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Power Integrity Analysis for Videoscope system Board

Scope : Stable and Reliable Power Distribution Network

Application : Manufacturing Industries

The Advanced Videoscope Systems PCB Board offers a cutting-edge solution for precision inspection and quality control in manufacturing industries. Built for high-resolution video capture and real-time processing, it guarantees outstanding performance and dependability in demanding industrial conditions.

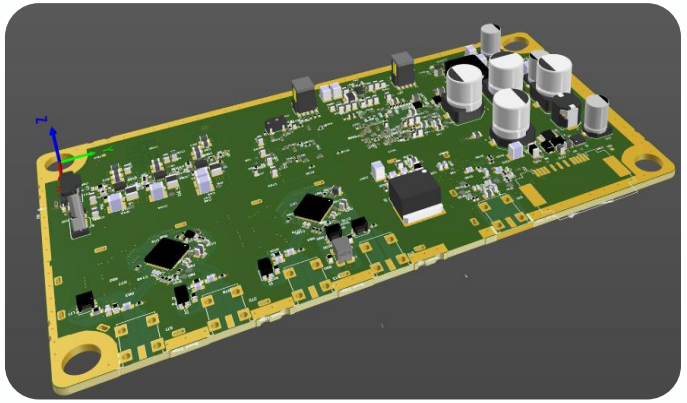
With a strong emphasis on durability and superior signal integrity, this board delivers accurate and reliable analysis, making it a critical component in maintaining product quality and boosting operational efficiency in modern manufacturing environments.

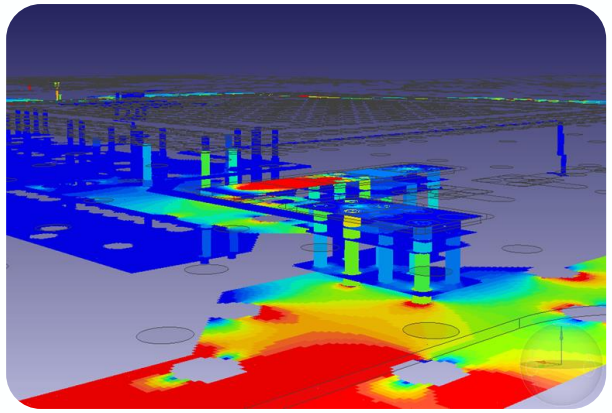
Power Integrity Analysis - Challenges

The client has tasked us with analyzing the power integrity of the layout to ensure it meets the necessary performance requirements. Below are the key challenges involved in the Power Integrity Analysis.

Challenges

- Optimization of Circuit Schematics
- Placement of Decoupling Capacitors
- Voltage Drop, Current Density, and Via Current
- Impedance of Power Distribution Network (PDN)
- Resonance Effects
- High-Frequency Behavior
- Power Supply Noise
- Design of Power Planes
- Effects of Ground Bounce
- EMI and EMC Considerations
- Internal Resistance of Power Planes





Power Integrity Analysis - SoW

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Investigation of Power Circuit

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Power Flow and Requirements Overview

Analysis Using HyperLynx

Essential Parameters for Analysis

02

Performance Analysis Review

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Graphs and Results

Recommendations for Improvement

For Performance Enhancement

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Implementation Strategies

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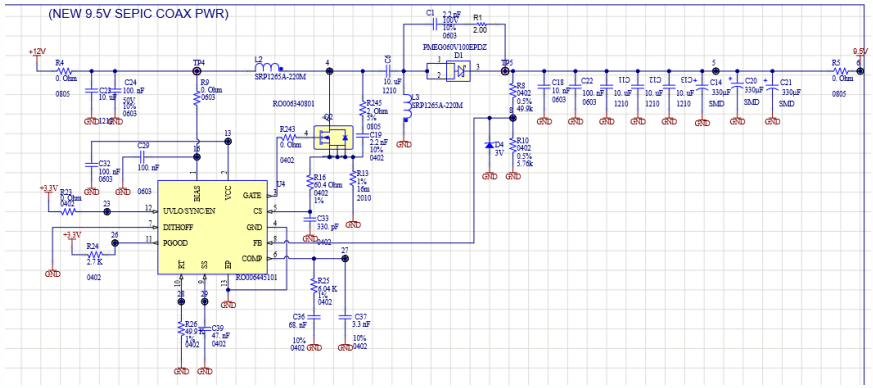
Improvements in Layout Design

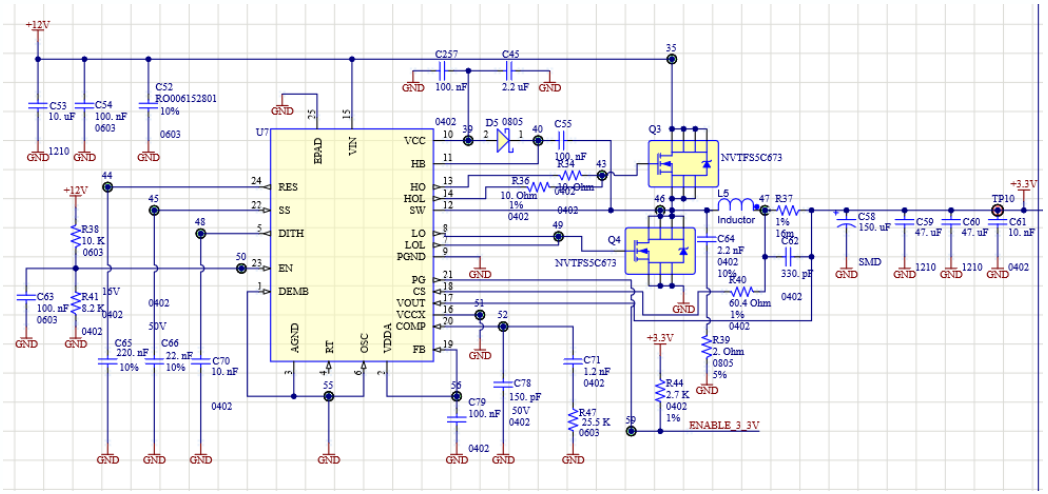
Investigation of Power Circuit

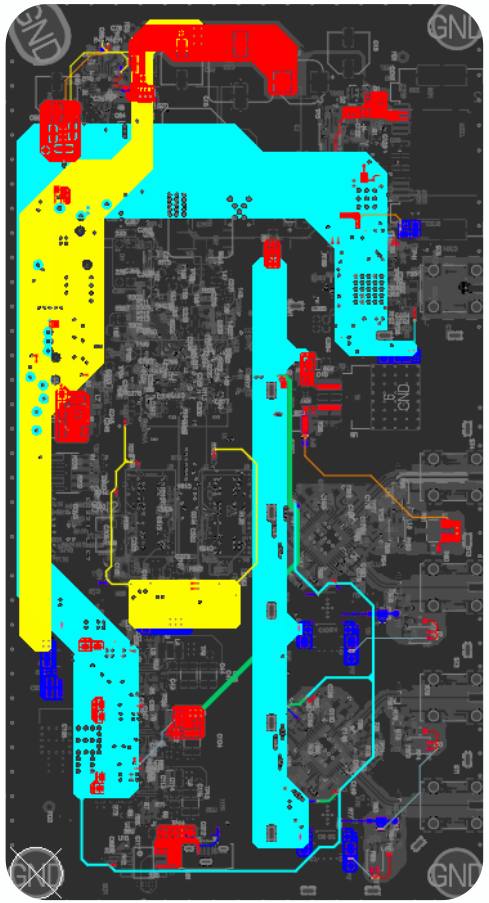
The power circuits in the project have been thoroughly examined to assess the performance of the power delivery network.

Power Circuits

- 12V
- Buck Converter – 3.3V
- SEPIC Converter – 9.5V
- 8.6V
- 1.8V
- 1.5V
- 0.8V
- 0.85V
- 1.1V
- 1.0 V
- 5V

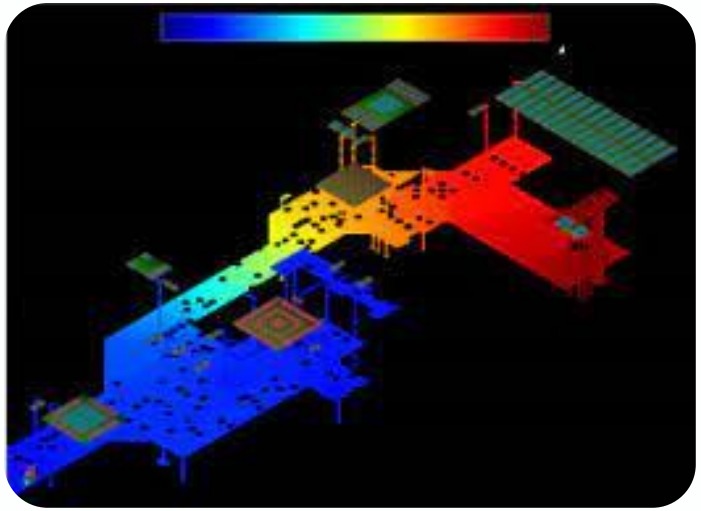






Analysis Execution

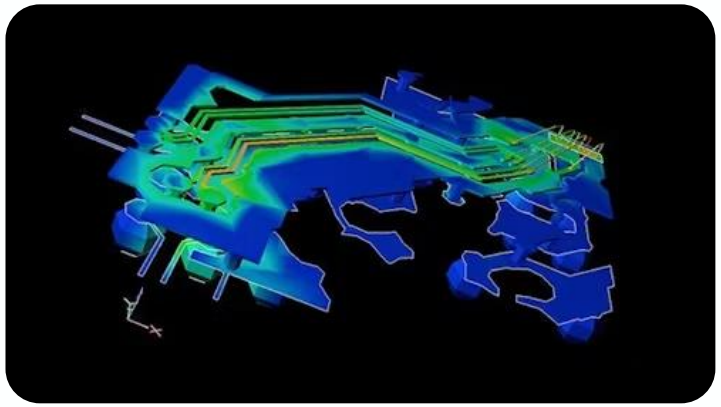
We conducted the analysis using the Hyper Lynx tool to assess the power integrity performance of the layout.



Problems in the power delivery network are identified from two perspectives:

DC (IR Drop) and AC (Frequency). The quantities to be calculated include:

- Current Density
- Voltage Drop
- Via Current



Analysis – Graphs and Results

Net Name: +12 V Voltage: 12V Current: 4.22A

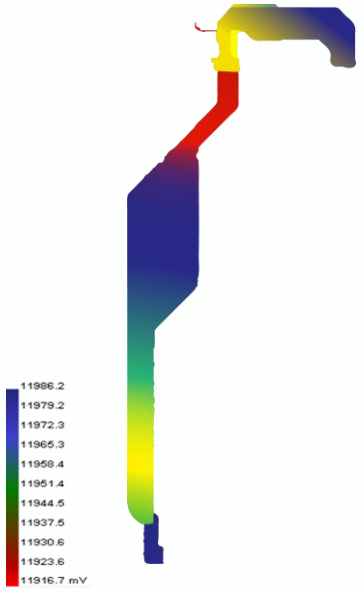
Analysis Parameters – Requirements

Max. Voltage Drop – 5.00%

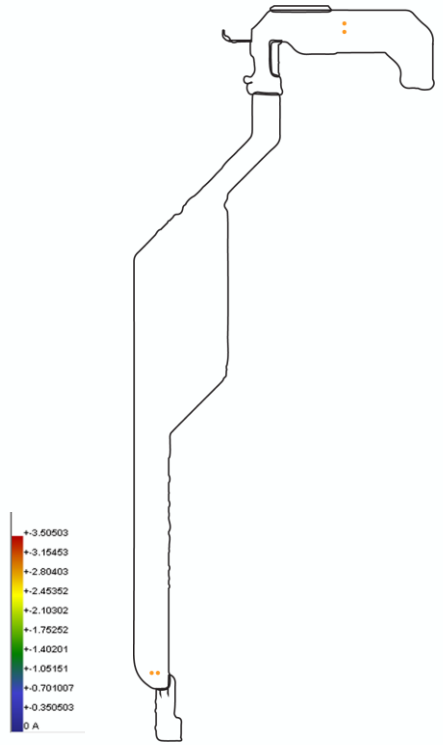
Max. Current Density – 100.00mA/mil²

Max. Via Current – 1000.0mA

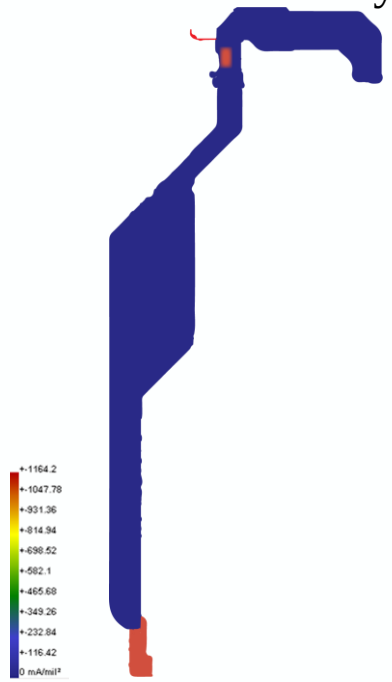
Voltage Drop



Via Current



Current Density



Analysis Result

#	Measurement	Test	Constraint
	Filter	Filter	Filter
1	Max Voltage Drop	PASS	5.000%
2	Max Current Density	FAIL	100.00mA/mil2
3	Max Via Current	FAIL	1000.0mA

Analysis – Graphs and Results

Net Name: +3.3V Voltage: 3.3V Current: 4A

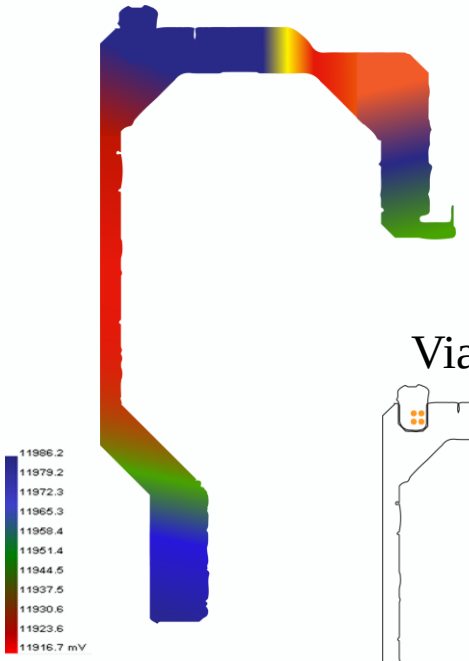
Analysis Parameters – Requirements

Max. Voltage Drop – 5.00%

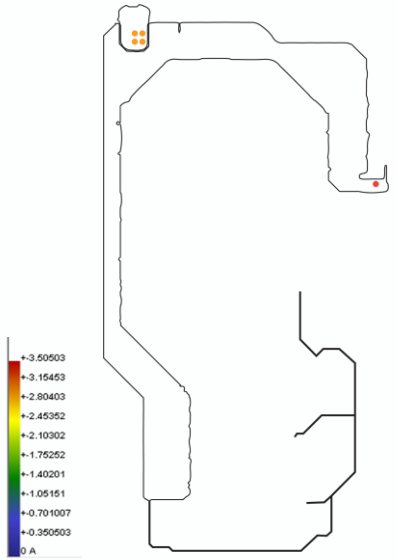
Max. Current Density – 100.00mA/mil²

Max. Via Current – 1000.0mA

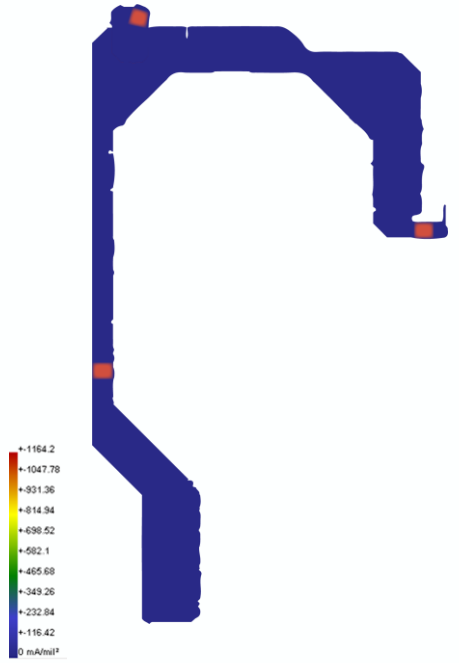
Voltage Drop



Via Current



Current Density



Analysis Result

#	Measurement	Test	Constraint
	Filter	Filter	Filter
1	Max Voltage Drop	PASS	5.000%
2	Max Current Density	FAIL	100.00mA/mil2
3	Max Via Current	FAIL	1000.0mA

Analysis – Graphs and Results

Net Name: +1.5V

Voltage: 1.5V Current: 3.25A

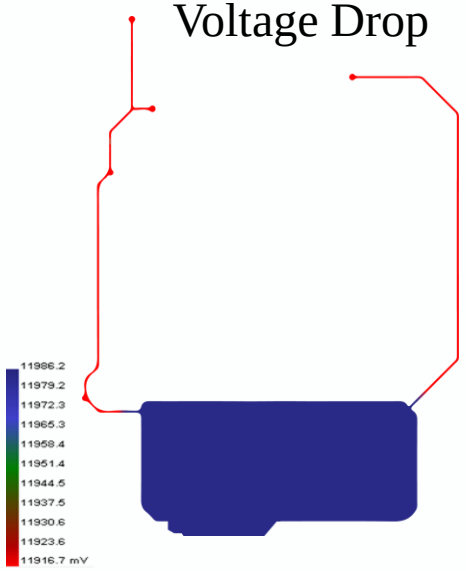
Analysis Parameters – Requirements

Max. Voltage Drop – 5.00%

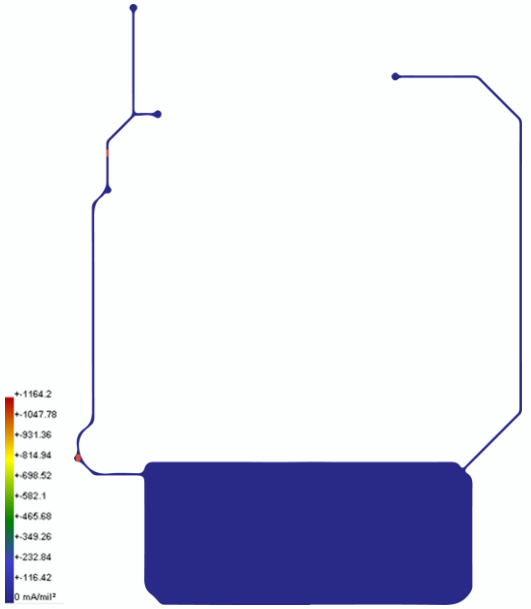
Max. Current Density – 50.00mA/mil²

Max. Via Current – 1000.0mA

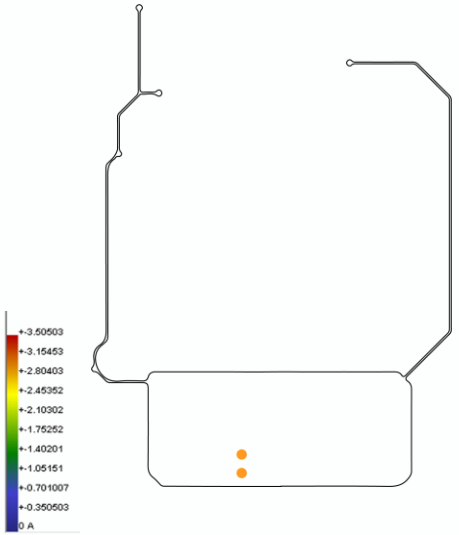
Voltage Drop



Current Density



Via Current



Analysis Result

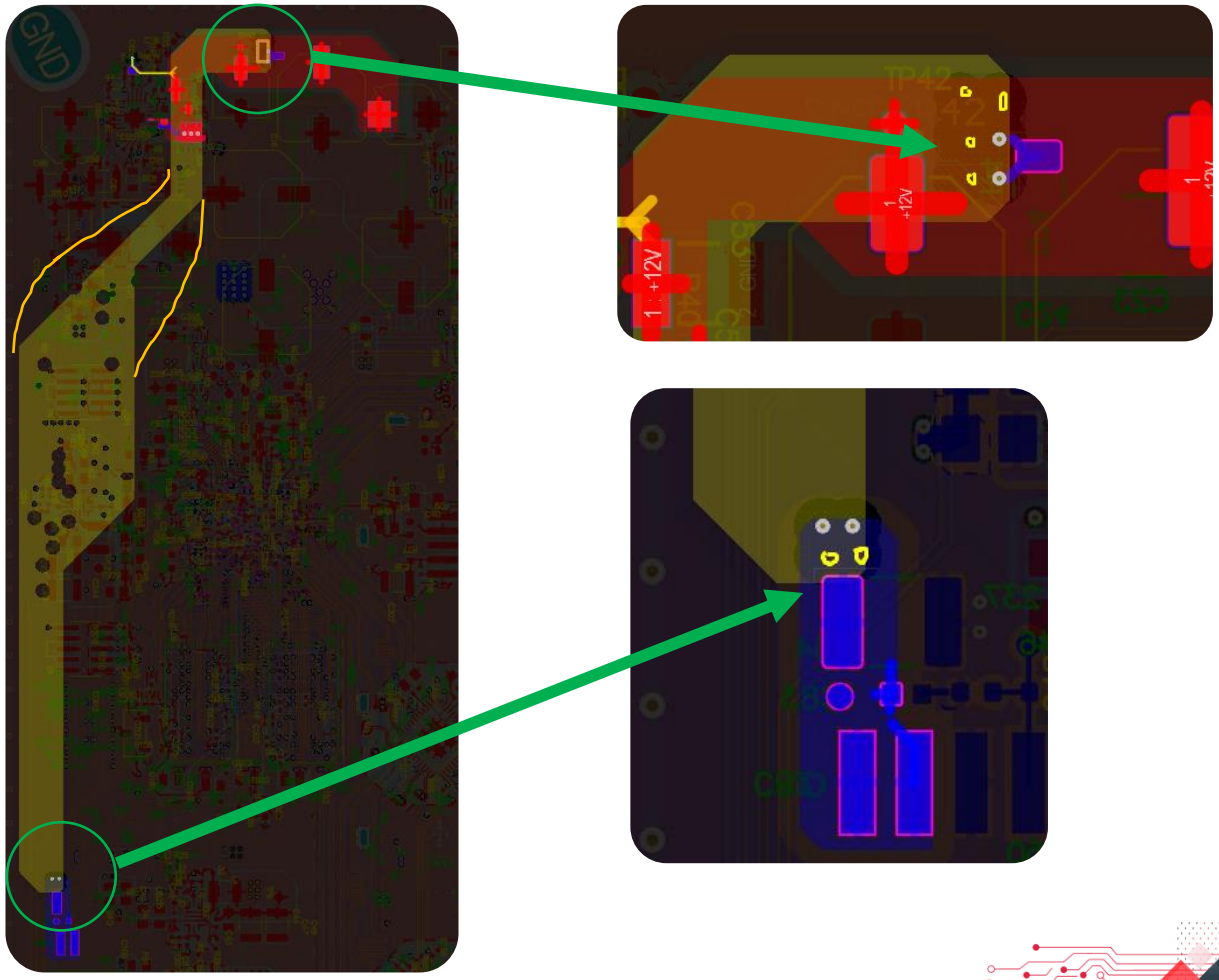
#	Measurement	Test	Constraint
	Filter	Filter	Filter
1	Max Voltage Drop	PASS	5.000%
2	Max Current Density	FAIL	50.00mA/mil2
3	Max Via Current	FAIL	1000.0mA

Recommendations for Improvement (Cont.)

The PCB layout's performance can be increased by the following recommendations

Power Net : 12V

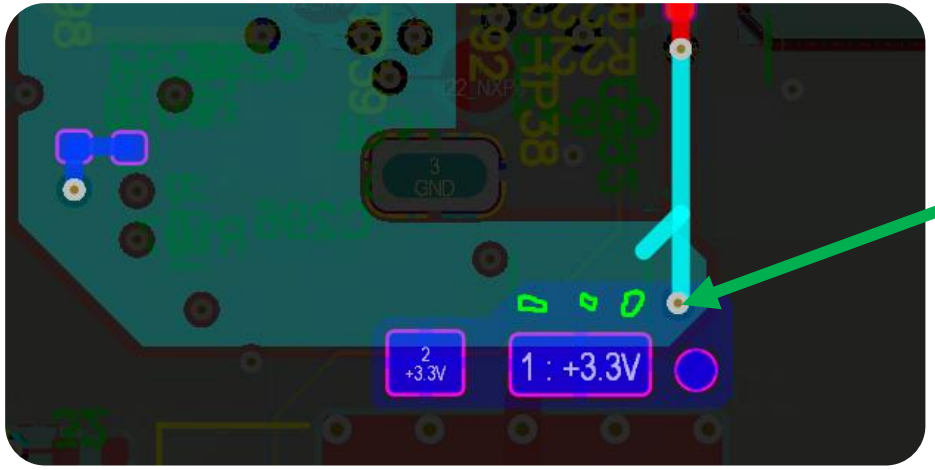
1. Increase the width of Cu pour at specified locations.
2. Add additional vias at the source point.
3. Add two via near Capacitor C82.

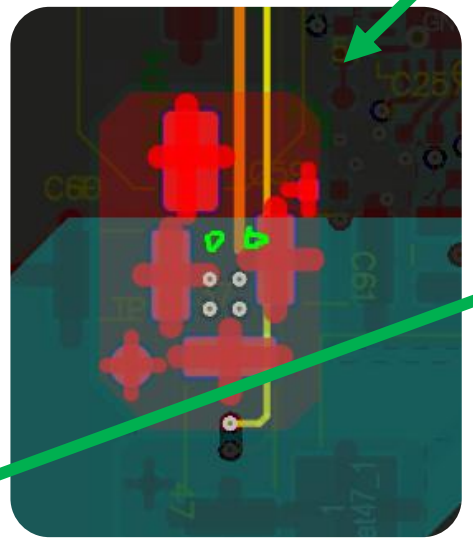


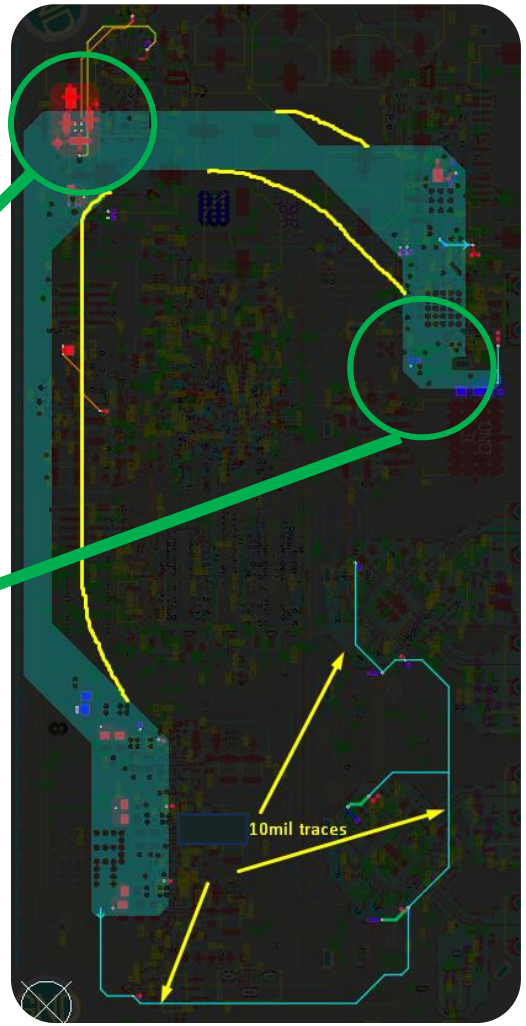
Recommendations for Improvement(Cont.)

Power Net : +3.3V

1. Increase the width of Cu pour at specified locations.
2. Increase the trace width in Layer 6 and Layer 8.
3. Add more vias to transfer power properly.







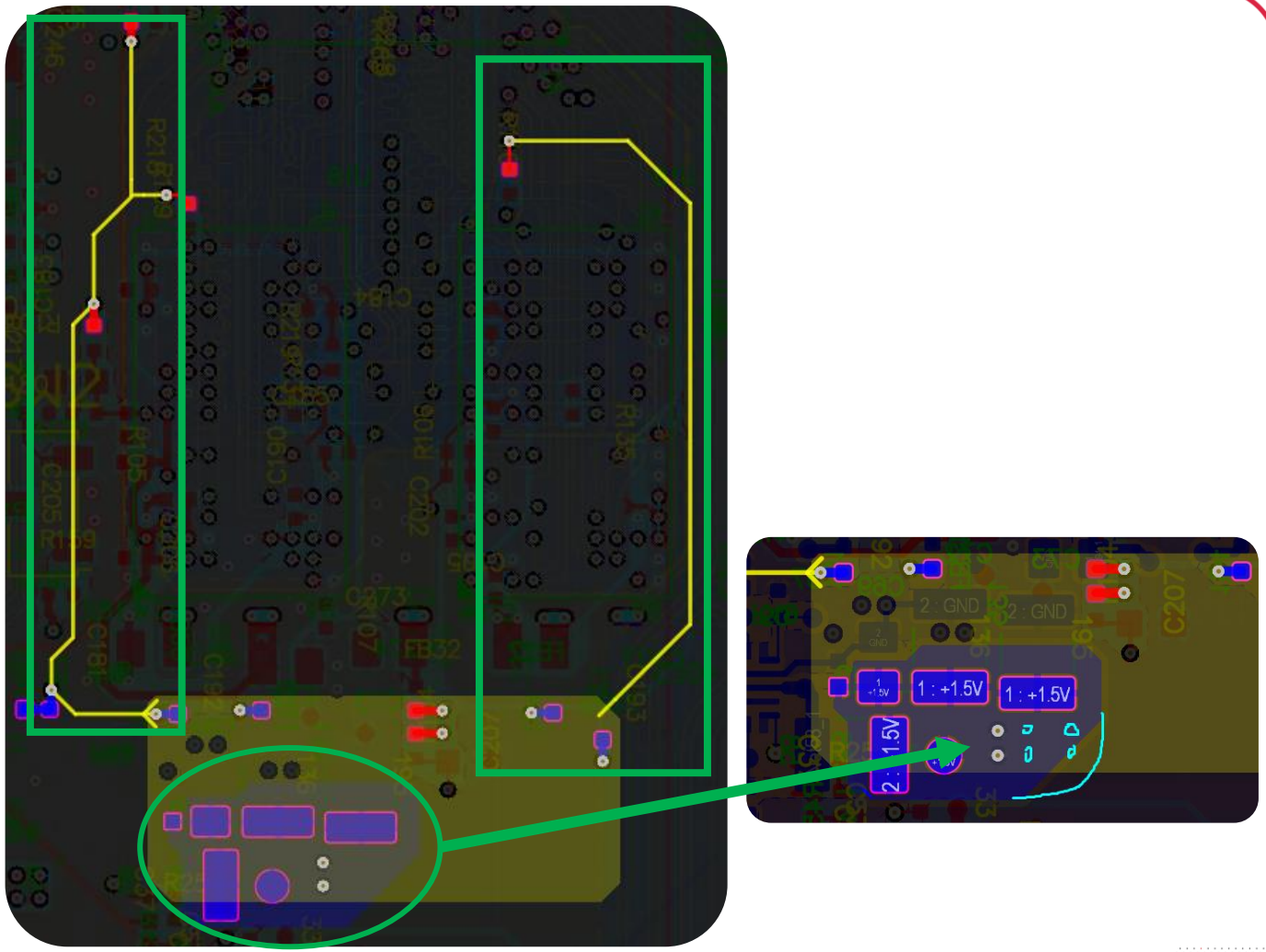
Recommendations for Improvement

Power Net : +1.5V

1. Increase the width of Cu pour at specified locations.

2. Increase the trace width to min. 20 mil on layer 5.

3. Add additional vias at the source point.



Implementation Strategies(Cont.)

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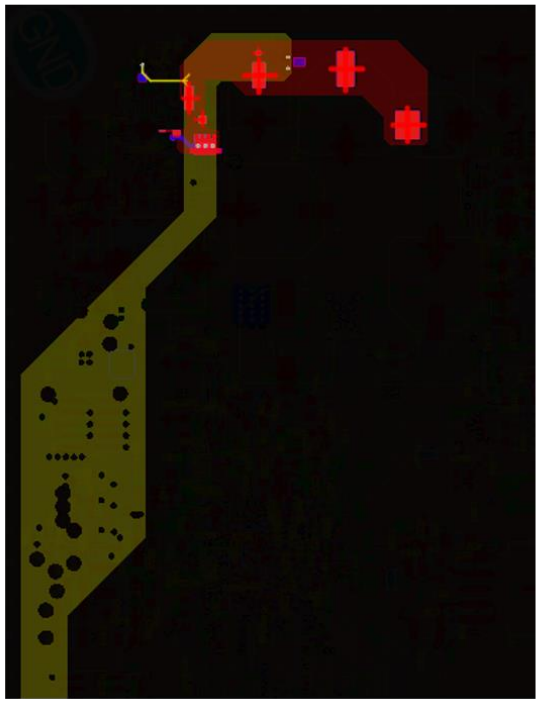
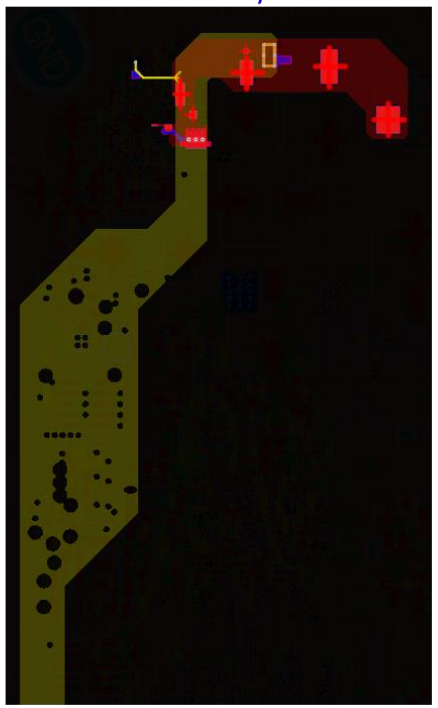
Power Net : +12V

1. Increased the width of Cu pour.
2. Vias added for proper transfer of power.

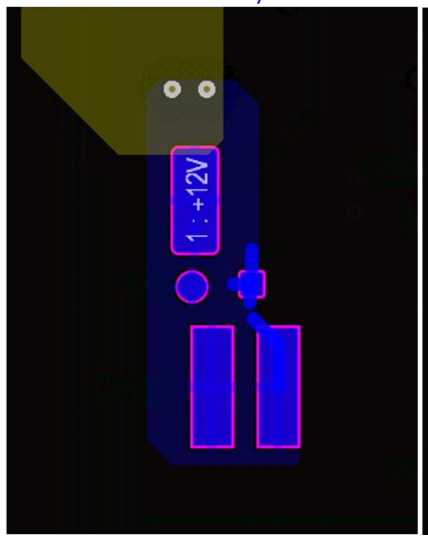
Before PI Analysis



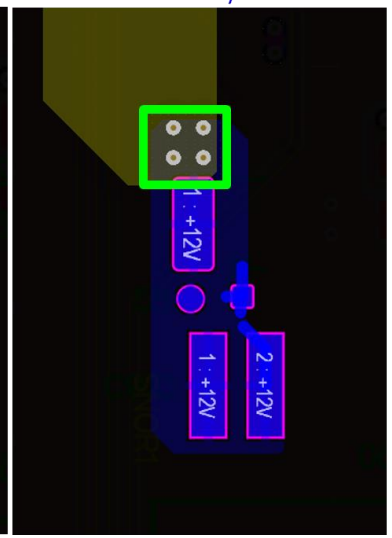
After PI Analysis



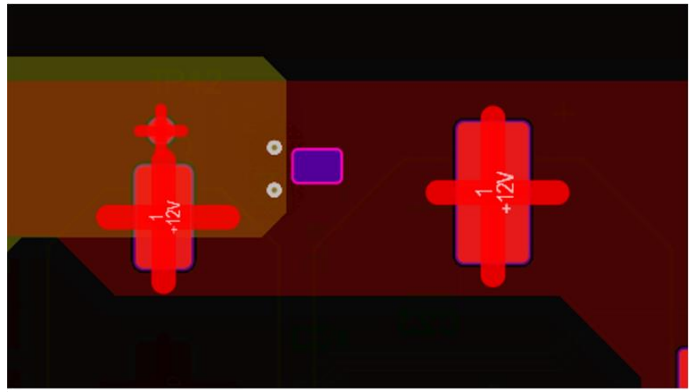
Before PI Analysis



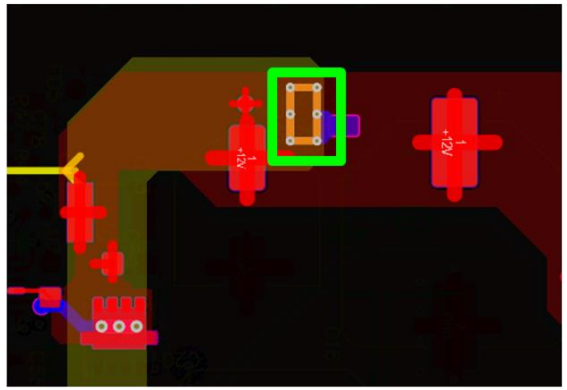
After PI Analysis



Before PI Analysis



After PI Analysis

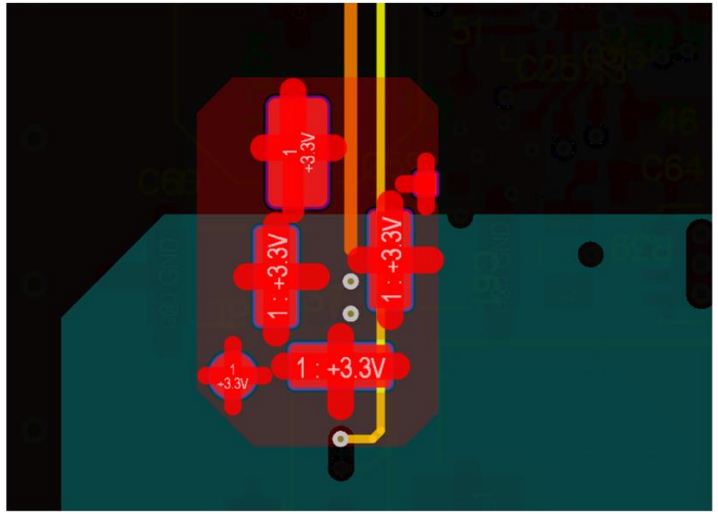


Implementation Strategies(Cont.)

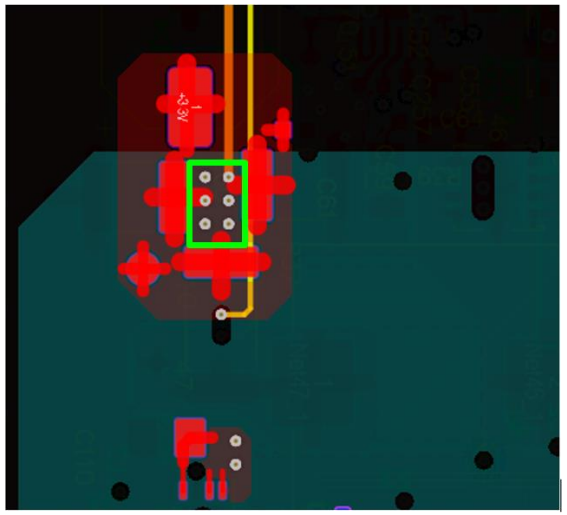
Power Net : +3.3V

1. Increased the width of Cu pour.
2. Trace width increased on Layer 5 & Bottom Layer.
3. Vias added for proper transfer of power.

Before PI Analysis



After PI Analysis



Before PI Analysis

After PI Analysis

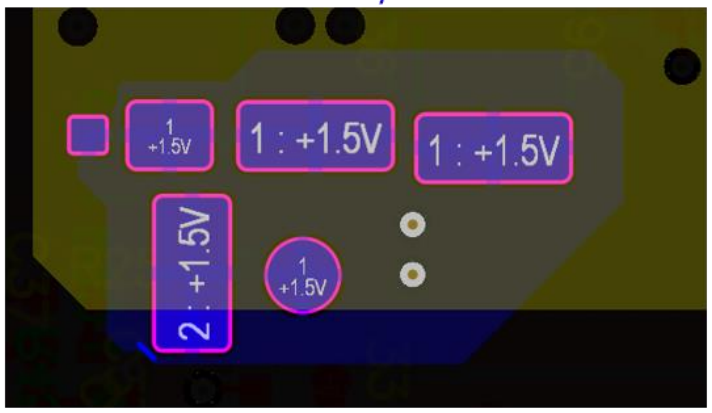
Implementation Strategies

Suggested recommendations are incorporated to the PCB layout to enhance its performance.

Power Net : +1.5V

1. Trace width increased to 30mil on Layer 5.
2. Vias added at source point and near capacitor C73.

Before PI Analysis



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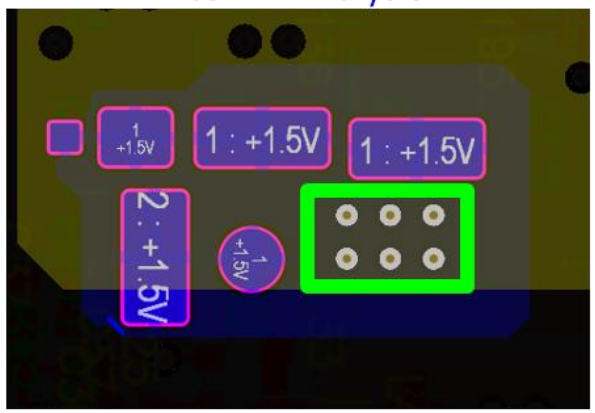
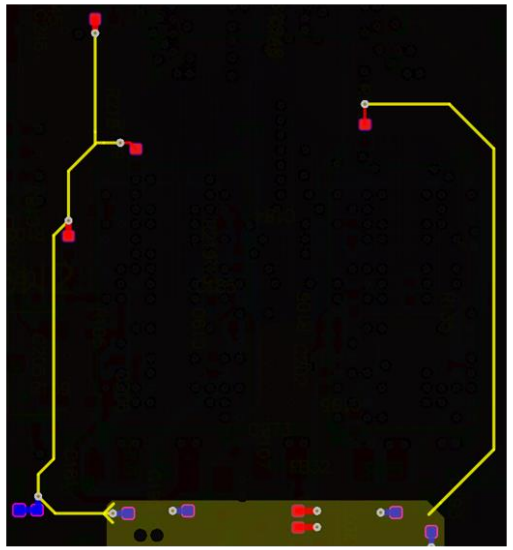


Before PI Analysis



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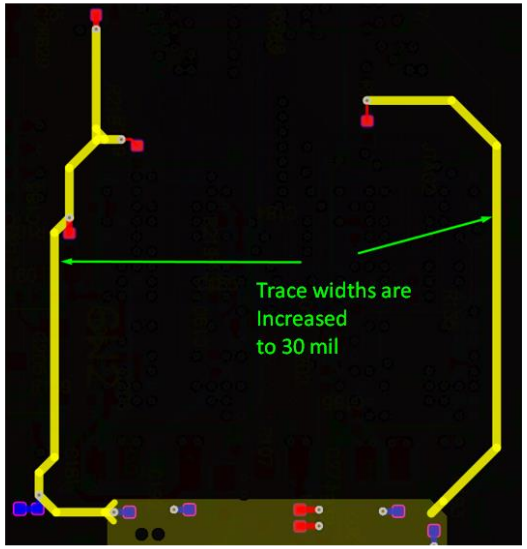

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Customer Testimonial

Excited to share a glowing testimonial from a client, highlighting the success and positive impact of our Power Integrity Analysis

"We engaged the team for Power Integrity Analysis of our PCB layout, and the results were outstanding. Their thorough analysis identified potential issues that could have affected the overall performance. The comprehensive insights, combined with practical recommendations and cost-effective adjustments to copper pours, enabled us to make informed decisions to optimize our power distribution network. The team's expertise and dedication to delivering high-quality results were evident throughout the process. We are extremely pleased with the quality and timely delivery of the analysis, which has significantly enhanced the reliability and efficiency of our design".

Conclusion

We provided the client with an optimized PDN layout design, integrating key layout enhancements to elevate overall performance. This highlights our dedication to delivering high-quality results and demonstrates our technical expertise.

Our collaboration went beyond the technical field, focusing on optimizing the PDN layout for enhanced performance by combining our expertise with a deep understanding of the client’s specific needs.

We remain committed to offering top-tier analysis services, showcasing our unmatched skills and Constant reliability in consistently achieving exceptional outcomes.