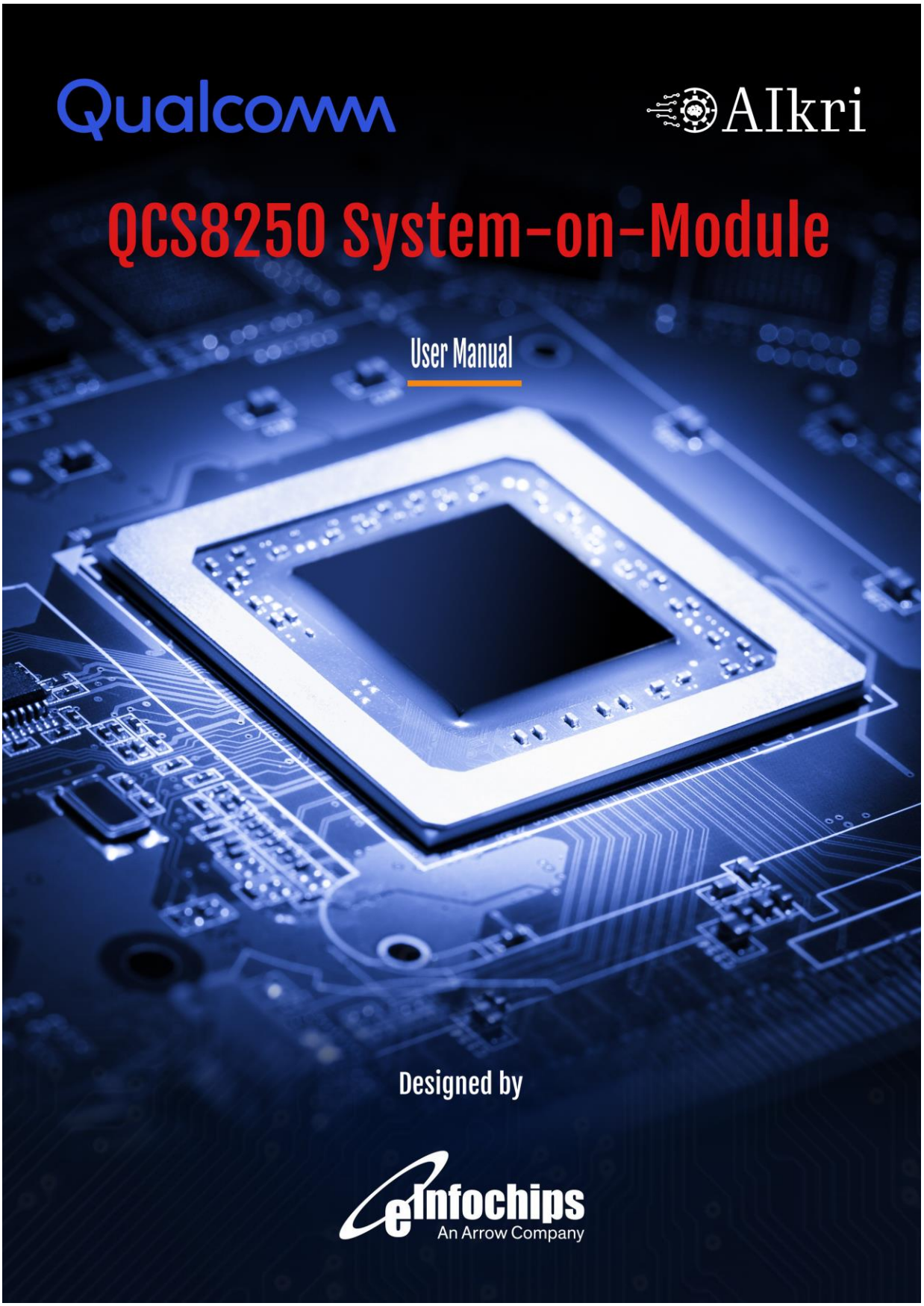
Qualcomm
AIkri
QCS8250 System-on-Module
User Manual
Designed by
eInfochips
An Arrow Company

Confidentiality Notice

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1 Document Details:

1.1 Document History

Version	Author		Description of Changes
	Name	Date	
0.1	eInfochips	23 Aug 2023	Initial release
0.2	eInfochips	2 May 2024	FCC ID – Texts updated with capital letters. Antenna details shown in image
0.3	eInfochips	27 May 2024	Regulatory compliance related details updated and caution statements added

1.2 Definition, Acronyms and Abbreviations

Definition/Acronym/Abbreviation	Description
ADB	Android Debug Bridge
ARM	Advanced RISC Machine
B2B Connectors	Board to Board Connectors
BOM	Bill of Material
BT	Bluetooth
CAN	Controller Area Network
CPU	Central Processing Unit
CSI	Camera Serial Interface
DC	Direct Current
DRAM	Dynamic Random-Access Memory
DSI	Display Serial Interface
DSP	Digital signal processing
EIC	eInfochips
GPIO	General Purpose Input Output
GPU	Graphics Processing Units
HDMI	High-Definition Multimedia Interface
HS	High Speed
I/O	Input Output
I2C	Inter-Integrated Circuit
I2S	Inter-IC Sound
IC	Integrated Circuit
IMU	Inertial Measurement Unit
IOT	Internet of Things
KB	Kilo Byte
LAN	Local Area Network
LED	Light Emitting Diode
LPDDR	Low Power Double Data Rate
LS	Low Speed
MDP	Mobile display processor

MIC	Microphone
MIMO	Multiple Input Multiple Output
MIPI	Mobile protocol working Alliance (not an Acronym)
MISO	Master in Slave Out
MMC	Multimedia Card
MOSI	Master Out Slave In
MP	Mega Pixel
MST	Multi Stream Transport
OEM	Original Equipment Manufacturer
PCB	Printed circuit board
PDM	Pulse Density Modulation
PMIC	Power Management IC
QC	Qualcomm
QDL	Qualcomm Downloader
Qty	Quantity
RAM	Random Access Memory
Ref des	Reference Designator
RF	Radio Frequency
RH	Relative Humidity
RoHS	Restriction of Hazardous Substances
SDIO	Secure Digital Input Output
SISO	Single Input Single Output
SMPS	Switched Mode Power Supply
SOC	System on chip
SoM	System on Module
SPI	Serial peripheral Interface
SPMI	System power management interface
SST	Single Stream Transport
TBD	To Be Decided
TDM	Time Division Multiplexing
UART	Universal Asynchronous Receiver Transmitter
USB	Universal Serial Bus
WLAN	Wireless Local Area Network

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3 Preface

This document provides an overview of the QCS8250SOM based on Qualcomm's QCS8250 chipset. It provides information about the hardware components and associated connector details.

3.1 Intended Audience

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

3.2 Intended Use

The development platform supports a wide range of industry interfaces and offers a comprehensive hardware and software design. It comes with QCS8250 software packages. This platform enables developers to evaluate and create solutions targeted at various market segments while customers and OEMs can build their products based on these designs directly or with customizations.

4 Pre-requisites

4.1 Development Device Notice

This device contains RF/digital hardware and software intended for engineering development, engineering evaluation, or demonstration purposes only and is intended for use in a controlled environment. This device is not being placed on the market, leased, or sold for use in a residential environment or for use by the general public as an end user device.

4.2 Anti-Static Handling Procedure

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

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

5 Compliance Specifications

5.1 FCC Compliance statement (USA)

FCC ID: 2ATUP-AIKRI-82X-50S

5.1.1 Compliance statements:

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, an interference that may cause undesired operation.

5.1.2 Caution Statements:

- Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.
- This equipment should be installed and operated with a minimum distance of 20cm between the radiator and your body.
- Changes or modifications not expressly approved by the party responsible for compliance could void the use's authority to operate the equipment.
- The modular transmitter is only FCC authorized for the specific rule parts (Part 15 Subpart C) listed on the grant, and the host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. The final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.
- This product is certified as type of the portable device with FCC Rules. To maintain compliance with RF Exposure requirement, please use within specification of this product.
- The following statement shall be indicated in the user manual of the host device;
    - The antenna used for this transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

5.1.3 Other Regulatory Requirements:

- Please notify certified ID by either one of the following method on your end product.
    - Contains Transmitter Module FCC ID:2ATUP-AIKRI-82X-50S
    - Contains FCC ID:2ATUP-AIKRI-82X-50
- The following statement shall be indicated in the user manual of the host device;
    - 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

5.1.4 Antenna Details:

- Manufacturing part number: FXP840.07.0055B
  - Flexible monopole antenna
- Manufacturer: Taoglas
- Mechanical Parameters:

Dimenions	14 x 5 x 0.1 mm
Material	Polymer
Connector	I-PEX MHF I (U.FL Compatible)
Cable	55mm of Ø0.81mm
Weight	1g

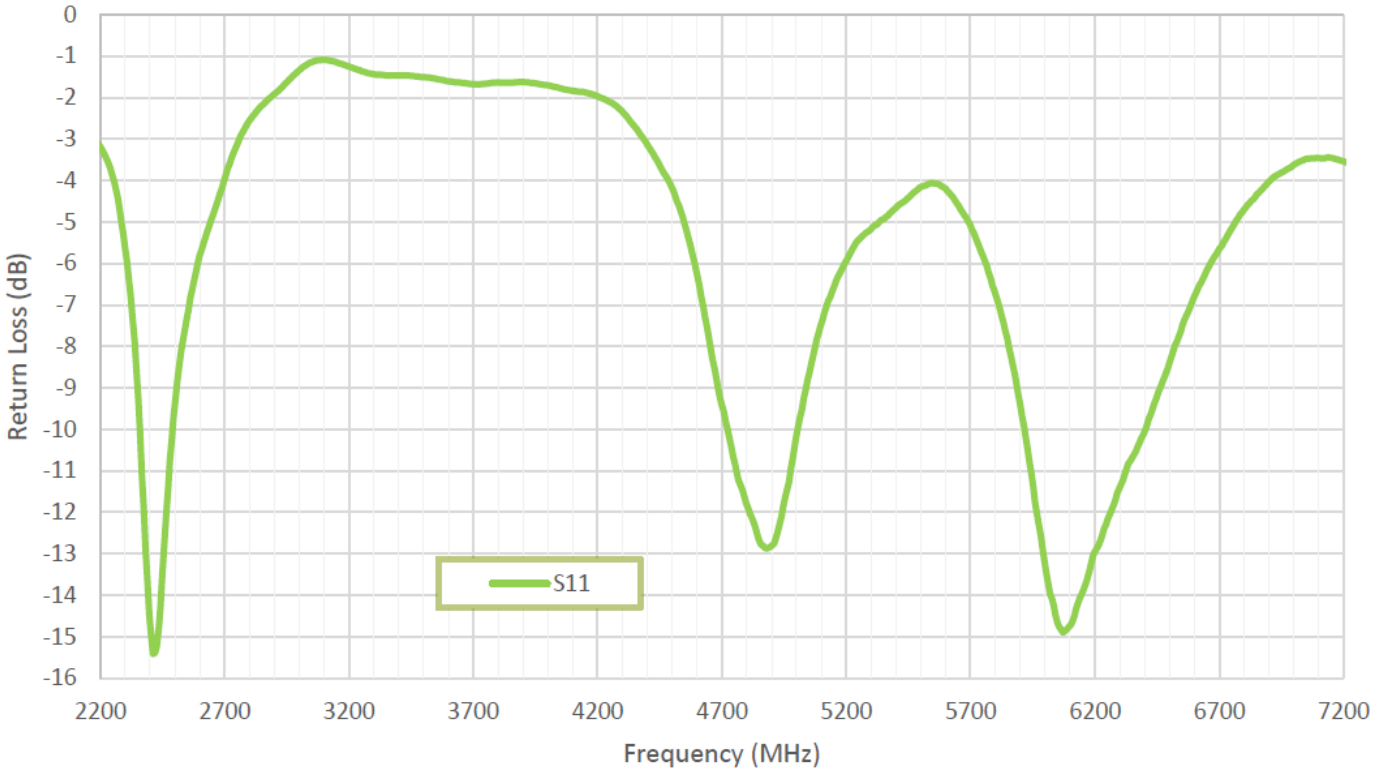
- Antenna Gain:

Band	Frequency (MHz)	Efficiency (%)	Average Gain (dB)	Peak Gain (dBi)	Impedance	Polarization	Radiation Pattern	Max Input Power
2.4GHz Wi-Fi	2400~2500	53.7	-2.7	3.6	50 Ω	Linear	Omni-Directional	2W
5.8GHz Wi-Fi	5150~5850	34.1	-4.8	1.3				
7.1GHz Wi-Fi 6	5925~7125	59.1	-2.3	2.7				

- Environmental conditions:

Operation Temperature	-40°C to +85°C
Storage Temperature	-40°C to +85°C
Humidity	Non-condensing 65°C 95% RH
RoHS Compliant	Yes
REACH Compliant	Yes

- S11 Plot: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-1
-2
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-9
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-11
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-14
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-16
Return Loss (dB)
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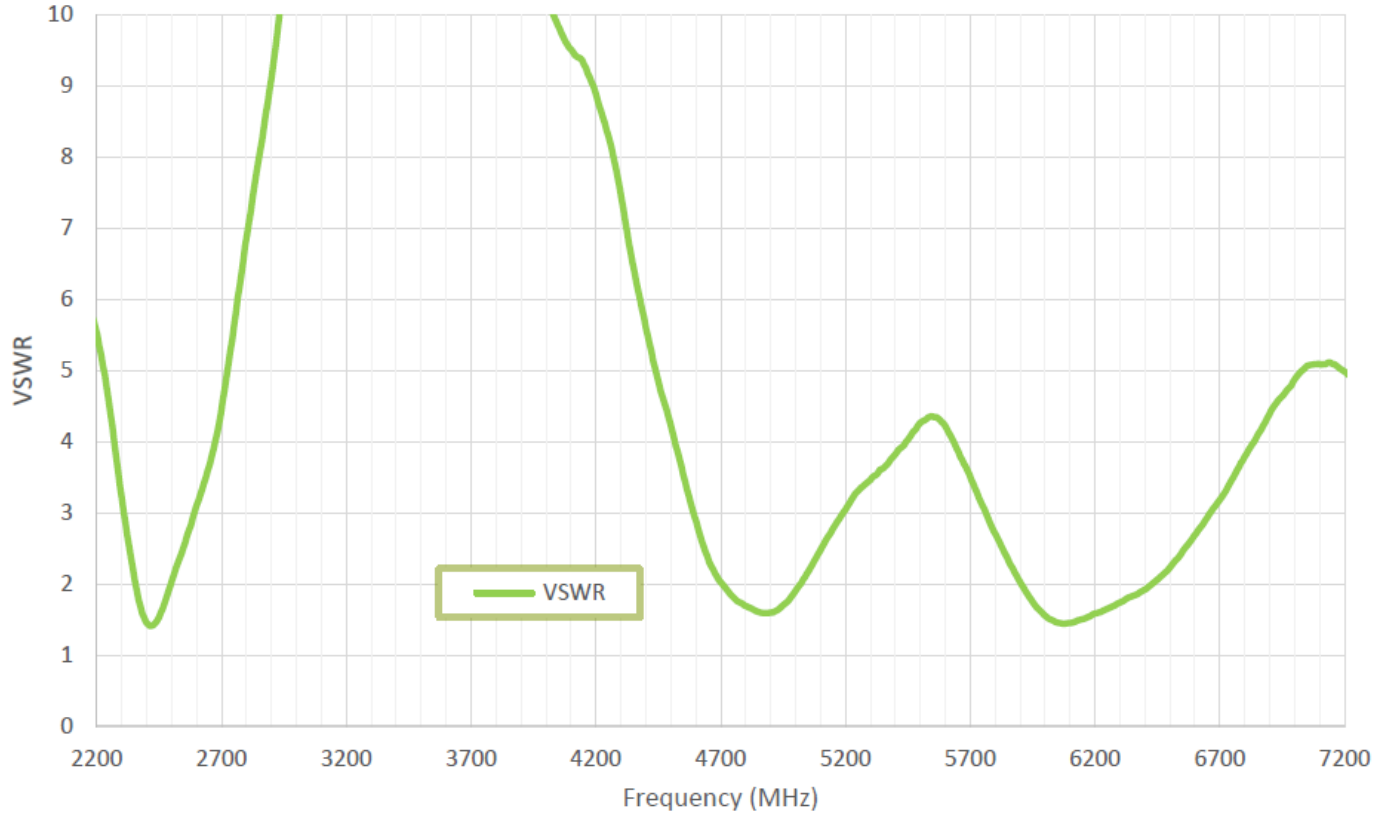
4700
5200
5700
6200
6700
7200
Frequency (MHz)

- VSWR: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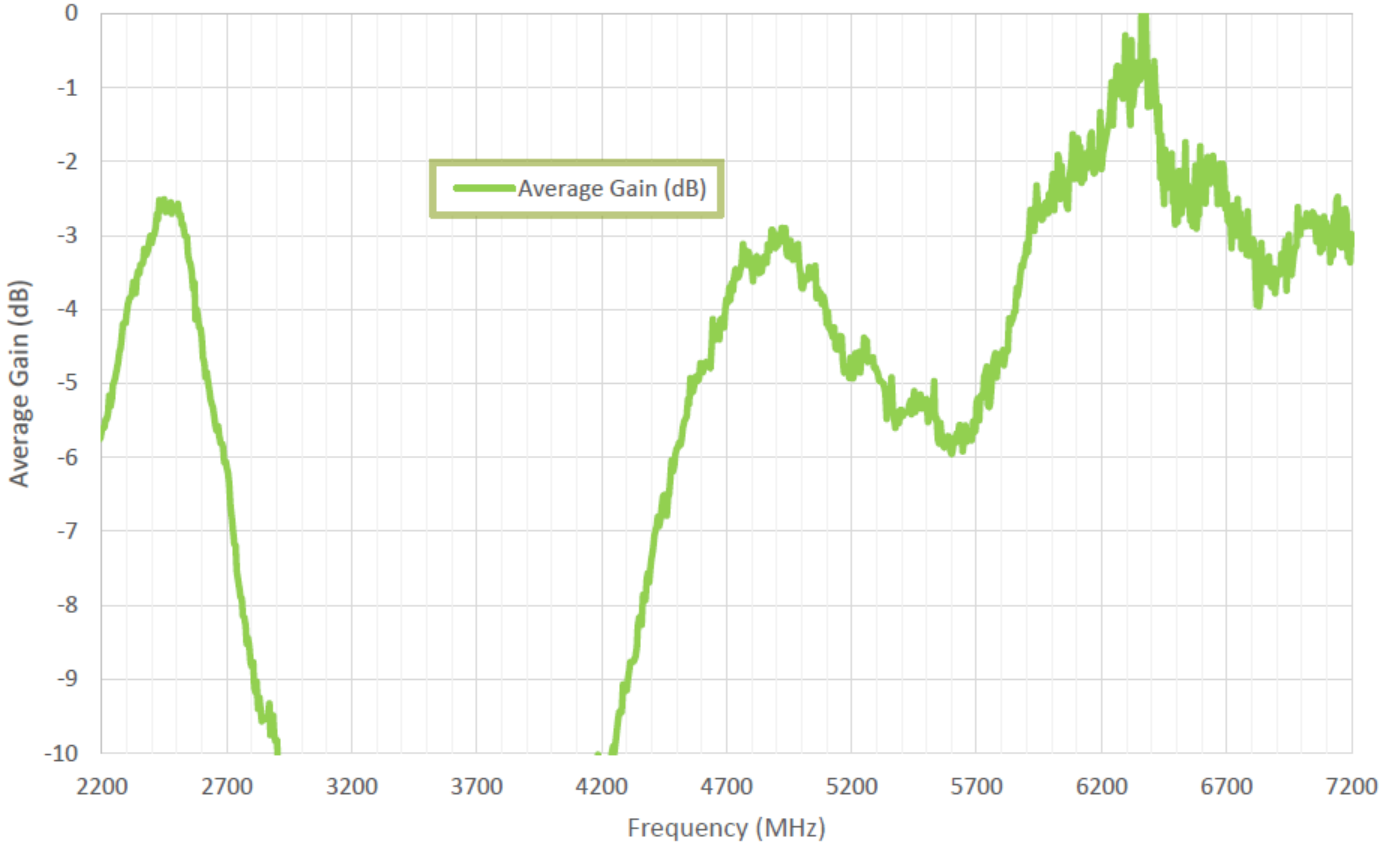
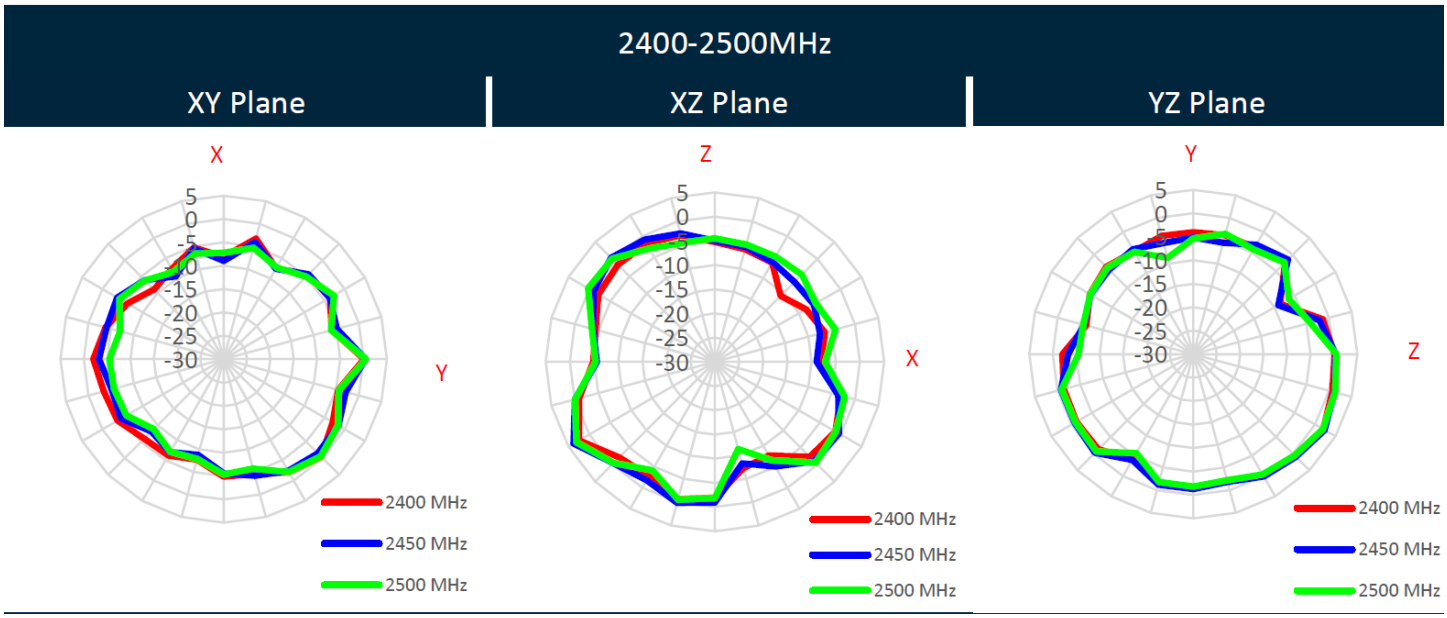
VSWR
VSWR
2200
2700
3200
3700
4200
4700
5200
5700
6200
6700
7200
Frequency (MHz)

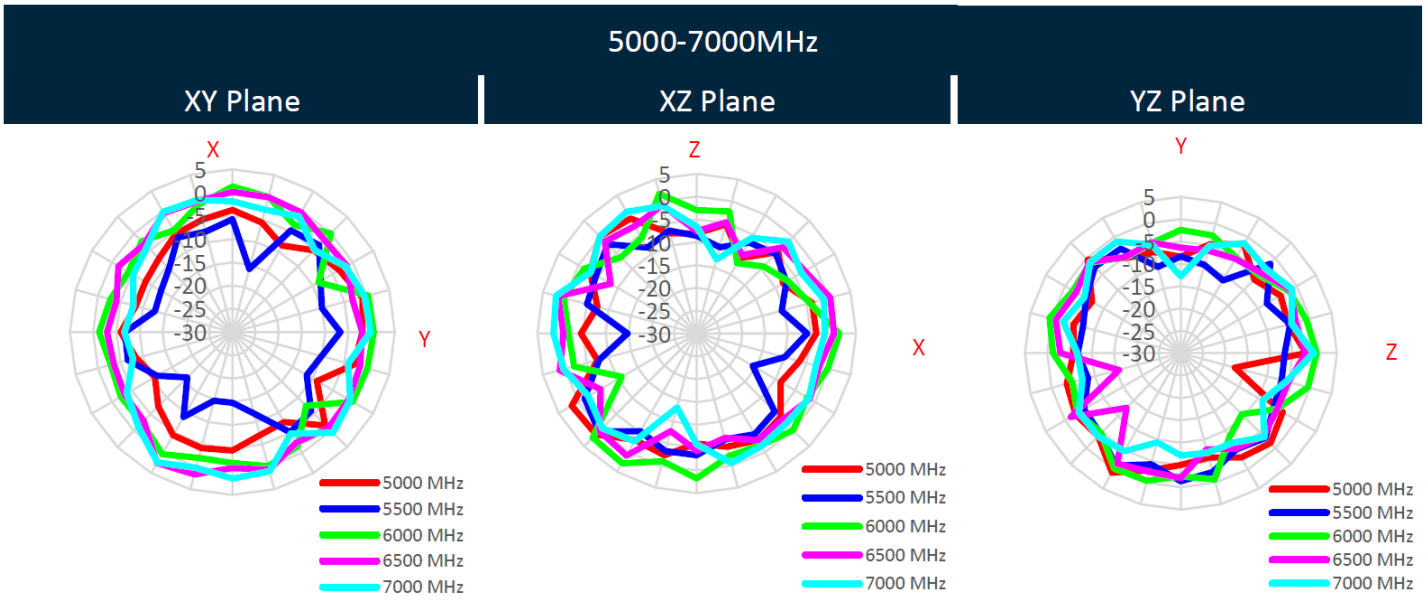
- Average Gain:



- Radiation pattern 2400 -2500 MHz



- Radiation Pattern 5000 - 7000 MHz



5.1.5 Device Wireless Specifications:

WLAN Specifications: 2.4 GHz

Features	Description
WLAN Standards	IEEE 802 11a/b/g/n/ac/ax
Antenna Port	Support 2 x 2 MIMO
Frequency Bands	2.400 GHz – 2.484 GHz
Number of sub channels	1 ~ 11 Channels
Modulation	**20MHz:** 802.11b: DSSS, CCK (1Mbps,11Mbps) 802.11g: OFDM (6Mbps, 54Mbps) 802.11n: OFDM (20MHz: MCS0, MCS7) 802.11ac: OFDM (20MHz: MCS0, MCS8) 802.11ax: OFDM (20MHz: MCS0, MCS11) **40MHz:** 802.11n: OFDM (40MHz: MCS0, MCS7) 802.11ac: OFDM (40MHz: MCS0, MCS8) 802.11ax: OFDM (40MHz: MCS0, MCS11)
Supported Data Rates	802.11b mode: 1Mbps to 11Mbps (20MHz) 802.11g Mode: 6Mbps to 54Mbps (20MHz) 802.11n Mode: MCS0 to MCS7 (20MHz, 40MHz) 802.11ac Mode: MCS0 to MCS11 (20MHz, 40MHz) 802.11ax Mode: MCS0 to MCS11(20MHz, 40MHz)

WiFi 2.4 GHz Power Table

Channel BandWidth (MHz)	Mode	Data rate	Channel Frequency (MHz)	Power level (dBm)
20 MHz	b	1	2412	13.0
			2437	18.0
			2462	18.0
		11	2412	18.0
			2437	18.0
			2462	18.0
	g	6	2412	13.0
			2437	13.0
			2462	13.0
		54	2412	13.0
			2437	13.0
			2462	13.0
	n	MCS 0	2412	13.0
			2437	13.0
			2462	13.0
		MCS 7	2412	13.0
			2437	13.0
			2462	13.0
	ac	MCS 0	2412	13.0
			2437	13.0
			2462	13.0
		MCS 8	2412	13.0
			2437	13.0
			2462	13.0
	ax	MCS 0	2412	12.0
			2437	12.0
			2462	12.0
		MCS 11	2412	12.0
			2437	12.0
			2462	12.0

P.T.O.

Channel BandWidth (MHz)	Mode	Data rate	Channel Frequency (MHz)	Power level (dBm)
40 MHz	n	MCS 0	2422	13.0
			2437	13.0
			2452	13.0
		MCS 7	2422	13.0
			2437	13.0
			2452	13.0
	ac	MCS 0	2422	13.0
			2437	13.0
			2452	13.0
		MCS 8	2422	13.0
			2437	13.0
			2452	13.0
	ax	MCS 0	2422	12.0
			2437	12.0
			2452	12.0
		MCS 11	2422	12.0
			2437	12.0
			2452	12.0

WLAN Specifications: 5 GHz

Features	Description
WLAN Standards	IEEE 802 11a/n/ac/ax
Antenna Port	Support 2 x 2 MIMO
Frequency Bands	UNII-1 _ 5150MHz to 5250MHz UNII-3 _ 5725MHz to 5825MHz
Number of sub channels	36 to 48 149 to 165
Modulation	802.11a: OFDM (6Mbps, 54Mbps) 802.11n: OFDM (MCS0, MCS7) 802.11ac: OFDM (MCS0, MCS9) 802.11ax: OFDM (MCS0, MCS11)
Supported Data Rates	802.11a Mode: 6Mbps to 54Mbps (20MHz) 802.11n Mode: MCS0 to MCS7 (20MHz, 40MHz) 802.11ac Mode: MCS0 to MCS11 (20MHz, 40MHz, 80MHz) 802.11ax Mode: MCS0 to MCS11(20MHz, 40MHz, 80MHz)

WiFi 5 GHz Power Level Used for Testing

Channel Bandwidth (MHz)	Mode	Data rate (Mbps)	Channel Frequency (MHz)	Power level used for testing (dBm)
20MHz	a mode	6	5180	16.5
			5240	16.5
			5745	16.5
			5825	16.5
		54	5180	15.5
			5240	15.5
			5745	15.5
			5825	15.5
	n mode	MCS 0	5180	16.5
			5240	16.5
			5745	16.5
			5825	16.5
		MCS 7	5180	14.5
			5240	14.5
			5745	14.5
			5825	14.5
	ac mode	MCS 0	5180	16.5
			5240	16.5
			5745	16.5
			5825	16.5
		MCS 9	5180	13.5
			5240	13.5
			5745	13.5
			5825	13.5
	ax mode	MCS 0	5180	16.5
			5240	16.5
			5745	16.5
			5825	16.5
		MCS 11	5180	12.0
			5240	12.0
			5745	12.0
			5825	12.0
40MHz	n mode	MCS 0	5190	14.5
			5230	16.5
			5755	16.5
			5795	16.5
		MCS 7	5190	12.5
			5230	14.5
			5755	14.5
			5795	14.5
	ac mode	MCS 0	5190	13.5
			5230	16.5
			5755	16.5
			5795	16.5
		MCS 9	5190	13.5
			5230	13.5
			5755	13.5
			5795	13.5
	ax mode	MCS 0	5190	13.5
			5230	16.5
			5755	16.5
			5795	16.5
		MCS 11	5190	12.0
			5230	12.0
			5755	12.0
			5795	12.0

Channel Bandwidth (MHz)	Mode	Data rate (Mbps)	Channel Frequency (MHz)	Power level used for testing (dBm)
80MHz	ac mode	MCS 0	5210	14.5
			5775	16.5
		MCS 9	5210	12.0
			5775	12.0
	ax mode	MCS 0	5210	14.5
			5775	16.5
		MCS 11	5210	12.0
			5775	12.0

BT Specifications: 2.400 GHz

Features	Description
Antenna Port	Support 2 x 2 MIMO
Frequency Bands	2402MHz to 2480MHz
Number of sub channels	79 Channels
Modulation	GFSK, pi/4-DQPSK,8-DPSK
Supported Data Rates	1Mbps, 2Mbps and 3Mbps

BT Power Table:

Channel BandWidth	Data rate (Mbps)	Channel Frequency (MHz)	Power level (dBm)
1MHz	1	2402	9.00
		2440	9.00
		2480	9.00
	2	2402	9.00
		2440	9.00
		2480	9.00
	3	2402	9.00
		2440	9.00
		2480	9.00

6 Overview

The QCS8250 SOM is based on Qualcomm® QCS8250 chipset.

QCS8250 SOM has been tested with QCS8250 Carrier Board along with below mentioned Daughter boards to run the interfaces.
Daughter boards:

1. Audio Daughter Board
2. Dual DSI to HDMI Daughter board
3. Camera Daughter Board

It provides an ideal building block for simple integration with a wide range of products in target markets requiring rich multimedia functionality and video capabilities, as well as high-processing power, in a compact (SoM) and cost effective solution.

The QCS8250 Platform leverages cutting edge mobile computing for embedded and industrial product designs, based on the Qualcomm® QCS8250.

The QCS8250 Platform is used to quick start their application development and is ideal for rapid prototyping of product. With support for almost all the peripherals, it reduces the design time of innovative applications and helps to achieve early time to market. With a variety of peripherals, this kit is targeted for wide range of applications supporting bulk storage, faster connectivity, higher through put and performance at lower power.

Note: SOM Cannot work Independently any customized host board will be required to provide power and interfaces to connect various interfaces like display camera etc.

6.1 Key Features

Sr. No	Feature	Configuration
SoM Board Features:		
1	Processor	QCS8250 64-bit ARM Cortex Kryo 585 application processor
2	RAM	LPDDR5 Four-channel PoP high-speed memory (8GB)
3	ROM	UFS Memory 64GB (UFS v2.1)
4	Display	2x 4-Lane MIPI DSI D-PHY 1.2 supporting resolutions up to 4K@60 USB Display port 1.4 supporting resolutions up to 4K@60.
5	Camera	6x 4-Lane MIPI CSI D-PHY v1.2 (C-PHY can support over D-PHY routing)
6	USB	1x USB 3.1 Gen2 (10Gbps) port – Type-C 1x USB 3.1 Gen2 (10Gbps) port – Type-A
7	PCIe	2x PCIe Gen3 2-lane
8	UART	1x UART (Debug)
9	Audio	x6 DMICs x1 SWIRE out for speaker amplifier (WSA881x) – chipset present on Audio Board x1 SWIRE out for audio codec (WCD9385) – chipset present on Audio Board
10	Wireless	QCA6391 chipset supports Wi-Fi 6 (802.11 b, g, n, a, ac, ax modes) & BT 5.1 with external power amplifier for 2.4G, 5G frequencies 2 x 2 - MIMO configuration – U.FL connectors on board
11	QUPs/BLSPs/SSC	1. QUPs/BLSPs – 12 pairs 2. SSC GPIOs – 12 GPIOs
12	Output Power	Six PMICs 1. PM8150B 2. PM8250 3. PM8150L 4. PM8002 5. PM8009 6. PM3003 Different PMIC supply provision at B2B connector for carrier board, if required on carrier board/externally.
13	Board to Board connectors	Total 4 numbers of connectors with 100 pins each SOM B2B connector PN# DF40C-100DP-0.4V(51) Note: Refer to Section 9.2 regarding SOM connector precautions to be followed during insertion on carrier board.
14	Operating Temperature	-20°C to +50 °C

6.2 Applications

The QCS8250 Platform is used in a wide range of products across many different target markets. Some of the typical applications are:

- Industrial IoT
- Enterprise security cameras
- Smart AI home security
- Home IP cameras
- Smart display, videoconferencing
- Consumer Electronics
- Internet of Things
- Domestic Robot
- Digital signage
- Security & Surveillance
- Biometric Access Control Systems
- Home and Health Hub
- Human-machine interface
- Home energy management systems
- Intelligent industrial control systems

7 QCS8250 SOM Platform

7.1 System Block Diagram

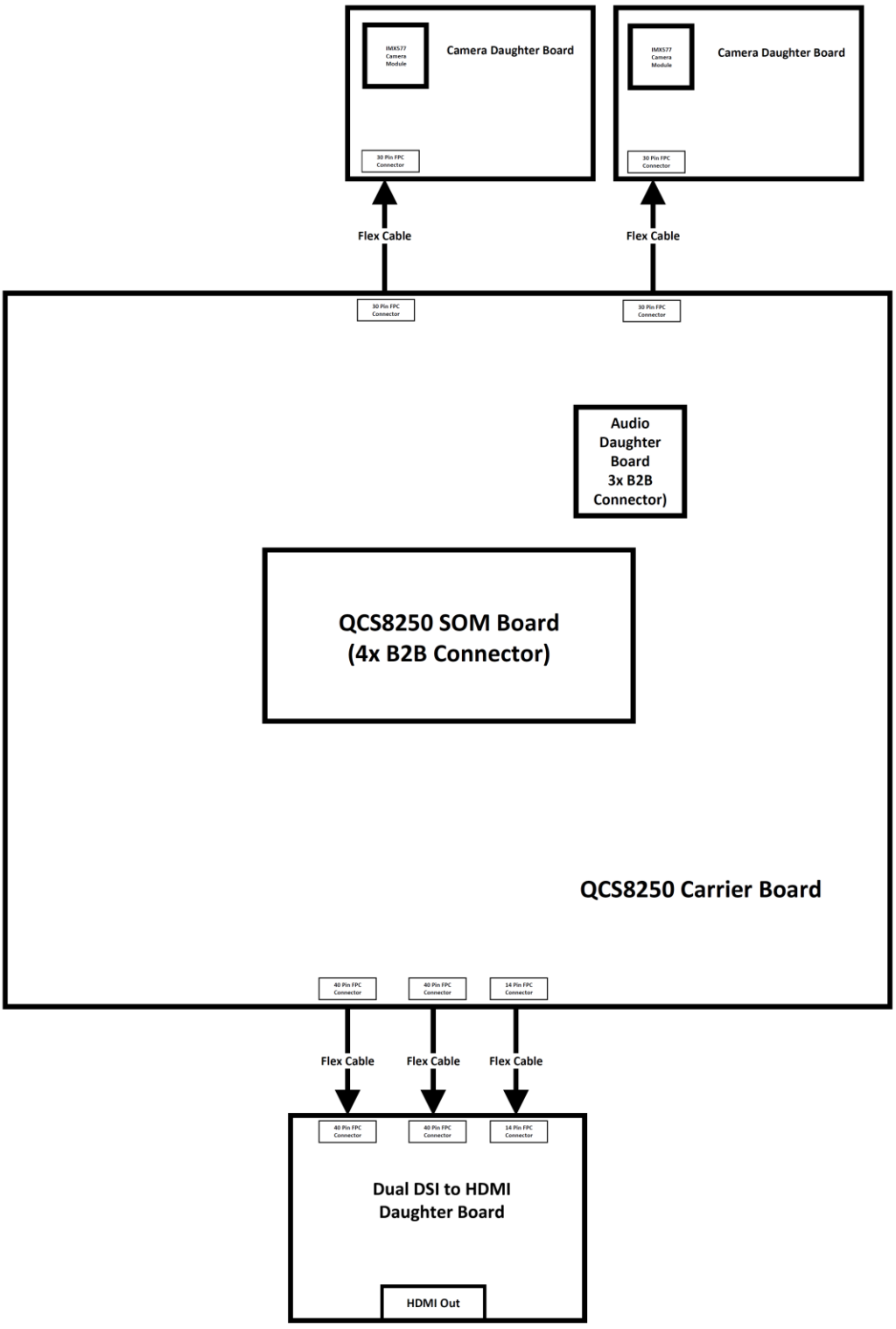


Figure 1: High Level Design Diagram

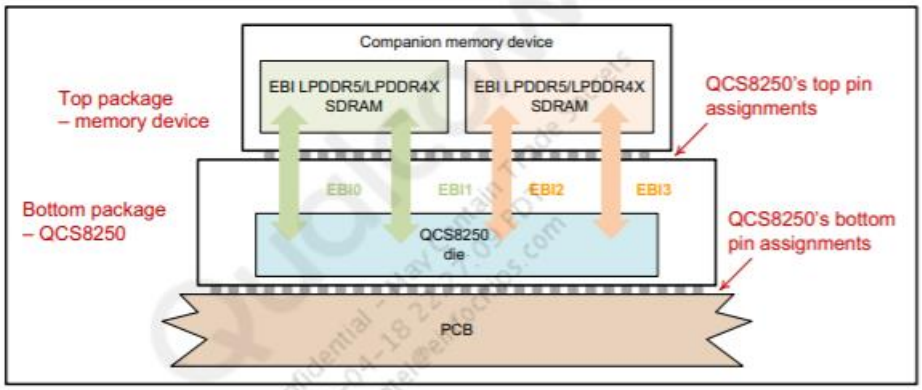


Figure 2: POP Memory block diagram

7.2 Major blocks of QCS8250 System on Module (SOM)

7.2.1 Processor QCS8250 Features

- SoM is based on QCS8250 Qualcomm® processor.
- QCS8250 is the new generation Qualcomm® Snapdragon™ premium-tier processor with robotic application. It is designed with the 7 nm process, for superior performance and power efficiency. QCS8250 includes the following key components:
- Qualcomm® Kryo™ 585 CPU built on Arm Cortex technology.
- Qualcomm® Adreno™ 650 GPU for the highest in graphics performance and power efficiency
- Qualcomm® Hexagon™ DSP with quad Hexagon Vector eXtensions (Qualcomm® Hexagon™ Vector eXtensions (HVX)) processor for vision processing and machine learning
- Qualcomm® Spectra™ 480 image processing engine for the ultimate photography and videography experiences
- Adreno 665 VPU for high-quality, ultra-HD video encode and decode.
- Adreno 995 DPU for on-device and external ultra-HD display support
- Qualcomm® All-Ways Aware™ Sensor Technology for contextual awareness and always-on sensor support
- Qualcomm® Secure Processing Unit (SPU240) for advanced secure use cases
- Qualcomm® Neural Processing Unit (NPU230) for high-performance machine learning use cases
- External 802.11ax, b, g, n, a, ac - 2 × 2 MIMO, and Bluetooth 5.1
- Quad-channel package-on-package (PoP) high-speed LPDDR5 SDRAM

7.2.2 Memory:

LPDDR5:

- The PoP technology uses an extra top substrate to accommodate area-array memory packages.
- The QCS8250 device PoP supports 64-bit (4 × 16) 4-channel stacked memory LPDDR5, thereby increasing operational bandwidth and simplifying routing—no pre-stacking is needed.
- The technology includes a low-package warpage.

UFS:

- The UFS host controller support UFS 3.1, QCS8250 kit memory configuration is UFS 2.1

7.2.3 Multimedia Features

- Supports 6x 4-lane CSIs (D-PHY V1.2), supporting 2.5Gbps per lane. Dedicated camera I2C ports for the camera control interface

- Supports 2x 4-Lane MIPI DSI D-PHY 1.2 supporting resolutions up to 4K@60 (after combined 2 MIPI ports)
- Support USB Display port 1.4 over Type C, can support two 4K@60 streams using MST HUB or one 4K@60 stream using SST adapter.
- Supports 2x PCIe Gen3 2-lane.
- Supports 1x USB 3.1 Type-C connector.
- Supports 1x USB 3.1 Type-A connector.
- Supports 1x Micro-SD card V3.0 interface.

7.2.4 Audio Features

- Six Native DMIC support on carrier board
- SWR1 – for CODEC Interface (CODEC on Audio Board)
- SWR2 – for Audio Amplifiers (x2 Qty – on Audio Board)
- SLIMBUS – BT Audio (with Wi-Fi/BT chipset on SoM)

7.2.5 Wireless Connectivity

- Wi-Fi and BT combo chipset QCA6391 of Qualcomm on SOM
- QCA6391 chipset supports Wi-Fi 6 (802.11 b/g/n/a/ac/ax) and Bluetooth 5.1 (with BLE) with external power amplifier for 2.4G, 5G frequencies.
- QCA6391 Chipset supports 2.4GHZ and 5GHZ (MIMO).
- To connect external antenna on SoM board, U.FL connector is provided.
- Throughput and performance have been measured using external antenna: PN# FXP840.07.0055B by eInfochips.

7.2.6 Power Management

Six PMICs:

- PM8150B
- PM8250
- PM8150L
- PM8002
- PM8009
- PM3003
- Different PMIC supply provision at B2B connector for carrier board, if required.
- Dedicated clock and reset lines; plus, other GPIOs as needed.

7.2.7 Board Images

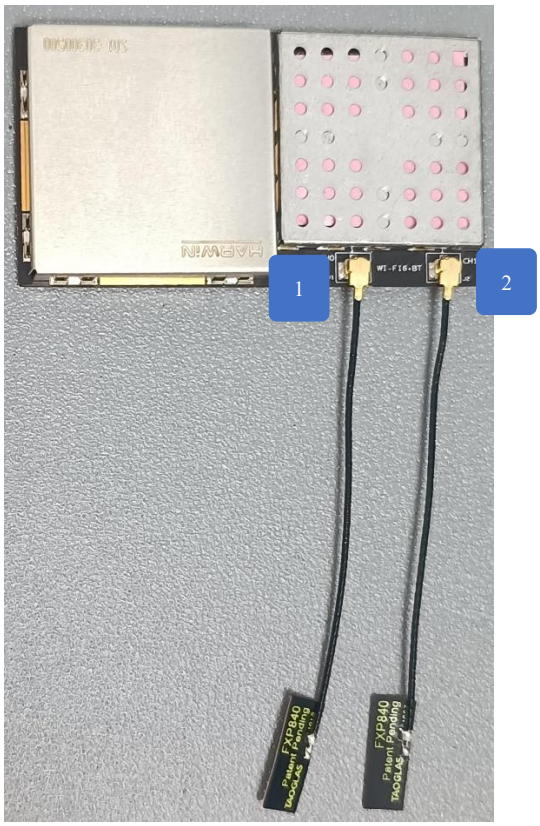


Figure 3: SOM Top Side

1	Wi-Fi / BT Antenna (U.FL) – CH0
2	Wi-Fi / BT Antenna (U.FL) – CH1

Table 1: SOM TOP Connector

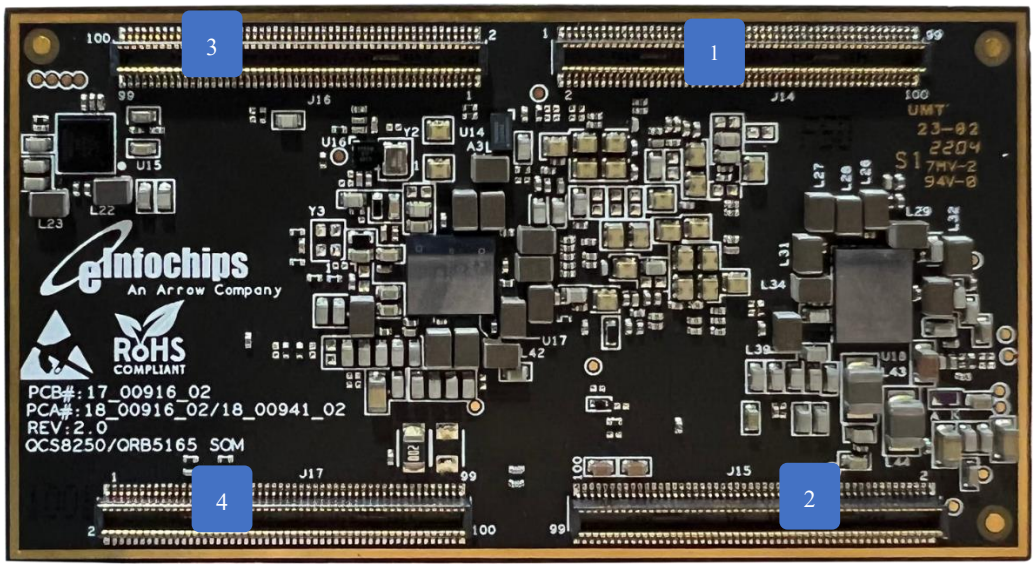


Figure 4: SOM Bottom Side

1	Board to Board Connector – J14
2	Board to Board Connector – J15
3	Board to Board Connector – J16
4	Board to Board Connector – J17

Table 2: SOM Bottom Connector

7.2.8 Board to Board Connector

- Carrier board and SoM are interfaced through four DF40HC(3.0)-100DS-0.4V(58) board to board connector from Hirose on carrier board.
- Pin out of connectors and reference designators are as below:

CON-1 (LEFTSIDE TOP CORNER) - J14							
Net Name	**Signal Description**	**Voltage**	**SoM**		**Voltage**	**Signal Description**	**Net Name**
GND	GND	GND	2	1	GND	GND	GND
VREG_L14A_1P8	PMIC PM8250	1.8V	4	3	1.8V	PM8150L - L8;	VREG_L8C_1P8
NFC_EN	GPIO_6	1.8V	6	5	3.0V	PM8150L - L10;	VREG_L10C_3P0
NFC_CLK_REQ	GPIO_7	1.8V	8	7	3.0V	PM8150L - L10;	VREG_L10C_3P0
GPIO_112_MGPI	GPIO_112	1.8V	10	9	GND	GND	GND
CAM6_RST_N	GPIO_114	1.8V	12	11	1.8V	PM8250 - S4;	VREG_S4A_1P8
SNS_I3C0_SDA	GPIO_160	1.8V	14	13	1.8V	PM8250 - S4;	VREG_S4A_1P8
SNS_I3C0_SCL	GPIO_161	1.8V	16	15	1.8V	PM8250 - S4;	VREG_S4A_1P8
USB_DP_HPD_1P8	GPIO_68	1.8V	18	17	1.8V	PM8250 - S4;	VREG_S4A_1P8
SDC2_DATA_2	SD Card DATA_2	1.8V	20	19	GND	GND	GND
SDC2_DATA_3	SD Card DATA_3	1.8V	22	21	1.8V	GPIO_100	CAM_MCLK6
SDC2_CMD	SD Card CMD	1.8V	24	23	1.8V	GPIO_66	MDP_VSYNC_P_MIRA
SDC2_DATA_0	SD Card DATA_0	1.8V	26	25	1.8V	GPIO_67	MDP_VSYNC_S_MIRA
SDC2_DATA_1	SD Card DATA_1	1.8V	28	27	1.8V	GPIO_162	SNS_I3C1_SDA
SDC2_CLK_CONN	SD Card Clock	1.8V	30	29	1.8V	GPIO_163	SNS_I3C1_SCL
GND	GND	GND	32	31	1.8V	GPIO_115	CAM_SPI2_MISO
CAM_MCLK4	GPIO_98	1.8V	34	33	1.8V	GPIO_116	CAM_SPI2_MOSI
GND	GND	GND	36	35	1.8V	GPIO_117	CAM_SPI2_CLK
CSI4_C2_LN3_M	CSI	-	38	37	1.8V	GPIO_118	CAM_SPI2_CS0_N
CSI4_B2_LN3_P	CSI	-	40	39	1.8V	GPIO_8	CAM_SPI1_MISO
CSI4_A1_LN1_P	CSI	-	42	41	1.8V	GPIO_9	CAM_SPI1_MOSI
CSI4_B1_LN1_M	CSI	-	44	43	1.8V	GPIO_10	CAM_SPI1_CLK
CSI4_C0_LN0_M	CSI	-	46	45	1.8V	GPIO_11	CAM_SPI1_CS0_N
CSI4_B0_LN0_P	CSI	-	48	47	1.8V	GPIO_94	CAM_MCLK0
CSI4_A0_CLK_M	CSI	-	50	49	GND	GND	GND
CSI4_NC_CLK_P	CSI	-	52	51	-	CSI	CSI0_NC_CLK_P
CSI4_C1_LN2_P	CSI	-	54	53	-	CSI	CSI0_A0_CLK_M
CSI4_A2_LN2_M	CSI	-	56	55	-	CSI	CSI0_B0_LN0_P
GND	GND	GND	58	57	-	CSI	CSI0_C0_LN0_M
VREG_WLED	PMIC PM8150L -	-	60	59	-	CSI	CSI0_A1_LN1_P
WLED_SINK1	PMIC PM8150L -	-	62	61	-	CSI	CSI0_B1_LN1_M
WLED_SINK2	PMIC PM8150L -	-	64	63	-	CSI	CSI0_B2_LN3_P
GND	GND	GND	66	65	-	CSI	CSI0_C2_LN3_M

CAM_MCLK5	GPIO_99	1.8V	68	67	-	CSI	CSI0_A2_LN2_M
GND	GND	GND	70	69	-	CSI	CSI0_C1_LN2_P
CSI5_NC_CLK_P	CSI	-	72	71	GND	GND	GND
CSI5_A0_CLK_M	CSI	-	74	73	1.8V	GPIO_4	NFC_I2C_SDA
CSI5_C0_LN0_M	CSI	-	76	75	1.8V	GPIO_5	NFC_I2C_SCL
CSI5_B0_LN0_P	CSI	-	78	77	3.3V	PM8150L LED GPIO	B_LED
CSI5_C2_LN3_M	CSI	-	80	79	3.3V	PM8150L LED GPIO	G_LED
CSI5_B2_LN3_P	CSI	-	82	81	3.3V	PM8150L LED GPIO	R_LED
CSI5_A2_LN2_M	CSI	-	84	83	1.8V	SD Card Detect pin	SD_UFS_CARD_DET_N
CSI5_C1_LN2_P	CSI	-	86	85	1.8V	GPIO_28	NFC_SE_SPI_MISO_I3C_SDA
CSI5_A1_LN1_P	CSI	-	88	87	1.8V	GPIO_29	NFC_SE_SPI_MOSI_I3C_SCL
CSI5_B1_LN1_M	CSI	-	90	89	1.8V	GPIO_31	NFC_SE_SPI_CS
GND	GND	GND	92	91	1.8V	GPIO_30	NFC_SE_SPI_CLK
VREG_L9C_2P96	PM8150L - L9; SD	2.96V	94	93	1.8V	GPIO_170	SNS_I2C4_SDA
VREG_L9C_2P96	PM8150L - L9; SD	2.96V	96	95	1.8V	GPIO_171	SNS_I2C4_SCL
VREG_L9C_2P96	PM8150L - L9; SD	2.96V	98	97	-5.5V	LCDB negative	VDISP_M_OUT
GND	GND	GND	100	99	+5.5V	LCDB positive	VDISP_P_OUT

Table 3: SoM-Carrier board B2B Connector – J14 pinouts

CON-2 (LEFTSIDE DOWN CORNER) - J15							
Net Name	**Signal Description**	**Voltage**	**SoM Board Pin**		**Voltage Level**	**Signal Description**	**Net Name**
GND	GND	GND	2	1	GND	GND	GND
CSI2_C2_LN3_M	CSI	-	4	3	-	DSI	DSI0_B2_LN2_M
CSI2_B2_LN3_P	CSI	-	6	5	-	DSI	DSI0_A2_LN2_P
CSI2_C0_LN0_M	CSI	-	8	7	-	DSI	DSI0_A0_LN0_P
CSI2_B0_LN0_P	CSI	-	10	9	-	DSI	DSI0_B0_LN0_M
CSI2_B1_LN1_M	CSI	-	12	11	-	DSI	DSI0_B1_CLK_P
CSI2_A1_LN1_P	CSI	-	14	13	-	DSI	DSI0_C1_CLK_M
CSI2_A0_CLK_M	CSI	-	16	15	-	DSI	DSI0_C0_LN1_P
CSI2_NC_CLK_P	CSI	-	18	17	-	DSI	DSI0_A1_LN1_M
CSI2_A2_LN2_M	CSI	-	20	19	-	DSI	DSI0_C2_LN3_P
CSI2_C1_LN2_P	CSI	-	22	21	-	DSI	DSI0_NC_LN3_M
GND	GND	GND	24	23	GND	GND	GND
PM8150L_GPIO10_PWM	PM8150L_GPIO10_PWM	3.8V or VBAT	26	25	GND	GND	GND
PM8150L_GPIO06_PWM	PM8150L_GPIO06_PWM	1.8V	28	27	-	Display Port AUX - N	DP_AUX_N
FLASH_STROBE	PM8150L Camera Flash Strobe Input	1.8V	30	29	-	Display Port AUX - P	DP_AUX_P
GND	GND	GND	32	31	GND	GND	GND
CSI3_B1_LN1_M	CSI	-	34	33	-	DSI	DSI1_NC_LN3_M
CSI3_A1_LN1_P	CSI	-	36	35	-	DSI	DSI1_C2_LN3_P
CSI3_C0_LN0_M	CSI	-	38	37	-	DSI	DSI1_A2_LN2_P
CSI3_B0_LN0_P	CSI	-	40	39	-	DSI	DSI1_B2_LN2_M

CSI3_C2_LN3_M	CSI	-	42	41	-	DSI	DSI1_B1_CLK_P
CSI3_B2_LN3_P	CSI	-	44	43	-	DSI	DSI1_C1_CLK_M
CSI3_A2_LN2_M	CSI	-	46	45	-	DSI	DSI1_A0_LN0_P
CSI3_C1_LN2_P	CSI	-	48	47	-	DSI	DSI1_B0_LN0_M
CSI3_A0_CLK_M	CSI	-	50	49	-	DSI	DSI1_C0_LN1_P
CSI3_NC_CLK_P	CSI	-	52	51	-	DSI	DSI1_A1_LN1_M
GND	GND	GND	54	53	GND	GND	GND
PCIE2_TX1_M	PCIe2	-	56	55	-	USB0	USB0_SS_RX0_P
PCIE2_TX1_P	PCIe2	-	58	57	-	USB0	USB0_SS_RX0_M
GND	GND	GND	60	59	GND	GND	GND
PCIE2_TX0_M	PCIe2	-	62	61	-	USB0	USB0_SS_RX1_M
PCIE2_TX0_P	PCIe2	-	64	63	-	USB0	USB0_SS_RX1_P
GND	GND	GND	66	65	GND	GND	GND
PCIE2_RX0_P	PCIe2	-	68	67	-	USB0	USB0_SS_TX1_M
PCIE2_RX0_M	PCIe2	-	70	69	-	USB0	USB0_SS_TX1_P
GND	GND	GND	72	71	GND	GND	GND
PCIE2_RX1_P	PCIe2	-	74	73	-	USB0	USB0_HS_DM
PCIE2_RX1_M	PCIe2	-	76	75	-	USB0	USB0_HS_DP
GND	GND	GND	78	77	GND	GND	GND
PCIE2_REFCLK_P	PCIe2	-	80	79	-	USB0	USB0_SS_TX0_P
PCIE2_REFCLK_M	PCIe2	-	82	81	-	USB0	USB0_SS_TX0_M
GND	GND	GND	84	83	GND	GND	GND
USB_VBUS	USB_VBUS - Input	5V	86	85	3.3V	CAMERA Flash LED	FLASH_LED1
USB_VBUS	USB_VBUS - Input	5V	88	87	3.3V	CAMERA Flash LED	FLASH_LED1
USB_VBUS	USB_VBUS - Input	5V	90	89	3.3V	CAMERA Flash LED	FLASH_LED1
USB_VBUS	USB_VBUS - Input	5V	92	91	3.3V	CAMERA Flash LED	FLASH_LED1
USB_VBUS	USB_VBUS - Input	5V	94	93	3.3V	CAMERA Flash LED	FLASH_LED1
USB_VBUS	USB_VBUS - Input	5V	96	95	5V	USB_VBUS - Input	USB_VBUS
USB_VBUS	USB_VBUS - Input	5V	98	97	5V	USB_VBUS - Input	USB_VBUS
GND	GND	GND	100	99	5V	USB_VBUS - Input	USB_VBUS

Table 4: SoM-Carrier board B2B Connector – J15 pinouts

CON-3 (RIGHTSIDE TOP CORNER) - J16							
Net Name	**Signal Description**	**Voltage Level**	**SoM Board Pin**		**Voltage Level**	**Signal Description**	**Net Name**
GND	GND	GND	2	1	GND	GND	GND
PCIE1_RX0_M	PCIe1	-	4	3	3.6V	VPH_PWR from PMIC - PM8250B	VPH_PWR
PCIE1_RX0_P	PCIe1	-	6	5	3.6V	VPH_PWR from PMIC - PM8250B	VPH_PWR
GND	GND	GND	8	7	3.6V	VPH_PWR from PMIC - PM8250B	VPH_PWR
PCIE1_RX1_P	PCIe1	-	10	9	3.6V	VPH_PWR from PMIC - PM8250B	VPH_PWR
PCIE1_RX1_M	PCIe1	-	12	11	3.6V	VPH_PWR from PMIC - PM8250B	VPH_PWR

GND	GND	GND	14	13	3.6V	VPH_PWR from PMIC - PM8250B	VPH_PWR
PCIE1_REFCLK_P	PCIe1	-	16	15	3.6V	VPH_PWR from PMIC - PM8250B	VPH_PWR
PCIE1_REFCLK_M	PCIe1	-	18	17	3.6V	VPH_PWR from PMIC - PM8250B	VPH_PWR
GND	GND	GND	20	19	3.6V	VPH_PWR from PMIC - PM8250B	VPH_PWR
PCIE1_TX1_M	PCIe1	-	22	21	3.6V	VPH_PWR from PMIC - PM8250B	VPH_PWR
PCIE1_TX1_P	PCIe1	-	24	23	3.6V	VPH_PWR from PMIC - PM8250B	VPH_PWR
GND	GND	GND	26	25	3.6V	VPH_PWR from PMIC - PM8250B	VPH_PWR
PCIE1_TX0_P	PCIe1	-	28	27	GND	GND	GND
PCIE1_TX0_M	PCIe1	-	30	29	1.8V	GPIO_149	WCD_SWR_RX_CLK
GND	GND	GND	32	31	1.8V	GPIO_150	WCD_SWR_RX_DATA0
SNS_SPI2_MISO	GPIO_164	1.8V	34	33	1.8V	GPIO_151	WCD_SWR_RX_DATA1
SNS_SPI2_CS_N	GPIO_167	1.8V	36	35	1.8V	GPIO_146	WCD_SWR_TX_CLK
SNS_SPI2_MOSI	GPIO_165	1.8V	38	37	1.8V	GPIO_147	WCD_SWR_TX_DATA0
SNS_SPI2_CLK	GPIO_166	1.8V	40	39	1.8V	GPIO_148	WCD_SWR_TX_DATA1
CAM_MCLK2	GPIO_96	1.8V	42	41	1.8V	GPIO_26	GPIO26
CAM_MCLK3	GPIO_97	1.8V	44	43	1.8V	GPIO_105	CCI_I2C_SDA2
GND	GND	GND	46	45	1.8V	GPIO_106	CCI_I2C_SCL2
CAM_MCLK1	GPIO_95	1.8V	48	47	1.8V	GPIO_107	CCI_I2C_SDA3
SNS_I2C3_SCL	GPIO_169	1.8V	50	49	1.8V	GPIO_108	CCI_I2C_SCL3
SNS_I2C3_SDA	GPIO_168	1.8V	52	51	1.8V	GPIO_102	CCI_I2C_SCL0
PM8250_GPIO3_M2_SLEEP_CLK	PM8250 GPIO3	1.8V	54	53	1.8V	GPIO_101	CCI_I2C_SDA0
PM8250_GPIO6_KYPD_VOLP_N	PM8250 GPIO6: VOL+ or ZOOM+ button	1.8V	56	55	1.8V	GPIO_104	CCI_I2C_SCL1
PM_RESIN_N	PMIC Reset IN: VOL- or ZOOM- button	1.8V	58	57	1.8V	GPIO_103	CCI_I2C_SDA1
CABC	Display CABC - PWM Input	1.8V	60	59	1.8V	GPIO_44	APPS_I2C_SDA
GND	GND	GND	62	61	1.8V	GPIO_45	APPS_I2C_SCL
CSI1_NC_CLK_P	CSI	-	64	63	1.8V	GPIO_84	PCIE1_11AD_WAKE_N
CSI1_A0_CLK_M	CSI	-	66	65	1.8V	GPIO_82	PCIE1_11AD_PERST_N
CSI1_A1_LN1_P	CSI	-	68	67	1.8V	GPIO_83	PCIE1_11AD_CLK_REQ_N
CSI1_B1_LN1_M	CSI	-	70	69	1.8V	COEX TXD GPIO	WLAN_COEX_MDMUART_TX
CSI1_C1_LN2_P	CSI	-	72	71	1.8V	COEX RXD GPIO	WLAN_COEX_MDMUART_RX
CSI1_A2_LN2_M	CSI	-	74	73	3.8V or VBAT	PM8150L GPIO08 - CABC Function	PM8150L_GPIO08
CSI1_B0_LN0_P	CSI	-	76	75	GND	GND	GND
CSI1_C0_LN0_M	CSI	-	78	77	1.8V	PM8250 BB CLK3	LN_BB_CLK3

CSI1_B2_LN3_P	CSI	-	80	79	GND	GND	GND
CSI1_C2_LN3_M	CSI	-	82	81	1.8V	GPIO_131	CAM5_RST_N
GND	GND	GND	84	83	1.8V	GPIO_130	CAM4_RST_N
LPI_DMIC3_CLK	GPIO_158	1.8V	86	85	1.8V	PM8250 BB CLK2	LN_BB_CLK2
LPI_DMIC3_DATA	GPIO_159	1.8V	88	87	1.8V	GPIO_113	GPIO_113_MAG_INT_N
LPI_DMIC2_CLK	GPIO_154	1.8V	90	89	1.8V	GPIO_90	SDM_FAST_BOOT_3
LPI_DMIC2_DATA	GPIO_155	1.8V	92	91	1.8V	PM8009 PMIC L7 Supply - CAM DOVDD	VREG_L7F_1P8
CAM0_RST_N	GPIO_93	1.8V	94	93	2.85V	PM8009 PMIC L5 Supply - CAM AVDD	VREG_L5F_2P85
CAM1_RST_N	GPIO_92	1.8V	96	95	1.1V	PM8009 PMIC L1 Supply - CAM DVDD	VREG_L1F_1P1
CAM2_RST_N	GPIO_78	1.8V	98	97	1.1V	PM8009 PMIC L1 Supply - CAM DVDD	VREG_L1F_1P1
CAM3_RST_N	GPIO_109	1.8V	100	99	GND	GND	GND

Table 5: SoM-Carrier board B2B Connector – J16 pinouts

CON-4 (RIGHTSIDE DOWN CORNER) - J17							
Net Name	**Signal Description**	**Voltage Level**	**SoM Board Pin**		**Voltage Level**	**Signal Description**	**Net Name**
PHONE_ON_N	PWR Button - PHONE_ON	1.8V	2	1	1.8V	GPIO_127	WSA1_EN
CBL_PWR_N	Cable Power input to PMIC	1.8V	4	3	GND	GND	GND
SDM_FORCE_USB_BOOT	GPIO_132	1.8V	6	5	1.2V	PM8009 L2: CAMERA DVDD Supply	VREG_L2F_1P2
SDR_GRFC2	WLAN XFEM control LAA TX enable	1.8V	8	7	1.2V	PM8009 L2: CAMERA DVDD Supply	VREG_L2F_1P2
HST_WL_TX_EN	WLAN XFEM control for WLAN Tx enable	1.8V	10	9	1.05V	PM8009 L3: CAMERA DVDD Supply	VREG_L3F_1P05
WSA_SWR_CLK	GPIO_156	1.8V	12	11	3.0V	PM8250 L13	VREG_L13A_3P0
WSA_SWR_DATA	GPIO_157	1.8V	14	13	1.8V	GPIO_89	W_DISABLE_N
FP_SPI_MISO	GPIO_40	1.8V	16	15	1.8V	GPIO_128	SDM_WDOG_DISABLE
FP_SPI_MOSI	GPIO_41	1.8V	18	17	1.8V	GPIO_0	GNSS_IRQ
FP_SPI_CLK	GPIO_42	1.8V	20	19	GND	GND	GND
FP_SPI_CS	GPIO_43	1.8V	22	21	1.8V	PMIC Reset Out Signal	SDM_RESOUT_N
LPI_DMIC1_CLK	GPIO_152	1.8V	24	23	1.8V	GPIO_136	MI2S0_MCLK
LPI_DMIC1_DATA	GPIO_153	1.8V	26	25	1.8V	GPIO_138	MI2S0_SCK
SDM_FAST_BOOT_0	GPIO_27	1.8V	28	27	1.8V	GPIO_139	MI2S0_DATA0
GND	GND	GND	30	29	1.8V	GPIO_140	MI2S0_DATA1

TS_I2C_SDA	GPIO_36	1.8V	32	31	1.8V	GPIO_141	MI2S0_WS
TS_I2C_SCL	GPIO_37	1.8V	34	33	1.8V	GPIO_133	MI2S2_I2S_SCK
TS_RESET_N	GPIO_38	1.8V	36	35	1.8V	GPIO_134	MI2S2_I2S_DAT0
TS_INT_N	GPIO_39	1.8V	38	37	1.8V	GPIO_135	MI2S2_I2S_WS
GPIO56_CTS_SDA_MISO	GPIO_56	1.8V	40	39	1.8V	GPIO_137	MI2S2_I2S_DAT1
GPIO57_RFR_SCL_MOSI	GPIO_57	1.8V	42	41	1.8V	GPIO_46	MIPI_ERR_FG
GPIO58_TX_SCLK	GPIO_58	1.8V	44	43	1.8V	GPIO_47	SDM_FAST_BOOT_1
GPIO59_RX_CS0	GPIO_59	1.8V	46	45	1.8V	Battery ID Input	BATT_ID
WCD_RESET_N	GPIO_32	1.8V	48	47	1.8V	Battery THERM Input	BATT_THERM
SDM_FAST_BOOT_2	GPIO_76	1.8V	50	49	3.6V	Battery VBAT Sense P	VBATT_CONN_VSENSE_P
PCIE2_CLK_REQ_N	GPIO_86	1.8V	52	51	0V	Battery VBAT Sense M	VBATT_CONN_VSENSE_M
PCIE2_RST_N	GPIO_85	1.8V	54	53	GND	GND	GND
PCIE2_WAKE_N	GPIO_87	1.8V	56	55	GND	GND	GND
DEBUG_UART_RX	GPIO_35	1.8V	58	57	3.0V	VCOIN	VCOIN
DEBUG_UART_TX	GPIO_34	1.8V	60	59	3.6V	VBAT Input supply to PMIC/SoM	VBAT
HDMI_INT	GPIO_1	1.8V	62	61	3.6V	VBAT Input supply to PMIC/SoM	VBAT
HDMI_EN	GPIO_3	1.8V	64	63	3.6V	VBAT Input supply to PMIC/SoM	VBAT
HDMI_RSTN	GPIO_2	1.8V	66	65	3.6V	VBAT Input supply to PMIC/SoM	VBAT
CCI_I3C_SDA0	GPIO_24	1.8V	68	67	3.6V	VBAT Input supply to PMIC/SoM	VBAT
CCI_I3C_SCL0	GPIO_25	1.8V	70	69	3.6V	VBAT Input supply to PMIC/SoM	VBAT
GND	GND	GND	72	71	3.6V	VBAT Input supply to PMIC/SoM	VBAT
USB1_HS_DM	USB1	-	74	73	3.6V	VBAT Input supply to PMIC/SoM	VBAT
USB1_HS_DP	USB1	-	76	75	3.6V	VBAT Input supply to PMIC/SoM	VBAT
GND	GND	GND	78	77	3.6V	VBAT Input supply to PMIC/SoM	VBAT
USB1_SS_RX_M	USB1	-	80	79	3.6V	VBAT Input supply to PMIC/SoM	VBAT
USB1_SS_RX_P	USB1	-	82	81	3.6V	VBAT Input supply to PMIC/SoM	VBAT
GND	GND	GND	84	83	3.6V	VBAT Input supply to PMIC/SoM	VBAT
USB1_SS_TX_M	USB1	-	86	85	3.6V	VBAT Input supply to PMIC/SoM	VBAT
USB1_SS_TX_P	USB1	-	88	87	3.6V	VBAT Input supply to PMIC/SoM	VBAT

GND	GND	GND	90	89	3.6V	VBAT Input supply to PMIC/SoM	VBAT
PM855_USB_SBU 2	SBU2 - PM8150B	-	92	91	3.6V	VBAT Input supply to PMIC/SoM	VBAT
PM855_USB_SBU 1	SBU1 - PM8150B	-	94	93	3.6V	VBAT Input supply to PMIC/SoM	VBAT
USB_CC1	CC1_ID - PM8150B	-	96	95	3.6V	VBAT Input supply to PMIC/SoM	VBAT
USB_CC2	CC2 - PM8150B	-	98	97	3.6V	VBAT Input supply to PMIC/SoM	VBAT
VREG_L11C_3P3	PM8150L L11 Supply	3.3V	100	99	GND	GND	GND

Table 6: SoM-Carrier board B2B Connector – J17 pinouts

8 Electrical Specifications (QCS8250 Kit)

8.1 Absolute Maximum Rating

Parameter		Min	Max	Unit
VBAT	SoM - Battery Input Supply Voltage (VBAT)	-0.3	6.0	V
VCOIN	RTC Input Supply Voltage (from Coin cell)	-0.5	3.5	V
USB_VBUS	USB VBUS Input Supply Voltage (from USB TypeC)	-0.3	28	V

Table 7: Absolute Maximum Rating

8.2 Operating Conditions

Parameter		Min	Typical	Max	Unit
VBAT	SoM - Battery Input Supply Voltage (VBAT)	2.5	3.8	4.75	V
VCOIN	RTC Input Supply Voltage (from Coin cell)	2.0	3.0	3.25	V
USB_VBUS	USB VBUS Input Supply Voltage (from USB TypeC)	3.7	5.0	12.6	V

Table 8: Operating Conditions

9 Mechanical Specifications

All dimensions are in millimetres (mm).

9.1 SOM Board Dimensions

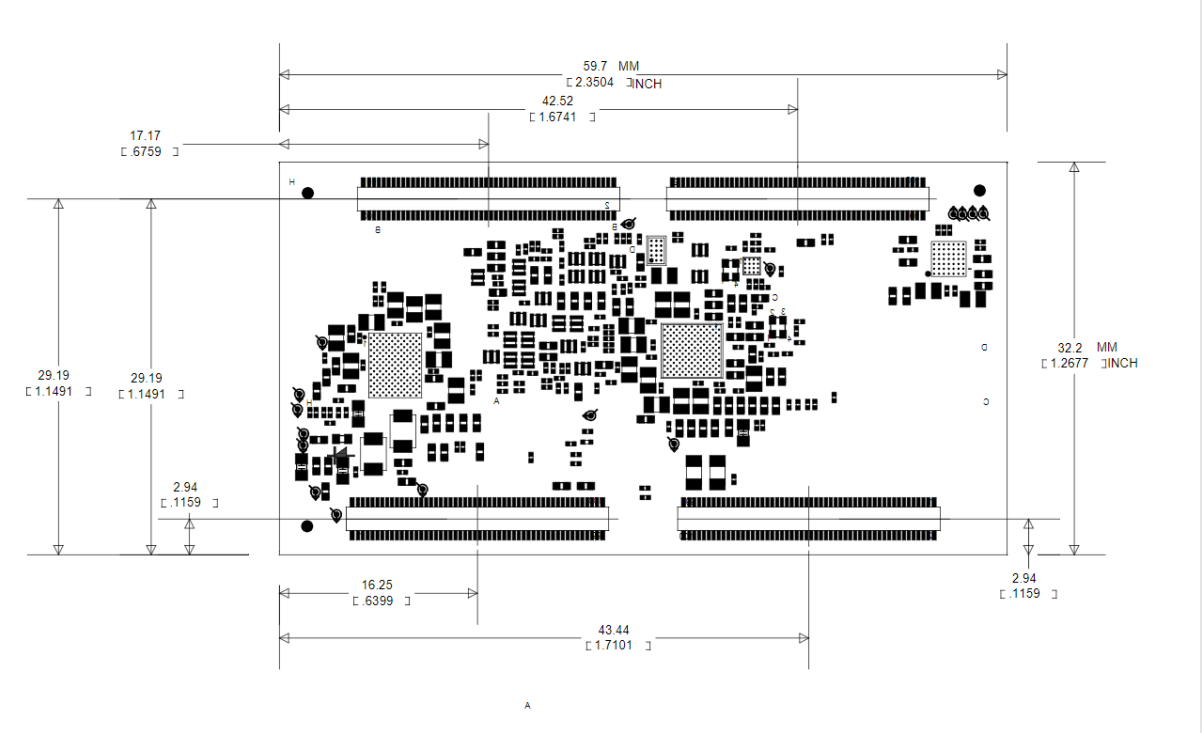


Figure 5: SoM Mechanical specification.

Note: *Dimensions are in mm [Inches].*

9.2 SOM Connector Precautions (x4 qty -> PN# DF40C-100DP-0.4V(51))

1. Do not mate or unmate these connectors until they are mounted, failure to follow this precaution can lead to deformation or damage to these connectors.
2. Mating and unmating with excessive force can cause damage.
3. Do not mate or unmate the SoM Board more than 5 times, failure to follow this precaution can lead to deformation or damage to these connectors.
4. B2B connector on the carrier board should have zero X-Y tolerance against SoM to avoid connector damage/mating/quality issues.

10 Annexure