The role of SD Express Card Reader in SD Express-Ecosystem of Devices
讀卡機控制晶片在SD Express生態系的功能與定位
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Sean Chen
Product Marketing of Storage Product Team, Genesys Logic Inc.
Genesys Logic Inc. 創惟科技

**ESTABLISHED**  April, 1997

**IPO at TAIWAN**  May 22, 2001 (OTC: 6104)

**BUSINESS SCOPE**  IC Design, Develop, Test, and Distribute ICs, ASIC Service

**PRODUCTS**  Storage, USB Hub & PD, Image & Video, Analog, Silicon Intellectual Properties (IPs), Others

**HEADQUARTERS**  New Taipei City, Taiwan

**SUBSIDIARIES**  USA - Genesys Logic America, Inc.
China - Eclat Holding Ltd
Memory Cards since 1992
Memory Cards since 1992

1992 PCMCIA Card
1994 microSD Card
1997 MMC Card
1998 SD Card
2000 PCIe-based memory card
2002 CFast Card
2009 mSD Card
2012 ADATA 512GB PCIe Card

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Various Choices of Card Reader Products
The Memory Card Reader Controller

- A bridge to transfer data from host to card or from card to host
- Data correctness and data integrity
- Maximum the compatibility to Host and Card
- Complete the data transfer in the shortest time
- Minimize the power consumption
- The consistent performance in every use
Leverage the Existing PCIe Technology

**PCle-based memory cards**
- SSD-like storage in card form factor
- PCIe move to external from internal
- Fixed disk to removable device

![PCI Express Memory Card Diagram](image-url)
## Backward Support of SD Express Card

<table>
<thead>
<tr>
<th>Pin Layout</th>
<th>SD Memory Card</th>
<th>SD Express Memory Card</th>
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</thead>
<tbody>
<tr>
<td>PCIe Bus Interface</td>
<td>25MB/sec</td>
<td>UHS-I 25MB/sec</td>
</tr>
<tr>
<td></td>
<td>104MB/sec</td>
<td>UHS-II 104MB/sec</td>
</tr>
<tr>
<td></td>
<td>312MB/sec</td>
<td>UHS-III 312MB/sec</td>
</tr>
<tr>
<td></td>
<td>624MB/sec</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3940MB/sec</td>
<td>PCIe Gen.4x2</td>
</tr>
<tr>
<td></td>
<td>1970MB/sec</td>
<td>PCIe Gen.3x2</td>
</tr>
<tr>
<td></td>
<td>985MB/sec</td>
<td>PCIe Gen.4x1</td>
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</tbody>
</table>

*miSD Express supports only PCIe Gen.3x1
SD Express Host support both SD and PCIe interface

Source: SD Express (SD7.x) Host Implementation Guideline
SD Express Reader support UHS-II is important

- At least 79 cameras support UHS-II card slot in past ten years
  - Canon, Fujifilm, Leica, Nikon, Olympus, Panasonic, Samsung, Sony…etc
- All top brands of laptops support UHS-II card slot
  - Apple, ASUS, Acer, Dell, HP, Lenovo, MSI, Chromebook…etc
- Thunderbolt / USB-C docking support UHS-II card slot

- From the view point of SD reader vendor, it might be hard to explain to end users who only have UHS-II cards why their UHS-II cards perform more slowly with a new SD Express card slot than they older UHS-II card slot.

1/3 speed
A Case: SD Express in Camera

- UHS-II card slot is widely supported by Cameras

- However, SD Express cards perform more slowly with the existing UHS-II card slot
- Meanwhile, CFexpress offer the high writing speed to card

- What we can do to make the SD Express card to be adopted by Camera?
Genesys Solution – GL9767
PCIe to SD8/7/4/3 all-in-one card reader controller

- The major applications of GL9767 are the internal SD Express card reader of laptop, mini PC, Server system, professional camera, game console and drone devices that demand the high speed of SD storage or the second SSD-like storage for the real memory expansion.

- The support of SD Express interface can be up to SD 8.0 SD Express (PCIe Gen.4 x 2) and support SD 8.0 SD Express (PCIe Gen.4 x 1), SD 8.0 SD Express (PCIe Gen.3 x 2) and SD 7.1 SD Express (PCIe Gen.3 x 1)

- GL9767 is the first SD Express card reader controller which can backward support SD 4.0 UHS-II speed mode and SD 3.0 UHS-I speed mode.

- For power saving, GL9767 support PCI Express ASPM, L1 sub-states (L1.1 and L1.2) and RTD3 (Runtime D3 Hot/Cold), Modern Standby and S0ix.

- The supported OS are Windows OS, Chrome OS and Linux OS
Host interface
- Support 1-Lane 16 GT/s PCI Express Bus connect to PCIe host
- Support 2-Lane 32 GT/s PCI Express Bus connect to PCIe host by system design

The supported SD specification
- Compliant with SD Specifications Part 1 Physical Layer Specification Version 8.0
- Compliant with SD Specifications Part 1 Physical Layer Specification Version 7.1
- Compliant with SD Specifications Part A2 SD Host Controller Specification Version 4.20

The supported SD cards and SD speed mode
- Secure Digital™ (SD), SDXC, SDHC, SDUC
- SD 8.0 Express mode up to 3940 MB/sec
- SD 7.1 Express mode up to 985 MB/sec
- SD 4.0 UHS-II FD/HD mode up to 312 MB/sec
- SD 3.0 UHS-I SDR104, SDR50 and DDR50
GL9767 is the only SD host SVP product for both SD Express and UHS-II

### SVP Verified Product List --- SD Express

<table>
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<tr>
<th>Model</th>
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### SVP Verified Product List --- UHS-II

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SD Express Host Implementation

Figure 7 SD Express Host – Block Diagram

Source: SD Express (SD7.x) Host Implementation Guideline
Controller Block Diagram – GL9767

SD Card
- UHS-I
- UHS-II
- SD Express

GL9767
- High Speed MUX

PCIe Gen2
- SD 4.0 Host Controller

PCIe RC
SD Express card directly connect to PCIe root complex and the in-box NVME driver is loaded.

The PCIe root port need to enable PCIe hot-plug function to support SD7 card plug and un-plug.
The legacy SD cards are initialized by the internal SD host controller and the vendor driver is loaded.
Benchmark test – GL9767

PCle G4x2 Device

SD 8.0 PCIe G3x2

Gen3x1 SD7

SD4 UHS-II

SD3 UHS-I SDR104
Conclusion

The Role of SD Express Card Reader in SD Express-Ecosystem

- Faster speed with PCI Express technology
- Don’t forget UHS-II have been widely adopted by various devices
- Genesys Logic’s all-in-one solution GL9767 is MP now

- Looking forward the grow up of SD Express market!
GL9767 Exhibition at SDA booth in Computex

**SanDisk**

**SD Ver. 7.00 SD Express Solution with PCIe 3.1 x 1 up to 985 MB/s with a Single SD Card Slot Solution Supporting UHS-I, UHS-II**

Genesys Logic’s PCI Express to SD Express Bridge Reader/Writer Controller “GL9767” supporting

1) SD 7.0 SD Express PCIe Bus Interface Mode
2) SD 4.0 UHS-II Bus Interface Mode
3) SD 3.0 UHS-I Bus Interface Mode

using SanDisk SD Cards in the benchmark test to show the data transfer speed using the CrystalDiskMark.

**PHISON**

**SD Ver. 8.00 SD Express Solutions with PCIe 3.1 x2 up to 1969 MB/s**

GL9767:
Genesys Logic’s PCI Express to SD 8.0 SD Express Card Reader Controller

PSS017:
Phison’s SD 8.0 Solution with PCIe 3.1 x2 Interface

using Phison SD 8.0 SD Express Device on the evaluation board of GL9767 with the "CrystalDiskMark" benchmark test software showing transfer speed performance.
Thank you very much for your time and listening!