

Summary

Xilinx® Alveo™ U200 and U250 Data Center accelerator cards are PCI Express® Gen3 x16 compliant cards designed to accelerate compute-intensive applications such as machine learning, data analytics, and video processing.

Alveo Product Details

Table 1: Alveo U200/U250 Accelerator Card Product Details

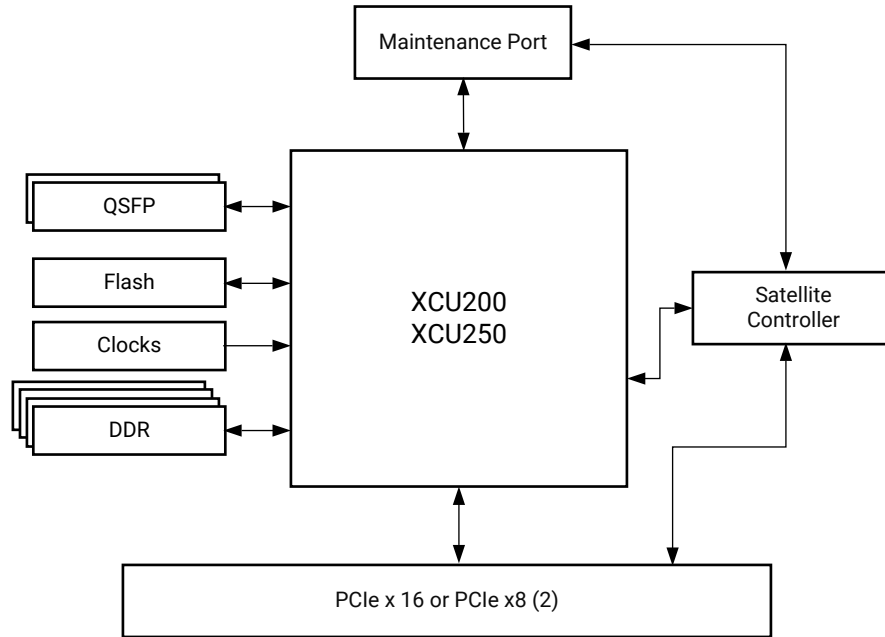
| Specification | U200 | | U250 | |
|---|--------------------------------------|-----------------------------------|--------------------------------------|-----------------------------------|
| | Active Cooling Version | Passive Cooling Version | Active Cooling Version | Passive Cooling Version |
| Product SKU | A-U200-A64G-PQ-G | A-U200-P64G-PQ-G | A-U250-A64G-PQ-G | A-U250-P64G-PQ-G |
| Thermal cooling solution | Active | Passive | Active | Passive |
| Weight | 1122g | 1066g | 1122g | 1066g |
| Form factor | Full height, full length, dual width | Full height, ¾ length, dual width | Full height, full length, dual width | Full height, ¾ length, dual width |
| Total electrical card load ¹ | 225W | | 225W | |
| Network interface | 2x QSFP28 | | 2x QSFP28 | |
| PCIe Interface | Gen3 x16 | | Gen3 x16 | |
| Look-up tables (LUTs) | 1,182K | | 1,728K | |
| Registers | 2,364K | | 3,456K | |
| DSP slices | 6,840 | | 12,288 | |
| UltraRAMs | 960 | | 1,280 | |
| DDR total capacity | 64 GB | | 64 GB | |
| DDR maximum data rate | 2400 MT/s | | 2400 MT/s | |
| DDR total bandwidth | 77 GB/s | | 77 GB/s | |

Notes:

1. The 225W PCIe CEM card can take 65W from the standard connector 12V supply and an additional 150W from the AUX connector 12V supply. The 3.3V supply from the standard connector is not used on this card. The CEM card requires that a 150W PCIe AUX power cable be connected to the card.

The following figure shows the components within an Alveo accelerator card.

Figure 1: U200/U250 Block Diagram



X23520-111319

Card Specifications

Dimensions

The card is compliant with the PCIe CEM rev.3.0 Specification as a dual-slot, standard height card. The card with the passive cooling enclosure is three-quarter length, and the card with the active cooling enclosure is full length.

Table 2: Card Dimensions

| Parameter | Dimension |
|--|--------------------------------|
| Height | 4.381 inch (111.28 mm) maximum |
| Active cooling enclosure installed | |
| Assembly length | 11.5 inch (291 mm) |
| Assembly width | 1.54 inch (39.04 mm) |
| Passive cooling enclosure installed | |
| Assembly length | 9.3 inch (236 mm) |
| Assembly thickness | 1.54 inch (39.04 mm) |

PCIe Connector/Data Rates

Table 3: PCI Express 16-Lane Data Transfer Rate Performance

| PCI Express Generation | Performance |
|------------------------|-------------------------------------|
| Gen 1 | 2.5 GigaTransfers per second (GT/s) |
| Gen 2 | 5.0 GT/s |
| Gen 3 | 8.0 GT/s |

DDR4 Specifications

Four 288-pin DDR4 DIMM sockets are populated with single rank DIMMs capable of operating at data rates up to 2400 MegaTransfers per second (MT/s).

Table 4: DDR4 Interfaces

| Alveo Card | Parameter | Description | |
|--|--------------|----------------------|---|
| A-U200-A64G-PQ-G A-U200-P64G-PQ-G A-U250-A64G-PQ-G A-U250-P64G-PQ-G | Manufacturer | Micron | |
| | Part Number | MTA18ASF2G72PZ-2G3B1 | |
| | Description | | 16 GB 288-pin DDR4 RDIMM |
| | | | Configuration: 2 Gb x 72 |
| | | | Single rank |
| | | | Supports ECC error detection and correction |
| | | Supports 2400 MT/s | |

Network Interfaces

The Alveo U200/U250 accelerator cards host two 100G interfaces, each comprised of a 4-lane QSFP28 connector. The QSFP case temperature must be less than 85°C for class 3 optical modules (< 2.5W), and less than 70°C for class 4 optical modules (< 3.5W). The user needs to provide sufficient airflow and ambient temperature to ensure the optical module remains within the manufacturer's specification. QSFP connectors are not supported in the current version of the target platform. For available platforms, see *Alveo Data Center Accelerator Card Platforms User Guide (UG1120)*. Each connector is housed within a single QSFP cage assembly located at the I/O bracket.

USB Maintenance Port

The Alveo U200/U250 accelerator cards include a micro-USB maintenance port located at the front of the card.

Qualified Servers

A list of servers on which Alveo cards are fully qualified can be found here: <https://www.xilinx.com/products/boards-and-kits/alveo/qualified-servers.html>.

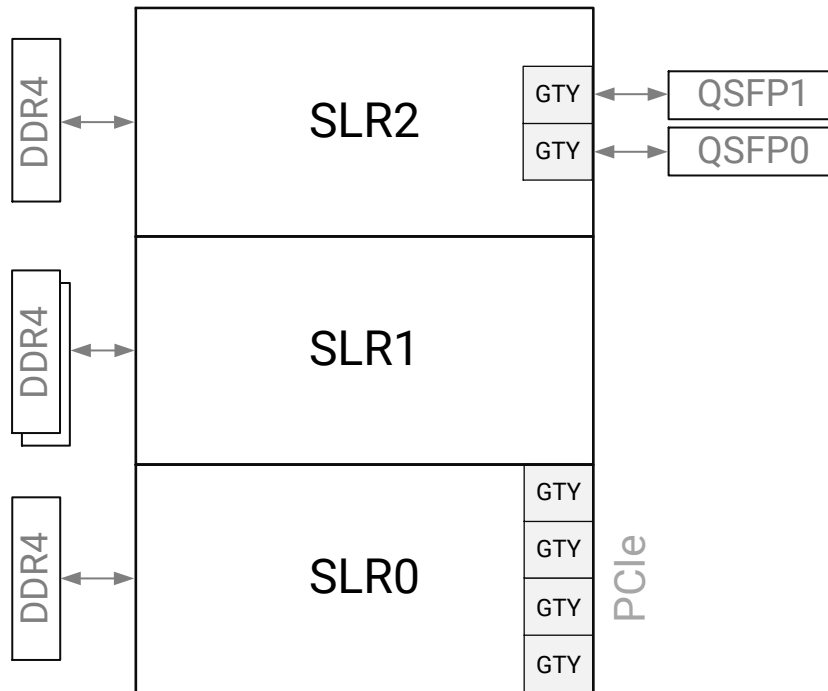
Operating System Compatibility

For the most up-to-date operating system support, refer to the *Vitis Unified Software Platform Documentation: Application Acceleration Development* ([UG1393](#)).

FPGA Resource Information

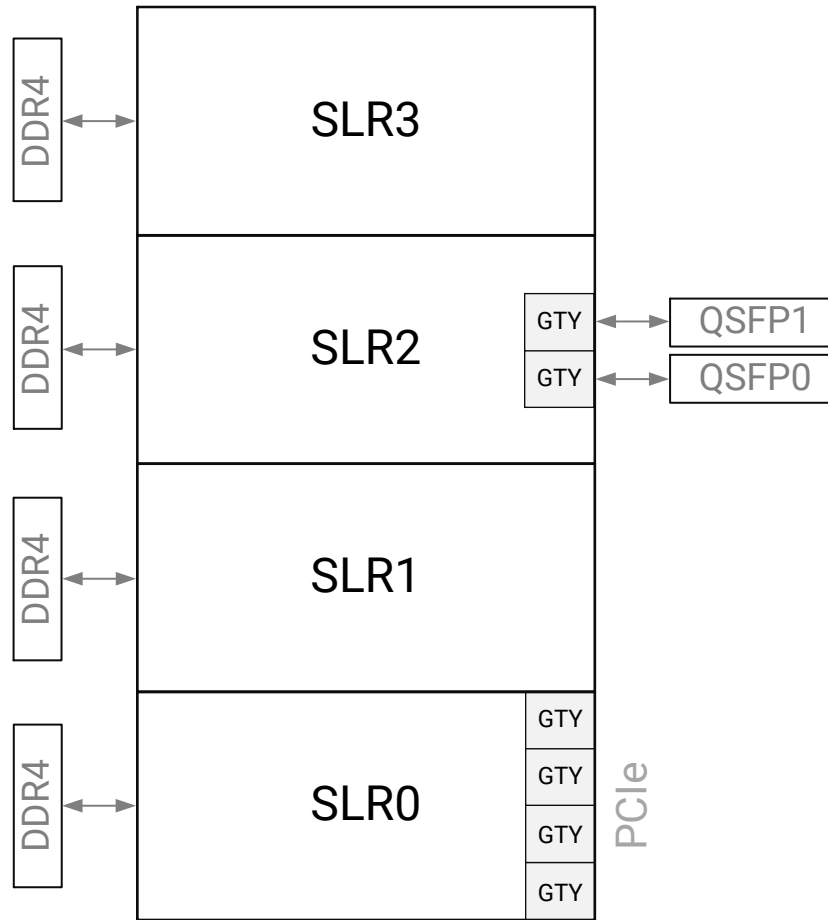
The Xilinx Alveo U200 and U250 accelerator cards are custom-built UltraScale+ FPGAs that run optimally (and exclusively) on the Alveo architecture. The Alveo U200 card uses the XCU200 FPGA and the Alveo U250 card uses the XCU250 FPGA, both of which use Xilinx stacked silicon interconnect (SSI) technology to deliver breakthrough FPGA capacity, bandwidth, and power efficiency. This technology allows for increased density by combining multiple super logic regions (SLRs). The XCU200 comprises three SLRs and the XCU250 comprises four SLRs. Both devices connect to 16 lanes of PCI Express® that can operate up to 8 GT/s (Gen3). Both devices connect to four DDR4 16 GB, 2400 MT/s, 64-bit with error correcting code (ECC) DIMMs for a total of 64 GB of DDR4. Both devices connect to two QSFP28 connectors with associated clocks generated on board. The following figures show the SLR regions along with the PCIe, DDR4 and QSFP28 connections for the Alveo U200 and U250 cards. The U250 card has four SLRs while the U200 card has three SLRs.

Figure 2: Floorplan of the XCU200 Device



X23477-110719

Figure 3: Floorplan of the XCU250 Device



X23478-110719

For customers using the Vitis™ application acceleration development flow, a platform is created that manages the PCIe interface, data transfers, and card status information. It also remotely loads kernels and performs several functions that greatly simplify developing an application. This platform is part of the static region (an area of the FPGA that is not reconfigurable). This platform consumes resources from the available resources listed in [Table 1](#). The specific amount of resources depends on which platform, and even which version of a platform is used. This information is available in the *Alveo Data Center Accelerator Card Platforms User Guide (UG1120)*.

For developing applications, refer to the *Vitis Unified Software Platform Documentation: Application Acceleration Development (UG1393)*.

Thermal Specification

Ambient Conditions

The ambient conditions are detailed in the following sections.

Operating and Storage Temperature Conditions

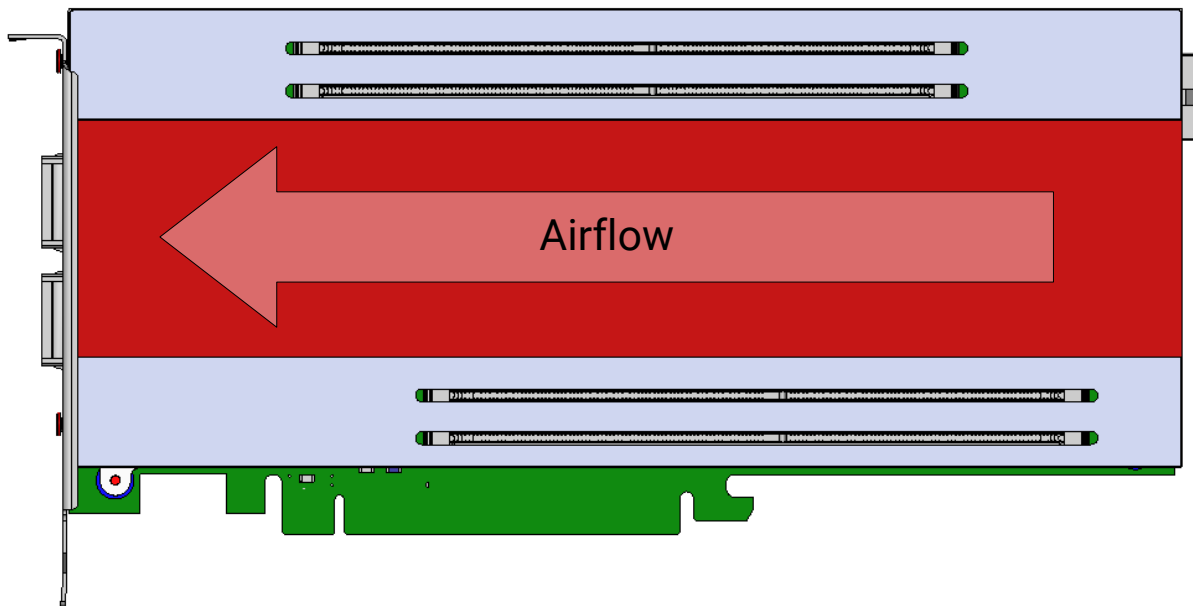
Table 5: Operating and Storage Temperatures and Humidity Conditions

| Specification | Condition |
|------------------------------------|---------------|
| Operating temperature | 0°C to 45°C |
| Storage temperature | -40°C to 75°C |
| Operating humidity, non-condensing | 8% to 90% |
| Storage humidity, non-condensing | 5% to 95% |

Airflow Direction Support

Passive cards do not include a built-in fan and therefore require an external mechanism to ensure proper airflow for cooling. Passive cards should not be powered without a forced airflow mechanism in place. The passively cooled Alveo U200/U250 cards support airflow as illustrated below.

Figure 4: Airflow Direction for Passively Cooled Cards



X21217-091018

Note: Other environmental conditions are possible, including bidirectional flow. However, this is specific to server configurations, and testing is performed by individual OEMs. Contact your server provider for more information and options.

Operating Conditions

Inlet Temperature versus Airflow Requirement in Server

The following tables state the required airflow rate and airflow speed to the card under different operating conditions.

Table 6: Required Flow at Sea Level for an Example 180W Load for 70°C Rated QSFP

| Inlet Temperature versus Airflow Requirement of PCIe Card Slot (34.8 mm x 106.65 mm) at Sea Level for 70°C Rated QSFP | | | |
|---|------------------------------|-----------------------------|-----------------|
| Inlet Temperature to the Card (°C) | Linear Feet per Minute (LFM) | Cubic Feet per Minute (CFM) | Pressure (inwg) |
| 5 | 300 | 12.0 | 0.15 |
| 10 | 320 | 12.8 | 0.17 |
| 15 | 350 | 14.0 | 0.19 |
| 20 | 390 | 15.6 | 0.23 |
| 25 | 440 | 17.6 | 0.28 |
| 30 | 500 | 20.0 | 0.35 |
| 35 | 570 | 22.7 | 0.44 |
| 40 | 660 | 26.3 | 0.57 |
| 45 | 750 | 29.9 | 0.71 |
| 50 (not supported) | 870 | 34.7 | 0.93 |

Table 7: Required Flow at Sea Level for an Example 180W Load for 85°C Rated QSFP

| Inlet Temperature versus Airflow Requirement of PCIe Card Slot (34.8 mm x 106.65 mm) at Sea Level for 85°C Rated QSFP | | | |
|---|------------------------------|-----------------------------|-----------------|
| Inlet Temperature to the Card (°C) | Linear Feet per Minute (LFM) | Cubic Feet per Minute (CFM) | Pressure (inwg) |
| 5 | 220 | 8.8 | 0.09 |
| 10 | 230 | 9.2 | 0.10 |
| 15 | 250 | 10.0 | 0.11 |
| 20 | 280 | 11.2 | 0.13 |
| 25 | 310 | 12.4 | 0.16 |
| 30 | 350 | 14.0 | 0.19 |
| 35 | 390 | 15.6 | 0.23 |
| 40 | 450 | 18.0 | 0.29 |
| 45 | 520 | 20.8 | 0.37 |
| 50 (not supported) | 600 | 23.9 | 0.48 |

Table 8: Required Flow at 1200m above Sea Level for an Example 180W Load for 70°C Rated QSFP

| Inlet Temperature versus Airflow Requirement of PCIe Card Slot (34.8 mm x 106.65 mm) at 1200m above Sea Level for 70°C Rated QSFP | | | |
|---|------------------------------|-----------------------------|-----------------|
| Inlet Temperature to the Card (°C) | Linear Feet per Minute (LFM) | Cubic Feet per Minute (CFM) | Pressure (inwg) |
| 5 | 320 | 12.8 | 0.17 |
| 10 | 340 | 13.6 | 0.18 |
| 15 | 380 | 15.2 | 0.22 |
| 20 | 420 | 16.8 | 0.26 |
| 25 | 480 | 19.2 | 0.33 |
| 30 | 540 | 21.5 | 0.40 |

Table 8: Required Flow at 1200m above Sea Level for an Example 180W Load for 70°C Rated QSFP
(cont'd)

| Inlet Temperature versus Airflow Requirement of PCIe Card Slot (34.8 mm x 106.65 mm) at 1200m above Sea Level for 70°C Rated QSFP | | | |
|---|------------------------------|-----------------------------|-----------------|
| Inlet Temperature to the Card (°C) | Linear Feet per Minute (LFM) | Cubic Feet per Minute (CFM) | Pressure (inwg) |
| 35 | 620 | 24.7 | 0.51 |
| 40 | 710 | 28.3 | 0.65 |
| 45 | 810 | 32.3 | 0.82 |
| 50 (not supported) | 930 | 37.1 | 1.05 |

Table 9: Required Flow at 1200m above Sea Level for an Example 180W Load for 85°C Rated QSFP

| Inlet Temperature versus Airflow Requirement of PCIe Card Slot (34.8 mm x 106.65 mm) at 1200m above Sea Level for 85°C Rated QSFP | | | |
|---|------------------------------|-----------------------------|-----------------|
| Inlet Temperature to the Card (°C) | Linear Feet per Minute (LFM) | Cubic Feet per Minute (CFM) | Pressure (inwg) |
| 5 | 240 | 9.6 | 0.11 |
| 10 | 250 | 10.0 | 0.11 |
| 15 | 270 | 10.8 | 0.13 |
| 20 | 300 | 12.0 | 0.15 |
| 25 | 330 | 13.2 | 0.17 |
| 30 | 370 | 14.8 | 0.21 |
| 35 | 420 | 16.8 | 0.26 |
| 40 | 480 | 19.2 | 0.33 |
| 45 | 560 | 22.3 | 0.43 |
| 50 (not supported) | 650 | 25.9 | 0.55 |

Temperature Gradient

The Alveo accelerator card and its thermal management device should be able to operate at a temperature/time gradient of 15°C/hour in its ambient surroundings. The thermal management device is the heat sink, shroud, backplate, top plate, and fan (for active solutions).

Humidity

The Alveo accelerator card and its thermal management device should be able to operate in a RH (relative humidity) range of 8% to 90% and a dew point of -12°C DP without condensation.

Storage and Non-Operating Conditions

The Alveo accelerator card and its thermal management device should be stored or maintained in non-operating conditions in a RH range of 5% to 95% without condensation and an ambient temperature range of -40°C to 75°C.

Regulatory Compliance Statements

Note: The following sections contain information in languages other than English. This is required for regulatory compliance.

FCC Class A Products

- U200-A64G
- U200-P64G
- U250-A64G
- U250-P64G

Note: These devices are for use with UL Listed Servers or I.T.E.

Safety Compliance

The following safety standards apply to all products listed above.

- UL 60950-1, 2nd Edition, 2014-10-14 (Information Technology Equipment - Safety - Part 1: General Requirements)
- CSA C22.2 No. 60950-1-07, 2nd Edition, 2014-10-14 (Information Technology Equipment - Safety - Part 1: General Requirements)
- EN 60950-1:2006+A11:2009+A1:2012+A12:2011+A2:2013 (European Union)
- IEC 60950-1:2005 (2nd Edition); Am 1:2009 (International)
- EU LVD Directive 2014/35/EU
- IEC 62368-1:2014 (2nd Edition)

EMC Compliance

The following standards apply.

Class A Products

- FCC Part 15 – Radiated & Conducted Emissions (USA)
- CAN ICES-3(A)/NMB-3(A) – Radiated & Conducted Emissions (Canada)
- CISPR 32 – Radiated & Conducted Emissions (International)
- EN55032: 2015 – Radiated & Conducted Emissions (European Union)
- EN55024: 2010 +A1:2001+A2:2003 – Immunity (European Union)
- EMC Directive 2014/30/EU
- VCCI (Class A)– Radiated & Conducted Emissions (Japan)
- CNS13438 – Radiated & Conducted Emissions (Taiwan)
- CNS 15663 - RoHS (Taiwan)

- AS/NZS CISPR 32 – Radiated and Conducted Emissions (Australia/New Zealand)
- Article 58-2 of Radio Waves Act, Clause 3 (Korea)

Regulatory Compliance Markings


When required, these products are provided with the following Product Certification Markings:


- UL Listed Accessories Mark for the USA and Canada
- CE mark
- FCC markings
- VCCI marking
- Australian C-Tick mark
- Korea MSIP mark
- Taiwan BSMI mark
- German GS mark


FCC Class A User Information

The Class A products listed above comply with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference.
2. This device must accept any interference received, including interference that may cause undesired operation.

 **IMPORTANT!** *This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his or her own expense.*

 **IMPORTANT!** *Cet équipement a été testé et jugé conforme à la Class A digital device, conformément à la règle 15 du standard FCC. Ces limites sont conçues pour fournir des protections contre des interférences nuisibles lorsque l'équipement est utilisé dans un environnement commercial. Cet équipement génère, utilise et peut émettre des énergies de radio-fréquence et, s'il n'est pas installé et utilisé conformément aux instructions, peut nuire aux communications radio. L'exploitation de cet équipement dans une zone résidentielle est susceptible de causer des interférences nuisibles, auquel cas l'utilisateur peut être tenu de prendre des mesures adéquates à ses propres frais.*

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Canadian Compliance (Industry Canada)

CAN ICES-3(A)/NMB-3(A)

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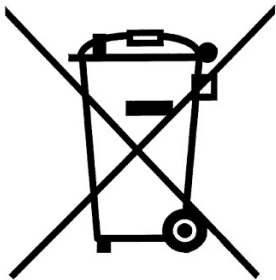
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EU WEEE Logo



Manufacturer Declaration European Community



Manufacturer Declaration

Xilinx declares that the equipment described in this document is in conformance with the requirements of the European Council Directive listed below:

- Low Voltage Directive 2014/35/EU
- EMC Directive 2014/30/EU
- RoHS 3 Directive 2011/65/EU, 2015/863
- China RoHS Declaration: Standards SJ/T 11363-2006, 11364-2006, and GB/T 26572-2011

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Este producto cumple con las normas del Directivo Europeo 1999/5/EC.

Denna produkt har tillverkats i enlighet med EG-direktiv 1999/5/EC.

This declaration is based upon compliance of the Class A products listed above to the following standards:

EN 55032 (CISPR 32 Class A) RF Emissions Control.

EN 55024:2010 (CISPR 24) Immunity to Electromagnetic Disturbance.

EN 60950-1:2006/A11:2009A1:2010/A12:2011 Information Technology Equipment- Safety-Part 1: General Requirements.

EN 50581:2012 - Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances.

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VORSICHT! *In einer häuslichen Umgebung können Produkte der Klasse A Funkstörungen verursachen. In diesem Fall muss der Benutzer möglicherweise geeignete Maßnahmen ergreifen.*

Responsible Party

Xilinx, Inc.
 2100 Logic Drive, San Jose, CA 95124
 United States of America
 Phone: (408) 559-7778

References

The following documents provide additional information.

- [Getting Started with Alveo Data Center Accelerator Cards \(UG1301\)](#)
- [Alveo U200 and U250 Data Center Accelerator Cards User Guide \(UG1289\)](#)

Revision History

The following table shows the revision history for this document.

| Section | Revision Summary |
|---|---|
| 05/05/2020 Version 1.3.1 | |
| FPGA Resource Information | Updated link to <i>Vitis Unified Software Platform Documentation: Application Acceleration Development (UG1393)</i> . |
| Revision History | Corrected date for version 1.3. |

| Section | Revision Summary |
|--|---|
| 05/04/2020 Version 1.3 | |
| Table 2 | Updated assembly length for active and passing cooling enclosure installed. |
| Network Interfaces | Updated wattage description. |
| FPGA Resource Information | Updated first two paragraphs. |
| Standard Compliance Details | Removed section. |
| Airflow Direction Support | Added note after figure. |
| Operating Conditions | Updated tables and removed figures. |
| Humidity | Updated upper end of relative humidity range from 85% to 90%. |
| Storage and Non-Operating Conditions | Updated upper end of relative humidity range from 90% to 95%. |
| 12/09/2019 Version 1.2.1 | |
| FPGA Resource Information | Added link to UG1416. |
| 11/20/2019 Version 1.2 | |
| General updates | Updated to the Vitis unified software platform throughout. |
| Alveo Product Details | Updated table and figure. |
| Qualified Servers | Replaced table with link to Alveo qualified servers catalog. |
| Operating System Compatibility | Updated section. |
| FPGA Resource Information | Updated section, including figures. |
| 06/28/2019 Version 1.1 | |
| Alveo Product Details | Updated the block diagram. |
| Qualified Servers | Added servers. |
| Operating System Compatibility | Updated Ubuntu operating systems. |
| Standard Compliance Details | Added a note about altitude. |
| 10/02/2018 Version 1.0 | |
| Initial release. | N/A |

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