Digital Video Interfacing Products

AT720USB

DVB-C (QAM-B, 8VSB) Input
Receiver & Recorder & TS Player
DVB-ASI & DVB-SPI outputs

Standard Features

- High Speed USB 2.0.
- Windows 2000, XP and **BDA / Direct Show** Drivers.
- Accompanied by DVSStaion2, Alitronika's Integrated TS Player, Recorder & Real Time Quick Analyser Software.
- Supports DVB Standards **A1010Rev1** and **EN50083.**

Input
- DVB-CATV Compliant QAM-B & 8-VSB Receptions.
- Input Frequency Range: 54 MHz to 864 MHz.
- Channel Bandwidth: 6 MHz.
- Integrated RF Loop Through output.
- Sync, Error & Code Violation Detection.
- Support for Time Stamping, PID filtering.
- Supports 188 /204 byte Packet Sizes.

Output
- **Two** DVB-ASI and **One** DVB-SPI outputs.
- Programmable Output Bit Rate.
- Null Packet Insertion by hardware.
- Selectable Burst size mode & continuous mode TS output.

Application

Targeted for Digital Video Professionals, Sophisticated End Users and OEMs the AT720USB ***is an ideal solution for*** *A number of applications such as:*
- Development Tools.
- DVB to IP or IP to DVB Gateway.
- Transport Stream Recording.
- Transport Stream Playing.
- Transport Stream Analysing
- Transport Stream Monitoring.
- Video on Demand Server.
- Transport Stream Test Generator.
- DVB-C to DVB-ASI & DVB-SPI converter hence replacing an IRD.
- Software Based decoding
- DVB-C TS for Tans-modulation into DVB-S or DVB-T/H.
- PC TV using Alitronika's Direct Show compatible BDA Drivers.

RF Input Specifications

On Board Buffer: 16Mbytes
RF Tuner Connector: 75 Ohms Female RCA Type.
RF Loop Through: 75 Ohms Female RCA Type.
Input Frequency Range: 54 MHz to 864 MHz.
Input Level: -15dBmV to +15dBmV (QAM-B) and -80dBmV to 0dBmV (8-VSB).
Channel Bandwidth: 6 MHz.
Standards: ETS 300-429/ITU-T J83 Annex B **USA**.
Modulation Modes: 8VSB/64 QAM/256 QAM.

Output Specifications

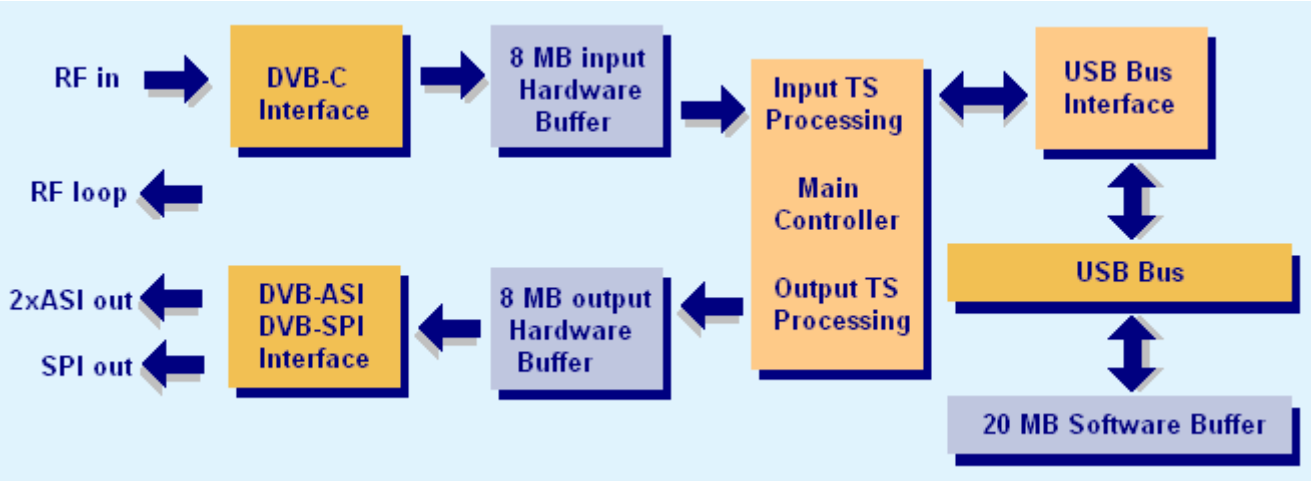
Serial Connectors: 75 Ohms BNC
Parallel Connectors: 25-pin sub-D
DVB-ASI Output Bit Rate: 0 to 214 Mbit/s
DVB-SPI Output Bit Rate: 0 to 108 Mbit/s
Bit Rate Stability: +/- 25ppm
DVB-ASI Output Clock: 270 MHz
DVB-ASI Output Signal level: 1.0Vp-p nominal
DVB-SPI Output Clock: 0 to 13.5 MHz
DVB-SPI Output Level: LVDS
Power Consumption: 5 Watts
Size WxLxH: 170mm**x**210mm**x**65mm

1 GENERAL DESCRIPTION

A member of Alitronika's state of art digital video interfacing products.
The AT720USB is a USB based interface device suitable for Recording, Playing and Analyzing of DVB-ASI Transport Streams.

2 BLOCK DIAGRAM

FIG4 illustrates the block diagram of the AT720USB device. The device communicates with the PC via the USB interface device. On the input side, the RF signal is demodulated and then de-coded before entering the PC via the main controller and the USB bus as Full TS files. On the output side, the MPEG-II transport streams enter the device via the PCI interface device. The AT720USB then transmits the transport streams according to the settings provided by the application software. The data is 8b/10b encoded for DVB-ASI signals before it is serialized and transmitted via the BNC output connectors.



3 EXTERNAL INTERFACES

The external interfaces for the AT720USB are shown. There are 2 Female 75 Ohms RCA type connectors for the RF input & Loop Through, 2 BNC connectors for the DVB-ASI outputs and two 25-pin D-type connectors for DVB-SPI outputs (LVDS & LVTTL), as well as USB and DC power inlet connectors. The Unit is supplied with power supply and USB2.0 cable.

The LED in the back of the unit function as follows:

OFF = Power is off/ device not activated
Flashing (Red) = Play /Record not activated – Error condition
ON (Green) = Normal operational condition
In Record mode this LED indicates that a Carrier has been detected and the device has locked to incoming TS.
In Play mode this LED indicates that the output section has valid TS (normal operating conditions).

4 APPLICATION

Targeted for digital video professionals, sophisticated end users and OEMs the AT720USB is an ideal solution for a number of applications such as, development tools, universal interface for MPEG-II Transport Stream Playing and Recording, video on demand server, transport stream test generator, high speed serial data link, software based MPEGII decoders & encoders and many other applications.

5 HARDWARE DESCRIPTION

5.1 USB interface device

The Cypress CY7C68013 High speed USB peripheral controller is for the USB interfacing. This device combines the USB 2.0 transceiver, SIE controller and a programmable peripheral interface in one chip.
Please refer to CY7C68013 Data book for more information about the operation and register setting of this device.

5.1.1 USB Interfacing

For the full description of USB Interfacing please refer to the Universal Serial Bus Interface Specification Revision 2.0 document. Alitronika Digital Interfacing Products comply with USB standard as defined by these specifications.

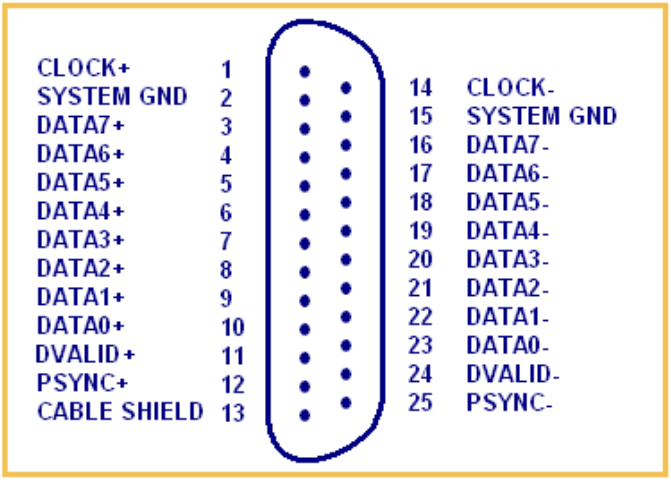
5.2 Main Controller

For the main controller the Altera Cyclone FPGA device is used. Most of the function of the AT720USB is carried out by the firmware residing in this device. The main controller configures and communicates with the various devices on board the AT720USB device. It carries out all the transport stream processing required by the application software, including data buffering, clock synthesizer, synchronization to the transport stream, time stamping, error flag generation, bit rate estimation and others.

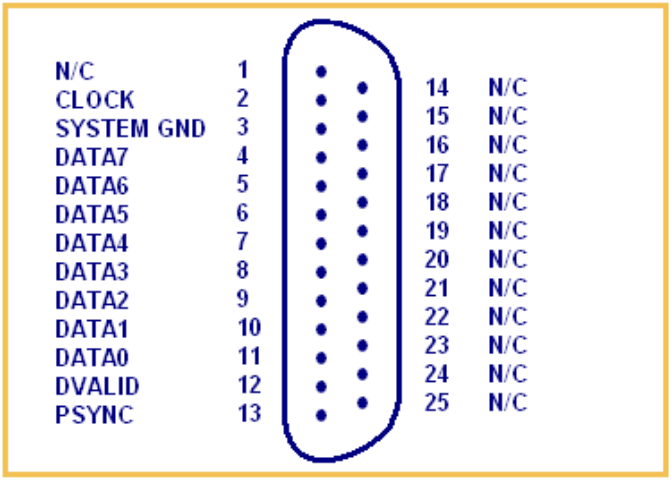
5.3 Configuration Scheme

The FPGA on board most devices use SRAM configuration elements that require configuration data, better known as the firmware, to be loaded each time the device powers up. This process is called configuration. The description of configuration schemes used for such devices is beyond the scope of this document. A configuration device is almost always used. The devices are configured whenever the PC is powered up. Often this process is not carried out successfully and the device is not fully operational, the system must then be reset. Alitronika interface devices have provision for such a scheme, so it could be implemented on all the products if requested. But a much better scheme, whereby the configuration data is loaded by the application via the device driver is used. This gives Alitronika's products the flexibility that the firmware could be up-graded, customized and up-dated. More importantly, more than one firmware could be and has been developed for each device.
Instead of the FPGA being configured on power up, it could be configured at all times by the application, without the need for resetting the system. This method is called dynamic configuration scheme and places Alitronika's products at the top when it comes to flexibility and reliability.

Parallel (DVB-SPI) Pinouts
For Alitronika's devices which support DVB-ASI input/output (LVDS and/or LVTTL/LVCMOS)



Standard DVB-SPI input/output Pinout



LVTTL/LVCMOS output Pinout

6 THE INPUT

6.1 The RF DVB-C Cable (QAM-B) Input
The DVB-C input section comprises of a DVB-S NIM (Network Interface Module).
The DVB-C NIM, based on " Direct Conversion Concept " incorporates the PLL Frequency Synthesizer, QAM-B demodulator and RF loop through. The RF input can be from any source as well as directly from a QAM-B modulator.

6.2 RF Loop through output
The RF output terminal of the AT720USB is able to output RF input signal for another DVB-C device such as a STB.

6.4 Input Transport stream processing
The Input data processing module, implemented in firmware, resides inside the main controller and carries out most of the input data processing. These include the following:

6.4.1 Packet size detection
The AT720USB can accept both 188 and 204 bytes packets. The 188 or 204 packet size flag is then set high accordingly.

6.4.2 Data Error Indication
Every byte of the transport packet which can not be decoded due to errors are indicated to the input transport stream processing unit. These errors are counted by a free running Data Error Counter and are presented to the application and are then displayed during recording and monitor modes. In addition a data error flag is raised when the number of errors are more than the number of acceptable errors for the integrity of the serial link to be maintained.

6.4.3 Sync Loss Error
The Packet Synchronizer Algorithm within the input transport stream processor, monitors the synchronization byte of the transport stream, H"47", if it does not find it at the start of a packet, it indicates it to the application software in record and monitor modes by means of a Sync Loss Counter.

6.4.4 Input TS Bit Rate Estimation.
The input transport stream bit rate is obtained from the PCR, otherwise the bit rate is estimated by counting the number of received packets in a certain time period and the calculating the bit rate.

6.4.5 Time Stamping
There are applications in which it is important to know the time of arrival of the transport packets. These applications include, real-time transport stream processing e.g. PCR correction, BRT (Bit Rate Trans-coding) and re-multiplexing of transport streams. The time of arrival of a transport packet is when the PCR byte, the 11th byte of the transport stream, enters the input data processing module.
The time stamp is derived from a 32bit reference clock counter running at the master clock frequency of the main controller.
On arrival of the 11th byte of the transport stream, the content of this counter is taken.
This 32bit time stamp value is then added to the end of the transport packet, hence creating a transport packet of 192 for a 188 byte packet or 208 byte for a 204 byte packet size.

6.4.6 PID Filtering
The AT720USB supports PID filtering. In order to avoid having long PID tables, two modes of PID filtering are used, Exclusive & Inclusive. In exclusive mode PIDs in the table are filtered out and in inclusive mode the PIDs in the table are kept and all other PIDs are removed.

6.4.6 Data Buffering
It is beyond the scope of this document to explain the trivial details of streaming and buffering of the MPEG-II transport streams. It is sufficient to state that a DMA buffer is used to transfer data to the PC from the AT720USB device rather than direct read cycles. In addition to this software buffer, the AT720USB uses an 8Mbytes of SDRAM to implement a hardware input FIFO buffer. Two or three other internal FIFO's are used by the main controller for smooth recording of the transport streams. In addition there are two 10Mb software buffers. The application software indicates the buffer usage during recording.

7 OUTPUT

7.1 The Serial Output (DVB-ASI)
The serial output section consists of mainly buffers, filters and a line driver device.

7.2 The Parallel Output (DVB-SPI)
The Parallel output section consists of LVDS according to DVB-SPI standards.

7.3 Transmit FIFO Buffer
An 8Mbytes SDRAM is used to implement the transmit buffer. The buffer enables the AT200USB to generate low jitter DVB-ASI stream by compensating for any Bus latencies.
In addition to this rather large FIFO, two or three other internal FIFo's are used by the main controller for smooth transmission of the transport streams. There are also two 10Mb software buffers. The application software indicates the buffer usage during playing.

7.4 On board transmission clock and clock Synthesizer
An accurate 27MHz clock generator on board the AT720USB is used for the transmission of the output stream.
The byte rate clock of the transmitted transport stream is obtained from this clock using a clock synthesizer. Unlike other so-called "direct-digital synthesizers", the clock synthesizer on board AT720USB is not made up of a simple accumulator. It is based on a sophisticated algorithm to generate an accurate, jitter free output transmission even at high bit rates. The clock synthesizer obtains the transmission bit rate set by the application software, and generates a transmit pulse, which could be regarded as the byte rate for DVB-ASI transmission. One byte of the payload per transmit pulse is transmitted. In between these transmit pulses the controller transmits the stuffing character, K28.5 (Comma). For the DVB-SPI, the synthesizer generates a byte rate clock from the numerical bit rate value. Here as the DVB-SPI standards require a 10 bit data is transmitted per clock with no stuffing allowed.

7.5 Transport packet size
AT720USB can transmit packet sizes of 188 or 204 bytes, in addition if desired it can generate a 204 byte transport packet from a 188 byte packet by adding 16 zero bytes to the end of the payload. This function is useful for the designers of receiver equipments to test if the system under development could handle both 188 and 204 packet sizes. The application software corrects the PCR accordingly.

7.6 Burst mode and Continuous mode
AT720USB can transmit transport stream in continuous mode in which the bytes are spread with stuffing " Comma" character filling the stream when there are no payloads. In the burst mode the transport packets are transmitted in user selectable burst sizes of up to the full packet size (188 or 204).

7.7 Null packet insertion by hardware
AT720USB allows the transmitted bit rate higher than of the bit rate of the transport stream file. In such cases the difference between the default bitrate and play bitrate is filled with Null packets. The application software corrects the PCR accordingly.

7.9 RAW data mode
AT720USB can play back none DVB TS files of any kind to be played back. In this mode the device acts as fast serial data interface.

7.10 DVB-C to DVB-ASI & DVB-SPI conversion.
The AT720USB having both DVB-ASI and DVB-SPI outputs is capable of converting from DVB-C to DVB-ASI & DVB-SPI.

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