

Inforce 6309™

User Guide

002685 Rev H

November 13, 2018

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E	7/July/2017	➤ Updated Preface & Section 1	MSS
F	24/October/2018	➤ Updated Figure 1 ➤ Added section 3.4.3	DJ
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Checked By	SS/DJ	13/November/2018
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Preface

This User Guide familiarizes the end user with the specification, interfaces, setup, and usage of the Inforce 6309 board.

Intended Audience

This User Guide is intended for technically qualified personnel. It is not intended for general audiences.

Document Organization

The chapters in this document are arranged as follows:

1. Scope
2. Hardware Specification
3. System Setup and Usage
4. Appendix A
5. Contact Information

Conventions

The following conventions are used in this document:



CAUTION

Cautions warn the user about how to prevent damage to hardware or loss of data.



NOTE

Notes call attention to important information.

References

1. IFC6309X Schematics, 002546
2. IFC6309 Hardware Reference Manual, 002547

Note

This document is subject to change without notice.

Support Information

Every effort has been made to ensure the accuracy of the User Guide. If you have any comments, questions, or ideas regarding this document, contact Inforce's technical support at: techsupport@inforcecomputing.com

Terminology

The table below gives descriptions to some common terms used in the User Guide.

Term	Description
CSI	Camera Serial Interface
DDR	Double Data Rate
DSI	Display Serial Interface
eMMC	Embedded Multimedia Card
HD	High Definition
HDMI	High-Definition Multimedia Interface
I2C	Inter-Integrated Circuit
JTAG	Joint Test Action Group
LED	Light-Emitting Diode
MAC	Media Access Control
MIPI	Mobile Industry Processor Interface
OS	Operating System
OTG	On The Go
PCIe	Peripheral Component Interconnect Express
SATA	Serial Advanced Technology Attachment
SBC	Single Board Computer
SDC	Secure Digital Controller
SPI	Serial Peripheral Interface
UART	Universal Asynchronous Receiver Transmitter
USB	Universal Serial Bus

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1. SCOPE

This document describes the system setup and usage of Qualcomm Snapdragon 410 processor-based Inforce 6309 Single Board Computer (SBC).

Anti-Static Handling Procedures

SBC has exposed PCB and chips. Accordingly, proper anti-static precautions should be employed when handling the kit, including:

- Use a grounded anti-static mat
- Use a grounded wrist or foot strap

Hardware Identification Labels

Labels are present on the Inforce 6309 board. The following information is conveyed on the Inforce 6309 board:

- Serial Number
- Ethernet MAC Address
- Wi-Fi and BT MAC Address
- Product Revision

2. HARDWARE SPECIFICATION

2.1 INTRODUCTION

The Inforce 6309 SBC can be used to develop, test, and deploy end-user product solutions around Qualcomm Snapdragon 410, APQ8016 processor.

2.2 ARCHITECTURE

The functional diagram of the Inforce 6309 SBC is shown below.

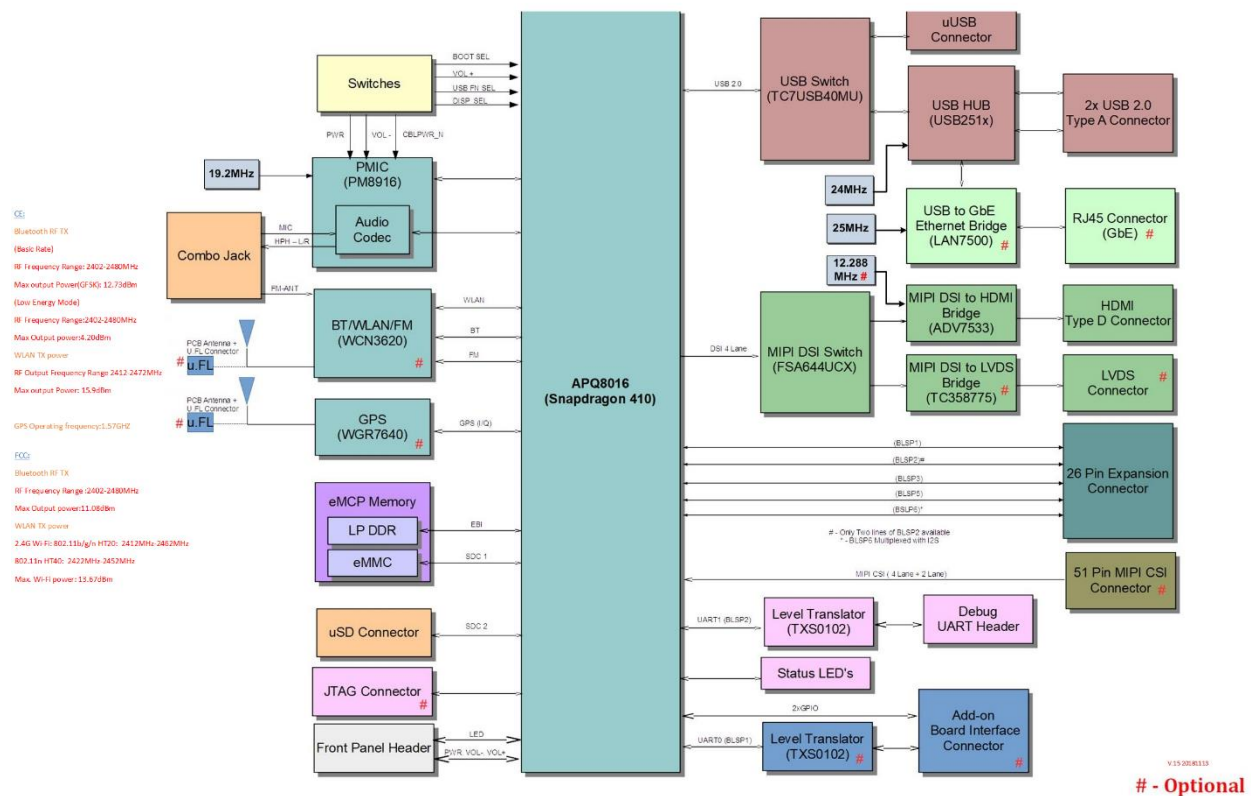


Figure 1: Block Diagram

2.3 SYSTEM SPECIFICATION

The following table shows the hardware specification of the Inforce 6309 SBC.

Table 1: System Hardware Specification

Processor and Peripherals	
Processor	Qualcomm Snapdragon 410 APQ8016 (14mm x 12mm package)
Memory Devices	
Main Memory and Storage	1GB LPDDR, 8GB eMMC
I/O Interfaces	
Interfaces	1x USB v2.0 (Debug), 2x USB v2.0 (Host), 1x HDMI, 1x LVDS [#] , 1x Dual MIPI-CSI [#] , 1x UART, 1x UFL-Wi-Fi/BT [#] , 1x UFL-GPS [#] , 1x uSD, 1x Headset Out, 1x Front-Panel Header, 1x Expansion Header, 1x Add-On Interface [#] , 1x Ethernet [#] , 1x I2S Header, 1x JTAG [#] , 1x Battery Header
Form Factor	
Mechanical	85mm x 54mm (credit-card form factor)
Power	
Power Input	12V DC jack and 12V from add-on interface [#]
Others	
Temperature Specification	Commercial: 0°C to 70°C Extended: -30°C to 85°C
Software	
Operating System	Linux and Android

[#] Optional Interfaces.



NOTE

- The system has been validated at ambient temperature ranges of 0°C to 55°C and -10°C to 70°C for commercial and extended variants respectively.
- The USB debug and the USB host/Ethernet interfaces are mutually exclusive.
- HDMI and LVDS interfaces are mutually exclusive.



CAUTION

- "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, and (2) this device must accept any interference received, including interference that may cause undesired operation."
- This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.
- Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.
- To comply with FCC's RF radiation exposure limits for general population/uncontrolled exposure, the antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be collocated or operating in conjunction with any other antenna or transmitter.

2.4 ELECTRICAL CHARACTERISTICS

Power Supplies

The Inforce 6309 board is operated from the following sources:

- 12V DC jack/12V from add-on interface
- 3.7V battery operation (with limited functionality)



NOTE

- 12V is the default power supply
- For battery operation:
 - Populate: R43, R275
 - Depopulate: R79, R51, R274

2.5 BOARD LAYOUT AND SUBSYSTEMS

Figure 2: Inforce 6309 Board Locations (Top View)

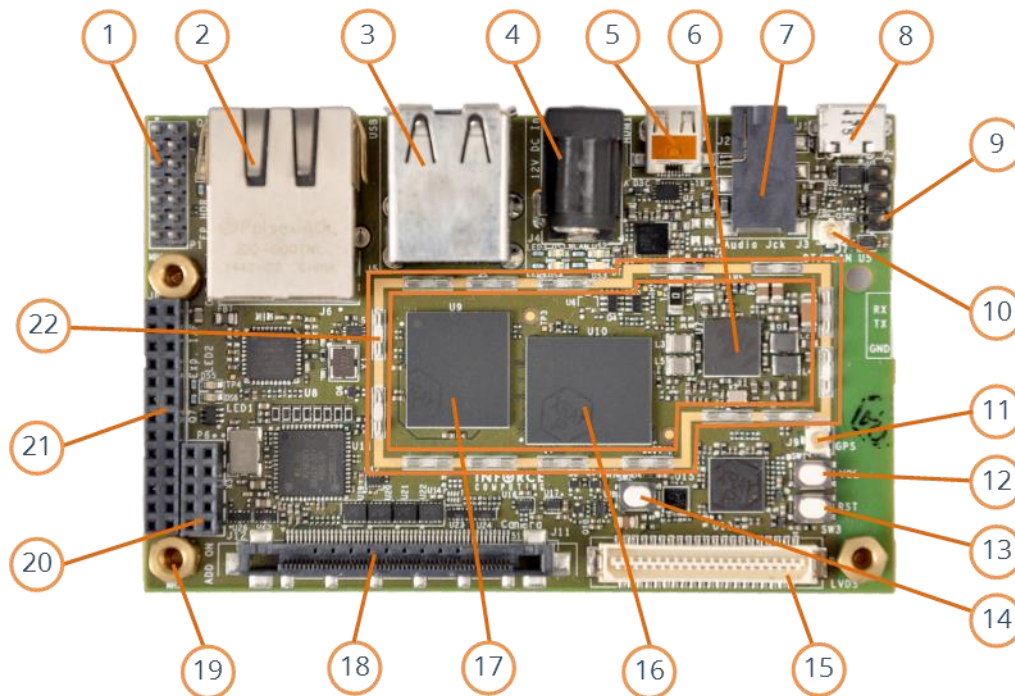


Figure 3: Inforce 6309 Board Locations (Bottom View)

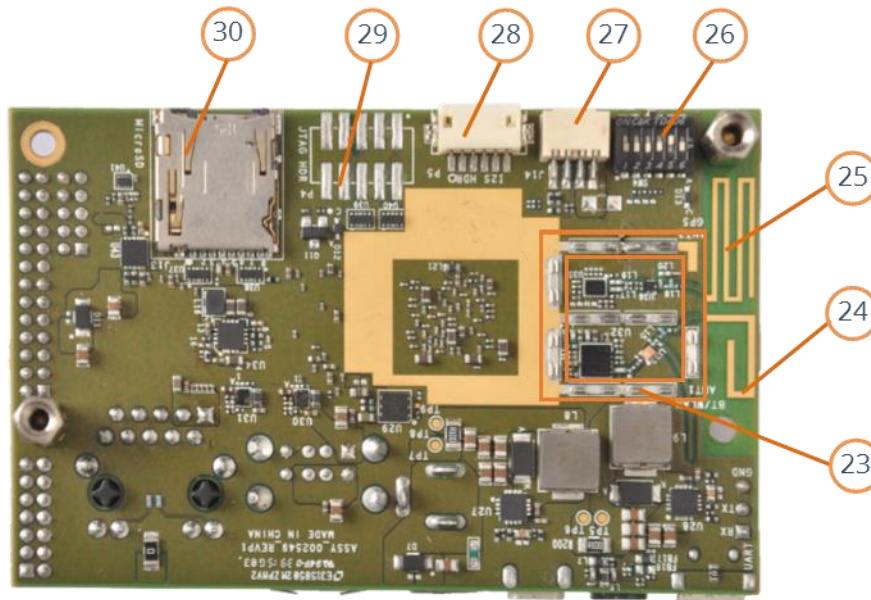


Table 2: Inforce 6309 Board Locations

No.	Description	No.	Description
1	Front Panel Header	16	APQ8016 Processor
2	RJ45 Ethernet Connector [#]	17	eMCP Memory
3	USB Type A Dual Connector	18	51-Pin Camera Interface [#]
4	DC Power Jack	19	Mounting Holes
5	uHDMI Connector	20	Add-On Interface for PoE/RS485 Card [#]
6	PM8916 PMIC	21	Expansion Interface
7	3.5mm Mic In–Speaker Out Combo Jack	22	Placeholders for Top Shield [#]
8	Micro-AB USB Connector	23	Placeholders for Bottom Shield [#]
9	Debug UART	24	BT/Wi-Fi PCB Antenna
10	BT/WLAN UFL Connector [#]	25	GPS PCB Antenna
11	GPS UFL Connector [#]	26	Boot Select/Configuration Switches
12	Vol + Button	27	Battery Header
13	Vol – Button	28	I2S Header
14	Power Button	29	JTAG Header [#]
15	LVDS Connector [#]	30	uSD Interface

[#] Optional Interfaces.

3. SYSTEM SETUP AND USAGE

3.1 HARDWARE SETUP

Set the proper boot configuration using the boot-selection switch on the board.

Refer to **Section 3.2.1** for more details on various boot configuration settings.

Refer to LED locations on the board.

Refer to **Section 3.2.4** for booting.

3.2 HARDWARE OPERATION

3.2.1 CONFIGURATION SWITCHES

- SW4 switch on the Inforce 6309 board can be used for configuring the board for various modes of operations.
- Each position on SW4 has a defined functionality:
 - Boot configuration — Positions 1 and 2
 - USB mode selection — Position 3
 - Display selection — Position 4
 - Boot-on power — Position 5

Figure 4: Configuration Switch SW4



Table 3: Boot Selection

FORCED_USB_BOOT (Position-1)	BOOT_CONFIG1 (Position-2)	Function
ON	X	Forces to QFIL mode
OFF	OFF	SDC1 (eMMC) followed by SDC2 (uSD) followed by USB
OFF	ON	SDC2 (uSD) followed by SDC1 (eMMC) followed by USB

Table 4: USB Mode Selection

USB_SW_SEL (Position-3)	Function
ON	Forces to Host Mode
OFF	Auto Switch Mode

Table 5: Display Selection

DSI_SELECT_SW (Position-4)	Function
ON	Forces HDMI Output
OFF	Auto Switch Mode

Table 6: Auto Boot Selection

CBLPWR_N (Position-5)	Function
ON	Directly boots when powered UP
OFF	Waits for PWR button for booting

**NOTE**

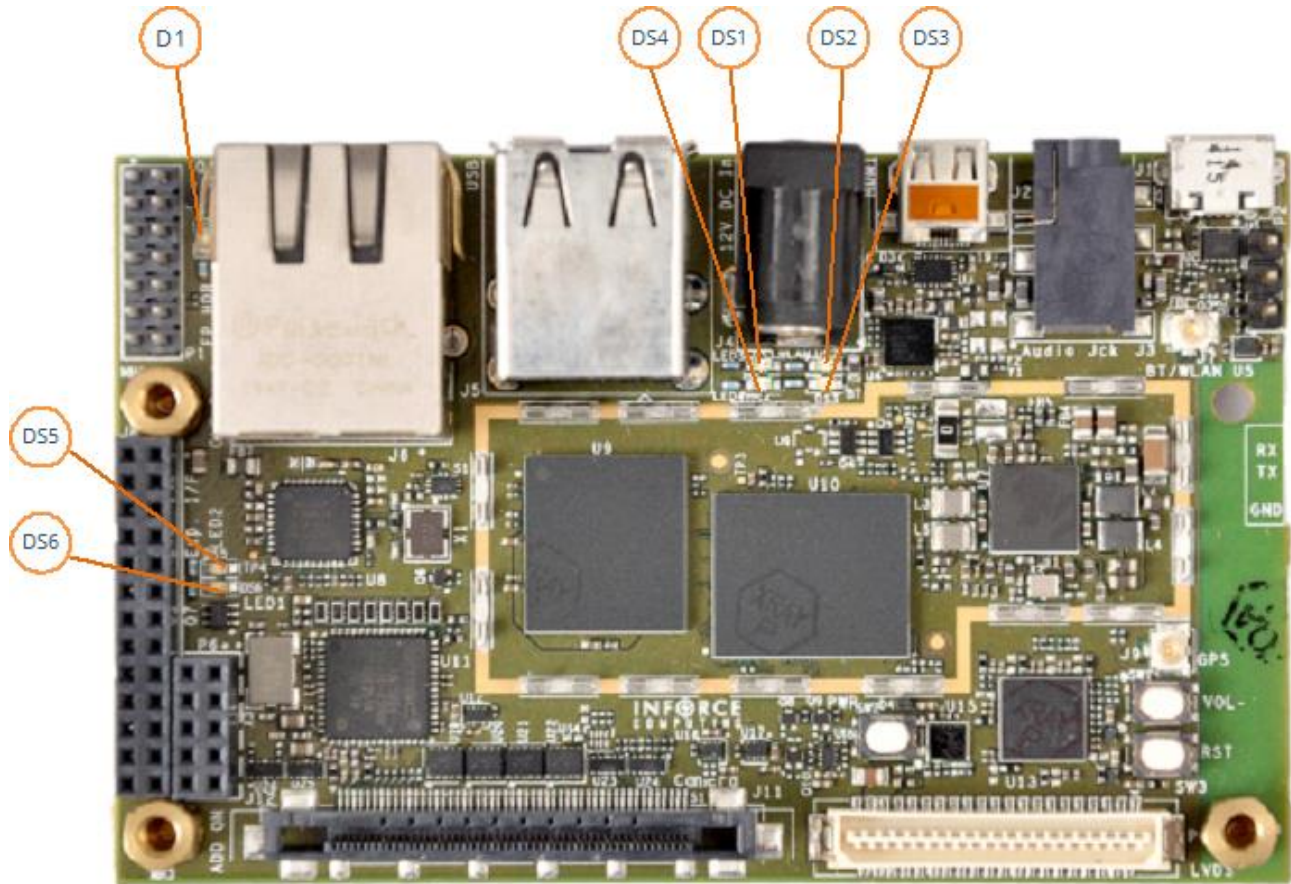
- "X" in the above table indicates a DON'T CARE situation, i.e., the functionality is independent of that switch position.
- Position 6 of SW4 is reserved for future use in the Inforce 6309 board.

3.2.2 LED INDICATIONS

Table 7: LED Indications

Ref. Des.	Function	LED State
DS1	User LED (PMIC GPIO 01)	User configurable
DS2	WLAN Status LED	ON: When WLAN is switched ON
DS3	BT Status LED	ON: When BT is switched ON
DS4	User LED (PMIC GPIO 02)	User configurable
DS5	User LED (APQ GPIO 120)	User configurable
DS6	User LED (APQ GPIO 95)	User configurable
D1	CPU RESET LED	ON: When CPU is out of RESET

Figure 5: LED Locations on the Board



3.2.3 CONNECTOR COORDINATES

Figure 6: Top Connector Coordinates

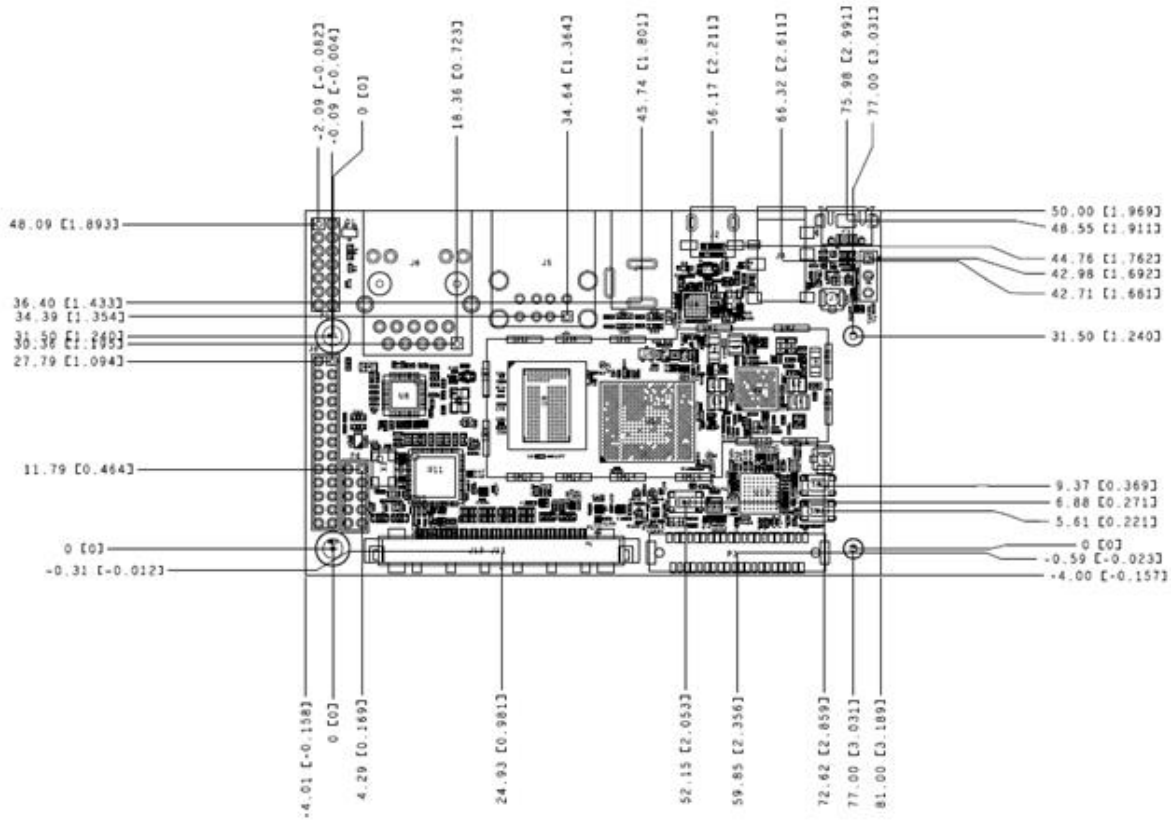
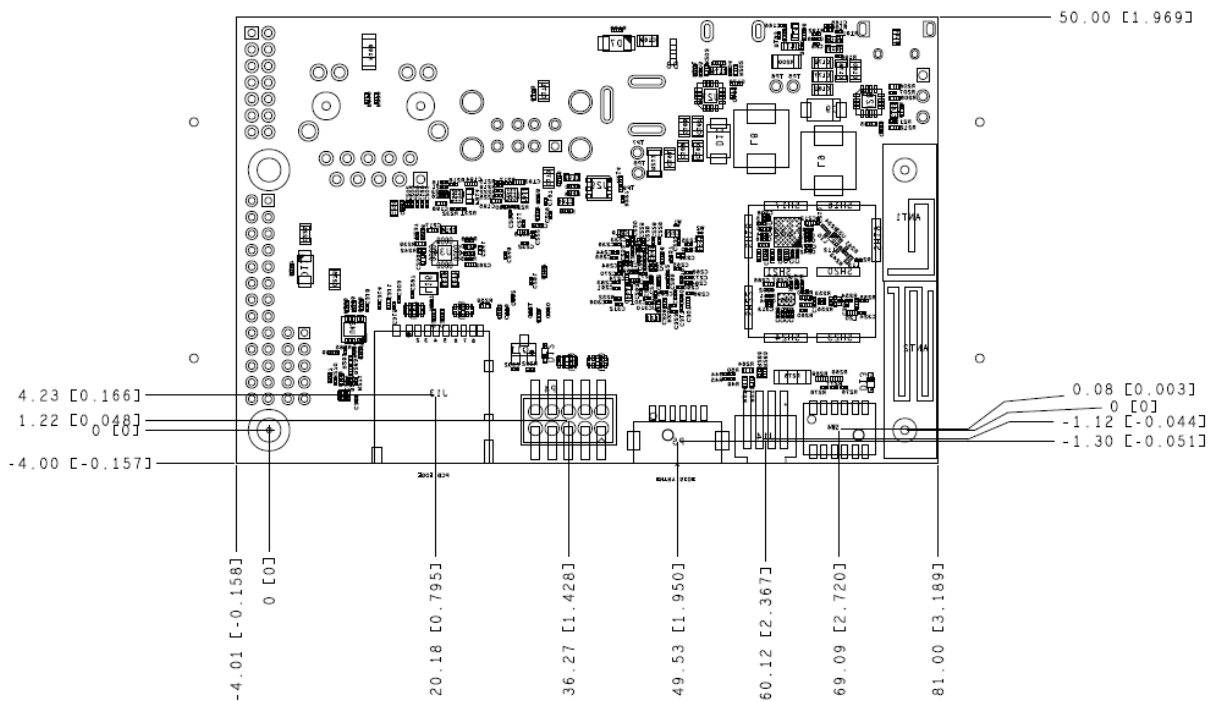


Figure 7: Bottom Connector Coordinates



3.2.4 STEPS TO BOOT INFORCE 6309 SBC

1. Remove the Inforce 6309 board carefully from the anti-static bag.

**NOTE**

Handle with care, while plugging, to avoid physical damage.

2. Connect the display through HDMI or LVDS interfaces.
3. Configure the boot and selection switches.
4. Connect the 12V power adapter to the wall socket.
5. Switch ON the power to the wall socket and press the POWER button, if the board is not in the auto-power ON mode.

Android Version: After a few minutes, the "android" logo followed by the *lock screen* will be displayed on the screen as shown in **Figure 8**.

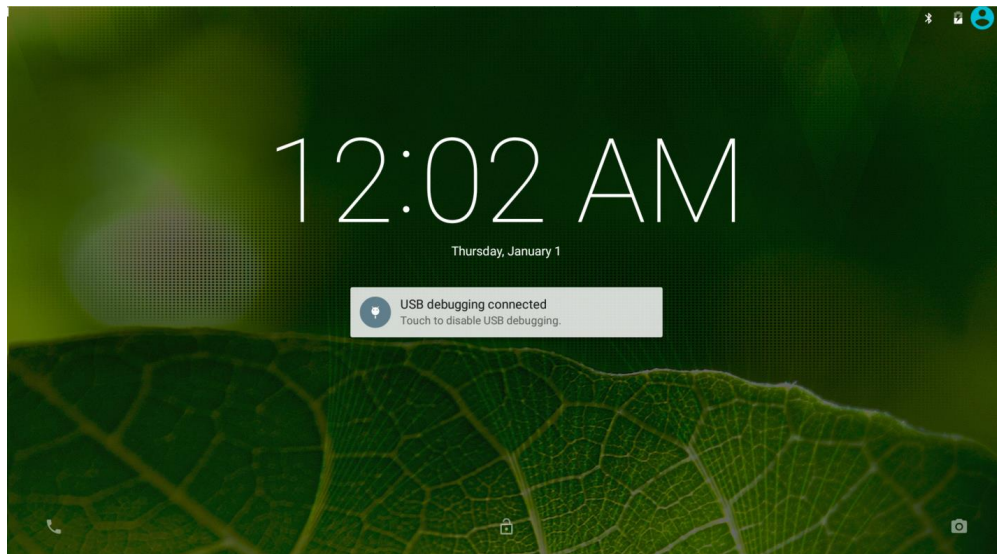
**NOTE**

- *Carefully connect the DC connector to the jack provided on the board.*
- *Once the processor is out of reset, D1 LED will glow.*

**CAUTION**

- *Use only the DC adaptor provided by Inforce Computing.*
- *Do not use the third party DC adaptor without our technical support, as it may damage your board.*

Figure 8: Lock Screen Display

**NOTE**

- *First time booting might take longer than the normal booting.*
- *Screenshots shown above are for reference only; the actual display may vary depending on the software release.*

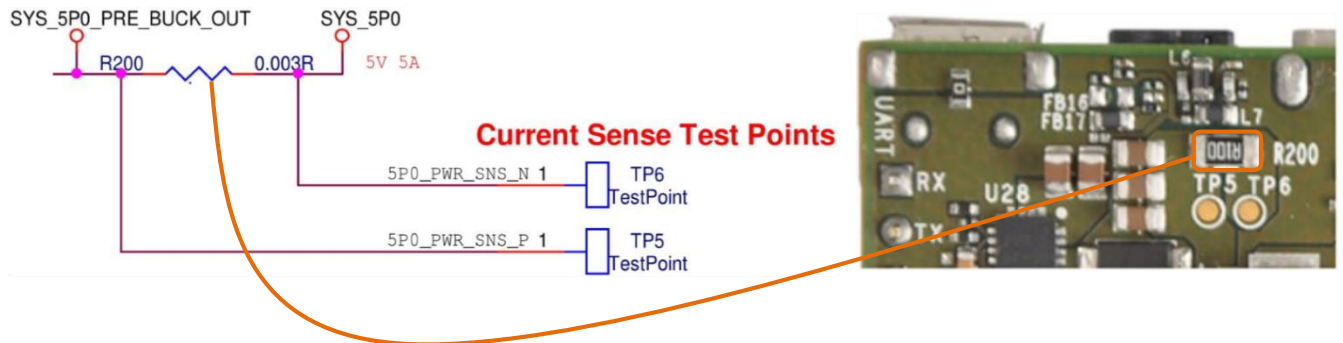
3.3 POWER MEASUREMENT

The Inforce 6309 board has a current sense resistor and test points on 5V and 3.7V rails for current/power measurement.

3.3.1 5V RAIL

- TP5 and TP6 shall be used for the current measurement.
- Both are on the bottom side of the Inforce 6309 board.

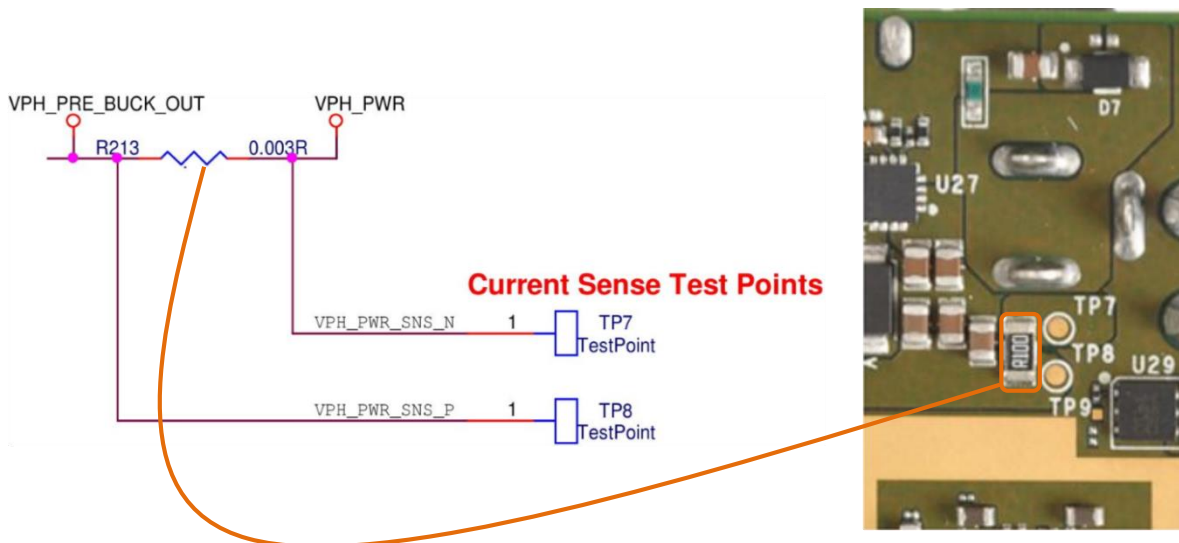
Figure 9: 5V Current Measurement



3.3.2 VPH RAIL

- TP7 and TP8 shall be used for the current measurement.
- Both are on the bottom side of the Inforce 6309 board.

Figure 10: VPH Current Measurement



3.4 ANTENNA CONFIGURATIONS

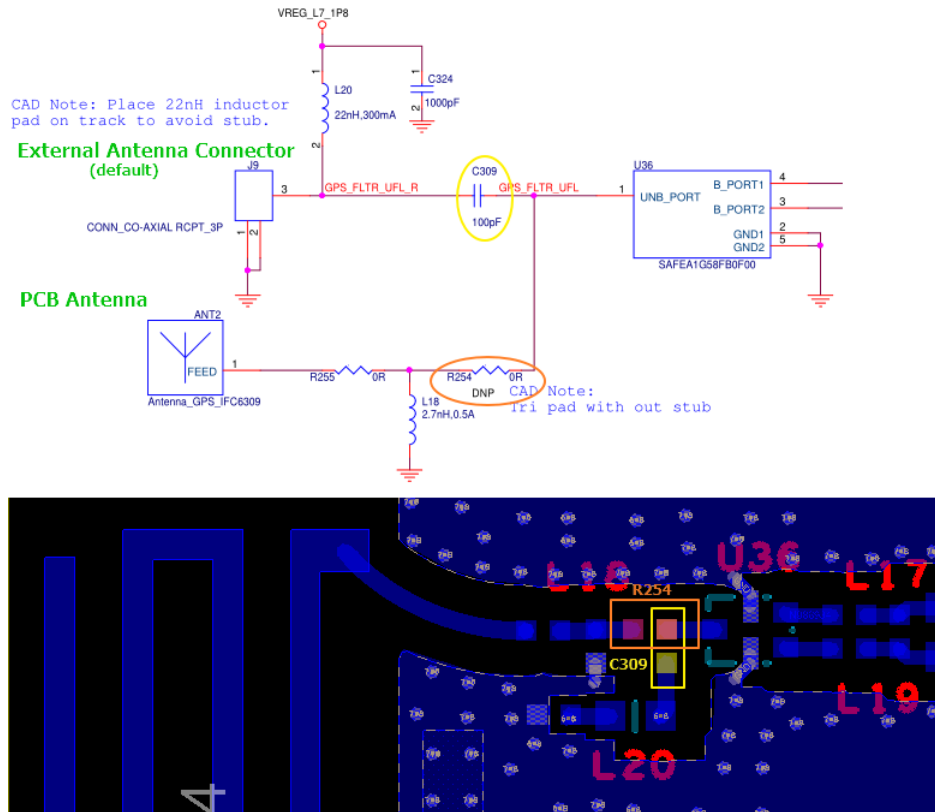
Both GPS and Wi-Fi interfaces have provision for onboard PCB antenna and external Antenna.

Default Antenna Configurations are given below:

- Wi-Fi Interface, Onboard PCB Antenna is default.
- GPS Interface, external antenna connector is default.

3.4.1 GPS ANTENNA SELECTION

Figure 11: GPS Antenna Topology



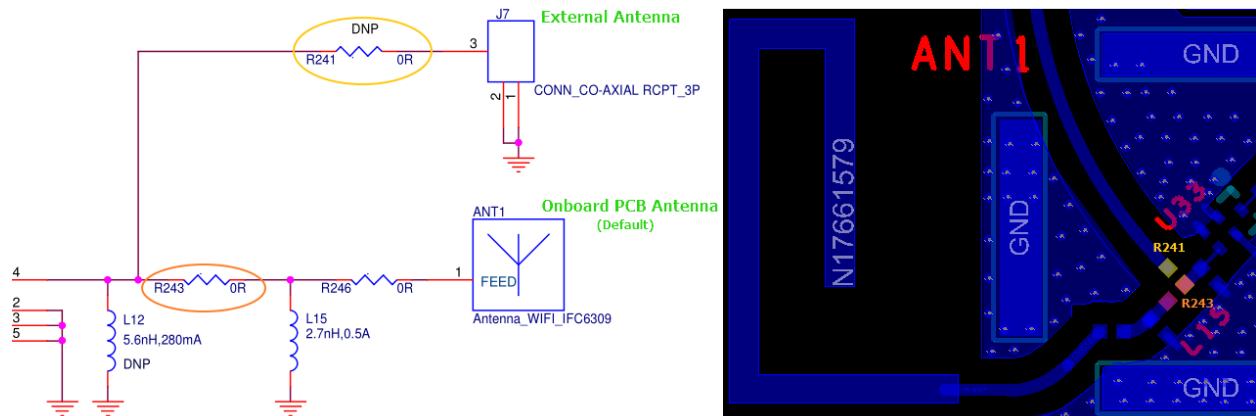
Refer configurations listed below to change the default GPS antenna path.

Table 8: GPS Antenna Selection Configurations

GPS Antenna Selection	
1 External Antenna	Mount C309 , Unmount R254 (default)
2 Onboard PCB Antenna	Mount R254, Unmount C309

3.4.2 WI-FI ANTENNA SELECTION

Figure 12: Wi-Fi Antenna Topology



Refer configurations listed below to change the default Wi-Fi antenna path.

Table 9: Wi-Fi Antenna Selection Configurations

Wi-Fi Antenna Selection		
1	Onboard PCB Antenna	Mount R243 , Unmount R241 (default)
2	External Antenna	Mount R241 , Unmount R243

3.4.3 WIFI / BT RF TX SPECIFICATIONS

Bluetooth RF TX

(Basic Rate)

RF frequency range: 2402 – 2480 MHz

Max output power (GFSK) 12.73 dBm

(Low Energy Mode)

RF frequency range: 2402 – 2480 MHz

Max output power: 4.20 dBm

WLAN TX power

RF output frequency range: 2412 – 2472 MHz

Max Output Power: 15.90 dBm

4. APPENDIX A

4.1 CONNECTOR PIN ASSIGNMENTS

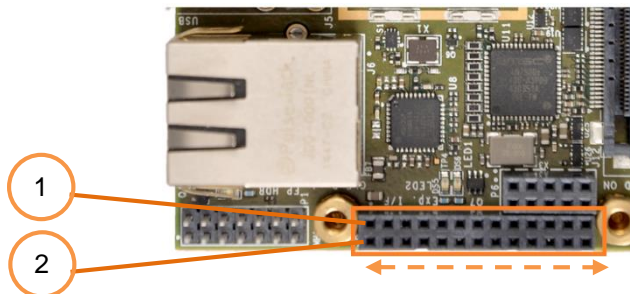
4.1.1 EXPANSION CONNECTOR

Reference Designator : J8
 Manufacturer : Molex
 Manufacturer Part : 0791077012

Table 10: Connector J8 Pinout

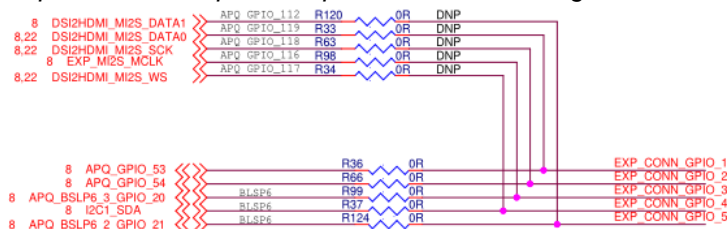
Net	Number		Net
GND	2	1	SYS_5P0
UART0_RTS_N	4	3	UART0_CTS_N
EXP_CONN_GPIO_1	6	5	EXP_CONN_GPIO_4
EXP_CONN_GPIO_2	8	7	EXP_CONN_GPIO_3
SPI1_MISO	10	9	EXP_CONN_GPIO_5
SPI1_MOSI	12	11	SPI1_CS_N
GND	14	13	GND
SPI0_CS_N	16	15	SPI0_MISO
SPI0_MOSI	18	17	SPI0_CLK
I2C0_SDA	20	19	I2C0_SCL
I2C1_SCL	22	21	SPI1_CLK
UART0_RX	24	23	UART0_TX
V1P8_EXP	26	25	GND

Figure 13: Expansion Connector



NOTE

EXP_CONN_GPIO_X pins have multiple APQ pins connected through a series resistor.



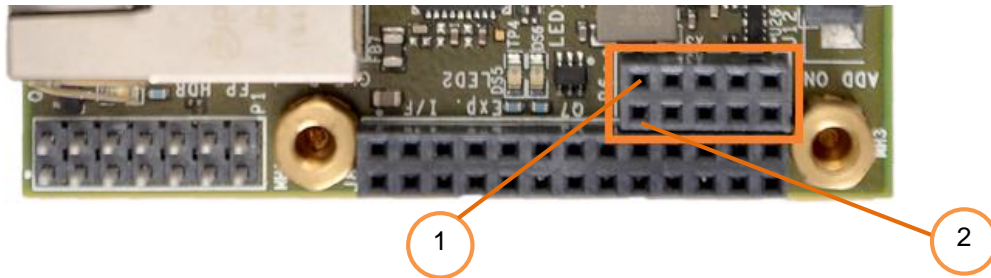
4.1.2 ADD-ON INTERFACE PINOUT#

Reference Designator : P6
 Manufacturer : Harwin/Wurth
 Manufacturer Part : M22-7140542/62001021821

Table 11: Connector P6 Pinout

Net	Number		Net
V3P3_LDO	2	1	V12_POE
SYS_5P0	4	3	V12_POE
CPU_GPIO_102	6	5	CPU_GPIO_101
GND	8	7	RX_ADDON_3V3
GND	10	9	TX_ADDON_3V3

Figure 14 : Add-On Interface Header



4.1.3 FRONT PANEL HEADER PINOUT

Reference Designator : P1

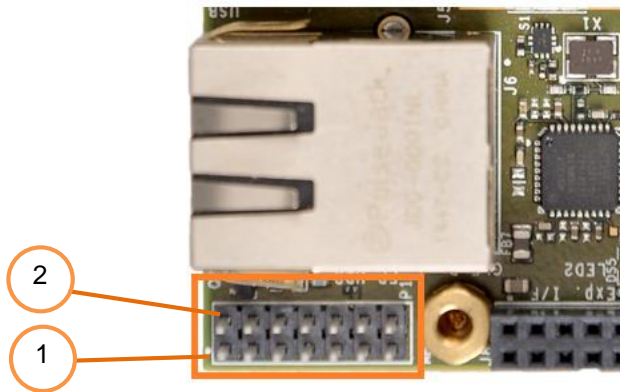
Manufacturer : Molex

Manufacturer Part : 877581450

Table 12: Connector P1 Pinout

Net	Number		Net
KEY_VOLP_N	1	2	PHONE_ON_N
PM_RESIN_N	3	4	APQ_GPIO_108
NC	5	6	GND
LED_CPURESET_CATHODE	7	8	VPH_PWR
USERLED1_CATHODE	9	10	VPH_PWR
USERLED3_CATHODE	11	12	VPH_PWR
GND	13	14	VPH_PWR

Figure 15: Front Panel Header



4.1.4 MIPI CAMERA INTERFACE PINOUT#

Reference Designator : J11/J12

Manufacturer : JAE Industry Ltd

Manufacturer Part : FI-RE51S-HF-R1500/FI-RE51S-VF-R1300

Table 13: Connector J11/12 Pinout

Number	Net	Number	Net	Number	Net
1	VDD_CAM_PIN1	18	MIPI_CSI1_LANE1_EMI_P	35	CLK_MIPI_CSI0_EMI_N
2	VDD_CAM_PIN2	19	GND	36	CLK_MIPI_CSI0_EMI_P
3	NC	20	CLK_MIPI_CSI1_EMI_P	37	GND
4	NC	21	CLK_MIPI_CSI1_EMI_N	38	MIPI_CSI0_LANE0_EMI_N
5	NC	22	GND	39	MIPI_CSI0_LANE0_EMI_P
6	CSI0_PWDN_CONN	23	MIPI_CSI1_LANE0_EMI_P	40	GND
7	I2C2_SDA	24	MIPI_CSI1_LANE0_EMI_N	41	I2C3_SDA
8	I2C2_SCL	25	GND	42	I2C3_SCL
9	CSI0_RST_CONN	26	MIPI_CSI0_LANE3_EMI_P	43	CAM_MCLK0
10	GND	27	MIPI_CSI0_LANE3_EMI_N	44	CAM_MCLK2
11	FLASH_CTRL_EN1_CONN	28	GND	45	CSI1_RST_CONN
12	FLASH_NOW_CONN	29	MIPI_CSI0_LANE2_EMI_N	46	CSI1_PWDN_CONN
13	GND	30	MIPI_CSI0_LANE2_EMI_P	47	GND
14	NC	31	GND	48	CAM_MCLK1
15	NC	32	MIPI_CSI0_LANE1_EMI_P	49	NC
16	GND	33	MIPI_CSI0_LANE1_EMI_N	50	NC
17	MIPI_CSI1_LANE1_EMI_N	34	GND	51	NC

Figure 16: MIPI Camera Connector



4.1.5 LVDS INTERFACE PINOUT#

Reference Designator : P3

Manufacturer : Hirose

Manufacturer Part : DF9-41P-1V(32)

Table 14 : Connector P3 Pinout

Number	Net	Number	Net
1	V3P3_LVDS	22	LVDS_TX5_N
2	V3P3_LVDS	23	LVDS_TX6_P
3	GND	24	LVDS_TX6_N
4	GND	25	LVDS_TX7_P
5	LVDS_TX0_P	26	LVDS_TX7_N
6	LVDS_TX0_N	27	CLK_170M_1_LVDS_P
7	LVDS_TX1_P	28	CLK_170M_1_LVDS_N
8	LVDS_TX1_N	29	GND
9	LVDS_TX2_P	30	GND
10	LVDS_TX2_N	31	DISP_PWR_EN_3P3_N
11	LVDS_TX3_P	32	LVDS_TS_RST_GPIO12_3P3
12	LVDS_TX3_N	33	DISP_3P3_RST#
13	CLK_170M_0_LVDS_P	34	LVDS_TS_INT_GPIO13_3P3
14	CLK_170M_0_LVDS_N	35	BACKLIGHT_PWM_3P3_EN
15	I2C3_SDA_3P3	36	VREG_L5_1P8
16	I2C3_SCL_3P3	37	V12_SYS_5P0_LVDS
17	GND	38	GND
18	GND	39	V12_SYS_5P0_LVDS
19	LVDS_TX4_P	40	GND
20	LVDS_TX4_N	41	NC
21	LVDS_TX5_P		

Figure 17: LVDS Connector



4.1.6 DEBUG UART INTERFACE PINOUT

Reference Designator : P2
 Manufacturer : SHINMENG INDUSTRY CO.
 Manufacturer Part : 2011-1X03G00SB

Table 15 : Connector P2 Pinout

Number	Net
1	UART1_RX_3V3
2	UART1_TX_3V3
3	GND



CAUTION

The UART signal level is 3.3V, and use compatible devices only.

Figure 18 : Debug Header



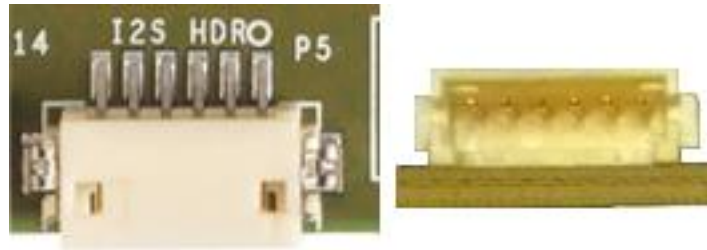
4.1.7 I2S INTERFACE

Reference Designator : P5
 Manufacturer : Hirose
 Manufacturer Part : DF13A-6P-1.25H (50)

Table 16 : Connector P5 Pinout

Number	Net
1	APQ_MI2S1_DATA0
2	APQ_MI2S1_DATA1
3	APQ_MI2S1_SCLK
4	APQ_MI2S_MCLK
5	APQ_MI2S1_WS
6	GND

Figure 19 : I2S Header



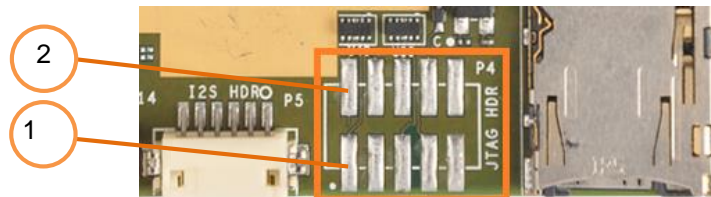
4.1.8 JTAG INTERFACE

Reference Designator : P4
 Manufacturer : FCI
 Manufacturer Part : 98424-G52-10ALF

Table 17: Connector P4 Pinout

Net	Number		Net
CPU_JTAG_SRST#	1	2	CPU_JTAG_TRST#
NC_CPU_JTAG_RTCK	3	4	CPU_JTAG_TDI
CPU_JTAG_TDO	5	6	CPU_JTAG_TMS
CPU_JTAG_TCK	7	8	JTAG_CONN_DET#
GND	9	10	VREG_L5_1P8

Figure 20 : JTAG Header



NOTE

JTAG header is depopulated in all the product SKUs.

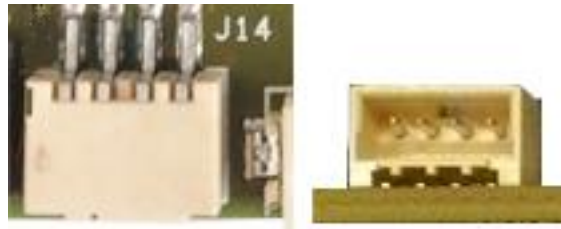
4.1.9 BATTERY INTERFACE PINOUT

Reference Designator : J14
 Manufacturer : MOLEX
 Manufacturer Part : 874380443

Table 18 : Connector J14 Pinout

Number	Net
1	VBATT_CONN
2	BATT_ID
3	BATT_THERM
4	GND

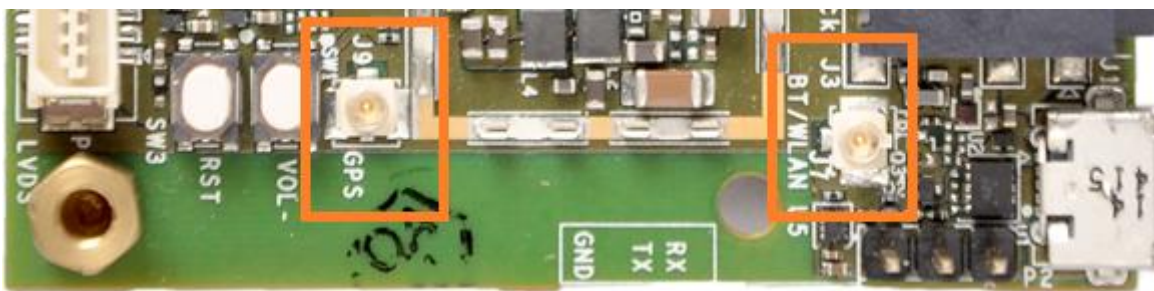
Figure 21 : Battery HDR



4.1.10 RF CONNECTORS#

Reference Designator : J7 and J9
 Manufacturer : Hirose
 Manufacturer Part : U.FL-R-SMT-1(01)
 Description : CONN,CO-AXIAL SMALL RCPT,H=1.25,SMD
 Functions : GPS, Wi-Fi/Bluetooth

Figure 22 : RF Connectors



NOTE

- For BT/WLAN: On-board PCB antenna is connected, by default.
- For GPS: External antenna connector (J9) is connected by default, and require an external antenna for operation.

5. CONTACT INFORMATION

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