

Summary

The Xilinx® Alveo™ U280 Data Center accelerator card is a full height, dual slot, ¾ length (passive cooling) or full length (active cooling) form factor. It supports PCI Express® Gen3 x16 or Gen4 x8, is equipped with 8 GB of high-bandwidth memory (HBM2), 16 GB DDR4 operating at 2400 MT/s, and two QSFP Ethernet ports capable of 100 Gb/s each. The Alveo U280 card is designed to accelerate memory-bound, compute-intensive applications including database analytics and machine learning inference.

Alveo Product Details

Table 1: Alveo U280 Accelerator Card Product Details

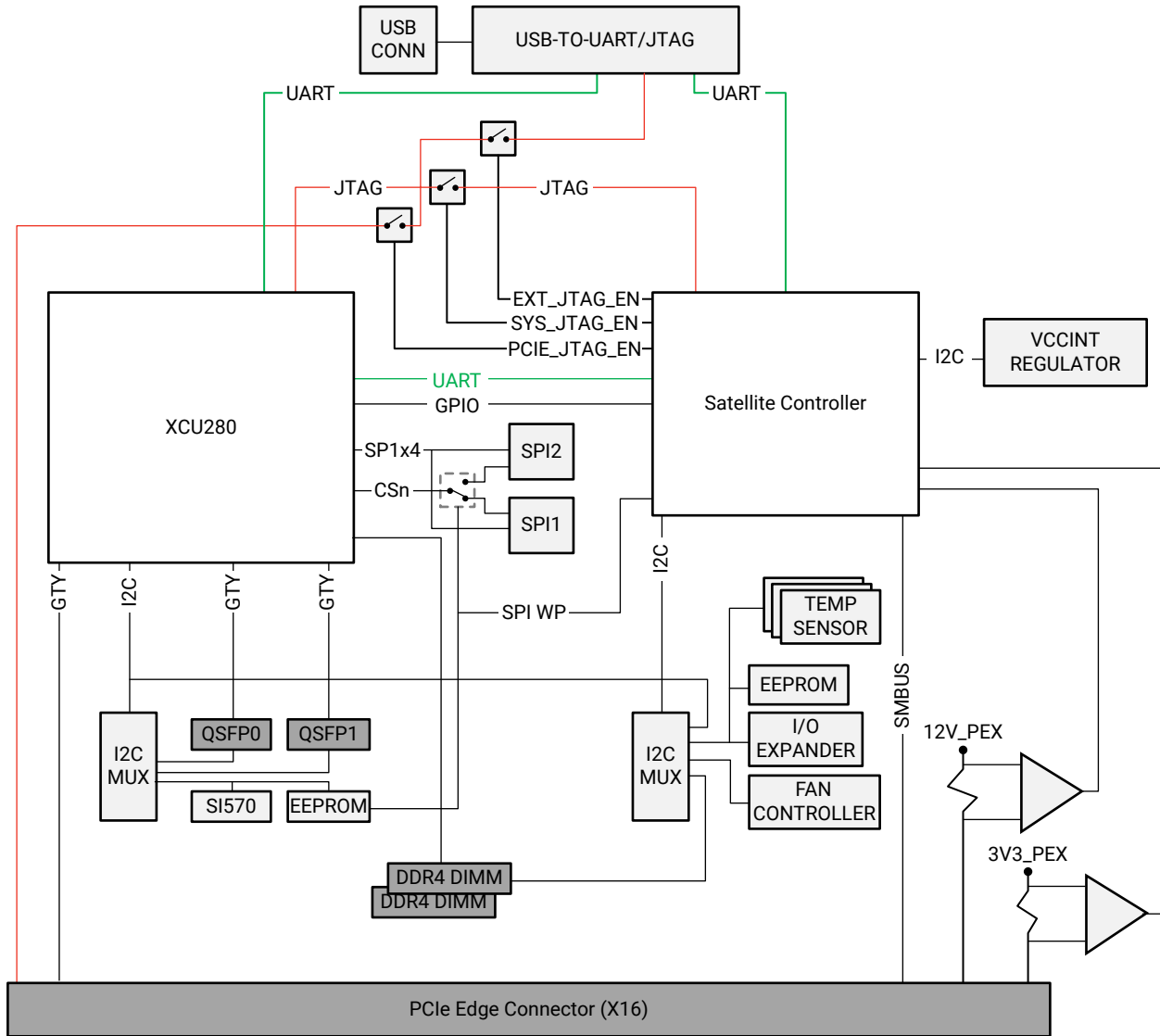
Specification ¹	Active Cooling Version	Passive Cooling Version
Product SKU	A-U280-A32G-DEV-G ³	A-U280-P32G-PQ-G ³
Total electrical card load ²	225W	225W
Thermal cooling solution	Active	Passive
Weight	1187g	1130g
Form factor	U280 cards fully comply with the dual-slot PCIe form factor.	U280 cards fully comply with the dual-slot PCIe form factor.

Notes:

1. The specifications in this data sheet apply to production U280 cards. Any differences in U280 ES1 card specifications and capabilities are documented in the U280 ES1 Known Issues Xilinx Answer Record [71925](#).
2. 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.
3. Actively cooled cards are for development only. They are not qualified for deployment. Passively cooled cards are qualified for deployment.

The following figure shows the components within an Alveo U280 accelerator card.

Figure 1: U280 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 2: Card Dimensions

Parameter	Dimension
Height	4.375 inch (111.15 mm)

Table 2: Card Dimensions (cont'd)

Parameter	Dimension
Active cooling enclosure installed	
Assembly length	11.73 inch (298 mm)
Assembly width	1.54 inch (39.04 mm)
Passive cooling enclosure installed	
Assembly length	9.53 inch (242 mm)
Assembly thickness	1.54 inch (39.04 mm)

PCIe Connector/Data Rates

The Alveo U280 accelerator card uses an UltraScale+™ FPGA containing a PCIE4C block. The PCIE4C block is compliant to the PCI Express Base Specification v3.1 supporting up to 8.0 GT/s (Gen3 x16) and compatible with PCI Express Base Specification v4.0 supporting up to 16.0 GT/s (Gen4 x8). The PCIE4C block is also compliant with CCIX Base Specification Revision 1.0 v0.9, supporting speeds up to 16.0 GT/s.

Table 3: PCI Express 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
Gen 4 ¹	16.0 GT/s

Notes:

- The Gen4 (16.0 GT/s) line rate is currently not supported in the deployment shell. Xilinx IP that supports PCIe operating at the Gen4 rate is available in Vivado. For a list of limitations when operating at the Gen4 rate, see *UltraScale+ Devices Integrated Block for PCI Express LogiCORE IP Product Guide (PG213)*.

DDR4 Specifications

Two 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-U280-A32G-DEV-G A-U280-P32G-PQ-G	Manufacturer	Micron	
	Part Number	MTA18ASF2G72PZ-2G3B1	
	Description		16 GB 288-pin DDR4 RDIMM
			Configuration: 2Gb x 72
			Single rank
			Supports ECC error detection and correction
		Supports 2400 MT/s	

Network Interfaces

The Alveo U280 accelerator cards host two 100G interfaces, each comprised of a 4-lane QSFP28 connector, which accepts up to 5W modules. QSFP connectors are not supported in the current version of the deployment shell. Each connector is housed within a single QSFP cage assembly located at the I/O bracket.

USB Maintenance Port

The Alveo U280 accelerator cards include a micro-USB maintenance port located at the front of the card.

Validated Servers

The Alveo accelerator cards have been validated for interoperability by Xilinx in the following servers and workstations.

Table 5: Validated Servers and Workstations

Manufacturer	Model/Platform
Dell EMC	PowerEdge R7425 Server
Dell EMC	PowerEdge R730 Server
Dell EMC	PowerEdge R740 Server
HPE	ProLiant DL380 G10 Server
Inspur	NF5280M5 Server
Inspur	NF5468M5 Server
SuperMicro	SYS-4028GR-TR Server
SuperMicro	SYS-4029GP-TRT Server
SuperMicro	SYS-7049GP-TRT Workstation

Operating System Compatibility

The following operating systems are supported:

- Centos 7.4/7.5/7.6
- RHEL 7.4/7.5/7.6
- Ubuntu 16.04 LTS
- Ubuntu 18.04 LTS

FPGA Resource Information

At the heart of the Xilinx Alveo U280 accelerator card is a custom-built UltraScale+ FPGA that runs optimally (and exclusively) on the Alveo architecture. The Alveo U280 card features the XCU280 FPGA, which uses Xilinx stacked silicon interconnect (SSI) technology to deliver breakthrough FPGA capacity, bandwidth, and power efficiency. This technology provides increased density by using multiple super logic regions (SLRs). The XCU280 comprises three SLRs.

The deployment shell that handles device bring-up and configuration over PCIe is contained within a static region of the FPGA. The remaining dynamic region is available for application developers to implement custom accelerators.

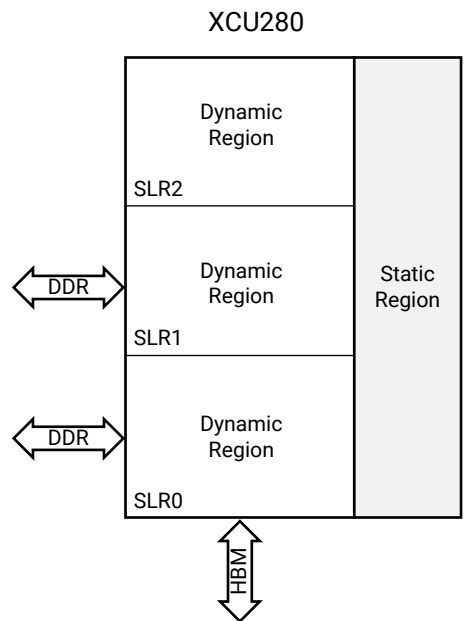
For developing applications, refer to the *SDAccel Environment User Guide (UG1023)*.

Dynamic Regions

The resources in the dynamic region are available for creating custom accelerators. The following figure and table show the amount and location of resources available. For more information on the various resources and their capabilities, see the [Xilinx® UltraScale+™ documentation](#).

The following figure shows the allocation of static and dynamic regions of the XCU280 device. It is partitioned across all three SLRs.

Figure 2: Floorplan of the XCU280 Device



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SLR0 contains an HBM controller with 32 HBM AXI interfaces to communicate with the 8GB (two 4GB stacks) of HBM2 memory. Through a built-in switch mechanism, any of the 32 HBM AXI interfaces can access any memory address on either of the HBM stacks.

The following table lists available resources in the XCU280 device after the static region is programmed with the development shell.

Table 6: Dynamic Region Resources

Resource	Total	SLR0	SLR1	SLR2
Look-Up tables (LUTs) (K)	1082	360	352	370
Registers (K)	2180	736	710	734
36 Kb block RAMs	1490	490	490	510
288 Kb UltraRAMs	960	320	320	320

Table 6: Dynamic Region Resources (cont'd)

Resource	Total	SLR0	SLR1	SLR2
DSP slices	8490	2733	2877	2800

Thermal Specification

Ambient Conditions

The ambient conditions are detailed in the following sections.

Operating and Storage Temperature Conditions

Table 7: 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%

Related Information

[Operating Conditions](#)

Standard Compliance Details

The Alveo U280 accelerator cards are compliant with ASHRAE classes A1, A2, and A3. The maximum operating altitude is 1200m above sea level.

Note: Operating at an altitude higher than 1200m above sea level might require additional air flow or lower inlet temperatures.

Table 8: Standard Compliance Details

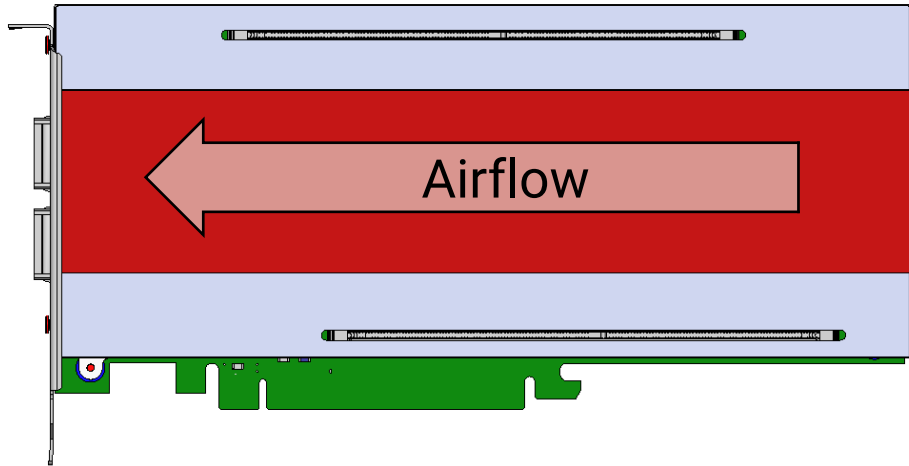
Standard	Operation		Recommended		
	Temperature (°C)	Humidity Ratio	Temperature (°C)	Humidity Ratio	
ASHRAE	A1	15 to 32	20% to 80%	18 to 27	-9°C to 15°C DP and 60% RH
	A2	10 to 35	20% to 80%	18 to 27	-9°C to 15°C DP and 60% RH
	A3	5 to 40	-12°C DP and 8% to 85%	18 to 27	-9°C to 15°C DP and 60% RH
	A4	5 to 45	-12°C DP and 8% to 90%	18 to 27	-9°C to 15°C DP and 60% RH

The inlet ambient temperature for long-term operation under the stated standard must not exceed the 45°C inlet to the card.

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 U280 cards support airflow as illustrated below.

Figure 3: Airflow Direction for Passively Cooled Cards



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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 9: Inlet Temperature versus Airflow Requirement for the U280 Card at Sea Level

Inlet Temperature versus Airflow Requirement PCIe Card Slot (34.8 mm x 106.65 mm) at Sea Level for 85°C Rated QSFP ¹		
Inlet Temperature to the Card (°C)	Linear Feet per Minute (LFM)	Cubic Feet per Minute (CFM)
25	425	17
30	425	17
35	475	19
40	525	21
45	600	24
50	700	28

Notes:

1. Airflow requirements are for U280 production cards. For U280 ES1 airflow requirements, see the U280 ES1 Known Issues Xilinx Answer Record [71975](#).

Table 10: Inlet Temperature versus Airflow Requirement for the U280 Card above Sea Level

Inlet Temperature versus Airflow Requirement PCIe Card Slot (34.8 mm x 106.65 mm) at 1200m above Sea Level for 85°C Rated QSFP ¹		
Inlet Temperature to the Card (°C)	Linear Feet per Minute (LFM)	Cubic Feet per Minute (CFM)
25	425	17
30	425	17
35	525	21
40	575	23
45	650	26
50	750	30

Notes:

1. Airflow requirements are for U280 production cards. For U280 ES1 airflow requirements, see the U280 ES1 Known Issues Xilinx Answer Record [71975](#).

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 85% 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 90% 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

Regulatory Compliance Statements are valid for the production version of Alveo™ cards; not for ES cards.

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/EC

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/EC
- 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.


 **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.*

 **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 Xilinx, the user may void his or her authority to operate the equipment.*

 **ATTENTION!** *Si l'appareil est modifié sans l'autorisation de Xilinx, l'utilisateur peut annuler son ability à utiliser l'équipement.*

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

Canadian Compliance (Industry Canada)

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

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VCCI-A

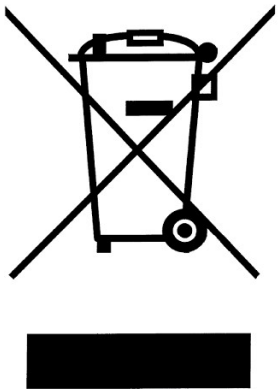
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EU WEEE Logo



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 Directive 2011/65/EU, 2015/863

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

Dette produkt er i overensstemmelse med det europæiske direktiv 1999/5/EC.

Dit product is in navolging van de bepalingen van Europees Directief 1999/5/EC.

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Ce produit est conforme aux exigences de la Directive Européenne 1999/5/EC.

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Pessi vara stenst reglugerð Evrópska Efnahags Bandalagsins númer 1999/5/EC.

Questo prodotto è conforme alla Direttiva Europea 1999/5/EC.

Dette produktet er i henhold til bestemmelsene i det europeiske direktivet 1999/5/EC.

Este produto cumpre com as normas da Diretiva Europeia 1999/5/EC.

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/A11:2009/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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 **ATTENTION!** *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.*

 **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 document provides 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
06/28/2019 Version 1.1	
Alveo Product Details	Updated the block diagram.
Validated Servers	Added servers.
Operating System Compatibility	Updated operating systems.
Standard Compliance Details	Added a note about altitude.
02/15/2019 Version 1.0	
Initial release.	N/A

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