SD Association

SDA 2021 GLOBAL WORKSHOP EVENT

USA Webinar

October 27, 2021 | 2:00pm Pacific Time

Global Workshop USA

SD Association

Welcome and Introduction

Sharlene Chin
Senior Product Manager (SanDisk LLC)

SanDisk

Global Workshop Webinar Presenters

SD Association

1 **Opening and Introduction**
- Sharlene Chin, Sr. Product Manager
SDA Member Company, SanDisk LLC

2 **SDA and Technology Update**
- Kazunori Nakano
SDA Board Member & Marketing Committee Chair

3 **SD Express Host Implementation**
- Yosi Pinto
SDA Chairman of the Board

4 **SVP Introduction**
- Miki Takahashi, Exec. VP of Engineering
SDA Member Company, Granite River Labs

5 **SD Express Applications**
- Anson Phan, Sr. Product Manager
SDA Member Company, Phison

6 **SD Express Interconnect Solution Provider**
- Zhineng Fan, Technologist
SDA Member Company, Amphenol

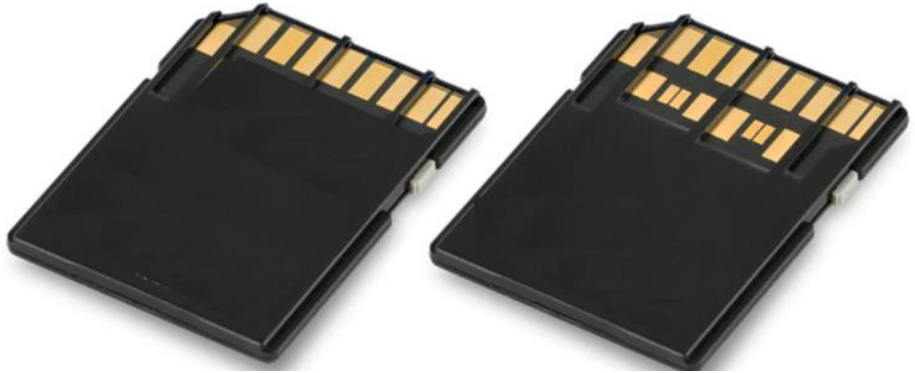
7 **Lexar Introduction of SD Express**
- Julia Huang, Sr. Marketing Manager
SDA Member Company, Lexar

8 **AMP SD Express Solutions Roadmap**
- Rick Neil, Application Engineer
SDA Member Company, AMP Inc.

9 **Delkin Devices SD Express Cards**
- Jenn Sherry, WW Retail Sales Director
SDA Member Company, Delkin Devices

What is the SD Association?

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



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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

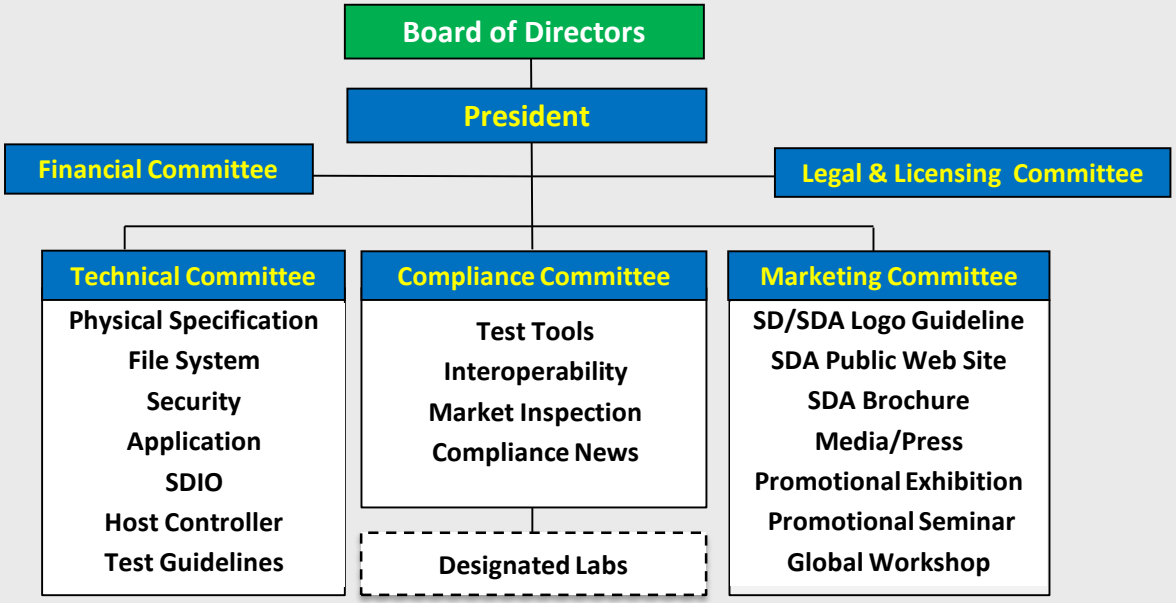
SD Association Overview

SD Association Organization

SD Association

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

License Scheme & Compliance

SD Association

	SD Association	SD-3C LLC
Specification	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

SD Association

- **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

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

** 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)

SD Association

ATP		Danny Lin		Jeff Hsieh
Kingston Technology		David Chen		Joel Tang
KIOXIA		Kazunori Nakano		Open
Lexar		Joseph Yuan		Jordan Zhong
Micron		Jyh Chau		Open
Panasonic		Shuichi Ohki		Takuji Maeda

PHISON Phison Electronics Corp.		T.H. Kuang		Andre Chen
SAMSUNG		HeeChang Cho		JiCheol Hong
SanDisk		Yosi Pinto		Jeff Tsujimoto
SiliconMotion		Janice Chiu		Josh Chen
SONY		Kenichi Satori		Shingo Aso
TUXERA		Joel Catala		Thom Denholm

Marketing Committee Organization

SD Association

Marketing Committee Chair
Kazunori Nakano (KIOXIA)

TC Relations Advisory Directors
Yosi Pinto (SanDisk)

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

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

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

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

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

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

Technical Committee Organization

Technical Committee

●Yosi Pinto (SanDisk)

Test Guideline WG
- Minoru Ohara (Allion)
- Akihisa Fujimoto (KIOXIA)

IO WG
- Katsutoshi Akagi (Bayhub)

Host TG
- Katsutoshi Akagi (Bayhub)
- Akihisa Fujimoto (KIOXIA)

Application WG
●Shinji Inoue (Panasonic)
●Yoni Shternhell (SanDisk)

Specification WG
●Michael Lavrentiev (SanDisk)

Mechanical TG
●John Burke (SanDisk)

UHS TG
●Miki Takahashi (Granite River Labs)
●Tadashi Ono (Panasonic)

SD-PCIe TG
●Michael Lavrentiev (SanDisk)

Advanced Security WG
●Yoni Shternhell （SanDisk)

iSDIO TG
Bluetooth TG
GPS TG
PHS TG
Camera TG
WiMAX TG

Content Format TG
Content Delivery TG
Application Platform TG
Visual TG
Audio TG
Document TG
Binding AD

Random Performance TG
Low Voltage TG
File System TG
NFC Ad-hoc
OTP TG
SS TG
MS TG
eSD TG
Core Security TG

Non-active groups in TC

Compliance Committee Organization

Compliance Committee Co-Chair

Minoru Ohara, Allion
Hiroshi Noda, Canon

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

SVP 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 Specifications Structure

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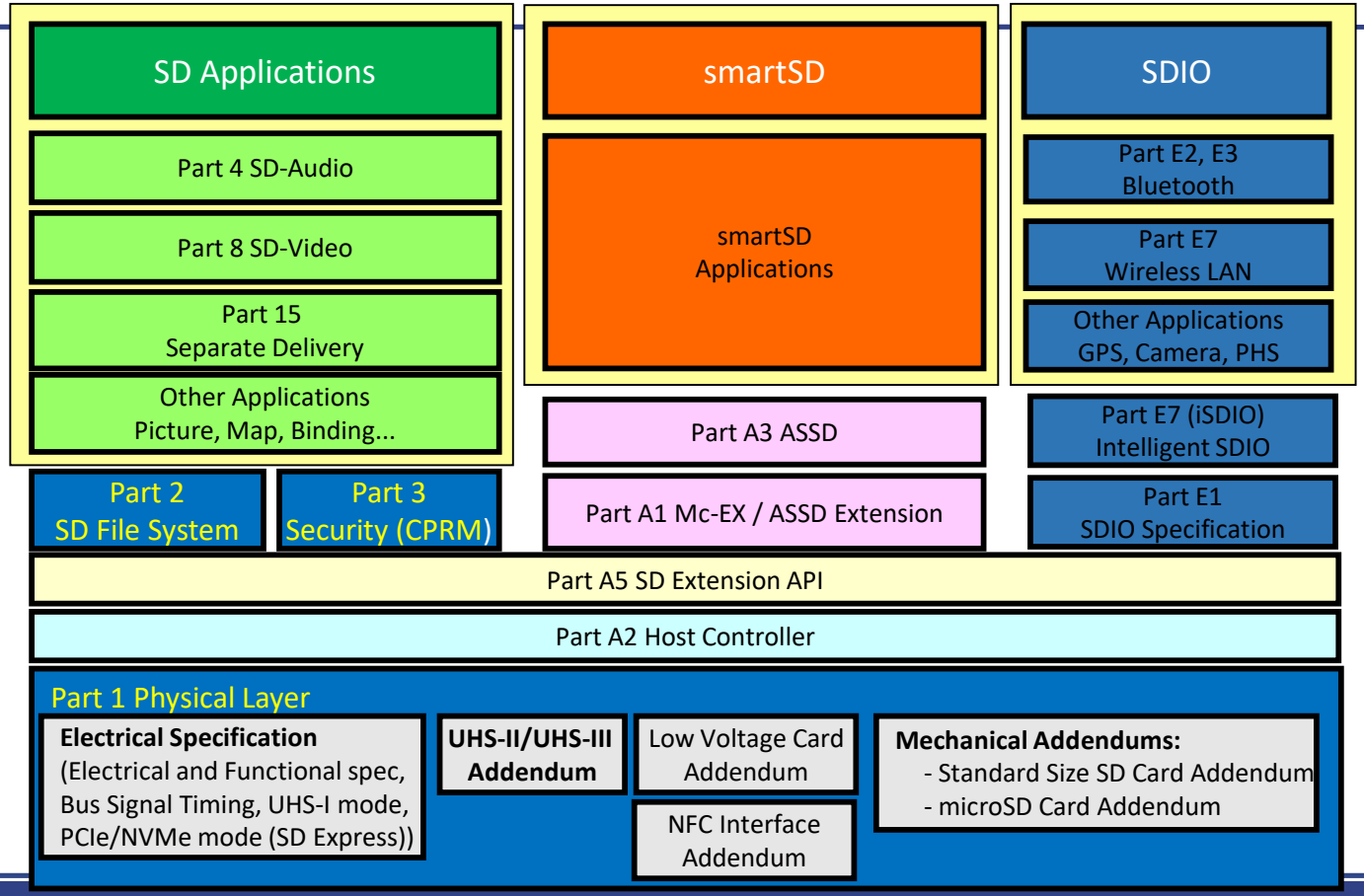
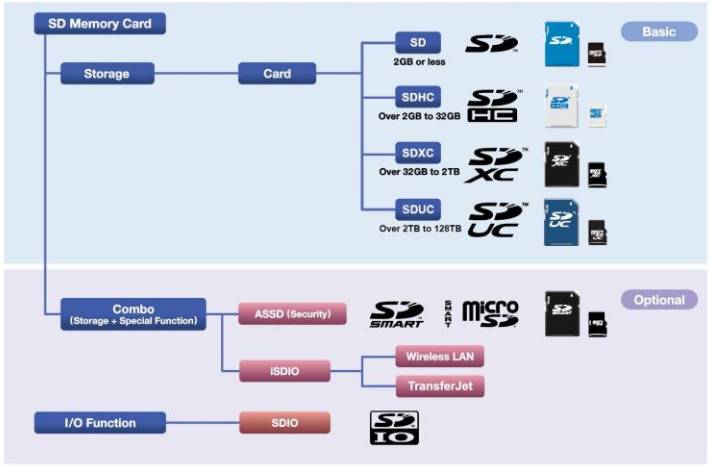


SD Card Types

- **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/secx 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

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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

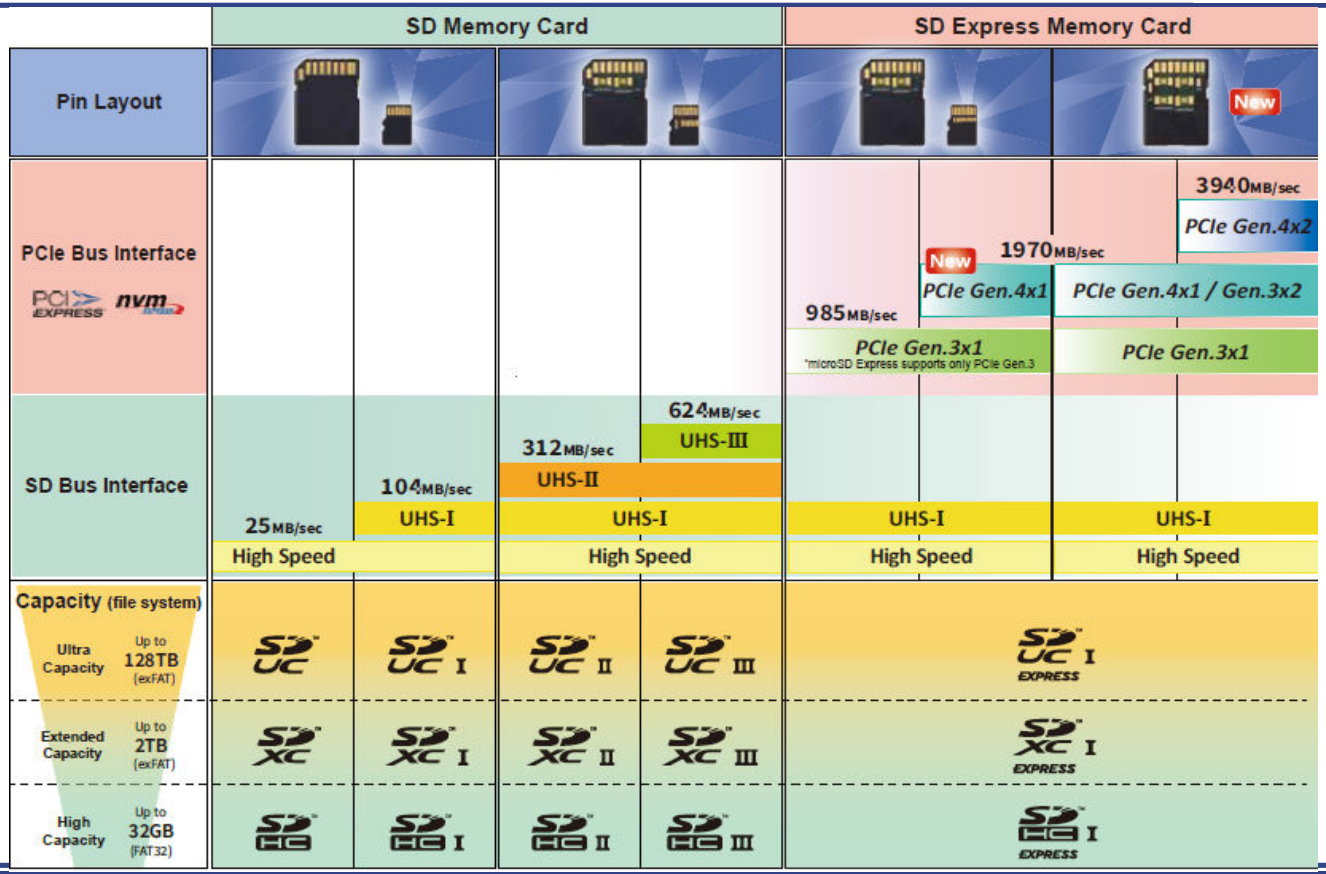
2. Bus Mark: Data Transfer Performance

No Mark	UHS-I	UHS-II	UHS-III	SD Express
				
High Speed	Ultra High Speed			PCIe Gen.3 Gen.4
2004	2010	2011	2017	2018-2020

3. Speed Class Mark: Video Recording

Speed Class		UHS Speed Class		Video Speed Class
				
2006	2009	2010	2013	2016

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



Bus Speed Mode

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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 4.20
	HD312	52MHz x 30 (PLL)	UHS-II PHY	312 MB/sec	
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

SD Express Card: Background

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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

Set Top Box

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

- Imaging market is already heading to PCIe

Modem / Gateway

NAS

- Edge Computing Gateway : High Speed, Small and Robust

Advantages of PCIe Interface

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- **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…

SerialTek

TELEDYNE TECHNOLOGIES INCORPORATED

OakGate Technology

JDSU

KEYSIGHT TECHNOLOGIES

PCIe® is registered trademark of PCI-SIG. NVMe™ is trademark of NVM Express

Summary of New SD Standards

SD Association

- **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 - Inventures

inventures®
Accelerating results through collaboration

SD™
SD Association

- **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

SD Association

Thank You

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

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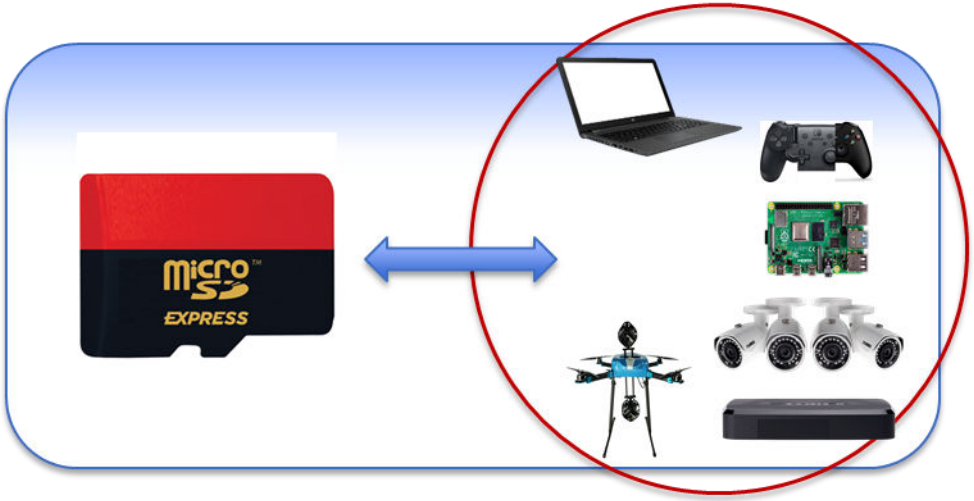
SD Express Host Implementation

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

SanDisk

Agenda

- ☐ **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

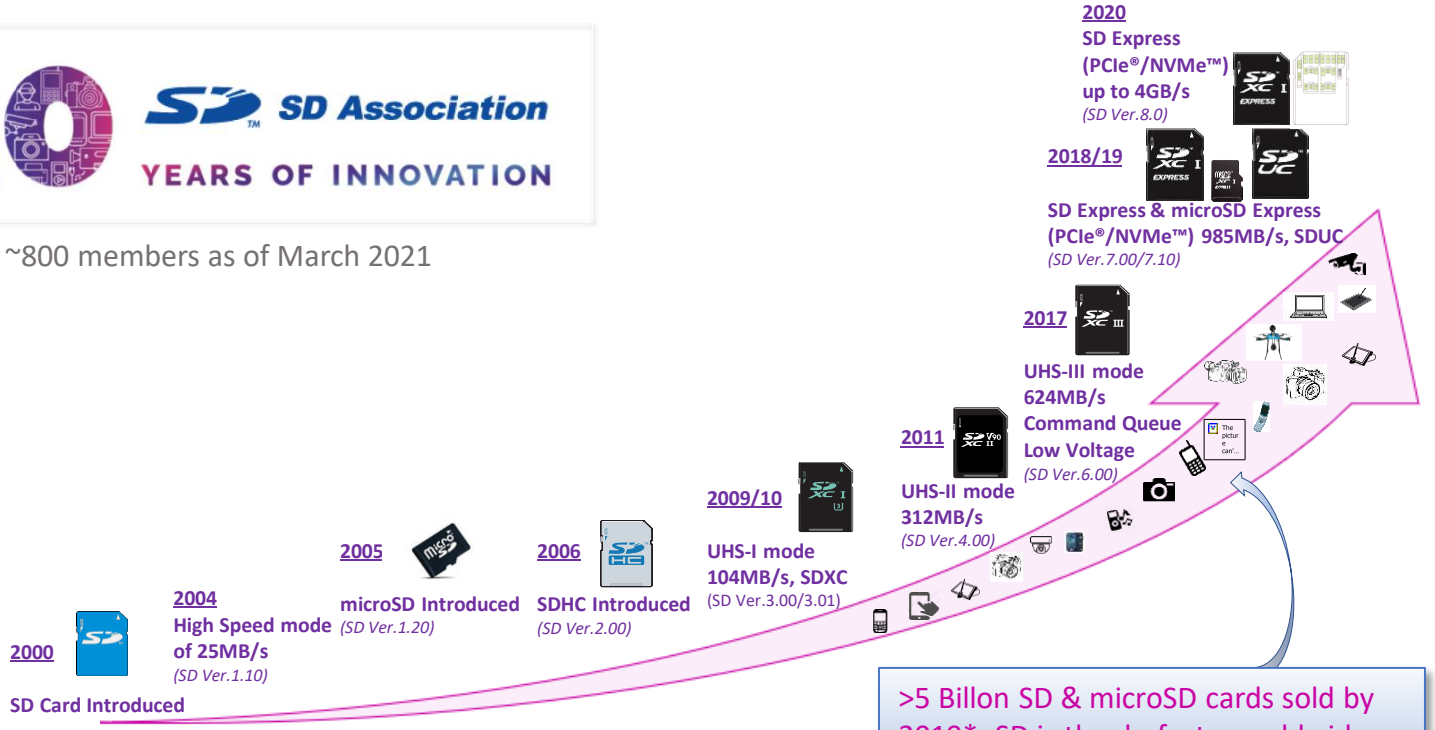


SD Memory Card Standard Evolution

SD Association

20 SD Association YEARS OF INNOVATION

~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")

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

SD Express Cards

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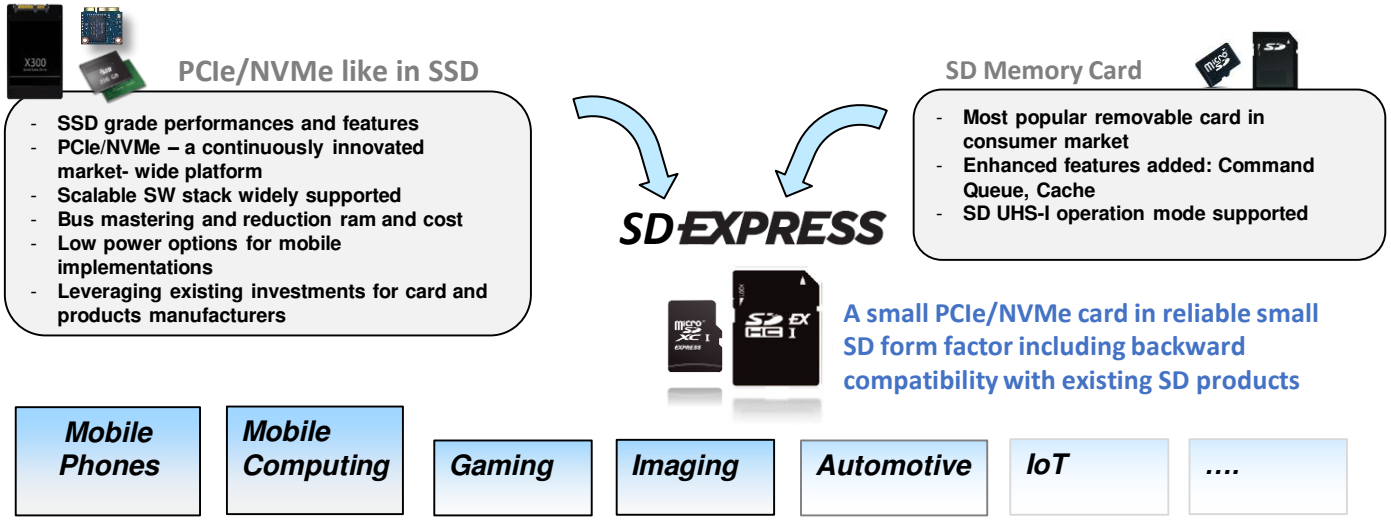
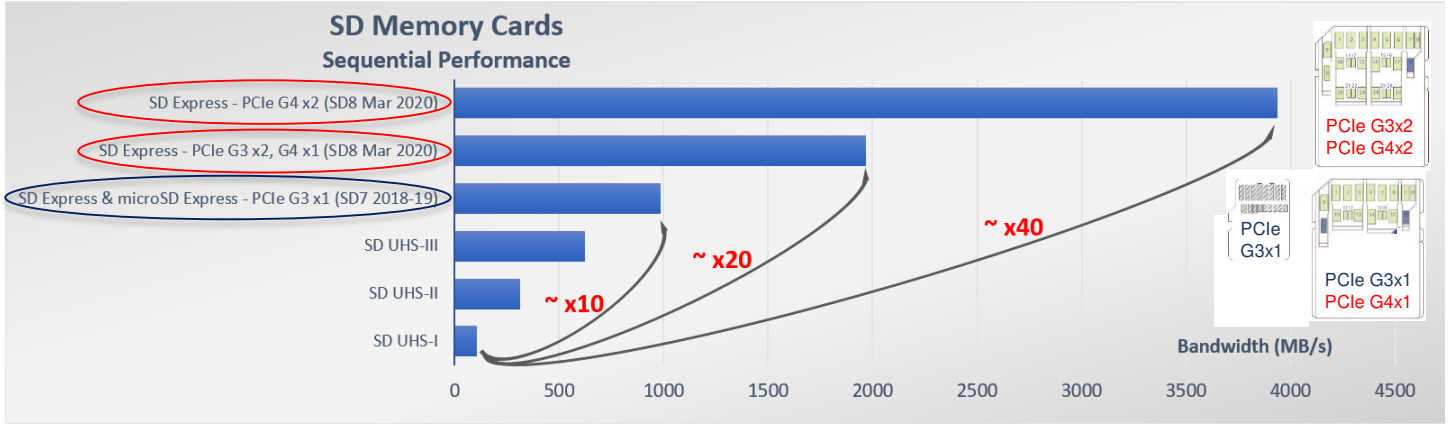


- SD Express cards are SD cards that supports both: PCIe/NVMe interface and the standard legacy SD (UHS-I) interface, allowing backward compatibility
- SD7.0 and SD7.1 (2019) introduced the full size SD Express and microSD Express, respectively, supporting the PCIe 3.1 x1 interface (up to 985MB/s)
-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

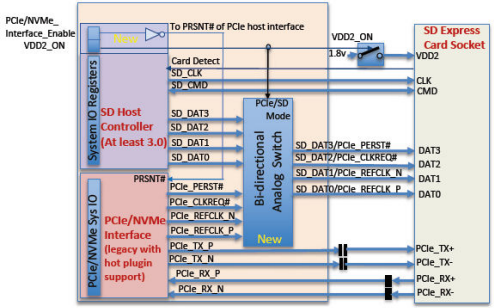
SD Memory Card Bit Rates



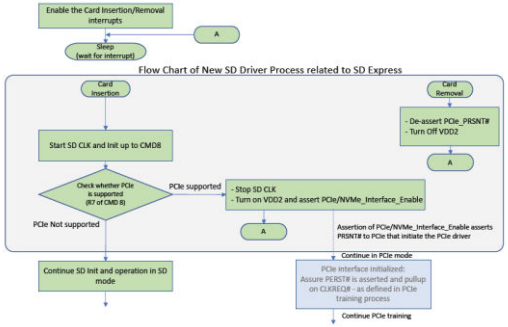
SD Express Benefits and Implementation Method

Material published by SDA that you may use

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

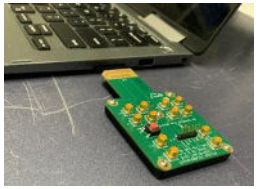


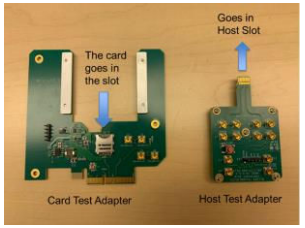
Update to existing SD Driver – As explained in Implementation Guideline



- 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

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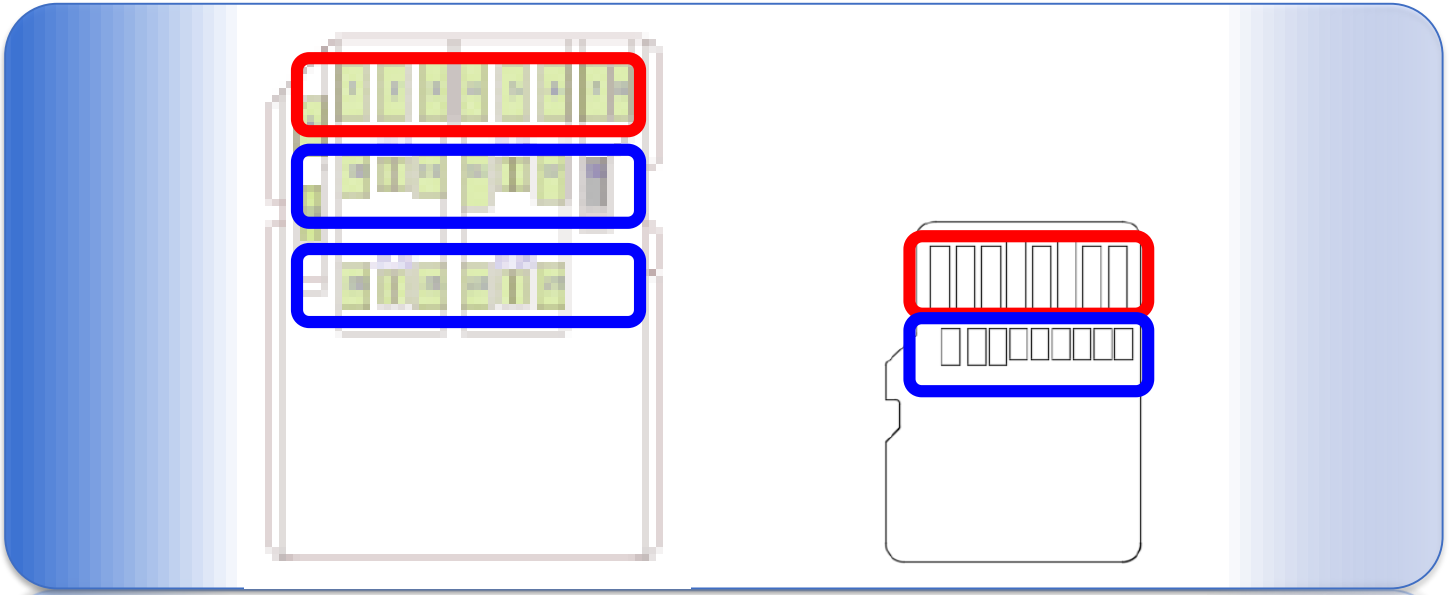
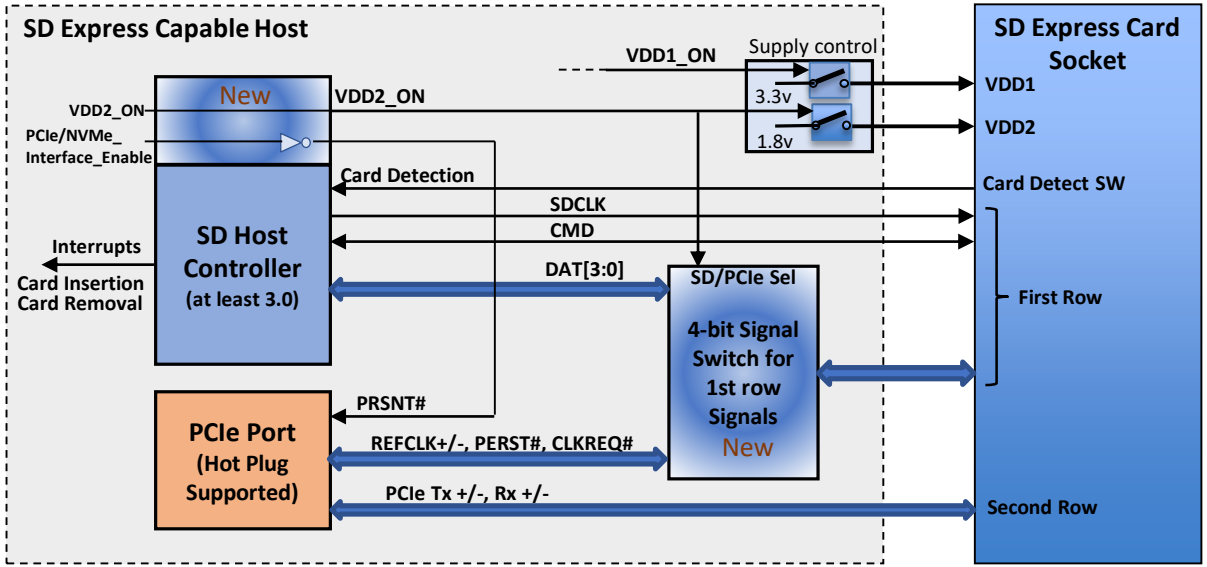
=1st row: conventional SD in SD mode or PCIe side band (PERST#, CLKREQ#, REFCLK+/-) in PCIe mode

=2nd row: PCIe 1st lane differential IO's in PCIe mode

=3rd row: PCIe 2nd lane differential IO's in PCIe mode

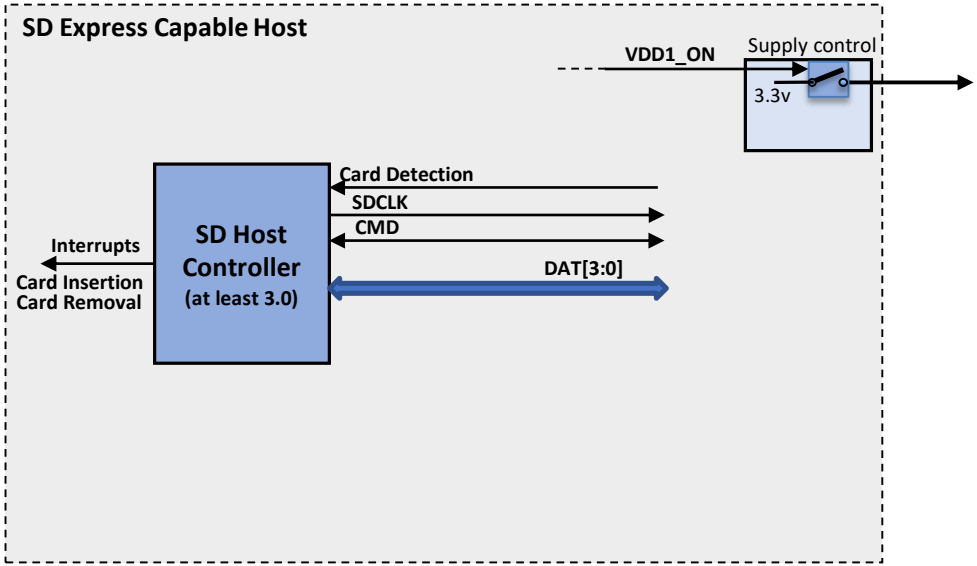


SD Express Host Implementation



SD Express Host Controller – Full Circuit Example

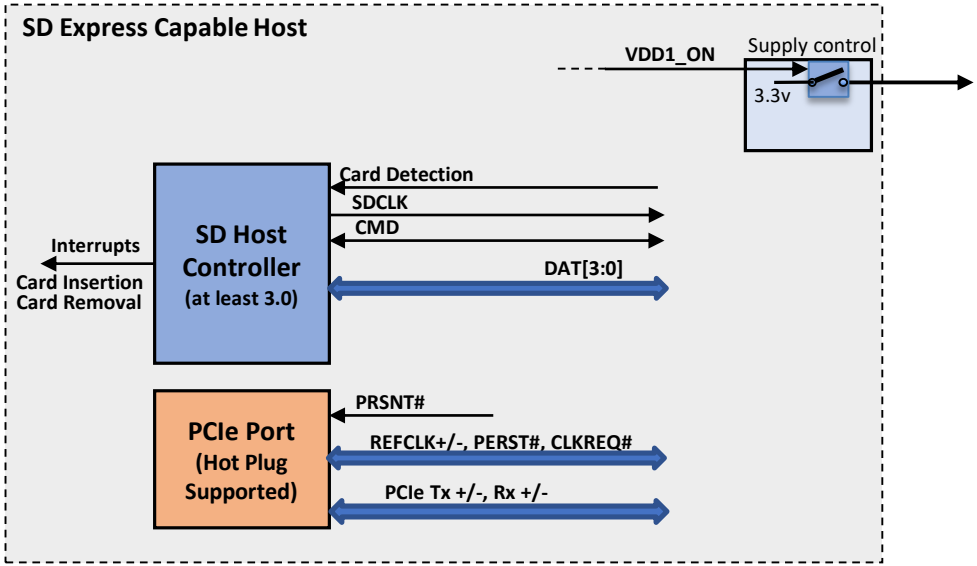
SD Express Host Implementation



SD Express Host Controller – Building blocks:

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

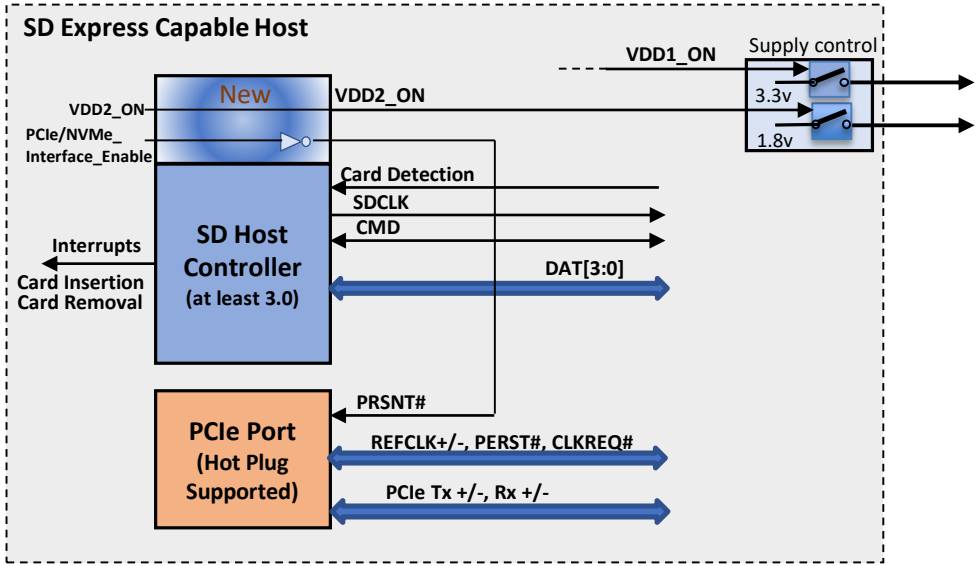
SD Express Host Implementation



SD Express Host Controller – Building blocks:

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

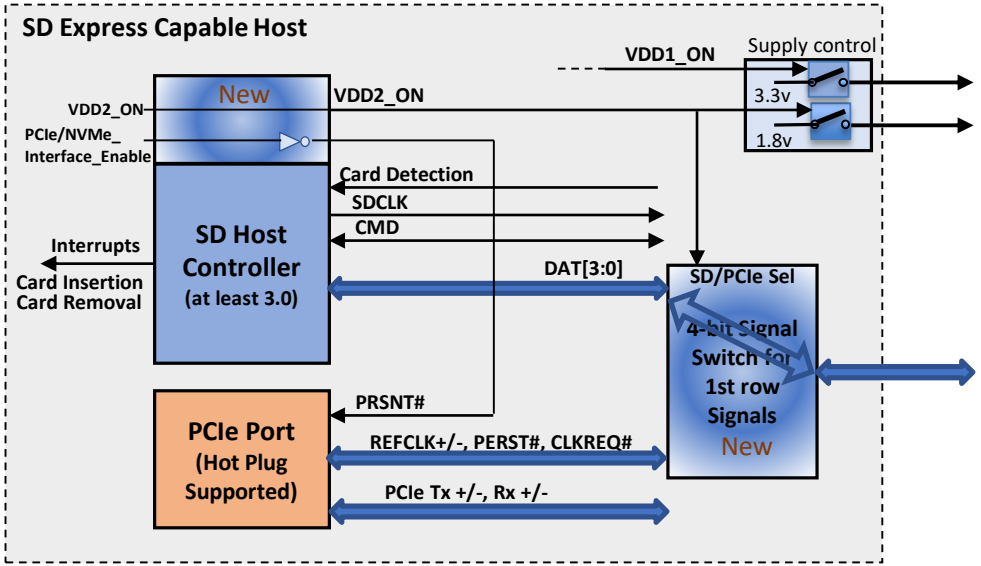
SD Express Host Implementation



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**

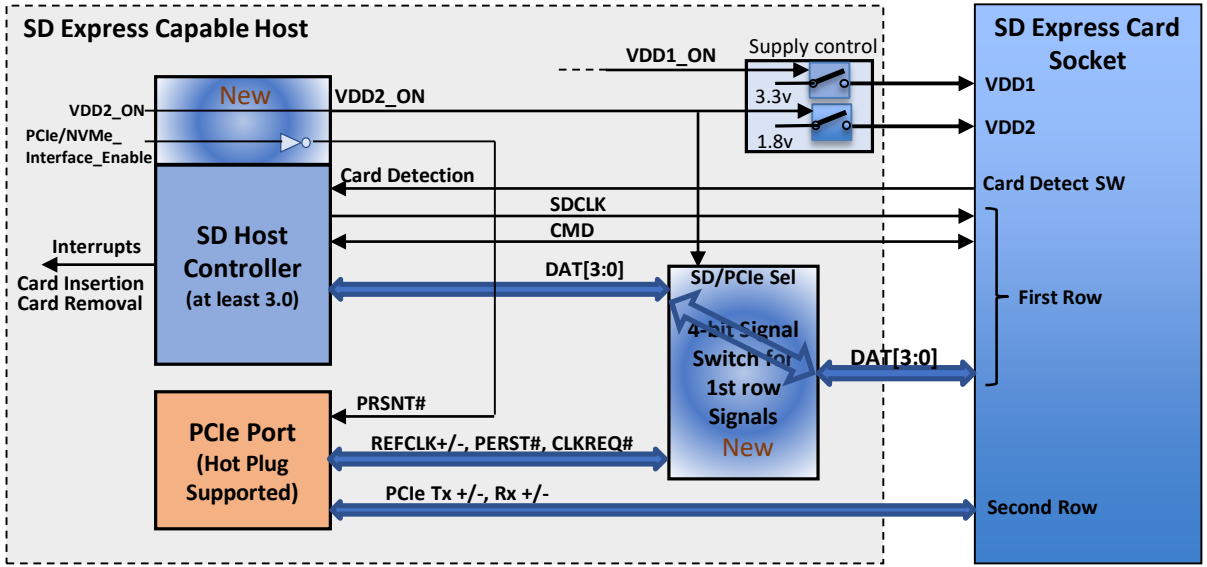
SD Express Host Implementation



SD Express 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 Host Controller – Full Circuit

SD Express Host Implementation

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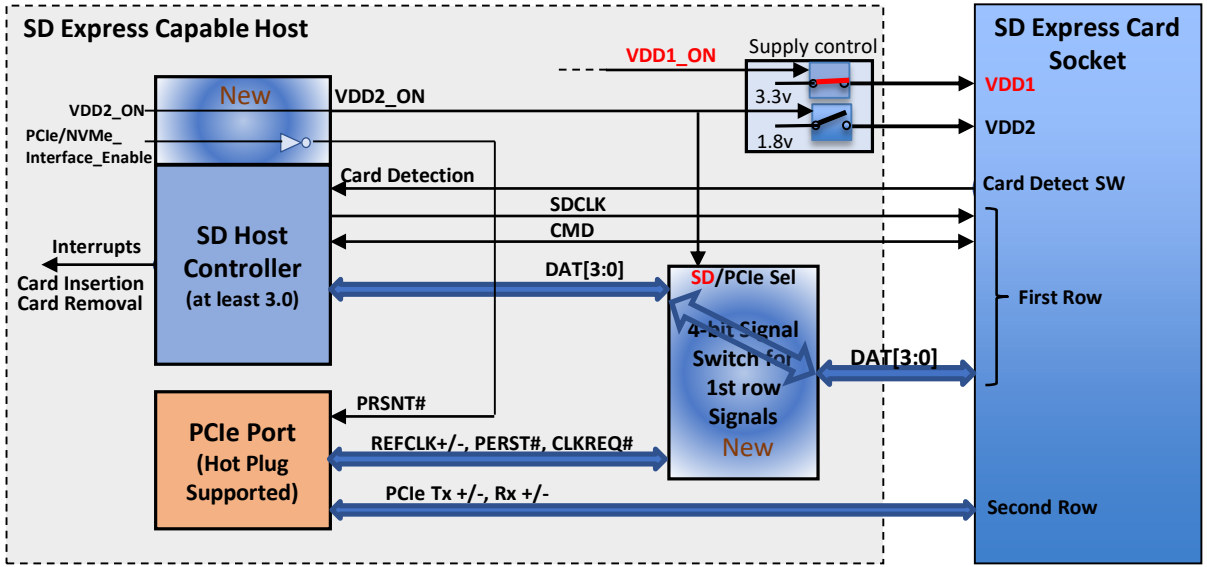
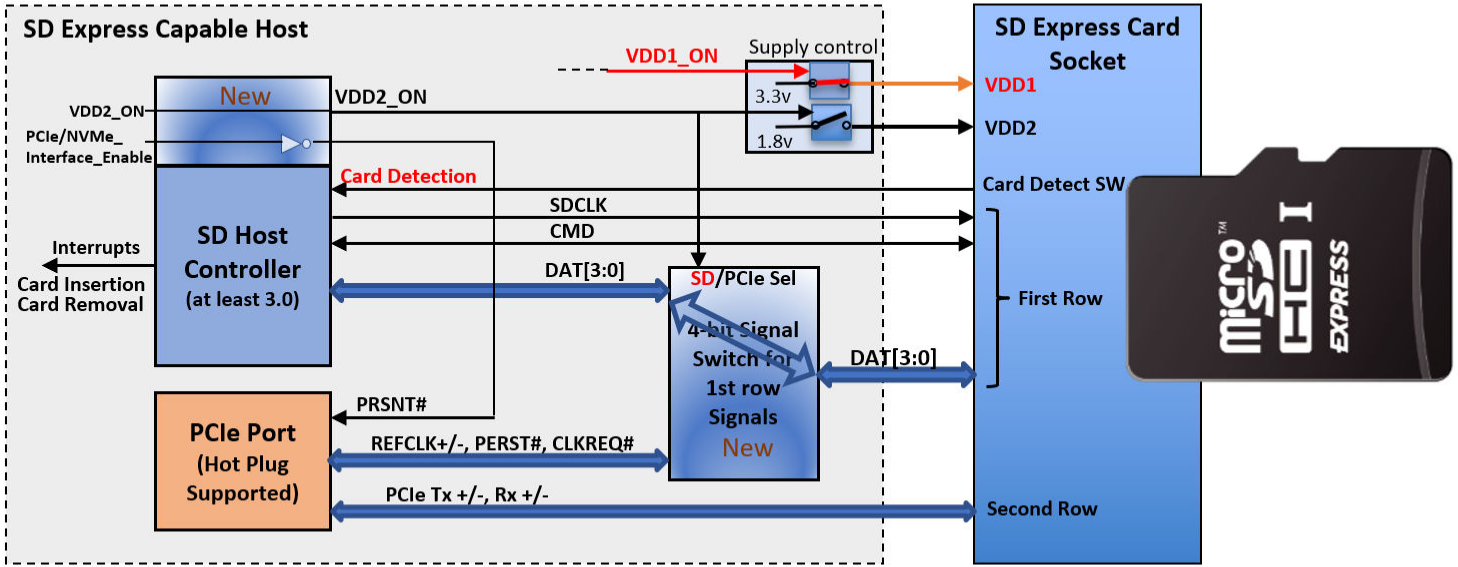


SD Express Host Controller – Operation:

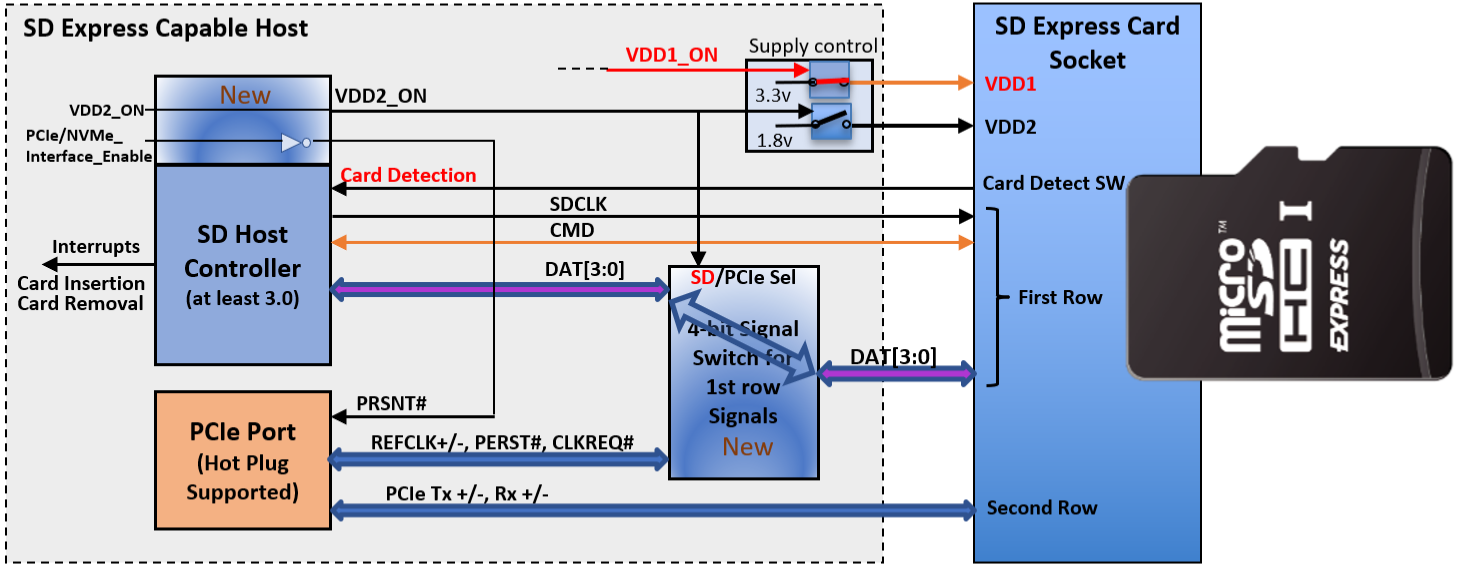
SD Express Host Implementation



SD Express Host Controller – Operation: Card Insertion-detection

SD Express Host Implementation

SD driver initiates the SD card & checks PCIe support



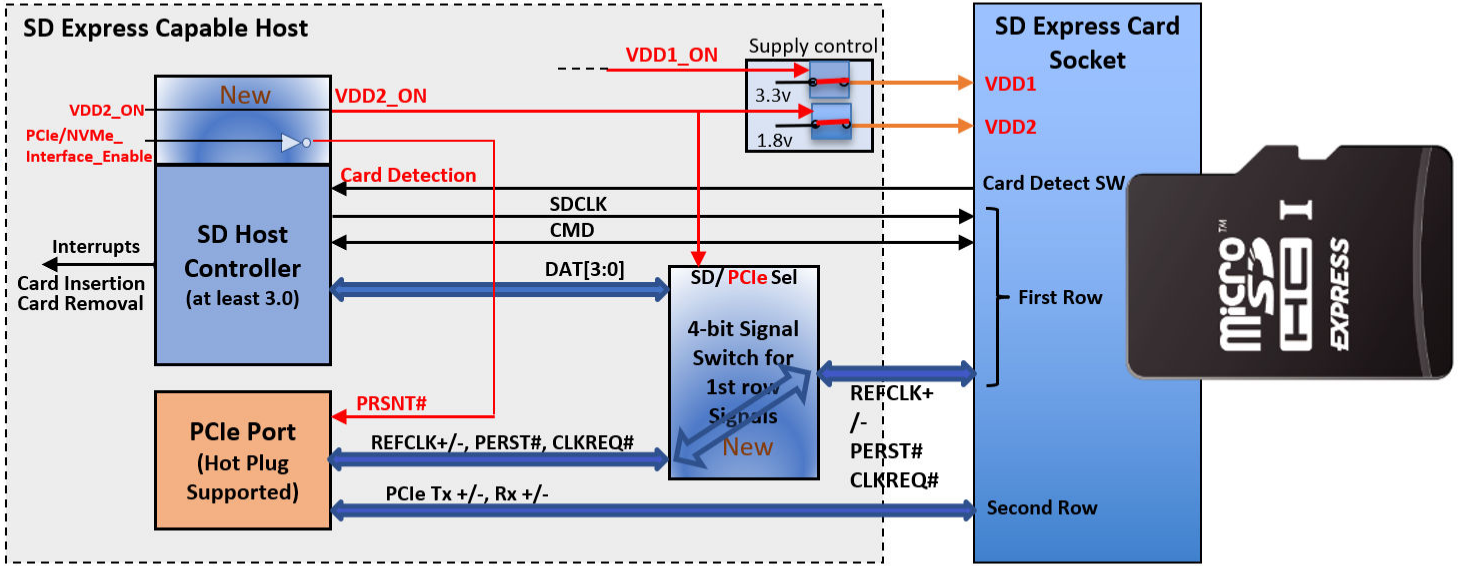
SD Express Host Controller – Operation:
Card Insertion-detection, PCIe support check

SD Express Host Implementation

SD Association

SD driver asserts:
- VDD2_ON
- PCIe/NVMe_int_Enable

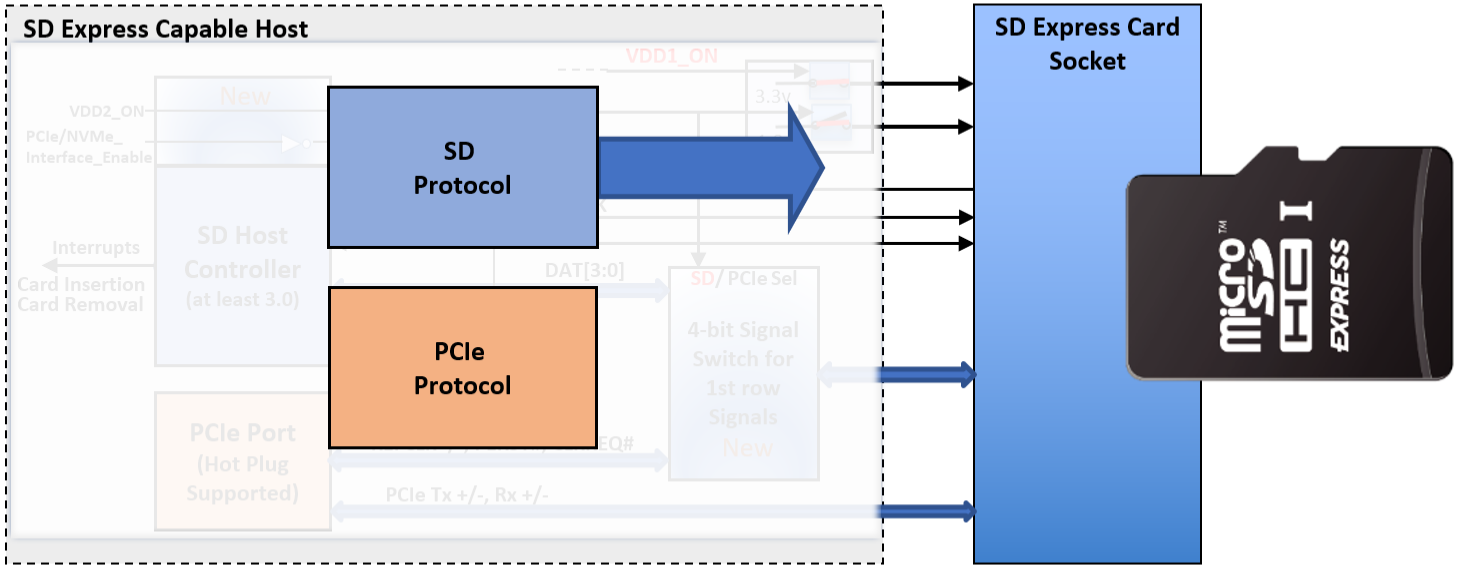
PCIe & NVMe drivers starts operation



SD Express Host Controller – Operation:

Transfer control to the PCIe host and start operation through PCIe channel

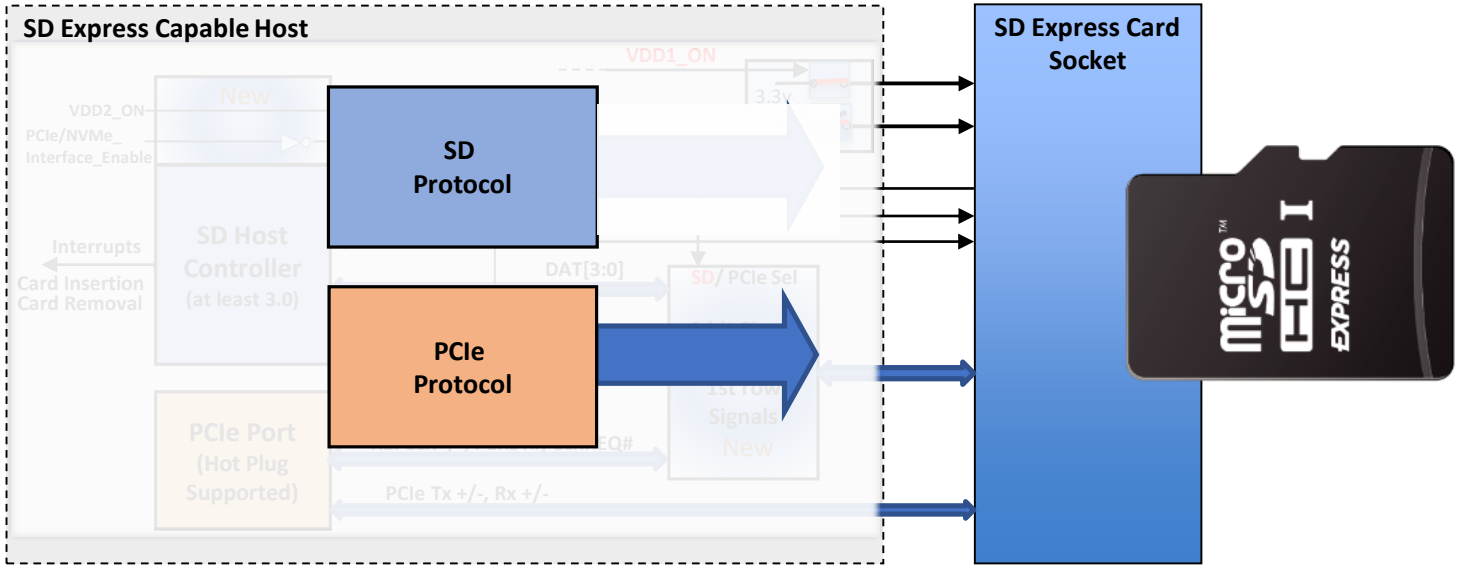
SD Express Host Implementation – other possible methods



The shown example recommends to initiate first through SD interface

SD Express Host Implementation – other possible methods

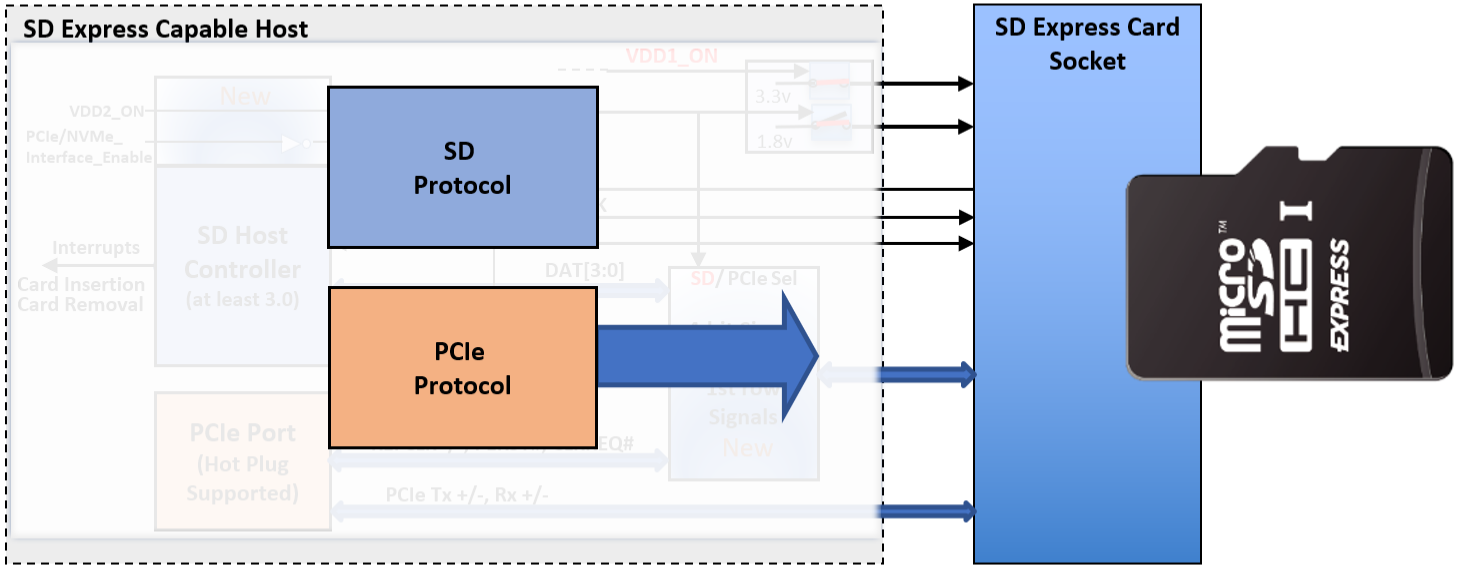
SD Association



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

SD Express Host Implementation – other possible methods

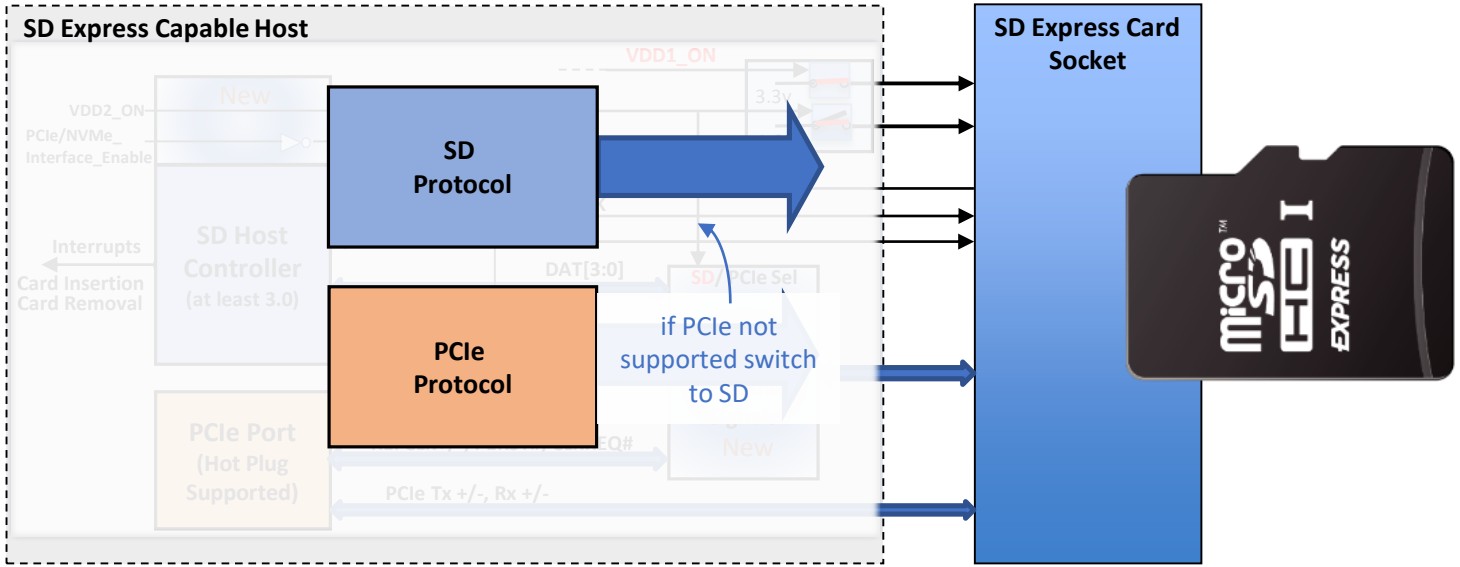
SD Association



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

SD Express Host Implementation – other possible methods

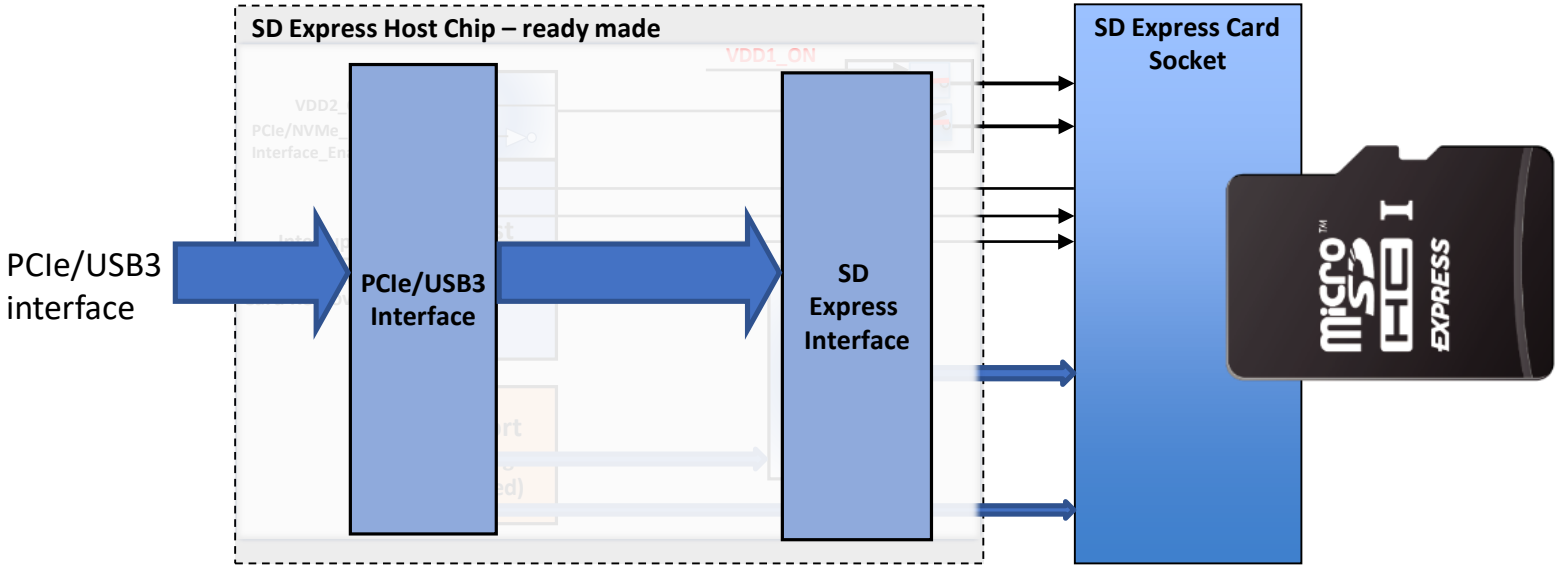
SD Association



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

SD Express Host Implementation – other possible methods

SD Association



Off the shelf components that may serve PCIe/USB3 to SD Interface

Thank You

Email: yosi.pinto@wdc.com

Global Workshop USA

SD Association

SVP Introduction

Miki Takahashi
Executive Vice President of Engineering (Granite River Labs)

GRL

SVP Overview

- **SVP** -**S**D 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

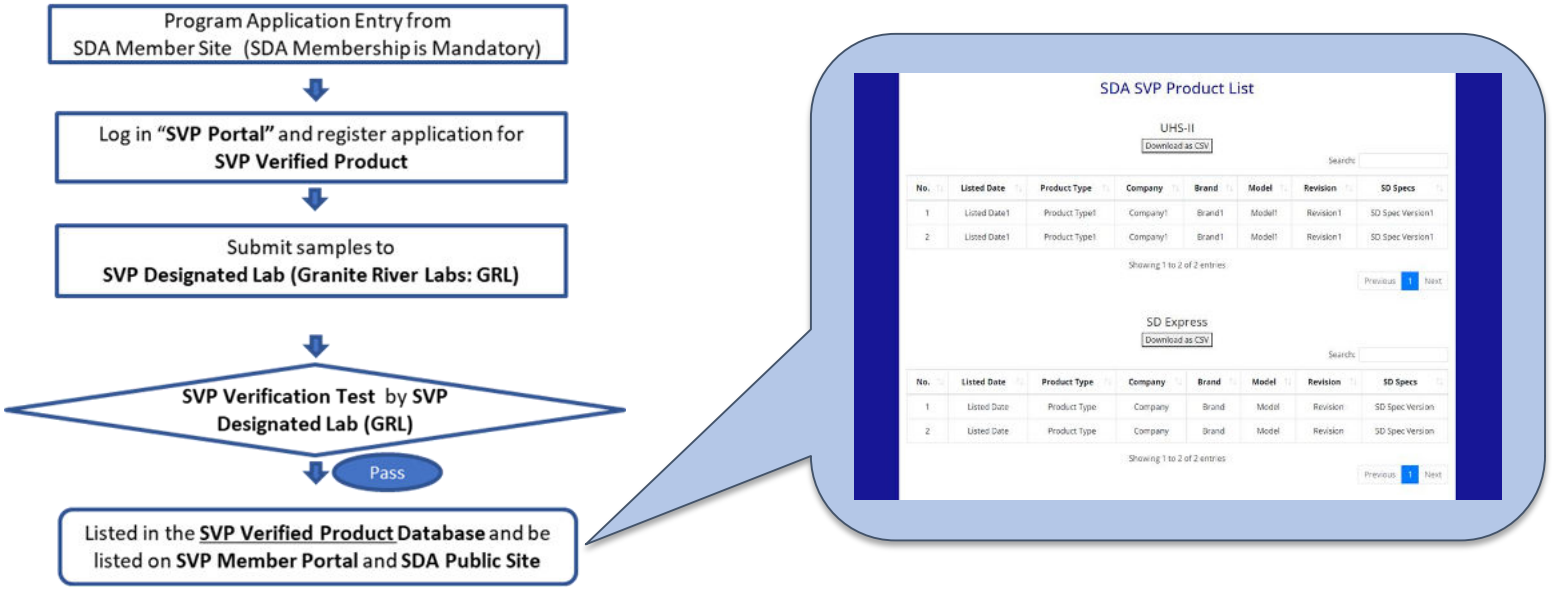
How SVP helps SDA members and End Users

- 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.

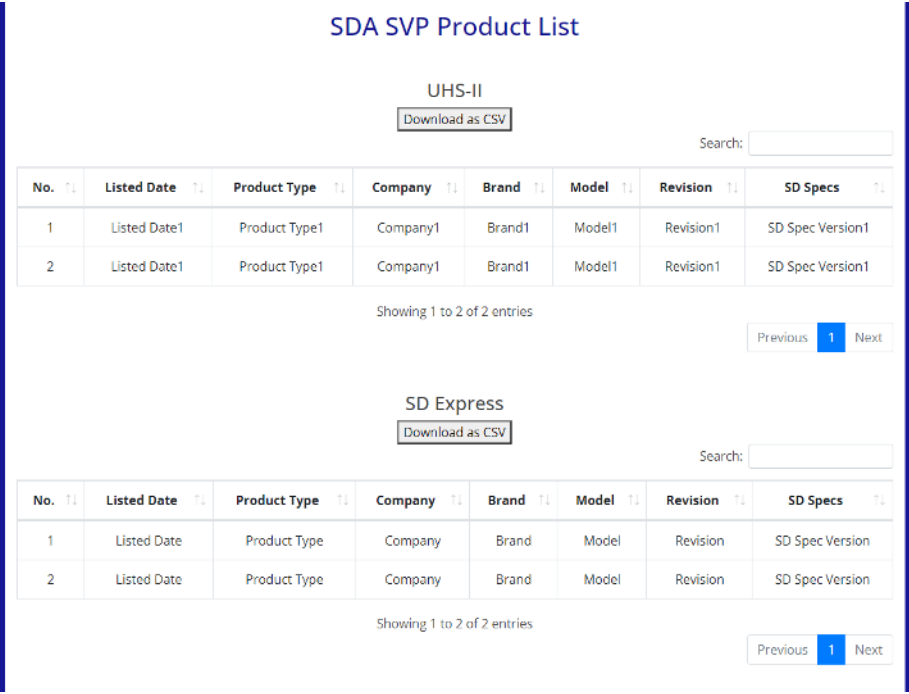
SVP Procedure

SD Association

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



SVP Product List Image



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

Who is GRL?

SD Association

- 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

GRL
Connecting the World

https://graniteriverlabs.com/

SD Association

Thank You

Miki Takahashi
Email: mtakahashi@graniteriverlabs.com

Global Workshop USA

SD Association

SD Express Applications

Anson Phan
Senior Product Marketing Manager (Phison Electronics Corp.)

PHISON

SD Express Card An Overview

SD Association

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

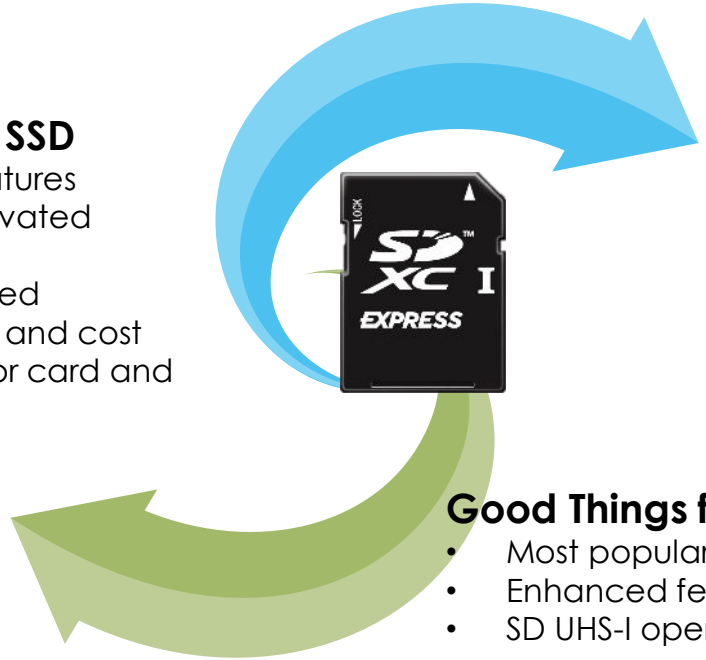
SD Express A SSD-Like Card

SD Association

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

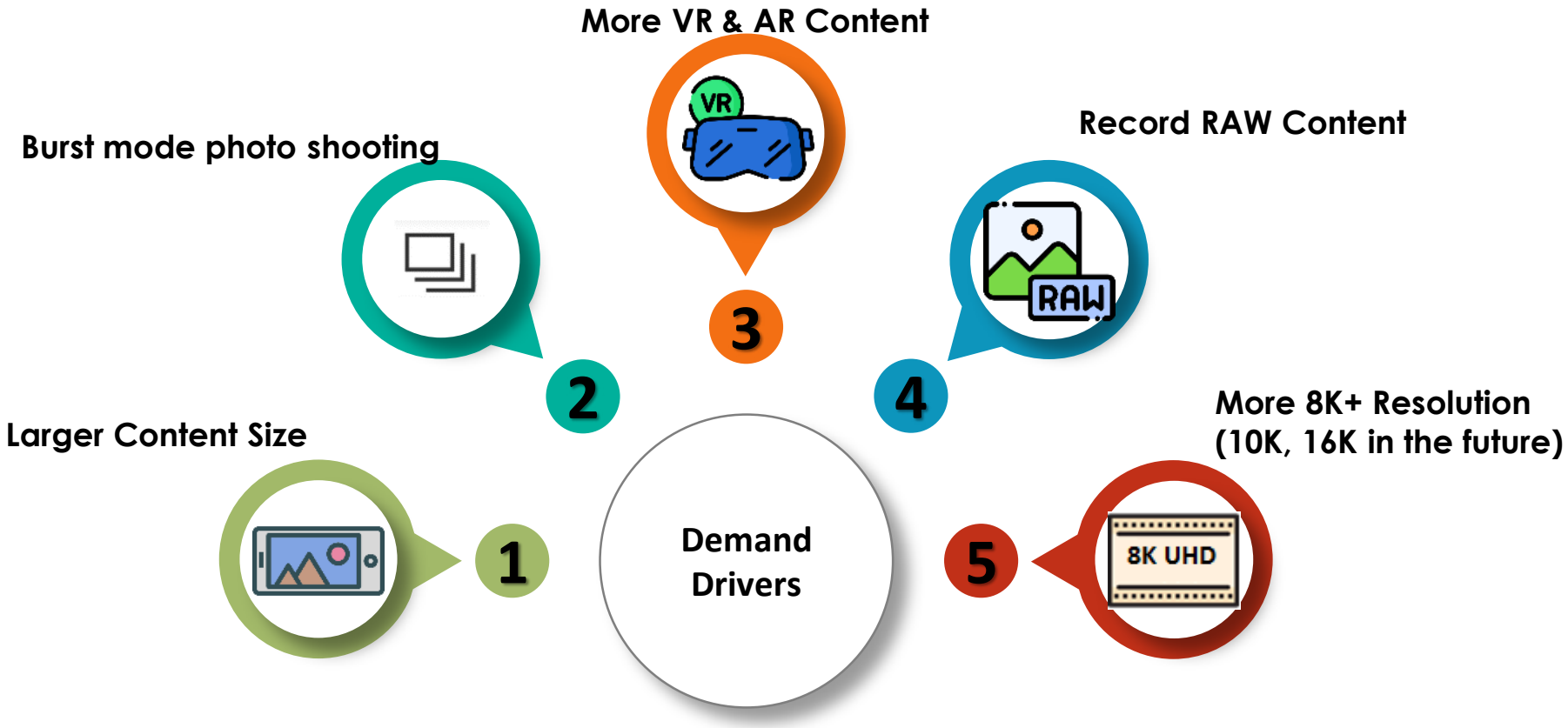
Why We Need SD Express?

SD Association

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

Higher Performance Requirement

SD Association



High Resolution Video & Photo Device

SD Association

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 Association

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

UHS-I
104MB/s

UHS-II
312MB/s

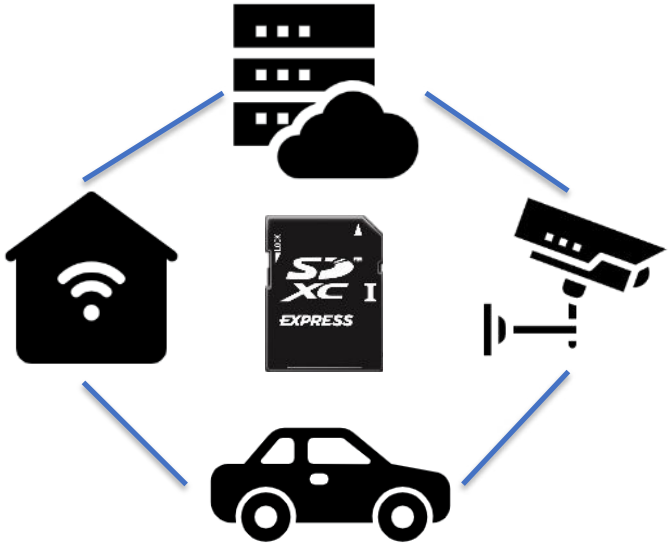
SD Express (SD7.0 Gen3 x1)
985MB/s

SD Express (SD8.0 Gen4x2)
3940MB/s

Smart City

SD Association

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

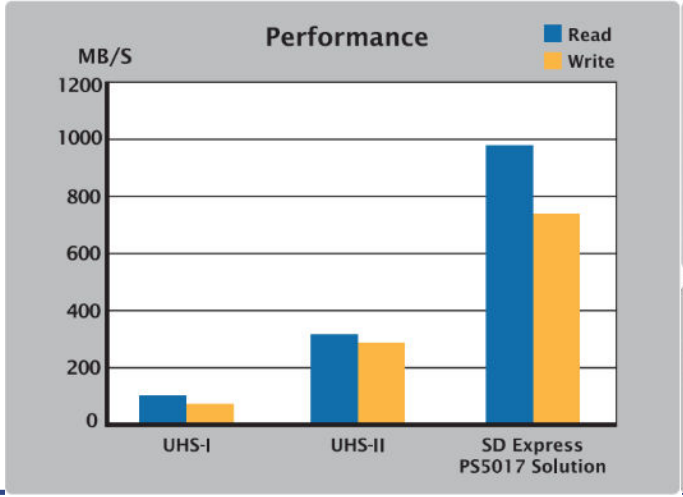
https://www.youtube.com/watch?v=RjrbhKD8O48&ab_channel=PhisonElectronicsCorp.

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 Association

SD Express Interconnect Solution

Zhineng Fan
Technologist, Amphenol

Amphenol

AMPHENOL: THE BRIDGE

SD Association

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;

- 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)

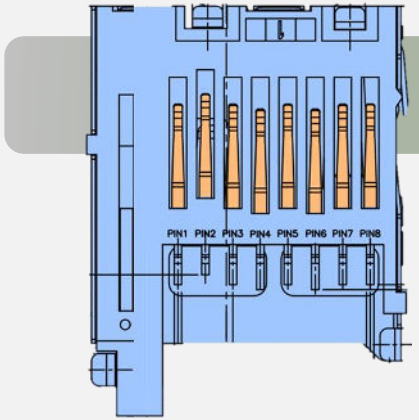
**Contact Amphenol for more details

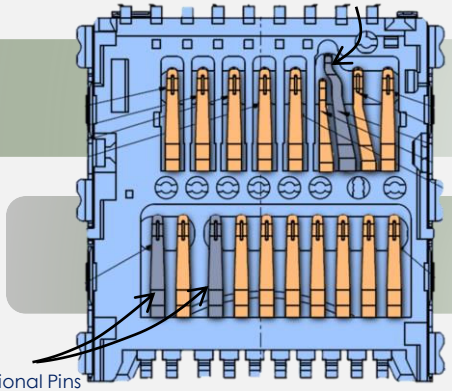
Connector Evolution with micro SD Express

SD Association

The Big Leap

Amphenol





Card Detect Pin

Optional Pins for Other Standards

LVDS
TIA/EIA-644

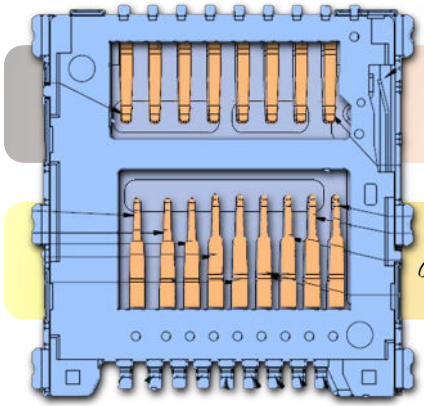
1st Row Contacts

2nd Row Contacts

PCI EXPRESS nvm EXPRESS

Different Foot Print

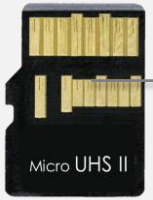
Standard
Off the Shelf



Connector is rated up to Gen 4

SD3.0

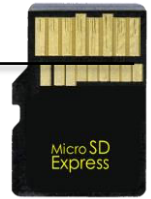
SD3.0



SD4.0

High Speed Pads are OFFSET

SD3.0



SD7.0

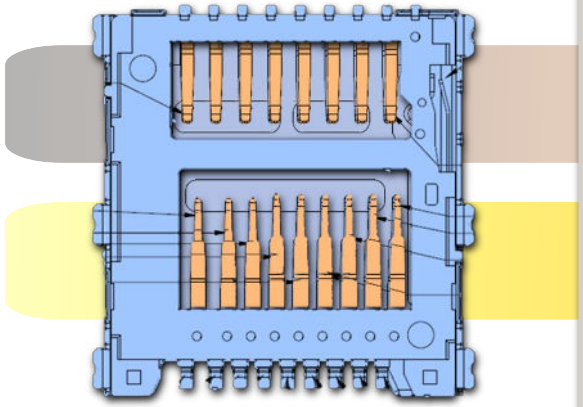
SD EXPRESS

PCI EXPRESS Gen 3

Connector Evolution with micro SD Express

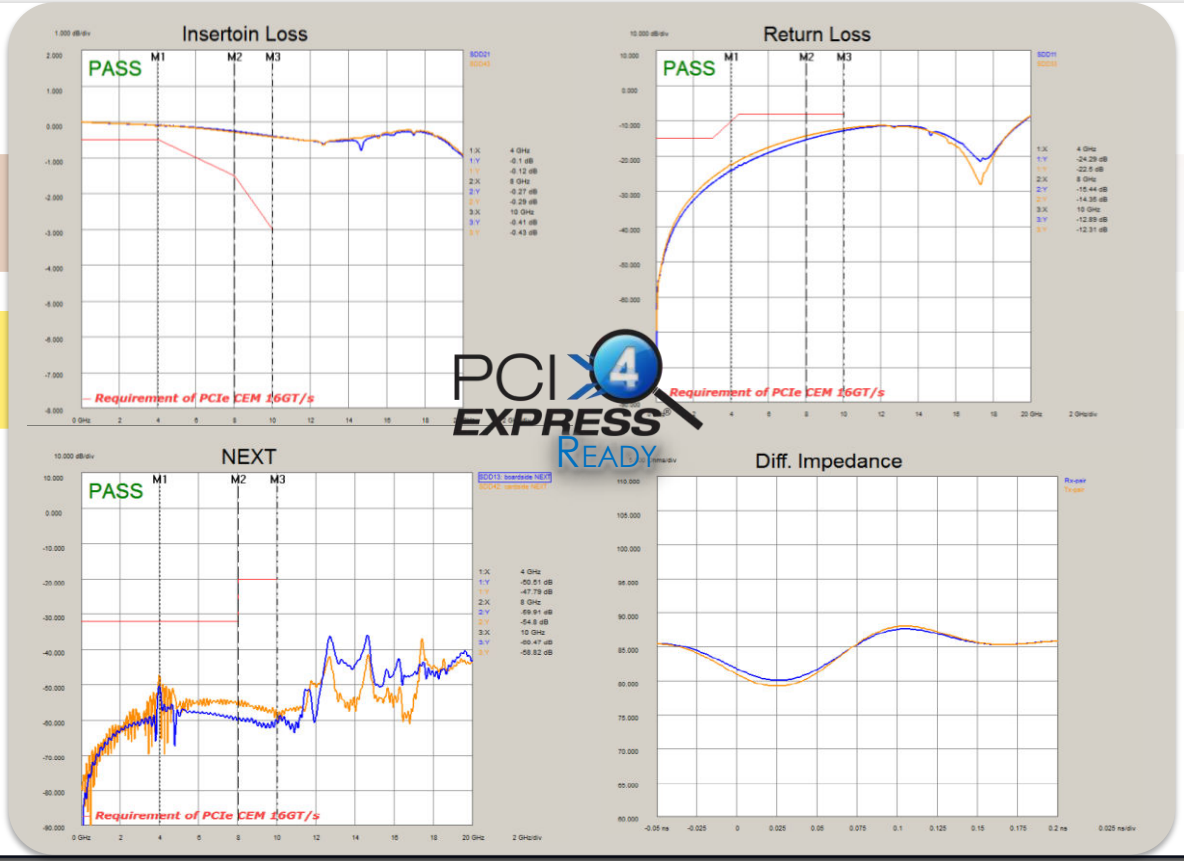
SD Association

Standard
Off the Shelf



P/N: 101019966912A

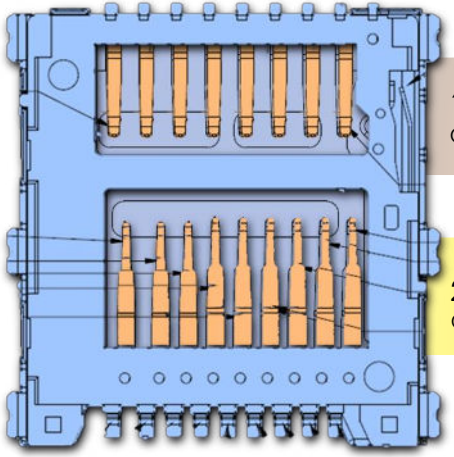
Dimension spec
L*W*H=14.65*13.50*1.55mm



Connector Evolution with micro SD Express

SD Association

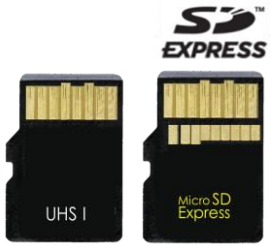
Standard
Off the Shelf



1st Row Contacts

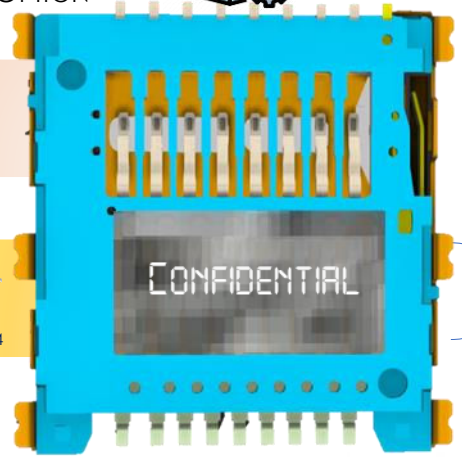
2nd Row Contacts

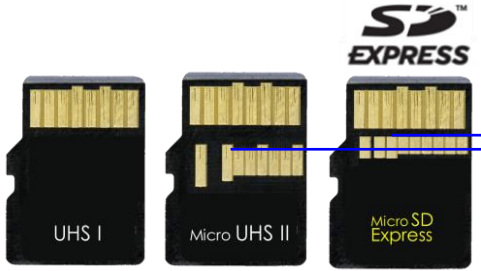
PCI EXPRESS
LVDS
TIA/EIA-644



BACKWARD COMPATIBLE OPTION

NEW DEVELOPEMENT





VERY CHALLENGING

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

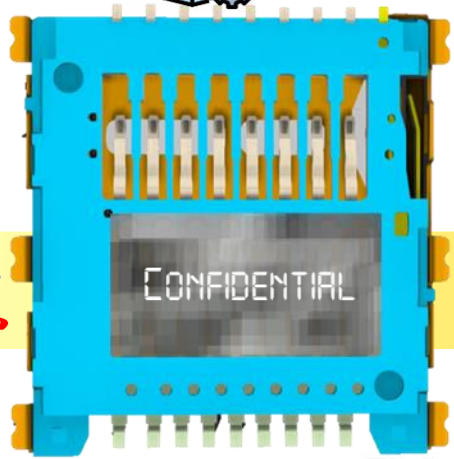
PCI EXPRESS & **LVDS**
TIA/EIA-644

Connector Evolution with micro SD Express

SD Association

BACKWARD COMPATIBLE OPTION

NEW DEVELOPEMENT



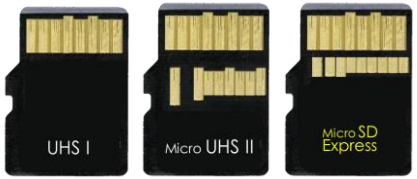
PCI EXPRESS

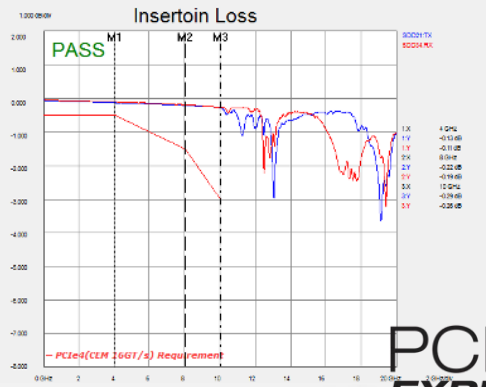
nvm EXPRESS

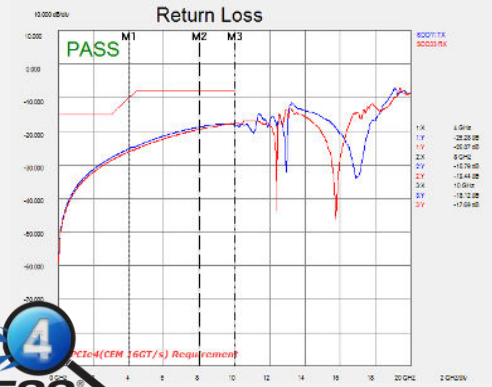
LVDS
TIA/EIA-644

SD EXPRESS

WORK IN PROGRESS

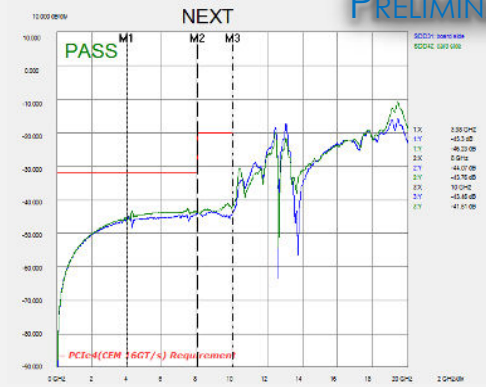


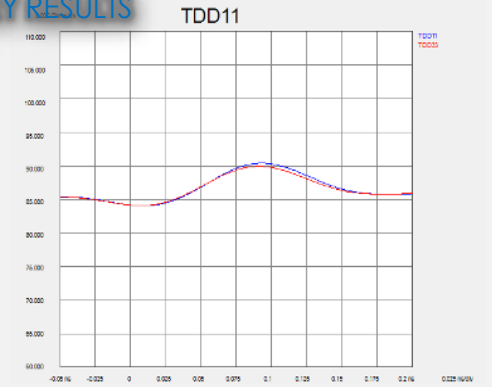




PCI EXPRESS 4

PRELIMINARY RESULTS

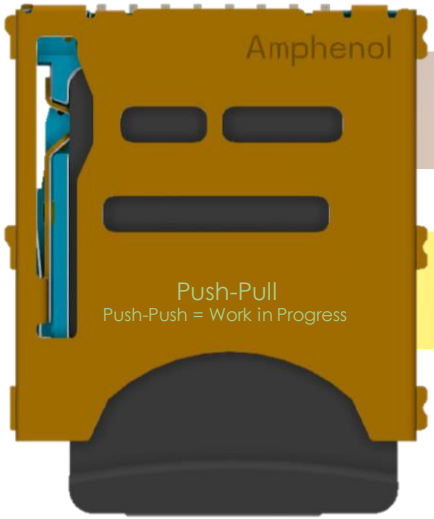




Micro SD Express SD7.1 Connector
With UHS II Compatibility

SD Association

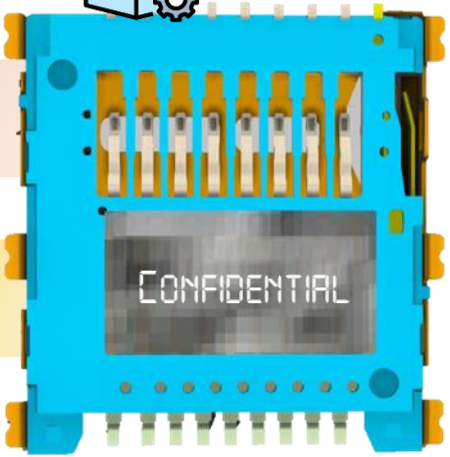
INDUSTRY'S
1ST



1st Row Contacts

2nd Row Contacts

NEW DEVELOPEMENT



SD EXPRESS

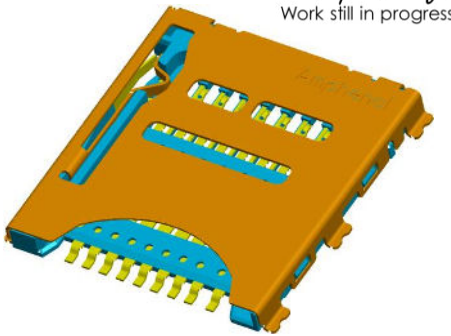
Backward UHS II compatibility powered **by Bayhub** controller enabled **by Amphenol connector**

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)

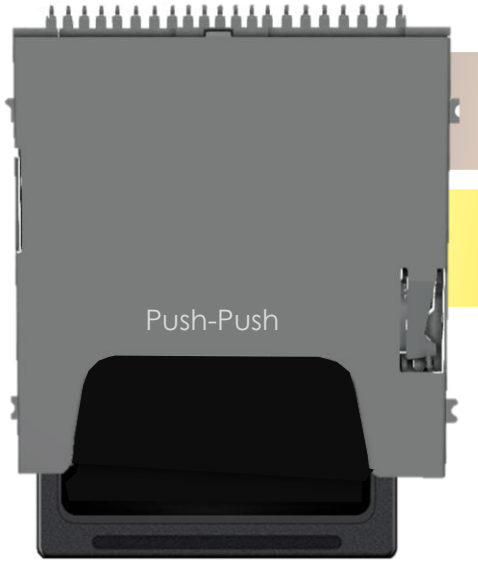
Electronic spec
Working current:0.5A
Voltage: 100V AC

Concept Design
Work still in progress



Full Size SD Express SD7.0 Connector
With UHS II Compatibility

SD Association

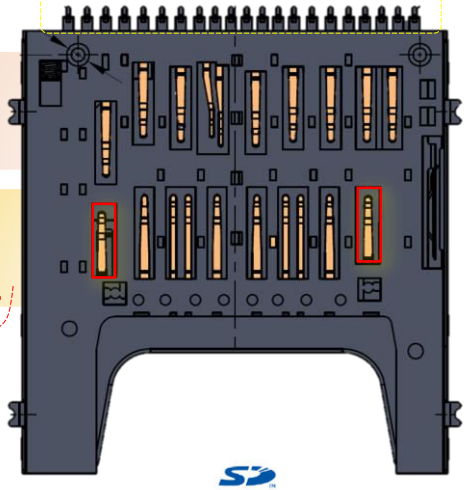


1st Row Contacts

2nd Row Contacts

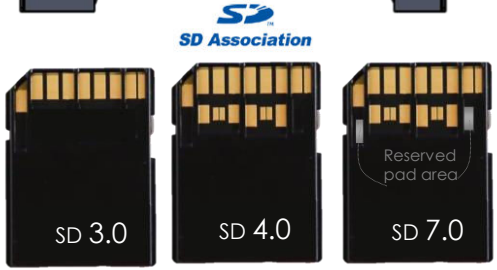
PCI EXPRESS Gen 3

Solder leads arranged in a single row for ease of AOI deployment



Contacts for reserved area pending for future definition

Host has the option of deploying these contacts for customisation.



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

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**X**7BHR

CONTACT FINISH
0: GOLD FLASH
1: 5 μ" GOLD
2: 10 μ" GOLD
3: 15 μ" GOLD

Amphenol

SD Association

WE ARE "THE BRIDGE" FOR SD EXPRESS

Do drop us a mail if you have any enquiries

louis.feng@amphenol.com.tw

Thank You!

SD Association

Thank You

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

SD Association

Introduction of Lexar SD Express

Julia Huang
Senior Marketing Manger (Lexar)

Lexar™
Live For The Memory

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

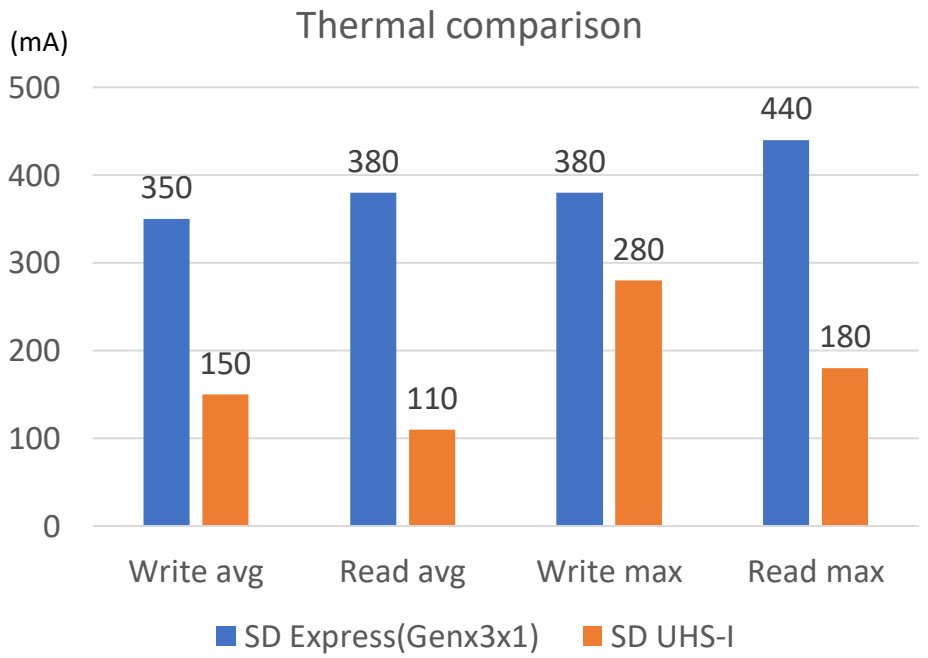
Status

- 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

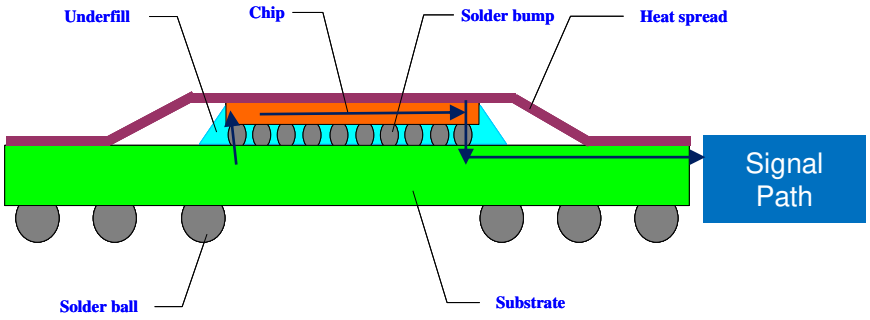


Advanced Packaging

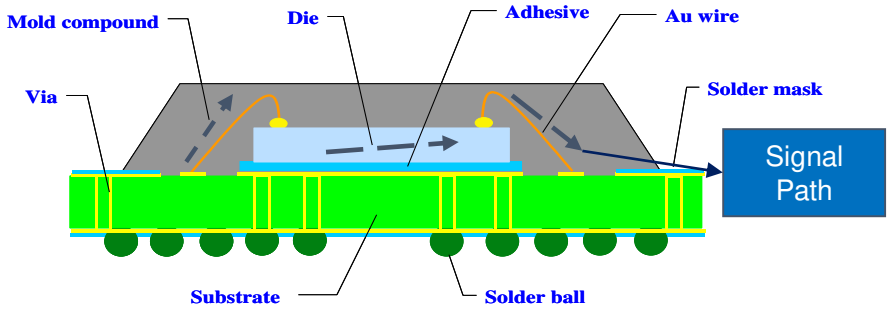
Flip Chip advantage vs Wire Bonding

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

Market Application

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

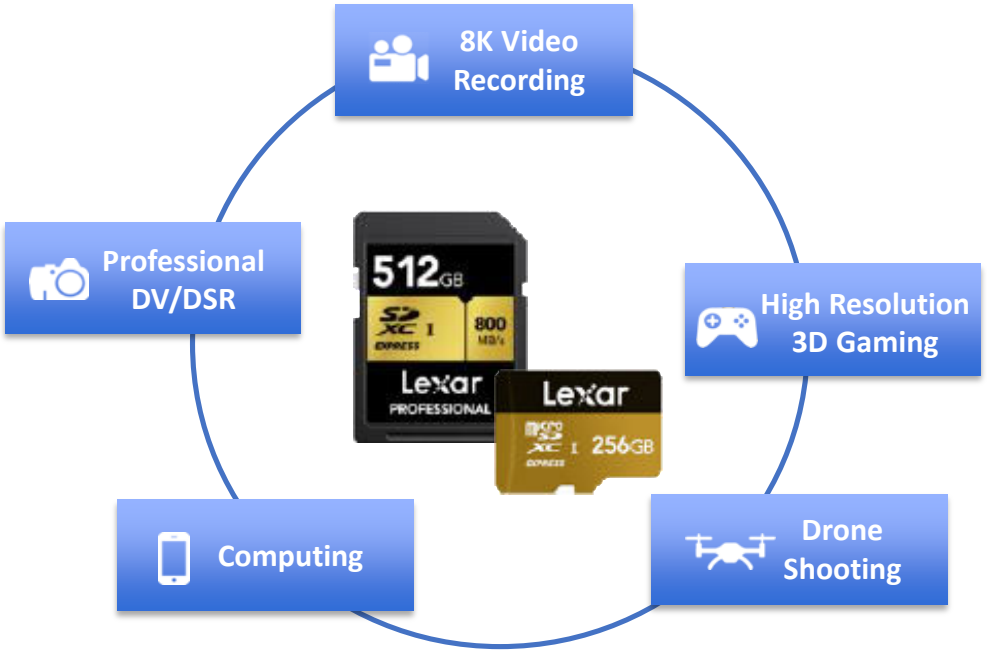
  The laptop comes packed with every port that may need such as HDMI, SD 7.0 and many more.

Market Visibility

2022

Future Application for Retail/OEM Market

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



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Thank You

Julia Huang
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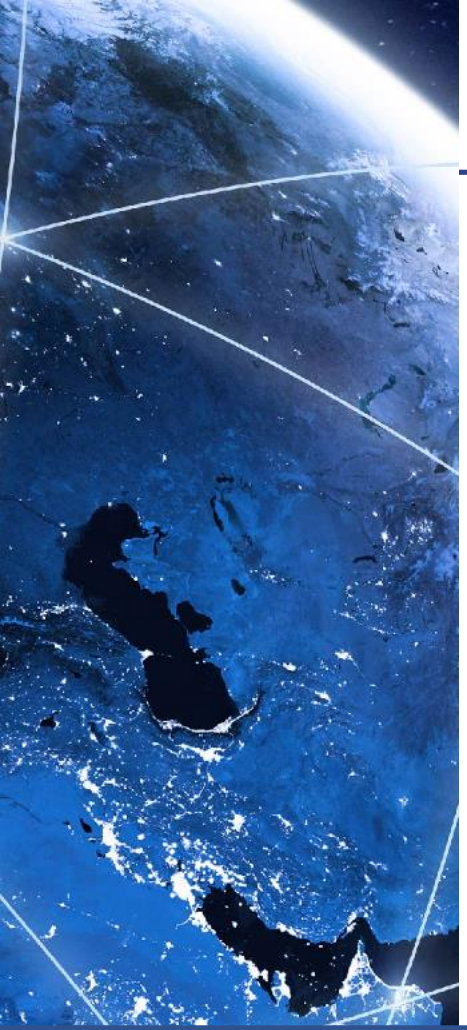


SD Association

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

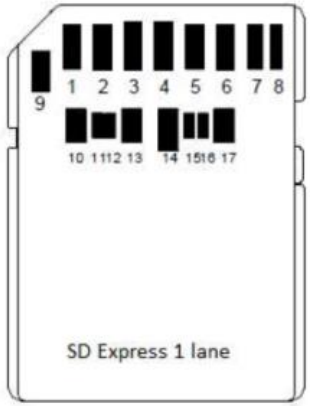
Form Factor	SDXC Express SD
Interface	PCIe/NVMe Gen 3x1
Flash	QLC
SDA Specification	• Part 1 Physical Layer Specification Ver. 7.10 • Part 2 File System Specification Ver. 7.00 • Part 3 Security Specification Ver. 7.00 • Standard Size SD Card Mechanical Addendum Ver. 8.00
Capacity	256GB, 512GB
Speed 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:

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Santa Ana, CA 92705

Phone: 714-460-9800

https://www.ampinc.com

sales@ampinc.com

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Thank You

Rick Neil
Email: rick.neil@ampinc.com

Global Workshop USA

SD Association

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

35 ANNIVERSARY YEARS

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

Can We Launch Without SD Express Hosts?

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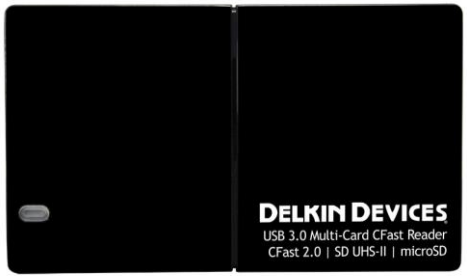

YES:

It is Slightly Faster in Existing Hosts

Future Proofs Users with the Purchase

Improves Workflow (Time is Money)

Backwards Compatibility – to UHS-I/II

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.

Canon EOS R5 Performance Test

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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)

Delkin SD Express Specifications

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

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Final Testing

Production

Market Launch

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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
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