

XE88LC03

Ultra Low-Power Low-Voltage Microcontroller

General Description

The XE88LC03 is an ultra low-power low-voltage micro-controller unit (MCU) with extremely high efficiency, allowing for 1 MIPS at 300uA and 2.4 V, and 8 x 8 bits multiplying in one clock cycle at 1.2 V.

XE88LC03 is available with on chip ROM or Multiple-Time-Programmable (MTP) program memory.

Applications

- Portable, battery operated instruments
- RF system supervisor
- Remote control
- HVAC control

Key product Features

- Ultra low-power MCU
 - 300 uA at 1 MIPS operation
 - 6 uA at 32 kHz operation
 - 1 uA time keeping
- Low-voltage operation (1.2 - 5.5 V supply voltage)
- 22 kB (8 kW) ROM/MTP, 512 B RAM
- 4 counters
- PWM
- UART
- Analog matrix switching
- independant RC and crystal oscillators
- 5 reset, 15 interrupt, 8 event sources

Ordering Information

Samples available: Q1/00

Samples of the XX88LC05 are available now

Nomenclature: (**XX** identifies pre-production products)

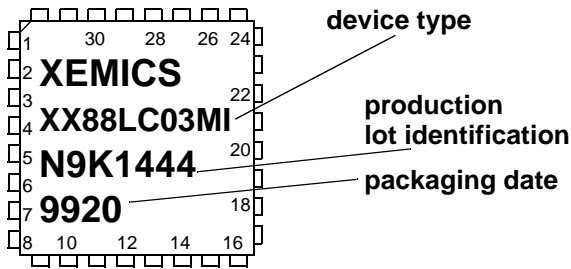
XE88LC03ME012

program memory	package:	015: SO28
R: ROM	temperature	026: TQFP32
M: MTP	I: -40 to 85 °C	
	E: -40 to 125 °C	

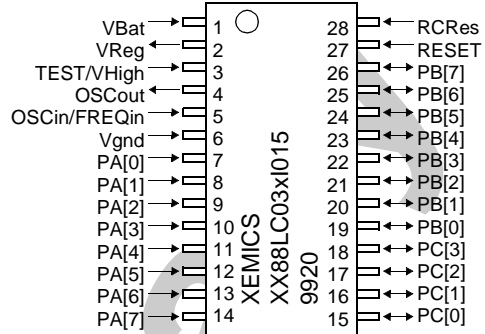
Low-Power Microcontroller

XX-XE88LC03

Detailed Pin Description



Pinout of the XX-XE88LC03 in TQFP32 package



Pinout of the XX-XE88LC03 in SOP28 package

Pin					Description
Position in SO28	Position in TQFP32	Function name	Second function name	Type	
1	13	Vbat		Power	Positive power supply
2	14	Vreg		Analog	Regulated supply
3	15	TEST/Vhigh	Vhigh	Special	Test mode/High voltage for MTP programming
4	16	OscOut	ptck	Analog/Input	Connection to Xtal/ Peripheral clock for test and MTP programming
5	17	OscIn	ck_cr	Analog/Input	Connection to Xtal/ CoolRISC clock for test and MTP programming
6	18	Vss		Power	Negative power supply, connected to substrate
7	19	PA(0)	testin	Input	Input of Port A/ Data input for test and MTP programming/ Counter A input
8	20	PA(1)	testck	Input	Input of Port A/ Data clock for test and MTP programming/ Counter B input
9	21	PA(2)		Input	Input of Port A/ Counter C input/ Counter capture input
10	22	PA(3)		Input	Input of Port A/ Counter D input/ Counter capture input
11	23	PA(4)		Input	Input of Port A
12	24	PA(5)		Input	Input of Port A
13	25	PA(6)		Input	Input of Port A
14	26	PA(7)		Input	Input of Port A
15	27	PC(0)		Input/Output	Input-Output of Port C
16	28	PC(1)		Input/Output	Input-Output of Port C
17	29	PC(2)		Input/Output	Input-Output of Port C
18	30	PC(3)		Input/Output	Input-Output of Port C
	31	PC(4)		Input/Output	Input-Output of Port C
	32	PC(5)		Input/Output	Input-Output of Port C
	1	PC(6)		Input/Output	Input-Output of Port C
	2	PC(7)		Input/Output	Input-Output of Port C
19	3	PB(0)	testout	Input/Output/Analog	Input-Output-Analog of Port B/ Data output for test and MTP programming/ PWM output
20	4	PB(1)		Input/Output/Analog	Input-Output-Analog of Port B/ PWM output

Pin-out of the XX-XE88LC03 in SO28, SO20 and TQFP32

Low-Power Microcontroller

XX-XE88LC03

Position in SO28	Position in TQFP32	Pin			Type	Description
		Function name	Second function name			
21	5	PB(2)			Input/Output/Analog	Input-Output-Analog of Port B
22	6	PB(3)	SOU		Input/Output/Analog	Input-Output-Analog of Port B, Output pin of USRT
23	7	PB(4)	SCL		Input/Output/Analog	Input-Output-Analog of Port B/ Clock pin of USRT
24	8	PB(5)	SIN		Input/Output/Analog	Input-Output-Analog of Port B/ Data input or input-output pin of USRT
25	9	PB(6)	Tx		Input/Output/Analog	Input-Output-Analog of Port B/ Emission pin of UART
26	10	PB(7)	Rx		Input/Output/Analog	Input-Output-Analog of Port B/ Reception pin of UART
27	11	RESET			Input	Reset pin (active high)
28	12	RRes			Analog	Optional external resistor for RC oscillator

Pin-out of the XX-XE88LC03 in SO28, SO20 and TQFP32

XE88LC03xl Electrical Characteristics

Operation conditions		min	typ	max	Unit	Remarks
Power supply		2.4		5.5	V	1
	CPU running at 1 MIPS			310	uA	1
Current requirement	CPU running at 32 kHz on Xtal, RC off			10	uA	1
	CPU halt, timer on Xtal, RC off			1	uA	1
	CPU halt, timer on Xtal, RC ready			1.7	uA	1
	CPU halt, Xtal off timer on RC at 100 kHz			1.4	uA	1
	Voltage level detection			15	uA	1
	MTP	Prog. voltage	10.3		10.8	V
Erase time			3	30	s	
Write/Erase cycles		10				2
Data retention		10			year	3

Current requirement of the XE88LC03

Note: 1) Power supply: 2.4 V - 5.5 V, at 27°C; min voltage of XX version may be higher, max frequency of XX version is 2 MHz

Note: 2) More cycles possible during development, with restraint retention

Note: 3) Temperature < 85°C

Low-Power Microcontroller

XX-XE88LC03

CPU

The XE88LC03 CPU is a low power RISC core. It has 16 internal registers for efficient implementation of the C compiler. Its instruction set is made of 35 generic instructions, all coded on 22 bits, with 8 addressing modes. All instructions are executed in one clock cycle, including conditional jumps and 8x8 multiplication, therefore the XE88LC03 runs at 1 MIPS on a 1 MHz clock.

A complete tool suite for development is available from XEMICS, including programmer, C-compiler, assembler, simulator, linker, all integrated in a modern and efficient graphical user interface.

NAME	Parameters	res	op1	op2	FUNCTION	MODIF.
JUMP	addr:16				PC0 <- addr	
	ip				PC0 <- ip	
Jcc	addr:16				if cc then PC0 <- addr	
	ip				if cc then PC0 <- ip	
CALL	addr:16				PCn <- PCn-1 (n>1), PC1 <- PC0+1, PC0 <- addr	- , - , - , -
	ip				PCn <- PCn-1 (n>1), PC1 <- PC0+1, PC0 <- ip	
CALLS	addr:16				ip <- PC0+1, PC0 <- addr:16	
	ip				ip <- PC0+1, PC0 <- ip	
RET					PCn-1 (n>0) <- PCn	
RETS					PC0 <- ip	
RETI					PCn-1 (n>0) <- PCn, GIE <- 1	- , - , - , -
PUSH					PCn <- PCn-1 (n>1), PC1 <- ip, PC0 <- PC0+1	
POP					ip <- PC1, PCn-1 (n>1) <- PCn, PC0 <- PC0+1	
MOVE	reg, data:8	reg	data		res <- op1	- , - , Z , a
	reg1, reg2	reg1	reg2			
	reg, eaddr	reg	eaddr			
	eaddr, reg	eaddr	reg			
	addr:8, data:8	addr	data			- , - , - , -
CMVD	reg1, reg2	reg1	reg2		if C=0 then res <- op1	- , - , Z , a
CMVS	reg, eaddr	reg	eaddr		if C=1 then res <- op1	
SHL	reg1, reg2	reg1	reg2		res(bitn) <- op1(bitn-1) (0<n<8), res(0) <- 0, C <- op1(7)	C , V , Z , a
	reg, eaddr	reg	eaddr			
SHLC	reg1, reg2	reg1	reg2		res(bitn) <- op1(bitn-1) (0<n<8), res(0) <- C, C <- op1(7)	C , V , Z , a
	reg, eaddr	reg	eaddr			
SHR	reg1, reg2	reg1	reg2		res(bitn-1) <- op1(bitn) (0<n<8), res(7) <- 0, C <- op1(0)	C , V , Z , a
	reg, eaddr	reg	eaddr			
SHRC	reg1, reg2	reg1	reg2		res(bitn-1) <- op1(bitn) (0<n<8), res(7) <- C, C <- op1(0)	C , V , Z , a
	reg, eaddr	reg	eaddr			
SHRA	reg1, reg2	reg1	reg2		res(bitn-1) <- op1(bitn) (0<n<8), res(7) <- op1(7), C <- op1(0)	C , V , Z , a
	reg, eaddr	reg	eaddr			
CPL1	reg	reg	reg		res <- NOT (op1)	- , - , Z , a
	reg, eaddr	reg	eaddr			
CPL2	reg1, reg2	reg1	reg2		res <- NOT (op1) +1, if op1 = 0 then C = 1	C , V , Z , a
	reg, eaddr	reg	eaddr			
CPL2C	reg1, reg2	reg1	reg2		res <- NOT (op1) +C, if op1 = 0 then C = 1	C , V , Z , a
	reg, eaddr	reg	eaddr			

Table 1.2: XE8000 Instruction Set

Low-Power Microcontroller

XX-XE88LC03

NAME	Parameters	res	op1	op2	FUNCTION	MODIF.
INC	reg1, reg2	reg1	reg2		res <- op1 + 1, if overflow then C = 1	C, V, Z, a
	reg	reg	reg			
	reg, eaddr	reg	eaddr			
INCC	reg1, reg2	reg1	reg2		res <- op1 + C, if overflow then C = 1	C, V, Z, a
	reg	reg	reg			
	reg, eaddr	reg	eaddr			
DEC	reg1, reg2	reg1	reg2		res <- op1 - 1, if underflow then C = 0	C, V, Z, a
	reg	reg	reg			
	reg, eaddr	reg	eaddr			
DECC	reg1, reg2	reg1	reg2		res <- op1 -(1 - C), if underflow then C = 0	C, V, Z, a
	reg	reg	reg			
	reg, eaddr	reg	eaddr			
AND	reg, data:8	reg	reg	data	res <- op1 AND op2	-, -, Z, a
	reg1, reg2, reg3	reg1	reg2	reg3		
	reg1, reg2	reg1	reg2	reg1		
	reg	reg	reg	eaddr		
OR	reg, data:8	reg	reg	data	res <- op1 OR op2	-, -, Z, a
	reg1, reg2, reg3	reg1	reg2	reg3		
	reg1, reg2	reg1	reg2	reg1		
	reg	reg	reg	eaddr		
XOR	reg, data:8	reg	reg	data	res <- op1 XOR op2	-, -, Z, a
	reg1, reg2, reg3	reg1	reg2	reg3		
	reg1, reg2	reg1	reg2	reg1		
	reg	reg	reg	eaddr		
ADD	reg, data:8	reg	reg	data	res <- op1 + op2, if overflow then C=1	C, V, Z, a
	reg1, reg2, reg3	reg1	reg2	reg3		
	reg1, reg2	reg1	reg2	reg1		
	reg	reg	reg	eaddr		
ADDC	reg, data:8	reg	reg	data	res <- op1 + op2 + C, if overflow then C=1	C, V, Z, a
	reg1, reg2, reg3	reg1	reg2	reg3		
	reg1, reg2	reg1	reg2	reg1		
	reg	reg	reg	eaddr		
SUBD	reg, data:8	reg	reg	data	res <- op1 - op2, if underflow then C=0	C, V, Z, a
	reg1, reg2, reg3	reg1	reg2	reg3		
	reg1, reg2	reg1	reg2	reg1		
	reg	reg	reg	eaddr		
SUBDC	reg, data:8	reg	reg	data	res <- op1 - op2 - (1-C), if underflow then C=0	C, V, Z, a
	reg1, reg2, reg3	reg1	reg2	reg3		
	reg1, reg2	reg1	reg2	reg1		
	reg	reg	reg	eaddr		
SUBS	reg, data:8	reg	reg	data	res <- op2 - op1, if underflow then C=0	C, V, Z, a
	reg1, reg2, reg3	reg1	reg2	reg3		
	reg1, reg2	reg1	reg2	reg1		
	reg	reg	reg	eaddr		
SUBSC	reg, data:8	reg	reg	data	res <- op2 - op1 - (1-C), if underflow then C=0	C, V, Z, a
	reg1, reg2, reg3	reg1	reg2	reg3		
	reg1, reg2	reg1	reg2	reg1		
	reg	reg	reg	eaddr		
MUL	reg, data:8	reg	reg	data	res <- op1 * op2 (15:8), a <- op1 * op2 (7:0), unsigned	-, -, -, a
	reg1, reg2, reg3	reg1	reg2	reg3		
	reg1, reg2	reg1	reg2	reg1		
	reg	reg	reg	eaddr		
MULA	reg, data:8	reg	reg	data	res <- op1 * op2 (15:8), a <- op1 * op2 (7:0), signed (2 complement)	-, -, -, a
	reg1, reg2, reg3	reg1	reg2	reg3		
	reg1, reg2	reg1	reg2	reg1		
	reg	reg	reg	eaddr		
MSHL	reg, shift:3				a(bitn) <- reg(bitn-shift) for (bitn >= shift), reg(bitn) <- reg (bitn+8-shift) for (bitn < shift)	-, -, -, a

Table 1.2: XE8000 Instruction Set

Low-Power Microcontroller

XX-XE88LC03

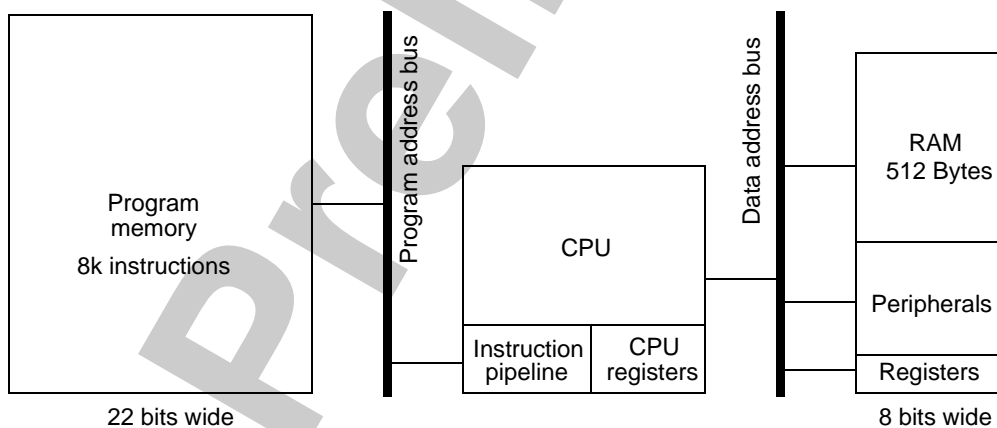
NAME	Parameters	res	op1	op2	FUNCTION	MODIF.
MSHR	reg, shift:3				reg(bitn) <- reg(bitn+shift) for (bitn + shift < 8), a(bitn) <- reg (bitn-8+shift) for (bitn + shift >= 8)	r, r, r, a
MSHRA	reg, shift:3				a <- SHRA(shift,reg), a <- SHL(8-shift,reg), SHRA propagates sign, do not use with shift=0x01	r, r, r, a
CMP	reg, data:8		reg	data	if op2 > op1 then C <- 0, V = C AND NOT(Z), unsigned	C, V, Z, a
	reg1, reg2		reg1	reg2		
	reg, eaddr		reg	eaddr		
CMPA	reg, data:8		reg	data	if op2 > op1 then C <- 0, V = C AND NOT(Z), signed	C, V, Z, a
	reg1, reg2		reg1	reg2		
	reg, eaddr		reg	eaddr		
TSTB	reg, bit:3				Z <- NOT(reg(bit))	r, r, Z, a
SETB	reg, bit:3				reg(bit) <- 1	r, r, Z, a
CLRB	reg, bit:3				reg(bit) <- 0	r, r, Z, a
INVB	reg, bit:3				reg(bit) <- NOT(reg(bit))	r, r, Z, a
SFLAG					a(7) <- C, a(6) <- C XOR V	r, r, r, a
RFLAG	reg		reg		flags <- op1, SHL op1, SHL a	C, V, Z, a
	eaddr		eaddr			
FREQ	divn:4				set cpu frequency divider	r, r, r, -
HALT					stops CPU	r, r, r, -
NOP					no operation	r, r, r, -
PMD	s:1				if s=1 then starts program dump, if s=0 stops program dump	r, r, r, -

Table 1.2: XE8000 Instruction Set

Memory organisation

The CPU uses a Harvard architecture, so that memory is organised in two separated fields: program memory and data memory. As both memory are separated, the central processing unit can read/write data at the same time it loads an instruction. Peripherals and system control registers are mapped on data memory space.

Program memory is made in one page. Data is made of several 256 bytes pages.



Memory organization

Low-Power Microcontroller

XX-XE88LC03

Program memory

The program memory is implemented as Multiple Time Programmable (MTP) Flash memory or Read-Only Memory (ROM).

The power consumption of MTP and ROM is linear with the access frequency (no static current).
Memory sizes:

- Flash MTP: 8192 x 22 bits (= 22 kBytes)
- ROM: 8192 x 22 bits (= 22 kBytes)

block	size	address
ROM/MTP	8192 x 22	H0000 - H1FFF

Program addresses

Data memory

The data memory is implemented as static Random-Access Memory (RAM). The size is 512 x 8 bits plus 8 low power RAM bytes that require very low current when addressed, programs using this low power RAM instead of regular RAM will spare even more current.

Note: The registers in Data memory are not related to the CPU registers.

block	size	address
LP RAM	8 x 8	H0000 - H0007
RAM	512 x 8	H0080 - H027F

RAM addresses

Low-Power Microcontroller

XX-XE88LC03

Peripherals mapping

block	size	address	Page	
LP RAM	8x8	H0000-H0007	Page 0	
System control	16x8	H0010-H001F		
Port A	8x8	H0020-H0027		
Port B	8x8	H0028-H002F		
Port C	4x8	H0030-H0033		
Port D	4x8	H0034-H0037		
MTP	4x8	H0038-H003B		
Event	4x8	H003C-H003F		
Interrupts control	8x8	H0040-H0047		
reserved	8x8	H0048-H004F		
UART	8x8	H0050-H0057		
Counters	8x8	H0058-H005F		
reserved	8x8	H0060-H0067		
reserved	12x8	H0068-H0073		
reserved	8x8	H0074-H007B		
Other (VLD)	4x8	H007C-H007F		
RAM1	128x8	H0080 - H00FF		Page 1
RAM2	256x8	H0100 - H01FF		Page 2
RAM3	128x8	H0200 - H027F		

Peripherals addresses

Peripherals

The XE88LC03 includes usual microcontroller peripherals and some other blocks more specific to low-voltage or mixed-signal operation. They are 3 parallel ports, one input port (A), one IO and analog port (B) with analog switching capabilities and one general purpose IO port (C). A watchdog is available, connected to a prescaler. Four 8-bit counters, with capture, PWM and chaining capabilities are available. The UART can handle transmission speeds as high as 38kbaud.

Low-power low-voltage blocks include a voltage level detector, two oscillators (one internal 0.1-4 MHz RC oscillator and a 32 kHz crystal oscillator) and a specific regulation scheme that largely uncouples current requirement from external power supply (usual CMOS ASICs require much more current at 5.5 V than they need at 2.4 V. This is not the case for the XE88LC03).

Low-Power Microcontroller

XX-XE88LC03

XE8000 Family

Features

The main characteristics of the XE8000 MCU family is

- Ultra low power operation
- Low voltage operation (1.2 V for the XE88LC04, XE88LC06 and XE88LC07, 2.4 V for the others)
- High efficiency CPU
 - 1 instruction per clock cycle, for all instructions
 - 22 bits wide instructions
 - Integrated 8x8 -> 16 bits multiplier
 - All instructions on one page
 - 8 bits data bus
 - 8 addressing modes
- MTP (multiple time programmable) memory available
- Dual clock (X-tal and/or RC)
- Each peripheral can be set on/off individually for minimal power consumption
- UART
- Watch dog
- 4x8 bits timers with PWM ability
- Advanced acquisition path
 - Fully differential analog signal path on signal and reference
 - 4x2 or 7x1 + 1 signal input
 - 2x2 reference input
 - 0.5 - 1000 programmable gain amplifier
 - Offset programmed over +- 10 full scale
 - 5 - 16 bits resolution ADC
 - Low speed modes with reduced bias current for minimal power consumption
- Bias and signal DACs for resistive bridge sensing and analog output
- Complete development tools using Windows95 or NT graphical interface
 - Assembler
 - ANSI-C compiler
 - Source level debugger
 - Current and memory usage monitoring (Profiler)
 - CPU Simulator
 - CPU Emulator XE8000HaCE
 - Programmer and starter kit (XE88LC01ProStart)
 - Hardware emulators (works with XE8000HaCE, in preparation)

Family

The XE8000 Family ultra low-power microcontroller is made of several members, all using the same microprocessor core and differing by the peripherals available.

The XE88LC01 is a low power sensing microcontroller, based on the XE88LC03, with an advanced acquisition path including differential programmable gain amplifiers and a high resolution analog to digital converter. Its main applications are dataloggers and process control.

The XE88LC02 is a low power sensing microcontroller, based on the XE88LC06 with the analog part of the XE88LC01, with an additional LCD driver. Its main applications are metering and dataloggers.

The XE88LC03 is a low power, low voltage, general purpose microcontroller. Its main points are the very efficient CoolRISC core, the low voltage function and the real time clock. Its main applications are low voltage control and supervision.

Low-Power Microcontroller

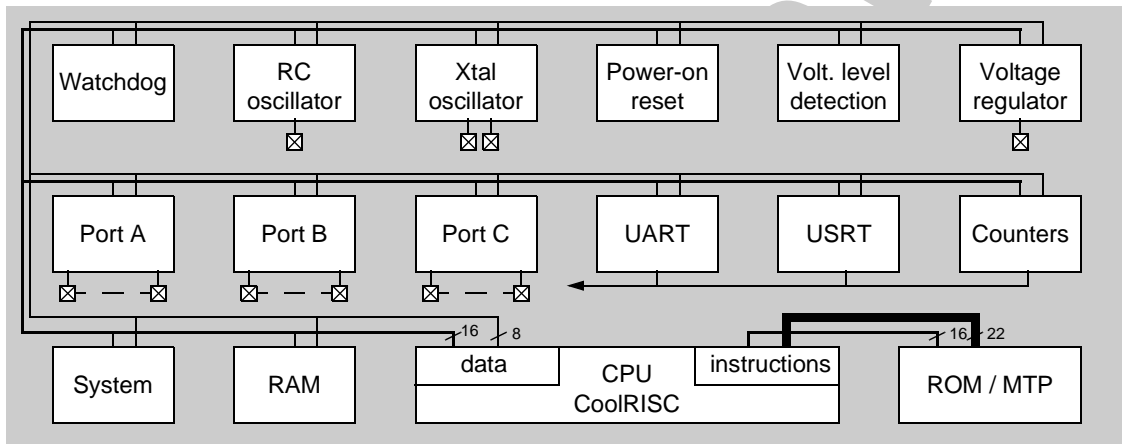
XX-XE88LC03

The XE88LC04 is a low power, low voltage, general purpose microcontroller, based on the XE88LC06, with an additional LCD driver. Its main points are the very efficient CoolRISC core, the low voltage function and the real time clock. Its main applications are low voltage control and supervision.

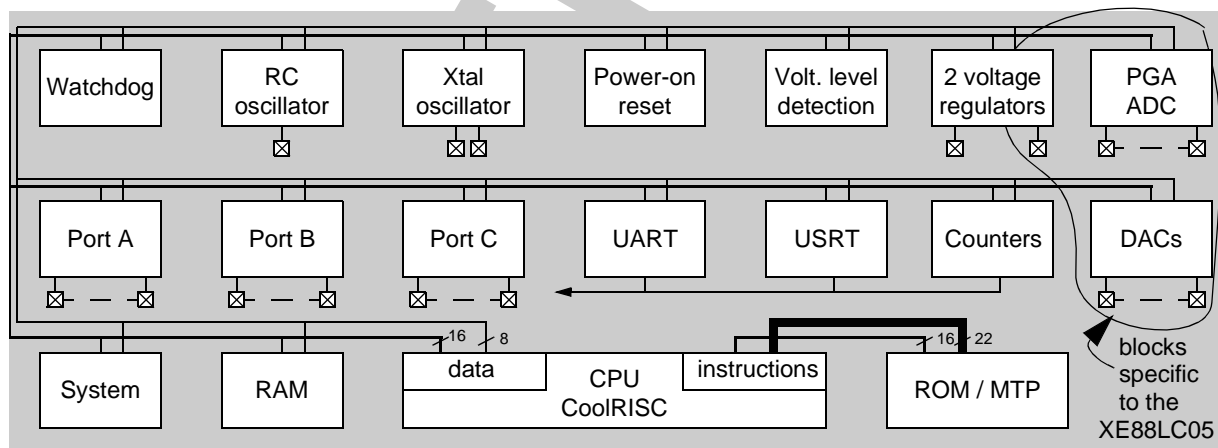
The XE88LC05 is a low power sensing microcontroller, based on the XE88LC01, with analog outputs. Its main applications are piezoresistive sensors and 4 - 20 mA loops systems.

The XE88LC06 is an improved XE88LC03, with 4 low power analog comparators. Its main applications are low voltage control and supervision.

The XE88LC07 is a smaller and even lower power microcontroller, based on the XE88LC06, with less memory.



XE88LC03 block schematics



XE88LC05 block schematics.

	XE88LC01	XE88LC02	XE88LC03	XE88LC04	XE88LC05	XE88LC06	XE88LC07
Supply voltage	2.7 - 5.5 V	2.4 - 5.5 V	2.7 - 5.5 V	1.2 - 5.5 V for ROM 2.4 - 5.5 V for MTP	2.7 - 5.5 V	1.2 - 5.5 V for ROM 2.4 - 5.5 V for MTP	1.2 - 5.5 V for ROM 2.4 - 5.5 V for MTP

Table 1.3: List of the XE8000 family members functions

Low-Power Microcontroller

XX-XE88LC03

	XE88LC01	XE88LC02	XE88LC03	XE88LC04	XE88LC05	XE88LC06	XE88LC07
Max speed	2 MIPS	4 MIPS	2 MIPS	4 MIPS at 2.4 V	2 MIPS	4 MIPS at 2.4 V	4 MIPS at 2.4 V
Operating temperature	-40 - 85 °C -40 - 125 °C	-40 - 85 °C -40 - 125 °C	-40 - 85 °C	-40 - 85 °C	-40 - 85 °C -40 - 125 °C	-40 - 85 °C -40 - 125 °C	-40 - 85 °C -40 - 125 °C
CPU	CoolRISC 816, 22 bits instructions 8 bits data HW multiplier	CoolRISC 816, 22 bits instructions 8 bits data HW multiplier	CoolRISC 816, 22 bits instructions 8 bits data HW multiplier	CoolRISC 816, 22 bits instructions 8 bits data HW multiplier	CoolRISC 816, 22 bits instructions 8 bits data HW multiplier	CoolRISC 816, 22 bits instructions 8 bits data HW multiplier	CoolRISC 816, 22 bits instructions 8 bits data HW multiplier
Program memory	8k Instructions = 22 kB ROM or MTP	8k Instruction = 22 kB ROM or MTP	8k Instructions = 22 kB ROM or MTP	8k Instructions = 22 kB ROM or MTP	8k Instructions = 22 kB ROM or MTP	8k Instructions = 22 kB ROM or MTP	2k Instructions = 5.5 kB ROM or MTP
Data memory	512 Bytes	512 Bytes	512 Bytes	512 Bytes	512 Bytes	512 Bytes	128 Bytes
Port A	8 input and external interrupt	8 input and external interrupt	8 input and external interrupt	8 input and external interrupt	8 input and external interrupt	8 input and external interrupt	0-4 input and external interrupt
Port B	8 input/output and analog	8 input/output and analog	8 input/output and analog	8 input/output and analog	8 input/output and analog	8 input/output and analog	8 input/output and analog
Port C	8 input/output	8 input/output	4 to 8 input/output	4 to 8 input/output	8 input/output	8 input/output	
Watchdog timer	yes	yes	yes	yes	yes	yes	yes
General purpose timers with PWM	4 x 8 bits	4 x 8 bits	4 x 8 bits	4 x 8 bits	4 x 8 bits	4 x 8 bits	4 x 8 bits
UART	yes	yes	yes	yes	yes	yes	yes
2-3 wires serial interface	transition detection + software	transition detection + software	transition detection + software	transition detection + software	transition detection + software	transition detection + software	transition detection + software
Voltage level detector	yes	yes	yes	yes	yes	yes	yes
Oscillators	32 kHz quartz, internal RC	32 kHz quartz, internal RC	32 kHz quartz, internal RC	32 kHz quartz, internal RC	32 kHz quartz, internal RC	32 kHz quartz, internal RC	32 kHz quartz, internal RC
LCD drivers		yes		yes			
Analog mux	Port B and 4x2 or 7x1+1	Port B and 4x2 or 7x1+1	Port B	Port B	Port B and 4x2 or 7x1+1	Port B	Port B
LP comparators		4		4		4	4
PGA	gain 0.5 - 1000	gain 0.5 - 1000			gain 0.5 - 1000		
ADC	5 - 16 bits resolution	5 - 16 bits resolution			5 - 16 bits resolution		
DAC	PWM	PWM	PWM	PWM	PWM in timers 8 bit bias DAC, 4 - 16 bits signal DAC	PWM	PWM
Package	TQFP44, die		SO28, TQFP32, die		TQFP64, die	SO28, TQFP32, die	SO16, SO20, die
Availability	Q2/00	samples Q1/01	Q2/00 LC06 is a better choice for new designs	samples Q1/01	yes	samples Q3/00	

Table 1.3: List of the XE8000 family members functions

Contacting XEMICS

You can contact XEMICS at
 XEMICS SA
 Tel: +41 32 720 5170
 Fax: +41 32 720 5770
 E-mail: info@xemics.ch

You will find more information about the XE88LC03 and other XEMICS products, as well as addresses of our representatives and distributors for your region on www.xemics.ch.

Low-Power Microcontroller

XX-XE88LC03

Preliminary

Copyright XEMICS

All rights are reserved. Reproduction whole or in part is prohibited without the prior written consent of the copyright owner. The information presented in this document does not form part of any quotation or contract, is believed to be accurate and reliable and may be changed without notice. No liability will be accepted by the publisher for any consequence of its use. Publication thereof does not convey nor imply any license under patent- or other industrial or intellectual property rights. Printed in Switzerland.

SUNSTAR 商斯达实业集团是集研发、生产、工程、销售、代理经销、技术咨询、信息服务等为一体的高科技企业，是专业高科技电子产品生产厂家，是具有 10 多年历史的专业电子元器件供应商，是中国最早和最大的仓储式连锁规模经营大型综合电子零部件代理分销商之一，是一家专业代理和分销世界各大品牌 IC 芯片和电子元器件的连锁经营综合性国际公司，专业经营进口、国产名厂名牌电子元件，型号、种类齐全。在香港、北京、深圳、上海、西安、成都等全国主要电子市场设有直属分公司和产品展示展销窗口门市部专卖店及代理分销商，已在全国范围内建成强大统一的供货和代理分销网络。我们专业代理经销、开发生产电子元器件、集成电路、传感器、微波光电元器件、工控机/DOC/DOM 电子盘、专用电路、单片机开发、MCU/DSP/ARM/FPGA 软件硬件、二极管、三极管、模块等，是您可靠的一站式现货配套供应商、方案提供商、部件功能模块开发配套商。商斯达实业公司拥有庞大的资料库，有数位毕业于著名高校——有中国电子工业摇篮之称的西安电子科技大学（西军电）并长期从事国防尖端科技研究的高级工程师为您精挑细选、量身订做各种高科技电子元器件，并解决各种技术问题。

微波光电部专业代理经销高频、微波、光纤、光电元器件、组件、部件、模块、整机；电磁兼容元器件、材料、设备；微波 CAD、EDA 软件、开发测试仿真工具；微波、光纤仪器仪表。欢迎国外高科技微波、光纤厂商将优秀产品介绍到中国、共同开拓市场。长期大量现货专业批发高频、微波、卫星、光纤、电视、CATV 器件：晶振、VCO、连接器、PIN 开关、变容二极管、开关二极管、低噪晶体管、功率电阻及电容、放大器、功率管、MMIC、混频器、耦合器、功分器、振荡器、合成器、衰减器、滤波器、隔离器、环行器、移相器、调制解调器；光电子器件和组件：红外发射管、红外接收管、光电开关、光敏管、发光二极管和发光二极管组件、半导体激光二极管和激光器组件、光电探测器和光接收组件、光发射接收模块、光纤激光器和光放大器、光调制器、光开关、DWDM 用光发射和接收器件、用户接入系统光收发器件与模块、光纤连接器、光纤跳线/尾纤、光衰减器、光纤适配器、光隔离器、光耦合器、光环行器、光复用器/转换器；无线收发芯片和模组、蓝牙芯片和模组。

更多产品请看本公司产品专用销售网站：

商斯达微波光电产品网：[HTTP://www.rfoe.net/](http://www.rfoe.net/)

商斯达中国传感器科技信息网：<http://www.sensor-ic.com/>

商斯达工控安防网：<http://www.pc-ps.net/>

商斯达电子元器件网：<http://www.sunstare.com/>

商斯达消费电子产品网：<http://www.icasic.com/>

商斯达实业科技产品网：<http://www.sunstars.cn/> 射频微波光电元器件销售热线：

地址：深圳市福田区福华路福庆街鸿图大厦 1602 室

电话：0755-83396822 83397033 83398585 82884100

传真：0755-83376182 (0) 13823648918 MSN: SUNS8888@hotmail.com

邮编：518033 E-mail:szss20@163.com QQ: 195847376

深圳赛格展销部：深圳华强北路赛格电子市场 2583 号 电话：0755-83665529 25059422

技术支持：0755-83394033 13501568376

欢迎索取免费详细资料、设计指南和光盘；产品凡多，未能尽录，欢迎来电查询。

北京分公司：北京海淀区知春路 132 号中发电子大厦 3097 号

TEL: 010-81159046 82615020 13501189838 FAX: 010-62543996

上海分公司：上海市北京东路 668 号上海赛格电子市场 D125 号

TEL: 021-28311762 56703037 13701955389 FAX: 021-56703037

西安分公司：西安高新开发区 20 所(中国电子科技集团导航技术研究所)

西安劳动南路 88 号电子商城二楼 D23 号

TEL: 029-81022619 13072977981 FAX:029-88789382