



**LibreSync & GC4A & Google Voice Assistant  
High Performance Network Media Module  
1x1 Dual Band 802.11 a/b/g/n/ac  
With Integrated Bluetooth 4.1 + Low Energy (BLE)**

**LIBRE SYNC**

**LS9AD Data Sheet**

**Module: LS9AD-AC11DBT and LS9AD-AC11DBT-GV**

**Rev: 1.6**

## 1. Introduction

Libre Wireless, LS9AD-AC11DBT is a high performance media / audio streaming module. LS9AD-AC11DBT comes with Dual core Coretex-A7 CPU and Dual Neon/VFPU subsystems running at 1.3GHz, 256MB of DDR3 DRAM memory and 256MB of NAND Flash, an 802.11a/b/g/n/ac, Bluetooth v4.1 Low Energy (BLE), Multi- standard Video encoding, 2D/3D Graphics Engine and a USB OTG. This Module also supports antenna diversity.

Libre Wireless, LS9AD-AC11DBT-GV is a high-performance media / voice module. LS9AD-AC11DBT-GV comes with Dual core Coretex-A7 CPU and Dual Neon/VFPU subsystems running at 1.3GHz, 512MB of DDR3 DRAM memory and 512MB of NAND Flash, an 802.11a/b/g/n/ac, Bluetooth v4.1 Low Energy (BLE), Multi- standard Video encoding, 2D/3D Graphics Engine and a USB OTG. This Module also supports antenna diversity.

## 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, WinX, Miracast, etc
- Features: Hi-Rez Audio (192KHz/24bits), Stereo Decode, HD Graphics and HD Video On Screen Display
- LPCM, MP3, AAC/AAC+, AC3, OGG Vorbis, HE-AAC, WMA decode capability
- Lossless audio decode, like FLAC, APE and DSD
- Support for JPEG/GIF
- Supports WMV9, AVS, VP6,
- Libre's advanced multi-zone audio streaming technology (DDMS)
- Libre Crypto IC for code protection and secure transaction feature options
- Data Transport De-MUX
- 1DES/3DES/AES/CSS/CPRM/DTCP copy protection
- Feature Rich 2D/3D Hardware Graphics Engine,

- I2S interface
  - LS9AD module can be configured only as **I2S-Master mode**
  - DSD over PCM
- SPDIF Output (Muxed with I2S port TXD Line - optional)



In LS9AD, SPDIF and I2S are mutually exclusive. I2S is available only when SPDIF output is disabled, and vice versa.

- HDMI1.4 transmitter MAC and PHY with HDCP 1.4
- 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 2x Dual Band Antenna Diversity support
- Bluetooth 4.1 and Low Energy
- WiFi/BT concurrent coexistence
- Standard configuration includes 256MB /512MB NAND FLASH and 256MB /512MB DDR3

### WLAN Features

- IEEE 802.11 a/b/g/n and 802.11ac compliant
- Dual band 1T1R supporting STB and Receive Beamforming

### Bluetooth Features

- Bluetooth specification v2.1+EDR
- Bluetooth specification 3.0+HS (802.11 AMP) compliance
- Bluetooth v4.1 Low Energy (LE)

- Best-in-class BT/Wi-Fi coexistence performance
- BT Profiles: A2DP 1.2, AVRCP 1.3, SPP, HFP, HSP, HOGP

### LS9AD-AC11DBT-GV Features

- Digital MIC can be directly connected to I2S Rx line
- Consists 512MB of NAND Flash and DDR3
- Module dimensions and connector details are same as LS9AD-AC11DBT module variant.

## 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 “LibreSync Feature List” for details of supported features.



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

## 4. Block Diagram

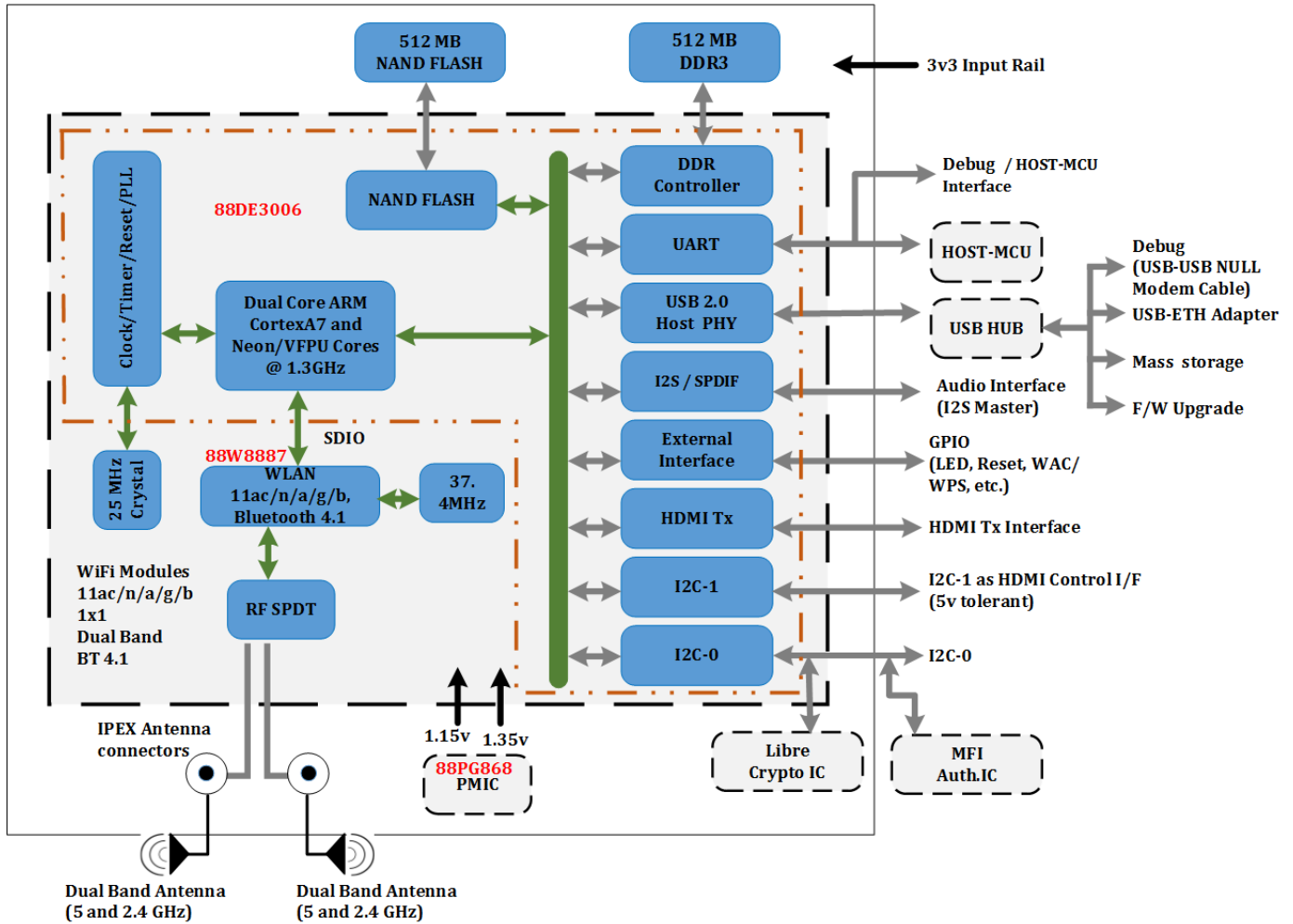


Figure 4-1: LS9AD-AC11DBT MODULE Block Diagram

## 5. Specifications

### 5.1. General Specification

Parameter	Description / Values
Model	LS9AD-AC11DBT / LS9AD-AC11DBT-GV MODULE
Product Name	Network Media Module
Standard	<ul style="list-style-type: none"> <li>Wi-Fi – IEEE802.11a, IEEE802.11b, IEEE802.11g, IEEE802.11n, IEEE802.11ac standards</li> </ul>

Parameter	Description / Values
	<ul style="list-style-type: none"> <li>BT – v2.1+EDR, v4.1 BT Low Energy (BLE)</li> </ul>
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	56mm x 41 mm x 6.8 mm (L x W x H) ± 0.2mm

## 5.2. Wi-Fi Specification

Parameter	Description / Values
Standard	IEEE802.11a, IEEE802.11b, IEEE802.11g, IEEE802.11n, and IEEE802.11ac (draft compliant)
Data Rate	<ul style="list-style-type: none"> <li>802.11b : 11, 5.5, 2, 1 Mbps</li> <li>802.11a/g : 54, 48, 36, 24, 18, 12, 9, 6 Mbps</li> <li>802.11n : MCS 0 to 7 for HT20MHz MCS 0 to 7 for HT40MHz</li> <li>802.11ac : MCS 0 to 9 for HT40MHz MCS 0 to 9 for HT80MHz</li> </ul>
Modulation	<ul style="list-style-type: none"> <li>802.11b : CCK, DQPSK, DBPSK</li> <li>802.11g : 64QAM, 16QAM, QPSK, BPSK</li> <li>802.11n : 64QAM, 16QAM, QPSK, BPSK</li> <li>802.11ac : 256 QAM, 64QAM, 16QAM, QPSK, BPSK</li> </ul>

Parameter	Description / Values
Network Architecture	<ul style="list-style-type: none"> <li>• Ad-hoc mode (Peer-to-Peer)</li> <li>• Infrastructure Mode</li> </ul>
Operation Channel	2.4GHz <ul style="list-style-type: none"> <li>• 11: (Ch. 1-11) – United States</li> <li>• 13: (Ch. 1-13) – Europe</li> <li>• 5.0 GHz</li> <li>• 21: (Ch. 36, 40, 44, 48, 52.....161, and 165) – USA</li> <li>• 19: (Ch. 36, 40, 44, .....136, and 140) - Europe</li> </ul>
Frequency Range	2.4GHz: 2.412 ~ 2.483 GHz 5.0 GHz: 5.180GHz ~ 5.825GHz
Receiver Sensitivity	<ul style="list-style-type: none"> <li>• 2.4 GHz               <ul style="list-style-type: none"> <li>○ 802.11b : &lt; -92 dBm (1Mbps)</li> <li>○ 802.11g : &lt; - 70 dBm (54Mbps)</li> </ul> </li> </ul>

Parameter	Description / Values
	<ul style="list-style-type: none"> <li>○ 802.11n : &lt; -69 dBm (MCS 7)</li> <li>• 5.0 GHz               <ul style="list-style-type: none"> <li>○ 802.11a : &lt; -65 dBm (54Mbps)</li> <li>○ 802.11n : &lt; -64dBm (MCS 7)</li> </ul> </li> <li>• 802.11ac :               <ul style="list-style-type: none"> <li>○ -76 dBm (MCS 0)</li> <li>○ -60 dBm (MCS7)</li> <li>○ -54 dBm (MCS 9)</li> </ul> </li> </ul>
Security	WEP 64&128 bit, WPA, WPA-PSK, WPA2, WPA2-PSK, WPS, IEEE 802.1x, IEEE 802.11i

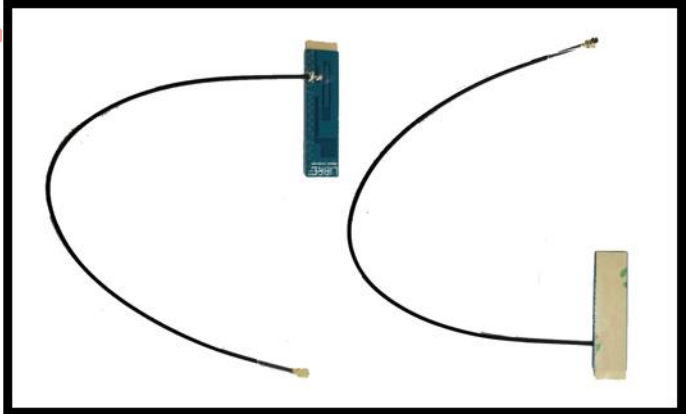
### 5.3. Bluetooth Specification

Parameter	Description / Values
Standard	V2.1+EDR, V3.0+HS, V4.1 BT Low Energy (BLE)
Audio CODEC Support	SBC
Profile Support	A2DP 1.2, AVRCP 1.3, SPP, HFP, HSP, HOGP
Sampling Rates	<ul style="list-style-type: none"> <li>• 44.1 KHz, 48 KHz</li> <li>• Joint Stereo 32 KHz</li> </ul>
Coexistence Support	Intelligent AFH (Advanced Frequency Hopping) – Channel Assessment WLAN/Bluetooth Coexistence (BCA) Protocol Support
Data Rate	<ul style="list-style-type: none"> <li>• GFSK : 1 Mbps</li> <li>• <math>\pi/4</math> DQPSK : 2 Mbps</li> <li>• 8DPSK : 3 Mbps</li> </ul>



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"> <li>• BDR : 6 dBm</li> <li>• EDR : 4 dBm</li> <li>• LE : 6 dBm</li> </ul>
Receiver Sensitivity	<ul style="list-style-type: none"> <li>• BDR: &lt; -86 dBm</li> <li>• EDR : &lt; - 84 dBm</li> <li>• LE : &lt;-86 dBm</li> </ul>

## 5.4. Antenna Specification

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

## 5.5. LS9AD-AC11DBT Module Ordering Information

Product Number	Wi-Fi Tx/Rx	Wi-Fi Bands	Bluetooth	Memory	Module Height* (±0.2mm)
LS9AD-AC11DBT	802.11 b/g/n/ac 1x1	2.4 / 5.0 GHz	4.1 BT + BLE	256 MB NAND 256 MB DDR3	56 mm x 41mm x 6.8 mm (L x W x H) ± 0.2mm
LS9AD-AC11DBT-GV	802.11 b/g/n/ac 1x1	2.4 / 5.0 GHz	4.1 BT + BLE	512 MB NAND 512 MB DDR3	56 mm x 41mm x 6.8 mm (L x W x H) ± 0.2mm

**Note:**

- The LS9AD-AC11DBT / LS9AD-AC11DBT module height does not include the measurement of bottom-side media-connector.

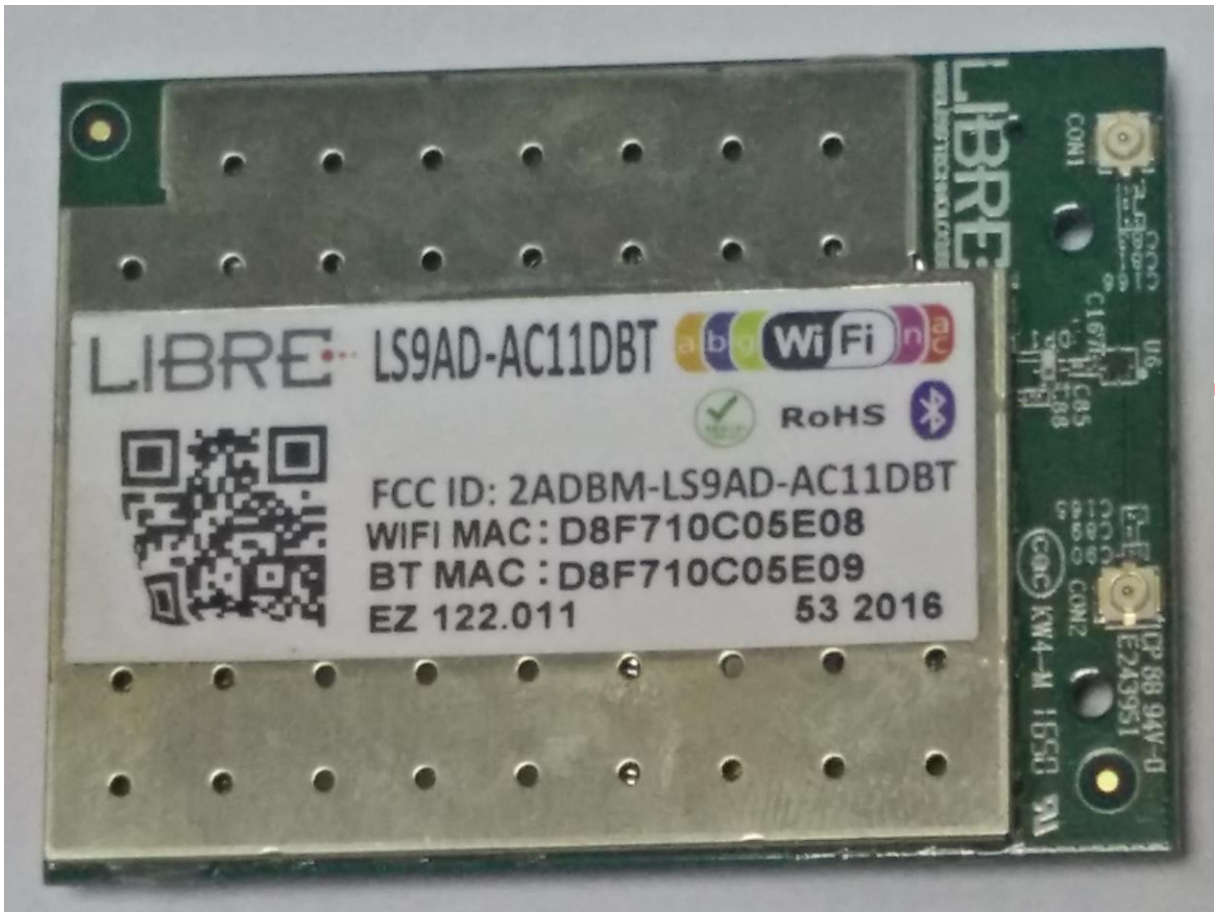
## 6. Mechanical, Connectors and Interfaces

### 6.1. Physical Module

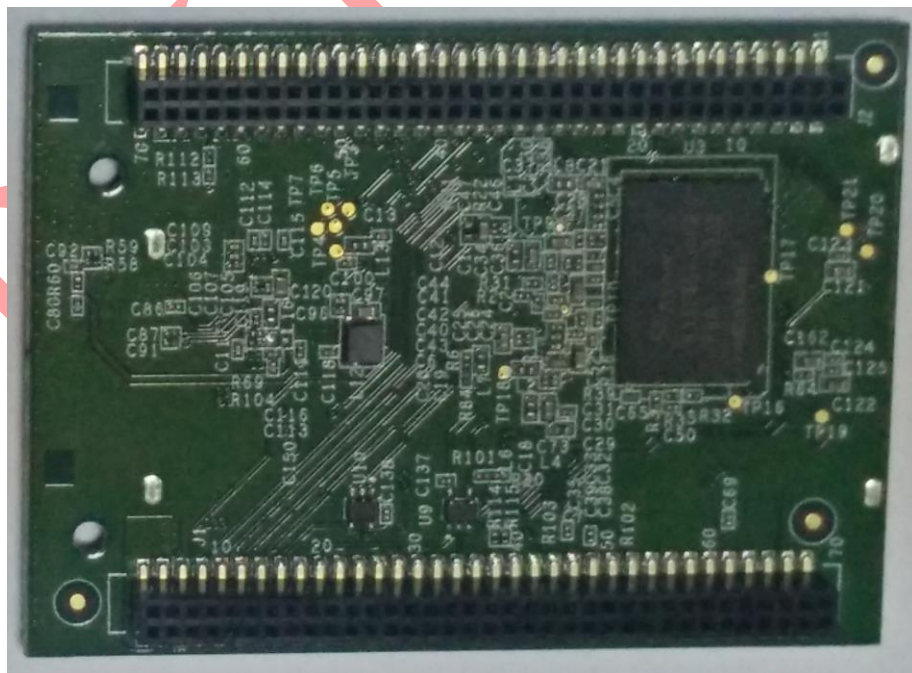
Physical module dimension is 56 mm x 41mm x 6.8 mm (L x W x H) ± 0.2mm.

Height of the module varies depending on the LS9AD Module variant used; for information on height of the module see Section [5.2.2. LS9AD-AC11DBT Module Ordering Information](#).

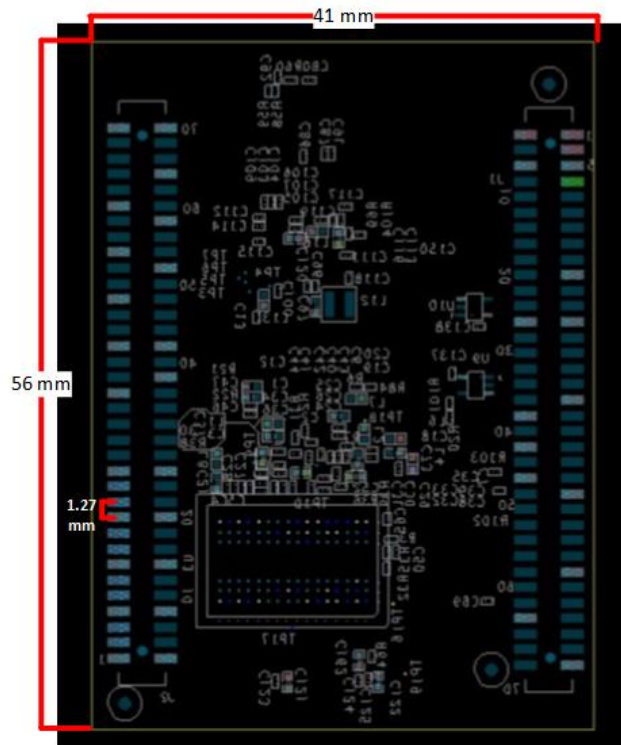
[Figure 6-1](#) and [Figure 6-2](#) represent module's top and bottom.



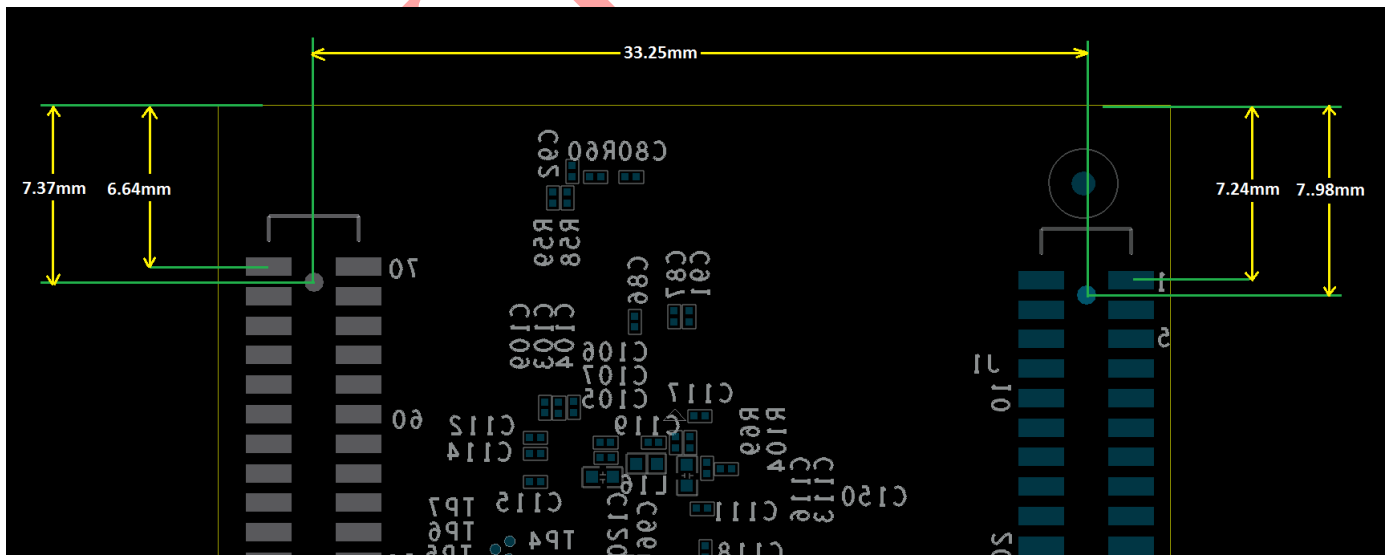
**Figure 6.1-1: LS9AD-AC11DBT Module Top**



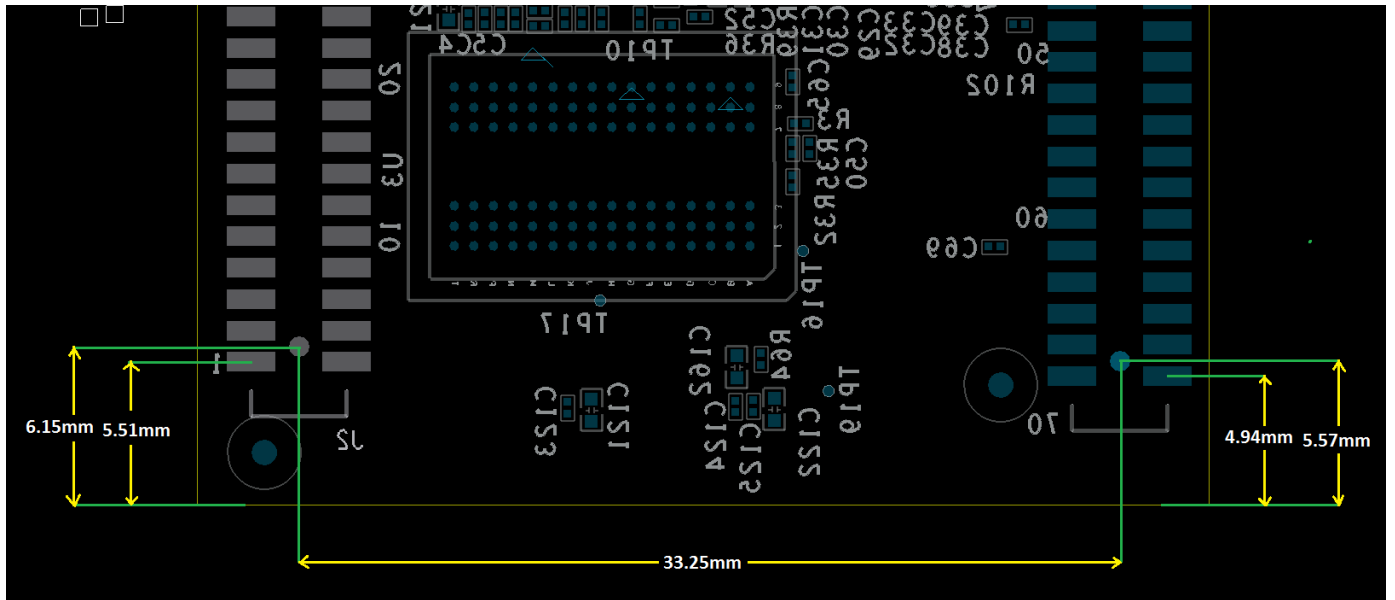
**Figure 6.1-2: LS9AD-AC11DBT Module Bottom**



**Figure 6.1-3: LS9AD-AC11DBT MODULE Top View Mechanical Dimension (1)**



**Figure 6.1-4: LS9AD-AC11DBT MODULE Top View Mechanical Dimension (2)**



**Figure 6.1-5: LS9AD-AC11DBT MODULE Top View Mechanical Dimension (3)**

**Note:**

- The module dimension is measured in millimetres (mm).

## 6.2. Media Connector Specification

**SPECIFICATIONS**

Rated Current:1.0AMP  
Contact Resistance:20mΩ Max  
Withstand Voltage:500V AC/DC  
Insulation Resistance:1000MΩ Min  
Operation Temperature:-40°c to +105°c

Contact Material:Phosphor Bronze  
Contact Plating:Au Over Ni  
Insulator Material:Polyester(UL94V-0)  
Standard: PA6T  
Max.Processing Temp: 230°C for 30-60 seconds  
(260°C for 10 seconds)

**Ordering Information**

2443 02 XX X S XX M U 01

No. of Pins Per Row 2*50	Insulator Material Option A=BK-PBT B=BK-PA66 C=BK-PA6T D=BK-PA46 F=BK-LCP	Contact Plating G0:Gold Flash G2:5U" Gold G3:10U" Gold G4:15U" Gold G5:30U" Gold S0:Gold Flash/Tin SN:tin
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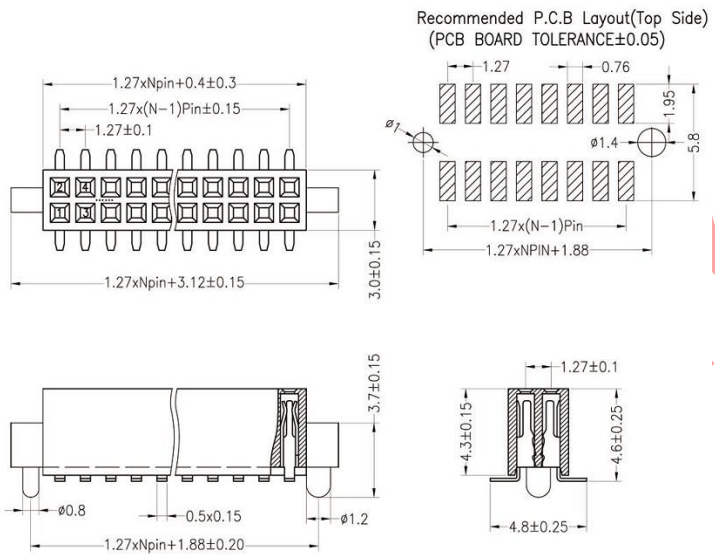


Figure 6.2-1: Media Connector


## 6.3. Pin Descriptions

### 6.3.1. Connector-1

LS9AD-AC11DBT-GV: Media Connector Pin out: J1					
FUNCTIONALITY	SIGNAL NAME			SIGNAL NAME	FUNCTIONALITY
3V3 POWER SUPPLY I/P	3V3	1	2	3V3	3V3 POWER SUPPLY I/P
	3V3	3	4	NC	NO CONNECT
	GND	5	6	GND	GROUND
I2C_SCL	I2C0_SCL/GPI O6	7	8	MCLK	AUDIO O/P MASTER CLOCK
I2C_SDA	I2C0_SDA/GPI O7	9	10	BCLK	AUDIO O/P BIT CLOCK
POWER ON RESET INPUT	RESET#	11	12	LRCLK	AUDIO O/P LR CLOCK

NO CONNECT	NC	13	14	I2S_TXD/I2S_RXD2	I2S_TXD/SPDIF_OUT/I2S_RXD2
NO CONNECT	NC	15	16		
USB VBUS PORT1	USB_VBUS_P1	17	18		
GROUND	GND	19	20	I2S_RXD1	I2S Input channel 1 & 2
USB DP	USB_DP_P1	21	22		
USB DM	USB_DM_P1	23	24		
GROUND	GND	25	26	GND	GROUND
NO CONNECT	NC	27	28	NC	NO CONNECT
NO CONNECT	NC	29	30	NC	NO CONNECT
NO CONNECT	NC	31	32	NC	NO CONNECT
NO CONNECT	NC	33	34	I2S_RXD1	I2S Input channel 1 & 2
GROUND	GND	35	36		
NO CONNECT	NC	37	38	GND	GROUND
NO CONNECT	NC	39	40		
NO CONNECT	NC	41	42	GND	GROUND
Host MCU communication/Debugging	UATXD/GPIO4	43	44		
Host MCU communication/Debugging	UARXD/GPIO3	45	46	GND	GROUND
GROUND	GND	47	48	NC	NO CONNECT
NO CONNECT	UART1_TXD/NC	49	50	NC	NO CONNECT
NO CONNECT	UART1_RXD/NC	51	52	NC	NO CONNECT

GPIO8/SPI1_SCLK	GPIO8/SPI1_S CLK	53	54	NC	NO CONNECT
GPIO9/SPI1_SDO	GPIO9/SPI1_S DO	55	56	NC	NO CONNECT
GROUND	GND	57	58	NC	NO CONNECT
GPIO10/SPI1_SDI	GPIO10/SPI1_ SDI	59	60	NC	NO CONNECT
NO CONNECT	NC	61	62	NC	NO CONNECT
NO CONNECT	NC	63	64	<b>GND</b>	<b>GROUND</b>
GPIO5/SPI1_SS0n	GPIO5/SPI1_SS 0n	65	66	NC	NO CONNECT
USB_ID	USB_ID	67	68	NC	NO CONNECT
GROUND	GND	69	70	NC	NO CONNECT

 **Note:**

- Revision 2.0 module of LS9AD, HOST MCU communication is on pin 43(Tx) and 45(Rx); pin 49(Tx) and 51(Rx).

**For LS9AD-AC11DBT-GV Modules**

- Pin J1.8 → I2S\_MCLK will be configured as PDM\_CLK when Google voice assistant image is updated.
  - There will be no MCLK output and this pin must be connected to PDM MEMS MIC.
- Pin J1.20 → I2S\_RXD will be configured as PDM\_DAT when Google voice assistant image is updated.
  - There will be no AUX input and this pin must be connected to PDM MEMS MIC.

### 6.3.2. Connector-2

LS9AD-AC11DBT-GV: Media Connector Pin out: J2					
FUNCTIONALITY	SIGNAL NAME			SIGNAL NAME	FUNCTIONALITY
GROUND	GND	1	2	GND	GROUND



HDMI TX DATA2 +	HDMI_TX_2P	3	4	NC	NO CONNECT
HDMI TX DATA2 -	HDMI_TX_2M	5	6	NC	NO CONNECT
GROUND	GND	7	8	GND	GROUND
HDMI TX DATA1 +	HDMI_TX_1P	9	10	NC	NO CONNECT
HDMI TX DATA1 -	HDMI_TX_1M	11	12	NC	NO CONNECT
GROUND	GND	13	14	GND	GROUND
HDMI TX DATA0 +	HDMI_TX_0P	15	16	NC	NO CONNECT
HDMI TX DATA0 -	HDMI_TX_0M	17	18	NC	NO CONNECT
GROUND	GND	19	20	GND	GROUND
HDMI TX CLOCK +	HDMI_TX_CLKP	21	22	NC	NO CONNECT
HDMI TX CLOCK -	HDMI_TX_CLKM	23	24	NC	NO CONNECT
GROUND	GND	25	26	GND	GROUND
HDMI TX CEC/GPIO14 - Antenna Diversity	CEC/GPIO14	27	28	NC	NO CONNECT
HDMI I2C CLOCK/GPIO12 (10K external pull up resistor required)	HDMISCK/GPIO12	29	30	NC	NO CONNECT
HDMI I2C DATA/GPIO13 (10K external pull up resistor required)	HDMISD/GPIO13	31	32	NC	NO CONNECT
HDMI HOT PLUG/GPIO15 - TSF (10K external pull up resistor required)	HTPLG/GPIO15	33	34	NC	NO CONNECT
GROUND	GND	35	36	NC	NO CONNECT
NO CONNECT	NC	37	38	GND	GROUND
NO CONNECT	NC	39	40	NC	NO CONNECT
GROUND	GND	41	42	GND	GROUND
NO CONNECT	NC	43	44	NC	NO CONNECT
NO CONNECT	NC	45	46	NC	NO CONNECT
GROUND	GND	47	48	NC	NO CONNECT
NO CONNECT	NC	49	50	NC	NO CONNECT

NO CONNECT	NC	51	52	GND	GROUND
GROUND	GND	53	54	NC	NO CONNECT
NO CONNECT	NC	55	56	NC	NO CONNECT
NO CONNECT	NC	57	58	GND	GROUND
GROUND	GND	59	60	NC	NO CONNECT
NO CONNECT	NC	61	62	NC	NO CONNECT
NO CONNECT	NC	63	64	GND	GROUND
NO CONNECT	NC	65	66	NC	NO CONNECT
NO CONNECT	NC	67	68	NC	NO CONNECT
GROUND	GND	69	70	GND	GROUND

## 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	
HDMI control signals	TW1_SCL	GPI012	Input/output (requires external pull up)	YES
	TW1_SDA	GPI013	Input/output (requires external pull up)	
	HDMI_HPD	GPI015	Input/output (requires external pull up)	
	HDMI_CEC	GPI014	Input/output (requires external pull up)	No Used to control the antenna diversity S/W
UART	UART_RXD	GPI03	Input/output	Yes
	UART_TXD	GPI04	Output	

				HOST UART/Debug / GPIO Interface
I2C interface	I2C_SCL	GPIO6	Input/output	Yes
	I2C_SDA	GPIO7	Input/output	I2C interface for Crypto, ACP CODEC, and HOST-MCU Communication (optional)

## 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.

## 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 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 LS9AD refer to the latest **LS9AD-EVK Schematic**, file in the portal

### 9.1. EVK Block Diagram

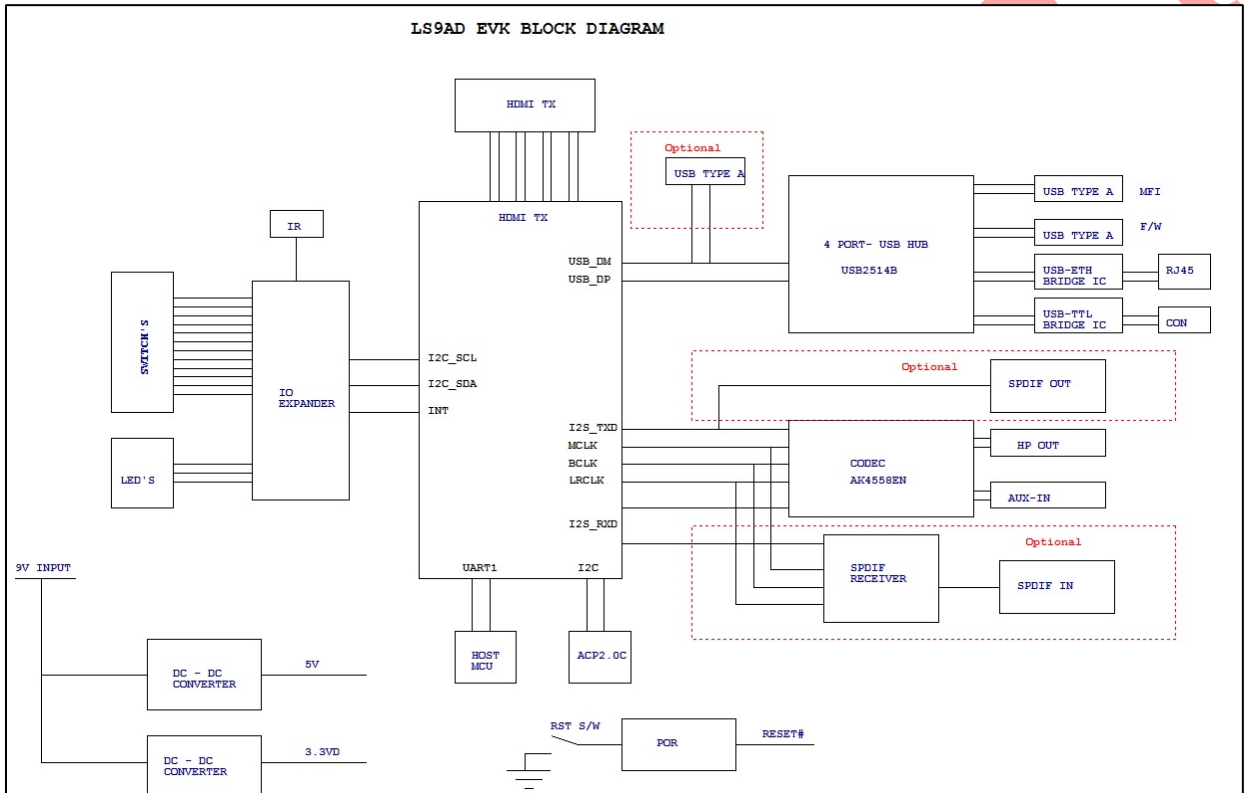


Figure 8-1: LS9AD EVK Block Diagram

## 9.2. MFI 2.0C Authentication Circuit

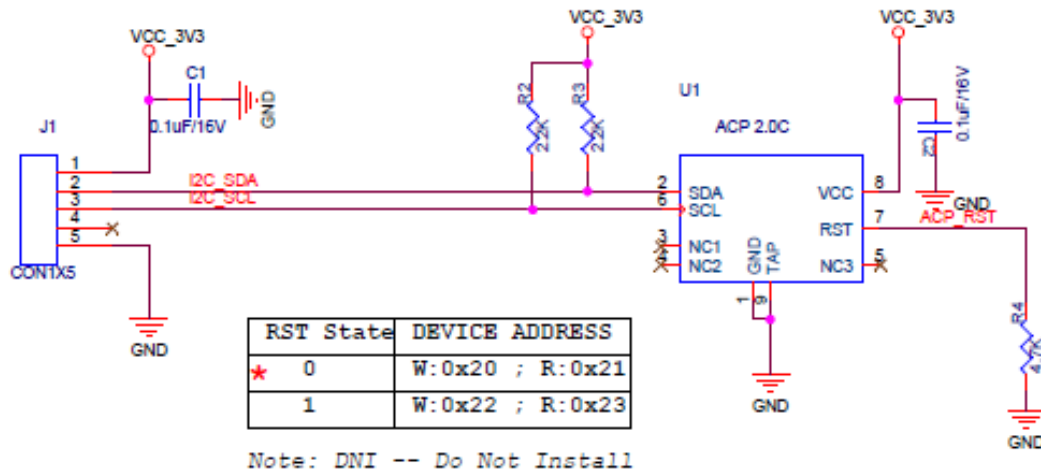


Figure 8-2: LS9AD EVK Block Diagram

## 10. Disclaimer

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## 11. Appendix

### 11.1. 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-LS9ADAC11DBT Or Contains 2ADBM-LS9ADAC11DBT"

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 ,15.407 and 15.209 requirement, Only if the test result comply with FCC part 15C : 15.247,15.407 and 15.209 requirement , then the host can be sold legally.