Global Workshop Taiwan

Introduction and Agenda

Anne Tsou 鄒雅婷
SDA協會行銷委員會台灣區主席 (百佳泰)
SDA MC Taiwan Chair
### Global Workshop Webinar Agenda - Taiwan

<table>
<thead>
<tr>
<th>#</th>
<th>Topic</th>
<th>Presenter</th>
<th>Company</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Opening, Introduce event and Agenda</td>
<td>鄒雅婷 Anne Tsou</td>
<td>Allion Labs</td>
<td>SDA協會行銷委員會台灣區主席 (百佳泰) SDA MC Taiwan Chair</td>
</tr>
<tr>
<td>2</td>
<td>Welcome Message</td>
<td>鄭宗宏 TH Kuang</td>
<td>Phison</td>
<td>SDA協會董事/行銷委員會亞太區主席 SDA BOD &amp; MC APAC Region Chair</td>
</tr>
<tr>
<td>3</td>
<td>SDA Update/Overview</td>
<td>Kazunori Nakano</td>
<td>KIOXIA</td>
<td>SDA協會董事/行銷委員會全球主席 SDA BOD &amp; MC Global Chair</td>
</tr>
<tr>
<td>4</td>
<td>SD Express Host Implementation</td>
<td>Yosi Pinto</td>
<td>SanDisk LLC</td>
<td>SDA協會董事會主席/技術委員會主席 SDA Chairman and TC Chair</td>
</tr>
<tr>
<td>5</td>
<td>SD Express Host Controller</td>
<td>呂育德 Louis Lu</td>
<td>Bayhub</td>
<td>倍昊資深經理 Senior Manager</td>
</tr>
<tr>
<td>6</td>
<td>SD Express–Ecosystem of Storage Devices</td>
<td>蕭俊銘 Jim Shiau</td>
<td>Realtek</td>
<td>瑞昱經理 Manager</td>
</tr>
<tr>
<td>7</td>
<td>SD Express Host Device</td>
<td>陳江村 CT Chen</td>
<td>Acer</td>
<td>宏碁資訊產品事業群資深經理 Senior Manager</td>
</tr>
<tr>
<td>8</td>
<td>SD and UHS-II Verification Program (SVP)</td>
<td>張靜宜 Sandy Chang</td>
<td>GRL</td>
<td>GRL技術總監 Taiwan Technical Director</td>
</tr>
<tr>
<td>9</td>
<td>SD Express Card and Applications</td>
<td>郭育立 Rex Kuo</td>
<td>Phison</td>
<td>群聯電子產品經理 PM Manager</td>
</tr>
<tr>
<td>10</td>
<td>SD Express Card and Applications</td>
<td>Hitoshi Hatakeyama</td>
<td>Allion Labs</td>
<td>百佳泰/Allion Japan, Senior SI Expert/ Sales Engineering Supervisor</td>
</tr>
<tr>
<td>11</td>
<td>Q&amp;A</td>
<td>All</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* 英文主講 / English language
SD協會台灣線上研討會

Welcome Message
鄺宗宏, 協會董事 / 推廣委員會亞太區主席
T. H. Kuang,
SDA Board of Directors/
Marketing Committee APAC Region Chair (Phison)
歡迎大家參加SD協會臺灣線上研討會

Welcome to the SDA Global Workshop Taiwan Webinar
Big Data is Driving Performance & Capacity of SD Technology Development

更多更新的SD卡技術&規格
More New SD Technology & Specification
2012年開始中國的推廣計畫
Strategic Activity in China started in 2012
26 New Member Company in China adopted SDA Membership in 2012
2012年四月有五十多家公司參與SD協會上海活動
Welcomed more than 50 company in Shanghai, April, 2012
2012年十一月有五十多家公司參與SD協會北京活動
Welcomed more than 50 company in Beijing, Nov, 2012
2013年五月SD協會全球技術研討會台灣活動
Global Workshop Taipei, May, 2013
2013年十月SD協會全球技術研討會上海活動
Global Workshop Shanghai, Oct, 2013
2014年四月SD協會全球技術研討會 上海活動
Global Workshop Shanghai, Apr, 2014
2015年五月SD協會全球技術研討會 上海活動
Global Workshop Shanghai, May, 2015
2015年十月SD協會全球技術研討會 北京活動
Global Workshop Beijing, Oct, 2015
2016年四月SD協會全球技術研討會 北京活動
Global Workshop Beijing, Apr, 2016
2016年十一月SD協會全球技術研討會 上海活動
Global Workshop Shanghai, Nov, 2016
2017年四月SD協會全球技術研討會 東京活動
Global Workshop Tokyo, Apr, 2017
2017年九月SD協會全球技術研討會 立陶宛
Global Workshop Kaunas, Sep, 2017
2017年十二月SD協會全球技術研討會 日本活動
Global Workshop Tokyo, Dec. 2017
2018年三月SD協會全球技術研討會 印度活動
Global Workshop Mumbai, Mar, 2018
2018年三月SD協會全球技術研討會 印度活動
Global Workshop New Delhi, Mar, 2018
2018年三月SD協會全球技術研討會 東京活動
Global Workshop Hangzhou, Mar, 2018
2018年九月SD協會全球技術研討會 印度活動
Global Workshop Bangalore, Sep/25, 2018
2018年九月SD協會全球技術研討會 印度活動
Global Workshop Pune, Sep/27, 2018
2018年十月SD協會全球技術研討會 廣州活動
Global Workshop Guangzhou, Oct/26, 2018
2019年三月SD協會全球技術研討會 印度活動
Global Workshop Chennai, Mar/12, 2019
2019年三月SD協會全球技術研討會 印度活動
Global Workshop Hyderabad, Mar/14, 2019
2019年四月SD協會全球技術研討會上海活動
Global Workshop Shanghai, Apr/12, 2019
2019年四月SD協會全球技術研討會俄羅斯活動
Global Workshop Moscow, Apr/16, 2019
2019年九月SD協會全球技術研討會 印度活動
Global Workshop Bangalore, Sep/24, 2019
2019年九月SD協會全球技術研討會 印度活動
Global Workshop New Delhi, Sep/26, 2019
2019年十一月SD協會全球技術研討會俄羅斯活動
Global Workshop San Petersburg, Nov/7, 2019
2021年三月SD協會全球技術中國線上研討會活動
Global Workshop China Webinar, Mar/25, 2021
2021年三月SD協會全球技術研討會俄羅斯活動
Global Workshop Moscow Webinar, Mar/21, 2021
2021年四月SD協會全球技術研討會 印度活動
Global Workshop India Webinar, Apr/23, 2021
2021年九月SD協會全球技術研討會西班牙活動
Global Workshop Europe Webinar, Sep/22, 2021
2021年十月SD協會全球技術研討會美國活動
Global Workshop USA Webinar, Oct/27, 2021
2022年一月SD協會中國線上研討會活動
Global Workshop Taiwan Webinar, Jan/13, 2022
歡迎加入SD協會, 共創未來
Welcome to join SDA for a better future
Thank You

Email: kuang@phison.com
Global Workshop Taiwan

SD Association Overview

Kazunori Nakano
SDA Board of Directors/Marketing Committee Chair (KIOXIA)
Table of Contents

• SD Association Overview
  • Organization
  • License Scheme & Compliance
  • Benefit of SDA Membership

• SD Standard Specification Overview and New Standard Ver.8.00
  • SD Specification Structure
  • Card Types
  • SD Logos & SDA Pictographs
  • SD Ver.8.00 (SD EXPRESS PCIe Gen.4)

• Summary of SD Standards
SD Association Overview
Mission: SD Card Standardization with Promotion and Adoption of SD Standard Worldwide

- Organization Established in 2000
- Member Company: Approximately 800 Companies Worldwide
- Member Fee: Executive Member $4,500/year, General Member $2,500/year
# License Scheme & Compliance

<table>
<thead>
<tr>
<th>Specification</th>
<th>SD Association</th>
<th>SD-3C LLC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SDA Specification</td>
<td>SD Group Specification</td>
</tr>
<tr>
<td></td>
<td>SDA Pictographs</td>
<td>SD Logos</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Essential Patents</td>
</tr>
<tr>
<td>License</td>
<td>Contract with SDA</td>
<td>Contract with SD-3C LLC</td>
</tr>
<tr>
<td>Card</td>
<td>SDA Membership Agreement (SDAMA)</td>
<td>Card License Agreement (CLA)</td>
</tr>
<tr>
<td>Host</td>
<td>SDA License Agreement (SDALA)</td>
<td>Host Ancillary Product License Agreement (HALA)</td>
</tr>
</tbody>
</table>

Licensee should comply with SD/SDA Specifications and SD/SDA Logo Guideline (As Normative Document)
Benefit of SDA Membership

- Access to all detailed updated specifications. (Card, Host, Test & Logo Guideline)
- Not only exposed to all on-going standardization activity but up-coming standards well in advance.
- Not only be able to influence on new evolving standards but be able to propose new features for standards.

Membership Comparison ➔

https://www.sdcard.org/join/membership-benefits-comparison/

<table>
<thead>
<tr>
<th>Member Benefits</th>
<th>Executive</th>
<th>General</th>
</tr>
</thead>
<tbody>
<tr>
<td>Can be a candidate to serve on the Board of Directors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Voting Rights in SDA, including Committees and Workgroups</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ability to chair Committees and Workgroups</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Participate in Committee and Workgroup all email reflectors, except closed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Obtain pre-release access to documents and deliverables</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ability to make proposals for additions and/or modifications for SD Specifications</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ability to execute the SD Association License Agreement</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Access to the SD Specification matrix</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Participate in and contribute to Committee and Workgroup activities</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attend General and Interim Meetings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Access to the “Members Only” website</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Participate in Interoperability Test Events</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Participate in marketing events and workshops</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Annual Dues</td>
<td>$4500</td>
<td>$2500</td>
</tr>
</tbody>
</table>
SDA Officers

☐ President: Hiroyuki Sakamoto
  Hiroyuki.sakamoto@t-net.ne.jp

☐ Chairman: Yosi Pinto
  Yosi.pinto@sandisk.com

☐ Treasurer: Bo Li
  Bo.Li@sandisk.com

☐ Executive Director*: Stan Moyer
  sdcard_ed@inventures.com

☐ Secretary: Open

* Stan is not an official SDA officer per the bylaws definition. Though he is considered as a team member in the Officers Team as being the Executive Director of the association. A service provided by our SDA Office contractor – Global Inventures
SDA Board of Directors – 12 Companies

(in alphabetical order)

- AIC
  - Danny Lin
  - Jeff Hsieh

- Kingston
  - David Chen
  - Joel Tang

- KIOXIA
  - Kazunori Nakano

- Lexar
  - Joseph Yuan
  - Jordan Zhong

- Micron
  - Jyh Chau
  - Open

- Panasonic
  - Shuichi Ohki
  - Takuji Maeda

- Phison
  - HeeChang Cho
  - Yosi Pinto
  - T.H. Kuang

- HiSoi
  - Andre Chen
  - JiCheol Hong

- Samsung
  - Janice Chiu
  - Josh Chen
  - Janice Chiu

- Sandisk
  - Jeff Tsujimoto
  - Jeff Chen

- Silicon Motion
  - Kenichi Satori
  - Shingo Aso

- Sony
  - Joel Catala
  - Joel Catala

- Tuxera
  - Thom Denholm

©SD Association. All Rights Reserved.
Marketing Committee Organization

Marketing Committee Chair
Kazunori Nakano (KIOXIA)

CC Relations
Advisory Directors
Minoru Ohara (Allion)
Hiroshi Noda (Canon)

TC Relations
Advisory Directors
Yosi Pinto (SanDisk)

Global Public Website & Events Management
Mana Shimizu (Acube)
Marketing & Events Support
Belinda Lucero (GI)

Application WG
Chair: Shinji Inoue (Panasonic)
Kuo Ting Lu (Phison)/Surveillance & Automotive

Web WG
Chair: Kaz Nakano
Anne Tsou (Allion)
Kuo Ting Lu (Phison)

Regional Marketing WG
Kaz Nakano/Japan
T.H.Kuang / APAC (Phison)
Joe Su / China (Phison)
Anne Tsou/ Taiwan (Allion)
Cathy Huang / Russia (Phison)

Logo Guideline WG
Chair: Jeff Tsujimoto (WD)
Sharlene Chin (WD)
Shinji Inoue (Panasonic)
Compliance Committee Organization

Interoperability WG Co-Chair
Minoru Ohara, Allion
Hiroshi Noda, Canon

Test Tool Evaluation Ad-hoc
Managed by Compliance Committee Chair
*This group is set up based on requests from test tool vender

SD Express & UHS-II Verification Program Ad-hoc
Managed by Compliance Committee Chair

Compliance WG Co-Chair
Hiroshi Noda, Canon
Shinji Inoue, Panasonic

Designated Labs
Allion Test Labs. (SDHC/SDXC/UHS-I/UHS-II/UHS-III)
Panasonic (SDHC/SDXC/UHS-I)
Granite River Labs, (UHS-II/UHS-III/SD Express)
SD Standard Specification Overview
And
New Standard Ver.8.00 SD Express
SD Card Types

- **Form Factors**
  - Standard SD Card  
  - microSD Card

- **Functions**
  - SD Memory Card  
  - SDIO Card  
  - SD Combo Card (SD Memory + SDIO Functions)  
    - iSDIO Wireless LAN SD Card  
    - iSDIO TransferJet SD Card  
  - smart microSD  
    - microSD with Secure Element or with/without NFC interface

- **Memory Capacities**
  - SDSC: Standard Capacity (≤ 2GB) / SDHC: High Capacity (2GB< - ≤32GB)
  - SDXC: eXtended Capacity (32GB< - ≤2TB)
  - **SDUC: Ultra Capacity (2TB< - ≤128TB)**

- **Bus Interfaces**
  - Non UHS (Non Ultra High Speed) Card  
    - Default Speed : 12.5 MB/sec  
    - High Speed : 25 MB/sec
  - **UHS-I Card**  
    - UHS 50: SDR50 is mandatory (50MB/sec Max.)  
    - UHS104: SDR50 and SDR104 is mandatory (104MB/sec Max.)
  - **UHS-II Card**  
    - UHS156: FD156 is mandatory (Full Duplex 156MB/sec Max.)  
    - HD312 is optional (Half Duplex 312MB/sec Max.)
  - **UHS-III Card**  
    - UHS312: FD312 is mandatory (Full Duplex 312MB/sec Max.)
    - UHS624: FD624 is mandatory (Full Duplex 624MB/sec Max.)
  - **SD Express Card (New)**  
    - PCIe Gen.3 x 1 Lane : (985MB/sec Max.) & NVMe protocol with legacy UHS-I interface
    - PCIe Gen.3 x 2 Lane / Gen.4 x 1 Lane : (1,970MB/sec Max.) & NVMe protocol with legacy UHS-I interface
    - PCIe Gen.4 x 2 Lane : (3,940MB/sec Max.) & NVMe protocol with legacy UHS-I interface
### 1. SD Logo: Capacity (4 Types)

- **2000**: ≤ 2GB Standard Capacity
- **2006**: 2GB < - ≤ 32GB High Capacity
- **2009**: 32GB < - ≤ 2TB eXtended Capacity
- **2018**: 2TB < - ≤ 128TB Ultra Capacity

### 2. Bus Mark: Data Transfer Performance

- **No Mark**
- **UHS-I**
- **UHS-II**
- **UHS-III**
- **SD Express**: PCIe Gen.3 Gen.4

### 3. Speed Class Mark: Video Recording

- **Speed Class**
- **UHS Speed Class**
- **Video Speed Class**
### SD Ver.8.00 SD Express PCIe Gen.4 x 2 Lane

<table>
<thead>
<tr>
<th>Pin Layout</th>
<th>SD Memory Card</th>
<th>SD Express Memory Card</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCIe Bus Interface</td>
<td><img src="image1.png" alt="Image" /></td>
<td><img src="image2.png" alt="Image" /></td>
</tr>
<tr>
<td>SD Bus Interface</td>
<td><img src="image3.png" alt="Image" /></td>
<td><img src="image4.png" alt="Image" /></td>
</tr>
</tbody>
</table>

- **Capacity (file system):**
  - Ultra Capacity: Up to 128TB (UHS-I)
  - Extended Capacity: Up to 2TB (UHS-II)
  - High Capacity: Up to 32GB (UHS-I)
<table>
<thead>
<tr>
<th>Bus Mode</th>
<th>Clock Frequency</th>
<th>Interface Method</th>
<th>Bus Maximum Performance</th>
<th>Spec. Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>Default Speed (DS)</td>
<td>25MHz</td>
<td>3.3V single-ended</td>
<td>12.5MB/sec</td>
<td>1.01</td>
</tr>
<tr>
<td>High Speed (HS)</td>
<td>50MHz</td>
<td>3.3V single-ended</td>
<td>25 MB/sec</td>
<td>1.10</td>
</tr>
<tr>
<td><strong>UHS-I</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SDR12</td>
<td>25MHz</td>
<td>1.8V single-ended</td>
<td>12.5MB/sec</td>
<td></td>
</tr>
<tr>
<td>SDR25</td>
<td>50MHz</td>
<td>1.8V single-ended</td>
<td>25 MB/sec</td>
<td></td>
</tr>
<tr>
<td>SDR50</td>
<td>100MHz</td>
<td>1.8V single-ended</td>
<td>50 MB/sec</td>
<td>3.01</td>
</tr>
<tr>
<td>SDR104</td>
<td>208MHz</td>
<td>1.8V single-ended</td>
<td>104 MB/sec</td>
<td></td>
</tr>
<tr>
<td>DDR50</td>
<td>50MHz</td>
<td>1.8V single-ended</td>
<td>50 MB/sec</td>
<td></td>
</tr>
<tr>
<td><strong>UHS-II</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FD156</td>
<td>52MHz x 30 (PLL)</td>
<td>UHS-II PHY</td>
<td>156 MB/sec</td>
<td>4.00</td>
</tr>
<tr>
<td>HD312</td>
<td>52MHz x 30 (PLL)</td>
<td>UHS-II PHY</td>
<td>312 MB/sec</td>
<td>4.20</td>
</tr>
<tr>
<td><strong>UHS-III</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FD312</td>
<td>52MHz x 60 (PLL)</td>
<td>UHS-III PHY</td>
<td>312 MB/sec</td>
<td>6.00</td>
</tr>
<tr>
<td>FD624</td>
<td>52MHz x 120 (PLL)</td>
<td>UHS-III PHY</td>
<td>624 MB/sec</td>
<td></td>
</tr>
<tr>
<td><strong>PCIe</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gen.3</td>
<td>100MHz x 40 (PLL)*</td>
<td>PCIe Gen3 PHY</td>
<td>1-Lane 1GB/sec</td>
<td>7.00</td>
</tr>
<tr>
<td>Gen.4</td>
<td>100MHz x 80 (PLL)*</td>
<td>PCIe Gen4 PHY</td>
<td>1-Lane 2GB/sec</td>
<td>8.00</td>
</tr>
</tbody>
</table>

* Theoretical Value
SD Express Card: Background

Client Computing, Imaging, Automotive – Transition to Higher Speed Interfaces
New Markets Demand More Memory with Higher Speed

- Autonomous vehicles and connected cars with multi-sensor data collection & processing
- Multi-channel video capture
- Gaming with 3D high resolution graphics
- New evolving imaging market (360o, VR, AR etc...)
- Imaging market is already heading to PCIe
- Edge Computing Gateway: High Speed, Small and Robust
Advantages of PCIe Interface

- **PCIe® standard developed by PCI SIG**
  - PCIe Gen 3 (up to 8Gb/s) and Gen 4 (up to 16Gb/s) are proven….
  - PCIe released already Gen 5 and Gen6 is underway…

- **NVMe™ standard developed by NVM Express**
  - The command layer protocol for Non Volatile Memories that teamed up with PCIe…
  - A scalable and sophisticated protocol – ready to handle future system needs
  - Become more and more popular as the de-facto standard for SSDs and other…
  - Supported by all major OSs
  - Proven test environments were defined

*Both are world wide recognized as the preferable protocols for future needs ➔ Easy to adopt !*

**PCle and NVMe Interfaces – Test Advantages**

Many Bus Analyzers, Protocol Analyzers, Test Suites are in the market…

PCIe® is registered trademark of PCI-SIG. NVMe™ is trademark of NVM Express
Summary of New SD Standards

- SDA defined until today performance standards for sequential writes serving the imaging market with focus on growing demands of video capturing
  - SDA defined UHS-III (624MB/s) to further enhance these market needs

- But its not just storing content …its App Running demanding enhanced random access…
  - SDA defined Application Perf Class A1 (Nov. 2016) and A2 (Feb. 2017) along with enhanced features; Command Queuing, Cache and Maintenance

- Evolving technology trends of mobile SoCs raised a request to operate only with 1.8v Signaling (w/o need for 3.3v initialization)
  - SDA defined the Low Voltage Signaling card with full backward compatibility

- New evolving technologies of multi-core, high-speed IOs with SD Express PCIe Gen.3 & Gen.4 NVMe will raise even higher demands for SD card performance in high end applications
  - 1.8W Max. Power Consumption vs (Normal SSD ~ 3W)
  - Bus Mastering for inter chip communication between devices to help efficient latency path and longer battery life
  - Dedicated CMD Queue in DRAM for every CPU core
  - Host Memory Buffer (HMB) to save cost (No SRAM Model)
  - Backward Compatibility with SD Interface
SDA Office – Official Address (Inventures Offices):
SD Card Association, 5000 Executive Parkway, Suite 302, San Ramon, CA 94583, USA
T: +1.925.275.6698 | E-Fax: +1.925.886.4870 | M: +1.510.427.6976

The team that directly supports the SDA with their titles related to SDA:

- Stan Moyer – Executive Director
- Kevin Schader – Director of Communication
- Belinda Lucero - Marketing & Events Manager
- Jessica Esparza – Finance
- Jamie Reyes – Membership Services
Thank You

Email: kazunori.nakano@kioxia.com
Global Workshop Taiwan

SD Express Host Implementation

Yosi Pinto
SDA Chairman of the Board/Technical Committee Chair (SanDisk LLC)
Agenda

- SD Standard Evolution
- SD Express Host Implementation
  - How to implement hosts with SD Express interface using SDA’s Host Controller Spec
  - Other implementation methods
SD Memory Card Standard Evolution

~800 members as of December 2021

2000
SD Card Introduced

2004
High Speed mode of 25MB/s (SD Ver.1.10)

2005
microSD Introduced (SD Ver.1.20)

2006
SDHC Introduced (SD Ver.2.00)

2009/10
UHS-I mode 104MB/s, SDXC (SD Ver.3.00/3.01)

2011
UHS-II mode 312MB/s (SD Ver.4.00)

2017
UHS-III mode 624MB/s Command Queue Low Voltage (SD Ver.6.00)

2018/19
SD Express & microSD Express (PCIe®/NVMe™) 985MB/s, SDUC (SD Ver.7.00/7.10)

2020
SD Express (PCIe®/NVMe™) up to 4GB/s (SD Ver.8.0)


>5 Billion SD & microSD cards sold by 2019*. SD is the de-facto worldwide removable memory card standard

©SD Association. All Rights Reserved.
SD Express Benefits and Implementation Method
Material published by SDA that you may use

- **SD Express Host Implementation Guideline** (for SD7.x cards)

- **SD Express Test Fixtures** –
  - As explained in the [SD7 Test Guideline](#)
    Enables Host and Card vendors to test their PCIe interface using standard test equipment
    The set is available for borrow by our members at our approved labs (GRL and Allion)
  - As explained in the [SD8 Test Guideline](#)
    Similar test fixtures for SD8.0 cards are currently under development and expected to be ready in Q2/2022

- **SDA Brochure** – updated for SD8.0

- **Two SD Express whitepaper** (updated with new material about SD8.0):
  - [SD Express Memory Cards with PCIe® and NVMe™ Interfaces](#)
  - [SD Express and microSD Express Cards: The Best Choice for Your Future Product Designs](#)
SD Express Host Implementation
Pinout Functionality in SD Express Cards – General Description

- 1st row: conventional SD in SD mode or PCIe side band (PERST#, CLKREQ#, REFCLK+/-) in PCIe mode
- 2nd row: PCIe 1st lane differential IO’s in PCIe mode
- 3rd row: PCIe 2nd lane differential IO’s in PCIe mode
SD Express Host Controller – Full Circuit Example

- **SD Express Capable Host**
  - SD Host Controller (at least 3.0)
  - PCIe Port (Hot Plug Supported)
  - Card Detection
  - SDCLK
  - CMD
  - DAT[3:0]
  - PRSNT#
  - REFCLK+/-, PERST#, CLKREQ#
  - PCIe Tx +/-, Rx +/-
  - Interrupts
  - Card Insertion
  - Card Removal
  - Supply control

- **SD Express Card Socket**
  - VDD1
  - VDD2
  - Card Detect SW
  - First Row
  - Second Row

- **New**
  - VDD1_ON
  - VDD2_ON

- **PCIe/NVMe Interface_Enable**
  - VDD2_ON

- **VDD1_ON**
  - 3.3v
  - 1.8v

**VDD2**

**New**

- Card Detection
- SDCLK
- CMD
- DAT[3:0]
- PRSNT#
- REFCLK+/-, PERST#, CLKREQ#
- PCIe Tx +/-, Rx +/-
- Interrupts
- Card Insertion
- Card Removal
- Supply control
SD Express Host Implementation

SD Express Capable Host

SD Host Controller (at least 3.0)

Card Detection
SDCLK
CMD
DAT[3:0]

Interrupts
Card Insertion
Card Removal

VDD1_ON
Supply control
3.3v

SD Express Host Controller – Building blocks:
⇒ SD Host Controller (at least v3.0)
SD Express Host Implementation

SD Express Capable Host

- SD Host Controller (at least 3.0)
  - SDCLK
  - CMD
  - DAT[3:0]
  - Interrupts
  - Card Insertion
  - Card Removal

- PCIe Port (Hot Plug Supported)
  - PCIe Tx +/-, Rx +/-
  - REFCLK+/-, PERST#, CLKREQ#
  - PRSNT#

Supply control
- VDD1_ON
- 3.3v

SD Express Host Controller – Building blocks:
- SD Host Controller (at least v3.0)
- PCIe Port with hot plugin support
SD Express Host Implementation

SD Express Capable Host

SD Host Controller
(at least 3.0)

PCIe Port
(Hot Plug Supported)

Card Detection
SDCLK
CMD
DAT[3:0]

PRSNT#

PCIe Tx +/-, Rx +/-

REFCLK+/-, PERST#, CLKREQ#

Supply control

VDD1_ON

VDD2_ON

3.3v

1.8v

SD Express Host Controller – Building blocks:

⇒ SD Host Controller (at least v3.0) + VDD2_ON & PCIe/NVMe_Interface_Enable (New)
⇒ PCIe Port with hot plugin support
SD Express Host Implementation

SD Express Capable Host

SD Host Controller (at least 3.0)

PCIe Port (Hot Plug Supported)

Card Detection
SDCLK
CMD
DAT[3:0]

PRSNT#
REFCLK+/-, PERST#, CLKREQ#
PCIe Tx +/-, Rx +/-

SD/PCIe Sel
4-bit Signal Switch for 1st row Signals

New

VDD1_ON
Supply control

VDD2_ON

New

VDD2_ON

PCIe/NVMe_Interface_Enable

INTERRUPTS
Card Insertion
Card Removal

NEW

SD Express Host Controller – Building blocks:

- SD Host Controller (at least v3.0) + VDD2_ON & PCIe/NVMe_Interface_Enable (New)
- PCIe Port with hot plugin support
- 4 bit Signal Switch (New)
SD Express Host Implementation

SD Express Capable Host

SD Host Controller (at least 3.0)

PCIe Port (Hot Plug Supported)

VDD2_ON

PCIe/NVMe_Interface_Enable

Interrupts

Card Insertion Card Removal

Card Detection

SDCLK

CMD

DAT[3:0]

SD/PCIe Sel

4-bit Signal Switch for 1st row Signals

New

VDD1_ON

Supply control

VDD1

VDD2

3.3v

1.8v

Card Detect SW

First Row

Second Row

New

New

New

New

SD Express Card Socket

SD Express Host Controller – Full Circuit
SD Express Host Controller – Operation:
Card Insertion-detection
SD Express Host Implementation

SD Express Capable Host

SD Host Controller (at least 3.0)

PCIe Port (Hot Plug Supported)

SD Express Card Socket

VDD1_ON
Supply control

VDD2_ON

3.3v
1.8v

Card Detection

SDCLK

CMD

DAT[3:0]

PRSNT#

PCIe/NVMe_Interface_Enable

Interrupts
Card Insertion Card Removal

SD driver initiates the SD card & checks PCIe support

SD Express Host Controller – Operation:
PCIe support check
**SD Express Host Controller – Operation:**

**SD Driver indicates to card to move to PCIe mode and switch its internal host circuits to operate through PCIe interface**
SD Express Host Controller – Operation:
SD Driver Transfer control to the PCIe host and start operation through PCIe channel.

SD Express Capable Host

- SD Host Controller (at least 3.0)
- PCIe Port (Hot Plug Supported)
- PCIe/NVMe Interface_Enable
- PRSNT#
- Card Detection
- SDCLK
- CMD
- DAT[3:0]
- PCIe Tx +/-, Rx +/-
- REFCLK+/-, PERST#, CLKREQ#

SD Express Card Socket

- VDD1
- VDD2
- Card Detect SW
- PCIe/NVMe Interface_Enable
- PRSNT#
- VDD2_ON
- VDD1_ON
- Supply control
- 3.3v
- 1.8v

SD driver asserts:
- VDD2_ON
- PCIe/NVMe_int_Enable

PCIe & NVMe drivers:
PCIe & NVMe drivers starts operation.
The shown example recommends to initiate first through SD interface and than switch to PCIe, if supported.
Host may be also implemented with initiation first through PCIe interface (the specification allows it)
SD Express Host Implementation - other possible methods

Off the shelf components that may serve PCIe or USB3 to SD Express Interface
Thank You

Email: yosi.pinto@wdc.com
Global Workshop Taiwan

SD Express Host Controller

Louis Lu
Senior Manager (Bayhub)
Why SD Express?  - Image sensor trend

- Current pixel size is 100Mpixel and it will exceed 500M pixel in 2025
- Human eyes’ resolution is 500M pixel
- Larger and faster storage is a MUST trend for both removable and embedded
Why SD Express? - Worldwide IP Traffic Trend

- Worldwide IP traffic increased from 100EB (2016) to 270EB (2021)
- Consumer devices drive IP traffic explosion
- Larger and faster storage is a MUST trend for both removable and embedded

Exabyte/month

- Business
- Consumer

1 Exabyte = 10^6 Tera byte
SD Host Devices Now and Future

- SD host products have strong motivation for larger and faster removable media
- SD Express has the best positioning to support the trend
- SD Express eco-system is ready
  - SD Express host controller, SD Express card, SD Express card controller
- BayHub offers SD Express host controllers for above all SD host products
BayHub SD7.x Host Solutions

- For SD7.x Host, below solutions are available:
  - Solution-1: BH770GG7 (PCIe-to-SD7.x Bridge Chip)
  - Solution-2: BH768GG7 (Companion Chip)

**Solution-1: BH770GG7 (PCIe to SD7.x Bridge)**

BH770GG7 will work system’s PCIe-port which supports Hot-plug.

**Solution-2: BH768GG7 (Companion Chip)**

BH768GG7 will work system’s SD Host and PCIe-port which supports Hot-plug.
BayHub Legacy SD Host Solutions

- OZ711LV2 PCIe to SD3 host controller
  - Host interface; PCIe
  - SD3 (UHS-I) support
  - Package; 32QFN (4 x 4mm)
  - High performance and ultra low power
  - Successful track record in PC and embedded industry

- BH201 Native SD3 companion chip
  - Bidirectional signal re-driver
  - QFN28 (4x4mm)
  - High performance and ultra low power
  - Successful track record in PC and mobile device industry
BayHub Technology

☐ Bridge IC and SD host controller leading company
☐ Strong expertise in SD, eMMC, PCIe, USB, SATA, Hi-speed I/O, etc.
☐ Worldwide office to support customers
☐ Strong partnership in SD eco-system
  – SD card vendors, card controller vendors, testing companies, etc.
☐ Strong partnership with platform companies
  – Intel, AMD, Google, etc.
☐ Strong partnership with SD host products companies
  – PC, camera, game, etc.
Thank You

Email: louis.lu@bayhubtech.com
Global Workshop Taiwan

存裝置生態系
2022 SDA SD Express 產品應用工作坊技術研討會

Jim Shiau
Manager (Realtek)
SD Express 生態系的入口: SD Express 讀卡機晶片

- SD Express 讀卡機晶片高度整合存取 SD Express 卡必要功能，能加快電子產品開發

- 市場上有 Universal Serial Bus (USB) 和 PCI Express (PCIe) 讀卡機晶片要如何挑選？

PCIe or USB？？

PCI Express

- VS -

RTL9211DS

SUPERSPEED+

10 Gbps

PCIe is trademark of of PCI-SIG. USB is trademark of USB-IF.
讀卡機晶片選擇第一關：產品的系統底層能否客製化？

- 底層客製化舉例：例如開啟系統的PCIe熱插拔功能，系統也要支援熱插拔，產品屬性可額外安裝驅動程式，需要修改BIOS配置一些東西，是否搭配固定系統...

是

× 否
讀卡機晶片選擇第二關：產品的是否當外接式裝置/或走線較長

☐ 外接式裝置表示不和系統整合（如外接式讀卡機），或是走線較長需要使用線

是

否
讀卡機晶片選擇第三關：產品是否極端在意BOM cost

- 談錢傷感情...但如您的產品在前兩關兩者都可選的話...

是

PCI EXPRESS

否

PCI EXPRESS

SUPER SPEED+ USB 10 Gbps
SD Express讀卡機晶片適合的產品與介面

看狀況選擇！
SD Express的應用範例1: 後疫情時代的辦公方式

- 後疫情時代的辦公方式
  - 居家辦公於疫情間雖不完美但是證明可行
  - 混和辦公(hybrid workplace)趨勢
    - 部份員工居家辦公，部份來公司辦公。公司不用租大場地(省錢) ，不再是每個員工有座位，公司變成開會/實驗/討論的空間
    - 員工配發筆電，非固定位需預約座位 (Hot Desk的方式)
      - 座位統一，標配docking擴充基座和螢幕方便員工連接筆電
      - 辦公室私人空間受限，下班要清空，家和公司兩邊跑，東西難帶多

- SD Express卡輕薄短小速度超過SATA SSD，使用直覺不用要拆開筆電即插即用，是擴充空間或備份資料的好幫手
- SD Express卡用NVMe協議時支援SMART，可簡單了解卡片健康度，能提前示警用戶，確保重要資料的完整性
- SD Express讀卡機可兼容目前CP值很高的UHS-I卡，亦可滿足對價格敏感但速度要求普通的使用者
SD Express的應用範例2：自駕車

- 自駕車
  - 自駕車撞車，釐清責任
  - 提供真實路況資料供製造商訓練下一代AI模型

- SD Express卡採用NVMe協議，適合多工，且有足夠頻寬，可以同時記錄多鏡頭行車影像，多感測器數據，自駕系統判斷的log作為撞車後釐清責任的依據

- SD Express卡是抽換式的適合數據紀錄這種不斷寫入損耗NAND flash壽命的情境

- SD Express卡向下兼容UHS-I協議，近10年的SD讀卡機產品都可以讀取，方便一般使用者使用，讀取行車紀錄
常見疑問?

- 我的系統只支援PCIe Gen2或是USB3.2 Gen1, 使用SD Express讀取卡機晶片會有幫助嗎?
  - 有!
  - 不管是PCIe或是USB協議都可以向下兼容, 這一類系統搭配SD Express讀取卡機晶片和SD Express記憶卡可以得到快500MB/s的速度, 接近SATA SSD (600MB/s)速度

- 市場上真的有這一類SD Express的產品嗎?
  - 有!
  - 在瑞昱於2019推出SD Express讀取卡機晶片後, 搭載SD Express讀取卡機晶片的系統(筆電)前年2020就開始可以買到, 去年2021有更多家筆電廠商不約而同推出多款SD Express相關產品可供選購, 2022已知會有更多產品, 敬請期待!!~ 另外卡片也可以在去年2021買到了, 所以從讀卡機到卡都有了
Thank You

Email: jim_shiau@realtek.com
Global Workshop Taiwan

ConceptD & SD Application

CT Chen
Senior Manager of Product Management (Acer)
This is how we discovered

We research the target audience for overall laptops over the world.

METHODOLOGY

- Homework
- Lifestyle collage
- Laptop usage
- Other devices / IOT
- Retail simulation
- Acer Brand
We discovered the "Creator" segment since then...
ConceptD Logo Design

Concept D
"PERFORMANCE = NOISE?"

"WHAT I IMAGINE IS NOT WHAT I SEE"

UNTAPPED NEEDS FROM CREATORS

"I want to create whenever, wherever"

"I want a nice looking machine that's different"
Design Principle

- **Built for PRECISION**
  - Color Accuracy
  - Screen Resolution
  - High Refresh Rates

- **Built for PERFORMANCE**
  - Supreme Processor Performance
  - Optimum Graphic Performance
  - High Storage & Memory Space

- **Built for SILENCE**
  - Efficient Thermal Solution
  - Enhanced Air Flow
  - Silent Operation

- **Built for DESIGN**
  - Thin-and-Light Design
  - Clean and Elegant
  - Practical and Ergonomic
Design focus

Sketching is the fundamental for the design

“I prefer drawing to talking. Drawing is faster, and leaves less room for lies”
Charles-Édouard Jeanneret-Gris a.k.a. Le Corbusier (1887-1965) architect

“Drawing is putting a line (around an idea. “
Henry Matisse (1869 - 1954) artist

“I have learned that what I have not drawn, I have never really seen”
Frederick Franck (1909 - 2006) sculptor

“You can’t do sketches enough. Sketch everything and keep your curiosity fresh.”
John Singer Sargent (1856 - 1925) artist
ConceptD 7 Ezel Pro

A NEW TWIST ON CREATION

A one step high performance laptop for all your creative needs. This convertible laptop with five available display modes, is ideal for professional 3D graphics artists who need the speed and responsiveness of a desktop in a highly portable format to demonstrate and correct their creations in real-time.
Elevate Your Creative Workflow

Acer’s patented Ezel Hinge™ gives users five modes to choose from, allowing them to easily collaborate with others in share mode, create efficiently in float mode, work on the move with pad mode, present their work in display mode, and otherwise work in peace in standard mode.
ConceptD Signature design - Ezel

ConceptD 3 Ezel (14‘)

ConceptD 7 Ezel (15.6‘)

ConceptD 3 Ezel (15.6‘)
Usage Behavior

#Major complaints are mostly aligned with our known facts

5. Tell us your top 3 DISLIKES of this ConceptD device based on your creation experiences:

- Audio
- Fingerprint
- Keyboard
- Service
- Software
- Others

SD Card

"Missing SD card reader"

"NO SD input"

“没有SD读卡器口”
Packed with Ports

This laptop comes packed with every port you may need such as HDMI, SD 7.0, and many more. Further, quickly move even the largest of files or work between multiple devices and displays with the Thunderbolt™ 4 USB Type-C port, giving you file transfer speeds of up to 40Gbps.

- SD 7.0 Card Reader
- USB 3.2 Gen 2 Type-A
- USB Type-C w/ Thunderbolt™ 4
- Mini DisplayPort
Concept D™ x 20 YEARS OF INNOVATION 2000-2020
Thank You

Email: CT.Chen@acer.com
SVP 介紹
SD and UHS-II Verification Program

Sandy Chang
Taiwan Technical Director (Granite River Labs)
SVP 介紹

SVP -SD Express/UHS-II Verification Program

- SDA 協會推出的驗證計畫，讓 SDA 會員能夠進行以下測試：
  - SD Express Electric 測試
  - UHS-II Electric 測試
  - PCI Express Protocol 測試
- SVP 計畫提供 SDA 會員較低成本測試費用與更好的性能測試
- 通過 SVP 測試的產品，SDA 官網會列入“已通過驗證”的產品，供使用者查詢
- SVP 兩種測試時程方案
  - Test Shuttle 共享專車方案：固定送測時間表，好處是能夠與其他 SDA 會員一同分攤測試費用 （下一班車 Shuttle：2022 Q1）
  - On Demand 隨到即測方案：提供立即測試服務
當產品的傳輸速度不斷提升，協議越來越複雜，同時，所帶來相容性問題的風險也越高。對此高速測試驗證環境所需要投入資源也更昂貴。SVP 提供更符合成本效益的 Signal Integrity 與 Protocol 測試方案。

SDA 在初始階段會對 SVP 測試費用進行補貼，以快速啟用該計劃。

SDA 官網將公布通過 SVP 測試的產品清單，讓終端消費者可以搜尋及確認符合品質要求的產品。
首要步驟：成為SDA會員，然後進入SVP網頁

成為SDA協會會員（需為SDA才能後瀏覽相關內容）

進到“SVP Portal”，且為您將要認證的產品註冊“SVP Verified Product”

將待測物寄送至SVP指定實驗室（Granite River Labs: GRL）

GRL進行SVP測試

Pass

Pass的產品被列上SVP Verified Product資料庫且在SVP Member Portal & SDA Public Site皆可查詢
## SVP 產品列表

### SDA SVP Product List

#### UHS-II

<table>
<thead>
<tr>
<th>No.</th>
<th>Listed Date</th>
<th>Product Type</th>
<th>Company</th>
<th>Brand</th>
<th>Model</th>
<th>Revision</th>
<th>SD Specs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Listed Date1</td>
<td>Product Type1</td>
<td>Company1</td>
<td>Brand1</td>
<td>Model1</td>
<td>Revision1</td>
<td>SD Spec Version1</td>
</tr>
<tr>
<td>2</td>
<td>Listed Date1</td>
<td>Product Type1</td>
<td>Company1</td>
<td>Brand1</td>
<td>Model1</td>
<td>Revision1</td>
<td>SD Spec Version1</td>
</tr>
</tbody>
</table>

Showing 1 to 2 of 2 entries

#### SD Express

<table>
<thead>
<tr>
<th>No.</th>
<th>Listed Date</th>
<th>Product Type</th>
<th>Company</th>
<th>Brand</th>
<th>Model</th>
<th>Revision</th>
<th>SD Specs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Listed Date</td>
<td>Product Type</td>
<td>Company</td>
<td>Brand</td>
<td>Model</td>
<td>Revision</td>
<td>SD Spec Version</td>
</tr>
<tr>
<td>2</td>
<td>Listed Date</td>
<td>Product Type</td>
<td>Company</td>
<td>Brand</td>
<td>Model</td>
<td>Revision</td>
<td>SD Spec Version</td>
</tr>
</tbody>
</table>

Showing 1 to 2 of 2 entries

- 可下載名單
- 可篩選
- UHS-II 與 SD Express 分別列表
Who is GRL?

☐ 自2013年起，擔任SDA的執行委員

☐ SD 協會指定實驗室

☐ 提供SD卡生態系統測試服務&解決方案

☐ GRL的總部位於美國矽谷中心

  ● 全球8個據點以服務全球各地廠商
  ● SD Card/Host 測試服務 & 除錯分析
  ● SD Card/Host 解決方案（電性層&協議層測試方案）
  ● GRL 為SVP獨家指定的測試實驗室

https://graniteriverlabs.com/
Thank You

Email: schang@graniteriverlabs.com
Global Workshop Taiwan

SD Express 卡片介紹與應用範例
SD Express Card and Applications

Rex Kuo
PM Manager (Phison)
SD Express 卡介紹

SD Express card introduction
SD Express Card 概述
SD Express Card description

SD7.0 (SD Express) Spec
在2018年六月導入

PCIe Gen3, Gen4 and NVMe v1.3 v1.4 介面導入

沿用目前SD card外觀設計

向下相容Legacy SD 平臺
SD Express 一張像SSD的卡
SD Express Card is a SSD like SD card

集結SSD優點及向下相容現行SD介面的全新世代存儲卡

Good Things from PCIe NVMe SSD
- SSD grade performances and features
- PCIe/NVMe – a continuously innovated market-wide platform
- Scalable SW stack widely supported
- Bus mastering and reduction ram and cost
- Leveraging existing investments for card and products manufacturers

Good Things from SD Card
- Most popular removable card in consumer market
- Enhanced features added: Command Queue, Cache
- SD UHS-I operation mode supported
SD Express Card is currently the portable storage device that reaches SSD speed levels.
### Differences between SD Express and legacy SD card

<table>
<thead>
<tr>
<th></th>
<th>Transmission Interface</th>
<th>Transfer Speed</th>
<th>Pad Design</th>
<th>Compatibility</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SD Express</strong></td>
<td>PCIe</td>
<td>Up to 3940MB/s</td>
<td>2 row/3 row</td>
<td>Support PCIe &amp; UHS-I</td>
</tr>
<tr>
<td><strong>Legacy SD</strong></td>
<td>UHS-II</td>
<td>Up to 312MB/s</td>
<td>2 row</td>
<td>Support UHS-II &amp; UHS-I</td>
</tr>
<tr>
<td><strong>Legacy SD</strong></td>
<td>UHS-I</td>
<td>Up to 104MB/s</td>
<td>1 row</td>
<td>Support UHS-I</td>
</tr>
</tbody>
</table>

![Pin Layout](image-url)
SD Express Card 應用
SD Express card applications
等級傳送速率的應用渴望

Applications

1. 檔案容量變大
   Larger Content Size

2. 連拍攝影
   Burst mode photo shooting

3. VR & AR的應用
   More VR & AR Content

4. RAW檔格式照片
   Record RAW Content

5. 8K以上高畫質影片
   More 8K+ Resolution (10K, 16K in the future)
未來展望-SD Express Card 一日生活

Future – 1 Day life with SD Express card

未來高速存儲的需求，會充滿你的生活周遭
透過SD Express Card來滿足這類的需求
隨著5G時代來臨，各類裝置間的資料傳輸即時性要求會越來越高，未來高速存儲的存在是無可或缺的。
目前SD Express解決方案的供應鏈已成型，從Host, Connector, Reader/Bridge, Card都有整套的對應方案。
Phison SD Express 卡片方案
Phison SD Express Card solution PS5017


FEBRUARY 24, 2021

PHISON IS THE FIRST TO SHIP THE NEW PCIe SD EXPRESS CARD (SD 7.0)

San Jose, Calif. — February 24th, 2021 — Phison Electronics Corp., a global leader in NAND flash controllers, integrated circuits, and storage solutions, announced today that it will be the first to ship the new PCIe interface SD card, SD Express 7.0. The card will start shipping in March 2021 and will come in a PS5017 and a PS5018 variant.

SD Express (SD 7.0) is the first memory card to apply a PCIe interface in an SD interface compatible with all the existing but not SD slots. This innovation takes the

https://www.youtube.com/watch?v=RjrbhKD8O48&ab_channel=PhisonElectronicsCorp.
## Phison SD Express 卡片方案

**Phison SD Express Card solution PS5017**

<table>
<thead>
<tr>
<th>Controller</th>
<th>Sequential Read/Write (up to)</th>
<th>Capacity</th>
<th>NAND Flash</th>
<th>Application Performance Class</th>
<th>Video Speed Class</th>
<th>UHS Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>PS5017</td>
<td>870/740 MB/s</td>
<td>256GB ~ 1TB</td>
<td>3D QLC</td>
<td>A1</td>
<td>V30 (SD Express)</td>
<td>U3</td>
</tr>
</tbody>
</table>

### Performance Graph

- **Read**
- **Write**

![Performance Graph](image_url)
Thank You

Email: rex_kuo@phison.com
SD Card/Host Compliance and Test Services

Hitoshi Hatakeyama
Senior SI Expert/Sales Engineering Supervisor
(Allion Labs)
Allion Test Service for SD Card and Host

• For Host
  – SQ (Signal Quality) Test and Power Management
  – Protocol Test
  – File System/ Format Function
  – Design Verification: Includes Other Logo: USB/PCIe
• For Card
  – Mechanical Test: 3D-Dimension/Surface Roughness
  – Host Interoperability
SD Host Fail Analysis Example

• Problem Occurred: Card Data Lost on Certain SD Host
• Root Cause Found: Power On Control, Protocol Error

Host Command LOG: Protocol Analyzer
SD Card Interoperability Test

In the questionnaire of the SDA IOP events, there was an opinion from a participant company that “it would like to increase the number of host devices”. Allion can prepare multiple devices as “SD Host Devices” from the following categories. The following categories are topical products that use SD cards. We would like to select host devices based on the market share.

- Music Player
- Game Console
- Drone
- Action CAM
- Professional Camera
- Car Navigation System
- Drive Recorder
- Mobile Phone
SD Card Mechanical Test

• Environmental Test : Harsh Environments (For Automotive)
• Durability Test with Connectors: Insertion and Removable
• Mechanical Dimensions with 3D
• Any Other Tests for Physical /Mechanical
Card Mechanical Dimension Test Environments

- Surface Roughness Measure
  - Wide-Area 3D Measurement System with 3D Analysis Software

3D Image of the Card Surface
Test Environments: Insertion & Removable

- 4.1.1 Total Insertion Force, Total Pulling Force
Allion is the premier resource for all of your third party testing needs. Our services bring products to market more quickly, reliably, and cost effectively to protect your brand quality and that of your suppliers.

Thank you

© 2021 Allion Labs Inc. All rights reserved. No text, logo, or graphic from this document may be copied or retransmitted unless expressly permitted by Allion Labs Inc. and their respective owners.
QUESTIONS???