

### USB On-The-Go

USB OTG Function Controller is a highly integrated USB OTG solution for USB OTG applications. SI22USBOTG11 is a USB OTG Function Controller Core designed as per USB OTG specification, which is a supplement to USB 2.0 specification. It has the standard UTM+ Interface at Host end and a generic Microcontroller Interface at the Device end. It is a single core solution, incorporating USB OTG operating in Link Layer of Open System Interconnect (OSI) which significantly reduces the time and cost of implementing complex USB OTG target system designs.

The USB On-The-Go specification has been introduced to provide a Low-cost connectivity solution for consumer portable devices such as mobile phones, PDAs, digital still cameras and MP3 players. Devices that are solely peripherals initiate transfers through a Session Request Protocol (SRP) while Dual-Role Devices support both SRP and Host Negotiation Protocol (HNP).

SI22USBOTG11 is user-configurable and individually programmable for Bulk/Interrupt or Isochronous transfers. Access to the FIFOs associated with these endpoints and to the internal Control / Status Registers is either via an 8 bit micro-controller bus.

Following are the two modes of operation that SI22USBOTG11 supports,

Peripheral mode

Host mode

When acting as a Peripheral, SI22USBOTG11 provides all the encoding, decoding and checking needed in sending and receiving USB packets – interrupting the CPU only when endpoint data has been successfully transferred. When acting as a Host, SI22USBOTG11 additionally maintains a Frame Counter and automatically schedules SOF. It also includes support for the Session Request and Host Negotiation Protocols required for point-to-point communications, details of which are given in the USB On-The-Go supplement to the USB 2.0 specification.

The initial operation of SI22USBOTG11 (Host mode or in Peripheral mode) depends on whether it is being used as an A-device or a B-device. When SI22USBOTG11 is operating as an A-device, it is configured to operate in Host mode in which it generates transactions. When operating as a B-device, SI22USBOTG11 is configured to operate in Peripheral mode, which is same as a normal USB 2.0 peripheral. The SI22USBOTG11 determines whether it is the 'A' device by monitoring the ID pin on the mini-AB receptacle. Using HNP, the roles (Host or Peripheral) can be changed in runtime without the knowledge of the user.

### Product Specifications

- ◆ Fully synthesizable Register Transfer Level (RTL) Verilog core
- ◆ Test Bench (Environment Variable: Verilog , Vera)

### Options:

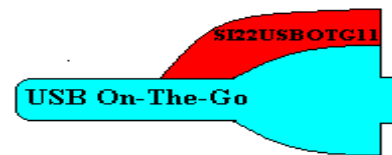
(May be separately priced)

#### Adaptations:.

- √ 16 bit UTM Interface possible

#### Add-ons:

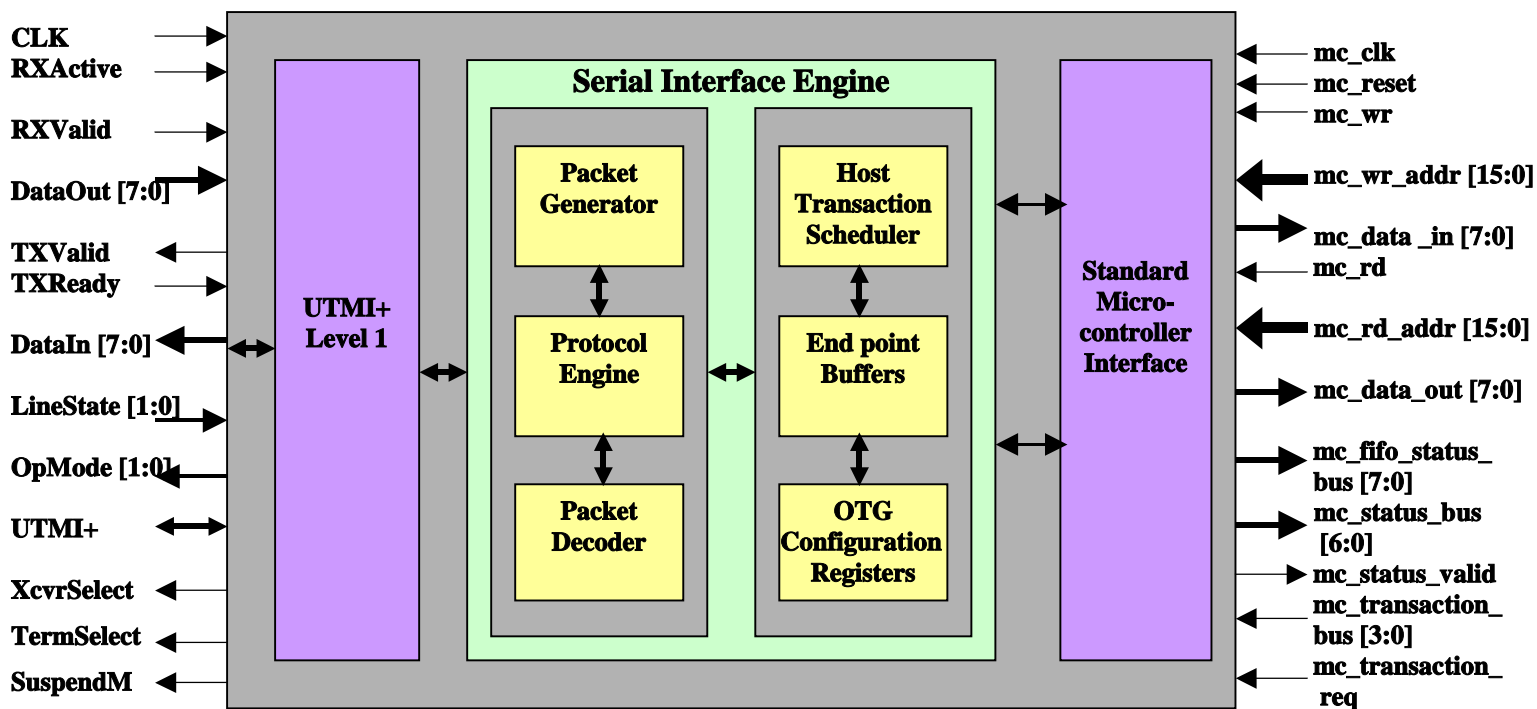
- √ Verification IP - OVA (OpenVera Assertions) - AIP
- √ RVM (Reuse Verification Methodology) based OpenVera VIP



### Product Highlights

- ☑ Dual Role Device: Operates either as a Function Controller for a USB peripheral or as the Host / Peripheral in point-to-point communication with another USB Function
- ☑ Complies with the USB standard for Full-Speed (12 Mbps), High-Speed (480 Mbps) Functions and with the On-The-Go supplement to the USB 2.0 specification
- ☑ Supports point-to-point communication with a Full-Speed or High-Speed device
- ☑ Supports both Session Request Protocol (SRP) and Host Negotiation Protocol (HNP)
- ☑ Supports Dataline Pulsing for A device SRP Detection
- ☑ UTMI+ Level 1 Transceiver Macrocell Interface
- ☑ Supports 8-bit mode of operation
- ☑ Supports 3 Endpoints
  - Endpoint 0 INOUT
  - Endpoint 1 IN
  - Endpoint 2 OUT
- ☑ It supports 256 bytes for EP0 and 4 Kbytes for other endpoints
- ☑ Supports Suspend and Remote Resume signaling

## USB On-The-Go Block Representative



The USB OTG consists of five main modules: UTMI+ level 1 Interface, Host Transaction Scheduler, Endpoint Buffers, Protocol Engine and Microcontroller Interface.

**UTMI+ level 1 Interface:** This interface allows communication between the IP and the external UTM module.

**Host Transaction Scheduler:** This block generates all the traffic as per USB 2.0 specification. It also responds to HNP and SRP which are defined by the USB OTG specification.

**Endpoint Buffers:** It is the ultimate source / sink of information. It supports 3 endpoints. One is the Bi-directional Control endpoint. Other two endpoints can be configured to support any of the three transfer types by making one IN and the other OUT.

**Protocol Engine:** Protocol Engine implements standard USB Protocol which includes maintaining the flow of Token, Data and Status paradigm. It works with Packet Generator and Packet Decoder. Packet Generator generates packet as per USB 2.0 format and sends it over the USB line. Packet Decoder decodes the incoming packet and Protocol Engine takes the decision on it.

**Microcontroller Interface:** This block communicates with Microcontroller on one side and Core on other side. Microcontroller can configure the Core and read the status of the Core through this block.

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