

## Protocol Analysis for Tektronix Logic Analyzers

### eMMC Protocol Software Data Sheet

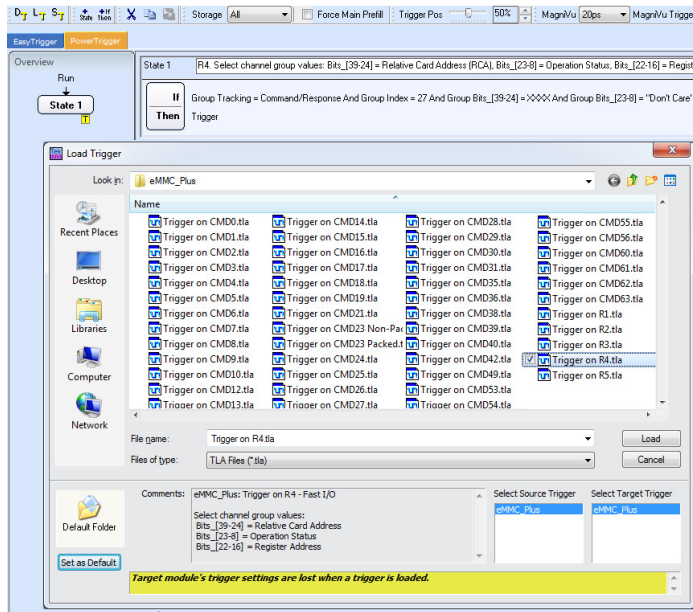
Sample	eMMC_CMD
9	<b>CMD1: Send_Op_Cond</b> Busy: No Access Mode: Sector 2.7 - 3.6V Supported 2.0 - 2.6V Supported 1.7 - 1.95V Supported
10	<b>R3 Response: CMD1 (Send_Op_Cond)</b> Busy: No Access Mode: Sector 2.7 - 3.6V Supported 2.0 - 2.6V Supported 1.7 - 1.95V NOT supported
11	<b>CMD4: Set_DSR</b> DSR: 0x1221
12	<b>R1 Response: CMD4 (Set_DSR)</b> Status: Current_State = Idle
13	<b>CMD5: Sleep_Awake</b> RCA: 0xBEAD Sleep/Awake: Sleep
14	<b>R1 Response: CMD5 (Sleep_Awake)</b> Status: Current_State = Slp
15	<b>CMD5: Sleep_Awake</b> RCA: 0xBEAD Sleep/Awake: Awake
16	<b>R1 Response: CMD5 (Sleep_Awake)</b> Status: Current_State = Idle
17	<b>CMD9: send_CSD</b> RCA: 0xFADE
18	<b>R2 Response:</b> CSD_Structure: CSD v1.2 Spec_Vers: v4.1, v4.2, and v4.3 TAAC: 350ns TAAC Bits[6-3]: 3.5 Multiplier TAAC Bits[2-0]: 100ns Time Unit NSAC: 700 Clocks Tran_Speed: 52MHz Tran_Speed bits[6-3]: 5.2 Multiplier Tran_Speed bits[2-0]: 10MHz Frequency
19	<b>CCC: Classes supported include,</b> Class 1 Class 2 Class 4 Class 6 Class 7 Class 8 Class 9 Class 10 Class 11 Read_B1_Len: 2k Bytes Read_B1_Partial: Yes Write_B1_Misalign: Invalid Read_B1_Misalign: Valid DSR_Imp: DSR implemented C_Size: 4083 Device capacity: 32672kB (rounded down to next kB) VDD_R_Curr_Min: 5mA VDD_R_Curr_Max: 25mA VDD_W_Curr_Min: 10mA VDD_W_Curr_Max: 45mA C_Size_Mult: 256 Erase_Grp_Size: 15 Erase_Grp_Mult: 0
20	Erase Unit: 16 blocks WP_Grp_Size: 8 WP_Grp_Enable: Not enabled Default_ECC: BCH R2W_Factor: 16x Write_B1_Len: 2k Bytes Write_B1_Partial: No Content_Prot_App: Not supported File_Format_Grp: (File_Format Group field is valid) Copy: Content original Perm_Write_Protect: No Temp_Write_Protect: Not protected File_Format: HD Type w/ Partition Table ECC: BCH
21	<b>CMD13: Send_Status</b> RCA: 0xFADE HPI Flag: 1
22	<b>R1 Response: CMD13 (Send_Status)</b>

## Features & Benefits

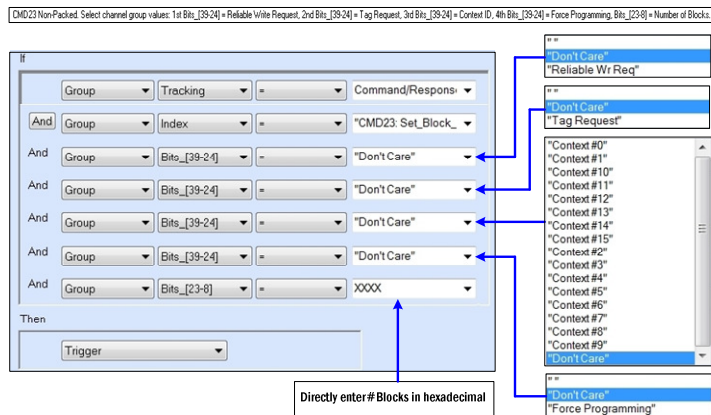
- Real-time Serial-to-Parallel Conversion of eMMC Command and Response Bit Streams Enables Protocol Analysis with Your Tektronix TLA Logic Analyzer
  - Comprehensive Triggering Capability – The trigger state machine sees an entire packet at one time (not a bit-by-bit serial stream) providing the ability to trigger on individual packet fields or combinations of fields.
  - Complete Suite of Trigger Templates – Triggering on the command or response of your choice is a simple matter of loading one of over 50 predefined trigger templates.
  - Maximized Memory Usage – Data is stored packet-by-packet allowing capture of large amounts of command/response activity. CMD line idle conditions are detected and not stored so that capture memory is not wasted.
  - Flexible Probing Options – Serial-to-parallel conversion is done inside the TLA acquisition hardware eliminating the need for external adapter hardware. Use the probing technology of your choice: D-Max, Mictor, Connectorless Compression, or leadsets.
  - All JESD84-B451 Bus Modes & Voltages Supported – High Speed SDR, High Speed DDR, HS200, and MMC legacy transfer rates are supported.
- Comprehensive Command and Response Packet Decoding Simplifies Tracing Host-Device Communications.
  - Color Coding – Commands and responses are color coded for easier identification. Personalize color coding of your display by editing a simple text file.
  - Protocol Error Detection – Required packet field values (such as stuff bits) and reserved entries are validated versus the protocol specification and errors are flagged in red to ease identification of protocol errors.
  - Display Filtering – Preprogrammed display filters speed tracing of host command and device response sequences by filtering out extraneous data. Quickly zero in on protocol errors with advanced filtering that shows only those problem areas.

## Easily Capture the Host-Device Traffic of Interest

An extensive library of over 50 predefined trigger templates simplifies defining which host-device traffic the logic analyzer will capture. Just click the Load Trigger icon (L\_T), pick the command or response type you want to have trigger the analyzer, add any specific field values you wish, and press the Run key.



Each trigger contains a list of the fields within the command or response packet type you selected. Numeric fields, such as a device's Relative Card Address (RCA), allow direct input in the radix of your choice. Fields with a predefined list of options provide a pop-up selection list. The trigger groups corresponding to each packet field are identified in the comment header.



## Rapidly Identify Protocol Errors

Every command or response packet acquired by the logic analyzer is checked for compliance to the eMMC standard. Protocol violations such as stuff-bit fields  $\neq 0$ , fields with reserved values, obsolete commands being issued, or incorrect response types for a specific command are clearly marked in red for easy visibility. Advanced display filtering is available which removes all valid packet information leaving only the errors behind.

Sample	Timestamp	eMMC_Plus_13Gen3 eMMC Command/Response
2	95.997 226 us	Protocol Error: Current_State = Reserved value, 0xF
3	47.997 910 us	Protocol Error: Non-zero Stuff bits, Argument Bits: [19:11]
5	191.993 731 us	Protocol Error: Non-zero Stuff bits, Argument Bits: [13:10]
7	191.993 887 us	Protocol Error: CCC = No classes supported, 0x000
9	191.992 773 us	Protocol Error: Non-zero Stuff bits, Argument Bits: [75:74]
18	95.994 727 us	Protocol Error: Default_ECC = Reserved value, 2
21	47.997 988 us	Protocol Error: Non-zero Stuff bits, Argument Bits: [20:17]
22	220.991 074 us	Protocol Error: File_Format_Grp = Reserved value, 0x1
23	48.002 031 us	Protocol Error: TAAC = Reserved multiplier value TAAC Bits[6-3]: Reserved value, 0x0 Multiplier
27	1.991 524 s	Protocol Error: Non-zero Stuff bits, Argument Bits: [103:103]
29	50.001 992 us	Protocol Error: Tran_Speed = Reserved multiplier value
30	141.993 125 us	Protocol Error: CCC = No classes supported, 0x000
35	47.996 543 us	Protocol Error: Default_ECC = Reserved value, 3 Protocol Error: Non-zero Stuff bits, Argument Bits: [20:17] Protocol Error: File_Format_Grp = Reserved value, 0x1 Protocol Error: ECC = Reserved value, 0x3

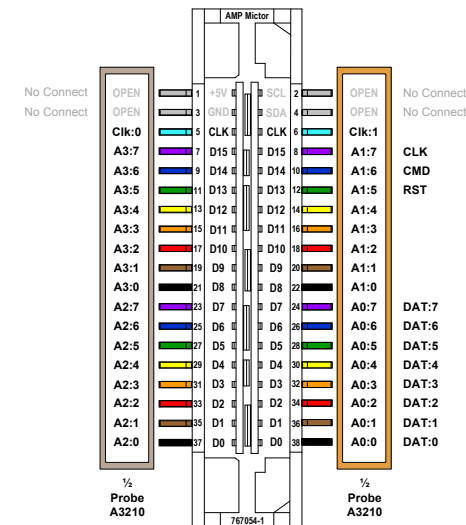
## Connection Information

You have a variety of probing options available for connecting the logic analyzer to eMMC signals.

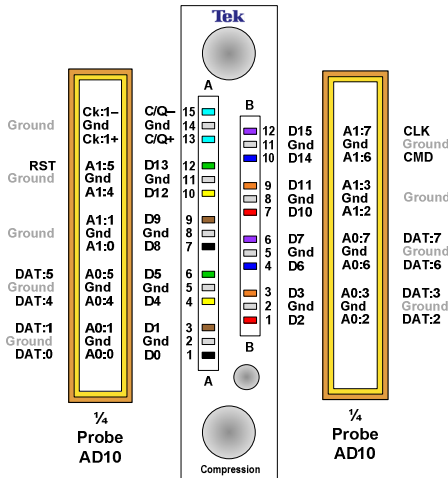
Probe using leadsets: P5910, P6810, P6910.

eMMC Signal	Logic Analyzer Channel
CLK	A1:7
CMD	A1:6
RST	A1:5
DAT:7	A0:7
DAT:6	A0:6
DAT:5	A0:5
DAT:4	A0:4
DAT:3	A0:3
DAT:2	A0:2
DAT:1	A0:1
DAT:0	A0:0

Probe using MICTOR connectors: P5934.



Probe using Connectorless Compression: P6860.



Modular Logic Analyzer <small>(Simultaneous Command and Data requires two acquisition modules)</small>	
Mainframe	TLA7012 or TLA7016
Command/Response	
Acquisition Module	TLA7BB2, TLA7BB3, TLA7BB4, or TLA7BC4
Acquisition Probe	One P68xx or P69xx Series
Data Bus	
Acquisition Module	TLA7BB2, TLA7BB3, TLA7BB4, TLA7BC4, TLA7AA2, TLA7AA3, TLA7AA4, TLA7AB2, TLA7AB4, TLA7AC2, TLA7AC3, or TLA7AC4
Acquisition Probe	One P68xx or P69xx Series
Monolithic Logic Analyzer <small>(Acquires either Command or Data)</small>	
Mainframe	TLA6402, TLA6403, or TLA6404
Acquisition Probe	One P59xx Series

Ordering Information

eMMC\_Plus Protocol Software

The software provides command and response packet protocol decoding and data bus acquisition for eMMC interfaces conforming to JESD84-B451. Licensing is one copy per TLA logic analyzer. Warranty covers one year with free software upgrades. Offline viewing version of the software with an unlimited license is included.

eMMC\_Plus Protocol Software Option 1

Option 1 provides a customized version using the eMMC signal to TLA channel mapping of your choice. Due to the nature of the serial-to-parallel conversion process all of the eMMC signals (CLK, CMD, DAT:[0-7], & RST) must be mapped to one of four groups of channels. Please contact [sales@trideus.com](mailto:sales@trideus.com) for details.

Pricing

eMMC\_Plus Protocol Software

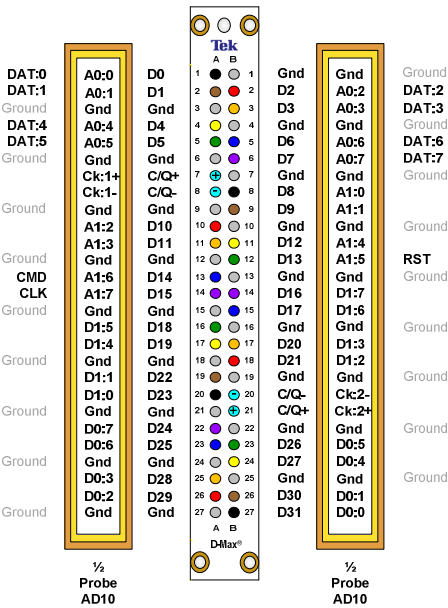
- \$4600.00 USD each – Single TLA license.
- \$4370.00 USD each – Two TLA licenses.
- \$4140.00 USD each – Three to five TLA licenses.
- \$3680.00 USD each – Six or more TLA licenses.
- Contact [sales@trideus.com](mailto:sales@trideus.com) for site or corporate licensing.

eMMC\_Plus Protocol Software Option 1

- \$500.00 USD, one-time non-recurring engineering (NRE) charge.

Please note that pricing is subject to change without notice. Contact [sales@trideus.com](mailto:sales@trideus.com) to obtain current pricing information.

Probe using D-Max Technology: P5960, P6960.



Configuration Information

eMMC Protocol Software programs the advanced capabilities of the TLA acquisition hardware’s clocking state machines to monitor the status of the command/response signal (CMD) in real-time and properly synchronize the serial-to-parallel (S2P) conversion process to align with command and response packet boundaries. This conversion process is what makes packet-by-packet storage and triggering possible.

S2P conversion uses a significant portion of the acquisition hardware’s clocking circuitry and therefore it is not possible to correctly acquire command/response and data transfers simultaneously within the same module. To acquire both simultaneously will require two logic analyzer modules.

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