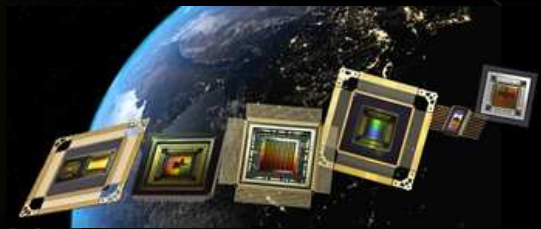




MICROCHIP



A Leading Provider of Microcontroller,
Mixed-Signal, Analog & Flash-IP Solutions



Microchip CAN Eco-system

June 2019



Microchip CAN Eco-system

Products:

- Radiation Tolerant microcontrollers
- Radiation Hardened microcontrollers

Hardware tools

- Evaluation board
- Programming and debugging tools

Software tools

- Microchip GUI development environment
- Third party GUI development environment

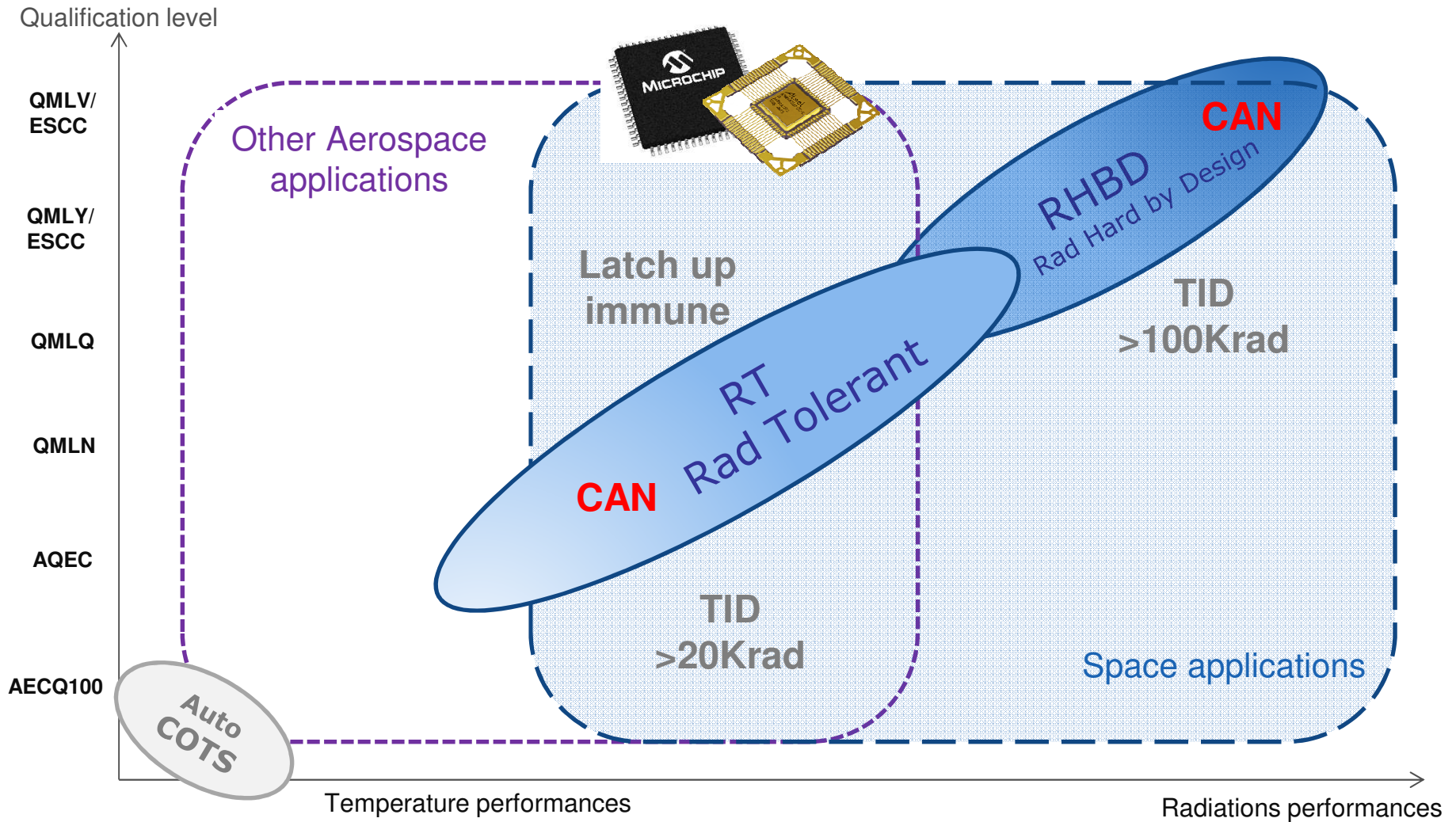
Software examples

- Microchip CAN transmit/received examples

Software library

- Third party CAN stack

CAN Scalable Solutions for Aerospace



Rad Tolerant devices - Concept

- ***Start from Industrial/Automotive products***

- Same mask set
- Same functionality
- Same development tools

Easy access via commercial eval kit
 Free tool chain & libraries
 Same pin out as commercial device



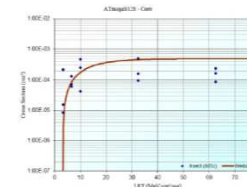
- ***No compromise with Aerospace required quality***

- Full wafer lot traceability
- Space QML/ESCC screening (Visual inspection (TM2010), PIND test, Burn-in (PDA))
- Space QML/ESCC qualification (Group A, B, C & D)
- Avionic qualification, Military screening (Extended temperature)

- ***Hardening of critical parameters***

- Technology process change / tuning
 - Target no **single event latch-up up to 60 MeV/mg/cm² @ 125°C**
- Embedded Flash & SRAM robustness, **SEFI LET > 30Mev**
- Select best design candidate and Full characterization, blocks by blocks
 - **TiD > 20KRad (Space)**
 - **SEU LET > 3Mev**

Heavy ions
 Protons





Microchip CAN Total System Solution

- Wide range a microcontrollers with CAN capabilities.
- Low cost hardware tools (programmer, debugger) from automotive & Industrial worlds
- Free of charge GUI from Microchip to program, compile and debug your software
- Products supported by third party compiler environment
- Software code examples to received and transmit can frames on the network.
- External CAN stack from third party.



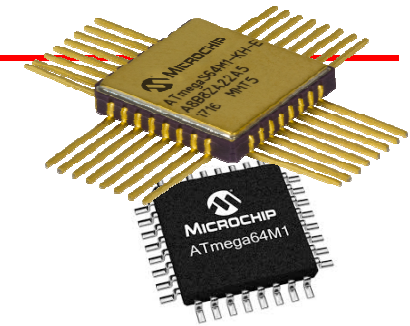
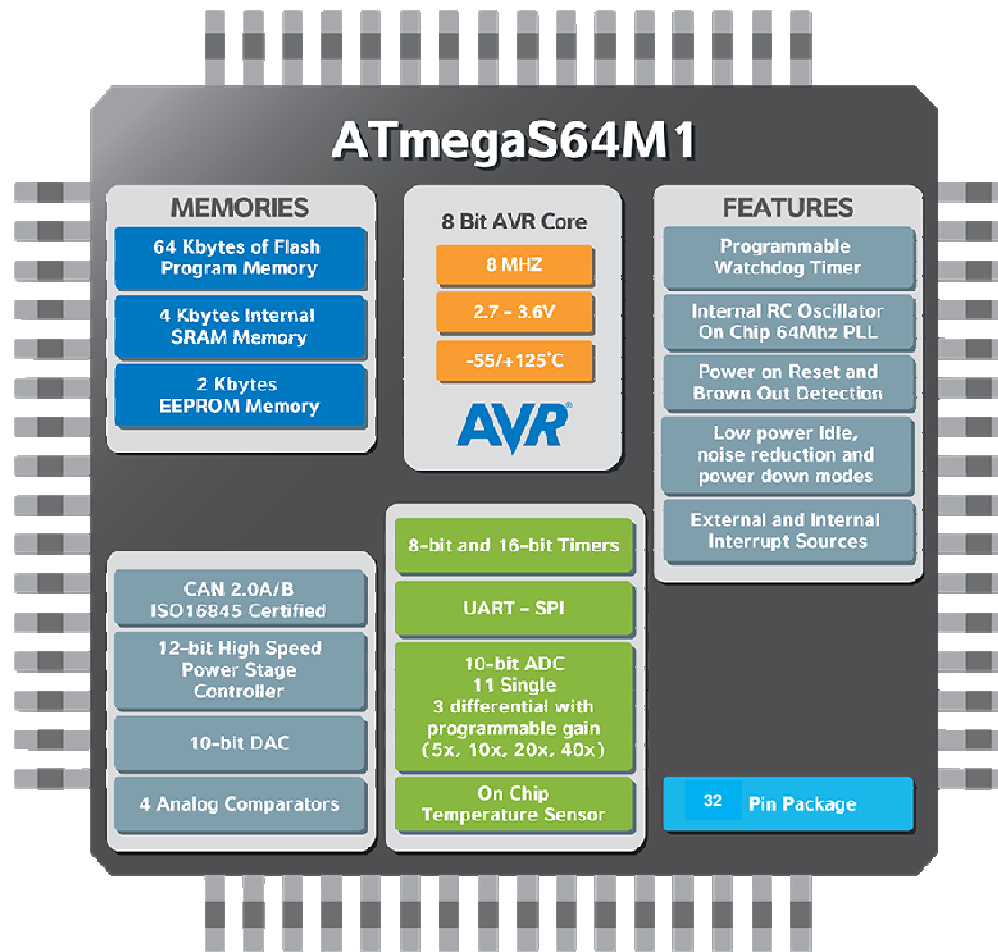
ATmegaS64M1 Rad Tolerant

ES available
FM available

64KB Flash
4KB SRAM

Small package
QFP32

-55°C/125°C



CAN 1Mbit/s

Motor Control

DAC



ATmegaS64M1 Evaluation kit

- STK600 Motherboard (order code: ATSTK600)
<https://www.microchip.com/developmenttools/ProductDetails/PartNo/ATSTK600>
- STK600 RCPWM-22 Routing board (order code: ATSTK600-RC22)
<https://www.microchip.com/developmenttools/ProductDetails/PartNo/ATSTK600-RC22>
- STK600-TQFP32 (order code: ATSTK600-SC10)
<https://www.microchip.com/developmenttools/ProductDetails/PartNo/ATSTK600-SC10>
- Commercial part to be used with development boards (order code: ATmega64M1-AU)

Board features

- Leds
- Push buttons
- I/O's
- Can transceivers

CAN





ATmegaS64M1 Programing and debugging tools

ATmegaS64M1 can be programmed by USB link directly connected to STK600

Atmel ICE programmer and debugger

Ordering code P/N: ATATMEL-ICE



Atmel Studio, a all in one software PC based

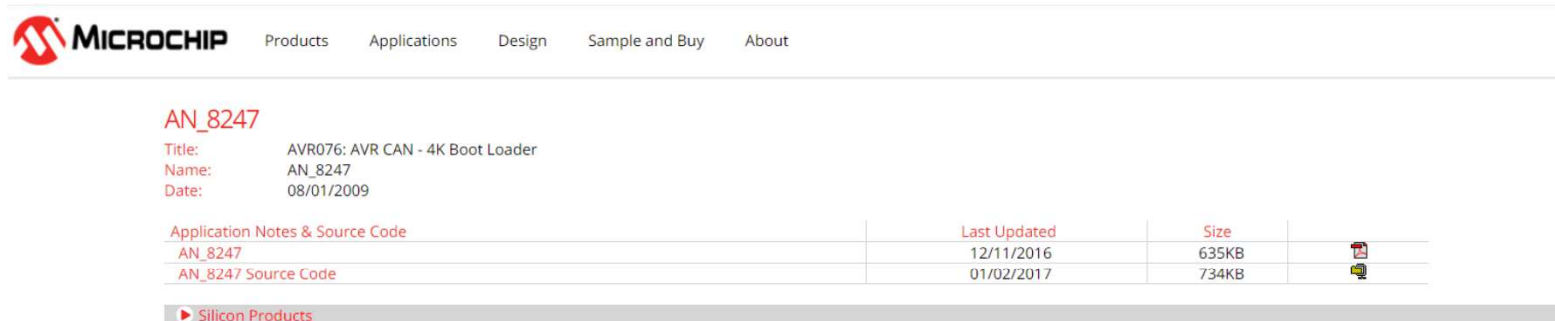
- Edit source code
- Compile (GCC or third party compiler)
- Program
- Simulate
- Emulate
- Debug



ASF - Microchip Advance Software Framework

- Can drivers
- Basic examples for CAN Tx and Rx
- Basic examples source code for all the peripherals (ADC, Uart, Timers, SPI)
- PSC cookbook for PWM generation, automatic dead time insertion

CAN Bootloader



MICROCHIP Products Applications Design Sample and Buy About

AN_8247
 Title: AVR076: AVR CAN - 4K Boot Loader
 Name: AN_8247
 Date: 08/01/2009

Application Notes & Source Code	Last Updated	Size	
AN_8247	12/11/2016	635KB	
AN_8247 Source Code	01/02/2017	734KB	

[▶ Silicon Products](#)

Motor Control

~ Application Notes [Download All](#)

AN_7546 - AVR495: AC Induction Motor Control Using the Constant V/f Principle and a Space-vector PWM Algorithm	12/01/2005	456KB	☆
AN_8017 - AVR446: Linear speed control of stepper motor on tinyAVR and megaAVR devices	06/01/2006	152KB	☆
AN_8138 - AVR194: Brushless DC Motor Control using ATmega32M1	04/01/2008	528KB	☆



SAM3X8E Rad Tolerant

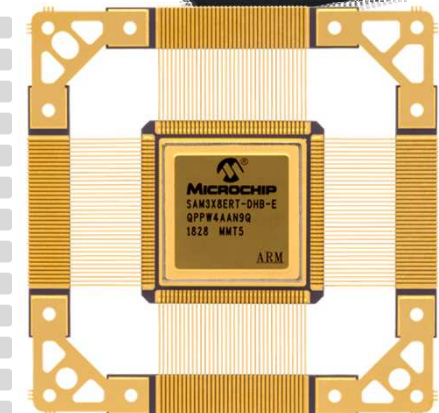
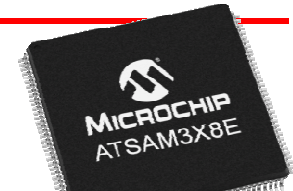
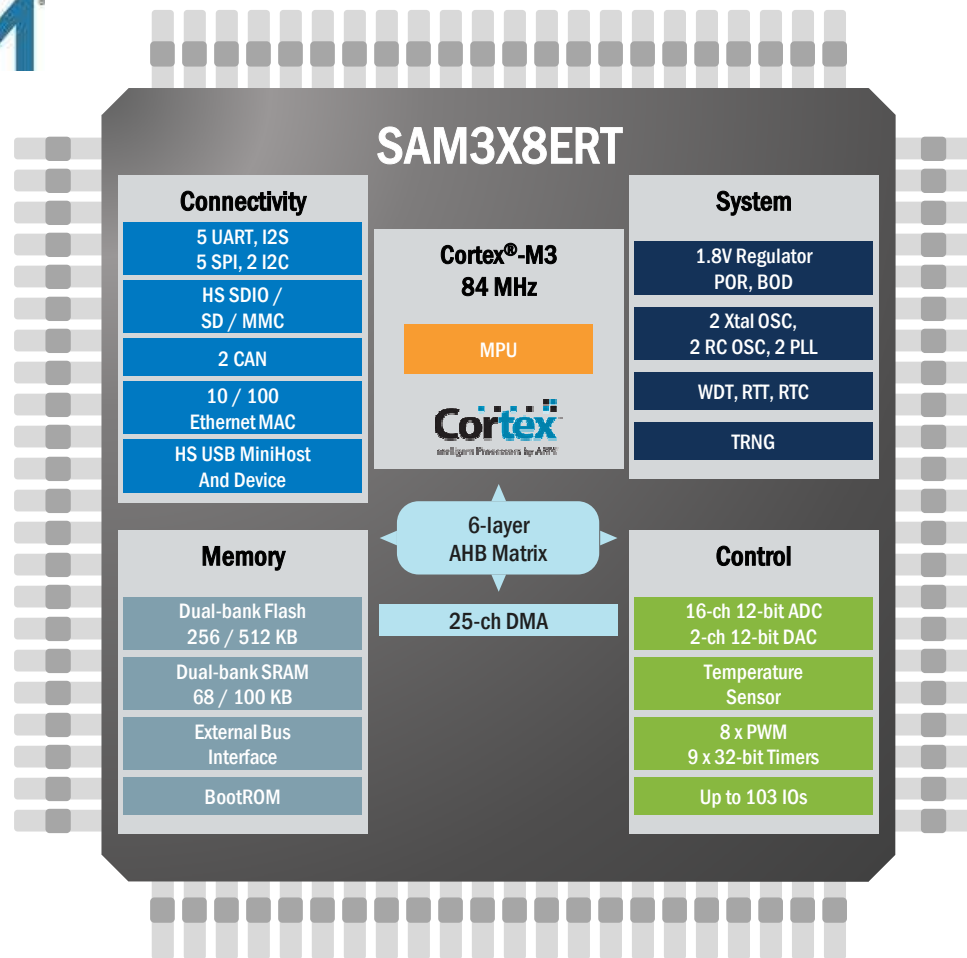
ARM

ES Q3-19
FM Q1-20

512KB Flash
100KB SRAM
Ext Mem

QFP144

-40°C/105°C



100 DMIPS

Dual CAN

Ethernet

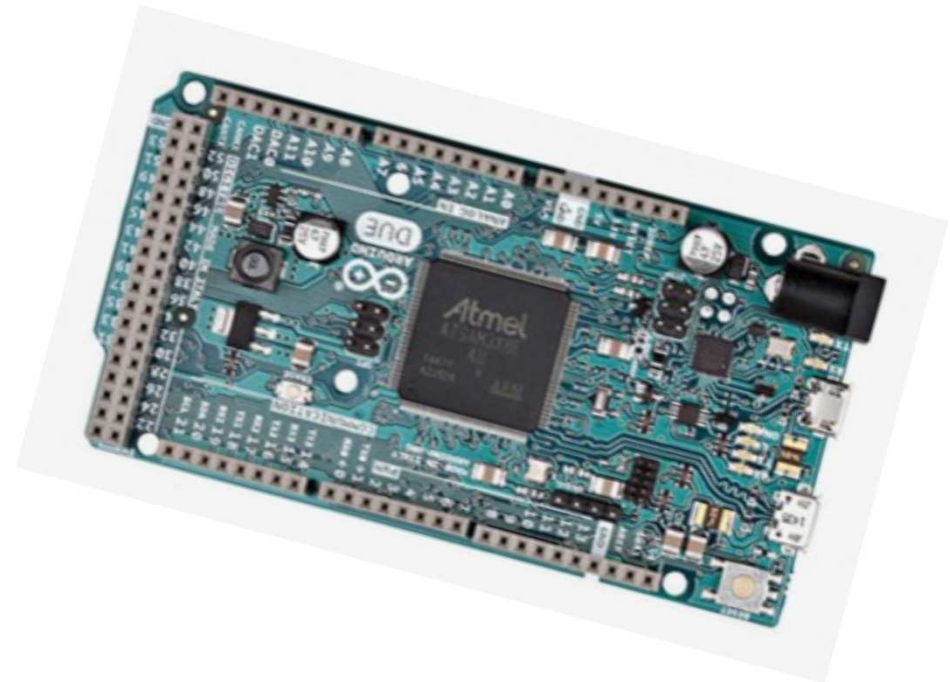
Dual Bank
Flash/SRAM

SAM3X8E Evaluation kit

Arduino Due

- 54 Digital IO
- 12 analog inputs

Digital CAN Rx/Tx on connector





SAM3X8E Programming and debugging tools

SAM3X8E can be programmed and debug using USB link directly connected to the Arduino Due. Atmel Ice debugger can also be used.

Atmel ICE programmer and debugger

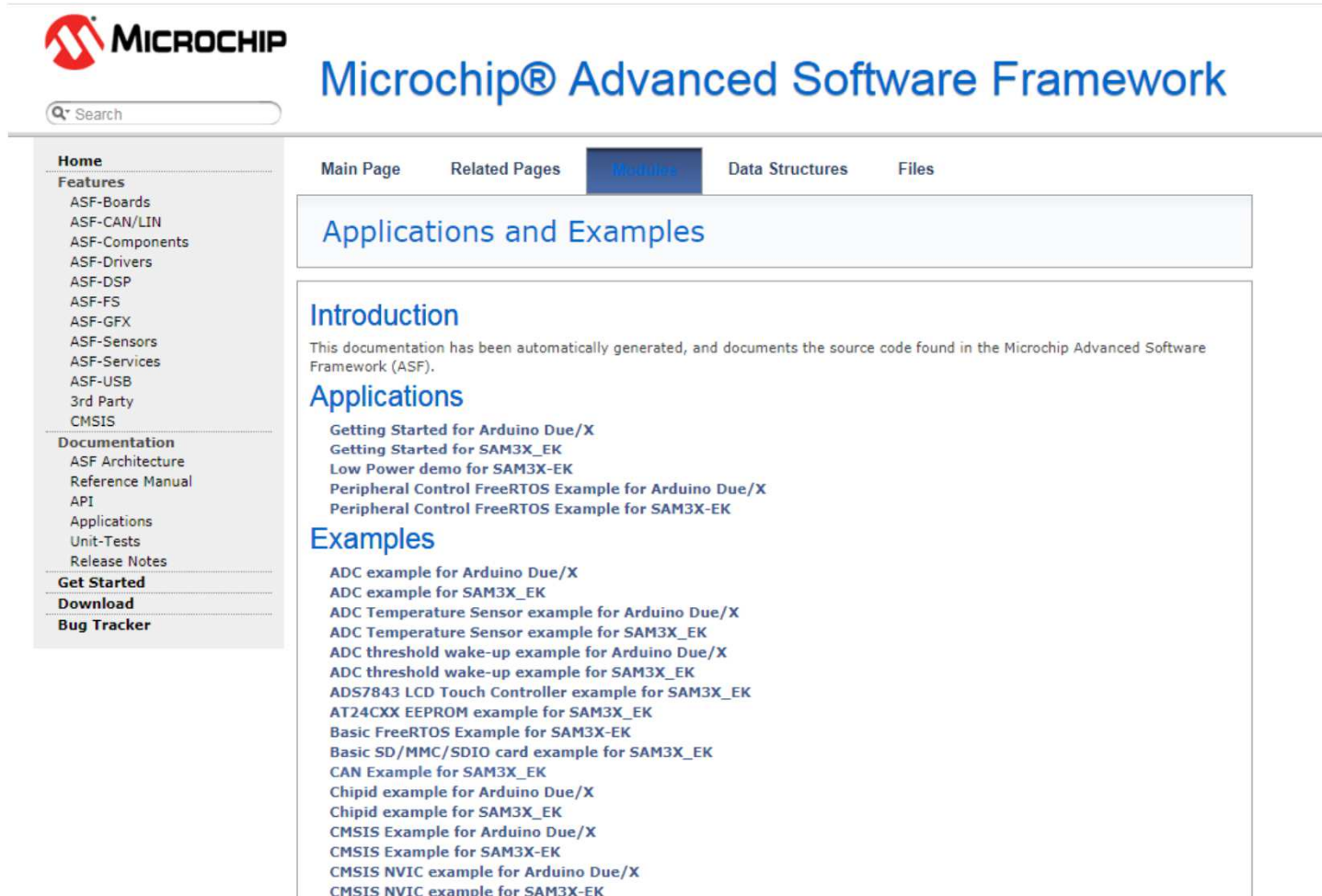
Ordering code P/N: ATATMEL-ICE



Atmel Studio, a all in one software PC based

- Edit source code
- Compile (GCC or third party compiler)
- Program
- Simulate
- Emulate
- Debug





The screenshot shows the Microchip SAM3X8E Advanced Software Framework website. At the top left is the Microchip logo. The main heading is "Microchip® Advanced Software Framework". Below the heading is a search bar. A navigation menu includes "Main Page", "Related Pages", "Modules" (highlighted), "Data Structures", and "Files". The "Applications and Examples" section is active, containing sub-sections for "Introduction", "Applications", and "Examples". The "Introduction" section states that the documentation is automatically generated from source code. The "Applications" section lists several examples, and the "Examples" section lists a larger set of examples.

MICROCHIP

Microchip® Advanced Software Framework

Search

Home

Features

- ASF-Boards
- ASF-CAN/LIN
- ASF-Components
- ASF-Drivers
- ASF-DSP
- ASF-FS
- ASF-GFX
- ASF-Sensors
- ASF-Services
- ASF-USB
- 3rd Party
- CMSIS

Documentation

- ASF Architecture
- Reference Manual
- API
- Applications
- Unit-Tests
- Release Notes

Get Started

Download

Bug Tracker

Main Page Related Pages **Modules** Data Structures Files

Applications and Examples

Introduction

This documentation has been automatically generated, and documents the source code found in the Microchip Advanced Software Framework (ASF).

Applications

- Getting Started for Arduino Due/X
- Getting Started for SAM3X_EK
- Low Power demo for SAM3X-EK
- Peripheral Control FreeRTOS Example for Arduino Due/X
- Peripheral Control FreeRTOS Example for SAM3X-EK

Examples

- ADC example for Arduino Due/X
- ADC example for SAM3X_EK
- ADC Temperature Sensor example for Arduino Due/X
- ADC Temperature Sensor example for SAM3X_EK
- ADC threshold wake-up example for Arduino Due/X
- ADC threshold wake-up example for SAM3X_EK
- ADS7843 LCD Touch Controller example for SAM3X_EK
- AT24CXX EEPROM example for SAM3X_EK
- Basic FreeRTOS Example for SAM3X-EK
- Basic SD/MMC/SDIO card example for SAM3X_EK
- CAN Example for SAM3X_EK
- Chipid example for Arduino Due/X
- Chipid example for SAM3X_EK
- CMSIS Example for Arduino Due/X
- CMSIS Example for SAM3X-EK
- CMSIS NVIC example for Arduino Due/X
- CMSIS NVIC example for SAM3X-EK

https://www.arduino-libraries.info/libraries/du_e_can

Arduino Library List

due_can

Allows for CAN bus communications with the Arduino Due

Author [Collin Kidder, Thibaut Viard, Wilfredo Molina](#)
Maintainer Collin Kidder
Website https://github.com/collin80/du_e_can
Category Communication
License LGPL 2.1
Library Type Contributed
Architectures sam

Implements interrupt driven communication and supports both object oriented and non-OOP callbacks

Downloads

Filename	Release Date	File Size
due_can-2.0.1.zip	2015-12-04	31.47 KiB
due_can-2.0.0.zip	2015-11-18	31.47 KiB



SAM3X8E Scheduler

<https://www.arduino-libraries.info/libraries/scheduler>

Arduino Library List Categories ▾ Types ▾

Scheduler

Allows multiple tasks to run at the same time, without interrupting each other. For Arduino sam and samd architectures only (Due, Zero...).

Author [Arduino](#)
Website <http://www.arduino.cc/en/Reference/Scheduler>
Github <https://github.com/arduino-libraries/Scheduler>
Category [Other](#)
License Unknown
Library Type Official
Architectures sam, samd

The Scheduler library enables the Arduino to run multiple functions at the same time. This allows tasks to happen without interrupting each other. This is a cooperative scheduler in that the CPU switches from one task to another. The library includes methods for passing control between tasks.

Downloads

Filename	Release Date	File Size
Scheduler-0.4.4.zip	2015-10-12	5.87 KiB
Scheduler-0.4.3.zip	2015-05-20	5.47 KiB
Scheduler-0.4.1.zip	2015-04-23	5.46 KiB
Scheduler-0.4.0.zip	2015-03-27	5.52 KiB



SAM3X8E uCos-II Operating System

<https://www.arduinolibraries.info/libraries/u-cos-ii>

Arduino Library List

uCOS-II

MicroC/OS-II 2.92.10 for ARM Cortex M3.

Author [Gibartes and Jean J. Labrosse](#)
Maintainer Gibartes
Website <https://github.com/Gibartes/uCOS-II-Arduino>
Category [Uncategorized](#)
License Unknown
Library Type Contributed
Architectures sam

MicroC/OS-II 2.92.10 for ARM Cortex M3

Downloads

Filename	Release Date	File Size
uCOS II-2.92.10.zip	2017-08-14	150.01 KiB

https://www.freertos.org/RTOS_ports.html

[Quick Start](#) | [Supported MCUs](#) | [PDF Books](#) | [Trace Tools](#) | [Ecosystem](#)

Home

[FreeRTOS Books and Manuals](#)

FreeRTOS

[About FreeRTOS](#)

[Features / Getting Started...](#)

[More Advanced...](#)

[Demo Projects](#)

[Supported Devices & Demos](#)

[Official & Contributed Definitions](#)

[Simple List of Ports](#)

[Officially Supported Demos](#)

[TCP/IP Demos](#)

[API Reference](#)

[Contact and Support](#)

[FreeRTOS Interactive!](#)

[Quick Start Guide](#)

[Support Forum](#)

[Download Source](#)

[FreeRTOS+ Ecosystem](#)

[FreeRTOS+TCP:](#)

[Thread safe TCP/IP stack](#)

[SafeRTOS:](#)

[TUV certified RTOS](#)

[OpenRTOS:](#)

[Commercial Licensed RTOS](#)

Official FreeRTOS Ports

Don't see an exact match for your microcontroller part number and compiler vendor choice? These demos can be adapted to any microcontroller within a supported microcontroller family. See the [Creating a new FreeRTOS application](#) and [Adapting a FreeRTOS Demo](#) documentation pages. As many IDEs are now based on Eclipse, also see the page that describes [how to use virtual and linked paths in the Eclipse project explorer](#) to ensure you do not need to copy the RTOS source files into an Eclipse project directory.

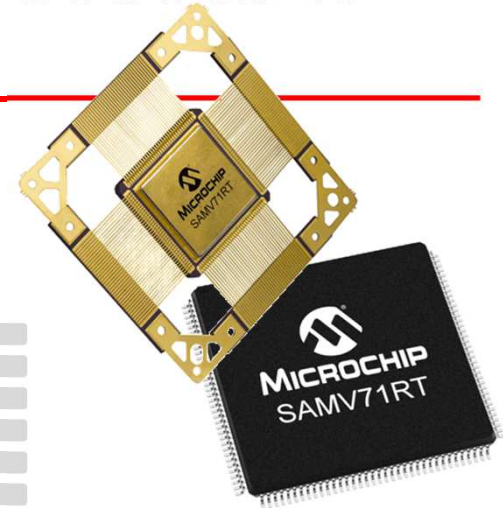
FreeRTOS ports are categorised as either being officially supported, or contributed. The [Official and Contributed Definitions](#) page describes the categories, and the rationale for making the distinction. This page only lists the official RTOS ports:

- [Altera](#)
 - Supported processor families: Cyclone V SoC (ARM Cortex-A9), Nios II
 - Supported tools: Altera SoC EDS (ARM DS-5 with GCC), Nios II IDE with GCC
- [ARMv8-M](#)
 - Supported processor families: ARM Cortex-M33 simulator
 - Supported tools: GCC (and ARMclang building the FreeRTOS ARMv8-M GCC port)
- [Atmel](#)
 - Supported processor families: SAMV7 (ARM Cortex-M7), **SAM3 (ARM Cortex-M3)**, SAM4 (ARM Cortex-M4), SAMD20 (ARM Cortex-M0+), SAMA5 (ARM Cortex-A5), SAM7 (ARM7), SAM9 (ARM9), AT91, AVR and AVR32 UC3
 - Supported tools: IAR, GCC, Keil, Rowley CrossWorks





SAMV71Q21 Rad Tolerant



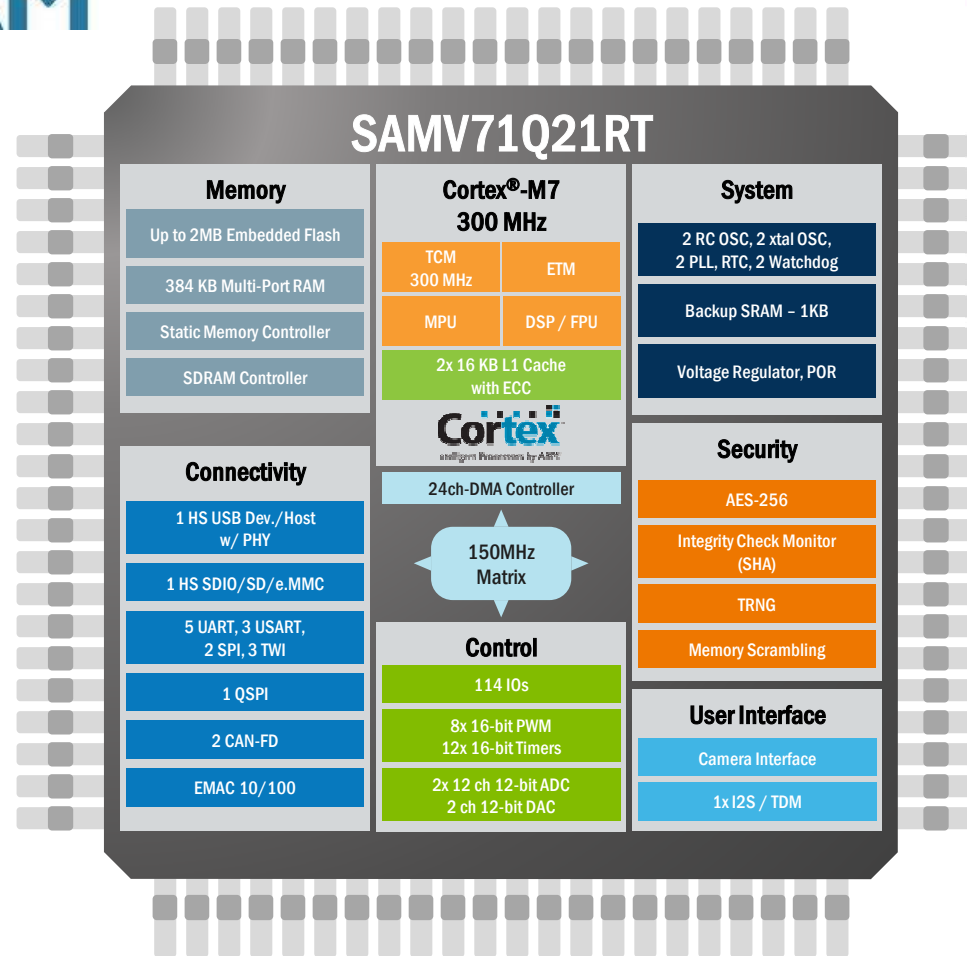
ES available
FM available

2MB Flash
384KB SRAM
Ext Mem

QFP144

-55°C/+125°C

TID 30Krad
SEL immune 60Mev



600 DMIPS

“R like” Archi
TCM/MPU/ECC

FPU/DSP copro

Dual CAN FD

Ethernet AVB

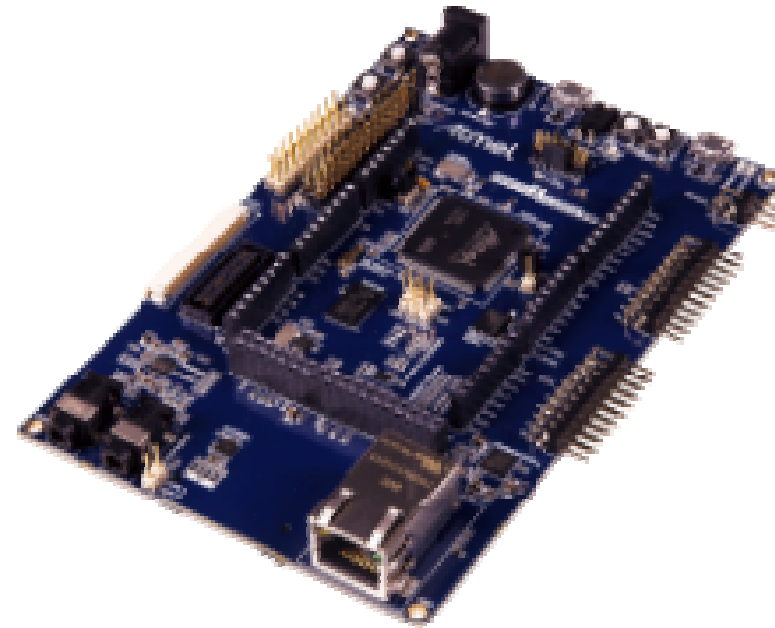
Crypto AES



SAMV71Q21 Evaluation kit

Xplained board

Ordering Code: ATSAMV71-XULT



Can FD transceiver integrated

On board programming and debugging through USB

Atmel SAM-ICE Emulator
Ordering Code: AT91SAM-ICE



Trace module - J Trace segger



Atmel Studio, a all in one software PC based

- Edit source code
- Compile (GCC or third party compiler)
- Program
- Simulate
- Emulate
- Debug



Ready to use Software example projects

- demo with detailed documentation for all peripheral of the mcu
- [SAMV71 softpack 1.5 for AtmelStudio and IAR Ewarm, KEIL, XULT GNU](#)

SAMV71Q21 MCHP Advanced Software Framework 3.0

- Reuse of all software drivers developed for Automotive version of SAMV71.

Name	Date modified	Type
afe_temp_sensor	29/12/2016 10:50	File folder
afe12_dma	29/12/2016 10:50	File folder
eefc_pgm	29/12/2016 10:50	File folder
getting-started	29/12/2016 10:50	File folder
isi	18/02/2019 17:11	File folder
isi_gray	29/12/2016 10:50	File folder
lcd	18/02/2019 17:08	File folder
lcd_ebi	20/10/2017 09:02	File folder
lcd_ebi - Copy	20/10/2017 08:32	File folder
loader	29/12/2016 10:50	File folder
low_power	29/12/2016 10:50	File folder
mcan	08/03/2018 15:00	File folder
mpu	29/12/2016 10:50	File folder
periph_protect	29/12/2016 10:50	File folder
pmc_clock_switching	29/12/2016 10:50	File folder
pwm	21/10/2017 03:54	File folder
qspi_xip	29/12/2016 10:50	File folder
rtc	29/12/2016 10:50	File folder
rtt	29/12/2016 10:50	File folder
sdram	29/12/2016 10:50	File folder
spi	29/12/2016 10:50	File folder
ssc_dma_audio	29/12/2016 10:50	File folder
tc_capture_waveform	29/12/2016 10:50	File folder
tcm	29/12/2016 10:50	File folder
trng	29/12/2016 10:50	File folder
twi_eeprom	29/12/2016 10:50	File folder
twi_slave	29/12/2016 10:50	File folder
uart	29/12/2016 10:50	File folder
usart	29/12/2016 10:50	File folder
usart_7816	29/12/2016 10:50	File folder
usart_hw_handshaking	29/12/2016 10:50	File folder
usart_lon	29/12/2016 10:50	File folder
usart_rs485	29/12/2016 10:50	File folder
usart_spi	29/12/2016 10:50	File folder



SAMV71Q21 Third Party software

Free RTOS available on Microchip Advance Software framework



N7 Space development under ESA project

- Bootloader compliant with the ESA SAVOIR requirements
 - Utilization of PUS-C stack supported by ASN.1/ACN formal modelling
- Board Support Package
 - Driver library for MCU
- CANopen library implementing tailored ECSS-E-ST-50-15C
- Demonstration applications based on RTEMS 5



Micrium RTOS

Micrium[®]

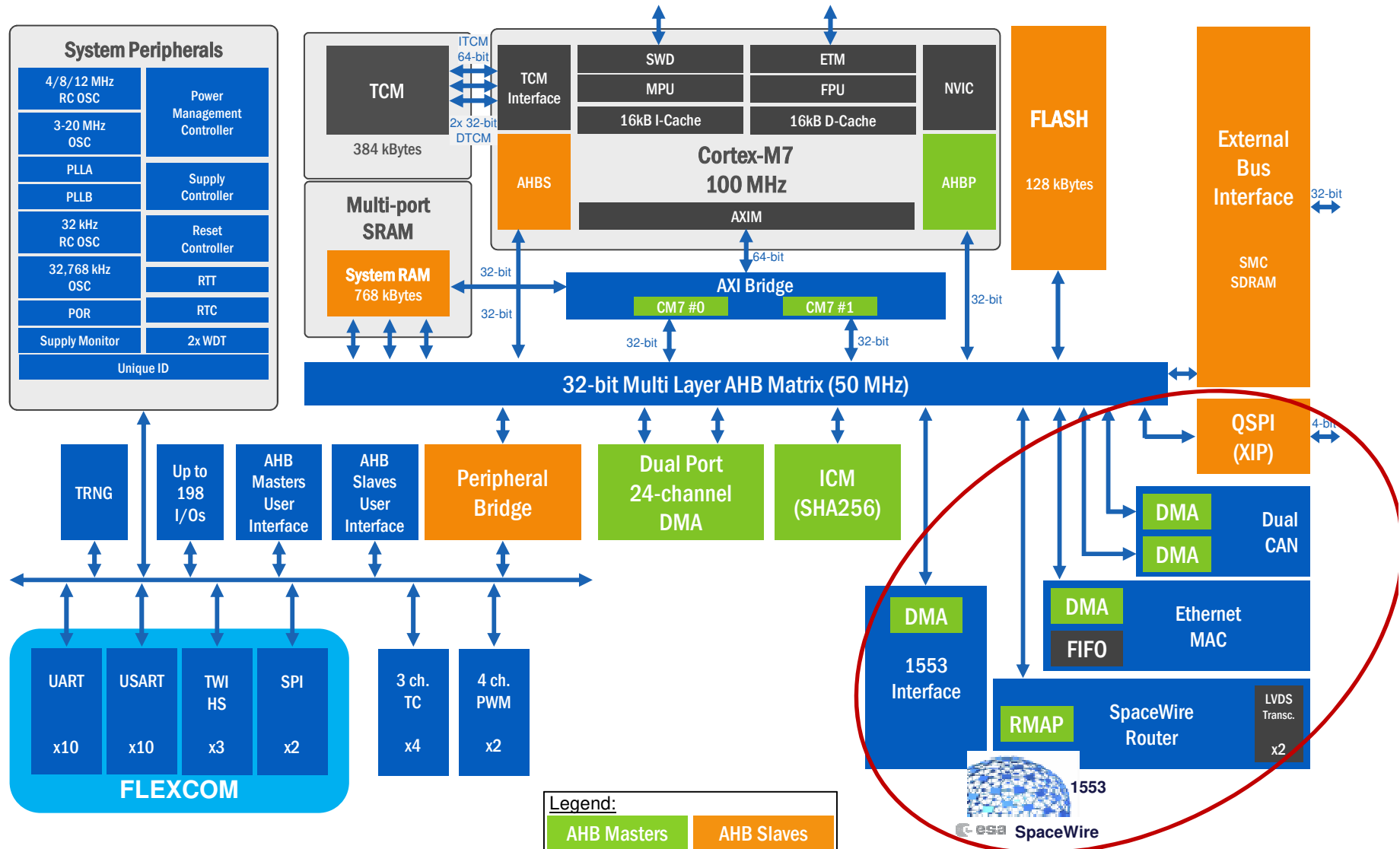
μC/OS[™]
RTOS and Stacks

Ada is fully supported on the SAMV71Q21RT through GNAT Pro Bare Metal

AdaCore

SAMRH71 Architecture

Space Connectivity



SAMRH71 Evaluation kit

- 512Kbytes of PROM
- 256Mbits of SDRAM
- **Ethernet**
- **2 x SpaceWire**
- **2 x CAN FD**
- **2 x 1553**
- 4 x LEDs
- 3 x Pushbuttons
- Extension connector
- JTAG Debug connector
- TRACE connector



User guide

Atmel SAM-ICE Programmer Debugger Emulator Ordering Code: AT91SAM-ICE



Trace module - J Trace segger



SAMRH71-Software Package

- **SAMRH71 Tools**

- MPLAB/HARMONY support
- ASTUDIO support



- **SAMRH71 Embedded Software - Full set of software examples**

- Harmony Workbench
- ASTUDIO Software Package (GCC & IAR)



- **SAMRH71 Documentation**

- Datasheet
- Evaluation Kit User Manual
- Application Notes (Getting Started, ICM management, ...)

- ▼ SAMRH71_Eval
 - > documentation
 - ▼ examples
 - > flash_pgm
 - > getting-started
 - > icm
 - > icm_benchmark
 - > icm_with_ecc_error
 - > mcan
 - > mil1553_bc
 - > mil1553_rt
 - > pmc_clock_switching_rh71
 - > rtc
 - > rtt
 - > spw_loopback
 - > spw_rmap_loopback
 - > tc_capture_waveform
 - > tc_event
 - > twi
 - > twi_eeprom
 - > twi_slave
 - > libraries
 - > utils

Available from

<https://www.microchip.com/wwwproducts/en/SAMRH71>



SAMRH71 Third Party software

N7 Space ongoing development

BSW & BSP adaptation to the RH71

Support for SpaceWire and IO Switch Matrix
Remote application booting through SPI and
RMAP



FreeRTOS integration

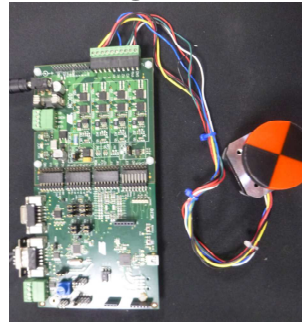


CAN Network RT and RH Microcontrollers

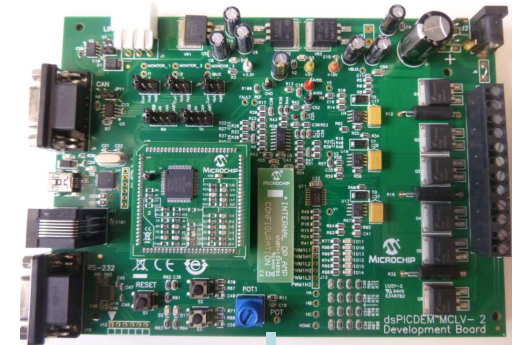
ATmegaS64M1



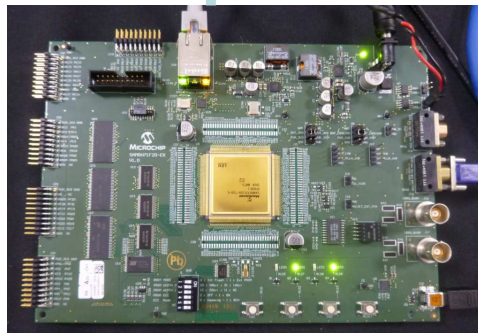
ATmegaS64M1



SAMV71RT



CAN Network



SAMRH71

SpaceWire

Ethernet

4 nodes CAN Network

- SAMRH71 – Ethernet/SpaceWire gateway to CAN
- SAMV71RT – Motor Control through CAN
- ATmegaS64M1 – Motor Control through CAN
- ATmegaS64M1 – HMI through CAN

**Visit us on our booth
to enjoy our
CAN Demo**



MICROCHIP

THANK YOU!

