# SAMRH71 Radiation-Hardened Arm® Microcontroller (MCU)



### **Summary**

The SAMRH71 is a radiation-hardened MCU providing the best combination of space connectivity interfaces and high processing power of more than 200 DMIPS. The SAMRH71 is designed for high-level radiation performances, extreme temperature and high reliability in space applications. It takes advantage of the powerful Arm® Cortex®-M7 core coupled with high-bandwidth communication interfaces such as SpaceWire, MIL-STD-1553, CAN FD and Ethernet with TSN capabilities.

#### Core

- Arm Cortex-M7 core running up to 100 MHz delivering 2.14 DMIPS/MHz
- 16 Kbytes of iCache and 16 Kbytes of dCache with Error Code Correction (ECC)
- Simple- and double-precision HW Floating Point Unit (FPU)
- Memory Protection Unit (MPU) with 16 zones
- DSP Instructions, Thumb<sup>®</sup>-2 Instruction Set
- Embedded Trace Module (ETM) with instruction trace stream, including Trace Port Interface Unit (TPIU)

#### **Memory**

- 128 Kbytes embedded Flash with build-in ECC (up to two errors correction)
- 384 Kbytes embedded SRAM for Tightly-Coupled Memory (TCM) interface or System SRAM with ECC
- 768 Kbytes of multiport SRAM with ECC
- Hardened External Memory Controller (HEMC) to address PROM SRAM and SDRAM with variable data size (from 8- to 48-bits)
- Up to two Gbytes of external memory accessible with built-in ECC

## **System**

- Built-in Power Fail Detect (PFD), programmable supply monitors and two independent watchdog timers
- Non-Maskable Interrupt Controller (NMIC)
- Crystal or ceramic resonator oscillators: 3 to 20 MHz main oscillator with failure detection
- RTC with Gregorian calendar and UTC mode, waveform generation in low-power modes
- 32-bit low-power Real-Time Timer (RTT)
- High-precision 4/8/10/12 MHz factory-trimmed internal RC oscillator
- 32.768 kHz crystal oscillator input or embedded 32 kHz (typical) RC oscillator as source of low-power mode device clock (SCLK)
- One PLL for system clock and one PLL for peripherals
- One dual-port 32-channel central DMA Controller (XDMAC)
- Four three channel, 32-bit Timer Counters (TCs) with capture, waveform, compare and PWM modes, Quadrature Decoder logic and 2-bit Gray up/down counter for stepper motor
- Two 4-channel, 16-bit PWMs with complementary outputs, Dead Time Generator and several fault inputs per PWM for motor control, two external triggers to manage Power Factor Correction (PFC), DC-DC and lighting control

# **Communication Peripherals**

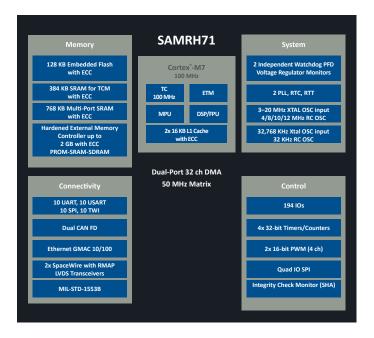
- One 10/100 Ethernet Media Access Control (GMAC) energy efficiency, AVB/TSN, time-stamping and PTP support
- Ten FLEXCOMs, each supporting USART/UART, SPI and TWI/I<sup>2</sup>C
- Single data rate transfer Quad I/O Serial Peripheral Interface (QSPI)
- CAN FD controller compliant with CAN protocol version 2.0 Part A, B and CAN FD specification
- SpaceWire interface with two SpaceWire ports with integrated RMAP support and embedded SpaceWire router
- One 1553 interface with redundant links compliant to MIL-STD-1553B standard





#### **Space Environment**

- CQFP256 hermetic ceramic package
- BGA625 HiRel plastic for high-volume programs
- Space-grade QML-Q/QML-V qualification
- Total Ionizing Dose (TID): 15 krad (with Flash)
- Heavy ions and proton test
- Latchup immune SEL> 62 MeV.cm<sup>2</sup>.mg<sup>-1</sup>
- SEU full characterization LET>20 MeV.cm<sup>2</sup>.mg<sup>-1</sup>
- Temperature range -55°C to +125°C



#### **System Performance**

- Deterministic code execution using TCM
- Complex calculation and co-processing (FPU)
- Communication threads parallelism (H-matrix architecture)
- Low-latency memories access

#### **Software Environnement**

- Development platform MPLAB® Harmony
- Software libraries with code as examples
- Multiple operating systems supported: FreeRTOS™, RTEMS
- Space software services proposed by N7 Space, RTEMS, Addicore™, fentISS
- Heritage benefit from SAMV7 ecosystem: IAR, Arm Keil® compiler, Micrium, SEGGER





SAMRH71 Evaluation Kit Supported by MPLAB Harmony

# **SAMRH71 Tools guide**

Tool	Description	Part Number
SAMRH71 Evaluation Kit	The SAMRH71 Evaluation Kit is ideal for evaluating the SAMRH71 and prototyping your own application using expansion connectors.	SAMRH71F20-EK
J-32 Debug Probe	The J-32 Debug Probe Debugger/Programmer provides affordableDV164232 fast and easy debugging and programming for Microchip's PIC32 and SAM MCU and MPU products	DV164232

#### **Product Selection Guide**

Part Number	Speed	Power Supply	Package	Flow
SAMRH71F20C-7GB-E	100 MHz	3.0-3.6V	CQFP256	Engineering samples
SAMRH71F20C-7GB-MQ	100 MHz	3.0-3.6V	CQFP256	QML-Q Equivalent
SAMRH71F20C-7GB-SV	100 MHz	3.0-3.6V	CQFP256	QML-V Equivalent
SAMRH71F20C-7GB-SR	100 MHz	3.0-3.6V	CQFP256	QML-V RHA Equivalent
951200601	100 MHz	3.0-3.6V	CQFP256	ESCC QPL
951200601R	100 MHz	3.0-3.6V	CQFP256	ESCC QPL RHA
SAMRH71F20C-HFB-SN	100 MHz	3.0-3.6V	BGA625	HiRel Plastic (-SN)

For plastic packaging, please contact your sales office.

