指数科技
Index Tech

AI In Electronic Development

—— From Traditional Electronic Design to AI-Driven Intelligent Transformation

Reporter： Leo Ye Shenzhen Index Technology Co., Ltd.

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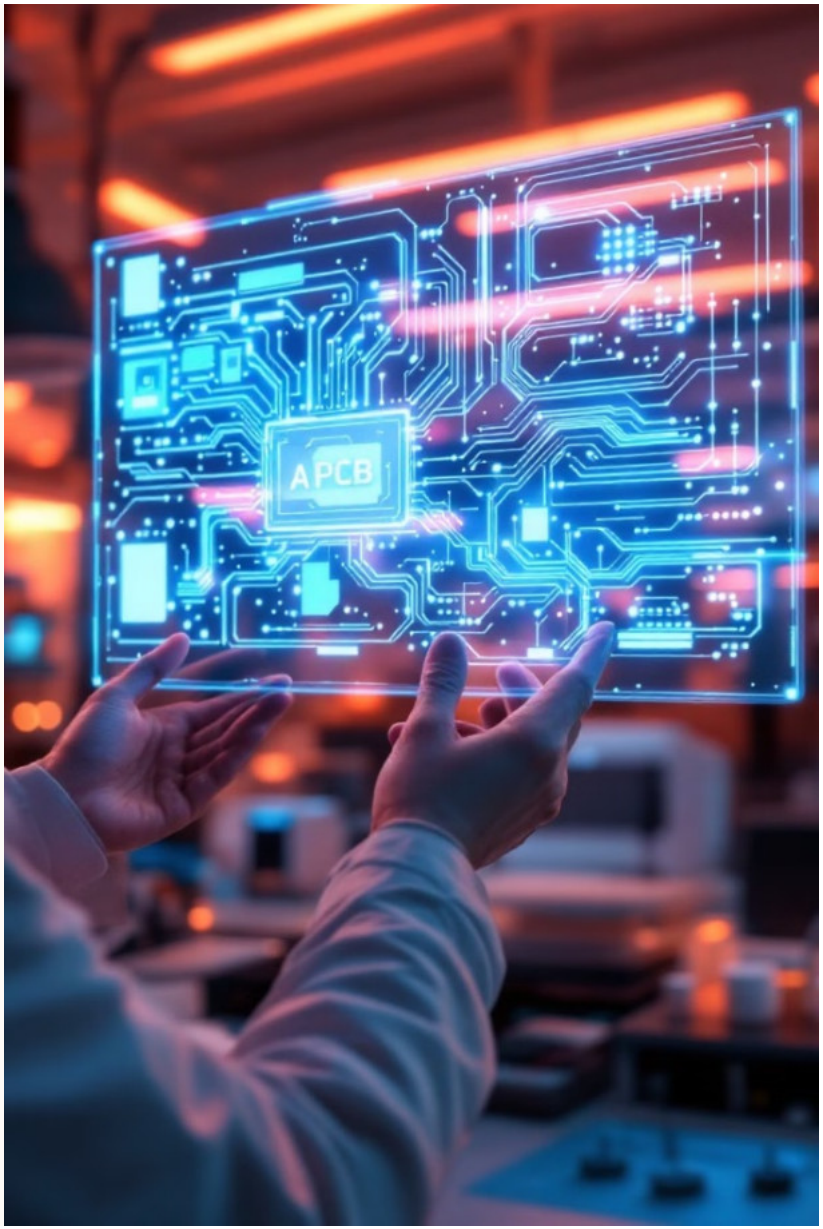

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Challenges of traditional electronic design

Limitations of manual design

The use of cumbersome EDA tools leads to a long design cycle and is error - prone.

Limited innovative thinking

Traditional methods restrict engineers' innovative capabilities and design flexibility.

AI leads the transformation

From automated design and optimization to intelligent verification, it unleashes the innovative potential of designers.

Time cost of electronic product R & D

- Schematic + PCB design time: 3.3 - 9 billion hours

What can be constructed by the combination of generative AI and traditional PCBA design?

Large models at home and abroad are evolving rapidly and gradually becoming infrastructure.

overseas: LLAMA-2, Claude, GPT-3.5, GPT-4, Gemini, ……

domestic: 文心一言, 通义千问, 华为盘古, 腾讯混元, 讯飞星火, 智谱·AI, MINIMAX, 零一万物, 百川智能, Moonshot AI, ……

Implementation paths for AI industry applications

- Deepen the capabilities of general large language models
- Integrate industry know - how to create vertical industry models

Applications of generative AI are constantly being unlocked. Industries such as "finance + government + film + education" are the first to implement it. The generated content mainly includes "text + image + audio + video", and there is no AI application implemented in the direction of hardware generation yet.

	Text Generation	Picture Generation	Voice generation	Video generation
Search	AI sumary			
E-commerce	AI marketing	Marketing Picture	AI customer service	Automated advertising
Gove. office	AI document	Ai Picture		
Finance Law	AI Research		AI Finance CS	
Film television	Script generation	Role Image	Character dubbing	Film&Television Gen
Education	Courseware	Courseware	Companion Robot	Courseware Gen

ai, Jasper, Midjourney, WONDER, AIVA, copy.ai, anyword, runway, Synthesia, Sora, MURF.AI, ……

The development path of generative AI

Since the 1950s, it has gone through the emergence of the Turing machine, AI 1.0, and then modern generative AI. Throughout the evolution, mathematical operations have always served as the cornerstone.

Tipping Point

Tech stack of generative AI:

- ✓ Mathematical operations: Machine learning, matrix operations, artificial intelligence models, skills in algorithm model selection and tuning, artificial intelligence deployment capabilities

The development path of PCB EDA

From the 1940s to the 1980s, it evolved from the first - generation hand - drawn methods to the emergence of commercial EDA applications. Meanwhile, a training system for a group of millions of engineers began to take shape.

Tech stack of PCB EDA : Inertial thinking

- ✓ Professional capabilities in electronic information engineering
- ✓ Manufacturing capabilities

?

Understanding of the input and output languages of generative AI

- text
- voice
- video
- ……

→ Generative AI (Understanding + Reasoning) →

- text
- voice
- picture
- video
- scheme
- ……

Professional constraints and understanding from requirements to drawings

- PRS
- Tech constraints

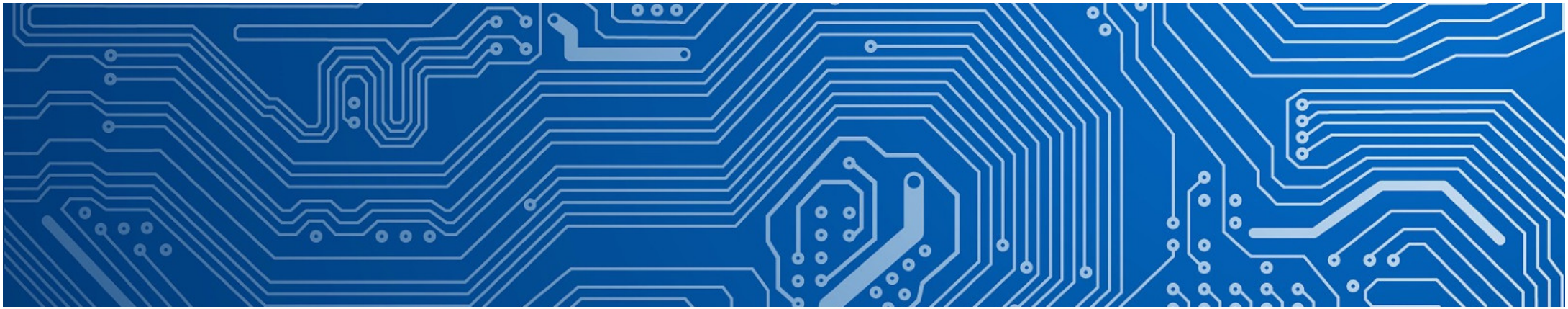
→ Engineers+PCB EDA (Understanding + Combination + Constraints) →

- scheme
- BOM
- Prod Files
- ……

What can be constructed by combining generative AI and traditional PCBA design?

AI+PCBA →

- **Crossing of physical boundaries**: *Physical World* → *Digital World*
- **Leap in working methods**: *Traditional Dev* → *AI+Dev*
- **Release of creativity**: Physical strength + Skills → Creation + Intelligence



The evolution of electronic design driven by AI technology

The integration of AI and electronic design

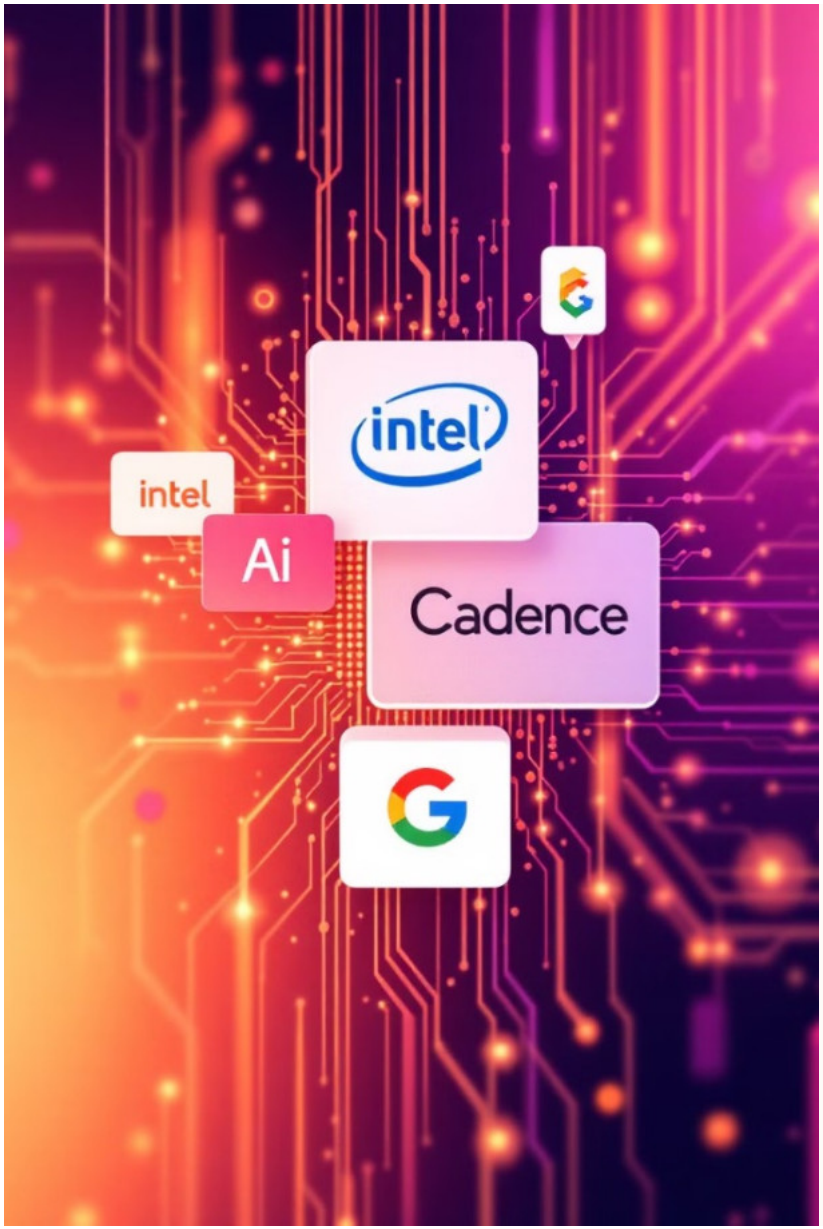
- AI understands requirements and generates schematic diagrams.
- AI automatically generates circuit diagrams and layouts.
- Optimize wiring to reduce interference and improve design quality.
- Fault prediction and maintenance

Specific applications of AI in electronic design

- Reading component manuals based on large language models
- Conducting design optimization based on reinforcement learning
- Carrying out device heat dissipation design based on deep learning
- Generating system designs based on generative models

Reference papers

- A Graph Placement Methodology for Fast Chip Design--Nature, 2021.
- CircuitNet: An Open-Source Dataset for Machine Learning Applications in Electronic Design Automation——Science China Information Sciences, 2022
- Deep Learning for Electronic Design Automation: A Survey——IEEE. 2020



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Sharing of successful cases

Intel's AI-driven circuit optimization

- Utilize AI for circuit optimization and routing automation to enhance chip design efficiency.

Cadence's AI-assisted design tools

- Integrate AI technology into EDA tools to provide automatic circuit design and layout optimization functions.

The hardware optimization of Google DeepMind

- Optimize hardware design through AI to improve the computing efficiency of data centers and reduce energy consumption.

KiCad HuaQiu Edition

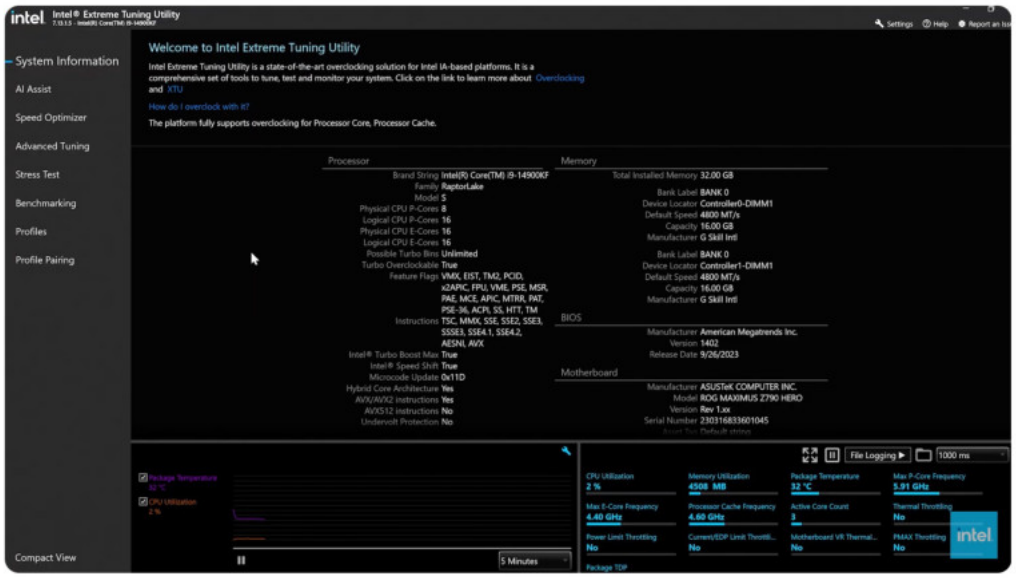
- AI Copilot improves engineers' efficiency and lowers the entry barrier of electronic design.

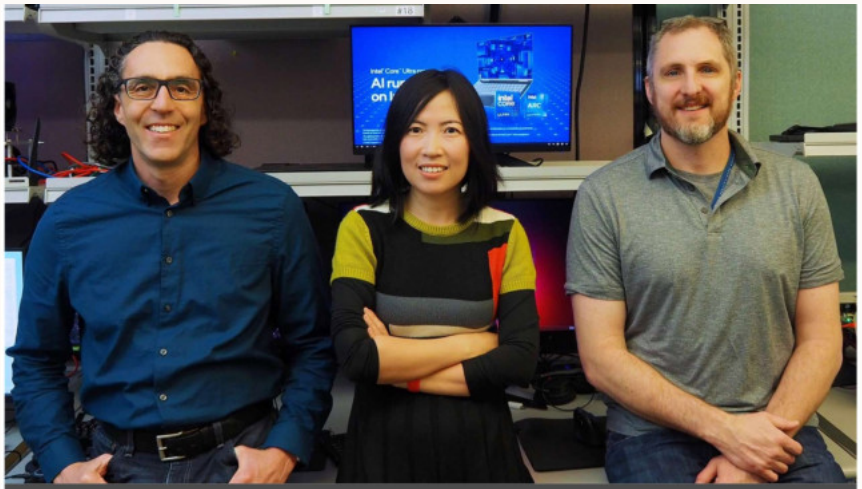
AFH (AI For Hardware) of Index Technology: AI-Generated Hardware

- Combine AI and KiCad for the automatic generation of lamp boards for LED lighting products and reduce repetitive work.

Intel's AI-driven circuit optimization

Utilize AI to optimize circuits and automate routing, improving the efficiency of chip design.





英特尔增强智能团队成员，左起：Mark Gallina，Olena Zhu 和 Michael Frederick，位于俄勒冈州希尔斯伯勒的英特尔客户端计算事业部实验室。

- Use enhanced AI to determine the position of thermal sensors: from 6 weeks to 5 minutes.
- Use enhanced AI to identify thermal workloads: optimize chip design.
- A fast and accurate signal integrity analysis tool for high - speed I/O: from 3 months to 1 hour.
- An artificial intelligence - based automatic fault analysis tool for high - speed I/O design: 60% efficiency improvement.
- Enhanced intelligent tools of “AI Assist” to achieve overclocking: from 3 days to 1 minute.
- AI automatically places micro - circuit board components: from 5 days to 2 hours.

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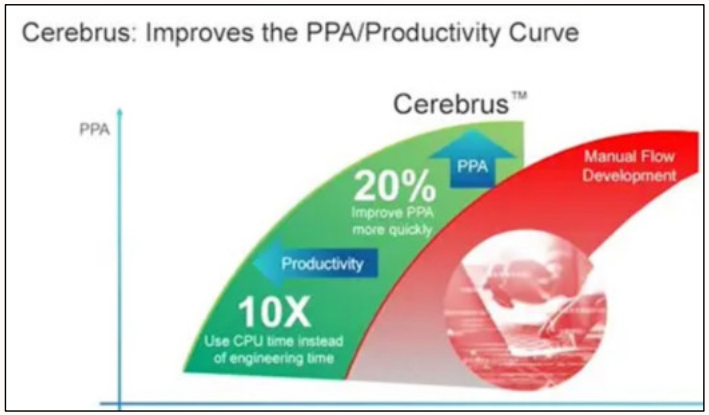
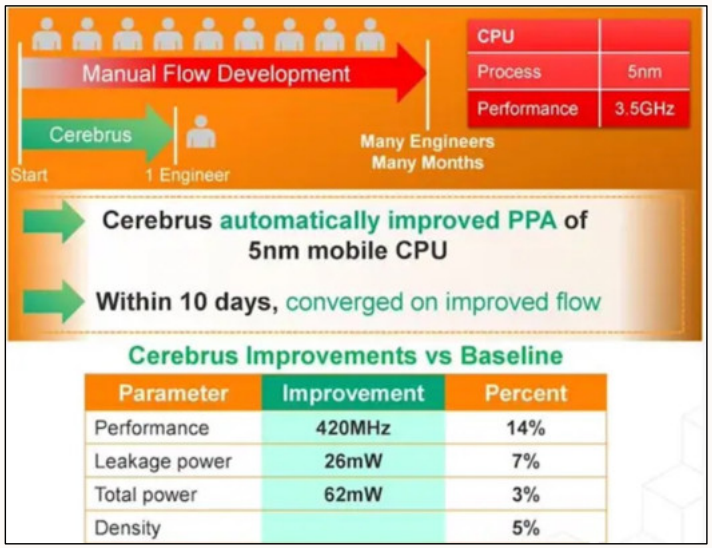
Cadence's AI-assisted design tools

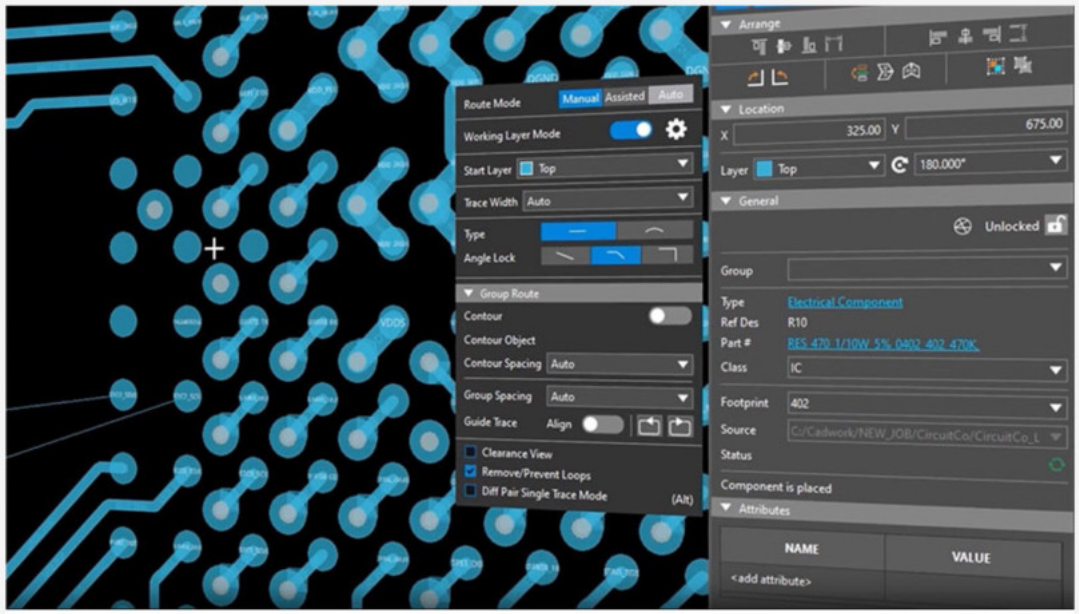
Integrate AI technology into EDA tools to provide automated circuit design and layout optimization functions.





Cerebrus Improvements vs Baseline

Parameter	Improvement	Percent
Performance	420MHz	14%
Leakage power	26mW	7%
Total power	62mW	3%
Density		5%



The hardware optimization of Google DeepMind

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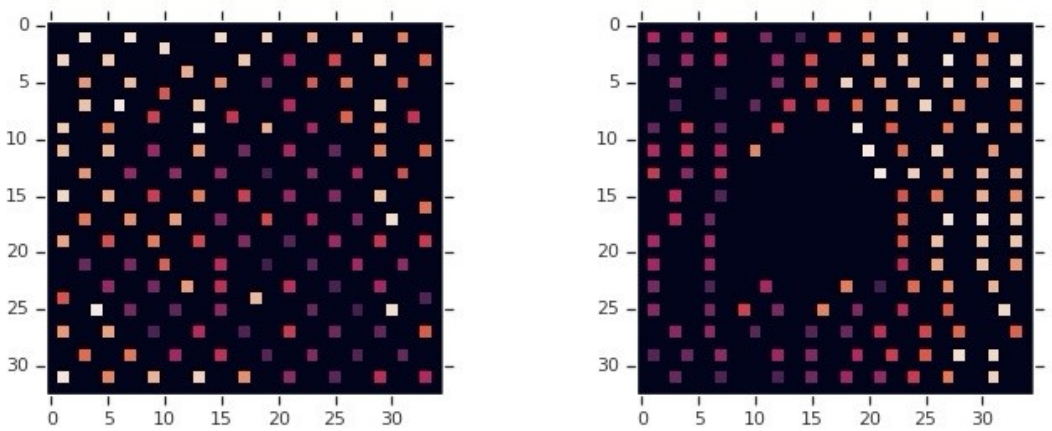
Optimize hardware design through AI to improve the computing efficiency of data centers and reduce energy consumption.

Several Months → < 6 hours

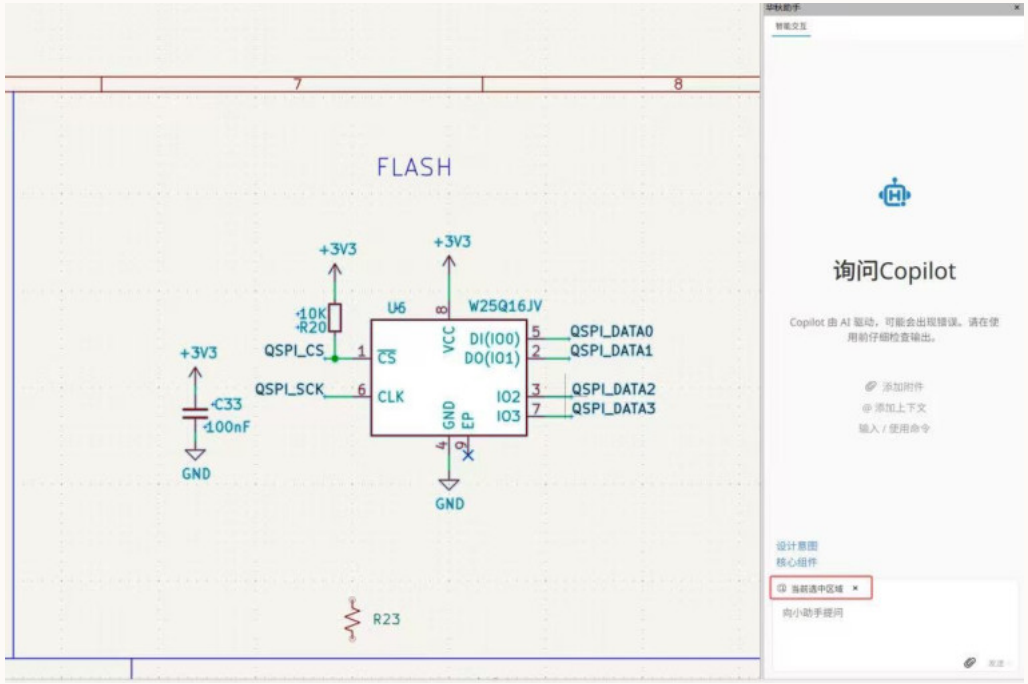


Left: Animation showing AlphaChip placing the open-source, Ariane RISC-V CPU, with no prior experience.
Right: Animation showing AlphaChip placing the same block after having practiced on 20 TPU-related designs.

"With GNoME, we've multiplied the number of technologically viable materials known to humanity. Of its 2.2 million predictions, 380,000 are the most stable, making them promising candidates for experimental synthesis," the company states in their announcement.

Several years → < few hours

AI Copilot in KiCad HuaQiu Edition



好的，我将根据您提供的网表信息来分析电路的功能。

主要功能模块识别：

- 电源: 网络名称 "+3V3" 和 "GND" 明显表明了电源供电部分。大量的 `#PWRXXX` 元件是电源连接点。
- Flash存储器: `U6` 是 `W25Q16JV`，这是一个 16Mbit 的 SPI Flash 存储器。它的连接线 `/QSPI_CS`，`/QSPI_SCK`，`/QSPI_DATA0`，`/QSPI_DATA1`，`/QSPI_DATA2`，`/QSPI_DATA3` 共同构成 QSPI 接口。
- 微控制器 (推测): `U2` 似乎是一个微控制器，因为它有很多连接到 +3.3V 和 GND 的引脚，并且有 QSPI 接口。引脚名称例如 `QSPI_SS`，`QSPI_SD0`，`QSPI_SCLK`，`QSPI_SD1`，`QSPI_SD2`，`QSPI_SD3` 都连接到了flash 存储器，这意味着微控制器可以通过QSPI接口与Flash存储器通信。名称为 `USB_VDD`，`ADC_AVDD`，`VREG_IN` 以及 `IOVDD` 都支持了这是一个微控制器的推测。
- 其他元件:
  - `U1`： `VBAT1`，`VBAT2`，`VBAT` 引脚提示这个可能是一个实时时钟 (RTC) 或其他需要电池供电的元件。
  - `U4`： `VOUT` 引脚提示这可能是一个电源稳压器或者LDO。
  - `U5` 和 `U7`：没有给出具体型号，需要更多信息才能判断。
  - `Y1`：晶振，与 `U2` 配合提供时钟源.
  - `P1`：连接器，连接GND
  - `SW1`， `SW2`：开关
  - `JP1`：跳线器

AI assistants for electronic design significantly lower the entry barriers to electronic design.

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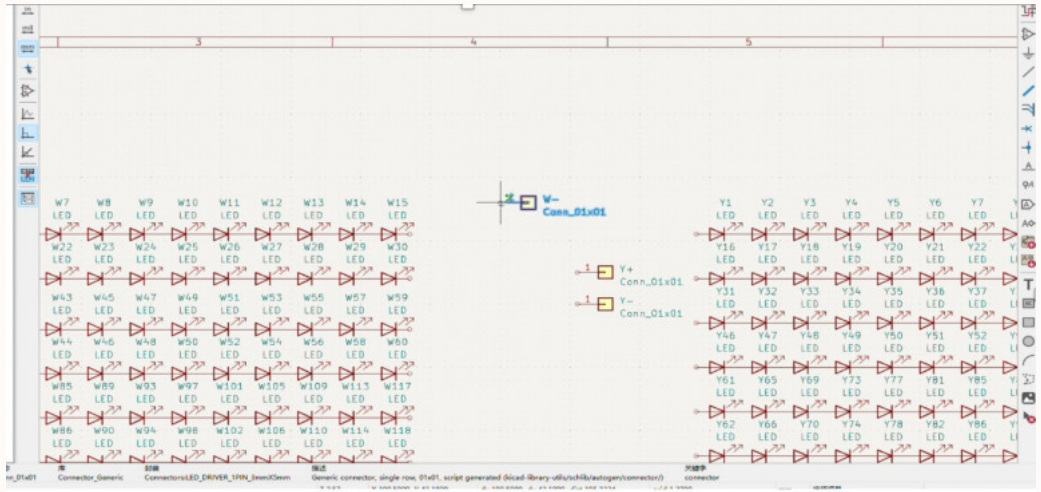
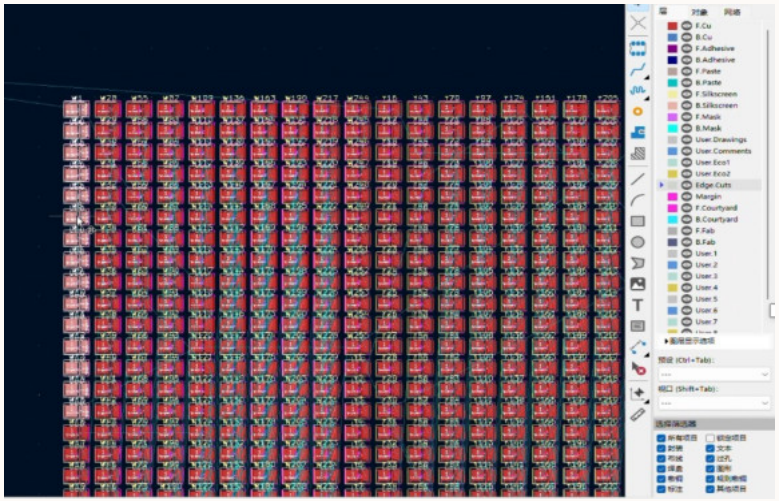
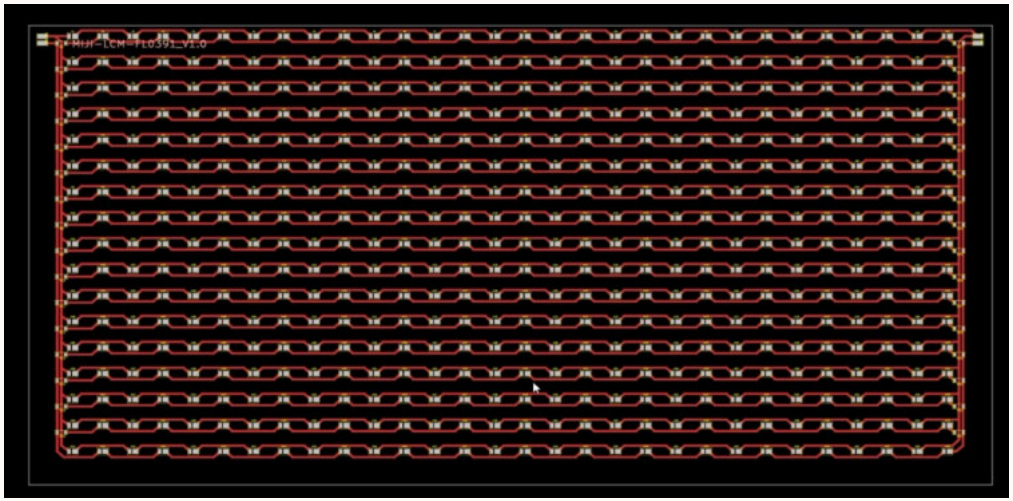
AFH-Lumiboard







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AFH-Lumiboard

AFH-Lumiboard： Combine AI and KiCad to generate lamp boards for LED lighting products, significantly reducing the tedious and repetitive lamp board design work and lowering the defect rate.

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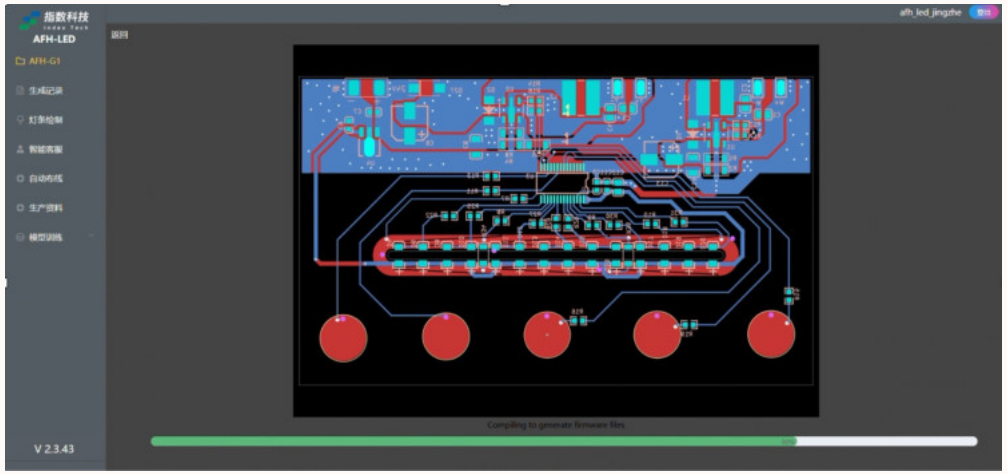
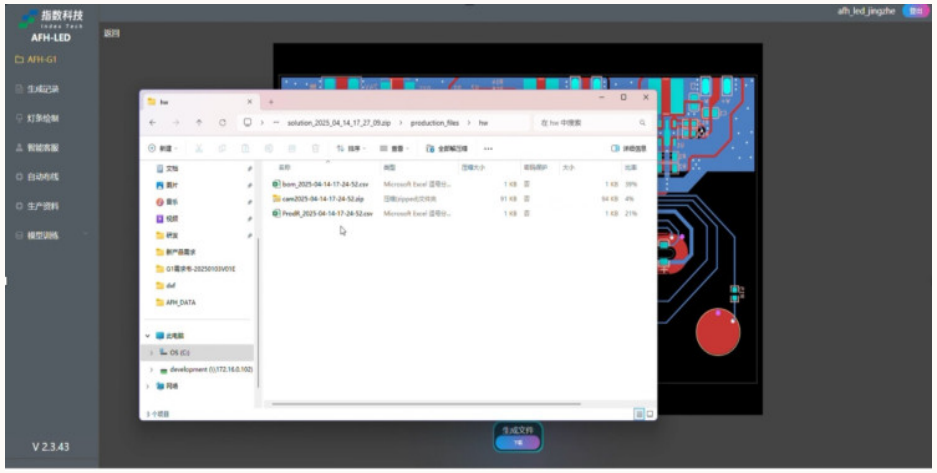
AFH-LED AI+KiCad PCBA Gen.





AFH-LED AI+KiCad PCBA Gen.

AFH-LED：

AI + KiCad generates control boards for LED lighting products according to requirements, including electronic design and supporting embedded code projects, bringing an extremely fast experience to prototype design.

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Advantages and Prospects of AI - enabled PCB Design

01

Improve design efficiency

Shorten the product development cycle and improve design accuracy.

02

Liberate innovation

AI handles tedious tasks, allowing engineers to focus on innovation.

03

Security and efficiency

Anticipate circuit failures, detect potential problems and enhance design safety.

04

Future

Combine with quantum computing and edge computing to promote intelligent design.

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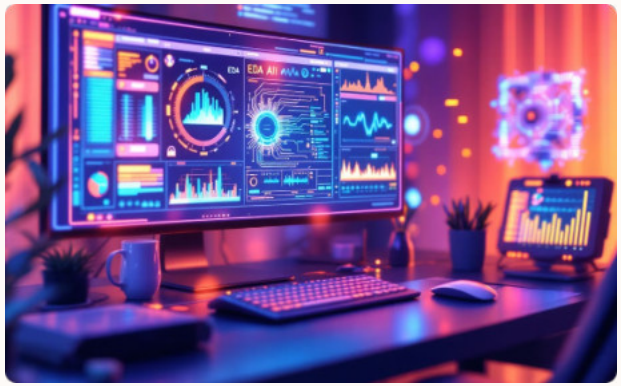
The future development direction of AI and electronic design



The integration of AI and EDA tools

Promote a more efficient design process and enhance the collaborative design capabilities.

Interdisciplinary cooperation

AI deeply integrates with multiple fields, facilitating the emergence of more intelligent hardware products.

The future of intelligent design

AI drives the innovation of electronic design and shapes an intelligent and connected future world.

The new era of AI + electronic design

The significance of the transformation is profound.

AI has completely revolutionized the electronics design industry, enhancing efficiency and innovation.

The future is irresistible

AI + electronic design will become the industry standard.

Seize the opportunities

Actively embrace AI technology and shift from traditional development to AI - integrated development.

Welcome the intelligent future

Jointly promote the intelligent transformation of the electronic design industry.

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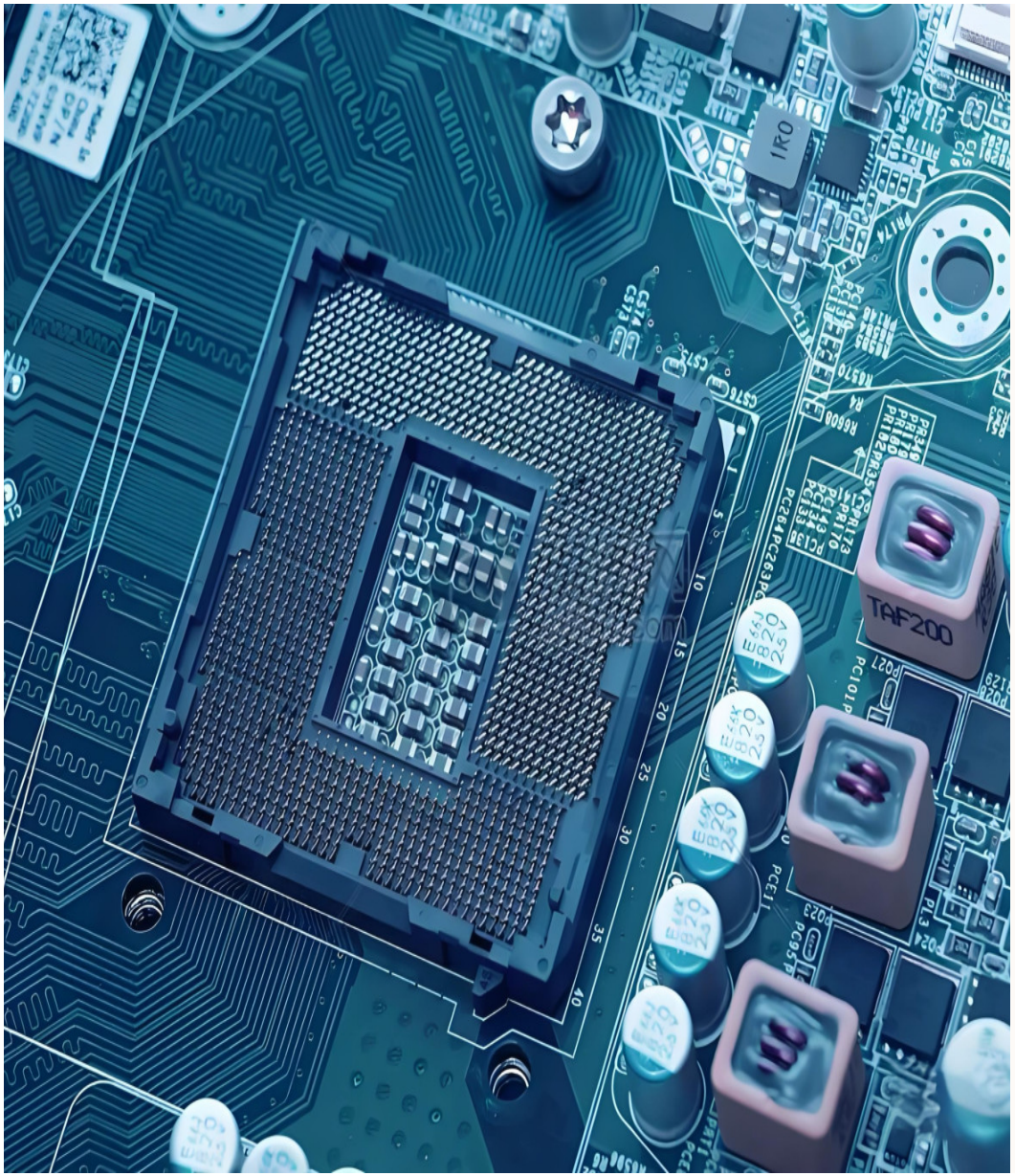

THANK YOU

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