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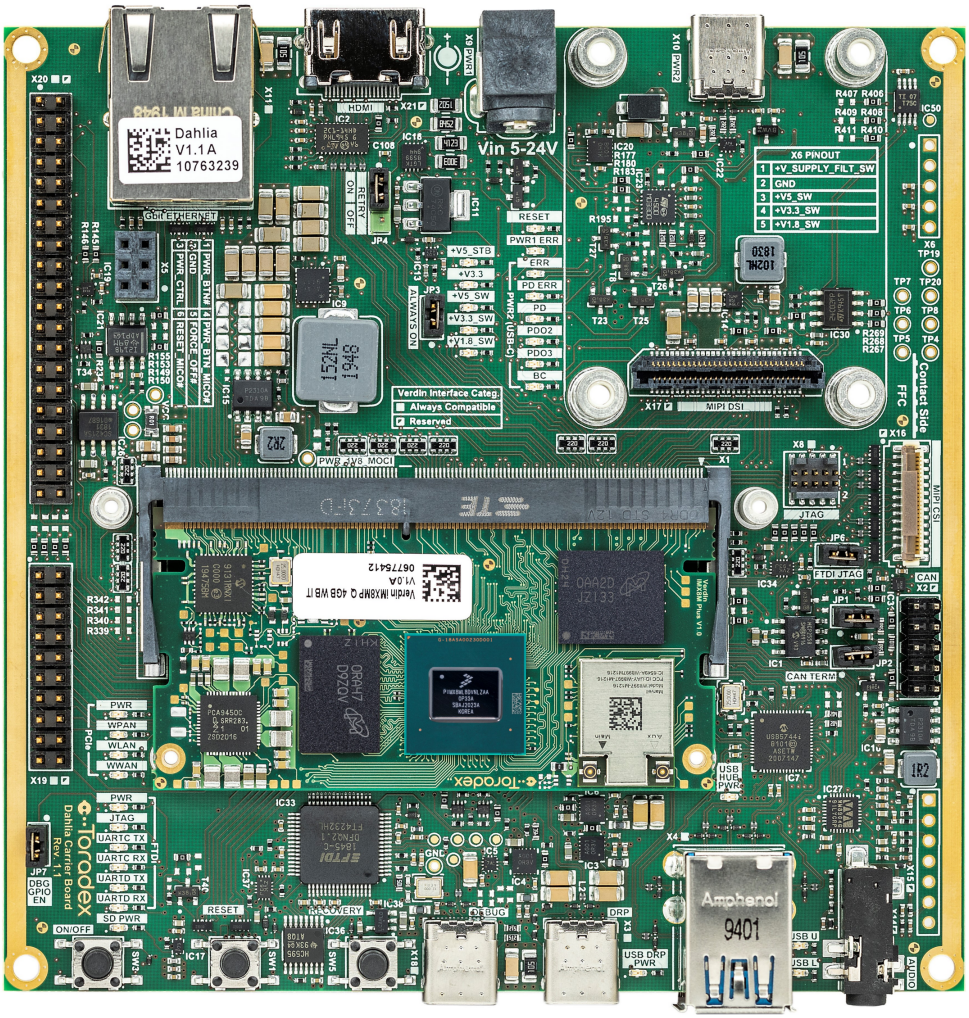
Dahlia Carrier Board

HW Datasheet



Revision History

Document Revisions

Date	Doc. Revision	Product Version	Changes
17-Jun-2021	Rev. 1.0	V1.1	Initial Release
01-Jul-2021	Rev. 1.01	V1.1	Minor improvements
06-Sep-2021	Rev. 1.02	V1.1	Minor fixes on the Block Diagram. Contact e-mail update.
21-Oct-2022	Rev. 1.03	V1.1	Minor fixes in Sections 2.13.1.1 and Sections 2.13.2.1.
26-Oct-2023	Rev. 1.04	V1.1	Section 1: Added note about Verdin DSI to HDMI adapter. Section 1.1.19: Added to document.
08-Mar-2024	Rev. 1.05	V1.1	Minor fixes on Figure 1 on page 9. Minor fixes on Figure 6 on page 15. Section 2.8.2: Corrected signal names on Table 21. Section 2.10.2: Corrected signal name on Table 25. Section 2.12.1: Corrected signal name on Table 29. Section 2.13.1.3: Corrected signal voltages on Table 35. Section 2.13.1.3: Corrected descriptions on Table 36. Section 2.13.2.2: Corrected assembled components on Table 40.

Contents

1 Introduction

Dahlia is a carrier board for the Verdin family of System-on-Modules (SoMs) / Computer on Modules (CoMs). Dahlia provides access to some of the most important features supported by the Verdin family.

The majority of standard interfaces supported by the Verdin modules are exposed on the Dahlia Carrier Board through a combination of real-world connectors, card slots, and 2.54mm pitch pin headers.

CAE data for the board, including schematics, layout, and IPC-7351 compliant component libraries, are freely downloadable from the Toradex developer website.

To ensure optimal compatibility and user experience with the Dahlia Carrier Board, it must be ordered with the Verdin DSI to HDMI Adapter. This adapter uses a MIPI DSI interface to provide an HDMI output that seamlessly integrates with all Verdin System on Modules, guaranteeing an enhanced and comprehensive user experience.

1.1 Reference Documents

For detailed technical information, please refer to the documents listed below.

1.1.1 Verdin Family Specification

https://docs.toradex.com/109262-verdin-family-specification.pdf

1.1.2 Verdin Carrier Board Design Guide

https://docs.toradex.com/108140-verdin-carrier-board-design-guide.pdf

1.1.3 Verdin Computer on Module family overview

https://www.toradex.com/computer-on-modules/Verdin-arm-family

1.1.4 Toradex Developer Website – Verdin Computer on Module documents

https://developer.toradex.com/products/verdin-som-family/modules

1.1.5 Carrier Board Layout Guide

https://docs.toradex.com/102492-layout-design-guide.pdf

1.1.6 Toradex Developer Website – Dahlia Carrier Board Design Files

https://developer.toradex.com/products/dahlia-carrier-board

1.1.7 Push-button On/Off Controller datasheet

https://www.analog.com/media/en/technical-documentation/data-sheets/2954fb.pdf

1.1.8 USB Hub Datasheet

https://ww1.microchip.com/downloads/en/DeviceDoc/USB5744-Data-Sheet-DS00001855J.pdf

1.1.9 Audio Codec Datasheet

https://statics.cirrus.com/pubs/proDatasheet/WM8904_Rev4.0.pdf

1.1.10 CAN FD Transceiver Datasheet

https://ww1.microchip.com/downloads/en/DeviceDoc/20005533A.pdf

1.1.11 USB Type-C Configuration Channel Logic Datasheet

https://www.ti.com/lit/ds/symlink/tusb321ai.pdf

1.1.12 USB Type-C Port Controller for Power Sinks Datasheet

https://www.st.com/resource/en/datasheet/stusb4500.pdf

1.1.13 UV/OV and Reverse Protection Controller Datasheet

https://www.analog.com/media/en/technical-documentation/data-sheets/LTC4368.pdf

1.1.14 USB Type-C Power Switch Datasheet

http://www.aosmd.com/res/data_sheets/AOZ1327DI-01.pdf

1.1.15 Current/Power Monitor Datasheet

https://www.ti.com/lit/ds/symlink/ina219.pdf?ts=1624942141618

1.1.16 EEPROM Datasheet

https://www.st.com/resource/en/datasheet/m24c02-f.pdf

1.1.17 Digital Temperature Sensor Datasheet

https://www.ti.com/lit/gpn/tmp75c

1.1.18 DC/DC converters Datasheets

http://www.aosmd.com/res/data_sheets/AOZ2261AQI-10.pdf

http://www.ti.com/lit/ds/symlink/tps61022.pdf

https://www.diodes.com/assets/Datasheets/PAM2310.pdf

1.1.19 Toradex Developer Website – Verdin DSI to HDMI Adapter

https://developer.toradex.com/hardware/verdin-som-family/add-ons/verdin-dsi-to-hdmi-adapter/

1.2 Abbreviations

Table 1: Abbreviations

Abbreviation	Explanation
ADC	Analog to Digital Converter
CAN	Controller Area Network, a bus that is mainly used in the automotive and industrial environment
CAN FD	Controller Area Network Flexible Data-Rate, an extension to the original CAN bus protocol which allows higher data rates and larger message sizes.
CEC	Consumer Electronic Control, HDMI feature that allows controlling CEC compatible devices
CPU	Central Processor Unit
CSI	Camera Serial Interface
DAC	Digital to Analog Converter
DDC	Display Data Channel, interface for reading out the capability of a monitor. In this document DDC2B (based on I2C) is always meant.
DFP	Downstream Facing Port, USB Type-C port that acts as a host
DRP	Dual-Role Port, USB Type-C port that can operate as power sink and source
DSI	Display Serial Interface
DVI	Digital Visual Interface, digital signals are electrically compatible with HDMI
EDID	Extended Display Identification Data, timing setting information provided by the display in a PROM
EMI	Electromagnetic Interference, high-frequency disturbances
ESD	Electrostatic Discharge, high voltage spike or spark that can damage electrostatic-sensitive devices
FPD-Link	Flat Panel Display Link, high-speed serial interface for liquid crystal displays. In this document is also called the LVDS interface.
GBE	Gigabit Ethernet, Ethernet interface with a maximum data rate of 1000Mbit/s
GND	Ground
GND_CHASSIS	Chassis Ground
GPIO	General Purpose Input/Output, pin that can be configured as an input or output
GSM	Global System for Mobile Communications
HDA	High-Definition Audio (HD Audio), the digital audio interface between CPU and audio codec
I2C	Inter-Integrated Circuit, the two-wire interface for connecting low-speed peripherals
I2S	Integrated Interchip Sound, serial bus for connecting PCM audio data between two devices
I/O	Input-Output
JTAG	Joint Test Action Group, widely used debug interface
LCD	Liquid Crystal Display
LSB	Least Significant Bit
LVDS	Low-Voltage Differential Signaling, electrical interface standard that can transport high-speed signals over twisted-pair cables. Many interfaces like PCIe or SATA use this interface. Since the first successful application was the Flat Panel Display Link, LVDS became a synonymous for this interface. In this document, the term LVDS is used for the FPD-Link interface.
MAC	Medium Access Control is part of the second layer (data link layer) in the Ethernet stack
MIPI	Mobile Industry Processor Interface Alliance
MDI	Medium Dependent Interface, the physical interface between Ethernet PHY and cable connector
MDIO	Management Data Input/Output, an interface that is used for controlling the Ethernet PHY. The bus consists of the MDC clock and the MDIO bidirectional data signal.
mini PCIe	PCI Express Mini Card, the card form factor for internal peripherals. The interface features PCIe and USB 2.0 connectivity
MMC	MultiMediaCard, flash memory card

Continued on next page

Table 1: Abbreviations (Continued)

Abbreviation	Explanation
MSB	Most Significant Bit
NC	Not Connected
OD	Open-Drain
OTG	USB On-The-Go, a USB host interface that can also act as USB client when connected to another host interface
PCB	Printed Circuit Board
PCI	Peripheral Component Interconnect, parallel computer expansion bus for connecting peripherals
PCIe	PCI Express, a high-speed serial computer expansion bus, replaces the PCI bus
PCM	Pulse-Code Modulation, digitally representation of analog signals, standard interface for digital audio
PD	Pull-Down Resistor
PHY	The physical layer of the OSI model
PU	Pull-up Resistor
PWM	Pulse-Width Modulation
PWR	Power
QSPI	Quad SPI, SPI interface with four bidirectional data signals
RGMII	Reduced Gigabit Media-Independent Interface, the interface between Ethernet MAC and PHY for up to 1Gb/s
RJ45	Registered Jack, common name for the 8P8C modular connector that is used for Ethernet wiring
RS232	The single-ended serial port interface
RS485	Differential signaling serial port interface, half-duplex, multi-drop configuration possible
R-UIM	Removable User Identity Module, identifications card for CDMA phones and networks, an extension of the GSM SIM card
SD	Secure Digital, flash memory card
SDIO	Secure Digital Input Output, an external bus for peripherals that uses the SD interface
SIM	Subscriber Identification Module, an identification card for GSM phones
SMBus	System Management Bus (SMB), a two-wire bus based on the I^2C specifications, is used in x86 designs for system management.
SoC	System on a Chip, IC which integrates the main component of a computer on a single chip
SoM	System on a Module, PCB which integrates the main component of a computer on a single board
SPI	Serial Peripheral Interface Bus, synchronous four-wire full-duplex bus for peripherals
TIM	Thermal Interface Material, thermally conductive material between CPU and heat spreader or heat sink
TMDS	Transition-Minimized Differential Signaling, serial high-speed transmitting technology that is used by DVI and HDMI
TVS Diode	Transient-Voltage-Suppression Diode, a diode that is used to protect interfaces against voltage spikes
UFP	Upstream Facing Port, USB Type-C port that acts as a client
UART	Universal Asynchronous Receiver/Transmitter, serial interface, in combination with a transceiver an RS232, RS422, RS485, IrDA or similar interface can be achieved
USB	Universal Serial Bus, serial interface for internal and external peripherals

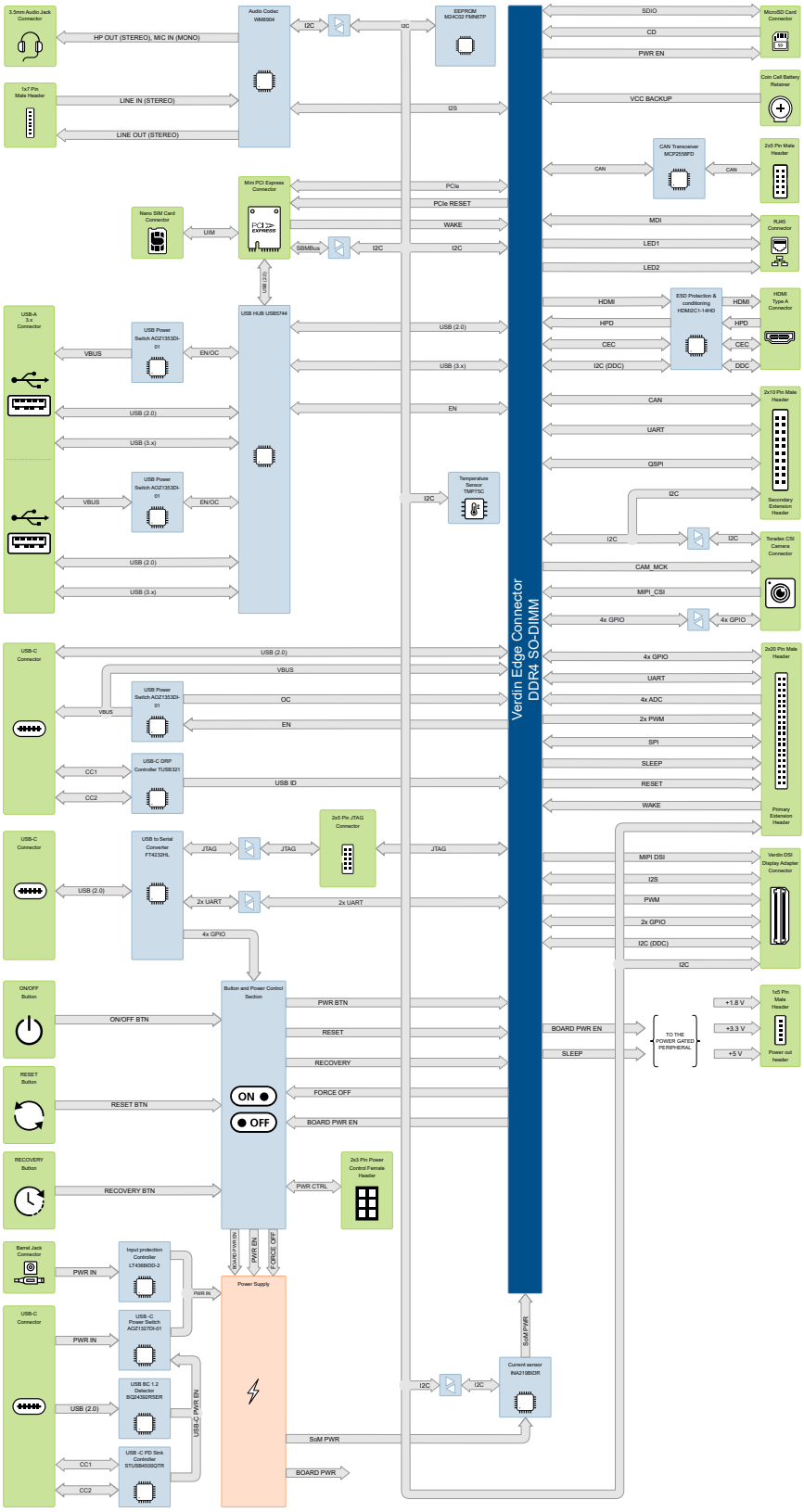
1.3 Main Features

The Dahlia Carrier Board provides the following features and communication interfaces:

- 2x USB 3.x Host ports (with USB Type-A connectors) through the on-board USB hub
- 1x USB 2.0 Dual-Role-Port (DRP) (with a USB-C connector)
- 1x USB 2.0 debug port (with a USB-C connector; optionally connected to UART3, UART4, control signals, and JTAG) for connecting the multipurpose USB to serial converter based on the FT4232HL IC
- 1x USB Power Input (with a USB-C connector)
- 1x Ethernet port (with an RJ45 connector) featuring a 10/100/1000 Mbps interface
- 1x PCIe port (with Mini PCIe connector)
- Nano-SIM Card holder
- 1x HDMI port (with Type A connector)
- 2x Low-speed 2.54mm pitch male extension headers (Primary 40-pin header, Secondary 20-pin header)
- 1x MIPI® CSI Camera Interface (with an FFC connector)
- 1x MIPI DSI Display Interface (with a board-to-board connector) allows for connecting various DSI display adapters: DSI to HDMI, DSI to LVDS, DSI to parallel RGB, etc.
- 1x JTAG port (with a 10-pin Cortex debug connector)
- 1x 4-bit SD® Card port (with MicroSD connector)
- 1x I^2C 2Kb EEPROM IC
- 1x Digital Temperature Sensor with I^2C interface
- 1x Current/Power Monitor with I^2C interface
- Audio I/O on 3.5mm stereo jack (Mic IN, Headphone OUT)
- Audio I/O on 2.54mm male pin header (Line IN, Line OUT)
- 4x I^2C, 1x SPI, 3x PWM, 4x ADC inputs
- 1x CAN interface (Male Header Connector) supporting CAN FD up to 8Mbps
- 1x Battery Holder for the Verdin VCC_BACKUP supply
- 8x GPIOs
- Undervoltage, overvoltage, overcurrent, and reverse voltage protected power input
- Power input either from a barrel connector or from a dedicated USB-C connector
- Nano-ITX board size

1.4 Architecture Block Diagram

Figure 1: Dahlia Carrier Board Hardware Architecture



1.5 Physical Drawing

1.5.1 Top Side Connectors

Figure 2: Dahlia Carrier Board top side connectors (top, front, and back view)

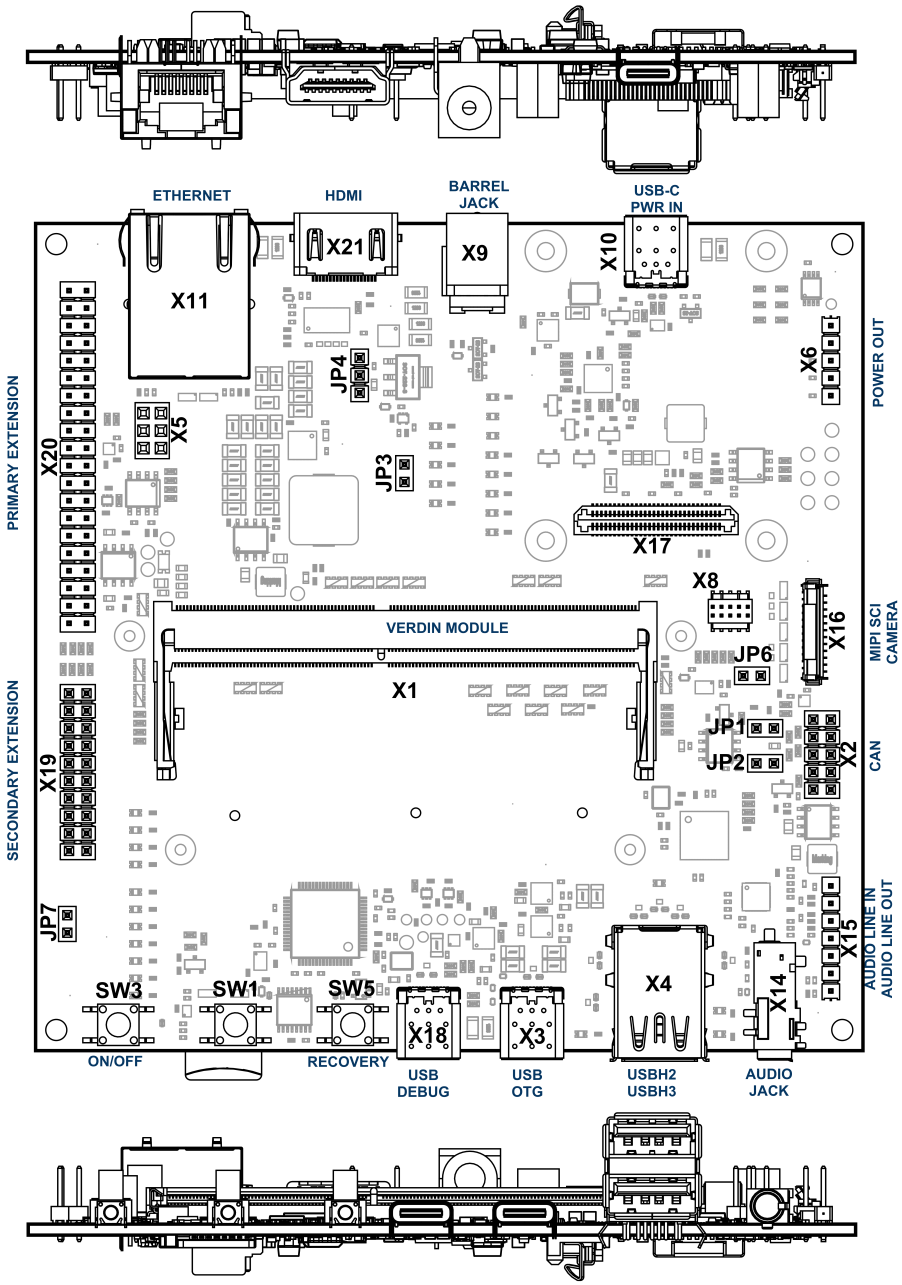


Table 2: Top Side Connectors

Designator	Description	Remarks
X1	Verdin Edge Connector	DDR4 SO-DIMM
X2	CAN Connector	CAN_1 interface
X3	USB-C Connector	Dual-role-port (DRP) (USB 2.0 interface only)
X4	2x USB 3.x Host Connector	UPPER: USBH3 - LOWER: USBH2
X5	Power Control Header	
X6	Power Out Header	Not assembled
X8	JTAG Header	
X9	Barrel Jack Connector	Power Input: 5 - 27V
X10	USB-C Power Input Connector	Power Input: 5 - 20V
X11	Ethernet Connector	Ethernet_1 interface
X14	Audio Jack Connector	Headphone's output and microphone input
X15	Audio Pin Header	Audio Line IN/OUT interface, not assembled
X16	MIPI CSI Camera Connector	
X17	Verdin DSI Display Adapter Connector	Display adapter board connector
X18	USB Debug Connector	USB to Serial, USB to JTAG interface USB-C connector
X19	Secondary Extension Header	Low-speed extension header
X20	Primary Extension Header	Low-speed extension header
X21	HDMI Connector	

1.5.2 Bottom Side Connectors

Figure 3: Dahlia Carrier Board bottom side connectors (bottom view)

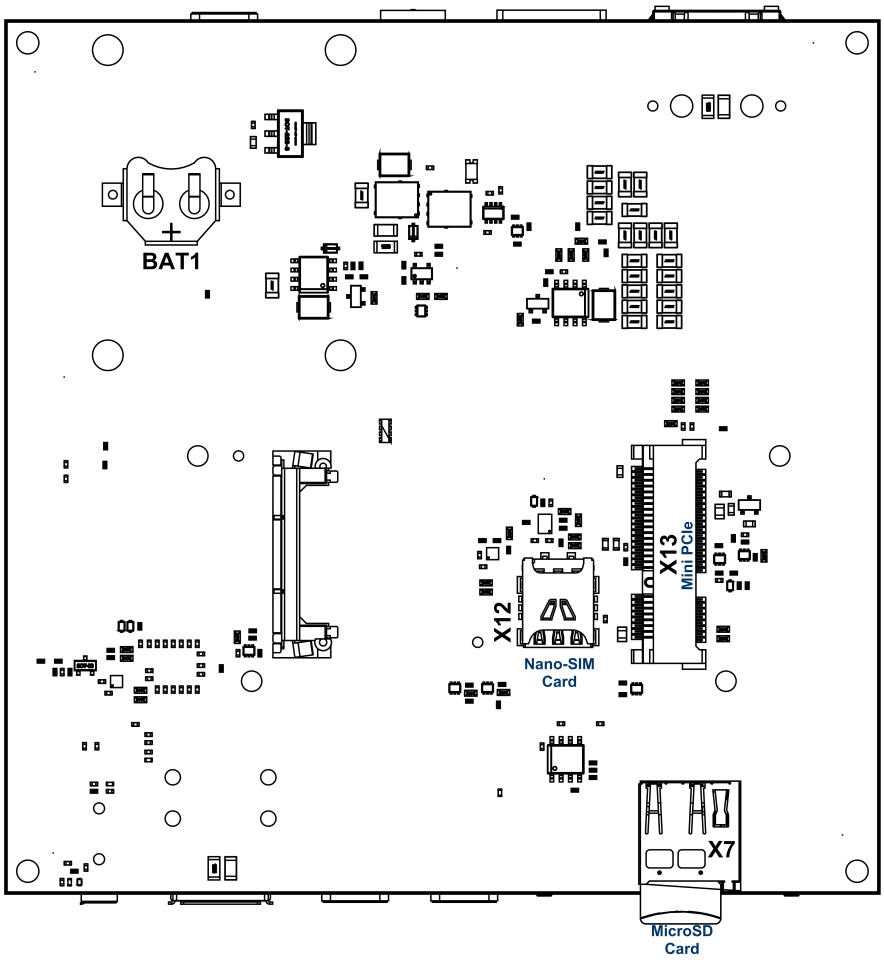


Table 3: Bottom Side Connectors

Designator	Description	Remarks
X7	MicroSD Card Connector	
X12	Nano-SIM Card Connector	
X13	Mini PCIe Connector	
BAT1	12mm Battery Holder	Supported batteries: CR1216, BR1220, BR1216, CR1216, BR1220, CL1220, CR1220, BR1225

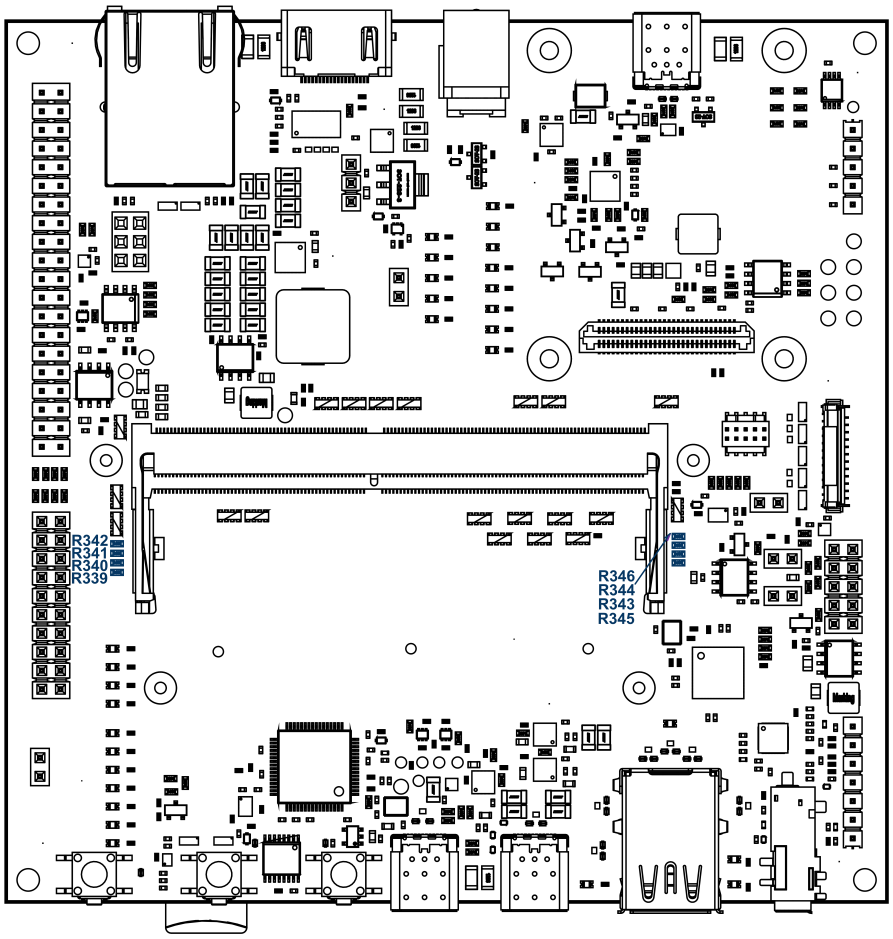
1.6 Assembly Options

This section marks/highlights the components on the Dahlia Carrier Board that can be used to configure different features and optional functionalities.

Changes in the PCB assembly voids the product warranty.
Toradex does not take any responsibility for malfunction or damage caused by changing assembly options.

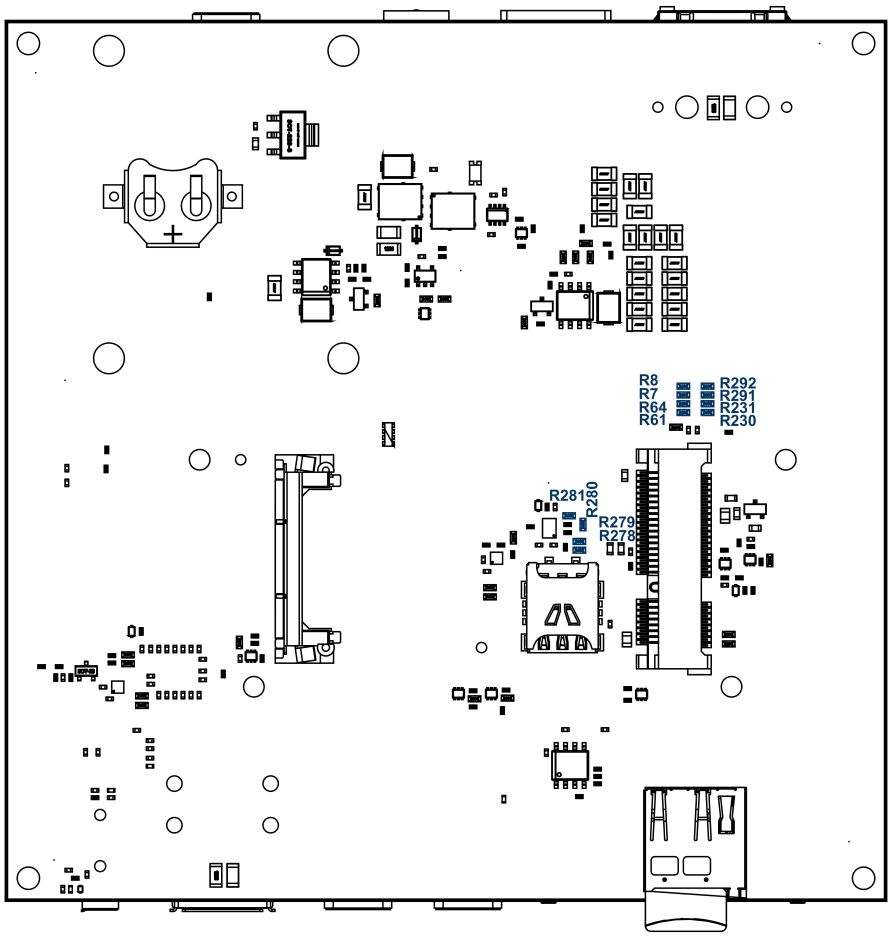
1.6.1 Top Side Assembly Options

Figure 4: Dahlia Carrier Board top side assembly options (top view)



1.6.2 Bottom Side Assembly Options

Figure 5: Dahlia Carrier Board bottom side assembly options (bottom view)



2 Interface Description

2.1 Verdin Computer-On-Module

Connector Type: DDR4 SO-DIMM 260 pin Socket

Manufacturer: TE-2309409-2

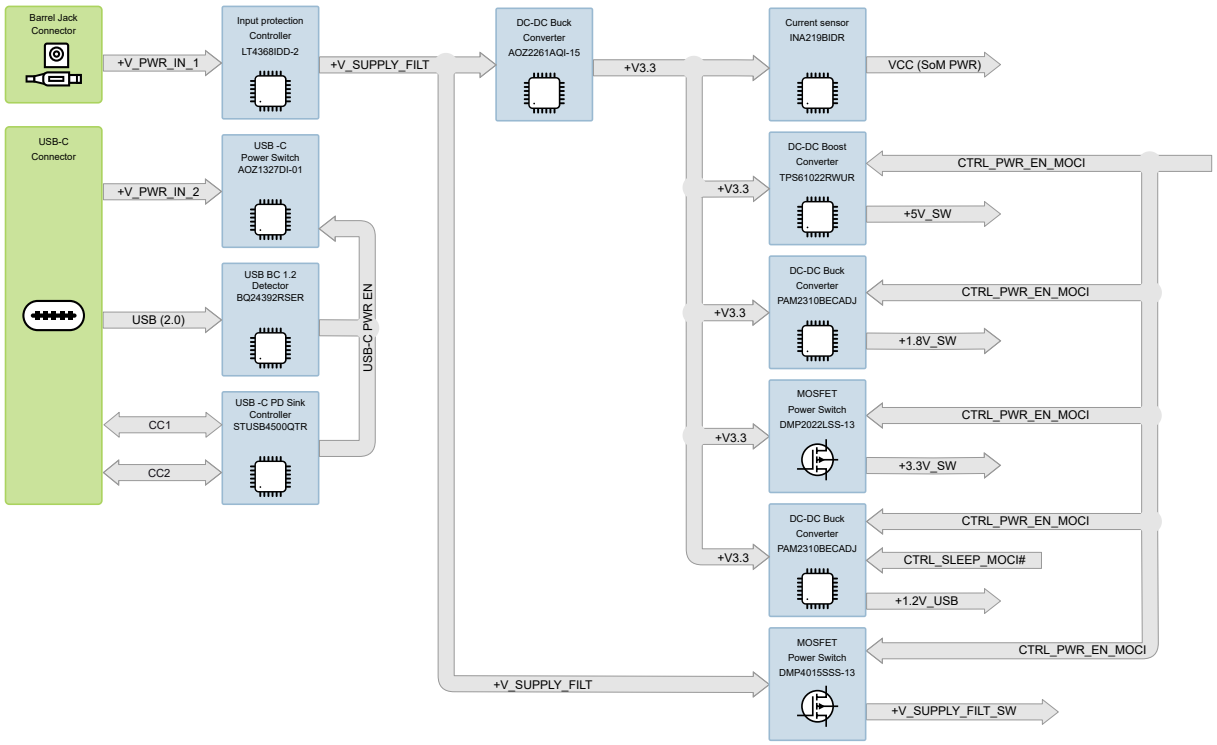
For the pinout of the Verdin module, please refer to the applicable Verdin module datasheet. Standoffs are available on the Dahlia Carrier Board for fixing the Verdin module to the carrier board.

2.2 Power Supply

The Dahlia Carrier Board has two different power connectors that can be used to power the board.X9, X10 are both wide input range connectors. Nominal input voltage can vary across 5V - 24V ±10% for X9 and 5V - 20V ±5% for X10. The Dahlia Carrier Board can automatically switch between these power sources, depending on the voltage applied to their inputs. The board's power supply will switch to the power source with a higher voltage.

Several power domains are available on the Dahlia board. The board's power supply architecture is shown in the picture below.

Figure 6: Power supply architecture



The on-board DC-DC converters provide the following supplies (maximum power):

- 5V / 3A (15W)
- 3.3V / 8A (24W)
- 1.8V / 2A (3.6W)

The Barrel Jack power supply input is protected against reverse voltage polarity, overvoltage, under-voltage, and short circuits. The maximum input current is limited to about 5A.

The X6 header connector provides these three primary system voltages and can power up external boards or modules.

2.2.1 Barrel Jack Connector (X9)

Connector Type: SWC RAPC722X

Table 4: Barrel Jack Connector (X9)

Pin	Signal Name	Voltage/Range
1	+V_PWR_IN_1	5V - 24V ±10%
2	GND_IN_1	
3	NC	

2.2.2 USB-C Power Input Connector (X10)

Connector Type: Amphenol 12401598E4#2A

Table 5: USB-C Power Input Connector (X10)

Pin	Signal Name	Voltage/Range
A1	GND_IN_2	
A2	NC	
A3	NC	
A4	+V_PWR_IN_2	5V - 20V ±5%
A5	PWR_IN_2_CC1	
A6	USB_CHG_CON_P	
A7	USB_CHG_CON_N	
A8	NC	
A9	+V_PWR_IN_2	5V - 20V ±5%
A10	NC	
A11	NC	
A12	GND_IN_2	
B1	GND_IN_2	
B2	NC	
B3	NC	
B4	+V_PWR_IN_2	5V - 20V ±5%
B5	PWR_IN_2_CC2	
B6	USB_CHG_CON_P	
B7	USB_CHG_CON_N	
B8	NC	
B9	+V_PWR_IN_2	5V - 20V ±5%
B10	NC	
B11	NC	
B12	GND_IN_2	

2.2.3 Power Out Header (X6)

Connector Type: 1×5 Pin Header Female, 2.54mm

Table 6: Power Out Header (X6)

Pin	Description	Remarks
1	+V_SUPPLY_FILT_SW	
2	GND	
3	+V5_SW	
4	+V3.3_SW	
5	+V1.8_SW	

2.2.4 Power Control

The circuit responsible for powering on and off the Dahlia Carrier Board is implemented using the Linear LTC2954 Push-button ON/OFF controller. The signal CTRL_PWR_EN_MOCI is used to enable the peripheral power supplies or power switches.

For further information about the signals provided by the LTC2954 controller, please refer to the device datasheet.

The SW1 and SW3 buttons have been assigned to the RESET and ON/OFF functions, respectively. The SW5 is used to put the installed Verdin Computer Module into Recovery Mode.

The Power CTRL connector X5 allows the RESET and POWER Button control signals to be accessed from an external system connected to it.

2.2.4.1 Power Control Header (X5)

Connector Type: 2×3 Pin Header Female, 2.54mm Pitch

Table 7: Power Out Header (X5)

Pin	Signal Name	IO Type	Voltage	Pull-up/Pull-down	Description
1	PWR_BTN#	I (OD)	+1.9V	100k to +1.9V	It is connected to the POWER ON/OFF button SW2 and pulled up to 1.9V inside the pushbutton controller IC. Short pulling down, turns on Dahlia Carrier Board power and the Computer Module. A long pull-down forces the carrier board in the power-off state.
2	GND	PWR			
3	PWR_CTRL	I	+3.3V max	100k to GND	The behavior is similar to the "Always ON" Jumper. HIGH level on the PWR_CTRL input forcing on the Dahlia Carrier Board power.
4	CTRL_PWR_BTN_MICO#	I (OD)	+1.8V	on SoM	This signal is an open-drain input with a pull-up on the module. Long pulling down shuts down the module. Short pulling down, turns on the module from the off state. The signal can be left floating on the carrier board.
5	CTRL_FORCE_OFF_MOCI#	I (OD)	+5V	100k to +V5_STB	It is forcing the main power rail off. This signal is ignored for the first 512ms during the power-up sequence. The signal is 5V tolerant.
6	CTRL_RESET_MICO#	I (OD)	+1.8V	on SoM	Open-drain input, which resets the module if shorted to ground. It is pulled up on SoMs to be left floating on the carrier board if not needed.

Pin 3 of the connector X5 can be used to override the Pushbutton controller. The following table shows the behavior of the board according to the level of the PWR_CTRL signal:

Table 8: Behavior according to the PWR_CTRL signal

PWR_CTRL Level	Description
0 V	The Push-button controller is working normally
3.3 V	The Dahlia Carrier Board is Always ON when power is applied

2.2.4.2 Always-ON Jumper (JP3)

Jumper JP3 can be used to obtain "Always-On" behavior.

Connector Type: 1×2 Pin Header Male, 2.54mm Pitch

Table 9: Always-ON Jumper (JP3)

Jumper position	Description
OPEN	The power ON/OFF Switch controls the board power supply
CLOSED	The board power supply is in the "Always-On" state. The Dahlia Carrier Board powers up as soon as external power is applied

By default, jumper JP3 is open.

2.2.5 Power Supply Input Protection

The power supply input (X9) is protected against voltage reverse polarity, overvoltage, undervoltage, and short circuits. The protection circuit is based on the LTC4368 IC from Analog Devices. For detailed information, please refer to the LTC4368 datasheet.

The maximum input voltage in which the protection circuit is operating and capable of protecting the other circuits on the board without being damaged is specified in the table below. The table also lists the threshold values for overvoltage, undervoltage, and overcurrent protection.

Table 10: Power Supply Input Ratings

Parameter name	Min	Typ	Max	Unit
Input voltage (Absolute maximum)	-40		50	V
Undervoltage threshold	3.9	4.1	4.2	V
Overvoltage threshold	26.1	27.1	28.1	V
Overcurrent protection	4	5	6.1	A
Reverse current protection	99	300	505	mA
Recommended input voltage	**5**		**24**	V

Jumper JP4 controls the retry function of the power input protection circuit.

Connector Type: Type: 1×3 Pin Header Male, 2.54 mm Pitch

Table 11: Position of jumper JP4

Jumper position	Description
1-2	Power supply input restarts automatically after a forward overcurrent fault. The restart delay time is defined by the C108 capacitor $5.5ms/nF$. The typical value for Dahlia Carrier Board is 550ms
2-3	Power supply input stays OFF after a forward overcurrent fault. The external power supply should be switched OFF and ON to turn the power input again.

By default, jumper JP4 is in position 1-2.

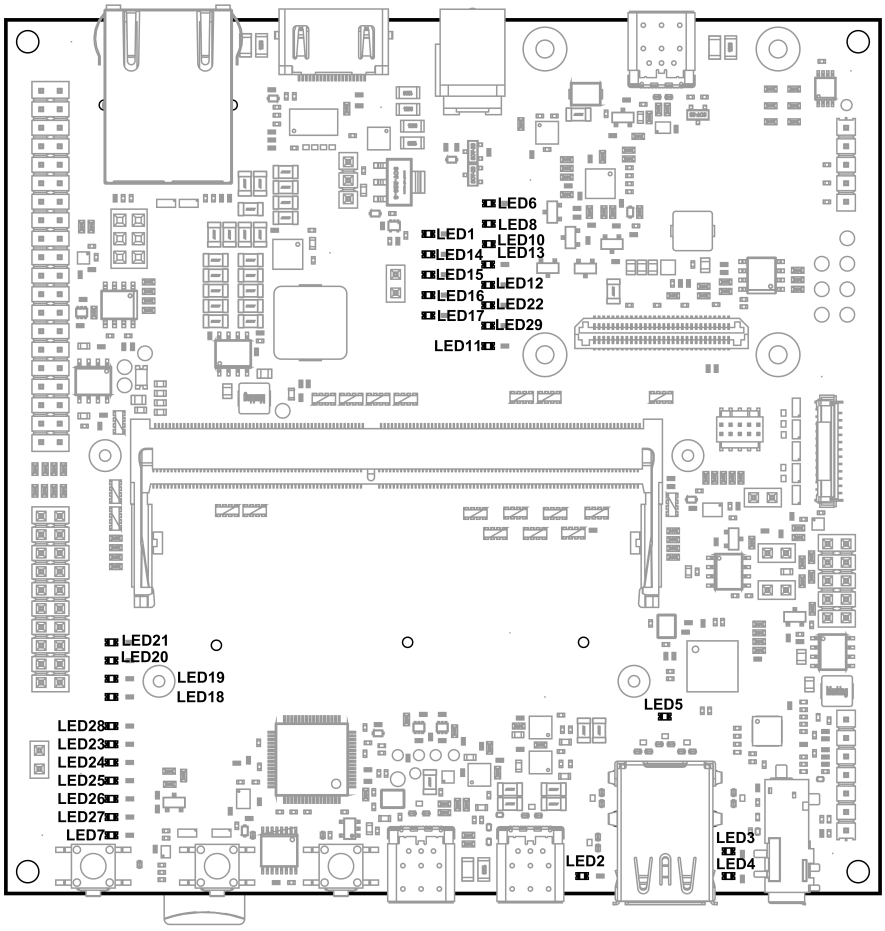
2.2.6 Current/Power Monitor

The Dahlia Carrier Board provides the option to measure the power consumption of a Verdin module. The INA219 power measurement IC measures current, voltage, and power. This IC21 is accessible through the I^2C_1 bus at the address 0×40 by default. For the details, please refer to the INA219 datasheet.

2.3 Indicators

The Dahlia Carrier Board features 28 LEDs. These LEDs indicate the status of the main power supplies and the activity statuses of some peripherals.

Figure 7: Indicators LEDs



The LEDs and their functions are listed below.

Table 12: LEDs Functions

Designator	Color	Description
LED1	Green	LED is lit when +V5 standby voltage is available
LED2	Green	LED is lit when USB_1 port power is ON (Connector X3)
LED3	Green	LED is lit when USBH3 host power is ON (X4 UPPER)
LED4	Green	LED is lit when USBH2 host power is ON (X4 LOWER)
LED5	Green	LED is lit when USB hub power is ON
LED6	Red	LED is lit when SoM and board peripherals are in a “RESET” state (CTRL_RESET_MOCI# is LOW).
LED7	Green	LED is lit when MicroSD Card power is ON
LED8	Red	LED is lit when power supply input protection is at fault due to the forward Overcurrent
LED10	Red	LED is lit when the USB-C power switch is at fault. For more details, check the AOZ1327DI datasheet

Continued on next page

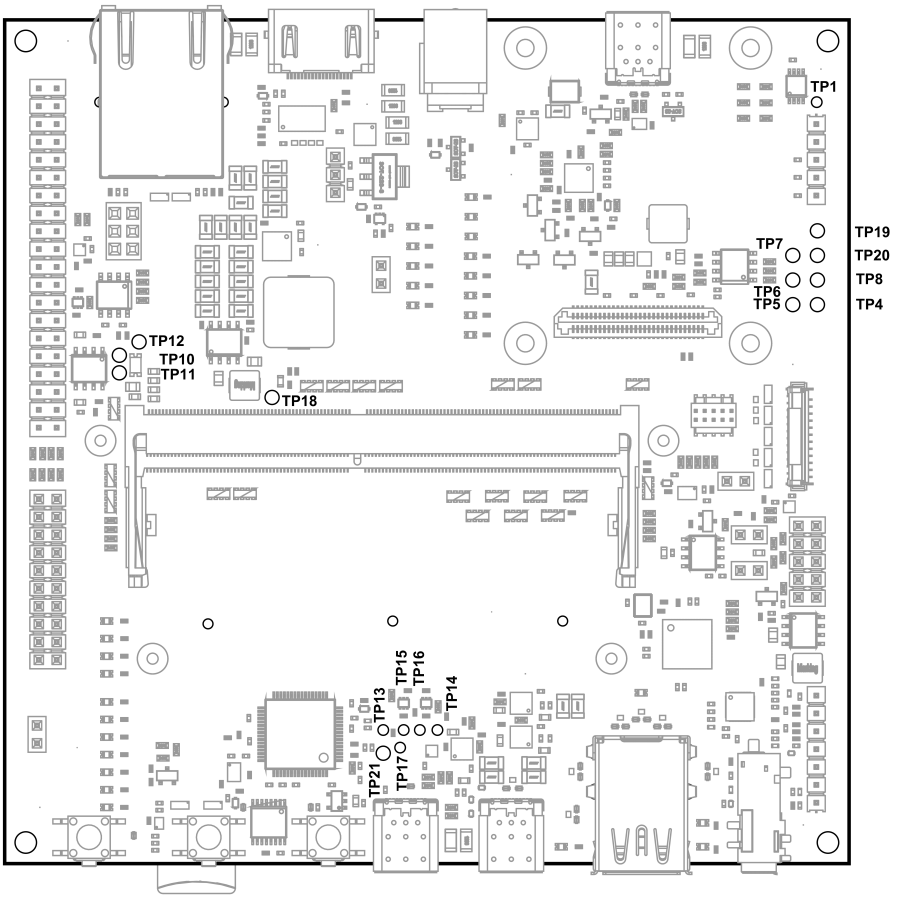
Table 12: LEDs Functions (Continued)

Designator	Color	Description
LED11	Green	LED is lit when the board powered through the USB-C connector from BC 1.2 standard compliant power supply
LED12	Green	LED is lit when the board powered through the USB-C connector from the USB PD protocol compliant power supply
LED13	Red	LED is lit when the USB-C PD controller (IC23) is at fault. For more details, check the STUSB4500 datasheet
LED14	Green	LED is lit when +V3.3 power is available
LED15	Green	LED is lit when +V5_SW power is available
LED16	Green	LED is lit when +V3.3_SW power is available
LED17	Green	LED is lit when +V1.8_SW power is available
LED18	Green	Mini PCIe status indicator: WWAN (Indication depend on the installed card)
LED19	Green	Mini PCIe status indicator: WLAN (Indication depend on the installed card)
LED20	Green	Mini PCIe status indicator: WPAN (Indication depend on the installed card)
LED21	Green	LED is lit when Mini PCIe connector power is ON
LED22	Green	LED is lit when USB-C PD power profile number 2 is ON
LED23	Yellow	FTDI JTAG Activity indicator
LED24	Yellow	LED is blinking when data transmission on FTDI_UARTC_TXD occurs
LED25	Yellow	LED is blinking when data receiving on FTDI_UARTC_RX occurs
LED26	Yellow	LED is blinking when data transmission on FTDI_UARTD_TXD LED occurs
LED27	Yellow	LED is blinking when data receiving on FTDI_UARTD_RX occurs
LED28	Green	LED is lit when USB Debugger (IC33) power is available - USB Debugger connected to the PC
LED29	Green	LED is lit when USB-C PD power profile number 3 is ON

Refer to the Dahlia Carrier Board schematics for more details.

2.4 Test Points

Figure 8: Dahlia Carrier Board Test Points - top side (top view)



The Test Points and their purpose are listed in the table below.

Table 13: Test Points

Designator	Description
TP1	IC50 Temperature Sensor Alert (Open Drain)
TP4	POWER_OK2# Signal of the IC23 USB PD sink controller
TP5	POWER_OK3# Signal of the IC23 USB PD sink controller
TP6	ATTACH# Signal of the IC23 USB PD sink controller
TP7	SCL Signal of the IC23 USB PD sink controller
TP8	SDA Signal of the IC23 USB PD sink controller
TP10	SoM power supply current sensing resistor (High side)
TP11	SoM power supply current sensing resistor (Low side)
TP12	SoM power supply voltage
TP13	USB_1_ID of the USB Type-C Configuration Channel Logic (IC5)
TP14	VCONN_FAULT# of the USB Type-C Configuration Channel Logic (IC5) (Open Drain)
TP15	OUT2 of the USB Type-C Configuration Channel Logic (IC5)

Continued on next page

Table 13: Test Points (Continued)

Designator	Description
TP16	OUT1 of the USB Type-C Configuration Channel Logic (IC5)
TP17	DIR of the USB Type-C Configuration Channel Logic (IC5)
TP18	PWR_1V8_MOCI of SoM
TP19	DM_HOST of High-Speed Switch (IC22)
TP20	DP_HOST of High-Speed Switch (IC22)
TP21	GND

2.5 Ethernet

The Dahlia Carrier Board provides a 1x RJ45 connector with integrated magnetics for 10/100/1000Mb Ethernet.

2.5.1 Ethernet_1 Connector (X11)

Connector Type: RJ45, BEL A829-1J1T-KM / LINK-PP LPJK7436A98NL

Table 14: Ethernet_1 Connector (X11)

Pin	Signal Name	SODIMM Pin	I/O Type	Voltage	Description
1	ETH_1_CTREF_2				Integrated magnetics center tap 2
2	ETH_1_ MDI2_N	241	I/O (Analog)		Negative differential Media Dependent Interface signal, lane 2
3	ETH_1_ MDI2_P	239	I/O (Analog)		Positive differential Media Dependent Interface signal, lane 2
4	ETH_1_ MDI1_P	233	I/O (Analog)		Positive differential Media Dependent Interface signal, lane 1
5	ETH_1_ MDI1_N	231	I/O (Analog)		Negative differential Media Dependent Interface signal, lane 1
6	ETH_1_CTREF_1				Integrated magnetics center tap 1
7	ETH_1_CTREF_3				Integrated magnetics center tap 3
8	ETH_1_ MDI3_P	247	I/O (Analog)		Positive differential Media Dependent Interface signal, lane 3
9	ETH_1_ MDI3_N	245	I/O (Analog)		Negative differential Media Dependent Interface signal, lane 3
10	ETH_1_ MDI0_N	227	I/O (Analog)		Negative differential Media Dependent Interface signal, lane 0
11	ETH_1_ MDI0_P	225	I/O (Analog)		Positive differential Media Dependent Interface signal, lane 0
12	ETH_1_CTREF_0				Integrated magnetics center tap 0
13	ETH_1_LED_1_C	235	O (OD)		LED for indication Ethernet activity
14	+V3.3_SW		PWR	+3.3 V	Power supply for the indication LEDs
15	NC				Not connected
16	+V3.3_SW		PWR	+3.3 V	Power supply for the indication LEDs
17	ETH_1_LED_2_C	237	O (OD)		LED for indication established Ethernet link
S1/S2	GND_CHASSIS		PWR		

2.6 Verdin USB_1 Port

The Dahlia Carrier Board integrates a USB-C connector X3, connected to the Verdin USB_1 port (USB 2.0 interface only). This port is usually used in the recovery mode to load new software onto the module and work as a dual-role-port (DRP), which means host or client. This behavior is similar to the On-The-Go

(OTG) functionality, but the term USB OTG is only used in conjunction with the USB Micro-AB or the obsolete USB Mini-AB receptacle. ID pin is absent on the USB Type-C receptacle. The determination of host or client functionality is handled differently in Type-C using the configuration channel (CC) pins. The CC pins perform the same functions that the ID pin previously served: they indicate the role of equipment as host, client, or both. The CC pins also detect if the connection is being made or if it is broken.

To handle all the operations required for the USB dual-role-port TUSB321AI chip has been used. It can function as an upstream-facing port (UFP), downstream-facing port (DFP), or a dual-role port (DRP) product based on a pin configuration. The device handles all aspects of the USB Type-C connection process (including the CC pins that mirror the micro-A/B ID pin behavior) to determine the port role. When connected as a peripheral (UFP), the TUSB321AI indicates the VBUS current provided by the attached host through the general-purpose input/output (GPIO) pins. When connected as a DFP, these devices advertise VBUS current to the attached peripheral. On the Dahlia Carrier Board, this port is configured as a dual-role port (DRP) by default, and its output current is limited to 1A. For the details, please check the TUSB321AI datasheet.

2.6.1 USB DRP Connector (X3)

Connector Type: USB Type-C, Amphenol 12401598E4#2A

Table 15: USB DRP Connector (X3)

Pin	Signal Name	SODIMM Pin	I/O Type	Voltage	Description
A1	GND		PWR		
A2	NC				Not Connected
A3	NC				
A4	+V5_VBUS_USB_1	159 (via R13)	PWR	+5V	+5V USB power output
A5	USB_1_CC1				USB-C configuration channel signal 1
A6	USB_1_D_CON_P	165 (via L2)	I/O		Positive differential USB 2.0 signal
A7	USB_1_D_CON_N	163 (via L2)	I/O		Negative differential USB 2.0 signal
A8	NC				Not Connected
A9	+V5_VBUS_USB_1	159 (via R13)	PWR	+5V	+5V USB power output
A10	NC				Not Connected
A11	NC				Not Connected
A12	GND		PWR		
B1	GND		PWR		
B2	NC				Not Connected
B3	NC				
B4	+V5_VBUS_USB_1	159 (via R13)	PWR	+5V	+5V USB power output
B5	USB_1_CC2				USB-C configuration channel signal 2
B6	USB_1_D_CON_P	165 (via L2)	I/O		Positive differential USB 2.0 signal
B7	USB_1_D_CON_N	163 (via L2)	I/O		Negative differential USB 2.0 signal
B8	NC				Not Connected
B9	+V5_VBUS_USB_1	159 (via R13)	PWR	+5V	+5V USB power output
B10	NC				Not Connected
B11	NC				

Continued on next page

Table 15: USB DRP Connector (X3) (Continued)

Pin	Signal Name	SODIMM Pin	I/O Type	Voltage	Description
B12	GND		PWR		

2.7 Verdin USB_2 Port

The Dahlia Carrier Board integrates a four-port USB hub (Microchip USB5744T-I/2G) connected to the SoM's USB_2 port, providing 4x USB 3.x / USB 2.0 host interfaces. The level of USB 3.x standard supported depends on the SoM. Some SoMs may not support the USB 3.x interface at all. Refer to the respective SoM datasheet to get detailed information about supported USB interfaces and their speed. The hub itself supports USB 3.2 Gen 1 / USB 2.0 standards.

The naming schemes of the USB 3.x (SuperSpeed) interface can be a bit confusing. There are different names for the same speed grade, depending on the revision of the specifications that are taken. Not all the USB 3.x transfer modes are possible with the Verdin modules since only one lane of SuperSpeed signals is reserved in the Verdin standard. A short comparison of the various transfer modes and their naming schemes has been made in the table below.

Table 16: USB 3.x transfer modes

Marketing Name	USB 3.2 Name	USB 3.1 Name	USB 3.0 Name	Nominal Speed	SuperSpeed Lanes	Supported by Verdin
SuperSpeed USB	USB 3.2 Gen 1x1	USB 3.1 Gen 1	USB 3.0	5 Gbit/s 0.5 GByte/s	1	Possible
SuperSpeed USB 10 Gbit/s	USB 3.2 Gen 1x2			10 Gbit/s 1 GByte/s	2	No
SuperSpeed USB 10 Gbit/s	USB 3.2 Gen 2x1	USB 3.1 Gen 2		10 Gbit/s 1.2 GByte/s	1	Possible
SuperSpeed USB 20 Gbit/s	USB 3.2 Gen 2x2			20 Gbit/s 2.4 GByte/s	2	No

The OC sensing pin of the USB_2 port is not used, and the USB hub handles OC conditions. Port 1 of the USB hub is disabled; on Port 4, only the USB 2.0 interface is used and routed to the Mini PCIe connector (X13). Port 2 and Port 3 are routed to a stacked USB 3.0 Type-A connector (X4). For further information about the USB hub, please refer to its datasheet.

A USB hub is a power-gated peripheral. The source of the power control signal for the USB hub can be defined with resistors R61, R64. The assembly option can be found in the table below:

Table 17: Power control signal for USB 3.x

Solution Selected	Assembly Options	Assembled Components	PCB Side
USB hub power is controlled by CTRL_SLEEP_MOCI# signal	Assemble resistor R64 Disassemble resistor R61	R64	Bottom
USB hub power is controlled by CTRL_PWR_EN_MOCI signal	Assemble resistor R61 Disassemble resistor R64	R61	Bottom

Please refer to Figure 4 on page 13 and Figure 5 on page 14 in Assembly Options for the position of the resistors.

2.7.1 USB Host Connector (X4)

Connector Type: Stacked USB 3.0 Type-A, Amphenol GSB311231HR

Pins with the 'U' prefix belong to the UPPER port, pins starting with 'L' connect to the LOWER port.

Table 18: USB Host Connector (X4)

Pin	Signal Name	I/O Type	Voltage	Description
U1	+V5_VBUS_USBH3	PWR	+5V	+5V USB power output
U2	USBH3_D_CON_N	I/O		Negative differential USB 2.0 signal
U3	USBH3_D_CON_P	I/O		Positive differential USB 2.0 signal
U4	GND	PWR		
U5	USBH3_SSRX_CON_N	I		Negative differential USB 3.x receive signal
U6	USBH3_SSRX_CON_P	I		Positive differential USB 3.x receive signal
U7	GND	PWR		
U8	USBH3_SSTX_CON_N	O		Negative differential USB 3.x transmit signal
U9	USBH3_SSTX_CON_P	O		Positive differential USB 3.x transmit signal
L1	+V5_VBUS_USBH2	PWR	+5V	+5V USB power output
L2	USBH2_D_CON_N	I/O		Negative differential USB 2.0 signal
L3	USBH2_D_CON_P	I/O		Positive differential USB 2.0 signal
L4	GND	PWR		
L5	USBH2_SSRX_CON_N	I		Negative differential USB 3.x receive signal
L6	USBH2_SSRX_CON_P	I		Positive differential USB 3.x receive signal
L7	GND	PWR		
L8	USBH2_SSTX_CON_N	O		Negative differential USB 3.x transmit signal
L9	USBH2_SSTX_CON_P	O		Positive differential USB 3.x transmit signal
S1/S2	GND_CHASSIS	PWR		
S3/S4	GND_CHASSIS	PWR		

2.8 PCIe

The Dahlia Carrier Board makes the standard PCIe interface on the Verdin module available on a mini PCIe slot. PCI Express Mini Card edge connector provides multiple connections and buses, such as listed below:

- PCI Express 1 lane (with SMBus)
- USB 2.0
- Indication LEDs for wireless network status
- SIM card for cellular applications (UIM signals)

Source of the power control signal for the Mini PCIe connector can be defined with resistors R230, R231. Assembly options can be found in the table below:

Table 19: Power control signal for Mini PCIe

Solution Selected	Assembly Options	Assembled Components	PCB Side
Mini PCIe power is controlled by CTRL_SLEEP_MOCI# signal	Assemble resistor R231 Disassemble resistor R230	R231	Bottom

Continued on next page

Table 19: Power control signal for Mini PCIe (Continued)

Solution Selected	Assembly Options	Assembled Components	PCB Side
Mini PCIe power is controlled by CTRL_PWR_EN_MOCI signal	Assemble resistor R230 Disassemble resistor R231	R230	Bottom

Please refer to Figure 4 on page 13 and Figure 5 on page 14 in Assembly Options for the position of the resistors.

2.8.1 Mini PCIe Connector (X13)

Connector Type: Mini PCIe Card Connector and Latch, Molex 67910-5700, 48099-5701

Table 20: Mini PCIe Connector (X13)

Pin	Signal Name	SODIMM Pin	I/O Type	Voltage	Pull-up/Pull-down	Description
1	PCIE_1_WAKE#	252	O (OD)	+1.8V	5.1k to +V1.8_SW	Wake-up to SoM
3	NC					Not Connected
5	NC					
7	NC					
9	GND		PWR			
11	PCIE_1_CLK_N	226	I			Negative differential PCIe reference clock signal
13	PCIE_1_CLK_P	228	I			Positive differential PCIe reference clock signal
15	GND		PWR			
17	NC					Not Connected
19	NC					
21	GND		PWR			
23	PCIE_1_L0_RX_N	232	O			Negative differential PCIe receive signal
25	PCIE_1_L0_RX_P	234	O			Positive differential PCIe receive signal
27	GND		PWR			
29	GND		PWR			
31	PCIE_1_L0_TX_N	238	I			Negative differential PCIe transmit signal
33	PCIE_1_L0_TX_P	240	I			Positive differential PCIe transmit signal
35	GND		PWR			
37	GND		PWR			
39	+V3.3_PCIE_1		PWR	+3.3V		+3.3V Power input
41	+V3.3_PCIE_1		PWR	+3.3V		
43	GND		PWR			
45	NC					Not Connected
47	NC					
49	NC					
51	NC					
2	+V3.3_PCIE_1		PWR	+3.3V		+3.3V Power input
4	GND		PWR			

Continued on next page

Table 20: Mini PCIe Connector (X13) (Continued)

Pin	Signal Name	SODIMM Pin	I/O Type	Voltage	Pull-up/Pull-down	Description
6	+V1.5_PCIE_1		PWR	+1.5V		+1.5V Power input
8	PCIE_1_UIM_PWR		PWR			SIM Card Power
10	PCIE_1_UIM_DATA		I/O			SIM Card Data
12	PCIE_1_UIM_CLK		O			SIM Card Clock
14	PCIE_1_UIM_RESET		O			SIM Card RESET
16	PCIE_1_UIM_VPP		PWR			SIM Card Programing voltage
18	GND		PWR			
20	PCIE_1_WDISABLE#		I (OD)		47k to +V3.3_PCIE_1	PCIe Wireless interface disable
22	PERST#	244	I (OD)		10k to +V3.3_PCIE_1	PCIe Power enable/RESET
24	+V3.3_SW		PWR	+3.3V		+3.3V Standby power input
26	GND		PWR			
28	+V1.5_PCIE_1		PWR	+1.5V		+1.5V Power input
30	PCIE_1_SMCLK	12	I	+3.3V	10k to +V3.3_PCIE_1	PCIe SMBus Clock
32	PCIE_1_SMDAT	14	I/O	+3.3V	10k to +V3.3_PCIE_1	PCIe SMBus Data
34	GND		PWR			Negative differential USB 2.0 data signal
36	USBH4_D_N		I/O			Positive differential USB 2.0 data signal
38	USBH4_D_P		I/O			
40	GND		PWR			
42	PCIE_1_WWLAN#		O (OD)			WWLAN LED
44	PCIE_1_WLAN#		O (OD)			WLAN LED
46	PCIE_1_WPAN#		O (OD)			WPAN LED
48	+V1.5_PCIE_1		PWR	+1.5V		+1.5V Power input
50	GND		PWR			
52	+V3.3_PCIE_1		PWR	+3.3V		+3.3V Power input

2.8.2 Nano-SIM Card Connector (X12)

Connector Type: Nano-SIM, Molex 1042240820

Table 21: Nano-SIM Card Connector (X12)

Pin	Signal Name	I/O Type	Voltage	Pull-up/Pull-down	Description
S1	PCIE_1_UIM_PWR	PWR			SIM Card Power
S2	PCIE_1_UIM_RESET	O			SIM Card RESET
S3	PCIE_1_UIM_CLK	O			SIM Card Clock
S4	GND	PWR			
S5	PCIE_1_UIM_VPP	PWR			SIM Card Programing voltage
S6	PCIE_1_UIM_DATA	I/O			SIM Card Data
G1/G2	GND	PWR			
G3/G4	GND	PWR			

2.9 SD Card

The Dahlia Carrier Board features a 4-bit SDIO interface and supports the hardware-based card detection function. The Verdin family supports SD Card Low Voltage Signaling mode. If the MicroSD card itself supports this mode, the communication will start at 3.3V and switch to 1.8V after it has been initialized. The SD_1_PWR_EN signal allows for switching the SD card supply (+V3.3_SD).

2.9.1 MicroSD Card Connector (X7)

Connector Type: Wurth 693071010811

Table 22: MicroSD Card Connector (X7)

Pin	Signal Name	SODIMM Pin	I/O Type	Voltage	Description
1	SD_1_D2	70	I/O	+1.8/3.3V	Serial Data 2
2	SD_1_D3	72	I/O	+1.8/3.3V	Serial Data 3
3	SD_1_CMD	74	O		Command
4	+V3.3_SD		PWR	+3.3V	SD Card power input
5	SD_1_CLK	78	O	+1.8/3.3V	Serial Clock
6	GND		PWR		
7	SD_1_D0	80	I/O	+1.8/3.3V	Serial Data 0
8	SD_1_D1	82	I/O	+1.8/3.3V	Serial Data 1
CD1					Card Detect
CD2/GND					
S1/S2	GND				

2.10 Display Interface

The Dahlia Carrier Board provides multiple options for connecting displays and monitors, with the following two interfaces supported:

- HDMI
- MIPI DSI

Almost any TFT display can be connected to the Verdin module by HDMI port X21 or via the Verdin DSI display adapter connector X17. As there is a wide range of MIPI DSI connectors and displays, a universal board-to-board connector was used (X17). This solution allows for connecting different DSI display adapters, e.g., DSI to HDMI, DSI to LVDS, DSI to RGB. Custom adapters with appropriate MIPI DSI connectors can be developed as well.

2.10.1 HDMI Connector (X21)

Connector Type: HDMI Connector Right Angle, Amphenol 10029449-111RLF

Table 23: HDMI Connector (X21)

Pin	Signal Name	SODIMM Pin	I/O Type	Voltage	Pull-up/Pull-down	Description
1	HDMI_1_TXD2_CON_P	87	O			Positive differential HDMI data signal, lane 2

Continued on next page

Table 23: HDMI Connector (X21) (Continued)

Pin	Signal Name	SODIMM Pin	I/O Type	Voltage	Pull-up/Pull-down	Description
2	GND		PWR			
3	HDMI_1_TXD2_CON_N	85	O			Negative differential HDMI data signal, lane 2
4	HDMI_1_TXD1_CON_P	81	O			Positive differential HDMI data signal, lane 1
5	GND		PWR			
6	HDMI_1_TXD1_CON_N	79	O			Negative differential HDMI data signal, lane 1
7	HDMI_1_TXD0_CON_P	75	O			Positive differential HDMI data signal, lane 0
8	GND		PWR			
9	HDMI_1_TXD0_CON_N	73	O			Negative differential HDMI data signal, lane 0
10	HDMI_1_TXC_CON_P	69	O			Positive differential HDMI reference clock signal
11	GND		PWR			
12	HDMI_1_TXC_CON_N	67	O			Negative differential HDMI reference clock signal
13	HDMI_1_CEC_CON	63	I/O	+5V	27k to +V3.3_SW	HDMI Consumer Electronic Control
14	HDMI_1_HEC_CON	NC				
15	HDMI_1_DDC_SCL	59	O	+5V	1.8k to +V5_HDMI_1_DISP	DDC Interface Clock
16	HDMI_1_DDC_SDA	57	I/O	+5V	1.8k to +V5_HDMI_1_DISP	DDC Interface Data
17	GND		PWR			
18	+V5_HDMI_1_DISP		PWR	+5V		HDMI power out
19	HDMI_1_HPD_CON	61	I	+5V		HDMI Hot Plug Detect
S1/S2	GND_CHASSIS					
S3/S4	GND_CHASSIS					

2.10.2 Verdin DSI Display Adapter Connector (X17)

Connector Type: Samtec LSS-130-03-L-DV-A-K-TR

Table 24: Verdin DSI Display Adapter Connector (X17)

Pin	Signal Name	SODIMM Pin	I/O Type	Voltage	Pull-up/Pull-down	Description
1	NC					Not connected
3	GND		PWR			
5	NC					Not connected
7	+V_SUPPLY_FILT_SW		PWR	5-24V ±10%		7-24V power supply output
9	+V_SUPPLY_FILT_SW		PWR	5-24V ±10%		
11	+V_SUPPLY_FILT_SW		PWR	5-24V ±10%		
13	+V_SUPPLY_FILT_SW		PWR	5-24V ±10%		
15	+V_SUPPLY_FILT_SW		PWR	5-24V ±10%		

Continued on next page

Table 24: Verdin DSI Display Adapter Connector (X17) (Continued)

Pin	Signal Name	SODIMM Pin	I/O Type	Voltage	Pull-up/Pull-down	Description
17	NC					Not connected
19	+V5_SW		PWR	+5V		+5V power supply output
21	+V5_SW		PWR	+5V		
23	+V5_SW		PWR	+5V		
25	+V5_SW		PWR	+5V		
27	+V5_SW		PWR	+5V		
29	NC					Not connected
31	+V3.3_SW		PWR	+3.3V		+3.3V power supply output
33	+V3.3_SW		PWR	+3.3V		
35	+V3.3_SW		PWR	+3.3V		
37	+V3.3_SW		PWR	+3.3V		
39	+V3.3_SW		PWR	+3.3V		
41	NC					Not connected
43	+V1.8_SW		PWR	+1.8V		+1.8V power supply output
45	+V1.8_SW		PWR	+1.8V		
47	+V1.8_SW		PWR	+1.8V		
49	+V1.8_SW		PWR	+1.8V		
51	+V1.8_SW		PWR	+1.8V		
53	NC					Not connected
55	GND		PWR			
57	CTRL_RESET_MOCI#		O (OD)	+1.8V	10k to +V3.3_SW	Board peripheral RESET
59	DSI_1_PWR_EN		O	+1.8V		DSI Adapter power enable
2	NC					Not connected
4	I^2C_1_SDA	12	I/O	+1.8V	1.8k to +V1.8_SW	Generic I^2C bus Data
6	I^2C_1_SCL	14	O	+1.8V	1.8k to +V1.8_SW	Generic I^2C bus Clock
8	GPIO_9_DSI	17	I/O	+1.8V		Reserved general-purpose IO for DSI display adapters
10	GND		PWR			
12	DSI_1_D0_P	49	I/O			Positive differential MIPI DSI data signal, lane 0
14	DSI_1_D0_N	47	I/O			Negative differential MIPI DSI data signal, lane 0
16	GND		PWR			
18	DSI_1_D1_P	43	O			Positive differential MIPI DSI data signal, lane 1
20	DSI_1_D1_N	41	O			Negative differential MIPI DSI data signal, lane 1
22	GND		PWR			
24	DSI_1_CLK_P	37	O			Positive differential MIPI DSI reference clock signal
26	DSI_1_CLK_N	35	O			Negative differential MIPI DSI reference clock signal
28	GND		PWR			

Continued on next page

Table 24: Verdin DSI Display Adapter Connector (X17) (Continued)

Pin	Signal Name	SODIMM Pin	I/O Type	Voltage	Pull-up/Pull-down	Description
30	DSI_1_D2_P	31	O			Positive differential MIPI DSI data signal, lane 2
32	DSI_1_D2_N	29	O			Negative differential MIPI DSI data signal, lane 2
34	GND		PWR			
36	DSI_1_D3_P	25	O			Positive differential MIPI DSI data signal, lane 3
38	DSI_1_D3_N	23	O			Negative differential MIPI DSI data signal, lane 3
40	GND		PWR			
42	I2S_2_BCLK	42	O	+1.8V		Serial audio bit clock
44	I2S_2_SYNC	44	O	+1.8V		Synchronization / field select / left-right channel select
46	I2S_2_D_OUT	46	O	+1.8V		Serial audio output data
48	I2S_2_D_IN	48	I	+1.8V		Serial audio input data
50	GND		PWR			
52	I^2C_2_DSI_SCL	55	O	+1.8V		DSI adapters DDC Clock
54	I^2C_2_DSI_SDA	53	I/O	+1.8V		DSI adapters DDC Data
56	GPIO_10_DSI	21	I/O	+1.8V		Reserved general-purpose I/O for DSI display adapters
58	PWM_3_DSI	19	O	+1.8V		DSI Display adapters PWM brightness control
60	GND		PWR			

Some general-purpose I/Os are routed to the Verdin Display Adapter Connector X17 to provide additional features for the display adapters, e.g., INTERRUPT or RESET signals. The various DSI display adapters available may use the different GPIO-capable pins for different purposes.

The source of the power control signal for the Display adapter boards can be defined with 0 Ohm resistors. The assembly options are detailed in the table below:

Table 25: Power control signal for Verdin DSI Display Adapter

Solution Selected	Assembly Options	Assembled Components	PCB Side
Display adapter power is controlled by CTRL_SLEEP_MOCI# signal	Assemble resistor R292 Disassemble resistor R291	R292	Bottom
Display adapter power is controlled by CTRL_PWR_EN_MOCI signal	Assemble resistor R291 Disassemble resistor R292	R291	Bottom

Please refer to Figure 4 on page 13 and Figure 5 on page 14 in Assembly Options for the position of the resistors.

2.11 Audio

The Dahlia Carrier Board offers two audio interfaces: analog audio and a digital audio interface.

2.11.1 Analog Audio

The Analog Audio interface is based on the WM8904CGEFL/RV audio codec IC from Cirrus Logic. For more detailed info, refer to the WM8904CGEFL/RV datasheet.

The Analog Audio interface is available on the connectors X14, X15.

X14 is a 3.5 mm TRRS (stereo-plus-mic) audio jack connector for active loudspeakers or headphones and microphone input. The audio jack follows the CTIA (AHJ) pinout standard. Please refer to this Wikipedia page to view the compatible headphones list.

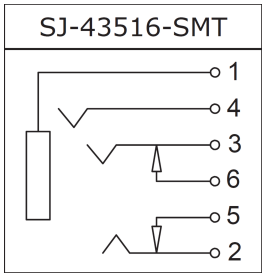
2.11.1.1 Audio Jack (X14)

Connector Type: 3.5mm Jack, CUI SJ-43516-SMT

Table 26: Audio Jack (X14)

Pin	Signal Name	I/O Type	3.5mm Jack pin	Description
1	AAP_MICIN_CON_L	I	Sleeve	Microphone input (Left channel)
2	AAP_HP_CON_L	O	Tip	Headphone output (Left channel)
3	AAP_HP_CON_R	O	Ring 1	Headphone output (Right channel)
4	GND	PWR	Ring 2	
5	AAP_HP_CON_L	O	Tip	Headphone output (Left channel)
6	AAP_HP_CON_R	O	Ring 1	Headphone output (Right channel)

Figure 9: Audio Jack Pinout



2.11.1.2 Audio Pin Header (X15)

Connector Type: 1×7 Pin Header Male, 2.54mm Pitch

Table 27: Audio Pin Header (X15)

Pin	Signal Name	I/O Type	Voltage	Description
1	+V1.8_SW	PWR	1.8V	+1.8V Carrier Board power supply output
2	AAP_LIN_CON_L	I		Line input (Left channel)
3	AAP_LIN_CON_R	I		Line input (Right channel)
4	GND	PWR		
5	AAP_LOUT_CON_L	O		Line output (Left channel)
6	AAP_LOUT_CON_R	O		Line output (Right channel)
7	GND	PWR		

2.11.2 Digital Audio

Digital audio on the Dahlia Carrier Board is available as an I2S interface. It is provided on the X17 connector (the DSI Display Adapter Connector) to use an audio interface along with display solutions. For detailed information, refer to the X17 connector pinout.

2.12 MIPI CSI Camera Interface

The MIPI CSI Camera Interface on connector X16 is intended for applications requiring image capturing from CMOS or CDD image sensors. For details, please see the Verdin module datasheet.

2.12.1 MIPI CSI Camera Connector (X16)

Connector Type: 24 Position FFC, FPC, vertical 0.5mm, Hirose FH12-24S-0.5SVA(55)

Table 28: MIPI CSI Camera Connector (X16)

Pin	Signal Name	SODIMM Pin	I/O Type	Voltage	Description
1	GND		PWR		
2	CSI_1_D0_CON_N	125 (via L33)			Negative differential MIPI CSI data signal, lane 0
3	CSI_1_D0_CON_P	123 (via L33)			Positive differential MIPI CSI data signal, lane 0
4	GND		PWR		
5	CSI_1_D1_CON_N	119 (via L34)			Negative differential MIPI CSI data signal, lane 1
6	CSI_1_D1_CON_P	117 (via L34)			Positive differential MIPI CSI data signal, lane 1
7	GND		PWR		
8	CSI_1_CLK_CON_N	113 (via L35)			Negative differential MIPI CSI reference clock signal
9	CSI_1_CLK_CON_P	111 (via L35)			Positive differential MIPI CSI reference clock signal
10	GND		PWR		
11	CAM_1_CON_RST	216 (via R278)	O		MIPI CSI camera RESET
12	CSI_1_MCLK	91	O		MIPI CSI camera master clock
13	I^2C_4_CSI_CON_SCL	95 (via IC31)	O	+3.3V	MIPI CSI camera control I^2C bus Clock
14	I^2C_4_CSI_CON_SDA	93 (via IC31)	I/O	+3.3V	MIPI CSI Camera control I^2C bus Data
15	+V3.3_SW		PWR	+3.3V	+3.3V power out
16	CSI_1_D2_CON_N	107 (via L36)			Negative differential MIPI CSI data signal, lane 2
17	CSI_1_D2_CON_P	105 (via L36)			Positive differential MIPI CSI data signal, lane 2
18	GND		PWR		
19	CSI_1_D3_CON_N	101 (via L37)			Negative differential MIPI CSI data signal, lane 3
20	CSI_1_D3_CON_P	99 (via L37)			Positive differential MIPI CSI data signal, lane 3
21	+V5_SW		PWR	+5V	+5V power out
22	CAM_1_CON_PWRDWN	218 (via R279)	O	+3.3V	MIPI CSI Camera Power Down
23	CAM_1_CON_IC_DETECT	220 (via R280)	I	+3.3V	MIPI CSI Camera Identification
24	CAM_1_CON_PWRCTRL	222 (via R281)	O	+3.3V	MIPI CSI Power Supply Control

The following table describes the assembly options available on the Dahlia Carrier Board concerning the MIPI CSI camera connector X16:

Table 29: Power control signal for MIPI CSI Camera

Solution Selected	Assembly Options	Assembled Components	PCB Side
GPIO_5-GPIO_8 connected through the level shifter to camera connector X16 List of the connected nets: GPIO_5 - CAM_1_CON_RST GPIO_6 - CAM_1_CON_PWRDWN GPIO_7 - CAM_1_CON_IC_DETECT GPIO_8 - CAM_1_CON_PWRCTRL	Assemble resistors R278, R279, R280, R281 Disassemble resistors R340, R341, R342	R278, R279, R280, R281	Top/Bottom
GPIO_5-GPIO_8 connected to Primary Extension Header X20 List of the connected nets: GPIO_5 - GPIO_5_R GPIO_6 - GPIO_6_R GPIO_7 - GPIO_7_R GPIO_8 - GPIO_8_R	Assemble resistors R339, R340, R341, R342 Disassemble resistors R278, R279, R280, R281	R339, R340, R341, R342	Top/Bottom

Please refer to Figure 4 on page 13 and Figure 5 on page 14 in Assembly Options for the resistor positions.

2.13 Digital and Analog I/O

2.13.1 Communication Interface

2.13.1.1 CAN

The Dahlia Carrier Board uses the Microchip MCP2558FDT-H/SN CAN FD transceiver connected to the CAN_1 interface on the Verdin module. The CAN interface is available on connector X2.

The CAN port is not electrically isolated from the system power supply.

The power control signal source for the CAN Transceiver (CAN_1) can be defined with resistors R7, R8. Assembly options can be found in the table below:

Table 30: Power control signal for CAN

Solution Selected	Assembly Options	Assembled Components	PCB Side
CAN power is controlled by CTRL_SLEEP_MOCI# signal	Assemble resistors R8 Disassemble resistors R7	R8	Bottom
CAN power is controlled by CTRL_PWR_EN_MOCI signal	Assemble resistors R7 Disassemble resistors R8	R7	Bottom

Please refer to Figure 4 on page 13 and Figure 5 on page 14 in Assembly Options for the position of the resistors.

2.13.1.1.1 CAN1 Connector (X2)

Connector Type: 2×5 Pins, 2.54mm pitch Header

Table 31: CAN1 Connector (X2)

Pin	Signal Name	I/O Type	Voltage	Description
1	NC			Not Connected

Continued on next page

Table 31: CAN1 Connector (X2) (Continued)

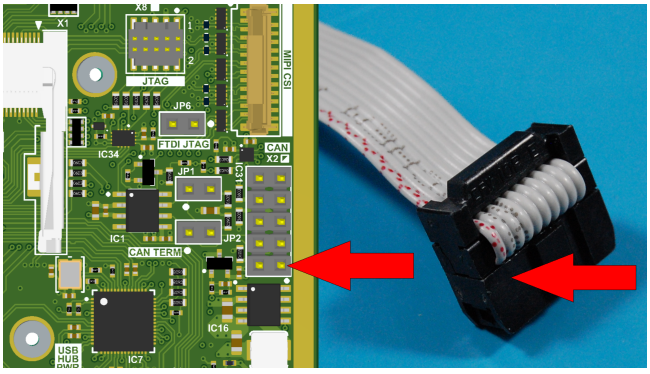
Pin	Signal Name	I/O Type	Voltage	Description
2	GND	PWR		
3	CAN_1_L	I/O		Low-level CAN_1 bus line
4	CAN_1_H	I/O		High-level CAN_1 bus line
5	GND			
6	NC			Not connected
7	NC			Not connected
8	+V5_SW	PWR	+5V	Power out
9	NC			Not connected
10	NC			Not connected

Equipment intended to be interfaced with a CAN bus often comes with a 9-pin male D-sub plug connector. The Dahlia does not provide a 9-pin D-sub connector, but a CAN Port Adapter (D-sub to IDC adapter) can be used for establishing the connection.

Figure 10: 9-pin D-sub to IDC Adapter

Connecting the CAN Port Adapter to the connector X2 needs particular attention as X2 is not keyed. Pin 1 of the connector X2 needs to be aligned with pin 1 of the IDC header on the CAN Port Adapter (see the red arrows on Figure 11).

Figure 11: Pin 1 position of connector X2 and D-sub to IDC adapter



Pin 1 on the Dahlia Carrier Board is marked with a white dot on the silkscreen. Pin 1 of the IDC header is usually marked with a small, extruded arrow, and the ribbon cable wire connected to the first pin is often marked with a red color.

The jumpers JP1, JP2 provide hardware configuration for this interface:

Connector Type: 1×2 Pin Header Male, 2.54 mm

Table 32: Jumpers JP1 and JP2

Jumper	Status	Function
JP1, JP2	CLOSED	CAN_1 split terminated (Termination resistors connected).

By default, jumpers JP1 and JP2 are closed.

2.13.1.2 UART Interfaces

The Dahlia Carrier Board features 4 UART interfaces that are connected to the following connectors:

- UART1: connected to the primary extension header.
- UART2: connected to the second extension header.
- UART3 (Verdin primary serial console/debug log output): connected to a built-in USB to Serial transceiver (Debug interface).
- UART4 (Verdin secondary serial console/debug log output): connected to a built-in USB to Serial transceiver (Debug interface).

The UART3 and UART4 interfaces have an assembly option. By default, those interfaces are connected to the USB to UART converter based on the FT4232HL integrated circuit. The UART3 and UART4 interfaces can be routed to the Primary Extension Header as well.

The following table describes the assembly options for the UART3 interface:

Table 33: UART3 Assembly Options

Solution Selected	Assembly Options	Assembled Components	PCB Side
UART3 interface connected through the level shifter to USB-UART converter and accessible via the X18 USB connector.	Assemble resistor R327, R328 Disassemble resistor R333, R334	R327, R328	Top
UART3 interface connected to the Primary Extension Header	Assemble resistor R333, R334 Disassemble resistor R327, R328	R333, R334	Top

Please refer to Figure 4 on page 13 and Figure 5 on page 14 in Assembly Options for the position of the resistors.

Table 34: UART4 Assembly Options

Solution Selected	Assembly Options	Assembled Components	PCB Side
UART4 interface connected through the level shifter to USB-UART converter and accessible via the X18 USB connector.	Assemble resistor R325, R326 Disassemble resistor R335, R336	R325, R326	Top
UART4 interface connected to the Primary Extension Header	Assemble resistor R335, R336 Disassemble resistor R325, R326	R335, R336	Top

Please refer to Figure 4 on page 13 and Figure 5 on page 14 in Assembly Options for the position of the resistors.

2.13.1.3 USB to Serial Connector (X18)

The Dahlia Carrier Board features a built-in USB to Serial UART converter (FTDI FT4232HL), which can interface with the serial debug UART via the USB Type C connector X18.

Connector Type: Amphenol 12401598E4#2A

Table 35: USB to Serial Connector (X18)

Pin	Signal Name	I/O Type	Voltage	Pull-up/Pull-down	Description
A1	GND	PWR			
A2	NC				Not connected
A3	NC				Not connected
A4	+V5_DBG	PWR	+5V		FTDI debugger power supply input
A5	USB_DBG_CC1			5.1k to GND	USB-C configuration channel signal 1
A6	USB_DBG_CON_P	I/O			Positive Differential USB 2.0 signal
A7	USB_DBG_CON_N	I/O			Negative Differential USB 2.0 signal
A8	NC				Not connected
A9	+V5_DBG	PWR	+5V		FTDI debugger power supply input
A10	NC				Not connected
A11	NC				Not connected
A12	GND	PWR			
B1	GND	PWR			
B2	NC				Not connected
B3	NC				Not connected
B4	+V5_DBG	PWR	+5V		FTDI debugger power supply input
B5	USB_DBG_CC2			5.1k to GND	USB-C configuration channel signal 2
B6	USB_DBG_CON_P	I/O			Positive Differential USB 2.0 signal
B7	USB_DBG_CON_N	I/O			Negative Differential USB 2.0 signal
B8	NC				Not connected
B9	+V5_DBG	PWR	+5V		FTDI debugger power supply input
B10	NC				Not connected
B11	NC				Not connected
B12	GND	PWR			
SH1/SH2	GND_CHASSIS				
SH3/SH4	GND_CHASSIS				

Additional features of the FTDI FT4232HL IC have been implemented on the Dahlia Carrier Board, namely the JTAG debugger and GPIO functions. GPIO interfaces are connected to the SoM and Carrier Board via resistors R293-R296. Jumpers JP6 and JP7 can be used to configure JTAG and GPIO of serial debugger functionality.

Jumper JP6 can be used to control FTDI JTAG.

Connector Type: 1×2 Pin Header Male, 2.54 mm Pitch

Table 36: Position of jumper JP6

Jumper position	Description
OPEN	The FTDI JTAG debugger is connected to the SoM. An external debugger must be disconnected from the JTAG Header X8 before closing the jumper.
CLOSED	The FTDI JTAG debugger is disconnected from the SoM. An external debugger can be connected to the JTAG Header X8.

By default, jumper JP6 is closed.

If an external JTAG debugger is used with a Dahlia Carrier Board, jumper JP6 should be removed. Simultaneous use of the on-board and external JTAG Debugger is not allowed. Violating this requirement may damage the Debuggers or the Dahlia Carrier Board.

Jumper JP7 can be used to control FTDI GPIO.

Connector Type: 1×2 Pin Header Male, 2.54 mm Pitch

Table 37: Position of jumper JP7

Jumper position	Description
OPEN	FTDI GPIOs are disconnected from the board control functions. So, the board can be switched ON and OFF, reset, and put into Recovery Mode by using the dedicated buttons only.
CLOSED	FTDI GPIOs are connected to the board control functions, and the board can be controlled externally.

By default, jumper JP7 is closed.

2.13.2 Extension Headers

2.13.2.1 Primary Extension Header (X20)

Connector Type: 2×20 Pin Header Male, 2.54 mm Pitch

Table 38: Primary Extension Header (X20)

Pin	Signal Name	SODIMM Pin	I/O Type	Voltage	Description
1	ADC_1	2	I	+1.8V	Analog Input 1
2	ADC_2	4	I	+1.8V	Analog Input 2
3	ADC_3	6	I	+1.8V	Analog Input 3
4	ADC_4	8	I	+1.8V	Analog Input 4
5	GND		PWR		
6	I^2C_1_SDA	12	I/O	+1.8V	Generic I^2C Data
7	I^2C_1_SCL	14	O	+1.8V	Generic I^2C Clock
8	GND		PWR		
9	PWM_1	15	O	+1.8V	General-purpose PWM 1
10	PWM_2	16	O	+1.8V	General-purpose PWM 2
11	GND		PWR		
12	UART_1_RXD	129	I	+1.8V	UART1 Receive Data

Continued on next page

Table 38: Primary Extension Header (X20) (Continued)

Pin	Signal Name	SODIMM Pin	I/O Type	Voltage	Description
13	UART_1_TXD	131	O	+1.8V	UART1 Transmit Data
14	UART_1_RTS	133	O	+1.8V	UART1 Request to Send (RTS)
15	UART_1_CTS	135	I	+1.8V	UART1 Clear to Send (CTS)
16	GND		PWR		
17	UART_3_RXD_R	147 (via R333)	I	+1.8V	UART3 Receive Data (SoC's Cortex-A core debugger input)
18	UART_3_TXD_R	149 (via R334)	O	+1.8V	UART3 Transmit Data (SoC's Cortex-A core debugger output)
19	UART_4_RXD_R	151 (via R335)	I	+1.8V	UART4 Receive Data (SoC's Cortex-M core debugger input)
20	UART_4_TXD_R	153 (via R336)	O	+1.8V	UART4 Transmit Data (SoC's Cortex-M core debugger output)
21	GND		PWR		
22	SPI_1_CLK	196	I/O	+1.8V	SPI Serial Clock
23	SPI_1_MISO	198	I	+1.8V	SPI Master Input, Slave Output
24	SPI_1_MOSI	200	O	+1.8V	SPI Master Output, Slave Input
25	SPI_1_CS	202	O	+1.8V	SPI Slave Select
26	+V1.8_SW		PWR	+1.8V	+1.8V power supply output
27	GPIO_1	206	I/O	+1.8V	General-purpose I/O
28	GPIO_2	208	I/O	+1.8V	General-purpose I/O
29	GPIO_3	210	I/O	+1.8V	General-purpose I/O
30	GPIO_4	212	I/O	+1.8V	General-purpose I/O
31	GND		PWR		
32	GPIO_5_R	216 (via R339)	I/O	+1.8V	General-purpose I/O
33	GPIO_6_R	218 (via R339)	I/O	+1.8V	General-purpose I/O
34	GPIO_7_R	220 (via R339)	I/O	+1.8V	General-purpose I/O
35	GPIO_8_R	222 (via R339)	I/O	+1.8V	General-purpose I/O
36	+V3.3_SW		PWR	+3.3V	+3.3V power supply output
37	CTRL_SLEEP_MOCI#	256	O	+1.8V	
38	CTRL_RESET_MOCI#	258	O	+1.8V	General reset signal
39	CTRL_WAKE1_MICO#	252	I	+1.8V	
40	+V5_SW		PWR	+5V	+5V power supply output

2.13.2.2 Secondary Extension Header (X19)

Connector Type: 2×10 Pin Header Male, 2.54 mm Pitch

Table 39: Secondary Extension Header (X19)

Pin	Signal Name	SODIMM Pin	I/O Type	Voltage	Description
1	CAN_2_TX	24	O	+1.8V	CAN port 2 transmit pin
2	CAN_2_RX	26	I	+1.8V	CAN port 2 receive pin
3	GND		PWR		

Continued on next page

Table 39: Secondary Extension Header (X19) (Continued)

Pin	Signal Name	SODIMM Pin	I/O Type	Voltage	Description
4	QSPI_1_CLK	52	O	+1.8V	QSPI Serial Clock
5	QSPI_1_CS#	54	O		QSPI Chip Select 0
6	QSPI_1_IO0	56	I/O		QSPI Serial I/Os for command, address, and data
7	QSPI_1_IO1	58	I/O		QSPI Serial I/Os for command, address, and data
8	GND		PWR		
9	QSPI_1_IO2	60	I/O	+1.8V	QSPI Serial I/Os for command, address, and data
10	QSPI_1_IO3	62	I/O	+1.8V	QSPI Serial I/Os for command, address, and data
11	QSPI_1_CS2#	64	O	+1.8V	QSPI Chip Select 1
12	QSPI_1_DQS	66	I	+1.8V	QSPI Data Strobe signal
13	GND		PWR		
14	UART_2_RXD	137	I	+1.8V	UART2 Receive Data
15	UART_2_TXD	139	O	+1.8V	UART2 Transmit Data
16	UART_2_RTS	141	O	+1.8V	UART2 Request to Send (RTS)
17	UART_2_CTS	143	I	+1.8V	UART2 Clear to Send (CTS)
18	+V1.8_SW		PWR	+1.8V	
19	I^2C_EXT_SDA	93/57 (via R343/R345)	I/O	+1.8V	1.8k to +V1.8_SW
20	I^2C_EXT_SCL	95/59 (via R344/R346)	O	+1.8V	1.8k to +V1.8_SW

I^2C_EXT_SDA and I^2C_EXT_SCL nets can be connected to the I^2C_4_CSI_SDA, I^2C_4_CSI_SCL, or the I^2C_3 _HDMI_SDA, I^2C_3 _HDMI_SCL nets, respectively.

Assembly options for the I^2C_EXT signals are detailed in the table below:

Table 40: Power control signal for I^2C

Solution Selected	Assembly Options	Assembled Components	PCB Side
I^2C_EXT_SDA connected to I^2C_4_CSI_SDA I^2C_EXT_SCL connected to I^2C_4_CSI_SCL	Assemble resistors R343, R344 Disassemble resistors R345, R346	R343, R344	Top
I^2C_EXT_SDA connected to I^2C_3_HDMI_SDA I^2C_EXT_SCL connected to I^2C_3_HDMI_SCL	Assemble resistors R345, R346 Disassemble resistors R343, R344	R345, R346	Top

Please refer to Figure 4 on page 13 and Figure 5 on page 14 in Assembly Options for the position of the resistors.

2.14 Memory

2.14.1 I^2C EEPROM

Verdin carrier boards feature an I^2C EEPROM. A 2 kbit M24C02-FMN6TP is assembled onto the Dahlia Carrier Board and is connected through the I^2C_1 bus (SODIMM_12_M and SODIMM_14_M). The default I^2C address is 0×57. The address can be configured with external pull-up resistors R267, R268, R269. Floating pins are connected internally to GND. For Write Protect (WP) features, please consult the [datasheet(#eeprom-datasheet)] and the schematics. 0 Ohm R265, R266 resistors are intended to define Write Protect (WP) features. The default configuration allows normal write operations.

2.15 Temperature Sensor

Dahlia Carrier Board is featuring Digital Temperature Sensor TMP75CIDGKR (IC50) with an I^2C interface. The sensor is connected to the I2C_1 bus. The default I^2C address is 0×4F. For details, please check the TMP75CIDGKR datasheet.

2.16 Backup Battery

A backup battery holder (BAT1) is available on the Dahlia Carrier Board to provide backup power to the VCC_BACKUP power input of a Verdin module when the main power is switched off.

For more details on how the backup voltage is used, please refer to the Verdin Computer-on-Module datasheet.

2.16.1 Battery Holder (BAT1)

A 12 mm (diameter) coin cell/battery should be used with the Battery Holder (BAT1). The following types of battery series are compatible: BR1216, CR1216, BR1220, CL1220, CR1220, BR1225.

The spring contact on the top side of the battery holder sets/bends based on the battery thickness. Inserting a thicker battery (like BR1225, 2.5mm thickness) expands the battery holder's spring contacts. A thinner battery $likeBR1220, 2.0mmthickness$ will not be held firmly after that. Customers are advised not to use a thinner battery after using the thicker battery with the battery holder (BAT1).

Connector Type: KEYSTONE-3000

Table 41: Battery Holder (BAT1)

Pin	Description	Voltage
1	+V_BAT	+3.0V
2	GND	

2.17 JTAG

The Dahlia Carrier Board features a JTAG port connected to the JTAG interface available on Verdin modules. The X8 connector connects to an external JTAG device via a Cortex Debug Connector (a 10-pin 1.27mm header). If an external JTAG debugger is used with the Dahlia Carrier Board, jumper JP6 should be removed. Please check the Dahlia schematic for more details (the document is available on the Toradex Developer Website).

If an external JTAG debugger is used with a Dahlia Carrier Board, jumper JP6 should be removed. Simultaneous use of the on-board and external JTAG Debugger is not allowed. Violating this requirement may damage the Debuggers or the Dahlia Carrier Board.

2.17.1 JTAG Connector (X8)

Connector Type: 2×5 Pin Keyed Header Male, 1.27 mm Pitch, Samtec FTSH-105-01-L-DV-K

Table 42: JTAG Connector (X8)

Pin	Signal Name	SODIMM Pin	I/O Type	Voltage	Pull-up/Pull-down	Description
1	JTAG_1_VREF	7	PWR	+1.8V		1.8V reference output for JTAG adapter
2	JTAG_1_TMS	13	I	+1.8V		Test Mode Select
3	GND		PWR			
4	JTAG_1_TCK	9	I	+1.8V	Pull-down on SOM	Test Clock
5	GND		PWR			
6	JTAG_1_TDO	5	O	+1.8V		Test Data Out
7	NC					Not Connected
8	JTAG_1_TDI	1	I	+1.8V		Test Data In
9	NC					Not Connected
10	JTAG_1_TRST#	3	I(OD)	+1.8V		Test Reset

3 Mechanical Data

Figure 12: Dahlia Carrier Board dimensions (in millimeters) – top side (top view)

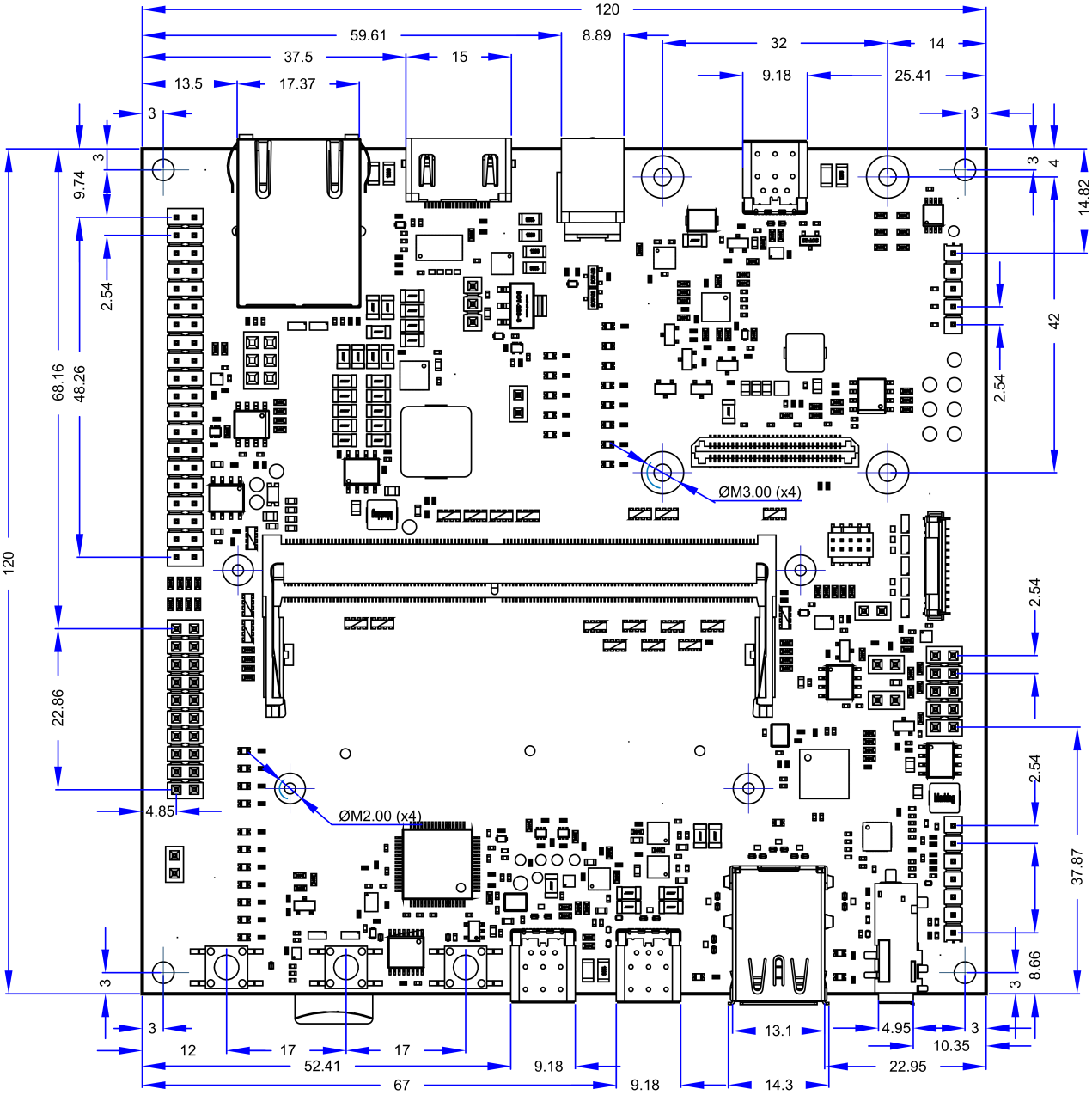


Figure 13: Dahlia Carrier Board dimensions (in millimeters) – front side (front view)

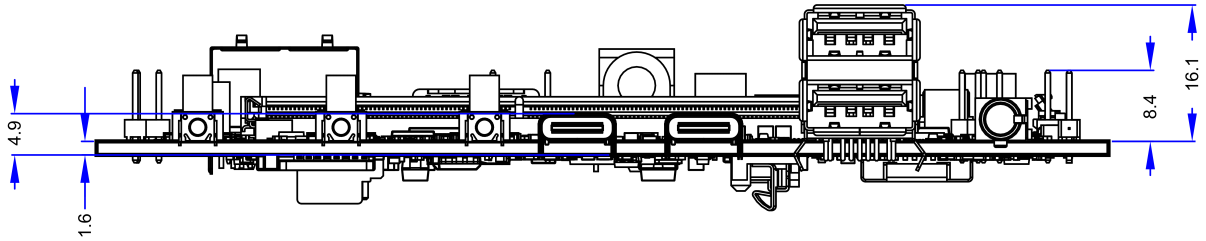


Figure 14: Dahlia Carrier Board dimensions (in millimeters) – back side (back view)

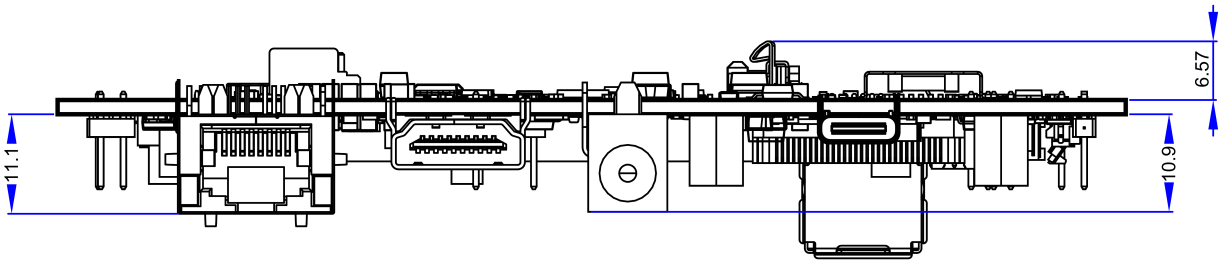
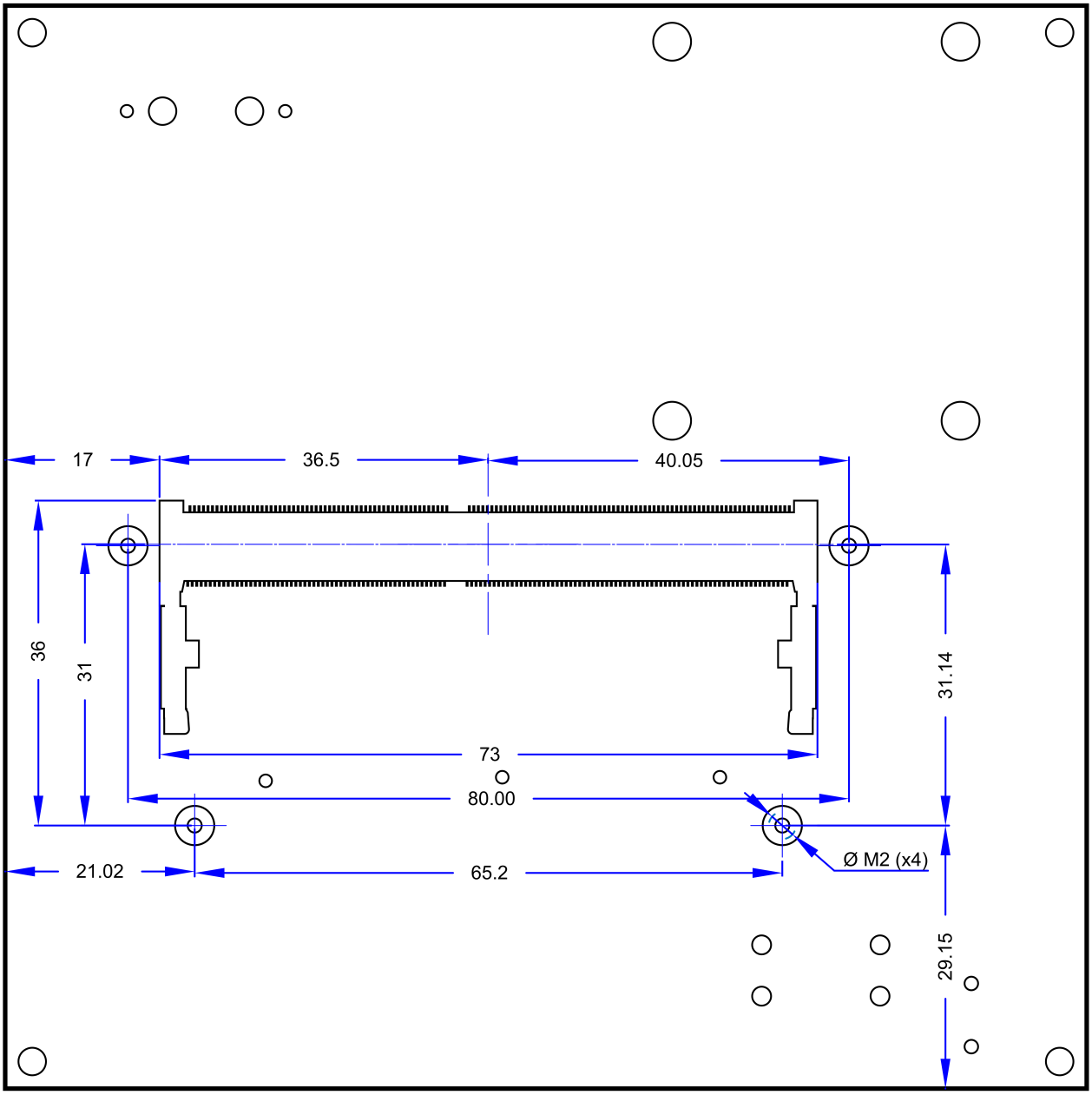


Figure 15: Dahlia Carrier Board SoM and spacers position (in millimeters) – top side (top view)



4 Design Data

The design data for Toradex Dahlia Carrier Board will be freely available in the Altium Designer format. The design data includes schematics, PCB layout, and component libraries.

The design data will be soon available on the Toradex developer website: http://developer.toradex.com/carrier-board-design

5 Product Compliance

Up-to-date information about product compliance such as RoHS, CE, UL-94, Conflict Mineral, REACH, etc. can be found on our website at: http://www.toradex.com/support/product-compliance

6 Device and Documentation Support

6.1 Trademarks

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