



**BF7264B+ eMMC5.1**  
**方案說明**

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## 概況

此方案僅於 BF6264B, BF7264B 以及 BF7264B+ 產品適用。

eMMC 5.1 方案，規格內容如下：

### 1. BF7264B+，32Gb RAM，搭配 eMMC 5.1 探棒組



### 2. 支援 eMMC 5.1

Up to eMMC 5.1 HS400

Standard*	Introduced	Sequential Read (MB/s)	Sequential Write (MB/s)	Random Read (IO/s)	Random Write (IOPS)
eMMC 5.1	2015	250	125	11,000	13,000
eMMC 5.0	2013	250	90	7,000	13,000
eMMC 4.5	2012	140	50	7,000	2,000

### 3. 可顯示 eMMC 協定封包資料以表格方式呈現，包含指令解析

Timestamp (Unix time in ns)	Event	Data	Information	Current state	Error average	Bus	Clock	CMD Duration	Data Duration	詳細
34821	15:04:40.513.388.768 1	CMD06 SWITCH	46 03 B9 03 01 11			20.8264 M	Hrc: 2002	2.25977us		<pre> CMD06 SWITCH (25:24) Access= Write Bits(3) (23:16) Index= H5_TIMING(165) (10:12) Selected Driver Strength(0) (11:0) Timing Interface= HS400(3) (2:0) Cmd Set= 1  [CR07] = 08h (8b:11h)  [Raw Data] 0 1 2 3 4 5 6 7 ASCII 0h 46 03 B9 03 01 11 F....                     </pre>
34822	15:04:40.513.391.651 2	Resp06 Rib	06 00 00 08 00 CB	Tran			Hrc: 12	2.25977us		
34823	15:04:40.513.391.988 3	Busy start								
34824	15:04:40.513.694.467 3	Busy end								
34825	15:04:40.513.806.553 1	CMD13 SEND_STATUS	4D 00 01 00 00 53			20.8264 M	Hrc: 8593	2.25644us		
34826	15:04:40.513.810.349 3	Resp13 Rl	0D 00 00 09 00 3F	Tran			Hrc: 32	2.28644us		
34827	15:04:40.533.313.985 1	CMD06 SWITCH	46 03 A1 01 01 53			165.534 M	Hrc: Over	283.305ns		
34828	15:04:40.533.314.469 4	Resp06 Rib	06 00 00 08 00 CB	Tran			Hrc: 33	279.972ns		
34829	15:04:40.533.314.509 3	Busy start								
34830	15:04:40.534.239.393 3	Busy end								
34831	15:04:40.534.306.219 6	CMD13 SEND_STATUS	4D 00 01 00 00 53			165.534 M	Hrc: Over	279.972ns		
34832	15:04:40.534.306.693 4	Resp13 Rl	0D 00 00 09 00 3F	Tran			Hrc: 32	283.305ns		
34833	15:04:40.534.451.945 1	CMD06 SWITCH	46 03 21 01 01 D9			165.534 M	Hrc: 2390	279.972ns		
34834	15:04:40.534.452.325 4	Resp06 Rib	06 00 00 08 00 CB	Tran			Hrc: 33	279.972ns		
34835	15:04:40.534.452.345 3	Busy start								
34836	15:04:40.534.469.590 1	Busy end								
34837	15:04:40.534.571.813 1	CMD13 SEND_STATUS	4D 00 01 00 00 53			165.438 M	Hrc: 2007	283.305ns		
34838	15:04:40.534.572.284 4	Resp13 Rl	0D 00 00 09 00 3F	Tran			Hrc: 31	283.305ns		
34839	15:04:40.534.694.107 1	CMD06 SWITCH	46 03 38 08 01 4F			165.438 M	Hrc: 20471	283.305ns		
34840	15:04:40.534.694.587 4	Resp06 Rib	06 00 00 08 00 CB	Tran			Hrc: 33	283.305ns		
34841	15:04:40.534.694.631 4	Busy start								
34842	15:04:40.534.707.613 1	Busy end								
34843	15:04:40.534.813.509 1	CMD13 SEND_STATUS	4D 00 01 00 00 53			165.438 M	Hrc: 19438	279.972ns		
34844	15:04:40.534.813.582 4	Resp13 Rl	0D 00 00 09 00 3F	Tran			Hrc: 32	283.305ns		
34845	15:04:40.558.468.036 2	CMD23 SET_BLOCK_COUNT	57 00 00 00 08 8F			165.438 M	Hrc: Over	283.305ns		
34846	15:04:40.558.468.514 4	Resp23 Rl	17 00 00 09 00 1D	Tran			Hrc: 32	283.305ns		
34847	15:04:40.558.500.203 3	CMD18 READ_MULTIPLE_BLOCK	52 00 00 00 00 E1			165.534 M	Hrc: 5158	279.972ns		
34848	15:04:40.558.500.683 4	Resp18 Rl	12 00 00 09 00 D3	Tran			Hrc: 33	279.972ns		
34849	15:04:40.559.352.171 8...	Read, 512 bytes	FA B8 00 10 8E D0 BC 00...	SC=1 WaitTime:851.208us		HS400			1.64317s	
34850	15:04:40.559.354.014 1...	Read, 512 bytes	1E 00 00 00 00 00 00 00...	SC=2 WaitTime:199.98ns					1.64317s	
34851	15:04:40.559.355.861 1...	Read, 512 bytes	53 3D 7D 55 C3 CC C7 9E...	SC=3 WaitTime:203.313ns					1.63984s	
34852	15:04:40.559.357.711 1...	Read, 512 bytes	33 71 E7 15 2C 34 5B E9...	SC=4 WaitTime:209.979ns					1.63984s	
34853	15:04:40.559.359.557 1...	Read, 512 bytes	D7 3D 2F 71 93 90 05 38...	SC=5 WaitTime:206.646ns					1.64317s	
34854	15:04:40.559.361.407 1...	Read, 512 bytes	DC DA B2 2B 1A 01 2D 7E...	SC=6 WaitTime:206.646ns					1.64317s	
34855	15:04:40.559.363.257 1...	Read, 512 bytes	63 E7 99 B5 6F 3C 22 A2...	SC=7 WaitTime:206.646ns					1.64317s	
34856	15:04:40.559.365.107 1...	Read, 512 bytes	EA A8 B1 70 B3 E1 50 F5...	SC=8 WaitTime:206.646ns					1.64317s	
34857	15:04:40.563.939.219 0...			WaitMax:851.208us Min:199.98ns					Sector 1	
34858	15:04:40.563.939.219 0...	CMD06 SWITCH	46 03 B3 4A 01 05			165.534 M	Hrc: Over	283.305ns		
34859	15:04:40.563.939.702 4...	Resp06 Rib	06 00 00 08 00 CB	Tran			Hrc: 33	279.972ns		
34860	15:04:40.563.939.742 3...	Busy start								

4. 使用 32Gb RAM 搭配硬碟串流來儲存 eMMC 通訊資料，可完整節錄待測物從低速初始化到高速傳輸資料的流程

5. 提供 Data Filter 功能，可將不必要的資料濾除以節省記憶體

6. 提供 Search 資料功能

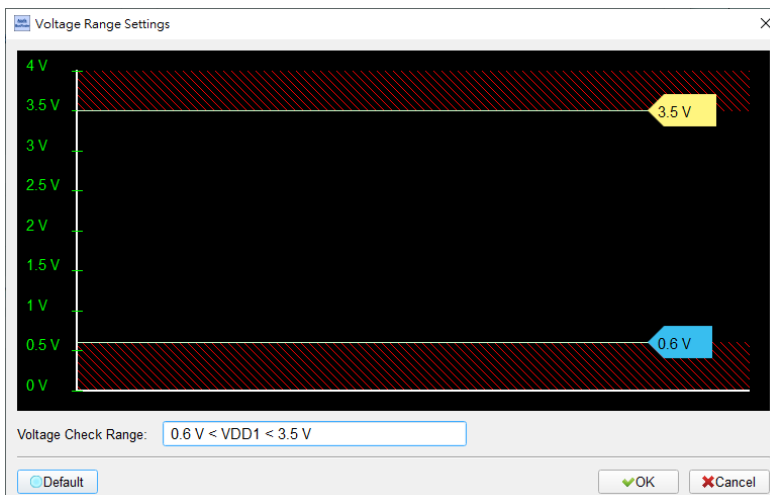
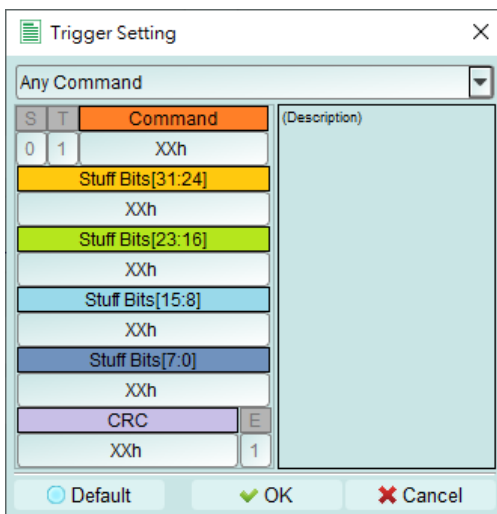
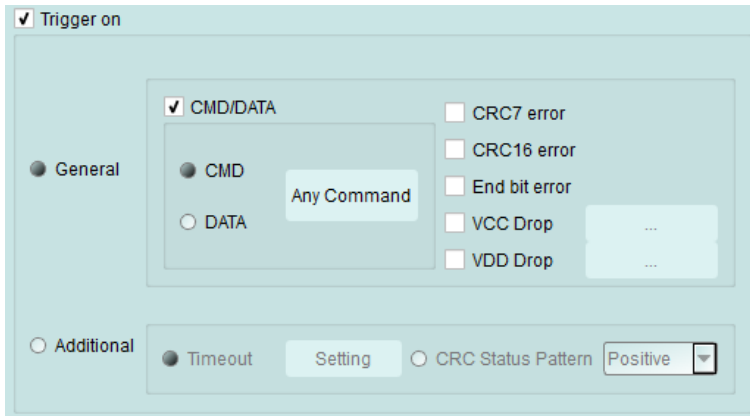
7. 提供 CRC Packet 計算及錯誤顯示

8. eMMC 命令統計功能，包含封包總數、各類別指令數量以及錯誤數量統計

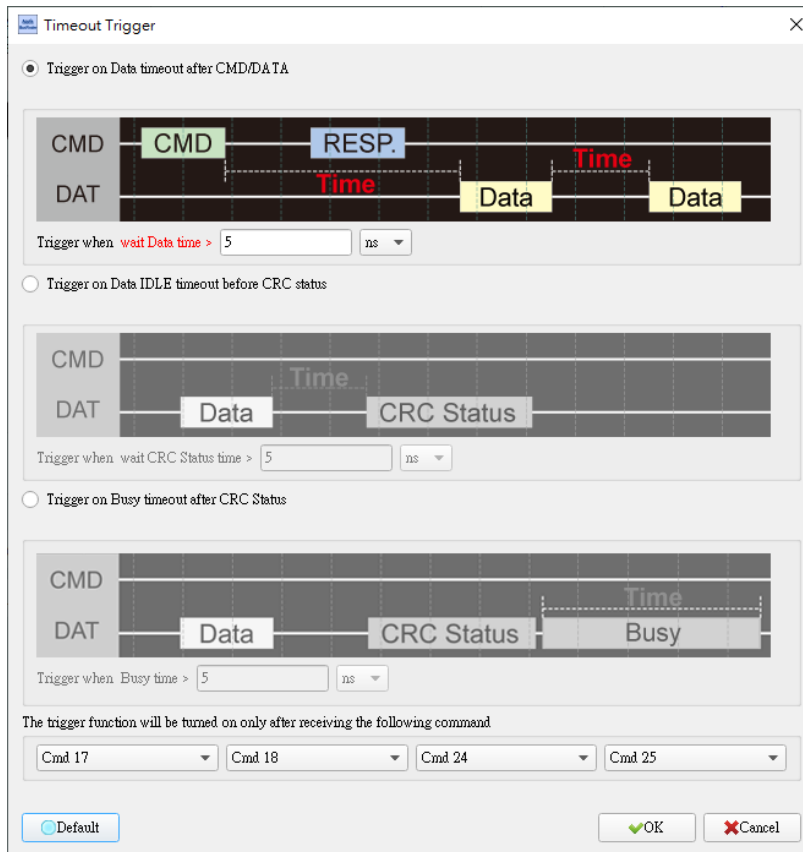
Navigator	Statistics	Txns	Bytes
Command	CMD00	4	192
Data	CMD08	7	336
Error	CMD55	5	240
Sector Count	CMD01	29	1392
CMD17	CMD02	2	96
CMD18	CMD03	2	96
CMD24	CMD09	2	96
CMD25	CMD13	114	5472
Wait Data Time(ns)	CMD07	2	96
Busy Time(ns)	CMD06	69	3312
	CMD16	1	48
	CMD17	55	2640
	CMD18	7021	337008
	CMD12	30	1440
	CMD52	2	96
	CMD05	4	192
	CMD21	8	384
	CMD23	7042	338016
	CMD25	40	1920
	CMD24	3	144

## 9. eMMC 命令觸發功能

- a. 觸發參數包含命令與參數資料可依據不同種類封包填入數值,
- b. 涵蓋所有 Command 或 16 byte Data,
- c. 可觸發 CRC7, CRC16, End Bit Error,
- d. 可觸發 3 種 timeout, CRC Status pattern,
- e. 可觸發 VCC drop, VCCQ2 drop
- f. 可透過 Trigger-Out 接孔同步觸發外部的示波器





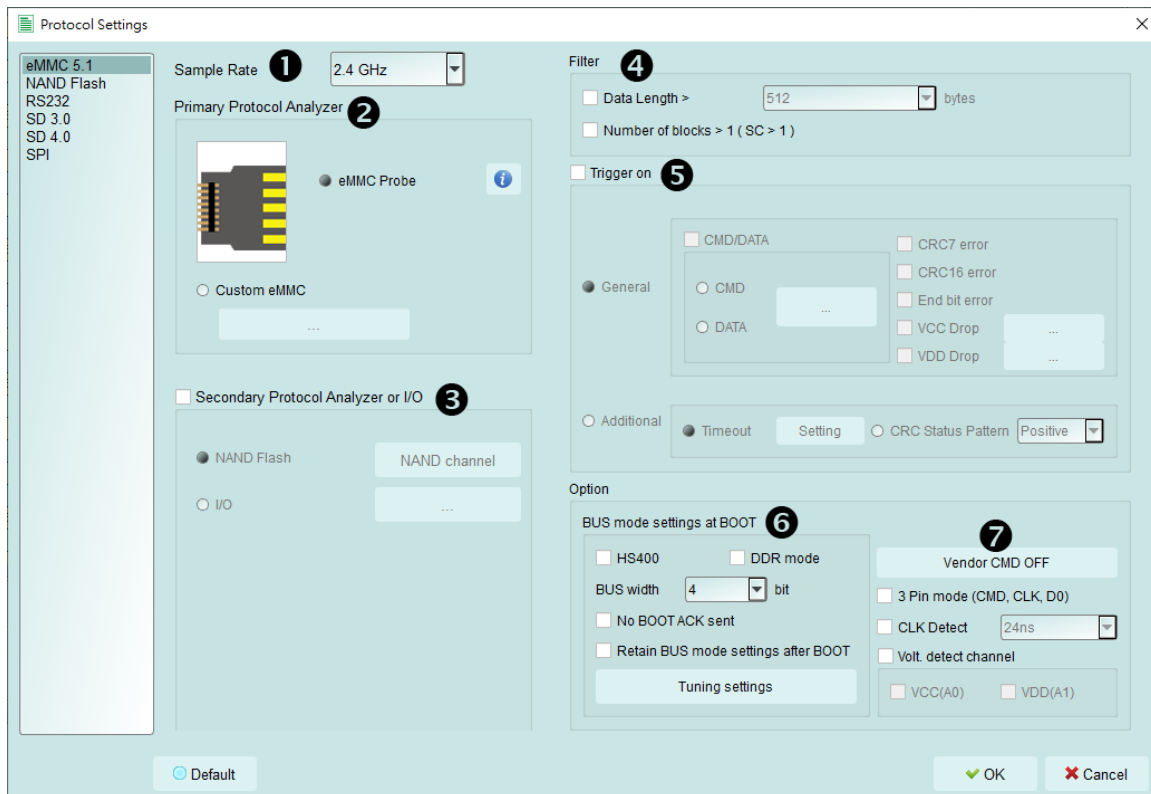


## 10. 報告區功能

統計列表: 以統計功能快速分類並可追蹤資料位置

Line No.	TimeStamp (h:m:s.ms ns)	Event	Date	Information	Current stat	Error message	Bus	Clock	CMD	Data position
29375	10:59:27.334.848.002.1.51ms	CMD06 SWTCH	16 03 89 02 01 07				100.456 K	Hzcc 53	121.934us	
29424	10:59:27.440.613.807.0.90ms	CMD06 SWTCH	16 03 89 08 01 49				165.534 K	Hzcc Over.	279.972ms	
29432	10:59:27.441.734.219.127.07ms	CMD06 SWTCH	16 03 89 01 01 30				165.534 K	Hzcc 20981	179.972ms	
29433	10:59:27.441.985.811.2	Busy end	16 03 89 08 01 30	BusyTime:123.899us	Tran					
29434	10:59:27.441.985.811.2	Resp04 Rib	16 03 89 08 01 30							
29435	10:59:27.441.985.811.2	Busy end	16 03 89 08 01 30							
29436	10:59:27.442.020.997.7	CMD13 SEND_STATUS	16 03 89 09 01 3F				165.534 K	Hzcc Over.	279.972ms	
29437	10:59:27.442.020.997.7	Resp13 R1	16 03 89 09 01 3F					Hzcc 12	283.12ms	
29438	10:59:27.442.020.997.7	CMD06 SWTCH	16 03 89 09 01 3F				165.534 K	Hzcc Over.	279.972ms	
29439	10:59:27.442.188.249.2	Busy start	16 03 89 09 01 30							
29440	10:59:27.442.188.249.2	Resp04 Rib	16 03 89 09 01 30							
29441	10:59:27.470.346.567.2	Busy end	16 03 89 09 01 30	BusyTime:2.14192ms	Tran					
29442	10:59:27.470.417.673.7	CMD13 SEND_STATUS	16 03 89 09 01 3F				165.534 K	Hzcc Over.	279.972ms	
29443	10:59:27.470.417.673.7	Resp13 R1	16 03 89 09 01 3F					Hzcc 12	283.12ms	
29444	10:59:27.470.420.820.2	CMD06 SWTCH	16 03 89 09 01 30				165.534 K	Hzcc Over.	279.972ms	
29445	10:59:27.470.420.820.2	Resp04 Rib	16 03 89 09 01 30							
29446	10:59:27.470.587.143.4	Resp04 Rib	16 03 89 09 01 30							
29447	10:59:27.470.587.143.4	Busy end	16 03 89 09 01 30	BusyTime:306.342us	Tran					
29448	10:59:27.470.915.830.3	CMD13 SEND_STATUS	16 03 89 09 01 3F				165.534 K	Hzcc 7477	279.972ms	
29449	10:59:27.470.915.830.3	Resp13 R1	16 03 89 09 01 3F					Hzcc 32	279.972ms	
29450	10:59:27.499.789.874.2	CMD06 SWTCH	16 03 89 01 01 53				165.534 K	Hzcc Over.	283.12ms	
29451	10:59:27.499.789.874.2	Busy start	16 03 89 01 01 53							
29452	10:59:27.499.789.874.2	Resp04 Rib	16 03 89 01 01 53							
29453	10:59:27.500.709.990.9	Busy end	16 03 89 01 01 53	BusyTime:920.818us	Tran					
29454	10:59:27.500.709.990.9	CMD13 SEND_STATUS	16 03 89 01 01 53				165.534 K	Hzcc Over.	283.12ms	
29455	10:59:27.500.784.894.4	Resp13 R1	16 03 89 01 01 53					Hzcc 32	279.972ms	

## 11. eMMC settings



1. **Sample Rate:** 選擇使用的取樣率，若要開啟 Secondary Protocol Analyzer – NAND Flash 選項，取樣率須設定為 1GHz 以下，
2. **Primary Protocol Analyzer:** 可選擇使用探棒類型，也可自定義通道/觸發準位，
3. **Secondary Protocol Analyzer or I/O:** 可額外開啟一組指定之邏輯分析，以剩下可用腳位同時進行分析，
4. **Filter:** 每一筆 Data Frame 可指定收錄之大小，大於設定值的資料則不會被記錄下來
5. **Trigger on:** 可設定 CMD, DATA, ERROR, Voltage, Timeout, CRC Status 觸發條件
6. **Startup:** 需設定於擷取當下，待測物所運行之模式，並有提供 Tuning 功能
7. **其他 Option 設定:**
  - a. **Vendor CMD:** 可自行更改命令組名稱，是否帶有資料，
  - b. **3 Pin mode:** 接上 CLK, CMD, D0 後，可進行命令流程以及狀態的協定分析，主要用於接線困難或是非資料錯誤的待測物使用，
  - c. **CLK Detect:** 可偵測 CLK 是否有動作，
  - d. **兩組電壓偵測功能**

## FAQ

### 1. 支援 eMMC 第幾版的規格?

A：支援到 eMMC 5.1 HS400 / HS200 / CMD Queue。

### 2. 量測時是否會影響訊號品質?

A：外接的儀器量測必然會有部分的負載效應影響，我們採用主動探棒的連接方式來降低對待測物干擾並提升訊號品質。

### 3. 是否有支援訊號發送 (Tx) 功能?

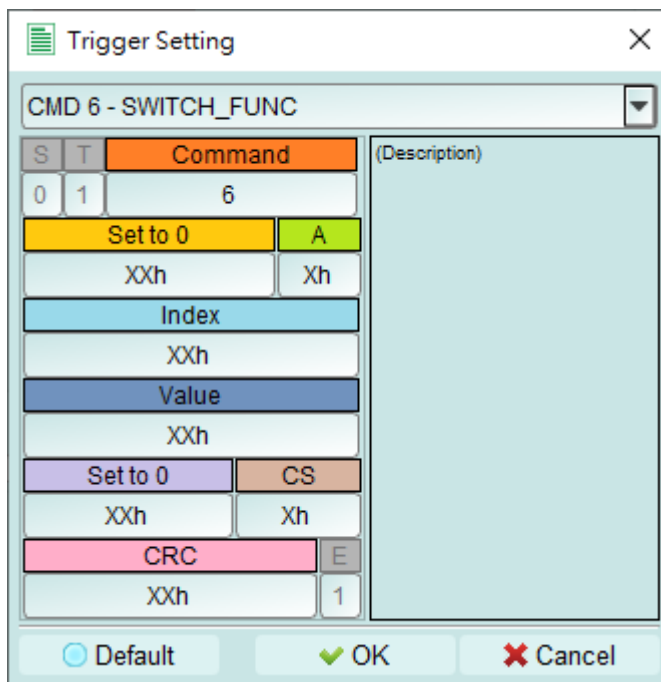
A：不支援訊號發送功能

### 4. 量測時須注意的事項

請確實按手冊**探棒與待測物連接方式**進行連接。

### 5. 有指定某個 eMMC CMD 做為 trigger 點的功能嗎?

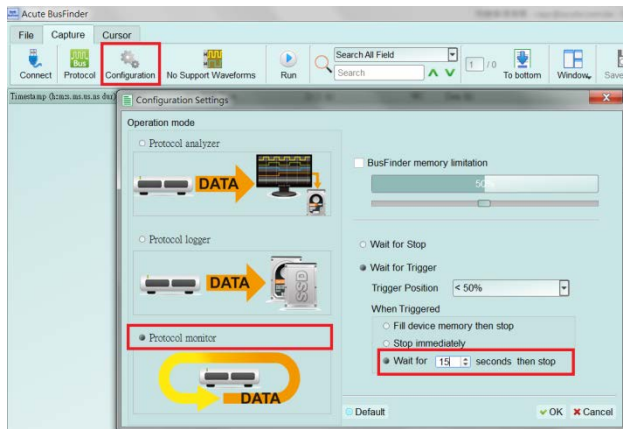
A：可以指定特定的 eMMC packet 或是 Error 進行觸發。



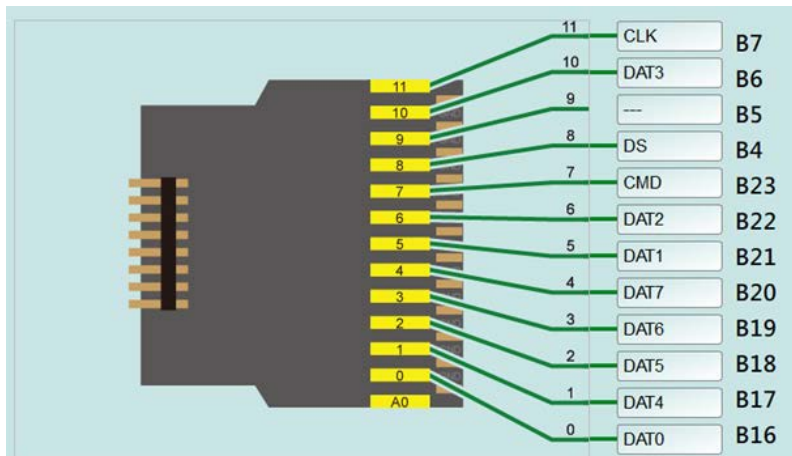


6. 是否可以自行設定一個 eMMC CMD 起始點，指定抓取多少時間內的 Data?

A: 可以將起始條件設定在觸發項目後，到工作模式選單內調整為資料監控儀模式，並指定擷取時間長度。



7. eMMC tip 腳位於 Logic Analyzer mode 的通道配置



8. 統計中的 Data 欄位是哪些 CMD 的 Data?

Discription	Txns	Bytes
Command	542	26016
No Response	0	0
Data	158	3045376
Error	/	
▼ Sector Count		
CMD17	0	0
CMD18	24	1789952
CMD24	0	0
CMD25	134	1255424
Wait Data Time(ns)		
Busy Time(ns)		

Statistics	Txns	Bytes	
READ	24	1789952	CMD 17+18
WRITE	134	1255424	CMD 24+25
BOOT	0	0	

9. PA 的 CRC7 數值如何對照 spec?

```

CMD25 WRITE_MULTIPLE_BLOCK
[31:0] data address= 015B9248h
[CRC7] = 72h (8b:E5h)

[Raw Data]
    0  1  2  3  4  5  6  7  ASCII
0h 59 01 5B 92 48 E5      Y.[.H.
  
```

**Table 42: Command Format**

Description	Start Bit	Transmission Bit	Command Index	Argument	CRC7	End Bit
Bit position	47	46	[45:40]	[39:8]	[7:1]	0
Width (bits)	1	1	6	32	7	1
Value	"0"	"1"	x	x	x	"1"

[CRC7] = 72h = 1110010b (7bits)

如果再加上 end bit, 其數值為 E5h = 11100101b (8b = 8 bits data)

