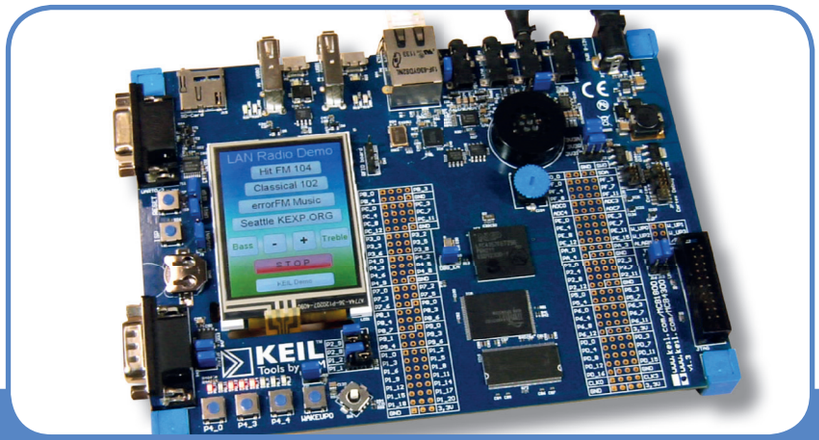


NXP LPC4357-based solution for internet radio

High-performance dual-core LPC4357 MCU for Internet Radio solution

This fully equipped solution provides everything you need to get started with a design, including a Keil evaluation board, based on the LPC4357 ARM Cortex-M4/M0 microcontroller, and complete source code.

KEY FEATURES

- Internet radio supporting SHOUTcast radio stream
- Full design based on Keil MCB4357 evaluation board
- 204-MHz ARM Cortex-M4/M0 LPC4357 microcontroller
- ARM Cortex-M4 core performs
  - Audio decoding without an OS
  - I/O activities
- ARM Cortex-M0 core implements
  - LwIP TCP/IP stack
  - emWin-based GUI
  - Application processing using FreeRTOS
- LCD interface with touchscreen display
- 10/100T Ethernet MAC for network connectivity
- SDRAM interface for buffering music streams
- Support for optional microSD card containing MP3 files
- On-chip High Speed USB device/host/On-The-Go controller
- 5 V power supply using on-board USB interface
- Compatible with Keil µVision 4.70

TARGET APPLICATIONS

- Audio entertainment

This design example, which highlights the capabilities of the dual-core LPC4357 microcontroller, can be used as an MP3 player, playing MP3 files from a user-supplied SD card, or as an internet radio, using a SHOUTcast radio stream.

Application tasks are divided between the two LPC4357 cores. The ARM Cortex-M4 deals with audio decoding and related I/O activities, without an OS, while the M0 core runs the LwIP TCP/IP stack, the emWin-based GUI, and the internet radio application, using FreeRTOS.

Dividing the tasks between the two cores creates a highly efficient system, with bandwidth to spare, and also makes the design easier to manage, from a development standpoint.

Having separate tasks performed by separate cores simplifies design optimization. The Cortex-M0 core can be configured to support a more robust GUI or a High Speed USB device/host function without impacting the job of MP3 decoding. Similarly, the Cortex-M4 can be programmed to perform extra audio processing, such as Dolby Surround 5.1, without impacting the GUI or the TCP/IP stack.

The application uses only a portion of the dual-core architecture's full capabilities, so there's plenty of bandwidth for user customization. The design can be modified to take on extra features, such as added connectivity or additional audio processing, while maintaining its run-time behavior.

Partitioning the design enables higher performance, because each core is used to its best advantage. Compared to a single-core microcontroller operating at the same clock frequency, the dual-core LPC4357 has more horsepower. It can implement tasks that require more MIPS and more run time, lowering the risk of impacting application functionality.

COMPLETE DESIGN

The design example includes all the necessary hardware components for the application. All that's needed to run the MP3/WAV Player is a microSD card and an internet connection for the Internet Radio.

Source code, developed using the Keil MDK-ARM environment and µVision version 4.70, is provided with the design. The project page can be found on LPCware.com: www.lpcware.com/internet-radio

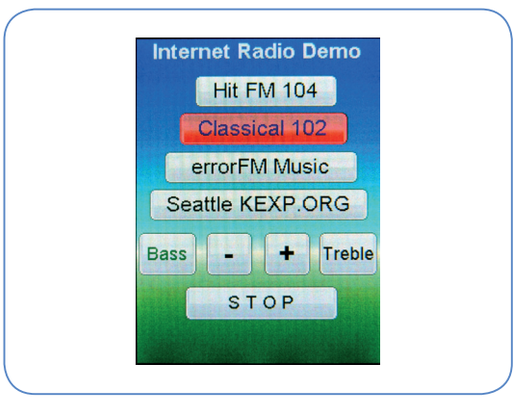
ABOUT THE LPC4357

The LPC4357 is an ARM Cortex-M4 based digital signal controller with an ARM Cortex-M0 coprocessor designed for embedded applications requiring signal processing. The ARM Cortex-M4 core offers single-cycle Multiply-Accumulate and SIMD instructions and a hardware floating-point unit to support signal processing, while the M0 coprocessor handles I/O and digital control processing. The LPC4357 includes 1 MB Flash memory, 136 kB of data memory, two High Speed USB 2.0 Host/OTG/Devices, advanced configurable peripherals such as the State Configurable Timer (SCT), Serial General Purpose I/O (SGPIO), and SPI Flash Interface (SPIFI) as well as Ethernet, LCD, an external memory controller, and multiple digital and analog peripherals.

Design architecture

Feature/Resource	Cortex-M0	Cortex-M4
CPU speed	180 MHz	180 MHz
Memory	▸ Code execution: Flash bank #B ▸ Internal SRAM, external SDRAM	▸ Code execution: Flash bank #A ▸ Internal SRAM, external SDRAM
Software components	▸ Free RTOS ▸ LwIP Ethernet stack ▸ emWin graphics library ▸ SHOUTcast application ▸ UART debug output	▸ MP3 decoder ▸ I²S interface handling ▸ UART debug output
Peripherals used	▸ Ethernet ▸ LCD ▸ UART ▸ GPIO	▸ I²S ▸ UART
Possible add-on features	▸ USB device for connection to PC host ▸ More sophisticated GUI	▸ Implementation of AAC+ decoder ▸ MP3 player from microSD Card ▸ USB host for MP3 player from USB memory stick ▸ Audio enhancements (equalizer, 5.1 Surround, etc.)

Figure 1



User interface for Internet Radio

Figure 2

User interface for MP3 Player

www.nxp.com

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