Appendix 1

Technical Specification of LPC 2148

ARM7

The ARM architecture defines a protocol for interaction between the main ARM core and coprocessors and instructions for data transfer between ARM and coprocessors. Coprocessors are required to expose load-store architecture. Each coprocessor can have up to sixteen registers of any size. There are three types of coprocessor-related instructions recognized by the main ARM core. First, there are data processing instructions. These are completely internal to the coprocessor. Whenever the ARM core fetches such an instruction, it executes a simple handshake protocol to make sure that one of coprocessors accepts this instruction.

The second type of coprocessor instructions are load-store instructions that transfer data between coprocessor registers and memory. The ARM core initiates execution of such instructions by computing a memory address and sending it to the address bus. However, since the ARM core does not know the size of coprocessor registers, the coprocessor controls the number of transferred words itself.

Finally, the ARM architecture supports register transfer instructions that transfer data between the integer pipeline and coprocessor registers. No matter what the native coprocessor register size is, these operations transfer 32-bit values only.
The Main features of LPC2148

- 16-bit/32-bit ARM7TDMI-S microcontroller in a tiny LQFP64 package.
- 8 Kb to 40 Kb of on-chip static RAM and 32 Kb to 512 Kb of on-chip flash memory.
- 128-bit wide interface/accelerator enables high-speed 60 MHz operation.
- In-System Programming/In-Application Programming (ISP/IAP) via on-chip boot loader software. Single flash sector or full chip erase in 400 ms and programming of 256 bytes in 1 ms.
- Embedded ICE RT and Embedded Trace interfaces offer real-time debugging with the on-chip Real Monitor software and high-speed tracing of instruction execution.
- USB 2.0 Full-speed compliant device controller with 2 Kb of endpoint RAM.
- In addition, the LPC2146/48 provides 8 Kb of on-chip RAM accessible to USB by DMA.
- One or two (LPC2141/42 vs. LPC2144/46/48) 10-bit ADCs provide a total of 6/14 analog inputs, with conversion times as low as 2.44 μs per channel.
- Single 10-bit DAC provides variable analog output (LPC2142/44/46/48 only).
- Two 32-bit timers/external event counters (with four capture and four compare channels each), PWM unit (six outputs) and watchdog.
- Low power Real-Time Clock (RTC) with independent power and 32 kHz clock input.
- Multiple serial interfaces including two UARTs (16C550), two Fast I2C-bus (400 kbit/s), SPI and SSP with buffering and variable data length capabilities.
- Vectored Interrupt Controller (VIC) with configurable priorities and vector addresses.
- Up to 45 of 5 V tolerant fast general purpose I/O pins in a tiny LQFP64 package.
- Up to 21 external interrupt pins available.
- 60 MHz maximum CPU clock available from programmable on-chip PLL with settling time of 100 μs.

- On-chip integrated oscillator operates with an external crystal from 1 MHz to 25 MHz.

- Power saving modes include Idle and Power-down.

- Individual enable/disable of peripheral functions as well as peripheral clock scaling for additional power optimization.

- Processor wake-up from Power-down mode via external interrupt or BOD.

- Single power supply chip with POR and BOD circuits:

  - CPU operating voltage range of 3.0 V to 3.6 V (3.3 V ± 10 %) with 5 V tolerant I/O pads.

**LPC 2148 Mini Board:**

![LPC 2148 Mini Board](image-url)

*Figure A.1 LPC 2148 Mini Board*
Figure A.1 shows LPC 2148 Development Board it uses an ARM7TMDI based microcontroller. The LPC2148 microcontroller has 512KB of internal flash and 32+8K RAM. Following are the salient features of the board.

- Dimensions: 160 X 160mm2 layer PCB (FR-4 material)
- Power supply: DC 9-12V with power LED
- Linear regulators generate +3.3V/500mA and +5v/500mA from the power supply
- USB connector (as alternate power source).
- 8 Led Array
- INT keys
- Extension headers for all microcontroller pins. Connectors (2).
- RS232 connectors (2).
- JTAG connector.
- SD/MMC connector.
- USB B-type connector with Link-LED.
- All peripheral configurable via jumpers.
- I²C based EEPROM.
- line X 16 character LCD with back light control.
- RDY to Interface 128X64 GRAPHICAL DISPLAY – Optional