NXP ARM® Cortex™-M3 MCUs LPC1500 series

Motion control – simplified

Equipped with an optimized motion-control unit comprised of interconnected 2 Msps ADCs, high-speed PWMs with dead time, on-chip comparators, and a Cortex-M3 core, these advanced MCUs simplify development and reduce time-to-market for sensored and sensorless motion-control applications in industrial and consumer segments.

KEY FEATURES
- 72-MHz ARM Cortex-M3
- Operating voltage: 2.4 to 3.6 V
- Up to 256 kB Flash
- Up to 36 kB SRAM
- 4 kB EEPROM with EEPROM ROM drivers
- Serial interfaces: C_CAN controller, FS USB with PHY, three USART, one I2C, two SPI
- State-configurable timer and PWM block (SCTimer/PWM) for advanced control functions
- Two 12-bit ADCs, one 12-bit DAC, and four comparators
- 18-channel DMA engine
- Quadrature Encoder Interface (QEI)
- ROM API support
- Up to 78 GPIO
- Extended temp range of -40 to +105 °C
- Compact LQFP package

The NXP LPC1500 series are 32-bit microcontrollers that integrate an extensive set of motion-control peripherals. They include special features for sensorless and sensored operation, and can control two motors simultaneously. They enable simpler development, with faster time-to-market, for cost-optimized, low-power systems that deliver advanced performance.

Each LPC1500 MCU is equipped with a PWM/timer subsystem that includes a total of four state-configurable timers (SCTimer/PWMs), a peripheral function exclusive to NXP that makes it easy to configure the advanced PWM and timing functions necessary for motion control. The on-chip QEI is ideal for applications that use sensored motion control.

Each LPC1500 device has two ADCs, each supporting a resolution of up to 12 bits and a fast conversion rate of up to 2 MHz. The ADCs are supported by a 12-bit DAC and four analog comparators. Sequences of A-to-D conversions can be triggered by multiple sources, including internal connections to other on-chip peripherals such as the SCTimer/PWM and analog comparator outputs. A temperature sensor completes this sophisticated analog subsystem.

TARGET APPLICATIONS
- Motion drives
- Motor control
- Digital power supplies
- Solar inverters
- Home appliances
- Building and factory automation
- Industrial and medical
The DMA controller, which has 18 channels and 20 programmable input triggers, services memory and peripheral resources.

Putting special functions in ROM helps improve time-to-market, reduce code size, and simplify development. Pre-loaded into the ROM are a boot loader, In-System Programming (ISP) and In-Application Programming (IAP) support for Flash (with an IAP erase command), and for EEPROM. There are ROM-based USB drivers and USB-compliant stacks for HID, CDC, and MS classes, as well as C_CAN drivers. Flash updates via USB and C_CAN are also supported. There are ROM-based drivers for USART, I²C, and DMA ROM-based power profiles configure power consumption, PLL settings, and power-saving modes.

To simplify the development of motion-control applications, the LPC1500 is equipped with “Quick Drive” firmware, which demonstrates sensored and sensorless motion-control functions. The firmware uses a fast Field Oriented Control (FOC) algorithm and a PI loop controller to maintain speed and torque, and minimize the code footprint.

The LPC1500 series is supported by NXP’s LPCXpresso IDE v6, a cross-platform C/C++ development suite that supports all of NXP’s LPC microcontrollers.

Selection guide

<table>
<thead>
<tr>
<th>Feature*</th>
<th>LPC1517</th>
<th>LPC1518</th>
<th>LPC1519</th>
<th>LPC1547</th>
<th>LPC1548</th>
<th>LPC1549</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flash (kB)</td>
<td>64</td>
<td>128</td>
<td>256</td>
<td>64</td>
<td>128</td>
<td>256</td>
</tr>
<tr>
<td>SRAM (kB)</td>
<td>12</td>
<td>20</td>
<td>36</td>
<td>12</td>
<td>20</td>
<td>36</td>
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<tr>
<td>Full-Speed USB with PHY</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>1</td>
<td>1</td>
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<tr>
<td>2 MHz ADC (bit/channel)</td>
<td>2x 12-ch/12 b</td>
<td>2x 12-ch/12 b</td>
<td>2x 12/12</td>
<td>2x 12-ch/12 b</td>
<td>2x 12/12</td>
<td>2x 12/12</td>
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<tr>
<td>Packages</td>
<td>LQFP48/64</td>
<td>LQFP64/100</td>
<td>LQFP64/100</td>
<td>LQFP48/64</td>
<td>LQFP64/100</td>
<td>LQFP48/64/100</td>
</tr>
</tbody>
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* Common features: CAN, I²C, UART, four SCTimer/PWMs, four comparators, 12-bit DAC, QEI, CRC engine