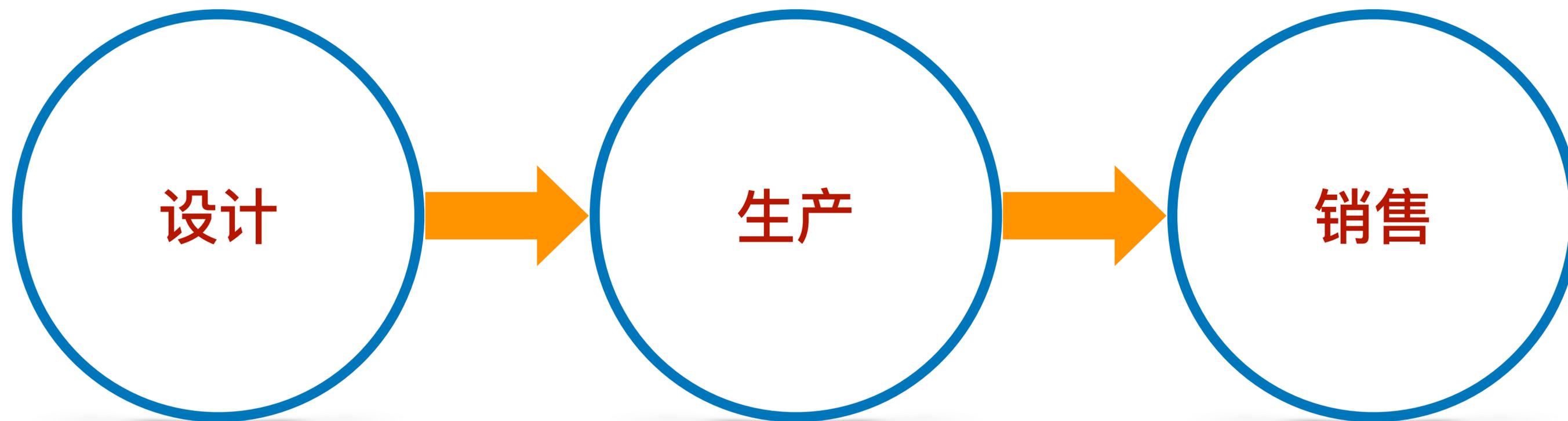


# PCB设计之可制造性设计 - 优化器件/系统组装



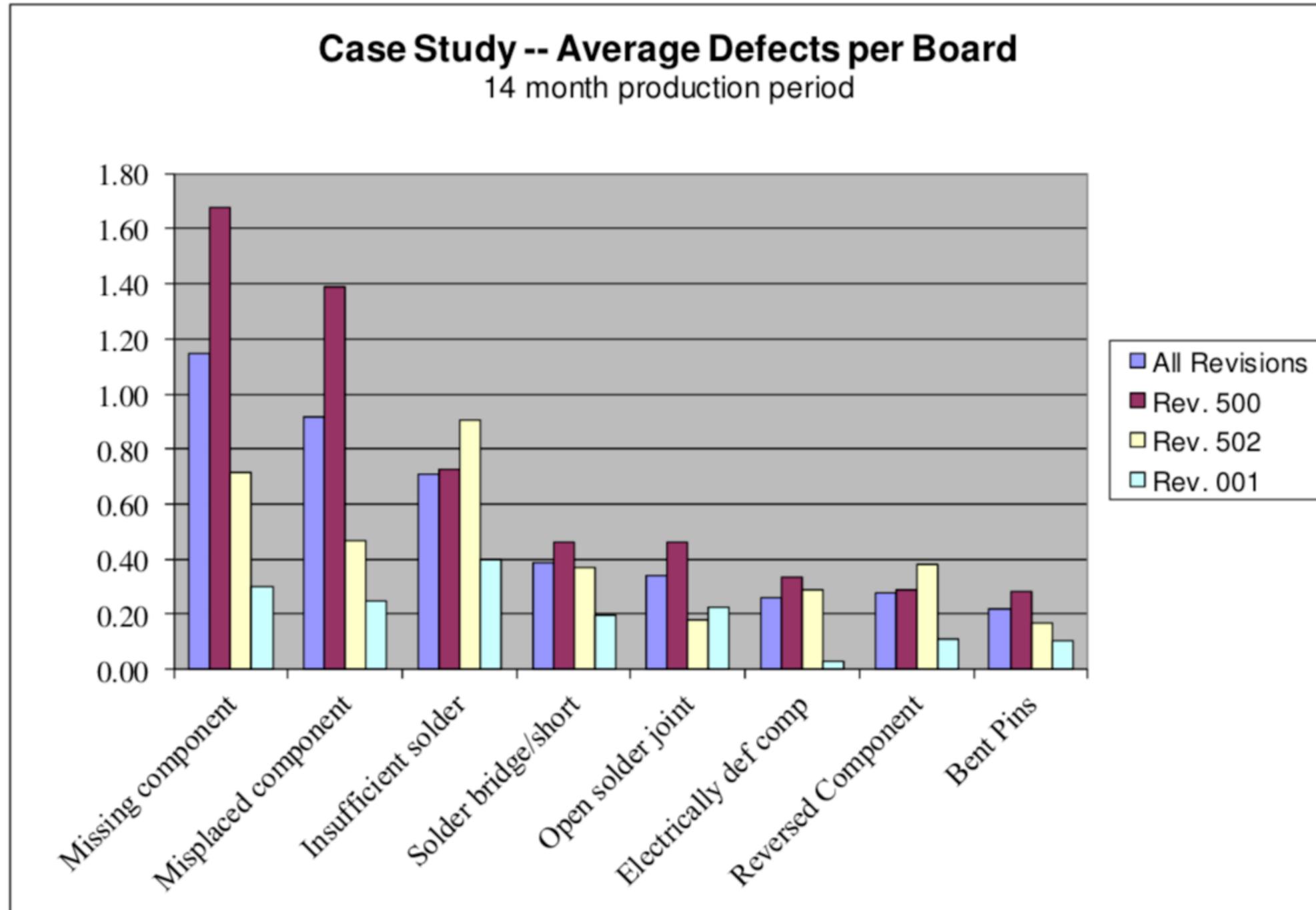
# 产品生命周期



快	三版到位、流程规范	环节少、工艺简单、大规模自动化生产	性价比高
好	性能满足各种设计要求	系统整体性能好、加工容易	稳定性、可靠性高
省	研发成本低、时间短	大批量成本低（产品+生产+测试）	远程诊断、远程升级



# 产品常见问题



# DFX

- DFF (Fabrication) - 可加工性设计
- DFA (Assembly) - 可装配性设计
- DFR (Reliability) - 可靠性设计
- DFS (Serviceability) - 可服务型设计
- DFT (Testing) - 可测试性设计
- DFM (Manufacturability) - 可制造性设计
- DFMA - DFA + DFM



# DFM的目标

- ① 保证产品质量和可靠性
- ② 缩短开发和生产周期
- ③ 降低产品成本
- ④ 提高加工效率



# DFM设计原则

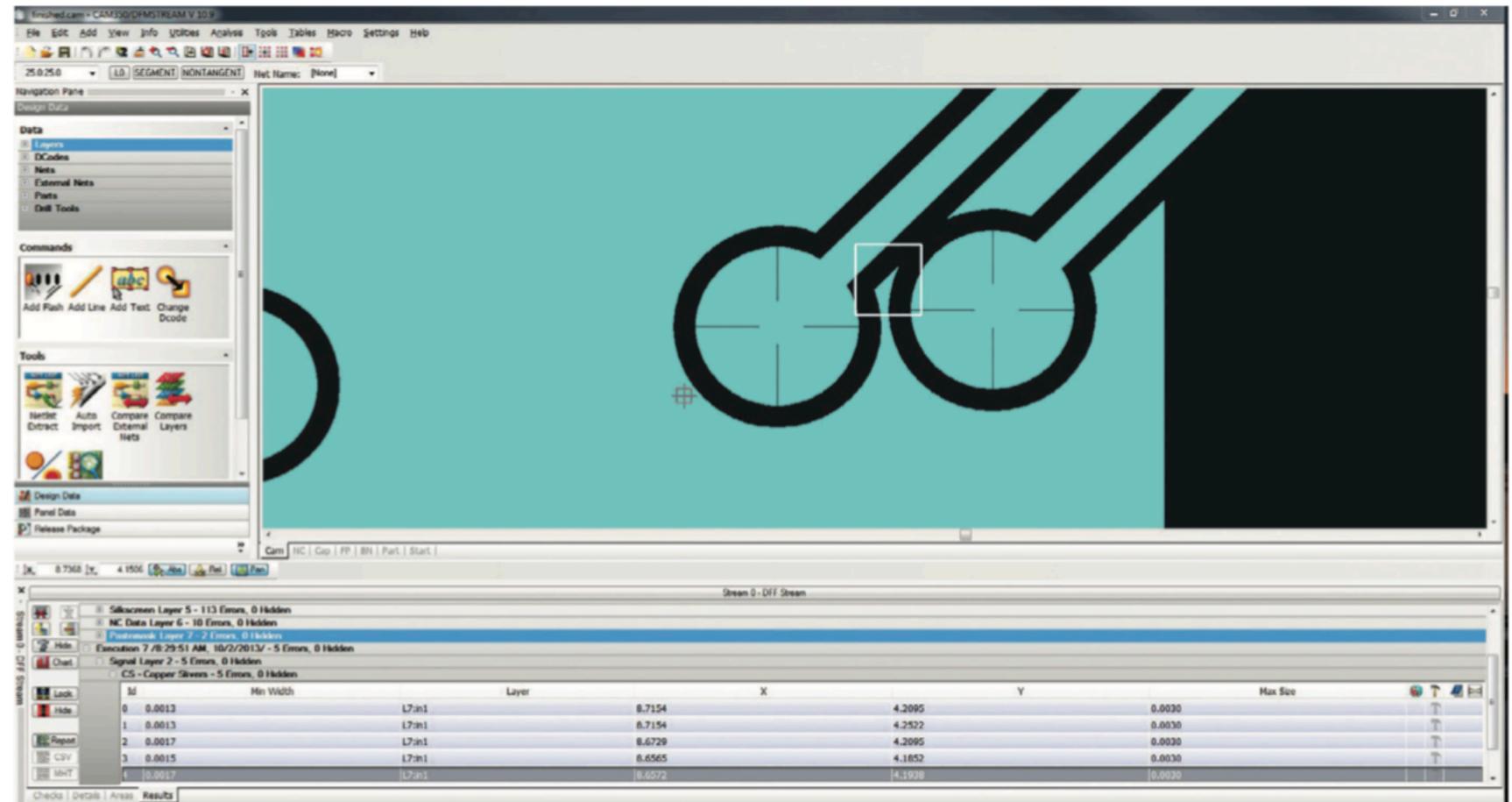
- 尽量少出错，减少上市时间！
- 了解PCB加工、组装工艺要求
- 从机械、电子两方面共同考虑对设计的要求和限制
- 对其它系统的影响以及其它系统带来的影响
- 预测加工误差导致的风险 - 线间距、孔距、孔间距等



# DRC和DFM的关系

- **DRC - Design Rule Check, 能帮助DFM**
- 导通孔、元器件孔径设计、焊盘环宽设计、隔离环宽设计、线宽、线间距设计
- 通过了DRC并不意味着能够满足DFM要求
- DFM分析工具非常贵, 需要加强同PCB制造厂商工程师的沟通

DFM Defect	Description
Starved Thermals	Plane connections that are tied correctly to a plane layer in a CAD system but inadvertently isolated from the rest of the plane.
Acid Traps	Acute angles that allow acid to build up in the fabrication process and over-etch a trace, potentially creating an open in the circuit.
Slivers	Narrow wedges of copper or soldermask that can peel off and either reconnect to other pieces of copper or expose copper that should be covered with soldermask.
Insufficient Annular Ring	A drill size is specified that exceeds the size of the pad being drilled and can result in a disconnect of the pin or short in a voltage plane.
Missing Clearance Pads on Planes	Pins that are missing a clearance pad will be connected to a plane layer. If clearance pads are missing from all plane layers for the pin, it will tie together all of the voltage planes as well.
Copper too close to board edge	When there is insufficient clearance of plane layers from board edges it's very likely that the voltage planes will be connected together when the PCB form factor is routed. The copper on each voltage layer is inadvertently "mashed" together.
Missing Solder-mask Pads	End user failed to define a soldermask pad for a pin or component. This exposes more copper and creates the potential for bridging pins together during assembly.



# DFM工具

Mentor Graphics Corporation [US] | <https://www.mentor.com/pcb-manufacturing-assembly/>

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- Compare your Netlist against Gerbers — get hints to fix
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- Some Design Issues Are Automatically Corrected
- Receive Detailed PCB Quote & Up to \$100 Discount Code
- FREE (Unlimited & Available 24/7)

"...My two boards I just sent for fab had global issues with the solder mask and silk screen. I wouldn't have found the issues without your DFM tool." - A.V.

Not Secure | [www.sunstone.com/pcb-products/dfm-solutions-for-cad-tools](http://www.sunstone.com/pcb-products/dfm-solutions-for-cad-tools)

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## DFM Solutions for CAD

Studies show that 70-80% of the quality and manufacturing yield of you from design, not manufacturing. Furthermore, finding and fixing design orders of magnitude more expensive as your design proceeds through. As a result, it pays to catch manufacturability issues as early as possible. Circuits offers DFMPplus for you to increase your odds of achieving a win on the first build spin.

DFMplus

With Sunstone's DFMPplus tool, you can submit your final design file to DFM service. We'll create a comprehensive report for your board. This only help you determine which of our manufacturing services is most a your design specifics, but it will also help you look forward to production details in your current design that may cause yield or reliability issues. not only helps verify your prototype, but keeps you focused on the end goal - a reliable, profitable final product. DFMPplus is available through your Sunstone My Account section.

PCB PRODUCTS & SERVICES

- PCB Manufacturing
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- DFMPPlus DFM Throughout Your Design Cycle
- Layout Services
- PCB Solder Stencils
- Bundled Assembly

Questions? We're here for you 24/7/365 1.800.228.8198



# DFM工具检查的内容

**Better DFM does a comprehensive Design For Manufacturability analysis on your files.**

**Our 40-Point Checklist includes the following DFM checks:**

## Signal Checks

- Conductor Width
- Spacing
- Annular Ring
- Drill to Copper
- Hole Registration
- Text Features
- Missing Copper
- Features Connection
- Missing Holes
- Unconnected Lines
- Rout to Copper

## Plane Checks

- Drill to Copper
- Annular Ring
- Spacing
- Conductor Width
- Thermal Air gap / Spoke Width
- Missing Copper
- Rout to Copper
- Drill Registration
- Clearance smaller than hole

## Solder Mask Checks

- Solder Mask Clearance
- Coverage
- Rout to Mask
- Spacing
- Missing Solder Mask Clearance
- Exposed Lines
- Partial Clearances

## Silk Screen Checks

- Silk Screen to Mask Spacing
- Silk Screen to Copper Spacing
- Silk Screen to Hole Spacing
- Silk Screen to Rout Spacing
- Line Width
- Text Height
- Silk Screen Over Copper Text

## Drill Checks

- Hole Size
- Duplicate Holes
- Hole Spacing
- Touching Holes
- Plane Shorts
- Holes to Rout
- Missing Holes



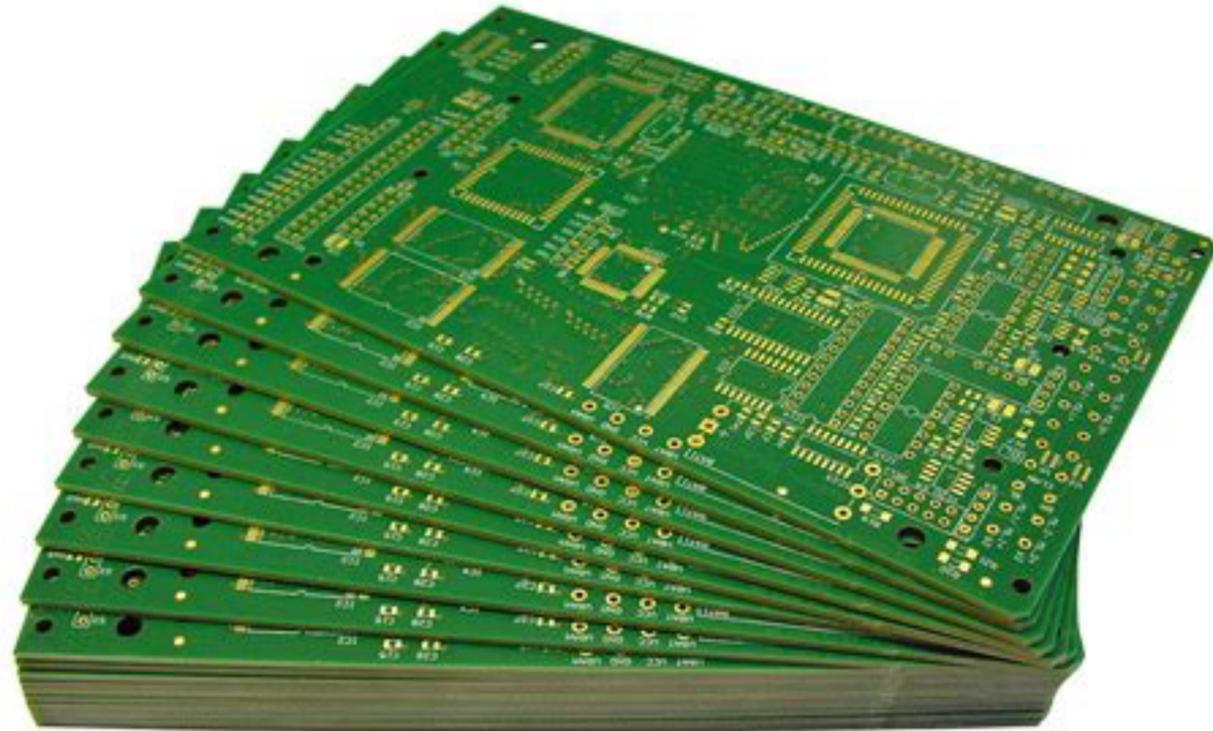
# 器件的选择



- 影响成本及焊接合格率
- 穿孔器件还是贴片器件?
- 值尽可能统一
- 封装尽可能统一



# 板材的选择

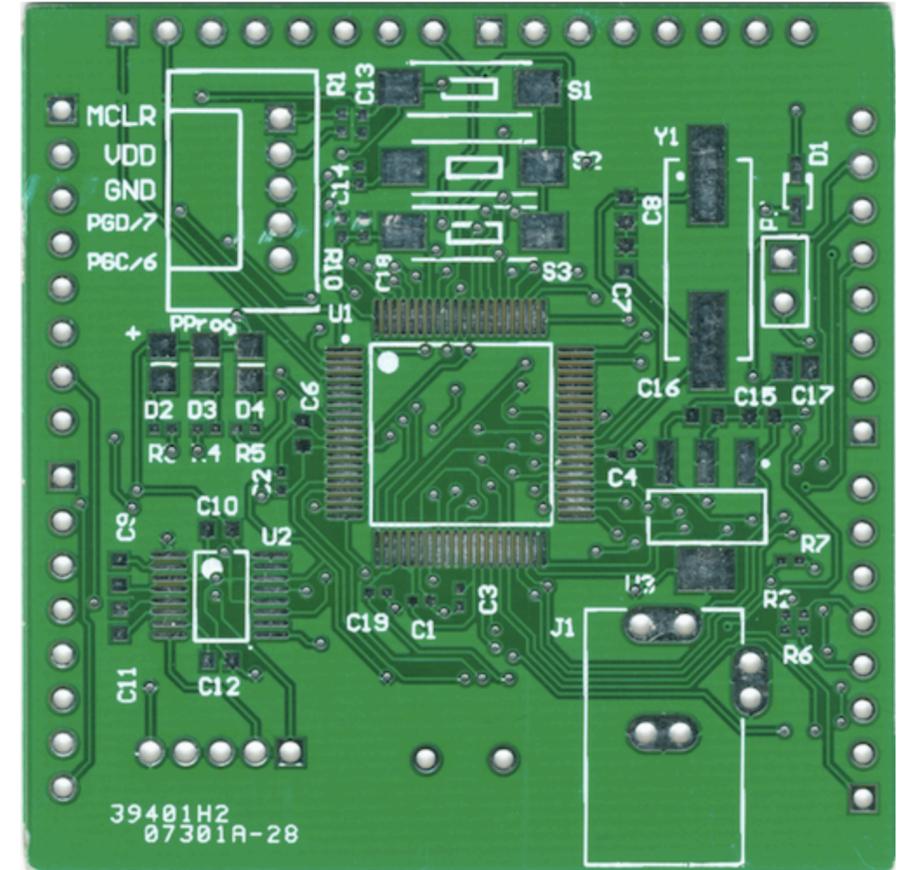


- 层数的选择
- 板材料的选择
- 工艺的选择



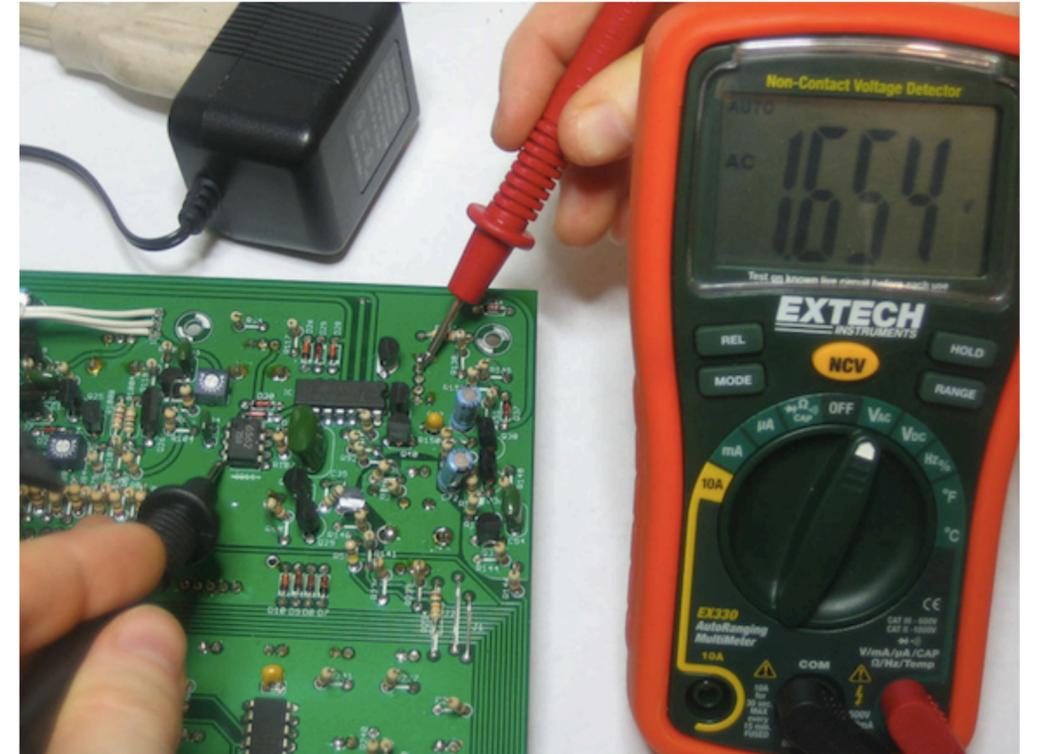
# 丝印

- 板上的文字是你同加工工人之间唯一的沟通手段
- 一个小小的错误有可能造成整个板子或整盘板子都无效
- 与装配、调试、接线有关 - 型号、外型、版本
- 元器件编号的放置 - 器件安装后不能遮挡



# 测试

- 问题消灭在产品送给客户前，根据客户的环境进行充分的可靠性测试
- 做测试夹具
- 反复测试、老化试验
- 抽样压力测试



# 其它与工艺相关的设计

- 自动化生产需要的传送边、定位孔、光学定位符号
- 拼板
- 与检查、维修、测试有关的元器件间距、测试焊盘设计
- 与压接、焊接、螺装、铆接工艺有关的孔径、安装空间



# 关于贸泽电子 - [www.mouser.cn](http://www.mouser.cn)

The screenshot shows the Mouser Electronics website interface. At the top, a blue banner features the slogan '在MOUSER 采购很EASY!' and three key benefits: '数百万产品 一站式购齐', '接受微信支付 付款更简单', and '上海客服 本土支持'. Below this is a navigation bar with the Mouser logo, 'MOUSER ELECTRONICS', and links for '产品', '制造商', '更多', '订单历史', '登录', '注册', and a shopping cart icon. A search bar is positioned below the navigation, with filters for '全部', '物料编号/关键字', '有库存', and 'RoHS'. The main content area includes a '产品类别' sidebar with categories like 'LED照明', '工业自动化', and '半导体'. A central promotional banner advertises '额满免运费\*' (Free shipping when order reaches a certain amount) with a QR code for WeChat updates. At the bottom, there is a '最新产品' (New Products) section featuring logos for Texas Instruments, Infineon, Intel, and Molex.

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- 小批量采购，170元免邮费
- 1-2周交货

