

UBS Global I/O®

Tech Hardware, Displays & Semis

1Q16 APAC Tech Tour Feedback

Equities

Global
Technology

Input: We visited 35 companies in Japan, Korea, Taiwan, HK and China

China smartphones volumes have not recovered as expected YTD in spite of some solid outperformers (Huawei, Oppo, LeTV). Neither have we seen an improvement in our Apple procurement estimates, although the silver lining is no incremental deterioration either. We estimate some modest upside to Samsung's GS initial shipments but remain cautious on FY growth. Dual camera adoption is not as enthusiastic as expected. PC demand in 1Q16 is biased to the downside, and a 2H16 recovery is possible but uncertain. We lower Intel/AMD ests.

Apple's adoption of OLED technology is becoming our Base Case

Whilst we do not know for sure, we affirm our view that Apple is very likely to adopt OLED displays. It is possible that the first iPhone model to use OLED may be in 2H17, may be an edge-type display. We base this view on the back of the recent filings for orders from Korea OLED display equipment vendors. By 2018, it remains conceivable that Apple eventually uses OLED across a wider range of devices, with foldable displays products appearing as well. This is positive for display equipment makers incl. Wonik IPS (Buy) in our coverage, but we also believe that the earnings impact on LGD and Samsung is under-appreciated; we reflect this in our company estimates. Medium term, changes in form factors could also turn as a positive for Apple devices demand.

Semis cycle slowly bottoming out; DRAM margins to improve in 2H16

Fabless cos we met are tracking in line with expectations for 1Q and channel inventories appear healthy. Our equipment findings confirm that TSMC is more assertive than Samsung LSI for 10nm. Considering the relative share price performance, we remove TSMC (Buy) from our APAC Tech Most Prefs list. We see near term downside to DRAM pricing and lower ests. However, we see supply growth biased downward (Samsung's L17) and expect modest undersupply in 2H16 as well 20nm tech migration to help margins for SK Hynix and Micron in particular. We forecast Samsung semis capex to decline 22% YoY in '16E in US\$ terms (was -12%) due to LIS; however for 17E we forecast +11% driven by 3D NAND.

Output: Positive takeaways from LGD, Samsung, Quanta, ADLINK, Screen

Please see our Most and Least Preferred list Page 2.

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Revised forecasts

Figure 1: Changes in price target

Companies	Ticker	Rating	New PT	Old PT
US Semis				
AMD	AMD.O	Sell	US\$1.75	US\$1.50
Intel	INTC.O	Buy	US\$35.0	US\$36.0
Micron	MU.O	Buy	US\$15.0	US\$16.5
Korea Tech				
LG Display	034220.KS	Buy	Won36,000	Won34,000
LG Electronics	066570.KS	Sell	Won50,000	Won44,000
Samsung Electronics	005930.KS	Buy	Won1,430,000	Won1,390,000
SK Hynix	000660.KS	Buy	Won36,000	Won40,000

Source: UBS estimates

Figure 2: UBS Global Most/Least preferred list

Companies	Rating	Price	PT	PE		PBV		EV/Sales	
				2016E	2017E	2015	2016E	2016E	2017E
Most preferred									
ADLINK	Buy	NT\$75	NT\$100	15.5	13.2	4.2	3.7	1.4	1.2
Apple Inc.	Buy	US\$105.8	US\$120	11.9	10.6	5.1	4.7	1.7	1.6
ams AG	Buy	€31.65	€47	14.8	12.2	3.1	2.8	3.2	2.8
ARM Holdings	Buy	£1008	£1200	29.8	25.9	7.9	6.7	10.8	9.8
Broadcom Limited	Buy	US\$151.55	US\$190	13.9	11.0	8.5	2.4	2.9	2.4
Infineon	Buy	€11.905	€13.8	15.7	12.5	2.9	2.6	1.9	1.8
LAM Research Corp.	Buy	US\$79.26	US\$90	12.5	12.1	2.6	2.2	2.1	2.0
NVIDIA	Buy	US\$32.82	US\$35	19.2	17.7	4.1	3.9	2.4	2.3
LG Display	Buy	Won24700	Won36000	49.2	6.6	0.7	0.7	0.2	0.1
Murata Mfg.	Buy	¥14075	¥20000	14.8	14.6	2.7	2.3	2.1	2.0
Quanta	Buy	NT\$59	NT\$65	12.0	10.9	1.7	1.7	0.2	0.2
Samsung Electronics	Buy	Won1263000	Won1430000	11.2	10.6	1.0	0.9	0.5	0.5
SCREEN Holdings	Buy	¥769	¥1100	11.2	10.5	1.5	1.4	0.7	0.7
SK Hynix	Buy	Won29250	Won36000	12.7	13.0	1.0	0.9	1.6	1.5
Sony	Buy	¥2936	¥4200	14.2	12.0	1.4	1.3	-0.7	-0.6
Sunny Optical	Buy	Rmb22.55	Rmb22.5	23.6	17.6	6.3	5.2	1.5	1.3
Least preferred									
Advanced Micro Dev.	Sell	US\$2.8	US\$1.75	NA	NA	NA	NA	0.7	0.7
Acer Inc.	Sell	NT\$12	NT\$10.7	69.5	72.4	0.6	0.6	0.0	0.0
Epistar	Sell	NT\$23.55	NT\$20	NA	NA	0.5	0.5	0.8	0.7
HTC Corporation	Sell	NT\$111.5	NT\$63	NA	NA	1.4	1.6	0.0	0.0
HP Inc	Neutral	US\$11.72	US\$11	7.5	7.1	7.0	NA	0.3	0.3
INNOLUX Corporation	Sell	NT\$10.85	NT\$8.55	NA	NA	0.5	0.5	0.4	0.5
LG Electronics	Sell	Won62800	Won50000	11.5	12.4	0.9	0.8	0.1	0.1
Marvell Technology	Sell	US\$10.27	US\$7	21.1	20.3	1.0	1.2	0.8	0.9
Kinsus Interconnect	Sell	NT\$78.8	NT\$62	13.8	13.7	1.2	1.2	1.0	0.9
Kyocera	Neutral	¥4949	¥5200	18.8	18.3	0.8	0.7	0.1	0.1
Qualcomm	Neutral	US\$51.38	US\$51	12.1	11.5	2.7	2.7	2.2	2.1
Realtek	Sell	NT\$83	NT\$50	19.5	18.8	2.2	2.2	0.7	0.7
Sharp	Sell	¥138	¥80	38.9	17.9	1.6	1.6	0.3	0.3
Toshiba	Neutral	¥200	¥220	56.5	9.2	1.4	1.4	0.4	0.4

Source: UBS estimates

1Q16 APAC Tech Tour takeaways

Figure 3: UBS 1Q16 APAC Tech Tour – companies visited

OEMs	Semis/Memory	Semicap Equipment	Displays/display equipt	IC substrates	Components	ODMs
Huawei	HiSilicon	Eugene Tech	Invenia	Ibiden	ADLINK	Quanta
Lenovo	MediaTek	Hitachi Kokusai	Japan Display	Kinsus Interconnect	Catcher	
LG Electronics	Novatek	Screen Holdings	LG Display	SEMCO	Chicony	
Samsung Elec	Realtek		Nikon		CrucialTec	
Sharp	Samsung Elec		Samsung Elec		Ibiden	
Skyworth Digital	SK Hynix		Sharp		KH Vatec	
TCL Multimedia	Toshiba		Viatron		Partron	
Toshiba	TSMC				Samsung SDI	
					SEMCO	
					TPK Holdings	

Source: UBS

Smartphones

Apple related supply chain

For 1QC16, findings were supportive of stable procurements post the Nov-to-January revisions down, but we did not find evidence of revisions up either (total incl. new 4 inch just below 40mil UBSe – note this does not equate to Apple Sell In). But the **silver lining is that at least, we do not get a sense of further procurement reductions. For 2CQ16, we estimate some modest improvement QoQ and this is reflected in most suppliers estimates – but with some debate/uncertainty on the magnitude of the improvement.**

Regarding the coming iPhone “7” refresh, visibility remains limited on volumes. We would however note that Catcher has filed it is investing US\$200m into its China subsidiaries – typically the equipment spending is about x2 this. This may indicate equipment spend down 15-20% YoY for ‘16 – which is perhaps less than feared. This would support further share gains from Catcher, and we would also point out that the co. expects new projects for existing customers / new customers (as now having the capacity to do so).

From a features perspective – we continue to see a slightly different metal casing (notably to support water-proof functionality). 3D/Force Touch is marginally evolving – with more of a step change in performance in 2017 (“7S” refresh). But the main recent change, we believe, is the likeliness of two large screens (“7+”) models – one of them being dual-camera and with 3GB of DRAM, the other single-camera/2GB. The “7” will have, we estimate, a single camera and 2GB of DRAM. This can still change before launch.

For 2017 and onwards – there is wider expectation now that OLED will likely be adopted by Apple for iPhone-type devices – our view since our last APAC Tech Tour last September. There is some debate still on for what purpose. Whilst it seems initial capacity planning is for flexible OLED – it now appears possible that Apple will initially go for one “edge-type” (meaning bezel-less display) OLED model in 2017, before wider adoption of OLED in 2018 – including a possible foldable display product. What is clear to us is that Apple adoption OLED widely for iPhone-type products is becoming our base case. (For a discussion on

displays capacity / technology see the Displays section). We hope that the innovation in Apple's form factors will contribute to improve demand by then. But it would very likely mark a more significant inflexion in hardware innovation than recent refreshes.

Other smartphones vendors

Samsung: 1Q16 smartphones volumes Sell in is tracking in line at 76-77mil, but with some upside to the GS7 volumes to 8.5mil (+1mil vs our initial expectations). This reflects strong pre-orders. Procurement, we estimate, is at 85mil (up from 76mil for initial January planning) with some of the recent A/J Series refreshes driving the upside. We estimate 1Q procurement for the GS7 at 11mil. As for 2Q, we estimate it will exceed 70mil (GS7: >13mil) – our Sell In estimate is 79.5 mil/13.5 mil respectively.

For '16 we estimate 325mil Sell In (+5mil YoY) with 37mil GS7. We expect the most growth to be achieved in the mid end whilst we expect GS+Note volumes (-) 1.3mil YoY. We forecast 37mil GS7 – more conservative from company expectations we believe closer to 40mil. We continue to expect Samsung to launch a foldable product in 1H17.

LGE: LGE is seeing downside in Sell In for 1Q16 to 14mil units (was 15.3mil before), implying -9.3% YoY. This is also driving downside to OP for Mobile .com to losses similar to 4Q15 levels.

On the flipside, the **company is optimistic about G5 shipments** post solid interest at Mobile World Congress, and expect 8-10mil in 16E (vs. only 4.4mil G4). We remain skeptical that the accessorization strategy adopted around the G5 is enough of a pull back to LGE for the high end as it continues to deal with a sub-scale position. We also note that the market share regain strategy in the high end primarily hinges upon success in the US. For total smartphones volumes in '16, LGE expects c. 65mil (+ 9% YoY) vs. UBS's 59mil. Whilst we could see OP positive for Mobile Com in 2Q16 if the G5 hits 3mil Sell In or more, we are still concerned about how sustainable the trend is after.

Huawei: Huawei remains confident it can hit 130mil smartphones units in 2016 (+20% YoY) – which would imply further market share gains. It also expects to grow ASPs as the mix shifts further to the higher end. It expects exports to grow faster than China (c. 60% of volumes in 2015). Current channel inventories are fairly low.

Lenovo/Moto: Lenovo did not see upside in the March Q for smartphone volumes but is realizing incremental savings to protect profits. China remains difficult with volumes down 20% YoY –the flipside being that overseas volumes are now 80% of total. Channel inventories in China are now healthier.

It continues to expect >10% unit growth in FY3/17 and break even. In order to drive this, it will rely more on exports – leveraging for instance recent success in India (c. 10% market share) and a coming products refresh for Lenovo (around May).

Other China smartphones vendors: Our checks indicate Oppo, Vivo and LeTV also likely to see growth in 2016. LeTV has been quite aggressive on selling smart phones, as this can be another way for them to grow paid users. The aim to sell 15mn smart phones in 2016. LeTV will release its LE 2 phones at end of March. But the market is increasingly bifurcated between "The Haves" and "Haves Not".

Our checks also indicate reduced targets at Meizu, and a cautious outlook for Coolpad. In general though, **supply chain indications on 1CQ16 are not indicative of any significant pickup from the overall China smartphones market.**

Smartphones components

Cameras

We are surprised a major module maker is not as bullish as before on dual-camera adoption and Samsung may not launch a dual-camera smartphone in 2016. We also noticed the dual-camera in LG G5 is not a "real" dual-camera given only one of them is used to capture the image instead of two at the same time.

Even though most smartphone OEMs could introduce new models with dual cameras, Huawei has acknowledged the challenge in software algorithm. While Lenovo announced its front dual camera model S1 in November last year, this model is not available until recently.

We recap the benefits of using dual cameras are:

- Better picture quality: with using two camera modules and combining two images into one, pictures taken by dual cameras would have better resolutions. By doing so, blurry shapes in pictures could be revised automatically.
- Better form factor: The physical height of camera modules which resolution is 16mp and above is usually thicker than the smartphone itself. This is because of more components (like OIS) and better/more lens used for the camera modules than lower resolution cameras. However with the dual cameras (usually a combination of 8mp/12mp cameras at this stage), the camera modules would be fitted at the slots and the back side of smartphones could become smoother.
- Fuller experience: depending on the application and software, users can play with photos in various ways for instance changing focuses, changing colour schemes depending on depths, and editing photos etc.

Many of the smartphone OEMs whom we met during the trip said that either they already launched smartphones with dual cameras or they have plans to launch dual-camera-adopted smartphones within this year. However, we think a broader adoption would only take off if one can come up with materially better user experience than what the current camera can provide. We think camera module makers have increased their capacity accordingly but the yield rate improvement could remain a bottleneck. In terms of the cost of dual cameras, we think the price for dual camera modules would be higher than a 21mp single camera (cUS\$15). We think however the cost could come down when and if the production yields are matured. Another hurdle should be lacks of software. We think how high the penetration of dual cameras could rise depends on how much the new camera can give value to consumers.

For large smartphone OEMs, we believe Apple will use the dual cameras from its smartphone refreshment in 2H16 and we think the dual camera would be adopted for one of the two potential 5.5" models only. In consequence, we forecast there would be four iPhones to be released this year, one for 4", one for 4.7" with the single camera, one for the 5.5" with single camera and another 5.5" with dual

cameras. On the other hand, we think Samsung will likely use the dual cameras in next year rather than this year.

We think the adoption of the optical image stabiliser (OIS) function could not grow as fast as we had expected due to improvements of software.

The OIS is to adjust blurry photos automatically by putting additional components and sensors. This causes additional BOM costs at least US\$2 in our view. However we think smartphone OEMs are considering to use advanced software to save the costs for OIS. We think increasing demand of dual cameras could be also negative to OIS due to redundancy.

We think the OIS could be adopted for the front end camera instead of the rear camera. Note that most of the OIS-adopted cameras are the rear ones currently. However we couldn't see particular demand from the front end cameras yet during the trip.

Metal casing

We think the penetration of metal casings would increase this year, based on die-casted metal casings being adopted for the lower end smartphone segment. Die-casted metal casings cost lower than the CNC/extrusion metal casings due to shorter process steps. Our cost estimate is below US\$15 for die casted metal casings vs above US\$20 for CNC/extrusion. The die-casted metal casings have not prevailed so far since its quality – touch feeling, looking and colours – could not have satisfied smartphone OEMs/consumers. However we think the quality of the die-casted metal casings has been improved and reached the level vis-à-vis costs.

On the other hand, our checks suggest it's still too early for liquid metals to replace the current aluminium metal casings given the capacity for mass productions. Hence we believe the existing aluminium based metal casings would be broadly used in 2-3 years later.

We expect aluminum casing with CNC/extrusion could still dominate the mid to high end handset models while there should be increasing adoption of die casted metal casing in the mid-range models with its improving quality and lower costs.

Fingerprint modules

We **believe more smartphone OEMs will adopt the finger print modules in their smartphones not only high-end smartphones but also the mid-range segment.** We think the trend is driven by the increasing penetration of mobile payment solutions. Since last year, OS providers (Apple Pay, Google Wallet) as well as smartphone OEMs (Samsung Pay in operation, and LG Pay and Huawei Pay etc coming online) and 3rd party vendors (Ali Pay) have been all aggressive in expanding market shares in the mobile payment market. Smartphone OEMs accordingly have started incorporating the finger print modules to support the security. However we think it's too early for the low end segment (ASP being below US\$100) to adopt the finger print module considering the BOM cost which we estimate is around US\$5-7.

We think component makers are working on transplanting fingerprint modules beneath the cover glass as a next generation. With this, smartphones can have a larger screen without the home button. We estimate the additional BOM costs from a display/cover glass perspective would be roughly around US\$5-10 depending on the production yields. This is based on fingerprint sensors transplanted only in a certain area of the cover glass (vs available in the all glass

area). This is still a high cost item given the additional cost could be around the cost of a regular fingerprint sensor module. It also takes time for the vendors to improve the design and production yield. Therefore, we think the adoption could be limited to very selective models compared to the current home button type fingerprint modules.

PCs

Near term demand on the weaker side

1Q appears to be trending on the lower side so far – although March is seeing some modest pull ins. Quanta expects a pickup in March but overall 1Q should be down more than 20% QoQ for notebook units (seasonality is more pronounced due to Apple high weighting in mix). Lenovo still sees a challenging demand environment. On the components side, power supplies at Chicony are down (revs wise) 10-15% YoY for notebooks and >15% for desktop PCs.

There are still some excess inventories in the channels although not deemed to be a major issue for neither Lenovo or HP. Visibility remains fairly limited for 2Q16 overall.

Improvement possible in 2H16?

Lenovo pointed to three factors: (1) low base; (2) demand for two-in-ones at lower pricing; (3) enterprise expected to modestly come back. Lenovo expect two-in-ones (incl. Yoga) to move from 5% of its total volumes to 14% by YE. But in general, we found the supply chain being on the cautious side, with expectations ranging from -3% to -7% YoY total units decline.

Servers

Shorter term datapoints were somewhat better than expected. Lenovo is seeing an overall stable market and expect some growth for the next couple of quarters. It may miss its US\$5bn revenues targets for FY3/16 by less than 5% due to ccy. Quanta is seeing servers revs slightly down QoQ in 1Q due to customers install schedule

Lenovo sees 7-10% YoY top line growth as being doable for FY3/17. Quanta expects 20% YoY growth with ASPs helping – as racks go up in the mix vs server boards. The main driver at the customers level segment is smaller internet customers (mainly US) whilst it still sees competition in China has tough. Chicony sees 30-40% growth YoY in '16 in power supplies for Cloud driven by more ODM business as well.

Displays

Apple adoption of OLED is shaping up

Earlier adoption is possible

Our findings confirm our view that Apple is very likely to adopt OLED displays for iPhone-type devices. One difference vs our prior expectations is that the first iPhone model to use OLED may be in 2H17 (vs. our prior expectation of 2018). We base this view on the back of the recent filings for orders

from Korea OLED display equipment vendors. We would also expect the initial device to use edge display – not foldable. Hence in 2H17, we could see both OLED and LCD displays being used by Apple, we believe.

By 2018, it is possible that Apple eventually uses OLED across a wider range of devices, with foldable displays products appearing as well.

Some uncertainty on Touch

One element which is not clear to us yet is how touch would be done. Currently, LTPS LCD displays used by Apple have in-cell touch. Whilst in-cell is possible with OLED, we understand it is hard to use. So options are on-cell (similar to Samsung's current AMOLED displays) or out-cell (better performance, more expensive). Silver Nanowire could be used for flexible displays. Out-cell would re-offer an opportunity for touch panel vendors such as TPK. But panel makers remain unconvinced it will be adopted for OLED. We recall though that when Apple moved to in-cell, the decision was quite late in the process; hence current development work may not yet be indicative of the future direction to be taken.

What we do see, and we expect, in terms of supply base

We continue to believe that Samsung will take the natural lead in supplying OLED displays to Apple, at least initially. Why? (1) Samsung has significantly more experience in RGB OLED manufacturing and specifically flexible OLED (pOLED) than anybody else; (2) Korean equipment vendors filed two weeks ago incremental orders for its A3 line.

Whilst at first glance we thought those orders would support c. 15k spm capacity (Gen 6), and hence would relate more to Samsung Mobile own requirements, we now believe that some of those orders are for c. 30k spm capacity. Hence, there is clearly an envelope for another large customer using pOLED and we see no other obvious candidate than Apple.

From a capacity requirement perspective, we see estimate that Apple may initially need c. 50k spm gen 6 capacity to support one model using 5.5 inch OLED for a 2H17 refresh. We then estimate another 100k spm necessary to support a full products portfolio, and upside over 200k spm if some of those are larger sheet OLED (7 inch type) – up to 240k spm depending upon volume / mix / yields. Recall that panel vendors need to support peak volumes in August-November higher than annualized run rates as Apple's seasonality is very pronounced. Panel vendors would need to deploy some of the incremental capacity by 1H17 to run pilot production in 2H17 and target a 2H18 end products refresh.

With that in mind, we expect follow up orders for OLED equipment vendors for gen 6 from Samsung in 2Q16 and 2H16. **We expect initial orders from LGD in 2Q16 and repeat orders by 4Q16.** We would assume the ratio of capacity to be 66% Samsung / 33% LGD (upside to 40%). We note a few important points when tracking OLED equipment orders:

- **Evaporation tools appear to be a bottleneck:** Suppliers include Canon Tokki and SFA Engineering. Capacity for those would need to be secured first in order not to bottleneck the rest of capacity deployment.
- **Lead times for gen 6 litho are >1 year vs 6 months a year ago with Nikon** c. 90% market share. Note that orders from Chinese customers (LCD and OLED) have aggravated the situation. The TAM is expected to

increase to 110 units in '16 from 80 in '15 for total display steppers but does not yet factor some of the upside mentioned above. The reason, however, why Nikon did not see a recent step up in OLED related orders is that due to long lead times, panel makers have placed orders earlier and gradually.

- In general orders in Korea are filed if for orders exceeding 10% of expected yearly revenues.
- We expect more confirmation or orders in 2Q16.

Large panels OLED

OLED TV adoption

LGE remains the most aggressive OEM regarding OLED TV volumes, on the back of (1) solid demand in 4Q15; (3) supply from LGD and panels cost coming down with scale. It expects 150k units in 1Q16 (4Q15: 160k) and 800k-1mil in 2016 ('15: 310k). Pricing is now expected to come down dramatically in the near term as 55 inch UHD OLED is already selling in the US market for c. US\$3,000.

Skyworth mentioned 200k OLED TV units target for FY3/17 – having just started shipping 55/65 inch OLED TV sets. Pricing appears fairly attractive to us with 2K 55 inch sets at RMB12,000 and 4K RMB15,000. Skyworth – as we are – is pretty positive about prospects for the OLED TV market. Supply is expected to remain 100% LGD for a while – although note that Skyworth does not tend to procure from Samsung.

Whilst Samsung remains focused on Quantum Dots LCD in 2016, there is little doubt to us that it will move to OLED in 2017.

OLED TV panel capacity plans

LGD: LGD will have as expected 60k spm gen 8.5 capacity by 2017 (currently 33k) with about 25k of the incremental capacity occurring in 2016 (through conversion from LCD). 60k would be sufficient to do 2.16mil units in 2016 of 65 inch models /4.32mil for 55 inch. After this, **we believe LGD is considering up to 50k spm of gen 10 capacity (x3 the number of cuts to 6) – with no decision taken yet.** This would be in the P10 fab for 2018 output we believe.

Samsung: Samsung is still due to take a final decision by 2Q on which OLED technology to go for, but we expect White OLED to prevail as accelerating time-to-market. This could allow for OLED TV launches in 2017. We expect 25-50k wpm gen 8 conversion from LCD in 4Q16. But longer term, Samsung could also consider gen 10.

BOE: Suppliers believes the HeiFei gen 10.5 site could end up having not only 60k a-Si LCD capacity, but also 30k oxide OLED. This is in a 2H18-2019 timeframe and we doubt BOE would see meaningful output, if they take that decision, before 2020.

CSOT: Is the only other large panel manufacturer in China which could make a move towards OLED. It has had some test equipment in for White OLED but so far, we believe, as not made a decision on commercialization.

TV demand and inventories

China Sell In started reasonably well in January and February – although impacted by shorter numbers of days – appear in line. CNY Sell Through seem to have been up mid-single digit YoY – better than expected, and within this, market leader Skyworth was up 12% YoY. Channel inventories are assessed to be fairly low across vendors with TCL Multimedia mentioning 600-700k (vs. 1mil last August).

For the FY the China LCVD TV market is expected to be up single digit YoY with TCL expecting their shipments up YoY and Skyworth expected to outperform the market. Some of the market support comes from the installed base back from the CCFL switch being now 7 years old.

Panel inventories at OEMs also appear to be reasonably low with c. 10 days at Skyworth and 18 days at TCL.

LCD panel pricing

Views amongst OEMs were not fully consistent with one large OEM expecting declines to continue (albeit more moderately) bar 32 inch (already below US\$55) – due to BOE in particular keeping higher utilization rates than peers. Another OEM sees stability in pricing for most sizes.

Semis

Cycle / demand: Slow (sluggish?) bottoming out

Fabless companies we met indicated revenues for 1Q16 in line with expectations so far – MediaTek down 7-15% QoQ; Realtek having seen strength in January but some earthquake related pushouts in March; Novatek seeing some catch up in March post-quake impact earlier. We also note that TSMC tightened up revs guidance earlier for the quarter in spite of the earthquake's negative impact. Fabless companies in general indicated poor visibility into 2Q16 but channel inventories clear – hence we expect sequential growth overall QoQ.

For more details in our revised semis industry revenues forecasts please see the following report: [\(link\)](#)

Foundry market & logic technology roadmap

Regarding 14/16nm current demand, we see reasonably well set parameters – with end demand the key variable. **We see no debate within the supply chain as per A10 (Apple application processors orders)** – which we continue to estimate will 100% go to TSMC, using Wafer Level Packaging Fan Out technology (better performance / thinner package). We also believe this is consensus view.

As for 10nm, we continue to see a discrepancy between TSMC deployment, which we estimate would be close to 50-70k wpm by 1Q17, and Samsung, closer to 10-20k wpm. This indicates at the very least that TSMC intends to retain its recent share gains (this also being consensus view). However, we continue to see the supply chain working towards alternatives to FO WLP – for instance embedded Package on Package. A customer like Apple could possibly adopt different packages for different devices by 2H17. If so, this would unlock the supply chain, and be positive to IC substrates makers (as FO does not need IC substrates). But at this stage, it is not clear to us this is the way that market

segment may go. Obviously, a key parameter remains execution regarding 10nm process itself.

Beyond this – we see initial customers positioning for 10nm. On the TSMC side, we expect MediaTek to be on the initial 10nm adopters – making this a first for a leading edge node for the Taiwan fabless company. HiSilicon also would use 10nm FF as soon as available, in our view. As for Samsung, we believe 10nm may initially be used for Exynos and Qualcomm (“S830”) also starting 1Q17 in wafers out terms.

Regarding 7nm FF (2Q18 wafers out expected), we believe it is too early for to have any firm customers commitment. However, we think customers engagements have started. We expect Samsung to have a “10nm+” process in the same time frame which could end up being comparable to TSMC’s 7nm. Extreme Ultra Violet (EUV) lithography is still expected to be used, we believe, for 5nm (2020 MP).

IC substrates

Our checks suggest the substrate industry is struggling given weak end-demands and the rise of the Fan-Out technology. We still believe TSMC will get 100% of the Apple’s A10 business from 2H16 and the chip will be packaged by their Integrated Fan-Out technology in spite of some concerns on production yields. This is negative to the substrate vendors given the FO technology needs less substrates than the existing packaging solutions. However we checked that some of them are developing alternative technologies with foundry makers which make the 2017 outlook less predictable. Moreover, we see no acceleration in adoption by Qualcomm, or other application processors vendors, so far, of FO.

Memory semis

Near term outlook still challenging

Our checks indicate 1Q16 DRAM blended ASPs likely down to 13-15% QoQ, with downside across PC, servers and consumer applications in particular. We also expect NAND Flash ASPs down mid-teens QoQ. Obviously, downside in PC procurement and the lack of a pickup for Chinese smartphones volumes have been weighting in pricing negotiations.

DRAM demand and content: Positives and negatives

The main negative is that should Apple only adopt dual camera for one out of 3 new iPhone models in 2H16, then the % of volumes adopting 3GB would be negatively biased. The positive is that China smartphones memory density are progressing faster than expected – consistent with our recent checks at Mobile World Congress. We also not more resilience in server DRAM demand than expected so far.

Some downside to DRAM supply growth

Until now, SK Hynix was expecting to recoup some of its wafer capacity loss when moving to 20nm later in 2016. Whilst so far delivery of equipment to M14 is not seeing push outs, there is some downside, we think, for 2H16 – depending very much upon end demand. As for Samsung, capacity additions for L17 may actually be closer to 5-10k wpm (vs. 15-20k expected 6 months ago). This would obviously

be positive to supply / demand. We continue to expect some undersupply in 2H16 for DRAM – although, for now, 0.7% oversupply in 2017.

3D NAND Flash ramp up: mixed signals

We have repeatedly flagged out that non-Samsung players will face initial challenges ramping up 3D NAND Flash production. Whilst industry players are progressing towards mass production schedules for (primarily) 48 layers Three-bits-per-Cell technology by year end, we sense some uncertainty on schedules (specifically, we believe, SK Hynix and Toshiba), and possibly less capacity deployment for Phase 1 of Intel's Dalian fab that what we initially expected (possibly closer to 20-30k vs. our initial 40k wpm expectation). In addition, sub 15nm technology migration will be largely done as we enter 2017 for existing 2D NAND capacity.

The combination of (1) less tech migration for 2D; (2) the pace of initial non-Samsung 3D production ramp up; could altogether bias to the downside our current expectation of +36% YoY bit supply growth in '17E. On the flipside, it appears that **Samsung's Peyongtaek fab is very much on schedule for wafer fab equipment starting to move in in 1Q17**. As it stands, we expect NAND Flash oversupply to moderate in '17 to 1.2% from 2.2% beforehand.

For more details in our revised memory industry revenues and supply / demand forecasts please see the following report: [\(link\)](#)

Semis capex: modest downside in '16, hopeful for '17

We now forecast semis industry capex down 2.6% YoY in 2016 (was -0.7%) and wafer fab equipment down 4.0% (was -2.0%). For 2017, we forecast 6.5% increase in capex YoY (was 6.5%) and WFE +7.5% (was 7.0%).

Samsung: The main change we make is to lower our Samsung LSI capex estimate as initial 10nm capacity deployment is through conversion of existing capacity, vs new capacity. **We hence forecast total Samsung semis capex to decline 22% YoY in '16E in US\$ terms (was -12%). However for 17E we forecast higher growth from a lower base to +11% from +7% before.**

SK Hynix: In addition, we keep our below-guidance capex estimate for SK Hynix for '16E at Won5.5tn – primarily on 3D NAND scheduling.

Toshiba: We believe the order schedule for the next phase of investment for Y2-B is still not clear for 48L 3D NAND – although development appears to have been on schedule. Toshiba continues to intend to average NAND capex close to JPY200bn per year.

Intel/Micron 3D NAND: Micron is taking in we believe tools in slightly earlier than expected in 1Q (we expected 2Q). Delivery to Intel's Dalian is ongoing with pretty identical toolsets and mix. The magnitude of the initial Dalian ramp may be less than we initially expected.

TSMC: We continue to expect TSMC to meet its capex guidance of \$9bn-\$10bn for '16E with 50-70k wpm of capacity deployment for 10nm FF.

Figure 4: Bottom-up Semiconductor Capital Spending (US\$ mil)

	2011	% YoY	2012	% YoY	2013	% YoY	2014	% YoY	2015	% YoY	2016E	% YoY	2017E	% YoY
N.America														
Intel	10,764	106.7%	11,027	2.4%	10,711	-2.9%	10,105	-5.7%	7,326	-27.5%	9,500	29.7%	11,000	15.8%
Micron NAND Flash	1,550	181.8%	1,000	-35.5%	737	-26.3%	1,674	127.2%	2,662	59.0%	3,279	23.2%	2,400	-26.8%
Micron DRAM	1,000	84.8%	663	-33.7%	631	-4.8%	1,116	76.8%	1,775	59.1%	2,186	23.2%	1,600	-26.8%
Texas Instruments	815	-32.0%	495	-39.3%	412	-16.8%	459	11.3%	551	20.1%	513	-6.9%	562	9.6%
Global Foundries	4,900		3,800	-22.4%	4,000	5.3%	3,500	-12.5%	2,500	-28.6%	1,750	-30.0%	1,800	2.9%
SanDisk	1,533	45.6%	769	-49.8%	859	11.6%	1,008	17.4%	1,353	34.2%	1,700	25.6%	1,800	5.9%
Europe														
ST Micro	1,258	21.7%	480	-61.8%	531	10.6%	496	-6.6%	519	4.7%	668	28.7%	639	-4.4%
Infineon	1,391	172.2%	895	-35.6%	496	-44.5%	719	44.7%	903	25.7%	1,002	11.0%	967	-3.5%
NXP	206	1.0%	251	21.8%	191	-23.9%	306	60.2%	322	5.1%	485	51.0%	514	6.0%
Korea														
Samsung Memory	7,233	-14.0%	5,842	-19.2%	7,120	21.9%	10,206	43.4%	9,618	-5.8%	7,693	-20.0%	8,333	8.3%
Samsung LSI	4,521	73.8%	6,598	45.9%	4,523	-31.4%	2,757	-39.0%	3,375	22.4%	2,450	-27.4%	2,917	19.0%
SK Hynix	3,025	4.7%	3,480	15.0%	3,412	-1.9%	4,668	36.8%	6,003	28.6%	4,547	-24.3%	5,682	25.0%
Japan														
Toshiba	1,757	-15.5%	904	-48.6%	1,435	58.7%	1,227	-14.4%	1,404	14.4%	1,404	0.0%	1,404	0.0%
Sony	1,784	208.7%	902	-49.4%	687	-23.9%	661	-3.7%	1,950	195.0%	578	-70.3%	1,652	185.7%
Taiwan														
TSMC	7,286	22.7%	8,322	14.2%	9,694	16.5%	9,522	-1.8%	8,051	-15.4%	10,011	24.3%	11,000	9.9%
UMC	1,600	-11.1%	1,756	9.7%	1,092	-37.8%	1,429	30.8%	1,902	33.1%	1,566	-17.7%	1,670	6.7%
Inotera	384	-76.6%	138	-64.2%	215	56.3%	613	185.1%	1,790	191.8%	791	-55.8%	1,107	40.0%
Nanya	357	-54.6%	65	-81.8%	189	191.4%	222	17.1%	122	-45.2%	748	515.1%	450	-39.8%
Other														
SMIC	800	9.9%	499	-37.6%	677	35.5%	614	-9.3%	1,000	63.0%	1,130	13.0%	1,130	0.0%
Others	14,484	-9.6%	10,855	-25.1%	10,205	-6.0%	12,576	23.2%	11,318	-10.0%	10,752	-5.0%	10,215	-5.0%
Total	66,649	17.9%	58,741	-11.9%	57,841	-1.5%	64,403	11.3%	64,444	0.1%	62,755	-2.6%	66,844	6.5%
WFE	36,387	15.2%	29,644	-18.5%	27,473	-7.3%	31,953	16.3%	32,912	3.0%	32,253	-4.0%	34,511	7.5%

Source: Company data, UBS estimates

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Investing in the technology sector involves a high degree of risk. Rapid technological changes, increasing competition and exposure to macroeconomic cycles are among the many risks faced by investors in technology stocks. Moreover, it is extremely difficult to project the financial results of tech companies, since their operating models are highly volatile and unpredictable. Finally, valuing technology stocks can prove challenging, as neither traditional nor non-traditional valuation measures have provided much insight into how these stocks trade.

We typically value memory and display stocks on P/B basis as more supply driven, and other semis and hardware stocks on PE

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Buy	FSR is > 6% above the MRA.	48%	36%
Neutral	FSR is between -6% and 6% of the MRA.	39%	28%
Sell	FSR is > 6% below the MRA.	12%	22%
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Buy	Stock price expected to rise within three months from the time the rating was assigned because of a specific catalyst or event.	<1%	<1%
Sell	Stock price expected to fall within three months from the time the rating was assigned because of a specific catalyst or event.	<1%	<1%

Source: UBS. Rating allocations are as of 31 December 2015.

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ADLINK Technology	6166.TW	Buy	N/A	NT\$76.00	21 Mar 2016
Advanced Micro Devices ¹⁶	AMD.O	Sell	N/A	US\$2.80	21 Mar 2016
ams AG ^{5, 13, 59}	AMS.S	Buy	N/A	CHF31.45	21 Mar 2016
Apple Inc. ^{6c, 7, 16, 18a}	AAPL.O	Buy	N/A	US\$105.91	21 Mar 2016
ARM Holdings Plc ^{4, 5, 7, 14, 16}	ARM.L	Buy	N/A	1,009p	21 Mar 2016
Broadcom Limited ¹⁶	AVGO.O	Buy	N/A	US\$152.89	21 Mar 2016
Epistar Corporation	2448.TW	Sell	N/A	NT\$24.05	21 Mar 2016
HP Inc ^{4, 6a, 6c, 7, 12, 16, 18b}	HPQ.N	Neutral	N/A	US\$12.21	21 Mar 2016
HTC Corporation	2498.TW	Sell	N/A	NT\$112.50	21 Mar 2016
Infineon Technologies AG ⁷	IFXGn.DE	Buy	N/A	€12.08	21 Mar 2016
INNOLUX Corporation	3481.TW	Sell	N/A	NT\$11.10	21 Mar 2016
Kinsus Interconnect Technology	3189.TW	Sell	N/A	NT\$76.00	21 Mar 2016
LAM Research Corp. ¹⁶	LRCX.O	Buy	N/A	US\$79.76	21 Mar 2016
LG Display ^{7, 16}	034220.KS	Buy	N/A	Won25,050	21 Mar 2016
LG Electronics ⁷	066570.KS	Sell	N/A	Won62,300	21 Mar 2016
Murata Manufacturing	6981.T	Buy	N/A	¥14,075	18 Mar 2016
NVIDIA Corporation ¹⁶	NVDA.O	Buy	N/A	US\$33.91	21 Mar 2016
Qualcomm Inc. ^{6b, 7, 16}	QCOM.O	Neutral	N/A	US\$52.21	21 Mar 2016
Quanta	2382.TW	Buy	N/A	NT\$59.20	21 Mar 2016
Realtek Semiconductor Corp.	2379.TW	Sell	N/A	NT\$84.60	21 Mar 2016
Samsung Electronics	005930.KS	Buy	N/A	Won1,267,000	21 Mar 2016
SCREEN Holdings Co., Ltd.	7735.T	Buy	N/A	¥769	18 Mar 2016
Sharp ⁵	6753.T	Sell	N/A	¥138	18 Mar 2016
SK Hynix	000660.KS	Buy	N/A	Won29,550	21 Mar 2016
Sony ^{2, 4, 5, 7, 16}	6758.T	Buy	N/A	¥2,936.0	18 Mar 2016
Sunny Optical Technology	2382.HK	Buy	N/A	HK\$22.80	21 Mar 2016
Taiwan Semiconductor Manufacturing ¹⁶	2330.TW	Buy	N/A	NT\$160.00	21 Mar 2016
Toshiba ^{4, 5, 7}	6502.T	Neutral	N/A	¥200.0	18 Mar 2016
Wonik IPS	030530.KQ	Buy	N/A	Won11,600	21 Mar 2016

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