iMX RT1176-32 uCOM Board
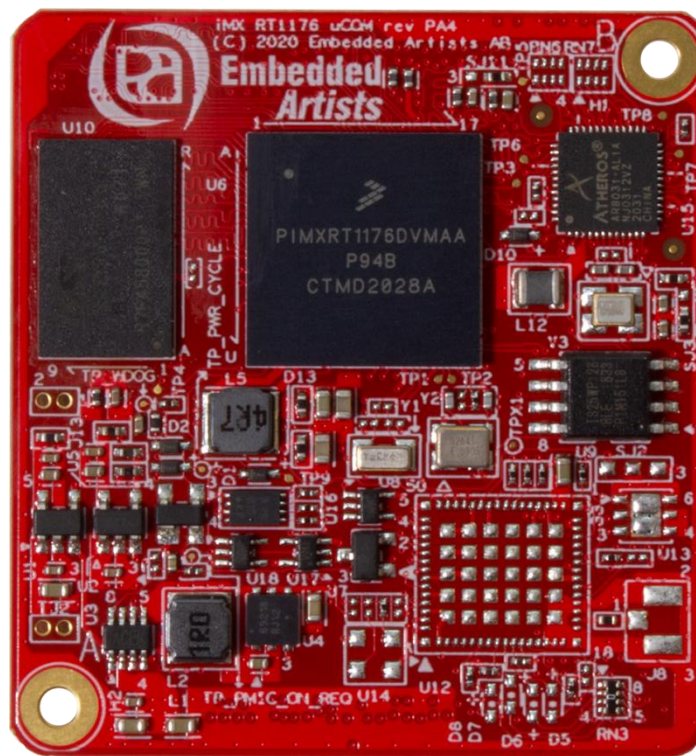# Datasheet

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1   Document Revision History

Revision	Date	Description
PA1	2021-03-08	First version.
PA2	2021-08-19	Corrected spelling errors.
PA3	2021-09-20	Added information about boards built with early silicon revision.
PA4	2021-11-12	Added information about on-board I2C-E2PROMs.
PA5	2022-08-17	Corrected information about connector JC (it is always mounted).
PA6	2022-11-15	Corrected JB pinning (pin 1, 3, 9, 11, 13, 15).
PA7	2023-01-31	Update pinning on expansion connector JC for rev C (and above) boards.
PA8	2023-04-21	Updated information about boot control.
PA9	2023-05-26	Updated max CM4 frequency.
PA10	2023-06-07	Added information about on-board I2C-E2PROM and powering architecture.
PA11	2023-07-05	Updated names on power supply inputs.
PA12	2023-07-13	Added information about pull-up resistor requirement on JB, pin 70.
PA13	2023-09-20	Corrected pin information for JA pin 98 (GPIO_EMC_B2_18).
PA14	2023-12-22	Corrected signaling voltage for JA pin 88 (1.8V). Added information about future board revision update involving the possibility of having an external ADC voltage reference, see JB pin 60 and 62. See section 5.3 for more details.
PA15	2025-02-03	Added information about board differences and clarified I2C-A usage.

2   Introduction

This document is a datasheet that specifies and describes the *iMX RT1176-32 uCOM Board* mainly from a hardware point of view. Some basic software related issues are also addressed, like booting and functional verification, but there are separate software development manuals that should also be consulted.

2.1   Hardware

The *iMX RT1176-32 uCOM Board* is a Computer-on-Module (COM) based on NXP's ARM dual-core Cortex-M7 / M4 i.MX RT1176 Crossover microcontroller. The board provides a quick and easy solution for implementing a high-performance ARM Cortex-M7 / M4 based design. The Cortex-M7 core runs at up to 1 GHz (800 MHz for industrial temperature version) and the Cortex-M4 core at up to 400 MHz.

The *iMX RT1176-32 uCOM Board* has a small form factor and shields the user from a lot of complexity of designing a high-performance system. It is a robust and proven design that allows the user to focus the product development, shorten time to market and minimize the development risk.

The *iMX RT1176-32 uCOM Board* targets a wide range of applications, such as:

- Industrial Computing Designs
    - PLCs
    - Factory automation
    - Test and measurement
    - M2M
    - assembly line robotics
- Home and Building Automation
    - HVAC climate control
    - Security
    - Lighting control panels
    - IoT gateways
- Motor Control and Power Conversion
- HMI/GUI solutions
- Connected vending machines

- Access control panels
- Audio Subsystem
- 3D printers, thermal printers, unmanned autonomous vehicles
- Audio
- Smart appliances
- Home energy management systems
- Smart Grid and Smart Metering
- Smart Toll Systems
- Data acquisition
- Communication gateway solutions
- Connected real-time systems
- ...and much more

The picture below illustrates the block diagram of the *iMX RT1176-32 uCOM Board*.
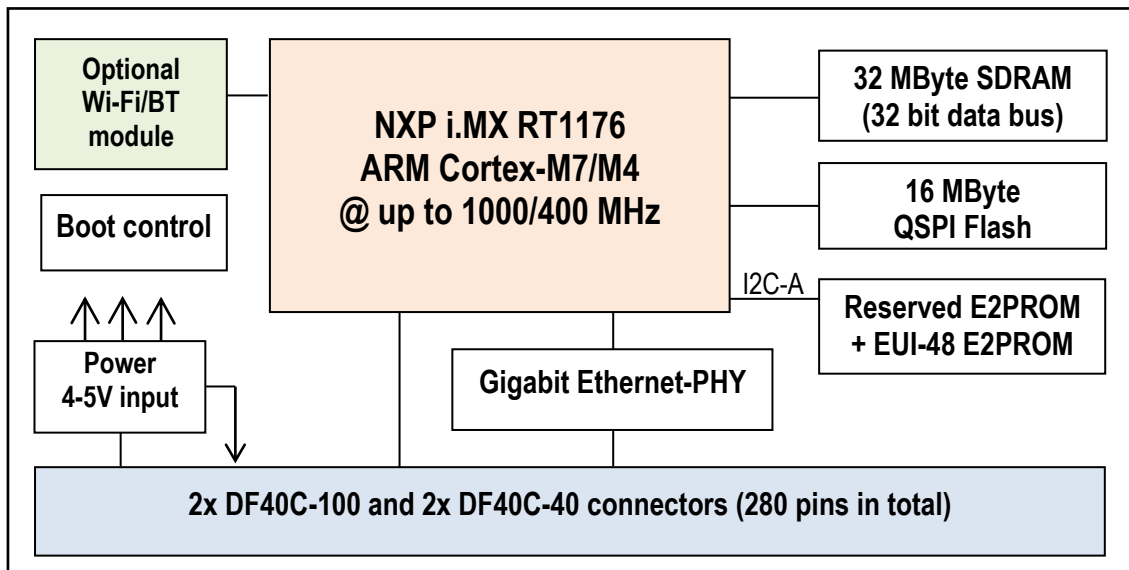

Figure 1 – iMX RT1176-32 uCOM Board Block Diagram

The *iMX RT1176-32 uCOM Board* pin assignment focuses on direct connection to (carrier board) interface connectors and minimize trace and layer crossing. This is important for high speed, serial interfaces with impedance controlled differential pairs. As a result, carrier boards can be designed with few routing layers. In many cases, a four-layer pcb is enough to implement advanced and compact carrier boards. The pin assignment is common for the *iMX RT/6/7/8/9 uCOM Boards* from Embedded Artists and the general, so called, EAuCOM specification is found in separate document.

2.2   Software

The *iMX RT1176 uCOM Developer's Kit* has a Board Support Package (BSP) that supports bare metal as well as FreeRTOS based architectures. It is based on NXP's SDK framework for the i.MX RT1170 family with patches from Embedded Artists to support the specifics of the uCOM board.

This document has a hardware focus and does not cover software development. See the document *iMX RT1176 uCOM Developer's Kit Program Development Guide* for more information about software development.

2.3   Features and Functionality

The i.MX RT1176 is a powerful crossover microcontroller. The full specification can be found in NXP's *i.MX RT1170 Crossover Processor Datasheet* and *i.MX RT1170 Processor Reference Manual*. The table below lists the main features and functions of the *iMX RT1176-32 uCOM board,* which represents Embedded Artists' integration of the i.MX RT1176 Crossover microcontroller. Due to pin configuration some functions and interfaces of the i.MX RT1176 many not be available at the same time. See the *i.MX RT1170 Crossover Processor Datasheet* and reference manual for details. Also see pin multiplexing Excel sheet for details.

Group	Feature		iMX RT1176 uCOM Board
CPUs	NXP MCU	commercial temp. range industrial temp. range	MIMXRT1176DVMAA (0 - 70° C) MIMXRT1176CVM8A (-40 - 85° C)
	CPU Cores		1x Cortex-M7 with FPU (single and double precision) 1x Cortex-M4 with FPU (single precision)

	Maximum M7 core frequency	1 GHz (0 - 70° C) 800 MHz (-40 - 85° C)
	Maximum M4 core frequency	400 MHz (0 - 70° C and -40 - 85° C)
	L1 Instruction cache	32 KByte on the Cortex-M7 16 KByte on the Cortex-M4
	L1 Data cache	32 KByte on the Cortex-M7 16 KByte on the Cortex-M4
	I-TCM, D-TCM for Cotex-M7	Configurable, up to 512 KByte
	TCM for Cotex-M4	256 MByte
	On-chip SRAM (TCM for Cortex-M7)	2048 MByte, of with up to 512 KByte M7 TCM, 256 KByte M4 TCM and 1.25 MByte OCRAM
Security Functions	High Assurance Boot	✓
	Cryptographic Acceleration and Assurance Module (CAAM)	✓
	Inline Encryption Engine (IEE)	✓
	On-the-Fly AES Decryption (OTFAD)	✓
	Secure Non-Volatile Storage	✓
	Secure always-on RAM (4 KB)	✓
	Secure key management and protection	✓
	Secure and trusted access control	✓
Memory	SDRAM RAM Size	32 MByte, default. Other on request.
	SDRAM Clock Speed	148 MHz
	SDRAM Memory Width	32 bit
	QSPI Flash	16MByte, default. Other on request.
Graphical Processing	2D Vector Graphics Processing Unit (GPU)	OpenVG1.1 support
	PiXel Processing Pipeline (PXP)	✓
Graphical Output	MIPI-DSI, 2 lanes	✓ up to 1080p30 resolution
	Parallel RGB	Support 8/16/24-bit interface with up WXGA resolution (1280x800px)@60fps Note that these pins are only available as a special mounting option.
Graphical Input	MIPI-CSI, 2 lanes	✓
	Parallel Camera Sensor Interface	✓
Connectivity Interfaces (all functions	2x USB2.0 OTG port with Phy	✓
	1000/100/10 Mbps Gigabit Ethernet controller with support for Audio Video	✓ with on-board Gigabit PHY

are not available at the same time)	Bridging (AVB)	
	1000/100/10 Mbps Gigabit Ethernet controller with support for Time Sensitive Networking (TSN)	✓ with carrier board PHY
	100/10 Mbps Ethernet controller with support for IEEE1588	✓ with carrier board PHY
	QuadSPI with support for XIP	✓
	4x I2S/SAI, MQS, SPDIF, 4-ch PDM, ASRC	✓
	2x SD3.0/MMC 5.0	✓ One interface used when on-board Wi-Fi/BT mounted
	6x SPI, 12x UART, 6x I²C, 3x FlexCAN	✓
	PWMs, WDOG	✓
Other	Full PMIC integration, including on-chip DCDC and LDOs	✓
	On-board RTC via i.MX RT1176	✓
	On-board watchdog functionality	✓
	Reserved I2C-E2PROM (do not use)	✓ connected to I2C-A, 7-bit address 0x55, 8-bit address 0xAA/0xAB
	1 Kbit I2C-E2PROM with EUI-48 number for unique Ethernet-MAC address	✓ connected to I2C-A, 7-bit address 0x53, 8-bit address 0xA6/0xA7

2.4   Reference Documents

The following documents are important reference documents and should be consulted when integrating the *iMX RT1176-32 uCOM board*:

- EAuCOM Board Specification

The following NXP documents are also important reference documents and should be consulted for functional details:

- IMXRT1170CEC, i.MX RT1170 Crossover Processors Data Sheet for Consumer Products, latest revision

- IMXRT1170IEC, i.MX RT1170 Crossover Processors Data Sheet for Industrial Products, latest revision

- IMXRT1170RM, i.MX RT1170 Processor Reference Manual, latest revision

- IMXRT1170SRM, Security Reference Manual for i.MX RT1170, latest revision

- IMXRT1170CE, Chip Errata for the i.MX RT1170, latest revision
  Note: It is the user's responsibility to make sure all errata published by the manufacturer are taken note of. The manufacturer's advice should be followed.

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

- 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)

- 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)

- 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)

- DSI (Display Serial Interface) The DSI standard is owned and maintained by the MIPI Alliance ("Mobile Industry Processor Alliance") (www.mipi.org)

- CSI-2 (Camera Serial Interface version 2) The CSI-2 standard is owned and maintained by the MIPI Alliance ("Mobile Industry Processor Alliance") (www.mipi.org)

- USB Specifications (www.usb.org)

3   Board Pinning

Embedded Artists has defined the EAuCOM board standard with 42 x 45 mm boards that use Hirose DF40C connectors. Note that this is not the same as the EACOM board standard with module size 82 x 50 mm. See the *EAuCOM Board specification* document for details and background information. Hereafter this standard will be referred to as **EAuCOM**.

There are four Hirose DF40C expansion connectors; two 100 pos and two 40 pos connectors. The 0.4mm pitch connectors have a board-to-board stacking height of only 1.5mm. There are also versions of the receptacle connectors that gives 3.0mm stacking height.

3.1   Pin Numbering

The figure below illustrates the location of the four expansion connectors and their respective pin numbering on the bottom side of the *iMX RT1176-32 uCOM Board*.
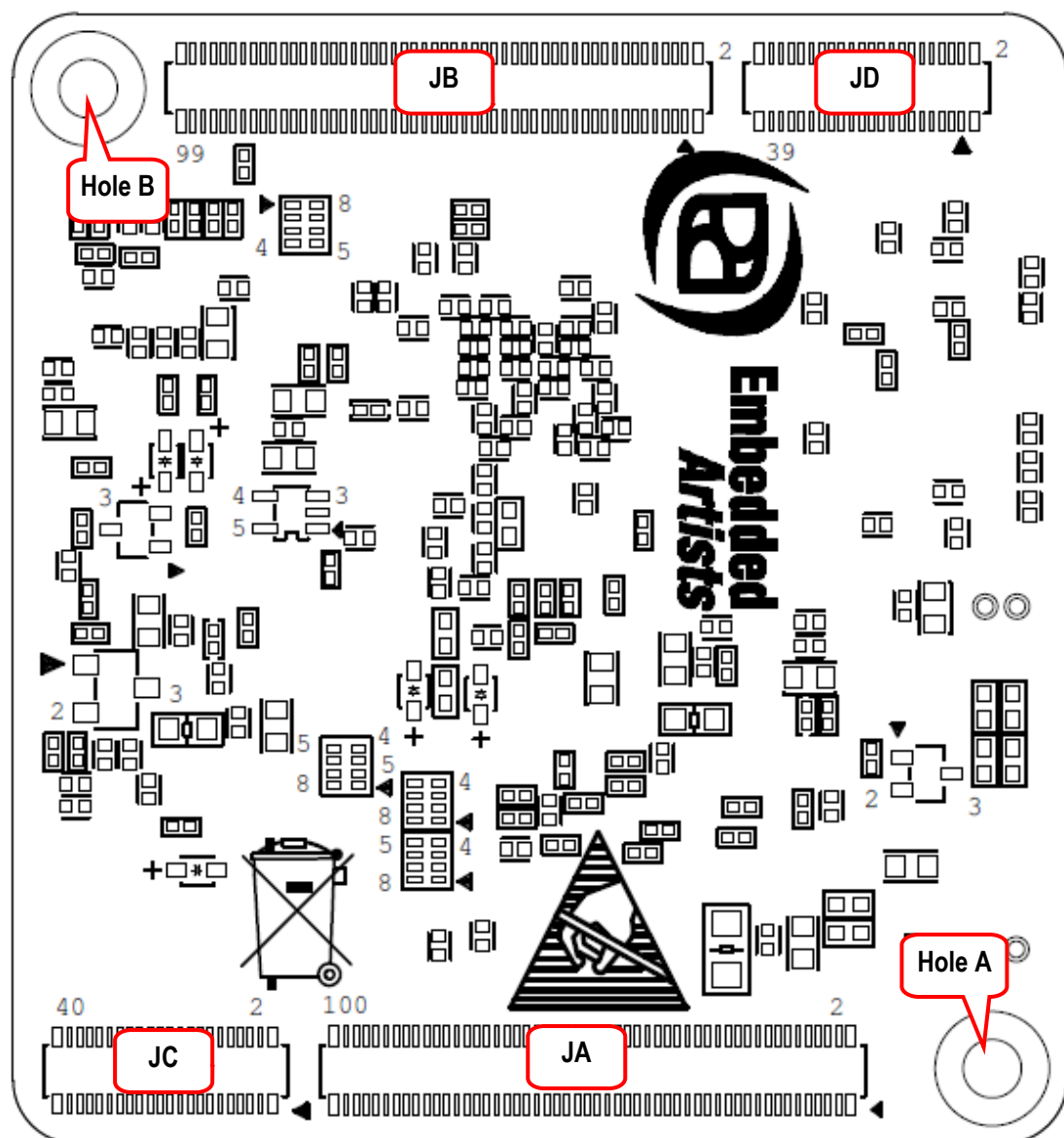

Figure 2 – iMX RT1176-32 uCOM (EAuCOM standard) Board Pin Numbering, Bottom Side

3.2 Pin Assignment

This section describes the pin assignment of the board, with the following columns:

Connector and Pin number	The pin numbers are listed in consecutive order. Odd pin numbers are on one row and even numbers on the other row.
Non-i.MX RT1176 signals	Lists signals that are not directly connected to the i.MX RT1176 MCU. These signals are typically related to powering and connected to the on-board Power Management.
i.MX RT1176 Ball Name	The name of the ball of the i.MX RT1176 MCU that is connected to this pin.
Alternative Pin Function	Information if the signal is a dedicated interface or a general pin that can multiples different signals. See separate Excel sheet for details about available multiplexing alternatives.
Notes	When relevant, the preferred pin function is listed.

Note that some pins are EAuCOM board *type specific*, meaning that these pins might not be compatible with other EAuCOM boards. Using these may result in lost compatibility between EAuCOM boards, but not always. Check details between EAuCOM boards of interest.

The table below lists the pins on expansion connector JA (100-pos connector).

JA Pin Number	EAuCOM Board Signal	i.MX RT1176 Ball Name	Alternative Pin Function?	Notes
1-8	VSYS_IN			System supply voltage, see chapter 5 and 6 for more details.
9-16	GND			
17	VDD_SNVS	VDD_SNVS_ANA		Internal 1.8V power supply rail. Do not connect to except a possible 100Kohm pullup of J1 pin 88 (WAKEUP pin).
18	VDD_RTC_IN	VDD_SNVS_IN		Power supply input for on-chip RTC, see chapter 5 and 6 for more details.
19, 21, 23, 25, 27, 29	VDD_1V8			1.8V voltage rail output, see chapter 5 and 6 for more details.
20, 22, 24, 26, 28, 30	VDD_3V3			3.3V voltage rail output, see chapter 5 and 6 for more details.
31-32	GND			
33	Board specific	GPIO_DISP_B1_00	Yes	**Not connected if Gigabit Ethernet-PHY is mounted**
34, 36, 38, 40, 42	VDD_RF			Not connected per default. Can optionally power on-board RF-module. Requires special order for this mounting option.
35	Board specific	GPIO_DISP_B1_02	Yes	**Not connected if Gigabit Ethernet-PHY is mounted**
37	Board specific	GPIO_DISP_B1_03	Yes	**Not connected if Gigabit Ethernet-PHY is mounted**
39	Board specific	GPIO_DISP_B1_01	Yes	**Not connected if Gigabit Ethernet-PHY is mounted**
41	GND			
43	Board specific	GPIO_DISP_B1_04	Yes	**Not connected if Gigabit Ethernet-PHY is mounted**
44	GND			
45	Board specific	GPIO_DISP_B1_05	Yes	**Not connected if Gigabit Ethernet-PHY is mounted**
46	GND			
47	Board specific	GPIO_DISP_B1_06	Yes	**Not connected if Gigabit Ethernet-PHY is mounted**
48	VBAT_TEMP	-		Not connected
49	Board specific	GPIO_DISP_B1_07	Yes	**Not connected if Gigabit Ethernet-PHY is mounted**

50	VBAT_CURRP	-		Not connected
51	GND			
52	VBAT_CURRN	-		Not connected
53	Board specific	GPIO_DISP_B1_08	Yes	**Not connected if Gigabit Ethernet-PHY is mounted**
54, 56, 58, 60	PSU_5V	-		Not connected
55	Board specific	GPIO_DISP_B1_09	Yes	**Not connected if Gigabit Ethernet-PHY is mounted**
57	Board specific	GPIO_DISP_B1_10	Yes	**Not connected if Gigabit Ethernet-PHY is mounted**
59	Board specific	GPIO_DISP_B1_11	Yes	**Not connected if Gigabit Ethernet-PHY is mounted**
61	GND			
62, 64, 66, 68	VBUS_USB	-		Not connected
63	Board specific	GPIO_DISP_B2_00	Yes	
65	Board specific	GPIO_DISP_B2_01	Yes	
67	Board specific	GPIO_DISP_B2_02	Yes	
69	Board specific	GPIO_DISP_B2_03	Yes	
70-71	GND			
72	Board specific	GPIO_SNVS_00	Yes	
73	Board specific	GPIO_DISP_B2_04	Yes	
74	Board specific	GPIO_LPSR_00	Yes	
75	Board specific	GPIO_DISP_B2_05	Yes	
76	Board specific	GPIO_LPSR_01	Yes	
77	Board specific	GPIO_DISP_B2_06	Yes	
78	Board specific	GPIO_AD_!6	Yes	
79	Board specific	GPIO_DISP_B2_07	Yes	
80	Board specific	GPIO_AD_!5	Yes	
81-82	GND			
83	Board specific	GPIO_DISP_B2_08	Yes	
84	Board specific	GPIO_AD_!4	Yes	
85	Board specific	GPIO_DISP_B2_09	Yes	
86	Board specific	GPIO_SNVS_09	Yes	
87	Board specific	GPIO_DISP_B2_10	Yes	
88	Board specific	WAKE_INP	Yes	**Note that this is a 1.8V signal.** The internal power supply is VDD_SNVS_ANA (available on JA pin 17), which is an internal power supply.
89	Board specific	GPIO_DISP_B2_11	Yes	
90	Board specific	GPIO_LPSR_08	Yes	
91-92	GND			
93	Board specific	GPIO_DISP_B2_12	Yes	
94	Board specific	GPIO_LPSR_09	Yes	
95	Board specific	GPIO_DISP_B2_13	Yes	
96	Board specific	-		Not connected
97	Board specific	GPIO_DISP_B2_14	Yes	
98	Board specific	GPIO_EMC_B2_18	Yes	
99	Board specific	GPIO_DISP_B2_15	Yes	

100	Board specific	BT_CFG1		Do not connect to.

The table below lists the pins on expansion connector JB (100-pos connector).

JB Pin Number	EAuCOM Board Signal	i.MX RT1176 Ball Name	Alternative Pin Function?	Notes
1	UART-C_RXD	GPIO_AD_01	Yes	
2	GPIO-A	GPIO_AD_05	Yes	
3	UART-C_TXD	GPIO_AD_00	Yes	
4	GPIO-B	GPIO_AD_12	Yes	
5	UART-A_RXD	GPIO_AD_25	Yes	
6	GPIO-C	GPIO_AD_26	Yes	
7	UART-A_TXD	GPIO_AD_24	Yes	
8	GPIO-D	GPIO_AD_27	Yes	
9	UART-C_CTS	GPIO_AD_03	Yes	
10	GPIO-E	GPIO_AD_35	Yes	
11	UART-C_RTS	GPIO_AD_02	Yes	
12	GPIO-F	-		Not connected
13	UART-B_RXD	GPIO_EMC_B1_41	Yes	
14	GPIO-G	PMIC_ON_REQ	No	Do not connect to this signal.
15	UART-B_TXD	GPIO_EMC_B1_40	Yes	
16	GPIO-H	PMIC_STBY_REQ	No	Do not connect to this signal.
17	GND			
18	GPIO-J	DAC_OUT	No	
19	SD-A_VDD	-		Not connected
20	GPIO-K	GPIO_AD_04	No	Internal watchdog signal (pin function: WDOG_B). Do not connect to this signal.
21	GND			
22	GPIO-L	GPIO_AD_34	No	Internal signal connected to SD1_VSEL, controlling voltage level on SD1 interface. Do not connect to this signal.
23	SD-A_CLK	-		Not connected
24	GPIO-M	GPIO_AD_13	Yes	**Note: Not connected on rev A boards.**
25	SD-A_CMD	-		Not connected
26	GND			
27	SD-A_DATA0	-		Not connected
28	SPI-A_SCLK	GPIO_AD_28	Yes	
29	SD-A_DATA1	-		Not connected
30	SPI-A_MISO	GPIO_AD_31	Yes	
31	SD-A_DATA2	-		Not connected
32	SPI-A_MOSI	GPIO_AD_30	Yes	
33	SD-A_DATA3	-		Not connected
34	SPI-A_SS0	GPIO_AD_29	Yes	
35	GND			
36	GND			

37	SD-A_WP	-		Not connected
38	SPI-B_SCLK	GPIO_SD_B2_00	Yes	**Note that signals voltage level is 1.8V** **Not connected if Wi-Fi/BT module mounted**
39	SD-A_NCD	-		Not connected
40	SPI-B_MISO	GPIO_SD_B2_03	Yes	**Note that signals voltage level is 1.8V** **Not connected if Wi-Fi/BT module mounted**
41	SD-A_NRST	-		Not connected
42	SPI-B_MOSI	GPIO_SD_B2_02	Yes	**Note that signals voltage level is 1.8V** **Not connected if Wi-Fi/BT module mounted**
43	USB-A_OC	GPIO_AD_11	Yes	
44	SPI-B_SS0	GPIO_SD_B2_01	Yes	**Note that signals voltage level is 1.8V** **Not connected if Wi-Fi/BT module mounted**
45	USB-A_PWR	GPIO_AD_10	Yes	
46	GND			
47	USB-A_VBUS	VBUS_OTG1	No	
48	I2C-A_SCL	GPIO_LPSR_05	No	Note: Do not change pin function. Must be an I2C channel since the interface is used on-board. **Note: This pin has a 4.7 Kohm pull-up resistor to 3.3V.**
49	USB-A_DN	OTG1_DN	No	
50	I2C-A_SDA	GPIO_LPSR_04	No	Note: Do not change pin function. Must be an I2C channel since the interface is used on-board. **Note: This pin has a 4.7 Kohm pull-up resistor to 3.3V.**
51	USB-A_DP	OTG1_DP	No	
52	I2C-B_SCL	GPIO_LPSR_07	Yes	**Note: This pin has a 4.7 Kohm pull-up resistor to 3.3V.**
53	USB-A_ID	GPIO_AD_09	No	
54	I2C-B_SDA	GPIO_LPSR_06	Yes	**Note: This pin has a 4.7 Kohm pull-up resistor to 3.3V.**
55	GND			
56	I2C-C_SCL	GPIO_AD_32	Yes	**Note: This pin has a 4.7 Kohm pull-up resistor to 3.3V.**
57	USB-B_OC	GPIO_AD_06		
58	I2C-C_SDA	GPIO_AD_33	Yes	**Note: This pin has a 4.7 Kohm pull-up resistor to 3.3V.**
59	USB-B_PWR	GPIO_AD_07		
60	I2C-D_SCL	-		Not connected on rev C1, or earlier versions. **Note: On rev C2 boards, this is the internally generated 1.8V ADC reference voltage output.**
61	USB-B_VBUS	VBUS_OTG2	No	
62	I2C-D_SDA	-		Not connected on rev C1, or earlier versions. **Note: On rev C2 boards, this is ADC reference voltage input, which shall be 1.8V.** **For future compatibility, either connect this pin to JB pin 60 or to an external 1.8V reference (powered by the internally generated 3.3V, VDD_3V3, available on JA pin 20/22/24/26/28/30).** **On rev C1, or earlier, boards, connecting this pin to JB pin 60 has no effect.**
63	USB-B_DN	OTG2_DN	No	
64	GND			

65	USB-B_DP	OTG2_DP	No	
66	GND			
67	USB-B_ID	GPIO_AD_08	Yes	
68	PERI_PWR_EN		No	**Power enable signal for external peripherals. No external must drive any signal to the i.MX RT1176 MCU before this signal is active.** The signal is active high and is connected to the on-board generate 3.3V supply rail. If all external circuits that can drive a signal to the i.MX1176 MCU are powered from the uCOM-generated 3.3V and 1.8V supplies, this gating signal can be ignored.
69	GND			
70	POR_B	POR_B		3.3V translated signal of the i.MX RT1176 MCU's POR_B. Signal shall normally only be used to connect to debug interface connector. Use signals PWR_CYCLE_IN (JB pin 74) to power cycle reset of the board. **Note: a 50K-100K ohm pull-up resistor must be connected to this signal and to JA pin 20, 22, 24, 26, 28, 30 in the other end (the internally generated 3.3V supply).** **Do not leave this pin floating!**
71	ETH_LED_10/100	ETH_LED_10/100		Connected to on-board Gigabit Ethernet PHY
72	ONOFF	ONOFF		Connected to ONOFF on the i.MX RT1176 MCU
73	ETH_LED_1000	ETH_LED_1000		Connected to on-board Gigabit Ethernet PHY
74	PWR_CYCLE_IN			A low pulse on this input cause a power cycle reset of the board.
75	ETH_LED_ACT	ETH_LED_ACT		Connected to on-board Gigabit Ethernet PHY
76	BOOT_MODE0	GPIO_LPSR_02	No	This signal shall be left unconnected under normal operation. The Boot Mode is controlled by signals ISP_ENABLE (JB pin 100) and BOOT_CTRL (JB pin 98). Note. This signal is 1.8V logic level.
77	GND			
78	BOOT_MODE1	GPIO_LPSR_03	No	This signal shall be left unconnected under normal operation. The Boot Mode is controlled by signals ISP_ENABLE (JB pin 100) and BOOT_CTRL (JB pin 98). Note. This signal is 1.8V logic level.
79	ETH_TRXP1	ETH_TRXP1		Connected to on-board Gigabit Ethernet PHY
80	TEST_MODE	-		Not connected
81	ETH_TRXN1	ETH_TRXN1		Connected to on-board Gigabit Ethernet PHY
82	JTAG_VCC			The supply voltage of the JTAG debug interface, 3.3V
83	GND			
84	GND			
85	ETH_TRXP0	ETH_TRXP0		Connected to on-board Gigabit Ethernet PHY
86	JTAG_TCK	GPIO_LPSR_14	Yes	
87	ETH_TRXN0	ETH_TRXN0		Connected to on-board Gigabit Ethernet PHY
88	JTAG_TMS	GPIO_LPSR_15	Yes	
89	GND			
90	JTAG_TDI	GPIO_LPSR_12	Yes	
91	ETH_TRXN3	ETH_TRXN3		Connected to on-board Gigabit Ethernet PHY
92	JTAG_TDO	GPIO_LPSR_11	Yes	

93	ETH_TRXP3	ETH_TRXP3		Connected to on-board Gigabit Ethernet PHY
94	JTAG_TRST	GPIO_LPSR_10	Yes	Leave this signal unconnected.
95	GND			
96	JTAG_MOD	GPIO_LPSR_13	Yes	
97	ETH_TRXN2	ETH_TRXN2		Connected to on-board Gigabit Ethernet PHY
98	BOOT_CTRL			See section 8.5 for details about boot control and options.
				Leave pin floating, which means that the i.MX RT1176 MCU boots from on-chip OTP fuses (programmed to boot from on-board QSPI flash) but **connect this pin to the ground via a zero-ohm resistor that is not mounted**. This would make it easy to ground the pin, if ever needed in the future.
99	ETH_TRXP2	ETH_TRXP2		Connected to on-board Gigabit Ethernet PHY
100	ISP_ENABLE			Leave floating/open for normal boot.
				Pull low to ground to place i.MX RT1176 MCU in USB OTG boot mode (during next power cycle).

The table below lists the pins on expansion connector JC (40-pos connector).

JC Pin Number	EAuCOM Board Signal	i.MX RT1176 Ball Name	Alternative Pin Function?	Notes
1	SD-B_VCC	NVCC_SD1		SD1 interface supply voltage output. Only use this supply voltage for pull-up resistors on SD1 SDIO signals (if needed).
2	GND			
3	SD-B_CLK	SD1_CLK	Yes	Note. This signal can be either 1.8V or 3.3V logic level.
4	Board specific	GPIO_EMC_B2_19	No	Do not connect to this pin. Signals is used for MDC signal for on-board Ethernet-PHY.
5	SD-B_CMD	SD1_CMD	Yes	Note. This signal can be either 1.8V or 3.3V logic level.
6	Board specific	GPIO_EMC_B2_20	No	Do not connect to this pin. Signals is used for MDIO signal for on-board Ethernet-PHY.
7	SD-B_DATA0	SD1_DATA0	Yes	Note. This signal can be either 1.8V or 3.3V logic level.
8	Board specific	GPIO_SNVS_02 (≤ rev B boards)		On rev B boards, or below, the signal is also available on JC, pin 17. Note: This signal is 1.8V logic level. **Not connected if on-board Wi-Fi/BT module is mounted.**
		GPIO_SNVS_07 (≥ rev C boards)		On rev C boards, or above, do not connect to this pin. Signal is used for reset signal to on-board Ethernet-PHY. Note: This signal is 1.8V logic level.
9	SD-B_ DATA1	SD1_DATA1	Yes	Note. This signal can be either 1.8V or 3.3V logic level.
10	Board specific	GPIO_SNVS_03 (≤ rev B boards)		On rev B boards, or below, the signal is also available on JC, pin 19. Note: This signal is 1.8V logic level. **Not connected if on-board Wi-Fi/BT module is mounted.**
		GPIO_SNVS_08 (≥ rev C boards)		On rev C boards, or above, this is signal GPIO_SNVS_08. Note: This signal is 1.8V logic level.
11	SD-B_ DATA2	SD1_DATA2	Yes	Note. This signal can be either 1.8V or 3.3V logic level.
12	GND			
13	SD-B_ DATA3	SD1_DATA3	Yes	Note. This signal can be either 1.8V or 3.3V logic level.
14	Board specific	GPIO_SNVS_04		Signal is also available on JC, pin 23 Note: This signal is 1.8V logic level. **Not connected if on-board Wi-Fi/BT module is mounted.**
15	Board specific	GPIO_SNVS_01	Yes	Note. This signal is 1.8V logic level.
16	Board specific	GPIO_SNVS_05		Signal is also available on JC, pin 25 Note: This signal is 1.8V logic level. **Not connected if on-board Wi-Fi/BT module is mounted.**

17	Board specific	GPIO_SNVS_02	Yes	Signal is also available on JC, pin 8, on rev B boards, or below. Note: This signal is 1.8V logic level. **Not connected if on-board Wi-Fi/BT module is mounted.**
18	Board specific	GPIO_SNVS_06		Do not connect to this pin. Signals is used for interrupt for on-board Ethernet-PHY. Note: This signal is 1.8V logic level.
19	Board specific	GPIO_SNVS_03	Yes	Signal is also available on JC, pin 10, on rev B boards, or below. Note: This signal is 1.8V logic level. **Not connected if on-board Wi-Fi/BT module is mounted.**
20	Board specific	GPIO_SNVS_07 (≤ rev B boards) Not connected (≥ rev C boards)		On rev B boards, or below, do not connect to this pin. Signals is used for reset signal to on-board Ethernet-PHY. Note: This signal is 1.8V logic level. On rev C boards, or above, this pin is not connected.
21	Board specific	GPIO_SD_B2_04	Yes	Note: This signal is 1.8V logic level. **Not connected if on-board Wi-Fi/BT module is mounted.**
22	GND			
23	Board specific	GPIO_SNVS_04	Yes	Signal is also available on JC, pin 14. Note: This signal is 1.8V logic level. **Not connected if on-board Wi-Fi/BT module is mounted.**
24	Board specific	GPIO_SNVS_08 (≤ rev B boards) Not connected (≥ rev C boards)		On rev B boards, or below, do not connect to this pin. Signals is used for WOL interrupt for on-board Ethernet-PHY. Note: This signal is 1.8V logic level. On rev C boards, or above, this pin is not connected.
25	Board specific	GPIO_SNVS_05	Yes	Signal is also available on JC, pin 16. Note: This signal is 1.8V logic level. **Not connected if on-board Wi-Fi/BT module is mounted.**
26	Board specific			Not connected
27	SAI_TXFS	GPIO_AD_23	Yes	**Not connected if on-board Wi-Fi/BT module is mounted.**
28	Board specific			Not connected
29	SAI_TXD	GPIO_AD_21	Yes	**Not connected if on-board Wi-Fi/BT module is mounted.**
30	Board specific			Not connected
31	SAI_TXC	GPIO_AD_22	Yes	**Not connected if on-board Wi-Fi/BT module is mounted.**
32	GND			
33	SAI_RXD	GPIO_AD_20	Yes	**Not connected if on-board Wi-Fi/BT module is mounted.**
34	Board specific			Not connected
35	Board specific	GPIO_AD_18	Yes	
36	Board specific			Not connected
37	Board specific	GPIO_AD_19	Yes	
38	Board specific			Not connected
39	Board specific	GPIO_AD_17	Yes	
40	Board specific			Not connected

The table below lists the pins on expansion connector JD (40-pos connector).

JD Pin Number	EAuCOM Board Signal	i.MX RT1176 Ball Name	Alternative Pin Function?	Notes
1	DSI_DN3	-		Not connected
2	CSI_CKN	CSI_CKN	No	
3	DSI_DP3	-		Not connected

4	CSI_CKP	CSI_CKP	No	
5	GND			
6	GND			
7	DSI_DN0	DSI_DN0	No	
8	CSI_DN0	CSI_DN0	No	
9	DSI_DP0	DSI_DP0	No	
10	CSI_DP0	CSI_DP0	No	
11	GND			
12	GND			
13	DSI_DN2	-		Not connected
14	CSI_DN1	CSI_DN1	No	
15	DSI_DP2	-		Not connected
16	CSI_DP1	CSI_DP1	No	
17	GND			
18	GND			
19	DSI_DN1	DSI_DN1	No	
20	CSI_DN2	-		Not connected
21	DSI_DP1	DSI_DP1	No	
22	CSI_DP2	-		Not connected
23	GND			
24	GND			
25	DSI_CKN	DSI_CKN	No	
26	CSI_DN3	-		Not connected
27	DSI_CKP	DSI_CKP	No	
28	CSI_DP3	-		Not connected
29	GND			
30	GND			
31	Board specific	-		Not connected
32	PCIE_RXN	-		Not connected
33	PCIE_CLKREQ_B	-		Not connected
34	PCIE_RXP	-		Not connected
35	GND			
36	GND			
37	PCIE_CLKN	-		Not connected
38	PCIE_TXN	-		Not connected
39	PCIE_CLKP	-		Not connected
40	PCIE_TXP	-		Not connected

4   Murata Wi-Fi/BT Module Mounting Option

There is a mounting option for the *iMX RT1176-32 uCOM* board where a high-performance, power-efficient Wi-Fi/BT module from Murata is mounted. The picture below illustrates where the 1ZM module is mounted in the board. Other Wi-Fi/BT modules can also be mounted. Contact Embedded Artists for a discussion. The u.fl. antenna connector is located in the lower left corner.
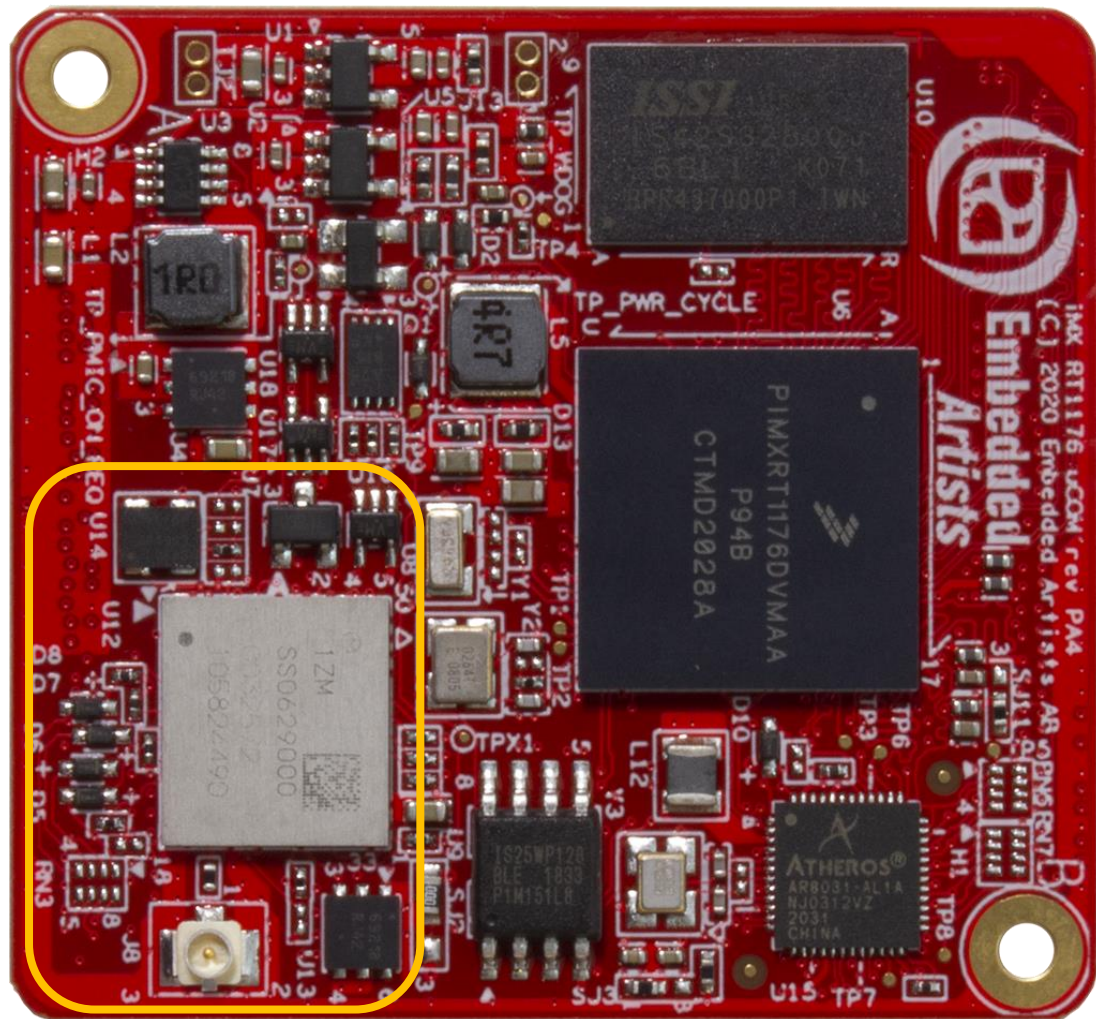

Figure 3 – Wi-Fi/BT Module Mounted on iMX RT1176 uCOM Board

With this mounting option, several of the JC signals are used to connect to the Wi-Fi/BT module. A UART channel is also dedicated to the Bluetooth interface, so the following JB signals/pins are also not available:

- **JB pin 1 (UART-B_RXD/ LPUART1_RXD)**
- **JB pin 3 (UART-B_TXD/ LPUART1_TXD)**
- **JB pin 9 (UART-B_CTS/ LPUART7_RXD)**
- **JB pin 11 (UART-B_RTS/ LPUART7_TXD)**

The Wi-Fi/BT module is powered by default from the on-board generated 3.3V. There is a mounting option that allows for the Wi-Fi/BT module to be powered from an external 3.3-3.6V supply. Contact Embedded Artists for further information.

Note that the version with on-board Wi-Fi/BT module is not a stocked mounting option. A minimum order quantity (MOQ) will apply. Contact Embedded Artists for further information.

5   Powering and Integration

The i.MX RT1176 uCOM board has several internal voltage regulators. Some of these are also available for the carrier board design, reducing integration cost. Designs with moderate power consumption may not need any external power supply at all on the carrier board. Everything can be handled by the on-board generated voltage supplies.

5.1   Available Power Supply Rails

The table below presents the available power rails that can be used on the carrier board that the *iMX RT1176 uCOM Board* is integrated on.

Power Rail Output	Description	Voltage Range	Max Current
NVCC_3V3 **on JA pins 20/22/24/26/28/30**	3.3V for external use on carrier board.	3.3V	400mA
NVCC_1V8 **on JA pins 19/21/23/25/27/29**	1.8V for external use on carrier board.	1.8V	150mA

Note that each pin on the Hirose DF40C expansion connectors can carry 300mA maximum. Connect to all pins on the expansion connectors that carry a specific power rail. High current power rails have more than one pin.

Note that external load variations can affect the internal voltage regulators operation and potentially disturb the i.MX RT1176 MCU operation. Make sure that the carrier board electronics does not have abrupt consumption variations and does not generate noise on the power rails. Also **calculate the heat dissipation** of the voltage converters in case the carrier board has high current consumption.

The 5 to 3.3V voltage regulator is a buck dc/dc voltage regulator with 85% efficiency and the 1.8V voltage regulator is an LDO, supplied from the 3.3V internal power supply.
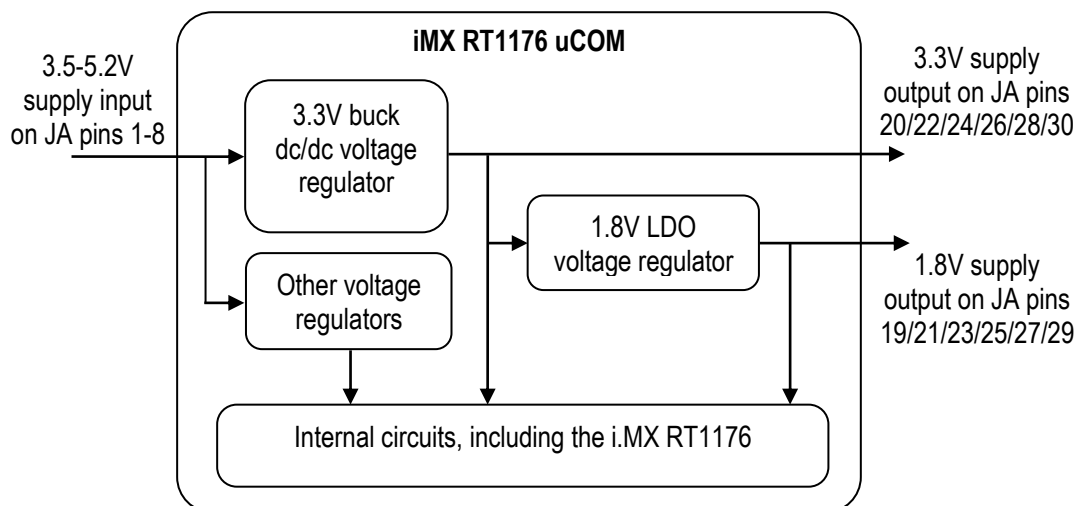

Figure 4 – iMX RT1176 uCOM Board Powering Architecture

5.2   Integration

This integration is very simple. An external 3.5-5.2V supply is basically all that is needed. The internal RTC can optionally be powered from a separate RTC supply input.

- Supply the 3.5-5.2V input voltage to **VSYS_IN** (connect to all eight pins on connector JA)

- Optionally supply a 3.5-5.2V input voltage to **VDD_RTC_IN** to power the real-time clock (RTC) and keep it running. If no supply is connected to VDD_RTC_IN, the RTC is powered from VSYS_IN supply input if this is valid.
- Leave signals BAT_TEMP, BAT_CURRP and BAT_CURRN unconnected.
- Leave supply inputs PSU_5V on JA pin 54/56/58/60 and VBUS_USB on JA pin 62/64/66/68 unconnected.

5.3   ADC Reference Voltage

On rev C1 boards and earlier, the ADC reference voltage is by default supplied from an on-board generated 1.8V voltage, DCDC_ANA. This supply voltage has +-2.5% accuracy. This limits the number of effective bits the ADC generates when converting an analog voltage.

On rev C2 boards, it is possible to optionally supply an externally generated precision reference voltage (1.8V) for achieving better precision on the ADC. If an external voltage reference is used, it shall be powered from the on-board generated 3.3V (available on expansion pins JA pin 20/22/24/26/28/30). The voltage reference must be capable of supplying up to 12 mA. If no external reference voltage is needed, the internally generated reference voltage (from supply DCDC_ANA) is available on JB pin 60. Just connect JB pin 60 and 62

For future compatibility, rev C1 and earlier boards shall connect JB pin 60 and 62.

The picture below illustrates how to connect an external prevision voltage reference or routing the internally generated voltage to the ADC reference supply input on JB pin 62.
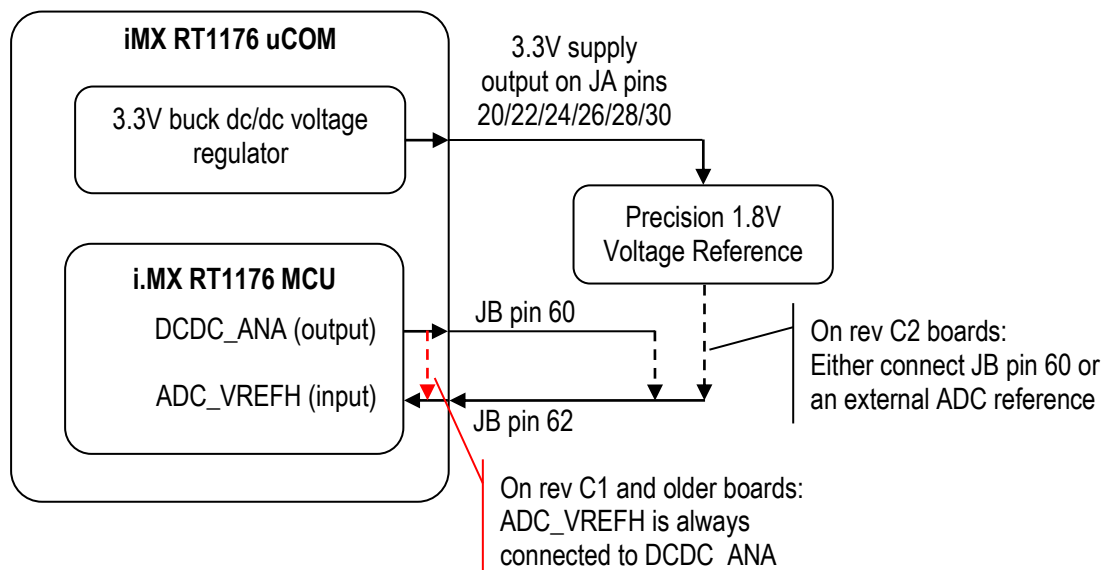

Figure 5 – iMX RT1176 uCOM Board ADC Voltage Reference

6   Technical Specification

6.1   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
VSYS_IN	Main input supply voltage	-0.3	5.5	V
VDD_RTC_IN	RTC supply voltage	-0.3	3.7	V
VIO	Vin/Vout (I/O VDD + 0.3): 3.3V IO	0	3.6	V
	Vin/Vout (I/O VDD + 0.3): 1.8V IO	0	1.98	V
USB_xx_VBUS	USB VBUS signals	-0.3	5.25	V
USB_xx_DP/DN	USB data signal pairs	-0.3	3.63	V

6.2   Recommended Operating Conditions

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

Symbol	Description	Min	Typical	Max	Unit
VSYS_IN[1]	Main input supply voltage Ripple with frequency content < 10 MHz Ripple with frequency content ≥ 10 MHz	4.2		5.2 50 10	V mV mV
VDD_RTC_IN[1]	RTC supply voltage **Note:** This voltage must remain valid at all times for correct operation of the board (including, but not limited to, the RTC).	3.0		3.5	V
USB_xx_VBUS	USB VBUS signals		5	5.25	V

[1] Either VSYS_IN or VDD_RTC_IN must be present (and within valid range) for correct operation of the board (including, but not limited, the ONOFF functionality and the RTC).

6.3   Power Ramp-Up Time Requirements

Input supply voltages (VSYS_IN and VDD_RTC_IN) shall have smooth and continuous ramp from 10% to 90% of final set-point. Input supply voltages shall reach recommended operating range in 1-20 ms.

6.4   Electrical Characteristics

For DC electrical characteristics of specific pins, see NXP's *i.MX RT1170 Crossover Processor Datasheet*. The internal VDD operating point for GPIOs is 3.3V or 1.8V for all signals.

6.4.1   Reset Input

The reset input is triggered by pulling the reset input low (0.2 V max). The internal power on sequence will start immediately on the negative edge of the reset input.

6.5   Power Consumption

There are several factors that determine power consumption of the *iMX RT1176-32 uCOM Board*, like input voltage, operating temperature, SDRAM/QSPI/Ethernet activity, operating frequencies for the different cores, body biasing and the software executed.

The values presented are typical values and should be regarded as an estimate. Always measure current consumption in the real system to get a more accurate estimate.

Symbol	Description (VIN = 5.0V, Toperating = 25°C)	Typical	Max Observed	Unit
I_{VSYS_IN}MAX	Maximum CPU load, 1000/400 MHz ARM Cortex-M7/M4 frequency, without Ethernet	TBD	TBD	mA
I_{VSYS_IN}SDRAM	Additional current for SDRAM	TBD	TBD	mA
I_{VSYS_IN}ETH	Additional current for Ethernet Phy	TBD	TBD	mA
I_{VSYS_IN}SYSIDLE	System idle state	TBD	TBD	mA
I_{VSYS_IN}LPIDLE	Low power idle state	TBD	TBD	mA
I_{VSYS_IN}SUSPEND	Suspend state	TBD	TBD	uA
$I_{VBAT\_RTC\_IN}$RTC	Current consumption to keep internal RTC running	TBD	TBD	uA

6.6   Mechanical Dimensions

The table below presents the mechanical dimensions of the module.

Dimension	Value (±0.1 mm)	Unit
Module width	42	mm
Module height	45	mm
Module top side height	2.0	mm
Module bottom side height	1.4	mm
PCB thickness	1.4	mm
Mounting hole diameter	2.3	mm
Module weight	2 ±0.5 gram	gram

The picture below show the mechanical details of the *iMX RT1176-32 uCOM Board*. The outer measurement is 42 x 45 mm. Note that the picture is seen from the bottom side.
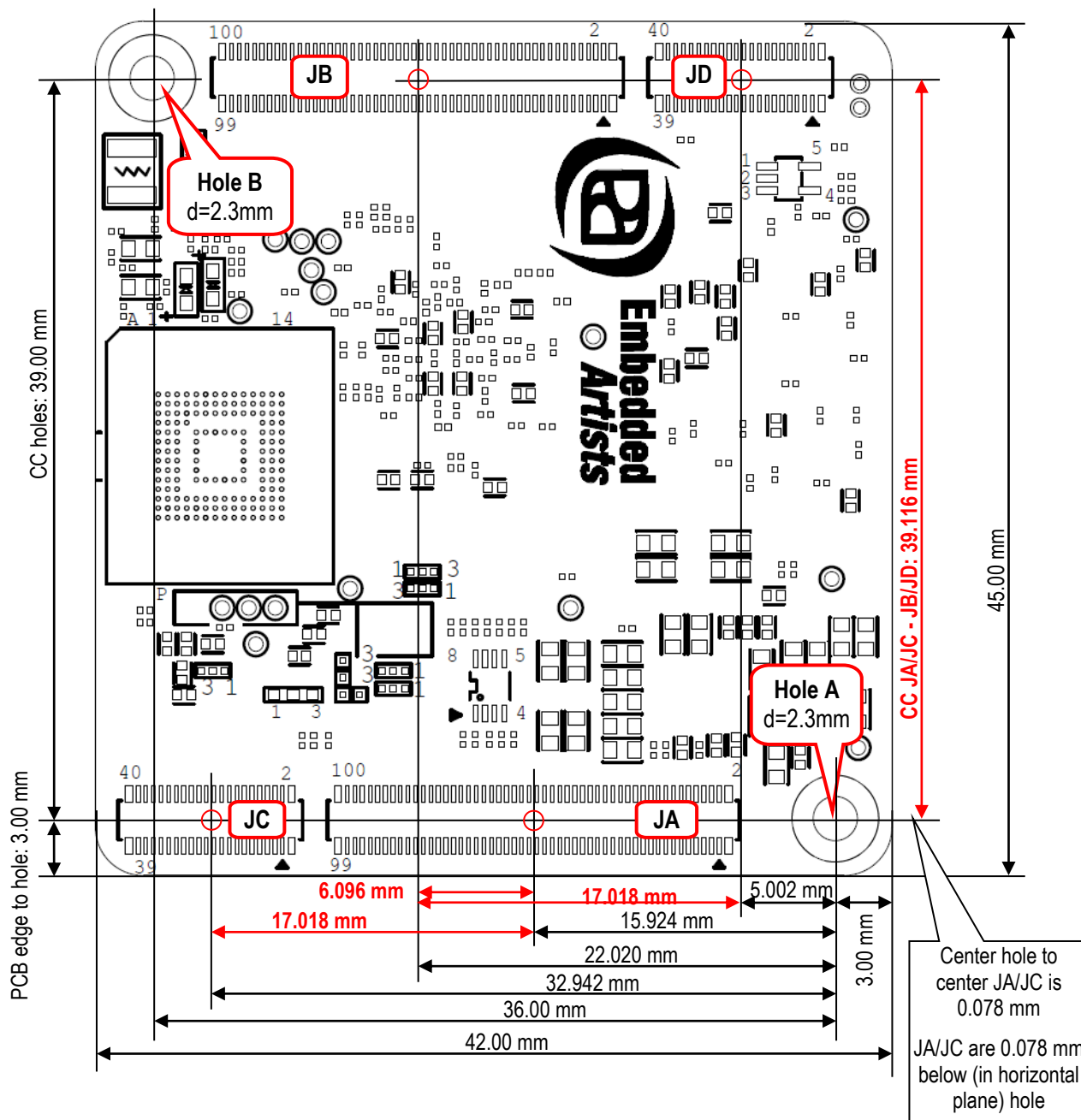
Figure 6 – iMX RT1176-32 uCOM Board Mechanical Outline, View from Bottom Side

Note that placement of the connectors on the carrier board is very important. They must be parallel and have a placement tolerance of +-0.1mm (non-accumulative). Make sure the relative measures between the connectors (marked with red in the picture above) are correct.

Note that the mounting hole location shall be measured relative to the three connectors, not relative to the pcb edge.

Since the stacking height is only 1.5mm in normal case, make sure no components other than the three connectors are within the dotted red line. When using 3mm stacking height it is possible to have low-profile components under the *iMX RT1176-32 uCOM Board*. The picture below illustrates the principal dimensions.
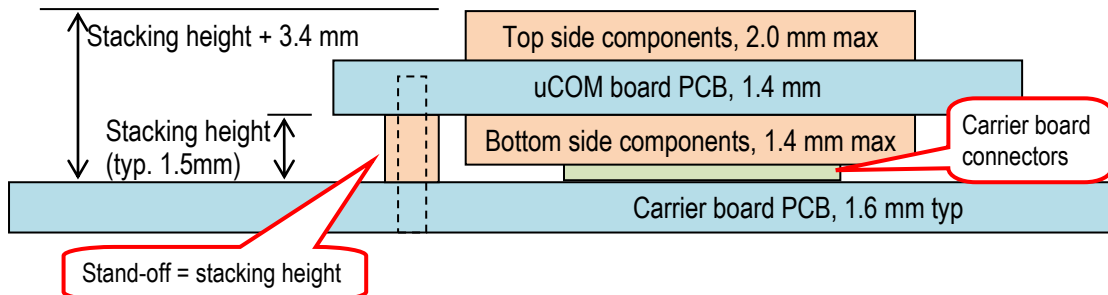

Figure 7 – uCOM Board Mounting on Carrier Board, Stacking Height

6.6.1   DF40C Socket

The headers mounted on the *iMX RT1176-32 uCOM Board* are DF40C-100DP-0.4V(51) (for JA / JB) and DF40C-40DP-0.4V(51) (for JC / JD).

The receptacles that are needed on the carrier board are, depending on stacking height:

Connector	1.5 mm stacking height (standard)	3.0 mm stacking height
100-pos (JA / JB)	DF40C-100DS-0.4V(51) HRS number: 684-4033-4 51	DF40HC(3.0)-100DS-0.4V(51) HRS number: 684-4151-0 51
40-pos (JC / JD)	DF40C-40DS-0.4V(51) HRS number: 684-4008-7 51	DF40HC(3.0)-40DS-0.4V(51) HRS number: 684-4169-6 51

If any of the connectors are not needed on the carrier board design, these do not have to be mounted. This typically applies to JC and JD.

6.6.2   Module Assembly Hardware

The *iMX RT1176-32 uCOM Board* has two 2.3 mm mounting holes for securing a good mechanical mounting. Use M2 screws and associated standoffs that have the same height as the stacking height (1.5mm or 3 mm, depending on carrier board connectors).

When mounting the *iMX RT1176-32 uCOM* board, match hole A on the carrier board with hole A on the uCOM board before the final mounting.

A suitable threaded insert is 9774015243R from Würth Elektronik. This component is used on the *uCOM Carrier Board*.

6.7 Environmental Specification

6.7.1 Operating Temperature

Ambient temperature (T_A)

Parameter		Min	Max	Unit
Operating temperature range:	commercial temperature range	0	70[1]	°C
	industrial temperature range	-40	85[1]	°C
Storage temperature range		-40	85	°C
Junction temperature i.MX RT1176 MCU, operating:	comm. temp. range	0	95	°C
	ind. temp. range.	-40	105	°C

[1] Depends on cooling/heat management solution.

6.7.2 Relative Humidity (RH)

Also make sure the relative humidity (RH) limits are met. The non-condensing requirement is important to meet. This can be a problem if temperature in the system is varying rapidly.

Parameter	Min	Max	Unit
Operating: 0°C ≤ T_A ≤ 70°C, non-condensing (comm. temp. range) Operating: -40°C ≤ T_A ≤ 85°C, non-condensing (ind. temp. range)	10	90	%
Non-operating/Storage: -40°C ≤ T_A ≤ 85°C, non-condensing	5	90	%

6.8 Thermal Design Considerations

Heat dissipation from the i.MX RT1176 MCU depending on many operating conditions, like operating frequency, operating voltage, activity type, activity cycle duration and duty cycle. Dissipated heat can be up to 2.5 Watt but is typically much lower. Note that an active Wi-Fi module or Ethernet-Phy can have considerable heat dissipation. This must be taken into account also.

If external cooling is needed, or not, depends on dissipated heat and ambient temperature range. In most cases it is possible to operate the *iMX RT1176 uCOM Board* without external cooling, at least with ambient temperature up to +50° Celsius. Above this, care must be taken not to exceed max junction temperature of the i.MX RT1176 MCU.

Verify operating conditions in the final product. Self-heating in an application can sometimes be significant (depending on ventilation and cooling). Always measure the operating temperature on the i.MX RT1176 MCU under worst case situation (lowest temperature, no execution/idle activity versus highest temperature, maximum execution/highest load). Verify that the case temperature is within allowed limits.

The i.MX RT1176 MCU has an integrated temperature sensor for monitoring the junction (i.e., die) temperature.

6.8.1 Thermal Parameters

The i.MX RT1176 MCU thermal parameters are listed in the table below.

Parameter	Typical	Unit
Thermal Resistance, Junction to ambient ($R_{\theta JA}$), natural convection	31.6	°C/W
Thermal Resistance, Junction to package top ($R_{\theta JC}$)	10	°C/W

6.9   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.

7 Functional Verification and RMA

There is a number of functional tests that can be performed on the *iMX RT1176-32 uCOM Board* to verify correct operation on the different interfaces. Note that these tests must be performed on the carrier board that is supplied with the *iMX RT1176-32 uCOM Developer's Kit* and with the latest version of an unmodified copy of the patched SDK that Embedded Artists provide.

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 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).

8   Things to Note

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

8.1   Shared Pins and Multiplexing

The i.MX RT1176 Crossover microcontroller has multiple on-chip interfaces that are multiplexed on the external pins. It is not possible to use all interfaces simultaneously and some interface usage is prohibited by the *iMX RT1176-32 uCOM* on-board design. Check if the needed interfaces are available to allocation before starting a design. These is a separate Excel sheet for this, showing all the pin multiplexing options available for each signal on the DF40C expansion connectors.

8.2   Boards with Early Silicon (rev A boards)

The first boards produced used the early silicon revisions made available by NXP. These boards are identified as being rev PA4 or rev A boards (written in the silk screen on the top side of the board) and also by the marking of the i.MX RT1176 processor itself. If the processor part number begins with a "P", as illustrated in the picture below, then it is an early silicon version.

The ten GPIO_SNVS_xx pins cannot be configured as GPIOs on this early silicon revision. This limits the some features of the M.2 and Ethernet-Phy interface.

GPIO_SNVS_01 to GPIO_SNVS_05 are used for BT_REG_ON, BT_DEV_WAKE, BT_HOST_WAKE, WL_REG_ON and WL_DEV_WAKE, respectively. There is functionality on the *uCOM Carrier Board* to implement the most important signals via an I2C GPIO expander. The M.2 interface is functional except for waking the M.2 module up from sleep.

GPIO_SNVS_06 to GPIO_SNVS_08 are used for Ethernet-Phy interrupt, reset and WOL (wake-on-LAN) interrupts. This functionality is missing on the affected boards.

On processors where the part number begins with an "M", the ten GPIO_SNVS_xx pins can be configured as GPIOs. For these, above is not an issue. All boards produced after June 2021 are rev B, or later, and have processors part numbers beginning with an "M".

8.3 On-board I2C Connected Devices

There are two I2C-E2PROM connected to the I2C-A channel, as outlined in the table below. Note that maximum clock frequency on I2C-A is 400kHz.

Board Revisions	Reserved I2C-E2PROM	1 Kbit I2C-E2PROM with EUI-48 number for unique Ethernet-MAC address
Component mounted	Microchip 24LC64T-E/MNY	Microchip 24AA025E48T-I/OT
A	Connected to I2C-A 7-bit address 0x55 8-bit address 0xAA/0xAB	Component not present on this board revision
Later revisions; PB1, B, C, C1, etc.	Connected to I2C-A 7-bit address 0x55 8-bit address 0xAA/0xAB	Connected to I2C-A 7-bit address 0x53 8-bit address 0xA6/0xA7

Note that the on-board I2C-E2PROM is reserved for future internal use. The E2PROM is write-protected in normal operation.

It is possible to connect an external I2C-device to IC2-channel #A on the carrier board.

However, note that it is not possible to connect an external I2C-device to IC2-channel #A on the carrier board to the already taken addresses, see table above.

8.4 Program Content when uCOM Boards are Delivered

The *iMX RT1176 uCOM* board is delivered with a pre-programmed application that is just a forever loop of NOP operations. No pin initialization is done so the application mimics what happens if the program flash would be empty or if USB Boot loader/ISP mode is enabled.

Note that in general **it is a bad idea to assume an *iMX RT1176 uCOM* board is always empty when you first mount in on a carrier board**. The board can have been accidentally programmed with another application during the program development work.

It is strongly recommended to implement a procedure to always make sure a known application is programmed an *iMX RT1176 uCOM* board when mounted on a carrier board. Before powering a board that has just been mounted on a carrier board, place the processor in USB Boot loader/ISP mode (by pulling pin ISP_ENABLE low). Design the carrier board so that a processor in USB Boot loader mode/ISP will not be damaged or do anything harmful to the carrier board. Program the correct application directly after powering the carrier board (with the new *iMX RT1176 uCOM* board).

Note that when the *iMX RT1176 uCOM* board is sold as part of an *iMX RT1176 Developer's Kit*, a demo application is programmed to the board. This is one of the reasons to never assume an *iMX RT1176 uCOM* board does not have an application programmed.

8.5 OTP Fuse Programming and Boot Control

The i.MX RT1176 MCU has on-chip OTP fuses that can be programmed, see NXP documents *IMXRT1170RM, i.MX RT1170 Processor Reference Manual* for details. Once a fuse is programmed, there is no possibility of reprogramming it.

***iMX RT1176 uCOM Boards* are delivered with BT_FUSE_SEL = 1**. No other OTP fuse has been programmed. It is completely up to the uCOM board user to decide if other OTP fuses shall be programmed, and in that case, which ones.

Just programming BT_FUSE_SEL = 1 will set the boot device to the on-board QSPI flash. It is possible to specify another boot mode by programming the BOOT_CFG1[7:0] and BOOT_CFG2[3:0] fuses.

Note that Embedded Artists does not replace iMX RT1176 uCOM Boards because of wrong OTP programming. It's the user's responsibility to be absolutely certain before OTP programming and not to program the fuses by accident.

Note that signal BOOT_CTRL can be either high or low. It does not matter. The result is the same since BT_FUSE_SEL = 1. The board will boot according to OTP fuses. The default (when no specific fuses, except BT_FUSE_SEL, are programmed) is from external QSPI flash. Other boot sources are possible by programming OTP fuses. See NXP document *IMXRT1170RM, i.MX RT1170 Processor Reference Manual* for details.

8.6 Handle the uCOM Board with Great Care

Handle the *iMX RT1176 uCOM board* with great mechanical care. Only remove/unmount it from the *uCOM Carrier board* if absolutely needed. Only use small movements and small force. Do not insert a screwdriver between the uCOM board and uCOM Carrier board and bend without having first watched the Youtube video we have published about this topic:
https://www.youtube.com/watch?v=-a1UGi_rrLM, title "How to mount and unmount a uCOM board"

8.7 Pull-up resistor required on JB pin 70 (POR_B)

A 50K-100K ohm pull-up resistor must be connected between pin JB pin 70 (POR_B) this signal and JA pin 20, 22, 24, 26, 28, 30 (the internally generated 3.3V supply).

Do not leave this pin floating.

8.8 Board Revision Differences

There are a couple of different board revisions. The differences are listed below.

Board Revision	Unique Ethernet-MAC address in I2C-E2PROM	Gigabit Ethernet Phy	Wi-Fi module supported	Internal 1.8V power supply	ADC reference
A	Not mounted	AR8031	1ZM	LDO	Internal
PB1, B	Present	AR8031	1ZM	LDO	Internal
C	Present	AR8031	1XK	LDO	Internal
C1	Present	RTL8211	1XK	LDO	Internal
C2	Present	RTL8211	1XK	Switching dcdc regulator	External reference supported

8.9   Note uCOM Orientation When Mounting

It is possible to mount the uCOM board with incorrect orientation. Doing that will damage the uCOM board beyond repair and can also damage the carrier board. Make sure (production) mounting instructions are particular about the orientation and how to identify the correct orientation of the uCOM. It is recommended to add notes in the silk screen on the carrier board to make operators aware of the issue. The picture below illustrates the silk screen text found on the *uCOM Carrier Board*.

Always match the "A" and "B" marking on the uCOM with the "A" and "B" on the *Carrier Board*.
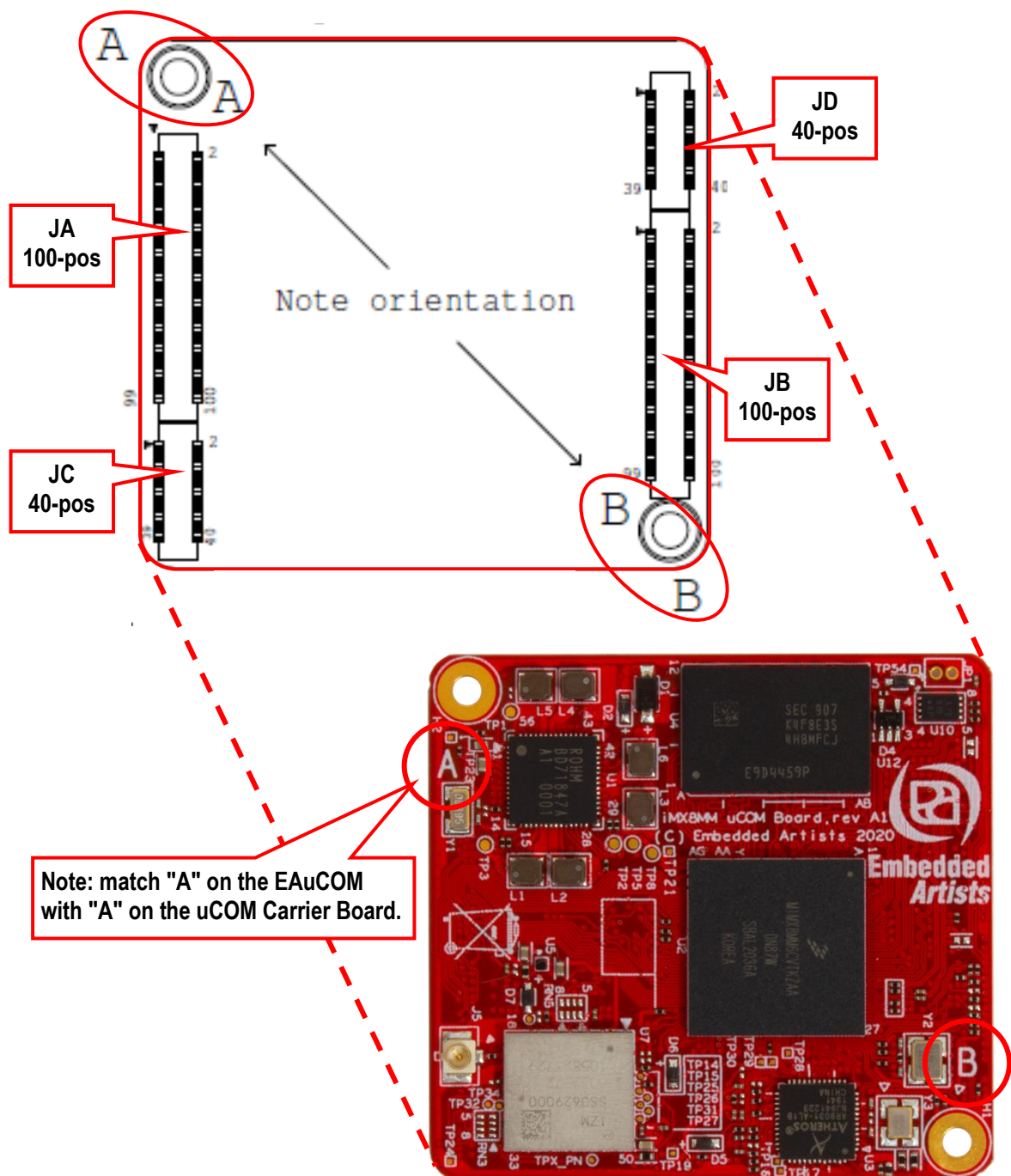

Figure 9 – Orientation of uCOM Board when Mounting on Carrier Board

8.10   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:

- *iMX RT1176 uCOM 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 *iMX RT1176-32 uCOM Board* targets a wide range of applications, such as:

- HMI/GUI solutions
- Connected vending machines
- Point-of-Sale (POS) applications
- Access control panels
- Audio
- IP phones
- Smart appliances
- Home energy management systems

- Industrial automation
- HVAC Building and Control Systems
- Smart Grid and Smart Metering
- Smart Toll Systems
- Data acquisition
- Communication gateway solutions
- Connected real-time 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 *iMX RT1176-32 uCOM 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 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 *iMX RT1176-32 uCOM 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 *iMX RT1176-32 uCOM Board*.

8.11   ESD Precaution when handling the uCOM Board

Please note that the *iMX RT1176-32 uCOM 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 mounting hole (which is grounded) 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.

In general touch as little as possible on the boards in order to minimize the risk of ESD damage. The only reasons to touch the board are when mounting/unmounting it on a carrier board.

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

8.12   EMC / ESD

The *iMX RT1176-32 uCOM 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.

The *iMX RT1176-32 uCOM Board* must be mounted on carrier board (typically an application specific board) and therefore EMC and ESD tests only makes sense on the complete solution.

No specific ESD protection has been implemented on the *iMX RT1176-32 uCOM Board*. ESD protection on board level is the same as what is specified in the i.MX RT1176 MCU datasheet. **It is strongly advised to implement protection against electrostatic discharges (ESD) on the carrier board** on all signals to and from the system. Such protection shall be arranged directly at the inputs/outputs of the system.

9   Custom Design

This document specifies the standard *iMX RT1176-32 uCOM Board* design. Embedded Artists offers many custom design services. Contact Embedded Artists for a discussion about different options.

Examples of custom design services are:

- Mounting a Wi-Fi/BT module.

- Different memory sizes on SDRAM and QSPI Flash.

- Different I/O voltage levels on all or parts of the pins.

- Different mounting options, for example remove Gigabit Ethernet interface to get access to the parallel RGB display interface.

- Different pinning on DF40C connectors.

- Different board form factor and different expansion connectors (different board standard).

- Different input supply voltage range.

- Single Board Computer solutions, where the core design of the *iMX RT1176-32 uCOM Board* is integrated together with selected interfaces.

- Changed internal pinning to make certain pins available.

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

- Standard Carrier boards ready for integration

- Custom Carrier board design

- Display solutions

- Mechanical solutions

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