iHALT

HASS/HASA Technology
高加速应力筛选/稽核技术

报告人：SKY周葛瑜

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个人简介

iHALT

2004年
大学毕业

2005~2020任
代理QualMark
应用工程师

2021~ iHALT
深圳艾浩仪器
CEO

周葛瑜sky

Tel:18145813381

- 国内第一批高加速寿命测试（HALT&HASS）应用从业人员
- 曾任代理QualMak机台技术应用工作，15年以上经验
- 承接HALT初创人员对HALT&HASS及HASA应用的精神
- 十多年积极推广HALT这一新的可靠性制程的导入
- 国内最多HALT机台安装调试及理论到实操的经历
- 服务经验有国内外各大制造厂商，研究机构，检测实验室和高校

HALT相关专利：

一种模拟地震岩层撞击动力学的宽频域振动测试装置

名词解释

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- **POS (Proof Of Screen)**

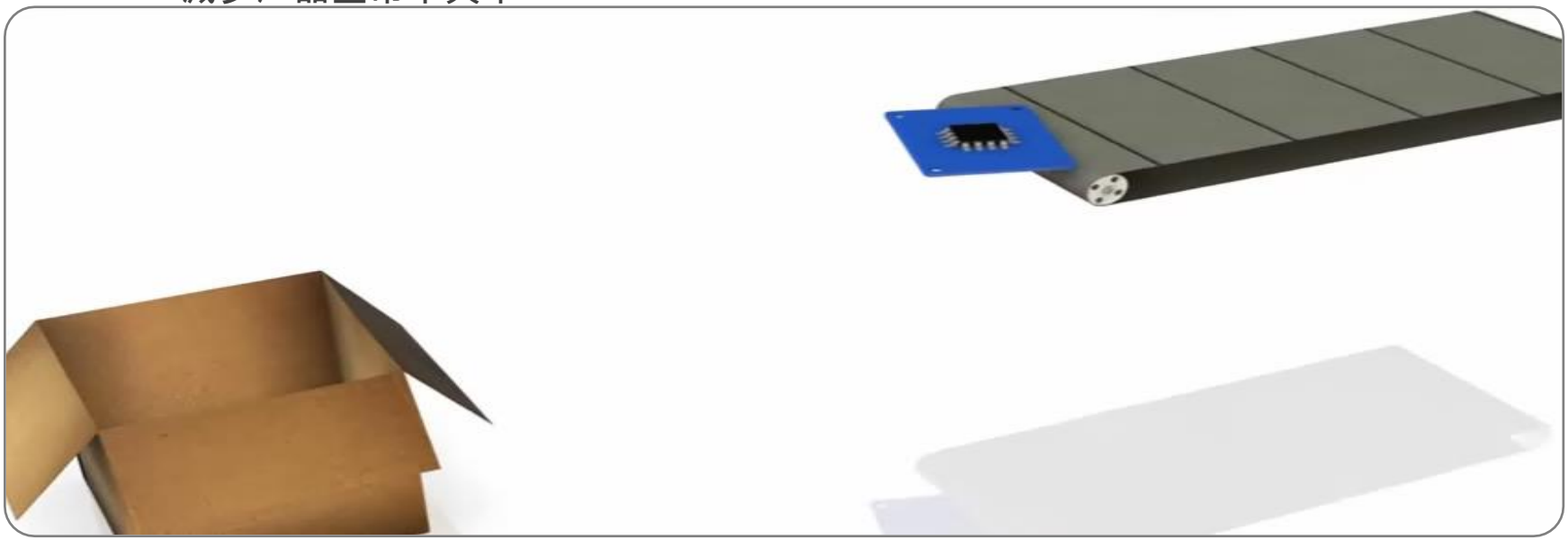
  验证产线测试条件有效性

  验证产线测试条件最多带走产品寿命10%

- **HASS (Highly Accelerated Stress Screen for production)**
- **HASA (Highly Accelerated Stress Audit for volume production)**

  监控产线制程

  减少产品上市早夭率



H A S S 的好处

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- 找出制程问题
  - 锡点和焊接的过程
  - 组装缺失- 接头, 螺丝/扣件
  - 线材配置- 摩擦, 转折, 锡点的连接
  - 快速检测出制程上的变异
  - 减少制造的时间和成本

- 找出元器件问题
  - 元件器合规(尺寸超差等)
  - IC供应商或制程的改变
  - 及早检测出产品强度边界的转变
  - 加速元器件早夭失效的出现
  - 长时间所造成的问题 (只在加上应力后会出现的议题)

◆强力筛选，产品上市前减少早夭率.
◆提升使用品质和服务可靠度.
◆减少售后服务和保固成本.

HASS的初始应力：
HALT发现温度极限的 80%，及HALT发现振动极限的 50%

- 根据HALT的数据产生出初始的profile
- 筛选应力大小(经过POS后可以修正初始的应力和测试时间).
- 于Profile期间, 决定何时/做何种功能测试，实时对产品状况进行监测。
- 决定要加入的产品特性的应力，并决定加入在profile的什么地方.

夹具设计:

- 适合大批量生产和容易装卸的夹具
- 考虑测试产品受应力的传导效率
- 考虑各产品受应力的均衡度
- 装配产品进行温度和振动响应的验证测试

怎么规划由HALT条件生HASS程序：
Standard HASS profile(HASS的测试条件)

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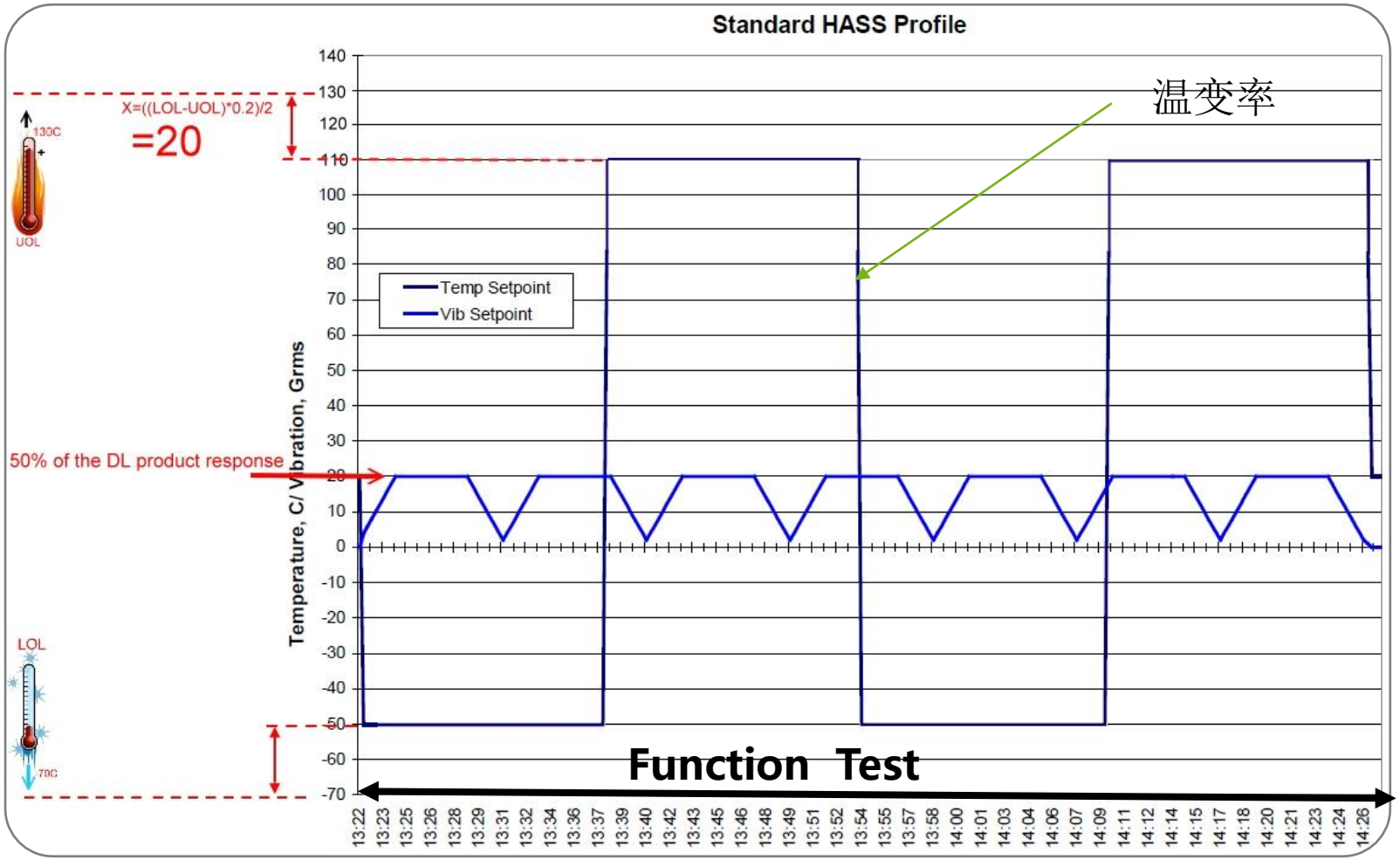

振动由5/10G启振，覆盖温度变化周期

怎么规划由HALT条件生HASS程序：
沉淀检测The Precipitation-Detection Profile

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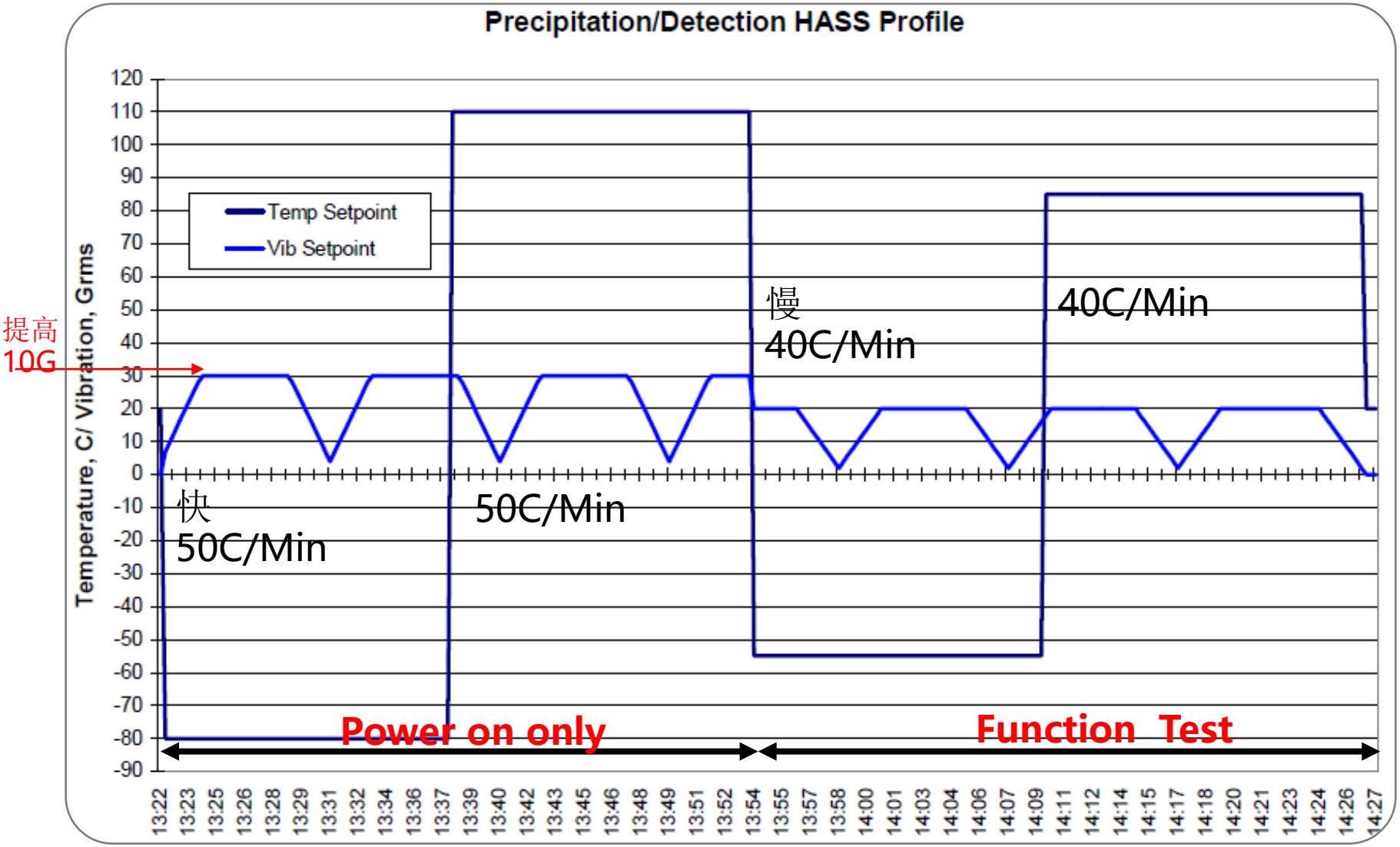

用于UDL与UOL相差比较大（>30%）的产品

Proof of Screen(产线测试条件验证)

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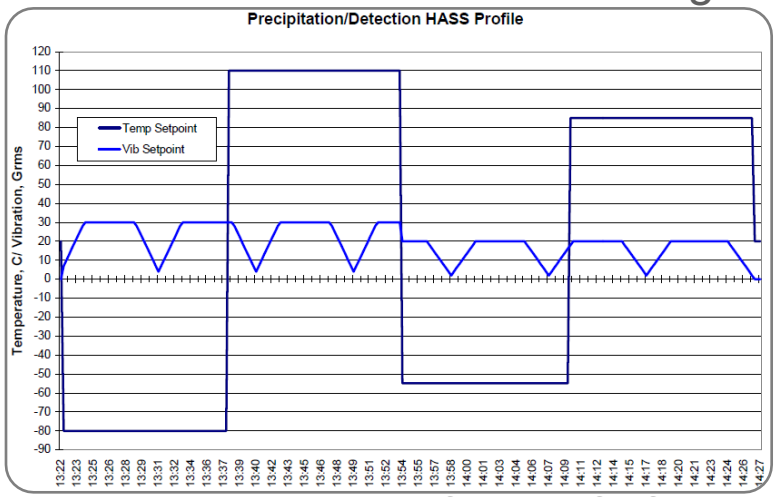
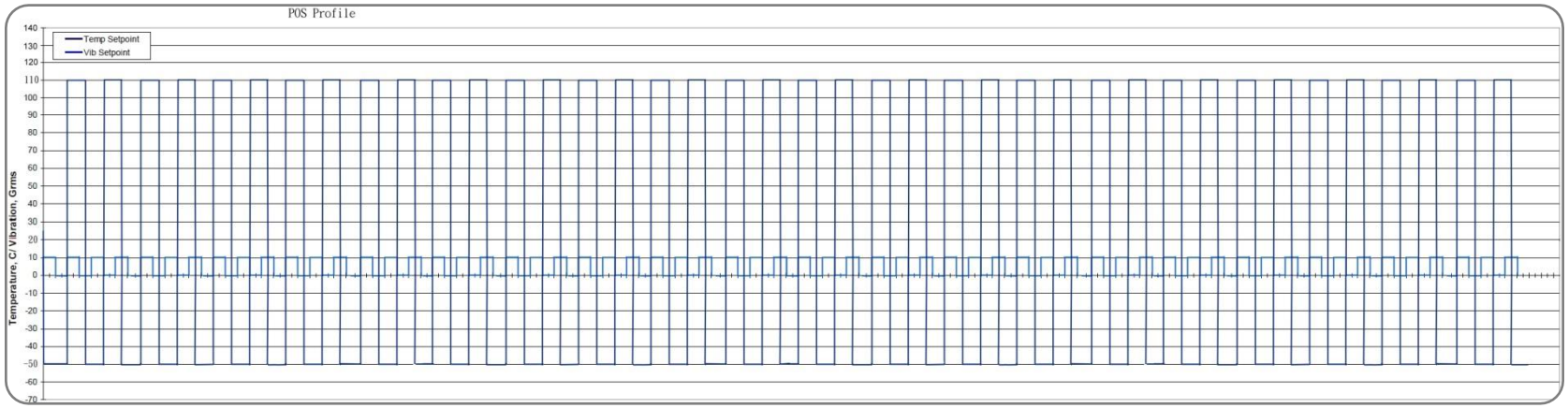
Screen Effectiveness: to determine how effective the screen is in detecting manufacturing flaws.

验证产线测试条件有效性

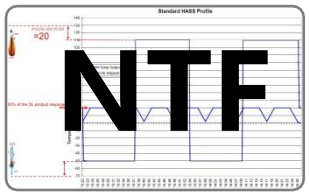


Life Valuation: to prove that the screen has not removed significant life from the screened products.

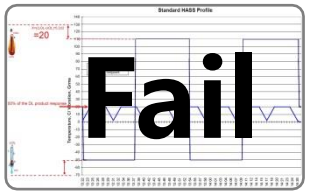
验证产线测试条件最多带走产品寿命10%



Screen Effectiveness(验证产线测试条件有效性) iHALT



→ Poor solder process(空焊模拟)
→ Damaged component(失效组件仿真)
→ Incorrect component(参数或规格错误仿真)



The screen's effectiveness is measured by its ability to precipitate latent defects. To demonstrate this effectiveness, it is necessary to screen products that would be expected to fail in the HASS screen due to latent defects. Units classified as No Trouble Found (NTF) are good for this purpose (ideally, production floor NTF's should be used versus field return NTF's). Other candidate units would be those that are determined to be marginal from parametric functionality testing. . If necessary, known good units can be "seeded" with defects. These defects should be representative of the manufacturing process going out of control. These defects attempt to replicate defects that could occur if there was a problem in the manufacturing or sourcing processes, i.e. poor solder process, damaged or incorrect component insertion, etc. The defects should not be detectable by the production testing that is normally done. They should include marginal but acceptable performance defects, component value errors and any other valid defects that would demonstrate the effectiveness of the screen.

典型的HASS测试故障:

-焊锡品质不良
-插座故障
-零件故障
-IC弯脚
-用错零件
-零件位置不正确
-测试治具/程序不正确
-制程变异

Life Valuation
(验证产线测试条件最多带走产品寿命10%)

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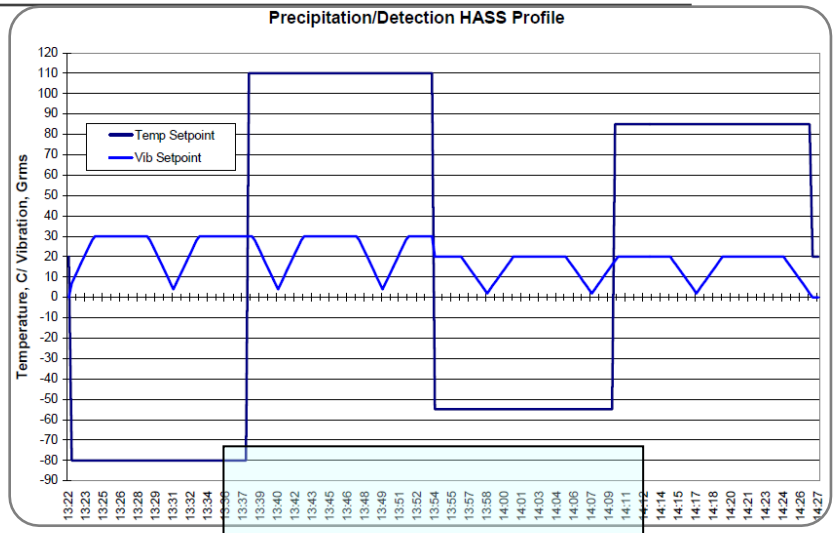
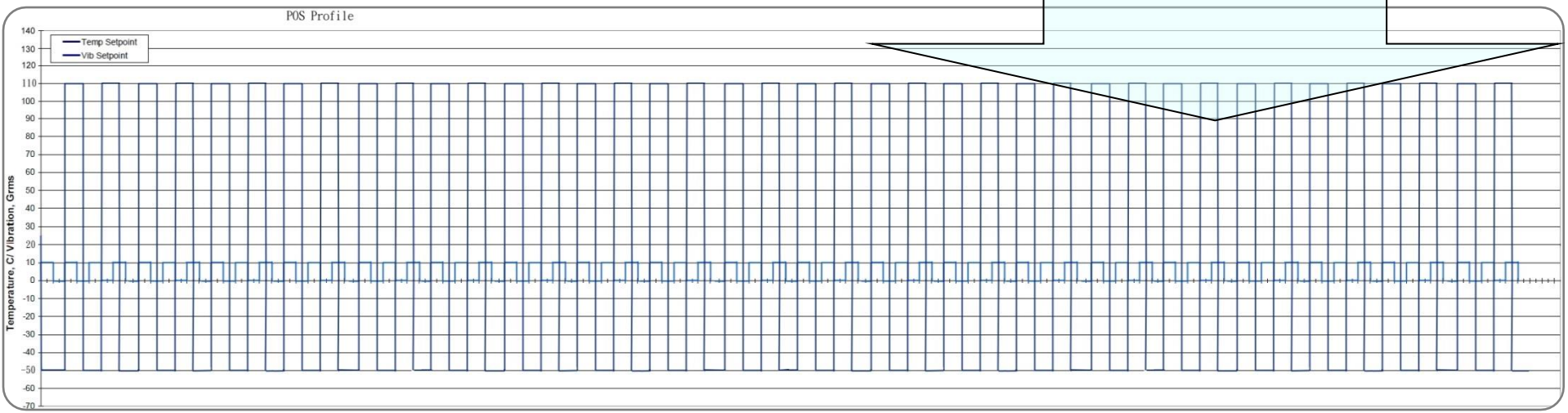
POS Profile:it is recommended that these repeats be in order of 30 to 50 times
建议重复次数为30 ~ 50次（至少20次）
The product should still have 90%, minimum, of the useful life remaining, or 10%, maximum, of life removed after HASS Profile.

For example, for typical HASS 2 cycle, if the fuctional test with failure at 20 Cycle of P.O.S. profile, the life removed after HASS Profile is:(1/20)*100=5% 。一次测试包括两个温度循环





HASS前置评估:

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- 确定生产线需求和产能
- 开始设计和制作夹治具
- 决定适用的应力
- 取得功能性测试和环境设备
- 了解人力资源的需求
- 决定执行HASS测试的产品程度(组件或系统)
- 确定HASS测试的场所(自行内部，委外试验室或协议厂家)
- 对大量的产品，要确定什么时候转移到稽核测试(HASA)阶段并确定它的目标

将profile释放到生产线

• 透过产品的实际生命周期, 定期的检讨筛选的执行效能.

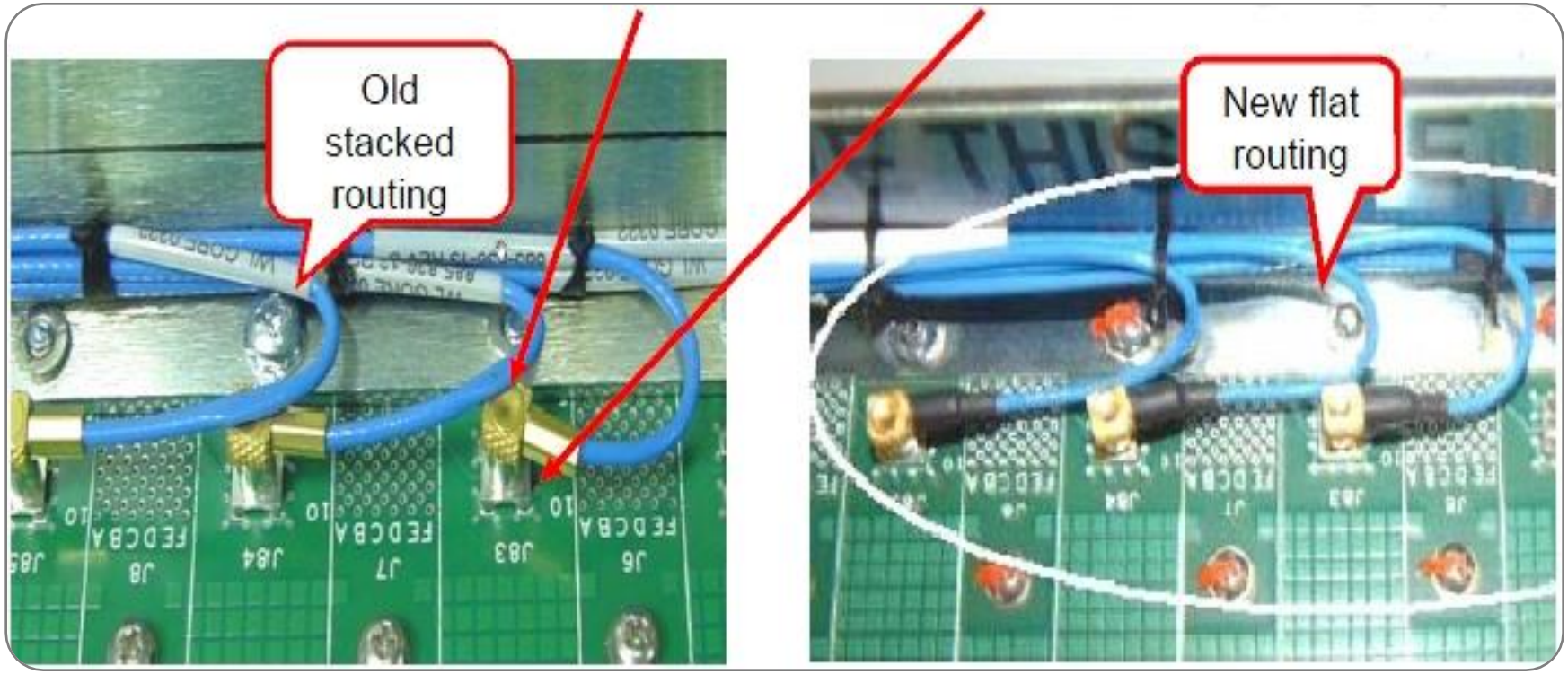
• 透过生产制程所发现的失效情况及市场实际的执行效能, 依所获取的讯息, 视需要来调整筛选曲线.

•定期评估

Screen Effectiveness(产在线找的失效模式案例) iHALT

Problem: Cables are not routed to lay flat, and place strain on circuit board, impacting adjacent boards.

Solution: New routing keeps cables from placing strain on distribution board and avoids gap to backplane.



Screen Effectiveness(在产线找的失效模式案例)

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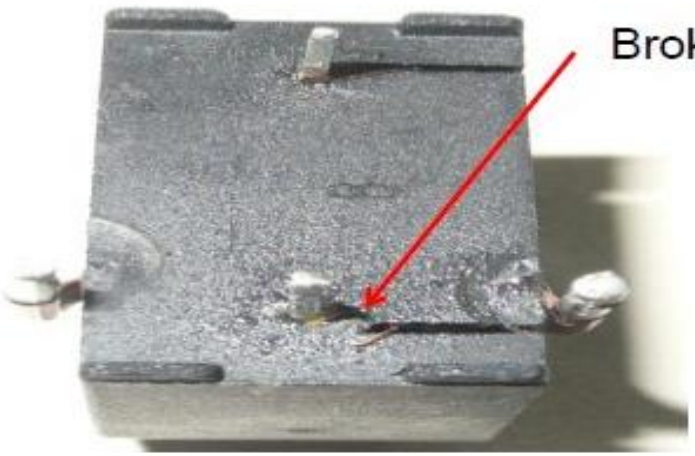
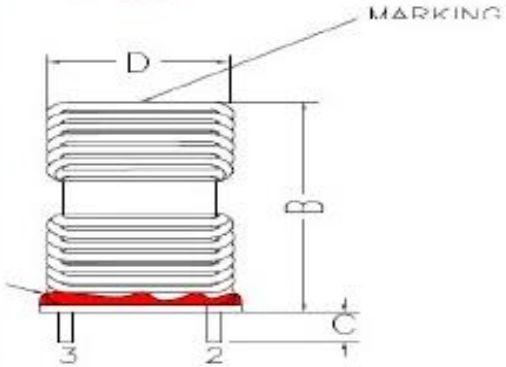
因为元件错误导致的失效，在实际中造成2百万以上的损失



- Pin1 and pin 2 was rectangular, but the PCB layout was round
- Caught in third cycle of HASA profile @33 minutes
- HALT samples had different PCB manufacture

Screen Effectiveness(产在线找的失效模式案例) iHALT

因为元件尺寸超差导致的失效，在测试中发生短路重大故障。



(LAST TWO CODE)

A	B	C	D	d
28.0 MAX	30.0 MAX	3.0±0.5	25.0 MAX	1.0 ±0.1

HASS/HASA前置评估:测试曲线样例

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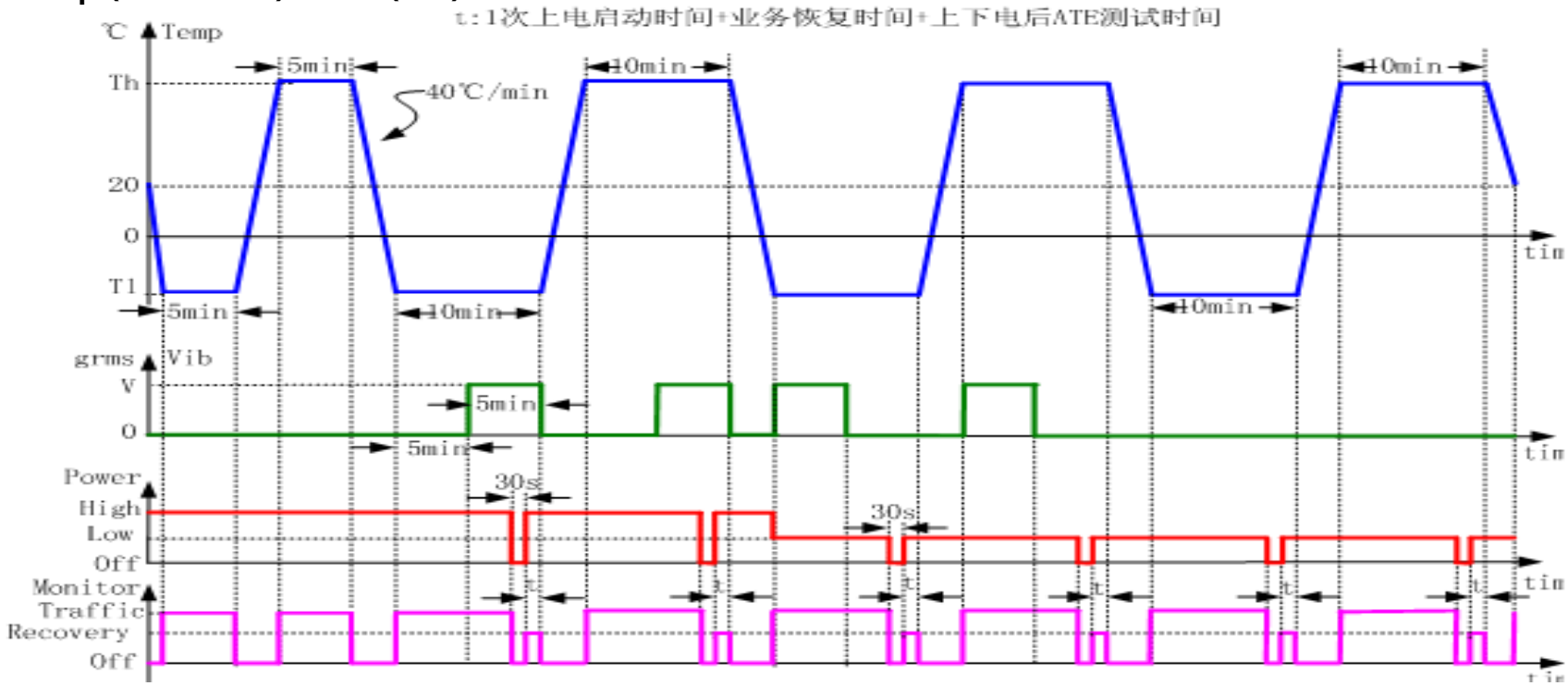
Type	Environment Condition			HALT Result						Pre HALT Thermal Study(℃)			
	Vib(Grms)	Thermal(℃)		Vib(Grms)		Cool(℃)		Heat(℃)		Published		Guard Band(OL)	
		UP	LOW	VOL	VDL	LOL	LDL	UOL	UDL	UP	LOW	UP	LOW
XXX	Little or no vibration	40	0	46	52	-62	-80	92	118	40	0	80	-30
What is mine?	?	?	?	?	?	?	?	?	?	?	?	?	?

Temp(77~-47); Vib(26) What is mine?



XXX CASE：

产品减寿评估：不超过10%

测试效率评估：评估抽样率。

HASA前置评估:

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HASA相较于HASS，最大的区别是测试的数量，HASA是对产品进行按比例抽样测试，而HASS为全检。

- 对于开始大批量生产的产品，考虑测试的性价比时，评估到稽核测试(HASA)并确定它的目标
- 适用的应力(HASS应力一致）
- 评估风险
- 利用统计方法进行抽样确认
- 确认故障接受率
- 定期审核

HASA的好处:

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- 对于大批量生产的测试成本大幅减少。
- 对批量的制程问题可以及早有效的发现。
- 对批量的元器件问题可以及早有效的发现。
- 有效减少测试成本的同时，可以快速常控生产品质。