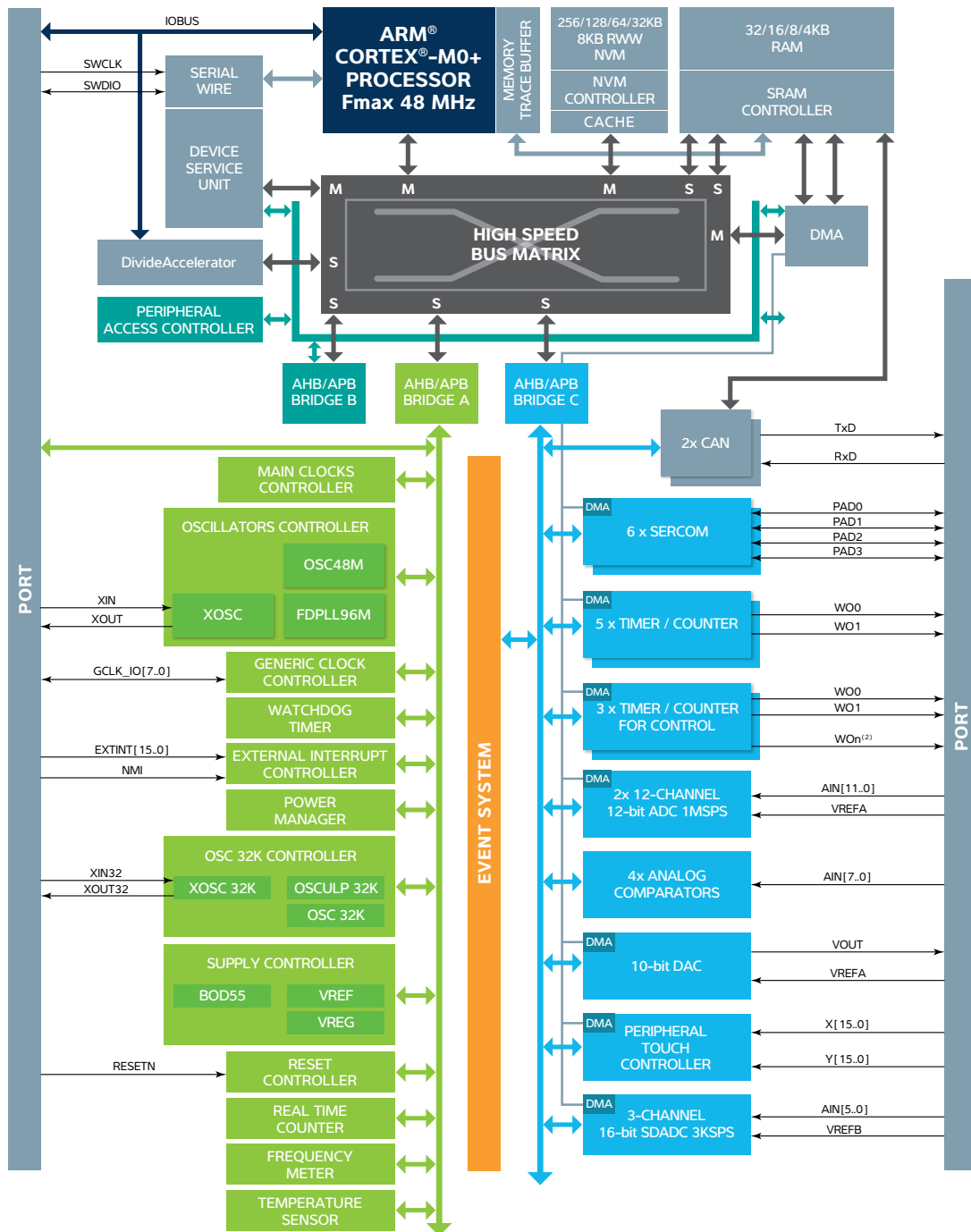# Atmel | SMART SAM C Series

5V ARM Cortex-M0+ Based Flash Microcontroller

Atmel | SMART SAM C Series

The Atmel® | SMART SAM C microcontroller (MCU) series is optimized for appliances, industrial automation, and other 5V applications. It uses the 32-bit ARM® Cortex®-M0+ processor and comes in configurations ranging from 32 to 64 pins with up to 256KB Flash and 32KB of SRAM.

Atmel | SMART SAM C devices operate at a maximum frequency of 48MHz and reach 2.46 Coremark/MHz. They are designed for simple and intuitive migration with identical peripheral modules, hex compatible code, identical linear address map and pin compatible migration paths between all devices in the product series. All devices include intelligent and flexible peripherals, Atmel® Event System for inter-peripheral signaling, and support for capacitive touch button, slider and wheel user interfaces.

IOBUS

SWCLK
SWDIO

SERIAL WIRE

ARM®
CORTEX®-M0+
PROCESSOR
Fmax 48 MHz

MEMORY TRACE BUFFER

256/128/64/32KB
8KB RWW
NVM

NVM CONTROLLER

CACHE

32/16/8/4KB
RAM

SRAM CONTROLLER

DEVICE SERVICE UNIT

DivideAccelerator

HIGH SPEED
BUS MATRIX

M M M S S M

S S S

DMA

PERIPHERAL ACCESS CONTROLLER

AHB/APB BRIDGE B

AHB/APB BRIDGE A

AHB/APB BRIDGE C

2x CAN   TxD   RxD

PORT

MAIN CLOCKS CONTROLLER

OSCILLATORS CONTROLLER
OSC48M
XOSC   FDPLL96M

XIN
XOUT

GCLK_IO[7..0]

GENERIC CLOCK CONTROLLER

WATCHDOG TIMER

EXTINT[15..0]
NMI

EXTERNAL INTERRUPT CONTROLLER

POWER MANAGER

OSC 32K CONTROLLER
XIN32
XOUT32
XOSC 32K   OSCULP 32K
OSC 32K

SUPPLY CONTROLLER
BOD55   VREF
VREG

RESETN

RESET CONTROLLER

REAL TIME COUNTER

FREQUENCY METER

TEMPERATURE SENSOR

EVENT SYSTEM

DMA 6 x SERCOM   PAD0 PAD1 PAD2 PAD3

DMA 5 x TIMER / COUNTER   WO0 WO1

DMA 3 x TIMER / COUNTER FOR CONTROL   WO0 WO1 WOn(2)

DMA 2x 12-CHANNEL 12-bit ADC 1MSPS   AIN[11..0] VREFA

4x ANALOG COMPARATORS   AIN[7..0]

DMA 10-bit DAC   VOUT VREFA

DMA PERIPHERAL TOUCH CONTROLLER   X[15..0] Y[15..0]

DMA 3-CHANNEL 16-bit SDADC 3KSPS   AIN[5..0] VREFB

PORT

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Sercom
SAM C devices feature multiple instances of the Serial Communication Module (SERCOM). The SERCOM is configurable to operate as I²C, SPI, USART LIN master/slave, and RS485, giving developers extended flexibility to mix serial interfaces and greater freedom in PCB layout. Each SERCOM instance can be assigned to different I/O pins through I/O multiplexing, further increasing versatility.

Timers/Counters
There are up to five TC peripheral instances. Each TC consists of a counter, prescaler, compare/capture channels and control logic. The counter can be set to count events, or clock pulses. The counter, together with the compare/capture channels, can be configured to timestamp input events or IO pin edges, allowing for capturing of frequency and/or pulse width. A TC can also perform waveform generation, such as frequency generation and pulse-width modulation.

Micro Trace Buffer
The Micro Trace Buffer available in the SAM C devices enables enhanced on-chip debugging with trace capabilities supported by Atmel and third-party debuggers.

DMA
Up to 12 DMA channels are available in SAM C. The DMA supports data transfers from 1B to 256KB, and has selectable transfer triggers and priority levels. The DMA is connected to the ADC, DAC, SDADC, SERCOM, T/C, T/CC, and the PTC.

CAN Controller
The Control Area Network (CAN) performs communication according to ISO 11898-1 (Bosch CAN specification 2.0 part A,B) and to Bosch CAN FD specification V1.0. Each CAN interface has two selectable pin locations to switch between two external CAN transceivers (without the need for an external switch).

Peripheral Touch Controller
An embedded peripheral touch controller (PTC) makes it easy to add capacitive touch sensing to your project with buttons, sliders, wheels and proximity. By offering superb sensitivity and noise tolerance as well as self-calibration, the PTC eliminates the need for external components and minimizes CPU overhead. The PTC supports up to 256 channels on 64-pin devices, 121 channels on 48-pin devices and 64 channels on 32-pin devices.

The Atmel | SMART SAM C series consist of two families of devices, the SAM C20 family optimized for appliances, and the SAM C21 family optimized for industrial automation. An outline on the families and their features is shown in the table below.

SAM C20 – Optimized for appliances

	SAM C20E	SAM C20G	SAM C20J
FLASH	32-256kB	32-256kB	32-256kB
SRAM	4-32kB	4-32kB	4-32kB
12-bit 1Msps ADC	10-ch	12-ch	12-ch
SERCOM (UART, SPI, I²C)	4	4	4
Timer/Counter	3	5	5
Timer/Counter for control	3	3	3
PTC Channels	64	121	256
Packages	32-pin TQFP 32-pin QFN	48-pin TQFP 48-pin QFN	64-pin TQFP 64-pin QFN
Features in all SAM C20 devices	ARM Cortex-M0+ CPU with MPU and HW divide at 48 MHz, 2.7-5.5V operation, -40°C – 105°C temp, 12-bit 1Msps ADC, Analog Comparators, Peripheral Touch Controller, 32-bit RTC with calendar mode, 6-ch Event system and 6-ch DMA Controller with SleepWalking, SERCOM supports USART/UART with autobaud, SPI, I²C up to 3.4MHz, PMBus, SMBus, RS485, IrDA LIN Master and Slave, Timer/Counters for Control and Drive Control applications (TCC)		

SAM C21 – Optimized for industrial automation

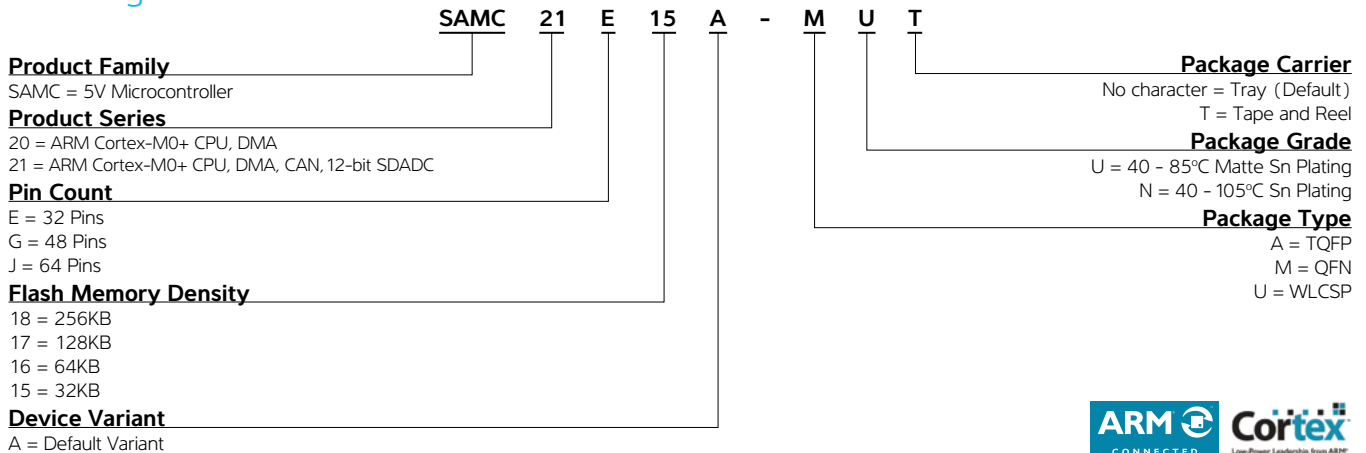|	SAM C21E	SAM C21G	SAM C21J
FLASH	32-256kB	32-256kB	32-256kB
SRAM	4-32kB	4-32kB	4-32kB
Dual 12-bit 1Msps ADC	10-ch	14-ch	20-ch
SERCOM (UART, SPI, I²C)	4	6	6
Timer/Counter	3	3	5
Timer/Counter for control	3	3	3
PTC Channels	64	121	256
Packages	32-pin TQFP 32-pin QFN	48-pin TQFP 48-pin QFN	64-pin TQFP 64-pin QFN
Features in all SAM C21 devices	ARM Cortex-M0+ CPU with MPU and HW divide at 48 MHz, 2.7-5.5V operation, -40°C – 105°C temp, Dual 12-bit 1Msps ADC, 10-bit 350ksps DAC, Analog Comparators, 16-bit SD ADC, Peripheral Touch Controller, 32-bit RTC with calendar mode, 12-ch Event system and 12-ch DMA Controller with SleepWalking, CAN SERCOM supports USART/UART with autobaud, SPI, I²C up to 3.4MHz, PMBus, SMBus, RS485, IrDA LIN Master and Slave, Timer/Counters for Control and Drive Control applications (TCC)		

Hardware and Software Tools

The Xplained Pro products available for the SAM C Family are perfect for rapid prototyping and development. Xplained Pro boards feature an embedded programmer and debugger, and they easily connect to your computer and Atmel Studio. Several expansion wings are available for Xplained Pro boards. The wings enable evaluation of different interfaces and peripherals. Wings are also available from third parties.

Evaluation Kit	Description	
SAM C21 Xplained Pro Evaluation Kit (ATSAMC21-XPRO)	For evaluation and prototyping with Atmel SAM C20 and C21 ARM Cortex-M0+ microcontrollers. Ordering code: ATSAMC21-XPRO	
SAM C20 QTouch Robustness Evaluation Kit (ATSAMC20-QTRDEMO)	The SAM C20 QTouch Robustness Evaluation kit demonstrates the high capacitive touch performance of the Peripheral Touch Controller (PTC) while achieving best-in-class conducted immunity and moisture tolerance required in home appliance and industrial applications. Ordering code: ATSAMC20-QTRDEMO	
RS485 Xplained PRO Extension Evaluation Kit (ATRS485-XPRO)	The RS485 Xplained Pro extension evaluation kit is ideal for evaluation and prototyping applications involving RS485 / 422 features of the SAM C21 ARM Cortex-M0+ processor-based microcontrollers. Ordering code: ATRS485-XPRO	
QT5 Xplained Pro Extension Pro Kit (ATQT5-XPRO)	The QT5 Xplained Pro kit is an extension board that enables evaluation of mutual capacitance touch using the Peripheral Touch Controller (PTC). Ordering code: ATQT5-XPRO	

In addition to the Xplained Pro platform, the SAM C family is fully supported by the STK600 development platform and Atmel and third-party debuggers and programmers.

Atmel Studio 7 is the integrated development platform (IDP) for developing and debugging Atmel | SMART ARM Cortex-M-based and Atmel AVR® microcontroller applications. The Studio 7 IDP gives you a seamless and easy-to-use environment to write, build and debug your applications written in C/C++ or assembly code. It includes the Atmel Software Framework, which is a vast source code library that includes drivers, stacks and more than 2000 project examples. Atmel Studio also incorporates a unique feature to enhance your productivity—Atmel Gallery. The online apps store allows you to easily access development tools and embedded software integrated with Atmel Studio.

Ordering Information

SAMC 21 E 15 A - M U T

Product Family
SAMC = 5V Microcontroller

Product Series
20 = ARM Cortex-M0+ CPU, DMA
21 = ARM Cortex-M0+ CPU, DMA, CAN, 12-bit SDADC

Pin Count
E = 32 Pins
G = 48 Pins
J = 64 Pins

Flash Memory Density
18 = 256KB
17 = 128KB
16 = 64KB
15 = 32KB

Device Variant
A = Default Variant

Package Carrier
No character = Tray (Default)
T = Tape and Reel

Package Grade
U = 40 - 85°C Matte Sn Plating
N = 40 - 105°C Sn Plating

Package Type
A = TQFP
M = QFN
U = WLCSP