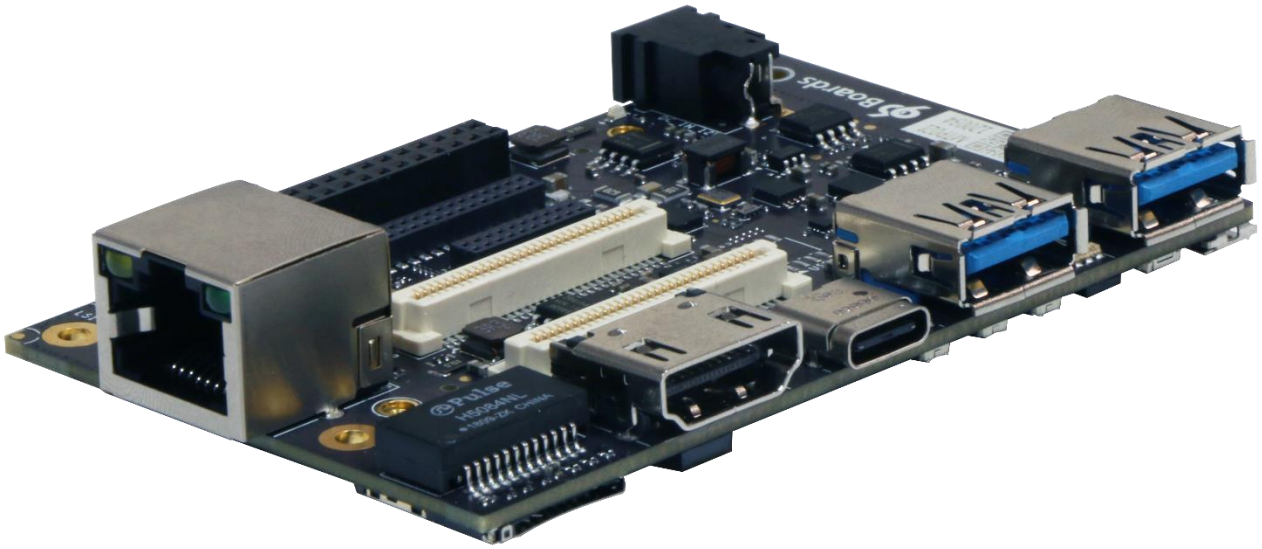
Qualcomm® Robotics RB3 Platform

Hardware User Manual



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1 Introduction

The Qualcomm Robotics RB3 Platform is a dedicated robotics platform designed to accelerate computing and intelligence capabilities for consumer and industrial robotics.It supports the development of smart, power-efficient and cost-effective robots by combining high-performance heterogeneous computing, Qualcomm® Artificial Intelligence (AI) Engine for on-device machine learning, computer vision, voice interface, multimedia and connectivity.The hardware of this platform mainly consists of DragonBoard™ 845c, navigation mezzanine and cellular mezzanine.

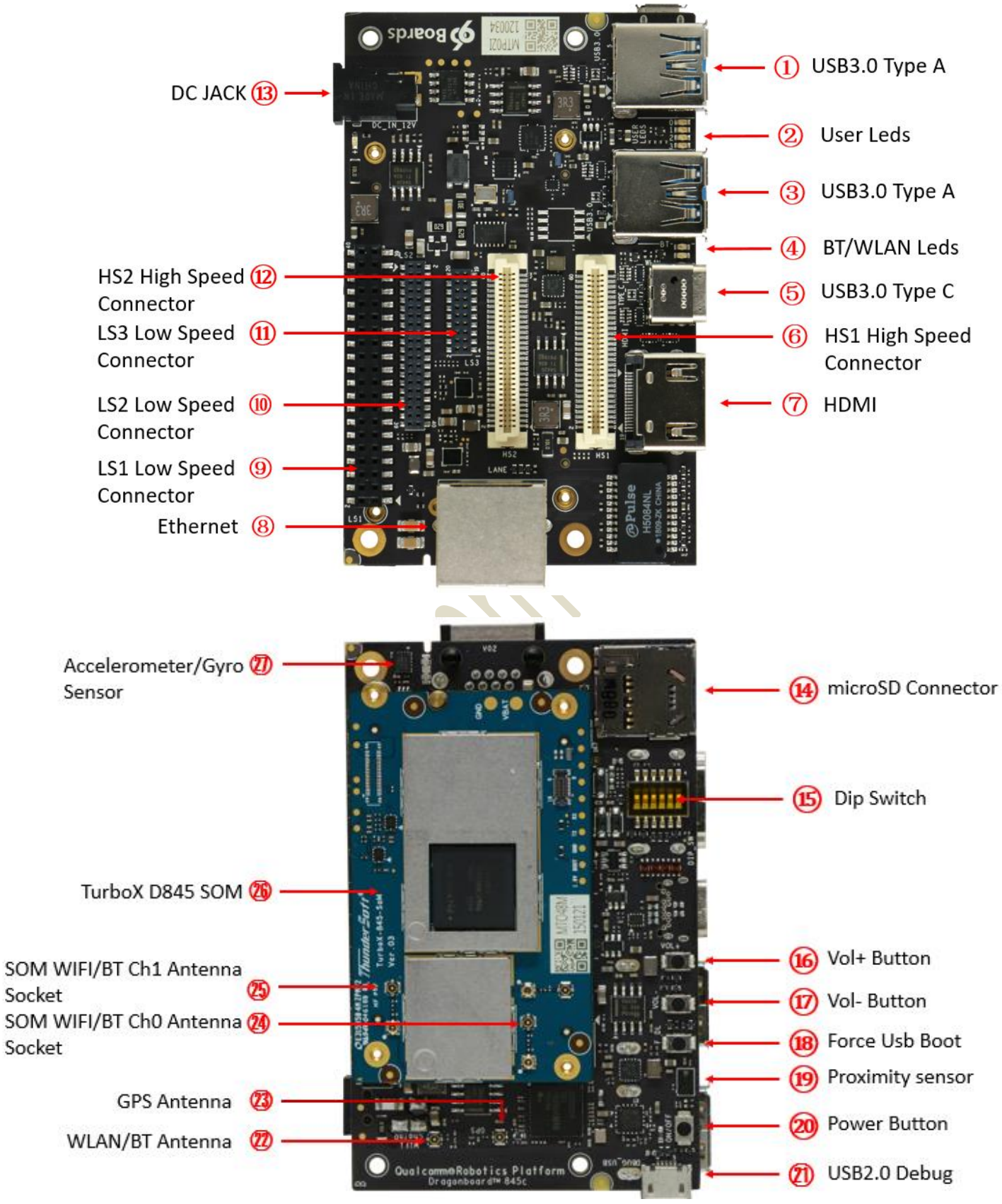
The DragonBoard™ 845c development board is a 96Boards compliant community board based on Qualcomm® Snapdragon™ 845 processor(SDA845).

The following table lists its key features:

SoC	Qualcomm® Snapdragon™ 845 platform (SDA845)
CPU	Custom 64-bit ARM v8-compliant octa-core CPU Up to 2.8 GHz, 10nm LPP FinFET process technology
GPU	Adreno™ 630 GPU OpenGL™ ES 3.2 + AEP , DX next, Vulkan® 2, OpenCL™ 2.0 full profile, RenderScript
DSP	Hexagon™ 685 DSP
RAM	4GB LPDDR4x SDRAM @ 1866 MHz
Storage	64GB UFS 2.1 on board storage and MicroSD card slot
Ethernet	1x GbE Ethernet
Wireless	WLAN 802.11a/b/g/n/ac 2.4/5Ghz 2×2 MIMO & Bluetooth 5.0, On board WLAN/BT/GPS antennas.
USB	1 x USB 2.0 Micro B (Debug only) 1 x USB 3.0 Type C (OTG mode) 2 x USB 3.0 Type A (Host mode only)
Display	Two 4-lane DSI, D-PHY 1.2 or C-PHY 1.0; VESA DSC 1.1 1 x HDMI 1.4 (Type A - full) connector
Video	4K60 decode for H.264 High Profile, H.265 Main 10 Profile and VP9 Profile 2 4K60 encode for H.264 High Profile, H.265 Main 10 Profile

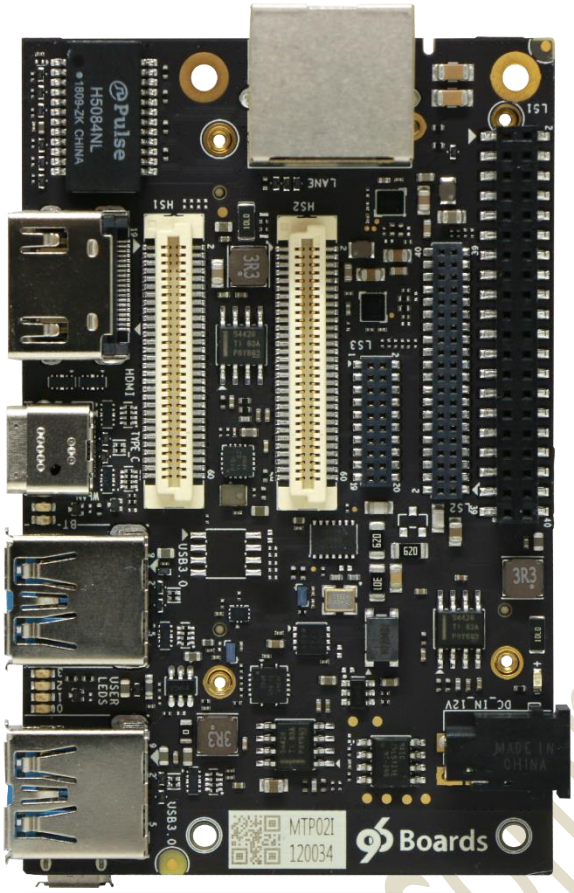
Audio	MP3; aacPlus, eAAC; WMA 9/Pro
Camera	Qualcomm Spectra™ 280 ISP, dual 14-bit ISP+one Lite ISP, 32 MP 30 fps ZSL with a dual ISP
Sensor	Accelerometer + Gyro Sensor/ Proximity sensor
Expansion Interface	Expansion Connectors: HS1:1 x 60 pin High-Speed connector (4L-MIPI DSI, USB 2.0 x 2, I2C x 2, 2L+4L-MIPI CSI) HS2:1 x 60 pin High-Speed connector (4L-MIPI CSI x 2, SSC SPI, PCIe 3.0, USB 3.0 x 1, GPIO x 9) LS1:1x 96boards 40 pin Low-Speed connector (UART x 2, SPI, I2S, I2C x2, GPIO x 12, DC power) LS2:1 x 96boards 40 pin Low-Speed connector (headset, stereo speaker, DMIC I/F x 3, CAN, I2S, GPIO x 7, PWM x 2, ADC x 2) LS3:1 x 96boards 20 pin Low-Speed connector (SSC SPI x 3, SSC I2C, sensor interrupt x 5)
LED	7 LED indicators: 4 - user controllable 2 - for radios (BT and WLAN activity) 1 -power indicator
Button	Power, Volume Up/Down, Force Usb Boot, Dip Switch (6 PIN)
Power Source	12V@2.5A adapter with a DC plug: Plug specification is inner diameter 1.75mm and outer diameter is 4.75mm
OS Support	Linux Embedded (LE)
Mechanical & Environmental	85mm by 54 mm meeting 96Boards™ Consumer Edition Standard form dimensions specifications Operating Temp: -20°C to +70°C RoHS and Reach compliant

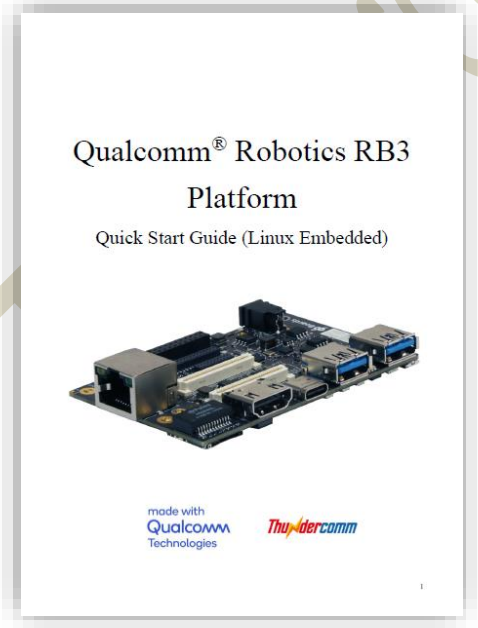
1.1 Board overview



2 What's in the Box

The box contains one DragonBoard 845c development board and a Quick Start Guide.





3 Getting started

3.1 Prerequisites

Before you power up your DragonBoard 845c for the first time you will need the following:

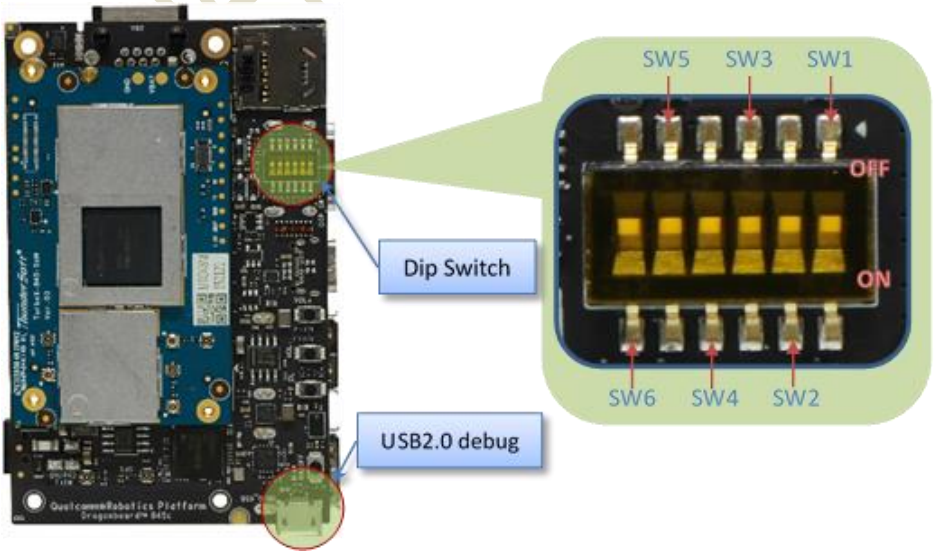
- DragonBoard 845c development board
  - Board based on Qualcomm® Snapdragon™ 845 processor
- Power adapter
  - 96Boards specification requires a 12V with 2500mA power adapter
- USB to micro USB cable
  - This is needed for serial console interface and fastboot/adb commands
- USB to USB Type C cable
  - This is needed to connect the USB3.0 Type C port and flash the images
- Host PC
  - This is needed to connect the DragonBoard and have fastboot installed

3.2 Starting the board for the first time

3.2.1 Starting process for LE OS

To start the board, follow these simple steps (Display is not supported in the LE OS):

- Step 1: Open the serial console tool on the Host PC.(for example:minicom)
- Step 2: Enable the USB2.0 debug port by turning on the SW2 of the Dip Switch ⑮



- Step 3: Connect the Micro-B plug on the USB cable to the USB2.0 debug port ㉑ on the device,and the other end to an available USB port on the host PC
  Note: please set the Bps/Par/Bits to 115200 8N1
- Step 4: Connect the power supply to power connector ⑬
- Step 5: Plug the power supply into a power outlet,and “power up” green Led should illuminate
- Step 6: Press and release the power button on the device,and user yellow Led0 should illuminate

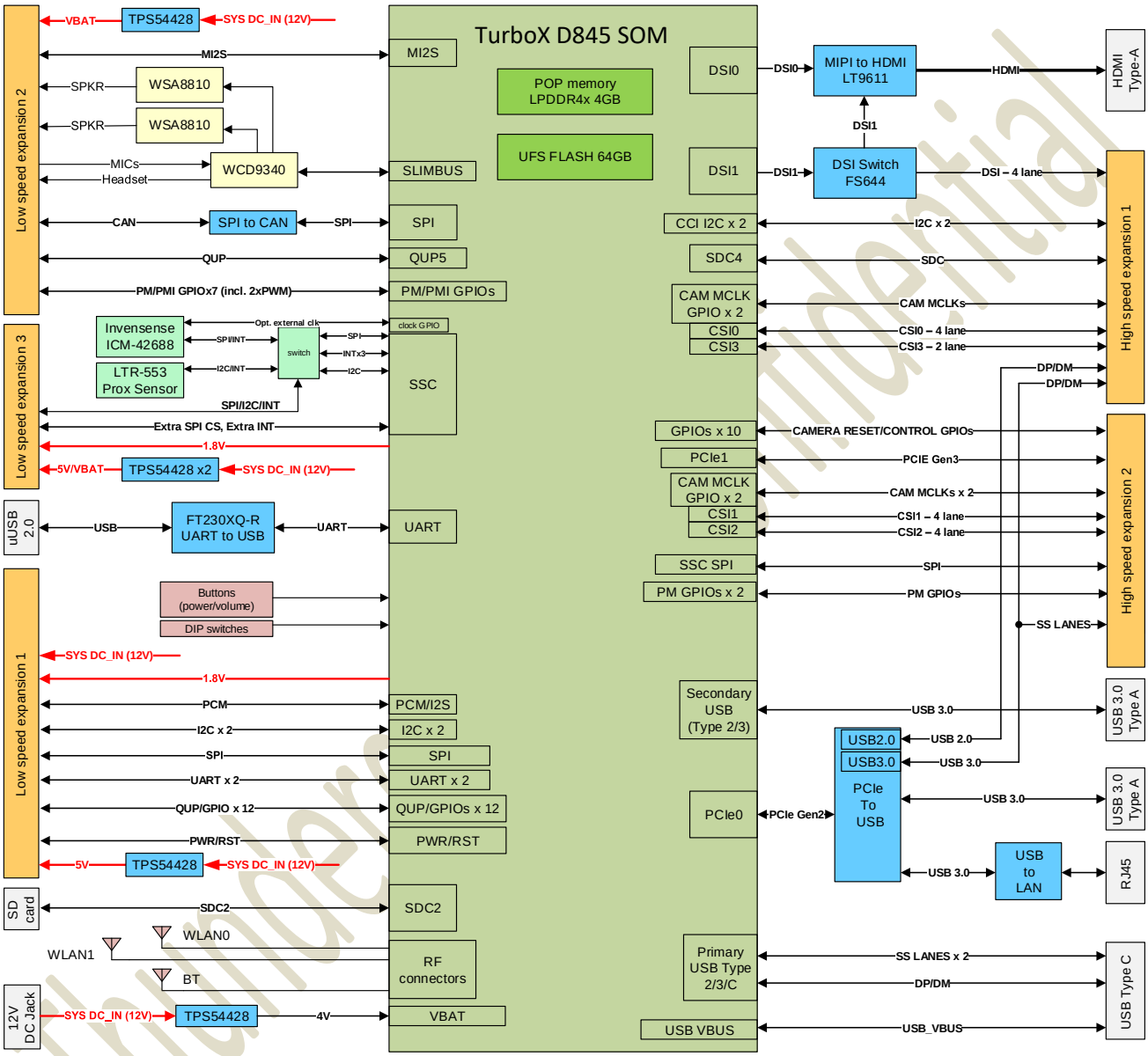
The board will start the booting process, and you should see Login Credentials displayed on the host PC:

sda845 login: root

Password: 123456

4 DragonBoard 845c Overview

4.1 System Block diagram



4.2 Processor

The Snapdragon 845 processor has a 64-bit ARM v8-compliant octa-core Qualcomm® Kryo™ 385 CPU, supports LPDDR4X SDRAM interface, Compute DSP with Hexagon Vector eXtensions, 32MP camera, Adreno 630 GPU, 4K video encode/decode, Bluetooth 5.0.

4.3 Memory

The DragonBoard 845c uses a package on package (PoP) LPDDR4X RAM configuration and discrete UFS2.1 flash memory.

●The LPDDR4X interface directly to the Snapdragon 845 built-in LPDDR controller. The maximum DDR clock is 1866 Mhz.

●The UFS flash memory interfaces with Snapdragon 845 over a dedicated UFS PHY bus supporting the UFS 2.1 specification.

4.4 MicroSD

The DragonBoard 845c µSD slot (⑭) signals are routed directly to the Snapdragon 845 SDC2 interface. The slot is a push-push type with a dedicated support for card detect signal (many µSD slots do not have a dedicated CD pins, they use DATA3 state as the card detected signal). The DragonBoard 845c board uses SDA GPIO_126 as the SD_CARD_DET_N.

4.5 WiFi/BT RF

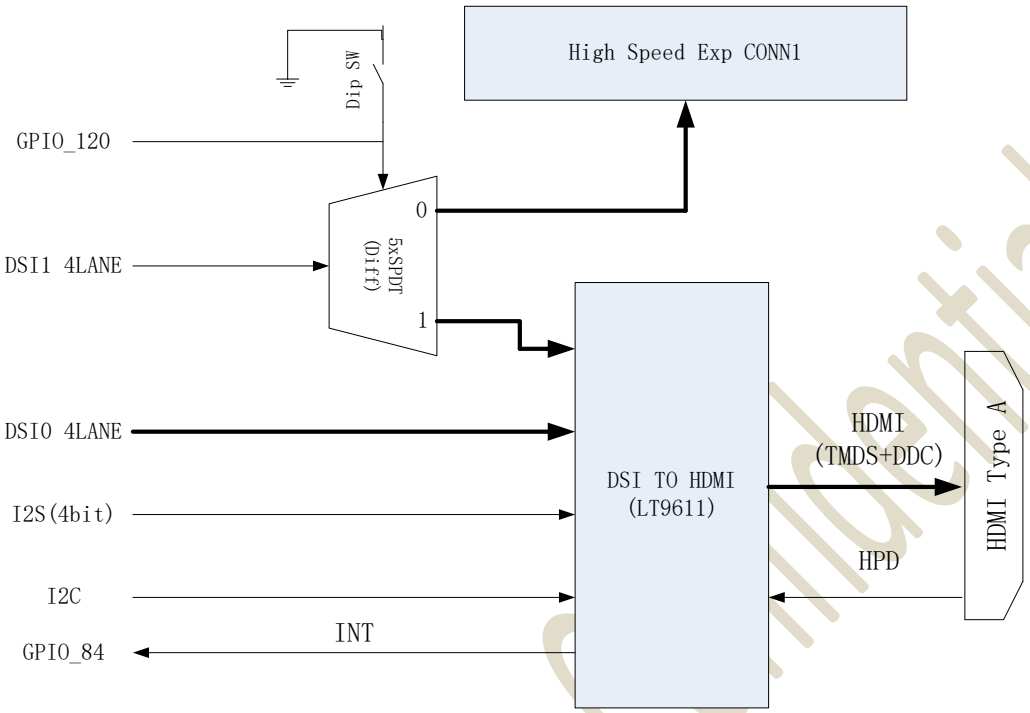
The DragonBoard 845c uses Qualcomm RF chip WCN3990 solution that integrates two wireless connectivity technologies into a single device. The interfaces are:

●WLAN compliant with IEEE 802.11 b/g/n/ac specifications, exceeding 96Boards minimal requirements for WiFi.

●Bluetooth compliant with the BT specifications version 5.0 (BR/EDT + BLE), meeting the 96Boards requirements for BT.

The DragonBoard 845c onboard antenna(㉒) are connected to SOM antenna socket with RF coaxial cable. The SOM antenna sockets adopts the MIMO type, the socket(㉓) combines BT and WIFI chain0; the socket(㉔) only supports WIFI chain1.

4.6 Display Interface



4.6.1 HDMI

The Snapdragon 845 doesn't include a built-in HDMI interface. The DragonBoard 845c deploys the built-in MIPI-DSI 2x4 lanes interface as the source for the HDMI output. A peripheral DSI to HDMI Bridge (LONTIUM SEMICONDUCTOR LT9611) performs this task and it supports a resolution from 1080p to 4K at 30Hz.

While the LT9611 supports automatic input video format timing detection (D-PHY1.2,DSI1.3/CSI-2 1.00 and DCS 1.02.00), an I2C channel from the Snapdragon 845 allows the user to configure the operation of this bridge. It is QUP10 I2C interface from the SoC that connects to the bridge.

This bridge supports audio as well (meeting the 96Boards requirements to provide audio via HDMI). The DragonBoard uses a 4 bit I2S2 interface from the Snapdragon 845 for this task.

Please note that the 96Boards specification calls for a MIPI-DSI interface to be routed to the High-Speed Expansion connector. Since the Snapdragon 845 has two MIPI-DSI interfaces for HDMI. A muxing device (FSA644UCX) is being use on the board. Only one interface, HDMI, or the Expansion MIPI-DSI can be active at a given time. The controlling signal is named 'GPIO120_DSI_SW_SEL'. When this signal is logic high, '1', the MIPI-DSI is routed to the DSI-HDMI Bridge. When 'GPIO120_DSI_SW_SEL' is logic level low, '0', the MIPI-DSI is routed to the High Speed Expansion connector. This design assigned the 'GPIO120_DSI_SW_SEL' function to GPIO_120.

User can overwrite the software control by sliding switch 4 of Dip Switch to the 'ON' position. That action forces the DSI mux to route the MIPI-DSI to the High Speed Expansion connector. The overwrite option exist for the High-

Speed Expansion only, you cannot software overwrite the mux to DSI-HDMI Bridge.

4.6.2 MIPI-DSI

The DragonBoard 845c implemented a four-lane MIPI_DSI interface meeting this requirement. More information about this implementation can be found in chapter 6 “High speed expansion connector”.

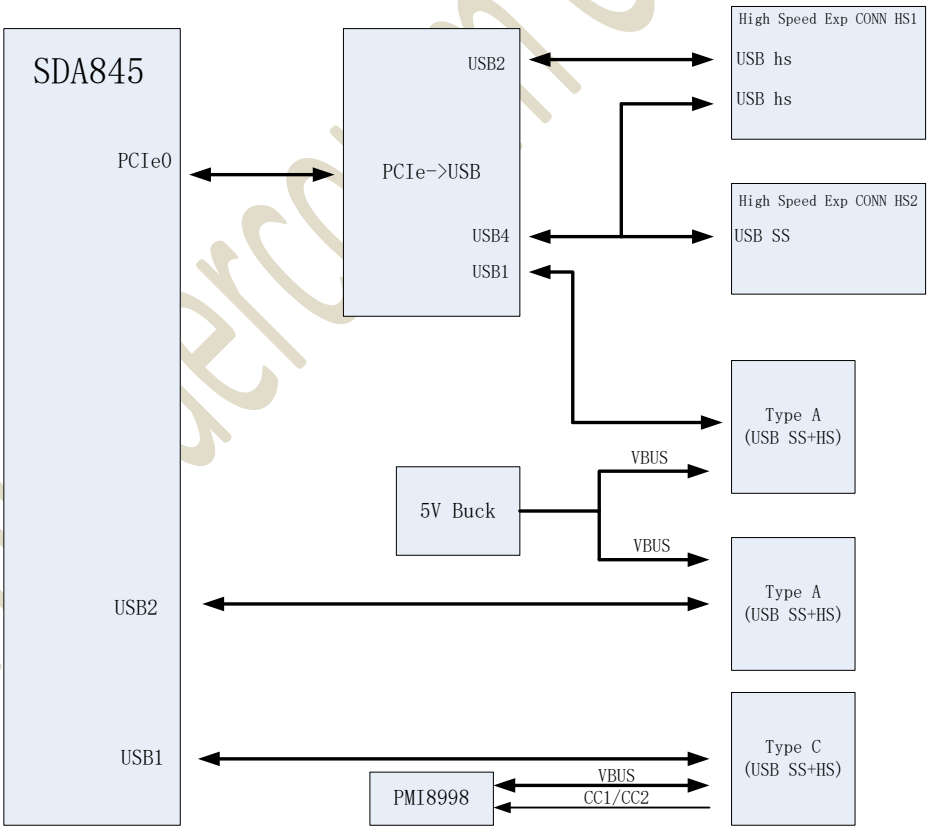
4.7 Camera Interfaces

The DragonBoard 845c implements four camera interfaces.

- 4 lane CSI0 camera on primary high speed connector ⑥(J2000).
- 4 lane CSI1camera on secondary high speed connector ⑫ (J2001).
- 4 lane CSI2 camera on secondary high speed connector ⑫ (J2001).
- 2 lane CSI3 camera on primary high speed connector ⑥(J2000).

More information about this implementation can be found in chapter 6 “High speed expansion connector”.

4.8 USB Ports



4.8.1 USB-Host ports

The Snapdragon 845 includes two USB channel: USB1(⑤) is for Type C port, the other USB2 (③)is for normal host port. The DragonBoard 845c supports 3 USB Host ports as follows:

Port 1 of the SoC USB2(③), a Type 'A' USB Host 3.0 (Super speed) connector. A current limited sets the Power Current limit to 1.0A.

Port 2 of the USB HUB (①), a Type 'A' USB Host 3.0 (Super speed) connector. A current limited sets the Power Current limit to 1.0A.

Port 3 of the USB HUB is routed to the High Speed Expansion connectors (Super speed to ⑥, High speed to ⑫). No current limited controller is implemented on the board for this channel.

Another USB HUB port is routed to the High Speed Expansion connectors ⑥ (High speed). No current limited controller is implemented on the board for this channel.

4.8.2 USB-Device port

The DragonBoard 845c implements a USB device port. The port is located at ⑤, a Type C connector.

The Type C supports the device or host with different peripheral, the Snapdragon 845 do the configure based on Type C rules. The board can work in one mode at a time, Host mode or Device mode, not both.

Note: There is a micro-B USB port ㉑, it is only for debug log output which is from Snapdragon 845 debug UART to USB transformation.

4.9 Audio

The 96Boards specifications calls for a minimum of single channel audio through two interfaces, BT and HDMI/MHL/DisplayPort.

The DragonBoard 845c meets this requirement with HDMI support, Display Port, and has additional audio channels, including support for headset jack. More information about these additional channels can be found in sections 5.

Note that MHL is not supported.

4.9.1 BT Audio

The BT 5.0 implementation on the DragonBoard 845c is via a MAC in the SDA845 and an external modem, WCN3990. The UART and IQ interface between the SoC and the modem carriers all communication including audio.

4.9.2 HDMI Audio

A 4-bit (audio out only) I2S channel is routed directly from the Snapdragon 845 SoC I2S interface pins to the DSI-HDMI bridge.

4.9.3 DisplayPort Audio

The DisplayPort audio is routed directly from the Snapdragon 845 SoC EDP interface pins to Type C USB connector.

4.10 DC-power and Battery Power

The DragonBoard 845c supports power to be provided to the board in one of the following ways:

- An 8V to 18V power from a dedicated DC jack
- An 8V to 18V power from the SYS_DCIN pins on the Low Speed Expansion Connector
- A USB Type C port at 5V

Please see section 7 for detailed information on 845c implementation of DC Power.

4.11 Measurements

The 96Boards specification calls for support for measuring power consumptions of the board.
Please see section 7 for detailed information on DragonBoard 845c power measurement implementation.

4.12 Buttons

The 96Boards specification calls for the present of two buttons, a Power on/sleep button and a Reset button.

The DragonBoard 845c meets these requirements. Please see section 8 for detailed information on the buttons of the DragonBoard 845c.

4.13 External Fan connection

The 96Boards specification calls for support for an external fan. That can be achieved by using the 5V or the DC IN. Both present on the Low Speed Expansion connector.

4.14 UART

The DragonBoard 845c supports for one SoC UART and an optional second UART both to be routed to the Low Speed Expansion Connector.

One UART is directly from SoC pins to Low Speed Expansion Connector; the other option one is for the UART debug log port, if the user wants to use the port for log output, it needs to switch the dip switch pin 2 to "OFF" state.

4.15 System and user LEDs

The DragonBoard 845c supports six LEDs to be implemented on the board. The specification defines the LEDs color and mechanical location on the board.

Two activity LEDs:

• WiFi activity LED – 845c drives this Yellow LED via GPIO9 from the PMIC(PM845).

• BT activity LED – 845c drives this Blue LED via GPIO5 from the PMIC(PM845).

Four User LEDs:

The four user LEDs are surface mount Green in 0603 size located next to the two USB type A connector and labeled ‘USER LEDS 3 2 1 0’. The 845c drives three LEDs from the red, green and blue LED drive from power management IC PMI8998. The fourth User LEDs is driven by the PM845 via GPIO13.

Power indicator LED:

A green LED is included to indicate the presence of input power to the DragonBoard 845c .

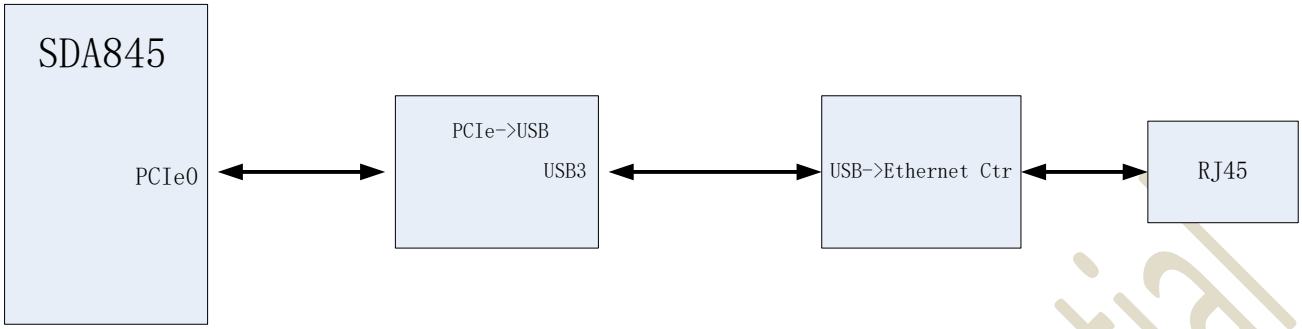
4.16 Expansion Connector

The 96Boards specification calls for two Expansion Connectors, a Low Speed and a High Speed.
The DragonBoard 845c meets this requirement, please review section 5 for detailed information regarding the Low Speed Expansion Connector and section 6 for detailed information regarding the High Speed Expansion Connectors.

4.17 Additional Functionality

The 96Boards specifications allows for additional functionality provided that all mandatory functionality is available and there is no impact on the physical footprint specifications including height and do not prevent the use of the 96Boards CE low speed and high speed expansion facilities.
The DragonBoard 845c board implements a few additional functions, which are listed in the following sub-chapters.

4.17.1 Ethernet Connector



Gigabit Ethernet is not supported by the Snapdragon 845 SoC, the DragonBoard 845c board has the translation from PCIe0 to USB and then USB to Gigabit Ethernet controller, it uses an RJ45⑧ as the physical interface.

4.17.2 Inertial Sensors

The DragonBoard 845c includes the following inertial sensors

- 6-axis Accelerometer/Gyroscope: INVENSENSE ICM-42688
- LIGHT SENSOR AND PROXIMITY SENSOR: LITEON LTR-553ALS-WA

4.17.3 Dip Switch

There is a dip switch ⑮ on the DragonBoard 845c.

Switch 1: NA;

Switch 2: 'ONBOARD_DEBUG_UART_EN_N', when set to 'ON' position, will force the debug UART log to micro USB port; when set to 'OFF', will force the debug UART log to Low Speed Expansion Connector.

Switch 3:' CBL_PWR_N ', when set to 'ON' position, SDA845 system will power on automatically; when set to 'OFF', SDA845 system will power on by ON-KEY manually.

Switch 4:' SW_DSI1_TO_LT9611_N ', when set to 'ON' position, the SDA845 DSI1 will force to High Speed Expansion Connector; when set to 'OFF', the DSI1will force to LT9611 DSI->HDMI bridge.

Switch 5:' SENSOR_DISCONNECT ', when set to 'ON' position, the SDA845 SSC sensor SPI/I2C will force to Low Speed Expansion Connector; when set to 'OFF', the SSC sensor SPI/I2C will force to onboard sensor.

Switch 6:' IMU_EXT_CLK_TOGGLE ', when set to 'ON' position, the onboard ICM-42688 sensor will use the external clk of GPIO78 from SoC; when set to 'OFF', the onboard ICM-42688 sensor will use another interrupt output to SoC GPIO118. These GPIOs needs the software configure setting.

4.17.4 Extra High Speed Expansion Connector

The DragonBoard 845c has another High Speed Expansion Connector. Detail information is provided in section 6.

4.17.5 Extra Low Speed Expansion Connectors

The DragonBoard 845c has another two Low Speed Expansion Connectors. Detail information is provided in section 5.

5 Low speed Expansion connector

5.1 Primary Low Speed Expansion Connector: LS1 ⑩

PIN	96 Boards Signals	845c Signal	Note
1	GND	GND	
3	UART0_CTS	GPIO41_UART0_CTS	
5	UART0_TxD	GPIO43_UART0_TXD	
7	UART0_RxD	GPIO44_UART0_RXD	
9	UART0_RTS	GPIO42_UART0_RTS	
11	UART1_TxD	GPIO4_DEBUG_UART_TX_LS1	
13	UART1_RxD	GPIO5_DEBUG_UART_RX_LS1	
15	I2C0_SCL	GPIO34_I2C0_SCL	
17	I2C0_SDA	GPIO33_I2C0_SDA	
19	I2C1_SCL	GPIO32_I2C1_SCL	
21	I2C1_SDA	GPIO31_I2C1_SDA	
23	GPIO-A	GPIO49_QUP12	
25	GPIO-C	GPIO50_QUP12	
27	GPIO-E	GPIO51_QUP12	
29	GPIO-G	GPIO10	
31	GPIO-I	GPIO9_CAM0_RST_N	
33	GPIO-K	GPIO8_CAM1_RST_N	
35	+1V8	VREG_S4A_1P8	
37	+5V	VDC_5V	
39	GND	GND	

PIN	96 Boards Signals	845c Signal	Note

2	GND	GND	
4	PWR_BTN_N	PHONE_ON_N	
6	RST_BTN_N	PM_RESIN_N	Default volume down;
8	SPI0_SCLK	GPIO29_SPI0_SCLK	
10	SPI0_DIN	GPIO27_SPI0_MISO	
12	SPI0_CS	GPIO30_SPI0_CS	
14	SPI0_DOUT	GPIO28_SPI0_MOSI	
16	PCM_FS	GPIO81_PCM_FS	
18	PCM_CLK	GPIO80_PCM_CLK	
20	PCM_DO	GPIO83_PCM_DO	
22	PCM_DI	GPIO82_PCM_DI	
24	GPIO-B	GPIO79_MI2S1_MCLK	
26	GPIO-D	GPIO52_QUP12	
28	GPIO-F	GPIO7_I2C_SCL	
30	GPIO-H	GPIO6_I2C_SDA	
33	GPIO-J	GPIO26_CAM0_VSYNC_OUT	
34	GPIO-L	GPIO40_CAM1_AFE_GPO	
36	SYS_DCIN	DC12V	
38	SYC_DCIN	DC12V	
40	GND	GND	

5.1.1 UART {0/1}

The 96Boards specifications calls for a 4-wire UART implementation, UART0 and an optimal second 2-wire UART, UART1 on the Low Speed Expansion Connector.

The DragonBoard 845c implements UART0 as a 4-wire UART that connects directly to the SDA845 SoC. These signals are driven at 1.8V.

The DragonBoard 845c implements UART1 as a 2-wire UART that connects directly to the Snapdragon 845 SoC.

These signals are driven at 1.8V.

5.1.2 I2C {0/1}

The 96Boards specification calls for two I2C interfaces to be implemented on the Low Speed Expansion Connector. The DragonBoard 845c implements both interfaces, I2C0 and I2C1 that connects directly to the Snapdragon 845 SoC. A resistor is needed to provide as pull-up for each of the I2C lines per the I2C specifications for further, these pull-ups need to be connected to the 1.8V voltage rail.

5.1.3 GPIO {A-L}

The 96Boards specifications calls for 12 GPIO lines to be implemented on the Low Speed Expansion Connector.

The DragonBoard 845c implements this requirement. 12 GPIOs are routed from the Snapdragon 845 SoC. The GPIOs are 1.8V voltage rail.

- GPIO A - Connects to GPIO_49 of SDA845 SoC, Can be configured to be an IRQ line.
- GPIO B - Connects to GPIO_79 of SDA845 SoC. Can be configured to be an IRQ line, and SEC_MI2S_MCLK
- GPIO C - Connects to GPIO_50 of SDA845 SoC.
- GPIO D - Connects to GPIO_52 of SDA845 SoC. Can be configured to be an IRQ line
- GPIO E - Connects to GPIO_51 of SDA845 SoC.
- GPIO F - Connects to GPIO_7 of SDA845 SoC. Can be configured to be I2C SCL.
- GPIO G - Connects to GPIO_10 of SDA845 SoC. Can be configured to be IRQ line.
- GPIO H - Connects to GPIO_6 of SDA845 SoC. Can be configured to be I2C SDA.
- GPIO I - Connects to GPIO_9 of SDA845 SoC. Can be configured to be a CAM0_RST signal.
- GPIO J - Connects to GPIO_26 of SDA845 SoC. Can be configured to be IRQ line and CAM0_VSYNC_OUT.
- GPIO K - Connects to GPIO_8 of SDA845 SoC. Can be configured to be a CAM1_RST signal.
- GPIO L - Connects to GPIO_40 of SDA845 SoC. Can be configured to be IRQ line and CAM1_AFE_GPO signal.

The IRQ lines create a wake-up event for the SoC.

5.1.4 SPI

The 96Boards specification calls for one SPI bus master to be provided on the Low Speed Expansion Connector. The DragonBoard 845C implements a full SPI master with 4 wires, CLK, CS, MOSI and MISO all connect directly to the SDA845 SoC. These signals are driven at 1.8V.

5.1.5 PCM/I2S

The 96Boards specification calls for one PCM/I2S bus to be provided on the Low Speed Expansion Connector. The CLK, FS and DO signals are required while the DI is optional.

The DragonBoard 845c implements a PCM/I2S with 4 wires, CLK, FS, D0 and DI. The I2S signals are connected directly to the SDA845 SoC. These signals are driven at 1.8V.

5.1.6 Power and Reset

The 96Boards specification calls for a signal on the Low Speed Expansion Connector that can power on/off the board and a signal that serves as a board reset signal.
The DragonBoard 845c routes the PWR_BTN_N (named PHONE_ON_N on 845c schematic) signal to the KYP_DPWR_N pin of the PM845 PMIC. This signal is driven by SW1301 as well, the on-board power on push-button switch(⑳). Please note that the push button only provides an On/Sleep function and not OFF functionality.
A mezzanine implementation of this signals should not drive it with any voltage, the only allowed operation is to force it to GND to start the board from a sleep mode. A board shutdown will occur when this signal is held to ground for more than 15 seconds.

The DragonBoard 845c board routes the RST_BTN_N (named PM_RESIN_N on DragonBoard 845c schematic) signal to the RESIN_N pin of the PM845 PMIC. This signal is driven by SW1302, the on-board reset switch(⑰). This signal is a dual purpose, the default purpose is Volume Down, the other purpose is the Reset function that needs the software configure setting.

5.1.7 Power Supplies

The 96Boards specification calls for three power rails to be present on the Low Speed Expansion Connector:

- +1.8V : Max of 100mA
- +5V : Able to provide a minimum of 5W of power (1A).
- SYS_DCIN : 9-18V input with enough current to support all the board functions or the output DCIN from on-board DC Connector able to provide a minimum of 7W of power.

The DragonBoard 845c supports these requirements as follows:
+1.8V : Driven by PMIC PM845 VREG_S4A_1P8, which can provide 100mA.
+5V : Driven by the 4A 5.0V DC to DC converter (U0801). This buck switcher powers HDMI and CAN current devices. The remaining capacity provides a max current of 2A to the Low Speed Expansion Connector to meets the 96Boards requirements.
SYS_DCIN: DC jack input can serve as the board's main power source.

5.2 Secondary Low Speed Connector:LS2 ⑩

PIN	845c Signal	Connect to	Note
1	DMIC_CLK1_OR_AMIC1_P	WCD9340	
3	DMIC_DATA1_OR_AMIC1_M	WCD9340	

5	MIC_BIAS1	WCD9340	
7	DMIC_CLK2_OR_AMIC3_P	WCD9340	
9	DMIC_DATA2_OR_AMIC3_M	WCD9340	
11	MIC_BIAS3	WCD9340	
13	DMIC_CLK3_OR_HPH_MIC_P	WCD9340	
15	DMIC_DATA3_OR_HPH_MIC_M	WCD9340	
17	MIC_BIAS4_OR_HS_MIC_BIAS2	WCD9340	
19	WCD_HPH_R	WCD9340	
21	WCD_HPH_REF	WCD9340	
23	WCD_HPH_L	WCD9340	
25	WSA0_SPKR_OUT_P	WSA8810	
27	WSA0_SPKR_OUT_M	WSA8810	
29	WSA1_SPKR_OUT_P	WSA8810	
31	WSA1_SPKR_OUT_M	WSA8810	
33	WCD_HSDET_L	WCD9340	
35	PM_GPIO13_GREEN_U4_LED	PM845	
37	VBAT		A board DC buck power 4.2V
39	GND		

PIN	845c Signal	Connect to	Note
2	LS2_CAN_H	MCP2561	
4	LS2_CAN_L	MCP2561	
6	VREG_LVS1A_1P8	PM845	
8	GND		
10	PMI_GPIO5	PMI8998	
12	PMI_GPIO8	PMI8998	
14	GPIO85_QUP5	SDA845	

16	GPIO86_QUP5	SDA845	
18	GPIO87_QUP5	SDA845	
20	GPIO88_QUP5	SDA845	
22	GPIO76_MI2S2_WS	SDA845	
24	GPIO75_MI2S2_SCK	SDA845	
26	GPIO77_MI2S2_DATA0	SDA845	
28	GPIO78_MI2S2_DATA1	SDA845	
30	PM_GPIO21	PM845	
33	PM_GPIO8	PM845	
34	PM_GPIO9_YEL_WIFI_LED	PM845	
36	PM_GPIO5_BLUE_BT_LED	PM845	
38	USB_VBUS	PMI8998	
40	GND		

5.2.1 Headset

The headset signals are routed from the WCD9340 codec, one signal is routed from the connector to the CODEC, the signals are:

- WCD_HPH_R - Headphone PA right channel output
- WCD_HPH_L - Headphone PA left channel output
- WCD_HPH_REF - Headphone PA ground sensing
- WCD_HSDET_L- Headset detection

5.2.2 Stereo speaker

The speaker signals are routed from the Stereo WSA8810; the signals are:

- WSA0_SPKR_OUT_P - Class-D speaker amplifier output+
- WSA0_SPKR_OUT_M - Class-D speaker amplifier output-
- WSA1_SPKR_OUT_P - Class-D speaker amplifier output+
- WSA1_SPKR_OUT_M - Class-D speaker amplifier output+

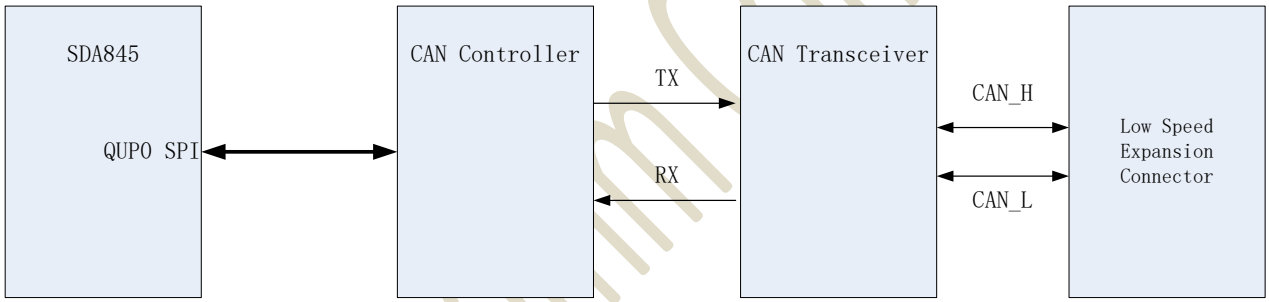
5.2.3 Digital Microphones

The expansion connector supports 3 additional default digital microphone inputs:

- DMIC_1 or AMIC_1
- DMIC_2 or AMIC_2
- DMIC_3 or HPH_MIC: Headset MIC
- MIC_BIAS1
- MIC_BIAS3
- MIC_BIAS4_OR_HS_MIC_BIAS2: Reference micbias4 or headset microphone bias

The analog microphone can be configured by changing the WCD codec audio share resistors. The HPH MIC is for headset microphone input.

5.2.4 CAN



The CAN signals are routed from CAN transceiver which is from SPI translation. The signals are:

- LS2_CAN_H: CAN High-Level Voltage I/O
- LS2_CAN_L: CAN Low-Level Voltage I/O

5.2.5 I2S

The DragonBoard 845c board implements another PCM/I2S with 4 wires, CLK, FS, D0 and DI. The I2S signals are connected directly to the SDA845 SoC. These signals are driven at 1.8V. The signals are:

●GPIO76_MI2S2_WS :TER_MI2S_WS
●GPIO75_MI2S2_SCK : TER_MI2S_SCK
●GPIO77_MI2S2_DATA0 : TER_MI2S_DATA0
●GPIO78_MI2S2_DATA1 : TER_MI2S_DATA1

5.2.6 GPIOs

The DragonBoard 845c board implements more GPIOs for Low Speed Expansion Connector. The GPIOs are 1.8V voltage rail.

- GPIO85_QUP5 - Connects to GPIO_85 of SDA845 SoC QUP5, Can be configured to be an IRQ line.
- GPIO86_QUP5- Connects to GPIO_86 of SDA845 SoC QUP5. Can be configured to be an IRQ line,
- GPIO87_QUP5 - Connects to GPIO_87 of SDA845 SoC QUP5.
- GPIO88_QUP5 - Connects to GPIO_88 of SDA845 SoC QUP5. Can be configured to be an IRQ line
- PMI_GPIO5 - Connects to GPIO_5 of PMI8998 PMIC. Can be configured to be a PWM
- PMI_GPIO8 - Connects to GPIO_8 of PMI8998 PMIC. Can be configured to be a PWM.
- PM_GPIO21 - Connects to GPIO_21 of PM845 PMIC. Can be configured to be ADC.
- PM_GPIO8 - Connects to GPIO_8 of PM845 PMIC. Can be configured to be ADC.
- PM_GPIO5_BLUE_BT_LED - Connects to GPIO_5 of PM845 PMIC. Can be configured to be Bluetooth LED enable.
- PM_GPIO9_YEL_WIFI_LED - Connects to GPIO_9 of PM845 PMIC. Can be configured to be WIFI LED enable.
- PM_GPIO13_GREEN_U4_LED - Connects to GPIO_13 of PM845 PMIC. Can be configured to be USER4 LED enable.

The IRQ lines create a wake-up event for the SoC.

5.2.7 Other signals on Secondary Low Speed Connector

The DragonBoard 845c implements more source voltage at the Lowe Speed Expansion Connector. The signals are:

- USB_VBUS : Connects to VBUS of PMI8998 PMIC, Can be configured to be an OTG USB VBUS.
- VBAT : Connects to a DC-DC buck of board power, be configured to output 4.2V source.
- VREG_LVS1A_1P8 : Connects to a SOM PMIC PM845 LVS1A LDO, be configured to output 1.8V source.

5.3 Tertiary Low Speed Connector:LS3 ⑪

PIN	845c Signal	Connect to	Note
1	SSC4_SPI_CLK	SDA845	
3	SSC3_SPI_MOSI	SDA845	
5	SSC2_SPI_MISO	SDA845	
7	SSC7_SPI_ACCEL_CS	SDA845	
9	SSC6_SPI_GYRO_CS	SDA845	
11	SSC5_SPI_MAG_CS	SDA845	
13	VREG_LVS2A_1P8	PM845	
15	VDC_5V		A board DC buck power 5V
17	VBAT		A board DC buck power 4.2V
19	GND		

PIN	845c Signal	Connect to	Note
2	GPIO124_PS_INT	SDA845	
4	GPIO117_ACCEL_INT	SDA845	
6	GPIO118_GYRO_INT	SDA845	
8	GPIO123_MAG_INT	SDA845	
10	GPIO119_MAG_DRDY_INT	SDA845	
12	SSC0_I2C_SDA	SDA845	
14	SSC1_I2C_SCL	SDA845	
16	VREG_S4A_1P8	PM845	
18	GND		
20	GND		

5.3.1 SSC SPI

The DragonBoard 845c implements a SSC SPI interface for different sensors that connect to Snapdragon 845 processor sensor core. The SPI can support 3 CS signals. The signals are:

- SSC4_SPI_CLK : Connects to SSC4 of SDA845 SoC, Be configured to CLK.
- SSC3_SPI_MOSI : Connects to SSC3 of SDA845 SoC. Be configured to MOSI.
- SSC2_SPI_MISO : Connects to SSC2 of SDA845 SoC. Be configured to MISO.
- SSC7_SPI_ACCEL_CS : Connects to SSC7 of SDA845 SoC. Be configured to Accelerometer CS.
- SSC6_SPI_GYRO_CS : Connects to SSC6 of SDA845 SoC. Be configured to Gyroscope CS.
- SSC5_SPI_MAG_CS : Connects to SSC5 of SDA845 SoC. Be configured to Magnetometer CS.

The dip switch(⑮) pin5 is the different configure setting for onboard 6-axis sensor ICM-42688 or other expansion. If the SPI for other expansion, dip switch pin5 needs to be removed from “OFF” to “ON”.

5.3.2 SSC I2C

The DragonBoard 845c implements a SSC I2C interface for different sensors that connect to Snapdragon 845 processor sensor core. A 2.2k resistor is neededto provide as pull-up for each of the I2C lines per the I2C specifications, these pull-ups need to connected to the 1.8V voltage rail. The signals are:

- SSC0_I2C_SDA : Connects to SSC0 of SDA845 SoC, Be configured to I2C SDA.
- SSC1_I2C_SCL : Connects to SSC1 of SDA845 SoC. Be configured to I2C SCL.

The dip switch(⑮) pin5 is the different configure setting for onboard I2C sensor LTR-553ALS-WA or other expansion. If the I2C for other expansion, dip switch pin5 needs to be removed from “OFF” to “ON”.

5.3.3 Sensor interrupt

The DragonBoard 845c implements a SSC interrupt for sensor interrupts that is the 1.8V voltage rail. The signals are:

- GPIO117_ACCEL_INT : Connects to GPIO_117 of SDA845 SoC, Be configured to Accelerometer INT.
- GPIO118_GYRO_INT : Connects to GPIO_118 of SDA845 SoC, Be configured to Gyroscope INT.
- GPIO119_MAG_DRDY_INT : Connects to GPIO_119 of SDA845 SoC, Be configured to Magnetometer data INT.
- GPIO123_MAG_INT : Connects to GPIO_123 of SDA845 SoC, Be configured to Magnetometer INT.
- GPIO124_PS_INT : Connects to GPIO_124 of SDA845 SoC, Be configured to Proximity INT.

5.3.4 Other signals on Tertiary Low Speed Connector

The DragonBoard 845c implements more source voltage at the Lowe Speed Expansion Connector. The signals are:

- VREG_LVS2A_1P8 : Connects to LVS2 LDO of PM845 PMIC, Can be as sensor IO voltage source.
- VDC_5V : Connects to a board DC buck power 5V, Can be as a 5V voltage source.
- VBAT : Connects to a board DC buck power 4.2V, Can be as a 4.2V voltage source.
- VREG_S4A_1P8 : Connects to S4A LDO of PM845 PMIC, Can be as a 1.8V voltage and 100mA source.

6 High speed expansion connectors

6.1 Primary High Speed expansion connector: HS1 ⑥

The following table shows the High Speed Expansion Connector pin out:

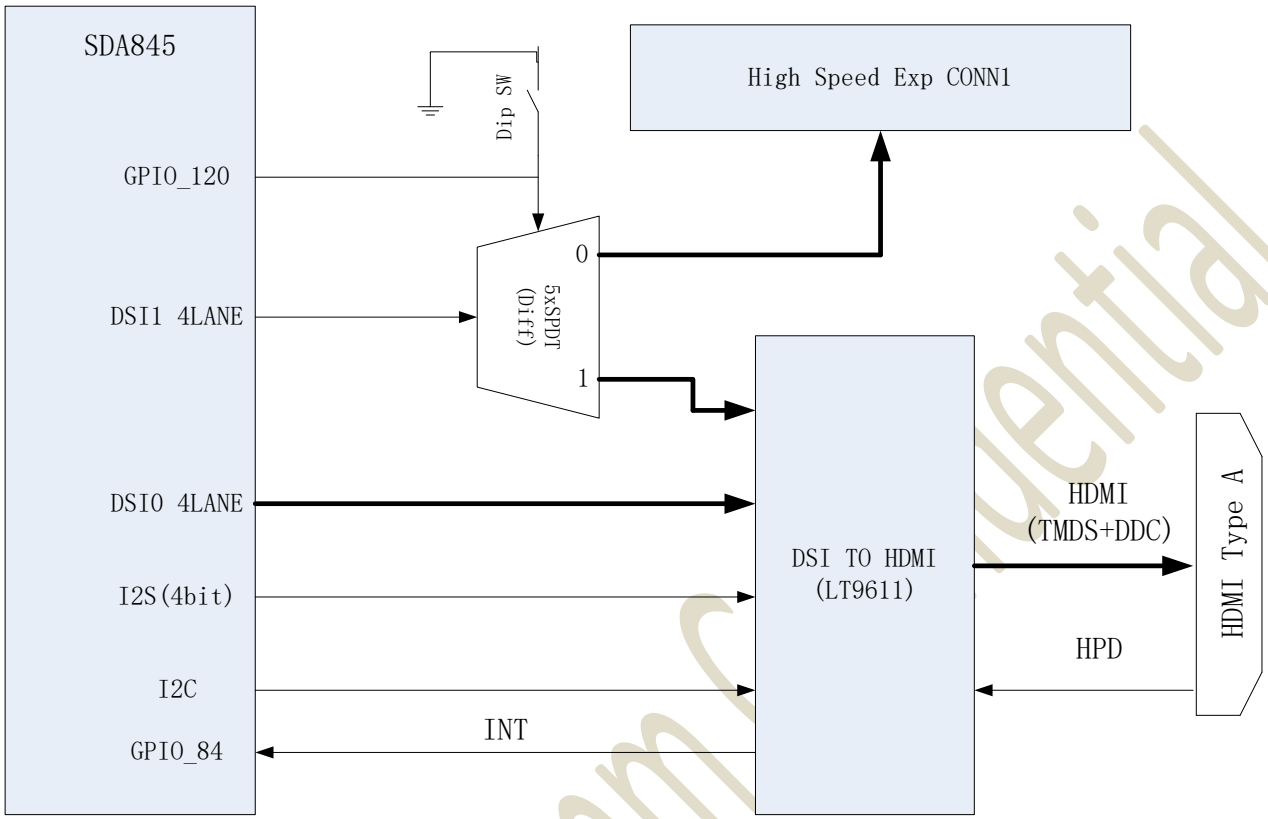
PIN	96Boards Signals	845c Signals	Note
1	SD_DAT0/SPI1_DOUT	SDC4_DATA0	
3	SD_DAT1	SDC4_DATA1	
5	SD_DAT2	SDC4_DATA2	
7	SD_DAT3/SPI1_CS	SDC4_DATA3	
9	SD_SCLK/SPI1_SCLK	SDC4_CLK	
11	SD_CMD/SPI1_DIN	SDC4_CMD	
13	GND	GND	
15	CLK0/CSI0_MCLK	CAM0_MCLK	
17	CLK1/CSI1_MCLK	CAM3_MCLK	
19	GND	GND	
21	DSI_CLK+	MIPI_DSI1_CLK_P	
23	DSI_CLK-	MIPI_DSI1_CLK_N	
25	GND	GND	
27	DSI_D0+	MIPI_DSI1_LANE0_P	
29	DSI_D0-	MIPI_DSI1_LANE0_N	
31	GND	GND	
33	DSI_D1+	MIPI_DSI1_LANE1_P	
35	DSI_D1-	MIPI_DSI1_LANE1_N	
37	GND	GND	
39	DSI_D2+	MIPI_DSI1_LANE2_P	
41	DSI_D2-	MIPI_DSI1_LANE2_N	

43	GND	GND	
45	DSI_D3+	MIPI_DSI1_LANE3_P	
47	DSI_D3-	MIPI_DSI1_LANE3_N	
49	GND	GND	
51	USB_D+	PCIE0_USB4_HS_DP	***PCIe USB HUB port 4.***
53	USB_D-	PCIE0_USB4_HS_DM	
55	GND	GND	
57	HSIC_STR	PCIE0_USB5_HS_DP	***No HSIC implementation; configured as USB 2.0 expansion. PCIe USB port 2.***
59	HSIC_DATA	PCIE0_USB5_HS_DM	

PIN	96Boards Signals	845c Signals	Note
2	CSI0_C+	MIPI_CSI0_CLK_P	
4	CSI0_C-	MIPI_CSI0_CLK_N	
6	GND	GND	
8	CSI0_D0+	MIPI_CSI0_LANE0_P	
10	CSI0_D0-	MIPI_CSI0_LANE0_N	
12	GND	GND	
14	CSI0_D1+	MIPI_CSI0_LANE1_P	
16	CSI0_D1-	MIPI_CSI0_LANE1_N	
18	GND	GND	
20	CSI0_D2+	MIPI_CSI0_LANE2_P	
22	CSI0_D2-	MIPI_CSI0_LANE2_N	
24	GND	GND	
26	CSI0_D3+	MIPI_CSI0_LANE3_P	
28	CSI0_D3-	MIPI_CSI0_LANE3_N	
30	GND	GND	

32	I2C2_SCL	CCI_I2C_SDA0	
34	I2C2_SCL	CCI_I2C_SCL0	
36	I2C3_SDA	CCI_I2C_SDA1	
38	I2C3_SDA	CCI_I2C_SCL1	
40	GND	GND	
42	CSI1_D0+	MIPI_CSI3_LANE0_P	
44	CSI1_D0-	MIPI_CSI3_LANE0_N	
46	GND	GND	
48	CSI1_D1+	MIPI_CSI3_LANE1_P	
50	CSI1_D1-	MIPI_CSI3_LANE1_N	
52	GND	GND	
54	CSI1_C+	MIPI_CSI3_CLK_P	
56	CSI1_C-	MIPI_CSI3_CLK_N	
58	GND	GND	
60	RESERVED	VREG_S4A_1P8	

6.1.1 MIPI DSI 0



The 96Boards specification calls for a MIPI-DSI to be present on the High Speed Expansion Connector. A minimum of one lane is required and up to four lanes can be accommodated on the connector.
The DragonBoard 845c implementation supports a full four lane MIPI-DSI interface that is routed to the Primary High Speed Expansion Connector. Since the SDA845 has no HDMI interface, and it is used to drive the DSI-HDMI Bridge, DSI muxing is required. A muxing device (FSA644UCX) is being use on the board. Only one interface, HDMI, or the Expansion MIPI-DSI can be active at a given time. The signal is named 'GPIO120_DSI_SW_SEL'. When this signal is logic high, '1', the MIPI-DSI is routed to the DSI-HDMI Bridge. When 'GPIO120_DSI_SW_SEL' is logic level low, '0', the MIPI-DSI is routed to the High Speed Expansion connector. This design assigned the 'GPIO120_DSI_SW_SEL' function to GPIO_120.

User can overwrite the software control by sliding switch 4 of Dip Switch to the 'ON' position. That action forces the DSI mux to route the MIPI-DSI to the High Speed Expansion connector. The overwrite option exist for the High Speed Expansion only, you cannot software overwrite the mux to DSI-HDMI Bridge.

6.1.2 MIPI CSI {0/1}

The 96Boards specification calls for two MIPI-CSI interfaces to be present on the High Speed Expansion Connector. Both interfaces are optional. CSI0 interface can be up to four lanes while CSI1 is up to two lanes.

The current DragonBoard 845c implementation supports a full four lane MIPI-CSI interface on CSI0 and two lanes of MIPI-CSI on CSI3. All MIPI-CSI signals are routed directly to/from the SDA845.

6.1.3 I2C {2/3}

The 96Boards specification calls for two I2C interfaces to be present on the High Speed Expansion Connector. Both interfaces are optional unless a MIPI-CSI interface has been implemented. Then an I2C interface shall be implemented.

The current DragonBoard 845c implementation supports two MIPI-CSI interfaces and therefore must support two I2C interfaces. For MIPI-CSI0 the companion I2C2 is routed directly from the SDA845. For MIPI-CSI3, the companion I2C is I2C3.

Note: Both interfaces, I2C2 and I2C3 have an on-board 2.2K pull-up resistors pulled-up to the 1.8V voltage rail.

6.1.4 HSIC

The 96Boards specification calls for an optional MIPI-HSIC interface to be present on the High Speed Expansion Connector.

The DragonBoard 845c implementation doesn't support this optional requirement.

6.1.5 Reserved

The 96Boards specification calls for a 10K pull-up to 1.8V to be connected to pin 60 of the High Speed Expansion Connector.

The DragonBoard 845c utilizes a 100K pull-up on pin 60.

6.1.6 SD/SPI

The 96Boards specification calls for an SD interface or a SPI port to be part of the High Speed Expansion Connector. The DragonBoard 845c implements a full SD master with SDIO (CLK/CMD/D0~D3) directly to the SDA845 SoC. These signals are driven at 1.8V.

6.1.7 Clocks

The 96Boards specification calls for one or two programmable clock interfaces to be provided on the High Speed Expansion Connector. These clocks may have a secondary function of being CSI0_MCLK and CSI1_MCLK. If these clocks can't be supported by the SoC than an alternative GPIO or No-Connect is allowed by the specifications.

The DragonBoard 845c implements two CSI clocks, CAM0_MCLK via SDA GPIO_13 for CSI0 and CAM3_MCLK via SDA GPIO_16 for CSI3. These signals are driven at 1.8V.

6.1.8 USB

The 96Boards specification calls for a USB Data line interface to be present on the High Speed Expansion Connector.

The DragonBoard 845c implements this requirement by routing USB channel 2/4 from the PCIe USB HUB to the High Speed Expansion Connector.

6.2 Secondary High Speed Connector: HS2⑫

PIN	845c Signals	Connect to	Note
1	PCIE1_REFCLK_M	SDA845	
3	PCIE1_REFCLK_P	SDA845	
4	PCIE1_RX_M	SDA845	
7	PCIE1_RX_P	SDA845	
9	PCIE1_TX_M	SDA845	
11	PCIE1_TX_P	SDA845	
13	GPIO102_PCIE1_RST_N	SDA845	Configured for PCIe1 RST
15	GPIO103_PCIE1_CLK_REQ	SDA845	Configured for PCIe1 CLK REQ
17	GPIO11_PCIE1_WAKE_N	SDA845	Configured for PCIe1 WAKE
19	GPIO12_CAM2_RST_N	SDA845	
21	GPIO21_CAM3_RST_N	SDA845	
23	GPIO116_CAM3_VSYNC_OUT	SDA845	
25	GND		
27	CAM1_MCLK	SDA845	
29	CAM2_MCLK	SDA845	
31	GND		
33	MIPI_CSI2_CLK_P	SDA845	

35	MIPI_CSI2_CLK_N	SDA845	
37	GND		
39	MIPI_CSI2_LANE0_P	SDA845	
41	MIPI_CSI2_LANE0_N	SDA845	
43	GND		
45	MIPI_CSI2_LANE1_P	SDA845	
47	MIPI_CSI2_LANE1_N	SDA845	
49	GND		
51	MIPI_CSI2_LANE2_P	SDA845	
53	MIPI_CSI2_LANE2_N	SDA845	
55	GND		
57	MIPI_CSI2_LANE3_P	SDA845	
59	MIPI_CSI2_LANE3_N	SDA845	

PIN	845c Signals	Connect to	Note
2	MIPI_CSI1_CLK_P	SDA845	
4	MIPI_CSI1_CLK_N	SDA845	
6	GND		
8	MIPI_CSI1_LANE0_P	SDA845	
10	MIPI_CSI1_LANE0_N	SDA845	
12	GND		
14	MIPI_CSI1_LANE1_P	SDA845	
16	MIPI_CSI1_LANE1_N	SDA845	
18	GND		
20	MIPI_CSI1_LANE2_P	SDA845	
22	MIPI_CSI1_LANE2_N	SDA845	

24	GND		
26	MIPI_CSI1_LANE3_P	SDA845	
28	MIPI_CSI1_LANE3_N	SDA845	
30	GND		
32	SSC10_SPI2_CLK	SDA845	
34	SSC11_SPI2_CS_L	SDA845	
36	SSC9_SPI2_MOSI	SDA845	
38	SSC8_SPI2_MISO	SDA845	
40	GPIO24_CAM2_SLM_IRQ	SDA845	
42	GPIO22_CAM0_STROBE_OUT	SDA845	
44	GPIO23	SDA845	
46	GPIO69_CAM2_SLM_EN	SDA845	
48	PM_GPIO12	PM845	
50	PM_GPIO10	PM845	
52	GND		
54	PCIE0_USB4_SS_TX_P	PCIe USB HUB PORT4	
56	PCIE0_USB4_SS_TX_M	PCIe USB HUB PORT4	
58	PCIE0_USB4_SS_RX_P	PCIe USB HUB PORT4	
60	PCIE0_USB4_SS_RX_M	PCIe USB HUB PORT4	

6.2.1 MIPI CSI {1/2}

The Secondary High Speed Expansion Connector supports a 4-lane MIPI-CSI bus (MIPI-CSI1/MIPI-CSI2). All MIPI-CSI signals are routed directly to/from the SDA845.

6.2.2 Clock

The DragonBoard 845c implements another two CSI clocks on the Secondary High Speed Expansion Connector, CAM1_MCLK via SDA GPIO_14 for CSI1 and CAM2_MCLK via SDA GPIO_15 for CSI2. These signals are driven at 1.8V.

6.2.3 SPI{SSC_SPI2}

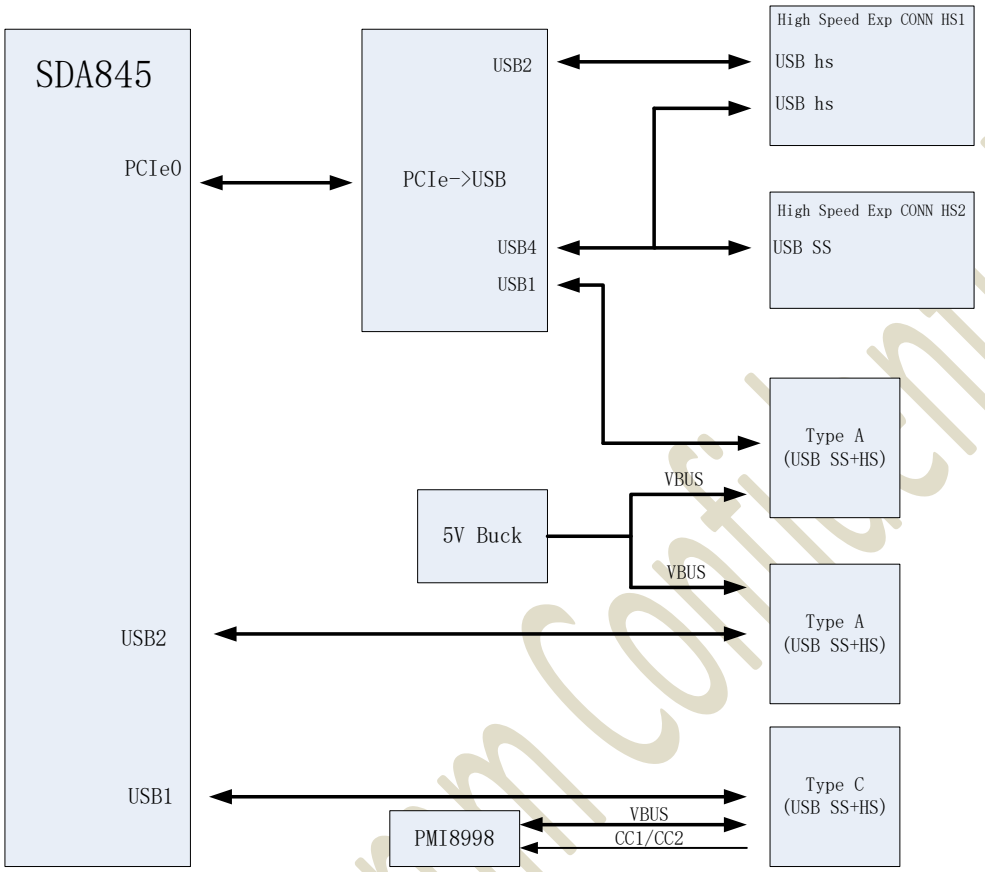
The DragonBoard 845c implements another SSC SPI interface on the Secondary High Speed Expansion Connector that connect to Snapdragon 845 processor sensor core. These signals are driven at 1.8V.

- SSC8_SPI2_MISO : Connects to SSC8 of SDA845 SoC. Be configured to MISO.
- SSC9_SPI2_MOSI : Connects to SSC9 of SDA845 SoC. Be configured to MOSI.
- SSC10_SPI2_CLK : Connects to SSC10 of SDA845 SoC. Be configured to CLK.
- SSC11_SPI2_CS_L : Connects to SSC11 of SDA845 SoC. Be configured to CS.

6.2.4 PCIe1

The SDA845 processor has two PCIe ports. The DraonBoard 845c implements one PCIe1 interface on the Secondary High Speed Expansion Connector that connect to SDA845.

6.2.5 USB



The DragonBoard 845c implements one USB Supper speed interface on the Secondary High Speed Expansion Connector.

The Supper Speed USB of HS2 and High Speed USB of HS1 can be combined to one USB3.0 port.

6.2.6 Other signals on Secondary High Speed Connector

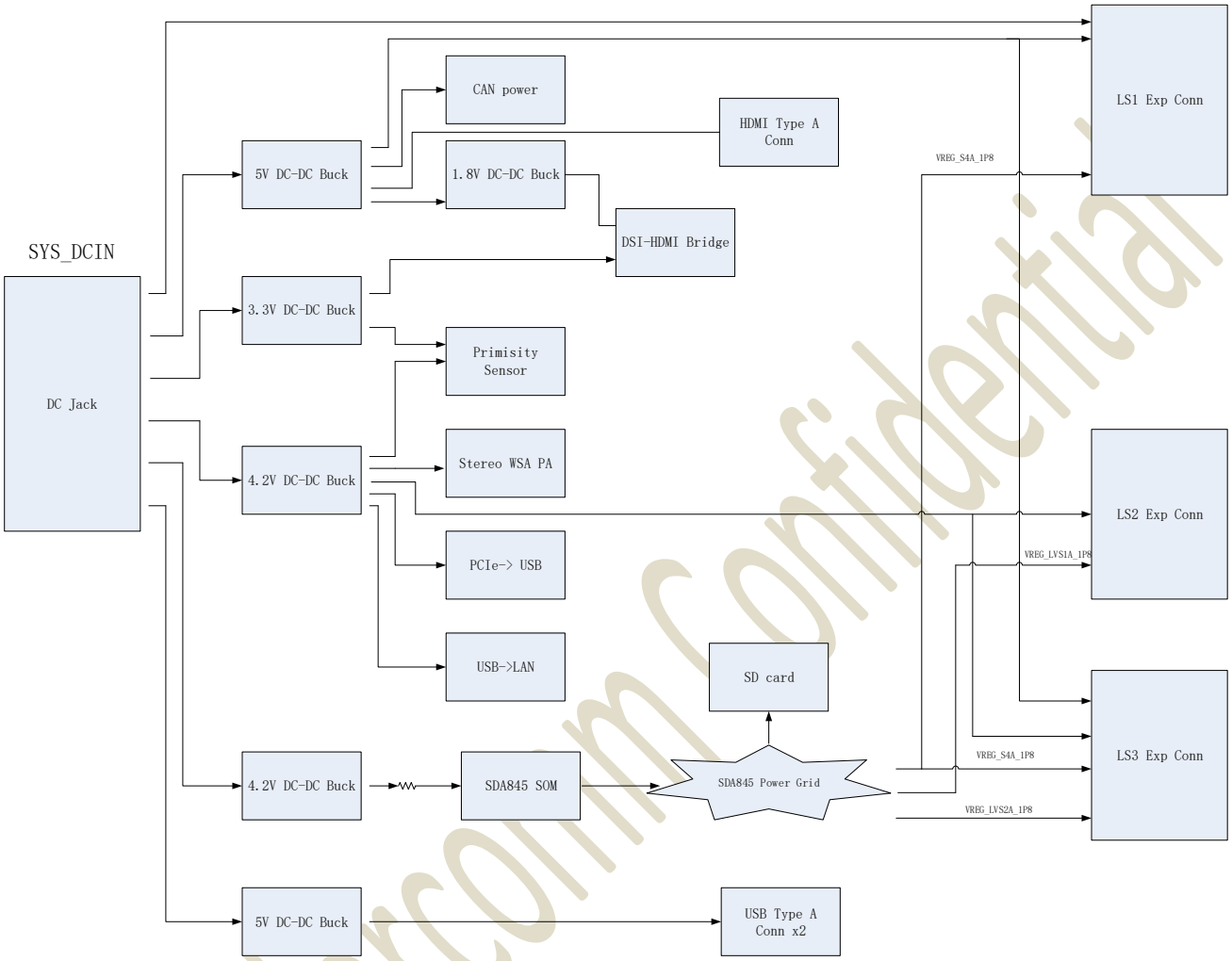
The DragonBoard 845c implements more GPIOs on the Secondary High Speed Expansion Connector. The GPIOs are 1.8V voltage rail.

- GPIO12_CAM2_RST_N - Connects to GPIO_12 of SDA845 SoC. Can be configured to be Camera 2 reset.
- GPIO21_CAM3_RST_N - Connects to GPIO_21 of SDA845 SoC. Can be configured to be Camera 3 reset.
- GPIO116_CAM3_VSYNC_OUT - Connects to GPIO_116 of SDA845 SoC. Can be configured to be an IRQ line or CAM3 VSYNC.
- GPIO24_CAM2_SLM_IRQ - Connects to GPIO_24 of SDA845 SoC. Can be configured to be an IRQ line

- GPIO22_CAM0_STROBE_OUT - Connects to GPIO_22 of SDA845 SoC. Can be configured to be IRQ line or camera 0 strobe.
- GPIO23 - Connects to GPIO_23 of SDA845 SoC.
- GPIO69_CAM2_SLM_EN - Connects to GPIO_69 of SDA845 SoC.
- PM_GPIO12 - Connects to GPIO_12 of PM845 PMIC.
- PM_GPIO10 - Connects to GPIO_10 of PM845 PMIC.

The IRQ lines create a wake-up event for the SoC.

7 Power management



The 96Boards specification defines how power arrives to the board and few supplies that the board needs to provide. The on-board power requirement for each 96Boards implementation depends on the SoC and the set of peripherals that are specific to that implementation.

The DragonBoard 845c uses five buck regulators, U0700, U0701, U0800, U0801 and U1505 takes the power in to the board. The U0700 and U0701 generates 4.2V at 4A. U0700 feeds the WSA power and others, U0701 feed the SDA845 SOM power. U0800 generates the 3.3V at 1A for sensor and HDMI IO voltage. U0801 generates at 5V at 2A, feeds the HDMI, CAN and LS1/LS3.U1505 generates 5V at 2A, feeds the USB type A power.

7.1 DC Power Input

The 96Boards specification calls for a power to be provided to the board in one of the following ways:

- An 8V to 18V power from a dedicated DC jack.

  The DragonBoard 845c supports this requirement through the use of ⑬, ‘SYS_DCIN’ power connector.

Please note: the SYS_DCIN can be as low as 6.5V on the 845c board.

- An 8V to 18V power from the SYS_DCIN pins on the Low Speed Expansion Connector.

  Please note: the SYS_DCIN can be as low as 6.5V on the 845c board.

  The DragonBoard 845c supports incoming power through this connector.

- A USB Type C port at 5V.

  The DragonBoard 845c supports the 5V from USB Type C port. But it can't support the bring up the system power on.

7.2 Power Source Selection

The 96Boards specification calls for only one power source to be applied to the board at any given time. Following this requirement, the user of the DragonBoard 845c should never apply power to the board from ⑬ and the Low Speed Expansion connector at the same time. There is no active or passive mechanism on the DragonBoard 845c to prioritize one source over the other.

7.3 Power Sequencing

Upon applying power to the DragonBoard 845c (either one of the two sources), both buck regulators will be enabled and will start regulating their target voltages. When the output of U0701 is on, it will power the on-board PMIC, the PMI8998 power management device. PMI8998 generates VPH_PWR which supplies the PM845. The sequencing of all power rails is set within the PMIC configuration scheme during the production of this part. The user has no access to alter, modify or change the PMIC power up sequencing.

7.4 Power Measurements

The 96Boards specification calls for a minimum of one current sense resistor to be placed on the board permitting a basic power measurement functions.
The DragonBoard 845c implements two different power measurements.

7.5 DC-In measurement

A 0.01ohm resistor R0719 is placed in line of the DC12V on the DC input. Placing a probe over the resistor pins will provide a voltage measurement of the voltage drop across the resistor. Dividing this measurement by 0.01 will give you the amount of the current flowing into the DC.

7.6 PMIC Power-In measurement

A 0.01ohm resistor R0709 is placed in line to the VBAT_SOM on the 4.2V supply on the output of U0701. Placing

a probe over the resistor pins will provide a voltage measurement of the voltage drop across the resistor. Dividing this measurement by 0.01 will give you the amount of the current flowing into the SDA PMIC.

8 Buttons and status LED's

8.1 Buttons

8.1.1 Volume up

The Volume UP button (⑯) is used to control the audio volume of the DragonBoard 845c.

8.1.2 Volume down

The Volume Down button (⑰) is used to control the audio volume of the DragonBoard 845c.

8.1.3 Power Button

The push-button ⑳ servers as the power-on/off/sleep button. Upon applying power to the board, the boot process will start. Once the board is powered on and booted up:

Sleep/suspend

- You can put the device to sleep by pressing this button momentarily.
- You can wake the device from sleep by pressing this button momentarily.

Power Off/On

Option 1: Long press/hold

- While the device is awake, pressing and holding the power button ⑳ for longer than 15 seconds will result in the device powering off.
- Once powered off, pressing and holding the power button ⑳ for longer than 3 seconds will result in the device powering on.

Option 2: Short press/hold

- While the device is awake, pressing and holding the power button ⑳ for 2~3 seconds will result in the user interface displaying the 'power off' notice.
- Using a mouse, clicking on this notice will cause the DragonBoard 845c to power off.
- Once powered off, pressing and holding the power button ⑳ for longer than 3 seconds will result in the device powering on.

8.1.4 Reset Button

The on-board ⑰ push-button has two functions, it serves as a reset button and as a Volume button.
The reset function needs to be software configured setting.

8.1.5 Force_USB_BOOT Button

The on-board ⑱ push-button is used for emergency USB boot for during development.

8.2 LED's

There are two status LEDs and four User LEDs on the 845c. The Status LEDs report the status of the Bluetooth and Wi-Fi devices onboard. The user LEDs are driven by the SoC directly.

8.2.1 User LED 1-4

The four user LEDs are surface mount Green LEDs, 0603 size, located next to the two USB type A connector and labeled 'USER LEDS 3 2 1 0'.

8.2.2 Bluetooth status

The BT LED on the DragonBoard 845c is located next to the USB OTG connector; this LED reflects the status of the Bluetooth device.

8.2.3 WiFi status

The WIFI LED on the DragonBoard 845c is located beside the BT LED, this LED reflects the status of the Wi-Fi device.

8.2.4 Power Indicator LED

The power indicator on the DragonBoard 845c is located beside the DC jack, this LED notify the user that the power is applied.

9 Boot configuration

There is a Dip Switch ⑮ located on the top of the development board.

Switch 1: NA.

Switch 2: 'ONBOARD_DEBUG_UART_EN_N' SD BOOT', when set to 'ON' position, will force the SDA UART log to USB port, when set to 'OFF' position, will force the SDA UART log to Low Speed Expansion Connector LS1.

Switch 3: 'CBL_PWR_N', when set to 'ON' position, will force the device to boot up automatically; when set to 'OFF' position, will force the deice to boot up by manual power button.

Switch 4: 'SW_DSI1_TO_LT9611_N', when set to 'ON' position, will force the MIPI-DSI1 to High Speed Expansion Connector HS1; when set to 'OFF ' position, the MIPI-DSI1 to LT9611 DSI-HDMI bridge.

Switch 5: ' SENSOR_DISCONNECT ', when set to 'ON' position, will force the SDA845 SSC sensor SPI/I2C to Low Speed Expansion Connector; when set to 'OFF', will force the SSC sensor SPI/I2C to onboard sensor.

Switch 6: ' IMU_EXT_CLK_TOGGLE ', when set to 'ON' position, the onboard ICM-42688 sensor will use the external clk of GPIO78 from SoC; when set to 'OFF', the onboard ICM-42688 sensor will use another interrupt output to SoC GPIO118. These GPIOs needs the software configure setting.

10 Mechanical specification

10.1 Board dimensions