COM Carrier Board V2
Datasheet

Get Up-and-Running Quickly and
Start Developing Your Application On Day 1!

Embedded Artists

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1 Document Revision History

Revision	Date	Description
PB1	2019-04-15	Updated for COM Carrier Board V2, rev E.
PB2	2019-10-24	Updated Figure 21.
PB3	2019-11-26	Added note about U5.
PB4	2020-03-19	Added information about boot control jumpers.
PB5	2020-05-29	Added information about iMX8M Nano uCOM.
B	2022-02-03	Corrected information about iMX6DualLite on section 2.7.

2 Introduction

This document is a datasheet that specifies and describes the *COM Carrier Board V2* mainly from a hardware point of view. Software related issues are not addressed. Note

2.1   Identify COM Carrier Board Version

The *COM Carrier Board V2* can be identified with the help of the two pictures below. Figure 1 illustrates the *COM Carrier Board V2*. **This is the version covered in this document**. Figure 2 illustrates the previous generation of *COM Carrier Board*. Note that this document does not cover this version of the board. See previous versions of this document that coverts that board.
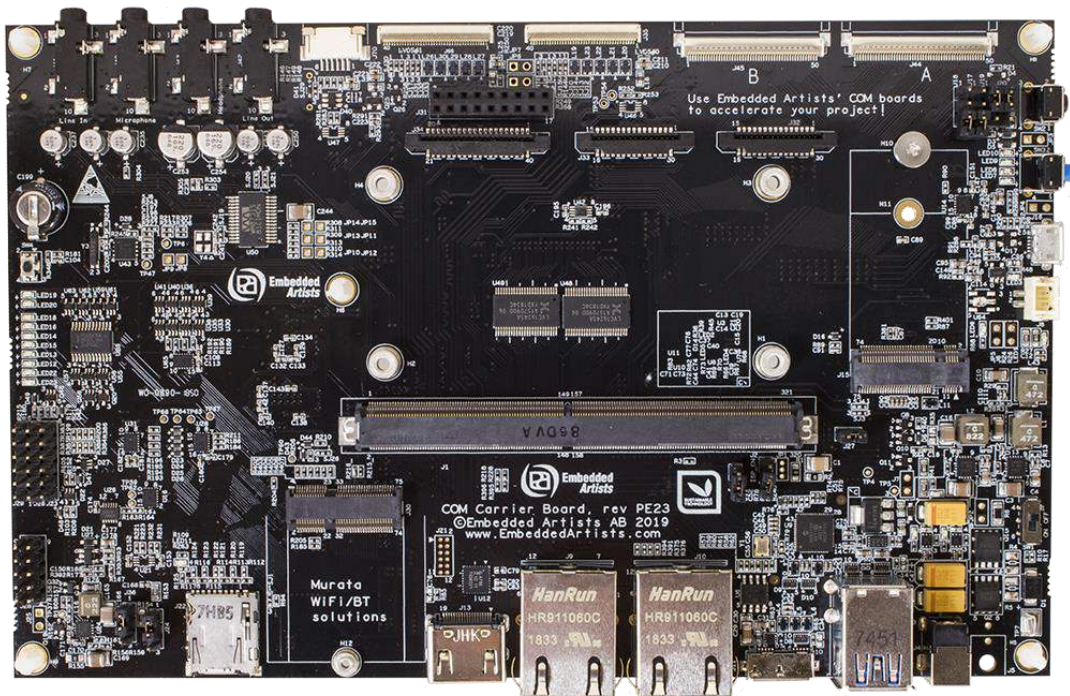
Figure 1 – COM Carrier Board V2, rev E - Covered in this Document
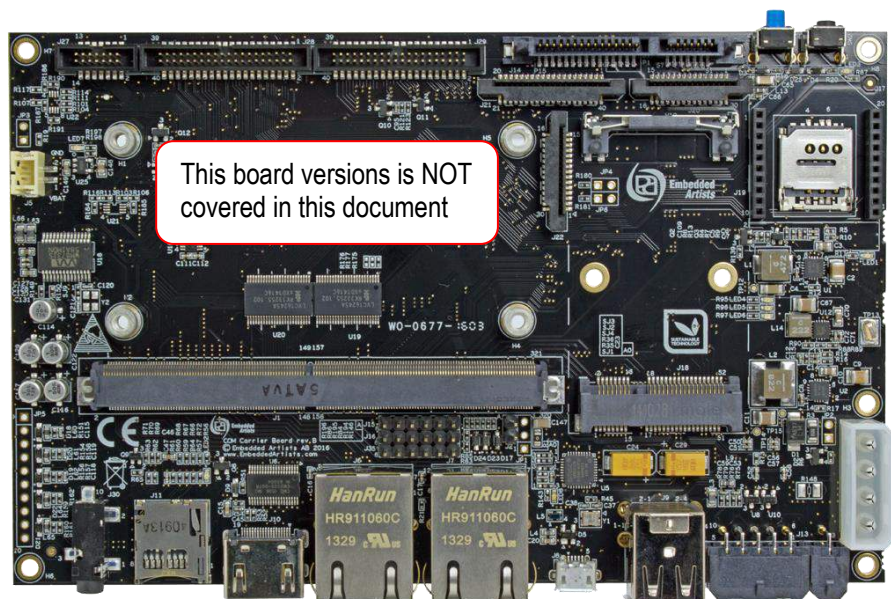
Figure 2 – COM Carrier Board, rev A/B/C/D - Not Covered in this Document

Note that for simplicity the *COM Carrier Board V2* will be addressed as just the *COM Carrier Board* for the rest of this document.

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

COM Carrier Board, rev A	*COM Carrier Board, rev B/C/D*	*COM Carrier Board V2, Rev E*
Designed for integration	Designed for integration	Designed for evaluation
3.3V powering of EACOM	3.3V powering of EACOM	Supports both 3.3V and 4.2V powering of EACOM
Parallel 18-bit RGB interface for 7" LCD solution	Generic 24-bit parallel RGB display interface	Generic 24-bit parallel RGB display interface
Coin cell battery holder (CR1220 size) for EACOM board RTC	Built-in battery charger	Built-in battery charger On-board RTC
Mini PCIe connector	Mini PCIe connector & SATA	M.2 connectors (Key E) with PCIe, SDIO and USB interfaces
SATA connector	SATA connector	M.2 connector (Key B) with SATA and USB interfaces
Headphone out	Headphone out	Full Audio codec
No expansion board	Simple expansion board on rev D	More extensive expansion board with XBee, RPi, Arduino and Click expansion connectors. CAN transceivers also moved to expansion board.

2.2   EACOM Overview

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

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

- **EACOM board**, containing the core design that encapsulate 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 EACOM board. The carrier board is typically a custom specific design where the *COM Carrier Board* is used as a reference design for the different interfaces.
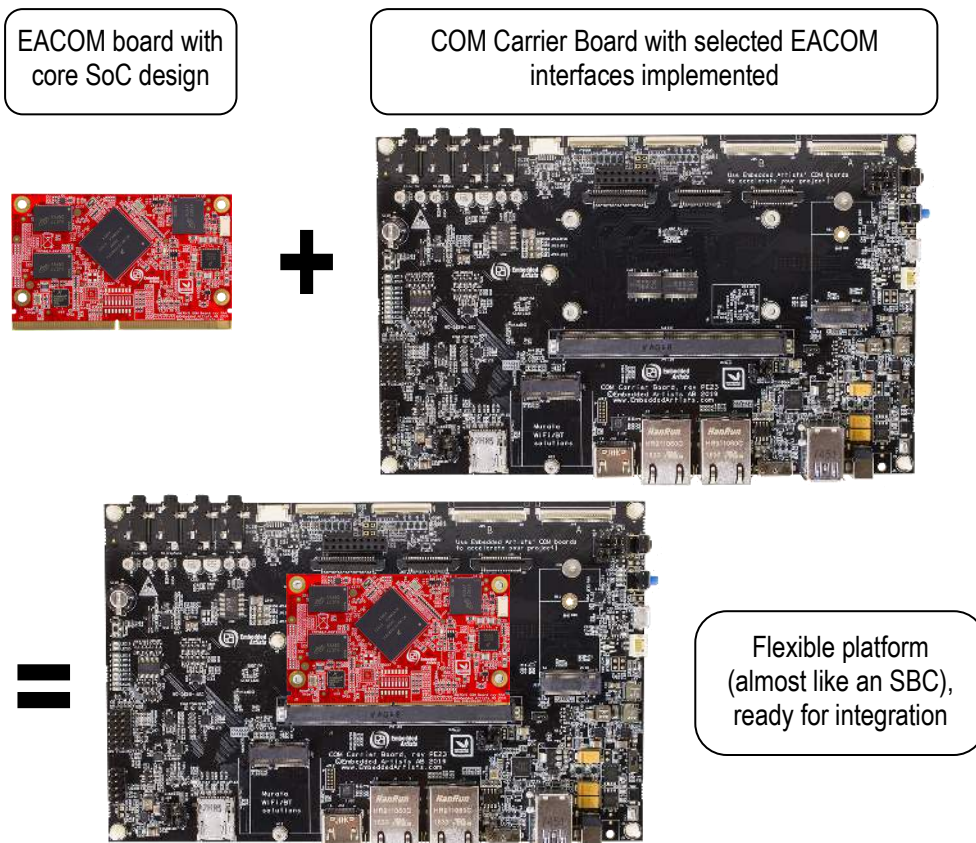
Figure 3 – EACOM Board Plus Carrier Board (almost) Equals Single Board Computer (SBC)

The combination of an EACOM board and accompanying carrier board is very much like a Single Board Computer (SBC), but more flexible. The carrier board can be a much better fit for each specific application than a standard 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 EACOM board, as opposed to redesigning an SBC.

2.3   COM Carrier Board Overview

The *COM Carrier Board* is a base board that implements a large part of interfaces that the EACOM 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 *COM Carrier Board* is ideal are:

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

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

- iMX6 UltraLite / ULL COM Board
- iMX6 SoloX COM Board
- iMX6 Quad / Dual / DualLite COM Board
- iMX7 Dual COM Board

- iMX7 Dual uCOM Board (needs an adapter board, supplied with the iMX Developer's Kit)
- iMX7 ULP uCOM Board (needs an adapter board, supplied with the iMX Developer's Kit)
- iMX8M COM Board
- iMX8M Mini uCOM Board (needs an adapter board, supplied with the iMX Developer's Kit)
- iMX8M Nano uCOM Board (needs an adapter board, supplied with the iMX Developer's Kit)

The COM Carrier Board has the following feature highlights:

Connectors for External Interfaces **Note** that all interfaces/ functions are not supported by all EACOM boards.	Connector to EACOM board, MXM3, 314-pos connector with 5 mm standoffs for EACOM board
	Dual 10/100/1000 Mbps Gigabit Ethernet RJ45 connectors
	USB 3.0 OTG interface
	Dual USB 3.0 Host interfaces (via USB 3.0 Hub)
	HDMI connector
	UART-to-USB bridge for console connection
	uSD connector
	Audio codec with line in/out, microphone and headphone 3.5mm audio jack connectors
Internal Interfaces **Note** that all interfaces/ functions are not supported by all EACOM boards.	M.2 connector (key E) with SDIO, PCIe and USB interfaces
	M.2 connector (key B) with SATA and USB interfaces, including SIM card holder
	Dual LVDS connectors, connects directly to a New Haven NHD-10.1-1024600AF-LSXV-CTP display
	FPC connectors for serial and parallel camera interface and VADC/serial display output (MIPI)
	Generic 24-bit parallel RGB display interface
	Expansion connectors for many EACOM Board signals: 　• Access to all signals 　• XBee™ compatible interface connector 　• Click board connector 　• PRi expansion connector 　• Arduino shield compatible connector 　• Dual CAN transceivers with ESD protection and optional termination
Powering	12V (+-30%) supply voltage
	Reverse polarity protection
	DC/DC converter: Internal 3.3V or 4.2V/4A (for EACOM board) DC/DC converter: 5V/3A and 3.3V/3A (for peripherals) DC/DC converter: 3.3V or 3.6V / 3A to power the M.2 E-key interface (Wi-Fi/BT)
	Built-in battery charger for RTC supply
Dimensions	200 x 126 mm
	Five M4 holes (4.3mm diameter) for mounting and grounding
Environment	0 - 60° Celsius

	5 - 90% relative humidity, non-condensing
Other	On/Off and Reset pushbuttons
	Real-Time Clock with supercap backup
	Input current and EACOM board current measurement

2.4   COM Carrier Board RF-Interfaces

Most EACOM boards do not integrated (on-board) RF interfaces. Nor does the *COM Carrier Board* (at least not typically). Instead the **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 much more flexible and cost effective. It allows the application to carefully evaluate the trade-offs between different solutions (as opposed to just have one option available).

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

Hardware Interface	Connectors on *COM Carrier Board*	RF technology (examples of typical modules)
SDIO via MMC (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	Wi-Fi, BTLE, ISM, Zigbee, NFC
UART interface	Expansion connectors, XBee™ interface	Wi-Fi, ISM, Zigbee, GPS, Cellular, BTLE, NFC
I2C interface	Expansion connectors, M.2, E-key interface	NFC

2.5   Software

There are different Linux Board Support Packages (BSPs) for each combination of an *EACOM Board* and the *COM Carrier Board*. The BSPs are setup to support the interface and GPIO usage on the *COM Carrier Board*. Precompiled images are available. Embedded Artists works with partners that can provide support for other operating systems (OS). For more information contact Embedded Artists support.

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

2.6   EACOM Interfaces

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

Interface	EACOM specification	COM Carrier Board
UART	3 ports (two 4 wire and one 2 wire)	Two ports (selectable) can connect to UART-to-USB bridge (only RX/TX). Port B connected to M.2 (key E) connector (for BT). Expansion connectors also carry the UART interface signals.
SPI	2 ports	Expansion connectors carry the SPI interface signals.
I2C	3 ports	Expansion connectors carry the I2C interface signals.
SD/MMC	2 ports (one 4 databits and one 8 databits)	Primary interface connected to M.2 (key E) connector. Secondary connected to uSD connector (4-databits used)
Parallel LCD	24 databits and CLK/HS/VS/DE	Generic 24-bit parallel RGB display interface
LCD support	LCD power ctrl, Backlight power/contrast control, touch panel ctrl (RST and IRQ)	Signals used to control parallel display (LCD) interface.
LVDS LCD	2 ports (18/24 bit LVDS data)	2x internal connectors.
HDMI (TDMS)		External connector.
Parallel Camera		Internal FPC connector.
Serial Camera	CSI, 4 lane	Internal FPC connector, 2 data lanes connected
Gigabit Ethernet	2 ports	2x external connectors supporting Gigabit as well as 10/100 Mbps speed.
PCIe	1 port, 1 lane	Connected to M.2 (key E) connector.
SATA		Connected to M.2 (key B) connector.
USB	1 USB3.0 OTG 1 USB3.0 Host 1 USB2.0 Host	1x external USB3.0 OTG connector 4 port internal USB3.0 hub with; 2x external USB3.0 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	Not supported.
CAN	2 ports	2x external interface connectors on expansion board.
I2S/SSI/AC97	1 port (4 wire synchronous plus MCLK)	Audio codec with external line out connector and an internal connector for mic/line in/heaphone out.
Analog audio	Stereo output	Not supported.

GPIO	9 pins	Used to control different interfaces on the board.
PWM	1 pin	Used by internal display interfaces.
ADC	8 inputs	Connected to internal expansion connector.
Type specific	39 pins	A few pins are connected to expansion connector.

2.7   Supported Interfaces/Features: COM Board Matrix

As noted in the previous section not all EACOM 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	iMX6 UltraLite	iMX6 SoloX	iMX6 DualLite	iMX6 Dual/Quad	iMX7 Dual	iMX7 ULP	iMX8M	iMX8M Mini	iMX8M Nano
Ethernet #1	√	√	√	√	√		√	√	√
Ethernet #2	√	√							
USB OTG	USB2	USB2	USB2	USB2	USB2	USB2	USB3	USB2	USB2
USB Host Hub	√	√	√	√	√		√	√	√
HDMI			√	√			√		
M.2 Key B, SATA				√					
uSD card interface		√	√	√	√	√*		√*	√*
M.2 Key E, SDIO	√	√	√	√	√	√	√	√	√
M.2 Key E, PCIe		√	√	√	√		√	√	√
MIPI-CSI camera connector			√	√	√		√	√	√
MIPI-DSI display connector			√	√	√	√	√	√	√
Parallel camera connector	√	√	√	√					
LVDS interface #0		√	√						
LVDS interface #1			√	√					
Parallel RGB display	√	√	√	√	√				
CAN	√	√	√	√					
ADC	√ (3.3V)	√ (3.3V)			√ (1.8V)	√ (3.3V)			

√   = feature/interface supported

√* = supported if no on-board Wi-Fi/BT module mounted, else not supported.

2.8   Reference Documents

For details about specific behavior of each interface, see the NXP's Datasheets and Reference Manuals for the respective iMX6/7/8 SoC mounted on the EACOM 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)

- MXM3 Graphics Module Mobile PCI Express Module Electromechanical Specification, Version 3.0, Revision 1.1, © 2009 NVIDIA Corporation (www.mxm-sig.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 *COM Carrier Board*.

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

Figure 4 below illustrates the main external interface connectors, i.e., the connectors that would typically be exposed if the board was places in a box.
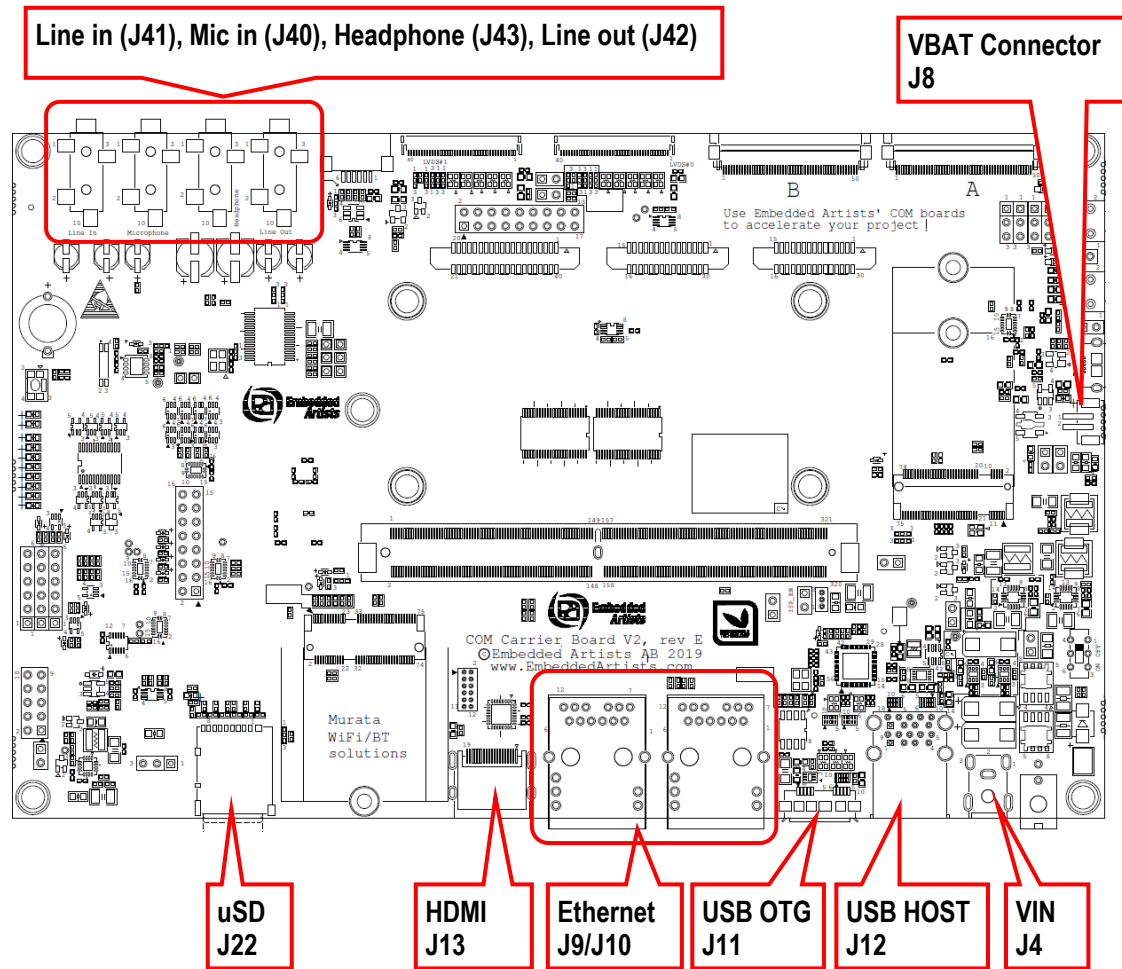
Figure 4 – COM Carrier Board, Main External Interface Connectors

Figure 5 below illustrates the main internal interface connectors. There are also a few connectors on the bottom side. Their positions are illustrated with dotted lines.

There are three types of internal interface connectors:

- Interface connectors where it is possible to **mount additional hardware**, like the two M.2 connectors and SIM card holder. Obviously the MXM3 connector for EACOM boards is also in this category.

- Interface connectors where it is possible to **access additional interfaces** but the hardware to interface must be placed on a separate board. Examples of these connectors are serial display connector, parallel camera connector, serial camera connector, expansion connectors, parallel (RGB) display connector and LVDS connectors.

- Connectors for accessing debug interface. These interfaces are only accessed during development work, never in a deployed product.
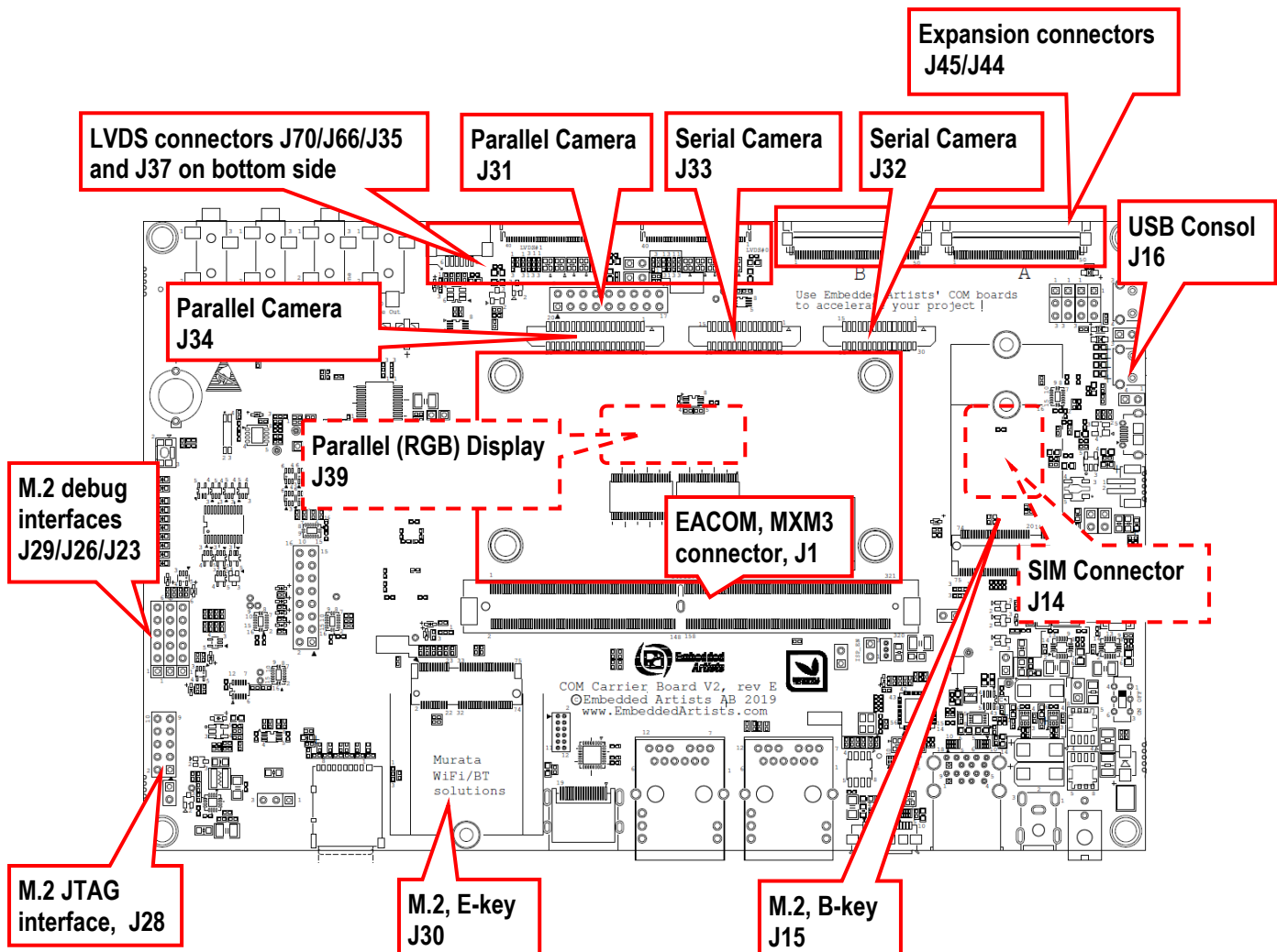
Figure 5 – COM Carrier Board, Main Internal Connectors

3.1   Power Supplies

The input voltage to the *COM 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 (J4), 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. 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.

It is possible to measure the input current on the 12V supply via a 50 milliOhm series resistor. JP2 is connected across this series resistor. 1A input current will result in 50mV across JP2.

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

JP2
Measure input current over 50 milliOhm series resistor

SW1
On/Off switch
Up location = off
Down location = on

J5
Alternative 12V input supply connector.
Molex Micro-Fit 3.0 connector, Lower +12V and upper is GND.

J4
12V input supply connector, Barrel jack, 2.1mm ID/5.5mm OD, positive center
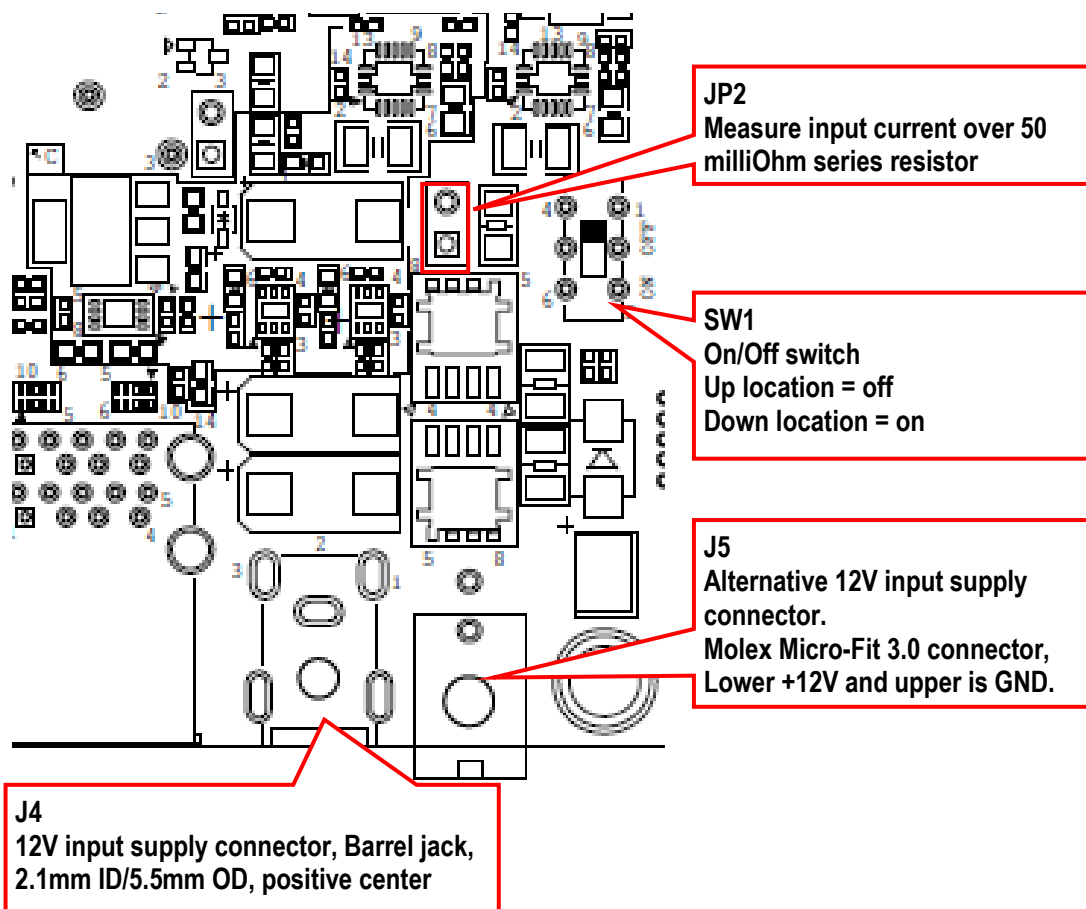
Figure 6 – COM Carrier Board, Power Supply Connectors

There are multiple DC/DC power supplies on the *COM Carrier Board*:

- 3.3V or 4.2V / 4A to power EACOM board. The EACOM board signals which input voltage it is designed for, 3.3V or 4.2V.

- 3.3V / 3A to power the *COM Carrier Board*. The 3.3V supply to the *COM Carrier Board* is enabled when signal PERI_PWR_EN is high.

- 5V / 3A to power the following interfaces: USB Host, HDMI, CAN, SATA, LVDS/RGB BL and expansion connectors. The 5V supply is enabled when signal PERI_PWR_EN is high.

- 3.3V or 3.6V / 3A to power the M.2 E-key powering. 3.6V is an optional voltage level for better RF-performance on some M.2 modules. This supply is enabled when signal PERI_PWR_EN is high.

Figure 7 illustrates the power supply chain on the board.

```
┌─────────────────────┐   ┌──────────────┐      ┌────────────────────┐      ┌────────────────────────────┐
│ J4/J5 Power Supply  │   │ Reverse      │  →   │ 3.3V or 4.2V / 4A  │  →   │ EACOM Board, 3.3V or 4.2V  │
│ Input Connectors    │ → │ Polarity     │      └────────────────────┘      └────────────────────────────┘
│ 12V nominal         │   │ Protection   │
└─────────────────────┘   └──────────────┘      ┌────────────────────┐      ┌────────────────────────────┐
                                          →     │ 3.3V / 3A          │  →   │ Carrier Board, 3.3V        │
                                                │ Enable             │      │ Peripherals                │
                                                └────────────────────┘      └────────────────────────────┘
          PERI_PWR_EN  - - - - - - - -
                                          →     ┌────────────────────┐      ┌────────────────────────────┐
                                                │ 5V / 3A            │  →   │ Carrier Board, 5V          │
                                                │ Enable             │      │ USB Host, HDMI, Expansion  │
                                                └────────────────────┘      │ connector, LVDS/RGB BL     │
                                                                            └────────────────────────────┘
                                          →     ┌────────────────────┐      ┌────────────────────────────┐
                                                │ 3.3V or 3.6V / 3A  │  →   │ Carrier Board              │
                                                │ Enable             │      │ M.2 E-key connector        │
                                                └────────────────────┘      └────────────────────────────┘
```
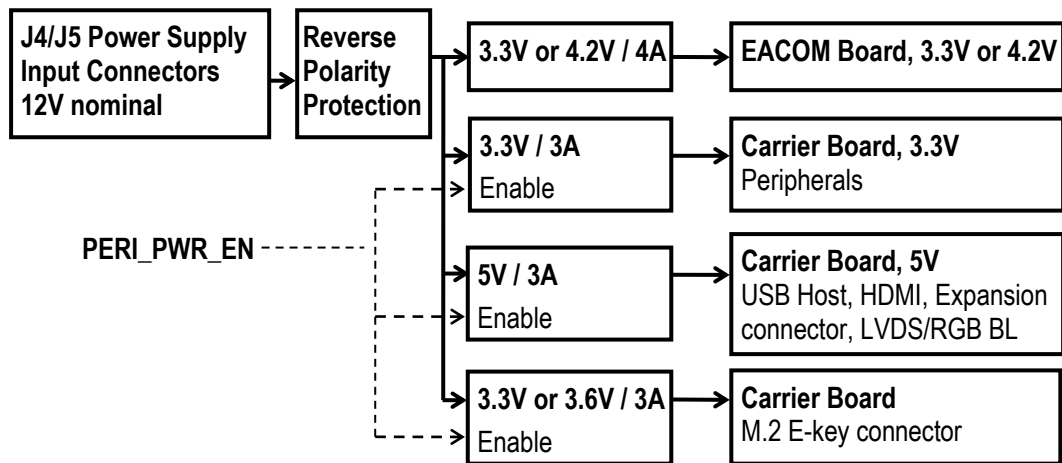
Figure 7 – COM Carrier Board, Power Supply Chain

Alternative 2-pos connector, J5, is Molex Micro-Fit 3.0 connector 0430450200. Note that this connector is not mounted.

3.1.1   VBAT Supply

EACOM boards have a VBAT input that powers an internal RTC on the boards. The *COM Carrier Board* has an on-board Li-Ion / Li-Polymer battery charger MCP73831T-2ACI/OT from Microchip. For exact details about the battery charger, see the MCP73831T-2ACI/OT datasheet.

Charging is set to 4.2V/50mA (which is a common Li-Ion battery voltage) and input voltage is +5V.

Figure 8 illustrates the location of the external Li-Ion / Li-Polymer battery connector, J8, which is B2B-PH-SM4-TB, a 2mm pitch connector from JST. LED3 is a charge status indicator LED.

There is a 3.3V LDO after the Li-Ion battery to make sure VBAT is within the valid voltage range for EACOM boards.

It is possible to measure VBAT current via a 1Kohm series resistor. JP5 is connected across this series resistor. 100uA input current will result in 100mV across JP5.
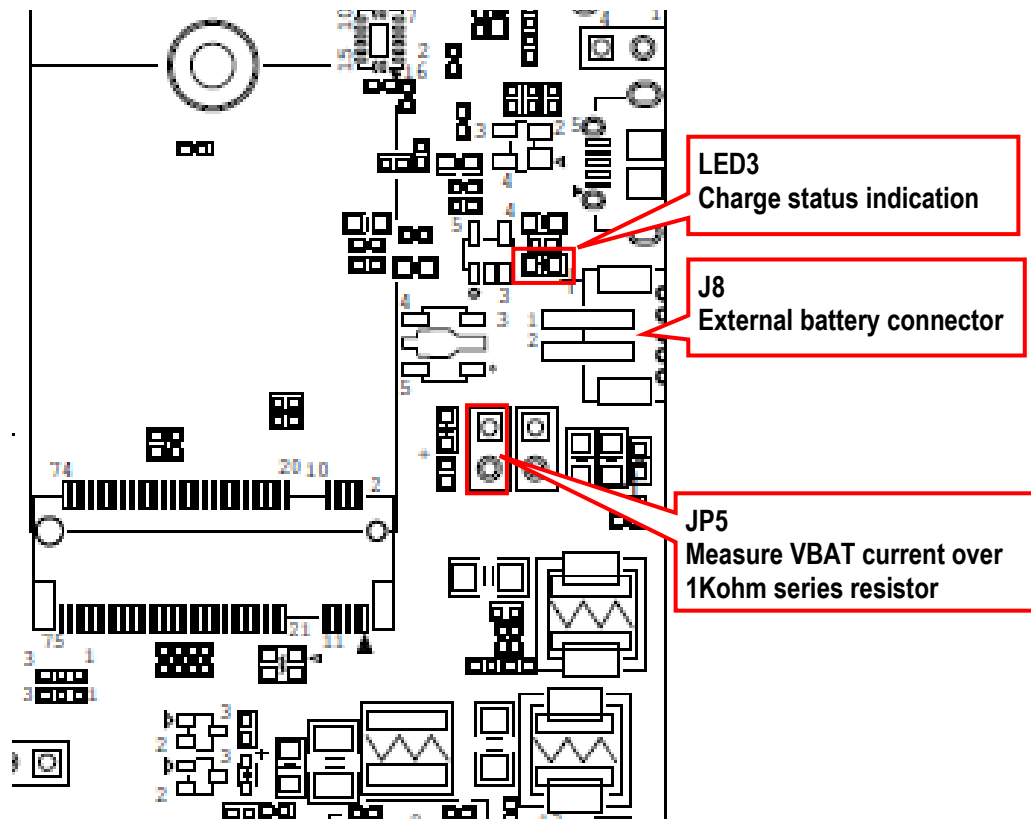
LED3
Charge status indication

J8
External battery connector

JP5
Measure VBAT current over
1Kohm series resistor

Figure 8 – COM Carrier Board, VBAT Coin Cell Holder Connector

Battery connector, J8, is B2B-PH-SM4-TB from JST.

3.1.2   Grounding

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

3.2 Reset and On/OFF Push-buttons

There are two push-buttons located on the right PCB edge, as illustrated in the picture below. There are also two connectors (with just pads), JP3 and JP4, for external control of these signals.
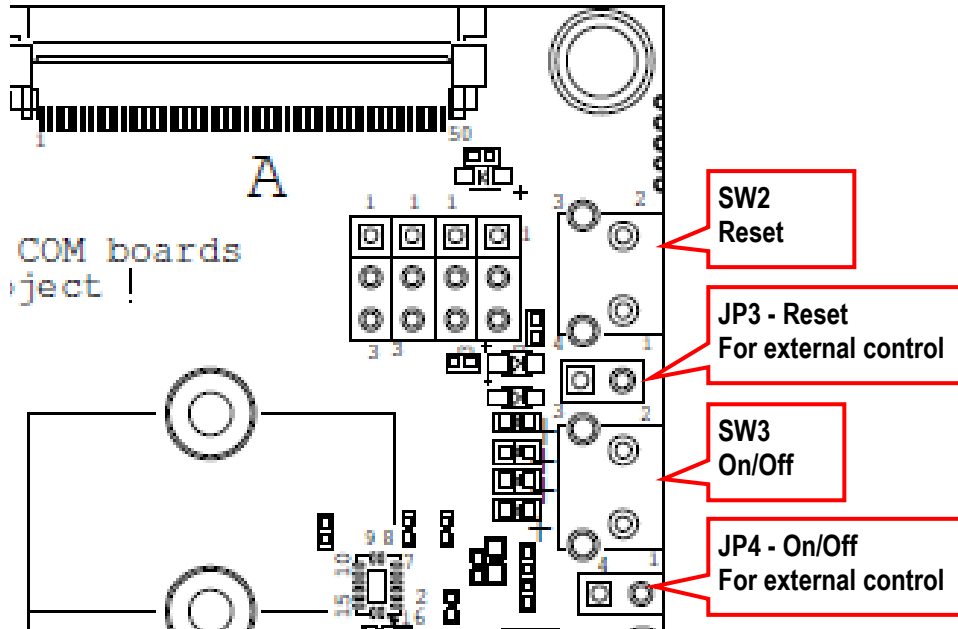

Figure 9 – COM Carrier Board, Reset and On/Off Push-buttons

3.3 Ethernet Interfaces

EACOM boards have up to two Ethernet interfaces (Gigabit and 10/100Mbps). There are two Gigabit and 10/100Mpbs capable Ethernet interface connectors on the *COM Carrier Board*. These connectors are also known as 1000 Base-T RJ45 connectors with integrated transformers. Figure 10 illustrates the location of the two connectors. J9 is located to the left and is Ethernet interface #1. J10 is located to the right and is Ethernet interface #2.
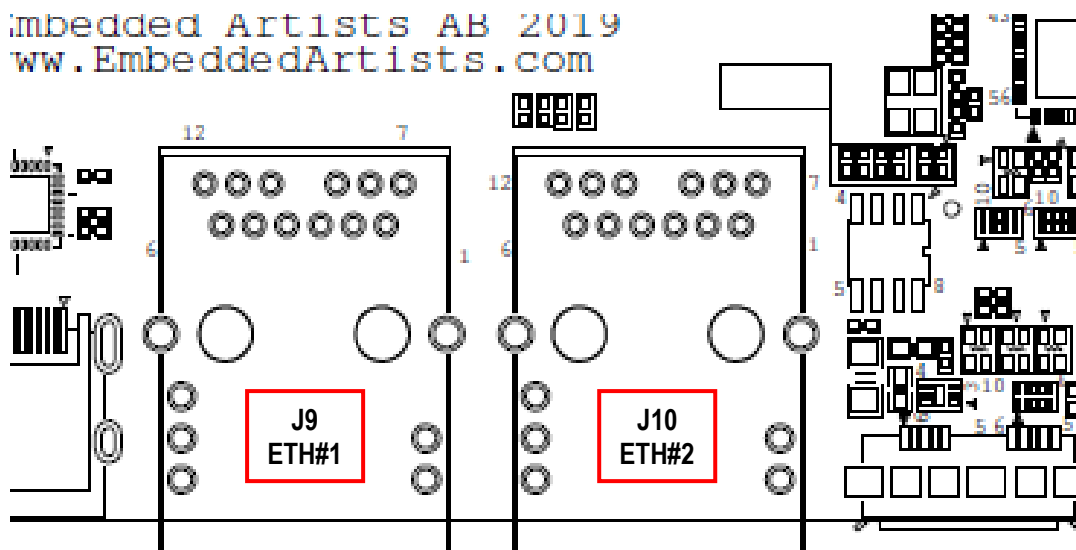

Figure 10 – COM Carrier Board, Dual Ethernet Connectors

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

Ethernet connectors, J9 and J10, are L829-1J1T-43 from Bel Fuse Inc. or equivalent.

3.4   USB 3.0 OTG Interfaces

EACOM boards have one USB 3.0 OTG interface. The *COM Carrier Board* implements a USB 3.0 OTG interface that is accessed via J11, see Figure 11 below. J11 is a micro-AB USB3 connector.

An USB 3.0 interface is backward compatible with USB 2.0. The pins that are specific for USB 3.0 are just left unconnected and are for future upgrade.
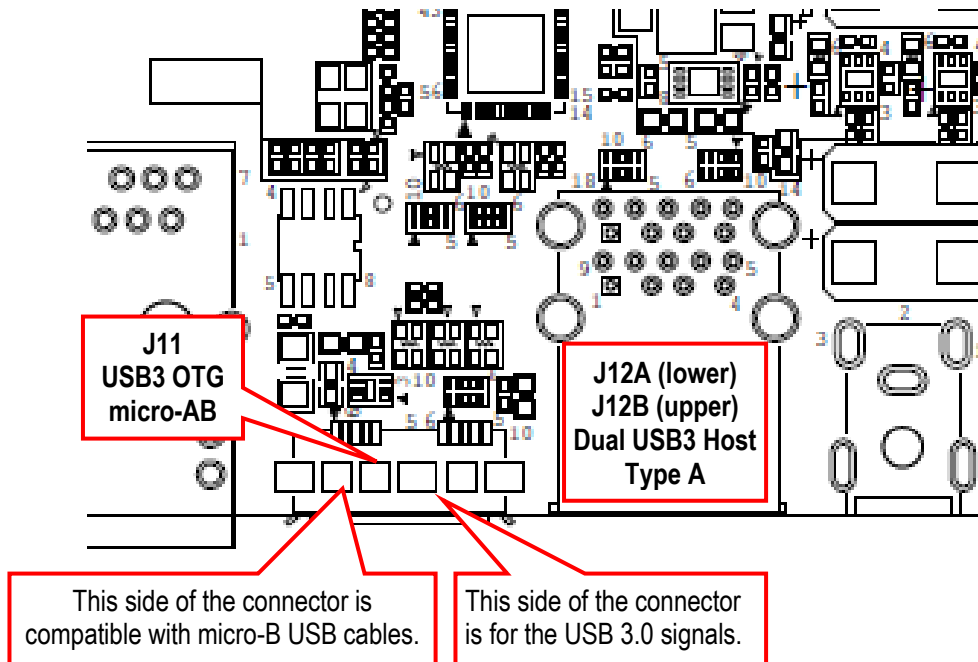
USB 3.0 OTG micro-AB connector, J11, is 1003-005-23100 from CNC Tech.

3.5   Dual USB 3.0 Host Interfaces

EACOM boards have two USB Host interfaces, one USB 3.0 (primary, #1) and one USB 2.0 (secondary, #2). The *COM Carrier Board* connects a 4-port USB 3.0 hub to the (primary, #1) USB 3.0 Host interface. USB 3.0 is backward compatible with USB 2.0. The pins that are specific for USB 3.0 are just left unconnected

Two of the USB 3.0 Host ports are available as external USB 3.0 Host interfaces (J12A/J12B connector).

The third port is connected to the M.2 E-key connector. Some M.2 modules use the USB channel instead of the SDIO or PCIe interface to communicate with the Wi-Fi/BT modules.

The fourth port is connected to the M.2 B-key connector. M.2 modules for cellular RF modules typically use the USB interface.

Figure 11 above illustrates the location of the two USB3 Host ports, J12A and J12B.

Dual USB3 Host connector, J12, is GSB311231HR from Amphenol.

3.6   HDMI Interface

EACOM boards have one HDMI interface. The *COM Carrier Board* implements one HDMI interface connector, with associated ESD protection, that can be accessed via connector J13. Figure 12 illustrates the location of the HDMI (J13) connector. It is a female/receptacle, type A (full size) connector.
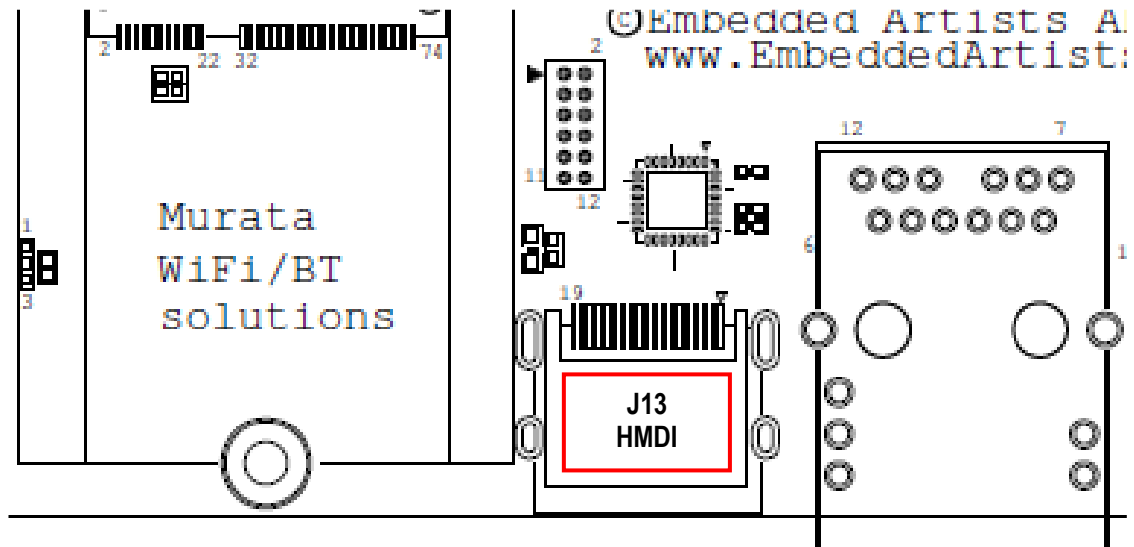

Figure 12 – COM Carrier Board, HDMI Connector

3.7   uSD/MMC Interfaces

EACOM boards have two SD/MMC interfaces:

- Primary: 4-bit SD interface, which is connected to the M.2 Key E connector, J30, as the SDIO interface for Wi-Fi/BT M.2 modules.
- Secondary: 4 or 8-bit SD/MMC interface (depending on what the EACOM board supports), which is connected (4-bits) to the uSD card connector, J22.
Note that this interface is implemented by most, but not all, EACOM boards.

Power to the memory card interfaces are controlled by signal GPIO_C (active high). LED11 is on when power to the memory card is on. The card detect signal (active low) from the uSD card connector is connected to signal GPIO_D.

Note that it is possible to connect the primary SD interface to the uSD card connector, J22, by reworking the *COM Carrier Board*:

- Remove the following 12 resistors: R287, R350. R367, R371, R372, R374, R402, R403, R404, R405, R406, R407
- Mount 12 zero ohm 0402 resistors: R119, R120, R121, R122, R123, R124, R268, R269, R270, R271, R272, R286

This might be useful to do for EACOM boards that only supports the primary SD interface (and where the M.2 interface is not needed).

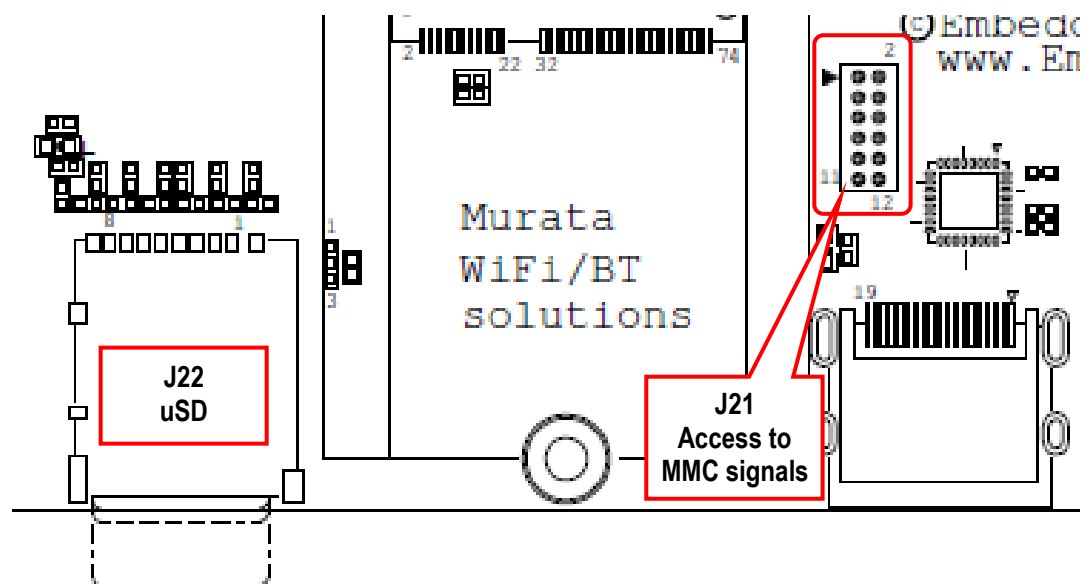Figure 13 illustrates the location of the uSD connector (J22) and MMC access connector (J21).

Figure 13 – COM Carrier Board, uSD Connector and Access to MMC Signals

uSD connector, J22, is DM3AT-SF-PEJM5 from Hirose.

MMC access connector, J21, is 2x6-pos, 50 mil pitch pad on the pcb.

3.8   M.2 Key B Interface

EACOM boards have an M.2 Key B interface. The *COM Carrier Board* implements this interface via connector J15. Two main categories of M.2 modules are supported: **Cellular modems** via USB interface and **SSD** (Solid-State Disks) via the SATA interface.

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

- USB, via the USB Hub.
- SIM Card connector, J14, located on the bottom side of the PCB, under the M.2 connector.
- SATA interface - note that not only a few i.MX SoCs support this interface.

The M.2 interface connector is powered with 3.3V and it is possible to measure current via R86. Some M.2 modules are controlled by the W_DISABLE# input. Signal GPIO_P is connected to this input.

Figure 14 illustrates the location of the M.2 connector and associated SIM card holder (J14).
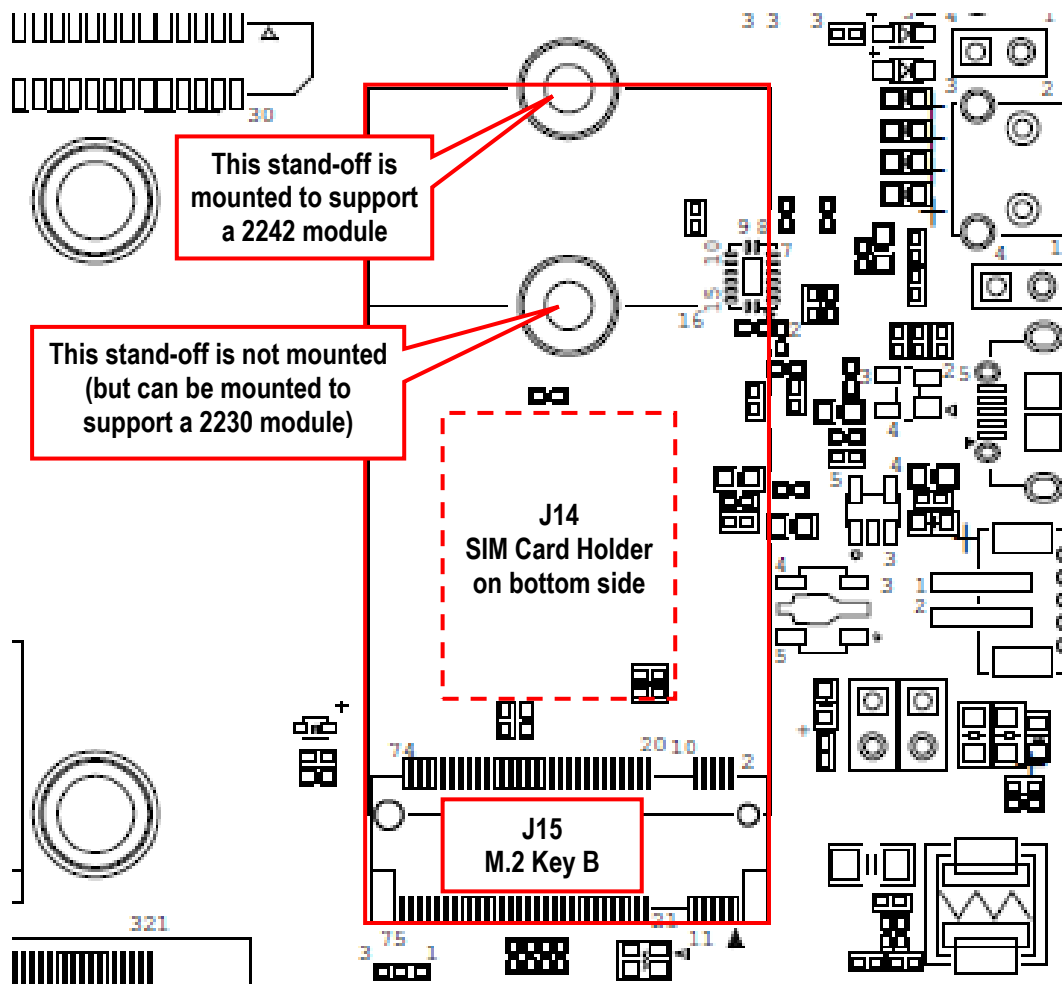

Figure 14 – COM Carrier Board, M.2 Key B Interface Connector

The M.2 Key B connector, J15, is MDT420B03001 from Amphenol.

The SIM card holder, J14, is 788000001 from Molex.

3.9 UART-to-USB Bridge Interface

EACOM boards have three UART interfaces (that are defined - an i.MX SoC can have several more UARTs). The *COM Carrier Board* has a dual channel UART-to-USB bridge, meaning that two of the three UART interfaces can be connected to a PC via USB:

- USB-to-UART channel#1 is typically used for the Linux console, i.e., the Cortex-A processor.
- For EACOM boards based on Heterogenous Multi-Processor i.MX SoCs, USB-to-UART channel#2 is typically used as console for the Cortex-M processor.

With jumpers J19/J20 it is possible to select between using UART-A or UART-C as console for the Cortex-A side. With jumpers J17/J18 it is possible to select between using UART-B or UART-C as console for the Cortex-M side. Note that jumpers J17/J18 are not inserted by default.

Note that UART channel B is also connected to the M.2 Key E connector and is typically used there to communicate with the Bluetooth interface. These interfaces cannot be used simultaneous.

Also note that all UART channels are available on the expansion connectors. Make sure there is no contention between used UART channels. Open jumpers J17/J18 and/or J19/J20 is needed to disconnect the UART-to-USB bridge from the UART channels.

Figure 15 illustrates the location of the micro-B USB connector, J16, for the USB-to-UART bridge and jumpers J17-J20 to control UART connections.

**J18, J17, J19, J20
Left to right**

**J19, J20
Upper position: connect UART-A to Cortex-A console
Lower position: connect UART-C to Cortex-A console**

**J18, J17
Upper position: connect UART-B to Cortex-M console
Lower position: connect UART-C to Cortex-M console**
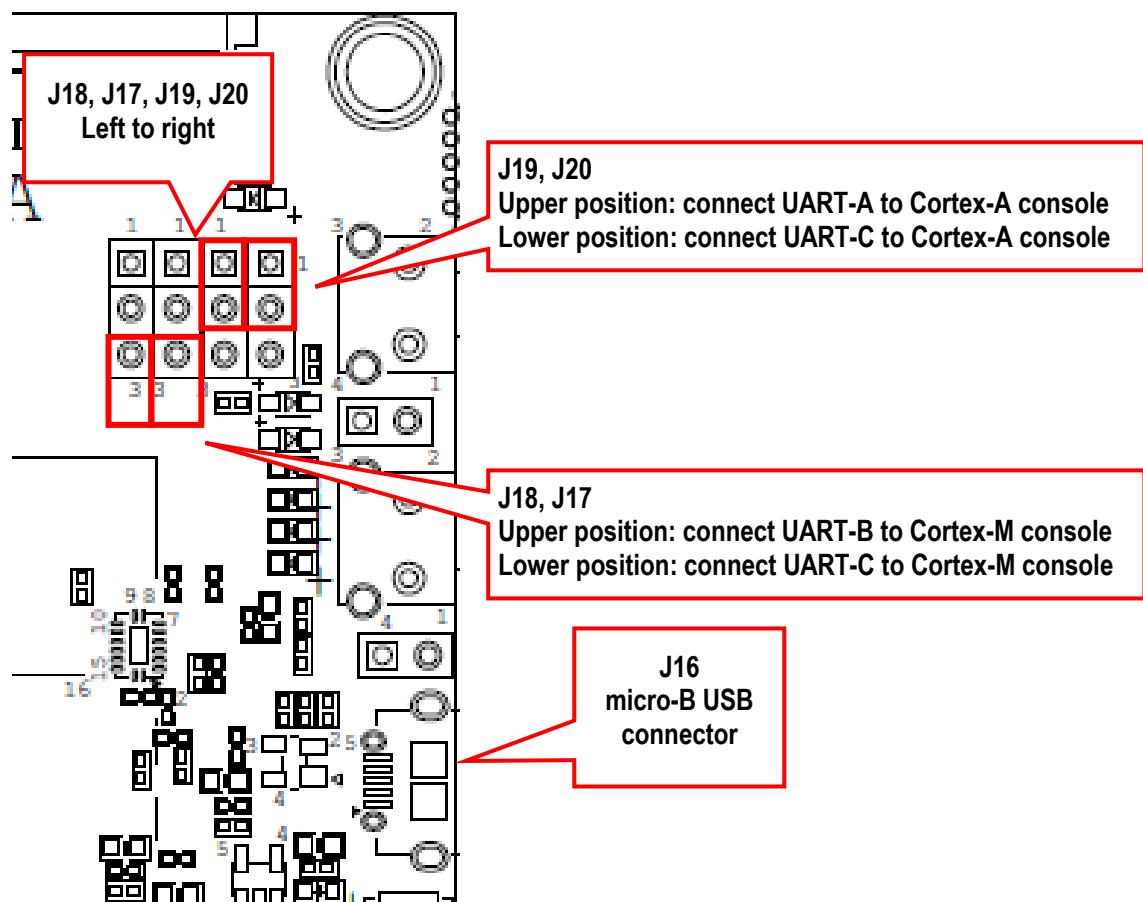
**J16
micro-B USB
connector**

Figure 15 – COM Carrier Board, UART Interface Connectors

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

The design around the M.2 Key E connector, J30, has focus on flexibility and debug friendliness. The M.2 Key E interface has both SDIO and PCIe interfaces defined, and both are implemented. M.2 Key E modules mainly implements Wi-Fi/BT modules. The connector supports 2230 and 3030 M.2 modules.

Page 11 in the schematic gives an overview picture of the design around the M.2 connector and the following sub-sections will describe the different parts.

The pinning for the non-standard debug channels has been developed in cooperation with Murata and Cypress. There are several advanced and unique features of the *COM Carrier Board* that has been added to be able to do professional evaluation/benchmarking and also debugging.

The picture below illustrates the different connectors and jumpers located on the lower left corner of the *COM Carrier Board*.

Indicator LEDs for status and control signals.
Top-to-bottom:
LED19, LED20,
LED18, LED16,
LED14, LED15,
LED13, LED12,
LED22, LED23

J36, isolation jumpers for Bluetooth UART and control signals.

FTDI cable connectors,
Left to right:
J29: BT UART
J26: WL Debug
J23: BT Debug

Wi-Fi/BT module JTAG connector, J28

Location where M.2 module is mounted

Murata WiFi/BT solutions

VBAT Current Measurement, J24
Default: 1-2 pos.
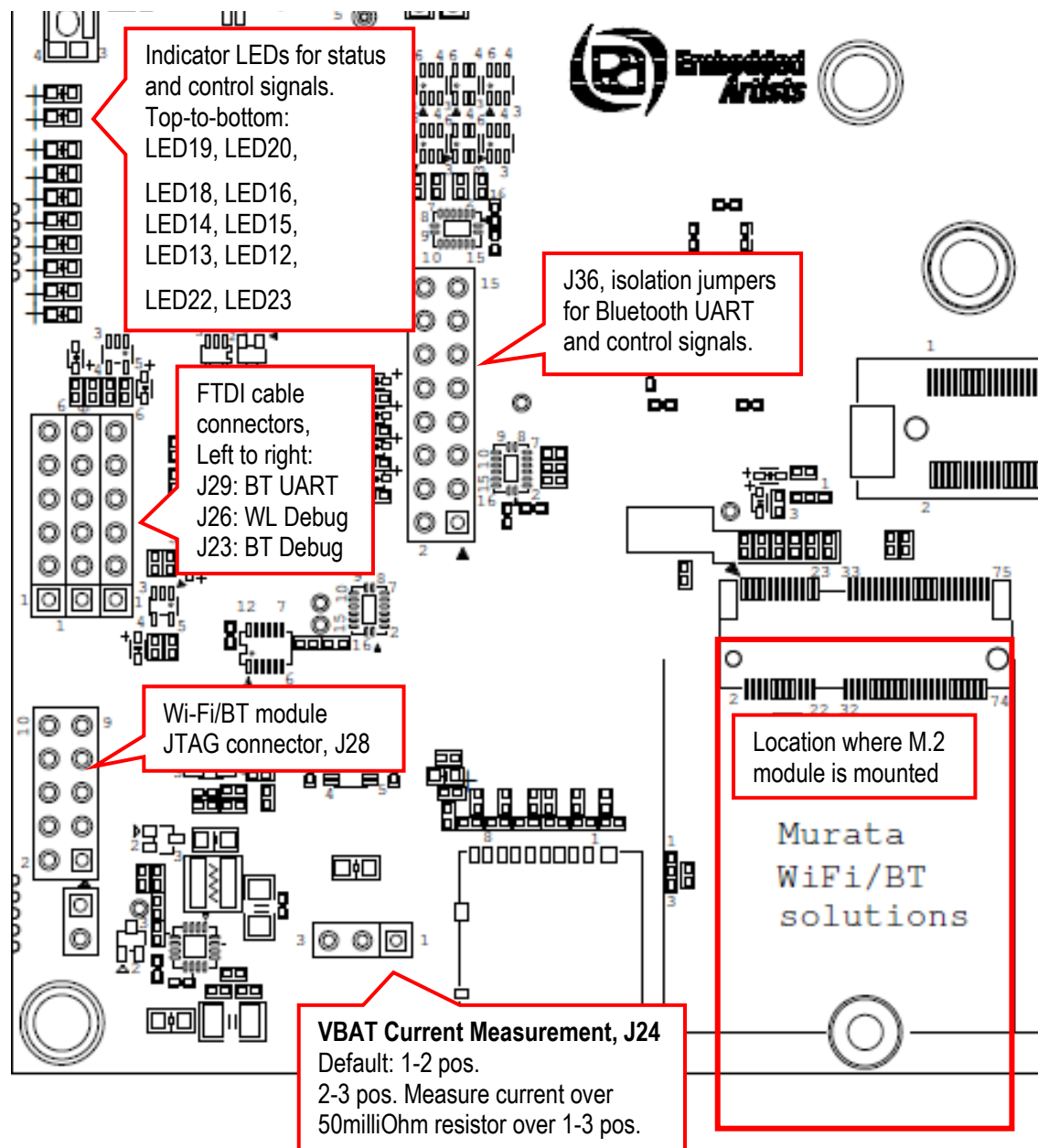2-3 pos. Measure current over 50milliOhm resistor over 1-3 pos.

Figure 16 – COM Carrier Board, M.2 Interface with Advanced Debug Features

3.10.1   VBAT 3.3V or 3.6V

There is a 3.3-3.6V / 3A VBAT power supply that is dedicated to the M.2 Key E interface. Signal PERI_PWR_EN controls the power supply. It is possible to set VBAT to either 3.3V or 3.6V during run time. This is controlled via an I2C mapped GPIO, named VBAT_VSEL. 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 the added performance.

3.10.2   VBAT Current Measurement

It is possible to measure the VBAT current to the M.2 module exactly.

- Option #1, lift the short jumper (in 1-2 position) and use an external current meter to measure the current exactly, with the resolution possible with the selected meter.
  Note: make sure the current meter does not add a voltage drop more than 50-100mV maximum.
- Option #2, move the short jumper to position 2-3. This will add a 50 milliOhm series resistor and it is possible to measure the voltage over this series resistor on pos 1 and 3.

Do not forget to move the short jumper back to position 1-2 after a measurement session.

3.10.3   Support for 3.3V IO logic level

The M.2 standard defines the IO voltage logic levels to a mixture of 1.8V and 3.3V. It is possible to set the 1.8V logic signals to 3.3V logic level during run time. This is controlled via a I2C mapped GPIO, named VDDIO_VSEL. This 1.8 or 3.3V / 350mA VDDIO voltage is generated from VBAT.

Note that before doing changing VDDIO to 3.3V (for all signals) make sure the M.2 module used supports this feature. Not all of them do this.

Also note that this control only affects the controls signals that have 1.8V logic level, not the SDIO bus. The SDIO bus voltage level is controlled via other means (some EACOM modules can control this in run-time, some have it fixed to 3.3V). It is however a requirement to set VDDIO to 3.3V if the SDIO bus shall run at 3.3V.

3.10.4   SDIO Interface

The primary 4-bit SD interface of the EACOM board is connected to the SDIO interface of the M.2 connector, J30.

Note that the M.2 interface standard dictates 1.8V SDIO voltage signaling. Some, but not all, EACOM boards support this. For the ones that do not, there is an option (see above) to set the voltage level to 3.3V instead. This only works if the connected M.2 module also supports 3.3V SDIO voltage.

3.10.5   PCIe Interface

EACOM boards have a PCIe interface defined and this is connected to the PCIe interface of the M.2 connector, J30.

PCIe clocking has two modes (controlled in run-time with I2C mapped GPIO, named PCIE_CLK_MUX_CTRL):

- Generate the 100 MHz reference clock on the EACOM board and just route it to the M.2 connector.
  This is the solution for iMX6 SoloX/DualLite/Dual/Quad and 7 Dual (u)COM boards.
- Generate two copies of the 100 MHz reference clock on the COM Carrier Board. Route on of the clocks to the EACOM board and one to the M.2 connector.
  This is the solution for iMX8M/M-Mini (u)COM boards.

3.10.6   Bluetooth UART Interception

It is possible to intercept/overtake the Bluetooth UART communication via connector J29. Insert a UART-to-USB bridge cable from FTDI (TTL-232R-3V3) into J29 and use a PC application to communicate directly with the Bluetooth part of the M.2 module.

Cypress has a tool called CyBluetool that can be used to debug Bluetooth communication problems. The program and instructions on how to use it can be downloaded here:
https://community.cypress.com/docs/DOC-16475

3.10.7   Dual UART Debug Channels and JTAG

In a cooperation with Murata, Cypress and Embedded Artists a number of pins on the M.2 connector have been defines to carry UART debug channels as well as JTAG signals to the chipset on the M.2 module. Note that not all M.2 modules support all debug channels.

Connector J26 carry the Wi-Fi UART debug channel. Connect a UART-to-USB bridge cable from FTDI (TTL-232R-3V3) into J26 and use a PC terminal application to get access to the debug interface.

Connector J23 carry the Bluetooth UART debug channel. Connect a UART-to-USB bridge cable from FTDI (TTL-232R-3V3) into J26 and use a PC terminal application to get access to the debug interface.

J28 is a JTAG debug interface to the chipset on the M.2 module.

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

3.10.8   Audio Codec Multiplexing

Audio interface routing between i.MX processor on EACOM board, M.2 module and audio codec are three corners in an imaginary triangle. With multiplexing, any corner can connect to any other corner. The three options are listed below. Control is done in run time with two I2C mapped GPIOs, named AUDIO_CODEC_MUX_CTRL1 and AUDIO_CODEC_MUX_CTRL2.

- Option #1, connect M.2 module audio interface to audio codec on COM Carrier Board
- Option #2, connect M.2 module audio interface to i.MX processor on the EACOM board
- Option #3, connect audio interface from i.MX processor (on the EACOM board) to audio codec on COM Carrier Board. This is the default when no M.2 module is used.

3.11   I2C Connected User LEDs and Push-button

There are some spare pins on the I2C mapped GPIO expander used to control the M.2 Key E connector, J30. These spare pins have been used to connect two user controlled LEDs (LED19/LED20) and one push-button (SW4) input. Note that the I2C mapped GPIO expander is not connected to an interrupt so the push-button in put must be polled.

3.12 Real-Time Clock

There is an I2C Real-time Clock, PCF8523, with very low stand-by current. This serves as an alternative real-time lock implementation since several on-board EACOM solutions have quite high current consumption.

3.13 Serial Camera Interface

EACOM boards have one serial camera interface (MIPI CSI-2). The *COM Carrier Board* implements this interface with a 15 position, 1mm pitch FPC connector (J32). The FPC connector, J32, is 1-1734248-5 from TE Connectivity.

Two data lanes (besides the clock) are supported by the connector. Some EACOM boards support 4 data lanes. All four data lanes and clock signals can be accessed on test pads TP33-36,TP 38-39 and TP48-51 located on bottom side of the PCB under J32. Figure 17 illustrates the location of J32.
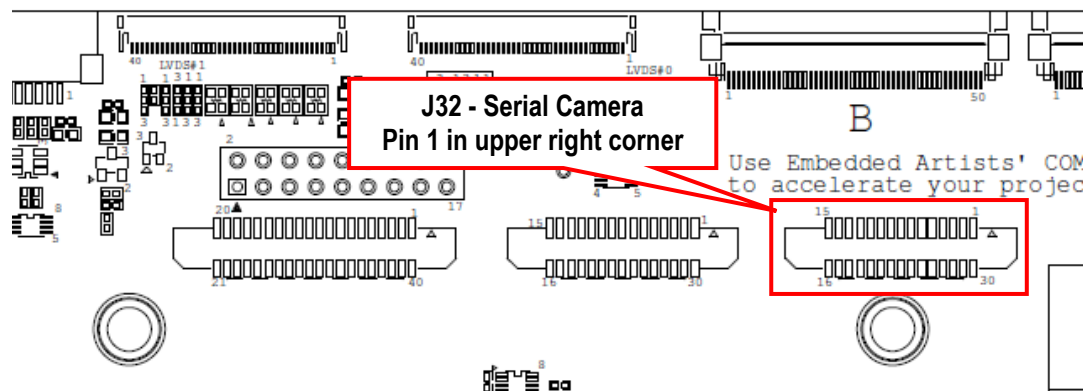
Figure 17 – COM Carrier Board, Serial Camera Interface Connector

The 15 position FPC connector (J32) is compatible with the RPi camera connector and has the following pinning:

J32 position	EACOM position	Signal
1		GND
2	S137/279	CSI_D0M
3	S138/281	CSI_D0P
4		GND
5	S134/273	CSI_D1M
6	S135/275	CSI_D1P
7		GND
8	S140/285	CSI_CLK0M
9	S141/287	CSI_CLK0P
10		GND
11	S113/231	SCAM_DATA, GPIO_AM
12	S112/229	SCAM_CLK, GPIO_AN
13	S47/93	SCAM_I2C_SCL, indirectly I2C-A_SCL

14	S46/91	SCAM_I2C_SDA, indirectly I2C-A_SDA
15		+3.3V, controlled by signal PERI_PWR_EN

3.14   Parallel Camera Interface

EACOM boards have one parallel camera interface with two different connectors:

- 20 position, 1mm pitch FPC connector (J34).
  The FPC connector, J32, is 2-1734248-0 from TE Connectivity.
- 18 position, 2.54mm pitch female pin header (J31).
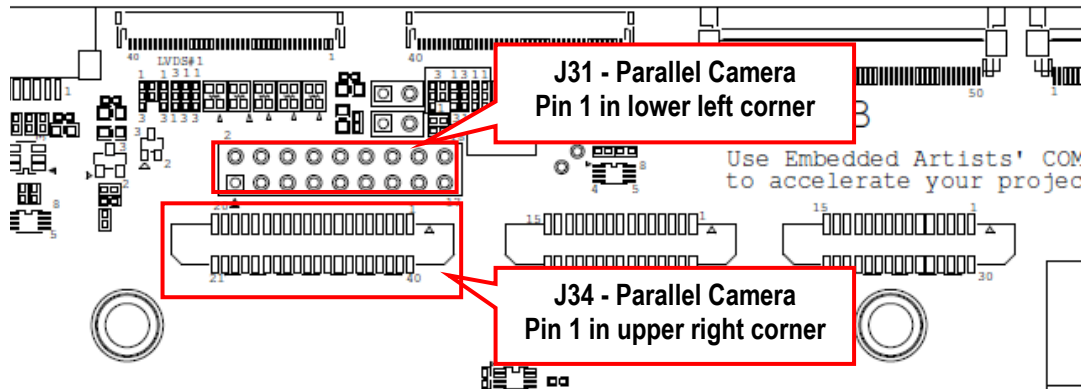
Figure 18 illustrates the location of J31 and J34.

Figure 18 – COM Carrier Board, Parallel Camera Interface Connectors

The different iMX6/7/8 SoC typically supports many different input formats on the parallel camera interface. See the reference manual for the specific SoC used on the EACOM board for details.

The connectors have the following pinning:

J34 position	J31 position	EACOM position	Signal
1	2		GND
2	9	S126/257	CSI_DATA7
3	10	S125/255	CSI_DATA6
4	11	S124/253	CSI_DATA5
5	12	S123/251	CSI_DATA4
6	13	S122/249	CSI_DATA3
7	14	S121/247	CSI_DATA2
8	15	S120/245	CSI_DATA1
9	16	S119/243	CSI_DATA0
10	2		GND
11	7	S117/239	CSI_PIXCLK
12	8	S116/237	CSI_MCLK
13	5	S115/235	CSI_VSYNC

14	6	S114/233	CSI_HSYNC
15	2		GND
16	17	P143/294	RESET_OUT
17	3	S47/93	PCAM_I2C_SCL, indirectly I2C-A_SCL
18	4	S46/91	PCAM_I2C_SDA, indirectly I2C-A_SDA
19	1		+3.3V, controlled by signal PERI_PWR_EN
20	1		+3.3V, controlled by signal PERI_PWR_EN

3.15 High Speed Serial: Serial Display (MIPI-DSI) or VADC Interface

EACOM boards have type specific pins that are not dedicated to a specific interface, but rather to iMX SoC type specific interfaces. The *COM Carrier Board* implements an interface for six (serial) high-speed signals with a 15 position, 1mm pitch FPC connector (J33). The FPC connector, J33, is 1-1734248-5 from TE Connectivity. Figure 19 illustrates the location of J33.

This connector typically carries MIPI-DSI signals from the EACOM boards that supports this interface. EACOM boards that do not support the interface can use these pins for other signals. The iMX6 SoloX COM board, for example, use these signals for Video ADC inputs.
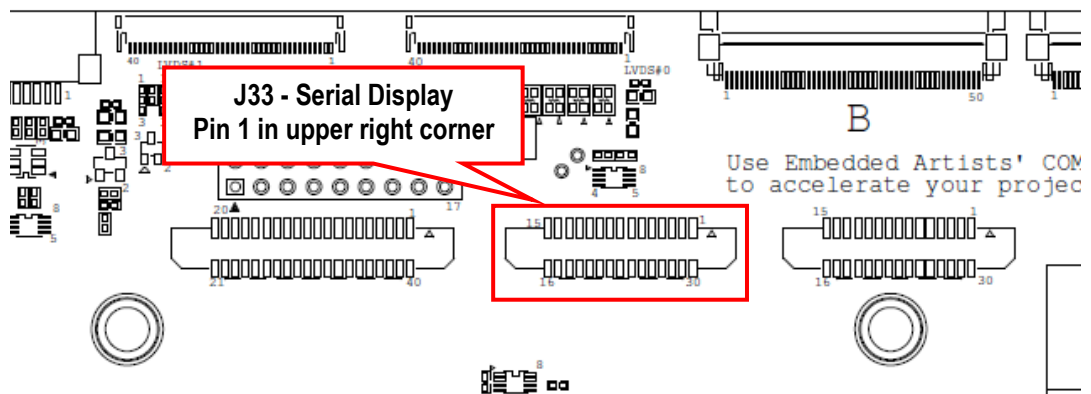

Figure 19 – COM Carrier Board, Serial Display (DSI/MIPI) Interface Connector

The 15 position FPC connector (J33) has the following pinning:

J33 position	EACOM position	Signal
1		GND
2	S96/197	Type specific, DSI_DN1 / ADC1_IN1 **Note: There is a long stub on signal ADC1_IN1-MIPI_DSI_DN1 between J33 and expansion connector J44. R246 can be removed (to remove this stub) if signal integrity is a problem.**
3	S97/199	Type specific, DSI_DP1 / ADC1_IN0 **Note: There is a long stub on signal ADC1_IN0-MIPI_DSI_DP1 between J33 and expansion connector J44. R247 can be removed (to remove this stub) if**

		signal integrity is a problem.
4		GND
5	S102/209	Type specific, DSI_CN / VADC_IN1
6	S103/211	Type specific, DSI_CP / VADC_IN0
7		GND
8	S99/203	Type specific, DSI_DN0 / VADC_IN3
9	S100/205	Type specific, DSI_DP0 / VADC_IN2
10		GND
11		Not connected
12		Not connected
13		GND
14		+3.3V, controlled by signal PERI_PWR_EN
15		+3.3V, controlled by signal PERI_PWR_EN

3.16 LVDS Interfaces

EACOM boards have two LVDS interfaces. The *COM Carrier Board* implements these two interfaces via connectors J35 and J66. The pinning of these connectors matches the New Haven display NHD-10.1-1024600AF-LSXV-CTP, a 10.1 inch 1024x600px resolution LVDS display that is readily available. Note that even though the pinning is for a specific display, the connector can be used to connect to any other LVDS display via an adapter. All needed LVDS and control signals are available via the connectors.

The new Haven display also has a capacitive touch panel, accessible via a 6 pos, 1 mm pitch PFC. Connector J37 matches LVDS connector #0, J35 and connector J70 matches LVDS connector #1, J66. Figure 20 illustrates the location of these four connectors. Note that J37 is location on the bottom side.
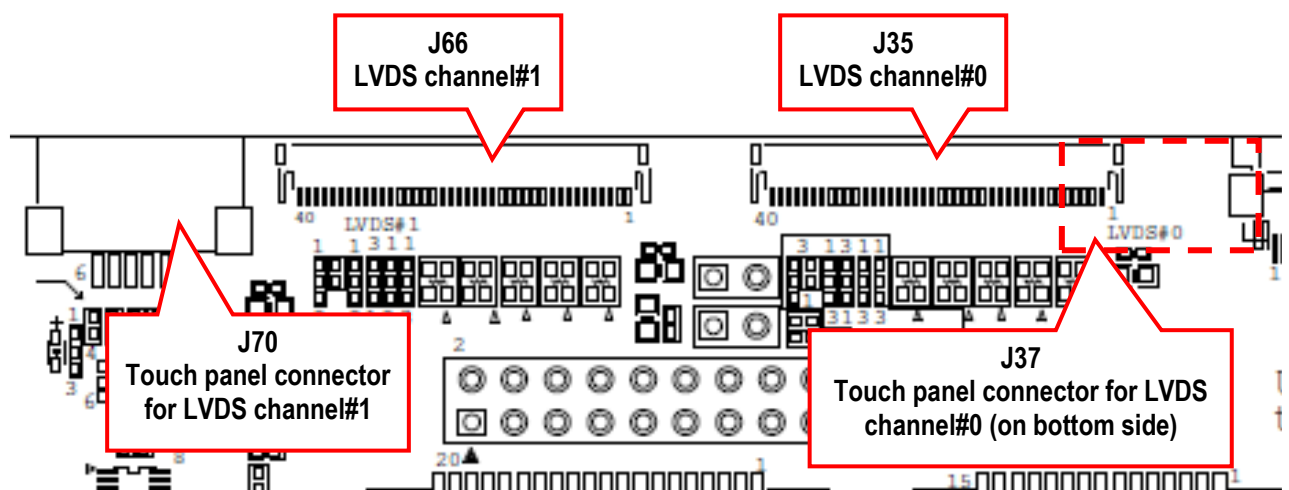

Figure 20 – COM Carrier Board, LVDS Interface Connectors

LVDS interface connectors , J35 and J66, are XF2W-4015-1A from Omron.

Touch panel connector with bottom side contacts, J37, is 0522710679 from Molex.
Touch panel connector with top side contacts, J70, is 0522070660 from Molex.

The picture below illustrates how to connect the New Haven display (NHD-10.1-1024600AF-LSXV-CTP). Note that a 40-pos, 125 mm/5 inch, 0.5 mm pitch flat cable is needed.
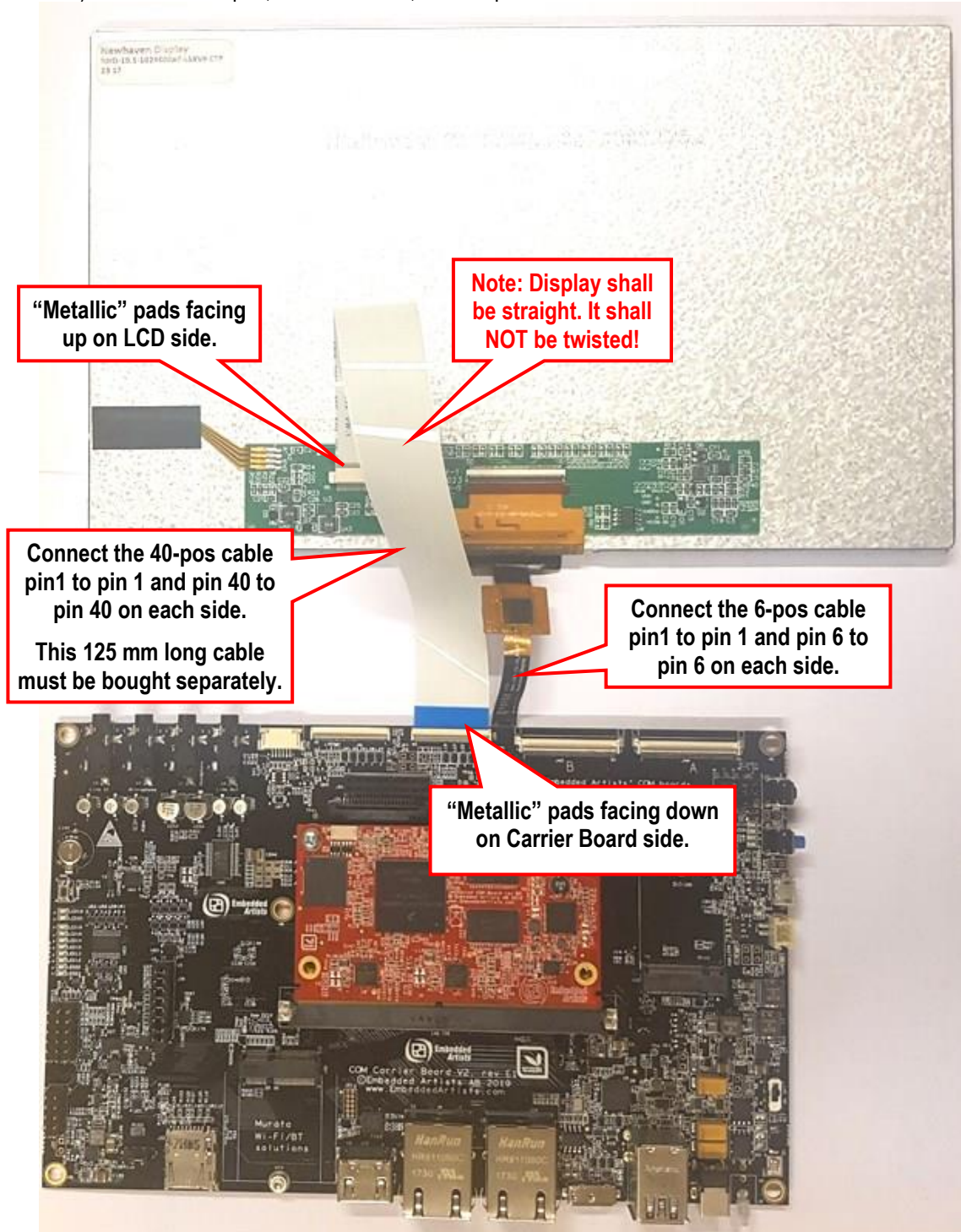
Figure 21 – COM Carrier Board and New Haven LVDS Display Connected

As seen, the display is facing down when the cables have been connected. With a simple 3D-printed structure it is possible to create a tray for the display to be placed in as illustrated in the picture below.

Figure 22 – COM Carrier Board and Display Mounted on 3D Printed Stand

To make the display align horizontally with the COM Carrier Board, the flat cable must absorb the horizontal misalignment as shown in the picture below.

Figure 23 – Horizontal Alignment of COM Carrier Board and New Haven LVDS Display

3.17   Parallel (RGB) Display Interface

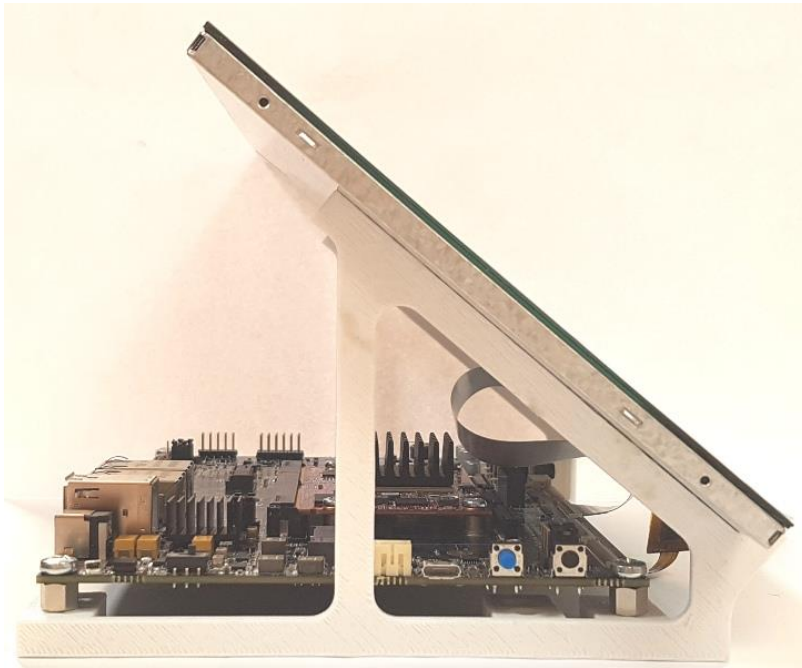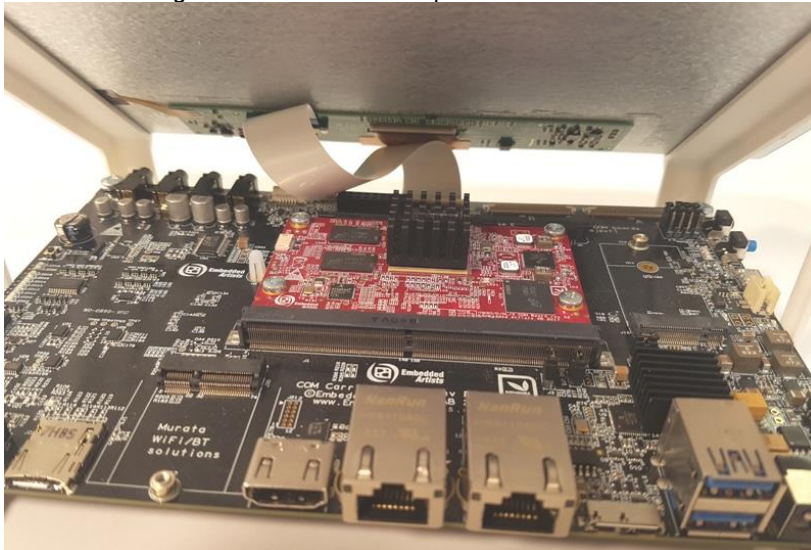EACOM boards have one 24-bit parallel (RGB) display interface that is made available, via buffers, on J39. Figure 24 illustrates the location of the 50 position FPC connector (J39) on the bottom side of the board, right under the EACOM board location.
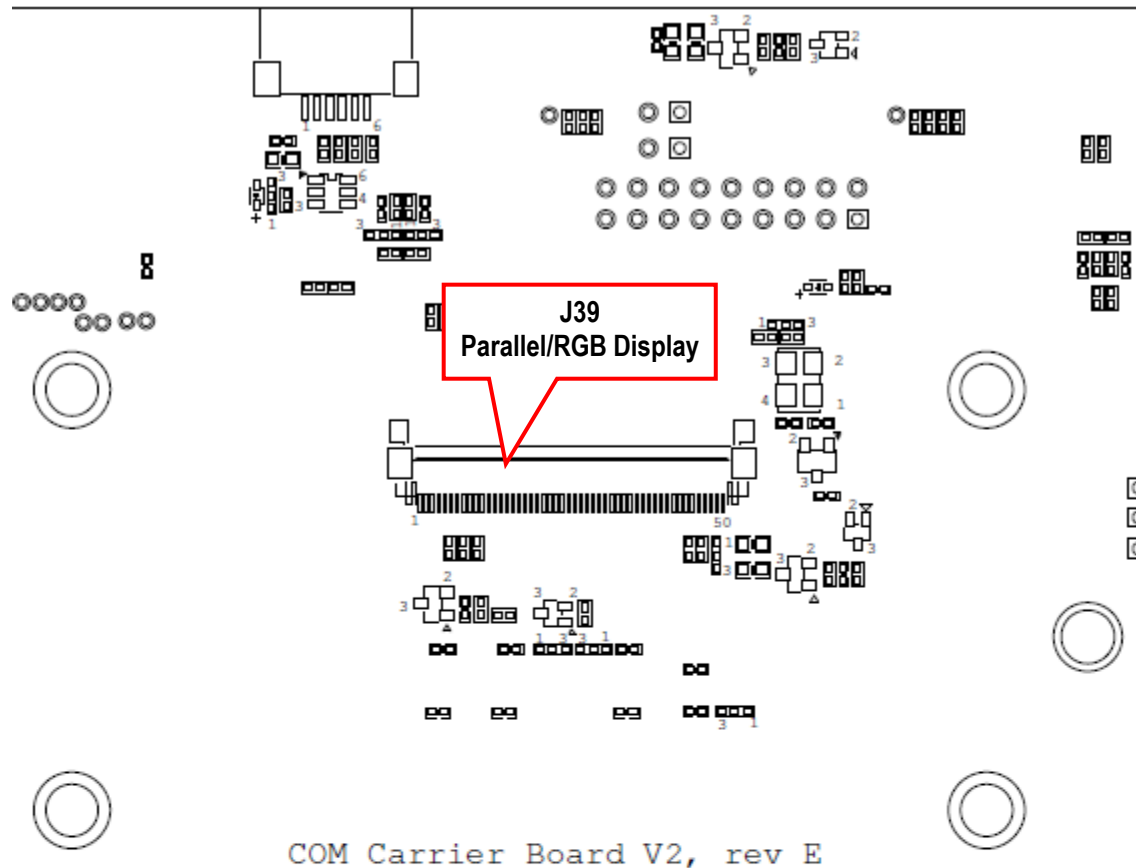
Figure 24 – COM Carrier Board, Parallel (RGB) Display Interface Connector

The 50 position FPC connector (J39) has all 24 bits available. It has the following pinning:

J39 position	EACOM position	Signal
1, 2	Indirectly S55/109	Backlight power supply, +5V, controlled by signal BL_PWR_EN
3	S56/111	Backlight contrast control, controlled by signal BL_CONTRAST_PWM
4,5		Ground for backlight power supply
6	S83/171	LCD pixel clock signal
7		GND
8	S87/179	LCD data enable signal (DEN)
9	S86/177	LCD vertical sync signal (VS), also called frame sync
10	S85/175	LCD horizontal sync signal (HS), also called line sync
11		GND
12	S82/169	LCD data signal, Blue7 (MSB)
13	S81/167	LCD data signal, Blue6

14	S80/165	LCD data signal, Blue5
15		GND
16	S79/163	LCD data signal, Blue4
17	S78/161	LCD data signal, Blue3
18	S77/159	LCD data signal, Blue2
19		GND
20	S76/157	LCD data signal, Blue1
21	S75/149	LCD data signal, Blue0 (LSB)
22	S73/145	LCD data signal, Green7 (MSB)
23		GND
24	S72/143	LCD data signal, Green6
25	S71/141	LCD data signal, Green5
26	S70/139	LCD data signal, Green4
27		GND
28	S69/137	LCD data signal, Green3
29	S68/135	LCD data signal, Green2
30	S67/133	LCD data signal, Green1
31		GND
32	S66/131	LCD data signal, Green0 (LSB)
33	S65/129	LCD data signal, Red7 (MSB)
34	S64/127	LCD data signal, Red6
35		GND
36	S63/125	LCD data signal, Red5
37	S62/123	LCD data signal, Red4
38	S61/121	LCD data signal, Red3
39		GND
40	S60/119	LCD data signal, Red2
41	S59/117	LCD data signal, Red1
42	S58/115	LCD data signal, Red0 (LSB)
43		GND
44	S47/93	LCD_I2C_SCL, indirectly I2C-A_SCL
45	S46/91	LCD_I2C_SDA, indirectly I2C-A_SDA
46		+3.3V, controlled by signal PERI_PWR_EN
47	S52/103	TP_RST-GPIO
48	S122/249	CSI_DATA03-TP_IRQ_LCD
49,50	indirectly S54/107	+3.3V power supply to LCD, controlled by signal DISP_PWR_EN

Because of portability, the *EACOM Board specification* defines a 24-bit parallel LCD interface. Even though only 16 or 18 bits are used, the LCD interface shall be setup for 24-bit mode. The lower bits (in each color) that are not used are just discarded.

Due to EMI consideration, it is recommended not to run the parallel (RGB) display interface at too high pixel clock rate. Having many signals in parallel that switch as high clock rate will generate a considerable amount of EMI. LVDS and HDMI are better interface choices for high resolution displays.

Parallel RGB display interface connector, J39, is XF2W-5015-1A from Omron.

3.18   Audio Codec

EACOM boards have one (pin-defined) digital audio interface. The *COM Carrier Board* implements this interface via an audio codec, WM8731. The Line out, Headphone out, Line in and Microphone interfaces are supported via 3.5mm stereo phone jacks. Figure 25 illustrates the location and order of the connectors, J40-J43.

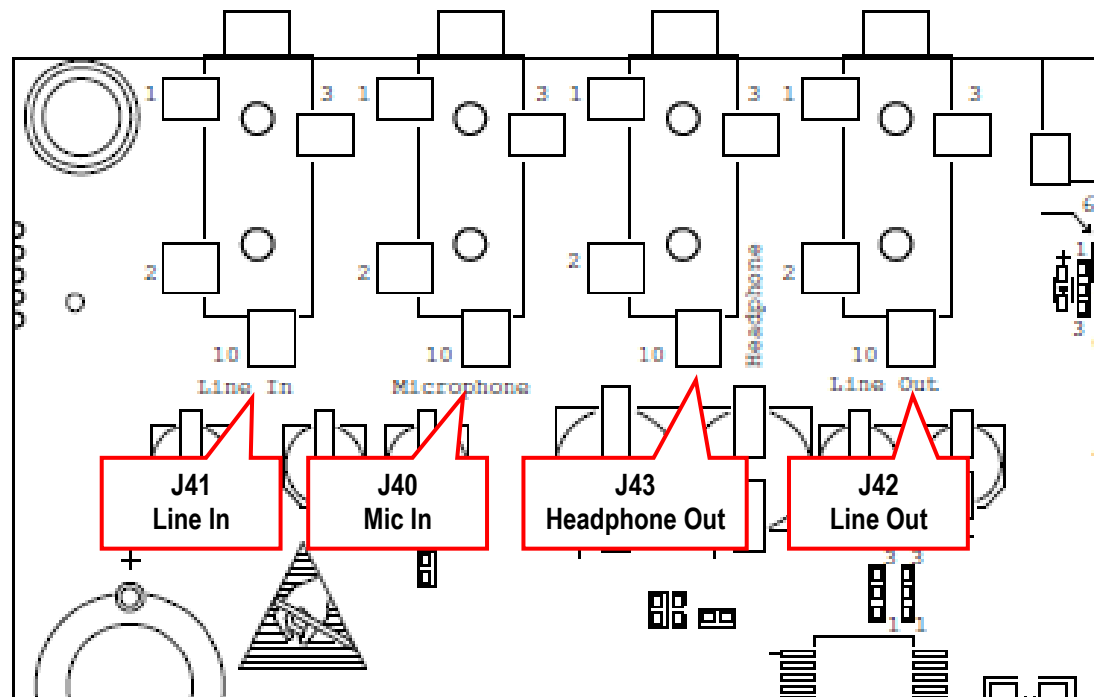

Figure 25 – COM Carrier Board, Audio Interface Connectors

The digital interface (EACOM signals) to the audio codec use the following signals:

EACOM pin	EACOM Signal
S5/9	AUD_RXD
S7/13	AUD_TXD
S6/11	AUD_TXC
S4/7	AUD_TXFS
S8/15	AUD_MCLK
S47/93	AUD_I2C_SCL, indirectly I2C-A_SCL
S46/91	AUD_I2C_SDA, indirectly I2C-A_SDA

Note that EACOM specifies a digital audio interface that runs with **synchronous** transmit and receive sections (meaning that transmit and receive share the clock and frame synchronization signals). The audio codec is I2S master meaning that the codec generates bit clock and frame synchronization signals. The MCLK clock is generated on the EACOM board side.

The 3.5mm (1/8", mini plug) stereo phone jacks, J40-J43, are SJ-3524-SMT from CUI Inc.

3.19 Boot Control

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

Two signals controls the booting source/process of the (u)COM boards; BOOT_CTRL and ISP_ENABLE, see table below:

Boot source	BOOT_CTRL Controlled by J27	ISP_ENABLE Controlled by J2
Boot from on-board eMMC, typical default boot mode without having to program OTP fuses	LOW (grounded) J27 shorted	Floating J2 open
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.	Floating J27 open	Floating J2 open
USB OTG 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 J27 do not care	LOW (grounded) J2 shorted

Note that J27 only exist on COM Carrier Board rev E, or later. On earlier COM Carrier boards, signal BOOT_CTRL is always grounded (J27 shorted).

J27 - controls BOOT_CTRL
Short to enable default boot from eMMC (without OTP fuses programmed)

Open to enable boot from OTP fuses

J2 - controls ISP_ENABLE
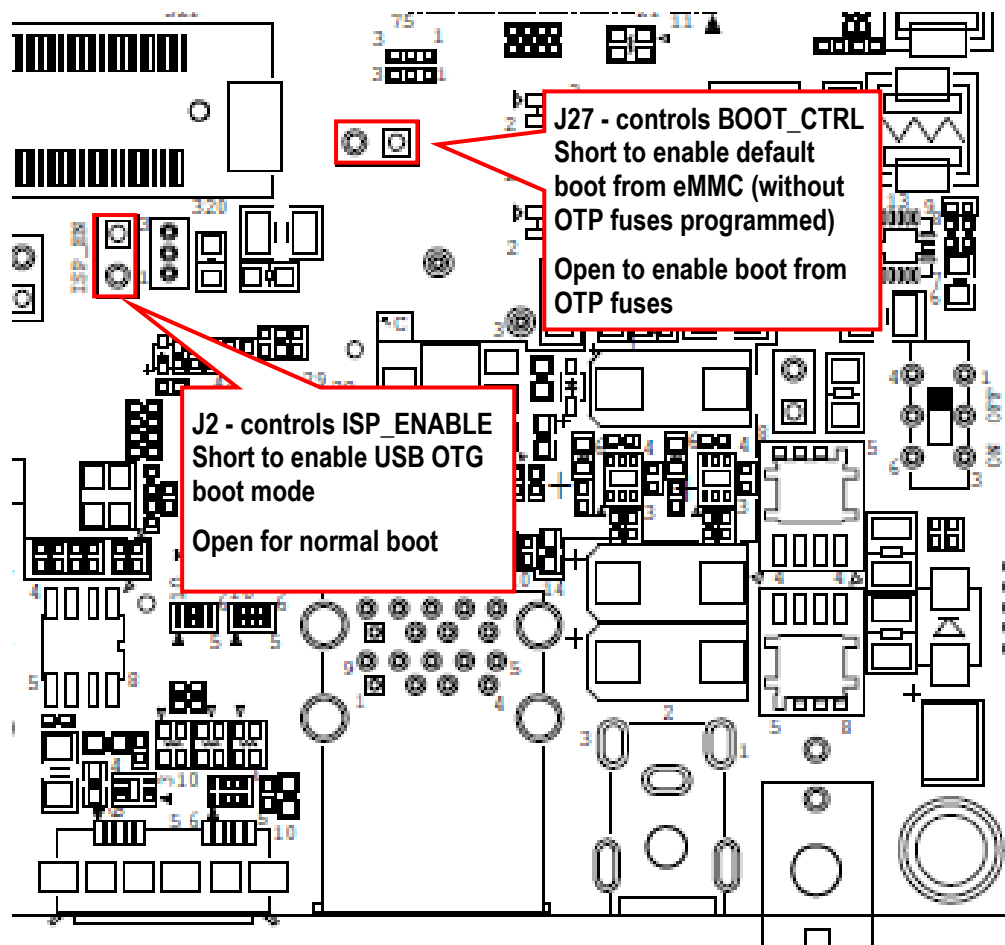Short to enable USB OTG boot mode

Open for normal boot

Figure 26 – COM Carrier Board rev E/E1, Boot Control Jumpers

3.20 Expansion Connectors

See chapter 4 for more information about expansion.

4 Expansion Board with Expansion Possibilities

4.1 Expansion Board

There is an associated expansion board that can be used for initial testing and prototyping. This expansion board has the following features:

- Matrix of access pads for all expansion connector signals
- Arduino shield receptacle - for prototyping with Arduino shields
- Click module connector - for prototyping with Click modules
- Raspberry Pi expansion connector - for prototyping with RPi HATs
- XBee module compatible connector
- Dual CAN interfaces
- I2C temperature and light sensors
- Two LEDs

There are hundreds, if not thousands, of Arduino shields, Click modules and Raspberry Pi HATSs that can be used for prototyping and experimenting when evaluating the i.MX platform. The picture below illustrates the different connectors on the Expansion board:
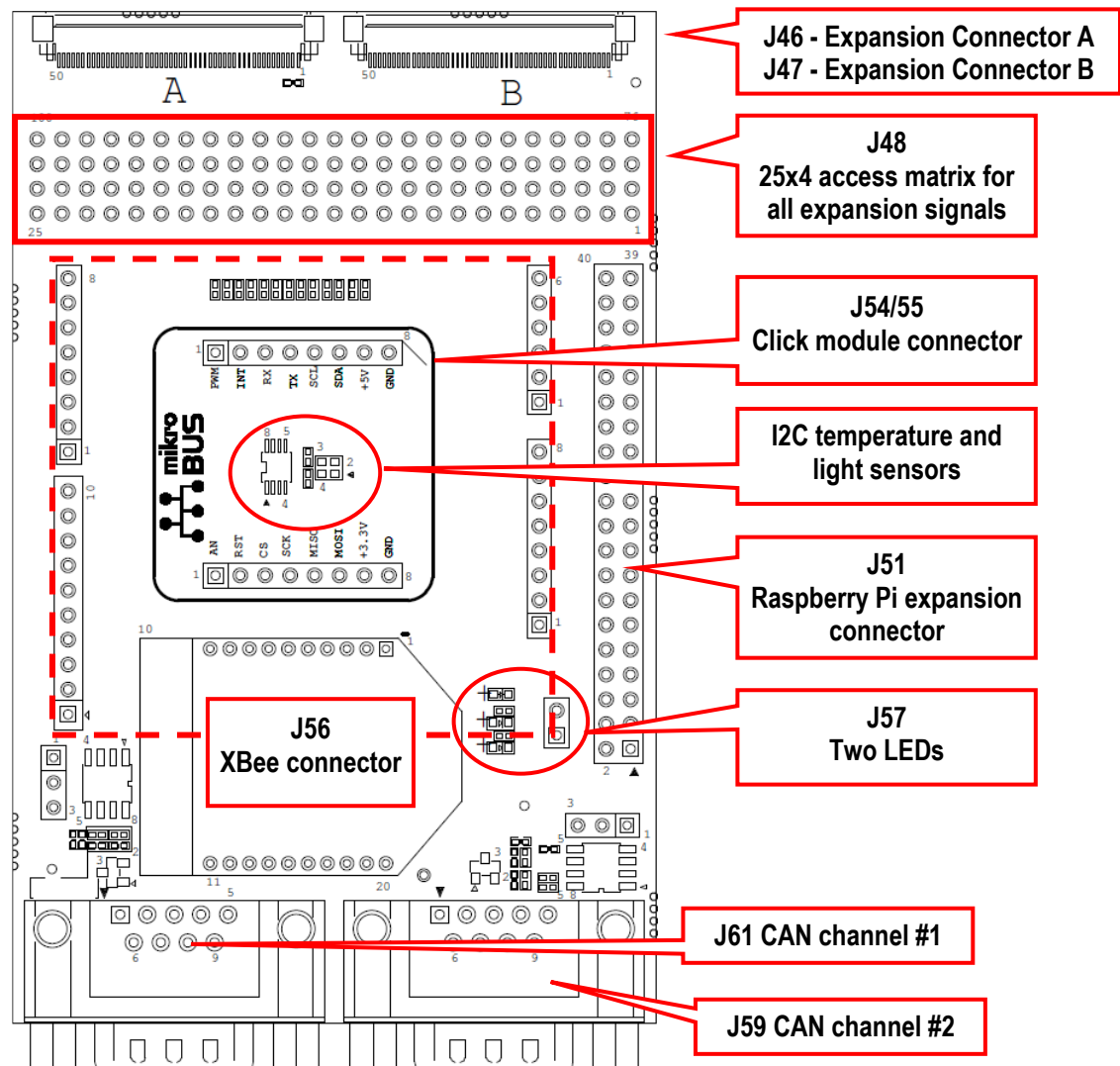

Figure 27 –Expansion Board

4.2   Expansion Connectors

There are two internal expansion connectors on the *COM Carrier Board*, see Figure 28 below for their location on the board. The expansion connectors are 50-position, 0.5mm pitch FPC connectors. They can be used to create customer add-on boards that implements customer specific interfaces. The UART, SPI and I2C interfaces are available as well as ADC inputs. Most type specific EACOM pins are also available.

Note that many of the signals on the expansion connectors has alternative functions also. They can be the EACOM-defined function but also for example GPIOs. See the COM board datasheet for details about alternative functions for each pin on the expansion connectors.

There is an accompanying Excel sheet where all signals related to the Expansion connectors and the Expansion board are listed for all EACOM boards.
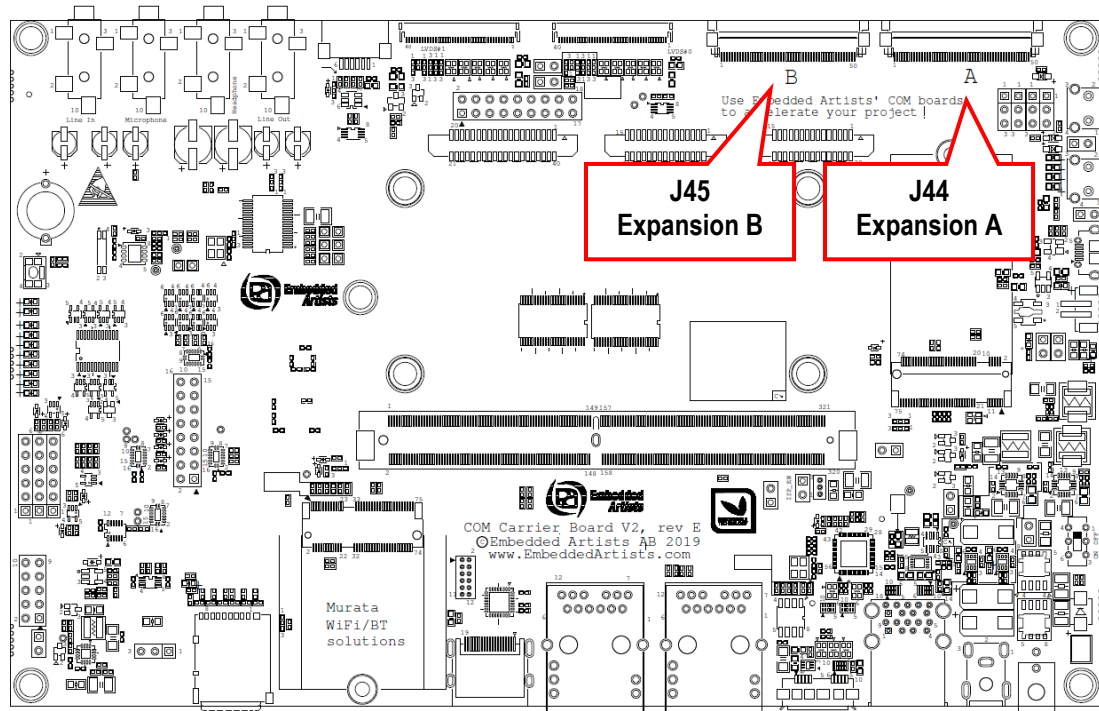
Figure 28 – COM Carrier Board, Expansion Connectors

The expansion connectors, J44 and J45, are XF2W-5015-1A from Omron. The 50 position flex cables with 0.5mm pitch are 50mm long and of type 0151660537 from Molex. The mating connectors on the expansion board, J46 and J47, are the same.

The picture below illustrates how the COM Carrier board and Expansion board are connected with two 50 pos flex cables. Note that the two connectors marked with the letter "A" are connected and the same for the two "B" connectors.
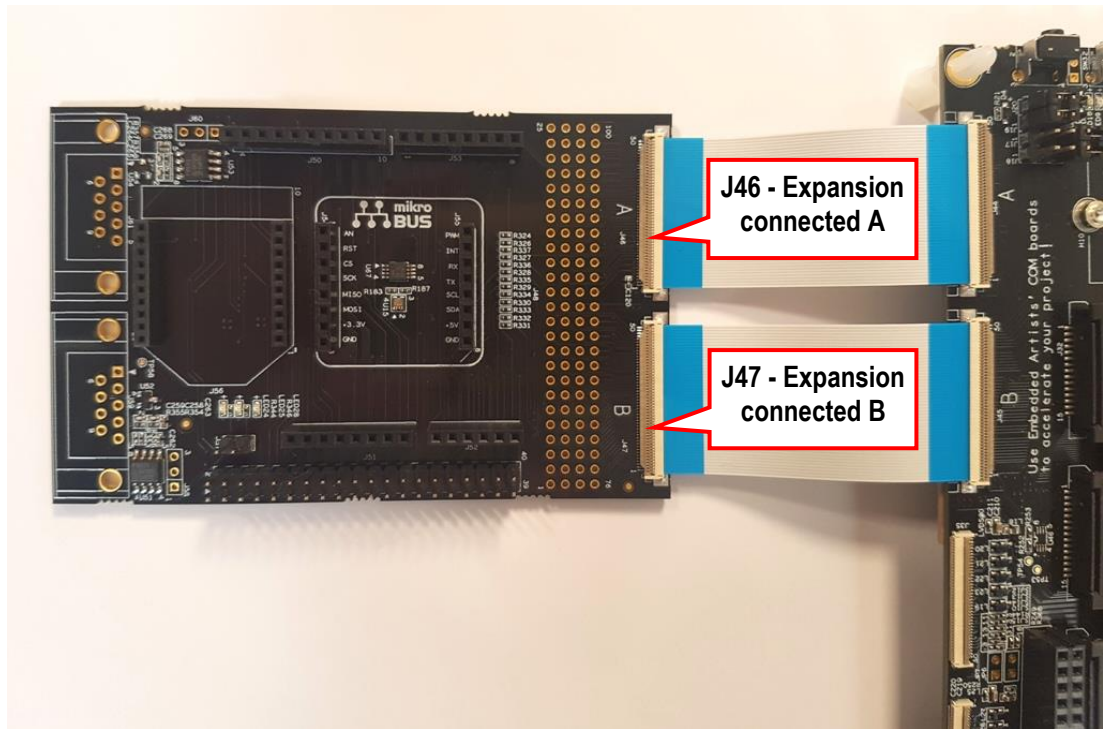
Figure 29 – COM Carrier Board and Expansion Board Connected

4.3   Break-Out Area with Access Pads

There is a break-out area on the Expansion board that gives easy access to the 2x50 signals in a 25x4, 100 mil pitch matrix.

4.4   I2C Temperature and Light Sensors

There are two sensors connected to the I2C-B channel. The sensors are:

- U67, LM75, which is a temperature sensor
- U15, LTR329, which is a light intensity sensor

4.5   LEDs

There are two LEDs (one red and one green) with 1.5Kohm series resistors that can be accessed via pin header J57. The LEDs can for example connect to a suitable GPIO on the access matrix and be used as indicator LEDs, controlled via software.

4.6 Arduino Shield Receptacle

J49/J50/J25/J53 implements an Arduino shield compatible connector.

Arduino Shield Signal	Connector Pin	EACOM Signal	Note
RX (D0)	J53, pin 8	UART-C _RXD	
TX (D1)	J53, pin 7	UART-C _TXD	
D2	J53, pin 6	GPIO_Y	
D3	J53, pin 5	GPIO_X	
D4	J53, pin 4	GPIO_W	
D5	J53, pin 3	GPIO_V	
D6	J53, pin 2	GPIO_U	
D7	J53, pin 1	GPIO_T	
D8	J50, pin 10	GPIO_S	
D9	J50, pin 9	GPIO_R	
D10	J50, pin 8	SPI-A_SSEL	
D11	J50, pin 7	SPI-A_MOSI	
D12	J50, pin 6	SPI-A_MISO	
D13	J50, pin 5	SPI-A_SCLK	
SDA	J50, pin 2	I2C-B_SDA	
SCL	J50, pin 1	I2C-B_SCL	
A0	J52, pin 1	ADC1_IN2-GPIO	**Note** that there are 10Kohm+10Kohm voltage dividers on all analog inputs (A0-A5) just to protect the EACOM boards that have a 1.8V maximum input voltage.
A1	J52, pin 2	ADC1_IN3-GPIO	
A2	J52, pin 3	ADC2_IN0-GPIO	
A3	J52, pin 4	ADC2_IN1-GPIO	
A4	J52, pin 5	ADC2_IN2-GPIO	
A5	J52, pin 6	ADC2_IN3-GPIO	

Note that the Arduino, Click and Raspberry Pi connectors share several signals. Use only one of these connectors at a time. Also note that all EACOM boards might not have available signals for all pins on the Arduino shield connector.

4.7   Click Module Connector

J54/J55 are two 1x8 pos, 100mil pitch headers (female) that implements a Click module connector.

Click Module Signal	Connector Pin	EACOM Signal	Note
AN	J54, pin 1	ADC1_IN2-GPIO	**Note** that there is a 10Kohm+10Kohm voltage dividers on this input to protect the EACOM boards that have a 1.8V maximum input voltage.
RST	J54, pin 2	GPIO_Q	
CS	J54, pin 3	SPI-A_SSEL	
SCK	J54, pin 4	SPI-A_SCLK	
MISO	J54, pin 5	SPI-A_MISO	
MOSI	J54, pin 6	SPI-A_MOSI	
PWM	J55, pin 1	GPIO_Z	
INT	J55, pin 2	GPIO_AA	
RX	J55, pin 3	UART-C_RXD	
TX	J55, pin 4	UART-C_TXD	
SCL	J55, pin 5	I2C-B_SCL	
SDA	J55, pin 6	I2C-B_SDA	

Note that the Arduino, Click and Raspberry Pi connectors share several signals. Use only one of these connectors at a time. Also note that all EACOM boards might not have available signals for all pins on the Click module connector.

4.8   Raspberry Pi Expansion Connector

J51 is a 2x20 pos, 100mil pitch pin header that implements a Raspberry Pi expansion connector.

RPi Signal	Connector Pin	EACOM Signal	Note
GPIO02/I2C-SDA1	J51, pin 3	I2C-B_SDA	
GPIO03/I2C-SCL1	J51, pin 5	I2C-B_SCL	
GPIO04/GPIO_GCLK	J51, pin 7	GPIO_R	
GPIO14/TXD0	J51, pin 8	UART-C_TXD	
GPIO15/RXD0	J51, pin 10	UART-C_RXD	
GPIO18	J51, pin 12	GPIO_T	
GPIO27	J51, pin 13	GPIO_U	
GPIO22	J51, pin 15	GPIO_V	
GPIO23	J51, pin 16	GPIO_W	
GPIO24	J51, pin 18	GPIO_X	

GPIO10/SPI_MOSI	J51, pin 19	SPI-A_MOSI
GPIO09/SPI_MISO	J51, pin 21	SPI-A_MISO
GPIO25	J51, pin 22	GPIO_Y
GPIO11/SPI_CLK	J51, pin 23	SPI-A_SCLK
GPIO08/SPI_CE0	J51, pin 24	SPI-A_SSEL
GPIO07/SPI_CE1	J51, pin 26	GPIO_Z
ID_SD/I2C-SDA2	J51, pin 27	I2C-C_SDA
ID_SC/I2C-SCL2	J51, pin 28	I2C-C_SCL
GPIO05	J51, pin 29	GPIO_AA
GPIO06	J51, pin 31	GPIO_AB
GPIO12	J51, pin 32	GPIO_AC
GPIO13	J51, pin 33	GPIO_AD
GPIO19	J51, pin 35	GPIO_AE
GPIO16	J51, pin 36	GPIO_AF
GPIO26	J51, pin 37	GPIO_AG
GPIO20	J51, pin 38	GPIO_AH
GPIO21	J51, pin 40	GPIO_AJ

Note that the Arduino, Click and Raspberry Pi connectors share several signals. Use only one of these connectors at a time. Also note that all EACOM boards might not have available signals for all pins on the Raspberry Pi connector.

4.9   CAN Interfaces

Many EACOM boards have two CAN interfaces. The Expansion board implements these two interfaces with CAN transceivers. The two CAN channels are accessed via DSUB-9M (male) connectors (note, these are not mounted) or via a 3-pos 100mil pitch access pads.

The CAN transceivers have a standby mode that is controlled via access point TP58. A low level activates the transceivers and a high level place them in a standby/inactive mode.

4.10   XBee Module Compatible Interface

The Expansion board implements one XBee compatible interface that is connected to UART channel B and part of UART channel A (as GPIO signals). Note that UART channel B is also connected to the M.2 Key E connector and is typically used for UART communication with Bluetooth modules. These interfaces cannot be used simultaneous.

XBee Signal	XBee Connector Pin	EACOM Signal	Note
DIN	3	UART-B_TXD	UART-B used as UART channel with hardware flow control.
DOUT	2	UART-B _RXD	
CTS	12	UART-B _RTS	
RTS	16	UART-B _CTS	
CD	4	UART-A_RTS	Used as GPIO
DTR	9	UART-A_CTS	Used as GPIO
ON	13	GPIO_P	Used as GPIO
RESET	5	GPIO_Q	Used as GPIO

4.11   I2C Channel Isolation

I2C channel A has an isolation buffer (U42) that block unpowered devices on the *COM Carrier Board* from affecting/blocking I2C communication. This happens during every startup when the EACOM board is booting but the carrier board is still not enabled. Such buffers can also be needed on I2C channel B, depending on what is connected to these interfaces.

5 I2C Interfaces

EACOM specifies three I2C interfaces and these are available, and used, on the *COM Carrier Board*. Their usage is listed in the tables below.

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

I2C channel A	8-bit I2C address	7-bit I2C address	Max speed
Audio codec WM8731	0x34/0x35 (0.0.1.1.0.1.0.RW)	0x1A (0.0.1.1.0.1.0)	400 kHz
U43, PCF8523, Real-time Clock	0xD0/0xD1 (1.1.0.1.0.0.0.RW)	0x68 (1.1.0.1.0.0.0)	400 kHz
Serial Camera Interface on J20			
Parallel Camera Interface on J21			
Possible capacitive touch controller connected to J26			

I2C channel B	8-bit I2C address	7-bit I2C address	Max speed
LVDS0 interface on J23, EDID information			
LVDS0 interface on J23, touch controller			
I2C channel on HDMI connector, J10			
U15, LTR329, Light intensity sensor	0x52/0x53 (0.1.0.1.0.0.1.RW)	0x29 (0.1.0.1.0.0.1)	400 kHz
U67, LM75, temperature sensor	0x92/0x93 (1.0.0.1.0.0.1.RW)	0x49 (1.0.0.1.0.0.1)	400 kHz

I2C channel C	8-bit I2C address	7-bit I2C address	Max speed
LVDS1 interface on J24, EDID information			
LVDS1 interface on J24, touch controller			
I2C interface to PCIe interface on J18			

6 Using Multiple Display Interfaces

It is possible to use several of the display interfaces simultaneous. The first restriction is what the iMX SoC used on the EACOM board supports. The second restriction is what the *COM Carrier Board* supports in individual control of the different display interfaces. The table below lists the possible conflicts that can be caused by pin usage:

Signal(s)	RGB interface	LVDS0 interface	LVDS1 interface	HDMI interface
Display enable/pwr	DISP_PWR_EN	DISP_PWR_EN	GPIO_L	-
Backlight pwr	BL_PWR_EN	BL_PWR_EN	GPIO_M	-
Backlight contrast	BL_CONTRAST_PWM	PWM_1	PWM_1	-
I2C Touch ctrl	I2C-A	I2C-B	Not connected, can be I2C-C	I2C-B
Touch ctrl IRQ	CSI_DATA03	TP_IRQ	Not connected, can be I2C-C	-
I2C EDID	-	I2C-B	I2C-C	I2C-B

Possible contentions are:

- Signal DISP_PWR_EN controls both LVDS0 and RGB interfaces. LVDS0 has an option to have signal GPIO_G-LCD_DISPL_EN controlling the display enable/power signal.
- Signal BL_PWR_EN controls both LVDS0 and RGB interfaces.
- Signal PWM_1 controls both LVDS0, LVDS1 and RGB interfaces. LVDS1 has an option to have signal SPI-B_SSEL controlling the contrast.
- I2C channel B is used for both LVDS0 and HDMI interface. If the same I2C address are used on both interfaces there will be problem. This can happen if the LVDS display also has an EDID memory.

7 Technical Specification

7.1 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 J4/J4	-1	16	V
VBAT	VBAT connector, J8	-0.3	5.5	V
VIO	Vin/Vout (OVDD + 0.3)	-0.5	3.4	V

7.2 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	External rechargeable battery	3.0	4.2	5.5	V

7.3 Electrical Characteristics

For DC electrical characteristics, see EACOM board datasheet, used iMX SoC datasheets and individual component (used on the *COM Carrier Board*) datasheets.

It is possible to set the internal VDD operating point (OVDD) for the iMX SoC on some EACOM boards. It is typically in the region between 3.1-3.3V. OVDD affects absolute maximum VIO voltage.

7.4 Power Consumption

There are many factors that determine power consumption of the *COM Carrier Board* together with an EACOM 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, XBee 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.

7.5   Mechanical Dimensions

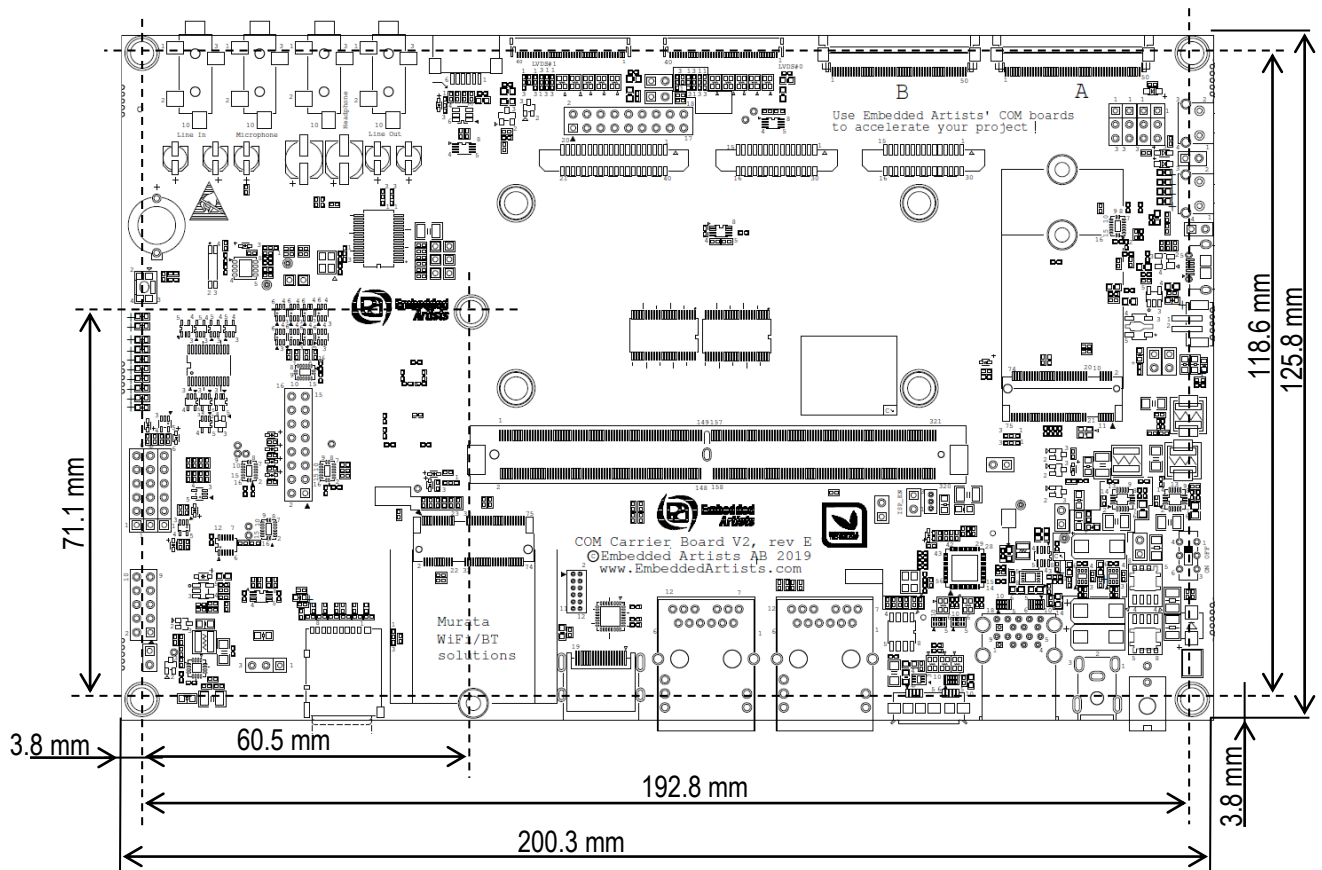| Dimension	Value (±0.5 mm)	Unit
Board width	200.3	mm
Board height (excluding components protruding the pcb edge)	125.8	mm
Maximum top side height	16	mm
Maximum bottom side height	3.5	mm
PCB thickness	1.6	mm
Mounting hole diameter (x5)	4.3	mm

Figure 30 –COM Carrier Board Mechanical Outline

7.5.1   Module Assembly Hardware

The *COM Carrier Board* has five 4.3 mm holes for mounting the board. There are also four M3 stand-offs for mounting the EACOM board. Use 5-8 mm M3 screws for this.

7.6 Environmental Specification

7.6.1 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 EACOM board and associated thermal management solution.

7.6.2 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	%

7.7 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, Conflict Minerals, REACH, etc.

8 Functional Verification and RMA

There are separate documents that present a number of functional tests that can be performed on the *COM Carrier Board* to verify correct operation on the different interfaces. There is one separate document for each EACOM board that the *COM 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 *COM 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 EACOM board and the *COM Carrier Board*. It is this combination that is tested. If an interface fail a test then it might not be possible to pin point the error to the EACOM board or to the *COM Carrier Board*, unless the EACOM board that is mounted on the *COM Carrier board* is replaced with another EACOM board. Either the failing interface follow the EACOM board or the *COM Carrier board* and that makes it possible to locate the possible error to a single board.

9 Things to Note

This chapter presents a number of issues and considerations that users must note.

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

Different EACOM 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 *COM Carrier Board* and on the EACOM board.

Note that Embedded Artists does not replace damaged COM 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 EACOM compatible when using the *COM Carrier board*.

9.2   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 *COM 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 more harsh use and environments, and where fail-safe operation, redundancy or other strict reliability or safety requirements exists, always contact Embedded Artists for a discussion about suitability.

There are application areas that the *COM 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**. In order 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 of the *COM Carrier Board* directly 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 of the *COM Carrier Board*.

9.3   ESD Precaution when Handling COM Carrier Board

Please note that the *COM 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 damages.

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

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

9.4   EMC / ESD

The *COM 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 adherence to the limits for the overall system. This is for example true when connecting a display solution or an external power supply to the *COM Carrier Board*.

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

9.5   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 too high it can potentially damage the *COM Carrier Board*. Make sure the external 12V power supply (that power the *COM Carrier Board*) can handle (near) zero-load while still maintaining regulation and keeping the output voltage within specification.

9.6   VBAT Current

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

Note that EACOM boards do not need VBAT voltage to startup. VBAT is only needed to keep the iMX6/7/8 on-chip RTC running in case the main input voltage supply is removed.

The *COM Carrier board* implements an external low-current Real-time Clock solution, as an alternative to the EACOM on-board RTC solution.

9.7   VBAT_RTC Not Supplied On Rev E and Some rev E1 Boards

The 3.3V LDO to create supply net VBAT_RTC has not been mounted on rev E and some rev E1 boards. This supply is needed to evaluate the ONOFF functionality and (u)COM board's RTC functionality. This is mostly used for battery operated applications.

The picture below illustrates where U5 is located, on bottom side under the battery connector J8. If U5 is needed, mount either RT9169-33GVL from Richtek or MCP1701AT-3302I/CB from Microchip.

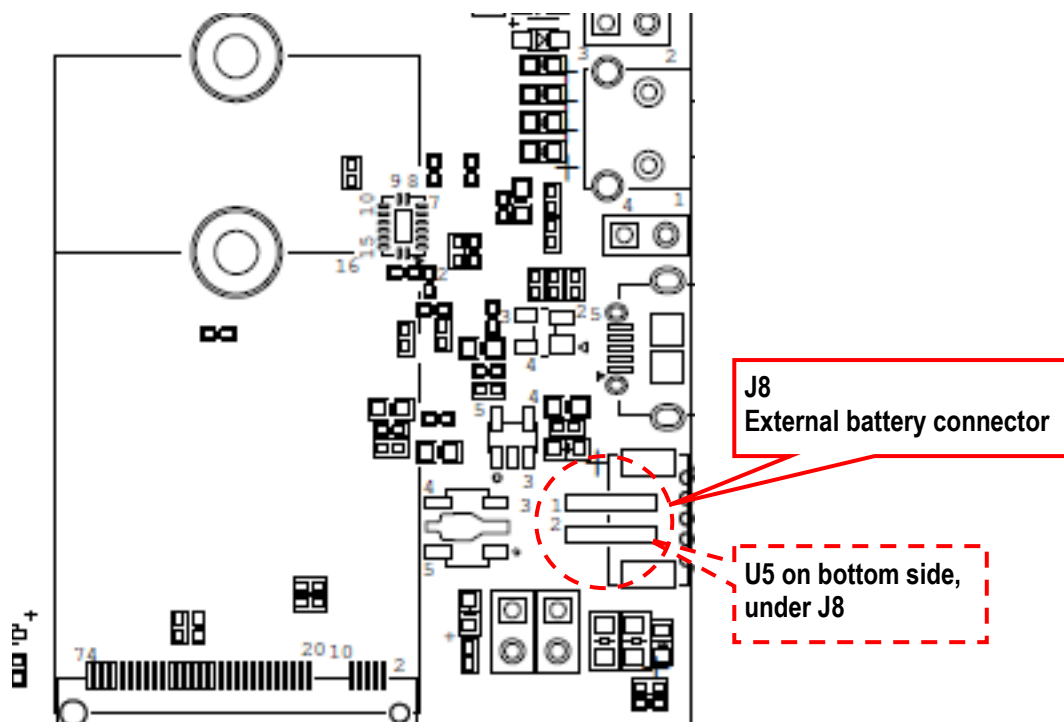COM Carrier boards, rev E1 shipped after December 2019 has U5 mounted.

Figure 31 –COM Carrier Board, Location of U5

9.8 Difference Between COM Carrier Board Revision PE23 and E

Revision PE23 has been released in a small number for early access partners. Below, the main changes **between rev PE23 and rev E** are listed:

- Schematic page 7: 1.2V power supply to the USB 3.0 hub (U9) has been redesigned. On revision PE23 there must have a heat sink mounted on U11. This heat problem mainly occurs when an iMX6 Quad/DualLite COM board is mounted.

- Schematic page 15: Measurement of VBAT current to the M.2 connector via J24 is not functional on revision PE23. Measurement of VDDIO current via J36 has been removed on revision E since it makes no sense to measure this current.

- Schematic page 16: J36 has been added on revision E in order to provide isolation of several M.2 signals (from J30), if ever needed.

10 Custom Design

This document specify the standard *COM 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 *COM 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 *COM 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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