PCIe* BGA SSD

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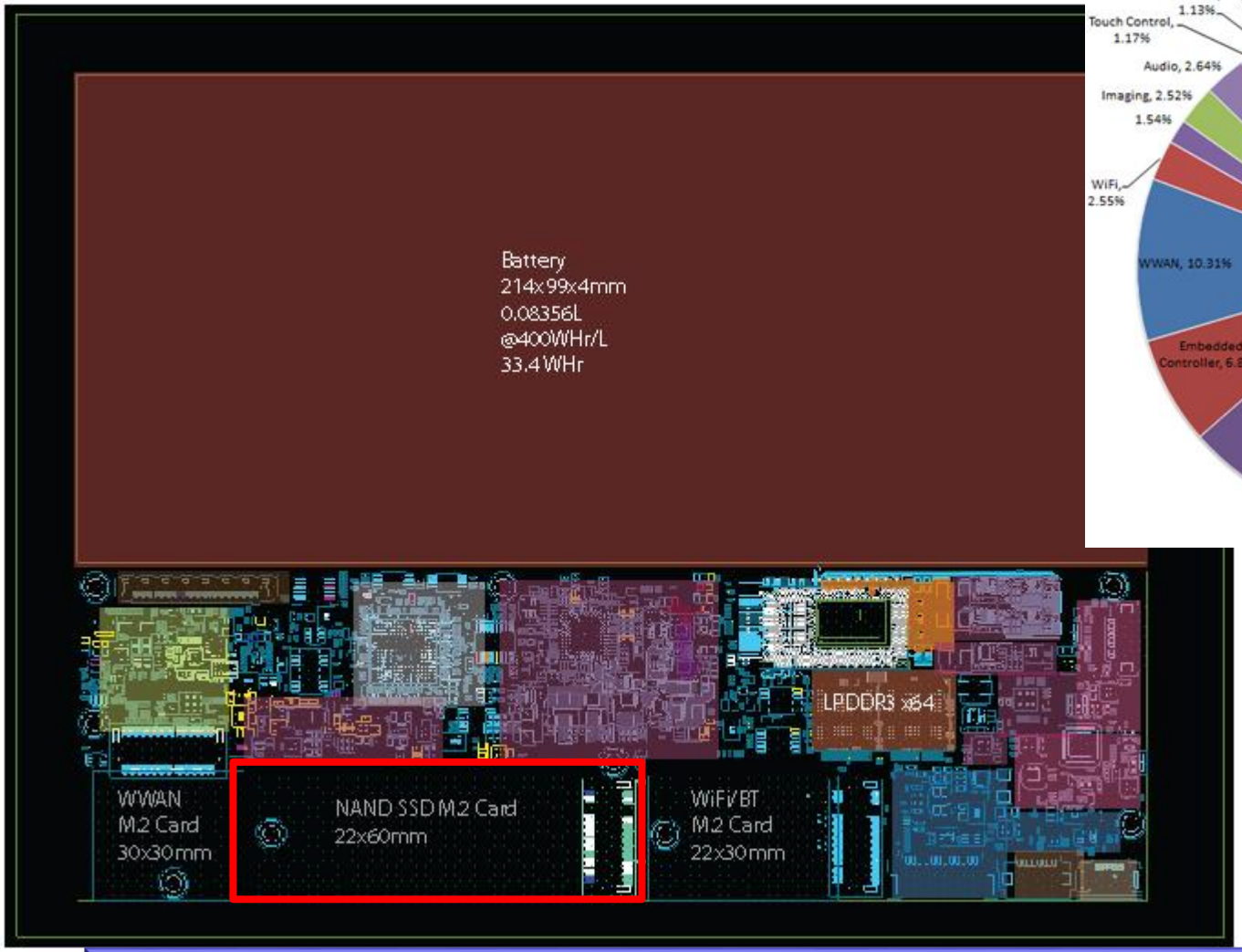
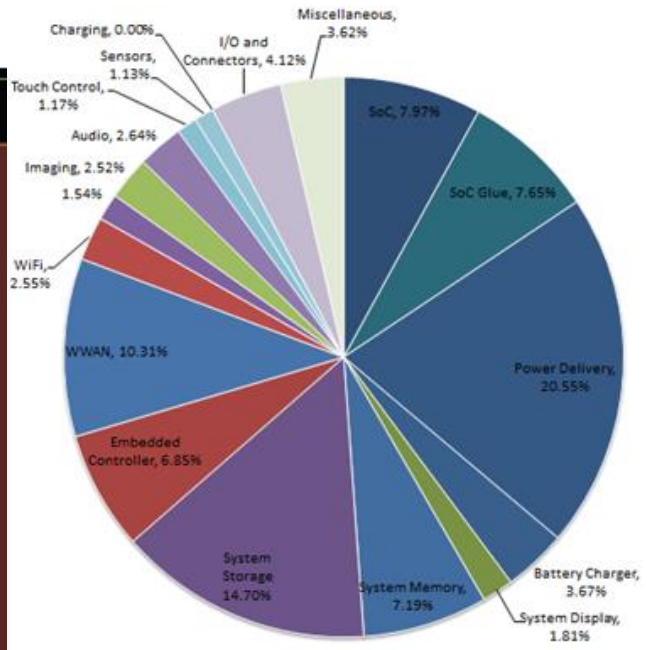
Intel Product for 10” 2 in 1 Platform Study





From calculations of the area of each subsystem, storage is taking ~15% of platform area in an M.2 form factors.

Intel Product Study using NAND BGA solution

- M.2 storage ~15% of platform area
- In this case, PCIe* BGA increases battery size by 10%
- Saves 0.5 – 1.5mm Z-height.

System Needs for Leadership Form Factors

Segment	Leadership Storage Form Factor	Planned 2015+ Targets
Enthusiast Tower	M.2 or 2.5”	M.2 22x80mm or 2.5”
Mainstream DT & AIO	M.2 or 2.5”	M.2 22x80mm or 2.5”
Ultra Small Form Factor DT	M.2 or 2.5”	M.2 22x80mm or 2.5”
Mainstream and High End Notebook or Portable AIO	M.2 card	M.2 22x42 or 22x80mm
Convertible Notebooks	M.2 card	22x42mm
10.6” to 13” Detachable Notebooks	BGA	16x20mm (Z-height: <2mm)
7” to 10” Tablets	BGA	12 x14 mm (Z-height: <1.5mm)

Focus of this presentation is on detachable notebooks and tablets.

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NAND BGA – Intel Proposed Targets

Metric	eMMC 5.0 Capabilities	Entry Level 2015+	Performance 2015+
Lanes	Single	1 lane SATA Or up to 2 lanes PCIe Gen3	2 lanes PCIe Gen3 (up to 4 lanes)
Capacity	N/A		
Media Playback			
Web Browsing			
MM12			
Peak Active Write Power	< 3 W		
Peak Active Read Power	< 1 W		
Idle Power (DEVSLP for SATA or L1.2OFF PCIe)	< 0.5 mW		
Idle Wake Time	< 2 ms		
Sleep Power	< 1.5 mW		
Sleep Wake Time	< 20 ms		

Metric	2014 Ultrabook Targets	eMMC 5.0 Capability	Entry Level 2015+	Performance 2015+
Lanes	N/A	Single	1 lanes SATA Or up to 2 lanes PCIe Gen3	2 lanes PCIe Gen3 (up to 4 lanes)
Random 4KB Read IOPs*	5,000	6,000 – 8,000	25,000	80,000
Random 4KB Write IOPs*	3,500	1,500 – 2,500	8,000	16,800
Sequential 128KB Read Bandwidth*	350 MB/s	300 MB/s	500 MB/s	1600 MB/s
Sequential 128KB Write Bandwidth*	100 MB/s	100 MB/s	100 MB/s	175 MB/s

- Set footprint with family of package sizes
- Worked closely with multiple IHVs on initial proposal
- Signals used in BGA similar to M.2 socket 3
- Key Differences from existing socket 3
  - 3 power rails (1.2V, 1.8V, 3.3V)
  - GPIO using 1.8V instead of 3.3V

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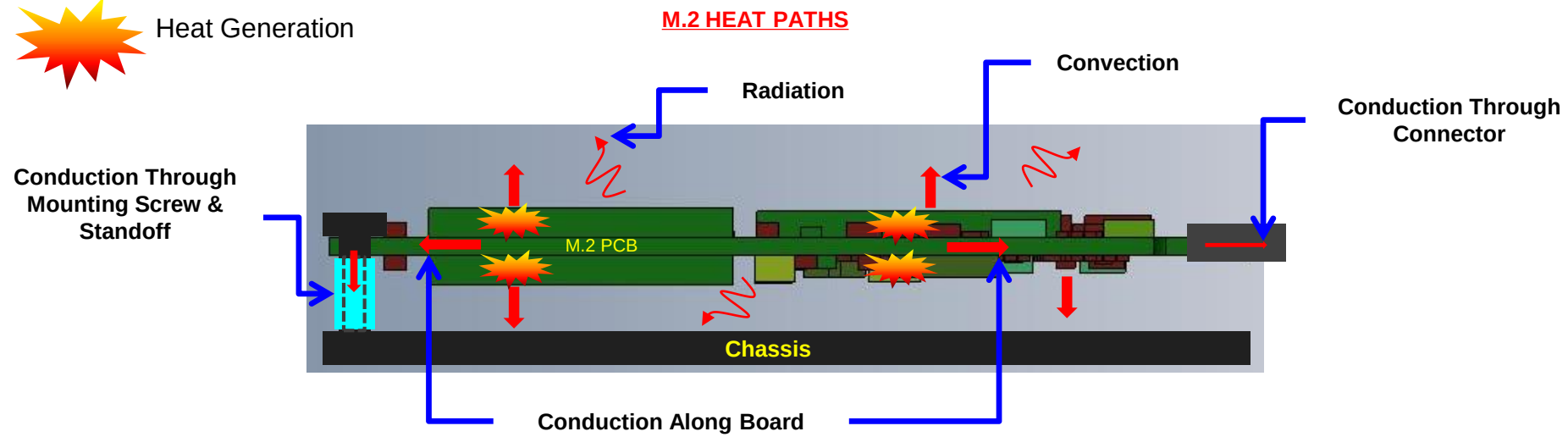
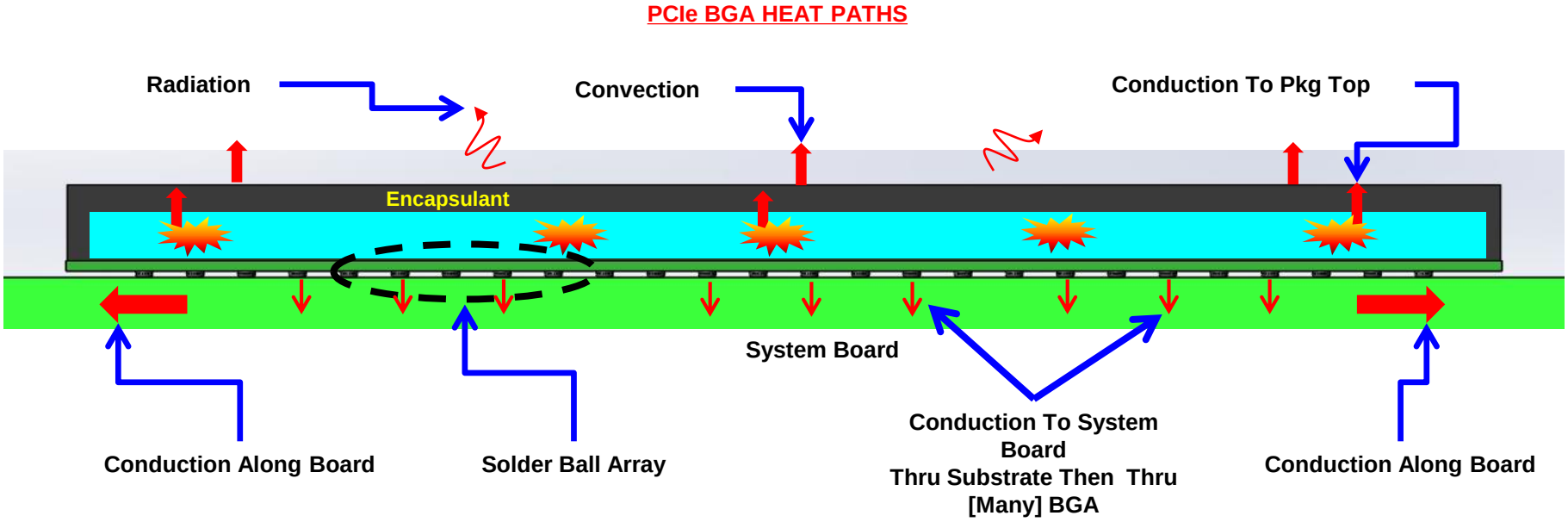
Generic M.2 Thermal Assessment



- Small board connected to system chassis and motherboard
- Thermal path is via convection and radiation off card surface as well as conduction through the standoff and end connector
- Local chassis, board, and air temperatures greatly impact M.2 module cooling

Generic BGA Thermal Assessment



- Primary heat path is conduction into the motherboard
  - Local board and air temperature and nearby heat generating components will have a major impact on BGA cooling
  - Improved conduction paths through BGA balls to ground plane can improve BGA cooling

Summary

- Platform form factors driving need for smaller storage solutions
  - 22x60 M.2 module is ~15% of a 10” tablet board area
  - BGA solution provides room for 10% battery growth or additional features
- Power/performance targets allow differentiation relative to other technologies
- Analysis shows BGA would provide better thermal solution than M.2 module