Raspberry Pi 5 2GB: A Deep Dive into the D0 Stepping

This document outlines the key findings from a detailed analysis of the Raspberry Pi 5 2GB model, which features a new "D0" stepping of the BCM2712 chip.

Key Takeaways:

* **D0 Stepping:** The new stepping is a simplified version of the BCM2712 chip found in the 4GB Pi 5, featuring the removal of unused functionality ("dark silicon"). This makes the chip smaller and cheaper to produce, while still offering comparable performance.
* **Smaller Chip Size:** The D0 chip is 32.5% smaller than the C1 stepping, leading to potential cost savings and increased efficiency.
* **Overclocking:** Both the 2GB and 4GB Pi 5 models can be overclocked significantly, with the 2GB model reaching 3.4GHz with a Peltier cooler and exceeding 3.6GHz with a delidded chip and direct die cooling.
* **Performance:** The 2GB Pi 5 delivers comparable performance to the 4GB model, especially when running tasks that don't require heavy RAM usage.
* **Power Efficiency:** The smaller chip size results in improved power efficiency, particularly at idle. The 2GB Pi 5 consumes approximately 30% less power than the 4GB model at idle.
* **RAM Limitations:** The 2GB model's limited RAM can be a bottleneck for memory-intensive tasks.
* **Thermal Performance:** Despite the smaller chip, thermal performance doesn't seem significantly impacted, and the heat spreader remains beneficial for overall heat dissipation.

Detailed Analysis:

* **Benchmarking:** The 2GB Pi 5 was tested with Geekbench and sysbench, showing comparable performance to the 4GB model with lighter workloads. Overclocking results showed a slight performance advantage for the 2GB model at certain clock speeds.

* **Delidded Chip Analysis:** The smaller die size of the D0 stepping was confirmed through visual inspection.

* **Power Consumption:** Detailed testing revealed a significant improvement in power efficiency for the 2GB model, particularly at idle.

* **Thermal Testing:** Removing the heat spreader did not significantly improve thermal performance.

Recommendations:

* **Use Case Considerations:** The 2GB Pi 5 is a great option for applications that don't demand large amounts of RAM.

* **4GB Pi 5 as Goldilocks:** The 4GB Pi 5 provides a balance between performance and cost for most users.

* **Future Considerations:** It would be beneficial for the 4GB Pi 5 to adopt the D0 stepping for improved efficiency.

Overall:

The Raspberry Pi 5 2GB model offers a cost-effective alternative to the 4GB version, with comparable performance and improved power efficiency. However, its limited RAM makes it unsuitable for memory-intensive tasks.