

Dahlia Carrier Board

Datasheet



Revision History

Date	Doc. Rev.	Board Version	Changes
20-Feb-2020	Rev. 0.90	V1.0	Initial Release.

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1 Introduction

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

The majority of standard interfaces which are 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.

The real-world connectors, LEDs, and push buttons are all placed on the board edge in a way that easily allows for a boxed version of the Dahlia. CAE data for the board including schematics, layout, and IPC-7351 compliant component libraries are freely downloadable from the Toradex developer website.

1.1 Reference Documents

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

1.1.1 Verdin Computer Modules

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

1.1.2 Push-button On/Off Controller Datasheet

<http://cds.linear.com/docs/en/datasheet/2954fb.pdf>

1.1.3 USB Hub Datasheet

<http://ww1.microchip.com/downloads/en/DeviceDoc/USB5744-Data-Sheet-DS00001855G.pdf>

1.1.4 Audio Codec Datasheet

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

1.1.5 CAN FD Transceiver Datasheet

<http://ww1.microchip.com/downloads/en/DeviceDoc/20005533A.pdf>

1.1.6 USB Type-C Configuration Channel Logic Datasheet

<http://www.ti.com/lit/ds/symlink/tusb321ai.pdf>

1.1.7 USB Type-C Port Controller for Power Sinks Datasheet

<https://www.cypress.com/file/460416/download>

1.1.8 UV/OV and Reverse Protection Controller datasheet

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

1.1.9 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>

1.1.10 Toradex Developer Website - Development Board Design

<http://developer.toradex.com/carrier-board-design>

2 Features

2.1 Overview

The Dahlia carrier board provides the following features and communication interfaces:

- 2x USB 3.0 Type-A interfaces through on-board USB HUB
- 1x USB 2.0 OTG USB-C interface for host and host/client
- 1x multipurpose USB to serial converter based on the FT4232HL IC accessible on a USB-C connector (optionally connected to UART3, UART4, control signals and JTAG)
- 1x RJ45 Ethernet 10/100/1000 Mbps interface
- 1x Mini PCIe interface
- Nano-SIM Card holder
- 2x Low-speed 2.54mm pitch male extension headers (Primary 40-pin header, secondary 20-pin header)
- 1x MIPI-CSI camera interface
- 1x MIPI-DSI display interface with a mezzanine connector that allows connecting different display adapters: DSI to HDMI, DSI to LVDS, DSI to parallel RGB, etc.
- 1x JTAG interface
- 1x 4-bit MicroSD Card connector
- 1x I2C 2Kb EEPROM IC
- 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 I2C, 1x SPI, 3x PWM, 4x ADC inputs
- 1x CAN interface 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

The diagram illustrates a complex PCB layout for a Raspberry Pi 4B, featuring a variety of components and connectors. The layout is organized into several functional sections:

- Top Section:** Includes a 3.5mm Audio jack connector (S3-43516-SMT), a Spring loaded Connector (TBLH10-500-04BK), a CAN Transceiver (MCP2558FD), and a DSI Mezzanine Connector (QSH-030-01-L-0-A).
- Left Section:** Features a CSI FFC connector (PH12-345-0.55V195), a USB-C Connector (12401598E412A), an RJ45 connector with Magnetics (AB29-1.21T-KM), a USB-C Connector (12401598E412A), and a USB 3.0 Type-A Connector (G5B311231HR).
- Right Section:** Contains a USB-C Connector (12401598E412A), a USB 3.0 Hub (USB5744), and a USB 3.0 Hub (USB5744).
- Bottom Section:** Includes a Power section with a Barrel jack Power connector (RACP722X), a USB-C Connector (12401598E412A), and a USB 3.0 Hub (USB5744).
- Central Section:** Features a Raspberry Pi 4B, a System control section, and a Power section with a Barrel jack Power connector (RACP722X), a USB-C Connector (12401598E412A), and a USB 3.0 Hub (USB5744).

The diagram shows a dense arrangement of components, with various connectors and components labeled with their part numbers and functions. The layout is designed to be a comprehensive reference for the PCB design.

Fig.1 Dahlia Carrier Board Hardware Architecture

2.3 Physical Drawing

2.3.1 Top Side Connectors

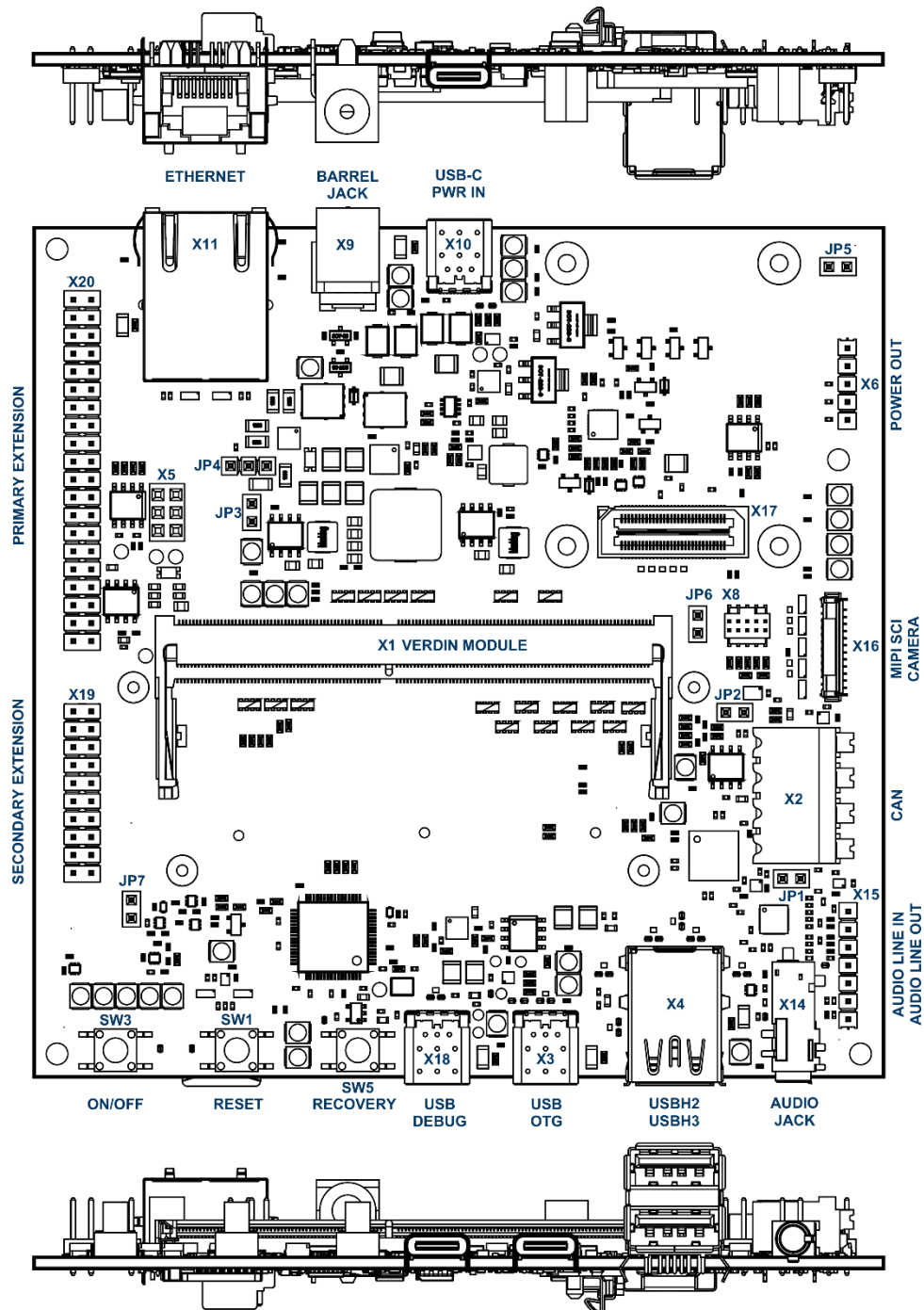


Fig.2 Dahlia Carrier Board Connectors – Top Side

Ref	Description	Remarks
X1	Verdin SoM Connector	SODIMM DDR4
X2	CAN Connector	CAN_1 interface
X3	USB OTG Connector	USB 2.0 USB-C connector
X4	2x USB 3.0 HOST SS 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 PWR IN Connector	Power Input: 5 – 20V
X11	ETHERNET Connector	Ethernet_1 interface
X14	AUDIO JACK Connector	Headphones output and microphone input
X15	AUDIO Pin Header	Audio Line IN/OUT interface, not assembled
X16	MIPI-CSI CAMERA Connector	
X17	MIPI-DSI MEZZANINE 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

2.3.2 Bottom Side Connectors

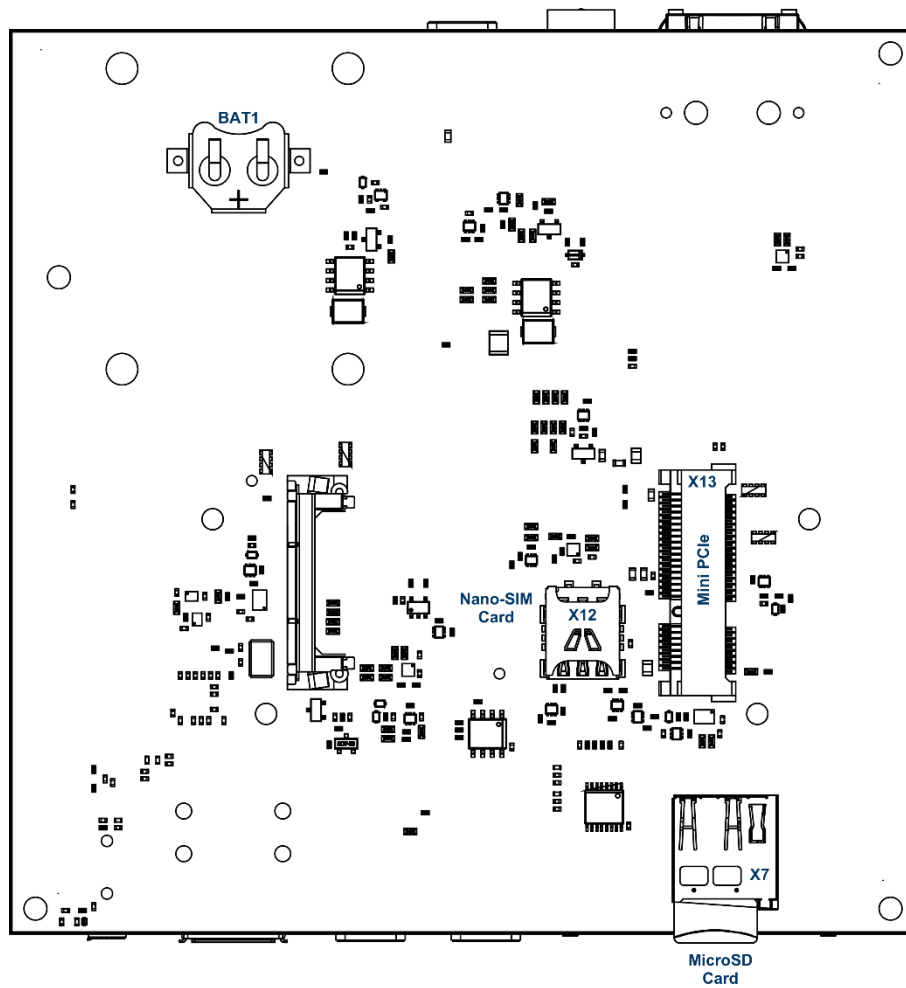


Fig.3 Dahlia Carrier Board Connectors – Bottom Side

Ref	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

2.4 Assembly Options

This section marks/highlights the components on the Dahlia carrier board that can be used to configure different features and functional options

WARNING:

- Changing the PCB assembly voids the product warranty.
- Toradex does not take any responsibility for malfunction or damages caused by changing any assembly option.

2.4.1 Top Side Assembly Options

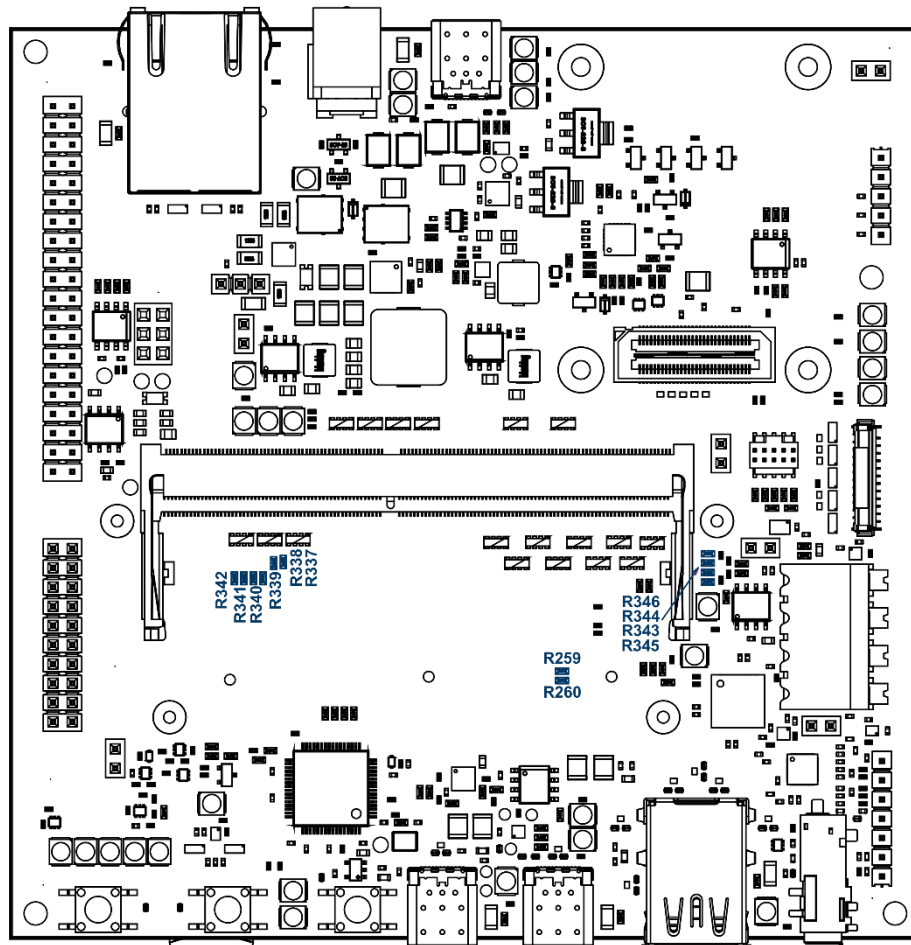


Fig.4 Dahlia Carrier Board Assembly Options – Top Side

2.4.2 Bottom Side Assembly Options

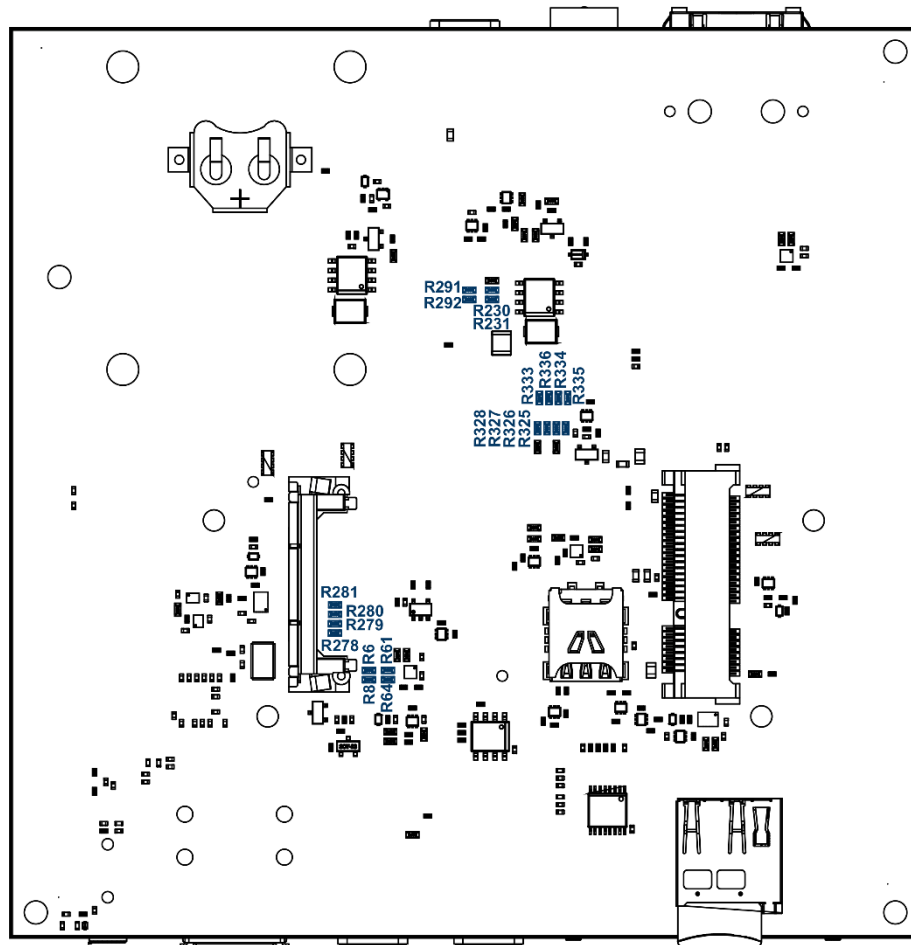


Fig.5 Dahlia Carrier Board Assembly Options – Bottom Side

3 Interface Description

3.1 Verdin Computer On Module

Type: SODIMM-DDR4 260 pin Socket

Manufacturer: TE-2309409-2

For the pin-out of the Verdin module, please refer to the applicable Verdin module datasheet.

Spacers are available on the Dahlia carrier board for fixing the Verdin module on the carrier board.

It is recommended to use two M2 size screws to fasten the Verdin module.

3.2 Power Supply

Dahlia carrier board has two different power connectors that can be used to power the board:

X9, X10 are both wide input range connectors. Input voltage can vary across a range of 5V - 24V +/-10% for X9 and 5-20V for X10.

The on-board DC-DC converters provides 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, undervoltage and short circuits, limiting the maximum input current to about 5A.

The X6 header connector provides these three primary system voltages to be used to power-up external boards or modules.

3.2.1 BARREL JACK Connector (X9)

Connector type: SWC RAPC722X

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

3.2.2 USB-C POWER IN Connector (X10)

Connector type: Amphenol 12401598E4#2A

Pin	Description	Voltage / Range
A1	GND_IN_2	
A2	NC	
A3	NC	
A4	+V_PWR_IN_2	5 – 20V
A5	PWR_IN_2_CC1	
A6	USB_CHG_CON_P	
A7	USB_CHG_CON_N	
A8	NC	
A9	+V_PWR_IN_2	5 – 20V
A10	NC	
A11	NC	
A12	GND_IN_2	
B1	GND_IN_2	
B2	NC	
B3	NC	
B4	+V_PWR_IN_2	5 – 20V
B5	PWR_IN_2_CC2	
B6	USB_CHG_CON_P	

Pin	Description	Voltage / Range
B7	USB_CHG_CON_N	
B8	NC	
B9	+V_PWR_IN_2	5 – 20V
B10	NC	
B11	NC	
B12	GND_IN_2	

3.2.3 POWER OUT Header (X6)

Connector type: 1x5 Pin Header Female, 2.54mm

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

3.2.4 Power Control

The circuit that is responsible for powering-ON/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 push buttons SW1 and SW3 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.

3.2.4.1 POWER CONTROL Header (X5)

Connector type: 2x3 Pin Header Female, 2.54mm Pitch

Pin	Signal Name	IO Type	Voltage	Pull-up/Pull-down
1	PWR_BTN#	I	+1.9V	100k to +1.9V
2	GND	PWR		
3	PWR_CTRL	I	+3.3V max	100k to GND
4	CTRL_PWR_BTN_MICO#	I	+1.8V	100k to +1.8V on SoM
5	CTRL_FORCE_OFF#	I	+3.3V	100k to +3.3V
6	CTRL_RESET_MICO#	I/O	+1.8V	100k to +1.8V on SoM

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

PWR_CTRL Level	Description
0V	The Push-button controller is working normally
3.3V	The Dahlia carrier board is Always On when power is applied

3.2.4.2 Always-ON Jumper (JP3)

Jumper JP3 can be used to obtain “Always-On” behaviour.

Type: 1x2 Pin Header Male, 2.54mm Pitch

Jumper position	Description
OPEN	The board power supply is controlled by the power ON/OFF Switch
CLOSED	The board power supply will be in the “Always-On” state. Dahlia carrier board will be powered-up as soon as external power is applied.

3.2.5 Power supply input protection

Supply input (X9) is protected against reverse voltage 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 following table shows the maximum and reverse input voltage in which the protection circuit is working and is capable to protect the other circuits on the board without being damaged.

3.2.5.1 Power supply input protection absolute maximum ratings

Parameter name	Max value	Unit
Input voltage	50	V
Reverse polarity input voltage	-40	V

3.2.5.2 Power supply input protection configuration

The LTC4368 has been configured for the following threshold values:

Parameter name	Nominal value	Unit
Undervoltage limit	5	V
Overvoltage limit	24	V
Input current	5	A

Jumper JP4 can be used to turn ON or OFF the retry function of the power supply input protection circuit.

Type: 1x3 Pin Header Male, 2.54 mm Pitch

Jumper position	Description
1-2	Power supply input will restart automatically after a forward overcurrent fault. The restart delay time is defined by capacitor C108 (55ms/nF).
2-3	Power supply input stays OFF after a forward overcurrent fault. To turn the power input again, the external power supply should be switched OFF and ON.

Also, the current, voltage, and power measurement IC21 INA219 is placed on the Dahlia carrier board. This IC provides an option to measure the power consumption of a Verdin module.

3.3 Indications

The Dahlia carrier board features 28 LEDs. These indicate the status of the main power supplies and all power gated peripherals, in addition to indicating the activity of some peripherals. The LEDs and their functions are listed below.

LED No.	Description
LED1	CAN_1 Transceiver Power
LED2	USB_1 OTG Power
LED3	USBH3 Host Power (X4 UPPER)
LED4	USBH2 Host Power (X4 LOWER)
LED5	USB HUB Power
LED6	Indicate RESET state (RESET_MOC1# signal is LOW).
LED7	MicroSD Card Power
LED8	BARREL JACK POWER IN Fault
LED9	USB-C Power in Enable
LED10	USB-C Power Switch Fault
LED11	USB-C BC 1.2 Enable
LED12	USB-C PD Enable
LED13	USB-C PD Fault
LED14	+V3.3 Power indicator
LED15	+V5_SW Power indicator
LED16	+V3.3_SW Power indicator
LED17	+V1.8_SW Power indicator
LED18	Mini PCIe status indicator: WWAN
LED19	Mini PCIe status indicator: WLAN
LED20	Mini PCIe status indicator: WPAN
LED21	Mini PCIe Power indicator
LED22	Audio Codec Power indicator
LED23	FTDI JTAG Activity indicator
LED24	FTDI UARTC TX LED
LED25	FTDI UARTC RX LED
LED26	FTDI UARTD TX LED
LED27	FTDI UARTD RX LED
LED28	FTDI Interface Converter Power indicator

Refer to the Dahlia carrier board schematics for more details.

3.4 Ethernet

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

3.4.1 Ethernet_1 Connector (X11)

Connector type: RJ45, BEL A829-1J1T-KM

Pin	Signal Name	SODIMM Pin Number	I/O Type	Voltage	Pull-up/Pull-down
1	ETH_1_CTREF_2				
2	ETH_1_MDI2_N	241			
3	ETH_1_MDI2_P	239			
4	ETH_1_MDI1_P	233			
5	ETH_1_MDI1_N	231			
6	ETH_1_CTREF_1				
7	ETH_1_CTREF_3				
8	ETH_1_MDI3_P	247			
9	ETH_1_MDI3_N	245			
10	ETH_1_MDI0_N	227			
11	ETH_1_MDI0_P	225			
12	ETH_1_CTREF_0				
13	ETH_1_ACT_C	237 (via R204)			
14	+V3.3_SW		PWR	+3.3V	
15	ETH_1_LINK_GB	235 (via R206)			
16	+V3.3_SW		PWR	+3.3V	
17	ETH_1_LINK_C	235 (via R205)			
S1/S2	GND_CHASSIS		PWR		

3.5 Verdin USB_1 Interface

3.5.1 USB OTG Connector (X3)

The Dahlia carrier board integrates a USB 2.0 OTG USB-C connector (X3). This port can work as a dual role port HOST or OTG.

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

Pin	Signal Name	SODIMM Pin Number	I/O Type	Voltage	Pull-up/Pull-down
A1	GND		PWR		
A2	NC				
A3	NC				
A4	+V5_VBUS_USB_1	159 (via R13)	PWR	+5V	
A5	USB_1_CC1				
A6	USB_1_D_CON_P	165 (via L2)	I/O		
A7	USB_1_D_CON_N	163 (via L2)	I/O		
A8	NC				
A9	+V5_VBUS_USB_1	159 (via R13)	PWR	+5V	
A10	NC				
A11	NC				
A12	GND		PWR		
B1	GND		PWR		
B2	NC				
B3	NC				
B4	+V5_VBUS_USB_1	159 (via R13)	PWR	+5V	
B5	USB_1_CC2				
B6	USB_1_D_CON_P	165 (via L2)	I/O		
B7	USB_1_D_CON_N	163 (via L2)	I/O		
B8	NC				
B9	+V5_VBUS_USB_1	159 (via R13)	PWR	+5V	
B10	NC				
B11	NC				
B12	GND				

3.6 Verdin USB_2 Interface

The Dahlia carrier board integrates a 4 port USB HUB based on the Microchip USB5744T-I/2G to provide 3x USB 3.1 Gen 1 / USB 2.0 host interfaces. The HUB is connected to the Verdin USB_2 port. Port 1 of the USB HUB is disabled. On Port 4 of the USB HUB, only the USB 2.0 interface is used, and it is routed to the Mini PCIe connector (X13).

For further information about the USB5744T device, please refer to the Microchip website.

Source of the power control signal for the USB HUB can be defined with resistors R61, R64. Assembly option can be found in the table below:

Solution Selected	Assembly Options	Assembled Components on Dahlia V1.0A	PCB Side
USB HUB power is controlled by CTRL_SLEEP_MOC1# signal	Assemble resistor R64 Disassemble resistor R61	R64	Bottom
USB HUB power is controlled by CTRL_PWR_EN_MOC1 signal	Assemble resistors R61 Disassemble resistor R64	R64	Bottom

Please refer to figure 5 in [Section 2.4, Assembly Options](#) for the position of the resistors.

3.6.1 USB 3.0 HOST Connector (X4)

Dahlia carrier board features a 2x USB 3.0 Type-A port, which can be used with modules that support a USB SuperSpeed interface.

Connector type: Stacked USB 3.0 Type-A, Amphenol GSB111231HR

Pin	Signal Name	I/O Type	Voltage	Pull-up/Pull-down
U1	+V5_VBUS_USBH3	PWR	+5V	
U2	USBH3_D_CON_N	I/O		
U3	USBH3_D_CON_P	I/O		
U4	GND	PWR		
U5	USBH3_SSRX_CON_N	I		
U6	USBH3_SSRX_CON_P	I		
U7	GND	PWR		
U8	USBH3_SSTX_CON_N	O		
U9	USBH3_SSTX_CON_P	O		
L1	+V5_VBUS_USBH2	PWR	+5V	
L2	USBH2_D_CON_N	I/O		
L3	USBH2_D_CON_P	I/O		
L4	GND	PWR		
L5	USBH2_SSRX_CON_N	I		
L6	USBH2_SSRX_CON_P	I		
L7	GND	PWR		
L8	USBH2_SSTX_CON_N	O		
L9	USBH2_SSTX_CON_P	O		
S1/S2	GND_CHASSIS	PWR		
S3/S4	GND_CHASSIS	PWR		

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

3.7 PCIe

The Dahlia carrier board makes the standard PCIe interface on the Verdin module available on a mini PCIe slot.

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:

Solution Selected	Assembly Options	Assembled Components on Dahlia V1.0A	PCB Side
Mini PCIe power is controlled by CTRL_SLEEP_MOCI# signal	Assemble resistor R231 Disassemble resistor R230	R231	Bottom
Mini PCIe power is controlled by CTRL_PWR_EN_MOCI signal	Assemble resistors R230 Disassemble resistor R231	R231	Bottom

Please refer to figure 5 in [Section 2.4, Assembly Options](#) for the position of the resistors.

3.7.1 Mini PCIe Connector (X13)

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

Pin	Signal Name	SODIMM Pin Number	I/O Type	Voltage	Pull-up/Pull-down
1	PCIE_1_WAKE#	252	O		100k to +V1.8_SW
2	+V3.3_PCIE_1		PWR	+3.3V	
3	NC				
4	GND		PWR		
5	NC				
6	+V1.5_PCIE_1		PWR	+1.5V	
7	NC				
8	PCIE_1_UIM_PWR		PWR		
9	GND		PWR		
10	PCIE_1_UIM_DATA		I/O		
11	PCIE_1_CLK_N	226	I		
12	PCIE_1_UIM_CLK		O		
13	PCIE_1_CLK_P	228	I		
14	PCIE_1_UIM_RESET		O		
15	GND		PWR		
16	PCIE_1_UIM_VPP		PWR		
17	NC				
18	GND		PWR		
19	NC				
20	PCIE_1_WDISABLE#		I		47k to +V3.3_PCIE_1
21	GND		PWR		
22	PERST#	244	I		10k to +V3.3_PCIE_1
23	PCIE_1_L0_RX_N	232	I		
24	+V3.3_SW	(via L3)	PWR	+3.3V	
25	PCIE_1_L0_RX_P	234	I		
26	GND		PWR		
27	GND		PWR		
28	+V1.5_PCIE_1		PWR	+1.5V	
29	GND		PWR		

Pin	Signal Name	SODIMM Pin Number	I/O Type	Voltage	Pull-up/Pull-down
30	PCIE_1_SMCLK	12 (via IC25)	I	+3.3V	10k to +V3.3_PCIE_1
31	PCIE_1_L0_TX_N	238	O		
32	PCIE_1_SMDAT	14 (via IC25)	I/O	+3.3V	10k to +V3.3_PCIE_1
33	PCIE_1_L0_TX_P	240	O		
34	GND		PWR		
35	GND		PWR		
36	USBH4_D_N		I/O		
37	GND		PWR		
38	USBH4_D_P		I/O		
39	+V3.3_PCIE_1		PWR	+3.3V	
40	GND		PWR		
41	+V3.3_PCIE_1		PWR	+3.3V	
42	PCIE_1_WWLAN#		O		
43	GND		PWR		
44	PCIE_1_WLAN#		O		
45	NC				
46	PCIE_1_WPAN#		O		
47	NC				
48	+V1.5_PCIE_1		PWR	+1.5V	
49	NC				
50	GND		PWR		
51	NC				
52	+V3.3_PCIE_1		PWR	+3.3V	

3.7.2 Nano-SIM Card Connector (X12)

Connector type: Nano-SIM, Molex 1042240820

Pin	Signal Name	I/O Type	Voltage	Pull-up/Pull-down
S1	PCIE_1_UIM_PWR	PWR		
S2	PCIE_1_UIM_RESET	O		
S3	PCIE_1_UIM_CLK	O		
S4	GND	PWR		
S5	PCIE_1_UIM_VPP	PWR		
S6	PCIE_1_UIM_DATA	I/O		
G1/G2	GND	PWR		
G3/G4	GND	PWR		

3.8 SD Card

The Dahlia carrier board features a 4-bit SDIO interface. The hardware supported card detect function is implemented. Verdin family supports SD Card Low Voltage Signaling. So, if the MicroSD card itself supports this mode of communication, the signaling will start with 3.3V I/O signals and, after initialization, will switch to 1.8V.

SD_1_PWR_EN signal allows for switching the SD card supply +V3.3_SD.

3.8.1 MicroSD Card Connector (X7)

Connector type: Wurth 693071010811

Pin	Signal Name	SODIMM Pin Number	I/O Type	Voltage	Pull-up/Pull-down
1	SD_1_D2	70	I/O	+1.8/3.3V	
2	SD_1_D3	72	I/O	+1.8/3.3V	
3	SD_1_CMD	74	O		
4	+V3.3_SD		PWR	+3.3V	
5	SD_1_CLK	78	O	+1.8/3.3V	
6	GND		PWR		
7	SD_1_D0	80	I/O	+1.8/3.3V	
8	SD_1_D1	82	I/O	+1.8/3.3V	
CD1			I	+3.3V	10k to +V3.3_SW
CD2/GND					10k Pull-up on a SoM
S1/S2	GND				

3.9 Display Interface

The Dahlia carrier board provides many options for connecting LCD panels and monitors by using an appropriate mezzanine board which converts the MIPI-DSI display data to the needed signals. As there is a wide range of MIPI-DSI connectors and displays, a universal mezzanine board connector X17 was used. This solution allows for the connection of different types of display interface mezzanine boards and converters e.g., MIPI-DSI to HDMI, MIPI-DSI to LVDS, etc. Also, custom boards with appropriate connectors can be used.

3.9.1 MIPI-DSI Mezzanine Connector (X17)

Connector type: Samtec QSH-030-01-L-D-A

Pin	Signal Name	SODIMM Pin Number	I/O Type	Voltage	Pull-up/Pull-down
1	GPIO_1	206	I/O	+1.8V	
2	GPIO_2	208	I/O	+1.8V	
3	I2C_1_SDA	14	I/O	+1.8V	1.8k to +V1.8_SW
4	GND		PWR		
5	I2C_1_SCL	12	O	+1.8V	1.8k to +V1.8_SW
6	NC				
7	GPIO_9_DSI	17	I	+1.8V	
8	+V_SUPPLY_FILT_SW		PWR	+5V - 24V +/-10%	
9	GND		PWR		
10	+V_SUPPLY_FILT_SW		PWR	+5V - 24V +/-10%	
11	DSI_1_D0_CON_P	49			
12	+V_SUPPLY_FILT_SW		PWR	+5V - 24V +/-10%	
13	DSI_1_D0_CON_N	47			
14	+V_SUPPLY_FILT_SW		PWR	+5V - 24V +/-10%	
15	GND		PWR		
16	+V_SUPPLY_FILT_SW		PWR	+5V - 24V +/-10%	
17	DSI_1_D1_CON_P	43			
18	NC				
19	DSI_1_D1_CON_N	41			
20	+V5_SW		PWR	+5V	
21	GND		PWR		
22	+V5_SW		PWR	+5V	
23	DSI_1_CLK_CON_P	37			
24	+V5_SW		PWR	+5V	
25	DSI_1_CLK_CON_N	35			
26	+V5_SW		PWR	+5V	
27	GND		PWR		
28	+V5_SW		PWR	+5V	
29	DSI_1_D2_CON_P	31			
30	NC				
31	DSI_1_D2_CON_N	29			
32	+V3.3_SW		PWR		
33	GND		PWR		
34	+V3.3_SW		PWR	+3.3V	
35	DSI_1_D3_CON_P	25			
36	+V3.3_SW		PWR	+3.3V	

Pin	Signal Name	SODIMM Pin Number	I/O Type	Voltage	Pull-up/Pull-down
37	DSI_1_D3_CON_N	23			
38	+V3.3_SW		PWR	+3.3V	
39	GND		PWR		
40	+V3.3_SW		PWR	+3.3V	
41	I2S_2_BCLK	42	O	+1.8V	
42	NC				
43	I2S_2_SYNC	44	O	+1.8V	
44	+V1.8_SW		PWR	+1.8V	
45	I2S_2_D_OUT	46	O	+1.8V	
46	+V1.8_SW		PWR	+1.8V	
47	I2S_2_D_IN	48	I	+1.8V	
48	+V1.8_SW		PWR	+1.8V	
49	GND		PWR		
50	+V1.8_SW		PWR	+1.8V	
51	I2C_2_DSI_SCL	55	O	+1.8V	1.8k to +V1.8_SW
52	+V1.8_SW		PWR	+1.8V	
53	I2C_2_DSI_SDA	53	I/O	+1.8V	1.8k to +V1.8_SW
54	NC				
55	GPIO_10_DSI	21	O	+1.8V	
56	GND		PWR		
57	PWM_3_DSI	19	O	+1.8V	
58	CTRL_RESET_MOCi#		O	+1.8V	
59	GND		PWR		
60	DSI_PWR_EN		O	+1.8V	
61	GND		PWR		

To provide additional features for the display adapters e.g., INTERRUPT or RESET signals, some general-purpose I/Os are routed to the Mezzanine board connector X17. But there is an assembly option, and these GPIOs can be routed to the Primary Extension Header.

The following table describes the assembly options for the GPIO_1 and GPIO_2:

Solution Selected	Assembly Options	Assembled Components on Dahlia V1.0A	PCB Side
GPIO1, GPIO2 used on the Mezzanine board connector X17	Install Display adapter board Disassemble resistors R337, R338		Top
GPIO1, GPIO2 connected to Primary Extension Header X20	Assemble resistors R337, R338 Remove Display adapter board		Top

Please refer to figure 4 in [Section 2.4, Assembly Options](#) for the position of the resistors.

The source of the power control signal for the Display adapter boards can be defined with 0 Ohm resistors. Assembly option can be found in the table below:

Solution Selected	Assembly Options	Assembled Components on Dahlia V1.0A	PCB Side
Display adapter power is controlled by CTRL_CTRL_SLEEP_MOCi# signal	Assemble resistor R292 Disassemble resistor R291	R292	Bottom
Display adapter power is controlled by CTRL_PWR_EN_MOCi signal	Assemble resistors R291 Disassemble resistor R292	R292	Bottom

Please refer to figure 5 in [Section 2.4, Assembly Options](#) for the position of the resistors.

3.10 Audio

The Dahlia carrier board offers two audio interfaces: an analog audio and a digital audio interface.

3.10.1 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 connector is a standard jack for active loudspeakers or headphones and microphone input. The audio jack follows the CTIA (AHJ) pinout standard. Please refer to this Wikipedia page [https://en.wikipedia.org/wiki/Phone_connector_\(audio\)#TRRS_standards](https://en.wikipedia.org/wiki/Phone_connector_(audio)#TRRS_standards) to view the list of the compatible headphones.

Analog Audio Codec power can be switched ON or OFF during Verdin module reboot or when peripherals go into sleep mode.

Source of the power control signal for the Analog Audio Codec can be defined with resistors R259, R260. Assembly options can be found in the table below:

Solution Selected	Assembly Options	Assembled Components on Dahlia V1.0A	PCB Side
Analog Audio Codec power is controlled by CTRL_SLEEP_MOCI# signal	Assemble resistor R260 Disassemble resistor R259	R260	Top
Analog Audio Codec power is controlled by CTRL_PWR_EN_MOCI signal	Assemble resistors R259 Disassemble resistor R260	R260	Top

Please refer to figure 4 in [Section 2.4, Assembly Options](#) for the position of the resistors.

3.10.1.1 Audio Jack (X14)

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

Pin	Signal Name	I/O Type	Voltage	3.5mm Jack pin
1	AAP_MICIN_CON_L	I		Sleeve
2	AAP_HP_CON_L	O		Tip
3	AAP_HP_CON_R	O		Ring 1
4	GND_A	PWR		Ring 2
5	AAP_HP_CON_L	O		Tip
6	AAP_HP_CON_R	O		Ring 1

3.10.1.2 Audio Pin Header (X15)

Connector type: 1x7 Pin Header Male, 2.54mm Pitch

Pin	Signal Name	I/O Type	Voltage
1	+V1.8_AAP	PWR	1.8V
2	AAP_LIN_CON_L	I	
3	AAP_LIN_CON_R	I	
4	GND_A	PWR	
5	AAP_LOUT_CON_L	O	
6	AAP_LOUT_CON_R	O	
7	GND_A	PWR	

3.10.2 Digital Audio

Digital audio on the Dahlia carrier board is available as an I2S interface. It is provided on the X17 connector (the MIPI-DSI interface connector) to provide the option of using an audio interface along with display solutions. For detailed information, refer to the X17 connector pinout.

3.11 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.

3.11.1 MIPI-CSI Camera Connector (X16)

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

Pin	Signal Name	SODIMM Pin Number	I/O Type	Voltage	Pull-up/Pull-down
1	GND		PWR		
2	CSI_1_D0_CON_N	125 (via L33)			
3	CSI_1_D0_CON_P	123 (via L33)			
4	GND		PWR		
5	CSI_1_D1_CON_N	119 (via L34)			
6	CSI_1_D1_CON_P	117 (via L34)			
7	GND		PWR		
8	CSI_1_CLK_CON_N	113 (via L35)			
9	CSI_1_CLK_CON_P	111 (via L35)			
10	GND		PWR		
11	CAM_1_CON_RST	216 (via R278)	O		
12	SCI_1_MCLK	91	O		
13	I2C_4_CSI_CON_SCL	95 (via IC31)	O	+3.3V	10k to +V3.3_SW
14	I2C_4_CSI_CON_SDA	93 (via IC31)	I/O	+3.3V	10k to +V3.3_SW
15	+V3.3_SW		PWR	+3.3V	
16	CSI_1_D2_CON_N	107 (via L36)			
17	CSI_1_D2_CON_P	105 (via L36)			
18	GND		PWR		
19	CSI_1_D3_CON_N	101 (via L37)			
20	CSI_1_D3_CON_P	99 (via L37)			
21	+V5_SW		PWR	+5V	
22	CAM_1_CON_PWRDWN	218 (via R279)	O	+3.3V	
23	CAM_1_CON_IC_DETECT	220 (via R280)	I	+3.3V	100k to GND
24	CAM_1_CON_PWRCTRL	222 (via R281)	O	+3.3V	

The following table describes the assembly options available on the Dahlia carrier board concerning the MIPI-CSI camera connector X16:

Solution Selected	Assembly Options	Assembled Components on Dahlia V1.0A	PCB Side
GPIO_5-GPIO_8 connected thru 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 R339, R340, R341, R342	R339, R340, R341, R342	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 and 5 in [Section 2.4, Assembly Options](#) for the position of the resistors.

3.12 Digital and Analog I/O

3.12.1 Communication Interface

3.12.1.1 CAN

The Dahlia carrier board uses the Microchip MCP2558FDT-H/SN CAN FD transceiver which is connected to the CAN_1 interface on the Verdin module. The CAN port is not electrically isolated from the system power supply! CAN interface is available on connectors X2.

The source of the power control signal for the CAN Transceiver (CAN_1) can be defined with resistors R6, R8. Assembly options can be found in the table below:

Solution Selected	Assembly Options	Assembled Components on Dahlia V1.0A	PCB Side
Analog Audio Codec power is controlled by CTRL_SLEEP_MOCI# signal	Assemble resistor R8 Disassemble resistor R6	R8	Bottom
Analog Audio Codec power is controlled by CTRL_PWR_EN_MOCI signal	Assemble resistors R6 Disassemble resistor R8	R8	Bottom

Please refer to figure 5 in [Section 2.4, Assembly Options](#) for the position of the resistors.

3.12.1.1.1 CAN1 Connector (X2)

Connector type: CUI TBLH10-500-04BK

Pin	Signal Name	I/O Type	Voltage	Pull-up/Pull-down
1	+V5_SW	PWR	+5V	
2	CAN_1_H	I/O		
3	CAN_1_L	I/O		
4	GND	PWR		

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

Connector type: 1x2 Pin Header Male, 2.54 mm

Jumper	Status	Function
JP1, JP2	CLOSED	CAN_1 split terminated.

3.12.1.2 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 secondary extension header.
- UART3 connected to a built-in USB to Serial transceiver (Debug interface).
- UART4 connected to a built-in USB to Serial transceiver (Debug interface).

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. But also, UART3 and UART4 interfaces can be routed to the Primary Extension Header.

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

Solution Selected	Assembly Options	Assembled Components on Dahlia V1.0A	PCB Side
UART3 interface connected through the level shifter to USB-UART converter and accessible via X18 USB connector.	Assemble resistors R327, R328 Disassemble resistors R333, R334	R327, R328	Bottom
UART3 interface connected to the Primary Extension Header	Assemble resistors R333, R334 Disassemble resistors R327, R328	R327, R328	Bottom

Please refer to figure 5 in [Section 2.4, Assembly Options](#) for the position of the resistors.

Assembly options for the UART4 can be found in a table below:

Solution Selected	Assembly Options	Assembled Components on Dahlia V1.0A	PCB Side
UART4 interface connected through the level shifter to USB-UART converter and accessible via X18 USB connector.	Assemble resistors R325, R326 Disassemble resistors R335, R336	R325, R326	Bottom
UART4 interface connected to the Primary Extension Header	Assemble resistors R335, R336 Disassemble resistors R325, R326	R325, R326	Bottom

Please refer to figure 5 in [Section 2.4, Assembly Options](#) for the position of the resistors.

3.12.1.3 USB to Serial Connector (X18)

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

Connector type: Amphenol 12401598E4#2A

Pin	Signal Name	I/O Type	Voltage	Remarks
A1	GND	PWR	+5V	
A2	NC			
A3	NC			
A4	+V5_DBG	PWR		
A5	USB_DBG_CC1			
A6	USB_DBG_CON_P	I/O		
A7	USB_DBG_CON_N	I/O		
A8	NC			
A9	+V5_DBG	PWR		
A10	NC			
A11	NC			
A12	GND	PWR		
B1	GND	PWR		

Pin	Signal Name	I/O Type	Voltage	Remarks
B2	NC			
B3	NC			
B4	+V5_DBG	PWR		
B5	USB_DBG_CC2			
B6	USB_DBG_CON_P	I/O		
B7	USB_DBG_CON_N	I/O		
B8	NC			
B9	+V5_DBG	PWR		
B10	NC			
B11	NC			
B12	GND	PWR		
SH1/SH2	GND_CHASSIS			
SH3/SH4	GND_CHASSIS			

Also, 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.

Type: 1x2 Pin Header Male, 2.54 mm Pitch

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

Jumper JP7 can be used to control FTDI GPIO.

Type: 1x2 Pin Header Male, 2.54 mm Pitch

Jumper position	Description
OPEN	FTDI GPIOs are disconnected from the board control functions. So, the board switching ON and OFF, resetting, and recovery can be done only manually by dedicated buttons.
CLOSED	FTDI GPIOs are connected to the board control functions, and now board can be controlled by some external software

3.12.2 Extension Headers

3.12.2.1 Primary Extension Header (X20)

Connector Type: 2x20 Pin Header Male, 2.54 mm Pitch

Pin	Signal Name	SODIMM Pin Number	I/O Type	Voltage	Pull-up/Pull-down
1	ADC_1	2	I	+1.8V	
2	ADC_2	4	I	+1.8V	
3	ADC_3	6	I	+1.8V	
4	ADC_4	8	I	+1.8V	
5	GND		PWR		
6	I2C_1_SDA	12	I/O	+1.8V	1.8k to +V1.8_SW
7	I2C_1_SCL	14	O	+1.8V	1.8k to +V1.8_SW
8	GND		PWR		
9	PWM_1	15	O	+1.8V	
10	PWM_2	16	O	+1.8V	
11	GND		PWR		
12	UART_1_RXD	129	I	+1.8V	
13	UART_1_TXD	131	O	+1.8V	
14	UART_1_RTS	133	O	+1.8V	
15	UART_1_CTS	135	I	+1.8V	
16	GND		PWR		
17	UART_3_RXD_R	147 (via R333)	I	+1.8V	
18	UART_3_TXD_R	149 (via R334)	O	+1.8V	
19	UART_4_RXD_R	151 (via R335)	I	+1.8V	
20	UART_4_TXD_R	153 (via R336)	O	+1.8V	
21	GND		PWR		
22	SPI_1_CLK	196	I/O	+1.8V	
23	SPI_1_MISO	198	I	+1.8V	
24	SPI_1_MOSI	200	O	+1.8V	
25	SPI_1_CS	202	O	+1.8V	
26	+V1.8_SW		PWR	+1.8V	
27	GPIO_1_R	206 (via R337)	I/O	+1.8V	
28	GPIO_2_R	208 (via R338)	I/O	+1.8V	
29	GPIO_3	210	I/O	+1.8V	
30	GPIO_4	212	I/O	+1.8V	
31	GND		PWR		
32	GPIO_5_R	216 (via R339)	I/O	+1.8V	
33	GPIO_6_R	218 (via R340)	I/O	+1.8V	
34	GPIO_7_R	220 (via R341)	I/O	+1.8V	
35	GPIO_8_R	222 (via R342)	I/O	+1.8V	
36	+V3.3_SW		PWR	+3.3V	
37	CTRL_SLEEP_MOCI#	256	O	+1.8V	
38	CTRL_RESET_MOCI#	258	O	+1.8V	
39	CTRL_WAKE1_MICO#	252	I	+1.8V	
40	+V5_SW		PWR	+5V	

3.12.2.2 Secondary Extension Header (X19)

Connector Type: 2x10 Pin Header Male, 2.54 mm Pitch

Pin	Signal Name	SODIMM Pin Number	I/O Type	Voltage	Pull-up/Pull-down
1	CAN_2_TX	24	O	+1.8V	
2	CAN_2_RX	26	I	+1.8V	
3	GND		PWR		
4	QSPI_1_CLK	52	O	+1.8V	
5	QSPI_1_CS#	54	O	+1.8V	
6	QSPI_1_IO0	56	I/O	+1.8V	
7	QSPI_1_IO1	58	I/O	+1.8V	
8	GND		PWR		
9	QSPI_1_IO2	60	I/O	+1.8V	
10	QSPI_1_IO3	62	I/O	+1.8V	
11	QSPI_1_CS2#	64	O	+1.8V	
12	QSPI_1_DQS	66	I	+1.8V	
13	GND		PWR		
14	UART_2_RXD	137	I	+1.8V	
15	UART_2_TXD	139	O	+1.8V	
16	UART_2_RTS	141	O	+1.8V	
17	UART_2_CTS	143	I	+1.8V	
18	+V1.8_SW		PWR	+1.8V	
19	I2C_EXT_SDA	93/57 (via R343/R345)	I/O	+1.8V	1.8k to +V1.8_SW
20	I2C_EXT_SCL	95/59 (via R344/R346)	O	+1.8V	1.8k to +V1.8_SW

I2C_EXT_SDA and I2C_EXT_SCL nets can be connected to I2C_4_CSI_SDA, I2C_4_CSI_SCL or to I2C_3_HDMI_SDA, I2C_3_HDMI_SCL nets respectively.

Assembly options for the I2C_EXT signals can be found in a table below:

Solution Selected	Assembly Options	Assembled Components on Dahlia V1.0A	PCB Side
I2C_EXT_SDA connected to I2C_4_CSI_SDA. I2C_EXT_SCL connected to I2C_4_CSI_SCL	Assemble resistors R343, R344 Disassemble resistors R345, R346	R343, R344	Top
I2C_EXT_SDA connected to I2C_3_HDMI_SDA. I2C_EXT_SCL connected to I2C_3_HDMI_SCL	Assemble resistors R345, R346 Disassemble resistors R343, R344	R343, R344	Top

Please refer to figure 4 in [Section 2.4, Assembly Options](#) for the position of the resistors.

3.13 Memory

3.13.1 I2C EEPROM

Verdin Carrier Board supports an I2C EEPROM. The 2-kbit M24C02-FMN6TP is assembled and is connected through the I2C_1 bus (SODIMM_12_M and SODIMM_14_M). The default I2C address is 0x57. 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 consider the datasheet and the schematics. 0 Ohm resistors R265, R266 are intended to define Write Protect (WP) features. The default configuration allows normal write operations.

3.14 Backup battery

A backup battery holder (BAT1) is available on the Dahlia carrier board to provide backup power to a Verdin module VCC_BACKUP power input 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.

3.14.1 Battery Holder (BAT1)

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

NOTE:

The spring contact on the top side of the battery holder sets/bends based on the battery thickness. In case a thicker battery (like BR1225, 2.5mm thickness) is inserted first, the spring contact will set and later if the battery is replaced by a thinner battery (like BR1220, 2.0mm thickness), the battery holder will not hold the replacement battery firmly. Customers are advised to not to use a thinner battery after using the thicker battery with the battery holder (BAT1).

Connector type: KEYSTONE-3000

Pin	Description	Voltage
1	+V_BAT	+3.0V
2	GND	

3.15 JTAG

The Dahlia carrier board provides a JTAG interface to the JTAG port available on Verdin modules. Connector X56 provides an interface to an external JTAG device via Cortex Debug Connector, which is a 10-pin 1.27mm header. If an external JTAG debugger is used with a Dahlia carrier board V1.0, jumper JP6 should be removed. Check the Dahlia Schematic file. This document is available on the Toradex developer website.

3.15.1 JTAG Connector (X8)

Connector Type: 2x5 Pin Keyed Header Male, 1.27 mm Pitch, Samtec FTSH-105-01-L-DV-K

Pin	Signal Name	SODIMM Pin Number	I/O Type	Voltage	Pull-up/Pull-down
1	JTAG_1_VREF	7	PWR	+1.8V	
2	JTAG_1_TMS	13	I	+1.8V	
3	GND		PWR		
4	JTAG_1_TCK	9	I	+1.8V	10k to GND on SOM
5	GND		PWR		
6	JTAG_1_TDO	5	O	+1.8V	1M to GND
7	NC				
8	JTAG_1_TDI	1	I	+1.8V	
9	NC				
10	JTAG_1_TRST#	3	I	+1.8V	

4 Mechanical Data

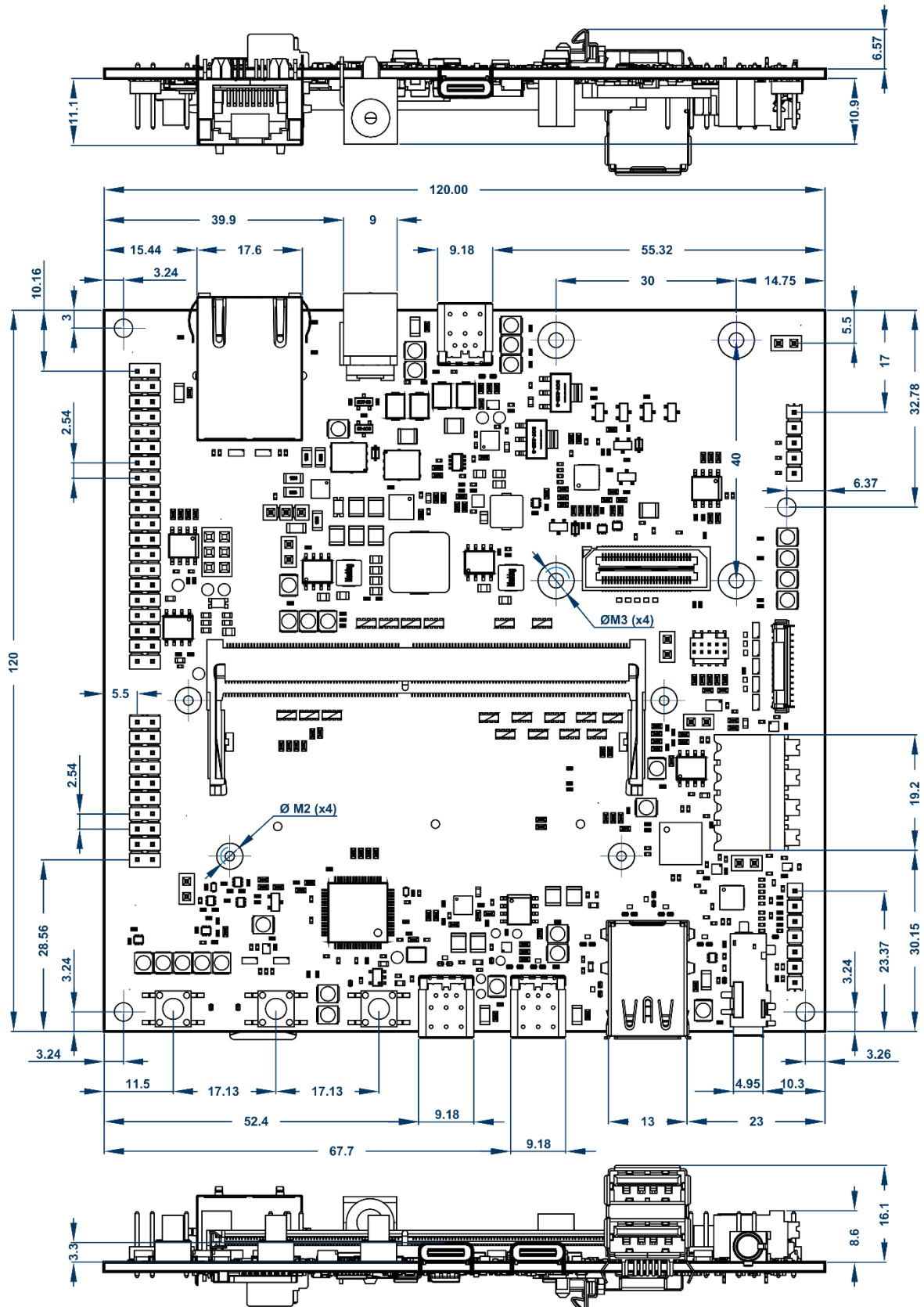


Fig.6 Dahlia Carrier Board Dimensions (in millimeters) – Top Side

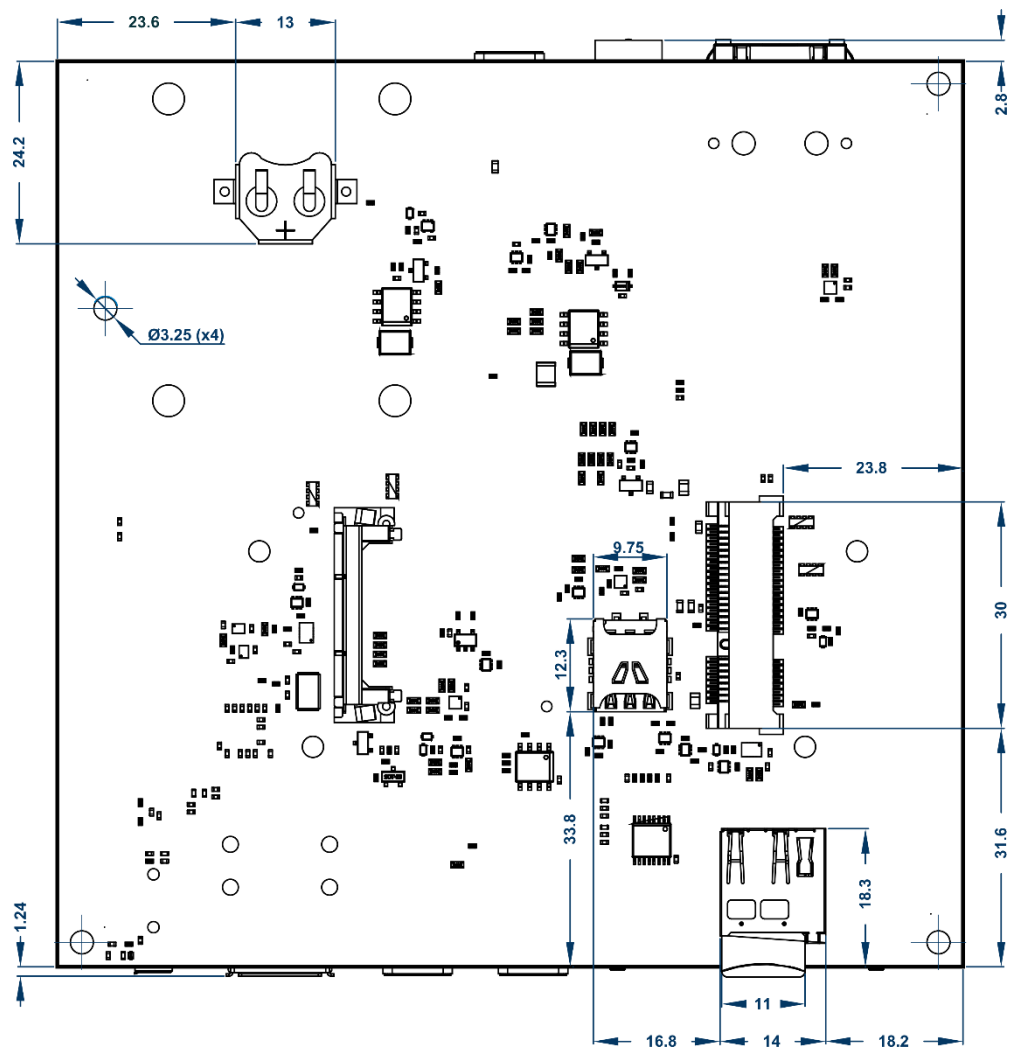


Fig.7 Dahlia Carrier Board Dimensions (in millimeters) – Bottom Side

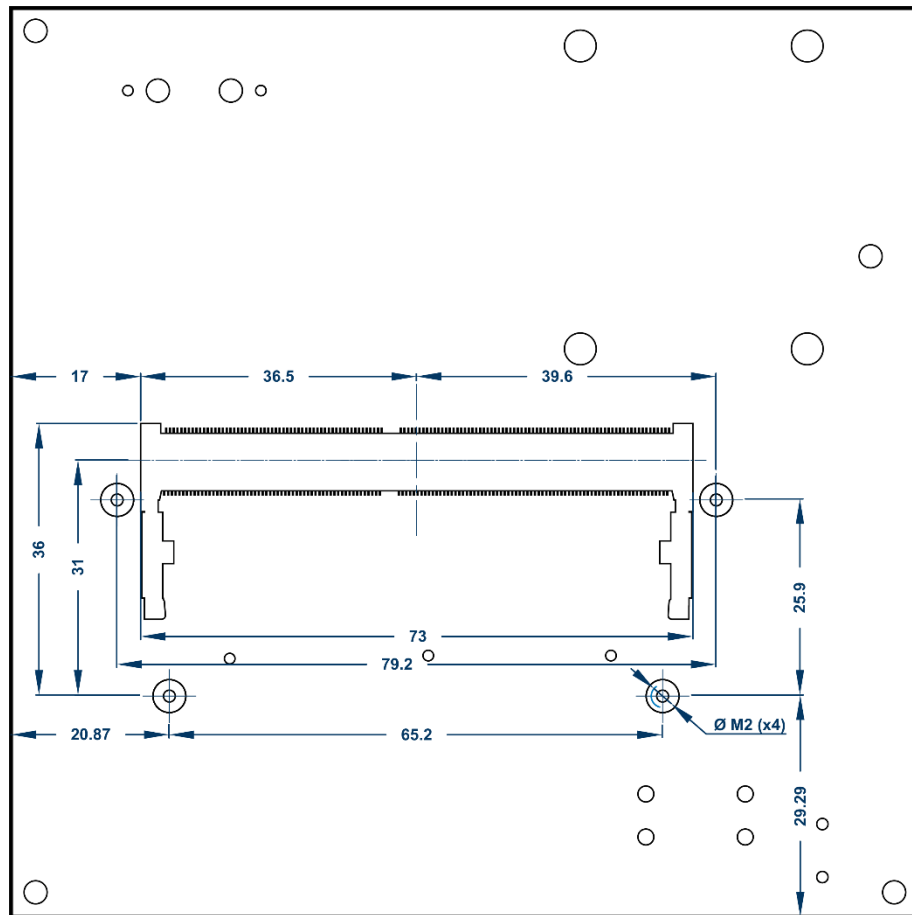


Fig.8 Dahlia Carrier Board SoM and Spacers Position (in millimeters) – Top Side

5 Design Data

The design data for Toradex Dahlia carrier board will be freely available in the Altium Designer format. The design data will include schematics, layout, and component libraries.

The design data will be soon available on the Toradex developer website:

<http://developer.toradex.com/carrier-board-design>

6 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>

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