



BF7264 系列
eMMC5.1
方案說明

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概況

支援型號:

BF6264B	BF7264B	BF7264B+	BF7264 Pro
●	●	●	●

BF7264B/B+/Pro 產品正面有兩個 USB 孔

eMMC 5.1 方案，規格內容如下：

1. BF7264B/B+/Pro，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 (h:m:s.ms.uu.nu.du)	Event	Data	Information	Current state	Error message	Bus	Clock	CMD Duration	Data Duration	細節
34821	15:04:40.513.388.768 1	CMD06 SWITCH	46 03 B9 03 01 11			20.8264 M	Mcr: 2802	2.25977us		CMD06 SWITCH
34822	15:04:40.513.391.651 2	Resp06 Rlb	06 00 00 08 00 CB	Tran			Mcr: 12	2.25977us		[25:24] Access= Write Bits(3)
34823	15:04:40.513.391.988 3	Busy start								[23:16] Index= HS_TIMING(185)
34824	15:04:40.513.694.467 3	Busy end								[15:12] Selected Driver Strength(0)
34825	15:04:40.513.806.553 1	CMD13 SEND_STATUS	4D 00 01 00 00 53			20.8264 M	Mcr: 8593	2.25644us		[11:8] Timing Interface= HS400(3)
34826	15:04:40.513.810.349 3	Resp13 Rl	0D 00 00 09 00 3F	Tran			Mcr: 32	2.25644us		[2:0] Cmd Set= 1
34827	15:04:40.533.313.985 1	CMD06 SWITCH	46 03 A1 01 01 53			165.534 M	Mcr: Over...	283.305ns		
34828	15:04:40.533.314.469 4	Resp06 Rlb	06 00 00 08 00 CB	Tran			Mcr: 33	279.972ns		
34829	15:04:40.533.314.509 3	Busy start								
34830	15:04:40.534.239.393 9	Busy end								
34831	15:04:40.534.306.219 6	CMD13 SEND_STATUS	4D 00 01 00 00 53			165.534 M	Mcr: Over...	279.972ns		
34832	15:04:40.534.306.693 4	Resp13 Rl	0D 00 00 09 00 3F	Tran			Mcr: 32	283.305ns		
34833	15:04:40.534.451.645 1	CMD06 SWITCH	46 03 21 01 01 D9			165.534 M	Mcr: 23980	279.972ns		
34834	15:04:40.534.452.325 4	Resp06 Rlb	06 00 00 08 00 CB	Tran			Mcr: 33	279.972ns		
34835	15:04:40.534.452.365 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			168.438 M	Mcr: 20079	283.305ns		
34838	15:04:40.534.572.286 4	Resp13 Rl	0D 00 00 09 00 3F	Tran			Mcr: 31	283.305ns		
34839	15:04:40.534.694.107 1	CMD06 SWITCH	46 03 38 08 01 4F			168.438 M	Mcr: 20471	283.305ns		
34840	15:04:40.534.694.587 4	Resp06 Rlb	06 00 00 08 00 CB	Tran			Mcr: 33	283.305ns		
34841	15:04:40.534.694.631 4	Busy start								
34842	15:04:40.534.707.813 1	Busy end								
34843	15:04:40.534.813.509 1	CMD13 SEND_STATUS	4D 00 01 00 00 53			165.534 M	Mcr: 19638	279.972ns		
34844	15:04:40.534.813.982 4	Resp13 Rl	0D 00 00 09 00 3F	Tran			Mcr: 32	283.305ns		
34845	15:04:40.558.468.036 2	CMD23 SET_BLOCK_COUNT	57 00 00 00 08 BF			168.438 M	Mcr: Over...	283.305ns		
34846	15:04:40.558.468.516 4	Resp23 Rl	17 00 00 09 00 1D	Tran			Mcr: 32	283.305ns		
34847	15:04:40.558.500.203 3	CMD18 READ_MULTIPLE_BLOCK	52 00 00 00 00 F1			165.534 M	Mcr: 5198	279.972ns		
34848	15:04:40.558.500.683 4	Resp18 Rl	12 00 00 09 00 D3	Tran			Mcr: 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			1.64317u	
34850	15:04:40.559.354.014 1	Read, 512 bytes	1E 00 00 00 00 00 00 00...	SC=2 WaitTime:199.98ns					1.64317u	
34851	15:04:40.559.355.861 1	Read, 512 bytes	53 3D 7D 55 C3 CC C7 9E...	SC=3 WaitTime:203.313ns					1.63984u	
34852	15:04:40.559.357.711 1	Read, 512 bytes	33 71 E7 15 2C 34 5B E9...	SC=4 WaitTime:209.979ns					1.63984u	
34853	15:04:40.559.359.557 1	Read, 512 bytes	D7 3D 2F 71 93 98 05 38...	SC=5 WaitTime:206.646ns					1.64317u	
34854	15:04:40.559.361.407 1	Read, 512 bytes	DC DA B2 2B 1A 01 2D 7E...	SC=6 WaitTime:206.646ns					1.64317u	
34855	15:04:40.559.363.257 1	Read, 512 bytes	63 E7 99 B5 6F 3C 22 A2...	SC=7 WaitTime:206.646ns					1.64317u	
34856	15:04:40.559.365.107 1	Read, 512 bytes	EA A8 B1 70 B3 E1 50 F5...	SC=8 WaitTime:206.646ns					1.64317u	
34857	15:04:40.563.939.219 4			WaitMax:851.208us Min:199.98ns						Sector I
34858	15:04:40.563.939.219 0	CMD06 SWITCH	46 03 B3 4A 01 05			165.534 M	Mcr: Over...	283.305ns		
34859	15:04:40.563.939.702 4	Resp06 Rlb	06 00 00 08 00 CB	Tran			Mcr: 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	
Description	Txns	Bytes	Txns	Bytes
Command	14442	693216	CMD00	4
Data	539533	276233832	CMD08	7
Error	21		CMD55	5
▼ Sector Count			CMD01	29
CMD17	55	28160	CMD02	2
CMD18	7021	275227264	CMD03	2
CMD24	3	1536	CMD09	2
CMD25	40	344064	CMD13	114
Wait Data Time(ns)			CMD07	2
Busy Time(ns)			CMD06	69
			CMD16	1
			CMD17	55
			CMD18	7021
			CMD12	30
			CMD52	2
			CMD05	4
			CMD21	8
			CMD23	7042
			CMD25	40
			CMD24	3

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

☒ 觸發條件

General 錯誤 CRC Status 逾時觸發 VCC Drop GPIO

☒ CMD / RESP. ☐ No Response ☐ Data  Any Command

☒ 觸發條件

General 錯誤 CRC Status 逾時觸發 VCC Drop GPIO

☐ CRC7 error ☐ CRC16 error ☐ End bit error

☒ 觸發條件

General 錯誤 CRC Status 逾時觸發 VCC Drop GPIO

CRC Status Pattern Positive

Positive
Negative

☒ 觸發條件

General 錯誤 CRC Status 逾時觸發 VCC Drop GPIO

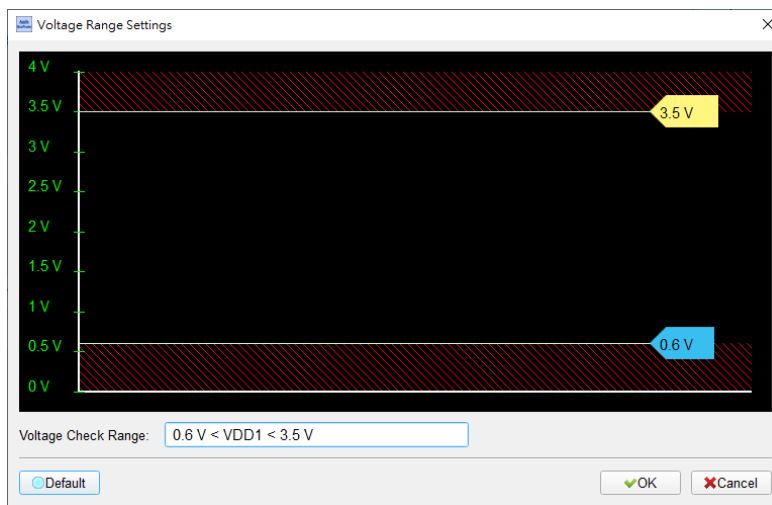
☐ VCC Drop ... ☐ VDD Drop ...

Trigger Setting

Any Command

S	T	Command	(Description)
0	1	XXh	
		Stuff Bits[31:24]	
		XXh	
		Stuff Bits[23:16]	
		XXh	
		Stuff Bits[15:8]	
		XXh	
		Stuff Bits[7:0]	
		XXh	
		CRC	
		XXh	
			E
			1

Default OK Cancel



Timeout Trigger

☒ Trigger on Data timeout after CMD/DATA

Trigger when wait Data time > 5 ns

☐ Trigger on Data IDLE timeout before CRC status

Trigger when wait CRC Status time > 5 ns

☐ Trigger on Busy timeout after CRC Status

Trigger when Busy time > 5 ns

The trigger function will be turned on only after receiving the following command

Cmd 17 Cmd 18 Cmd 24 Cmd 25

Default OK Cancel

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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

The screenshot displays the Acute BusFinder (Ver: 1.4.48) interface. The main window shows a list of captured events. The 'Statistics List' panel at the bottom provides a summary of the data, including a table with columns: Line No, Timestamp, Event, Data, Information, Current state, Error message, Bus, Clock, CMD, and Data length. The 'Navigator' panel on the right shows a hierarchical view of the data, including Command, Data, Error, Sector Count, CMD17, CMD18, CMD24, CMD25, and Wait Data Time(s).

11. eMMC settings

The screenshot shows the '通訊設定' (Communication Settings) dialog box for eMMC. The left sidebar lists various protocols, with 'eMMC 5.1' selected. The main area is divided into several sections:

- 取樣率 (Sampling Rate):** Set to 2.4 GHz.
- Primary Protocol Analyzer:** Includes an image of an eMMC probe and options for 'eMMC Probe', 'Custom eMMC', and 'Secondary Protocol Analyzer or I/O'.
- Startup Settings:** Includes 'Bus Mode' (High Speed), 'Tuning Function' (Settings), 'Detect BOOT ACK' (Choose when the DUT is not powered on), and 'Retain settings after BOOT'.
- Filter:** Includes 'Data Length' (512 bytes) and 'Number of blocks > 1 (SC > 1)'.
- 觸發條件 (Trigger Conditions):** Includes 'General', '錯誤' (Error), 'CRC Status', '逾時觸發' (Timeout Trigger), 'VCC Drop', and 'GPIO'.
- 選項 (Options):** Includes 'Vendor CMD OFF', 'Timing', '3 Pin mode (CMD, CLK, D0)', 'CLK Detect' (24ns), 'LBAFormat' (Hex), 'Voltage Detect' (VCC(A0), VDD(A1)).

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. **Startup Setting:** 需設定於擷取當下，待測物所運行之模式，並有提供 Tuning 功能
5. **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
6. **Trigger on:** 可設定 CMD, DATA, ERROR, Voltage, Timeout, CRC Status 觸發條件
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. **Timing:** 設定 symbols 的 clock 數量。
 - c. **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，
 - d. **CLK Detect:** 可偵測 CLK 是否有動作，
 - e. **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？

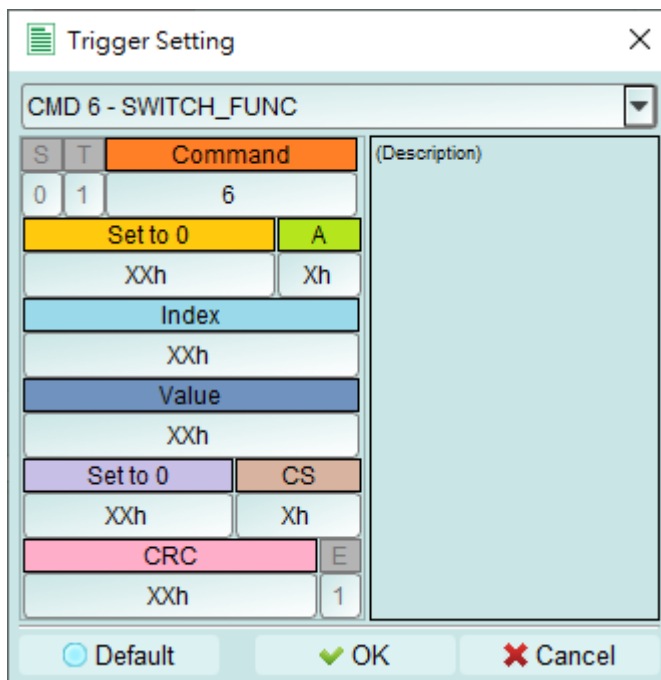
A：不支援訊號發送功能

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。

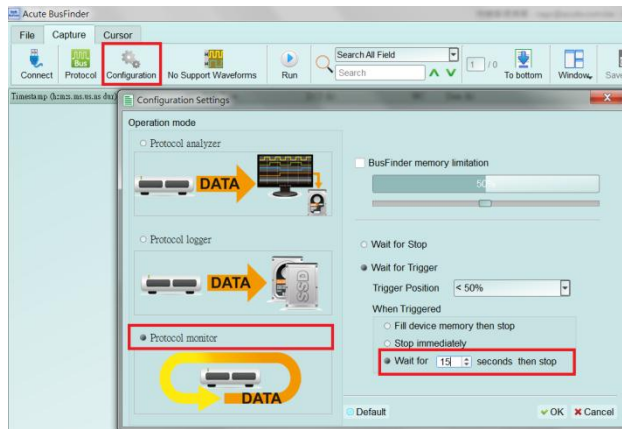
5. 有指定某個 eMMC CMD 做為 trigger 點的功能嗎？

A：可以指定特定的 eMMC packet 或是 Error 進行觸發。

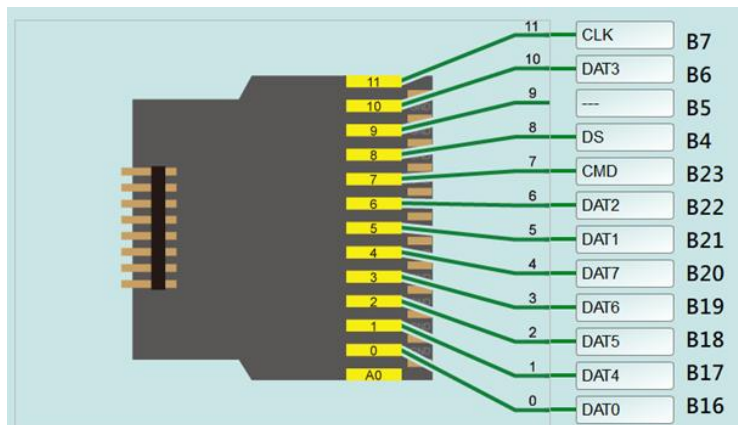


6. 是否可以自行設定一個 eMMC CMD 起始點，指定抓取多少時間內的 Data?

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?

Navigator		
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
WRITE	134	1255424
BOOT	0	0

CMD 17+18

CMD 24+25

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.

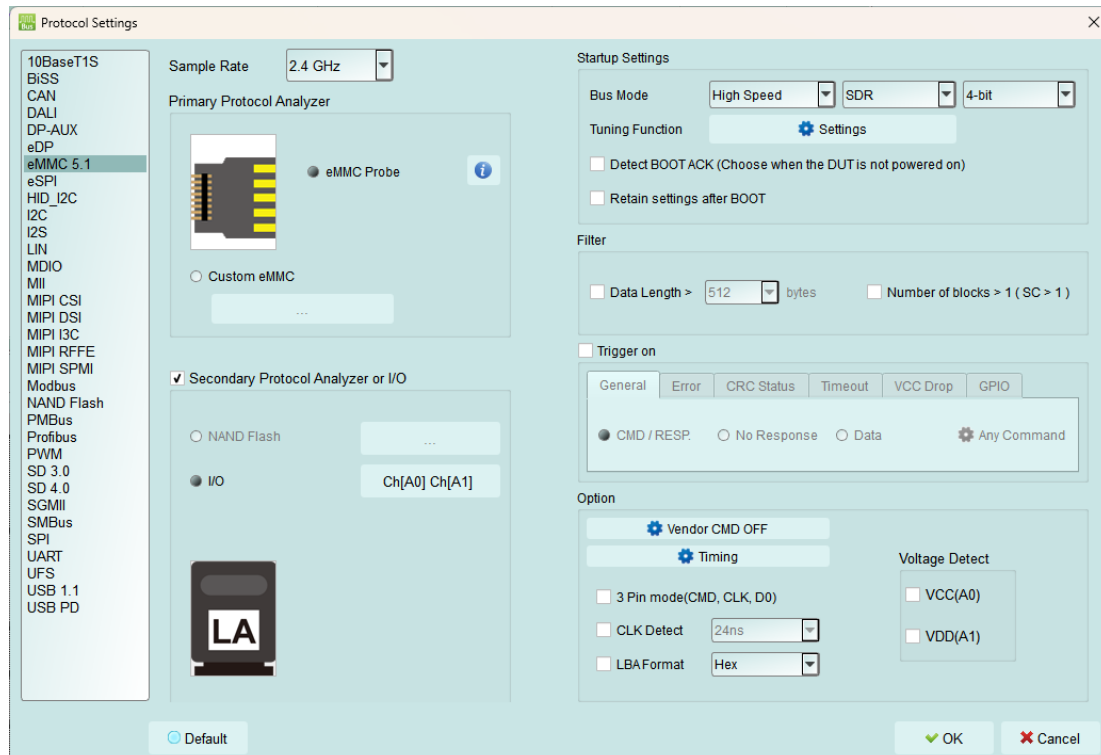
Table 42: Command Format

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)

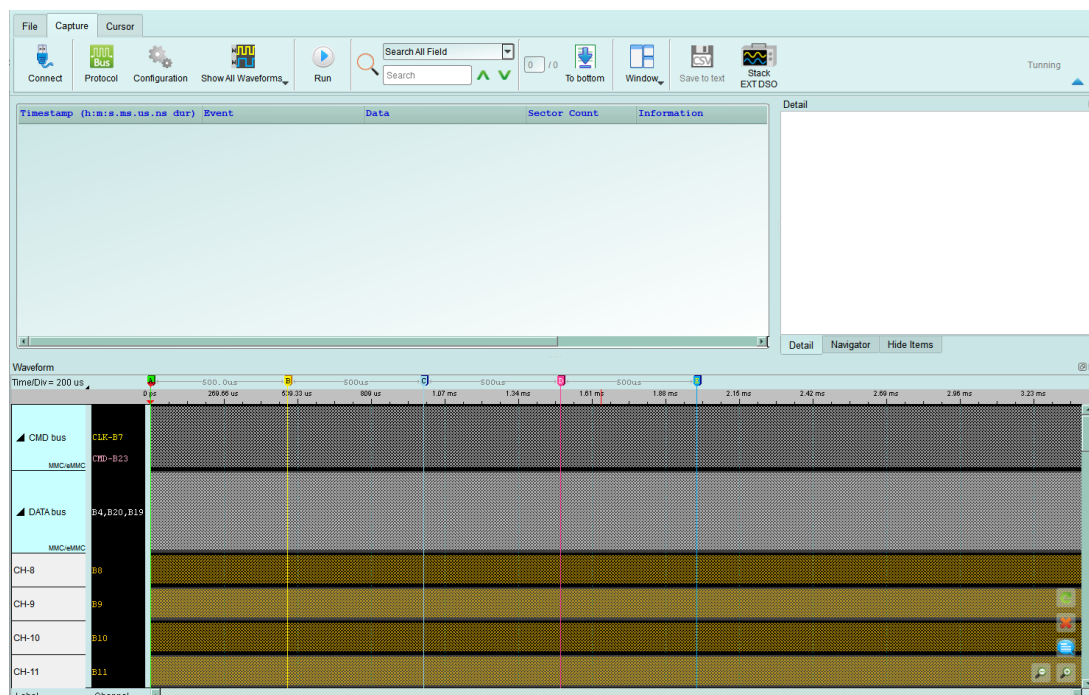
如果再加上 end bit, 其數值為 E5h = 11100101b (8b = 8 bits data)

10. Secondary Protocol Analyzer or I/O



在使用 eMMC 5.1 協定分析儀的同時，可額外開啟 NAND Flash 邏輯分析儀功能或是額外的 I/O 腳位進行分析。

使用此功能必須在協定分析儀主畫面將顯示波形開啟才能使用。

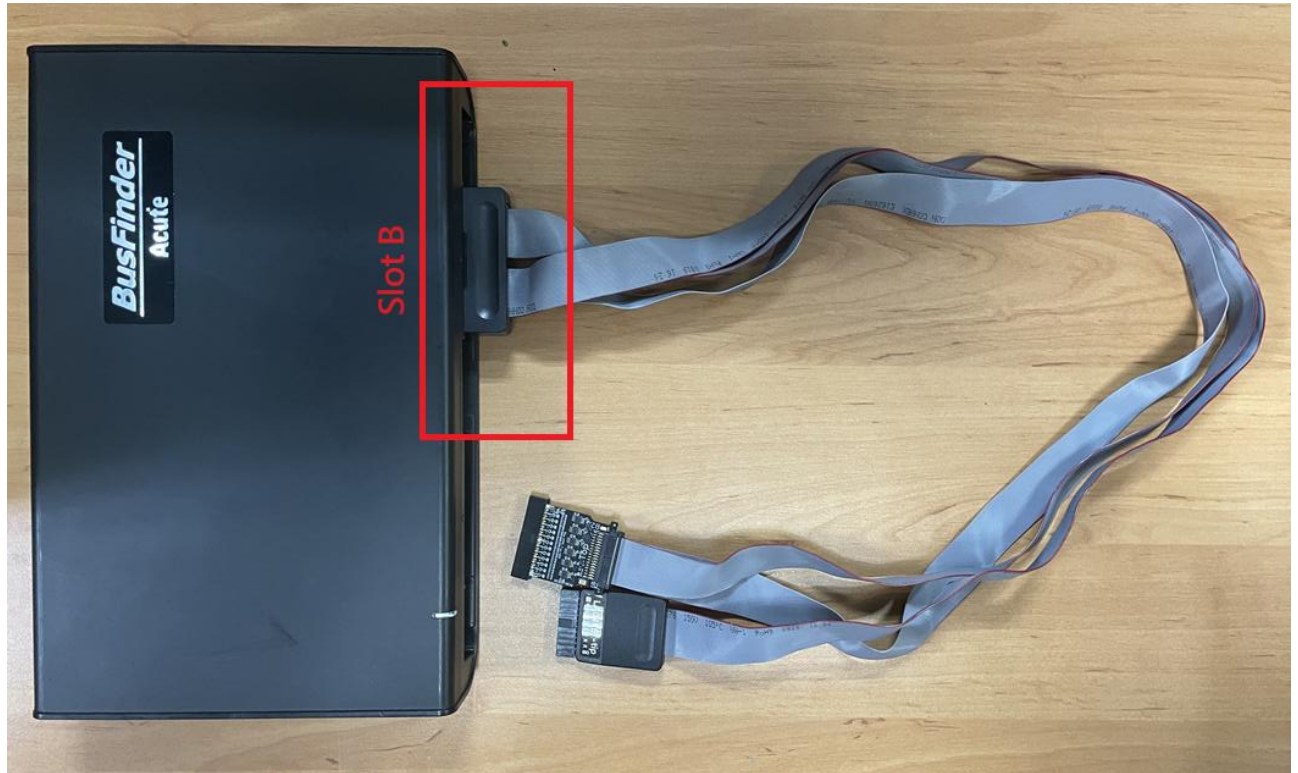


由於 NAND Flash 的分析需要使用更多的通道，因此需要一條 LA 探棒接於 Slot A，且僅能使用 1GHz 的採樣率才能開啟。

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主機與探棒連接方式

主機僅能使用 Slot B 作為探棒連接槽。



探棒與待測物連接方式

