



# **Alveo U200 and U250 Data Center Accelerator Cards Data Sheet (DS962)**

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# Summary

AMD 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.

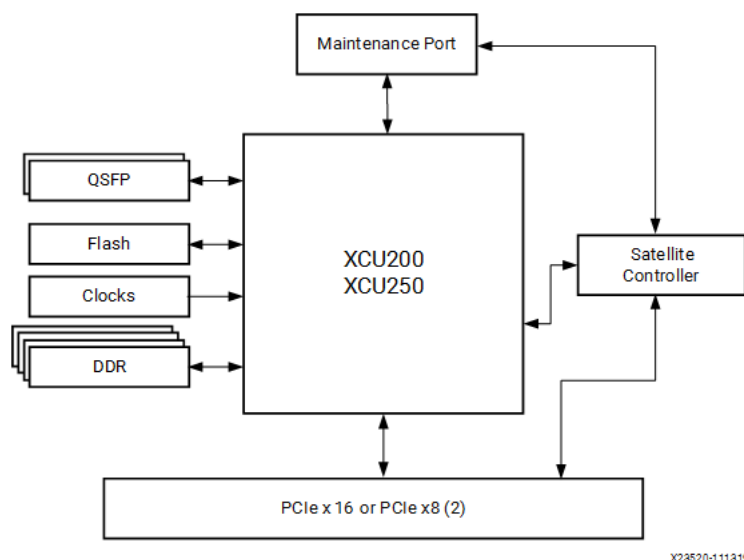
## Alveo Product Details

Table: 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 <sup>1</sup>	215W		215W	
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	
1. The 215W 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: U200/U250 Block Diagram



## 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: 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: 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: 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

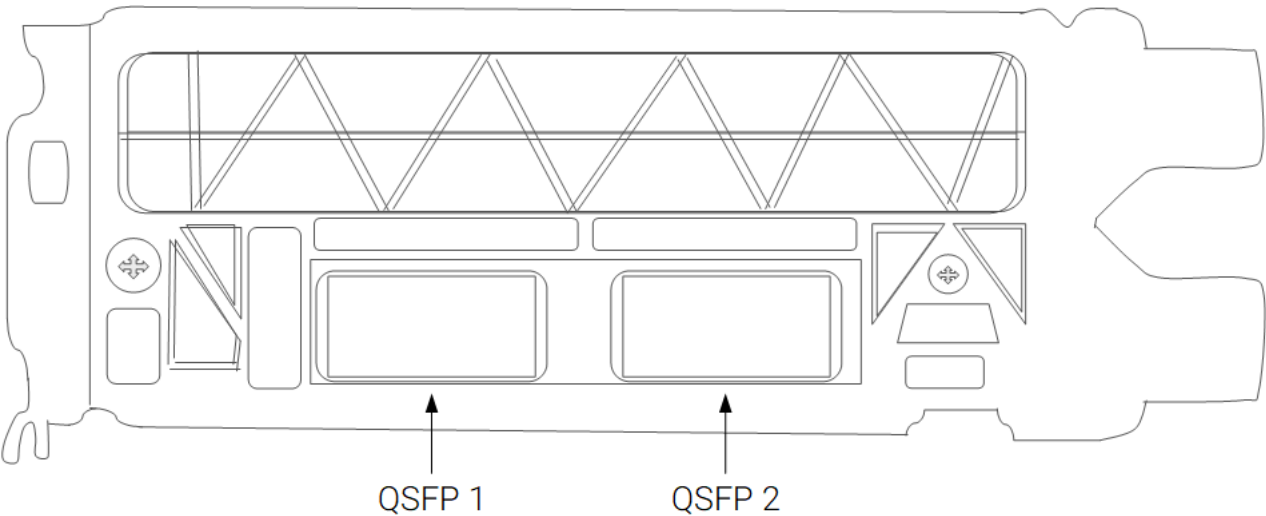
For more details about the Micron DDR4 DIMM, see the Micron MTA18ASF2G72PZ-2G3B1IG data sheet at [www.micron.com](http://www.micron.com).

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.

Each connector is housed within a single QSFP cage assembly, located on the I/O bracket. The QSFP port number and location are shown in the following figure.

Figure: QSFP Port Location



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The following table provides the mapping of the I/O bracket QSFP port name to the QSFP FPGA GT Quad. In addition, for those using the AMD Vitis™ flow, it provides the GT index allocated in the Vitis software platform.

Table: QSFP Port to Quad and Index Mapping

QSFP Port	QSFP FPGA GT Quad	QSFP GT Index (Vitis Platform)
QSFP 1	QUAD_X1Y12 (U200) QUAD_X1Y11 (U250)	GTS0
QSFP 2	QUAD_X1Y11 (U200) QUAD_X1Y10 (U250)	GTS1

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).

# Card Thermal and Electrical Protections

Built-in shutdown logic protects the card from damage by removing power to the FPGA when either electrical or thermal limits (given in the following table) reach or exceed their respective card shutdown thresholds. VCCINT current and temperature are monitored by the card regulator while FPGA temperature is monitored by the satellite controller (SC). Power to the card SC remains on during card shutdown. Card shutdown protection logic is always enabled and cannot be disabled.

**Note:** When card shutdown occurs, the card is pulled off the PCIe bus and consequently is not seen by the host. No AXI firewall trip is issued. A cold reboot of the server is required to recover.

The following table lists the card shutdown power and thermal thresholds.

Table: Thermal and Electrical Protection Thresholds

Sensor Description	Card Shutdown Threshold
VCCINT Current	<ul style="list-style-type: none"><li>53.5A (no PCIe AUX power)</li><li>214A (2x3 PCIe AUX power)</li><li>321A (2x4 PCIe AUX power)</li></ul>
VCCINT Temperature	125°C
FPGA Temperature	107°C

# FPGA Resource Information

The AMD 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 AMD 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: Floorplan of the XCU200 Device

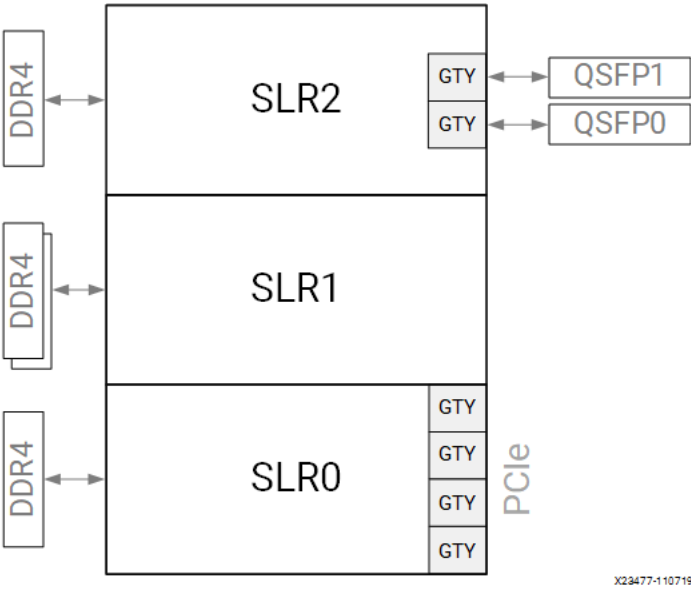
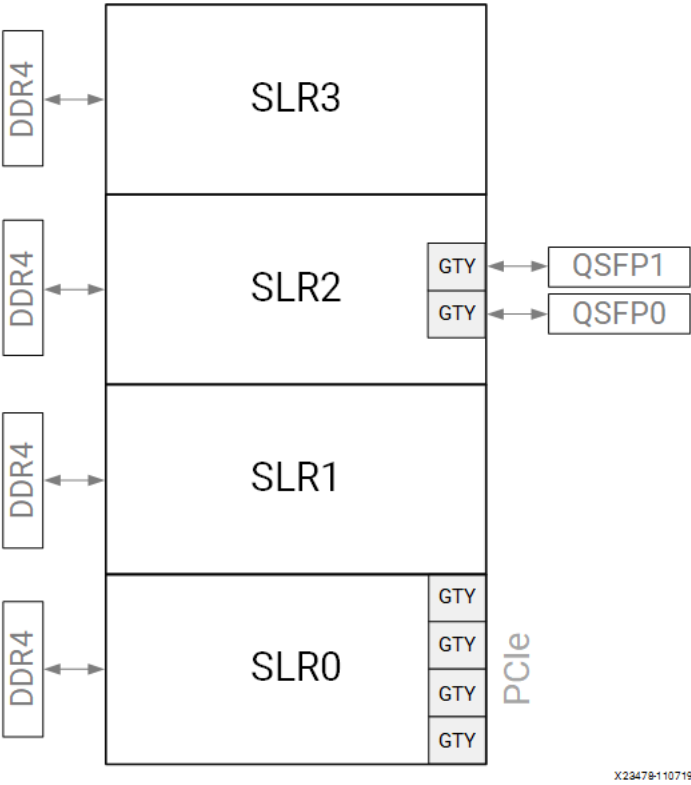


Figure: Floorplan of the XCU250 Device



For customers using the AMD 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: 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%

## Board and Temperature Limits

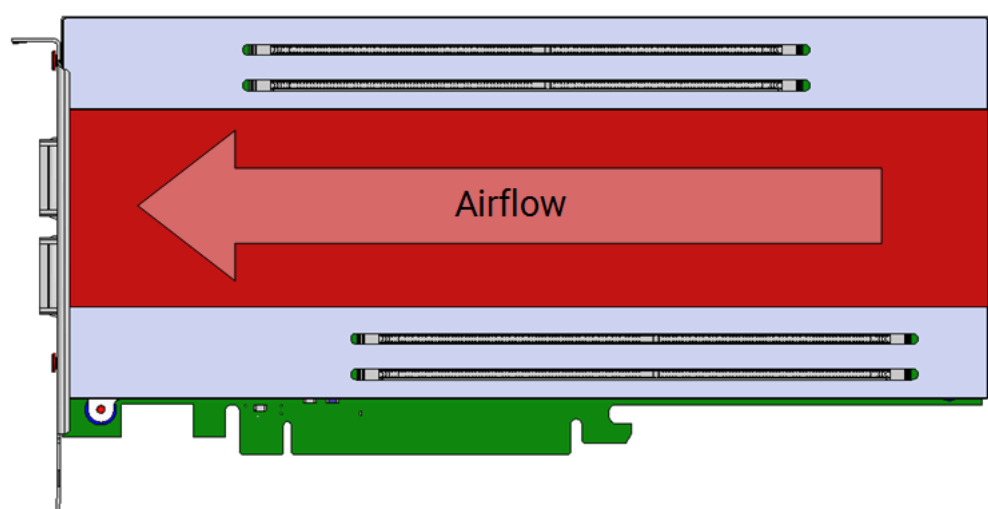
**Table: Board and Temperature Limits**

Sensor Name	Warning Limit (°C)	Critical Limit (°C)	Fatal Limit (°C)
FPGA Device Temperature	88	97	107
Board Temperature	100	110	125

## 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: Airflow Direction for Passively Cooled Cards**



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**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 provide the required airflow rate and airflow speed to the card under various operating conditions.

**Note:** In the following tables, the term *load* refers to the total thermal power dissipation of the card.

**Table: 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)



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: 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: 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 R			
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
35	620	24.7	0.51

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

**Table: 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 R			
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)
- EN55035:2017 – 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

## 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.

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**!! 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.

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**!! 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.

**!! Wichtig:** Dieses Gerät wurde getestet und entspricht den Grenzwerten für digitale Geräte der Klasse A gemäß Teil 15 der FCC-Bestimmungen. Diese Grenzwerte bieten einen angemessenen Schutz gegen schädliche Interferenzen, wenn das Gerät in einer gewerblichen Umgebung betrieben wird. Dieses Gerät erzeugt und verwendet Hochfrequenzenergie und kann diese abstrahlen. Wenn es nicht gemäß den Anweisungen installiert und verwendet wird, kann dies Funkstörungen verursachen. Der Betrieb dieses Geräts in einem Wohngebiet kann schädliche Interferenzen verursachen. In diesem Fall muss der Benutzer die Interferenz auf eigene Kosten beheben.

**⚠ CAUTION!** If the device is changed or modified without permission from AMD, the user may void his or her authority to operate the equipment.

**⚠ CAUTION!** Si l'appareil est modifié sans l'autorisation de AMD, l'utilisateur peut annuler son abilité à utiliser l'équipement.

**⚠ CAUTION!** Wenn das Gerät ohne Erlaubnis von AMD geändert wird, kann der Benutzer seine Berechtigung zum Betrieb des Geräts verlieren.

Canadian Compliance (Industry Canada)

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

VCCI Class A Statement

この装置は、クラス A 情報技術装置です。この装置を家庭環境で使用すると電波妨害を引き起こすことがあります。この場合には使用者が適切な対策を構ずよう要求されることがあります。

VCCI-A

KCC Notice Class A (Republic of Korea Only)

A급 기기 (업무용 방송통신기기)	이 기기는 업무용(A급)으로 전자파적합등록을 한 기기이오니 판매자 또는 사용자는 이 점을 주의하시기 바라며, 가정외의 지역에서 사용하는 것을 목적으로 합니다.
CLASS A device (commercial broadcasting and communication equipment)	This device has been approved by EMC registration. Distributors or users pay attention to this point. This device is usually aimed to be used in other area except at home

BSMI Class A Notice (Taiwan)

警告使用者:  
此為甲類資訊技術設備，於居住環境中使用時，可能會造成射頻擾動，在此種情況下，使用者會被要求採取某些適當的對策。

EU WEEE Logo



# Manufacturer Declaration European Community



## Manufacturer Declaration

AMD 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

These products follow the provisions of the European Directive 2014/53/EU.

Dette produkt er i overensstemmelse med det europæiske direktiv 2014/53/EU.

Dit product is in navolging van de bepalingen van Europees Directief 2014/53/EU.

Tämä tuote noudattaa EU-direktiivin 2014/53/EU määräyksiä.

Ce produit est conforme aux exigences de la Directive Européenne 2014/53/EU.

Dieses Produkt entspricht den Bestimmungen der Europäischen Richtlinie 2014/53/EU.

Pessi vara stenst reglugerð Evrópska Efnahags Bandalagsins númer 2014/53/EU.

Questo prodotto è conforme alla Direttiva Europea 2014/53/EU.

Dette produktet er i henhold til bestemmelsene i det europeiske direktivet 2014/53/EU.

Este produto cumpre com as normas da Diretiva Europeia 2014/53/EU.

Este producto cumple con las normas del Directivo Europeo 2014/53/EU.

Denna produkt har tillverkats i enlighet med EG-direktiv 2014/53/EU.

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/A11:2009/A1:2010/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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**⚠ CAUTION!** In a domestic environment, Class A products may cause radio interference, in which case the user may be required to take adequate measures.

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**⚠ CAUTION!** Dans un environnement domestique, les produits de Classe A peuvent causer des interférences radio, auquel cas l'utilisateur peut être tenu de prendre des mesures adéquates.

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

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## Responsible Party

- AMD, 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 Data Center Accelerator Card Platforms User Guide* ([UG1120](#))

# Revision History

The following table shows the revision history for this document.

Section	Revision Summary
06/23/2023 Version 1.7	
<a href="#">Card Thermal and Electrical Protections</a>	Added new section.
03/22/2023 Version 1.6	
General updates	Moved QSFP port location figure from <a href="#">Summary</a> to <a href="#">Network Interfaces</a> .
<a href="#">Table 1</a>	Added table.
09/01/2022 Version 1.5	
<a href="#">Summary</a>	Added I/O bracket figure.
<a href="#">Board and Temperature Limits</a>	Added section.
09/24/2021 Version 1.4	
<a href="#">Table 1</a>	Updated total electrical card load from 225W to 215W.
<a href="#">Manufacturer Declaration European Community</a>	Removed GS compliance mark.
05/05/2020 Version 1.3.1	
<a href="#">FPGA Resource Information</a>	Updated link to <i>Vitis Unified Software Platform Documentation: Application Acceleration Development</i> ( <a href="#">UG1393</a> ).
<a href="#">Revision History</a>	Corrected date for version 1.3.
05/04/2020 Version 1.3	
<a href="#">Table 1</a>	Updated assembly length for active and passing cooling enclosure installed.
<a href="#">Network Interfaces</a>	Updated wattage description.
<a href="#">FPGA Resource Information</a>	Updated first two paragraphs.
Standard Compliance Details	Removed section.
<a href="#">Airflow Direction Support</a>	Added note after figure.
<a href="#">Operating Conditions</a>	Updated tables and removed figures.
<a href="#">Humidity</a>	Updated upper end of relative humidity range from 85% to 90%.
<a href="#">Storage and Non-Operating Conditions</a>	Updated upper end of relative humidity range from 90% to 95%.
12/09/2019 Version 1.2.1	
<a href="#">FPGA Resource Information</a>	Added link to UG1416.

Section	Revision Summary
11/20/2019 Version 1.2	
General updates	Updated to the Vitis unified software platform throughout.
<a href="#">Alveo Product Details</a>	Updated table and figure.
<a href="#">Qualified Servers</a>	Replaced table with link to Alveo qualified servers catalog.
<a href="#">Operating System Compatibility</a>	Updated section.
<a href="#">FPGA Resource Information</a>	Updated section, including figures.
06/28/2019 Version 1.1	
<a href="#">Alveo Product Details</a>	Updated the block diagram.
<a href="#">Qualified Servers</a>	Added servers.
<a href="#">Operating System Compatibility</a>	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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