



SAM 32-Bit ARM Rad-Hard Microcontrollers

SAMRH71F20-EK Evaluation Kit User's Guide

Preface

The Microchip SAMRH71F20-EK Evaluation Kit is a hardware platform to evaluate the SAMRH71 microcontroller.

Supported by the MPLAB® HARMONY integrated development platform from Microchip, as well as other commercially available development environments, the Evaluation Kit provides easy access to the Microchip Rad-Hard SAMRH71F20 microcontroller and its Aerospace-specific feature set, and explains how to integrate the device in a custom design.

The SAMRH71F20-EK Evaluation Kit is also compliant with Microchip Xplained extension kits that offer additional peripherals to extend the features of the board and ease the development of custom designs.

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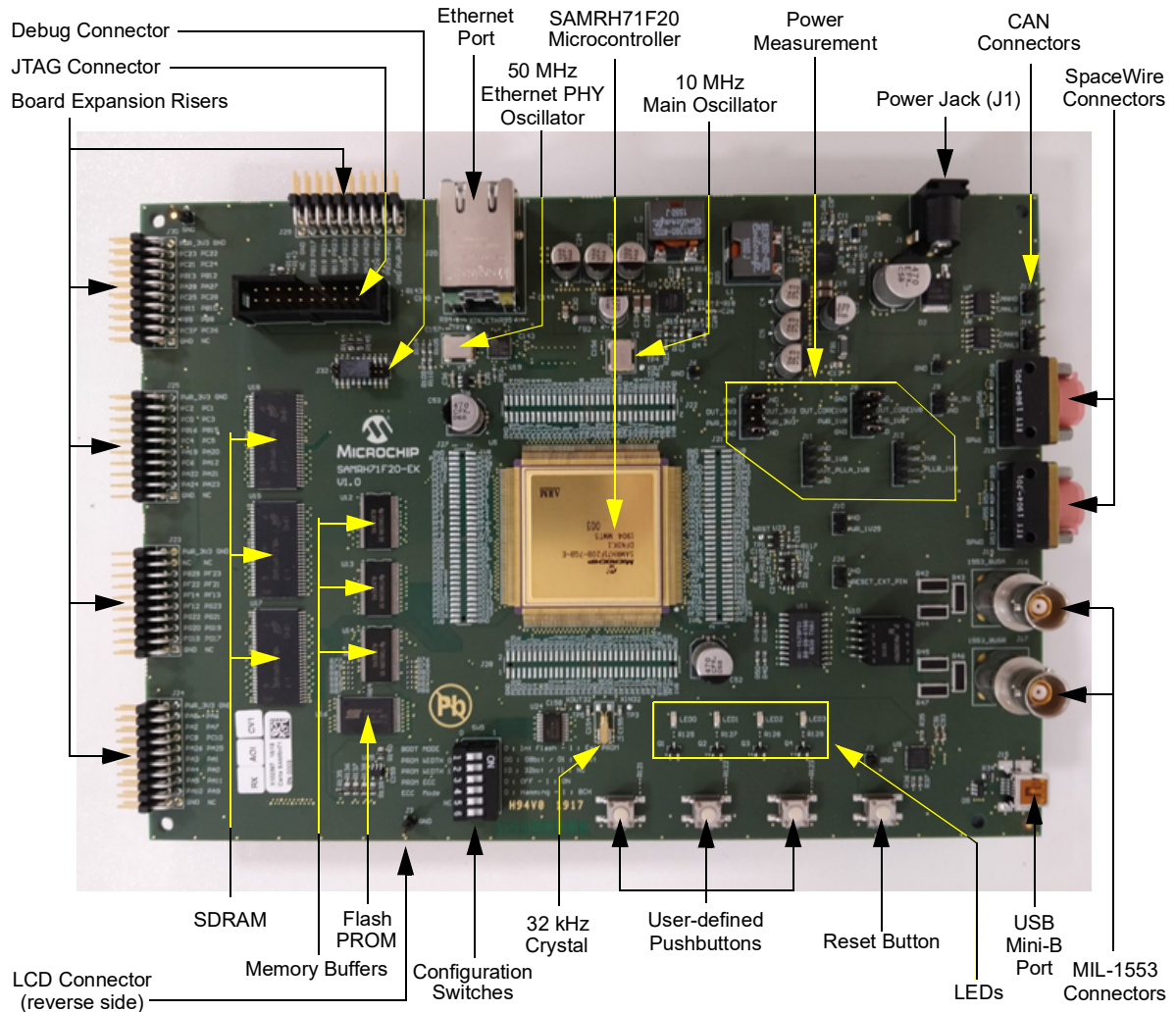
1. Features

- SAMRH71F20x-7GB-E Sample Microcontroller
- On-Board Memories:
 - 512 Kbytes (8-bit wide) PROM
 - 256 Mbits (32-bit wide) SDRAM
- On-Board Clock Management:
 - 32.768 kHz crystal
 - 10 MHz oscillator
- Communication Interfaces:
 - UART emulation through USB interface
 - Ethernet MAC with external IEEE[®] 802.3az 10Base-T/100Base-TX Ethernet RMI PHY (KSZ8061-RND transceiver) and dedicated clock source
 - Two CAN transceivers (ATA6563)
 - Two SpaceWire connectors
 - Two MIL-1553 connectors
- Embedded Debug Access:
 - JTAG Debug connector
 - TRACE connector
- Extension Capability:
 - Five headers compatible with Xplained mezzanine board
 - Four connectors with direct access to the processor pins
- On-Board End User Interface
 - One mechanical Reset button
 - Three mechanical user push buttons
 - Four user LEDs
 - One pin for NMIC
 - One LCD edge connector
- 12V Power Supply:
 - Jack connector
 - LED indicator for 12V power supply

2. Kit Overview

The SAMRH71F20-EK Evaluation Kit is a hardware platform that allows users to start working with the SAMRH71 Cortex®-M7 processor. The Evaluation Kit offers a set of aerospace-specific features that enable the user to get started with SAMRH71 peripherals right away, and to learn how to integrate the device into their own design.

Figure 2-1. SAMRH71 Evaluation Board Layout



3. Atmel Studio Quick Start

There are four steps to start exploring the SAMRH71F20-EK Evaluation Kit:

1. Download and install Atmel Studio (v7.0.1931 or later).
2. Launch Atmel Studio.
3. Power the Evaluation Kit by connecting the 12V power supply to the power connector (J1).
4. Connect a USB cable (Standard-A to Standard-B) between the host PC and the Microchip SAM-ICE™ Debugger. Connect the ribbon cable from the debugger to the Evaluation Kit's JTAG port (J31).

When the SAMRH71F20-EK Evaluation Kit is connected to your computer for the first time, the operating system will perform a driver software installation.

Once the kit is powered, the green power LED will be lit and Atmel Studio will auto-detect the kit and any extension board(s) which may be connected. Atmel Studio will present relevant information such as data sheets and kit documentation.

3.1 Starting with MPLAB IDE

MPLAB® X Integrated Development Environment (IDE) is an expandable, highly configurable software program that incorporates powerful tools to help you discover, configure, develop, debug and qualify embedded designs for most of Microchip's microcontrollers and digital signal controllers. MPLAB X IDE works seamlessly with the MPLAB development ecosystem of software and tools, many of which are completely free.

Follow the [user guide](#) to create new projects.

3.2 Starting with IAR

IAR™ Embedded Workbench® for ARM® is a proprietary, high-efficiency compiler not based on GCC. The programming and debugging of the Evaluation Kit is supported in Embedded Workbench for ARM using the common CMSIS-DAP interface. Some initial settings have to be set up in the project to get programming and debugging to work.

Follow the [user guides](#) to create projects.

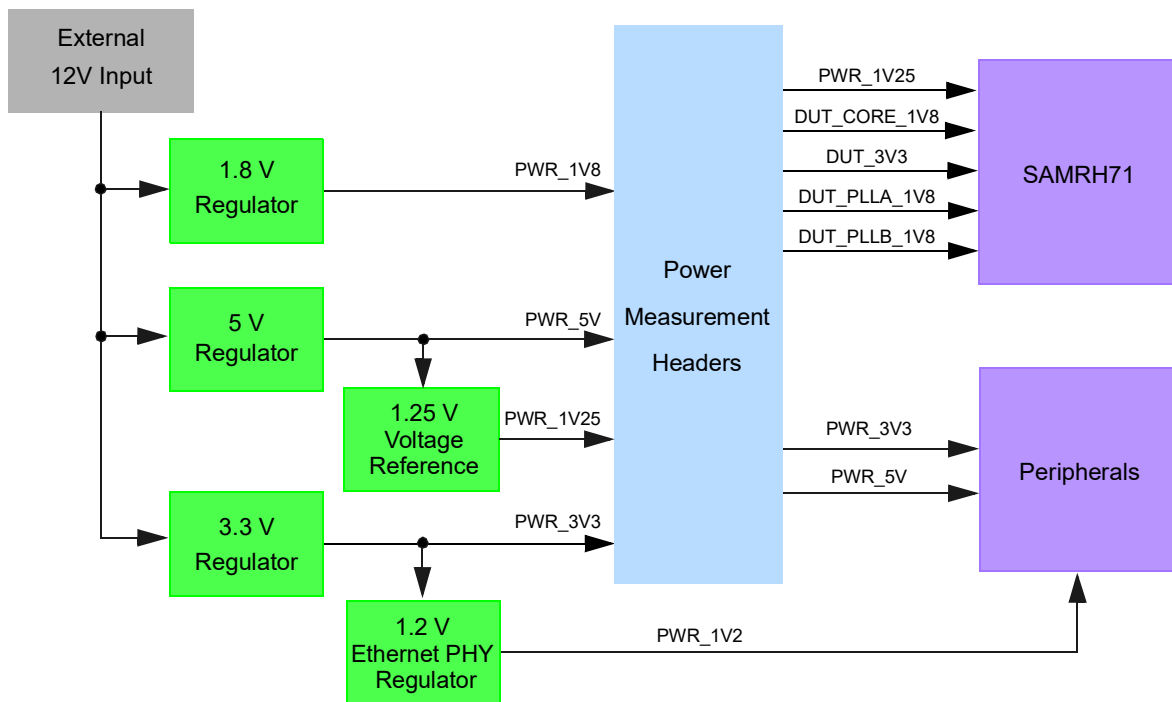
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4.1 Power Distribution

The SAMRH71F20-EK Evaluation Kit is powered by an external 12.0V supply via connector J1. There are five regulators to power supply the SAMRH71 microcontroller and the peripherals:

- 3.3V (U1) for the microcontroller's VDDIO and peripherals power supply
- 1.8V (U3) for the microcontroller's core and PLLs
- 1.25V (U4) for SpaceWire reference voltage
- 5V (U2) for CAN transceivers
- 1.2V (U6) for Ethernet PHY transceiver

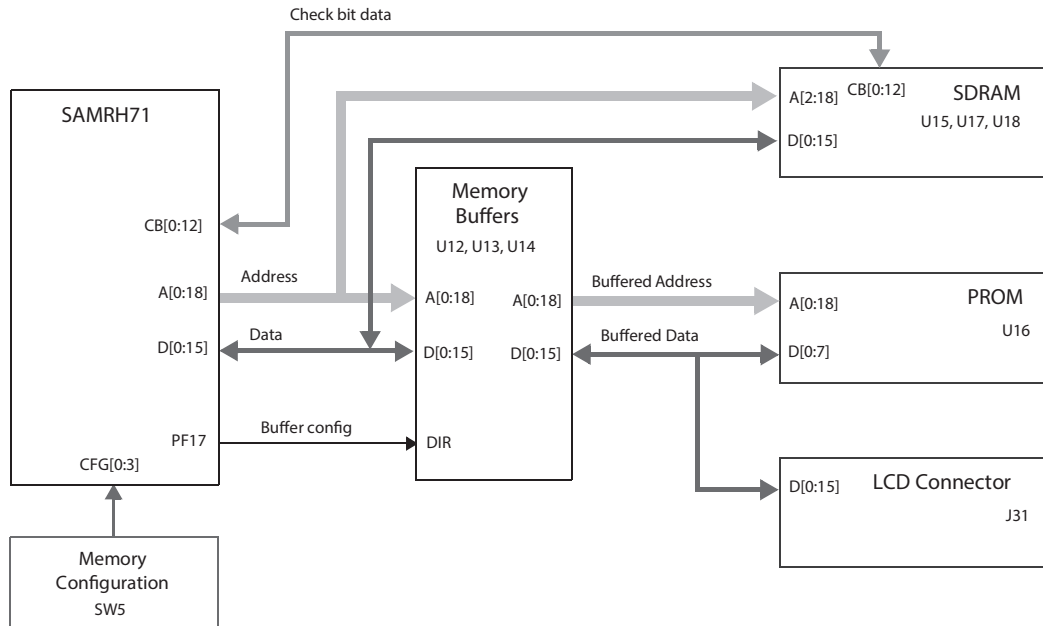
Figure 4-1. Power Supply Block Diagram



4.2 External Memories

The SAMRH71F20-EK Evaluation Kit includes two types of memory external to the microcontroller: SDRAM with ECC, and PROM that may be used as a boot device. The Evaluation Kit incorporates buffering on the Address and Data lines for the PROM. The buffered data bus is also shared by the LCD edge connector.

Figure 4-2. External Memory Connections



4.2.1 External Memory Buffers

Memory lines between the microcontroller and external memories and the LCD port are furnished with transceiver/buffers (U12 through U14). There are three buffers:

- Data lines (D0-D15) are buffered by U12, which functions as a bidirectional buffer. Data direction is controlled through microcontroller port PF17.
- The lower address bus lines (A0-A15) are buffered by U13, which is unidirectional.
- The upper address lines (A16-A18) and Chip Selects/Write Enable/Output Enable for the LCD and PROM are buffered by U14.

4.2.2 SDRAM

The SAMRH71F20-EK Evaluation Kit features three external MT48LC16M16A2P-6A SDRAM devices, for a total of 768 Mbits (16M x 16 per chip). The SDRAM is connected to chip select NCS4.

Data in the SDRAM is organized in 45-bit “words” across the three devices. U15 contains the lower 16 bits; U17 contains the upper 16 bits; and U18 contains the 13 check bits for each word. All signals (address, data, check bits and control) are presented by the microcontroller without buffering.

4.2.3 External PROM

The SAMRH71F20-EK Evaluation Kit features an external SST39VF040 Flash memory (U16) with 4 M (512 K x 8) serving as a programmable ROM. By default, the Evaluation Kit is configured to accept 8-bit data via SW5. If a different memory device is substituted, SW5 can be used to reconfigure the data width as needed. See the section on [DIP Configuration Switches](#) for more information.

4.3 Connectors

4.3.1 Extension Headers

Five extension headers (J23, J24, J25, J29 and J30) offer access to the microcontroller's I/O in order to expand the board by connecting extension boards. They are compatible with the Microchip Xplained Extension Board. The headers have a pitch of 2.4mm.

Table 4-1. Extension Header J23

J23 Pin	SAMRH71 pin	PIO Peripheral A	PIO Peripheral B	PIO Peripheral C
1 [ID]	-	-	-	-
2 [GND]	-	-	-	-
3 [ADC+]	PG17	A17	-	-
4 [ADC-]	PG18	A18	-	-
5 [GPIO]	PG19	A19	-	-
6 [GPIO]	PG20	A20	-	-
7 [PWM+]	PG21	A21	-	-
8 [PWM-]	PG22	A22	-	-
9 [GPIO]	PG23	A23	-	-
10 [GPIO]	PF12	NCS1	-	-
11 [TWI_SDA]	PF13	NCS2	-	-
12 [TWI_SCL]	PF14	NCS3	-	-
13 [UART_RX]	PF21	NWR2	-	-
14 [UART_TX]	PF22	NWR3	-	-
15 [SPI_SS]	PF23	NWR4	-	-
16 [SPI_MOSI]	PB29	PWMC1_PWMFI2	-	-
17 [SPI_MISO]	-	-	-	-
18 [SPI_SCK]	-	-	-	-
19 [GND]	-	-	-	-
20 [VCC]	-	-	-	-

Table 4-2. Extension Header J24

J24 Pin	SAMRH71 pin	PIO Peripheral A	PIO Peripheral B	PIO Peripheral C
1 [ID]	-	-	-	-
2 [GND]	-	-	-	-
3 [ADC+]	PA9	FLEXCOM5_IO2	-	PWMC0_PWMFI1
4 [ADC-]	PA10	FLEXCOM5_IO3	PCK2	PWMC0_PWMEXTRG0
5 [GPIO]	PA11	FLEXCOM5_IO4	PCK0	PWMC0_PWNEXTRG1
6 [GPIO]	PA5	-	TIOB1	PWMC0_PWML1
7 [PWM+]	PA0	-	TCLK0	PWMC0_PWMH0
8 [PWM-]	PA4	-	TIOA1	PWMC0_PWML0
9 [GPIO]	PA1	-	TIOA0	PWMC0_PWMH1
10 [GPIO]	PA3	FLEXCOM2_IO4	TCLK1	PWMC0_PWMH3
11 [TWI_SDA]	PA25	FLEXCOM9_IO0	-	-
12 [TWI_SCL]	PA26	FLEXCOM9_IO1	-	-
13 [UART_RX]	PC10	FLEXCOM5_IO1	-	-
14 [UART_TX]	PC9	FLEXCOM5_IO0	-	-
15 [SPI_SS]	PA7	FLEXCOM2_IO3	TIOA2	PWMC0_PWML3
16 [SPI_MOSI]	PA2	FLEXCOM2_IO0	TIOB0	PWMC0_PWMH2
17 [SPI_MISO]	PA6	FLEXCOM2_IO1	TCLK2	PWMC0_PWML2

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J24 Pin	SAMRH71 pin	PIO Peripheral A	PIO Peripheral B	PIO Peripheral C
18 [SPI_SCK]	PA8	FLEXCOM2_IO2	TIOB2	PWMC0_PWMF10
19 [GND]	-	-	-	-
20 [VCC]	-	-	-	-

Table 4-3. Extension Header J25

J25 Pin	SAMRH71 pin	PIO Peripheral A	PIO Peripheral B	PIO Peripheral C
1 [ID]	-	-	-	-
2 [GND]	-	-	-	-
3 [ADC+]	PA23	FLEXCOM3_IO2	-	QIO1
4 [ADC-]	PA24	FLEXCOM3_IO3	-	QIO0
5 [GPIO]	PA21	FLEXCOM3_IO4	-	QSCK
6 [GPIO]	PA22	FLEXCOM3_IO5	-	QCS
7 [PWM+]	PA12	FLEXCOM3_IO6	-	PWMC0_PWMF12
8 [PWM-]	PC6	FLEXCOM4_IO6	-	-
9 [GPIO]	PA20	FLEXCOM3_IO0	PCK0	QIO2
10 [GPIO]	PA19	FLEXCOM3_IO1	-	QIO3
11 [TWI_SDA]	PC5	FLEXCOM4_IO5	-	-
12 [TWI_SCL]	PC4	FLEXCOM4_IO4	-	-
13 [UART_RX]	PB15	TIOA5	-	-
14 [UART_TX]	PB16	TIOB5	NWDT1	-
15 [SPI_SS]	PC3	FLEXCOM4_IO3	-	-
16 [SPI_MOSI]	PC0	FLEXCOM4_IO0	-	-
17 [SPI_MISO]	PC1	FLEXCOM4_IO1	-	-
18 [SPI_SCK]	PC2	FLEXCOM4_IO2	-	-
19 [GND]	-	-	-	-
20 [VCC]	-	-	-	-

Table 4-4. Extension Header J29

J29 Pin	SAMRH71 pin	PIO Peripheral A	PIO Peripheral B	PIO Peripheral C
1 [ID]	-	-	-	-
2 [GND]	-	-	-	-
3 [ADC+]	PB28	PWMC1_PWMF11	-	-
4 [ADC-]	PB17	PWMC1_PWMEXTRG0	-	-
5 [GPIO]	PB18	PWMC1_PWMEXTRG1	-	-
6 [GPIO]	PB24	PWMC1_PWML1	-	-
7 [PWM+]	PB19	PWMC1_PWMH0	-	-
8 [PWM-]	PB23	PWMC1_PWML0	-	-
9 [GPIO]	PB20	PWMC1_PWMH1	-	-
10 [GPIO]	PB22	PWMC1_PWMH3	-	-
11 [TWI_SDA]	PA27	FLEXCOM8_IO0	-	-
12 [TWI_SCL]	PA28	FLEXCOM8_IO1	-	-
13 [UART_RX]	PA26	FLEXCOM9_IO1	-	-
14 [UART_TX]	PA25	FLEXCOM9_IO0	-	-
15 [SPI_SS]	PB26	PWMC1_PWML3	-	-
16 [SPI_MOSI]	PB21	PWMC1_PWMH2	-	-
17 [SPI_MISO]	PB25	PWMC1_PWML2	-	-
18 [SPI_SCK]	PB27	PWMC1_PWMF10	-	-
19 [GND]	-	-	-	-

.....continued				
J29 Pin	SAMRH71 pin	PIO Peripheral A	PIO Peripheral B	PIO Peripheral C
20 [VCC]	-	-	-	-

Table 4-5. Extension Header J30

J30 Pin	SAMRH71 pin	PIO Peripheral A	PIO Peripheral B	PIO Peripheral C
1 [ID]	-	-	-	-
2 [GND]	-	-	-	-
3 [ADC+]	PC26	FLEXCOM0_IO5	-	TIOA11
4 [ADC-]	PC27	FLEXCOM0_IO6	-	TIOB11
5 [GPIO]	PB8	TCLK3	-	-
6 [GPIO]	PB9	TIOA3	-	-
7 [PWM+]	PB10	TIOB3	-	-
8 [PWM-]	PB11	TCLK4	-	-
9 [GPIO]	PC28	FLEXCOM0_IO7	-	TCLK10
10 [GPIO]	PC25	FLEXCOM0_IO4	-	TCLK11
11 [TWI_SDA]	PA27	FLEXCOM8_IO0	-	-
12 [TWI_SCL]	PA28	FLEXCOM8_IO1	-	-
13 [UART_RX]	PB12	TIOA4	-	-
14 [UART_TX]	PB13	TIOB4	-	-
15 [SPI_SS]	PC24	FLEXCOM0_IO3	-	TIOB9
16 [SPI_MOSI]	PC21	FLEXCOM0_IO0	-	-
17 [SPI_MISO]	PC22	FLEXCOM0_IO1	-	-
18 [SPI_SCK]	PC23	FLEXCOM0_IO2	-	-
19 [GND]	-	-	-	-
20 [VCC]	-	-	-	-

4.3.2 Current Measurement Headers

Four headers are provided on the SAMRH71F20-EK Evaluation Kit for measuring current. All power to the SAMRH71F20 is routed through these headers (excluding power to extension headers and peripherals). To measure the power consumption of the device, remove the jumper and replace it with an ammeter. They are:

- J7, a 4 x 2 header, for the 3.3 V I/O power supply
- J8, a 4 x 2 header, for the 1.8 V microcontroller core power supply
- J11, a 1 x 4 header, for the 1.8 V supply for PLL A
- J12, a 1 x 4 header, for the 1.8 V supply to PLL B



Removing the jumpers from the pin headers while the kit is powered may cause the SAMRH71F20 to be powered through its I/O pins. This may cause permanent damage to the device.

4.3.3 JTAG Connector

The SAMRH71F20-EK Evaluation Kit implements a 20-pin (2 x 10), keyed male connector at J33. It can be used with Microchip debugging tools, such as the SAM-ICE debugger, to program the microcontroller and debug board operations via JTAG.

Table 4-6. JTAG Connector J33

Pin number	SAMRH71 pin	Function
1 [PWR]	-	PWR_3V3
2 [PWR]	-	PWR_3V3

.....continued

Pin number	SAMRH71 pin	Function
3 [NC]	-	-
4 [GND]	-	GND
5 [TDI]	PB1	TDI
6 [GND]	-	GND
7 [TMS]	PA17	TMS
8 [GND]	-	GND
9 [TCK/SWCLK]	PA16	TCK/SWCLK
10 [GND]	-	GND
11 [NC]	-	-
12 [GND]	-	GND
13 [TDO/SWO]	PB3	TDO/SWO
14 [GND]	-	GND
15 [NRST]	NRST	RESET
16 [GND]	-	GND
17 [NC]	-	-
18 [GND]	-	GND
19 [NC]	-	-
20 [GND]	-	GND

4.3.4 Trace Connector

The SAMRH71F20-EK Evaluation Kit implements a 20-pin (2 x 10), 50-mil Cortex Debug Connector (J32) with Embedded Trace Module (ETM). The connector can be used to attach external debugger hardware to the microcontroller in order to trace and debug code execution. Debugging tools, such as the J-Link TRACE, will connect directly to J32.

Table 4-7. Debug Trace Connector

Pin number	SAMRH71 pin	Function
1 [VTREF]	-	PWR_3V3
2 [TMS]	PA17	SWDIO/TMS
3 [GND]	-	GND
4 [TCK]	PA16	SWCLK/TCK
5 [GND]	-	GND
6 [TDO]	PB3	SWO/TDO
7 [KEY/NC]	-	-
8 [TDI]	PB1	TDI
9 [GND]	-	GND
10 [NSRST]	NRST	NRST
11 [NC]	-	-

.....continued

Pin number	SAMRH71 pin	Function
12 [RTCK/TRACECLK]	PB2	TRACECLK
13 [NC]	-	-
14 [SWO/D0]	PA25	TRACED0
15 [GND]	-	GND
16 [NRST/D1]	PA26	TRACED1
17 [GND]	-	GND
18 [DBGRRQ/D2]	PA27	TRACED2
19 [GND]	-	GND
20 [DBGACK/D3]	PA28	TRACED3

4.3.5 Other Headers

In addition to the Extension Headers, the Evaluation Kit provides four unpopulated 2 x 32 headers (J21, J22, J27 and J28) directly surrounding the microcontroller. These allow for direct access to all microcontroller pins and signals, and are labeled according to the primary pin function.

4.4 Peripherals

4.4.1 Crystals

The SAMRH71F20-EK Evaluation Kit includes three crystals or oscillators that can be used as clock sources for the board. Y1 is a mounted 32.768 kHz crystal, and Y2 is a mounted 10 MHz oscillator package; these serve as the microcontroller's clock sources. Y3 is a mounted 50 MHz oscillator package that serves as the dedicated clock source for the Ethernet PHY.

All three crystals/oscillators have adjacent test points that can be used to measure oscillator frequency.

4.4.2 LEDs

There are four green LEDs available on the SAMRH71F20-EK Evaluation Kit board. The LEDs can be turned on and off by driving the connected I/O lines.

An additional LED, D3, is used to show when power is applied to the board.

Table 4-8. LED Connections

SAMRH71Pin	Function	Shared Functionality
PB19	LED0 (D6)	PWMCI_PWMH0
PB23	LED1 (D7)	PWMCI_PWML0
PF19	LED2 (D8)	NWR0
PF20	LED3 (D9)	NWR1

4.4.3 Mechanical Buttons

The SAMRH71F20-EK Evaluation Kit has four mechanical buttons. One button (SW1) is the RESET button connected to the SAMRH71F20 microcontroller Reset line through external logic. The other three (SW2 through SW4) are generic user-configurable buttons. When a button is pressed it drives the I/O line to GND.

Table 4-9. Mechanical Buttons

SAMRH71 pin	Function	Shared functionality
RESET	RESET (SW1)	-
PC29	PB0 (SW2)	-
PC30	PB1 (SW3)	-
PC31	PB2 (SW4)	-

4.4.4 LCD Extension Connector

J31 is a special 50-pin, FFC/FPC edge connector for LCD displays. It can be controlled with either a 16-bit parallel data bus, or with I²C.

Table 4-10. SAMRH71 Board LCD Connector J31

Pin on J31	SAMRH71Pin	Function
1 [ID]	-	N/C
2 [GND]	-	GND
3 [D0]	PD0	D0
4 [D1]	PD1	D1
5 [D2]	PD2	D2
6 [D3]	PD3	D3
7 [GND]	-	GND
8 [D4]	PD4	D4
9 [D5]	PD5	D5
10 [D6]	PD6	D6
11 [D7]	PD7	D7
12 [GND]	-	GND
13 [D8]	PD8	D8
14 [D9]	PD9	D9
15 [D10]	PD10	D10
16 [D11]	PD11	D11
17 [GND]	-	GND
18 [D12]	PD12	D12
19 [D13]	PD13	D13
20 [D14]	PD14	D14
21 [D15]	PD15	D15
22 [GND]	-	GND
23 [NC]	-	N/C
24 [NC]	-	N/C
25 [NC]	-	N/C
26 [NC]	-	N/C
27 [GND]	-	GND
28 [NC]	-	N/C
29 [NC]	-	N/C
30 [NC]	-	N/C
31 [NC]	-	N/C
32 [GND]	-	GND
33 [CMD_DATA_SEL]	PF27	GPIO
34 [NCS]	PF16	NCS5
35 [NWE]	PF18	NWE

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Pin on J31	SAMRH71Pin	Function
36 [NRE]	PF17	NRD
37 [NC]	-	N/C
38 [NC]	-	N/C
39 [NC]	-	N/C
40 [NC]	-	N/C
41 [DISP ENABLE]	-	100K resistor to VCC_TARGET_P3V3
42 [I2C SDA]	PA20	TWD0
43 [I2C SCL]	PA19	TWCK0
44 [NC]	-	N/C
45 [NC]	-	N/C
46 [BACKLIGHT CONTROL]	PE12	GPIO
47 [RESET]	PF26	GPIO
48 [VCC]	-	VCC_TARGET_P3V3
49 [VCC]	-	VCC_TARGET_P3V3
50 [GND]	-	GND

4.4.5 Ethernet

The SAMRH71F20 microcontroller has a built in 10/100Mbps Ethernet IEEE 802.3 compatible MAC with RMII and MII interface. The SAMRH71F20-EK Evaluation Kit connects the MAC to a Microchip KSZ8061RNDW RMII physical-layer transceiver (PHY), with IEEE 802.3az support. This connects to J20, a compact RJ45 Ethernet connector with built-in magnetics and status LEDs.

Table 4-11. KSZ8061RNDW Connections

SAMRH71 Pin	Ethernet Function
PC11	RXD1
PC12	RXD0
PC13	TXD1
PC14	TXD0
PC15	RXER
PC16	CRS_DV
PC17	TXEN
PC18	REF_CLK
PC19	MDIO
PC20	MDC
PF28	RESET

The KSZ8061RNDW also has a set of parameters that are latched in during reset based on I/O pin levels. These configuration options have a default mode on the kit done by external pull-up and pull-down resistors. For detailed information about the configuration, see the *KSZ8061RNDW Data Sheet*, available from the Microchip Technology website.

Table 4-12. KSZ8061RNBW Configuration Parameters

Configuration Name	Default Value on Kit	Default Configuration
PHYAD	001	The PHYs address is 00001
CONFIG	111	RMII mode with MDI/MDI-X enabled

.....continued

Configuration Name	Default Value on Kit	Default Configuration
AUTONEG	0	Auto negotiation of link speed enabled
NAND_TREE	1	NAND TREE test mode disabled
QWF	0	Quiet-WIRE filtering enabled

4.4.6 SpaceWire

The SAMRH71F20 incorporates the SpaceWire communication protocol, compliant with ECSS standards ECSS-E-ST-50, 51, 52 and 53C. Two ports are provided by connectors J18 and J19, which are 9-pin micro D-shell connectors. The microcontroller connects directly to the SpaceWire ports.

Table 4-13. SpaceWire Connections

SpaceWire Port0/1 Pin	SAMRH71 Pin	SpaceWire Function
1	SPW0/1_DIN_P	SpaceWire Data Input 0/1
6	SPW0/1_DIN_N	
2	SPW0/1_SIN_P	SpaceWire Strobe Input 0/1
7	SPW0/1_SIN_N	
3	-	GND
8	SPW0/1_SOUT_P	SpaceWire Strobe Output 0/1
4	SPW0/1_SOUT_N	
9	SPW0/1_DOUT_P	SpaceWire Data Output 0/1
5	SPW0/1_DOUT_N	

4.4.7 1553 Communications

The SAMRH71F20 incorporates the MIL-1553 interface. The interface embeds the Bus Controller, Remote Terminal and Bus Monitor functions, as defined by MIL-STD-1553B.

J16 and J17 are triaxial female connectors, which provide access to the 1553 Bus A and B respectively. They are connected to the microcontroller through an on-board HI-1579 PHY transceiver and matching isolation transformer.

Table 4-14. MIL-1553 Connections

SAMRH71 Pin	HI-1579 Function	MIL-1553 Function
ARXINN	NRXA	Complement and nominal reception line from transceiver
ARXINP	RXA	
BRXINN	NRXB	Redundant complement and nominal reception line from transceiver
BRXINP	RXB	
ATXOUTN	NTXA	Complement and nominal reception line to transceiver
ATXOUTP	TXA	
BTXOUTN	NTXB	Redundant complement and nominal reception line to transceiver
BTXOUTP	TXB	

4.4.8 CAN

The SAMRH71F20 microcontroller has two CAN modules that perform communication according to ISO11898-1 (Bosch CAN specification 2.0 part A,B) and Bosch CAN FD specification V1.0.

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CAN0 and CAN1 are connected to on-board ATA6563 CAN physical-layer transceivers (U7 and U8, respectively). J13 and J14 are 1 x 2-pin risers that provide an interface between the CAN transceivers and external CAN devices.

Table 4-15. SAMRH71 and ATA6563 CAN Connections

SAMRH71 pin	Function	ATA6563 function	J13 and J14 Connections
PB6	CANTX0	TXD (U7)	-
PB7	CANRX0	RXD (U7)	-
PC7	GPIO	STBY (U7)	-
-	-	CANH	CANH0 (J13)
-	-	CANL	CANL0 (J13)
PB4	CANTX1	TXD (U8)	-
PB5	CANRX1	RXD (U8)	-
PG30	GPIO	STBY (U8)	-
-	-	CANH	CANH1 (J14)
-	-	CANL	CANL1 (J14)

4.4.9 UART and USB

The SAMRH71F20-EK Evaluation Kit includes a USB mini-B port (J15) for communication and debugging purposes. The microcontroller communicates through its FLEXCOM serial communication module in UART mode to an on-board CP2103 UART-to-USB bridge (U9). The converter provides USB 2.0 Full Speed device functionality.

Table 4-16. SAMRH71 and CP2103 UART/USB Connections

SAMRH71 pin	Function	CP2103 function	J5 Connection
PF29	FLEXCOM1_IO1	TXD	-
PF30	FLEXCOM1_IO0	RXD	-
NRST	RESET	NRST	-
-	-	D+	D+
-	-	D-	D-
-	-	VBUS	VBUS

4.4.10 DIP Configuration Switches

The SAMRH71F20-EK Evaluation Kit uses a DIP switch bank to configure the board's boot and memory configuration. SW5 is a 6-place SPST switch bank, of which five are used. These configure the Boot mode, PROM ECC usage and PROM ECC mode. Closing a switch pulls its line to ground, while leaving a switch open pulls the line up to Vcc.

Table 4-17. DIP Configuration Switches

Switch Number	Function	Default State	SAMRH71 pin	Function (Default in bold)
1	Boot Mode	Off	PF24	0: Internal Flash 1: External PROM
2	PROM Width 0	On	PG24	00: 8-bit 01: 16-bit 10: 32-bit 11: Not used
3	PROM Width 1	On	PG25	

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Switch Number	Function	Default State	SAMRH71 pin	Function (Default in bold)
4	PROM ECC	On	PG26	0: ECC off 1: ECC On
5	ECC Code	On	PG27	0: Hamming (32,7) 1: BCH (32,12)

5. Document Revision History

Table 5-1. Rev. A - 09/2019

Section Name or Type	Update Description
All sections	Initial document release

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