HD/SD H.264 Capture Device
(SDI HD/SD H.264 Video Encoder)
User's Manual

Model 2224 | Rev.0 | September 2013

SENSORAY | embedded electronics

Designed and manufactured in the U.S.A

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Table of Contents

Limited warranty

Sensoray Company, Incorporated (Sensoray) warrants the hardware to be free from defects in material and workmanship and perform to applicable published Sensoray specifications for two years from the date of shipment to purchaser. Sensoray will, at its option, repair or replace equipment that proves to be defective during the warranty period. This warranty includes parts and labor.

The warranty provided herein does not cover equipment subjected to abuse, misuse, accident, alteration, neglect, or unauthorized repair or installation. Sensoray shall have the right of final determination as to the existence and cause of defect.

As for items repaired or replaced under warranty, the warranty shall continue in effect for the remainder of the original warranty period, or for ninety days following date of shipment by Sensoray of the repaired or replaced part, whichever period is longer.

A Return Material Authorization (RMA) number must be obtained from the factory and clearly marked on the outside of the package before any equipment will be accepted for warranty work. Sensoray will pay the shipping costs of returning to the owner parts that are covered by warranty. A restocking charge of 25% of the product purchase price will be charged for returning a product to stock.

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Special handling instructions

The circuit board contains CMOS circuitry that is sensitive to Electrostatic Discharge (ESD).

Special care should be taken in handling, transporting, and installing circuit board to prevent ESD damage to the board. In particular:

- Do not remove the circuit board from its protective anti-static bag until you are ready to install the board into the enclosure.
- Handle the circuit board only at grounded, ESD protected stations.
- Remove power from the equipment before installing or removing the circuit board.

Introduction

The Sensoray Model 2224 is a USB 2.0 SDI HD/SD H.264 video encoding capture device. It supports HD (High Definition) 1080p, 1080i & 720p, and SD (Standard Definition) 480i/576i.

For the need of combining audio capturing, the Model 2224 provides three different audio input options -- stereo/mono Line-in audio input, XLR3 microphone input, and SDI embedded-in audio.

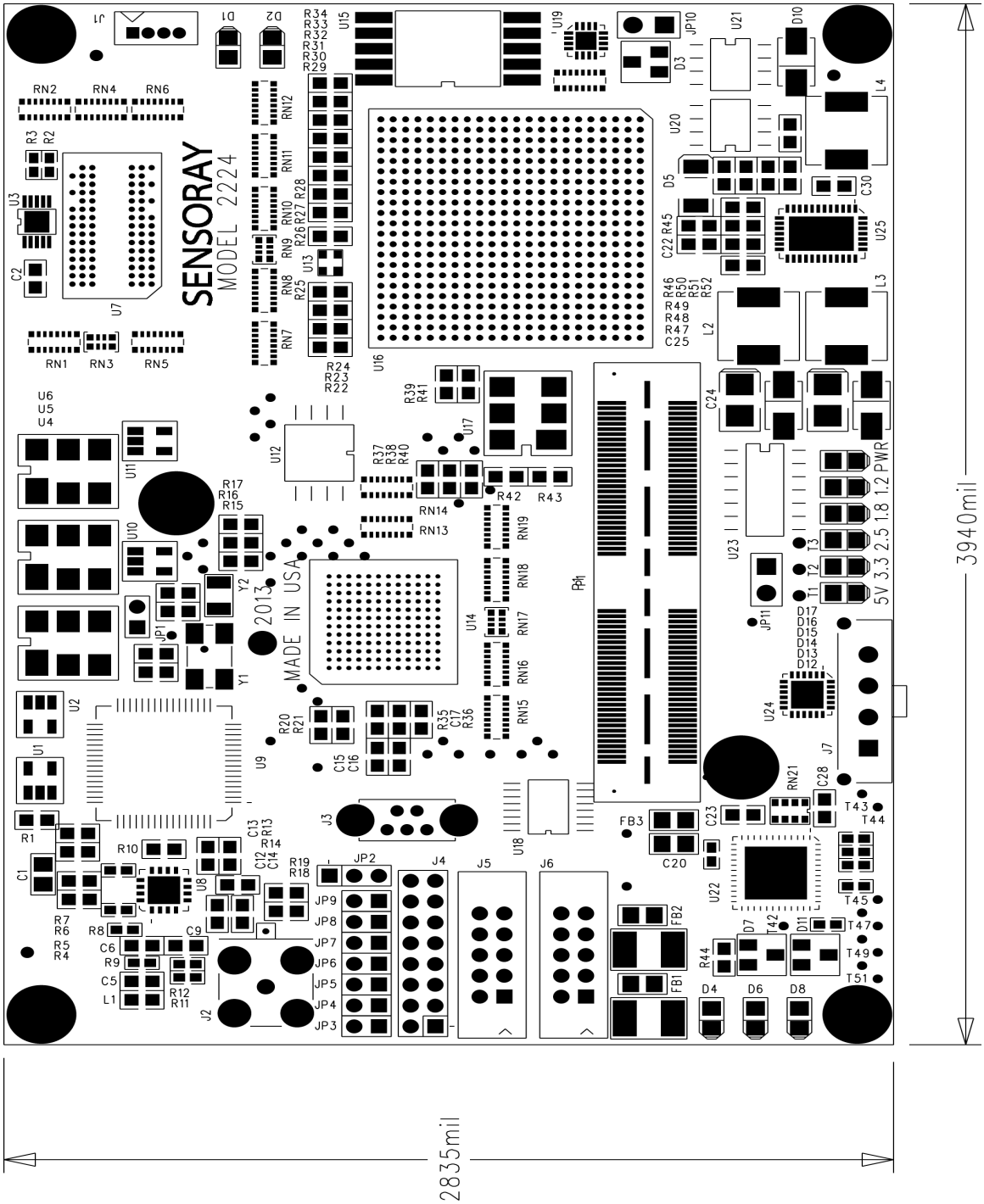
A single +5V power supply through a Molex 43650-0403 connector is required to power the board. (As a reference, the Molex 43645-0400 connector is a mating connector to the Molex 43650-0403 connector).

Feature Summary

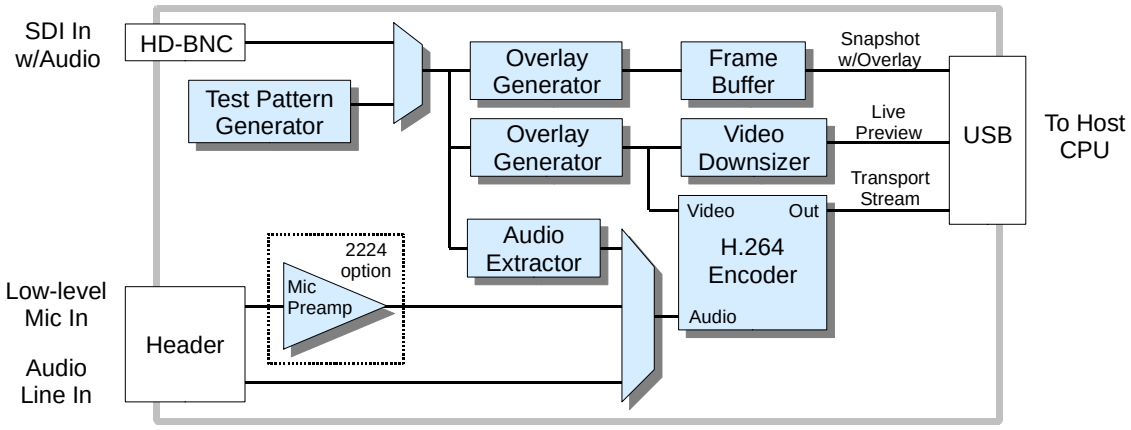
- Host Interface: USB 2.0 (High Speed)
- Video Systems: SD: NTSC and PAL
  HD: SMPTE 292M, SMPTE 344M, and SMPTE 259M
  SMPTE 125M, ITU-R BT601.5, SMPTE 274, SMPTE 296
- Video Input: SDI
- Audio Inputs: Stereo/Mono Line-in
  XLR3 Microphone input (optional)
  SDI embedded-in audio
- H.264 CODEC:
  HD: ISO/IEC14496-10 (H.264/AVC) High Profile Level 4.0
  SD: ISO/IEC14496-10 (H.264/AVC) Main Profile Level 3.0
- Video Formats and Bit Rates:
  HD: 1920x1080p, 24/24/23.98Hz, 2Mbps to 20Mbps
  1920x1080p, 30/29.97Hz, Overlay/Snapshot only
  1920x1080i, 30/29.97/25Hz, 2Mbps to 20Mbps
  1280x720p, 60/59.94Hz/50/24/23.98Hz, 2Mbps to 20Mbps
  SD: 720x480i, 29.97Hz (NTSC), 1Mbps to 10Mbps
  720x576i, 25Hz (PAL), 1Mbps to 10Mbps
- Audio CODEC:
  MPEG-1 Audio Layer 2
- Audio Sampling Rate and Bit Rates:
  48 KHz
  MPEG-1 Layer 2: 64, 96, 112, 128, 160, 192, 224, 256 Kbps
- Stream Format:
  MPEG-2 TS (Transport Stream),
  Hardware Multiplexing of Video stream + Audio stream
- Driver and SDK:
  Windows and Linux
- Applications:
  DVR (Digital Video Recorder)
  NVR (Network Video Recorder)
  Streaming Server — H.264 Encoder/Decoder
  Complex text/image overlay

Reference

Board Picture and Connector Layout



Diagram



Connector List

J1	TEST[3:0]: (Internal Manufacturing Test Use Only)
J2	SDI Input: HD-BNC Connector, 75 Ohms
J3	Mini-USB Connector: USB 2.0 HS (High Speed)
J4	JTAG and SAM-ICE Connector: 16-Pin (Internal Manufacturing Use Only)
J5	Audio Break-in: 10-Pin Audio In: Line-In (Stereo/Mono) Audio In: XLR3 Microphone (differential)
J6	Audio Output Connector: 10-Pin (Internal Manufacturing Test Use Only)
J7	Power Supply Connector: 4-Pin, +5V

Connector Pin/Signal Definitions

Internal Board Test Connector: J1

It is used for internal/manufacturing test only. Therefore, it is not described in this manual.

SDI Video Input, HD-BNC: J2

HD/SD video input using SDI (Serial Digital Interface). A stereo/mono audio could be embedded in the same SDI input.

Pin	Signal	Pin	Signal
Inner	SDI Video Signal	Outer/Ring	Shield, Analog Ground

USB 2.0 HS (High Speed) Connector, 5-Pin Mini-USB: J3

It is main interface from a Host PC or CPU Module to the Model 2224, via this USB 2.0 HS (High Speed) connector.

Pin	Signal
1	VBUS +5V
2	Data-
3	Data+
4	Ground
5	Shield

JTAG and SAM-ICE Connector: J4

It is for internal manufacturing/debugging use only. Therefore, it is not described in this manual.

Audio Break-in Connector, 10-Pin: J5

It is used for Audio Break-in.

Pin	Signal	Pin	Signal
1	Balanced Audio Signal In+, from XLR Microphone	2	Ground
3	Balanced Audio Signal In-, from XLR Microphone	4	Ground
5	Not used	6	Not used
7	Stereo Line-in Left	8	Ground
9	Stereo Line-in Right	10	Ground

Audio Break-out Connector, 10-Pin: J6

It breaks-out all the Audio Outputs. (for manufacturing/test only)

Pin	Signal	Pin	Signal
1	Headphone Output -- Left	2	Headphone Output -- Right
3	Mono Line Output -- LO+	4	Mono Line Output -- LO-
5	Stereo Line Output -- Left+	6	Stereo Line Output -- Left-
7	Stereo Line Output -- Right+	8	Stereo Line Output -- Right-
9	Analog Ground	10	Analog Ground

Power Supply Connector, 4-Pin: J7

Main Power Supply connector, used for supplying +5V power to the board.

Pin	Signal
1	+5V
2	Ground
3	Ground
4	+5V

LEDs

Power-OK Indicators: D12 ~ D17

The LED D12 to D17 are used for indicating on-board Power-OK status.

LED	Signal
D12	+5V Power-OK Status
D13	+3.3V Power-OK Status
D14	+2.5V Power-OK Status
D15	+1.8V Power-OK Status
D16	+1.2V Power-OK Status
D17	All On-board +3.3V, +2.5V, and +1.8V Power-OK Status

FPGA General Purpose Indicators: D1 and D2

The LED D1 and D2 are connected to the dedicated on-board FPGA's I/O pins. They can be used as general purpose indicators and are software controllable via internal FPGA register. Note that a logic 0 (low) turns the LED on and a logic 1 (high) turns the LED off.

LED	Signal
D1	EP3C40_LED1
D2	EP3C40_LED0

ARM9 General Purpose or Status Indicators: D4 and D6

The LED D4 and D6 are connected to the on-board ARM9 microcontroller's pin PB14 and PB15, respectively. They can be used as general purpose indicators or status indicators, and are software controllable through ARM9 program. Note that a logic 0 (low) turns the LED on and a logic 1 (high) turns the LED off.

LED	Signal
D4	AT91SAM9R_PB14
D6	AT91SAM9R_PB15

Audio CODEC Status Indicator: D8

The LED D8 is connected to the on-board Audio CODEC's microcontroller's GPIO1 pin, and can be used as the Audio CODEC status indicators. Note that a logic 0 (low) turns the LED on and a logic 1 (high) turns the LED off.

LED	Signal
D8	TLV320AIC33_GIOP1

Software

Device Driver and SDK

Device driver and SDK including driver, DLL, API, and demo application programs are available for both Windows and Linux.

Since the Model 2224 is a derived/simplified sub-version of the Sensoray Model 2226, with H.264 encoding portion only. Sensoray uses one generic Windows/Linux 2226 driver+SDK package to support both models.

Windows

Refer to the "2226 WinSDK User's Manual" for the Windows SDK, DLL, API, App Demo, and programming details, except ignoring (not applying) decoding related details for the Model 2224.

Linux

Refer to the "2226 Linux SDK User's Manual" for the Linux SDK, DLL, API, App Demo, and programming details, except ignoring (not applying) decoding related details for the Model 2224.

Specifications

Host Interface	USB 2.0 (High Speed)
Video Systems	SD: NTSC or PAL HD: SMPTE 292M, SMPTE 344M, and SMPTE 259M
Video Inputs	SDI Video: HD/SD, 1 Channel, compliant with: SMPTE 292M, SMPTE 344M, and SMPTE 259M SMPTE 125M, ITU-R BT601.5, SMPTE 274, SMPTE 296
Audio Inputs	Stereo/Mono: 1 Channel, Line-in +/- 1.0V signal level XLR (optional): 1 Channel, XLR3 balanced SDI Embedded: 1 Stereo/Mono Channel
Audio Outputs (for testing only)	Stereo: 1 Channel, via 10-Pin Connector, Differential Left & Right Mono: 1 Channel, via 10-Pin Connector, Differential pair signals HeadPhone: 1 Channel, via 10-Pin Connector, Stereo, COM-mode L/R
H.264 CODEC Conformance	HD: ISO/IEC14496-10 (H.264/AVC) High Profile Level 4.0 SD: ISO/IEC14496-10 (H.264/AVC) Main Profile Level 3.0
Video Formats and Bit Rates	HD: 1920x1080p, 24/23.99 Hz, 2Mbps to 20Mbps 1920x1080p, 30/29.97 Hz, Overlay/Snapshot only 1920x1080i, 30/29.97/25 Hz, 2Mbps to 20Mbps 1280x720p, 60/59.94/50/24/23.98, 2Mbps to 20Mbps SD: 720x480i, 29.97 Hz (NTSC), 1Mbps to 10Mbps 720x576i, 25 Hz (PAL), 1Mbps to 10Mbps
Audio CODEC	MPEG-1 Audio Layer 2
Audio Sampling Rate and Bit Rates	48 kHz MPEG-1 Layer 2: 64, 96, 112, 128, 160, 192, 224, 256 Kbps
Stream Format	MPEG2-TS (Transport Stream), Hardware Multiplexing of Video stream + Audio stream
Bus/Interface	USB 2.0: Compliant with Universal Serial Bus Specification 2.0
OS Platform	Windows and Linux
Power	5W, +5V @ 1.0A
Temperature	0 – 70 C
Board Dimension	Pico-ITX: 3.9” x 2.8” (10 cm x 7.2 cm)
Applications	DVR (Digital Video Recorder) NVR (Network Video Recorder) Streaming Server — H.264 Encoder Complex text/image overlay