



NXP 80C51-based MCUs LPC93x1

28-pin, 8-bit MCUs with enhanced RC oscillator and temp sensor

Building on the success of the LPC900 family, these high-performance MCUs use an accelerated 80C51 CPU to enhance performance. They offer high integration and are available in small, 28-pin packages.

Key Features

- ▶ Accelerated 80C51 CPU
- ▶ 4/8 KB code Flash
- ▶ 256-Byte RAM
- ▶ System supervisory functions (POR, enhanced brownout detection)
- ▶ Two 16-bit timers
- ▶ System timer/RTC, Watchdog timer
- ▶ Dual 8-bit ADCs/DACs (LPC9331/9341)
- ▶ On-chip temperature sensor (LPC9331/9341)
- ▶ Two analog comparators
- ▶ Enhanced UART, I²C-bus, SPI
- ▶ Internal RC oscillator trimmed to a $\pm 1\%$ accuracy with clock-doubler option
- ▶ Clock switching on the fly
- ▶ 26 configurable I/O pins
- ▶ Temperature range: -40 to + 85 °C
- ▶ Small, 28-pin packages: TSSOP28

Application

- ▶ Consumer
- ▶ Industrial products

- ▶ Battery-powered devices
- ▶ Security systems
- ▶ HVAC
- ▶ Protocol conversion

These 8-bit microcontrollers use an accelerated architecture that executes instructions in two to four clocks, delivering performance that is six times higher than that of a standard 80C51 device.

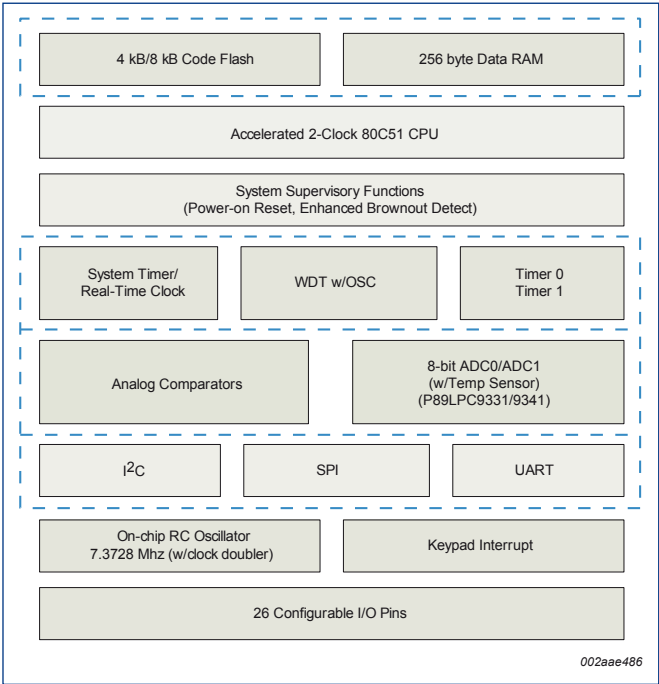
Integrated features such as byte-erasable Flash memory, enhanced timing functions, and power monitoring, make these microcontrollers well suited to a very wide range of applications. On-chip features combine to reduce chip count, save board space, and lower overall cost.

The LPC93x1 microcontroller has 4/8 KB of byte-erasable Flash code memory that can be used to simulate an EEPROM, with a full erase or program taking only 2 ms. It also has 256 bytes of Data RAM.

Serial interfaces include a 400-kHz I²C bus, an SPI bus, and an enhanced UART with fractional baud-rate generator, break detect, framing error detection, automatic address detection, and versatile interrupt capabilities.

The LPC9331/9341 has dual 4-channel 8-bit A/Ds and 1-channel D/As. The on-chip temperature sensor is integrated within ADC0 and operates over a wide range (-40 to +85 °C). There are two 16-bit counter/ timers, each configurable to toggle a port output on timer overflow or to act as a PWM output.

LPC93x1 Block Diagram



A 7.37-MHz internal RC oscillator with a $\pm 1\%$ tolerance over voltage and ambient temperature lets the microcontroller operate without external oscillator components. Users can adjust the IRC oscillator to other frequencies. When the clock doubler option is enabled, the output frequency is 14.746 MHz. The on-chip Watchdog timer has a separate on-chip oscillator (nominal 400 kHz), calibrated to $\pm 5\%$ at room temperature, requires no external components, and is selectable from eight values. To provide optimal support for active mode with minimal power, there is on-the-fly clock switching for the internal RC oscillator, the Watchdog oscillator, and the external clock source. Fast switching maximizes performance.

System supervisory functions include Power-on reset (POR) and enhanced brownout detection (BOD). Enhanced low voltage (brownout) detect allows a graceful system shutdown when power fails and can be optionally configured as an interrupt. To reduce power consumption further, each processor supports an idle mode and two different power-down modes. Total power-down current is less than 1 μ A.

There are up to 26 I/O, each with a V_{DD} operating range of 2.4 to 3.6 V and a tolerance to 5 V. These MCUs are pin-to-pin compatible with P89LPC930/931/933/934 devices housed in the same packages.

Third-Party Development Tools

Through third-party suppliers, NXP offers a range of development and evaluation tools for its microcontrollers. For the most current listing, please visit www.nxp.com/microcontrollers.

Selector Guide

| Type | Memory | | I/O pins | ADC | DAC | Temp. Sensor | Serial interfaces | | Temperature range (°C) | Package |
|-------------|--------|-------|----------|----------|------|--------------|----------------------|------|---------------------------|---------|
| | Flash | RAM | | | | | I ² C-bus | UART | | |
| P89LPC9301 | 4K | 256 B | 26 | | | | • | • | -40 to +85 | TSSOP28 |
| P89LPC931A1 | 8K | 256 B | 26 | | | | • | • | -40 to +85 | TSSOP28 |
| P89LPC9331 | 4K | 256 B | 26 | 2x4ch/8b | 2x8b | • | • | • | -40 to +85 -40 to +125 | TSSOP28 |
| P89LPC9341 | 8K | 256 B | 26 | 2x4ch/8b | 2x8b | • | • | • | -40 to +85 | TSSOP28 |

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Date of release: April 2009
Document order number: 9397 750 16683
Printed in the Netherlands