uCOM Carrier Board Datasheet, ≤ rev B

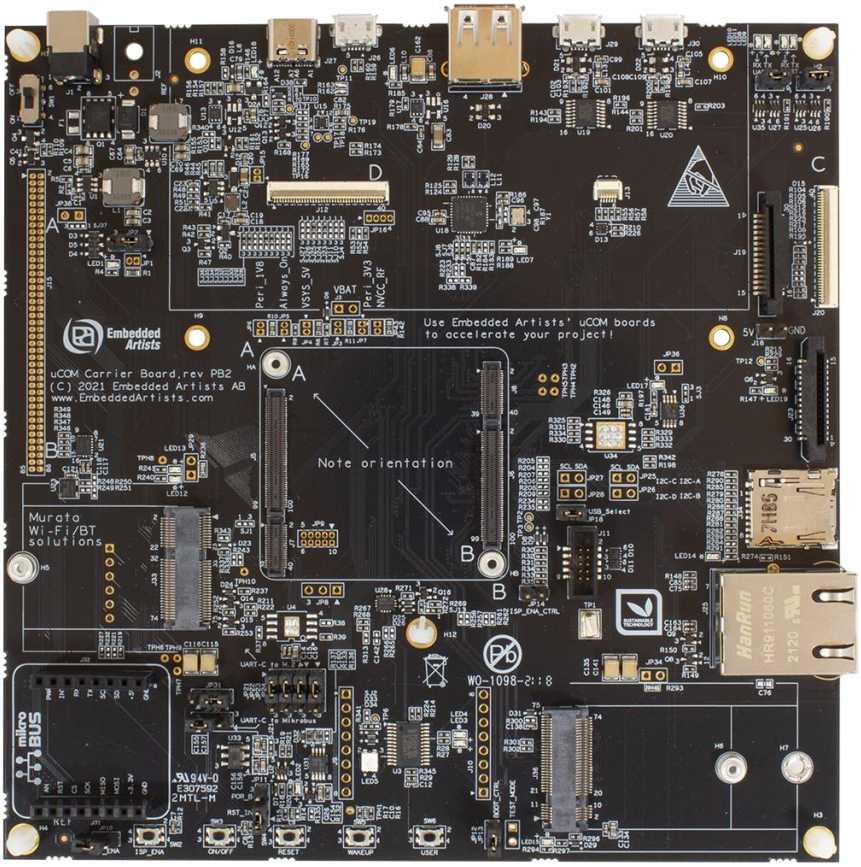

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Table of Contents

1 Document Revision History

Revision	*Date*	*Description*
PA1	2021-09-09	Initial release.
PA2	2021-09-20	Added information about how to connect MIPI displays.
PA3	2021-12-19	Added information about LCD mounting and note about U23.
PA4	2022-01-28	Added information about supported displays for MIPI-DSI interface.
PA5	2023-03-13	Added information about rev PB3 and rev B of the uCOM Carrier board and the iMX93 uCOM board.
PA6	2023-04-21	Added clarification about signal BOOT_CTRL.
PA7	2023-06-13	Added information about sensitive area on pcb, close of On-Off switch.
PA8	2024-12-12	Added information that SIM connector, J35, is not functional.

2 Introduction

This document is a datasheet that specifies and describes the *uCOM Carrier Board* mainly from a hardware point of view. Note that software-related issues are not addressed.

2.1 Identify uCOM Carrier Board Revision

The revision of the *uCOM Carrier Board* can be identified with the help of the two pictures below. Figure 1 illustrates the *uCOM Carrier Board, rev A* and Figure 2 illustrates the *uCOM Carrier Board, rev PB2*. There are more versions, and this document covers all versions of the board.

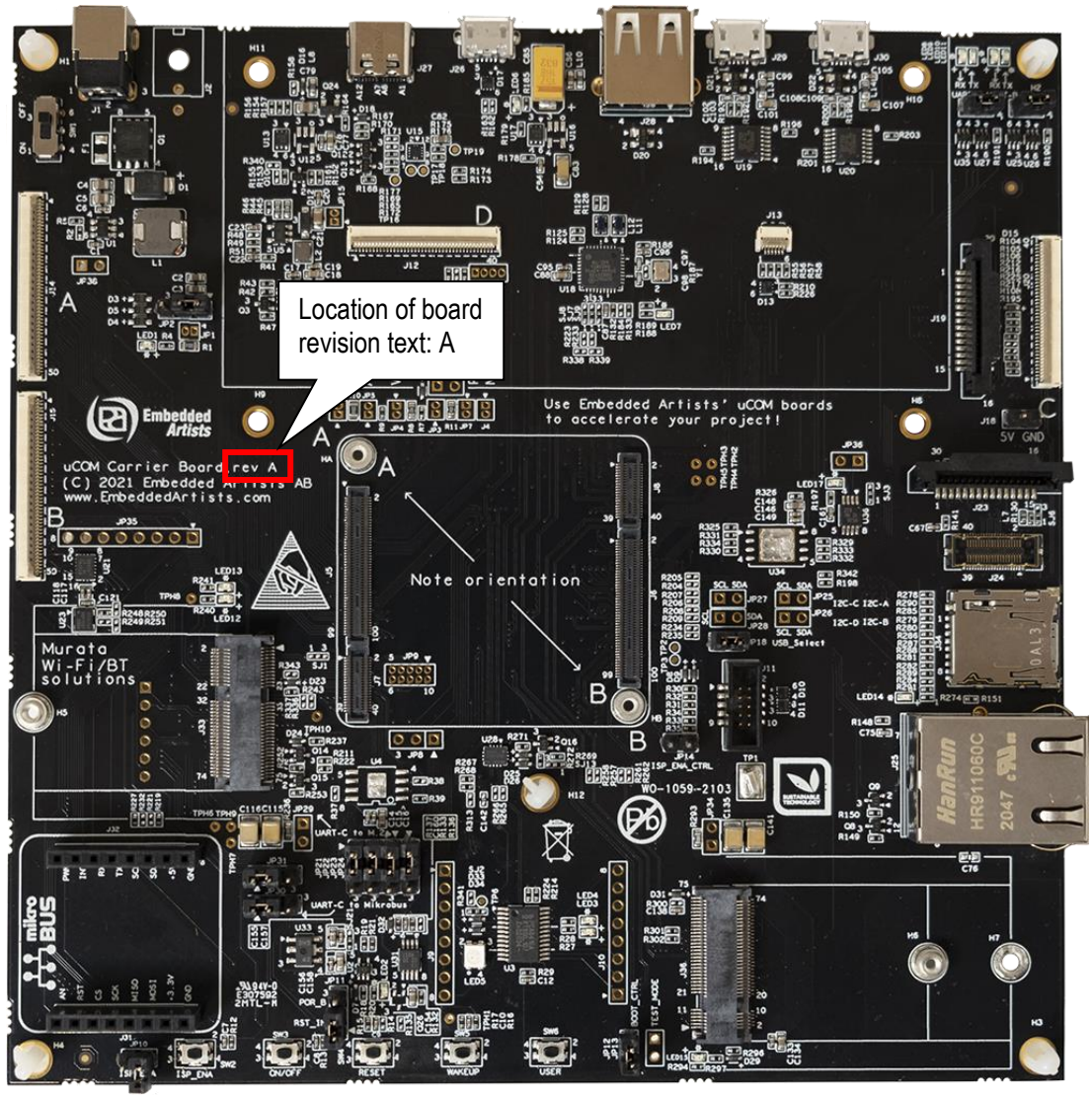

Figure 1 – uCOM Carrier Board, rev A

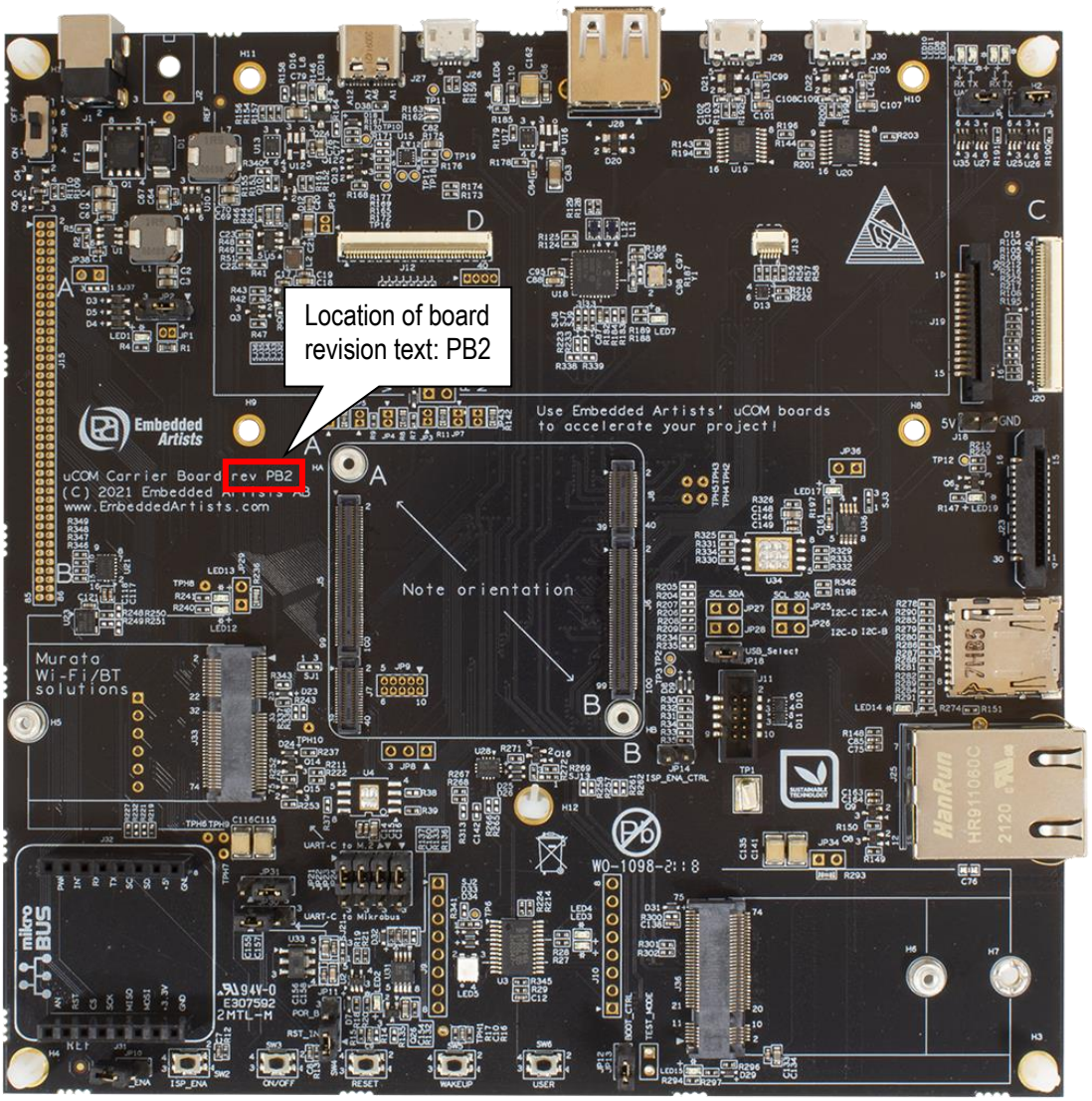

Figure 2 – uCOM Carrier Board, rev PB2

Note that for simplicity, both board revisions will be referenced just as the *uCOM Carrier Board*. The board revision will only be referenced when there is an explicit difference.

The table below lists the main revision updates for the uCOM Carrier Board.

Feature	*uCOM Carrier Board, rev A*	*uCOM Carrier Board, rev PB2*	*uCOM Carrier Board, rev PB3*	*uCOM Carrier Board, rev B*
Expansion connector	Dual 50 pos FPC connectors.	Dual row, 50 mil pitch holes.	Dual row, 50 mil pitch holes.	Dual row, 50 mil pitch holes. 8 pins less than rev PB2/PB3.
Powering of wireless module	Powered from uCOM on-board 3.3V supply. **Note** that current consumption peaks on wireless modules can	Separate 3.3V power supply for wireless modules.	Separate 3.3V power supply for wireless modules.	Separate 3.3V power supply for wireless modules.

	cause problems for on-board 3.3V uCOM voltage regulator.			
Camera interface	Supports both RPi camera interface pinning and NXP's camera from their i.MX RT1170-EVK.	Supports RPi camera interface pinning.	Supports RPi camera interface pinning.	Supports RPi camera interface pinning.
Parallel RGB interface	Supports 16-bit color mapping by default. Requires an external 16-to 24-bit color adapter for 24-bit color mapping.	Supports 16-bit color mapping by default. Requires an external 16-to 24-bit color adapter for 24-bit color mapping.	Supports 16-bit color mapping by default. Requires an external 16-to 24-bit color adapter for 24-bit color mapping.	Plugin adapters supports both 16-bit and 24-bit color mapping
Support SPI extension to M.2 interface	No	No	No	Yes
Other				Supports second Gigabit Ethernet interface adapter for iMX93 uCOM. Support for the iMX93 uCOM in general. USB back-powering issue addressed.

2.2 EAuCOM Overview

The *uCOM Carrier Board* is part of the EAuCOM board infrastructure. EAuCOM is a board standard defined by Embedded Artists and is the core design around an i.MX RT/6/7/8/9 SoC. An EAuCOM board typically includes, besides the i.MX RT/6/7/8/9 SoC, external SDRAM and FLASH memories, power management, Ethernet PHYs and wireless module.

An EAuCOM based system solution has the following overall physical structure:

- **EAuCOM board**, containing a proven and robust core design that encapsulates a lot of the complexity of a modern, high-performance ARM SoC design.
- **Carrier board** that implements the needed interfaces for the specific solution. The carrier board also typically contains the powering solution and creates the mechanical entity that shall be mounted in a box, or similar. The carrier board is typically a simpler design (i.e., less complex) than the EAuCOM board. The carrier board is typically a custom specific design where the *uCOM Carrier Board* is used as a reference design for the different interfaces.

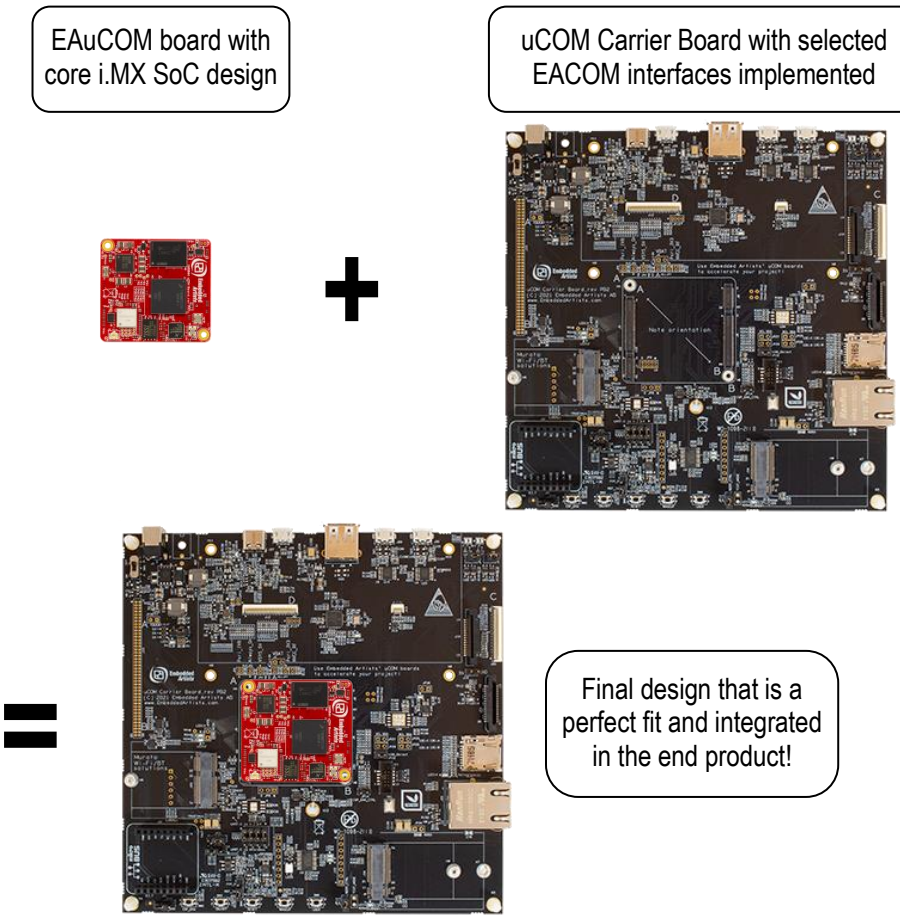

Figure 3 – EAuCOM Board Plus Custom Carrier Board Equals Final Product

The combination of an EAuCOM board and accompanying carrier board is very much like a Single Board Computer (SBC), but more flexible. A carrier board developed for a specific application will be a perfect fit, as opposed to a standard single board computer (SBC). Normal design updates are more likely to be on the carrier board, which is simpler to update than a complete SBC would be. Upgrading a design for more execution power or more memory is as easy as changing EAuCOM board, as opposed to redesigning the complete SBC.

2.3 uCOM Carrier Board Overview

The *uCOM Carrier Board* is a base board that implements a large part of interfaces that the EAuCOM standard defines. The board offers a good mix of features and serves as a reference implementation for the different interfaces. It allows projects with lower volume to save considerable development time by using this base design as a general carrier board (with minimal adjustments). Example applications where the *uCOM Carrier Board* is ideal are:

- Industrial applications like factory, process and building automation
- Test and measurement equipment
- Telematics and gateway applications

Since all relevant EAuCOM interfaces are implemented, the *uCOM Carrier Board* is used as base for iMX Developer's Kits that exists for different EAuCOM boards. Currently the board is compatible with the following EAuCOM boards:

- iMX RT1176 uCOM board
- iMX RT1166 uCOM board
- iMX RT1064 uCOM board
- iMX8M Mini uCOM board
- iMX8M Nano uCOM board
- iMX7ULP uCOM board
- iMX93 uCOM board

The *uCOM Carrier Board* has the following feature highlights:

Interfaces **Note** that all interfaces/ functions **are not supported** by all EAuCOM boards.	Connector to EAuCOM board, DF40C connectors, dual 100 pos and dual 40 pos connectors (280 pos in total) with M3 standoffs for mounting EAuCOM board
	Gigabit Ethernet RJ45 connector
	USB 2.0 OTG interface in parallel with USB-C interface
	USB 2.0 Host interfaces (via USB 2.0 Hub)
	Dual UART-to-USB bridges for console connections
	Mikrobus Module Interface, dual 8 pos 100 mil pitch female connectors
	uSD connector
	16-bit parallel RGB Display connector, 40-pos 0.5mm pitch FPC, with backlight voltage generator
	M.2 connector (key E) with SDIO, PCIe and USB interfaces
	M.2 connector (key B) with optional PCIe and USB interfaces, including SIM card holder
	MIPI-DSI display interface; one connector is RPi compatible (15 pos, 1mm pitch FPC) and one is NXP RK055HDMIPI4M compatible (40 pos, 0.5mm pitch FPC). **Note** that not all uCOM boards has a MIPI-DSI interface and not all has a driver for the NXP RK055HDMIPI4M display.
	ADV7535 MIPI-DSI to HDMI adapter (connects to 40-pos MIPI-DSI connector)
	MIPI-CSI interface, 15 pos, 1mm pitch FPC connector (RPI compatible pinning). **Note** that not all uCOM boards has a MIPI-CSI interface.
	Expansion connector, 86 pos 50 mil pitch

	100/10 Mbps Ethernet-Phy adapter, with EUI-48 MAC address in I2C E2PROM (for iMX RT1064 / RT1166 / RT1176 uCOM boards)
	Gigabit Ethernet-Phy adapter (for iMX93 uCOM boards)
Powering	12V (+-30%) supply voltage
	Reverse polarity protection
	DC/DC converter: 5V/3A for EAuCOM board and USB interfaces DC/DC converter: 3.3V/3A for powering the M.2 interfaces (Wi-Fi/BT and cellular)
Dimensions	152 x 152 mm
	Five M4 holes (4.3mm diameter) for mounting and grounding
Environment	0 - 60° Celsius
	5 - 90% relative humidity, non-condensing
Other	Onoff, wakeup, ISP enable and Reset pushbuttons
	I2C GPIO and GPIO-PWM expanders, RGB-LED and LEDs
	JTAG interface, 2x5 pos, 50 mil pitch connector
	Pads for QSPI interfaces to uCOM board
	Easy access to I2C signals
	Series resistors for measuring supply currents to/from EAuCOM board

2.4 uCOM Carrier Board RF-Interfaces

Most EAuCOM boards offer an option to mount an integrated Wi-Fi/BT module. Sometime this perfectly meets the needs, but sometime a more flexible solution is needed where different solutions are used in different regions and possibly also over time. The **EAuCOM design philosophy is to have multiple interfaces** that will allow a broad range of RF solutions to be easily integrated. This solution is believed to be flexible and cost effective. It allows the application to carefully evaluate the trade-offs between different solutions (as opposed to just having one fixed option available).

There are multiple interfaces that can be used to connect to an RF module, see table below.

Hardware Interface	Connectors on *uCOM Carrier Board*	RF technology (examples of typical modules)
SDIO (4-bit databus)	M.2 (Key E) interface, uSD card interface	Wi-Fi, NFC
USB Host interface	M.2, E-key interface, M.2, B-key interface, USB A connectors	Wi-Fi, Cellular, BTLE, NFC
SPI interface	Expansion connectors, M.2 (Key E) interface via non-standard SPI interface expansion	Wi-Fi, BTLE, ISM, Thread, Zigbee, NFC
UART interface	Expansion connectors	Wi-Fi, ISM, Zigbee, GPS, Cellular, BTLE, NFC
I2C interface	Expansion connectors, M.2, E-key interface	NFC

2.5 Software

For EAuCOM boards with i.MX 6/7/8/9 application processors (Cortex-A cores) there are different Linux Board Support Packages (BSPs) for each combination of an *EACOM Board* and the *uCOM Carrier Board*. The BSPs are set up to support the interface and GPIO usage on the *uCOM Carrier Board*. Precompiled images are available. Embedded Artists work with partners that can provide support for other operating systems (OS). For more information contact Embedded Artists support.

For EAuCOM boards with i.MX RT crossover processors (Cortex-M cores) there are patched versions of NXP's SDKs. The SDKs contain multiple code examples and implement at least one real time operating system, which serves as a good base for creating an application.

Several i.MX 6/7/8/9 application processors implement a heterogeneous multiprocessor system with a Cortex-M core (besides the Cortex-A cores). For these EAuCOM boards, there is also a patched SDK for the Cortex-M core.

This document has a hardware focus and does not cover software development. See other documents, related to the specific EAuCOM board that is used, for more information about software development.

2.6 EAuCOM Interfaces

The table below lists the interfaces that are specified in the EAuCOM specification (see separate document for details) and what is supported by the *uCOM Carrier Board*. Note that different EAuCOM boards may not implement all interfaces in the EAuCOM specification.

Interface	EAuCOM specification	uCOM Carrier Board
UART	3 ports (one 4 wire and two 2 wire)	Two ports can connect to UART-to-USB bridge (only RX/TX). Port C connected to M.2 E-key connector (for BT). Expansion connectors also carry the UART interface signals.
SPI	2 ports	Expansion connectors carry the SPI interface signals.
I2C	4 ports	Expansion connectors carry the I2C interface signals.
SD	2 4-bit port	Connects to uSD card interface and M.2 E-key connector.
Parallel LCD	24 data bits and CLK/HS/VS/DE	Generic 24-bit parallel RGB display interface. 16 data bits connector to RGB565 FPC connector.
Serial display	MIPI-DSI, 4 lanes	Expansion FPC connector.
Serial Camera	MIPI-CSI, 4 lanes	Expansion FPC connector, 2 data lanes connected
Gigabit Ethernet	1 port	External connector supporting Gigabit as well as 100/10 Mbps speed.
PCIe	1 port, 1 lane	Connected to M.2 E-key connector (default) or M.2 B-key connector (requires rework).
USB	2 USB2.0 OTG	1x USB2.0 OTG and USB-C connector Internal USB2.0 hub with; 1x external USB2.0 Host connector and 1x internal USB2.0 Host internal to M.2 E-key and 1x internal USB2.0 Host internal to M.2 B-key

SPDIF	1 TX/RX port	Expansion connectors carry the signals.
CAN	2 ports	Expansion connectors carry the signals.
I2S/SSI/AC97	1 port (4 wire synchronous plus MCLK)	Signals connects to audio interface of M.2 E-key connector.
GPIO	12 pins	Used to control different interfaces on the board.
WAKEUP	1 pin	Connects to pushbutton.

2.7 Supported Interfaces/Features: uCOM Board Matrix

As noted in the previous section not all EAuCOM boards implement all interfaces because of differences in the i.MX SoCs. The table below lists the main differences in supported interfaces/connectors.

Interface / Feature	iMX RT1064	iMX RT1166	iMX RT1176	iMX7 ULP	iMX8M Mini	iMX8M Nano	iMX93
Ethernet	√[1]		√[2]		√[2]	√[2]	√[2]
100/10 Mbps Ethernet Adapter	√	√	√				
Gigabit Ethernet Adapter							√
USB OTG / USB-C	√	√	√	√	√	√	√
USB Host Hub	√	√	√	√[3]	√	√[3]	√
MIPI-DSI display interface		√	√	√	√	√	√
Support for ADV7535 MIPI-DSI to HDMI Adapter		√	√		√	√	√
Support for NXP RK055HDMIPI4M display		√	√				√
MIPI-CSI camera interface		√	√		√	√	√
Parallel RGB display	√	√	√[5]				√
uSD card interface	√[4]			√[4]	√[4]	√[4]	√
M.2 Key E, SDIO		√	√	√	√	√	√
M.2 Key E, PCIe					√		
M.2 Key E, USB	√	√	√	√[3]	√	√[3]	√
M.2 Key B, USB/PCIe	USB	USB	USB	USB[3]	√	USB[3]	USB

√ = feature/interface supported
√[1] = 100/10 Mbps speed
√[2] = Gigabit speed
√[3] = Supported via USB multiplexor (processor has only one USB interface)
√[4] = supported if no on-board Wi-Fi/BT module mounted, else not supported
√[5] = Not available as default, but available with special mounting option

2.8 Modifications to uCOM Carrier Board

The *uCOM Carrier Board* has been designed to be flexible. Most options can be controlled via jumpers, but some options might need soldering.

Note that modifications to the board are done at your own risk and void all warranties.

2.9 Reference Documents

For details about specific behavior of each interface, see the NXP's Datasheets and Reference Manuals for the respective iMX RT/6/7/8/9 SoC mounted on the EAuCOM board that is used.

The following documents are external industry standard reference documents and should also be consulted when applicable:

- eMMC (Embedded Multi-Media Card) the eMMC electrical standard is defined by JEDEC JESD84-B45 and the mechanical standard by JESD84-C44 (www.jedec.org)
- GbE MDI (Gigabit Ethernet Medium Dependent Interface) defined by IEEE 802.3. The 1000Base-T operation over copper twisted pair cabling is defined by IEEE 802.3ab (www.ieee.org)
- The I2C Specification, Version 2.1, January 2000, Philips Semiconductor (now NXP) (www.nxp.com)
- I2S Bus Specification, Feb. 1986 and Revised June 5, 1996, Philips Semiconductor (now NXP) (www.nxp.com)
- JTAG (Joint Test Action Group) defined by IEEE 1149.1-2001 - IEEE Standard Test Access Port and Boundary Scan Architecture (www.ieee.org)
- PCI Express Specifications (www.pci-sig.org)
- SD Specifications Part 1 Physical Layer Simplified Specification, Version 3.01, May 18, 2010, © 2010 SD Group and SD Card Association (Secure Digital) (www.sdcard.org)
- SPDIF (aka S/PDIF) (Sony Philips Digital Interface) - IEC 60958-3
- SPI Bus – “Serial Peripheral Interface” – de-facto serial interface standard defined by Motorola. A good description may be found on Wikipedia (http://en.wikipedia.org/wiki/Serial_Peripheral_Interface_Bus)
- USB Specifications (www.usb.org)

3 Interface and Function Description

This chapter lists details about all different interfaces and functions on the *uCOM Carrier Board*.

Note that all EAuCOM boards may not support all interfaces and/or functions on the *uCOM Carrier Board*. It is the features of the specific i.MX SoC that is mounted on the used EAuCOM board that dictates what interfaces and functions that are supported. The i.MX SoC datasheets and reference manuals from NXP shall always be consulted for details about different interfaces and functions.

Figure 4 below illustrates the main interface connectors.

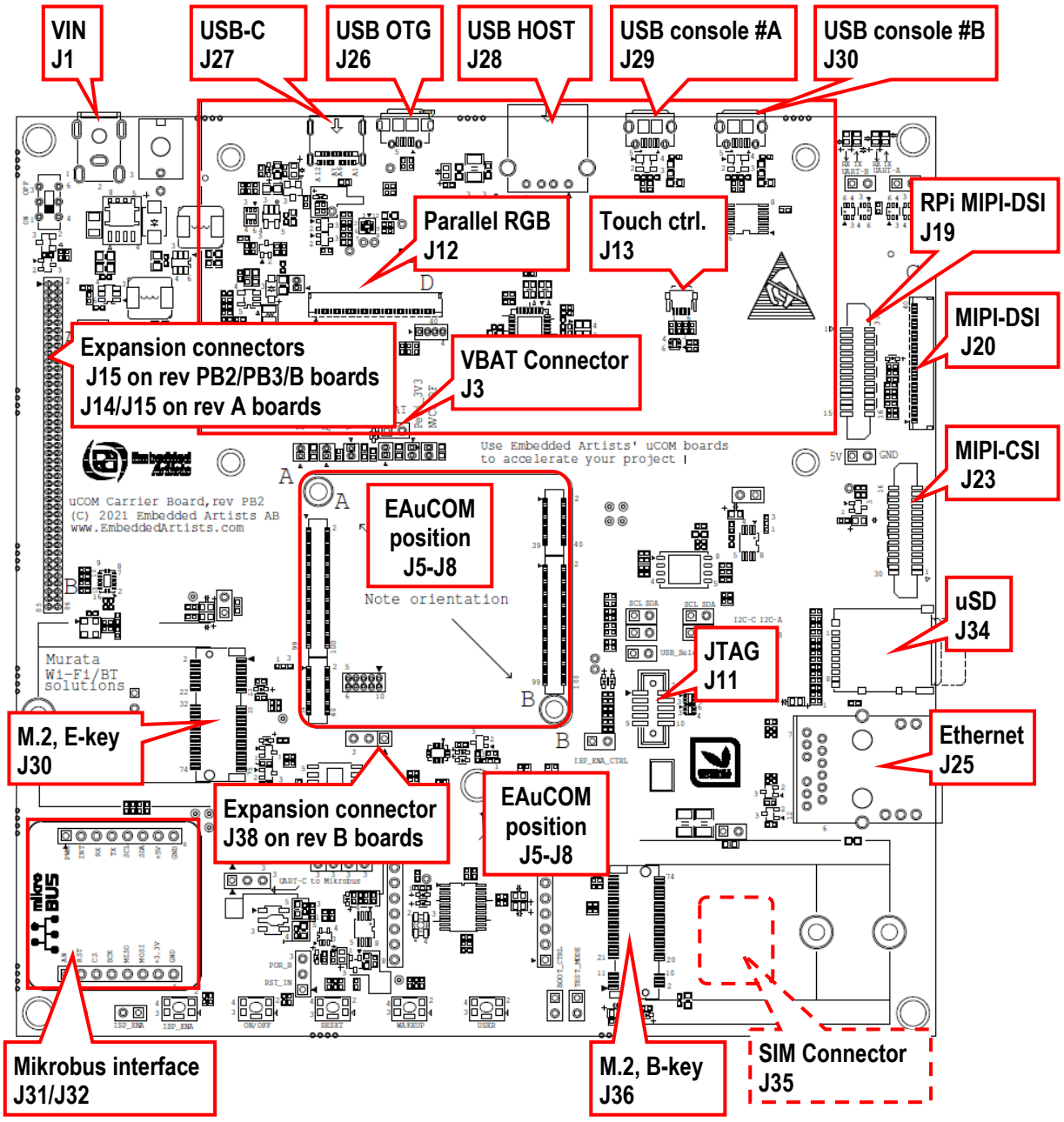

Figure 4 – uCOM Carrier Board, Main Interface Connectors

3.1 EAuCOM Connectors

There are four Hirose DF40C-DS connectors for mounting the EAuCOM. There are two 100-pos and two 40-pos connectors. Note that some EAuCOM boards do not have all four DF40C connectors. To simplify identification between different EAuCOM boards, the connectors are named JA, JB, JC and JD. JA and JB are typically always present, and JC and JD are optional.

Note: match the "A" marking on the EAuCOM with the "A" on the *uCOM Carrier Board.* It is possible to mount the EAuCOM board with incorrect orientation but never do that - it will damage the EAuCOM board beyond repair.

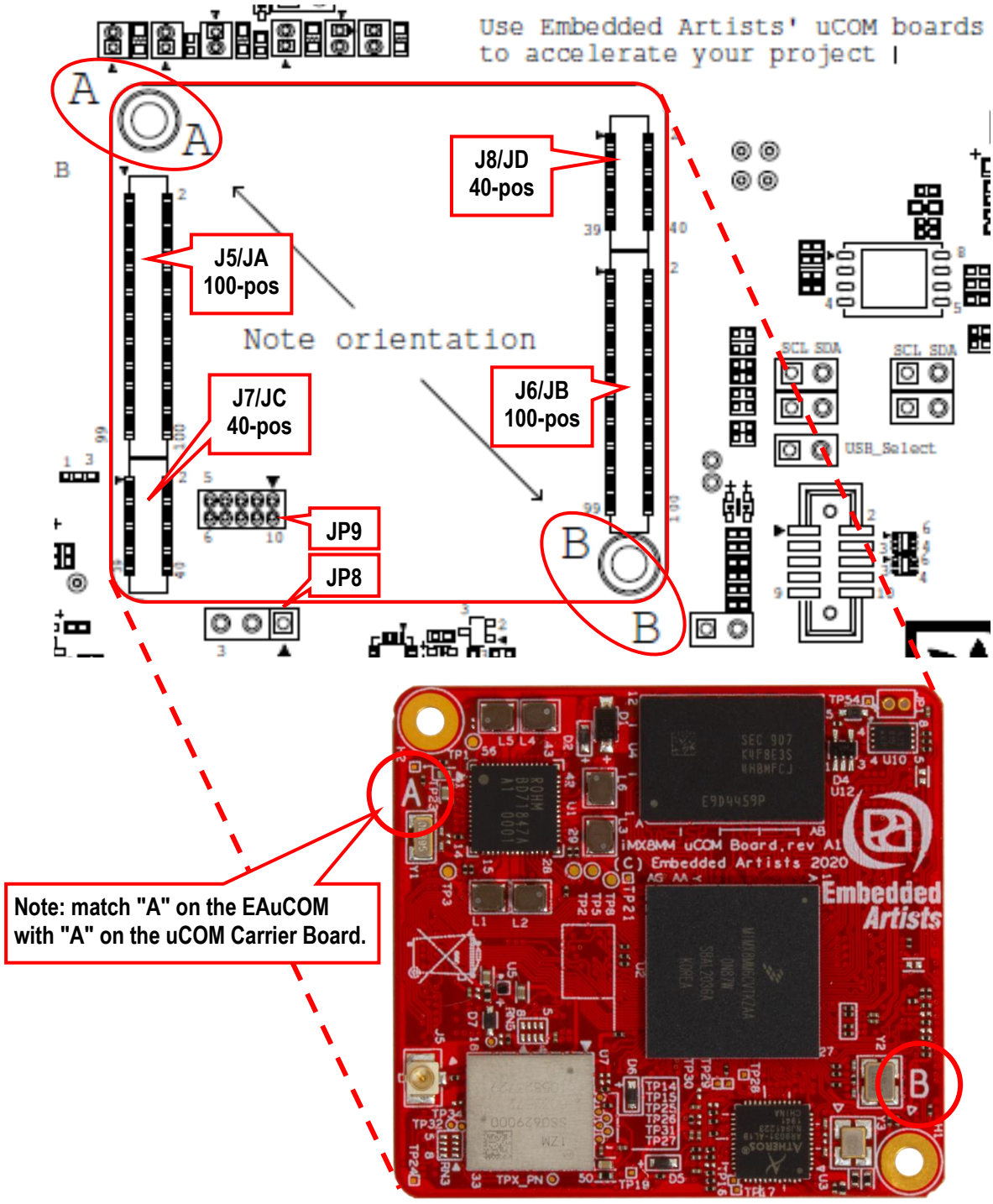

Figure 5 – uCOM Carrier Board, EAuCOM Connectors

JP8 and JP9 allow direct access to some signals that are not available on the expansion connector.

3.2 Power Supplies

The input voltage to the *uCOM Carrier Board* is 12V nominal (input range is 7-17V). There is reverse voltage protection on the input supply. There is one main input supply connector (J1), which is a 2.1mm ID/5.5mm OD barrel connector with positive center. There is also pads for an alternative 2-pos input connector; Molex Micro-Fit 3.0 connector 0430450200. As default, this alternative connector is not mounted. There is an on/off-switch that can be used to power cycle the board without having to disconnect the power supply cable.

There are two DC/DC power supplies on the *uCOM Carrier Board*:

- 5V / 3A to power EAuCOM board and some peripherals on the *uCOM Carrier board*, like USB Host and LCD backlight.
- 3.3V / 3A to power the M.2 E-key and B-key interfaces (for RF modules). This supply is enabled when signal PERI_PWR_EN is high.
  Note that uCOM Carrier boards rev A does not have this DC/DC supply. On these boards, 3.3V for RF modules is generated on the EAuCOM boards. **Also note** that current consumption peaks on wireless modules can cause problems for EAuCOM on-board 3.3V uCOM voltage regulator. Therefore, an external 3.3V regulator was added on rev PB2 of the *uCOM Carrier Board*.

For applications with low current consumption, it is possible to power the board from one of the USB interfaces that are connected to the PC. Set JP2 in 2-3 position for USB powering but only use this option if the current consumption is less than what the USB port can provide (typically less than 0.5 Amp). Also note that it is not possible to power the M.2 E-key and B-key interfaces from the USB ports.

It is possible to measure the 5V current to the *uCOM Carrier Board* over a 100 milliOhm series resistor. JP1 is connected across this series resistor. 1A current will result in 100mV across JP1 pads.

Figure 6 illustrates the location of the two input connectors, the on/off switch, JP1 and JP2.

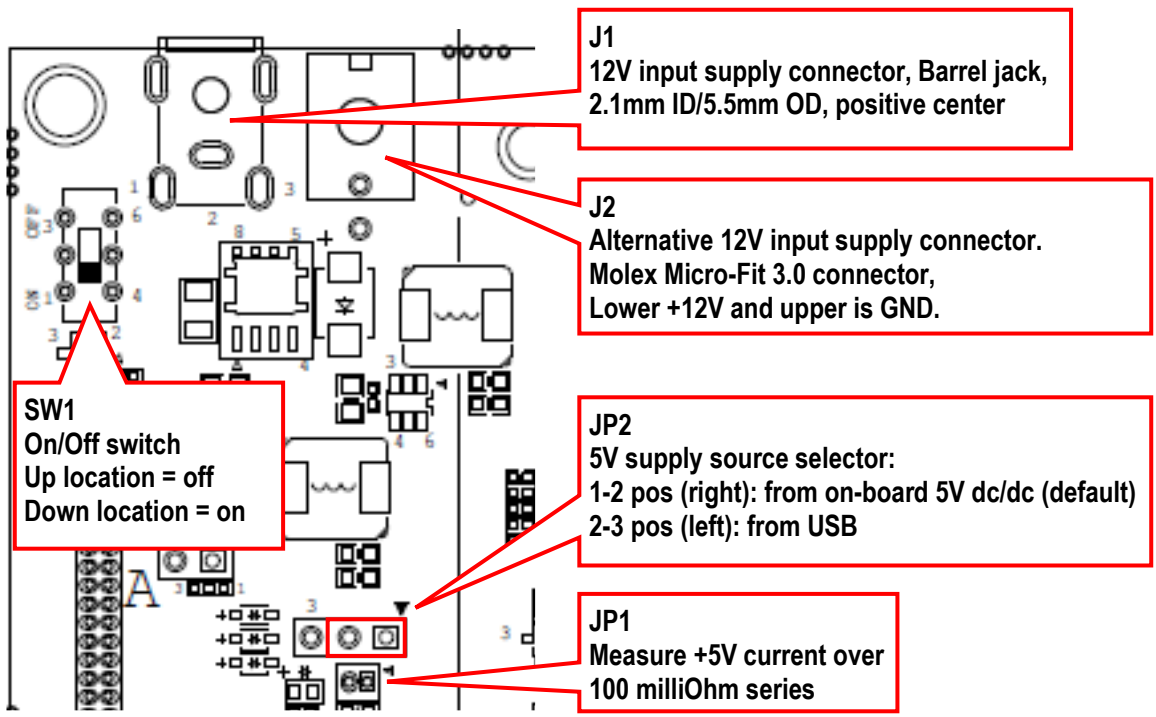

Figure 6 – uCOM Carrier Board, Power Supply Connectors

Figure 7 illustrates the power supply chain on the board.

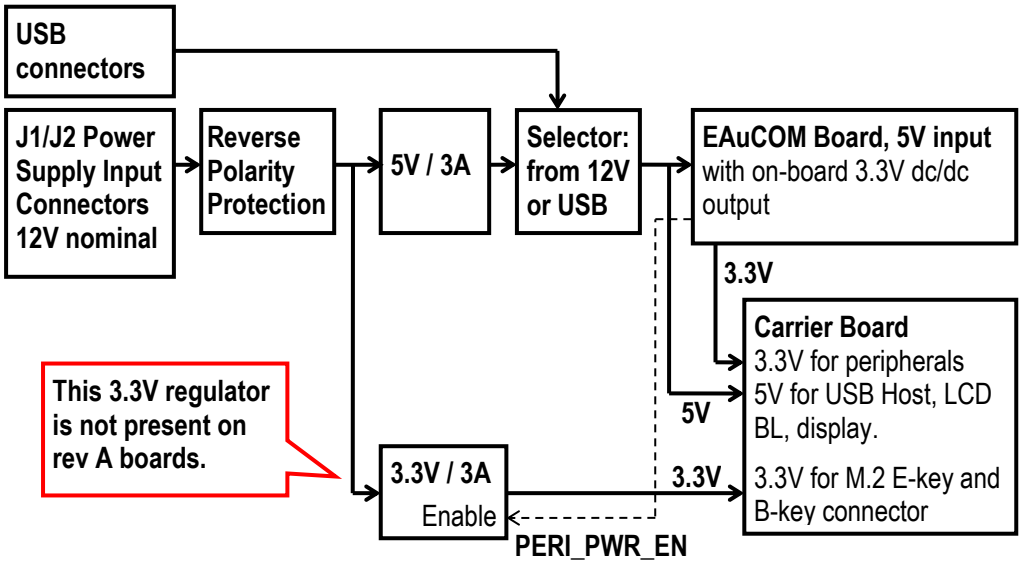

Figure 7 – uCOM Carrier Board, Power Supply Chain

3.2.1 VBAT Supply

EAuCOM boards have a VBAT input connector, J3, that powers an internal RTC on the boards. *Figure 8* illustrates the location of J3. See the EAuCOM datasheet for valid input voltage range.

It is possible to measure VBAT current via a 1Kohm series resistor. JP3 is connected across this series resistor. 100uA input current will result in 100mV across JP3.

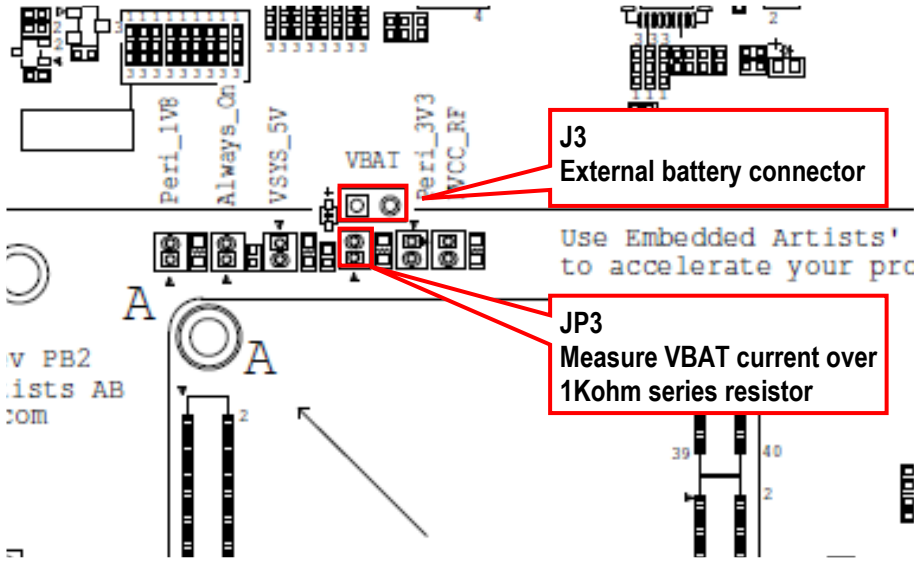

Figure 8 – uCOM Carrier Board, VBAT Input Connector

3.2.2 Current Measurement – on Rev A and Rev PB2 boards

There are series resistors on all EAuCOM supply voltage inputs and outputs to simplify current measurements. The series resistor values have been kept low to minimize the voltage drop. The series resistors might need to be replaced if the measured current is low. *Figure 9* illustrates the location of the JPx connector pads to measure the voltage drops.

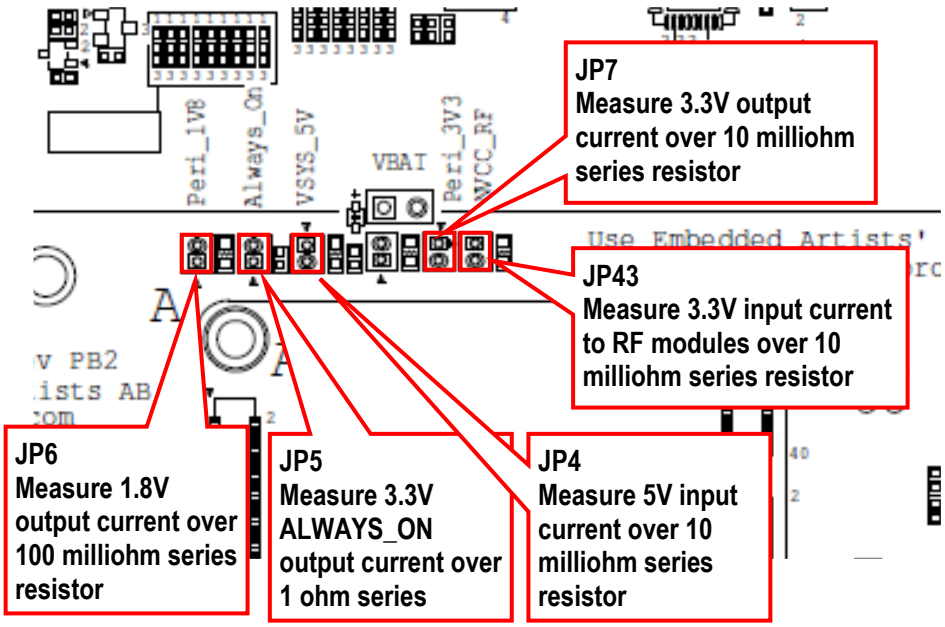

Figure 9 – uCOM Carrier Board, rev A/PB2 EAuCOM Current Measurement Connector Pads

3.2.3 Current Measurement – on Rev PB3 and Rev B boards

There are series resistors and jumpers on all EAuCOM supply voltage inputs and outputs to simplify current measurements. By default, the jumpers are inserted, and no series resistors are mounted. The simplest way to measure the current is to lift the jumper of interest and measure the current between the two pins. An alternative way is to mount a series resistor and measure the voltage drop over it. The series resistor values must be kept low to minimize the voltage drop. *Figure 9* illustrates the location of the JPx connectors and series resistor pads.

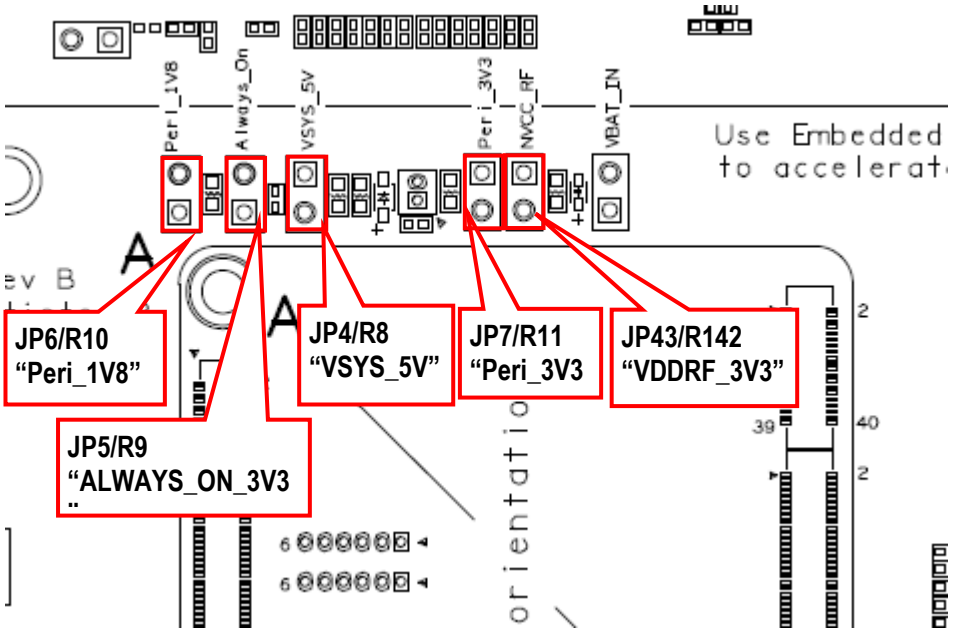

Figure 10 – uCOM Carrier Board, rev PB3/B EAuCOM Current Measurement Connector Pads

3.2.4 Grounding

There are five mounting holes on the *uCOM Carrier Board*. In an installation, all holes shall typically be connected to ground via a metal stand-off and screw.

3.3 Pushbuttons

There are five pushbuttons located along the lower PCB edge, as illustrated in the picture below.

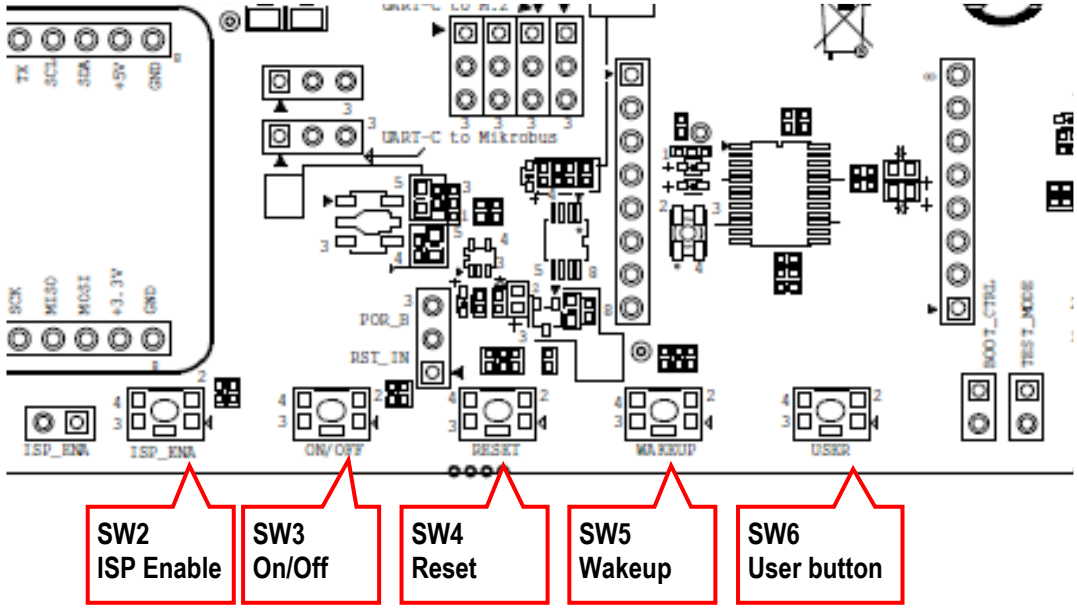

Figure 11 – uCOM Carrier Board, Pushbuttons

3.4 GPIO controlled LED

There is green LED, LED19, that is directly controlled by a GPIO (connected to EAuCOM connector JA, pin 78). *Figure 12* illustrates the location of LED19.

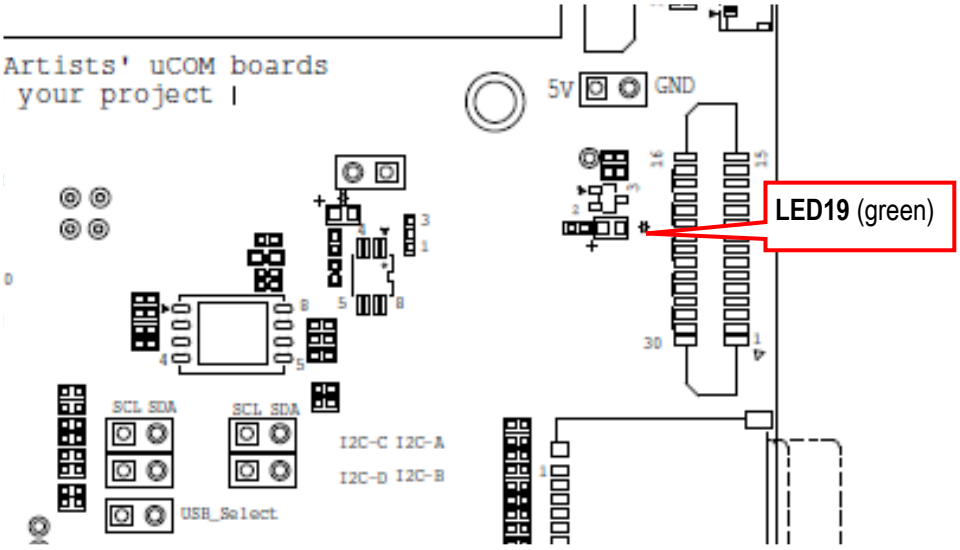

Figure 12 – uCOM Carrier Board, GPIO Controlled LED

3.5 On-Board Ethernet Interface

EAuCOM boards can have one Ethernet interface (Gigabit or 100/10 Mbps) and there is one Gigabit (and 10/100Mpbs) capable Ethernet interface connector on the *uCOM Carrier Board*. This connector is also known as a 1000 Base-T RJ45 connector with integrated transformer. Figure 13 illustrates the location of the connector, J25, which is located along the right PCB edge.

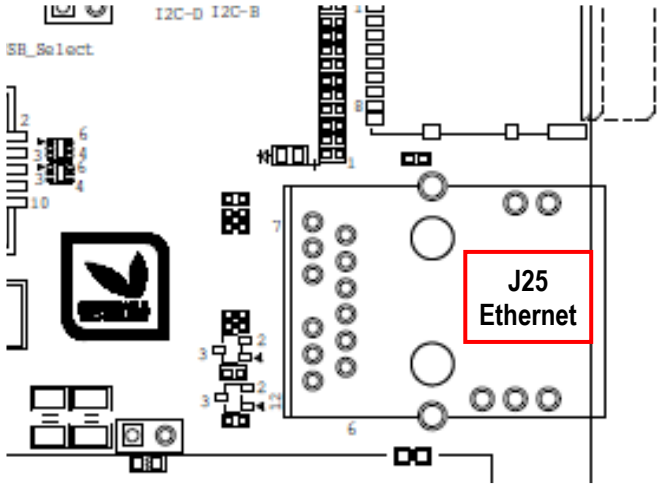

Figure 13 – uCOM Carrier Board, Ethernet Interface Connector

There are three LEDs on the RJ45 connector. These are connected to the activity, 100M link and 1000M link signals from the EAuCOM board.

The Ethernet connector, J25, is L829-1J1T-43 from Bel Fuse Inc. or equivalent.

3.6 100Mbps Ethernet Interface Adapter

Some EAuCOM boards support a second Ethernet interface. There is a 100/10Mbps Ethernet Adapter for i.MX RT1064 / RT1166 / RT1176 uCOM boards. It is based on the KSZ8081RNB Ethernet-Phy. The adapter also includes the 24AA025E48T-I/OT I2C-E2PROM with an EUI-48 (MAC address) number. The Ethernet connector, J16, is HY931168C from Hanrun, or equivalent.

The picture below illustrates how the Ethernet adapter is connected to J12. Note that J12 is the parallel RGB display interface connector. It is identified on the uCOM Carrier Board with a "D". It is not possible to connect a parallel RGB LCD while the Ethernet adapter is connected. They are mutually exclusive.

Note that there are two 40-pos FPC connectors on the Ethernet adapter, J17 and J37.

- J17 is the connector closest to the PCB edge. Use this connector when using an iMX RT1064 uCOM board.
- Use J37, the inner connector, when using an iMX RT1166 or RT1176 uCOM board.

The picture below illustrates how to connect the 40-pos flat cable. If an iMX RT1166/RT1176 uCOM board is used, there are also four cables that must be connected. See the picture for details. Note that these four cables are not needed if an iMX RT1064 uCOM board is used.

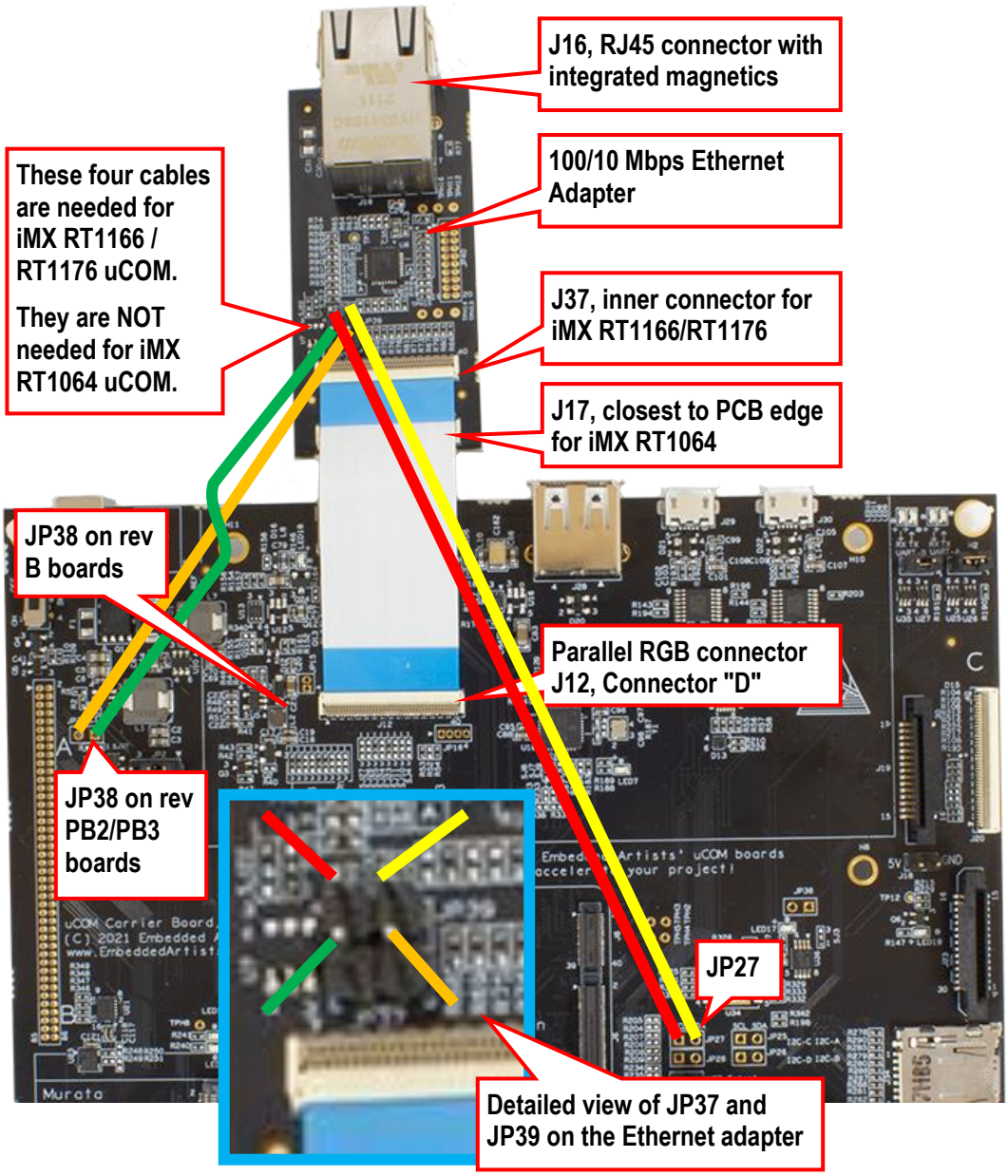

Figure 14 – uCOM Carrier Board rev PB2/PB3/B, Ethernet Interface Adapter

Note that on *uCOM Carrier Board, rev B*, the 16-bit color adapter board (as opposed to the 24-bit color adapter) must be mounted to get correct pinning.

There is a small difference between *uCOM Carrier Board*, rev A and PB2/PB3/B. **On rev A boards the green and orange cables shall not be switched**, see picture below for details.

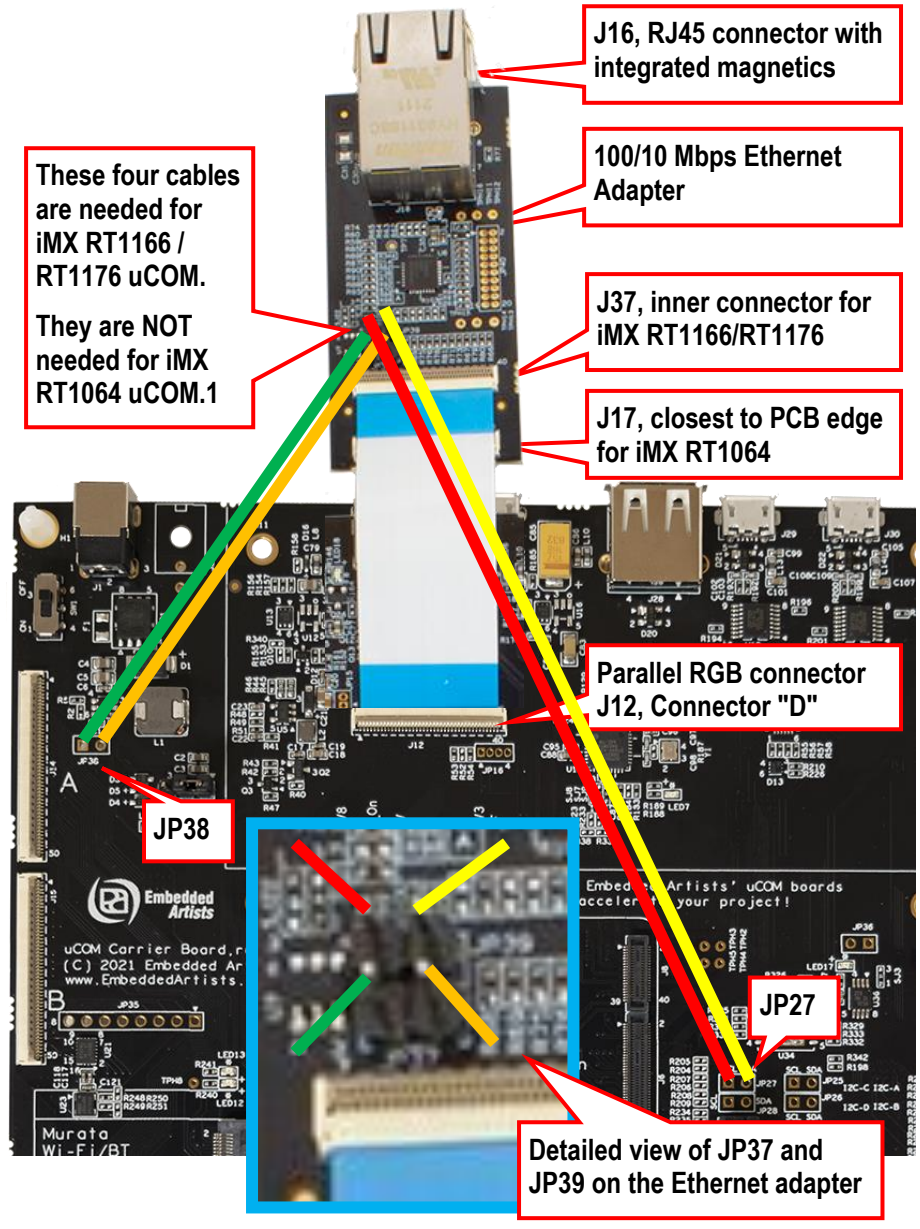

Figure 15 – uCOM Carrier Board rev A, Ethernet Interface Adapter

3.7 Gigabit Ethernet Interface Adapter for iMX93 uCOM

The iMX93 uCOM board supports a second Gigabit Ethernet interface. There is a Gigabit Ethernet Adapter for this. It is based on the RTL8211FDI Ethernet-Phy, see picture below.

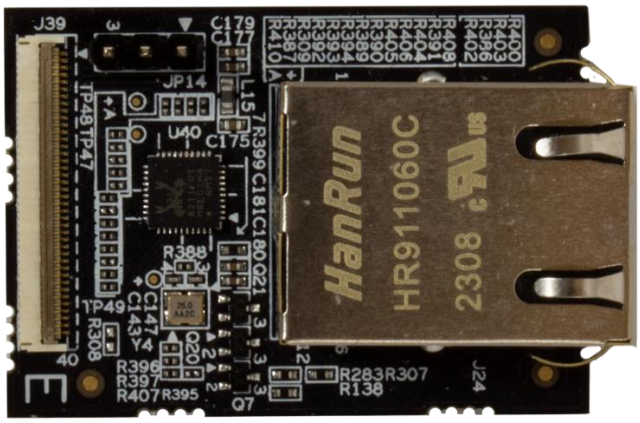

Figure 16 –Gigabit Ethernet Interface Adapter

The picture below illustrates where expansion connector “E”, J38, can be found. The Gigabit Ethernet Adapter connects to this connector via the 40 pos flat cable. Note that it can be a little difficult to close connector J38 when the uCOM board is mounted.

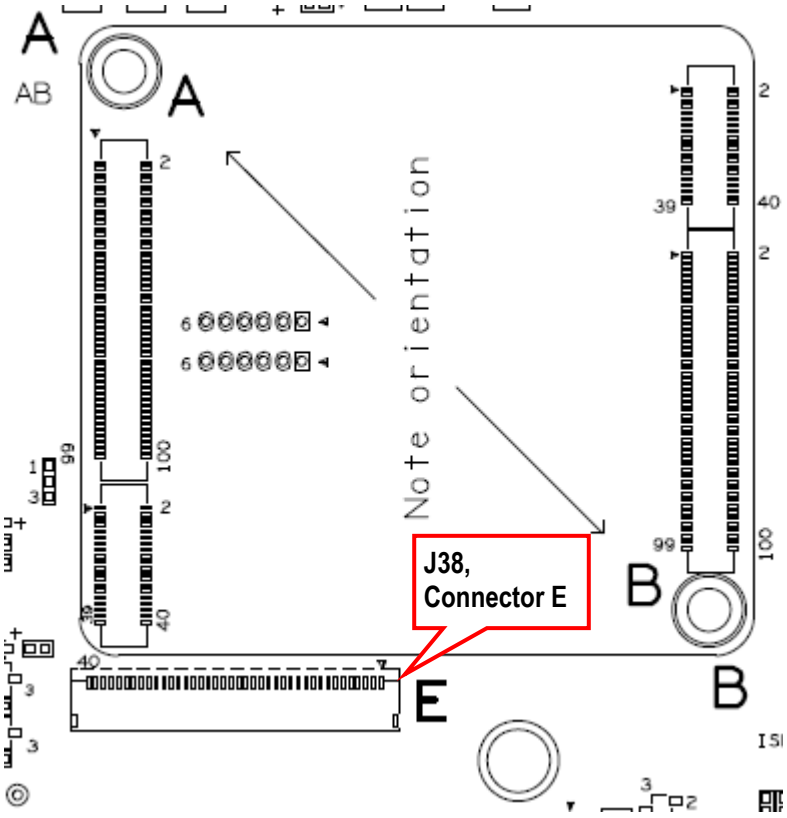

Figure 17 – uCOM Carrier Board rev B, Gigabit Ethernet Interface Adapter

3.8 USB 2.0 OTG and USB-C Interfaces

The EAuCOM specification allows for two USB2 OTG interfaces. The first of the two USB interfaces is connected to a USB 2.0 OTG and USB-C interface on the *uCOM Carrier Board*. J26 is the micro-AB USB connector and J27 is the USB-C connected.

Note that the USB OTG (J26) and USB-C (J27) interfaces are connected in parallel to the USB data signals. They cannot be used simultaneously. Only one at a time can be used. Also note that the signal integrity is compromised by connecting the two connectors in parallel to the USB data signals. This is a deliberate trade-off made to get a flexible *uCOM Carrier Board*. A final carrier board should never implement a USB interface like this.

If there are signal integrity problems on the *uCOM Carrier Board*, it is possible to disconnect any of the two USB connectors from the USB data signals.

- R159/R160 are mounted to route the USB data signals to the micro-AB USB connector, J26. Remove R159/R160 to disconnect J26.
- R162/R163 mounted to route the USB data signals to the USB-C connector, J27. Remove R162/R163 to disconnect J27.

The picture below illustrates where the USB interfaces are located as well as the four resistors.

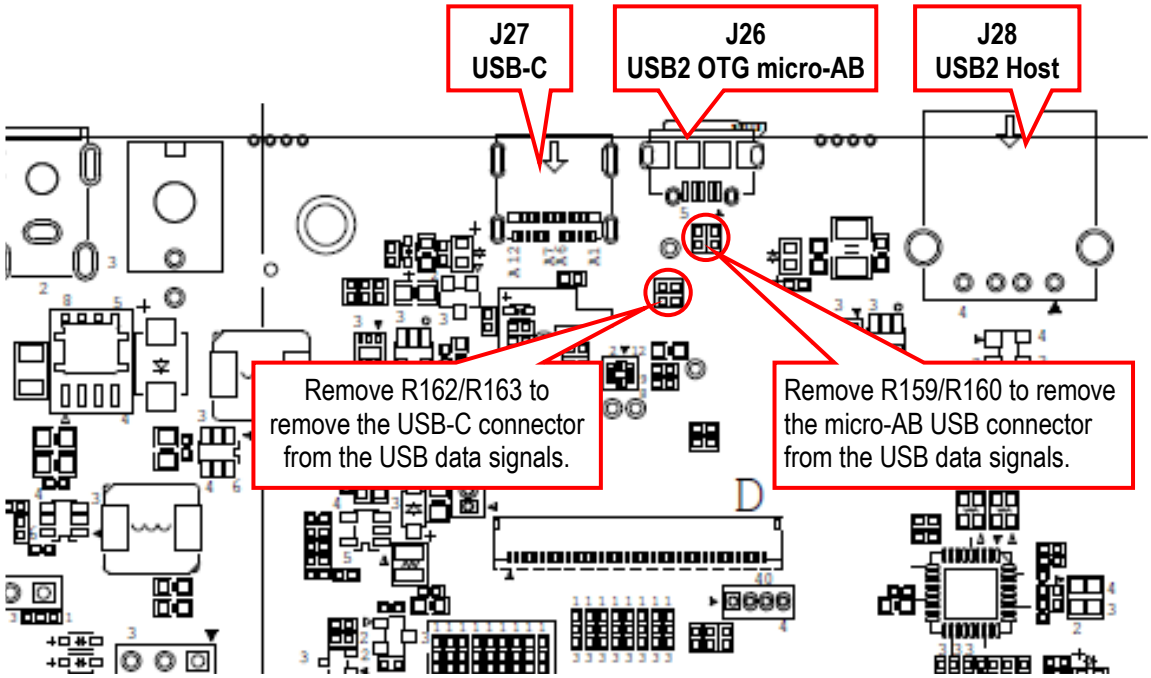

Figure 18 – uCOM Carrier Board, USB Interfaces

The micro-AB USB connector, J26, is ZX62D-AB-5P8(30) from Hirose.

The USB-C connector, J27, is 1054500101 from Molex.

3.9 USB 2.0 Host Interface

The second USB interface of EAuCOM boards is connected to a USB2 hub on the *uCOM Carrier Board*. This USB hub connects to:

- USB Host interface, J28, for an external USB device to connect to.

- M.2 E-key connector, J33. Some M.2 modules use the USB channel instead of the SDIO or PCIe interface to communicate with a Wi-Fi/BT module.
- M.2 B-key connector, J36. M.2 modules for cellular RF modules typically use the USB interface.

Figure 18 above illustrates the location of the USB Host connector, J28.

3.10 USB Multiplexer

Some EAuCOM boards only have one USB interface. It is common and most practical (at least during program development) to connect this USB interface to the USB OTG / USB-C interface (J26 or J27).

There is a USB multiplexor on the *uCOM Carrier Board* that allows the first USB channel (of the EAuCOM board) to connect to the USB hub instead of the USB2 OTG/USB-C interface. This

The USB multiplexor is controlled by jumper JP18:

- Shorted: the USB channels are separate
- Open: connects the first USB channel to the USB hub

Figure 19 illustrates there JP18 is located.

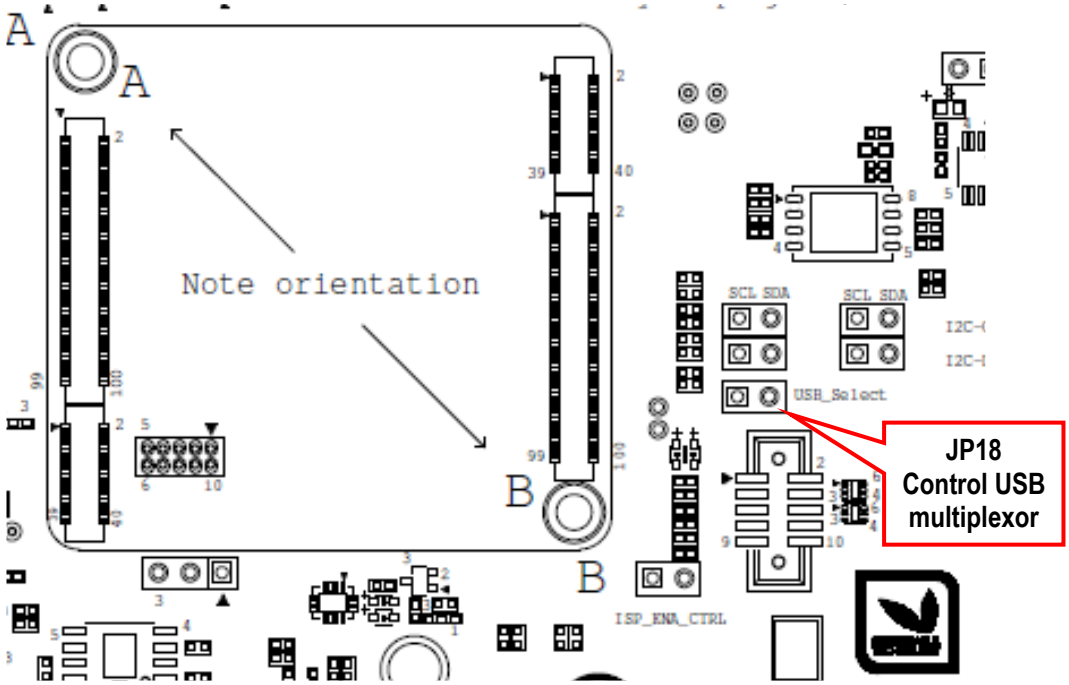

Figure 19 – uCOM Carrier Board, USB Multiplexer

3.11 MIPI-DSI Display Interfaces

EAuCOM boards can have one MIPI-DSI display interface. Four data lanes are defined. Note that not all processors have a MIPI-DSI interface. See the respective EAuCOM datasheet for details.

The *uCOM Carrier Board* implements two connectors:

- J19, Raspberry Pi 7-inch display compatible connector that is a 15 pos, 1mm pitch FPC with two data lanes. The connector is 1-1734248-5 from TE Connectivity. The 7-inch LCD has 800x480 pixels resolution and a capacitive touch screen.
  Note that as of January 2022, there is only a limited functionality driver for the 7-inch Raspberry Pi LCD for iMX8M Mini/Nano uCOM boards.
- J20, NXP IMXRT1170-EVK compatible connector that is a 40 pos, 0.5mm pitch FPC with four data lanes. NXP has a 5.5-inch 720x1280 pixel LCD in portrait mode with direct MIPI-DSI interface, called RK055HDMIPI4M. The display also has a capacitive touch screen.
  Note that J20 is defined as connector "C". This is to simplify identification how external adapters are connectors, see *section 3.12* for more information.
  Note that as of January 2022, there are only drivers for the NXP RK055HDMIPI4M display for iMX RT1166/1176 uCOM boards. There is no RK055HDMIPI4M for the iMX8M Mini/Nano uCOM boards.

The picture below illustrates where the two connectors can be found. Note that J19 and J20 route the MIPI-DSI signals in parallel and both connectors cannot be used simultaneously. No flat cables should be connected in the connector that is not used.

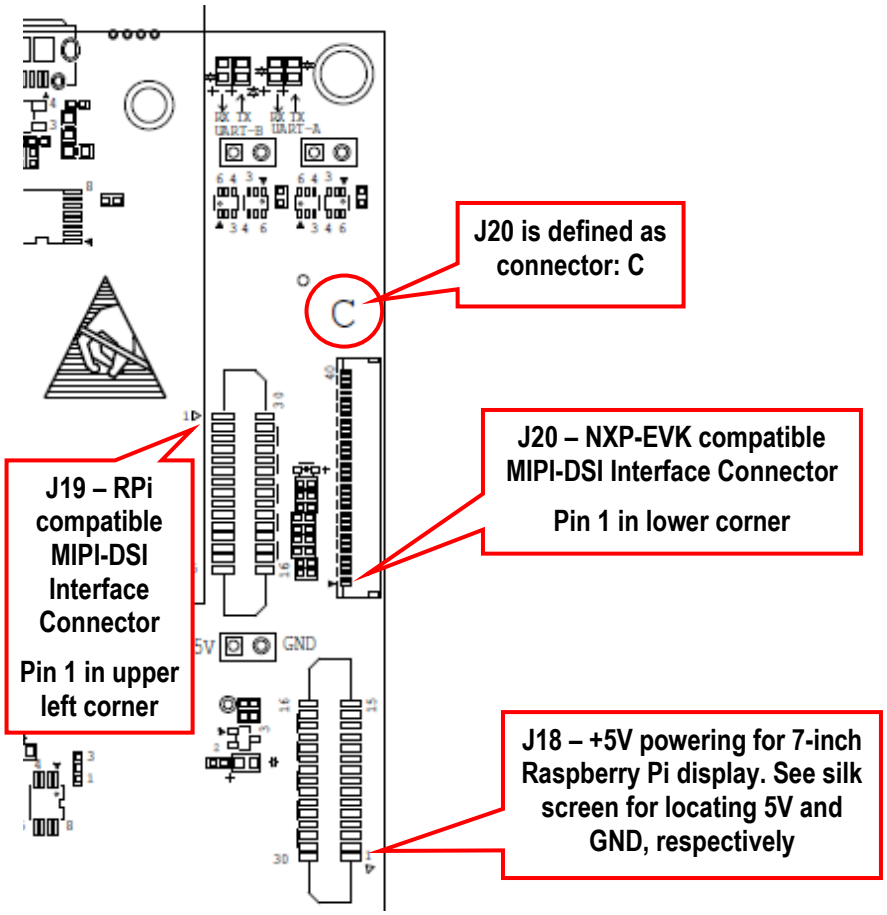

Figure 20 – uCOM Carrier Board, MIPI-DSI Display Connectors

The picture below illustrates how to connect a 7-inch Raspberry Pi LCD to J18 and J19. The 15-pos flat cable and the red and black wires comes with the display. Note that the orientation of the flat cable is important as well as the red/black wires. After making the connections it is possible to turn the display side up (it is facing down in the picture). Make sure the radius of the flat cable turn/rotation is not too small.

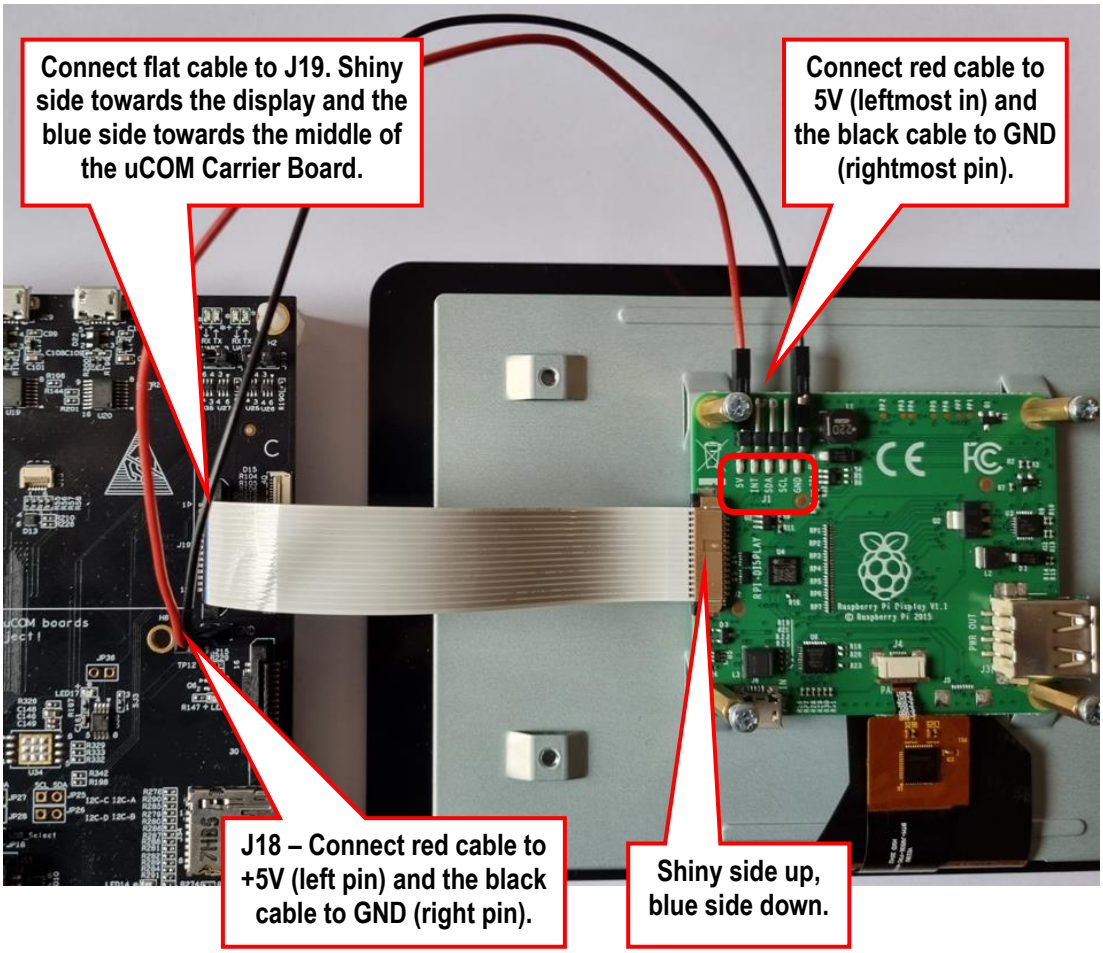

Figure 21 – Connecting a Raspberry Pi 7-inch Display to the uCOM Carrier Board

The picture below illustrates how to connect the 5.5-inch 720x1280 pixel LCD, RK055HDMIPI4M - the display from NXP's IMXRT1170-EVK. This display is in portrait mode. The 40-pos flat cable comes with the display. Note the orientation of the flat cable.

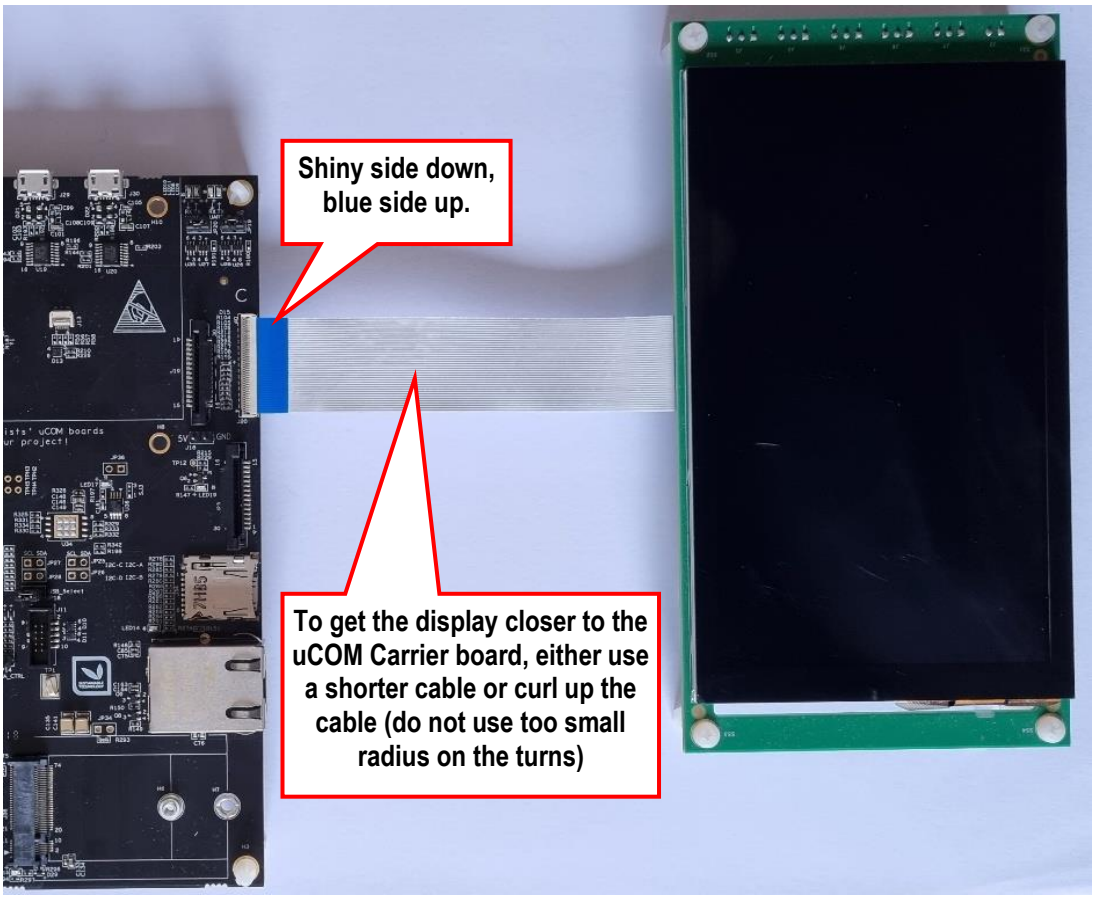

Figure 22 – Connecting the RK055HDMIPI4M Display to the uCOM Carrier Board, Top Side View

The picture below illustrates the orientation of the flat cable when observed from the bottom side.

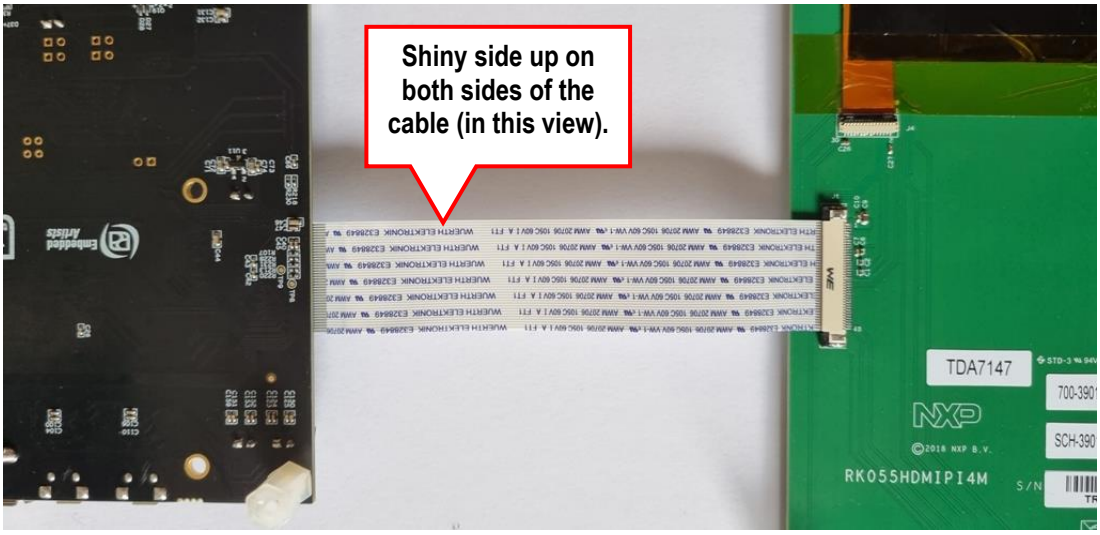

Figure 23 – Connecting the RK055HDMIPI4M Display to the uCOM Carrier Board, Bottom Side View

3.12 MIPI-DSI to HDMI Adapter

As an alternative to connect NXP's LCD RK055HDMIPI4M to J20 (also known as connector "C"), it is possible to connect a MIPI-DSI to HDMI adapter board. This adapter board is based on the MIPI-DSI to HDMI bridge, ADV7535 from Analog Devices. There are drivers for the ADV7535 in Linux as well as SDK examples (for the i.MX RT processors that support MIPI-DSI).

Figure 24 illustrates how to connect the MIPI-DSI to HDMI adapter to J20. Since there are other 40-pos FPC connectors on the *uCOM Carrier Board*, the connectors to use are identified with a common "C".

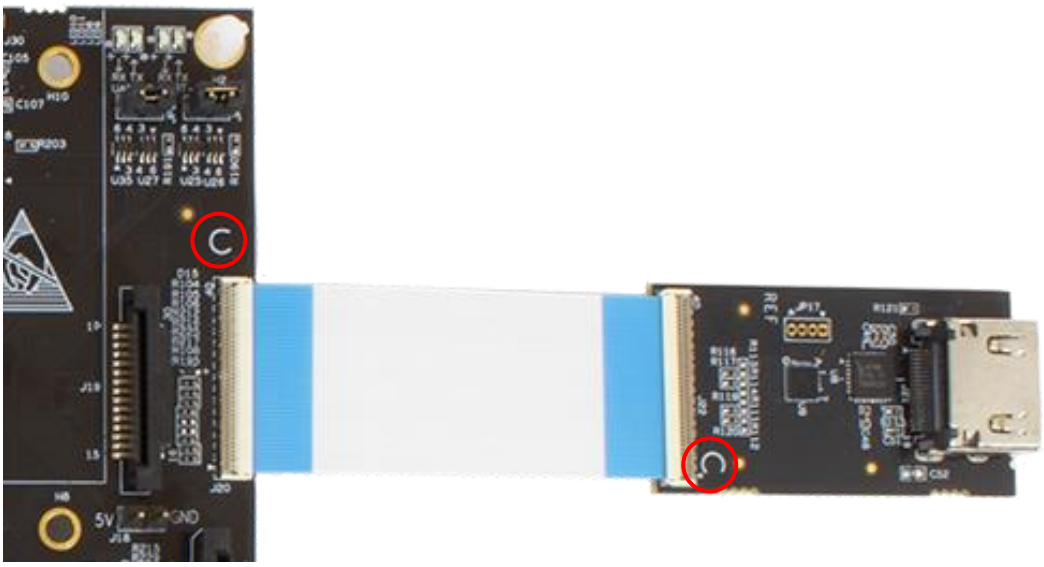

Figure 24 – MIPI DSI-to-HDMI Adapter Connected to uCOM Carrier Board, Connector C

A suitable 40 pos, 0.5mm pitch 50 mm long flat cable is 0151660427 from Molex. Other brands and lengths exist. Keep the FPC cable length below 200 mm. Longer cables will degrade the MIPI-DSI signal integrity.

Other MIPI-DSI bridge solutions can be connected to J20. Below are two examples of adapters that are sold separately.

The adapter below is based on Lontium's LT8912B MIPI-DSI to HDMI and LVDS bridge. This chip has both an HDMI and dual LVDS output.

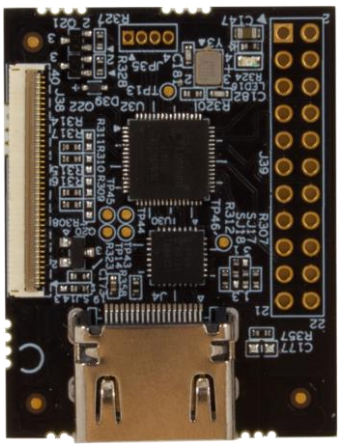

Figure 25 – MIPI DSI-to-HDMI/LVDS Adapter Connected to uCOM Carrier Board, Connector C

The adapter below is based on TI's SN65DSI84ZQER MIPI-DSI to dual LVDS interfaces bridge.

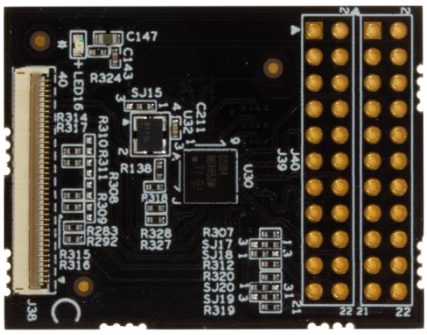

Figure 26 – MIPI DSI-to-LVDS Adapter Connected to uCOM Carrier Board, Connector C

3.13 uSD Memory Card Interface

The EAuCOM specification allows for two SDIO interfaces:

- Primary, located on connector JB: 4-bit SDIO interface, which is connected to the uSD memory card interface connector, J34, on the *uCOM Carrier Board*.
  Note that this interface is implemented by most, but not all, EAuCOM boards. A notable exception is the iMX RT1166/RT1176 uCOM boards.
- Secondary, located on connector JC: 4 or 8-bit SDIO/MMC interface, which connects to the M.2 E-key connector, J33, as the SDIO interface for Wi-Fi/BT M.2 modules. This interface is not addressed in this section. See next section for more details.

Power to the memory card interfaces is controlled by signals SD-A_NRST (active high) and POR_B. The POR_B signal is included to ensure a proper power cycle when resetting the board. LED14 is on when the power to the memory card is on. The card-detect signal (active low) from the uSD card connector is connected to signal SD-A_NCD.

Figure 27 illustrates the location of the uSD connector, J34.

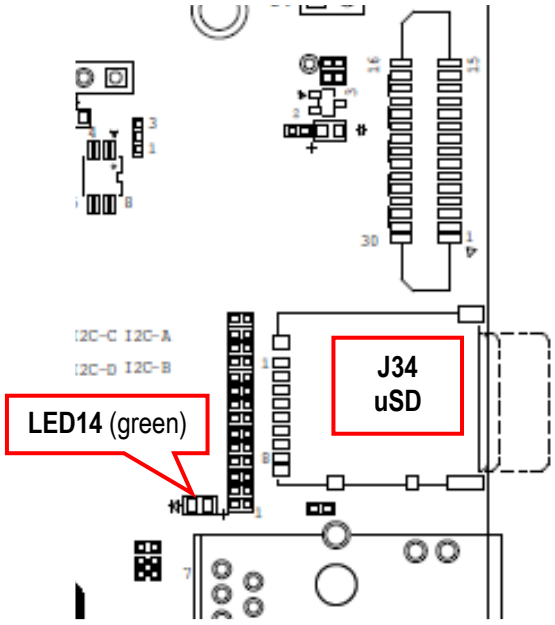

Figure 27 – uCOM Carrier Board, uSD Connector

uSD connector, J34, is DM3AT-SF-PEJM5 from Hirose.

3.14 M.2 E-Key Interface - for Wi-Fi/BT M.2 Modules

The design around the M.2 E-key connector, J33, focused on flexibility and debug friendliness. The M.2 E-key interface has SDIO, USB, UART, I2C and PCIe interfaces defined, and all are connected. M.2 E-key modules mainly implements a Wi-Fi/BT or NFC interface. The connector supports 2230 and 3030 M.2 modules.

Note that this interface is implemented by most, but not all, EAuCOM boards. A notable exception is the iMX RT1064 uCOM board. To connect an M.2 module to an iMX RT1064 uCOM board, use Murata's uSD-to-M2 adapter LBEE0ZZ1WE-uSD-M2 connected to the uSD interface, J34.

The picture below illustrates the main M.2 connector and related jumpers on the *uCOM Carrier Board, rev A/PB2/PB3*. See Figure 29 on page 34 for *uCOM Carrier Board, rev B* details.

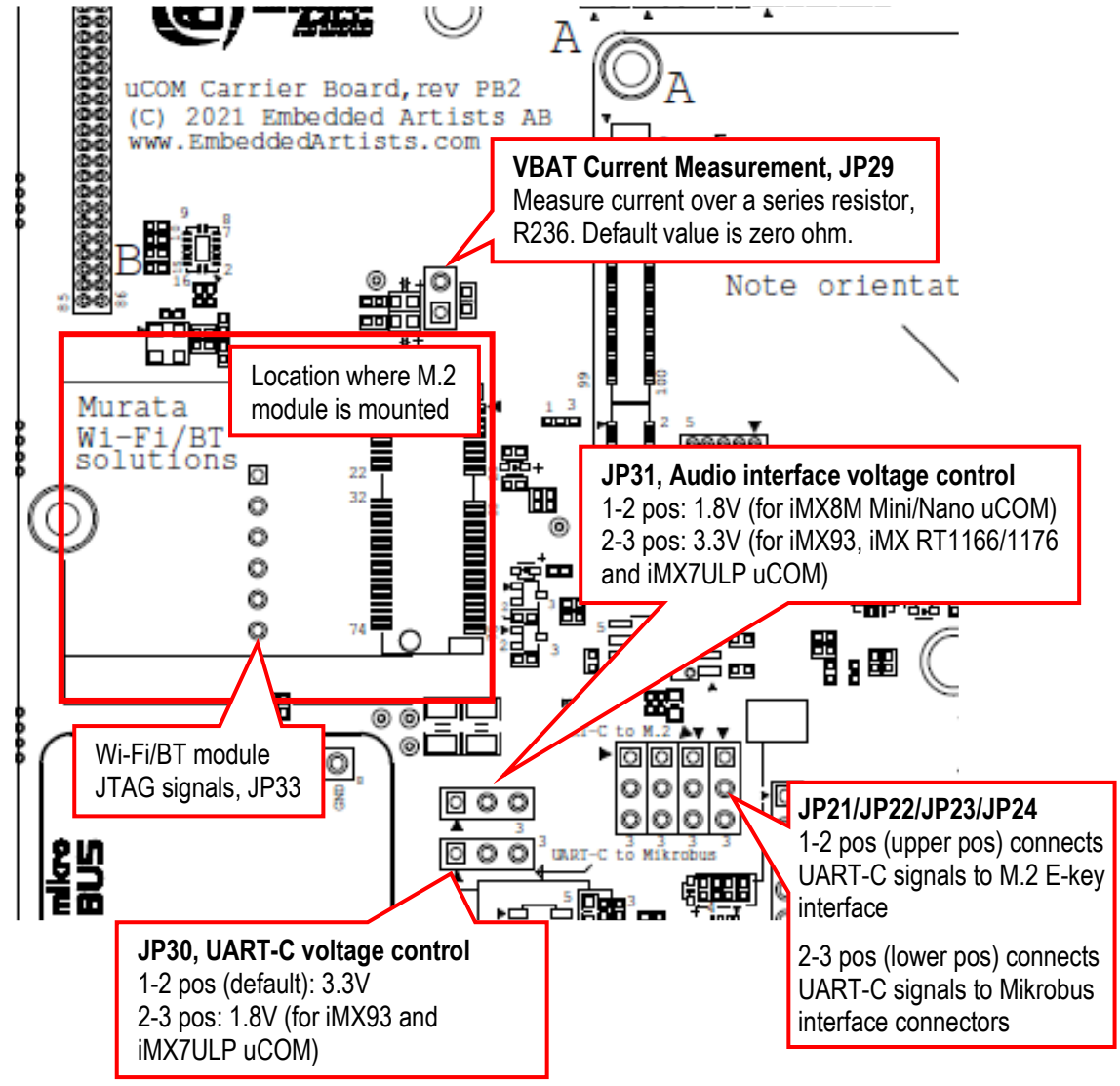

Figure 28 – uCOM Carrier Board, rev A/PB2/PB3, M.2 E-Key Interface with Debug Features

There are several features and functions of the M.2 E-key interface that has been added to be able to do professional evaluation/benchmarking and debugging. These will be addressed in the following subsections.

3.14.1 VBAT Powering

There is a 3.3V / 3A VBAT power supply that is dedicated to the M.2 interfaces, both the E-key and B-key interfaces. Signal PERI_PWR_EN controls the power supply. The default output voltage is 3.3V but it is possible to change it to 3.6V by removing resistor R140. Setting VBAT to 3.6V can improve radio performance on the M.2 module. **Note** that setting VBAT to 3.6V is outside of the M.2 specification, but if the radio chip/module on the M.2 module is known to handle VBAT set to 3.6V then it can be an option to measure/evaluate the added performance.

Note that uCOM Carrier Board rev A does not have a separate 3.3V / 3A power supply. On this version of the board, it is the EAuCOM board that powers the M.2 interfaces. This can be a problem if the M.2 module has large current spikes (which is not uncommon).

3.14.2 VBAT Current Measurement

It is possible to measure the VBAT current to the M.2 module. JP29 is connected over series resistor R236 that powers the M.2 connector, J33. Note that R236 is a zero-ohm resistor per default. To measure the current, R236 must be replaced with a suitable resistor. Selecting a suitable value is a trade-off between measurement resolution and voltage drop. It is recommended to keep the voltage drop below 100mV. Also remember that there can be current spikes during for example startup calibration. A value between 50-100 milliohm can be a good starting point.

3.14.3 SDIO Interface

The secondary 4-bit SDIO interface of the EAuCOM board (located on connector JC) is connected to the SDIO interface of the M.2 connector, J33.

Note that the M.2 interface standard specifies 1.8V SDIO voltage signaling. Make sure the EAuCOM SDIO interface is set to 1.8V signaling level.

3.14.4 PCIe Interface

Some EAuCOM boards have a PCIe interface and for these boards, the PCIe interface is connected to the M.2 E-key interface per default. It is possible to rework the board by moving 6 resistors to connect the PCIe interface to the M.2 B-key interface.

3.14.5 Bluetooth UART Voltage Level

The Bluetooth UART channel has different voltage levels on different EAuCOM boards. With jumper JP30 it is possible to select either 3.3V or 1.8V level:

- iMX RT1166/RT1176 and iMX8M Mini/Nano have 3.3V and this is the default setting (JP30 in 1-2 position).
- iMX93 and iMX7ULP have 1.8V (JP30 in 2-3 position).

3.14.6 Audio Signal Voltage Level

The audio interface has different voltage levels on different EAuCOM boards. With jumper JP31 it is possible to select either 3.3V or 1.8V level:

- iMX8M Mini/Nano has 1.8V (JP31 in 1-2 position).
- iMX93, iMX RT1166/RT1176 and iMX7ULP have 3.3V (JP31 in 2-3 position).

The audio source of the audio signals interface of the M.2 connector comes from the Bluetooth module (on the mounted M.2 module). This audio interface connects to the audio interface of EAuCOM boards. There is no audio codec on the *uCOM Carrier Board*. This can be added via the expansion connector. A realistic use case is to either connect the audio interface signals directly to an audio codec or have the EAuCOM board interface an audio codec.

3.14.7 JTAG Debug Channel

In cooperation with Murata, Cypress/Infineon and Embedded Artists several pins on the M.2 connector have been defined to carry JTAG signals to the chipset on the M.2 module. Note that not all M.2 modules support this debug interface.

JP33 is a JTAG debug interface to the chipset on the M.2 module.

Note that using the JTAG debug interfaces requires understanding and access to the firmware.

3.14.8 Non-standard SPI interface

NXP has defined a non-standard SPI interface on the M.2 Key-E connector. uCOM Carrier Board, rev B, implements this interface. It is enabled by placing the short-jumper in 1-2 position of JP9.

Jumper cables are needed to connect the SPI signals (from JP33) to specific pins on the used uCOM. Details about this will be added in future revisions of this document.

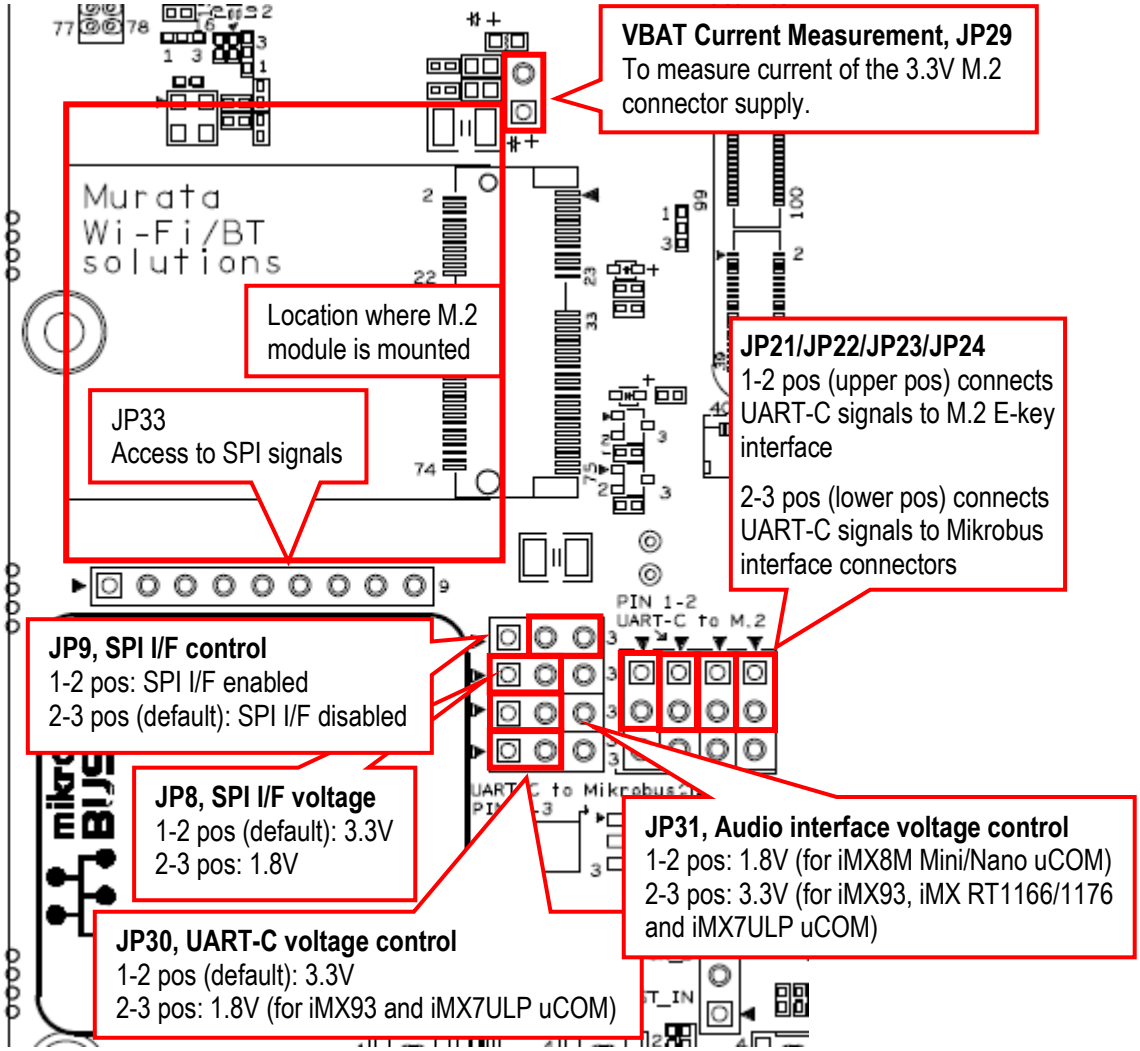

Figure 29 – uCOM Carrier Board, rev B, M.2 E-Key Interface

3.15 M.2 B-Key Interface

EAuCOM boards have an M.2 B-key interface. The *uCOM Carrier Board* implements this interface via connector J36. Two main categories of M.2 modules are supported: **Cellular modems** via USB interface and **SSD** (Solid-State Disks) via the PCIe interface.

Three of the M.2 interfaces are implemented to support these two categories of M.2 modules:

- USB, via the USB Hub.
- SIM Card connector, J35, located on the bottom side of the PCB, under the M.2 connector. **Note** that due to a layout error, J35 is not functional. Pins 4 and 6 have been switched. This error exists on all board revisions up to, and including, rev C1.
- PCIe interface - note that only a few EAuCOM boards support this interface.
  By default, the PCIe interface is connected to the M.2 E-key connector, J33, but it can be rerouted to the M.2 B-key connector, J36, instead by performing the following rework:
  - Remove R255/256, R259/260 and R263/264
  - Mount zero ohm 0402 resistors in R257/258, R261/262 and R265/266.

There are two signals generated from the I2C GPIO expander to control the M.2 interface; I2C_GPIO-M2_B_PWR_OFF_N and I2C_GPIO-M2_B_DISABLE_N.

It is possible to measure the VBAT current to the M.2 module. JP34 is connected over series resistor R293 that powers the M.2 connector, J36. Note that R293 is a zero-ohm resistor per default. To measure the current, R293 must be replaced with a suitable resistor. Selecting a suitable value is a trade-off between measurement resolution and voltage drop. It is recommended to keep the voltage drop below 100mV. Also remember that there can be current spikes during for example startup calibration. A value between 25-50 milliohm can be a good starting point.

Note that uCOM Carrier Board rev A does not have a separate 3.3V / 3A power supply. On this version of the board, it is the EAuCOM board that powers the M.2 interfaces. This can be a problem if the M.2 module has large current spikes (which is not uncommon) or high current consumption in general.

Figure 30 illustrates the location of the M.2 B-key connector, J36, and associated SIM card holder (J35). It also illustrates the location of the resistors that need rework to connect the PCIe interface to J36.

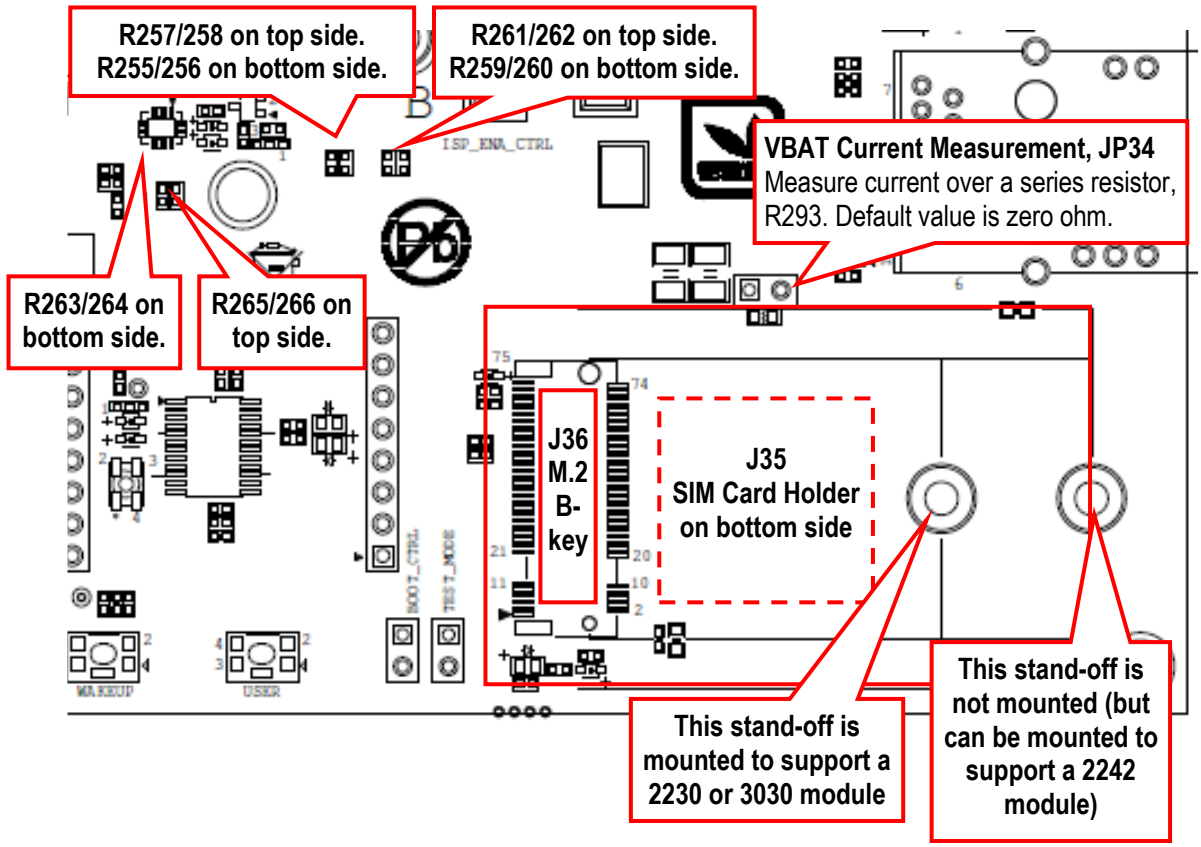

Figure 30 – uCOM Carrier Board, M.2 B-Key Interface Connector

The M.2 B-key connector, J36, is MDT420B03001 from Amphenol.

The SIM card holder, J35, is 788000001 from Molex.

3.16 UART-to-USB Bridge Interfaces

The EAuCOM specification defines three UART interfaces; two 2-wire and one 4-wire, named A, B and C. The i.MX SoC on EAuCOM boards can have several more UARTs but they are not defined by the EAuCOM standard. The *COM Carrier Board* has dual UART-to-USB bridges for the A and B UARTs. The bridges create virtual COM ports that are simple to connect to on the PC side.

UART A is typically used as the main console. If the EAuCOM runs Linux, this channel is the Linux console, i.e., the Cortex-A processor.

For EAuCOM boards based on Heterogeneous Multi-Processor i.MX SoCs, UART B is typically used as console for the Cortex-M processor.

Also note that all UART channels are available on the expansion connectors. Make sure there is no contention between used UART channels. Open jumpers JP19/JP20 to disconnect the UART-to-USB bridge receive signals from driving the UART channels.

Figure 31 illustrates the location of the micro-B USB connectors, J29/J30, for the USB-to-UART bridges and jumpers JP19/JP20

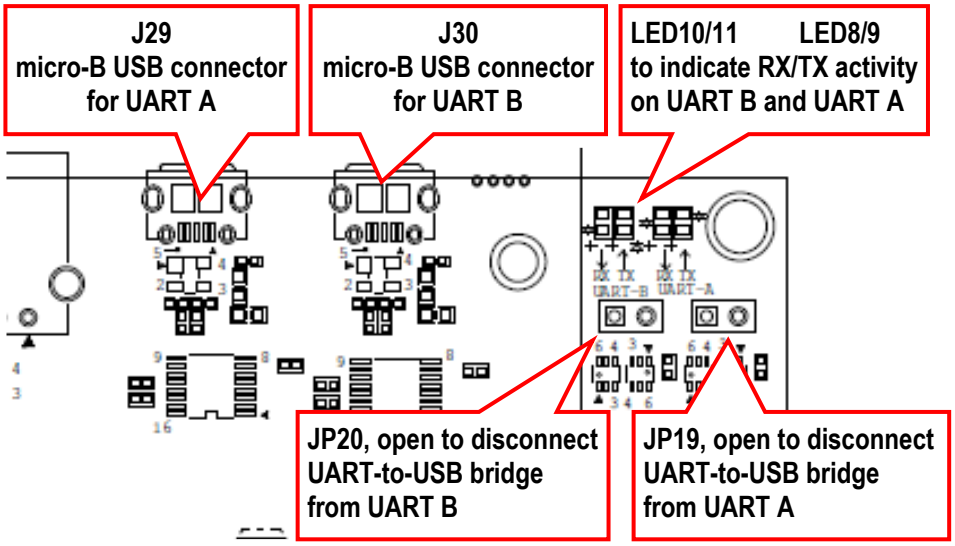

Figure 31 –uCOM Carrier Board, USB-to-UART Bridge Interface Connectors

3.17 I2C Connected User LEDs and Push-button

There are some spare pins on the I2C mapped GPIO expander, U3, used to control the M.2 Key E connector, J33. All 16 GPIOs can be accessed via J9 and J10 pads. The spare pins have been used to connect three user-controlled LEDs (LED3/LED4/LED5) and one push-button (SW6) input. Note that the I2C mapped GPIO expander is not connected to an interrupt so the push-button in put must be polled.

There is also an I2C PWM/GPIO expander, U36, that generates two signals. These are available on JP36 pads. The second PWM signal also drives LED17.

Figure 32 illustrates the location of all associated LEDs, connector pads and pushbutton.

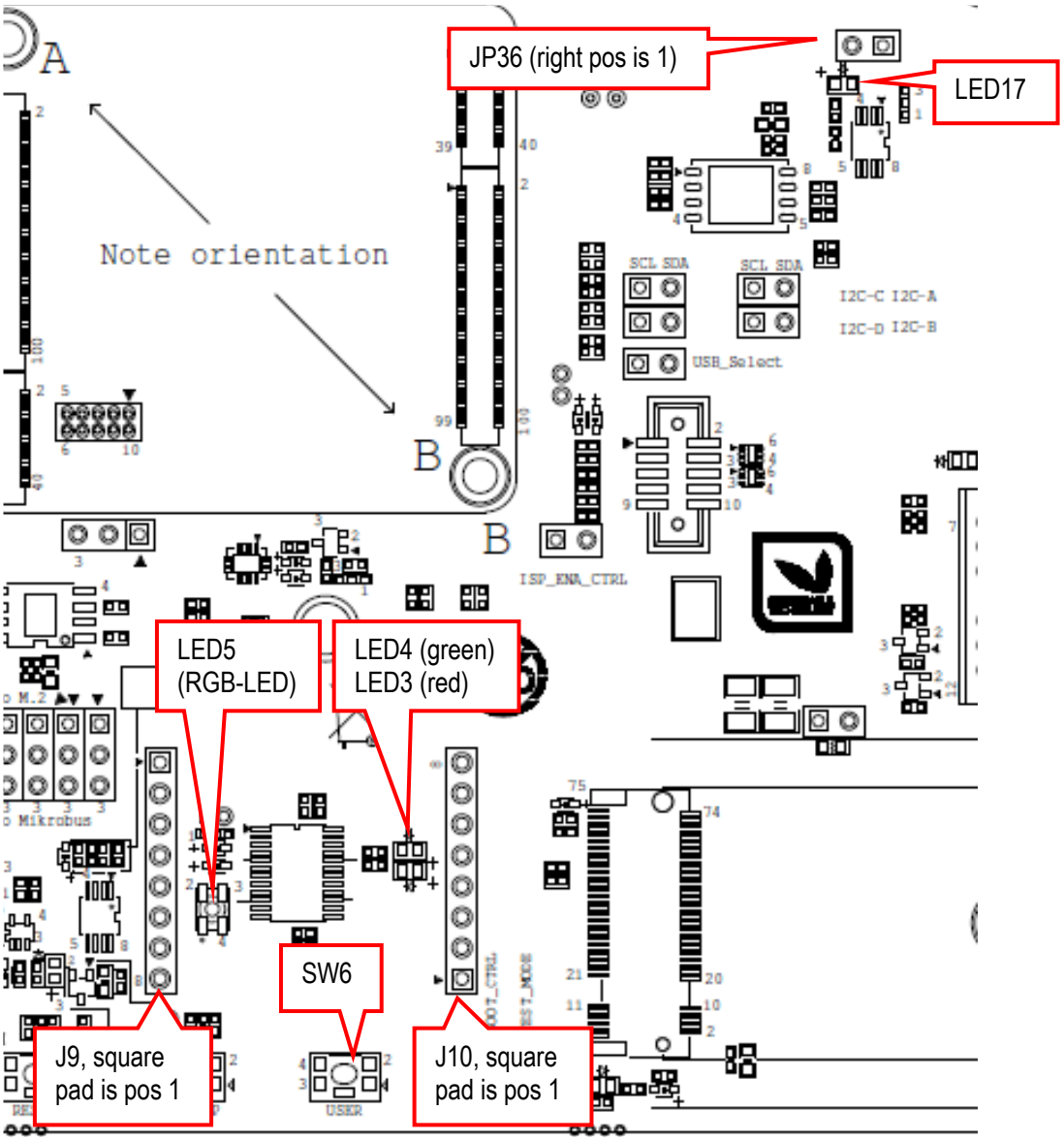

Figure 32 – uCOM Carrier Board, I2C-GPIOs

3.18 MIPI-CSI Serial Camera Interface

EAuCOM boards have one serial camera interface (MIPI CSI-2). The *uCOM Carrier Board* implements this interface with a 15 position, 1mm pitch FPC connector (J23). The FPC connector, J23, is 1-1734248-5 from TE Connectivity.

Two data lanes (besides the clock) are supported by the connector. Some EAuCOM boards support 4 data lanes. All four data lanes and clock signals can be accessed on access pads TPH2-5 located just right of the EAuCOM board. Figure 33 illustrates the location of J23 and the access pads.

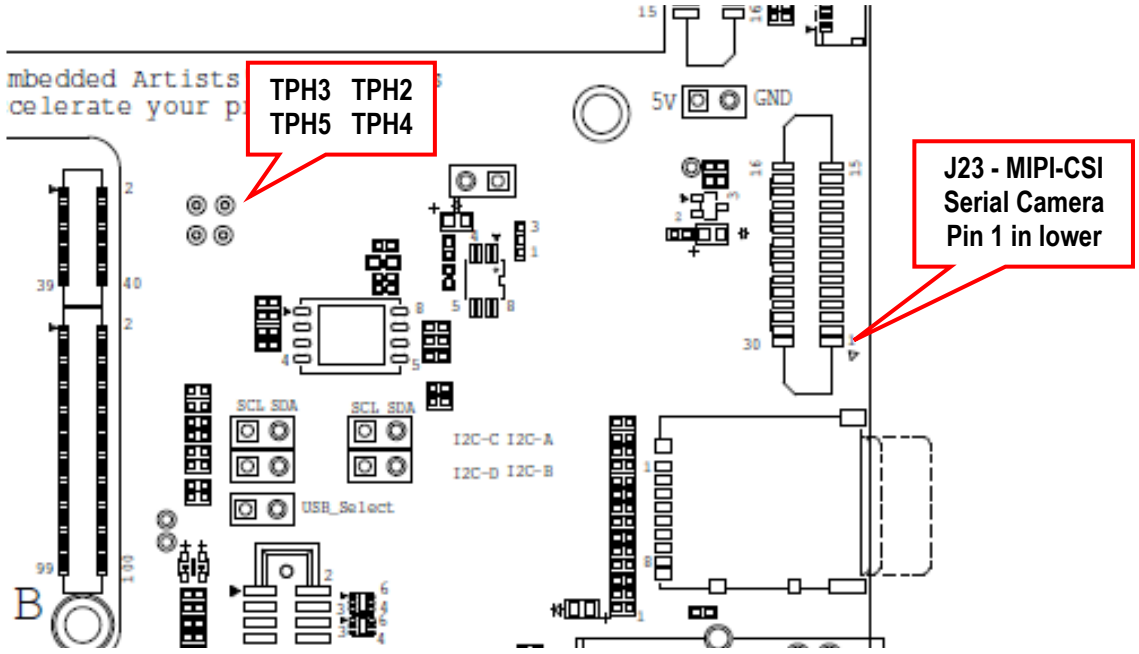

Figure 33 – uCOM Carrier Board, Serial Camera Interface Connector

The 15 position FPC connector (J23) is compatible with the RPi camera connector and has the following pinning:

J23 position	EAuCOM position	Signal
1		GND
2	JD pin 8	CSI_D0M
3	JD pin 10	CSI_D0P
4		GND
5	JD pin 14	CSI_D1M
6	JD pin 16	CSI_D1P
7		GND
8	JD pin 2	CSI_CLK0M
9	JD pin 4	CSI_CLK0P
10		GND
11	JA pin 78	SCAM_DATA, GPIO-CSI_RST-DATA
12	JA pin 80	SCAM_CLK, GPIO-CSI_PWR-CLK
13	JB pin 48	SCAM_I2C_SCL, connected to I2C-A_SCL
14	JB pin 50	SCAM_I2C_SDA, connected to I2C-A_SDA
15		+3.3V, controlled by signal PERI_3V3

3.19 Parallel (RGB) Display Interface – Rev A/PB2/PB3 boards

EAuCOM boards have one 24-bit parallel (RGB) display interface. Most designs only use the lower 16 bits in RGB565 mode, and this is what is made available via the parallel RGB display interface, J12.

It is possible to directly connect LCD model RK043FN02H-CT from Rocktech. It is a 4.3-inch TFT LCD with 480*272 pixels resolution, LED backlight and capacitive touch panel. The parallel RGB interface connects to J12, and the capacitive touch panel controller connects to J13.

The pinning in J12 is common and supported by many other displays.

Note that also the Ethernet Adapter, described in section 3.6 , connects to J12 so it is not possible to have a second Ethernet interface simultaneous with a parallel RGB display interface.

Figure 34 illustrates the location of J12 and J13.

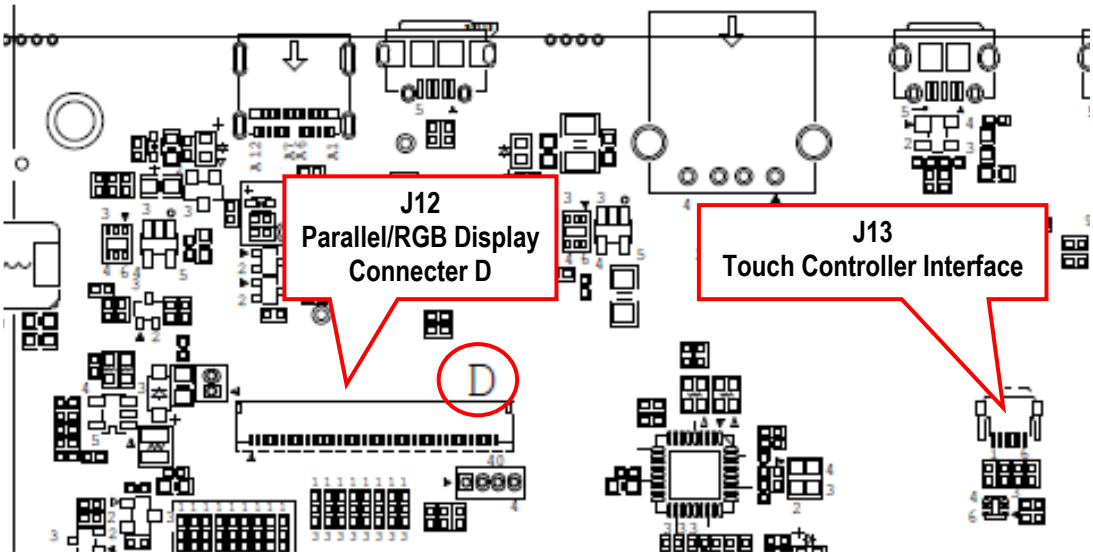

Figure 34 – uCOM Carrier Board, Parallel (RGB) Display Interface Connector

The parallel RGB display interface connector, J12, is XF2W-4015-1A from Omron. It is a 40-pos, 0.5mm pitch FPC connector.

The touch controller interface connector, J13, is XF2W-0615-1A from Omron. It is a 6-pos, 0.5mm pitch FPC connector.

There is a backlight LED driver that generates 40mA (20mA if R46 s removed). I2C GPIO expander signal I2C_GPIO-LCD_BL_PWR controls power to the LED driver (high = enabled).

It is also possible to dim the backlight via I2C PWM expander signal I2C_GPIO_PWM0 (high = 100% on). Control the intensity with a 200-1000 Hz PWM signal.

3.19.1 Mounting the LCD

On some iMX RT Developer's Kit (the ones that has default support for parallel RGB display output) there is a 4.3-inch 480x272pixel LCD with capacitive touch included.

Below are mounting instructions for the LCD. Note that if you are going to work with the second Ethernet interface (via the Ethernet Adapter), then do not mount the LCD because the same connector is used for the second Ethernet interface as for the parallel RGB display interface.

Begin with mounting the two 3D-printed display mounts. Each of them has two M3 screws. Remove the screws from the mounts. Place the mounts as illustrated in the picture below.

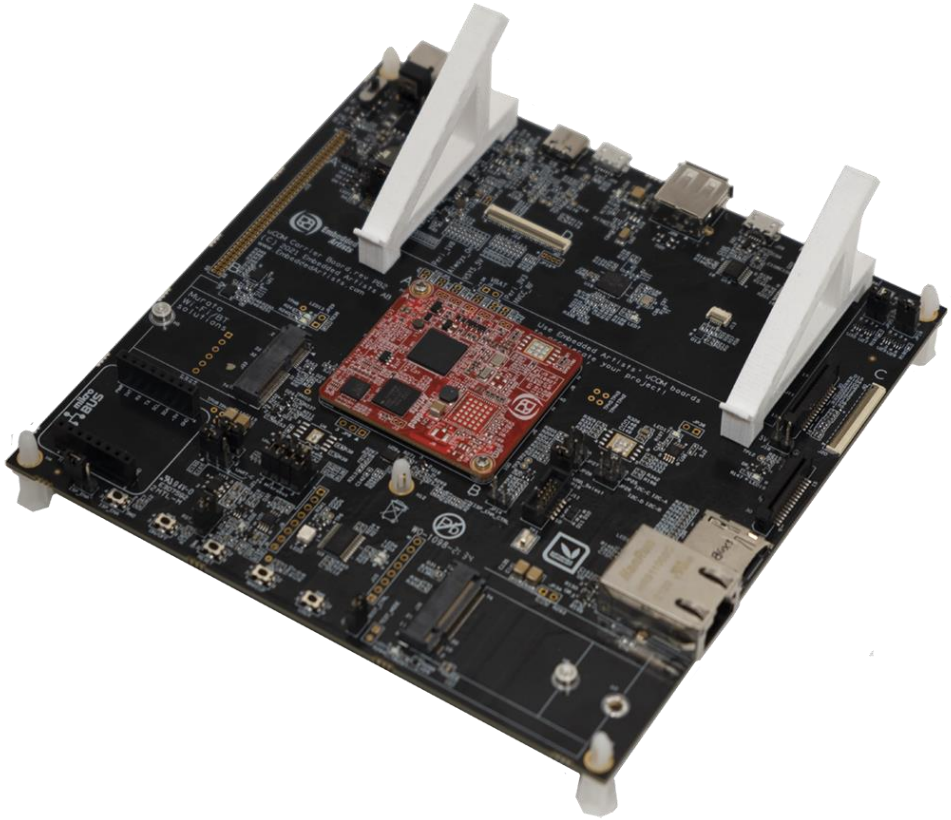

Figure 35 – uCOM Carrier Board with LCD Mounts

Use the screws to fasten the mounts from the bottom side, as illustrated in the picture below. Do not tighten the screws too much.

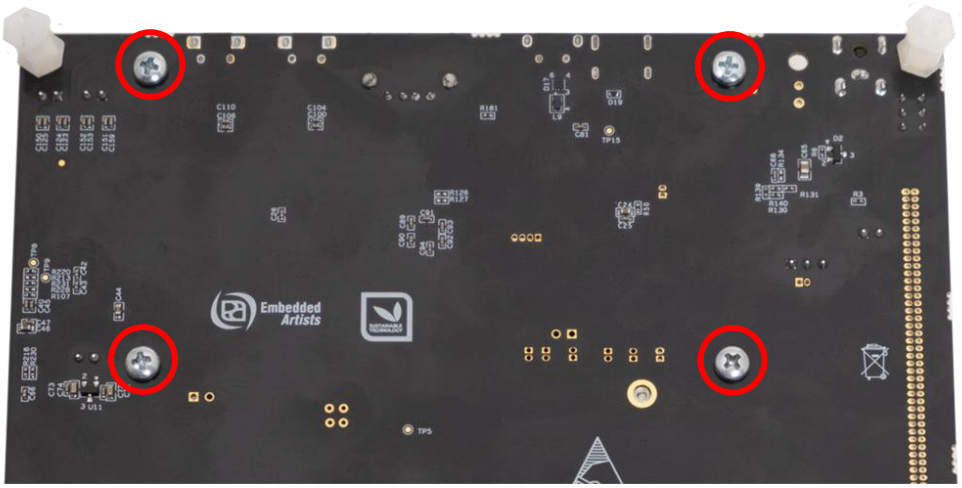

Figure 36 – Screws for LCD Mounts on Bottom Side of uCOM Carrier Board

Next, place the LCD behind the mounts, as illustrated in the picture below. This position makes it easier to connect the two flat cables to the LCD. Make sure the locks on the flat cable connector on the uCOM Carrier Board are open before inserting the two flat cables from the LCD.

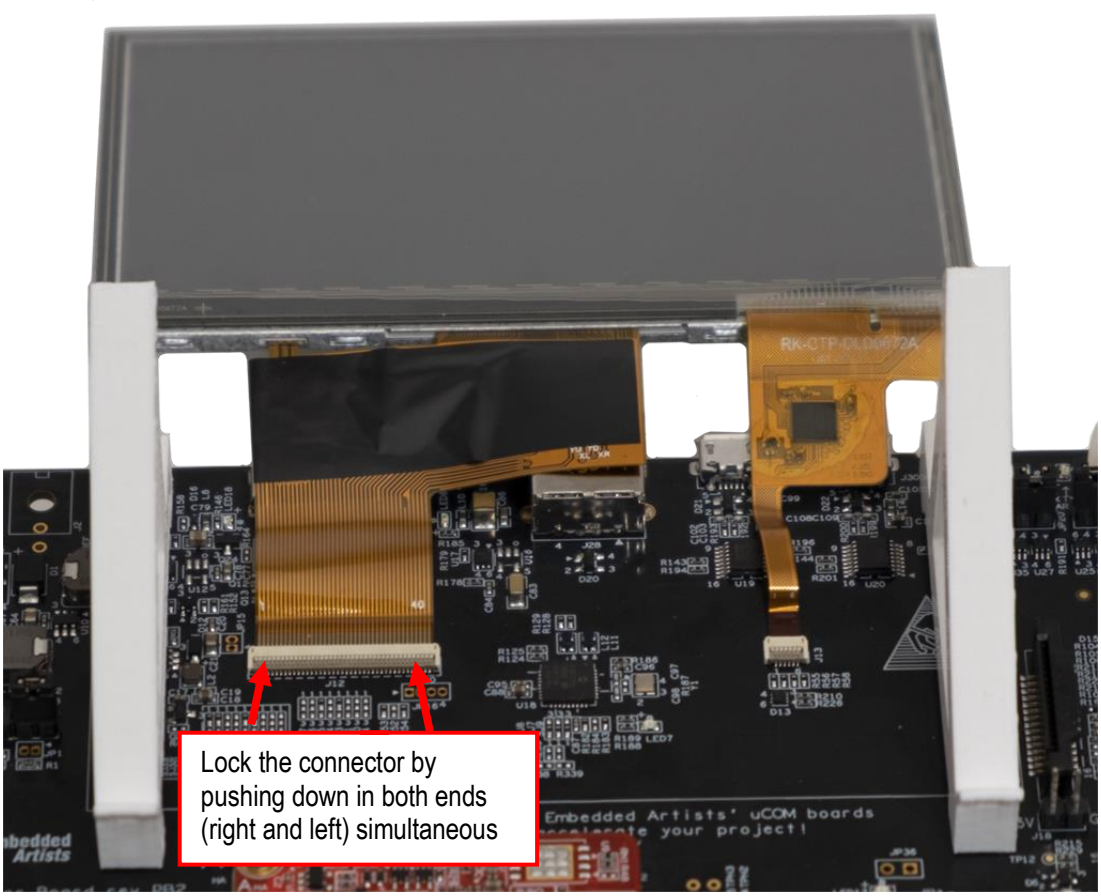

Figure 37 – Placement of LCD to Connect Flat Cables

Remove the protection over the four double-sided tapes and carefully place the LCD in the mounts.

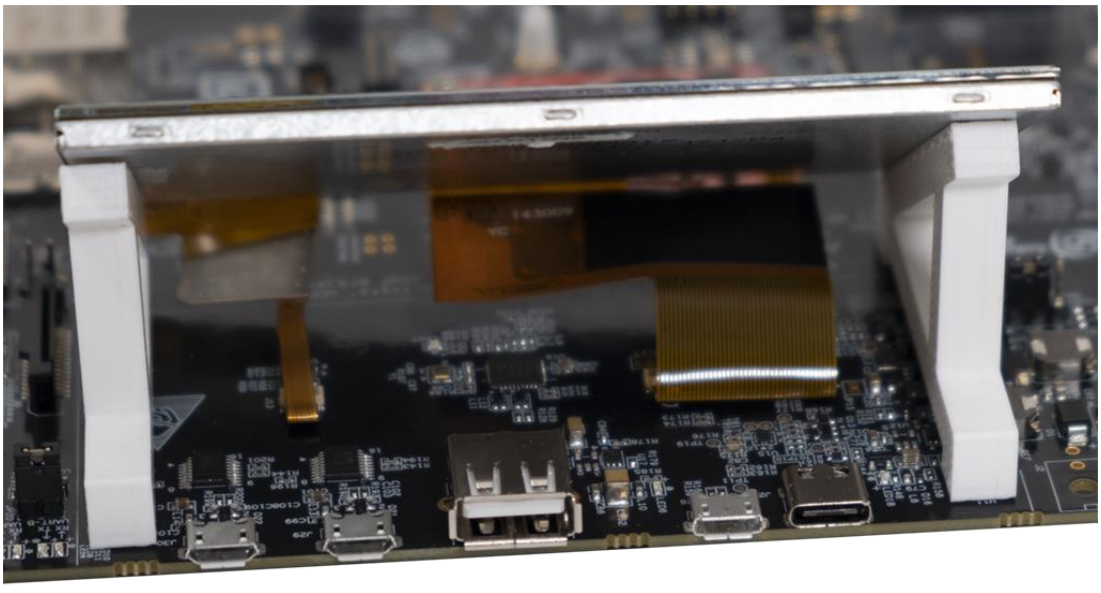

Figure 38 – Placing LCD on Mounts

The picture illustrates how it will look like from the side. Between the mounts and the LCD, there is double-sided tape.

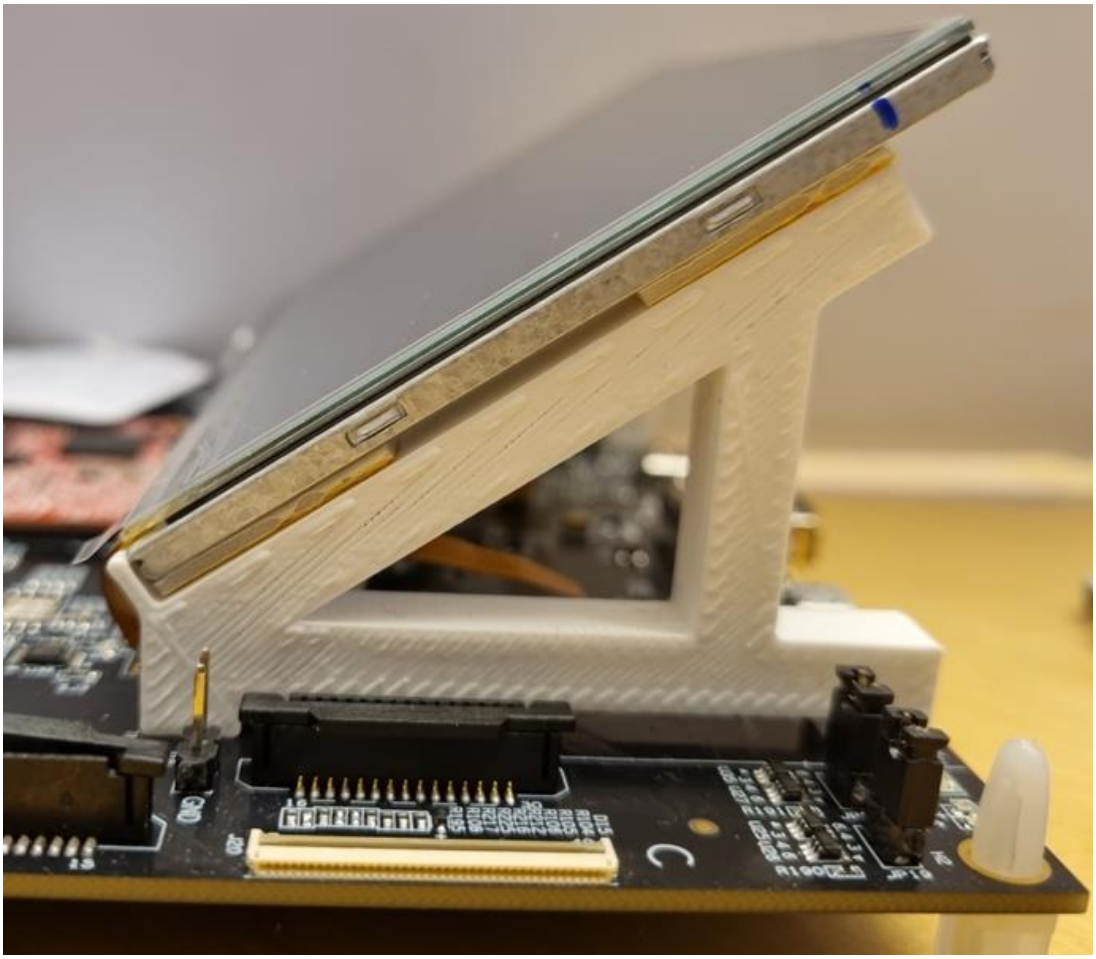

Figure 39 – Side View of LCD Mount

Make sure the flat cable for the capacitive touch panel is carefully bent over the mounts.

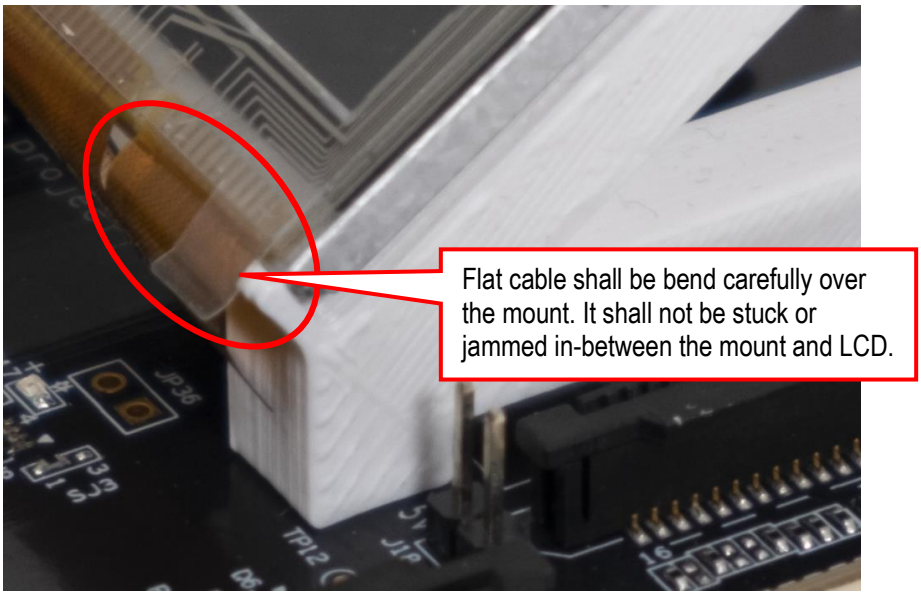

Figure 40 – Side View of LCD Mount

In the end, it will look like the picture below illustrates.

Figure 41 – LCD Mounted on uCOM Carrier Board

3.20 Parallel (RGB) Display Interface – Rev B boards

EAuCOM boards have one 24-bit parallel (RGB) display interface. Most designs only use the lower 16 bits in RGB565 mode. There are two different adapters to support both 16-bit and 24-bit color depth displays. The 16-bit color depth adapter is mounted by default to support the LCD that is included in some iMX Developer's Kits.

It is possible to directly connect LCD model RK043FN02H-CT from Rocktech. It is a 4.3-inch TFT LCD with 480*272 pixels resolution, LED backlight and capacitive touch panel. The parallel RGB interface connects to J12 and the capacitive touch panel controller connects to J13. Note that this display requires the 16-bit color depth adapter to be mounted.

The pinning in J12 is common and supported by many other displays.

Note that also the Ethernet Adapter, described in section 3.6 , connects to J12 so it is not possible to have a second Ethernet interface simultaneous with a parallel RGB display interface.

Figure 34 illustrates the location of J12 and J13 as well as where the color depth adapters are mounted.

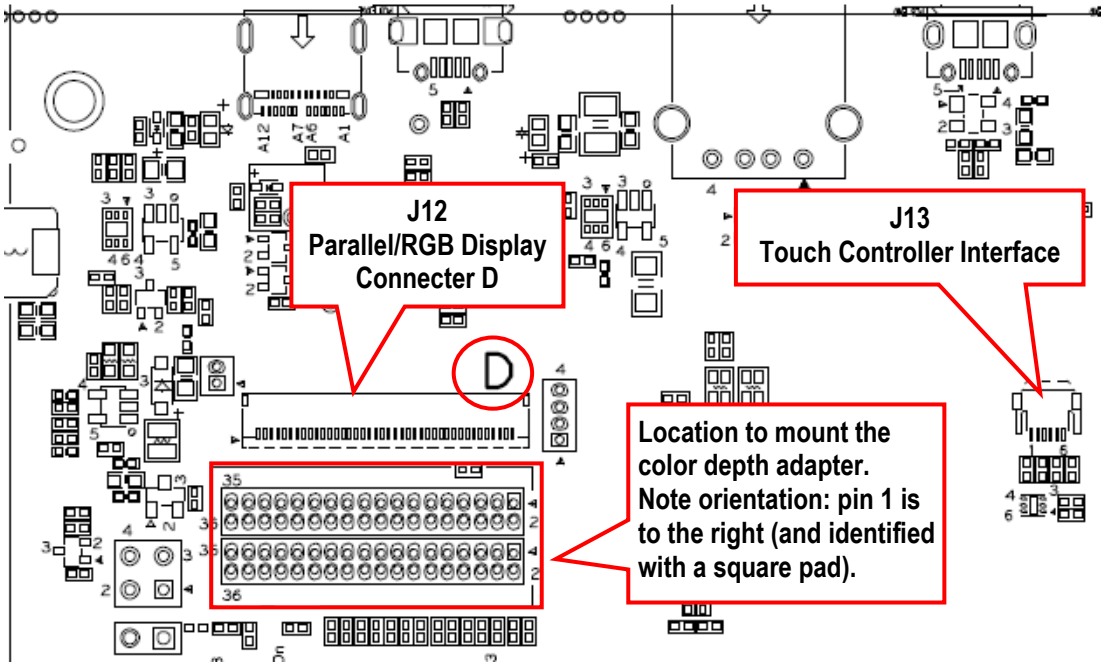

Figure 42 – uCOM Carrier Board, rev B, Parallel (RGB) Display Interface Connector

The parallel RGB display interface connector, J12, is XF2W-4015-1A from Omron. It is a 40-pos, 0.5mm pitch FPC connector.

The touch controller interface connector, J13, is XF2W-0615-1A from Omron. It is a 6-pos, 0.5mm pitch FPC connector.

There is a backlight LED driver that generates 40mA (20mA if R46 s removed). I2C GPIO expander signal I2C_GPIO-LCD_BL_PWR controls power to the LED driver (high = enabled).

It is also possible to dim the backlight via I2C PWM expander signal I2C_GPIO_PWM0 (high = 100% on). Control the intensity with a 200-1000 Hz PWM signal.

3.21 Boot Control

This section describes where to find the two boot control jumpers.

Two signals control the booting source/process of the EAuCOM boards; BOOT_CTRL and ISP_ENABLE, see table below:

Boot source	BOOT_CTRL Controlled by JP12	ISP_ENABLE Controlled by JP10/SW2
Boot according to OTP fuses (eFuses) • Programming OTP fuses is a critical operation. If wrong fuses are programmed boards will likely become unusable and there is no recovery. • This is the default option.	Floating JP12 open	Floating JP10 open (and SW2 not pressed)
Boot according to GPIO settings (sources and settings are different between EAuCOM boards). Note that there is no default setting. This must be actively configured. If OTP-fuse BT_FUSE_SEL = 1, then it does not matter if BOOT_CTRL is low. The processor will still boot according to the OTP fuses.	LOW (grounded) JP12 shorted	Floating JP10 open (and SW2 not pressed)
USB OTG Boot Mode This is known as "Serial Download" or "Recovery" mode. This mode is used during development and in production to download the first stage bootloader. It is typically not used by the end-product during normal operation. This mode is activated by pulling signal ISP_ENABLE low regardless of signal BOOT_CTRL.	Do not care JP12 do not care	LOW (grounded) JP10 shorted or SW2 pressed

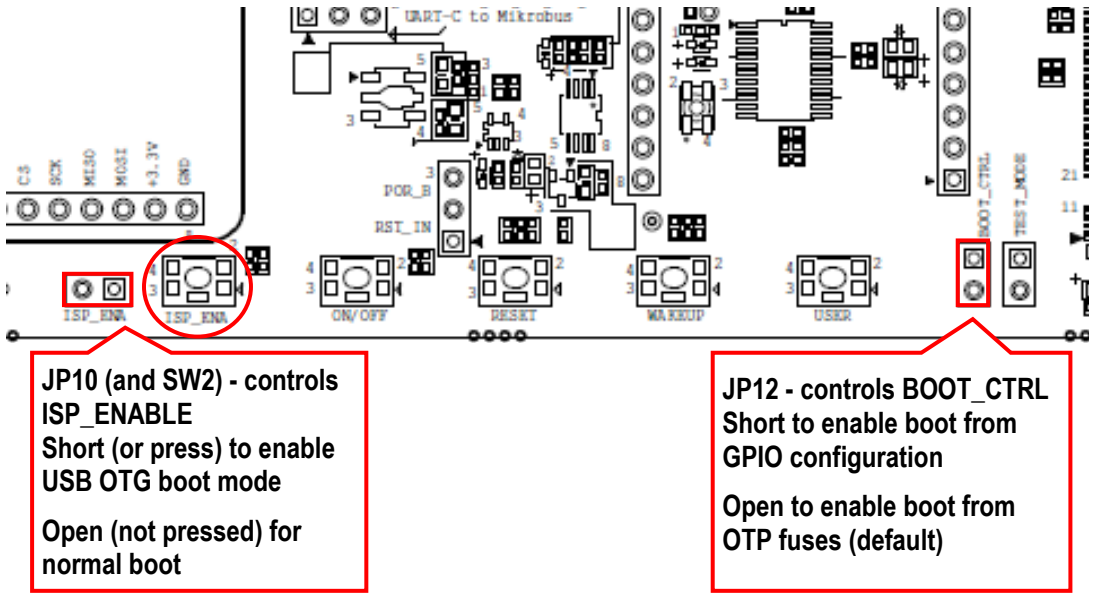

Figure 43 – uCOM Carrier Board, Boot Control Jumpers

In general, it is recommended to use the default boot mode for the EAuCOM boards, but it is possible to verify GPIO control of the boot mode via selectors SJ36-SJ23/SJ11/SJ10/SJ4. Mount a 10K ohm 0402 resistor on the signals needed to be pulled high. The BT_SEL fuse must not be programmed on the EAuCOM board for this to work. The picture below illustrates where the selectors are located (on uCOM Carrier Board, rev A/PB2/PB3), close to J12.

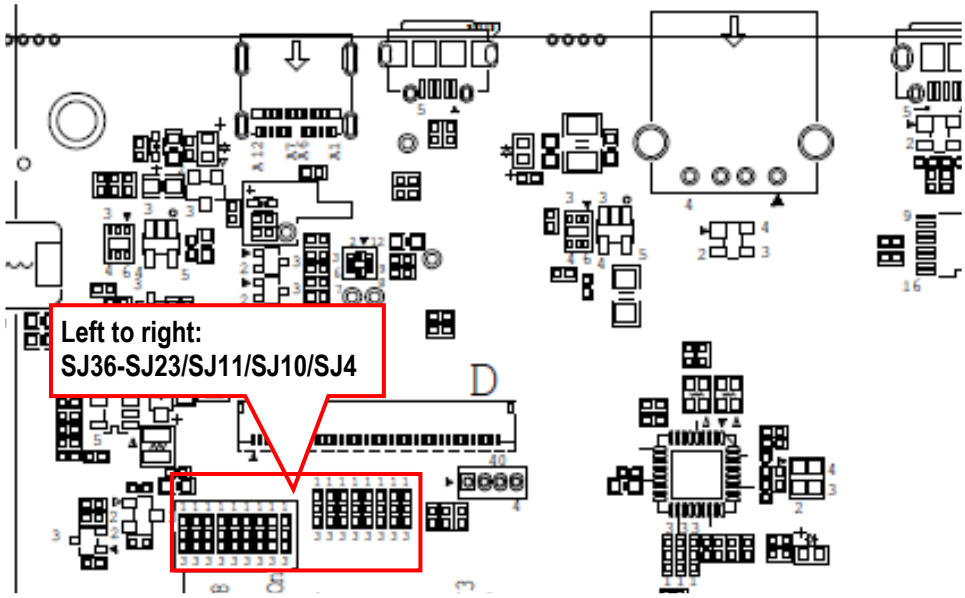

Figure 44 – uCOM Carrier Board, rev A/PB2/PB3, GPIO Boot Control Selectors

The picture below illustrates where the selectors are located (on uCOM Carrier Board, rev B), close to J14.

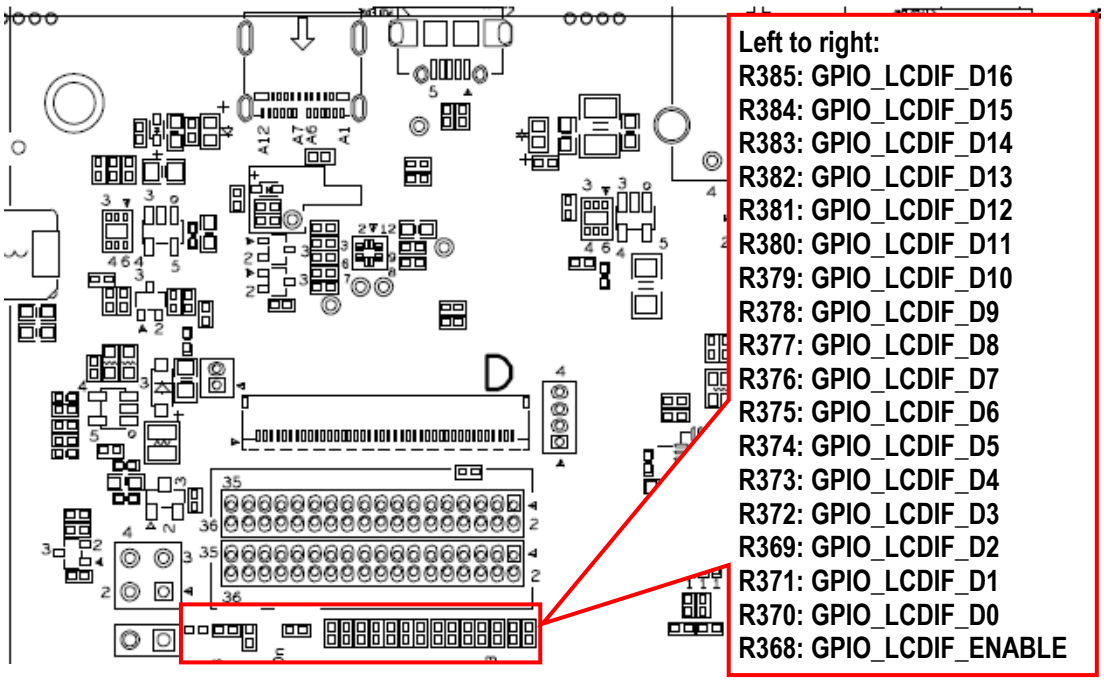

Figure 45 – uCOM Carrier Board, rev B, GPIO Boot Control Selectors

3.22 QSPI Interfaces

Several EAuCOM boards support external QSPI flash memories for executing code or storing additional data. For EAuCOM boards based on Heterogeneous Multi-Processor i.MX SoCs it is typically the Cortex-M core that is connected to the optional QSPI memory.

To support evaluation and prototyping with QSPI flash there are two different pads for mounting a QSPI on the uCOM Carrier Board:

- For iMX8M Mini/Nano uCOM there is U4 that supports a 1.8V QSPI, for example IS25WP128-JBLE from ISSI.
- For iMX RT1064 uCOM there is U34 that supports 3.3V QSPI, for example IS25LP064A-JLLE from ISSI.

The picture below illustrates the location of the two QSPI pads.

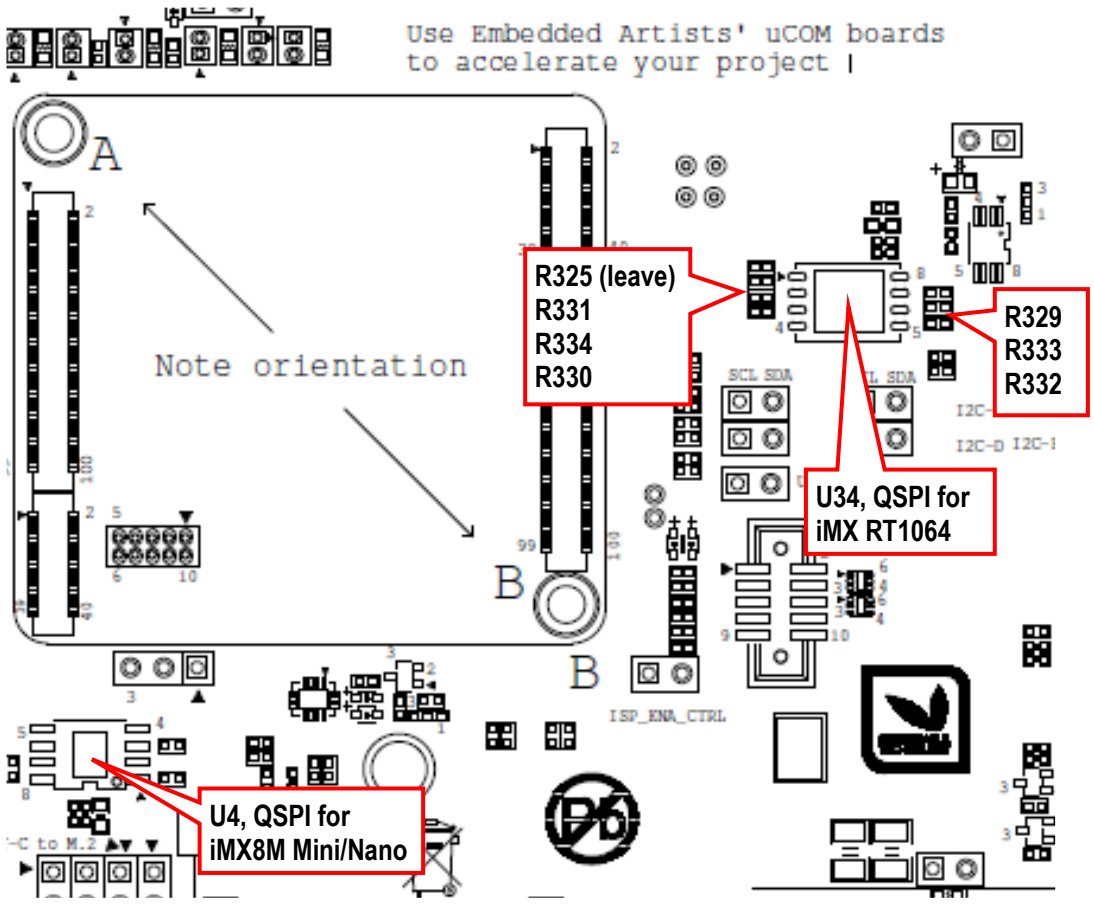

Figure 46 – uCOM Carrier Board, rev A/PB2/PB3, QSPI Pads

Note that on *uCOM Carrier Board, rev B*, U4 is located on the bottom side.

3.23 Mikrobus/Click Module Interface

J31/J32 are two 1x8 pos, 100mil pitch headers (female) that implements a Mikrobus/Click module interface.

Mikrobus Module Signal	Connector Pin	EAuCOM Connector and Signal Name	Note
AN	J31, pin 1	JB pin 9, UART-C_CTS/UART-D_RXD	JP24 must be in 2-3 position
RST	J31, pin 2	JB pin 11, UART-C_RTS/UART-D_TXD	JP23 must be in 2-3 position
CS	J31, pin 3	JB pin 34, SPI-A_SSEL	
SCK	J31, pin 4	JB pin 28, SPI-A_SCLK	
MISO	J31, pin 5	JB pin 30, SPI-A_MISO	
MOSI	J31, pin 6	JB pin 32, SPI-A_MOSI	
PWM	J32, pin 1	I2C_GPIO_PWM0	Signal generated by U36
INT	J32, pin 2	JB pin 10, GPIO_E	
RX	J32, pin 3	JB pin 1, UART-C_RXD	JP21 must be in 2-3 position
TX	J32, pin 4	JB pin 3, UART-C_TXD	JP22 must be in 2-3 position
SCL	J32, pin 5	JB pin 52, I2C-B_SCL	
SDA	J32, pin 6	JB pin 54, I2C-B_SDA	

Note that different interfaces can share signals. When using this interface, make sure no other interface drives the used signals.

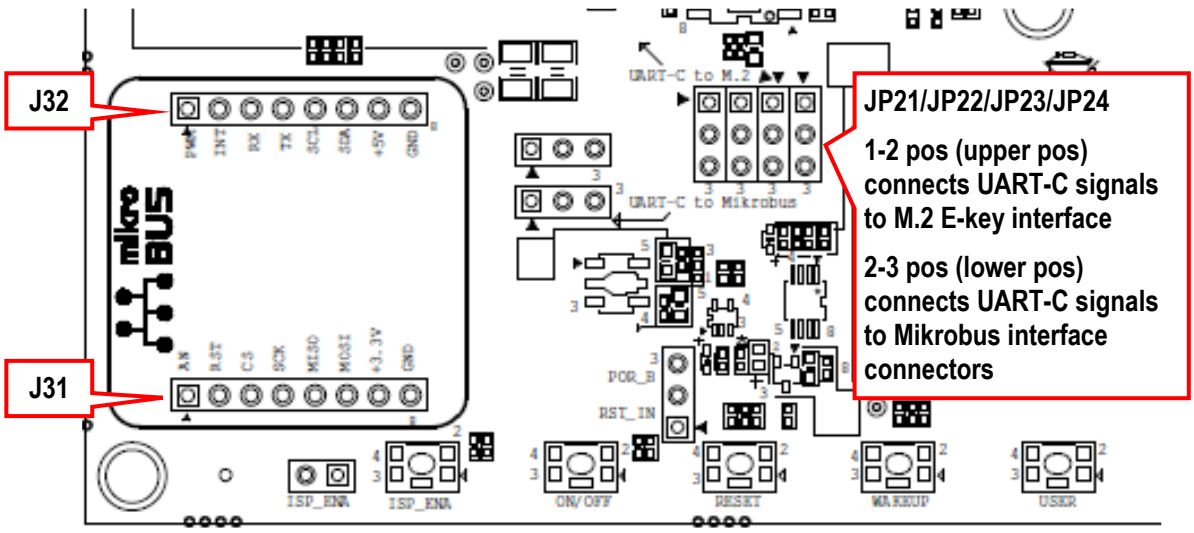

Figure 47 – uCOM Carrier Board, Mikrobus Interface

3.24 Expansion Connectors

The expansion connector design has been changed between the two *uCOM Carrier Board* revisions, see the picture below for details.

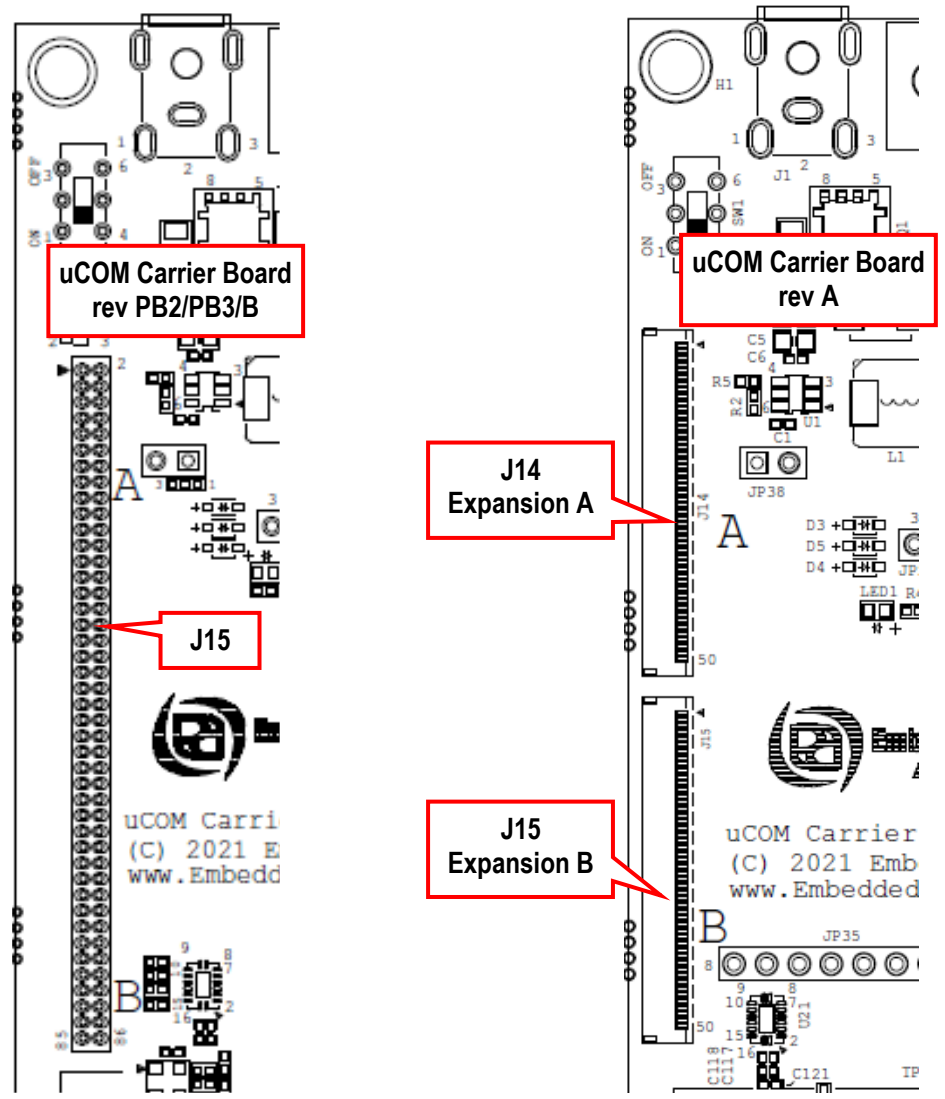

Figure 48 – uCOM Carrier Board rev A and PB2/PB3/B Expansion Connectors

On *uCOM Carrier Board*, rev A, the expansion connectors, J14/J15, are XF2W-5015-1A from Omron. We can recommend using 50 mm long 50 position flex cables with 0.5mm pitch of type 0151660537 from Molex.

On *uCOM Carrier Board*, rev PB2/PB3/B, the expansion connector is a 2 row, 50 mil pitch through-hole matrix. No specific connector is suitable for this matrix of holes. To simplify prototyping, it is intended for soldering directly of wires instead.

4 I2C Interfaces

EAuCOM specifies four I2C interfaces and these are available, and used, on the *uCOM Carrier Board*. Their usage is listed in the tables below. Note that all four interfaces are not supported by all EAuCOM boards.

Note that I2C channel A is also used internally on the EAuCOM boards, typically for PMIC and internal E2PROM communication. Check EAuCOM datasheet to get list of I2C devices connected to I2C channel A complete.

I2C channel A signals are available on JP25.

I2C channel A	8-bit I2C address	7-bit I2C address	Max speed
PWM GPIO Expander PCA9530, U36 **Note: not present on rev A uCOM Carrier boards**	0xC2/0xC3 (1.1.0.0.0.0.1.RW)	0x61 (1.1.0.0.0.0.1)	400 kHz
E2PROM with EUI-48 on Ethernet Adapter 24AA025E48T, U7 **Note: not present on rev A uCOM Carrier boards**	0xA6/0xA7 (1.0.1.0.0.1.1.RW)	0x53 (1.0.1.0.0.1.1)	400 kHz
MIPI-CSI Interface (Serial Camera) on J23			
MIPI-DSI (display) Interface on J19			
Capacitive touch controller connected to RGB-LCD on J12/J13			
Possible PMIC on EAuCOM			
Typical EAuCOM on-board E2PROM	0xAA/0xAB (1.0.1.0.1.0.1.RW)	0x55 (1.0.1.0.1.0.1)	400 kHz

I2C channel B signals are available on JP26.

I2C channel B	8-bit I2C address	7-bit I2C address	Max speed
GPIO Expander PCA6416A, U3	0x42/0x43 (0.1.0.0.0.0.1.RW)	0x21 (0.1.0.0.0.0.1)	1000 kHz
Mikrobus Interface connector J31/J32			
M.2 E-key connector, J33			

I2C channel C signals are available on JP27. It is connected to the MIPI-DSI (display) interface on J20, communication with touch panel or MIPI-to-HDMI/LVDS bridge (possibly also to read EDID information from connected HDMI display)

I2C channel D is not connected to anything on the uCOM Carrier Board. The signals are available on JP28.

5 Technical Specification

5.1 Absolute Maximum Ratings

All voltages are with respect to ground, unless otherwise noted. Stress above these limits may cause malfunction or permanent damage to the board.

Symbol	Description	Min	Max	Unit
VIN	Main input supply voltage on J1/J2	-1	16	V
VBAT_RTC	VBAT connector, J3	-0.3	3.6	V
VIO-3.3V	Pins powered from 3.3V supply	-0.3	3.6	V
VIO-1.8V	Pins powered from 1.8V supply	-0.3	1.9	V

5.2 Recommended Operating Conditions

All voltages are with respect to ground, unless otherwise noted.

Symbol	Description	Min	Typical	Max	Unit
VIN	Main input supply voltage Ripple with any frequency content	9	12	15 100	V mV
VBAT_RTC	External "keep alive" supply for RTC	3.0	3.3	3.6	V

5.3 Electrical Characteristics

For DC electrical characteristics, see EAuCOM board datasheet, used i.MX SoC datasheets and individual component (used on the *uCOM Carrier Board*) datasheets.

5.4 Power Consumption

There are many factors that determine power consumption of the *uCOM Carrier Board* together with an EAuCOM board. Therefore, no power consumption number is published. General system and communication activity along with externally connected devices, like USB Devices, RF-modules (M.2 modules, cellular modules, etc.) and displays all have a big impact on power consumption.

Always measure current consumption in the real system, in all different operating conditions, to get accurate numbers. Observe the peak power consumption. Add at least 30% margin (preferably more) to the external 12V power supply that feeds the system.

5.5 Mechanical Dimensions

Dimension	Value (±0.5 mm)	Unit
Board width (excluding components protruding the pcb edge)	152.1	mm
Board height (excluding components protruding the pcb edge)	152.1	mm
Maximum top side height	16	mm
Maximum bottom side height	3.5	mm
PCB thickness	1.6	mm
Mounting hole diameter (x5)	4.3	mm

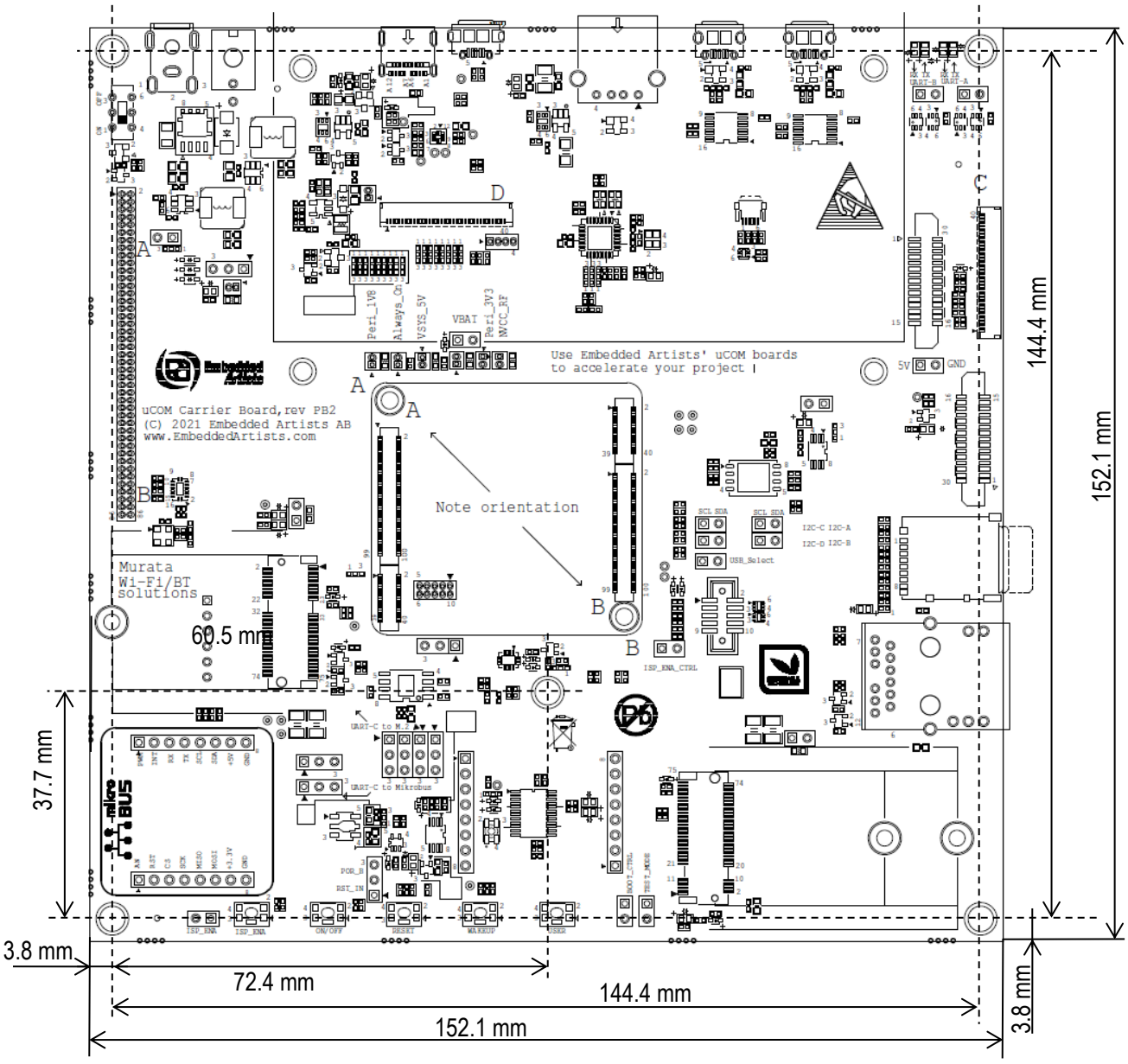

Figure 49 –uCOM Carrier Board Mechanical Outline

5.5.1 Module Assembly Hardware

The *uCOM Carrier Board* has five 4.3 mm holes for mounting the board. There are also two M2 stand-offs for mounting the EAuCOM board. Use 4 mm M2 screws for this.

5.6 Environmental Specification

5.6.1 Operating Temperature

Ambient temperature (T_A)

Parameter	Min	Max	Unit
Operating temperature range	0	60[1]	°C
Storage temperature range	-40	85	°C

[1] Typically limited by EAuCOM board and associated thermal management solution.

5.6.2 Relative Humidity (RH)

Parameter	Min	Max	Unit
Operating: 0°C ≤ T_A ≤ 60°C, non-condensing	10	90	%
Non-operating/Storage: -40°C ≤ T_A ≤ 85°C, non-condensing	5	90	%

5.7 Product Compliance

Visit Embedded Artists' website at http://www.embeddedartists.com/product_compliance for up-to-date information about product compliances such as CE, RoHS2/3, Conflict Minerals, REACH, etc.

6 Functional Verification and RMA

There are separate documents that present several functional tests that can be performed on the *uCOM Carrier Board* to verify correct operation on the different interfaces. There is one separate document for each EAuCOM board that the *uCOM Carrier Board* supports. Note that these tests must be performed with a precompiled kernel from Embedded Artists.

The tests can also be done to troubleshoot a board that does not seem to operate properly. It is strongly advised to read through the list of tests and actions that can be done before contacting Embedded Artists. The different tests can help determine if there is a problem with the *uCOM Carrier Board*, or not. For return policy, please read Embedded Artists' General Terms and Conditions document (http://www.embeddedartists.com/sites/default/files/docs/General_Terms_and_Conditions.pdf).

The different interfaces are implemented by the combination of an EAuCOM board and the *uCOM Carrier Board*. It is this combination that is tested. If an interface fails a test then it might not be possible to pin point the error to the EAuCOM board or to the *uCOM Carrier Board*, unless the EAuCOM board that is mounted on the *uCOM Carrier board* is replaced with another EAuCOM board. Either the failing interface follows the EAuCOM board or the *uCOM Carrier board*, and that makes it possible to locate the possible error to a specific board.

7 Things to Note

This chapter presents several issues and considerations that users must note.

7.1 Important Note About Sensitive PCB Area

There is a sensitive area, close to the On-Off switch, where you should never place your finger.

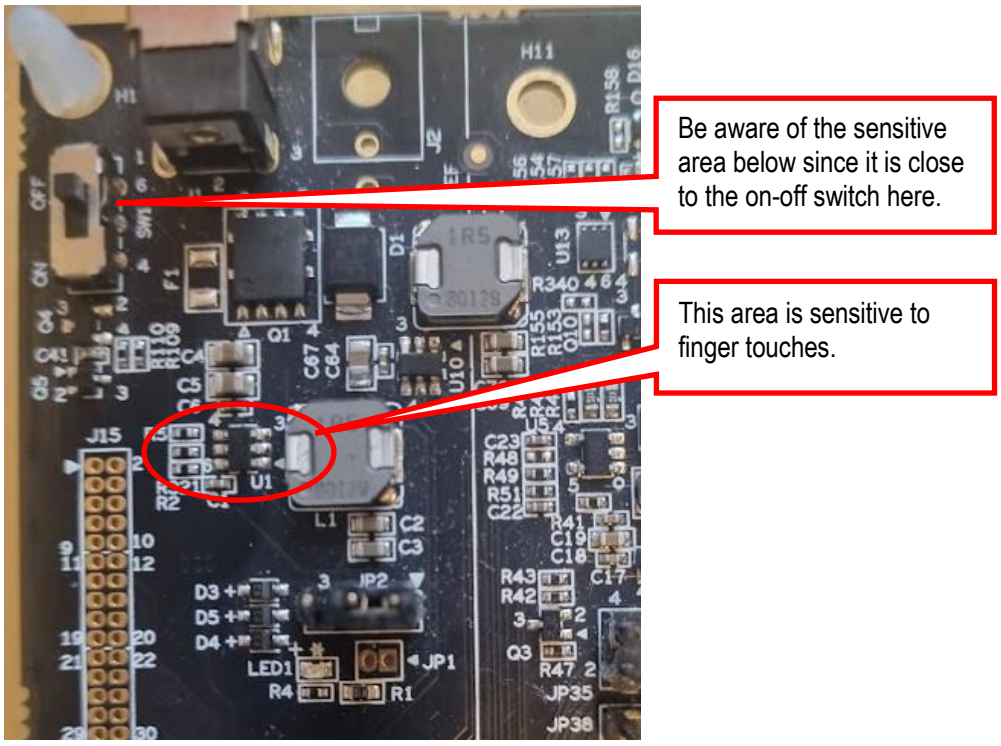

Figure 50 – Sensitive Area on uCOM Carrier Board

The picture below illustrates how **not to place a finger. It will damage the board!**

Figure 51 – Never Place a Finger Like Illustrated

We recommend protecting the area with, for example, glue from a glue gun, as illustrated in the picture below.

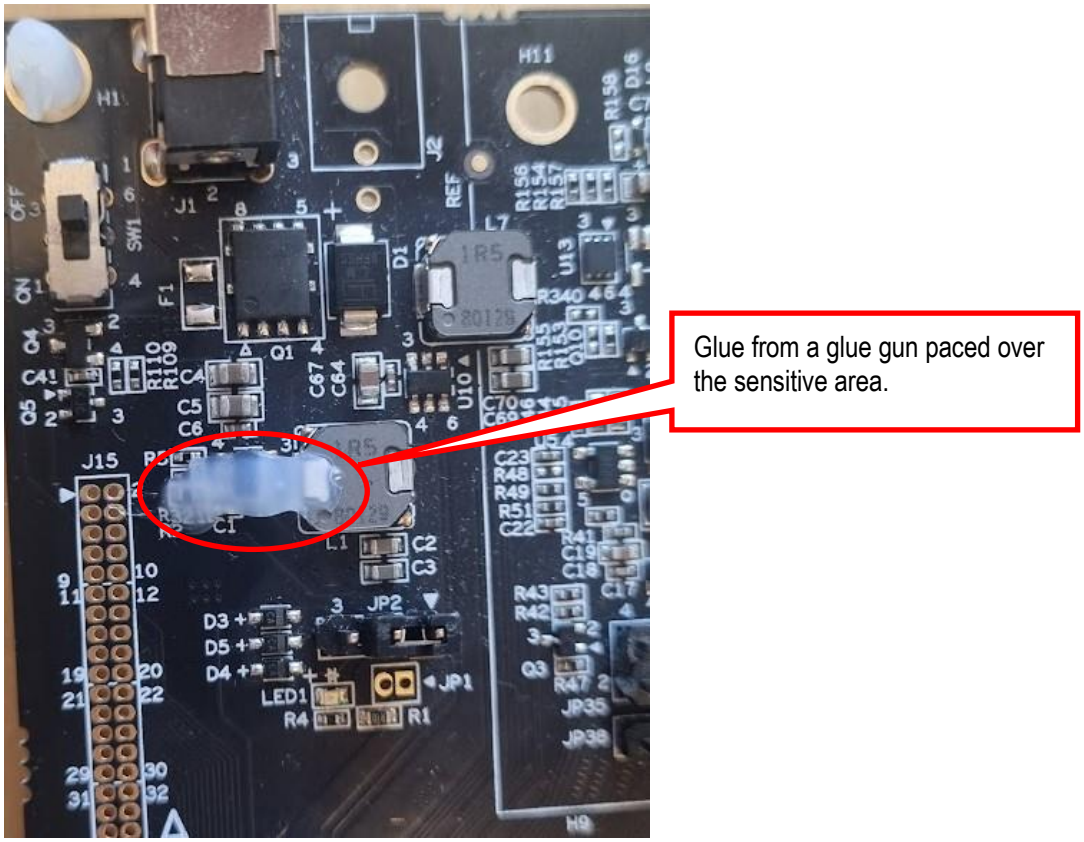

Figure 52 – Glue Over Protective Area

7.2 Only Use Board Support Package (BSP) from Embedded Artists

Different EAuCOM boards use multiple on-board interfaces for the internal design, for example PMIC, eMMC flash, (Q)SPI flash, Ethernet, and watchdog. Only use the BSP that is delivered by Embedded Artists (or official BSPs from our partners). Do not change interface initialization and/or pin assignment for the on-board interfaces. Changing BSP settings can result in permanent board failure, both on the *uCOM Carrier Board* and on the EAuCOM board.

Note that Embedded Artists does not replace damaged uCOM Carrier Boards because of improper interface initialization and/or improper pin assignment.

Similarly, if custom modifications are done to the DTS file (for example when designing expansion boards), make sure the DTS file is still EAuCOM compatible when using the *uCOM Carrier board*.

7.3 Integration - Contact Embedded Artists

It is strongly recommended to contact Embedded Artists at an early stage in your project. A wide range of support during evaluation and the design-in phase are offered, including but not limited to:

- Developer's Kit to simplify evaluation
- Custom Carrier board design, including 'ready-to-go' standard carrier boards
- Display solutions
- Mechanical solutions

- Schematic review of customer carrier board designs
- Driver and application development

The *uCOM Carrier Board* function as a reference implementation of the available interfaces and targets a wide range of applications, such as:

- Industrial controllers and HMI systems
- Home automation and facility management
- Audiovisual equipment
- Instrumentation and measuring equipment
- Vending machines
- Industrial automation
- HVAC Building and Control Systems
- Smart Grid and Smart Metering
- HMI/GUI solutions
- Smart Toll Systems
- Connected vending machines
- Digital signage
- Point-of-Sale (POS) applications
- Data acquisition
- Communication gateway solutions
- Connected real-time systems
- Portable systems
- ...and much more

For harsher use and environments, and where fail-safe operation, redundancy or other strict reliability or safety requirements exist, always contact Embedded Artists for a discussion about suitability.

There are application areas that the *uCOM Carrier Board* is not designed for (and such usage is strictly prohibited), for example:

- Military equipment
- Aerospace equipment
- Control equipment for nuclear power industry
- Medical equipment related to life support, etc.
- Gasoline stations and oil refineries

If not before, **it is essential to contact Embedded Artists well in time before production begins**. To ensure a reliable supply for you, as a customer, we need to know your production volume estimates and forecasts. Embedded Artists can typically provide smaller volumes from stock (for evaluation and prototyping), but **larger volumes need to be planned**.

The more information you can share with Embedded Artists about your plans, estimates and forecasts the higher the likelihood is that we can provide a reliable supply to you.

7.4 ESD Precaution when Handling uCOM Carrier Board

Please note that the *uCOM Carrier Board* come without any case/box and all components are exposed for finger touches – and therefore extra attention must be paid to ESD (electrostatic discharge) precaution, for example use of static-free workstation and grounding strap. Only qualified personnel shall handle the product.

Make it a habit always to first touch the metal surface of the Ethernet or USB connectors for a few seconds with both hands before touching any other parts of the boards. That way, you will have the same potential as the board and therefore minimize the risk for ESD damage.

In general, touch as little as possible on the boards to minimize the risk of ESD damage.

Note that Embedded Artists does not replace boards that have been damaged by ESD.

7.5 EMC / ESD

The *uCOM Carrier Board* has been developed according to the requirements of electromagnetic compatibility (EMC). Nevertheless, depending on the target system, additional anti-interference measurement may still be necessary to adhere to the limits for the overall system. This is for example true when connecting a display solution or an external power supply to the *uCOM Carrier Board*.

ESD protection has in general been implemented on the *uCOM Carrier Board*, but it is **strongly advised to verify that the protection is adequate for the specific operating conditions for the board**.

7.6 Input Voltage

Many power supplies require a minimum load to regulate the output voltage to within specification. Low load can result in increased output voltage. If it is too high, it can potentially damage the *uCOM Carrier Board*. Make sure the external 12V power supply (that powers the *uCOM Carrier Board*) can handle (near) zero-load while still maintaining regulation and keeping the output voltage within specification.

7.7 VBAT Current

VBAT current is relatively high on several EAuCOM boards, in the region of 100-200uA. This makes it unsuitable for powering via a smaller rechargeable battery.

Note that EAuCOM boards do not need VBAT voltage to startup. VBAT is only needed to keep the i.MX RT/6/7/8/9 on-chip RTC running in case the main input voltage supply is removed.

If a low-current solution is needed, implement an external low-current Real-time Clock on the *uCOM Carrier board*.

7.8 SIM connector J35 Not Functional

The SIM Card connector, J35, located on the bottom side of the PCB, under the M.2 B-key connector, J36 is not function. Due to a layout error, pins 4 and 6 have been switched. This error exists on all board revisions up to, and including, rev C1.

7.9 U23 Issue - 32.768kHz Oscillator for M.2 E-key Interface

Due to component shortage during Q4-2021 a small number of *uCOM Carrier Boards* were produced with a different 32.768kHz oscillator, U23. A mounting error occurred for these boards. Only a small number of boards were shipped with the mounting error.

Please check your uCOM Carrier Board, rev PB2 (it is only on this revision the error has occurred). If U23 looks like on the picture below (metal case instead of a black package), make sure there is a **resistor mounted in R249 and not in R248**. If there is a resistor mounted in R248, please remove it and mount a zero ohm 0402-size resistor in the R249 position, which is just below the R248 position. A solder bridge also works.

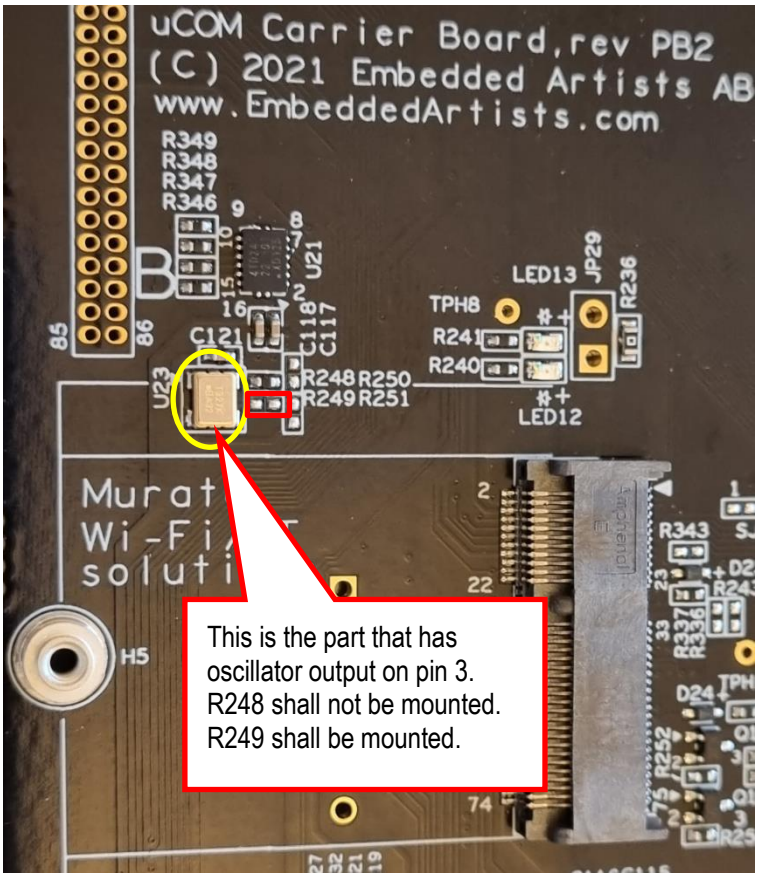

Figure 53 –uCOM Carrier Board rev PB2, U23 with potentially incorrect mounting of R248/249

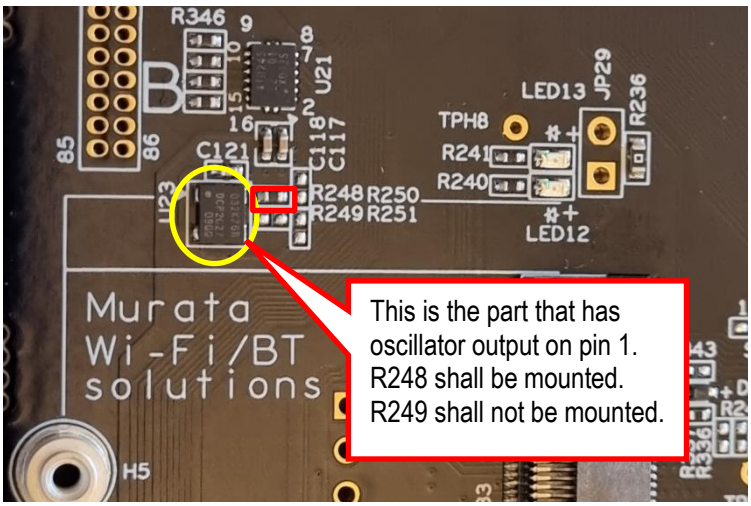

Figure 54 –uCOM Carrier Board rev PB2, U23 with correct mounting of R248/249

8 Custom Design

This document specifies the standard *uCOM Carrier Board* design. Embedded Artists offers many custom design services. Contact Embedded Artists for a discussion about different options and services.

Examples of custom design services are:

- Different or modified interfaces.
- Different mounting options, for example remove some interface.
- Redesign carrier board for custom pinning *uCOM boards*.
- Different input supply voltage range.
- Different mechanical dimensions (or connector positions), for example to fit custom boxed solution.
- Single Board Computer solutions, where the core design of a *uCOM Board* is integrated together with selected interfaces or a carrier board.

Embedded Artists also offers a range of services to shorten development time and risk, such as:

- Display solutions
- Mechanical solutions

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