ATM Cell-Based UTOPIA Level 1 Interface Megafunction

Target Applications:
Networking
Data Communications
Multiplexers
Cross-Connects

Family:
FLEX 10K

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Features

- Provides a cell-based Transmission Convergence (TC) sublayer for design of asynchronous transfer mode (ATM) physical interfaces
- Nominal interface bit rate of 155.520 Mbits/second
- ATM transfer capability of either 154.800 Mbits/second or 149.760 Mbits/second for alignment with a synchronous digital hierarchy (SDH) transfer capability
- TC functions are fully compliant with ITU-T Recommendation 1.432
- Provides UTOPIA level 1 interface with an embedded first-in first-out (FIFO) buffer
- Optimized for the Altera® FLEX® 10K device architecture
- Internal 8-bit data path (19.44-MHz clock frequency)

General Description

The ATM cell-based UTOPIA level 1 interface megafunction provides the functions required to design a 155.520 Mbits/second ATM cell-based interface. The TC sublayer must be associated with an optical or electrical physical-medium dependent (PMD) sublayer to form the actual ATM physical interface.

The cell-based physical layer provides the following advantages for the transmission of ATM cells:

- Specifically designed and optimized to carry ATM cells
- Does not require SDH sublayer
- Provides maximum ATM transfer capability (99.5% of the nominal bit rate)
- Provides full operation and maintenance (OAM) functions through F2 OAM cells

The megafunction provides the UTOPIA level 1 interface with the FIFO buffer, a microcontroller unit (MCU) interface, and the cell-based TC functions associated with the transmit and receive directions. The UTOPIA level 1 interface is fully compliant with the ATM forum specification AF-PHY-0017.000 (UTOPIA level 1 version 2.01). The TC functions are fully compliant with the ITU-T Recommendation I.432.

Transmit

The transmit function performs the following actions:

- Insertion of F3 OAM cells for performance monitoring. One F3 OAM cell is inserted after 215 contiguous ATM layer cells or idle cells. F3 OAM cells carry defect information and BIP-8 calculation for performance monitoring as specified in ITU Recommendation I.610 and G.826.
- Insertion of idle cells when an ATM layer cell will not be transmitted.
- Cell scrambling by using the distributed sample scrambler (DSS). Both the cell header and cell payload are scrambled to improve transmission performance. The DSS is a self-synchronous scrambler that does not multiply errors.
- Header error control (HEC) calculation over the scrambled header.

Receive

The receive function performs the following actions:

■ Cell delineation using the HEC syndrome.
■ Cell descrambling using the DSS.
■ Extraction of idle cells and F3 OAM cells.
■ Performance monitoring through information received in the F3 OAM cell payload. The performance measurements and the defect indications can be sent to an MCU through the MCU interface.

Figure 1 shows the block diagram for the ATM cell-based UTOPIA level 1 interface megafunction. Functions shaded in gray are provided with the megafunction; the other functions must be provided by the designer.

Figure 1. ATM Cell-Based UTOPIA Level 1 Interface Megafunction Block Diagram
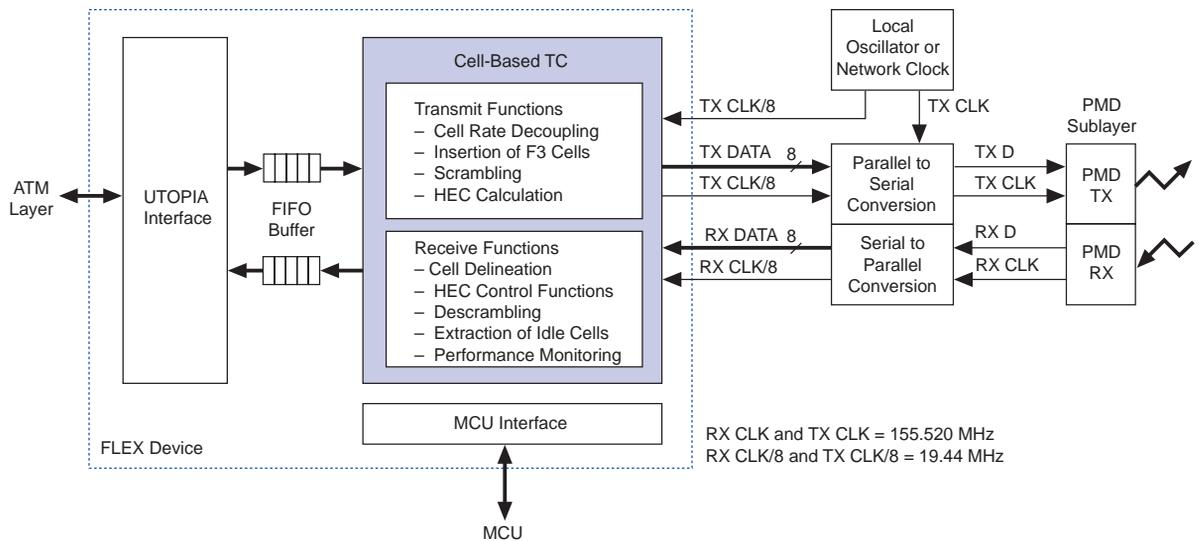
Parameters

PLD Applications can modify the following parameters to meet user specifications.

■ *FIFO size*—PLD Applications can change the size of the FIFO buffers used between the ATM layer and the TC sublayer. Typically, each FIFO buffer can contain at least three ATM cells (one ATM cell = 424 bits).
■ *ATM transfer capability*—The transfer capability is normally 154.800 Mbits/second because of the F3 OAM cell insertion rate (1/216). When alignment with the SDH transfer capability is required, the transfer capability of this interface can be lowered to 149.760 Mbits/second through the insertion of idle stuff cells).
■ *Implementation*—The UTOPIA interface and the MCU interface can be separated from the cell-based TC functions and provided as external functions. The TC sublayer can also be split into separate functions when only part of the TC needs to be implemented (i.e., ITU-T Recommendation G.983 for ATM PON systems where the downstream ATM TC is cell-based and the upstream uses a TDMA multiplier-accumulator (MAC) sublayer).

Applications

The ATM cell-based UTOPIA level 1 interface megafunction provides a 155.520 Mbits/second ATM physical layer interface that is ideal for ATM multiplexers, cross-connects, or terminal equipment. The cell-based TC sublayer can be used for a wide variety of PMD sublayers, including single-mode fiber, multi-mode fiber, coaxial, or twisted pair cables.

Utilization

Table 1 describes the logic cell requirements for the ATM cell-based UTOPIA level 1 interface megafunction.

Table 1. ATM Cell-Based UTOPIA 1 Interface Megafunction Logic Cell Requirements

Device	Speed Grade	Utilization		f_{MAX} (MHz)	Availability
		Logic Cells	EABs *(1)*		
EPF10K50V	-1	2,160	0	20	Now

Note:
(1)   EABs = embedded array blocks.