# Summary

The AMD Kria™ KD240 Drive Starter Kit is comprised of a non-production version of the K24 system-on-module (SOM), carrier card, and thermal solution. The SOM is very compact and only includes key components such as an AMD Zynq™ UltraScale+™ MPSoC based silicon device, memory, boot, and security module. The carrier card includes a power solution, three network interfaces, a microSD card, three-phase power inverter, and multiple analog-to-digital converter channels. The thermal solution has a passive heat sink. The Kria KD240 Drives Starter Kit is designed to provide customers a platform to evaluate their target applications and ultimately design their own carrier card with AMD K24 SOMs. While the SOM itself has broad applicability across markets and applications, the target applications for the Kria KD240 Drives Starter Kit are focused on electric drives.

Figure 1: **Kria KD240 Drives Starter Kit**
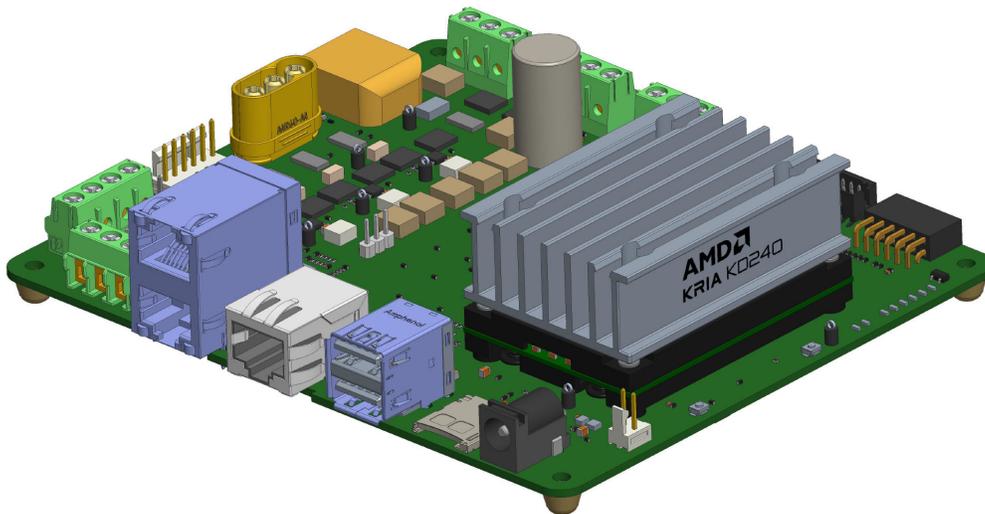

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Product Details

The Kria KD240 Drives Starter Kit is an evaluation platform for the K24 SOM focused on motor control and power conversion applications. The kit brings together a Zynq UltraScale+ MPSoC based SOM with a peripheral set and pre-built accelerated applications focused on motor control. The KD240 and its base K24 SOM are supported for full user customization through the AMD Vitis™ platforms, customizable acceleration overlays, and AMD Vivado™ tools hardware board files. The integrated combination of hardware, platform, and software provides a quick out-of-box experience for developers that can then be leveraged for product designs.

Note: The SOM on the Kria KD240 Drives Starter Kit does not populate the eMMC.

Figure 2: **KD240 Starter Kit Block Diagram**
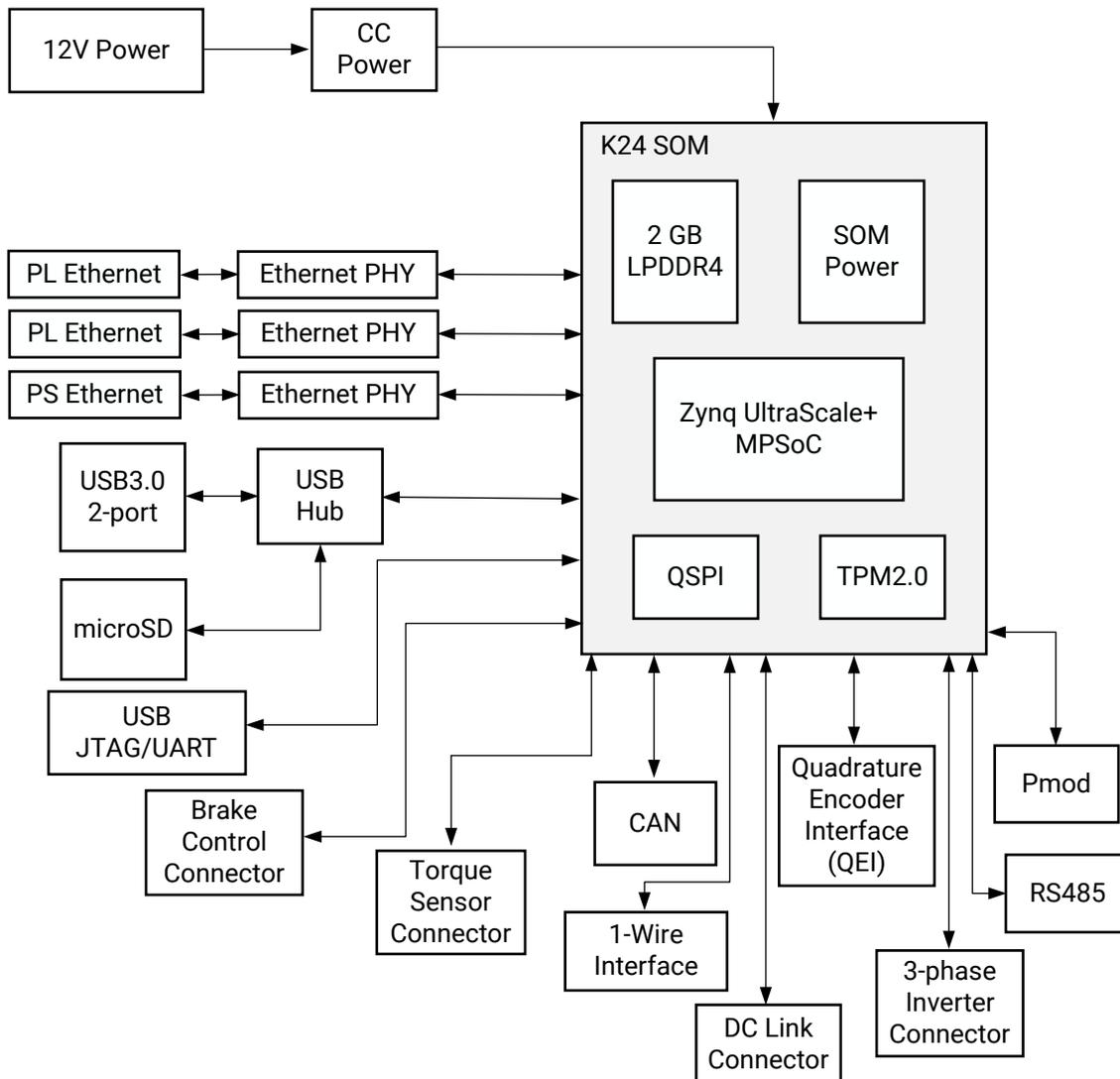
X27683-022123

Table 1: **Kria KD240 Drives Starter Kit Product Details**

Specification	Description
Thermal cooling solution	Passive
Weight	237g
Form factor	SOM + Carrier Card
Dimensions of the KD240 Starter Kit	124 mm x 142 mm x 37 mm
Dimensions of the K24 SOM with thermal solution	60 mm x 41.3 mm x 30 mm
Dimensions of the carrier card	124 mm x 142 mm x 34 mm
System logic cells	154K
Block RAM blocks	216
UltraRAM blocks	0
DSP slices	360
Ethernet interface	x1 PS (GEM1) Gb RGMII Ethernet x2 PL Gb RGMII Ethernet with time sensitive networking (TSN), Ethernet for control automation technology (EtherCAT) support
LPDDR4 memory	2 GB (2 channel x 256 Mb x 16 bit/channel)
Primary boot memory	512 Mb QSPI
Secondary boot memory	microSD card
Device Security	Zynq UltraScale+ MPSoC hardware root of trust (RoT) in support of secure boot. Infineon TPM2.0 in support of measured boot.
USB3.0 interface	USB 3.0 downstream (Host), with 2 user physical ports
PMOD 12-pin interface	x1, supporting interfaces
CAN connector	x1 PS-based CAN
Torque sensor connector	x1
QEI connector	x1 single ended and x1 differential, with on board 2-pin header that is used to choose one
3-phase motor connector	x1
DC link connector	x1
RS485 connector	x1 PS-based RS485
Brake control connector	x1
1-wire interface	x1

Ordering Information

Table 2: **Ordering Information**

Product SKU	Device	Temperature Grade	Description
SK-KD240-G	XCK24-C	Commercial	KD240 Starter Kit with encryption enabled

Power and Electrical

This section describes the power requirements, power-on sequence, power-on reset sequence, and power management functions.

Table 3: **KD240 Starter Kit Power Specifications**

Parameter	Description
DC input power	+12V, 3A
Recommended power adapter	The CUI Inc. SMI36-12-V-P6 adapter connected using a center-pin positive barrel connector (2.5 mm ID, 5.5 mm OD)
SOM supply	+5V, 3A (V_{CC_SOM})
SOM power telemetry	Current sense device (INA260) is available through the I2C bus address `0x40` to monitor the current on the V_{CC_SOM} power rail. Refer to the *Kria KD240 Drives Starter Kit User Guide* (UG1093) for the `xlnx_platformstats` application that is provided in the AMD pre-built images to read this information.
USB 3.0	5V, 900 mA per port (limited to 2.1A total)
microSD card	3.3V, 200 mA
Pmod interface from Digilent Inc.	3.3V, 100 mA
1-wire temperature sensor I/O	3.3V
1-wire temperature sensor power	3.3V, 100 mA
Single-ended encoder I/O	V_{IH} = 3.3V to 5.5V, V_{IL} = 0 to 1.8V
Single-ended encoder power	5V, 0.1A
Differential encoder I/O	V_{IH} = 2V to 5.5V, V_{IL} = 0 to 0.8V
Differential encoder power	5V, 0.1A
Torque sensor analog input	0.3V to 3.4V
Torque sensor power	4.5V, 400 mA, can support 350Ω and 120Ω passive strain gauges
Inverter Power Domain	
DC link	33V 20A nominal, absolute maximum of 36.7V 30A [1, 2]. The DC link voltage and current measurements are available through readback of the 12-bit AD7352 ADC. • ADC SCLK for DC link is connected to HPA12P_CLK • ADC CS_N for DC link is connected to HPA13N • DC link voltage data is read from HPA12N • DC link current data is read from HPA13P
Interface voltage	Set by DC_LINK input
Interface current	Current based on safe operating area (SOA) of MOSFET. CSD18512 SOA < 40V, DC_LINK 36.7V maximum.[1] Refer to the CSD18512 data sheet for details and other design criteria surrounding the SOA.
Brake connector voltage	DC_LINK
Brake connector current	Current based on SOA of MOSFET. CSD18512 SOA < 40V, DC_LINK 36.7V maximum.[1] Refer to the CSD18512 data sheet for details and other design criteria surrounding the SOA.

Table 3: **KD240 Starter Kit Power Specifications** *(cont'd)*

Parameter	Description
3-phase inverter telemetry	Three phases of voltage and current sense are available through readback of the 12-bit AD7352 ADC. The three ADC are wired in parallel. With one ADC per phase, the AD7352 has dual, simultaneous sampling, allowing simultaneous readback of all three phases, both voltage and current. For further information, refer to the AD7352 data sheet. • ADC SCLK fanout for phase ADCs are connected to HPA00_CCP_CLK • ADC CS_N fanout for phase ADCs are connected to HPA03N • Phase A voltage data is read from HPA00_CCN • Phase A current data is read from HPA01P • Phase B voltage data is read from HPA01N • Phase B current data is read from HPA02P • Phase C voltage data is read from HPA02N • Phase C current data is read from HPA03P

Notes:

1. Maximum voltage limited by TVS diode.
2. Maximum current limited by fuse at DC_LINK input.

KD240 Starter Kit Power On Sequence

1. External power adapter supplies 12V power

2. On-board regulator generates 5V supply and provides power to other voltage regulators

3. SOM power rail (V_{CC_SOM}) is powered by a 5V supply

4. When the 5V regulator output voltage level is within the specified range and a power-good signal is asserted and the `POWER_OFF_C2M_L` signal is deasserted by the carrier card

5. SOM on board power on sequencing starts

6. Carrier card provides PS and PL V_{CCO} voltage rails after the SOM asserts the $V_{CCOEN\_PS\_M2C}$ and $V_{CCOEN\_PL\_M2C}$ signals

KD240 Starter Kit Power On Reset

1. The SOM reset signal (`PS_POR_L`) is held in reset until the `PS_PGOOD` signal is asserted.

2. To perform a hard reset on the SOM, use the reset push-button on the carrier card to assert the `PS_POR_L` signal.

3. All the PS and PL I/O device reset signals on the carrier card are held in reset until 25 ms after the PS and PL power domain are powered up and stable.
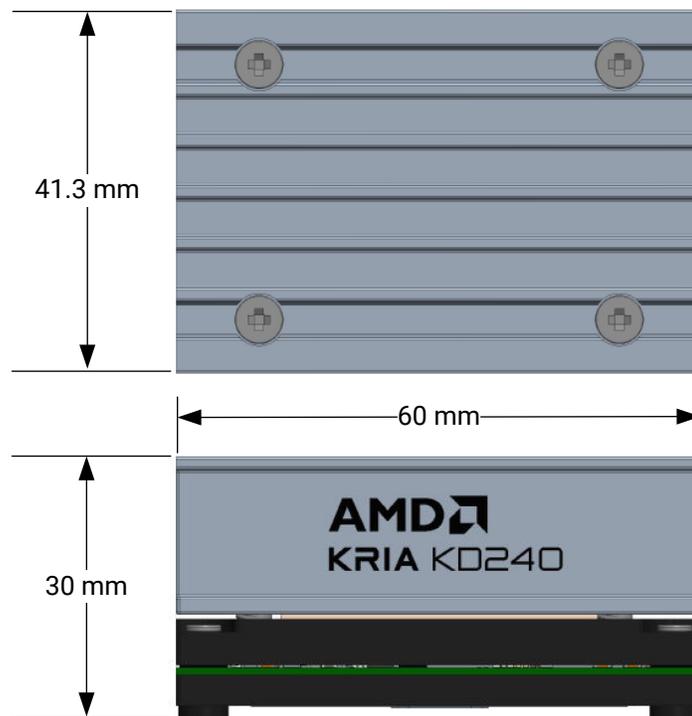
Mechanical

This section outlines the mechanical specifications of the Kria KD240 Drives Starter Kit.

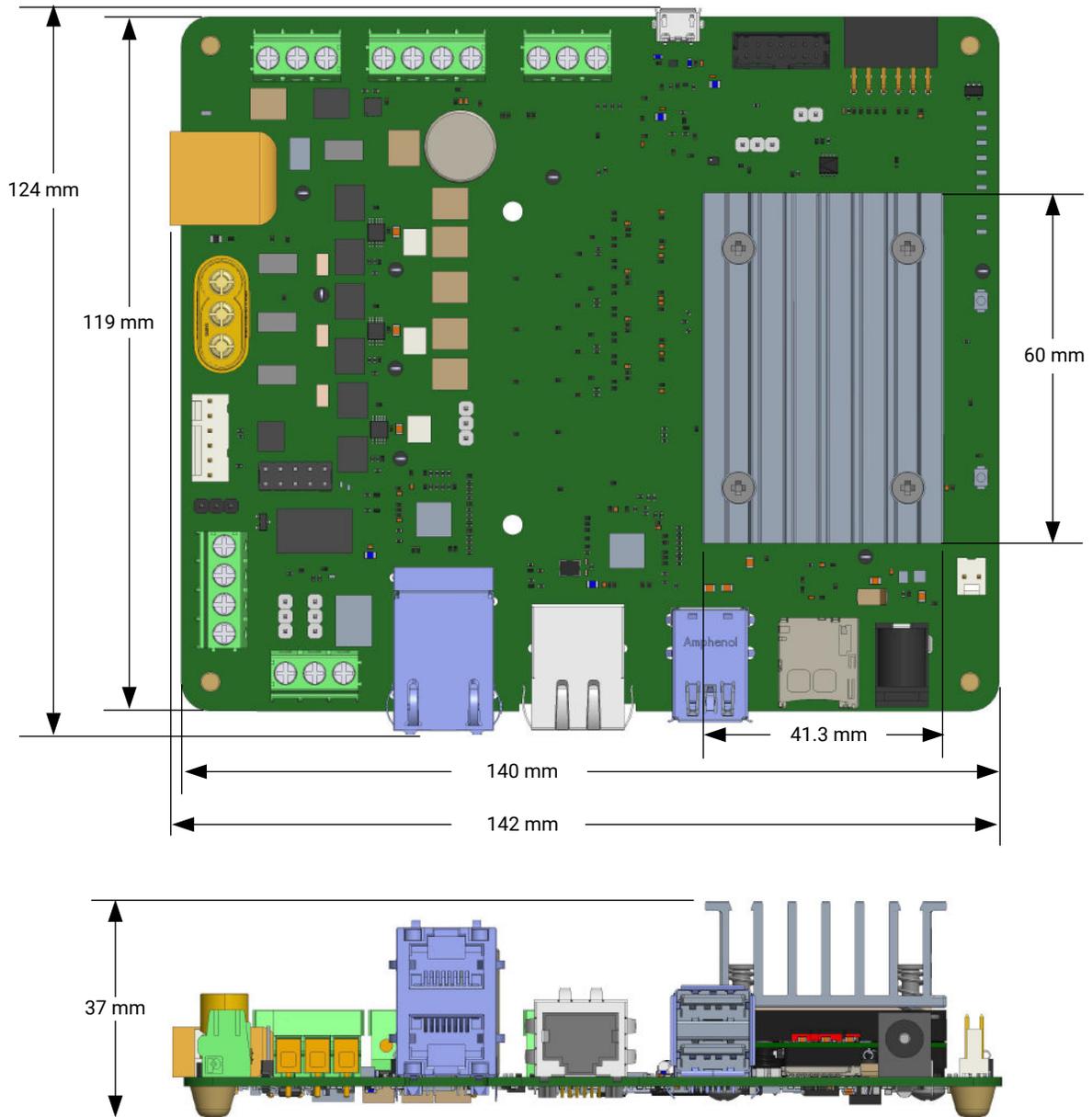*Table 4:* **Kria KD240 Drives Starter Kit Mechanical Details**

Specification	Dimensions
Dimensions of the KD240 Starter Kit	124 mm x 142 mm x 37 mm
Dimensions of the K24 SOM with thermal solution	60 mm x 41.3 mm x 30 mm
Dimensions of the carrier card	124 mm x 142 mm x 34 mm

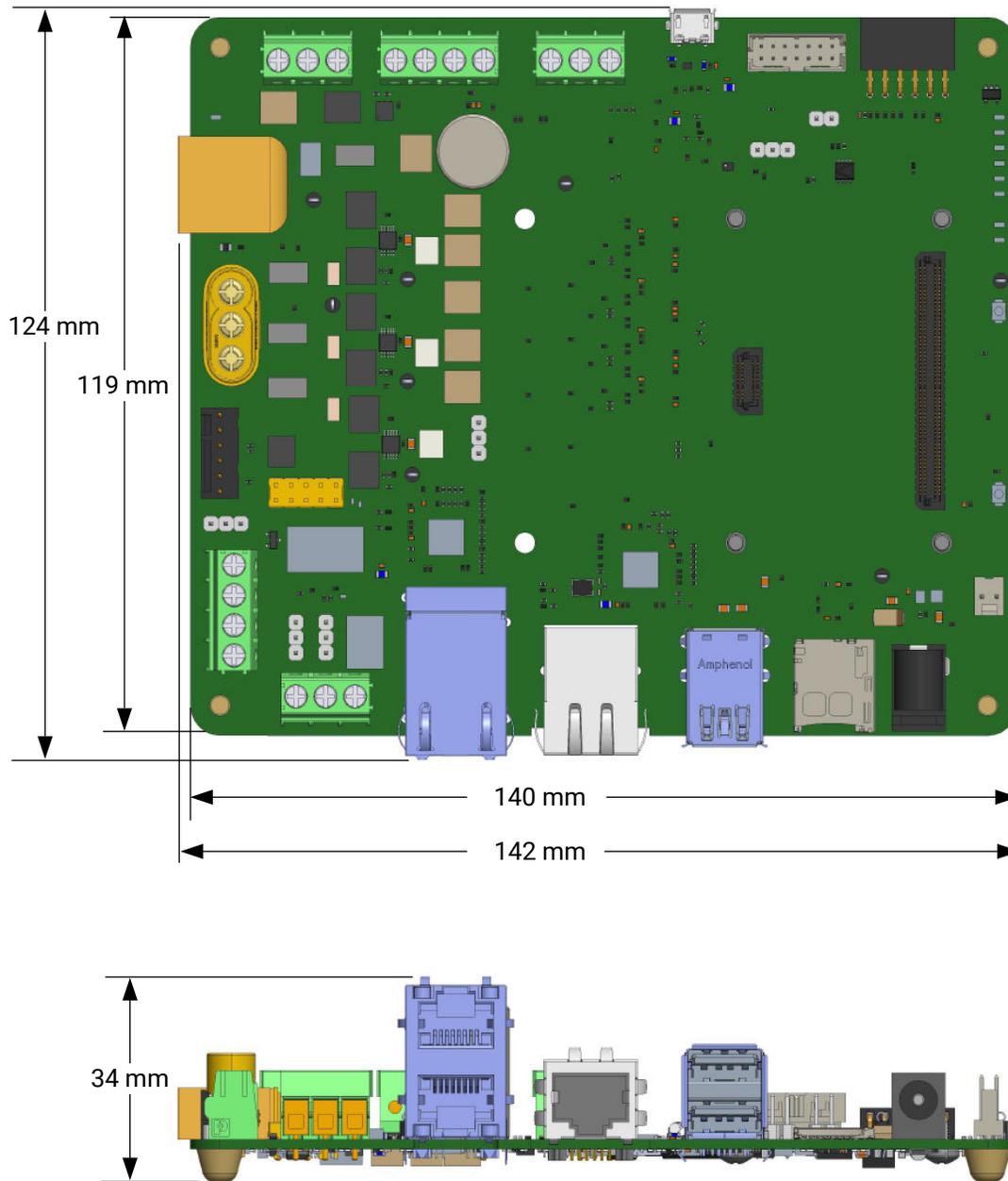*Figure 3:* **K24 SOM on the Kria KD240 Drives Starter Kit Mechanical Dimensions**

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Figure 4: **Kria KD240 Drives Starter Kit Mechanical Dimensions**

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Send Feedback

Figure 5: **Kria KD240 Drives Starter Kit Carrier Card Mechanical Dimensions**

X27729-020723

Starter Kit Firmware and Software

The KD240 Starter Kit is preloaded at the time of manufacturing with a supporting set of boot and platform recovery firmware. The boot firmware is maintained in the QSPI non-volatile memory device and the drives carrier card fixes the Zynq UltraScale+ MPSoC device boot mode to QSPI32. The operating system (OS) and application software are managed in the microSD card secondary boot device. Linux is the default OS for the AMD example applications. A pre-built Linux image is provided for the KD240 Starter Kit on the Getting Started web page as well as the Kria SOM Wiki.

Thermal

Operating and Storage Temperature Conditions

Table 5: **Operating and Storage Temperatures and Humidity Condition**

Specification	Condition
Operating temperature	0°C to 35°C (maximum at continuous operation)[1]
Storage temperature	0°C to 70°C
Operating humidity, non-condensing	8% to 90%, and a dew point of −12°C
Storage humidity, non-condensing	5% to 95%

Notes:

1. The Kria KD240 Drives Starter Kit is for evaluation purposes only. The operating temperature range is not fully tested, it is a general guideline. Use the Kria KD240 Drives Starter Kit in a typical lab environment. Do not operate beyond room temperature.

KD240 Starter Kit Cooling Solution

The KD240 Starter Kit uses a passive cooling solution to support the maximum 6.5W base K24 SOM thermal power dissipation at 35°C ambient temperature. Variable fan speed control can be implemented through an FPGA-based PWM fan controller. The fan gating signal is connected to an FPGA HD I/O bank pin for control. Consult the corresponding KD240 Starter Kit carrier card schematic for the specific pin assignment. Refer to Kria SOM Wiki for the latest thermal solution options.

Supported Tools

The Kria KD240 Drives Starter Kitis enabled in the AMD Vivado and AMD Vitis™ tools. For details on getting started with the kit see the *Kria KD240 Drives Starter Kit User Guide* (UG1093).

Reliability

The Kria SOM Starter Kits are not designed or qualified for production use. The kits undergo a basic level of testing and reliability and should pass all the certification requirements necessary for evaluation kit purposes (for example RoHS and CE). To develop and deploy a production quality product based upon this starter kit, design your own (compatible) carrier cards and test them to the appropriate and required certification standards for your end application. By purchasing the K24 SOM (available in commercial (C) or industrial (I) temperature grades) and designing your own (compatible) carrier card, you leverage the advantages of the K24 SOM in your end application.

Regulatory Compliance Statements

Safety

The following safety standards apply to all products listed in this document.

IEC 62368-1, 2nd Edition, 2014/A11:2017, *Information technology equipment – Safety, Part 1: General requirements*

EN 62368-1, 2nd Edition, 2014/A11:2017, *Information technology equipment – Safety, Part 1: General requirements*

FCC Class A Products

The following is a list of the products covered by this data sheet:

- SK-KD240-G

Regulatory Compliance Statements are valid for the production version of the K24 SOM; not for ES boards and the non-production SOM on the KD240 Starter Kit .

Safety Compliance

The following safety standards apply to all products listed above.

- UL 62368-1, 2nd Edition, 2014/A11:2017 (Information Technology Equipment - Safety - Part 1: General Requirements)
- CSA C22.2 No. 60950-1-07, 2nd Edition, 2014/A11:2017 (Information Technology Equipment - Safety - Part 1: General Requirements)
- EU LVD Directive 2014/35/EU
- EN/IEC-62368-12014/A11:2017

EMC Compliance

Class A Products

The following standards apply:

- 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
- UKCA mark
- FCC markings
- VCCI marking
- Australian RCM 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.

> ⚠️ **CAUTION!** *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 their own expense.*

> ⚠️ **ATTENTION!** *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.*

⚠️ **VORSICHT!** *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 their authority to operate the equipment.*

⚠️ **ATTENTION!** *Si l'appareil est modifié sans l'autorisation d'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)

RoHS Compliance

- RoHS Directive 2011/65/EU
- RoHS 3 Directive 2015/863
- SJ/T 11363-2006, 11364-2006, and GB/T 26572-2011 (China RoHS)

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 appoved 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對當的對策。

EU WEEE Logo
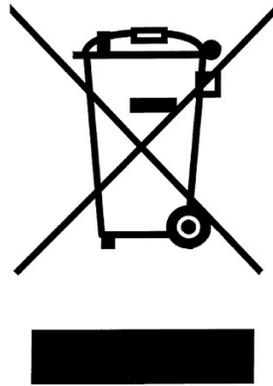
Manufacturer Declaration European Community

Manufacturer Declaration

Xilinx declares that the equipment described in this document is in conformance with the requirements of the European Council Directives 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
- REACH Regulation 1907/2006
- POP Regulation 2019/1021

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.

EN 55032 (CISPR 32 Class A) RF Emissions Control

EN 55035:2017 (CISPR 35) Electromagnetic compatibility of multimedia equipment – Immunity requirements

EN 62368-1, 2nd Edition, 2014/A11:2017 *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 could 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

References

These documents provide supplemental material useful with this guide:

1. *Kria KD240 Drives Starter Kit User Guide* (UG1093)

2. *Kria K24 SOM Data Sheet* (DS985)

3. *Kria SOM Carrier Card Design Guide* (UG1091)

Revision History

The following table shows the revision history for this document.

Section	Revision Summary
1/31/2024 Version 1.1	
Thermal	Updated storage temperature in Table 5: Operating and Storage Temperatures and Humidity Condition.
9/19/2023 Version 1.0	
Initial release.	N/A

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