



COREXOM R5165C SOM DATASHEET

Rev. V0.0 (Draft)
2023/12/22

P/N : 80.Z6H02G012



Revision History

Rev.	Date	Description
0.0	2023/12/22	Draft

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- Illustrations in this documentation might look different from your product.
- Depending on the model, some optional accessories, features, and software programs might not be available on your device.
- Depending on the version of operating systems and programs, some user interface instructions might not be applicable to your device.
- Documentation content is subject to change without notice. Coretronic Reality Inc. (CRI) makes constant improvements on the documentation of your computer, including this guidebook.

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Table of Contents

1. Introduction	1
1.1 Features	1
1.2 Block Diagram	3
1.3 Major components location.....	4
1.4 Connector function and Part number	5
2. Interface Specification.....	6
2.1 Interface pin type definition	6
2.2 Interface detail description	6
2.3 Connector pin summary	7
3. Electrical Characteristics	13
3.1 Absolute Maximum Ratings	13
3.2 Operating conditions	13
3.3 Output Power	13
3.4 GPIO characteristics	13
4. Mechanical Specification	14
4.1 SOM Mechanical dimensions.....	14
4.2 Weight	14
4.3 Thermal Characteristics.....	14
5. Product Marking, Ordering and Shipping Info	15

1. Introduction

CRI COREXOM R5165C SOM (System on Module) is a high-performance intelligent module, integrating Linux, based on Qualcomm QRB5165 processor. It integrates the advanced 7 nm FinFET process, a customized 64-bit Octa-core Qualcomm Kryo 585 applications processor.

R5165C SOM supports two 4-lanes MIPI-DSI, six 4-lanes MIPI-CSI integrates multiple audio and video input/output interfaces. It provides a variety of GPIO, I2C, UART and SPI standard interfaces. In addition, it supports together with SOM common standard protocol interfaces such as USB3.1, PCIE2.1/3.0 and I2S.

R5165C SOM provides convenient and stable system solution for IOT field, it can be embedded into the device on VR/AR, Robot, Smart Camera, AI devices, and any other connecting fields. The size of module is 90mm x 48mm x 10.2mm, besides a 240pins B2B connector.

1.1 Features

The following table shows the detailed features of QRB5165 and R5165C SOM

Key features of QRB5165 SoC

Item	Description
CPU	Kryo 585-64-bit applications processor with a 4MB L3 cache <ul style="list-style-type: none"> ● Quad high-performance Kryo Gold cores ● Quad low-power Kryo Silver cores
GPU	<ul style="list-style-type: none"> ● Adreno GPU 650 - 4K 60 fps UI or 2x 2k 60 fps UI ● OpenGL ES 3.2, Vulkan 1.1, DX12 FL 12_1 ● OpenCL 2.0 full profile
DSP	<ul style="list-style-type: none"> ● Compute Hexagon DSP with quad Hexagon Vector eXtensions (quad-HVX) and Hexagon Co-processor (Hexagon CP) 2.0 ● Audio Hexagon DSP dedicated to audio subsystem ● Sensor Hexagon DSP in the Qualcomm All-Ways Aware Hub to support always-on, low- power use cases ● All Hexagon DSP are cache-based processors with full access to DDR
Display	2x 4-lane DSI D-PHY 1.2 and DisplayPort 1.4 data concurrency over USB Maximum concurrency configurations as below <ul style="list-style-type: none"> ● 5040 × 2160 at 60Hz 30bpp primary + 3840 × 2160 at 60Hz 30bpp DisplayPort or 3840 × 2160 at 60Hz 30bpp Wi-Fi display ● 5040 × 2160 at 60Hz 30bpp primary + 7680 × 4320 at 30 Hz 24bpp

Item	Description
	DisplayPort <ul style="list-style-type: none"> ● 5040 × 2160 at 60Hz 30bpp primary + 2 × 3840 × 2160 at 60 Hz DisplayPort
Video Encode	4K120/8K30 encode for H.265 Main 10, H.265 Main, H.264 High, and VP8 codecs
Video Decode	4K240/8k60 decode for H.265 Main 10, H.265 Main, H.264 High, VP9 profile 2, VP8, and MPEG-2 codecs
Camera support	<ul style="list-style-type: none"> ● Qualcomm Spectra 480 Camera ISP ● Support 6 x 4 Lane MIPI CSI ● Real-time sensor input resolution: 25 + 25 + 2 + 2 + 2 + 2 + 2 MP ● 64 MP 30 fps ZSL with a dual ISP
WLAN/BT	Through PCIe to access WiFi and BT functions <ul style="list-style-type: none"> ● 2.4G/5G, support 802.11 a/b/g/n/ac/ax, 2 x 2 MIMO ● Support Bluetooth 5.1 + HS, BLE
ADC I/F	<ul style="list-style-type: none"> ● Support ADC features ● Used for input voltage sense, battery temperature detection and general-purpose ADC

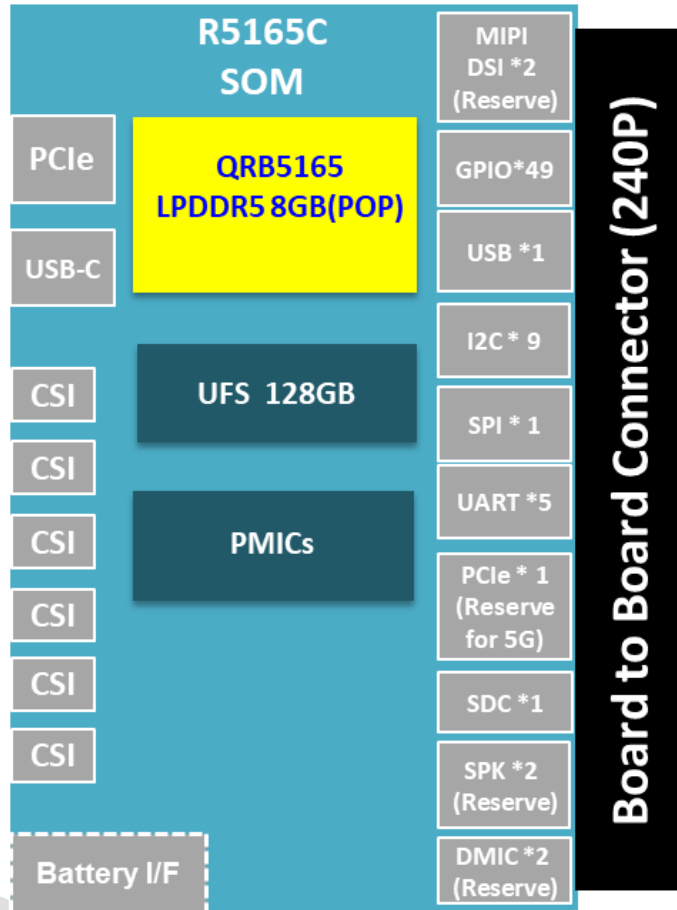
Key features of R5165C

Item	Description
Processor	Snapdragon™ QRB5165
Memory	LPDDR5(POP) 8GB + UFS3.0 128GB
Display I/F	2 x MIPI-DSI 4-lane, 5040 x 2160@60fps
Camera I/F	6x 4 data lane MIPI CSI
Audio I/F	<ul style="list-style-type: none"> ● SoundWire interface for codec ● SoundWire interface for smart speaker amplifier ● 3x MI2S with two data lanes to support full duplex stereo ● 1x MI2S with four data lanes for up to eight channels ● 3x DMIC ports support up to 6 DMICs
USB	2x USB 3.1 GEN2, <u>one can support Type-C with DisplayPort (TBC)</u>
PCIe	2x 2-lane PCIe Gen3.0
Peripheral (QUP) I/F	<ul style="list-style-type: none"> ● 1x UART, 1x SDC for SD card, ● 11x 4pin QUPs (can be set as 4-pin SPI or 2-pin I2C) ● 2x QUPs can be set as 2pin I2C ● 4x camera dedicated I2C ● 2x sensor dedicated I2C ● 1x sensor dedicated SPI
Connectivity	Through PCIe to access external WiFi and BT features

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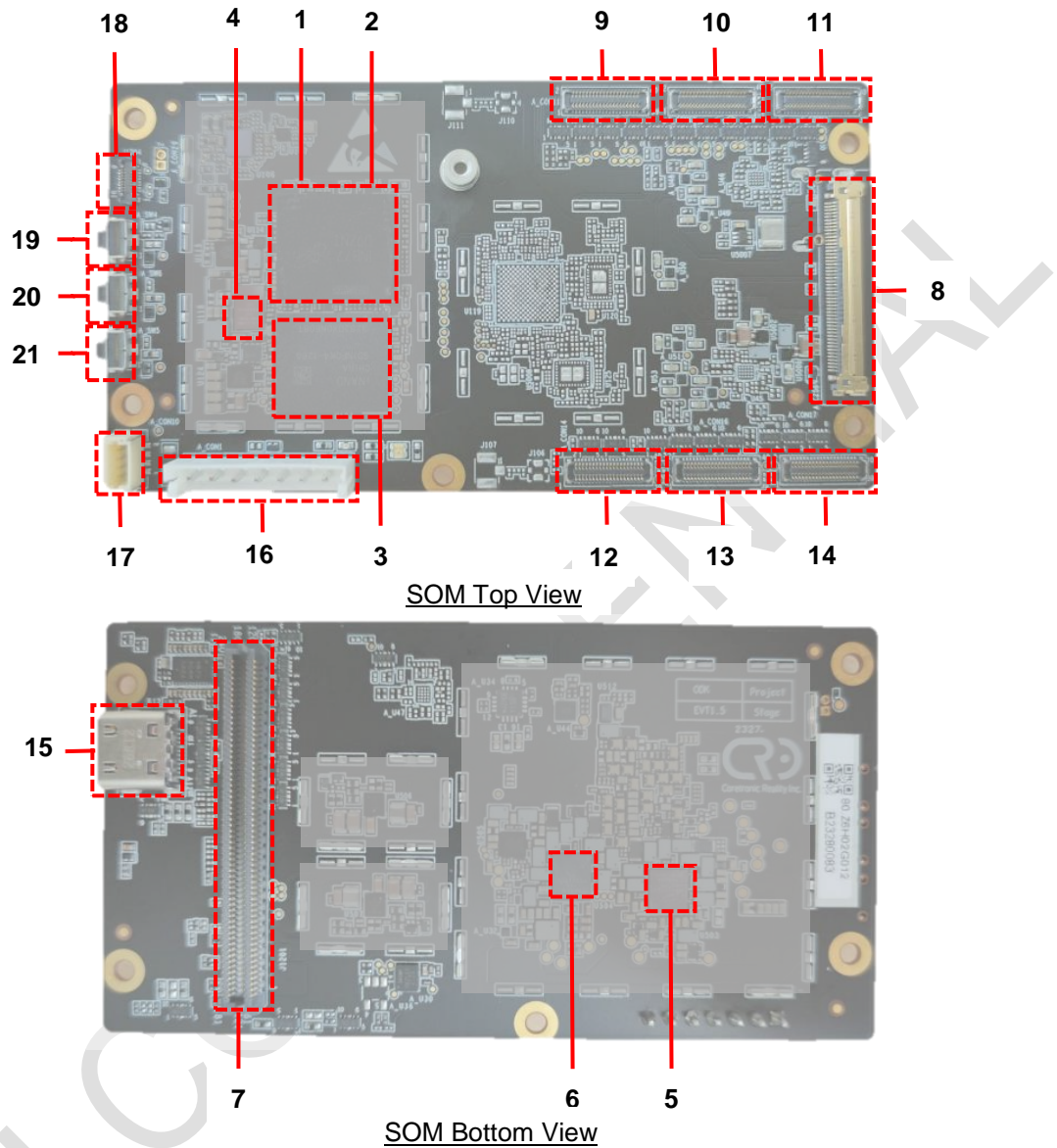
1.2 Block Diagram

R5165C Hardware Block diagram shown in below



1.3 Major components location

Below picture identify the major components and connectors found on the top and bottom of the COREXOM R5165C SOM

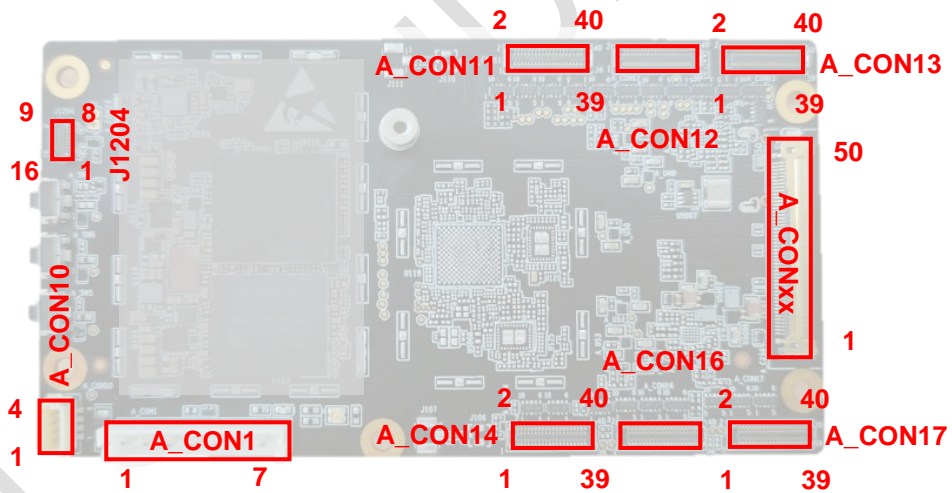


1	SoC QRB5165	12	A_CON14 40P BTB on FPC for CSI-3
2	LPDDR5 8GB	13	A_CON16 40P BTB on FPC for CSI-1
3	UFS 128GB	14	A_CON17 40P BTB on FPC for CSI-0
4	PM8150B	15	USB-C
5	PM8250	16	A_CON1 Battery pack
6	PM8150L	17	A_CON10 Debug UART
7	J1201 BTB 240P	18	J1204 16P BTB on FPC for JTAG
8	A_CONxx 50P BTW by Coaxial cable	19	A_SW4 Power ON/OFF key
9	A_CON11 40P BTB on FPC for CSI-5	20	A_SW6 Volume UP key
10	A_CON12 40P BTB on FPC for CSI-4	21	A_SW5 Volume DOWN key
11	A_CON13 40P BTB on FPC for CSI-2		

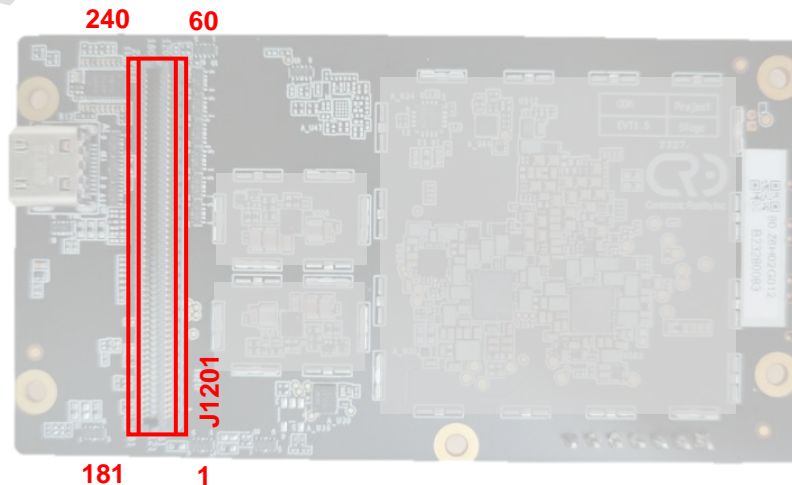
1.4 Connector function and Part number

The below table and pictures are indicated the detailed information of connectors and pin numbers.

Part Reference	Description	MPN	Vendor
J1201	BTB connector, used to connect with IO board.	ADM6-60-01.5-L-4-2-TR	SAMTEC
A_CONxx	BTW connector by Coaxial cable, used to connect with Bridge board which has function by PCIe over M.2	20525-240E-02	I-PEX
A_CON11, A_CON12, A_CON13, A_CON14, A_CON16, A_CON17	BTB connector on FPC, used to connect with CSI I/F devices, which like Camera module.	505550-4020	Molex
A_CON1	BTW connector, used to connect with Battery pack	JS-1132-07	JS
A_CON10	BTW connector, used for Debug UART	SH1.0T-1-ST-4P	JIND
J1204	(TBC)		



SOM Top View



SOM Bottom View

2. Interface Specification

This chapter introduces all the interfaces definition, purpose to guide developer easy to design and verification on CRI COREXOM R5165C SOM.

2.1 Interface pin type definition

Type	Description
AI	Analog input
AO	Analog output
BIO	Bidirectional digital CMOS I/O
CSI	MIPI CSI related circuits and I/O
DSI	MIPI DSI related circuits and I/O
DI	Digital CMOS input
DO	Digital CMOS output
H	High voltage tolerance
Nppdpukp	
PCIe	PCIe related circuits and I/O
OD	Open drain
PU	Contains an internal pull-up device
PD	Contains an internal pull-down device
PI	Power input
PO	Power output
PX3	Power for PX3 group by 1.8V
PX2	Power for SDC PX2 group by 2.95V
USB	USB SS/HS/FS related circuits and I/O

2.2 Interface detail description

2.3 Connector pin summary

2.3.1 J1201 BTB connector (240P) for IO board

MPN : ADM6-60-01.5-L-4-2-TR (60 pins x 4 rows)



Function	Type	Row-1 Pin #	Row-2 Pin #	Type	Function
R5165C_SOM_4.2V	PI	1	61		GND
R5165C_SOM_4.2V	PI	2	62		GND
R5165C_SOM_4.2V	PI	3	63		GND
R5165C_SOM_4.2V	PI	4	64		GND
R5165C_SOM_4.2V	PI	5	65		GND
R5165C_SOM_4.2V	PI	6	66		GND
VPH_PWR	PO	7	67		GND
VPH_PWR	PO	8	68		GND
VREG_BOB	PO	9	69		GND
VREG_L6C_2P96	PO	10	70		GND
VREG_L9C_2P96	PO	11	71		GND
VREG_S4A_1P8	PO	12	72		GND
VREG_L10A_3P3	PO	13	73		GND
VREG_L11C_3P3	PO	14	74		GND
NC		15	75		NC
SPKR_OUT_RIGHT_P	AO	16	76	PX3-IO	SEN0_IMUB_INT
SPKR_OUT_RIGHT_M	AO	17	77	PX3-IO	SPI_SEN0_MISO
GND		18	78	PX3-IO	SPI_SEN0_MOSI
SPKR_OUT_LEFT_P	AO	19	79	PX3-IO	SPI_SEN0_CLK
SPKR_OUT_LEFT_M	AO	20	80	PX3-IO	SPI_SEN0_CS0
GND		21	81		GND
PCIE2_RCLK_M_WLAN	PCIe-AO	22	82	PX3-DO	DMIC02_WCD_CLK
PCIE2_RCLK_P_WLAN	PCIe-AO	23	83	PX3-DO	DMIC01_CLK
PCIE2_RX0_M_WLAN	PCIe-AI	24	84	PX3-IO	DMIC02_DATA_WCD
PCIE2_RX0_P_WLAN	PCIe-AI	25	85	PX3-IO	DMIC01_DATA
PCIE2_RX1_M_WLAN	PCIe-AI	26	86	PX3-DO	DMIC03_WCD_CLK
PCIE2_RX1_P_WLAN	PCIe-AI	27	87	PX3-DO	DMIC02_CLK
PCIE2_TX0_M_WLAN	PCIe-AO	28	88	PX3-IO	DMIC03_DATA_WCD
PCIE2_TX0_P_WLAN	PCIe-AO	29	89	PX3-IO	DMIC02_DATA
PCIE2_TX1_M_WLAN	PCIe-AO	30	90		GND
PCIE2_TX1_P_WLAN	PCIe-AO	31	91		SLEEVE
GND		32	92		WCD_HPH_R
USB1_HS_DP	USB-IO	33	93		WCD_HS_DET_L
USB1_HS_DM	USB-IO	34	94		WCD_HPH_L
USB1_SS_TX_P	USB-AO	35	95		WCD_HPH_REF_R

Function	Type	Row-1 Pin #	Row-2 Pin #	Type	Function
USB1_SS_TX_M	USB-AO	36	96		WCD_HPH_REF_L
USB1_SS_RX_P	USB-AI	37	97		GND
USB1_SS_RX_M	USB-AI	38	98	PX3-IO	LR_3V3_EN_IO
GND		39	99	PX3-IO	LR_5V_EN
DSI1_CLK_P_C	DSI-AO	40	100	PX3-IO	5G_PWR_EN
DSI1_CLK_M_C	DSI-AO	41	101	PX3-IO	3.3V_Power_EN_MCU
DSI1_L0_P_C	DSI-AO	42	102	PX3-IO	1.8V_Power_EN
DSI1_L0_M_C	DSI-AO	43	103	PX3-IO	EN_AOI
DSI1_L1_P_C	DSI-AO	44	104	PX3-IO	USB_HUB_RESET
DSI1_L1_M_C	DSI-AO	45	105		IM
DSI1_L2_P_C	DSI-AO	46	106		Confirm
DSI1_L2_M_C	DSI-AO	47	107		PQM1
DSI1_L3_P_C	DSI-AO	48	108		PQM2
DSI1_L3_M_C	DSI-AO	49	109		GPIO
GND		50	110		RESX
DSI0_CLK_P_C	DSI-AO	51	111		RL_SEL
DSI0_CLK_M_C	DSI-AO	52	112		VDDI_EN
DSI0_L0_P_C	DSI-AO	53	113		GND
DSI0_L0_M_C	DSI-AO	54	114	PX2-DO	SDC2_CLK
DSI0_L1_P_C	DSI-AO	55	115	PX2-IO	SDC2_CMD
DSI0_L1_M_C	DSI-AO	56	116	PX2-IO	SDC2_DATA_0
DSI0_L2_P_C	DSI-AO	57	117	PX2-IO	SDC2_DATA_1
DSI0_L2_M_C	DSI-AO	58	118	PX2-IO	SDC2_DATA_2
DSI0_L3_P_C	DSI-AO	59	119	PX2-IO	SDC2_DATA_3
DSI0_L3_M_C	DSI-AO	60	120	PX3-DI	SD_CARD_DET_N

Function	Type	Row-3 Pin #	Row-4 Pin #	Type	Function
VDD_6DOF_IR_HI		121	181	PX3-DO	PCIE1_UART_TXD
PP1800_MIC_BIAS1		122	182	PX3-DI	PCIE1_UART_RXD
PP1800_MIC_BIAS4		123	183		LAA_TX_EN
NC		124	184	PX3-DI	WLAN_COEX_UART_RX
GND		125	185	PX3-DO	WLAN_COEX_UART_TX
DLP_HOST_IRQ_R	PX3-IO	126	186	PX3-IO	FAN_I2C_SDA
DLP_HOST_IRQ_L	PX3-IO	127	187	PX3-IO	FAN_I2C_SCL
1WIRE_EEPROM_R_C	PX3-IO	128	188	PX3-IO	SNS_I2C0_SCL_MAG
1WIRE_EEPROM_L_C	PX3-IO	129	189	PX3-IO	SNS_I2C0_SDA_MAG
PROJ0_ON_XR2	PX3-IO	130	190	PX3-IO	SNS_I2C5_SDA_RTC



Function	Type	Row-3 Pin #	Row-4 Pin #	Type	Function
LR_Pairing		131	191		SNS_I2C5_SCL_RTC
PXM_INT_N		132	192		RTC_INT_N
ALS_INT_N		133	193		UART_RX_GPS
FAN_PWR_EN		134	194		UART_TX_GPS
FAN_PWR_BP		135	195		Radar_UART4_TX
Forward		136	196		Radar_UART4_RX
Backward		137	197		RADAR_INT
EN_EXT_VDD		138	198		Gimbal_UART_TX
OTP_PWR		139	199		Gimbal_UART_RX
NC		140	200		SBUS_USART6_TX
NC		141	201		SBUS_USART6_RX
NC		142	202		TS_I2C_SDA
NC		143	203		TS_I2C_SCL
NC		144	204		TS_RESET_N
NC		145	205		TS_INT_N
NC		146	206		GND
NC		147	207		HDMI_INT
NC		148	208		HDMI_RSTN
NC		149	209		HDMI_3P3_EN
NC		150	210		I2S_MCLK
NC		151	211		GND
NC		152	212		DISPO_RESET_N
NC		153	213		ETH_RESET
NC		154	214		PCIE2_RST_N
NC		155	215		PCIE2_CLK_REQ_N
NC		156	216		PCIE2_WAKE_N
NC		157	217		5G_AIRPLANE_N
NC		158	218		5G_W_DISABLE2_N
NC		159	219		DPR
NC		160	220		5G_Reset_N
NC		161	221		WAKE_ON_WAN_N
NC		162	222		MCU_UART_TX
NC		163	223		MCU_UART_RX
NC		164	224		DLPC_SDA_R
NC		165	225		DLPC_SCL_R
NC		166	226		DLPC_SDA_L
NC		167	227		DLPC_SCL_L
NC		168	228		SNS_I2C5_SDA_PXM

Function	Type	Row-3 Pin #	Row-4 Pin #	Type	Function
NC		169	229		SNS_I2C5_SCL_PXM
NC		170	230		SNS_I2C4_SDA_ALS
NC		171	231		SNS_I2C4_SCL_ALS
NC		172	232		WG_SDA
NC		173	233		WG_SCL
NC		174	234		OP Key-1
NC		175	235		OP Key-2
NC		176	236		NC
NC		177	237		PWM
NC		178	238		6DOF_L_STROBE_AP
NC		179	239		6DOF_R_STROBE
NC		180	240		POWER KEY_IO

2.3.2 A_CONxx BTW Connector (for Bridge board of PCIe over M.2)
 MPN : I-PEX 20525-050E-02 (50P, BTW by Coaxial cable)



2.3.3 A_CON11/12/13/14/16/17 BTB connector for CSI
 A_CON17 for CSI-0
 MPN : Molex 505550-4020 (40P, BTB on FPC)



Pin #	Type	Function	Pin #	Type	Function
1	PX3-IO	CAM0_RST_N_C	2	PX3-DO	CAM_MCLK0_CSI0
3		GND	4		GND
5	PX3-OD	CSI0_I2C_SCL	6	CSI-AO	CSI0_CLK_P_C
7	PX3-OD	CSI0_I2C_SDA	8	CSI-AO	CSI0_CLK_M_C
9		GND	10		GND
11	CSI-AO	CSI0_LN0_P_C	12	CSI-AO	CSI0_LN2_P_C
13	CSI-AO	CSI0_LN0_M_C	14	CSI-AO	CSI0_LN2_M_C
15		GND	16		GND
17	CSI-AO	CSI0_LN1_M_C	18	CSI-AO	CSI0_LN3_P_C
19	CSI-AO	CSI0_LN1_P_C	20	CSI-AO	CSI0_LN3_M_C
21		GND	22		GND
23		NC	24	PO	CAM0_2V8(No Use)
25	PO	CAM0_1V2(No use)	26	PO	CAM0_1V8(No Use)
27	PO	CAM0_1V2(No use)	28	PO	CAM0_1V8(No Use)
29	PO	CAM0_1V2(No use)	30		NC

Pin #	Type	Function	Pin #	Type	Function
31		NC	32	PX3-IO	CSI0_RGB0_FRM_SYNC
33	PX3-IO	CSI0_RGB0_SISEL	34	PX3-IO	CSI0_RGB0_SID
35	PX3-IO	GPO_CSI_0	36	PO	6DOF_AVDD_2V8
37	PX3-IO	Test Point	38	PO	6DOF_DOVDD_1V8
39	PX3-IO	CSI0_ULPM	40	PO	6DOF_DVDD_1V2

A_CON16 for CSI-1

MPN : Molex 505550-4020 (40P, BTB on FPC)

Pin #	Type	Function	Pin #	Type	Function
1	PX3-IO	CAM1_RST_N_C	2	PX3-DO	CAM_MCLK1_CSI1
3		GND	4		GND
5	PX3-OD	CSI1_I2C_SCL	6	CSI-AO	CSI1_CLK_P_C
7	PX3-OD	CSI1_I2C_SDA	8	CSI-AO	CSI1_CLK_M_C
9		GND	10		GND
11	CSI-AO	CSI1_LN0_P_C	12	CSI-AO	CSI1_LN2_P_C
13	CSI-AO	CSI1_LN0_M_C	14	CSI-AO	CSI1_LN2_M_C
15		GND	16		GND
17	CSI-AO	CSI1_LN1_M_C	18	CSI-AO	CSI1_LN3_P_C
19	CSI-AO	CSI1_LN1_P_C	20	CSI-AO	CSI1_LN3_M_C
21		GND	22		GND
23		NC	24	PO	CAM1_2V8(No Use)
25	PO	CAM1_1V2(No use)	26	PO	CAM1_1V8(No Use)
27	PO	CAM1_1V2(No use)	28	PO	CAM1_1V8(No Use)
29	PO	CAM1_1V2(No use)	30		NC
31		NC	32	PX3-IO	CSI1_RGB1_FRM_SYNC
33	PX3-IO	CSI1_RGB1_SISEL	34	PX3-IO	CSI1_RGB1_SID
35	PX3-IO	GPO_CSI_1	36	PO	6DOF_AVDD_2V8
37	PX3-IO	Test Point	38	PO	6DOF_DOVDD_1V8
39	PX3-IO	CSI1_ULPM	40	PO	6DOF_DVDD_1V2

A_CON13 for CSI-2

MPN : Molex 505550-4020 (40P, BTB on FPC)

A_CON14 for CSI-3

MPN : Molex 505550-4020 (40P, BTB on FPC)

A_CON12 for CSI-4

MPN : Molex 505550-4020 (40P, BTB on FPC)

A_CON11 for CSI-5

MPN : Molex 505550-4020 (40P, BTB on FPC)

2.3.4 A_CON1 Board to Wire Connector (for Battery pack)

MPN : JS-1132-07

Pin #	Type	Function
1		BAT+
2		BAT+
3		BAT+
4		Thermistor 100K, B=4250
5		BAT-
6		BAT-
7		BAT-

2.3.5 A_CON10 Board to Wire Connector (for Debug UART port)

MPN : JIND, SH1.0T-1-ST-4P

Pin #	Type	Function
1		TP, Test Pin
2	DO	UART TX
3	DI	UART RX
4		GND

2.3.6 MPN : JS-1132-07

3. Electrical Characteristics

3.1 Absolute Maximum Ratings

The absolute maximum ratings in which the SOM input power sources can be exposed to without experiencing functional failure.

Function	Min	Max	Unit
Battery or DC power input (R5165C_SOM_4.2V)	-0.3	6	V
USB VBUS input voltage source (USB_VBUS)	-0.3	28	V

3.2 Operating conditions

The recommended operating conditions for the SOM to meet all performance specifications (provided the absolute maximum ratings have never been exceeded)

Function	Min	Typ.	Max	Unit
Battery or DC power input (R5165C_SOM_4.2V)	3.45	3.8	4.8	V
USB VBUS input voltage source (USB_VBUS)	3.6	5	12	V

3.3 Output Power

The SOM provide power supply for external device, like camera module, SD card, Sensor, and so on. Below map show the details

Function	Voltage (V)	Range (V)	Rated (mA)	Usage
VPH_PWR	+3.6	+3.2~4.2	TBD	
VREG_BOB	+3.7	+3.6~4.0	600	
VREG_L6C_2P96	+2.96	+2.7~2.96	150	Peripheral IO
VREG_L9C_2P96	+2.96	+2.7~2.96	600	SD/MMC or UFS card
VREG_S4A_1P8	+1.8	+1.8	2000	Generic 1.8V
VREG_L10A_3P3	+3.104	+3.0~3.312	600	Peripheral IO
VREG_L11C_3P3	+3.104	+3.0~3.312	600	Sensors

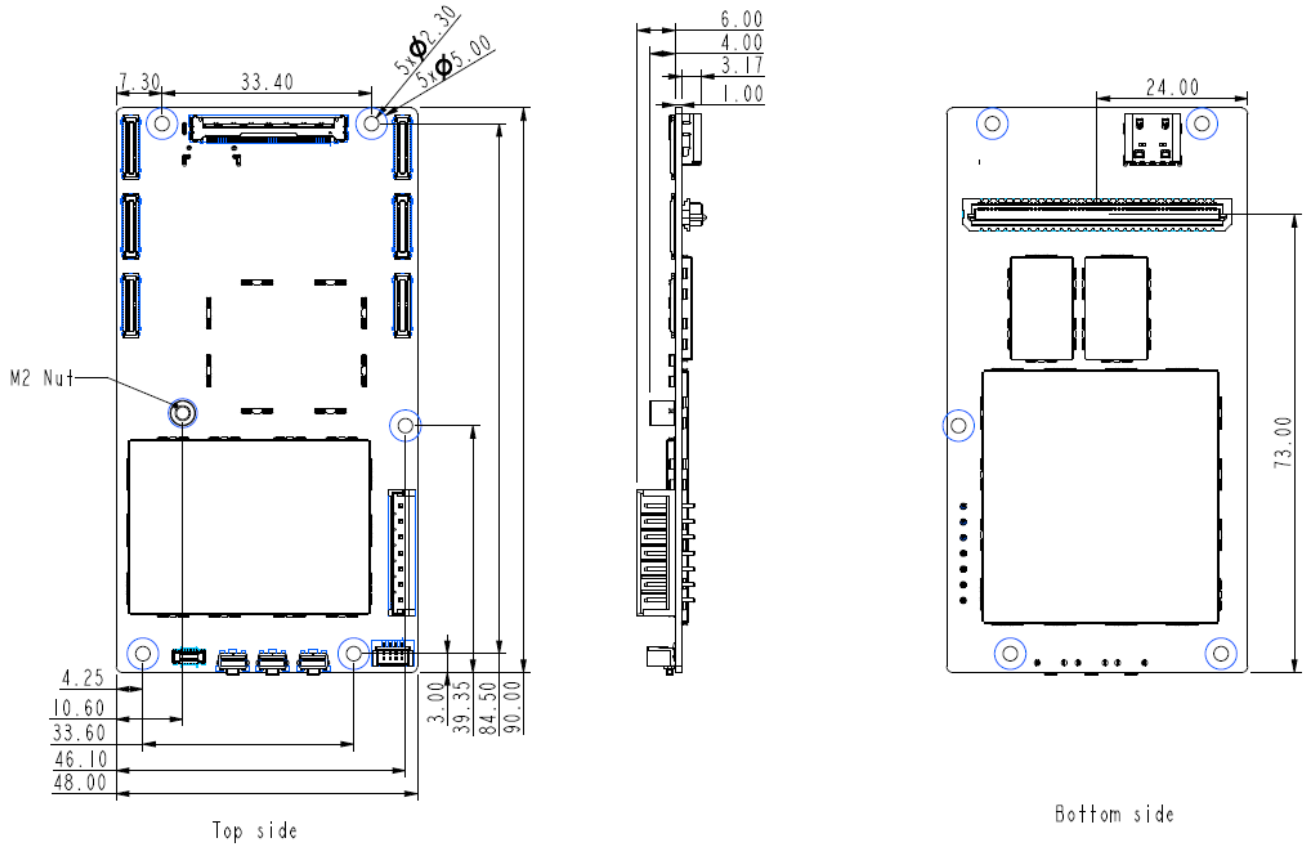
3.4 GPIO characteristics

The below table shows the GPIO characteristics (VDDPX3=1.8V)

Parameter	Description	Min	Max	Unit
V _{IH}	High-level input voltage, CMOS/Schmitt	VDDPX3 x0.7	VDDPX3 +0.3	V
V _{IL}	Low-level input voltage, CMOS/Schmitt	-0.3	VDDPX3 x0.3	V
V _{SHYS}	Schmitt hysteresis voltage	300	-	mV
V _{OH}	High-level output voltage, CMOS	VDDPX3 -0.45	VDDPX3	V
V _{OL}	Low-level output voltage, CMOS	0.0	0.45	V
R _{PULL-UP}	Pull-up resistance	20	60	KΩ
R _{PULL-DOWN}	Pull-down resistance	20	60	KΩ

4. Mechanical Specification

4.1 SOM Mechanical dimensions



4.2 Weight

The SOM weighs approximately 23.5 +/- 2 g

4.3 Thermal Characteristics

5. Product Marking, Ordering and Shipping Info.

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