

SEMICONDUCTOR TECHNICAL DATA

MC92052

Product Brief

MC92052

FTTC User Framer

The MC92052 is a peripheral device for the user side of an FTTC drop. It is composed of downstream and upstream TC-sublayer functionality with UTOPIA compliant ATM-layer ports.

MC92052 Features

- Implements the DAVIC short-range baseband asymmetrical physical layer standard
- Supports a bit rate of up to 51.84 Mbit/sec downstream
- Provides TDMA at a bit rate of up to 6.48 Mbit/s upstream, including DAVIC Bit Rates B, C, and D
- Interfaces to an ATM-layer device using a UTOPIA compliant interface
- Performs convolutional deinterleaving of the downstream payload blocks for the full range of interleaving depths ($M = 1-31$) using an external 16K x 8 SRAM
- Can optionally use an internal RAM for deinterleaving when the interleaving depth is small ($M \leq 2$)
- Performs Reed-Solomon encoding of the upstream frames and decoding of the downstream frames
- Performs HEC-based cell delineation and error correction on the downstream data
- Optionally filters received ATM cells based on GFC/VPI pattern matching
- Includes serial data interfaces to a Physical Medium Dependent (PMD) sublayer device
- Optional serial data link interfaces for upstream and downstream frames
- Includes a power level control interface to the transmitter
- Provides an 8-bit system interface as a generic slave device
- IEEE 1149.1 (JTAG) boundary scan test port
- 3.3 V operation with TTL compatibility on I/O pins
- Extended temperature operation: -40 to 85 °C
- Available in 128 Pin Plastic Quad Flat Package

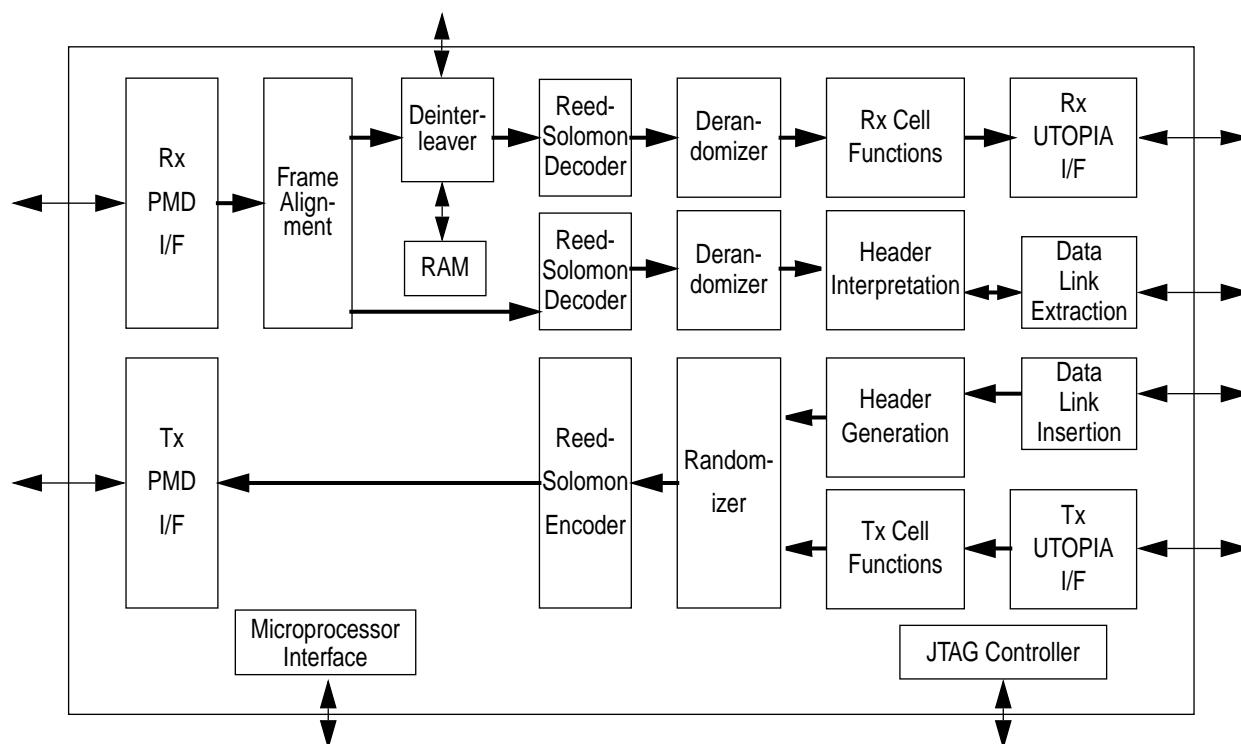


Figure 1. MC92052 Block Diagram

This document contains information on a new product. Specifications and information herein are subject to change without notice.



General Description

The MC92052 implements the TC sublayer of the DAV-IC asymmetrical FTTC PHY specification for user devices. The MC92052 key functional blocks are described in the paragraphs which follow.

Rx PMD Interface

The receive PMD interface receives a clock signal and a serial data stream. The clock is used both to sample the data and to clock the operation of the MC92052.

Frame Alignment

When in the “out-of-frame” condition, the frame alignment block searches the serial data (which is LSB first) for the 16-bit framing pattern and then converts it to 8-bit parallel data aligned to the framing pattern. When in the “in-frame” condition, the serial-to-parallel block verifies the framing pattern and continues to convert it to parallel data using the current alignment. In each frame, the two framing bytes are discarded, the next 16 bytes are provided to the header flow, and the following $(12 * 66)$ bytes are provided to the payload flow.

Deinterleaver

The deinterleaver block recovers the original data blocks from the interleaved data that it receives. Transmitting interleaved data allows for better correction of bursts of errors because the deinterleaver spreads the incorrect data over many blocks so that the Reed-Solomon decoder can correct the small number of errors in each block.

The deinterleaver separates the data byte stream into 33 branches. Each of the branches is delayed by a different amount, and then they are recombined into a single data stream. The delay of branch k ($0 \leq k \leq 32$) is $M * (32 - k)$. M is the Interleaving Depth Parameter recovered from the frame header and ranges from 0 to 31. $M=0$ effectively disables the deinterleaver.

The delay of the interleaver/deinterleaver combination is $1056 * M$ payload byte periods. The deinterleaver is implemented using an external SRAM (Motorola MCM6306 or equivalent). Alternatively, the internal RAM can be used if the value of M is 1 or 2.

Reed-Solomon Decoders

One Reed-Solomon decoder is used for the header. It decodes the (16,12) code in order to correct up to 2 bytes or declare the header to be uncorrectable.

The other decoder is used for the payload blocks. It decodes the (66,58) codes in order to correct up to 4 bytes

or declare the block to be uncorrectable, in which case the data is not touched.

Derandomizers

The received data has been randomized on the network side for better transmission performance. The derandomizers perform the inverse function to restore the original data.

The two derandomizers are identical. One is used for the 12 header bytes per frame, and the other is used for the $12 * 58$ payload bytes per frame. The derandomizers are self-synchronizing since they depend only on the previously received data.

Frame Header Interpretation Block

The header interpretation block extracts the useful information from the received frame header. It provides information to the transmit flow regarding when to transmit a cell, etc.

Data Link Extraction

The data link extraction block optionally provides the data link bytes of the downstream frame headers to a serial data link controller (e.g., MC68360 QUICC) for further processing. The received downstream data link bytes are extracted using a clock pin and a data pin.

Rx Cell Functions

The receive cell functions block recovers 53-octet ATM cells from the derandomized byte stream using the HEC-based method described in ITU-T Recommendation I.432.

Once the cell alignment has been recovered, the receive cell functions block checks the received HEC value against the calculated value and corrects single-bit errors in the header. Any cell with non-correctable errors is discarded. Then the cells are filtered based on the header value. Idle cells are discarded. Additional cells may be discarded as a result of the GFC/VPI pattern matching option.

The cell functions block also derandomizes the payload of the ATM cells to recover the original data and transfers entire ATM cells to the receive cell FIFO.

Counts of the cells transferred to the receive cell FIFO and the cells that are discarded due to header errors are maintained.

Rx UTOPIA Interface

The receive UTOPIA interface reads the ATM cells from the receive cell FIFO and transfers them to the ATM layer according to the ATM Forum UTOPIA Level 1 speci-

fication. This block uses RXCLK provided by the ATM layer. The FIFO is used for rate adaptation between RXCLK (the UTOPIA interface clock) and the device clock.

Tx UTOPIA Interface

The Transmit UTOPIA interface accepts ATM cells from the ATM layer according to the UTOPIA specification. The cells are stored in the transmit cell FIFO. This block uses TXCLK provided by the ATM layer. The FIFO is used for rate adaptation between TXCLK (the UTOPIA interface clock) and the device clock.

Tx Cell Functions

The transmit cell functions block reads ATM cells from the transmit cell FIFO. If there are no cells available when an upstream frame should be transmitted, the cell functions block generates an idle cell. It calculates the HEC value based on the ATM header of each cell and inserts it in the fifth octet of the cell.

A count of the cells transferred from the transmit cell FIFO is maintained.

Data Link Insertion

The data link insertion block provides direct serial access to the data link bytes of the upstream frame headers. The data link stream for the upstream frames is optionally inserted using an output clock pin and an input data pin.

Frame Header Generation

The frame header generation block generates the six header bytes for each upstream frame.

Randomizer

The randomizer operates on 4 header bytes and 53 ATM cell bytes of each upstream frame. It is initialized to all ones at the beginning of each frame. The 2 SYNC bytes are not randomized.

Reed-Solomon Encoder

The Reed-Solomon encoder operates on 57 bytes of the upstream frame and adds 8 parity bytes to produce a (65,57) RS code.

Tx PMD Interface

The transmit PMD interface block transfers bursts of serial data. The control signals of this interface include a transmit enable signal and a clock signal that is generated internally by dividing down the clock provided at the receive PMD interface.

Microprocessor Interface

The microprocessor interface is an 8-bit generic slave interface. It is used for initializing the internal registers and reading status registers and counters.

JTAG

The MC92052 provides JTAG boundary scan.

System Functional Description

Downstream Data Flow

In the downstream direction, the MC92052 receives the data and clock recovered by the PMD device. The frame alignment is recovered by searching for the SYNC bytes. Once the frame alignment is known, the header and payload are split into separate processing paths. The header undergoes error correction by a Reed-Solomon decoder. It is then derandomized and processed in accordance with the definition of the header bytes.

The payload passes through a convolutional deinterleaver and is then divided into blocks of 66 bytes. Each block undergoes error correction by a Reed-Solomon decoder. The corrected payload data is then derandomized. The resulting data stream is delineated into ATM cells using the HEC-based delineation method of ITU-T Recommendation I.432. Any physical layer cells are discarded, and the remaining cells are transferred to the ATM layer using a UTOPIA compliant interface.

Upstream Data Flow

In the upstream direction, the MC92052 implements TDMA, including sign-on, as directed by the network device using the frame overhead of the downstream frames. If no cell is available from the ATM layer, an idle cell is generated. The frame overhead is added to the ATM cell, and then the 57-byte frame is randomized. A Reed-Solomon encoder adds eight parity bytes. The entire frame is transferred to the PMD device along with an enable signal to provide the proper timing with respect to the downstream superframe.

Other Functions

A microprocessor interface is provided for configuration, control, and status monitoring.

A standard IEEE 1149.1 boundary scan test port is provided.

Applications

The primary application of the MC92052 is to provide TC-sublayer processing functions for a user device, e.g., a set-top box, in an FTTC network. Figure 2 shows the location of the user device within an FTTC network

using a passive network termination. Figure 3 shows a generic user device architecture using the MC92052.

The MC92052 uses an external memory for convolutional interleaving of the downstream data. If the interleaving depth is very small or if interleaving is not used, the external memory is not required.

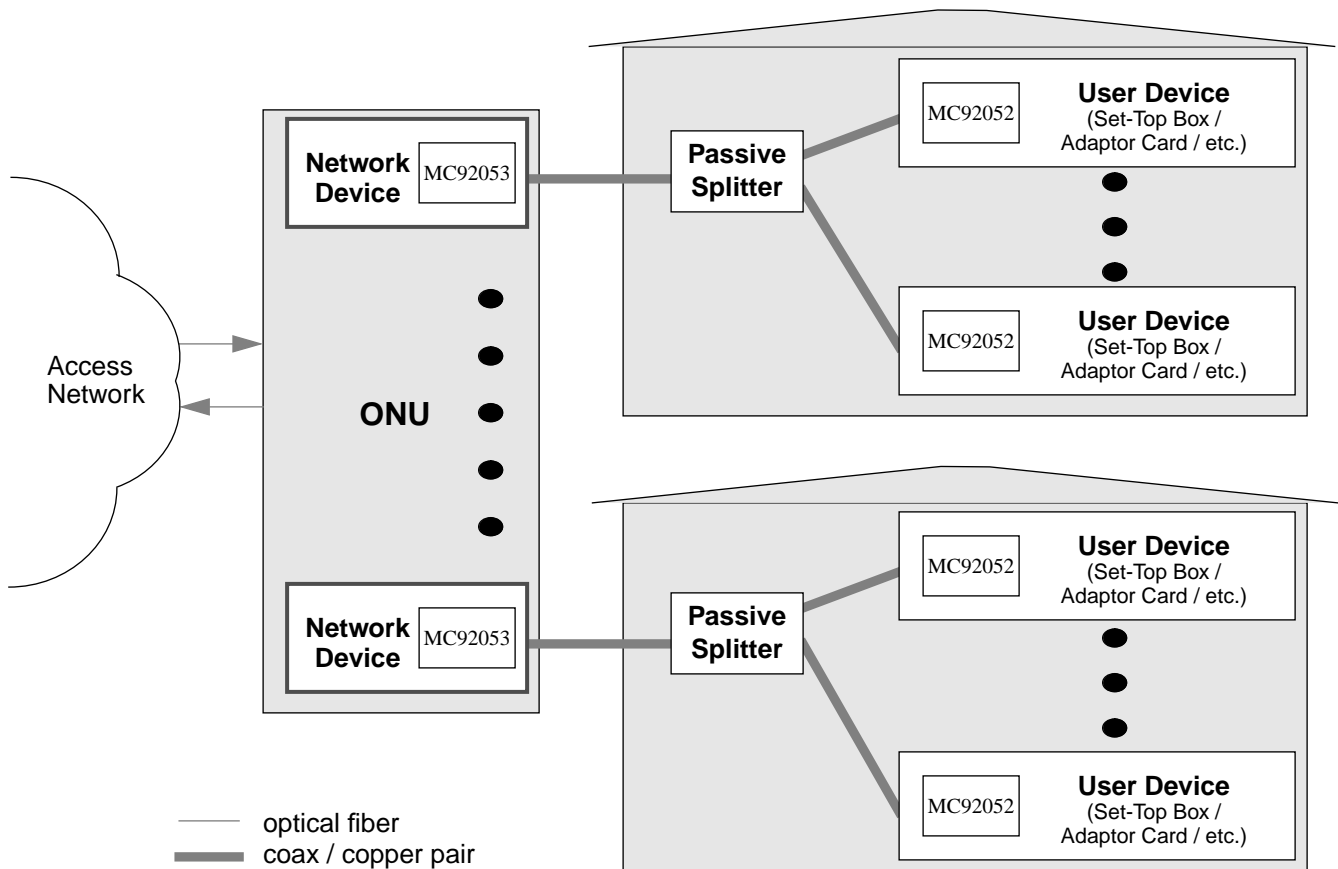


Figure 2. Typical FTTC Network

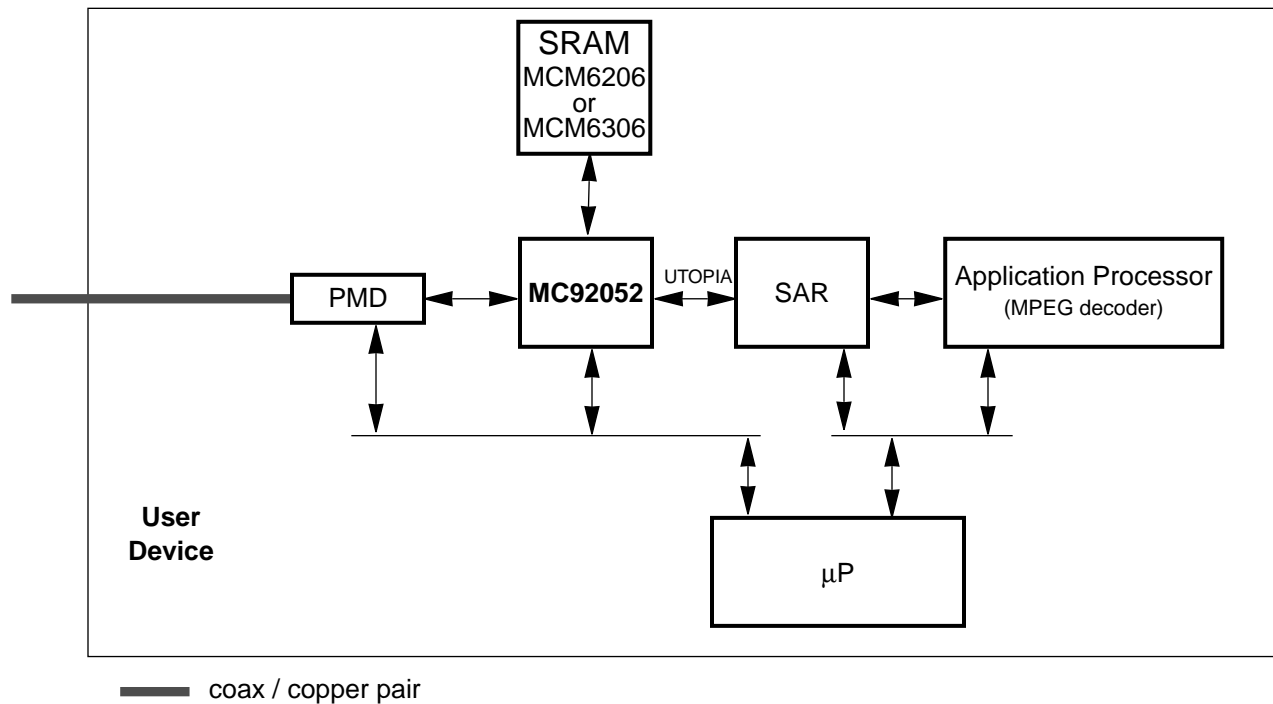



Figure 3. Generic User Device

Table 1. MC92052 Package/Frequency Availability

Package Type	Frequency (MHz)	Temperature	Order Number
128-pin PQFP	0 - 52	-40° to 85° C	MC92052CG

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