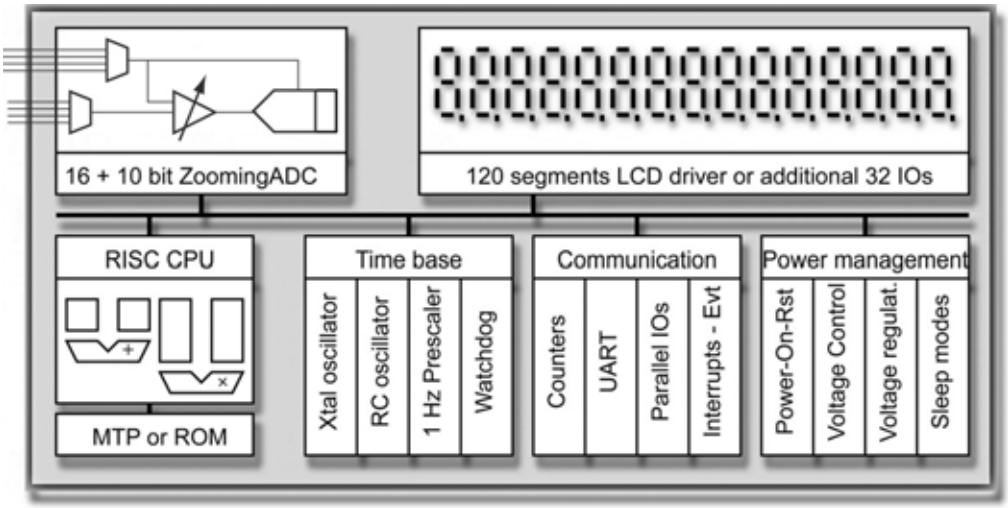
XEMICS

Product Brief
XE8000 series



XE8000 series

Radio and Sensor Interface SoC
With embedded low-power microcontroller

General Description

XE8000 is a series of high performance, ultra low-power, low-voltage CMOS microcontrollers based application specific standard products, with advanced features like the 16+10 bits **ZoomingADC**™ for sensor interfacing or the **BitJockey™** for wireless connectivity.

The XE8000 family is built around a high efficiency 8/22-bit RISC architecture. All instructions, including 8 * 8 bit multiplication, are executed in 1 clock cycle.

Applications

- Portable, battery operated instruments
- RF powered instruments
- Battery capacity monitoring
- Motor control
- Low-power data loggers
- Bar code readers
- Home automation
- 4-20 mA loop
- Sensor interfacing
- ISM band transceiver interfacing
- Automated meter reading

Key product Features

- **8/22-bit RISC architecture**
- **Low-power operation:**
  - One clock per instruction, no exception
  - 300 uA @ 1 MIPS (MTP memory)
  - 10 uA @ 32 kHz
  - 1 uA, hibernating mode (Xtal clock on)
- **Low-voltage operation, 1.2 V - 5.5 V**
- **ZoomingADC™ and DACs**:
  - 16 bits ADC
  - 0.5 - 1000 gain preamplifier
  - Sensor offset cancellation
  - Up to 6 differential or 13 single ended inputs
  - 2 differential reference inputs
- **BitJockey™:**
  - Asynchronous Receiver/Transmitter for digital radio transceivers
  - Exploit full bandwidth of the transceiver
  - NRZ, Manchester and Miller coding
  - Relieves MCU speed and memory requirements
- **Available in die and packaged form**

Functional description of the XE8000

The heart of the controller is a high efficiency 8/22-bit RISC core. The RC oscillator and events management ensures fast start-up. The circuit includes numerous analog and digital peripherals:

Main Peripherals:

- Multiple Time Programmable (MTP) instruction memory
- UART (300 – 115000 bauds)
- BitJockey (Asynchronous receiver/transmitter for radio transceiver)
- 32 KHz Xtal oscillator
- Internal RC oscillator:
  100 kHz - 5 MHz; 2% software trimming
- Prescaler down to 1 Hz
- Up to 19 interrupt sources (8 external)
- Events management
- Analog switches matrix on 8 I/O pins
- Reset with input combination on I/O pins
- 4 stand alone timers which can cascade into divisions of two PWM, capture and compare
- Voltage Level Detection:
  programmable detection level
- 16 + 10 bits ADC:
  preamplification gain up to 1000
- 8 bits and 16 bits DACs:
  inclusive buffer for current or voltage output
- 120 segments (1-2-3-4 multiplex) LCD driver:
  LCD lines can be used as additional I/O

CPU:

The XE8000 series uses the CoolRISC® processor core that has a separate 22-bit instruction bus and 8-bit data bus. The reduced instruction set (35 generic instructions) includes efficient multiplication instructions (8x8 bits in one cycle). Its 3-stage pipeline allows execution of all instructions (including conditional branches, multiplication, multiple position shifts, and set/test bit) in one clock cycle.

Data can be accessed through 8 powerful addressing modes. Instructions are all on one single page (no need to swap pages).

CoolRISC® Instruction set:

All instructions execute in one clock cycle

JUMP, Jcondition, CALL, CALLS
RET, RETS, RETI
PUSH, POP, MOVE
CMVD, CMVS
SHL, SHLC, SHR, SHRC, SHRA
CPL1, CPL2, CPL2C
INC, INCC, DEC, DECC
AND, OR, XOR
ADD, ADDC, SUBD, SUBDC, SUBS, SUBSC
MUL, MULA, MSHL, MSHR, MSHRA
CMP, CMPA
TSTB, SETB, CLRB, INVB
SFLAG, RFLAG
FREQ
HALT
NOP

Low-power capabilities:

In addition to its extremely efficient CPU, the XE8000 includes many low-power modes. The resulting current consumption is proportional to the clock frequency of the CPU.

Speed related low-power modes:

The RC oscillator can be set to any frequency within the defined operating range. The current requirement of the XE8000 series will decrease based on the clock frequency decreasing. Minimal operating frequency is reached when using only the Xtal oscillator with 32 kHz.

Most analog blocks have a low-power mode: the ADC requires only 1/4 of its nominal current if used at 1/4 of its full speed.

Ecology related low-power modes:

Each block can be individually deactivated.
The CoolRISC core and its peripheral make extensive use of gated-clock technology, delivering clocks only to active blocks.
Deactivated blocks are not biased.

Voltage reduction:

The digital elements inside the XE8000 products are powered through a regulator. Therefore, a minimal constant current is delivered to the XE8000 even at maximum VDD voltage. A side advantage of the voltage regulator is that the maximal operation speed of the processor does not depend on the voltage supply. Therefore, the embedded software does not have to verify the voltage supply before going full speed.

Hibernating low-power mode:

The XE8000 can be completely halted. The oscillator and the Prescaler will still be running while in halt mode. In such a configuration, the CPU will awaken the XE8000 to perform housekeeping activities before going back to Halt mode.

Sleep mode:

When completely halted, and with disabled clocks, data remain kept in the static RAM as long as the power supply voltage is sufficient, with nearly no current required (idle current near to 0.1 uA at 27 °C). Any reset condition will wake up the CPU.

Events:

In addition to the interrupts, the XE8000 also manages events. The main advantage of the event over the interrupt is threefold:

- No stack-register saving is required
- No latency as to interrupt routine

Low-power RAM:

Additional 8 bytes of ultra low-power RAM have been added in the peripherals. When using this RAM instead of the regular RAM, circuit current consumption is even lower than the 300 uA/MIPS of the CPU using regular RAM.

Product card for XE8000 Microcontrollers Series:

	Supply voltage	Memory				Peripherals															Devices are available in lead free packages and in die
		Program (kB)	Program (kInstruction)	Data (B)	LP RAM (B)	RC programmable	Xtal 32 kHz	Max sustained speed (MIPS)	PIO	Voltage level det.	Watchdog	Prescaler	Serial interface	**BitJockey™**	Counters - Timers	PWM DAC	Dual Buffered DAC	LP Comparators	**ZoomingADC™**	ADC resolution	LCD drivers	
XE88LC01A	2.4 to 5.5	22	8	512	8	+	+	2	24	+	+	+	UA		4 CC	2			+	16+10		LQFP44
XE88LC02	1.2°/2.4 to 5.5	22/ 11°°	8/ 4°°	1024	8	+	+	7° 2.5/5°°	32 to 64	+	+	+	UAS		4 CC	2		4	+	16+10	120 seg	LQFP100
XE88LC05A	2.4 to 5.5	22	8	512	8	+	+	2	24	+	+	+	UA		4 CC	2	+		+	16+10		LQFP64
XE88LC06A	1.2°/2.4 to 5.5	22	8	512	8	+	+	7° 2.5	12 to 24	+	+	+	UA	+	4 CC	2		4				TQFP32
XE88LC07A	1.2°/2.4 to 5.5	11	4	512	8	+	+	5	12 to 24	+	+	+	UA	+	4 CC	2		4				TQFP32

BitJockey™: Asynchronous receiver/transmitter for radio transceivers, supporting NRZ, Manchester and Miller coding
CC: counters with Capture and Compare capabilities
Dual Buffered DACs: 8-bit and 16-bit DAC with amplifying buffers
LCD: Liquid Crystal Display
LP RAM: Low-Power RAM
ProgRC: oscillator can be programmed in narrow steps over a wide frequency range
PWM: pulse width modulation
UA: Universal Asynchronous Receiver Transmitter (UART)
UAS: Universal Asynchronous Receiver Transmitter (UART) and SPI interfaces
ZoomingADC™: 16+10 bit ADC with 0.5 - 1000 gain preamplification stage

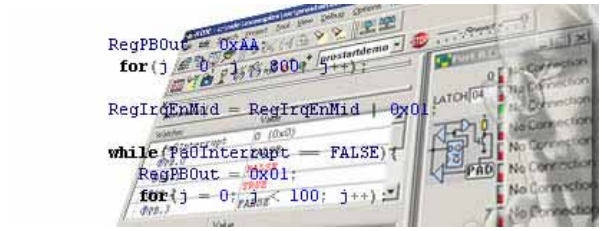
+: included

°: ROM version only
°°: 5 MIPS for 4 kInstructions mode

Development tools for XE8000 series:

Integrated Development Environment (RIDE)

RIDE IDE provides all the necessary software to develop applications on the XE8000 micro-controller based devices.



Assembler - Compiler

This powerful macro assembler supports the complete instruction set for the XE8000 series microcontroller family. The ANSI C compliant compiler integrates extended features to address the XE8000 core. It enables in-lining of assembler instructions.

Librarian

Allows you to build re-useable libraries of objects, functions and modules that can be linked with other applications.

Source Level Debugger and ROM monitoring

A symbolic debugger enables debugging of the application at the source code level. Trouble shooting can be conducted through the built-in simulator or with the ROM monitor that can be downloaded in the final application to set breakpoints and monitor registers during program execution for real world testing.

Different software packages available

RIDE is available in complete and demo versions. An extended version with code compressor is available from Raisonance. All share the same basic software, and upgrading from one package to another is made with a software key without the need to reinstall the environment.

ProStart

RIDE together with the multipurpose board and the corresponding evaluation board build a complete development kit.

In-Circuit-Emulator (PICE)

An ICE is available from Phyton. The ICE makes it possible to develop and debug the application by executing and tracing it in the final product conditions.

The ICE includes an IDE, a board with a bondout version of the MCU and an adapter to the real chip pin layout. The ICE has additional digital inputs and outputs to synchronize with other instruments.

Multipurpose board

The multipurpose board (XE8000MP) interfaces the MTP products with a host PC for development. It includes the programming algorithm, a power supply and level shifters for RS-232 communication.

Evaluation board

The product specific evaluation boards (XE8000EV1xx) include a zero-insertion force socket for the product sample.

All evaluation boards also include a battery socket for stand-alone operation, buttons and LEDs to activate and see the parallel ports' status, pins for direct connection to the chip pins, and 3 product samples. Some evaluation boards also include an EEPROM for local data storage, a free development area and an LCD driver.

The evaluation boards directly connect to the multipurpose board for chip programming and software debugging.

Programmer

XE8000 series devices are supported by the BPmicro BP1600 programmer.

Partners:

BPmicro : programmers
www.bpmicro.com

Phyton Inc. : development tools for XE8000: www.phyton.com

Raisonance : development environment for XE8000: www.raisonance.com