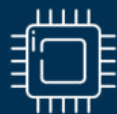


KiCad在先楫半导体EVK设计中的使用

KiCad in HPMicro Evaluation Kit Design

2025年11月13日

HPMicro: Global Leader of General Purpose RISC-V MCU



High Performance MCU series for Industrial and Automotive Applications



Extensive Eco-system include Comprehensive HW/SW Development Tools, SDK, Middleware.

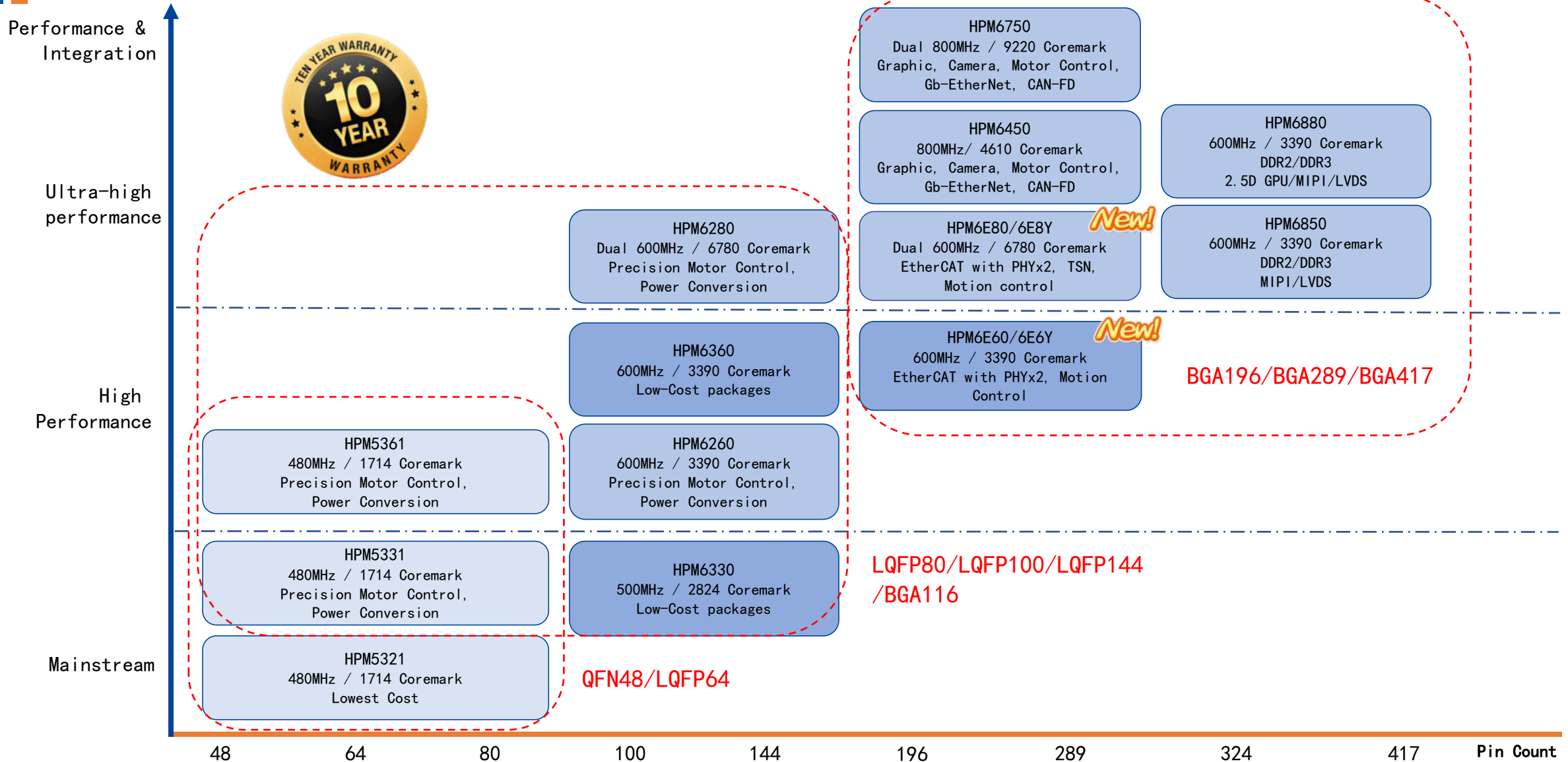


ISO 9001, ISO 26262/IEC 61508 Certified



10-year Longevity Program, Stable Supply Chain

HPMicro High-Performance RISC-V MCUs Portfolio



HPMicro Product Features

Superior Computing Power

- Heterogeneous Multi-Core
- Record-breaking CoreMark
- Powerful DSP
- Algorithm Hardware Acceleration

Best-in-class for Multi-Media

- 2.5D GPU w OpenVG
- Low-Power Graphics Acceleration
- MIPI/LVDS/RGB Display
- DMIC/Voice Processing

Outstanding Connectivity

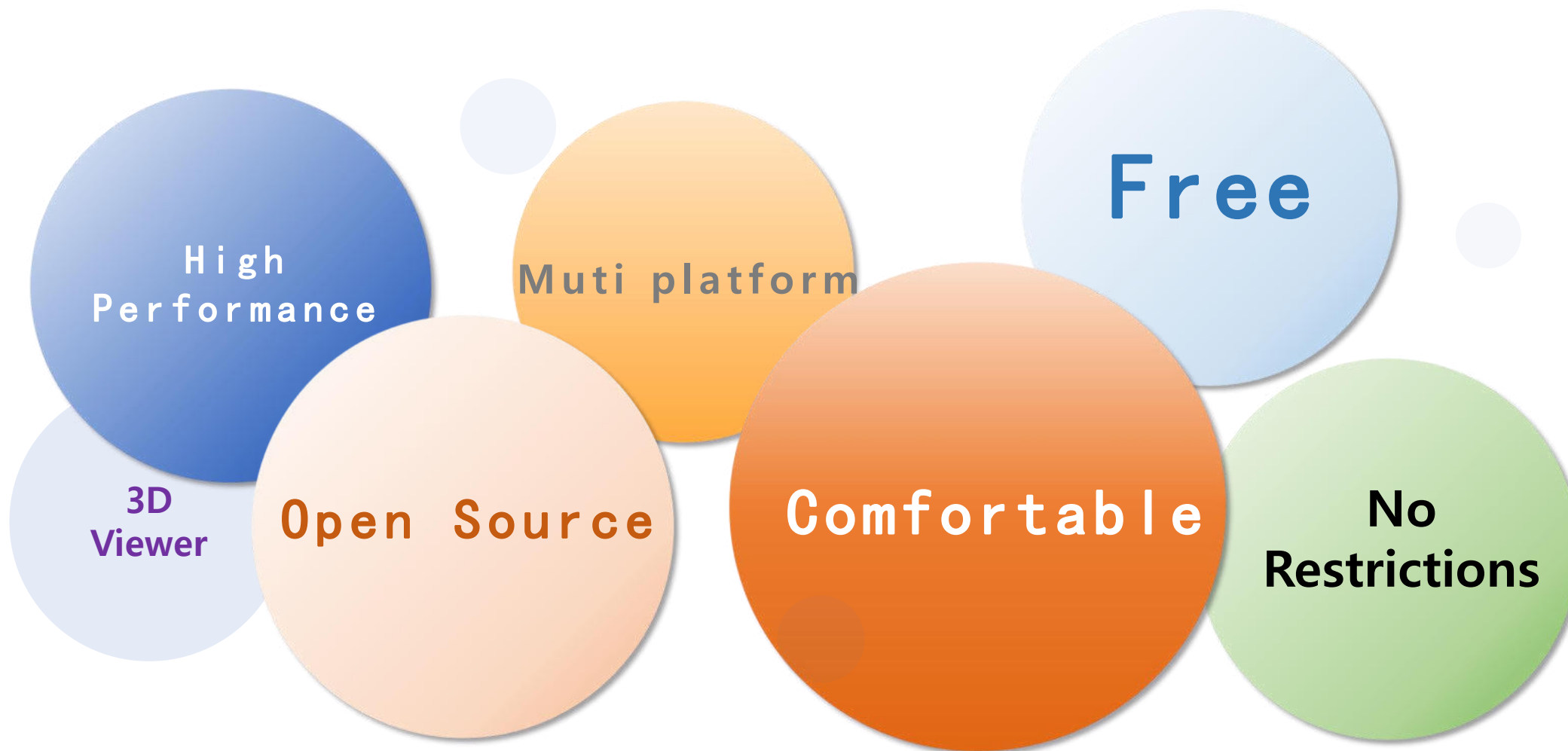
- TSN with Switch
- EtherCAT
- Gb Ethernet
- High Speed USB with PHY
- CAN-FD

Excellent Precision Control

- 16-bit ADC, 12-bit DAC, Operational Amplifiers, Analog Comparators
- Programmable Logic Array
- High Resolution PWM
- Incremental/absolute position sensor interfaces
- Hardware Closed-Loop Controller



Why KiCad?



HPMicro

首页 引脚配置工具 时钟配置工具

信号 引脚 自动组合信号 GPIOM TRGM

查询模块

ACMP

ADC

BATT

DAO

ESC

ETH

FEMC

GPIO

GPTMR

I2C

I2S

JTAG

MCAN

PDM

PMIC

PPI

PWM

QEI

QEO

RDC

SDM

SEI

SOC

SPI

SYSCTL

TRGM

UART

USB

XPI

当前函数使用引脚数: 0
配置共用引脚数: 0
复用引脚数: 0

HPM6E60 / BGA289 / BGA 14x14mm/0.8mm

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17

A VSS PB24 PB26 PB28 PB30 PC00 PC03 PC05 PC07 PC18 PC20 PC22 PC24 PC26 PC28 PC30 VSS

B PB10 PB05 PB27 PB29 PB31 PC01 PC04 PC06 PC08 PC19 PC21 PC23 PC25 PC27 PC29 PC31 PD14

C PB08 PB09 PB11 PB22 PB23 PC02 VSS PC12 PC15 PC00 VSS PC06 PD08 PD11 PD13 PD15 PD18

D PB06 PB07 PB17 VSS PB21 PC09 PC10 PC13 PC16 PD01 PD03 PD06 PD09 VSS PD12 PD17 PD18

E PB04 PB05 PB15 PB16 PB19 PB20 PC11 PC14 PC17 PD02 PD04 PD07 PD10 PD24 PD23 PD19 PD20

F PB02 PB03 PB13 PB14 PB18 VDD VDD VDD VDD VDD VDD VDD PD27 PD26 PD25 PD21 PD22

G PB00 PB01 VSS PB12 PA07 VDD VDD VSS VSS VSS VDD VDD PD29 PD28 VSS PE01 PE30

H PA14 PA15 PA04 PA05 PA06 VDD VSS VDD VSS VDD VSS USB PE10 PD31 PC30 PE03 PE02

J PA11 PA12 PA13 PA02 PA03 VDD VSS VSS VDD VSS VSS VDD PE13 PE09 PE08 PE05 PE04

K PA08 PA09 PA10 PA20 PA01 VDD VSS VDD VSS VDD VSS VDD PE16 PE12 PE11 PE07 PE06

L PA22 PA23 VSS PA30 PA31 VDD VDD VSS VSS VSSA VDD VDD PE15 PE14 VSS XTA XTA

M PA20 PA21 PA27 PA28 PA29 GND VDD VDD VDD VSS VSSA VDD PE16 PE18 PE17 USB USB

N PA18 PA19 PA25 PA26 PY07 PZ05 PZ03 PZ01 PF30 PF29 PF21 PF01 PF03 PF04 PE28 PE27 PE26

P PA16 PA17 PA24 VSS PY06 PZ04 PZ02 PZ00 PF24 PF25 PF27 PF11 PF06 VSS PE31 PE30 PE29

R GND GND GND VDD PY05 PY04 VSS PF23 PF31 PF28 VSS PF08 PF07 PF06 PE22 PE21 PE20

T GND GND GND BSTR PY03 PY01 RTC PF19 PF22 PF18 PF20 PF26 PF00 PF12 PF15 PE24 PE23

U VSS GND GND VDD PY02 PY00 RTC VDD PF16 PF17 PF06 PF02 PF10 PF13 PF14 PE25 VSS

HPM6E60 / BGA289 / BGA 14x14mm/0.8mm

导出封装信息

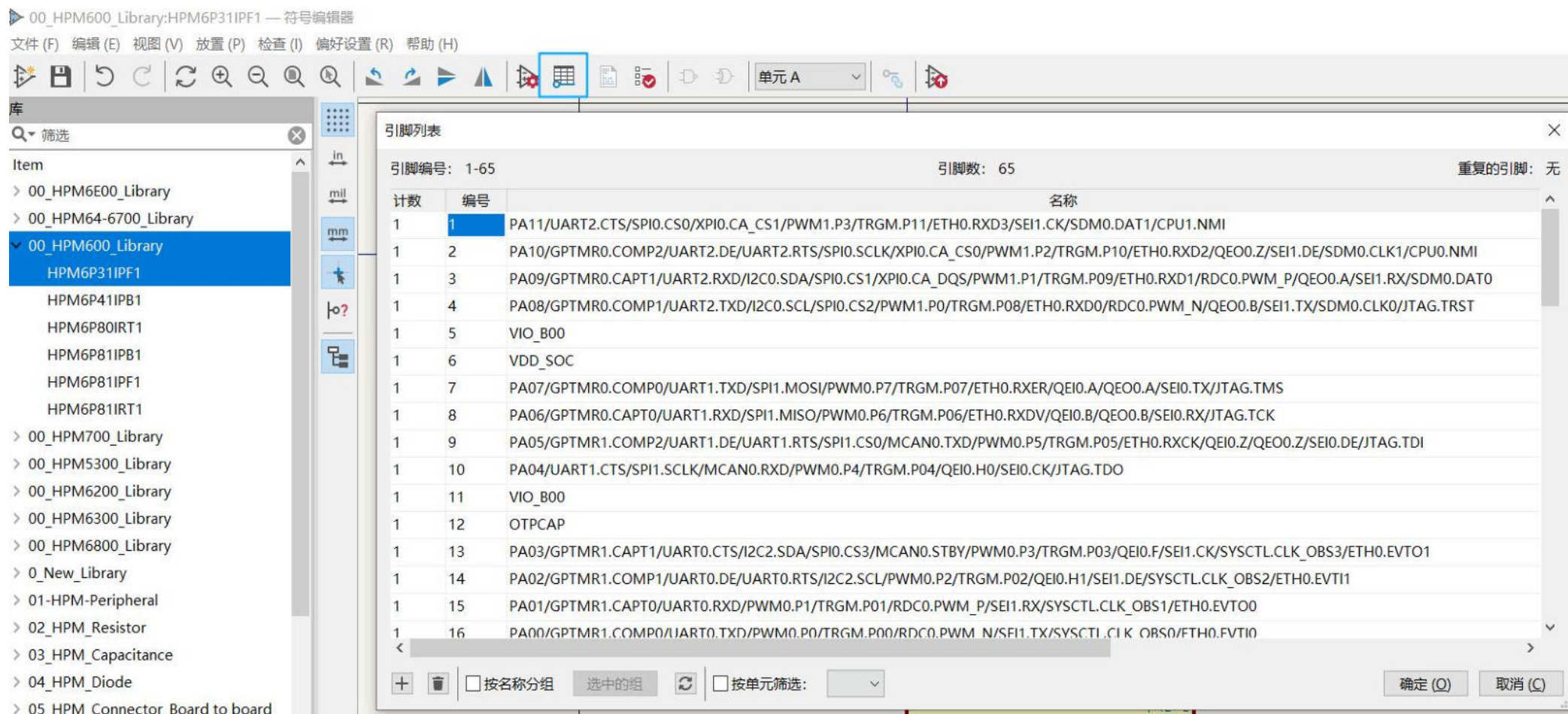
导出已选择引脚信息

引脚 请输入内容 清除 删除

PinName	Signal	Loop Back	Schmitt Trigger	Pull Enable	Pull Select	Pull Resistance Strength	Drive Strength	Open Drain	Keeper Capability Enable	Slew Rate	Speed	操作
---------	--------	-----------	-----------------	-------------	-------------	--------------------------	----------------	------------	--------------------------	-----------	-------	----

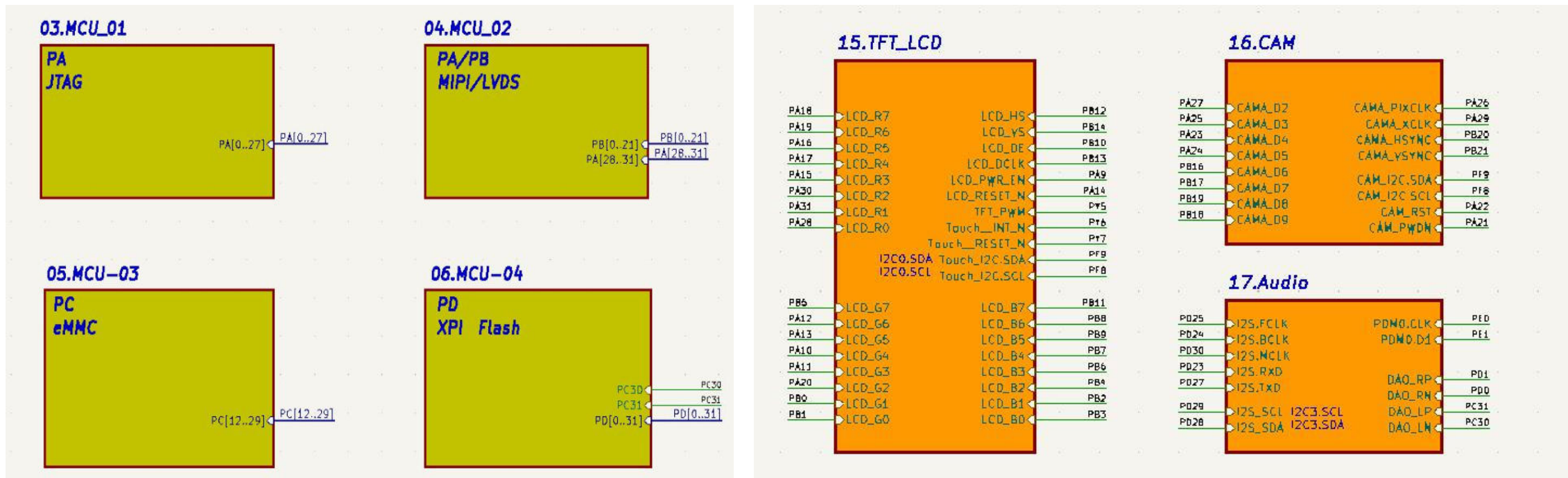
Feedback From Engineers

Information from pinmux tool of HPMicro, export to KiCad symbol editor - pin table, easy to build symbols
先楫半导体pinmux工具导出的封装信息，可直接粘贴到KiCad的符号编辑器-引脚信息表中，快速建库



Feedback From Engineers

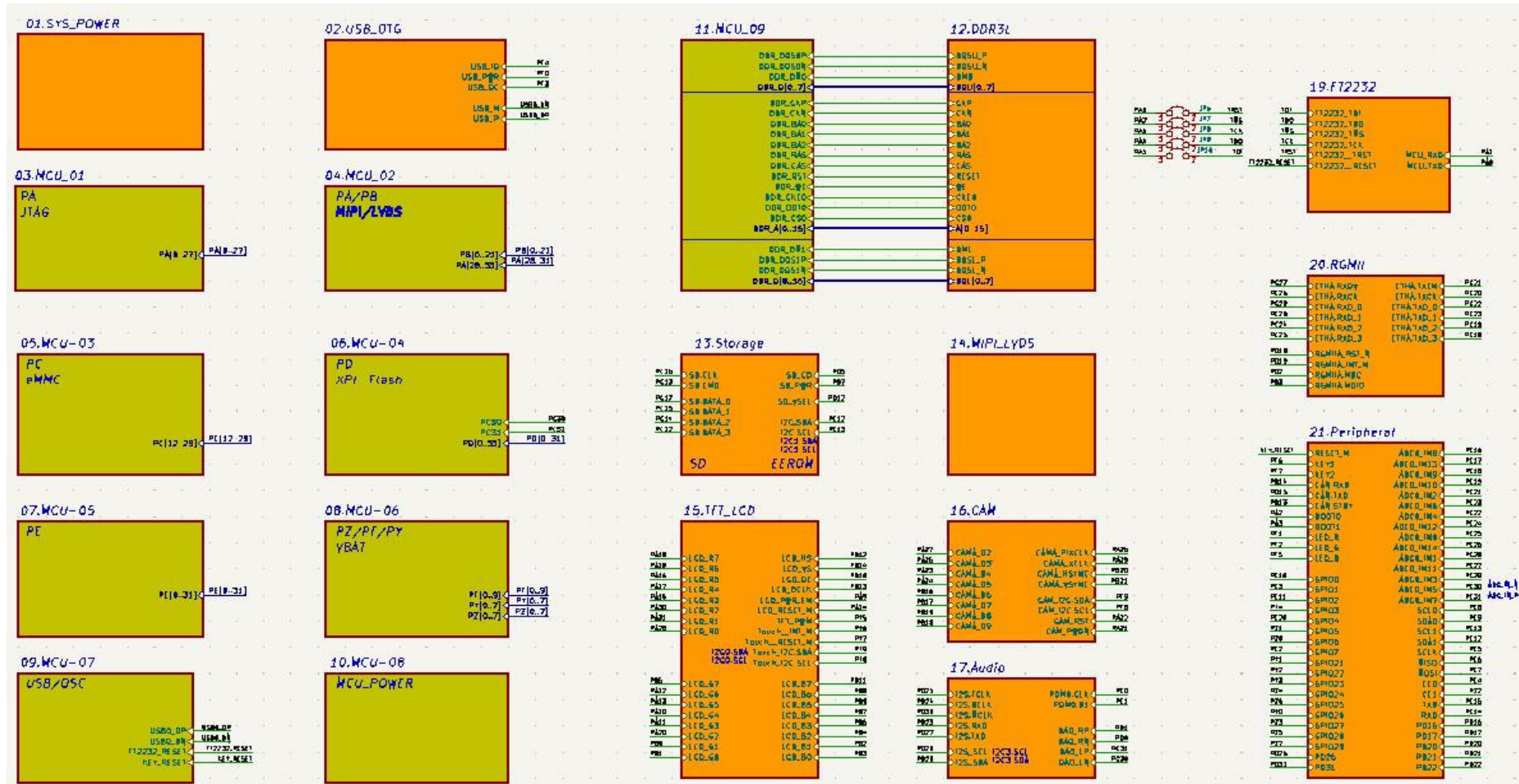
The hierarchical schematic diagram greatly enhances the manageability, readability, and collaboration efficiency of the project.
层次式原理图极大的提升了项目的可管理型、可阅读性、协作效率



Pin information can also be linked in the top-level design of hierarchical schematics.
层次式原理图的顶层设计中也可以链接引脚信息

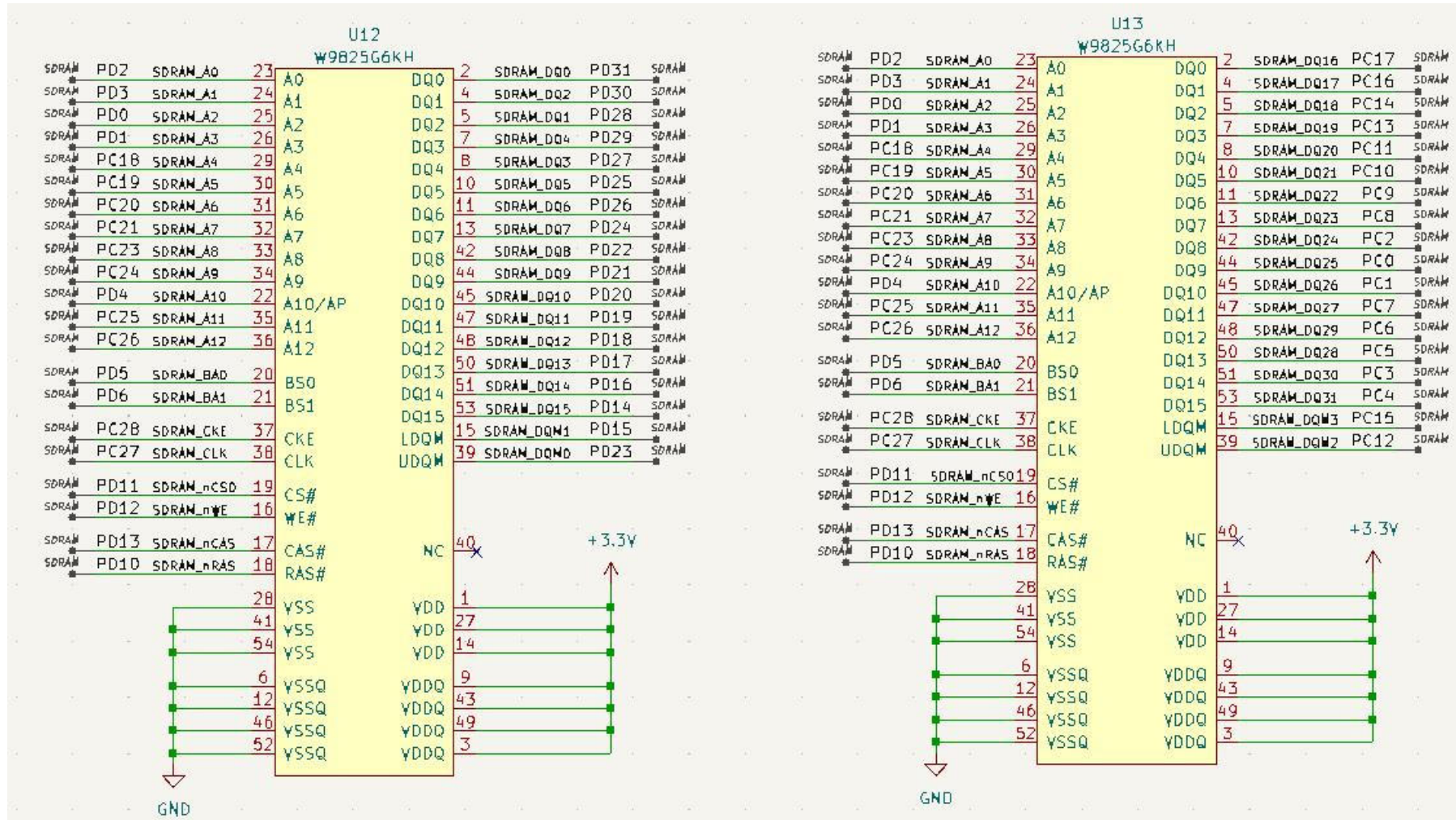
Feedback From Engineers

In the usage scenarios of chip manufacturers evaluation kit development, there is a significant reuse of peripheral circuits, difference among various series is the choice of pins
 芯片原厂设计EVK的使用场景中，大量的外围电路复用，各型号差异仅在于不同系列引脚选择不同



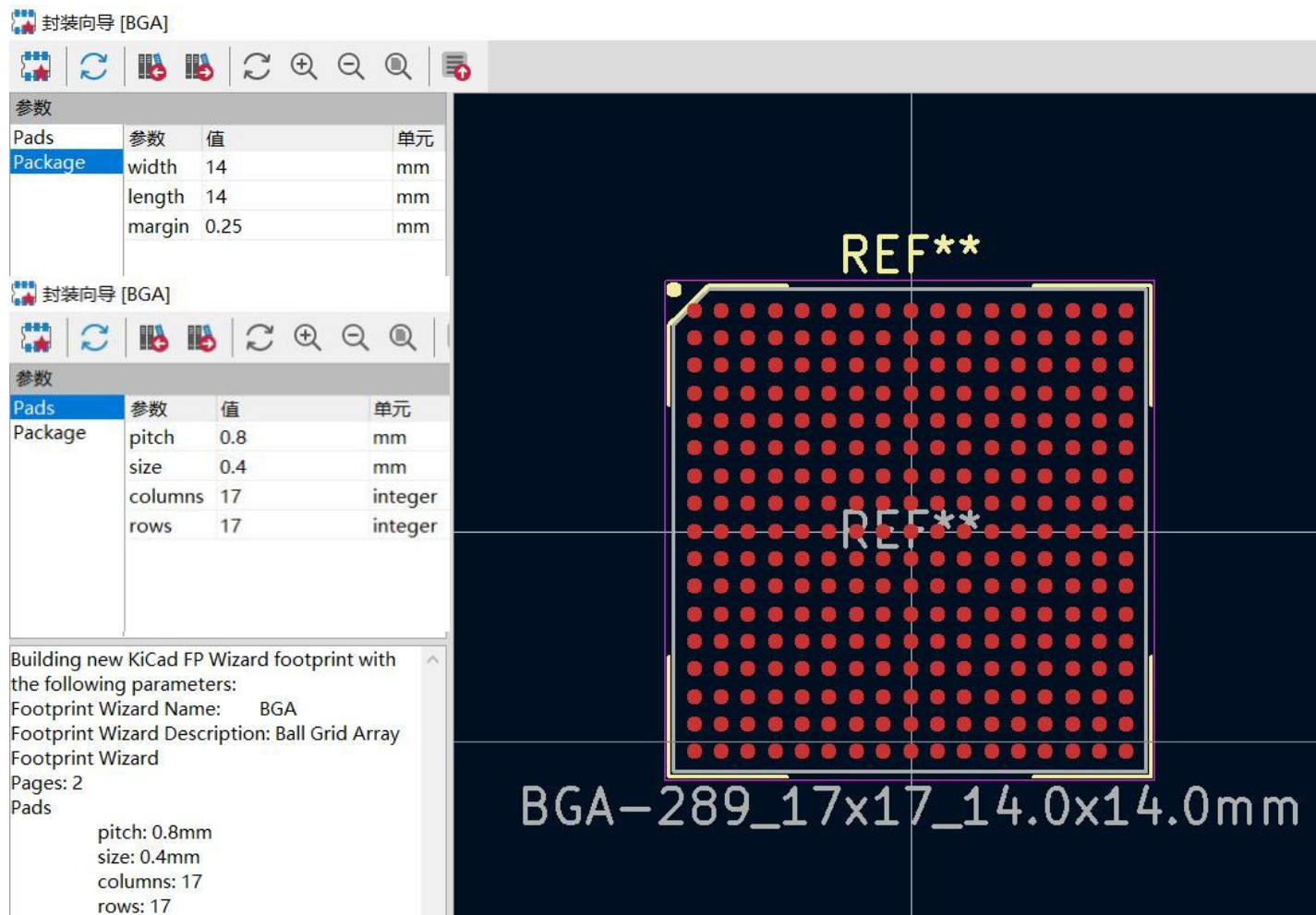
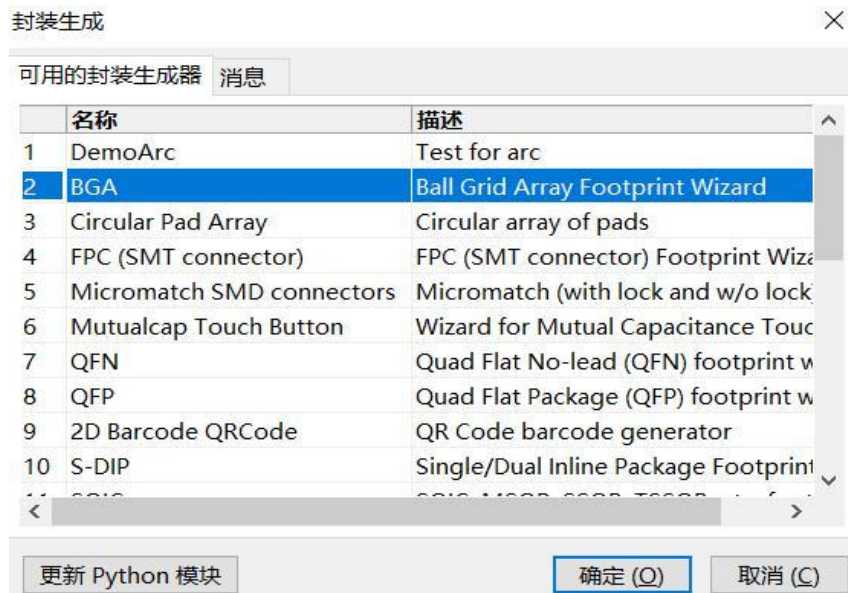
Feedback From Engineers

Set network classes and rules to facilitate subsequent PCB layout rule settings
设置网络类与规则，方便后续PCB布线设置规则



Feedback From Engineers

The footprint wizard facilitates the generation of footprint
封装向导轻松创建PCB封装，如BGA289，输入以下参数即可完成创建



Feedback From Engineers

The footprint wizard facilitates the generation of footprint
不同网络规则单独设置线宽线距，匹配模式高效的对网络进行分类

电路板设置

电路板层叠
电路板编辑器图层
物理层叠
板面处理
阻焊/锡膏
文本与图形
默认
格式
文本变量
设计规则
约束
预定义尺寸
网络类
自定义规则
违规严重程度

网络类:

名称	间隙	布线宽度	过孔尺寸	过孔孔洞	微孔外径	微孔孔洞	差分对线宽	差分对间距
Default	4 mils	4 mils	16 mils	10 mils	11.81102362 m	3.937007874 m	4 mils	8 mils
1GMDI	4 mils	4 mils	16 mils	10 mils	11.81102362 m	3.937007874 m	4 mils	8 mils
MII	4 mils	4 mils	16 mils	10 mils	11.81102362 m	3.937007874 m	4 mils	8 mils
RGMII	4 mils	4 mils	16 mils	10 mils	11.81102362 m	3.937007874 m	4 mils	8 mils
Relay	4 mils	10 mils	16 mils	10 mils	11.81102362 m	3.937007874 m	4 mils	8 mils
SDRAM	12 mils	4 mils	16 mils	10 mils	11.81102362 m	3.937007874 m	4 mils	8 mils
USB_DIFF	5.5 mils	4.5 mils	16 mils	10 mils	11.81102362 m	3.937007874 m	4 mils	5 mils

网络类分配:

匹配模式	网络类
+	power
GND*	power
/* /ENETx2/* /GO_MDI*	RGMII
/* /USB*P	USB_DIFF
/* /USB*N	USB_DIFF
/* /Relay*	Relay

匹配 '++' 的网络:

- +3.3VA
- +36V
- +3V3
- +5P
- +5V

从另一个电路板导入设置...

确定 (O) 取消 (C)

Feedback From Engineers

Custom Rules 自定义规则



Feedback From Engineers

InteractiveHtmlBom plugin generates BOM.
InteractiveHtmlBom插件一键生成BOM。

符号属性

通用
备用引脚关联

字段

名称	
位号	R67
值	0Ω
封装	02_HPM_Resistor:R_0402_1005Metric
数据手册	
Model	RC0402JR-070RL
Company	YAGEO(国巨)
ASSY_OPT	

InteractiveHtmlBom v2.9.0

General
Html defaults
Fields

Extra data file
F:/2025工作文件/20.HPM6P00EVK2RevA/01_工程文件/HP...

Fields

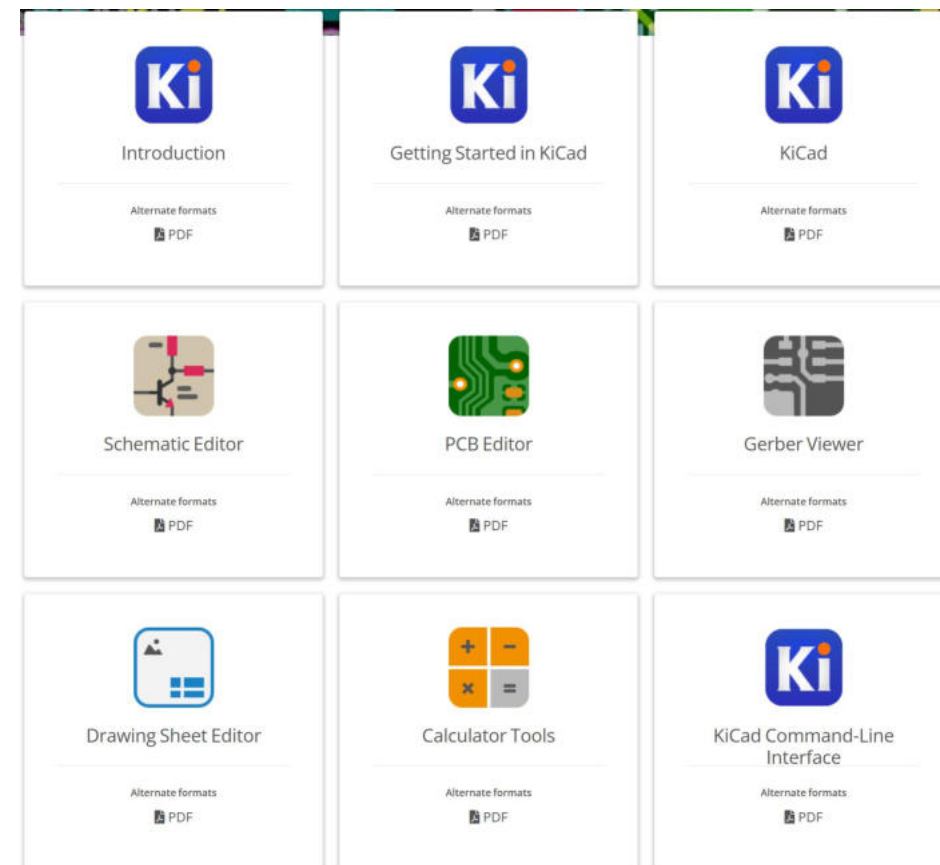
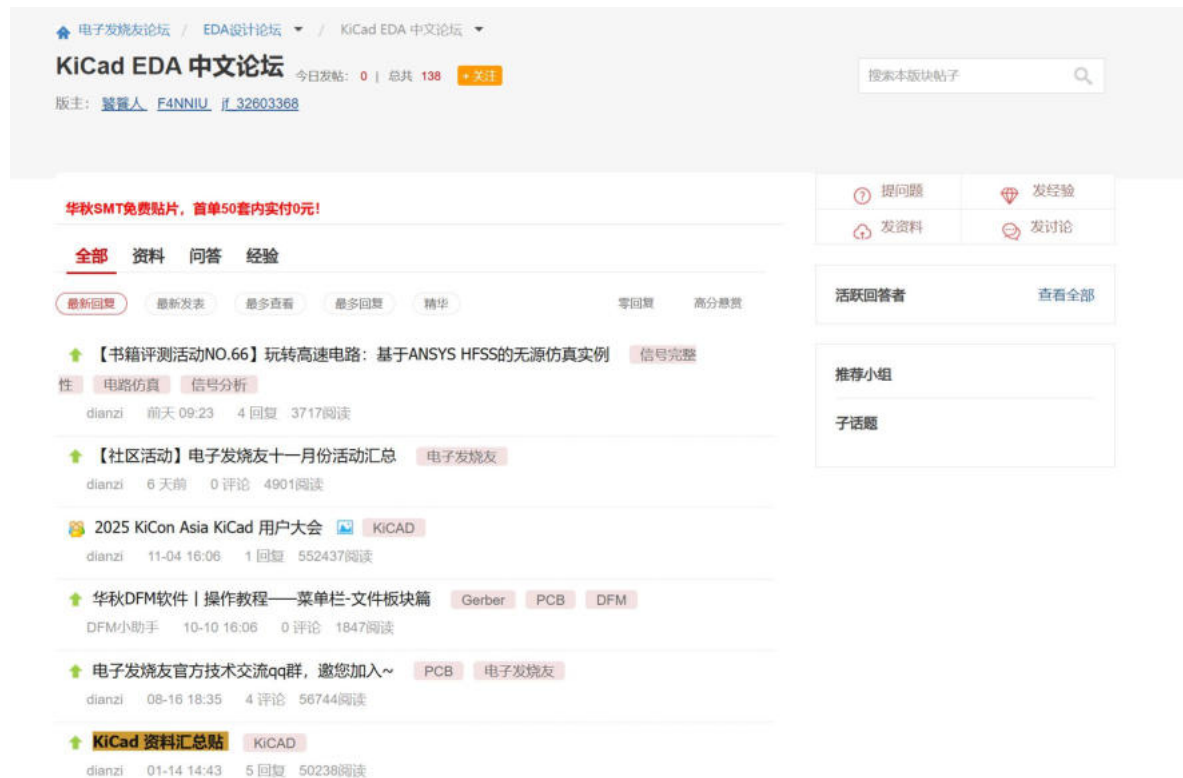
Show	Group	Name
☒	☒	Value
☒	☒	Footprint
☒	☒	Company
☒	☒	Model
☒	☒	ASSY_OPT
☐	☐	DNP

☐ Normalize field name case

Feedback From Engineers

Easy to use, intuitive UI, rich documentation and community support, making it very quick to learn.

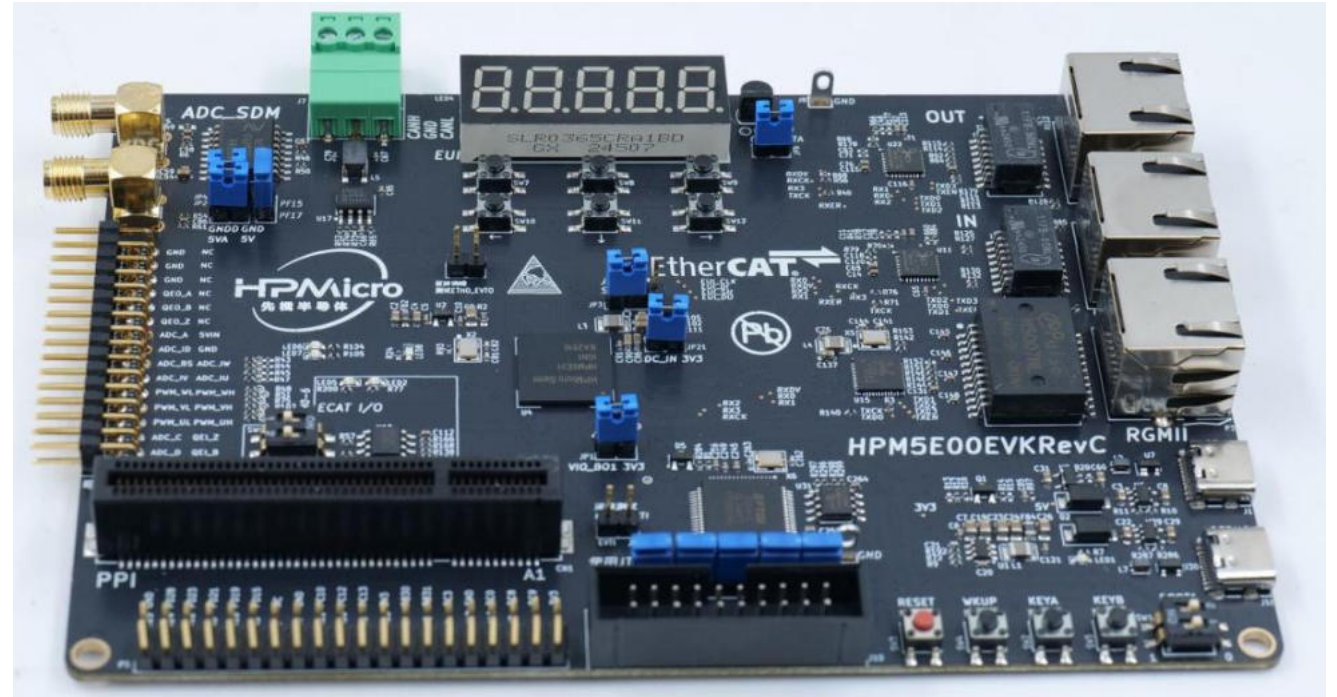
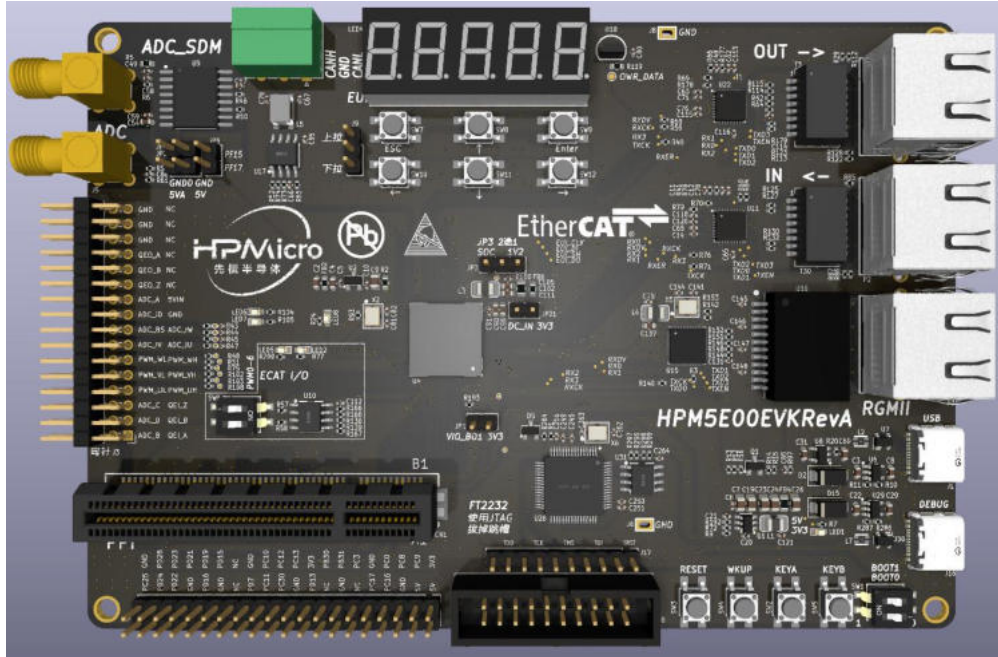
用户界面直观，文档和社区支持丰富，易学易用



Feedback From Engineers

3D Viewer

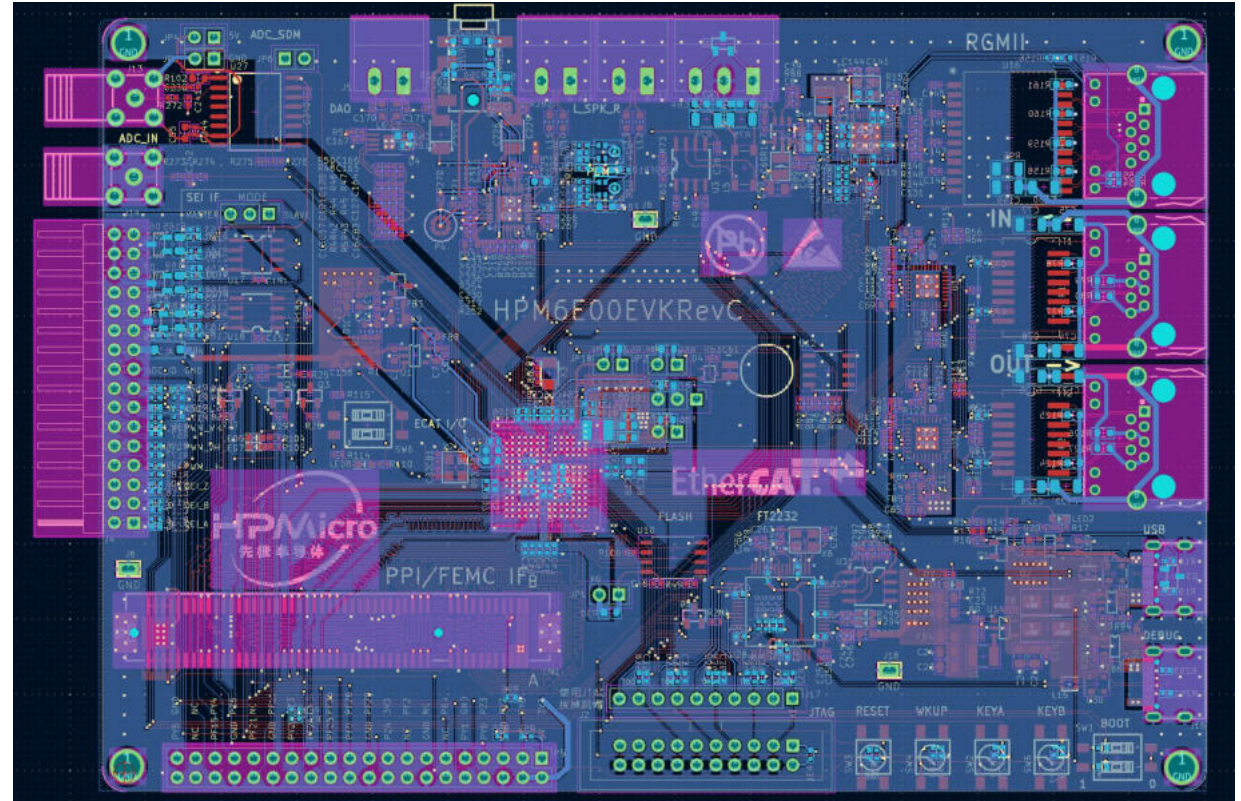
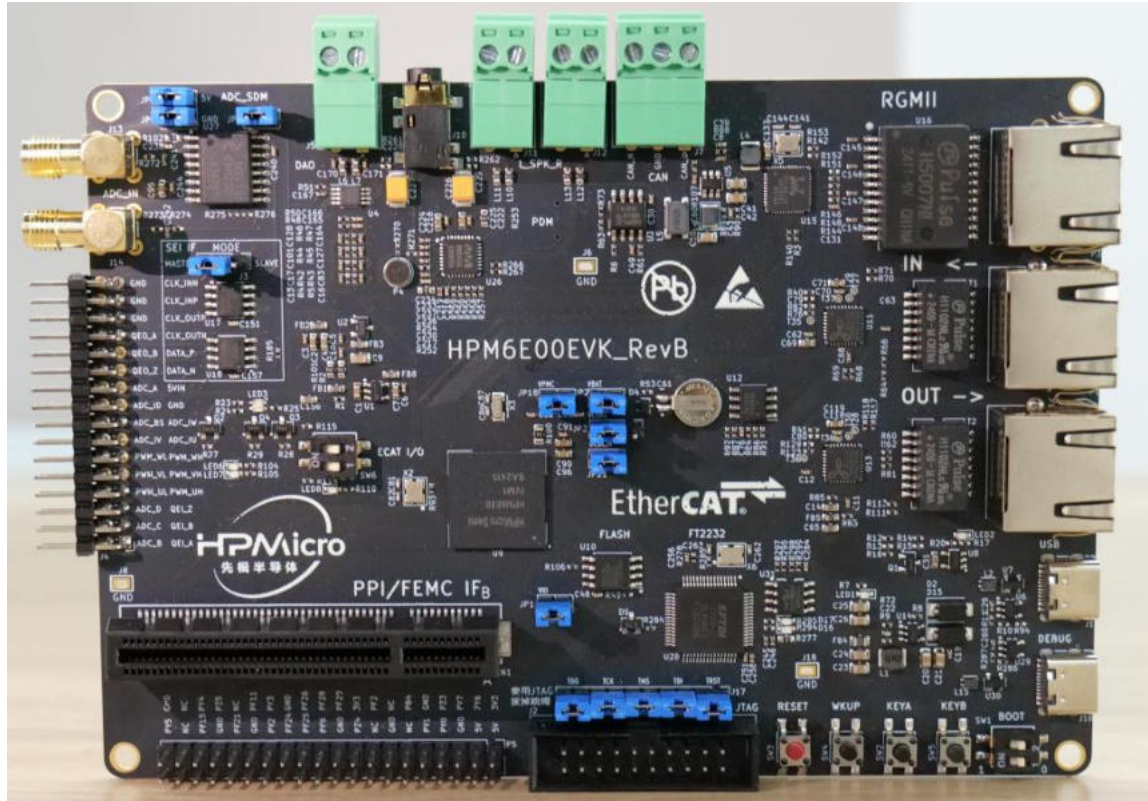
HPM5E00EVK



RGMII , Ethercat , FEMC , Motor Interface , Sigma-Delta , CAN , USB , On board debugger , 千兆网、Ethercat、并口内存拓展、电机接口、隔离采样、CAN通信、USB、板载调试器

Reference Design

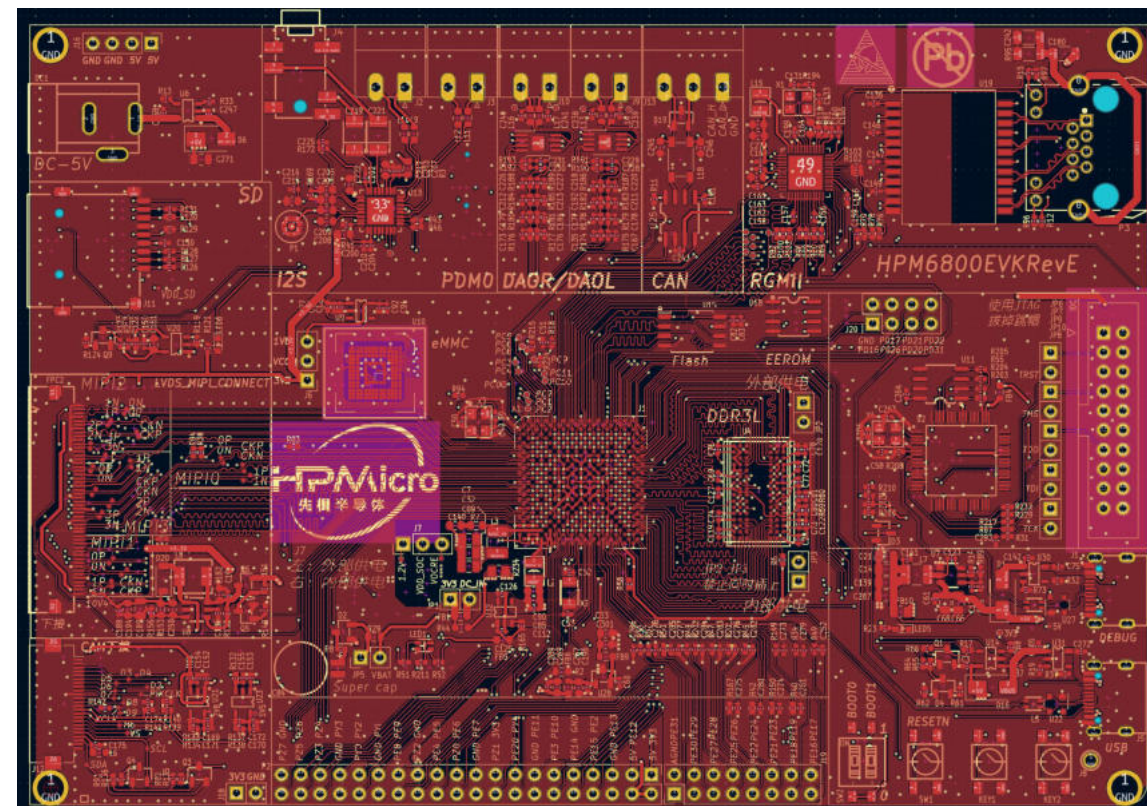
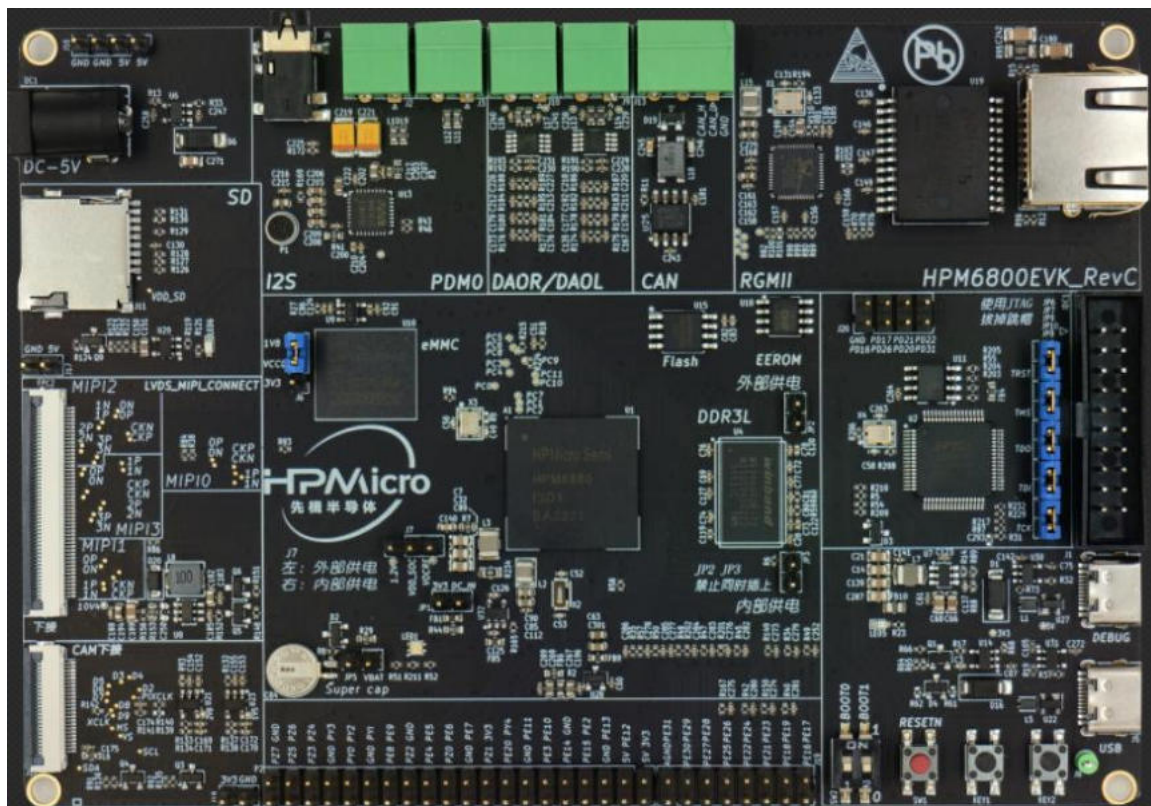
HPM6E00EVK



RGMII , Ethercat , FEMC , Motor Interface , Sigma-Delta , CAN , USB , On board debugger , Audio
千兆网、Ethercat、并口内存拓展、电机接口、隔离采样、CAN通信、USB、板载调试器、音频

Reference Design

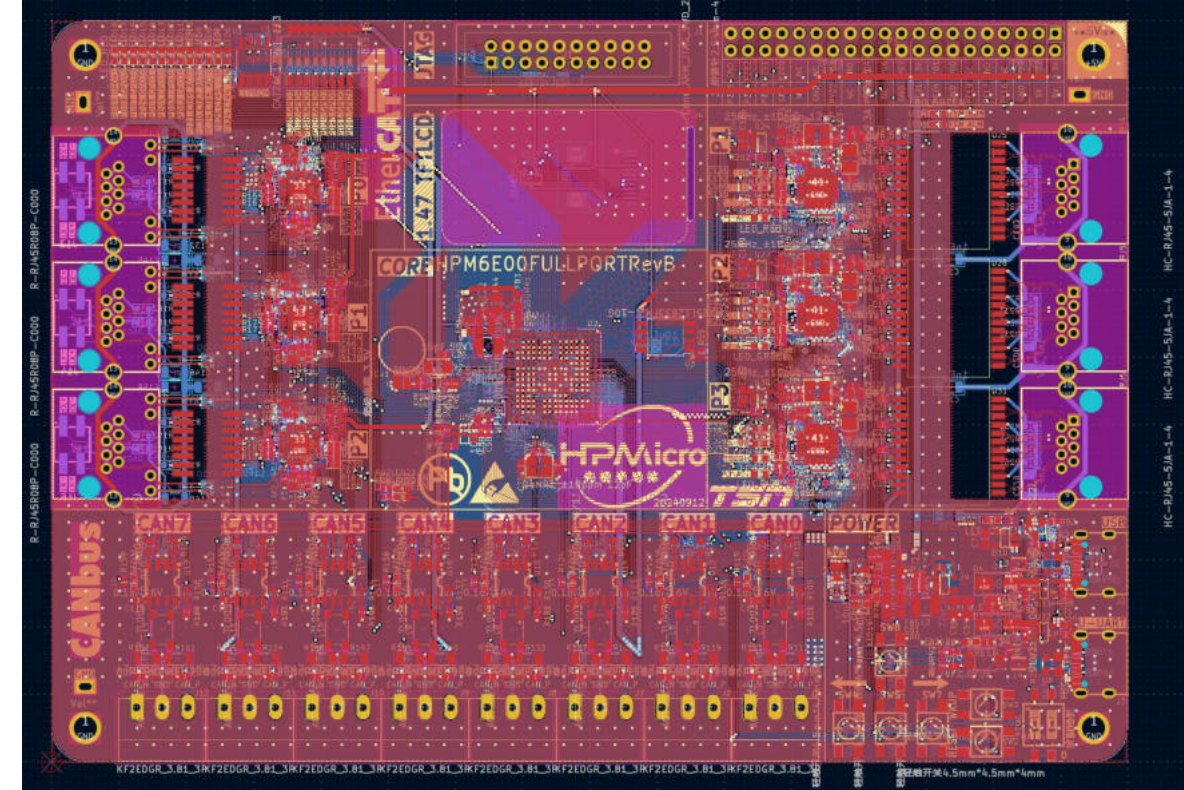
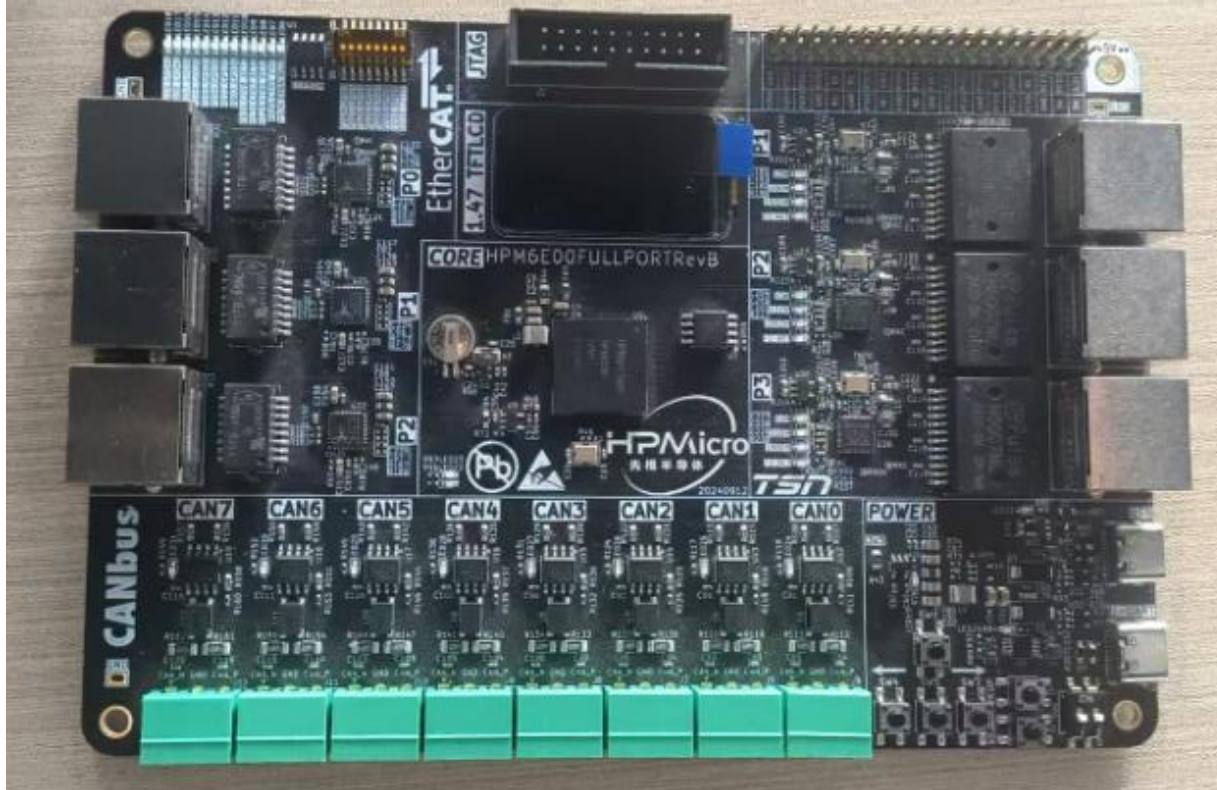
HPM6800EVK



RGMII , DDR3 , MIPI DSI , MIPI CSI , LVDS , EMMC , Audio , On board debugger
千兆网、DDR3、MIPI显示接口、MIPI相机接口、LVDS、EMMC、音频、板载调试器

Reference Design

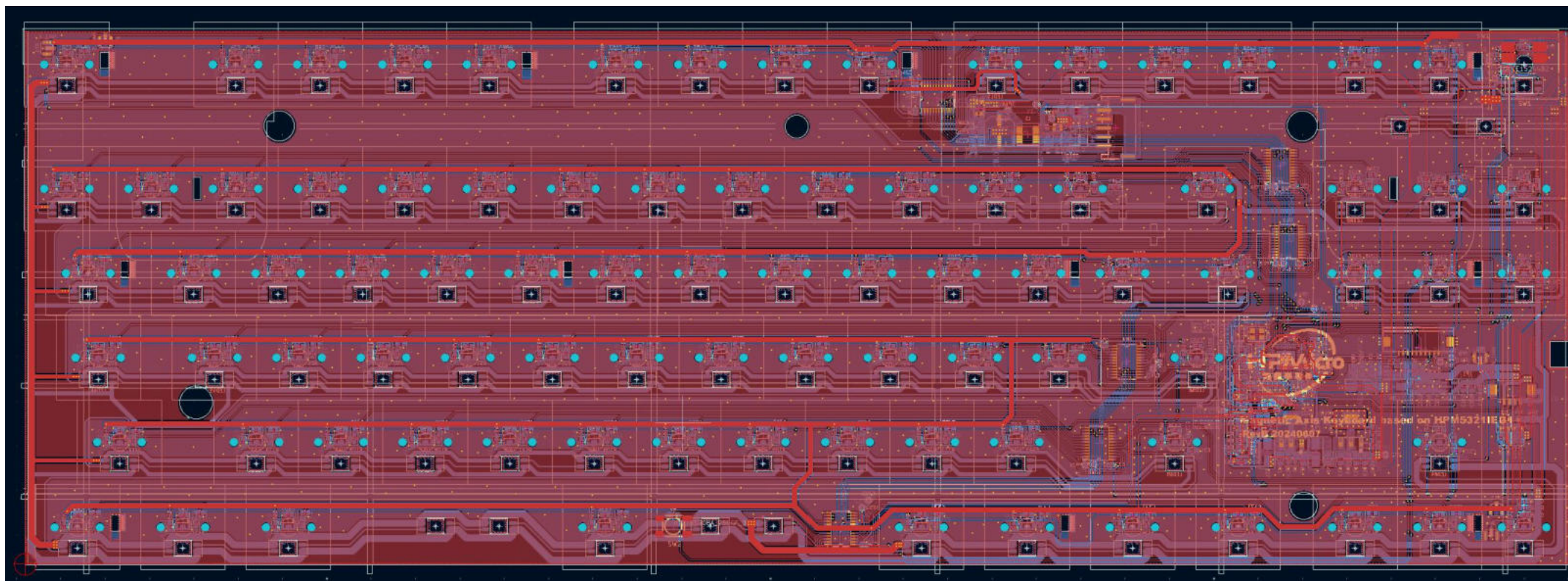
HPM6E-Communicate board



CANFD*8 , Ethercat*3 , TSN*3
8路CANFD, 3个Ethercat网口, 3个TSN交换机网口

Reference Design

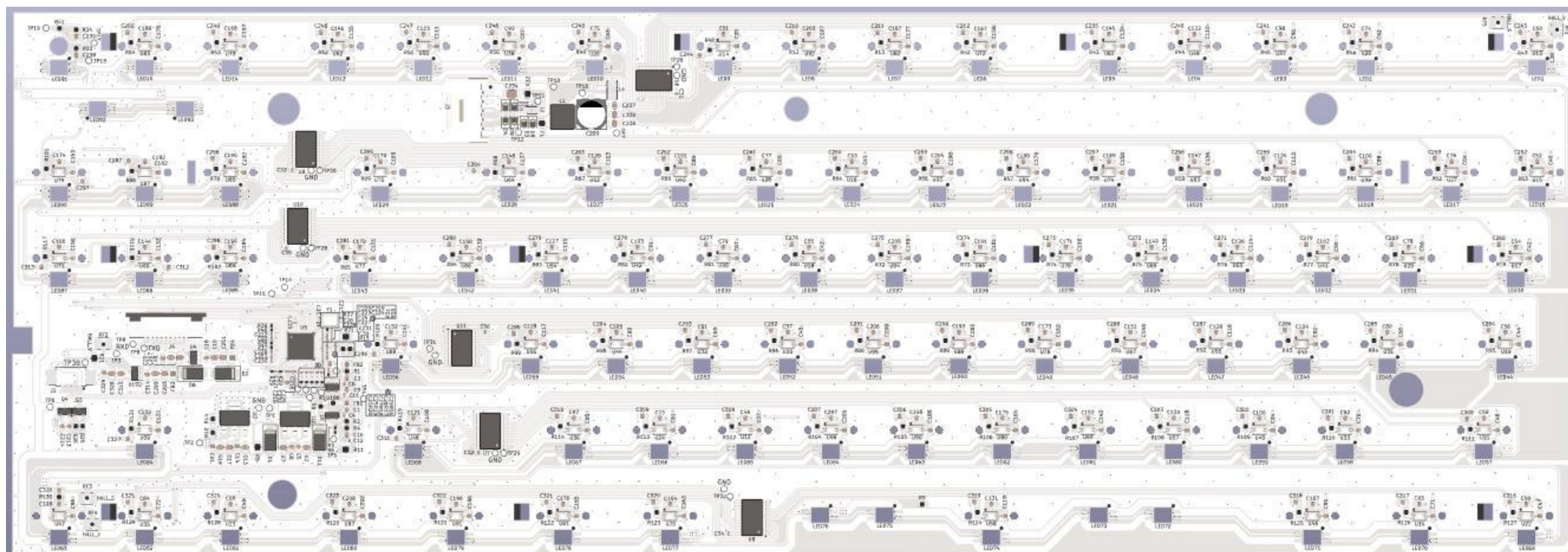
Keyboard solution



HPMicro 键盘方案

Reference Design

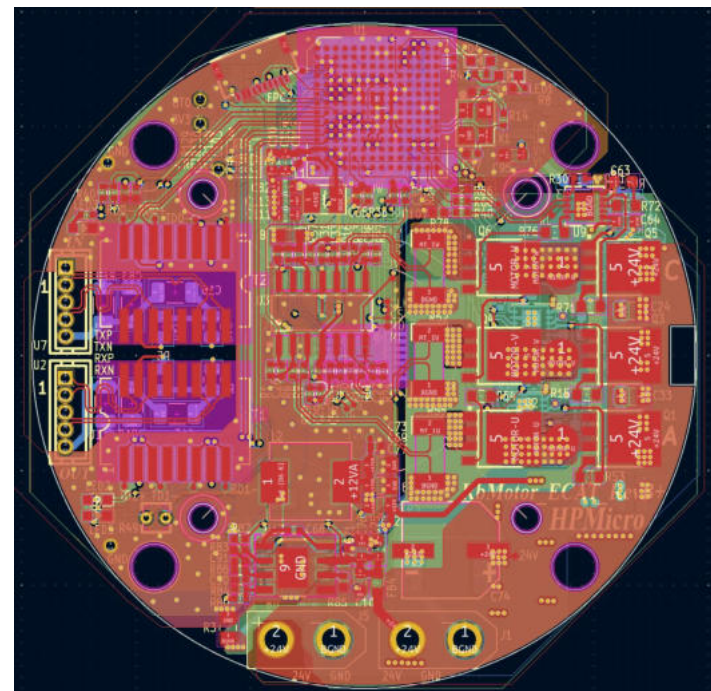
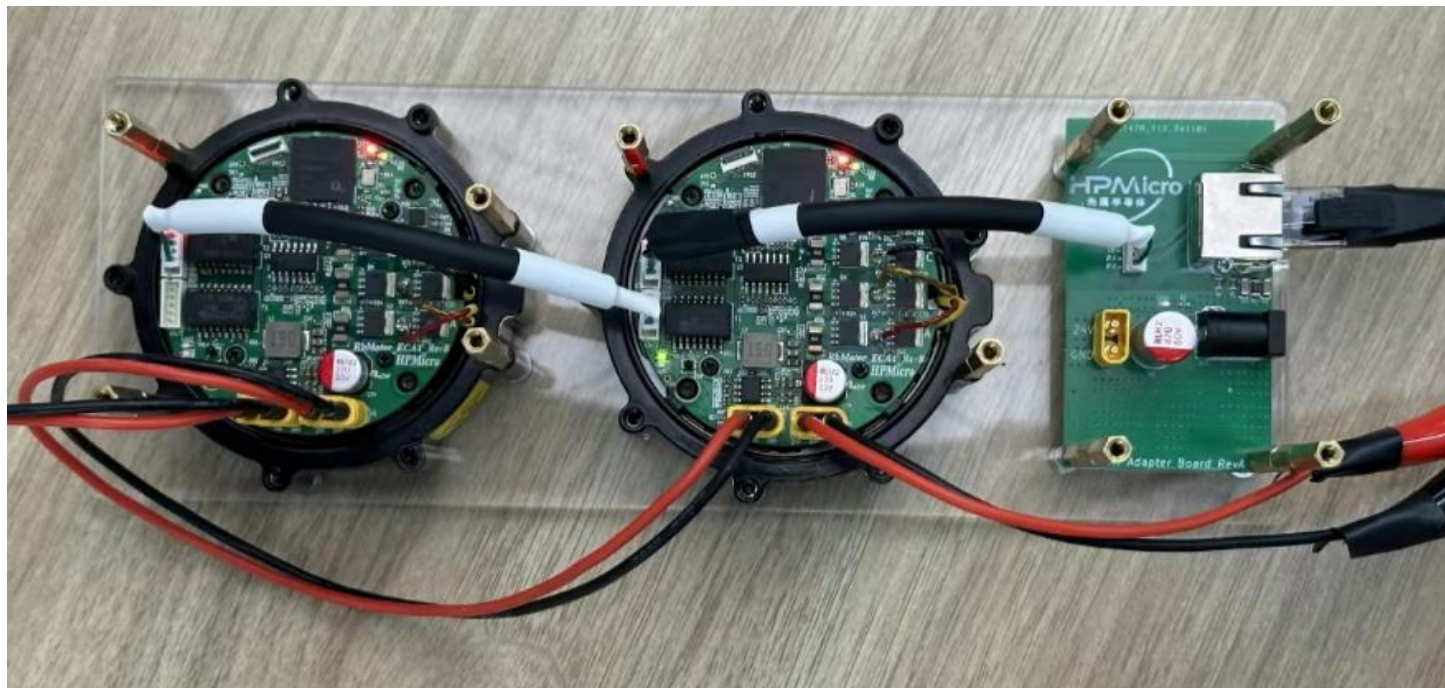
Keyboard solution



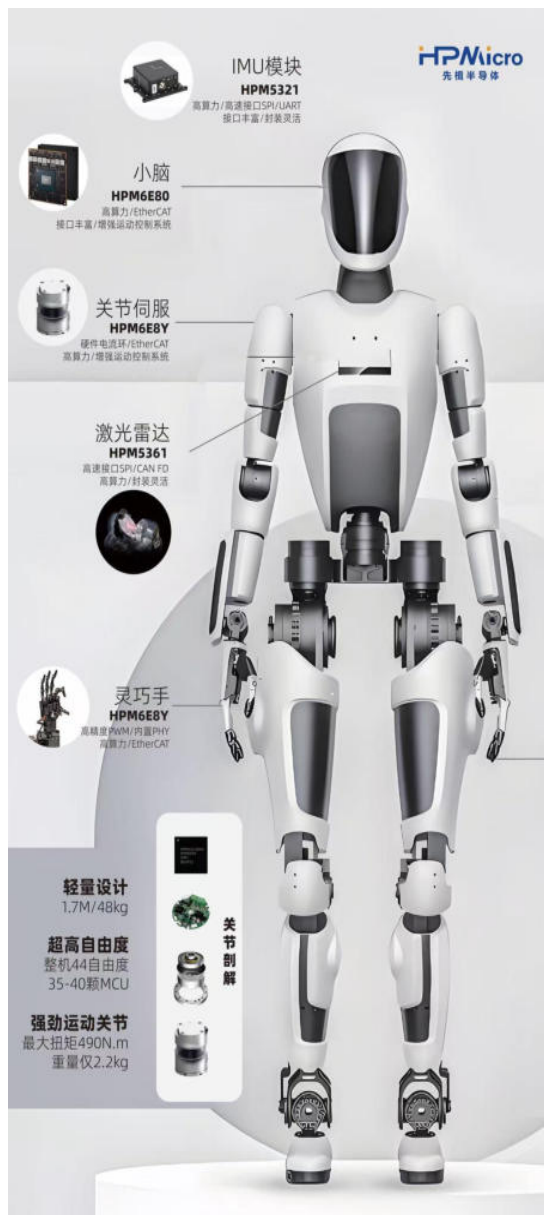
HPMicro 键盘方案

Reference Design

Robot joint motor driver



HPMicro 机器人关节电机方案



从芯片到智能，推动机器人的底层进步

先楫产品覆盖机器人运动控制，实时通信及环境感知

高算力：单核480MHz ~ 双核600MHz

- 减少关节伺服的三环计算延时，提高系统响应特性；
- 实现IMU、力矩等传感器的快速计算、滤波等；

丰富的Roadmap：HPM6E00~HPM5300

- 满足关节驱动、编码器、IMU等多场景需求；
- 实现平台统一，减少研发成本；

电机控制专用外设：硬件电流环/SEI等

- 电流环处理延时减少到~200ns，提高响应性；
- 高算力助力提高驱动的功率密度；
- 兼容脉冲、Tamagawa等主流编码器协议；

集成正版授权的EtherCAT 从站：

- 满足机器人对实时性通讯的要求；
- 支持应用层协议；
- 支持机器人产品全球化

高精度ADC，SDM等：

- 提高电流、位置等信号采样精度；
- 实现电机精准控制

灵活的封装：

- 从6X6 QFN 48到 14X14 BGA289；
- 集成PHY等外围芯片，减少PCB面积

HPM6E8Y: Integrate 100Mbps PHY and Flash

【产品特点】

- 高性能RISC-V双核，主频高达600MHz；
- 高达2MB SRAM，192KB ROM，4Kb OTP；
- TSN交换机，3个外部端口+1个内部端口
- EtherCAT Slave控制器，3个MAC端口
- 1个千兆以太网MAC控制器
- 2个100Mbps以太网PHY
- 32通道高分辨率PWM控制器，100ps
- 增量式和绝对值位置传感器接口x4
- 串行编码器输入/输出：支持多摩川，BISS-C，ENDAT等
- 8个CAN-FD接口
- 4个16b SAR ADC
- 2个4通道 $\Sigma \Delta$ 滤波器
- 289MAPBGA，14x14，0.8 pitch
- 196MAPBGA，12x12，0.8 pitch
- TA: -40 ~ 105°C

电源 DCDC LDOPMC LDOOTP LDOBAT POR/BOR	内核 RISCV CPU 0 32KB L1I 32KB L1D FPU DSP PLIC 256KB ILM 256KB DLM RISCV CPU 1 32KB L1I 32KB L1D FPU DSP PLIC 256KB ILM 256KB DLM FFT/IFFT 4096 实时以太网系统 EtherCAT ESC 3x Ports ENET PHY 100 Mbps x2 TSN Switch 3+1 Port 1Gbps ENET 1000/100/10Mbps x1	通讯接口 UART x17 SPI x8 I2C x8 CAN FD x8 USB HS x1 运动控制系统 PWM 32CH 100ps 正交输入x4 正交输出x4 可编程逻辑 触发互联 位置管理 空间坐标 旋转解调 闭环控制 串行传感器接口x4 Tamawaga BiSS-C ENDAT
时钟 小数分频PLL x3 OSC 24M IRC 24M OSC 32K IRC 32K	系统 DMAx2 WDG x5 MBX信箱 RTC JTAG调试	模拟 16b SAR-ADC 2Msps x4 $\Sigma\Delta$ 滤波器 4CH x2 模拟比较器x8 温度传感器
内部存储器 高速RAM 1024KB 外设RAM 32KB 闪存 4MB ROM 128KB OTP 4Kb	外部存储器 4b/8b 串行NOR/PSRAM x1 32b SDRAM/16b SRAM 并口总线	安全 EXIP在线解密执行 AES/SHA TRNG 安全调试 密钥管理 产品生命周期管理 安全启动 加密/可信任
	定时器 32位通用定时器x9 音频 I2S x2/PDM-MIC/DAO 输入输出 GPIO/快速GPIO	



关节模组(1) - HPM6ExY

- EtherCAT通讯, 正版授权IP
- 高集成度: 内置2个PHY
- 高算力 600MHz & 硬件电流环
- 宽工作温度: 105° C

关节模组(2) - HPM5300

- 4个CANFD\16b ADC
- 丰富的编码器接口
- 宽工作温度: 105° C



IMU 模块- HPM5300

- 高算力 480MHz
- 高速接口 SPI/UART;
- 小封装: 6*6;



编码器- HPM5300

- 16b高精度ADC;
- 适合磁编、电感编;
- 封装灵活QFN48;

HPMicro Semiconductor

China

Category: **Enterprise Technology & Robotics**

Forbes Asia
HPMicro | **100**
TO WATCH

The full list can be found at <http://www.forbes.com/100towatch>
and in the September issue of Forbes Asia magazine.



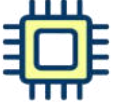
Software Tools and IDE

IDE

Free commercial license Commercial license needed HPM Studio

开发工具

SDK HPM Pin Mux HPMLink HPMPerTool HPMLx

RTOS & Middleware

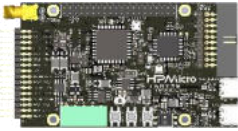
   

RTOS Middleware

Evaluation Kit

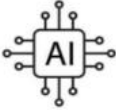
  

HPM6750EVK HPM6300EVK HPM5300EVK

HPM6750EVKMini HPM6200EVK HPM6000 Motor Control Board

Application

Dashboard Motor control UI AI

ESI/PCS Communication Audio/Audio Edge computing

联系先楫

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咨询热线：（+86）021-58993108

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咨询邮箱：marketing@hpmicro.com
sales@hpmicro.com

微信公众号“先楫半导体”

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关注 @HPM-FAE



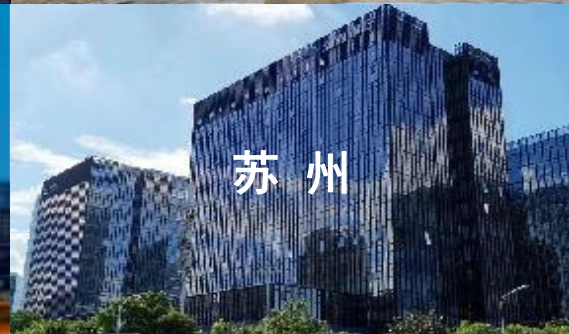
上海



天津



深圳



苏州