Alveo U50 Data Center Accelerator Card Data Sheet

DS965 (v1.8) June 23, 2023 **Product Specification**

Summary

The AMD Alveo™ U50 data center accelerator card, shown in the following figure, is a single slot, low profile form factor passively-cooled card operating up to a 75W maximum power limit. It supports PCI Express® (PCIe®) Gen3 x16 or dual Gen4 x8, is equipped with 8 GB of high-bandwidth memory (HBM2), and Ethernet networking capability. The Alveo U50 is designed to accelerate memory-bound, compute-intensive applications in financial computing, computational storage, data search and analytics. The Alveo U50 LV is recommended for accelerating machine learning inference workloads. The Alveo U50 and U50 LV cards are identical with the exception of the core operating voltage. The U50 operates with the core voltage set to V_{NOM} and the U50 LV has the core voltage set to V_{LOW}.

The U50 and U50 LV cards, qualified for deployment, have a single QSFP28 connector capable of 4x25G.

Figure 1: **Alveo U50/U50 LV Production Data Center Accelerator Card**

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The card can be used with the AMD Vitis™ unified software platform and target platform that simplifies the design process and allows for high-level languages such as C, C++ and OpenCL™ to be used. A platform enables the card to be configured from onboard flash memory and upgraded through PCI Express. For experienced programmable logic developers, the card can be used with the AMD Vivado™ Design Suite where the full resources of the programmable logic device are made available for development.

Product Details

Table 1: **Alveo U50/U50 LV Accelerator Card Product Details**

Specification	U50 Production[1]	U50 LV Production[1]
Product SKU	A-U50-P00G-PQ-G	A-U50-P00G-LV-G
Total electrical card load[2]	75W	75W
Thermal cooling solution	Passive	Passive
Weight	300g – 325g	300g – 325g
Form factor	Half height, half length	Half height, half length
Network interface	1x QSFP28 (100 GbE)	1x QSFP28 (100 GbE)
Network clock precision	IEEE 1588	IEEE 1588
PCIe interface[3, 4]	Gen3 x16, Gen4 x8, CCIX	Gen3 x16[5,6]
HBM2 total capacity	8 GB	8 GB
HBM2 bandwidth	316 GB/s[7]	316 GB/s[7]
Look-up tables (LUTs)	872K	872K
Registers	1,743K	1,743K
DSP slices	5,952	5,952
Max. Dist. RAM	24.6 Mb	24.6 Mb
36 Kb block RAM	1344 (47.3 Mb)	1344 (47.3 Mb)
288 Kb UltraRAM	640 (180.0 Mb)	640 (180.0 Mb)
GTY transceivers	20	20
V_{CCINT} supported	V_{NOM} (0.85V)	V_{LOW} (0.72V)
AMD Vitis™ Development Enviroment	Yes	Yes
Vitis platform	Gen3 x16 XDMA, Gen3 x4 XDMA[8]	Gen3 x4 XDMA[9]
Vivado Design Suite	Yes	Yes
Target workloads	Fintech, video, database, and computational storage	Machine learning (ML) inference

Table 1: **Alveo U50/U50 LV Accelerator Card Product Details** *(cont'd)*

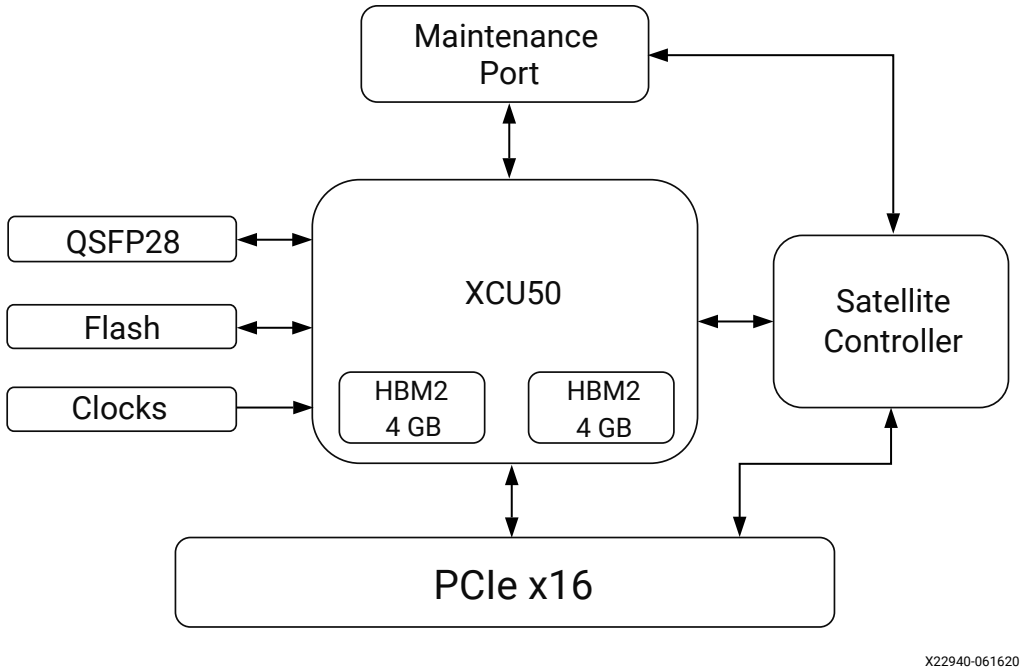
Specification	U50 Production[1]	U50 LV Production[1]
Qualified for deployment	Yes	Yes

Notes:

1. The Alveo programmable cable (sold separately) is required for development access. The cable provides micro-USB support from a host PC to the maintenance connector and can be purchased from AMD (Alveo Accessories). For more information about this cable, refer to *Alveo Programming Cable User Guide* (UG1377).
2. The Alveo U50/U50 LV card has separate power rails for FPGA fabric and HBM2 memory. Developers must ensure their designs do not draw too much power for each rail. More information can be found in *Alveo U50 Data Center Accelerator Card Installation Guide* (ds962).
3. The PCIe interface can be configured to support a variety of link widths and speeds. The maximum is Gen3 (8 GT/s) x16, Gen4 (16 GT/s) x8 or CCIX operating at 16 GT/s x8. The PCIe interface can also be configured into dual x8 interfaces and connected to hosts that support PCIe bifurcation.
4. This block operates in compatibility mode for 16.0 GT/s (Gen4) operation. Refer to *UltraScale+ Devices Integrated Block for PCI Express LogiCORE IP Product Guide* (PG213) for details on compatibility mode.
5. The Alveo U50 LV card with V_{CCINT} core voltage set to V_{LOW} only supports Gen3 x4 platform shells.
6. The A-U50-P00G-LV-G card requires a PCI Express x16 slot for the edge connector and a supply of 75W.
7. The HBM2 power is limited to 10W from the PCIe 3.3V rail. The performance that can be achieved using HBM2 is limited by this power limit and varies between designs. The nominal bandwidth for HBM2 is 201 GB/s. Peak HBM2 bandwidth measured for the A-U50-P00G-LV-G and A-U50-P00G-PQ-G cards is 316 GB/s in the non-PCIe compliant specification.
8. The A-U50-P00G-PQ-G card with V_{CCINT} core voltage set to 0.85V supports PCIe Gen3 x4 deployment platform shells for the AMD video solution.
9. The A-U50-P00G-LV-G card with V_{CCINT} core voltage set to 0.72V supports PCIe Gen3 x4 deployment platform shells for the AMD Vitis AI solution.

The following figure shows the components within an Alveo U50/U50 LV production accelerator card.

Figure 2: **U50/U50 LV Production Block Diagram**



Card Specifications

Dimensions

The U50/U50 LV production card is compliant with the PCIe CEM rev.3.0 Specification as single slot, half height, half length cards.

Table 2: **Card Dimensions**

Parameter	Dimension
Height	2.71 inch (68.90 mm)
PCB thickness (± 0.13 mm (0.005 inch))	0.62 inch (1.57 mm)
Primary side width	0.570 inch (14.47 mm)
Secondary side width	0.105 inch (2.67 mm)
Length	6.60 inch (167.65 mm)

PCIe Connector/Data Rates

The Alveo U50/U50 LV accelerator card uses an AMD 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.

Note: The Alveo U50 LV card only supports PCIe Gen3 x4 with V_{CCINT} set to V_{LOW}.

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:

1. For a list of limitations when operating at the Gen4 rate, see *UltraScale+ Devices Integrated Block for PCI Express LogiCORE IP Product Guide* (PG213).

Network Interfaces

The Alveo U50/U50 LV card comes with a single 4-lane QSFP28 (U50 production) that can electrically accept modules up to 5W. The QSFP28 can connect interfaces up to 100G using optical modules or cables. 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. A 161.1328125 MHz clock is provided to the QSFP28 interface such that different Ethernet IP cores can be enabled. Multiple I/O brackets are shipped with the U50/U50 LV card, and the correct bracket can be attached to the card to match the panel interface size of the server slot. For the latest information about platform support for these connectors, see *Vitis Unified Software Platform Documentation: Application Acceleration Development* (UG1393).

Satellite Controller

A TI MSP432 satellite controller resides on the U50/U50 LV card to control and monitor voltages, currents and temperatures. The host server board management controller (BMC) can interact with the satellite controller to monitor and control U50/U50 LV cards through out-of-band communication. AMD supports the PLDM protocol over MCTP over SMBUS, complying with DMTF standards. Refer to the *Alveo Card Out-of-Band Management Specification for Server BMC* (XD038) for more information. When used with the AMD provided platform, you can easily monitor for any abnormal operating conditions and react accordingly. If you are not using the platform, AMD provides a Card Management Solution IP allowing you to quickly develop and interact with the satellite controller from the FPGA. See the *Card Management Solution Subsystem Product Guide* (PG348) for more information.

Maintenance Port

The maintenance port allows access to a number of different features and signals including JTAG, UARTs, PMBus, and resets. Connecting the Alveo programming cable to the maintenance port allows access to these features. See the *Alveo Programming Cable User Guide* (UG1377) for more information.

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 4: **Thermal and Electrical Protection Thresholds**

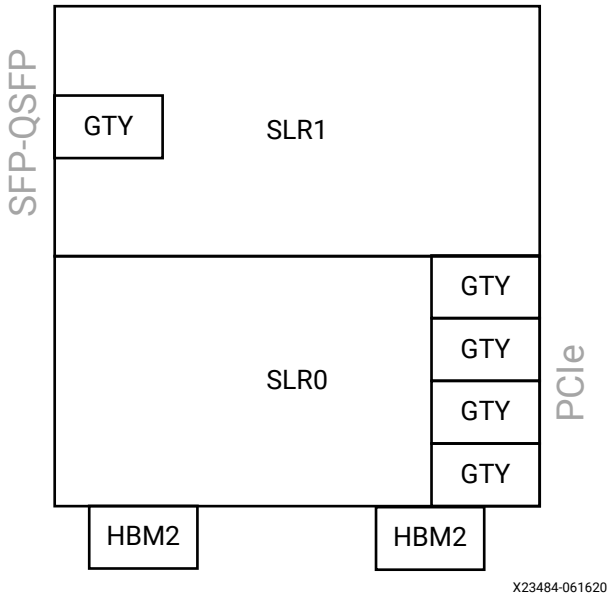
Sensor Description	Card Shutdown Threshold
VCCINT Current	60A
VCCINT Temperature	125°C
FPGA Temperature	107°C

FPGA Resource Information

The AMD Alveo U50/U50 LV accelerator card is a custom-built UltraScale+ FPGA that runs optimally (and exclusively) on Alveo architecture. The Alveo U50/U50 LV card features the XCU50 FPGA, which uses 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 XCU50 comprises two SLRs with the bottom SLR (SLR0) integrating an HBM2 controller to interface with the adjacent 8 GB HBM2 memory.

The following figure shows the two SLR regions along with the connections for PCIe and SFP-QSFP. The HBM2 is co-located on the XCU50 device and connects directly to SLR0.

Figure 3: **Floorplan of the XCU50 Device with SFP-QSFP Connection**



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 a number of other functions. 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. 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 50°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

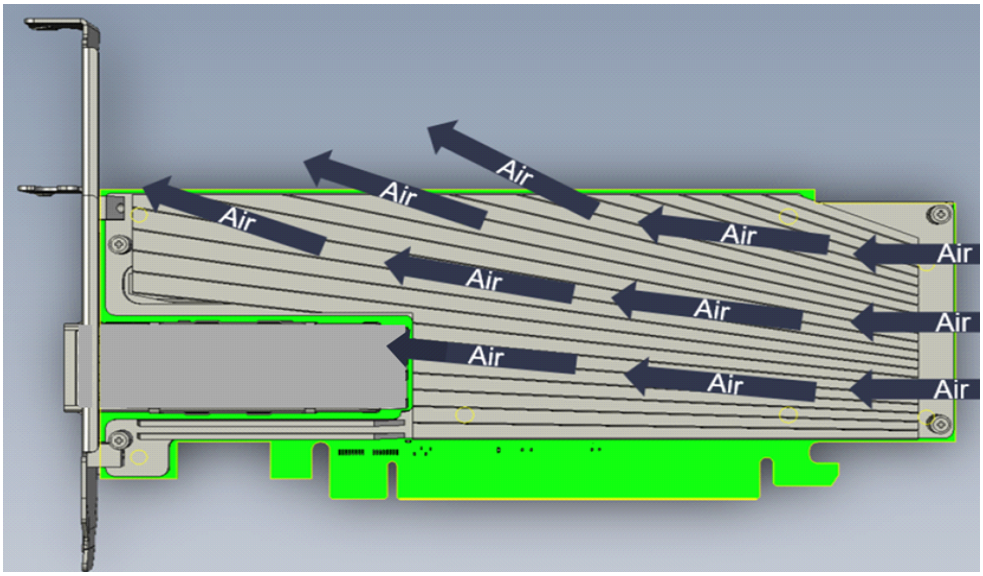
Table 6: **Board and Temperature Limits**

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

Airflow Direction Support

Forced airflow is required when the card is powered at all times. The Alveo U50/U50 LV cards support front-to-back airflow. The following figures illustrate this supported airflow.

Figure 4: **Airflow Direction for U50/U50 LV Passively Cooled Cards**



***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 U50/U50 LV card under various operating conditions. In these tables, the term *load* refers to the total power drawn by the card.

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

Table 7: **Specification for the U50/U50 LV Card at Sea Level for 85°C Optical with ~63W Load**

Inlet Temperature versus Airflow Requirement of PCIe Card Slot (19.51 mm x 56.15 mm) at Sea Level for 85°C Optical			
Inlet Temperature to the Card (°C)	**Linear Feet per Minute (LFM)**	**Cubic Feet per Minute (CFM)**	**Pressure (inwg)**
5	160	1.9	0.07
10	170	2.0	0.07
15	180	2.1	0.08
20	200	2.4	0.09
25	260	3.1	0.13
30	300	3.5	0.15
35	390	4.6	0.22
40	520	6.1	0.35
45	680	8.0	0.53
50	870	10.3	0.79
55 (not supported)	1000	11.8	1.00

Table 8: **Specification for the U50/U50 LV Card at Sea Level for 70°C Optical with ~63W Load**

Inlet Temperature versus Airflow Requirement of PCIe Card Slot (19.51 mm x 56.15 mm) at Sea Level for 70°C Optical			
Inlet Temperature to the Card (°C)	**Linear Feet per Minute (LFM)**	**Cubic Feet per Minute (CFM)**	**Pressure (inwg)**
5	160	1.9	0.07
10	170	2.0	0.07
15	180	2.1	0.08
20	200	2.4	0.09
25	260	3.1	0.13
30	300	3.5	0.15
35	390	4.6	0.22
40	520	6.1	0.35
45	680	8.0	0.53
50	870	10.3	0.79
55 (not supported)	1000	11.8	1.00

Table 9: **Specification for the U50/U50 LV Card at 1200m above Sea Level for 85°C Optical with ~63W Load**

Inlet Temperature versus Airflow Requirement of PCIe Card Slot (19.51 mm x 56.15 mm) at 1200m above Sea Level for 85°C Optical			
Inlet Temperature to the Card (°C)	**Linear Feet per Minute (LFM)**	**Cubic Feet per Minute (CFM)**	**Pressure (inwg)**
5	170	2.0	0.07
10	180	2.1	0.08
15	200	2.4	0.09
20	210	2.5	0.09
25	280	3.3	0.14
30	320	3.8	0.17
35	420	5.0	0.25
40	560	6.6	0.39
45	730	8.6	0.59
50	930	11.0	0.88
55 (not supported)	1080	12.7	1.14

Table 10: **Specification for the U50/U50 LV Card at 1200m above Sea Level for 70°C Optical with ~63W Load**

Inlet Temperature versus Airflow Requirement of PCIe Card Slot (19.51 mm x 56.15 mm) at 1200m above Sea Level for 70°C Optical			
Inlet Temperature to the Card (°C)	**Linear Feet per Minute (LFM)**	**Cubic Feet per Minute (CFM)**	**Pressure (inwg)**
5	170	2.0	0.07
10	180	2.1	0.08
15	200	2.4	0.09

Table 10: **Specification for the U50/U50 LV Card at 1200m above Sea Level for 70°C Optical with ~63W Load** *(cont'd)*

Inlet Temperature versus Airflow Requirement of PCIe Card Slot (19.51 mm x 56.15 mm) at 1200m above Sea Level for 70°C Optical			
Inlet Temperature to the Card (°C)	**Linear Feet per Minute (LFM)**	**Cubic Feet per Minute (CFM)**	**Pressure (inwg)**
20	210	2.5	0.09
25	280	3.3	0.14
30	320	3.8	0.17
35	420	5.0	0.25
40	560	6.6	0.39
45	730	8.6	0.59
50	930	11.0	0.88
55 (not supported)	1080	12.7	1.14

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

- U50-P00G

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.

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

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

VORSICHT! *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)

China RoHS Compliance

- SJ/T 11363-2006, 11364-2006, and GB/T 26572-2011
- RoHS 3 directive 2015/863
- EU 2015/863

VCCI Class A Statement

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この場合には使用者が適切な対策を構ずるよう要求されることがあります。 VCCI-A

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BSMI Class A Notice (Taiwan)

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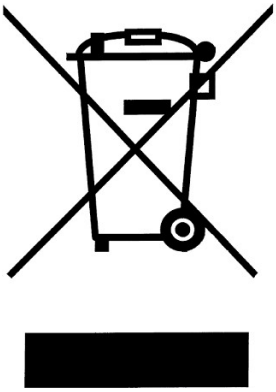
EU WEEE Logo



Manufacturer Declaration European Community

CE

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

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.

Þessi 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 Européia 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/A11:2009A1:2010/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.

CAUTION! *In a domestic environment, Class A products may cause radio interference, in which case the user may be required to take adequate measures.*

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

AMD, 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 U50 Data Center Accelerator Card Installation Guide* (UG1370)
- *Card Management Solution Subsystem Product Guide* (PG348)
- *Alveo Programming Cable User Guide* (UG1377)
- *Alveo Out-of-Band Management Specification for Server BMC User Guide* (UG1363)
- *Alveo FRU Data Specification* (UG1378)

Revision History

The following table shows the revision history for this document.

Section	Revision Summary
06/23/2023 Version 1.8	
Card Thermal and Electrical Protections and Board and Temperature Limits	Added new sections.
08/27/2020 Version 1.7.1	
General updates	Editorial updates only. No technical content changes.
06/29/2020 Version 1.7	
General updates	• Removed U50DD ES3 card and SFP-DD connector. • Added U50 LV production card. • Replaced HBM with HBM2.
Figure 1	Updated figure.
Table 1	• Removed column for U50DD ES3. • Added column for U50 LV. • Updated rows for weight, network interface, PCIe interface, and HBM2 bandwidth. • Added rows for network clock precision, Vitis development environment, Vitis platform, Vivado Design Suite, and target workloads. • Removed note about U50DD cards. • Updated note 1. • Added notes 5, 6, 8, and 9.
Table 2	Changed height from 62.40 mm to 68.90 mm.
Operating Conditions	Added sentence explaining the term *load*.

Section	Revision Summary
05/14/2020 Version 1.6	
General updates	Changed from *advance product specification* to *product specification*.
Figure 1	Updated figure.
Network Interfaces	Added sentence about SFP-DD connector support and updated wattage description.
Table 5	Updated operating humidity and storage humidity.
Airflow Direction Support	Added Figure 4 and note about other environmental conditions.
Operating Conditions	Appended "63W Load" to table titles.
02/18/2020 Version 1.5	
Table 2	Updated height to 2.46 inch (62.40 mm).
Table 5	Updated operating humidity and storage humidity conditions.
Satellite Controller	Added description of board management controller.
Operating Conditions	Updated inlet temperature versus airflow requirement table at sea level and added tables for 1200m above sea level at both 85°C and 70°C optical.
12/19/2019 Version 1.4	
Qualified Servers	Added web link to qualified servers.
12/16/2019 Version 1.3	
Operating and Storage Temperature Conditions	Revised the operating temperature from 55°C to 50°C.
Operating Conditions	Removed the 55°C row from Table 5.
11/19/2019 Version 1.2	
General updates	Updated to the Vitis unified software platform throughout.
Summary	Reversed order of figures.
Table 1	• Corrected form factor to *half length*. • Added HBM2 bandwidth. • Updated note 1. • Added note about Alveo programming cable.
Product Details	Reversed order of figures.
Dimensions	In first paragraph, replaced *half width* with *half length*.
Network Interfaces	Updated section.
Operating System Compatibility	Updated section.
Figure 3	Added new figure.
09/26/2019 Version 1.1	
Table 1	Added note about power rails.
09/17/2019 Version 1.0.1	
General updates	Editorial updates only. No technical content updates.
08/02/2019 Version 1.0	
Initial release	N/A

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