

Alveo U30 Data Center Accelerator Card

Installation Guide

UG1425 (v1.1) November 2, 2020



Revision History

The following table shows the revision history for this document.

Section	Revision Summary
11/02/2020 Version 1.1	
Chapter 1: Introduction	Updated operating power.
Installing the Card	Updated output log.
Installing the Deployment Software	Removed chapter.
Multiple Devices and YAML Configuration	Removed chapter.
Changing XRT and Target Platform Versions	Removed appendix.
06/16/2020 Version 1.0	
Initial release.	N/A

Table of Contents

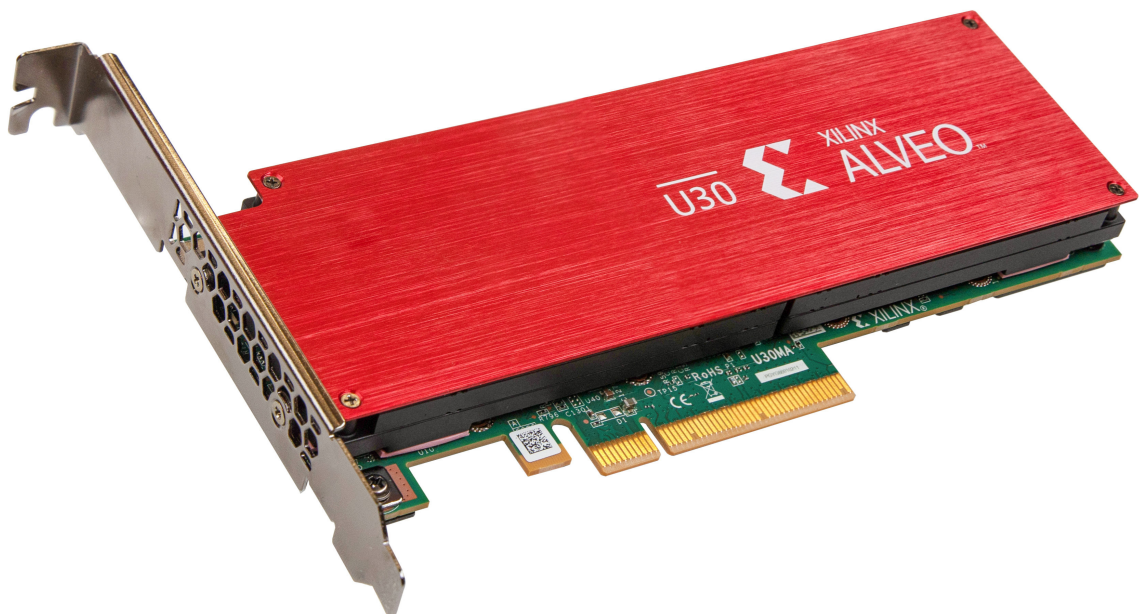
Revision History.....	2
Chapter 1: Introduction.....	4
Minimum System Requirements.....	5
Chapter 2: Card Installation Procedures.....	6
Safety Instructions.....	6
Before You Begin.....	8
Installing the Card.....	9
Chapter 3: Troubleshooting.....	11
Appendix A: Regulatory and Compliance Information.....	12
Safety Compliance.....	12
EMC Compliance.....	12
CE Directives.....	13
CE Standards.....	13
Other Compliance Statements.....	14
Appendix B: Additional Resources and Legal Notices.....	18
Xilinx Resources.....	18
Documentation Navigator and Design Hubs.....	18
References.....	18
Please Read: Important Legal Notices.....	19

Introduction

This document provides hardware installation procedures for the Alveo™ U30 Data Center accelerator card.

The Xilinx® Alveo U30 data center accelerator card, shown in the following figure, is a single slot, half-height, half-length, low profile form factor passively-cooled card operating up to a 25W total dissipated power (TDP). It has a bifurcated Gen3 x8 to form two independent Gen3 x4 PCI Express® (PCIe) compliant interfaces. It features two Zynq® UltraScale+™ MPSoCs to accelerate HD video transcoding and analytics. It targets high density video transcoding application, capable of decoding, scaling, and encoding up to eight 1080p60 streams. The U30 card provides superb power and cost performance for such video applications.

Figure 1: Alveo U30 Card with Full-Height Bracket



Minimum System Requirements

The minimum system requirements for running the Alveo™ U30 Data Center accelerator cards are listed below:

Table 1: Minimum System Requirements

Component	Requirement
Motherboard	Can be used with either PCI Express®-compliant Gen3x16 or Gen3x8 with x4x4 bifurcation enabled in the BIOS.
System Power Supply	75W
Operating System	Linux, 64-bit: <ul style="list-style-type: none"> • Ubuntu 16.04
System Memory	For deployment installations, a minimum of 16 GB is required.
Internet Connection	Required for downloading drivers and utilities.
Hard disk space	Satisfy the minimum system requirements for your operating system.
Licensing	None required for application deployment.

For details on the acceptable environmental conditions, see *Alveo U30 Data Center Accelerator Cards Data Sheet* ([DS970](#)).

Card Installation Procedures

To reduce the risk of fire, electric shock, or injury, always follow basic safety precautions.



CAUTION! *You must always use an ESD strap or other antistatic device when handling hardware.*



ATTENTION! *Il est fortement recommandé d'utiliser un bracelet ESD ou autres dispositifs antistatiques.*



VORSICHT! *Beim Umgang mit Hardware müssen sie immer ein Erdungs Armband oder ein anderes antistatisches Gerät verwenden.*

Safety Instructions

Safety Information

To ensure your personal safety and the safety of your equipment:

- Keep your work area and the computer/server clean and clear of debris.
- Before opening the computer/system cover, unplug the power cord.

Dispositif de Sécurité

Pour assurer votre sécurité personnelle et la sécurité de votre équipement:

- Maintenez votre zone de travail et l'ordinateur/serveur propre et dégagé de débris.
- Avant d'ouvrir le capot de l'ordinateur/système, débranchez le cordon d'alimentation.

Sicherheitsinformation

Um ihre persönliche Sicherheit und die Sicherheit ihrer Ausrüstung zu gewährleisten:

- Halten sie ihren Arbeitsbereich und den Computer / Server sauber und frei von Ablagerungen.
- Ziehen sie vor dem Öffnen der Computer / Systemabdeckung das Netzkabel ab.

Electrostatic Discharge Caution

Electrostatic discharge (ESD) can damage electronic components when they are improperly handled, and can result in total or intermittent failures. Always follow ESD-prevention procedures when removing and replacing components.

To prevent ESD damage:

- Use an ESD wrist or ankle strap and ensure that it makes skin contact. Connect the equipment end of the strap to an unpainted metal surface on the chassis.
- Avoid touching the card against your clothing. The wrist strap protects components from ESD on the body only.
- Handle the card by its bracket or edges only. Avoid touching the printed circuit board or the connectors.
- Put the card down only on an antistatic surface such as the bag supplied in your kit.
- If you are returning the card to Xilinx Product Support, place it back in its antistatic bag immediately.

Attention aux Décharge Électrostatique (ESD)

L'ESD peut endommager les composants électroniques lorsqu'ils sont mal manipulés, et peut entraîner des défaillances totales ou intermittentes. Suivez toujours les procédures de prévention contre les ESD lors du retrait et remplacement des composants.

Pour prévenir les dommages dus aux ESD:

- Utilisez une sangle de poignet ou de cheville anti-ESD et assurez-vous qu'elle est en contact avec la peau. Branchez l'extrémité du câble de la sangle à une surface métallique non peinte du châssis et à la masse.
- Évitez de mettre en contact la carte de circuit imprimé ou les connecteurs avec vos vêtements. La sangle de poignet protège la carte ou connecteurs contre les ESD du corps seulement.
- Manipulez la carte uniquement par son support ou par ses bords. Évitez de toucher la carte de circuit imprimé ou les connecteurs.
- Ne posez la carte de circuit imprimé ou les connecteurs que sur une surface antistatique telle que le sac anti-statique fourni avec la carte.
- Si vous retournez la carte à Xilinx, remettez-la dans son sac antistatique immédiatement.

Vorsicht Elektrostatische Entladung

Elektrostatische Entladung (ESD) kann elektronische Bauteile beschädigen, wenn sie unsachgemäß behandelt werden, und es kann zu totalen oder zeitweiligen Ausfällen kommen. Befolgen sie beim Entfernen und Austauschen von Komponenten stets die ESD-Schutzmaßnahmen.

So verhindern sie ESD-Schäden:

- Verwenden sie einen ESD-Handgelenk-oder Knöchelriemen und stellen sie sicher, dass er Hautkontakt hat. Verbinden sie das Ende des Riemens mit einer unlackierten Metalloberfläche am Gehäuse.
- Berühren sie die Karte nicht mit ihrer Kleidung. Der Riemen schützt Komponenten nur vor ESD am Körper.
- Fassen sie die Karte nur an der Halterung oder an den Kanten an. Berühren sie nicht die Leiterplatte oder die Anschlüsse.
- Legen sie die Karte nur auf einer antistatischen Oberfläche ab, z.B. dem antistatischen Beutel der mit dem Kit mitgeliefert wurde.
- Wenn sie die Karte an den Xilinx Product Support zurücksenden, legen Sie sie bitte sofort wieder in den antistatischen Beutel.

Before You Begin



IMPORTANT! *Alveo™ cards are delicate and sensitive electronic devices; equipment is to be installed by a qualified technician only. This equipment is intended for installation in a Restricted Access Location.*



IMPORTANT! *Les cartes Alveo™ sont des appareils électronique sensibles et fragiles; l'équipement doit être installé par un technicien certifié seulement. Cet équipement est destiné à être installé dans un lieu d'accès restreint.*



WICHTIG! *Die Karten Alveo™ sind sensible und empfindliche elektronische Geräte. Das Gerät darf nur von einem qualifizierten Techniker installiert werden. Dieses Gerät ist für die Installation an einem Ort mit begrenztem Zugang vorgesehen.*

- Verify that the minimum card space is available to install your card. Card specifications and dimensions can be found in *Alveo U30 Data Center Accelerator Cards Data Sheet* ([DS970](#)).
- Check for card compatibility with the system. Also check for proper system requirements such as power, bus type, and physical dimensions to support the card.

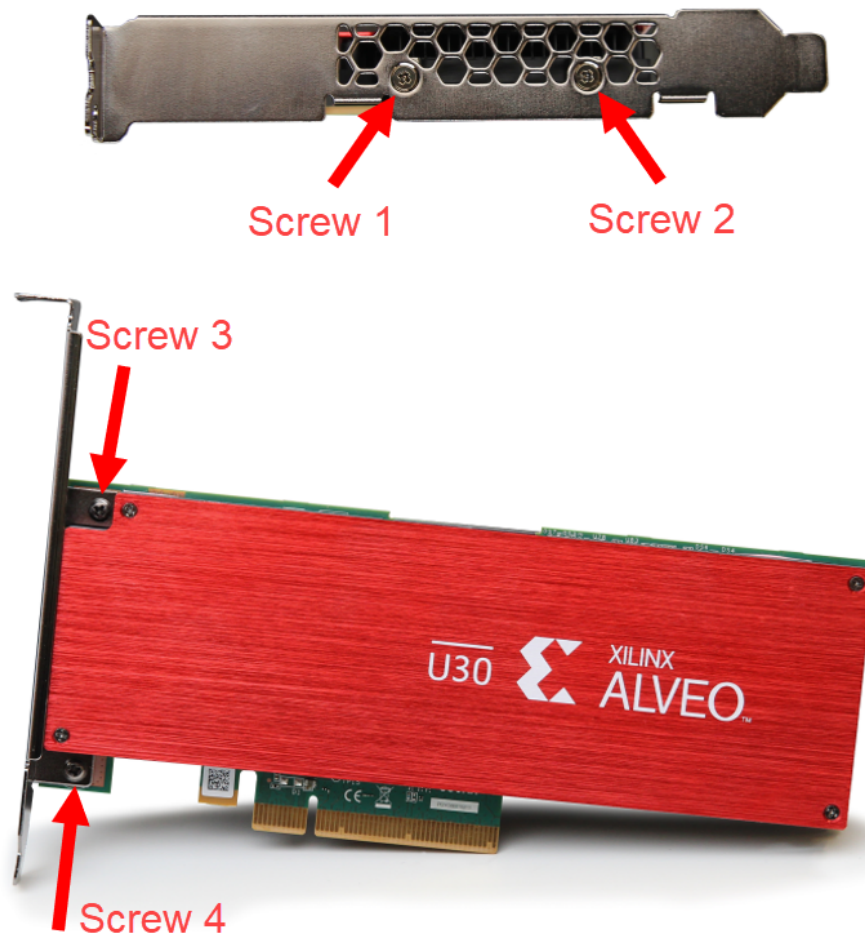
Replacing the Bracket

The Alveo U30 card can be used with either a full-height or half-height bracket. Depending on your system, it may be necessary to switch between the full and half-height bracket on the card. The bracket is secured to the card with four screws, as shown in the figure below. To replace the bracket, follow the instructions below.

1. Remove screws 1 and 2 from the card.
2. Remove screws 3 and 4 from the card.

3. Remove the bracket from the card.
4. Place the new bracket on the card and align it with the card's connectors and screw locations.
5. Replace screws 1 and 2 on the new bracket.
6. Replace screws 3 and 4 on the new bracket.

Figure 2: Screw Locations on Bracket



Installing the Card

The following procedure is a guide for the Xilinx® Alveo™ U30 Data Center accelerator card installation. Consult your computer documentation for additional information.

Note: For use with UL Listed Servers or ITE.

If you encounter any issues during installation, see [Chapter 3: Troubleshooting](#).

1. Shut down the host computer and unplug the power cord.
2. Open your computer by removing the casing.
3. If necessary, remove the adjacent PCIe® slot cover corresponding to the PCIe slot in which you are installing the Alveo card.
4. Plug the Alveo card into the PCIe x8 or x16 slot on the motherboard.
5. Re-install the computer casing.
6. Connect the power cord and turn on the computer.



WARNING! Do not power-on a passively cooled card without adequate forced airflow across the card with proper air flow direction, otherwise the card can be damaged. This card can heat up after use in the server. Use caution when handling. For more information, see Alveo U30 Data Center Accelerator Cards Data Sheet ([DS970](#)).

7. To verify that the device has been installed correctly, enter the following Linux command in the terminal:

```
$ sudo lspci -vd 10ee:
```

If the card is successfully installed and found by the operating system, a message similar to the one below will be displayed.

```
00:08.0 Processing accelerators: Xilinx Corporation Device d03c (rev 02)
Subsystem: Xilinx Corporation Device 000e
Physical Slot: 8
Flags: fast devsel, IRQ 11
Memory at fc000000 (32-bit, non-prefetchable) [size=32M]
Memory at fe050000 (32-bit, non-prefetchable) [size=64K]
Capabilities: [40] Power Management version 3
Capabilities: [48] MSI: Enable- Count=1/1 Maskable- 64bit+
Capabilities: [70] Express Endpoint, MSI 00
```

If you do not see a similar message, see [Chapter 3: Troubleshooting](#).

Troubleshooting

The following table lists potential issues, causes, and fixes related to card installation.

Table 2: Card Troubleshooting

Issue	Potential Cause	Fix
Card not found.	Card not correctly installed.	Reinstall the card following the installation instructions. Check if the card shows up by typing the following Linux command: <code>lspci -vd 10ee:</code>
	Card not compatible with server.	Use qualified server. For system capabilities, see <i>Alveo U30 Data Center Accelerator Cards Data Sheet (DS970)</i> .
	Kernel version is incompatible.	Run <code>uname -r</code> to check the kernel version.
lspci no longer recognizes the card.	Card is overheating.	Ensure that operating ambient conditions do not exceed specifications and passive cards are in a system that provides adequate airflow. For more information about airflow requirements, see <i>Alveo U30 Data Center Accelerator Cards Data Sheet (DS970)</i> .

Regulatory and Compliance Information

This product is designed and tested to conform to the European Union directives and standards described in this section.

Safety Compliance

The following table shows the safety standards that apply to the Alveo U30 cards.

Table 3: Safety Standards

Safety Standard	Alveo U30
IEC 62368-1:2014 (Second Edition)	✓
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 tables show the EMC standards that apply to the Alveo U30 cards.

Class A Products

Table 4: EMC Standards

Standard	Alveo U30
FCC Part 15 – Radiated & Conducted Emissions (USA)	✓
CAN ICES-3(A)/NMB-3(A) – Radiated & Conducted Emissions (Canada)	✓
CISPR 32 – Radiated & Conducted Emissions (International)	✓

Table 4: EMC Standards (cont'd)

Standard	Alveo U30
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

The following table shows the product certification markings that are provided, when required, with the Alveo U30 cards.

Table 5: Product Certification Markings

Product Certification Markings	Alveo U30
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	✓

CE Directives

2014/35/EC, *Low Voltage Directive (LVD)*

2014/30/EC, *Electromagnetic Compatibility (EMC) Directive*

CE Standards

EN standards are maintained by the European Committee for Electrotechnical Standardization (CENELEC). IEC standards are maintained by the International Electrotechnical Commission (IEC).

Electromagnetic Compatibility

EN:55032:2015, *Information Technology Equipment Radio Disturbance Characteristics – Limits and Methods of Measurement*

EN:55024:2015, *Information Technology Equipment Immunity Characteristics – Limits and Methods of Measurement*

This is a Class A product. In a domestic environment, this product can cause radio interference, in which case the user might be required to take adequate measures.


Other Compliance Statements


The following sections only apply to Alveo U30 cards.

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)

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る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)

CLASS A device
(commercial broadcasting
and communication
equipment)

이 기기는 업무용(A급)으로 전자파적합등록을 한 기기이오니 판매자 또는 사용자는 이 점을 주의하시기 바라며, 가정외의 지역에서 사용하는 것을 목적으로 합니다.

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。

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

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 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.



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

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

Additional Resources and Legal Notices

Xilinx Resources

For support resources such as Answers, Documentation, Downloads, and Forums, see [Xilinx Support](#).

Documentation Navigator and Design Hubs

Xilinx[®] Documentation Navigator (DocNav) provides access to Xilinx documents, videos, and support resources, which you can filter and search to find information. To open DocNav:

- From the Vivado[®] IDE, select **Help** → **Documentation and Tutorials**.
- On Windows, select **Start** → **All Programs** → **Xilinx Design Tools** → **DocNav**.
- At the Linux command prompt, enter `docnav`.

Xilinx Design Hubs provide links to documentation organized by design tasks and other topics, which you can use to learn key concepts and address frequently asked questions. To access the Design Hubs:

- In DocNav, click the **Design Hubs View** tab.
- On the Xilinx website, see the [Design Hubs](#) page.

Note: For more information on DocNav, see the [Documentation Navigator](#) page on the Xilinx website.

References

These documents provide supplemental material useful with this guide:

1. *Vitis Unified Software Platform Documentation: Application Acceleration Development* ([UG1393](#))
2. *Vitis Unified Software Platform Documentation: Embedded Software Development* ([UG1400](#))
3. [Vitis 2020.1 Software Platform Release Notes](#) in the *Vitis Unified Software Platform Documentation* ([UG1416](#))
4. *Vitis Application Acceleration Development Flow Tutorials* ([GitHub](#))

Alveo Documents

1. *Alveo U30 Data Center Accelerator Cards Data Sheet* ([DS970](#))

Additional Xilinx Resources

1. Xilinx licensing website: <https://www.xilinx.com/getproduct>
2. Vitis Developer Zone: <https://www.xilinx.com/products/design-tools/vitis/vitis-platform.html>
3. Xilinx Community Forums: <https://forums.xilinx.com>
4. [Xilinx Third-Party End User License Agreement](#)
5. [End-User License Agreement](#)

Please Read: Important Legal Notices

The information disclosed to you hereunder (the "Materials") is provided solely for the selection and use of Xilinx products. To the maximum extent permitted by applicable law: (1) Materials are made available "AS IS" and with all faults, Xilinx hereby DISCLAIMS ALL WARRANTIES AND CONDITIONS, EXPRESS, IMPLIED, OR STATUTORY, INCLUDING BUT NOT LIMITED TO WARRANTIES OF MERCHANTABILITY, NON-INFRINGEMENT, OR FITNESS FOR ANY PARTICULAR PURPOSE; and (2) Xilinx shall not be liable (whether in contract or tort, including negligence, or under any other theory of liability) for any loss or damage of any kind or nature related to, arising under, or in connection with, the Materials (including your use of the Materials), including for any direct, indirect, special, incidental, or consequential loss or damage (including loss of data, profits, goodwill, or any type of loss or damage suffered as a result of any action brought by a third party) even if such damage or loss was reasonably foreseeable or Xilinx had been advised of the possibility of the same. Xilinx assumes no obligation to correct any errors contained in the Materials or to notify you of updates to the Materials or to product specifications. You may not reproduce, modify, distribute, or publicly display the Materials without prior written consent. Certain products are subject to the terms and conditions of Xilinx's limited warranty, please refer to Xilinx's Terms of Sale which can be viewed at [https://](#)

www.xilinx.com/legal.htm#tos; IP cores may be subject to warranty and support terms contained in a license issued to you by Xilinx. Xilinx products are not designed or intended to be fail-safe or for use in any application requiring fail-safe performance; you assume sole risk and liability for use of Xilinx products in such critical applications, please refer to Xilinx's Terms of Sale which can be viewed at <https://www.xilinx.com/legal.htm#tos>.

AUTOMOTIVE APPLICATIONS DISCLAIMER

AUTOMOTIVE PRODUCTS (IDENTIFIED AS "XA" IN THE PART NUMBER) ARE NOT WARRANTED FOR USE IN THE DEPLOYMENT OF AIRBAGS OR FOR USE IN APPLICATIONS THAT AFFECT CONTROL OF A VEHICLE ("SAFETY APPLICATION") UNLESS THERE IS A SAFETY CONCEPT OR REDUNDANCY FEATURE CONSISTENT WITH THE ISO 26262 AUTOMOTIVE SAFETY STANDARD ("SAFETY DESIGN"). CUSTOMER SHALL, PRIOR TO USING OR DISTRIBUTING ANY SYSTEMS THAT INCORPORATE PRODUCTS, THOROUGHLY TEST SUCH SYSTEMS FOR SAFETY PURPOSES. USE OF PRODUCTS IN A SAFETY APPLICATION WITHOUT A SAFETY DESIGN IS FULLY AT THE RISK OF CUSTOMER, SUBJECT ONLY TO APPLICABLE LAWS AND REGULATIONS GOVERNING LIMITATIONS ON PRODUCT LIABILITY.

Copyright

© Copyright 2020 Xilinx, Inc. Xilinx, the Xilinx logo, Alveo, Artix, Kintex, Spartan, Versal, Virtex, Vivado, Zynq, and other designated brands included herein are trademarks of Xilinx in the United States and other countries. PCI, PCIe, and PCI Express are trademarks of PCI-SIG and used under license. All other trademarks are the property of their respective owners.