# 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®-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/I²C
- 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

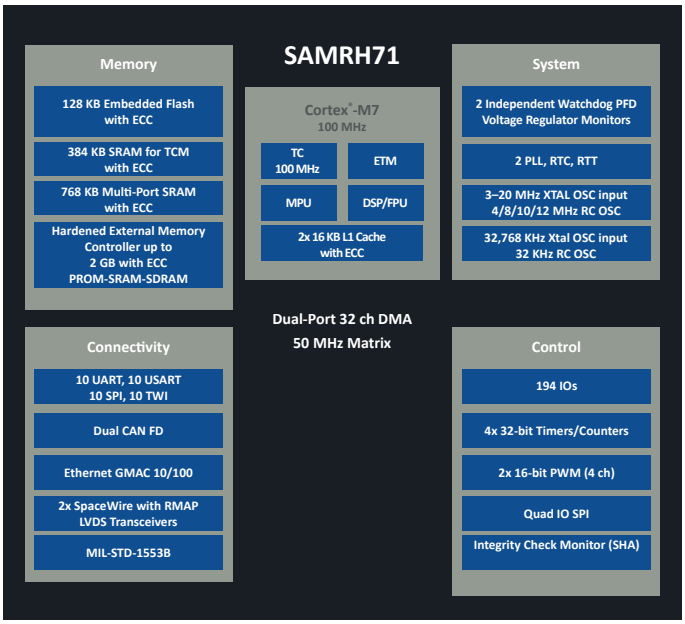
- CQFP256 hermetic ceramic package
- BGA625 HiRel plastic for high-volume programs
- Space-grade QML-Q/QML-V qualification
- Total Ionizing Dose (TID): 15 krad (with Flash)
- Heavy ions and proton test
- Latchup immune SEL> 62 MeV.cm$^2$.mg$^{-1}$
- SEU full characterization LET>20 MeV.cm$^2$.mg$^{-1}$
- 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.