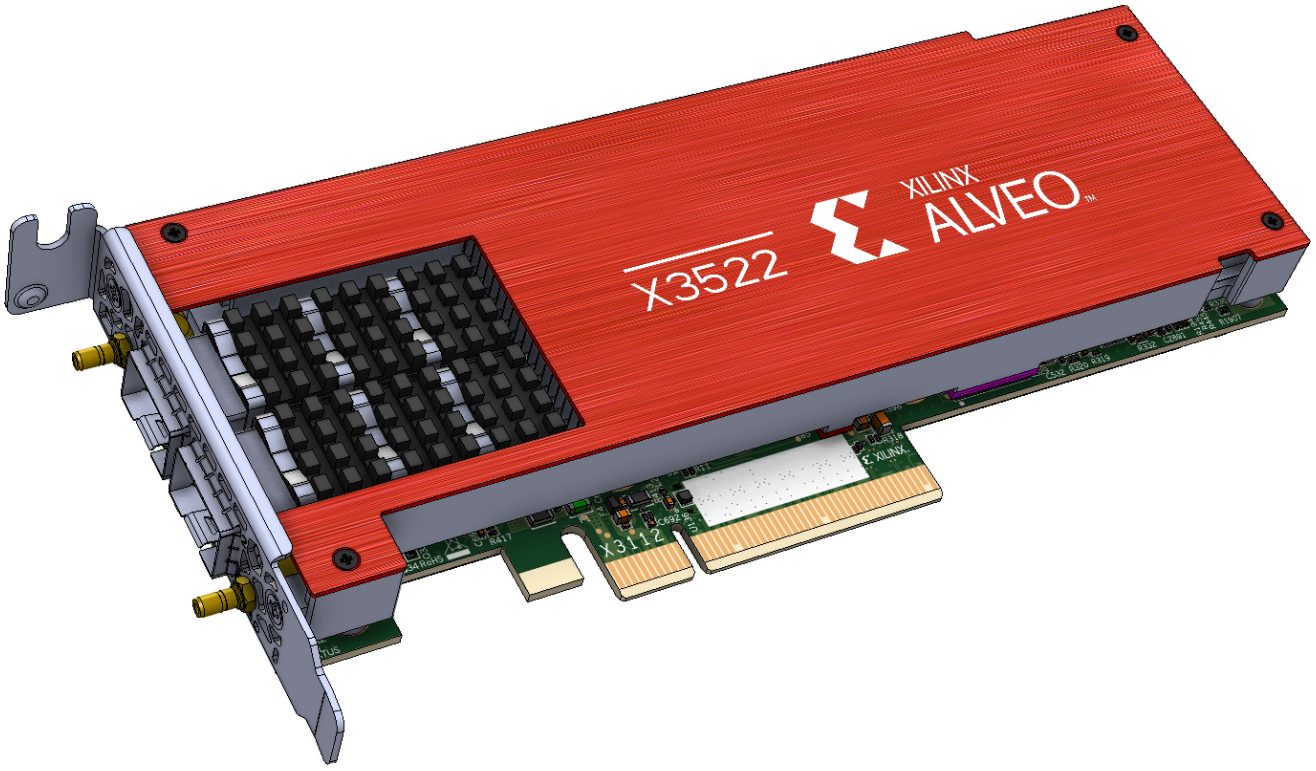
Alveo X3522 Data Sheet

DS1002 (v1.3) August 25, 2023 **Product Specification**

Summary

The AMD Alveo™ X3522 NICs bring low latency networking and compute acceleration to a single platform for use in a data center. As shown in the following figure, the Alveo X3522 NICs are offered in a single slot, half length, half height form factor. The card uses an XCUX35 FPGA (XCUX35-3VSVA1365E). The card is passively-cooled, and has two DSFP28 network connections and a PCI Express® Gen4 ×8 / Gen3 ×8 interface connected to the XCUX35. Each DSFP28 cage supports two ports via a shared PF, currently at 10 GbE. The card has a maximum electrical power limit of 70W.

Figure 1: **Alveo X3522 NICs**



X25586-072321

Product Details

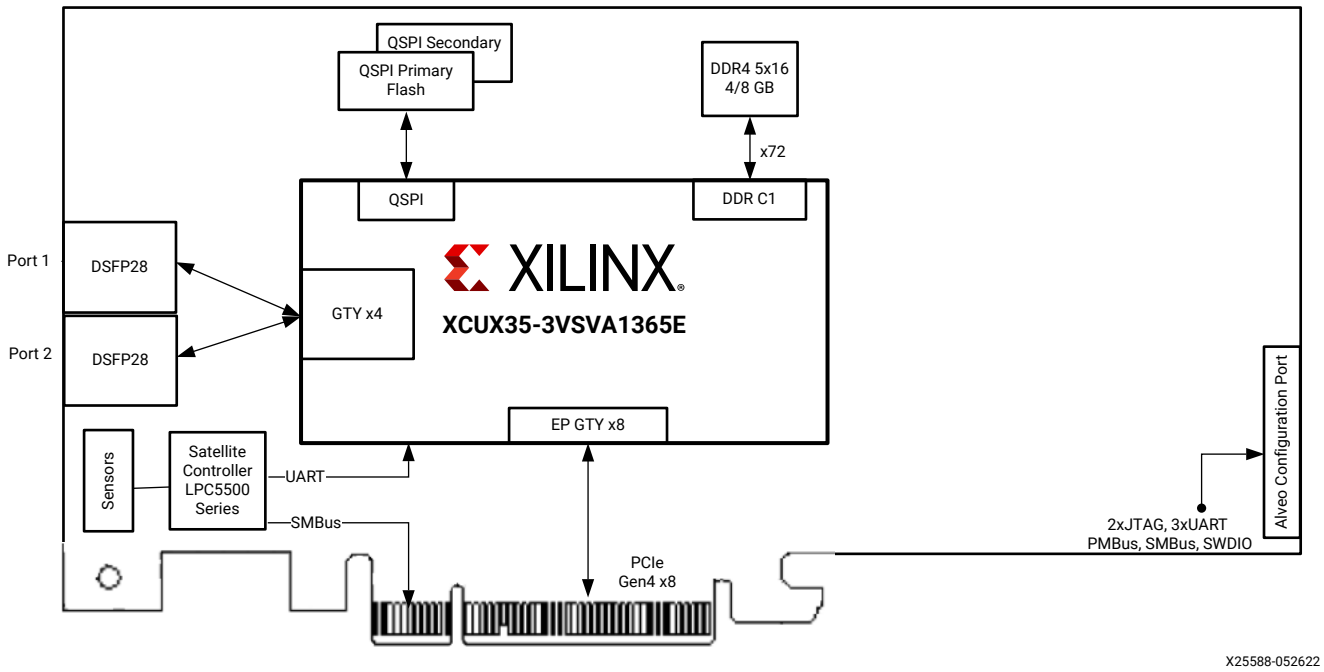
Table 1: **Alveo X3522 NICs Product Details**

Specification	Alveo X3522 NICs
Production product SKU	X3522-P08G (low latency network adapter) X3522PV-P08G (adaptable accelerator card)
Total electrical card load	X3522: 35W X3522PV: 70W
Thermal design power (TDP)	70W
Thermal cooling solution	Passive
Form factor	Half height, half length
Network interface	2 × DSFP28, each of which supports two ports via a shared PF, currently at 10 GbE
PCIe interface	Gen4 ×8 / Gen3 ×8
FPGA	
FPGA DDR memory	2 × 4 GB DDR4 component interface 72b with ECC operating at 2400 MT/s
LUTs/Registers/DSP slices	1030K/2059K/1320
Maximum distributed RAM/block Ram/UltraRAM	14.2 Mb/74.3 Mb/99 Mb

Feature summary	X3522:
	• Secure firmware upgrade and hardware root of trust
	• OS support:
	  ◦ Red Hat Enterprise Linux (RHEL)
	  ◦ Ubuntu
	• UEFI boot support
	• PXE over UEFI
	• NC-SI/PLDM over MCTP SMBus
	• MCTP PCIe VDM
	• Onload support
	• TCPDirect support
	• ef_vi support
	X3522PV:
	• Secure firmware upgrade and hardware root of trust
	• Support for XRT/XOCL
	• Support for custom accelerated applications to enable new functionality programmed via P4, HLS, or RTL

The following figure shows the components within the Alveo X3522 NICs.

Figure 2: **Alveo X3522 Block Diagram**



The XCUX35 is based on the AMD 16 nm AMD UltraScale™ architecture. The programmable logic (PL) region is connected to two DSFP28 cages, each of which supports two ports via a shared PF, currently at 10 GbE. The XCUX35 also has two 4 GB ×72 DDR4 memory component interfaces and a PCIe CEM 3.0 compliant ×8 edge-finger interface.

Card Specifications

Dimensions

The Alveo X3522 NICs are compliant with the PCIe CEM rev. 3.0 specification as single slot, half height, half length cards. The dimensions in the following table do not include the bracket.

Table 2: **Card Dimensions**

Parameter	Dimension
Height	0.72 inch (18.3 mm)
Width	2.73 inch (68.90 mm)
Length	6.6 inch (167.65 mm)

Network Interfaces and Manageability

The X3522 low latency network adapter supports both in-band and out-of-band communication with the host.

In-band communication is provided by PCIe bus with eight lanes allocated to the XCUX35. In addition, in-band communication with the management subsystem, particularly reading any sensor values, is done via the satellite microcontroller on board the NIC. The sensor values can be read using the sensors command from the lm_sensors package in your Linux distribution.

For out-of-band communications, the platform management subsystem on the NIC uses Platform Management Components Intercommunication (PMCI) conformance standards and command implementations. Adapter manageability is supported through the platform level data model (PLDM) and network controller sideband interface (NC-SI) specifications. Limited manageability is also available through the unified extensible firmware interface (UEFI) and command line processing (CLP) interfaces.

The X3522 low latency network adapter supports the following manageability protocols:

- PLDM
- NC-SI

The X3522 low latency network adapter supports the following manageability transports:

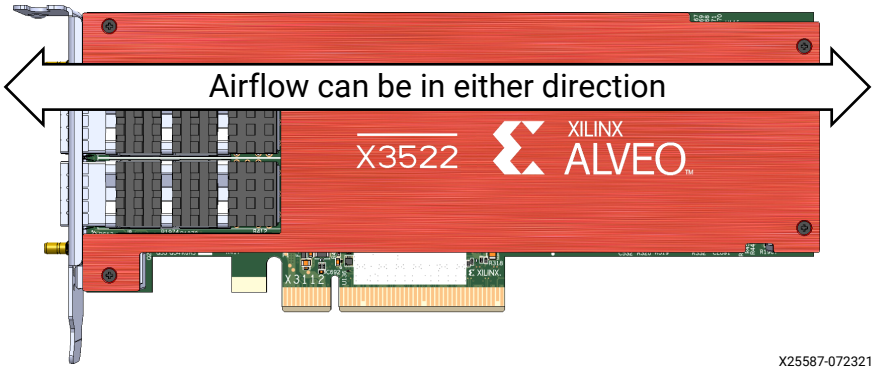
- MCTP SMBus
- MCTP PCIe VDM

Thermal Specifications

The Alveo X3522 NICs support airflow in either direction:

- Normal flow, where airflow is out from the I/O bracket.
- Reverse flow, where airflow is into the I/O bracket.

Figure 3: **Airflow Direction for X3522 NICs**



The following table shows requirements for Alveo X3522 NICs that are dependent on airflow direction.

Table 3: **Airflow Direction Dependent Requirements**

Specification	Requirements
DSFP case temperature for airflow entering PCIe bracket	DSFP(≤ 2.5W) case should be rated 70°C
DSFP case temperature for airflow exiting PCIe bracket	DSFP (≤ 2.5W) case should be rated 85°C
Airflow entering PCIe bracket area	66.87 mm x 13.18 mm
Airflow exiting PCIe bracket area	56.51 mm x 20.33 mm

Inlet Temperature versus Airflow Requirement in Server

The following tables provide the required airflow rate and airflow speed to X3522 NICs under various operating conditions for 35W total card power. This is indicative of requirements for the X3522 low latency network adapter.

Table 4: **Normal Flow (Exhaust Air from I/O Bracket) at Sea Level for 35W**

Inlet Temperature vs Airflow Requirement of PCIe Card Slot (56.51 mm x 20.33 mm) at Sea Level for 35W Total Card Power						
Inlet Temperature to the Card (°C)	With SFP28 (75°C)			Without SFP28[1]		
	CFM	LFM	Static Pressure	CFM	LFM	Static Pressure
25	1.4	110	0.08	1.4	120	0.09
30	1.6	130	0.10	1.7	140	0.11
35	2.0	160	0.12	2.1	170	0.13
40	2.5	210	0.17	2.6	220	0.18
45	3.3	270	0.24	3.5	290	0.26
50	4.6	380	0.38	4.9	400	0.41
55	7.3	600	0.74	7.7	630	0.80

Notes:

1. A card without SFP28 allocates more power in the FPGA than one with SFP28.

Table 5: **Normal Flow (Exhaust Air from I/O Bracket) at 1200m Above Sea Level for 35W**

Inlet Temperature vs Airflow Requirement of PCIe Card Slot (56.51 mm x 20.33 mm) at 1200m Above Sea Level for 35W Total Card Power						
Inlet Temperature to the Card (°C)	With SFP28 (75°C)			Without SFP28[1]		
	CFM	LFM	Static Pressure	CFM	LFM	Static Pressure
25	1.4	120	0.09	1.5	130	0.09
30	1.7	140	0.11	1.8	150	0.12
35	2.1	180	0.14	2.2	190	0.15
40	2.7	220	0.18	2.8	230	0.20
45	3.5	290	0.26	3.7	310	0.28
50	5.0	410	0.42	5.3	430	0.46
55	7.9	640	0.84	8.3	680	0.90

Notes:

1. A card without SFP28 allocates more power in the FPGA than one with SFP28.

Table 6: **Reverse Flow (Inlet Air from I/O Bracket) at Sea Level for 35W**

Inlet Temperature vs Airflow Requirement of PCIe Card Slot (66.87 mm x 13.18 mm) at Sea Level for 35W Total Card Power						
Inlet Temperature to the Card (°C)	With SFP28 (75°C)			Without SFP28[1]		
	CFM	LFM	Static Pressure	CFM	LFM	Static Pressure
25	0.7	70	0.04	0.8	80	0.04
30	0.8	80	0.04	0.9	90	0.04
35	0.9	100	0.05	1.0	110	0.05
40	1.0	110	0.07	1.1	130	0.06
45	1.2	130	0.09	1.4	150	0.08
50	1.5	160	0.12	1.6	180	0.10
55	1.6	180	0.14	1.8	190	0.11
60	2.1	220	0.20	2.2	240	0.16

Notes:

1. A card without SFP28 allocates more power in the FPGA than one with SFP28.

Table 7: **Reverse Flow (Inlet Air from I/O Bracket) at 1200m Above Sea Level for 35W**

Inlet Temperature vs Airflow Requirement of PCIe Card Slot (66.87 mm x 13.18 mm) at 1200m Above Sea Level for 35W Total Card Power						
Inlet Temperature to the Card (°C)	With SFP28 (75°C)			Without SFP28[1]		
	CFM	LFM	Static Pressure	CFM	LFM	Static Pressure
25	0.7	80	0.04	0.8	90	0.04
30	0.8	90	0.05	0.9	100	0.05
35	0.9	100	0.06	1.1	120	0.06
40	1.1	120	0.08	1.2	130	0.07
45	1.3	140	0.10	1.5	160	0.09
50	1.6	180	0.13	1.8	190	0.11
55	1.8	190	0.15	1.9	210	0.13
60	2.2	240	0.22	2.4	260	0.18

Notes:

1. A card without SFP28 allocates more power in the FPGA than one with SFP28.

The following tables provide the required airflow rate and airflow speed to X3522 NICs under various operating conditions for 70W total card power. This is indicative of requirements for the X3522PV adaptable accelerator card.

Table 8: **Normal Flow (Exhaust Air from I/O Bracket) at Sea Level for 70W**

Inlet Temperature vs Airflow Requirement of PCIe Card Slot (56.51 mm x 20.33 mm) at Sea Level for 70W Total Card Power						
Inlet Temperature to the Card (°C)	With SFP28 (75°C)			Without SFP28[1]		
	CFM	LFM	Static Pressure	CFM	LFM	Static Pressure
25	3.6	300	0.27	3.8	310	0.29
30	4.3	350	0.34	4.5	370	0.37
35	5.2	430	0.45	5.5	450	0.49
40	6.6	540	0.64	6.9	570	0.68
45	8.7	710	0.97	9.1	740	1.04
50	12.3	1000	1.69	12.8	1040	1.81
55	19.5	1580	3.67	20.2	1640	3.92

Notes:

1. A card without SFP28 allocates more power in the FPGA than one with SFP28.

Table 9: **Normal Flow (Exhaust Air from I/O Bracket) at 1200m Above Sea Level for 70W**

Inlet Temperature vs Airflow Requirement of PCIe Card Slot (56.51 mm x 20.33 mm) at 1200m Above Sea Level for 70W Total Card Power						
Inlet Temperature to the Card (°C)	**With SFP28 (75°C)**			**Without SFP28[1]**		
	CFM	**LFM**	**Static Pressure**	**CFM**	**LFM**	**Static Pressure**
25	3.9	320	0.30	4.1	330	0.32
30	4.6	380	0.38	4.9	400	0.41
35	5.6	460	0.50	5.9	480	0.54
40	7.1	580	0.71	7.5	610	0.76
45	9.4	760	1.09	9.8	800	1.17
50	13.3	1080	1.91	13.8	1120	2.05
55	21.1	1710	4.20	21.8	1770	4.48

Notes:

1. A card without SFP28 allocates more power in the FPGA than one with SFP28.

Table 10: **Reverse Flow (Inlet Air from I/O Bracket) at Sea Level for 70W**

Inlet Temperature vs Airflow Requirement of PCIe Card Slot (66.87 mm x 13.18 mm) at Sea Level for 70W Total Card Power						
Inlet Temperature to the Card (°C)	**With SFP28 (75°C)**			**Without SFP28[1]**		
	CFM	**LFM**	**Static Pressure**	**CFM**	**LFM**	**Static Pressure**
25	2.6	280	0.29	2.8	300	0.22
30	3.0	330	0.37	3.2	340	0.27
35	3.5	380	0.47	3.7	390	0.34
40	4.2	440	0.62	4.3	450	0.43
45	5.0	530	0.85	5.0	540	0.57
50	6.1	640	1.22	6.1	640	0.78
55	6.6	700	1.42	6.6	700	0.89
60	8.3	880	2.19	8.2	870	1.31

Notes:

1. A card without SFP28 allocates more power in the FPGA than one with SFP28.

Table 11: **Reverse Flow (Inlet Air from I/O Bracket) at 1200m Above Sea Level for 70W**

Inlet Temperature vs Airflow Requirement of PCIe Card Slot (66.87 mm x 13.18 mm) at 1200m Above Sea Level for 70W Total Card Power						
Inlet Temperature to the Card (°C)	With SFP28 (75°C)			Without SFP28[1]		
	CFM	LFM	Static Pressure	CFM	LFM	Static Pressure
25	2.8	300	0.33	3.0	320	0.25
30	3.3	350	0.41	3.4	360	0.30
35	3.8	400	0.53	3.9	420	0.38
40	4.5	480	0.71	4.6	490	0.49
45	5.3	570	0.97	5.4	580	0.64
50	6.5	690	1.40	6.5	690	0.88
55	7.1	760	1.64	7.1	750	1.02
60	9.0	960	2.53	8.8	940	1.50

Notes:

1. A card without SFP28 allocates more power in the FPGA than one with SFP28.

Operating and Storage Conditions

Table 12: **Operating and Storage Environmental Conditions**

Specification	Requirements
Storage temperature	–40°C to 75°C
Storage humidity, non-condensing	5% to 95%
Operating temperature gradient	15°C/hour
Operating humidity, non-condensing	8% to 90%, and a dew point of –12°C

Notes:

1. The above operating conditions are based on preliminary data. X3522 NICs are targeted to operate between an inlet ambient from 5°C to 55°C. For more information, contact your AMD sales representative.

Regulatory Compliance Statements

FCC Class A Products

***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.

- EU LVD Directive 2014/35/EU
- Electrical Equipment (Safety) Regulations 2016 (UK)

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
- Electromagnetic Compatibility Regulations 2016 (UK)
- 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
- UKCA mark
- FCC markings
- VCCI marking
- Australian C-Tick mark
- Korea MSIP mark
- Taiwan BSMI mark

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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.*

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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

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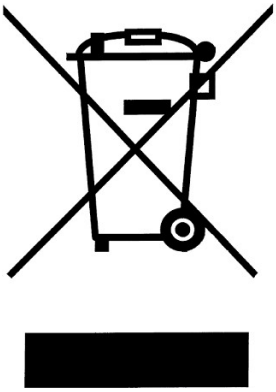

Manufacturer Declaration European Community

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

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.

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Responsible Party

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Revision History

The following table shows the revision history for this document.

Section	Revision Summary
08/25/2023 Version 1.3	
Product Details	Updated to remove hybrid mode.

Section	Revision Summary
Inlet Temperature versus Airflow Requirement in Server	Updated to remove hybrid mode.
07/31/2023 Version 1.2	
General updates.	Editorial updates only. No technical content updates.
04/07/2023 Version 1.1	
General updates.	Editorial updates only. No technical content updates.
10/18/2022 Version 1.0	
Initial release.	N/A

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