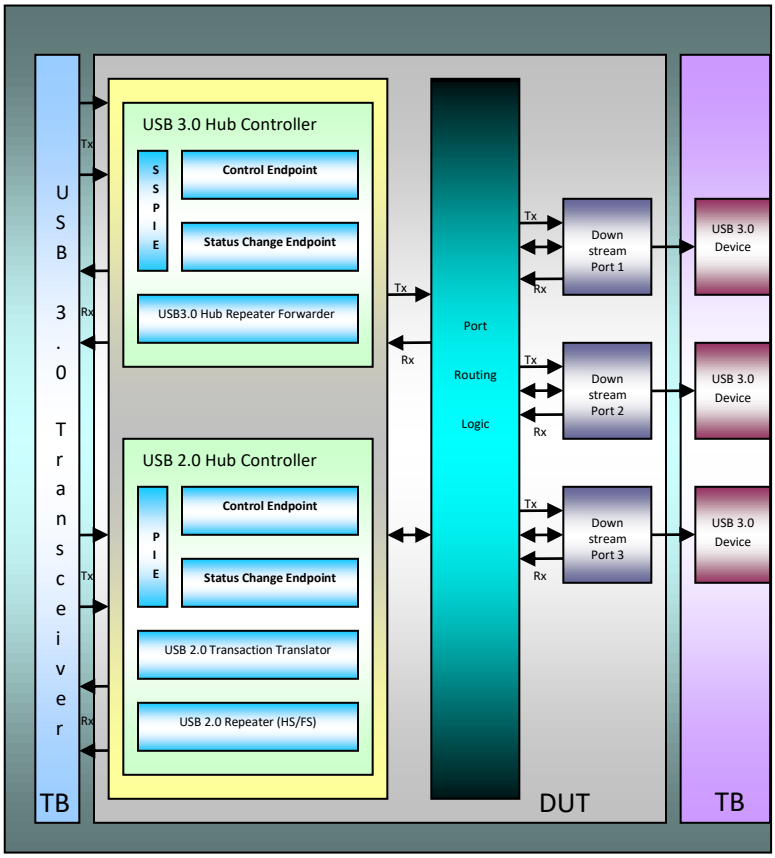
VINCHIP USB 3.0 CORE IP
SUPER-SPEED USB3.0 HUB CONTROLLERPRODUCT BRIEF

VUSB30HUB



USB3.0 SuperSpeed Hub

The Super Speed USB bus is implemented as a separate dual-simplex data path consisting of two uni-directional differential links, one for transferring data from the host downstream to Hub3.0 or USB3.0 Peripherals and one for transferring data from Hub or Peripherals upstream to the USB host. The D+/D- signal pins defined by USB 2.0 are not used for Super Speed operation but are provided to allow for backward compatible operation.

Super-Speed USB3.0 Hub Controller (VUSB30HUB)

The Vinchip VUSB30HUB core provides a USB3.0 functional Hub controller and a Repeater / Forwarder that conforms to the USB 3.0 specification for Super-Speed (5 Gbps) and with backward compatible USB2.0 Hub (480, 12 and 1.5 Mbps) functions. The 3.0 Hub Repeater / Forwarder is responsible for connectivity setup, tear down, bus fault detection and recovery and connect / disconnect detection. Hub specific status and control commands allows host to configure the hub and control its individual downstream facing ports. The backward compatible USB 2.0 Hub core consists of Hub Controller, Repeater and Transaction Translator.

Major product features:

- Complies with USB 3.0 standard for Super-Speed (5.0 Gbps), Hi-Speed (480 Mbps), Full-Speed (12 Mbps) and Low-Speed (1.5 Mbps).
- Backward compatible with USB2.0 devices and hubs and the type A connectors.
- Technology and Process independent.
- Data Interface is Dual-simplex, 4-wire differential signaling, separate from USB2.0 signaling with downstream connect / disconnect detection.
- Supports Super speed UTMI transceiver interface with extension to the existing UTMI Interface for USB2.0
- Super-Speed Hub3.0 consists of Hub Forwarder/Repeater and a Hub Controller.
- Separate Header Buffers for each Upstream and Downstream Port's traffic Forwarding / Repeating.
- Compatible USB transfer support for Control and Interrupt transfers to USB3.0 Hub using USB3.0 Transaction / Handshake Packets and the Data Packets.
- Super-speed Independent Data Packet Buffering and Concurrent transactions in both Upstream and Downstream directions
- Bus Transaction protocol is host directed and has asynchronous traffic flow. The packet traffic is explicitly routed.
- Store and Forward more than one data packets at the same time.
- End-to-End Protocol will retry for recovery.
- Support all standard and Hub specific control transfer requests.
- Super-speed Repeater / Forwarder reclock packets in both the directions.
- Supports suspend and resume signaling and also handle Hub Power Management.
- Utility for wiring of parameterizable downstream Ports, its routing and descriptor generation.
- Fully synthesizable.

Deliverables:

- Verilog source code and test-bench.
- Scripts for simulation and synthesis.

The VUSB30HUB provides a USB 3.0 Transceiver Interface (UTMI extension to usb3.0) to connect to a super speed transceiver.

The VUSB30HUB has a USB2.0 Hub and a Super-Speed Hub comprising of the USB3.0 Hub controller and the Hub Repeater / Forwarder. The Hub Repeater/Forwarder is responsible for managing connectivity between upstream and downstream facing ports which are operating at Super Speed.
The USB 3.0 Architecture allows concurrent transactions to occur in both the upstream and downstream directions.

The Hub Controller provides status and control and permits host access to the Super Speed Hub.
A Utility is provided for configuring the hub downstream ports to the user's requirements.

This document describes its salient features and its internal organization below.

USB2.0 Hub controller
This block consists of the Hub Controller, Repeater and Transaction Translator. The Hub Controller provides the mechanism for host to hub communication. Hub-specific status and control commands permit the host to configure a hub and to monitor and control its transaction translator and individual downstream ports.

Hub Controller - PIE interface between the usb2.0 utmi phy interface and the hub controller containing a control endpoint and a status change endpoint. The **Control Endpoint** handles all Hub2.0 specific requests. The **Status Change Endpoint** reports the Hub and its Downstream Port Status to the upstream USB Host.

Transaction Translator handles all the usb transfers between the High speed USB2.0 Host/Hub on the upstream with the USB1.1 legacy devices.

Hub Repeater (High / Full Speed) handles either broadcasting of the upstream packets on the downstream or repeating any one of the downstream packets to the upstream.

USB3.0 Hub controller and Forwarder/Repeater
This block contains the SSPIE (SuperSpeed PHY Interface Engine, USB3 SuperSpeed control endpoint, USB3 super speed status change endpoint blocks).

Super Speed Hub Controller - SSPIE interfaces between the usb3.0 super speed signals of the utmi transceiver extension. The control endpoint handles hub standard control requests, the hub enumeration and also reports hub / downstream port status to the USB Host

Forwarder / Repeater routes the upstream packets to the specific downstream ports as mentioned in the route string. And also forward the downstream packets to the Upstream. Handles downstream port connect/disconnect. It also handles suspend / resume signaling on the downstream ports.

Hub Header and Data Buffer Architecture
The hub ports provide buffers to handle independently the packet headers and the data packets in both the direction.

Downstream Port Handler

This block detects connect / disconnect events in the port and has the capability to enable, disable / suspend the port. This also reports the port status and change information to the Hub Controller block, and also determines whether the device attached is Super Speed, High speed, Full speed or Low speed.

Products & Services

VinChip's suite of soft cores for SoCs includes USB, WUSB, WiMedia Mboa Mac, PCI, AHB2PCI, SATA, Ethernet, PCI_Express and Bluetooth controllers. These soft cores come with comprehensive documentation, verification environment, test suite, Drivers and tech support. Please contact us at info@vinchip.com for more information on our products and services.

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