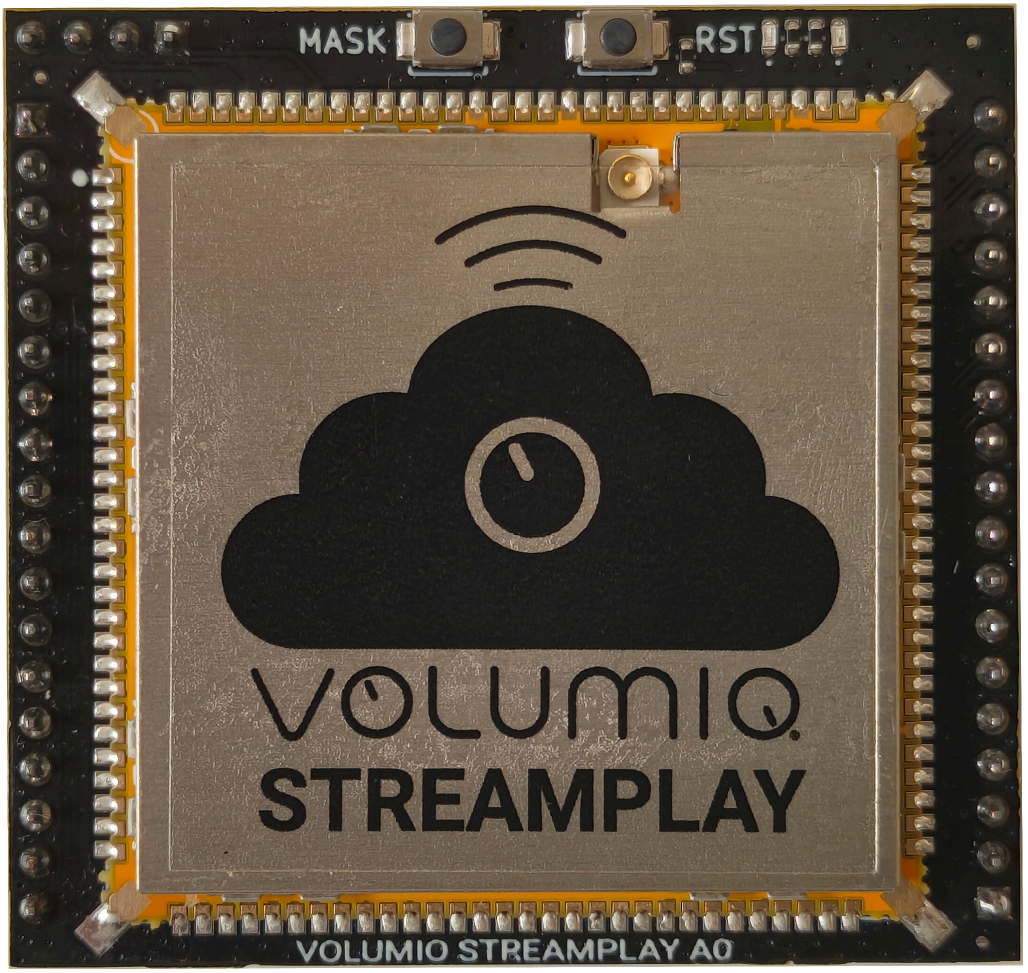
VOLUMIO®

THE MUSIC PLAYER



Streamplay Module A0

User Manual

Rev 0.12

SEP. 12, 2024

HISTORY

Version	Date	Description	Author
0.1	12/09/2024	Initial document	Leo Reboul
0.11	30/09/2024	Tech description enhancement	Leo Reboul
0.12	11/03/2025	Power Supply text update	Leo Reboul

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Features

- Supported Formats: MP3/WMA/AAC/AAC+/ALAC/FLAC/APE/WAV/DSD and others
- Support Internet audio streaming: Apple AirPlay via Shairport Sync and UPNP DLNA renderer with Open Home support
- Supported Services: Spotify & Spotify Connect, TIDAL & TIDAL Connect, QOBUZ
- Available Plugins: Youtube, Squeezelite, Radio Paradise, Podcasts, Pandora, Fusion DSP, Roon Bridge, Soundcloud, Mixcloud and many more...
- Support multi-room audio (a.k.a. party mode)
- Support module configuration and control via iOS/Android APP or any web-browser from PC/Smartphone/Tablet
- Support online OTA firmware upgrade
- Read files over USB, Internal Memory or Network (NAS + DLNA)
- Multilanguage (29 languages supported)
- Bluetooth AD2P Playback
- Alarm and Sleep function

1. Overview

Volumio StreamPlay is a cost-effective ready-to-embed system-on-module that empowers manufacturers to integrate cutting-edge audiophile streaming capabilities into their products.

It's powered by the award-winning Volumio OS, providing end users with the most advanced streaming engine on the market.

1.1 Parameters

	Parameter	Performance
Wireless	Certification	FCC (pending), CE-RED
	Standard	802.11 b/g/n 1T1R
	Frequency	2.412 GHz - 2.484 GHz
	Antenna options	External on IPEX connector
Hardware	Work voltage	4.9V - 5.2V
	Work current	180 mA - 500 mA
	Peak current	500 mA
	Work temperature	-5 °C / 60 °C
	Storage temperature	-40 °C / 100 °C
	I2S input/output	192 kHz / 24 bit
	S/PDIF output	192 kHz / 24 bit
	IO extension	Ethernet, USB, UART, GPIO, I2C
	Size	44 mm x 41.5 mm, 40 DIP

2. Hardware Specs

- CPU RK3308B, Quad-core ARM Cortex-A35 CPU 1.3GHz
- RAM 512MB DDR3
- EMMC 8GB onboard storage
- Support for additional SD-card external storage
- Ethernet 10/100M
- Wi-Fi 2.4GHz 802.11 b/g/n with highly optimised performance
- Bluetooth 4.2
- External Antenna connector on Wi-Fi/BT module
- Digital audio input and output via I2S interface, playback up to 192KHz/24bit
- Digital audio output via S/PDIF interface, playback up to 192KHz/24bit
- GPIO, UART, I2C and USB2.0 interfaces

2.1 Description of hardware interface

The Streamplay makes it possible to connect a customer board through its 40-pin DIP. The connector placement and the pinout are shown in the following picture.

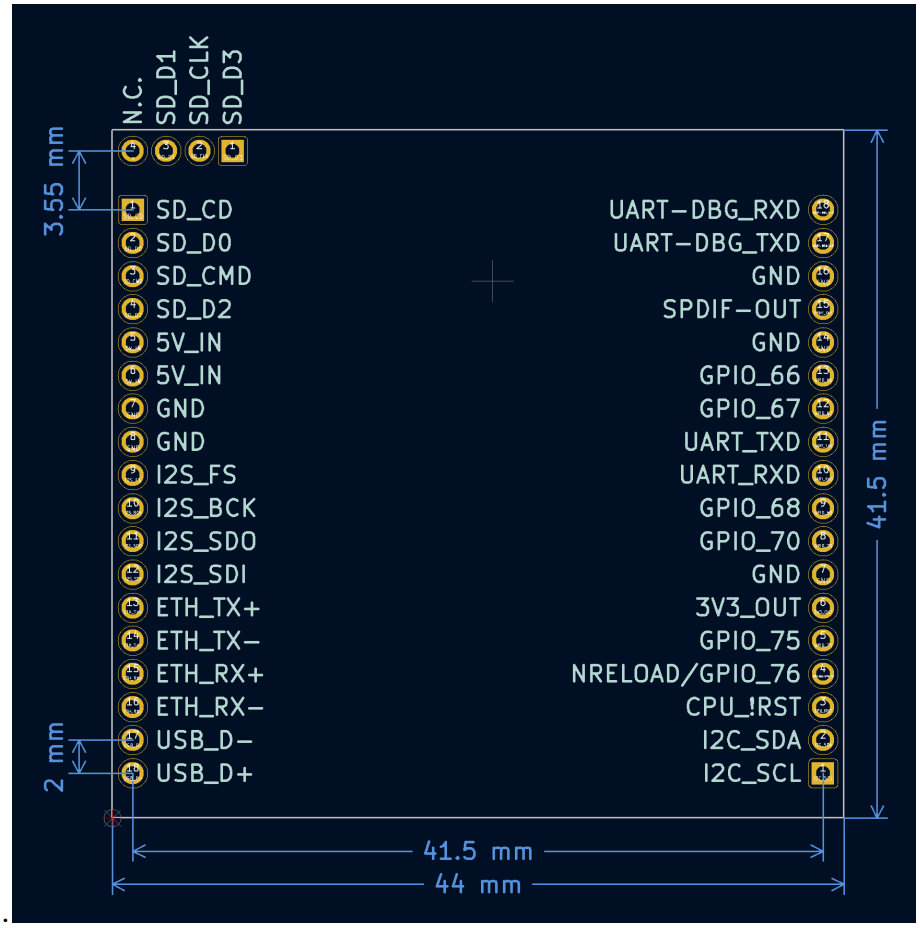

Figure 1: Streamplay interface pins

Pin description:

Connector	Pin	Name	Description	Type	Comments
J1	1	SD_D3	SDIO Data	I/O	SD-card interface D3
J1	2	SD_CLK	SDIO Clock	O	SD-card interface CLK
J1	3	SD_D1	SDIO Data	I/O	SD-card interface D1
J1	4	N.C.	Not Connected		Leave floating or connected to GND
J2	1	SD_CD	SDIO Detect	I	SD-card interface CD
J2	2	SD_D0	SDIO Data	I/O	SD-card interface D0
J2	3	SD_CMD	SDIO Command	O	SD-card interface CMD
J2	4	SD_D2	SDIO Data	I/O	SD-card interface D2
J2	5	5V_IN	+5V DC Input	P, I	Requires a stable +5V input supply, up to 500 mA current
J2	6	5V_IN	+5V DC Input	P, I	
J2	7	GND	GND Reference	P	Connect to a solid GND Plane
J2	8	GND	GND Reference	P	
J2	9	I2S_FS	I2S Audio Frame Select	O	I2S Audio Master Interface, up to 192kHz/24bit
J2	10	I2S_BCK	I2S Audio Bit Clock	O	
J2	11	I2S_SDO	I2S Audio Serial Data Out	O	
J2	12	I2S_SDI	I2S Audio Serial Data In	I	
J2	13	ETH_TX+	Ethernet Transmit Data +	O	10/100M Ethernet interface
J2	14	ETH_TX-	Ethernet Transmit Data -	O	
J2	15	ETH_RX+	Ethernet Receive Data +	I	
J2	16	ETH_RX-	Ethernet Receive Data -	I	
J2	17	USB_D-	USB Interface DM	I/O	USB 2.0 Host interface
J2	18	USB_D+	USB Interface DP	I/O	
J3	1	I2C_SCL	I2C Serial Clock	O	Internal 2.2kΩ pull-up to 3.3V
J3	2	I2C_SDA	I2C Serial Data	I/O	Internal 2.2kΩ pull-up to 3.3V
J3	3	CPU_!RST	Module CPU Reset	I	Internal 10kΩ pull-up to 1.8V Toggle low > 300ms to reset
J3	4	NRELOAD/GPIO_76	Restore OS Factory Settings	I/O	Internal 4.7kΩ pull-up to 3.3V Toggle low > 1s to factory-reset
J3	5	GPIO_75	General-purpose IO	I/O	Internal 4.7kΩ pull-up to 3.3V
J3	6	3V3_OUT	+3.3V DC Output	P, O	+3.3V DC output, up to 100mA current
J3	7	GND	GND Reference	P	Connect to a solid GND Plane
J3	8	GPIO_70	General-purpose IO	I/O	Internal 4.7kΩ pull-up to 3.3V
J3	9	GPIO_68	General-purpose IO	I/O	Internal 4.7kΩ pull-up to 3.3V
J3	10	UART_RXD	Serial UART Receive Data	I	Serial interface to send and receive data with an external MCU. It is used by the serial API implemented in the OS
J3	11	UART_TXD	Serial UART Transmit Data	O	
J3	12	GPIO_67	General-purpose IO	I/O	Internal 2.2kΩ pull-up to 3.3V
J3	13	GPIO_66	General-purpose IO	I/O	Internal 2.2kΩ pull-up to 3.3V
J3	14	GND	GND Reference	P	Connect to a solid GND Plane
J3	15	SPDIF_OUT	S/PDIF Audio output	O	S/PDIF Audio, up to 192kHz/24bit
J3	16	GND	GND Reference	P	Connect to a solid GND Plane
J3	17	UART-DBG_TXD	Debug Serial Transmit Data	O	Serial debug interface for CPU and OS additional information
J3	18	UART-DBG_RXD	Debug Serial Receive Data	I	
LEGEND I: Input, O: Output, P: Power					

2.1.1 Mechanical Dimensions

The Streamplay board dimensions are: 44 mm long, 41.5 mm wide and 9 mm high including RF shield and headers.

2.2 Audio Interfaces

2.2.1 I2S Audio Interface

The StreamPlay provides an internal I2S Audio Interface, working in Master mode.
This interface supports PCM playback up to 192 kHz / 24 bits.

It can be used to provide the audio digital bitstream to a DAC or Codec on the customer carrier board.

The following diagram shows how to connect the I2S Audio Interface to a PCM5100A DAC from Texas Instruments. This is an example.

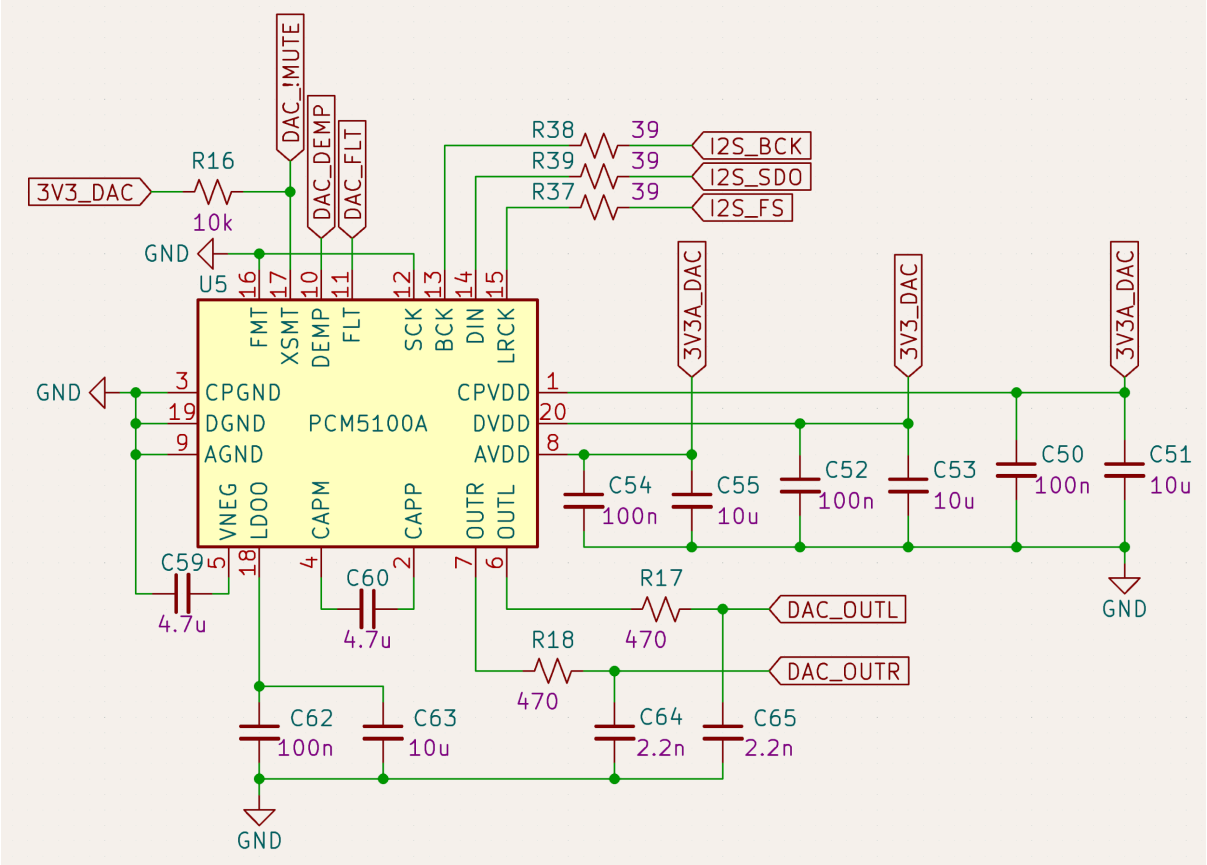

Figure 2: StreamPlay I2S DAC reference-design

2.2.2 S/PDIF Audio Interface

The StreamPlay provides an internal S/PDIF Audio Interface, working as a signal transmitter. This interface supports PCM playback up to 192 kHz / 24 bits.

The S/PDIF Audio interface can be used to provide the digital audio bitstream to a Coaxial output connector, to a Photolink Fiber Optic Transmitter (TOSLINK), to a DAC or Codec on the customer carrier board, or a combination of them.

The following diagram shows how to connect the S/PDIF Audio Interface to a Coaxial RCA connector, as an example. If galvanic isolation is required in the customer application, a transformer suitable for S/PDIF Audio can be added before the RCA connector.
The recommended part number for such a transformer is DA101JC from Murata.

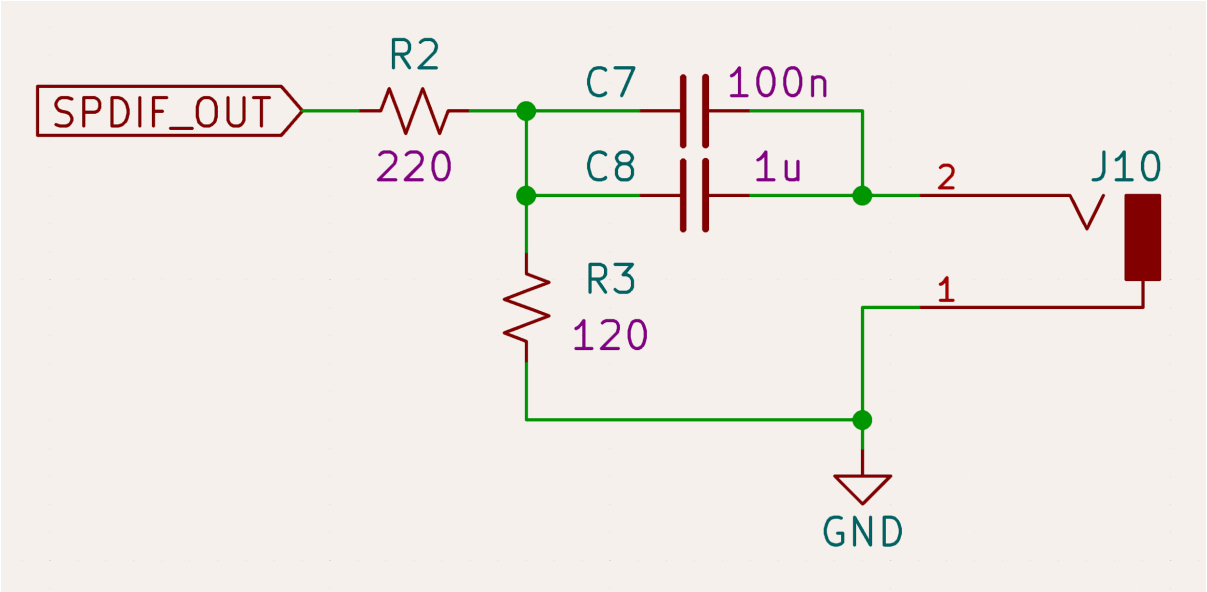

Figure 3: StreamPlay S/PDIF Coaxial reference design

The following diagram shows how to connect the S/PDIF Audio Interface to an Optical TOSLINK Transmitter. This is an example.

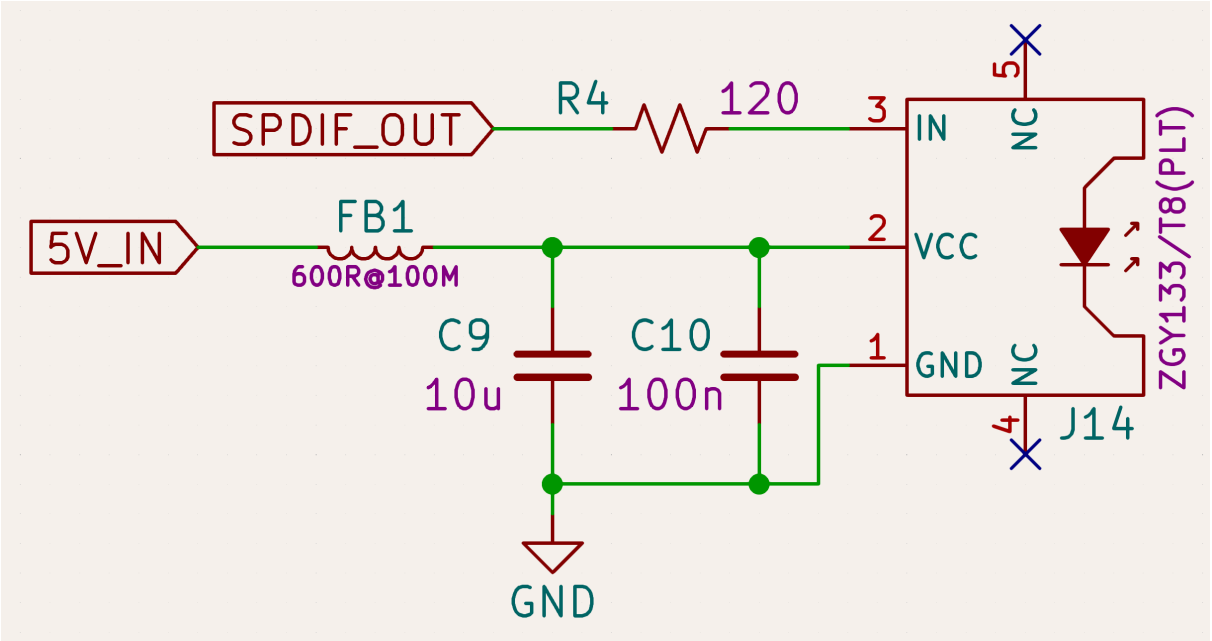

Figure 4: StreamPlay S/PDIF Optical reference-design

2.2.3 External USB Audio Interface

With the StreamPlay, a USB-to-I2S/DSD Bridge can be used as an additional Audio Interface (XMOS, Amanero, CT7601, etc.). The Bridge can be connected to the exposed USB interface, directly or with a USB HUB in between.

The possibility of using an external USB Audio Interface has been implemented to provide the freedom of choice to the StreamPlay customer.
For example, if it is required to support a higher sample frequency, or it is required to support DSD playback.
Depending on the selected USB Audio Interface, it is possible to achieve PCM playback up to 768 kHz / 32 bit and DSD playback up to DSD512.

If an external USB Audio Interface is connected to the system, it is possible to disable one or both internal Audio Interfaces (I2S, S/PDIF), to avoid any interference.

2.3 Wi-Fi and Bluetooth

2.3.1 Internal Wi-Fi and Bluetooth

The StreamPlay has an internal Wi-Fi and Bluetooth chipset, based on the Realtek RTL8723DS controller. This onboard interface provides Wi-Fi 802.11 b/g/n and Bluetooth 4.2 capabilities to the system, it does not need additional components.

For optimal Wi-Fi and Bluetooth performance, it is required to connect an external antenna to the IPEX connector of the StreamPlay. The antenna must meet the requirements of IEEE 802.11 b/g/n Wi-Fi standard running at 2.4 GHz frequency. The detailed parameters are listed in the table below.

Parameter	Requirement
Frequency Range	2.4 GHz ~ 2.5 GHz
Impedance	50 Ohm
VSWR	2 (Max)
Reflection Loss	-10 dB (Max)
Connector	IPEX

If the enclosure of the customer product based on the StreamPlay is made with metal, it is recommended to place the antenna externally.
If placed internally, the metal chassis might act as a Faraday cage, deteriorating the performance of the signal transmission and reception.

2.3.2 External Wi-Fi and Bluetooth

With the StreamPlay it is possible to use an external Wi-Fi/Bluetooth module, connected to the exposed USB interface, directly or with a USB HUB in between.

The possibility to use an external Wi-Fi/Bluetooth module has been implemented to provide the freedom of choice to the StreamPlay customer. For example, if it is required to support dual-band Wi-Fi (2.4 GHz and 5 GHz) or it is required to use more than one antenna for Wi-Fi and Bluetooth transmission.

If an external Wi-Fi/Bluetooth module is connected to the system, the internal one will be disabled, to avoid any interference.

The StreamPlay has been validated with the following external Wi-Fi/Bluetooth module. Additional information on this application can be provided upon request.

Module Part-Number	FG6221EUUC-07
Manufacturer	FN-Link
Description	Wi-Fi Dual-band 1×1 11ac + Bluetooth 4.2 Combo Module
Wi-Fi support	IEEE 802.11 a/b/g/n/ac
Bluetooth support	Bluetooth V4.2+HS, BLE
Certification	CE, FCC

2.4 10/100M Ethernet Interface

The StreamPlay has an internal 10/100M Ethernet chipset, based on the Realtek RTL8201F controller. The exposed pins of the interface can be connected to a RJ45 connector, either with a transformer in between, or directly to a connector with embedded magnetic transformers.
In both cases, the magnetic transformers must be compliant with the 10/100M IEEE 802.3u standard requirements.

In the following diagram, it is shown how to connect the 10/100M Ethernet interface to a RJ45 connector with embedded magnetic transformers, as an example.

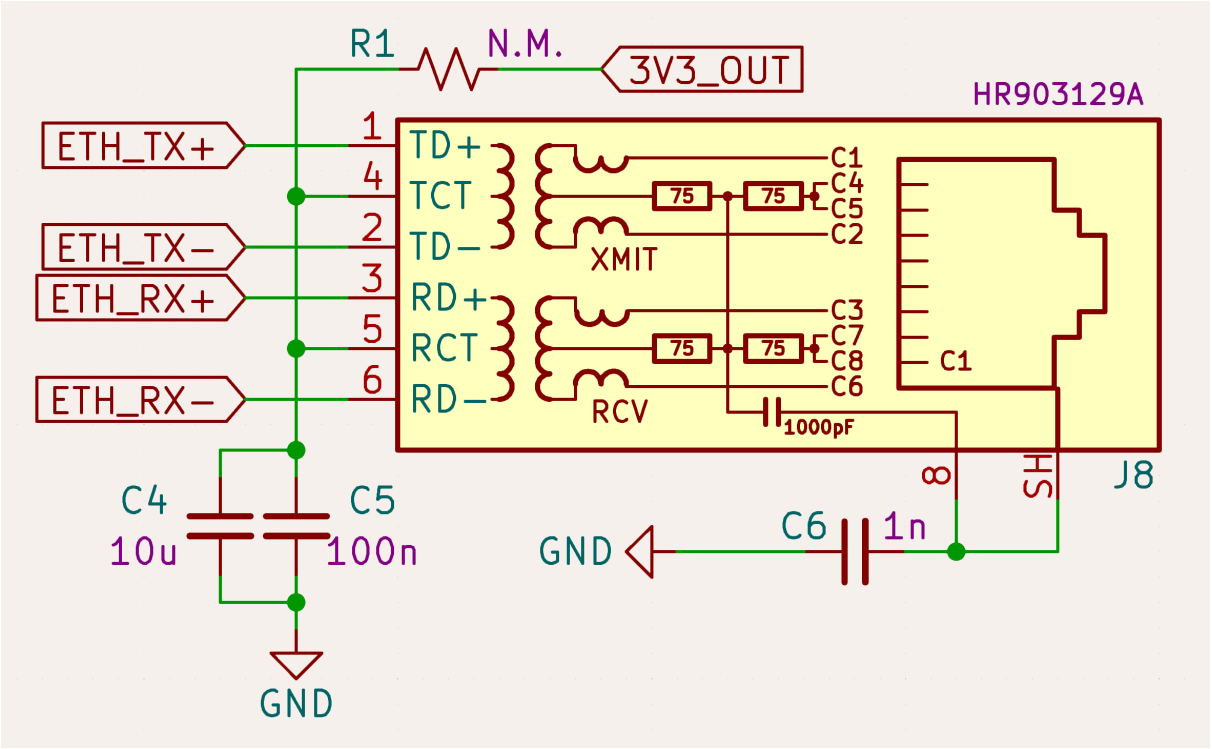

Figure 5: StreamPlay Ethernet reference-design

2.5 USB Interface

2.5.1 USB Host

The StreamPlay provides a high-speed USB 2.0 host interface. The interface can be connected to a USB port or a USB HUB, on the customer carrier-board.
In both cases, it is recommended to add a common mode choke in between and to route the USB data lines as a 90 Ω differential pair.

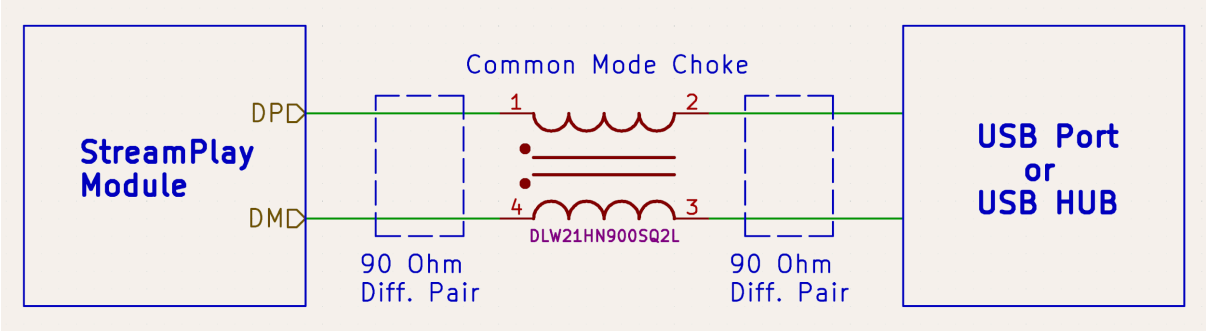

Figure 6: StreamPlay USB-Host connection

2.5.2 USB OTG Interface

The StreamPlay features an additional USB-OTG port. It is located on the bottom side of the board, exposed on a 4-pin FFC connector (1.0 mm pitch, contacts on top).
By default, this port is used during production, for debugging purposes and for flashing the Volumio OS on the EMMC.

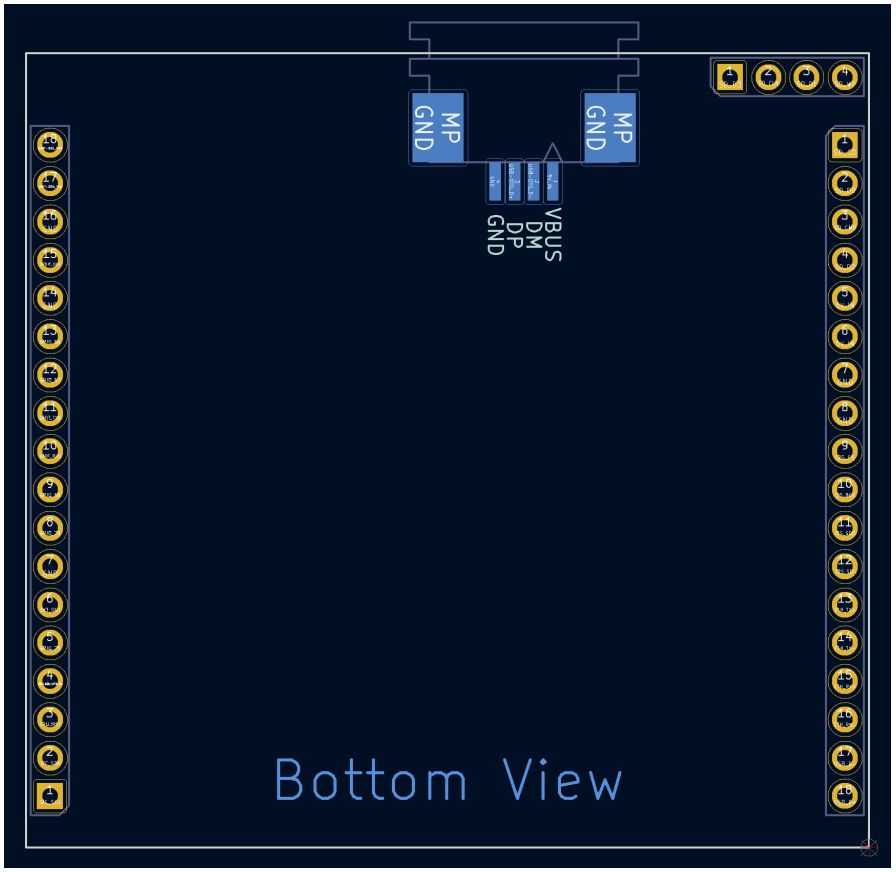

Figure 7: StreamPlay USB-OTG pinout

If an additional USB 2.0 port is required by the customer application, this port can be enabled and set as host mode with a dedicated dt-overlay, included in the Volumio OS image. This will provide a second independent USB 2.0 port, in addition to the first one exposed on the 2.0 mm pitch header.

To make use of this additional USB port, it is required to connect the FFC connector of the StreamPlay to the customer carrier board with an FFC cable, with a length equal to or lower than 10 mm.

2.6 UART Serial Interface

The StreamPlay provides a Serial UART interface, commonly used to exchange information between Volumio OS and an external MCU implemented on the customer carrier board. An example of the recommended connection is shown in the diagram below.

Figure 8: StreamPlay UART connection

If the customer application requires advanced controls and advanced input selection capabilities, it is recommended to implement an external MCU on the customer carrier board, connecting it to the StreamPlay via the Serial UART Interface.
If, for example, it is required to change the volume level from a Rotary Encoder connected to the MCU, or to show the volume level on an external I2C display connected to the MCU, Volumio OS running on the StreamPlay and the MCU must exchange information to keep each other aligned and perform some actions.

An extensive Serial API has been developed and implemented on the StreamPlay for this purpose. Additional information can be provided upon request.

2.7 Power Supply

The StreamPlay can be powered with a single power supply, with a voltage between 4.9 V and 5.2 V (nominal 5.0 V). The peak current consumption is around 500 mA, the normal working current consumption is 180 mA on average.

A clean and stable power supply is important for system stability and Wi-Fi performance. It is recommended to use 10uF and 100uF decoupling capacitors in parallel, to reduce the ripple of the power supply and filter the high-frequency noise.

If you have any questions, requests or recommendations, please contact us at leo@volumio.org

Figure Table