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ConnectCore XP 270
Hardware Reference

Seamless migration to total integration.

Making
DEVICE NETWORKING *easy* ™

ConnectCore™ XP 270 Hardware Reference

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Using This Guide

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Review this section for basic information about the guide you are using, as well as general support and contact information.

About this guide

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This guide provides information about the Digi ConnectCore XP 270, a fully integrated system-on-chip solution on a 67.6 x 36.7mm card.

The ConnectCore XP 270 module is built on the Intel XScale processor PXA270, flash and SDRAM memory, and the SMSC LAN91C111 Ethernet controller.

What's in this guide

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This table shows where you can find specific information in this guide.

To read about	See
ConnectCore XP 270 module	Chapter 1, "About the Module"
ConnectCore XP development board	Chapter 2, "About the Development Board"
Customizing the ConnectCore XP 270	Chapter 3, "ConnectCore XP 270 Customization"

To read about	See
Module specifications	Appendix A, "ConnectCore XP 270 Module Specifications
Using the JTAG-Booster	Appendix B, "JTAG -Booster for Intel XScale PXA270"

Conventions used in this guide

This table describes the typographic conventions used in this guide:

This convention	Is used for
italic type	Emphasis, new terms, variables, and document titles.
`monospaced type`	Filenames, pathnames, and code examples.

Related documentation

- Intel® PXA27x Processor Family
  Developer's Manual
  October 2004
  Order Number: 280000-002

Documentation updates

Digi occasionally provides documentation updates on the Web site (www.digi.com/support).

Be aware that if you see differences between the documentation you received in your package and the documentation on the Web site, the Web site content is the latest version.

Customer support

To get help with a question or technical problem with this product, or to make comments and recommendations about our products or documentation, use the contact information listed in this table:

For	Contact information
Technical support	United States: +1 877 912-3444 Other locations: +1 952 912-3444 www.digi.com/support www.digi.com

About the Module

The ConnectCore XP 270 module is a fully integrated system-on-chip solution on a 67.6 x 36.7mm card — a system built on Intel XScale processor PXA270, flash and SDRAM memory, and the SMSC LAN91C111 Ethernet controller.

Intel XScale PXA270

Features

- Intel XScale Technology highly scalable core from 104 MHz up to 520 MHz
- Little Endian operation
- Embedded Packaging: 23 x 23 mm with 1.0 mm ball pitch
- Enhanced LCD Controller
- Large Peripheral Set:
    - USB Host / Client
    - USB OTG
    - PCMCIA / Compact Flash
    - IrDA
    - I²C
    - AC97 Controller
    - Full Function UART
    - Bluetooth UART
    - LCD controller
    - SSP and NSSP Serial ports

Intel XScale PXA270 processor block diagram
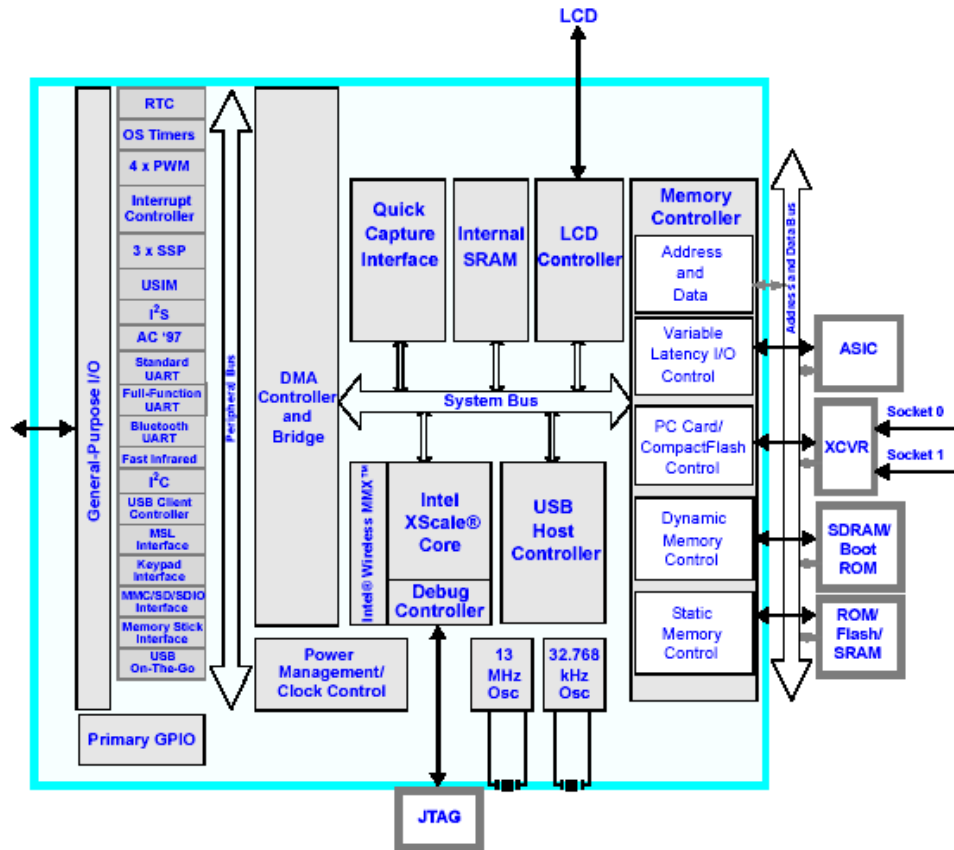
ConnectCore XP 270 module

Features

- 32-bit Intel XScale PXA270 processor
- 64 Mbytes SDRAM memory (32-bit@100 MHz)
- 32 Mbytes Flash memory (32-bit)

- 1 Full Function UART, 1 Bluetooth UART, 1 IrDA, 1 NSSP, 1 SSP serial port
- I²C Bus
- USB Host and/or USB Device
- GPIOs and Interrupt signals
- PCMCIA / Compact Flash interface
- Multimedia Card/SD/SDIO Controller
- LCD controller
- 10/100 Mbit/s Ethernet connection (through the SMSC chip LAN91C111)
- 1-wire EEPROM DS2431
- AC'97 interface
- PWM
- DMA request pins
- Complete external 32-bit interface available
- Reset circuitry
- Single +3.3V Power Supply
- Integrated Power I2C interface
- PMIC – Power Management IC supporting PXA270 DVM (Dynamic Voltage Management)
- JTAG interface

ConnectCore XP 270 module
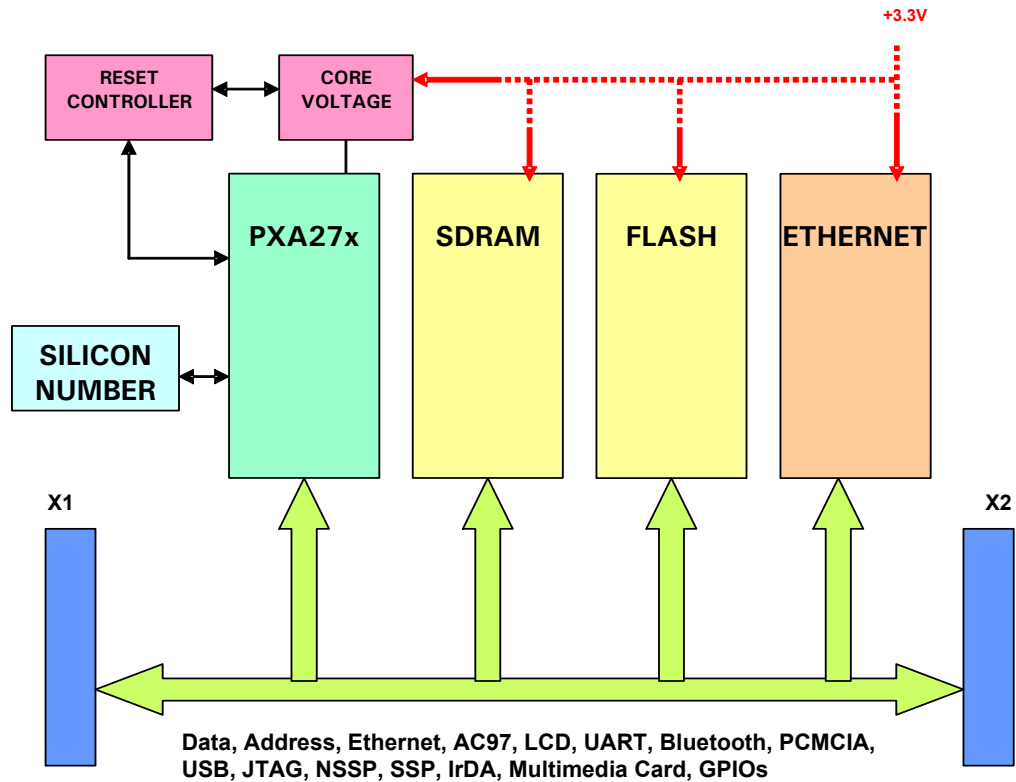
Using the ConnectCore XP 270 chip select

Chip Select	Use
CS0#	Flash memory
CS1#	Ethernet Controller – SMSC LAN91C111
CS2#	Free for external use
CS3#	Free for external use
CS4#	Free for external use
CS5#	Free for external use

Reset Logic

The Connect Core XP 270 module has two reset signals:

- RESET_IN#
- RESET_OUT#

Both signals are low-active. If RESET_IN# is activated outside the module (through reset controller or reset button), the signal is first debounced by the on-board reset circuitry (MAXIM MAX6390XS29D4 chip) and a reset signal is transmitted to the PXA270 processor. The reset input of the PXA270 can also be activated by a power-on sequence.

Once the processor receives the reset input signal, it resets its internal peripherals and a processor specific output reset signal — RESET_OUT# — becomes active. This signal is available on ConnectCore XP 270 connectors.

On-board flash memories receive the reset signal through the RESET_IN# pin and the Ethernet controller receives the reset signal through the RESET_OUT# signal.

Intel PXA270 power-on sequence timing is fully respected on the ConnectCore XP 270 module — no special care has to be taken outside the module. For more information about power on timing, see "Intel PXA270 Processor Electrical, Mechanical and Thermal Specification – Order Number 280002-004 p.64."

Watchdog

The Intel XScale PXA270 processor comes with a watchdog unit. The processor's OSCR0 register can be programmed to generate a watchdog-reset signal. When the OWER[WME] field is set, the OSCR0 register is compared to the OSMR3 register every rising edge of the internal-made 3.25MHz clock.

If a match is detected, the OS timer asserts the internal WDOG_RST pin, which asserts the RESET_OUT# pin. A reset is applied to the PXA270 processor and most internal states are cleared.

Once enabled, the watchdog function can be disabled only by one of the reset functions (hardware reset, watchdog reset, or GPIO reset). Writing a zero to the Watchdog Match Enable bit after it has been set has no effect.

For more information about the watchdog unit, see the "Intel PXA27x Processor Family Developer's Manual – Order Number: 280000-002".

Clock signals

The processor needs two clock signals:

- The 13-MHz processor oscillator provides the primary clock source for the PXA270 processor. The on-chip PLL frequency multipliers and several peripheral modules use the processor oscillator as a reference. If the application has not enabled the 32.768-kHz timekeeping oscillator, the processor oscillator also drives the real-time clock (RTC) and power manager.

- The 32.768-kHz timekeeping oscillator is a low-power, low-frequency oscillator that clocks the real-time clock (RTC) and power manager.

Both clock sources are used and implemented on the ConnectCore XP 270 module.

Flash memory

The ConnectCore XP 270 module support two Intel StrataFlash Flash Memory chips. Each chip is 16-bit wide, making a whole 32-bit Flash Memory area. All accesses to the flash memory are made with 32-bit words.

The Flash Memory chips are controlled by CS0#, so the module can support a maximum of 64MB of memory. Flash Memory chips have an initial access speed of 120ns and a block sector size of 64-Kword (= 128-Kbyte).

The Flash Memories reset signal is connected to the RESET_IN# input signal. With this choice, Flash Memories aren't reset for software reset events such as sleep mode, watchdog reset, and GPIO reset.

SDRAM memory

Intel PXA270 processor supports a SDRAM interface at a maximum frequency of 104 MHz. On the ConnectCore XP 270 module, two SDRAM memory chips have been connected to the processor SDRAM partition 0 (controlled by SDCS0# signal).

There are two possible considerations regarding the size of SDRAM partition on a PXA270-based product:

- Use a normal 256-Mbyte memory map; in this case, the SDRAM partition is 64-Mbyte wide.

- Use a large 1-Gbyte memory map; in this case, the SDRAM partition is 256-Mbyte wide. This memory map allows the possibility of connecting to bigger SDRAM chips.

Note: As far as SDRAM signals available on ConnectCore XP 270 module connectors, the signals are available as references only. The module has not been adapted to support SDRAM memory outside the module, nor "length-adapted" to support PXA270 SDRAM timing.

Power Management Chip for PXA270 processor

The ConnectCore XP 270 module comes with an integrated chip that manages Intel XScale PXA270 voltages and can implement some minor power management functions. The chip is a versatile power management IC designed especially for the XScale type of processors. The chip contain three regulators, which share a common enable pin. When disabled using the enable pin, the chip enters a low-power state.

To assure stability and minimize overshoot at start-up and during DVM transitions, Power Management IC implements a controlled rise time of each regulator output.

This is a short list of available features implemented by the PMIC (Power Management Integrated Circuit):

- Three voltage regulators (1 Buck for core voltage, 2 LDOs for SRAM, and PLL voltage)
- Full-integrated synchronous buck regulator with DVM (Dynamic Voltage Management) — 800mA DC output current
- I^2C interface module for DVM from 0.58V to 1.6V
- Battery fault signal
- Input supply voltage range: 2.76V – 5.5V
- 4x4 mm QFN package

Note: The power management chip doesn't control all the XScale PXA270 voltages. The other voltages (VCC_LCD, VCC_MEM, VCC_IO, VCC_BB, VCC_USB) are controlled directly by a MOS switch from main +3.3 Vdc power supply.

Ethernet Controller

The ConnectCore XP 270 module provides an Ethernet connection (Link + PHY Layer) directly on the module board. This connection is made with the LAN91C111 chip from SMSC.

These are features of the chip:

- 10/100 non-PCI Ethernet Single Chip Ethernet Controller (MAC + PHY)
- Fully supports Full Duplex Switched Ethernet
- Supports burst data transfer
- 8 Kbytes internal memory for receive and transmit FIFO buffers
- Supports 16 and 32-bit CPU accesses
- Internal 32 bit wide data path (into packet buffer memory)
- 3.3V operation with 5V tolerant I/O buffers
- Single 25 MHz reference clock for both PHY and MAC
- 128-pin TQFP package, 1.0 mm height
- Industrial temperature range from -40°C to 85°C
- Fully integrated IEEE 802.3/802.3u - 100BASE-TX/10BASE-T physical layer
- Auto negotiation: 10/100, full/half duplex
- LED outputs (user selectable, up to 2 LED functions at one time): link, activity, full duplex,10/100, transmit, and receive

The Intel PXA270 processor CS1# signal enables accesses to the Ethernet Controller chip. Although the chip can be accessed in 8, 16, and 32-bit accesses, ConnectCore XP 270 has been designed to support only 16-bit and 32-bit accesses.

The memory area reserved for the ConnectCore XP 270 Ethernet Controller is 0x0400 0300 to 0x0400 030F. Accesses to the chip are made with the PXA270 processor's VLIO (Variable Latency) interface. LAN91C111 has no special external EEPROM, but receive the MAC address from the 1-wire EEPROM.

The LAN91C111 interrupt pin is connected to the PXA270 processor GPIO90 pin.

External schematics for SMSC LAN91C111 Ethernet Controller
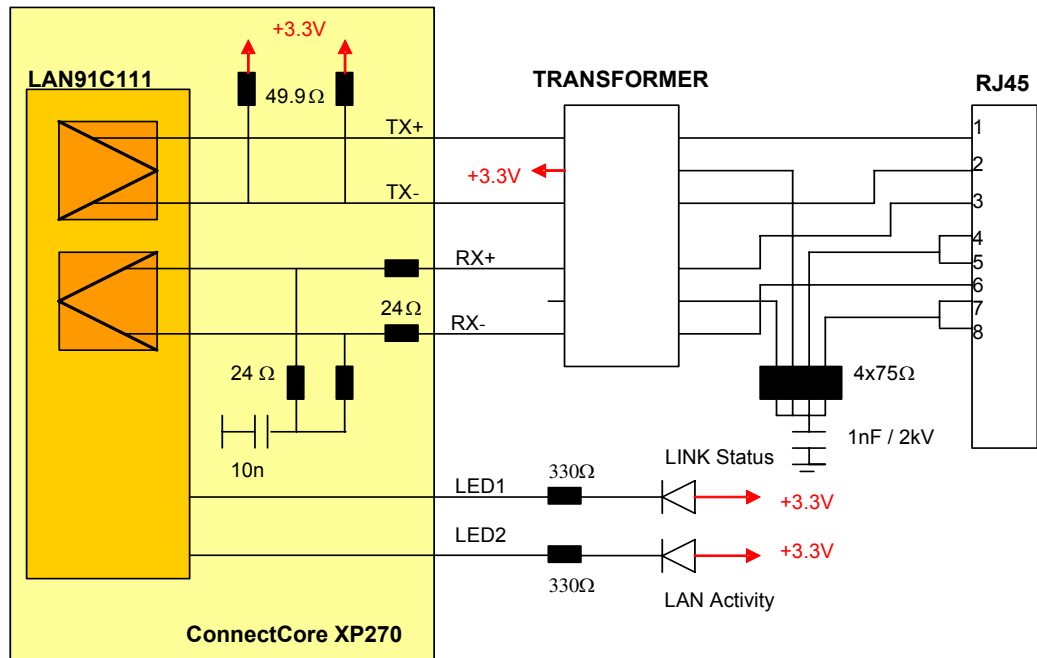
This diagram shows the external components needed for implementing Ethernet connectivity on a product based on the ConnectCore XP 270 module. SMSC has a reference design for their LAN91C111 chip (see http://www.smsc.com). SMSC also provides an application note, where suggested magnetics are listed (application note 8- 13).

The most important component is the isolation transformer module. Because the ConnectCore XP 270 uses a supply voltage of 3.3V, a transformer module with a 1:1 ratio between the primary and the secondary windings on the receive side and a ratio of 1:1 for the Tx path must be used.

These are recommended transformers; this information comes from SMSC application note 8-13.

Qualified Magnetics(*)				
Vendor	**Part number**	**Package**	**Temperature**	**Configuration**
Halo	TG110-S050N2	16-pin SOIC	0-+70°C	Auto MDIX
Pulse	J1012F21C	Integrated RJ45	0-+70°C	10/100 Legacy
Suggested Magnetics(**)				
Vendor	**Part**	**Number**	**Package**	**Temperature**
Halo	TG22-3506NL	16-pin SOP	0-+70°C	10/100 Legacy
Halo	TG22-3506ND	16-pin SOP	0-+70°C	10/100 Legacy
Halo	TG110-S055N2	16-pin SOIC	0-+70°C	Auto MDIX
Halo	TG110-S050P1	CardBus	0-+70°C	Single channel
Halo	TG110-S050P2	CardBus	0-+70°C	Auto MDIX
Halo	TG110-S050J2	CardBus	0-+70°C	Auto MDIX
Halo	TG110-E050N5	16-pin SOIC	-40-+85°C	Auto MDIX
Halo	TG110-E055N5	16-pin SOIC	-40-+85°C	Auto MDIX
Pulse	H1086	16-pin SOP	0-+70°C	10/100 Legacy
Pulse	H1012	16-pin SOP	0-+70°C	10/100 Legacy
Pulse	PE-68515L	16-pin SOP	0-+70°C	10/100 Legacy
Pulse	H1089	16-pin SOP	0-+70°C	10/100 Legacy
Pulse (Valor)	ST6118T	16-pin SOP	0-+70°C	10/100 Legacy
Pulse	H1102	16-pin SOIC	0-+70°C	Auto MDIX
Pulse	J1012F01C	Integrated RJ45	0-+70°C	10/100 Legacy
Pulse	HX1188	16-pin SOIC	-40-+85°C	Auto MDIX
Pulse	HX1198	16-pin SOIC	-40-+85°C	Auto MDIX
Bel Fuse	S558-5999-U7	16-pin SOIC	0-+70°C	Auto MDIX
Bel Fuse	0810-1X1T-03	Integrated RJ45	0-+70°C	10/100 Legacy

Suggested Magnetics(**) continued				
Bel Fuse	0817-1G1T-21	Integrated RJ45	0-+70°C	Auto MDIX
YCL	20PMT04	16-pin SOP	0-+70°C	10/100 Legacy
YCL	PH163112	16-pin SOIC	+25°C	Auto MDIX
Midcom	000-6241-37R	16-pin SOP	-40-+85°C	10/100 Legacy
Midcom	000-6181-37R	16-pin SOP	-40-+85°C	10/100 Legacy
Midcom	JFM24111-0101	Integrated RJ45	0-+70°C	Auto MDIX
PCA	EPF8033GM	16-pin SOP	0-+70°C	10/100 Legacy
PCA	EPF8143S	16-pin SOIC	0-+70°C	Auto MDIX
Tamura	TTC-8139	16-pin SOIC	0-+70°C	Auto MDIX

* Qualified Magnetics: Magnetics listed under this heading have been tested to verify proper operation with LAN91C111. The testing has been either formal UNH 100BASE-TX PMD testing, UNH 10BASE-T MAU testing, and/or in-house testing performed by SMSC. You can presume with a high degree of confidence, that with proper PCB design techniques, the combinations of SMSC devices and magnetics presented in this category will perform to the highest standards.

** Suggested Magnetics: Magnetics listed under this heading have not been tested to verify proper operation with LAN91C111. This category of magnetic has been evaluated by the contents of the vendor-supplied data sheet and legacy performance only. You can presume, however, with some degree of confidence, that with proper PCB design techniques, the combinations of SMSC LAN91C111 and magnetics presented in this category will perform to high standards.

1-Wire EEPROM

The ConnectCore XP 270 module comes with the Dallas Semiconductor DS2431 1-wire EEPROM memory chip. This chip is mainly used for storing the ConnectCore XP 270 MAC address for the LAN91C111 Ethernet Controller.

The memory chip also provides these features:

- 1024-bit EEPROM memory organized as four memory pages of 256 bits each.

- Memory pages that can be individually write-protected or put in EPROM-emulation mode

- 8-byte scratch pad

- Communication over the single-conductor 1-wire bus. Communication follows standard Dallas Semiconductor 1-wire protocol.

- Communication with Host with a single digital signal at 15.4kbps or 111kbps using the 1-wire protocol

- Its own unalterable and unique 64-bit ROM registration number that is factory lasered into the chip

The DS2431 is a 1024-bit 1-wire EEPROM chip organized as four memory pages of 256-bit each. Data is written to an 8-byte scratch pad, verified and then copied to the EEPROM memory.

The ConnectCore XP 270 module uses GPIO87 for "bit-toggling" and implementing the 1-wire protocol to communicate with this device. For more information, see the DS2431 datasheet.

This table shows the 1-wire EEPROM memory map:

Address range	Type	Description	Protection codes
0x000–0x001F	R/(W)	Data Memory Page 0 Used for MAC ADDRESS	
0x0020–0x003F	R/(W)	Data Memory Page 1	
0x0040–0x005F	R/(W)	Data Memory Page 2	
0x0060–0x007F	R/(W)	Data Memory Page 3	
0x0080	R/(W)	Protection Control Byte Page 0	0x55: Write Protect 0xAA: EPROM mode 0x55 or 0xAA: Write protect 0x80
0x0081	R/(W)	Protection Control Byte Page 1	0x55: Write Protect 0xAA: EPROM mode 0x55 or 0xAA: Write protect 0x81