

reComputer Robotics J401

Thermal Design Guide

This document serves as the Thermal Design Guide (TDG) for the reComputer Robotics J401 series and its carrier board. It provides system-level thermal, mechanical, and qualification requirements for the Jetson Orin module series and carrier board. For detailed drawings and module dimensions, refer to:

- [reComputer Robotics User Manual](#)
- [Jetson Orin NX Series Data Sheet](#)
- [Jetson Orin Nano Series Data Sheet](#)

The reComputer Robotics system consists of a carrier board, power supply extension Board, Jetson Orin module, and accessories (e.g., SSD, wireless modules). **Dominant hotspots include:**

1. Jetson Orin modules (e.g., Orin NX 16GB/8GB, Orin Nano 8GB/4GB);
2. Power Supply Extension Board;
3. M.2 NVMe SSD.

Thermal Design References

- Power Supply Extension Board Cooling:

This guide focuses on thermal data and design references for the Power Supply Extension Board, including power consumption distribution, thermal resistance parameters, and heatsink selection recommendations (see specific sections in the document).

- Jetson Orin Module Cooling:

Strictly follow NVIDIA's official thermal design specifications. Refer to:

[Jetson Orin NX Series and Jetson Orin Nano Series Modules Thermal Design Guide](#)

- SSD Cooling:

Design based on the thermal parameters specified in the SSD datasheet (e.g., 128GB NVMe 2280 SSD). It is recommended to use the aluminium heatsink.

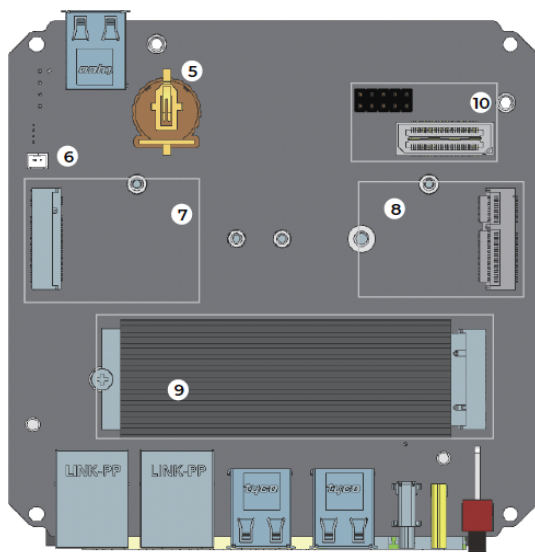
Mechanical and Environmental Requirements

The cooling system specification of reComputer Robotics are listed below:

- **Operating Temperature:** -20°C ~ 55°C (25W mode); -20°C ~ 50°C (40W/MAXN mode).
- **Cooling Solution:** The system supports 5V/12V PWM fans and includes an aluminum case with heatsinks (accessories provided with the product).

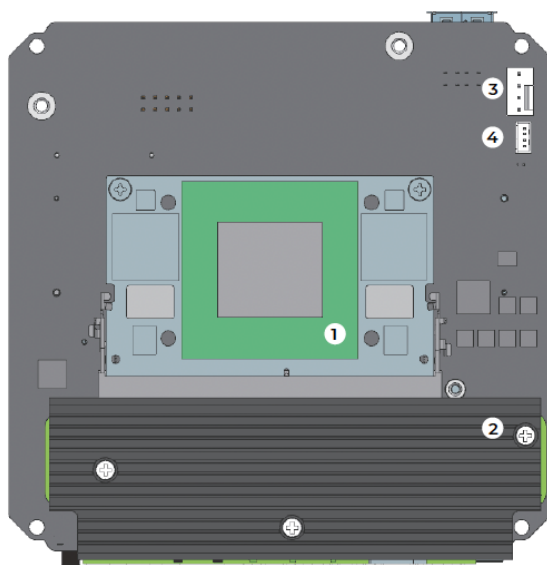
For customized cooling solutions for reComputer Robotics J401 carrier board, customers are responsible for reading and understanding this entire thermal design guide.

reComputer Robotics J401 Carrier Board Placement-Top View



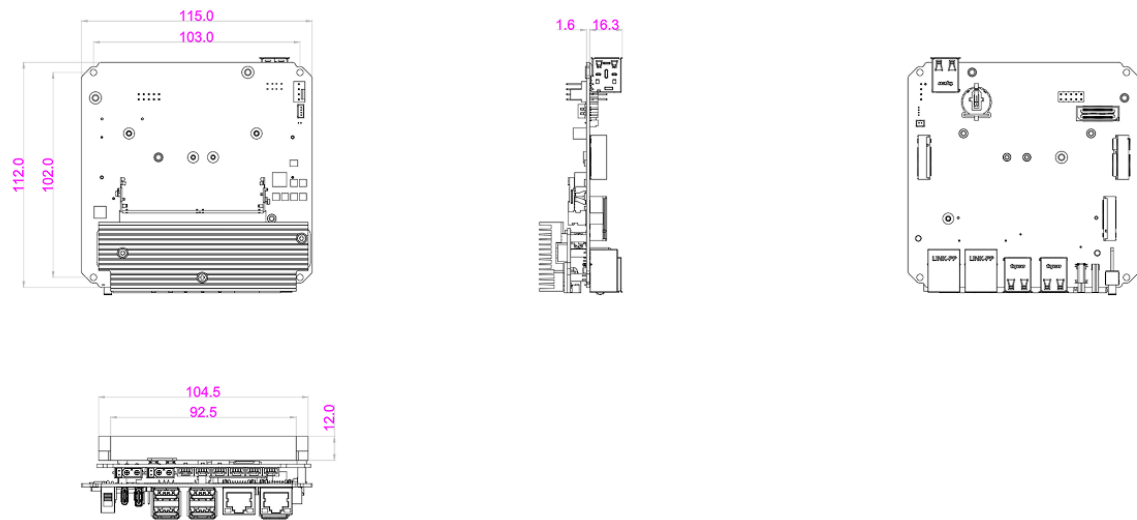
- ⑤ RTC Battery Socket
- ⑥ RTC 2-Pin Header
- ⑦ M.2 Key B Slot
- ⑧ M.2 Key E Slot
- ⑨ M.2 Key M Slot(with SSD)
- ⑩ Camera Expansion Header

reComputer Robotics J401 Carrier Board Placement-Bottom View

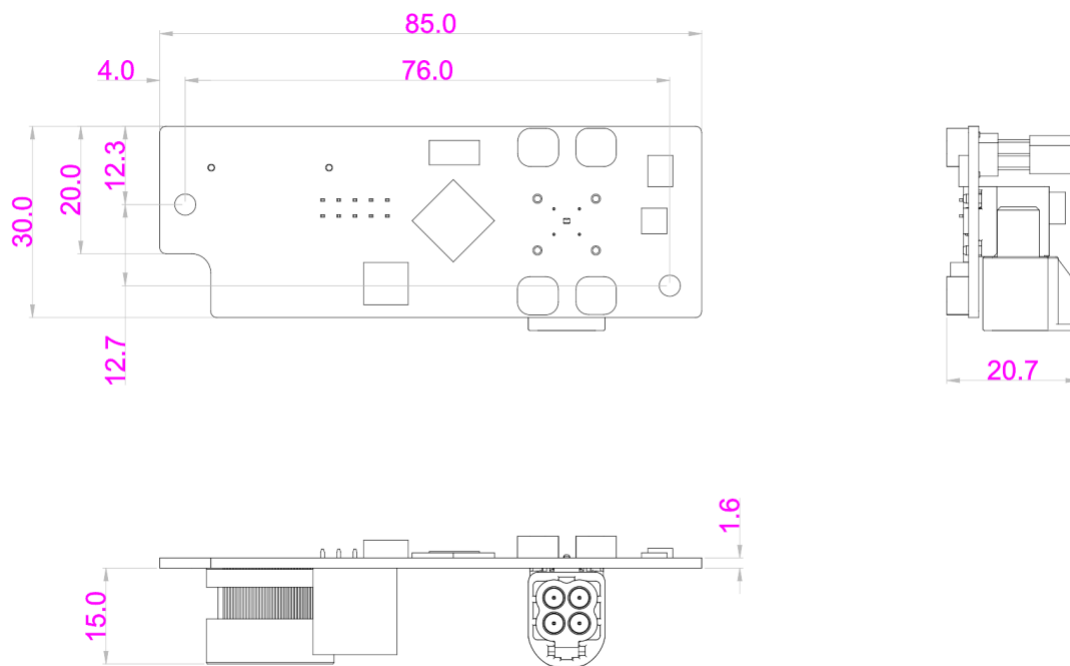


- ① Nvidia Jetson Orin Module
- ② Power Supply and JST Expansion Board
- ③ 4-Pin Fan Connector (12V PWM)
- ④ 4-Pin Fan Connector (5V PWM)

Orthographic view of reComputer Robotics J401 PCBA



Orthographic view of GMSL2(MAX96712) extension board PCBA



The Thermal Performance of Power Supply Board

The required system thermal performance can be determined based on the ambient temperature conditions and TMP level required by the customer. Consider the following example of reComputer Robotics Power Supply Board:

- The ambient Temperature: $T_{amb} = 60^{\circ}\text{C}$
- The maximum inductor temperature: $T_{max} = 125^{\circ}\text{C}$
- Allowable Temperature Rise: $\Delta T = T_{max} - T_{amb} = 125^{\circ}\text{C} - 60^{\circ}\text{C} = 65^{\circ}\text{C}$
- Power Dissipation: $P = 1.9\text{W}$

The heat sink thermal performance requirement for these conditions. The target total thermal resistance:

$$R\theta_{total} \leq \frac{\Delta T}{P} = \frac{65^{\circ}\text{C}}{1.9\text{ W}} \approx 34.2^{\circ}\text{C/W}$$

In this example, 1.9W is the empirical value of power dissipation obtained under 54V power input with a 60W peripheral connected (totally 100W with Orin NX module in 40W mode). A thermal solution of 34.2 °C/W is expected to be sufficient to maintain the power supply board within the maximum temperature specification. In addition to this, the customer is responsible to verify the Jetson module following NVIDIA thermal design reference guide and all other components following the datasheet within their maximum temperature specifications.

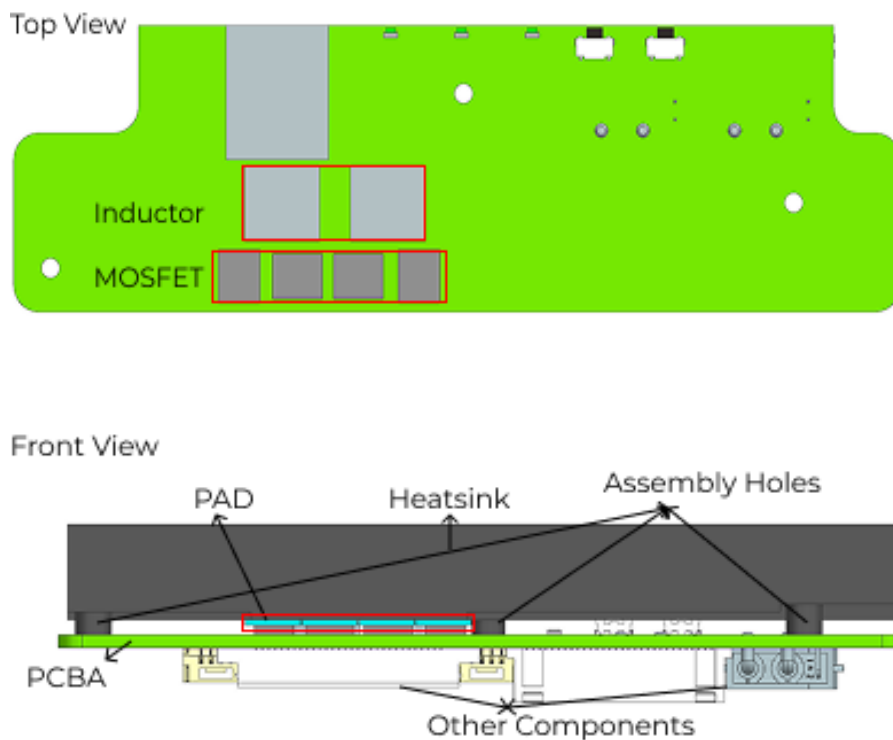
Key Takeaways

- The design must ensure heat dissipation paths (e.g., PAD, heat sink) have a combined thermal resistance $\leq 34.2^{\circ}\text{C/W}$ to prevent overheating.
- Reducing the PAD's thermal resistance (e.g., using higher-conductivity materials or thicker pads) is critical to meeting this target. The 4 thermal PADs with 6 W/m·K thermal conductivity are recommended for heat dissipation.
- This approach balances power handling, temperature limits, and thermal management to ensure reliable operation.

reComputer Robotics Thermal Design Details

The customer is responsible for the following items:

- Thermal Solution: A system thermal solution capable of cooling the appropriate amount of TMP for the target workload.
- TIM(Thermal Interface Material): The customer is responsible for providing the TIM between the power supply board and customer's system level thermal solution. For best thermal performance, the TIM should provide low thermal impedance within the mechanical, reliability, and cost constraints of the customer's product.
- Maximum Temperature: To ensure that the maximum Orin SoC operating temperature is less than the value specified in [TDC](#), and the maximum component temperatures on the PCB must not exceed the values specified in Table and jetson Orin module thermal design.
- Example thermal stack up is shown in Figure below.



Document History

Version	Date	Description
V1.0	2025/6/11	Initial Version