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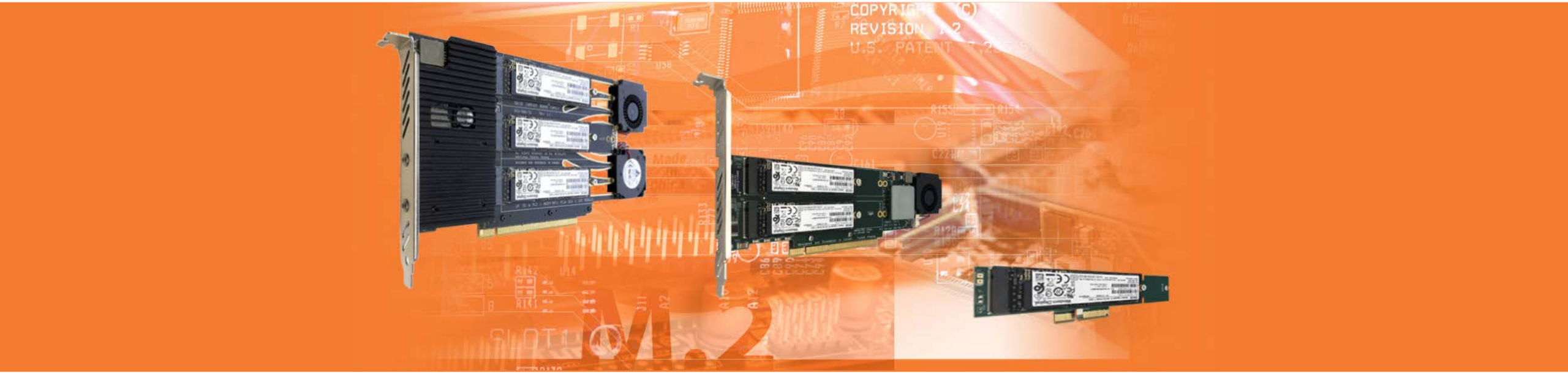

“Three-in-one” PCIe solution for modern-day SSD storage challenges

Flash Memory Summit 2019
Santa Clara, CA

Flash Memory Summit

August 7th, 2019

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Who are we and what we do?

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Our history and expertise

Innovation

Our innovation capability rests on our **deep engineering expertise**, understanding of emerging **technology trends** and **broad industry scope**.

Quality

We adhere to high-quality standards **through all stages of product creation, from design and engineering to manufacturing**.

Relationships

Although electronics are at the core of our business, we believe that **people always come first**.

Amfeltec's mission is **to empower engineers to develop complex electronic products and systems, and enable innovation-oriented engineering work** by designing and supplying high-quality, robust electronic components and tools engineered for impeccable functionality, scalability and reliability.

We create products for:

- **Telecommunications Industry**
- **High Speed Data Processing**
- **SSD Storage**
- **Inter-connectivity Devices**
- **Testing, Debugging and Production Tools**

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Trends & Challenges

Three major trends impacting the industry and beyond

High Performance Computing

Moore's law still holds true and the processing power, as well as overall computer performance continues to increase. As computers continue becoming more powerful they require more resources.

Shrinking Device

While the performance increases the size shrinks. Personal, professional and industrial devices are shrinking in size. Physical space in data-centers is dictating new demands on dimensions of the devices as well.

Data Proliferation

Both the increasing performance of computers and wide spread of smart devices lead generation of new data every moment. All this data have to be captured, stored and processed.

Data Processing Speed

Large volumes of data lead to difficulties in accessing, processing and and transferring the data between storage drives and processing units.

Physical Space Utilization

Shrinking devices and the cost of space in data-centers amplify the need for components and boards that utilize space efficiently and cost-effectively.

Data Storage Capacity

Big Data requires large storage capacities connected to processing units in optimal way.

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External SSD Storage Expansion

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Possible solution #1

How external SSD storage expansion works?

External SSD storage expansion is one way to solve for the aforementioned challenges. This solution is based on external racks that can hold additional SSDs. This additional storage connects to the host computer via cable.

Criteria	Performance
Data Storage Capacity	Facilitates multiple SSDs that allow for significant storage capacity expansion.
Physical Space Utilization	Requires additional storage space for external chassis in the rack.
Data Processing Speed	Speed of processing data may suffer due increased latency resulting from the bridged connection to the CPU.

SSD PCIe Boards (AIC)

Possible solution #2

How SSDs in PCIe form factor works?

SSD PCIe boards (also referred to as Add-In Cards) are typically an integrated non-expandable storage solution. Many newer add-in SSD cards operate on NVMe protocol and utilize PCIe slot directly on your motherboard.

Criteria	Performance
Data Storage Capacity	The storage capacity is limited to amount of the integrated flash. Further expansion is not possible.
Physical Space Utilization	Add-In PCIe boards plug directly into a PCIe slot in motherboard.
Data Processing Speed	Direct connection into the motherboard. The flash storage today is slower than current M.2 SSD modules.

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PCIe Carrier Boards

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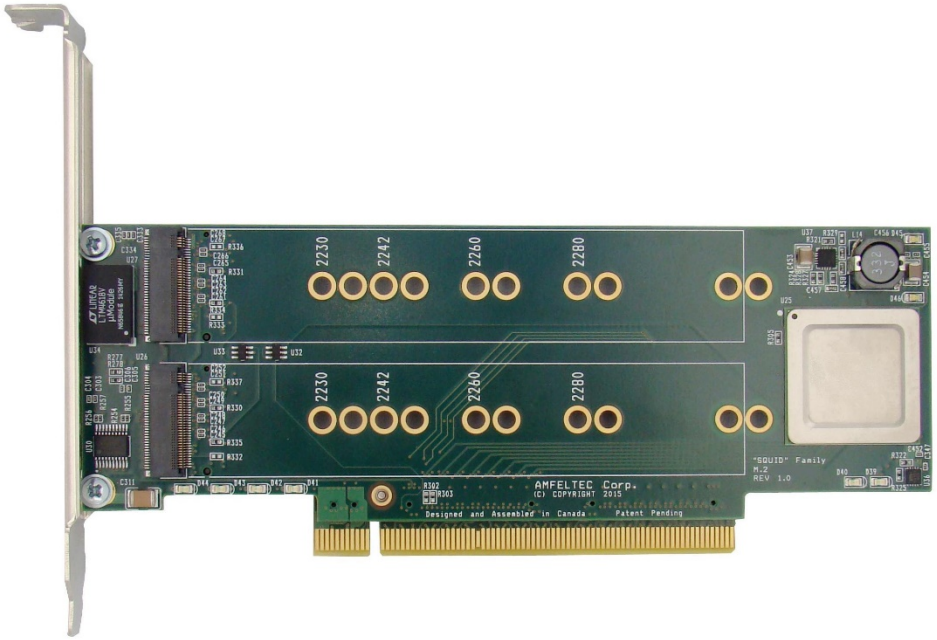
Possible solution #3



How PCIe Carrier Boards work?

Carrier boards is an M.2-circuit-based, flexible, storage expansion solution. Multiple SSD modules in M.2 form factor may be attached to a carrier board, which connects via PCIe interface directly into the motherboard.

Criteria	Performance
Data Storage Capacity	The storage capacity is limited to number of M.2 circuits; however, modules of various capacity can facilitate significant disk space.
Physical Space Utilization	Occupies one standard PCIe slot.
Data Processing Speed	Direct connection to motherboard and possibility to combine multiple SSDs into RAID provide higher processing speeds.

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Squid Carrier Board™ Family

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Why choose Squid family products over other market solutions?

Meet *Squid* Carrier Boards Family

Squid PCI Express family is a series of PCIe Carrier Boards designed for desktop computers, servers, embedded appliances or storage expansion. Squid family products expand motherboard's PCIe slot with multiple full-size or half-size Mini PCI Express, or multiple M.2/NGSFF (NF1) PCI Express, SSD modules.

Mounting a module is easy on all Squid Carrier Board™ products, it is a matter of a single screw per each module. All carrier boards in the family comply with the PCIe specification 3.0, and M.2 specification 1.1.

Squid CARRIER BOARD™ FAMILY

Variety of Sizes
Squid carrier boards come in 1U, 2U and Full Size configurations

Module Agnostic
Squid family products can be used to expand SSD storage or connectivity capabilities by adding appropriate M.2 modules to your device

Made in Canada
All products made and tested in Markham, ON

RoHS Compliant
Environmentally friendly

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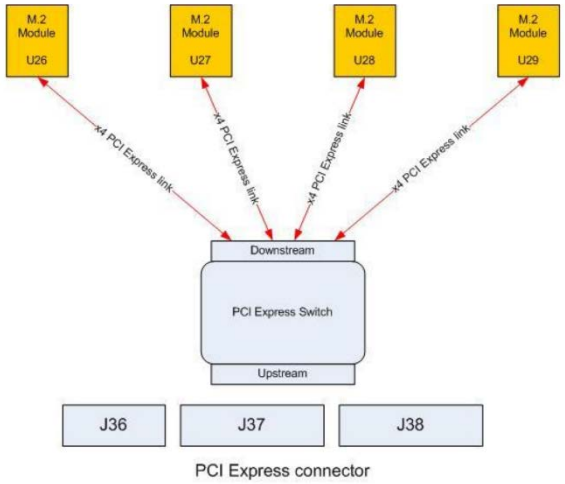
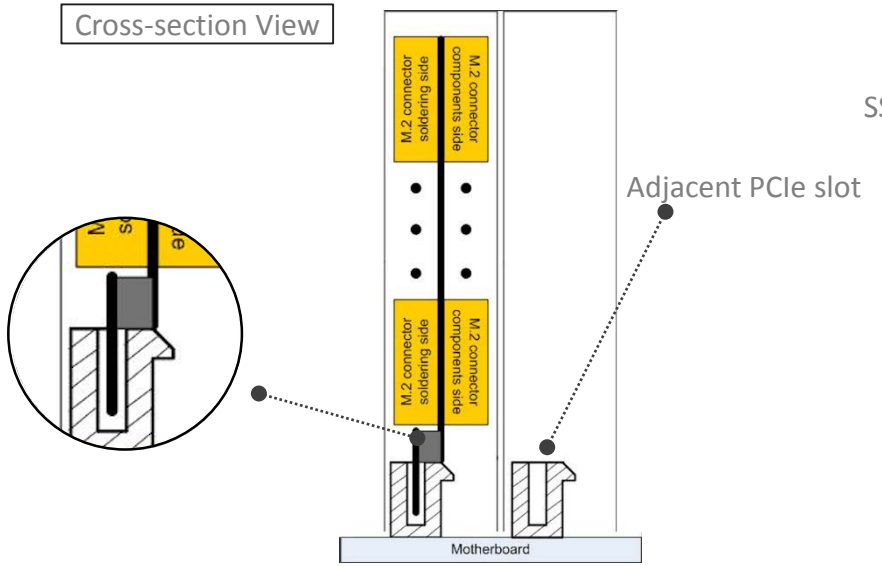
The Squid Advantage

Why you should choose Squid Carrier Boards™?



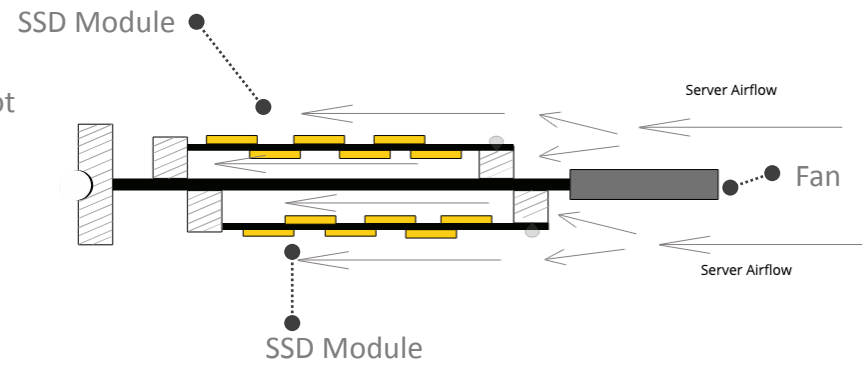
PCI Express Switch

Cross-section View



PCIe One-Slot-Wide solution

Top View



Open Concept Module Connection

Physical Space Utilization

Patented architecture of Squid Carrier Boards™ allows for efficient allocation of SSD modules on both sides of the board

Motherboard Agnostic

Compatible with **any** motherboard on the market

PCIe Connector Agnostic

Upstream connection via interchangeable adaptor (x1, x4, x8, x16)

Support all chassis-heights

Our boards fit into all chassis including 1U, 2U and Full-size

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PCIe Gen 3 Carrier Board for four M.2 PCIe SSD modules

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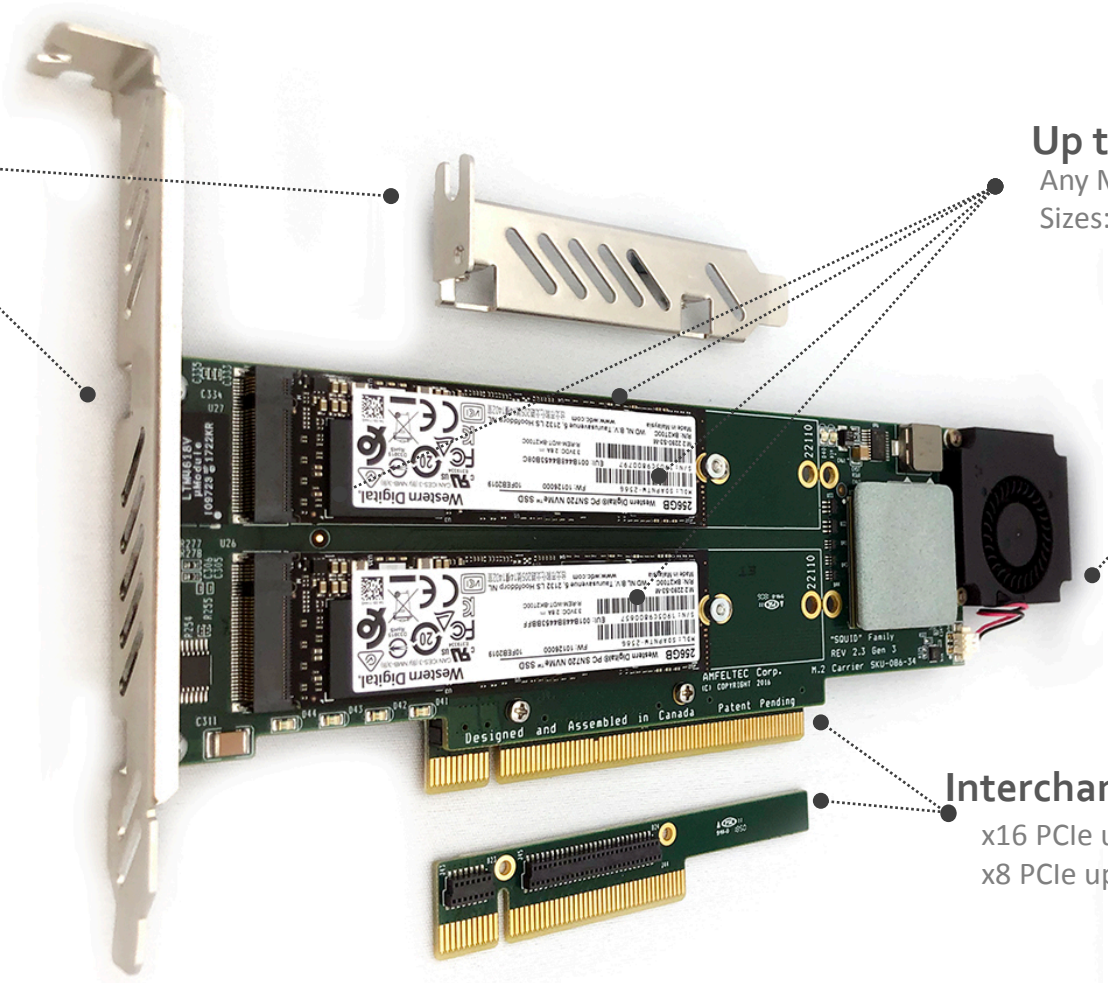
Most popular Squid Carrier Board™



Replicable brackets

Full size of half-height bracket

Up to 4 PCIe SSD modules

Any M.2 PCIe SSD modules (M-key):
Sizes: 2242, 2260, 2280 and 22110

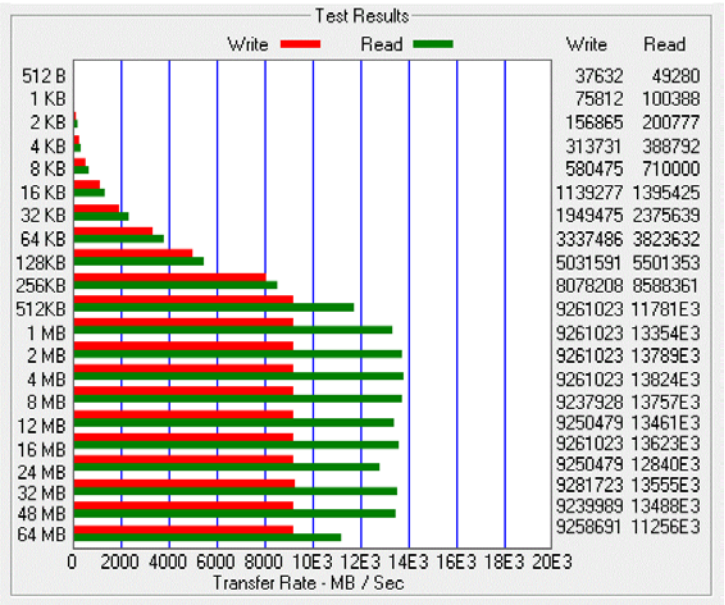
Removable fan

Length:
with fan 8.23” (209 mm);
without fan 6.81” (174 mm)

Interchangeable PCIe upstream adapters

x16 PCIe upstream adapter;
x8 PCIe upstream adapter (optional)

Performance



	Write	Read
512 B	37632	49280
1 KB	75812	100388
2 KB	156865	200777
4 KB	313731	388792
8 KB	580475	710000
16 KB	1139277	1395425
32 KB	1949475	2375639
64 KB	3337486	3823632
128KB	5031591	5501353
256KB	8078208	8588361
512KB	9261023	11781E3
1 MB	9261023	13354E3
2 MB	9261023	13789E3
4 MB	9261023	13824E3
8 MB	9237928	13757E3
12 MB	9250479	13461E3
16 MB	9261023	13623E3
24 MB	9250479	12840E3
32 MB	9281723	13555E3
48 MB	9239989	13488E3
64 MB	9258691	11256E3

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PCIe Gen 3 Carrier Board for one M.2 PCIe SSD module

Perfect size for expansion of storage or capabilities in embeded appliances

PCIe SSD module

Any M.2 PCIe SSD modules (M-key):
Sizes: 2242, 2260, 2280 and 22110

PCIe Retainer

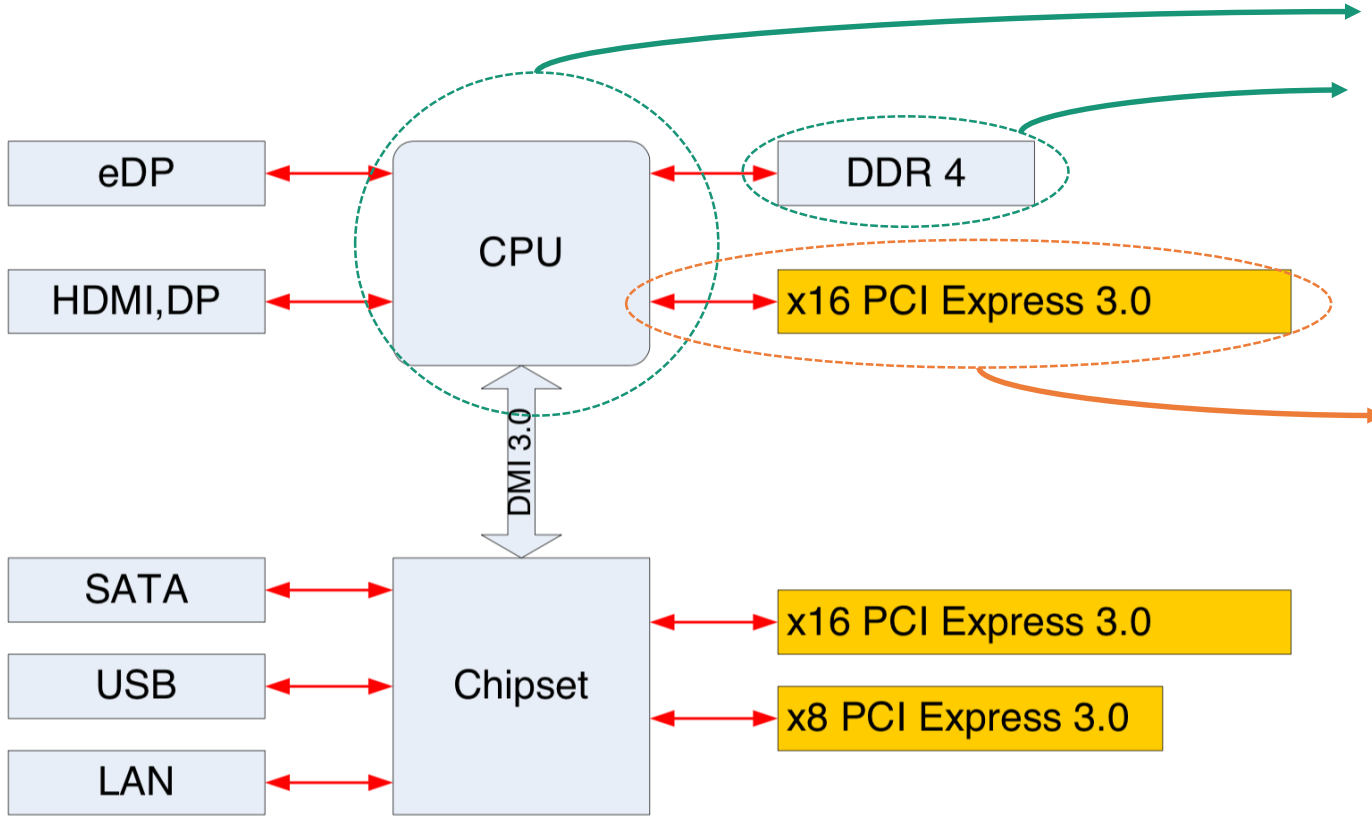
Holds a carrier board inside 1U chassis without bracket

Interchangeable PCIe upstream adapters

x4 PCIe upstream adapter;
x1 PCIe upstream adapter (optional)

Why Speed Suffers?

What affects the processing speed?



Overall computer speed

CPU, RAM speed and motherboard type are key for high speed

Location of the PCIe slot on the motherboard

For optimal speed x16 PCIe connector has to be directly connected to the CPU

Type of the module

The write/read performance of each SSD module will have an impact on the speed

Number of Modules in RAID

Storage speed is proportional to, and determined by, the number of SSD modules in RAID

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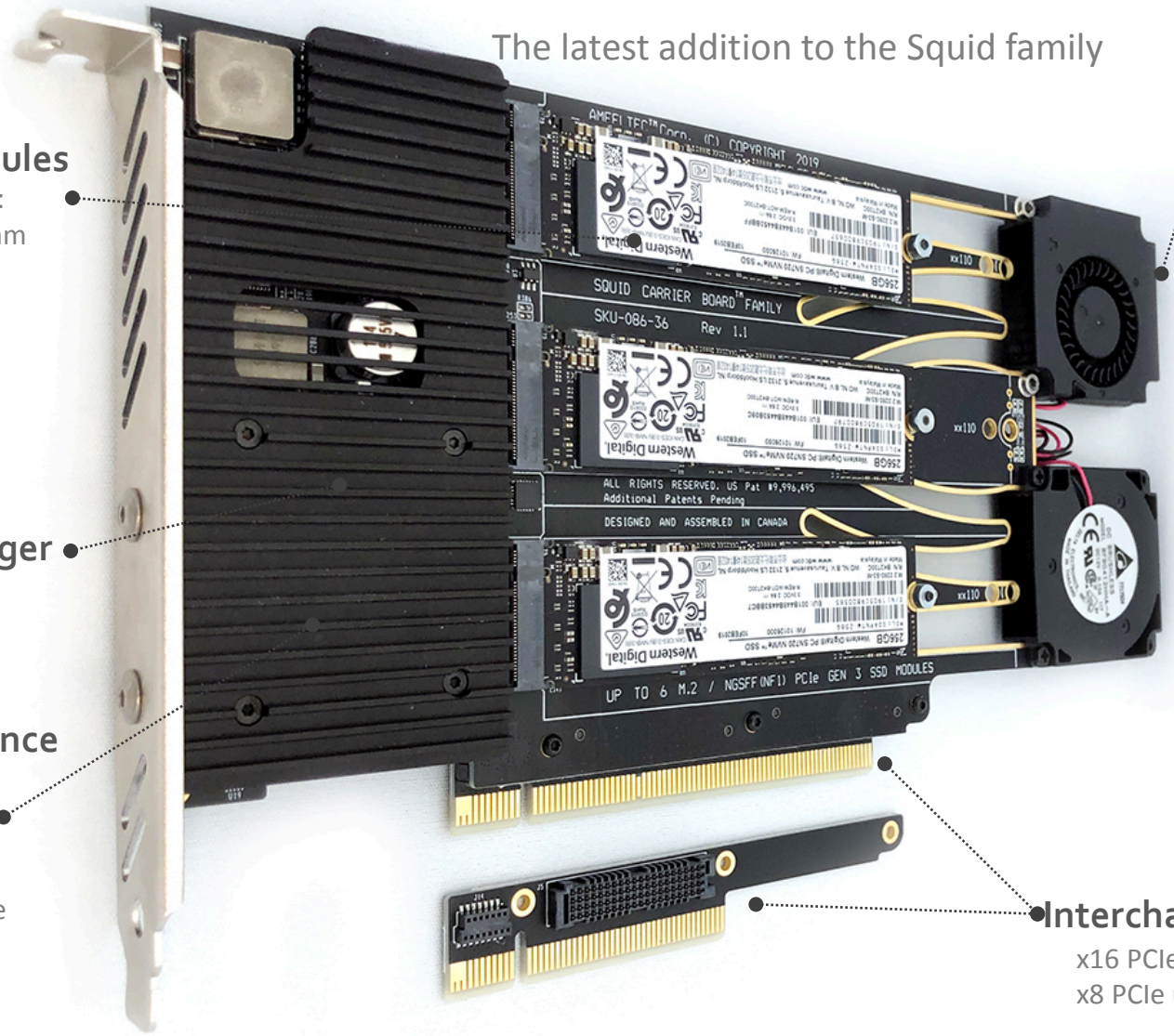
PCIe Gen 3 Carrier Board for six SSD modules

The latest addition to the Squid family



Up to 6 PCIe SSD modules

Any PCIe SSD module (M-key):
Dimensions: 80 mm or 110 mm length; up to 32 mm width

Batteryless Data Logger

Backup operation status

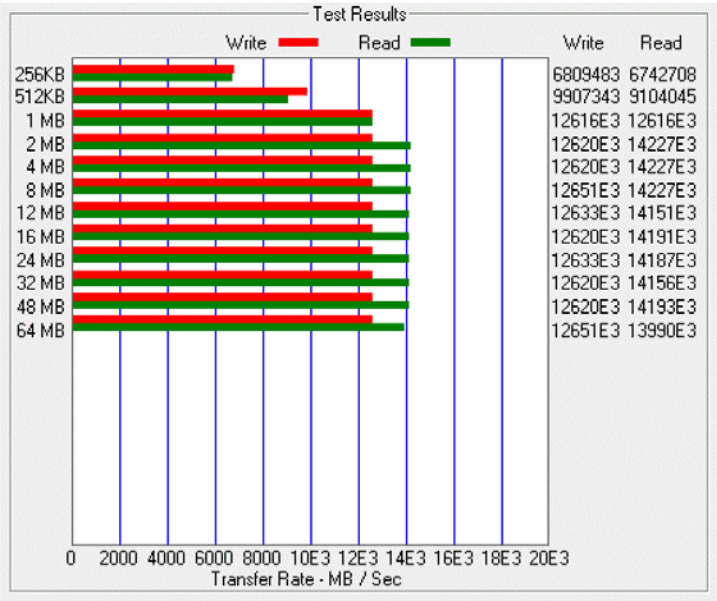
Real-time performance and temperature monitoring

Data transferred to host computer via USB port (PCIe bandwidth is not utilized)

Two Removable Fans

Length:
with fans 202.65 mm x 111.15;
without fans 167.55 x 111.15

Performance



Interchangeable PCIe upstream adapters

x16 PCIe upstream adapter;
x8 PCIe upstream adapter (optional)

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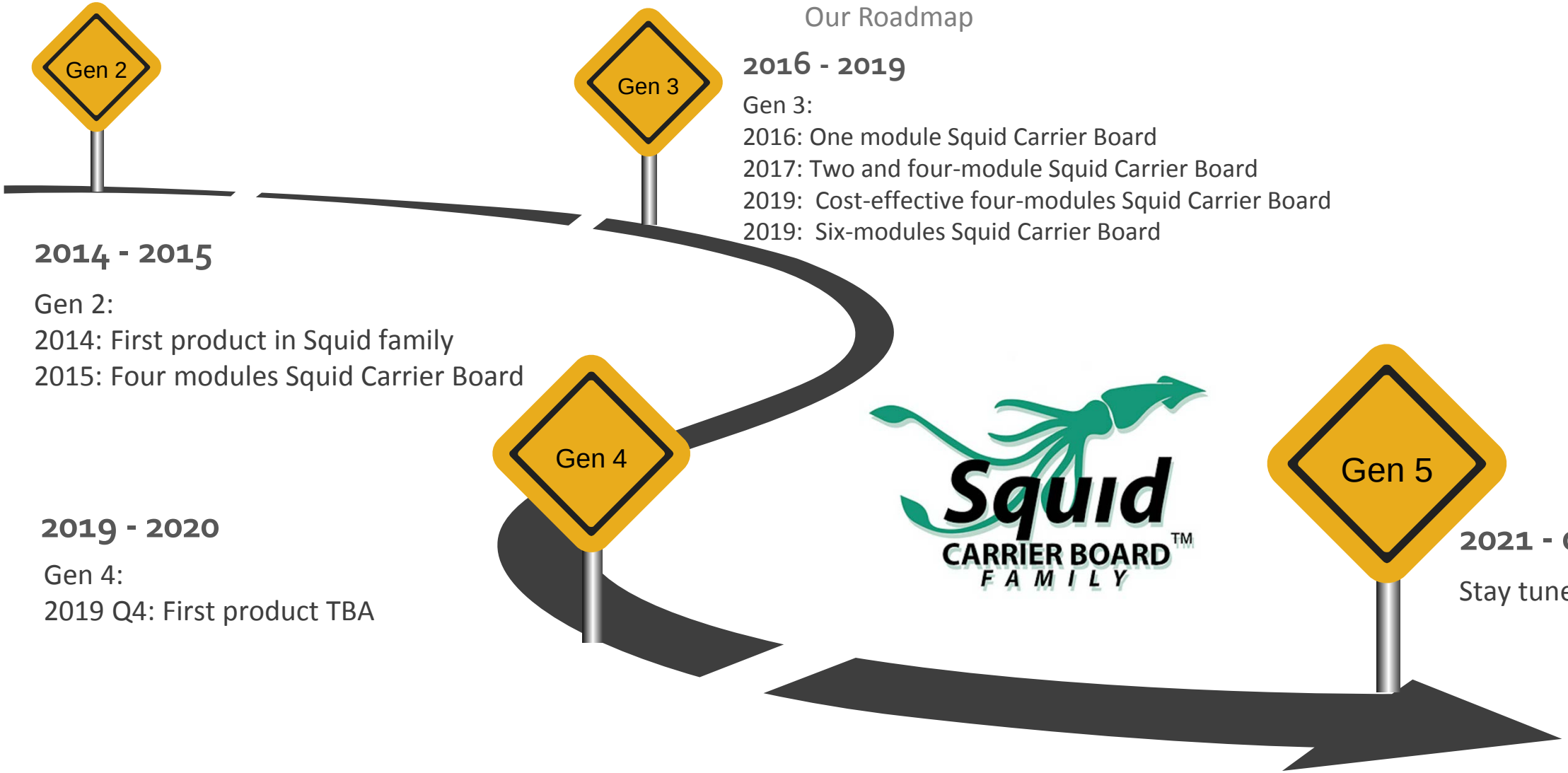
What's next?

Our Roadmap



2014 - 2015

Gen 2:
2014: First product in Squid family
2015: Four modules Squid Carrier Board

2016 - 2019

Gen 3:
2016: One module Squid Carrier Board
2017: Two and four-module Squid Carrier Board
2019: Cost-effective four-modules Squid Carrier Board
2019: Six-modules Squid Carrier Board

2019 - 2020

Gen 4:
2019 Q4: First product TBA

2021 - onwards

Stay tuned…

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Thank you for your time and attention! amfeltec

Got questions?

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