CFexpress 4.0

Type A card (Essential Pro)

Specifications

Capacity
- 256GB/512GB/1TB

Components
- Controller: Maxio Map1602
- Flash: 1.6GT/S 3D TLC

Compliance
- PCIe Gen4x1

Performance (up to)[1]
- Burst Read: Up to 1800 MB/s
- Burst Write: Up to 1650 MB/s
- Sequential Read: Up to 1800 MB/s
- Sequential Write(1TB): 1650 MB/s
- Sequential Write(512GB): 850 MB/s
- Sequential Write(256GB): 850 MB/s

Power management
- Auto idle
- PCIe link power management
- Temperature monitoring and throttling

Security
- NVMe Format

Reliability
- Advanced LDPC error correction
- Global static and dynamic wear leveling
- UBER: <1 sector per 10^{17} bits read
- MTBF: 2.0 million hours

Endurance[2]
- 256GB TBW: 150TB
- 512GB TBW: 300TB
- 1TB TBW: 600TB

Data retention
- JESD218A-compliant

Compatibility
- Windows 10/8.1/7
- Windows Server 2016/2012 R2/2012
- CentOS, Fedora, FreeBSD, openSUSE, Red Hat, Ubuntu, VMware ESXi, Citrix, KVM

Mechanical form factor
- CFexpress 4.0 type A: 20 mm x 28 mm x 2.8 mm

Power consumption (TYP)
- Active: <2.8 W
- Idle: <0.5 W

Environment
- Operating temperature: -12–72 °C
- Storage temperature: -40–85 °C

Shock & vibration
- Operating: 50 G
  (11 ms duration, half sine wave)
- Non-operating: 1500 G
  (0.5 ms duration, half sine wave)
- Vibration: 10 G
  (peak,10–2000 Hz)

Warranty
- Lifetime-limited warranty [3]

Specification notes:

1. Performance claims
   a. Actual performance may vary based on the hardware, software, and overall system configuration.
   b. Sequential performance is measured with 128 KB transfer size, QD 32 and 4 KB alignment with Iometer.
   c. Random performance is sustained performance measured with 4K/8K transfer size, QD 32 and 4 KB alignment with Iometer.
   d. Performance test platform: CPU: Intel Core i7 4770K; motherboard: ASUS Z87-DELUXE; chipset: Intel Z87 Express; OS: Windows 8.1 Pro x64.
2. Endurance claims
   a. DWPD stands for Drive Writes Per Day. TBW = DWPD * capacity * warranty * 365 / 1000.
   b. Access patterns used for random workload during endurance testing is compliant with the JESD219 standard.
3. Limited warranty details: please refer to limited warranty policy and warranty terms.

Table of Contents

Product datasheet

1. Order information

The following table lists the standard part numbers for Exascend CFexpress 4.0 Type A card. For customization and design service inquiries, including – but not limited to – custom operating temperature, capacity, over-provisioning, endurance, performance, and power, please contact your Exascend account manager or send us an email at sales@exascend.us

Table 1: CFexpress 4.0 type A card product list

PART NUMBER	CAPACITY*	FLASH TYPE	FORM FACTOR
EXPC4EA256GB	256GB *	3D TLC	CFexpress 4.0 type A
EXPC4EA512GB	512GB *	3D TLC	CFexpress 4.0 type A
EXPC4EA001TB	1TB *	3D TLC	CFexpress 4.0 type A

2. Part number decoder

EX	PC4	EA	001TB

1. Exascend
2. Product series

   PC4= CFexpress 4.0 series
3. Form factor

   EA= CFexpress 4.0 type A Essential Pro
4. Capacity

3. Product overview

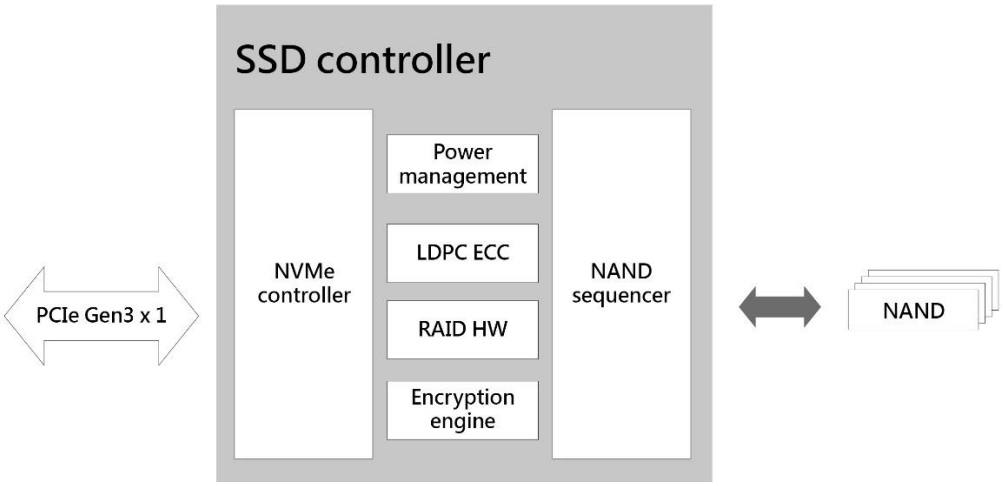
3.1 CFexpress 4.0 Type A card

Exascend is a technology-leader in the cinematography storage industry, providing uniquely capable flash storage solutions for premium cinematography and photography. Utilizing its unique hardware and firmware technologies to unlock unparalleled performance and reliability, Exascend's cinematography-optimized memory cards guarantee extreme sustained read and write speeds, unwavering reliability and mission critical-grade ruggedness. For cinematography and photography professionals, that means ample sustained performance for the most demanding capture modes and durability that can handle shoots in the world's toughest environments.

Key product highlights include:

- Stable performance in thermally challenging environments with Exascend's *Adaptive Thermal Control*™ technology
- Sustained performance-enhancement with Exascend's *SuperCruise*™ technology
- Protection against shocks, vibrations, magnetism and more with a rugged product design
- Fully compatible with all existing camera systems utilizing CFexpress 4.0 Type A currently on the market, including Sony a1, a7S III, A7 IV, FX3, and FX6.
- Generous lifetime-limited global warranty

Figure 1: CFexpress 4.0 Type A card functional logic diagram



3.2 Customization and tuning services

Exascend provides customized hardware and firmware design services, tailoring cutting-edge SSD products for advanced storage systems. Combining world-class R&D and engineering support capabilities, Exascend provides customers with best-in-class products and services, enabling enhanced boot times, faster-loading applications, reduced power consumption, and extended reliability. To learn more about our extended engineering support services, e.g., tailored capacity, over-provisioning, extended operating temperature range, endurance, performance, power, and longevity, please contact your Exascend account manager or send us an email at sales@exascend.com.

4. Detailed specifications

Exascend CFexpress 4.0 Type A provides extreme maximum performance, generous sustained performance, and unrivaled reliability – ensuring a seamless experience for even the most demanding users.

Made possible by its premium 3D TLC NAND flash and the embedded PCIe Gen3 controller, Exascend CFexpress 4.0 Type A's burst performance tops out at 900 MB/s read and 850 MB/s write, with sequential performance of 900 MB/s read and 850 MB/s write. This extreme level of performance guarantees not only seamless photo capture but also enables high-frequency burst photography and smooth video capture without frame drops or occasional stutters.

The Exascend CFexpress 4.0 Type A memory card's compact and rugged design also provides protection against environmental and external hazards including shocks, vibrations, X-ray and magnetism. These features paired with Exascend's generous lifetime-limited global warranty and industry-leading data recovery services make it a reliable companion for demanding shoots and storing invaluable footage.

4.1 Capacity

Table 2: CFexpress 4.0 Type A card logical block address configuration

CFEXPRESS 4.0 TYPE A CARD SERIES	UNFORMATTED CAPACITY (TOTAL USER ADDRESSABLE SECTORS IN LBA MODE)
256 GB	500,118,192
512 GB	1,000,215,216
1TB	2,000,409,264

Notes:
- The LBA count shown represents total user-accessible storage capacity and will remain the same throughout the drive's lifetime.
- The total usable capacity of the SSD may be less than the total physical capacity because a small portion of the capacity is used for NAND flash management and maintenance purposes.

4.2 Performance

Table 3: Drive performance – CFexpress 4.0 Type A card series

	UNIT	CFEXPRESS 4.0 TYPE A CARD SERIES		
Capacity	GB	**256GB**	**512GB**	**1TB**
Burst Read	MB/s	1800	1800	1800
Burst Write	MB/s	1650	1650	1650
Sequential Read	MB/s	1800	1800	1800
Sequential Write	MB/s	850	850	1650
TBW	TB	150	300	600
Form factor		CFexpress 4.0 Type A		

Notes:
- Measured with device connected as secondary drive.
- Actual performance may vary based on the hardware, software, and overall system configuration.
- Sequential performance is measured with 128 KB transfer size, QD 32 and 4 KB alignment with Iometer.
- Random performance is sustained performance measured with 4K/8K transfer size, QD 32 and 4 KB alignment with Iometer.
- Performance test platform: CPU: Intel Core i7 4770K; motherboard: ASUS Z87-DELUXE; chipset: Intel Z87 Express; OS: Windows 8.1 Pro x64.

4.3 Environment specification

Table 4: Environmental specification table

PARAMETER	VALUE
Operating temperature	-12–72 °C
Storage temperature	-40-85 °C
Power supply voltage range	3.3 V ± 5%
Humidity (non-condensing)	5–95% (Operating)
Vibration	10 G (peak, 10–2000 Hz)
Shock (operating)	50 G, (11 ms duration, half sine wave)
Shock (non-operating)	1500 G, (0.5 ms duration, half sine wave)

4.5 Power consumption

Table 5: CFexpress 4.0 Type A card series power consumption table

PARAMETER	VALUE	UNIT
Active power (average)	<2.8	W
Idle mode power (average)	<0.5	W

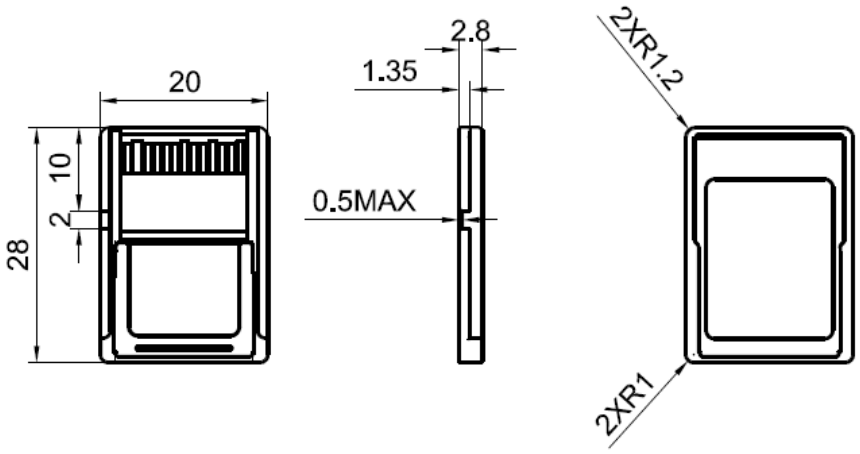
4.6 Reliability

Products in the Exascend CFexpress 4.0 Type A card series meet or exceed SSD endurance and data retention requirements as specified in the JESD218 standard. Reliability specifications are listed in the following table.

Table 6: Reliability table

PARAMETER	VALUE
Mean Time Between Failures (MTBF) Mean Time Between Failures is a measure of how reliable a hardware product or a component is. The value describes the expected time between two failures.	2,000,000 hours
Uncorrectable Bit Error Rate (UBER) A metric for the rate of occurrence of data errors, equal to the number of data errors per bits read.	<1 sector per 10^{17}

5. Physical dimension diagram



GENERAL TOLERANCE IS ±0.1mm
DIMENSION UNIT: mm

Table 7: Physical dimensions for CFexpress 4.0 type A card

PHYSICAL DIMENSIONS	VALUE	UNIT
Length	28	mm
Width	20	mm
Thickness	2.8	mm

6. Pin Assignment

6.1 CFexpress 4.0 Type A card connector

Table 8: CFexpress 4.0 Type A card connector signal name, power pin assignment, and description

PIN NAME	SIGNAL NAME	DESCRIPTION
1	PERST#	PCIe Reset
2	3V3	3.3V Power
3	CLKREQ#	PCIe Clock Request
4	INS#	card detection
5	REFCLK-	PCIe Reference clk-
6	REFCLK+	PCIe Reference clk+
7	GND	Ground
8	PETn0	PCIe Lane 0 TX-
9	PETp0	PCIe Lane 0 TX+
10	GND	Ground
11	PERn0	PCIe Lane 0 RX-
12	PERp0	PCIe Lane 0 RX+
13	GND	Ground

7. Compliance

Exascend CFexpress 4.0 Type A card card complies with the following specifications:

- FCC
- CE
- RoHS

8. Supported NVMe commands

Exascend CFexpress 4.0 Type A card series support the NVMe commands that are shown in the following table. For details about the NVMe commands, please refer to the NVMe 1.4 command set specifications.

Table 9: Admin commands

COMMAND NAME	CODE (HEX)	COMMAND NAME	CODE (HEX)
Delete I/O submission queue	00h	**Abort**	08h
Create I/O completion queue	01h	**Set features**	09h
Get log page	02h	**Get features**	0Ah
Delete I/O submission queue	04h	**Asynchronous event request**	0Ch
Create I/O completion queue	05h	**Firmware commit**	10h
Identify	06h	**Firmware image download**	11h

Table 10: I/O commands

COMMAND NAME	CODE (HEX)	COMMAND NAME	CODE (HEX)
Flush	00h	**Compare**	05h
Write	01h	**Dataset management**	09h
Read	02h	**Write zeroes**	08h
Write uncorrectable error	04h		

Table 11: Get log commands

COMMAND NAME	CODE (HEX)	COMMAND NAME	CODE (HEX)
Reserved	00h	**S.M.A.R.T. / health information**	02h
Error information	01h	**Firmware information**	03h

9. S.M.A.R.T. support

9.1 Overview of S.M.A.R.T. support

Data storage drives capture a variety of information during operation that may be used to analyze drive "health." Drive manufacturers have adopted S.M.A.R.T. (Self-Monitoring, Analysis, and Reporting Technology) to help warn system software, a system administrator, or a user of impending drive failure, when time still remains to take preventive action. The S.M.A.R.T. standard defines the protocols for reporting errors and for invoking self-tests to collect and analyze data on demand. The specification is flexible and provides for individual manufacturers to define their own unique vendor-specific information. This section describes the baseline S.M.A.R.T. commands and attributes supported by products in the Exascend CFexpress 4.0 Type A card series. Further, it is recommended to consult the list of public S.M.A.R.T. attributes.

9.2 S.M.A.R.T. health information

Table 12: S.M.A.R.T. health information

BYTE	DESCRIPTION
00	**Critical warning:** This field indicates critical warnings for the state of the controller. Each bit corresponds to a critical warning type; multiple bits may be set. If a bit is cleared to '0', then that critical warning does not apply. Critical warnings may result in an asynchronous event notification to the host. Bits in this field represent the current associated state and are not persistent.
2:1	**Composite temperature:** Contains a value corresponding to a temperature in degrees Kelvin that represents the current composite temperature of the controller and namespace(s) associated with that controller. The manner this value is computed is implementation-specific and may not represent the actual temperature of any physical point in the NVM subsystem. The value of this field may be used to trigger an asynchronous event. Warning and critical overheating composite temperature threshold values are reported by the WCTEMP and CCTEMP fields in the Identify Controller data structure.
3	**Available spare:** Contains a normalized percentage (0 to 100%) of the remaining spare capacity available.
4	**Available spare threshold:** When the *available spare* falls below the threshold indicated in this field, an asynchronous event completion may occur. The value is indicated as a normalized percentage (0 to 100%).
5	**Percentage used:** Contains a vendor-specific estimate of the percentage of NVM subsystem life used based on the actual usage and the manufacturer's prediction of NVM life. A value of 100 indicates that the estimated endurance of the NVM in the NVM subsystem has been consumed but may not indicate an NVM subsystem failure. The value allowed to exceed 100. Percentages greater than 254 shall be represented as 255. This value shall be updated once per power-on hour (when the controller is not in a sleep state).
47:32	**Sectors read:** Contains the number of 512-byte user data units read from the controller; This value is reported in thousands (i.e., a value of 1 corresponds to 1000 units of 512 bytes read) and is rounded up. When the LBA size is a value other than 512 bytes, the controller shall convert the amount of data read to 512-byte units.
63:48	**Sectors written:** Contains the number of 512-byte user data units written to the controller. This value is reported in thousands (i.e., a value of 1 corresponds to 1000 units of 512 bytes written) and is rounded up. When the LBA size is a value other than 512 bytes, the controller shall convert the amount of data written to 512-byte units. For the NVM* command set, logical blocks written as part of write operations shall be included in this value.
79:64	**Host read commands:** Indicates the number of read commands completed by the controller. For the NVM command set, this is the number of *compare* and *read* commands
95:80	**Host write commands:** Indicates the number of write commands completed by the controller. For the NVM command set, this is the number of *write* commands.
111:96	**Controller busy time:** Contains the amount of time the controller is busy with I/O commands. The controller is busy when there is a command outstanding to an I/O queue (specifically, a command was issued via an I/O submission queue tail doorbell write and the corresponding completion queue entry has not been posted yet to the associated I/O completion queue). This value is reported in minutes.

127:112	**Power cycles:** Contains the number of power cycles.
143:128	**Power-on hours:** Indicates the number of actively power-on hours. This does not include time the controller was powered and in a lower state condition.
159:144	**Number of unsafe shutdowns:** Indicates the number of unsafe shutdowns. This count is incremented when a shutdown notification (CC.SHN) is not received prior to loss of power
175:160	**Number of media errors:** Indicates the number of occurrences where the controller detected an unrecovered data integrity error. Errors such as uncorrectable ECC, CRC checksum failure, or LBA tag mismatch are included in this field.
195:192	**Warning composite temperature time:** Indicates the amount of time in minutes that the controller is operational and the Composite Temperature is greater than or equal to the Warning Composite Temperature Threshold (WCTEMP) field and less than the Critical Composite Temperature Threshold (CCTEMP) field in the Identify Controller data structure. If the value of the WCTEMP or CCTEMP field is 0h, then this field is always cleared to 0h regardless of the Composite Temperature value.
199:196	**Critical composite temperature time:** Contains the amount of time in minutes that the controller is operational, and the Composite Temperature is greater the Critical Composite Temperature Threshold (CCTEMP) field in the Identify Controller data structure. If the value of the CCTEMP field is 0h, then this field is always cleared to 0h regardless of the Composite Temperature value.
201:200	**Temperature sensor 1:** Contains the current temperature reported by temperature sensor 1 in degrees Kelvin.

Legal information

Limited Warranty Policy

Exascend, Inc. ("Exascend") warrants that Exascend's product, in its original sealed packaging, will be free from defects in materials and workmanship. Subject to the conditions and limitations set forth below, Exascend will either repair or replace any part of its products that prove defective by reason of improper workmanship or materials. This warranty is non-transferable and valid only for the original purchaser of the Exascend products, except where prohibited by law. The original sales receipt or invoice, or a copy thereof, is required to establish the purchase date and original purchaser.

1. This warranty supersedes all other warranties and representations, whether oral or written, between you and Exascend. Exascend makes no other warranties, including any warranty of merchantability or fitness for a particular purpose, whether expressly or implied.

2. All warranties, whether express or implied, are limited to the periods of time set forth below. Some states and jurisdictions do not allow such exclusion of implied warranties, limitations or warranty period, so above restrictions may not apply to you.

3. Exascend may acknowledge or read and save the data and information (collectively, "Information") stored in the product during after-services. Exascend hereby agrees that Exascend will not disclose any Information to any third parties, except Exascend's employees, who may need to access the Information, with or without your prior written consent.

Warranty Terms

We offer lifetime-limited warranty for our enterprise products.

The warranty period is the SHORTER OF:

- a period of lifetime beginning from the date of purchase; or
- the period ending when the drive reached advertised DWPD or TBW rating; or
- the period ending when the device's Lifespan indicator has reached 0% or below.

This Limited Warranty will not apply to, and Exascend will have no liability or obligation with respect to, problems or damage resulting from any of the following: (i) accident, modification, neglect, abuse, careless or incorrect handling, misuse or improper operation, disassembly, misapplication or use in unusual physical environments or under operating conditions not approved by Exascend (including, but not limited to, use of the Product with an improper voltage supply); (ii) normal wear and tear; (iii) removal of label(s) or sticker(s) provided on or with the Product (including all warranty or quality-control stickers, product serial or electronic numbers); (iv) problems relating to or residing in non-Exascend hardware, software or other items with which the Product is used; (v) use in an environment, in a manner or for a purpose for which the Product was not designed or not in accordance with Exascend’s published documentation; (vi) installation, modification, alteration or repair by anyone other than Exascend or its authorized representatives; (vii) problems that do not relate to materials or workmanship or that have an insignificant impairment on the use or operation of the Product; or (viii) problems related to consumables; (ix) Product purchased “AS-IS” or “with known faults, defects or problems.” Additionally, Exascend will have no liability or obligation to recover any data in the Product.

Disclaimer of liability

Exascend, Inc. reserves the right to make changes to specifications and product descriptions such as but not limited to numbers, parameters and other technical information contained herein without notice. Please contact Exascend, Inc. to obtain the latest specifications. Exascend, Inc. grants no warranty with respect to this datasheet, explicit or implied, and is not liable for direct or indirect damages. Some states do not grant the exclusion of incidental damages and as such this statement may not be valid in such states. The provisions of the datasheet do not convey to the purchaser of the device any license under any patent right or other intellectual property right of Exascend, Inc.

Customers must not use Exascend products in applications where a device failure or malfunction may cause personal injury or death, e.g., in life support systems or devices.

Exascend shall not be liable for any loss, injury or damage caused by use of the products in any of the following applications:

- Medical-related devices, life support, medical measurement devices, etc.
- Control devices for trains, ships, mass transportation systems or automotive vehicles, etc.

- Specific applications including military/defense-related equipment, aerospace, nuclear facility control systems, etc.
- Safety systems for disaster prevention/crime prevention, etc.

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Revision history

Table 13: CFexpress 4.0 Type A card datasheet revision history

REVISION	DESCRIPTION	DATE
001	First released	Dec, 2023
002	Modify speed	Jan, 2024
003	Modify warranty	Mar, 2024
004	Website & warranty updated	Apr, 2024
005	Modify format	Jun, 2024