

# Kria K26 SOM Thermal

## *Design Guide*

UG1090 (v1.0) November 19, 2021

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# Revision History

The following table shows the revision history for this document.

Section	Revision Summary
<b>11/19/2021 Version 1.0</b>	
Initial release.	N/A

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# Introduction

The objective of this document is to provide thermal design guidelines for designers of Kria™ K26 SOM based products. The goal is to ensure that the temperature of all components in a system are maintained within their functional temperature range. Within this temperature range, a component is expected to meet its specified performance and lifetime. Operation outside the functional temperature range can degrade system performance, cause logic errors, or cause component and/or system damage. Temperatures exceeding the maximum operating limit of a component can result in irreversible changes in the operating characteristics of the component.

In a system-level environment, the Zynq® UltraScale+™ MPSoC temperature is a function of both the system and the individual component thermal characteristics. The system-level thermal constraints consist of the local ambient air temperature and airflow over the Zynq UltraScale+ MPSoC as well as the physical constraints at and above the Zynq UltraScale+ MPSoC. The Zynq UltraScale+ MPSoC temperature depends upon the on-board component power dissipation, the Zynq UltraScale+ MPSoC package thermal characteristics, and the system cooling solution.

All these parameters are affected by the increase in Zynq UltraScale+ MPSoC performance levels and packaging density (more transistors). With an increase in operating frequencies and decrease in package sizes, the power density increases while the thermal solution space and airflow typically become more constrained or remain the same. The system design becomes more important to ensure that thermal design requirements are met for each component including the Zynq UltraScale+ MPSoC in the system.

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## Requirements for Designers

- It is very important that you read and understand this guide before designing your system.
- The thermal solution on your system must provide adequate cooling to maintain all PCB components (including the K26 SOM) at or below the maximum temperature specifications as described in the [K26 SOM Temperature](#) section, using maximum thermal load and worst-case system conditions.
- You are responsible for qualification of the K26 SOM in your system and any issues arising from failure to qualify your system level product which the K26 SOM is a component.

## K26 SOM

The K26 SOM is available in the commercial and industrial temperature grades. The K26C SOM and K26I SOM support different temperature ranges.

*Table 1: K26 SOM Thermal Specifications*

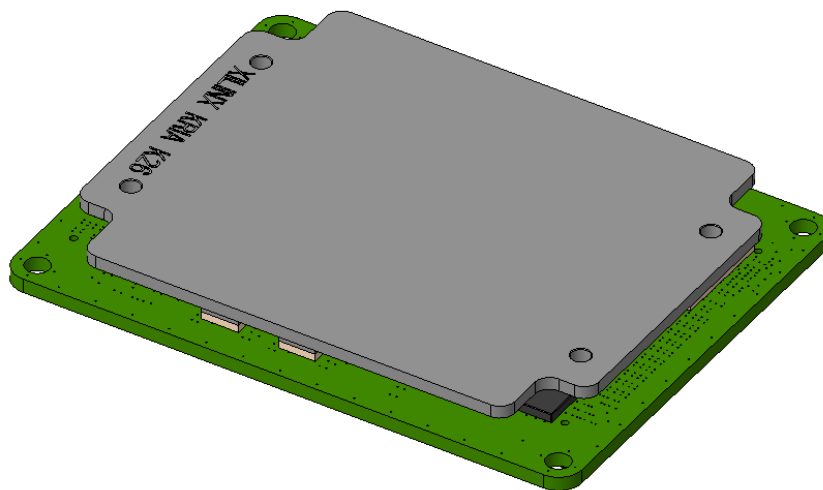
K26 SOM	Operating Temperature	
K26C SOM	0°C to 85°C	
K26I SOM	-40°C to 100°C	
Heat spreader plate (HSP-00075-01)	C grade	70°C maximum
	I grade	85°C maximum



**TIP:** The K26 is a production qualified SOM. For evaluation, the KV260 Starter Kit is available but is not intended for deployment. See [Versal AI Core Series Data Sheet: DC and AC Switching Characteristics \(DS957\)](#).

The K26 SOM is supplied with an aluminum heat spreader (HS). This heat spreader makes full contact with all the high-power active components, including the Zynq UltraScale+ MPSoC, DDR4 memory, eMMC, power management integrated circuit (PMIC), and power regulators. The primary function of the heat spreader is to transfer the non-uniform heat distribution of the module that is generated on the PCB assembly to the heat spreader, making the heat flux more uniform and spread over a larger surface area. This allows for more efficient heat transfer out of the package to an attached cooling device. The user-defined system cooling solutions should be designed to directly attach to the heat spreader.

*Figure 1: K26 SOM*



The heat spreader has four M3 mounting holes on the corners to attach the appropriate thermal solution for your system. Further details are available in the *Kria SOM Carrier Card Design Guide (UG1091)*. Your system thermal solution must provide adequate cooling to maintain all the components on the PCB, including the K26 SOM, below the maximum temperature specifications as detailed in [Table 3: K26 SOM Component Thermal Specifications](#).

## K26 SOM Temperature

The K26 SOM Zynq UltraScale+ MPSoC device junction temperature ( $T_j$ ) represents the die temperature read from either the PS or PL System Monitor sensors. The on-die thermal sensors are used for  $T_j$  management and many other temperature-dependent functions.

The on-die temperature sensors of the Zynq UltraScale+ MPSoC device System Monitors on the K26 SOM are placed for a high accuracy measurement of the maximum junction temperature. To maintain the performance and reliability of the K26 SOM module, your design must be in compliance with the specifications in the following table.

**Table 2: K26 SOM Thermal Specifications**

Parameter	SOM	Junction Temperature ( $T_j$ )
Maximum K26 SOM operating temperature <sup>1</sup>	K26C SOM	85°C
	K26I SOM	100°C
K26 SOM critical temperature <sup>2</sup>	K26C SOM	90°C
	K26I SOM	105°C

**Notes:**

1. The K26 SOM maximum operating temperature is the temperature below which the product will operate at the specified clock speeds.
2. The K26 SOM is considered damaged if it reaches or exceeds critical temperature. Maintain or shutdown the SOM prior to reaching this temperature.

# Thermal Design Guidance

This chapter provides design guidance for your system to work with the Kria™ K26 SOM thermal specifications.

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## Thermal Information

The K26 SOM is not designed with a system thermal solution to dissipate the total module power (TMP) thermal load into the ambient environment. This is because every system has unique environmental, operating, and mechanical constraints. Your system design is required to have an adequate thermal solution to maintain all the component temperatures below the derated limits as specified in the following [Total Thermal Module Power](#) section.

The K26 SOM thermal model enables you to simulate and design the appropriate thermo-mechanical system-level solution to ensure all the component temperatures are below their specified rated limits. The simulation models support both the Ansys Icepak and Siemens Flotherm thermal software packages.

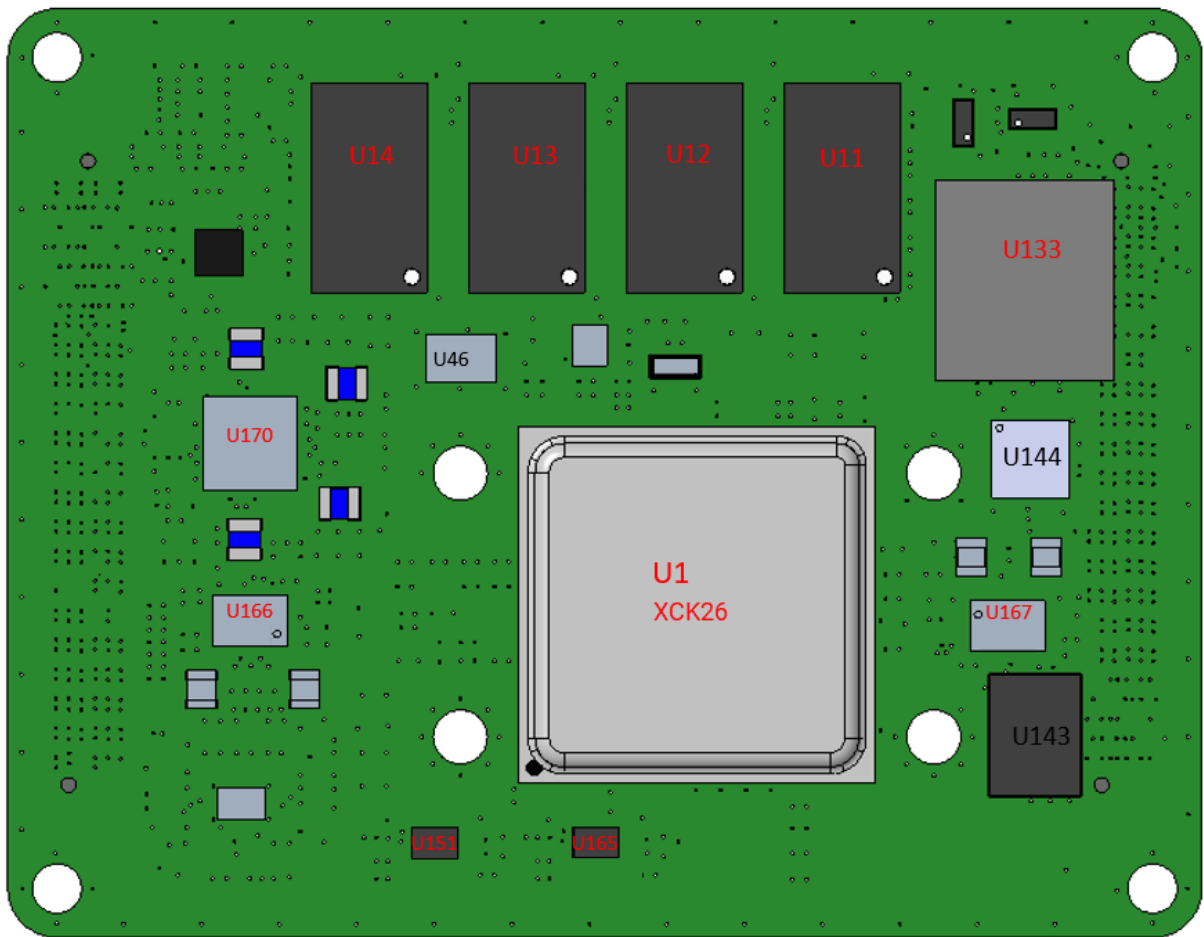
The design goal for system thermal management is to keep the temperature of the Zynq UltraScale+ MPSoC in the K26 SOM below the limits specified in [Table 1: K26 SOM Thermal Specifications](#).

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## Total Thermal Module Power

The total module power (TMP) represents the maximum board power dissipation while the system is running the target workload under worst-case conditions. System designs must be capable of providing enough cooling for the K26 SOM when operating at the TMP level. The TMP depends on how the SOM is configured and used. The TMP can be obtained via an accurate power estimation of the K26 SOM using the power design manager (PDM) tool, detailed in the [Power Estimation](#) section. Prior to evaluating a thermal solution, the PDM tool provides the appropriate thermal loading based on your estimated inputs. The following figure maps the top-side view of the component placement on the K26 SOM PCB. The power dissipation values are listed in the following table.

Figure 2: K26 SOM Component Placement Map



The power presented in the following table is only an example. The actual power dissipation should be obtained from the PDM. For the purpose of a thermal simulation, U11 – U14 are combined into a single component in the thermal model.



Table 3: K26 SOM Component Thermal Specifications

Type	Part Reference	Description	Maximum Thermal Specifications		Heat Spreader T <sub>c</sub> Monitor
			T <sub>j</sub> (°C)	T <sub>c</sub> (°C)	
MPSoC	U1	XCK26-SFVC784-2LV-C (or -I)	85 (C) 100 (I)	N/A	yes
Memory	U11, U12, U13, U14	DDR4 memory	N/A	95	yes
	U133	eMMC memory	N/A	85 (C) 105 (I)	yes
	U143	Quad-SPI memory	N/A	85 (C) 105 (I)	
	U144	Trusted platform module (TPM)	N/A	N/A	
IC and Clocks	U168	PS supervisor	125	N/A	
	U169	PL supervisor	125	N/A	
	U151	Power module	125	N/A	
	U165	Power module	125	N/A	
Power Supplies	U170	PMIC	125	N/A	yes
	L60-L63	Power inductors	125	N/A	
	U166	Power regulator	125	N/A	yes
	L66, L67	Current inductors	125	N/A	
	U167	Power regulator	125	N/A	yes
	L64, L65	Current inductors	125	N/A	

These thermal specifications are for simulation evaluations. The designed SOM thermal solution is expected to be sufficient to maintain the on board components within their maximum temperature limits as detailed in the table. T<sub>j</sub> of the K26 SOM can be accessed during qualification test via the SYSMON.

**Note:** There are no active components included on the bottom side of the PCB that require thermal consideration.

## Thermal Solution Requirements

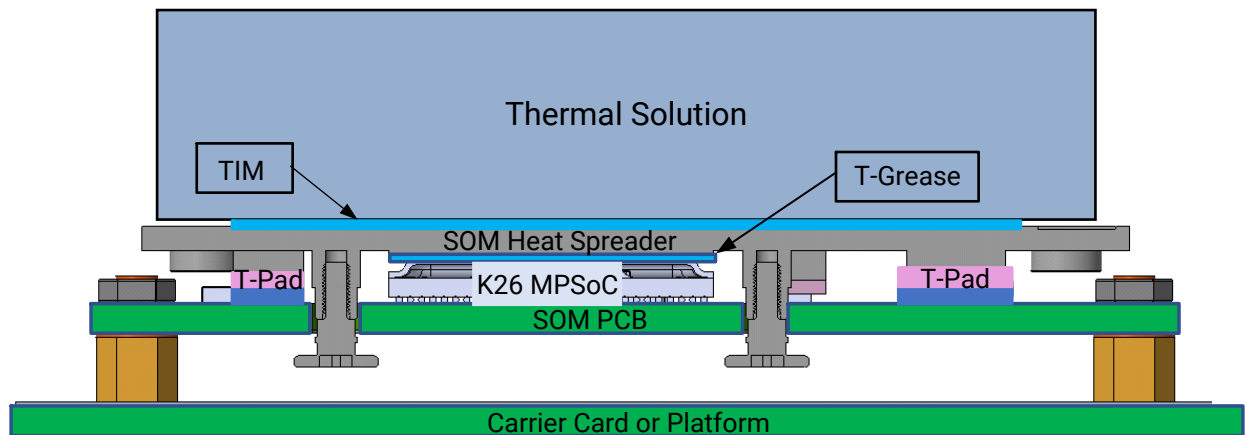
When designing your system to mate with the K26 SOM, the design must consider the following items.

- **Thermal Solution:** A system thermal solution is capable of cooling the appropriate amount of TMP for the target workload.

- Thermal Interface Material (TIM):** The TIM is the thermally conductive compound between the heat sink and the device. This material fills the air gaps and voids and enhances the transfer of heat from the device to the heat sink. Your design must include the TIM between the K26 SOM heat spreader and your system thermal solution. For the best thermal performance, the TIM should provide the lowest thermal impedance within the mechanical, reliability, and cost constraints of the end product.
- Maximum Temperature:** The thermal solution design must ensure that the maximum Zynq UltraScale+ MPSoC based K26 SOM operating temperature is less than the value specified in [Table 1: K26 SOM Thermal Specifications](#) and that the maximum component temperatures on the PCB do not exceed the values specified in [Table 3: K26 SOM Component Thermal Specifications](#).

The following illustration is of a thermal stack-up.

Figure 3: K26 SOM Thermal Stack-up



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The overall system thermal solution is the mechanical element that interfaces to the K26 SOM and provides cooling. A variety of thermal solution configurations (passive cooling, air cooling, and liquid cooling) are possible, depending on the system design. In all cases, the following recommendations are applicable:

- Good contact between the thermal solution and the K26 SOM is critical for maximizing performance. In general, the K26 SOM consumes the majority of the TMP.
- You must ensure that the system thermal solution has the appropriate direct-contact surface mounting on the heat spreader top to cover all selected heat sources.



**RECOMMENDED:** The recommended contact pressure is between 20 and 30 PSI.

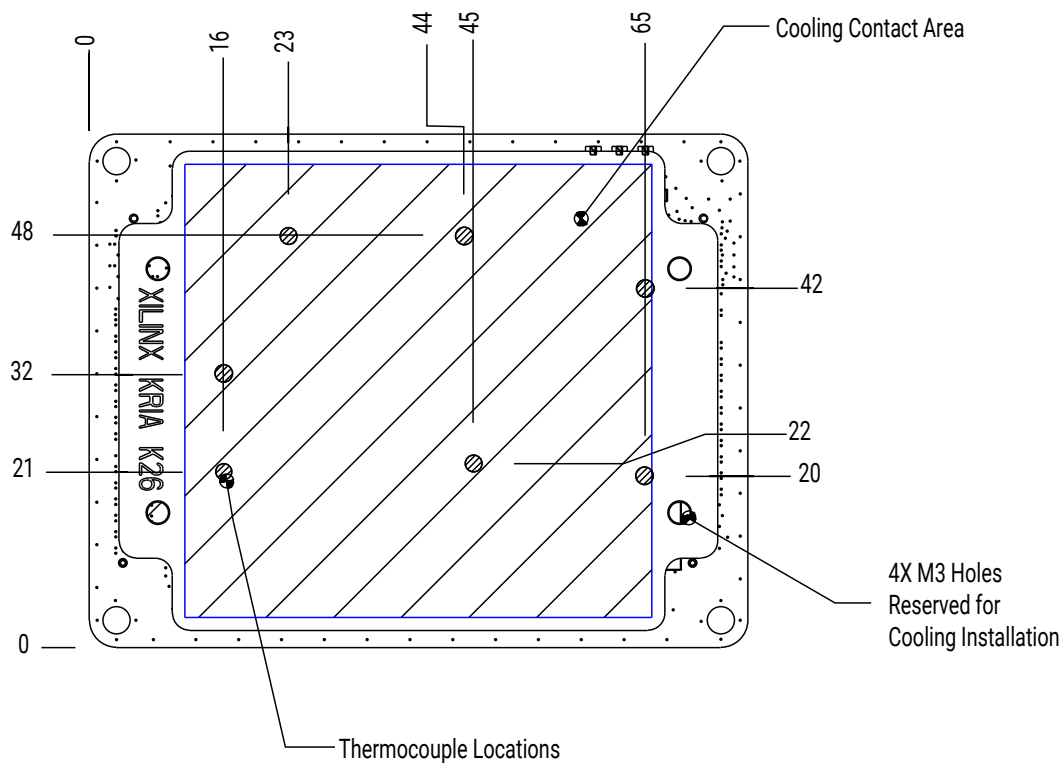
- The cooling solution must be capable of maintaining the surface temperature on top of the heat spreader at or less than the values specified in [Table 1: K26 SOM Thermal Specifications](#).

- The four M3 mounting holes on the heat spreader are provided to accommodate a variety of thermal solution assembly variances in your system design. Spring screws are recommended to maintain the contact pressure within a specific range with a preset torque driver.

**RECOMMENDED:** Ensure the bond-line thickness (BLT) is kept to a minimum to ensure an optimal thermal solution, where the recommendation is below 0.5 mm. A TIM with a thermal conductivity of ~5.0 W/mK is also recommended.

The following figure shows the recommended thermocouple locations on the top heat spreader to verify cooling performance (dimensions in mm). The four M3 holes are reserved for the cooling installation in your system design.

**Figure 4: Recommended Contact Area and 7X Thermocouple Locations on Top Heat Spreader for Characterization and Debug**

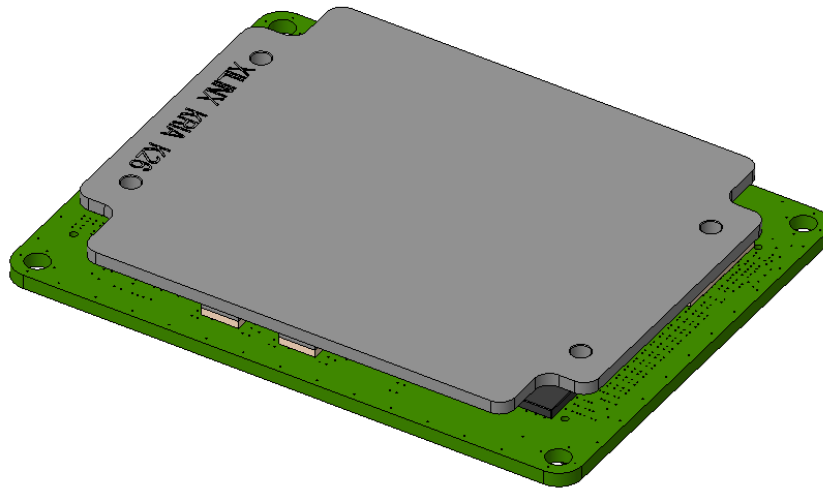


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## Thermal Solution Installation Examples

A stand-alone (heat spreader only) K26 SOM can be used in your application when the environment is able to maintain the temperature of the key components below the specifications listed in [Table 3: K26 SOM Component Thermal Specifications](#).

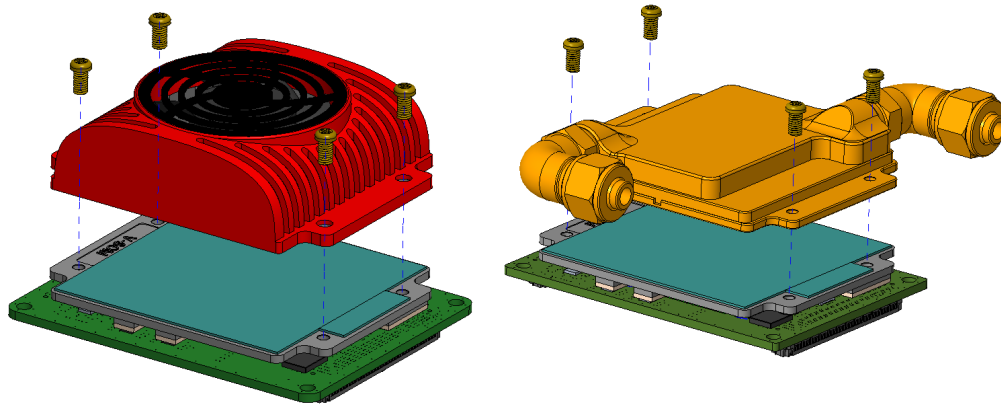
Figure 5: K26 SOM Stand-alone Solution



However, one of the following cooling solutions can be introduced:

- An off-the-shelf aluminum heat sink mounted to the heat spreader to extend the thermal performance.
- The following figure shows an active heat sink to further extend the thermal performance (left) and a cooling plate to maximize the thermal performance (right).

Figure 6: Examples of Active or Cooling Plate Solutions



No matter the application, a thorough thermal model simulation must be conducted to ensure that the thermal solution is capable of maintaining the active components at temperatures below their rated temperatures. Also, if a thermal solution is added to the heat spreader, the appropriate thermal interface material (TIM) must be used.

**Note:** Avnet provides a thermal solution for the K26 SOM that attaches to the aluminum heat spreader, for more information see [www.avnet.com](http://www.avnet.com).

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## Thermal Simulation

Numerical simulation plays an important role in thermal design. The thermal requirements of the on-board components are the prime reason for cooling selection and mechanical design parameters. With this thermal design guide, Xilinx provides K26 SOM compact thermal models in both Icepak and Flotherm formats to enable system cooling design based upon your system thermal power and boundary conditions. The thermal models have the heat spreader integrated as a thermal interface base to help you build a solution to install on it with a selected TIM (see the detailed thermal stack up in [Figure 3: K26 SOM Thermal Stack-up](#)).

Figure 7: K26 SOM Icepak Compact Model

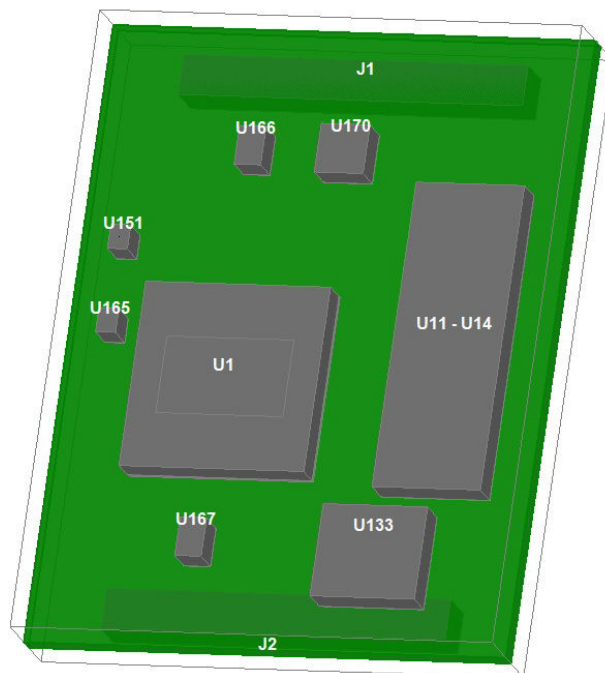
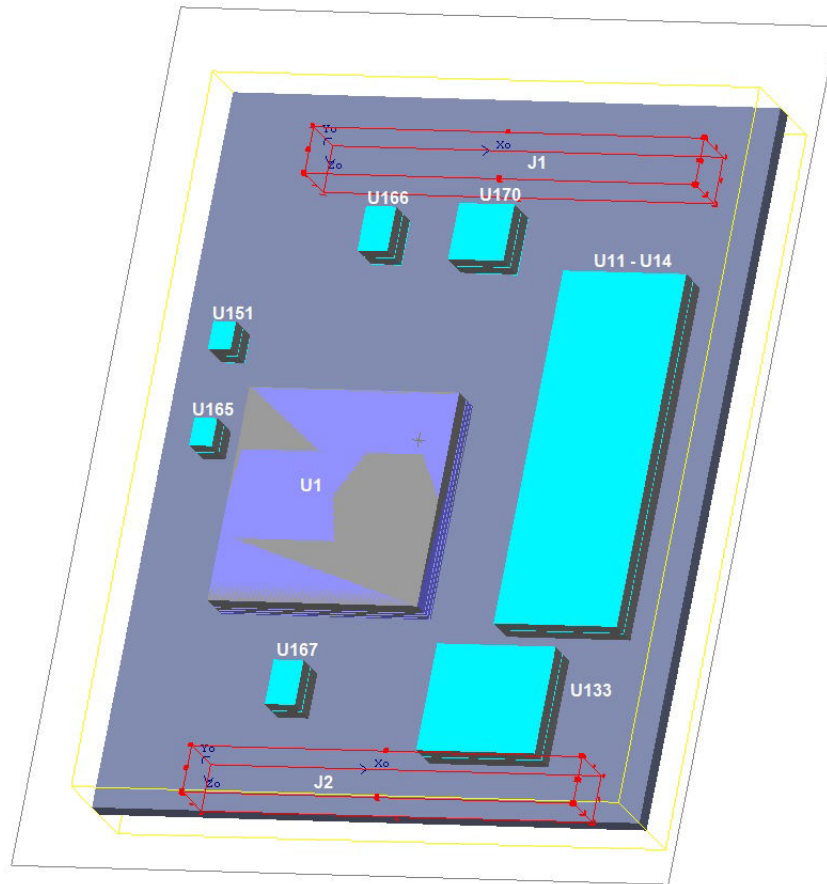


Figure 8: K26 SOM Flotherm Compact Model



## Modeling in Detail

To help reduce the computation time to solve and model the K26 SOM in your system, a technical treatment is implemented as follows.

- For the K26 MPSoC, a DELPHI thermal model is used in the K26 SOM thermal compact model.
- Two resistance models were used for the components.
- A lumping model is used to represent the four DDRs.
- These individual models have their own TIM, metal islands combined, and resistance re-characterized to the desired precision and accuracy.
- SOM Icepak models have I-grade or C-grade component temperature limits applied. As Flotherm has no such temperature limitation feature in the tool, Flotherm users need to look up on-board component temperature, which cannot exceed its maximum specification according to I-grade or C-grade rating.

- Dissipation values should be applied according to their targeted system performances as reported by the PDM (see [Power Estimation](#)).
- Numerical model boundary conditions are system parameters such as the operating ambient temperature, airflow, and pressure drop. In some cases the system platform altitude affect also needs to be considered and simulated.
- Cooling simulation results should address design margins due to sensor accuracy, the character tolerances of the thermal interface material, mechanical manufacturing variations from fans, fins, heat pipe or vapor chamber soldering, and the heat sink base contact surface flatness.

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## Empirical Correlations to Determine the Thermal Solution Performance

### Empirical Formula for the Heat Spreader Temperature Rise

The following empirical formula is used to calculate the heat spreader temperature rise:

$$\text{Heat Spreader Temperature Rise (}^{\circ}\text{C)} = 1.0437 * \text{Power (W)} * \text{R-SA (}^{\circ}\text{C/W)}$$

Where,

Heat Spreader Temperature = Ambient Temperature + Heat Spreader Temperature Rise

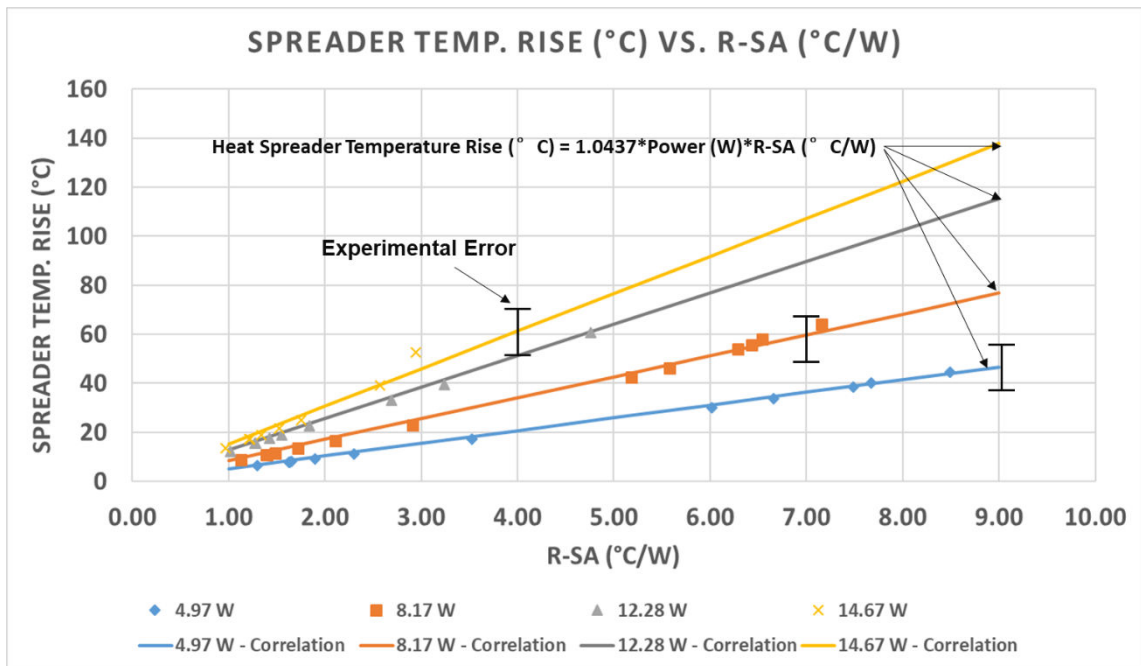
R-SA is the thermal resistance of the cooling solution designed for your system, with TIM to ambient in  $^{\circ}\text{C/W}$ .

Power is the total SOM input power (W).

The following plot shows the deviation of the heat spreader temperature rise obtained from the above correlation for different input system powers associated to the experimental values. The points represent experimental data while the solid lines show the correlation trend which aligns very well with the test points.



Figure 9: Heat Spreader Temperature Rise vs. Thermal Resistance R-SA



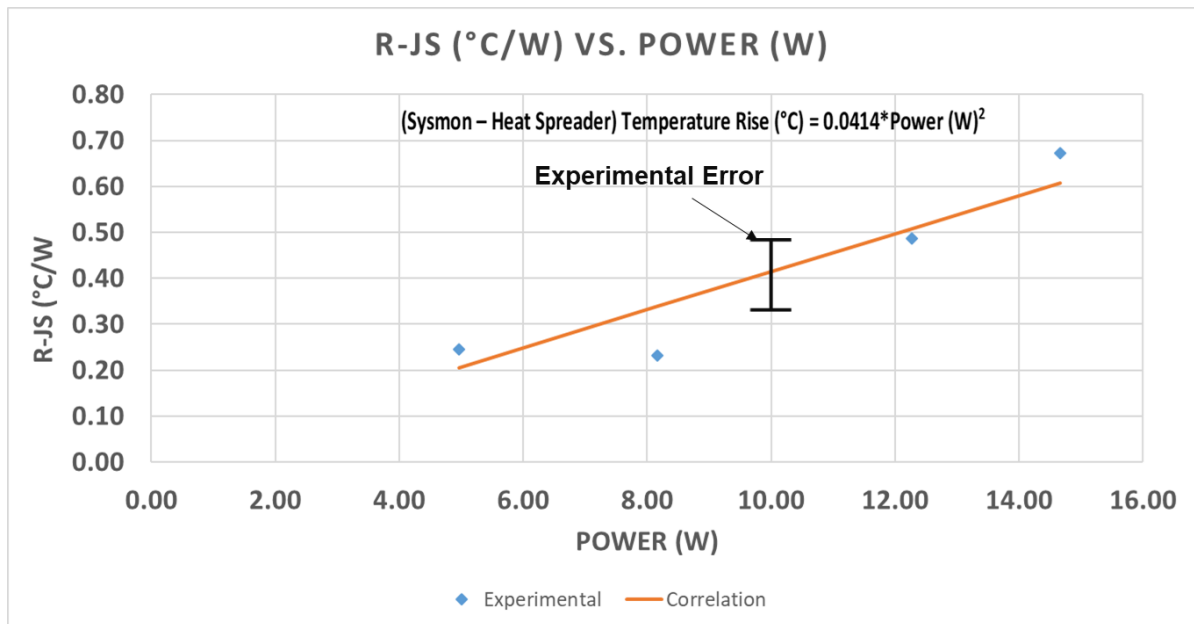
From this image you can use the correlation obtained from the estimated system power of your application and the target system thermal resistance of the solution installed on the K26 SOM heat spreader to find the heat spreader temperature rise.

### Empirical Formula to Find the Temperature Rise between the SYSMON and Heat Spreader

The following empirical formula is used to calculate the temperature rise between the K26 SYSMON and the heat spreader.

$$(\text{SYSMON} - \text{Heat Spreader}) \text{ Temperature Rise (}^\circ\text{C)} = 0.0414 * \text{Power (W)}^2$$

Figure 10: Junction to Heat Spreader Temperature Rise vs. Total Power



Using the correlation with the target system power, the expected temperature rise between the K26 SOM SYSMON and heat spreader can be calculated.

**Note:** The SYSMON temperature should always be less than the temperature specification given in [Table 1: K26 SOM Thermal Specifications](#).

### Illustrations of Applying the Empirical Correlations

In this first example, the system is operated at 35°C ambient, with a total estimated power of 15W and the thermal resistance of a cooling solution is 3°C/W. The SYSMON temperature is obtained by using the correlations outlined earlier in this section. Using the *Empirical Formula for the Heat Spreader Temperature Rise*:

$$\text{Heat Spreader Temperature Rise } (^\circ\text{C}) = 1.0437 * \text{Power } (W) * R\text{-SA } (^\circ\text{C}/W) = 1.0437 * 15 * 3 = 49.97^\circ\text{C}$$

$$\text{Heat Spreader Temperature } (^\circ\text{C}) = 49.97^\circ\text{C} + T_a$$

$$\text{Heat Spreader Temperature } (^\circ\text{C}) = 49.97^\circ\text{C} + 35.00^\circ\text{C} = 84.97^\circ\text{C}$$

$$\text{SYSMON Temperature } (^\circ\text{C}) = 0.0414 * \text{Power } (W)^2 + \text{Heat Spreader Temperature } (^\circ\text{C}) = 0.0414 * 15^2 + 84.97^\circ\text{C} = 94.29^\circ\text{C}$$

The result of this example is that with the estimated SYSMON temperature obtained from the empirical relations, you can verify whether your selected thermal solution meets the K26 SOM thermal specifications list in [Table 1: K26 SOM Thermal Specifications](#).

The second example has an estimated system power of 15W when operating in 25°C ambient temperature, the maximum SYSMON temperature is specified as 85°C. Using the correlations outlined earlier in this section, an estimated thermal resistance from heat spreader to ambient (R-SA) is calculated, defining an appropriate thermal solution as:

$$\text{Heat Spreader Temperature } (^\circ\text{C}) = \text{SYSMON Temperature } (^\circ\text{C}) - (0.0414 * \text{Power (W)}^2) = 85 - (0.0414 * 15^2) = 75.69 \text{ } ^\circ\text{C}$$

$$\text{Heat Spreader Temperature Rise } (^\circ\text{C}) = 75.69^\circ\text{C} - 25^\circ\text{C} = 50.69^\circ\text{C}$$

$$\text{R-SA } (^\circ\text{C/W}) = \text{Heat Spreader Temperature Rise } (^\circ\text{C}) / (1.0437 * \text{Power (W)}) = 50.69 / (1.0437 * 15) = 3.2^\circ\text{C/W}$$

### K26 SOM Standalone and Exposed to Air

In a K26 SOM system where the heat spreader is exposed to air, the recommended clearance above the heat spreader is approximately 30 mm. In this case, it is anticipated that the thermal resistance from the heat spreader to the ambient would be in the range of ~9 to 10°C/W. This arrangement can produce limited performance where the dissipated power from K26 SOM is smaller. It is crucial that K26 SOM is operating in a system arrangement that keeps the SYSMON temperature below the specification outlined in [Table 1: K26 SOM Thermal Specifications](#).

For example, a K26 SOM with a heat spreader that has a thermal resistance from the spreader to an ambient temperature of 9°C/W. The area surrounding the K26 SOM in 30 mm of free area is 35°C, and the maximum SYSMON temperature specified from the specification is 100°C. Under this condition, the maximum dissipated power from the K26 SOM is described in the following formulas.

$$\text{Heat Spreader Temperature} - \text{Ambient temperature } (^\circ\text{C}) = 1.0437 * \text{Power (W)} * \text{R-SA } (^\circ\text{C/W}) = 1.0437 * \text{Power} * 9$$

$$\text{Heat Spreader Temperature} - 35 (^\circ\text{C}) = 9.39 * \text{Power}$$

$$\text{SYSMON Temperature } (^\circ\text{C}) - \text{Heat Spreader Temperature } (^\circ\text{C}) = 0.0414 * \text{Power (W)}^2$$

$$100 (^\circ\text{C}) - \text{Heat Spreader Temperature } (^\circ\text{C}) = 0.0414 * \text{Power (W)}^2$$

Calculating the sum of the two equations:

$$65 (^\circ\text{C}) = 9.39 * \text{Power} + 0.0414 * \text{Power (W)}^2$$

Solving this equation gives Power = 6.8W.



**THERMAL TIP:** Following best engineering practices includes numerically modeling the parameters using the thermal models provided by Xilinx. The numerical model must be validated with experimental data to ensure that the K26 SOM system is operated under the rated specifications as per these guidelines and the data sheet. The empirical correlations provided in this document are only for an initial thermal assessment and cannot be used for production thermal design.

## Power Estimation

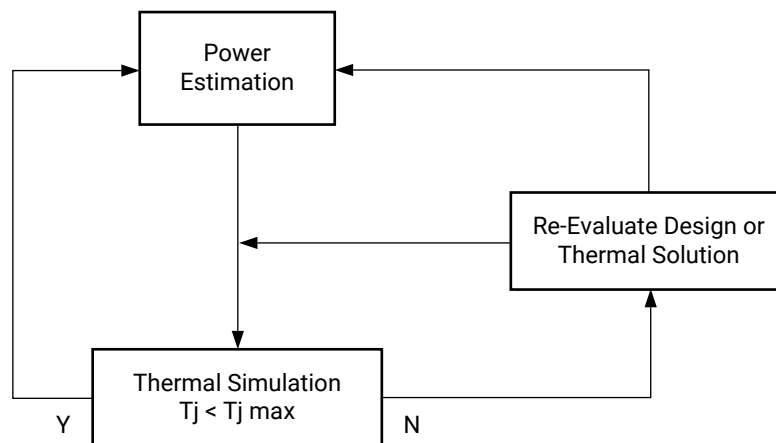
The K26 SOM power estimation is done using two tools. The [Power Design Manager \(PDM\)](#) tool provides early power estimation. After implementation, the output from the Vivado [Power Report](#) (as described in *Vivado Design Suite User Guide: Power Analysis and Optimization (UG907)*) ensures the implemented design is within the SOM and carrier card constraints. Vivado Power Report only provides the power estimation for the Zynq UltraScale+ MPSoC, you must estimate the power consumption of the other peripherals on the SOM using the values found in the [Thermal Loading](#) table.



**POWER TIP:** When designing a SOM carrier card, the PDM lists the required 5V and  $V_{CC0}$  current requirements, which is critical for a thorough estimation. The same estimation also generates the thermal loading information needed for thermal simulation. Either your Vitis or Vivado design should be appropriately constrained for power based on the results of the estimation and thermal analysis.

An accurate power estimation is critical to defining an effective thermal solution and keeping the K26 SOM components below their maximum junction temperature ( $T_j$ ). When designing the K26 SOM thermal solution, the worst-case power is the starting point for simulation. Once a thermal solution is defined and the  $T_j$  is within the limits, the theta  $J_A$  ( $\Theta_{JA}$ ) of the system can be input back into the PDM for a more accurate estimation of the power requirements for the K26 SOM.

Figure 11: Recommended Thermal Validation Flow



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Based on the temperature grade of the commercial temperature grade K26C SOM or the industrial temperature grade K26I SOM, the junction temperature should be forced to the maximum desired operating temperature (often maximum device operating temperature) to get the worst-case power estimation for the K26 SOM. The following example shows the K26C SOM when the  $T_j$  is forced to 85°C. The power dissipation of each of the components on the SOM is shown in the Thermal Loading table.

Figure 12: Example Showing Thermal Loading

This tab contains summary of results.

**Part**

Form factor: Vision SOM Family: SM-K26-XCL2GC Process: Maximum  
 Selected part: XCK26-SFVC784-2LV-C

**Power Summary**

Total Power	9.749 W
Junction Temperature (Tj)	85 C
Thermal Margin	15 C
Thermal Power Margin	1.931 W
Characterization	Production(+/- 15% accuracy)

**Environment**

Junction Temperature	85 C
Ambient Temperature (Ta)	25 C
Effective ThetaJA	7.768 C/W
Max. Junction Temperature	100 C

**Voltage & Current Requirements**

Rail	Voltage	Current	Range
VCC_SOM	5.0 V	1.950 A	4.750 - 5.250 V
VCCO_HPA	1.5 V	0.000 A	1.470 - 1.545 V
VCCO_HPBB	1.5 V	0.000 A	1.470 - 1.545 V
VCCO_HPC	1.5 V	0.000 A	1.470 - 1.545 V
VCCO_HDA	3.3 V	0.028 A	3.234 - 3.399 V
VCCO_HDB	1.8 V	0.000 A	1.764 - 1.854 V
VCCO_HDC	1.8 V	0.000 A	1.764 - 1.854 V
VCC_BATT	1.5 V		

**Thermal Loading**

Component	Power
K26	7.724 W
DDR4: U11-U14	0.469 W
VR: U170	0.569 W
VR: U167	0.473 W
VR: U166	0.714 W
VR: U151	0.000 W
VR: U165	0.105 W
PCB.1	0.164 W
eMMC: U133	0.000 W

In this example:

1.  $T_j$  is forced to the maximum allowed for the K26C SOM (85°C)
2. Maximum process is selected to get the worst-case static power
3. The thermal power of the SOM components
4. Total electrical power required on the SOM 5V connector is based on the current estimation

The thermal loading in the PDM matches the components in the SOM thermal model, the thermal power for every component listed should be added. The PCB also has a small amount of power loss to account for an inductor or other ancillary components, this power should be applied to the PCB in the model.



**THERMAL TIP:** The SOM thermal model supports both the Siemens Flotherm and Ansys Icepack EDA tools. For thermal modeling assistance, the following [Thermal Partners](#) are available.

Once a capable thermal solution is designed and validated in thermal simulation, the power estimation can be refined using the simulation results.

1. Apply the calculated effective  $\Theta_{JA}$  of the system in the PDM along with the maximum supported  $T_a$  for the product. This is the recommended approach because the power estimation dynamically estimates the anticipated  $T_j$  and provides a more accurate estimated power.



**THERMAL TIP:**  $\Theta_{JA}$  is a measure of how the junction temperature ( $T_j$ ) will increase above the ambient temperature ( $T_a$ ) for every watt of power dissipated ( $P_d$ ) in the device, the units are  $^{\circ}\text{C}/\text{W}$ .  $\Theta_{JA}$  is calculated using the following equation:  $\Theta_{JA} = (T_j - T_a) / P_D$ .

The following example shows a  $T_a$  of  $25^{\circ}\text{C}$  with a  $\Theta_{JA}$  of  $3.9^{\circ}\text{C}/\text{W}$  and the estimate  $T_j$  based on the current estimation is  $52^{\circ}\text{C}$ , which is a more accurate total power estimation for the SOM. The total power at  $52^{\circ}\text{C}$  is  $8.7\text{W}$ , compared to  $9.7\text{W}$  at  $85^{\circ}\text{C}$  in the worst-case estimate.

Power Summary		Environment	
Total Power	8.705 W	Junction Temperature	52 C
Junction Temperature (Tj)	51.9 C	Ambient Temperature (Ta)	25 C
Thermal Margin	48 C	Effective ThetaJA	3.954 C/W
Thermal Power Margin	12.164 W	Max. Junction Temperature	100 C
Characterization	Production(+/- 15% accuracy)		

Voltage & Current Requirements				Thermal Loading	
Rail	Voltage	Current	Range	Component	Power
VCC_SOM	5.0 V	1.741 A	4.750 - 5.250 V	K26	6.803 W
VCCO_HPA	1.5 V	0.000 A	1.470 - 1.545 V	DDR4: U11-U14	0.000 W
VCCO_HPBB	1.5 V	0.000 A	1.470 - 1.545 V	VR: U170	0.564 W
VCCO_HPC	1.5 V	0.000 A	1.470 - 1.545 V	VR: U167	0.406 W
VCCO_HDA	1.8 V	0.000 A	1.764 - 1.854 V	VR: U166	0.652 W
VCCO_HDB	1.8 V	0.000 A	1.764 - 1.854 V	VR: U151	0.000 W
VCCO_HDC	1.8 V	0.000 A	1.764 - 1.854 V	VR: U165	0.118 W
VCC_BATT	1.5 V			PCB.1	0.164 W
				eMMC: U133	0.000 W

Use the results of your initial estimation and thermal simulations to constrain a Vitis or Vivado design to keep the power of the deployed application within the required power limits. As a minimum, use the following constraints to report power for a correct analysis of the SOM power and to accurately assess static and dynamic power:

```
set_operating_conditions -design_power_budget <Power in Watts>
set_operating_conditions -process maximum
set_operating_conditions -ambient_temp <Max Supported by Application>
set_operating_conditions -thetaja <Increase in Tj for every W dissipated C/W>
```



---

**POWER TIP:** To get the complete SOM power estimation from a currently implemented design, load the *XPE* file from the report power into the PDM to estimate the power required for the other components on the SOM.

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**Note:** For further power estimation design resources, consult the *Power Design Manager User Guide (UG1556)*.

# Additional Resources and Legal Notices

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## Xilinx Resources

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

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## Documentation Navigator and Design Hubs

Xilinx<sup>®</sup> 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<sup>®</sup> 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.

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## References

These documents provide supplemental material useful with this guide:



1. *Kria SOM Carrier Card Design Guide* ([UG1091](#))
2. [Power Design Manager](#) tool.
3. *Power Design Manager User Guide* ([UG1556](#))
4. *Kria K26 SOM Thermal Models* ([XTP717](#))
5. *Kria K26 SOM Data Sheet* ([DS987](#))
6. *Kria KV260 Vision AI Starter Kit Data Sheet* ([DS986](#))
7. *Kria KV260 Vision AI Starter Kit User Guide* ([UG1089](#))
8. *Kria K26 SOM 3D CAD Step File* ([XTP680](#))

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