Intro to M.2 SSDs

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Presented by:
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What are M.2 drives? Is it different from NGFF?

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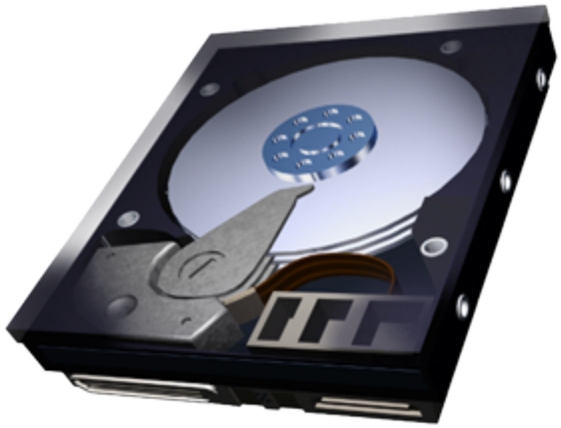
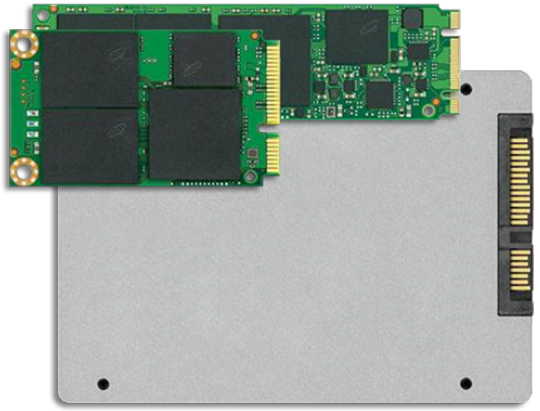


First evolution from HDD to SSD. Same form factor!!

- Quick Realization! Why be stuck in this same physical limitation?

SSD Proliferates to unique, SSD-only platforms



What are M.2 drives? Is it different from NGFF?

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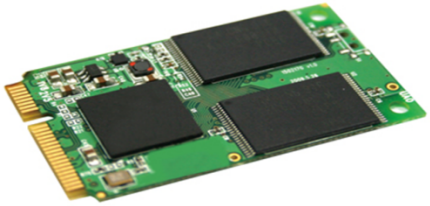
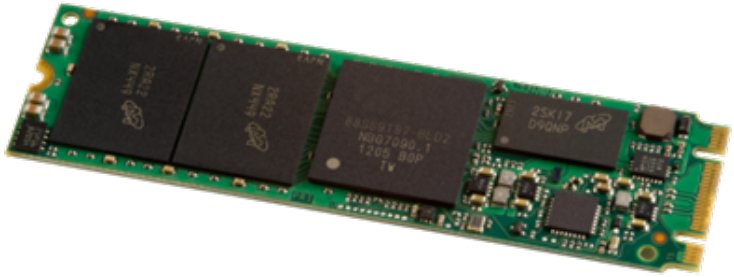
- First came card-only form factors, based on the standard SATA connector, e.g. JEDEC MO-297 ("slim/light"), and then MO-300 mSATA.
- mSATA gained wide adoption in notebook computers. Uses same connector as WiFi and other devices.
- **But!** SATA is running into performance limitations at SATA Gen 3, 6.0Gb/s
- "NGFF" for Next Generation Form Factor, soon became "M.2"; initial proposal in SATA-IO and PCI-SIG.
- Physical configuration that can support SATA **and** PCIe, and a host of other non-storage applications!



mSATA evolves to M. 2 SATA and beyond!

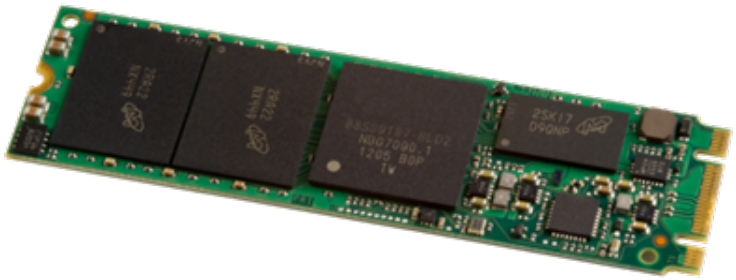


How many PCIe lanes are used?

- Detailed M.2 specifications are included in the PCI-SIG M.2 spec; the SATA version of M.2 is described in the SATA v3.2 spec.

www.pcisig.com	www.sata-io.org

- Resolves the performance extensibility issues with mSATA SSD.
  - Brings superior throughput capability to "Ultra thin and light" computing, by leaping past the plateau of 6.0 Gbps SATA.
- Enables 2- or 4-lane transfer speeds ~ 900 MB/s (read) & 800 MB/s (write) for first generation drives. Significantly faster in the x4 options to come!



M.2 Capability in Storage

- Legacy SATA/AHCI. Allows form factor transition; no driver change for SATA 6 Gbps hosts.
- PCIe/AHCI. Allows backwards compatibility, but can't reach full performance potential.
- PCIe/NVMe. Allows full access to PCI Express lanes, with an interface designed to work most efficiently with new, faster storage technologies, e.g. Flash. Takes advantage of the ability of SSD to execute data transfers in parallel. Requires driver updates.

M.2 Capability

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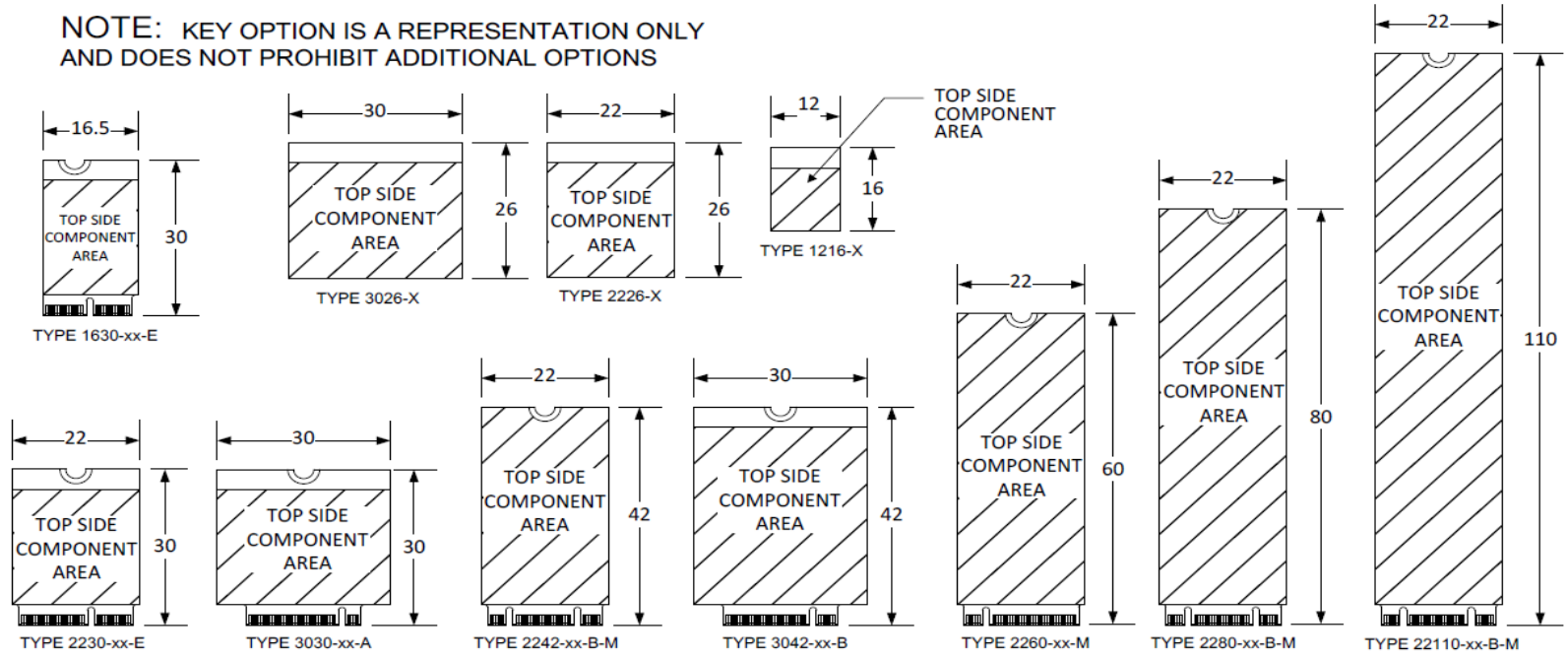
- Greater Flexibility than mSATA in physical dimension (including soldered-down options.
- Like mSATA, low insertion rating; not intended for hot-plug!



M.2 Form Factor Options

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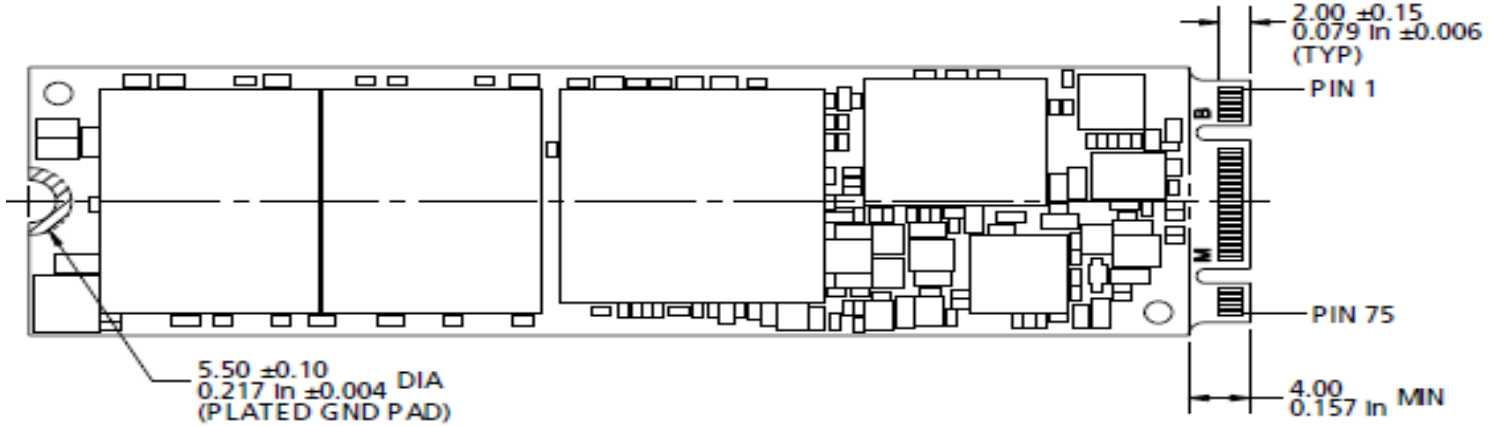
- Denoted by a "Type."
  - Specifically: 2280, 2260, 2242, 2230. Also, 3030, 3042, 1630, etc.!
- "Type" designates X-Y dimension: e.g. 2280 = 22mm x 80mm



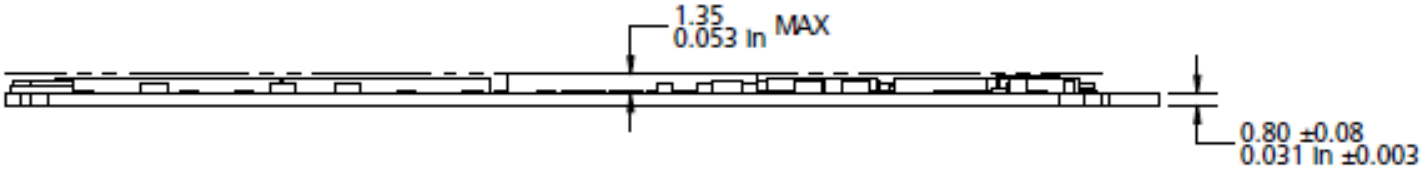
- Above is shown an M.2 SATA option.
- Interface is keyed to denote interface and device type!
  - Described as a "Socket", Socket 2 configuration is for SATA
  - Socket 3 configuration is for PCIe in a x4 configuration

M.2 Form Factor Options

- Height in Z-dimension also has options

  S = single-sided; D = double-sided, as below:

Designator	Top side (mm)	Bottom side (mm)
S1	1.2	
S2	1.35	
S3	1.5	
D1	1.2	1.35
D2	1.35	1.35
D3	1.5	1.35



M.2 Form Factor Options: Connector Keys

- M.2 provides great flexibility for system designers by providing key options to determine device types; storage, WiFi, WiGig, Bluetooth, et. al.
- Card specification can be very specific.
  - E.G.: "TYPE 2242-D2-B-M"
  - This indicates a 22x42mm card, double-sided, with keys in the B and M positions (can fit B or M connector!).

Key ID	Pin Location	Interface
A	8-15	2x PCIe x1 / USB 2.0 / I2C / DP x4
B	12-19	PCIe x2/SATA/USB 2.0/USB 3.0/HSIC/SSIC/Audio/UIM/I2C
C	16-23	Reserved for Future Use
D	20-27	Reserved for Future Use
E	24-31	2x PCIe x1 / USB 2.0 / I2C / SDIO / UART / PCM
F	28-35	Future Memory Interface (FMI)
G	39-46	Not Used for M.2; for Custom/Non-Standard Apps
H	43-50	Reserved for Future Use
J	47-54	Reserved for Future Use
K	51-58	Reserved for Future Use
L	55-62	Reserved for Future Use
M	59-66	PCIe x4 / SATA

Source: PCI Express M.2 Specification.

Is it for Client or Enterprise applications? What specific applications are they designed for?

- The first designs are for mobile computing; Notebook, Thin-and-Light, UltraBook, PC Tablet and beyond.
- Enables smaller, lighter, "stylish" desktops and workstations.
- Small form factors are attractive to server and data center designers.
  - Boot drives, in storage array, firewall, network appliance.
- Limitations for enterprise computing
  - Connectors have low insertion ratings.
  - Connector contacts have extremely small pitch, making hot-plug "impossible". Ground pins are not extended, as on larger form factors.
  - Carrier or "sled" could be used to overcome plug/unplug issue, *with caution*.
    - Drive designers may not include in-rush current limiter, since hot-plug is not expected.

Need more information??

SNIA WEBCAST

- **10 June 2014**: SNIA will hold a more in-depth Webcast.
- Representatives from other major industry contributors.
- M.2 Topics:
  - M.2 Market Overview
  - M.2 Card Options
  - M.2 Connection Schemes
  - NVMExpress Technology and Outlook
  - More on M.2 Performance
- Please watch for e-mail announcement from SNIA, and www.snia.org

Question & Answer

Webcast Presenter

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Jon is a Sr. Technical Marketing Engineer in Micron's Storage Business Unit, which includes SSD and NAND Flash organizations, serving in this capacity for the past five years. Jon facilitates new product integration and customer qualifications for notebook and desktop applications, as well as SSD in the data center, as well as responsibility for technical documentation. Jon plays a key role in product planning and development, with an eye toward market requirements.

Jon has more than 20 years of experience in the data storage industry, working with both magnetic media and solid state technologies.

Jon earned his Bachelor of Science degree in Electrical and Computer Engineering from the University of Colorado at Boulder.

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