Getting Started with the RISC-V Based PolarFire® SoC FPGA Webinar Series

Session 14 The PolarFire SoC Icicle Kit Model in Renode

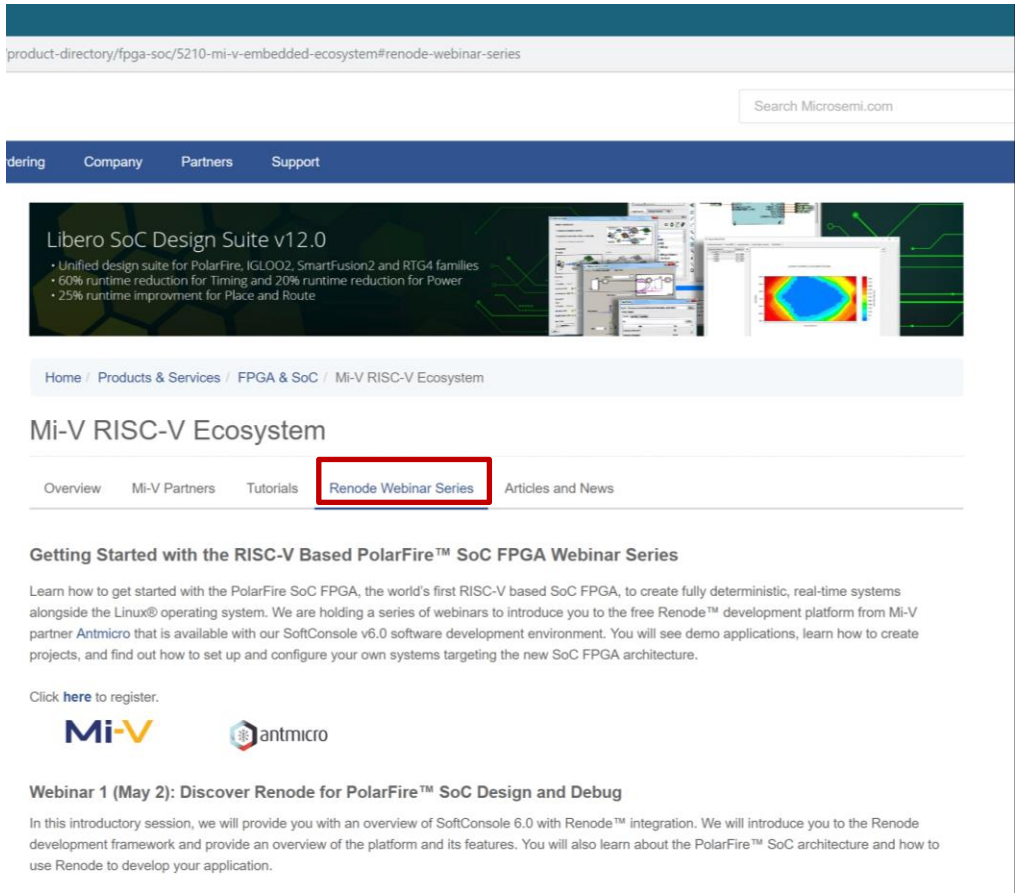
A Leading Provider of Smart, Connected and Secure Embedded Control Solutions

Hugh Breslin, Design Engineer

Thursday June. 11, 2020

Supporting Content

www.microsemi.com/Mi-V “Renode Webinar Series”



Webinar 1: Discover Renode for PolarFire® SoC Design and Debug

Webinar 2: How to Get Started with Renode for PolarFire SoC

Webinar 3: Learn to Debug a Bare-Metal PolarFire SoC Application with Renode

Webinar 4: Tips and Tricks for Even Easier PolarFire SoC Debug with Renode

Webinar 5: Add and Debug PolarFire SoC Models with Renode

Webinar 6: Add and Debug Pre-Existing Model in PolarFire SoC

Webinar 7: How to Write Custom Models

Webinar 8: What’s New in SoftConsole v6.2

Webinar 9: Getting Started with PolarFire SoC

Webinar 10: Introduction to the PolarFire SoC Bare-Metal Library

Webinar 11: Handling Binaries

Webinar 12: Simple Peripheral as Software Stimulus

Webinar 13: Two Baremetal Applications on PolarFire SoC

MICROCHIP

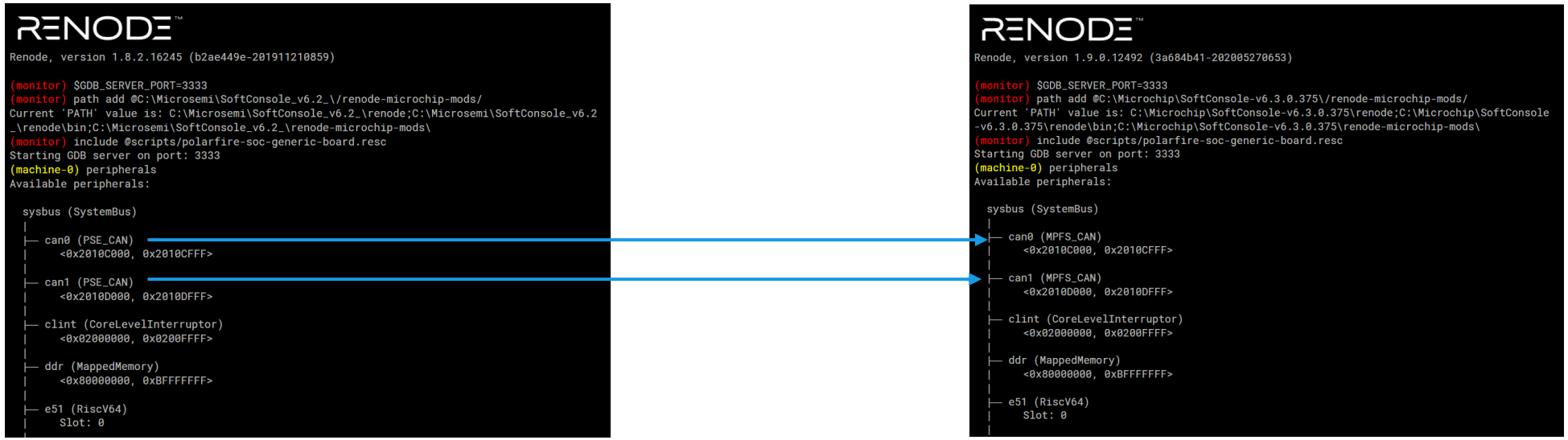
Agenda

- SoftConsole v6.3
- Renode Icicle Kit Model

SoftConsole v6.3

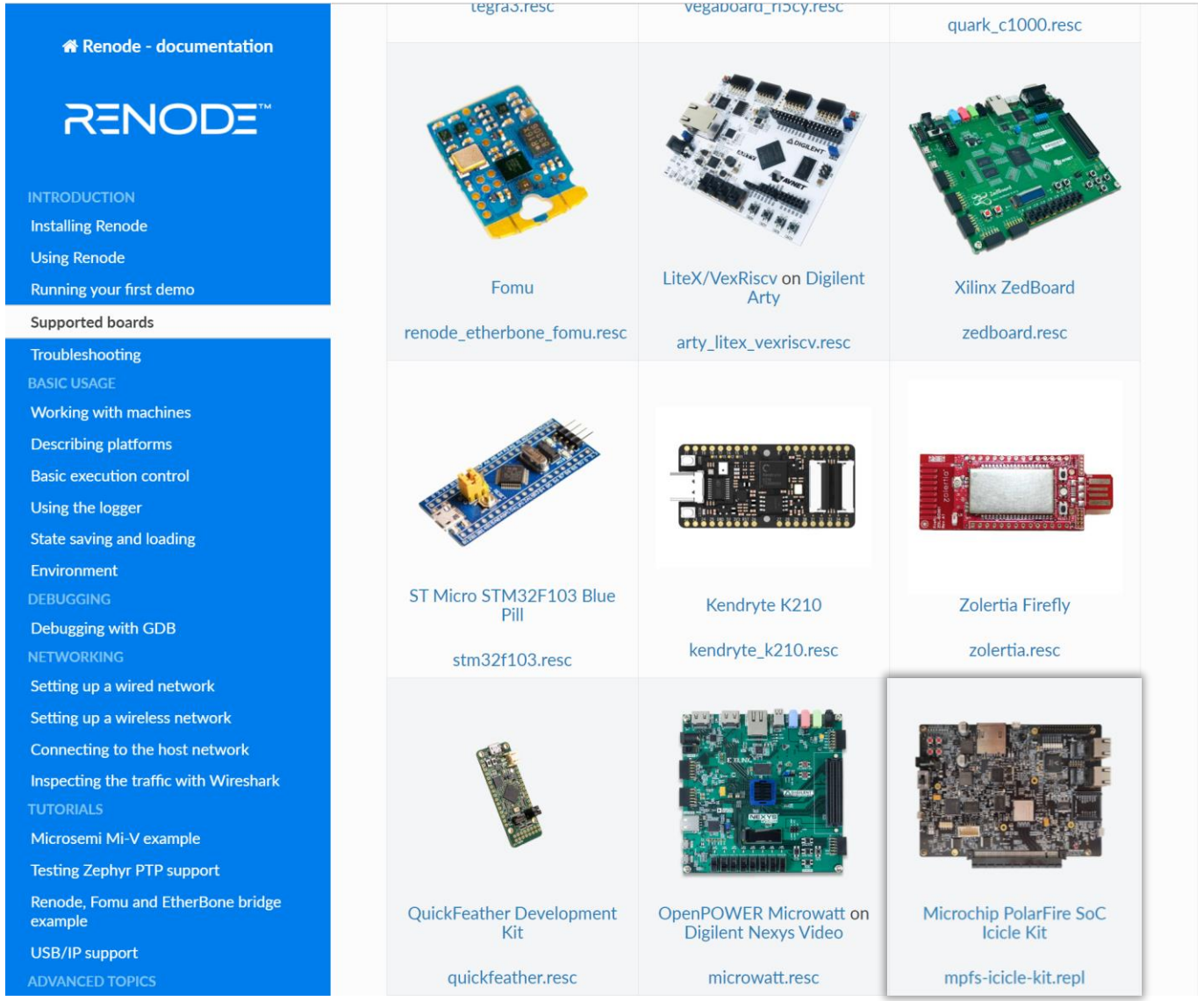
SoftConsole v6.3

- **SoftConsole v6.3 released July 2020**
- **Renode v1.9.0 will be included in SoftConsole v6.3, which includes the Icicle Kit model**
- **Model names all updated to MPFS naming convention**



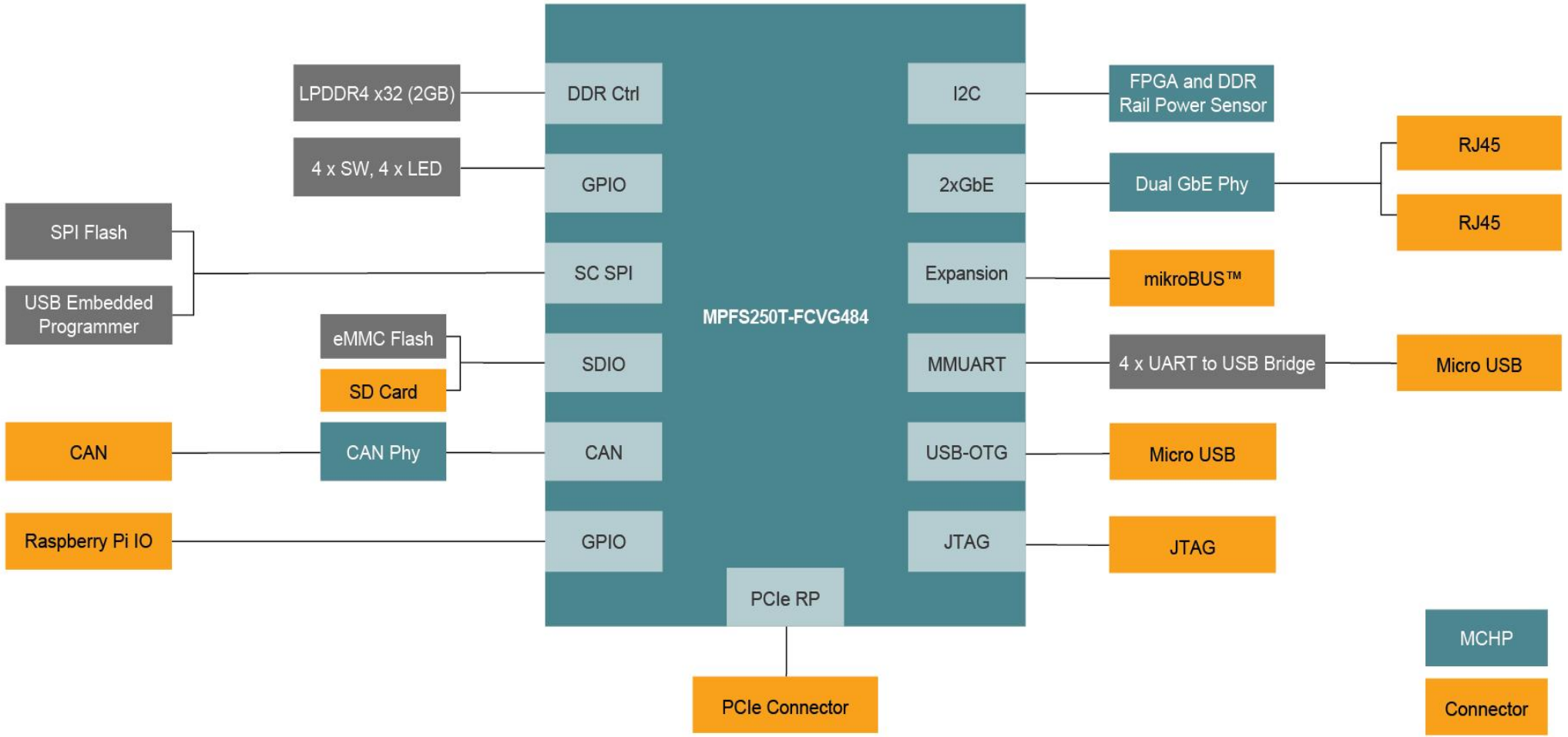
Renode Icicle Kit Model

Renode Icicle Kit Model



MICROCHIP

Renode Icicle Kit Model



MICROCHIP

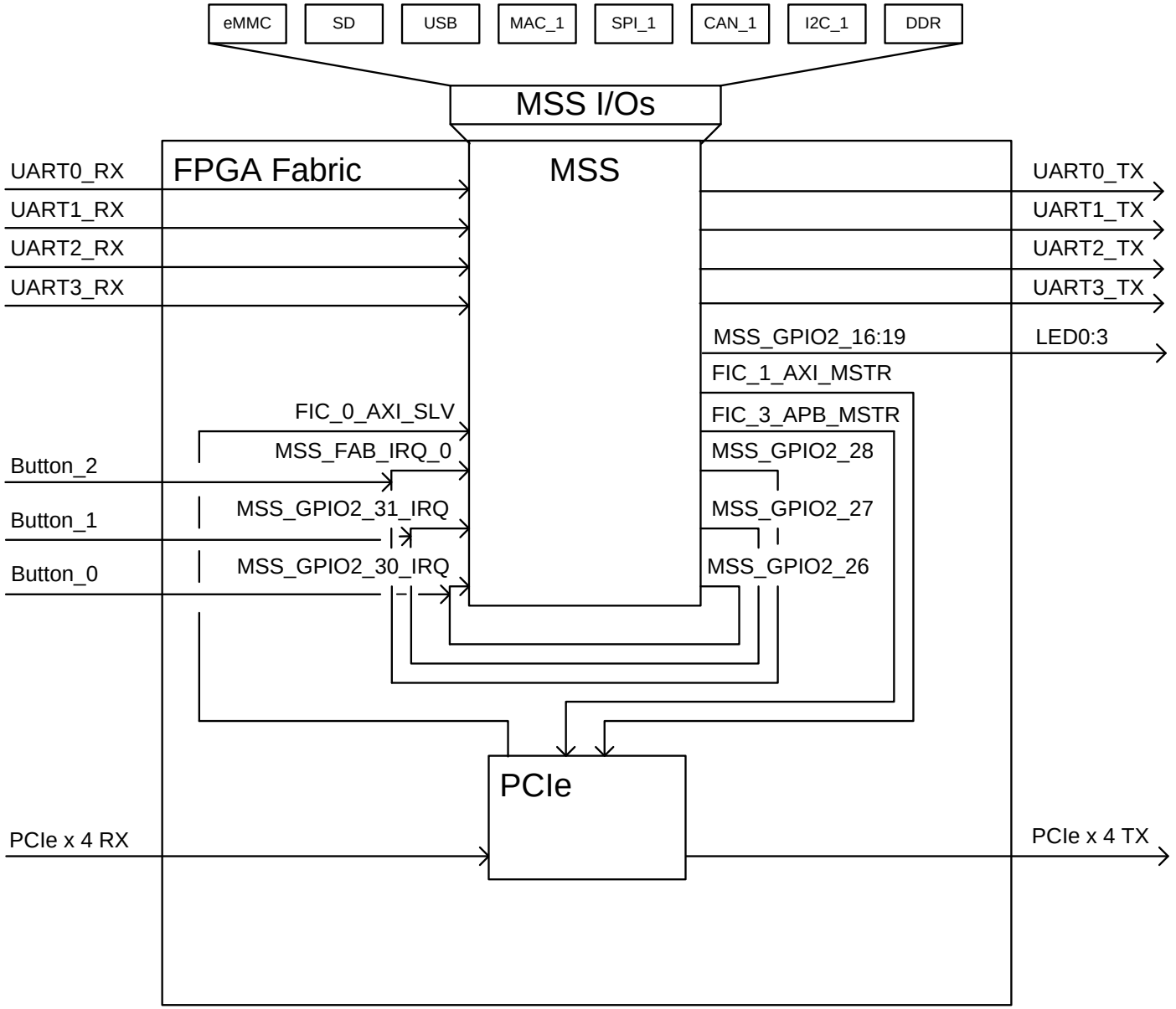
Renode Icicle Kit Model

- **Expands on the original PolarFire SoC Icicle Kit Renode model**

```
:name: PolarFire SoC Icicle
:description: This is a sample script prepared to create a PolarFire SoC Icicle platform

include @scripts/polarfire-soc-generic-board.resc

```

```
:name: PolarFire SoC Icicle
:description: This is a sample script prepared to create a PolarFire SoC Icicle platform

include @scripts/macros-pfsoc.resc

logLevel 3

using sysbus
mach create

machine LoadPlatformDescription @platforms/cpus/polarfire-soc.repl
machine LoadPlatformDescriptionFromString
"""
gpio0: @ none

gpio1: @ none

gpio2:
    16 -> led0@0
    17 -> led1@0
    18 -> led2@0
    19 -> led3@0
    26 -> gpio2@30
    27 -> gpio2@31
    28 -> plic@118

pseFlash: @ none

led0: Miscellaneous.LED @ gpio2 16

led1: Miscellaneous.LED @ gpio2 17

led2: Miscellaneous.LED @ gpio2 18

led3: Miscellaneous.LED @ gpio2 19

button1: Miscellaneous.Button @ gpio2 30
    -> gpio2@30

button2: Miscellaneous.Button @ gpio2 31
    -> gpio2@31

button3: Miscellaneous.Button @ gpio2 28
    -> plic@118
"""

logLevel 3 sysbus.e51
logLevel 3 sysbus.u54_1
logLevel 3 sysbus.u54_2
logLevel 3 sysbus.u54_3
logLevel 3 sysbus.u54_4

# Before invoking this script the GDB port has to be set, example:
# $GDB_SERVER_PORT=3333
# When this script (or its children) are invoked from the SoftConsole external
# launcher then the GDB port can be set by adding the following argument before
# the platform script is invoked:
# -e "$GDB_SERVER_PORT=3333"
echo -n "Starting GDB server on port: "
echo $GDB_SERVER_PORT
machine StartGdbServer `echo $GDB_SERVER_PORT`
```

Renode Icicle Kit Model



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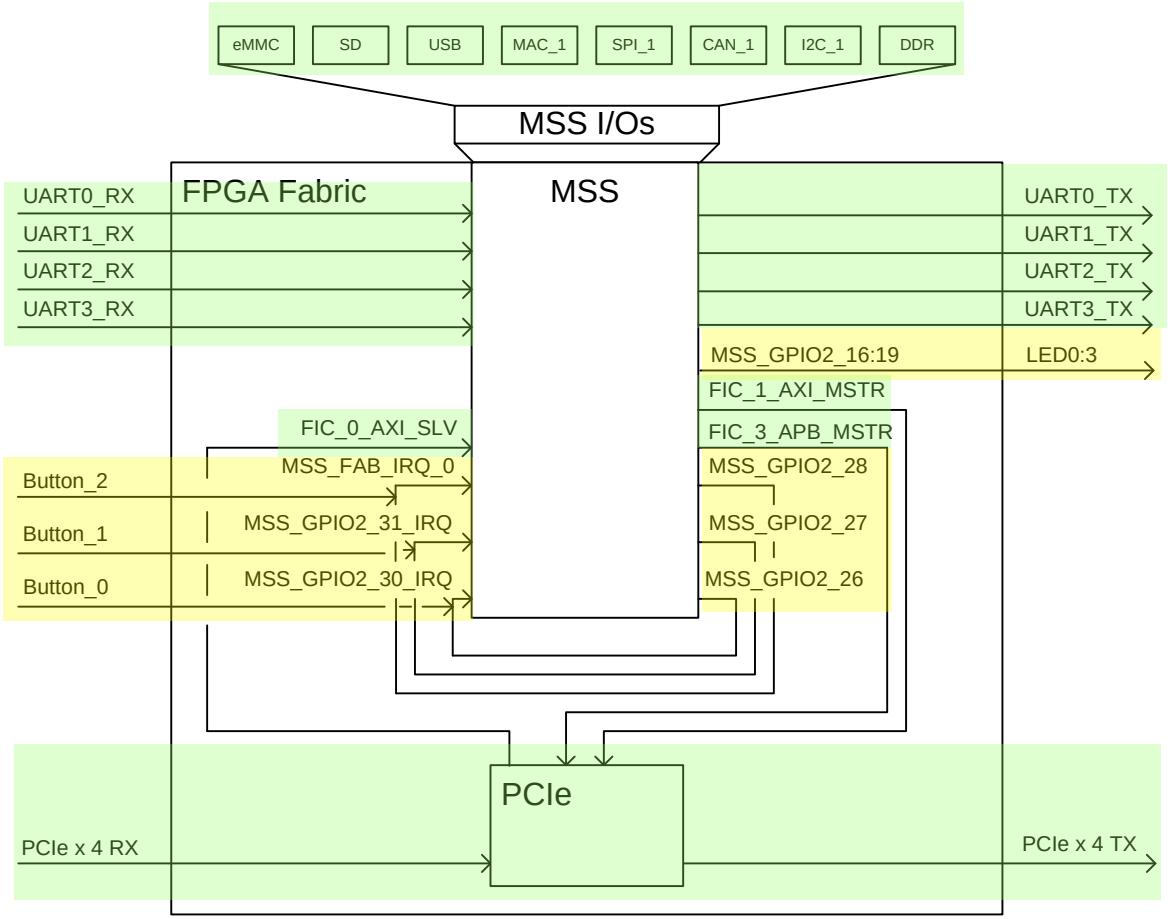


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Renode Icicle Kit Model

polarfire-soc.repl

E51	U54_1	U54_2	U54_3	U54_4
CLINT	PDMA	PLIC	MMUART0	MMUART1
MMUART2	MMUART3	MMUART4	eMMC	SPI0
SPI1	I2C0	I2C1	CAN0	CAN1
MAC0	MAC1	PHY	GPIO0	GPIO1
GPIO2	WDOG0	WDOG1	WDOG2	WDOG3
WDOG4	RTC	MSTIMER	eNVM	USB
DDR	PCIe0	PCIe1	QSPI	

Renode Icicle Kit Model

- The current sensor model is still a work in progress
- It will be available at the end of June
- When its released the model can be downloaded and added as JiT
- Watch webinar 6 “Add and Debug Pre-Existing Model in PolarFire SoC”
- Watch webinar 12 “Simple Peripheral as Software Stimulus”

Icicle Kit Model

renode / renode-infrastructure

Used by 18 | Watch 6 | Star 4 | Fork 15

Code | Pull requests 2 | Actions | Security 0 | Insights

Branch: master | renode-infrastructure / src / Emulator / Peripherals / Peripherals / Sensors / | Create new file | Upload files | Find file | History

mateusz-holenko [#18461] Add ADXL345 model — Latest commit d13a15b on Mar 26

..

ADXL345.cs	[#18461] Add ADXL345 model	2 months ago
DummySensor.cs	[#9650] Update copyright headers.	3 years ago
MAX6682MUA.cs	[#9650] Update copyright headers.	3 years ago
SI70xx.cs	[#9650] Update copyright headers.	3 years ago
TI_LM74.cs	[#9650] Update copyright headers.	3 years ago

workspace.examples - mpfs-gpio/src/application/hart0/e51.c - SoftConsole v6.3.0.376

File Edit Source Refactor Navigate Search Project Git Run Window Help

Project Explorer

- mpfs-blinky
- mpfs-freertos-lwip
- mpfs-gpio
  - Binaries
  - Includes
  - src
    - application
      - demos
      - hart0
        - e51.c
      - hart1
      - hart2
      - inc
    - modules
    - platform
  - Debug
  - renode
  - mpfs-gpio hw Debug.launch
  - mpfs-gpio Renode Debug.launch
  - mpfs-gpio Renode Start-platform-and-d
  - README.html
  - README.md

e51.c

```
137  * Application code running on HART0 is placed here.
138  * U54 HARTs are not used and they are kept in WFI
139  */
140 void e51 (void)
141 {
142     /*Reset UART0 */
143     SYSREG->SOFT_RESET_CR &= ~(0x01UL << 5);
144
145     /* all clocks on */
146     SYSREG->SUBBLK_CLOCK_CR = 0xffffffff;
147
148     PLIC_init();
149
150     PLIC_SetPriority_Threshold(0);
151     PLIC_SetPriority(GPIO1_BIT16_or_GPIO2_BIT30_PLIC_30, 2);
152     PLIC_SetPriority(GPIO1_BIT17_or_GPIO2_BIT31_PLIC_31, 2);
153     PLIC_SetPriority(GPIO0_NON_DIRECT_PLIC, 2);
154     PLIC_SetPriority(GPIO1_NON_DIRECT_PLIC, 2);
155     PLIC_SetPriority(GPIO2_NON_DIRECT_PLIC, 2);
156     PLIC_SetPriority(FABRIC_F2H_0_PLIC, 2);
157
158     PLIC_EnableIRQ(GPIO1_BIT16_or_GPIO2_BIT30_PLIC_30);
159     PLIC_EnableIRQ(GPIO1_BIT17_or_GPIO2_BIT31_PLIC_31);
160     PLIC_EnableIRQ(GPIO2_NON_DIRECT_PLIC);
161     PLIC_EnableIRQ(FABRIC_F2H_0_PLIC);
162     PLIC_EnableIRQ(MMUART0_PLIC_77);
163
164     __disable_local_irq((int8_t) MMUART0_E51_INT);
165     __enable_irq();
166
167     /* GPIO2 */
168     MSS_GPIO_init(GPIO2_LO);
```

Outline

- stdio.h
- string.h
- ../inc/common.h
- mpfs_hal/mss_hal.h
- drivers/mss_gpio/mss_gpio.h
- drivers/mss_uart/mss_uart.h
- mpfs_hal/mss_clint.h
- uart_lock : uint64_t
- uart_buf : char[]
- gpio1_bit16_or_gpio2_bit30_plic_30_IRQHandler(void) : uint8_t
- gpio1_bit17_or_gpio2_bit31_plic_31_IRQHandler(void) : uint8_t
- fabric_f2h_0_plic_IRQHandler(void) : uint8_t
- SysTick_Handler(uint32_t) : void
- rx_size : uint8_t
- rx_buff : uint8_t[]
- uart0_rx_handler(mss_uart_instance_t*) : void
- e51(void) : void

Expressions Disassembly

Debug Breakpoints

Problems Markers Console Terminal Search Debugger Console

CDT Build Console [mpfs-mustein-julia]

Variables Registers

Name	Type	Value

Renode Icicle Kit Mode

- Available in SoftConsole v6.3
- Current sensor model will be available from

- Add the model to your SoftConsole project
- Add the path to the model in your external tools
- Add your launch script to your SoftConsole project and add it to the external tool configurations

- Watch webinar 6 “Add and Debug Pre-Existing Model in PolarFire SoC”
- Watch webinar 12 “Simple Peripheral as Software Stimulus”

Agenda

- SoftConsole v6.3
- Renode Icicle Kit Model

Thank you!

Any questions?

Second Thursdays

July 9 - Webinar 15: Linux® on Renode

Aug. 13 - Webinar 16: Building Applications for Linux on PolarFire SoC

Sep. 10 - Webinar 17: Real-Time (AMP Mode) on PolarFire SoC