



SDA 2021 GLOBAL WORKSHOP EVENT

USA Webinar

October 27, 2021 | 2:00pm Pacific Time

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Welcome and Introduction

Sharlene Chin

Senior Product Manager (SanDisk LLC)

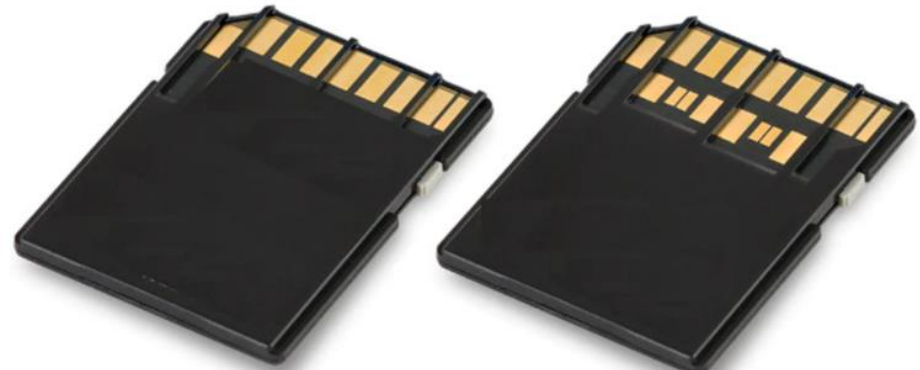
The SanDisk logo, featuring the word "SanDisk" in a bold, red, sans-serif font.

Global Workshop Webinar Presenters

- | | | | | | |
|---|--|---|---|---|---|
| 1 | Opening and Introduction - Sharlene Chin, Sr. Product Manager SDA Member Company, SanDisk LLC |  | 6 | SD Express Interconnect Solution Provider - Zhineng Fan, Technologist SDA Member Company, Amphenol |  |
| 2 | SDA and Technology Update - Kazunori Nakano SDA Board Member & Marketing Committee Chair |  | 7 | Lexar Introduction of SD Express - Julia Huang, Sr. Marketing Manager SDA Member Company, Lexar |  |
| 3 | SD Express Host Implementation - Yosi Pinto SDA Chairman of the Board |  | 8 | AMP SD Express Solutions Roadmap - Rick Neil, Application Engineer SDA Member Company, AMP Inc. |  |
| 4 | SVP Introduction - Miki Takahashi, Exec. VP of Engineering SDA Member Company, Granite River Labs |  | 9 | Delkin Devices SD Express Cards - Jenn Sherry, WW Retail Sales Director SDA Member Company, Delkin Devices |  |
| 5 | SD Express Applications - Anson Phan, Sr. Product Manager SDA Member Company, Phison |  | | | |

What is the SD Association?

- ☐ Established in 2000
- ☐ A global ecosystem of companies
- ☐ Develops and promotes memory card storage standards
- ☐ 800 member companies strong





SD Association Overview and New SD Standard Ver. 8.00

Kazunori Nakano

SDA Board of Directors/Marketing Committee Chair (KIOXIA)

KIOXIA

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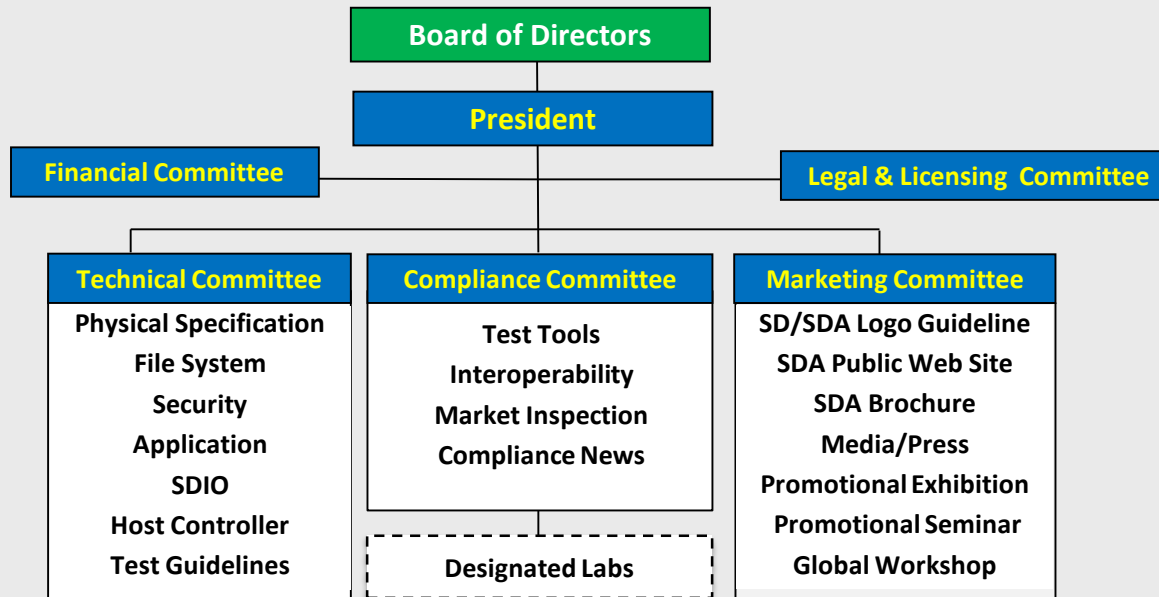
- **SD Association Overview**
 - Organization
 - License Scheme & Compliance
 - Benefit of SDA Membership
- **SD Standard Specification Overview and New Standard Ver.8.00**
 - SD Specification Structure
 - Card Types
 - SD Logos & SDA Pictographs
 - SD Ver.8.00 (SD EXPRESS PCIe Gen.4)
- **Summary of SD Standards**

SD Association Overview



SD Association Organization

SD Association: SDA (www.sdcard.org)

Mission: SD Card Standardization with Promotion and Adoption of SD Standards Worldwide



- Organization Established in 2000
- Member Company: About 800 Companies Worldwide
- Member Fee: Executive Member \$4,500/year General Member \$2,500/year

| Specification | SD Association | SD-3C LLC |
|---|---|--|
| | SDA Specification | SD Group Specification |
| | SDA Pictographs | SD Logos |
| | | Essential Patents |
| License | Contract with SDA | Contract with SD-3C LLC |
| Card  | SDA Membership Agreement (SDAMA) | Card License Agreement (CLA) |
| Host  | SDA License Agreement (SDALA) | Host Ancillary Product License Agreement (HALA) |

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

Benefits of SDA Membership

- **Access to all detailed, updated specifications (Card, Host, Test & Logo Guidelines)**
 - **Exposed to all on-going standardization activity and upcoming standards well in advance**
 - **Ability to influence new evolving standards and propose new features for standards**
 - **Two Types of Membership are available**
 - Executive and General Membership →
- <https://www.sdcard.org/join/membership-benefits-comparison/>

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

☐ **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



** 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)



Danny Lin



Jeff Hsieh



David Chen



Joel Tang



Kazunori Nakano



Open



Joseph Yuan



Jordan Zhong



Jyh Chau



Open



Shuichi Ohki



Takuji Maeda



T.H. Kuang



Andre Chen



HeeChang Cho



JiCheol Hong



Yosi Pinto



Jeff Tsujimoto



Janice Chiu



Josh Chen



Kenichi Satori



Shingo Aso

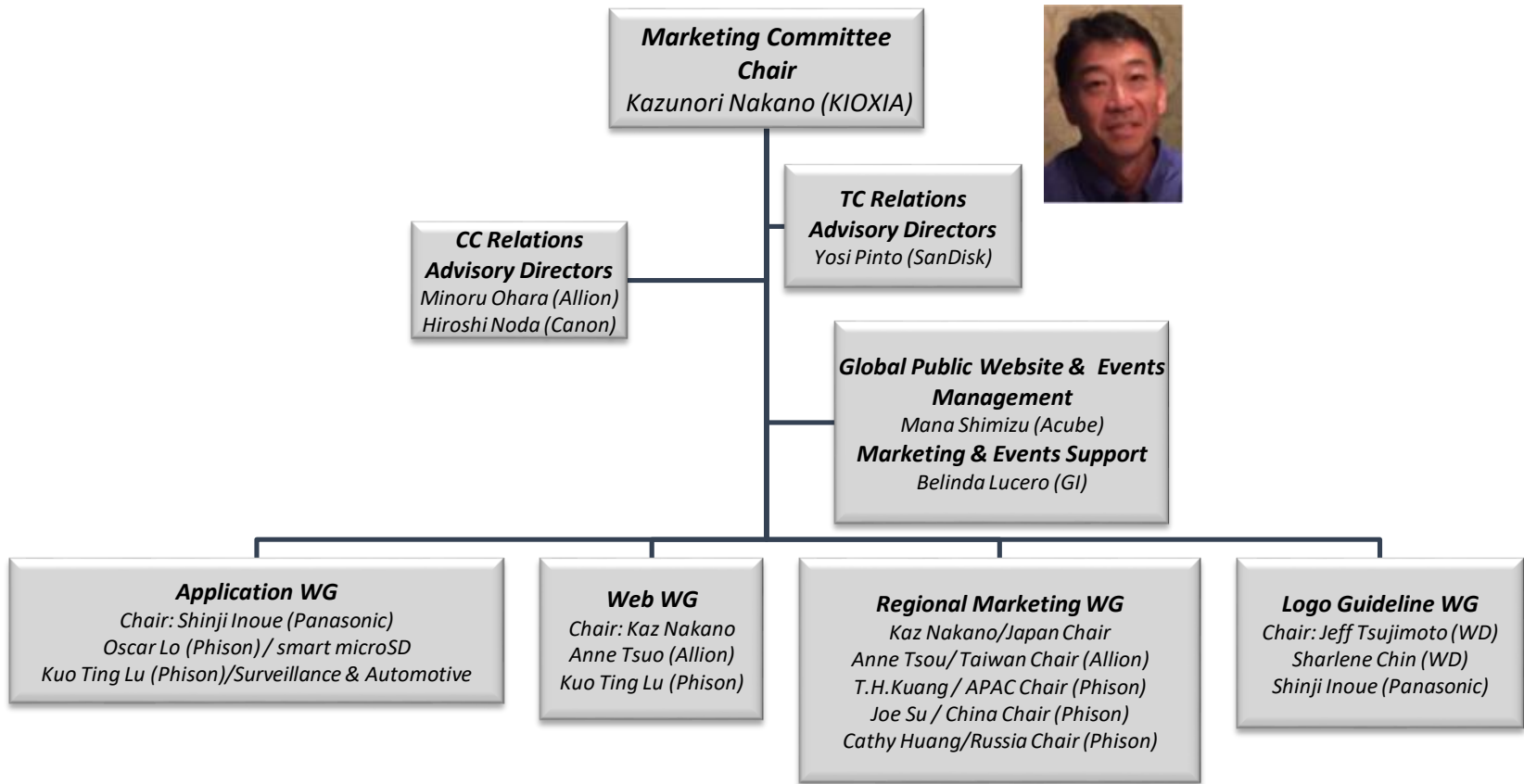


Joel Catala

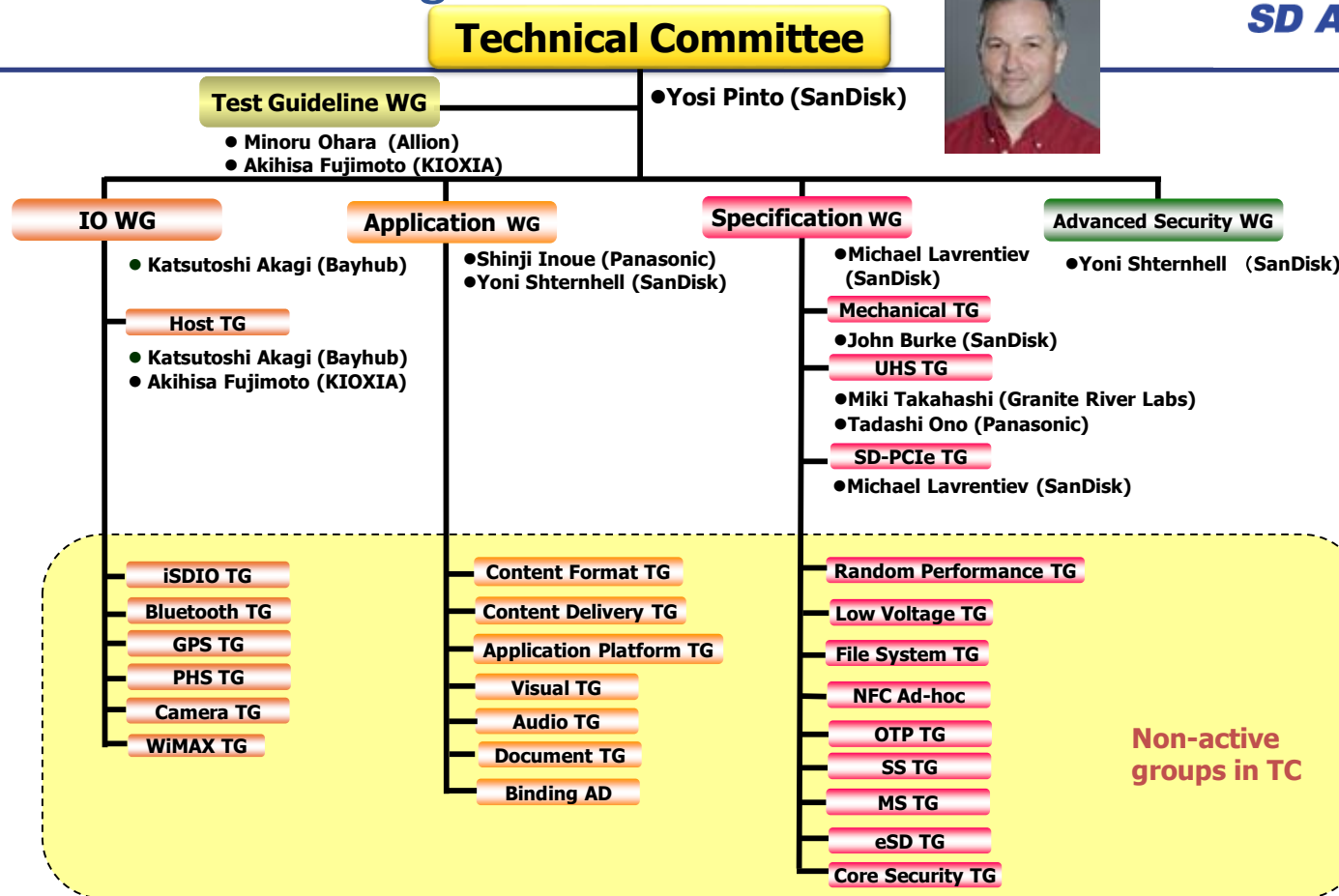


Thom Denholm

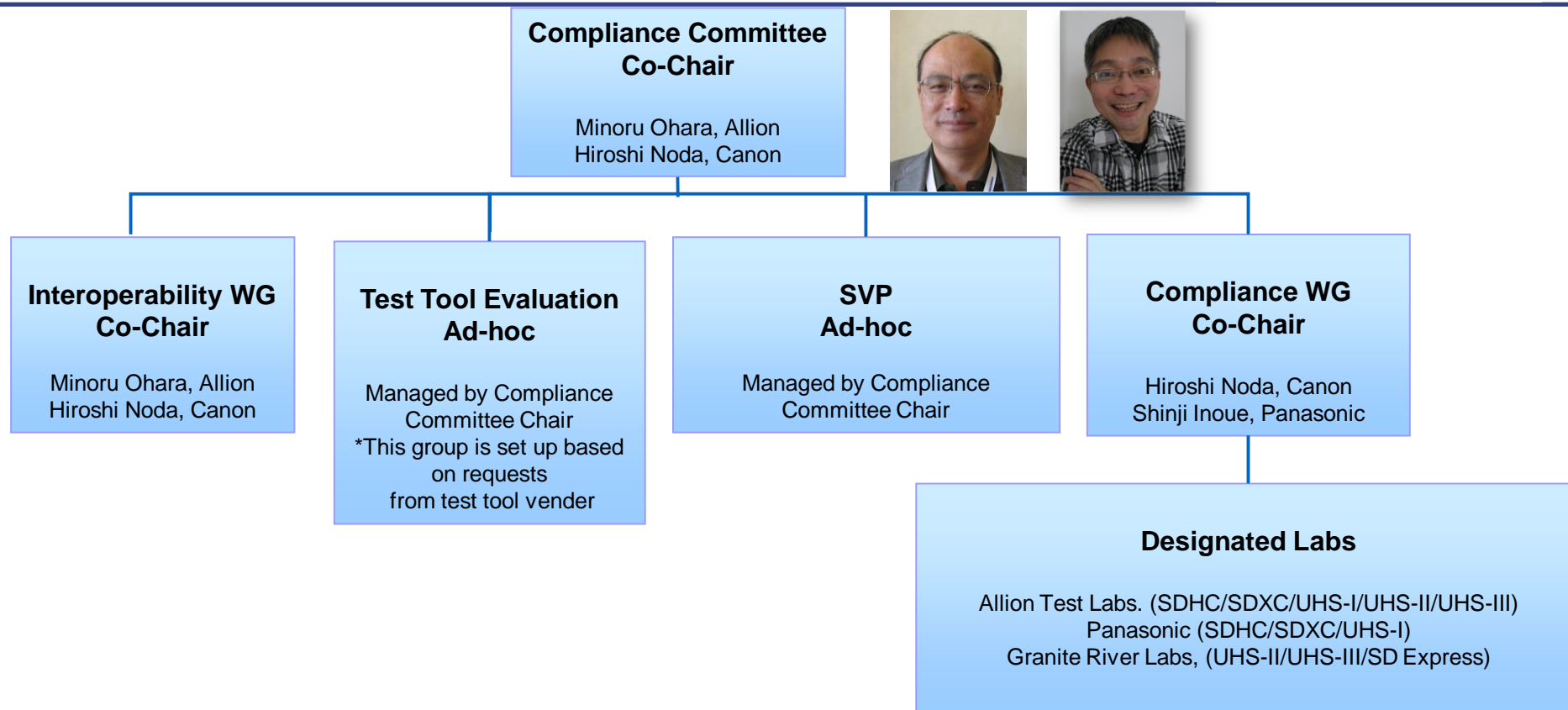
Marketing Committee Organization



Technical Committee Organization

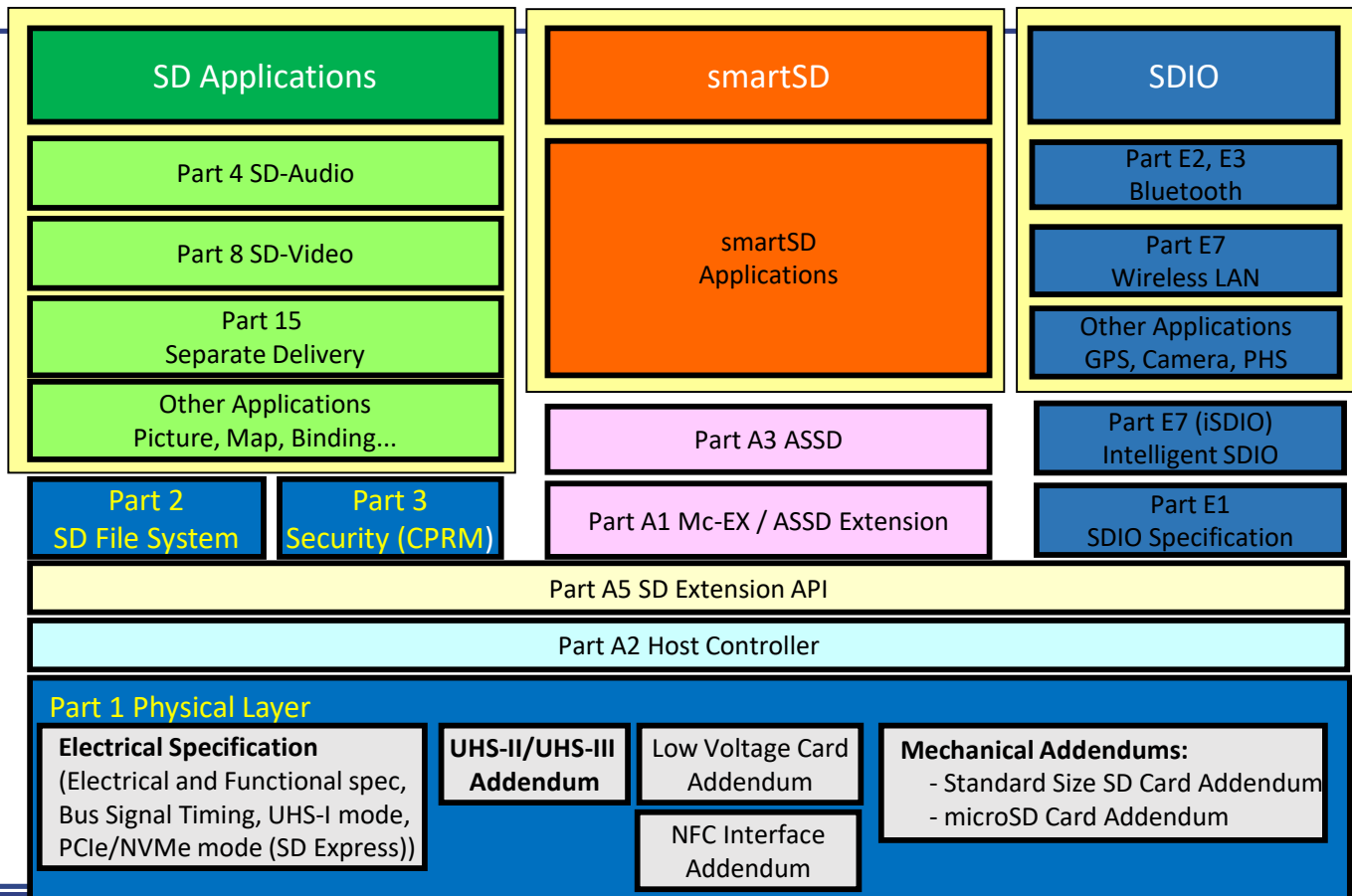


Compliance Committee Organization



SD Standard Specification Overview And New Standard Ver.8.00 SD Express

SD Specifications Structure



SD Card Types

Form Factors

- Standard SD Card



microSD Card



Functions

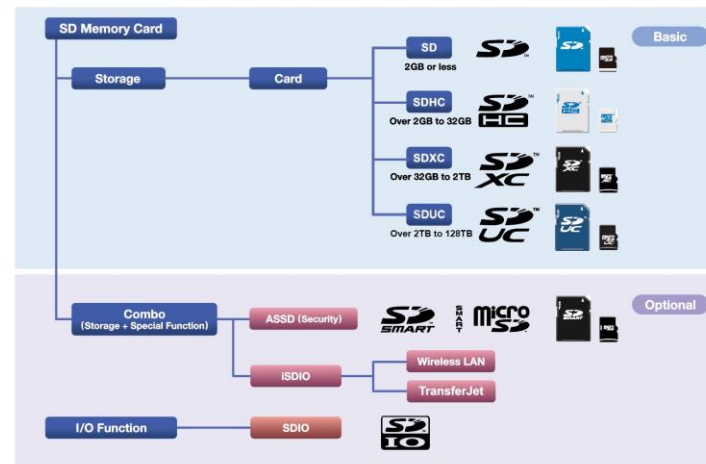
- SD Memory Card
- SDIO Card
- SD Combo Card (SD Memory + SDIO Functions)
 - iSDIO Wireless LAN SD Card iSDIO TransferJet SD Card
- smart microSD
 - microSD with Secure Element or with/without NFC interface

Memory Capacities

- SDSC: Standard Capacity ($\leq 2\text{GB}$) / SDHC: High Capacity ($2\text{GB} < - \leq 32\text{GB}$)
- SDXC: eXtended Capacity ($32\text{GB} < - \leq 2\text{TB}$)
- SDUC: Ultra Capacity ($2\text{TB} < - \leq 128\text{TB}$)**

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



SD Logos & SDA Pictographs

1. SD Logo: Capacity (4 Types)

2000



$\leq 2\text{GB}$
Standard Capacity

2006



$2\text{GB} < - \leq 32\text{GB}$
High Capacity

2009



$32\text{GB} < - \leq 2\text{TB}$
eXtended Capacity

2018



$2\text{TB} < - \leq 128\text{TB}$
Ultra Capacity

2. Bus Mark: Data Transfer Performance

No Mark



High Speed

2004

UHS-I



Ultra High Speed

2010

UHS-II



2011

UHS-III



2017

SD Express



PCIe Gen.3
Gen.4

2018-2020

3. Speed Class Mark: Video Recording

Speed Class



2006



2009

UHS Speed Class



2010



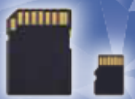




2013

Video Speed Class



2016

SD Ver.8.00 SD Express PCIe Gen.4 x 2 Lane

| | SD Memory Card | | | | SD Express Memory Card | | | |
|------------------------|---|--|--|--|---|--|---|--|
| Pin Layout |  | |  | |  | |  New | |
| PCIe Bus Interface | | | | | 985MB/sec  <i>nvm</i> | | 3940MB/sec PCIe Gen.4x2 New 1970MB/sec PCIe Gen.4x1 PCIe Gen.4x1 / Gen.3x2 | |
| SD Bus Interface | 25MB/sec High Speed | | 104MB/sec UHS-I 312MB/sec UHS-II 624MB/sec UHS-III | | High Speed | | High Speed | |
| Capacity (file system) | Ultra Capacity Up to 128TB (exFAT) | | SD UC I SD UC II SD UC III | | SD UC EXPRESS I | | | |
| | Extended Capacity Up to 2TB (exFAT) | | SD XC I SD XC II SD XC III | | SD XC EXPRESS I | | | |
| | High Capacity Up to 32GB (FAT32) | | SD HC I SD HC II SD HC III | | SD HC EXPRESS I | | | |

Bus Speed Mode

| Bus Mode | | Clock Frequency | Interface Method | Bus Maximum Performance | Spec. Version |
|--------------------|--------|--------------------|-------------------|----------------------------------|---------------|
| Default Speed (DS) | | 25MHz | 3.3V single-ended | 12.5MB/sec | 1.01 |
| High Speed (HS) | | 50MHz | 3.3V single-ended | 25 MB/sec | 1.10 |
| UHS-I | SDR12 | 25MHz | 1.8V single-ended | 12.5MB/sec | 3.01 |
| | SDR25 | 50MHz | 1.8V single-ended | 25 MB/sec | |
| | SDR50 | 100MHz | 1.8V single-ended | 50 MB/sec | |
| | SDR104 | 208MHz | 1.8V single-ended | 104 MB/sec | |
| | DDR50 | 50MHz | 1.8V single-ended | 50 MB/sec | |
| UHS-II | FD156 | 52MHz x 30 (PLL) | UHS-II PHY | 156 MB/sec | 4.00 |
| | HD312 | 52MHz x 30 (PLL) | UHS-II PHY | 312 MB/sec | 4.20 |
| UHS-III | FD312 | 52MHz x 60 (PLL) | UHS-III PHY | 312 MB/sec | 6.00 |
| | FD624 | 52MHz x 120 (PLL) | UHS-III PHY | 624 MB/sec | |
| PCIe | Gen.3 | 100MHz x 40 (PLL)* | PCIe Gen3 PHY | 1-Lane 1GB/sec | 7.00 |
| | | | | 2-Lane 2GB/sec | 8.00 |
| | Gen.4 | 100MHz x 80 (PLL)* | PCIe Gen4 PHY | 1-Lane 2GB/sec 2-Lane 4GB/sec | |

* Theoretical Value

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



Gaming PC



High End Laptop



Tablet

- New evolving imaging market (360o, VR, AR etc...)



- Imaging market is already heading to PCIe



- Edge Computing Gateway : High Speed, Small and Robust



NAS



Set Top Box

Modem / Gateway



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 others...
- Supported by all major OS's
- Proven test environments were defined



Both are recognized worldwide as the preferable protocols for future needs → Easy to adopt!

PCIe 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 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



Short Version



Long Version

□ 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 Manager



– Jamie Reyes – Program Manager & Membership Services



New SDA Virtual Booth on SDA Public Home Page

sdcard.org





Thank You

Kazunori Nakano, Marketing Chair
Email: kazunori.nakano@kioxia.com



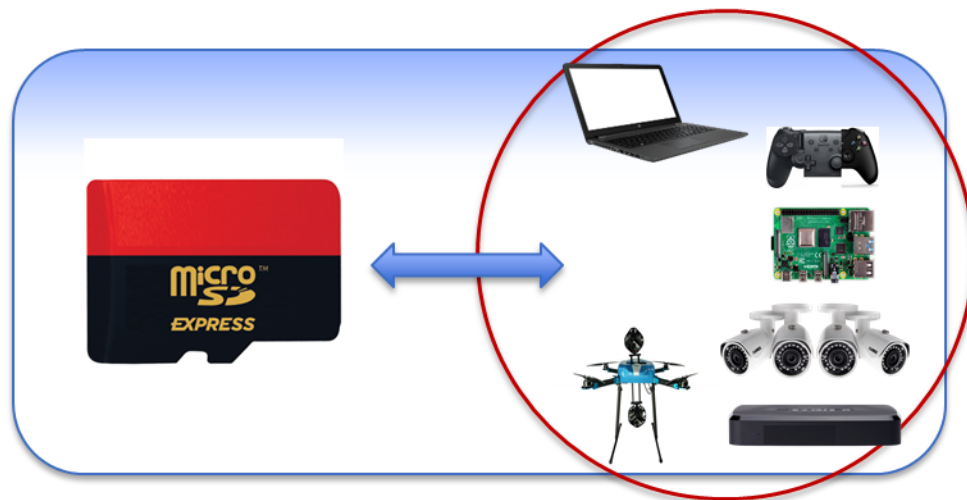
SD Express Host Implementation

Yosi Pinto

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

SanDisk

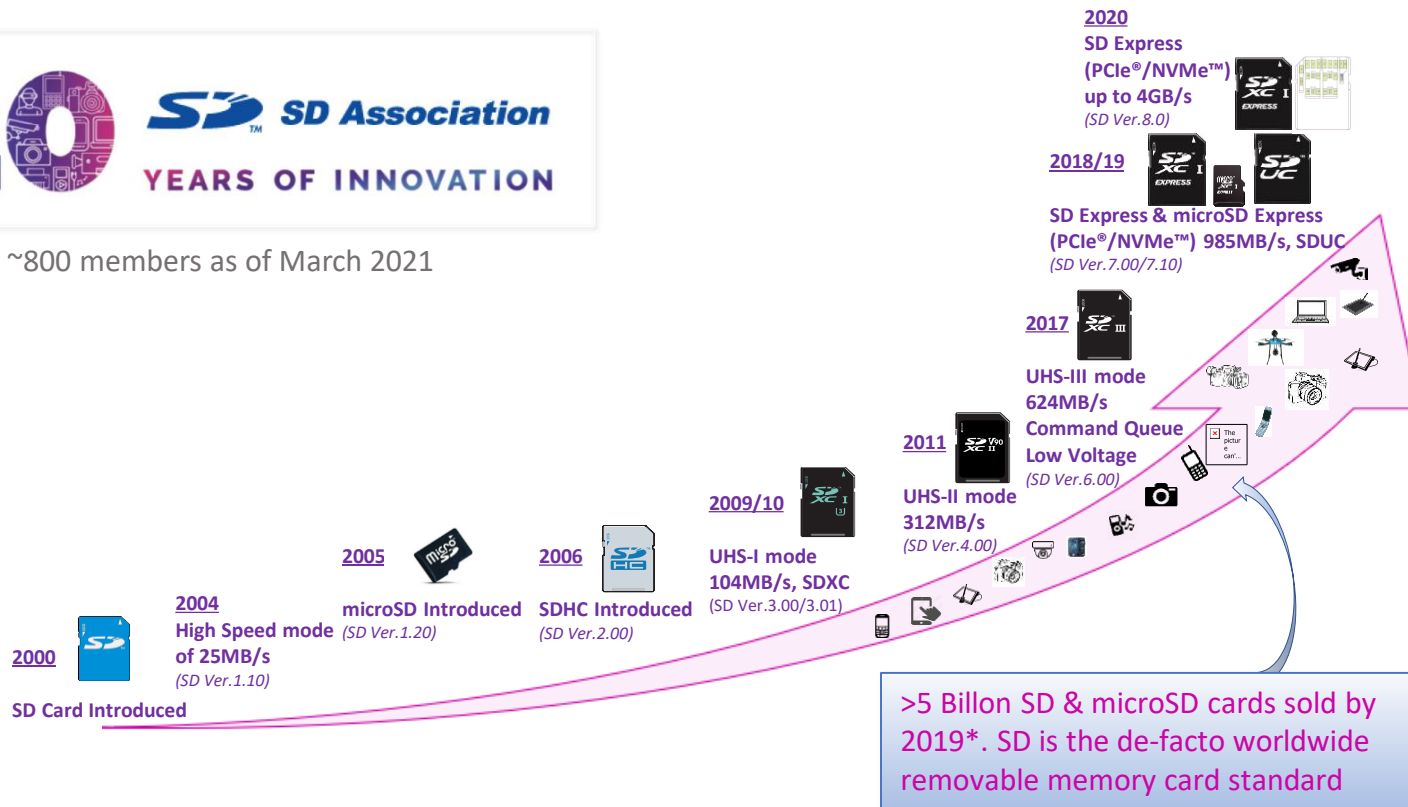
- **SD Standard Evolution**
- **SD Express cards – SD7.0, SD7.1 and SD8.0 in brief**
- **SD Express Host Implementation**
 - How to implement hosts with SD Express interface using SDA's Host Controller Spec
 - Other implementation methods



SD Memory Card Standard Evolution



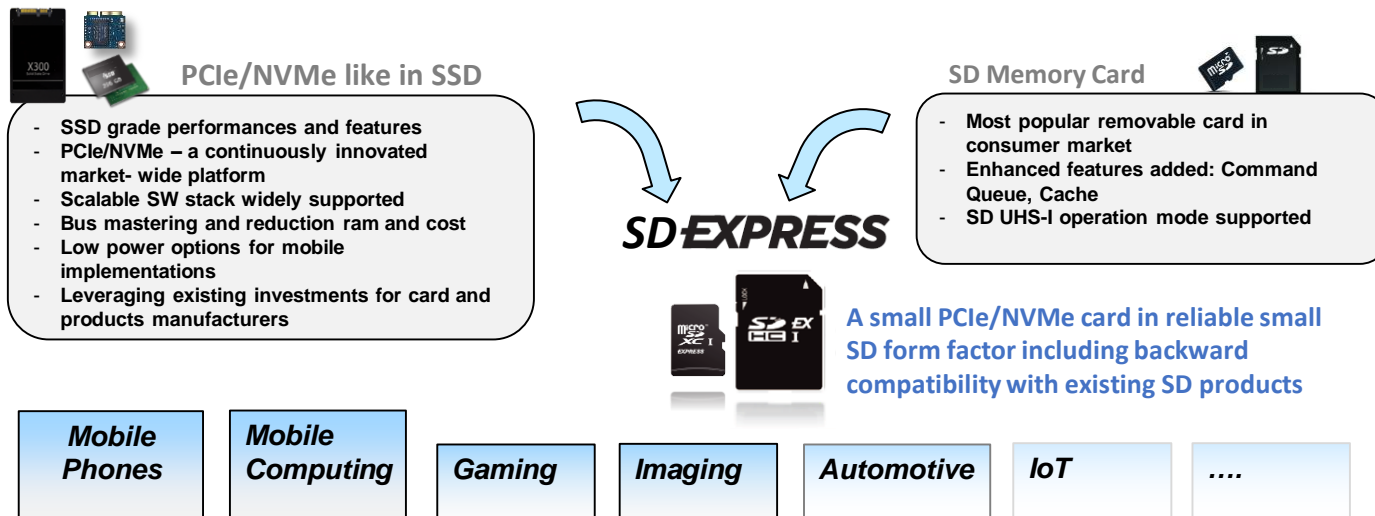
~800 members as of March 2021



* Source: Estimation using news published by SanDisk in 2015 ("2 Billion microSD cards sold by 2015") and TrendForce's report from 2019 ("total of ~3 billion cards sold within 2016-2019")

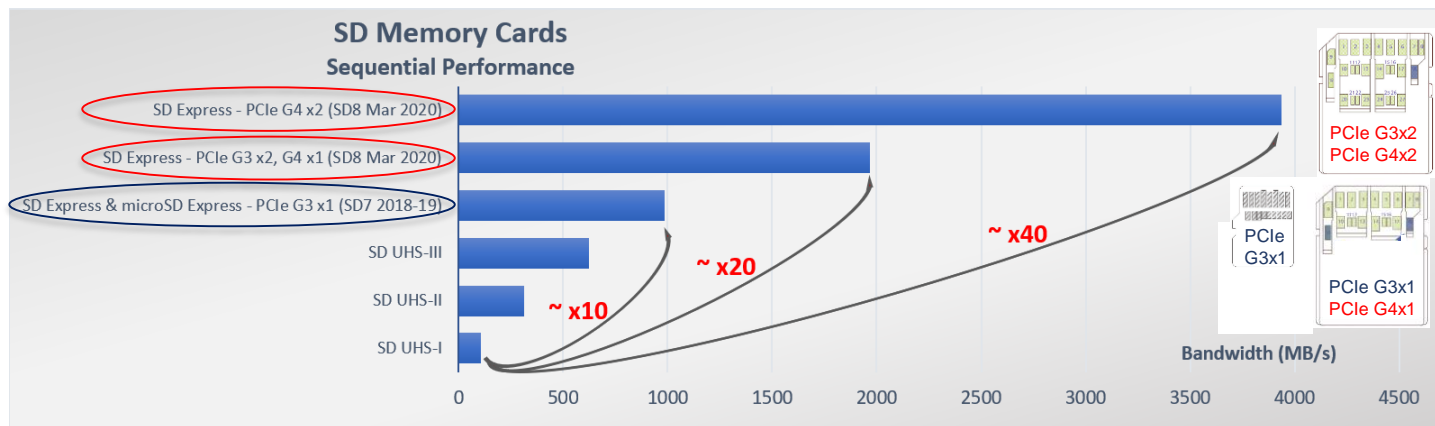
SD Express Cards – SD7.0, SD7.1 and SD8.0 in brief

SD Express Cards



- ❑ SD Express cards are SD cards that supports both: PCIe/NVMe interface and the standard legacy SD (UHS-I) interface, allowing backward compatibility
- ❑ SD7.0 and SD7.1 (2019) introduced the full size SD Express and microSD Express, respectively, supporting the PCIe 3.1 x1 interface (up to 985MB/s)
- ❑ SD8.0 (2020) introduced the full size SD Express with PCIe 3.1 x2, PCIe 4.0 x1, PCIe 4.0 x2 (up to 4GB/s)

SD Memory Card Bit Rates



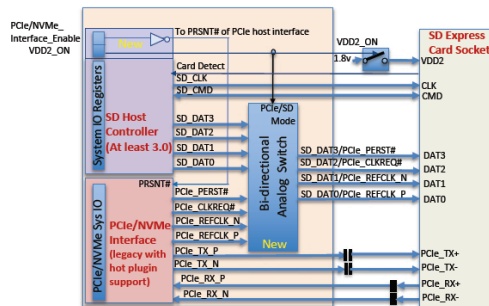
SD Express Benefits and Implementation Method

Material published by SDA that you may use

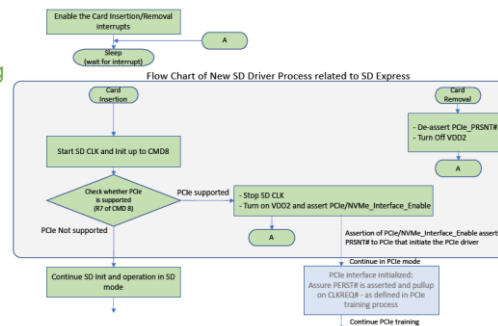


SD Association

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



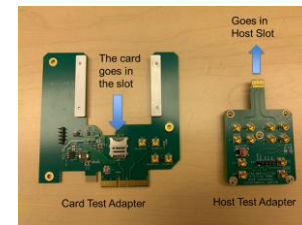
Update to existing SD Driver – As explained in Implementation Guideline



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)



SDA Brochure – updated for SD8.0




Two SD Express whitepaper (updated with new material about SD8.0):

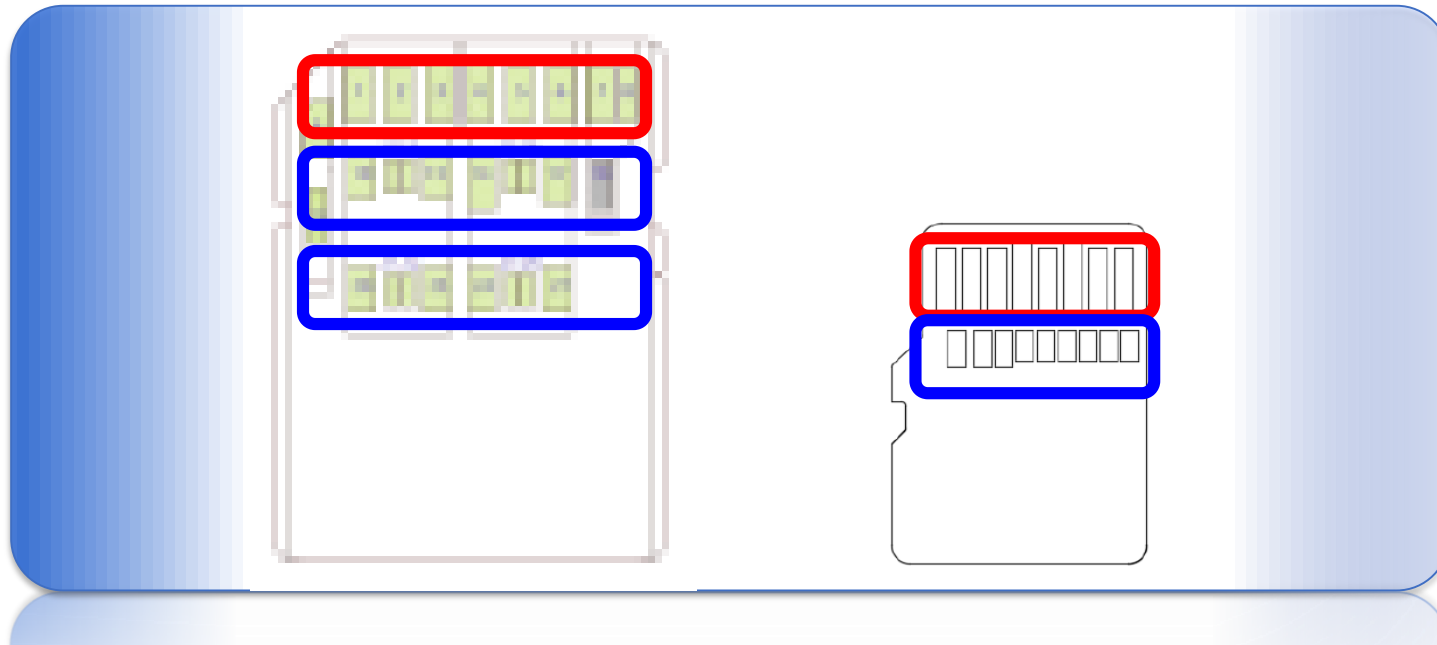
- SD Express Memory Cards with PCIe® and NVMe™ Interfaces

- SD Express and microSD Express Cards: The Best Choice for Your Future Product Designs

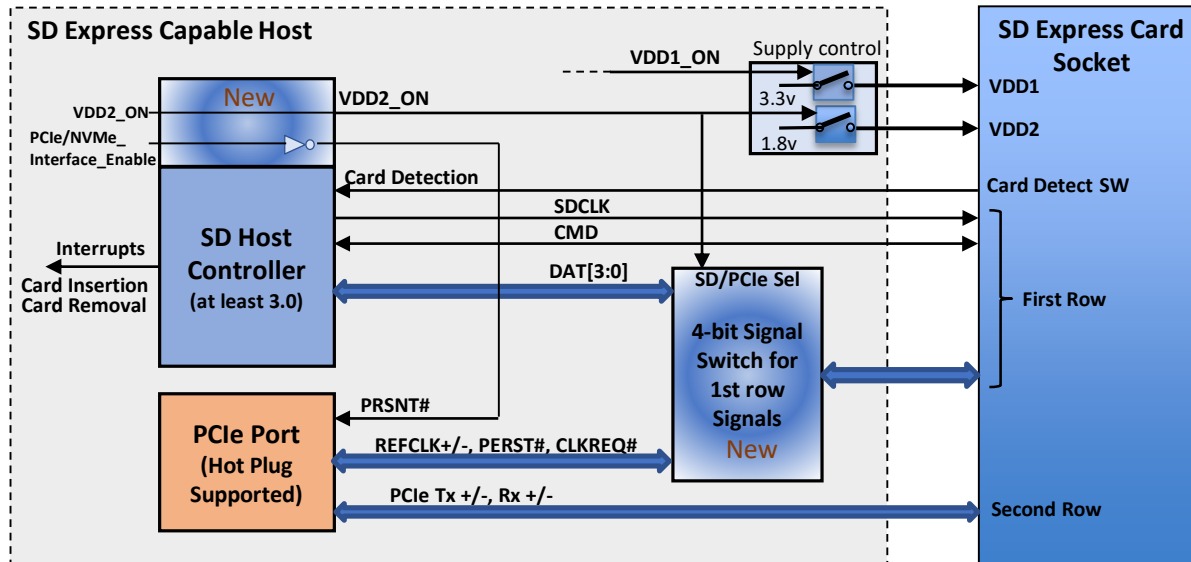
SD Express Host Implementation

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

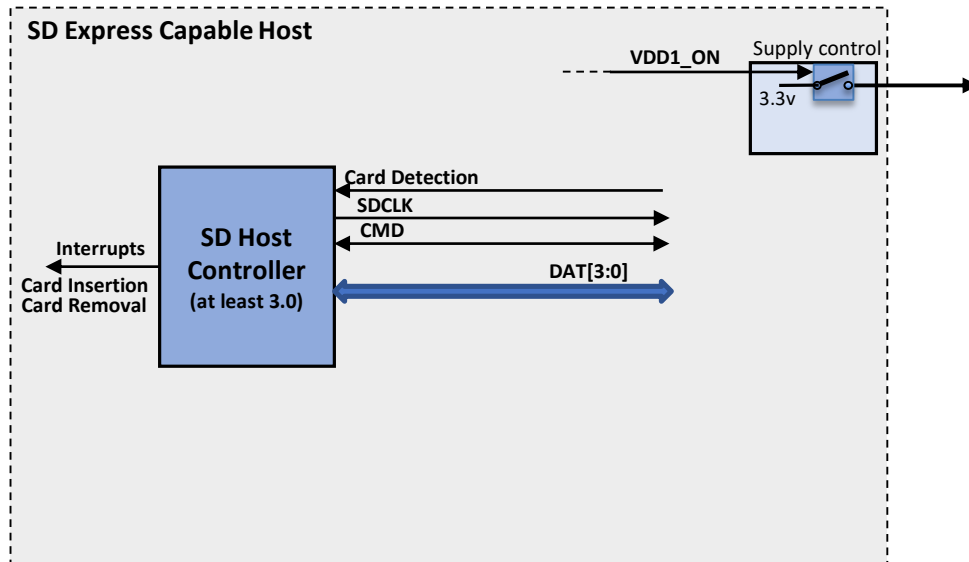


SD Express Host Implementation



SD Express Host Controller – Full Circuit Example

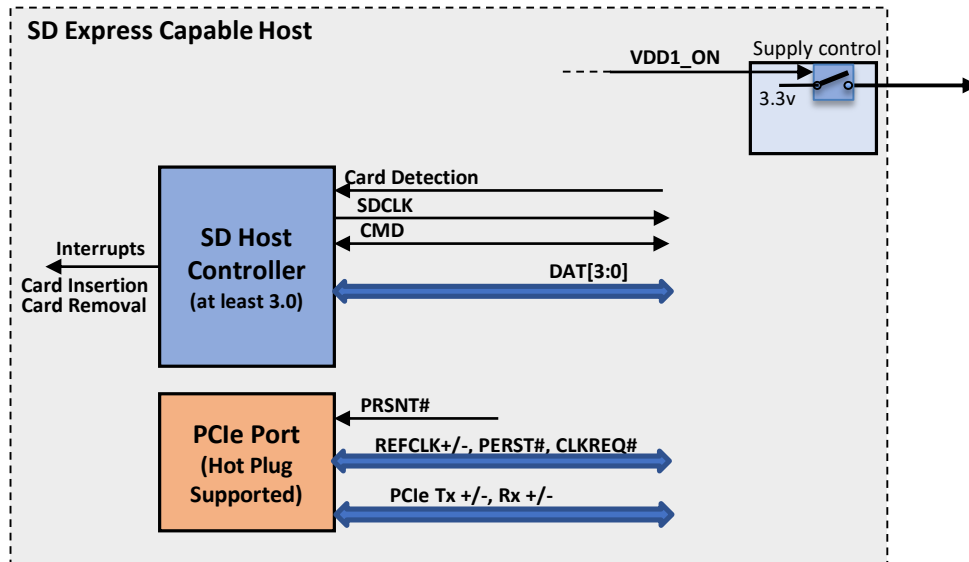
SD Express Host Implementation



SD Express Host Controller – Building blocks:

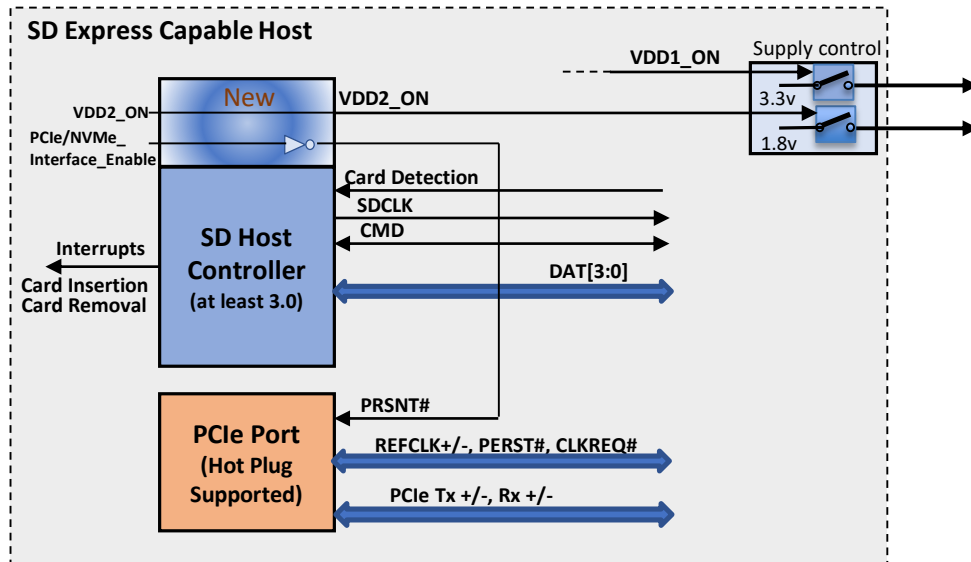
➔ **SD Host Controller (at least v3.0)**

SD Express Host Implementation



SD Express Host Controller – Building blocks:

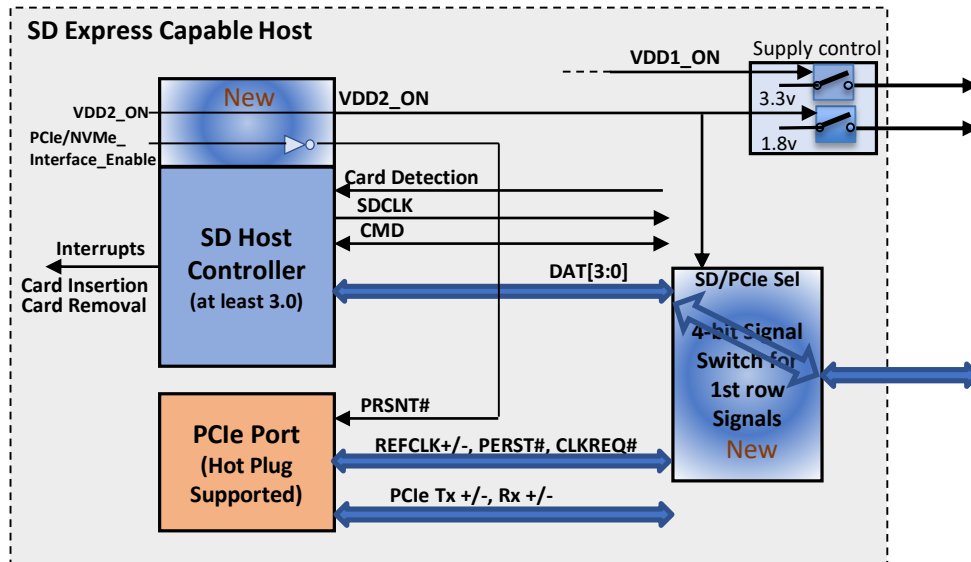
- ➔ SD Host Controller (at least v3.0)
- ➔ PCIe Port with hot plugin support



SD Express Host Controller – Building blocks:

- ➔ SD Host Controller (at least v3.0) + VDD2_ON & PCle/NVMe_Interface_Enable (New)
- ➔ PCIe Port with hot plugin support

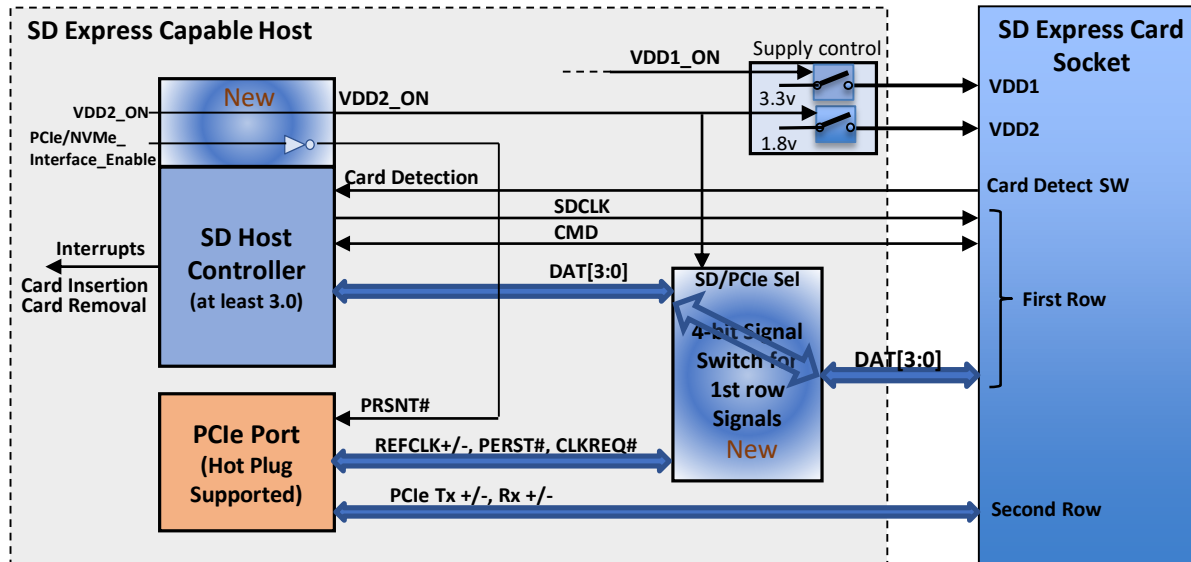
SD Express Host Implementation



SD Express Host Controller – Building blocks:

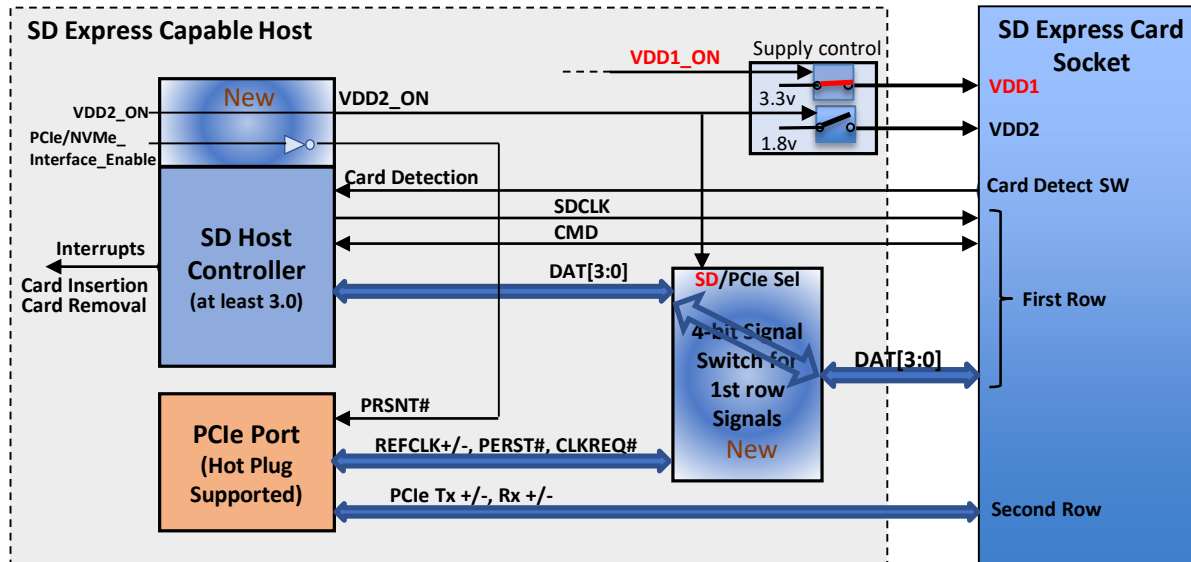
- ➔ SD Host Controller (at least v3.0) + VDD2_ON & PCle/NVMe_Interface_Enable (New)
- ➔ PCle Port with hot plugin support
- ➔ 4 bit Signal Switch (New)

SD Express Host Implementation



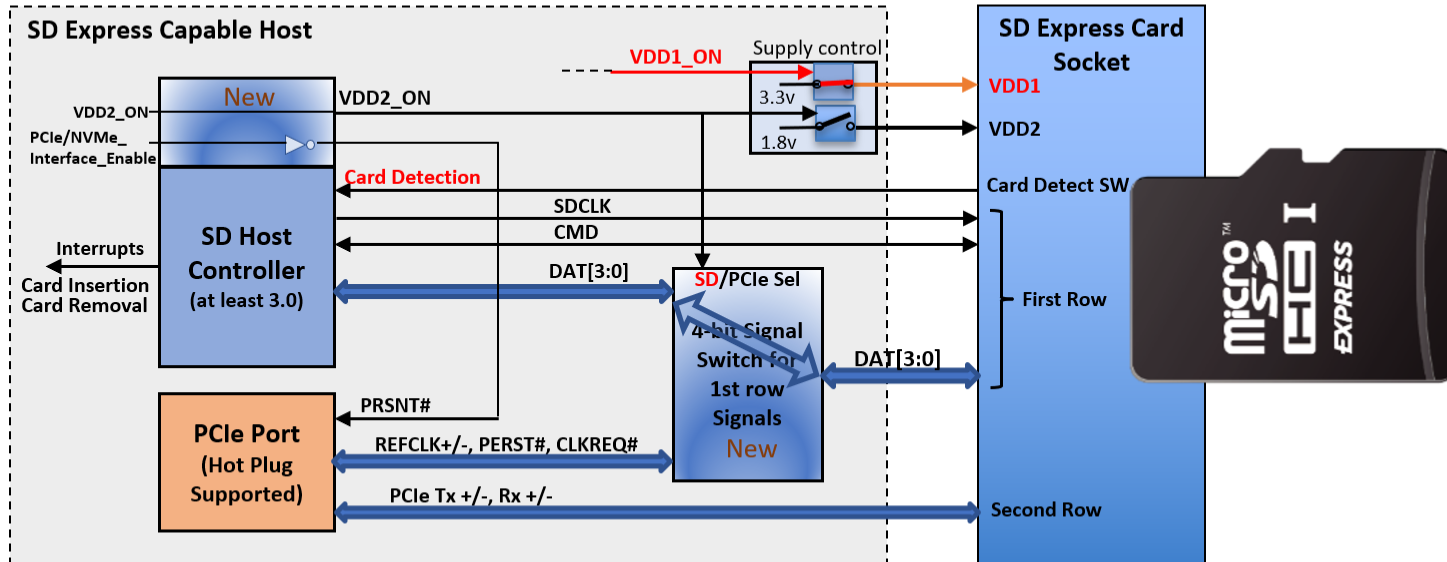
SD Express Host Controller – Full Circuit

SD Express Host Implementation



SD Express Host Controller – Operation:

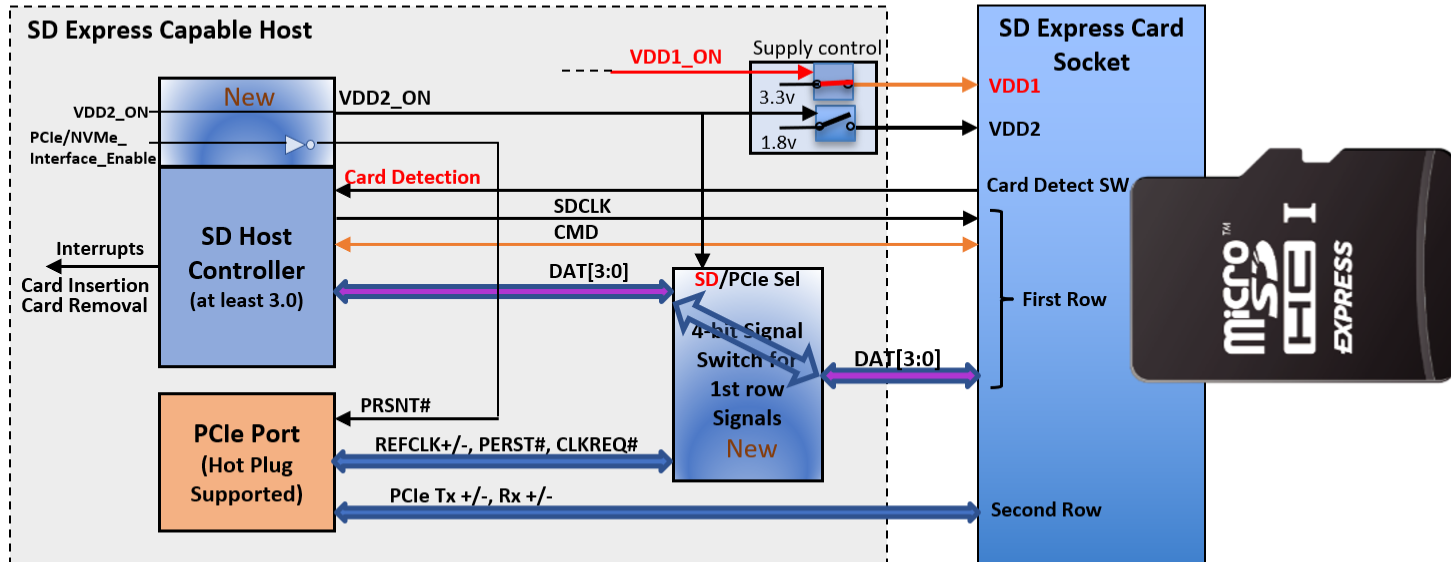
SD Express Host Implementation



SD Express Host Controller – Operation: Card Insertion-detection

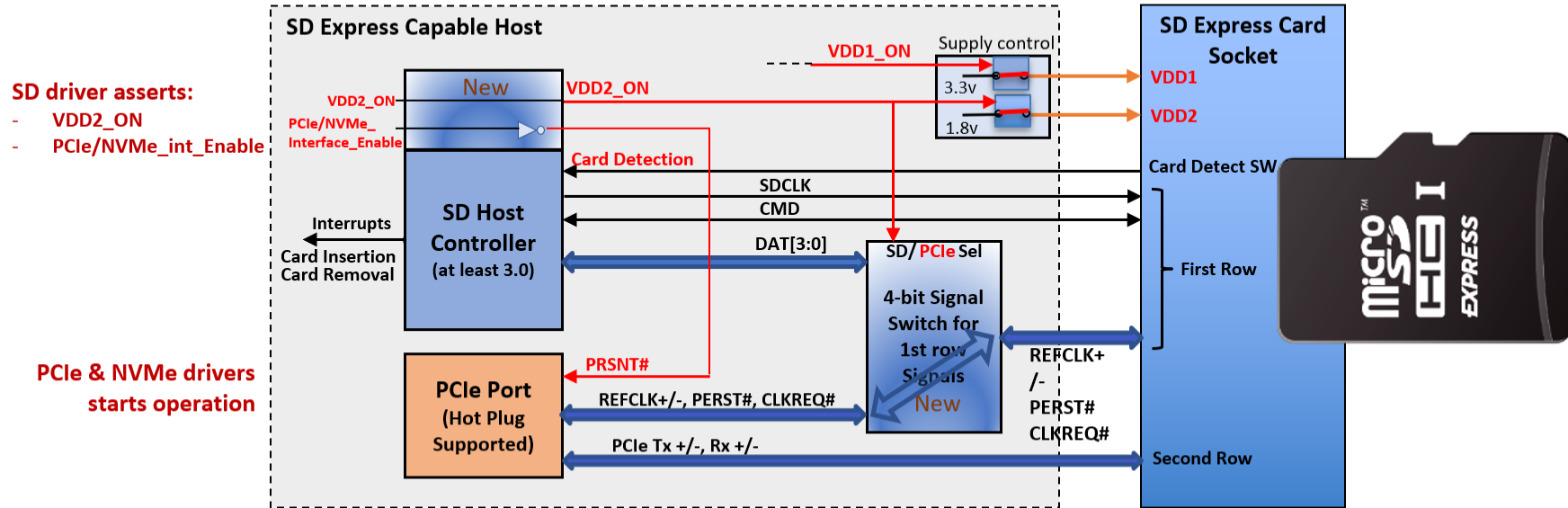
SD Express Host Implementation

SD driver initiates
the SD card &
checks PCIe
support



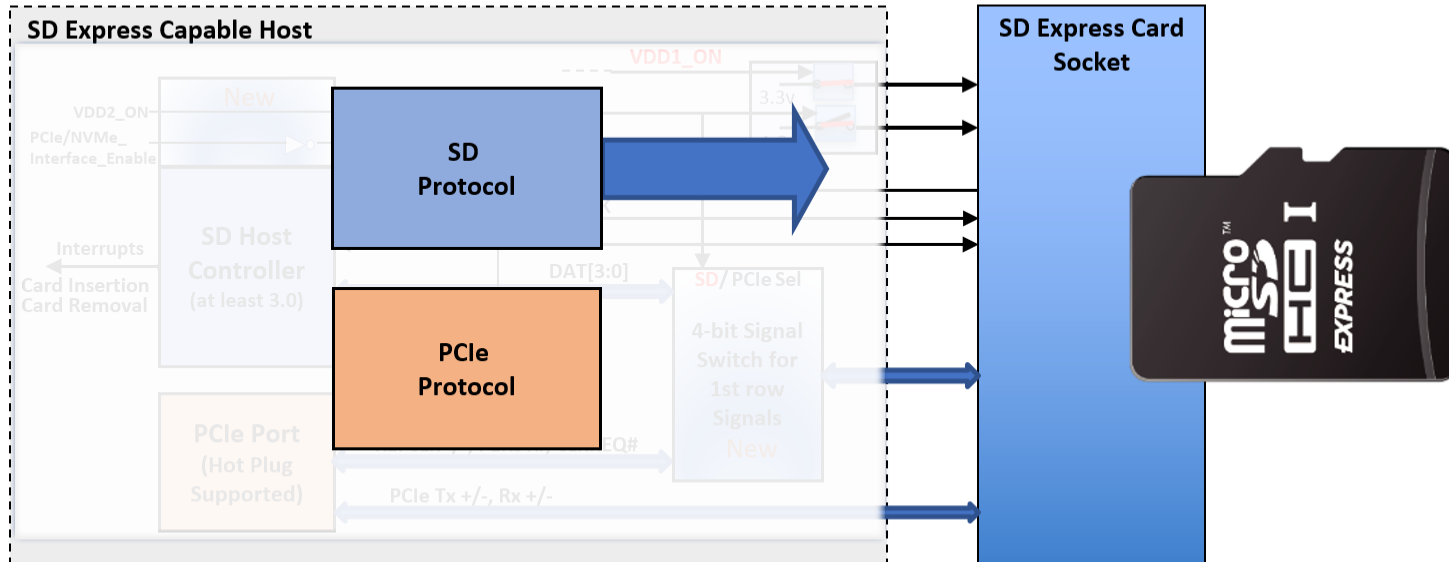
SD Express Host Controller – Operation:
Card Insertion-detection, PCIe support check

SD Express Host Implementation



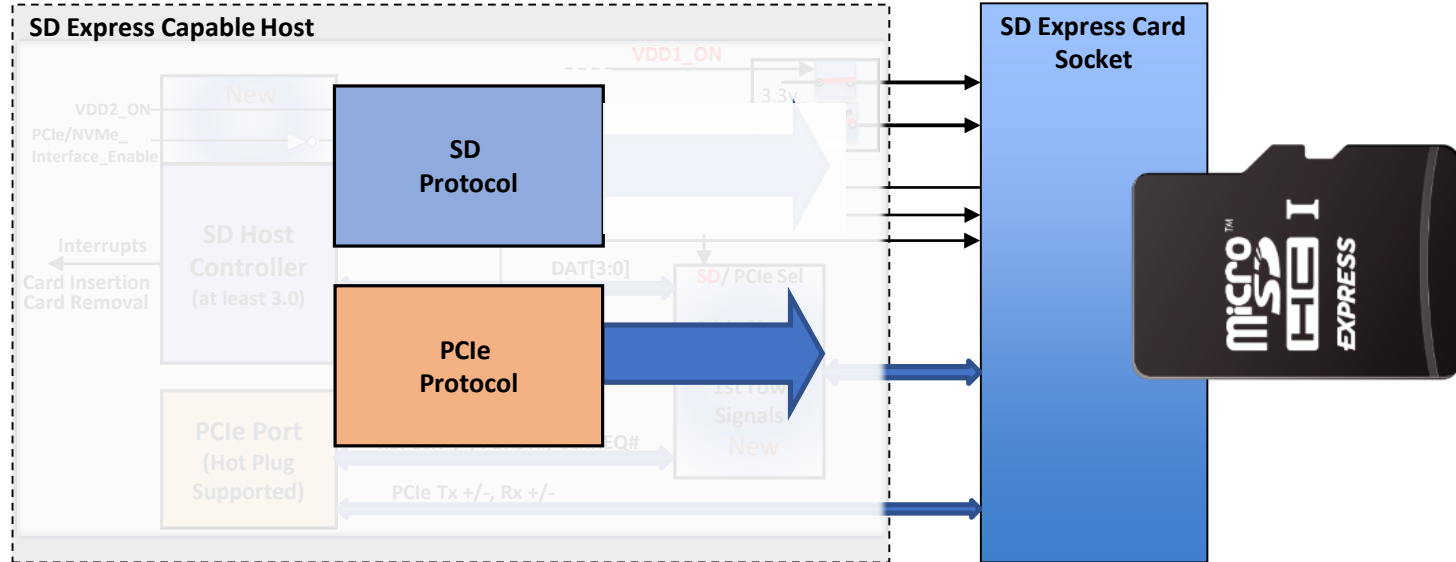
SD Express Host Controller – Operation:
Transfer control to the PCIe host and start operation through PCIe channel

SD Express Host Implementation – other possible methods



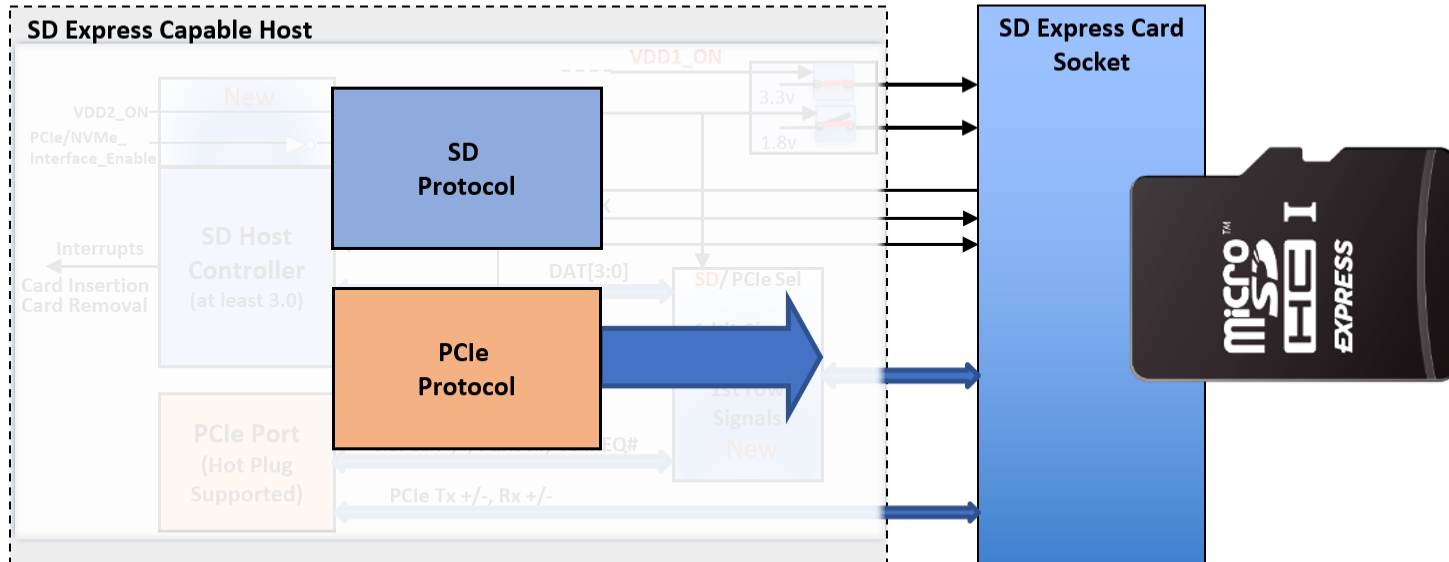
The shown example recommends to initiate first through SD interface

SD Express Host Implementation – other possible methods



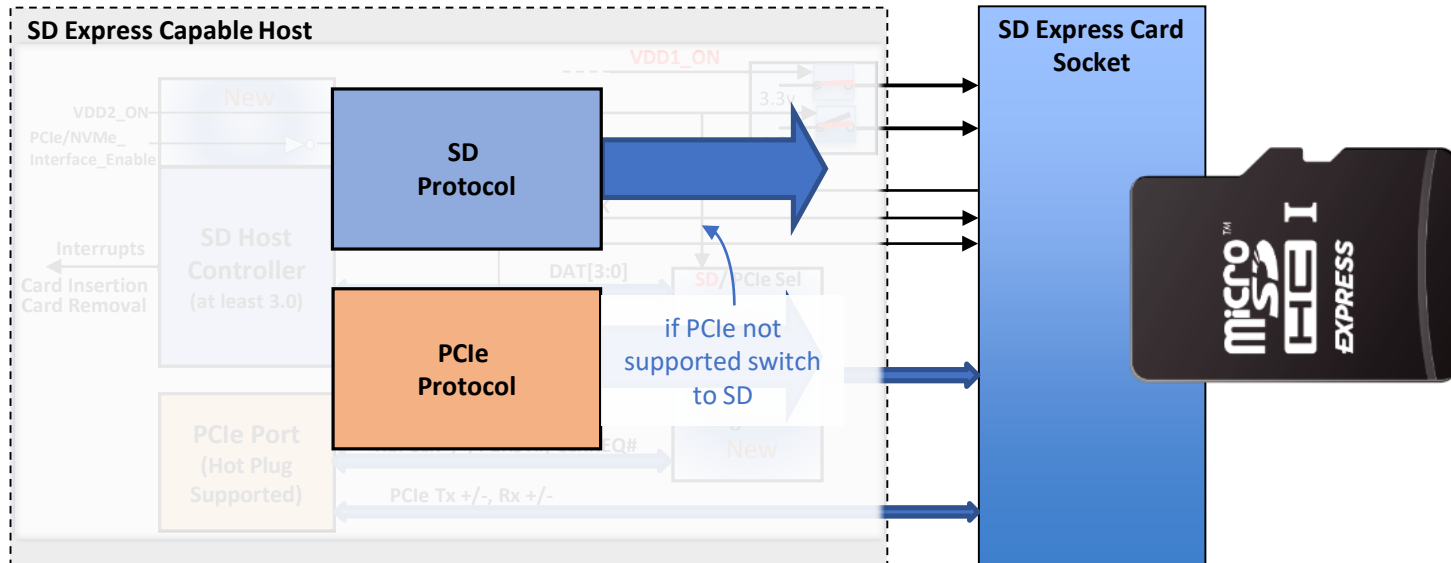
The shown example recommends to initiate first through SD interface and then switch to PCIe, if supported

SD Express Host Implementation – other possible methods



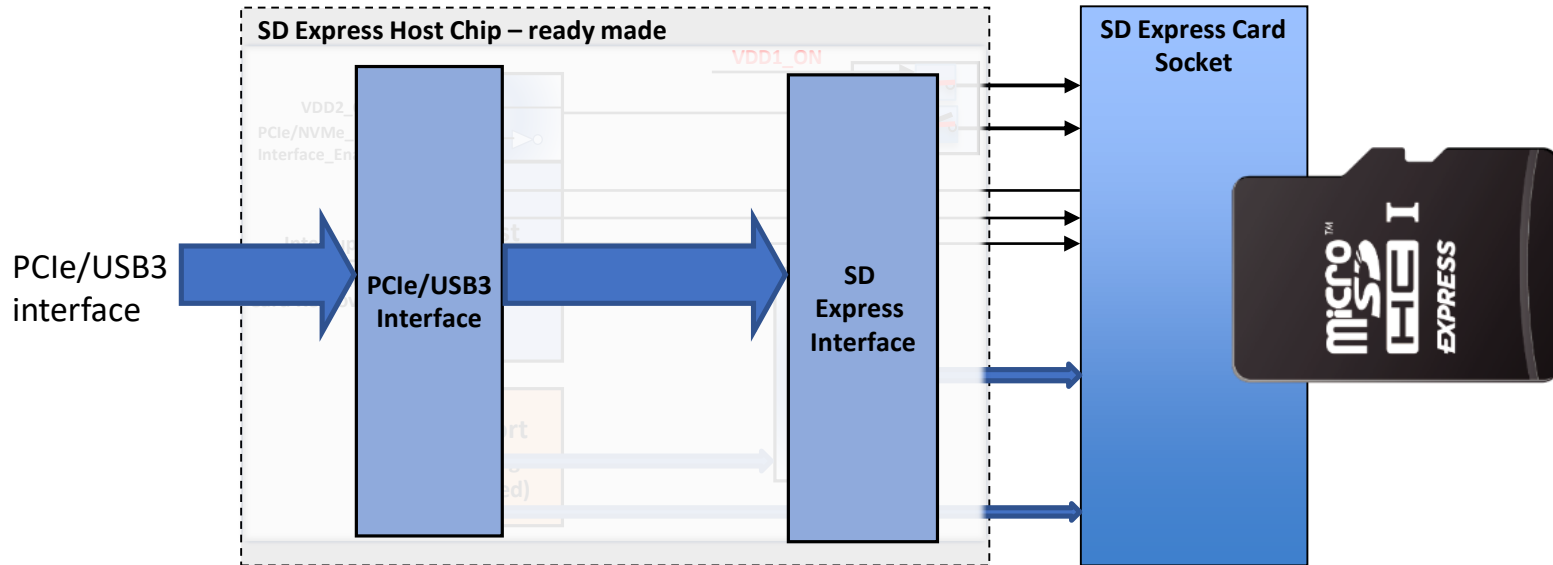
Host may be also implemented with initiation first through PCIe interface (the specification allows it)

SD Express Host Implementation – other possible methods



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/USB3 to SD Interface



SD Association

Thank You

Email: yosi.pinto@wdc.com



SVP Introduction

Miki Takahashi

Executive Vice President of Engineering (Granite River Labs)



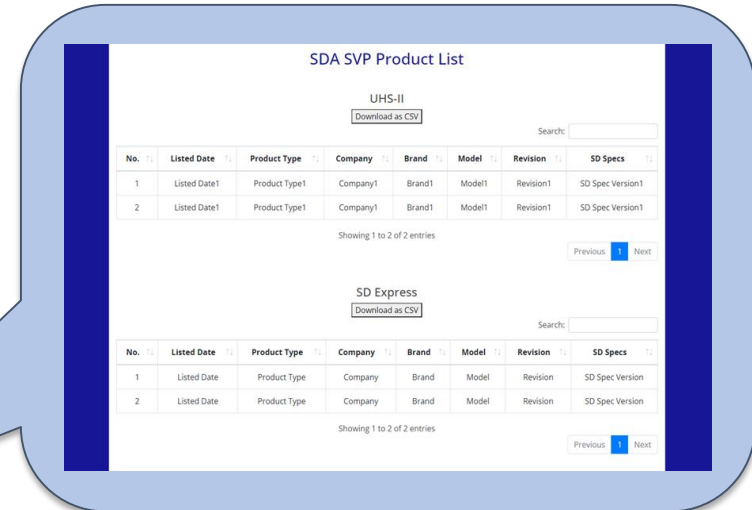
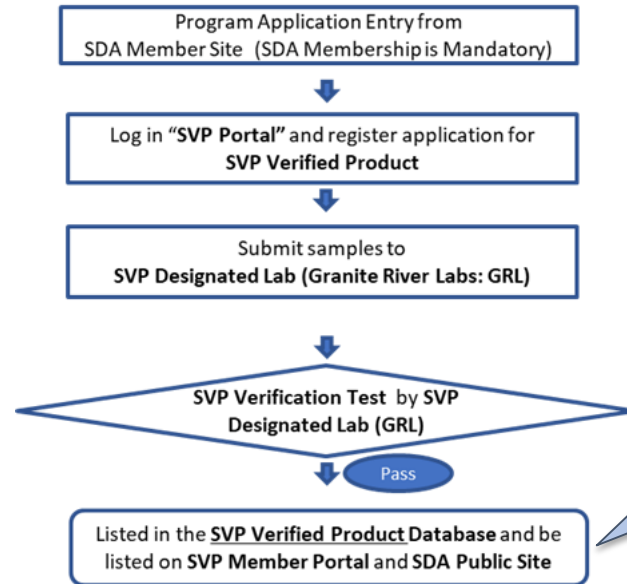
- ❑ **SVP** -SD Express/UHS-II **V**erification **P**rogram
- ❑ SDA runs the program allowing SDA members to check UHS-II electrical conformance and SD Express Electrical /PCI Express protocol conformance. The product which passes the test will be listed as Verified Product. The list will be open to public.
- ❑ SVP provides better interoperability and cost effective option for partial conformance test for SDA members.
- ❑ Two options in Test Schedule
 - 1)Test Shuttle : Fixed Test Schedule and Share test cost with multiple members (1st Round (closed) : Sep 13, 2nd Round : Planned in Jan 2022)
 - 2)On Demand : Test immediately

How SVP helps SDA members and End Users

- ☐ Data Rate gets higher and protocol gets complicated. At the same time, the risk of interoperability gets higher. However large investment is involved to create test environment. SVP provide cost effective option to assess the risk of signal integrity and protocol conformance.
- ☐ SDA is subsidizing SVP in initial phase to enable the program quickly.
- ☐ SDA will publish the list of products which pass SVP. User will see the products qualified in a certain quality requirement.

SVP Procedure

□ “Be a member of SDA and go to SVP webpage”



SDA SVP Product List

UHS-II

Download as CSV

Search:

| No. | Listed Date | Product Type | Company | Brand | Model | Revision | SD Specs |
|-----|--------------|---------------|----------|--------|--------|-----------|------------------|
| 1 | Listed Date1 | Product Type1 | Company1 | Brand1 | Model1 | Revision1 | SD Spec Version1 |
| 2 | Listed Date1 | Product Type1 | Company1 | Brand1 | Model1 | Revision1 | SD Spec Version1 |

Showing 1 to 2 of 2 entries

Previous 1 Next

SD Express

Download as CSV

Search:

| No. | Listed Date | Product Type | Company | Brand | Model | Revision | SD Specs |
|-----|-------------|--------------|---------|-------|-------|----------|-----------------|
| 1 | Listed Date | Product Type | Company | Brand | Model | Revision | SD Spec Version |
| 2 | Listed Date | Product Type | Company | Brand | Model | Revision | SD Spec Version |

Showing 1 to 2 of 2 entries

Previous 1 Next

SVP Product List Image

SDA SVP Product List

UHS-II

[Download as CSV](#)

Search:

| No. | Listed Date | Product Type | Company | Brand | Model | Revision | SD Specs |
|-----|--------------|---------------|----------|--------|--------|-----------|------------------|
| 1 | Listed Date1 | Product Type1 | Company1 | Brand1 | Model1 | Revision1 | SD Spec Version1 |
| 2 | Listed Date1 | Product Type1 | Company1 | Brand1 | Model1 | Revision1 | SD Spec Version1 |

Showing 1 to 2 of 2 entries

Previous **1** Next

SD Express

[Download as CSV](#)

Search:

| No. | Listed Date | Product Type | Company | Brand | Model | Revision | SD Specs |
|-----|-------------|--------------|---------|-------|-------|----------|-----------------|
| 1 | Listed Date | Product Type | Company | Brand | Model | Revision | SD Spec Version |
| 2 | Listed Date | Product Type | Company | Brand | Model | Revision | SD Spec Version |

Showing 1 to 2 of 2 entries

Previous **1** Next

- ✓ Downloadable List
- ✓ Sortable
- ✓ Separate List for UHS-II and SD Express

Who is GRL?

- ☐ SDA Executive Member since 2013
- ☐ SD Association Designated Lab
- ☐ Support SD Card Eco-System for Testing and Test Solution
 - GRL Headquarters in the Heart of Silicon Valley
 - 8 Labs World Wide (Europe, Asia and India) to support global supply chain
 - SD Card/Host Test Services and Troubleshooting
 - SD Card/Host Test Solutions (Protocol and Electrical Test Solutions)
 - Runs SVP as Exclusive Designated Lab



<https://graniteriverlabs.com/>



Thank You

Miki Takahashi

Email: mtakahashi@graniteriverlabs.com



SD Express Applications

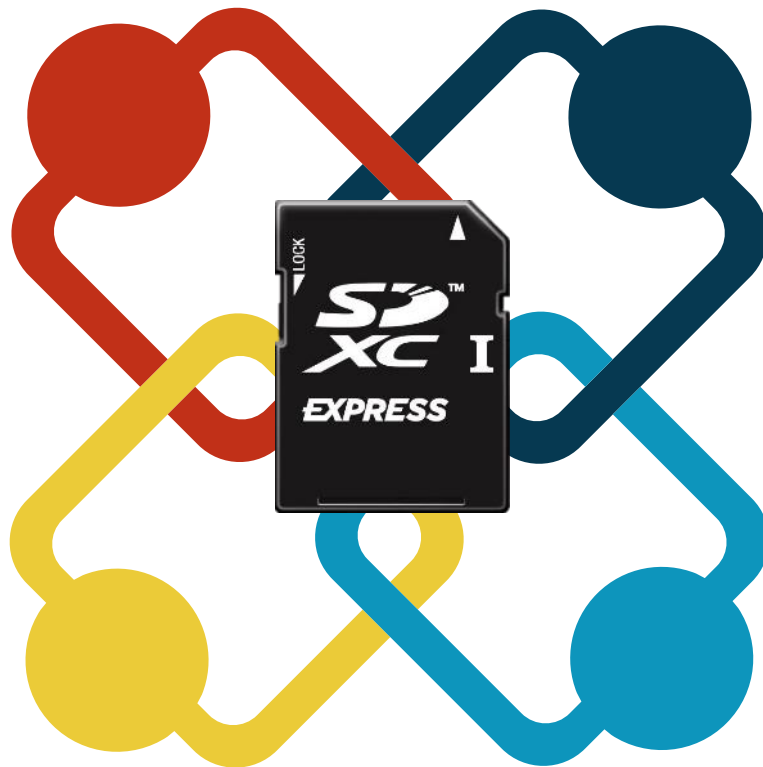
Anson Phan

Senior Product Marketing Manager (Phison Electronics Corp.)

PHISON

SD Express Card An Overview

First Released in June
2018 as part of SD7.0



Existing SD form factor

PCIe Gen3 , Gen4 and
NVMe v1.3 v1.4 interface
added

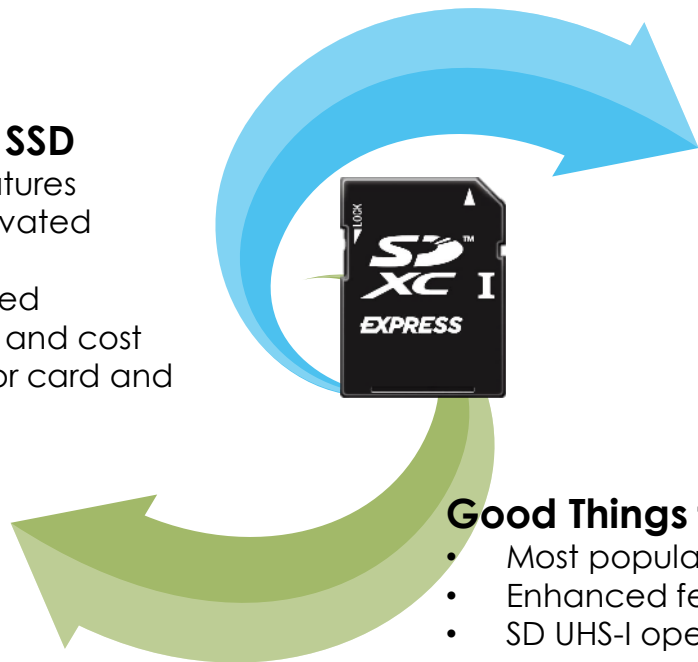
Legacy UHS-I interface
supported allowing
backward compatibility with
billions of host devices

SD Express A SSD-Like Card

**A small SSD-Like card in reliable small SD form factor
including backward compatibility with existing SD products**

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

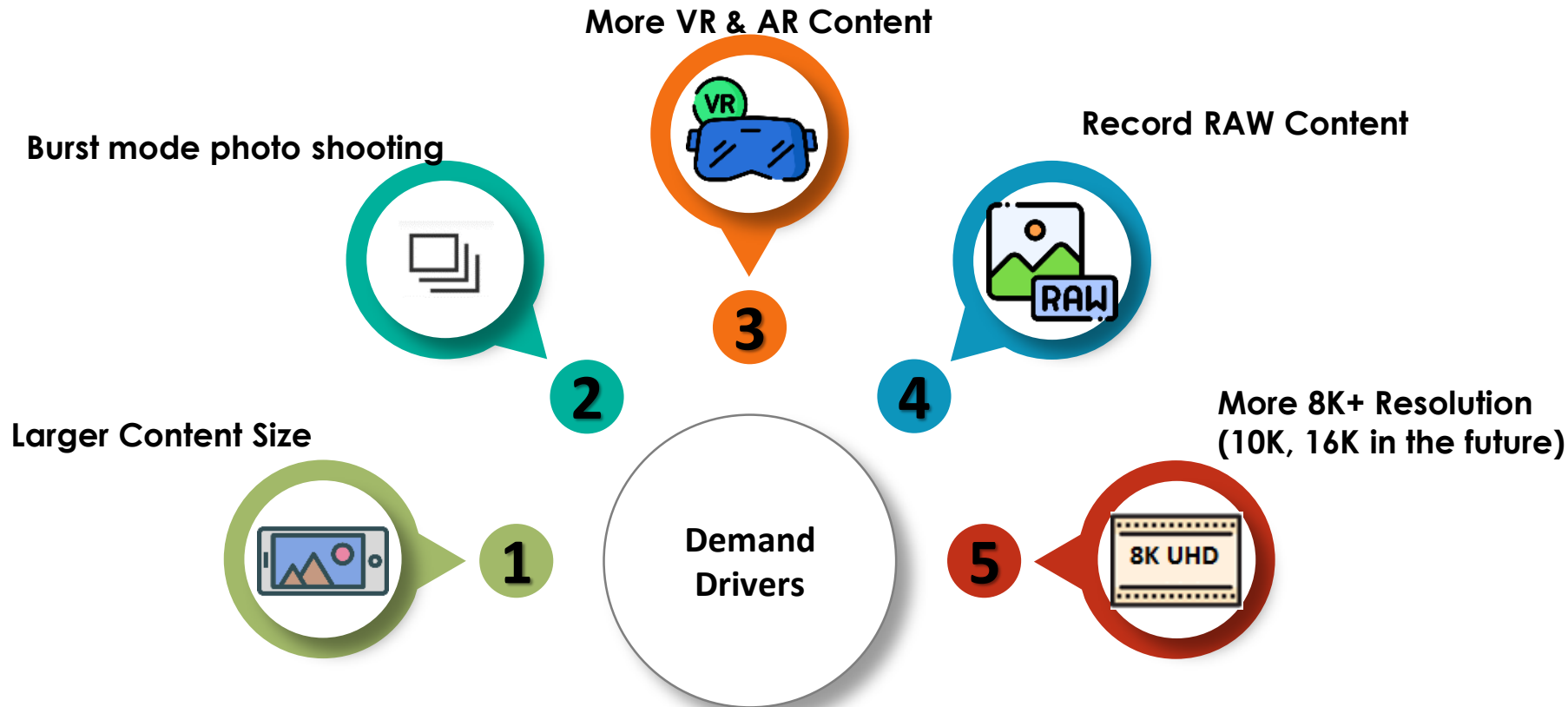
- Most popular removable card in consumer market
- Enhanced features: Command Queue, Cache
- SD UHS-I operation mode supported

Why We Need SD Express?

Theoretical sequential read and write transfer performance ranging from 985 MB/s to a maximum of nearly 4 GB/s



Higher Performance Requirement



High Resolution Video & Photo Device

Video Capacity is increasing with higher resolution technology showing
Those device will increase dependence a memory card with SSD like performance

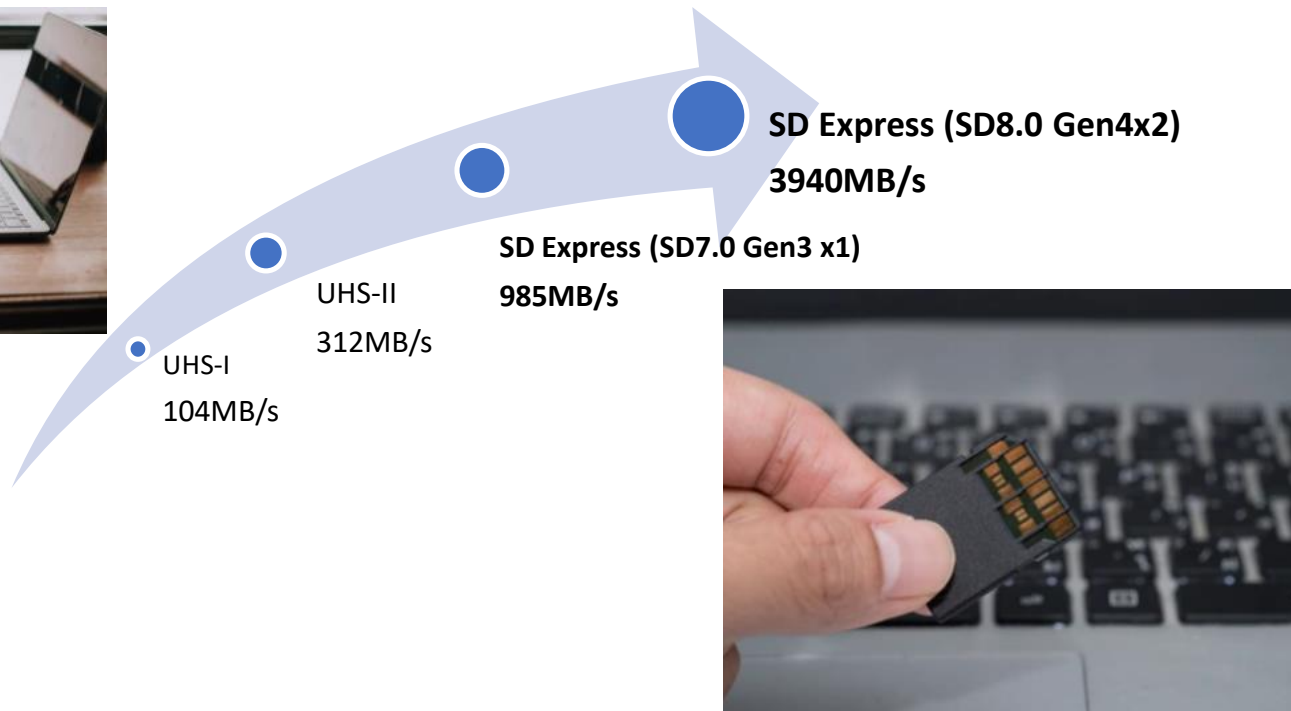


Drone
360 Degree Camera
8K UHD Video device

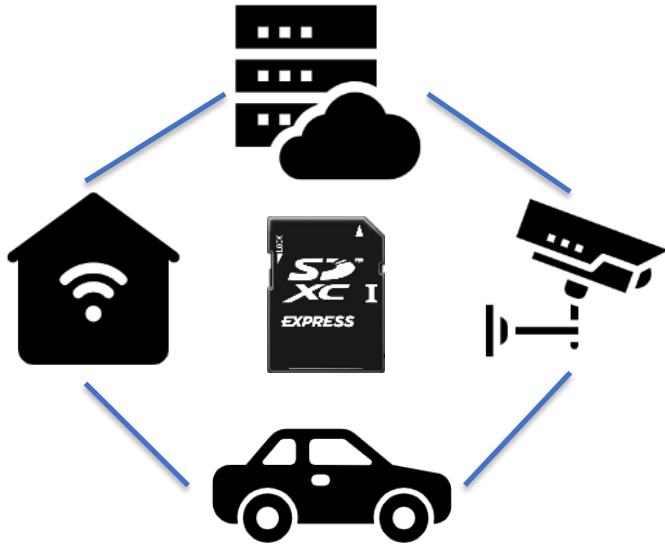


Portable SSD Level Storage

SD Express Card is the smallest portable storage with SSD level transfer performance



Data/information capacity is increasing in the future and People will always look for the storage with faster performance to handle these data



Phison SD Express Card solution PS5017

<https://www.phison.com/en/company/newsroom/press-releases/general/1963-phison-is-the-first-to-ship-the-new-pcie-sd-express-card-sd-7-0>

FEBRUARY 24, 2021

PHISON



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 256GB and a 512GB offering.





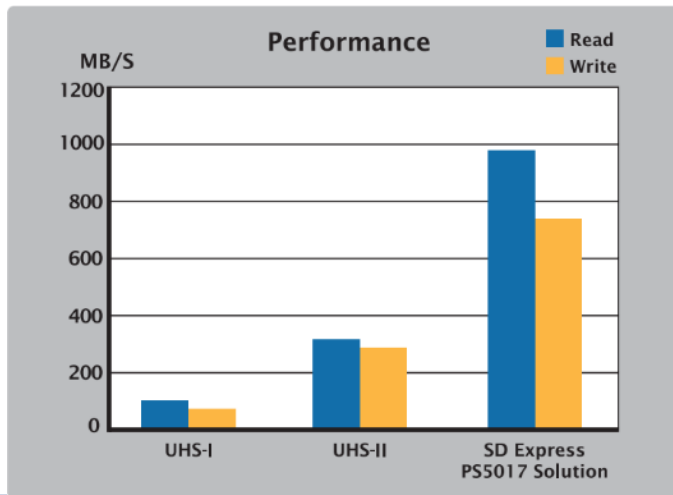
SD Express (SD 7.0) is the first memory card to apply a PCIe interface in an SD interface compatible with all the existing built-in SD slots. This innovation takes the

https://www.youtube.com/watch?v=RjrbhKD8O48&ab_channel=PhisonElectronicsCorp.



Phison SD Express Card solution PS5017

|  | SD Card |  | microSD Card | | | |
|---|-------------------------------|---|--------------|-------------------------------|-------------------|-----------|
| Controller | Sequential Read/Write (up to) | Capacity | NAND Flash | Application Performance Class | Video Speed Class | UHS Speed |
| PS5017 | 870/740 MB/s | 256GB ~ 1TB | 3D QLC | A1 | V30 (SD Express) | U3 |





SD Association

Thank You

Anson Phan

Email: anson_phan@phison.com



SD Express Interconnect Solution

Zhineng Fan

Technologist, Amphenol

Amphenol

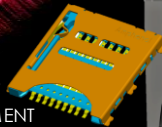
Amphenol

SD EXPRESS
INTERCONNECT
SOLUTION PROVIDER



HOST & DEVICES

NEW
DEVELOPMENT



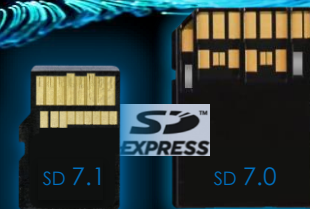
microSD Connector supports multi standards.

- **SD 7.1** (PCIe Gen 3)
- SD 3.01 (UHS-I)
- SD4.0 (UHS-II)

Connector SI performance is future proof;
o up to PCIe Gen 4

SD Connector supports multi standards.

- **SD 7.0** (PCIe Gen 3)
- SD 3.01 (UHS-I)
- SD 4.0 (UHS-II)

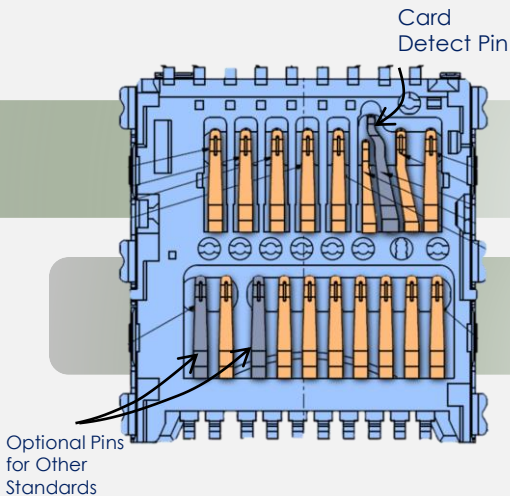
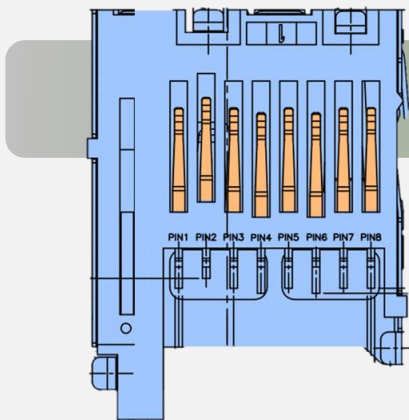


MEMORY CARD

**Contact Amphenol for more details

Connector Evolution with micro SD Express

Amphenol



LVDS
TIA/EIA-644

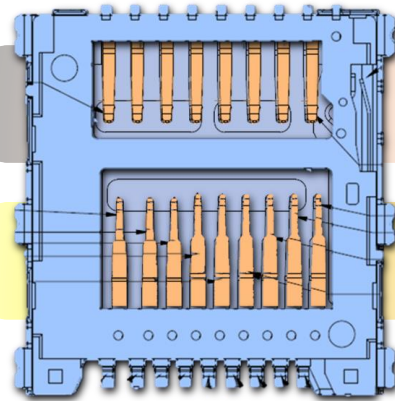
1st Row
Contacts

2nd Row
Contacts



PCI EXPRESS **nvm** EXPRESS

Different Foot Print



Standard
Off the Shelf

Connector is rated up to Gen 4



SD3.0



SD3.0



SD4.0

High Speed
Pads are OFFSET



SD3.0

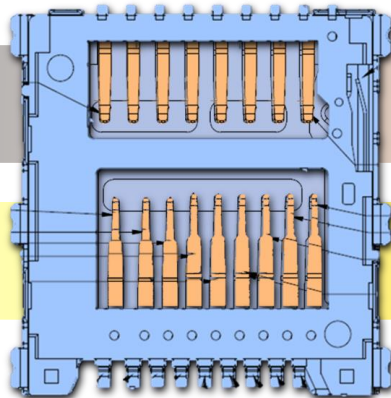


SD7.0

SD EXPRESS
PCI EXPRESS Gen 3

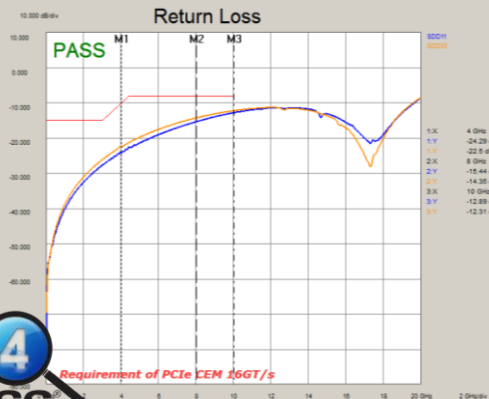
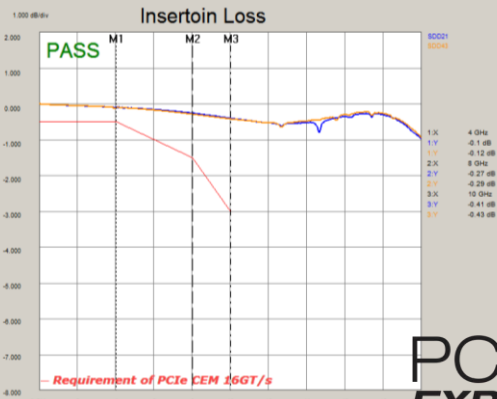
Connector Evolution with micro SD Express

Standard
Off the Shelf

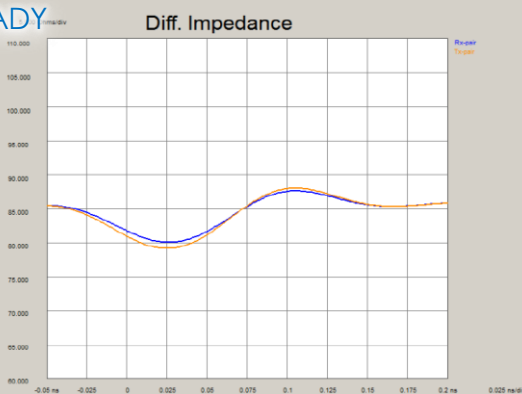
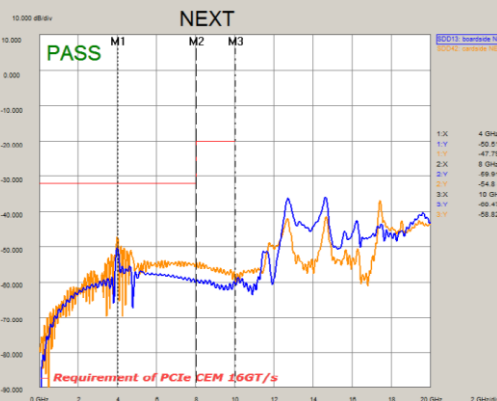


P/N: 101019966912A

Dimension spec
L*W*H=14.65*13.50*1.55mm

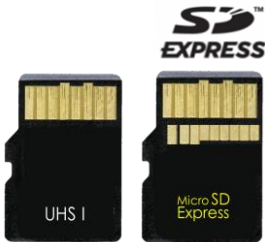
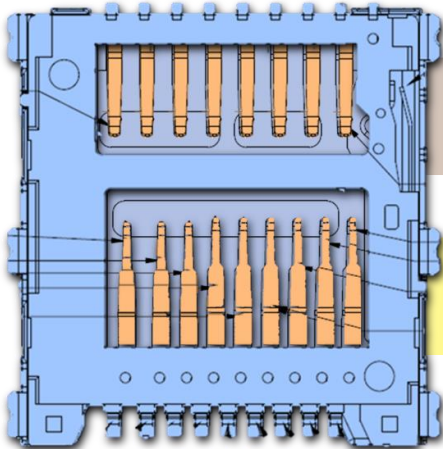


PCIe 4
EXPRESS
READY



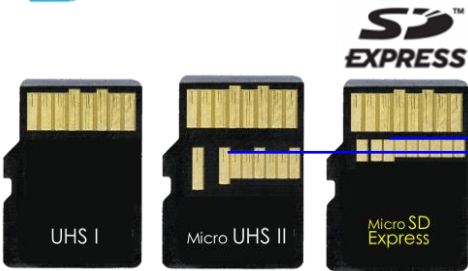
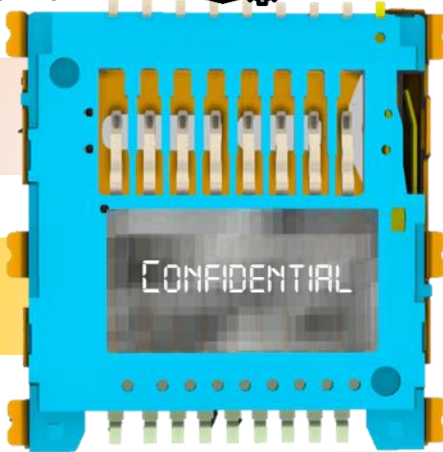
Connector Evolution with micro SD Express

Standard
Off the Shelf



BACKWARD
COMPATIBLE
OPTION

NEW
DEVELOPMENT



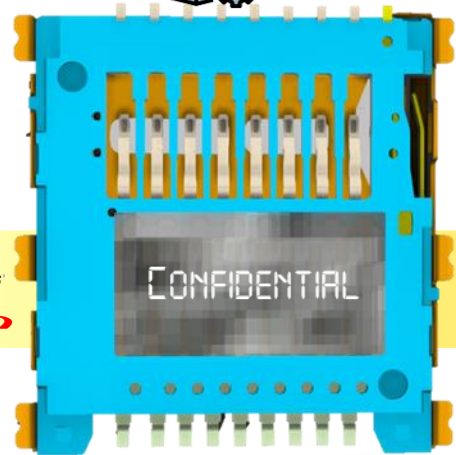
VERY CHALLENGING
Dual contact apex to handle
offset 2nd row high speed signal
transmission

PCI EXPRESS & LVDS
TIA/EIA-644

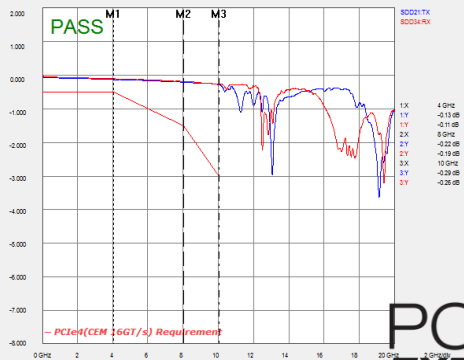
Connector Evolution with micro SD Express

BACKWARD
COMPATIBLE
OPTION

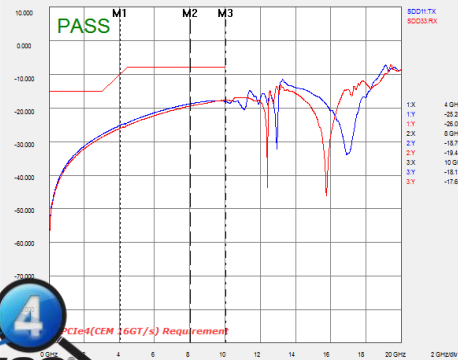
 **NEW
DEVELOPMENT**



Insertion Loss



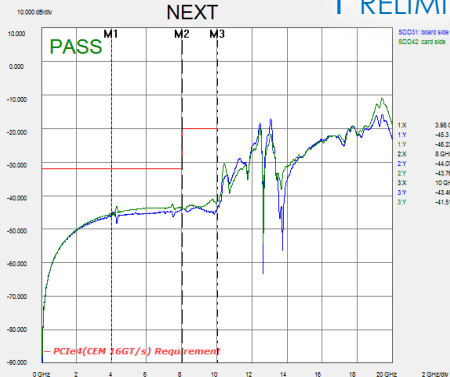
Return Loss



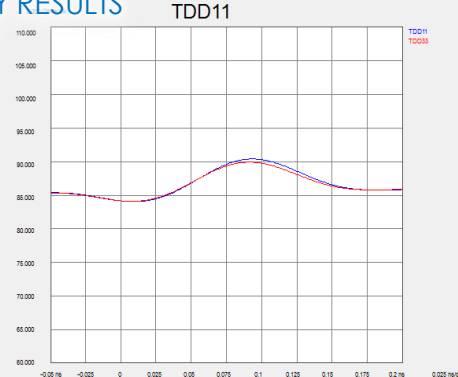
PCI EXPRESS 4

PRELIMINARY RESULTS

NEXT

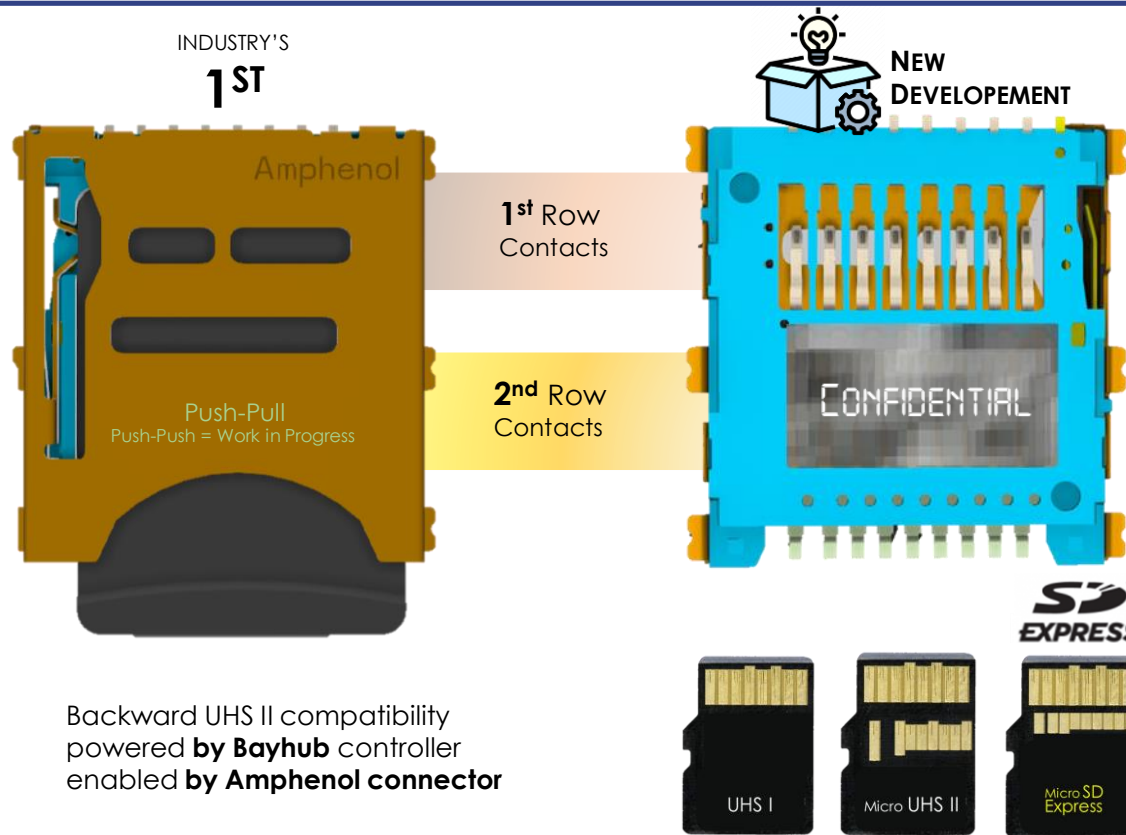


TDD11



Micro SD Express SD7.1 Connector

With UHS II Compatibility



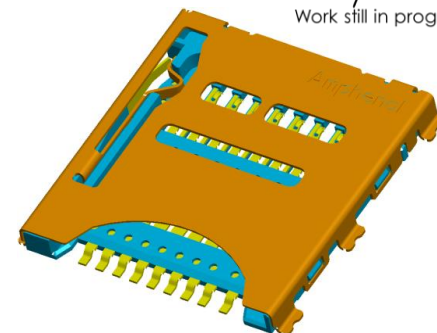
Backward UHS II compatibility
powered **by Bayhub** controller
enabled **by Amphenol** connector

Dimension spec (TBC)
L*W*H=14.65*13.50*2.10mm

Mechanical Spec
Durability:5000 cycles(TBD)
Mating force:40N max(TBD)
Un-mating force:0.5N-40N(TBD)

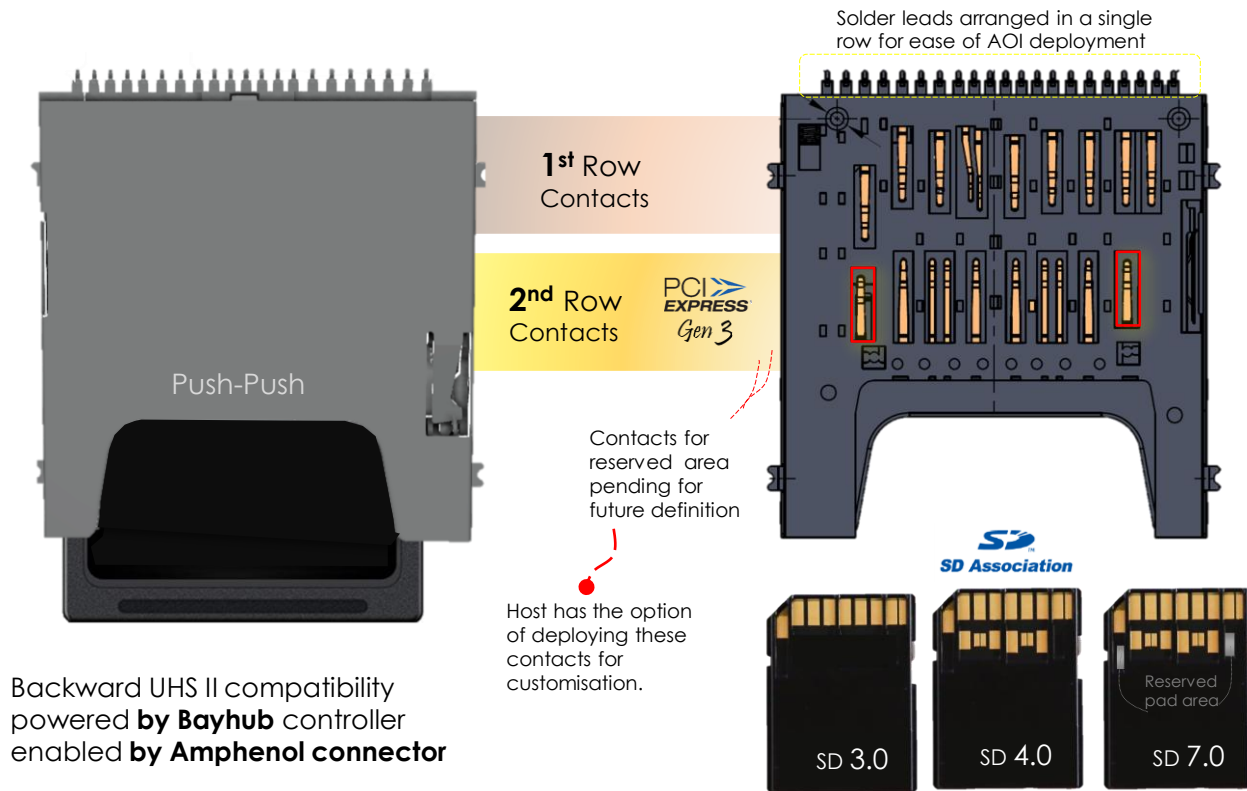
Electronic spec
Working current:0.5A
Voltage: 100V AC

Concept Design
Work still in progress



Full Size SD Express SD7.0 Connector

With UHS II Compatibility



Dimension spec

L*W*H= 29.40 * 28.35 *3.15mm

Mechanical Spec

Durability:5000 cycles (min)

Mating force:40N max

Un-mating force:0.5N-40N

Electronic spec

Working current:0.5A

Voltage: 100V AC

P/N:

GSD21001**X7**BHR

CONTACT FINISH

0: GOLD FLASH

1: 5 μ " GOLD2: 10 μ " GOLD

3: 15 μ " GOLD



WE ARE “**THE BRIDGE**” FOR SD EXPRESS

Do drop us a mail if you have any enquiries

louis.feng@amphenol.com.tw

Thank You!



Thank You

Zhineng Fan
Email: zhineng.fan@amphenol-tcs.com



Introduction of Lexar SD Express

Julia Huang

Senior Marketing Manager (Lexar)



Product Overview



| PCIe Gen3x1 Performance | 128G&256GB |
|-------------------------|------------|
| Sequential Read | 824 MB/s |
| Sequential Write Burst | 410 MB/s |
| Random Read | 404 MB/s |
| Random Write | 349MB/s |



Specification

- SD7.1, PCIe Gen 3x1
- Capacity: 128G/256G/512GB (SD)
128G/256G (microSD)
- Form factor: SD and microSD
- Controller: SMI SM2708
- Flash: WD BiCS4 3D TLC
- Power/performance throttling

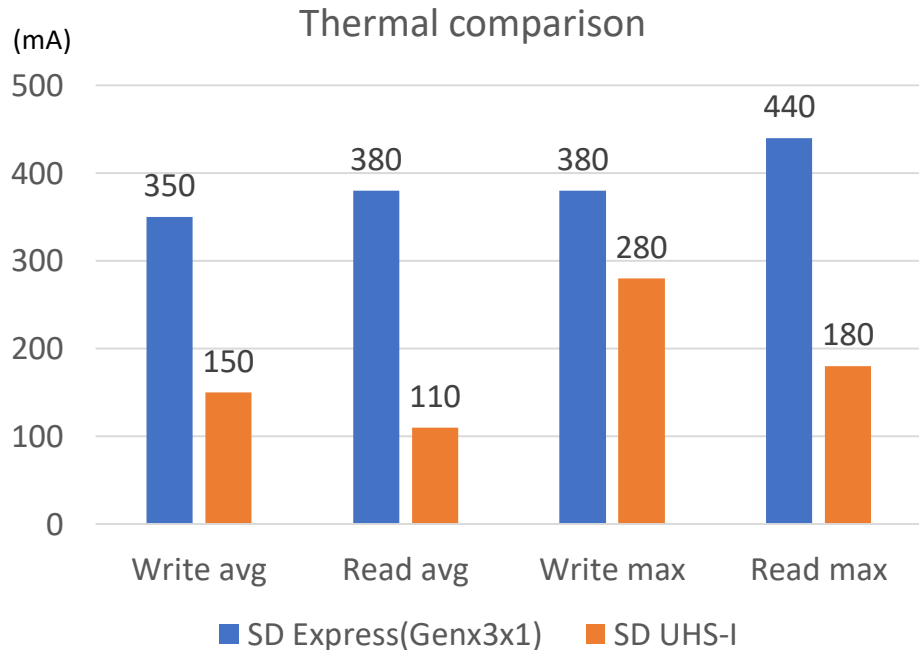
Status

- UHS-I compatibility test
Passed over 200pcs UHS-I devices
- Passed SD7.1 card reader test
Realtek (PCIe Gen3x1 to SD7.x)
Genesys (PCIe Gen3x1 to SD7.x)
BayHub (PCIe Gen3x1 to SD7.x)
JMicron (USB3.2 Gen2 to SD7.x)
- Device list
Notebook/Laptop--ongoing

Thermal Comparison vs UHS-I

Test Method

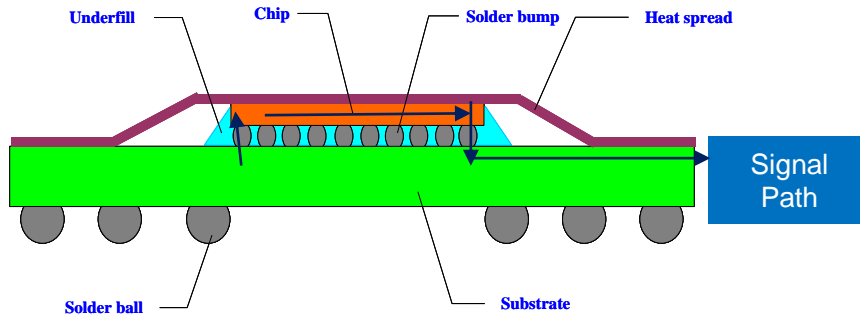
1. Write and read 20GB data through H2testw
2. Measure power consumption
3. Based on the same Flash type
4. 256GB capacity



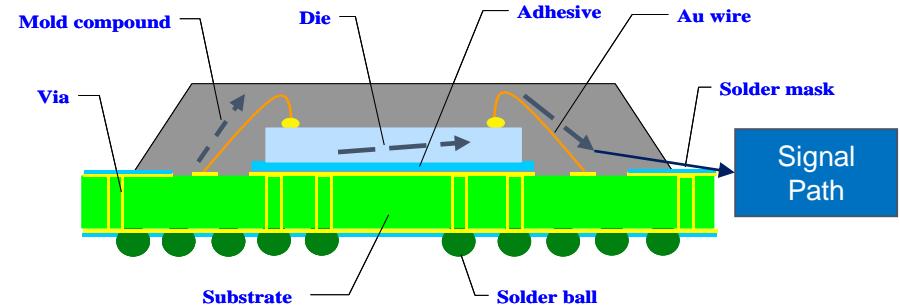
Flip Chip advantage vs Wire Bonding

1. Excellent electrical and thermal properties.
2. With arrayed pad design, can have higher pin count within same die size.
3. Can greatly reduce the size and weight.

Flip Chip



Traditional Wire Bond



Plan and Challenge

Next Plan

- SD 8.0 Gen3x2 2Gb/s evaluation
- High-capacity evaluation




Challenge

- Thermal control for both small form factor size (especially microSD) with high PCIe performance
- Packaging process capability of high capacity of 512GB/1TB/2TB
- New protocol interface requires more host manufacturers to participate. Laptop is the first to support SD Express



| Brand | Application | Status |
|-------|--------------------|--------|
| ACER | Concept Laptop | MP |
| ASUS | ProArt Studio Book | MP |
| MSI | GE76 Raider | MP |

Three laptops are shown: an Acer Concept Laptop, an ASUS ProArt Studio Book, and an MSI GE76 Raider.

Host Adoption Status

- SD7.x Bridge Chip
 - Realtek (PCIe to SD7.x / USB3.2 Gen 2 to SD7.x)
 - Genesys (PCIe to SD7.x)
 - BayHub (PCIe to SD7.x)
 - JMicron (USB3.2 Gen 2 to SD7.x)
- Workstation/PC/Laptop
 - ACER/ASUS/MSI Laptop MP

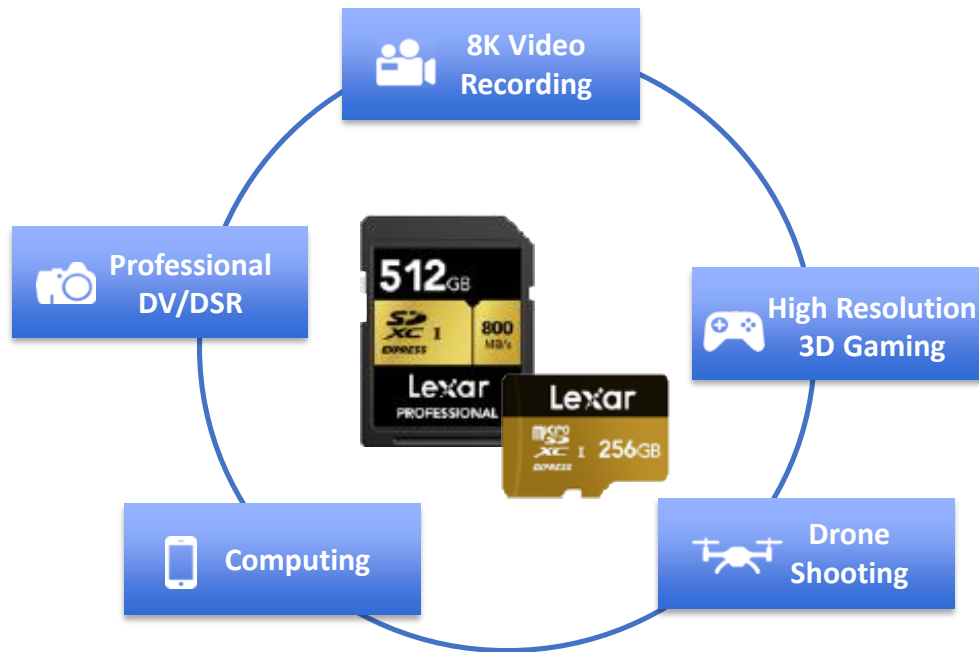
The laptop comes packed with every port that may need such as HDMI, SD 7.0 and many more.

Market Visibility

2022

Future Application for Retail/OEM Market

The speed of SD Express is essential for high-resolution content applications



The background of the slide is a solid blue color with a repeating pattern of white line-art icons representing various electronic devices and technologies, including smartphones, cameras, headphones, and medical equipment.

Thank You

Julia Huang
Email: julia.huang@lexar.com



AMP Inc.'s Current & Future SD Express Products & Solutions Roadmap

Rick Neil

Sr. Principal Memory Module Applications Engineer & Digital Hardware SME (AMP Inc.)

□ Presentation Agenda:

- 01 -- Introduction to AMP Inc..
- 02 -- AMP Inc. Memory Solutions In General
- 03 -- AMP Inc. SD Express Solutions: Current
- 04 -- AMP Inc. SD Express Solutions: Datasheet Overview
- 05 -- AMP Inc. Roadmap to SD Express Solutions
 - Data Encryption
 - Security Tool Chain
 - Hidden Card
 - TRNG and Authentication
 - Hardware Security Module
 - Key Generation
 - Symmetric Cryptography Support Ecosystem

□ Introduction to AMP Inc.

- * AMP Inc is Based in Southern California, in Santa Ana.
- * AMP Inc products are available worldwide to a wide array of businesses and industries: Commercial, Industrial, Medical, Military, Space, Automotive, Surveillance, Data Center.
- * AMP Inc specializes in standard and advanced, and custom Memory and Storage Solutions.
- * From concept to completion, AMP delivers fully integrated R&D support.
- * Every AMP Inc product is backed by a commitment to the highest quality and the fastest turnaround times possible.
- * AMP Inc is proud of the Alliances & Affiliations developed in the memory and storage industry throughout the years. We are a proud member of SD Association and JEDEC.
- * AMP Inc is committed to customer satisfaction and compliance with AS9100D and DFARS standards.



□ **AMP Inc. Memory Solutions In General.**

- DRAM Modules
 - DDR1, DDR2, DDR3, DDR4, Coming Soon DDR5
 - Every available mechanical form-factor
- Solid State Drives (SSD): SATA, PATA, mSATA, mPATA, PCIe-Express
 - M.2, 1.8", 2.5", NVMe, EDSFF
- SD Cards
 - SD, microSD, [SD Express](#)
- USB, USB Embedded & Compact Flash Solutions
 - eMMC, BGA, UFS

☐ AMP Inc. SD Express Value Proposition

- For SD Express Cards:
 - Life Time Support [7 to 10 year Life Cycle Support]
 - Locked BOM [upon customer request]
 - Full Spectrum SD Express Compliance Testing

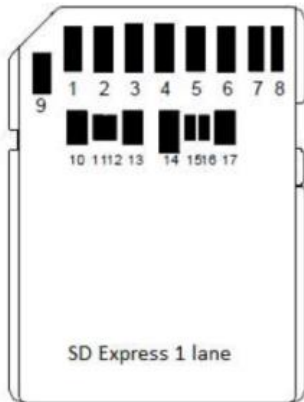
| | |
|-------------------------------|---|
| Form Factor | SDXC Express SD |
| Interface | PCIe/NVMe Gen 3x1 |
| Flash | QLC |
| SDA Specification | <ul style="list-style-type: none"> • Part 1 Physical Layer Specification Ver. 7.10 • Part 2 File System Specification Ver. 7.00 • Part 3 Security Specification Ver. 7.00 • Standard Size SD Card Mechanical Addendum Ver. 8.00 |
| Capacity | 256GB, 512GB |
| Speed Class | U3 |
| Application Performance Class | A1 |
| Video Speed Class | V30 |
| Performance | Reads: Up to 894 MB/s Writes: Up to 774 MB/s |
| Temperature Range | Operating: -25 °C to 85 °C Storage: -40 °C to 85 °C |
| Compliance | RoHS, EMI, ESD |

Product Features:

- Optional CPRM (Content Protection for Recordable Media)
- Static and Dynamic Wear Leveling
- ECC
- Bad Block Management
- Write Protect
- Hot Plug
- SD SPI mode
- Optional Password Protection
- S.M.A.R.T
- Design for intensive R/W applications
- Shock/Vibration Proof
- Waterproof

3. ELECTRICAL INTERFACE OUTLINES

3.1. Pad Assignment and Descriptions



— **AMP Inc. Roadmap to SD Express Solutions**

- Data Encryption
- Security Tool Chain
- Hidden Card
- TRNG and Authentication
- Hardware Security Module
- Key Generation
- Symmetric Cryptography Support Ecosystem

— **Technology Feature Set:**

- Wear leveling, Longevity, Wide temperature support, Data care management
- Power Fail Protection & Recovery, Power fail protection, Shock & Vibration, ESD and EMI safe
- Optional: Ruggedization.

— **Markets**

— **Applications**

Contact Us:

Accelerated Memory Production, Inc. [Amp Inc.]
1317 E Edinger Ave,
Santa Ana, CA 92705

Phone: 714-460-9800

<https://www.ampinc.com>

sales@ampinc.com



SD Association

Thank You

Rick Neil

Email: rick.neil@ampinc.com



Delkin Devices SD Express Memory Cards

Jenn Sherry

Worldwide Retail Sales Director (Delkin Devices)

DELKIN DEVICES.
Rugged Controlled Storage.

DELKIN DEVICES

SUPERIOR MEMORY TRUSTED BY CAREER PHOTOGRAPHERS



US Headquarters / UK Office / Japanese Agent / Government Programs Officer
Retail & Industrial Support

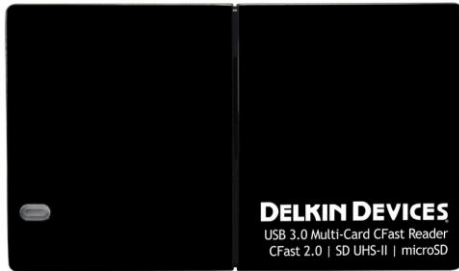


YES:

It is Slightly Faster in Existing Hosts

Future Proofs Users with the Purchase

Improves Workflow (Time is Money)





How Important is Backwards Compatibility?

- It is critical to the launch success of SD Express
- The opposing standard is not backwards compatible, thus giving SD Express a HUGE selling advantage
- Must include Hosts, OS and Readers

SDA has carved out a unique position in allowing this.



Test #1 - 512GB ADVANTAGE UHS-I (V30) SDXC Memory Card:

- 58 Photos (RAW + JPEG at Highest Resolution and Quality) Captured in 6 Seconds [Maximum Buffer Capacity]
- Wait Time to Take Next Photo: **7 Seconds**
- Wait Time to Completely Clear Camera Buffer: 41 Seconds (After Taking 58 Continuous Photos)



Test #2 - 512GB SD Express Memory Card:

- 58 Photos (RAW + JPEG at Highest Resolution and Quality) Captured in 6 Seconds [Maximum Buffer Capacity]
- Wait Time to Take Next Photo: **0.5 Second**
- Wait Time to Completely Clear Camera Buffer: 34 Seconds (After Taking 58 Continuous Photos)



Initial Testing Performance Speeds:

256GB: Up to 820 MB/s Read, 500 MB/s Write

512GB: Up to 894 MB/s Read, 774 MB/s Write

Initial Specifications:

- SDXC Express Memory Card
- UHS Speed Class 3 / Video Speed Class 30
- SD Express will be available in SDXC
- Capacities: 256GB & 512GB (Intention to Add Larger Capacities)
 - Operating Temperature: -25°C to 85°C
 - Storage Temperature: -40°C to 85°C



Final Testing

Production

Market Launch

Consumers can “Future Proof” themselves by buying a form factor that works in their current hosts, but is also fast enough for high-resolution video capture and high-speed data transfers that are likely to be available in future hosts.

Even today, the advantage of the improved workflow speeds makes it a viable product.



SD Association

Thank You

Jenn Sherry

Email: jsherry@delkin.com