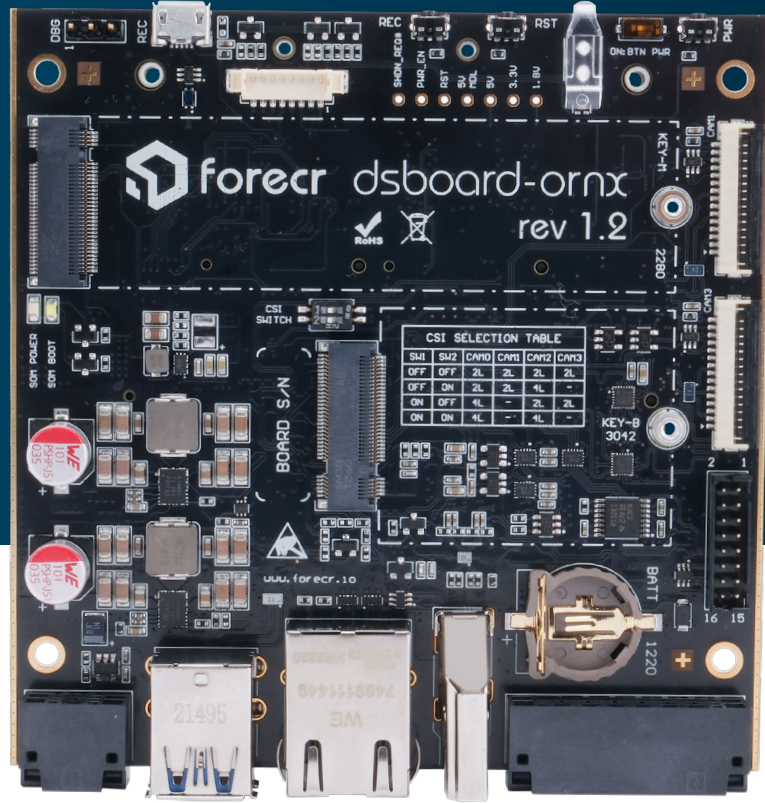




DSBOARD ORNX Rev 1.2

USER MANUAL

UM-DSBDORNX-01

Revision 1.2

01/10/2024

Table of Contents

Preface	4
Disclaimer.....	4
Customer Support	4
Contact Information	4
Copyright Notice.....	4
Trademark Acknowledgment.....	4
Symbols	5
Limited Product Warranty.....	6
Revision History	6
1. Introduction	7
2. Product Specification	7
2.1 Technical Specification	7
2.2 Block Diagram	8
2.3 Board Visuals	8
3. Hardware Information	9
3.1 Connector and Button Location.....	9
3.1.1 Top Side	9
3.2 Bottom Side	10
3.2 List of Connectors and Buttons	11
3.3 The Definition of Each Connector	12
3.3.1 Power Connector	12
3.3.2 SIM Card Connector	12
3.3.3 M.2 Key-M Connectors	13
3.3.4 M.2 Key-B Connector.....	15
3.3.5 M.2 Key-E Connector.....	16
3.3.6 CSI Connectors.....	17
3.3.6.1 CSI Switch and Selection Table.....	17
3.3.7 I/O Terminal Connector	18
3.3.8 Serial Communication Connector	18
3.3.9 Panel Connector	19
3.3.10 RTC Battery Connector.....	19
3.3.11 HDMI Connector	19
3.3.12 USB 3.1 Type-A Connector	19
3.3.13 10/100/1000 Ethernet Connector.....	19
3.3.14 Fan Connector	20

3.3.15 Recovery Mode Micro USB Connector	20
3.3.16 Debug Mode Header Connector	20
3.4 The Definition of Buttons	20
3.4.1 Power Button	20
3.4.2 Recovery Pushbutton.....	20
3.4.3 Reset Pushbutton	20
4. Software Information	21
4.1 Installation	21
5. Connectivity.....	21
5.1 General Purpose Input/Output (GPIO)	21
5.2 I/O Connector	22
5.2.1 CANBus Interface	22
5.2.2 Industrial Input Output Interface.....	22
5.2.2.1 Setting and Reading Input Pin	22
5.2.2.2 Setting Digital Output as High and Low	23
5.2.3 Serial Communication Interface.....	24
5.2.3.1 RS422	24
5.2.3.2 RS232.....	24
6. 3D Model & Mechanical Information	25
7. Power Consumption	29
7.1 Orin NX 16GB	29
7.2 Orin NX 8GB	29
7.3 Orin Nano 8GB.....	29
7.4 Orin Nano 4GB.....	29
8. MTBF Prediction.....	30
9. Ordering Information	30

Preface

Disclaimer

Forecr emphasizes that the information contained in this user manual is continuously updated in line with the technical modifications and enhancements made by Forecr to its carrier board. Therefore, this manual only represents the technical status of Forecr carrier board at the time of publishing.

Forecr shall not be held responsible for any damages that may occur directly or indirectly as a result of any technical or typographical errors or omissions found in this document or for any discrepancies between the product and the user's manual.

Customer Support

In case you encounter any challenges after reading the user manual and/or using the carrier board, please reach out to the Forecr reseller from which you purchased the carrier board.

See the contact information section below for more information on how to contact us directly.

Contact Information

E-mail Address	For information requests: info@forecr.io For support requests: support@forecr.io For wholesale inquiries: sales@forecr.io
Address	Forecr OÜ Akadeemia tee 21/1 (II floor), Room 219, 12618, Tallinn, Estonia
Telephone Number	Estonia +372 5332 2632
Website	https://www.forecr.io

Copyright Notice

The information provided in this manual is subject to change without notice. Forecr shall not be held responsible for any errors contained herein or for any incidental or consequential damages that may arise from the provision, implementation, or utilization of this material. This manual is protected by copyright. All rights are reserved by Forecr. No part of this manual may be reproduced, copied, translated or transmitted in any form without the prior written consent of Forecr.

Copyright © 2023 - Forecr.io

Trademark Acknowledgment

Forecr recognizes and acknowledges that all trademarks, registered trademarks, and/or copyrights mentioned in this user manual belong to their respective owners. All possible trademarks or copyright acknowledgments that are not listed herein do not mean a lack of acknowledgment to the rightful owners of mentioned trademarks and copyrights. Forecr acknowledge the rights of the trademark owners and respect their intellectual property.

Symbols



ElectroStatic Discharge (ESD) Sensitive Device!

Electronic boards and their components are sensitive to static electricity. When handling any circuit board assemblies, it is recommended that ESD safety precautions be observed.

ESD safe best practices include, but are not limited to:

- Do not handle the carrier board out of its antistatic packaging while it is not used for operational purposes unless it is otherwise protected.
- Whenever possible, unpack or pack this product only at ESD safe work stations.
- Where a safe work station is not guaranteed, it is important for the user to be electrically discharged before touching the product with his/her hands or tools.
- Try to handle the board by the edges, avoiding contact with components.



HOT Surface!

Do not touch. Contact may cause burns. Allow to cool before servicing.



Waste Electrical and Electronic Equipment (WEEE)!

The carrier board should not be discarded as unsorted waste but must be sent to separate collection facilities for recovery and recycling.



Restriction of Hazardous Substances (RoHS)!

The carrier board complies with the regulations and restrictions established by the ROHS Directive and does not contain hazardous substances in concentrations that may be harmful to health or the environment.

Limited Product Warranty

Forecr provides a 1-year Warranty for the carrier board. This warranty period is valid from the original purchase date of the carrier board. In order to maintain warranty, the carrier board must not be altered or modified in any way. Changes or modifications to the board, that are not explicitly approved by Forecr and described in this user manual or received from Forecr Support as a special handling instruction, will void your warranty.

To receive warranty service, the carrier board must be delivered to Forecr within the warranty period together with the original invoice or proof of purchase.

Revision History

Revision No	Revision Date	Revision Description
rev 1.0	19.07.2024	Preliminary Release
rev 1.1	01.10.2024	Key-M, Key-B and Key-E connector pinouts have been added to section 3.3.3, 3.3.4 and 3.3.5.

1. Introduction

DSBOARD-ORNX is an industrial carrier board designed for harsh environments and applications that demand high processing power and reliability. It is based on the NVIDIA Orin NX system-on-module (SOM), which features multiple NVIDIA Ampere GPU cores and ARM64 CPU cores. The compact design of the carrier board makes it a versatile and flexible solution for a wide range of industrial applications such as autonomous systems, robotics, and intelligent video analytics.

DSBOARD-ORNX comes with various connectivity options, including Gigabit Ethernet, USB 3.1, HDMI, and CAN, enabling seamless integration with a wide range of devices and systems. The NVIDIA Orin NX SOM provides the processing power and capabilities needed to support intensive data processing and analysis.

In addition to its compact size, DSBOARD-ORNX also features multiple expansion slots for adding peripherals and customizing the system to meet specific requirements. Its wide operating temperature range ensures reliable operation in challenging environments.

Overall, DSBOARD-ORNX is an effective solution for industrial applications that demand high processing power and a reliable platform. Its advanced features and compact design make it an ideal choice for applications where space is limited, and flexibility is key.

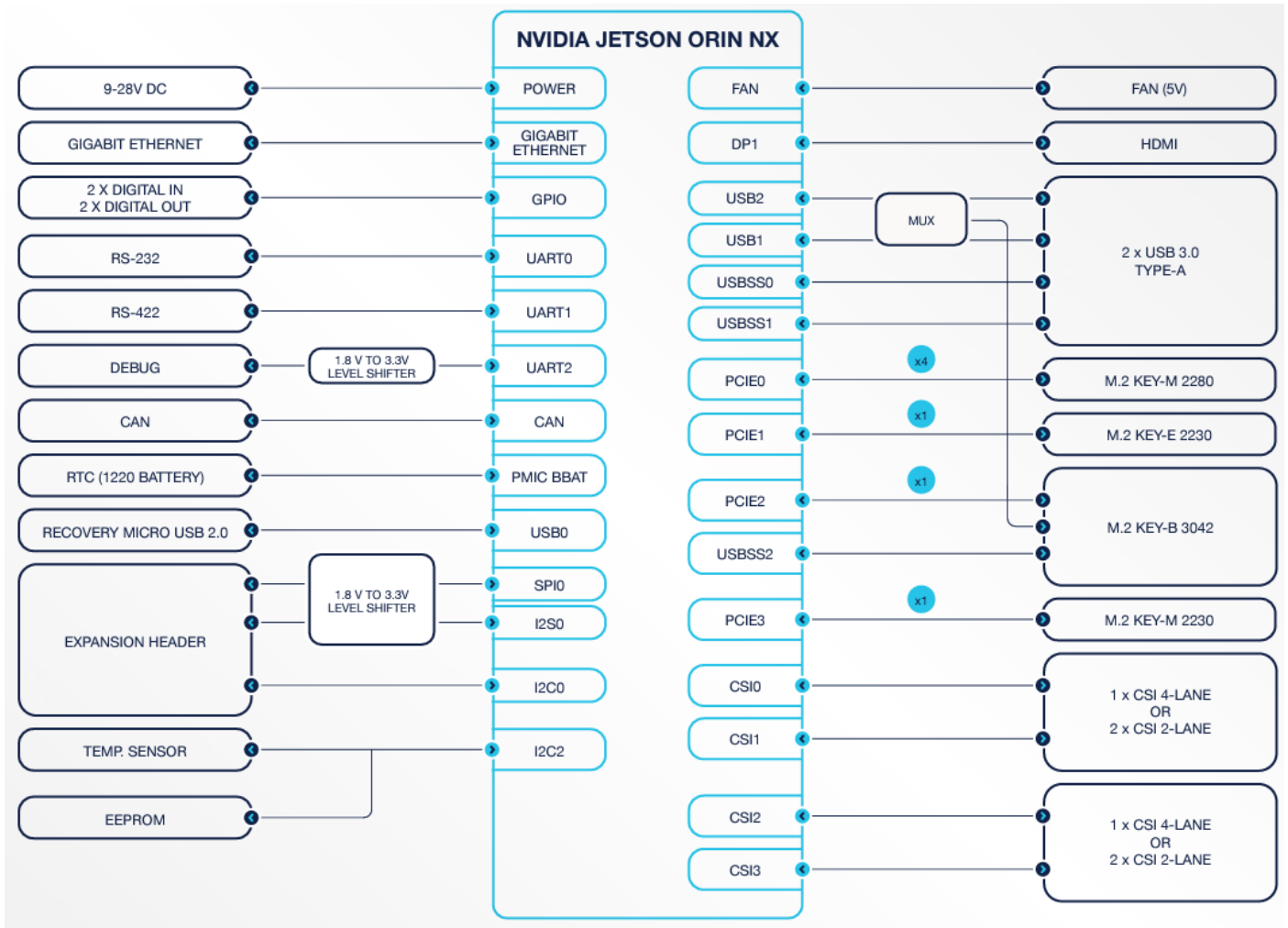
Latest revision of this user manual, datasheet, and 3D model can be downloaded from [Forecr Web Page](#).

2. Product Specification

2.1 Technical Specification

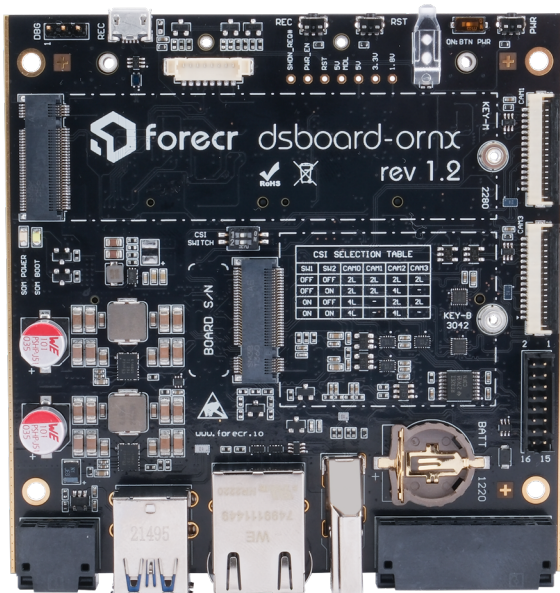
Supported Modules	NVIDIA Jetson Orin Nano 4GB / 8GB NVIDIA Jetson Orin NX 8GB / 16GB
Memory	4 GB 64-bit LPDDR5 / 8 GB 128 bit LPDDR5 8 GB 256-bit LPDDR5 / 16 GB 128 bit LPDDR5
Graphics Interfaces	1x HDMI 2.0 (max resolution 3840x2160)
Interfaces	1x Gigabit Ethernet 2x USB 3.1 Type-A 1x CAN Bus 1x RS232 & 1x RS422 1x microUSB 2.0 (Recovery) 2x Digital Input 2x Digital Output 2x CSI 4-LANE or 4x CSI 2-LANE
Wireless Communication	WIFI/LTE/5G/Bluetooth Connectivity by extension sockets
Power Supply	9-28 VDC
Extension Sockets	1x M.2 Key-E, 1x M.2 Key-B, 1x SIM, 1x 5V FAN, 1x SPI, 1x I2S, 1x I2C
Mass Storage	2x M.2 Key-M SSD Slot
Ambient Conditions	-25°C ... +85°C
Form Factor / Dimensions	100 mm x 100 mm, 85gr
Operating Systems	Ubuntu Linux 20.04
JetPack Support	JetPack 5.x JetPack 6.x

2.2 Block Diagram

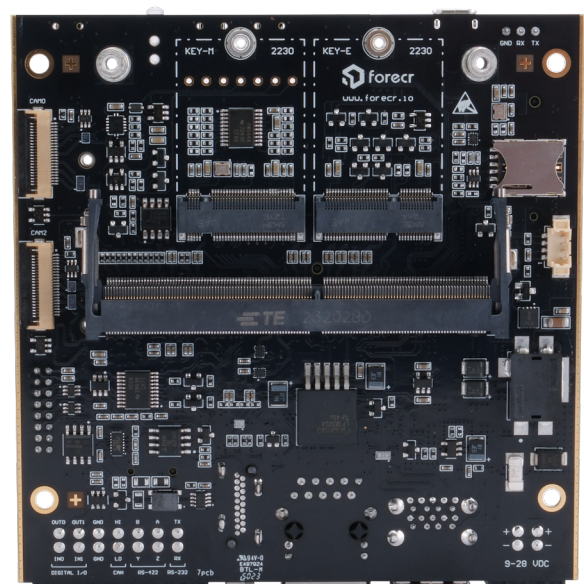


2.3 Board Visuals

Top Side



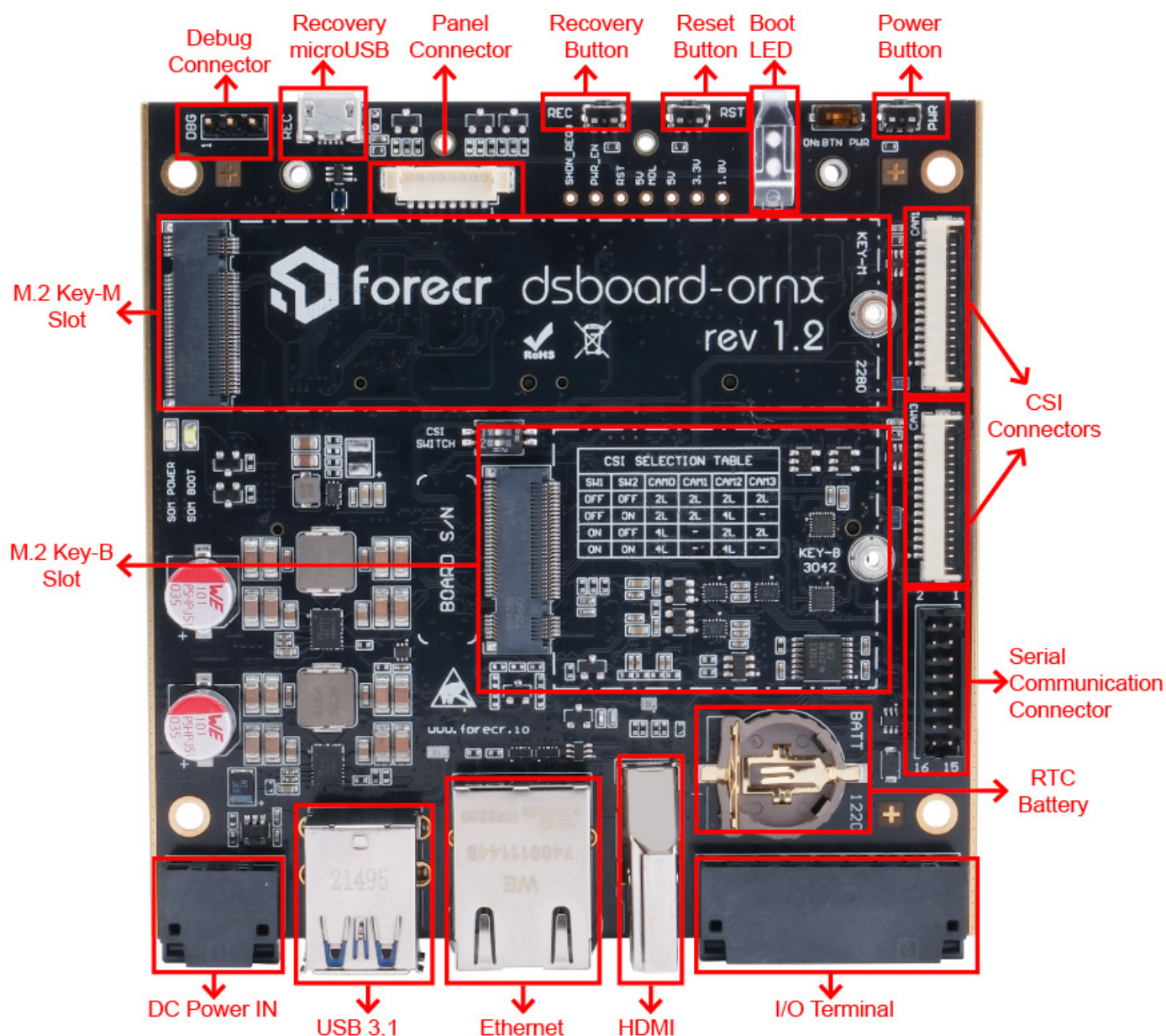
Bottom Side



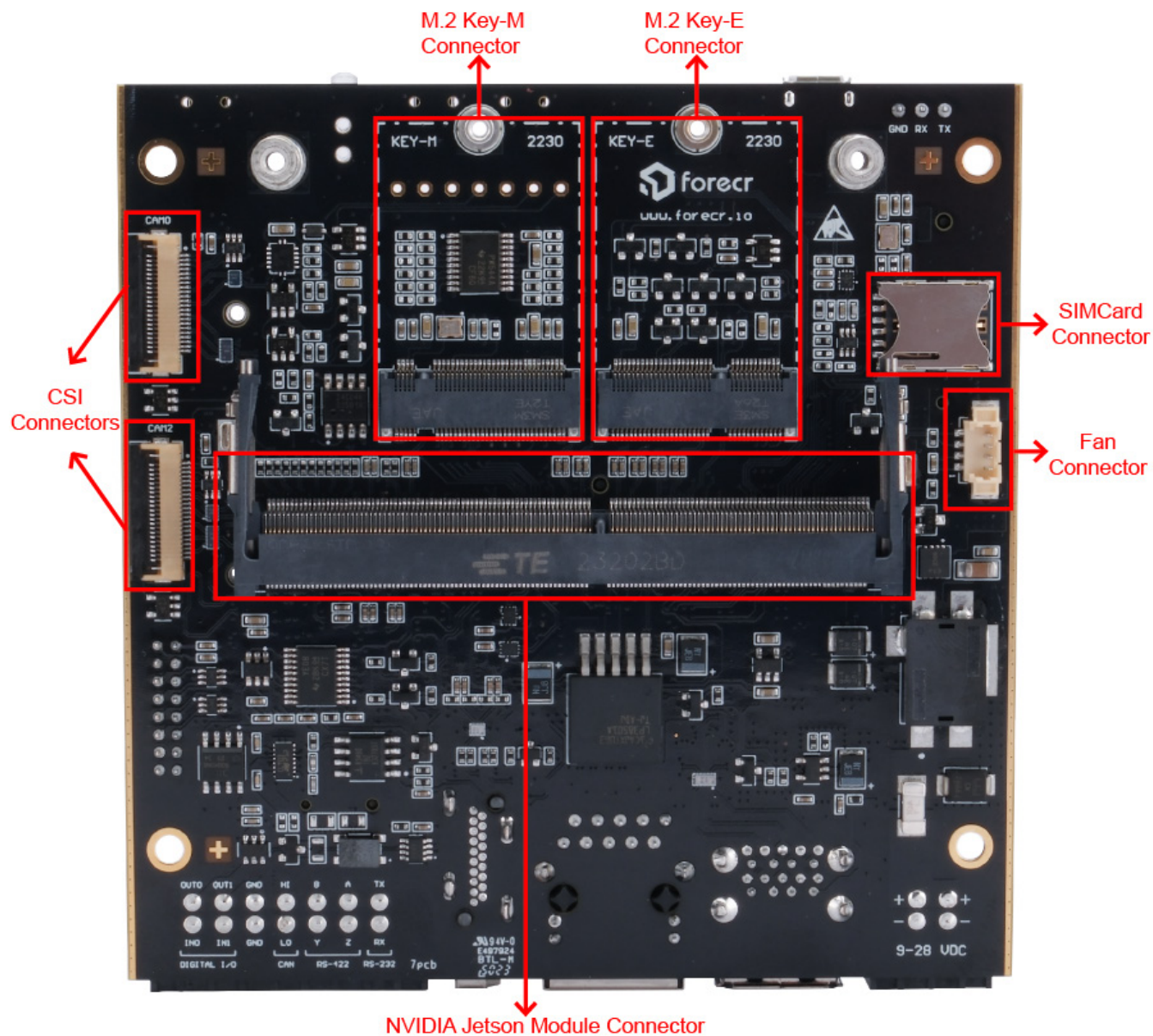
3. Hardware Information

3.1 Connector and Button Location

3.1.1 Top Side



3.2 Bottom Side

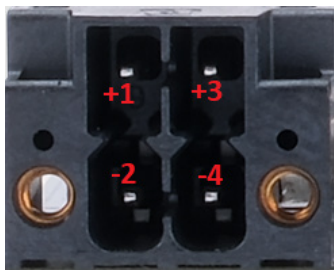


3.2 List of Connectors and Buttons

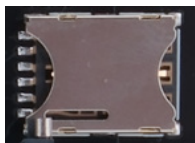
Connectors
DSBOARD-ORNX Power Connector
DSBOARD-ORNX SIM Card Connector
DSBOARD-ORNX M.2 Key-M Connectors
DSBOARD-ORNX M.2 Key-B Connector
DSBOARD-ORNX M.2 Key-E Connector
DSBOARD-ORNX CSI Connectors
DSBOARD-ORNX I/O Terminal Connector
DSBOARD-ORNX Serial Communication Connector
DSBOARD-ORNX Panel Connector
DSBOARD-ORNX RTC Battery Connector
DSBOARD-ORNX HDMI Connector
DSBOARD-ORNX USB 3.1 Type-A Connector
DSBOARD-ORNX 10/100/1000 Ethernet Connector
DSBOARD-ORNX Fan Connector
DSBOARD-ORNX Recovery Mode Micro USB Connector
DSBOARD-ORNX Debug Mode Header Connector
Buttons
DSBOARD-ORNX Power Button
DSBOARD-ORNX Recovery Pushbutton
DSBOARD-ORNX Reset Pushbutton

3.3 The Definition of Each Connector

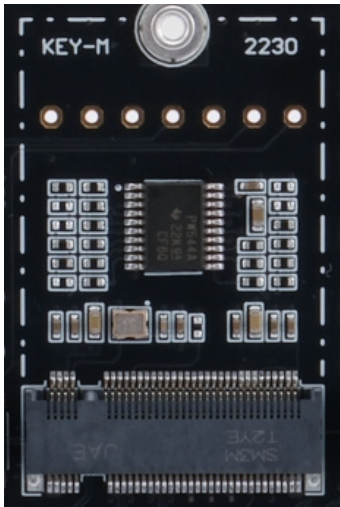
3.3.1 Power Connector

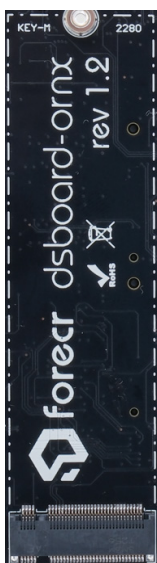
	Function		Description
	Mating Connector		1708595
	Minimum Input Voltage		+9V
	Maximum Input Voltage		+28V
	Pinout		
	Pin	Description	
	1	Positive	
	2	Negative	
	3	Positive	
	4	Negative	

3.3.2 SIM Card Connector

	Description
	The DSBOARD-ORNX implements a nano SIM card connector.

3.3.3 M.2 Key-M Connectors

M.2 Key M-2230		Description					
	Pinout	Pin	Description	Pin	Description	Pin	Description
		1	DGND	24	NC	47	PCIE3.TX0_N
		2	VDD_3V3	25	NC	48	NC
		3	DGND	26	NC	49	PCIE3.TX0_P
		4	VDD_3V3	27	DGND	50	PCIE3.RST_N
		5	NC	28	NC	51	DGND
		6	NC	29	NC	52	PCIE3.CLKREQ_N
		7	NC	30	NC	53	PCIE3.CLK_N
		8	NC	31	NC	54	PCIE.WAKE_N
		9	DGND	32	NC	55	PCIE3.CLK_P
		10	NC	33	DGND	56	NC
		11	NC	34	NC	57	DGND
		12	VDD_3V3	35	NC	58	NC
		13	NC	36	NC	67	NC
		14	VDD_3V3	37	NC	68	32KHZ_CLK
		15	DGND	38	NC	69	NC
		16	VDD_3V3	39	DGND	70	VDD_3V3
		17	NC	40	NC	71	DGND
		18	VDD_3V3	41	PCIE3.RX0_N	72	VDD_3V3
		19	NC	42	NC	73	DGND
		20	NC	43	PCIE3.RX0_P	74	VDD_3V3
		21	DGND	44	NC	75	DGND
		22	NC	45	DGND	MNT1	DGND
		23	NC	46	NC	MNT2	DGND
Board to board spacing=1.45 mm Max component height=1.2 mm Blue: Board-to-Board spacing Red: Max component height 							

M.2 Key M-2280

Description

Pinout	Pin	Description	Pin	Description	Pin	Description
	1	DGND	24	NC	47	PCIE0.TX0_N
	2	VDD_3V3	25	PCIE0.TX2_P	48	NC
	3	DGND	26	NC	49	PCIE0.TX0_P
	4	VDD_3V3	27	DGND	50	PCIE0.RST_N
	5	PCIE0.RX3_N	28	NC	51	DGND
	6	NC	29	PCIE0.RX-1_N	52	PCIE0.CLKREQ_N
	7	PCIE0.RX3_P	30	NC	53	PCIE0.CLK_N
	8	NC	31	PCIE0.RX1_P	54	PCIE.WAKE_N
	9	DGND	32	NC	55	PCIE0.CLK_P
	10	NC	33	DGND	56	NC
	11	PCIE0.TX3_N	34	NC	57	DGND
	12	VDD_3V3	35	PCIE0.TX1_N	58	NC
	13	PCIE0.TX3_P	36	NC	67	NC
	14	VDD_3V3	37	PCIE0.TX1_P	68	32KHZ_CLK
	15	DGND	38	NC	69	NC
	16	VDD_3V3	39	DGND	70	VDD_3V3
	17	PCIE0.RX2_N	40	NC	71	DGND
	18	VDD_3V3	41	PCIE0.RX-0_N	72	VDD_3V3
	19	PCIE0.RX2_P	42	NC	73	DGND
	20	NC	43	PCIE0.RX0_P	74	VDD_3V3
	21	DGND	44	NC	75	DGND
	22	NC	45	DGND	MNT1	DGND
	23	PCIE0.TX2_N	46	NC	MNT2	DGND

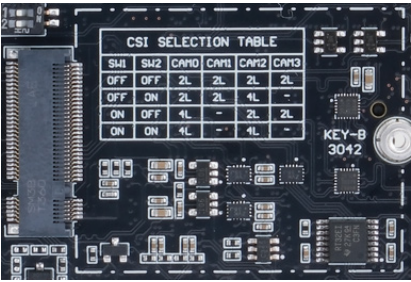
Board to board spacing=2.45 mm
Max component height=0 mm

Blue: Board-to-Board spacing
Red: Max component height



3.3.4 M.2 Key-B Connector

Pinout	Description			
	Pin	Description	Pin	Description
	1	NC	44	NC
	2	VDD_3V8	45	DGND
	3	DGND	46	NC
	4	VDD_3V8	47	PCIE2.TX0_N
	5	DGND	48	NC
	6	M2B_FULLCARD_PWOFF#	49	PCIE2.TX0_P
	7	USB2_KEYB.AP_P	50	PCIE2.RST_N
	8	M2B_W_DISABLE1#	51	DGND
	9	USB2_KEYB.AP_N	52	PCIE2.CLKREQ_N
	10	NC	53	PCIE2.CLK_N
	11	DGND	54	PCIE.WAKE_N
	20	NC	55	PCIE2.CLK_P
	21	NC	56	NC
	22	NC	57	DGND
	23	NC	58	NC
	24	NC	59	NC
	25	NC	60	NC
	26	M2B_W_DISABLE2#	61	NC
	27	DGND	62	NC
	28	NC	63	NC
	29	USBSS2_RX_N	64	NC
	30	M2_USIM_RST	65	NC
	31	USBSS2_RX_P	66	NC
	32	M2_USIM_CLK	67	M2B_RESET
	33	DGND	68	NC
	34	M2_USIM_DAT	69	NC
	35	USBSS2_TX_N	70	VDD_3V8
	36	M2_USIM_VDD	71	DGND
	37	USBSS2_TX_P	72	VDD_3V8
	38	NC	73	DGND
	39	DGND	74	VDD_3V8
	40	NC	75	NC
	41	PCIE2.RX0_N	MNT1	DGND
	42	NC	MNT2	DGND
	43	PCIE2.RX0_P		



Board to board spacing=2.45 mm
Max component height=1.3 mm

Blue: Board-to-Board spacing
Red: Max component height



3.3.5 M.2 Key-E Connector

Description				
Pinout	Pin	Description	Pin	Description
	1	DGND	44	NC
	2	VDD_3V3	45	DGND
	3	USB2_KEYE.AP2_P	46	NC
	4	VDD_3V3	47	PCIE2.CLK_P
	5	USB2_KEYE.AP2_N	48	NC
	6	NC	49	PCIE2.CLK_N
	7	DGND	50	M2E_SUSCLK_32KHZ
	8	NC	51	DGND
	9	MC	52	PCIE2.RST_N
	10	NC	53	PCIE2.CLKREQ_N
	11	NC	54	M2E_WDISABLE2_N
	12	NC	55	PCIE.WAKE_N
	13	NC	56	M2E_WDISABLE1_N
	14	NC	57	DGND
	15	NC	58	NC
	16	NC	59	NC
	17	NC	60	NC
	18	DGND	61	NC
	19	NC	62	NC
	20	NC	63	DGND
	21	NC	64	NC
	22	NC	65	NC
	23	NC	66	NC
	32	NC	67	NC
	33	DGND	68	NC
	34	NC	69	DGND
	35	PCIE2.TX0_P	70	NC
	36	NC	71	NC
	37	PCIE2.TX0_N	72	VDD_3V3
	38	NC	73	NC
	39	DGND	74	VDD_3V3
	40	NC	75	DGND
	41	PCIE2.RX0_P	MNT1	DGND
	42	NC	MNT2	DGND
	43	PCIE2.RX0_N		



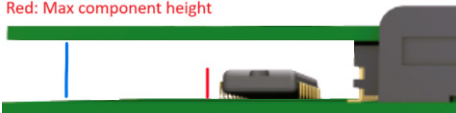
KEY-E 2230

forecr

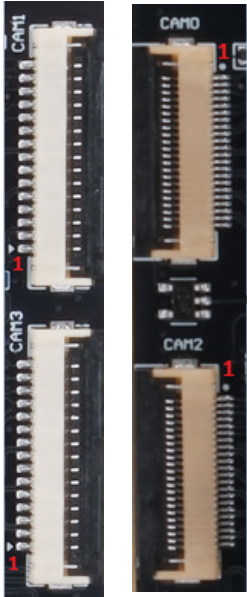
www.forecr.io

Board to board spacing=1.45 mm
Max component height=1.1 mm

Blue: Board-to-Board spacing
Red: Max component height



3.3.6 CSI Connectors

	Function	Description							
	Pin/Pitch/Bottom contact	CAM0, CAM2= 22-pin, 0.5mm pitch, bottom contact CAM1, CAM3= 15-pin, 1mm pitch, bottom contact							
	Pinout	CAM0		CAM1		CAM2		CAM3	
		Pin	Description	Pin	Description	Pin	Description	Pin	Description
		1	+3.3V	1	GND	1	+3.3V	1	GND
		2	SDA	2	DATA0_N	2	SDA	2	DATA0_N
		3	SCL	3	DATA0_P	3	SCL	3	DATA0_P
		4	GND	4	GND	4	GND	4	GND
		5	MCLK	5	DATA1_N	5	MCLK	5	DATA1_N
		6	PWDN	6	DATA1_P	6	PWDN	6	DATA1_P
		7	GND	7	GND	7	GND	7	GND
		8	DATA3_P	8	CLK_N	8	DATA3_P	8	CLK_N
		9	DATA3_N	9	CLK_P	9	DATA3_N	9	CLK_P
		10	GND	10	GND	10	GND	10	GND
		11	DATA2_P	11	PWDN	11	DATA2_P	11	PWDN
		12	DATA2_N	12	CLK	12	DATA2_N	12	CLK
		13	GND	13	SCL	13	GND	13	SCL
		14	CLK_P	14	SDA	14	CLK_P	14	SDA
		15	CLK_N	15	+3.3V	15	CLK_N	15	+3.3V
		16	GND			16	GND		
		17	DATA1_P			17	DATA1_P		
		18	DATA1_N			18	DATA1_N		
		19	GND			19	GND		
		20	DATA0_P			20	DATA0_P		
		21	DATA0_N			21	DATA0_N		
		22	GND			22	GND		

3.3.6.1 CSI Switch and Selection Table



SW1	SW2	CAM0	CAM1	CAM2	CAM3
OFF	OFF	2L	2L	2L	2L
OFF	ON	2L	2L	4L	-
ON	OFF	4L	-	2L	2L
ON	ON	4L	-	4L	-

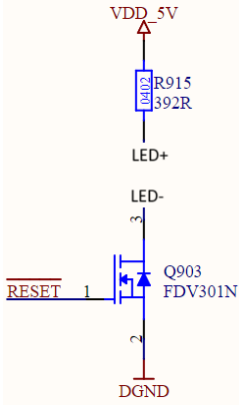
3.3.7 I/O Terminal Connector

	Function	Description		
	Mating connector	1790344 (DFMC 1,5/ 7-STF-3,5) from Phoenix Contact.		
	Pinout	Pin	Description	I/O Type
		1	RS232 TX	I/O
		2	RS232 RX	I/O
		3	RS422 A	I/O
		4	RS422 Z	I/O
		5	RS422 B	I/O
		6	RS422 Y	I/O
		7	CAN_H	I/O
		8	CAN_L	I/O
		9	GROUND	Power
		10	GROUND	Power
		11	DIGITAL_OUT1 Note: Up to 24V, low-side switch	Output
		12	DIGITAL_IN1	Input
		13	DIGITAL_OUT0 Note: Up to 24V, low-side switch	Output
		14	DIGITAL_IN0	Input

3.3.8 Serial Communication Connector

	Function	Description	
	Connector Type	DF11-16DP-2DSA(24)	
	Mating connector	DF11-16DS-2C	
	Pinout	Pin	Description
		1	+5V (1A)
		2	+3.3V (1A)
		3	GND
		4	GND
		5	SPI0_CS0
		6	SPI0_SCK
		7	SPI0_MISO
		8	SPI0_MOSI
		9	I2S0_DIN
		10	I2S0_DOUT
		11	I2S0_SCLK
		12	I2S0_FS
		13	I2C0_SCL
		14	AUD_MCLK
		15	I2C0_SDA
		16	SPI0_CS1

3.3.9 Panel Connector

	Function		Description	
	Connector type		53398-0871	
	Mating connector		51021-0800 from Molex	
	Pinout	Pin	Description	
		1	PWR_BTN(1.8V)	
		2	GND	
		3	RST (1.8V)	
		4	GND	
		5	RECOVERY (1.8V)	
		6	GND	
		7	LED +	
		8	LED -	

3.3.10 RTC Battery Connector

	Description
	The DSBOARD-ORNX implements a RTC battery holder. The connector is suitable for CR1220 batteries.

3.3.11 HDMI Connector

	Description
	The NVIDIA® Jetson Orin NX module will output video via the DSBOARD-ORNX vertical HDMI connector that is HDMI 2.0 capable.

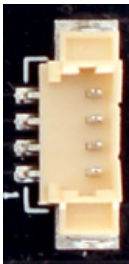
3.3.12 USB 3.1 Type-A Connector

	Description
	The DSBOARD-ORNX incorporates 2 USB 3.1 Type-A connectors with a 1.5A current limit per connector.

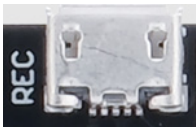
3.3.13 10/100/1000 Ethernet Connector

	Description
	The DSBOARD-ORNX implements RJ-45 ethernet connector for internet communication. RJ-45 connector is connected directly to the NVIDIA Jetson module.

3.3.14 Fan Connector

	Function		Description
	Connector Type		53398-0471 from Molex
	Mating Connector		0510210400
	Pinout	Pin	Description
		1	GND
		2	+5V
		3	FAN_TACH
		4	FAN_PWM

3.3.15 Recovery Mode Micro USB Connector

	Description
	The DSBOARD-ORNX implements a Micro USB connector to allow to install or upgrade the operating system.

3.3.16 Debug Mode Header Connector

	Function		Description
	Pinout		
		Pin	Description
		1	TX
		2	RX
		3	GND

3.4 The Definition of Buttons

3.4.1 Power Button

	Description
	The DSBOARD-ORNX implements a power button for energize the platform.

3.4.2 Recovery Pushbutton

	Description
	The DSBOARD-ORNX implements a recovery pushbutton. Recovery button should be pressed with reset button at the same time. After released reset button, recovery button should be pressed a little bit more (min. 250 ms).

3.4.3 Reset Pushbutton

	Description
	The DSBOARD-ORNX implements a reset button to reset the Jetson SoM.

4. Software Information

4.1 Installation

JetPack-5.x Installation can be found here: <https://www.forecr.io/blogs/installation/jetpack-5-x-installation-for-ds-board-ornx>

JetPack-6.x Installation can be found here: <https://www.forecr.io/blogs/installation/jetpack-6-x-installation-for-ds-board-ornx>

5. Connectivity

5.1 General Purpose Input/Output (GPIO)

MODULE PIN NUMBER	I/O NAME	MODULE PIN NAME	TYPE	DESCRIPTION
220	PWRLED_R	I2S1_DOUT	OUTPUT	Drive high to turn on the Red LED.
222	PWRLED_G	I2S1_DIN	OUTPUT	Drive high to turn on the Green LED.
224	PWRLED_B	I2S1_FS	OUTPUT	Drive high to turn on the Blue LED.
112	USB.MUX1	SPI1_CS1	OUTPUT	Drives USB mux #1. Drive high to connect USB2.0 interface to Key-B connector. Drive low to connect USB2.0 interface to Type-A USB connector.
226	USB.MUX2	I2S1_SCLK	OUTPUT	Drives USB mux #2. Drive high to connect USB2.0 interface to Key-E connector. Drive low to connect USB2.0 interface to Type-A USB connector.
228	M2E_WDIS-ABLE1	GPIO13	OUTPUT	WiFi/BT module full powerdown control for the WiFi/BT radio. Drive low to disable WiFi/BT. Drive high for normal operation.
130	M2B_PWR_ON#	GPIO06	OUTPUT	LTE/5G module 3.8V power supply LDO enable control. Drive high to disable LDO. Drive low for normal operation.
206	M2B_RESET	GPIO07	OUTPUT	LTE/5G module reset control input. Drive low to trigger reset. Drive high for normal operation.
126	M2B_W_DIS-ABLE1#	GPIO03	OUTPUT	LTE/5G module airplane mode control. Drive low to enable airplane mode. Drive high for normal operation.
124	M2B_W_DIS-ABLE2#	GPIO02	OUTPUT	LTE/5G module GNSS enablement control. Drive low to disable GNSS. Drive high for normal operation.
218	M2B_FULL-CARD-PWROFF#	GPIO12	OUTPUT	LTE/5G module power on/off control. Drive low to power off the module. Drive high for normal operation.
116	CAM0_MCLK	CAM0_MCLK	OUTPUT	Camera 0 reference clock (1.8V Level)
114	CAM0_PWDN	CAM0_PWDN	OUTPUT	Camera 0 powerdown (3.3V Level)
118	CAM2_MCLK	GPIO01	OUTPUT	Camera 2 reference clock (1.8V Level)
127	CAM2_PWDN	GPIO04	OUTPUT	Camera 2 powerdown (3.3V Level)
122	CAM1_MCLK	CAM1_MCLK	OUTPUT	Camera 1 reference clock (1.8V Level)
120	CAM1_PWDN	CAM1_PWDN	OUTPUT	Camera 1 powerdown (3.3V Level)
216	CAM3_MCLK	GPIO11	OUTPUT	Camera 3 reference clock (1.8V Level)
212	CAM3_PWDN	GPIO10	OUTPUT	Camera 3 powerdown (3.3V Level)
110	DIGITAL_OUT1	SPI1_CS0	OUTPUT	Control signal for DIGITAL_OUT1 in I/O Connector. See Section 5.2.2 for more details.

104	DIGITAL_OUT0	SPI1_MOSI	OUTPUT	Control signal for DIGITAL_OUT0 in I/O Connector. See Section 5.2.2 for more details.
108	DIGITAL_IN1	SPI1_MISO	INPUT	Control signal for DIGITAL_IN1 in I/O Connector. See Section 5.2.2 for more details.
106	DIGITAL_IN0	SPI1_SCK	INPUT	Control signal for DIGITAL_IN0 in I/O Connector. See Section 5.2.2 for more details.

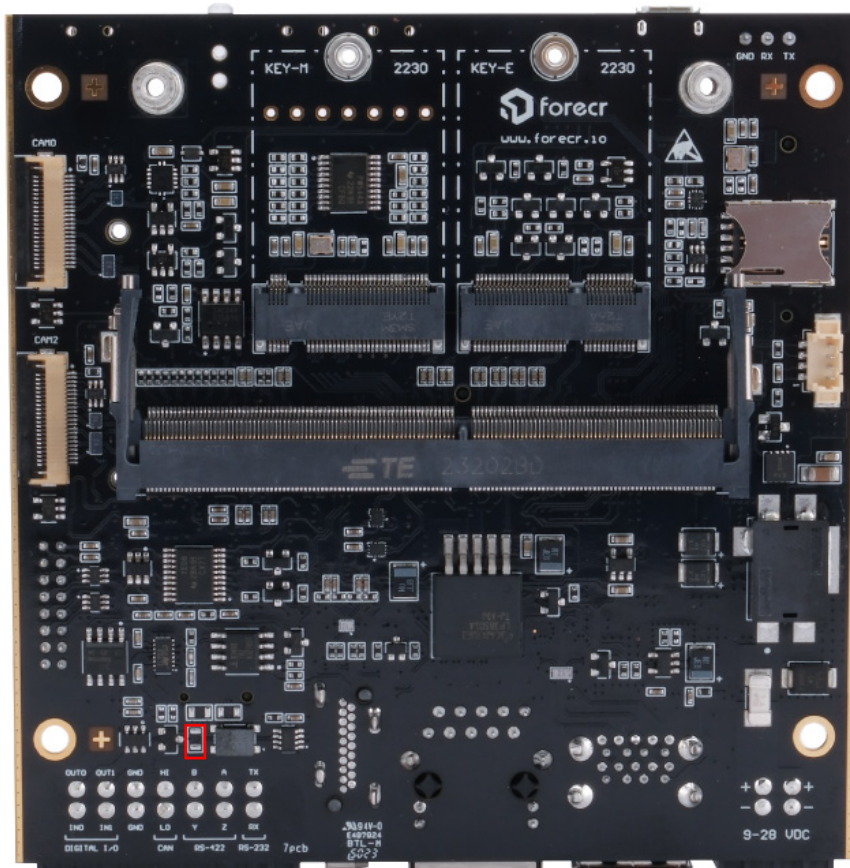
5.2 I/O Connector

On the connector, there are 6 serial communication, 2 ground, 2 CANBus, 2 digital input and 2 digital output pins.

5.2.1 CANBus Interface

There is a single CAN Bus interface on the DSBOARD-ORNX. MAX3051 transceiver is used between native CAN pins of the Jetson and connector. There is a 0805 size 120R termination resistor between CAN_H and CAN_L pins on the board, which is not populated by default. A standard resistor with above specs can be fitted if termination resistor is needed on the DSBOARD-ORNX side.

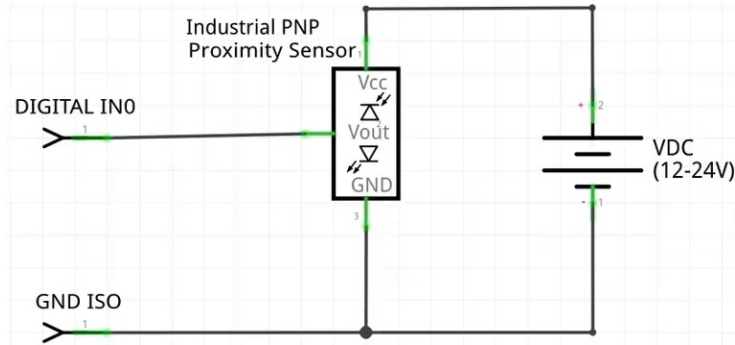
CANBus Termination Resistor



5.2.2 Industrial Input Output Interface

5.2.2.1 Setting and Reading Input Pin

Digital input side accepts signals between 12-24V (rated for 2.25mA). In our application, we used [Heschen M12 Inductive Proximity Sensor \(PNP & Normally Open\(NO\)\)](#) with 24V voltage source.



Find sysfs equivalent of the connected output pin from the table below. For this setup, it is DIGITAL_IN0. After proper hardware connection with industrial LED, we can continue with the software side.

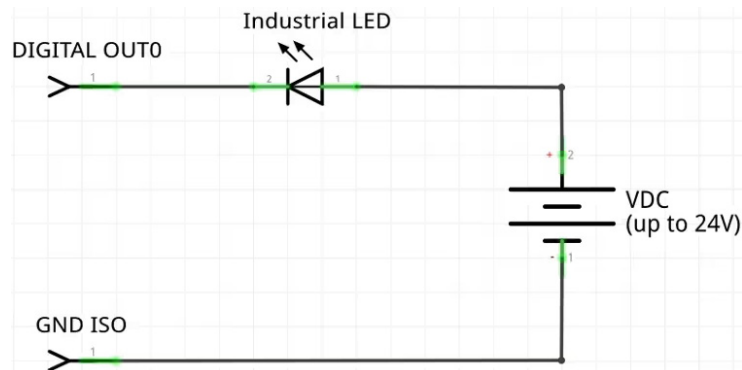
Pin Name	Sysfs Name
DIGITAL_IN0	gpio-470 (PY.00)
DIGITAL_IN1	gpio-471 (PY.01)
GROUND	GND

Set DIGITAL_IN0 as input and read sensor value. To do this, you should use the commands below.

```
sudo sh -c "echo 470 > /sys/class/gpio/export"
sudo sh -c "echo in > /sys/class/gpio/PY.00/direction"
sudo sh -c "cat /sys/class/gpio/PY.00/value"
```

5.2.2.2 Setting Digital Output as High and Low

Digital output side can drive loads up to 24V and has a current limit of 1A. They work as low side switches, open-close between them and GND. So, you should have a circuitry as in the schematic below. In our application, we used [GASH-ER 24V Indicator Light](#) with 24V voltage source.



Find sysfs equivalent of the connected output pin from the table below. For this setup, it is DIGITAL_OUT0. After proper hardware connection with industrial LED, we can continue with the software side.

Pin Name	Sysfs Name
DIGITAL_OUT0	gpio-472 (PY.02)
DIGITAL_OUT1	gpio-473 (PY.03)
GROUND	GND

Then, set DIGITAL_OUT0 as output and control light state. To do this, you should use the commands below.

```
sudo sh -c "echo 472 > /sys/class/gpio/export"
sudo sh -c "echo out > /sys/class/gpio/PY.02/direction"
```

To short output:

```
sudo sh -c "echo 1 > /sys/class/gpio/PY.02/value"
```

To open output:

```
sudo sh -c "echo 0 > /sys/class/gpio/PY.02/value"
```

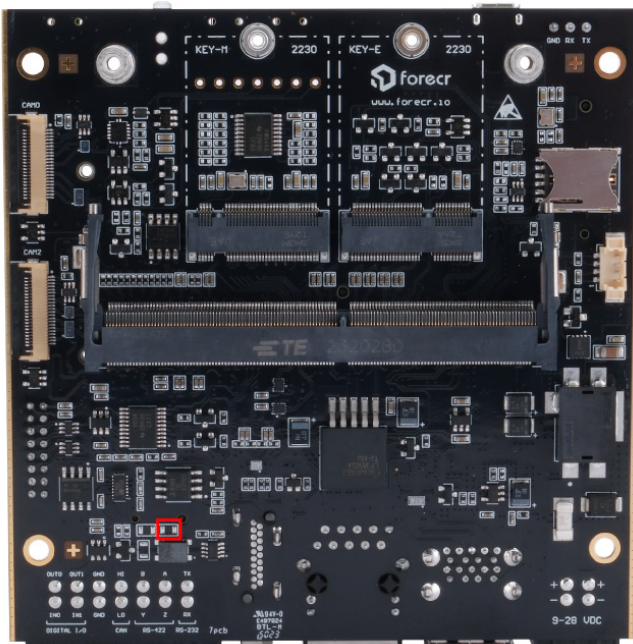
5.2.3 Serial Communication Interface

5.2.3.1 RS422

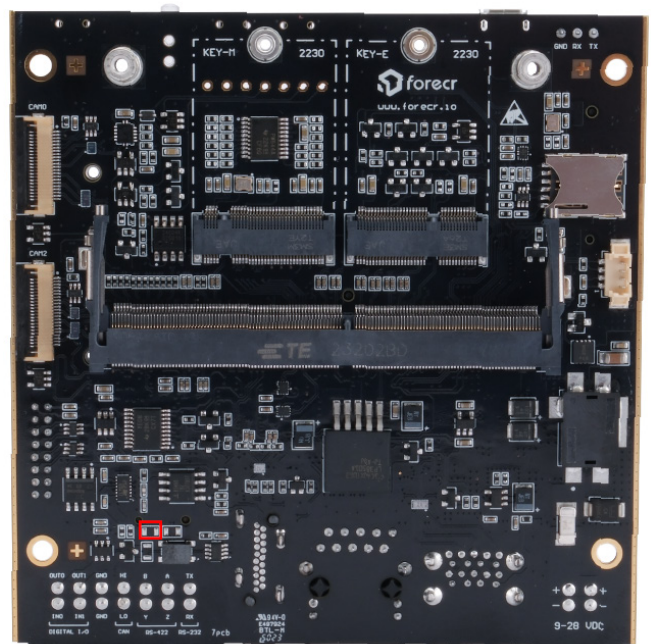
ISL83490 from Renesas is used to convert UART1 to RS-422 from Jetson. An example application can be found on the Forecr blog webpage <https://www.forecr.io/blogs/all>.

There are two 0805 size 120R termination resistors, one between transmit lanes and one between receive lanes. These are not populated by default. In case termination resistors are needed on the dsboard-ornx side, standard resistors with above specs can be fitted.

RS422 RX (A/B) Termination Resistor



RS422 TX (Z/Y) Termination Resistor



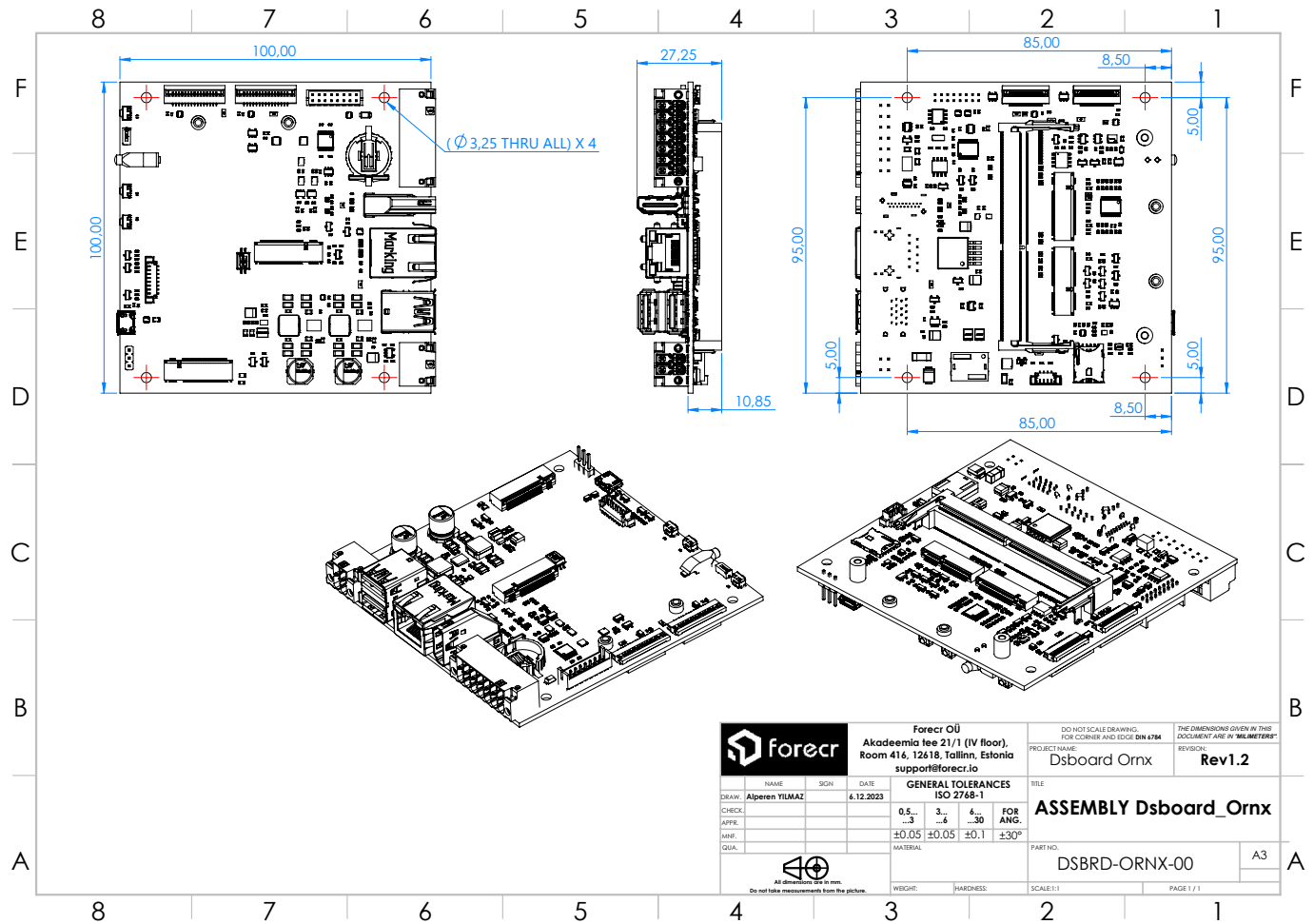
5.2.3.2 RS232

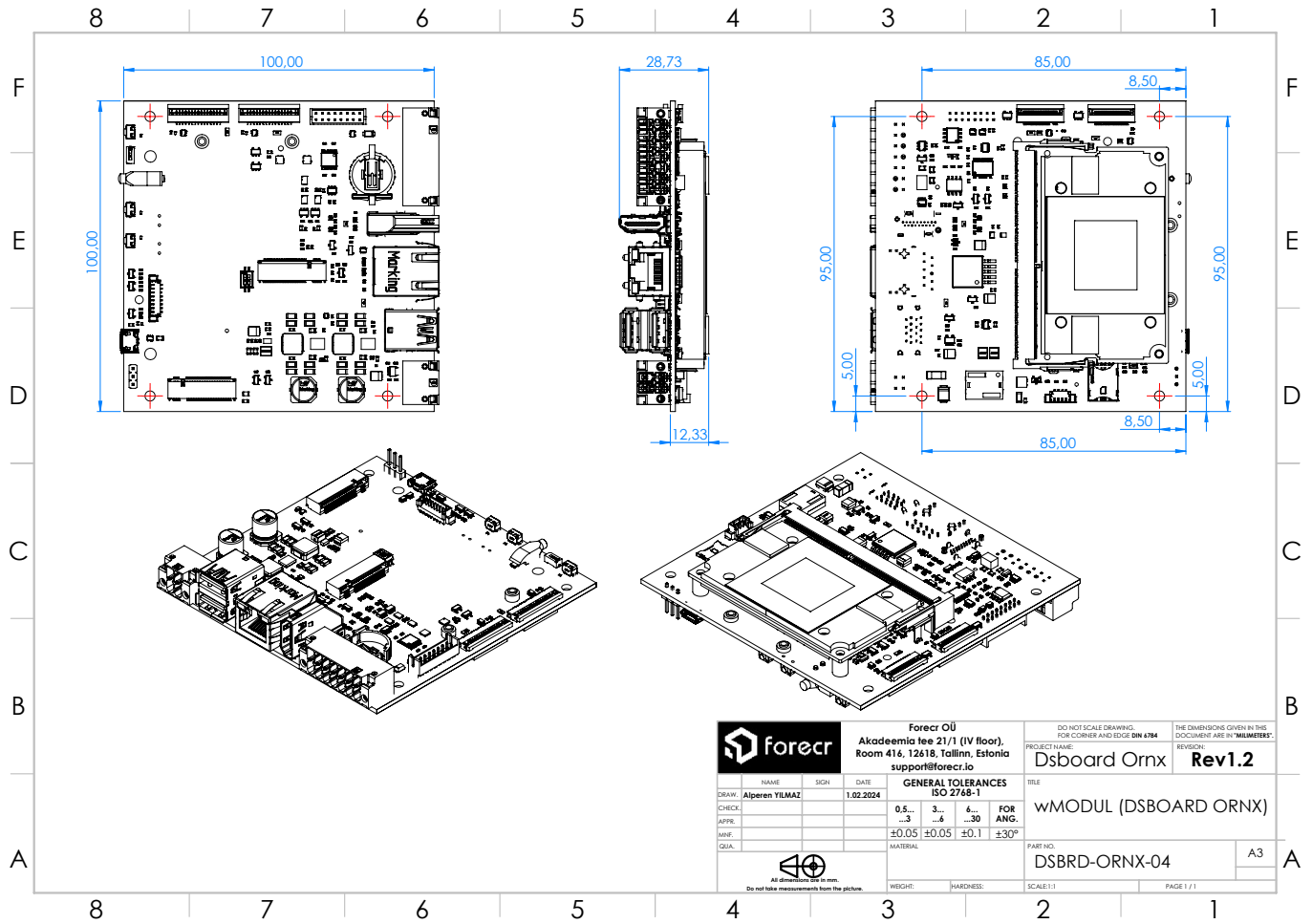
TRSF3232E from Texas Instruments is used to convert UART0 to RS-232 from Jetson. An example application can be found on the Forecr blog webpage <https://www.forecr.io/blogs/all>.

6. 3D Model & Mechanical Information

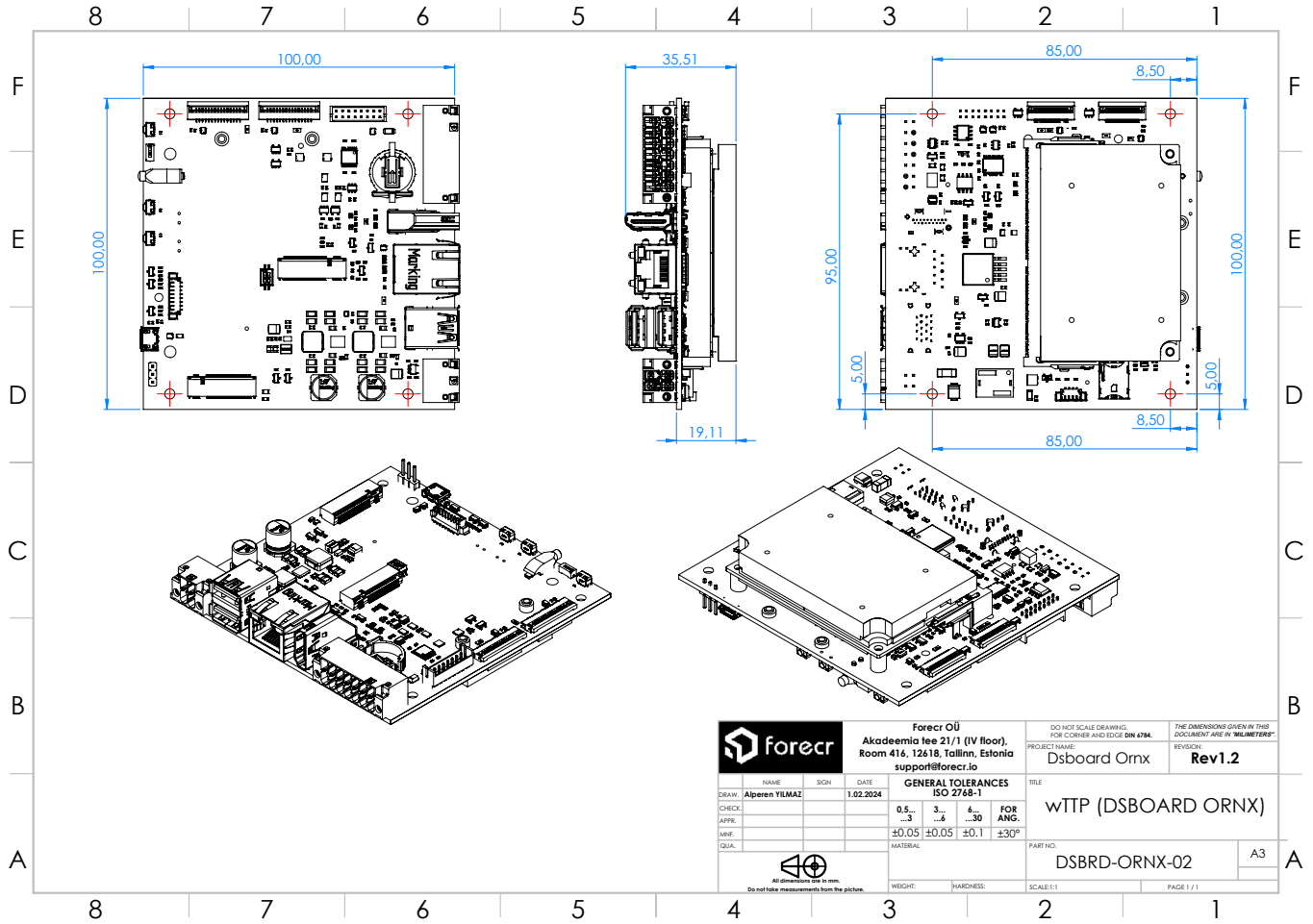
Full 3D models of all DSBOARD ORNX Carrier Board can be found here: https://github.com/forecr/forecr_3d_models/tree/master/DSBOARD-ORNIX

DSBOARD-ORNIX Stand Alone

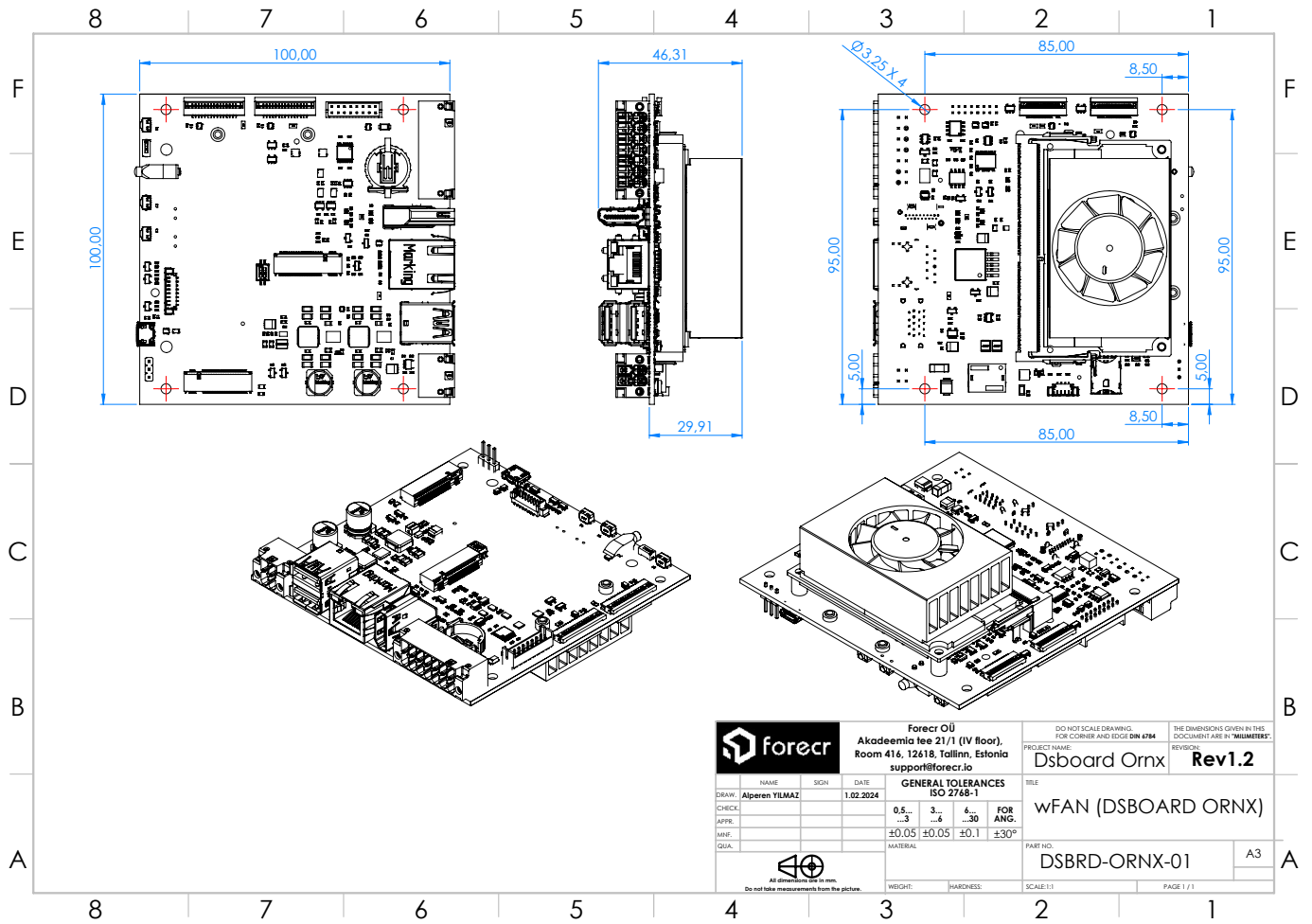


DSBOARD-ORNIX with Jetson Orin Nano/NX Module


DSBOARD-ORN[™] with Jetson Orin Nano/NX Module and TTP Integration Details



DSBOARD-ORNIX with Jetson Orin Nano/NX Module and Thermal Integration Details



7. Power Consumption

7.1 Orin NX 16GB

Power Supply: 12V-5A

All CPU and GPU cores are %100 loaded.

	Power Up Sequence	Idle	Standby (Suspend mode)	10W (4 core)	15W (4 core)	25W (8 core)	MAXN (8 core)
Current (A)	1,34	0,55	0,07	1,23	1,51	1,8	2,5
Power (W)	16,08	6,6	0,84	14,76	18,12	21,6	30

7.2 Orin NX 8GB

Power Supply: 12V-5A

All CPU and GPU cores are %100 loaded.

	Power Up Sequence	Idle	Standby (Suspend mode)	10W (4 core)	15W (4 core)	20W (6 core)	MAXN (6 core)
Current (A)	1,44	0,6	0,08	1,3	1,56	1,64	2,04
Power (W)	17,28	7,2	0,96	15,6	18,72	19,68	24,48

7.3 Orin Nano 8GB

Power Supply: 12V-5A

All CPU and GPU cores are %100 loaded.

	Power Up Sequence	Idle	Standby (Suspend mode)	7W (4 core)	15W (6 core)
Current (A)	1,1	0,6	0,09	1,08	1,6
Power (W)	13,2	7,2	1,08	12,96	19,2

7.4 Orin Nano 4GB

Power Supply: 12V-5A

All CPU and GPU cores are %100 loaded.

	Power Up Sequence	Idle	Standby (Suspend mode)	7W_CPU (4 core)	7W_AI (4 core)	10W (6 core)
Current (A)	1,05	0,5	0,06	0,92	0,96	1,04
Power (W)	12,6	6	0,72	11,04	11,52	12,48

8. MTBF Prediction

Prediction method	Mil Hdbk 217F2, parts count
Environment	GF - Ground Fixed, $T_A=40^{\circ}\text{C}$, $T_J=60^{\circ}\text{C}$
Date	5-Feb-2024
Total Failure Rate	5.694616 (FPMH)
MTBF	175604 (Hours), 20.05 (Years)

9. Ordering Information

