



## **NXP LPC32x0系列微控制器介绍**

**April, 2008**



# 内容

- ▶ **LPC32x0**系列价值所在
- ▶ **LPC3000**系列中已上市器件
- ▶ **LPC3180/01** 和 **LPC32x0**
- ▶ **LPC32x0**系列的目标市场
- ▶ **LPC32x0** 技术细节
- ▶ 开发工具

# LPC32x0系列价值所在

## NXP's ARM9 Value Proposition

- ▶ A clear advantage over competition
  - Vector Floating Point co-processor
  - High Integration (Ethernet, USB, LCD)
  - 90nm low-power process
  - Most attractive in price/performance
  - 32KB I-Cache & 32KB D-Cache (at least 2x competition)
  - 256KB on-Chip SRAM (at least 1.6x competition)
- ▶ And... a clear commitment to further broaden the ARM9 portfolio available to customers

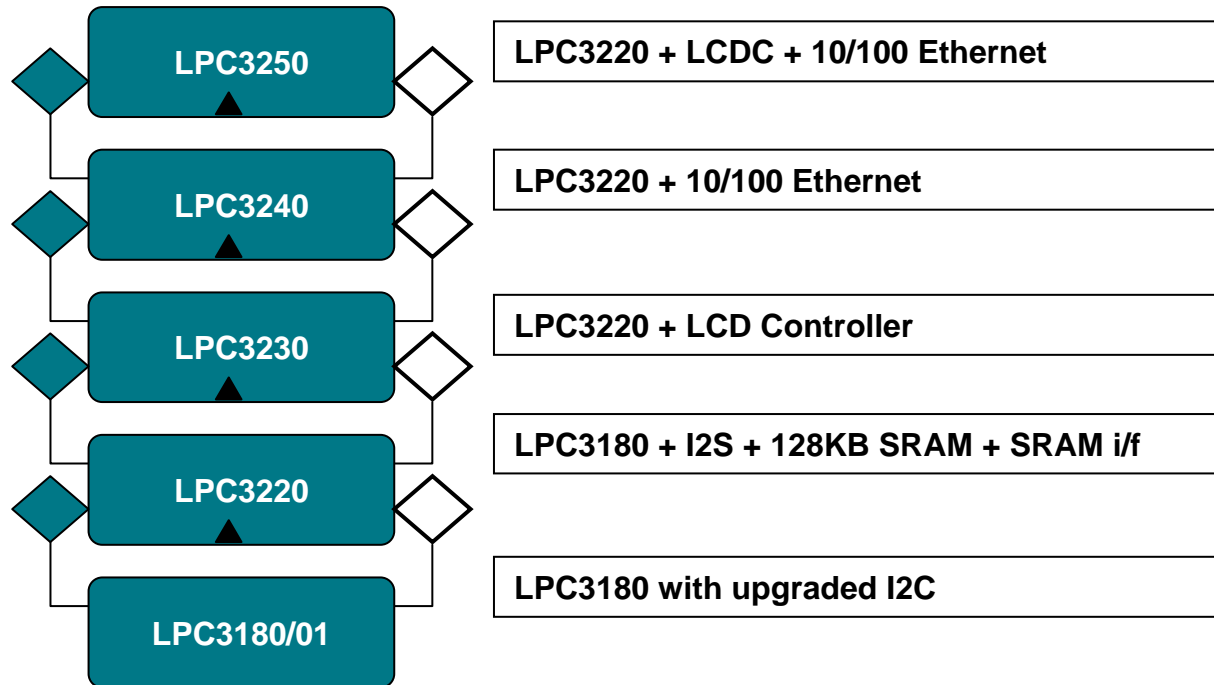
# LPC3000系列中已上市器件

# NXP and ARM Expand Strategic Relationship with Major Licensing Agreement

- ▶ NXP and ARM have expanded their **strategic relationship** with a new licensing agreement
- ▶ **NXP will have access to all ARM Cortex family processors** as well as other ARM technology including:
  - High-performance, low-power ARM® Cortex™-M3 processor,
  - Cortex-A9 MPCore™ Multicore Processor
  - ARM Mali™ family of Graphics Processing Units (GPUs)
  - CoreSight™ on-chip debug and trace technology
  - Full suite of ARM physical IP for the development of future solutions with minimized power consumption



# LPC3000 系列中已上市器件 (ARM926EJ内核)

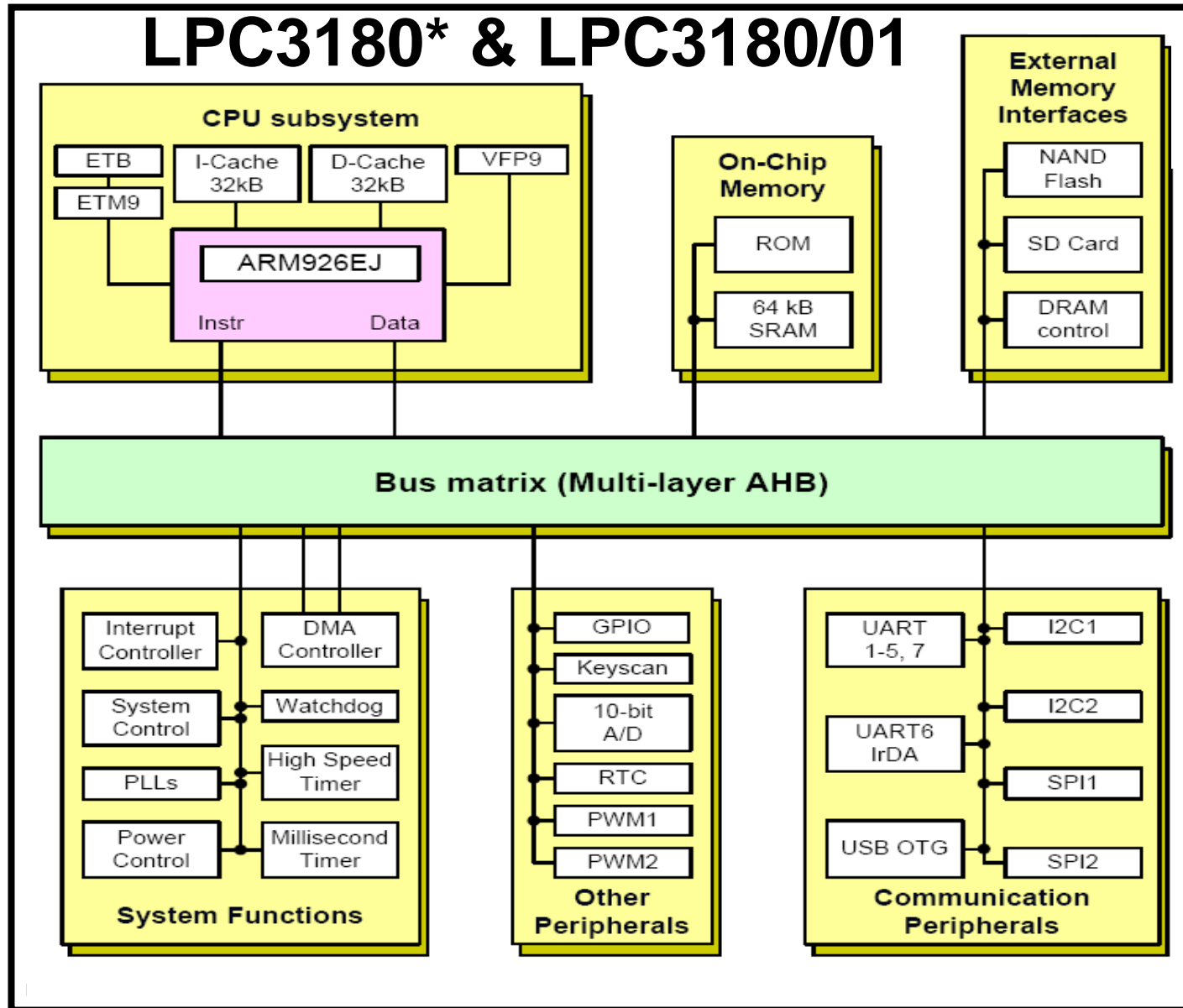


LPC3180/01



# LPC3180\* & LPC3180/01

\* In Production



**First LPC3000 Member**  
**Industry's First 90nm ARM9 MCU**

**Industry's First ARM9 MCU with USB OTG**

**Industrial Temp Range**

**208MHz ARM926EJ + VFP**

**0.9v Low Power Mode**

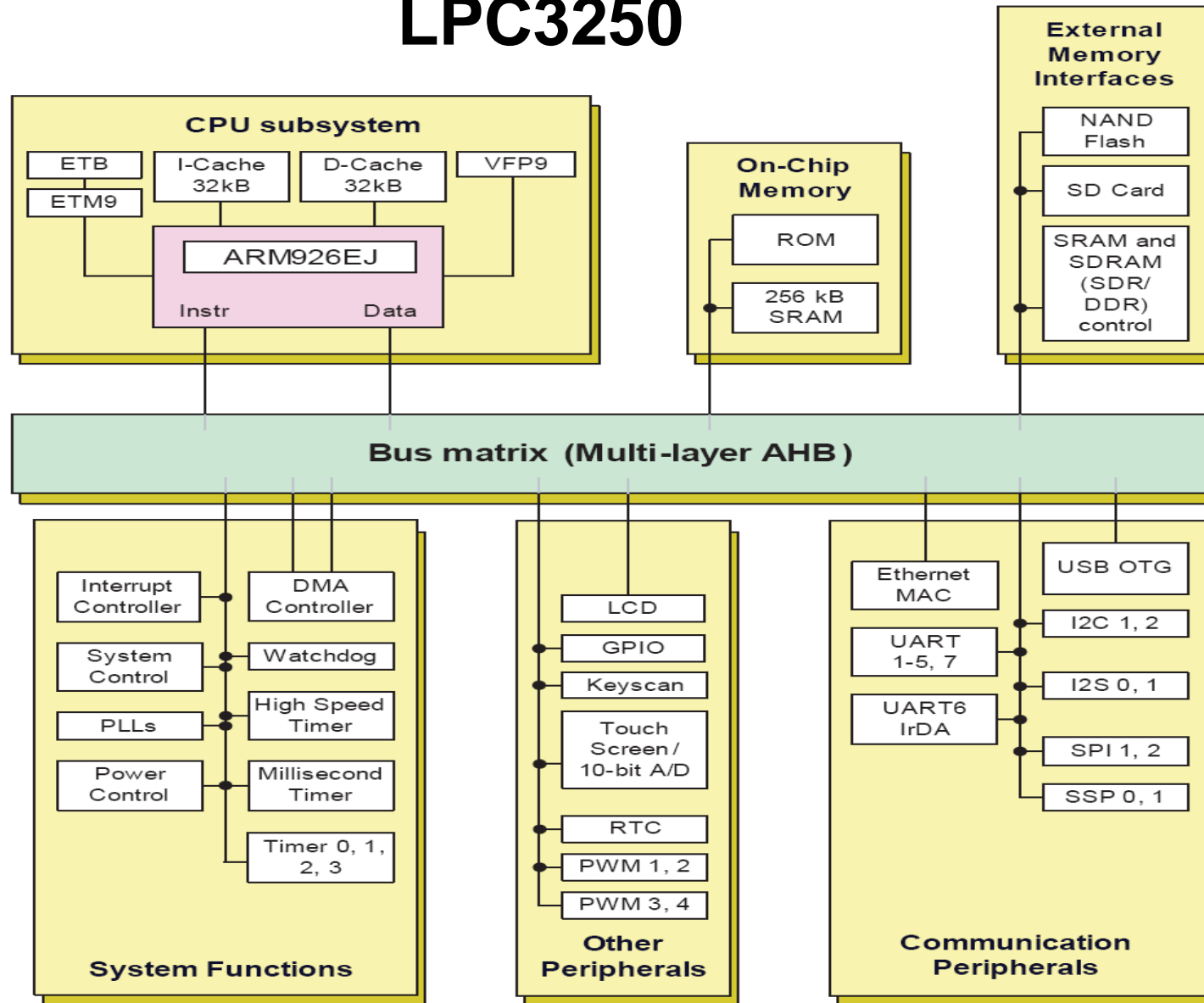
**WinCE & Linux BSPs**

LPC32x0

# LPC32x0 Overview

- ▶ A family of high performance/high integration MCUs based on ARM926EJ core in 90nm process allowing embedded designers to reduce on-chip components and maximizing power savings without sacrificing performance
  - 208MHz, 32-bit ARM926EJ processor
  - Up to 256KB SRAM and 32KB I-cache / 32KB D-cache
  - Vector Floating Point coprocessor
  - Ethernet, USB and LCD Controller
  - 10-bit A/D converter with Touch-Screen Interface
  - Comprehensive Set of Serial Interfaces

# LPC3250



# LPC32x0 Family

Type number	SRAM(KB)	10/100 Ethernet	LCD Controller	Temperature range (°C)	Package
LPC3220FET296	128	0	0	-40 to +85	TFBGA296
LPC3230FET296	256	0	1	-40 to +85	TFBGA296
LPC3240FET296	256	1	0	-40 to +85	TFBGA296
LPC3250FET296	256	1	1	-40 to +85	TFBGA296

**0.8mm Ball Pitch for Ease of Manufacturing**

# LPC3000 Family

	LPC3180	LPC3180/01	LPC3220	LPC3230	LPC3240	LPC3250
<b>Fabrication Facility (90nm)</b>	Crolles2	TSMC	TSMC	TSMC	TSMC	TSMC
<b>RAM (KB)</b>	64	64	128	256	256	256
<b>I2S</b>	No	No	2x	2x	2x	2x
<b>Ethernet</b>	No	No	No	No	10/100	10/100
<b>LCD</b>	No	No	No	Yes	No	Yes
<b>Static Mem. Controller</b>	No	No	Yes	Yes	Yes	Yes
<b>I2C</b>	Master Only	Master Multi-Master Slave	Master Multi-Master Slave	Master Multi-Master Slave	Master Multi-Master Slave	Master Multi-Master Slave
<b>Package</b>	320 LFBGA	320 LFBGA	296 TFBGA	296 TFBGA	296 TFBGA	296 TFBGA
<b>Ball Pitch (mm)</b>	0.5	0.5	0.8	0.8	0.8	0.8

Only major features that are different from one member to the other are shown

**LPC3180 is not recommended for new designs, promote LPC3180/01 instead.**

# LPC32x0 的目标市场

# Target Application Examples

## ▶ Consumer

- Advanced Remote Controls
- Digital Picture Frames
- Exercise Equipment
- High End White Goods
- Language Translators
- A/V Home

## ▶ Recreational

- Fish Finders
- Marine GPS
- Portable GPS

## ▶ Industrial

- Industrial Control
- Factory Automation
- Building Automation
- POS Systems
- e-Metering
- Security Systems
- Power Management Systems

## ▶ Medical

- Portable Diagnostics
- Pump & Flow Metering
- Medical Monitors
- Respiratory Equipment
- Imaging Equipment

## ▶ Automotive

- Engine Diagnostics
- Fleet Management
- High End Audio
- Navigation
- Farming Tractors

## ▶ Communications

- Base Stations
- VoIP
- Avionics

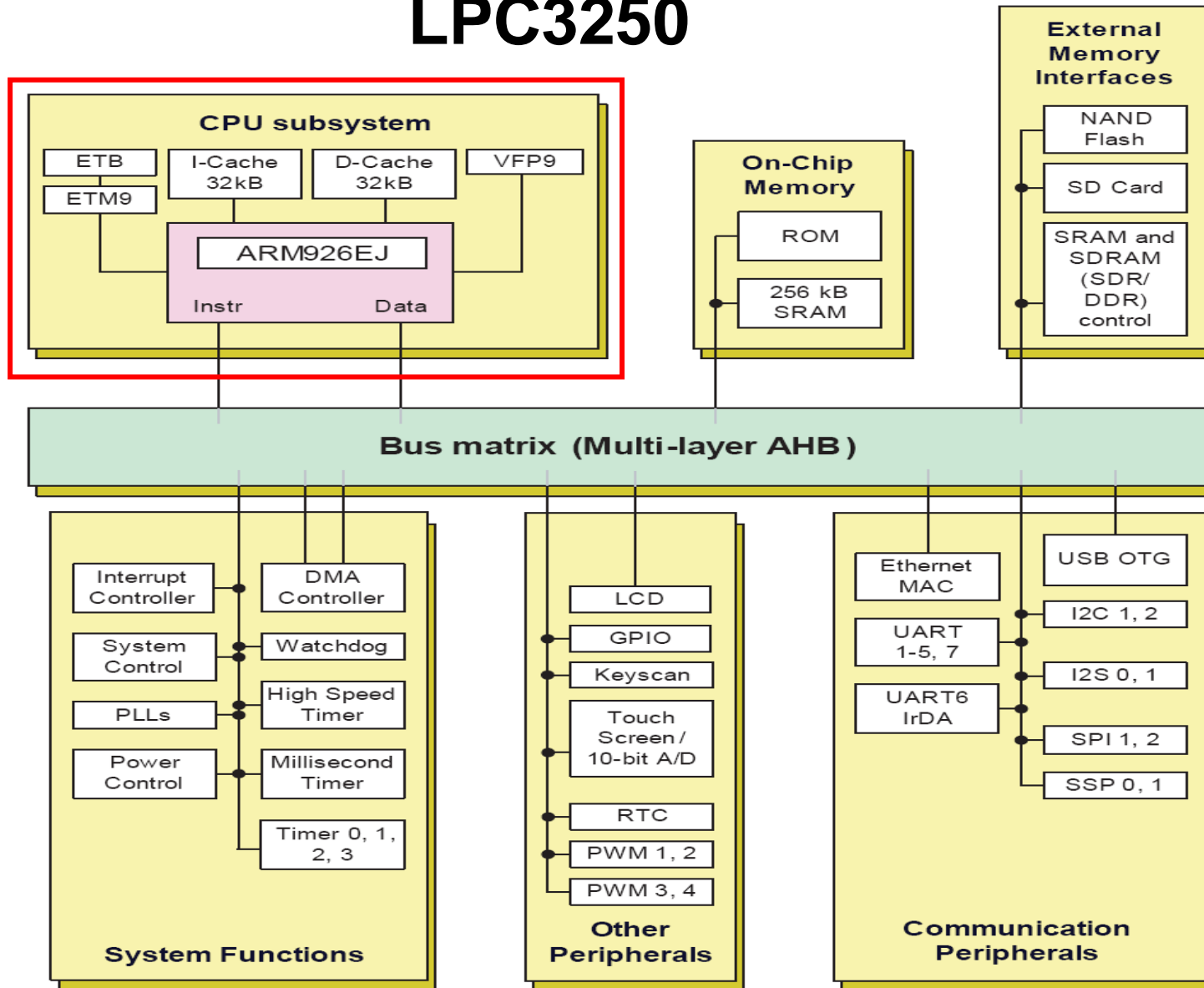
## ▶ Instrumentation & Testing

- Digital Scopes
- Digital Analyzers



# LPC32x0 技术细节

# LPC3250



# CPU subsystem

- ▶ ARM926EJS processor, running at CPU clock speeds up to 208 MHz
  - 16-bit Fixed Point DSP Extension
  - Single Cycle MAC
  - Java Byte Code Coprocessor
  - ARM (32-bit) & Thumb (16-bit) Instruction sets
  - Harvard Architecture: Separate Instruction and Data Paths
- ▶ A Vector Floating Point coprocessor
- ▶ A 32KB instruction cache and a 32KB data cache
- ▶ Emulation Trace Module (ETM) with a 2K x 24 bit Emulation Trace Buffer (ETB)

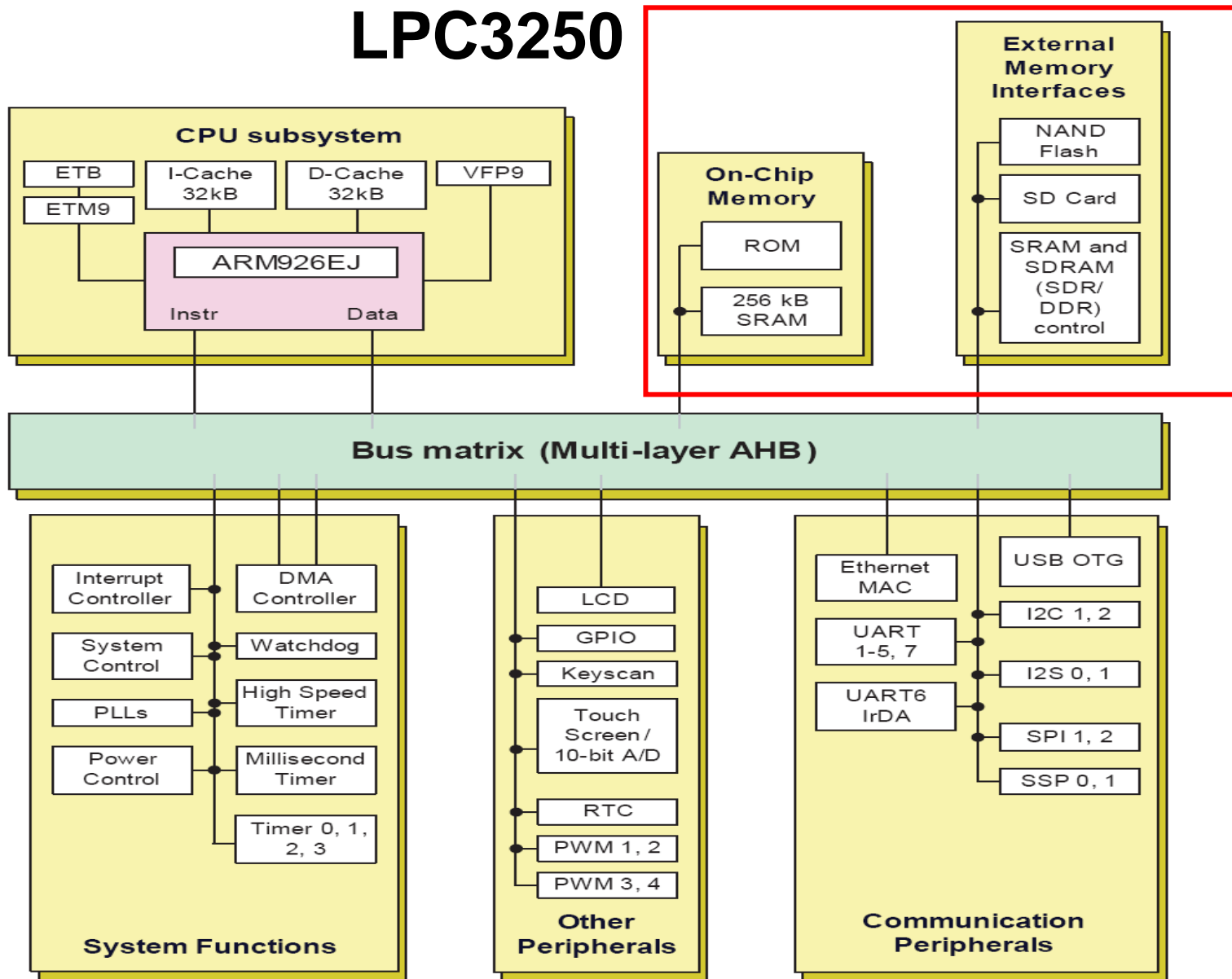
# VFP increases performance, reduces code size and lowers power consumption

- ▶ Trigonometry Intense Floating Point Benchmark (Fbench) with & without VFP coprocessor ([www.fourmilab.ch/fbench/fbench.html](http://www.fourmilab.ch/fbench/fbench.html))

Micro	Frequency MHz	Execution from	I-Cache	VFP9	Time Normalized	Icore mA	Code & constants kB	Variables kB
LPC3180	60	iRAM	No	No	100	39.91	35.2	1.7
LPC3180	60	iRAM	Yes	No	78	43.65	35.3	"
LPC3180	60	iRAM	No	Yes	19	38.65	26.8	"
LPC3180	60	iRAM	Yes	Yes	15	40.67	26.8	"
LPC3180	200	iRAM	No	No	48	77.66	35.2	"
LPC3180	200	iRAM	Yes	No	28	91.73	35.3	"
LPC3180	200	iRAM	No	Yes	8	75.81	26.8	"
LPC3180	200	iRAM	Yes	Yes	6	88.80	26.8	"

1. VFP increases performance by about 5x
2. VFP usage reduced Code size (from 37KB to 27KB)
3. VFP usage reduces power

# LPC3250



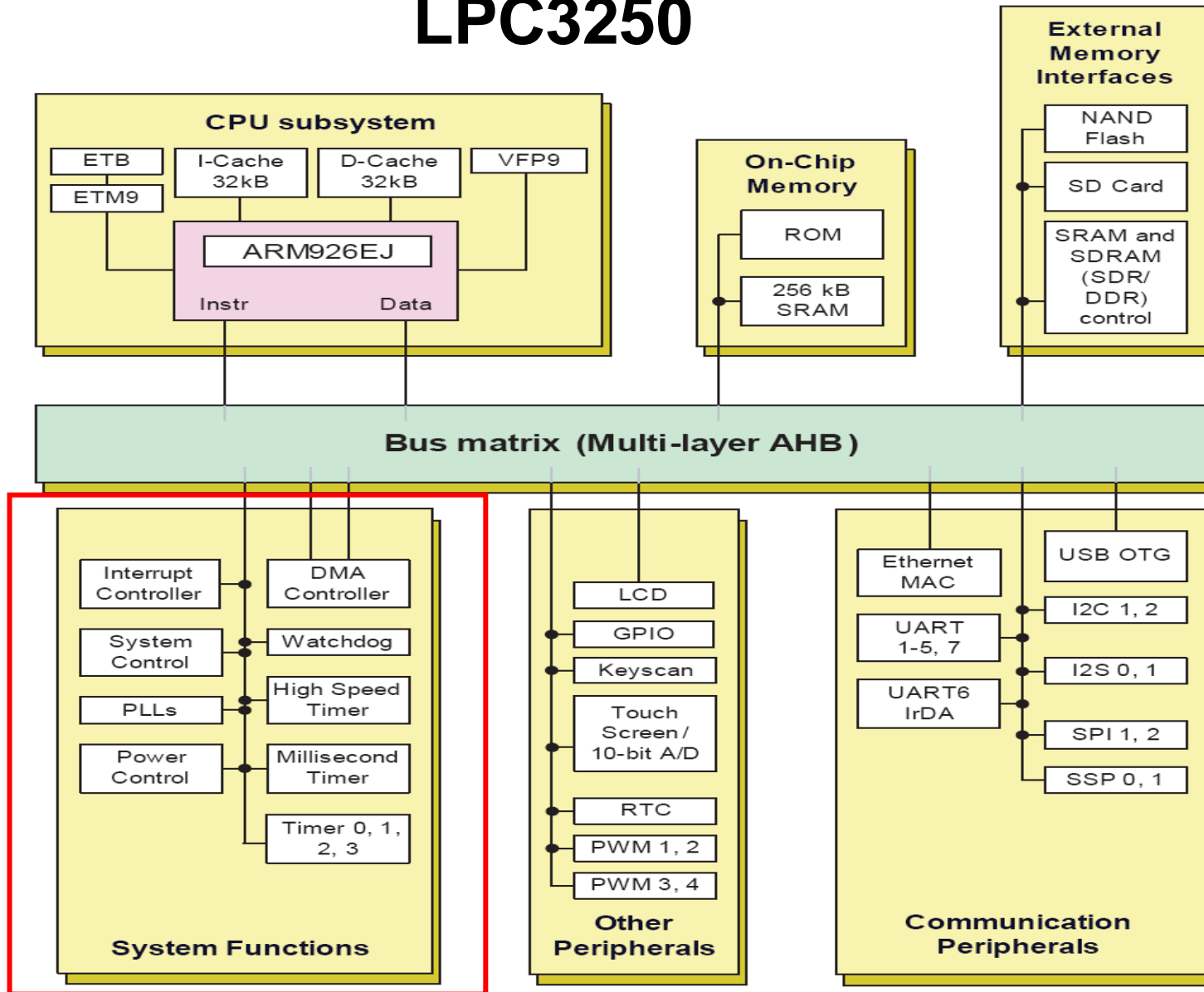
# On-Chip Memory

- ▶ Up to 256KB SRAM.
- ▶ Boot ROM
  - Selectable boot-up from various external devices: NAND Flash, NOR Flash, SPI memory or UART

## External Memory Interface

- ▶ An External memory controller for DDR and SDR DRAM, as well as static devices
- ▶ Two NAND Flash controllers:
  - Single level & Multi level
- ▶ Secure Digital (SD) memory card interface

# LPC3250

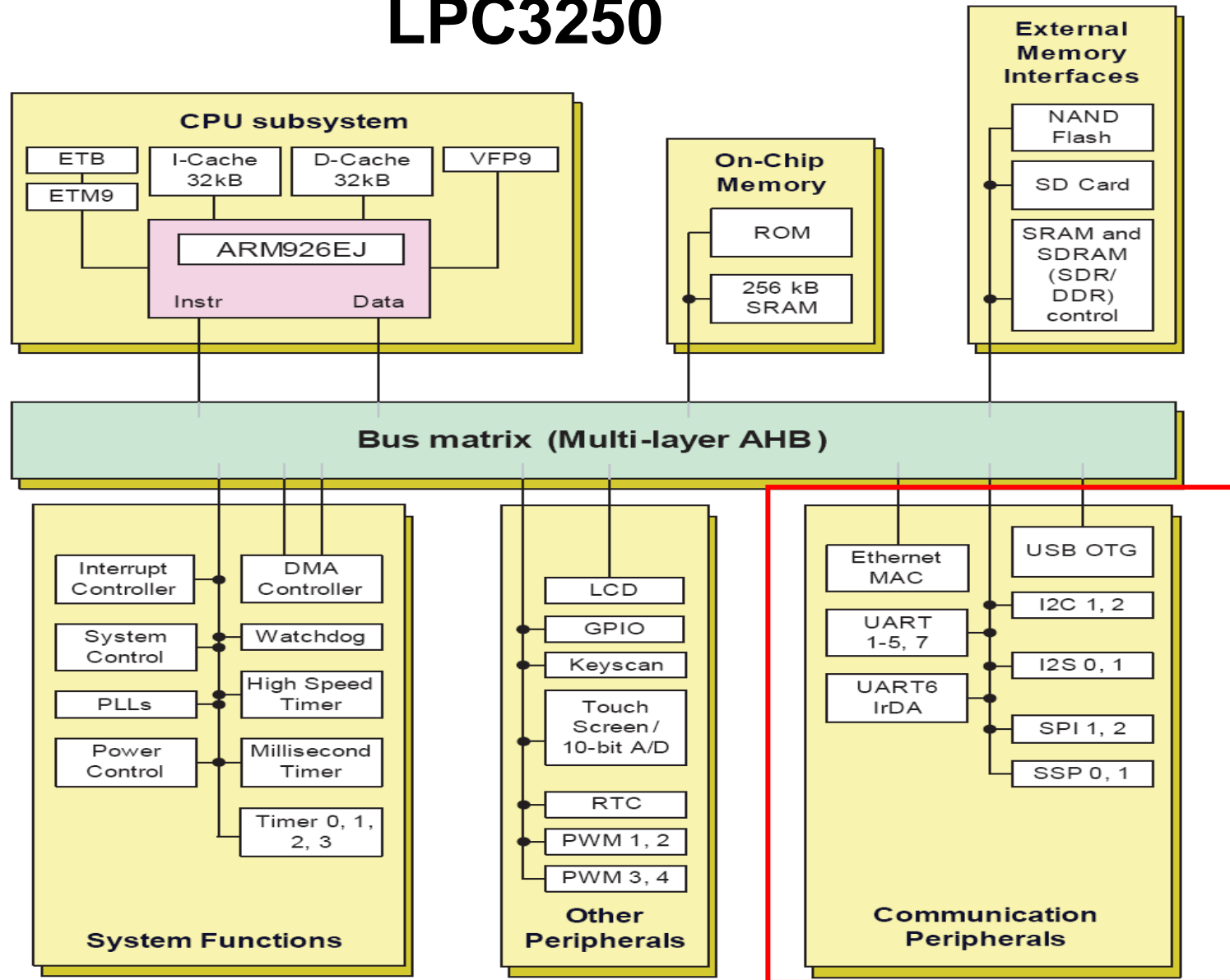


# System Functions

- ▶ An Interrupt Controller, supporting 73 interrupt sources.
- ▶ Eight channel General Purpose DMA controller (GPDMA):
  - SD Card
  - High-speed UARTs
  - I2S ports
  - SPI
  - Memory to Memory
- ▶ Five 32-bit Timers with capture/compare channels
- ▶ 32-bit RTC-driven Timer
- ▶ Watchdog Timer
- ▶ Multiple Power Down Modes
  - Including 0.9v Ultra Low Power Mode
- ▶ On-chip crystal oscillator and PLLs
- ▶ Separate PLL for USB



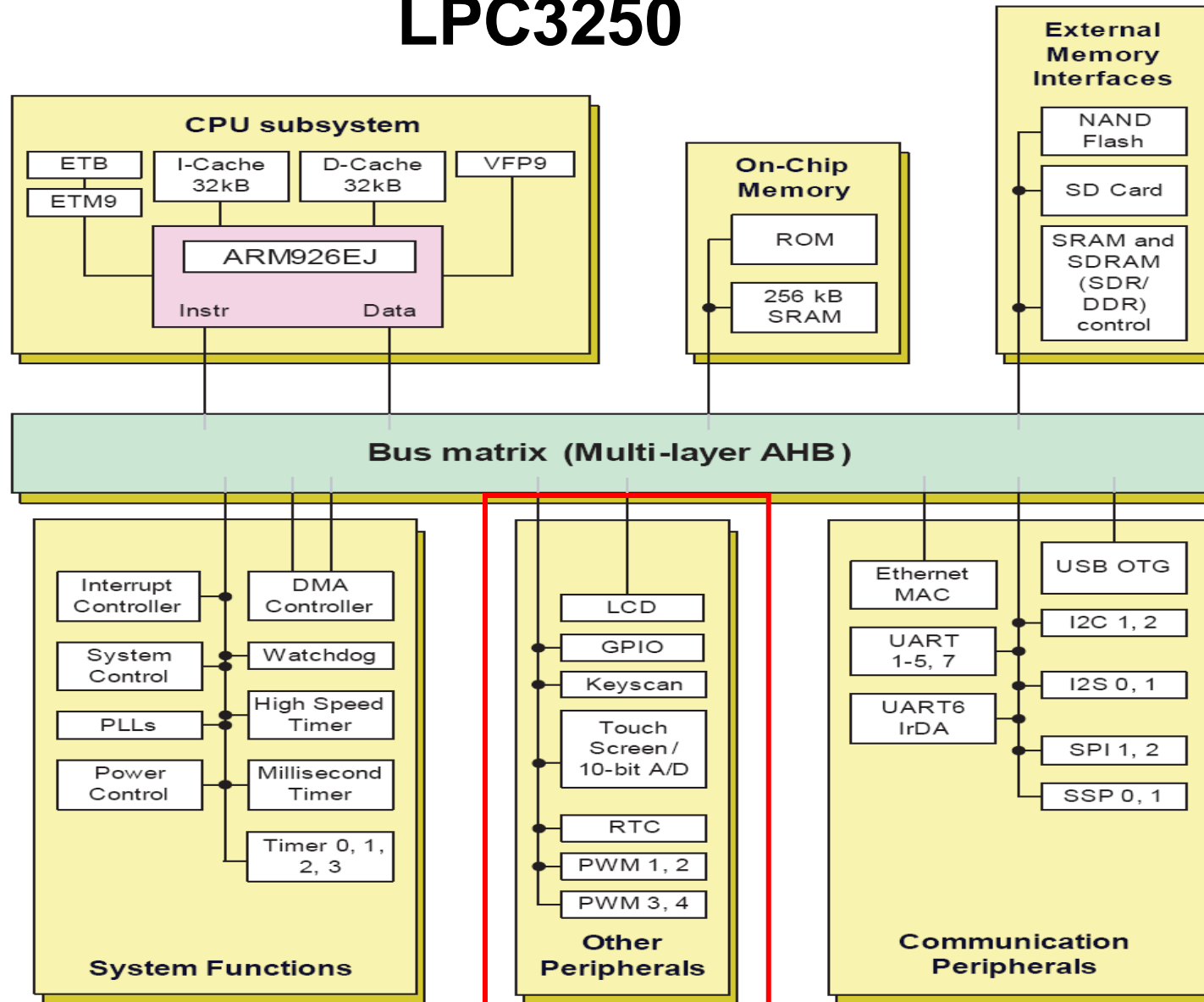
# LPC3250



# Communication Peripherals

- ▶ A **10/100 Ethernet MAC** with dedicated DMA Controller
- ▶ A **USB interface** with a dedicated DMA controller and PLL
  - Device
  - Host (OHCI compliant)
  - On-The-Go (OTG)
- ▶ Four standard UARTs & three high speed UARTs with fractional baud rate generation and 64 byte FIFOs
- ▶ Two SPI controllers
- ▶ Two SSP controllers
- ▶ Two I2S interfaces
- ▶ Two I2C-bus Interfaces supporting single master, slave and multi-master I2C configurations

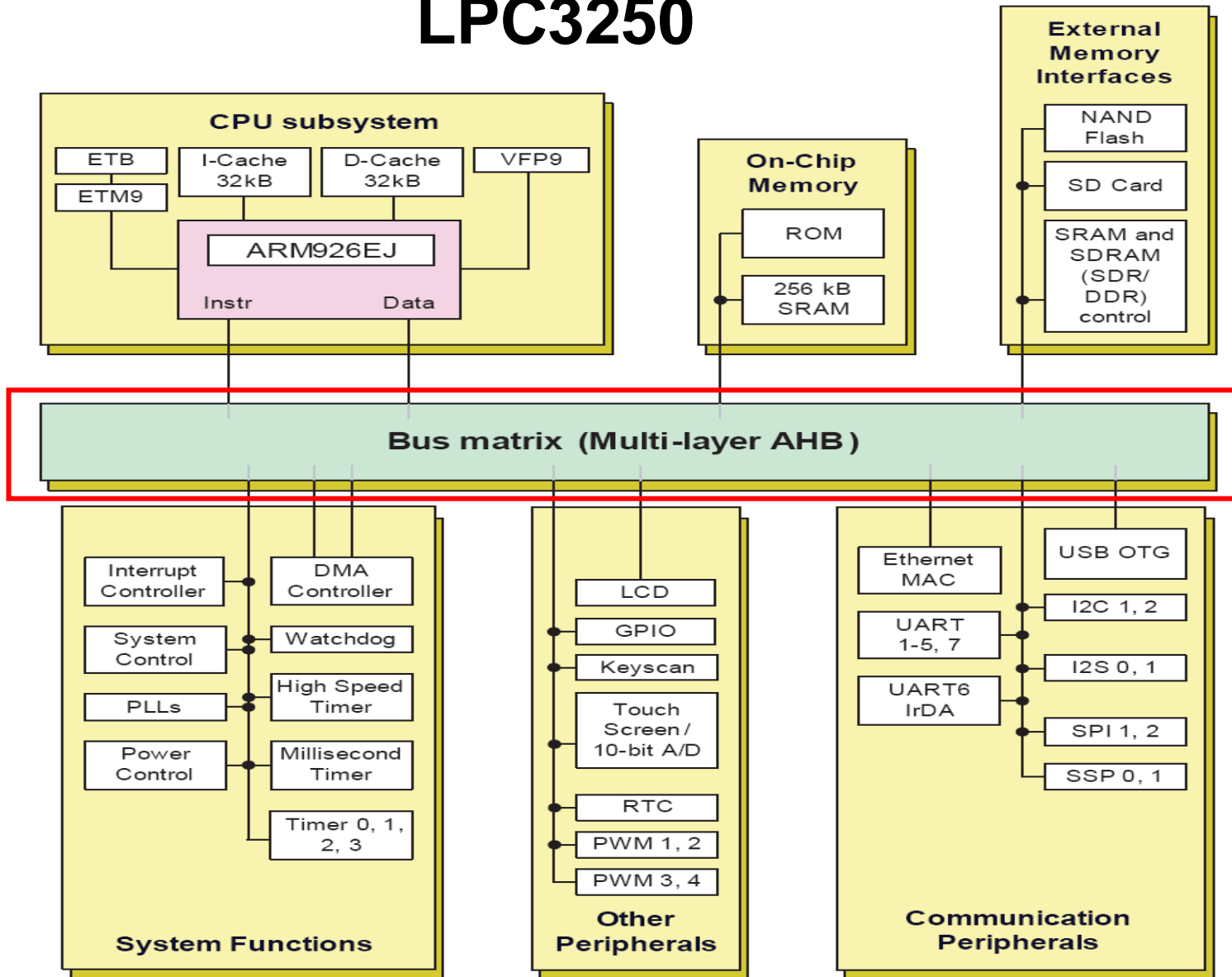
# LPC3250



# Other Peripherals

- ▶ Real Time Clock with separate clock and power domain and a dedicated 32kHz oscillator
- ▶ Eleven PWM channels
- ▶ **LCD controller** supporting both STN and TFT panels, with dedicated DMA controller
- ▶ 87 General Purpose Input, Output, and I/O pins
- ▶ Three channel/10-bit, 400kHz A/D Converter and touch screen controller
- ▶ Automatic keyboard scanner function that supports 8 x 8 keys

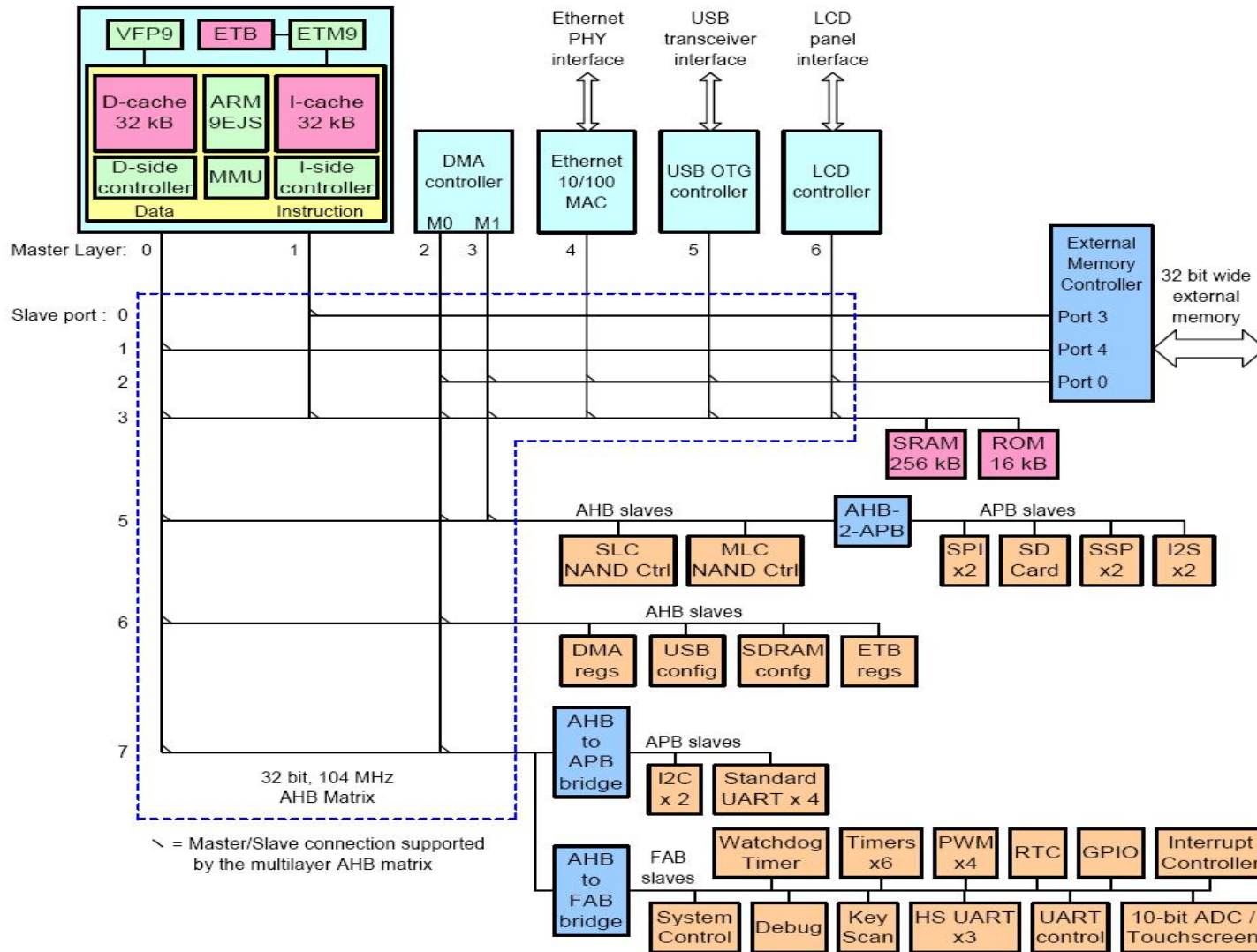
# LPC3250



# Multi-layer AHB Bus Matrix

- ▶ AHB Bus Matrix is a seven-layer 32-bit, 104MHz matrix that provides a separate bus for each of the seven AHB masters:
  - D-Cache
  - I-Cache
  - DMA (2x)
  - Ethernet MAC
  - USB Controller
  - LCD Controller
- ▶ AHB Matrix eliminates all arbitration delays as long as two masters are not attempting to access the same slave at the same time.

# Multi-layer AHB Bus Matrix



# 开发工具



# NXP's Tools Partners & Support Network



# Tools, OS/RTOS, Stacks & S/W

- ▶ Over the next six months, NXP's worldwide partners will be introducing LPC32x0 compatible tools:
  - Development Boards
  - Compiler Packages
  - Integrated Development Environments (IDEs)
  - Debuggers
  - Emulators
  - Operating Systems (Real Time & Platform)
  - GUI
  - Stacks (TCP/IP and USB)
  - Flash File Systems
  - A/V Decoders
  - Security S/W

# LPC3250 Phytex Development Board Details I

## ▶ Basic phyCORE-LPC3250 Rapid Development Kit

- phyCORE-LPC3250 Single Board Computer module
- phyCORE-LPC3250 Carrier Board
- Bare PCB expansion board
- Grayhills 12 key, keyboard (only 9 keys are supported)
- Ethernet cable
- Standard Serial cable (DB-9)
- USB Standard-A to mini-B cable
- AC power adapter 5V/3.2 A
- Electronic documentation
- Printed Schematics
- Module removal tool

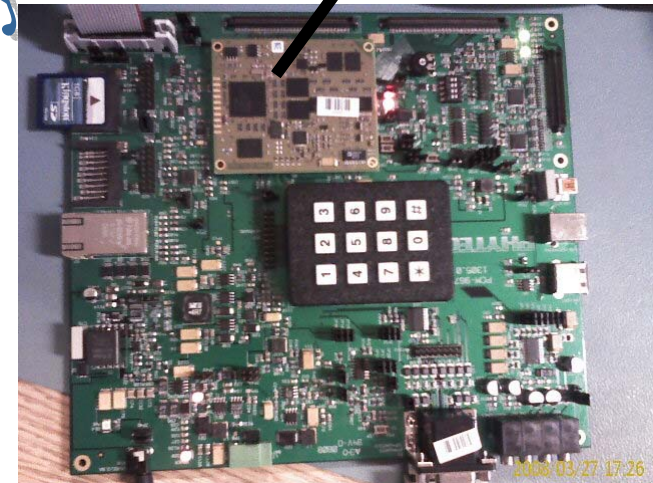
PHYTEC

July Availability

SBC Module



Carrier Board



## ▶ Optional Add-Ons

- Hitachi 3.5" LCD with integrated touch (TX09D70VM1CCA) + LCD adapter board (LCD-011)
- Li-Ion Battery

# LPC3250 Phyttec Development Board Details II

- ▶ Keil Kit
  - Includes the basic kit contents plus:
  - Keil ULINK
  - Keil Tool CD
  
- ▶ IAR Kit
  - Includes the basic kit contents plus:
  - IAR JLINK
  - IAR Tool CD
  
- ▶ Linux Kit
  - Includes the basic kit contents plus:
  - Tool CD with Linux demo OS Image, bootloaders, tools, etc..
  
- ▶ WinCE Kit:
  - Includes the basic kit contents plus:
  - Microsoft Visual Studio + Platform Builder eval CD
  - PHYTEC Tool CD with OS Image, bootloaders, tools, etc...

# The NXP & NTRU solution for Microcontroller Security

- ▶ The NTRU software security libraries for NXP ARM microcontrollers provide the user the tools to **achieve the benefits and features of security** by providing in software: Encryption and Decryption of messages, Digital Signatures, and utilities protocols like Key Negotiation and Random Number Generation in an inexpensive and flexible manner
- ▶ Encryption algorithms work on both LPC2000 and the LPC3000 families microcontrollers
- ▶ Allows customers who need **short time-to-market** to leverage NTRU's encryption expertise on their products quickly and efficiently
- ▶ Customers can **update the software in the field** to keep ahead of hackers and protect their IP

<http://www.ntru.com/>

Available Now

Ntrū



# The NXP & Interniche solution for Ethernet

- ▶ NicheLite for LPC is a fully featured TCP/IP stack
  - Requires as little as 12 KB of code
- ▶ Support for the following protocols:
  - Address Resolution Protocol (ARP), Internet Protocol (IP), Internet Control Message Protocol (ICMP), User Datagram Protocol (UDP), Transmission Control Protocol (TCP), Dynamic Host Configuration Protocol (DHCP) Client, Domain Name System (DNS) Client, Bootstrap Protocol (BOOTP), Trivial File Transfer Protocol (TFTP)
- ▶ NicheLite for LPC available to all NXP LPC customers
  - Unlimited use with NXP LPC2000 and LPC3000 microcontrollers
  - Example applications (TFTP Client, TFTP Server, HTTP Listener)
  - Add-On protocols (HTTP, DHCP, ...) can be licensed from Interniche

<http://www.iniche.com/>

Available Now



# The NXP & Actimagine solution for high quality / low power video compression

- ▶ Files are smaller in size, Decompression needs less CPU
- ▶ Eliminates the need for dedicated media engines and reduces power consumption

320 x 240 (QVGA) on embedded platform\*

Video Codec	Mobiclip	MPEG2	MPEG4 ASP	H.264 Baseline
Average CPU requirement	110MHz	150MHz	300MHz	450MHz
Typical bitrate (Kbps)	200	800	260	215

\*  
Full screen 24 frames per second, with no slow-down  
  
System is Generic CPU + Software (no co-processor)  
  
Includes Audio

## Already Proven on BlueStreak MCUs

<http://www.actimagine.com/>

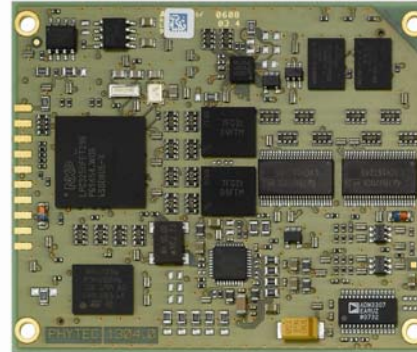


# ESC-SJ NXP Booth #624 (April 15<sup>th</sup>-17<sup>th</sup>, 2008)

## ▶ Rapid Development Kit from PHYTEC

- phyCORE-LPC3250 Single Board Computer module
  - LPC3250
  - 64 MB SDRAM
  - 32 MB Flash
  - 32KB EEPROM
  - Ethernet PHY 10/100Mbits/s
  - USB transceiver
- phyCORE-LPC3250 Carrier Board
- 3.5" LCD with integrated touch

**PHYTEC**



## ▶ WinCE 6.0 BSP from Adeneo

- Bootloader
  - Boot through Ethernet
  - Local boot from Compact flash
  - CE Image update in flash
- Kernel
  - Full support of ARM9 core
  - Ethernet/Serial debugging
- Communications
  - USB Host+Device drivers







**THANK YOU!**