Features

- **8-bit AVR® Core with 83 ns Instruction Cycle Time**
- **16K Bytes ROM Program Memory**
- **512 Bytes SRAM**
- **32 x 8 General Purpose Working Registers**
- **20 Programmable I/O Port Pins**
- **Programmable Serial UART**
- **SPI Serial Interface**
- **One 8-bit Timer/Counter with Separate Prescaler**
- **One 16-bit Timer/Counter with Separate Prescaler**
- **External and Internal Interrupt Sources**
- **Programmable Watchdog Timer with On-chip Oscillator**
- **Bus-or Self-powered USB Hub with Four Downstream Ports**
- **One Attached Function Port with Three Endpoints**
- **Programmable 6/12 MHz Oscillator with PLL**
- **On-chip 3.3V Supply for USB**
- **42-pin SDIP and 48-lead TQFP Packages**

Overview

The Atmel AT43USB321 is a single-chip microcontroller based USB hub with an embedded function and a 16K byte masked ROM. The USB hub has five downstream ports, one of which is permanently attached. Internally the AT43320 consists of a USB hub and function interface, a hub repeater, and a high-performance, efficient 8-bit RISC microcontroller. The hub and peripheral device controller function is implemented in the microcontoller's firmware. To the USB host, the embedded function appears as an attached port of the hub with its own device address and endpoints. The AT43USB321 can also be configured as a USB function without the hub.

The USB hardware block consists of a USB transceiver, SIE, hub repeater, endpoint controllers, and an interface to the microcontroller. The USB hardware interfaces to the USB host at the transaction level. The CPU of the microcontroller is based on the Atmel AVR microcontroller. The AVR architecture was developed to be programmed in C efficiently and with maximum performance.
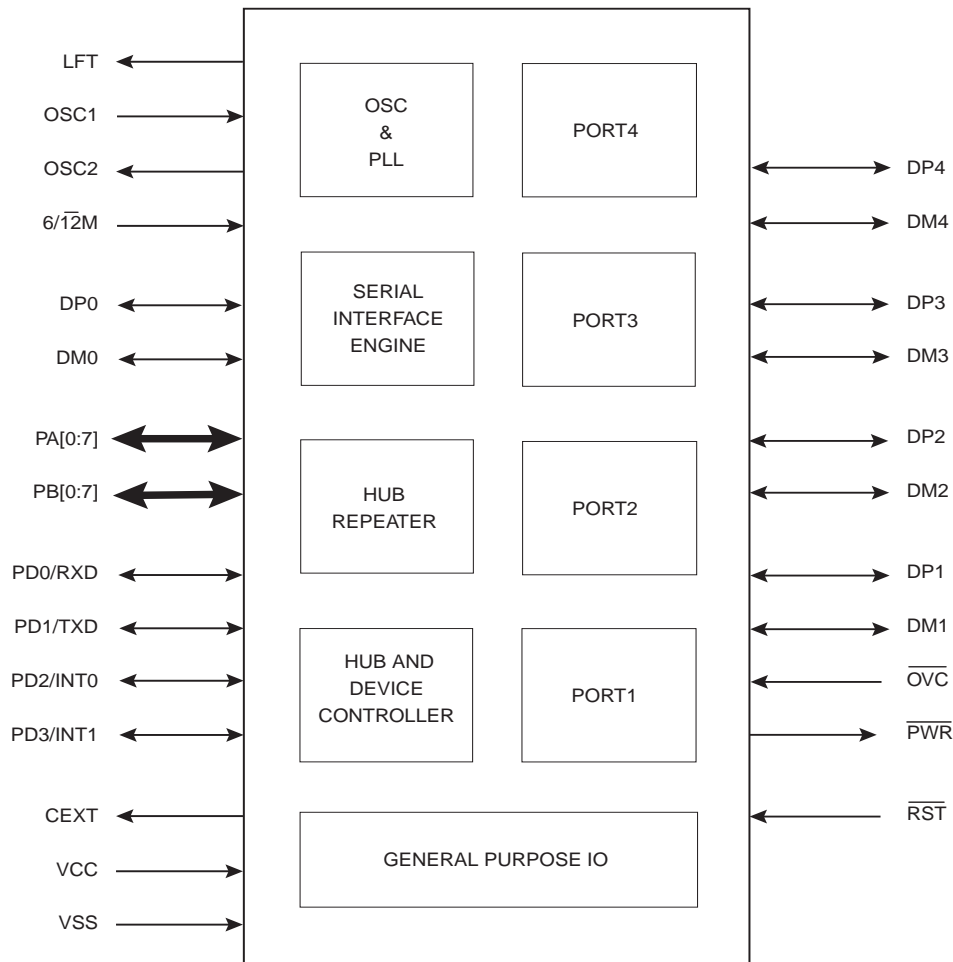
Full-speed USB Hub/Function Microcontroller

AT43USB321

Figure 1. AT43USB321 Block Diagram

Development Support

The AT4USB321 uses the same program and development tools as the Atmel AVR microcontrollers including: C compilers, macro assemblers, program debuggers/simulators, in-circuit emulators. The AT43USB321 is binary compatible with the AT43320 and the two share the same development kit, which includes firmware source code for the most common USB applications.

Applications

The attached diagram shows an application of the AT43USB321 in a monitor as a hub with two embedded functions: a monitor display controller and IR receiver. The number of external downstream ports of the hub is pro-

grammable from one to four. The hub can be self-powered or bus-powered. In most cases, hubs in the monitors will be self-powered because of the readily availability of the power supply and its more versatility.

In this example, the AT43USB321 interfaces to the monitor's microcontroller, the host microcontroller, through an I^2C serial bus that supports two way communications such as DDC2Bi. The firmware inside the AT43USB321 acts as the translator between the host system and the host microcontroller. This function can be performed without any modification in the host microcontroller's firmware resulting in a very flexible way of adding USB capability in any monitor. The IR receiver function is also implemented in firmware also and can support any consumer type IR protocol that uses a frequency in the range of up to 52 kHz.

Figure 2. Hub/Monitor/IR Chip Application
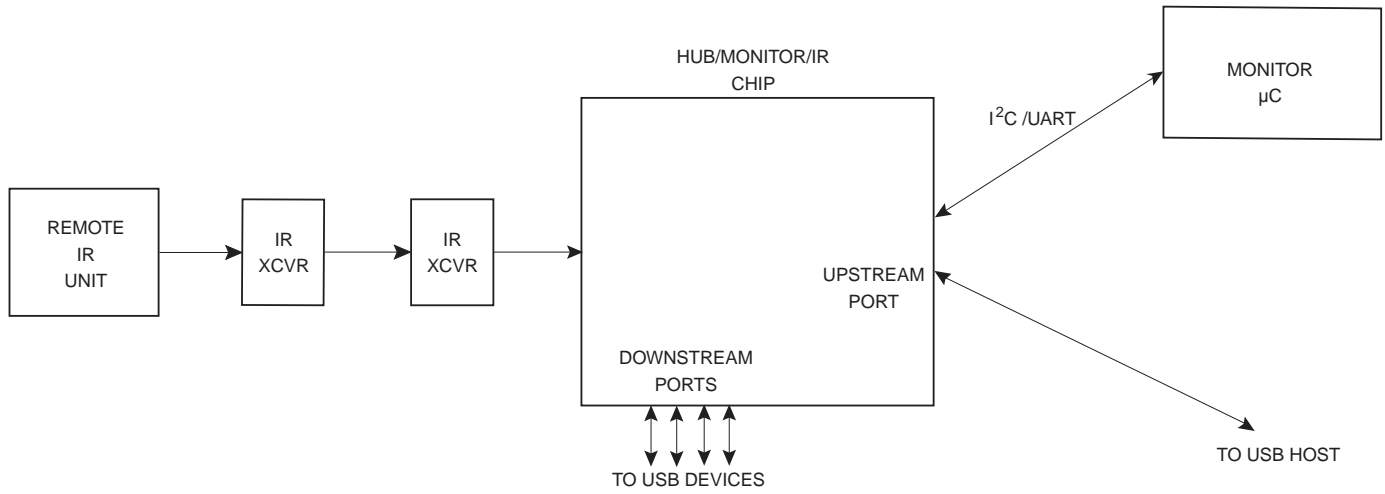
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