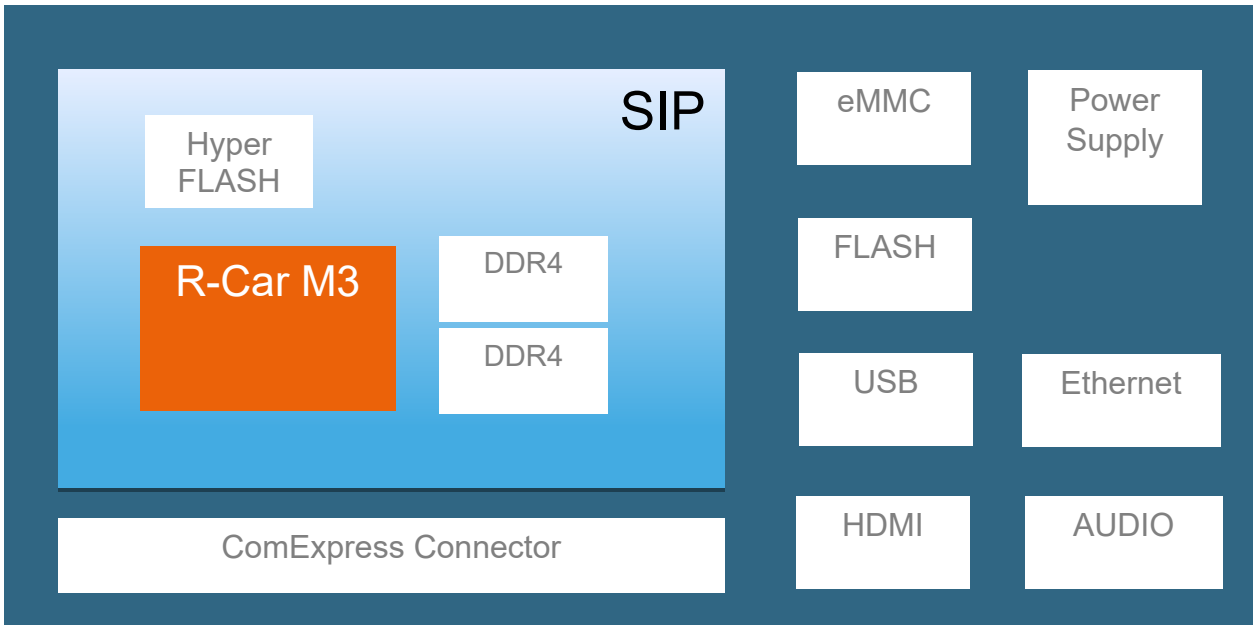


Figure 3 M3 Starter Kit board block diagram

1.5 H3 & M3 Starter Kit Board Functions Supported

This table describes the functions available on the H3 & M3 Starter Kit board. Observe due to the pin-sharing some functions are shared and can't be used in parallel. It's important to check this carefully.

Function	Description
DEBUG Serial	Micro-USB available @ CN12 with Pin-Sharing on ComExpress
JTAG DEBUG	SICA 20pin available @CN3 with Pin-Sharing on ComExpress
QSPI FLASH	Pins available @ CN2 with Pin-Sharing on ComExpress
Ethernet 10/100	PHY and RJ45 available @CN7 with Pin-Sharing on ComExpress
SDHI-0	SD card slot available @CN6
USB2.0-1	USB available @ CN5
HDMI-0	Micro-HDMI available @CN4
MIC INPUT	3.5mm Jack @CN9
LINE OUT	3.5mm Jack @CN8
FAN CONNECTOR	Pins available @ CN14
CPLD JTAG	Pins available @ CN11

TABLE 2 SHARED FUNCTIONS

1.6 Major Components

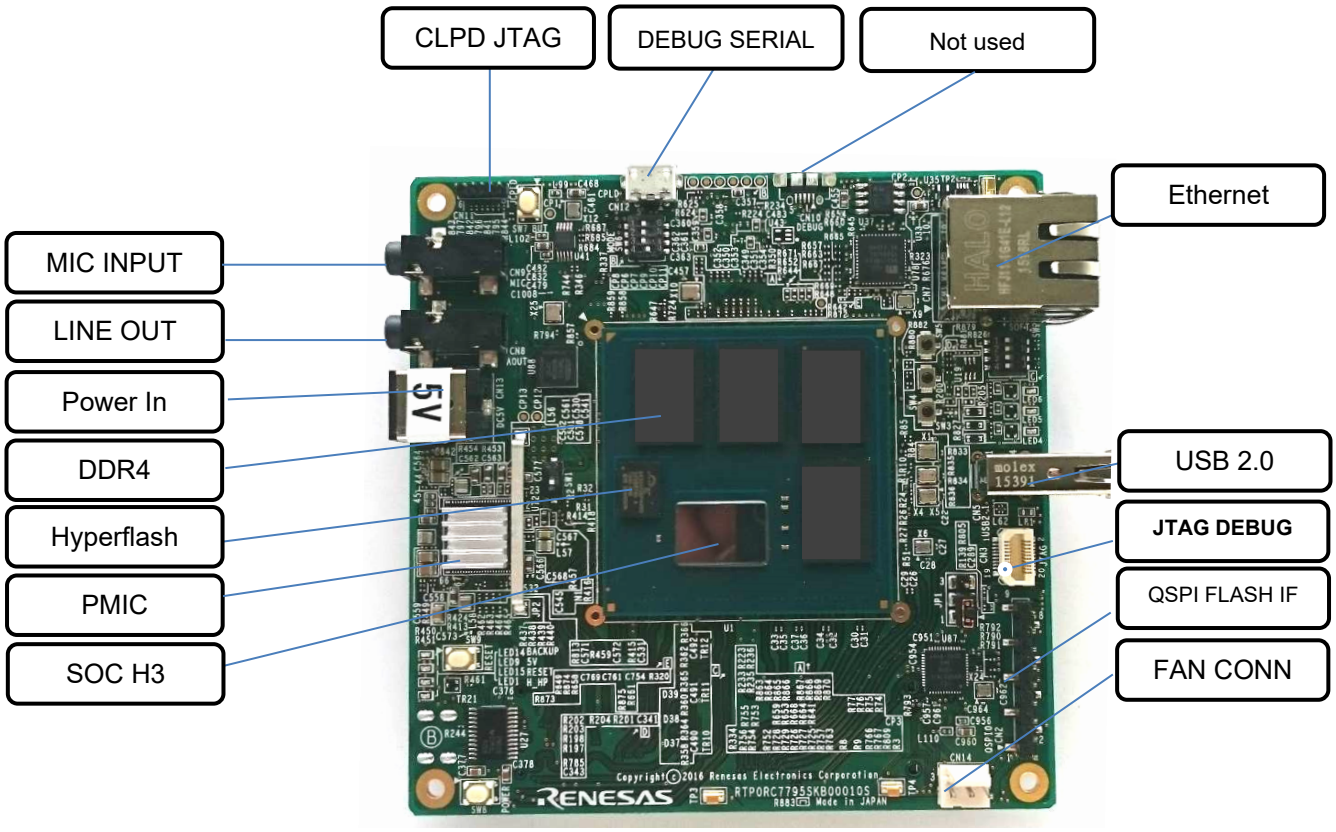


FIGURE 4 H3 STARTER KIT BOARD LAYOUT (TOP VIEW /COMPONENT SIDE)

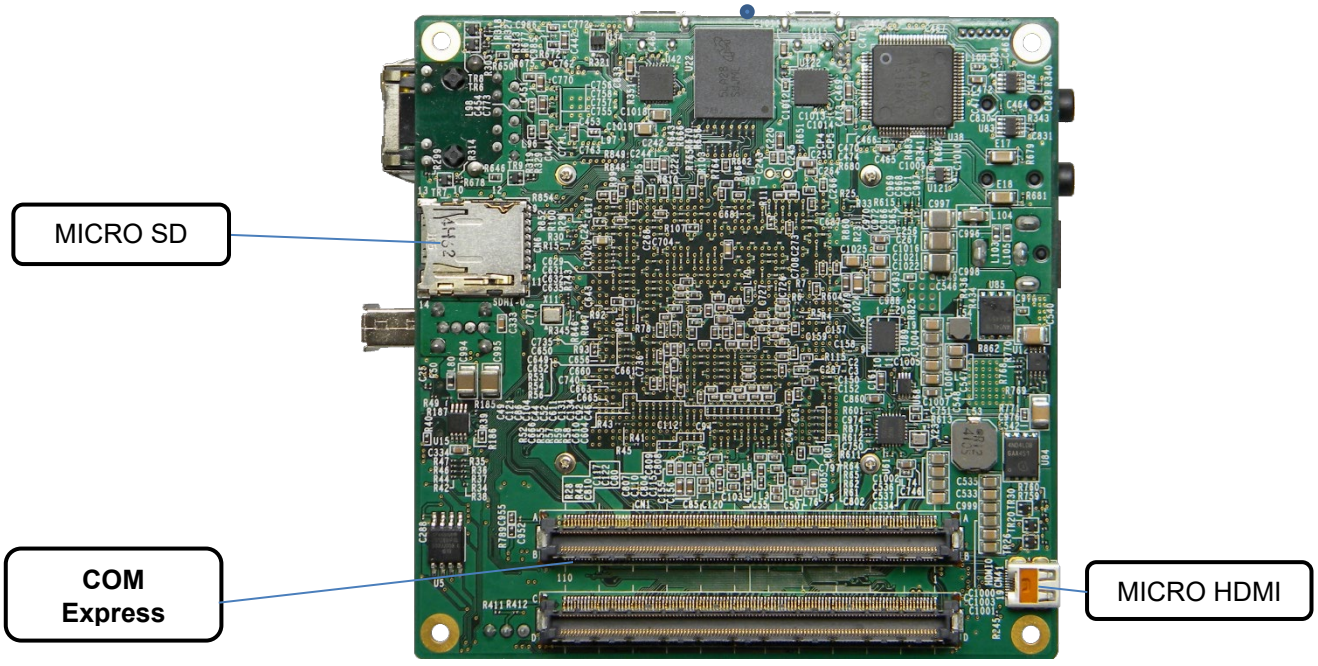


FIGURE 5 H3 STARTER KIT BOARD LAYOUT (BOTTOM VIEW /COMPONENT SIDE)

1.7 Switches locations

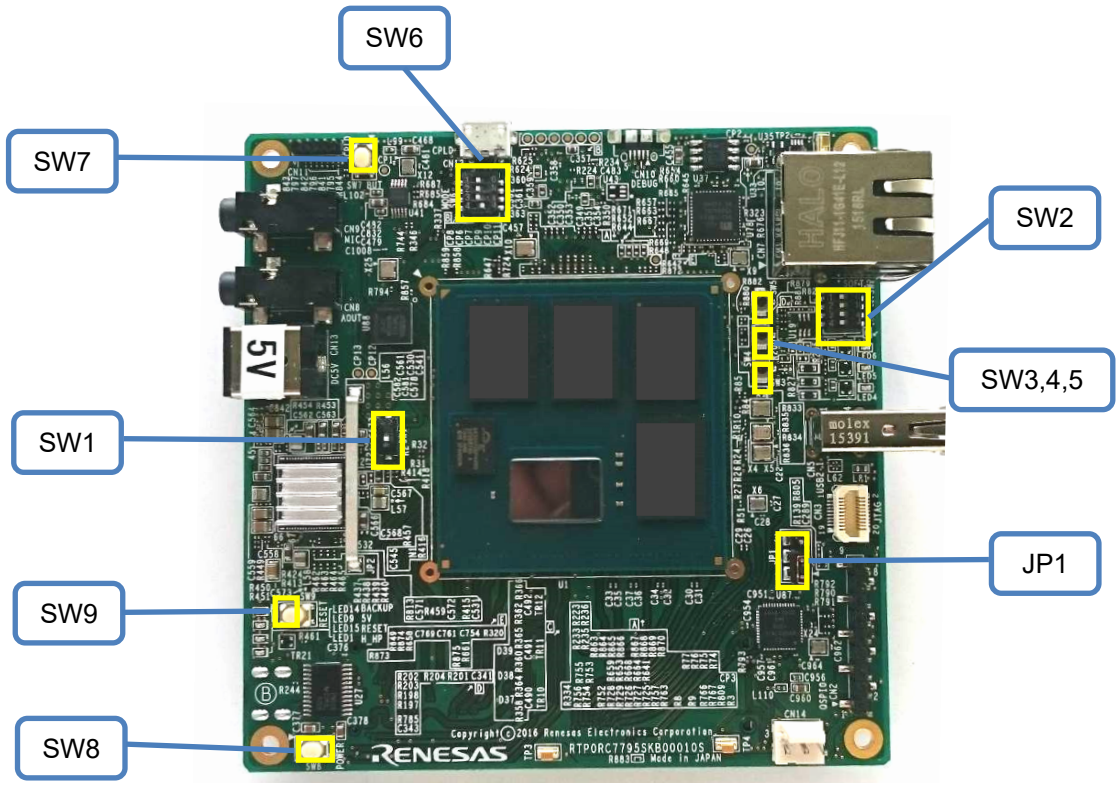


FIGURE 6 H3 STARTER KIT BOARD LAYOUT (TOP VIEW /COMPONENT SIDE)

Switches and LED's description are on chapter 3.13-3.14

1.8 Electrical characteristic

(1) Recommended Operating Conditions

Over free-air temperature range

		Min	Nom	Max	Unit
DC5.0V	Supply Voltage	4.5	5	5.5	V

(2) Absolute Maximum Rating

@25 deg

		Min	Nom	Max	Unit
DC5.0V	Supply Voltage	-0.3		6	V

2. Quick Start up Guide

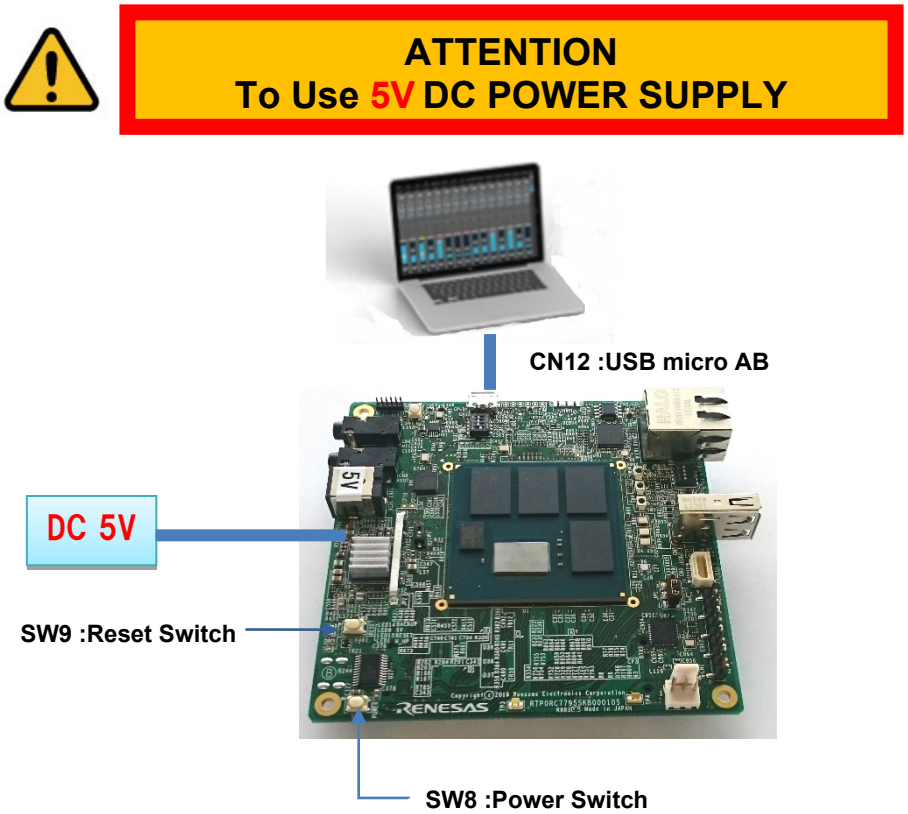
2.1 Default Switch setting

This table describes the Default switch setting to boot from Minimonitor program stored in on board QSPI device.

Switch Number	Switch Name	Switch Location	Pin1	Pin2	Pin3	Pin4
SW1	QSPI/Hyper Flash SW	Top	OFF	-	-	-
SW4	SOFTSW	Top	OFF	OFF	OFF	ON
SW6	MODESW	Top	OFF	OFF	OFF	ON
JP1	QSPI SEL	Top	ON	ON	OFF	-

2.2 Cables setup

This figure explains minimum setup to check connection between PC console to the board.



2.2 Procedure

(1) Connect the DC 5V and CN12 Micro USB to PC.
(2) Power ON the board by Press SW8.
(3) Then on PC, FT232 Driver is download automatically.
(4) Launch the Console(Teraterm), and set up the serial port setting
[Serial port set up]
Port - choose which assigned to board connection
Baud rate - 115200
Date – 8bit
Varity –none
Stop – 1bit

(5) Reset the board by Press SW9.
(6) Then Minimonitor is starting up.
Message example:

```
--------------------------------------------------------------------------------
M3-W SAMPLE LOADER V0.17 2016.xx.xx
 CPU  : AArch64 CA57
 DRAM  : LPDDR4 DDR1600 / 1RANK (4GB)
 DEVICE: QSPI Flash(S25FS128) at 40MHz DMA
 BOOT  : Normal Boot
 Backup: Unknown
 Init_DDR:M3 Starter Kit

 jump to 0xE6330000

M3-W MiniMonitor V0.16 2016.09.29
 Work Memory SystemRAM (H'E6328000-H'E632FFFF)
>
--------------------------------------------------------------------------------
```

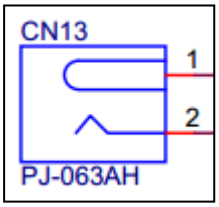
3. Functions & Interfaces

3.1 Power In

On Board:
5V/8A input
PMIC for all required voltages; SEEPROM-configured
Power button

On ComExpress:
Power-up/down by edge or level
Power-good status

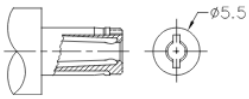
FIGURE 7 POWER CN13



CN13	
1	D5.0V
2	GND
PJ-063AH	

TABLE 3 POWER CN13

Matching Plug:
Ø5.5 mm, Center pin Ø2.0 mm, Jack Insertion Depth: 8.85 mm



3.2 Fan Connector

On Board:
CPU 3-Pin Fan Connector

FIGURE 8 FAN CONNECTOR

CN14	
1	D5.0V
2	GND
3	x
22-04-1031	

TABLE 4 FAN CONN. CN14

3.3 Debug Serial (via USB)

On Board:

Standard micro USB connector

The SCIF2 interface of the R-Card Device is provided over the Converter FT232RQ

By default available on-board

On ComExpress:

Available after reassembling

Note: This is not a USB Port of the SOC

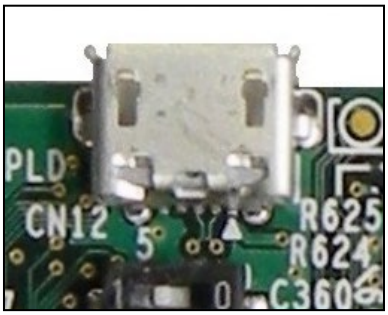


FIGURE 9 DEBUG SERIAL

3.4 Debug Serial (via USB) *not used on MP version.

On Board:

Standard micro USB connector

The SCIF1 interface of the R-Card Device is provided over the Converter CP2102

Available after reassembling

On ComExpress:

By default available ComExpress

Note: This is not a USB Port of the SOC

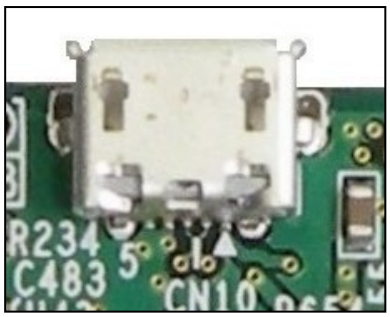


FIGURE 10 DEBUG SERIAL

3.5 QSPI Flash

On Board:

16MBytes QSPI (128 Mbits, 80 MHz, 80 MBytes/s)
1 header for QSPI module VIO=1.8V,VCC=3.3V
SW1 to Switch between the Modes Hyper Flash | On: Hyperflash / Off: QSPI

On ComExpress:

QSPI flash memory: 1ch QSPI
(Max. 80 MHz, 80 MBytes/s)

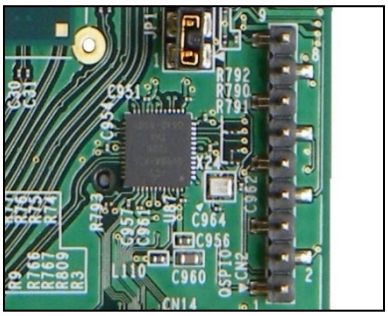


FIGURE 11 QSPI FLASH

SW 1	SW 6.3	JP1	QSPI Source
ON	ON	*	Hyperflash
OFF	OFF	1-2	INT.QSPI
OFF	OFF	2-3	EXT.QSPI
OFF	OFF	OPEN	QSPI @ComEx.

CN2	
1	Reset#/NC
2	IO3
3	IO2
4	CS#
5	IO0
6	IO1
7	CK
8	GND
9	VCC
PSM-410336-09	
SMT PinHeader	

TABLE 5 QSPI FLASH CN2

3.6 Micro HDMI

On Board:

HDMI0 / HDMI connector (micro type D, 19 pins)
HDMI 1.4b, up to 1080p60, 148.5MHz, with audio

On ComExpress:

HDMI1 / 1 additional HDMI channel 1.4b, up to 1080p60, 148.5MHz with audio

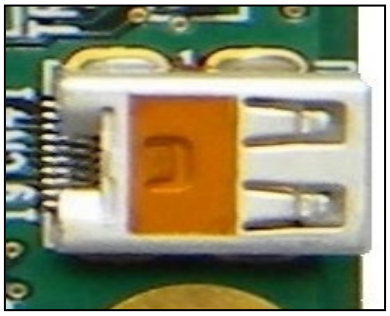


FIGURE 12 MICRO HDMI

3.7 Micro SD-Card

On Board:
SDHI0 / MicroSD-Card slot (SDR104 100 MBytes/s)

On ComExpress:
SDHI3 / 1 additional SD host interface available (SDR104 104 MBytes/s)

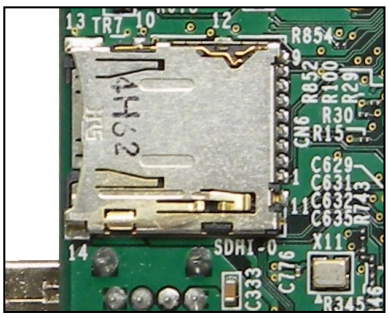


FIGURE 13 MICRO SD-CARD

3.8 JTAG Coresight Debug

On Board:
20-pin SICA2P20S connector (via adapter SICA20I2P)

On ComExpress:
Available

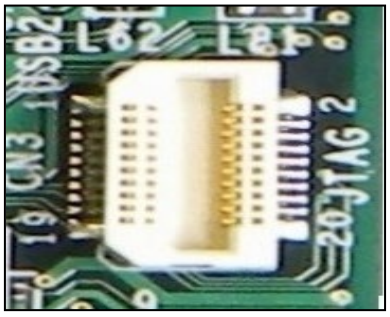


FIGURE 14 JTAG DEBUG

		CN3		
D1.8V	-------	1	2	D1.8V
TRSTn18	-------	3	4	GND
TDI_18	-------	5	6	GND
TMS_18	-------	7	8	GND
TCK_18	-------	9	10	GND
x	-------	11	12	GND
TDO_18	-------	13	14	GND
Presetn_18	-------	15	16	GND
ASEBRK_18	-------	17	18	GND
GND	-------	19	20	GND
		SICA2P20S05		

TABLE 6 JTAG DEBUG CN3

3.9 Ethernet

On Board:
PHY + RJ45 connector (100/1000)

On ComExpress:
Alternatively to on-board PHY: RGMII V1.3 interface (2.5V)

Note: For this Interface are 2 different Order codes available.

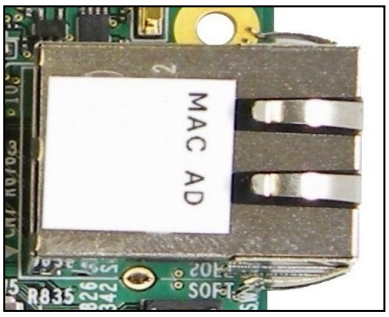


FIGURE 15 ETHERNET

3.10 USB 2.0 host

On Board:
USB 2.0 host, USB-A connector

On ComExpress:
2 additional USB 2.0 host channels (EHCI/OHCI); PHYs integrated
2 additional channels available on USB 3.0 interfaces

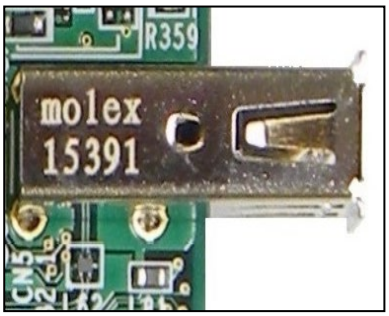


FIGURE 16 USB 2.0

3.11 Line Out / MIC Input

On Board:

Stereo microphone input (AK4613 codec)
Stereo line out (AK4613 codec)

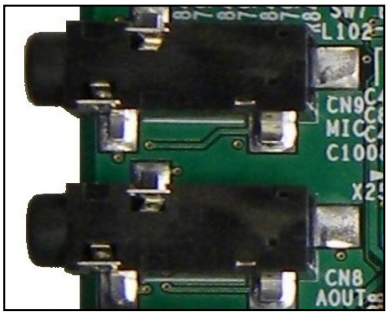


FIGURE 17 **LINE OUT / MIC INPUT**

3.12 CPLD JTAG

On Board:

Interface for programming the CPLD
6-Pin 1.27 Pin Header

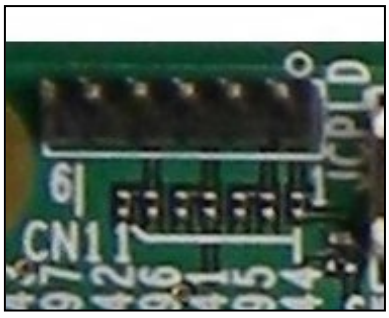


FIGURE 18 CPLD JTAG

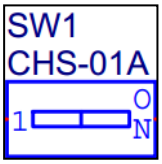
	CN11
BS1_TDO	1
BS1_TMS	2
BS1_TCK	3
BS1_TDI	4
D3.3V	5
GND	6

PSS-710153-06

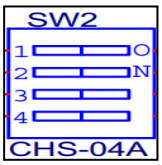
TABLE 7 CPLD JTAG CN11

3.13 Buttons and Switches

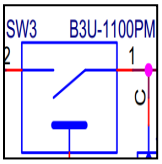
SW 1
Hyper Flash | On: Hyperflash / Off: QSPI



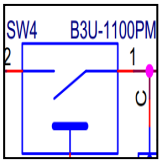
SW 2
4x DIPSW Software Readable
SW2.1 at GP5_17
SW2.2 at GP5_20
SW2.3 at GP5_22
SW2.4 at GP5_23



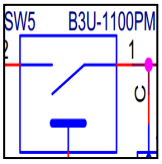
SW 3
Software Readable Push button
SW3 at GP6_11



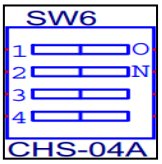
SW 4
Software Readable Push button
SW4 at GP6_12



SW 5
Software Readable Push button
SW5 at GP6_13

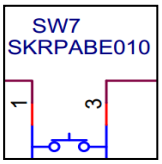


SW 6
4x Mode Settings via CPLD

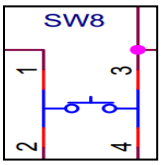


SW6-1	SW6-2	SW6-3	SW6-4	Selects boot device
OFF(0)	**OFF(0)**	**OFF(0)**	**OFF(0)**	A57 boot(AArch64), from SCIF, (DDR1600)
ON(1)	OFF(0)	OFF(0)	OFF(0)	A57 boot(AArch64), from SCIF, (DDR3200)
OFF(0)	ON(1)	OFF(0)	OFF(0)	CR7 boot(AArch32), from SCIF, (DDR1600)
ON(1)	ON(1)	OFF(0)	OFF(0)	CR7 boot(AArch32), from SCIF, (DDR3200)
OFF(0)	OFF(0)	ON(1)	OFF(0)	A57 boot(AArch64), from eMMC 50M (DDR1600)
ON(1)	OFF(0)	ON(1)	OFF(0)	not active
OFF(0)	ON(1)	ON(1)	OFF(0)	A57 boot(AArch64), from eMMC 50M (DDR2133)
ON(1)	ON(1)	ON(1)	OFF(0)	A57 boot(AArch64), from eMMC 50M (DDR3200)
OFF(0)	**OFF(0)**	**OFF(0)**	**ON(1)**	A57 boot(AArch64), from QSPI, (DDR1600)
ON(1)	OFF(0)	OFF(0)	ON(1)	not active
OFF(0)	ON(1)	OFF(0)	ON(1)	A57 boot(AArch64), from QSPI, (DDR2133)
ON(1)	ON(1)	OFF(0)	ON(1)	A57 boot(AArch64), from QSPI, (DDR3200)
OFF(0)	OFF(0)	ON(1)	ON(1)	A57 boot(AArch64), from HyperFlash 80M (DDR1600)
ON(1)	OFF(0)	ON(1)	ON(1)	not active
OFF(0)	ON(1)	ON(1)	ON(1)	A57 boot(AArch64), from HyperFlash 80M (DDR2133)
ON(1)	ON(1)	ON(1)	ON(1)	A57 boot(AArch64), from HyperFlash 80M (DDR3200)

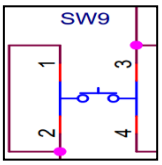
SW 7
Reset (same as SW 9)



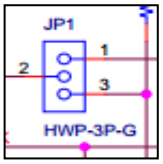
SW 8
Power



SW 9
Reset (same as SW 7)



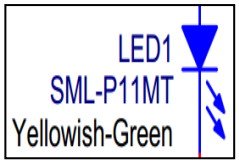
JP1
QSPI Selector



3.14 On Board LED's

LED1

HDMI / Hot Plug Sync Detect

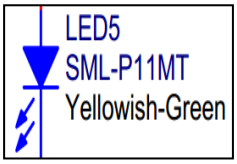


LED4

Software Controllable LED

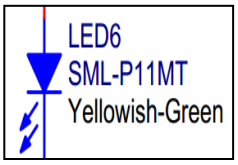
LED5

Software Controllable LED



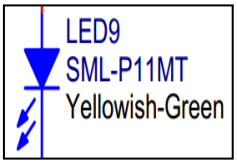
LED6

Software Controllable LED



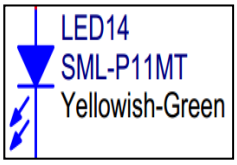
LED 9

5V Main Supply



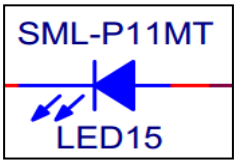
LED14

Backup LED



LED15

System Reset



3.15 Booting

The on-board QSPI flash and Hyperflash are pre-loaded with a bootloader and U-boot.
It is possible to boot a Linux from Ethernet (TFTP), from a microSD card or from a USB stick.
A console is available at the USB/UART CN12. The default parameters are 115200BD, 8N1

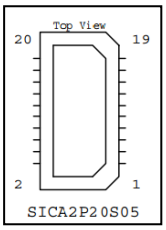
Note: Caution - if all flashes are deleted, the system is rendered unbootable. A recovery must be performed.
Booting is possible from external QSPI flash or via the JTAG debugger interface.

3.16 JTAG SICA Debug Interface

The JTAG debug connector for R-CAR H3 is a SICA2P0S05 20pin Port, which is to use with a SICA-Small Interface Cable Adapter.

Debug interface can be directly connected to a debugger.

D1.8V	1	2	D1.8V
TRST	3	4	GND
TDI	5	6	GND
TMS	7	8	GNDI
TCK	9	10	GND
n.u.	11	12	GND
TDO	13	14	GND
PRESET	15	16	GND
ASEBRK	17	18	GND
GND	19	20	GND



Note: Conversion cable information - SICA20I2P can be used to covert to normal JTAG Connector. (http://www.tetc.co.jp/e_index.htm)

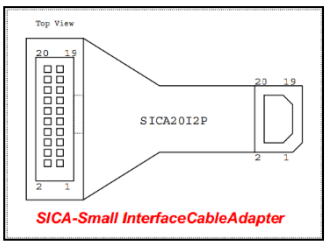


FIGURE 19 SICA ADAPTER

3.17 Board to Board Connector (COM Express 440pin)

The board to board connector on the bottom side is according the COM Express definition. The pin mapping is not identical to this standard, it's only similar. Refer to the attached table for the H3 Starter Kit pin mapping. For the mechanical dimension please refer to the attached drawing.

Pin description are described in ***"R-Car_Gen3_StarterKit_CoM_Express_Interfaces_rev110_(M3&H3).pdf "***.

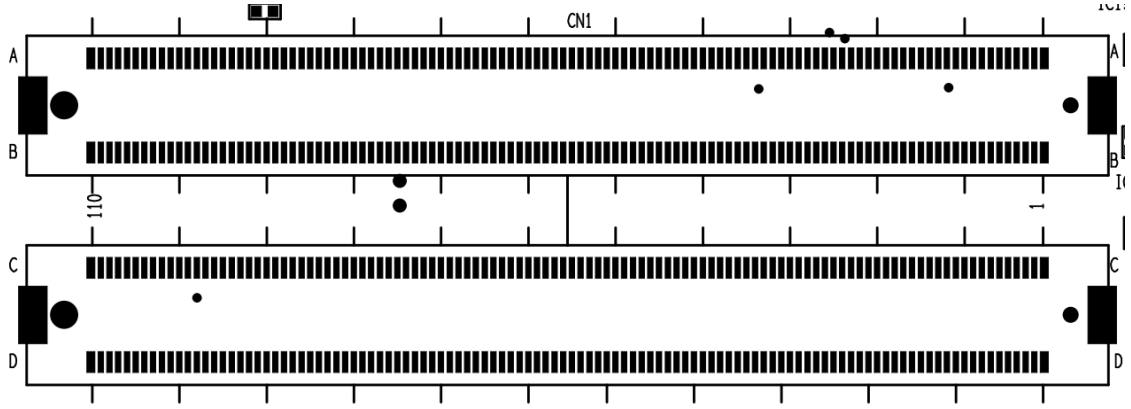


FIGURE 20 BOARD TO BOARD CONNECTOR COM EXPRESS

COM Express, a computer-on-module (COM) form factor.
H3 Start Kit type on bottom side: CN1 COM Express 440pin (TYCO ELECTRONICS 3-5353652-6)
Mating type on top side of any application boards 440pin (TYCO ELECTRONICS 3-1827231-6)

Note: Com Express Replacement part information are also described in COM Express Carrier Design Guide "PICMG_COMDG_2.0-RELEASED-2013-12-061.pdf".

Following interfaces are available at this connector. Some signals are shared (on the board or from R-CAR H3 device), so not all can be used at the same time. Refer to the table "pin-sharing" for details.

CSI2 length matching for custom designed add-on boards

According to the MIPI Standard, the CSI2 data and clock lanes need to be length-matched, inter-lane and also inter-lane. The complete lane length from transmitter (here: add-on board) to receiver (here: H3 SoC) must be considered.
This table shows the length of the signals on the H3 Starter Kit.
If you are designing a custom add-on board, please constrain the lengths on that board, so that the sum of the lengths match the MIPI standard requirements.

Net Name	Length [mm]
CSI0_CLKP	56.2201
CSI0_CLKN	56.0873
CSI0_DATAP0	46.7633
CSI0_DATAN0	46.7876
CSI0_DATAP1	54.6317
CSI0_DATAN1	54.6398
CSI0_DATAP2	69.6125
CSI0_DATAN2	69.6932
CSI0_DATAP3	75.4055
CSI0_DATAN3	75.4257
CSI1_CLKP	22.9172
CSI1_CLKN	22.9604
CSI1_DATAP0	18.5268
CSI1_DATAN0	18.5179
CSI1_DATAP1	24.9266
CSI1_DATAN1	24.9015
CSI2_CLKP	31.464
CSI2_CLKN	31.4391
CSI2_DATAP0	48.2885
CSI2_DATAN0	48.2843
CSI2_DATAP1	38.782
CSI2_DATAN1	38.7304
CSI2_DATAP2	41.1817
CSI2_DATAN2	41.1121
CSI2_DATAP3	39.5967
CSI2_DATAN3	39.5811
CSI3_CLKP	26.2212
CSI3_CLKN	26.2613
CSI3_DATAP0	27.8771
CSI3_DATAN0	27.8609

Note: Com Express pin descriptions are described in "H3_M3 Starter Kit CoM Express Interfaces".

3.18 Power supply and control from add-on boards

By default, the board is supplied with 5V by the on-board connector (CN13).

By default, the board can be turned on and off by pressing the power button (SW8).

When designing a custom add-on board, it is possible to supply the board through the CoM Express connector.

It is also possible to turn the board on or off from the add-on board.

The signal PWRONZ (pin A15) is in parallel to SW8. Pulsing it low will toggle the power-state of the H3 Starter Kit (the same behavior as pushing SW8).

Alternatively, if the signal RSTMODE (pin A18) is clamped low, the signal on pin A15 will become level-sensitive. In that case holding A15 high will enable power, holding it low will turn it off.

3.19 CPLD contents

(1) MODE pins
/ ExA[0 : 19], ExD[0 : 15]
Mode signals MD0 to MD28 and MDT0, MDT1 multiplexed on ExA/ExD lines be latched during reset; release after reset phase (t_hold min 3ns), each mode signal is set according to Mode Pin settings.
Note: Refer to SiP or SOC manual about each mode pin descriptions.

(2) QSPI mode control
/ [QSPI_CPLDSW]
QSPI_CPLDSW[K10] is Switch output QSPI signals to QSPIs (and HyperFlash), output depends on SW6 setting.

(3) DIPSW pins.
/ Mode Pin 0-3 [SW6]
Effective setting of mode pins.

(4) Switch pins
/ PWM1, PWM2, BKUP_TRG, BOOST, BKUP_REQB and SYSTRG, CS0n, ExA8{GP1_08}, ExA9{GP1_09}, ExA11{GP1_11}

[Pin connections]		:[Default set up]
ExA21/PWM1(in)[K3]	= PWM1[D9]	:ON
ExA20/PWM2(in)[K4]	= PWM2[C6]	:ON
BKUP_TRG(in)[H9]	= ExA8(GP1_08)[A6]	:ON
SYS_TRG(in)[C7]	= ExA8(GP1_08)[A6]	:OFF
ExA9{GP1_09}(in)[A7]	= BKUP_REQB[J6]	:OFF
ExA11{GP1_11} (in)[A5]	= BOOST[C5]	:OFF
DVFS_PGD(in)[J5]	= CS0n(out)[F10]	:OFF(function not active)

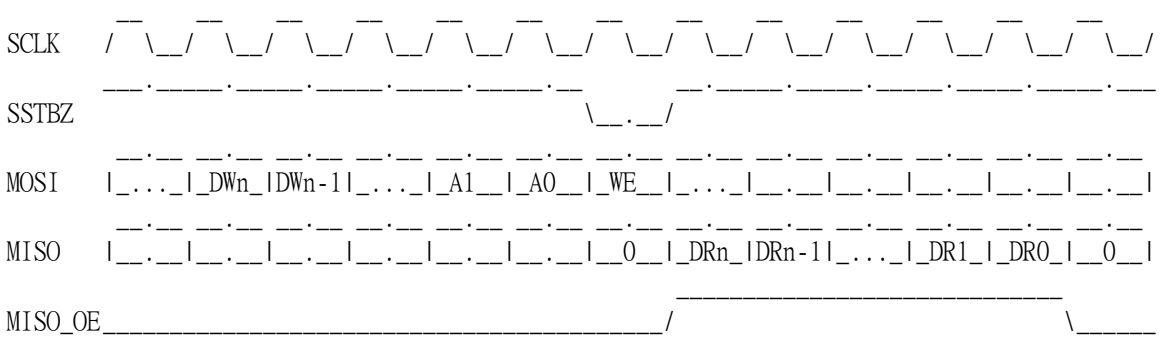
(5) RESET pins
/ PRESET_SYSZ_PMIC(out), DVFS_PGD(in), PUSH RESET(in), PRESET_SYSZ(out), and register Reset.
Reset to PMIC is generated by combined signal of reset inputs.

PRESET_SYSZ_PMIC[H10] =
DVFS_PGD[J5] && PUSH_RESET[K5] && PRESET_SYSZ[B10] && !reg[RESET_SSLAVE]

(6) Dynamic, volatile reconfiguration via SoC, GPIOs MSIOF / MSIOF1_SCK[K6], MSIOF1_TXD[G10], MSIOF1_RXD[C10], ExA25/PWM4

Interface to SiP - MSIOF1.

This figure explains serial I/F Frame format implemented in CPLD.



(7) REGISTER Map

Register address	Reg. bit	RW	Default value	Default function	Function description
0x00	0	RW	0	free running	mode pin MD00
0x00	1	RW	0	Serial flash (QSPI U5 or external)	mode pin MD01
0x00	2	RW	0	Serial flash (QSPI U5 or external)	mode pin MD02
0x00	3	RW	1	Serial flash (QSPI U5 or external)	mode pin MD03
0x00	4	RW	0	Serial flash (QSPI U5 or external)	mode pin MD04
0x00	5	RW	1	enabled	mode pin MD05
0x00	6	RW	0	CA57	mode pin MD06
0x00	7	RW	0	CA57	mode pin MD07
0x00	8	RW	1	8-bit	mode pin MD08
0x00	9	R	0	clock @ EXTAL	mode pin MD09
0x00	10	RW	0	CoreSight	mode pin MD10
0x00	11	RW	0	CoreSight	mode pin MD11
0x00	12	R	0	not used	mode pin MD12
0x00	13	RW	0	16.67MHz	mode pin MD13
0x00	14	RW	0	16.67MHz	mode pin MD14
0x00	15	RW	1	AArch32	mode pin MD15
0x00	16	R	1	reserved, fix to H	mode pin MD16
0x00	17	RW	0	DDR3200	mode pin MD17
0x00	18	RW	0	66.6MHz	mode pin MD18
0x00	19	RW	0	DDR3200	mode pin MD19
0x00	20	RW	0	CoreSight	mode pin MD20
0x00	21	RW	1	CoreSight	mode pin MD21
0x00	22	R	0	LPDDR4	mode pin MD22
0x00	23	RW	0	mode 0	mode pin MD23
0x00	24	R	0	not used	mode pin MD24
0x00	25	RW	0	disabled	mode pin MD25
0x00	26	R	0	reserved, fix to L	mode pin MD26
0x00	27	R	0	LPDDR4	mode pin MD27
0x00	28	R	0	reserved, fix to L	mode pin MD28
0x00	29	RW	0	CoreSight	mode pin MDT0
0x00	30	RW	0	CoreSight	mode pin MDT1
0x00	31	RW	0	use SW6 (through a 4-to-30 table) for mode pins	override mode pins
0x01	[30:0]	R	*	depends on SW6 setting	Effective setting of mode pins, of not overridden (after 4-to-30 table)
0x01	31	R	0	unused	
0x02	8	RW	0	do not override (SW6 specifies mode)	QSPI signal output enable
0x02	0	RW	0	do not override (SW6 specifies mode)	QSPI signal output enable
0x02	1	RW	1	output GP2_07 to CoM-Express (pin C44)	PWM1 output of CoM-Express (pin C44)
0x02	2	RW	1	output GP2_08 to CoM-Express (pin B44) and SYNC of PMIC	PWM2 output of CoM-Express (pin B44) and SYNC of PMIC
0x02	3	RW	1	keep GP1_08 at HIZ	GP1_08 of SoC (enable)
0x02	4	RW	0	keep GP1_08 at HIZ	GP1_08 of SoC (source)
0x02	5	RW	0	BKUP_REQB from CoM-Express (pin A5) / pull-down	BKUP_REQB to PMIC
0x02	6	RW	0	keep BOOST of PMIC at HIZ	BOOST to PMIC
0x02	7	RW	0	keep GP1_20 at HIZ	GP1_20 of SoC
0x02	[31:9]	R	0	unused	
0x08	[3:0]	R	*	depends on SW6 setting	SW6 setting readback
0x08	[31:4]	R	0	unused	
0x80	0	RW	0	normal operation	RESET (gets cleared by hardware)
0x80	[31:1]	R	0	unused	
0xFF	[31:16]	R	*	depends on CPLD version	CPLD version timestamp (in BCD) year
0xFF	[15:8]	R	*	depends on CPLD version	CPLD version timestamp (in BCD) month
0xFF	[7:0]	R	*	depends on CPLD version	CPLD version timestamp (in BCD) day

Please refer to SiP or SOC hardware manual about each mode pin description.

4. CE

This equipment complies with the EMC protection requirements class A EN 55022:2010.

The board code on test.

Y-ASK-RCAR-M3-ETH-WS1	(M3)
Y-ASK-RCAR-H3-ETH-WS1	(H3)

RENESAS Renesas Electronics Europe GmbH

CE

This equipment complies with the EMC protection requirements

WARNING

This is a 'Class A' (EN 55022: 2010) equipment. This equipment can cause radio frequency noise when used in the residential area. In such cases, the user/operator of the equipment may be required to take appropriate countermeasures under his responsibility.

EEDT-ST-001-30

CAUTION

This equipment should be handled like a CMOS semiconductor device. The user must take all precautions to avoid build-up of static electricity while working with this equipment. All test and measurement tool including the workbench must be grounded. The user/operator must be grounded using the wrist strap. The connectors and/or device pins should not be touched with bare hands.

EEDT-ST-004-10

For customers in the European Union only

The WEEE (Waste Electrical and Electronic Equipment) regulations put responsibilities on producers for the collection and recycling or disposal of electrical and electronic waste. Return of WEEE under these regulations is applicable in the European Union only. This equipment (including all accessories) is not intended for household use. After use the equipment cannot be disposed of as household waste, and the WEEE must be treated, recycled and disposed of in an environmentally sound manner. Renesas Electronics Europe GmbH can take back end of life equipment, register for this service at http://www.renesas.eu/weee

EEDT-CD-0175-4.2

5. Appendix

5.1 R-Car_Gen3_StarterKit_schematic_Revxxx
5.2 R-Car_Gen3_StarterKit_BOM_revxxx_(M3)
5.3 R-Car_Gen3_StarterKit_BOM_revxxx_(H3)
5.4 R-Car_Gen3_StarterKit_board_dimensions_drawing_xxx_revxxx_(M3&H3)
5.5 R-Car_Gen3_StarterKit_board_assembly_drawing_046B_revxxx_(M3&H3)
5.6 R-Car_Gen3_StarterKit_CoM_Express_Interfaces_revxxx_(M3&H3)

Refer to the attachments of this Hardware Manual file.

Revision History	RCar_H3_M3_Starter_Kit_Hardware_Manual

Rev.	Date	Description	
		Page	Summary
0.0	May 30, 2016	—	First Edition issued
0.9	Nov 08, 2016	All	Initialized for Starterkit. Draft version.
1.0	Dec 21, 2016	1	Title name changed and updated to rev1.
1.1	Apr.6, 2020	15	Delete “4k” and update the Renesas logo

RCar Starter Kit H3 / M3 Starter Kit Hardware Manual

Publication Date: Rev.0.9 Nov 08, 2016

Published by: Renesas Electronics

RENESAS

SALES OFFICES Renesas Electronics Corporation http://www.renesas.com

Refer to "http://www.renesas.com/" for the latest and detailed information.

Renesas Electronics America Inc.
2801 Scott Boulevard Santa Clara, CA 95050-2549, U.S.A.
Tel: +1-408-588-6000, Fax: +1-408-588-6130
Renesas Electronics Canada Limited
9251 Yonge Street, Suite 8309 Richmond Hill, Ontario Canada L4C 9T3
Tel: +1-905-237-2004
Renesas Electronics Europe Limited
Dukes Meadow, Millboard Road, Bourne End, Buckinghamshire, SL8 5FH, U.K
Tel: +44-1628-585-100, Fax: +44-1628-585-900
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 1709, Quantum Plaza, No.27 ZhiChunLu Haidian District, Beijing 100191, P.R.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, P. R. China 200333
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, Unit #06-02 Hyflux Innovation Centre, Singapore 339949
Tel: +65-6213-0200, Fax: +65-6213-0300 **Renesas Electronics Malaysia Sdn.Bhd.**
Unit 1207, Block B, Menara Amcorp, Amcorp Trade Centre, No. 18, Jln Persiaran Barat, 46050 Petaling Jaya, Selangor Darul Ehsan, Malaysia
Tel: +60-3-7955-9390, Fax: +60-3-7955-9510
Renesas Electronics India Pvt. Ltd.
No.777C, 100 Feet Road, HALII Stage, Indiranagar, Bangalore, India
Tel: +91-80-67208700, Fax: +91-80-67208777 **Renesas Electronics Korea Co., Ltd.**
12F., 234 Teheran-ro, Gangnam-Gu, Seoul, 135-080, Korea
Tel: +82-2-558-3737, Fax: +82-2-558-5141

© 2016 Renesas Electronics Corporation. All rights reserved.

Colophon 4.0

H3 Starter Kit
M3 Starter Kit

Renesas Electronics Corporation

R01UH0001XJ090-RCSKB