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User Manual

3U VPX Rugged Module

Aetina V3T3000-QRC

Document Change History

Version	Date	Description	Authors
v01	2022/01/13	Initial Release.	Emily Chou

Contents

1. General Overview

The V3T3000-QRC includes an NVIDIA® Quadro® Turing™ RTX3000 embedded GPU in a rugged 3U VPX module. It supports operability in an extended temperature range of -40°C to 71°C, suitable for mission-critical harsh environments.

The Module MXM RTX3000 includes CUDA cores for parallel processing, Tensor cores for dedicated AI inference and ray tracing cores for superior rendering speeds. With its 1920 CUDA core Turing GPU and additional 240 Tensors Cores, the Quadro RTX 3000 supports 4 UHD displays, delivering the latest leading-edge GPU performance for your embedded system with AI capabilities enabled.

Unlocking the best performance requires the best cooling capability. Aetina's advanced cooling technology is designed to move heat using a low weight, high efficiency path from the GPU die to the Wedge-lock.

1.1 Features

- 3U VPX VITA 46, Open VPX VITA 65, VPX REDI 48
- VITA 46.0 VPX Base Standard
- VITA 46.4 PCI Express on VPX Fabric Connector
- 1920 CUDA cores
- 5.3 TFLOPS Peak FP32 performance
- 6 GB GDDR6 memory, 192-bit
- 336 GB/s maximal memory bandwidth
- Support for up to 4 Display, 80W TGP
- 5 years life cycle availability

1.1.1 GPU

- Nvidia Quadro RTX 3000
- Stream Processing Unites: 1920
- Boost Core clock: 1380 MHz
- Base Core clock: 945 MHz
- Voltage: Variable

1.1.2 Board

- 16-lanes PCI Express 3.0 capable
- Conduction cooled 3U form factor
- Dimensions: 100mm x 160mm
- Board power (TGP): 80 W
- High-Bandwidth Digital Content Protection (HDCP) support

1.1.3 Memory Configuration

- Memory clock: 14.0 Gbps
- Interface: 192-bit
- Local frame buffer: 6GB (6 pieces 256M x 32 GDDR6, FBGA-180 package)

1.1.4 Support

- Nvidia CUDA Technology (Compute capability 7.5)
- Nvidia GPU Boost 3.0
- Microsoft DirectX 12
- Vulkan 1.1
- OpenCL 1.2
- OpenGL 4.6

1.1.5 Display Support

- Four DisplayPort 1.4 outputs to VPX P2

1.1.6 Cooling System

- Conduction cooled

1.1.7 Operating System Support

- Windows® 10 64-bit
- Linux 64-bit

1.2 Configuration

Table 1.1 lists the SKU configuration currently available for the V3T3000-QRC.

Table 1.1 Board configuration

Specification	V3T3000-QRC
Module	MXM Quadro RTX 3000
Core clock	Base=945 MHz; Boost= 1380 MHz
Memory clock	14.0 Gbps
Frame buffer	6GB GDDR6
Memory interface	192-bit
Memory type	256M x 32 GDDR6 FBGA-180 package
Board power (TGP)	80 W
HDCP support	Yes
Supplementary Power Connector	No
Operating Temperature	Standard version: 0°C to +55°C Wide-temperature version: -40°C to +71°C
Storage Temperature	-40°C to 85°C
Operating Humidity	5~90%, No Condensation.

1.3 Display Options

Table 1.2 list the V3T3000-QRC supports 4x DisplayPort outputs to VPX P2 by default, with display options as shown below.

Table 1.2: Display Options

Displays Supported for Each Interface			
DP_A	DP_B	DP_C	DP_D
DisplayPort	DisplayPort	DisplayPort	DisplayPort

2. Functional Description

2.1 Board Architecture

The AETINA V3T3000-QRC form factor as shown below.

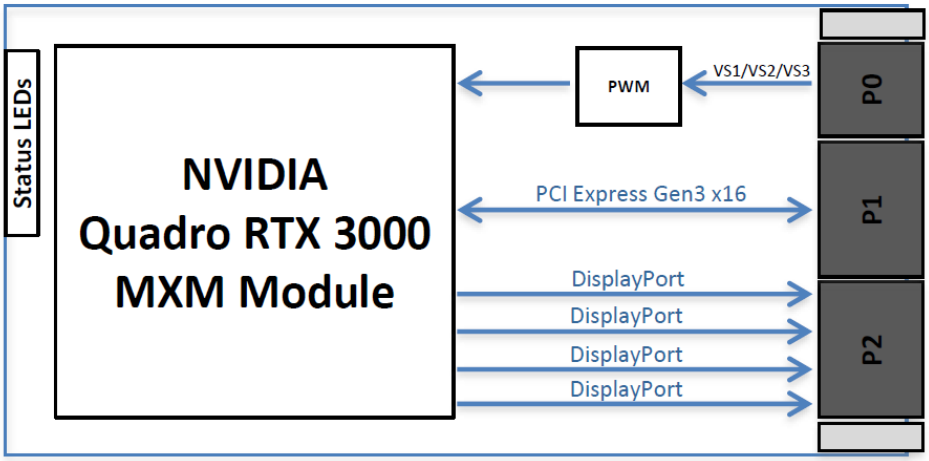

Figure 2.1 V3T3000-QRC Block diagram

2.2 General Purpose Graphics Processing Unit

The AETINA V3T3000-QRC is based on TURING Quadro RTX 3000 GPU from Nvidia. 1920 CUDA core enabled. Base core clock is 945 MHz and it is compliant with Nvidia's CUDA computing capability 7.5.

2.2.1 GPU Resources

- GDDR6 SDRAM
  -6 pieces 256M x 32 GDDR6, total capacity of 6144 Mbytes
  -192bit data bus width
  -14.0 Gbps clock frequency

- BIOS ROM
  -8Mbit SPI FLASH for BIOS image

2.3 Display Interface

The V3T3000-QRC provides four digital output channels.

2.3.1 Graphics Output channels

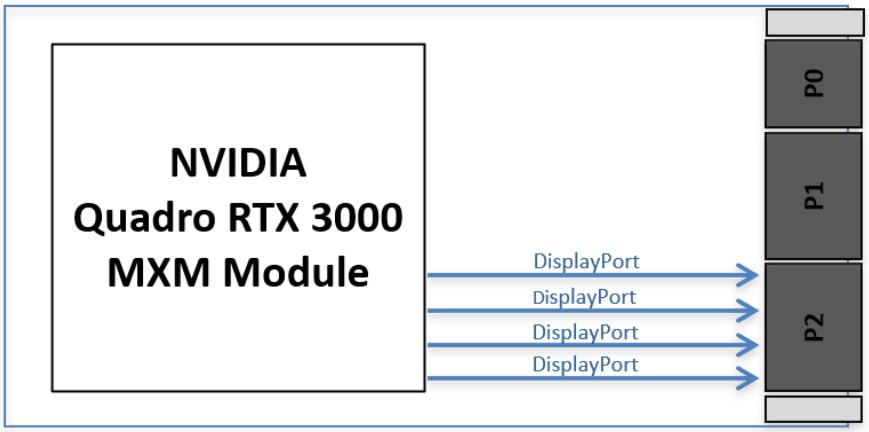

Figure 2.2 Output channels

2.3.2 Digital Output

- DisplayPort 1.4
  - Maximum pixel clock: 1050 MP/s
  - Maximum bandwidth: 25.9 GB/s/connector

2.3.3 Analog Output

This model does not support Analog output.

2.3.4 Hot Plug

The V3T3000-QRC supports Hot Plug detect for digital monitors.

2.4 PCI Express

The V3T3000-QRC supports a native x16 PCI Express Gen3/2/1 bus interface.

3. Pin Definition

3.1 VPX connector Pinout

3.1.1 P0 connector

P0 Wafer	Wafer Type	Row G	Row F	Row E	Row D	Row C	Row B	Row A
1	Power	P12V	P12V	P12V	No PAD	P3V3	P3V3	P3V3
2	Power	P12V	P12V	P12V	No PAD	P3V3	P3V3	P3V3
3	Power	P5V	P5V	P5V	No PAD	P5V	P5V	P5V
4	Single-	N.C	N.C	GND	N.C	GND	SYSRST	N.C
5	Single-	N.C	N.C	GND	P3V3_AUX	GND	SMCLK	SMDAT
6	Single-	N.C	N.C	GND	N.C	GND	N.C	N.C
7	Differentia	JTAG_TCLK	GND	JTAG_TDO	JTAG_TDI	GND	JTAG_TMS	JTAG_TRS
8	Differentia	GND	REF_CLKN	REF_CLKP	GND	Rsvd	Rsvd	GND

Table 3.1: Connector pinout

P1 Wafer	Wafer Type	Row G	Row F	Row E	Row D	Row C	Row B	Row A
1	Differential	N.C	GND	L15-TX-	L15-TX+	GND	L15-RX-	L15-RX+
2	Differential	GND	L14-TX-	L14-TX+	GND	L14-RX-	L14-RX+	GND
3	Differential	N.C	GND	L13-TX-	L13-TX+	GND	L13-RX-	L13-RX+
4	Differential	GND	L12-TX-	L12-TX+	GND	L12-RX-	L12-RX+	GND
5	Differential	N.C	GND	L11-TX-	L11-TX+	GND	L11-RX-	L11-RX+
6	Differential	GND	L10-TX-	L10-TX+	GND	L10-RX-	L10-RX+	GND
7	Differential	N.C	GND	L9-TX-	L9-TX+	GND	L9-RX-	L9-RX+
8	Differential	GND	L8-TX-	L8-TX+	GND	L8-RX-	L8-RX+	GND
9	Differential	N.C	GND	L7-TX-	L7-TX+	GND	L7-RX-	L7-RX+
10	Differential	GND	L6-TX-	L6-TX+	GND	L6-RX-	L6-RX+	GND
11	Differential	N.C	GND	L5-TX-	L5-TX+	GND	L5-RX-	L5-RX+
12	Differential	GND	L4-TX-	L4-TX+	GND	L4-RX-	L4-RX+	GND
13	Differential	N.C	GND	L3-TX-	L3-TX+	GND	L3-RX-	L3-RX+
14	Differential	GND	L2-TX-	L2-TX+	GND	L2-RX-	L2-RX+	GND
15	Differential	N.C	GND	L1-TX-	L1-TX+	GND	L1-RX-	L1-RX+
16	Differential	GND	L0-TX-	L0-TX+	GND	L0-RX-	L0-RX+	GND

Table 3.2: Connector pinout (continued)

P2 Wafer	Wafer Type	Row G	Row F	Row E	Row D	Row C	Row B	Row A
1	Differential	DP_B_HPD	GND	DP_B_L3*	DP_B_L3	GND	DP_B_L0*	DP_B_L0
2	Differential	GND	DP_B_L1*	DP_B_L1	GND	DP_B_L2*	DP_B_L2	GND
3	Differential	DDC_5V	GND	DP_A_AUX*	DP_A_AUX	GND	DP_D_AUX*	DP_D_AUX
4	Differential	GND	DP_C_L3*	DP_C_L3	GND	DP_C_L0*	DP_C_L0	GND
5	Differential	DP_C_HPD	GND	DP_C_L1*	DP_C_L1	GND	DP_C_L2*	DP_C_L2
6	Differential	GND	DDC_5V	DDC_5V	GND	N.C	N.C	GND
7	Differential	DDC_5V	GND	N.C	N.C	GND	DP_B_AUX*	DP_C_AUX
8	Differential	GND	N.C	N.C	GND	DP_B_AUX	DP_C_AUX*	GND
9	Differential	N.C	GND	DP_D_L3*	DP_D_L3	GND	DP_D_HPD	DP_A_HPD
10	Differential	GND	DP_D_L0*	DP_D_L0	GND	N.C	N.C	GND
11	Differential	N.C	GND	DP_D_L1*	DP_D_L1	GND	N.C	N.C
12	Differential	GND	DP_D_L2*	DP_D_L2	GND	N.C	N.C	GND
13	Differential	N.C	GND	DP_A_L3*	DP_A_L3	GND	GND	N.C
14	Differential	GND	DP_A_L0*	DP_A_L0	GND	N.C	N.C	GND
15	Differential	N.C	GND	DP_A_L1*	DP_A_L1	GND	N.C	N.C
16	Differential	GND	DP_A_L2*	DP_A_L2	GND	N.C	N.C	GND

Table 3.3: Connector pinout (continued)

INPUT
Bidirectional
OUTPUT
Power

4. Mechanical Specifications

4.1 Dimensions

The Actual dimensions of the V3T3000-QRC are shown in below.

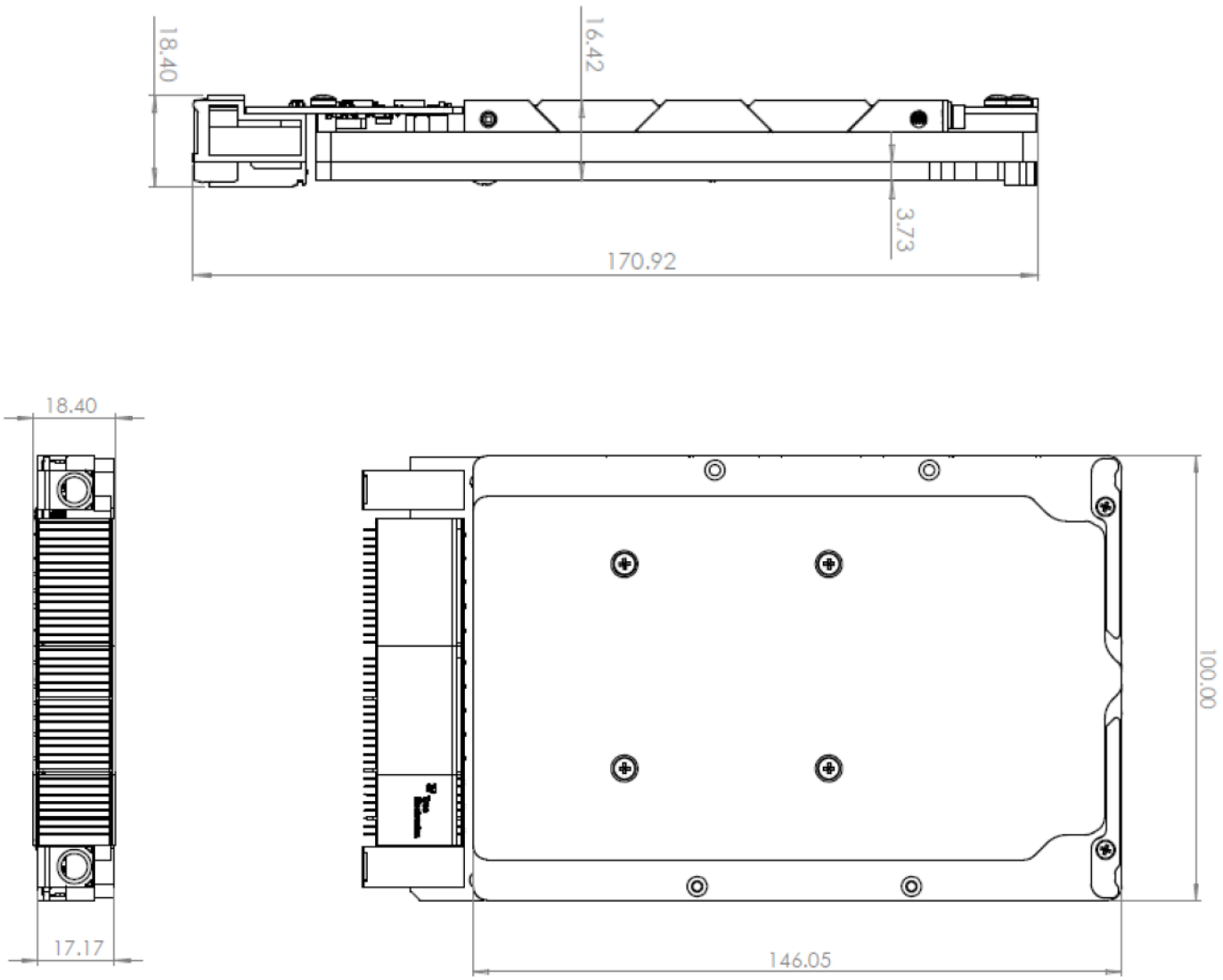

Figure 4.1: Dimensions of V3T3000-QRC

5. Embedded GPU Thermal Specifications

5.1 Thermal Policy

GPU Core Clock throttles at temperature (T_J) above those listed in table 6.1, which lists the throttling temperature and behavior. Thermal throttling is necessary to ensure that the hottest temperature on the die does not exceed the sense temperature for prolonged periods of time.

Table 6.1: Thermal slowdown policy table

Parameter	Value	Units
Thermal Resistance (Junction to Case, R_{JC})	0.017	°C/W
Thermal Resistance (Junction to PCB Board, R_{jb})	0.96	°C/W
GPU Shutdown Temperature (OVERT)[1]	97	°C
GPU Slowdown Temperature (THERM_ALERT)[2]	92	°C
GPU Maximum Operating Temperature[3]	89	°C

Note:

1. OVERT results in an 87.5% (÷8) hardware clock slowdown.
2. THERM_ALERT results in a 50% (÷2) hardware clock slowdown.
3. The GPU maximum operating temperature is the maximum GPU temperature at which the GPU is guaranteed to operate at the target performance (base clock) under the total board power level.

6. Certificates and Agencies

6.1 Certifications

Driver for WHQL certified Windows 10 available from Nvidia.

6.2 Agencies

Conformité Européenne (CE) : TBD.

Federal Communications Commission (FCC) : TBD.

7. Appendix

7.1 Ordering Information

Table 7.1 Models available

Model Number	Description
V3T3000-QRC	VPX3U, NVIDIA Quadro RTX 3000, 6GB GDDR6, Conduction-cooled, 0°C to +55°C (at Wedge-lock)
V3T3000-QRC-H	VPX3U, NVIDIA Quadro RTX 3000, 6GB GDDR6, Conduction-cooled, -40°C to +71°C (at Wedge-lock)

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