



BF7264B+ MIPI M-PHY UFS2.1

方案说明

目录

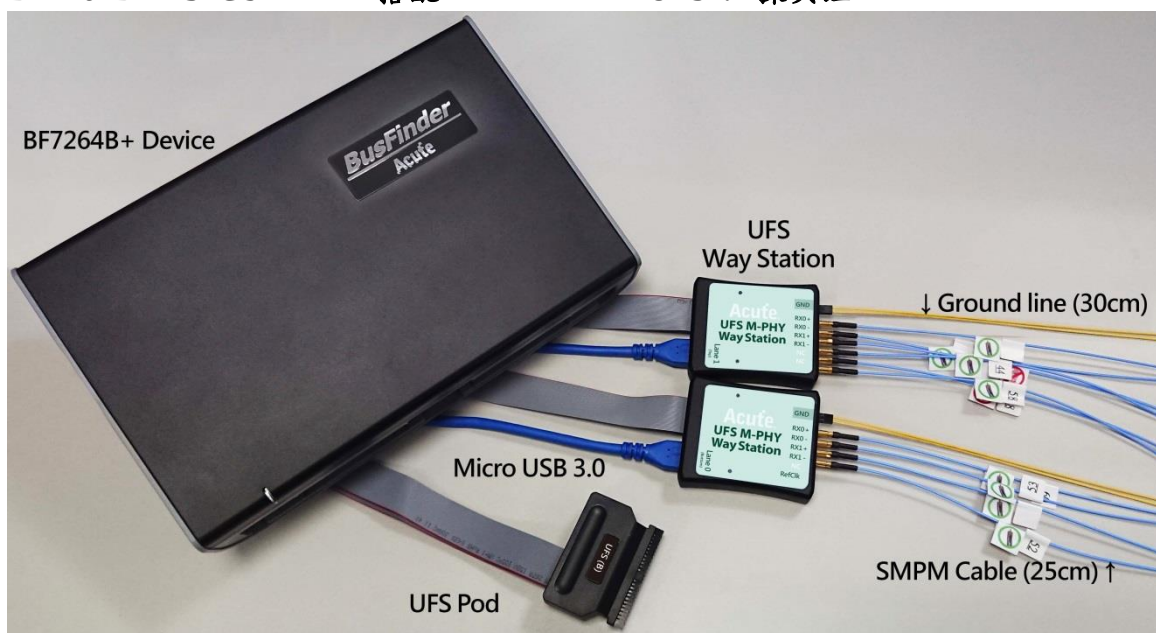
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概况

此方案仅于 BF7264B+ 产品提供 MIPI M-PHY UFS2.1 分析仪功能(可解析 UFS3.1 命令组)。

MIPI M-PHY UFS2.1 方案，规格内容如下：

1. BF7264B+，32Gb RAM，搭配 MIPI M-PHY UFS2.1 探头组



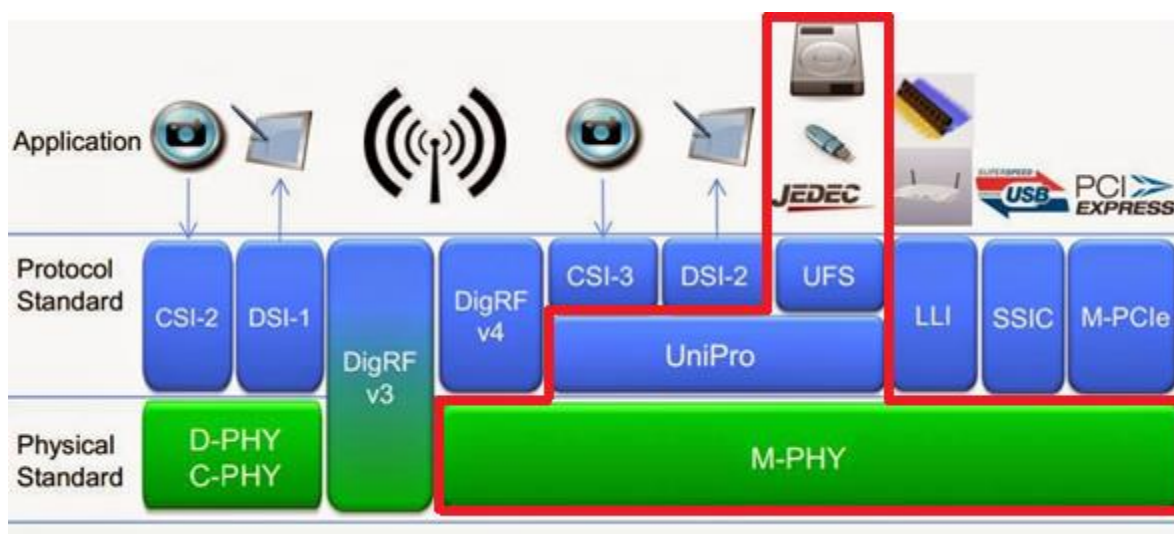
2. 完整支持 MIPI M-PHY UFS2.1 以及支持 UFS3.1 命令组

MIPI M-PHY 3.0, Up to 5.8Gbps (Gear 3, Rate A / B), 2 Lanes

MIPI Unipro 1.8

JEDEC UFS 2.1

JEDEC UFS 3.1 commands



3. 可同时显示 Unipro 及 UFS 协议封包数据以表格方式呈现，包含指令解析

Timing (mm:ss.ms.us) User				Host	Device	Seq. #	Timing (mm:ss.ms.us) User				Host	Device	Seq. #	Detail																																																																																																																																																																																																																
3504	11:29:31.586.787.079	170.1			Start of Burst		227	2.824.603.474	803.56us	QREQ(READ FLAG)				CMD (START STOP UNIT) <table><tr><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td></tr><tr><td colspan="8">Transaction Code</td><td colspan="8">Task Tag</td></tr><tr><td colspan="8">01h 01h 01h 01h 01h 01h 01h 01h</td><td colspan="8">00h 00h 00h 00h 00h 00h 00h 00h</td></tr><tr><td colspan="8">ID</td><td colspan="8">Reserved</td></tr><tr><td colspan="8">00h 00h 00h 00h 00h 00h 00h 00h</td><td colspan="8">00h 00h 00h 00h 00h 00h 00h 00h</td></tr><tr><td colspan="8">EHS Length</td><td colspan="8">Data Segment Length</td></tr><tr><td colspan="8">00h 00h 00h 00h 00h 00h 00h 00h</td><td colspan="8">0000h 0000h 0000h 0000h</td></tr><tr><td colspan="8">Data Transfer Length</td><td colspan="8">Data Transfer Length</td></tr><tr><td colspan="8">00h 00h 00h 00h 00h 00h 00h 00h</td><td colspan="8">00h 00h 00h 00h 00h 00h 00h 00h</td></tr><tr><td colspan="8">OPERATION CODE</td><td colspan="8">CONDITION</td></tr><tr><td colspan="8">16h 00h 00h 00h 00h 00h 00h 00h</td><td colspan="8">X00h 00h 00h 00h 00h 00h 00h 00h</td></tr><tr><td colspan="8">R CONDITION</td><td colspan="8">CONTROL</td></tr><tr><td colspan="8">20h 1h 01h 01h 01h 01h 01h 01h</td><td colspan="8">00h 00h 00h 00h 00h 00h 00h 00h</td></tr></table> <pre>1 [6]R Flag Bit= 0 2 [5]W Flag Bit= 0 3 [2]CP= 0 4 [1:0]AITR= Simple (0h) 5 [7:0]LUN= 208 6 [7:0]Task Tag= 18h 7 [7:4]ID= 0 8 [3:0]Command Set Type= SCSI Command Set (SPC, SBC) (0h) 9 [7:0]EHS Length= 00h 10 [15:0]Data Segment Length= 0000h 11 [31:0]Expected Data Transfer Length= 00000000h 12 [7:0]OPERATION CODE= START STOP UNIT (16h) 13 [0]IMMED= 0h 14 [3:0]POWER CONDITION MODIFIER= 0h 15 [3:0]POWER CONDITION MODIFIER= 0h 16 [7:4]POWER CONDITION= 1h 17 [2]NO_FLUSH= 0h 18 [1]L0E= 0h 19 [0]START= 0h 20 [7:0]CONTROL= 00h 21</pre>	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	Transaction Code								Task Tag								01h 01h 01h 01h 01h 01h 01h 01h								00h 00h 00h 00h 00h 00h 00h 00h								ID								Reserved								00h 00h 00h 00h 00h 00h 00h 00h								00h 00h 00h 00h 00h 00h 00h 00h								EHS Length								Data Segment Length								00h 00h 00h 00h 00h 00h 00h 00h								0000h 0000h 0000h 0000h								Data Transfer Length								Data Transfer Length								00h 00h 00h 00h 00h 00h 00h 00h								00h 00h 00h 00h 00h 00h 00h 00h								OPERATION CODE								CONDITION								16h 00h 00h 00h 00h 00h 00h 00h								X00h 00h 00h 00h 00h 00h 00h 00h								R CONDITION								CONTROL								20h 1h 01h 01h 01h 01h 01h 01h								00h 00h 00h 00h 00h 00h 00h 00h							
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3505	11:29:31.586.787.079	170.1			Start of Burst		228	2.824.803.614	200.13us	QRESP(READ FLAG)	(Su...																																																																																																																																																																																																																			
3506	11:29:31.586.787.086	6.66ns			Filler(2x)	06	229	2.825.610.440	806.82us	QREQ(READ FLAG)																																																																																																																																																																																																																				
3507	11:29:31.586.789.598	5.78us			Filler(2x)		230	2.825.816.500	206.05us	QRESP(READ FLAG)	(Su...																																																																																																																																																																																																																			
3508	11:29:31.586.804.347	5.74us			AFC TCO CReq=0	06	231	2.826.617.393	800.89us	QREQ(READ FLAG)																																																																																																																																																																																																																				
3509	11:29:31.586.810.097	5.74us			Filler(2x)		232	2.826.817.846	200.45us	QRESP(READ FLAG)	(Su...																																																																																																																																																																																																																			
3510	11:29:31.586.815.833	5.73us			AFC TCO CReq=0	06	233	2.827.624.342	806.49us	QREQ(READ FLAG)																																																																																																																																																																																																																				
3511	11:29:31.586.821.609	5.77us			Filler(2x)		234	2.827.830.785	206.44us	QRESP(READ FLAG)	(Su...																																																																																																																																																																																																																			
3512	11:29:31.586.827.318	5.70us			Data Frame TCO		235	2.828.631.308	800.52us	QREQ(READ FLAG)																																																																																																																																																																																																																				
3513	11:29:31.586.879.120	51.80...			EOF EVEN	17	236	2.828.832.105	200.79us	QRESP(READ FLAG)	(Su...																																																																																																																																																																																																																			
3514	11:29:31.586.884.876	5.75us			End of Burst		237	2.829.638.301	806.19us	QREQ(READ FLAG)																																																																																																																																																																																																																				
3515	11:29:31.586.884.883	6.66ns			Filler(2x)		238	2.829.845.100	206.79us	QRESP(READ FLAG)	(Su...																																																																																																																																																																																																																			
3516	11:29:31.586.998.931	114.0...			PREPARE		239	2.830.645.253	800.15us	QREQ(READ FLAG)																																																																																																																																																																																																																				
3517	11:29:31.587.027.862	28.93...			Start of Burst		240	2.830.846.393	201.13us	QRESP(READ FLAG)	(Su...																																																																																																																																																																																																																			
3518	11:29:31.587.027.868	6.66ns			Filler(4x)		241	2.831.652.216	805.82us	QREQ(READ FLAG)																																																																																																																																																																																																																				
3519	11:29:31.587.032.528	4.65us			AFC TCO CReq=0	17	242	2.831.859.332	207.11us	QRESP(READ FLAG)	(Su...																																																																																																																																																																																																																			
3520	11:29:31.587.041.770	9.24us			Data Frame TCO		243	2.832.659.235	799.90us	CMD (TEST UNIT READY)		D																																																																																																																																																																																																																		
3521	11:29:31.587.051.283	9.51us			STALL		244	2.832.860.692	201.45us	RESPONSE		D																																																																																																																																																																																																																		
3522	11:29:31.587.106.624	55.34...			EOF EVEN	07	245	2.833.240.377	379.68us	QREQ(READ DESCRIPTOR)																																																																																																																																																																																																																				
3523	11:29:31.587.111.270	4.64us			Data Frame TCO		246	2.833.450.076	209.69us	QRESP(READ DESCRIPTO...																																																																																																																																																																																																																				
3524	11:29:31.587.152.959	41.68...			EOF EVEN	08	247	2.833.827.315	377.23us	CMD (REQUEST SENSE)		D																																																																																																																																																																																																																		
3525	11:29:31.587.157.592	4.63us			Filler(4x)		248	2.834.041.770	214.45us	REQUEST_SENSE_RESPON...		D																																																																																																																																																																																																																		
3526	11:29:31.587.175.584	17.99...			PREPARE		249	2.834.111.270	69.49us	RESPONSE		D																																																																																																																																																																																																																		
3527	11:29:31.587.208.560	32.97...			End of Burst		250	2.834.428.705	317.43us	CMD (START STOP UNIT)		D																																																																																																																																																																																																																		
3528	11:29:31.587.208.567	6.66ns			Filler(2x)		251	2.834.645.047	216.34us	RESPONSE		D																																																																																																																																																																																																																		
3529	11:29:31.587.244.577	36.00...			STALL		252	2.835.441.380	796.33us	CMD (INQUIRY)		D																																																																																																																																																																																																																		
3530	11:29:31.587.371.111	126.5...			Start of Burst		253	2.835.647.220	205.83us	INQUIRY_RESPONSE		D																																																																																																																																																																																																																		
3531	11:29:31.587.371.117	6.66ns			Filler(2x)		254	2.835.744.483	97.26us	RESPONSE		D																																																																																																																																																																																																																		
3532	11:29:31.587.376.897	5.77us			AFC TCO CReq=0	07	255	2.836.062.902	318.41us	QREQ(READ DESCRIPTOR)																																																																																																																																																																																																																				
3533	11:29:31.587.382.630	5.73us			Filler(2x)		256	2.836.276.064	213.16us	QRESP(READ DESCRIPTO...																																																																																																																																																																																																																				
3534	11:29:31.587.388.379	5.74us			AFC TCO CReq=0	07	257	2.836.810.970	534.90us	QREQ(READ ATTRIBUTE)																																																																																																																																																																																																																				
3535	11:29:31.587.394.142	5.76us			Filler(2x)		258	2.837.023.105	212.13us	QRESP(READ ATTRIBUTE...																																																																																																																																																																																																																				
3536	11:29:31.587.399.918	5.77us			AFC TCO CReq=0	07	259	2.837.829.438	806.33us	QREQ(READ ATTRIBUTE)																																																																																																																																																																																																																				
3537	11:29:31.587.405.654	5.73us			Filler(2x)		260	2.838.034.361	204.92us	QRESP(READ ATTRIBUTE...																																																																																																																																																																																																																				
3538	11:29:31.587.411.403	5.74us			AFC TCO CReq=0	08	261	2.838.836.431	802.06us	QREQ(READ DESCRIPTOR)																																																																																																																																																																																																																				
3539	11:29:31.587.417.166	5.76us			Filler(2x)		262	2.839.039.024	201.59us	QRESP(READ DESCRIPTO...																																																																																																																																																																																																																				
3540	11:29:31.587.422.942	5.77us			AFC TCO CReq=0	08	263	2.839.466.686	448.66us	CMD (TEST UNIT READY)		D																																																																																																																																																																																																																		
3541	11:29:31.587.428.705	5.76us			Data Frame TCO		264	2.839.694.728	208.04us	RESPONSE		D																																																																																																																																																																																																																		
3542	11:29:31.587.480.510	51.80...			EOF EVEN	18	265	2.841.782.943	2.08ms	CMD (REQUEST SENSE)		D																																																																																																																																																																																																																		
3543	11:29:31.587.486.266	5.75us			Filler(2x)		266	2.841.788.047	5.10us	REQUEST_SENSE_RESPON...		D																																																																																																																																																																																																																		
3544	11:29:31.587.492.002	5.73us			End of Burst		267	2.841.788.767	719.92ms	RESPONSE		D																																																																																																																																																																																																																		
3545	11:29:31.587.492.009	6.66ns			Filler(2x)		268	2.841.823.555	34.78us	QREQ(READ DESCRIPTOR)																																																																																																																																																																																																																				
3546	11:29:31.587.603.491	111.4...			PREPARE		269	2.841.829.351	5.79us	QRESP(READ DESCRIPTO...																																																																																																																																																																																																																				

Unipro

UFS

Detail

4. 使用 32Gb RAM 搭配硬盘串流来储存 Unipro, UFS 通讯数据，可完整节录待测物从 PWM Mode 初始化到 High Speed Mode 的流程
5. 提供 Data Filter 功能，可将不必要的数据滤除以节省内存
6. 提供 Search 数据功能
7. 提供 CRC Packet 计算及错误显示
8. Unipro, UFS 命令统计功能，包含封包总数、各类别指令数量以及错误数量统计

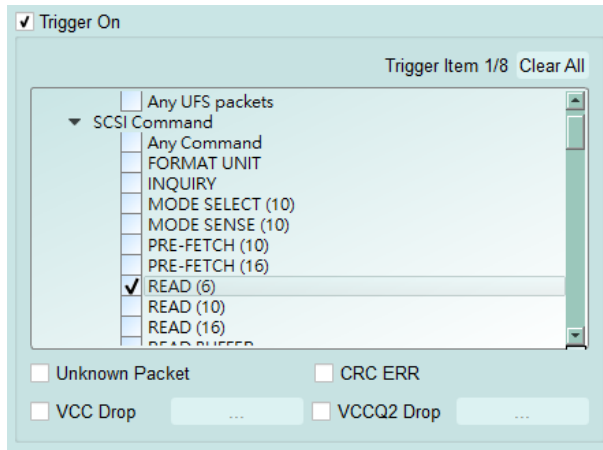
Unipro			UFS		
Navigator			Navigator		
Discription	Txns	Bytes	Discription	Txns	Bytes
▼ Unipro			▼ UFS		
▼ L2	83257		SCSI Command	148	
SOF	8318		UFS Protocol	655	
AFC TC0	66591		QUERY REQUEST	34	
AFC TC1	8		QUERY RESPONSE	34	
NAC	0		TASK MANAGEMENT	0	
COF TC0	22		LUN	799	
EOF EVEN	8318		TRANSFER LENGTH	129	
EOF ODD	0		RESERVED		
▶ L1.5	1252				
▼ L1	310				
HIBERN8	2				
STALL	135				
SLEEP	19				
LINE RESET	0				
LINE CONFIG	0				
PREPARE	154				
▶ Error Packets	13				
Statistics			Statistics		
	Txns	Bytes		Txns	Bytes
▼ AFC TC0	66591		NOP OUT	2	
Host	66311		NOP IN	2	
Device	280		RESPONSE	147	
			READ(10) DATA(DATA IN)	496	
			REQUEST SENSE RESPONSE DATA(DATA IN)	7	
			INQUIRY RESPONSE DATA(DATA IN)	1	

Unipro

UFS

9. Unipro, UFS 命令触发功能

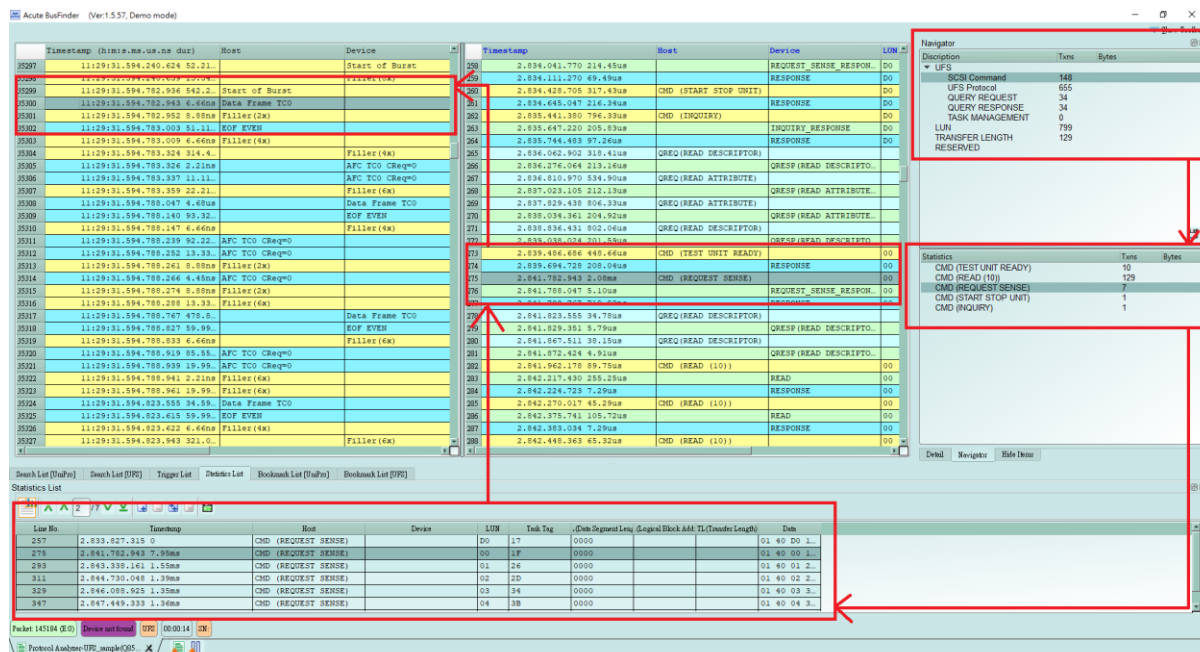
- 触发参数包含命令与参数资料可依据不同种类封包填入数值,
- 涵盖所有 Unipro, UFS Packet,
- 可触发 CRC Error, Unknown packet
- 可触发 VCC drop, VCCQ2 drop
- 可透过 Trigger-Out 接孔同步触发外部的示波器



READ (6)

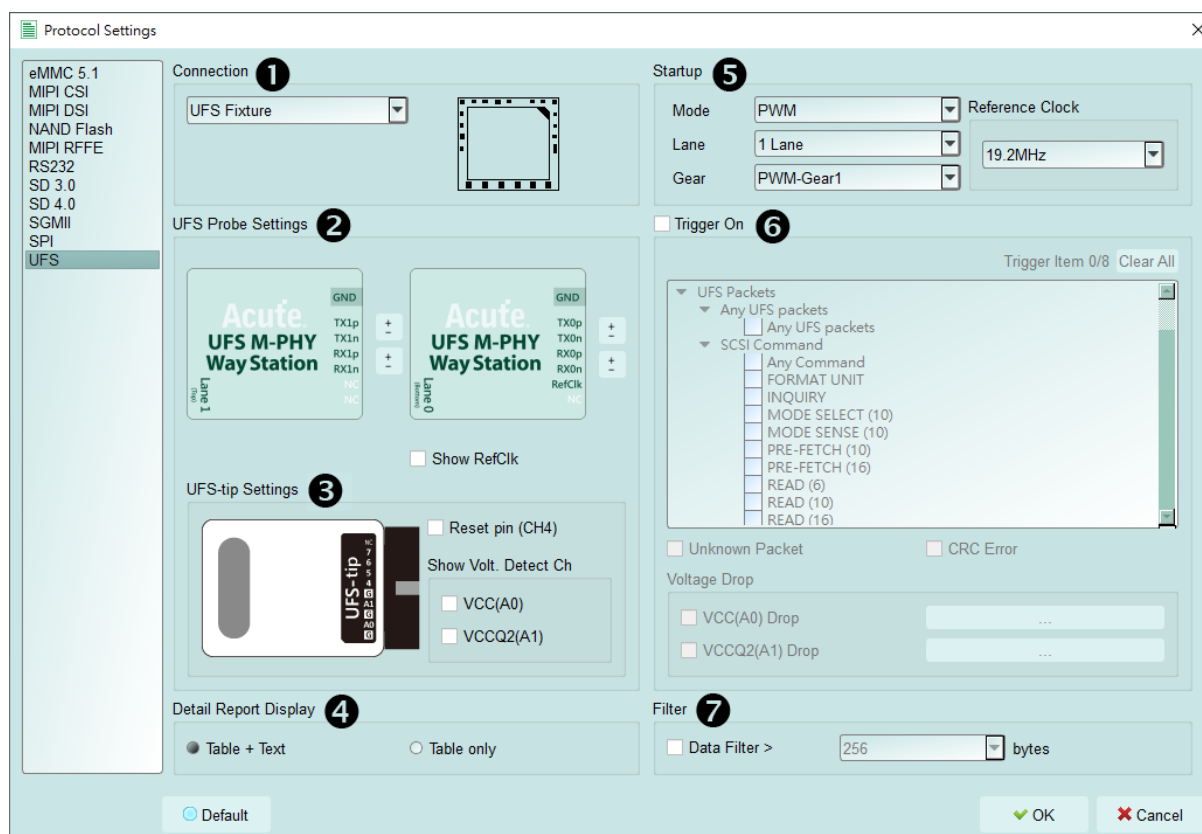
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0										
Transaction Code								Reserved								R Flag Bit		W Flag Bit		Reserved		CP		ATTR	
01h								X								X		X		Xh		X		Xh	
LUN								Task Tag																	
XXh								XXh																	
IID				Command Set Type				Reserved																	
Xh				Xh				XXh																	
Reserved								XXXXh																	
EHS Length								Reserved																	
XXh								XXh																	
Data Segment Length																									
XXXXh																									
Expected Data Transfer Length																									
XXXXh																									
Expected Data Transfer Length																									
XXXXh																									
OPERATION CODE								Reserved				LOGICAL BLOCK ADDRESS													
08h								Xh				XXh													
LOGICAL BLOCK ADDRESS																									
XXXXh																									
TRANSFER LENGTH								CONTROL																	
XXh								XXh																	
Reserved																									
XXXXh																									
Reserved																									
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Reserved																									
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Reserved																									
XXXXh																									

Default OK Cancel



从UFS的统计数据追寻至Unipro原始数据的过程

11. UFS Settings



1. **Connection:** 需选择 BF7264B+ 与待测物的连接方式
2. **UFS Probe Settings:** 可交换同一 Lane 之 p / n; 可选择是否要显示 RefClk 量测数据
3. **UFS-tip Settings:**
 - a. 可开启 UFS Reset pin 之判断, 需接上 reset pin 于 UFS probe 之 LA tip CH4 位置. 当协议分析收到 Reset 信号时, 就会重置 Power mode 回到 PWM mode.
 - b. 打开电压侦测之后, 当电压有变化时会显示所侦测到的电压值
4. **Detail Report Display:** 可选择是否需要文字描述的解析方式
5. **Startup:** 需设定于撷取当下, 待测物所运行之模式; 必须设定 Reference Clock, 可选择 19.2 / 26 / 38.4 / 52 MHz 选项 (无论 RefClk 信号是否有接上, 此数值都必须正确设定, 不然信号分析可能会出现错误)
6. **Trigger On:** 可设定 Unipro/UFS packets, 共 8 组, 以及 Unknown Packet, CRC Error 触发选项, 另加入两组电压侦测可使用
7. **Filter:** 开启后将会滤除大于设定值之封包后方数据

FAQ

1. 支持 UFS 第几版的规格，是否有 Differential 对数或 port 数限制呢？

A：MIPI M-PHY 3.0, Up to 5.8Gbps (Gear 3, Rate A / B), 2 Lanes

MIPI Unipro 1.8

JEDEC UFS 2.1

JEDEC UFS 3.1 commands

2. 量测时是否会影响讯号质量？

A：外接的仪器量测必然会有部分的负载效应影响，我们采用 SMPM Coaxial Cable 的连接方式来降低对待测物干扰并提升讯号质量。

3. 是否有支持讯号发送 (Tx) 功能？

A：不支持讯号发送功能

4. 量测时须注意的事项

a. 接线问题判断与排除方法：

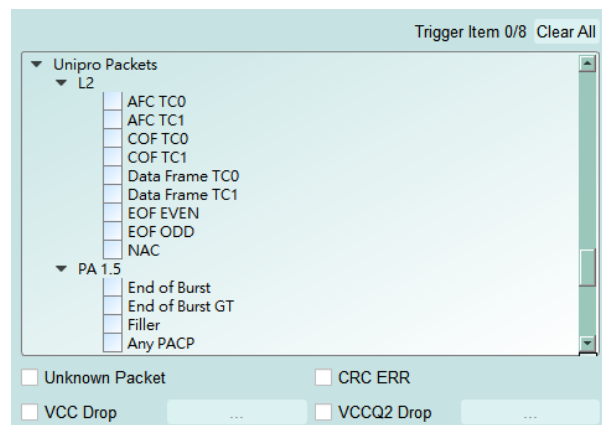
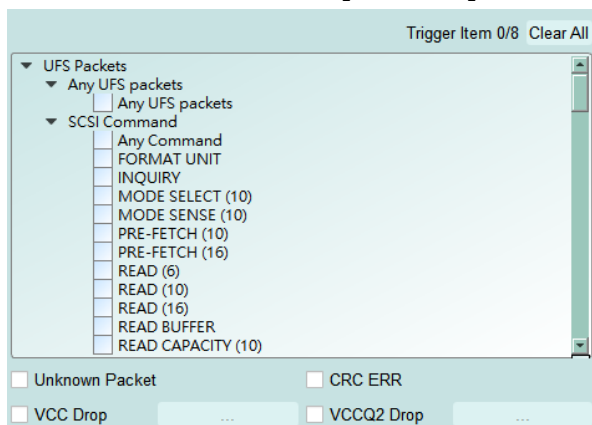
请确实按手册探头与待测物连接方式进行连接。若量测起来 PWM 正常，但无法看到任何 HS data 或只能上 1 Lane 而无法上 2 Lane 时，就应先检查接线是否有错误。

b. Reference clock 设定方式：

在 Settings 有提供 Ref Clk 19.2MHz(default) / 26MHz / 38.4MHz / 52MHz 四个选项。若不清楚所使用的 Ref clk 为何时，可按下列方式做判断。若 PWM 正常，但 HS Data 都是错误的，请尝试调整 Ref Clk 为其他速率再抓一次。

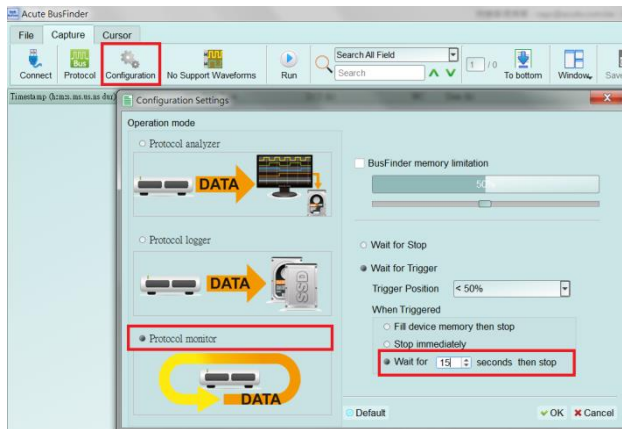
5. 有指定某个 Unipro, UFS packet 做为 trigger 点的功能吗？

A：可以指定特定的 Unipro, UFS packet 或是 Error 进行触发。



6. 是否可以自行设定一个 Unipro, UFS 起始点，指定抓取多少时间内的 Data?

A :可以将起始条件设定在触发项目后，到工作模式选单内调整为数据监控仪模式，并指定撷取时间长度。



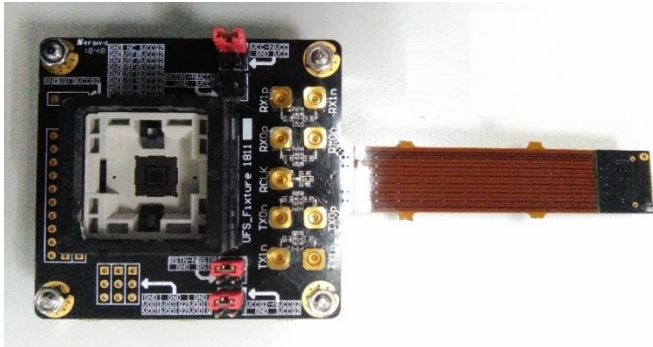
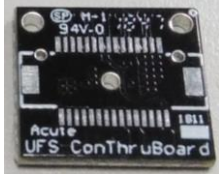
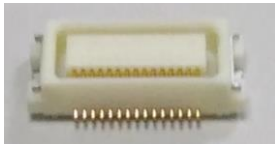
探头与待测物连接方式

a. 使用 UFS Fixture (连接器)方式连接

使用时机：

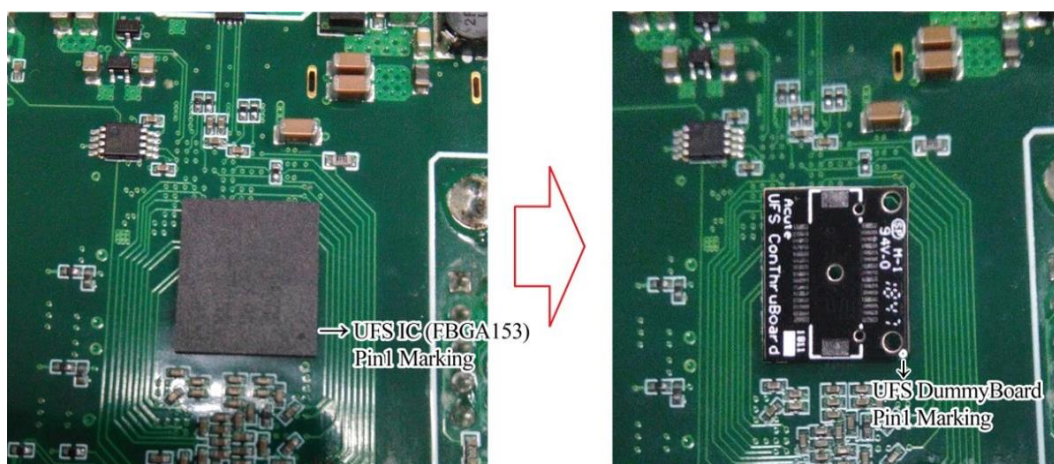
若 Host 有多套时可用连接器的方式，方便更换 Host 与 UFS Chip，以及不需要跳线直接使用 SMPM Cable 连接 Way Station。

由于连接器使用软扁平电缆延伸讯号，只适合应用于 UFS Chip 周边组件不干涉的情况。

零件列表	
1. 连接器主板(Con Fixture)	
2. 连接器小板(Con Dummy Board)	 背面需植 0.3mm 锡球
3. 连接器 DF17-30DS-0.5V (HiRose Connector)	

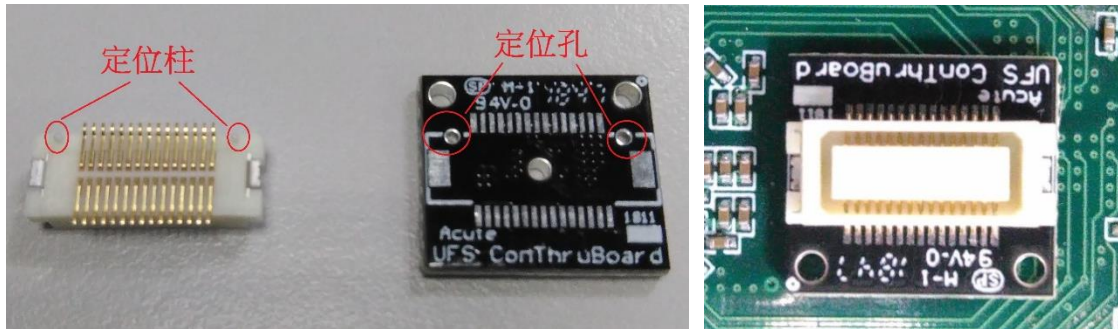
Step1: 将待测物上的 UFS Chip 拔起，拔起来的 UFS Chip 需重新植锡球。

Step2: 将连接器小板，焊在已拆下 UFS Chip 位置。



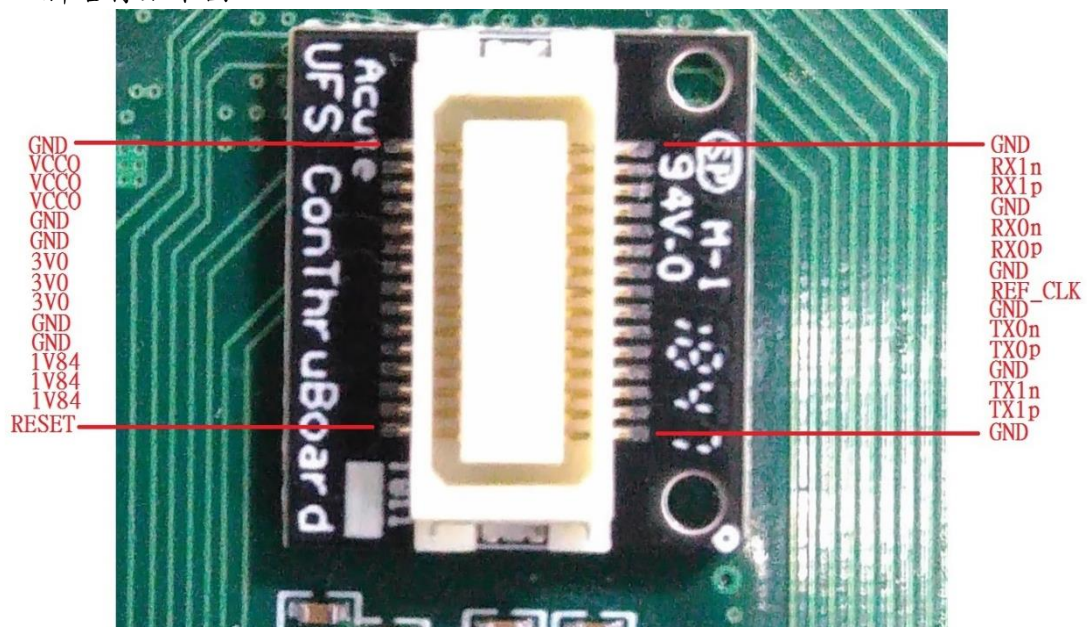
焊接连接器小板时请注意 Pin1 方向

Step3: 将连接器(DF17-30DS-0.5V)放在连接器小板上，在焊接之前请先注意连接器背后定位柱方向与小板定位孔位置

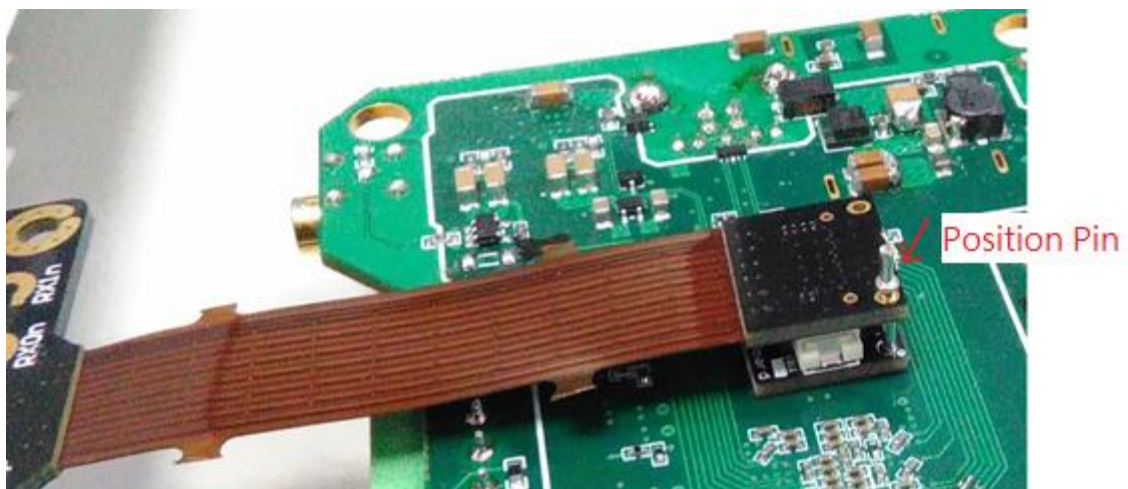


Step4: 连接器放置小板确认完成开始焊接，焊接完成后确认 pin 脚之间有无短路。

Pin 脚名称如下图



Step5: 连接主板，连接前请先注意主板连接器上定位针与小板定位孔位置

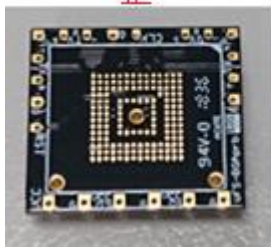
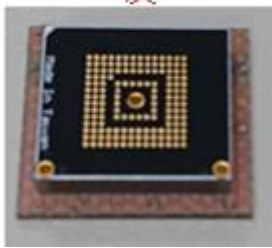
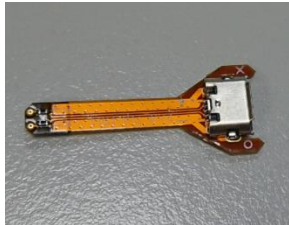
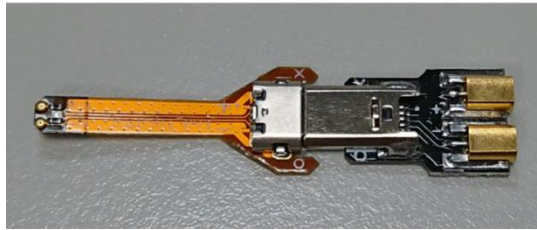
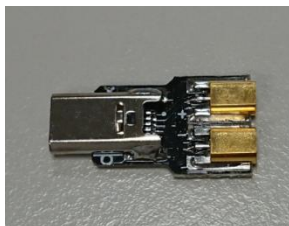


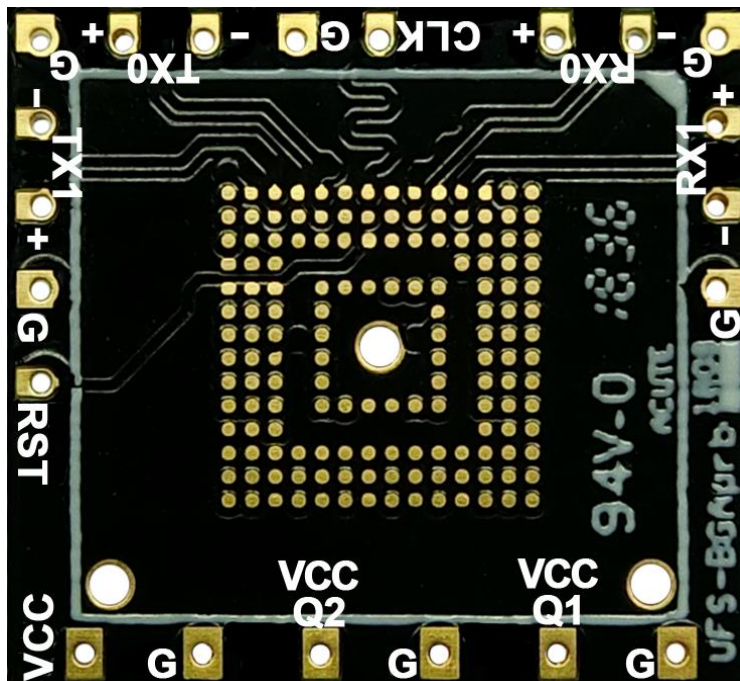
Step6: 将拔起来的 UFS Chip 放进连接器主板 UFS Socket (FBGA153 Socket) ,完成。

b. 使用增高板搭配 End-tip 方式连接

使用时机：

若原 UFS Chip 周边组件干涉，无法使用 UFS Fixture 时以及 UFS Chip 周边没有测试点(Test point)可进行跳线时，就需拔除原 UFS Chip，以增高板垫高之后再从测试点接上 End-tip 后再使用 SMPM Cable 连接 Way Station。

零件列表		
增高板	 	
End-tip 软板		組合完成 
End-tip 软板连接器		



增高板脚位图

c. 使用 End-tip 方式连接

使用时机：

若待测板已留有测试点(Test point)可进行跳线时，可直接使用 End-tip 接上测试，就不需使用增高板。

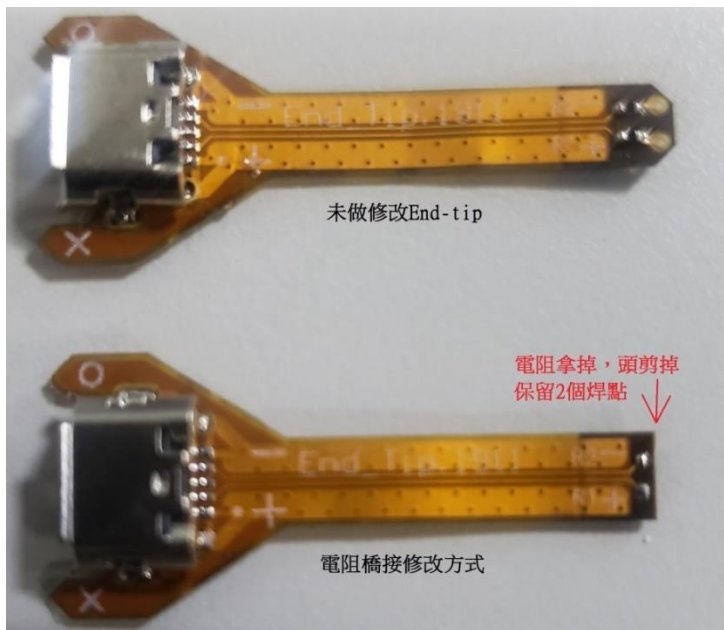
UFS 标配的 End-tip 软板上面的电阻为 250ohm，一般的情况下可直接使用。

若希望缩短跳线距离以提升讯号质量，可按照下列方式以电阻桥接的方式处理即可。

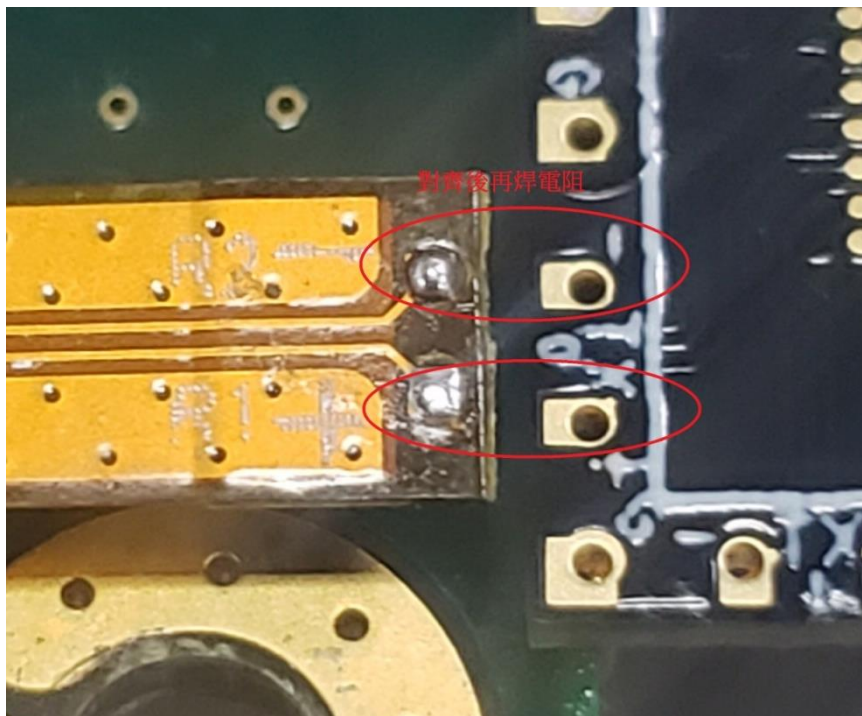
若要不跳线利用电阻桥接方式(如下图)，End-tip 就要做修改。

修改流程：

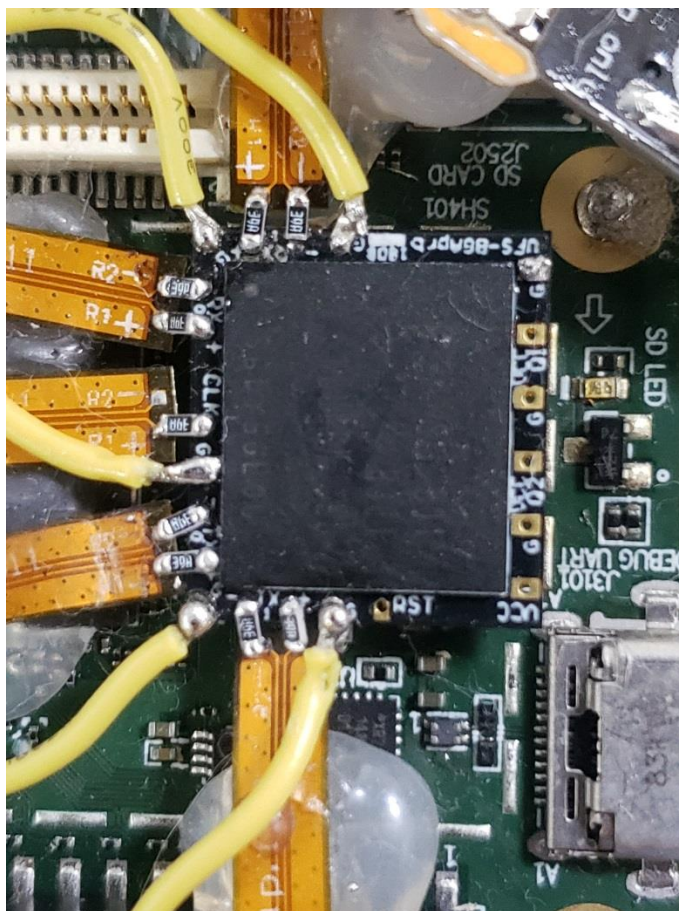
Step1: 电阻拿掉，头剪掉，保留 2 个焊点。

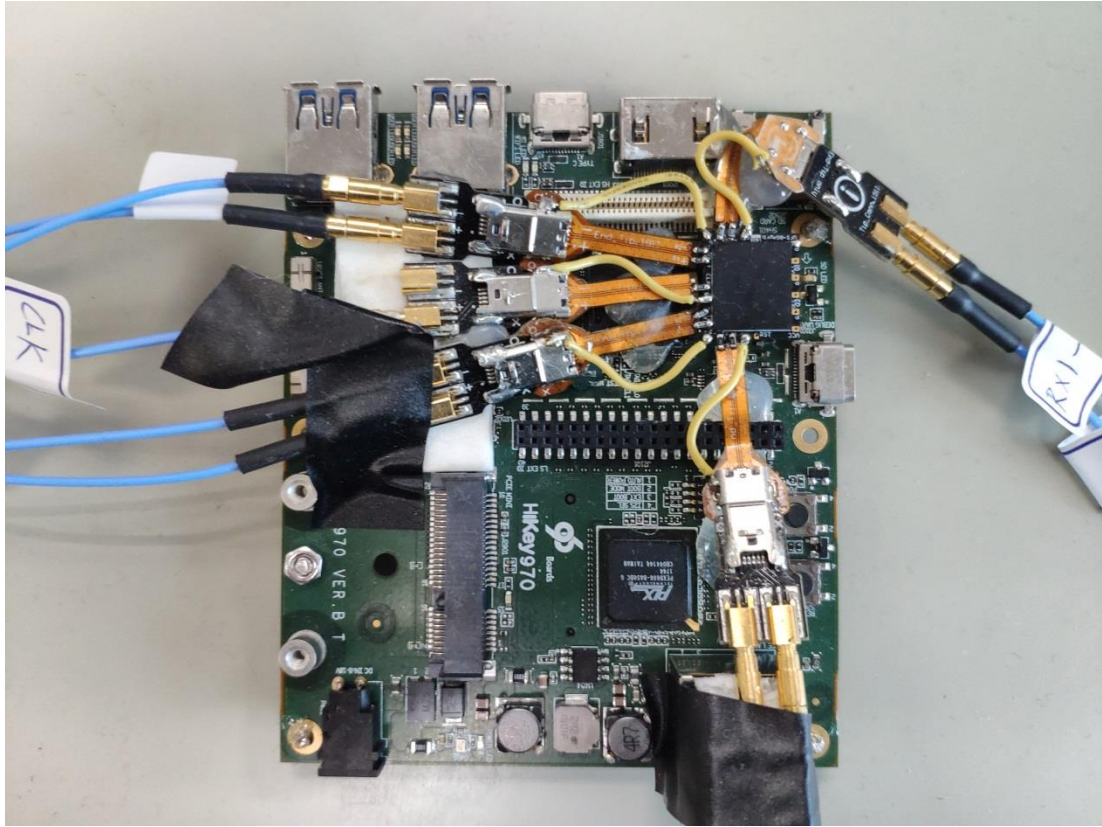


Step2: 改完后 End-tip 上面的 P/N 焊点与增高板的 P/N 焊点对齐，对齐后再将电阻 250ohm 焊上去，4 组 data +1 条 clk 焊完后再焊接地线。



完成示意图 此种方式因距离最短使得讯号质量会比 End-tip 跳线连接的方式来的好。





Way Station 连接

1. UFS Probe 请安装于 BusFinder 7264B+ 的 Slot B 插槽
2. Way Station 转接盒各有一个 USB Type B 插孔，请使用对应之 USB Cable 安装于主机正面插孔。安装时，请按照 Way Station 铭板标示之 Top/Botom 安装即可。

