

US Semiconductors

CES: Cloud AI solid, Auto muted, Edge AI work in progress

Price Objective Change

Met with NVDA, MRVL, INTC, ADI, MU, ON and SWKS

We attended the CES tradeshow in Las Vegas this week and met with several mgmt teams. As expected, AI was the main topic, especially its spread into edge devices such as PC, smartphones and other consumer devices. Chip investor excitement was tempered somewhat by CQ1 warnings from MCHP, Aehr Systems and prior from Mobileye, all exposed to the industrial/auto mkt. All-in, we flag: 1) Solid Cloud AI demand trends at NVDA, MRVL (raising PO to \$80 on custom AI chip ramp); 2) Pricing optimism and start of HBM cycle at MU; 3) Manufacturing recovery and AI PC excitement at INTC; 4) Acknowledgement of muted demand but no incremental weakness and downside execution at ADI and ON; and 5) Inline smartphone demand at SWKS.

Cloud AI crowded but still best house in neighborhood

In our view the tech industry is still in early phases of figuring out how best to use generative AI. However, before we figure out use cases, the core infrastructure first needs to be built out. This upfront buildout is expensive (genAI servers priced \$200-\$450K, or 20-45x traditional servers, with only ~10% or so traditional servers converted over). However, we see enough ecosystem momentum for this to last into next year. Our discussions with NVDA and MRVL were very positive, with both vendors (along with AVGO, AMD) supplying critical compute and networking parts to cloud customers. NVDA emphasized strong visibility and fertile roadmap. The MRVL discussion indicated their custom AI chip ramp could be 1.5-2x the \$250mn/\$450mn we assumed prior for CY24/25E, and we consequently raise our PO on MRVL to \$80 from \$68 on higher 32x CY25E P/E vs. 27x prior, though still within our 1-2x PEG ratio framework.

Edge AI work in progress

INTC and AMD announced multiple new products for AI (essentially the microprocessor includes an extra chip called the Neural Processing Unit or NPU) that is able to provide genAI inference faster on device while keeping user data secure. However, it's unclear if it can stimulate any new PC replacement cycle, nor if it's able to command higher average selling prices. We suspect AI might spread faster on smartphones as users already have more personal photos/videos data on the phone. In our view, ARM will prove to be less appreciated but most critical beneficiary of edge AI, providing crucial IP for more consumer devices to become smarter. If AI PC takes off, INTC/AMD benefit most though NVDA also announced several gaming products and software to take part.

Autos/industrial in downcycle, potential for 2H recovery

Our ADI and ON meetings suggested that while the demand environment is muted, there are no incremental read-thrus from recent peer warnings to ON, ADI broad CY24 expectations. Despite cyclical headwinds, we believe stocks here are important diversifiers from rest of semis that are very AI concentrated. While EV demand has slowed somewhat, our BofA Global Research auto analyst Horst Schneider and his team are forecasting solid 25% xEV growth in 24E, same as 23E (see their [recent EV tracker report](#)). Our top auto picks are NXPI and ON.

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Glossary:

CES: Consumer Electronics Show
AI: Artificial Intelligence
PC: Personal Computer
NVDA: Nvidia
MRVL: Marvell
PO: Price Objective
MU: Micron
INTC: Intel
ADI: Analog Devices
ON: onsemi
SWKS: Skyworks
AMD: Advanced Micro Devices
AVGO: Broadcom
PEG: Price to Earnings Growth
P/E: Price to Earnings
IP: Intellectual Property
EV/xEV: Electric Vehicle
NXPI: NXP Semiconductor
HBM: High Bandwidth Memory
MCHP: Microchip

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ADI Meeting Takeaways

Q: Thoughts on recent preannouncements, most notably from MCHP?

- ADI strategically cut capex, reduced fab starts, conducted customer due diligence
- Believe recent industry news affirm conservative actions

Q: Any material changes in terms of +/- by each end market?

- Saw substantial weakening in the Q4
- As mentioned, all markets down, but auto will fare best, industrial worst
- Despite weakness, ADI building out die bank buffers, looking at customer revenue growth versus shipment to customers and seeing under-shipping consumption
- Inventory digestion trends contemplated into guidance
- ADI allowed customers to adjust backlog in order to ensure that they did not make customer inventory situation worse, wanted to improve customer signaling

Q: Peak/trough framework: How do investors determine what is appropriate?

- At a company level, Street estimates for peak-to-trough revenue decline around -27%
- Do not necessarily use peak-trough to determine bottom, but do compare to past cycles and see if market trends indicate bottoming
- ADI highlighted improving sequential bookings, potential indications of return to normalized ordering patterns

Q: Comment on undershipping end demand by 15%-20%, how quickly does that normalize?

- Start with a stair-step function down, then it gradually recovers back up
- ADI expecting to undership demand this quarter, potentially Q2, improving bookings can help improve sentiment
- Customers react in a trend but not the same simultaneously, visibility can differ, law of large numbers often suggests a gradual recovery

Q: Thoughts on ADI normalizing lead times vs. competitors keeping them extended?

- Keeping lead times extended can have potential impacts on customer relationships
- Critical to be strategic, innovative partner – this requires normalizing lead times, not keeping them extended to positively develop relationships
- In times of shortages, ADI kept open lines of communications with customers so they can operate their business effectively

Q: Are there concerns on supply around chips from China being dumped into global markets?

- ADI views their business as driven by their product innovation, seen by elevated R&D intensity versus peers
- Ex: wireless BMS and autos, hearables/wearables in healthcare, industrial system control applications (beyond smarthome/city), etc.
- This is critical because it creates a strategic moat, even with potential risk of increased global supply in trailing edge, ADI has software/hardware niche that can help them maintain competitive leadership

Q: ADI performance vs. trendline is above peers, but can this be repeated in upcoming upcycle with tough comps?

- In upcycle, will see normalization of various trends (pricing back to parity, fab loadings will get back to normal, etc.)
- Key differences moving forward are cost synergies realized over the years (Maxim, Linear Tech M&A integration)
- Secular growth drivers remain in place too: ADI has more conviction in content density in solutions to be released

- Highlighted edge opportunities, needs to support lower power, lower latency that are supporting confidence in growth targets
- ADI believes they are focused in higher growth areas versus broader industry
- ADI peaks and troughs historically have been higher each cycle, showcases continued ability to drive value

Q: Edge AI – what are conversations like with customers?

- Believe they need to discuss this topic even more with investor community
- They are embedding AI in several products at the edge (transceivers/5G radios, ML for audio processing, motion control, power tuning, etc.)
- New CTO from AMD also has extensive AI edge experience
- When mapping top 50 intelligent edge products to revenue, it accounted for north of \$5bn of \$12bn top line and will certainly be a majority of revenue long-term
- Outside products, using AI to optimize internal solutions

Q: On pricing, why is assumption parity? Aren't parties pushing for higher or lower pricing?

- ADI does not renegotiate pricing on all products every year; some costs they pass off, others they do not
- Net net, some areas in pricing go up, others go down, but in the end it should even out accordingly
- Pricing can naturally go up as ADI gains more content in boards/systems
- Noted if legacy processing costs goes up, that is something they often pass through to customers

Q: What percentage of ADI revenue comes from products 20+ years old

- 50% of sales come from products 10+ years old (20 years old or more likely closer to 10% or so)

MRVL Meeting Takeaways

Q: Custom silicon – Recent commentary suggests it could be multi-\$bn business, is that feasible?

- Data center tracking to \$2.2bn this year, over half of that is Inphi
- As custom silicon and accelerator demand drives market growth, see it as feasible that custom silicon becomes a much larger part of the business
- Not any indication of optics weakness, just bullish outlook in custom silicon

Q: View on AI revenue versus previous assumptions a few quarters ago?

- Initially assumed CY24 AI revenue would be \$800mn, majority of which would be optics, but now will exceed previous targets as custom silicon gains traction (though still more optics weighted)
- Initial target of few-hundred \$mn in AI custom silicon revenue is now higher
- Non-AI custom silicon opportunities also still on solid trajectory
- Not providing exact number on AI custom silicon opportunity in CY24, as ramp times can vary slightly and can change valued realized in CY24/25
- Regardless of timing, still quite bullish on AI custom silicon opportunity

Q: If you were supposed to be doing \$200mn-\$300mn in custom silicon revenue, what is “way more”?

- Not defining specific target, but noted not to make assumptions that AI custom silicon revenue is capped; have enough supply to support 6mo ramp/build times (through Q3), Q4 upside is even possible

Q: Hypothetically, if NVDA data center revenue saw substantial weakness in CY25, what would MRVL custom silicon do?

- NVDA mostly being deployed in the cloud, others will compete in IaaS markets

- First workloads using custom silicon will likely start with internal workloads

Q: How does growth in custom silicon impact gross margin?

- Great growth from custom silicon, but recovery in storage/strength in optics and other tailwinds offer balanced growth
- 64% GM feasible as mix likely balances out, not too concerned on GM impact in end
- Even if custom silicon accelerates, it is still accretive to the operating margin given it has low operating intensity (previous massive IP development)

Q: Does custom silicon create more revenue variability?

- Not necessarily the case, 6mo lead times for custom silicon already give 2+ quarters of visibility
- On a longer-term basis, there could certainly be higher variability with upside from custom silicon

Q: If you did \$1bn in custom silicon by CY25, would GM be 60%?

- There will be recovery in other areas of the business (storage) that will be additive

Q: What made custom silicon slip before and why is there more confidence today?

- AI programs always scheduled for calendar '24, other non-AI programs were scheduled for '23
- Spend shifted to AI projects, non-AI programs not “slipping” but just did not rise as much as expected last year
- On the positive, AI project opportunities quickly rose leading to strong upside in custom silicon

Q: How do we reconcile AI accelerator ramps with modest cloud capex trends?

- Believe they have a decent idea on accelerator attach rate and DSPs, as their diversified portfolio allows them to piece together a more accurate AI data center/accelerator TAM, in their view
- MRVL formed an AI task force to understand the ecosystem, how their products fit into the ecosystem; it is rapidly evolving, and ratios of accelerators to DSPs for example can change, but MRVL has own internal estimates
- Acknowledges quarter-to-quarter these secular opportunities can see digestion periods, but 5-year view they believe in the AI opportunity

Q: Innovium – how should we think about the revenue and share gain potential?

- Share gains are a long-term story, do not win share gains with one product, it requires significant share
- starts with MRVL 51.2TB product, sampling but gaining share will require execution
- 51.2TB is serving one large cloud customer, few other various small customers

Q: What is the optics potential in CY24, can it reach \$1bn

- Exiting this year at a \$200mn, likely did well above \$400mn this year
- AI optics business is already large, overshot initial estimates
- What MRVL is shipping in optics typically gets deployed alongside accelerators 2-3 quarters later
- Optics is historically lumpy (even in Inphi days), there could always be 1-2 quarters of digestion, but MRVL still on escalation calls – it is still going to great next year
- There are only two key customers on 800G, there are still some customers using 400G for AI (everything 100G per lane)

Q: 800G – any reason to think ASPs could decline next year?

- Introduce products at highest ASPs, it can zig zag as time goes on
- ASPs can come down naturally from erosion, initial ramp comes from individually packaged parts, but despite this, there really is not much of a gross margin impact

Q: Storage – what is recovery look like, and can we get back to prior runrate?

- Most of the revenue in data center, challenges here, rest is consumer and that is back to normal
- In consumer/gaming: Up Q2/Q3, down Q4/Q1
- Fibre channel has been weak because enterprise is weak
- On the cloud side saw HDD/SSD builds (cloud vendors trying to maximize efficiency)
- Sub-\$100mn in Q1, growing every quarter, should not go down from here but difficult to call where it goes from here

Q: Enterprise networking – what is a framework we can use?

- There was an inventory correction period that seems largely over
- Now it is more of a demand issue that is seen in Q4
- China is relatively larger in enterprise markets, quite a weak market

Q: Carrier – wired vs. wireless?

- Last year was likely 75% wireless as wired underwent correction in Q1
- Wireless will likely remain more than half, but likely not as skewed
- Wireless just starting to correct, so tough to say true split

Q: \$2.2bn Data center business – Inphi >50%, can you break it out?

- Storage would've been next biggest (around \$800mn) but this was quite weak (few hundred \$mn range)
- Next biggest is non-optical connectivity
- Smallest in CY23 was custom silicon (few hundred-\$mn), but custom could be #2+ in a couple years

MU Meeting Takeaways

Q: Comments on growing opportunity in HBM?

- Mentioned prepayments for leading edge products previously
- MU finishing up qualifications, feedback is that it is industry leading
- Ramped product from MayQ to AugQ, reiterated near-term HBM revenue target, eventually will ramp share to be equivalent to DRAM market share

Q: What are cycle times to get HBM out this year?

- Somewhere in the 4-5 month range
- Not sure it changes dramatically next year, core die technology on 1-beta which ramped in Sep-22 (faster ramp to maturity than any node in company history)
- Newer area for production in back-end, reiterated confidence

Q: Customer concentration in the HBM market?

- Given capacity constraints probably narrow customer set into next year
- Eventually it should broaden given quality of technology
- Engaged with the “usual suspects”

Q: HBM and size in the DRAM market?

- Likely low-single digit % of bits in '23, low- to mid-single digit percent of bits in '24, but important to note HBM requires 2x+ number of wafers in equivalent bits
- Have visibility into DRAM pricing

Q: Thoughts on future capacity investments?

- Capex raise of \$7bn to \$7.5bn-\$8bn based on need to support HBM
- Industry will need greenfield capacity

Q: Is there a gross margin threshold to raise WFE spending?

- Need line of sight into through cycle model



- Will modulate build and base on economics of the business
- Not expanding as much now given fundamentals do not support it

Q: Samsung has talked about increasing utilization to facilitate HBM – will market remain constrained?

- Will be constrained likely this year and potentially beyond

Q: Puts and takes in gross margin given recently strong guide?

- Pricing is much better than MU thought in the end
- Pricing should remain a tailwind through the year (Q3/Q4 will also see pricing increases)
- Slope of GM increase from Q2 to Q3 may not be the same
- Cost downs flattish in middle of the year
- As production normalizes and utilization improves, period costs return to normal, HBM mix will increase over time (larger die size makes costs a little larger)
- Some Underutilization charges last year also went into inventory, that will slowly go out as they move through the year

Q: When should we expect spending on WFE to rise?

- Both '23, '24 down YoY
- WFE increases would be likely more meaningful in DRAM vs. NAND (HBM)
- When WFE increases, it does not necessarily mean price is peaking (needs to account for HBM demand)
- MU believes capacity increases from Samsung, Hynix focused on HBM

Q: Can you triangulate HBM demand from NVDA? How do you ensure you are not overshipping?

- Contracts set up to give clarity, though notes industry needs to watch environment carefully given widespread focus
- Factors exist to limit downturn severity and imbalance (customer concentration)

Q: Edge AI impacts on memory?

- LPDDR can have benefits in AI PC and smartphone
- Edge AI products can have 4GB-8GB more DRAM memory, though it is dependent on model parameters presented in PCs and smartphones
- AI PCs and smartphones positive for memory, though certainly adds difficulties around unit power (highlights new LPCAMM2 solution)
- Not endorsing any end unit number as market ramps

Q: MU benefits from CHIPS Act?

- Capex guidance contemplates grants (it is a net number)
- MU does not know when they will receive grants (or amount) but have estimates
- Have been in active communication with commerce department
- Less concerned on capital restraints related to CHIPS Act, have viable alternatives in Asia as well in event difficulties emerge

INTC Meeting Takeaways

Q: AI PC - What does this mean in terms of refresh cycle or higher ASPs?

- It's early so remains to be seen
- Anything with an NPU is an AI PC
- Will push NPU into the marketplace, partners will then develop applications utilizing the NPU
- To the extent that there is buzz on the AI PC, they think mostly comes from Arm (it's a new trend in PCs, they are citing it's a reason they can be successful)
- Bullish on AI PCs, but will take time; data center only gets monetized on the edge

- INTC: Competitive advantages come from manufacturing and ecosystem they have built around x86 (enterprise servers, NEX telco/edge, consumer PC, etc.)
- As AI proliferates, it's coming to be supported by ecosystems they have built, why they see continued advantage over arm

Q: ASP increase from Meteor Lake to Raptor Lake

- Meteor Lake higher ASP but higher cost
- Pursuing strategy to drive PC value up the stack
- Jury is still out though on exact ASP increase from Meteor Lake

Q: What AI workloads can be done on edge on the client side?

- Copilot is running 24/7 on background, need hardware to run the software
- it is optimal to run large portion of AI workloads on client because it can optimize experience (can lead to lower latency) and increase privacy
- Difficult to say at what parameter it is optimal to use CPU vs GPU, but see several hardware solutions being viable/tried with redundancy built in

Q: Risk the smartphone becomes hardware choice for AI edge?

- PC vs Handset = content creation vs consumption
- it's a risk, but there are several applications that can be more optimal to use a PC for vs a handset

Q: Thinking about cost savings as the company invests in AI?

- 60/40 gross/operating model a maybe cleaner way to talk about it versus finite dollar amount in future cost savings
- ultimately will glide into 20% opex intensity, need to be conscious in spending but not disrupt company
- Not worried about 60% gross margin, could even get higher than that
- 60%+ incremental gross margin important to achieve, as INTC goes beyond its 5 nodes in 4 years objective, could see upwards 10pts gross margin upside

Q: How has INTC been available to effectively alter its cost profile

- Aligning incentives to effectively execute on cost management
- Simultaneously, they are still investing in high growth opportunity projects

Q: P&L for IFS - Q4 or Q1?

- when Intel reports Q1 there will be a re-segmentation
- product co (cpg, dca, nex), manufacturing co (ifs vs internal, won't break it out but can back into it), other (psg, mobileye, etc.)
- Will see operating profit for product sub-buckets, manufacturing co, other
- Giving manufacturing a P&L can help adjust operating inefficiencies that are present

Q: TSMC comments seem to indicate holding competitive lead - what is INTC view?

- If INTC wasn't a threat why say anything?
- Complicated relationship with TSMC, they are a supplier, competitor, and even a customer (and therefore collaborator)
- Since INTC buys wafers from TSMC, they have some insight
- 18A viability late '25-26

Q: What signals can we get to show INTC traction in foundry?

- Provide breadcrumbs, will not provide customers though, no competitive advantage in doing so
- Have a CEO all in on foundry, proper ROI on investments requires long-term revenue generation
- Plus, geopolitical landscape is changing, creating more interest

Q: Overview of the accelerator pipeline and INTC position in the market?

- Pipeline of \$2bn in 2024, 50% conversion a standard target
- Not executing as fast on accelerators as people prefer, but just absorbed AXG back in DCAI
- when they were two separate businesses, it created confusion among customers
- 2-3qtrs behind AMD given original set up
- Current ask for customers is to go from NVDA GPU to Gaudi to INTC GPU (vs AMD proposing just GPU switch); INTC plans to make switch seamless

Q: Integration of High NA EUV in manufacturing process?>

- High NA EUV important technology for future nodes, will not disclose which nodes will use high NA EUV right now
- When they use High NA EUV, it will be backward compatible with previous manufacturing techniques to reduce risk

Q: Mobileye/PSG updates?

- PSG will quickly reach \$2bn trough, share position is getting better, went through extended period of tight supply and customers ordered than what they need
- Mobileye certainly weak in interim, still viewed to have strategic value

Q: Comments on recent INTC auto semi acquisition?

- Have been in auto for a long time, recent acquisition allow consolidation of ASICs into a few general compute chips which can help limit supply risks
- Unrelated to Mobileye

Q: Relationship with hyperscalers on server CPU?

- Sierra and Granite can hopefully drive share gains
- Need to get chips into marketplace, but saw no share loss in 1H, some share loss in Q3, but maybe can stabilize from here

Q: Is Grace CPU any threat?

- Dependent on future of CPU-GPU traction, but note hyperscalers may not want to be beholden to prices generated from system sales
- The combo CPU GPU likely more enterprise friendly as they do not have expertise to pool sources of compute, INTC here has historical competitive moat

Q: Revenue/core growth in the server market

- server core growth mid/high teens long term
- server ASP declines slows to moderate levels versus higher rates prior
- competitor they viewed was being price aggressor on cores, more difficult at larger market share

Q: CHIPS Act updates?

- Have had 2 small announcements, will say more when they have updates
- Have gross capex and net capex, so have plan to spend funds accordingly

ON Meeting Takeaways

Q: Since the year started there have been multiple auto related data points that are weak, how do you see auto demand?

- Efforts have been to control channel inventory, utilize LTSAs to improve demand
- Company has new floor of gross margin in 40s versus 20 prior
- Last quarter, ON saw signs of some correction in autos, called it out early
- Therefore, not surprised by announcements, saw it coming before peers

Q: Do weak auto signals apply to SiC?

- EVs are a decade plus long term opportunity
- Even if auto units weak, EV penetration should still go

- ON only company doing brownfield investment in SiC; already have facilities, can modulate spending on equipment as needed
- Limits the risk of underutilization from having new buildings

Q: Peak to trough framework for autos?

- ON's diverse sensor and power portfolio gives them good line of sight into number of components in vehicles
- ON can use its multitude of business lines and customer conversations to triangulate auto production/demand trends, modulate output accordingly
- ON already taking utilization headwinds, when upturn begins in industry they are ready to benefit

Q: Is weakness still most pronounced at European Tier-1?

- Top 3 broadest auto suppliers in Europe, called

Q: Just in time vs just in case inventory model in autos creating inventory issue

- when does market normalize?

- When customers initially have signed LTSAs, request vs committed is not 1:1, there have been aspects of undershipment
- Taking the inventory and demand signals, CY24 could be a "sideways" year

Q: what is the SiC growth potential today?

- ON can grow 2x SiC market

Q: Thoughts on AeHR Systems negative preannouncement?

- Burn-in is expensive and costs time, it is essentially at the start of any ramp
- As burn-in time improves, equipment/furnace demand goes down
- Look to reduce burn-in on all product ramps as it impacts margin and capex
- No correlation between AeHR and ON

Q: Customers helping support capacity

- Some Customers give equipment for process

Q: If demand comes back and customers ask for lower prices, how would that be handled?

- ON taking utilization down, they are not going to dilute value just to fill a fab
- ON is not similar to what it was in the last downturn

Q: Slower than expected exit of certain businesses?

- Increasing pain for companies to switch cheaper suppliers (product ASPs can go up 1-2c but can be hundreds of thousands)
- Customers choosing to stay with ON to avoid pains of requalification, have trusted supplier

Q: Is SiC revenue for CY24 still on track to initial expectations prior to Q4 miss?

- SiC revenue across 500 customers
- Despite Q4 miss, ability to fulfill more in other LTSAs can offset this
- Fulfillment not immediate, but can be offset in the year

Q: Timing of SiC shipments to vehicle ramp?

- If ON is shipping module it's shorter, if it's a discrete part it's longer
- Process not much different than silicon

Q: Relationship and visibility with Tier-1s?

- Giving better visibility, but it's as good as they get from the OEM

Q: Gross margin - what is it if market is sideways?

- Utilization was 72%, going to high-60s, worst case would be mid-60s
- Every pt of utilization is 15bp of gross margin roughly (logic applies to downturn and upturn)



- '25 also has nice tailwinds from fab divestments, continued business exit, etc.

SWKS Meeting Takeaways

Q: Content this year in iPhone flattish, is there concern that we fall below historical 10% content runrate?

- Historically going up 10% gen-to-gen, varies but averages 10%, high confidence this will continue
- already working generations that are 3-4 devices out, see the complexity rising
- major performance leaps and needs pushing suppliers to improve performance
- more recently large customer investments in AI is resulting in focus on space savings, form factors, power reduction that require RF innovation

Q: What will be classified as an AI smartphone, and what will applications look like?

- GenAI is in flux, so industry fluid
- OEMs want to bring processing and AI capability on device
- Replacement cycles now 4.5 years, incentive to slow that any amount positive for OEMs
- There are multiple service opportunities with AI, especially virtual assistants and recommenders
- These smartphone co's have so much structured and unstructured data relating to people, AI can help harness it
- How it impacts silicon is positive, bigger AI processor, results in more power consumption but now RF needs more power efficiency, has to operate at a smaller size with more memory
- RF and spectral data important, more throughput requires higher efficiency

Q: When looking at AI at the edge, how do we think about use of AI in PCs vs Smartphones?

- Looking at compute parallels, processing began in data centers and migrated to end consumer devices
- In AI, it is starting large at data centers but getting smaller
- PC and smartphones will both need/use AI

Q: When will see AI in iPhone?

- Seeing mediatek or QCOM launching processors to support AI enabled phone
- Acknowledge it is not a flip being switched, it is more gradual transformation over time
- AI is another element that is driving RF vendors to further reduce space and power consumption, optimize module integration

Q: Is AI more a unit or content story for SWKS?

- Can accelerate replacement cycle
- RF content increases (on need for more performance)

Q: How should we think about optimization of training in cloud vs on-device?

- more data traffic from AI activity positive for SWKS who handles information flow
- Enabling flow of data requires that integrity is very high
- Data being transferred wirelessly keeps doubling every few years
- Require continuous addition of new bands (maybe next range to 8GHz to 12GHz)
- getting to a point where machine to machine connection another vital avenue

Automotive: Is SWKS seeing any weakness in the business?

- Power isolation business has exposure to Tesla/EVs, saw weakness there
- On average it is a \$200mn per year business, on way to \$300-\$500mn, December and March could be a little softer, then can be 60-80mn/qtr long-term
- Long term auto drivers remain key: connected car and in vehicle networking, EV and power isolation,
- Auto RF TAM of \$1bn

Q: More broadly on Broad Markets, any change in thoughts on demand?

- Maintain December is the bottom, March is flat to slightly up
- 40-45% is consumer IoT, inventory correction is largely done
- 30-35 cloud/data infra/infrastructure: cloud strong long-term, enterprise networking improving, telco is weak
- Auto/industrial remainder of the business

Q: On the WiFi side, what is the benefit transitioning to new products in terms of ASPs?

- WiFi 6-6e provides roughly 20-25% ASP lift
- WiFi 6e-7 roughly another 10%-15% lift

Q: Gross margin recovery?

- MarQ likely down slightly from DecQ on seasonality
- From there, as utilization picks up and broad markets rebounds they will work towards 50% as fast as they can

AMD CES Address Takeaways

"AI is the future of computing"

- 1 year ago introduced NPU to x86 processors with launch of Ryzen 7040 series
- Launched Instinct MI300 GPUs last month, highest performance accelerator for GenA

AI ecosystem partnerships

- OpenAI, Meta, HuggingvFace, Oracle, Microsoft, etc

Ryzen 8040 Series

- Next leap in personal AI processing, up to 60% higher NPU performance
- 10 to 16 TOPS, with total TOPS increasing from 33 to 39
- Features Zen 4 CPU cores, built-in Radeon 700 Series graphics, amazing battery life
- Laptops powered by 8040 Series will launch this February

HP Inc.

- Will bring AI to the PC with enhanced performance, personalization, privacy, and cost benefits, driven by local inferencing
- In partnership with AMD will introduce new high-performance solutions with Ryzen 8000 Series processors in the coming months

Lenovo

- Create AI personalized and controlled by the user
- Personal laptops and gaming laptops will be among the 1st products to bring 8040 Series processors to market
- Faster video editing, quicker 3D rendering, gaming performance improvements, without sacrificing battery life

Gaming Partnerships

- Sony: PlayStation 4-5
- Microsoft: XBOX 1- latest gen
- Valve, ASUS, Lenovo: latest handheld gaming devices

ASUS

- Last year launched first laptop with integrated NPU (Ryzen 7040 Series), now redesigned with Ryzen 8040 Series (which also power devices coming early-2024)

Ryzen 8000G Series

- Announcing 8000G Series processor, available for purchase end of January



- Combines power of discrete graphics card with Zen 4 CPU cores, and world's 1st NPU on desktop processor
- 1st desktop processor with built-in Radeon 700 M Series graphics: allowing players to play full HD games without discrete graphics card

CD Projekt RED

- 8000G Series can run leading games without separate graphics card

Radeon RX 7600 XT

- 16 GB of memory
- Hitting shelves later in January
- Enables popular LLMs

Ryzen AI

- Ryzen AI now enabled across desktop and laptop PCs
- Based on open source ONNX runtime framework, giving developers access to thousands of AI models

ROCm

- Released ROCm software support for Radeon graphics cards for model training and ML development workloads using PyTorch
- Developing continuous optimizations for Direct ML and Shark frameworks

Hugging Face

- Leading open platform for AI builders
- Working to make best models more accessible for all developers
- Today host over 1mn models, data sets, and AI applications
- All transformer models work seamlessly on AMD GPUs
- Text Generation Inference is natively integrated with AMD ROCm to give best performance out of the box on AMD Instinct GPUs
- Thousands of models already optimized for new Ryzen

Adobe

- Introduction of Adobe FireFly: family of GenAI models

Microsoft

- Long partnership with AMD across Azure and Windows
- Marquis AI experience is Copilot: entry point into the world of AI on the PC
- Can create apps that take advantage of local and Cloud inferencing
- Next-gen Strix Point processors will include new NPU powered by 2nd-gen XDNA architecture, coming in 2024
 - o XDNA 2 is designed for leadership GenAI performance, 3x+ NPU performance of Ryzen 7040 Series
 - o Working to make sure Windows AI features will run well on Strix Point

NVDA CES Address Takeaways

GeForce RTX Introduction

- With DLSS 3.5, 7 out of every 8 pixels are generated by AI
- 100mn shipped RTX GPUs: massive installed base for GenAI applications

Hybrid AI

- AI experiences will be delivered with a hybrid of Cloud and PC computation
- Will use NVDA GPUs in the Cloud to run large models, while using Tensor cores on PC to run latency-sensitive applications
 - o Microsoft Teams Copilot: an assistant running in the Cloud, while NVDA Broadcast runs locally
 - o Adobe Photoshop uses FireFly generative fill running in the Cloud, while RTX GPUs power AI tools on the PC
 - o Gaming: AI in Cloud and PC

NVIDIA ACE

- Introduced last year, platform for AI-powered gameplay
- Brings digital avatars to life, with models designed to run in the Cloud or locally on the PC

RTX Remix

- Game modification
- App will be releasing in open beta on January 22nd

iStock by Getty Images

- Releasing iStock service built on NVDA Picasso (AI foundry for visual design), trained on Getty Images' catalog of creative content (available today)

Twitch streaming

- Enhanced broadcasting announced, allowing streamers to broadcast up to 5 concurrent streams at different resolutions and quality, supported on all RTX GPUs
- Twitch will use 4K and AV1 on GeForce RTX 40 Series

SUPER Series Announcement

- RTX 4080 SUPER: can power fully ray traced games in 4K, 836 AI TOPS, DLSS frame generation, 2x faster than 3080 Ti, more cores, faster memory (available 1/31)
- RTX 4070 Ti SUPER: more cores and increased frame buffer, great for video editing and rendering 3D scenes (1/24)
- RTX 4070 SUPER: 20% more cores (1/17)
- RTX platform has grown 5x in last 4 years

RTX Laptops Announcement

- Announcing new RTX laptops launching from every major OEM
- Every laptop is AI-ready

Robotics – NVIDIA ISAAC and Omniverse

- 1st use cases: logistics, warehouses, manufacturing
- Next use cases: agriculture, construction, healthcare, retail
- Bringing ChatGPT to autonomous robots, using natural language prompts
- AI factory is where training of AI model occurs, this process can go on throughout the model's operating life, continuously improving it
- Can generate scenes in Omniverse using ChatGPT-like GenAI technology
- GenAI can act as copilot for writing scripts, saving expense and time
- Humans can interact with robots using natural language prompts



NVDA CFO Conference Takeaways

Q: Intro thoughts?

- NVDA RTX ready for AI on PCs
- Over 100mn shipped RTX GPUs
- SUPER series will come to market later this month
- Bringing laptops focused on NVDA Studio for creative world
- GEFORCE Now: Cloud gaming platform, expanding to Japan, starting in Q2 will see GFN day passes available
- Automotive: use of Orin is impt driver of AI compute within vehicles, to be followed by Thor
 - o New NEV OEM wins (Great Wall Motor), on Orin
 - o New wins with Li Auto on Thor
 - o Zeekr added Orin opportunities
 - o Auto focused on using NVDA solutions inside cars and in the data centers, helping end-to-end
 - o Growing adoption of Omniverse for auto factory digital twins (Mercedes, BMW, etc)
 - Also used for synthetic data generation (Mercedes, BMW, JLR)

Q: Overall business trends as we enter CY24E. Revenue for CY23E expected to more than double. What's the team's confidence on driving sustained outsized performance this year when global demand trends could remain soft? How to think about overall growth profiles?

- Data center: accelerated compute and GenAI trends will continue into CY24E
 - o Ending of Moore's Law pushing customers to look to make data centers more efficient
 - o Last 5 years spent influencing more LLMs increases NVDA's ability to participate in GenAI
 - o Early days of GenAI deployment: changing infrastructure to handle GenAI, and once that gets moving will see more and more opportunities (will see this in CY24E)
 - o CY23E was the year of NVDA catching up to demand for GenAI and improving supply, pleased in ability to ramp supply thus far and this will improve in first couple Qs of CY24E
 - o Will grow supply all through 2024
 - o Ability to provide new products, increase speed of architectures from over 2 years to 1 year
 - o More AI solutions help customers in their planning
 - o DC growth from regional and sovereign growth, multi-billion \$ market
 - o Enterprise AI: esp software companies modernizing software solutions, or large database companies using AI to support data
 - New solutions also come with software (Nemo, BioNeMo, Picasso) is helping build out enterprise work
- Gaming: great growth opportunity
 - o Adoption of RTX and Ada with DLSS has helped GenAI growth in PCs
- ProVis: adoption of GPUs and workstations to support AI longer-term is key
- Auto: additional growth in Orin, design wins ramping
 - o Longer-term work with JLR and Mercedes will be impt for hardware and software

Q: Supply/demand balance? Puts and takes in data center business? Confidence on driving QoQ growth through remainder of CY23E?

- ChatGPT influenced quick demand to support Hopper series use in GenAI
- Helped NVDA move to increasing overall supply
- Most challenges with Coos and Hopper architecture, but have ramped new suppliers for that, influencing CY23E and 1H24E
- Incorporated NVDA networking when selling GPU solutions, expanding this

- New product introductions coming to market (H200, Grace Hopper), re-working supply to be prepared, working with customers on demand leads for new products (all going well)
- Making a statement on supply growth in CY24E

Q: Continued data center growth beyond CY24E and into CY25E? On earnings said business will growth through CY25E. Was this referring to calendar or fiscal growth? What type of visibility is there?

- Supply constraints are still there, still on allocation model right now, so comfort level on CY24E has led people to say yes we'll have growth
- Referring to CY25E in those earnings comments
- In CY25E will see new products coming to market: can grow in CY25E from new products/architectures
- Market adoption of AI will continue for decades

Q: China new products in data center. How to recapture China data center sales through CY25E?

- Reviewing all products in China to ensure in-line with US requirements
- With new products, discuss China customers' needs and what solutions NVDA has available
- On track right now
- In CY24E will have China customer solutions
- Nothing out of the ordinary right now
- Still working through very detailed process

Q: Investor conversations focus on demand sustainability through CY25E and beyond. High ROI opportunity in GPU hosting (\$1 of upfront investments into \$5 of CSP revenue over several years). Data center infra market (server + networking) \$220bn market in CY27E according to 3rd party data. NVDA GPU spending as it relates to this framework beyond initial buildout?

- Accelerated computing opportunity looking at installed base of \$1tn, of \$250bn per year spent on GPU architecture
- That size of DC spending will need to address new AI and accelerated computing solutions
- Just CPU based and what will be GPU based will change over time
- Don't see normalization, but a continual shift
- GenAI is massive TAM expansion on hardware and software
 - o Those looking for solutions are turning to Cloud as easy way of moving to GenAI solutions
 - o Copilots and assistants will modernize over time to include AI
- Also see companies infusing AI into search tech

Q: Why not target the entire PC market (280mn unit TAM per year)?

- PC market for years has been focused on x86, but there is an opportunity for ARM products. Focusing now on ARM in data center, now using ARM (one of most energy efficient OS) to enable productivity in DC
 - o Will continue to grow and support ARM ecosystem
- Focused on Arm in DC and auto currently
- Have great start on AI in PCs

Q: How to think about software/services revenue ramp profile over next few years?

- Very close to annualized revenue run rate of \$1bn of SW SAAS support
- NVDA AI Enterprise is impt piece of this work, when working with enterprises they need assistance of software platform
 - o If you purchase DGX solutions, come with full SW stack
 - o Purchasing solutions with OEM providers, can buy NVDA Ai enterprise SW stack

- Using SW stack as reference within NVDA, so all SW is kept up to date, with backwards compatibility
- Growth will be consistent with what we're seeing in terms of infrastructure and HW that's being sold
- Still have DRIVE software for Mercedes/JLR coming up
- Omniverse is imp't part of SW work

Q: Automotive growth? \$1.1bn in CY23E revenue ramping to \$14bn pipeline over next years?

- CY24E will be opportunity for Orin designs and ramping of new opportunities there
- Will start to be getting those design wins on Thor too
- Have huge ramp related to Mercedes (CY25E) and JLR (CY26E) both to drive meaningful HW/SW opportunities
- Orin has been key in NEV market used in computing and AI solutions

Q: Opex has growth about 15% this past year. How to think about pace of opex with more aggressive roadmaps?

- Providing additional products within same architectures
- Increasing investments and growth rate of opex QoQ
- Will have grown opex well in Q4 and will continue to see that in CY24E
- Focus is on investing in talent

Intel CES Keynote Takeaways

Q: How to make sure that AI is used for good?

- Tech moves faster than products, products move faster than business, and business moves faster than regulation
- Companies should be engaged in policy networks, in regulatory frameworks
- Open technology access is the key to trusting aims of tech companies

Q: Can you tell us about the use of AI servers?

- Are you able to achieve certain levels of performance on AI workloads, if doing high-end training workload need GPU, use AI-augmented CPUs for inferencing
- A few create models, many use, so that inferencing workloads driven to Xeon CPUs, so it can be enabled everywhere
 - Use enterprise data, in their data centers, on AI-enhanced CPUs from Intel

Q: Can you explain the hybrid AI market?

- Will be cloud-assisted environments: foundational models in the Cloud, but most people will use smaller models
 - Can run smaller models at lower cost per inference on their own existing infrastructure

Q: Will the Cloud keep growing like this?

- There is no end in sight to the science of AI, machines will get bigger as develop more complex models

Q: Can you give us an overview of what AI PCs are?

- Analogous to the early days of WiFi: for 2-3 years nothing really happened, then launched a laptop that integrated WiFi, and suddenly every place needed to have WiFi
- A couple of years after standards were finished, the tech can be very widely adopted
- Adding neural capabilities for AI workloads directly into PC will change user interface (talk to PC instead of talking), instead of needing to access Cloud can do on local PC
- 100 ISVs running on Core Ultra that are building their applications

Q: Gaudi 3: were expecting a little more at that announcement, can you add anything?

- In 2024 will be launching Gaudi 3, in early test debug at labs right now, will be pushed out to OEMs in next few months
- Israel production location have not missed a single commitment

Q: In response to Mobileye and auto-related weakness, what are you seeing today?

- There was a period coming off of Covid where everyone was so brutalized by not having inventories that everyone was over-buying
- This is the last correction cycle as a result of Covid in the auto industry

Q: Thoughts on the Asia recovery outlook?

- China didn't come back as strong as expected, otherwise Asia has done ok, India had a good cycle ending the year, Europe not as strong, US pretty good
- Overall wasn't as strong as people were hoping for

Q: How do you see the regulatory environment for AI developing?

- Won't come out with regulations quickly, courts will race to catch up for a while
- Will be about a broader corpus of information going into those models

Q: How is the use of AI in the Edge going to change the economics of AI?

- It's cheaper to run AI on device, aka running it locally
- If you have to roundtrip data to the Cloud and back, won't be as responsive as what can be run locally
- Will you take real-time data to the Cloud or keep it on the device? Many users don't want their data going to the Cloud

Key Product/Service Announcements

NVDA

Gaming Product Announcements:

- GeForce RTX 40 SUPER Series desktop GPUs on Ada Lovelace architecture, with specialized AI Tensor Cores delivering up to 836 AI TOPS
 - o GeForce RTX 4080 SUPER (\$999) launching 1/31: 1.4x faster than RTX 3080 Ti, 2x faster with DLSS
 - o GeForce RTX 4070 Ti SUPER (\$799) launching 1/24: 1.6x faster than RTX 3070 Ti, 2.5x faster with DLSS
 - o GeForce RTX 4070 SUPER (\$599) launching 1/17: 1.5x faster than RTX 3090 with DLSS
- GeForce RTX 40 Series laptops and NVIDIA Studio laptops/desktops

Auto Customer Announcements:

- DRIVE Orin customer wins:
 - o Great Wall Motor (Chinese NEV maker) announced upcoming EVs will use DRIVE Orin centralized car computer for assisted-driving, with first model launching 1H24E
 - o ZEEKR (EV subsidiary of Geely) launched Luxury Sedan, the carmaker's fourth model with DRIVE Orin
 - o Xiaomi EV announced its first EV, launching 1H24E, is built on a dual DRIVE Orin configuration
- DRIVE Thor customer wins:
 - o Li Auto announced it will use DRIVE Thor to power its next-gen models

AMD

Ryzen 8040 Series (initially announced in December)

- Zen 4 CPU cores
- x86 architecture
- XDNA neural processing engines
- Built-in Radeon 700 Series graphics
- 60% higher NPU performance
- 10 to 16 TOPS, with total TOPS increasing from 33 to 39
- Available in February 2024
- Competes against Intel's Meteor Lake

Ryzen 8000G Series desktop processors

- Combines power of discrete graphics card with Zen 4 CPU cores and world's first NPU in a desktop processor
- Built-in Radeon 700 Series graphics
- Available Q2 CY24E

Ryzen 5000 Series desktop processors

- For Legacy Socket AM4 platforms
- Built on Zen 3 architecture with higher clock speeds
- Available starting 1/31

Radeon RX 7600 XT graphics card

- Available later this January
- 16GB of memory
- Enables popular LLMs

Ryzen 8040 Series laptops

- OEM partners (ACER, ASUS, Lenovo, HP, Razer) are launching handheld gaming systems, gaming laptops, and personal laptops, powered by Ryzen 8040 Series

Ryzen AI

- Enabled across desktop and laptop PCs
- Available now

ROCm

- Software support for Radeon 700 Series graphics cards

*Next-gen Ryzen CPUs will be announced later in 2024

INTC**Intel Core 14th Gen HX-series mobile processors**

- 8 P-cores and 16 E-cores (up to 24 cores) and 32 threads
- Intel Core i9-14900HX
- Up to 5.8 GHz turbo frequency
- Supports up to 192 GB of total DDR5 memory
- More than 60 partner systems coming to market in CY24E

Intel Core 14th Gen mainstream desktop processors

- 18 new processors
- Up to 5.8 GHz turbo frequency
- Up to 24 cores and 32 threads on i9-14900 processors
- Supports up to 192 GB of DDR5/DDR4 memory (backward compatible with existing 600 and 700 series motherboards from Intel)
- Support for PCIe Gen 5.0, Gen 4.0
- Now available

Intel Core U Processor Series 1 for thin-and-light systems

- Up to 5.4 GHz turbo frequency
- Up to 10 cores and 12 thread on its Intel Core 7 processor 150U
- Up to 96 GB of DDR5/DDR4 memory
- Supports PCIe Gen 4.0 and 3.0
- Powering mobile systems coming to market in Q1 CY24E

Automotive announcements:

- New family of AI-enhanced SDV SoCs
 - o Adopted by Zeekr for next-gen vehicles
 - o Feature AI acceleration capabilities from Intel's AI PC roadmap
 - o Can run advanced workloads concurrently
- Intel to work with imec to ensure advanced chiplet packaging tech meets requirements for auto-specific use cases
- Announced committee with SDV, Intel, and SAE International to deliver an auto standard for Vehicle Platform Power Management (Intel will chair)

MU**LPCAMM2**

- Micron announced LPCAMM2, a compression-attached memory module for laptops
- Packages dual-channel LPDDR5/X and DDR5 memory onto a thin, replaceable circuit board
- Will be supplied in 16GB, 32GB, and 64GB modules



Exhibit 1: Companies mentioned

Companies mentioned in this report

BofA Ticker	Bloomberg ticker	Company name	Price	Rating
ADI	ADI US	Analog Devices	\$188.37	B-1-7
AMD	AMD US	Advanced Micro Devices	\$148.54	C-1-9
INTC	INTC US	Intel	\$47.47	B-2-8
MRVL	MRVL US	Marvell	\$63.43	C-1-7
MU	MU US	Micron	\$82.38	B-1-7
NVDA	NVDA US	Nvidia	\$543.50	C-1-7
NXPI	NXPI US	NXP Semiconductors	\$211.29	B-1-7
ON	ON US	Onsemi	\$75.61	C-1-9
SWKS	SWKS US	Skyworks	\$104.33	B-3-7

Source: BofA Global Research

BofA GLOBAL RESEARCH

Price objective basis & risk**Advanced Micro Devices, Inc (AMD)**

Our \$165 PO is based on 32x our 2025E non-GAAP EPS, which is towards the middle of AMD's historical 17x-64x range, justified by AI upside offset by slowdown in cyclical embedded/console markets.

Downside risks: 1) M&A integration risks, 2) Strong competition from larger names, 3) Lumpy nature of consumer and enterprise spending that could create delays in acceptance and success of new products, 4) High reliance on one outsourced manufacturing partner, 5) Maturity of current game console cycle.

Analog Devices Inc. (ADI)

Our \$225 PO is based on 34x CY2025E EV/FCF, within its historical 15x-33x range, and justified based on ADI's best in class profitability and differentiated/secular comms exposure.

Downside risks to our price objective: 1) Economic downturn, which could reduce demand for automotive, industrial products, impacting gross margins, especially given recent capital expenditures and higher fixed cost footprint. 2) Inability to realize the planned cost synergies from the Maxim combination. 3) Competition from larger vendors, such as TXN, which have lower-cost production facilities.

Intel (INTC)

Our \$50 price objective is based on 25x our 2025E pf-EPS ex-stock comp expense, in the middle of compute peers (15x-40x), which we view as appropriate given manufacturing uncertainties and risks of new foundry strategy.

Upside risks to our price objective are 1) clarity or breakthrough on yields for 7nm process technology, 2) new products allowing Intel to limit share loss, 3) improving product mix which can drive upside to gross margins, 4) manufacturing slip up at key foundry competitors.

Downside risks to our price objective are 1) weaker-than-expected trends in a mature PC market, which is largest revenue generator for Intel, 2) further delays in 7nm process technology and roadmap, 3) accelerated share loss to AMD, 4) more competition in profitable data center market.

Marvell Technology Group Ltd. (MRVL)

Our \$80 PO is based on a 32x FY26E/CY25E pf-EPS, which is well-supported by the 20%-30%+ longer-term compounded annual EPS growth potential, and within the normal 1x-2x range for high growth semi peers.

Downside risks: 1) Integration risks in recent deals, 2) Financial risks related to going to net debt from net cash position, and in achieving expected cost synergies in a timely manner, and 3) Cyclical industry risks including potential slowdown in legacy hard disk drive, infrastructure spending, and storage assets, 4) Competitive risks against larger well resourced rivals.

Micron Technology, Inc (MU)

Our \$100 PO is based on 2.1x our CY25E P/B, which is within MU's long term range 0.8x-3.0x as we potentially enter the next memory upcycle.

Downside risks: (1) larger than expected memory ASP decline, (2) greater competition from China newcomers, (3) share loss to other large competitors like Samsung or SK Hynix, (4) softening of demand across major end markets such as data center, smartphones, or PCs.

NVIDIA Corporation (NVDA)

Our \$700 PO is based on 27x CY25E PE ex cash, within NVDA's historical 26x-69x forward year PE range, justified given stronger growth opportunities ahead as gaming cycle troughs and data center demand potentially faces strong, long-term demand dynamics.

Downside risks to our price objective are: 1) weakness in consumer driven gaming market, 2) Competition with major public firms, internal cloud projects and other private companies in accelerated computing markets, 3) Larger than expected impact from restrictions on compute shipments to China, or additional restrictions placed on activity in the region, 4) Lumpy and unpredictable sales in new enterprise, data center, and autos markets, 5) Potential for decelerating capital returns.

NXP Semiconductors NV (NXPI)

Our PO of \$280 is based on 19x 2025E EV/FCF, in line with median diversified auto/industrial compares which trade in a range of 16x-32x CY24E EV/FCF.

Downside risks: 1) Semiconductor cycle risks, 2) Lumpy nature of projects in key identification segment, 3) Some exposure to and growth driven by Apple, which could add volatility, 4) Execution risk surrounding management's capability to reengage following two-year hiatus, 5) Macroeconomic supply/demand disruption.

onsemi (ON)

Our PO of \$100 PO is based on 17x 2025E P/E, in line with ON's 7x-27x trading range, in our view justified given improving profitability, though partially offset by the heavier capex required for SiC ramp.

Downside risks to our PO are: 1) Macro/cyclical risks, given high exposure to automotive and industrial markets, make ON susceptible to any potential global trade tensions/tariffs, 2) Prolonged COVID-19 headwinds limiting pace of automotive/industrial recovery, impacting utilization levels, 3) Difficulty in ramping 300mm fabrication facility limiting gross margin improvement, 4) sustained elevated capex levels relative to peers.

Skyworks Solutions, Inc. (SWKS)

Our \$100 PO is based on 11x CY 2025E PE (ex. stock comp expense, cash adjusted), towards the lower end of its historical 8x-22x range and justified given uncertainty around consumer/mobile demand.

Upside risks are: (1) Share gains, (2) Sustained boost from 5G adoption, (3) semis consolidation, (4) unique M&A opportunities fueling stronger growth.

Downside risks are: (1) Share loss from Apple (60% of sales), (2) Stronger than expected decline in YoY smartphone units, (3) Faster than expected ASP degradation given muted pricing power.

Analyst Certification

I, Vivek Arya, hereby certify that the views expressed in this research report accurately reflect my personal views about the subject securities and issuers. I also certify that no part of my compensation was, is, or will be, directly or indirectly, related to the specific recommendations or view expressed in this research report.

Special Disclosures

BofA Securities is currently acting as financial advisor to Intel Corp in connection with its sale of a minority stake in IMS Nanofabrication GmbH to Taiwan Semiconductor Manufacturing Co Ltd, which was announced on September 12, 2023.

US - Semiconductors and Semiconductor Capital Equipment Coverage Cluster

Investment rating	Company	BofA Ticker	Bloomberg symbol	Analyst
BUY				
	Advanced Micro Devices, Inc	AMD	AMD US	Vivek Anya
	Analog Devices Inc.	ADI	ADI US	Vivek Anya
	Applied Materials, Inc.	AMAT	AMAT US	Vivek Anya
	Arm Holdings	ARM	ARM US	Vivek Anya
	Broadcom Inc	AVGO	AVGO US	Vivek Anya
	Cadence	CDNS	CDNS US	Vivek Anya
	Camtek	CAMT	CAMT US	Vivek Anya
	KLA Corporation	KLAC	KLAC US	Vivek Anya
	Lam Research Corp.	LRCX	LRCX US	Vivek Anya
	M/A-Com	MTSI	MTSI US	Vivek Anya
	Marvell Technology Group Ltd.	MRVL	MRVL US	Vivek Anya
	Microchip	MCHP	MCHP US	Vivek Anya
	Micron Technology, Inc	MU	MU US	Vivek Anya
	Nova	NVMI	NVMI US	Vivek Anya
	NVIDIA Corporation	NVDA	NVDA US	Vivek Anya
	NXP Semiconductors NV	NXPI	NXPI US	Vivek Anya
	onsemi	ON	ON US	Vivek Anya
	Synopsys	SNPS	SNPS US	Vivek Anya
NEUTRAL				
	Advanced Energy Industries	AEIS	AEIS US	Duksan Jang
	Allegro MicroSystems	ALGM	ALGM US	Blake Friedman
	Axcelis Technologies	ACLS	ACLS US	Duksan Jang
	Coherent Corp	COHR	COHR US	Vivek Anya
	GlobalFoundries	GFS	GFS US	Vivek Anya
	Intel	INTC	INTC US	Vivek Anya
	Lattice Semiconductor	LSCC	LSCC US	Blake Friedman
	Texas Instruments Inc.	TXN	TXN US	Vivek Anya
UNDERPERFORM				
	Ambarella	AMBA	AMBA US	Vivek Anya
	Credo Technology	CRDO	CRDO US	Vivek Anya
	Lumentum Holdings	LITE	LITE US	Vivek Anya
	Qorvo Inc.	QRVO	QRVO US	Vivek Anya
	Skyworks Solutions, Inc.	SWKS	SWKS US	Vivek Anya
	Teradyne	TER	TER US	Vivek Anya
	Wolfspeed Inc	WOLF	WOLF US	Vivek Anya

Disclosures

Important Disclosures

Equity Investment Rating Distribution: Technology Group (as of 31 Dec 2023)

Coverage Universe	Count	Percent	Inv. Banking Relationships ^{R1}	Count	Percent
Buy	215	53.09%	Buy	111	51.63%
Hold	97	23.95%	Hold	45	46.39%
Sell	93	22.96%	Sell	24	25.81%

Equity Investment Rating Distribution: Global Group (as of 31 Dec 2023)

Coverage Universe	Count	Percent	Inv. Banking Relationships ^{R1}	Count	Percent
Buy	1895	53.62%	Buy	1083	57.15%
Hold	832	23.54%	Hold	454	54.57%
Sell	807	22.84%	Sell	383	47.46%

^{R1} Issuers that were investment banking clients of BofA Securities or one of its affiliates within the past 12 months. For purposes of this Investment Rating Distribution, the coverage universe includes only stocks. A stock rated Neutral is included as a Hold, and a stock rated Underperform is included as a Sell.

FUNDAMENTAL EQUITY OPINION KEY: Opinions include a Volatility Risk Rating, an Investment Rating and an Income Rating. **VOLATILITY RISK RATINGS**, indicators of potential price fluctuation, are: A - Low, B - Medium and C - High. **INVESTMENT RATINGS** reflect the analyst's assessment of both a stock's absolute total return potential as well as its attractiveness for investment relative to other stocks within its Coverage Cluster (defined below). Our investment ratings are: 1 - Buy stocks are expected to have a total return of at least 10% and are the most attractive stocks in the coverage cluster; 2 - Neutral stocks are expected to remain flat or increase in value and are less attractive than Buy rated stocks and 3 - Underperform stocks are the least attractive stocks in a coverage cluster. An investment rating of 6 (No Rating) indicates that a stock is no longer trading on the basis of fundamentals. Analysts assign investment ratings considering, among other things, the 0-12 month total return expectation for a stock and the firm's guidelines for ratings dispersions (shown in the table below). The current price objective for a stock should be referenced to better understand the total return expectation at any given time. The price objective reflects the analyst's view of the potential price appreciation (depreciation).

Investment rating	Total return expectation (within 12-month period of date of initial rating)	Ratings dispersion guidelines for coverage cluster ^{R2}
Buy	≥ 10%	≤ 70%
Neutral	≥ 0%	≤ 30%
Underperform	N/A	≥ 20%

^{R2} Ratings dispersions may vary from time to time where BofA Global Research believes it better reflects the investment prospects of stocks in a Coverage Cluster.

INCOME RATINGS, indicators of potential cash dividends, are: 7 - same/higher (dividend considered to be secure), 8 - same/lower (dividend not considered to be secure) and 9 - pays no cash dividend. *Coverage Cluster* is comprised of stocks covered by a single analyst or two or more analysts sharing a common industry, sector, region or other classification(s). A stock's coverage cluster is included in the most recent BofA Global Research report referencing the stock.

Price Charts for the securities referenced in this research report are available on the [Price Charts website](#), or call 1-800-MERRILL to have them mailed.

BofAS or one of its affiliates acts as a market maker for the equity securities recommended in the report: Advanced Micro, Analog Devices, Intel, Marvell, Micron, NVIDIA, NXP Semiconductors, ON Semiconductor, Skyworks.

BofAS or an affiliate was a manager of a public offering of securities of this issuer within the last 12 months: Intel, Marvell Tech, Micron, ON Semiconductor.

The issuer is or was, within the last 12 months, an investment banking client of BofAS and/or one or more of its affiliates: Advanced Micro, Analog Devices, Intel, Marvell Tech, Micron, NVIDIA, NXP Semiconductors, ON Semiconductor, Skyworks.

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