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# Hardware

This section provides documentation for current BrightSign hardware platforms. It also includes installation instructions for add-ons and modules.

- **XTx43:** XT243, XT1143
- **XDx33:** XD233, XD1033
- **HDx23:** HD223, HD1023
- **LS423**
  
- **4Kx42:** 4K242, 4K1042, 4K1142
- **XDx32:** XD232, XD1032, XD1132
- **HDx22:** HD222, HD1022
- **LSx22:** LS322, LS422
  
- **XDx30:** XD230, XD1030, XD1230
- **HDx20:** HD120, HD220, HD1020

## XT243, XT1143

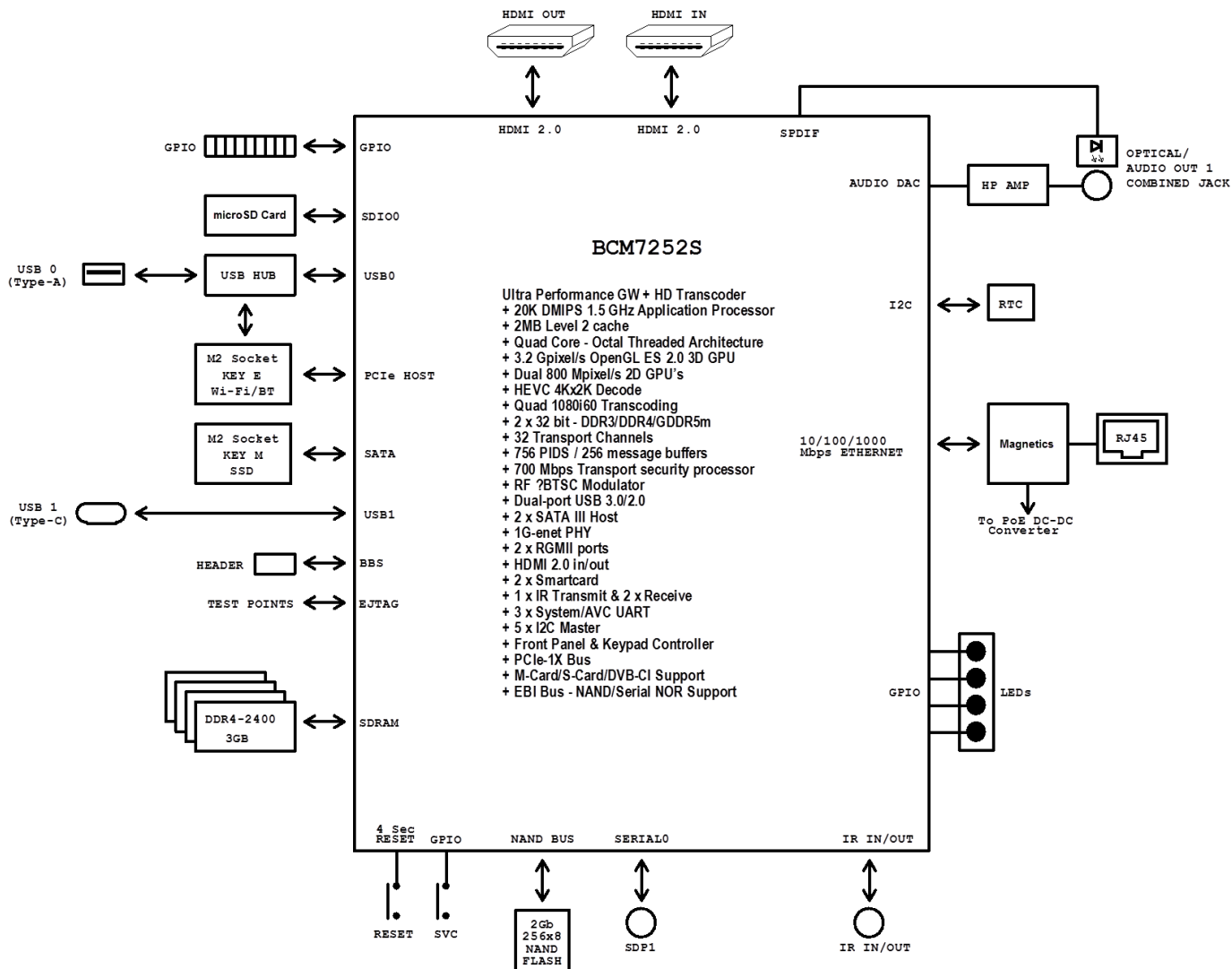
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- [Block Diagram](#)
- [Interfaces](#)
  - [XT243](#)
  - [XT1143](#)

The BrightSign XT243 and XT1143 media players can be used to decode images, audio, and video (at resolutions up to 4096x2160x60p) for digital-signage and kiosk applications. In addition to driving audio/video devices, these players can be controlled with various networked and built-in interfaces.

This manual specifies the hardware interfaces and operational theory of the XTx43 series.

### BLOCK DIAGRAM



## INTERFACES

### XT243

Front	Back
Status LEDs	WiFi antenna connector (1 of 2)
microSD card slot	3.5mm audio out
HDMI out	3.5mm IR in/out
Service button (SVC)	GPIO (12 pins)
Reset button (Reset)	12V@3A Molex power connector
RJ45 LAN	WiFi antenna connector (2 of 2)

### XT1143

Front	Back
Status LEDs	WiFi antenna connector (1 of 2)
microSD card slot	3.5mm audio out

HDMI out	USB 2.0 (Type A connector)
HDMI in	3.5mm IR in/out
USB 2.0 (Type C connector)	3.5mm RS-232 serial
GPIO service button (SVC)	GPIO (12 pins)
GPIO reset button (Reset)	12V@3A Molex power connector
RJ45 LAN	WiFi antenna connector (2 of 2)

## XTx43 Hardware Interfaces

### ON THIS PAGE

- [Power Connector](#)
- [3.5mm Serial](#)
- [GPIO](#)
- [RJ45 LAN](#)
- [USB](#)
- [3.5mm Audio Connector](#)
- [3.5mm IR Input/Output](#)
- [HDMI Output](#)
- [HDMI Input](#)

This section describes the characteristics and operation of all connectors on the XT243 and XT1143.

### Power Connector

The power connector for the XT243 and XT1143 is rated for 12V@3A. The plug is a right-side positive, locking 2-pin (1x2) connector.

### 3.5mm Serial

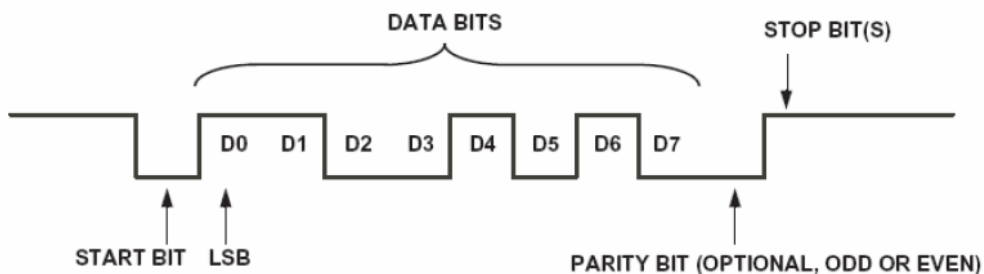
The UART (asynchronous serial) interface is a 3.5mm (1/8") jack and will interoperate with most RS-232 compatible devices. The receiver will tolerate input voltages between -30V and +30V, with anything below 3V interpreted as a logical 1. The transmitter drives +5V for logical 0 and 0V for logical 1.

The default baud rate of the RS-232 interface is 115200, with no parity, 8 data bits, and 1 stop bit. These settings can be configured in the software. The serial interface supports TX, RX, and ground only—RTS/CTS hardware flow control is not supported.

A serial cable plug that is inserted into the 3.5mm jack should use the following signaling:

- **Tip:** Transmit
- **Ring:** Recieve
- **Sleeve:** Ground

The following diagram illustrates the behavior of the TX and RX signal:



### GPIO

The XT243 and XT1143 have a 12-pin GPIO switch and LED connector, which allows the player to control external LEDs or other devices requiring 24mA of current or less.

The GPIO port is a standard design manufactured by Phoenix Contact, Würth Electronics, and others. The XT series ships with two pluggable GPIO terminal blocks, which can be inserted into the GPIO connector to make bare-wire contacts. An example part number for these terminal blocks can be found [here](#).

Connect the LED outputs to the LED ANODE and connect the LED CATHODE to the ground. If you want to connect another device, then the output is capable of sourcing or sinking up to 3.3V at 24mA, but there is a series resistor of 100Ω in each line.

The connector also allows the connecting of external contact closures to the ground. In order to connect a switch, connect one side of the switch to the switch input, and connect the other side to one of the ground pins on the GPIO connector. The connector can also supply 3.3V at up to 500mA to an external device. The 3.3V output is polyfuse-protected and can source up to 500mA.

If one BrightSign player is driving the inputs on another BrightSign player, then you can drive at most three inputs from one output. The following calculations explain this limitation:

**Note**

The GPIO outputs have 100Ω series resistors; the GPIO inputs have 1K pullup resistors to 3.3V; and the input threshold is 2V high and .8V low. The high voltage is not problematic, but the low voltage can be if there are too many inputs connected to one output.

1 out driving 1 in	$V=3.3*100/(100+1,000)=0.3$
1 out driving 2 in	$V=3.3*100/(100+500)=0.55$
1 out driving 3 in	$V=3.3*100/(100+333.3)=0.76$
1 out driving 4 in	$V=3.3*100/(100+250)=.94$ (This is too high, so 1 output driving 3 inputs is the maximum)

The following table illustrates the pinout of the GPIO on the XT243 and XT1143:

Pin	Function	Pin	Function
1	GND	7	GND
2	3.3V	8	3.3V
3	BUTTON 0	9	BUTTON 4
4	BUTTON 1	10	BUTTON 5
5	BUTTON 2	11	BUTTON 6
6	BUTTON 3	12	BUTTON 7

**RJ45 LAN**

The XT series has an RJ45 connector for 1000BASE-T networking, as well as Power over Ethernet (PoE) capabilities. The maximum length for Cat 5E cable is 91 meters for PoE applications and 100 meters for non-PoE applications; the allowed length can be higher or lower depending on the quality of the cable.

**Important**

The equipment should be connected only to PoE networks without routing to the outside plant.

**USB**

The XT1143 has two USB 2.0 ports: one Type A and one Type C. The Type A connector can act as a dedicated charging port (DCP) when the two data pins are shorted together, and the Type C connector can operate as either a host or a device (i.e. a dual-role port).

Both ports are capable of transfer speeds up to 480 Mbit/s. The maximum length for a USB cable is 5 meters.

The following table illustrates the pinout of the USB 2.0 Type A host port:

pin	Description	pin	Description
1	VBUS	2	D-
3	D+	4	Ground

The following table illustrates the pinout of the USB 2.0 Type C host port:

pin	Signal Name	Description	Mating Sequence	pin	Signal Name	Description	Mating Sequence
A1	GND	Ground return	First	B12	GND	Ground return	First
A2				B11			
A3				B10			
A4	VBUS	Bus power	First	B9	VBUS	Bus power	First
A5	CC1	Configuration channel	Second	B8			
A6	Dp1	Positive half of USB 2.0 differential pair – position 1	Second	B7	Dn2	Negative half of USB 2.0 differential pair – position 2	Second
A7	Dn1	Negative half of USB 2.0 differential pair – position 1	Second	B6	Dp2	Positive half of USB 2.0 differential pair – position 2	Second
A8				B5	CC2	Configuration channel	Second
A9	VBUS	Bus power	First	B4	VBUS	Bus power	First
A10				B3			
A11				B2			
A12	GND	Ground return	First	B1	GND	Ground return	First

### 3.5mm Audio Connector

The XT243 and XT1143 have a combination analog/optical audio jack. To transmit a digital audio signal, use an optical audio cable. Analog and digital audio cannot be transmitted simultaneously.

The full-scale voltage output of the analog audio is 2V RMS. The minimum load impedance is 32W.

The analog audio connector has the following pinout:

- **Tip:** Left audio
- **Ring:** Right audio
- **Sleeve:** Ground for audio signal

### 3.5mm IR Input/Output

The IR blaster generates or receives a space-encoded NEC or Pronto Hex signal. The two transported bit values of the signal (0 and 1) are encoded using differing lengths of low-time IR pulses.

The 3.5mm IR in/out port has the following pinout:

- **Tip:** 3.3V
- **Ring:** IR Input
- **Sleeve:** IR Output

#### Note

The sleeve is used as a ground during input operations.

### HDMI Output

The HDMI-out connector is used to send digital video and audio to HDMI-enabled sink devices. This connector is compatible with HDMI 2.0 devices, capable of outputting a maximum video resolution of 4096x2160x60p.

The following table illustrates the pinout of the HDMI connector:

pin	Description	pin	Description
1	TX2p	2	Ground
3	TX2n	4	TX1p
5	Ground	6	TX1n
7	TX0p	8	Ground
9	TX0n	10	TXCp

11	Ground	12	TXCn
13	CEC	14	NC
15	DDC SCL	16	DDC SDA
17	Ground	18	+5V DDC
19	HPD (Hot Plug Detect)	--	

## HDMI Input

The HDMI-in connector is used to receive digital video and audio from HDMI-enabled source devices. This connector is compatible with HDMI 2.0 devices and capable of accepting a maximum video resolution of 4096x2160x60p. The signaling also conforms with DVI 1.0, HDMI 1.4, and HDCP 2.2 standards.

The HDMI signaling has CEC (but no ARC or HEC) functionality. The CEC channel is electrically coupled to the corresponding signal on the HDMI output, and the CEC commands will pass through the player even when it does not have power.

## XTx43 Environmental and Power Usage

The XT243 and XT1143 are designed to be used between 0°C and 40°C, at 90% maximum relative humidity, non-condensing.

The power supply for the XT243 and XT1143 is 36W (12V@3A). The device will use approximately 1A of power when playing a 4096x2160x60p H.265 (HEVC) source file.

An additional 2A of power is available for peripherals connected to the player. The user should not connect any combination of peripherals that will exceed 2A draw. If more than 2A is drawn, the external power supply may shut down due to over-current conditions. The unit will not be damaged, but it may reboot or not operate properly until the overload is removed.

If the device is being powered by the power supply, the 2A can be shared in any way among the following connectors:

Connector	Maximum Power Usage
RJ-45	Approx. 180mA (when transferring data)
USB 2.0	500mA (on each connector)
GPIO 3.3V	500mA
HDMI 5V	70mA
IR blaster output	300mA

## XTx43 Theory of Operation

### ON THIS PAGE


- [On-Board LEDs](#)
- [On-Board Switch](#)
- [Reset Switch/GPIO Button](#)
- [microSD Slot](#)
- [Wireless Module](#)
- [SSD Module](#)

This section describes how specific components operate on the XT243 and XT1143.

### On-Board LEDs

There are four on-board LEDs that indicate the following:

LED	Indication
Green power ( <b>Pwr</b> )	Displays when the board is powered up and not in reset mode. Flashes during firmware update process.
Green file-system activity ( <b>Bsy</b> )	Flashes any time there is file-system activity (on any storage device)

Blue WiFi (  )	Flashes when the player is connecting to the wireless network. Displays when connected.	
Red status (Err)	Flashes a certain number of times to indicate which error is occurring. The flash codes are described below.	
	2	Unspecified error
	3	Network recovery script is preparing to run on a device configured for network recovery.
	4	No upgrade file found.
	5	Failed to load kernel module.
	6	Board is not capable of running the current firmware version.
	7	A piece of on-board hardware is not working correctly.
	8	Problem related to the storage device (either the USB drive or microSD card)
	9	Problem related to the registry/NAND
	10	The autorun script encountered a load/run error.
	11	WiFi-related error
	12	Unable to find a bootable image.

#### On-Board Switch

The on-board switch is connected to the GPIO02, which is pulled low when the service (SVC) button is pressed. Conversely, a pull-up on the button normally sets the GPIO02 to be pulled high.

#### Reset Switch/GPIO Button

The on-board switch is connected to the reset circuit. Pressing down the reset button will send an initial signal to the system software, and holding the reset button low for approximately 4 seconds will cause a hard reset.

#### microSD Slot

The XT243 and XT1143 have one microSD slot, which supports transfer modes up to UHS-1 DDR50 (50MB/s). There is no inherent limit on the storage capacity of microSD cards used with the player.

#### Wireless Module

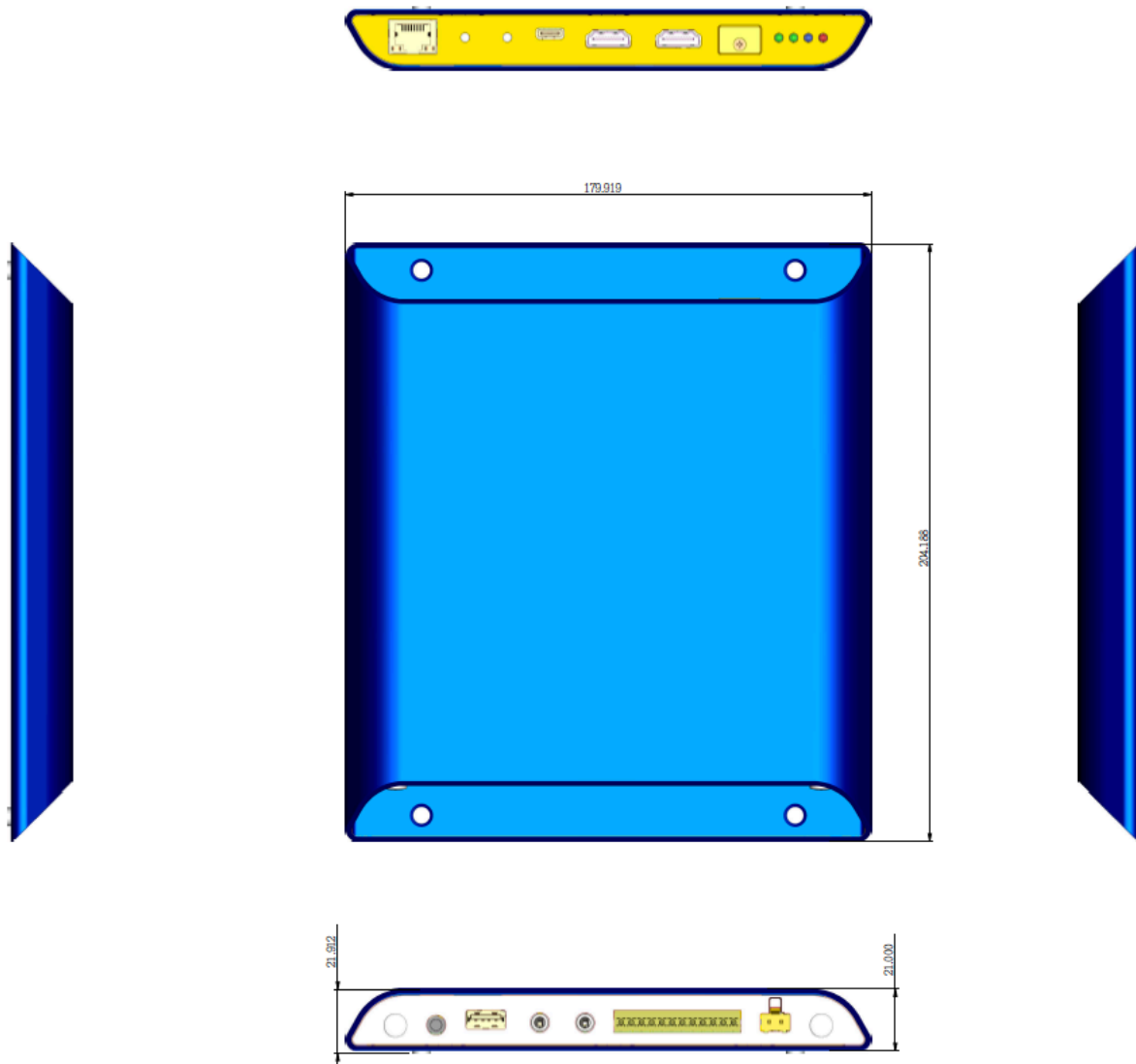
The XT243 and XT1143 have an internal M.2 slot for installing a compatible wireless module. The M.2 wireless module connects via cables to two external, attachable wireless antennas.

#### SSD Module

The XT243 and XT1143 have an internal M.2 slot for SSD drives.

## XTx43 Dimensions





## XTx43 Mounting Procedure

The XT243 and XT1143 can be mounted on a wall using the sealed mounting holes on the front and back. It is recommended that you mount the device using four screws (one for each hole). The screws should have a major diameter between 3.5mm and 4.2mm.

### **Important**

Nails should not be used to mount the device.

## XD233, XD1033

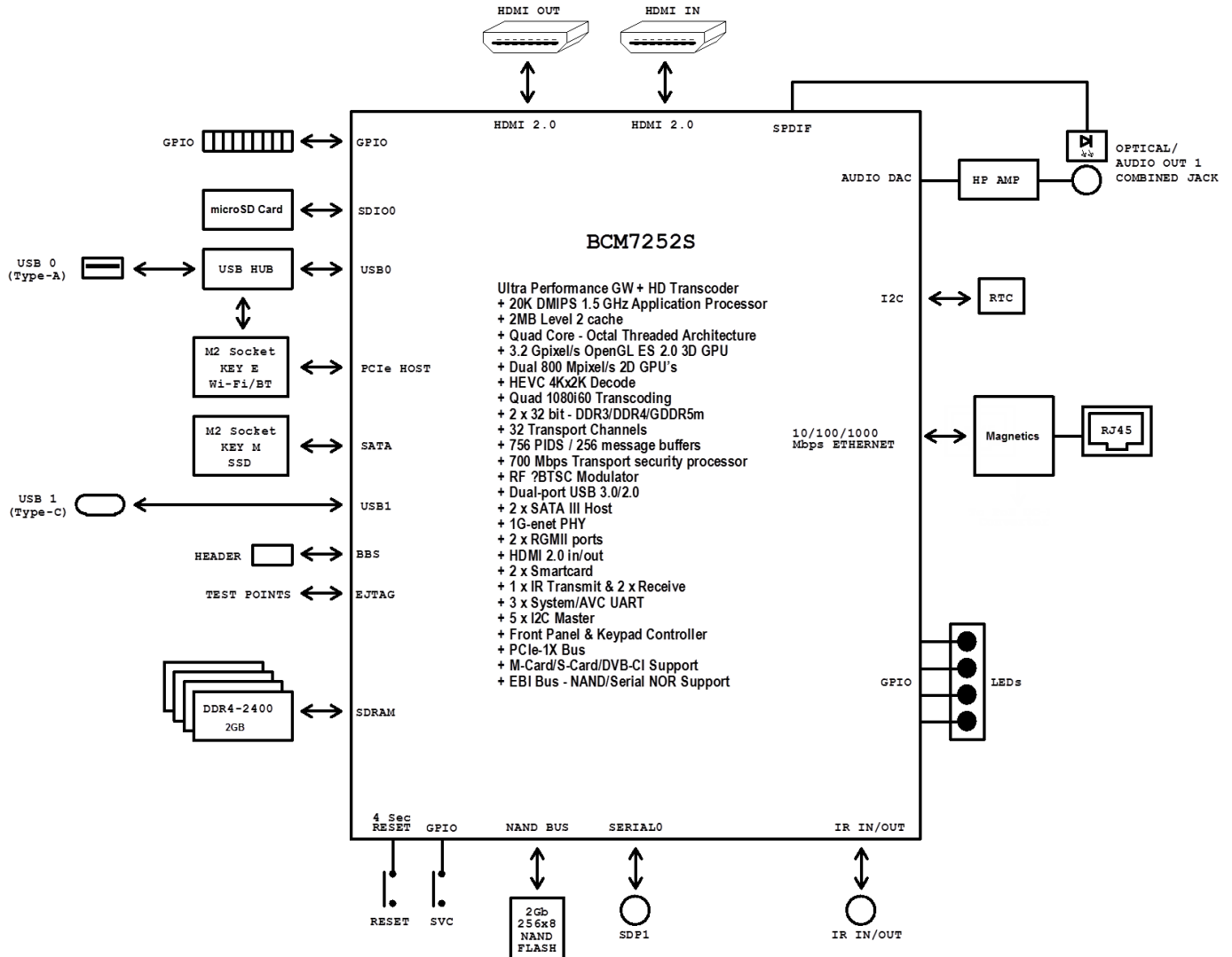
### ON THIS PAGE

- [Block Diagram](#)
- [Interfaces](#)
  - [XD233](#)
  - [XD1033](#)

The BrightSign XD233 and XD1033 media players can be used to decode images, audio, and video (at resolutions up to 4096x2160x60p) for digital-signage and kiosk applications. In addition to driving audio/video devices, these players can be controlled with various networked and built-in interfaces.

This manual specifies the hardware interfaces and operational theory of the XDx33 series.

# BLOCK DIAGRAM



## INTERFACES

### XD233

Front	Back
Status LEDs	WiFi antenna connector (1 of 2)
microSD card slot	3.5mm audio out
HDMI out	3.5mm IR in/out
Service button (SVC)	GPIO (12 pins)
Reset button (Reset)	12V@3A Molex power connector
RJ45 LAN	WiFi antenna connector (2 of 2)

### XD1033

Front	Back

Status LEDs	WiFi antenna connector (1 of 2)
microSD card slot	3.5mm audio out
HDMI out	USB 2.0 (Type A connector)
USB 2.0 (Type C connector)	3.5mm IR in/out
Service button (SVC)	3.5mm RS-232 serial
Reset button (Reset)	GPIO (12 pins)
RJ45 LAN	12V@3A Molex power connector
	WiFi antenna connector (2 of 2)

## XDx33 Hardware Interfaces

### ON THIS PAGE

- [Power Connector](#)
- [3.5mm Serial](#)
- [GPIO](#)
- [RJ45 LAN](#)
- [USB](#)
- [3.5mm Audio Connector](#)
- [3.5mm IR Input/Output](#)
- [HDMI Output](#)

This section describes the characteristics and operation of all connectors on the XD233 and XD1033.

### Power Connector

The power connector for the XD233 and XD1033 is rated for 12V@3A. The plug is a right-side positive, locking 2-pin (1x2) connector.

### 3.5mm Serial

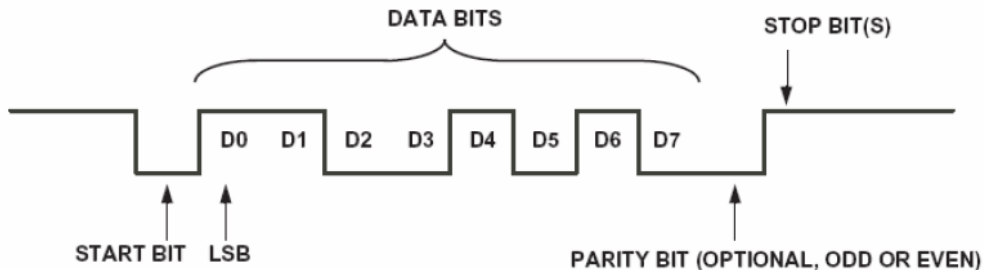
The UART (asynchronous serial) interface is a 3.5mm (1/8") jack and will interoperate with most RS-232 compatible devices. The receiver will tolerate input voltages between -30V and +30V, with anything below 3V interpreted as a logical 1. The transmitter drives +5V for logical 0 and 0V for logical 1.

The default baud rate of the RS-232 interface is 115200, with no parity, 8 data bits, and 1 stop bit. These settings can be configured in the software. The serial interface supports TX, RX, and ground only—RTS/CTS hardware flow control is not supported.

A serial cable plug that is inserted into the 3.5mm jack should use the following signaling:

- **Tip:** Transmit
- **Ring:** Recieve
- **Sleeve:** Ground

The following diagram illustrates the behavior of the TX and RX signal:



### GPIO

The XD233 and XD1033 have a 12-pin GPIO switch and LED connector, which allows the player to control external LEDs or other devices requiring 24mA of current or less.

The GPIO port is a standard design manufactured by Phoenix Contact, Würth Electronics, and others. The XDx33 series ships with two pluggable GPIO terminal blocks, which can be inserted into the GPIO connector to make bare-wire contacts. An example part number for these terminal blocks can be found [here](#).

If you are using the GPIO connector to drive LEDs, connect the LED outputs to the LED ANODE and connect the LED CATHODE to the ground. If you want to connect another device, then the output is capable of sourcing or sinking up to 3.3V at 24mA, but there is a series resistor of 100W in each line.

The connector also allows the connecting of external contact closures to the ground. In order to connect a switch, connect one side of the switch to the switch input, and connect the other side to one of the ground pins on the GPIO connector. The connector can also supply 3.3V at up to 500mA to an external device. The 3.3V output is polyfuse-protected and can source up to 500mA.

If one BrightSign player is driving the inputs on another BrightSign player, then you can drive at most three inputs from one output. The following calculations explain this limitation:

**Note**

The GPIO outputs have 100W series resistors; the GPIO inputs have 1K pullup resistors to 3.3V; and the input threshold is 2V high and .8V low. The high voltage is not problematic, but the low voltage can be if there are too many inputs connected to one output.

1 out driving 1 in	$V=3.3*100/(100+1,000)=0.3$
1 out driving 2 in	$V=3.3*100/(100+500)=0.55$
1 out driving 3 in	$V=3.3*100/(100+333.3)=0.76$
1 out driving 4 in	$V=3.3*100/(100+250)=.94$ (This is too high, so 1 output driving 3 inputs is the maximum)

The following table illustrates the pinout of the GPIO on the XD233 and XD1033:

Pin	Function	Pin	Function
1	GND	7	GND
2	3.3V	8	3.3V
3	BUTTON 0	9	BUTTON 4
4	BUTTON 1	10	BUTTON 5
5	BUTTON 2	11	BUTTON 6
6	BUTTON 3	12	BUTTON 7

**RJ45 LAN**

The XD233 and XD1033 have an RJ45 connector for 1000BASE-T networking. The maximum length for Cat 5E cable is 100 meters; the allowed length can be higher or lower depending on the quality of the cable.

**USB**

The XD1033 has two USB 2.0 ports: one Type A and one Type C. The Type A connector can act as a dedicated charging port (DCP) when the two data pins are shorted together, and the Type C connector can operate as either a host or a device (i.e. a dual-role port).

Both ports are capable of transfer speeds up to 480 Mbit/s. The maximum length for a USB cable is 5 meters.

The following table illustrates the pinout of the USB 2.0 Type A host port:

pin	Description	pin	Description
1	VBUS	2	D-
3	D+	4	Ground

The following table illustrates the pinout of the USB 2.0 Type C host port:

pin	Signal Name	Description	Mating Sequence	pin	Signal Name	Description	Mating Sequence
A1	GND	Ground return	First	B12	GND	Ground return	First
A2				B11			
A3				B10			
A4	VBUS	Bus power	First	B9	VBUS	Bus power	First
A5	CC1	Configuration channel	Second	B8			
A6	Dp1	Positive half of USB 2.0 differential pair – position 1	Second	B7	Dn2	Negative half of USB 2.0 differential pair – position 2	Second
A7	Dn1	Negative half of USB 2.0 differential pair – position 1	Second	B6	Dp2	Positive half of USB 2.0 differential pair – position 2	Second
A8				B5	CC2	Configuration channel	Second
A9	VBUS	Bus power	First	B4	VBUS	Bus power	First
A10				B3			
A11				B2			
A12	GND	Ground return	First	B1	GND	Ground return	First

### 3.5mm Audio Connector

The XD233 and XD1033 have a combination analog/optical audio jack. To transmit a digital audio signal, use an optical audio cable. Analog and digital audio cannot be transmitted simultaneously.

The full-scale voltage output of the analog audio is 2V RMS. The minimum load impedance is 32W.

The analog audio connector has the following pinout:

- **Tip:** Left audio
- **Ring:** Right audio
- **Sleeve:** Ground for audio signal

### 3.5mm IR Input/Output

The IR blaster generates or receives a space-encoded NEC or Pronto Hex signal. The two transported bit values of the signal (0 and 1) are encoded using differing lengths of low-time IR pulses.

The 3.5mm IR in/out port has the following pinout:

- **Tip:** 3.3V
- **Ring:** IR Input
- **Sleeve:** IR Output

#### Note

The sleeve is used as a ground during input operations.

### HDMI Output

The HDMI-out connector is used to send digital video and audio to HDMI-enabled sink devices. This connector is compatible with HDMI 2.0 devices, capable of outputting a maximum video resolution of 4096x2160x60p.

The following table illustrates the pinout of the HDMI connector:

pin	Description	pin	Description
1	TX2p	2	Ground
3	TX2n	4	TX1p
5	Ground	6	TX1n
7	TX0p	8	Ground
9	TX0n	10	TXCp
11	Ground	12	TXCn

13	CEC	14	NC
15	DDC SCL	16	DDC SDA
17	Ground	18	+5V DDC
19	HPD (Hot Plug Detect)	--	

## XDx33 Environmental and Power Usage

The XD233 and XD1033 are designed to be used between 0°C and 40°C, at 90% maximum relative humidity, non-condensing.

The power supply for the XD233 and XD1033 is 36W (12V@3A). The device will use approximately 1A of power when playing a 4096x2160x60p H.265 (HEVC) source file.

An additional 2A of power is available for peripherals connected to the player. The user should not connect any combination of peripherals that will exceed 2A draw. If more than 2A is drawn, the external power supply may shut down due to over-current conditions. The unit will not be damaged, but it may reboot or not operate properly until the overload is removed.

If the device is being powered by the power supply, the 2A can be shared in any way among the following connectors:

Connector	Maximum Power Usage
RJ-45	Approx. 180mA (when transferring data)
USB 2.0	500mA (on each connector)
GPIO 3.3V	500mA
HDMI 5V	70mA
IR blaster output	300mA

## XDx33 Theory of Operation


### ON THIS PAGE

- [On-Board LEDs](#)
- [On-Board Switch](#)
- [Reset Switch/GPIO Button](#)
- [microSD Slot](#)
- [Wireless Module](#)
- [SSD Module](#)

This section describes how specific components operate on the XD233 and XD1033.

### On-Board LEDs

There are four on-board LEDs that indicate the following:

LED	Indication	
Green power/update ( <b>Pwr</b> )	Displays when the board is powered up and not in reset mode. Flashes during firmware update process.	
Green file-system activity ( <b>Bsy</b> )	Flashes any time there is file-system activity (on any storage device)	
Blue WiFi (  )	Flashes when the player is connecting to the wireless network. Displays when connected.	
Red status ( <b>Err</b> )	Flashes a certain number of times to indicate which error is occurring. The flash codes are described below.	
	2	Unspecified error
	3	Network recovery script is preparing to run on a device configured for network recovery.
	4	No upgrade file found.

5	Failed to load kernel module.
6	Board is not capable of running the current firmware version.
7	A piece of on-board hardware is not working correctly.
8	Problem related to the storage device (either the USB drive or microSD card)
9	Problem related to the registry/NAND
10	The autorun script encountered a load/run error.
11	WiFi-related error
12	Unable to find a bootable image.

### **On-Board Switch**

The on-board switch is connected to the GPIO02, which is pulled low when the service (SVC) button is pressed. Conversely, a pull-up on the button normally sets the GPIO02 to be pulled high.

### **Reset Switch/GPIO Button**

The on-board switch is connected to the reset circuit. Pressing down the reset button will send an initial signal to the system software, and holding the reset button low for approximately 4 seconds will cause a hard reset.

### **microSD Slot**

The XD233 and XD1033 have one microSD slot, which supports transfer modes up to UHS-1 DDR50 (50MB/s). There is no inherent limit on the storage capacity of microSD cards used with the player.

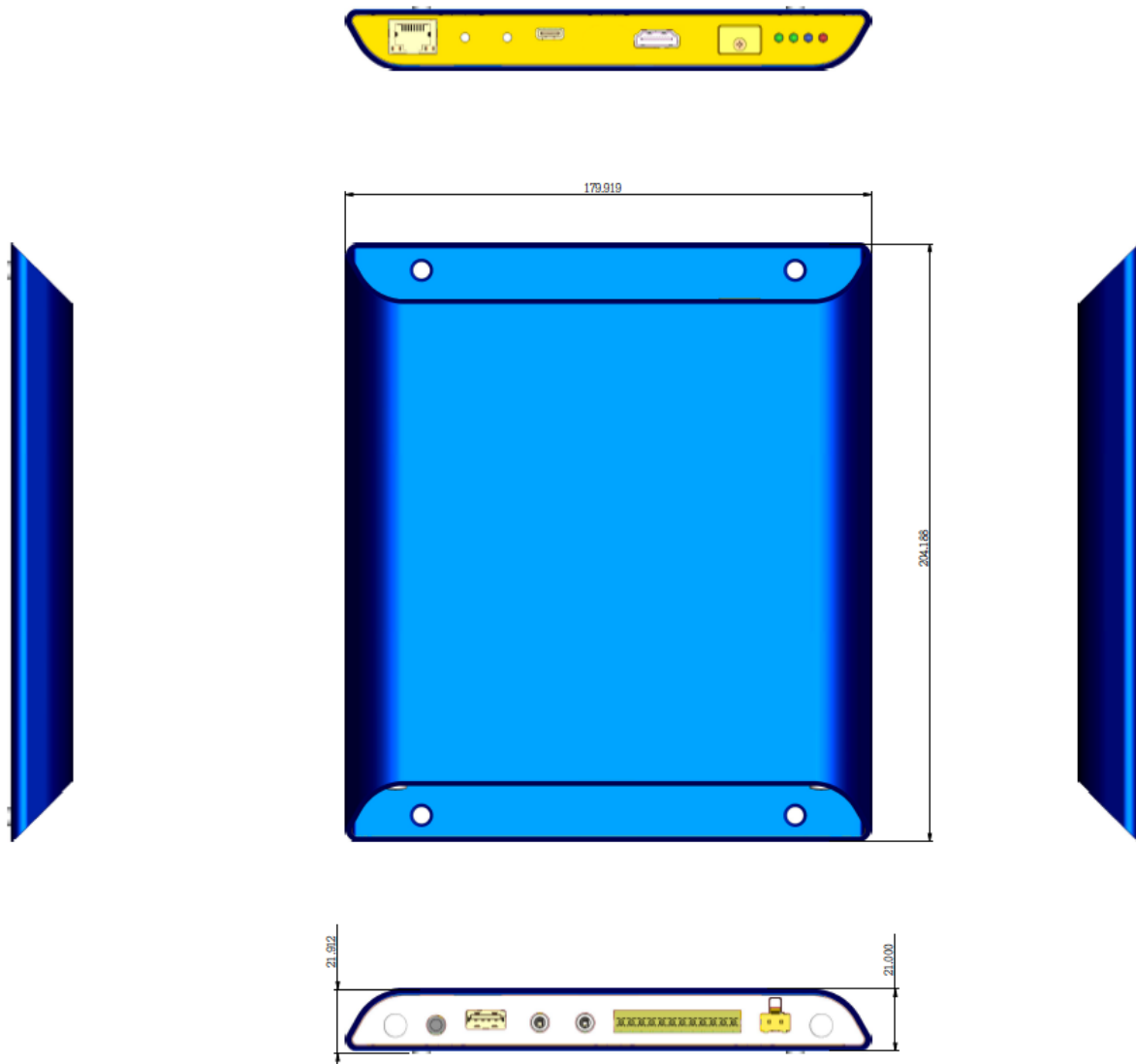
### **Wireless Module**

The XD233 and XD1033 have an internal M.2 slot for installing a compatible wireless module. The M.2 wireless module connects via cables to two external, attachable wireless antennas.

### **SSD Module**

The XD233 and XD1033 have an internal M.2 slot for SSD drives.

## **XDx33 Dimensions**



## XDx33 Mounting Procedure

The XD233 and XD1033 can be mounted on a wall using the sealed mounting holes on the front and back. It is recommended that you mount the device using four screws (one for each hole). The screws should have a major diameter between 3.5mm and 4.2mm.

### Important

Nails should not be used to mount the device.

## HD223, HD1023

### ON THIS PAGE

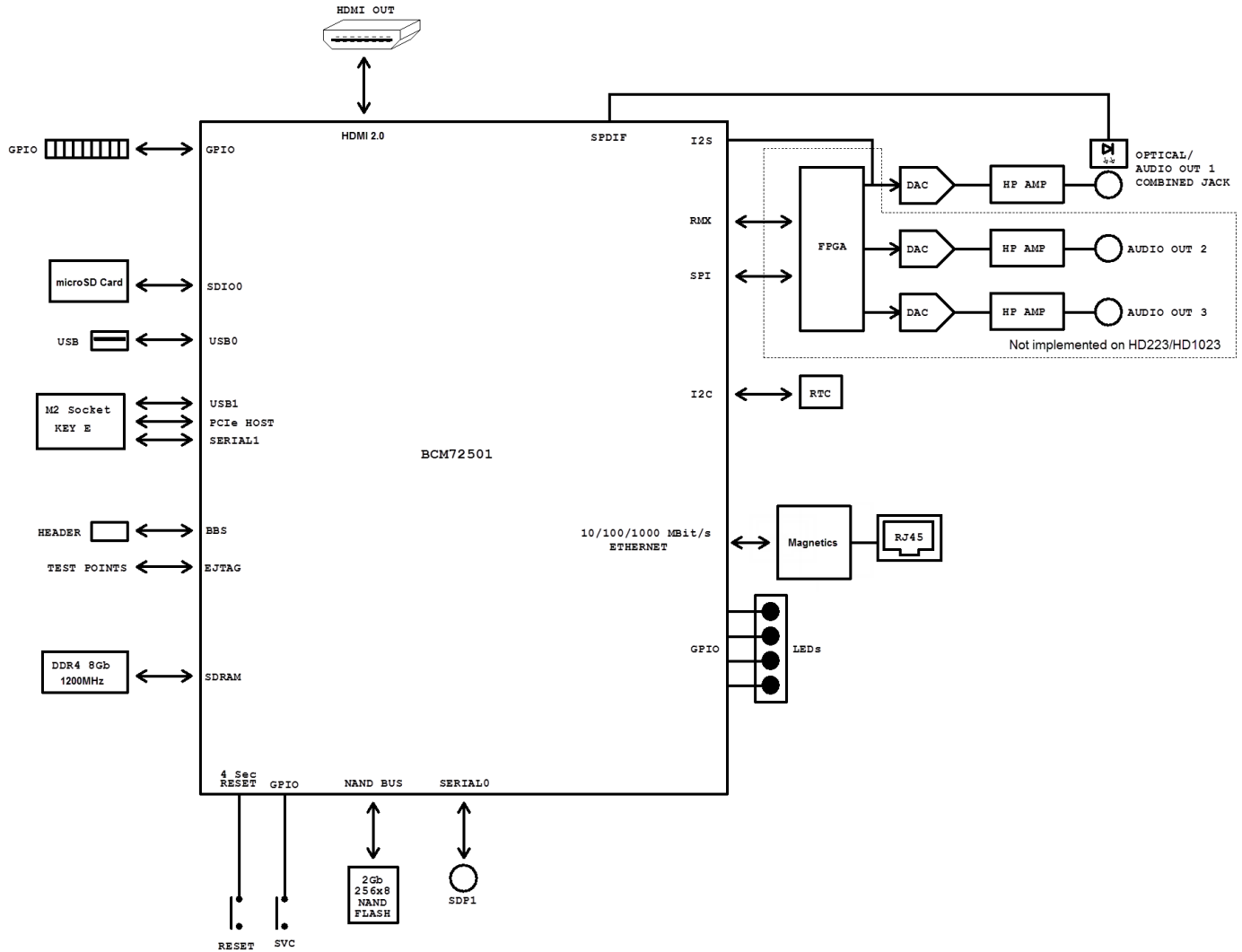
- [Block Diagram](#)
- [Interfaces](#)
  - [HD223](#)
  - [HD1023](#)

The BrightSign HD223 and HD1023 media players can be used to decode images, audio, and video (at resolutions up to 1920x1080x60p) for digital-signage and kiosk applications. In addition to driving audio/video devices, these players can be controlled with various networked and built-in interfaces.



This manual specifies the hardware interfaces and operational theory of the HDx23 series.

## BLOCK DIAGRAM



## INTERFACES

### HD223

Front	Back
Status LEDs	WiFi antenna connector (1 of 2)
microSD card slot	3.5mm audio out
HDMI out	GPIO (12 pins)
RJ45 LAN	12V@1.5A barrel power connector
Service button (SVC)	WiFi antenna connector (2 of 2)
Reset button (Reset)	

### HD1023

Front	Back
Status LEDs	WiFi antenna connector (1 of 2)
microSD card slot	3.5mm audio out
HDMI out	3.5mm RS-232 serial
USB 2.0 (Type C connector)	GPIO (12 pins)
RJ45 LAN	12V@1.5A barrel power connector
Service button (SVC)	WiFi antenna connector (2 of 2)
Reset button (Reset)	

## HDx23 Hardware Interfaces

### ON THIS PAGE

- [Power Connector](#)
- [3.5mm Serial](#)
- [GPIO](#)
- [RJ45 LAN](#)
- [USB](#)
- [3.5mm Audio Connector](#)
- [HDMI Output](#)

This section describes the characteristics and operation of all connectors on the HD223 and HD1023.

### Power Connector

The power connector for the HD223 and HD1023 is rated for 12V@1.5A. The plug is a 3.5mm barrel power connector.

### 3.5mm Serial

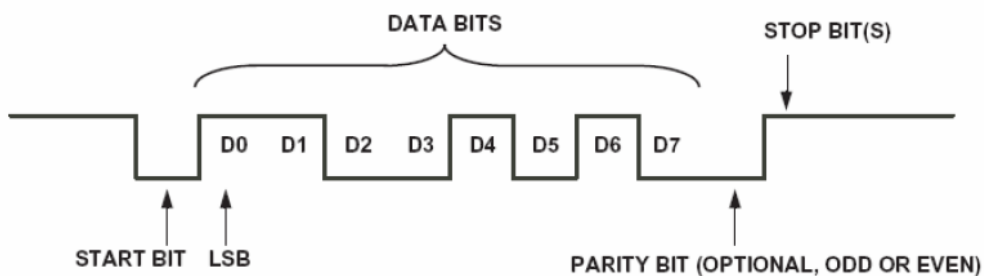
The UART (asynchronous serial) interface is a 3.5mm(1/8") jack and will interoperate with most RS-232 compatible devices. The receiver will tolerate input voltages between -30V and +30V, with anything below 3V interpreted as a logical 1. The transmitter drives +5V for logical 0 and 0V for logical 1.

The default baud rate of the RS-232 interface is 115200, with no parity, 8 data bits, and 1 stop bit. These settings can be configured in the software. The serial interface supports TX, RX, and ground only—RTS/CTS hardware flow control is not supported.

A serial cable plug that is inserted into the 3.5mm jack should use the following signaling:

- **Tip:** Transmit
- **Ring:** Recieve
- **Sleeve:** Ground

The following diagram illustrates the behavior of the TX and RX signal:



### GPIO

The HD223 and HD1023 have a 12-pin GPIO switch and LED connector, which allows the player to control external LEDs or other devices

requiring 24mA of current or less.

The GPIO port is a standard design manufactured by Phoenix Contact, Würth Electronics, and others. The HDx23 series ships with two pluggable GPIO terminal blocks, which can be inserted into the GPIO connector to make bare-wire contacts. An example part number for these terminal blocks can be found [here](#).

If you are using the GPIO connector to drive LEDs, connect the LED outputs to the LED ANODE and connect the LED CATHODE to the ground. If you want to connect another device, then the output is capable of sourcing or sinking up to 3.3V at 24mA, but there is a series resistor of 100W in each line.

The connector also allows the connecting of external contact closures to the ground. In order to connect a switch, connect one side of the switch to the switch input, and connect the other side to one of the ground pins on the GPIO connector. The connector can also supply 3.3V at up to 500mA to an external device. The 3.3V output is polyfuse-protected and can source up to 500mA.

If one BrightSign player is driving the inputs on another BrightSign player, then you can drive at most three inputs from one output. The following calculations explain this limitation:

**Note**

The GPIO outputs have 100W series resistors; the GPIO inputs have 1K pullup resistors to 3.3V; and the input threshold is 2V high and .8V low. The high voltage is not problematic, but the low voltage can be if there are too many inputs connected to one output.

1 out driving 1 in	$V=3.3*100/(100+1,000)=0.3$
1 out driving 2 in	$V=3.3*100/(100+500)=0.55$
1 out driving 3 in	$V=3.3*100/(100+333.3)=0.76$
1 out driving 4 in	$V=3.3*100/(100+250)=.94$ (This is too high, so 1 output driving 3 inputs is the maximum)

The following table illustrates the pinout of the GPIO on the HD223 and HD1023:

Pin	Function	Pin	Function
1	GND	7	GND
2	3.3V	8	3.3V
3	BUTTON 0	9	BUTTON 4
4	BUTTON 1	10	BUTTON 5
5	BUTTON 2	11	BUTTON 6
6	BUTTON 3	12	BUTTON 7

### RJ45 LAN

The HD223 and HD1023 have an RJ45 connector for 1000BASE-T networking. The maximum length for Cat 5E cable is 100 meters; the allowed length can be higher or lower depending on the quality of the cable.

### USB

The HD1023 has one USB 2.0 Type-A port, which is capable of transfer speeds up to 480 Mbit/s. The maximum length for a USB cable is 5 meters.

The following table illustrates the pinout of the USB 2.0 Type A host port:

pin	Description	pin	Description
1	VBUS	2	D-
3	D+	4	Ground

### 3.5mm Audio Connector

The HD223 and HD1023 have a combination analog/optical audio jack. To transmit a digital audio signal, use an optical audio cable. Analog and digital audio cannot be transmitted simultaneously.

The full-scale voltage output of the analog audio is 2V RMS. The minimum load impedance is 32W.

The analog audio connector has the following pinout:

- **Tip:** Left audio
- **Ring:** Right audio
- **Sleeve:** Ground for audio signal

### HDMI Output

The HDMI-out connector is used to send digital video and audio to HDMI-enabled sink devices. This connector is compatible with HDMI 2.0 devices, capable of outputting a maximum video resolution of 1920x1080x60p.

The following table illustrates the pinout of the HDMI connector:

pin	Description	pin	Description
1	TX2p	2	Ground
3	TX2n	4	TX1p
5	Ground	6	TX1n
7	TX0p	8	Ground
9	TX0n	10	TXCp
11	Ground	12	TXCn
13	CEC	14	NC
15	DDC SCL	16	DDC SDA
17	Ground	18	+5V DDC
19	HPD (Hot Plug Detect)	--	

## HDx23 Environmental and Power Usage

The HD223 and HD1023 are designed to be used between 0°C and 40°C, at 90% maximum relative humidity, non-condensing.

The power supply for the HD223 and HD1023 is 18W (12V@1.5A). The device will use less than 11W of power when playing a 1920x1080x60p H.265 (HEVC) source file.

An additional 6W of power is available for peripherals connected to the player. This is sufficient to provide up to 1A at 5V on the USB 2.0 port and up to 0.5A at 3.3V on the GPIO 3.3V pin.

## HDx23 Theory of Operation

### ON THIS PAGE


- [On-Board LEDs](#)
- [On-Board Switch](#)
- [Reset Switch/GPIO Button](#)
- [microSD Slot](#)
- [Wireless Module](#)

This section describes how specific components operate on the HD223 and HD10233.

### On-Board LEDs

There are four on-board LEDs that indicate the following:

LED	Indication
Green power ( <b>Pwr</b> )	Displays when the board is powered up and not in reset mode. Flashes during firmware update process.
Green file-system activity ( <b>Bsy</b> )	Flashes any time there is file-system activity (on any storage device)

Blue WiFi (  )	Flashes when the player is connecting to the wireless network. Displays when connected.	
Red status ( <b>Err</b> )	Flashes a certain number of times to indicate which error is occurring. The flash codes are described below.	
	2	Unspecified error
	3	Network recovery script is preparing to run on a device configured for network recovery.
	4	No upgrade file found.
	5	Failed to load kernel module.
	6	Board is not capable of running the current firmware version.
	7	A piece of on-board hardware is not working correctly.
	8	Problem related to the storage device (either the USB drive or microSD card)
	9	Problem related to the registry/NAND
	10	The autorun script encountered a load/run error.
	11	WiFi-related error
	12	Unable to find a bootable image.

#### On-Board Switch

The on-board switch is connected to the GPIO02, which is pulled low when the service (SVC) button is pressed. Conversely, a pull-up on the button normally sets the GPIO02 to be pulled high.

#### Reset Switch/GPIO Button

The on-board switch is connected to the reset circuit. Pressing down the reset button will send an initial signal to the system software, and holding the reset button low for approximately 4 seconds will cause a hard reset.

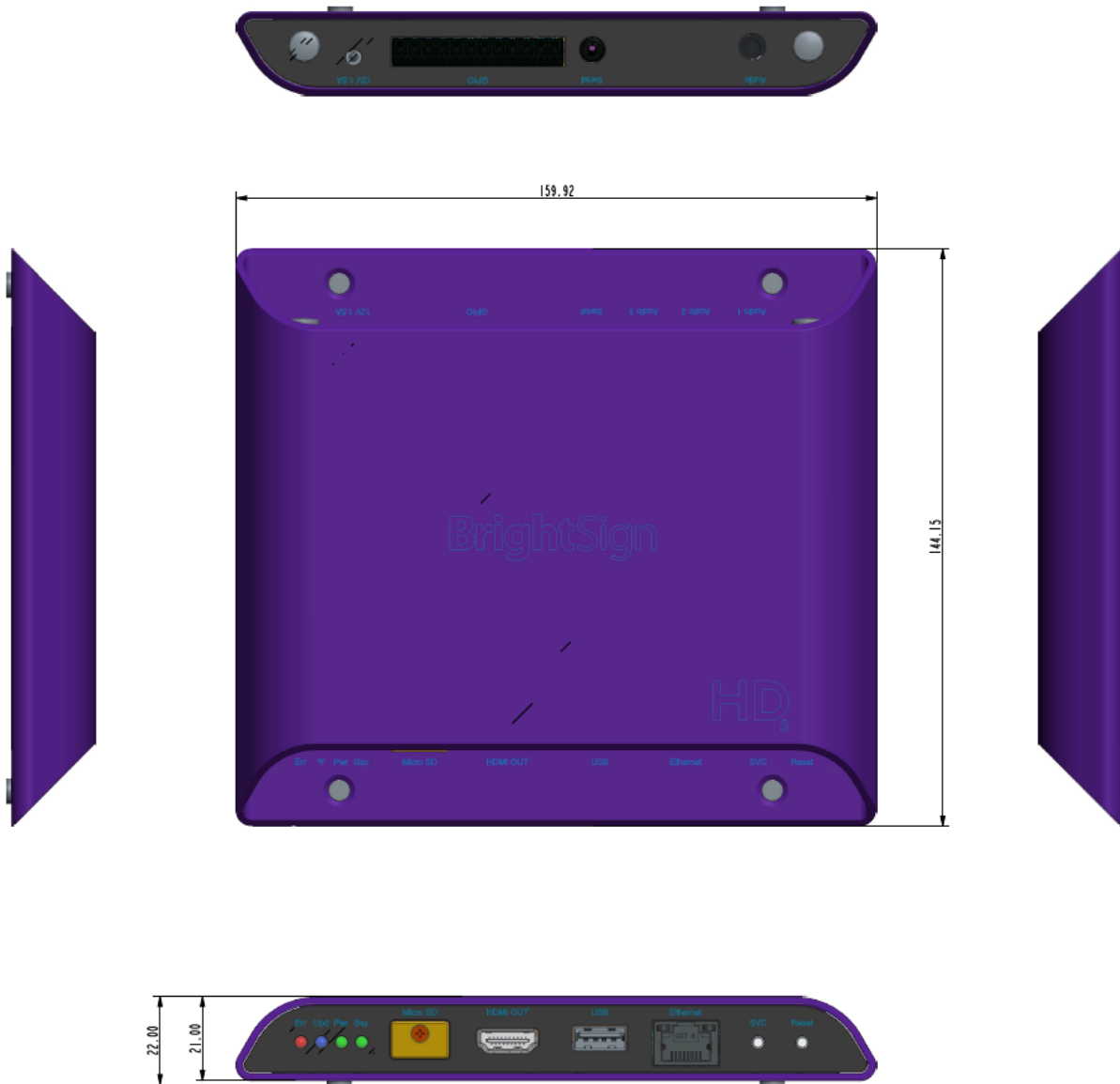
#### microSD Slot

The HD223 and HD1023 have one microSD slot, which supports transfer modes up to UHS-1 DDR50 (50MB/s). There is no inherent limit on the storage capacity of microSD cards used with the player.

#### Wireless Module

The HD223 and HD1023 have an internal M.2 slot for installing a compatible wireless module. The M.2 wireless module connects via cables to two external, attachable wireless antennas.

## HDx23 Dimensions



## HDx23 Mounting Procedure

The HD223 and HD1023 can be mounted on a wall using the sealed mounting holes on the front and back. It is recommended that you mount the device using four screws (one for each hole). The screws should have a major diameter between 3.5mm and 4.2mm.

### Important

Nails should not be used to mount the device.

## LS423

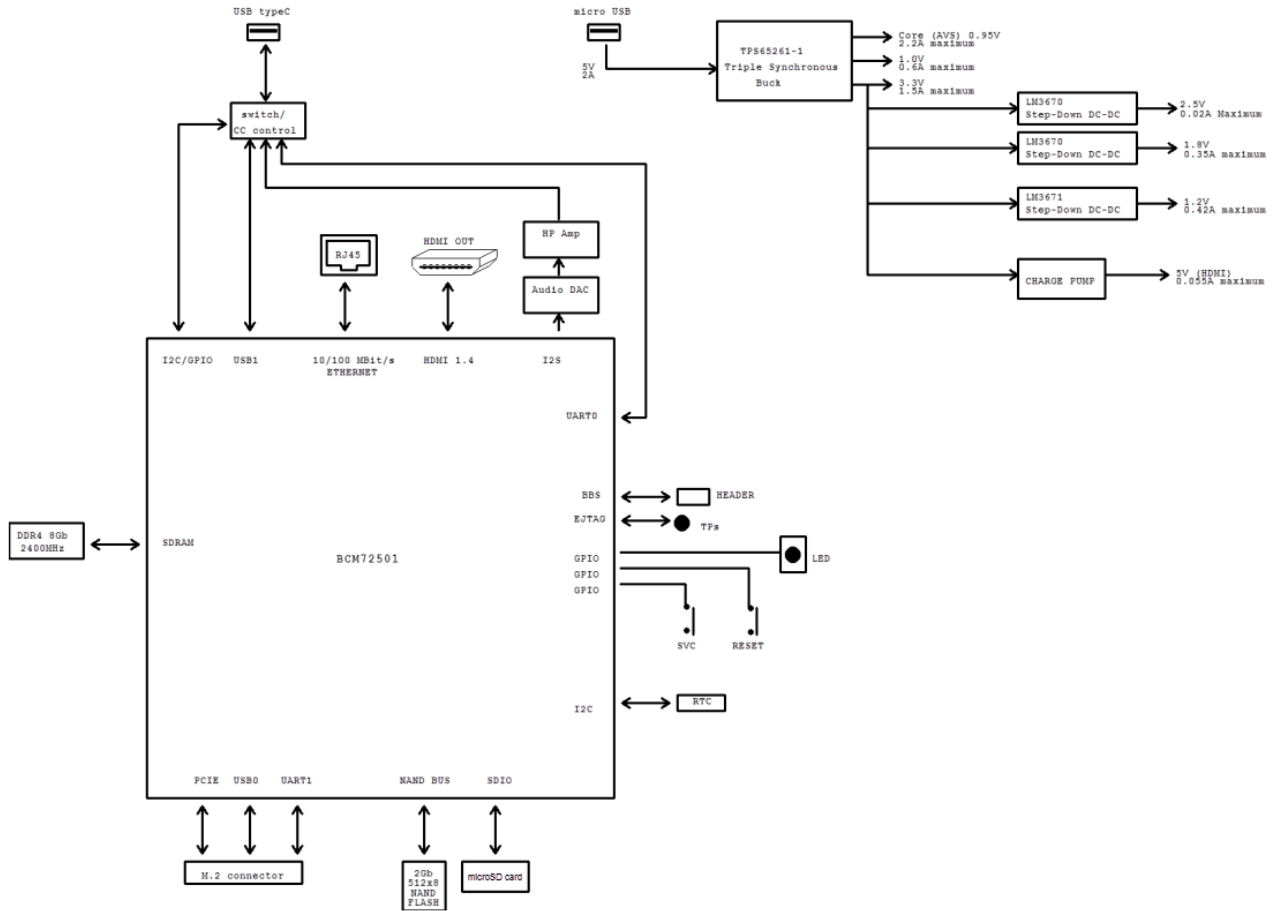
### ON THIS PAGE

- [Block Diagram](#)
- [Interfaces](#)

The BrightSign LS423 media player can be used to decode images, audio, and video (at resolutions up to 1920x1080x60p) for digital-signage and kiosk applications. In addition to driving audio/video devices, these players can be controlled with various networked and built-in interfaces.

This manual specifies the hardware interfaces and operational theory of the LS423.

## BLOCK DIAGRAM



## INTERFACES

Front	Back
RJ45 LAN	HDMI out
USB 2.0 (Type-C connector)	Power connector (USB Micro-B)
microSD card slot	Service button (SVC)
Power and status LED (red)	Reset button (Reset)
	WiFi antenna connector

## LS423 Hardware Interfaces

### ON THIS PAGE

- Power Connector
- RJ45 LAN
- USB
- HDMI Output

This section describes the characteristics and operation of all connectors on the LS423.

## Power Connector

The power connector for the LS423 is a USB Micro-B port rated for 5V@2A. The connector is used for power input only—it does not transfer data.

## RJ45 LAN

The LS423 has an RJ45 connector for 100BASE-TX networking. The maximum length for Cat 5E cable is 100 meters; the allowed length can be higher or lower depending on the quality of the cable.

## USB

The LS423 has a USB 2.0 Type-C port, which is capable of transfer speeds up to 480 Mbit/s. The maximum length for a USB cable is 5 meters.

The USB Type-C port will output analog audio if the CC1 or CC2 signal is shorted to ground via a 1K resistor. Analog output can also be enabled in system software. The Dp signal outputs right audio, and the Dn signal outputs left audio.

The following table illustrates the pinout of the USB 2.0 Type-C host port:

pin	Signal Name	Description	Mating Sequence	pin	Signal Name	Description	Mating Sequence
A1	GND	Ground return	First	B12	GND	Ground return	First
A2				B11			
A3				B10			
A4	VBUS	Bus power	First	B9	VBUS	Bus power	First
A5	CC1	Configuration channel	Second	B8			
A6	Dp1	Positive half of USB 2.0 differential pair – position 1	Second	B7	Dn2	Negative half of USB 2.0 differential pair – position 2	Second
A7	Dn1	Negative half of USB 2.0 differential pair – position 1	Second	B6	Dp2	Positive half of USB 2.0 differential pair – position 2	Second
A8				B5	CC2	Configuration channel	Second
A9	VBUS	Bus power	First	B4	VBUS	Bus power	First
A10				B3			
A11				B2			
A12	GND	Ground return	First	B1	GND	Ground return	First

## HDMI Output

The HDMI-out connector is used to send digital video and audio to HDMI-enabled sink devices. This connector is compatible with HDMI 2.0 devices, capable of outputting a maximum video resolution of 1920x1080x60p.

The following table illustrates the pinout of the HDMI connector:

pin	Description	pin	Description
1	TX2p	2	Ground
3	TX2n	4	TX1p
5	Ground	6	TX1n
7	TX0p	8	Ground
9	TX0n	10	TXCp
11	Ground	12	TXCn
13	CEC	14	NC
15	DDC SCL	16	DDC SDA
17	Ground	18	+5V DDC
19	HPD (Hot Plug Detect)	--	

## LS423 Environmental and Power Usage

The LS423 is designed to be used between 0°C and 40°C at 90% maximum relative humidity, non-condensing.



The LS423 requires a power supply at 5V +/- 10%. If the LS423 is powered by the USB power adapter that it ships with, or by any USB port that identifies itself as a Dedicated Charging Port (DCP), it will provide up to 500mA of bus power to downstream devices on the USB Type-C port.

If the LS423 is powered by a USB port that does not identify itself as a DCP, it will limit available current of the USB Type-C port to 100mA to ensure that the total power drawn by the player does not exceed 1A.

## LS423 Theory of Operation

### ON THIS PAGE

- [On-Board LEDs](#)
- [On-Board Switch](#)
- [Reset Switch/GPIO Button](#)
- [microSD Slot](#)
- [Wireless Module](#)

This section describes how specific components operate on the LS423.

### On-Board LEDs

The LS423 has a single red LED to indicate that the power is on. The LED will flash during the firmware update process. It will also flash a certain number of times to indicate an error state. The flash codes are described below:

Flash code	Description
2	Unspecified error
3	Network recovery script is preparing to run on a device configured for network recovery.
4	No upgrade file found.
5	Failed to load kernel module.
6	Board is not capable of running the current firmware version.
7	A piece of on-board hardware is not working correctly.
8	Problem related to the storage device (either the USB drive or microSD card)
9	Problem related to the registry/NAND
10	The autorun script encountered a load/run error.
11	WiFi-related error
12	Unable to find a bootable image.

### On-Board Switch

The on-board switch is connected to a GPIO pin that is pulled low when the service (SVC) button is pressed. Conversely, a pull-up on the button normally sets the GPIO pin to be pulled high.

### Reset Switch/GPIO Button

The on-board switch is connected to the reset circuit. Pressing down the reset button will send an initial signal to the system software, and holding the reset button low for approximately 4 seconds will cause a hard reset.

### microSD Slot

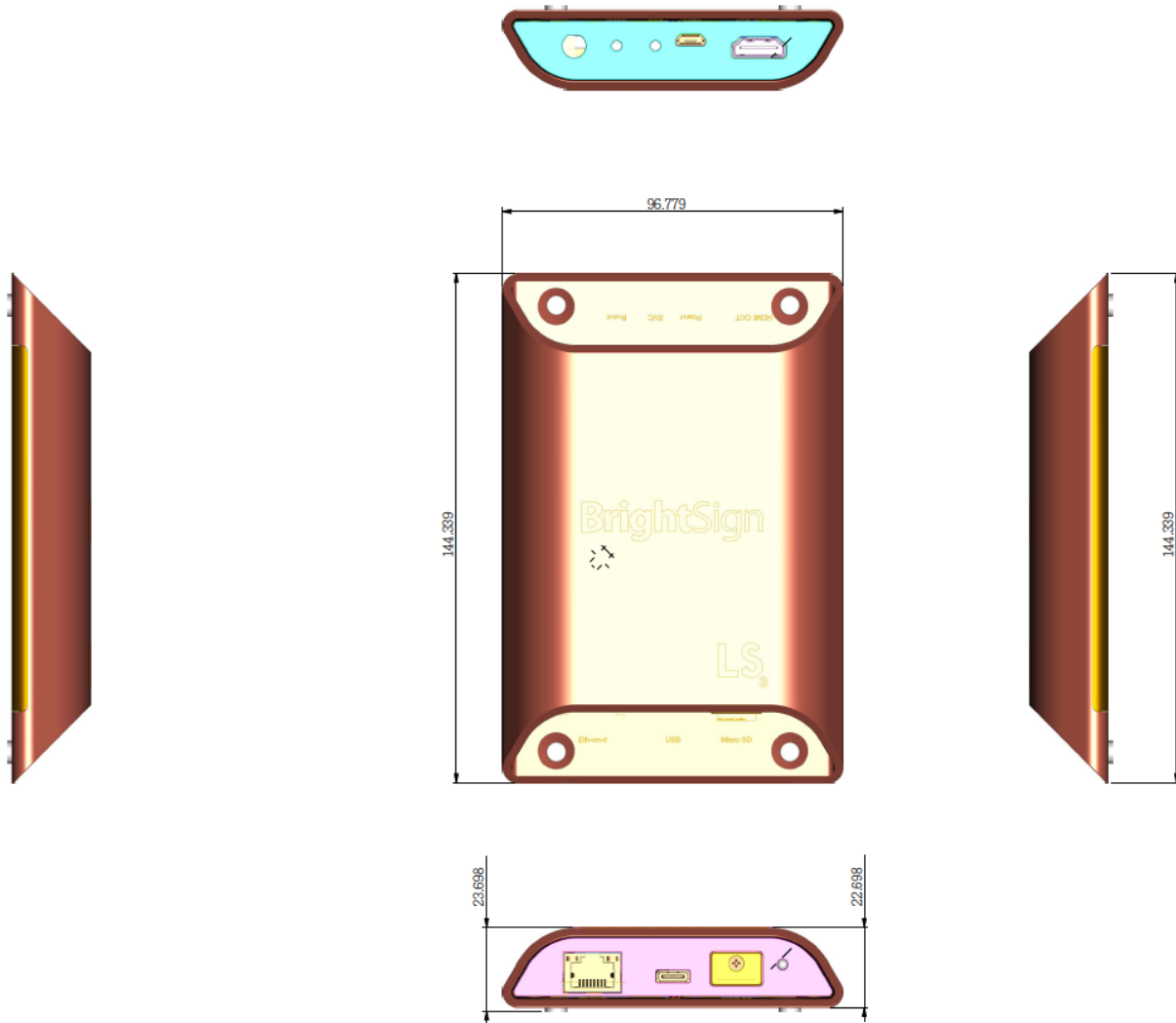
The LS423 has one microSD slot, which supports transfer modes up to UHS-1 DDR50 (50MB/s). There is no inherent limit on the storage capacity of microSD cards used with the player.

### Wireless Module

The LS423 has an internal M.2 slot for installing a compatible wireless module. The M.2 wireless module connects via cable to an external,

attachable wireless antenna.

## LS423 Dimensions



## LS423 Mounting Procedure

The LS423 can be mounted on a wall using the sealed mounting holes on the front and back. It is recommended that you mount the device using four screws (one for each hole). The screws should have a major diameter between 3.5mm and 4.2mm.

**Important**

Nails should not be used to mount the device.

## 4K242, 4K1042, 4K1142

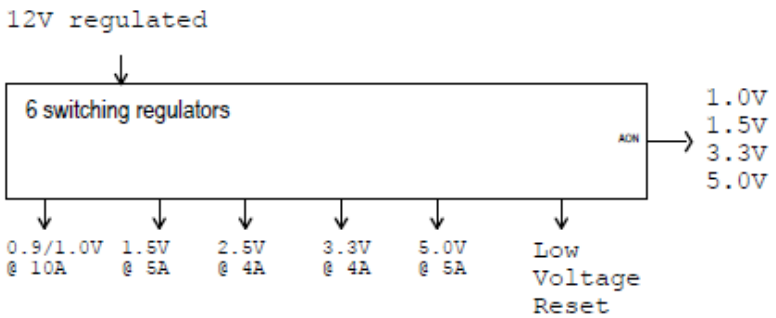
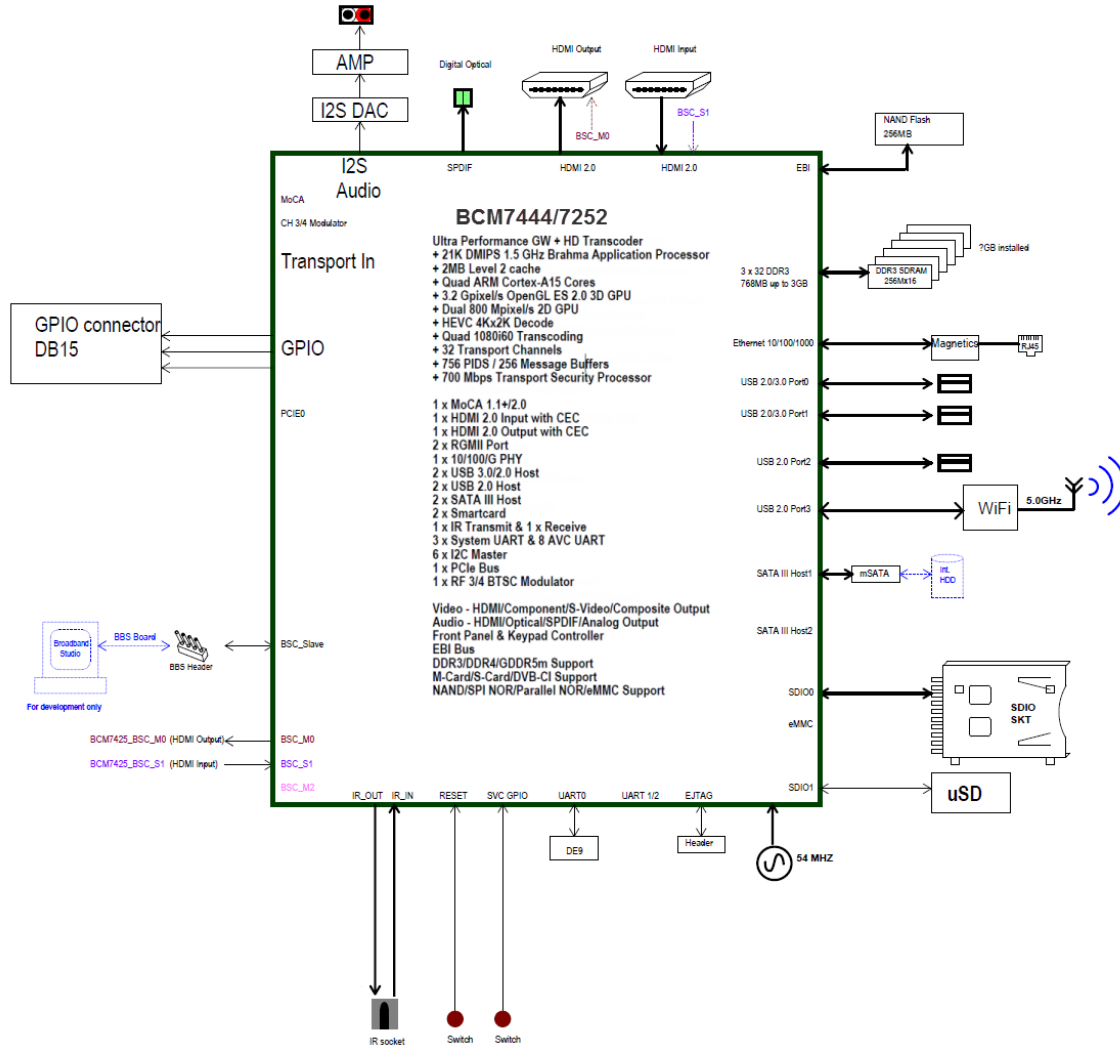
ON THIS PAGE

- [Block Diagram](#)
- [Interfaces](#)
  - [4K242](#)
  - [4K1042](#)
  - [4K1142](#)

The 4K series is a line of commercial-grade solid-state media players that can be used to decode images, audio, and video (up to 3840x2160x60p) for digital-signage and kiosk applications. In addition to driving audio/video devices, these players can be controlled with various networked and built-in interfaces.

This section specifies the hardware interfaces and operational theory of the 4K series.

### BLOCK DIAGRAM



### INTERFACES

4K242

Front	Left	Right	Back	Internal
DA15 GPIO	GPIO service button	SDHC/SDXC flash card slot	12V Molex power connector	MicroSD slot
3.5mm IR in/out	GPIO reset button	Status/error LED (red)	HDMI out	SATA connector
3.5mm audio out		Update LED (yellow)	RJ45 Ethernet (POE)	WiFi Module connector
		Power LED (green)		
		SD activity LED (green)		
		MicroSD presence LED (green)		
		Ethernet activity LED (green)		
		WiFi activity LED (green)		
		Server connection (green)		

#### 4K1042

Front	Left	Right	Back	Internal
DE9 RS232 serial (male)	GPIO service button	SDHC/SDXC flash card slot	12V Molex power connector	MicroSD slot
DA15 GPIO	GPIO reset button	Status/error LED (red)	SPDIF out	SATA connector
3.5mm IR in/out		Update LED (yellow)	HDMI out	WiFi Module connector
3.5mm audio out		Power LED (green)	USB 3.0	
		SD activity LED (green)	RJ45 Ethernet (POE)	
		MicroSD presence LED (green)		
		Ethernet activity LED (green)		
		WiFi activity LED (green)		
		Server connection (green)		

#### 4K1142

Front	Left	Right	Back	Internal
USB 2.0	GPIO service button	SDHC/SDXC flash card slot	12V Molex power connector	MicroSD slot
DE9 RS232 serial (male)	GPIO reset button	Status/error LED (red)	SPDIF out	SATA connector
3.5mm IR in/out		Update LED (yellow)	HDMI out	WiFi Module connector
3.5mm audio out		Power LED (green)	HDMI in	
		SD activity LED (green)	(2x) USB 3.0	
		MicroSD presence LED (green)	RJ45 Ethernet (POE)	
		Ethernet activity LED (green)		
		WiFi activity LED (green)		
		Server connection (green)		

### 4Kx42 Hardware Interfaces

## ON THIS PAGE

- [Power Connector](#)
- [DE9 RS-232 Serial](#)
- [DA15 GPIO](#)
- [RJ45 Ethernet](#)
- [USB](#)
  - [USB 2.0](#)
  - [USB 3.0](#)
- [3.5mm Audio Connector](#)
- [HDMI Output](#)
- [HDMI Input](#)
- [3.5mm IR Input/Output](#)
- [SPDIF Out](#)
- [Wireless](#)

This page describes the characteristics and operation of all connectors on 4K models.

### Power Connector

The power connector for 4K players is rated for 12V @ 5A. The plug is a right-side positive, keyed and locking 4-pin connector.

### DE9 RS-232 Serial

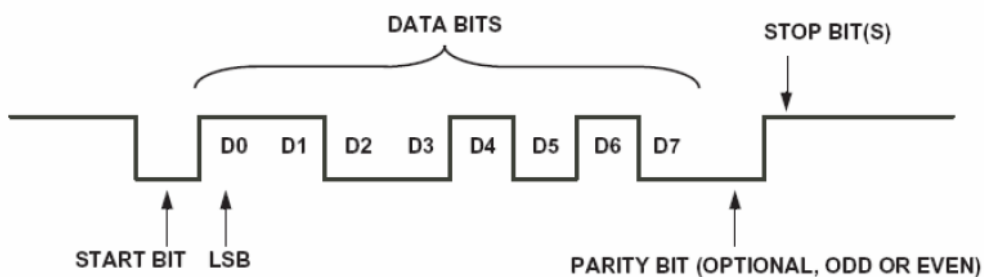
The RS-232 interface is a male DE9 connector. The BrightSign 4K player is a DTE device, similar to a PC. The input to the chip accepts a range between +25V and -25V, so it is compatible with +12V/-12V signaling.

The baud rate of the RS-232 interface (which is controlled by system software) is 115200, with no parity, 8 data bits, and 1 stop bit. The RS-232 interface supports RTS/CTS hardware flow control, but no software flow control. The maximum cable length is 50 meters, and the total cable capacitance is 2500pF.

#### Note

A lower capacitance cable allows you to use cable lengths beyond 50 meters.

The following diagram illustrates the behavior of the TX and RX signal:



The following table illustrates the pinout of the DE9 serial connector on 4K players:

pin	Description	pin	Description
1	NC	2	Receive data into the device
3	Transmit data out of the device	4	Available 5V@500mA
5	Ground	6	NC
7	RTS	8	CTS
9	NC	--	--

## DA15 GPIO

The GPIO switch/LED connector is a DA15 female. This connector is used to allow the player to control external LEDs or other devices requiring 24mA of current or less.

Connect the LED outputs to the LED ANODE and connect the LED CATHODE to the ground. If you want to connect another device, then the output is capable of sourcing or sinking up to 3.3V at 24mA, but there is a series resistor of 100Ω in each line.

The connector also allows the connecting of external contact closures to the ground. In order to connect a switch, connect one side of the switch to the switch input, and connect the other side to one of the ground pins on the DA15 connector. The connector can also supply 3.3V at up to 500mA to an external device. The 3.3V output is polyfuse-protected and can source up to 500mA.

If one BrightSign player is driving the inputs on another BrightSign player, then you can drive at most three inputs from one output. The following calculations explain this limitation:

### Note

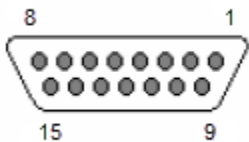
The GPIO outputs have 100Ω series resistors; the GPIO inputs have 1K pullup resistors to 3.3V; and the input threshold on the 541 chips is 2V high and .8V low. The high voltage is not problematic, but the low voltage can be if there are too many inputs connected to one output.

1 out driving 1 in	$V=3.3*100/(100+1,000)=0.3$
1 out driving 2 in	$V=3.3*100/(100+500)=0.55$
1 out driving 3 in	$V=3.3*100/(100+333.3)=0.76$
1 out driving 4 in	$V=3.3*100/(100+250)=.94$ (This is too high, so 1 output driving 3 inputs is the maximum)

The following table illustrates the pinout of the DA15 on the 4K series of players:

pin	Description	pin	Description
1	IR blaster input	2	Ground
3	Button 6 I/O	4	Button 5 I/O
5	Button 3 I/O	6	Ground
7	Button 1 I/O	8	+3.3V output at 500mA
9	Ground	10	Button 7 I/O
11	Ground	12	Button 4 I/O
13	Button 2 I/O	14	Ground
15	Button 0 I/O	--	--

Here is the DA15 female as viewed from the front of a BrightSign 4K player:



A button/LED/IR board can be used to demonstrate the GPIO and IR functions on a BrightSign player. This board is built by a third-party manufacturer and can be purchased upon request.

## RJ45 Ethernet

The 4K series has an RJ45 connector for Gigabit (10/100/1000) base-T Ethernet, as well as Power over Ethernet (PoE) capabilities. The maximum Ethernet-cable length is 91 meters for PoE applications and 100 meters for non-PoE applications. To operate using PoE, 4K players require type-2 PoE supplying a minimum of 25W.

**Important**

The equipment should be connected only to PoE networks without routing to the outside plant.

The following table illustrates the pinout of the RJ45:

pin	Description	pin	Description
1	TX+	2	TX-
3	RX+	4	BI+
5	BI-	6	RX-
7	BI+	8	BI-

**USB**

The 4K1042 has a single USB 2.0 port, and the 4K1142 has two USB 3.0 ports and a single USB 2.0 port. All ports are capable of transfer speeds up to 480 Mbit/s. The maximum length for a USB cable is 5 meters. The following tables illustrate the pinout of the USB 2.0/3.0 host ports:

## USB 2.0

pin	Description	pin	Description
1	VBUS	2	D-
3	D+	4	Ground

## USB 3.0

pin	Description	pin	Description
1	VBUS	2	D-
3	D+	4	Ground
5	StdA_SSTX-	6	StdA_SSTX+
7	Ground	8	StdA_SSRX-
9	StdA_SSRX+		

**3.5mm Audio Connector**

All 4K models have a single 3.5mm female audio connector, which transmits an analog stereo signal. The full-scale voltage output of the audio is 2V RMS. The minimum load impedance of the audio connector is 32W.

**Note**

The BrightSign expansion module allows you to drive up to three sets of 5W headphones directly.

The audio connector has the following pinout:

- **Tip:** Left audio
- **Ring:** Right audio
- **Sleeve:** Ground for audio signal

**HDMI Output**

The HDMI-out connector is used to send digital video and audio to HDMI-enabled sink devices. This connector is compatible with HDMI 2.0 devices, capable of outputting a maximum video resolution of 3840x2160x60p.

The following table illustrates the pinout of the HDMI connector:

pin	Description	pin	Description
1	TX2p	2	Ground

3	TX2n	4	TX1p
5	Ground	6	TX1n
7	TX0p	8	Ground
9	TX0n	10	TXCp
11	Ground	12	TXCn
13	CEC	14	NC
15	DDC SCL	16	DDC SDA
17	Ground	18	+5V DDC
19	HPD (Hot Plug Detect)	--	

### HDMI Input

The HDMI-in connector is used to receive digital video and audio from HDMI-enabled source devices. This connector is compatible with HDMI 2.0 devices, capable of accepting a maximum video resolution of 3840x2160x60p. The signaling also conforms with DVI 1.0, HDMI 1.4, and HDCP 2.2 standards.

The HDMI signaling has CEC (but no ARC or HEC) functionality. The CEC channel is electrically coupled to the corresponding signal on the HDMI output, and the CEC commands will pass through the player even when it does not have power.

### 3.5mm IR Input/Output

The IR blaster generates or receives a space-encoded NEC or Pronto Hex signal. The two transported bit values of the signal (0 and 1) are encoded using differing lengths of low-time IR pulses.

The 3.5mm IR in/out port has the following pinout:

- **Tip:** 3.3V
- **Ring:** IR Input
- **Sleeve:** IR Output

**Note**

The sleeve is used as a ground during input operations.

### SPDIF Out

The SPDIF\_OPT signal is generated within the BCM7444 CPU, which is connected directly to the SPDIF output.

### Wireless

BrightSign 4K players feature a six-pin connector on top of the printed circuit board (PCB) within the case. This connector allows installation of a peripheral wireless module that supports 802.11 a/b/g/n WiFi protocols.

## 4Kx42 Environmental and Power Usage

BrightSign 4K players are designed to be used between 0°C and 40°C, at 90% maximum relative humidity, non-condensing.

The power supply for 4K players is 60W and 12V at 5A. The device will use approximately 1A of power when playing a 3840x2160x60p H.265 (HEVC) source file.

**Important**

This product is intended to be supplied by power from a Listed Power Adapter, rated +12Vdc at 5A minimum.

An additional 4A of power is available for peripherals connected to a 4K player. The user should not connect any combination of peripherals that will exceed 4A draw. If more than 4A is drawn, the external power supply may shut down due to over-current conditions. The unit will not be damaged, but it may reboot or not operate properly until the overload is removed.

If the device is being powered by the power supply, the 4A can be shared in any way among the following connectors:

Connector	Maximum Power Usage
-----------	---------------------



Ethernet	Approx. 180mA (when transferring data)
USB 2.0/3.0	500mA (on each connector)
DE9 5V	500mA
DA15 3.3V	500mA
HDMI 5V	500mA
IR blaster output	300mA

If the device is being powered by PoE, only 1A is available for all connectors (or possibly less if the device is running a resource-intensive presentation). It can be shared in any way among the following connectors:

Connector	Maximum Power Usage
Ethernet	Approx. 180mA (when transferring data)
USB 2.0/3.0	500mA (on each connector)
DE9 5V	100mA
HDMI 5V	500mA
IR input/output	300mA

## 4Kx42 Theory of Operation

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- [Power Supply](#)
- [Reset](#)
- [BCM7444/7252 CPU](#)
- [Built-in Flash](#)
- [SDRAM](#)
- [Serial Port](#)
- [Audio Outputs](#)
- [On-Board LEDs](#)
- [On-Board Switch](#)
- [Reset Switch/GPIO Button](#)
- [SDHC/SDXC and MicroSD Slots](#)
- [NAND Flash](#)
- [Ethernet](#)
- [USB 2.0/3.0](#)

This page describes how specific components operate on BrightSign 4K players.

### Power Supply

There are several voltage levels present in BrightSign 4K players.

### Reset

BrightSign 4K players have a Low Voltage Reset circuit. This circuit will hold the RESET\_L signal low until a valid 3.3V power source is present.

### BCM7444/7252 CPU

The 4K242 and 4K1042 utilize a BCM7252 CPU, while the 4K1142 utilizes a BCM7444 CPU. The CPU is reset by the RESET\_L signal from the low voltage reset circuit going into the RESET\_IN pin on the CPU. When the RESET\_IN pin goes from low to high, the CPU will boot from the

NAND flash.

### Built-in Flash

The boot code in the BCM7252/BCM7444 instructs it to continue the boot process by reading additional code from the onboard NAND flash, which can be updated in the field, either from a SDHC/SDXC flash card or a USB mass-storage device. Part of the NAND flash is also used to hold non-volatile parameters. The contents of the boot flash are copied into the SDRAM. The CPU then jumps to the boot code.

### SDRAM

The 4K1142 contains six banks of DDR SDRAM (two 4GB banks and four 2GB banks), while the 4K242 and 4K1042 each contain four banks of DDR SDRAM (two 2GB banks and two 4GB banks). When the CPU boots, it will copy the code from the NAND flash device into the SDRAM and then execute the code from the SDRAM. The SDRAM runs at a clock rate of 1067MHz, with a data rate of 2133MT/s.

### Serial Port

The 4K1042 and 4K1142 have a built-in UART that communicates with the RS-232 level shifter. The MAX232 uses a capacitive voltage switcher to create valid RS-232 voltage levels for the transmit pin.

### Audio Outputs

BrightSign 4K players each have a single high quality audio DAC device, which takes in digital audio signals from the CPU in an I2S audio format. The AUD\_LRCIN is the framing signal for the audio and runs at the frame rate of the audio source (usually either 44.1KHz or 48KHz). The AUD\_BITCLK signal is typically 32 times higher than the AUD\_LRCIN.

The audio output is fed through an amplifier and sent directly to the audio output jack. It can drive a 32W load with a 2V RMS signal.

### On-Board LEDs

There are eight on-board LEDs that indicate the following:

LED	Indication	
Green power ( <b>Pwr</b> )	Displays when the board is powered up and not in reset mode.	
Green file-system activity ( <b>Bsy</b> )	Flashes any time there is file-system activity (on any storage device)	
Green MicroSD activity ( <b>µSD</b> )	Displays when a MicroSD card is present.	
Green network activity ( <b>Svr</b> )	Displays when the player is connected to the BrightSign Network.	
Green Ethernet activity ( <b>Eth</b> )	Flashes when the player is connecting to the network. Displays when connected.	
Green WiFi activity	Flashes when the player is connecting to the wireless network. Displays when connected.	
Yellow update ( <b>Upd</b> )	Flashes when the board is being upgraded.	
Red status ( <b>Err</b> )	Flashes a certain number of times to indicate which error is occurring. The flash codes are described below.	
	2	Unspecified error
	3	Network recovery script is preparing to run on a device configured for network recovery.
	4	No upgrade file found
	5	Failed to load kernel module
	6	Board is not capable of running the current firmware version.
	7	A piece of on-board hardware is not working.
	8	Problem related to the storage device (either the USB drive or SD card)
	9	Problem related to the registry/NAND
	10	The autorun script encountered a load/run error.
	11	WiFi-related error (mainly, WiFi not found on USB)

### On-Board Switch

The on-board switch is connected to the GPIO02. The GPIO02 is pulled low when the service (SVC) button is pressed. Conversely, a pull-up on the button normally sets the GPIO02 to be pulled high.

### Reset Switch/GPIO Button

The on-board switch is connected to the reset circuit. Pressing down the reset button will cause the GPIO07 to go low. Holding the reset button low for approximately 10 seconds will cause a hard reset. When the board goes into reset mode, the power LED will be dark until the reset button is released.

### SDHC/SDXC and MicroSD Slots

The 4K series has one SDHC/SDXC and one internal MicroSD card slot, both capable of transferring a 25 Mbit/sec video stream, one 5.1 AC3 stream (pass-through), and three stereo PCM tracks simultaneously. There is no inherent limit on the storage capacity of SD cards used for 4K series players.

### NAND Flash

BrightSign players have a built-in NAND flash. All the code for the player is stored on the NAND flash. It may also be possible to store some content on the NAND flash, which is connected directly to the CPU.

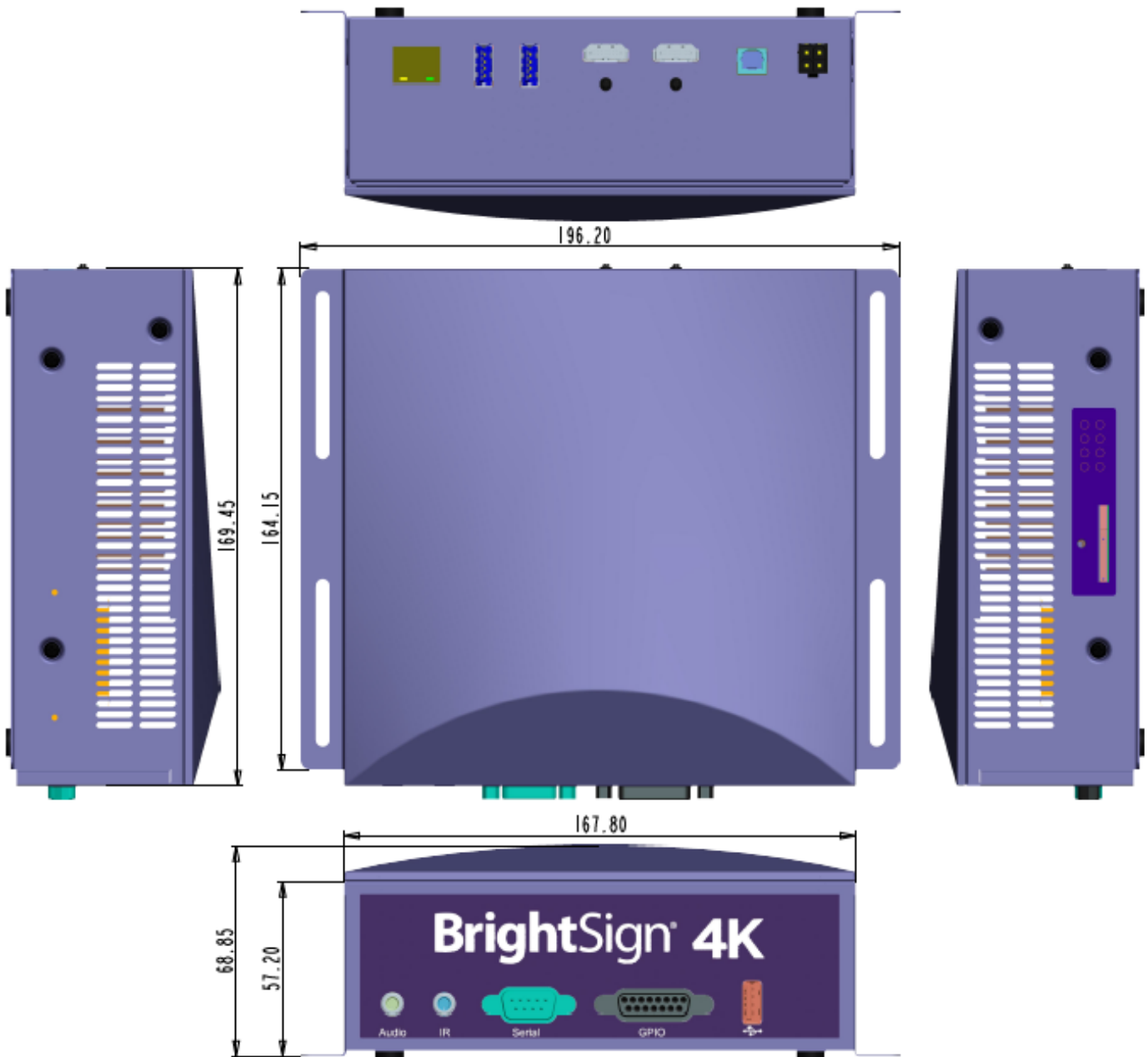
### Ethernet

The 10/100/1000 Base-T Ethernet is implemented on 4K players by directly interfacing with the BCM7252/BCM7444. The player has on-board Ethernet magnetics and termination for the RJ-45 cable.

### USB 2.0/3.0

The USB 2.0/3.0 high-speed host controller is implemented internally on the BCM7252/BCM7444 SOC. The board utilizes over-current protected switches that can be used to turn the power to USB devices on or off or to detect over-current situations.

## 4Kx42 Dimensions



## 4Kx42 Mounting Procedure

BrightSign 4K players can be mounted on a wall using the brackets attached to each side. It is recommended that you mount the device using four screws (one for each bracket slot). The screws should have a major diameter between 3.5mm and 4.2mm.

### **Important**

Nails should not be used to mount the device.

XD232, XD1032, XD1132

## ON THIS PAGE

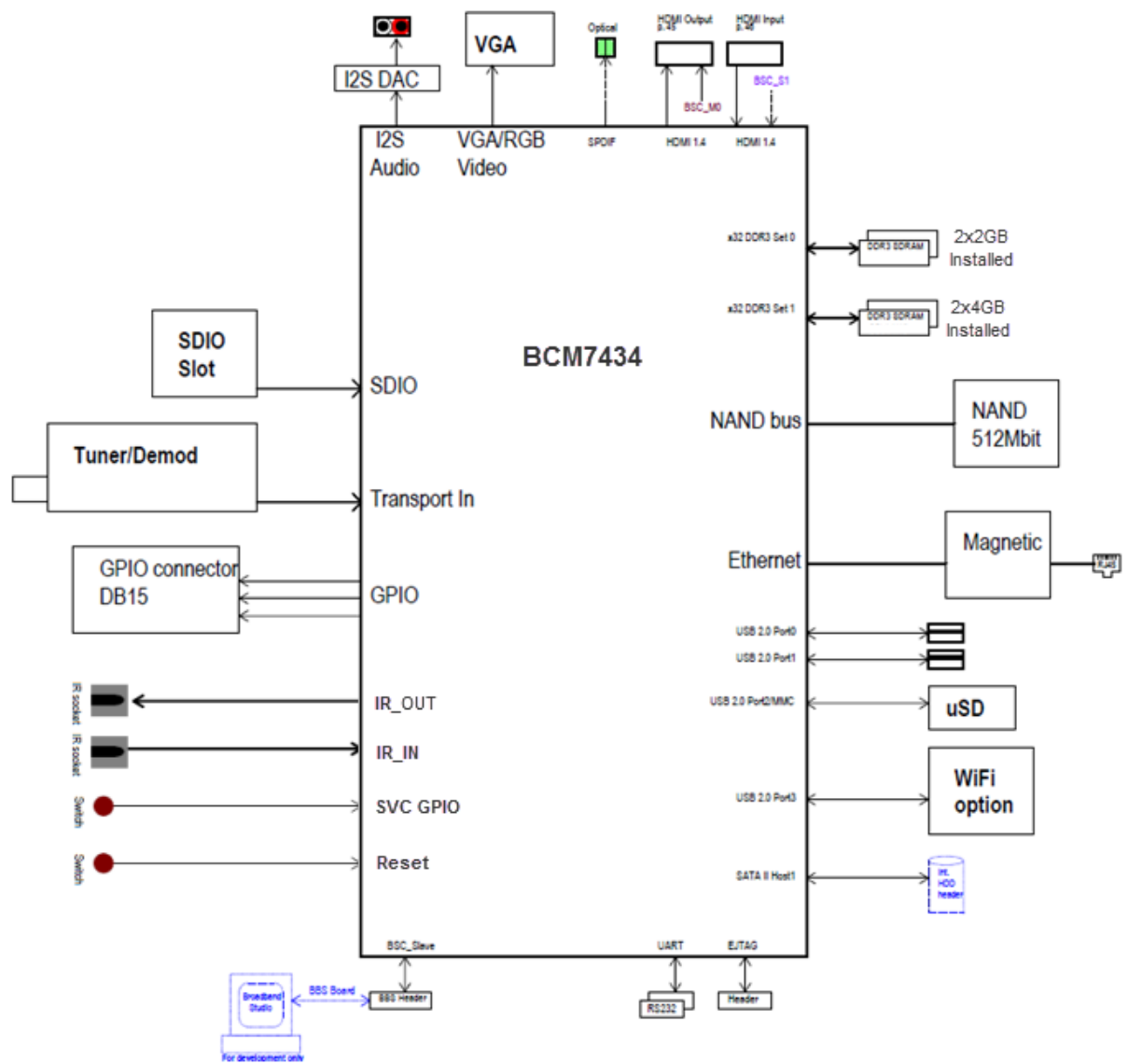
- [Block Diagram](#)
- [Interfaces](#)
  - [XD232](#)
  - [XD1032](#)
  - [XD1132](#)

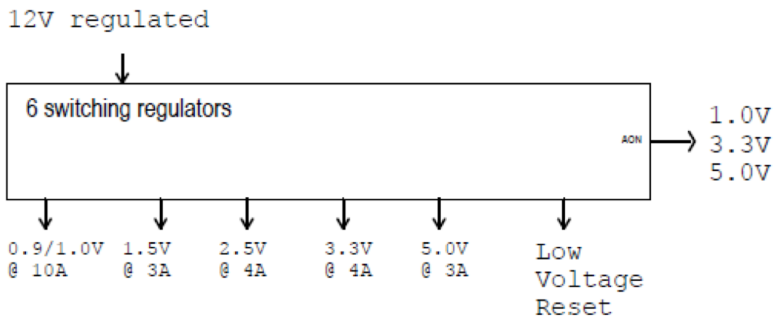
The BrightSign XD232, XD1032, and XD1132 players can be used to decode images, audio, and up to two HD video streams for digital sign and kiosk applications. In addition to driving video and audio displays, these players can be controlled with various networked and built-in interfaces.

This reference manual specifies the hardware interfaces and operational theory of the BrightSign XD232, XD1032, and XD1132.

The term "XDx32" is often used to denote the XD232, XD1032, and XD1132 models and differentiate them from the XD230, XD1030, and XD1230 models.

## BLOCK DIAGRAM





## INTERFACES

### XD232

Front	Left	Right	Back	Internal
3.5mm IR in/out	GPIO service button	SDHC/SDXC flash card slot	12V Molex power connector (4-pin)	MicroSD slot
DA15 GPIO		Status/error LED (red)	DE15 VGA video connector	WiFi Module connector
		Update LED (yellow)	Stereo 3.5mm mini plug for audio output	
		Power LED (green)	HDMI Out	
		SD activity LED (green)	RJ45 Ethernet (PoE)	
		MicroSD presence LED (green)	GPIO reset button	
		Ethernet activity LED (green)		
		WiFi activity LED (green)		
		Server connection (green)		

### XD1032

Front	Left	Right	Back	Internal
3.5mm IR in/out	USB 2.0 (2x)	SDHC/SDXC flash card slot	12V Molex power connector (4-pin)	MicroSD slot
DE9 RS232 serial (male)		Status/error LED (red)	DE15 VGA video connector	WiFi Module connector
DA15 GPIO		Update LED (yellow)	Stereo 3.5mm mini plug for audio output	
SPDIF out		Power LED (green)	HDMI Out	
		SD activity LED (green)	RJ45 Ethernet (PoE)	
		MicroSD presence LED (green)	GPIO reset button	
		Ethernet activity LED (green)		
		WiFi activity LED (green)		
		Server connection (green)		

### XD1132

Front	Left	Right	Back	Internal
3.5mm IR in/out	USB 2.0 (2x)	SDHC/SDXC flash card slot	12V Molex power connector (4-pin)	MicroSD slot
DE9 RS232 serial (male)		Status/error LED (red)	DE15 VGA video connector	WiFi Module connector
DA15 GPIO		Update LED (yellow)	Stereo 3.5mm mini plug for audio output	
SPDIF out		Power LED (green)	HDMI Out	

		SD activity LED (green)	HDMI Input	
		MicroSD presence LED (green)	RJ45 Ethernet (PoE)	
		Ethernet activity LED (green)	GPIO reset button	
		WiFi activity LED (green)		
		Server connection (green)		

## XDx32 Hardware Interfaces

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- [DE9 RS-232 Connector](#)
- [DA15 Switch/LED Connector](#)
- [Ethernet](#)
- [USB](#)
- [DE15 VGA Connector](#)
- [RCA Component HD Video Connector](#)
- [3.5mm Audio Connector](#)
- [HDMI Out Connector](#)
- [HDMI In Connector](#)
- [3.5mm IR Out](#)
- [S/PDIF Out](#)
- [Wireless](#)

### Power Connector

The power connector for the XDx32 series is rated for 12V @ 3A. The plug is a right-side positive, keyed and locking 4-pin connector.

### DE9 RS-232 Connector

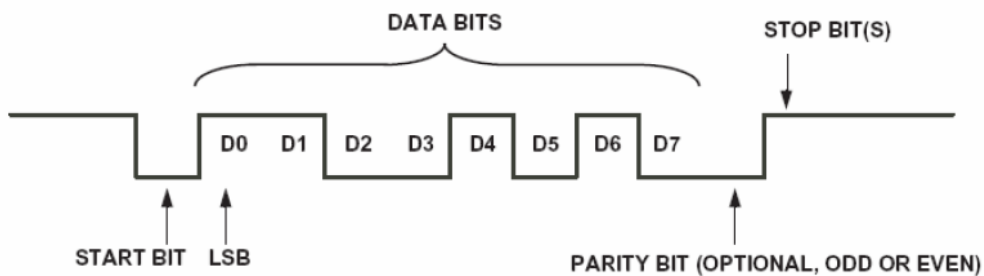
The RS-232 interface is a male DE9 connector. The BrightSign XDx32 players are DTE devices, similar to a PC. The input to the chip accepts a range between +25V and -25V, so it is compatible with +12V/-12V signaling.

The baud rate of the RS-232 interface (which is controlled by system software) is 115200, with no parity, 8 data bits, and 1 stop bit. The RS-232 interface supports RTS/CTS hardware flow control, but no software flow control. The maximum cable length is 50 meters, and the total cable capacitance is 2500pF.

#### Note

A lower capacitance cable allows you to use cable lengths beyond 50 meters.

The following diagram illustrates the behavior of the TX and RX signal:



The following table illustrates the pinout of the DE9 serial connector on the XDx32 series:

pin	Description	pin	Description
1	NC	2	Receive data into the player
3	Transmit data out of the player	4	Available 5V@500mA
5	Ground	6	NC
7	NC	8	NC
9	NC	--	--

### DA15 Switch/LED Connector

The switch/LED connector is a DA15 female. This connector is used to allow the player to control external LEDs or other devices requiring 24mA of current or less.

Connect the LED outputs to the LED ANODE and connect the LED CATHODE to the ground. If you want to connect another device, then the output is capable of sourcing or sinking up to 3.3V at 24mA, but there is a series resistor of 100W in each line.

The connector also allows the connecting of external contact closures to the ground. In order to connect a switch, connect one side of the switch to the switch input, and connect the other side to one of the ground pins on the DA15 connector. The connector can also supply 3.3V at up to 500mA to an external device. The 3.3V output is polyfuse-protected and can source up to 500mA.

If one BrightSign player is driving the inputs on another BrightSign player, then you can drive at most three inputs from one output. The following calculations explain this limitation:

#### Note

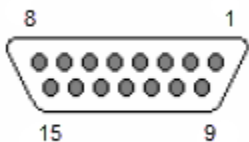
The GPIO outputs have 100W series resistors; the GPIO inputs have 1K pullup resistors to 3.3V; and the input threshold on the 541 chips is 2V high and .8V low. The high voltage is not problematic, but the low voltage can be if there are too many inputs connected to one output.

1 out driving 1 in	$V=3.3*100/(100+1,000)=0.3$
1 out driving 2 in	$V=3.3*100/(100+500)=0.55$
1 out driving 3 in	$V=3.3*100/(100+333.3)=0.76$
1 out driving 4 in	$V=3.3*100/(100+250)=.94$ (This is too high, so 1 output driving 3 inputs is the maximum)

The following table illustrates the pinout of the DA15 on the XDx32 series of players:

pin	Description	pin	Description
1	IR blaster input	2	Ground
3	Button 6 I/O	4	Button 5 I/O
5	Button 3 I/O	6	Ground
7	Button 1 I/O	8	+3.3V output at 500mA
9	Ground	10	Button 7 I/O
11	Ground	12	Button 4 I/O
13	Button 2 I/O	14	Ground
15	Button 0 I/O	--	--

Here is the DA15 female as viewed from the front of a XDx32 player.





A button/LED/IR board can be used to demonstrate the GPIO and IR functions on a BrightSign player. This board is built by a third-party manufacturer and can be purchased upon request.

## Ethernet

BrightSign XDx32 players have an RJ45 connector for 10/100 base-T Ethernet, as well as Power over Ethernet (PoE) capabilities. The maximum Ethernet-cable length is 91 meters for PoE applications and 100 meters for non-PoE applications. To operate using PoE, XDx32 players require type-2 PoE supplying a minimum of 25W.

### Important

The equipment should be connected only to PoE networks without routing to the outside plant.

The following table illustrates the pinout of the RJ45:

pin	Description	pin	Description
1	TX+	2	TX-
3	RX+	4	BI+
5	BI-	6	RX-
7	BI+	8	BI-

## USB

The XD1032 and XD1132 have two high-speed (480 Mbit) USB host ports, which also support USB 2.0 powered devices (up to 500mA for each port). The maximum length for the USB cable is 5 meters. The following table illustrates the pinout of the USB host port.

pin	Description	pin	Description
1	VBUS	2	D-
3	D+	4	Ground

## DE15 VGA Connector

The VGA connector is able to output RGB video. The following table illustrates the pinout of the DE15 VGA connector:

pin	Description	pin	Description
1	Red analog video output	2	Green analog video output
3	Blue analog video output	4	NC
5	Digital ground	6	Analog ground
7	Analog ground	8	Analog ground
9	+5V DDC supply	10	Digital ground
11	NC	12	DDC SDA
13	HSYNC output	14	VSYNC output
15	DDC SCL	--	--

## RCA Component HD Video Connector

Component video is provided over the VGA connector. To display component video, you will need to use a VGA-to-component converter. See this [FAQ](#) for more details.

## 3.5mm Audio Connector

All XDx32 models have a single 3.5mm female audio connector, which transmits an analog stereo signal. The full-scale voltage output of the audio is 2V RMS. The minimum load impedance of the audio connector is 32W.

### Note

The BrightSign expansion module allows you to drive up to three sets of 5W headphones directly.

The audio connector has the following pinout:

- **Tip:** Left audio
- **Ring:** Right audio
- **Sleeve:** Ground for audio signal

#### HDMI Out Connector

The HDMI-out connector is used to send digital video and audio to HDMI-enabled sink devices. The following table illustrates the pinout of the HDMI connector:

pin	Description	pin	Description
1	TX2p	2	Ground
3	TX2n	4	TX1p
5	Ground	6	TX1n
7	TX0p	8	Ground
9	TX0n	10	TXCp
11	Ground	12	TXCn
13	CEC	14	NC
15	DDC SCL	16	DDC SDA
17	Ground	18	+5V DDC
19	HPD (Hot Plug Detect)	--	

#### HDMI In Connector

The HDMI-in connector is used to receive digital video and audio from HDMI-enabled source devices. It accepts inputs of up to 1920x1080@60p, with 24-bits RGB. The signaling conforms to the DVI 1.0, HDMI 1.4, and HDCP 1.2 standards.

The HDMI signaling has CEC (but no ARC or HEC) functionality. The CEC channel is electrically coupled to the corresponding signal on the HDMI output, and the CEC commands will pass through the player even when it does not have power.

#### 3.5mm IR Out

The IR blaster generates or receives a space-encoded NEC or Pronto Hex signal. The two transported bit values of the signal (0 and 1) are encoded using differing lengths of low-time IR pulses.

The 3.5mm IR in/out port has the following pinout:

- **Tip:** 3.3V
- **Ring:** IR Input
- **Sleeve:** IR Output

#### Note

The sleeve is used as a ground during input operations.

#### S/PDIF Out

The SPDIF\_OPT signal is generated within the BCM7421 CPU, which has a direct connection to the S/PDIF port.

#### Wireless

BrightSign XDx32 players feature a six-pin connector on top of the printed circuit board (PCB) within the case. This connector allows installation of a peripheral wireless module that supports 802.11 a/b/g/n WiFi protocols.

## XDx32 Environmental and Power Usage

BrightSign XDx32 players are designed to be used between 0°C and 40°C, at 90% maximum relative humidity, non-condensing.

The power supply on the BrightSign XDx32 series is 36W and 12V at 3A. These players will use approximately 1A of power when playing a 720p or 1080i MPEG2 HD source file.

An additional 2A of power is available for peripherals connected to the player. The user should not connect any combination of peripherals that will exceed 2A draw. If more than 2A is drawn, the external power supply may shut down due to over-current conditions. The unit will not be damaged, but it may reboot or not operate properly until the overload is removed.

If the device is being powered by the power supply, the 2A can be shared in any way among the following connectors:

Connector	Maximum Power Usage
Ethernet	Approx. 180mA (when transferring data)
USB	500mA (on each connector)
DE9 5V	500mA
DA15 3.3V	500mA
HDMI 5V	500mA
IR blaster output	300mA

If the device is being powered by PoE, only 1A is available for all connectors (or possibly less if the device is running a resource-intensive presentation). It can be shared in any way among the following connectors:

Connector	Maximum Power Usage
Ethernet	Approx. 180mA (when transferring data)
USB	500mA (on each connector)
DE9 5V	100mA
HDMI 5V	500mA
IR input/output	300mA

## XDx32 Theory of Operation

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- [Reset](#)
- [BCM7434 CPU](#)
- [Built-in Flash](#)
- [SDRAM](#)
- [Serial Port](#)
- [Video Encoder and Filter](#)
- [Audio Outputs](#)
- [On-Board LEDs](#)
- [On-Board Switch](#)
- [Reset Switch/GPIO Button](#)
- [SDHC/SDXC and MicroSD Slots](#)
- [NAND Flash](#)
- [Ethernet](#)
- [USB](#)

This page describes how specific components operate on the XD232, XD1032, and XD1132.

### Power Supply

There are seven voltage levels present in the player: 12V, 5V, 3.3V, 2.5V, 1.8V, 1.5V, and 1V.

## Reset

BrightSign XDx32 players have a Low Voltage Reset circuit. This circuit will hold the RESET\_L signal low until a valid 3.3V power source is present.

## BCM7434 CPU

BrightSign XDx32 players utilize a BCM7434 Multimedia CPU. This CPU runs on 3.3V, 2.5V, and 1V and runs from a 27MHz oscillator. The CPU is reset by the RESET\_L signal from the low voltage reset circuit going into the RESET\_IN pin on the CPU. When the RESET\_IN pin goes from low to high, the BCM7434 will boot from the NAND flash.

## Built-in Flash

The boot code in the BCM7434 instructs it to continue the boot process by reading additional code from the onboard NAND flash, which can be updated in the field, either from a SDHC/SDXC flash card or a USB mass-storage device. Part of the NAND flash is also used to hold non-volatile parameters. The contents of the boot flash are copied into the SDRAM. The CPU then jumps to the boot code.

## SDRAM

BrightSign XDx32 players contain four banks of DDR SDRAM (two 2GB banks and two 4GB banks). When the CPU boots, it will copy the code from the NAND flash device into the SDRAM and then execute the code from the SDRAM. The SDRAM runs at a clock rate of 800MHz, with a data rate of 1600MHz.

## Serial Port

The XD1032 and XD1132 have a built in UART that communicates with the RS-232 level shifter. The MAX232 uses a capacitive voltage switcher to create valid RS-232 voltage levels for the transmit pin.

## Video Encoder and Filter

The BCM7421 streams decoded video using a single-data rate clock. It also streams the same video out of the on-board DACs.

## Audio Outputs

BrightSign XDx32 players each have a single high quality audio DAC device, which takes in digital audio signals from the CPU in an I2S audio format. The AUD\_LRCIN is the framing signal for the audio and runs at the frame rate of the audio source (usually either 44.1KHz or 48KHz). The AUD\_BITCLK signal is typically 32 times higher than the AUD\_LRCIN.

The audio output is fed through an amplifier and sent directly to the audio output jack. It can drive a 32W load with a 2V RMS signal.

## On-Board LEDs

There are eight on-board LEDs that indicate the following:

LED	Indication
Green power ( <b>Pwr</b> )	Displays when the board is powered up and not in reset mode.
Green file-system activity ( <b>Bsy</b> )	Flashes any time there is file-system activity (on any storage device)
Green MicroSD activity ( <b>µSD</b> )	Displays when a MicroSD card is present.
Green network activity ( <b>Svr</b> )	Displays when the player is connected to the BrightSign Network.
Green Ethernet activity ( <b>Eth</b> )	Flashes when the player is connecting to the network. Displays when connected.
Green WiFi activity	Flashes when the player is connecting to the wireless network. Displays when connected.
Yellow update ( <b>Upd</b> )	Flashes when the board is being upgraded.
Red status ( <b>Err</b> )	Flashes a certain number of times to indicate which error is occurring. The flash codes are described below.
	2   Unspecified error

3	Network recovery script is preparing to run on a device configured for network recovery.
4	No upgrade file found
5	Failed to load kernel module
6	Board is not capable of running the current firmware version.
7	A piece of on-board hardware is not working correctly
8	Problem related to the storage device (either the USB drive or SD card)
9	Problem related to the registry/NAND
10	The autorun script encountered a load/run error.
11	WiFi-related error (mainly, WiFi not found on USB)
12	Unable to find a bootable image

### On-Board Switch

The on-board switch is connected to the GPIO02. The GPIO02 is pulled low when the service (SVC) button is pressed. Conversely, a pull-up on the button normally sets the GPIO02 to be pulled high.

### Reset Switch/GPIO Button

The on-board switch is connected to the reset circuit. Pressing down the reset button will cause the GPIO07 to go low. Holding the reset button low for approximately 10 seconds will cause a hard reset. When the board goes into reset mode, the power LED will be dark until the reset button is released.

### SDHC/SDXC and MicroSD Slots

The XDx32 series has one SDHC/SDXC and one internal MicroSD card slot, both capable of transferring a 25 Mbit/sec video stream, one 5.1 AC3 stream (pass-through), and three stereo PCM tracks simultaneously. There is no inherent limit on the storage capacity of SD cards used for XDx32 players.

### NAND Flash

BrightSign players have a built-in NAND flash. All the code for the player is stored on the NAND flash. It may also be possible to store some content on the NAND flash, which is connected directly to the CPU.

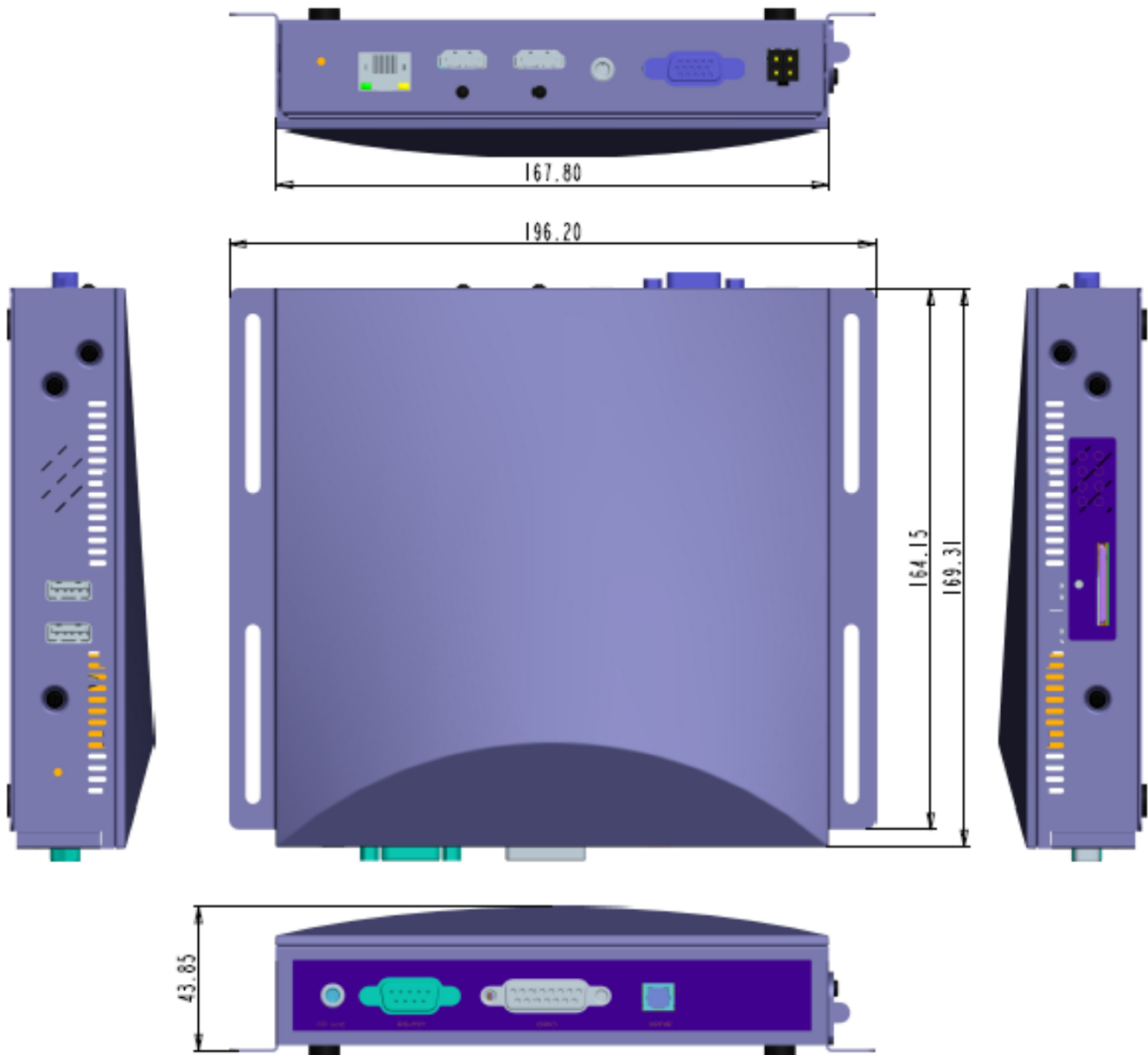
### Ethernet

The 10/100 Base-T Ethernet is implemented on XDx32 players by directly interfacing with the BCM7434. The player has on-board Ethernet magnetics and termination for the RJ-45 cable.

### USB

The USB 2.0 high-speed host controller is implemented internally in the BCM7434 SOC. The board utilizes over-current protected switches that can be used to turn the power to USB devices on or off or to detect over-current situations.

## [XDx32 Dimensions](#)



## XDx32 Mounting Procedure

A BrightSign XDx32 player can be mounted on a wall using the brackets attached to each side. It is recommended that you mount the device using four screws (one for each bracket slot). The screws should have a major diameter between 3.5mm and 4.2mm.

### **Important**

Nails should not be used to mount the device.

## HD222, HD1022

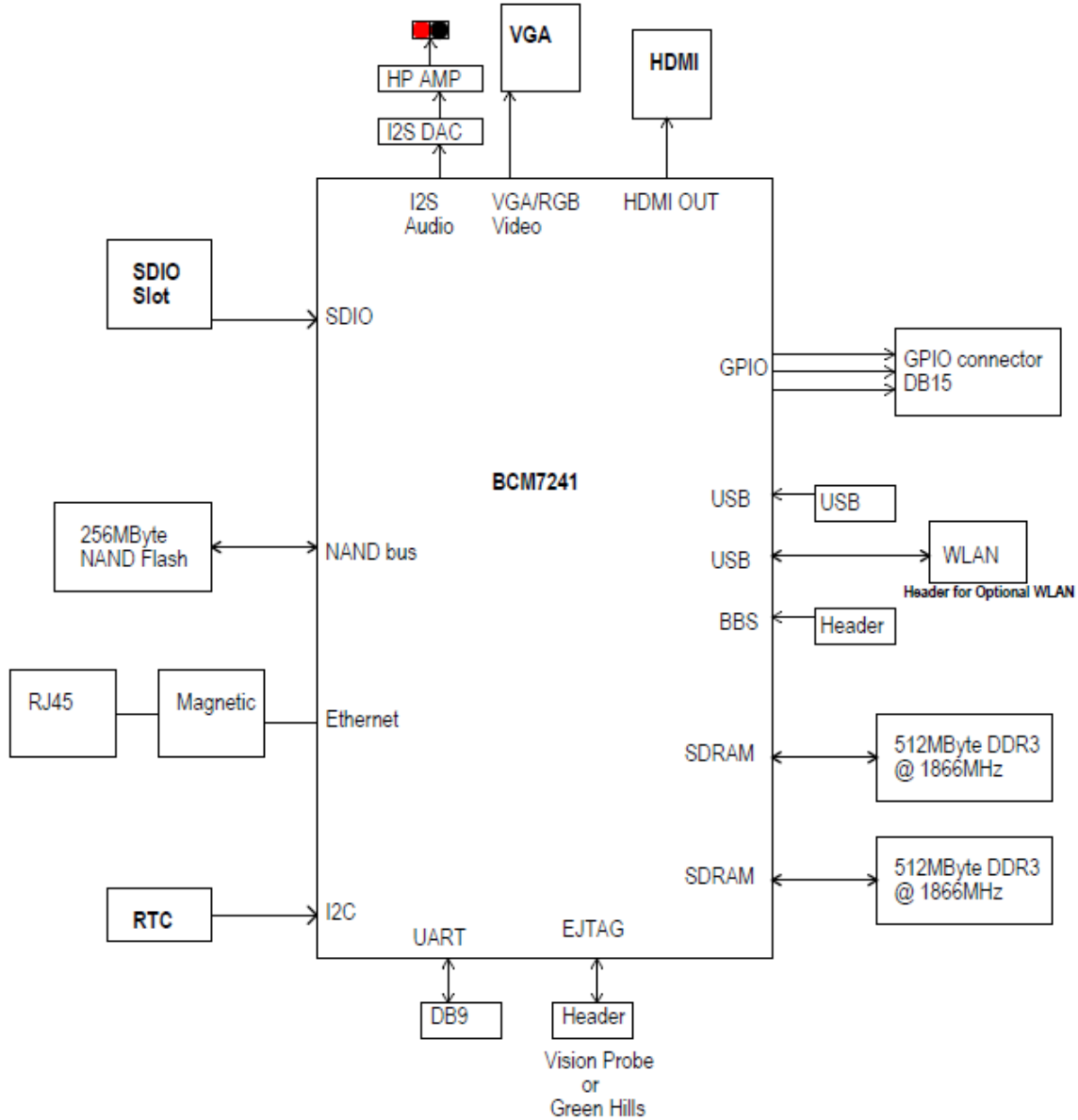
### ON THIS PAGE

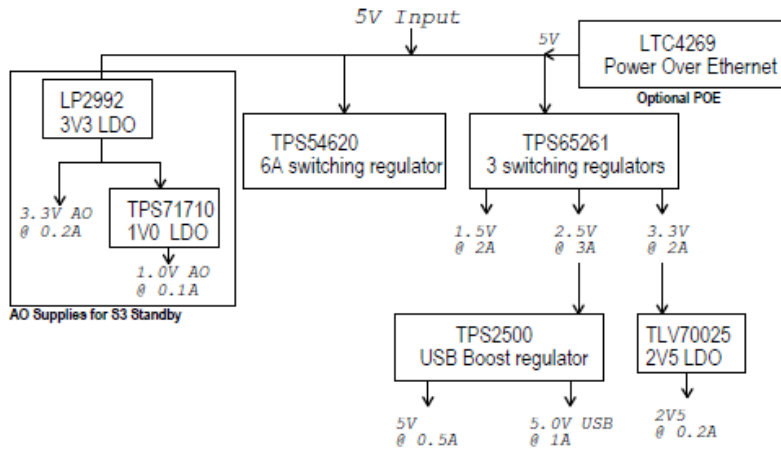
- [Block Diagram](#)
- [Interfaces](#)
  - [HD222](#)
  - [HD1022](#)

The BrightSign HD222 and HD1022 media players can be used to decode images, audio, and video (at resolutions up to 1920x1080x60p) for digital-signage and kiosk applications. In addition to driving audio/video devices, these players can be controlled with various networked and built-in interfaces.

This page specifies the hardware interfaces and operational theory of the HD222 and HD1022.

BLOCK DIAGRAM





## INTERFACES

### HD222

Front	Left	Right	Back
3.5mm audio out	GPIO service button	SDHC/SDXC flash card slot	3.5mm audio out
DA15 GPIO		Status/error LED (red)	GPIO reset button
		Update LED (yellow)	VGA out
		Power LED (green)	HDMI out
		SD activity LED (green)	RJ45 Ethernet
			5V@3A barrel power connector

### HD1022

Front	Left	Right	Back
3.5mm audio out	GPIO service button	SDHC/SDXC flash card slot	GPIO reset button
DA15 GPIO	USB 2.0	Status/error LED (red)	VGA out
DE9 RS232 serial (male)		Update LED (yellow)	HDMI out
		Power LED (green)	RJ45 Ethernet
		SD activity LED (green)	5V@3A barrel power connector

## HDx22 Hardware Interfaces

### ON THIS PAGE

- [Power Connector](#)
- [DE9 RS-232 Serial](#)
- [DA15 GPIO](#)
- [RJ45 Ethernet](#)
- [USB](#)
- [3.5mm Audio Connector](#)
- [VGA Output](#)
- [HDMI Output](#)

This section describes the characteristics and operation of all connectors on the HD222 and HD1022.



## Power Connector

The power connector for the HD222 and HD1022 is rated for 5V @ 3A. The plug for the connector is a standard, center-positive 5.5mm plug with a 1.65mm center pin hole.

## DE9 RS-232 Serial

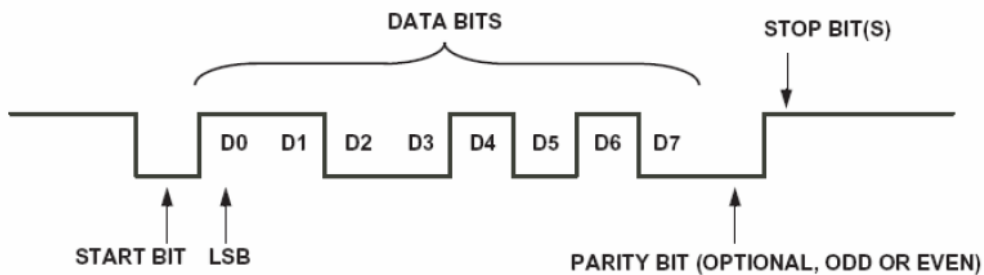
The RS-232 interface is a male DE9 connector. The HD1022 player is a DTE device, similar to a PC. The input to the chip accepts a range between +25V and -25V, so it is compatible with +12V/-12V signaling.

The baud rate of the RS-232 interface (which is controlled by system software) is 115200, with no parity, 8 data bits, and 1 stop bit. The RS-232 interface supports RTS/CTS hardware flow control, but no software flow control. The maximum cable length is 50 meters, and the total cable capacitance is 2500pF.

### Note

A lower capacitance cable allows you to use cable lengths beyond 50 meters.

The following diagram illustrates the behavior of the TX and RX signal:



The following table illustrates the pinout of the DE9 serial connector on the HD1022:

pin	Description	pin	Description
1	NC	2	Receive data into the device
3	Transmit data out of the device	4	Available 5V@500mA
5	Ground	6	NC
7	RTS	8	CTS
9	NC	--	--

## DA15 GPIO

The GPIO switch/led connector is a DA15 female. This connector is used to allow the player to control external LEDs or other devices requiring 24mA of current or less.

Connect the LED outputs to the LED ANODE and connect the LED CATHODE to the ground. If you want to connect another device, then the output is capable of sourcing or sinking up to 3.3V at 24mA, but there is a series resistor of 100W in each line.

The connector also allows the connecting of external contact closures to the ground. In order to connect a switch, connect one side of the switch to the switch input, and connect the other side to one of the ground pins on the DA15 connector. The connector can also supply 3.3V at up to 500mA to an external device. The 3.3V output is polyfuse-protected and can source up to 500mA.

If one BrightSign player is driving the inputs on another BrightSign player, then you can drive at most three inputs from one output. The following calculations explain this limitation:

### Note

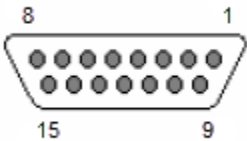
The GPIO outputs have 100W series resistors; the GPIO inputs have 1K pullup resistors to 3.3V; and the input threshold on the 541 chips is 2V high and .8V low. The high voltage is not problematic, but the low voltage can be if there are too many inputs connected to one output.

1 out driving 1 in	$V=3.3*100/(100+1,000)=0.3$
1 out driving 2 in	$V=3.3*100/(100+500)=0.55$
1 out driving 3 in	$V=3.3*100/(100+333.3)=0.76$
1 out driving 4 in	$V=3.3*100/(100+250)=.94$ (This is too high, so 1 output driving 3 inputs is the maximum)

The following table illustrates the pinout of the DA15 on the HD222 and HD1022:

pin	Description	pin	Description
1	IR blaster input	2	Ground
3	Button 6 I/O	4	Button 5 I/O
5	Button 3 I/O	6	Ground
7	Button 1 I/O	8	+3.3V output at 500mA
9	Ground	10	Button 7 I/O
11	Ground	12	Button 4 I/O
13	Button 2 I/O	14	Ground
15	Button 0 I/O	--	--

Here is the DA15 female as viewed from the front of the HD222 and HD1022:



A button/LED/IR board can be used to demonstrate the GPIO and IR functions on a BrightSign player. This board is built by a third-party manufacturer and can be purchased upon request.

### RJ45 Ethernet

The HD222 and HD1022 have an RJ45 connector for 10/100 base-T Ethernet. The maximum Ethernet-cable length is 100 meters.

The following table illustrates the pinout of the RJ45:

pin	Description	pin	Description
1	TX+	2	TX-
3	RX+	4	RC to ground
5	RC to ground	6	RX-
7	RC to ground	8	RC to ground

### USB

The HD1022 has a single USB 2.0 port, which is capable of transfer speeds up to 480 Mbit/s. The maximum length for a USB cable is 5 meters. The following tables illustrate the pinout of the USB 2.0 host ports:

pin	Description	pin	Description
1	VBUS	2	D-
3	D+	4	Ground

### 3.5mm Audio Connector

The HD222 and HD1022 have a single 3.5mm female audio connector, which transmits an analog stereo signal. The full-scale voltage output of the audio is 2V RMS. The minimum load impedance of the audio connector is 32W.

**Note**

The BrightSign expansion module allows you to drive up to three sets of 5W headphones directly.

The audio connector has the following pinout:

- **Tip:** Left audio
- **Ring:** Right audio
- **Sleeve:** Ground for audio signal

### VGA Output

The VGA output is a DE15 connector that is able to transmit RGB video. The following table illustrates the pinout of the DE15 VGA connector:

pin	Description	pin	Description
1	Red Analog video output	2	GREEN analog video output
3	Blue analog video output	4	NC
5	Digital ground	6	Analog ground
7	Analog ground	8	Analog ground
9	+5V DDC supply	10	Digital ground
11	NC	12	DDC SDA
13	HSYNC output	14	VSYNC output
15	DDC SCL	--	--

### HDMI Output

The HDMI-out connector is used to send digital video and audio to HDMI-enabled sink devices. This connector is compatible with HDMI 1.4 devices, capable of outputting a maximum video resolution of 1920x1080x60p.

The following table illustrates the pinout of the HDMI connector:

pin	Description	pin	Description
1	TX2p	2	Ground
3	TX2n	4	TX1p
5	Ground	6	TX1n
7	TX0p	8	Ground
9	TX0n	10	TXCp
11	Ground	12	TXCn
13	CEC	14	NC
15	DDC SCL	16	DDC SDA
17	Ground	18	+5V DDC
19	HPD (Hot Plug Detect)	--	

## HDx22 Environmental and Power Usage

The HD222 and HD1022 are designed to be used between 0°C and 40°C, at 90% maximum relative humidity, non-condensing.

The power supply for the HD222 and HD1022 is 15W and 5V @ 3A. The device will use approximately 1A of power when playing a 720p or 1080i source file.

An additional 2A of power is available for peripherals connected to the player. The user should not connect any combination of peripherals that will exceed 2A draw. If more than 2A is drawn, the external power supply may shut down due to over-current conditions. The unit will not be damaged, but it may reboot or not operate properly until the overload is removed.

If the device is being powered by the power supply, the 2A can be shared in any way among the following connectors:

Connector	Maximum Power Usage
Ethernet	Approx. 180mA (when transferring data)
USB 2.0	500mA (on each connector)
DE9 5V	500mA
DA15 3.3V	500mA
HDMI 5V	500mA

## HDx22 Theory of Operation

### ON THIS PAGE

- [BCM7241 CPU](#)
- [Built-in Flash](#)
- [SDRAM](#)
- [Serial Port](#)
- [Audio Outputs](#)
- [On-Board LEDs](#)
- [On-Board Switch](#)
- [Reset Switch/GPIO Button](#)
- [SDHC/SDXC Slot](#)
- [NAND Flash](#)
- [Ethernet](#)
- [USB 2.0](#)

This page describes how specific components operate on the HD222 and HD1022.

### BCM7241 CPU

The HD222 and HD1022 utilize a BCM7241 CPU. The CPU is reset by the RESET\_L signal from the low voltage reset circuit going into the RESET\_IN pin on the CPU. When the RESET\_IN pin goes from low to high, the CPU will boot from the NAND flash.

### Built-in Flash

The boot code in the BCM7241 instructs it to continue the boot process by reading additional code from the onboard NAND flash, which can be updated in the field, either from a SDHC/SDXC flash card or a USB mass-storage device. Part of the NAND flash is also used to hold non-volatile parameters. The contents of the boot flash are copied into the SDRAM. The CPU then jumps to the boot code.

### SDRAM

The HD222 and HD1022 contain a single bank of DDR SDRAM, consisting of two 16x256MB chips (1GB total). When the CPU boots, it will copy the code from the NAND flash device into the SDRAM and then execute the code from the SDRAM. The SDRAM runs at a clock rate of 933MHz, with a data rate of 1866MT/s.

### Serial Port

The HD1022 has a built-in UART that communicates with the RS-232 level shifter. The MAX232 uses a capacitive voltage switcher to create valid RS-232 voltage levels for the transmit pin.

### Audio Outputs

The HD222 and the HD1022 each have a single high quality audio DAC device, which takes in digital audio signals from the CPU in an I2S audio format. The AUD\_LRCIN is the framing signal for the audio and runs at the frame rate of the audio source (usually either 44.1KHz or 48KHz). The AUD\_BITCLK signal is typically 32 times higher than the AUD\_LRCIN.

The audio output is fed through an amplifier and sent directly to the audio output jack. It can drive a 32W load with a 2V RMS signal.

## On-Board LEDs

There are four on-board LEDs that indicate the following:

LED	Indication
Green power ( <b>Pwr</b> )	Displays when the board is powered up and not in reset mode.
Green file-system activity ( <b>Bsy</b> )	Flashes any time there is file-system activity (on any storage device)
Yellow update ( <b>Upd</b> )	Flashes when the board is being upgraded.
Red status ( <b>Err</b> )	Flashes a certain number of times to indicate which error is occurring. The flash codes are described below.
	2 Unspecified error
	3 Network recovery script is preparing to run on a device configured for network recovery.
	4 No upgrade file found.
	5 Failed to load kernel module.
	6 Board is not capable of running the current firmware version.
	7 A piece of on-board hardware is not working correctly.
	8 Problem related to the storage device (either the USB drive or SD card)
	9 Problem related to the registry/NAND
	10 The autorun script encountered a load/run error.
	11 WiFi-related error (mainly, WiFi not found on USB)
	12 Unable to find a bootable image.

## On-Board Switch

The on-board switch is connected to the GPIO02. The GPIO02 is pulled low when the service (SVC) button is pressed. Conversely, a pull-up on the button normally sets the GPIO02 to be pulled high.

## Reset Switch/GPIO Button

The on-board switch is connected to the reset circuit. Pressing down the reset button will send an initial signal to the system software, and holding the reset button low for approximately 4 seconds will cause a hard reset.

## SDHC/SDXC Slot

The HD222 and HD1022 series has one SDHC/SDXC slot capable of transferring a 25 Mbit/sec video stream, one 5.1 AC3 stream (pass-through), and three stereo PCM tracks simultaneously. There is no inherent limit on the storage capacity of SD cards used with the player.

## NAND Flash

BrightSign players have a built-in NAND flash. All the code for the player is stored on the NAND flash. It may also be possible to store some content on the NAND flash, which is connected directly to the CPU.

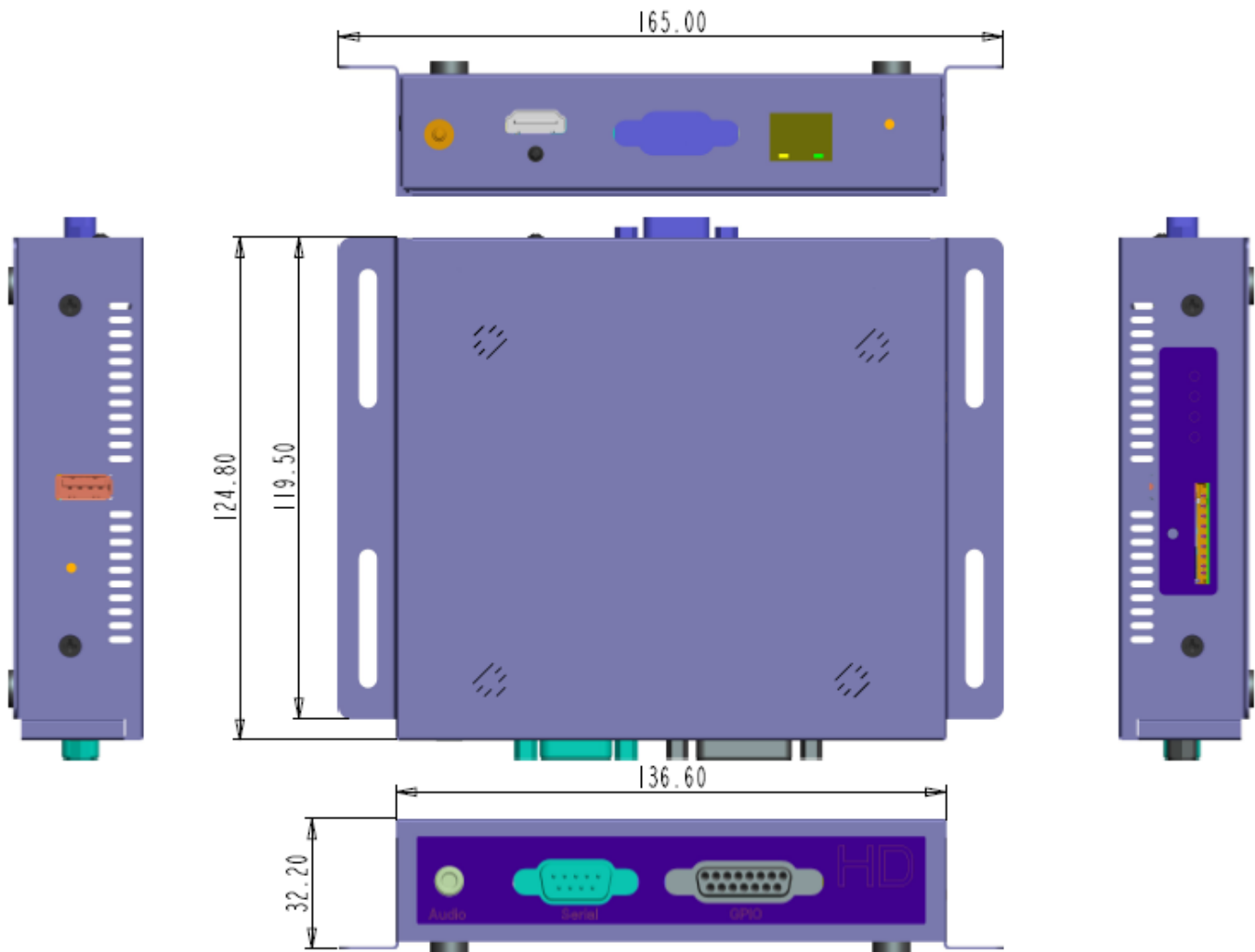
## Ethernet

The 10/100 Base-T Ethernet is implemented on the players by directly interfacing with the BCM7241. The player has on-board Ethernet magnetics and termination for the RJ-45 cable.

## USB 2.0

The USB 2.0 high-speed host controller is implemented internally on the BCM7241 SOC. The board utilizes over-current protected switches that can be used to turn the power to USB devices on or off (or to detect over-current situations).

## HDx22 Dimensions



## HDx22 Mounting Procedure

ON THIS PAGE

The HD222 and HD1022 can be mounted on a wall using the brackets attached to each side. It is recommended that you mount the device using four screws (one for each bracket slot). The screws should have a major diameter between 3.5mm and 4.2mm.

### Important

Nails should not be used to mount the device.

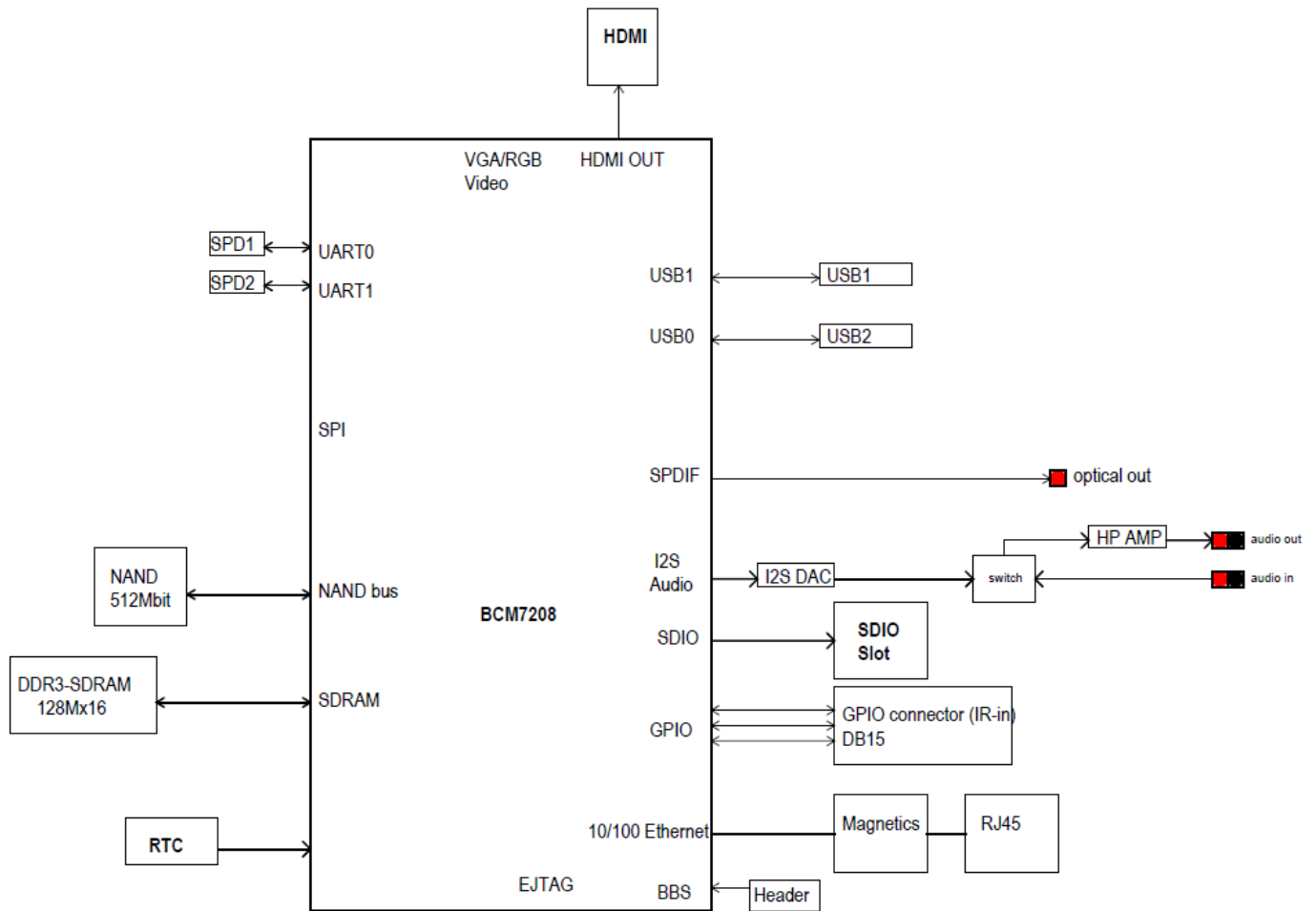
## LS322, LS422

ON THIS PAGE

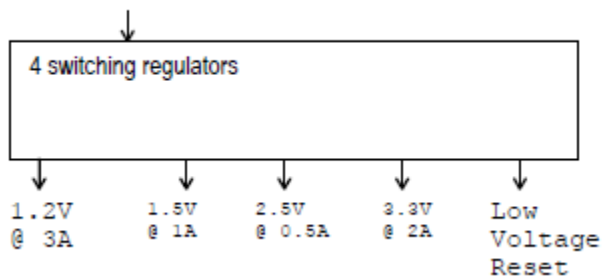
- [Block Diagram](#)
- [Interfaces](#)
  - [LS322](#)
  - [LS422](#)

The LS322 and LS422 are commercial-grade media players that enable consistent, high-quality demonstration of A/V content in retail environments. This section specifies the hardware interfaces and operational theory of the LS series.

## BLOCK DIAGRAM



5V regulated / 3A



## INTERFACES

### LS322

Front	Left	Right	Back
DA15 GPIO	GPIO service button	USB 2.0	12V@1A power connector
SD/SDHC/SDXC flash card slot	GPIO reset button		SPDIF out
			RJ45 Ethernet
			3.5mm audio out

## LS422

Front	Left	Right	Back
DA15 GPIO	GPIO service button	USB 2.0	12V@1A power connector
SD/SDHC/SDXC flash card slot	GPIO reset button		SPDIF out
			RJ45 Ethernet
			HDMI out
			3.5mm audio out

## LSx22 Hardware Interfaces

### ON THIS PAGE

- [HDMI Output](#)
- [3.5mm Stereo Connectors](#)
- [SPDIF \(TOSLink\) Connector](#)
- [USB Host Ports](#)
- [DA15 GPIO](#)
- [RJ45 Ethernet](#)
- [SD Port](#)
- [On-Board LEDs](#)

### HDMI Output

The LS422 has a single HDMI connector that is compliant with HDMI 1.3 A/V standards. It is capable of outputting 1080i and 720p video resolutions.

pin	Description	pin	Description
1	TX2p	2	Ground
3	TX2n	4	TX1p
5	Ground	6	TX1n
7	TX0p	8	Ground
9	TX0n	10	TXCp
11	Ground	12	TXCn
13	CEC	14	NC
15	DDC SCL	16	DDC SDA
17	Ground	18	+5V DDC
19	HPD (Hot Plug Detect)	--	

### 3.5mm Stereo Connectors

The LS322 and LS422 have a 3.5mm stereo connector for variable analog audio output. The full-scale voltage output of the audio is 2V RMS. The minimum load impedance of the audio connector is 32.

The audio connector has the following pinout:

- **Tip:** Left audio
- **Ring:** Right audio
- **Base:** Ground for audio signal

### SPDIF (TOSLink) Connector

The LS322 and LS422 have a SPDIF connector capable of outputting 16-bit, 48 kHz (AC3 5.1 encoded) stereo audio streams. Muting this



connector produces digital silence.

### USB Host Ports

The LS322 and LS422 each have a single USB 2.0 host port capable of providing 500mA of power. Each port also supports HID, and devices can be hot swapped without the need to reboot.

The following table illustrates the pinout of the USB host port:

pin	Description	pin	Description
1	VBUS	2	D-
3	D+	4	Ground

### DA15 GPIO

The LS322 and LS422 have a DA15 female switch/led connector. This connector allows the player to control external LEDs or other devices requiring 24mA of current or less.

Connect the LED outputs to the LED ANODE and connect the LED CATHODE to the ground. If you want to connect another device, then the output is capable of sourcing or sinking up to 3.3V at 24mA, but there is a series resistor of 100W in each line.

The connector also allows the connecting of external contact closures to the ground. In order to connect a switch, connect one side of the switch to the switch input, and connect the other side to one of the ground pins on the DA15 connector. The connector can also supply 3.3V at up to 500mA to an external device. The 3.3V output is polyfuse-protected and can source up to 500mA.

If one BrightSign player is driving the inputs on another BrightSign player, then you can drive at most three inputs from one output. The following calculations explain this limitation:

#### Note

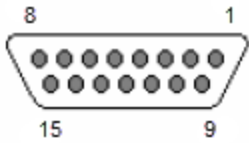
The GPIO outputs have 100W series resistors; the GPIO inputs have 1K pullup resistors to 3.3V; and the input threshold on the 541 chips is 2V high and .8V low. The high voltage is not problematic, but the low voltage can be if there are too many inputs connected to one output.

1 out driving 1 in	$V=3.3*100/(100+1,000)=0.3$
1 out driving 2 in	$V=3.3*100/(100+500)=0.55$
1 out driving 3 in	$V=3.3*100/(100+333.3)=0.76$
1 out driving 4 in	$V=3.3*100/(100+250)=.94$ (This is too high, so the maximum is one output driving three inputs)

The following table illustrates the pinout of the DA15 on LS players:

pin	Description	pin	Description
1	IR blaster input	2	Ground
3	Button 6 I/O	4	Button 5 I/O
5	Button 3 I/O	6	Ground
7	Button 1 I/O	8	+3.3V output at 500mA
9	Ground	10	Button 7 I/O
11	Ground	12	Button 4 I/O
13	Button 2 I/O	14	Ground
15	Button 0 I/O	--	--

Here is the DA15 female connector as viewed from the front:



A button/LED/IR board can be used to demonstrate the GPIO and IR functions on a BrightSign player. This board is built by a third-party manufacturer and can be purchased upon request.

### RJ45 Ethernet

The LS322 and LS422 have a single 10/100 RJ45 port for networking. The maximum length for the Ethernet cable is 100 meters. The following table illustrates the pinout of the RJ45:

pin	Description	pin	Description
1	TX+	2	TX-
3	RX+	4	RC to ground
5	RC to ground	6	RX-
7	RC to ground	8	RC to ground

### SD Port

The LS322 and LS422 have a card slot that supports SD, SDHC, and SDXC cards. It is capable of streaming video at 25Mbps or streaming three stereo PCM audio tracks simultaneously.

### On-Board LEDs

LS322 and LS422 have a single red LED located on the side of the device to indicate that the power is on.

## LSx22 Environmental and Power Usage

The LS322 and LS422 are designed to be used between 0°C and 40°C, at 90% maximum relative humidity, non-condensing.

The power supply on the BrightSign LS series is 12W and 12V at 1A.

1A at 12V is approximately 12W.

When an LS322 or LS422 is sitting idle, it draws approximately 220mA. When an LS422 is playing a 1080p24 H.264 video over HDMI, it draws approximately 270mA.

The remaining 720 to 770mA of available power can be used by peripherals connected to the player. Do not connect any combination of peripherals that will exceed this amount of draw. If more than 1A total is drawn, the external power supply will shut down due to overcurrent conditions. The unit will not be damaged, but it may reboot or not operate properly until the overload is removed.

The remaining 720 to 770mA can be shared in any way among the following connectors:

Connector	Power Usage
Ethernet	Approx. 180mA (when transferring data)
USB	Max 500mA*
DA15 3.3V	500mA
HDMI 5V	Max 500mA
6 LED outputs on the DA15	Up to 24mA (each)

## LSx22 Theory of Operation

## ON THIS PAGE

- [Power Supply](#)
- [BCM7208 CPU](#)
- [Built-in Flash](#)
- [SDRAM](#)
- [Audio Outputs](#)
- [On-Board Switch](#)
- [Reset Switch/GPIO Button](#)
- [NAND Flash](#)
- [Ethernet](#)
- [USB 2.0](#)

### Power Supply

There are five voltages present in the player: 5V, 3.3V, 2.5V, 1.5V, and 1.2V. The 3.3V level for the USB port is created from 12V using a switching regulator. Similar regulators are used to create the 2.5V level for the DDR SDRAM and the 1.2V level for the CPU core voltage.

### BCM7208 CPU

The LS322 and LS422 utilize a BCM7208 Multimedia CPU.

### Built-in Flash

The boot code in the BCM7208 instructs it to continue the boot process by reading additional code from the onboard NAND flash, which can be updated in the field from either SD or USB storage. Part of the NAND flash is also used to hold non-volatile parameters. The contents of the boot flash are copied into the SDRAM. The CPU then jumps to the boot code.

### SDRAM

The LS322 and LS422 each contain a single bank of 2GB (256MB) DDR SDRAM. When the BCM7208 boots, it will copy the code from the NAND flash device into the SDRAM and then execute the code from the SDRAM. The SDRAM runs at a clock rate of 667MHz, with a data rate of 1333MHz.

### Audio Outputs

The LS322 and LS422 each have a single high quality audio DAC device, which takes in digital audio signals from the CPU in I2S audio format. The AUD\_LRCIN is the framing signal for the audio and runs at the frequency of the audio source (usually either 44.1KHz or 48KHz). The AUD\_BITCLK signal is typically 32 times higher than the AUD\_LRCIN.

The audio output is fed through an amplifier and sent directly to the audio output jack. It can drive a 32W load with a 2V RMS signal.

### On-Board Switch

The on-board switch is connected to the GPIO02. The GPIO02 is pulled low when the service (SVC) button is pressed. Conversely, a pull-up on the button normally sets the GPIO02 to be pulled high.

### Reset Switch/GPIO Button

The on-board switch is connected to the reset button. Pressing down the reset button will send a reset signal to the system software.

### NAND Flash

BrightSign players have a built-in NAND flash. All the code for the player is stored on the NAND flash. It may also be possible to store some content on the NAND flash, which is connected directly to the BCM7208.

### Ethernet

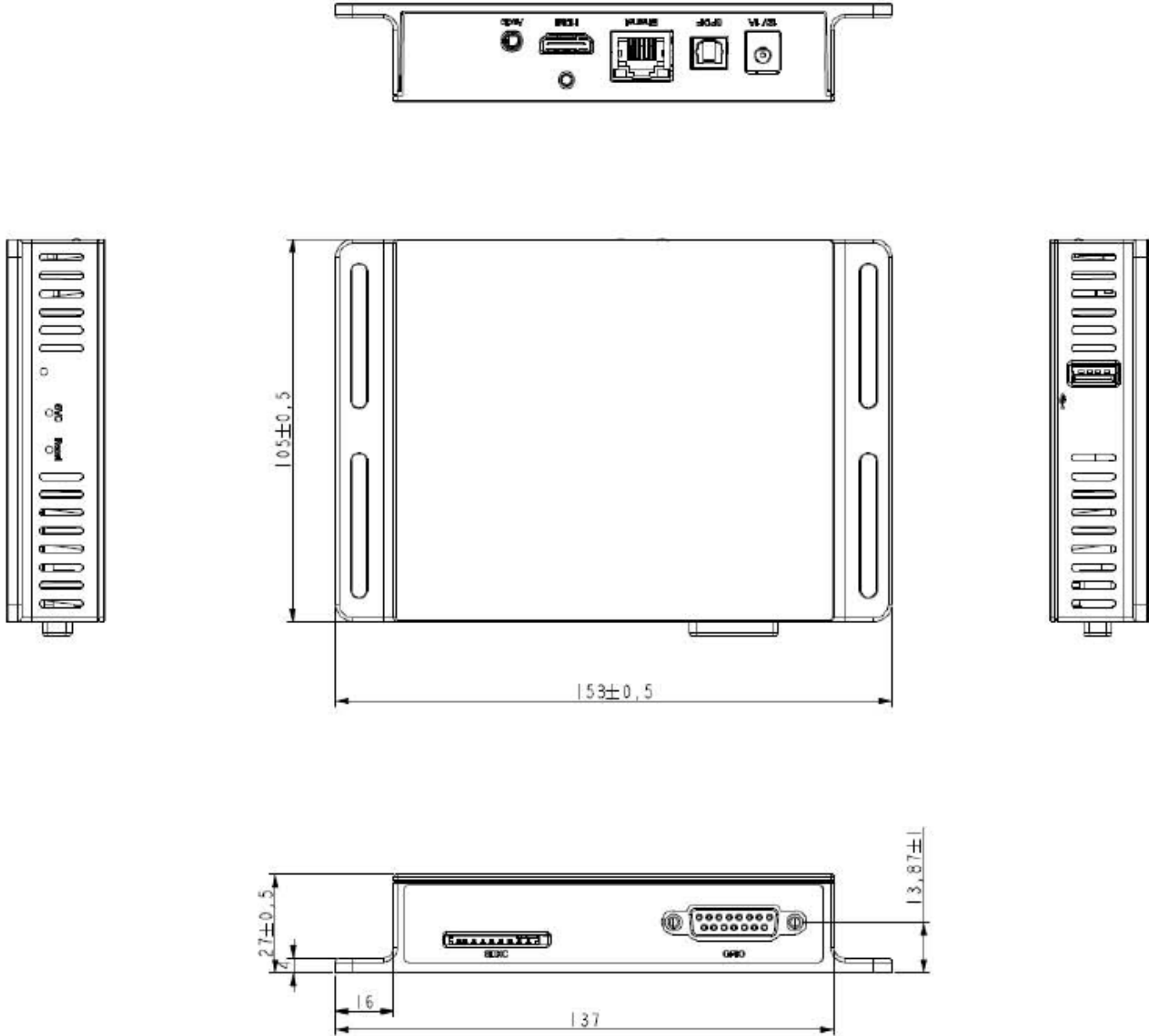
The 10/100 Base-T Ethernet is implemented on the LS322 and LS422 by directly interfacing with the BCM7208. The player has on-board

Ethernet magnetics and termination for the RJ-45 cable.

### USB 2.0

The USB 2.0 high-speed host controller is implemented internally in the BCM7208 SOC chip. The board utilizes over-current protected switches that can be used to turn the power to USB devices on or off (or to detect over-current situations).

### LSx22 Dimensions



### LSx22 Mounting Procedure

The LS322/LS422 can be mounted on a wall using the brackets attached to each side. BrightSign recommends mounting the device using four screws with a major diameter between 3.5mm and 4.2mm. BrightSign does not recommend using nails to mount the device.

### XD230, XD1030, XD1230

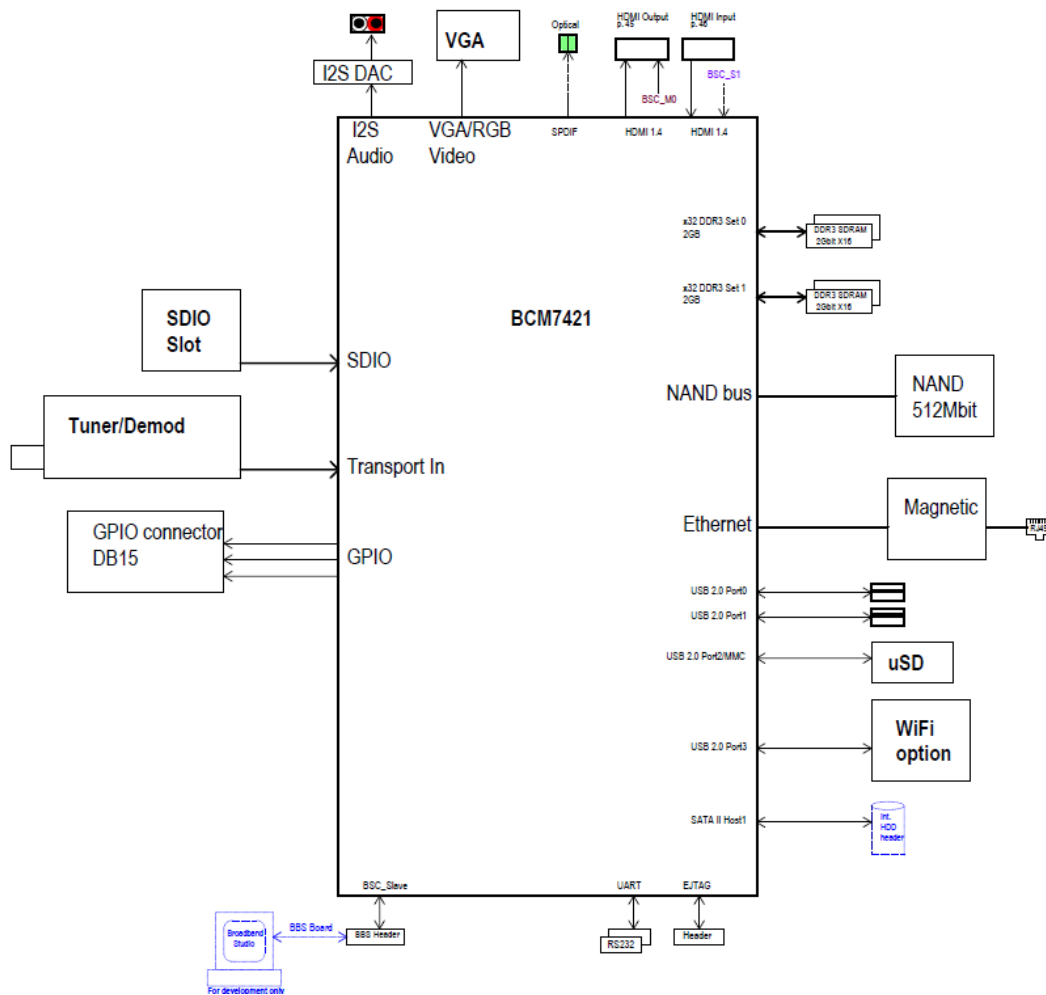
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- [Interfaces](#)
  - [XD230](#)
  - [XD1030](#)
  - [XD1230](#)

The BrightSign XD230, XD1030, and XD1230 players can be used to decode images, audio, and up to two HD video streams for digital sign and kiosk applications. In addition to driving video and audio displays, these players can be controlled with various networked and built-in interfaces.

This section specifies the hardware interfaces on the BrightSign XD230, XD1030, and XD1230.

## BLOCK DIAGRAM



## INTERFACES

### XD230

Front	Left	Right	Back	Internal
3.5mm IR out	GPIO button	SDHC/SDXC flash card slot	DE15 VGA video connector	MicroSD flash card slot
		Red status/error LED	Stereo 3.5mm mini plug for audio output	WiFi Module connector
		Yellow update LED	HDMI Out	
		Green power LED	10/100 Ethernet jack	

		Green SD activity LED	Reset button	
		Green MicroSD presence LED	4-pin power connector for 12V power input at 3A	
		Green BrightSign Network connection LED		
		Green Ethernet activity LED		
		Green WiFi activity LED		

### XD1030

Front	Left	Right	Back	Internal
3.5mm IR out	GPIO button	SDHC/SDXC flash card slot	DE15 VGA video connector	MicroSD flash card slot
DE9 male RS-232 connector	2x USB 2.0 connector	Red status/error LED	Stereo 3.5mm mini plug for audio output	WiFi Module connector
DA15 female for GPIO, IR in/out, and 3.3V power		Yellow update LED	HDMI Out	
S/PDIF out		Green power LED	10/100 Ethernet jack	
		Green SD activity LED	Reset button	
		Green MicroSD presence LED	4-pin power connector for 12V power input at 3A	
		Green BrightSign Network connection LED		
		Green Ethernet activity LED		
		Green WiFi activity LED		

### XD1230

Front	Left	Right	Back	Internal
3.5mm IR out	GPIO button	SDHC/SDXC flash card slot	DE15 VGA video connector	MicroSD flash card slot
DE9 male RS-232 connector	2x USB 2.0 connector	Red status/error LED	Stereo 3.5mm mini plug for audio output	WiFi Module connector
DA15 female for GPIO, IR in/out, and 3.3V power		Yellow update LED	HDMI Out	
S/PDIF out		Green power LED	HDMI In	
RF In for ATSC / Clear QAM		Green SD activity LED	10/100 Ethernet jack	
		Green MicroSD presence LED	Reset button	
		Green BrightSign Network connection LED	4-pin power connector for 12V power input @ 3A	
		Green Ethernet activity LED		
		Green WiFi activity LED		

## XDx30 Hardware Interfaces

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- [Power Connector](#)
- [DE9 RS-232 Connector](#)
- [DA15 Switch/LED Connector](#)
- [Ethernet](#)
- [USB](#)
- [DE15 VGA Connector](#)
- [RCA Component HD Video Connector](#)
- [3.5mm Audio Connector](#)
- [HDMI Out Connector](#)
- [HDMI In Connector](#)
- [3.5mm IR Out](#)
- [S/PDIF Out](#)
- [RF In](#)

### Power Connector

The power connector for the XD series is rated for 12V @ 3A. The plug for the connector is a keyed and locking 4-pin connector. It is right-side positive.

### DE9 RS-232 Connector

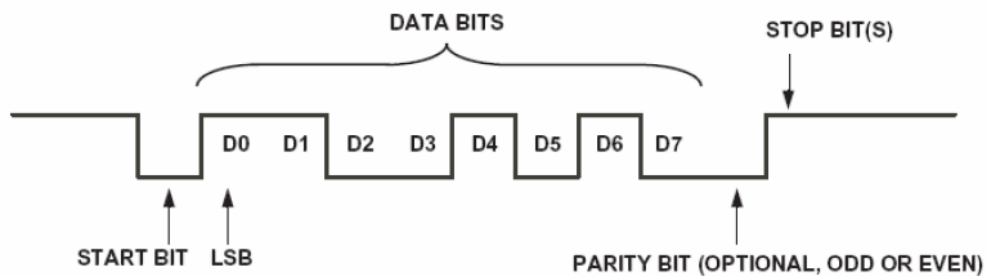
The RS-232 connector is a male DE9. Like PCs, BrightSign XD players are DTE devices. The input to the chip accepts a range between +25V and -25V, so it is compatible with standard +12V and -12V signaling.

The baud rate is 115200, with no parity, 8 data bits, and 1 stop bit. There is no hardware or software flow control. The maximum cable length is 50 meters, and the total cable capacitance is 2500pF.

#### Note

A lower capacitance cable allows you to use cable lengths beyond 50 meters.

The following diagram illustrates the behavior of the TX and RX signal:



The following table illustrates the pinout of the DE9 on the XD series of players:

pin	Description	pin	Description
1	NC	2	Receive data into the player
3	Transmit data out of the player	4	Available 5V@500mA
5	Ground	6	NC
7	NC	8	NC
9	NC	--	--

### DA15 Switch/LED Connector

The switch/led connector is a DA15 female. This connector is used to allow the player to control external LEDs or other devices requiring 24mA of

current or less.

Connect the LED outputs to the LED ANODE and connect the LED CATHODE to the ground. If you want to connect another device, then the output is capable of sourcing or sinking up to 3.3V at 24mA, but there is a series resistor of 100W in each line.

The connector also allows the connecting of external contact closures to the ground. In order to connect a switch, connect one side of the switch to the switch input, and connect the other side to one of the ground pins on the DA15 connector. The connector can also supply 3.3V at up to 500mA to an external device. The 3.3V output is polyfuse-protected and can source up to 500mA.

If one BrightSign player is driving the inputs on another BrightSign player, then you can drive at most three inputs from one output. The following calculations explain this limitation:

**Note**

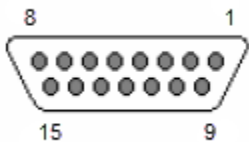
The GPIO outputs have 100W series resistors; the GPIO inputs have 1K pullup resistors to 3.3V; and the input threshold on the 541 chips is 2V high and .8V low. The high voltage is not problematic, but the low voltage can be if there are too many inputs connected to one output.

1 out driving 1 in	$V=3.3*100/(100+1,000)=0.3$
1 out driving 2 in	$V=3.3*100/(100+500)=0.55$
1 out driving 3 in	$V=3.3*100/(100+333.3)=0.76$
1 out driving 4 in	$V=3.3*100/(100+250)=.94$ (This is too high, so 1 output driving 3 inputs is the maximum)

The following table illustrates the pinout of the DA15 on the XD series of players:

pin	Description	pin	Description
1	IR blaster input	2	Ground
3	Button 6 I/O	4	Button 5 I/O
5	Button 3 I/O	6	Ground
7	Button 1 I/O	8	+3.3V output at 500mA
9	Ground	10	Button 7 I/O
11	Ground	12	Button 4 I/O
13	Button 2 I/O	14	Ground
15	Button 0 I/O	--	--

Here is the DA15 female as viewed from the front of the BrightSign XD1030 and XD1230:



A button/LED/IR board can be used to demonstrate the GPIO and IR functions on a BrightSign player. This board is built by a third-party manufacturer and can be purchased upon request.

**Ethernet**

BrightSign XD players have a standard RJ45 connector for 10/100 base-T Ethernet. The maximum length for the Ethernet cable is 100 meters. The following table illustrates the pinout of the RJ45:

pin	Description	pin	Description
1	TX+	2	TX-
3	RX+	4	RC to ground



5	RC to ground	6	RX-
7	RC to ground	8	RC to ground

## USB

The XD1030 and XD1230 have two high-speed (480 Mbit) USB host ports, which also support USB 2.0 powered devices (up to 500mA for each port). The maximum length for the USB cable is 5 meters. The following table illustrates the pinout of the USB host port.

pin	Description	pin	Description
1	VBUS	2	D-
3	D+	4	Ground

## DE15 VGA Connector

The VGA connector is able to output RGB video. The following table illustrates the pinout of the DE15 VGA connector:

pin	Description	pin	Description
1	Red analog video output	2	Green analog video output
3	Blue analog video output	4	NC
5	Digital ground	6	Analog ground
7	Analog ground	8	Analog ground
9	+5V DDC supply	10	Digital ground
11	NC	12	DDC SDA
13	HSYNC output	14	VSYNC output
15	DDC SCL	--	--

## RCA Component HD Video Connector

Component video is provided over the VGA connector. To display component video, you will need to use a VGA-to-component converter. See this [FAQ](#) for more details.

## 3.5mm Audio Connector

The XD230, XD1030, and XD1230 each have one 3.5mm female audio connector, which transmits a stereo signal. The full-scale voltage output of the audio is 2V RMS. The output impedance of the audio connector is 32Ω.

### Note

The BrightSign expansion module allows you to drive up to three sets of 5W headphones directly.

The audio connector has the following pinout:

- **Tip:** Left audio
- **Ring:** Right audio
- **Sleeve:** Ground for audio signal

## HDMI Out Connector

The HDMI-out connector is used to send digital video and audio to HDMI-enabled sink devices. The following table illustrates the pinout of the HDMI connector:

pin	Description	pin	Description
1	TX2p	2	Ground
3	TX2n	4	TX1p

5	Ground	6	TX1n
7	TX0p	8	Ground
9	TX0n	10	TXCp
11	Ground	12	TXCn
13	CEC	14	NC
15	DDC SCL	16	DDC SDA
17	Ground	18	+5V DDC
19	HDP (Hot Plug Detect)		

### HDMI In Connector

The HDMI In accepts inputs of up to 1920x1080@60p, with 24-bits RGB. The signaling conforms to the DVI 1.0, HDMI 1.4, and HDCP 1.2 standards. The HDMI signaling has CEC (but no ARC or HEC) functionality. The CEC channel is electrically coupled to the corresponding signal on the HDMI output, and the CEC commands will pass through players even when they do not have power.

### 3.5mm IR Out

The IR blaster generates a space-encoded (NEC) signal. The two transported bit values of the NEC signal (0 and 1) are encoded using differing lengths of low-time IR pulses.

The 3.5mm IR port has the following pinout:

- **Tip:** Power
- **Ring:** NC
- **Sleeve:** Signal

### S/PDIF Out

The SPDIF\_OPT signal is generated within the BCM7421 CPU, which has a direct connection to the S/PDIF port.

### RF In

The RF In is a 75R F-type female connector that accepts QAM digital TV input. The acceptable input range for incoming signals is +/- 0.5V maximum.

## XDx30 Environmental and Power Usage

BrightSign XD players are designed to be used between 0°C and 40°C, at 90% maximum relative humidity, non-condensing.

The power supply on the BrightSign XD series is 36W and 12V at 3A. These players will use approximately 1A of power when playing a 720p or 1080i MPEG2 HD source file.

An additional 2A of power is available for peripherals connected to the player. The user should not connect any combination of peripherals that will exceed 2A draw. If more than 2A is drawn, the external power supply may shut down due to over-current conditions. The unit will not be damaged, but it may reboot or not operate properly until the overload is removed.

The 2A can be shared in any way among the following connectors:

Connector	Maximum Power Usage
Ethernet	Approx. 180mA (when transferring data)
USB	500mA (on each connector)
DE9 5V	500mA
DA15 3.3V	500mA
HDMI 5V	500mA
IR blaster output	300mA

# XDx30 Theory of Operation

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- [Reset](#)
- [BCM7421 CPU](#)
- [Built-in Flash](#)
- [SDRAM](#)
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- [Video Encoder and Filter](#)
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- [On-Board LEDs](#)
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- [Reset Switch/GPIO Button](#)
- [SDHC/SDXC and MicroSD Slots](#)
- [NAND Flash](#)
- [Ethernet](#)
- [USB](#)

## Power Supply

There are seven voltage levels present in the player: 12V, 5V, 3.3V, 2.5V, 1.8V, 1.5V, and 1V.

## Reset

BrightSign XD players have a Low Voltage Reset circuit. This circuit will hold the RESET\_L signal low until a valid 3.3V power source is present.

## BCM7421 CPU

BrightSign XD players utilize a BCM7421 Multimedia CPU. This CPU runs on 3.3V, 2.5V, and 1V and runs from a 27MHz oscillator. The CPU is reset by the RESET\_L signal from the low voltage reset circuit going into the RESET\_IN pin on the CPU. When the RESET\_IN pin goes from low to high, the BCM7421 will boot from the NAND flash.

## Built-in Flash

The boot code in the BCM7421 instructs it to continue the boot process by reading additional code from the onboard NAND flash, which can be updated in the field, either from the flash slots or USB mass storage. Part of the NAND flash is also used to hold non-volatile parameters. The contents of the boot flash are copied into the SDRAM. The CPU then jumps to the boot code.

## SDRAM

BrightSign XD players each contain four DDR SDRAM devices. When the BCM7421 boots, it will copy the code from the NAND flash device into the SDRAM and then execute the code from the SDRAM. The SDRAM runs at a clock rate of 800MHz, with a data rate of 1600MHz.

## Serial Port

The XD1030 and XD1230 have a built in UART that communicates with the RS-232 level shifter. The MAX232 creates valid RS-232 voltage levels for the transmit pin by using a capacitive voltage switcher.

## Video Encoder and Filter

The BCM7421 streams decoded video using a single-data rate clock. It also streams the same video out of the on-board DACs.

## Audio Outputs

BrightSign XD players each have a single Texas Instruments high quality audio DAC device, which takes in digital audio signals from the BCM7421 in an I2S audio format. The AUD\_LRCIN is the framing signal for the audio and runs at the frame rate of the audio source (usually either 44.1KHz or 48KHz). The AUD\_BITCLK signal is typically 32 times higher than the AUD\_LRCIN.

The audio output is fed through a TI amplifier and sent directly to the audio output jack. It can drive a 32W load with a 2V RMS signal.

### On-Board LEDs

There are eight on-board LEDs that indicate the following:

LED	Indication
Green power	Displays when the board is powered up and not in reset mode.
Green SD activity	Flashes any time there is activity on the SD card.
Green MicroSD activity	Displays when a MicroSD card is present.
Green network activity	Displays when the player is connected to the BrightSign Network.
Green Ethernet activity	Flashes when the player is connecting to the network. Displays when connected.
Green WiFi activity	Flashes when the player is connecting to the wireless network. Displays when connected.
Yellow update	Flashes when the board is being upgraded.
Red status	Flashes a certain number of times to indicate which error is occurring. The flash codes are described below.
	2 Unspecified error
	3 Network recovery script is preparing to run on a device configured for network recovery.
	4 No upgrade file found
	5 Failed to load kernel module
	6 Board is not capable of running the current firmware version.
	7 A piece of on-board hardware is not working correctly (on firmware versions 4.1 and later).
	8 Problem related to the storage device (either the USB drive or SD card)
	9 Problem related to the registry/NAND
	10 The autorun script encountered a load/run error.
	11 WiFi-related error (mainly, WiFi not found on USB)
	12 Unable to find a bootable image (on firmware versions 4.0 and later)

### On-Board Switch

The on-board switch is connected to the GPIO02. A pull-up on the button normally sets the GPIO02 to be pulled high. Conversely, the GPIO02 is pulled low when the button is pressed.

### Reset Switch/GPIO Button

The on-board switch is connected to the reset circuit. Pressing down the reset button will cause the GPIO07 to go low. Holding the reset button low for approximately 10 seconds will cause a hard reset. When the board goes into reset mode, the power LED will be dark until the reset button is released.

### SDHC/SDXC and MicroSD Slots

The XD series has one SDHC/SDXC and one internal MicroSD card slot, both capable of transferring a 25 Mbit/sec video stream, one 5.1 AC3 stream (pass-through), and three stereo PCM tracks simultaneously. There is no inherent limit on the storage capacity of SD cards used for XD-series players.

### NAND Flash

BrightSign players have a built-in NAND flash. All the code for the player is stored on the NAND flash, and it may also be possible to store some content on the NAND flash, which is connected directly to the BCM7421.

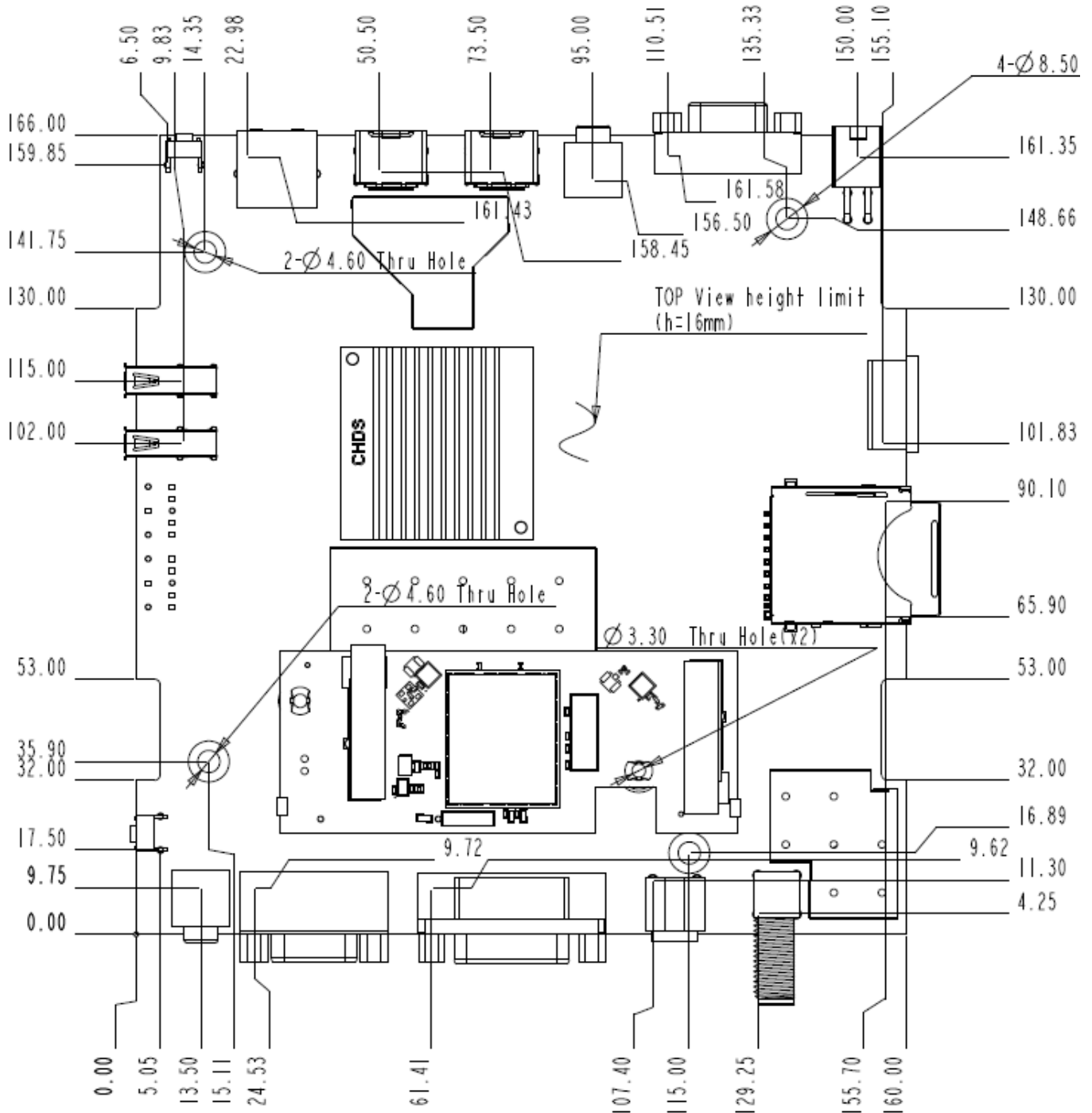
## Ethernet

The 10/100 Base-T Ethernet is implemented on XD players by directly interfacing with the BCM7421. The player has on-board Ethernet magnetics and termination for the RJ-45 cable.

## USB

The USB 2.0 high-speed host controller is implemented internally in the BCM7421 SOC chip. The board utilizes two TPS2065 devices. Each TPS2065 is an over-current protected switch that can be used to turn the power to the USB device on or off or to detect over-current situations.

## XDx30 Dimensions



HD120, HD220, HD1020

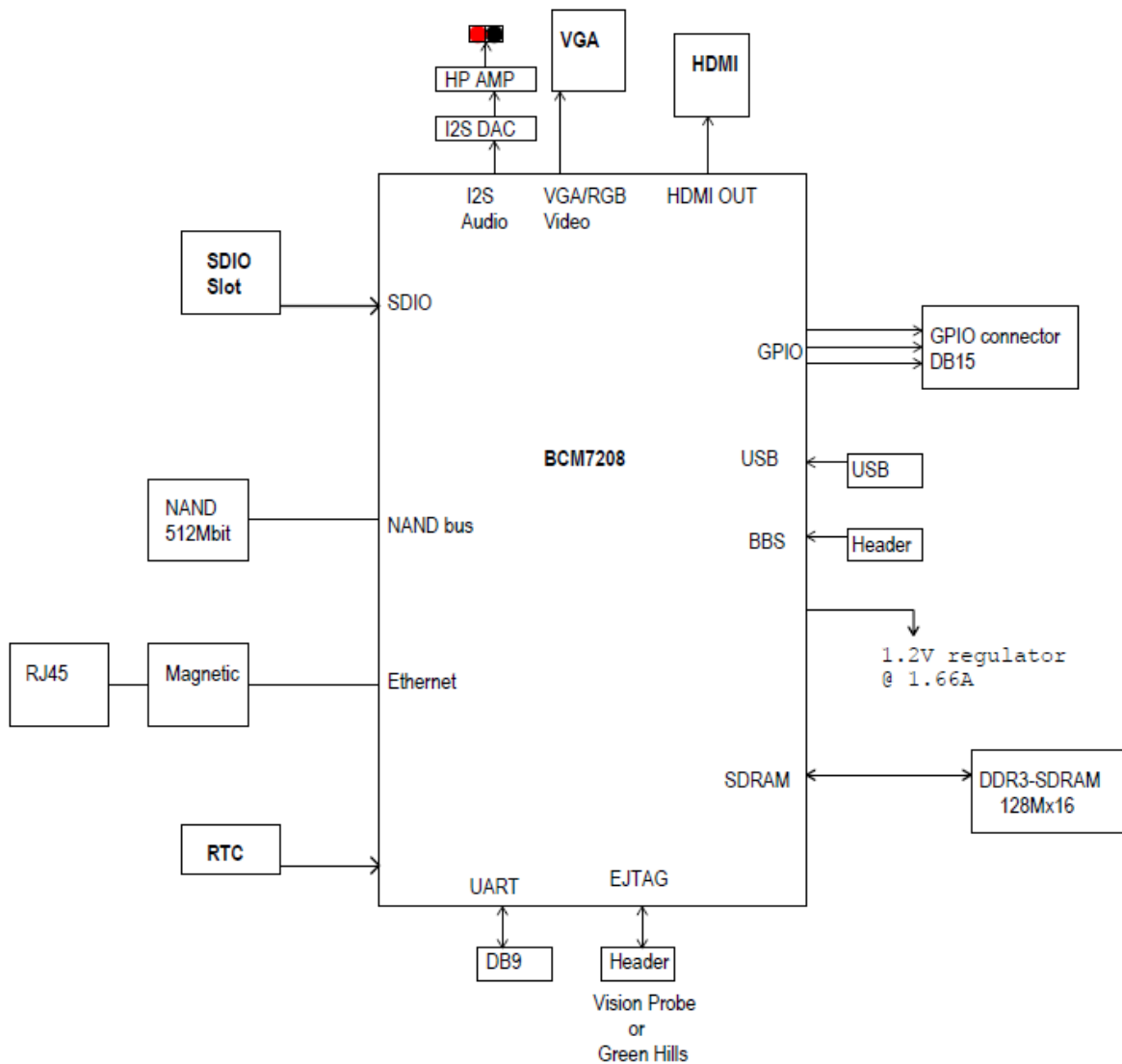
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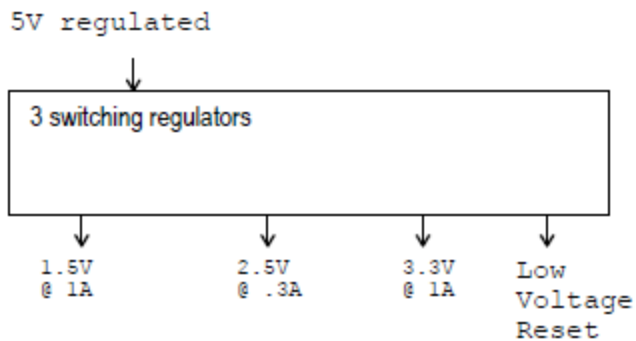
- [Block Diagram](#)
- [Interfaces](#)
  - [HD120](#)
  - [HD220](#)
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The BrightSign HD120, HD220, and HD1020 players can be used to drive a variety of HDTV and computer monitors for digital sign and kiosk applications. In addition to driving a video display, these players have many different built-in interfaces that allow them to be controlled.

This section specifies the hardware interfaces on the BrightSign HD120, HD220, and HD1020.

## BLOCK DIAGRAM





## INTERFACES

### HD120

Front	Left	Right	Back
DA15 female for GPIO, IR in/out, and 3.3 V power	GPIO button	SD/SDHC flash card slot	Reset button
	Stereo 3.5mm mini plug for audio output	Red status/error LED	DE15 VGA video connector
		Yellow update LED	HDMI connector
		Green power LED	Power plug for 5 V power input at 3 A
		Green flash activity LED	

### HD220

Left	Right	Right	Back
GPIO button	SD/SDHC flash card slot	SD/SDHC flash card slot	Reset button
Stereo 3.5mm mini plug for audio output	Red status/error LED	Red status/error LED	10/100 Ethernet jack
	Yellow update LED	Yellow update LED	DE15 VGA video connector
	Green power LED	Green power LED	HDMI connector
	Green flash activity LED	Green flash activity LED	Power plug for 5 V power input at 3 A

### HD1020

Front	Left	Right	Back
DE9 male RS-232	GPIO button	SD/SDHC flash card slot	Reset button
DA15 female for GPIO, IR in/out, and 3.3 V power	USB connector	Red status/error LED	DE15 VGA video connector
	Stereo 3.5mm mini plug for audio output	Yellow update LED	HDMI connector
		Green power LED	Power plug for 5 V power input at 3 A
		Green flash activity LED	

## HDx20 Hardware Interfaces

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- [Ethernet](#)
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- [RCA Component HD Video Connector](#)
- [3.5mm Audio Connector](#)
- [HDMI Connector](#)

### Power Connector

The power connector on this board is rated for 5 V at 3 A. The plug for the connector is a standard, center-positive 5.5mm plug with a 1.65mm center pin hole.

### DE9 RS-232 Connector

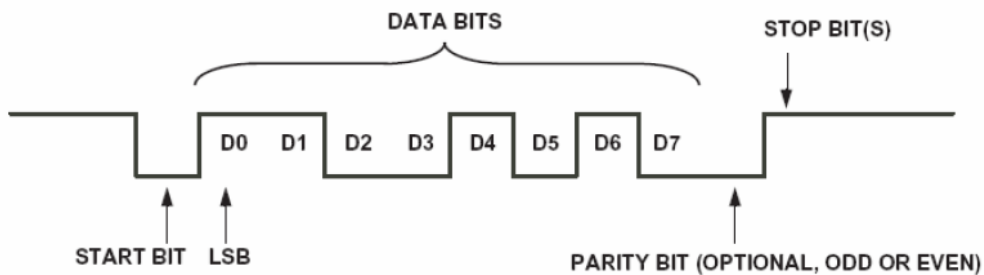
The RS-232 connector is a male DE9. Like PCs, the BrightSign HD series of players are DTE devices. The input to the chip accepts a range between +30V and -30V, so it is compatible with standard +12V and -12V signaling. The output from the chip is rated at a typical +7V and -7V, which exceeds the voltage required by the RS-232 specification.

The baud rate is 115,200, with no parity, 8 data bits, and 1 stop bit. There is no hardware or software flow control. The maximum cable length is 50 meters, and the total cable capacitance is 2500pF.

#### Note

A lower capacitance cable allows you to use cable lengths beyond 50 meters.

The following diagram illustrates the behavior of the TX and RX signal:



The following table illustrates the pinout of the DE9 on the HD series of players:

pin	Description	pin	Description
1	NC	2	Receive data into the player
3	Transmit data out of the player	4	Available 5V@500mA
5	Ground	6	NC
7	Optional TX 2nd channel	8	Optional RX 2nd channel
9	NC	--	--

### DA15 Switch/LED Connector

The switch/led connector is a DA15 female. This connector is used to allow the player to control external LEDs or other devices requiring 24 mA of current or less.

Connect the LED outputs to the LED ANODE and connect the LED CATHODE to the ground. If you want to connect another device, then the



output is capable of sourcing or sinking up to 3.3 V at 24 mA, but there is a series resistor of 100 Ohms in each line.

The connector also allows the connecting of external contact closures to the ground. In order to connect a switch, connect one side of the switch to the switch input, and connect the other side to one of the ground pins on the DA15 connector. The connector can also supply 3.3 V at up to 500 mA to an external device. The 3.3 V output is polyfuse-protected and can source up to 500 mA.

If one BrightSign player is driving the inputs on another BrightSign player, then you can drive at most three inputs from one output. The following calculations explain this limitation:

**Note**

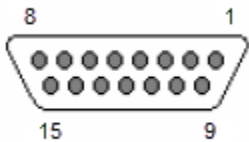
The GPIO outputs have 100Ω series resistors; the GPIO inputs have 1K pullup resistors to 3.3V; and the input threshold on the 541 chips is 2V high and .8V low. The high voltage is not problematic, but the low voltage can be if there are too many inputs connected to one output.

1 out driving 1 in	$V=3.3*100/(100+1,000)=0.3$
1 out driving 2 in	$V=3.3*100/(100+500)=0.55$
1 out driving 3 in	$V=3.3*100/(100+333.3)=0.76$
1 out driving 4 in	$V=3.3*100/(100+250)=.94$ (This is too high, so 1 output driving 3 inputs is the maximum)

The following table illustrates the pinout of the DA15 on the HD series of players:

pin	Description	pin	Description
1	IR blaster input	2	Ground
3	Button 6 I/O	4	Button 5 I/O
5	Button 3 I/O	6	Ground
7	Button 1 I/O	8	+3.3V output at 500mA
9	Ground	10	Button 7 I/O
11	Ground	12	Button 4 I/O
13	Button 2 I/O	14	Ground
15	Button 0 I/O	--	--

Here is the DA15 female as viewed from the front of the BrightSign HD120 and HD1020:



BrightSign provides a button/LED/IR board that can be used to demonstrate how the GPIO and IR functions. An example schematic for connecting to the GPIO connector can be provided upon request

**Ethernet**

The BrightSign HD220 has a standard RJ45 connector for 10/100 base-T Ethernet. The maximum length for the Ethernet cable is 100 meters. The following table illustrates the pinout of the RJ45:

pin	Description	pin	Description
1	TX+	2	TX-
3	RX+	4	RC to ground

5	RC to ground	6	RX
7	RC to ground	8	RC to ground

## USB

The HD1020 has a high-speed (480 Mbit) USB host port. The maximum length for the USB cable is 5 meters. The following table illustrates the pinout of the USB host port.

pin	Description	pin	Description
1	VBUS	2	D-
3	D+	4	Ground

## DE15 VGA Connector

The VGA connector is able to output RGB video. The following table illustrates the pinout of the DE15 VGA connector:

pin	Description	pin	Description
1	Red Analog video output	2	GREEN analog video output
3	Blue analog video output	4	NC
5	Digital ground	6	Analog ground
7	Analog ground	8	Analog ground
9	+5V DDC supply	10	Digital ground
11	NC	12	DDC SDA
13	HSYNC output	14	VSYNC output
15	DDC SCL	--	--

## RCA Component HD Video Connector

Using a component cable adaptor on the VGA port, the component triple RCA connector is able to output the following formats:

- **480p video:** Y from Green jack, Pr from Red jack, and Pb from Blue jack
- **720p video:** Y from Green jack, Pr from Red jack, and Pb from Blue jack
- **1080i video:** Y from Green jack, Pr from Red jack, and Pb from Blue jack
- **1080p video:** Y from Green jack, Pr from Red jack, and Pb from Blue jack

## 3.5mm Audio Connector

The HD120, HD220, and HD1020 each have one 3.5mm female audio connector, which transmits a stereo signal. The full scale voltage output of the audio is 2 V RMS, with no load. The minimum load resistance connected to the audio output should be 5K Ohms.

### Note

The BrightSign expansion module allows you to drive up to three sets of 5W headphones directly.

The audio connector has the following pinout:

- **Tip:** Left audio
- **Ring:** Right audio
- **Base:** Ground for audio signal

## HDMI Connector

The HDMI connector is used to send digital video and audio to HDMI-enabled sink devices. The following table illustrates the pinout of the HDMI connector:

pin	Description	pin	Description
-----	-------------	-----	-------------

1	TX2p	2	Ground
3	TX2n	4	TX1p
5	Ground	6	TX1n
7	TX0p	8	Ground
9	TX0n	10	TXCp
11	Ground	12	TXCn
13	CEC	14	NC
15	DDC SCL	16	DDC SDA
17	Ground	18	+5V DDC
19	HDP (Hot Plug Direct)	--	

## HDx20 Environmental and Power Usage

The HD120, HD220, and HD1020 players are designed to be used between 0°C and 40°C, at 90% maximum relative humidity, non-condensing.

The power supply on the BrightSign HD series is 15 W and 5.0 V at 3 A. These players will use approximately 1 A of power when playing a 720p or 1080i MPEG2 HD source file.

1 A at 5.0 V is approximately 5 W.

There is 2 A of additional available power that can be used by peripherals connected to a player. Do not connect any combination of peripherals that will exceed 2 A of draw. If more than 2 A is drawn, then the external power supply will shut down due to overcurrent conditions. The unit will not be damaged, but it may reboot or not operate properly until the overload is removed.

The remaining 2 A can be shared in any way among the following connectors:

Connector	Power Usage
Ethernet	Approx. 180 mA (when transferring data)
USB	Max 1500 mA*
DE9 5V	500 mA
DB25 3.3V	500 mA
HDMI 5V	Max 55 mA
6 LED outputs on DB25	Up to 24 mA (each)

\*The USB spec is 500mA, but more current has been placed on the USB connector to be able to use the BrightSign Expander, in some cases without an additional 5V power supply.

## HDx20 Theory of Operation

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- [SDRAM](#)
- [Serial Port](#)
- [Video Encoder and Filter](#)
- [Audio Outputs](#)
- [On-Board LEDs](#)
- [On-Board Switch](#)
- [Reset Switch/GPIO Button](#)
- [SDHC/SD Flash Slot](#)
- [NAND Flash](#)
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### Power Supply

There are five voltages present in the player: 5 V, 3.3 V, 2.5 V, 1.5 V and 1.2 V. 5 V comes in from the power connector and is used directly for the USB. 3.3 V is created from 5 V by a switching regulator. Similar regulators are used to create 2.5 V for the DDR SDRAM and 1.2 V for the CPU core voltage.

### Reset

The HD120, HD220, and HD1020 players have a Low Voltage Reset circuit. This circuit will hold the RESET\_L signal low until a valid 3.3 V power source is present.

### BCM7208 CPU

The HD120, HD220, and HD1020 players utilize a BCM7208 Multimedia CPU. This CPU runs on 3.3 V, 2.5 V, and 1.2 V and runs from a 27 MHz oscillator. The CPU is reset by the RESET\_L signal from the low voltage reset circuit going into the RESET\_IN pin on the BCM7208. When the RESET\_in pin goes from low to high, the BCM7208 will boot from the NAND flash.

### Built-in Flash

The boot code in the BCM7208 instructs it to continue the boot process by reading additional code from the onboard NAND flash, which can be updated in the field, either from on the flash slots or USB mass storage. Part of the NAND flash is also used to hold non-volatile parameters. The contents of the boot flash are copied into the SDRAM. The CPU then jumps to the boot code.

### SDRAM

The HD120, HD220, and HD1020 players each contain one DDR SDRAM device. When the BCM7208 boots, it will copy the code from the NAND flash device into the SDRAM and then execute the code from the SDRAM. The SDRAM runs at a clock rate of 666MHz, with a data rate of 1333MHz.

### Serial Port

The player has a built in UART that communicates with the RS-232 level shifter. The MAX232 creates valid RS-232 voltage levels for the transmit pin by using a capacitive voltage switcher.

### Video Encoder and Filter

The BCM7208 streams decoded video using a single-data rate clock. It also streams the same video out of the on-board DACs.

### Audio Outputs

The HD120, HD220, and HD1020 players each have a single Texas Instruments high quality audio DAC device, which takes in digital audio

signals from the BCM7208 in an I2S audio format. The AUD\_LRCIN is the framing signal for the audio and runs at the frame rate of the audio source (usually either 44.1KHz or 48KHz). The AUD\_BITCLK signal is typically 64 times higher than the AUD\_LRCIN.

The audio output from the TI amplifier is sent directly to the audio output jack. It can drive a 32 Ohm load with a 2 V RMS signal.

### On-Board LEDs

There are four on-board LEDs that indicate the following:

LED	Indication
Green power	Flashes any time the board is powered up and not in reset mode.
Green flash activity	Flashes any time there is CPU activity.
Yellow update	Flashes when the board is being upgraded.
Red status	Flashes a certain number of times to indicate which error is occurring. The flash codes are described below.
	2 Unspecified error
	3 Network recovery script is preparing to run on a device configured for network recovery.
	4 No upgrade file found
	5 Failed to load kernel module
	6 Board is not capable of running the current firmware version.
	7 Problem related to the Ethernet chip
	7 A piece of on-board hardware is not working correctly (on firmware versions 4.1 and later).
	8 Problem related to the storage device (either the USB drive or SD card)
	9 Problem related to the registry/EEPROM
	10 The autorun script encountered a load/run error.
	11 WiFi-related error (mainly, WiFi not found on USB)
	12 Unable to find a bootable image (on firmware versions 4.0 and later)

### On-Board Switch

The on-board switch is connected to the GPIO32. A pullup on the button normally sets the GPIO32 to be pulled high. Conversely, the GPIO32 is pulled low when the button is pressed.

### Reset Switch/GPIO Button

The on-board switch is connected to the GPIO12. Pressing down the reset button will cause the GPIO12 to go low. Holding the reset button low for approximately 10 seconds will cause a hard reset. When the board goes into reset mode, the power LED will be dark until the reset button is released.

### SDHC/SD Flash Slot

The SDHC/SD flash slot supports SDHC and SD flash cards.

### NAND Flash

BrightSign players have a built-in NAND flash. All the code for the player is stored on the NAND flash. It may also be possible to store some content on the NAND flash, which is connected directly to the BCM7208.

### Ethernet

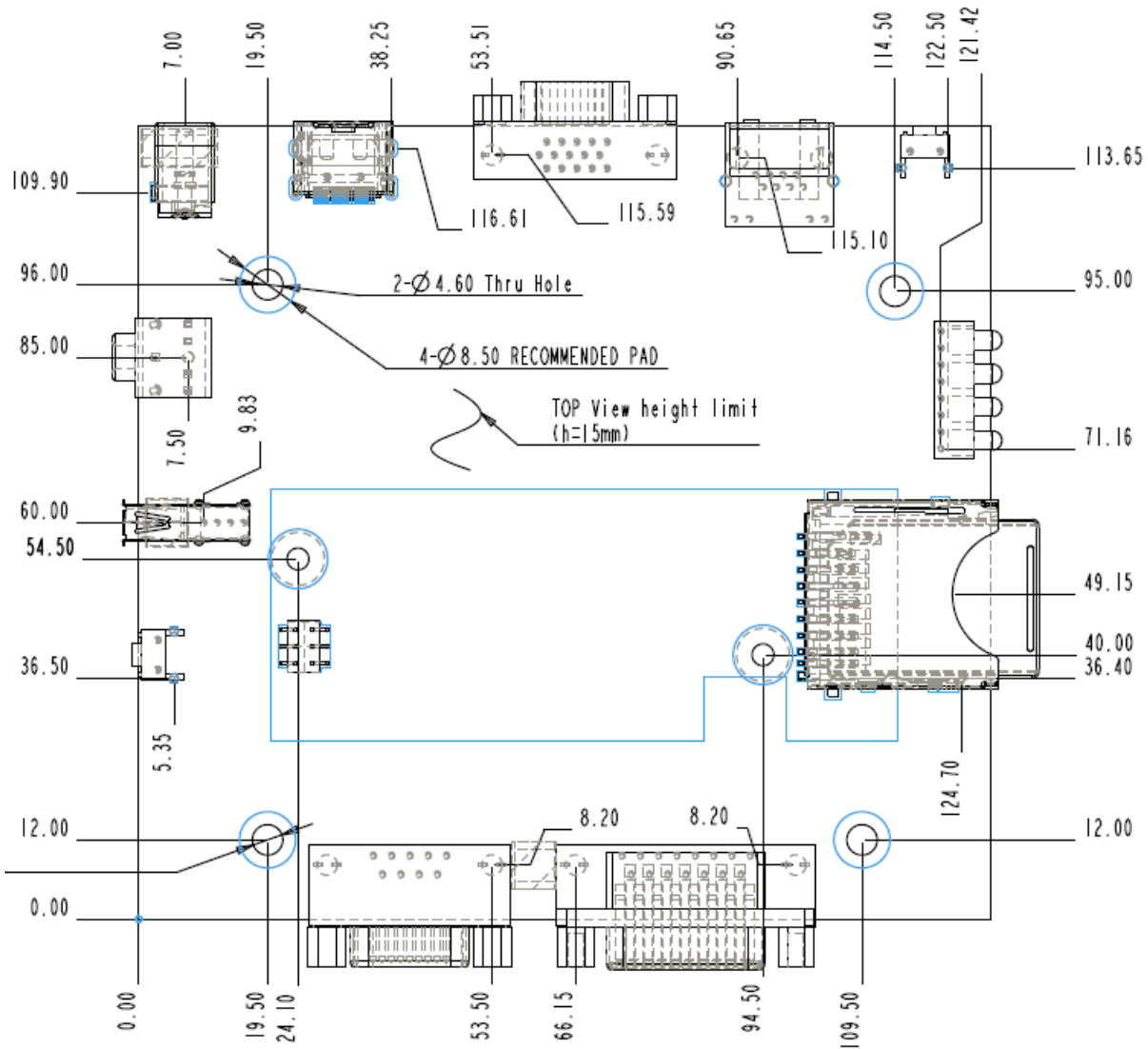
The 10/100 Base-T Ethernet is implemented on the HD120, HD220, and HD1020 by directly interfacing with the BCM7208. The player has

on-board Ethernet magnetics and termination for the RJ-45 cable.

## USB

The USB 2.0 high-speed host controller is implemented internally in the BCM2708 SOC chip. The board utilizes the TPS2065 device, which is over-current protected switch: It can be used to turn the power to the USB device on or off or to detect over-current situations.

## HDx20 Dimensions



## BP900/BP200 (Dimensions)

BP900 DIMENSIONS



BP900 Panel Dimensions.pdf

#### BP200 DIMENSIONS

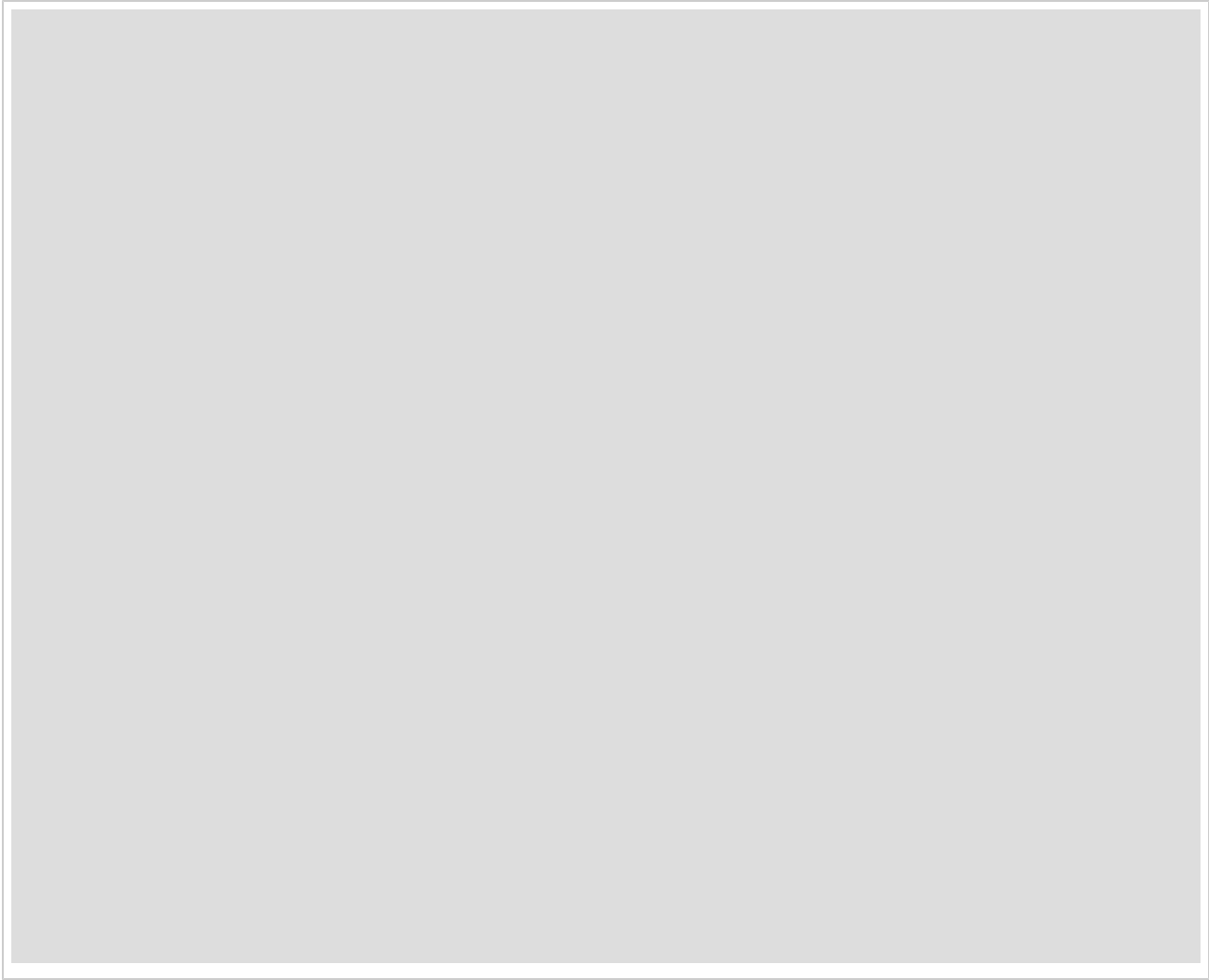


BP200 Panel Dimensions.pdf.pdf

## SSD Installation (XTx43, XDx33)

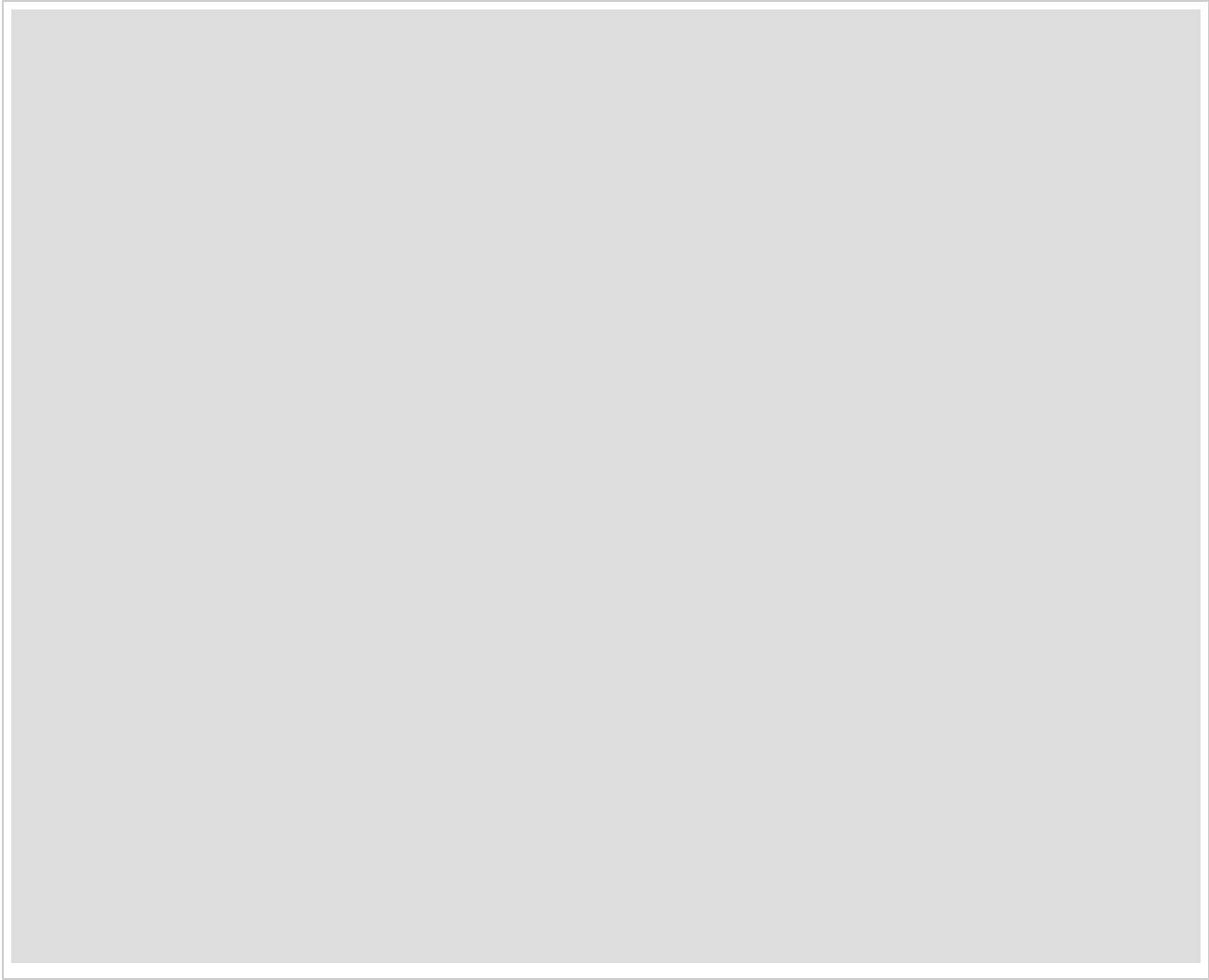
**Note**

We recommend 80mm SSD modules for use with BrightSign players. There are holes to accommodate standoffs for 40mm and 60mm SSD modules, but you will need to install your own standoff to secure the module to the circuit board.



WiFi Module Installation (4Kx42, XDx32, XDx30)





Brightsign\_XD\_WiFi\_Installation\_Guide.pdf