



LibreSync
High Performance Network Media Module
1x1 Dual Band 802.11 a/b/g/n/ac
With Integrated Bluetooth 5.0 + Low Energy (BLE)

LIBRE SYNC

LS9X Data Sheet

Rev: 1.0

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1. Introduction

Libre Wireless, LS9X-AC11DBT is a high-performance media/audio streaming module. LS9X-AC11DBT comes with Dual core Coretex-A7 CPU and Dual Neon/VFPU subsystems running at 1.3GHz, 802.11a/b/g/n/ac, Bluetooth v5.0 Low Energy (BLE) and USB OTG.

LS9X-AC11DBT have different variants, it differs only in memory configuration.

LS9X-AC11DBT-A: 128MB of DDR3 DRAM memory and 128MB of NAND Flash

LS9X-AC11DBT-C: 256MB of DDR3 DRAM memory and 256MB of NAND Flash

LS9X-AC11DBT-AC: 512MB of DDR3 DRAM memory and 256MB of NAND Flash

2. Module Feature Summary

Key Features:

- Dual core Cortex-A7 CPU and Dual Core Neon/VFPU running at 1.3GHz
- GC4A, Airplay, Home-kit, Spotify-Connect, DLNA DMP/DMR/DMS etc.,
- Features: Hi-Rez Audio (192KHz/24bits) Stereo
- LPCM, MP3, AAC/AAC+, AC3, OGG Vorbis, HE-AAC, WMA decode capability
- Lossless audio decodes, like FLAC, APE and DSD Support
- Supports WMV9, AVS, GC4A
- Libre in-built code protection and secure transaction
- 1DES/3DES/AES/CSS/CPRM/DTCP copy protection
- I2S interface:
- LS9X module can be configured only as **I2S-Master mode**
- DSD over PCM

- SPDIF Output (Muxed with I2S port TXD Line - optional)



In LS9X, SPDIF and I2S are mutually exclusive. I2S is available only when SPDIF output is disabled, and vice versa.

- 1x USB 2.0 OTG (For Debug Shell, Ethernet, Firmware update, USB Media Playback)
- 1x UART (For HOST-MCU communication)
- 2x I2C, 1x SPI, GPIOs
- Wi-Fi 1x1 802.11a/b/g/n/ac with 1x Dual Band Antenna
- Bluetooth 5.0 and Low Energy
- Wi-Fi/BT concurrent coexistence
- Standard configuration includes 256MB/256MB and 256MB/512MB (NAND/DDR3)

WLAN Features:

- IEEE 802.11 a/b/g/n and 802.11ac compliant
- 1x1 spatial stream with data rates up to MCS9 (433Mbps)
- Excellent WLAN power save modes features.

Bluetooth Features:

- Bluetooth v5.0
- Bluetooth Low Energy (LE)
- Best-in-class BT/Wi-Fi coexistence performance
- Intelligent Adaptive Frequency Hopping support.
- BT Profiles: A2DP 1.2, AVRCP 1.3, SPP, HFP, HSP, HOGP

3. LibreSync Features

LibreSync modules have extensive software features for connected media streaming and control applications. These include system level control and interface features as well as networking features. Please refer to the full “Master Feature List” for details of supported features.

Note: Platform features can vary based on module configuration/derivatives and commercial engagement details.

4. Block Diagram

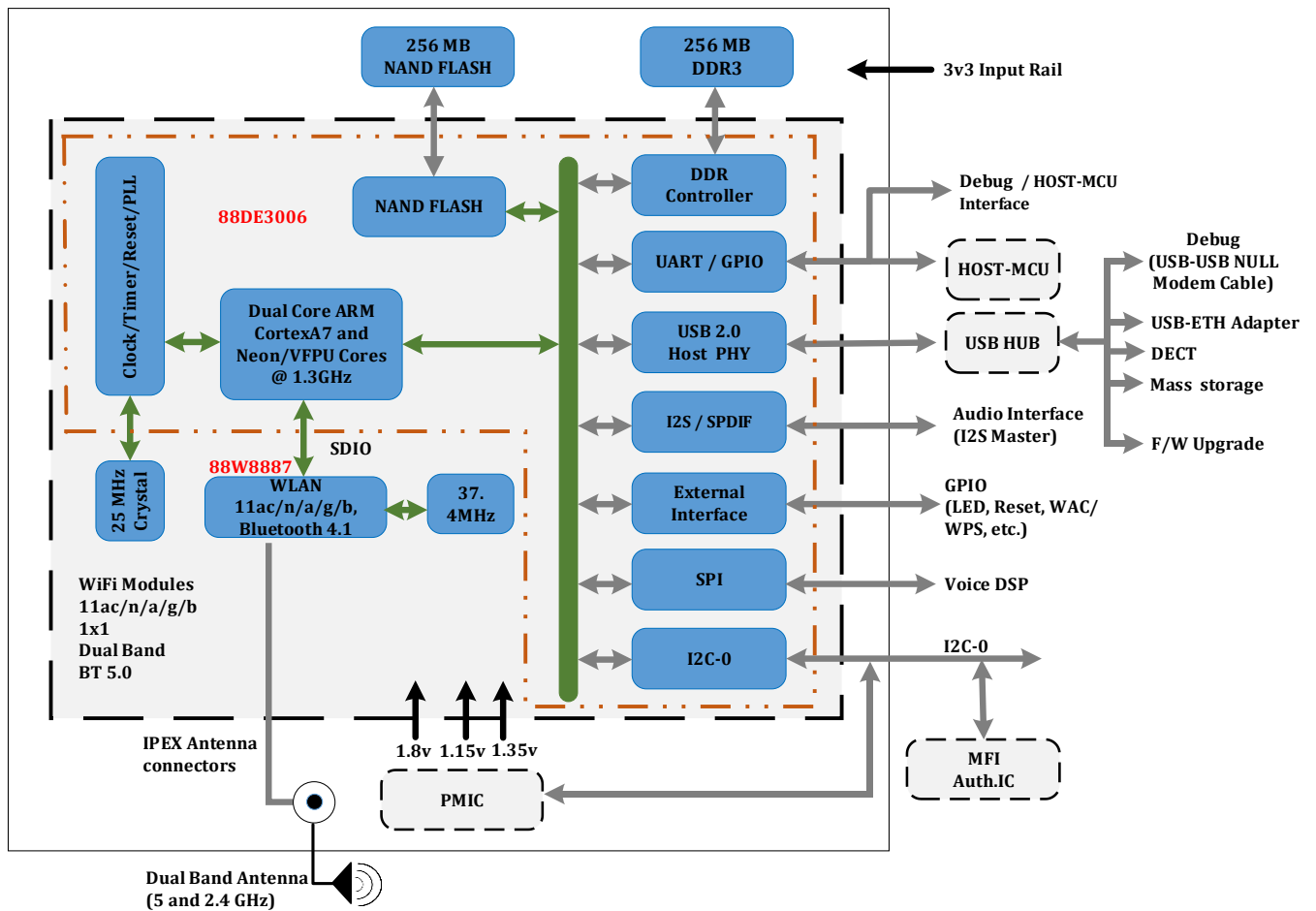


Figure 4-1: LS9X-AC11DBT-C MODULE Block Diagram

5. Specifications

5.1. General Specification

Parameter	Description / Values
Model	LS9X-AC11DBT-C/LS9X-AC11DBT-AC MODULE
Product Name	Network Media Module
Standard	<ul style="list-style-type: none"> • Wi-Fi – IEEE802.11a, IEEE802.11b, IEEE802.11g, IEEE802.11n, IEEE802.11ac standards • BT – v2.1+EDR, v5.0 BT Low Energy (BLE)
Data Transfer Rate	1,2,5.5,6,11,12,18,22,24,30,36,48,54,60,90,120,150, 300, and maximum of physical layer rate of 390 Mbps
Frequency Band	2.4 / 5.0 GHz
Input Voltage	3.3 V ± 5 %
Ripple Requirement	20-30 mVpk-pk
Operating Temperature	-5°C to + 70°C
Dimensions	50 mm x 40 mm x 7 mm (L x W x H) ± 0.2mm

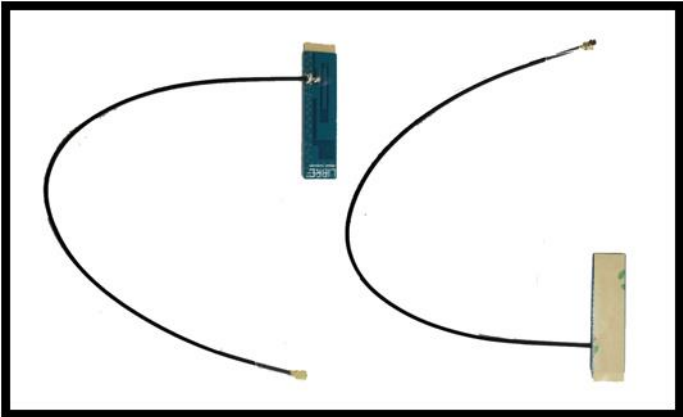
5.2. Wi-Fi Specification

Parameter	Description / Values
Standard	1x1 Dual Band 802.11 a/b/g/n/ac
Operating Band Support	Dual Band <ul style="list-style-type: none"> • 2.4GHz: 2.412 ~ 2.483 GHz • 5.0 GHz: 5.180GHz ~ 5.825GHz
Network Architecture	<ul style="list-style-type: none"> • Infrastructure Mode • Concurrent STA/AP and STA/STA
Transmit Output Power (+/- 2dBm tolerance)	<ul style="list-style-type: none"> • 2.4 GHz • 802.11b: 18 dBm (11Mbps) • 802.11g: 15 dBm (54Mbps) • 802.11n: 14 dBm (MCS 7) • 5.0 GHz • 802.11a: 14 dBm (54Mbps) • 802.11n: 13 dBm (MCS 7) • 802.11ac: 15 dBm (MCS 0) • 802.11ac: 13 dBm (MCS7) • 802.11ac: 10 dBm (MCS 9)
Receiver Sensitivity	TBD
Security	WEP 64&128 bit, WPA, WPA-PSK, WPA2, WPA2-PSK, WPS, IEEE 802.1x, IEEE 802.11i

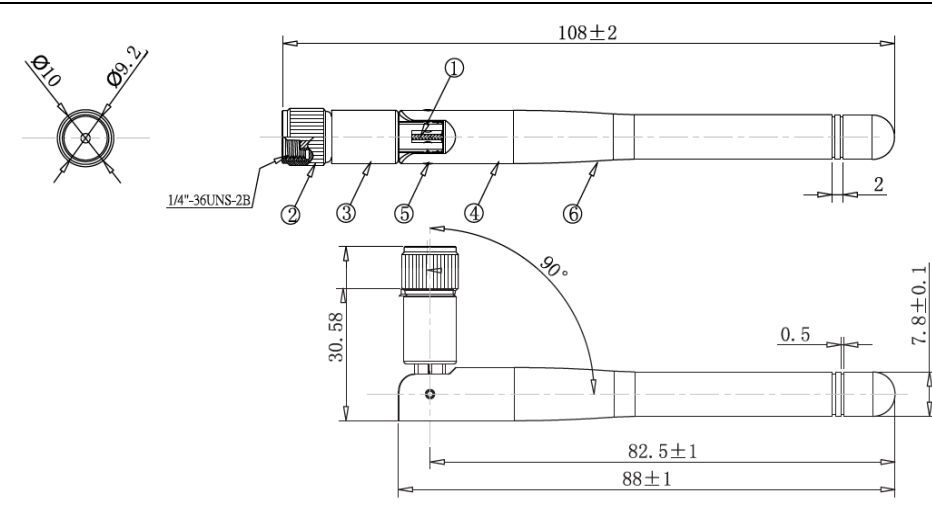
5.3. Bluetooth Specification

Parameter	Description / Values
Standard	V2.1+EDR, V3.0+HS, V5.0 BT Low Energy (BLE)
Audio CODEC Support	SBC
Profile Support	A2DP 1.2, AVRCP 1.3
Sampling Rates	<ul style="list-style-type: none"> • 44.1 KHz, 48 KHz • Joint Stereo 32 KHz
Coexistence Support	Intelligent AFH (Advanced Frequency Hopping) – Channel Assessment WLAN/Bluetooth Coexistence (BCA) Protocol Support
Data Rate	<ul style="list-style-type: none"> • GFSK: 1 Mbps • $\pi/4$ DQPSK: 2 Mbps • 8DPSK: 3 Mbps
Modulation	GFSK, $\pi/4$ DQPSK, 8DPSK
Operation Channel	0 to 78 for BDR / EDR 0 to 39 for BLE
Frequency Range	2.4 GHz (2402 -2480 MHz)
Security	AES Encryption
Transmit Output Power (+/- 1dBm tolerance)	<ul style="list-style-type: none"> • BDR: 6 dBm • EDR: 4 dBm • LE: 6 dBm
Receiver Sensitivity	<ul style="list-style-type: none"> • BDR: < -86 dBm • EDR: < - 84 dBm • LE: <-86 dBm

5.4. Antenna Specification

Antenna Module	LSANT-1C-180
Antenna Gain	$\leq 3.5\text{dBi}$
Manufacturer of Antenna	Golden Smart International Co., Ltd
Antenna Images	

5.5. Rubber Antenna Specification

Antenna Model	RC1WFI0886A																																			
Antenna Gain	≤ 2.0 dBi																																			
Manufacturer of Antenna	Suzhou Point Positive Electronic Technology Co., Ltd																																			
Antenna Image	 <p>SPECIFICATION</p> <ol style="list-style-type: none"> Frequency Range: 2.4--5.8Ghz Impedance: 50Ω VSWR : ≤ 2.0 Polanization: Vertical Radiation: Omni Gain: 2dBi <table border="1"> <thead> <tr> <th>NO</th> <th>PARTNAME</th> <th>DESCRIPTION</th> <th>Q'TY</th> <th>Part P/NO</th> </tr> </thead> <tbody> <tr> <td>⑥</td> <td>Connettor</td> <td>SM3033 Reverse</td> <td>1PCS</td> <td></td> </tr> <tr> <td>⑤</td> <td>Antenna Cover</td> <td>L153mm*□13.0mm TPEE Black</td> <td>1PCS</td> <td></td> </tr> <tr> <td>④</td> <td>Rivet</td> <td>L5.1mm*□2.4mm POM Black</td> <td>2PCS</td> <td></td> </tr> <tr> <td>③</td> <td>Antenna Base</td> <td>L28.2*□13.0mm PBT Black</td> <td>1PCS</td> <td></td> </tr> <tr> <td>②</td> <td>Antenna Base</td> <td>L29.4*□13.0mm PC Black</td> <td>1PCS</td> <td></td> </tr> <tr> <td>①</td> <td>Cable</td> <td>RG-178 Cable 50Ω</td> <td>1PCS</td> <td></td> </tr> </tbody> </table>	NO	PARTNAME	DESCRIPTION	Q'TY	Part P/NO	⑥	Connettor	SM3033 Reverse	1PCS		⑤	Antenna Cover	L153mm*□13.0mm TPEE Black	1PCS		④	Rivet	L5.1mm*□2.4mm POM Black	2PCS		③	Antenna Base	L28.2*□13.0mm PBT Black	1PCS		②	Antenna Base	L29.4*□13.0mm PC Black	1PCS		①	Cable	RG-178 Cable 50Ω	1PCS	
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①	Cable	RG-178 Cable 50Ω	1PCS																																	

5.6. LS9X-AC11DBT Module Ordering Information

Product Number	Wi-Fi Tx/Rx	Wi-Fi Bands	Bluetooth	Memory	Module Dimension* (±0.2mm)
LS9X-AC11DBT-A	802.11 b/g/n/ac 1x1	2.4 / 5.0 GHz	5.0 BT + BLE	128 MB NAND 128 MB DDR3	50mmx40mmx 3.5mm (L x W x H) ± 0.2mm
LS9X-AC11DBT-C	802.11 b/g/n/ac 1x1	2.4 / 5.0 GHz	5.0 BT + BLE	256 MB NAND 256 MB DDR3	50mmx40mmx 3.5mm (L x W x H) ± 0.2mm
LS9X-Ac11DBT-AC	802.11 b/g/n/ac 1x1	2.4 / 5.0 GHz	5.0 BT + BLE	256 MB NAND 512 MB DDR3	50mmx40mmx 3.5mm (L x W x H) ± 0.2mm

Note:

*The LS9X-AC11DBT-A/LS9X-AC11DBT-C/LS9X-AC11DBT-AC module height does not include the measurement of bottom-side media-connector.

6. Mechanical, Connectors and Interfaces

6.1. Physical Module

Physical module dimension is 50mm x 40mm x 3.5mm (L x W x H) ± 0.2mm.

[Figure 6.1-1](#), [6.1-2](#) represent module's top and bottom.

6.1.1. Module Manufacturer

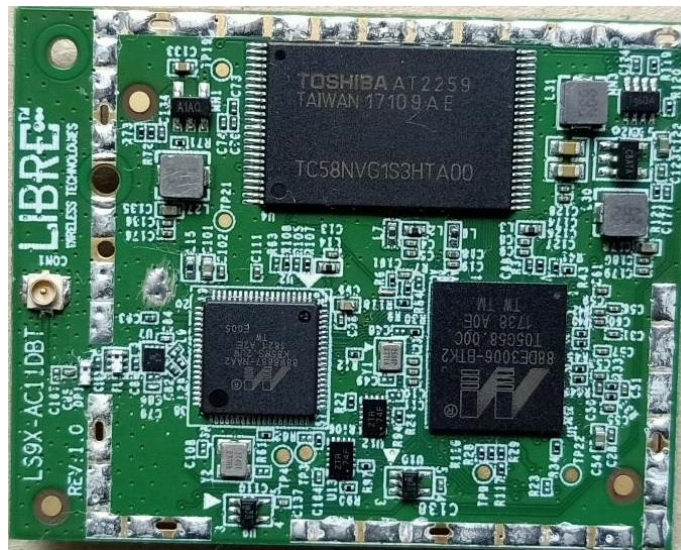


Figure 6.1-1: LS9X-AC11DBT Module Top

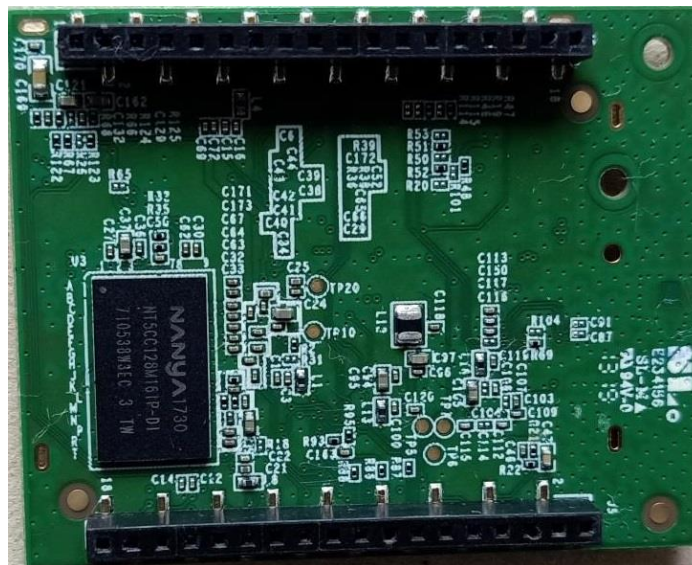


Figure 6.1-2: LS9X-AC11DBT Module Bottom

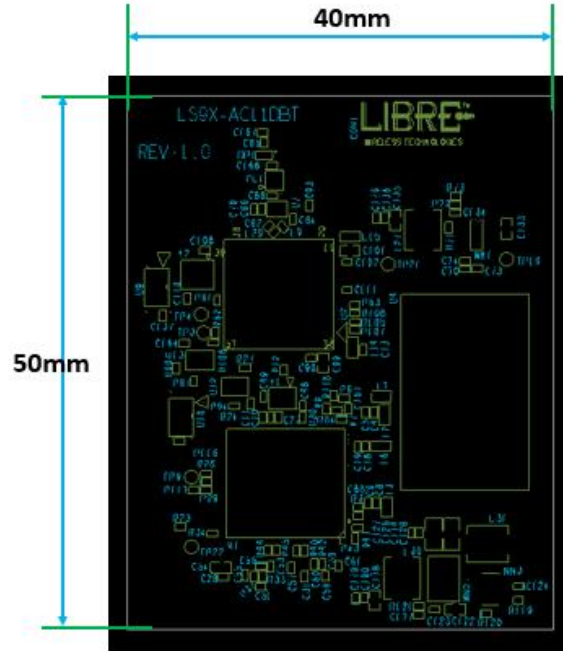


Figure 6.1-3: LS9X-AC11DBT MODULE Top View Mechanical Dimension

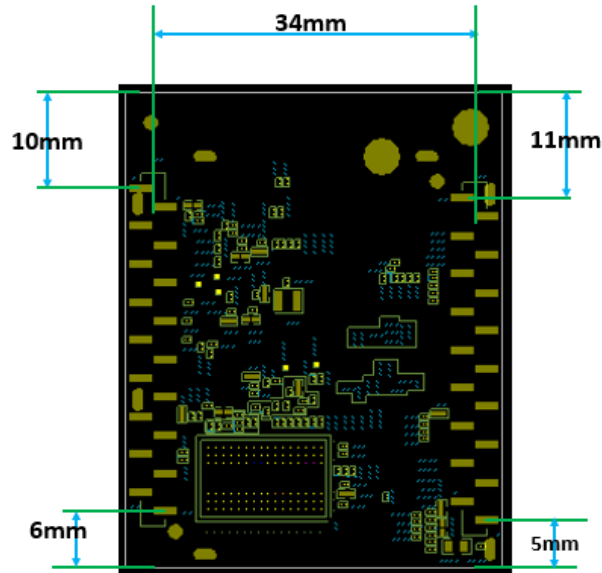


Figure 6.1-4: LS9X-AC11DBT MODULE Bottom View Mechanical Dimension

Note: The module dimension is measured in millimeters (mm).

6.2. Media Connector Specification

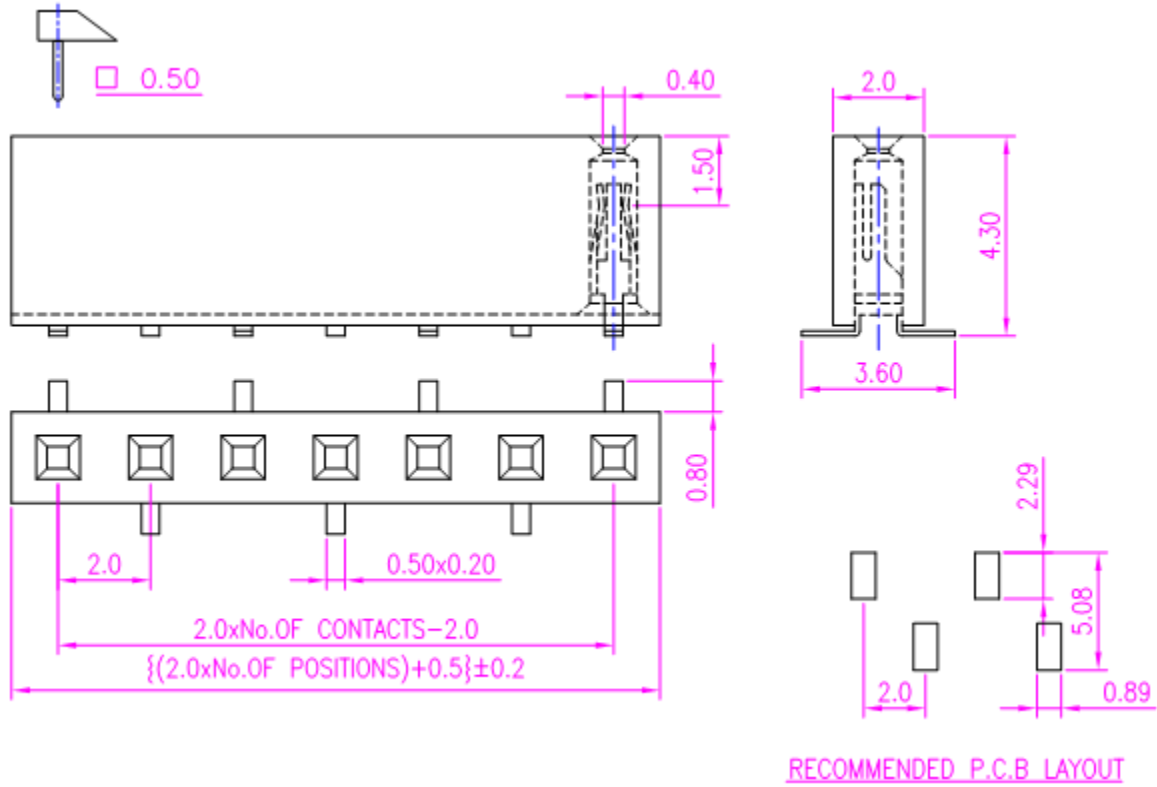


Figure 6.2-1: Media Connector

6.3. Pin Descriptions

6.3.1. Connector

Connector J5		
Pin No.	Signal Name	Functionality
1	GND	GROUND
2	BG2CDp_URTO_TXD	Host MCU communication /Debugging
3	UART0_RXD	Host MCU communication /Debugging
4	RESET	POWER ON RESET INPUT
5	I2S_TXD	I2S_TXD/SPDIF_OUT/I2S_RXD2
6	I2S_RXD	I2S Input channel
7	I2S_LRCLK	AUDIO O/P LR CLOCK
8	I2S_BCLK	AUDIO O/P BIT CLOCK
9	I2S_MCLK	AUDIO O/P MASTER CLOCK
10	GND	GND
11	I2C0_SCL	I2C0_SCL/GPIO6
12	I2C0_SDA	I2C0_SDA/GPIO7

Connector J6		
Pin No.	Signal Name	Functionality
19	PWR_3.3V	3V3 POWER SUPPLY I/P
20	PWR_3.3V	3V3 POWER SUPPLY I/P
21	GND	GND
22	GND	GND
23	USB_VBUS	USB VBUS PORT1
24	GND	GND
25	USB_DM	USB DP
26	USB_DP	USB_DP
27	GND	GND
28	TW1_SDA_IO13	GPIO13
29	TW1_SCL_IO12	GPIO12
30	GND	GND

13	GND	GND
14	SPI1_SCLK	GPIO8/SPI1_SCLK
15	SPI1_SDO	GPIO9/SPI1_SDO
16	SPI1_SDI	GPIO10/SPI1_SDI
17	SPI1_SS0n	GPIO5/SPI1_SS0n
18	GND	GND

31	BT_ACT_LED	BT_ACT_LED
32	WLAN_ACT_LED	WLAN_ACT_LED
33	GPIO15	GPIO15
34	GPIO14	GPIO14
35	USB_DEV_BOOT_EN	USB_DEV_BOOT_EN
36	GND	GND

6.4. GPIO Details

Interface	Signal Name	GPIO No	Type	Availability/Usage
SPI	SPI1_SS0	GPO5	Output	YES
	SPI1_SCLK	GPO8	Output	
	SPI1_SDO	GPI09	Input/output	
	SPI1_SDI	GPI010	Input/output	
UART	UART_RXD	GPI03	Input/output	Yes HOST UART/Debug / GPIO Interface
	UART_TXD	GPI04	Output	
I2C interface	I2C_SCL	GPI06	Input/output	Yes I2C interface for Crypto, ACP CODEC, and HOST-MCU Communication (optional)
	I2C_SDA	GPI07	Input/output	

7. Power Consumption

- The default power consumption when not connected to Access-Point is **246mA** at average operational condition and **252mA** at peak operational condition.
- The default power consumption when connected to Access-Point is **256mA** at average operational condition and **264mA** at peak operational condition.
- Power consumption during Google Cast for Audio (GCast) play back is **272mA** at average operational condition and **358mA** at peak operational condition.
- **LS9X GCast Configuration:**

	Idle	GCast Music Playback	BT Streaming	Network Standby Mode
I (A)	0.267	0.291	0.294	0.223
V (V)	3.3	3.3	3.3	3.3
P (W)	0.881	0.96	0.97	0.735

- **LS9X AVS Configuration:**

	Idle	AVS Music Playback	BT Streaming	Network Standby Mode
I (A)	0.267	0.291	0.294	0.223
V (V)	3.3	3.3	3.3	3.3
P (W)	0.881	0.96	0.97	0.735



Power number may vary based on features.

8. Environmental

8.1. Storage Conditions

The calculated shelf life in a sealed bag is 12 months if stored between 0°C and 70°C at less than 90% relative humidity (RH).

After the bag is opened, devices that are subjected to solder reflow or other high temperature processes must be handled in the following manner:

- Mounted within 168 hours in factory conditions, i.e. <30°C at 60% RH.
- Storage humidity needs to be maintained at <10%RH.
- Baking is necessary if the customer exposes the component to air for over 168 hrs.
 - Baking conditions: 125°C for 8hrs.

9. Reference Schematics

Note: For detailed schematics of LS9X refer to the latest *LS9X-EVK Schematic*, file in the portal

9.1. EVK Block Diagram

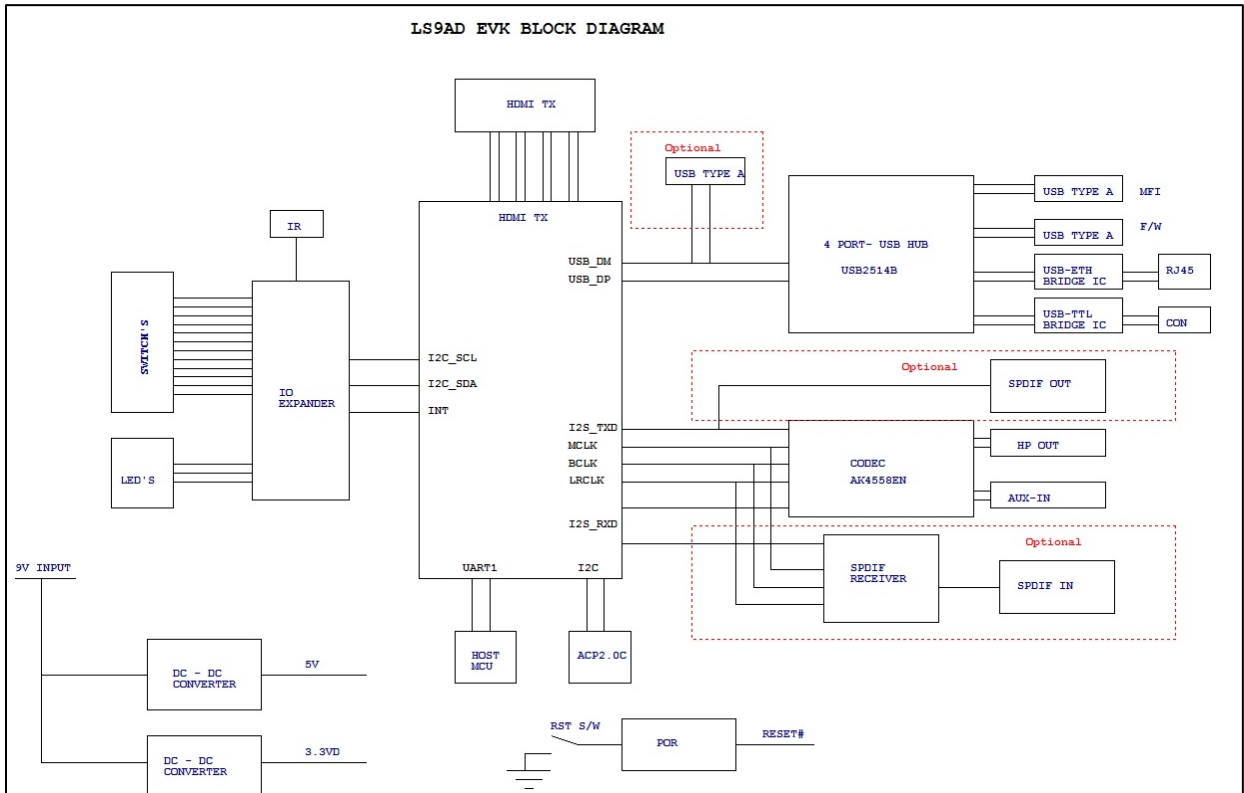


Figure 9.1-1: LS9X EVK Block Diagram

9.2. MFI 3.0C Authentication Circuit

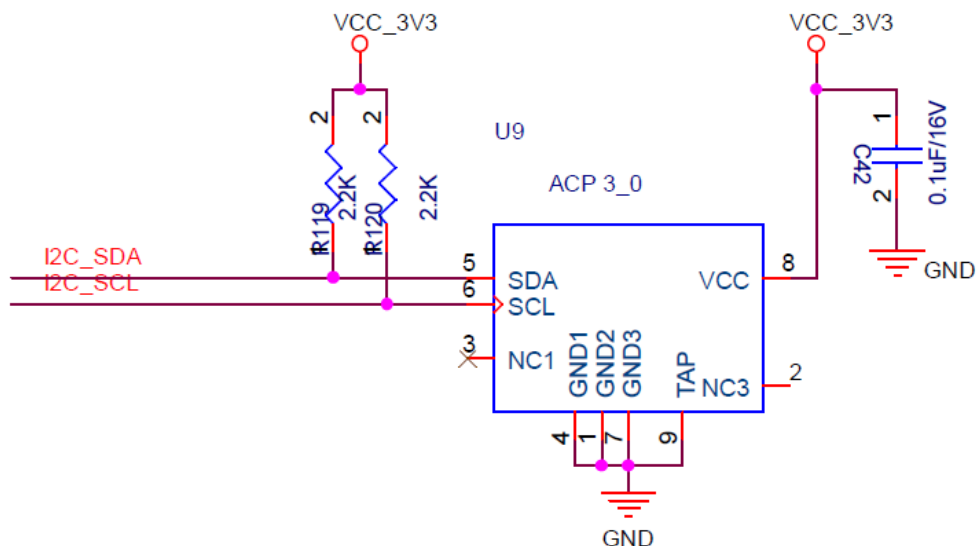


Figure 9.3-1: LS9X EVK ACP 3.0

10. Appendix

10.1. FCC Statement

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

- i. This device may not cause harmful interference, and
- ii. This device must accept any interference received, including interference that may cause undesired operation.

Any Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment. The modular can be installed or integrated in mobile or fix devices only. This modular cannot be installed in any portable device.

FCC Radiation Exposure Statement:

This modular complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

This modular must be installed and operated with a minimum distance of 20 cm between the radiator and user body. If the FCC identification number is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. This exterior label can use wording such as the following: “Contains Transmitter Module FCC ID: 2ADBM-LS9X-AC11DBT Or Contains FCC ID: 2ADBM-LS9X-AC11DBT, Contains Transmitter Module FCC ID: 2ADBM-LS9X-AC11DBT Or Contains FCC ID: 2ADBM-LS9X-AC11DBT”.

When the module is installed inside another device, the user manual of the host must contain below warning statements;

- 1 This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:
 - i. This device may not cause harmful interference.
 - ii. This device must accept any interference received, including interference that may cause undesired operation.
- 2 Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

The devices must be installed and used in strict accordance with the manufacturer's instructions as described in the user documentation that comes with the product.

Any company of the host device which install this modular with limit modular approval should perform the test of radiated emission and spurious emission according to FCC part 15C: 15.247 and 15.209 requirement, only if the test result comply with FCC part 15C : 15.247 and 15.209 requirement, then the host can be sold legally.

11. Disclaimer

THE MATERIALS AND INFORMATION ARE PROVIDED “AS IS” WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT.

We use reasonable efforts to include accurate and up-to-date information in this document. It does not however, make any representations as its accuracy or completeness of information. Use of this document is at your own risk. Libre Wireless Technologies, its suppliers, and other parties involved in creating and delivering this document’s contents shall not be liable for any special, indirect, incidental, or consequential damages, including without limitation, lost revenues or lost profits.

FCC Statement

1. This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) This device may not cause harmful interference.

(2) This device must accept any interference received, including interference that may cause undesired operation.

2. Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

NOTE:

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

Reorient or relocate the receiving antenna.

Increase the separation between the equipment and receiver.

Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

Consult the dealer or an experienced radio/TV technician for help.

IC STATEMENT

This device complies with Industry Canada's licence-exempt RSSs. Operation is subject to the following two conditions:

(1) This device may not cause interference; and

(2) This device must accept any interference, including interference that may cause undesired operation of the device.

Cet appareil est conforme aux CNR exemptes de licence d'Industrie Canada . Son fonctionnement est soumis aux deux conditions suivantes :

(1) Ce dispositif ne peut causer d'interférences ; et

(2) Ce dispositif doit accepter toute interférence , y compris les interférences qui peuvent causer un mauvais fonctionnement de l'appareil.

IC Radiation Exposure Statement

The modular can be installed or integrated in mobile or fix devices only. This modular cannot be installed in any portable device .

This modular complies with IC RF radiation exposure limits set forth for an uncontrolled

environment. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter. This modular must be installed and operated with a minimum distance of 20 cm between the radiator and user body.

Cette modulaire doit être installé et utilisé à une distance minimum de 20 cm entre le radiateur et le corps de l'utilisateur.

If the IC number is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. This exterior label can use wording such as the following:

“Contains IC: 20276-LS9X”

when the module is installed inside another device, the user manual of this device must contain below warning statements;

1. This device complies with Industry Canada’s licence-exempt RSSs. Operation is subject to the following two conditions:

(1) This device may not cause interference; and

(2) This device must accept any interference, including interference that may cause undesired operation of the device.

2. Cet appareil est conforme aux CNR exemptes de licence d'Industrie Canada . Son fonctionnement est soumis aux deux conditions suivantes :

(1) Ce dispositif ne peut causer d'interférences ; et

(2) Ce dispositif doit accepter toute interférence , y compris les interférences qui peuvent causer un mauvais fonctionnement de l'appareil.

The devices must be installed and used in strict accordance with the manufacturer's instructions as described in the user documentation that comes with the product