19-5259; Rev 0; 4/10

Security Token Microcontroller with RTC and USB

MAXQ1010

General Description

The MAXQ1010 is a small, low-cost, low-power secure microcontroller designed for security token applications and battery-powered applications where power and security are both critically important.

The microcontroller family contains a 32KB, 64KB, or 128KB programmable flash memory that can be used for both application code and data storage. Each 512B flash memory page supports 20,000 erase cycles and is programmable 16 bits at a time. This allows for unique schemes to extend the lifetime of the flash. For instance, dedicating four flash pages to store 32B of data that changes very often, the effective number of write cycles can approach 1.2 million (4 x 512 x 20,000/32). The device also contains 1KB or 2KB SRAM. An additional 128B secure key storage SRAM is instantly erased when a self-destruct input is triggered.

The microcontroller also contains a hardware DES engine and an AES accelerator, allowing applications to quickly respond to challenges and authenticate other devices using standards-based cryptography. A true-hardware random-number generator (RNG) is available for general application use, such as key generation, challenge generation, and random padding. Firmware and reference designs are available from Maxim for authentication applications.

Multiple communication interfaces are implemented; an integrated USB transceiver and serial interface engine make USB applications extremely low cost. Other communication options include ISO 7816 UART, SPI™, I²C, and a standard USART (universal synchronous/asynchronous receiver-transmitter). A real-time clock (RTC) is also included for security applications requiring a time base.

For the ultimate in low-power battery-operated performance, an ultra-low-power stop mode (400nA typ) is included. In this mode, the minimum amount of circuitry is powered. Wake-up sources include external interrupts, the power-fail interrupt, a wake-up timer interrupt, and an RTC interrupt.

Applications

One-Time Password Generator

USB Card Readers

MAXQ and 1-Wire are registered trademarks of Maxim Integrated Products, Inc.

SPI is a trademark of Motorola, Inc.

Features

- **High-Performance, Low-Power, 16-Bit RISC Core**
- **DC to 12MHz Operation Across Entire Operating Range**
- **6MHz Internal Oscillator**
- **12MHz External Crystal (Required for USB Operation)**
- **1.7V to 3.6V Operating Voltage Range**
- **33 Total Instructions for Simplified Programming**
- **Three Independent Data Pointers Accelerate Data Movement with Automatic Increment/Decrement**
- **Dedicated Pointer for Direct Read from Code Space**
- **16-Bit Instruction Word, 16-Bit Data Bus**
- **16 x 16-Bit General-Purpose Working Registers**
- **1-Wire® Interface for Debugger and Flash Programming**
- **Security Features**
  - **DES and AES Hardware Accelerators**
  - **Hardware True RNG**
  - **Self-Destruct Input Pin**
  - **128B, Fast Wipe, Secure Secret Key SRAM**
  - **RTC with Integrated Oscillator**
- **Memory**
  - **32/64/128KB Flash**
    - **512-Byte Memory Page Sectors**
    - **20,000 Erase/Write Cycles per Sector**
  - **Up to 2KB Data SRAM**
  - **6KB Utility ROM with User-Callable Routines**
- **I/O and Peripherals**
  - **USB 2.0 SIE and Transceiver**
  - **SPI and USART I²C Communication Ports**
  - **ISO 7816 UART**
  - **31 General-Purpose I/O Pins**
  - **Up to 15 External Interrupts Available**
- **Low Power Consumption**
  - **Single 1.7V to 3.6V Supply**
  - **< 1µA Current in Lowest Power Stop Mode**
  - **Divided System Clock Modes Available**
- **Additional Peripherals**
  - **Power-Fail Warning**
  - **Power-On Reset (POR)**
  - **Programmable Watchdog Timer**

Ordering Information

PART	TEMP RANGE	PIN-PACKAGE
MAXQ1010-A01+	-40°C to +85°C	48 TQFN-EP**
MAXQ1010X-0000+*	-40°C to +85°C	Bare die

Ordering Information continued on last page.

+Denotes a lead(Pb)-free/RoHS-compliant package.
**Contact factory for availability.*
***EP = Exposed pad.*

Selector Guide appears at end of data sheet.

Note: *Some revisions of this device may incorporate deviations from published specifications known as errata. Multiple revisions of any device may be simultaneously available through various sales channels. For information about device errata, go to:* ***www.maxim-ic.com/errata****.*

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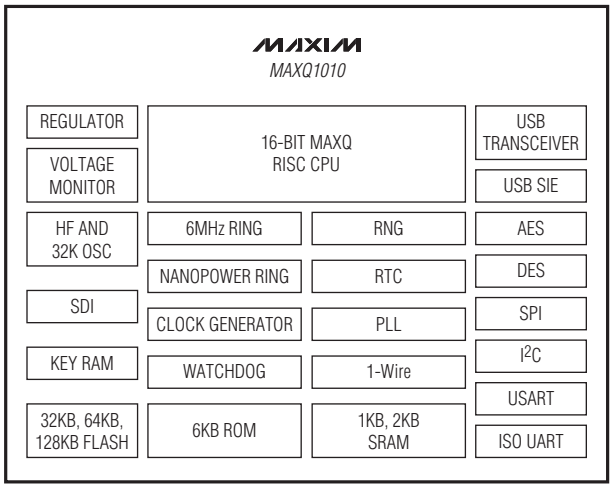
Block Diagram



Note to readers: This document is an abridged version of the full data sheet. To request the full data sheet, go to **www.maxim-ic.com/MAXQ1010** and click on **Request Full Data Sheet**.