72-MHz, 32-bit microcontroller with ARM7TDMI-S™ core LPC23xx

ARM7-based microcontrollers with Ethernet, USB, and CAN peripherals

Built for connectivity, these powerful yet cost-effective microcontrollers supports 10/100 Ethernet, full-speed (12 Mbps) USB 2.0, and CAN 2.0B. They have up to 512 KB of ISP/IAP Flash, up to 98 KB of SRAM, 10-bit A/D and D/A converters, an IRC oscillator, and options for an SD memory-card interface.

Key features

- 72-MHz, 32-bit ARM7TDMI-S with dual AHB buses
- Up to 512 KB of ISP/IAP Flash
- Up to 98 KB of SRAM
- Very fast Flash programming via on-chip boot loader
- 10/100 Ethernet MAC interface with DMA
- USB 2.0 full-speed (12 Mbps) device with PHY and DMA
- USB 2.0 full-speed Open Host Control Interface / On-The-Go
- Two CAN 2.0B controllers with acceptance filtering
- General-purpose DMA controller
- 10-bit A/D converter and 10-bit D/A converter
- Multiple serial interfaces: three I²C, one I²S, four UARTs, and three SPI/SSPs
- Four 32-bit timers
- Real-time clock and Watchdog timer

- 4-MHz internal RC (IRC) oscillator trimmed to 1% accuracy
- Secure Digital (SD) memory-card interface
- Single 3.3-V power supply (3.0 to 3.6 V)
- Several power-down modes, including "deep-power down"
- Boundary scan (LPC2377, LPC2378 and LPC2388 only)
- Packages:
  – LQFP100 (14 x 14 x 1.4 mm)
  – LQFP144 (20 x 20 x 1.4 mm)
  – TFBGA100 (9 x 9 x 0.7 mm)

Applications

- Industrial control
- POS systems
- Protocol conversion
- Building automation
- Security systems

The NXP microcontroller family LPC23xx uses a high-performance 32-bit ARM7 core that operates at up to 72 MHz. Each device has up to 512 KB of on-chip Flash and up to 98 KB of on-chip SRAM memory. Each LPC23xx device features two AHB buses, so high-bandwidth peripherals like Ethernet and USB can run simultaneously, without impacting the main application.

In-System Programming (ISP) and In-Application Programming (IAP) software minimize programming time – each 256-byte line takes only 1 ms to program, and a single-sector or full-chip erase takes only 400 ms. A 128-bit-wide memory interface and a patented memory accelerator enable 32-bit code execution from Flash with zero wait-states. For applications where code size

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is critical, an alternative 16-bit Thumb mode reduces code by more than 30% with minimal performance penalties.

Each microcontroller is equipped with a 10/100 Ethernet MAC interface, a USB 2.0 full-speed (12 Mbps) device, USB 2.0 full-speed Open Host Control Interface / On-The-Go, two CAN 2.0B channels, a general-purpose DMA controller, a 10-bit A/D converter and a 10-bit D/A converter. The Ethernet MAC has 16 KB of SRAM and an associated DMA controller on an independent AHB bus. The USB controller has 4 KB of USB SRAM and accessible DMA, and supports Control, Interrupt, Bulk, and Isochronous data-transfer modes with 32 endpoints.

Multiple serial communications interfaces increase design flexibility, provide larger buffer size, and deliver higher processing power. There are four 16C550 UARTs (one with IrDA), three I2C-bus interfaces, three SPI/SSP interfaces, an I2S interface, and an interface for SD/MMC memory cards.

There are four 32-bit capture/compare timers, a PWM unit, a low-power real-time clock with 2 KB of battery-backed SRAM, a Watchdog timer, and a 4-MHz internal RC oscillator that can be used as the main system clock.
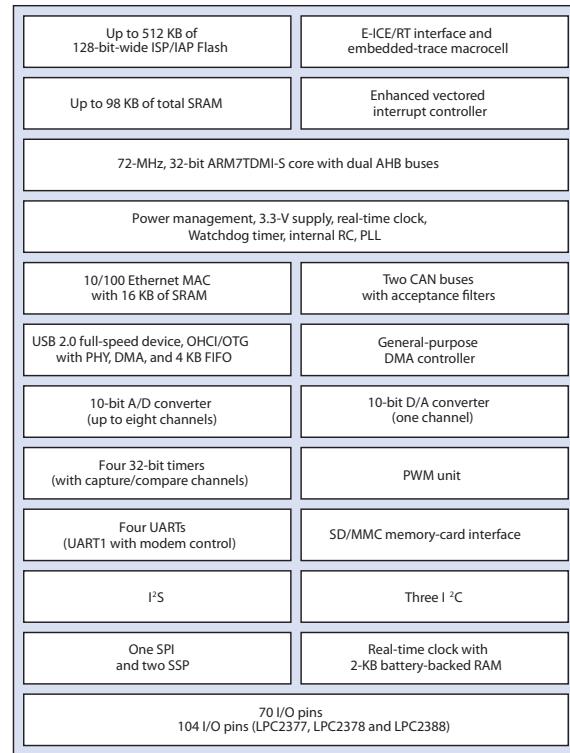
An independent clock divider for each peripheral lets the designer minimize power consumption. Also, each pin of Port 0 and Port 2 can be used as an external interrupt. There are up to 104 general-purpose I/O lines that toggle at rates up to 36 MHz. The operating temperature range for all the devices is -40 to 85 °C.

The LPC2378 and LPC2388 features an 8-bit MultiPort Memory Controller (MiniBus) that supports asynchronous RAM, ROM, and Flash. The MiniBus can also be used to interface off-chip memory-mapped devices and peripherals. For debugging, each device supports real-time emulation and embedded trace support and has an integrated vectored interrupt controller (VIC). Also, for compatibility with existing tools, each device uses the standard ARM test/debug JTAG interface.

Third-Party Development Tools
Through third-party suppliers, we offer a range of development tools for our microcontrollers. For the most current listing, please visit www.nxp.com/microcontrollers.

Up to 512 KB of 128-bit-wide ISP/IAP Flash	E-ICE/RT interface and embedded-trace macrocell
Up to 98 KB of total SRAM	Enhanced vectored interrupt controller
72-MHz, 32-bit ARM7TDMI-S core with dual AHB buses	
Power management, 3.3-V supply, real-time clock, Watchdog timer, internal RC, PLL	
10/100 Ethernet MAC with 16 KB of SRAM	Two CAN buses with acceptance filters
USB 2.0 full-speed device, OHCI/OTG with PHY, DMA, and 4 KB FIFO	General-purpose DMA controller
10-bit A/D converter (up to eight channels)	10-bit D/A converter (one channel)
Four 32-bit timers (with capture/compare channels)	PWM unit
Four UARTs (UART1 with modem control)	SD/MMC memory-card interface
I2S	Three I 2C
One SPI and two SSP	Real-time clock with 2-KB battery-backed RAM
70 I/O pins 104 I/O pins (LPC2377, LPC2378 and LPC2388)	

LPC23xx block diagram

Type	Memory		10/100 Ethernet	Serial							SD/ MMC	ADC/DAC options		Package
	Flash (KB)	SRAM (KB)		USB 2.0 (12 Mbps)	CAN	UART	I2C	I2S	SPI	SSP		ADC channels (10-bit)	DAC channels (10-bit)	
LPC2361FBD100	64	34	No	Device/ Host /OTG	2	4	3	1	1	2		6	1	LQFP100
LPC2362FBD100	128	58	1 (RMII)	Device/ Host /OTG	2	4	3	1	1	2		6	1	LQFP100
LPC2364FBD100	128	34	1 (RMII)	Device	2	4	3	1	1	2		6	1	LQFP100, TBGA100
LPC2365FBD100	256	58	1 (RMII)			4	3	1	1	2	•	6	1	LQFP100
LPC2366FBD100	256	58	1 (RMII)	Device	2	4	3	1	1	2		6	1	LQFP100
LPC2367FBD100	512	58	1 (RMII)			4	3	1	1	2	•	6	1	LQFP100
LPC2368FBD100	512	58	1 (RMII)	Device	2	4	3	1	1	2	•	6	1	LQFP100, TBGA100
LPC2377FBD144(1)	512	58	1 (RMII)			4	3	1	1	2	•	8	1	LQFP144
LPC2378FBD144(1)	512	58	1 (RMII)	Device	2	4	3	1	1	2	•	8	1	LQFP144
LPC2387FBD100	512	98	1 (RMII)	Device/ Host /OTG	2	4	3	1	1	2	•	6	1	LQFP100
LPC2388FBD144(1)	512	98	1 (RMII)	Device/ Host /OTG	2	4	3	1	1	2	•	8	1	LQFP144

(1) LPC2377, LPC2378, and LPC2388 are equipped with MiniBus