XA-S3 Microcontroller

The XA-S3 Microcontroller offers designers a high-performance, single-chip solution for demanding, closed-loop embedded control applications. This 16-bit microcontroller combines standard features of previous XA (eXtended Architecture) microcontrollers with a fast, high-resolution A/D converter and a programmable counter/timer array in a large pincount package. This device allows easy migration up from the 80C51 architecture and offers many powerful peripherals on a single chip. Advanced features of the XA-S3 support multi-tasking operating systems and such high-level languages as C, offering the high performance needed for data acquisition, servo control, and motor control.

Speed, Memory Capacity, and Flexibility

The XA-S3 can operate at speeds up to 30 MHz, providing designers with a high-performance platform for demanding applications. Capable of addressing up to 16 MB of memory in ROMless mode, the XA-S3 offers 32 KB of on-chip EPROM/ ROM program memory and 1024 bytes of RAM, which is crucial when external memory cannot be used. The XA-S3 has an I^2C serial interface that allows the use of hundreds of I^2C devices, including EEPROMs, real-time clock chips, and LCD drivers. This interface provides separate I^2C addresses to facilitate communication with other I^2C devices at rates up to 400 KHz.

The eight-channel, 8-bit A/D converter in the XA-S3 completes its operations in 4.5 microseconds at 30 MHz, for an order-of-magnitude boost in speed over the 80C51. The XA-S3 is the first in the XA family to have a five-channel, 16-bit PCA that can operate in four different modes, including 16-bit high-speed input capture, high-speed output, and pulse-width modulation.

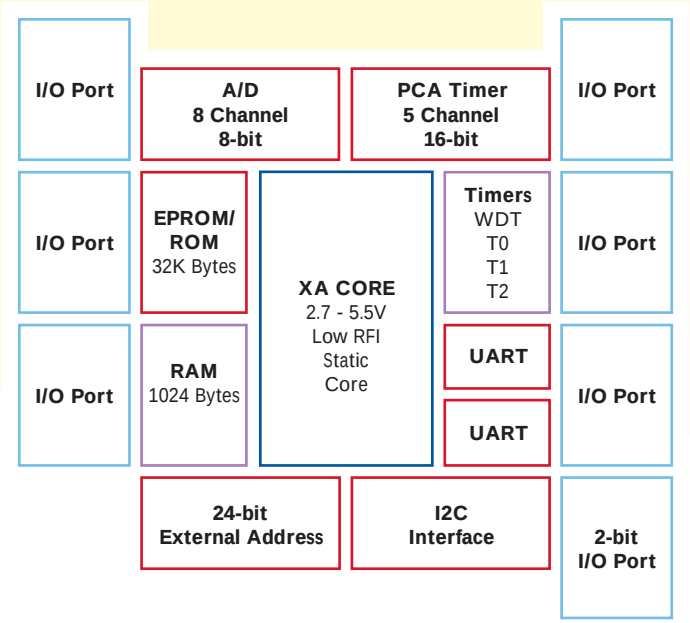
For applications requiring significant I/O to control surrounding circuitry, the XA-S3 has six 8-bit I/O ports and a 2-bit I/O port with programmable output configurations. In addition to its three standard timers, the XA-S3 features a watchdog timer that enhances fault tolerance and reliability. Unique to the XA-S3 are two enhanced UARTs that provide hardware flow control and reduce the burden on the CPU.

Key Features of the XA-S3

- **Analog-to-Digital Converter**
- **Programmable Counter Array**
- **Watchdog Timer**
- **I^2C Serial Bus**

XA-S3 Features

- Operation at 2.7 V to 5.5 V
- On-chip EPROM/ROM program memory (32 KB)
- On-chip data RAM (1024 bytes)
- Up to 16 MB of external address (24 address lines) supported
- I/O pins
  - 50 or 48, depending on package
  - Four programmable output configurations
- A/D converter
  - Eight channels, 8-bit
  - Automatic channel scan
  - Repeated Read functions
  - Operation down to 3 V
- Two enhanced UARTs with independent baud rates
- Programmable Counter Array (PCA)
  - Five channels; each channel has an associated I/O pin
  - Resolution: 16-bit
  - Four modes, including PWM Outputs and Input Capture
- Clock output for simplifying external bus interfacing
- Three enhanced counter/timers
  - (Same as G3 device timers)
  - Toggle output capability
- Watchdog timer
- Byte-type I2C-bus
  - Byte-oriented master and slave functions
  - Supports 100 KHz I2C at rates up to 400 KHz
- Seven software interrupts
- Active Low Reset output pin indicates all reset occurrences (external, watchdog, and the RESET instruction)
- Reset source register allows program determination of the cause of most recent reset
- EPROM/OTP versions programmable in circuit
- Operating frequency of 30 MHz at 2. 7 to 5.5 V VDD over commercial operating conditions
- Idle and Power-Down power-saving operating modes; wake-up from power-down via an external interrupt also supported
- Choice of packages
  - 68-pin PLCC or 80-pin PQFP



Migration Path: From the 8XC552 to the XA-S3

Philips Semiconductors has a long history of including analog-to-digital (A/D) converters on its microcontrollers. The XA-S3 builds upon knowledge and customer feedback gained from the 8XC552, which has an A/D converter. The XA-S3 features enhanced ADC implementation, with faster speeds, greater flexibility, and more operating modes. The faster ADC on the XA-S3 provides a conversion result every 4.5 microseconds when it is operating at 30 MHz.

The 8XC552 allowed only a specific channel to be selected, but the XA-S3 allows the system designer to choose either a single scan or continuous scan of selected input channels. A configuration register allows the conversion rate to be maintained constant, independent of the clock input. The other key enhancement is the XA-S3's new internal calibration scheme, which allows easy compensation for offset errors. Designers can improve accuracy and resolution because this ADC performs conversions during the Idle mode of chip operation.

Development Tools for the Latest Applications

Philips Semiconductors offers many hardware and software development tools for the XA-S3 Microcontroller to help designers bring products to market more quickly. For example, emulators and programmers support design and debugging activities. Most of these tools use the same software interface as used for the 80C51, so they are easy to learn. A host of leading third-party vendors of development tools are ready with ICE, C compilers, and evaluation boards to support the XA-S3 customer.

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