

MILBOARD-AGX Rev 1.21

# USER MANUAL

UM-MLBDAGX-01

Revision 1.21

01/10/2024



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## 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

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**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	18.04.2024	Preliminary Release
rev 1.1	16.07.2024	Technical specifications in the section 2.1 have been updated. The pin number in the High Speed Connector picture in section 3.3.5 has been corrected.
rev 1.2	02.09.2024	Key-M connector pinout has been added to section 3.3.3. Mating connector of the CSI Connector has been added to section 3.3.4. Mating cable of the High Speed Connector has been added to section 3.3.5.

## 1. Introduction

MILBOARD-AGX is a carrier board designed for harsh military and aerospace environments. It is powered by the NVIDIA Jetson AGX Orin module, which has an NVIDIA Ampere GPU and up to 12-core ARM64 CPU, providing high processing power for complex applications. The carrier board features a rugged design that ensures reliable performance even in the most extreme conditions. It has a wide operating temperature range and a robust power management system that can handle input voltages from 12V to 30V.

In addition to its powerful processing capabilities, MILBOARD-AGX also offers a variety of connectivity options, including multiple Gigabit Ethernet ports and UARTs. It also features several USB 3.0 ports, HDMI output, and two CAN bus interfaces. The carrier board also includes an M.2 Key-M slot for additional storage options.

MILBOARD-AGX runs on the NVIDIA JetPack SDK, providing a complete software development environment for building and deploying AI applications. It is a versatile solution for a wide range of military and aerospace applications.

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

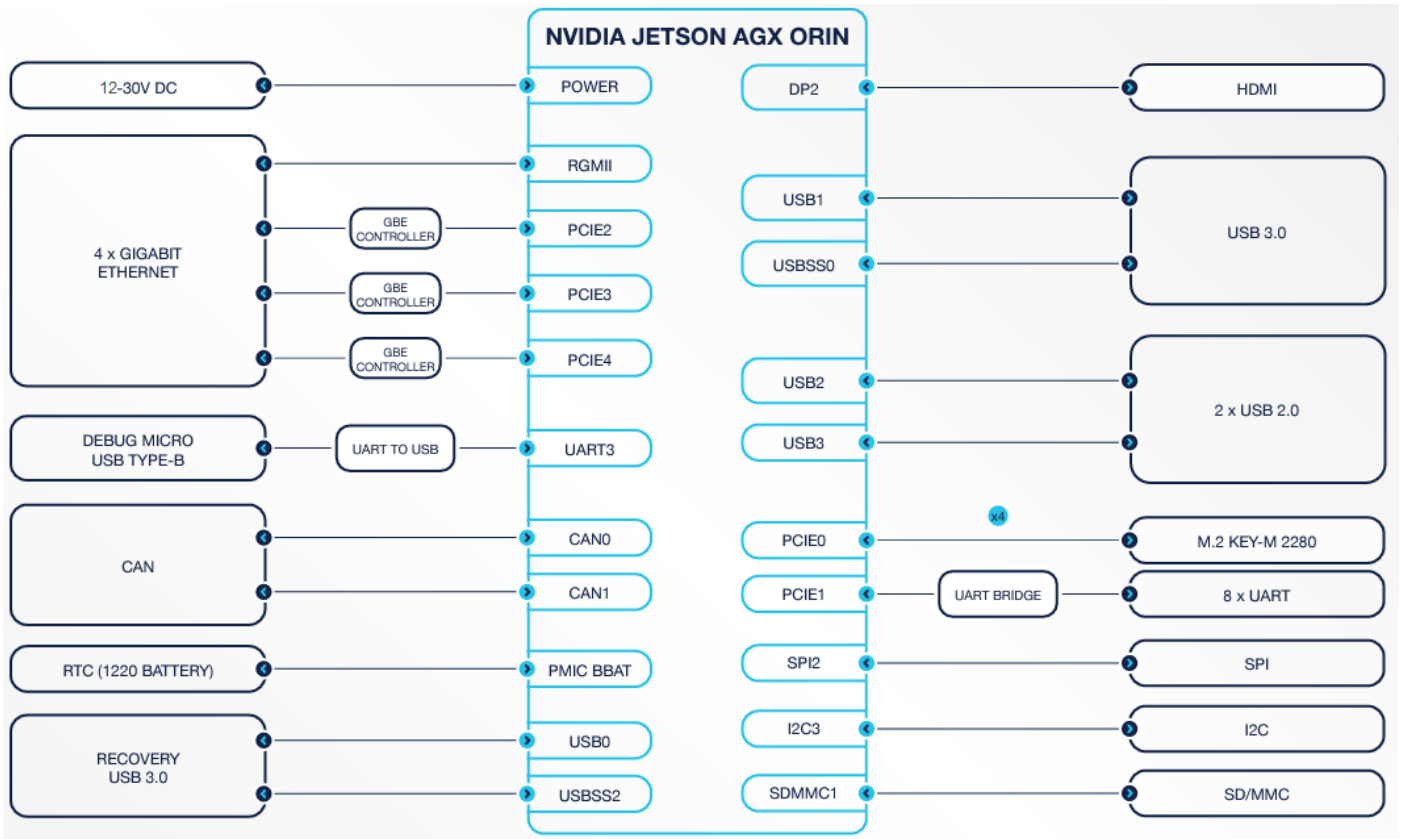
## 2. Product Specification

### 2.1 Technical Specification

<b>Supported Modules</b>	NVIDIA Jetson AGX Xavier 32GB NVIDIA Jetson AGX Xavier 64GB NVIDIA Jetson AGX Xavier Industrial 32GB NVIDIA Jetson AGX Orin 32GB NVIDIA Jetson AGX Orin 64GB NVIDIA Jetson AGX Orin Industrial 64GB
<b>Memory</b>	32 / 64 GB 256-bit LPDDR4x
<b>Graphics Interfaces</b>	1x HDMI 2.0(max resolution 3840x2160)
<b>Interfaces</b>	4x Gigabit Ethernet 2x USB 3.2 2x USB 2.0 2x CAN Bus 8x UART 1x MicroUSB 2.0 (Debug UART) 1x I2C 1x SPI 1x FAN (5V) 1x Temperature Sensor
<b>Wireless Communication</b>	None
<b>Power Supply</b>	12-30 VDC
<b>Extension Sockets</b>	1x Camera Connector (6 CSI camera support)
<b>Mass Storage</b>	32 / 64 GB eMMC 5.1 Flash 1x M.2 Key-M SSD Slot SD Card
<b>Ambient Conditions</b>	-40°C ... +85°C
<b>Form Factor / Dimensions</b>	150 mm x 140 mm, 120gr
<b>Operating Systems</b>	Ubuntu Linux 18.04 / 20.04
<b>JetPack Support</b>	JetPack 4.x JetPack 5.x JetPack 6.x

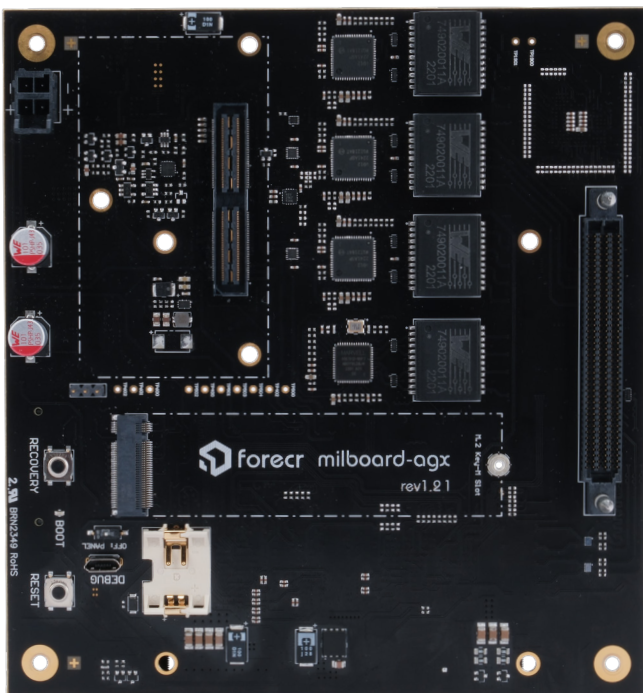


## 2.2 Block Diagram

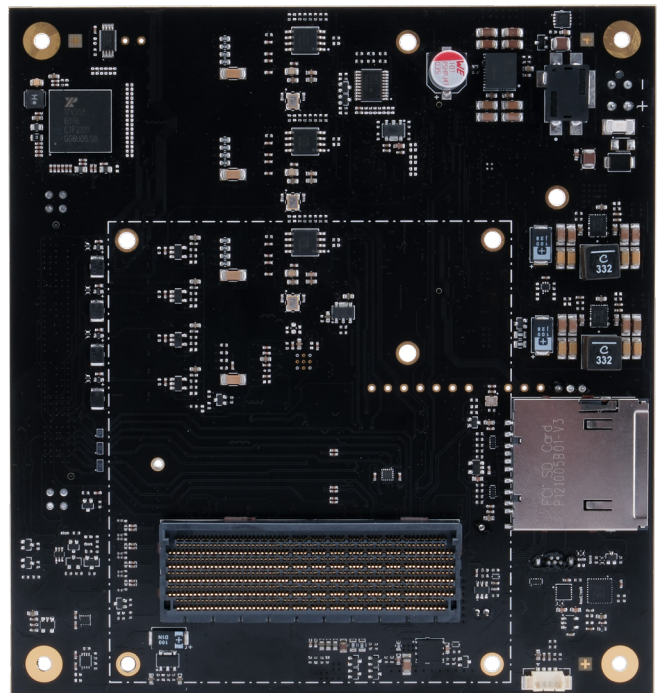


## 2.3 Milboard Visuals

Top Side



Bottom Side

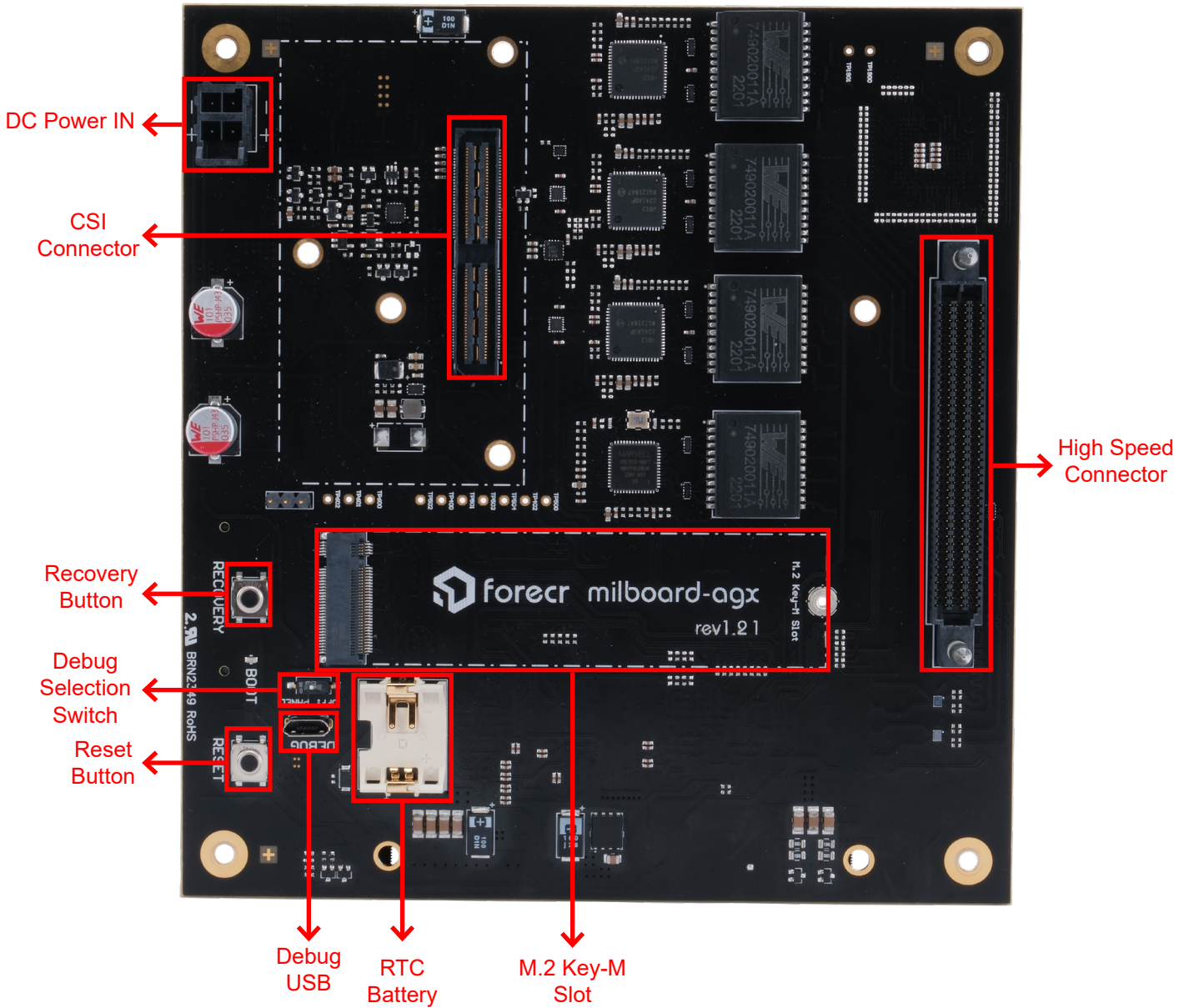




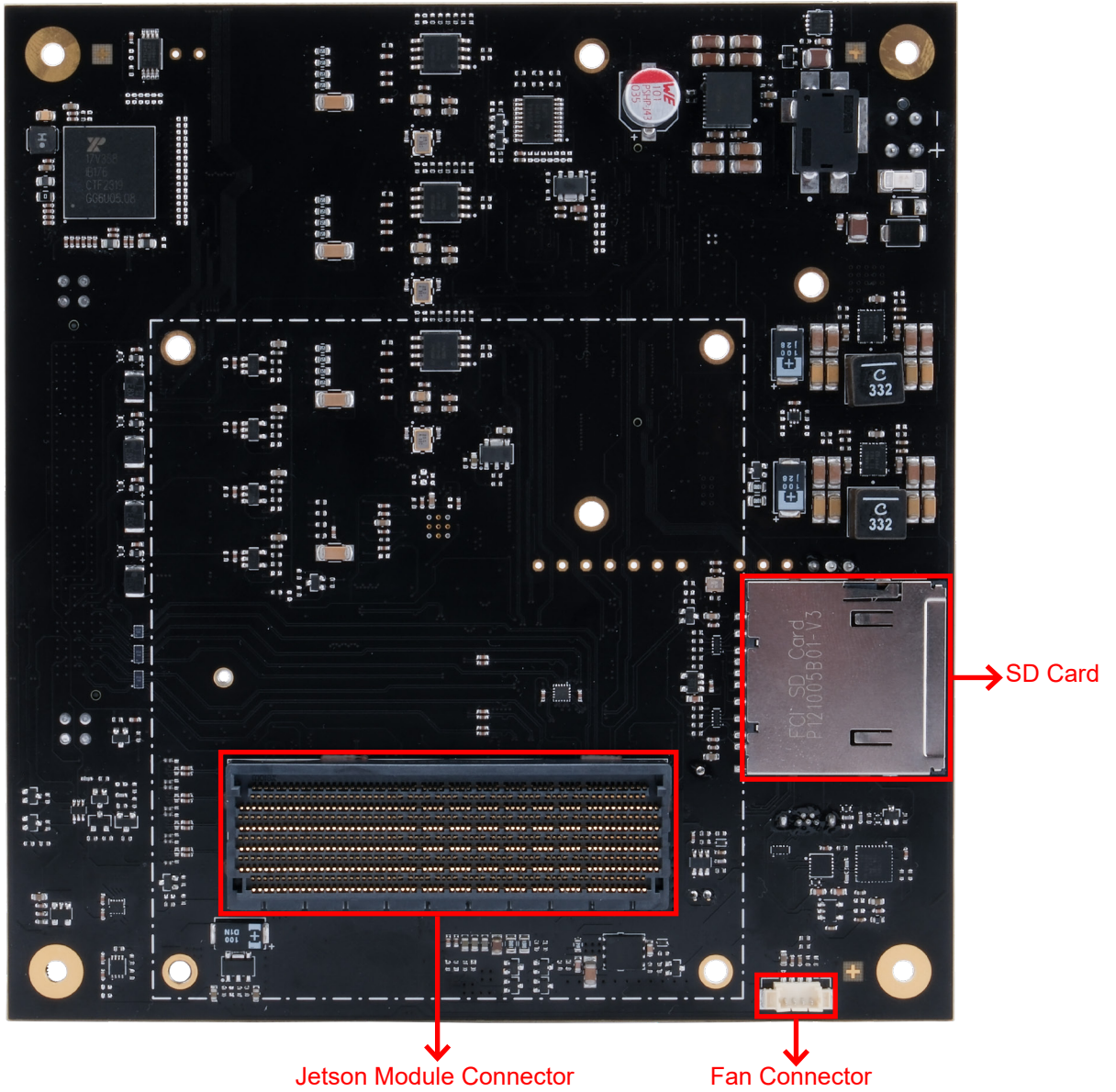
### 3. Hardware Information

#### 3.1 Connector and Button Location

##### 3.1.1 Top Side



3.1.2 Bottom Side

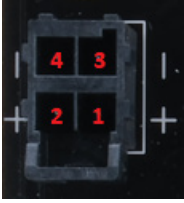


## 3.2 List of Connectors and Buttons

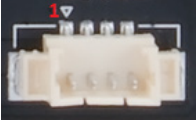
<b>Connectors</b>
MILBOARD-AGX Power Connector
MILBOARD-AGX CSI Connector
MILBOARD-AGX High Speed Connector
MILBOARD-AGX M.2 Key-M Connector
MILBOARD-AGX Fan Connector
MILBOARD-AGX SD Card Connector
MILBOARD-AGX RTC Battery Connector
MILBOARD-AGX Debug USB Connector
<b>Buttons</b>
MILBOARD-AGX Debug Slection Switch
MILBOARD-AGX Recovery Button
MILBOARD-AGX Reset Button

### 3.3 The Definition of Each Connector

#### 3.3.1 Power Connector

	Function		Description	
	Mating Connector		1722583104	
	Minimum Input Voltage		+12V	
	Maximum Input Voltage		+30V	
	Pinout	Pin	Description	
		1	Positive	
2		Positive		
3		Negative		
4		Negative		

#### 3.3.2 Fan Connector

	Function		Description	
	Mating Connector		0510210400 from Molex Picoblade series	
	Pinout	Pin	Description	
		1	GND	
		2	+5V	
		3	TACH	
4		PWM		


**3.3.3 M.2 Key-M Connector**

Pinout	Description					
	Pin	Description	Pin	Description	Pin	Description
	1	DGND	24	NC	47	PCIE_TX0_N
	2	VDD_3V3	25	PCIE_TX2_P	48	NC
	3	DGND	26	NC	49	PCIE_TX0_P
	4	VDD_3V3	27	DGND	50	PCIE.RST_N
	5	PCIE.RX3_N	28	NC	51	DGND
	6	NC	29	PCIE.RX1_N	52	PCIE.CLKREQ_N
	7	PCIE.RX3_P	30	NC	53	PCIE.CLK_N
	8	NC	31	PCIE.RX1_P	54	GPIO29_M2_KEYM_PEWAKE*
	9	DGND	32	NC	55	PCIE.CLK_P
	10	NC	33	DGND	56	NC
	11	PCIE_TX3_N	34	NC	57	DGND
	12	VDD_3V3	35	PCIE_TX1_N	58	NC
	13	PCIE_TX3_P	36	NC	67	NC
	14	VDD_3V3	37	PCIE_TX1_P	68	32KHZ_CLK
	15	DGND	38	NC	69	NC
	16	VDD_3V3	39	DGND	70	VDD_3V3
	17	PCIE.RX2_N	40	I2C4.SCL	71	DGND
	18	VDD_3V3	41	PCIE.RX0_N	72	VDD_3V3
	19	PCIE.RX2_P	42	I2C4.SDA	73	DGND
	20	NC	43	PCIE.RX0_P	74	VDD_3V3
	21	DGND	44	GPIO34_M2_KEYM_ALERT*	75	DGND
	22	NC	45	DGND	MNT1	DGND
	23	PCIE_TX2_N	46	NC	MNT2	DGND

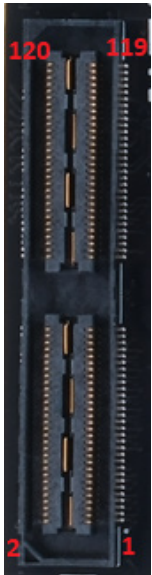
Board to board spacing=1.45 mm  
 Max component height=0.35 mm

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



## 3.3.4 CSI Connector

Function	Description							
Connector Type	QSH-060-01-L-D-A-K-TR							
Mating Connector	QTH-060-0X-L-D-A-K-TR							
Pinout	Pin	Description	Pin	Description	Pin	Description	Pin	Description
	1	CSI0.D0_P	37	CSI4.D0_P	73	CSI5.D1_N	109	CAM_BACK LIGHT_PWM
	2	CSI1.D0_P	38	CSI6.D0_P	74	CSI7.D1_N	110	VDD_3V3
	3	CSI0.D0_N	39	CSI4.D0_N	75	CAM_I2C.SCL	111	NC
	4	CSI1.D0_N	40	CSI6.D0_N	76	CAM_ERROR1	112	NC
	5	GND	41	GND	77	CAM_I2C.SDA	113	NC
	6	GND	42	GND	78	CAM_ERROR2	114	NC
	7	CSI0.CLK_P	43	CSI4.CLK_P	79	GND	115	GND
	8	CSI1.CLK_P	44	CSI6.CLK_P	80	GND	116	GND
	9	CSI0.CLK_N	45	CSI4.CLK_N	81	AVDD_CAM_ZV8	117	CAM_INT1
	10	CSI1.CLK_N	46	CSI6.CLK_N	82	AVDD_CAM_ZV8	118	VDD_3V3
	11	GND	47	GND	83	AVDD_CAM_ZV8	119	CAM_VDD_SYS_EN
	12	GND	48	GND	84	CAM_ERROR3	120	VDD_3V3
	13	CSI0.D1_P	49	CSI4.D1_P	85	CAM_FRSYNC1		
	14	CSI1.D1_P	50	CSI6.D1_P	86	CAM_ERROR4		
	15	CSI0.D1_N	51	CSI4.D1_N	87	I2C2.SCL		
	16	CSI1.D1_N	52	CSI6.D1_N	88	CAM1.MCLK		
	17	GND	53	GND	89	I2C2.SDA		
	18	GND	54	GND	90	CAM1.PWDN		
	19	CSI2.D0_P	55	NC	91	CAM0.MCLK		
	20	CSI3.D0_P	56	NC	92	CAM1.RST		
	21	CSI2.D0_N	57	NC	93	CAM0.PWDN		
	22	CSI3.D0_N	58	NC	94	CAM2.MCLK		
	23	GND	59	CSI5.D0_P	95	CAM0.RST		
	24	GND	60	CSI7.D0_P	96	CAM_FRSYNC4		
	25	CSI2.CLK_P	61	CSI5.D0_N	97	CAM_FRSYNC3		
	26	CSI3.CLK_P	62	CSI7.D0_N	98	CAM_FRSYNC2		
	27	CSI2.CLK_N	63	GND	99	GND		
	28	CSI3.CLK_N	64	GND	100	GND		
	29	GND	65	CSI5.CLK_P	101	CAM_TE_RSV		
	30	GND	66	CSI7.CLK_P	102	VDD_1V8		
	31	CSI2.D1_P	67	CSI5.CLK_N	103	CAM_INT3		
	32	CSI3.D1_P	68	CSI7.CLK_N	104	CAM_INT4		
	33	CSI2.D1_N	69	GND	105	I2C5.SCL		
	34	CSI3.D1_N	70	GND	106	CAM_INT2		
	35	GND	71	CSI5.D1_P	107	I2C5.SDA		
36	GND	72	CSI7.D1_P	108	VDD_3V3			





## 3.3.5 High Speed Connector

Function	Description			
Connector Type	SEAF-40-05.0-L-06-2-A-LP-K-TR			
Mating Cable	SEAC-040-06-XX.0-TU-TU-2			
Pinout	Pin	Description	Pin	Description
	A1	GND	A21	GND
	A2	GND	A22	ENET3_CONN.D1_N
	A3	USBSS0_CONN.D_N	A23	ENET3_CONN.D1_P
	A4	USBSS0_CONN.D_P	A24	GND
	A5	GND	A25	ENET3_CONN.D0_N
	A6	USBSS1_CONN.D_N	A26	ENET3_CONN.D0_P
	A7	USBSS1_CONN.D_P	A27	GND
	A8	GND	A28	ENET1_CONN.D3_N
	A9	USBHS1_CONN.D_N	A29	ENET1_CONN.D3_P
	A10	USBHS1_CONN.D_P	A30	GND
	A11	GND	A31	ENET1_CONN.D0_N
	A12	ENET_CONN.D0_P	A32	ENET1_CONN.D2_P
	A13	ENET_CONN.D0_N	A33	GND
	A14	GND	A34	ENET1_CONN.D1_N
	A15	ENET3_CONN.D3_N	A35	ENET1_CONN.D1_P
	A16	ENET3_CONN.D3_P	A36	GND
	A17	GND	A37	ENET1_CONN.D0_N
	A18	ENET3_CONN.D2_N	A38	ENET1_CONN.D0_P
	A19	ENET3_CONN.D2_P	A39	GND
	A20	GND	A40	GND
	Pin	Description	Pin	Description
	B1	GND	B21	GND
	B2	GND	B22	ENET2_CONN.D1_N
	B3	USBSS0_CONN.RX_N	B23	ENET2_CONN.D1_P
	B4	USBSS0_CONN.RX_P	B24	GND
	B5	GND	B25	ENET2_CONN.D0_N
	B6	USBSS1_CONN.RX_N	B26	ENET2_CONN.D0_P
	B7	USBSS1_CONN.RX_P	B27	GND
	B8	GND	B28	ENET0_CONN.D3_N
	B9	USBHS0_CONN.D_N	B29	ENET0_CONN.D3_P
	B10	USBHS0_CONN.D_P	B30	GND
	B11	GND	B31	ENET0_CONN.D2_N
	B12	ENET_CONN.D1_P	B32	ENET0_CONN.D2_P
	B13	ENET_CONN.D1_N	B33	GND
	B14	GND	B34	ENET0_CONN.D1_N
	B15	ENET2_CONN.D3_N	B35	ENET0_CONN.D1_P
	B16	ENET2_CONN.D3_P	B36	GND
	B17	GND	B37	ENET0_CONN.D0_N
	B18	ENET2_CONN.D2_N	B38	ENET0_CONN.D0_P
B19	ENET2_CONN.D2_P	B39	GND	
B20	GND	B40	GND	

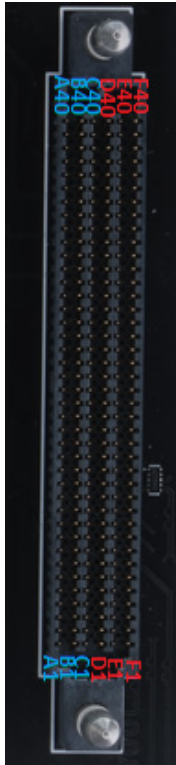




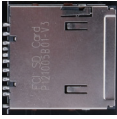
Pinout	Pin	Description	Pin	Description
		C1	GND	C21
	C2	GND	C22	NOT CONNECTED
	C3	USBSS0_CONN.TX_N	C23	NOT CONNECTED
	C4	USBSS0_CONN.TX_P	C24	GND
	C5	GND	C25	NOT CONNECTED
	C6	USBSS1_CONN.TX_N	C26	NOT CONNECTED
	C7	USBSS1_CONN.TX_P	C27	GND
	C8	GND	C28	UART_CH1.RX
	C9	USBSS0_VBUS	C29	UART_CH1.RT\S
	C10	USBSS0_VBUS	C30	GND
	C11	GND	C31	UART_CH0.RX
	C12	ENET_CONN.D2_P	C32	UART_CH0.RT\S
	C13	ENET_CONN.D2_N	C33	GND
	C14	GND	C34	UART_CH5.RX
	C15	I2C1_3V3.SCL	C35	UART_CH5.RT\S
	C16	I2C1_3V3.SDA	C36	GND
	C17	GND	C37	UART_CH3.RX
	C18	CAN0.DOUT	C38	UART_CH3.RT\S
	C19	CAN0.DIN	C39	GND
	C20	GND	C40	GND
	Pin	Description	Pin	Description
	D1	GND	D21	GND
	D2	GND	D22	NOT CONNECTED
	D3	USBSS0_CONN.ID	D23	NOT CONNECTED
	D4	HDMI_CON.HPD	D24	GND
	D5	GND	D25	NOT CONNECTED
	D6	HDMI_CON.SCL	D26	NOT CONNECTED
	D7	HDMI_CON.SDA	D27	GND
	D8	GND	D28	UART_CH1.TX
	D9	USBSS1_VBUS	D29	UART_CH1.CT\S
	D10	USBSS1_VBUS	D30	GND
	D11	GND	D31	UART_CH0.TX
	D12	ENET_CONN.D3_P	D32	UART_CH0.CT\S\
	D13	ENET_CONN.D3_N	D33	GND
	D14	GND	D34	UART_CH5.TX
	D15	HDMI_CON.CEC	D35	UART_CH5.CT\S\
	D16	NOT CONNECTED	D36	GND
	D17	GND	D37	UART_CH3.TX
	D18	CAN1.DOUT	D38	UART_CH3.TX
	D19	CAN1.DIN	D39	GND
	D20	GND	D40	GND




Pinout	Pin	Description	Pin	Description
		E1	GND	E21
	E2	GND	E22	VDD_3V3
	E3	HDMI_CON.TXD1_P	E23	VDD_3V3
	E4	HDMI_CON.TXD1_N	E24	GND
	E5	GND	E25	VDD_3V3
	E6	HDMI_CON.TXC_P	E26	VDD_3V3
	E7	HDMI_CON.TXC_N	E27	GND
	E8	GND	E28	UART_CH2.RX
	E9	USBHS0_VBUS	E29	UART_CH2.R\T\S\
	E10	USBHS1_VBUS	E30	GND
	E11	GND	E31	UART_CH7.RX
	E12	R\E\S\E\I\T\_CON	E32	UART_CH7.R\T\S\
	E13	R\E\C\O\I\O\I\E\R\I\Y\_CON	E33	GND
	E14	GND	E34	UART_CH4.RX
	E15	SPI1_3V3.CS0	E35	UART_CH4.R\T\S\
	E16	SPI1_3V3.MISO	E36	GND
	E17	GND	E37	UART_CH6.RX
	E18	VDD_3V3	E38	UART_CH6.R\T\S\
	E19	VDD_3V3	E39	GND
	E20	GND	E40	GND
	Pin	Description	Pin	Description
		F1	GND	F21
	F2	GND	F22	VDD_5V
	F3	HDMI_CON.TXD0_P	F23	VDD_5V
	F4	HDMI_CON.TXD0_N	F24	GND
	F5	GND	F25	VDD_5V
	F6	HDMI_CON.TXD2_P	F26	VDD_5V
	F7	HDMI_CON.TXD2_N	F27	GND
	F8	GND	F28	UART_CH2.TX
	F9	VBUS_DEBUG	F29	UART_CH2.C\T\S\
	F10	VDD_5V_HDMI_CON	F30	GND
	F11	GND	F31	UART_CH7.TX
	F12	DBG_USB_PANEL.D_P	F32	UART_CH7.C\T\S\
	F13	DBG_USB_PANEL.D_N	F33	GND
	F14	GND	F34	UART_CH4.TX
	F15	SPI1_3V3.SCK	F35	UART_CH4.C\T\S\
	F16	SPI1_3V3.MOSI	F36	GND
	F17	GND	F37	UART_CH6.TX
	F18	VDD_5V	F38	UART_CH6.C\T\S\
	F19	VDD_5V	F39	GND
	F20	GND	F40	GND




### 3.3.6 SD Card Connector

	Description	
	Full size SD Card Connector	

### 3.3.7 RTC Battery Connector


	Description	
	1225 size battery connector for RTC. Must be used with “BHSD-1225-COVER” part.	

### 3.3.8 Debug USB Connector


	Function		Description	
	Pinout	Pin	Description	
		1	VBUS	
		2	D-	
		3	D+	
		4	NC	
5		GND		

## 3.4 The Definition of Buttons


### 3.4.1 Debug Selection Switch

	Description	
	Set to OFF position to route Debug USB signals to High-Speed Connector. Set to ON position to route Debug USB signals to Debug USB Connector.	

### 3.4.2 Recovery Button

	Description	
	The MILBOARD-AGX 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 Button

	Description	
	The MILBOARD-AGX implements a reset button to reset the Jetson SoM.	

## 4. Software Information

### 4.1 Installation

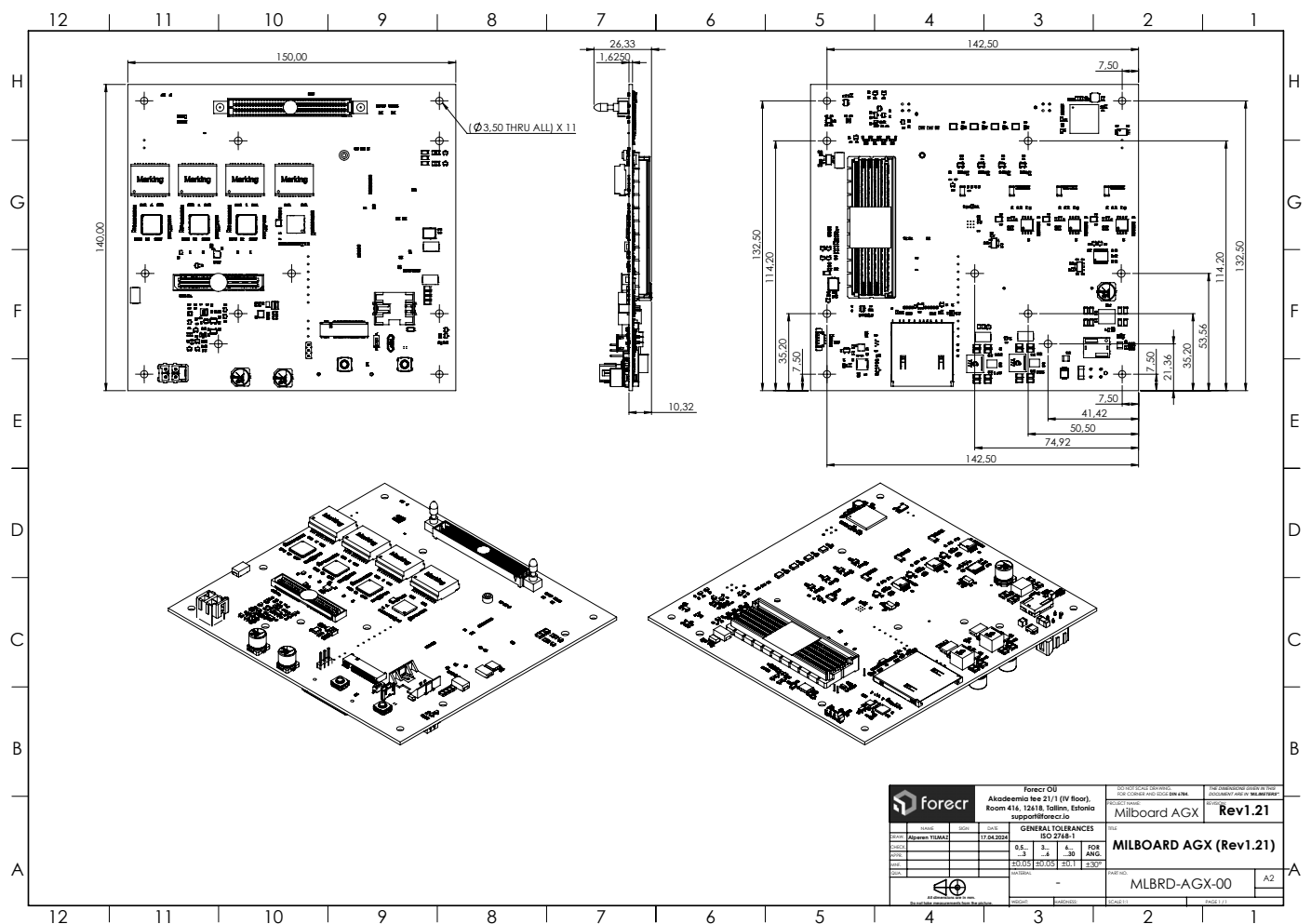
JetPack-5.x Installation can be found here: <https://www.forecr.io/blogs/installation/jetpack-5-x-installation-for-milboard-agx>

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

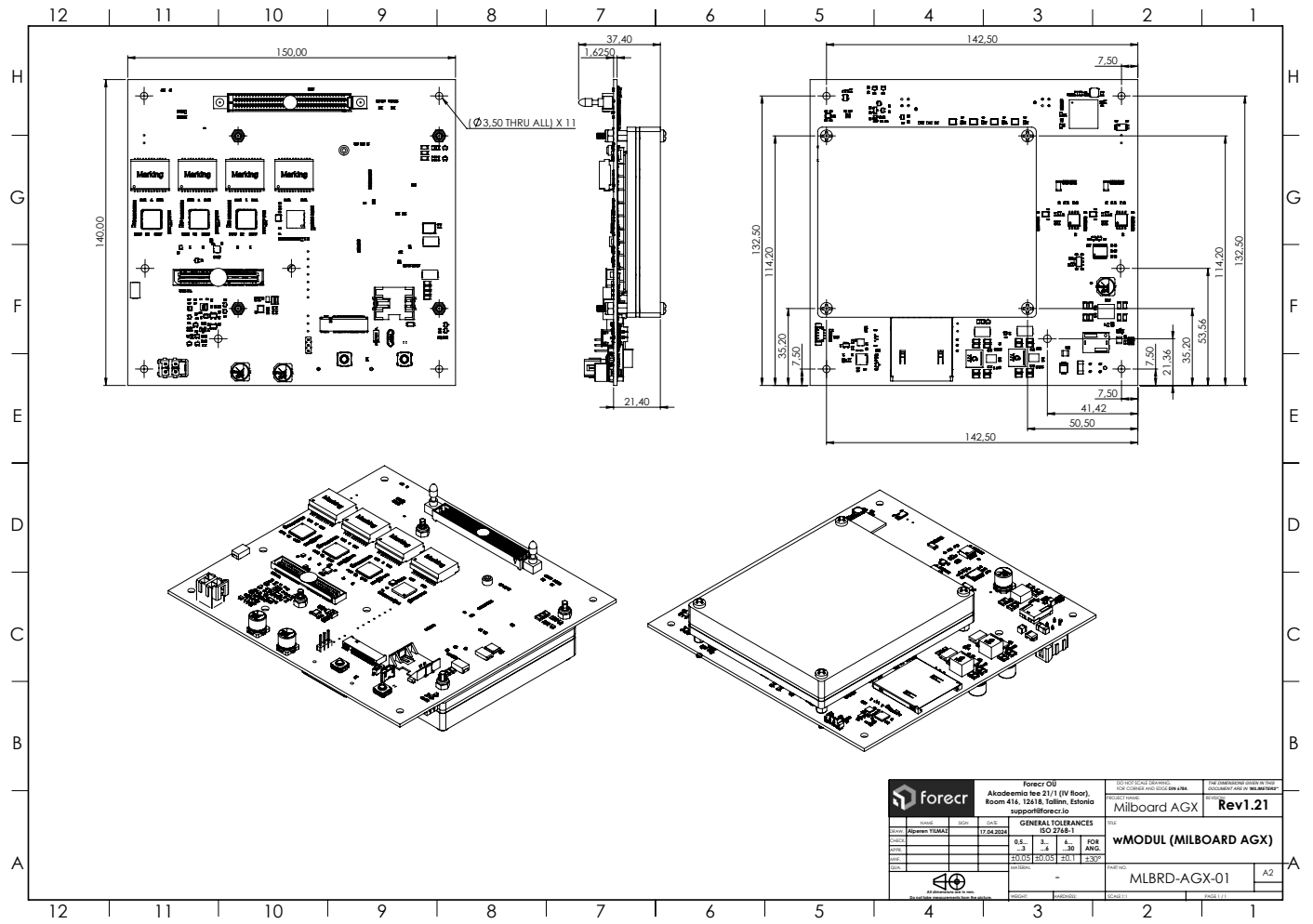
## 5. 3D Model & Mechanical Information

Full 3D models of all MILBOARD-AGX Carrier Board can be found here: [https://github.com/forecr/forecr\\_3d\\_models/tree/master/MILBOARD-AGX](https://github.com/forecr/forecr_3d_models/tree/master/MILBOARD-AGX)

### MILBOARD-AGX Stand Alone



MILBOARD-AGX with Jetson AGX Xavier/Orin Module



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Author: Armin TORMA		Date: 17.04.2024		Product Name: Milboard AGX		Revision: Rev1.21	
Standard: -		GENERAL TOLERANCES ISO 2768-1		Part Name: wMODUL (MILBOARD AGX)		Drawing Code: MLBRD-AGX-01	
Scale: 1:1	Material: -	0.5; 0.2	3; 0.4	0.8 ANG	0.1	0.3/0.2	A2
Drawn: 20.05	Checked: 20.05	20.1	20.1	20.1	20.1	20.1	20.1
All dimensions are in millimeters unless otherwise specified.		PROJ: -		PART NO: MLBRD-AGX-01		PAGE: 1 / 1	







## 6. Power Consumption

### 6.1 AGX Orin 32GB

Power Supply: 24V-4A

All CPU and GPU cores are %100 loaded.

	Power Up Sequence	Idle	Standby (Suspend mode)	15W (4 core)	30W (8 core)	40W (8 core)	MAXN (8 core)
Current (A)	1,16	0,56	0,28	1	1,49	2	2,39
Power (W)	27,84	13,44	6,72	24	35,76	48	57,36

### 6.2 AGX Orin 64GB

Power Supply: 24V-4A

All CPU and GPU cores are %100 loaded.

	Power Up Sequence	Idle	Standby (Suspend mode)	15W (4 core)	30W (8 core)	50W (12 core)	MAXN (12 core)
Current (A)	1,66	0,6	0,3	0,97	1,47	2,04	3,6
Power (W)	39,84	14,4	7,2	23,28	35,28	48,96	86,4

### 6.3 AGX Orin Industrial

Power Supply: 24V-4A

All CPU and GPU cores are %100 loaded.

	Power Up Sequence	Idle	Standby (Suspend mode)	15W (4 core)	35W (8 core)	60W (12 core)	MAXN (12 core)
Current (A)	1,6	0,67	0,3	1,05	1,58	2,25	3,57
Power (W)	38,4	16,08	7,2	25,2	37,92	54	85,68

## 7. MTBF Prediction

This section will be completed soon. It will be published on our Web Page once completed. Please check our [Forecr](#) Web Page regularly.

## 8. Ordering Information

