

# Global I/O Semiconductors

## Global IO Semis: Cycle Update - Stay (or get) involved?

### Lead indicators in the process of troughing

Back late August ([link](#)), we indicated that investors may start to soon revisit semis stocks post significant market underperformance. Since, it is clearer that semis lead indicators are in the process of troughing, with 3-month moving average YoY semis industry revenue growth moving from -3.0% to, we estimate, -15.2% by May '23 (expected low). NTM EPS estimates for the S&P semis and SPE industry group have been cut ~25% versus stocks down ~35% from peak and semis stocks tend to stabilise c.2 cuts before the last one. On the flip side, 12-month forward P/E is back at 18.4x which is mid-cycle; this suggests a possible pause in the near term after a 28% rally in the SOX index since the October trough. Assuming that end-demand starts to recover on aggregate in 2H23 and into 2024, we would expect investors to look through that, and semis stock to continue to outperform.

### Inventory days likely peaked in 3Q22, digestion under way for Smartphones/IT

For the recent Sep/Oct Q-end, OEM average inventory days were up both QoQ and YoY to an average of 91.2 days (up 6.6 days QoQ and 11.4 YoY). Interestingly though, Smartphones and PCs/IT Hardware segments showed QoQ declines in inventory days, suggesting digestion is likely under way, with other segments such as Automotive, Industrial, Networking and CE up. Conversely, non-memory semis vendors saw inventory days being further elevated to 159.6 days, up both QoQ and YoY (up 28.5 days QoQ and 52.6 days YoY), very much across the board and particularly for the Chinese semis vendors. The good news though is that: 1/ absolute inventory growth YoY has slowed down, 2/ inventory growth relative to revenue growth is peaking, and 3/ our company semis revenue growth forecast in 2023 is now slightly undershooting OEM revenue growth, suggesting excess inventory build should reverse.

### Semis (ex-memory) revenues to decline in 2023, modest recovery in 2024

We now forecast overall semis industry (Sell In) revenues to decline -6.2% YoY to US \$549.2bn in '23E (was US\$586bn and -1.4% YoY prior) within which we expect non-memory semis revenue to decline -2.1% (was +3.3%) to US\$441.4bn. We roll out our '24 semis (Sell In) revenue forecasts and expect growth to rebound to +17.1% YoY at US \$643.2bn, primarily supported by a rebound in memory semis revenues expected to grow +67.1% YoY, with a more modest recovery in non-memory semis revenue growth to +4.9% YoY.

### Semis stock preferences

Continue to prefer Key Call Buy SK Hynix, Buy-rated ADI, ASMI, ASML, AVGO, Infineon, MRVL, Mediatek, MU, Samsung, and TSMC. Least Preferred: ACM Research (Shanghai), GigaDevice, Melexis, NXP, SMIC, TXN, and Vanguard.

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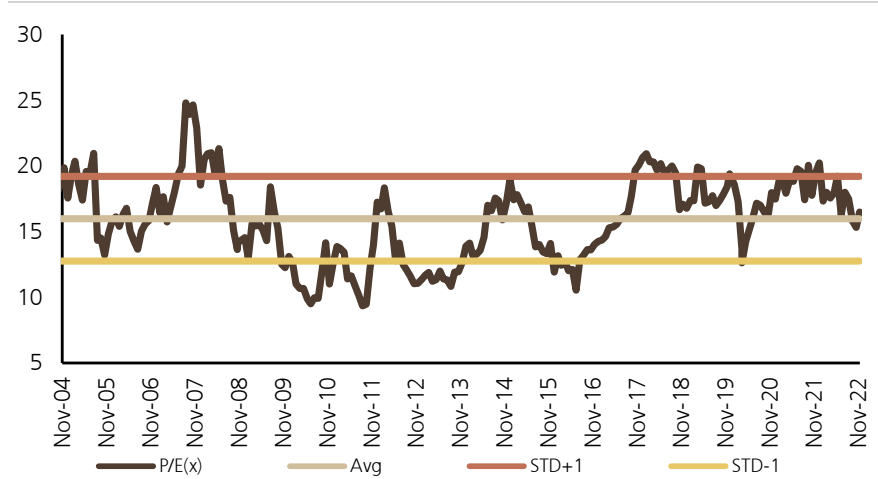
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**Figure 1: UBS Global Semis Most/Least preferred list**

Company	Ticker	Rating	Price	PT	'23E PE	'24E PE	'23E PB	'24E PB
<b>Most preferred</b>								
Analog Devices	ADI.O	Buy	US\$164.01	US\$195	16.2	17.1	2.36	2.41
ASMI	ASMI.AS	Buy	€248.95	€370	23.8	20.8	4.08	3.62
ASML	ASML.AS	Buy	€566.8	€660	34.6	24.4	29.43	26.04
Broadcom	AVGO.O	Buy	US\$522.21	US\$690	12.1	13.2	8.94	9.70
Infineon	IFXGn.DE	Buy	€30.64	€44	15.4	14.4	2.62	2.35
Marvell	MRVL.O	Buy	US\$42.67	US\$80	17.9	14.1	2.32	2.33
MediaTek	2454.TW	Buy	NT\$703	NT\$815	11.2	9.5	2.66	2.58
Micron	MU.O	Buy	US\$55.75	US\$75	-60.9	7.7	1.31	1.20
Samsung Electronics	005930.KS	Buy	Won60100	Won80000	14.8	7.3	0.97	0.86
SK Hynix	000660.KS	Buy	Won83100	Won135000	143.9	3.1	0.89	0.70
TSMC	2330.TW	Buy	NT\$480.5	NT\$745	12.2	10.4	3.37	2.72
<b>Least preferred</b>								
ACM Research	688082.SS	Sell	Rmb80.9	Rmb78.5	46.8	37.1	5.68	4.95
GigaDevice	603986.SS	Sell	Rmb98.06	Rmb77.5	36.1	30.7	4.00	3.67
Melexis	MLXS.BR	Sell	€83.2	€67	19.5	19.6	7.41	6.72
NXP	NXPI.O	Sell	US\$164.1	US\$160	12.0	10.7	5.32	4.59
SMIC	0981.HK	Sell (CBE)	HKD16.58	HKD14	14.7	13.3	0.60	0.57
Texas Instruments	TXN.O	Neutral	US\$173	US\$165	23.6	21.7	9.26	8.12
Vanguard	5347.TWO	Sell	NT\$83.5	NT\$55	15.2	12.3	2.93	2.72

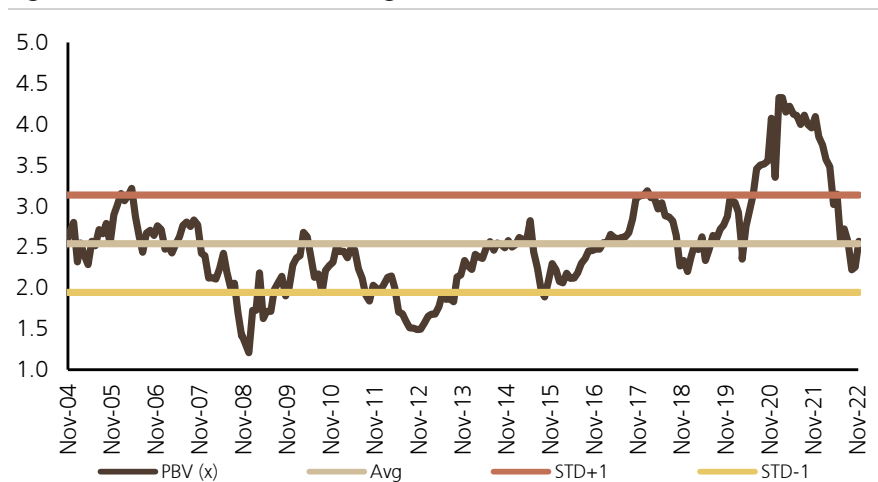
Source: UBS estimates. Priced as of 28 November 2022.

**Figure 2: Global Semis NTM average P/E**



Source: Company data, UBS estimates. Priced as of 28 November 2022.

**Figure 3: Global Semis NTM average P/BV**



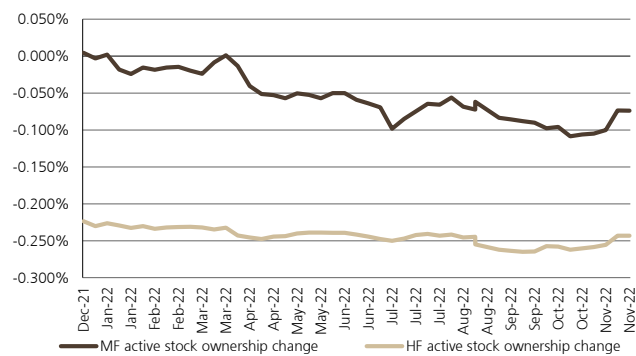
Source: Company data, UBS estimates. Priced as of 28 November 2022.

Figure 4: UBS Global Semis Valuation

					EV/Sales		EV/EBITDA		PE		PB	
Semiconductors	Rating	Mkt Cap (US\$m)	Price	Price Target	23E	24E	23E	24E	23E	24E	23E	24E
Analog/Diversified												
Analog Devices	Buy	84,357	US\$ 164.01	US\$ 195	7.1	7.2	10.5	10.7	16.2	17.1	2.36	2.41
GigaDevice	Sell	9,083	Rmb 98.06	Rmb 77.5	7.3	6.3	32.0	24.3	36.1	30.7	4.00	3.67
Infineon	Buy	41,236	€ 29.61	€ 44	2.8	2.6	9.0	8.3	15.4	14.4	2.62	2.35
Maxscend Microelectronics	Neutral	8,462	€ 114.18	€ 95.5	12.8	10.1	31.5	24.3	36.4	29.9	5.92	5.02
Melexis	Sell	3,474	€ 83.2	€ 67	4.1	3.8	13.4	13.1	19.5	19.6	7.41	6.72
Microchip Technology	Buy	40,709	US\$ 74.34	US\$ 90	5.6	5.5	9.5	9.4	12.3	12.5	6.11	5.44
Nordic semiconductor ASA	Neutral	3,379	NKr 176.85	NKr 147	3.2	2.8	16.0	12.8	30.2	24.4	4.89	4.07
NXP Semiconductor	Sell	43,024	US\$ 164.1	US\$ 160	3.5	3.1	7.9	7.3	12.0	10.7	5.32	4.59
Onsemi	Neutral (CBE)	30,315	US\$ 69.96	US\$ 65	3.8	3.4	10.0	8.6	15.1	13.4	4.03	3.35
Qorvo	Neutral	10,589	US\$ 94.21	US\$ 90	3.2	3.1	18.8	14.6	15.2	12.5	2.34	2.24
Renesas Electronics	Buy	17,819	¥ 1370	¥ 3300	1.6	1.3	3.7	2.9	6.0	5.6	1.37	1.16
Rohm	Buy	7,996	¥ 11210	¥ 14000	1.4	1.3	4.8	4.2	16.5	14.4	1.15	1.09
Silerqy	Buy	5,855	¥ 478.5	¥ 655	5.3	4.2	17.8	13.2	20.3	14.9	4.29	3.50
Skyworks	Neutral	14,662	US\$ 91.24	US\$ 110	2.6	2.4	5.3	4.9	9.1	8.0	2.13	1.84
STMicroelectronics	Neutral	34,481	€ 37.69	€ 36.5	2.0	1.9	5.4	6.1	12.0	14.1	2.36	2.04
Texas Instruments	Neutral	159,679	US\$ 173	US\$ 165	9.1	8.5	16.7	14.8	23.6	21.7	9.26	8.12
Average					4.7	4.2	13.3	11.2	18.5	16.5	4.10	3.60
Logic												
Advanced Micro Dev	Buy (CBE)	118,714	US\$ 73.19	US\$ 95	4.4	3.8	20.5	15.6	18.3	14.4	2.15	2.05
Broadcom	Buy	210,878	US\$ 522.21	US\$ 690	6.7	7.2	9.1	10.0	12.1	13.2	8.94	9.70
Intel	Neutral	116,652	US\$ 28.725	US\$ 29	2.0	1.9	5.2	4.2	14.5	10.0	1.20	1.19
Marvell Technology	Buy	36,291	US\$ 42.67	US\$ 80	6.5	5.6	NM	NM	17.9	14.1	2.32	2.33
MediaTek	Buy	36,276	NT\$ 703	NT\$ 815	1.6	1.5	6.5	5.7	11.2	9.5	2.66	2.58
NVIDIA	Buy	393,934	US\$ 158.27	US\$ 200	14.1	13.7	36.1	29.9	47.2	35.8	19.73	20.07
Qualcomm Inc.	Neutral	134,124	US\$ 119.54	US\$ 155	3.3	3.1	8.2	7.6	10.7	9.5	5.38	4.11
Average*					4.1	3.8	7.2	6.8	12.1	10.5	6.05	6.00
Memory												
Micron Technology	Buy	61,500	US\$ 55.75	US\$ 75	2.9	1.6	8.7	3.6	NA	7.7	1.31	1.20
Samsung Electronics	Buy	268,612	Won 60100	Won 80000	1.1	1.0	3.5	2.8	9.7	7.5	1.52	1.32
SK Hynix	Buy	45,293	Won 83100	Won 135000	1.7	1.3	3.0	2.2	5.6	3.5	1.26	0.95
Western Digital	Neutral	11,194	US\$ 36.11	US\$ 38	1.0	0.8	9.4	4.1	NA	6.6	0.93	0.82
Average					1.7	1.2	6.2	3.2	7.7	6.3	1.25	1.07
Foundries												
Hua Hong Semicon	Sell	4,322	HK\$ 25.95	HK\$ 16	2.5	2.5	6.3	6.3	16.9	21.6	1.36	1.28
SMIC	Sell (CBE)	16,766	HK\$ 16.58	HK\$ 14	2.9	2.8	5.0	4.6	NM	NM	0.60	0.57
TSMC	Buy	402,107	NT\$ 480.5	NT\$ 745	4.4	3.6	6.5	5.2	12.2	10.4	3.37	2.72
UMC	Neutral	17,509	NT\$ 44.4	NT\$ 37	1.7	1.7	3.6	4.0	9.7	10.5	1.75	1.76
Vanquard	Sell	4,417	NT\$ 83.5	NT\$ 55	2.5	2.0	6.0	5.0	15.2	12.3	2.93	2.72
Win Semis	Neutral	2,183	NT\$ 159.5	NT\$ 120	3.7	3.2	9.7	8.0	25.9	22.1	1.93	1.84
Average					3.0	2.6	6.2	5.5	16.0	15.4	1.99	1.81
OSAT												
ASE	Neutral	13,460	NT\$ 94.6	NT\$ 88	0.7	0.6	3.5	3.3	9.1	8.9	1.31	1.23
Huatai Technology	Neutral	3,822	Rmb 8.59	Rmb 9.7	2.0	1.8	7.9	6.5	28.7	23.2	1.65	1.55
Inari	Buy	1,915	RM 2.71	RM 4.2	3.4	3.0	10.9	9.6	19.5	17.4	3.45	3.29
JCET Group	Buy	6,081	Rmb 24.61	Rmb 35	1.3	1.1	6.5	6.0	14.1	12.6	1.66	1.49
Average					1.8	1.6	7.2	6.4	17.8	15.5	2.02	1.89
Silicon Wafers												
GWC	Neutral	6,630	NT\$ 472	NT\$ 365	2.4	2.6	5.3	5.6	10.8	13.8	3.47	3.20
Shin-Etsu	Neutral	53,477	¥ 17660	¥ 16100	3.0	2.9	7.2	7.4	14.2	14.1	1.99	1.91
Siltronic	Neutral	2,417	€ 77.95	€ 71	1.3	1.2	3.9	3.4	6.8	10.6	0.86	0.79
SUMCO	Neutral	5,243	¥ 2060	¥ 1950	1.4	1.2	3.2	2.9	8.2	8.5	1.15	1.06
Soitec	Buy	5,561	¥ 155.1	¥ 211	3.6	2.8	10.5	7.8	18.7	14.3	3.40	2.72
Average					2.0	2.0	4.9	4.8	10.0	11.8	1.87	1.74
Semiscap												
AccoTEST	Neutral	3,301	Rmb 261.02	Rmb 272	17.2	12.7	30.0	23.0	38.2	29.7	6.87	5.91
ACM Research	Sell	4,870	Rmb 80.9	Rmb 78.5	9.0	6.9	40.8	30.4	46.8	37.1	5.68	4.95
AMEC	Neutral	8,374	Rmb 97.86	Rmb 110.5	8.9	7.0	33.9	23.4	40.4	31.9	3.58	3.24
Applied Materials	Neutral (CBE)	89,016	US\$ 103.47	US\$ 98	3.8	4.2	12.9	13.5	15.1	15.4	8.25	8.36
ASMPT	Buy	2,974	HK\$ 56.35	HK\$ 69	1.2	1.0	7.3	5.2	13.9	10.3	1.38	1.28
ASMI	Buy	12,529	€ 248.95	€ 370	4.8	4.3	15.8	12.4	23.8	20.8	4.08	3.62
ASML	Buy	233,646	€ 566.8	€ 660	9.8	8.0	29.0	21.1	34.6	24.4	29.43	26.04
BE Semiconductor	Buy	4,864	€ 60.66	€ 72	6.8	5.2	14.5	10.3	21.4	14.7	6.91	5.92
Changchuan Tech	Sell	4,978	Rmb 59.32	Rmb 50	9.7	7.4	43.1	32.7	51.2	39.2	13.07	10.45
Disco	Neutral	10,782	¥ 41100	¥ 32000	5.2	4.8	13.5	12.4	23.9	22.4	4.09	3.82
Entegris Inc	Neutral	9,838	US\$ 72.25	US\$ 80	4.0	3.7	10.7	10.0	21.5	18.8	3.21	3.17
Eugene Technology	Buy	433	Won 25250	Won 35000	1.8	1.0	15.3	4.4	36.6	8.1	1.62	1.35
KLA Corporation	Neutral	57,102	US\$ 374.93	US\$ 310	5.6	7.4	12.9	20.8	14.8	24.5	25.66	42.98
LAM Research	Buy	60,711	US\$ 443.23	US\$ 450	3.2	3.9	9.7	13.3	11.9	16.3	7.13	7.99
NAURA Technology	Sell	16,437	Rmb 224	Rmb 224	6.1	4.9	32.8	24.6	43.0	33.7	5.50	4.78
SCREEN Holdings	Neutral	3,118	¥ 9050	¥ 8000	0.6	0.4	3.5	2.5	11.3	10.2	1.27	1.16
Teradyne	Buy	14,145	US\$ 90.22	US\$ 100	4.2	3.0	14.8	8.7	19.9	10.9	6.07	5.51
Tokyo Electron	Neutral	51,372	¥ 45300	¥ 40000	3.5	3.1	11.9	10.4	20.2	18.1	4.11	3.69
Wonik IPS	Neutral	1,008	Won 27900	Won 26000	1.2	0.7	10.1	3.7	38.1	9.0	1.46	1.28
Average					5.6	4.7	19.1	14.9	27.7	20.8	7.34	7.66
Sector / Regional Avg												
US Semis					4.8	4.6	12.5	11.1	17.1	14.7	6.19	6.87
Europe Semis					4.3	3.6	13.1	10.6	20.3	17.5	6.88	6.03
Asia Semis					4.5	3.6	15.2	11.4	24.6	18.7	3.29	2.88
Japan Semis					2.4	2.1	6.8	6.1	14.3	13.3	2.16	1.99
GLOBAL SEMIS*					3.7	3.3	11.1	9.2	18.4	15.1	4.26	4.22

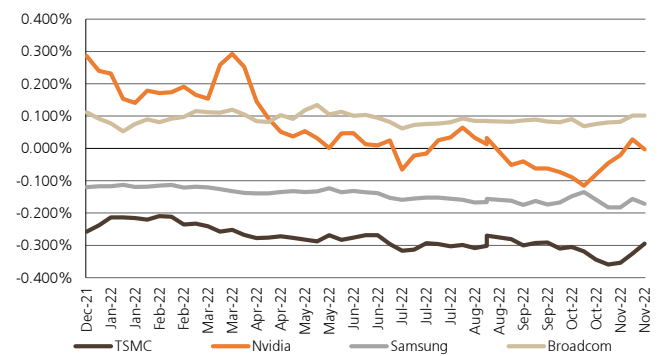
Source: UBS estimates. Priced as of 28 November 2022; \*Excluding AMD, Marvell, Nvidia, Qualcomm and A-shares.

**Figure 5: Mutual & hedge funds semis stock ownership change vs benchmark weight**



Source: UBS Quant Answers

**Figure 6: Mutual funds top 4 semis stock ownership change vs benchmark weight**



Source: UBS Quant Answers

## Semis stocks entering the Buy window, according to semis lead indicators

Since our last update in late August, global semis stocks initially retraced down further into October and have since almost recovered from the losses as of November - net net having found little overall support. Incrementally however, we have seen a continuous adjustment down of '23E earnings forecasts for global semis stocks, with SOX EPS consensus having been brought down another c. 13% since late August and now 24% from the peak. This hence leaves the group now trading at 18.4x NTM PE, in line with mid-cycle historical average. This may suggest that the semis stocks ease off slightly in the near term.

That said, this could be a short respite, as a look at key sector lead indicators **suggest we are now in the timeline where, all other things been equal, Semis should now be an Overweight.**

1/ Macro lead indicators including the PMI/Global Growth Surprise Index (Figures 13 & 14) have continued to trend down and are now at levels where we should soon be seeing support for semis stocks. Last September, the PMI fell below 50. Early cyclical sectors do tend to find more support once the 50 barrier is broken down, and typically before it finds an actual floor.

2/ We forecast both 3MMA semis industry revenues and 3MMA semis (ex-memory) industry revenues YoY growth (Figures 8 & 9) to trough by early 2Q23 (at -15% YoY for overall revenues). In a period of macroeconomic uncertainty, semis stocks have tended to trough 1-2 quarters ahead of that (suggesting 4Q22-1Q23).

3/ We continue to expect foundry capacity utilization rates (Figure 11) to trough in 1Q23 with respective stocks typically troughing c. 1-2 quarters ahead (suggesting 3Q-4Q22).

4/ Assembly equipment YoY revenues should decline about 36% YoY in 4Q22 (Figure 12), and possibly similar to slightly worse in 1Q23. This is likely to be at or close enough to a trough. The semis stocks typically correlate in the same timeline.

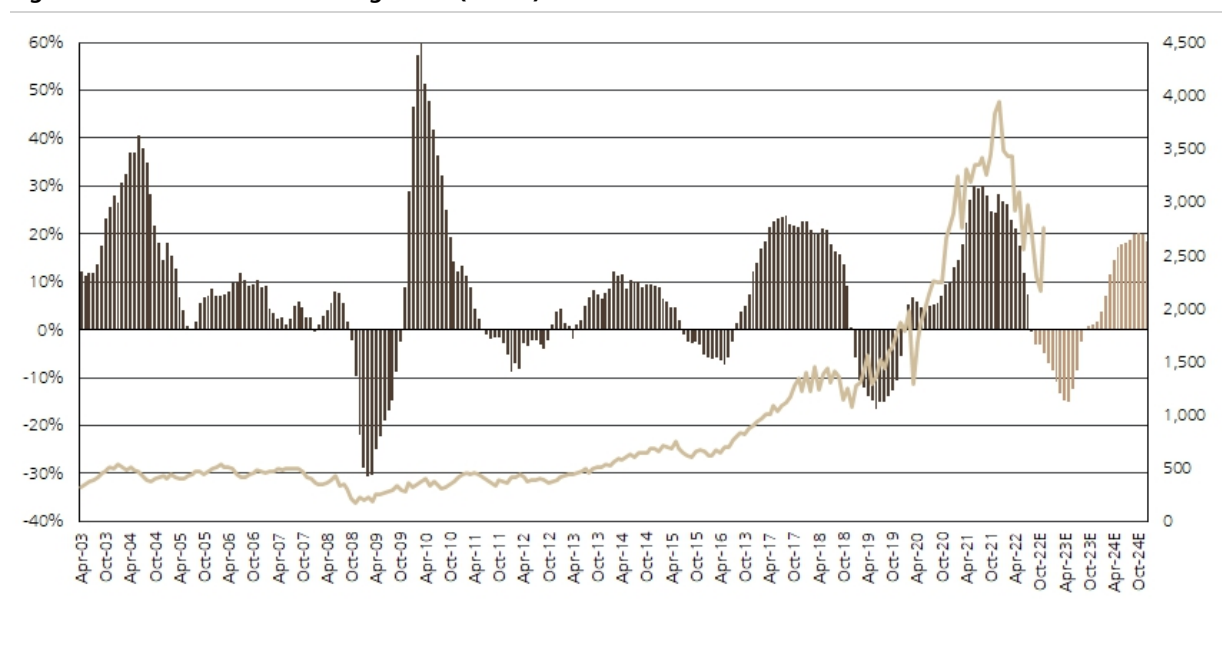
5/ Incremental from our last update in late August, we have seen forward earnings forecasts continue to be adjusted down (Figure 16) with consensus EPS forecasts discounted a further c. 13% since. The consensus earnings cuts are likely to continue til 1Q23. Semis stocks have historically troughed 2 earnings cut ahead of the last one, but given the rapid multiple compression this time, a case could be made that we could be seeing earlier support for stocks in the sector.

**Figure 7: Key indicators implied trough vs stock support timing**

Lead Indicator	Implied Trough	Stock Support Timing
3MMA semis industry YoY revs	Early 2Q23E	4Q22-1Q23E
Foundry capa utilization rates (%)	1Q23E	3Q22-4Q22E
Assembly equipment YoY revs (%)	1Q23E	1Q23E
PMI/Global growth surprise index		PMI below 50

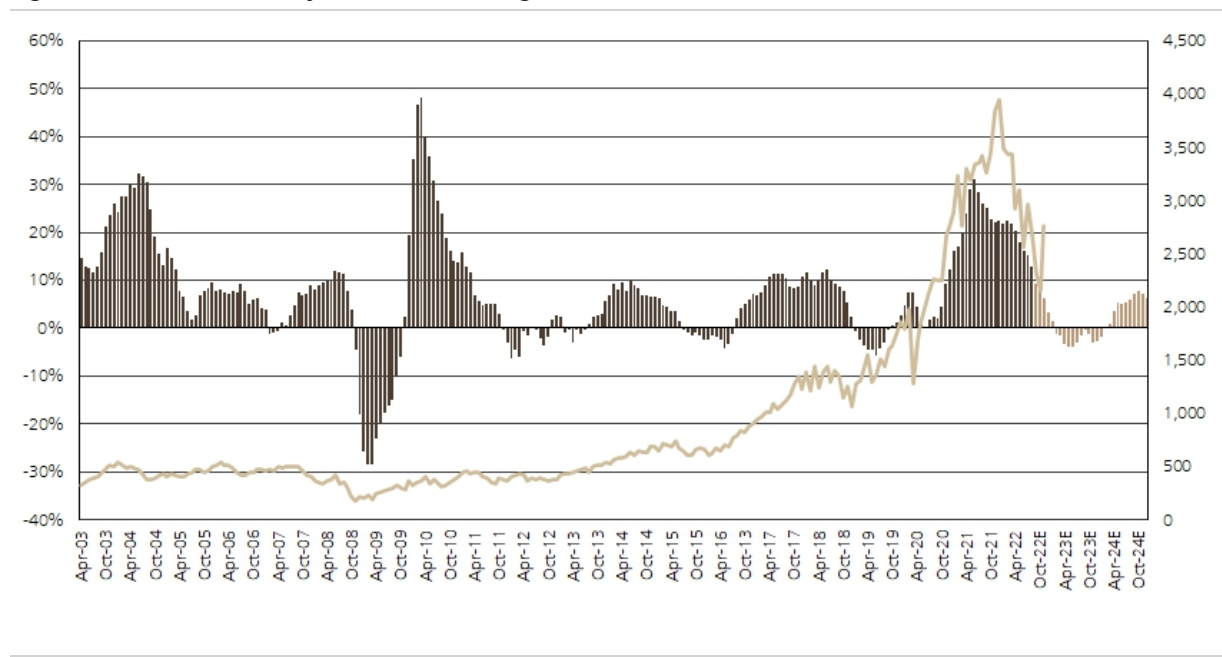
Source: Company data, UBS estimates

Figure 8: Semis YoY 3MMA revs growth (Sell In) vs. the semis SOX index



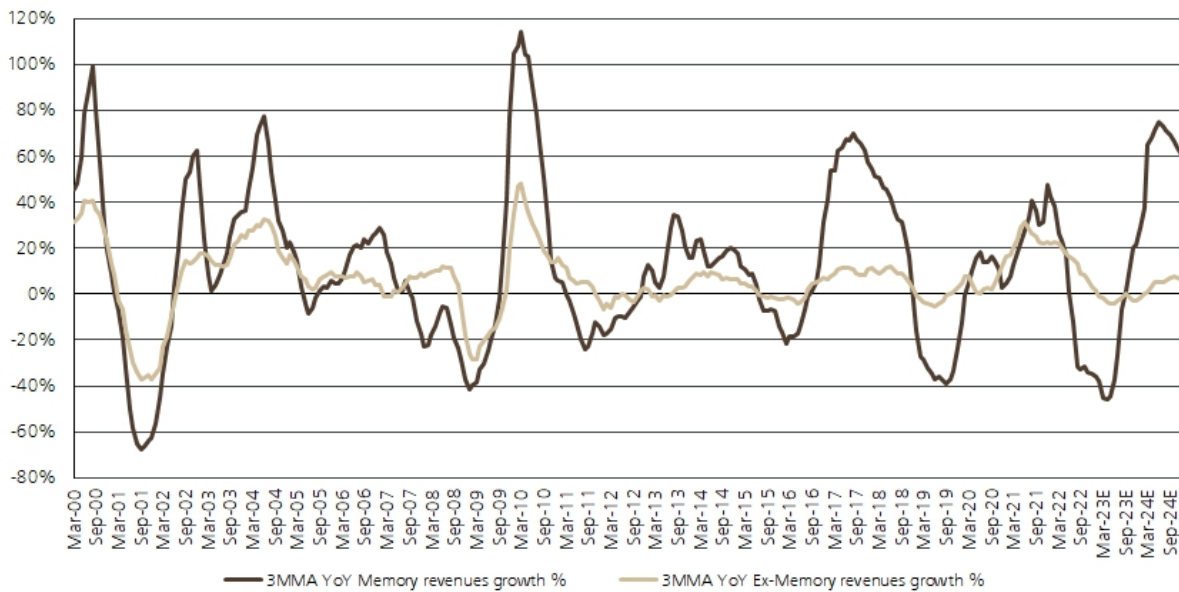
Source: SIA, Bloomberg, UBS estimates

Figure 9: Semis (ex-memory) YoY 3MMA revs growth (Sell In) vs. the semis SOX index



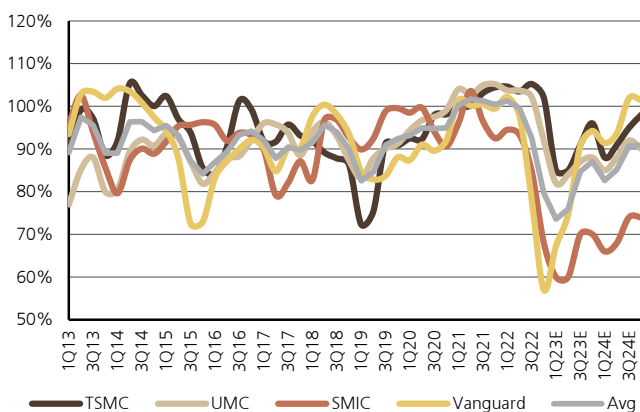
Source: SIA, Bloomberg, UBS estimates

**Figure 10: Memory YoY 3MMA revs growth vs. ex-memory semis YoY 3MMA revs growth**



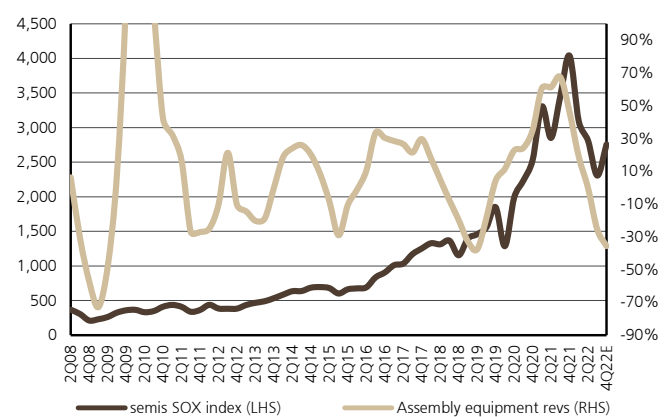
Source: SIA, UBS

**Figure 11: Foundry capacity utilisation rates (1Q13-3Q24E)**



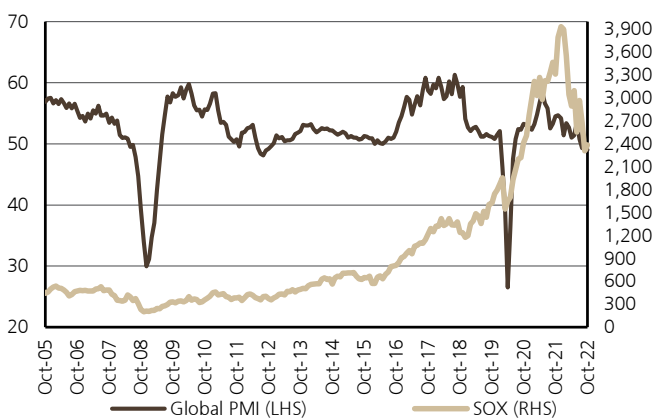
Source: Company data, SEMI, UBS estimates

**Figure 12: Assembly equipment revenues growth YoY (%) vs. semis SOX index**



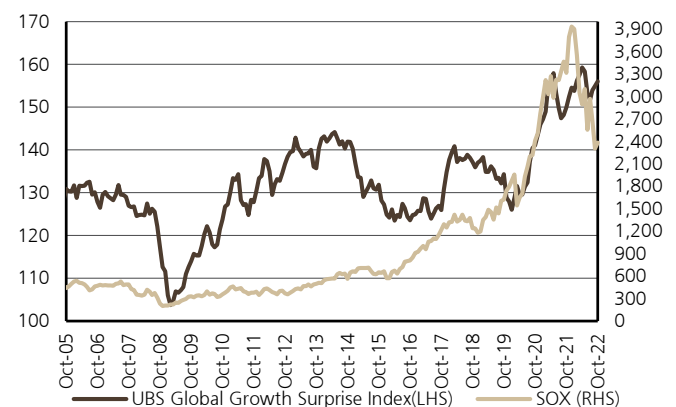
Source: Company data, Bloomberg, UBS estimates. \*Companies include KLIC, BE Semis, ASM Pacific Tech (excl SMT), Disco (Japan) and Towa (Japan).

**Figure 13: SOX vs. Global PMI**



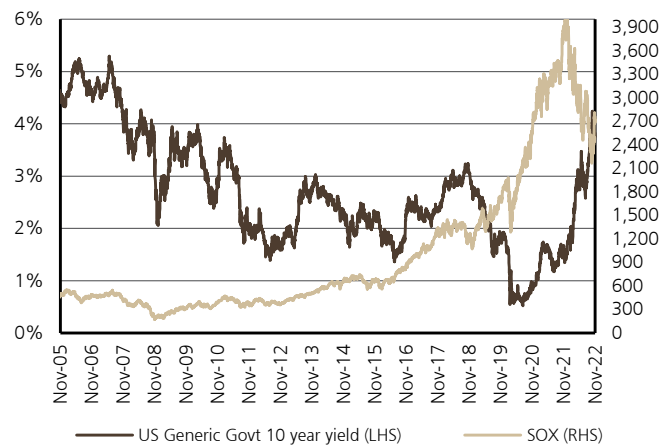
Source: Datastream, UBS estimates

**Figure 14: SOX vs. Global Growth Surprise Index**



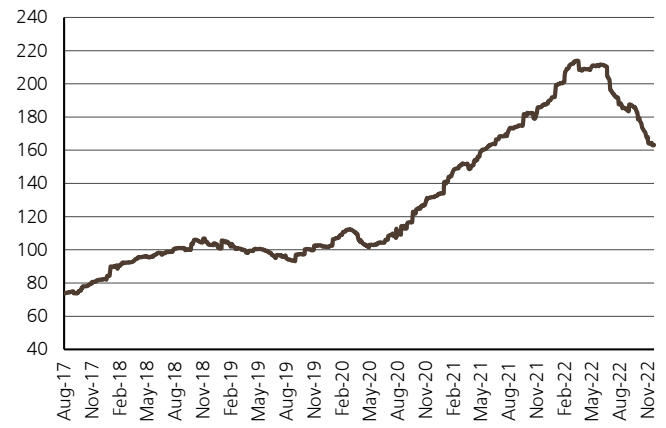
Source: Datastream, UBS estimates

**Figure 15: SOX vs. US 10-Y government bond yields**



Source: Bloomberg, UBS estimates

**Figure 16: SOX 2023E EPS consensus**



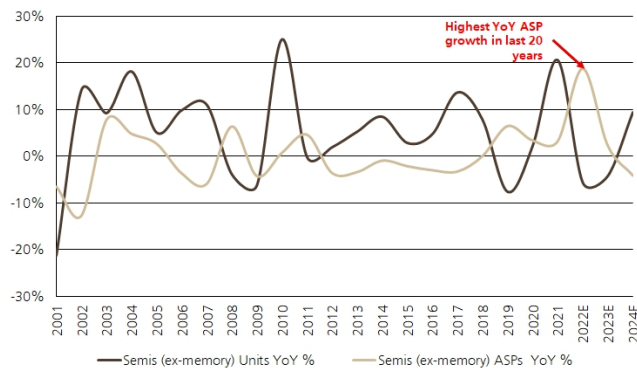
Source: Bloomberg



## Semis (ex-memory) ASP growth to normalize in '23

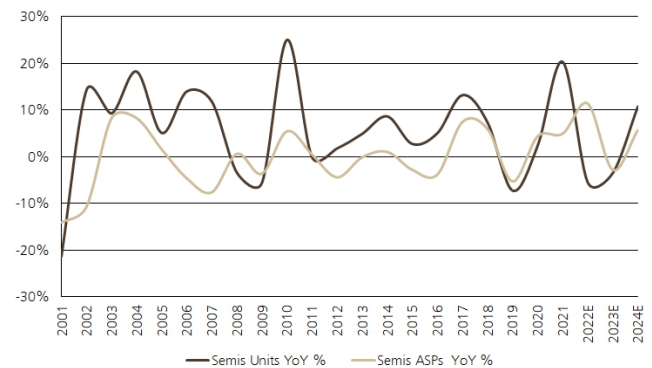
Semis (ex-memory) revenue growth year-to-date in '22 has primarily been supported by a strong pickup in ASP YoY growth (Figure 17) - in fact the highest level of YoY semis ASP growth recorded over the past 20 years at +19% YoY. This has overshadowed the trend that in contrast, semis (ex-memory) unit growth had most recently peaked in 2Q21 and **started to decelerate on the back of weaker end-demand and is now expected to continue before troughing by 3Q23**. Going forward, we expect the strong ASP support seen in '22 to largely normalize in '23 with QoQ ASP growth expected to decline and trough by 2Q23 before seeing some recovery into 2H23 (Figure 20). For FY '23, we forecast non-memory semis ASPs to only grow 2% YoY.

Figure 17: Semis (ex-memory) units & ASP YoY growth



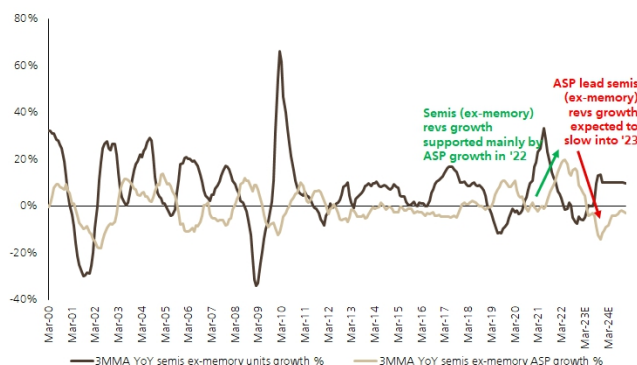
Source: SIA, UBS

Figure 18: Semis units & ASP YoY growth



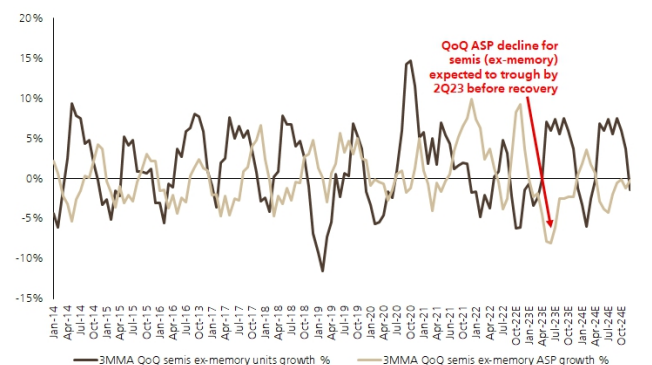
Source: SIA, UBS

Figure 19: Semis (ex-memory) units & ASP YoY 3MMA growth



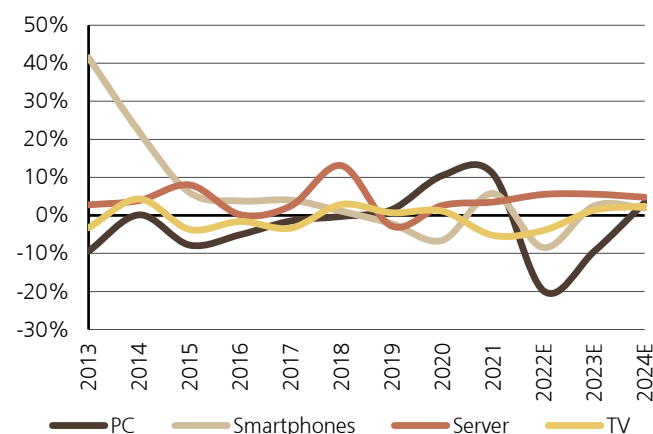
Source: SIA, UBS

Figure 20: Semis (ex-memory) units & ASP QoQ 3MMA growth



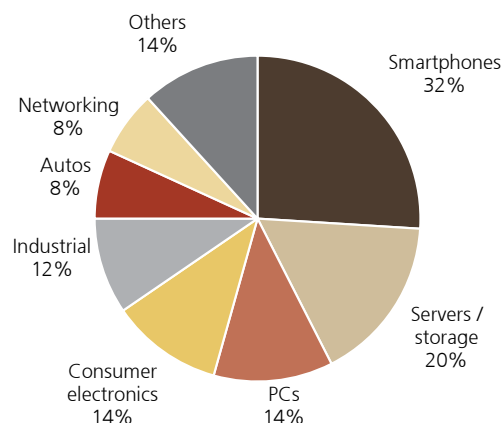
Source: SIA, UBS

**Figure 21: YoY shipment devices unit growth by application**



Source: UBS estimates

**Figure 22: Semis revs breakdown by application (2021)**



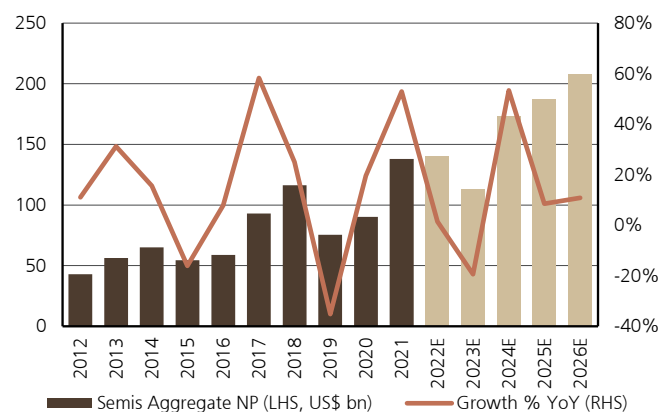
Source: Gartner

## Muted semis earnings growth outlook in '23 but re-acceleration in '24

Semis earnings have historically retained some cyclical and volatility, in part due to the memory cycle. This is evidenced by the fact that we now forecast 5-Y forward semis EPS CAGR to slow down to just 6.6% for '18-23E after having seen a 5-year period of accelerated longer-term growth. Even so on such occasions, it has also been followed with a sharp recovery in semis growth (forecast semis EPS CAGR of 20.1% for '19-24E) suggesting that through cycle, semis growth is set to continue to accelerate. We now forecast global semis EPS CAGR of 12.4% for '21-26E (was 12.0% back last August).

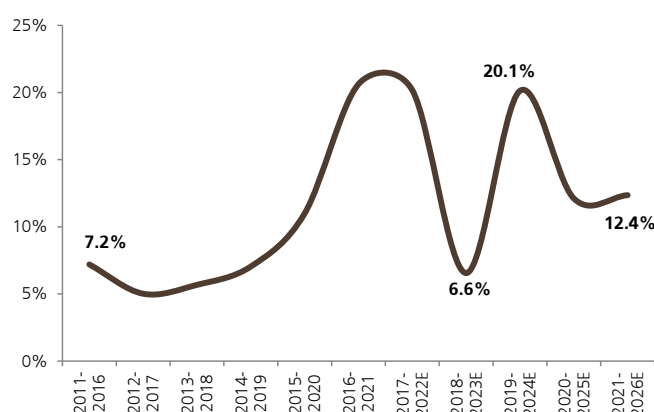
In addition, we now forecast YoY EPS growth to decelerate to a muted 1% in '22E (was +53% in '21) before turning negative to -19% YoY in '23E, marking the first time our forecasts have turned negative since the GFC. While the YoY decline largely reflects the likely environment of tepid demand, de-stocking, memory oversupply in 1H23 and normalised non-memory semis pricing, we forecast a strong recovery in '24E with YoY EPS growth expected to reaccelerate to 53%.

**Figure 23: Semis aggregate net profits % growth**



Source: Company data, UBS estimates (UBS research coverage)

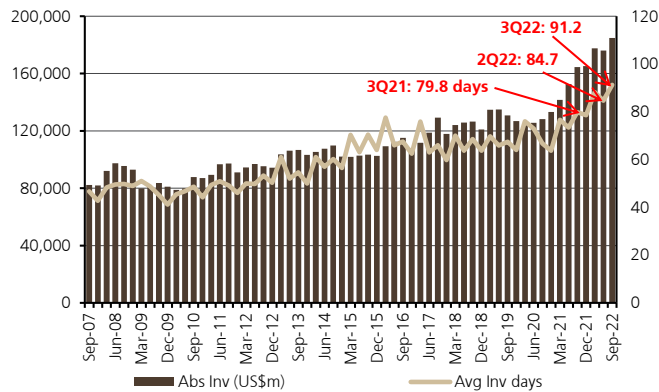
**Figure 24: 5-year forward semis EPS CAGR**



Source: UBS estimates, company data (UBS research coverage)

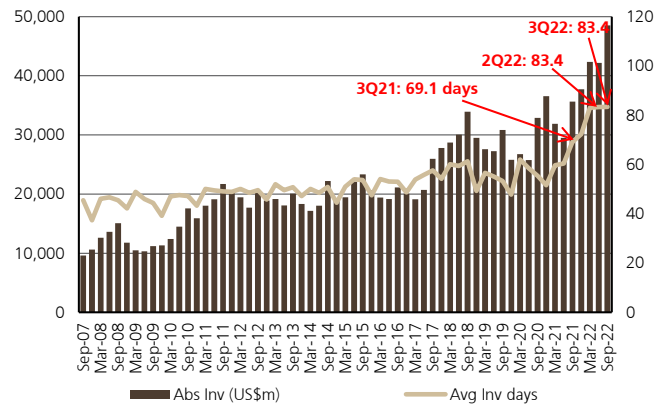
## Inventory Analysis

Figure 25: OEMs – Absolute inventory & Inventory days



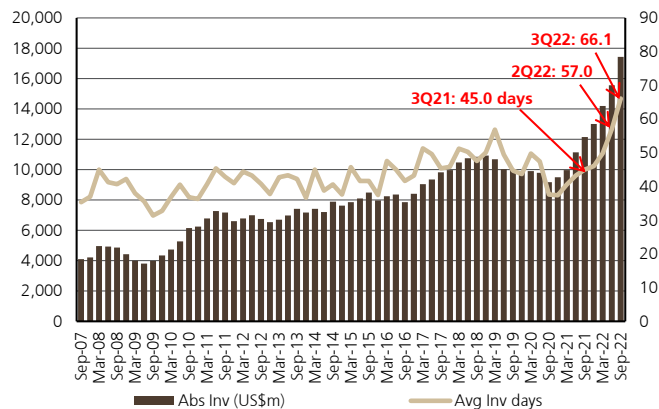
Source: Company data, UBS

Figure 26: EMS – Absolute inventory & Inventory days



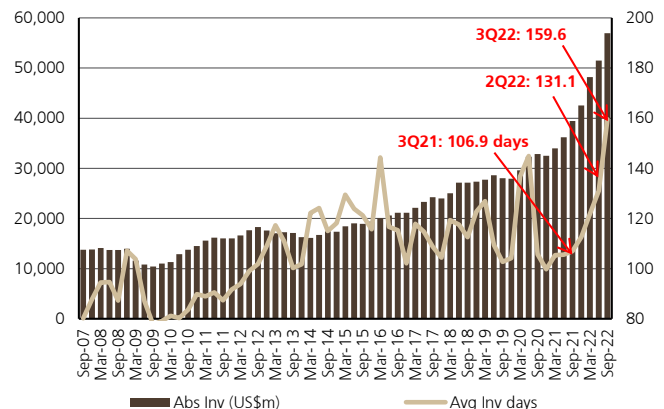
Source: Company data, UBS

Figure 27: Distributors – Absolute inventory & Inv. days



Source: Company data, UBS

Figure 28: Non Memory Semis – Abs. inv. & Inv. days



Source: Company data, UBS

## Downstream Inventories

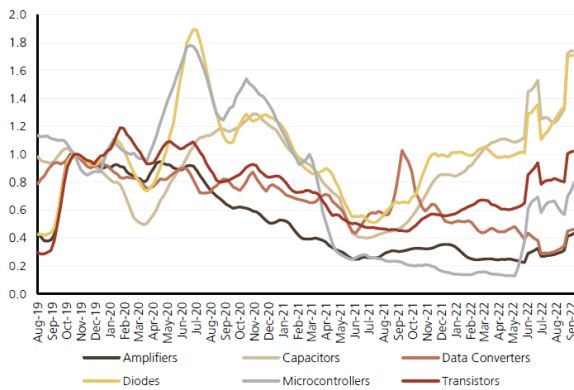
**OEM average inventory days continued to increase QoQ while also up YoY to 91.2 days on average (up 6.6 days QoQ and up 11.4 days YoY) trending much higher than the historical average of 67.0 days.** The QoQ and YoY increase was seen across OEM segments including Communication infra, Consumer electronics, Industrials, and Autos while Mobile Devices along with PCs/IT Hardware saw inventory days trend down QoQ but up YoY. Absolute inventory for OEMs on aggregate was up both 5.0% QoQ and 12.4% YoY.

- **Mobile Devices:** Apple's inventory days was down 1.9 days QoQ and 3.8 days YoY while Xiaomi saw a continued increase in inventory days, up both 0.4 days QoQ and 5.3 days YoY to 89.6 days even on the back of continuing inventory digestion.
- **Communication Infra:** Average inventory days for Communication Infra was up 10.4 days QoQ and 21.7 days YoY to 85.7 days with absolute inventory also up 14.2% QoQ and 34.2% YoY. Ericsson, Juniper, Nokia, VIAVI Solutions and ZTE all saw inventory days go up both QoQ and YoY while only Cisco had inventory days down QoQ but up YoY.
- **PCs and IT Hardware:** Average inventory days for PCs/IT Hardware was down 4.8 days QoQ while up 15.7 days YoY to 90.4 days, remaining at well elevated levels compared to historical average of 67.0 days. Absolute inventory was down 4.4% QoQ while up 6.4% YoY. Acer, Dell, Nidec and Seagate all had inventory days up

both QoQ and YoY. Only Inspur showed inventory days down both QoQ and YoY. Asustek, Gigabyte, HPQ, Lenovo and MSI all reported inventory days down QoQ whilst still up YoY. Positivo reported inventory days up QoQ while down YoY.

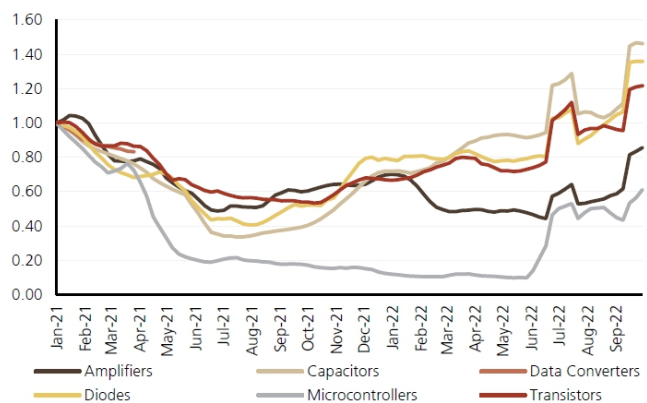
- Consumer Elec:** Inventory days for Consumer Elec OEMs was on aggregate up both QoQ and YoY on average to 47.9 days with absolute inventory also up 33.3% QoQ and 31.1% YoY. Nintendo and Sony both saw inventory days up QoQ and YoY with conversely LGE and Hisense recording inventory days slightly up QoQ but down YoY.
- Autos and Industrial:** Auto inventory days averaged 60.4 days, up 3.2 days QoQ and 1.9 days YoY. Aisin, Continental, Denso and Hyundai Mobis all saw inventory days increase both QoQ and YoY with inventory days for BorgWarner, Lear and Tenneco down both QoQ and YoY. Cummins saw inventory days down QoQ but up YoY while Magna had inventory days up QoQ but down YoY. Inventory days for Industrials on average was at 131.9 days, up 17.1 days QoQ and 12.6 days YoY. Emerson, Honeywell, Johnson Controls, Siemens and Suzhou Maxwell saw inventory days trend down QoQ while up YoY. Only General Electric had inventory days down both QoQ and YoY. Conversely, ABB, AVIC Jonhon, Estun Automation, Hongfa Tech, OPT Machine, Legrand and Zoomlion had inventory days up QoQ and YoY.

**Figure 29: Normalised semis components inventory trends at a distributor**



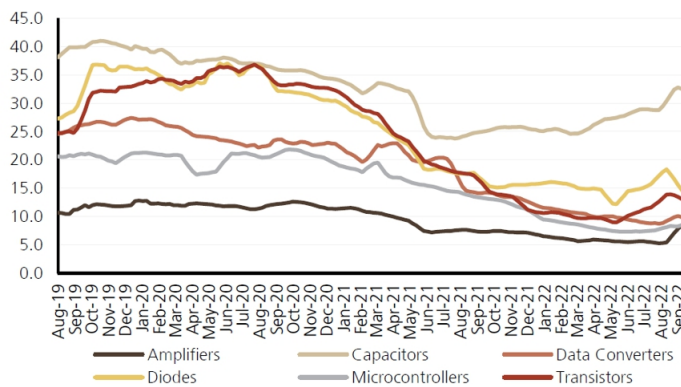
Source: UBS Evidence Lab ([Access Dataset](#))

**Figure 30: Recent semis components inventory trends at a distributor**



Source: UBS Evidence Lab ([Access Dataset](#))

**Figure 31: Semis component products in stock at a distributor (%)**



Source: UBS Evidence Lab ([Access Dataset](#))

## Upstream Inventories

**Average inventory days for non-memory semis saw a sharp pickup to 159.6 days (up 28.5 days QoQ whilst also up 52.6 days YoY), remaining well above historical average of 117.5 days.** Absolute inventory similarly was up 10.6% QoQ while also up 44.4% YoY.

- The pickup in inventory days both QoQ and YoY spanned most non-memory semis companies but was noticeably acute for Chinese non-memory semis companies. By companies, they were up QoQ and YoY for AMD, AMLogic, Cambricon, GigaDevice, Goodix, Guoxin Micro, Ingenic, Infineon, Intel, Lattice, Magnachip Semi, Maxscend, MediaTek, Microchip, Montage Tech, Novatek, NVIDIA, NXP, Qorvo, Qualcomm, Realtek, Renesas, Rockchip, Rohm, SG Micro, Silergy, 3Peak, Texas Instruments, Verisilicon and Will Semi.
- Overall, very few non-memory semis had inventory days trend down QoQ with only Diodes, Melexis, On Semis, and Skyworks seeing inventory days down QoQ but up YoY while Cirrus Logic and STM both had inventory days down QoQ and YoY.

## Semis revenues vs. end consumption

**Figure 32: Semis Sell-Through vs. OEM revenues**

	2019	2020	2021	1Q22	2Q22	3Q22E	4Q22E	2022E	1Q23E	2Q23E	3Q23E	4Q23E	2023E	2024E
<b>Semis revenues (Sell Through)</b>	<b>356.6</b>	<b>379.8</b>	<b>476.9</b>	<b>131.6</b>	<b>135.6</b>	<b>126.3</b>	<b>119.7</b>	<b>513.2</b>	<b>116.0</b>	<b>121.8</b>	<b>132.6</b>	<b>139.8</b>	<b>510.1</b>	<b>595.7</b>
% of total semis industry revs	86.5%	86.5%	85.8%	86.7%	90.1%	89.6%	84.3%	87.7%	88.1%	92.5%	93.8%	96.8%	92.9%	92.6%
%QoQ				0.6%	3.0%	-6.9%	-5.2%		-3.1%	5.0%	8.8%	5.5%		
%YoY	-13.9%	6.5%	25.6%	24.0%	17.9%	1.0%	-8.5%	7.6%	-11.8%	-10.2%	5.0%	16.8%	-0.6%	16.8%
<b>Semis revs ex memory (Sell Through)</b>	<b>245.2</b>	<b>269.0</b>	<b>336.3</b>	<b>94.9</b>	<b>96.0</b>	<b>95.8</b>	<b>92.8</b>	<b>379.4</b>	<b>91.1</b>	<b>94.1</b>	<b>99.9</b>	<b>103.7</b>	<b>388.8</b>	<b>414.1</b>
%QoQ				1.9%	1.1%	-0.2%	-3.1%		-1.8%	3.3%	6.1%	3.8%		
%YoY	-1.5%	9.7%	25.0%	23.3%	19.5%	11.5%	-0.3%	12.8%	-3.9%	-1.9%	4.3%	11.8%	2.5%	6.5%
<b>OEM revenues</b>	<b>1902.1</b>	<b>1724.6</b>	<b>1910.9</b>	<b>491.6</b>	<b>476.7</b>	<b>495.1</b>	<b>547.4</b>	<b>2010.9</b>	<b>508.7</b>	<b>494.4</b>	<b>505.1</b>	<b>561.1</b>	<b>2069.4</b>	<b>2170.9</b>
%QoQ				-6.8%	-3.0%	3.9%	10.6%		-7.1%	-2.8%	2.2%	11.1%		
%YoY	0.8%	-9.3%	10.8%	5.5%	4.3%	7.8%	3.8%	5.2%	3.5%	3.7%	2.0%	2.5%	2.9%	4.9%

Source: Company data, UBS estimates. OEMs: 74 companies sample; Semis: 49 companies

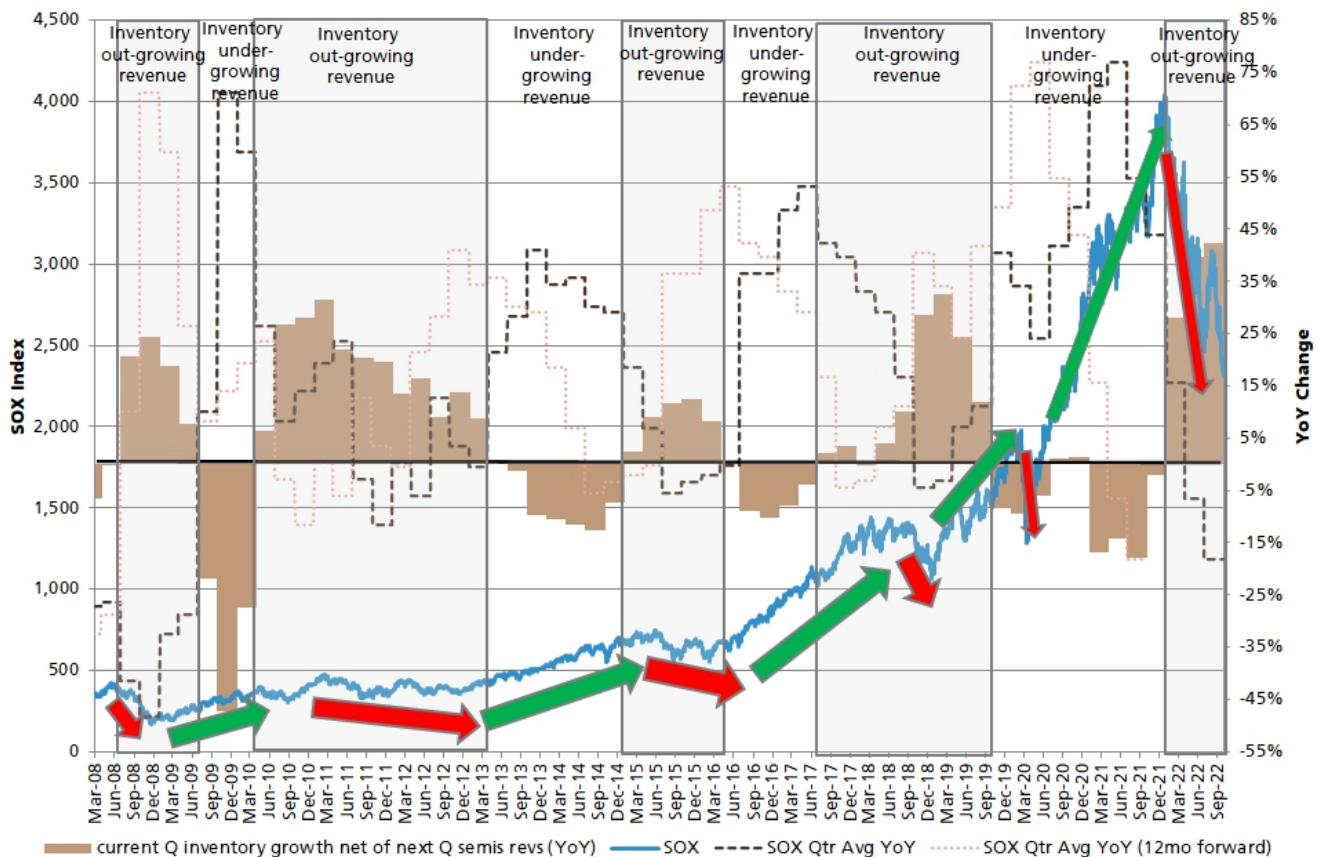
Our proprietary model comparing non-memory semis sell-through and OEM consumption now **indicates the over-shipment for semis (non-memory) vs OEM consumption to contract and reverse to -0.4% in 2023, with non-memory semis revenues expected to only grow 2.5% YoY with OEM revenues in contrast growing 2.9% YoY.** This comes on the back of our model suggesting a 7.6 pct pts over-shipment for 2022, with some of the delta having been ASP accretion now expected to weaken off into 2023. Beyond this, our model suggests both non-memory semis sell-through and OEM consumption will recover into 2024 with the over-shipment delta volatility narrowing down then to a more reasonable 1.6 pct pts.

## Net Inventory Growth

The analysis below compares Y/Y inventory growth to overall semiconductor revenue growth on a 1Q lag basis. In a perfect world, if the industry expected semiconductor revenue to grow, for example, 5% Y/Y into perpetuity, it would manage inventory growth to 5% Y/Y every Q. This, of course, is not the way the world works and instead it is these inventory cycles that create semiconductor cycles. Semiconductor stocks typically perform best when inventory is chasing demand – in other words, when inventory is growing more slowly than Y/Y revenue growth in the following Q. This is because this has very favourable implications up and down the P&L and cash flow in terms of improving leverage and factory capacity utilization.

Inventory has been chasing revenue growth essentially since Fall of 2019, but based on the inventory levels seen lately, we have been in a crossover period for the last several quarters where inventory has continued to OUTGROW forward revenue to a fairly substantial degree. A major buy signal has typically been when inventory growth peaks relative to forward revenue growth. Based on what companies have reported thus far for Sept/Oct-Q end, it is clear that this DELTA has peaked and it's most likely to compress from this point on as we have observed some inventory digestion taking place in certain pockets of the supply chain. In other words, this leading indicator is suggesting a positive green signal for semis stocks.

**Figure 33: Inventory Momentum Analysis**



Source: Company data, UBS estimates



## Semiconductor revenues forecasts

We now forecast overall semis industry (Sell In) revenues to decline -6.2% YoY to US \$549.2bn in '23E within which we expect non-memory semis revenue to decline -2.1% YoY to US\$441.4bn. For '23E, not only do we expect the strong YoY non-memory semis ASP growth that supported 2022 to largely normalize, we also expect the decline to be led by memory revenue declining -19.8% YoY. We roll out 2024 forecasts and forecast a +17.1% YoY rebound in semis (Sell In) revenues to US\$643.2bn in '24, primarily supported by a rebound in memory semis revenues expected to grow +67.1% YoY and non-memory semis revenue growth recovering to +4.9% YoY.

Figure 34: Changes to forecasts

(Unit: US\$bn)	New			Old		% change		
	2022E	2023E	2024E	2022E	2023E	2022E	2023E	2024E
<b>Semis revenues</b>	<b>585.2</b>	<b>549.2</b>	<b>643.2</b>	<b>594.4</b>	<b>586.2</b>	<b>-1.5%</b>	<b>-6.3%</b>	<b>NA</b>
YoY growth %	5.3%	-6.2%	17.1%	6.9%	-1.4%			
<b>Semis (ex-memory) revenues</b>	<b>450.8</b>	<b>441.4</b>	<b>463.0</b>	<b>459.1</b>	<b>474.4</b>	<b>-1.8%</b>	<b>-7.0%</b>	<b>NA</b>
YoY growth %	12.1%	-2.1%	4.9%	14.2%	3.3%			

Source: Company data, SIA, UBS estimates

Figure 35: Global Semis revenues forecasts by product segments (Sell-In basis)

Revenues (US\$bn)	2015	2016	2017	2018	2019	2020	2021	2022E	2023E	2024E
<b>MPU</b>	<b>43.3</b>	<b>43.1</b>	<b>44.4</b>	<b>46.9</b>	<b>48.0</b>	<b>51.8</b>	<b>57.8</b>	<b>48.5</b>	<b>49.2</b>	<b>51.2</b>
% YoY	-1.7%	-0.5%	3.1%	5.7%	2.3%	8.0%	11.5%	-16.0%	1.5%	4.0%
<b>MCU</b>	<b>15.5</b>	<b>16.3</b>	<b>16.4</b>	<b>17.1</b>	<b>15.8</b>	<b>15.5</b>	<b>19.6</b>	<b>23.5</b>	<b>23.1</b>	<b>24.7</b>
% YoY	1.1%	5.0%	1.1%	3.8%	-7.4%	-2.0%	26.7%	20.0%	-2.0%	7.0%
<b>DSP</b>	<b>2.6</b>	<b>2.9</b>	<b>3.3</b>	<b>3.3</b>	<b>2.7</b>	<b>2.4</b>	<b>2.8</b>	<b>3.1</b>	<b>3.0</b>	<b>3.1</b>
% YoY	-6.5%	12.5%	14.5%	-0.6%	-18.6%	-10.4%	19.4%	10.0%	-5.0%	3.0%
<b>Analog</b>	<b>45.2</b>	<b>47.8</b>	<b>53.1</b>	<b>58.8</b>	<b>53.9</b>	<b>55.7</b>	<b>74.1</b>	<b>86.7</b>	<b>83.2</b>	<b>87.0</b>
% YoY	1.9%	5.8%	10.9%	10.8%	-8.3%	3.3%	33.1%	17.0%	-4.0%	4.5%
<b>CMOS Logic</b>	<b>90.8</b>	<b>89.9</b>	<b>102.2</b>	<b>109.3</b>	<b>106.4</b>	<b>118.4</b>	<b>154.8</b>	<b>190.4</b>	<b>194.3</b>	<b>204.0</b>
% YoY	-1.0%	-0.9%	13.7%	6.9%	-2.7%	11.3%	30.8%	23.0%	2.0%	5.0%
<b>Memory</b>	<b>77.2</b>	<b>76.8</b>	<b>124.0</b>	<b>158.0</b>	<b>106.4</b>	<b>117.5</b>	<b>153.8</b>	<b>134.4</b>	<b>107.8</b>	<b>180.2</b>
% YoY	-2.6%	-0.6%	61.5%	27.4%	-32.6%	10.4%	30.9%	-12.6%	-19.8%	67.1%
<b>Total IC</b>	<b>274.5</b>	<b>276.6</b>	<b>343.3</b>	<b>393.3</b>	<b>333.2</b>	<b>361.2</b>	<b>463.0</b>	<b>486.8</b>	<b>460.6</b>	<b>550.1</b>
% YoY	-0.9%	0.8%	24.1%	14.5%	-15.3%	8.4%	28.2%	5.1%	-5.4%	19.4%
<b>Discrete, Opto &amp; Passives</b>	<b>60.7</b>	<b>62.2</b>	<b>68.7</b>	<b>75.5</b>	<b>78.9</b>	<b>79.2</b>	<b>92.9</b>	<b>98.5</b>	<b>88.6</b>	<b>93.0</b>
% YoY	3.7%	2.5%	10.5%	9.8%	4.6%	0.3%	17.3%	6.0%	-10.0%	5.0%
<b>Total Semiconductors</b>	<b>335.2</b>	<b>338.8</b>	<b>412.1</b>	<b>468.8</b>	<b>412.1</b>	<b>440.4</b>	<b>555.9</b>	<b>585.2</b>	<b>549.2</b>	<b>643.2</b>
% YoY	-0.1%	1.1%	21.6%	13.8%	-12.1%	6.9%	26.2%	5.3%	-6.2%	17.1%
<b>Semis ex memory</b>	<b>258.0</b>	<b>262.1</b>	<b>288.1</b>	<b>310.8</b>	<b>305.7</b>	<b>322.9</b>	<b>402.1</b>	<b>450.8</b>	<b>441.4</b>	<b>463.0</b>
% YoY	0.6%	1.6%	9.9%	7.9%	-1.7%	5.6%	24.5%	12.1%	-2.1%	4.9%
<b>Semis ex memory ex CPU</b>	<b>214.7</b>	<b>219.0</b>	<b>243.7</b>	<b>263.9</b>	<b>257.7</b>	<b>271.1</b>	<b>344.3</b>	<b>402.3</b>	<b>392.2</b>	<b>411.8</b>
% YoY	1.1%	2.0%	11.3%	8.3%	-2.4%	5.2%	27.0%	16.8%	-2.5%	5.0%

Source: Company data, SIA, UBS estimates

## Appendix: Industry Inventories

Figure 36: Inventory days – OEMs

	Sep-20	Dec-20	Mar-21	Jun-21	Sep-21	Dec-21	Mar-22	Jun-22	Sep-22
<b>Mobile Devices</b>									
Apple	9.3	6.8	9.2	10.2	12.5	7.7	9.1	10.5	8.7
Xiaomi	51.5	64.3	72.8	72.3	84.3	69.1	84.5	89.2	89.6
<b>Mobile Devices. - Average</b>	<b>30.4</b>	<b>35.5</b>	<b>41.0</b>	<b>41.3</b>	<b>48.4</b>	<b>38.4</b>	<b>46.8</b>	<b>49.9</b>	<b>49.1</b>
<b>Communication Infra</b>									
Cisco	27.3	31.4	31.2	29.8	34.5	40.2	43.2	46.4	46.0
Ericsson	91.5	62.0	100.8	92.9	101.9	78.0	118.6	116.4	142.4
Juniper	33.4	31.7	51.6	39.4	41.0	45.2	55.8	62.6	75.6
Nokia	87.8	66.1	79.4	71.2	69.4	56.8	75.9	76.2	83.9
VIAVI Solutions	69.1	67.1	68.0	67.8	73.3	84.0	80.9	74.8	80.5
ZTE	212.9	185.5	220.1	224.2	215.1	190.1	262.5	220.5	246.8
<b>Comm Infra - Average</b>	<b>61.8</b>	<b>51.7</b>	<b>66.2</b>	<b>60.2</b>	<b>64.0</b>	<b>60.8</b>	<b>74.9</b>	<b>75.3</b>	<b>85.7</b>
<b>PCs/IT Hardware/HDDs</b>									
Acer	48.0	53.7	73.6	77.8	76.1	71.7	83.8	89.1	100.6
Asustek	79.4	88.5	116.1	127.4	140.7	128.8	166.6	178.8	147.8
Dell Technologies	19.2	17.3	20.2	21.3	24.4	24.1	28.2	25.7	29.6
Gigabyte	71.6	72.1	85.9	89.1	87.1	106.0	121.8	138.7	109.1
HPQ	43.3	49.3	55.0	62.6	54.0	60.3	62.0	63.5	57.4
HPE	48.8	56.0	64.6	79.7	83.4	105.2	107.0	111.4	
Inspur	92.2	64.7	101.5	78.2	115.7	109.1	132.9	129.3	105.7
Lenovo	39.0	36.5	45.0	50.6	53.6	45.9	54.8	57.4	54.0
MSI	46.5	41.1	53.0	50.1	51.9	63.2	83.9	85.0	78.7
Nidec	76.2	75.0	84.7	89.0	93.3	94.0	101.3	108.1	126.6
Positivo	150.9	86.6	174.4	205.6	257.8	212.1	212.5	108.5	188.7
Seagate	70.3	62.4	58.7	51.6	50.2	54.2	67.6	76.4	94.4
<b>PC - OEM Average</b>	<b>58.6</b>	<b>56.1</b>	<b>69.4</b>	<b>69.8</b>	<b>74.7</b>	<b>75.7</b>	<b>90.3</b>	<b>95.2</b>	<b>90.4</b>
<b>Consumer Elec</b>									
Hisense	28.8	38.6	50.6	44.6	42.8	53.4	49.2	39.1	40.8
LG Elec	20.2	17.7	20.9	22.5	24.1	20.3	22.8	22.7	23.6
Nintendo	67.6	25.0	54.1	111.6	203.5	45.0	114.2	181.8	224.9
Skyworth	130.7	171.9	150.0	120.5	109.6	128.7	151.2	123.5	
Sony	42.2	28.6	35.6	42.7	46.1	31.6	47.6	59.4	79.3
TCL Electronics	47.2	50.1	60.6	89.4	75.0				
<b>CE - OEM Average</b>	<b>39.7</b>	<b>27.5</b>	<b>40.3</b>	<b>55.4</b>	<b>79.1</b>	<b>37.6</b>	<b>58.5</b>	<b>75.7</b>	<b>92.1</b>
<b>Autos</b>									
Aisin	40.8	36.5	42.4	43.0	54.3	51.9	55.7	58.7	67.9
BorgWarner	36.9	37.2	38.9	47.7	54.4	46.2	48.0	49.5	46.5
Continental	52.9	46.6	60.4	67.2	72.0	63.3	70.4	75.9	83.9
Cummins	84.0	69.9	74.4	80.3	86.6	87.7	86.2	89.5	88.9
Denso	53.8	51.4	58.6	63.1	78.0	69.2	72.9	78.9	89.8
Hyundai Mobis	33.0	30.4	36.4	37.8	40.4	36.8	42.2	40.7	50.3
Lear	25.9	26.7	27.5	33.3	39.9	31.1	30.7	31.1	29.9
Magna	41.7	35.9	38.4	47.2	55.0	46.3	46.3	44.9	46.1
Tenneco	42.4	40.2	41.1	44.1	45.7	43.7	45.5	45.4	40.5
<b>Auto - Average</b>	<b>45.7</b>	<b>41.6</b>	<b>46.5</b>	<b>51.5</b>	<b>58.5</b>	<b>52.9</b>	<b>55.3</b>	<b>57.2</b>	<b>60.4</b>
<b>Industrials</b>									
ABB	89.2	82.6	88.4	86.8	94.0	86.7	104.7	102.9	108.5
AVIC Jonhon	115.6	154.8	142.6	159.6	188.5	220.8	191.6	169.5	195.5
Emerson	65.7	75.3	71.6	71.1	63.4	80.4	77.1	72.8	65.7
Estun Automation	196.2	150.8	158.8	112.2	159.4	153.5	148.3	155.9	173.1
General Electric	83.1	83.3	112.7	108.2	114.3	96.8	116.7	116.1	111.3
Guangzhou Haige Comms	294.0	138.7	345.0	206.5	282.4	149.3	300.5	175.9	223.7
Honeywell	81.1	68.5	73.6	71.8	78.9	79.0	88.0	84.2	83.9
Hongfa Technology	101.0	84.9	92.6	92.9	116.3	141.4	115.6	113.2	132.6
Johnson Controls	40.7	48.3	49.8	45.4	44.7	55.7	55.4	53.2	51.7
Legrand	95.3	101.0	106.2	105.7	119.2	122.6	123.5	125.0	134.7
OPT Machine	127.3	150.3	165.0	192.3	144.8	187.4	211.1	151.0	163.2
Shenzhen Yinghe Technology	164.1	149.2	332.9	216.8	199.1	147.6	213.7	103.8	190.9
Siemens	70.5	80.7	78.9	81.9	72.4	84.3	81.7	83.3	81.3
Suzhou Maxwell	391.2	423.0	597.4	734.8	441.2	465.8	602.0	589.3	514.0
Zoomlion	113.7	94.5	112.0	85.9	155.3	124.9	186.7	160.9	222.1
<b>Industrials - Avg</b>	<b>91.8</b>	<b>92.4</b>	<b>117.2</b>	<b>107.3</b>	<b>104.7</b>	<b>108.2</b>	<b>118.7</b>	<b>100.5</b>	<b>112.4</b>
<b>OEM AVERAGE</b>	<b>66.7</b>	<b>63.7</b>	<b>76.6</b>	<b>73.5</b>	<b>79.8</b>	<b>78.6</b>	<b>88.2</b>	<b>84.7</b>	<b>91.2</b>
<b>OEM Avg. ex Auto, Indust.</b>	<b>52.3</b>	<b>48.7</b>	<b>60.7</b>	<b>59.6</b>	<b>63.8</b>	<b>62.2</b>	<b>74.5</b>	<b>77.5</b>	<b>78.7</b>

Source: Company data, UBS. \*Note: Average calculations only inclusive of companies that have reported 3Q22 earnings.



**Figure 37: Absolute Inventories – OEMs**

(USD mn)	Sep-20	Dec-20	Mar-21	Jun-21	Sep-21	Dec-21	Mar-22	Jun-22	Sep-22
<b>Mobile Devices</b>									
Apple	4,061	4,973	5,219	5,178	6,580	5,876	5,460	5,433	4,946
Xiaomi	5,057	6,391	7,645	8,793	8,992	8,200	8,738	8,628	8,104
<b>Agg. - Mobile Devices</b>	<b>9,118</b>	<b>11,364</b>	<b>12,864</b>	<b>13,971</b>	<b>15,572</b>	<b>14,076</b>	<b>14,198</b>	<b>14,061</b>	<b>13,050</b>
QoQ%	-3.6%	24.6%	13.2%	8.6%	11.5%	-9.6%	0.9%	-1.0%	-7.2%
YoY%	16.2%	30.3%	56.5%	47.7%	70.8%	23.9%	10.4%	0.6%	-16.2%
<b>Communication Infra</b>									
Cisco	1,303	1,436	1,579	1,559	1,832	2,059	2,231	2,568	2,664
Ericsson	3,698	3,426	3,596	3,624	4,026	3,969	4,693	4,681	5,608
Juniper	176	176	259	212	223	272	317	395	520
Nokia	3,192	2,772	2,730	2,392	2,428	2,392	2,636	2,910	3,434
VIAVI Solutions	87	88	91	95	103	114	114	110	111
ZTE	5,687	5,167	5,260	5,359	5,784	5,684	6,423	6,247	6,980
<b>Agg. - Infra OEMs</b>	<b>14,143</b>	<b>13,065</b>	<b>13,515</b>	<b>13,240</b>	<b>14,396</b>	<b>14,490</b>	<b>16,414</b>	<b>16,911</b>	<b>19,316</b>
QoQ%	7.3%	-7.6%	3.4%	-2.0%	8.7%	0.7%	13.3%	3.0%	14.2%
YoY%	4.1%	9.5%	14.1%	0.5%	1.8%	10.9%	21.5%	27.7%	34.2%
<b>PCs/IT Hardware/HDDs</b>									
Acer	1,282	1,519	1,787	2,098	2,097	2,109	2,284	2,133	2,023
Asustek	2,912	3,438	4,032	4,626	5,726	6,012	7,310	7,305	6,448
Dell Technologies	3,393	3,402	3,828	4,223	5,442	5,898	6,277	5,883	6,172
Gigabyte	507	538	710	797	804	955	1,181	1,007	797
HPQ (HP Inc)	5,963	6,668	7,502	8,165	7,930	9,018	8,944	8,192	7,595
HPE	2,674	2,791	3,117	3,942	4,511	5,321	5,322	5,554	
Inspur	1,978	1,678	1,731	1,902	2,989	3,506	3,479	3,258	2,583
Lenovo	5,243	5,785	6,381	7,825	8,727	8,441	8,301	8,868	8,418
MSI	489	508	530	559	604	788	952	1,071	1,157
Nidec	2,529	2,647	2,798	3,063	3,361	3,636	4,080	3,939	4,514
Positivo	124	124	150	198	269	303	359	316	321
Seagate	1,323	1,318	1,281	1,204	1,188	1,287	1,479	1,565	1,606
<b>Agg. - PC OEMs</b>	<b>25,742</b>	<b>27,626</b>	<b>30,730</b>	<b>34,660</b>	<b>39,137</b>	<b>41,954</b>	<b>44,647</b>	<b>43,538</b>	<b>41,634</b>
QoQ%	3.7%	7.3%	11.2%	12.8%	12.9%	7.2%	6.4%	-2.5%	-4.4%
YoY%	15.2%	25.6%	21.6%	39.6%	52.0%	51.9%	45.3%	25.6%	6.4%
<b>Consumer Elec</b>									
Hisense	473	659	935	972	989	1,320	1,251	1,036	906
LG Elec	1,418	1,437	1,543	1,607	1,921	1,882	1,971	1,869	2,162
Nintendo	1,319	796	819	1,434	2,453	1,490	1,821	1,887	2,427
Skyworth	1,537	2,003	2,468	2,561	2,475	2,682	2,888	2,743	
Sony	6,423	5,863	6,012	6,925	7,703	6,938	7,796	8,057	11,639
TCL Electronics	1,120	1,120	1,292	1,802	1,743	1,740			
<b>Agg. - CE OEMs</b>	<b>9,633</b>	<b>8,755</b>	<b>9,309</b>	<b>10,937</b>	<b>13,067</b>	<b>11,630</b>	<b>12,840</b>	<b>12,850</b>	<b>17,135</b>
QoQ%	20.1%	-9.1%	6.3%	17.5%	19.5%	-11.0%	10.4%	0.1%	33.3%
YoY%	-2.4%	7.6%	16.3%	36.3%	35.6%	32.8%	37.9%	17.5%	31.1%
<b>Autos</b>									
Aisin	3,356	3,424	3,583	3,648	4,282	4,546	5,074	4,534	5,215
BorgWarner	815	1,286	1,361	1,567	1,649	1,534	1,644	1,653	1,658
Continental	5,148	5,232	4,996	5,480	5,808	5,740	6,472	6,600	7,663
Cummins	3,470	3,425	3,753	4,076	4,322	4,355	4,586	4,765	5,543
Denso	6,304	6,454	6,850	7,153	8,165	8,346	9,207	8,275	9,413
Hyundai Mobis	2,647	2,815	3,037	3,282	3,411	3,613	4,000	3,867	4,466
Lear	1,266	1,401	1,465	1,590	1,766	1,572	1,642	1,613	1,594
Magna	3,509	3,444	3,645	3,999	4,150	3,969	4,258	4,064	4,108
Tenneco	1,678	1,743	1,830	1,920	1,893	1,846	2,049	2,073	1,948
<b>Agg. - Autos OEMs</b>	<b>28,193</b>	<b>29,224</b>	<b>30,520</b>	<b>32,715</b>	<b>35,446</b>	<b>35,521</b>	<b>38,932</b>	<b>37,445</b>	<b>41,608</b>
QoQ%	-2.3%	3.7%	4.4%	7.2%	8.3%	0.2%	9.6%	-3.8%	11.1%
YoY%	-2.8%	4.9%	4.9%	13.4%	25.7%	21.5%	27.6%	14.5%	17.4%
<b>Industrial</b>									
ABB	4,642	4,469	4,475	4,700	4,864	4,880	5,372	5,595	5,849
AVIC Jonhon	318	428	473	559	639	740	781	766	825
Emerson	1,928	2,013	2,016	2,114	2,050	2,335	2,399	2,319	2,191
Estun Automation	116	98	111	118	130	133	137	146	157
General Electric	14,925	15,890	16,530	17,016	16,790	15,847	16,570	17,553	17,536
Guangzhou Haiqe Comms	285	286	328	330	335	299	311	275	291
Honeywell	4,705	4,489	4,607	4,723	4,967	5,138	5,472	5,576	5,501
Hongfa Technology	193	228	236	266	325	391	377	379	398
Johnson Controls	1,773	1,913	1,994	2,064	2,057	2,425	2,515	2,574	2,510
Legrand	959	1,034	1,085	988	1,125	1,252	1,345	1,460	1,550
OPT Machine	10	11	16	22	22	24	27	29	27
Shenzhen Yinghe Technology	110	131	222	331	391	390	470	420	468
Siemens	9,064	9,559	9,586	10,790	10,395	11,192	11,767	11,308	11,720
Suzhou Maxwell	271	322	390	456	432	439	509	546	629
Zoomlion	2,158	2,247	2,601	2,581	2,427	2,113	2,549	2,364	2,513
<b>Agg. Industrial*</b>	<b>41,457</b>	<b>43,118</b>	<b>44,669</b>	<b>47,058</b>	<b>46,948</b>	<b>47,599</b>	<b>50,601</b>	<b>51,309</b>	<b>52,165</b>
QoQ%	0.4%	4.0%	3.6%	5.3%	-0.2%	1.4%	6.3%	1.4%	1.7%
YoY%	-14.0%	-10.6%	6.7%	14.0%	13.2%	10.4%	13.3%	9.0%	11.1%
<b>AGGREGATE OEMs</b>	<b>128,287</b>	<b>133,153</b>	<b>141,607</b>	<b>152,581</b>	<b>164,566</b>	<b>165,270</b>	<b>177,631</b>	<b>176,113</b>	<b>184,907</b>
QoQ%	2.1%	3.8%	6.3%	7.7%	7.9%	0.4%	7.5%	-0.9%	5.0%
YoY%	-1.9%	5.0%	13.9%	21.5%	28.3%	24.1%	25.4%	15.4%	12.4%

Source: Company data, UBS

**Figure 38: Inventory days – ODM, EMS, LCD, Retailers & Distributors**

	Sep-20	Dec-20	Mar-21	Jun-21	Sep-21	Dec-21	Mar-22	Jun-22	Sep-22
<b>PC ODMs</b>									
Compal Elec	36.7	27.3	32.4	43.8	37.4	30.3	48.1	52.4	47.8
Inventec	30.5	31.4	39.2	44.9	46.3	41.2	56.8	52.9	56.2
Pegatron	35.2	34.1	65.2	51.2	47.9	31.8	53.5	58.2	59.5
Quanta	67.2	47.9	59.4	62.9	73.4	57.8	79.8	89.0	70.8
Wistron	48.2	39.5	61.6	56.5	64.5	60.9	77.6	74.1	82.3
<b>PC ODM - Average</b>	<b>43.5</b>	<b>36.0</b>	<b>51.6</b>	<b>51.9</b>	<b>53.9</b>	<b>44.4</b>	<b>63.2</b>	<b>65.3</b>	<b>63.3</b>
<b>EMS</b>									
Celestica	77.1	78.3	92.9	85.8	95.5	113.0	123.1	122.7	120.9
Flextronics	59.2	54.3	61.7	69.1	81.9	88.7	94.5	97.0	98.3
Hon Hai	53.3	37.7	46.2	38.9	46.7	35.4	52.0	48.0	54.2
Jabil Circuits	42.0	41.5	51.9	54.6	59.0	54.1	70.9	70.8	67.4
Sanmina	45.6	46.3	46.1	53.5	62.5	70.3	74.6	78.3	76.2
<b>EMS - Average</b>	<b>55.4</b>	<b>51.6</b>	<b>59.7</b>	<b>60.4</b>	<b>69.1</b>	<b>72.3</b>	<b>83.0</b>	<b>83.4</b>	<b>83.4</b>
<b>TFT-LCD</b>									
AUO	37.3	36.5	38.1	39.7	45.3	42.8	49.4	55.0	52.8
BOE- China	44.7	67.0	53.1	57.3	70.8	58.7	70.2	85.5	70.7
Innolux	42.9	45.3	45.2	52.3	55.2	52.8	61.8	74.4	76.2
LGD	37.2	32.6	41.6	45.5	53.9	39.0	68.3	79.1	56.6
Sharp	48.4	43.8	50.9	53.7	57.1	49.9	59.9	70.2	68.0
<b>TFT-LCD Average</b>	<b>41.5</b>	<b>39.6</b>	<b>44.0</b>	<b>47.8</b>	<b>52.9</b>	<b>46.1</b>	<b>59.8</b>	<b>69.7</b>	<b>63.4</b>
<b>Retailers</b>									
Best-Buy	75.1	38.2	58.5	64.8	85.7	41.7	68.9	68.6	
Office Depot	50.7	47.4	46.3	48.1	45.8	48.7	46.6	55.1	48.2
Suning	41.7	31.2	42.4	29.7	61.2	42.4	60.8	60.8	59.7
<b>Retailer - Average</b>	<b>50.7</b>	<b>47.4</b>	<b>46.3</b>	<b>48.1</b>	<b>45.8</b>	<b>48.7</b>	<b>46.6</b>	<b>55.1</b>	<b>48.2</b>
<b>Distributors</b>									
Arrow	45.8	39.8	40.1	43.9	47.1	49.0	53.9	54.2	57.4
Avnet	63.9	61.8	57.9	64.5	60.8	62.7	59.2	69.2	71.0
Edom Technology	21.0	22.0	32.0	37.1	37.2	38.7	42.5	53.9	64.2
Synnex Technology Intl	26.0	29.5	33.1	33.1	36.0	37.6	48.5	51.5	61.8
WPG Holdings	31.6	34.0	39.4	37.6	44.0	42.0	45.0	56.1	76.0
<b>Distributor - Average</b>	<b>37.6</b>	<b>37.4</b>	<b>40.5</b>	<b>43.2</b>	<b>45.0</b>	<b>46.0</b>	<b>49.8</b>	<b>57.0</b>	<b>66.1</b>

Source: Company data, UBS

**Figure 39: Absolute Inventories – ODM, EMS, LCD, Retailers & Distributors**

(USD mn)		Sep-20	Dec-20	Mar-21	Jun-21	Sep-21	Dec-21	Mar-22	Jun-22	Sep-22
<b>PC ODMs</b>										
Compal Elec		3,559	3,398	3,240	4,242	4,690	4,133	4,871	4,992	4,617
Inventec		1,587	1,463	1,609	1,893	2,473	2,243	2,741	2,557	2,618
Pegatron		4,216	5,835	5,192	5,143	5,724	5,320	6,557	5,824	6,918
Quanta		5,460	5,273	5,751	5,871	6,874	7,064	8,937	8,552	8,808
Wistron		3,696	3,359	3,949	4,094	5,142	5,799	6,500	6,279	6,591
<b>Agg. PC ODMs</b>		<b>18,518</b>	<b>19,328</b>	<b>19,740</b>	<b>21,243</b>	<b>24,903</b>	<b>24,559</b>	<b>29,607</b>	<b>28,203</b>	<b>29,551</b>
	QoQ%	6.3%	4.4%	2.1%	7.6%	17.2%	-1.4%	20.6%	-4.7%	4.8%
	YoY%	5.4%	37.1%	14.5%	21.9%	34.5%	27.1%	50.0%	32.8%	18.7%
<b>EMS</b>										
Celestica		1,205	1,091	1,153	1,224	1,405	1,697	1,935	2,108	2,326
Flextronics		3,611	3,699	3,895	4,444	5,168	5,958	6,580	7,243	7,726
Hon Hai		24,073	27,680	22,493	18,986	23,633	24,152	26,991	25,247	30,649
Jabil Circuits		3,131	3,271	3,559	3,979	4,414	4,681	5,395	5,981	6,128
Sanmina		861	820	785	892	1,037	1,242	1,438	1,591	1,691
<b>Agg. EMS</b>		<b>32,881</b>	<b>36,560</b>	<b>31,886</b>	<b>29,525</b>	<b>35,656</b>	<b>37,730</b>	<b>42,339</b>	<b>42,170</b>	<b>48,520</b>
	QoQ%	27.8%	11.2%	-12.8%	-7.4%	20.8%	5.8%	12.2%	-0.4%	15.1%
	YoY%	6.7%	41.9%	19.2%	14.7%	8.4%	3.2%	32.8%	42.8%	36.1%
<b>TFT-LCD</b>										
AUO		909	945	948	1,039	1,246	1,239	1,352	1,252	1,038
BOE		2,350	2,742	3,169	3,648	4,410	4,339	4,749	4,929	4,360
CMI (Innolux)		1,082	1,091	1,080	1,254	1,405	1,375	1,486	1,584	1,498
LGD		2,021	1,999	2,278	2,429	3,089	2,831	3,636	3,667	2,910
Sharp		2,592	2,600	2,482	2,694	2,831	2,785	2,768	2,794	3,125
<b>Agg. LCD</b>		<b>8,956</b>	<b>9,376</b>	<b>9,957</b>	<b>11,063</b>	<b>12,982</b>	<b>12,570</b>	<b>13,991</b>	<b>14,225</b>	<b>12,932</b>
	QoQ%	0.4%	4.7%	6.2%	11.1%	17.3%	-3.2%	11.3%	1.7%	-9.1%
	YoY%	6.1%	17.3%	11.0%	24.0%	45.0%	34.1%	40.5%	28.6%	-0.4%
<b>Retailers</b>										
Best-Buy		7,459	5,612	5,721	6,417	8,553	5,965	6,258	6,043	
ODP Hold Co		1,000	930	929	957	841	859	866	968	890
Suning		3,500	3,719	3,285	1,846	1,969	1,923	1,632	1,467	1,481
<b>Agg. Retailers</b>		<b>11,959</b>	<b>10,261</b>	<b>9,935</b>	<b>9,220</b>	<b>11,363</b>	<b>8,747</b>	<b>8,756</b>	<b>8,478</b>	<b>2,371</b>
	QoQ%	41.4%	-14.2%	-3.2%	-7.2%	23.2%	-23.0%	0.1%	-3.2%	-72.0%
	YoY%	-0.8%	2.5%	22.3%	9.0%	-5.0%	-14.8%	-11.9%	-8.0%	-79.1%
<b>Distributors</b>										
Arrow		3,235	3,287	3,275	3,636	3,835	4,202	4,645	4,887	5,083
Avnet		2,944	2,816	2,760	3,236	3,283	3,542	3,681	4,244	4,655
Edom Technology		229	278	292	322	407	446	469	530	681
Synnex Technology Intl		832	1,091	1,052	1,177	1,342	1,714	1,836	1,900	2,226
WPG Holdings		1,929	2,018	2,583	2,776	3,279	3,098	3,558	3,997	4,787
<b>Aggregate</b>		<b>9,169</b>	<b>9,490</b>	<b>9,963</b>	<b>11,147</b>	<b>12,146</b>	<b>13,003</b>	<b>14,189</b>	<b>15,557</b>	<b>17,433</b>
	QoQ%	-6.3%	3.5%	5.0%	11.9%	9.0%	7.1%	9.1%	9.6%	12.1%
	YoY%	-8.2%	-4.2%	0.5%	13.9%	32.5%	37.0%	42.4%	39.6%	43.5%

Source: Company data, UBS

**Figure 40: Inventory days – Non-Memory Semiconductors**

	Sep-20	Dec-20	Mar-21	Jun-21	Sep-21	Dec-21	Mar-22	Jun-22	Sep-22
<b>Non-Memory Semis</b>									
AMD	75.0	71.2	81.5	79.7	77.9	74.3	74.5	70.5	95.8
AMLogic	37.6	48.8	56.9	86.6	109.5	117.1	138.5	108.3	155.2
Analog Devices	121.0	120.5	120.9	120.1	161.1	117.8	128.0	136.2	151.1
Austriamicrosystems	84.6	74.6	93.6	79.8	86.2	101.2	100.4	107.8	98.5
Broadcom (Avago)	52.4	48.0	54.0	61.3	61.7	72.2	77.9	80.9	
Cirrus Logic	114.1	55.3	109.1	128.1	74.6	52.4	54.6	83.3	55.8
Diodes Incorporated	119.7	123.4	96.4	98.9	101.3	109.9	118.3	115.1	112.7
GigaDevice	71.7	71.3	79.7	89.4	79.8	132.3	139.1	141.9	202.1
Goodix	62.9	78.2	77.2	89.7	138.2	111.3	246.2	273.4	518.6
Guoxin Micro	197.8	161.1	209.2	174.2	207.1	177.7	249.6	292.9	296.4
Ingenic	198.4	178.9	158.4	140.7	135.0	147.3	164.6	207.5	242.7
Infineon	110.3	108.4	104.8	115.8	112.5	111.9	123.2	124.0	131.9
Intel	98.5	89.1	96.5	102.2	112.4	108.8	119.6	114.1	133.0
Lattice	133.4	139.4	120.4	122.9	122.8	121.7	131.8	138.9	159.4
Magnachip Semiconductor	31.9	34.2	30.9	47.3	44.0	50.1	51.7	45.6	63.1
Marvell	67.0	65.0	118.6	59.6	92.0	100.1	109.5	114.0	
Maxscend	76.8	158.0	131.6	162.3	230.4	279.1	226.4	383.1	504.4
Mediatek	52.2	64.2	87.8	86.9	92.0	103.9	115.0	104.6	116.8
Melexis	152.3	119.1	106.3	130.5	133.1	137.9	141.4	145.3	135.2
Microchip	120.2	119.2	112.3	111.1	112.0	116.0	125.0	127.3	139.2
Montage Tech	162.8	154.4	172.4	159.0	50.0	67.5	72.3	102.1	126.9
Novatek	48.6	52.3	60.2	59.4	62.2	74.8	82.9	103.3	154.5
Nvidia	82.2	95.0	93.7	91.2	82.4	92.9	101.0	93.7	147.6
NXP	84.9	78.5	79.5	86.7	85.4	82.6	89.3	94.9	98.9
ON Semiconductor	133.4	120.4	123.0	116.0	118.6	124.1	138.8	136.1	126.7
Qorvo	76.5	78.5	85.2	92.2	86.1	115.0	116.0	117.2	123.9
Qualcomm	85.7	68.0	72.2	84.0	74.1	81.9	89.4	102.7	934.6
Realtek	55.3	62.5	70.0	94.9	105.7	120.0	112.0	117.6	162.7
Renesas	93.8	80.6	77.9	77.2	100.5	78.7	94.6	95.2	123.8
Rockchip	71.2	62.7	72.0	57.3	98.6	107.7	176.2	174.1	615.2
Rohm	181.4	168.9	198.3	154.3	167.0	170.1	200.0	184.3	234.4
SGMicro	107.2	125.3	136.5	124.2	135.9	124.0	122.3	115.1	210.1
Silergy	120.2	92.9	101.2	85.3	89.4	92.1	101.8	102.8	175.0
Skyworks	150.9	87.6	113.8	132.3	115.8	96.2	121.3	154.9	149.8
Starpower	133.2	111.1	121.1	105.1	97.0	122.8	118.6	117.2	132.3
3Peak	99.1	121.0	125.3	78.7	74.0	77.9	72.7	63.9	102.2
STM	103.2	84.8	91.3	101.0	96.2	92.4	103.6	104.3	96.1
Texas Instruments	138.6	124.8	115.6	112.7	114.0	117.6	128.5	126.4	135.1
Verisilicon	32.2	34.3	37.1	30.6	27.0	38.7	50.0	29.7	75.5
Will Semi	119.5	115.1	122.6	135.9	175.3	223.4	266.7	308.6	454.2
<b>Non-Memory Average</b>	<b>105.7</b>	<b>99.8</b>	<b>105.4</b>	<b>105.5</b>	<b>106.9</b>	<b>112.6</b>	<b>121.8</b>	<b>131.1</b>	<b>159.6</b>

Source: Company data, UBS

**Figure 41: Absolute Inventories – Non-Memory Semiconductors**

(USD mn)	Sep-20	Dec-20	Mar-21	Jun-21	Sep-21	Dec-21	Mar-22	Jun-22	Sep-22
<b>Non - Memory Semis</b>									
AMD	1,292	1,399	1,659	1,765	1,902	1,955	2,431	2,648	3,369
AMLogic	33	51	59	95	134	168	207	180	208
Analog Devices	608	618	641	658	1,201	973	1,075	1,203	1,400
Austriamicrosystems	890	858	890	879	829	938	947	985	1,020
Broadcom (Avago)	1,003	952	1,004	1,160	1,297	1,520	1,668	1,838	
Cirrus Logic	209	142	173	193	188	149	138	174	165
Diodes Inc	260	307	290	304	322	349	370	371	375
Giga Device	102	113	137	171	180	227	267	303	334
Goodix	99	95	95	113	152	153	204	228	302
Guoxin Micro	124	137	153	160	185	191	206	247	318
Ingenic	205	200	192	191	200	222	248	283	330
Infineon	2,386	2,414	2,334	2,473	2,566	2,666	2,955	2,971	3,398
Intel	9,273	8,427	8,487	8,817	9,798	10,776	11,935	12,174	12,831
Lattice	60	65	60	66	66	68	72	78	94
Magnachip	34	39	30	41	39	39	37	36	37
Marvell	268	268	538	460	629	720	836	913	
Maxscend	59	97	110	136	179	231	244	271	279
Mediatek	1,054	1,331	2,007	2,257	2,468	2,588	3,197	3,074	2,904
Melexis	149	144	124	155	158	170	182	195	184
Microchip	661	661	665	684	714	768	854	912	1,030
Montage Tech	29	29	30	44	45	59	63	100	101
Novatek	261	282	344	387	440	510	584	633	598
NXP	1,064	1,030	1,056	1,116	1,173	1,189	1,311	1,462	1,581
Nvidia	1,495	1,826	1,992	2,114	2,233	2,605	3,163	3,889	4,454
ON Semiconductor	1,281	1,251	1,295	1,309	1,327	1,379	1,496	1,563	1,575
Qorvo	477	479	508	570	598	710	756	847	841
Qualcomm	2,598	2,552	2,668	3,133	3,228	3,861	4,555	5,418	6,341
Realtek	271	305	347	467	557	595	625	665	868
Renesas	913	870	817	862	1,228	1,214	1,381	1,277	1,567
Rockchip	39	37	41	46	65	74	99	124	196
Rohm	1,132	1,156	1,215	1,155	1,174	1,224	1,378	1,227	1,459
SGMicro	34	40	47	50	56	62	64	68	97
Silergy	83	82	85	80	89	100	112	121	174
Skyworks	806	718	740	809	885	839	928	1,102	1,212
Starpower	35	39	43	45	50	62	65	70	86
3Peak	9	11	15	16	19	23	24	24	30
STM	1,931	1,841	1,843	1,970	1,969	1,972	2,147	2,307	2,381
Texas Instruments	2,072	1,955	1,890	1,856	1,863	1,910	2,060	2,199	2,404
Verisilicon	12	13	14	17	19	21	24	21	48
Will Semi	808	809	861	939	1,110	1,374	1,630	1,887	2,158
<b>Agg. Non-Memory Semis</b>	<b>32,859</b>	<b>32,492</b>	<b>33,973</b>	<b>36,171</b>	<b>39,443</b>	<b>42,532</b>	<b>48,185</b>	<b>51,492</b>	<b>56,955</b>
QoQ%	1.7%	-1.1%	4.6%	6.5%	9.0%	7.8%	13.3%	6.9%	10.6%
YoY%	17.3%	16.3%	14.8%	12.0%	20.0%	30.9%	41.8%	42.4%	44.4%

Source: Company data, UBS

**Figure 42: Inventory days – Memory Semis, Foundries and OSAT**

	Sep-20	Dec-20	Mar-21	Jun-21	Sep-21	Dec-21	Mar-21	Jun-21	Sep-22
<b>Memory</b>									
SK Hynix	106.2	101.2	99.4	95.9	98.4	123.1	140.5	142.1	219.0
Micron	128.5	124.6	87.7	96.4	93.9	107.1	119.6	111.6	151.4
Nanya Technology	135.1	128.4	90.5	79.0	83.9	124.7	96.8	126.8	257.5
Samsung Electronics	74.1	77.4	68.4	83.5	78.5	80.4	92.3	100.6	126.6
Western Digital	100.4	109.4	110.3	98.4	95.5	102.4	104.6	107.7	127.9
<b>Memory Average</b>	<b>108.8</b>	<b>108.2</b>	<b>91.3</b>	<b>90.6</b>	<b>90.0</b>	<b>107.5</b>	<b>110.8</b>	<b>117.7</b>	<b>176.5</b>
<b>Foundry</b>									
Hua Hong	97.7	99.1	152.9	124.7	109.7	105.9	121.1	131.8	144.7
SMIC	72.0	90.6	98.9	88.5	106.5	106.0	110.1	114.7	133.0
TSMC	60.2	75.5	82.6	85.3	84.3	87.1	83.8	89.9	90.8
UMC	59.4	62.3	59.2	59.7	60.8	62.5	64.5	64.0	76.5
Vanguard	47.6	51.4	54.3	56.3	55.2	56.5	55.8	54.7	66.7
<b>Foundry- Average</b>	<b>67.4</b>	<b>75.8</b>	<b>89.6</b>	<b>82.9</b>	<b>83.3</b>	<b>83.6</b>	<b>87.1</b>	<b>91.0</b>	<b>102.3</b>
<b>OSAT</b>									
Amkor	24.6	24.8	26.4	30.1	30.0	32.5	37.1	46.3	36.7
ASE	55.5	45.0	63.4	61.0	60.7	48.9	67.9	67.9	67.8
Chipbond	29.2	27.6	34.0	32.3	31.3	31.2	31.6	33.2	50.0
Chipmos	41.2	40.2	42.9	46.9	46.9	59.7	57.2	54.8	74.9
JiangsuChangjiang Electronic Tech.	50.8	41.3	43.4	46.6	51.6	43.4	45.1	55.6	54.2
Powertech	31.0	29.9	32.0	32.0	31.5	36.9	44.9	46.1	61.4
<b>OSAT - Average</b>	<b>38.7</b>	<b>34.8</b>	<b>40.3</b>	<b>41.5</b>	<b>42.0</b>	<b>42.1</b>	<b>47.3</b>	<b>50.7</b>	<b>57.5</b>

Source: Company data, UBS

**Figure 43: Absolute Inventories – Memory Semis, Foundries and OSAT**

(USD mn)	Sep-20	Dec-20	Mar-21	Jun-21	Sep-21	Dec-21	Mar-22	Jun-22	Sep-22
<b>Memory</b>									
SK Hynix	5,178	5,650	5,550	5,554	5,694	7,535	8,932	9,223	11,922
Micron	5,607	5,521	4,743	4,537	4,487	4,827	5,383	5,629	6,663
Nanya Technology	572	573	437	396	390	519	425	475	659
Samsung Electronics	27,311	29,506	27,486	29,960	32,613	34,971	40,903	40,444	46,598
Western Digital	3,355	3,576	3,683	3,616	3,544	3,647	3,661	3,638	3,862
<b>Agg. Memory Semi</b>	<b>42,023</b>	<b>44,826</b>	<b>41,898</b>	<b>44,062</b>	<b>46,728</b>	<b>51,498</b>	<b>59,305</b>	<b>59,409</b>	<b>69,704</b>
QoQ%	10.3%	6.7%	-6.5%	5.2%	6.1%	10.2%	15.2%	0.2%	17.3%
YoY%	6.6%	24.7%	12.4%	15.7%	11.2%	14.9%	41.5%	34.8%	49.2%
<b>Foundry</b>									
Hua Hong	205	226	390	356	396	434	577	595	628
SMIC	647	799	890	973	1,105	1,194	1,317	1,449	1,698
TSMC	3,724	4,859	5,475	6,091	6,539	6,939	7,159	7,311	7,600
UMC	777	830	787	802	831	827	909	919	1,048
Vanguard	98	109	119	130	137	145	152	156	169
<b>Aggregate</b>	<b>5,451</b>	<b>6,823</b>	<b>7,661</b>	<b>8,352</b>	<b>9,007</b>	<b>9,538</b>	<b>10,113</b>	<b>10,430</b>	<b>11,142</b>
QoQ%	18.7%	25.2%	12.3%	9.0%	7.8%	5.9%	6.0%	3.1%	6.8%
YoY%	17.6%	58.5%	82.3%	81.9%	65.2%	39.8%	32.0%	24.9%	23.7%
<b>OSAT</b>									
Amkor	300	297	307	374	446	485	516	637	669
ASE	2,140	2,190	2,371	2,393	2,793	2,632	3,084	3,183	3,525
Chipbond	44	47	59	58	57	52	56	55	63
ChipMoS	69	74	81	90	94	115	113	104	115
JiangsuChangjiang Electronic Techr	453	452	409	452	568	500	508	563	636
Powertech	177	176	179	194	206	243	286	305	366
<b>Aggregate</b>	<b>3,183</b>	<b>3,236</b>	<b>3,406</b>	<b>3,561</b>	<b>4,163</b>	<b>4,027</b>	<b>4,563</b>	<b>4,847</b>	<b>5,374</b>
QoQ%	18.6%	1.7%	5.3%	4.5%	16.9%	-3.3%	13.3%	6.2%	10.9%
YoY%	36.8%	39.8%	34.1%	32.7%	30.8%	24.4%	34.0%	36.1%	29.1%

Source: Company data, UBS

### **Valuation Method and Risk Statement**

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 tech stocks can prove challenging as neither traditional nor non traditional valuation measures have provided much insight into how these stocks trade. We value stocks on relative multiple basis – NTM P/E or NTM PB.

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### UBS Investment Research: Global Equity Rating Definitions

12-Month Rating	Definition	Coverage <sup>1</sup>	IB Services <sup>2</sup>
Buy	FSR is > 6% above the MRA.	56%	26%
Neutral	FSR is between -6% and 6% of the MRA.	35%	22%
Sell	FSR is > 6% below the MRA.	9%	18%
Short-Term Rating	Definition	Coverage <sup>3</sup>	IB Services <sup>4</sup>
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 30 September 2022.

1:Percentage of companies under coverage globally within the 12-month rating category.

2:Percentage of companies within the 12-month rating category for which investment banking (IB) services were provided within the past 12 months.

3:Percentage of companies under coverage globally within the Short-Term rating category.

4:Percentage of companies within the Short-Term rating category for which investment banking (IB) services were provided within the past 12 months.



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Company Name	Reuters	12-month rating	Price	Price date
ACM Research (Shanghai)	688082.SS	Sell	Rmb80.00	29 Nov 2022
ASM International	ASMI.AS	Buy	€248.95	28 Nov 2022
ASML <sup>16b</sup>	ASML.AS	Buy	€566.80	28 Nov 2022
Analog Devices Inc <sup>7,16b</sup>	ADI.O	Buy	US\$164.01	28 Nov 2022
Broadcom Inc. <sup>16b</sup>	AVGO.O	Buy	US\$522.21	28 Nov 2022
GigaDevice Semiconductor	603986.SS	Sell	Rmb102.10	29 Nov 2022
Infineon Technologies AG	IFXGn.DE	Buy	€30.64	28 Nov 2022
Marvell Technology Group <sup>16b</sup>	MRVL.O	Buy	US\$42.67	28 Nov 2022
MediaTek Inc.	2454.TW	Buy	NT\$713.00	29 Nov 2022
Melexis NV	MLXS.BR	Sell	€83.20	28 Nov 2022
Micron Technology Inc <sup>16b</sup>	MU.O	Buy	US\$55.75	28 Nov 2022
NXP Semiconductors <sup>16b</sup>	NXPI.O	Sell	US\$164.10	28 Nov 2022
SK Hynix	000660.KS	Buy	Won83,700	29 Nov 2022
Samsung Electronics	005930.KS	Buy	Won60,600	29 Nov 2022
Semiconductor Manufacturing Intl Corp <sup>18,16a,20</sup>	0981.HK	Sell (CBE)	HK\$17.02	29 Nov 2022
Taiwan Semiconductor Manufacturing <sup>16b</sup>	2330.TW	Buy	NT\$487.00	29 Nov 2022
Texas Instruments Inc <sup>16b</sup>	TXN.O	Neutral	US\$173.00	28 Nov 2022
Vanguard	5347.TWO	Sell	NT\$83.50	28 Nov 2022

Source: UBS. All prices as of local market close. Ratings in this table are the most current published ratings prior to this report. They may be more recent than the stock pricing date.

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