Atmel

8/16-bit Atmel AVR XMEGA D3 Microcontroller

ATxmega32D3 / ATxmega64D3 / ATxmega128D3 / ATxmega192D3 / ATxmega256D3 / ATxmega384D3

Features

- High-performance, low-power Atmel® AVR® XMEGA® 8/16-bit Microcontroller
- Nonvolatile program and data memories
  - 32K - 384KBytes of in-system self-programmable flash
  - 4K - 8KBytes boot section
  - 1K - 4KBytes EEPROM
  - 4K - 32KBytes internal SRAM
- Peripheral features
  - Four-channel event system
  - Five 16-bit timer/counters
    - Four timer/counters with four output compare or input capture channels
    - One timer/counter with two output compare or input capture channels
    - High resolution extension on two timer/counters
    - Advanced waveform extension (AWeX) on one timer/counter
  - Three USARTs with IrDA support for one USART
  - Two two-wire interfaces with dual address match (I^{2}C and SMBus compatible)
  - Two serial peripheral interfaces (SPIs)
  - CRC-16 (CRC-CCITT) and CRC-32 (IEEE®802.3) generator
  - 16-bit real time counter (RTC) with separate oscillator
  - One sixteen-channel, 12-bit, 300ksps Analog to Digital Converter
  - Two Analog Comparators with window compare function, and current sources
  - External interrupts on all general purpose I/O pins
  - Programmable watchdog timer with separate on-chip ultra low power oscillator
  - Atmel QTouch® library support
    - Capacitive touch buttons, sliders and wheels
- Special microcontroller features
  - Power-on reset and programmable brown-out detection
  - Internal and external clock options with PLL and prescaler
  - Programmable multilevel interrupt controller
  - Five sleep modes
  - Programming and debug interface
    - PDI (program and debug interface)
- I/O and packages
  - 50 programmable I/O pins
  - 64-lead TQFP
  - 64-pad QFN
- Operating voltage
  - 1.6 – 3.6V
- Operating frequency
  - 0 – 12MHz from 1.6V
  - 0 – 32MHz from 2.7V

1.   Ordering Information

Ordering code	Flash [bytes]	EEPROM [bytes]	SRAM [bytes]	Speed [MHz]	Power supply	Package (1)(2)(3)	Temp.
ATxmega32D3-AU	32K + 4K	1K	4K	32	1.6 - 3.6V	64A	-40°C - 85°C
ATxmega32D3-AUR (4)	32K + 4K	1K	4K				
ATxmega64D3-AU	64K + 4K	2K	4K				
ATxmega64D3-AUR (4)	64K + 4K	2K	4K				
ATxmega128D3-AU	128K + 8K	2K	8K				
ATxmega128D3-AUR (4)	128K + 8K	2K	8K				
ATxmega192D3-AU	192K + 8K	2K	16K				
ATxmega192D3-AUR (4)	192K + 8K	2K	16K				
ATxmega256D3-AU	256K + 8K	4K	16K				
ATxmega256D3-AUR (4)	256K + 8K	4K	16K				
ATxmega384D3-AU	384K + 8K	4K	32K				
ATxmega384D3-AUR (4)	384K + 8K	4K	32K				
ATxmega32D3-MH	32K + 4K	1K	4K			64M	
ATxmega32D3-MHR (4)	32K + 4K	1K	4K				
ATxmega64D3-MH	64K + 4K	2K	4K				
ATxmega64D3-MHR (4)	64K + 4K	2K	4K				
ATxmega128D3-MH	128K + 8K	2K	8K				
ATxmega128D3-MHR (4)	128K + 8K	2K	8K				
ATxmega192D3-MH	192K + 8K	2K	16K				
ATxmega192D3-MHR (4)	192K + 8K	2K	16K				
ATxmega256D3-MH	256K + 8K	4K	16K				
ATxmega256D3-MHR (4)	256K + 8K	4K	16K				
ATxmega384D3-MH	384K + 8K	4K	32K				
ATxmega384D3-MHR (4)	384K + 8K	4K	32K				

Ordering code	Flash [bytes]	EEPROM [bytes]	SRAM [bytes]	Speed [MHz]	Power supply	Package [1][2][3]	Temp.
ATxmega32D3-AN	32K + 4K	1K	4K	32	1.6 - 3.6V	64A	-40°C - 105°C
ATxmega32D3-ANR [4]	32K + 4K	1K	4K				
ATxmega64D3-AN	64K + 4K	2K	4K				
ATxmega64D3-ANR [4]	64K + 4K	2K	4K				
ATxmega128D3-AN	128K + 8K	2K	8K				
ATxmega128D3-ANR [4]	128K + 8K	2K	8K				
ATxmega192D3-AN	192K + 8K	2K	16K				
ATxmega192D3-ANR [4]	192K + 8K	2K	16K				
ATxmega256D3-AN	256K + 8K	4K	16K				
ATxmega256D3-ANR [4]	256K + 8K	4K	16K				
ATxmega384D3-AN	384K + 8K	4K	32K				
ATxmega384D3-ANR [4]	384K + 8K	4K	32K				
ATxmega32D3-MT	32K + 4K	1K	4K			64M	
ATxmega32D3-MTR [4]	32K + 4K	1K	4K				
ATxmega64D3-MT	64K + 4K	2K	4K				
ATxmega64D3-MTR [4]	64K + 4K	2K	4K				
ATxmega128D3-MT	128K + 8K	2K	8K				
ATxmega128D3-MTR [4]	128K + 8K	2K	8K				
ATxmega192D3-MT	192K + 8K	2K	16K				
ATxmega192D3-MTR [4]	192K + 8K	2K	16K				
ATxmega256D3-MT	256K + 8K	4K	16K				
ATxmega256D3-MTR [4]	256K + 8K	4K	16K				
ATxmega384D3-MT	384K + 8K	4K	32K				
ATxmega384D3-MTR [4]	384K + 8K	4K	32K				

Notes:
1. This device can also be supplied in wafer form. Contact your local Atmel sales office for detailed ordering information.
2. Pb-free packaging, complies to the European Directive for Restriction of Hazardous Substances (RoHS directive). Also Halide free and fully Green.
3. For packaging information, see "Packaging Information" on page 61.
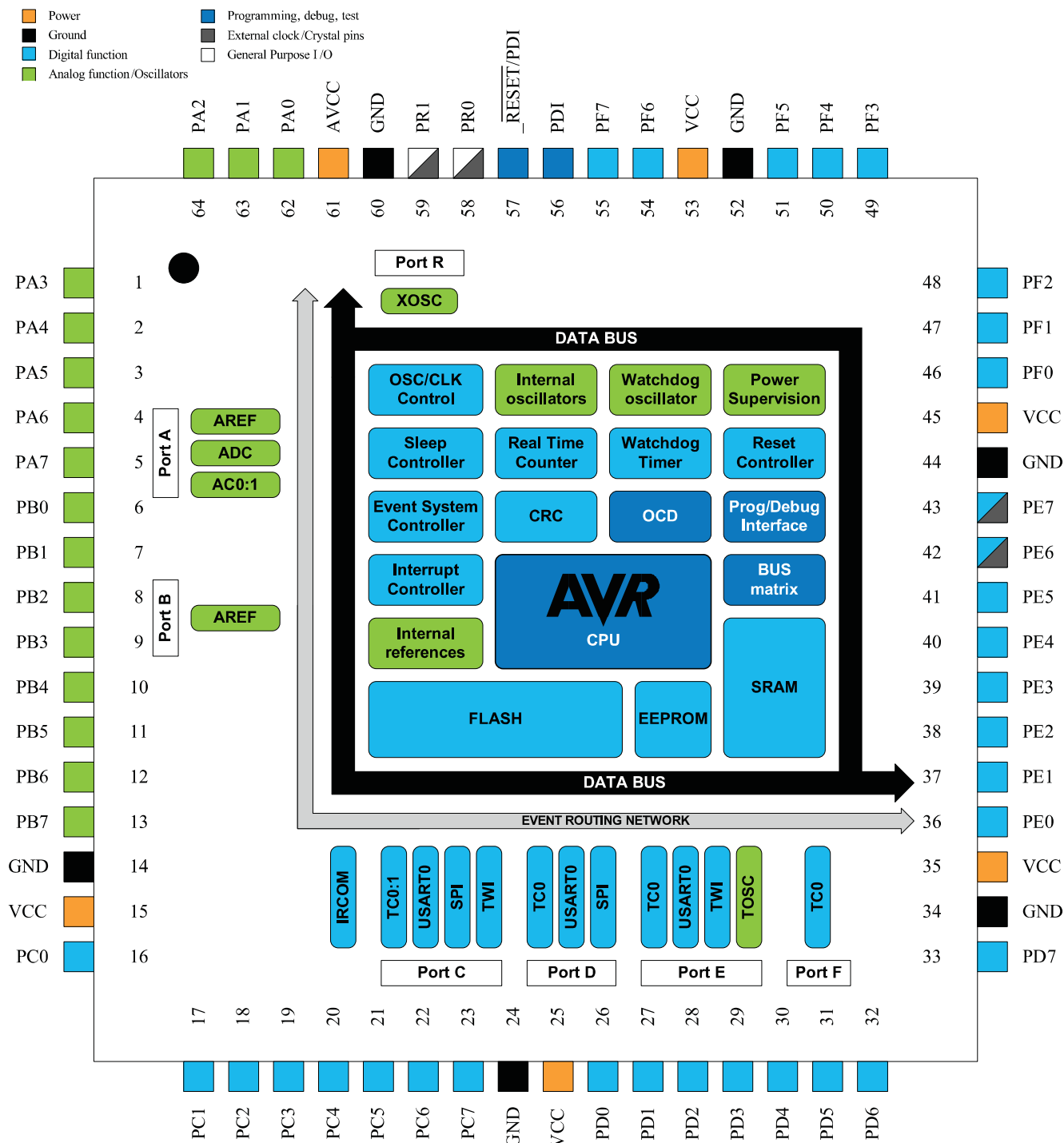4. Tape and Reel.

Package type	
64A	64-lead, 14 * 14mm body size, 1.0mm body thickness, 0.8mm lead pitch, thin profile plastic quad flat package (TQFP)
64M	64-pad, 9 * 9 * 1.0mm body, lead pitch 0.50mm, 7.65mm exposed pad, quad flat no-lead package (QFN)

Typical applications

Industrial control	Climate control	Low power battery applications
Factory automation	RF and ZigBee®	Power tools
Building control	Motor control	HVAC
Board control	Sensor control	Utility metering
White goods	Optical	Medical applications

2. Pinout/block Diagram

Figure 2-1. Block Diagram and Pinout

Notes: 1. For full details on pinout and alternate pin functions refer to .

2. The large center pad underneath the QFN/MLF package should be soldered to ground on the board to ensure good mechanical stability.

3. Overview

The Atmel AVR XMEGA is a family of low power, high performance, and peripheral rich 8/16-bit microcontrollers based on the AVR enhanced RISC architecture. By executing instructions in a single clock cycle, the AVR XMEGA devices achieve CPU throughput approaching one million instructions per second (MIPS) per megahertz, allowing the system designer to optimize power consumption versus processing speed.

The AVR CPU combines a rich instruction set with 32 general purpose working registers. All 32 registers are directly connected to the arithmetic logic unit (ALU), allowing two independent registers to be accessed in a single instruction, executed in one clock cycle. The resulting architecture is more code efficient while achieving throughputs many times faster than conventional single-accumulator or CISC based microcontrollers.

The XMEGA D3 devices provide the following features: in-system programmable flash with read-while-write capabilities; internal EEPROM and SRAM; four-channel event system and programmable multilevel interrupt controller, 50 general purpose I/O lines, 16-bit real-time counter (RTC); five, 16-bit timer/counters with compare and PWM channels; three USARTs; two two-wire serial interfaces (TWIs); two serial peripheral interfaces (SPIs); one sixteen-channel, 12-bit ADC with programmable gain; two analog comparators (ACs) with window mode; programmable watchdog timer with separate internal oscillator; accurate internal oscillators with PLL and prescaler; and programmable brown-out detection.

The program and debug interface (PDI), a fast, two-pin interface for programming and debugging, is available.

The AVR XMEGA devices have five software selectable power saving modes. The idle mode stops the CPU while allowing the SRAM, event system, interrupt controller, and all peripherals to continue functioning. The power-down mode saves the SRAM and register contents, but stops the oscillators, disabling all other functions until the next TWI, or pin-change interrupt, or reset. In power-save mode, the asynchronous real-time counter continues to run, allowing the application to maintain a timer base while the rest of the device is sleeping. In standby mode, the external crystal oscillator keeps running while the rest of the device is sleeping. This allows very fast startup from the external crystal, combined with low power consumption. In extended standby mode, both the main oscillator and the asynchronous timer continue to run. To further reduce power consumption, the peripheral clock to each individual peripheral can optionally be stopped in active mode and idle sleep mode.
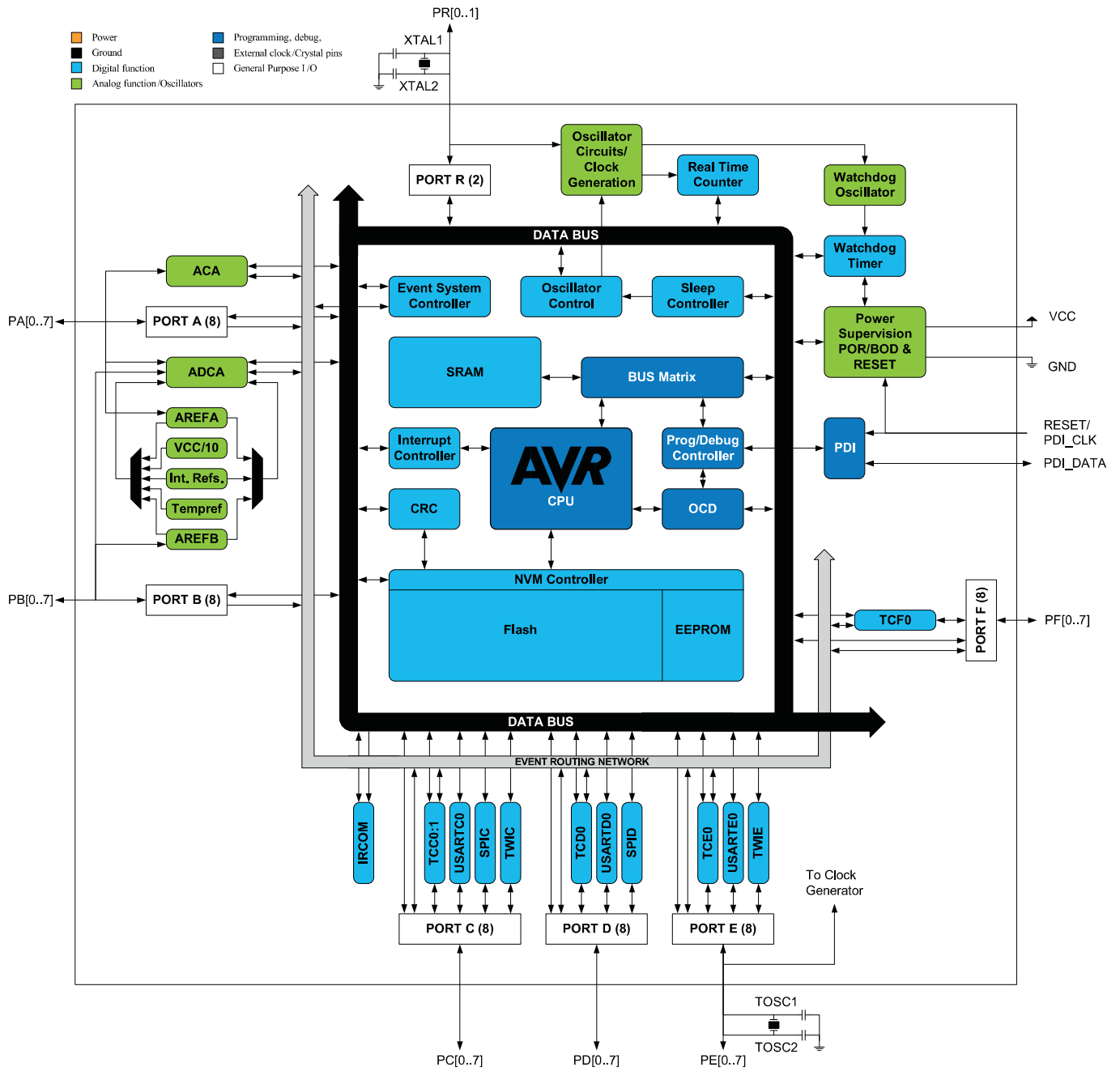
Atmel offers a free QTouch library for embedding capacitive touch buttons, sliders and wheels functionality into AVR microcontrollers.

The devices are manufactured using Atmel high-density, nonvolatile memory technology. The program flash memory can be reprogrammed in-system through the PDI. A boot loader running in the device can use any interface to download the application program to the flash memory. The boot loader software in the boot flash section will continue to run while the application flash section is updated, providing true read-while-write operation. By combining an 8/16-bit RISC CPU with in-system, self-programmable flash, the AVR XMEGA is a powerful microcontroller family that provides a highly flexible and cost effective solution for many embedded applications.

All AVR XMEGA devices are supported with a full suite of program and system development tools, including: C compilers, macro assemblers, program debugger/simulators, programmers, and evaluation kits.

3.1 Block Diagram

Figure 3-1. XMEGA D3 Block Diagram

4. Resources

A comprehensive set of development tools, application notes and datasheets are available for download on www.atmel.com/avr.

4.1 Recommended Reading

- Atmel AVR XMEGA D manual
- XMEGA application notes

This device data sheet only contains part specific information with a short description of each peripheral and module. The XMEGA D manual describes the modules and peripherals in depth. The XMEGA application notes contain example code and show applied use of the modules and peripherals.

All documentation are available from www.atmel.com/avr.

5. Capacitive Touch Sensing

The Atmel QTouch library provides a simple to use solution to realize touch sensitive interfaces on most Atmel AVR microcontrollers. The patented charge-transfer signal acquisition offers robust sensing and includes fully debounced reporting of touch keys and includes Adjacent Key Suppression™ (AKS™) technology for unambiguous detection of key events. The QTouch library includes support for the QTouch and Atmel QMatrix acquisition methods.

Touch sensing can be added to any application by linking the appropriate Atmel QTouch library for the AVR microcontroller. This is done by using a simple set of APIs to define the touch channels and sensors, and then calling the touch sensing API's to retrieve the channel information and determine the touch sensor states.

The QTouch library is FREE and downloadable from the Atmel website at the following location: http://www.atmel.com/tools/qtouchlibrary.aspx. For implementation details and other information, refer to the QTouch library user guide - also available for download from the Atmel website.