Efficient PCB Layout for DMS Systems

Scope: Complete End-to-End PCB Layout Design

Application: Advanced Driver Assistance Systems (ADAS)

Driver Monitoring Systems (DMS) are vital for the safety and efficiency of Advanced Driver Assistance Systems (ADAS). The performance and reliability of these systems depend significantly on the quality of the PCB (Printed Circuit Board) layout. A thorough and well-executed end-to-end PCB layout design is crucial for ensuring that the DMS operates effectively and reliably.

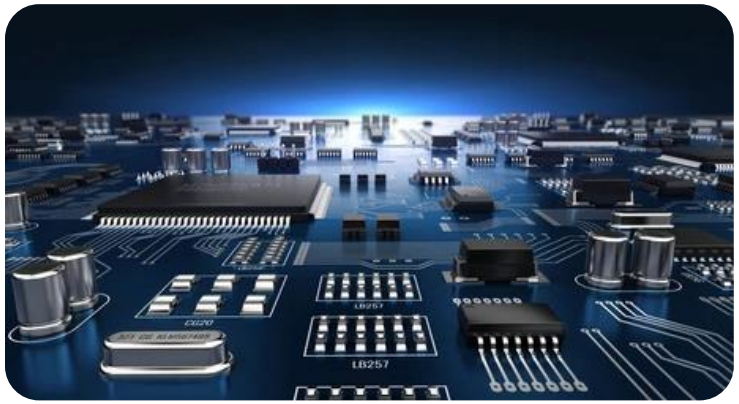
This Case study focuses on the complete end-to-end PCB layout design process and its impact on enhancing the reliability of DMS within ADAS applications. We will examine how optimizing each stage of the PCB design—from initial planning and component placement to final routing—can improve system performance, reduce errors, and ensure robust operation.

Challenges

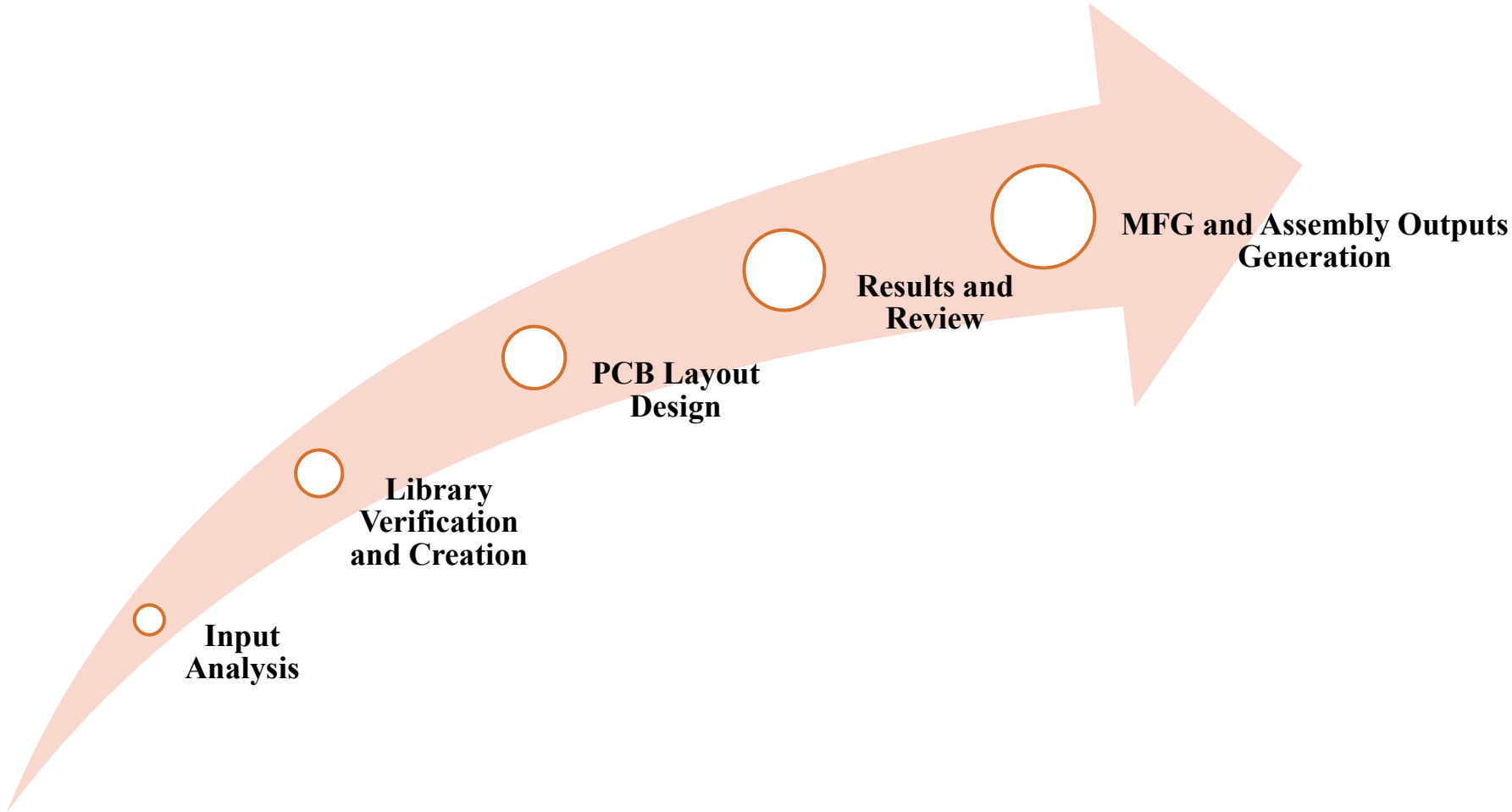
The client has tasked us with updating their existing PCB version, which involves a complete redesign of the PCB layout, including schematic verification to generating manufacturing outputs.

Challenges:

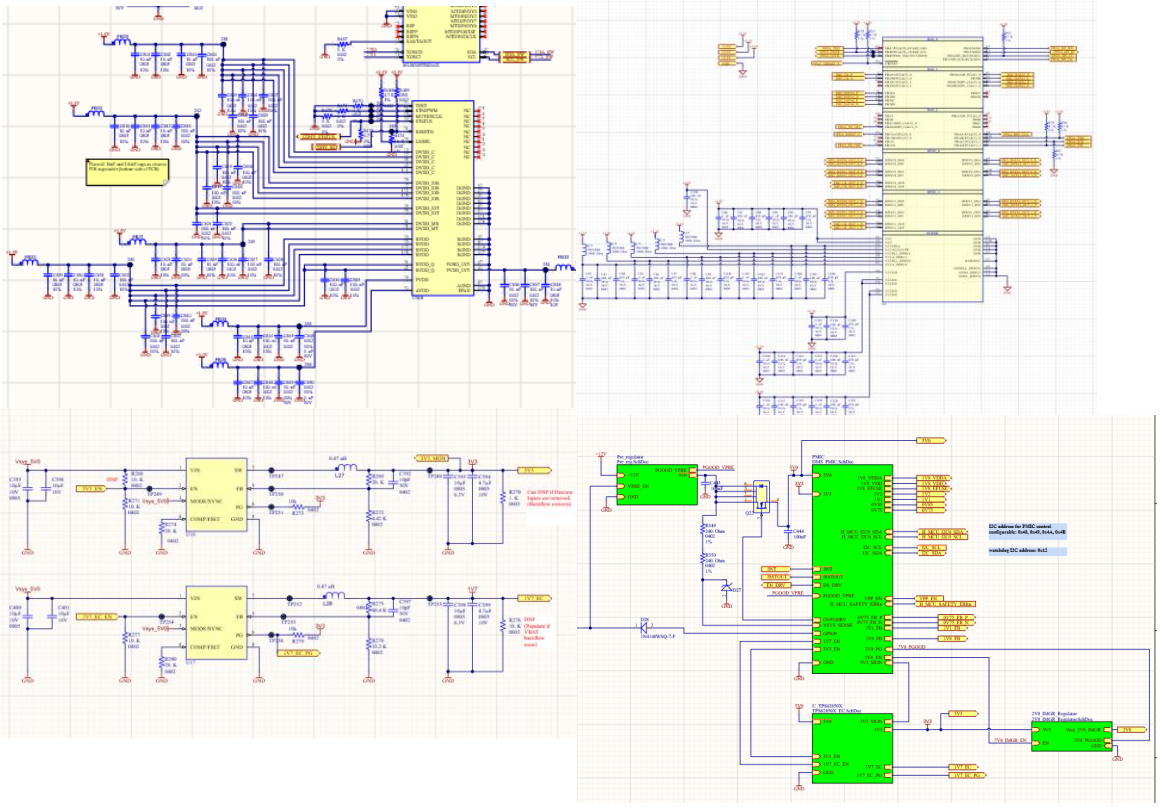
- Check and update the library to meet standards, especially for non-standard components.
- Build a library for project-specific components not currently in the database.
- Increased component count and a reduced board size.
- Maintain critical component sections from the previous version to preserve signal integrity without altering their locations.
- Design effective power distribution and Ensure compliance with EMI/EMC standards.
- Incorporate Design for Manufacturing (DFM) considerations.
- Address requirements for multiple high-speed signal groups.



PCB Layout Design - SoW



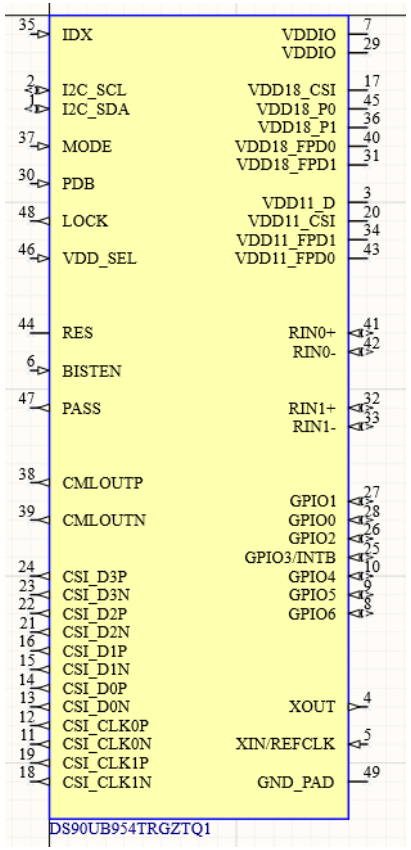
Input Analysis



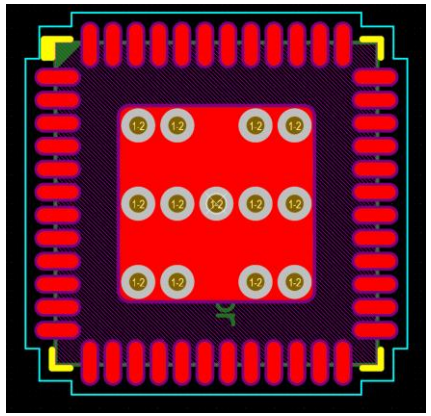
PCB Project contains,

- Total components → 2089
- Layer count → 12
- Total connection → 4512
- Dimension → 220mm X 53mm
- Pin count → 4440
- No. of powers → 16
- No. of High speed signal Groups → 10
- Devices → Video processor (TFBGA196),LPDDR4,Microprocessor (FCBGA-484),Deserializer, Microcontroller, Display controller, PMICs, Buck and Boos converters
- BGA Pitch
- 0.8mm X 0.8 mm - MPSoC
- 0.8mm X 0.65mm - DDR4
- 0.65mm X 0.65mm - Video Processor

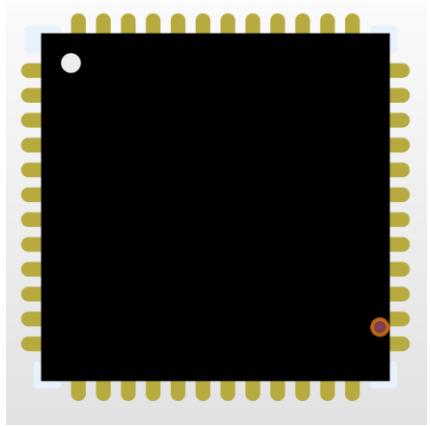
Library Verification and Creation



Symbol



Footprint



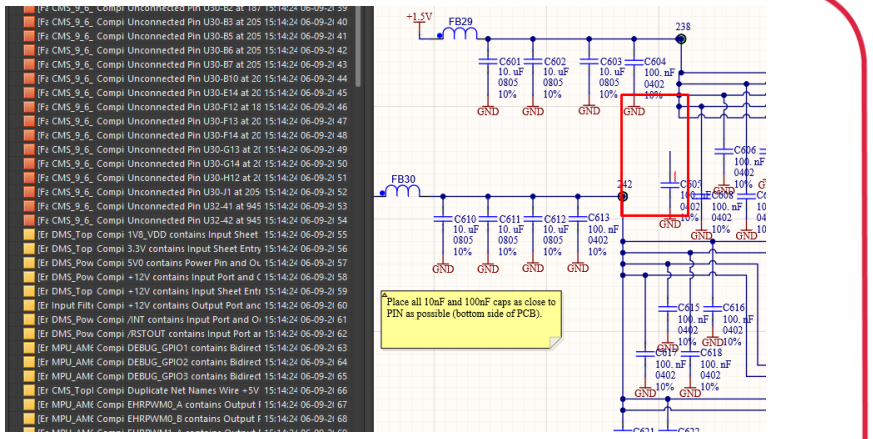
3D Model

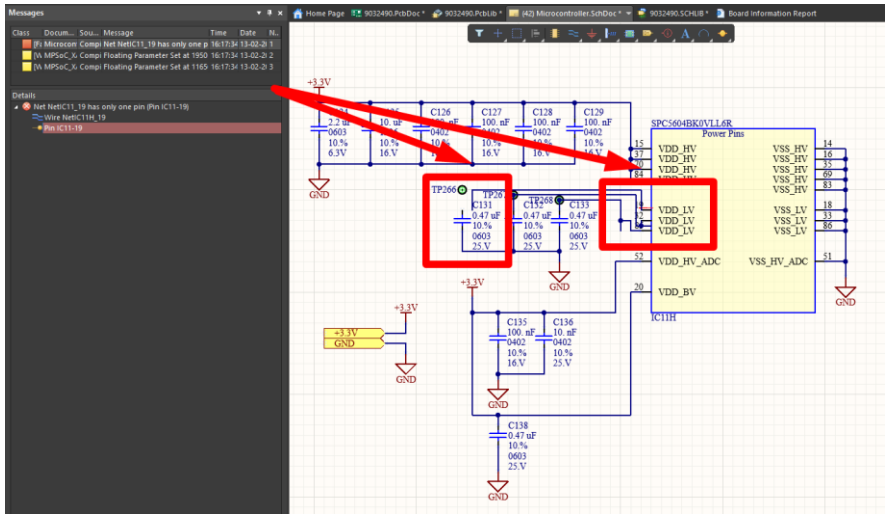
The library files, including symbols, footprints, and 3D models, will be reviewed to ensure they meet standards, with new libraries created as needed.

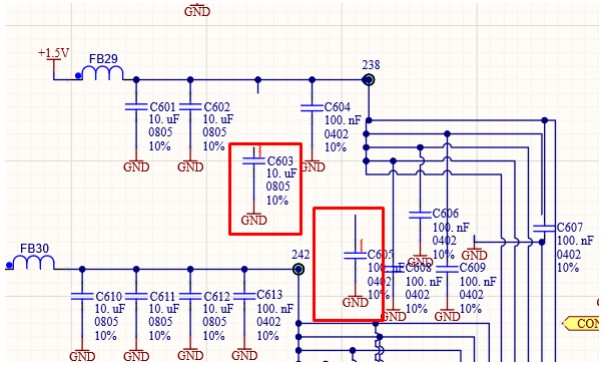
- **Verified:** 420 symbols and 260 footprints
- **Updated to Standards:** 40 symbols and 33 footprints
- **Created:** 20 new symbols and 32 new footprints

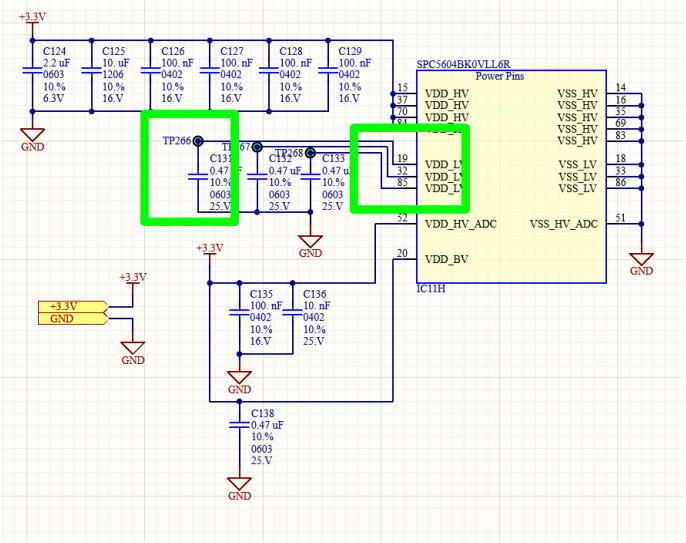
Schematic Review and Validation

- Developing a power flow diagram and block diagram based on the schematics.
- Manually checking net and port connections to eliminate any floating nets in the schematic.
- Correcting any errors found in the schematics.
- Performing verification through ERC (Electrical Rules Check).



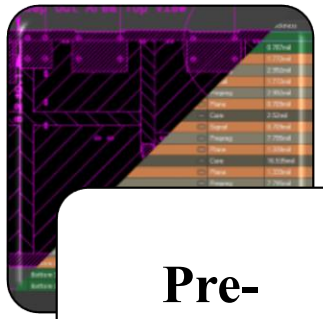






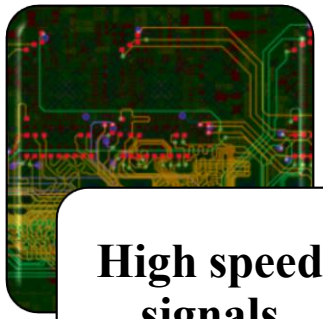
PCB Layout Design

PCB Layout Design - Execution



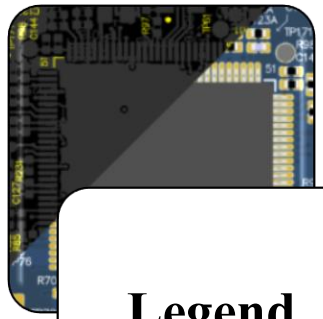
Pre-Layout Process

Placement and Routing



High speed signals Length Matching

DRC, Cu Clean up

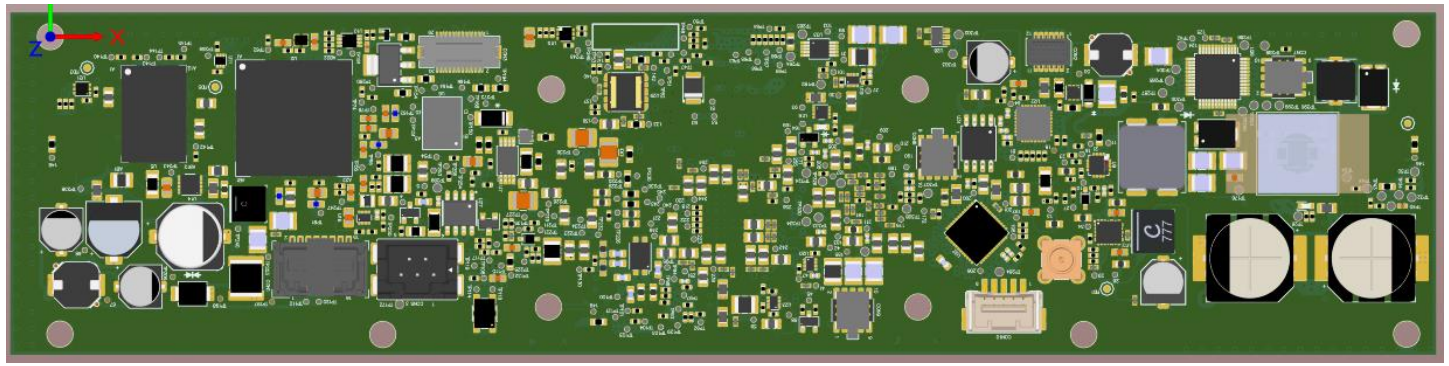


Legend cleanup

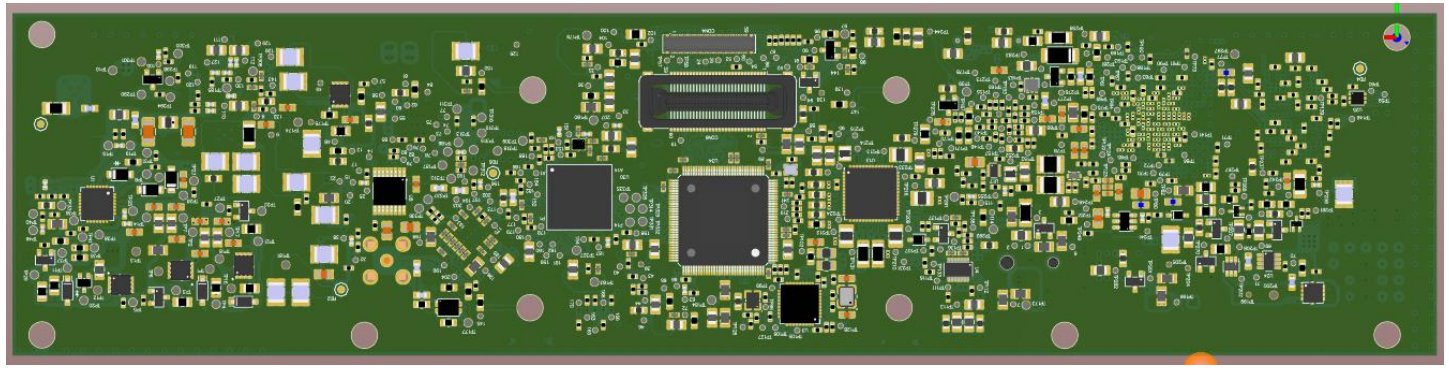
Results and Review

- Completed layout design with considerations for power distribution, EMI/EMC, and Design for Manufacturing
- Incorporated and verified client reviews and feedback at each stage of the design process.

Top view (3D)



Rear view (3D)

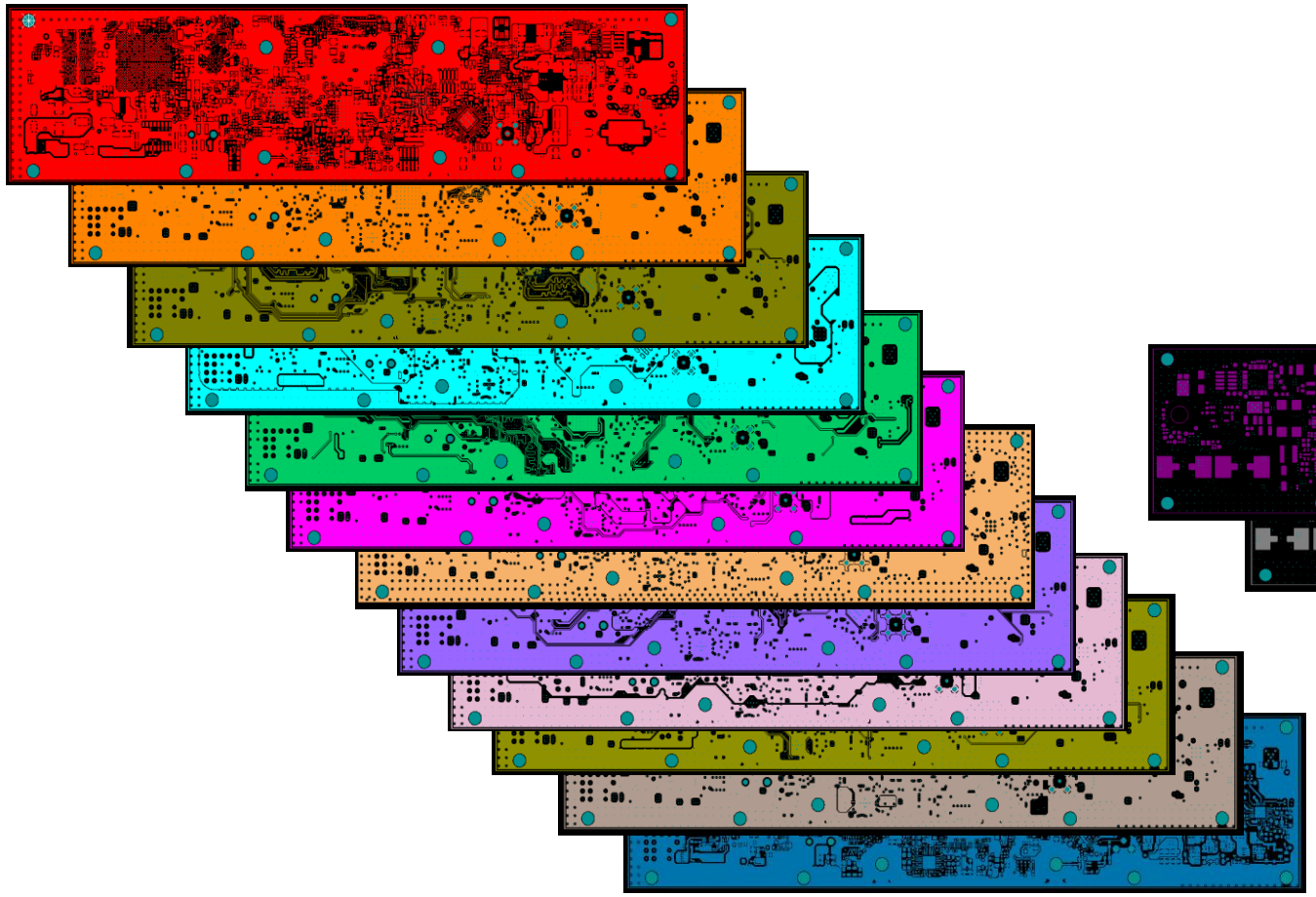


MFG Outputs Generation

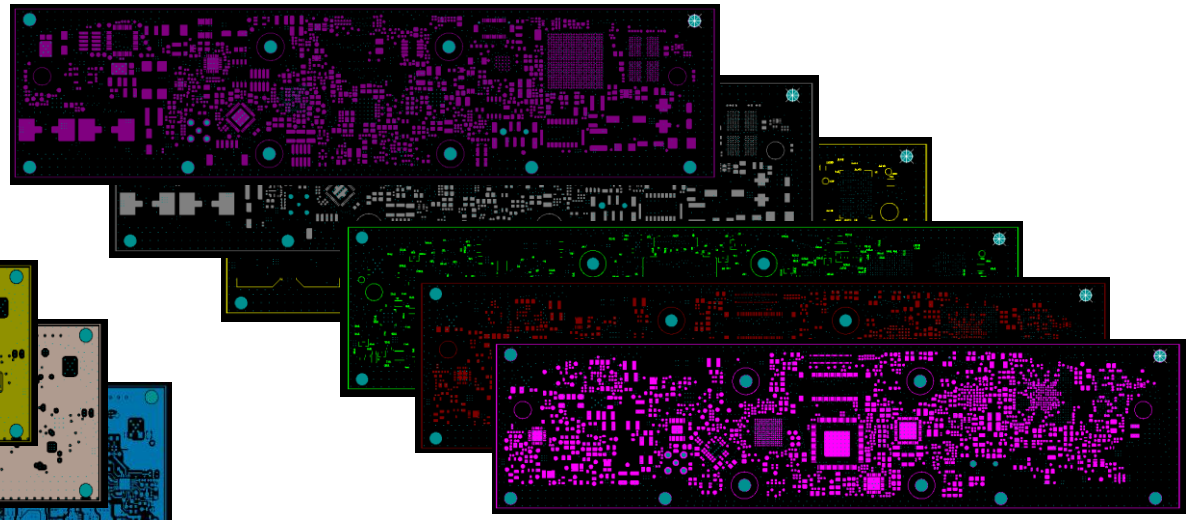
An ISO-27001 ISMS Certified Company

MFG Outputs

- Gerber Files
- NC Drill Files.
- ODB++ files
- Hyper Lynx File



Copper Layers (Electrical)



Solder Mask, Solder paste & Overlay Layers (Non-Electrical)

Fabrication Outputs Generation

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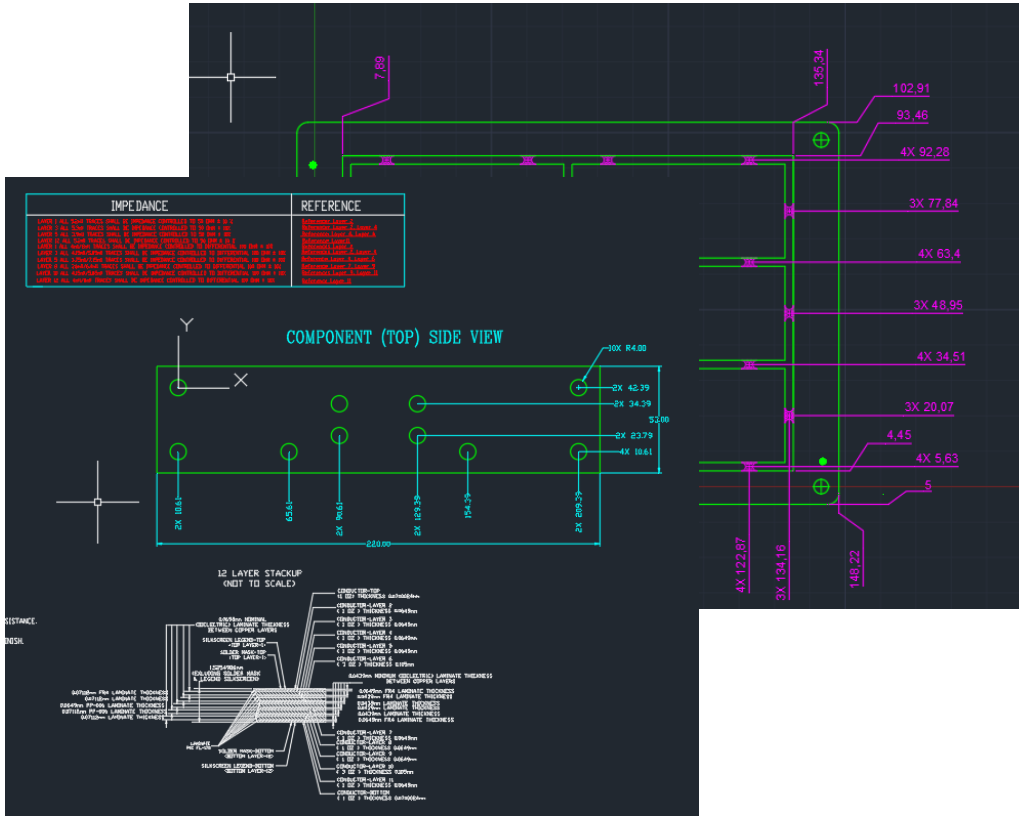
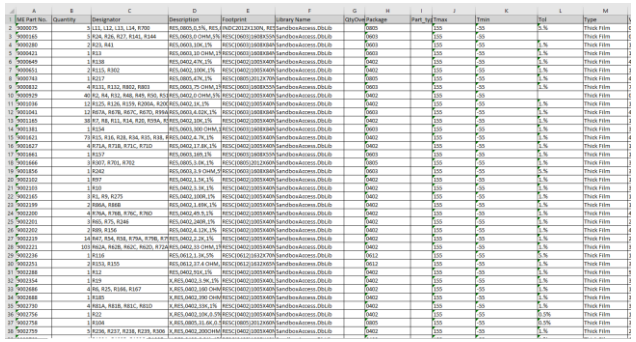
- Fab and Array Drawings

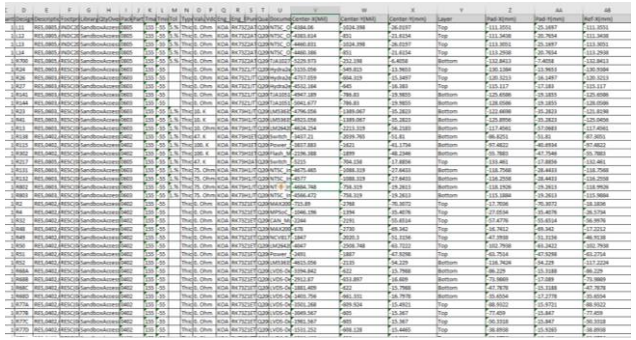


- 3D step File

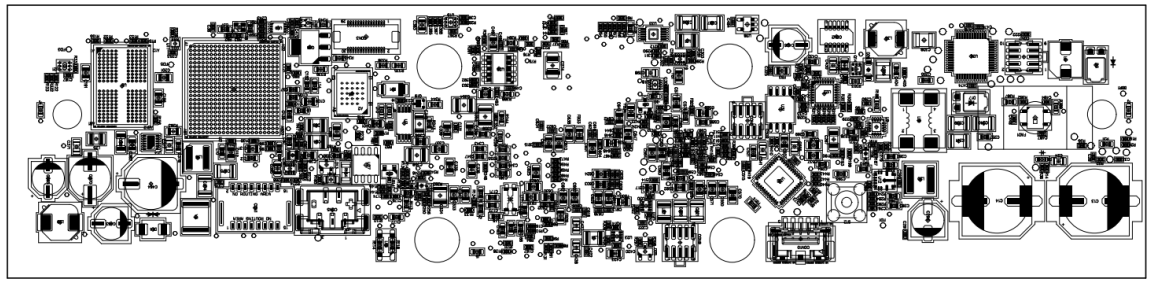
Assembly Outputs Generation

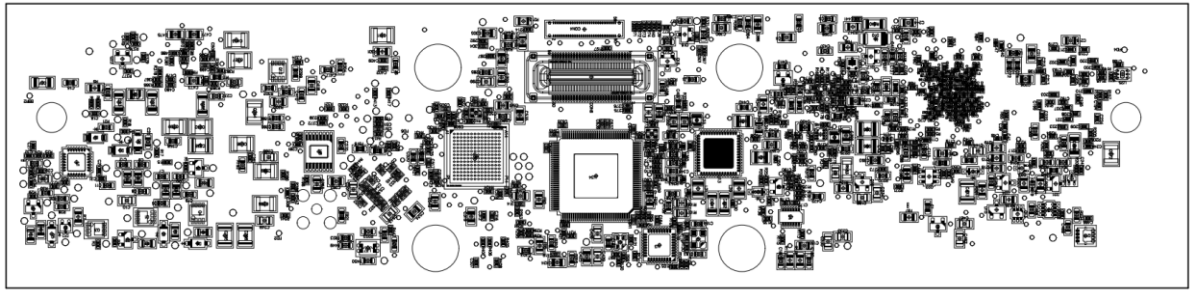
- BOM (Bill Of Materials) and PNP (Pick and Place) file





- Assembly Drawings (PDF file)





A Heartfelt Customer's Voice

The testimonial is a glowing review, highlighting the great effectiveness of PCB design and its impressive result,

"Collaborating with the GigHz team on our PCB design was a transformative experience. Their commitment to solving challenges, maintaining precision, and delivering a top-tier design within the timeframe and cost was remarkable. The final PCB not only met our technical needs but surpassed our expectations. Their expertise, passion, and dedication to quality were evident at every stage. We look forward to working with them again and highly recommend their exceptional services!"

Conclusion

- Designing the board presented challenges, particularly in managing a high number of connections within a compact space.
- Achieving the desired impedance profile for various signals required a strong focus on precision and quality.
- Leveraging our PCB design expertise, we efficiently overcame obstacles while upholding high quality standards.
- We proudly delivered a high-quality PCB that met technical requirements, adhered to timelines and budgets, and earned customer approval.