IP Leaflet
USB3.1 Gen1 xHCI Host Controller IP Core

Overview

The Renesas USB3.1 xHCI Host Controller IP is compliant with the Universal Serial Bus (USB) 3.1 Specification.

This IP uses AXI interconnection, which is a system interface that is based on the AMBA® AXI4, and AXI4-Lite Protocol Specification.

In addition, this IP has interfaces with USB3.1 PHY which is compliant with PHY Interface for the PCI Express, SATA, and USB 3.1 Architectures Version 4.3 (PIPE4.3), and with USB2.0 PHY which is compliant with USB2.0 Transceiver Macrocell Interface Plus (UTMI+) Specification Level 3.
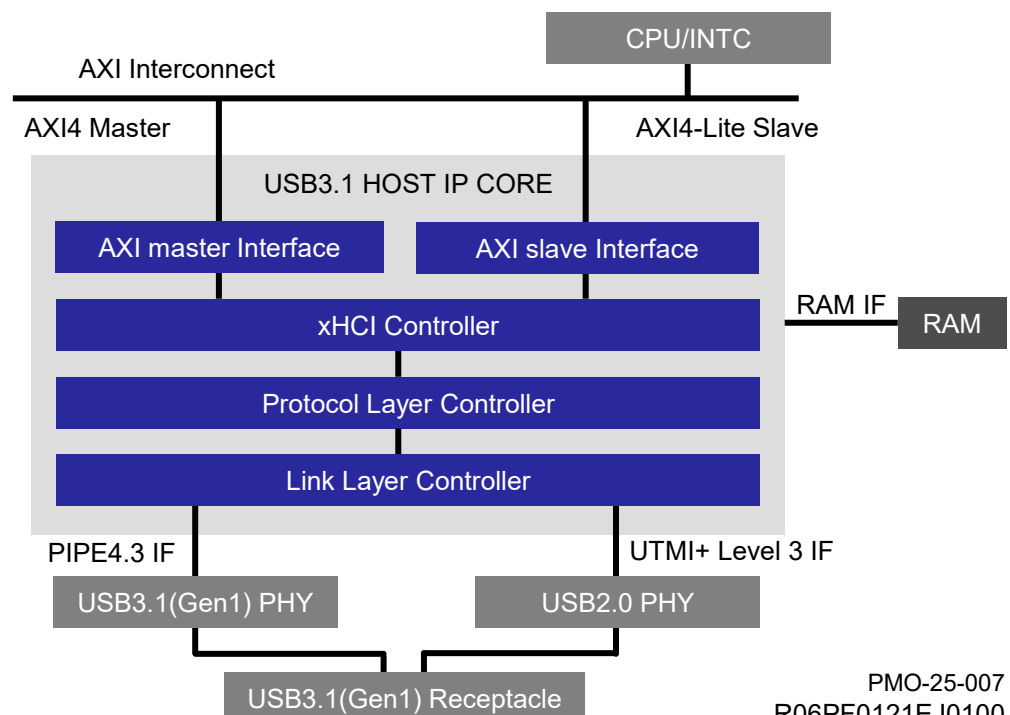
This IP supports USB3.1 bus-speeds: Super Speed (5 Gbps), High Speed (480 Mbps), Full Speed (12Mbps), and Low Speed (1.5Mbps).

This IP is also compliant with the Battery Charging Specification Revision 1.2 and based on the eXtensible Host Controller Interface for the Universal Serial Bus (xHCI) Specification as a Host Controller Interface.

Key Features

General

- Compliant with the Universal Serial Bus (USB) 3.1 Specification Revision 1.0.
- Compliant with the Universal Serial Bus Specification Revision 2.0.
- Compliant with the Battery Charging Specification Revision 1.2.
- Compliant with the PHY Interface for the PCI Express, SATA, and USB3.1 (PIPE) Version 4.3.
- Compliant with the eXtensible Host Controller Interface for the Universal Serial Bus Specification Revision 1.1.
- Compliant with the USB2.0 Transceiver Macrocell Interface Plus (UTMI+) Specification Revision 1.0 Level 3.
- Compliant with AMBA® AXI4, and AXI4-Lite Protocol Specification.

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USB function

- Supports 1 downstream USB receptacle.
  - Number of SS ports   : 1
  - Number of HS,FS,LS ports : 1
- Supports USB bus-speeds: Super Speed (5 Gbps), High Speed (480 Mbps), Full Speed (12 Mbps), and Low Speed (1.5 Mbps).
- Supports all transfer-types :Control, Bulk, Interrupt, Isochronous, and these split-transactions
- Supports Power Control and Over Current Detection.

Battery Charging Functions

- Supports the following charging port device's modes.
  - Standard Downstream Port (SDP) Mode
  - Charging Downstream Port (CDP) Mode
  - Dedicated Charging Port (DCP) Mode

xHCI Host Capabilities

- Number of Device Slots (MaxSlots)   : 32
- Number of Total Endpoints   : 64
- Number of Event Ring Segment Tables : 2 tables   (ERST Max is 1)
- Supported Page Size   : 4K bytes
- Context Size   : 64 bytes (CSZ is 1)
- Number of Interrupter (MaxIntrs)   : 1
- Number of Stream IDs   : 65536 (MaxPSASize is 15)
- Supports Primary Stream Array.
- Supports the USB Legacy Support.

PIPE4.3 interface

- Data Bus width and Frequency:
  - Gen1 : 32 bits @125 MHz

UTMI+ interface

- Supported Level : Level 3
- Data Bus width   : 8 bits @60MHz
- Data Bus mode : Unidirectional

AXI4 Master interface

- Address Bus width   : 32 bits (64bits optional)
- Data Bus width   : 128 bits
- ID width   : 4 bits
- Maximum Burst Length   : 16 bursts
- Incremental Burst
- Little Endian bus

AXI4-Lite Slave interface

- Address Bus width   : 32 bits (64 bits optional)
- Data Bus width   : 32 bits
- ID width   : 32 bits
- Little Endian bus

Product Details

IP Core

The Renesas USB3.1 Host controller is the xHCI-compliant IP which implements Link Layer Controller, Protocol Layer Controller, xHCI Controller and AXI bus Interface. Link Layer Controller frames the USB packet, treats link command and controls LTSSM (Link Training Sequence State Machine). Protocol Layer Controller buffers the transaction data, constructs/deconstructs the packets and controls the transaction. The xHCI Controller contains xHCI registers, schedules the transfer and interfaces to xHCI Driver.

This IP supports Super Speed (5 Gbps), High Speed (480 Mbps), Full Speed (12Mbps), and Low Speed (1.5Mbps).

This IP has three interfaces: AXI, PIPE, and UTMI+.

AXI interface

This IP has AXI4 Master interface and AXI4-Lite Slave interface. The master interface is for transaction data handling, and the slave interface is for register interface.

PIPE interface

This IP supports PIPE4.3 interface for USB Super Speed.

UTMI+ interface

This IP supports UTMI+ Level 3 interface for USB High Speed, Full Speed, and Low Speed.